11BP4

CATHODE RAY TUBE

11 INCH, RECTANGULAR, GLASS

FACEPLATE -- SPHERICAL GRAY

FOCUS -- ELECTROSTATIC

NON ION TRAP GUN

DEFLECTION -- MAGNETIC

ALUMINIZED SCREEN

110 DEGREE DEFLECTION ANGLE

EXTERNAL CONDUCTIVE COATING

----------DESCRIPTION AND RATING----------

The 11BP4 is an 11-inch electrostatic focus and magnetic deflection glass lightweight picture tube. Outstanding features include a short overall 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	700 max. uuf
	400 min. uuf
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)	80 Percent

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC

Syracuse, N. Y.

from JEDEC release #4765, July 27, 1964

MECHANICAL DATA

Overall Length	8-15/16 ± 1/4 inches
Greatest Dimensions of Tube	
Diagonal	10-7/8 ± 1/8 inches
Width	9-3/4 ± 1/8 inches
Height	8 ± 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)	200 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.

11BP4

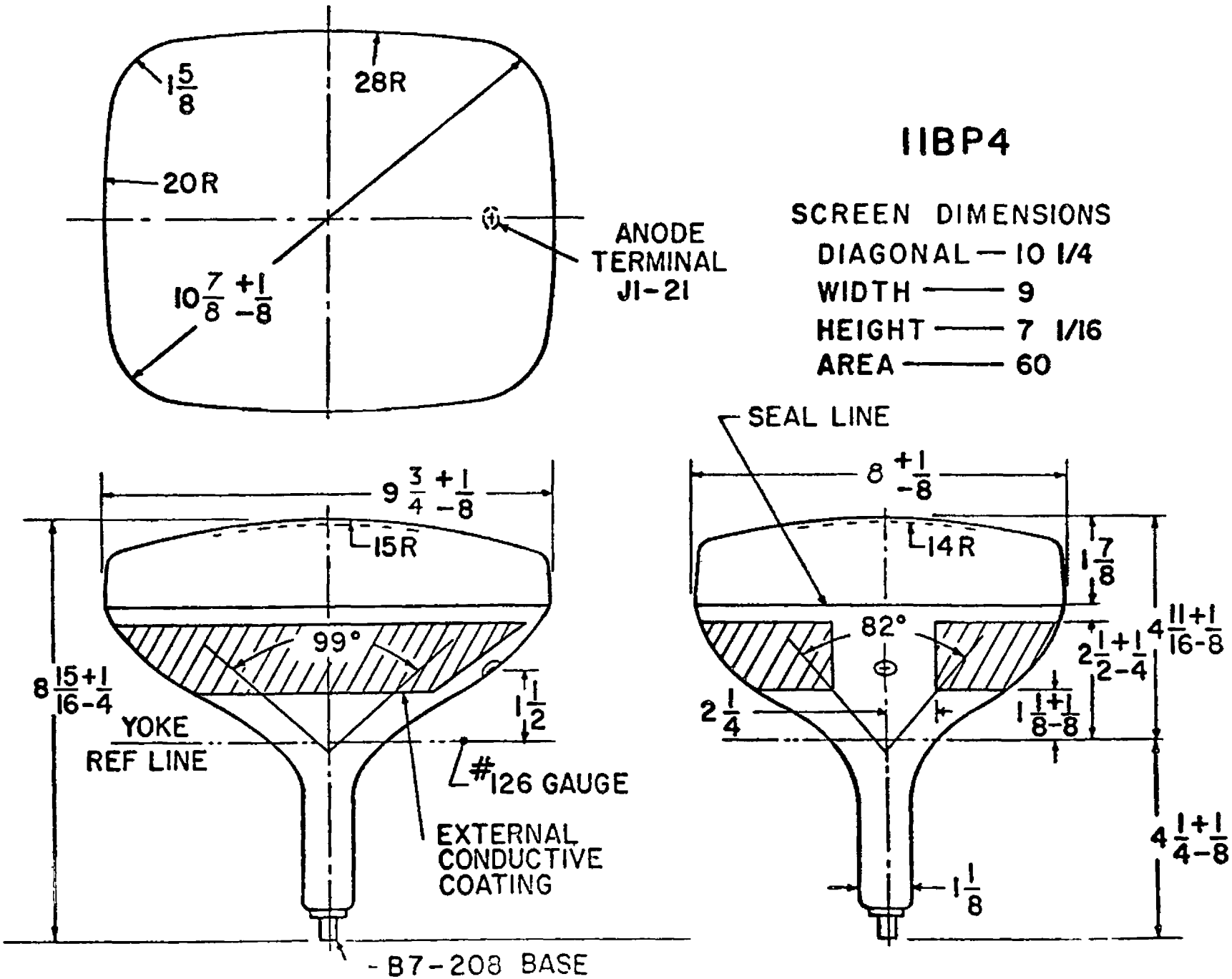
SCREEN DIMENSIONS

DIAGONAL — 10 1/4

WIDTH — 9

HEIGHT — 7 1/16

AREA — 60



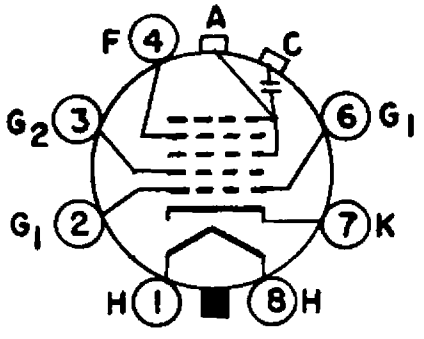
OUTLINE NOTES

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.

from JEDEC release #4582, Feb. 3, 1964

Toshiba

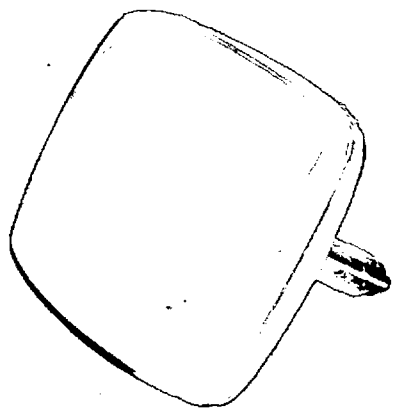
TOSHIBA ELECTRON TUBE 11EP4

PICTURE TUBE

Rectangular Glass Type
Low - Voltage Electrostatic focus

Aluminized Screen
Magnetic Deflection

Toshiba 11EP4 is a 11 inch, directly viewed, rectangular, glass picture tube of the low voltage electro-static focus and 114° magnetic deflection type.
The 11EP4 employs short neck, no ion trap gun featuring good focus over entire picture area.
11EP4 has a aluminized screen and it maximum overall length is only 215 mm or 8.5 inch thus very suitable for portable T.V. Set.



GENERAL DATA

Electrical :

Heater voltage	6.3	V
Heater current at 6.3 Volts	600±30	mA
Heater warm up time	11	second
Direct interelectrode capacitance		
Grid No. 1 to all other electrodes	6	PF
Cathode to all other electrodes	5	PF
External conductive coating to ultor	500 max. 300 min.	PF PF
Focusing method	Electrostatic	
Deflection method	Magnetic	

Deflection angles (approx)

Diagonal	114	deg
Horizontal	102	deg
Vertical	85	deg

Electron gun ..... Type requiring no ion-trap magnet

Optical :

Face plate ..... Filter glass

Light transmission at center (approx) 75%

Phosphor P4-Aluminized

Fluorescence ..... White

Phosphorescence ..... White

Persistence ..... Medium short

Mechanical :

Tube dimensions

Overall length	215±7mm	(8.46±0.28 inches)
Greatest width	243±3mm	(9.57±0.18 inches)
Greatest height	198±3mm	(7.80±0.18 inches)
Diagonal	278±3mm	(10.95±0.18 inches)
Neck length	105±5mm	(4.12±0.12 inches)

Screen dimension (minimum)

Greatest width	223 min mm	(8.78 min inches)
Greatest height	177 min mm	(6.97 min inches)
Diagonal	257 min mm	(10.12 min inches)
Projected area	38000 mm^2	(59 sq. inches)

Weight (approx) ..... 1.6 kg (3.5 Lbs)

Operating position ..... any

Cap ..... Recessed small cavity (JEDEC No. J1-21)

Base ..... Small-Button Neoeighter 7-pin (JEDEC B7-205)

Basing designation 8HR

GRID-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, Design - Maximum values:

Ultor voltage	14000	max.	Volts
	8000	min.	Volts
Grid No. 4 (focusing) voltage;			
Positive value	1100	max.	Volts
Negative value	550	max.	Volts
Grid No. 2 voltage	550	max.	Volts
	300	min.	Volts
Grid No. 1 voltage;			
Negative-peak value	220	max.	Volts
Negative-bias value	154	min.	Volts
Positive-bias value	0	max.	Volts
Positive-peak value	2	max.	Volts
Heater voltage	6.9	max.	Volts
	5.7	min.	Volts
Peak heater-cathode voltage;			
Heater negative with respect to cathode			
During equipment warm-up period not exceeding 15 second	450	max.	Volts
After equipment warm-up period	200	max.	Volts
Heater positive with respect to cathode ..	200	max.	Volts

Equipment Design Ranges;

With any ultor voltage① (Ec_5 k) between 8000 and 14000 volts and Grid - No. 2 voltage (Ec_2 k) between 200 and 550 volts.

Grid - No. 4 voltage for focus②	0 to 400	Volts
Grid - No. 1 voltage (Ec1k) for visual extinction of focused raster	See Raster - Cutoff - Range Chart for Grid - Drive Service	
Grid - No. 4 current	-25 to +25	μA
Grid - No. 2 current	-15 to +15	μA
Field strength of adjustable centering magnet③	0 to 8	gausses

Examples of Use of Design Ranges;

Ultor voltage①	10000	Volts
Grid - No. 2 voltage	400	Volts
Grid - No. 4 voltage for focus②	0 to 400	Volts
Grid - No. 1 voltage for visual extinction of focused raster④	-36 to -94	Volts

Maximum Circuit Values:

Grid - No. 1 circuit resistance	1.5 max.	megohms

CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid - No. 1

Maximum and Minimum Ratings, Design - Maximum values:

Ultor to Grid - No. 1 voltage	14000 max.	Volts
	8000 min.	Volts

Grid - No. 4 to Grid - No. 1 (focusing) voltage		
Positive value	1100 max.	Volts
Negative value	550 max.	Volts
Grid - No. 2 to Grid No. 1 voltage	700 max. 350 min.	Volts Volts
Grid - No. 2 to cathode voltage	550 max.	Volts
Cathode to Grid - No. 1 voltage		
Positive - peak value	220 max.	Volts
Positive - bias value	154 max.	Volts
Negative - bias value	0 max.	Volts
Negative - peak value	2 max.	Volts
Heater voltage	6.9 max. 5.7 min.	Volts Volts
Peak heater - cathode voltage;		
Heater negative with respect to cathode		
During equipment warm-up period not exceeding 15 second	450 max.	Volts
After equipment warm-up period	200 max.	Volts
Heater positive with respect to cathode	200 max.	Volts

Equipment Design Ranges :

With any ultor to Grid - No. 1 voltage①(Ec_5 g_1) between 8000 and 14000 volts and Grid - No. 2 to Grid - No. 1 voltage (Ec_2 g_1) between 400 and 690 volts

Grid - No. 4 to Grid - No. 1 voltage for focus②	0 to 400	Volts
Cathode to Grid - No. 1 voltage (Ekg_1) for visual extinction of focused raster	See Raster - Cutoff - Range Chart for Cathode - Drive Service	
Grid - No. 4 current	-25 to +25	μA
Grid - No. 2 current	-15 to +15	μA

Field strength of adjustable centering magnet③	0 to 8	gausses

Examples of Use of Design Ranges :

Ultor voltage	10000	Volts
Grid - No. 2 voltage	400	Volts
Grid - No. 4 Grid - No. 1 voltage for focus②	0 to 400	Volts
Cathode to Grid - No. 1 voltage for visual extinction of focused raster	36 to 78	Volts

Maximum Circuit Values :

Grid - No. 1 circuit resistance	1.5 max.	megohms

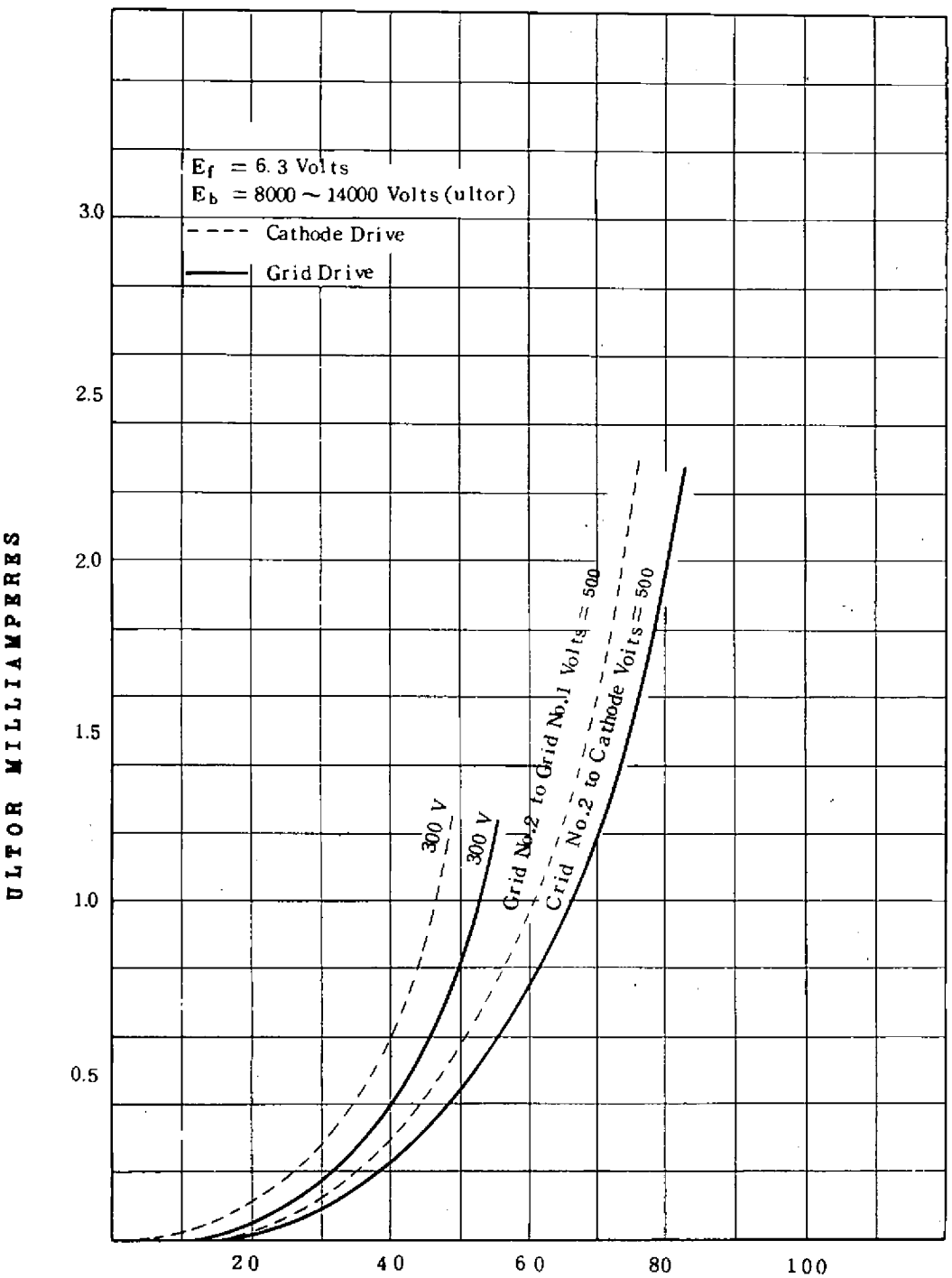
Notes:

1. Brilliance and definition decrease with decreasing voltage of ultor to Grid - No. 1 voltage. In general the ultor voltage or ultor to Grid- No. 1 voltage should not be less than 8000 volts.

2. Individual tubes will have satisfactory focus at same value of Grid-No. 4 (or Grid - No. 4 to Grid No. 1) voltage between 0 and 400 volts with the combined bias voltage and video - signal voltage adjusted to produce an ultor current of 100 micro amperes.

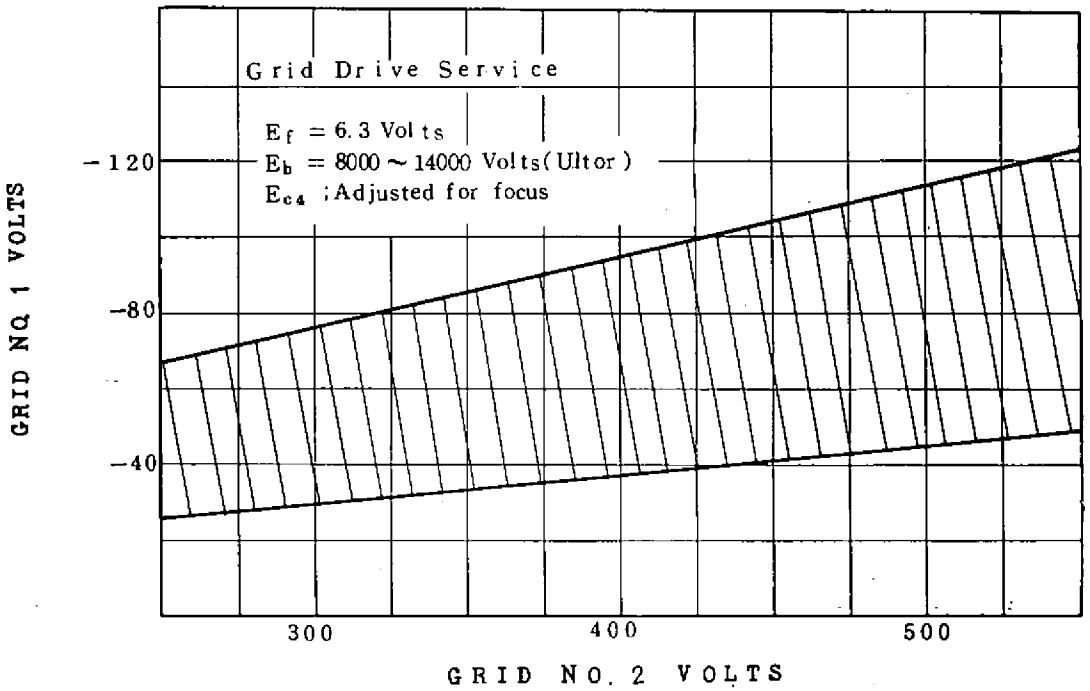
3. Distance from Reference line for suitable P. M. centering magnet should not exceed 2-1/8. Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 5/16 inch radius concentric with the center of the tube face. It is to be noted that the earths magnetic field can cause as much as 7/16 inch deflection of the spot from the center of the tube face.

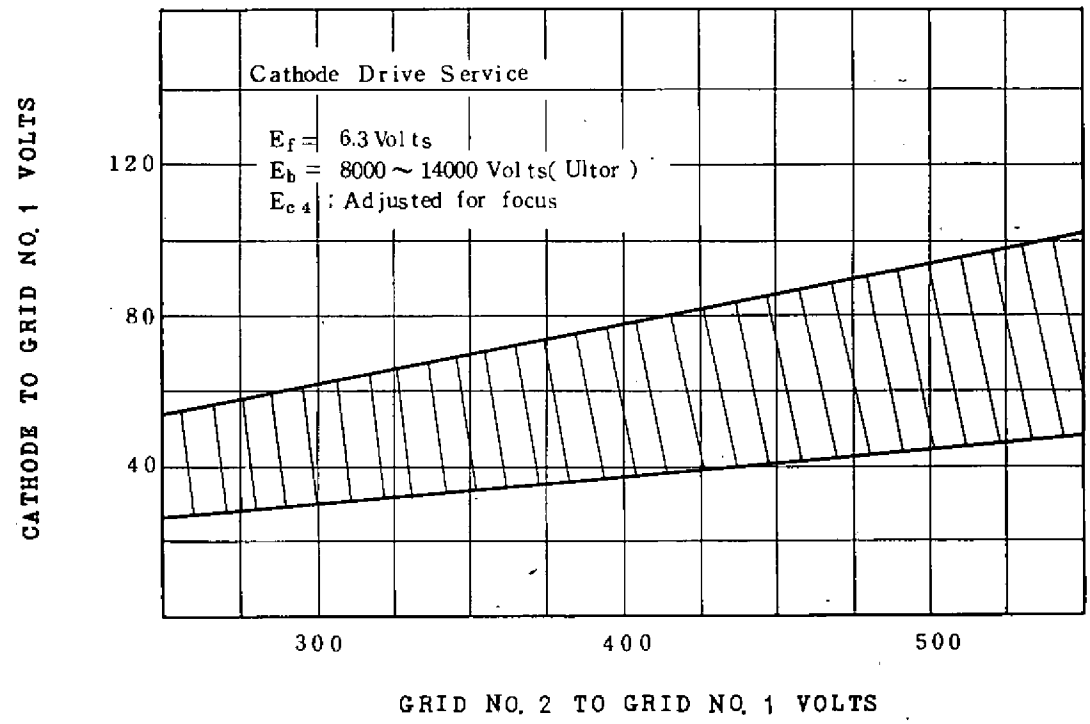
AVERAGE DRIVE CHARACTERISTICS



VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

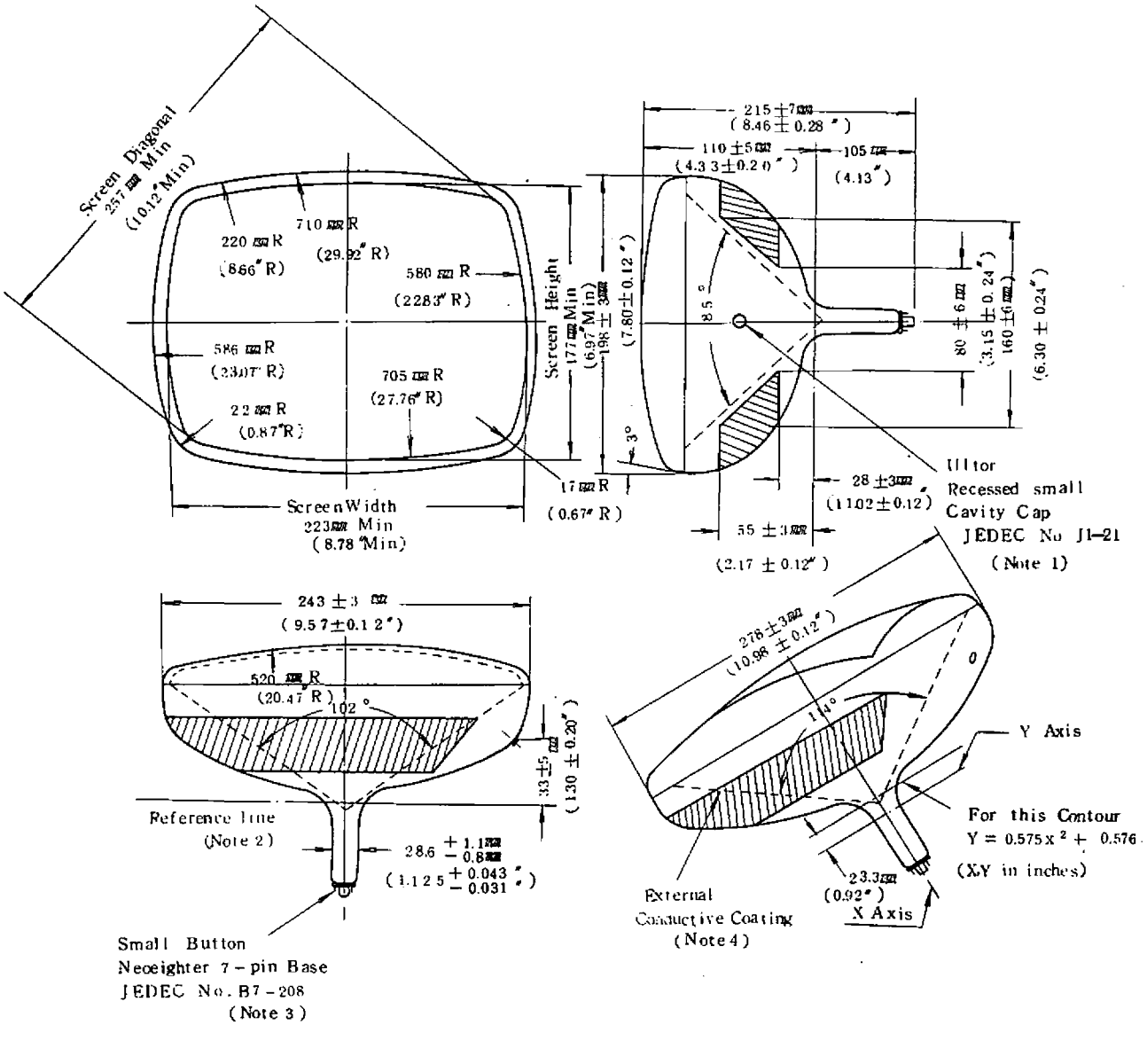
RASTER CUTOFF-RANGE CHARTS





Dimensional Outline

(Dimension in mm & inch)



NOTES FOR DIMENSIONAL OUTLINE

Notes:

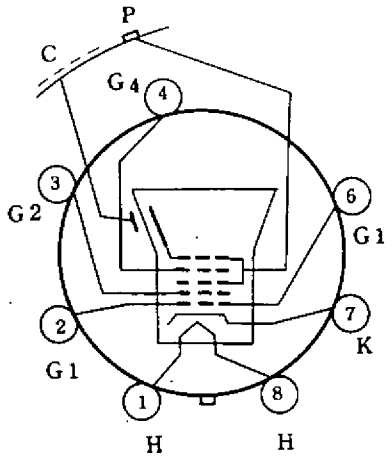
1. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance of ± 30 degree. Ultor terminal is on the same side as Pin No. 4.

2. With tube neck inserted through flare end of reference-line gauge JEDEC G-126 and with tube seated in gauge, the reference-line is determined by the inter-section of the plane CC' of the gauge with the glass funnel.

3. Socket for this base should not be rigidly mounted it should have flexible leads and be allowed to move freely.

4. External conductive coating must be grounded.

SOCKET CONNECTION BOTTOM VIEW (8HR)



Pin 1: Heater
Pin 2: Grid No. 1
Pin 3: Grid No. 2
Pin 4: Grid No. 4
Pin 6: Grid No. 1
Pin 7: Heater
P : Ultor
C : External conductive coating

All inquiries as to the data should be addressed to Tokyo Shibaura Electric Co., Ltd. Tube and Semiconductor Division, 12, 1-Chome, Yuraku-Cho, Chiyoda-Ku, Hibiya Mitsui Building, Tokyo, Japan.

from JEDEC release #4609,
Feb. 24, 1964

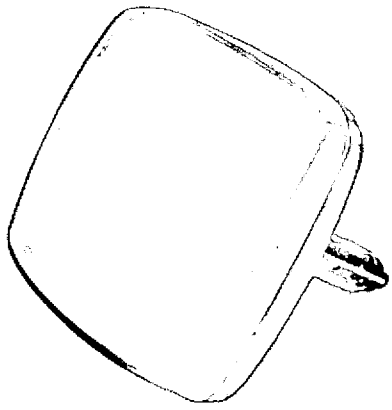
Toshiba

TOSHIBA ELECTRON TUBE 11FP4

PICTURE TUBE

Rectangular Glass Type — Aluminized Screen
Low - Voltage Electrostatic focus — Magnetic Deflection

Toshiba 11FP4 is a 11 inch, directly viewed, rectangular, glass picture tube of the low voltage electro-static focus and 114° magnetic deflection type.
The 11FP4 employs short neck, no ion trap gun featuring good focus over entire picture area.
11FP4 has a aluminized screen and it maximum overall length is only 215 mm or 8.5 inch thus very suitable for portable T. V. Set.



GENERAL DATA

Electrical :

Heater voltage	6.3	V
Heater current at 6.3 Volts	450±22	mA
Heater warm up time	11	second
Direct interelectrode capacitance		
Grid No. 1 to all other electrodes	6	PF
Cathode to all other electrodes	5	PF
External conductive coating to ultor	500 max. 300 min.	PF PF
Focusing method	Electrostatic	
Deflection method	Magnetic	

Deflection angles (approx)

Diagonal	114	deg
Horizontal	102	deg
Vertical	85	deg

Electron gun ..... Type requiring no ion-trap magnet

Optical :

Face plate ..... Filter glass

Light transmission at center (approx) 75%

Phosphor P4-Aluminized

Fluorescence ..... White

Phosphorescence ..... White

Persistence ..... Medium short

Mechanical :

Tube dimensions

Overall length	215±7mm	(8.46±0.28 inches)
Greatest width	243±3mm	(9.57±0.18 inches)
Greatest height	198±3mm	(7.80±0.18 inches)
Diagonal	278±3mm	(10.95±0.18 inches)
Neck length	105±5mm	(4.12±0.12 inches)

Screen dimension (minimum)

Greatest width	223 min mm	(8.78 min inches)
Greatest height	177 min mm	(6.97 min inches)
Diagonal	257 min mm	(10.12 min inches)
Projected area	38000 mm^2	(59 sq. inches)

Weight (approx) ..... 1.6 kg (3.5 Lbs)

Operating position ..... any

Cap ..... Recessed small cavity (JEDEC No. J1-21)

Base ..... Small-Button Neoeighter 7-pin (JEDEC B7-208)

Basing designation 8HR

GRID-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, Design - Maximum values:

Ultor voltage	14000	max.	Volts
	8000	min.	Volts
Grid No. 4 (focusing) voltage;			
Positive value	1100	max.	Volts
Negative value	550	max.	Volts
Grid No. 2 voltage	550	max.	Volts
	300	min.	Volts
Grid No. 1 voltage;			
Negative-peak value	220	max.	Volts
Negative-bias value	154	min.	Volts
Positive-bias value	0	max.	Volts
Positive-peak value	2	max.	Volts
Heater voltage	6.9	max.	Volts
	5.7	min.	Volts
Peak heater-cathode voltage;			
Heater negative with respect to cathode			
During equipment warm-up period not exceeding 15 second	450	max.	Volts
After equipment warm-up period	200	max.	Volts
Heater positive with respect to cathode ..	200.	max.	Volts

Equipment Design Ranges;

With any ultor voltage① (Ec_5 k) between 8000 and 14000 volts and Grid - No. 2 voltage (Ec_2 k) between 200 and 550 volts.

Grid - No. 4 voltage for focus②	0 to 400	Volts
Grid - No. 1 voltage (Ec_1k) for visual extinction of focused raster	See Raster - Cutoff - Range Chart for Grid - Drive Service	
Grid - No. 4 current	-25 to +25	μA
Grid - No. 2 current	-15 to +15	μA
Field strength of adjustable centering magnet③	0 to 8	gausses

Examples of Use of Design Ranges;

Ultor voltage①	10000	Volts
Grid - No. 2 voltage	400	Volts
Grid - No. 4 voltage for focus②	0 to 400	Volts
Grid - No. 1 voltage for visual extinction of focused raster④	-36 to -94	Volts

Maximum Circuit Values:

Grid - No. 1 circuit resistance	1.5 max.	megohms

CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid - No. 1

Maximum and Minimum Ratings, Design - Maximum values:

Ultor to Grid - No. 1 voltage	14000 max.	Volts
	8000 min.	Volts

Grid - No. 4 to Grid - No. 1 (focusing) voltage		
Positive value	1100 max.	Volts
Negative value	550 max.	Volts
Grid - No. 2 to Grid No. 1 voltage	700 max. 350 min.	Volts Volts
Grid - No. 2 to cathode voltage	550 max.	Volts
Cathode to Grid - No. 1 voltage		
Positive - peak value	220 max.	Volts
Positive - bias value	154 max.	Volts
Negative - bias value	0 max.	Volts
Negative - peak value	2 max.	Volts
Heater voltage	6.9 max. 5.7 min.	Volts Volts
Peak heater - cathode voltage;		
Heater negative with respect to cathode		
During equipment warm-up period not exceeding 15 second	450 max.	Volts
After equipment warm-up period	200 max.	Volts
Heater positive with respect to cathode	200 max.	Volts

Equipment Design Ranges :

With any ultor to Grid - No. 1 voltage① (Ec_5 g_1) between 8000 and 14000 volts and Grid - No. 2 to Grid - No. 1 voltage (Ec_2 g_1) between 400 and 690 volts

Grid - No. 4 to Grid - No. 1 voltage for focus②	0 to 400	Volts
Cathode to Grid - No. 1 voltage (Ekg_1) for visual extinction of focused raster	See Raster - Cutoff - Range Chart for Cathode - Drive Service	
Grid - No. 4 current	-25 to +25	μA
Grid - No. 2 current	-15 to +15	μA

Field strength of adjustable centering magnet③	0 to 8	gausses

Examples of Use of Design Ranges :

Ultor voltage	10000	Volts
Grid - No. 2 voltage	400	Volts
Grid - No. 4 Grid - No. 1 voltage for focus②	0 to 400	Volts
Cathode to Grid - No. 1 voltage for visual extinction of focused raster	36 to 78	Volts

Maximum Circuit Values :

Grid - No. 1 circuit resistance	1.5 max.	megohms

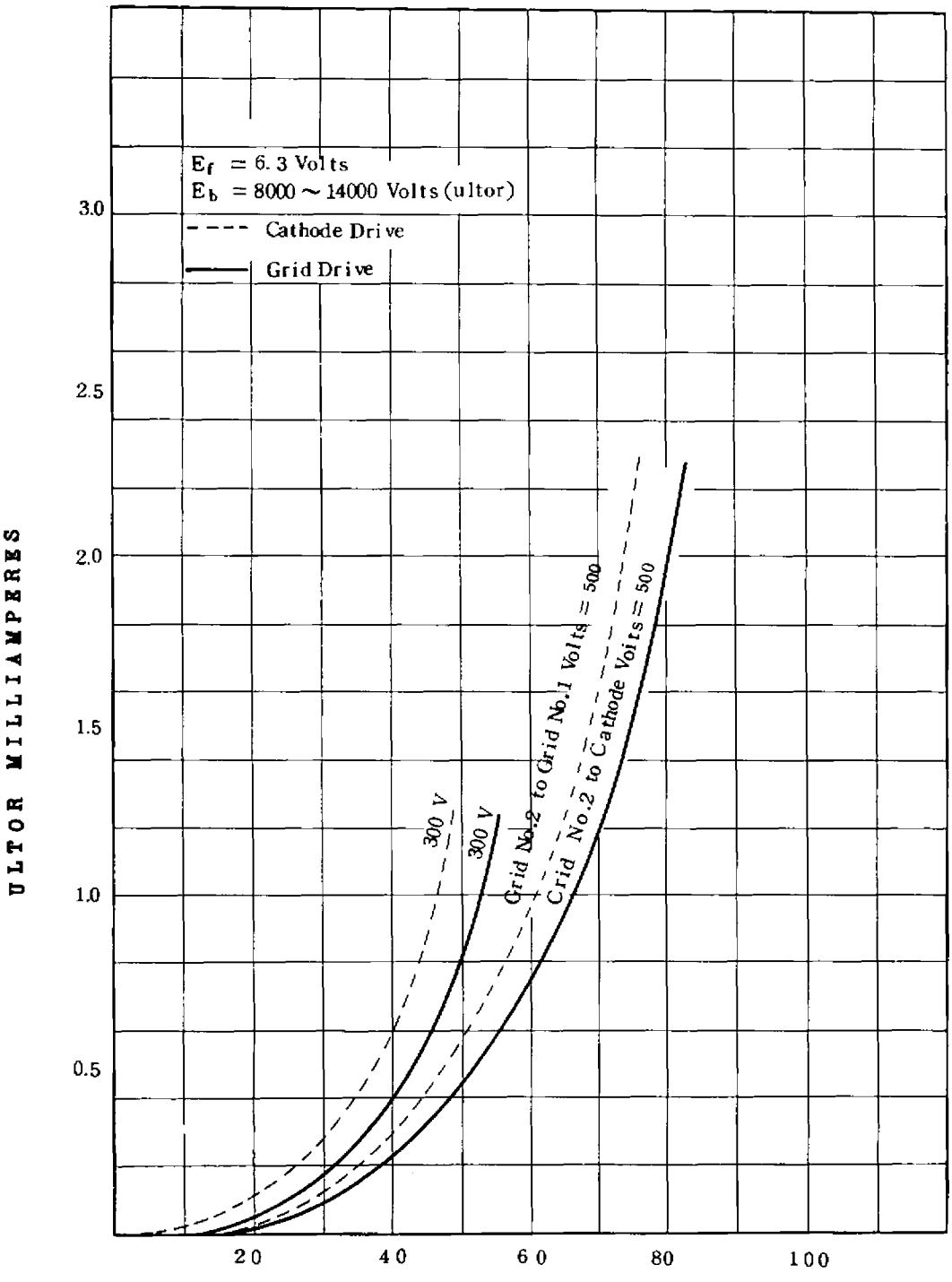
Notes:

1. Brilliance and definition decrease with decreasing voltage of ultor to Grid - No. 1 voltage. In general the ultor voltage or ultor to Grid- No. 1 voltage should not be less than 8000 volts.

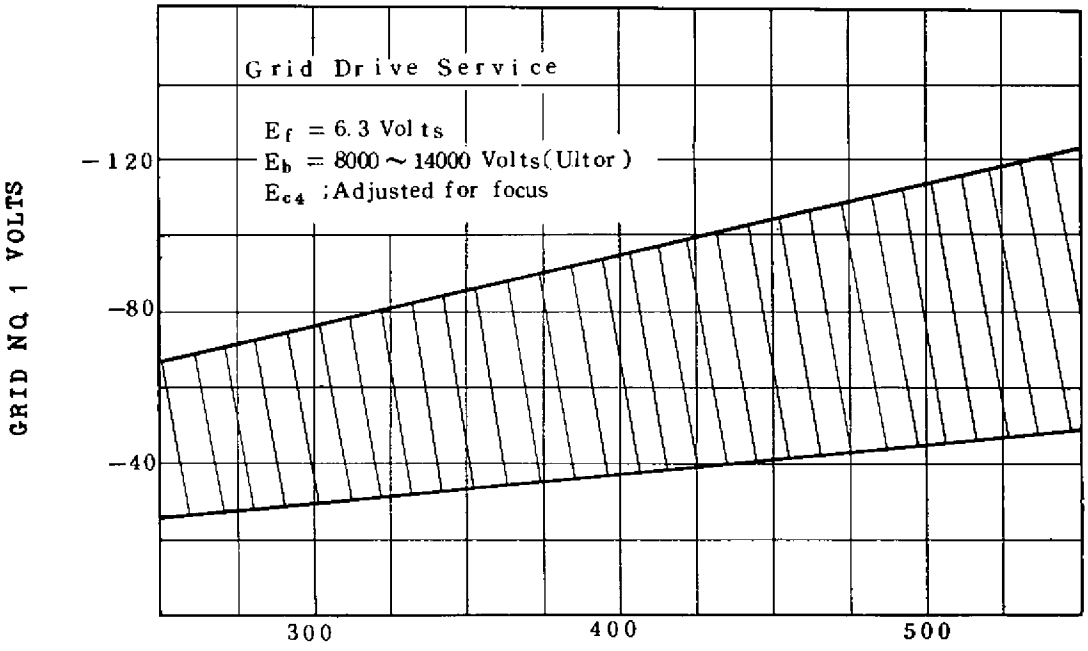
2. Individual tubes will have satisfactory focus at same value of Grid-No. 4 (or Grid - No. 4 to Grid No. 1) voltage between 0 and 400 volts with the combined bias voltage and video - signal voltage adjusted to produce an ultor current of 100 micro amperes.

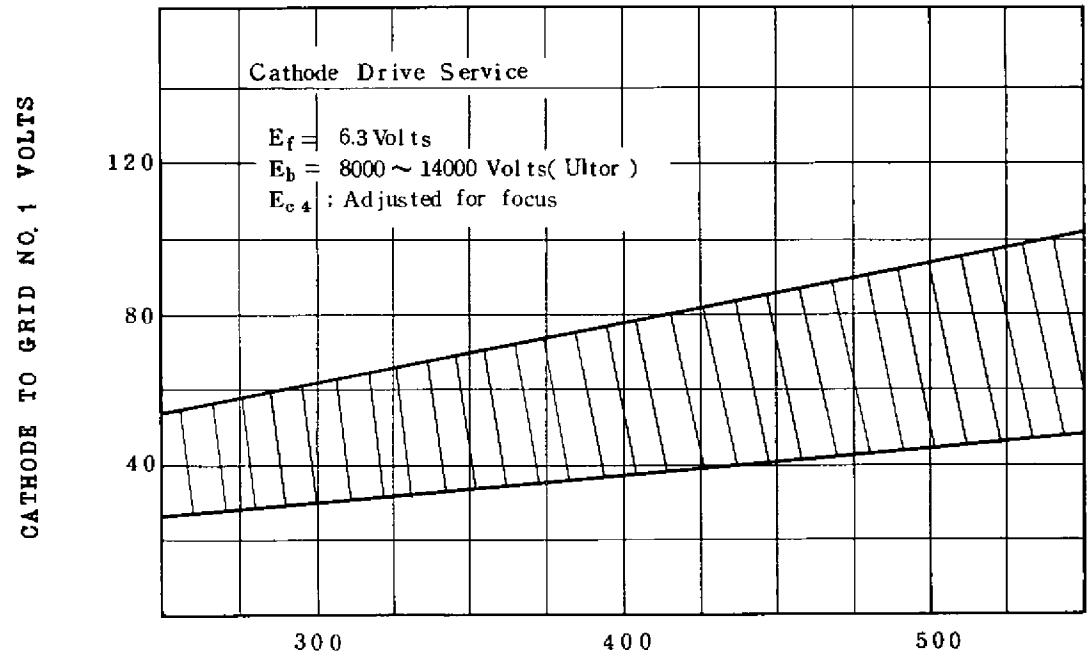
3. Distance from Reference line for suitable P. M. centering magnet should not exceed 2-1/8. Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 5/16 inch radius concentric with the center of the tube face. It is to be noted that the earths magnetic field can cause as much as 7/16 inch deflection of the spot from the center of the tube face.

AVERAGE DRIVE CHARACTERISTICS



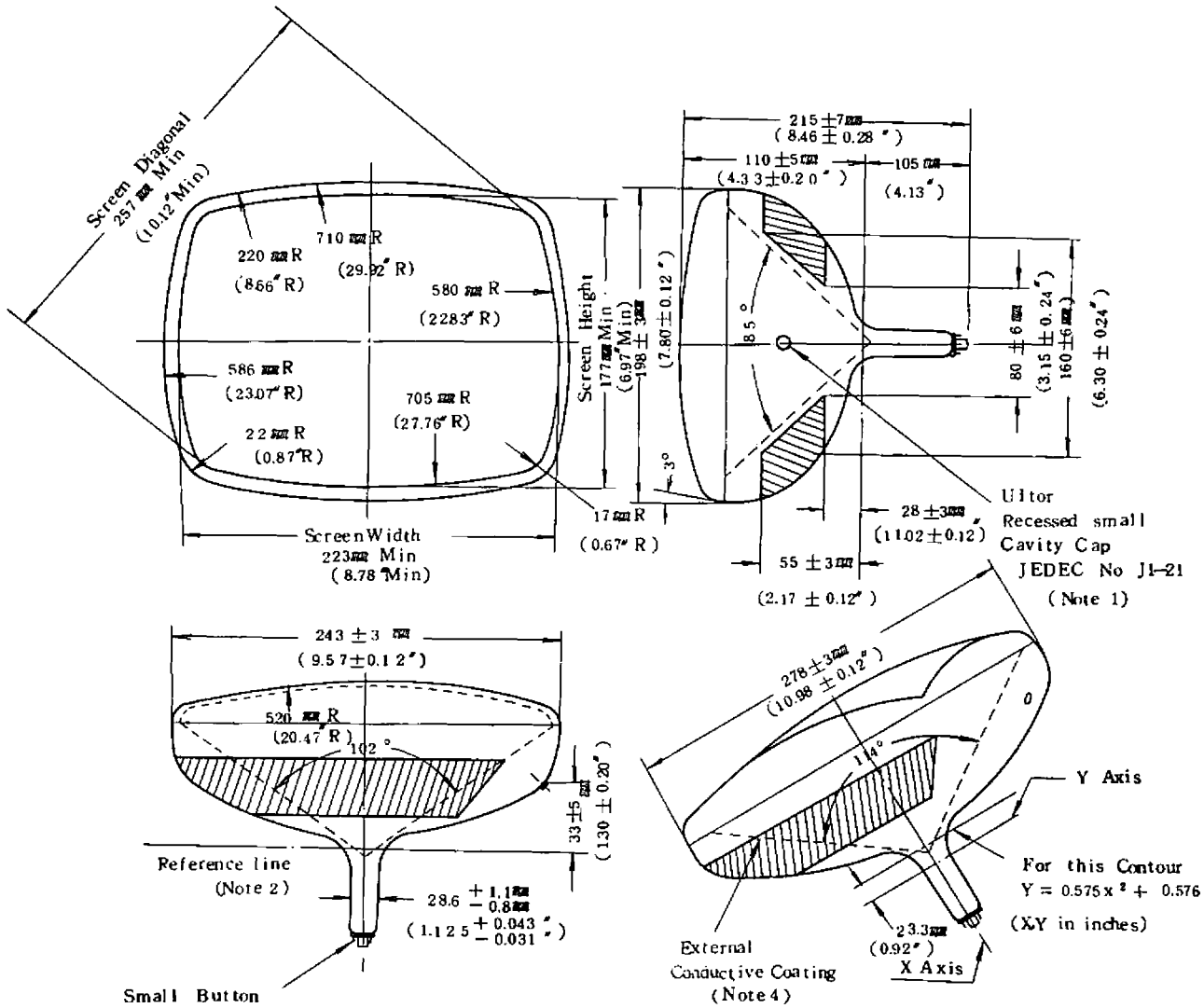
RASTER CUTOFF-RANGE CHARTS





Dimensional Outline

(Dimension in mm & inch)



NOTES FOR DIMENSIONAL OUTLINE

Notes:

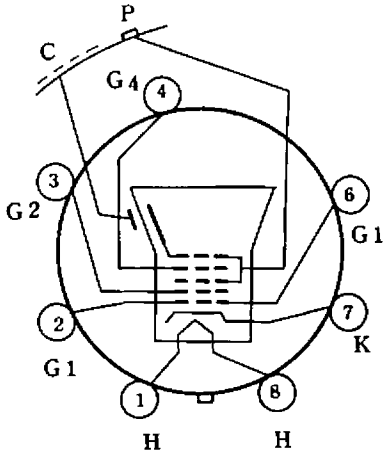
1. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance of ± 30 degree. Ultor terminal is on the same side as Pin No. 4.

2. With tube neck inserted through flare end of reference-line gauge JEDEC G-126 and with tube seated in gauge, the reference-line is determined by the inter-section of the plane CC' of the gauge with the glass funnel.

3. Socket for this base should not be rigidly mounted it should have flexible leads and be allowed to move freely.

4. External conductive coating must be grounded.

SOCKET CONNECTION BOTTOM VIEW (8HR)



Pin 1: Heater
Pin 2: Grid No. 1
Pin 3: Grid No. 2
Pin 4: Grid No. 4
Pin 6: Grid No. 1
Pin 7: Heater
P : Ultor
C : External conductive coating

All inquiries as to the data should be addressed to Tokyo Shibaura Electric Co., Ltd. Tube and Semiconductor Division, 12, 1-Chome, Yuraku-Cho, Chiyoda-Ku, Hibiya Mitsui Building, Tokyo, Japan.

11HP4

CATHODE RAY TUBE

11 INCH, RECTANGULAR, GLASS

FOCUS -- ELECTROSTATIC

DEFLECTION -- MAGNETIC

110 DEGREE DEFLECTION

FACEPLATE -- SPHERICAL GRAY

TENSION BAND IMPLOSION PROTECTION

ALUMINIZED SCREEN

EXTERNAL CONDUCTIVE COATING

----------DESCRIPTION AND RATING----------

The 11HP4 is an 11-inch electrostatic-focus and magnetic deflection glass lightweight picture tube employing tension banded type implosion protection. Other outstanding features include a short overall 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 ± 23 ma.
Heater Warm-up Time	11 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center (approximate)	52 Percent

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC

Syracuse, N. Y.

from JEDEC release #4874, Dec. 7, 1964

MECHANICAL DATA

Overall Length	8 15/16 ± 1/4 inches
Greatest Dimensions of Tube	
Diagonal	10.950 ± .125 inches
Width	9.825 ± .125 inches
Height	7.985 ± .100 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, Note 2)	0 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.

11HP4

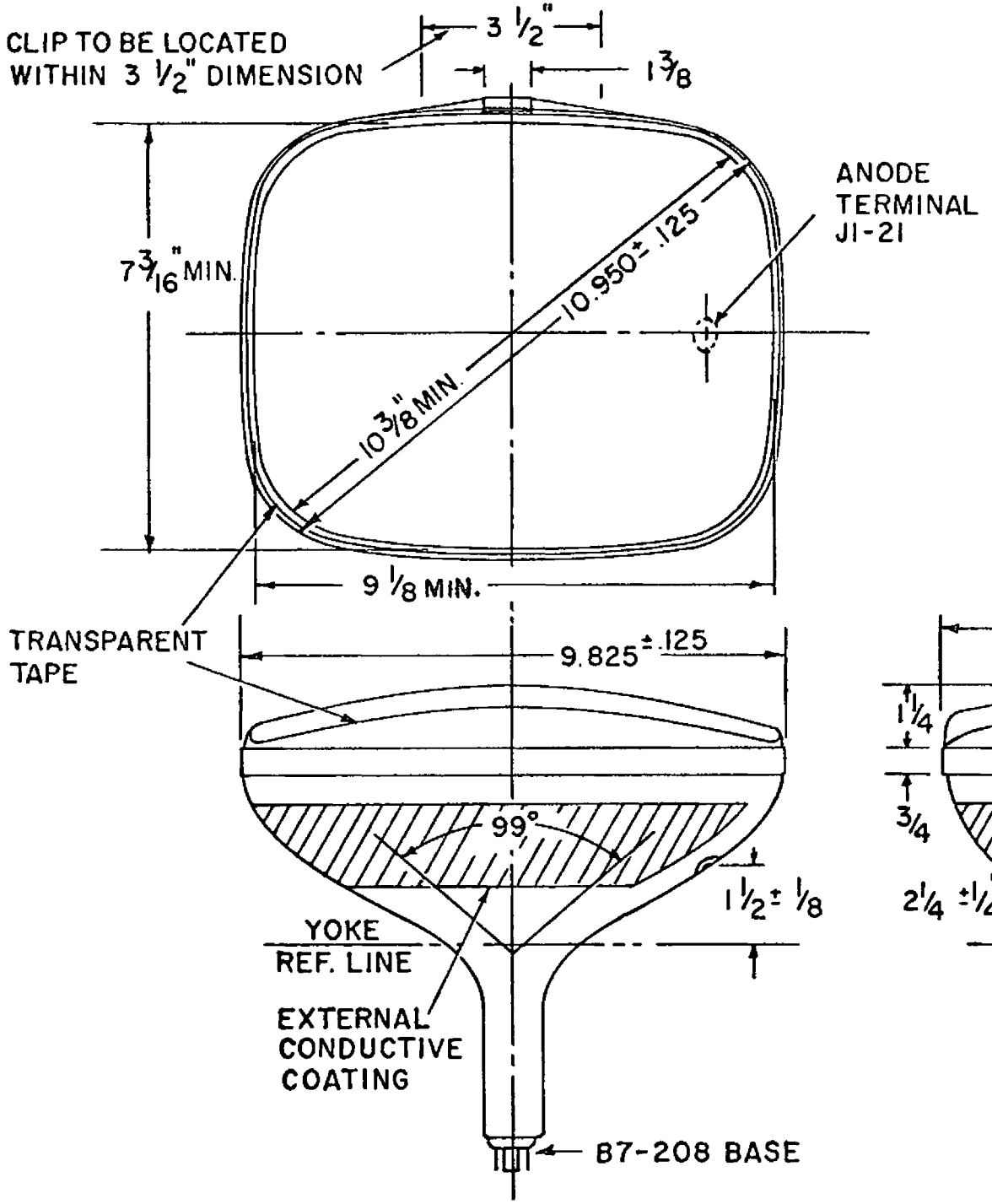
MINIMUM SCREEN DIMENSIONS

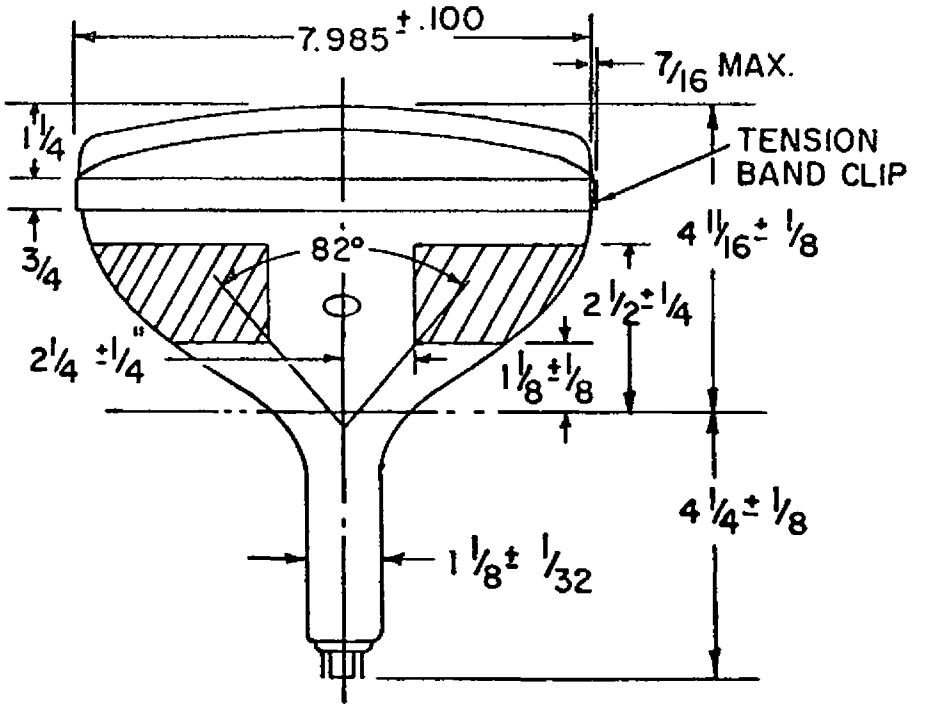
DIAGONAL — 10 1/4 IN.

WIDTH — 9 IN.

HEIGHT — 7 1/16 IN.

AREA — 60 SQ. IN.





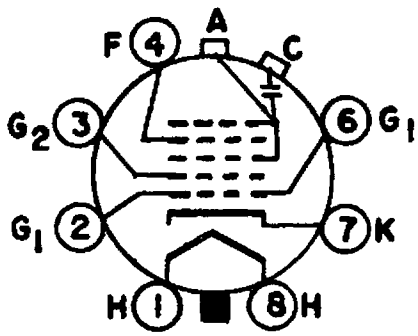
OUTLINE NOTES

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 ±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.

JOINT ELECTRON DEVICE ENGINEERING COUNCIL

JEDEC Type Administration Section
Electronic Industries Association
32 Green Street
Newark 2, New Jersey

E. I. A.
REGISTRATION
FILE

Announcement

of

Electron Device Type Registration

Release No. 4808

September 28, 1964

The Joint Electron Device Engineering Council announces the registration of the following electron device designations

11JP4 *

11MP4 **

on the application of

Sylvania Electric Products, Inc.
Ottawa, Ohio

* Type 11JP4 is similar to Type 11GP4 as registered in Release No. 4511, dated December 2, 1963, except for the following:

Heater Current at 6.3 volts	300 ± 15	Ma
Heater Warm-up Time	14	Seconds
Maximum Grid No. 2 Voltage	70	Volts
Minimum Grid No. 2 Voltage	40	Volts
Typical Operation (Cathode Drive Service)		
Grid No. 2 Voltage	50	Volts DC
Cathode Voltage		
(For visual extinction of focused raster)	27 to 45	Volts DC

** Type 11MP4 is similar to Type 11GP4 as registered in Release No. 4511, dated December 2, 1963, except for the following:

Heater Current at 6.3 volts	300 ± 15	Ma
Heater Warm-up Time	14	Seconds

National Video Corporation
4300 W. 47TH STREET CHICAGO 32, ILLINOIS
CLIFFSIDE 4-5600

The 12BGP4 is a 12"-110° cathode ray tube with filled rim and the anode contact J1-21 located on the long side of the bulb. This tube has a 4 3/8" neck length. A straight gun which requires no ion trap. A 450 milliampere 6.3 volt filament and 50 volt G2 for cathode drive design.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angles (Approximate)	
Diagonal	110 degrees
Horizontal	99 degrees
Vertical	80 degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approx.)	5 uuf
Grid No. 1 to all other electrodes (approx.)	6 uuf
External conductive coating to anode (Note 1)	850 max. uuf
	550 min. uuf
Resistance Between External Conductive Coating and Implosion Protection Hardware	50 min. megohms
Heater Current at 6.3 Volts	450 ± 20 ma
Heater Warm-up Time	11 seconds

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center (Approximate)	52 per cent
Antireflection Treatment	None

MECHANICAL DATA

Overall Length	9 5/16 ±1/4 inches
Neck Length	4 3/8 ±1/8 inches
Greatest Dimensions of Tube (Metal Rim)	
Diagonal	13 47/64 ±1/16 inches
Width	11 13/32 ±1/16 inches
Height	9 3/64 ±1/16 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	11 5/8 inches
Horizontal Axis	10 1/8 inches
Vertical Axis	7 5/8 inches
Area	74 sq. inches

from JEDEC release #4822, Oct. 5, 1964

Implosion Protection		Filled Rim
Bulb	JEDEC Designation	J-99-A1
Bulb Contact	JEDEC Designation	J1-21
Base	JEDEC Designation	B7-208
Basing	JEDEC Designation	8HR

Bulb Contact Alignment

J1-21 contact aligns with Pin Position No. 2 ± 30°.

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to Grid #1.

Maximum Anode Voltage	15,000 volts
Minimum Anode Voltage	8,000 volts
Maximum Grid No. 4 (Focusing Electrode) Voltage	+1,100 -500 volts
Maximum Grid No. 2 Voltage	60 volts
Minimum Grid No. 2 Voltage	25 volts
Cathode Voltage	
Maximum negative value	0 volts dc
Maximum negative peak value	2 volts
Maximum positive value	100 volts dc
Maximum positive peak value	150 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.8 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 seconds	400 volts
After equipment warm-up period	200 volts
Heater positive with respect to cathode	200 volts

TYPICAL OPERATING CONDITIONS

CATHODE DRIVE SERVICE

Unless otherwise specified, all voltage values are positive with respect to Grid No. 1

Anode Voltage	12,000 volts dc
Grid No. 4 Voltage (Focusing Electrode) (Notes 3 and 4)	250 volts dc
Grid No. 2 Voltage	50 volts dc
Cathode Voltage (Note 2)	35 to 55 volts dc

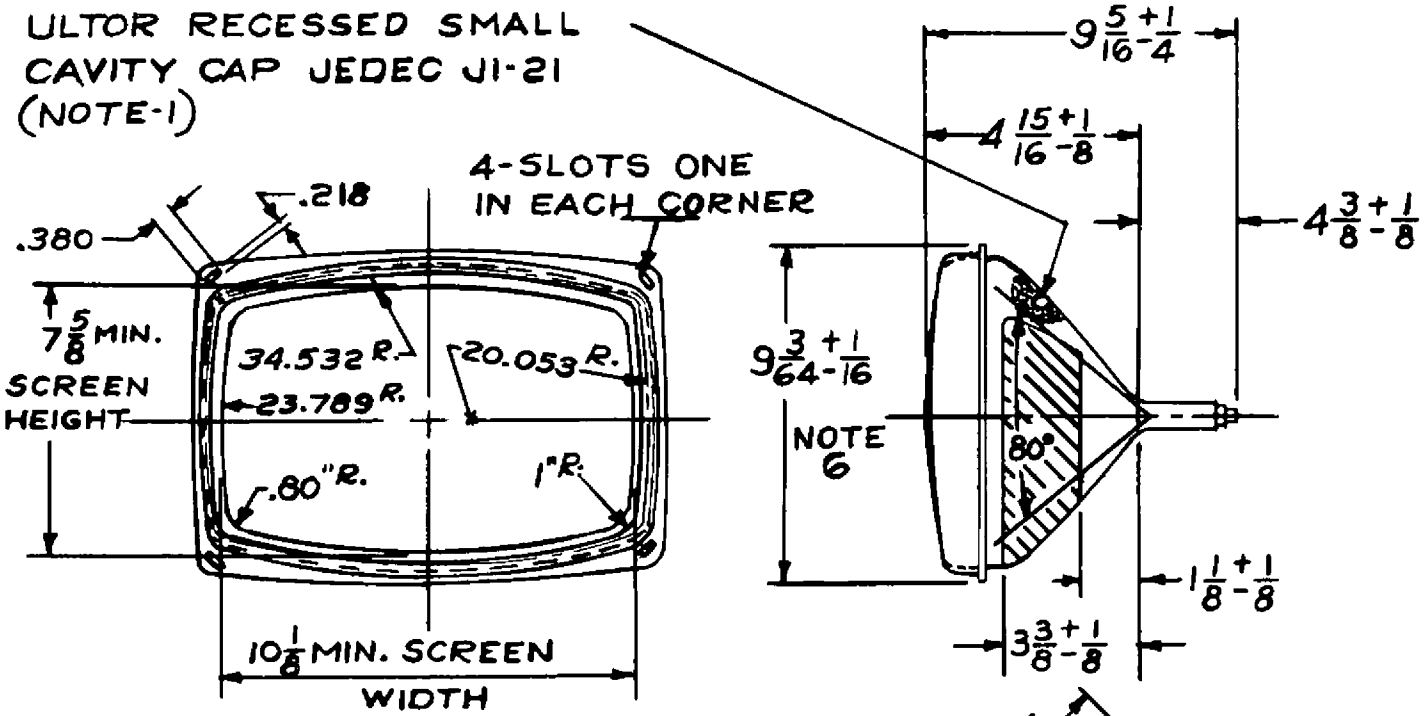
MAXIMUM CIRCUIT VALUES

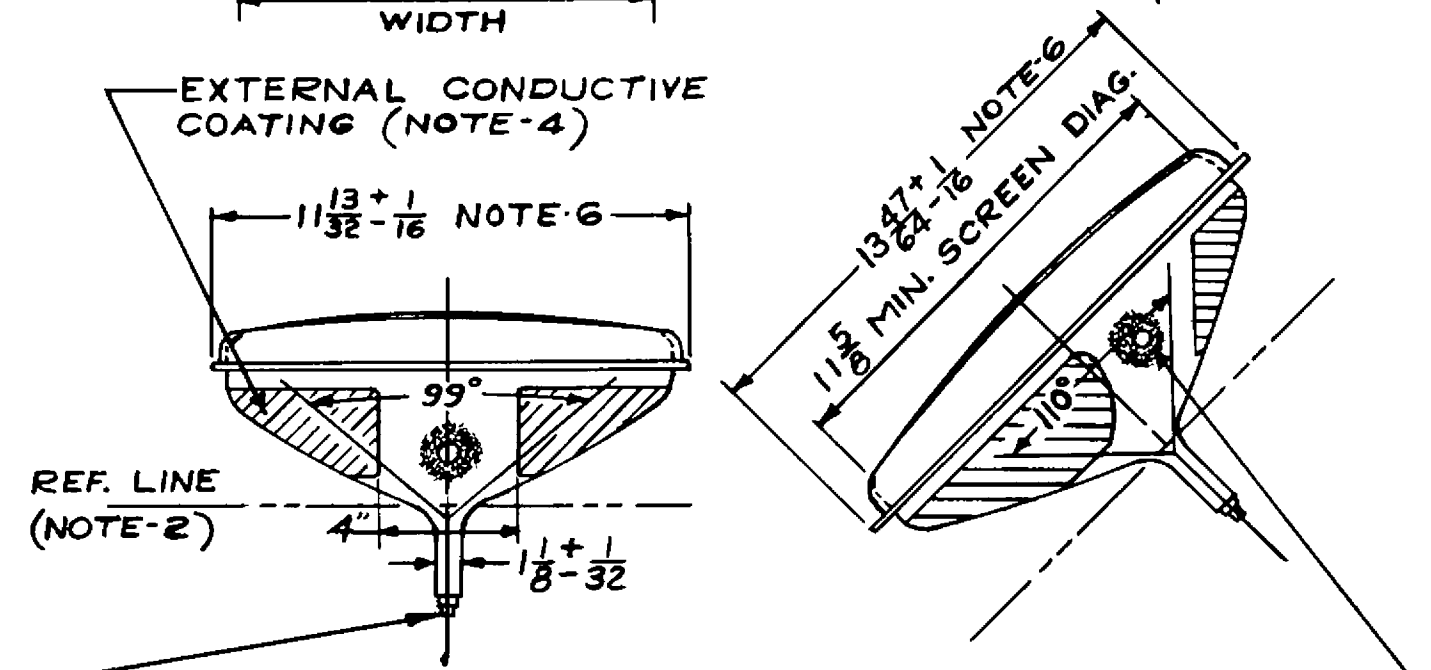
Maximum Grid No. 1 Circuit Resistance	1.5 megohms

GRAPHS AND DRAWINGS

Tube Outline with Essential Dimensions and Tolerances

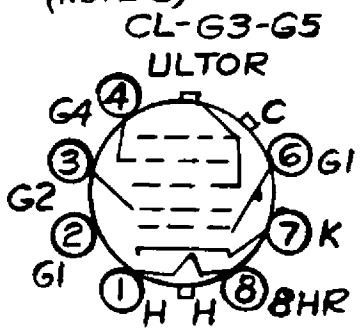
ULTOR RECESSED SMALL CAVITY CAP JEDEC J1-21 (NOTE-1)





SMALL BUTTON NEOEIGHTAR 7 PIN BASE ARRANGEMENT 1 JEDEC B7 208 (NOTE 3)

TRANSPARENT INSULATING COATING (NOTE-5)



PIN 1: HEATER
PIN 2: GRID NO.1
PIN 3: GRID NO.2
PIN 4: GRID NO.4
PIN 6: GRID NO.1
PIN 7: CATHODE
PIN 8: HEATER
CAP: ULTOR CL-G3-G5
C: EXTERNAL CONDUCTIVE COATING

DRAWN BY	SCALE	EFFECTIVE	DISTRIBUTION	DRG. NO.
R. ZIEMBA	~~~	8-28-64		12BGP4

GRAPHS AND DRAWINGS (CONT.)

Pin Connections:

Pin 1	Heater	Pin 6	Grid #1
Pin 2	Grid #1	Pin 7	Cathode
Pin 3	Grid #2	Pin 8	Heater
Pin 4	Grid #4		

NOTES

1. Measured with implosion protection hardware connected to external coating.

2. Visual extinction of focused raster.

3. With the combined Grid No. 1 bias Voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 10 1/8" by 7 5/8" pattern from RCA 2F21 monoscope or equivalent.

4. Individual tubes will have satisfactory focus at some value between 0 and +400 volts.

NOTES FOR DIMENSIONAL OUTLINE

1. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance (measured about the tube axis) of $\pm 30^{\circ}$. Ultor terminal is on same side as Pin No. 2.

2. With tube neck inserted through flared end of reference-line gauge JEDEC No. G-126 and with tube seated in gauge, the reference-line is determined by the intersection of the Plane CC' of the gauge with the glass funnel.

3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

4. External conductive coating must be grounded.

5. To clean this area, wipe only with soft dry lint-less cloth.

6. Measured at O.D. of shell.

from JEDEC release #4873, Dec. 7, 1964

12HG7

SHARP-CUTOFF PENTODE

RCA Dark Heater
Frame-Grid Construction

For Video-Output Amplifier Service in Color-TV Receivers

g_m = 32000 μmhos
P_b = 10 watts

RCA-12HG7 is a frame-grid type sharp-cutoff pentode in a T9 envelope utilizing a large-button neonoval 9-pin base. This type is especially useful as a video-output amplifier tube in color-TV receivers.

The 12HG7 incorporates a special large-area plate structure which, in combination with the T9 envelope, provides a dissipation capability of 10 watts. Because of this high dissipation capability, it is possible to eliminate a series plate-circuit dropping resistor and its associated bypass capacitor in new-equipment circuit designs.

The frame-grid construction of the 12HG7 provides an exceptionally high value of transconductance (32000 μmhos). This tube also features a plate current characteristic with controlled knee to provide good linearity at relatively low plate voltage.

The 12HG7 utilizes an RCA Dark Heater to provide long and dependable performance.

GENERAL DATA

Electrical:

Heater Characteristics and Ratings:			
Heater-section arrangement	Series	Parallel	
Voltage (AC or DC)	12.6±1.3	6.3±0.6	volts
Current at bogey voltage	0.260	0.520	amp
Peak heater-cathode voltage:			
Heater negative with respect to cathode	200 max.		volts
Heater positive with respect to cathode	200[a] max.		volts
Direct Interelectrode Capacitances:[b]			
Grid No.1 to plate	0.12 max.		pf
Input: G1 to (K,G3+IS, G2, H)	14.0		pf
Output: P to (K,G3+IS, G2,H)	4.4		pf

Characteristics, Class A_1 Amplifier:

Plate Supply Voltage	300	volts
Grid No.3	Connected to cathode at socket	
Grid-No.2 Supply Voltage	135	volts
Grid No.1	Connected to negative end of cathode resistor	
Cathode Resistor	47	ohms
Plate Resistance (Approx.)	60000	ohms
Transconductance	32000	μmhos
Plate Current	31	ma
Grid-No.2 Current	4.8	ma
Grid-No.1 Voltage (Approx.) for plate μa = 100	-4.5	volts

Mechanical:

Operating Position	Any
Type of Cathode	Coated Unipotential
Maximum Over-all Length	2.930"
Maximum Seated Length	2.620"
Length, Base Seat to Bulb Top (Excluding tip)	2.070" to 2.310"
Diameter	1.062" to 1.188"
Dimensional Outline	JEDEC No.9-70
Bulb	T9
Base	Large-Button Neonoval 9-Pin (JEDEC No.E9-68)

AMPLIFIER – Class A_1

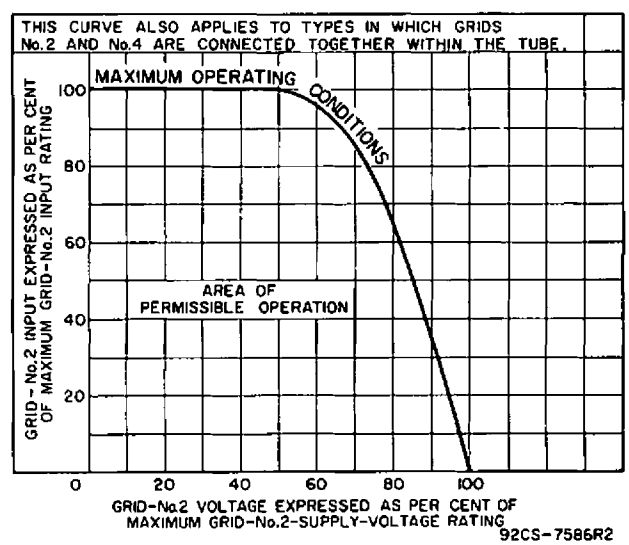
Maximum Ratings, *Design-Maximum Values:*

Plate Voltage	400 max.	volts
Grid-No.2 (Screen-Grid) Supply Voltage	330 max.	volts
Grid-No.2 Voltage	See *GRID-No.2 INPUT RATING CHART*	
Grid-No.1 (Control-Grid) Voltage:		
Positive-bias value	0 max.	volts
Plate Dissipation	10 max.	watts
Grid-No.2 Input:		
For grid-No.2 voltages up to 165 volts	1 max.	watt
For grid-No.2 voltage between 165 and 330 volts.	See *GRID-No.2 INPUT RATING CHART*	

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:		
For fixed-bias operation	0.1 max.	megohm
For cathode-bias operation	0.25 max.	megohm

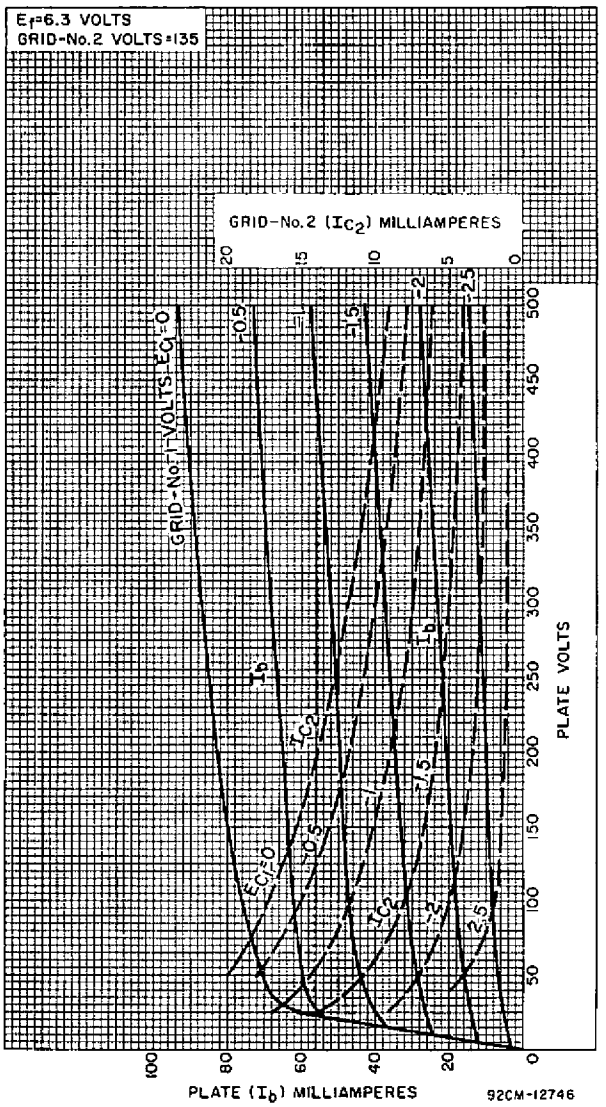
GRID-No.2-INPUT RATING CHART



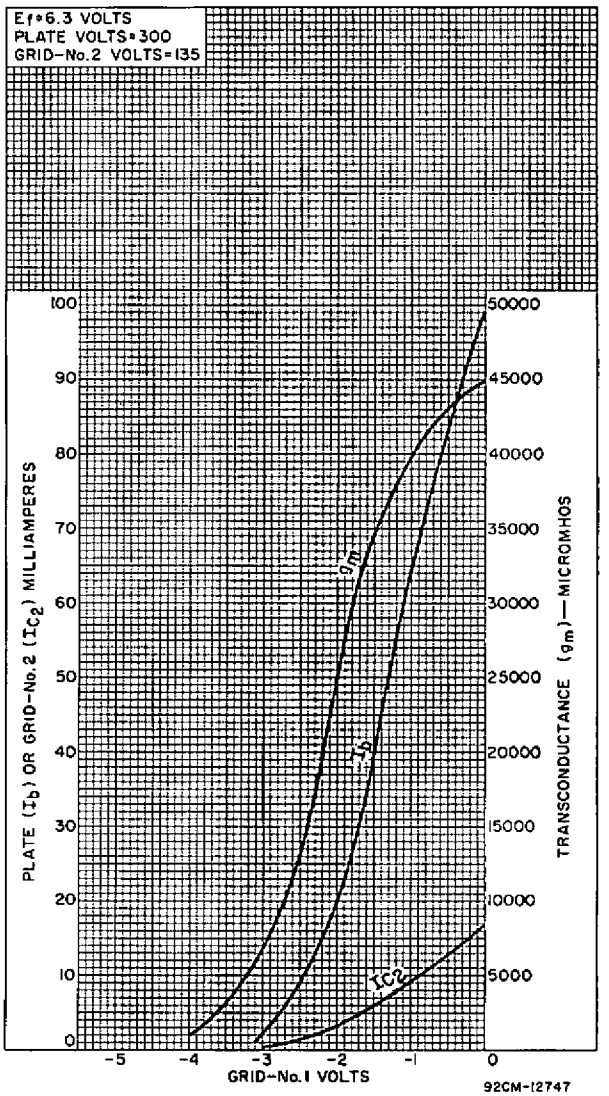
[a] The dc component must not exceed 100 volts.

[b] Without external shield.

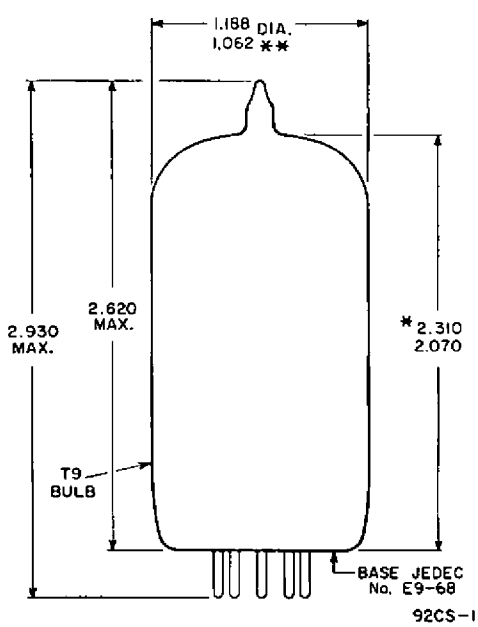
AVERAGE CHARACTERISTICS



AVERAGE CHARACTERISTICS



DIMENSIONAL OUTLINE JEDEC No.9-70



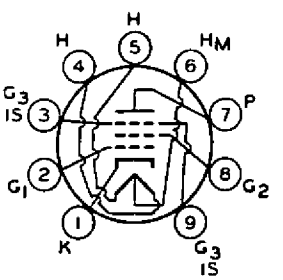
Dimensions in Inches

* MEASURED FROM BASE SEAT TO BULB-TOP LINE AS DETERMINED BY A RING GAUGE OF 0.600" I.D.

** APPLIES IN ZONE STARTING 0.375" FROM BASE SEAT.

TERMINAL DIAGRAM

Bottom View



JEDEC 9BF

Pin 1 - Cathode	Pin 6 - Heater Tap
Pin 2 - Grid No.1	Pin 7 - Plate
Pin 3 - Grid No.3, Internal Shield	Pin 8 - Grid No.2
Pin 4 - Heater	Pin 9 - Grid No.3, Internal Shield
Pin 5 - Heater	

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ELECTRONICS

12JN6-A
COMPACTRON BEAM PENTODE

DESCRIPTION AND RATING

The 12JN6-A 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-A is identical to the 6JN6-A.

The 12JN6-A is unilaterally interchangeable with the 12JN6 and differs in having a lower knee.

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.

from JEDEC release #4885, Dec. 21, 1964

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.

JOINT ELECTRON DEVICE ENGINEERING COUNCILS

JEDEC Electron Tube Council | JEDEC Semiconductor Device Council

EIA Building
2001 Eye Street, N. W.
Washington, D. C. 20006

Announcement

of

Electron Device Type Registration

Release No. 4674A

May 2, 1966

E. I. A. REGISTRATION FILE

The Joint Electron Device Engineering Council announces the registration of the following electron device designation

12JS6

on the application of

Tung-Sol Electric, Inc.
Bloomfield, New Jersey

Type 12JS6 is similar to Type 6JS6 as registered in Release No. 4674 dated April 20, 1964, except for the following:

Heater characteristics and ratings:

Heater voltage 12.6 ± 0.6 volts

Heater current @ E_f = 12.6 volts, 12.125 Amps.

National Video Corporation
4300 W. 47TH STREET CHICAGO 32, ILLINOIS
CLIFFSIDE 4-5600

The 13AP4 is a 13"-110° cathode ray tube with filled rim and a 4 1/4" neck length. This tube has a straight gun which requires no ion trap, a 450 milliampere 6.3 volt filament and 50 volt G2 for cathode drive design.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angles (Approximate)	
Diagonal	110 degrees
Horizontal	100 degrees
Vertical	82 degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approx.)	5 uuf
Grid No. 1 to all other electrodes (approx.)	6 uuf
External conductive coating to anode (Note 1)	800 max. uuf
	550 min. uuf
Resistance Between External Conductive Coating and Implosion Protection Hardware	50 min. megohms
Heater Current at 6.3 volts	450 ±20 ma
Heater Warm-up Time	11 seconds

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center (Approximate)	52 per cent
Antireflection Treatment	None

MECHANICAL DATA

Overall Length	9 17/64 ±1/4 inches
Neck Length	4 1/4 ±1/8 inches
Greatest Dimensions of Tube (Metal Rim)	
Diagonal	14 3/8 ±1/16 inches
Width	11 13/16 ±1/16 inches
Height	9 7/16 ±1/16 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	11 15/16 inches
Horizontal Axis	10 1/2 inches
Vertical Axis	8 inches
Area	79 sq. inches

from JEDEC release #4822, Oct. 5, 1964

Implosion Protection (Note 3 of instructions)		Filled Rim
Bulb	JEDEC Designation	J-101-A1
Bulb Contact	JEDEC Designation	J1-21
Base	JEDEC Designation	B7-208
Basing	JEDEC Designation	8HR

Bulb Contact Alignment

J1-21 contact aligns with Pin Position No. 4 $\pm 30^{o}$.

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to Grid #1.

Maximum Anode Voltage	15,000 volts
Minimum Anode Voltage	8,000 volts
Maximum Grid No. 4 (Focusing Electrode) Voltage	+1,100 -500 volts
Maximum Grid No. 2 Voltage	60 volts
Minimum Grid No. 2 Voltage	25 volts
Cathode Voltage	
Maximum negative value	0 volts dc
Maximum negative peak value	2 volts
Maximum positive value	100 volts dc
Maximum positive peak value	150 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.8 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 seconds	450 volts
After equipment warm-up period	200 volts
Heater positive with respect to cathode	200 volts

TYPICAL OPERATING CONDITIONS

CATHODE DRIVE SERVICE

Unless otherwise specified, all voltage values are positive with respect to Grid No. 1.

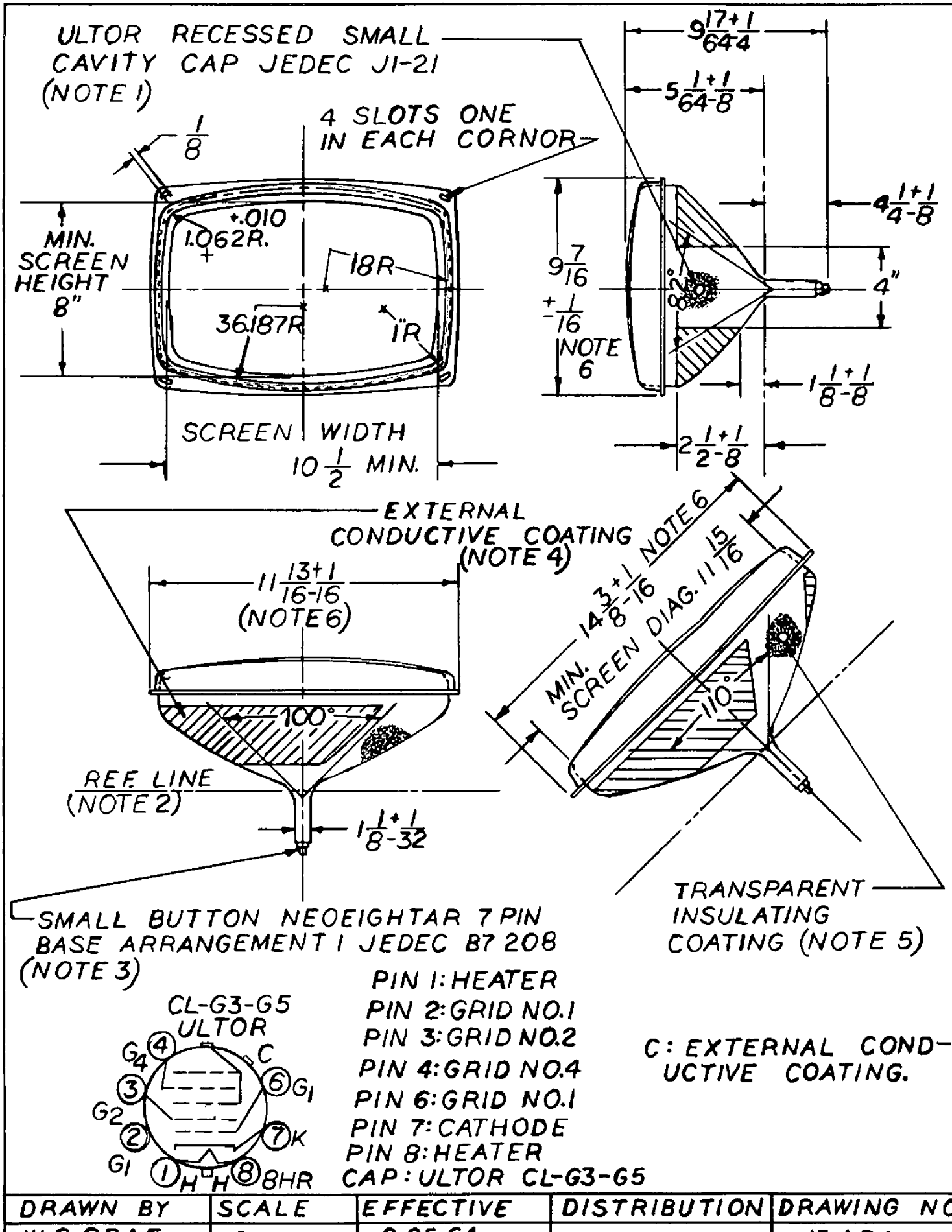
Anode Voltage	12,000 volts dc
Grid No. 4 Voltage (Focusing Electrode) (Note 3 and 4)	250 volts dc
Grid No. 2 Voltage	50 volts dc
Cathode Voltage (Note 2)	35 to 55 volts dc

MAXIMUM CIRCUIT VALUES

Maximum Grid No. 1 Circuit Resistance	1.5 megohms

GRAPHS AND DRAWINGS

Tube Outline with Essential Dimensions and Tolerances



DRAWN BY	SCALE	EFFECTIVE	DISTRIBUTION	DRAWING NO.
W.C.GRAF	C→	8-25-64		13AP4

GRAPHS AND DRAWINGS (Cont.)

Pin Connections:

Pin 1	Heater	Pin 6	Grid #1
Pin 2	Grid #1	Pin 7	Cathode
Pin 3	Grid #2	Pin 8	Heater
Pin 4	Grid #4		

NOTES

1. Measured with implosion protection hardware connected to external coating.

2. Visual extinction of focused raster.

3. With the combined Grid No. 4 bias voltage and video signal voltage adjusted to give an anode current of 100 microamperes on a 10 1/2" by 8" pattern from RCA 2F21 monoscope or equivalent.

4. Individual tubes will have satisfactory focus at some value between 0 and +400 volts.

NOTES FOR DIMENSIONAL OUTLINE

1. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance (measured about the tube axis) of $\pm 30^{\circ}$. Ultor terminal is on same side as Pin No. 4.

2. With tube neck inserted through flared end of reference-line gauge JEDEC No. G-126 and with tube seated in gauge, the reference-line is determined by the intersection of the Plane CC' of the gauge with the glass funnel.

3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

4. External conductive coating must be grounded.

5. To clean this area, wipe only with soft dry lint-less cloth.

6. Measured at O.D. of shell.

JOINT ELECTRON DEVICE ENGINEERING COUNCIL

JEDEC Type Administration Section
Electronic Industries Association
32 Green Street
Newark 2, New Jersey

E. I. A.
REGISTRATION
FILE

Announcement

of

Electron Device Type Registration

Release No. 4814

September 28, 1964

The Joint Electron Device Engineering Council announces the registration of the following electron device designation

14CP4B *

on the application of

Radio Corporation of America
Harrison, New Jersey

* Type 14CP4B is similar to Type 14CP4A as registered in Release No. 1678, dated July 2, 1956, except for the following:

Electron Gun - Does not require ion-trap magnet.

Overall Length - 16 1/2" ± 3/8"

Neck Length - 7 3/16" ± 3/16"

15AB9
TWIN TETRODE TUBE

The 15AB9 is a twin tetrode with a decal base, for using as VHF amplifiers and VHF autodyne mixes.

The 15AB9 is identical with the 17AB9 as registered in JEDEC Release No. 4740 dated June 29, 1964 except for the following:

General Data

Electrical

Heater voltage	15.0 volts
Heater current	150 ma

from JEDEC release #4740A, April 19, 1965

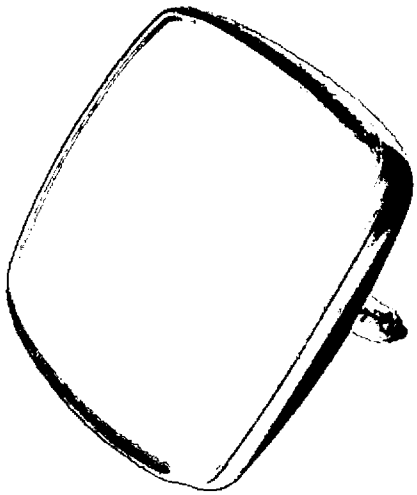
from JEDEC release #4609,
Feb. 24, 1964

Toshiba

TOSHIBA ELECTRON TUBE 16BFP4

PICTURE TUBE

The 16BFP4 is a 16 inch rectangular glass picture tube of the low-voltage electrostatic focus and 114° magnetic deflection type. It employs short neck no ion trap gun featuring good focus over the entire picture area and the position of the anode cap is convenient to design a compact T. V. set. The 16BFP4 utilizes 6.3 volt 450 mili-ampere heater having a controlled warm up time to insure dependable performance in television receivers employing series heater - string arrangement.



GENERAL DATA

ELECTRICAL:

Heater voltage	6.3	Volts
Heater current at 6.3 volts	450 ± 22	mA
Heater warm up time	11	Second
Direct interelectrode capacitance		
Grid No. 1 to all other electrodes	6	μμF
Cathode to all other electrodes	5	μμF
External conductive coating to ultor	1500 Max	μμF
	800 Min	μμF
Focusing method	Electrostatic	
Deflection method	Magnetic	
Deflection angles (Approx)		
Diagonal	114	Degrees
Horizontal	102	Degrees
Vertical	85	Degrees

Electron gun ..... Type requiring no ion-trap magnet.

OPTICAL:

Face plate	Filter glass
Light transmission at center (Approx)	78%
Phosphor	P4 - Aluminized
Fluorescence	White
Phosphorescence	White
Persistence	Medium Short

MECHANICAL:

Tube dimensions		
Over all length	10 1/16 $^{+\ 3/8}_{-\ 1/4}$	inches
Greatest width	13 45/64 ± 1/8	inches
Greatest height	11 3/32 ± 1/8	inches
Diagonal	15 5/8 ± 1/8	inches
Screen dimension (Minimum)		
Greatest width	12 3/4	inches
Greatest height	10 1/16	inches
Diagonal	14 11/16	inches
Projected area	119	Sq.inches
Weight (Approx)	9	Lbs
Operating position	any	
Cap	Recessed small cavity (JEDEC No. J1-21)	
Base	Small-button neoeighter 7-pin (JEDEC B7-208)	
Basing designation	8 HR	

GRID-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

MAXIMUM AND MINIMUM RATINGS, Design - maximum values:

Ultor voltage	15400 max.	Volts
	9000 min.	Volts
Grid - No. 4 (focusing) voltage;		
Positive value	1100 max.	Volts
Negative value	500 max.	Volts
Grid - No. 2 voltage	550 max.	Volts
	200 min.	Volts
Grid - No. 1 voltage;		
Negative - peak value	220 max.	Volts
Negative - bias value	154 max.	Volts
Positive - bias value	0 max.	Volts
Positive - peak value	2 max.	Volts
Heater voltage	6.9 max.	Volts
	5.7 min.	Volts
Peak heater - cathode voltage;		
Heater negative with respect to cathode		
During equipment warm-up period not exceeding 15 second	450 max.	Volts
After equipment warm-up period	200 max.	Volts
Heater positive with respect to cathode	200 max.	Volts

EQUIPMENT DESIGN RANGES:

With any ultor voltage① (E_{c_8} k) between 9000 and 15400 volts and grid-No. 2 voltage (E_{c_2} k) between 200 and 550 Volts.

Grid - No. 4 voltage for focus②	0 to 400	Volts
Grid - No. 1 voltage for visual extinction of focused raster	See Raster - Cutoff - Range Chart for Grid - Drive Service	
Grid - No. 4 current	-25 to + 25	μA
Grid - No. 2 current	-15 to + 15	μA
Field strength of adjustable centering magnet③	0 to 8	gausses

EXAMPLES OF USE OF DESIGN RANGES:

Ultor voltage①	12000	Volts
Grid - No. 2 voltage	400	Volts
Grid - No. 4 voltage for focus②	0 to 400	Volts
Grid - No. 1 voltage for visual extinction of focused raster	-36 to -94	Volts

MAXIMUM CIRCUIT VALUES:

Grid - No. 1 circuit resistance	1.5 max.	megohms

CATHODE-DRIVE SERVICE

Unless otherwise specified voltage values are positive with respect to grid - No. 1

MAXIMUM AND MINIMUM RATINGS, Design - Maximum values:

Ultor to grid - No. 1 voltage	15400 max.	Volts
	9000 min.	Volts
Grid - No. 4 to grid - No. 1 (focusing) voltage;		
Positive value	1250 max.	Volts
Negative value	400 max.	Volts
Grid - No. 2 to grid No. 1 voltage	700 max.	Volts
	350 min.	Volts
Grid - No. 2 to cathode voltage	550 max.	Volts
Cathode to grid - No. 1 voltage ;		
Positive - peak value	220 max.	Volts
Positive - bias value	154 max.	Volts
Negative - bias value	0 max.	Volts
Negative - peak value	2 max.	Volts
Heater voltage	6.9 max.	Volts
	5.7 min.	Volts
Peak heater - cathode voltage;		
Heater negative with respect to cathode		
During equipment warm-up period not exceeding 15 second	450 max.	Volts
After equipment warm-up period	200 max.	Volts
Heater positive with respect to cathode	200 max.	Volts

EQUIPMENT DESIGN RANGES:

With any ultor to grid - No. 1 voltage① (Ec_5 g_1). between 9000 and 15400 volts and grid - No. 2 to grid - No. 1 voltage (Ec_2 g_1) between 350 and 700 volts

Grid - No. 4 to grid - No. 1 voltage for focus	0 to 400	Volts
Cathode to grid - No. 1 voltage (Ekg_1) for visual extinction of focused raster	See Raster - Cutoff - Range Chart for Cathode - Drive Service	
Grid - No. 4 current	-25 to +25	μA
Grid - No. 2 current	-15 to +15	μA
Field strength of adjustable centering magnet③	0 to 8	gausses

EXAMPLES OF USE OF DESIGN RANGES:

Ultor voltage	12000	Volts
Grid - No. 2 voltage	400	Volts
Grid - No. 4 voltage for focus②	0 to 400	Volts
Cathode to grid - No. 1 voltage for visual extinction of focused raster	36 to 78	Volts

MAXIMUM CIRCUIT VALUES:

Grid - No. 1 circuit resistance	1.5 max.	megohms

Notes:

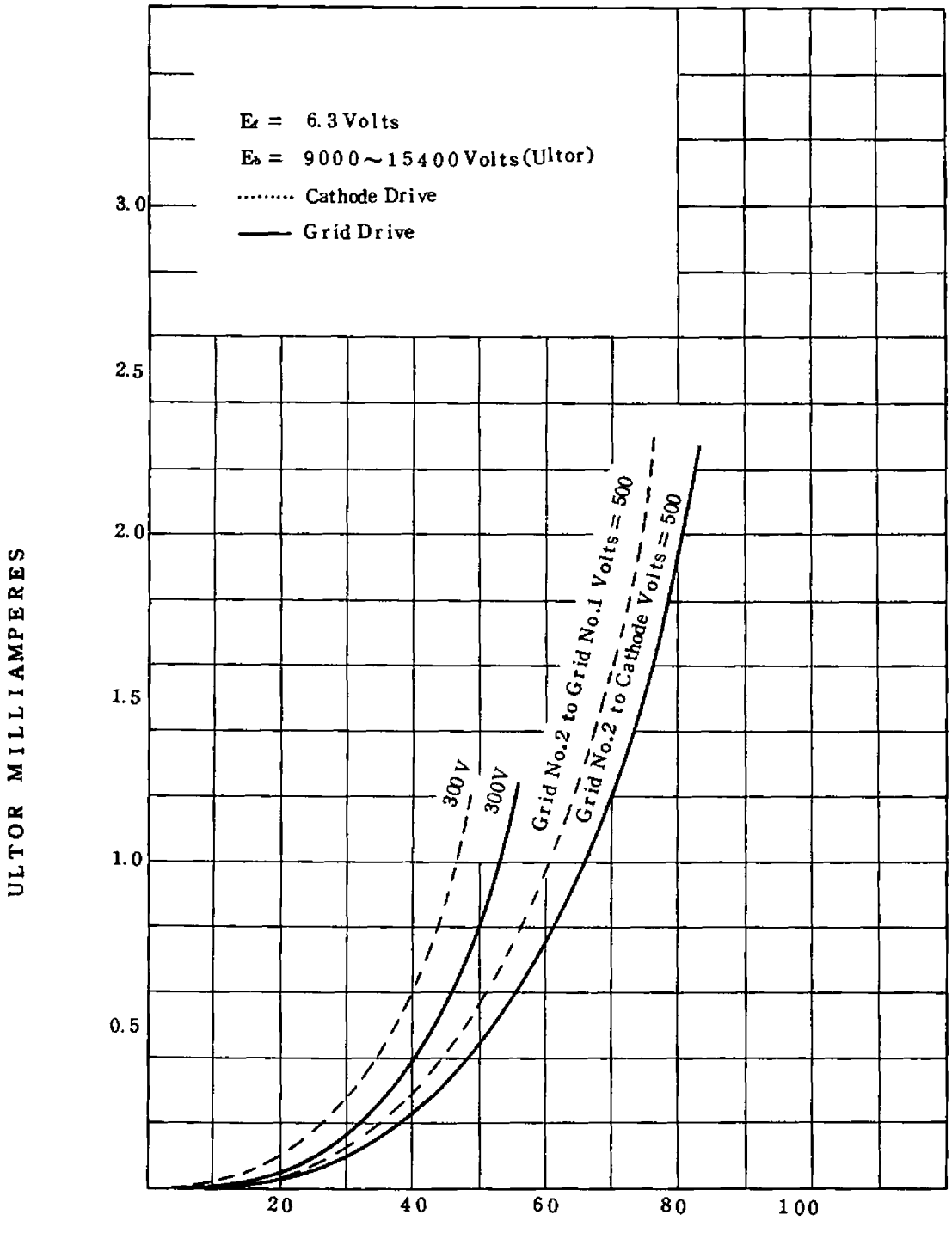
1. Brilliance and definition decrease with decreasing voltage of ultor to grid - No. 1 voltage. In general the ultor voltage or ultor to grid No. 1 voltage should not be less than 10000 volts.
2. Individual tubes will have satisfactory focus at some value of grid - No. 4 (or grid - No. 4 to grid No. 1) voltage between 0 and 400 volts with the combined bias voltage and video - signal voltage adjusted to produce an ultor current of 100 micro amperes.
3. Distance from reference line for suitable P.M. centering magnet should not exceed 2-1/8. Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 3/8 inch radius concentric with the center of the tube face. It is to be noted that the earths magnetic field can cause as much as 1/2 inch deflection of the spot from the center of the tube face.

OPERATING COSIDERATIONS

SHATTER PROOF COVER OVER THE TUBE FACE:

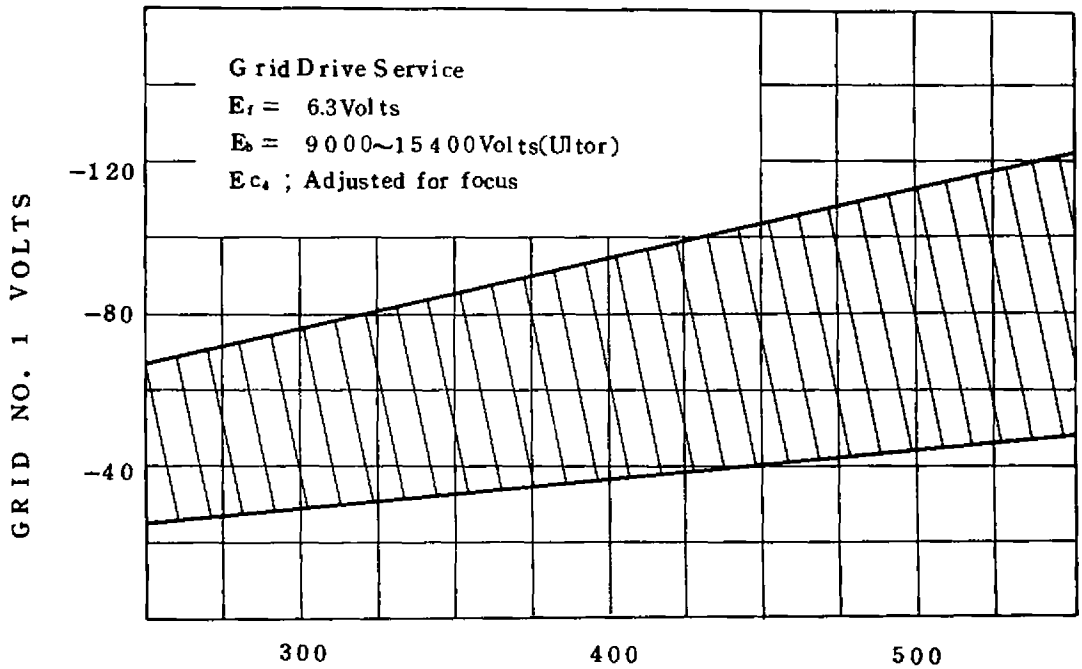
Following conventional picture tube practice, it is recommended that the cabinet be provided with a shatter - proof, glass cover over the face of the 16BFP4 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safty cover can also provide X-ray protection when required.

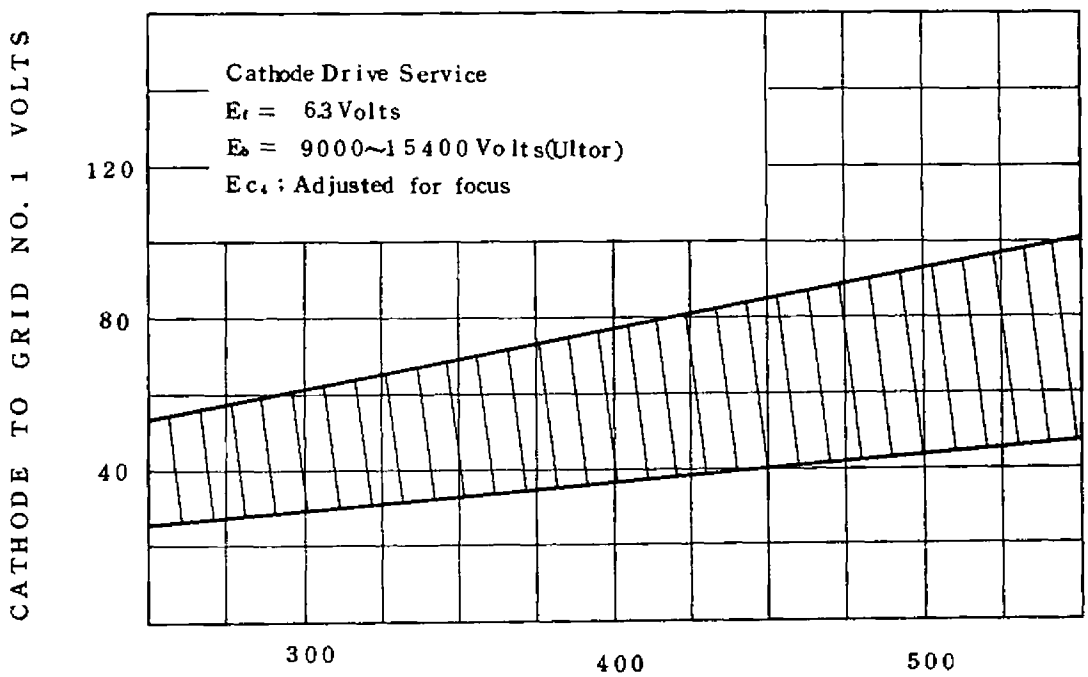
AVERAGE DRIVE CHARACTERISTICS



VIDEO SIGNAL VOLTS FROM RASTER CUTOFF

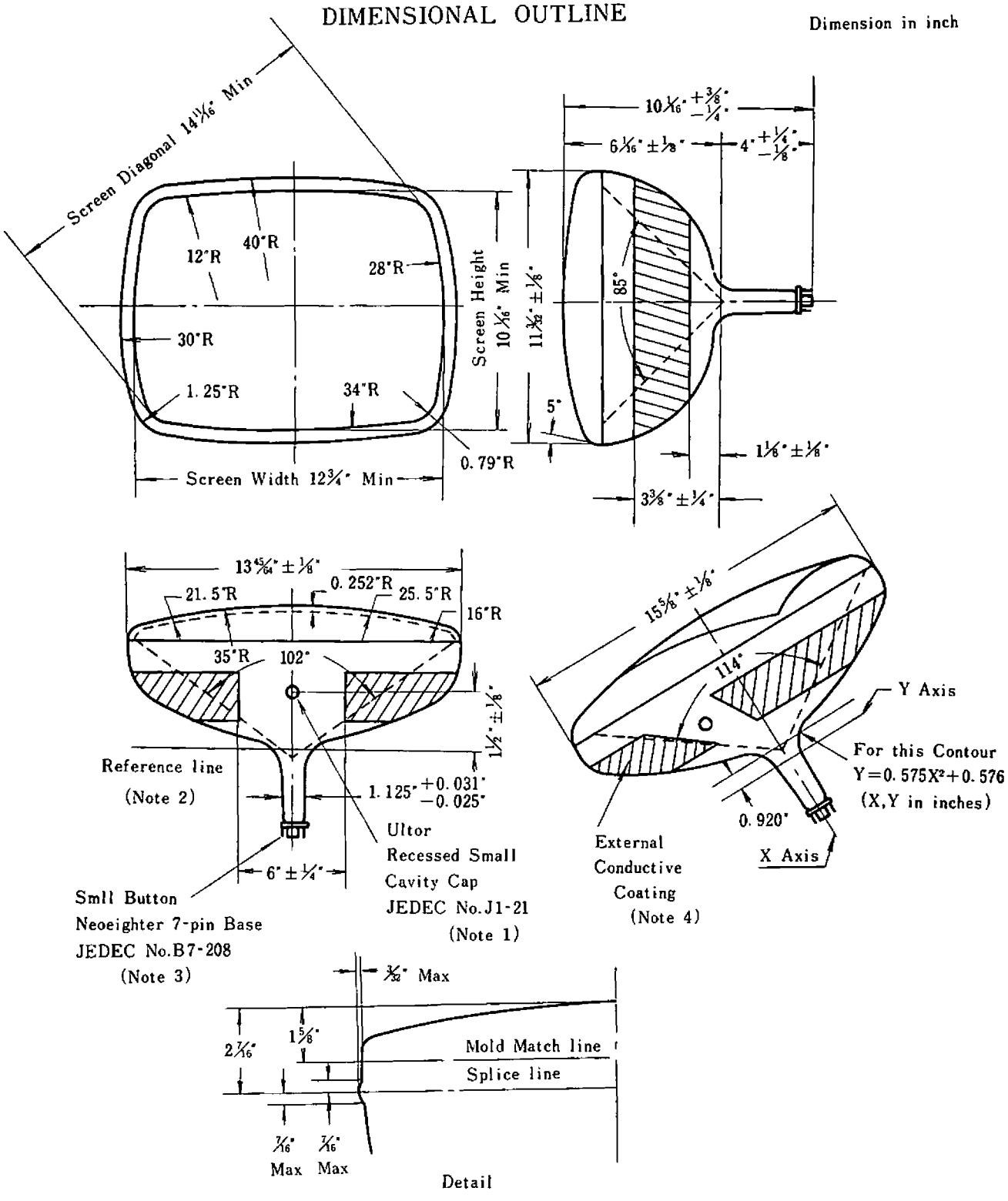
RASTER CUTOFF-RANGE CHARTS





DIMENSIONAL OUTLINE

Dimension in inch



NOTES FOR DIMENSIONAL OUTLINE

Notes;

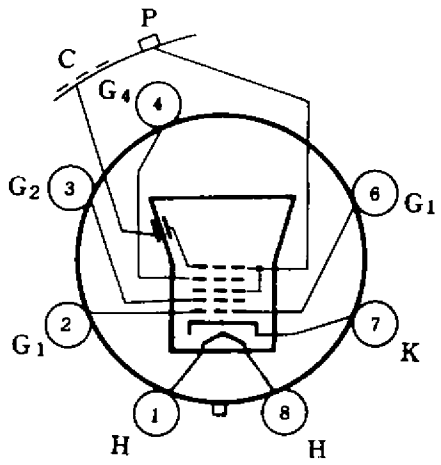
1. The plane through the tube axis and pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance of ± 30 degree. Ultor terminal is on the same side as pin No. 4.

1. With tube neck inserted through flare end of reference - line gauge JEDEC G - 126 and with tube seated in gauge, the reference - line is determined by the inter-section of the plane CC' of the gauge with the glass funnel.

3. Socket for this base should not be rigidly mounted, it should have flexible leads and be allowed to moved freely.

4. External conductive coating must be grounded.

SOCKET CONNECTION BOTTOM VIEW (8HR)



Pin 1: Heater
Pin 2: Grid No. 1
Pin 3: Grid No. 2
Pin 4: Grid No. 4
Pin 6: Grid No. 1
Pin 7: Cathode
Pin 8: Heater
P : Ultor
C : External conductive coating

16BUP4
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 16BUP4 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 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	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 #4804, Sept. 21, 1964

MECHANICAL DATA

Overall Length	10-3/8 ± 1/4 inches
Greatest Dimensions of Tube	
Diagonal	15-11/16 + 5/32 inches - 1/8
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. B7-208
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	16,000 volts
Minimum Anode Voltage	10,000 volts
Maximum Grid #4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid #2 Voltage	75 volts
Maximum Grid #2 Voltage	200 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	13,000 volts DC
Grid #4 Voltage (Focusing Electrode, Notes 2 & 3)	0 volts DC
Grid #2 Voltage	100 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.

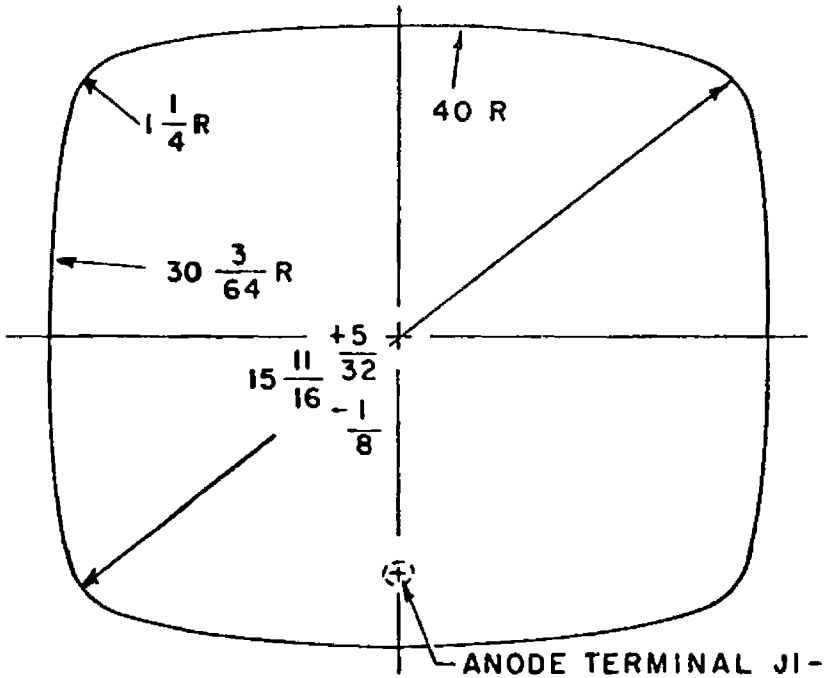
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 ua on a 12-15/16" x 10-1/4" pattern from RCA 2F21 monoscope or equivalent.

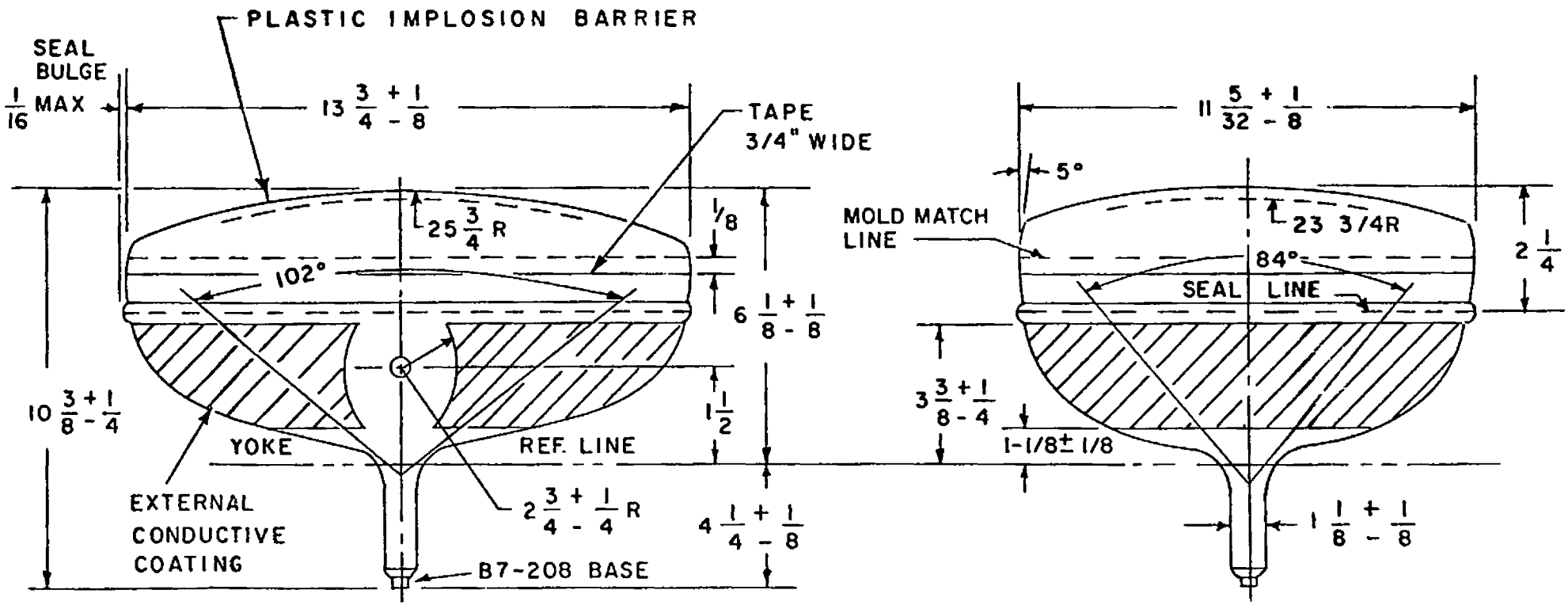
3. Individual tubes will have satisfactory focus at 0 volts.

16BUP4

SCREEN DIMENSIONS

DIAGONAL – 14 7/8
WIDTH —— 12 15/16
HEIGHT —— 10 1/4
AREA —— 125 SQ. IN.





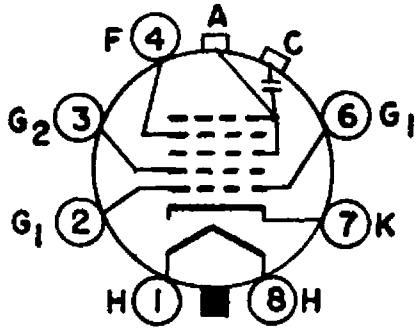
OUTLINE NOTES

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.

PHILCO CORPORATION

16BVP4

A SUBSIDIARY OF Ford Motor Company

Television Picture Tube

LANSDALE DIVISION

CATHODE RAY TUBE

DATA SHEET

Description

The 16BVP4 is a 16" - 114° direct view rectangular Cathode Ray Tube employing banded implosion protection. The tube incorporates an aluminized screen, non ion trap gun and is designed to operate with electrostatic focus and magnetic deflection.

The electron gun provides an exceptionally small spot size resulting in sharp picture resolution. The tube base is short and provides straigh through leads oriented by an indexing lug.

Electrical Data

Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angles (approximate)	
Horizontal	102 Degrees
Vertical	85 Degrees
Diagonal	114 Degrees
Direct Interelectrode Capacitances	
Cathode to All (approximate)	4 uuf
Grid #1 to All (approximate)	5 uuf
External Coating Capacitance (Note 1)	1050 Min. uuf
	1450 Max. uuf
Resistance between external conductive coating and implosion protection hardware	50 Megohms Min.
Heater Current at 6.3 Volts	.450 $\pm$5% ma
Heater Warm-up Time (Note 2)	11 Seconds
Electron Gun	
Ion Trap	None
Focus Lens	Unipotential

Optical Data

Phosphor Number	Aluminized P4
Light Transmission at Center (approximate)	54 Percent
Antireflection Treatment	None

from JEDEC release #4780, Aug. 17, 1964

Mechanical Data

Overall Length	10.413+.242-.180 Inches
Neck Length	4.219 ±.0625 Inches
Greatest Dimensions of Tube	
Diagonal	15.841 Inches
Width	13.960 Inches
Height	11.312 Inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	14.875 Inches
Horizontal Axis	12.938 Inches
Vertical Axis	10.250 Inches
Area	125 Sq. Inches
Implosion Protection	Banded Tube
Bulb	J125B1
Bulb Contact	J1-21
Base	B7-208
Basing	8HR

Bulb Contact Aligns with Pin #4 $\pm 30^{o}$

Minimum and Maximum Ratings (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Anode Voltage (Note 3)	(20,000 Max. Volts DC (11,000 Min. Volts DC
Grid No. 4 (Focusing Electrode) Voltage	
Positive Value	1100 Max. Volts DC
Negative Value	550 Min. Volts DC
Grid No. 2 Voltage	(550 Max. Volts DC (250 Min. Volts DC
Grid No. 1 Voltage	
Maximum Negative Value	154 Max. Volts DC
Maximum Negative Peak Value	220 Max. Volts
Maximum Positive Value	0 Max. Volts DC
Maximum Positive Peak Value	2 Max. Volts
Heater Voltage	(6.9 Max. Volts (5.7 Min. Volts
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
During Warm-up Period not to exceed 15 seconds	450 Max. Volts
After Equipment Warm-up Period	300 Max. Volts
Heater Positive with Respect to Cathode	300 Max. Volts

Typical Operating Conditions

Grid Drive Service

Unless otherwise specified, all voltage values are positive with respect to cathode.

Grid Drive Service (Cont'd.)

Anode Voltage	15,000 Volts DC
Grid No. 4 Voltage for Focus (Notes 4 & 5)	0 Volts DC
Grid No. 2 Voltage	300 Volts DC
Grid No. 1 Voltage (Note 6)	-43 to -70 Volts

Maximum Circuit Values

Grid No. 1 Circuit Resistance	1.5 Max. Megohms

Cathode Drive Service

Unless otherwise specified, all voltage values are positive with respect to Grid No. 1.

Anode Voltage	15,000 Volts DC
Grid No. 4 Voltage for Focus (Notes 4 & 5)	0 Volts DC
Grid No. 2 Voltage	300 Volts DC
Cathode Voltage (Note 6)	+38 to +59 Volts DC

Maximum Circuit Values

Grid No. 1 Circuit Resistance	1.5 Max. Megohms

Notes

1. Measured with implosion protection hardware connected to external coating.

2. Heater warm-up time is defined as the time required for the voltage across the heater to reach 80% 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.

3. Anode, Grid No. 3 and Grid No. 5 are connected together within the tube and are referred to herein as anode.

4. With the combined Grid No. 1 bias voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 10" by 12" pattern from RCA 2F21 monoscope or equivalent.

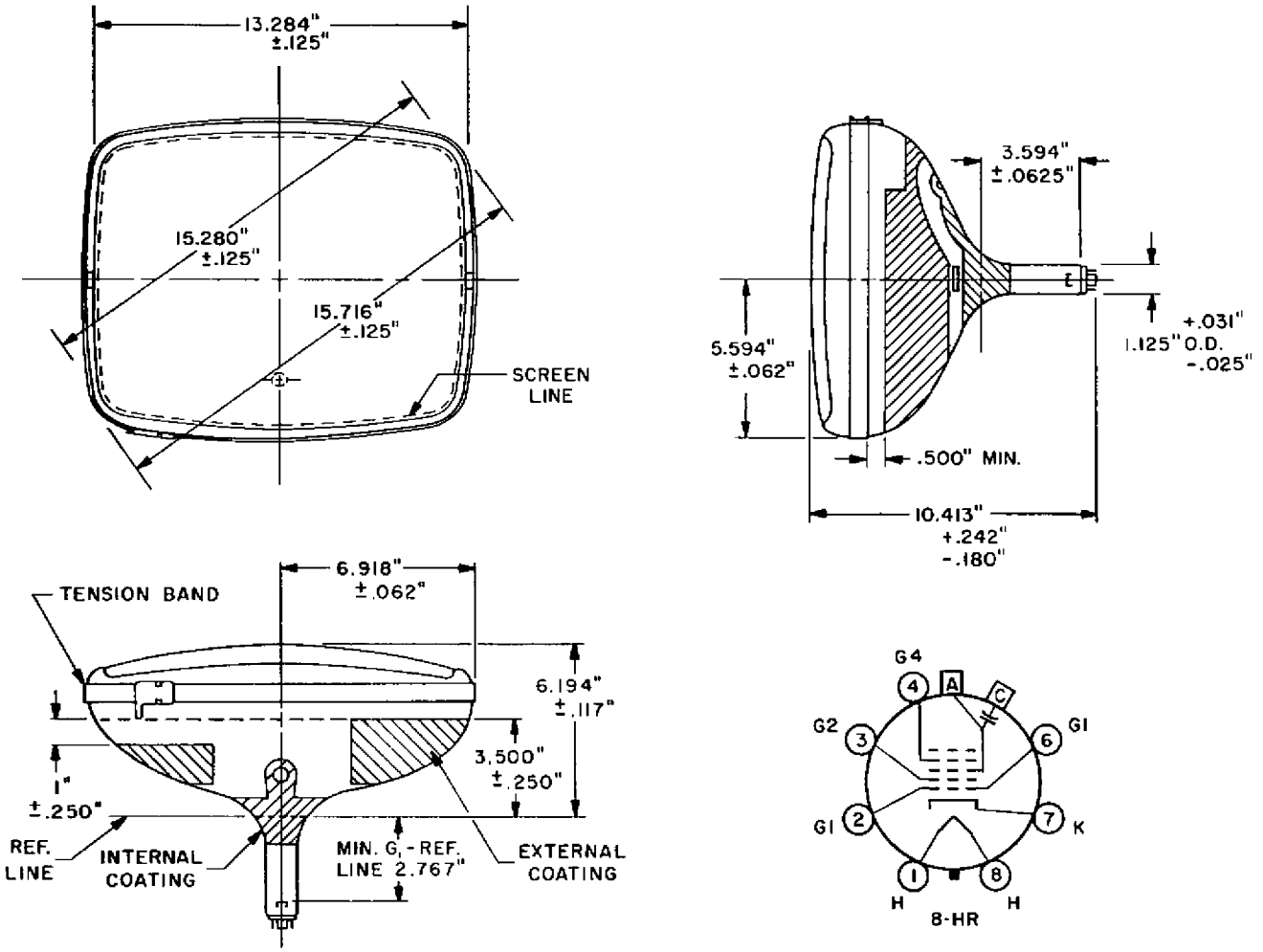
5. Individual tubes will have satisfactory focus at some value between -200 and +200 volts.

6. For visual extinction of the focused raster. For cutoff of undeflected focus spot, the absolute value of the bias between cathode and grid will increase by about 5 volts.

OUTLINE DRAWING

16BVP4

Television Picture Tube



MECHANICAL NOTES

1. The reference line is determined by reference line gauge JEDEC #126.
2. The area around the button is covered with an insulating coating.
3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of the base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

WARNING

X-ray radiation shielding may be necessary to protect against possible danger of personal injury from prolonged exposure at close range if this tube is operated at anode voltages higher than 16,000 volts.

The information, diagrams, or any other data included herein are believed to be accurate and reliable. However, the Philco Corporation, Lansdale Division, assumes no responsibility or liability whatsoever for the application, interpretation or use made of such information, diagrams or data especialy insofar as the use of said information, diagrams or data affects any patent, trademark or proprietary data rights.

THE Rauland CORPORATION
5600 WEST JARVIS AVENUE CHICAGO 48, ILLINOIS
TELEPHONE MULBERRY 5-5000
TELETYPE 312-265-1293

from JEDEC release #4894, Dec. 28, 1964

16BXP4

DESCRIPTION

16" Direct View	Filled Rim Implosion Protection
Rectangular Glass Envelope	114° Magnetic Deflection
Gray Filter Glass	Electrostatic Focus
Aluminized Screen	External Conductive Coating
6.3 Volts, 450 Ma. Heater	No Ion Trap
Cathode Drive Design	Low G_2 Voltage (35 V)

Rim Provides Mounting Holes

SPECIAL CHARACTERISTICS-Anode Penetration Current 150 ua Max. (Note 4)

ELECTRICAL DATA	
Focusing Method	Electrostatic
Deflection Angles (approx.)	
Horizontal	103 Degrees
Vertical	87 Degrees
Diagonal	114 Degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approx.)	5 uuf
Grid #1 to all other electrodes (approx.)	6 uuf
External Conductive Coating to Anode	1,400 max. uuf
(Including implosion protection hardware)	900 min. uuf
Heater Current at 6.3 Volts	450 ± 5%
Heater Warm-up time	11 Seconds
OPTICAL DATA	
Phosphor Number	P4 Aluminized
Light Transmittance at Center (approx.)	55 %
MECHANICAL DATA	
Overall Length	10 9/16 ± 1/4"
Greatest Dimensions of Tube (Metal Rim)	
Diagonal	17 1/2 ± 3/32"
Width	14 3/8 ± 1/16"
Height	11 3/4 ± 1/16"
Minimum Useful Screen Dimensions (Projected)	
Diagonal	14 7/8"
Horizontal Axis.	12 15/16"
Vertical Axis.	10 1/4"
Area	125 Sq. in.
Neck Length	4 3/8± 1/8"
Bulb	J125B1A
Bulb Contact	J1-21
Base	B6-214
Basing	7FA
Weight (approx.)	9 lb. 14 oz.
Bulb Contact Alignment	
J1-21 contact aligns with pin position #7 ± 30 degrees	

RATINGS (Design Maximum System)
Unless otherwise specified, voltage values are positive and measured with respect to Grid #1

Maximum Anode Voltage	17,600 Volts
Minimum Anode Voltage	12,000 Volts
Maximum Grid #4(Focusing Electrode)voltage	+1100 - 500
Maximum Grid #2 Voltage	60 Volts
Minimum Grid #2 Voltage	25 Volts
Cathode Voltage	100 Volts
Maximum Heater Voltage	7 Volts
Minimum Heater Voltage	5.8 Volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up time 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	15,000 Volts DC
Grid #4 (Focusing Electrode) voltage (Notes 2 and 3)	250 Volts DC
Grid #2 Voltage	35 Volts DC
Cathode Voltage (Note 1)	25 to 50 Volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 circuit resistance	1.5 Megohms

NOTES

1. Visual extinction of focused raster.

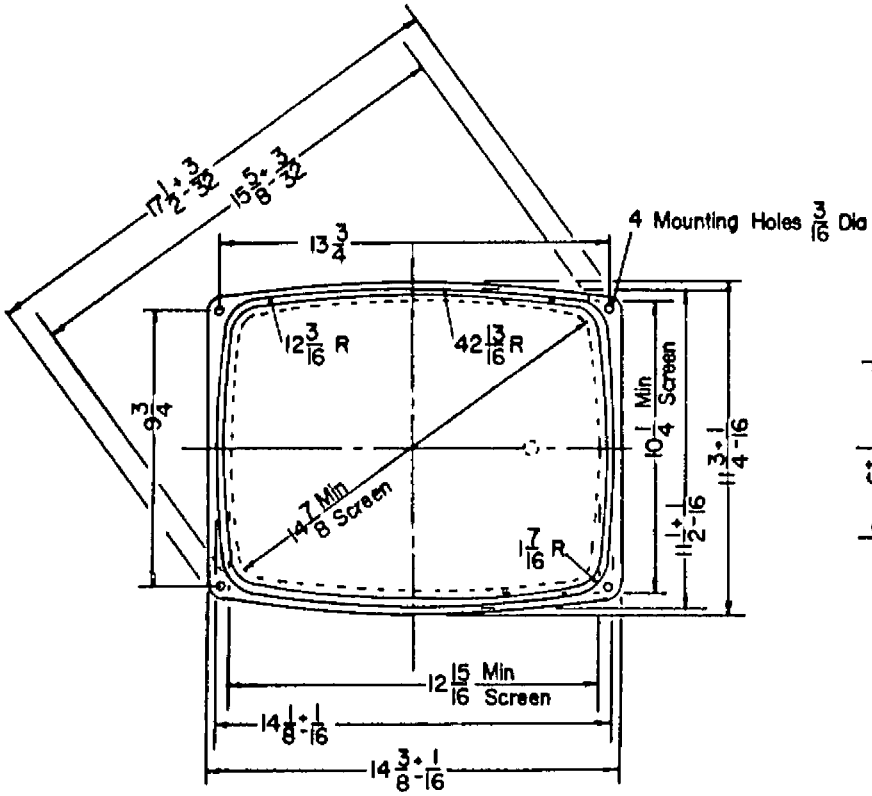
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 125 micro-amperes on a 12 15/16" X 10 1/4" pattern from RCA 2F21 Monoscope or equivalent.

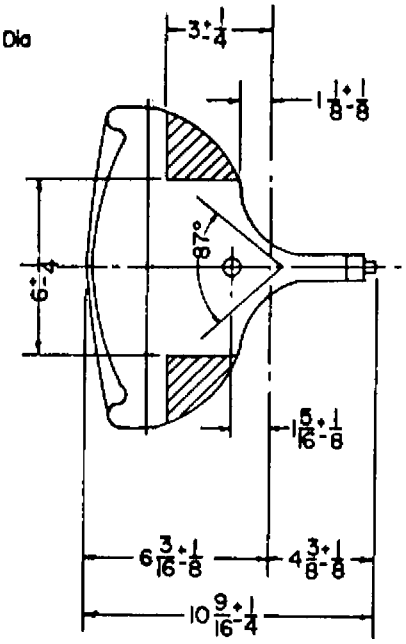
3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts

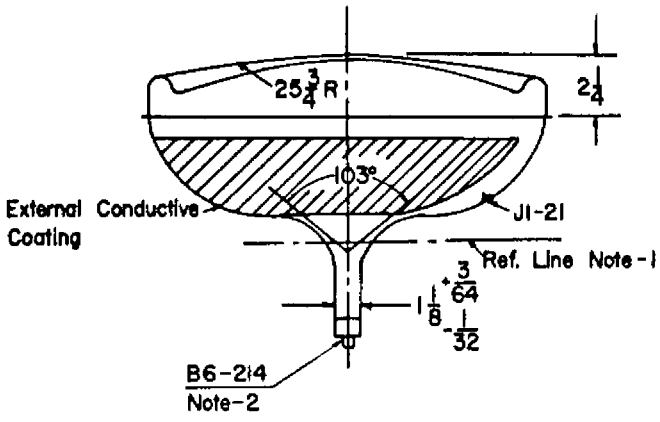
4. This is the maximum beam current with 17,600 volts (design max.) applied to Anode, zero voltage applied to Cathode, Grid #1, and Grid #2, all other elements to have nominal voltages.

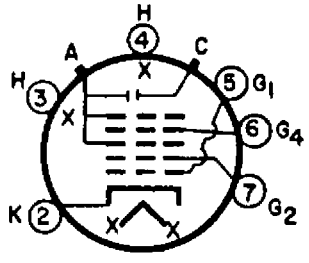
THE Rauland CORPORATION
5600 WEST JARVIS AVENUE CHICAGO 48, ILLINOIS
TELEPHONE MULBERRY 5-5000
TELETYPE 312-265-1293

16 BXP 4









7 FA Basing

Notes

1. Reference Line as determined by Plane C-C' of J.E.D.E.C. Reference Line Gauge no. 126.
2. Base Pin no. 7 aligns with anode contact within 30°

16BYP4
CATHODE RAY TUBE

16 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 16BYP4 is a 16-inch rectangular glass picture tube employing banded type implosion protection. Outstanding features include a non-ion-trap gun, a 450 ma heater and a small neck diameter. 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.

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, 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	450 ± 23 ma.
Heater Warm-up time	11 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light transmittance at center approx.	54 percent

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC

Syracuse, N. Y.

from JEDEC release #4804, Sept. 21, 1964

MECHANICAL DATA

Overall Length	10 7/16 ± 1/4 inches
Greatest Dimensions of Tube	
Diagonal	15.688 ± .100 inches
Width	13.780 ± .100 inches
Height	11.187 ± .100 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	J125-B1
Bulb Contact	JEDEC No. J1-21
Base	JEDEC No. B7-208
Basing	8 HR
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	16,000 volts
Minimum Anode Voltage	10,000 volts
Maximum Grid 4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid 2 Voltage	75 volts
Maximum Grid 2 Voltage	200 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, Note 2)	0 volts DC
Grid #2 Voltage	100 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:

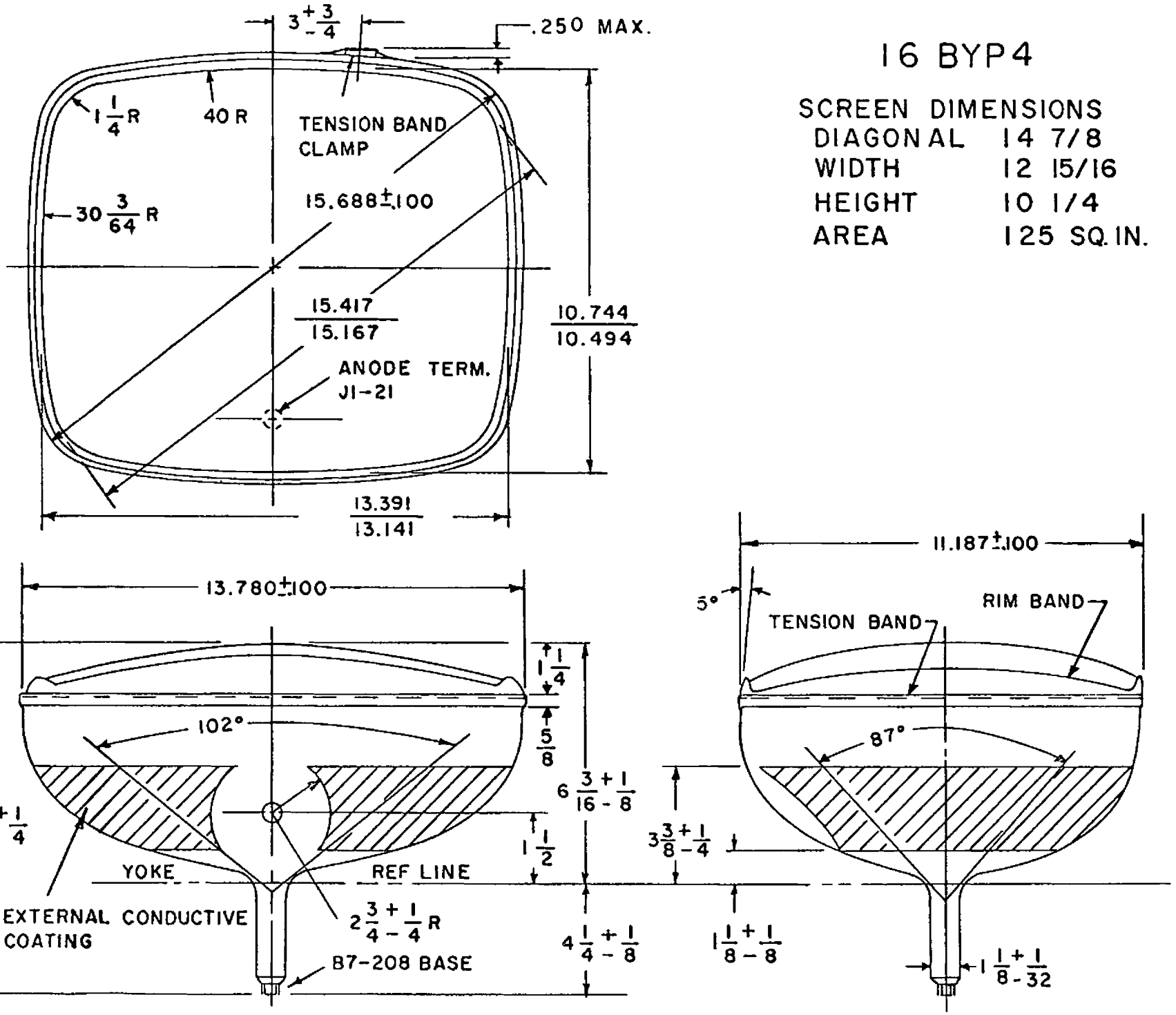
1. Visual extinction of focused raster.

2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 microamperes on a 12 15/16 x 10 1/4" pattern from RCA 2F21 monoscope or equivalent.

16 BYP4

SCREEN DIMENSIONS

DIAGONAL	14 7/8
WIDTH	12 15/16
HEIGHT	10 1/4
AREA	125 SQ. IN.



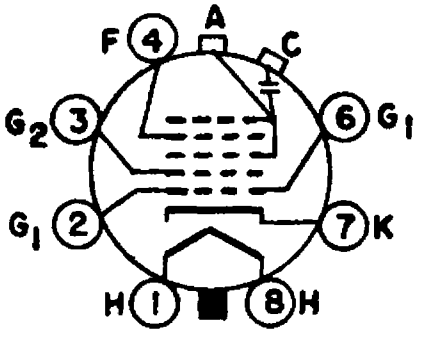
OUTLINE NOTES

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.

National Video Corporation
4300 W. 47TH STREET CHICAGO 32, ILLINOIS
CLIFFSIDE 4-5600

The 16CAP4 is a 16"-114° banded cathode ray tube with a 4 3/8" neck length. This tube has a straight gun which requires no ion trap and a 450 milliampere 6.3 volt filament.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angles (Approximate)	
Diagonal	114 degrees
Horizontal	103 degrees
Vertical	87 degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes (approx.)	5 uuf
Grid No. 1 to all other electrodes (approx.)	6 uuf
External conductive coating to anode (Note 1)	1,500 max. uuf
	1,000 min. uuf
Resistance Between External Conductive Coating and Implosion Protection Hardware	50 min. megohms
Heater Current at 6.3 volts	450 ±20 ma
Heater Warm-up Time	11 seconds

OPTICAL DATA

Phosphor Number	P4 aluminized
Light Transmittance at Center (Approximate)	53 percent
Antireflection Treatment	None

MECHANICAL DATA

Overall Length	10 17/32 ±5/16 inches
Neck Length	4 3/8 ±1/8 inches
Greatest Dimensions of Tube	
Diagonal	15 23/32 ±1/8 inches
Width	13 15/16 max. inches
Height	11 11/32 max. 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

from JEDEC release #4822, Oct. 5, 1964

Implosion Protection		Banded
Bulb	JEDEC Designation	J-125-B1
Bulb Contact	JEDEC Designation	J1-21
Base	JEDEC Designation	B7-208
Basing	JEDEC Designation	8HR

Bulb Contact Alignment
J1-21 contact aligns with Pin Position No. 4 $\pm 30^{o}$.

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	18,000 volts
Minimum Anode Voltage	10,000 volts
Maximum Grid No. 4 (Focusing Electrode) Voltage	+1,100 -500 volts
Maximum Grid No. 2 Voltage	550 volts
Minimum Grid No. 2 Voltage	200 volts
Grid #1 Voltage	
Maximum negative value	155 volts dc
Maximum negative peak value	220 volts
Maximum positive value	0 volts dc
Maximum positive peak value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.8 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 seconds	450 volts
After equipment warm-up period	200 volts
Heater positive with respect to cathode	200 volts

TYPICAL OPERATING CONDITIONS

GRID DRIVE SERVICE

Unless otherwise specified, all voltage values are positive with respect to cathode.

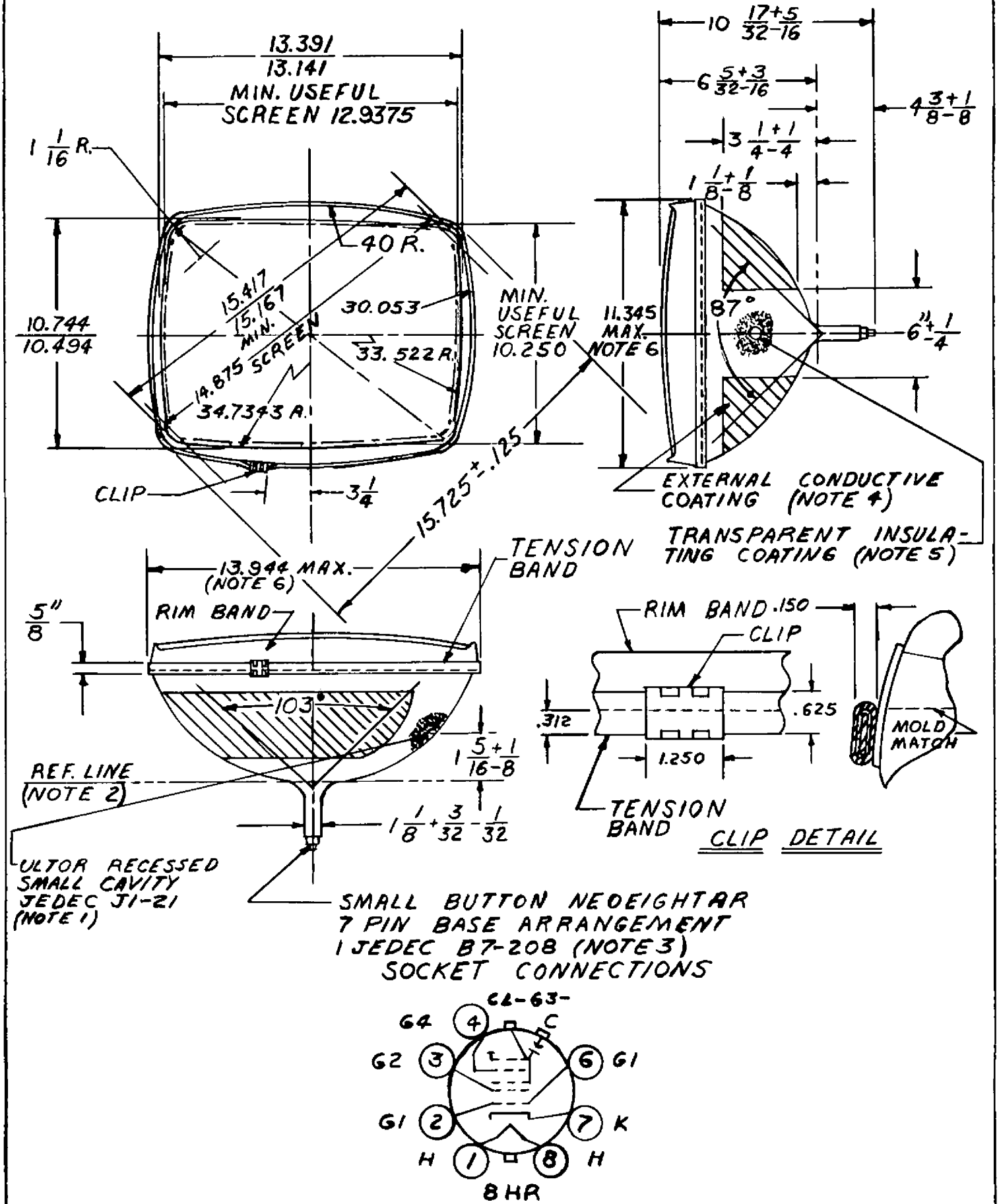
Anode Voltage	15,000 volts dc
Grid No. 4 (Focusing Electrode) Voltage (Notes 3 and 4)	250 volts dc
Grid No. 2 Voltage	400 volts dc
Grid No. 1 Voltage (Note 2)	46 to 94 volts dc

MAXIMUM CIRCUIT VALUES

Maximum Grid No. 1 Circuit Resistance	1.5 megohms

GRAPHS AND DRAWINGS

Tube Outline with Essential Dimensions and Tolerances



DRAWN BY	SCALE	EFFECTIVE	DISTRIBUTION	DRAWING NO.
W. C. GRAF		9-4-64		16 CAP4

GRAPHS AND DRAWINGS (CONT.)

Pin Connections

Pin 1	Heater	Pin 6	Grid #1
Pin 2	Grid #1	Pin 7	Cathode
Pin 3	Grid #2	Pin 8	Heater
Pin 4	Grid #4		

NOTES

1. Measured with implosion protection hardware connected to external coating.

2. Visual extinction of focused raster.

3. With the combined Grid No. 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 12 5/16" by 10 1/4" pattern from RCA 2F21 monoscope or equivalent.

4. Individual tubes will have satisfactory focus at some value between 0 and +400 volts.

NOTES FOR DIMENSIONAL OUTLINE

1. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance (measured about the tube axis) of $\pm 30^{o}$. Ultor terminal is on same side as Pin No. 4.

2. With tube neck inserted through flared end of reference-line gauge JEDEC No. G-126 and with tube seated in gauge, the reference-line is determined by the intersection of the plane CC' of the gauge with the glass funnel.

3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

4. External conductive coating must be grounded.

5. To clean this area, wipe only with soft dry lint-less cloth.

6. Measured to include rimband and tension strap.

from JEDEC release #4869, Nov. 30, 1964

TUNG-SOL ELECTRON TUBE DATA

TYPE 16KA6

BEAM POWER PENTODE

The Tung-Sol 16KA6 is a T-12 compactron beam-power pentode primarily designed for use as a horizontal deflection amplifier in television receivers. A separate connection is provided for grid 3 (beam plates) in order fo minimize "snivets".

MECHANICAL DATA

Cathode		Coated unipotential
Outline drawing		JEDEC 12-79
Maximum diameter		1.563 inches
Maximum seated height		3.250 inches
Minimum seated height		3.000 inches
Maximum overall length		3.625 inches
Bulb		T-12 glass
Base	Button 12 pin	JEDEC E12-74
Top cap	Skirted miniature	C1-3
Pin connections		Basing diagram 12GH
Pin 1 - heater		Pin 7 - internal connection
Pin 2 - no connection		Pin 8 - no connection
Pin 3 - grid 2		Pin 9 - internal connection
Pin 4 - grid 3		Pin 10 - cathode
Pin 5 - grid 1		Pin 11 - internal connection
Pin 6 - no connection		Pin 12 - heater
Top cap - plate		
Mounting position		Any

ELECTRICAL DATA

Heater Characteristics and Ratings - Design Maximum System
See EIA Standard RS-239

Average characteristics	15.8 volts	0.60	amps
Heater warm-up time		11	seconds
Limits of supplied current		0.60 ± 0.04	amp.
Maximum heater-cathode voltage			
Heater negative with respect to cathode			
Total DC and peak		200	volts
Heater positive with respect to cathode			
DC component		100	volts
Total DC and peak		200	volts

Formerly DT-979B

11/17/64

TUNG-SOL ELECTRIC INC.
ONE SUMMER AVENUE NEWARK 4, NEW JERSEY

Direct Interelectrode Capacitances - without external shield.

Grid 1 to plate	0.6	pf
Input (g1 to h+k+g2+g3)	23.0	pf
Output (p to h+k+g2+g3)	8.5	pf

Maximum Ratings - Design Maximum System - See EIA Standard RS-239

Horizontal-Deflection Amplifier Service

DC plate supply voltage (Boost & dc power supply)	770	volts
Peak positive pulse	6500	volts
Peak negative pulse	1500	volts
Grid 2 voltage	220	volts
Positive dc grid 3 voltage	70	volts
Negative grid 1 voltage	55	volts
Peak negative grid 1 voltage	330	volts
Plate dissipation	18	watts
Grid 2 dissipation	3.5	watts
DC cathode current	230	ma
Peak cathode current	800	ma
Grid 1 circuit resistance	1	megohm
Bulb temperature at hottest point	220	°C

Average Characteristics

Plate voltage	5000	60	60	130	volts
Grid 3 voltage	0	0	+25	0	volts
Grid 2 voltage	130	130	130	130	volts
Grid 1 voltage		0Δ	0Δ	-20	volts
Plate current		410	410	50	ma
Grid 3 current		-	2	-	ma
Grid 2 current		24	23	1.75	ma
Plate resistance (approx.)				11000	ohms
Transconductance				9,100	µmhos
Grid 1 voltage for I_b = 1 ma (approx.)	-66			-33	volts
Triode amplification factor				4.7	

Positive grid 3 voltage has little effect on the currents flowing under the above conditions of zero bias. It does effect a change in the shape of the plate voltage versus plate current curve, resulting in a smoothing of the knee characteristic and a slight lowering of the knee voltage.

Note:

Δ The tube should be operated with a duty cycle such that the maximum dissipation ratings are not exceeded.

Matsushita Electronics Corporation

Telephone No.
TAKATSUKI (5) 5521

Takatsuki, Osaka, Japan
Telex : OS 3461 MECTRON

Cable Address
"MECTRON" TAKATSUKI

17AB9

TWIN TETRODE TUBE

The Matsushita's 17AB9 is a twin tetrode with a 10 pin base, for using as VHF RF amplifiers and VHF autodyne mixers.

The Matsushita's 17AB9 is identical with the Matsushita's 6AB9 except for the following:

General Data

Electrical

Heater voltage	16.8 volts
Heater current	150 ma

from JEDEC release #4740, June 29, 1964

ELECTRONICS

17JM6-A
COMPACTRON BEAM PENTODE

DESCRIPTION AND RATING

The 17JM6-A 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 17JM6-A is identical to the 6JM6-A.

The 17JM6-A is unilaterally interchangeable with the 17JM6, and differs in having a lower knee.

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.

from JEDEC release #4885, Dec. 21, 1964

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from JEDEC release #4622B, July 6, 1964

ELECTRONICS

17JN6

COMPACTRON BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 17JN6 is a compactron beam-power pentode primarily designed for use as the horizontal-deflection amplifier in television receivers.

Except for heater characteristics, the 17JN6 is identical to the 6JN6.

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.

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ELECTRONICS

17JN6-A
COMPACTRON BEAM PENTODE

DESCRIPTION AND RATING

The 17JN6-A 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 17JN6-A is identical to the 6JN6-A.

The 17JN6-A is unilaterally interchangeable with the 17JN6 and differs in having a lower knee.

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.

from JEDEC release #4885, Dec. 21, 1964

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MECHANICAL DATA

Bulb	T-9
Base	E12-70, 12 Pin
Outline	9-58
Basing	12BT
Cathode	Coated Unipotential
Mounting Position	Any

ELECTRICAL DATA

HEATER CHARACTERISTICS AND RATINGS

Average Characteristics

	17X10 Series	
Heater Operation		
Heater Voltage	16.8	Volts
Heater Current	450[1]	Ma
Heater Warm-up Time[2]	11	Seconds

Ratings (Design Maximum Values)[4]

	Min-Max	
Heater Current[3]	420-480	Ma
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 (Unshielded)

Section No. 1

Grid No. 1 to (h+1k+1g2+1g3+IS)	4.4	pf
Grid No. 3 to (h+1k+1g1+1g2+1p+IS)	3.2	pf
Grid No. 1 to Grid No. 3	0.005	pf

Section No. 2

Grid to Plate	0.24	pf
Input: g to (h+2k+2g2+g3+1k+IS)	12.0	pf
Output: p to (h+2k+2g2+g3+1k+IS)	9.0	pf

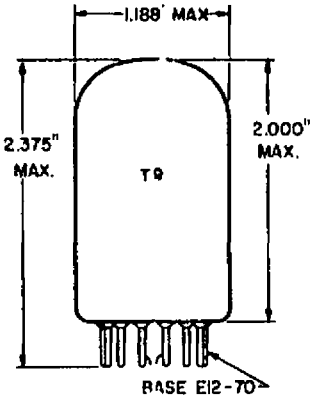
RATINGS (Design Maximum Values)[4]

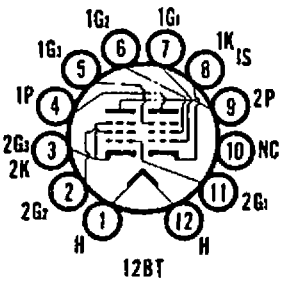
Section No. 1

Plate Supply Voltage	330	Volts
Accelerator Voltage (G2)	110	Volts
Peak Positive G1 Voltage	60	Volts
DC Cathode Current	13	Ma

QUICK REFERENCE DATA

The Sylvania Type 17X10 is a double dissimilar pentode contained in a T-9 bulb with 12 pin base. Section No. 1 is intended for Limiter/Discriminator service and Section No. 2 is designed as a power pentode.
The 17X10 has controlled heater warm-up time for series string circuits.





SYLVANIA ELECTRIC PRODUCTS INC.

Electronic Components Group
ELECTRONIC TUBE DIVISION
EMPORIUM, PA.

A Technical Publication

June 25, 1964

from JEDEC release #4760, July 20, 1964

RATINGS (Design Maximum Values)[4] Continued

Section No. 2

Plate Voltage	165	Volts
Screen Voltage	150	Volts
Plate Dissipation	6.5	Watts
Screen Dissipation	1.8	Watts
DC Cathode Current	65	Ma
Grid No. 1 Circuit Resistance		
Fixed Bias	0.25	Megohms
Cathode Bias	0.5	Megohms

AVERAGE CHARACTERISTICS

Section No. 1

Gated Beam Discriminator Section - Limiter/Discriminator Service				
Input Signal Center Frequency	10.7	10.7	4.5	mc
Frequency Deviation	±75	±75	±25	kc
Plate Supply Voltage	85	285	270	Volts
Plate Voltage	62	122	121	Volts
Accelerator Voltage	55	100	100	Volts
Cathode Bias Resistor - Variable[5]	200-400	200-400	200-400	Ohms
Plate Load Resistor	.085	.330	.330	Meg
Plate Linearity Resistor	470	1500	1000	Ohms
Integrating Capacitor	.002	.001	.001	µf
Coupling Capacitor	.25	.01	.25	µf
Minimum Signal Voltage for Limiting Action, rms[6]	1.25	1.25	1.25	Volts
DC Plate Current	.25	.49	.44	Ma
Accelerator Current	4.1	9.8	10	Ma
Input Signal Level for AM Rejection Adjustment[5]	1.25	2.0	2.0	Volts
AM Rejection At Esig = 2.0 Volts, rms	31	20	25	db
AM Rejection at Esig = 3.0 Volts, rms	30	29	30	db
Total Harmonic Distortion	2.0	1.6	1.8	Percent
Peak Audio Output Voltage	6.0	16.6	16.8	Volts

Section No. 2

Power Amplifier		
Plate Voltage	145	Volts
Screen Voltage	110	Volts
Grid No. 1 Voltage	-6.0	Volts
Peak AF Grid Voltage	6.0	Volts
Plate Resistance (Approx.)	30,000	Ohms
Transconductance	8600	µmhos
Zero Signal Plate Current	36	Ma
Maximum Signal Plate Current	40	Ma
Zero Signal Screen Current	3.0	Ma
Maximum Signal Screen Current	9.0	Ma
Load Resistance	3000	Ohms

Total Harmonic Distortion (Approx.)	10 Per Cent
Maximum Signal Power Output	2.4 Watts

NOTES:

1. For series operation of heaters, equipment should be designed that a normal supply voltage bogey tubes will operate at this value of heater current.

2. Heater warm-up time is defined as the time required for the voltage across the heater to reach 80% of the rated heater voltage after applying four (4) times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to three (3) times the rated heater voltage divided by the rated heater current.

3. Heater voltage supply variations shall be restricted to maintain heater current within the specified tolerance.

4. 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 characteristics of all other electron devices in the equipment.

5. 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% am and 30% fm.

6. At signal levels above specified value, limiting is within ±3 decibels. Adequate shielding between components of the limiter grid and the quadrature grid must be used to insure proper phasing of the voltage developed at 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 μμf. The capacitance may be composed of tube input capacitance, stray capacitance, and distributed capacitance, as well as physical capacitance.

from JEDEC release #4655, April 6, 1964

Matsushita Electronics Corporation

Telephone No.
TAKATSUKI (5) 5521

Takatsuki, Osaka, Japan
Telex: OS3461 MECTRON

Cable Address
"MECTRON" TAKATSUKI

7GS7
TRIODE-PENTODE TUBE

The Matsushita 7GS7 is a miniature medium mu triode and high-slope RF pentode for use as frequency changer in VHF television tunners.

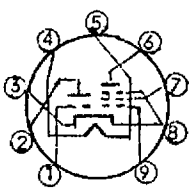
General Data

MECHANICAL DATA

Cathode	Coated unipotential
Outline drawing	6-2 Bulb . . T $6\frac{1}{2}$
Base	E9-1
Maximum diameter	7/8"
Maximum seated height	1 21/32"
Minimum seated height	1 15/32"
Maximum overall length	2 3/16"

Pin connections — Basing . . 9GF

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 No.2
Pin 8	Cathode, Pentode grid No.3
Pin 9	Pentode grid No.1



Mounting position . . . . . Any

ELECTRICAL DATA

Heater characteristics

Heater voltage	7.6 volts
Heater current	0.3 amp.

Maximum heater-cathode voltage* (Design center values)

Heater negative with respect to cathode:	
DC	100 volts
Total DC and peak	100 volts
Heater positive with respect to cathode:	
DC	100 volts
Total DC and peak	100 volts

Remark: * To fulfil the modulation hum requirements in intercarrier receivers, heater-cathode voltage should not exceed 75 volts rms.
With respect to modulation hum in A.M. sound receivers, heater-cathode voltage should not exceed 50 volts rms.

Direct interelectrode capacitances (without external shield)

Pentode section

Grid No.1 to cathode & grid No.3, grid No.2 and heater	6.0	$\mu\mu$f
Plate to cathode & grid No.3, grid No.2 and heater	3.6	$\mu\mu$f
Grid No.1 to plate	0.012	$\mu\mu$f

Triode section

Grid to cathode & pentode grid No.3, heater	2.4	$\mu\mu$f
Plate to cathode & pentode grid No.3, heater	1.25	$\mu\mu$f
Grid to plate	2.0	$\mu\mu$f

Maximum ratings (Design center values)

Pentode section

Maximum plate voltage	250	volts
Maximum grid No.2 voltage	150	volts
Maximum plate dissipation	2.0	watts
Maximum grid No.2 dissipation	0.5	watts
Maximum total cathode current	18	ma
Maximum grid No.1 circuit resistance with fixed bias	0.25	megohm
Maximum grid No.1 circuit resistance with automatic bias	0.5	megohm

Triode section

Maximum plate voltage	125	volts
Maximum plate dissipation	1.5	watts
Maximum cathode current	15	ma
Maximum grid circuit resistance	0.5	megohm

Typical characteristics

Pentode section

Plate voltage	170	volts
Grid No.2 voltage	150	volts
Grid No.1 voltage	-1.2	volts
Plate current	10	ma
Grid No.2 current	3.3	ma

Transconductance	12000	μmhos
Plate resistance	0.35min.	megohm

Triode section

Plate voltage	100	volts
Grid voltage	-3	volts
Plate current	14	ma
Transconductance	5500	μmhos
Amplification factor	17	

Operating characteristics

Pentode section for use as frequency changer

Plate voltage	190	volts
Grid No.2 supply voltage	190	volts
Grid No.2 circuit resistance	0.018	megohm
Grid No.1 circuit resistance	0.1	megohm
Oscillator voltage	2.3	volts rms
Plate current	8.5	ma
Grid No.2 current	2.7	ma
Grid No.1 current	30	μa
Plate resistance	0.6	megohm
Conversion transconductance	4500	μmhos

Triode section for use as oscillator

Plate supply voltage	190	volts
Plate circuit resistance	8200	ohms
Grid circuit resistance	10000	ohms
Oscillator voltage	4.5	volts rms
Plate current	12	ma
Transconductance	3500	μmhos

JOINT ELECTRON DEVICE ENGINEERING COUNCIL

JEDEC Type Administration Section
Electronic Industries Association
32 Green Street
Newark 2, New Jersey

E. I. A.
REGISTRATION
FILE

Announcement

of

Electron Device Type Registration

Release No. 4823

October 12, 1964

The Joint Electron Device Engineering Council announces the registration of the following electron device designation

8CW5A

on the application of

Radio Corporation of America
Harrison, New Jersey

* Type 8CW5A is similar to Type 8CW5 as registered in Release No. 2737B, dated June 15, 1964, except for the following:

Heater Voltage	8.0 * volts
Heater Current	0.600 ± 0.040 amp
Heater Warm-up Time	11 Seconds

* At heater amperes = 0.600

ELECTRONICS

8LT8
DUPLEX-DIODE PENTODE

DESCRIPTION AND RATING

The 8LT8 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

Heater Voltage, AC or DC*	8.1	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: (g1 to p)	0.05	pf
Input: g1 to (h + k + g2 + g3 + Dp2 + i.s.)	10	pf
Output: p to (h + k + g2 + g3 + Dp2 + i.s.)	3.8	pf

Diode Sections

Plate (Section 1) to Cathode: (p1 to k)	1.4	pf
Plate (Section 2) to Cathode: (p2 + Pg3 + i.s.) to k.	1.5	pf
Plate to Plate: p1 to (p2 + Pg3 + i.s.)	2.2	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, 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

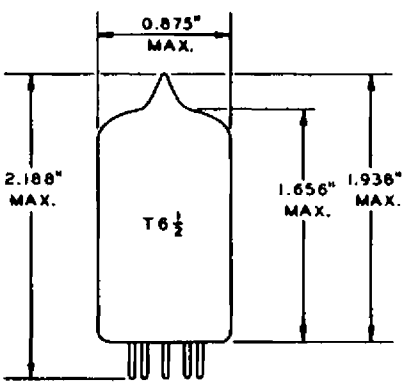
MAXIMUM RATINGS

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

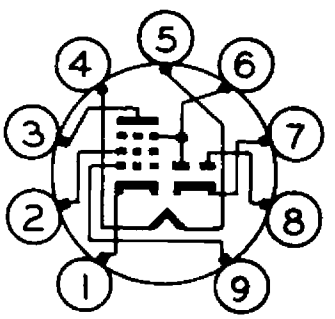


EIA 6-2

TERMINAL CONNECTIONS

Pin 1 - Pentode Cathode
Pin 2 - Pentode Grid Number 2 (Screen)
Pin 3 - Pentode Plate
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Diode Plate (Section 2), Pentode Grid Number 3, and Internal Shield
Pin 7 - Diode Cathode
Pin 8 - Diode Plate (Section 1)
Pin 9 - Pentode Grid Number 1

BASING DIAGRAM



EIA 9RD

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-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
Grid Number 3, Diode Plate (Section 2), and Internal Shield Connected to Ground		
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

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

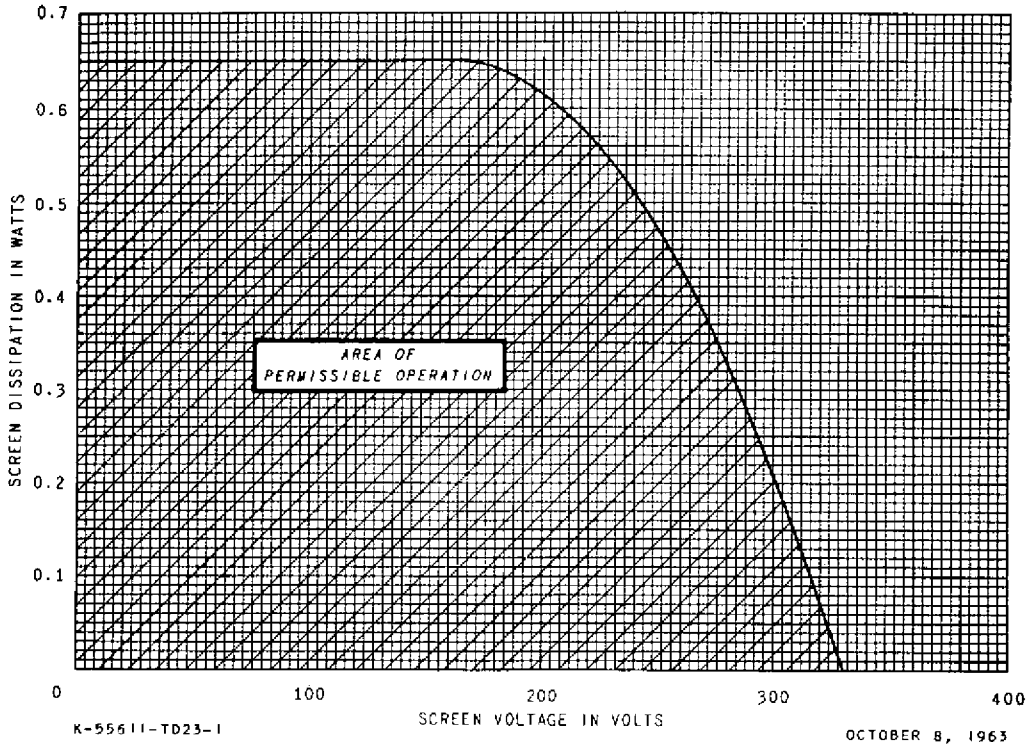
‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ 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.

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



JOINT ELECTRON DEVICE ENGINEERING COUNCILS

JEDEC Electron Tube Council — JEDEC Semiconductor Device Council

E. I. A.
REGISTRATION
FILE

2001 Eye Street, N. W.
Washington, D. C. 20006

Announcement

of

Electron Device Type Reregistration

Release No. 4851C (Tentative)*

November 10, 1969

The Joint Electron Device Engineering Council announced the reregistration of the following electron device designation

9JW8

on August 11, 1969, Release No. 4851A, under the sponsorship of Amperex Electronic Corporation, Hicksville, New York. Sylvania Electronic Components now proposes reregistration based on the following data:

ITEM	AS REGISTERED	AS PROPOSED
Heater Voltage	9.3 V	9.0 V
Heater Current	450 MA	300 MA

*Unless valid objection to this reregistration is lodged with EIA Engineering Office, 2001 Eye Street,NW, Washington, D. C. 20006, prior to Dec. 10, 1969, this reregistration will be made and this information will be considered "FINAL".

JOINT ELECTRON DEVICE ENGINEERING COUNCILS

JEDEC Electron Tube Council

JEDEC Semiconductor Device Council

2001 Eye Street, N. W.
Washington, D. C. 20006

Announcement

of

Electron Device Type Registration

Release No. 4851A

August 11, 1969



The Joint Electron Device Engineering Council announces the registration of the following electron device designation

9JW8

on the application of

Amperex Electronic Corporation
Hicksville, New York

*Type 9JW8 is similar to Type 6JW8 as registered in Release No. 4851, dated November 16, 1964, except for the following:

Heater Voltage - 9.3 volts
Heater Current - 450 mA.

MECHANICAL DATA

Bulb	T-6½
Base	E9-1
Outline	6-3
Cathode	Coated Unipotential
Mounting Position	Any
Basing	9RF

Pin Connection

Pin 1 - Cathode	Pin 5 - Heater
Pin 2 - Grid 1	Pin 6 - Grid 3
Pin 3 - No connection	Pin 7 - Plate
Pin 4 - Heater	Pin 8 - No connection
	Pin 9 - Grid 2

HEATER CHARACTERISTICS AND RATINGS

Average Characteristics

Heater Operation	Series	
Heater Voltage	8.7	Volts
Heater Current	450[1]	Ma
Heater Warm-up Time[2]	11	Seconds

Ratings (Design Maximum Values)

	Min-Max		
Heater Current[3]	420-480	Ma	
Maximum Heather-Cathode Voltage			
Heater Negative with Respect to Cathode			
Total DC and Peak	200	Volts	Max.
Heater Positive with Respect to Cathode			
DC	100	Volts	Max.
Total DC and Peak	200	Volts	Max.

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

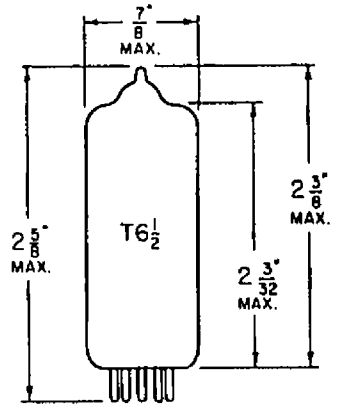
Grid 1 to plate: g1 to p	0.20 pf
Grid 3 to plate: g3 to p	2.2 pf
Grid 1 to all: g1 to h+k+g2+g3+p	16.5 pf
Grid 2 to all: g2 to h+k+g1+g3+p	9.5 pf
Grid 3 to all: g3 to h+k+g1+g2+p	7.5 pf
Plate to all: p to h+k+g1+g2+g3	3.0 pf
Grid 1 to grid 2: g1 to g2	4.7 pf

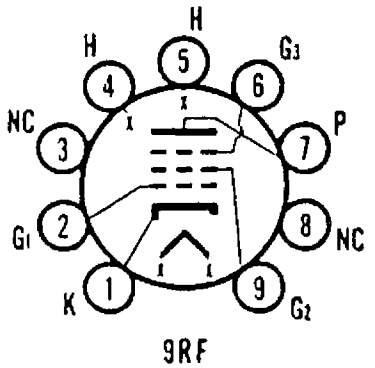
RATINGS (Design Maximum Values)

Plate Voltage	400 Volts
Grid #2 Supply Voltage	330 Volts

QUICK REFERENCE DATA

The Sylvania Type 9KC6 is a T6½ frame grid pentode intended for use as a Chroma Band-pass Amplifier, Color Demodulator, or Video Amplifier. It features a dual grid control characteristic.





9RF

SYLVANIA ELECTRIC PRODUCTS INC.

Electronic Components Group
ELECTRONIC TUBE DIVISION
EMPORIUM, PA.

A Technical Publication

November 19, 1964

146 (10-58)

from JEDEC release #4884, Dec. 21, 1964

Grid #2 Voltage		See Rating Chart	
Positive Grid #3 Voltage		0	Volt
Negative Grid #3 Voltage		100	Volts
Positive Grid #1 Voltage		0	Volt
Plate Dissipation		7.0	Watts
Grid #2 Dissipation		1.5	Watts
Grid #1 Circuit Resistance	Self Bias	.5	Megohm
	Fixed Bias	.25	Megohm
Grid #3 Circuit Resistance		1.0	Megohm

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 and shorts indicating devices, particularly where mechanical excitation of the tube is employed.

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	250	250	Volts
Grid #2 Voltage	150	100	Volts
Grid #1 Voltage	0	-1.0	Volt
Grid #3 Voltage (referred to negative end of Rk)	0	-25	Volts
Cathode Resistor	56	0	Ohms
Plate Current	18	1.0	ma
Grid #2 Current	9	13.0	ma
Transconductance (grid #1 to plate)	24,000	--	umhos
Transconductance (grid #3 to plate)	500	--	umhos
Plate Resistance (approx.)	55,000	--	ohms
Grid #1 Voltage for Ib=100 μA (Rk=0)	-4.1	--	Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS [4]

Eb = 50 Volts, Ec2 = 100 Volts, and Ec1 = 0 Volt
Ib = 25 Ma, and Ic2 = 25 Ma

NOTES:

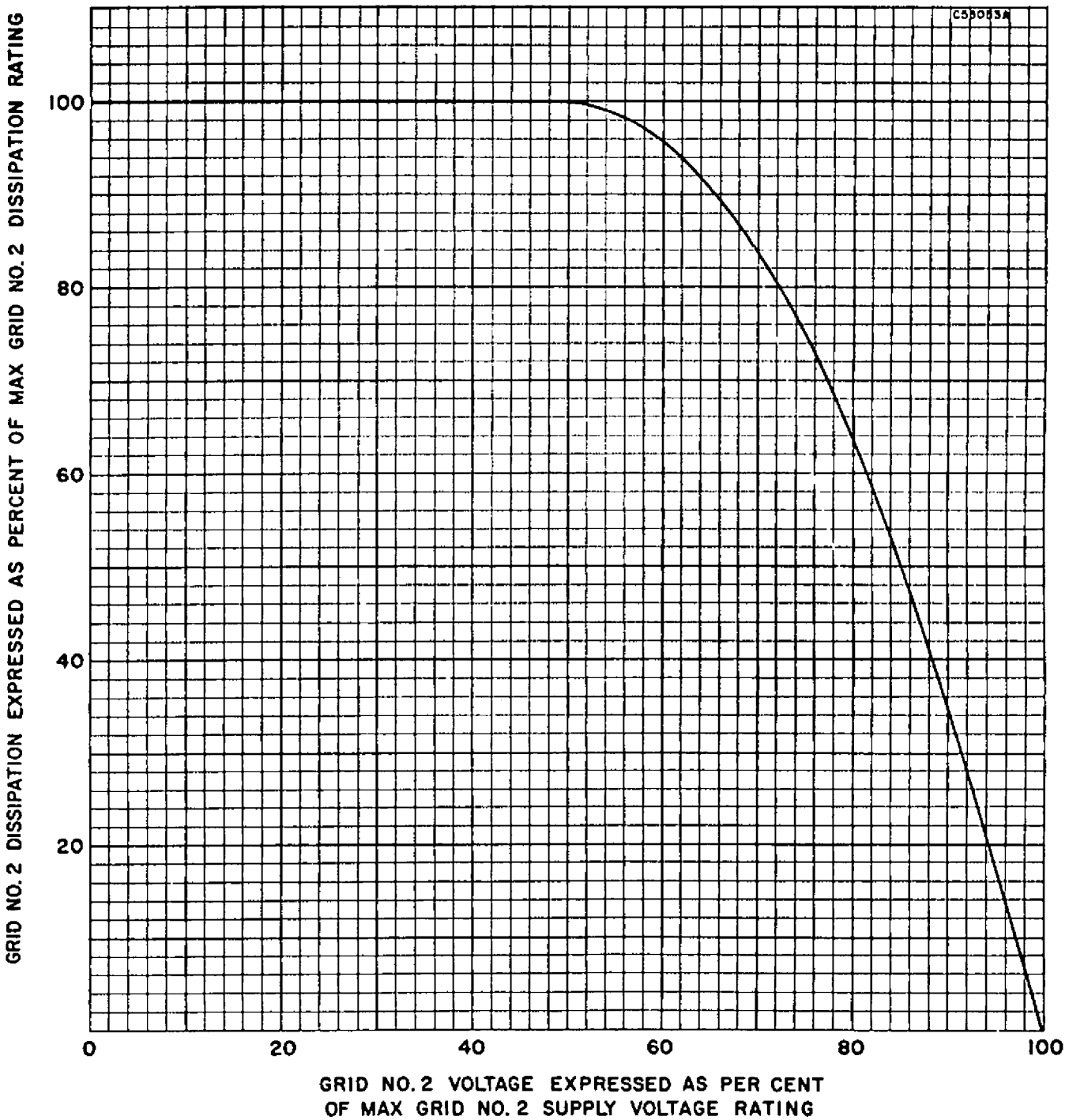
1. For series operation of heaters, equipment should be designed that at normal supply voltage bogey tubes will operate at this value of heater current.

2. Heater warm-up time is defined as the time required for the voltage across the heater to reach 80% of the rated heater voltage after applying four (4) times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to three (3) times the rated heater voltage divided by the rated heater current.

3. Heater voltage supply variations shall be restricted to maintain heater current within the specified values.

4. Applied for short interval (2 Sec. Max.) so as not to damage tube.

RATING CHART



MECHANICAL DATA

Bulb	T-6½
Base[1]	E9-1, Miniature Button 9-Pin
Outline	6-7
Basing	9Y
Cap	Skirted Miniature, C1-2 or C1-33
Cathode	Coated Filament
Mounting Position	Any

ELECTRICAL DATA

FILAMENT CHARACTERISTICS AND RATINGS

	Min.	Max.	
Average Characteristics			
Filament Voltage[2]		2.1	Volts
Filament Current		275	Ma
Ratings (Design Maximum Values)[3]			
Filament Voltage[4]	1.75	2.45	Volts

DIRECT INTERELECTRODE CAPACITANCES (APPROX.)

Plate To All (p to f+is)	1.1 pf

AVERAGE CHARACTERISTICS

Tube Drop (Approx.) With 7 Ma Plate Current	70 Volts

RATINGS - FLYBACK VOLTAGE RECTIFIER[3,5]

Inverse Plate Voltage		
Total DC and Peak	22 KV	Max.
DC	18 KV	Max.
Peak Plate Current	45 Ma	Max.
Average Plate Current	0.5 Ma	Max.

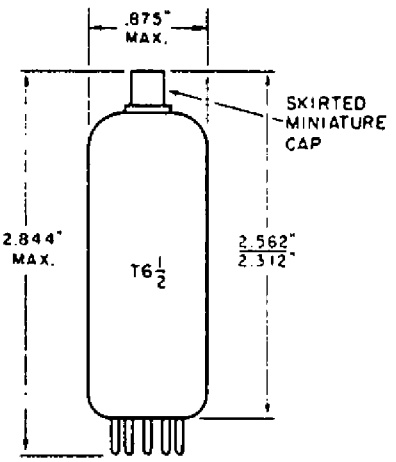
NOTES:

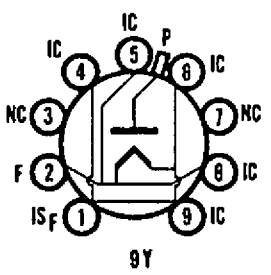
1. Socket terminals 3 and 7 may be used as tie points for component at or near filament potential.
2. The equipment shall be so designed that the filament voltage is centered at the specified value.
3. Design Maximum Ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

from JEDEC release #4794, Sept.7, 1964

QUICK REFERENCE DATA

The Sylvania Type 2AZ2 is a miniature filament type diode designed for use as a high voltage rectifier in television receivers and other high voltage rectifier applications. It is applicable for use in both flyback and RF types of supplies as well as for use at power line frequency.





SYLVANIA ELECTRIC PRODUCTS INC.

Electronic Components Group
ELECTRONIC TUBE DIVISION
EMPORIUM, PA.

A Technical Publication

August 17, 1964
Page 1 of 2

NOTES: (Cont'd.)

3. (Cont'd.)
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 variation in the characteristics of all other electron devices in the equipment.

4. Filament supply variations shall be restricted to maintain filament voltage within the specified values.

5. For operation in a 525 line, 30 frame system as described in Standards of Good Engineering Practice of Television Broadcasting Stations. Federal Communications Commission. The duty cycle of the voltage pulse is not to exceed 15% of a scanning cycle.

This tube may produce soft X-rays which can constitute a health hazard unless adequately shielded.

MECHANICAL DATA

Bulb	T-6½
Base	E9-1, Miniature Button 9-Pin
Outline	6-2
Cathode	Coated Filament
Mounting Position	Any
Basing[1]	9U

Pin - 1 - Plate
Pin - 2 - Internal Connection
Pin - 3 - Internal Connection
Pin - 4 - Filament
Pin - 5 - Filament
Pin - 6 - Internal Connection
Pin - 7 - Internal Connection
Pin - 8 - Internal Connection
Pin - 9 - Plate

ELECTRICAL DATA

FILAMENT CHARACTERISTICS

Filament Voltage[2]	1.8	Volts
Filament Current	300	Ma

DIRECT INTERELECTRODE CAPACITANCE (Unshielded)

Plate to Filament (Approx.)	0.8	pf

RATINGS (Design Maximum Values)

Flyback Voltage Rectifier[2]

Inverse Plate Voltage		
Total DC and Peak (Abs. Max.)	8250	Volts Max.
DC	7000	Volts Max.
Peak Plate Current	50	Ma Max.
Average Plate Current	0.6	Ma Max.

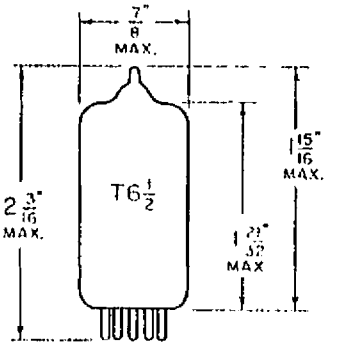
CHARACTERISTICS

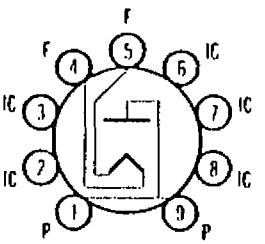
Tube Drop for Ib = 6.5 Ma (Approx.)	55	Volts

from JEDEC release #4844, Nov. 9, 1964

QUICK REFERENCE DATA

The Sylvania Type 2PA? is a filamentary half-wave diode intended for service as a focus rectifier in color television receivers.





9U

SYLVANIA ELECTRIC PRODUCTS INC.

Electronic Components Group
ELECTRONIC TUBE DIVISION
EMPORIUM, PA.

A Technical Publication

October 7, 1964

NOTES:

1. Socket terminals 2, 3, 7, and 8 shall not be used. Terminal 6 may be used as a tie point for components at or near filament potential.

2. Under no circumstances should the filament voltage be less than 1.9 volts or more than 2.1 volts.

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

JOINT ELECTRON DEVICE ENGINEERING COUNCIL

JEDEC Type Administration Section
Electronic Industries Association
32 Green Street
Newark 2, New Jersey

E. I. A.
REGISTRATION
FILE

Announcement

of

Electron Device Type Registration

Release No. 4655A

August 17, 1964

The Joint Electron Device Engineering Council announces the registration of the following electron device designation

4GS7 *

according to the following on the application of

Matsushita Electronic Corporation
Takatsuki, Osaki,
Japan

* The Type 4GS7 is identical with the 7GS7 as registered in JEDEC Release No. 4655 dated April 6, 1964, except for the following:

Heater Voltage	4.0 Volts
Heater Current	600 ma

TRIODE & FRAME-GRID PENTODE CONVERTER
TYPES 4GX7, 5GX7, 6GX7 AND 8GX7

The 4GX7, 5GX7, 6GX7 and 8GX7 are medium-mu triode and sharp-cutoff frame-grid pentode types designed for oscillator-mixer service in V.H.F. television tuners. The pentode section features high transconductance and low grid 1-to-plate capacitance to ensure high gain with good stability in amplifier operation.

The 4GX7, 5GX7 and 8GX7 feature controlled heater warm-up time and render reliable service in properly designed series heater circuits.

ELECTRICAL

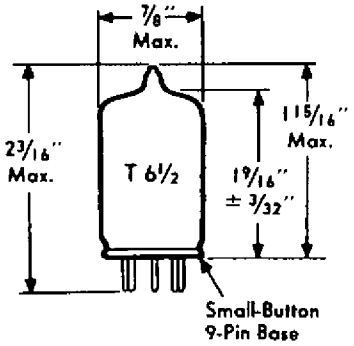
Cathodes				Coated Unipotential	
Heater:	4GX7	5GX7	6GX7	8GX7	
Voltage	4.2	5.6	6.3	7.7	Volts
Current	0.60	0.45	0.40	0.30	Ampere
Warm-Up Time (Note 1)	11	11	–	11	Seconds

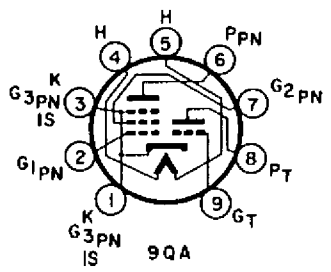
Direct Interelectrode Capacitances: Shielded (Note 2)

Triode:		
Grid to Plate	1.2	pf
Input	2.3	pf
Output	1.9	pf
Pentode:		
Grid 1 to Plate	0.005	pf
Input	5.40	pf
Output	3.30	pf
Grid 1 to Grid 2	1.6	pf

MECHANICAL

Bulb	T-6½
Base	Miniature 9-Pin (JEDEC E9-1)
Outline	6-2
Basing	9QA
Mounting Position	Any





RATINGS

Design Maximum Values

	Triode	Pentode		
Plate Voltage	275	275	max.	Volts
Grid 2 Supply Voltage	–	275	max.	Volts
Grid 2 Voltage	–	See Grid 2 Input Rating Curve		
Plate Dissipation	1.5	2.2	max.	Watts
Grid 2 Dissipation	–	0.45	max.	Watts
Positive Grid 1 Voltage	0	0	max.	Volts
Negative Grid 1 Voltage	40	40	max.	Volts
Cathode Current	20	20	max.	Ma.
Grid 1 Circuit Resistance				
Fixed Bias	0.5	0.25	max.	Megohm
Cathode Resistor Bias	1.0	0.5	max.	Megohm
Heater-Cathode Voltage:				
Heater Negative with Respect to Cathode				
Total DC + Peak	200	200	max.	Volts
Heater Positive with Respect to Cathode				
DC Component	100	100	max.	Volts
Total DC + Peak	200	200	max.	Volts

CHARACTERISTICS AND TYPICAL OPERATION

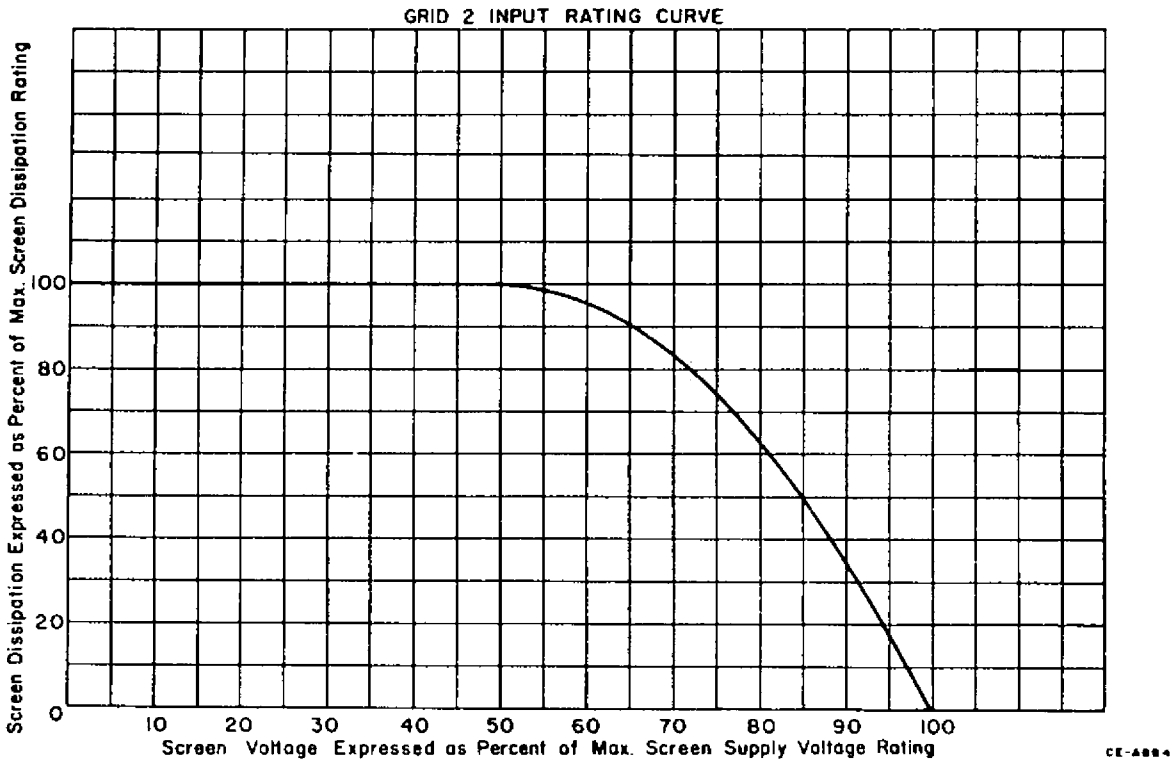
Triode Unit:			
Plate Voltage	100	125	Volts
Grid Voltage	–	–1.0	Volts
Grid Circuit Resistance	0.1	–	Megohm
Amplification Factor	–	40	–
Plate Resistance	–	4700	Ohms
Transconductance	8700	8500	μmhos
Plate Current	12.5	13	Ma.
Grid Cutoff Voltage (Note 3)	–6.0	–	Volts
Pentode Unit:			
Plate Voltage	120	125	Volts
Grid 2 Voltage	90	125	Volts
Grid 1 Voltage	–	–1.0	Volts
Grid 1 Circuit Resistance	0.1	–	Megohms
Plate Resistance	–	200000	Ohms
Transconductance	13000	11000	μmhos
Plate Current	8.5	8.0	Ma.
Grid 2 Current	2.8	2.5	Ma.
Grid 1 Cutoff Voltage (Note 3)	–2.5	–	Volts

NOTES

1. Heater Warm-Up Time is defined as the time required for the voltage across the heater to reach 80% 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 rated heater voltage divided by rated heater current.
2. With external shield connected to cathode.
3. For a plate current of 20 microamperes.

from JEDEC release #4647, March 30, 1964

Westinghouse®



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—PRODUCT INFORMATION—

Triode-Pentode

4JW8

The 4JW8 is a triode-pentode intended primarily for horizontal-oscillator and AFC service in the horizontal-deflection systems of television receivers.

Except for heater characteristics and ratings, the 4JW8 is identical to the 6JW8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	4.5	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.

from JEDEC release #4851E, April 24, 1972

from JEDEC release #4569, Jan. 27, 1964

4WP11 - 4WP16

Ultra-High Resolution

Cathode Ray Tube

PHILCO CORPORATION - LANSDALE DIVISION

CATHODE RAY TUBE

DATA SHEET

Tentative

Description

The Philco type 4WP- is an ultra-high resolution cathode ray tube of the magnetic focus and magnetic deflection type. It features an ultra-high resolution spot which is essentially constant over a radius of 0.75 inch. The tube is capable of resolving 3500 lines per inch.

The optical quality, non-browning, flat faceplate, combined with an essentially blemish-free, metal backed screen, makes it suitable for photo-oscillographic applications. The high quality settled screen results in considerably more light output than other types of high resolution screens.

Electrical Data

Focusing Method	Magnetic
Deflection Method	Magnetic
Deflection Angle, approximate	46.5°
Heater Voltage	6.3 Volts
Heater Current	0.60 ±10% Ampere
Direct Interelectrode Capacitance (Maximum)	
Cathode to All Other Electrodes	6.0uuf
Grid #1 to All Other Electrodes	6.0uuf

Optical Data

Phosphor Number	P11	P16
Fluorescent Color	Blue	Bluish Purple
Phosphorescence	Blue	Bluish Purple
Persistence	Medium Short	Very Short
Faceplate		
Optical Quality, Flat, Gray, Non-browning		

Mechanical Data

Overall Dimensions	
Length	12±1/4 Inches
Greatest Bulb Diameter	3 3/4±3/32 Inches
Minimum Useful Screen Diameter	2.8 Inches
Base	B5-57
Anode Contact	J1-21

Maximum Ratings

Anode Voltage (Note #1)	22,000 Volts DC
Grid No. 1	
Negative Bias Value	100 Volts DC
Positive Bias Value	0 Volts
Positive Peak Value	0 Volts
Heater-Cathode Voltage (Note #2)	±180 Volts DC
Grid No. 1 Circuit Resistance	1.0 megohm

Typical Operating Conditions

Anode Voltage	20,000 Volts
Grid #1 Voltage (Note #3)	-20 to -50 Volts
Line Width "A" (Note #4)	0.0003 Inch
Spot Size (Note #5)	0.0007 Inch

Notes

1. Anode and Grid #2 are connected together within the tube and are referred to herein as anode.

2. Cathode should be returned to one side or to the mid-tap of the heater transformer winding.

3. For visual extinction of the undeflected focused spot.

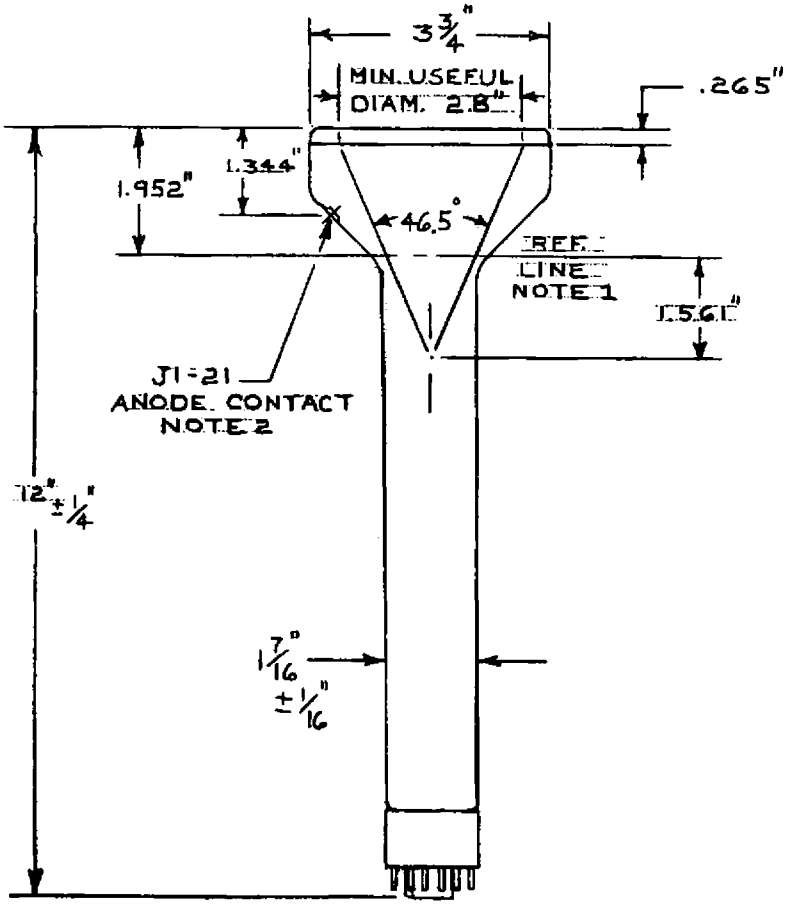
4. Measured with a 525 line pattern adjusted to 90% of minimum useful screen diameter at Ik = 1.0ua. The line width is the merged raster height divided by the number of lines (500) (measured in the center of tube face).

5. Measured to the half-brightness point at center of face with Ik = 1.0ua.

PHILCO CORPORATION - LANSDALE DIVISION

Outline Drawing
4WP11 - 4WP16

Ultra-High Resolution
Cathode Ray Tube





Base lug aligns with anode button

MECHANICAL NOTES

1. Reference line is determined by a 1.937" ±.002" diameter ring gauge 2 inches long.
2. Anode button is aligned with base lug ±10°.

WARNING

X-ray radiation shielding may be necessary to protect against possible danger of personal injury from prolonged exposure at close range if this tube is operated at anode voltages higher than 16,000 volts.

The information, diagrams, or any other data included herein are believed to be accurate and reliable. However, the Philco Corporation, Lansdale Division, assumes no responsibility or liability whatsoever for the application, interpretation or use made of such information, diagrams or data especially insofar as the use of said information, diagrams or data affects any patent, trademark or proprietary data rights.

PHILCO CORPORATION

A SUBSIDIARY OF Ford Motor Company

LANSDALE DIVISION

4XP11
4XP16

Ultra-High Resolution

Cathode Ray Tube

CATHODE RAY TUBE

DATA SHEET

Description

The Philco type 4XP_ is an ultra-high resolution cathode ray tube of the magnetic focus and magnetic deflection type. It features an ultra-high resolution spot which is essentially constant over a radius of 0.75 inch. The tube is capable of resolving 2600 lines per inch.

The tube also features a small neck diameter which reduces power requirements for deflection and focusing. This makes the tube particularly attractive for airborne applications where minimum weight is desirable.

The optical quality, non-browning, flat faceplate, combined with an essentially blemish-free, metal backed screen, makes it suitable for photo-oscillographic applications. The high quality settled screen results in considerably more light output than other types of high resolution screens.

Electrical Data

Focusing Method	Magnetic
Deflection Method	Magnetic
Deflection Angle, approximate	56°
Direct Interelectrode Capacitances	
Cathode to all other electrodes	6.0 uuf
Grid No. 1 to all other electrodes	6.0 uuf
Heater Current at 6.3 Volts	600±10% ma

Optical Data

Phosphor Number	P11	P16
Fluorescent Color	Blue	Bluish Purple
Phosphorescence	Blue	Bluish Purple
Persistence	Medium Short	Very Short
Faceplate		
Optical Quality, Flat, Gray, Non-browning		

from JEDEC release #4852, Nov. 16, 1964

Mechanical Data

Overall Length	12 ±1/4 Inches
Greatest Diameter of Tube	3 3/4 ±3/32 Inches
Minimum Useful Screen Diameter (Projected)	2.8 Inches
Implosion Protection	None
Bulb	Modified C30 Exp. 4
Bulb Contact	J1-21
Base	B6-185
Basing	7GP
Bulb Contact Alignment	
Anode Contact Aligns with Base Lug ±10°	

Ratings (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage (Note 1)	22,000 Volts DC
Minimum Anode Voltage (Note 2)	8,000 Volts DC
Grid No. 1 Voltage	
Maximum Negative Value	100 Volts DC
Maximum Positive Value	0 Volts DC
Maximum Positive Peak Value	0 Volts DC
Maximum Heater Voltage	7.0 Volts
Minimum Heater Voltage	5.0 Volts
Maximum Heater-Cathode Voltage (Note 3)	
Heater Negative with Respect to Cathode	
During Warm-up Period not to exceed 15 seconds	410 Volts
After Equipment Warm-up Period	180 Volts
Heater Positive with Respect to Cathode	180 Volts

Typical Operating Conditions (Grid Drive Service)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Anode Voltage	10,000 Volts DC
Grid No. 1 Voltage (Note 4)	-20 to -40 Volts DC
Focus Coil Current (Note 5)	50 ma DC
Resolution:	
Line Width "A" (Note 6)	0.0004 Inch
Spot Size (Note 7)	0.0007 Inch

Maximum Circuit Values

Maximum Grid No. 1 Circuit Resistance	1.0 Megohms

Notes

1. Anode and Grid No. 2 are connected together within the tube and are referred to herein as anode.

2. Due to the triode construction, tube performance is greatly affected by a reduction of anode voltage.

3. Cathode should be returned to one side or to the mid-tap of the heater transformer winding.

4. Visual extinction of the undeflected focused spot.

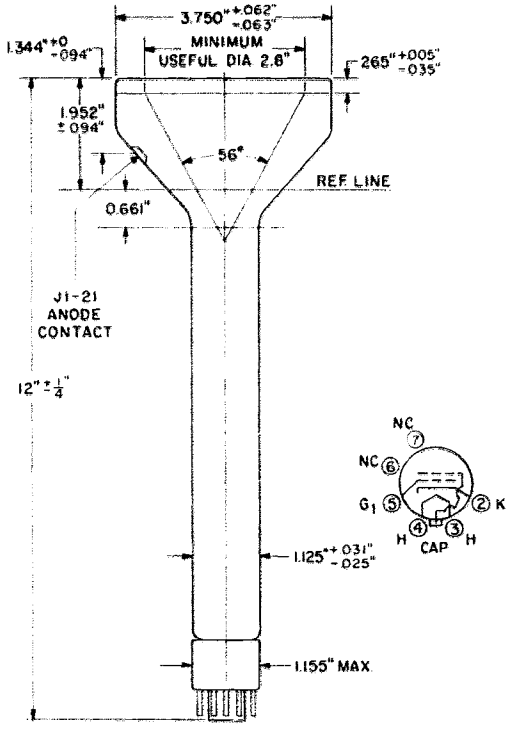
5. For Celco Focus Coil No. B1781, or equivalent, with the combined Grid No. 1 bias voltage and video-signal voltage adjusted to produce cathode current of 1.0 microampere. Distance from reference line to center of air gap on focus coil shall be 4 1/8 inches.

6. Measured with a 525 line pattern adjusted to 90% of minimum useful screen diameter at Ik = 10ua. The line width is the merged raster height divided by the number of lines (measured in the center of the tube face).

7. Measured to the half-brightness point at center of face with Ik = 1.0ua.

PHILCO CORPORATION - LANSDALE DIVISION

Outline Drawing
4XP__
Ultra High Resolution
Cathode Ray Tube



MECHANICAL NOTES

1. The reference line is determined by a 1.937" ±.002" diameter ring gauge 2" long.
2. Anode contact aligns with base lug ±10°.
3. A centering magnet should be used to center the beam in the aperture.

WARNING

X-ray radiation shielding may be necessary to protect against possible danger of personal injury from prolonged exposure at close range if this tube is operated at anode voltages higher than 16,000 volts.

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5ECP11

5ECP16 - 5ECP24

High Resolution

Cathode Ray Tube

PHILCO CORPORATION - LANSDALE DIVISION

CATHODE RAY TUBE

DATA SHEET

Description

The Philco type 5ECP—is a high resolution cathode ray tube of the magnetic focus and magnetic deflection type originally designed for data recognition applications. This tube features a very small spot size which makes the tube capable of resolving 2000 lines per inch.

The tube also features an optical quality, non-browning, flat, faceplate. This combined with the blemish-free, metal backed screen, makes the tube ideal for flying spot scanner applications.

Electrical Data

Focusing Method	Magnetic
Deflection Method	Magnetic
Deflection Angle, Nominal	50°
Heater Voltage	6.3 Volts
Heater Current	0.60 ±10% Ampere
Direct Interelectrode Capacitance (Maximum)	
Cathode to All Other Electrodes	3.5uuf
Grid #1 to All Other Electrodes	4.0uuf
External Coating Capacitance	400 min. uuf
	800 max. uuf

Optical Data

Phosphor Number	P11	P16	P24
Fluorescent Color	Blue	Bluish Purple	Green
Phosphorescence	Blue	Bluish Purple	Green
Persistence	Medium Short	Very Short	Short
Faceplate			
Optical Quality, Flat, Non-browning			

from JEDEC release #4743, June 29, 1964

Mechanical Data

Overall Dimensions	
Length	17 ±¼ Inches
Diameter (Exclusive of Corona Shield)	5 ±1/8 Inches
Minimum Useful Screen Diameter	4¼ Inches
Bulb	J40N1A
Bulb Contact	J1-21
Base	B5-57
Basing	12G

Bulb Contact Aligns with Pin Position #3 ±10%

Maximum Ratings

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage (Note #1)	30,000 Volts DC
Minimum Anode Voltage (Note #6)	20,000 Volts DC
Grid #1 Voltage	
Maximum Negative Value	350 Volts DC
Maximum Positive Value	0 Volts DC
Maximum Positive Peak Value	2 Volts
Maximum Heater Voltage	7.0 Volts
Minimum Heater Voltage	5.0 Volts
Maximum Heater-Cathode Voltage (Note #2)	
Heater Negative with Respect to Cathode	
During Warm-up Period not to exceed 15 seconds	410 Volts
After Warm-up Period	180 Volts
Heater Positive with Respect to Cathode	180 Volts

Grid #1 Circuit Resistance . . . . . 1.0 Megohm

Typical Operating Conditions (Grid Drive)

Anode Voltage	27,000 Volts	
Grid #1 Voltage (Note #3)	-50 to -90 Volts	
Resolution:	P11-P16	P24
Line Width "A" (Note #4)	0.0005 Inch.	0.0007 Inch
Spot Size (Note #5)	0.001 Inch.	0.0015 Inch
Focus Coil Current (Note #7)	200 Ma	

Notes

1. Anode and grid #2 are connected together within the tube and are referred to herein as anode.

2. Cathode should be returned to one side or the mid-tap of the heater transformer winding.

3. For visual extinction of the undeflected focused spot.

4. Measured with a 525 line pattern adjusted to 90% of minimum useful screen diameter at Ik = 20ua. The line width is the merged raster height divided by the number of lines (measured in the center of tube face).

5. Measured to the half-brightness point at center of face with Ik = 1.0ua.

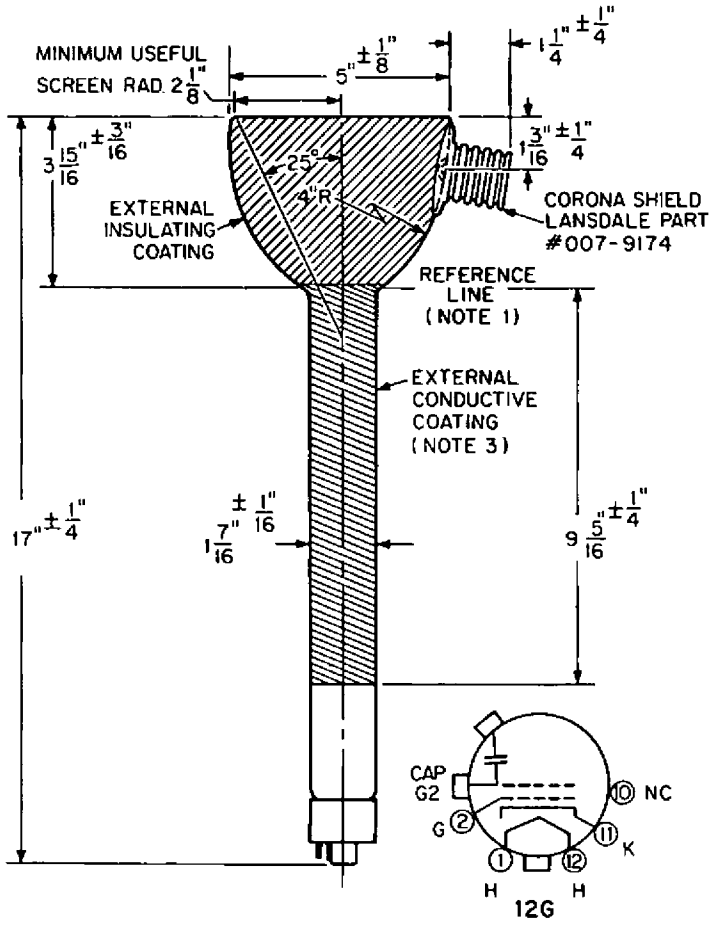
6. Due to the effect of the limiting aperture, screen brightness is greatly affected by a reduction of anode voltage.

7. For standard JEDEC focus coil #106 or equivalent, with the combined grid #1 bias voltage and video signal voltage adjusted for 10 microamperes of cathode current.

PHILCO CORPORATION - LANSDALE DIVISION

Outline Drawing
5ECP—

High Resolution
Cathode Ray Tube



MECHANICAL NOTES

1. The reference line is determined by reference line gauge JEDEC #112.
2. Anode contact aligns with vacant pin position #3 ±10%.
3. External conductive coating must be grounded.
4. A centering magnet should be used to center the beam within the aperture.

WARNING

X-ray radiation shielding may be necessary to protect against possible danger of personal injury from prolonged exposure at close range if this tube is operated at anode voltages higher than 16,000 volts.

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Amperex® ELECTRONIC CORPORATION
HICKSVILLE, LONG ISLAND, N. Y. 11802

TYPE 5EJP SERIES

The Amperex 5EJP series are electrostatically focused and deflected cathode ray tubes for use in precision instruments. They have a 5 inch flat face with neck connections to the deflection plates and incorporate a helical, distributed P.D.A. system.

The 5EJP series employ the modern mesh grid technique which yields a vertical deflection factor in the order of 2.9 V/cm.

GENERAL CHARACTERISTICS

MECHANICAL

Dimensions — see outline drawing
Screen

Type	Phosphor	Fluorescence	Persistence
5EJP2	P2	Yellowish-green	Medium Short
5EJP7	P7	Purplish-blue	Long
5EJP11	P11	Blue	Short
5EJP31	P31	Green	Medium Short

ELECTRICAL

Cathode	indirectly heated
Filament Voltage	6.3 volts
Filament Current	300 ma
Focusing and Deflection	electrostatic
Line Width[1]	0.024 inch
Interelectrode Capacitances	
Grid No. 1 to All Electrodes	6.0 pf
Cathode to All Electrodes	3.6 pf
Deflection Plate X1 to All Electrodes (except X2)	4.5 pf
Deflection Plate X2 to All Electrodes (except X1)	4.5 pf
Deflection Plate X1 to X2	2.7 pf
Deflection Plate Y1 to All Electrodes (except Y2)	3.8 pf
Deflection Plate Y2 to All Electrodes (except Y1)	3.8 pf
Deflection Plate Y1 to Y2	1.8 pf

[1] Line width measured by the shrinking raster method at 25 μa beam current.

Amperex

Rev. March 1964

MAXIMUM RATINGS, ABSOLUTE VALUES

Post Accelerator Voltage (G-9)	17.3 kv max.
	9.0 kv min.
Helix Voltage, Lower End (G-8)	1.8 kv max.
	1.0 kv min.
Post Deflection Shield Voltage (G-7)	1.8 kv max.
	900 volts min.
Pattern Adjustment Electrode Voltage (G-6)	1.8 kv max.
	1.0 kv min.
Interplate Shield Voltage (G-5)	1.8 kv max.
	1.0 kv min.
Astigmatism Adjustment Electrode Voltage (G-4)	1.8 kv max.
	1.0 kv min.
Focusing Electrode Voltage (G-3)	1.5 kv max.
Accelerator Voltage (G-2)	1.7 kv max.
	800 volts min.
Grid No. 1 Voltage	-200 volts max.
	-1 volt min.
Cathode to Heater Voltage	
Cathode Positive	200 volts max.
Cathode Negative	125 volts max.
Horizontal Deflection Plate to Grid No. 4 Voltage	500 volts max.
Vertical Deflection Plate to Grid No. 4 Voltage	500 volts max.
Grid No. 7 to Grid No. 6 Voltage	
Grid No. 7 Positive	0 volt max.
Grid No. 7 Negative	100 volts max.
Grid No. 5 to Grid No. 4 Voltage	200 volts max.
Grid No. 6 to Grid No. 4 Voltage	200 volts max.
Grid No. 8 to Grid No. 4 Voltage	200 volts max.
Grid No. 1 Circuit Resistance	1.0 megohm

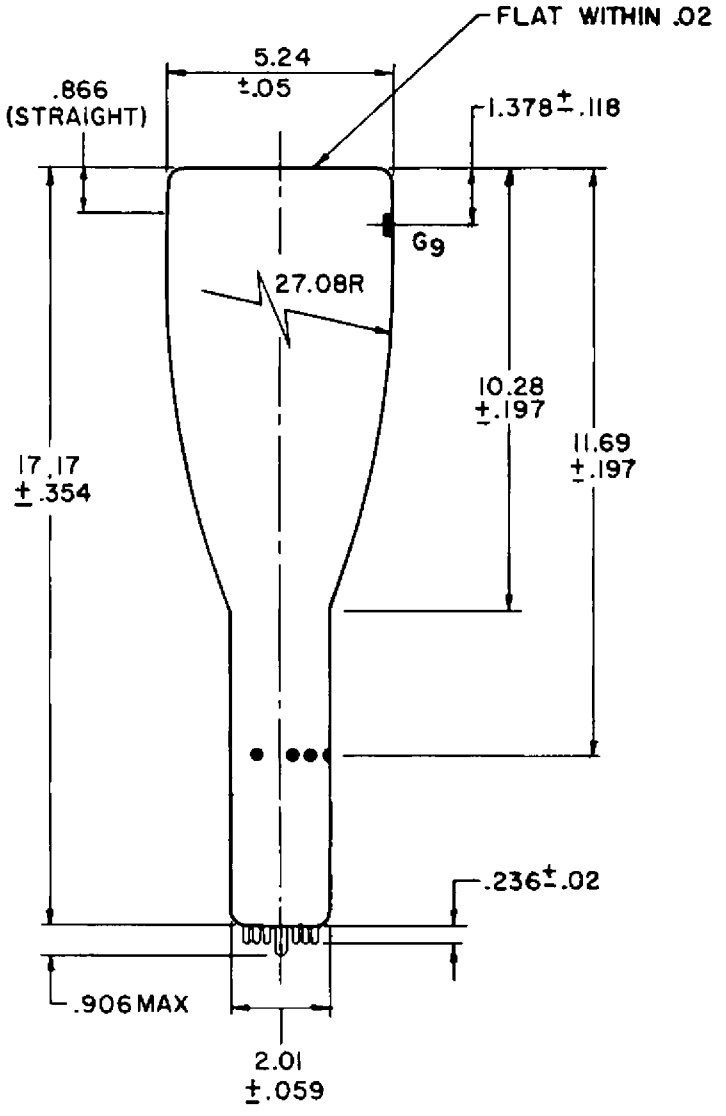
TYPICAL OPERATING CONDITIONS

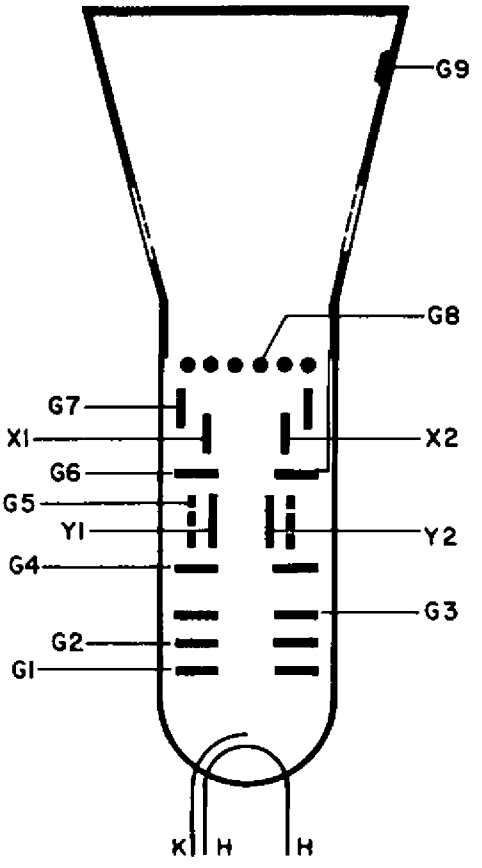
Post Accelerator Voltage (G-9)	15.0 kv
Helix Voltage, Lower End (G-8)	1.5 kv
Post Deflection Shield Voltage (G-7)	
(with respect to Grid No. 6)	-12 to -18 volts
Pattern Adjustment Electrode Voltage (G-6)	
(with respect to Deflection Plate Potential)	±70 volts
Mean X Deflection Plate Potential	1.5 kv
Interplate Shield Voltage (G-5)	1.5 kv
Mean Y Deflection Plate Potential	1.5 kv
Astigmatism Adjustment Electrode Voltage (G-4)	1500±70 volts
Focusing Electrode Voltage (G-3)	375-625 volts
Accelerator Voltage (G-2)	1.5 kv
Negative Grid No. 1 Voltage	
(for visual extinction of a focused spot)	45-85 volts
Deflection Factor	
Horizontal (X)	9.4-12.5 V/cm
Vertical (Y)	2.3-3.5 V/cm
Useful Scan	
Horizontal (X)	10 cm
Vertical (Y)	6 cm
Post Deflection Accelerator Helix Resistance	200 megohms min.
Spot Position	See Note 2
Linearity of Deflection	See Note 3
Raster Distortion	See Note 4.

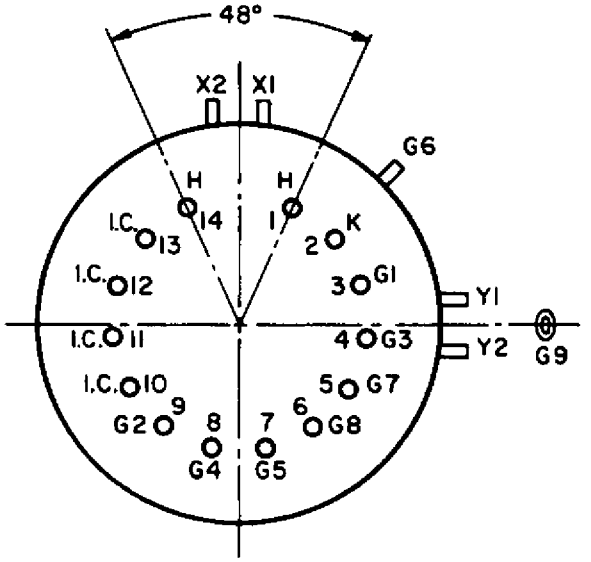
NOTES

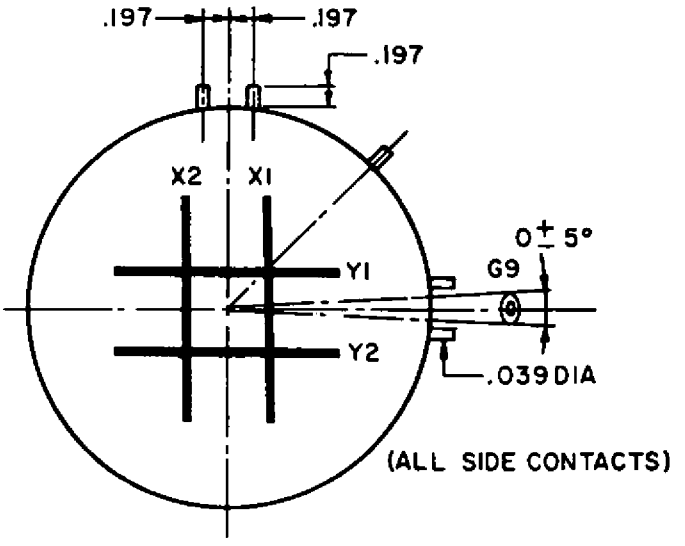
If use is made of the full deflection capabilities of the tube, the deflection plates will intercept part of the electron beam near the edge of the tube. Therefore a low impedance deflection plate drive is desirable.

2. With the tube shielded, the undeflected focused spot will fall within a rectangle 12x20 mm, centered at the geometric center of the tube face. The greater dimension being in the X direction.
3. The sensitivity at a deflection of less than 75% of the useful scan will not differ from the sensitivity at a deflection of 25% of the useful scan by more than 2%.
4. A focused raster, whose size is adjusted so that the widest points just touch a rectangle 100x50 mm, will have no point within a concentric rectangle 98x58.2 mm.


FLAT WITHIN .02
5.24
±.05
.866
(STRAIGHT)
1.378±.118
G9
27.08R
10.28
±.197
11.69
±.197
17.17
±.354
.236±.02
.906 MAX
2.01
±.059


G9
G8
G7
X1
X2
G6
G5
Y1
Y2
G4
G3
G2
G1
K
H
H


48°
X2
X1
G6
H
H
I.C.
13
14
1
2
K
I.C.
12
3
G1
Y1
I.C.
11
4
G3
Y2
G9
I.C.
10
5
G7
G2
9
8
7
6
G8
G4
G5


.197
.197
.197
X2
X1
Y1
Y2
0±5°
G9
.039 DIA
(ALL SIDE CONTACTS)

TECHNICAL DATA

JEDEC TYPE:
5 ELP

TEKTRONIX TYPE T5430

REVISION JUNE 10, 1964

DESCRIPTION: The 5ELP__ is an aluminized, 5-inch, flat-faced cathode-ray tube with electrostatic focus and deflection and a helical post accelerator. The tube was designed for oscilloscope use.

ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Electrostatic
Direct interelectrode capacitance, approximate:	
Cathode to all other electrodes	4.6 $\mu\mu$f
Grid No. 1 to all other electrodes	8.6 $\mu\mu$f
D1 to D2	1.8 $\mu\mu$f
D3 to D4	1.6 $\mu\mu$f
D1 to all other electrodes	5.6 $\mu\mu$f
D2 to all other electrodes	5.6 $\mu\mu$f
D3 to all other electrodes	4.8 $\mu\mu$f
D4 to all other electrodes	4.8 $\mu\mu$f
Post-accelerator helix resistance	200 megohms minimum 1500 megohms maximum

OPTICAL DATA

Phosphor Number	P1	P2	P7	P11	P31
Fluorescent color	Green	Blue-green	Blue-white	Blue	Green
Phosphorescent color	Green	Green	Yellow	Blue	Green
Persistence	Medium	Medium short	Long	Medium short	Medium

Faceplate Clear, flat

MECHANICAL DATA

Overall length	$18\frac{1}{8} \pm \frac{3}{16}$ inches
Greatest diameter of bulb	$5\frac{1}{4} \pm \frac{1}{16}$ inches
Minimum useful screen diameter	$4\frac{1}{2}$ inches
Bulb number	J42K
Bulb contact	J1-21
Base	B14-38

Basing	14 BG
Bulb contact alignment:	
J1-21 contact aligns with trace of D1-D2.	±5 degrees
J1-21 contact on same side as pin No. 4.	
Base alignment:	
Pin No. 1 aligns wih D3-D4 trace.	±10 degrees
Positive voltage on D1 deflects beam approximately toward pin No. 4.	
Positive voltage on D3 deflects beam approximately toward pin No. 1.	
Angle between D1-D2 and D3-D4 trace.	90 ±1 degree

RATINGS: (Design Center Values) (Note 1)

Heater voltage	6.3 volts
Heater current at 6.3 volts	0.6 ±10% ampere
Post-accelerator voltage	12,000 maximum volts DC
Isolation shield voltage	2,100 maximum volts DC
D3-D4 shield voltage	2,100 maximum volts DC
Average deflection plate voltage	2,100 maximum volts DC
Ratio post-accelerator voltage to average voltage of deflection plates (Note 2)	6 maximum
Astigmatism electrode voltage	2,100 maximum volts DC
Focusing electrode voltage	800 maximum volts DC
Accelerator voltage	2,100 maximum volts DC
Accelerator input	6 maximum watts
Grid No. 1 voltage:	
Negative-bias value	200 maximum volts DC
Positive-bias value	0 maximum volts DC
Positive-peak value	2 maximum volts DC
Peak heater-cathode voltage:	
Heater negative with respect to cathode:	
During warm-up period not to exceed 15 seconds	180 maximum volts
After equipment warm-up period	125 maximum volts
Heater positive with respect to cathode	125 maximum volts
Peak voltage between astigmatism and/or any deflection electrodes	600 maximum volts

TYPICAL OPERATING CONDITIONS: (Note 1)

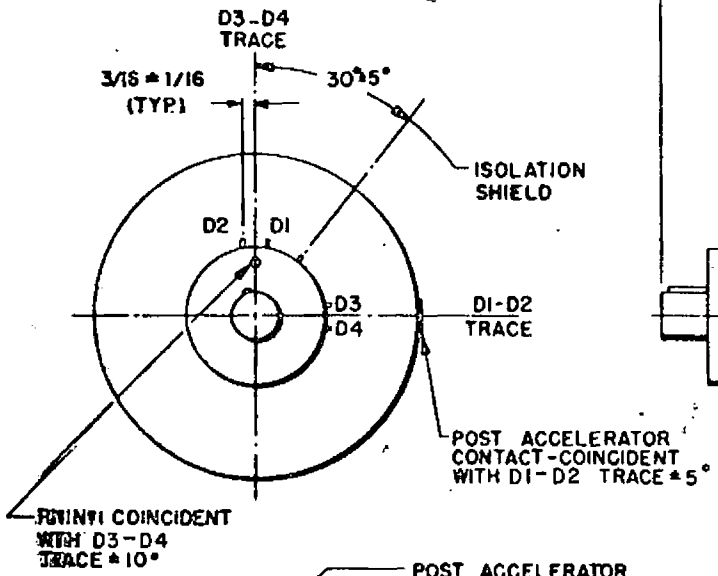
Post-accelerator voltage	10,000 volts DC
Isolation shield voltage (Note 3)	1575 to 1700 volts DC
D3-D4 shield voltage (Note 4)	1650 volts DC
Average deflection plate voltage	1650 volts DC
Astigmatism electrode voltage (Note 5)	1575 to 1850 volts DC
Focusing electrode voltage (Note 5)	210 to 550 volts DC
Accelerator voltage	1700 volts DC
Grid No. 1 voltage (Note 6)	—50 to —80 volts DC
Deflection factors:	
D1 and D2	28 to 32 volts DC per cm
D3 and D4	6.0 to 7.2 volts DC per cm
Useful scan D1-D2 (Note 7)	10 cm
Useful scan D3-D4 (Note 7)	4 cm
Focusing electrode current for any operating condition	—15 to +10 microamperes
Spot position (undeflected) (Note 8)	10 max millimeters from geometric
Pattern distortion at 100% useful scan (Note 9)	1.7% maximum

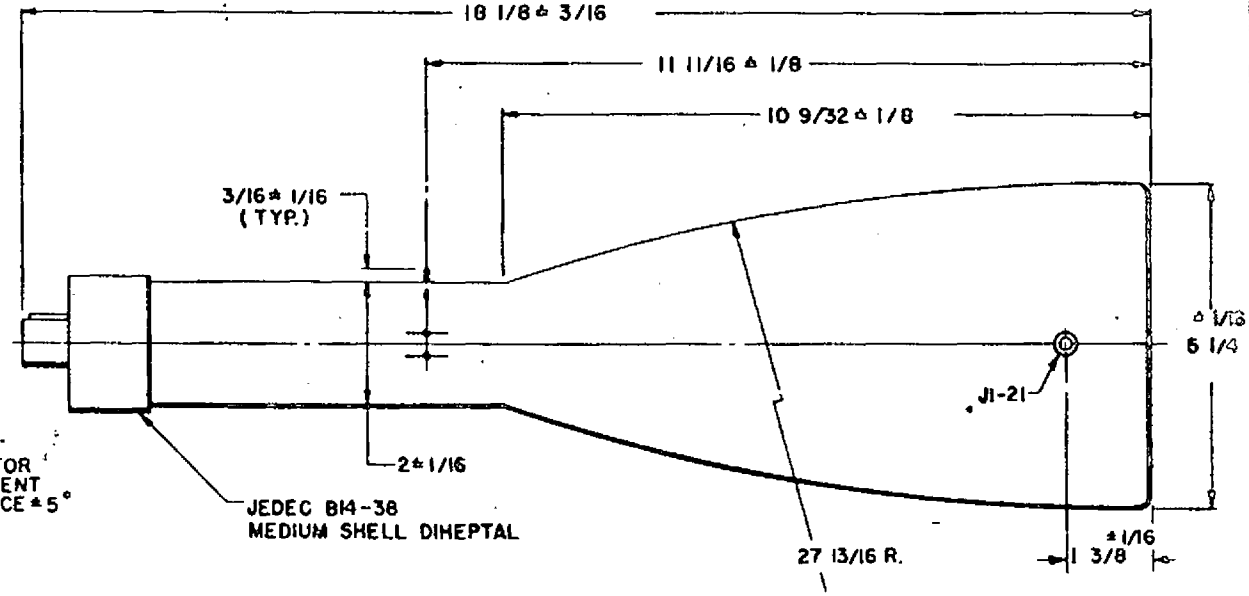
MAXIMUM CIRCUIT VALUES

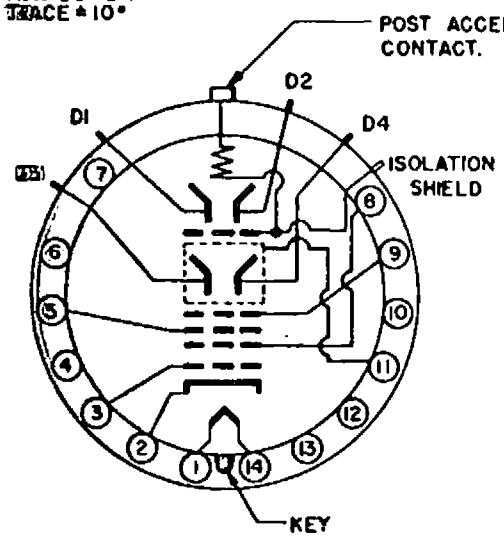
Grid No. 1 circuit resistance	1.5 maximum megohms

NOTES

1. All voltages taken with respect to cathode.
2. This tube is designed for optimum performance when operating at a ratio of 6. Operation at other ratios may result in changes in deflection uniformity, pattern distortion, and/or useful scan.
3. The isolation shield and the lower end of the post-accelerator helix are connected internally. Pattern distortion is minimized by proper adjustment of this potential.
4. Adjustment of D3-D4 deflection shield voltage controls linearity and scan of the D3-D4 deflection system.
5. Recommended range. Adjust for best overall focus.
6. Visual extinction of undeflected spot.
7. The deflection plates intercept part of the electron beam near the edge of scan; therefore, a low-impedance deflection drive is desirable.
8. Connect free deflecting electrodes to accelerator.
9. With a 4 x 10 cm rectangular raster centered on the face of the tube, the raster edges will not deviate from straight parallel lines by more than 0.67 mm total on the left and right edges, nor by more than 0.67 mm total at the top and bottom.







BASE SCHEMATIC

BASE CONNECTIONS

1, 14	HEATER
2	CATHODE
3	GRID Nº 1
4,6,7,10 12,13	N.C.
5	FOCUSING ELECTRODE
8.	ACCELERATOR
9.	ASTIGMATISM ELECTRODE
11.	D3-D4 SHIELD

MARK	DATE	DESCRIPTION	BY	APPR

CATHODE-RAY TUBE DIVISION
TEKTRONIX, INC.
PORTLAND, OREGON, U.S.A.

TUBE TYPE: 5ELP_

DATE: 10-18-63

MOD. C

Registration No. 293

CATHODE RAY TUBE

Type 5GP1

Heater		
Voltage ac or dc	6.3	volts
Current	0.6	amperes
Deflection		Electrostatic
Focus		Electrostatic
Screen		
Phosphor		P1
Flourescence		Green
Persistence		Medium
Mechanical Characteristics		
Overall Length		16-3/4" ± 3/8"
Diameter of greatest Transverse Section		5-1/4",+1/16",-3/32"
Bulb		J-42-C2
Base	Large Magnal	11 Pin
Basing	RMA Basing Designation	11A

The basing is such that:

1) The direction of the trace produced on the screen by deflecting electrodes D_3 and D_4 will not deviate more than ±10° from a plane through pin No. 1 and the axis of the tube while the angle between the direction of this trace and that of the trace produced on the screen by deflecting electrodes D_1 and D_2 will be 90° ± 5°.

2) With deflection electrode D_3 (Pin No. 9) positive with respect to D_4 (Pin No. 6) the spot will be deflected approximately toward pin No. 1; while with deflection electrode D_1 (Pin No. 3) positive with respect to D_2 (Pin No. 8) the spot will be deflected approximately toward Pin No. 4.

Direct Interelectrode Capacitances

Control Electrode (grid) to all other electrodes	9.0 uuf..
Deflecting Plate D_1 to D_2	2.4 uuf.
Deflecting Plate D_3 to D_4	1.0 uuf.
" " D_1 to all others	11.0 uuf.
" " D_3 " " "	12.0 uuf.
" " D_1 " " " except D_2	8.0 uuf.
" " D_2 " " " " D_1	8.0 uuf.
" " D_3 " " " " D_4	12.0 uuf..
" " D_4 " " " " D_3	8.0 uuf.

Ratings

Heater Voltage	6.3 volts
Heater Current	0.6±10% amp
High Voltage Electrode (Anode #2) Eb_2	2000 volts (max)
Focu sing Electrode (Anode #1) Eb_1	1000 volts (max)
Control Electrode (Grid) Voltage, Ec_1	Never Positive

From EIA registration # 293, May 7, 1942.
No sponsor manufacturer specified.

Ratings, (Continued)

Peak Voltage Anode #2 and any deflecting Electrode	500 volts (max)
Resistance of Circuit to Grid	1.5 megohms (max)
Impedance of circuit of any deflecting electrode at heater supply frequency	1.0 megohm (max)

Typical Operation

Heater Voltage (E_f)	6.3 volts
Anode #2 (E_{b_2})	2000 volts
Range of E_{b_1} to focus with values of E_{c_1} between 0 and cut-off	*425 volts (+20%,-30%)
Anode No. 1 Current, I_{b_1} at E_{c_1} = 0 and E_{b_1} adjusted for focus.	1000 ua (max)
Grid Voltage, E_{c_1}, for cut-off; i.e. visual extinction of an undeflected, focused spot.	-40 volts (±40%)

Deflection	Factor	Sensitivity
D_1 D_2	18v/(in.kv)± 20%	1.4 mm.kv/v (av)
D_3 D_4	36v/(in.kv)± 15%	.7 mm.kv/v (av)

The voltage required for any deflection within the useable screen area shall depart from linear relation to the deflection by not more than ±5% of the voltage required for full scale deflection.

Spot Position

When the tube is operated at (1) normal heater potential; (2) E_{b_2} at 2000 volts; (3) E_{b_1} for focus of spot and (4) control grid voltage is set at such a value as will avoid damage to screen and (5) with each of the deflecting electrodes connected to Anode No. 2 through a one megohm resistor and (6) with the tube shielded against external influences:

The spot will fall within a rectangle, the centre of which coincides with the geometric centre of the face of the tube; one side of which is 12 mm. long and parallel to the trace produced by deflecting electrodes D_3 and D_4; the other side of which is 15. mm. long and parallel to the trace produced by deflecting electrodes D_1 and D_2.

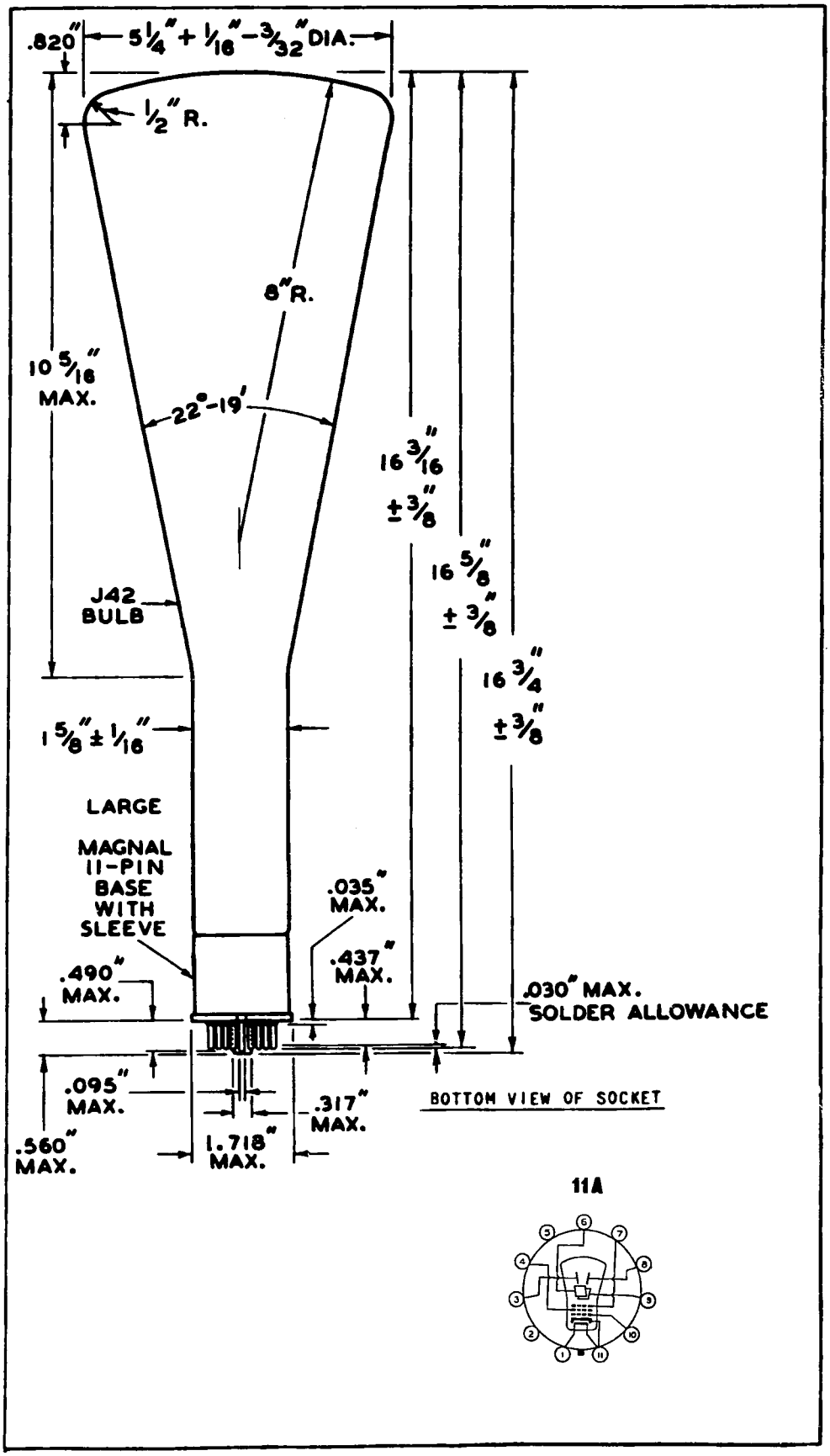
Useable Screen Area

The trace produced by deflection electrodes D_3 and D_4 shall not be less than 4-1/2" long.

The trace produced by deflection electrodes D_1 and D_2 shall not be less than 3-1/2" long.

5GP1

CATHODE-RAY TUBE



5GS7
TRIODE PENTODE TUBE

The 5GS7 is a miniature medium mμ triode and high slope RF pentode for use as frequency changer in VHF television tunners.

The type 5GS7 is identical with the 7GS7 as registered in JEDEC Release No. 4655 dated April 6, 1964 except for the following:

General Data

Electrieal

Heater voltage	5.4 volts
Heater current	450 ma

from JEDEC release #4655B, April 19, 1965

JOINT ELECTRON DEVICE ENGINEERING COUNCIL

JEDEC Type Administration Section
Electronic Industries Association
32 Green Street
Newark 2, New Jersey

E. I. A.
REGISTRATION
FILE

CORRECTION NOTICE

of

Electron Device Type Registration

Release No. 4589A

July 20, 1964

The Joint Electron Device Engineering Council announced the registration of the following electron device designation

5HB7

on July 6, 1964.

The footnote should be corrected to read:

* The 5HB7 is the same as Type 6HB7 as registered in Release No. 4589, dated February 10, 1964, except for the following:

Heater Voltage	4.7 Volts
Heater Current	0.6 amp. ± 0.04 amp.
Heater Warm Up	11 Seconds

Triode-Pentode

5JW8

The 5JW8 is a triode-pentode intended primarily for horizontal-oscillator and AFC service in the horizontal-deflection systems of television receivers.

Except for heater characteristics and ratings, the 5JW8 is identical to the 6JW8.

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.

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.

from JEDEC release #4851D, March 27, 1972

Matsushita Electronics Corporation

Telephone No.
TAKATSUKI (5) 5521

Takatsuki, Osaka, Japan
Telex: OS 3461 MECTRON

Cable Address
"MECTRON" TAKATSUKI

6AB9

TWIN TETRODE TUBE

The Matsushita's 6AB9 is a twin tetrode with a 10 pin base, for using as VHF RF amplifiers and VHF autodyne mixers.

General Data

Mechanical Data

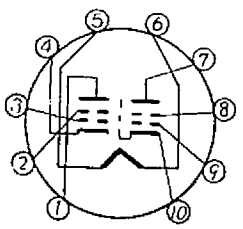
Cathode ..... Coated unipotential
Outline drawing ..... See outline drawing
Bulb T-6½
Base E10-61
Maximum diametcr ..... 0.750" to 0.875"
Maximum seated height ..... 1.660"
Minimum seated height ..... 1.460"
Maximum overall length ..... 2.190"

Pin connections

Pin 1	Plate of unit No.2	Pin 6	Heater
Pin 2	Grid No.2 of unit No.2	Pin 7	Plate of unit No.1
Pin 3	Grid No.1 of unit No.2	Pin 8	Grid No.2 unit No.1
Pin 4	Cathode of unit No.2	pin 9	Grid No.1 of unit No.1
Pin 5	Heater	Pin10	Cathode of unit No.1
			Internal shield

Basing

10N



Mounting Position ..... Any

Electrical Data

Heater characteristics

Heater voltage	6.3	volts
Heater current	365	ma

from JEDEC release #4740, June 29, 1964

Maximum Heater-cathode Voltage (Design Maximum Values)

Heater negative with respect to cathode:		
DC	200	volts
Total DC and peak	200	volts
Heater positive with respect to cathode:		
DC	100	volts
Total DC and peak	200	volts

Direct Inter-electrode Capacitances (with external shield)

	Unit No.1	Unit No.2	
Grid No.1 to Plate	0.055max.	0.055max.	$\mu\mu$f
Input: 2g1 to (h+2k+2g2+1k, i.s.+e.s.)	—	5.7	$\mu\mu$f
1g1 to (h+1k,i.s.+1g2+e.s.)	5.7	—	$\mu\mu$f
Output: 2p to (h+2k+2g2+1k,i.s.+e.s.)	—	2.7	$\mu\mu$f
1p to (h+1k,i.s.+1g2+e.s.)	2.7	—	$\mu\mu$f
Heater to cathode	3.0	3.0	$\mu\mu$f

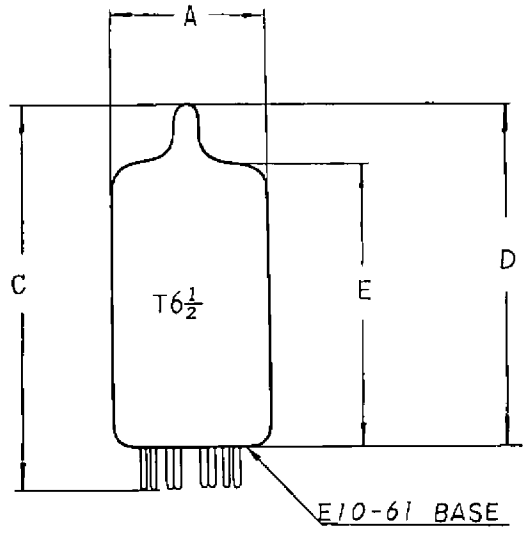
Maximum Ratings (Design Maximum Values)

Maximum plate voltage	250	volts
Maximum grid No.2 supply voltage	180	volts
Maximum grid No.2 voltage	See Grid No.2 Rating chart.	
Maximum Plate dissipation (Both plates)	3.5	watts
Maximum plate dissiPation	2.0	watts
Maximum grid No.2 dissipation	0.5	watts
Maximum cathode current	20	ma

Tvpical operating Conditions and Characteristics (Each unit)

Plate voltage	125	volts
Grid No.2 voltage	80	volts
Grid No.1 voltage	-1	volts
Plate current	8	ma
Grid No.2 current	2	ma
Transconductance	10,000	μmhos
Plate resistance (approx.)	0.11	megohms
Grid No.1 voltage for Ib=20 μa	−3.3	volts

Outline drawing



Ref.	inches			millimeters			notes
	min.	nom.	max.	min.	nom.	max	
A	0.750	—	0.875	19.1	—	22.2	1
C	—	—	2.190	—	—	55.56	
D	—	—	1.940	—	—	49.21	
E	1.460	1.562	1.660	37.4	39.7	42.2	2

Notes :

1. The minimum applies in zone starting 0.375″ (9.52mm) from base seat.

2. Measured from base seat to bulb-top line as determined by ring gauge of 7/16″ (11.1mm) internal diameter.

MECHANICAL DATA

Bulb	T-9
Base	E12-70, 12-Pin
Outline	9-56
Basing	12BY
Cathode	Coated Unipotential
Mounting Position	Any

ELECTRICAL DATA

HEATER CHARACTERISTICS AND RATINGS

Average Characteristics

Heater Operation	Series	Parallel	
Heater Voltage	6.3	6.3[1]	Volts
Heater Current	600[1]	600	Ma
Heater Warm-up Time[2]	11	-	Seconds

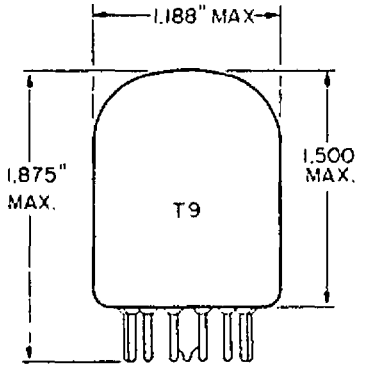
Ratings (Design Maximum Values)

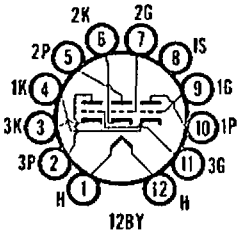
	Min-Max	Min-Max	
Heater Voltage[3]	- -	5.7-6.9	Volts
Heater Current[3]	560-640	- -	Ma
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Heater Positive with Respect to Cathode			
DC	100	100	Volts
Total DC and Peak	200	200	Volts

from JEDEC release #4741, June 29, 1964

QUICK REFERENCE DATA

The Sylvania Type 6BK11 is a compactron containing two 100 mu triodes and one 70 mu triode in a T-9 envelope. 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.





SYLVANIA ELECTRIC PRODUCTS INC.

Electronic Components Group
ELECTRONIC TUBE DIVISION
EMPORIUM, PA.

A Technical Publication

June 3, 1964

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

	Section No. 1	Section No. 2	Section No. 3	
Grid to Plate	1.3	1.3	1.3	pf
Input: g to (h+k+I.S.)	1.9	1.8	1.8	pf
Output: p to (h+k+I.S.)	1.8	0.7	1.8	pf

RATINGS (Design Maximum Values)

	Sections 1, 2, and 3	
Plate Voltage	330	Volts Max.
Plate Dissipation	0.4	Watts Max.
Positive Grid Voltage	0	Volt Max.
Negative Grid Voltage	50	Volts Max.

TYPICAL OPERATION

Class A1 Amplifier

	Section 1	Sections 2 and 3	
Plate Voltage	250	250	Volts
Grid Voltage	-2.5	-2.0	Volts
Plate Current	1.6	1.2	Ma
Plate Resistance (Approx.)	45,000	62,500	Ohms
Transconductance	1550	1600	µmhos
Amplification Factor	70	100	

NOTES:

1. For series/parallel operation of heaters, equipment should be designed that at normal supply voltage bogey tubes will operate at this value of heater current/voltage.

2. Heater warm-up time is defined as the time required for the voltage across the heater to reach 80% of the rated heater voltage after applying four (4) times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to three (3) times the rated heater voltage divided by the rated heater current.

3. Heater voltage supply variations shall be restricted to maintain heater voltage/current within the specified values.

from JEDEC release #4833, Oct. 26, 1964

ELECTRONICS

6EA4

COMPACTRON BEAM TRIODE

DESCRIPTION AND RATING

The 6EA4 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.

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 - C1-34, Small
Outline Drawing - EIA 12-90

Maximum Diameter	1.563	Inches
Maximum Over-all Length	4.375	Inches
Maximum Seated Height	4.000	Inches
Minimum Seated Height	3.750	Inches

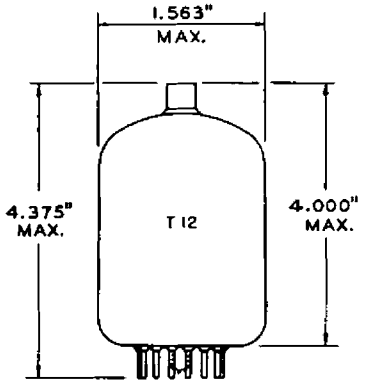
MAXIMUM RATINGS

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.

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

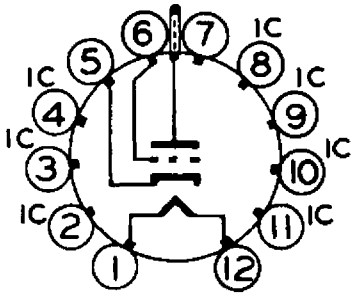


EIA 12-90

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 VALUES

Plate-Supply Voltage, Unregulated	60000	Volts
Plate Voltage	27000	Volts
Negative DC Grid Voltage	135	Volts
Peak Negative Grid Voltage¶	440	Volts
Plate Dissipation	.30	Watts
DC Plate Current	1.6	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	Not Recommended	
Heater Negative with Respect to Cathode	200	Volts
Grid-Circuit Resistance#	3.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

SHUNT VOLTAGE REGULATOR SERVICE—See Circuit Diagram, Page 3

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

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.

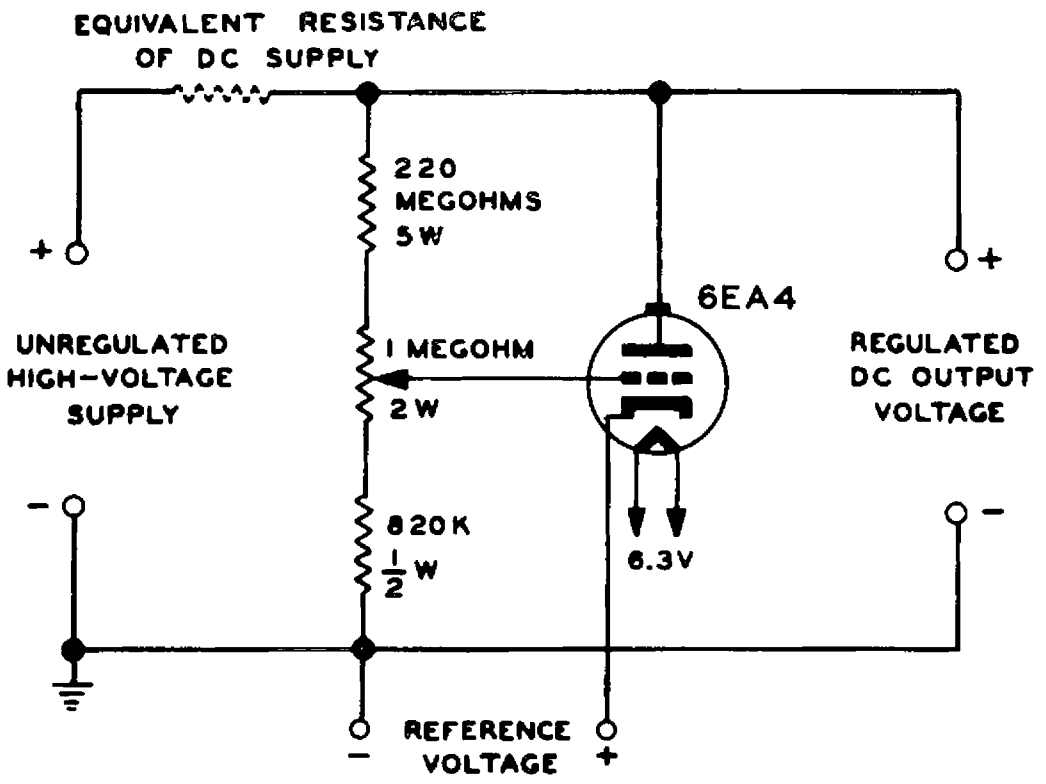
§ Without external shield.

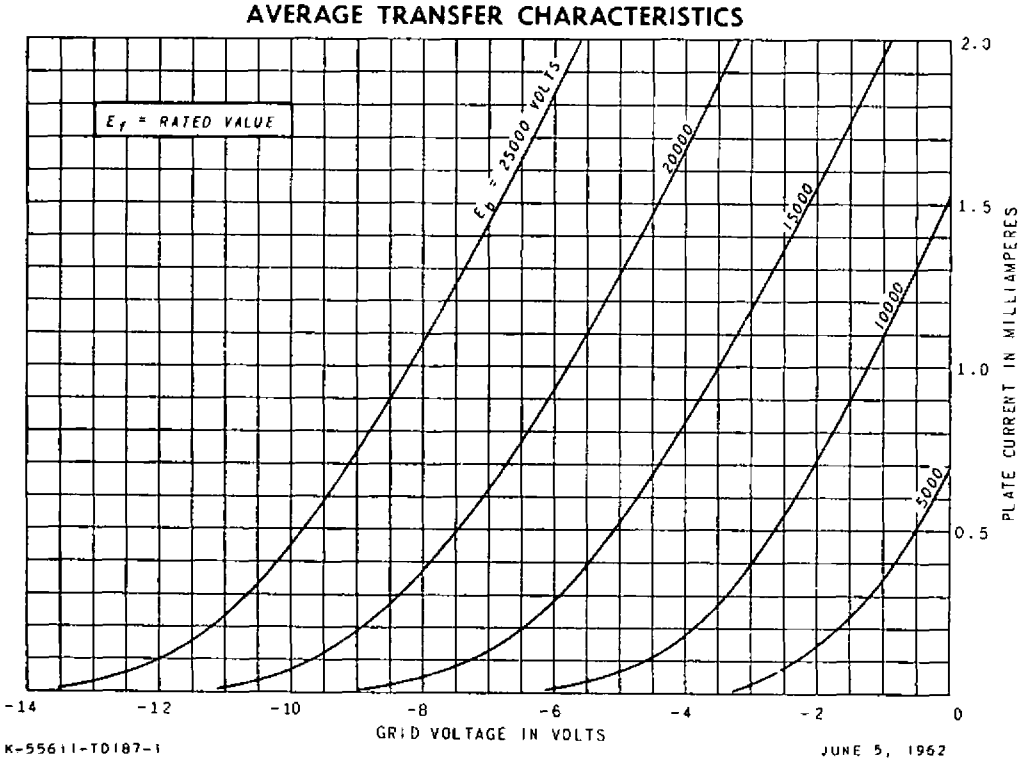
¶ Peak value for duration of 20 seconds maximum during equipment warm-up.

\# With flyback transformer high-voltage supply.

Note: High voltage operation of the 6EA4 can result in the production of x-rays which can constitute a health hazard unless these tubes are adequately shielded. The need for this precaution should be considered in equipment design. Relatively simple shielding should prove adequate.

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.


EQUIVALENT RESISTANCE
OF DC SUPPLY
220
MEGOHMS
5W
6EA4
UNREGULATED
HIGH-VOLTAGE
SUPPLY
1 MEGOHM
2W
REGULATED
DC OUTPUT
VOLTAGE
820K
1/2 W
6.3V
REFERENCE
VOLTAGE


AVERAGE TRANSFER CHARACTERISTICS
E_f = RATED VALUE
E_b = 25000 VOLTS
20000
15000
10000
5000
2.0
1.5
1.0
0.5
PLATE CURRENT IN MILLIAMPERES
-14
-12
-10
-8
-6
-4
-2
0
GRID VOLTAGE IN VOLTS
K-5561I-TD187-1
JUNE 5, 1962

RAYTHEON

POWER PENTODES 6HA6, 8HA6, 10HA6, 15HA6, 28HA6

The 6HA6 is a power pentode designed especially for use as a video amplifier in low B^+ television receivers. The very high transconductance sharp cutoff and low plate knee characteristic provide excellent linearity over a large operating range. Additional features include high plate dissipation and low interelectrode capacitance making this tube ideal for use in TV video and other wide band applications. The 8HA6, 10HA6, 15HA6, and 28HA6 are identical except for heater characteristics.

ELECTRICAL DATA

HEATER CHARACTERISTICS:

	6HA6	8HA6	10HA6	15HA6	28HA6	
Heater voltage (ac or dc)	6.3 ± 10%□	8.0●●	10.4●●	15.0●●	28.6●●	volts
Heater current	710●	600 ± 6%□	450 ± 6%□	300 ± 6%□	150 ± 6%□	ma

Peak heater–cathode voltage maximum

Heater negative to cathode	200	volts
Heater positive to cathode	200†	volts

DESIGN MAXIMUM RATINGS: (See EIA Standard RS–239)

Plate voltage	300	volts
Grid #2 voltage	250	volts
Negative grid #1 voltage	–100	volts
Plate dissipation	8.0	watts
Grid #2 dissipation	1.5	watts
Grid #1 circuit resistance		
Fixed bias	0.05	meg.
Self bias	0.15	meg.

AVERAGE CHARACTERISTICS:

Plate voltage	150	volts
Grid #2 voltage	100	volts
Cathode resistor	33	ohms
Plate current	28	ma
Grid #2 current	3.5	ma
Triode Mu*	31	
Transconductance	20000	umhos
Plate resistance	20K	ohms
Grid #1 voltage for Ib = 100 ua (approx.)	–5.0	volts

DIRECT INTERELECTRODE CAPACITANCES:

Grid #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	pf.

PLATE KNEE CHARACTERISTICS: (Instantaneous readings)

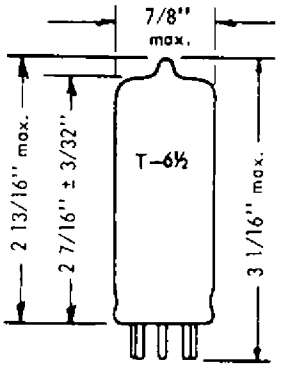
Eb = 60 volts, Ec2 = 100 volts, Ec1 = 0 volts

Plate current	45	ma
Grid #2 current	9.0	ma

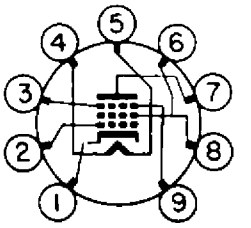
MECHANICAL DATA

ENVELOPE. . . . . T–6½ glass
BASE . . . 9 pin miniature (E9–1)
CATHODE . . . coated unipotential
MOUNTING POSITION . . . . . any

PHYSICAL DIMENSIONS



BASING 9NW



BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1 cathode
Pin 2 grid #1
Pin 3 grid #3
Pin 4 heater
Pin 5 heater
Pin 6 grid #2
Pin 7 plate
Pin 8 grid #2
Pin 9 grid #3

from JEDEC release #4617, March 2, 1964

□ The equipment designer shall design equipment so that the heater voltage for the 6HA6 and the heater current for the 8HA6, 10HA6, 15HA6 and 28HA6 are centered at the specified bogey value with heater supply variations restricted to maintain heater voltage (or current) within the specified tolerance.

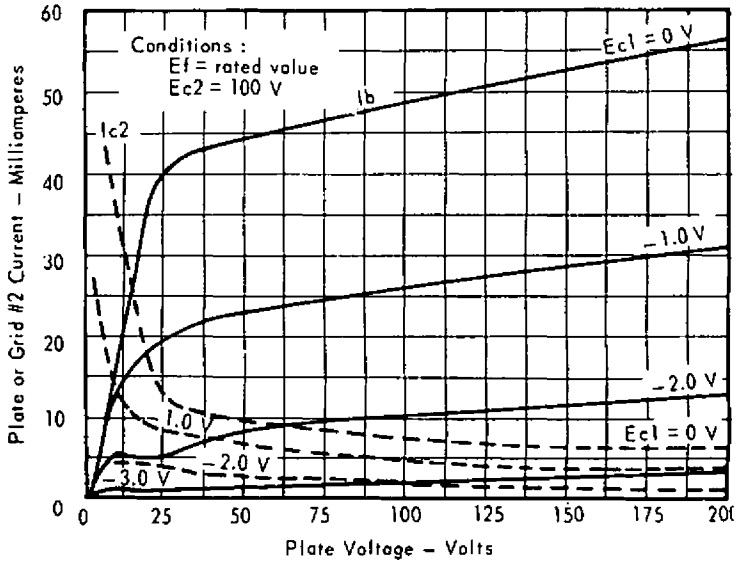
● Heater current at bogey heater voltage.

●● Heater voltage at bogey heater current.

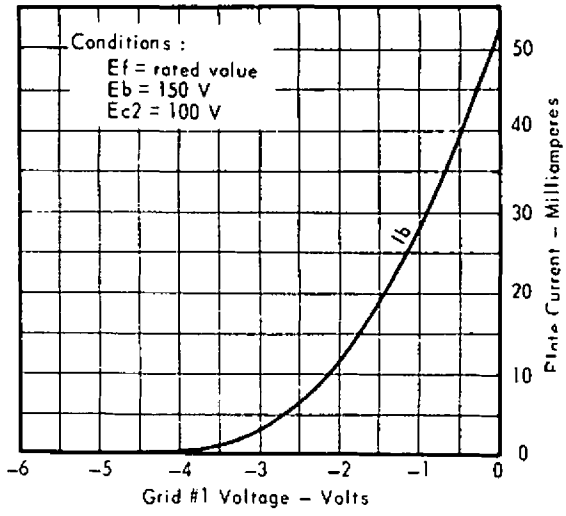
† The dc component must not exceed 100 volts.

* Plate tied to G2 at 100 volts.

AVERAGE CHARACTERISTICS



AVERAGE CHARACTERISTICS



from JEDEC release #4589, Feb. 10, 1964

RCA-6HB7

MEDIUM-MU TRIODE—SHARP-CUTOFF PENTODE

9-Pin Miniature Type

RCA Dark Heater | **For UHF Oscillator-Mixer Service in TV Receivers** | **Controlled Heater Warm-up Time**

RCA-6HB7 is a multiunit tube of the 9-pin miniature type containing a medium-mu triode and a sharp-cutoff pentode in one envelope. This type is useful as a combined oscillator-mixer tube in television receivers utilizing an intermediate frequency in the order of 40 Mc.

The pentode unit of the 6HB7 has a relatively high value of transconductance and an excellent knee-current characteristic. In addition, the pentode unit has an exceptionally low value of grid-No.1-to-plate capacitance (0.010 pf maximum) to minimize feedback problems.

Two base pin connections to the cathode minimize the cathode lead inductance of the pentode unit. An inter-unit shield reduces interaction between units.

The heater of the 6HB7 has controlled warm-up time for use in series-heater-string arrangements. The RCA Dark Heater is utilized for long life and dependable performance.

GENERAL DATA

Electrical:

Heater Characteristics and Ratings:			
Voltage (AC or DC)	6.3[a]		volts
Current	0.450 ±0.030		amp
Warm-up time (Average)	11		sec
Peak heater-cathode voltage:			
Heater negative with respect to cathode	200	max.	volts
Heater positive with respect to cathode	200[b]	max.	volts
Direct Interelectrode Capacitances:[c]			
Triode Unit:			
Grid to plate	1.9		pf
Grid to cathode & pentode grid No.3 & internal shield, and heater	3.0		pf
Plate to cathode & pentode grid No.3 & internal shield, and heater	1.9		pf
Pentode Unit:			
Grid No.1 to plate	0.010	max.	pf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, and heater	5.0		pf
Plate to cathode & grid No.3 & internal shield, grid No.2, and heater	3.4		pf
Heater to cathode[d]	3.8		pf

Characteristics, Class A_1 Amplifier:

	Triode Unit	*Pentode Unit*	
Plate Supply Voltage	150	125	volts
Grid-No.2 Supply Voltage	-	125	volts
Grid-No.1 Supply Voltage	0	-1	volts
Cathode Resistor	56	-	ohms
Amplification Factor	40	-	
Plate Resistance (Approx.)	5000	200,000	ohms
Transconductance	8500	6400	μmhos
Plate Current	18	12	ma
Grid-No.2 Current	-	4	ma
Grid-No.1 Voltage (Approx.) for plate μa = 10	-12	-9	volts

Mechanical:

Operating Position	Any
Type of Cathode	Coated Unipotential
Maximum Overall Length	2-3/16"
Maximum Seated Length	1-15/16"
Length, Base Seat to Bulb Top (Excluding Tip)	1-9/16" ± 3/32"
Diameter	0.750" to 0.875"
Dimensional Outline	JEDEC No.6-2
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)

AMPLIFIER – Class A_1

Maximum Ratings, *Design-Maximum Values:*

	Triode Unit	*Pentode Unit*	
Plate Voltage	330 max.	330 max.	volts
Grid-No.2 (Screen-Grid) Supply Voltage	-	330 max.	volts
Grid-No.2 Voltage	-	See *Grid-No.2 Input Rating Chart*	
Grid-No.1 (Control-Grid) Voltage:			
Positive-bias value	0 max.	0 max.	volts
Grid-No.2 Input:			
For grid-No.2 voltages up to 165 volts	-	0.55 max.	watt
For grid-No.2 voltages between 165 and 330 volts	-	See *Grid-No.2 Input Rating Chart*	
Plate Dissipation	2.5 max.	3.1 max.	watts

Maximum Circuit Values:

Grid-No.1 Circuit Resistance:			
For fixed-bias operation	0.5 max.	0.25 max.	megohm
For cathode-bias operation	1.0 max.	0.5 max.	megohm

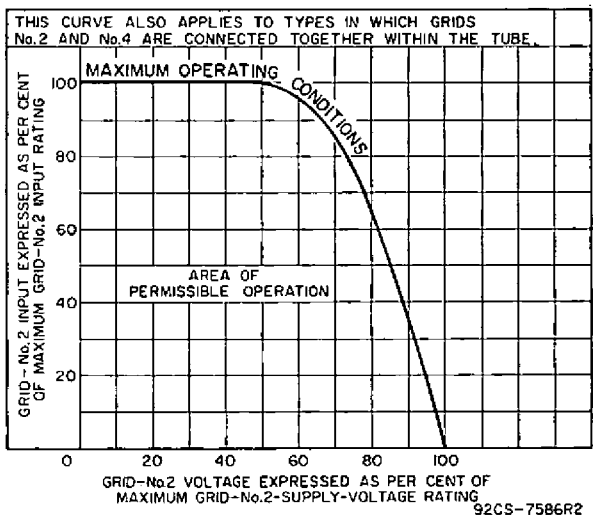
[a] At heater amperes = 0.450.

[b] The dc component must not exceed 100 volts.

[c] With external shield JEDEC No.315 connected to cathode except as noted.

[d] With external shield JEDEC No.315 connected to ground.

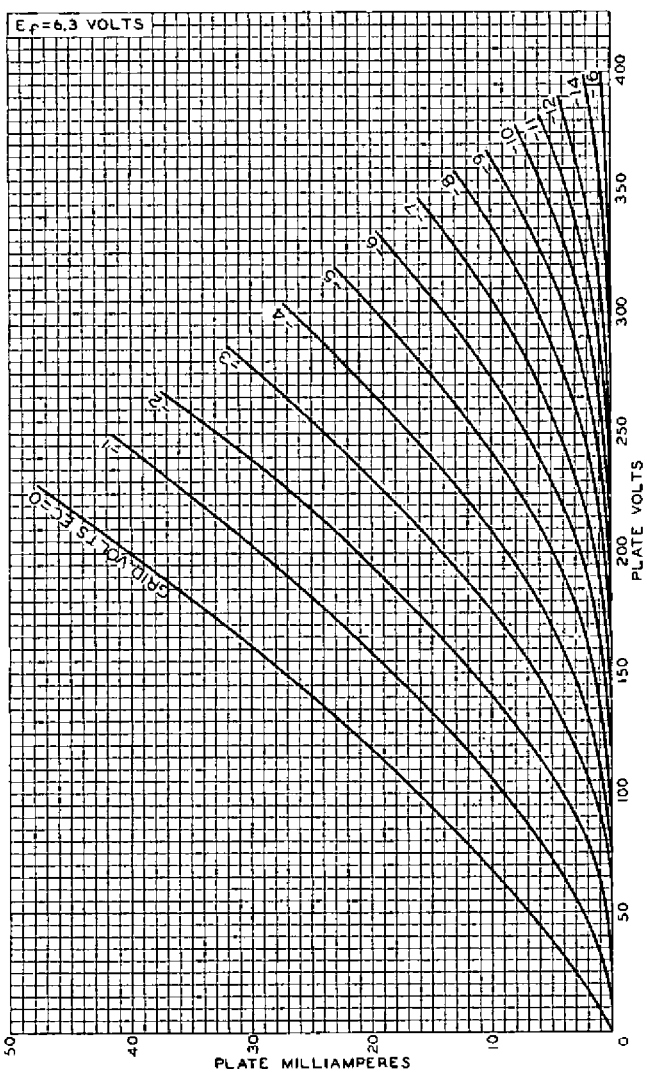
GRID-No.2-INPUT RATING CHART



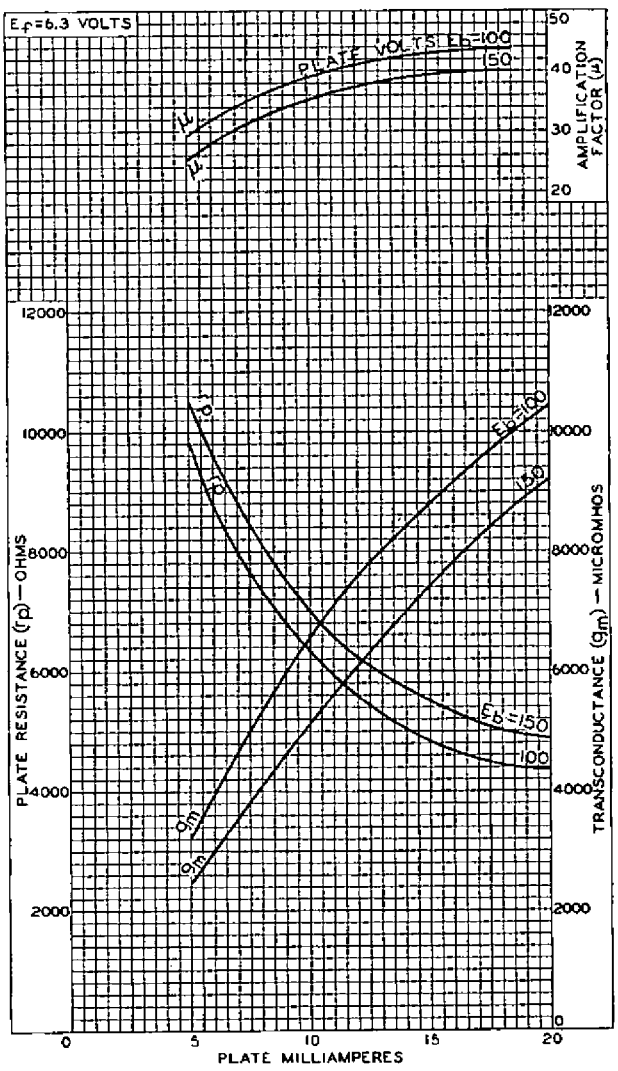
92CS-7586R2

AVERAGE CHARACTERISTICS

Triode Unit



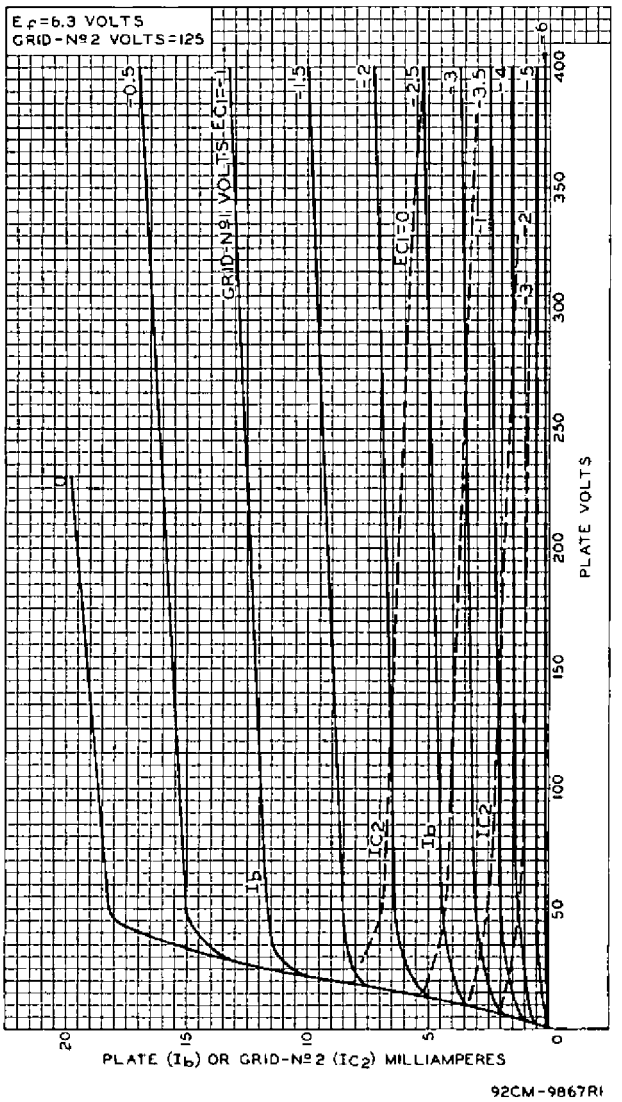
92CM-9866



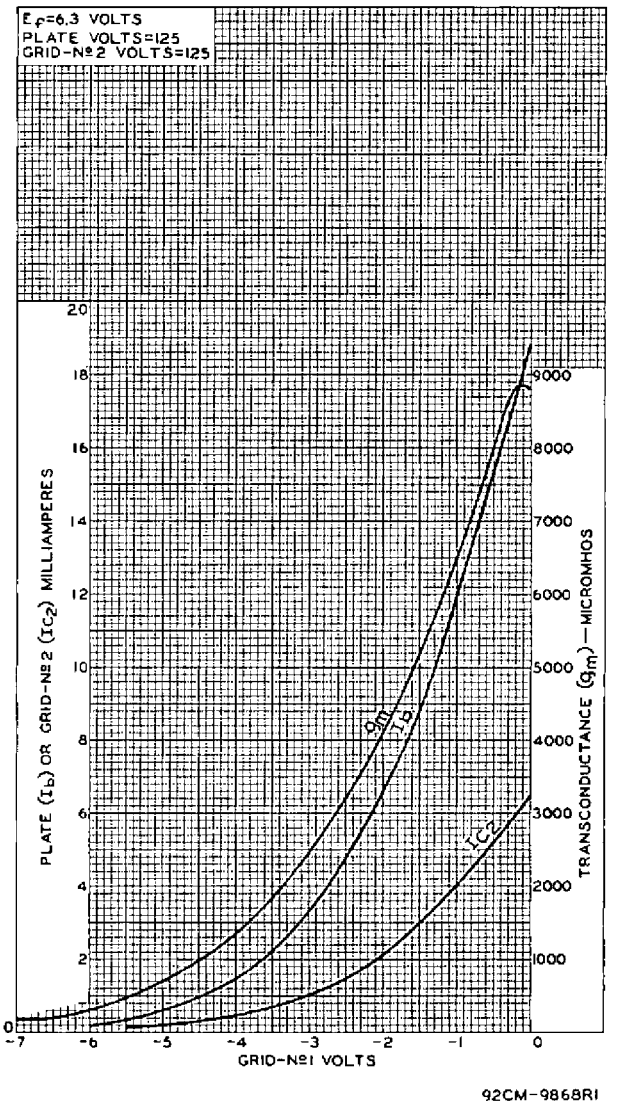
92CM-9882R1

AVERAGE CHARACTERISTICS

Pentode Unit



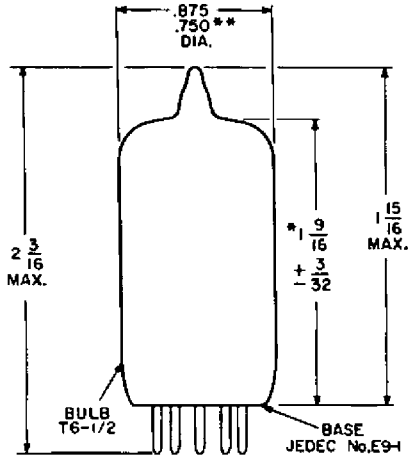
92CM-9867RI



92CM-9868RI

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DIMENSIONAL OUTLINE
JEDEC No.6-2



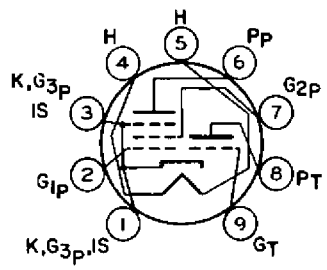
92CS-11893

Dimensions in Inches

* Measured from base seat to bulb-top line as determined by ring gauge of 7/16" inside diameter.

** Applies in zone starting 0.375" from base seat.

TERMINAL DIAGRAM
Bottom View



JEDEC 9QA

Pin 1 – Cathode, Pentode Grid No.3, Internal Shield

Pin 2 – Pentode Grid No.1

Pin 3 – Same as Pin 1

Pin 4 – Heater

Pin 5 – Heater

Pin 6 – Pentode Plate

Pin 7 – Pentode Grid No.2

Pin 8 – Triode Plate

Pin 9 – Triode Grid

from JEDEC release #4656D,
Feb. 14, 1966

RECEIVING

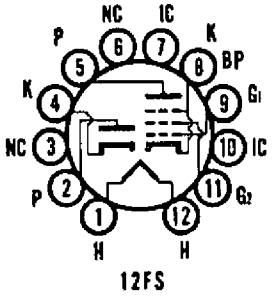
TUBES

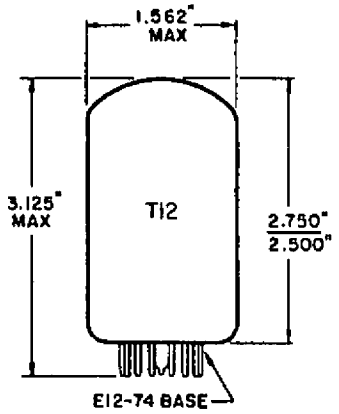
SYLVANIA

DAMPER DIODE - HORIZONTAL AMP.

6HE7, 12HE7, 38HE7, 58HE7

- COLOR TV TYPE
- HIGH PERVEANCE DIODE
- BEAM POWER PENTODE
- COMPACTRON
- MULTI-SECTION
- LOW B+ OPERATION
- T-12 ENVELOPE
- 12 PIN BASE





DESCRIPTION

Sylvania Types 6HE7, 12HE7, 38HE7 and 58HE7 contain a high perveance diode and a beam power pentode in a compactron style bulb. The diode section is intended for service as a damping diode and the pentode is designed for application as a horizontal deflection amplifier. The 38HE7 and 58HE7 have controlled heater warm-up time for series connected circuits.

MECHANICAL DATA

Envelope	T-12
Base	E12-74
Outline Drawing	12-57
Max. Diameter	1.562"
Max. Seated Height	2.750"
Max. Overall Length	3.125"
Cathode	Coated Unipotential
Operating Position	Any
Basing Diagram	12FS

Pin No. 1 - Heater
Pin No. 2 - Diode Plate
Pin No. 3 - No Connection
Pin No. 4 - Diode Cathode
Pin No. 5 - Pentode Plate
Pin No. 6 - No Connection

MECHANICAL DATA (Cont'd)

Pin No. 7 - Internal Connection
Pin No. 8 - Pentode Cathode and Beam Plates
Pin No. 9 - Pentode Grid No. 1
Pin No. 10 - Internal Connection
Pin No. 11 - Pentode Grid No. 2
Pin No. 12 - Heater
(Pins 3, 6, 7, and 10 should not be used as tie points)

ELECTRICAL DATA

HEATER CHARACTERISTICS AND RATINGS

Average Characteristics Heater Operation	58HE7 Series	38HE7 Series	12HE7 Parallel	6HE7 Parallel	
Heater Voltage	58.0	37.8	12.6(1)	6.3(1)	Volts
Heater Current	300(1)	450(1)	1350	2700	Ma
Heater Warm-up Time(2)	11	11	-	-	Seconds

Ratings (Design Maximum Values)(4)

	Min-Max	Min-Max	Min-Max	Min-Max	
Heater Voltage(3)	- -	- -	11.4-13.8	5.7-6.9	Volts
Heater Current(3)	280-320	420-480	- -	- -	Ma

Maximum Heater Cathode Voltage

	Diode	Pentode	
Heater Negative with Respect to Cathode			
DC	500	-	Volts
Total DC and Peak	4200	200	Volts
Heater Positive with Respect to Cathode			
DC	100	100	Volts
Total DC and Peak	200	200	Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Diode Section

Cathode to Plate and Heater	8.0	pf
Plate to Cathode and Heater	7.0	pf
Heater to Cathode	1.6	pf

Pentode Section

Grid No. 1 to Plate	0.38	pf
Input: g1 to (h + k + g2 + b.p.)	19	pf
Output: p to (h + k + g2 + b.p.)	8.0	pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier Service(5)

	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	Volt
Screen Voltage	150	Volts

ELECTRICAL DATA (Cont'd)

Negative DC Grid Number 1 Voltage	55	Volts
Peak Negative Grid No. 1 Voltage	330	Volts
Plate Dissipation	10.0	Watts
Screen Dissipation	3.5	Watts
Screen Dissipation (With Plate Dissipation Limited to 9 Watts)	4.0	Watts
DC Cathode Current	230	Ma
Peak Cathode Current	800	Ma
Grid No. 1 Circuit Resistance	1.0	Megohm

TV Damper Service(5)

	Diode Section	
Peak Inverse Plate Voltage	4200	Volts
Steady State Peak Plate Current	1200	Ma
DC Output Current	200	Ma
Bulb Temperature at Hottest Point	200	°C

AVERAGE CHARACTERISTICS

Pentode Section

Plate Voltage	5000	50	130	Volts
Screen Voltage	130	130	130	Volts
Grid No. 1 Voltage	-	0	-22	Volts
Plate Resistance (Approx.)	-	-	6200	Ohms
Transconductance	-	-	8800	Micromhos
Plate Current	-	450	60	Ma
Screen Current	-	40	2.8	Ma
Grid No. 1 Voltage (Approx.) Ib = 1.0 Ma	-80	-	-39	Volts
Triode Amplification Factor[7]	-	-	4.2	

Diode Section

Tube Voltage Drop Ib = 250 Ma DC	21	Volts

NOTES:

(1) For series/parallel operation of heaters, equipment should be designed that at normal supply voltage bogey tubes will operate at this value of heater current/voltage.

(2) Heater warm-up time is defined as the time required for the voltage across the heater to reach 80% of the rated heater voltage after applying four (4) times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to three (3) times the rated heater voltage divided by the rated heater current.

NOTES: (Cont'd)

(3) Heater voltage supply variations shall be restricted to maintain heater current/voltage within the specified values.

(4) 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 effect of changes in operating conditions due to variations in the characteristics of the tube under consideration.

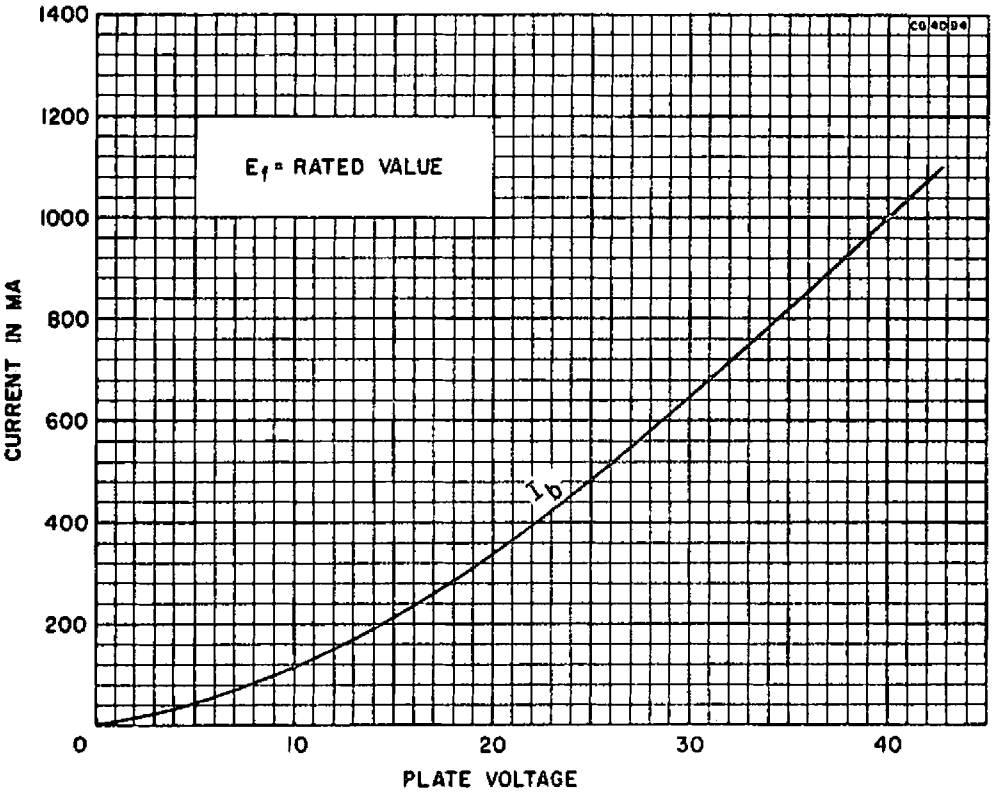
The equipment manufacturer should design so that initially and throughout life no design maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment,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

(5) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcasting Stations; Federal Communications Commission." The duty cycle of the voltage pulse is not to exceed 15% of a scanning cycle.

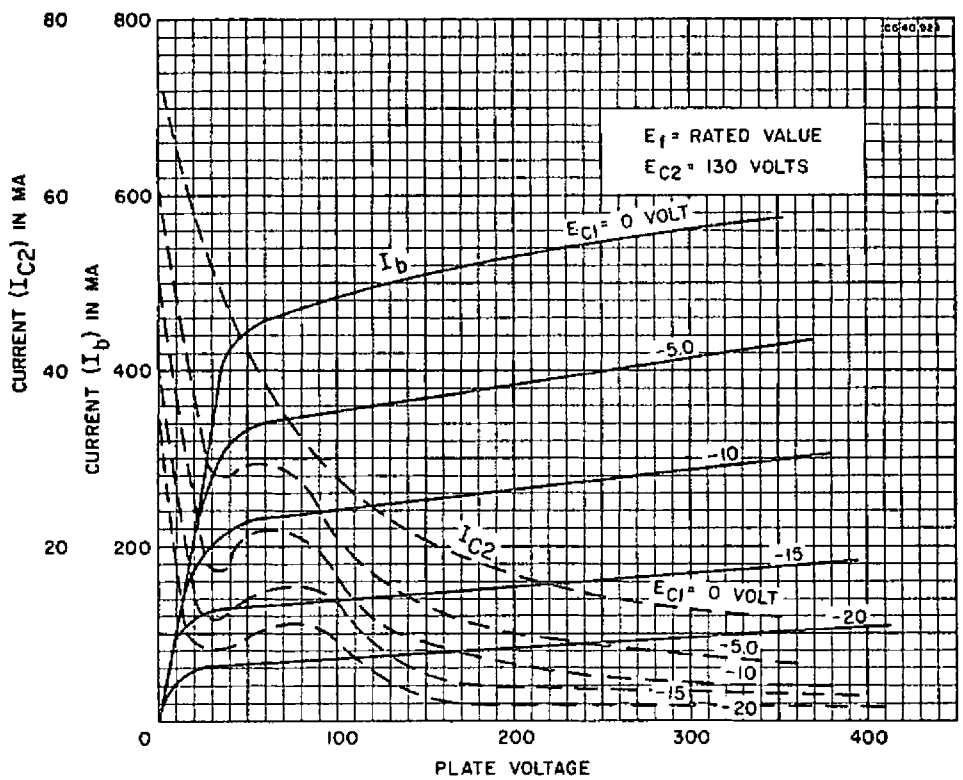
(6) In stages operating with grid leak bias, an adequate cathode bias resistor or other suitable means is required to protect the tube in the absence of excitation.

(7) Amplification factor with tube operating as a triode with 130 volts on the plate and Grid No. 2 and -22 volts on Grid No. 1.

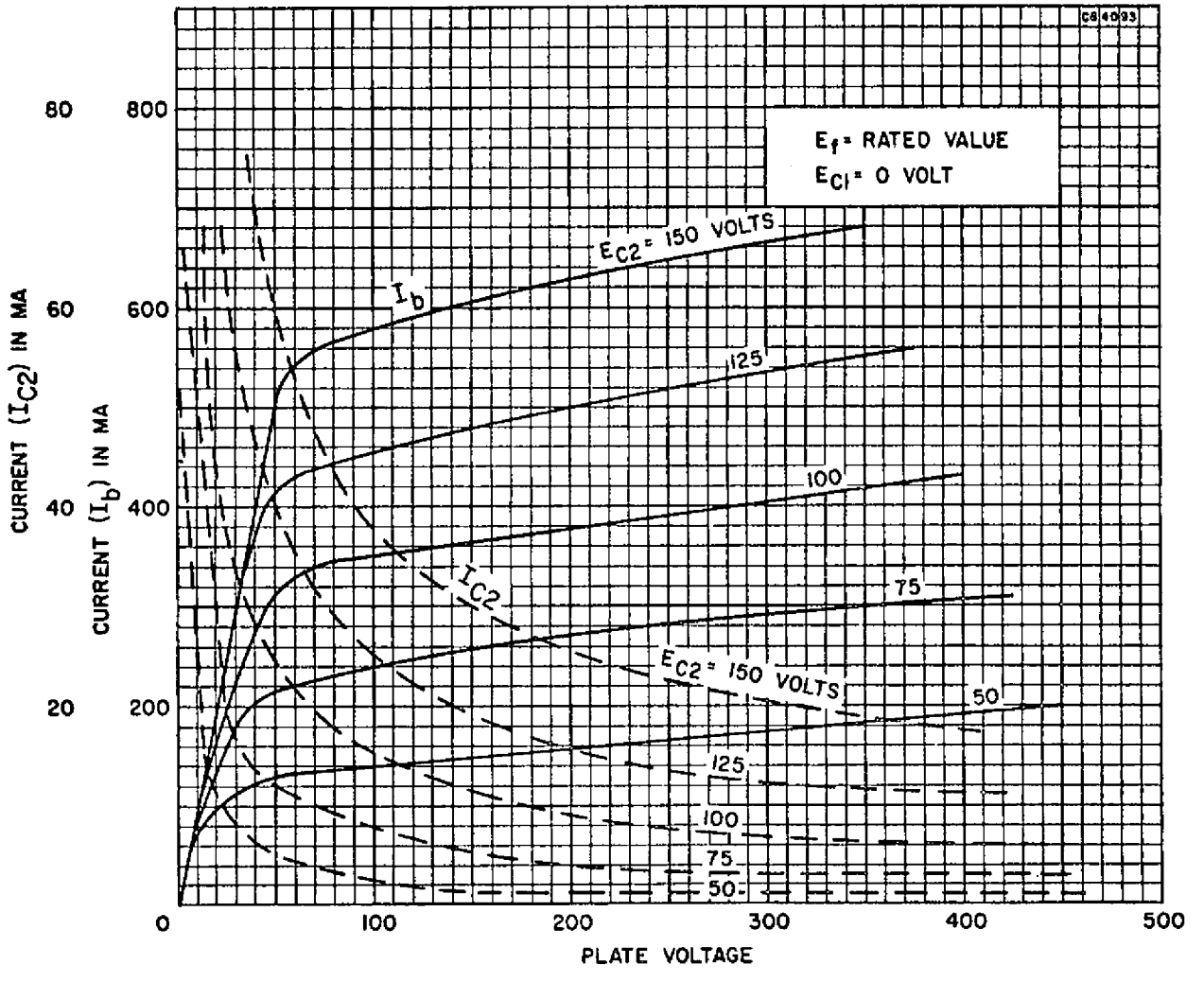
AVERAGE PLATE CHARACTERISTICS
(Diode Section)



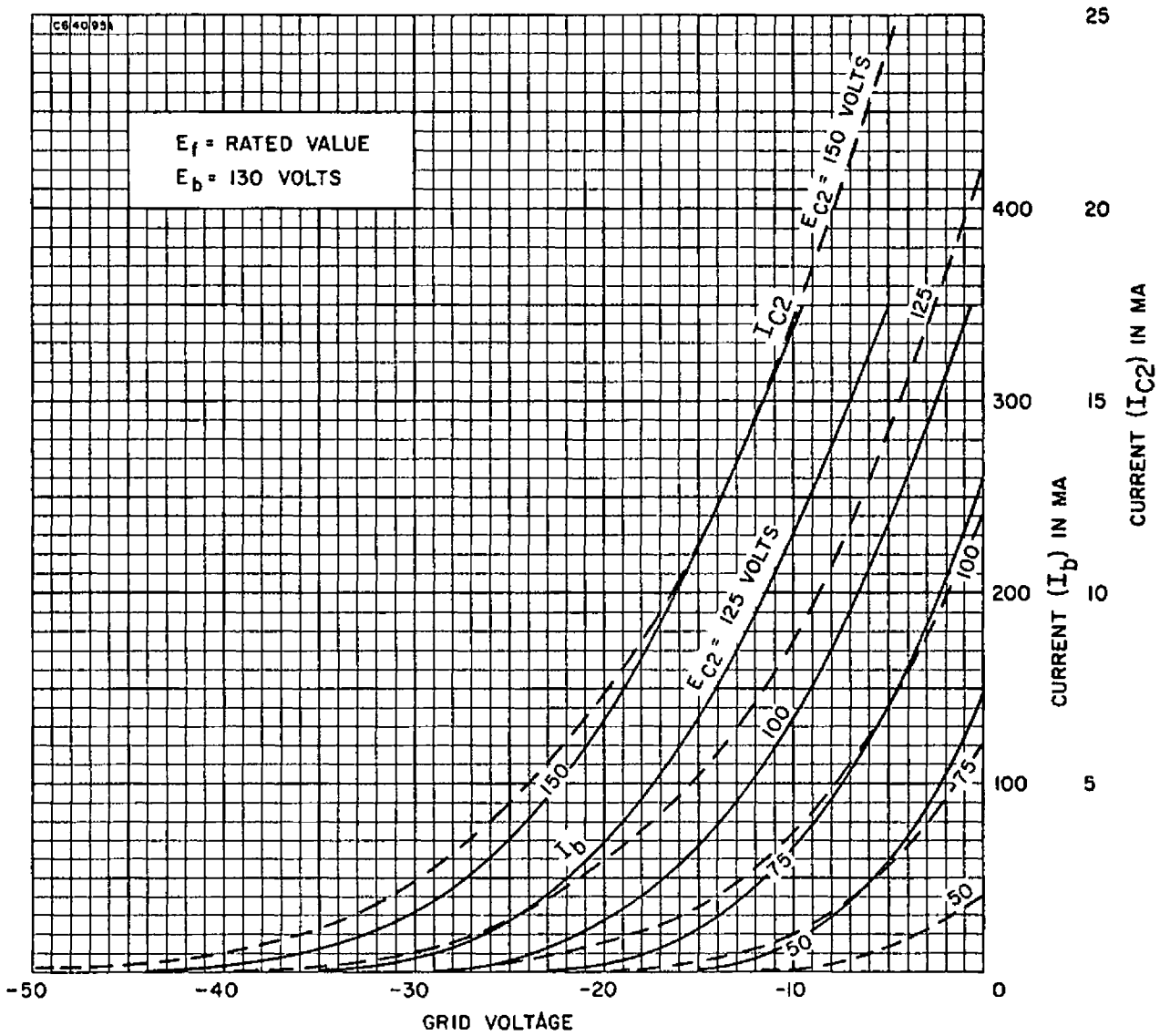
AVERAGE PLATE CHARACTERISTICS
(Pentode Section)



AVERAGE PLATE CHARACTERISTICS
(Pentode Section)



AVERAGE TRANSFER CHARACTERISTICS
(Pentode Section)



from JEDEC release #4589, Feb. 10, 1964

RCA-6HG5

BEAM POWER TUBE

7-Pin Miniature Type

Plate Dissipation: 12 Watts **Controlled Cathode Warm-up Time**

RCA-6HG5 is a beam power tube of the 7-pin miniature type for use in the audio output stages of television receivers. This tube features a controlled cathode warm-up time of 14 seconds minimum to delay the flow of cathode current during receiver warm up. As a result, extraneous sound is minimized until high voltage is developed and the picture appears.

The 6HG5 has a plate dissipation of 12 watts and can provide a relatively high power output at low plate current. In addition, this type utilizes the RCA "Dark Heater" for long life and dependable performance.

GENERAL DATA

Electrical:

Heater Characteristics and Ratings:			
Voltage (AC or DC)	6.3 ± 0.6		volts
Current	0.45		amp
Peak heater-cathode voltage:			
Heater negative with respect to cathode	200	max.	volts
Heater positive with respect to cathode	200[a]	max.	volts
Minimum Cathode Warm-up Time:[b]			
Heater volts = 6.3, plate and grid-No.2 volts = 250, and cathode resistor (ohms) = 680	14		sec
Direct Interelectrode Capacitances (Approx.):			
Grid No.1 to plate	0.4		pf
Grid No.1 to cathode & grid No.3, grid No.2, and heater	8		pf
Plate to cathode & grid No.3, grid No.2, and heater	8.5		pf

Mechanical:

Operating Position	Any
Maximum Overall Length	2-5/8"
Maximum Seated Length	2-3/8"
Length, Base Seat to Bulb Top (Excluding Tip)	2" ± 3/32"
Diameter	0.650" to 0.750"
Bulb	T5-1/2
Base . . .Small-Button Miniature 7-Pin (JEDEC No.E7-1)	
Basing Designation for BOTTOM VIEW	7BZ

AMPLIFIER – Class A1

Maximum Ratings, *Design-Maximum Values:*

Plate Voltage	275 max.	volts
Grid-No.2 (Screen-Grid) Voltage	275 max.	volts
Grid-No.2 Input	2 max.	watts
Plate Dissipation	12 max.	watts
Bulb Temperature (At hottest point on bulb surface)	250 max.	°C

Typical Operation and Characteristics:

Plate Voltage	180	250	volts
Grid-No.2 Voltage	180	250	volts
Grid-No.1 (Control-Grid) Voltage	-8.5	-12.5	volts
Peak AF Grid-No.1 Voltage	8.5	12.5	volts
Zero-Signal Plate Current	29	45	ma
Max.-Signal Plate Current	30	47	ma
Zero-Signal Grid-No.2 Current	3	4.5	ma
Max.-Signal Grid-No.2 Current	4	7	ma
Plate Resistance (Approx.)	58000	52000	ohms
Transconductance	3700	4100	μmhos
Load Resistance	5500	5000	ohms
Total Harmonic Distortion	8	8	%
Max.-Signal Power Output	2	4.5	watts

Maximum Circuit Values:

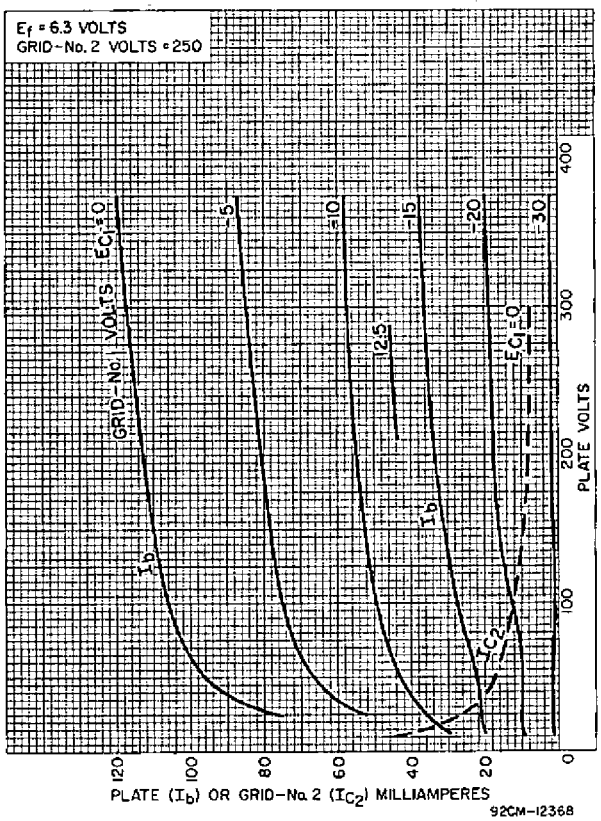
Grid-No.1-Circuit Resistance:		
For fixed-bias operation	0.1 max.	megohm
For cathode-bias operation	0.5 max.	megohm

[a] The dc component must not exceed 100 volts.

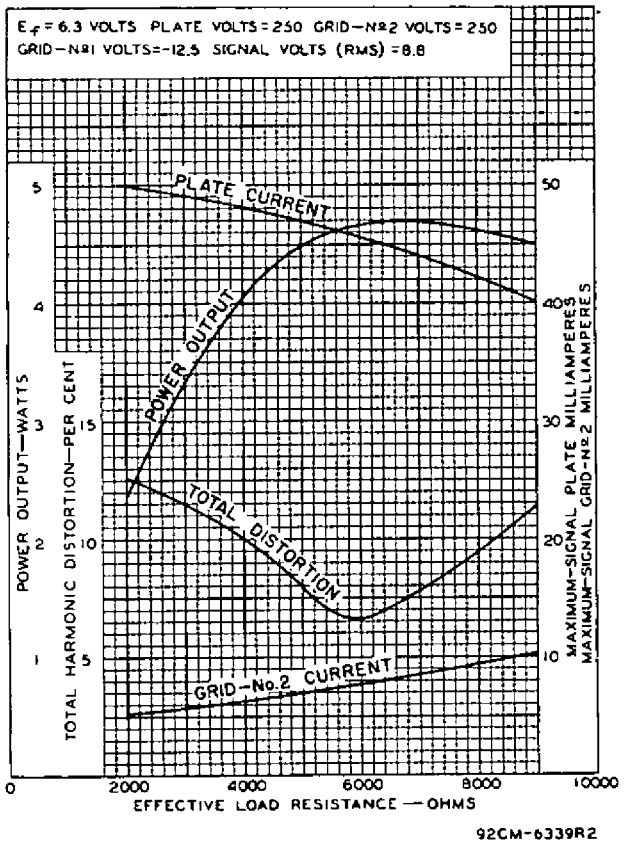
[b] The time interval between the instant all electrode voltages are applied and the instant a current of one milliampere flows in the plate circuit of the 6HG5.

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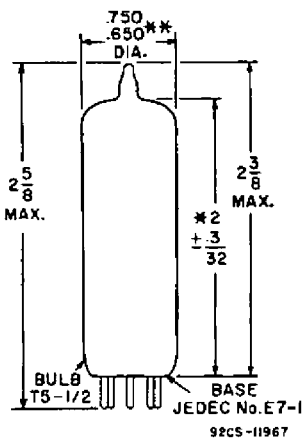
AVERAGE CHARACTERISTICS



OPERATION CHARACTERISTICS



DIMENSIONAL OUTLINE



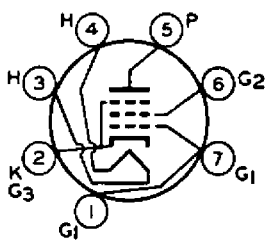
Dimensions in Inches

* Measured from base seat to bulb-top line as determined by ring gauge of 7/16 inside diameter.

** Applies in zone starting 0.375 from base seat.

TERMINAL DIAGRAM

Bottom View



7BZ

Pin 1 – Grid No.1
Pin 2 – Cathode, Grid No.3
Pin 3 – Heater
Pin 4 – Heater
Pin 5 – Plate
Pin 6 – Grid No.2
Pin 7 – Grid No.1

Westinghouse

6HL5
12HL5
60HL5

August 1, 1964

BEAM-POWER AMPLIFIER TYPES 6HL5, 12HL5 AND 60HL5

The 6HL5, 12HL5 and 60HL5 are high perveance 9-Pin miniature beam power pentodes designed for service as the output stage in audio amplifiers. Their special feature is very high power sensitivity, resulting in low drive required for full power output.

ELECTRICAL

Cathode	Coated Unipotential			
Heater:	6HL5	12HL5	60HL5	
Voltage (ac or dc)	6.3	12.6	60	Volts
Current	0.95	0.45	0.10	Ampere

MECHANICAL

Bulb	T-6½
Base	9-Pin Miniature (JEDEC E9-1)
Outline	6-4
Basing	9QW
Mounting Position	Any

MAXIMUM RATINGS

Design Maximum Values

Plate Voltage	330 max.	Volts
Grid 2 Voltage (Screen)	250 max.	Volts
Plate Dissipation	12 max.	Watts
Grid 2 Dissipation (Note 1)	2.5 max.	Watts
DC Cathode Current	110 max.	Ma.
Heater-Cathode Voltage:		
Heater Negative with Respect to Cathode		
Total DC + Peak	200 max.	Volts
Heater Positive with Respect to Cathode		
DC Component	100 max.	Volts
Total DC + Peak	200 max.	Volts

MAXIMUM CIRCUIT VALUES

Grid 1 Circuit Resistance		
For Fixed Bias	0.1 max.	Megohm
For Cathode Bias	0.5 max.	Megohm

CHARACTERISTICS

Plate Voltage	130	Volts
Grid 2 Voltage	130	Volts
Bypassed Cathode Bias Resistor	56	Ohms
Plate Current	70	Ma.
Grid 2 Current	5	Ma.
Plate Resistance (Approx.)	7500	Ohms
Transconductance	17000	μmhos
Triode Amplification Factor	13	–
Grid 1 Cutoff Bias (Note 2)	–33	Volts

TYPICAL CLASS A AMPLIFIER OPERATION

	Cathode Bias (Note 3)	Cathode Bias (Note 4)	Fixed Bias	
Plate Voltage	130	140	140	Volts
Grid 2 Voltage	130	140	140	Volts
Grid 1 Voltage	–	–	–5.7	Volts
RMS A.F. Grid 1 Voltage	3.3	7.3	4.0	Volts
Cathode Bias Resistor	56	68	–	Ohms
Zero Signal Plate Current	70	72	71	Ma.
Zero Signal Grid 2 Current	5	4	4	Ma.
Max. Signal Plate Current	68	67	68.5	Ma.
Max. Signal Grid 2 Current	15	13.5	14.5	Ma.
Load Resistance	2000	2000	1700	Ohms
Power Output	3.0	3.5	4	Watts
Total Harmonic Distortion	8	8	9	Per Cent

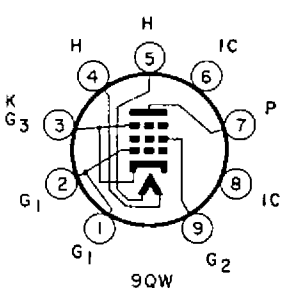
TYPICAL CLASS AB1 PUSH-PULL OPERATION

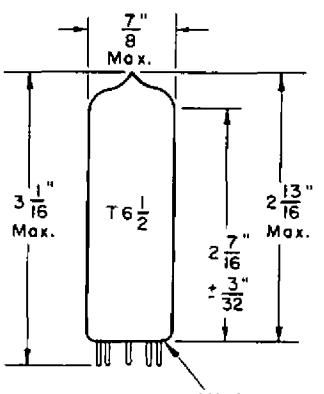
(Values are for 2 Tubes)

Plate Voltage	260	Volts
Grid 2 Voltage	130	Volts
Cathode Bias Resistor (Bypassed)	69	Ohms
Peak AF Grid 1-to-Grid 1 Voltage	16.5	Volts
Zero Signal Plate Current	90	Ma.
Zero Signal Grid 2 Current	3	Ma.
Max. Signal Plate Current	106	Ma.
Max. Signal Grid 2 Current	15	Ma.
Plate-to-Plate Load Resistance	5500	Ohms
Power Output	16.5	Watts
Total Harmonic Distortion	1.5	Per Cent

NOTES

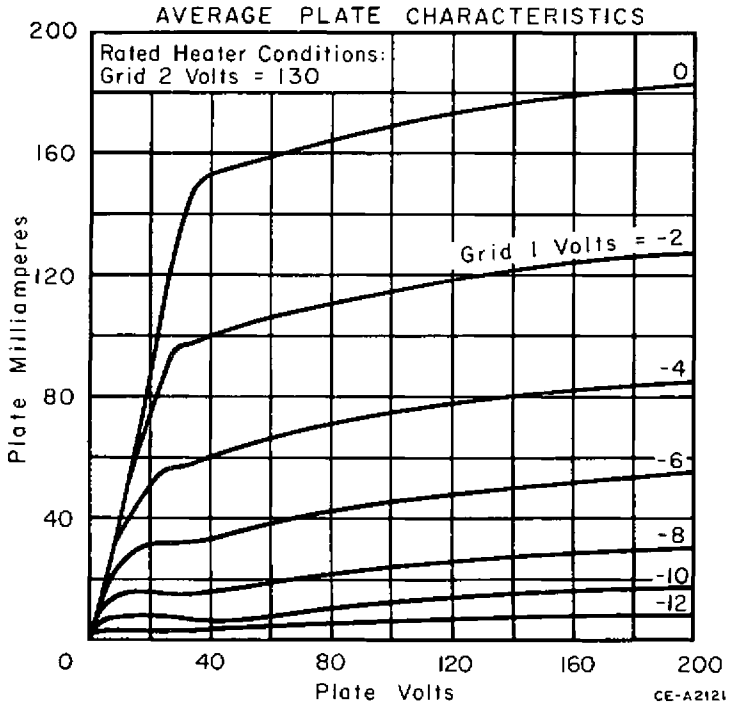
1. Screen dissipation may be permitted to reach 4-watts during the periods of maximum input of speech and music signals.
2. For plate current of 100 microamperes.
3. Cathode resistor bypassed.
4. Cathode resistor not bypassed.

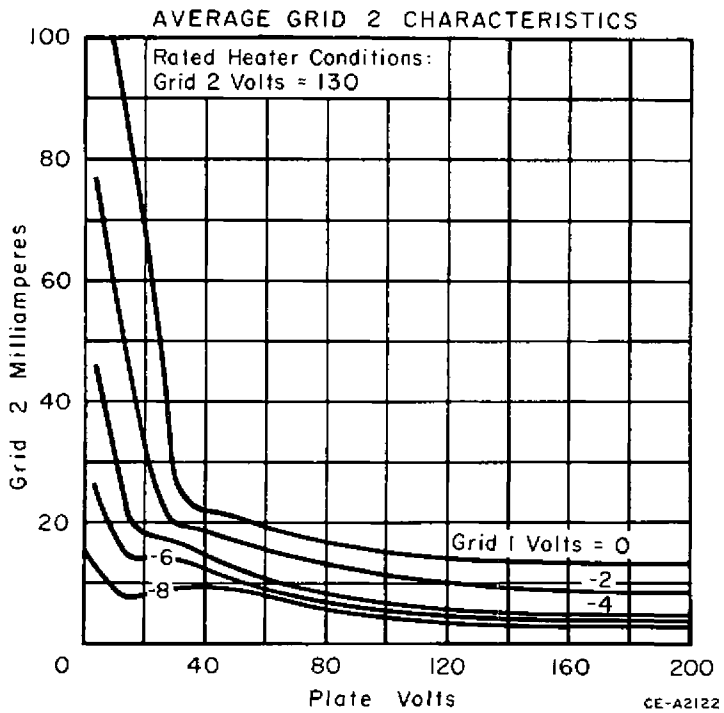


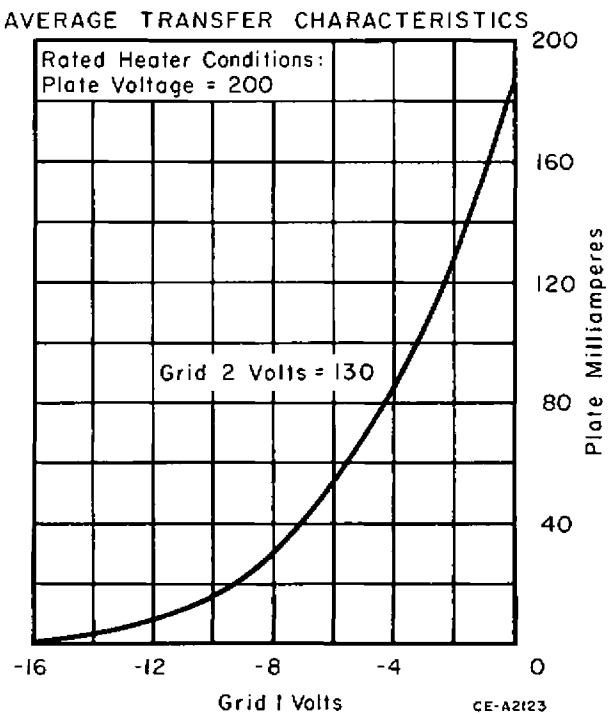


from JEDEC release #4787, Aug. 24, 1964

Westinghouse







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from JEDEC release #4772B,
April 11, 1966

6JE6A, 24JE6A
BEAM POWER TUBES

RCA Dark Heater | **For Color-TV Horizontal-Deflection Amplifier Circuits Using 270 V to over 400 V "B" Supplies** | **T12 Novar Types**

RCA-6JE6A and 24JE6A are double-ended, high-perveance beam power tubes of the novar type having a T12 envelope. These types are especially useful as horizontal-deflection-amplifier tubes in color-TV receivers. The 6JE6A has all the performance features of the 6JE6 and will directly replace the 6JE6 in all applications. In addition, it has a higher plate dissipation (30 watts) and offers the advantage of smaller size for compact equipment designs. The 6JE6A and 24JE6A can provide full-deflection power and high voltage in equipment using "B" supply voltages ranging from as low as 270 volts to as high as 400 volts or more.

Both the 6JE6A and 24JE6A have a maximum plate dissipation rating of 30 watts and a maximum grid-No.2 input rating of 5 watts. These ratings, in addition to high maximum ratings for peak positive-pulse plate voltage (7500 volts) and peak cathode current (1200 milliamperes), indicate the capability of these tubes to meet the stringent requirements of color-television deflection circuits. Other electrical features which contribute to the top performance of these tubes are high zero-bias plate current at low plate and grid-No.2 voltages, and a high operating ratio of plate current to grid-No.2 current.

The 6JE6A and 24JE6A feature a special plate structure designed to minimize secondary-electron emission from the plate and eliminate "knee" discontinuities in the zero-bias region of the Eb-Ib characteristic. A separate base-pin connection to grid No.3 is provided so that positive voltage can be applied to grid No.3 to minimize interference from "snivets" and to increase power output.

The 24JE6A has a 0.600-ampere/24.0-volt heater having a controlled 11-second warm-up time for use in series heater-string arrangements.

ELECTRICAL CHARACTERISTICS—Bogey Values

		6JE6A	24JE6A	
Heater Voltage, ac or dc	E_h	6.3	24.0	V
Heater Current	I_h	2.5	0.6	A
Heater Warm-up Time	t_h	-	11	s
Direct Interelectrode Capacitances:[a]				
Grid No.1 to plate	c_{g1-p}	0.56		pF
Input: G1 to (K, G3, G2, H)	c_i	22		pF
Output: P to (K, G3, G2, H)	c_o	11		pF

For the following characteristics, see Conditions below:

Amplification Factor (Triode Connection)[b]	μ	-	-	3[c]	-	-	2.8[d]		
Plate Resistance (Approx.)	r_p	-	-	5800	-	-	7000	Ω	
Transconductance	g_m	-	-	9600	-	-	7500	μmho	
DC Plate Current	I_b	-	580[e]	130	-	710[e]	95	mA	
DC Grid-No.2 Current	I_{c2}	-	40[e]	2.8	-	55[e]	2.4	mA	
Cutoff DC Grid-No.1 Voltage for I_b = 1 mA	$E_{c1(co)}$	-120	-	-54	-125	-	-60	V	
Conditions:									
Heater Voltage	E_h	← Bogey Value →						V	
Peak Positive-Pulse Plate Voltage[f]	e_{bm}	5000	-	-	5000	-	-	V	
DC Plate Voltage	E_b	-	55	175	-	60	175	V	
DC Grid-No.3 Voltage	E_{c3}	30	30	30	30	30	30	V	
DC Grid-No.2 Voltage	E_{c2}	125	125	125	145	145	145	V	
DC Grid-No.1 Voltage	E_{c1}	-	0	-25	-	0	-35	V	

MECHANICAL CHARACTERISTICS

Dimensional Outline	JEDEC No.12-116
Envelope	JEDEC Designation T12
Top Cap[g]	Small (JEDEC Designation C1-1)
Base[h]	Large-Button Novar 9-Pin with Exhaust Tip (JEDEC Designation E9-88)
Terminal Connections (See *TERMINAL DIAGRAM*)	JEDEC Designation 9QL
Type of Cathode	Coated Unipotential
Operating Position	Any

MAXIMUM RATINGS—Design-Maximum Values[k]

For operation as a Horizontal-Deflection-Amplifier Tube in a 525-line, 30-frame system

DC Plate Supply Voltage	E_{bb}	990	V
Peak Positive-Pulse Plate Voltage[m]	e_{bm}	7500	V
Peak Negative-Pulse Plate Voltage	$-e_{bm}$	1100	V
DC Grid-No.3 Voltage[n]	E_{c3}	75	V
DC Grid-No.2 (Screen-Grid) Voltage	E_{c2}	220	V
Peak Negative-Pulse Grid-No.1 (Control-Grid) Voltage	$-e_{c1m}$	330	V
Heater-Cathode Voltage:			
Peak	e_{hkm}	±200	V
Average	E_{hk}	100	V
Heater Voltage, ac or dc (*6JE6A*)	E_h	5.7 to 6.9	V
Heater Current (*24JE6A*)	I_h	560 to 640	mA
Cathode Current:			
Peak	i_{km}	1200	mA
Average	$I_{k(av)}$	350	mA
Grid-No.2 Input	P_{g2}	5	W
Plate Dissipation[p]	P_b	30	W
Envelope Temperature (at hottest point on envelope surface)	T_E	250	°C

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RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

6JE6A, 24JE6A 2-66
Supersedes 6JE6A issue dated 2-65
Printed in U.S.A.

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Marca(s) Registrada(s)

MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance:	$R_{g1(ckt)}$	
For grid-No.1-resistor-bias operation	-	0.47 MΩ
For plate-pulsed operation (horizontal-deflection circuits only)	-	10 MΩ

[a] Measured without external shield in accordance with the current issue of EIA Standard RS-191.

[b] With grid No.3 and grid No.2 connected, respectively, to cathode and plate at socket.

[c] Conditions: $E_b = E_{c2} = 125$ V, $E_{c1} = -25$ V.

[d] Conditions: $E_b = E_{c2} = 145$ V, $E_{c1} = -35$ V.

[e] This value can be measured by a method involving a recurrent waveform such that the Maximum Ratings of the tube will not be exceeded.

[f] Under pulse-duration condition specified in Footnote m.

[g] Designed to mate with connector for 0.360-inch cap, generally available from your local RCA Distributor.

[h] Designed to mate with "Novar 9-Contact" Socket generally available from your local RCA Distributor.

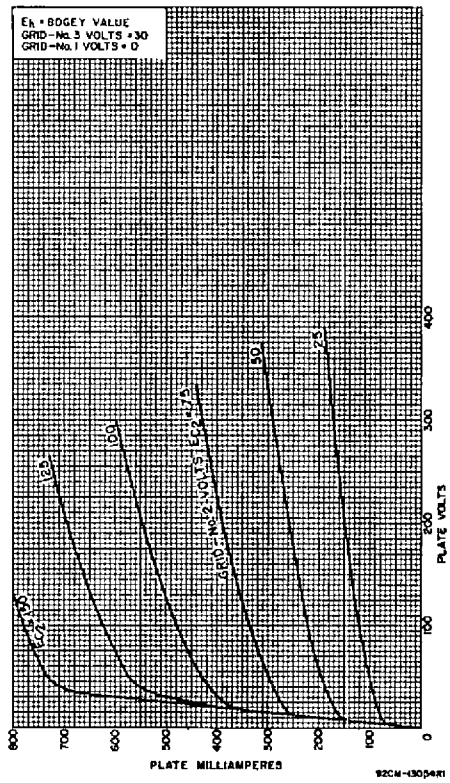
[k] As defined in the current issue of EIA Standard RS-239.

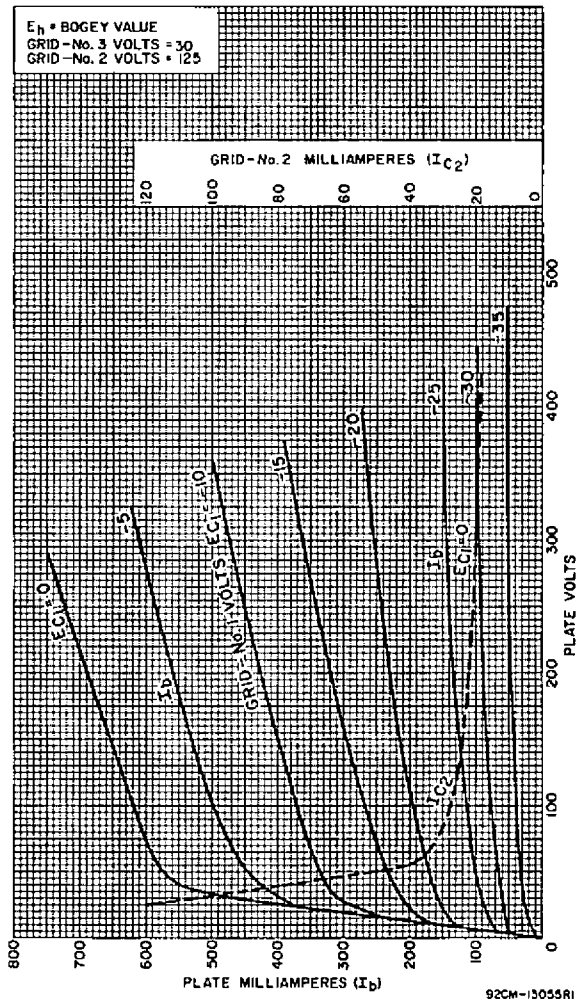
[m] This rating is applicable when the duration of the voltage pulse does not exceed 15% of one horizontal scanning cycle. In a 525-line, 30-frame system, 15% of one horizontal scanning cycle is 10 μs.

[n] In horizontal-deflection-amplifier service, 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 for this voltage is 30 volts.

[p] An adequate bias resistor or other means is required to protect the tube in the absence of excitation.

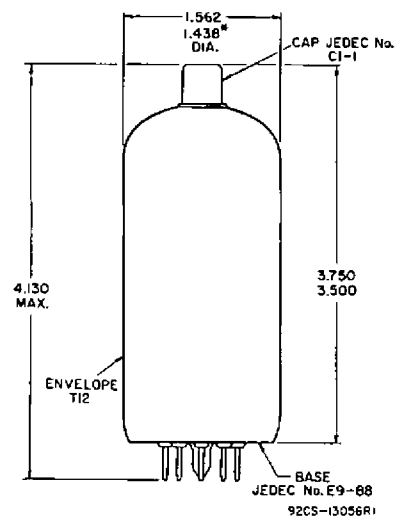
TYPICAL CHARACTERISTICS





DIMENSIONAL OUTLINE JEDEC No.12-116

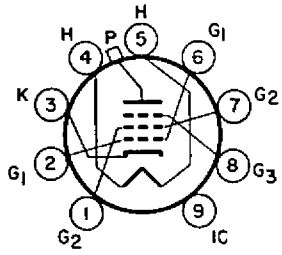
Dimensions in Inches



* Applies to the minimum diameter except in the area of the seal.

TERMINAL DIAGRAM (Bottom View)

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 - Do Not Use
Top Cap - Plate



JEDEC 9QL

ELECTRONICS

6JM6-A
COMPACTRON BEAM PENTODE

DESCRIPTION AND RATING

The 6JM6-A 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".

The 6JM6-A is unilaterally interchangeable with the 6JM6, and differs in having a lower knee.

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 - C1-2 or 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

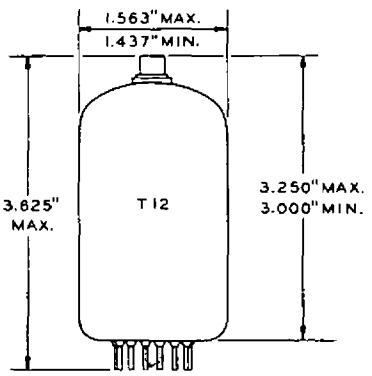
MAXIMUM RATINGS

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

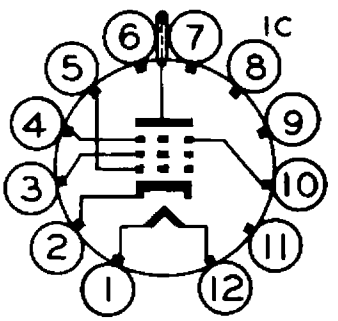


EIA 12-79

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 - 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

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)

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	55	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	---	---	15000	Ohms
Transconductance	---	---	7300	Micromhos
Plate Current	---	345	70	Milliamperes
Screen Current	---	30	2.4	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 Eb = Ec2 = 150 volts and Ec1 = -22.5 volts.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

from JEDEC release #4885, Dec. 21, 1964

GE ELECTRONICS

6JN6-A
COMPACTRON BEAM PENTODE

DESCRIPTION AND RATING

The 6JN6-A 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".

The 6JN6-A is unilaterally interchangeable with the 6JN6, and differs in having a lower knee.

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
Minimum Diameter	1.437	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches
Minimum Seated Height	2.250	Inches

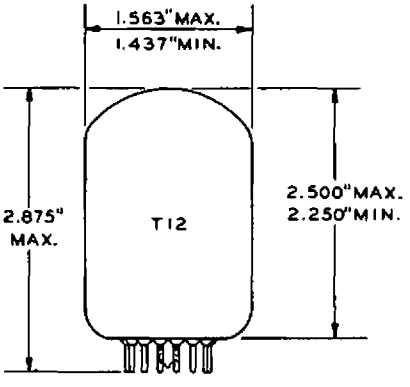
MAXIMUM RATINGS

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

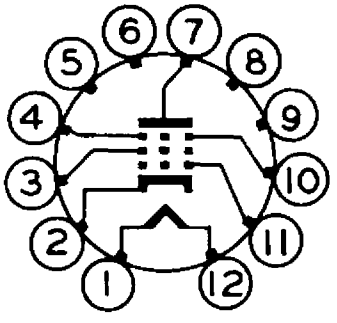


EIA 12-56

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - 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	55	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	---	---	15000	Ohms
Transconductance	---	---	7300	Micromhos
Plate Current	---	345	70	Milliamperes
Screen Current	---	30	2.4	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 Eb = Ec2 = 150 volts and Ec1 = -22.5 volts.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONICS

6JS6

COMPACTRON BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6JS6 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‡	2.25	Amperes
Direct Interelectrode Capacitances, approximate§		
Grid-Number 1 to Plate: (g1 to p)	0.7	pf
Input: g1 to (h + k + g2 + b.p.)	24	pf
Output: p to (h + k + g2 + b.p.)	10	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
Maximum Over-all Length . . .	4.125	Inches
Maximum Seated Height	3.750	Inches
Minimum Seated Height	3.500	Inches

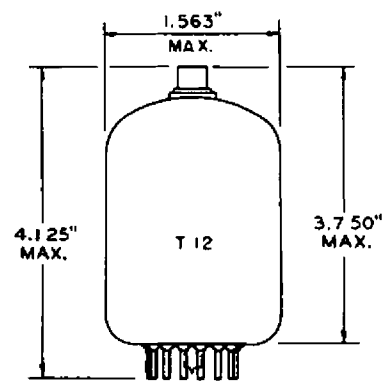
MAXIMUM RATINGS

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

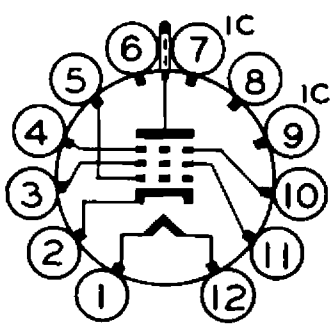


EIA 12-89

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - 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 - Grid Number 2 (Screen)
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12FY

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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)	7500	Volts
Peak Negative Pulse Plate Voltage	1100	Volts
Positive DC Beam Plate Voltage	70	Volts
Screen Voltage	190	Volts
Peak Negative Grid-Number 1 Voltage	250	Volts
Plate Dissipation#	28	Watts
Screen Dissipation	5.5	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	1.0	Megohms
Bulb TemperatureΔ	225	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	70	175	Volts
Beam Plates, Connected to Cathode at Socket				
Screen Voltage	125	125	125	Volts
Grid-Number 1 Voltage	---	0	-25	Volts
Plate Resistance, approximate	---	---	5600	Ohms
Transconductance	---	---	11300	Micromhos
Plate Current	---	570**	125	Milliamperes
Screen Current	---	34**	4.5	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 1.0 Milliamperes	-140	---	-54	Volts
Triode Amplification Factor‡‡	---	---	3	

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.

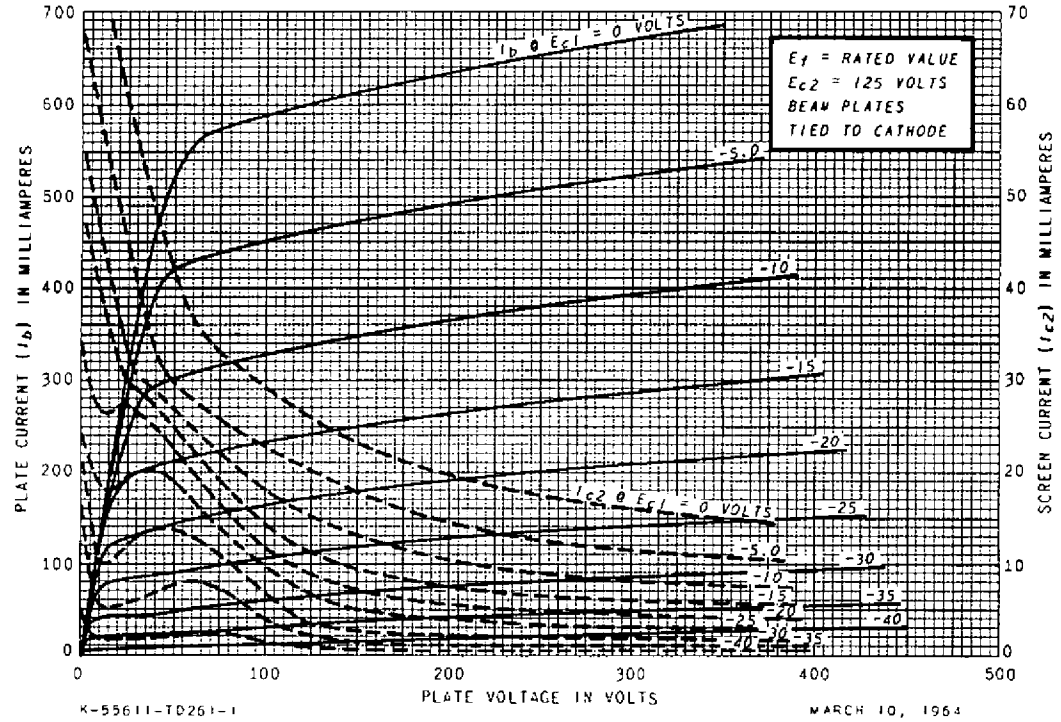
\# In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

Δ Measured using a thermocouple attached to a 0.1-inch wide phosphor-bronze ring placed at the hottest location on the bulb.

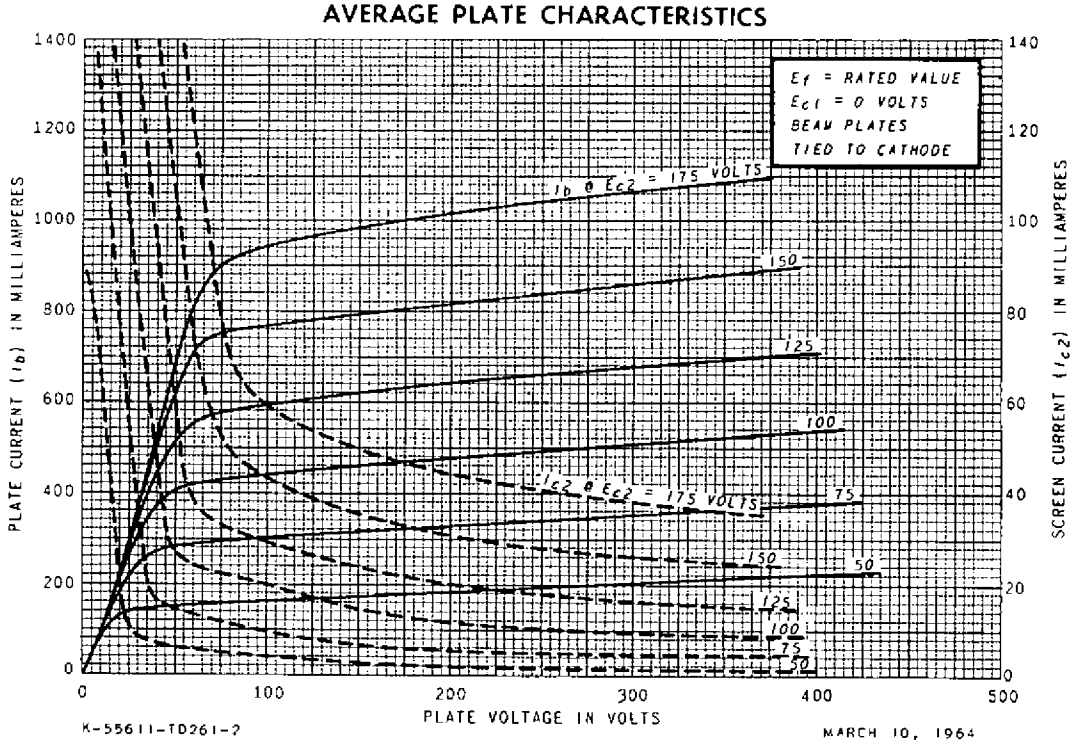
** Values measured by a method involving a recurrent waveform such that the plate and screen dissipations will be kept within ratings in order to prevent damage to the tube.

‡‡ Triode connection (screen tied to plate) with Eb = Ec2 = 125 volts, and Ec1 = -25 volts.

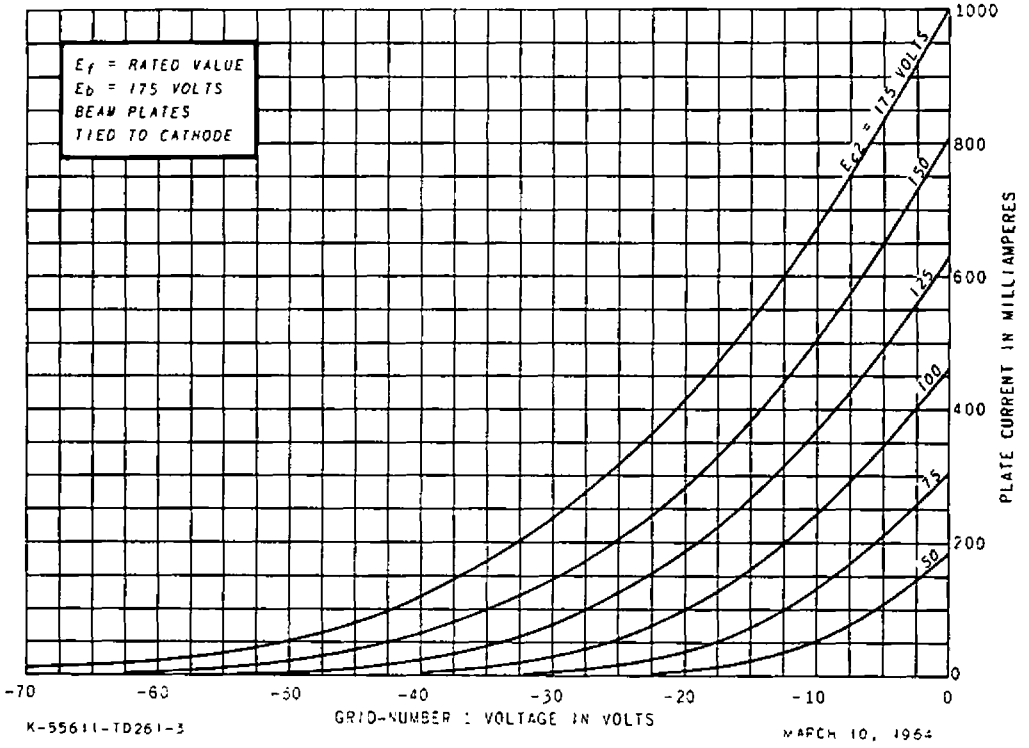
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



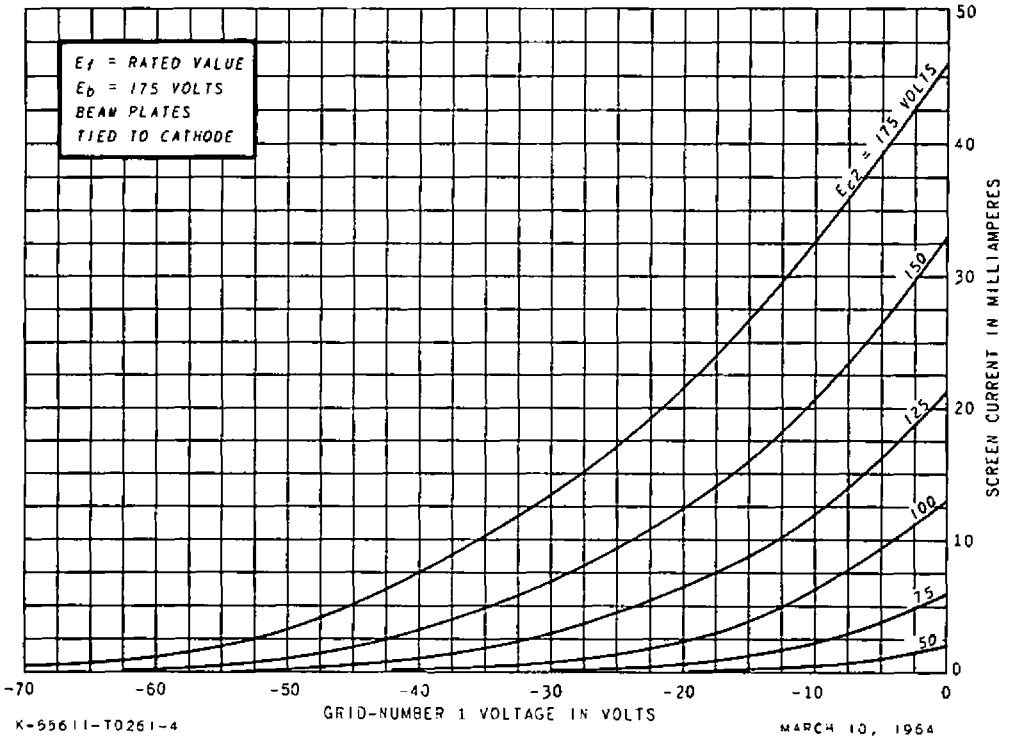
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD261-3

MARCH 10, 1964

AVERAGE TRANSFER CHARACTERISTICS



K-55611-T0261-4

MARCH 10, 1964

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

from JEDEC release #4790, Aug. 31, 1964

ELECTRONICS

6JS6-A

COMPACTRON BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6JS6-A 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".

The 6JS6-A is unilaterally interchangeable with the 6JS6 and differs in having a lower knee.

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)	0.7	pf
Input: g1 to (h + k + g2 + b.p.)	24	pf
Output: p to (h + k + g2 + b.p.)	10	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
Maximum Over-all Length	4.125	Inches
Maximum Seated Height	3.750	Inches
Minimum Seated Height	3.500	Inches

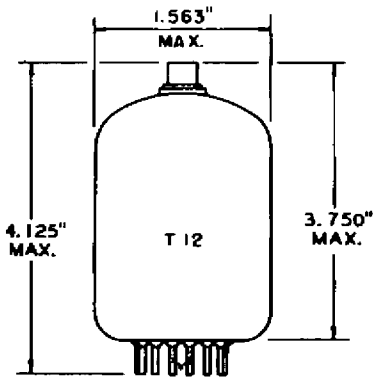
MAXIMUM RATINGS

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

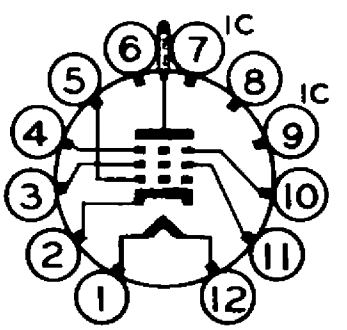


EIA 12-89

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - 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 - Grid Number 2 (Screen)
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12FY

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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)	7500	Volts
Peak Negative Pulse Plate Voltage	1100	Volts
Positive DC Beam Plate Voltage	70	Volts
Screen Voltage	190	Volts
Peak Negative Grid-Number 1 Voltage	250	Volts
Plate Dissipation#	28	Watts
Screen Dissipation	5.5	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	1.0	Megohms
Bulb TemperatureΔ	225	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	62	175	Volts
Beam Plates, Connected to Cathode at Socket				
Screen Voltage	125	125	125	Volts
Grid-Number 1 Voltage	---	0	-25	Volts
Plate Resistance, approximate	---	---	5600	Ohms
Transconductance	---	---	11300	Micrombos
Plate Current	---	570**	125	Milliamperes
Screen Current	---	34**	4.5	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 1.0 Milliamperes	-140	---	-54	Volts
Triode Amplification Factor‡‡	---	---	3	

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.

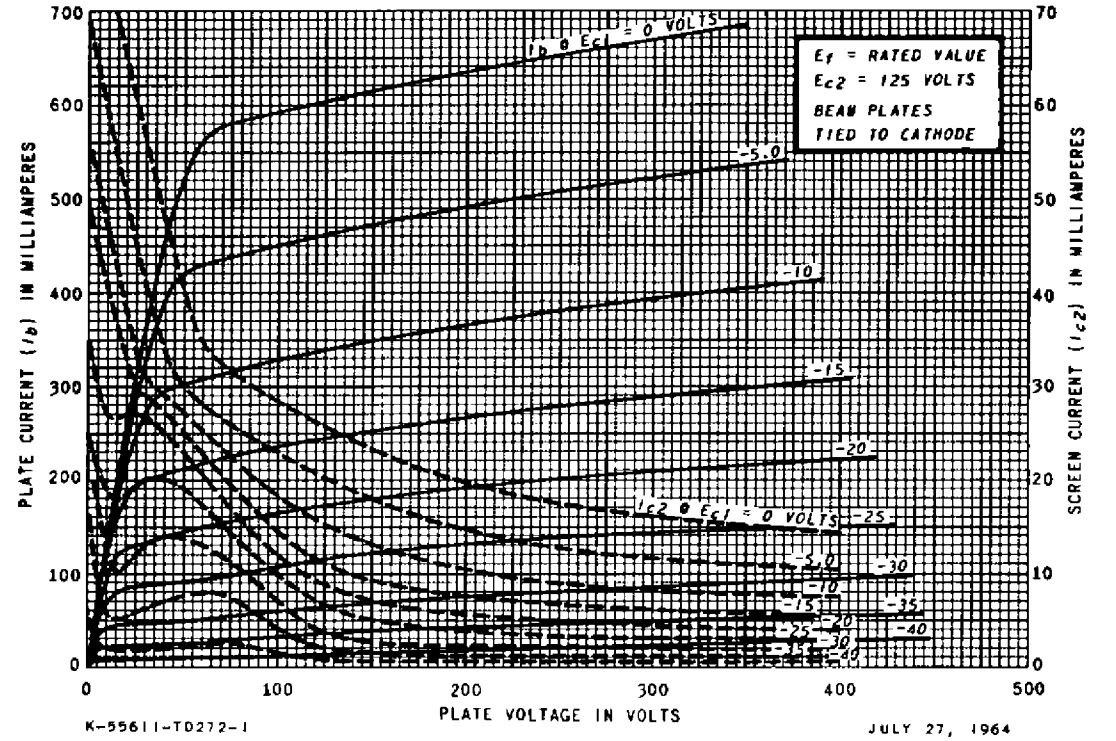
\# In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

Δ Measured using a thermocouple attached to a 0.1-inch wide phosphor-bronze ring placed at the hottest location on the bulb.

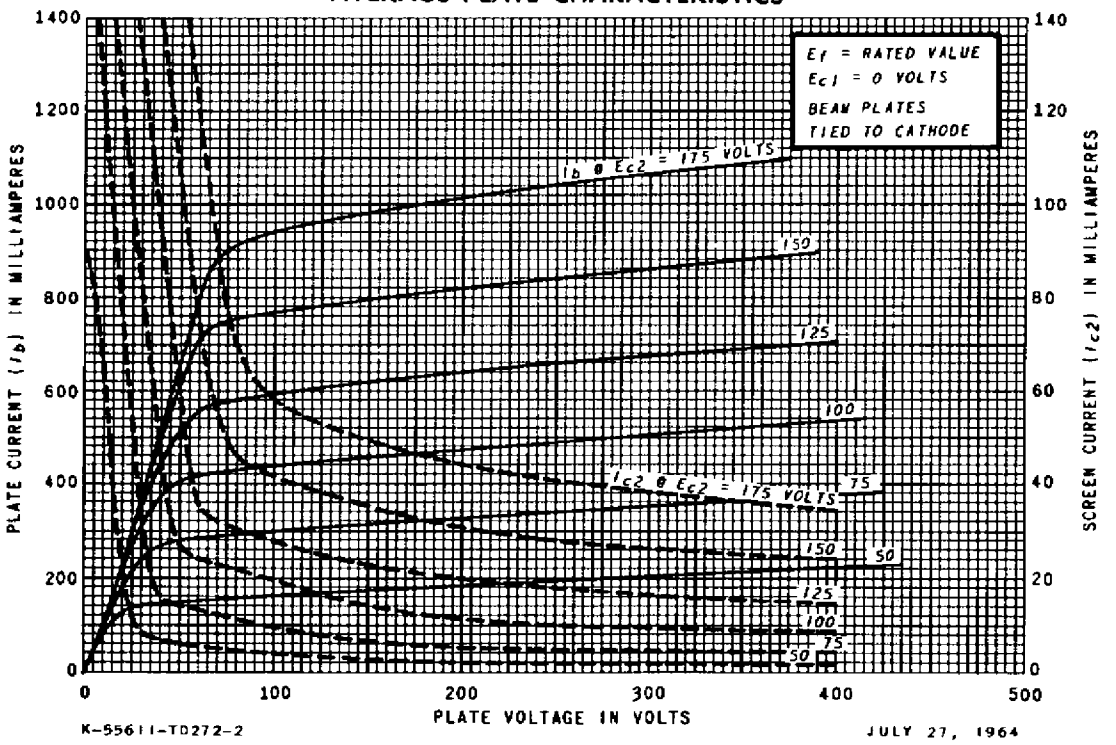
** Values measured by a method involving a recurrent waveform such that the plate and screen dissipations will be kept within ratings in order to prevent damage to the tube.

‡‡ Triode connection (screen tied to plate) with Eb = Ec2 = 125 volts, and Ec1 = -25 volts.

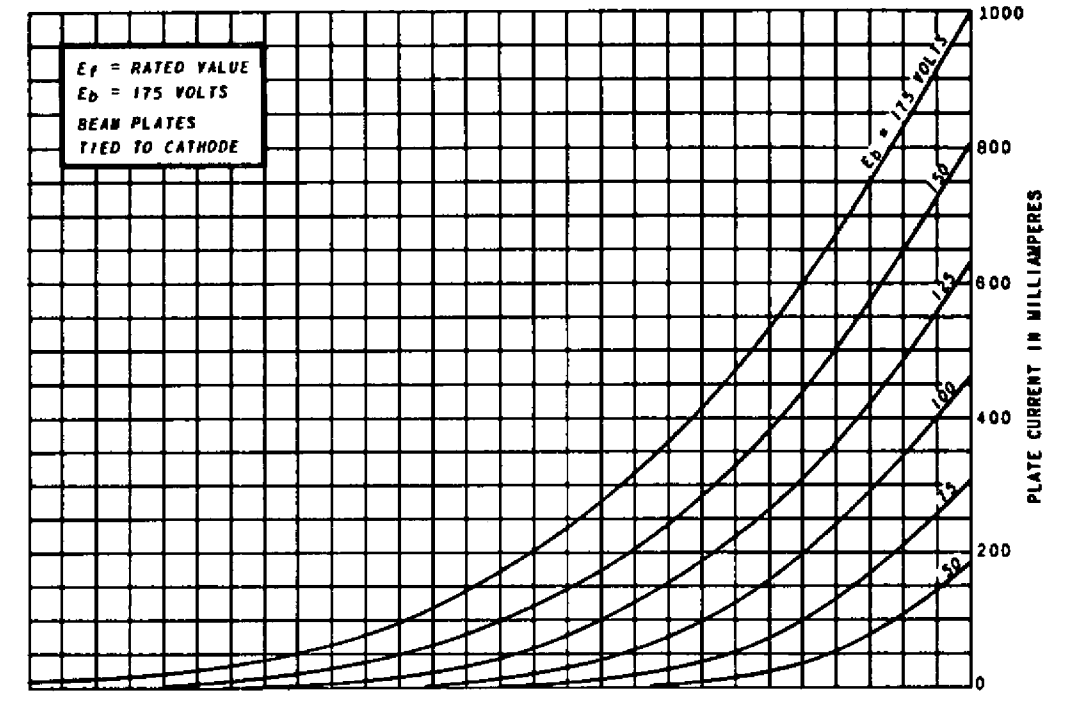
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



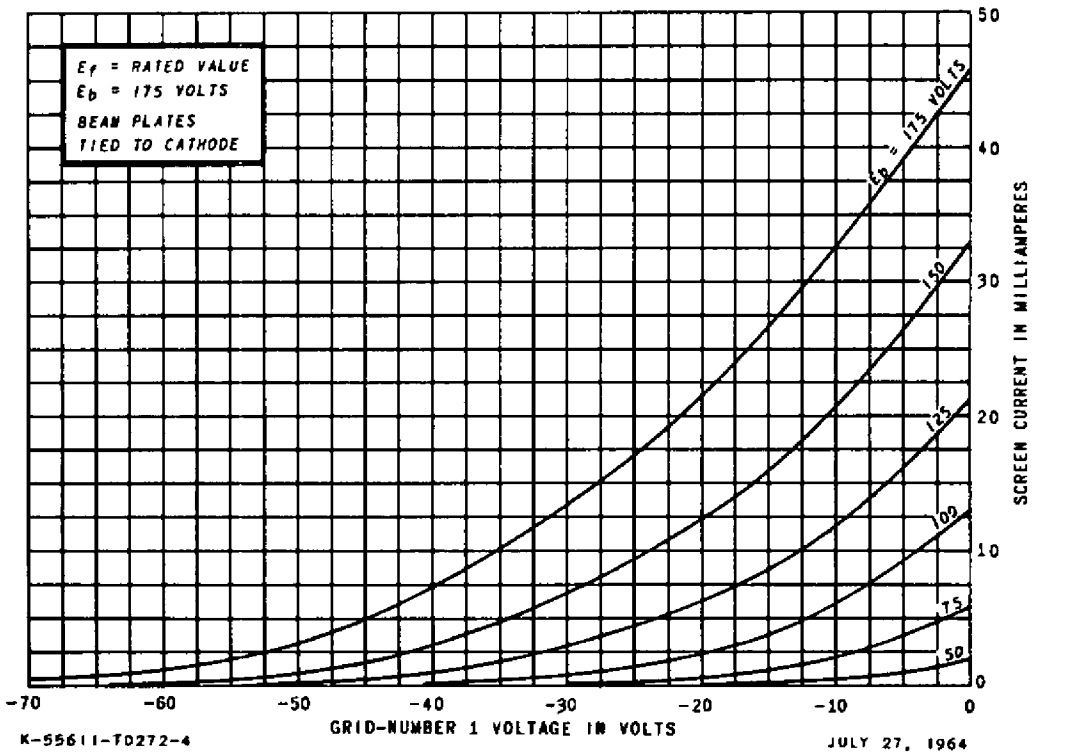
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD273-5

JULY 27, 1964

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD272-4

JULY 27, 1964

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

from JEDEC release #4675,
April 20, 1964

RCA-6JT6, 12JT6, 17JT6

BEAM POWER TUBES

NOVAR TYPES

T12 Bulb
RCA Dark Heater

For Horizontal-Deflection-Amplifier Service in Black-and-White TV Receivers

Controlled Heater Warm-Up Time

RCA-6JT6, 12JT6, and 17JT6 are single-ended, high-perveance beam power tubes of the novar type having a T12 bulb. These types are useful in high-efficiency horizontal-deflection-amplifier circuits of black-and-white television receivers.

These tubes have exceptionally good knee-current characteristics, permitting them to draw a plate current of 390 milliamperes with zero grid-No.1 bias and only 60 volts on the plate. The 6JT6, 12JT6, and 17JT6 also have a high ratio of plate current to grid-No.2 current. These features, in addition to high voltage ratings and high dissipation ratings, permit the design of horizontal-deflection-amplifier circuits capable of providing full deflection for systems employing wide-angle or high-voltage picture tubes.

A separate base-pin terminal is provided to permit the application of a positive voltage to grid No.3 to minimize interference from "snivets" which may occur in both vhf and uhf television receivers.

Two base-pin terminals are provided for grid No.2 to increase the grid-No.2-dissipation capability and to provide added flexibility in circuit design.

The 6JT6, 12JT6, and 17JT6 utilize the RCA Dark Heater for long life and dependable performance.

The 6JT6 has a 6.3-volt/1.200-ampere heater. The 12JT6 and 17JT6 are identical to the 6JT6 except that the 12JT6 has a 0.600-ampere/12.6-volt heater and the 17JT6 has a 0.450-ampere/16.8-volt heater. The heaters of the 12JT6 and the 17JT6 have a controlled 11-second warm-up time for use in series heater-string arrangements.

GENERAL DATA

Electrical:

Heater Ratings and Characteristics:

	6JT6	12JT6	17JT6	
Voltage (AC or DC).	6.3 ± 0.6[a]	12.6	16.8	volts
Current at bogey voltage	1.200	0.600[b]	0.450[b]	amp
Warm-up time (Average)	-	11	11	sec
Peak heater-cathode voltage:				
Heater negative with respect to cathode.		200	max.	volts
Heater positive with respect to cathode.		200[c]	max.	volts
Direct Interelectrode Capacitances (Approx.):[d]				
Grid No.1 to plate:		0.26		pf
Input: G1 to (K,G3,G2,H).		15.0		pf
Output: P to (K,G3,G2,H).		6.5		pf

Characteristics, Class A_1 Amplifier:

	Triode Connection[e]			
Plate Voltage . .	150	60	250	volts
Grid No.3	-	Connected to cathode at socket		
Grid-No.2 Voltage	150	150	150	volts
Grid-No.1 Voltage	-22.5	0	-22.5	volts
Amplification Factor. . . .	4.4	-	-	
Plate Resistance (Approx.) . . .	-	-	15000	ohms
Transconductance.	-	-	7100	μmhos
Plate Current . .	-	390[f]	70	ma
Grid-No.2 Current	-	32[f]	2.1	ma
Grid-No.1 Voltage (Approx.) for plate ma = 1. .	-	-	-42	volts

[a] For operation of the heater of this tube in parallel with the heaters of other tubes.

[b] When the heater of this tube is operated in series with the heaters of other tubes, the heater current of the 12JT6 must be limited to 0.600 ± 0.040 ampere; that of the 17JT6 to 0.450 ± 0.030 ampere.

[c] The dc component must not exceed 100 volts.

[d] Without external shield.

[e] With grid No.2 connected to plate at socket.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

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Marca(s) Registrada(s)

Printed in U.S.A.

HORIZONTAL-DEFLECTION AMPLIFIER

Maximum Ratings, *Design-Maximum Values:*

For operation in a 525-line, 30-frame system[g]

DC Plate Supply Voltage	770 max.	volts
Peak Positive-Pulse Plate Voltage[h]	6500 max.	volts
Peak Negative-Pulse Plate Voltage	1500 max.	volts
DC Grid-No.3 (Suppressor-Grid) Voltage[j]	70 max.	volts
DC Grid-No.2 (Screen-Grid) Voltage	220 max.	volts
DC Grid-No.1 (Control-Grid) Voltage:		
Negative-bias value	55 max.	volts
Peak Negative-Pulse Grid-No.1 Voltage	330 max.	volts
Cathode Current:		
Peak	550 max.	ma
Average	175 max.	ma
Grid-No.2 Input	3.5 max.	watts
Plate Dissipation[k]	17.5 max.	watts
Bulb Temperature (At hottest point on bulb surface)	240 max.	°C

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:		
For grid-resistor-bias operation	1 max.	megohm

[f] This value can be measured by a method involving a recurrent wave form such that the maximum ratings of the tube will not be exceeded.

[g] As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission.

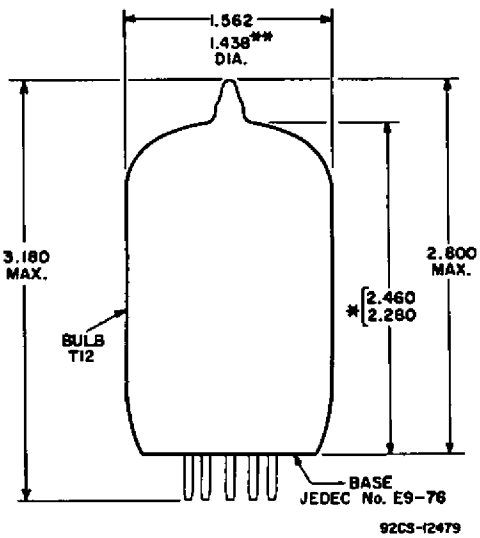
[h] This rating is applicable where the duration of the voltage pulse does not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

[j] A positive voltage may be applied to grid No.3 to reduce interference from "snivets" which may occur in television receivers. A typical value for this voltage is 30 volts.

[k] An adequate bias resistor or other means is required to protect the tube in the absence of excitation.

DIMENSIONAL OUTLINE

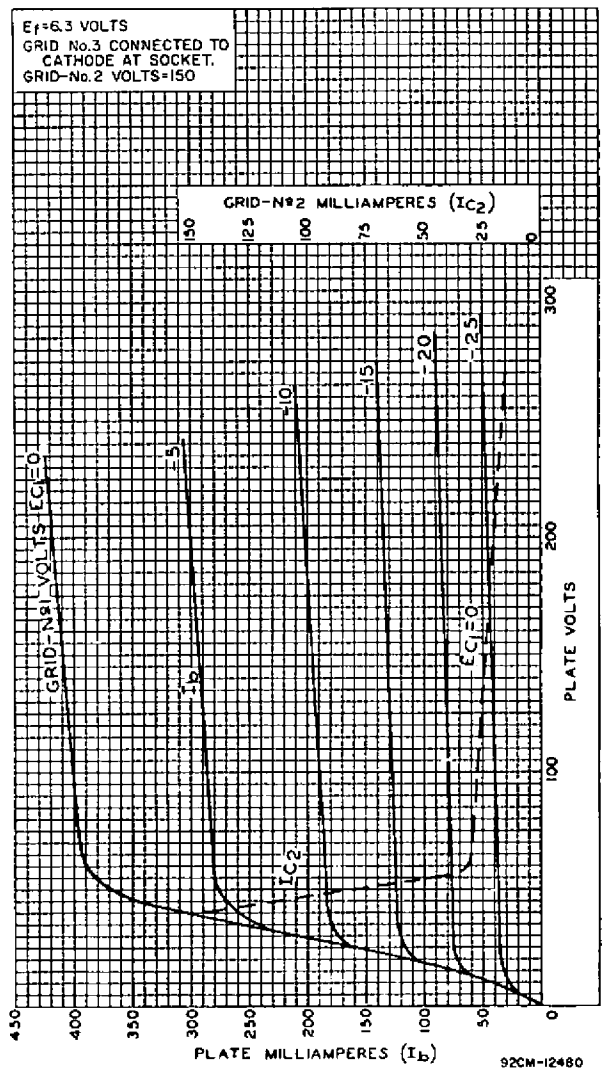
Dimensions in Inches



* Measured from base seat to bulb-top line as determined by a ring gauge of 0.600" inside diameter.

** The minimum applies in the zone starting 0.375" from the base seat.

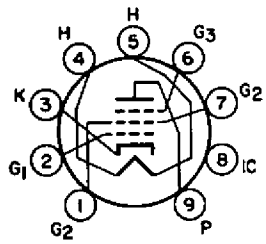
AVERAGE CHARACTERISTICS



For Type 6JT6, and for Types 12JT6 (E_f = 12.6 V) and 17JT6 (E_f = 16.8 V).

TERMINAL DIAGRAM

Bottom View



JEDEC 9QU

Pin 1 – Grid No.2	Pin 6 – Grid No.3
Pin 2 – Grid No.1	Pin 7 – Grid No.2
Pin 3 – Cathode	Pin 8 – Do Not Use
Pin 4 – Heater	Pin 9 – Plate
Pin 5 – Heater	

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from JEDEC release #4759E,
Feb. 14, 1966

6JU6, 22JU6

BEAM POWER TUBES

T12 Novar Types

Controlled Heater Warm-Up Time (22JU6)

For Horizontal-Deflection-Amplifier Service in Low-B+, Black-and-White TV Receivers

RCA Dark Heater

RCA-6JU6* and 22JU6 are high-perveance beam power tubes of the novar type having a T12 envelope. These types are particularly useful as horizontal-deflection amplifier tubes in black-and-white television receivers operating at low B + voltages.

A major feature of the 6JU6 and 22JU6 is a special plate structure designed to minimize secondary-electron emission from the plate. This structure provides a high ratio of plate current to grid-No.2 current and a high zero-bias plate current at low plate voltage and low grid-No.2 input. The low-voltage knee characteristic of the 6JU6 and 22JU6 permits the development of the high voltage required for the picture tube and a reserve of horizontal scan at low-B+ supply voltages. These tubes require a relatively low value of grid-No.1 bias voltage for plate current cutoff under high pulse voltage conditions. This feature makes possible efficient operation in receivers with low grid-No.1 driving voltage.

A separate base-pin terminal is provided for grid No.3 to permit the application of a positive voltage to this grid to minimize possible interference from "snivets". Two base-pin terminals are provided for grid No.2 to increase grid dissipation capability and to provide added flexibility in circuit design.

The 22JU6 has a 0.450-A/22.0-V heater having a controlled 11-second warm-up time for use in series heater-string arrangements. Both the 6JU6 and 22JU6 utilize the RCA Dark Heater for long life and dependable performance.

* Formerly Developmental Type A40523A.

ELECTRICAL CHARACTERISTICS -- Bogey Values

		6JU6	22JU6	
Heater Voltage, ac or dc	E_h	6.3	22.0	V
Heater Current	I_h	1.6	0.450	A
Heater Warm-up Time	t_h	-	11	s
Direct Interelectrode Capacitances:[a]				
Grid No.1 to plate	c_{g1-p}	1.2		pF
Input: G1 to (K,G3,G2,H)	c_i	22		pF
Output: P to (K,G3,G2,H)	c_o	9.0		pF

For the following characteristics, see Conditions below:

Amplification Factor (Triode Connection)[b]	μ	-	-	4.7		
Plate Resistance (Approx.)	r_p	-	-	-	18	kΩ
Transconductance	g_m	-	-	-	7000	μmho
DC Plate Current	I_b	-	470[c]	-	45	mA
DC Grid-No.2 Current	I_{c2}	-	32[c]	-	1.5	mA
Cutoff DC Grid-No.1 Voltage for I_b = 1 mA	$E_{c1(co)}$	-75	-	-	-32	V

Conditions:

Heater Voltage	E_h	Bogey value				V
Peak Positive-Pulse Plate Voltage[d]	e_{bm}	6500	-	-	-	V
DC Plate Voltage	E_b	-	50	125	130	V
Grid No.3	-	Connected to cathode at socket				
DC Grid-No.2 Voltage	E_{c2}	125	125	125	125	V
DC Grid-No.1 Voltage	E_{c1}	-	0	-20	-20	V

MECHANICAL CHARACTERISTICS

Maximum Overall Length	3.550 in
Maximum Seated Length	3.170 in.
Maximum Diameter	1.562 in
Envelope	JEDEC Designation T12
Top Cap[e]	Skirted Miniature (JEDEC Designation C1-2 or C1-3)
Bases[f] (Alternatives)	Large-Button Novar 9-Pin with Exhaust Tip (JEDEC Designation E9-88) or Large-Button Novar 9-Pin (JEDEC Designation E9-76)
Terminal Connections (See TERMINAL DIAGRAM)	JEDEC Designation 9QL
Type of Cathode	Coated Unipotential
Operating Position	Any

MAXIMUM RATINGS -- Design Maximum Values[g]

For operation as a Horizontal-Deflection-Amplifier Tube in a 525-line, 30-frame system

DC Plate Supply Voltage	E_{bb}	770 V
Peak Positive-Pulse Plate Voltage[h]	e_{bm}	6500 V
Peak Negative-Pulse Plate Voltage	$-e_{bm}$	1500 V
DC Grid-No.3 Voltage[k]	E_{c3}	75 V
DC Grid-No.2 (Screen-Grid) Voltage	E_{c2}	220 V
DC Grid-No.1 (Control-Grid) Voltage:		
Negative-bias value	$-E_{c1}$	55 V
Peak Negative-Pulse Grid-No.1 Voltage	$-e_{c1m}$	330 V

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

Trademark(s) ® Registered
Marca(s) Registrada(s)

6JU6, 22JU6, 12-65
Supersedes 22JU6 issue dated 6-64
Printed In U.S.A.

Heater-Cathode Voltage:			
Peak	e_{hkm}	±200	V
Average	$E_{hk(av)}$	100	V
Heater Voltage, ac or dc *(6JU6)*	E_h	5.7 to 6.9	V
Heater Current *(22JU6)*	I_h	0.420 to 0.480	A
Cathode Current:			
Peak	i_{km}	950	mA
Average	$I_{k(av)}$	275	mA
Grid-No.2 Input	P_{g2}	3.5	W
Plate Dissipation[m]	P_b	17	W
Envelope Temperature (at hottest point on envelope surface)	T_E	240	°C

MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance:	$R_{g1(ckt)}$		
For grid-No.1-resistor-bias operation	-	0.47	MΩ
For plate-pulsed operation (horizontal-deflection circuits only)	-	10	MΩ

[a] Measured without external shield in accordance with the current issue of EIA Standard RS-191.

[b] With grid No.2 connected to plate at socket.

[c] This value can be measured by a method involving a recurrent waveform such that the Maximum Ratings of the tube will not be exceeded.

[d] Under pulse-duration condition specified in Footnote h.

[e] Designed to mate with "1/4-inch" Connector generally available from your local RCA Distributor.

[f] Designed to mate with "Novar 9-Contact" Socket generally available from your local RCA Distributor.

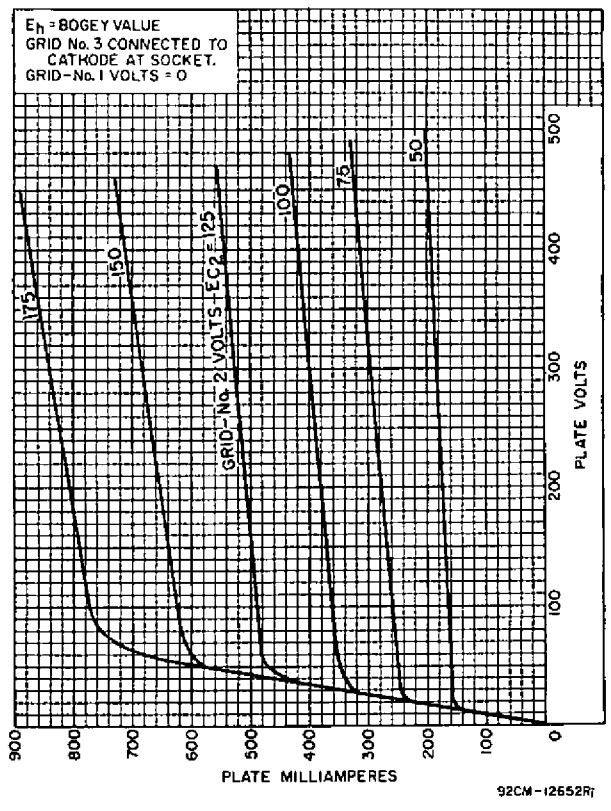
[g] As defined in the current issue of EIA Standard RS-239.

[h] This rating is applicable where the duration of the voltage pulse does not exceed 15% of one horizontal scanning cycle. In a 525-line, 30-frame system, 15% of one horizontal scanning cycle is 10 μs.

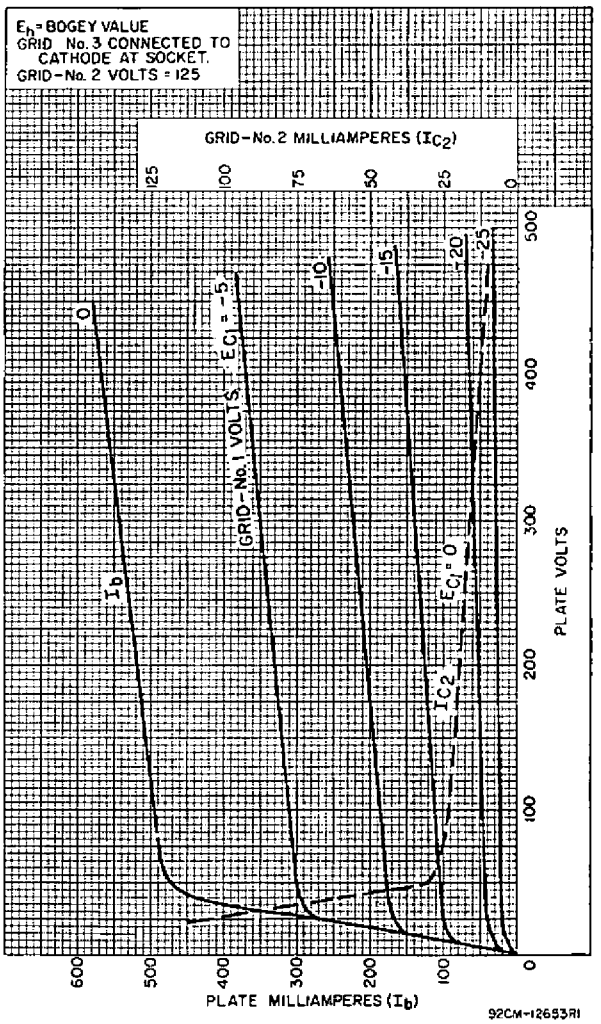
[k] In horizontal-deflection-amplifier service, a positive voltage may be applied to grid No.3 to reduce interference from "snivets" which may occur in both vhf and uhf television receivers. A typical operating value for this voltage is 30 V.

[m] An adequate bias resistor or other means is required to protect the tube in the absence of excitation.

TYPICAL PLATE CHARACTERISTICS

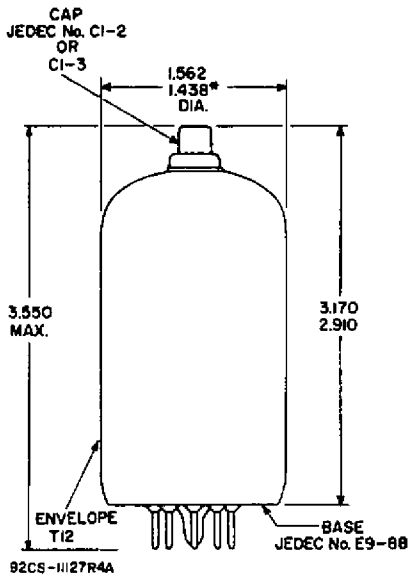


TYPICAL CHARACTERISTICS

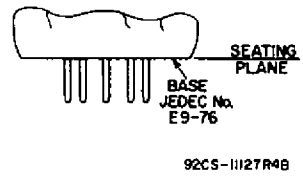


DIMENSIONAL OUTLINE

Dimensions in Inches

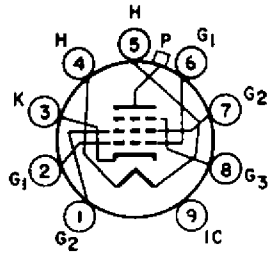


Alternative Base



* Applies to the minimum diameter except in the area of the seal.

TERMINAL DIAGRAM (Bottom View)



JEDEC 9QL

Pin 1 - Grid No.2	Pin 6 - Grid No.1
Pin 2 - Grid No.1	Pin 7 - Grid No.2
Pin 3 - Cathode	Pin 8 - Grid No.3
Pin 4 - Heater	Pin 9 - Do Not Use
Pin 5 - Heater	Top Cap - Plate

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MECHANICAL DATA

Bulb	T-6½
Base	E9-1
Outline	6-3
Basing	9PU
Cathode	Coated Unipotential
Mounting Position	Any

HEATER CHARACTERISTICS AND RATINGS

Average Characteristics

Heater Operation	Series	Parallel	
Heater Voltage	6.3	6.3[1]	Volts
Heater Current	600[1]	600	Ma
Heater Warm-up Time[2]	11	-	Seconds

Ratings (Design Maximum Values)

	Min-Max	Min-Max	
Heater Voltage[3]	- -	5.7-6.9	Volts
Heater Current[3]	560-640	- -	Ma
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
Total DC and Peak		200	Volts Max.
Heater Positive with Respect to Cathode			
DC		100	Volts Max.
Total DC and Peak		200	Volts Max.

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid No. 1 to Plate	0.13 pf
Input: g1 to (h+k, g3, I.S.+g2)	16.0 pf
Output: p to (h+k, g3, I.S.+g2)	5.0 pf

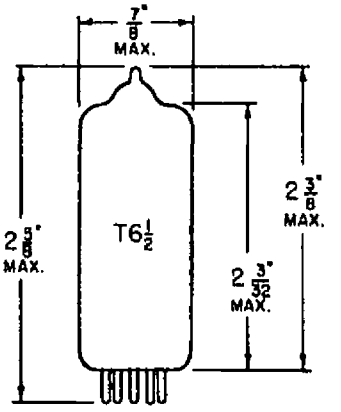
RATINGS (Design Maximum Values)

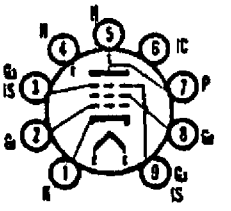
Plate Voltage	400	Volts Max.
Grid No. 2 Supply Voltage	330	Volts Max.
Grid No. 2 Voltage	See Rating Chart	
Positive Grid No. 1 Voltage	0	Volt Max.
Plate Dissipation	11.5	Watts Max.
Grid No. 2 Dissipation	1.0	Watt Max.
Grid No. 1 Circuit Resistance	0.25	Megohm Max.

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 and shorts indicating devices, particularly where mechanical excitation of the tube is employed.

QUICK REFERENCE DATA

The Sylvania Type 6JW6 is a very high gm, strap frame grid, sharp cutoff pentode designed for video amplifier service. It has a gm of 36,000 and a plate dissipation of 11.5 watts. It is contained in a T-6½ bulb.





9PU

SYLVANIA ELECTRIC PRODUCTS INC.

Electronic Components Group
ELECTRONIC TUBE DIVISION
EMPORIUM, PA.

A Technical Publication

July 6, 1964
Page 1 of 3

from JEDEC release #4764A, Sept. 7, 1964

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	250	Volts
Grid No. 2 Voltage	150	Volts
Grid No. 1 Voltage	0	Volt
Cathode Bias Resistor	56	Ohms
Plate Current	28	Ma
Grid No. 2 Current	6.5	Ma
Transconductance	36,000	umhos
Plate Resistance (Approx.)	50,000	Ohms
Ec1 for Ib = 100 ua (Approx.)	-5.7	Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS[4]

Eb = 50 Volts, Ec2 = 125 Volts and Ec1 = 0 Volt
Ib = 70 Ma and Ic2 = 24 Ma

NOTES:

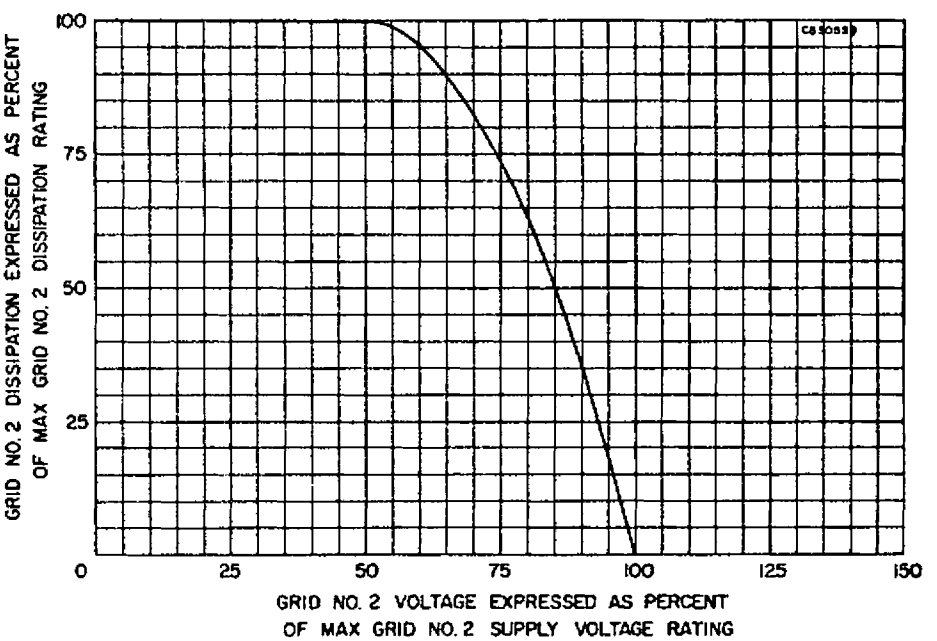
1. For series/parallel operation of heaters, equipment should be designed that at normal supply voltage bogey tubes will operate at this value of heater current/voltage.

2. Heater warm-up time is defined as the time required for the voltage across the heater to reach 80% of the rated heater voltage after applying four (4) times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to three (3) times the rated heater voltage divided by the rated heater current.

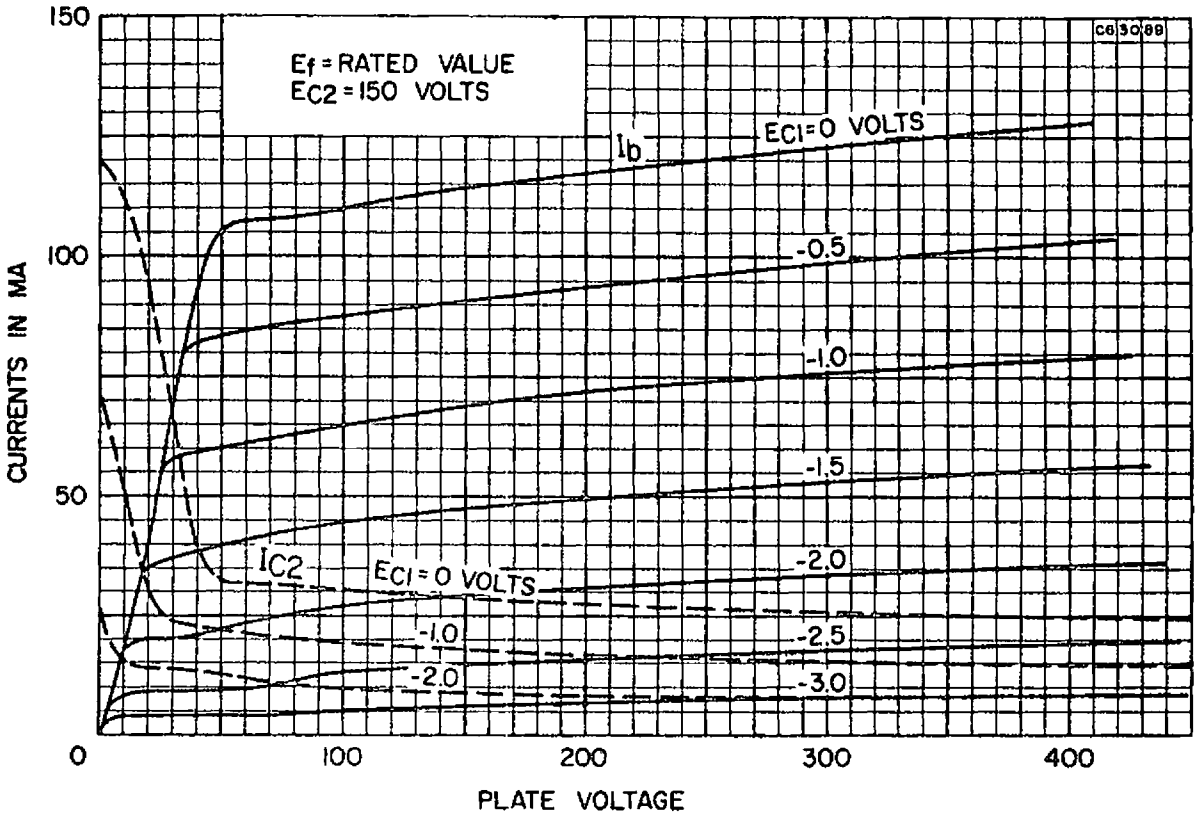
3. Heater voltage supply variations shall be restricted to maintain heater voltage/current within the specified values.

4. Applied for short interval (2 Sec. Max.) so as not to damage tube.

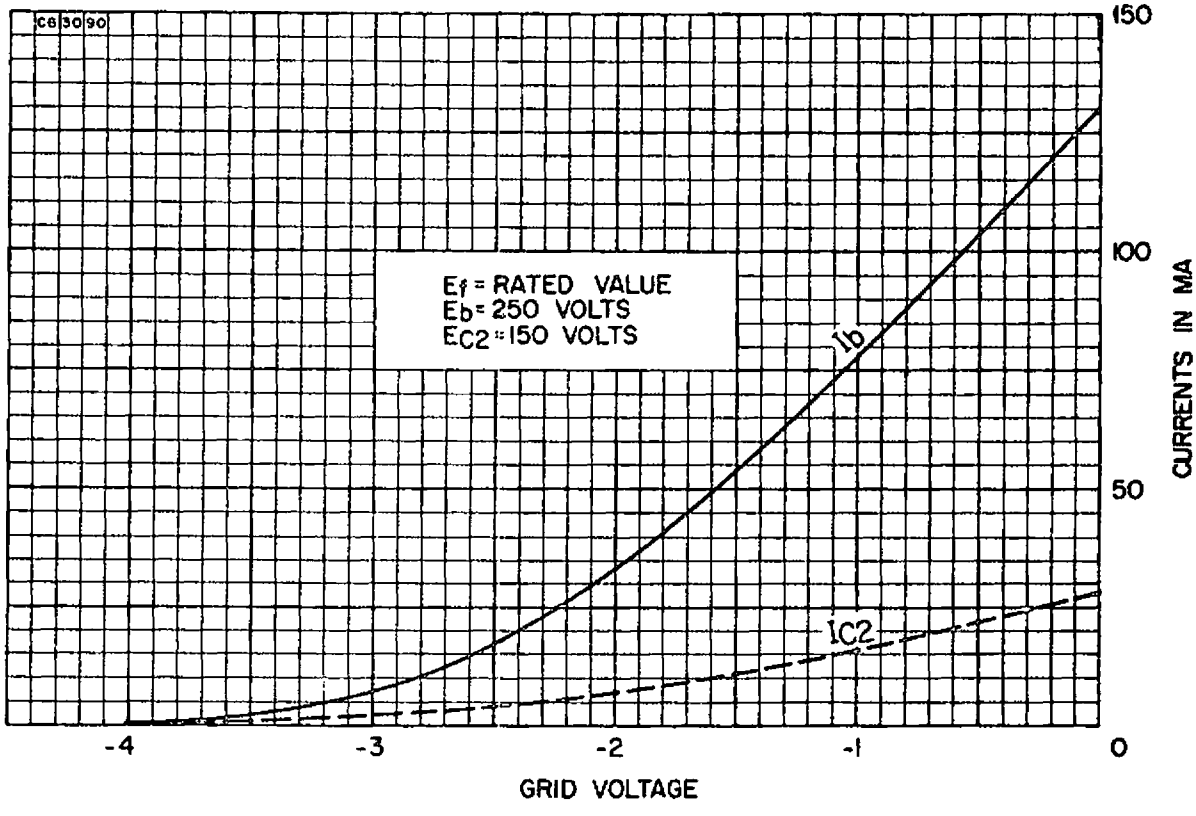
RATING CHART



AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



from JEDEC release #4623, March 9, 1964

RCA-6LF8

HIGH-MU TRIODE—SHARP-CUTOFF PENTODE

9-Pin Miniature Type

For Video-Amplifier Service in Color-TV Receivers and Other Applications Using Positive Triode-Grid Operation

Triode Mu = 70 — **RCA Dark Heater having Controlled Warm-Up Time**

RCA-6LF8 is a multiunit tube of the 9-pin miniature type containing a high-mu triode and a sharp-cutoff pentode in the same envelope. This type is useful in those applications where operation of a triode in the positive-grid region is desirable—such as in video-amplifier stages of color-television receivers.

A primary design feature of the triode unit of the 6LF8 is a maximum positive-grid-bias-voltage rating of 4 volts and a maximum grid-current rating of 8 milliamperes. When this triode unit is operated with positive grid bias of 3 volts, it has an amplification factor of 40.

The pentode unit features a plate-current characteristic having a controlled "knee" to provide good linearity at relatively low plate voltage (75 volts), and high transconductance (11,000 micromhos).

Each unit of the 6LF8 has a separate cathode with individual base-pin terminal to provide greater flexibility of circuit connections. In addition, the basing arrangement and internal connections are designed to minimize coupling between the triode and pentode units.

The 6LF8 has a 0.600-ampere/6.3-volt heater having controlled 11-second warm-up time, and utilizes the RCA Dark Heater for long life and dependable performance.

GENERAL DATA

Electrical:

Heater Characteristics and Ratings:

Voltage (AC or DC)	6.3[a]	6.3±0.6	volts
Current	0.600±0.040	0.600[b]	amp
Warm-up time (Average)	11	-	sec
Peak heater-cathode voltage (Each unit):			
Heater negative with respect to cathode		200 max.	volts
Heater positive with respect to cathode		200[c] max.	volts

Direct Interelectrode Capacitances:[d]

Triode Unit:		
Grid to plate: G_T to P_T	2.2	pf
Input: G_T to (K_T,K_P + $G3_P$ + IS,H)	3.2	pf
Output: P_T to (K_T,K_P + $G3_P$ + IS,H)	1.8	pf
Pentode Unit:		
Grid No.1 to plate: $G1_P$ to P_P	0.060 max.	pf
Input: $G1_P$ to (K_P + $G3_P$ + IS,$G2_P$,H)	10	pf
Output: P_P to (K_P + $G3_P$ + IS,$G2_P$,H)	3.6	pf
Pentode grid No.1 to triode plate: $G1_P$ to P_T	0.008 max.	pf
Pentode plate to triode plate: P_P to P_T	0.15 max.	pf

Characteristics, Class A Amplifier:

	Triode Unit		*Pentode Unit*		
Plate Voltage	200	40	75	100	volts
Grid-No.2 Voltage	-	-	150	150	volts
Grid-No.1 Voltage	-2	+3	0	-2.5	volts
Amplification Factor	70	40	-	-	
Plate Resistance (Approx.)	17500	10000	-	200000	ohms
Transconductance	4000	4000	-	11000	μmhos
Plate Current	4	11	50[e]	20	ma
Grid-No.2 Current	-	-	12[e]	5	ma
Grid-No.1 Current	0	2.7	0	0	ma
Grid-No.1 Voltage (Approx.) for plate μa = 20	-5	-	-	-8	volts

Mechanical:

Operating Position	Any
Type of Cathodes	Coated Unipotential
Maximum Overall Length	2-5/8"
Maximum Seated Length	2-3/8"
Length, Base Seat to Bulb Top (Excluding tip)	2" ± 3/32"
Diameter	0.750" to 0.875"
Dimensional Outline	JEDEC No.6-3
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)

AMPLIFIER – Class A[f]

Maximum Ratings, *Design-Maximum Values:*

	Triode Unit as Class A_1 or A_2 Amplifier	*Pentode Unit as Class A_1 Amplifier*	
Plate Voltage	330 max.	330 max.	volts
Grid-No.2 (Screen-Grid) Supply Voltage	-	330 max.	volts
Grid-No.2 Voltage	-	See *GRID-No.2-INPUT RATING CHART*	

	Triode Unit as Class A_1 or A_2 Amplifier	*Pentode Unit as Class A_1 Amplifier*	
Grid-No.1 (Control-Grid) Voltage:			
Negative-bias value	55 max.	55 max.	volts
Positive-bias value	4 max.	0 max.	volts
Grid-No.1 Current .	8 max.	0 max.	ma
Grid-No.2 Input:			
For grid-No.2 voltages up to 165 volts. . .	-	1.1 max.	watts
For grid-No.2 voltages between 165 and 330 volts. . .	-	See *GRID-No.2-INPUT RATING CHART*	
Plate Dissipation .	1.1 max.	3.75 max.	watts

Maximum Circuit Values:

	Triode Unit	*Pentode Unit*
Grid-No.1-Circuit Resistance:		
For fixed-bias operation . .	0.5 max.	0.25 max. megohm
For cathode-bias operation .	1 max.	1 max. megohm

[a] At heater amperes = 0.600.

[b] At heater volts = 6.3.

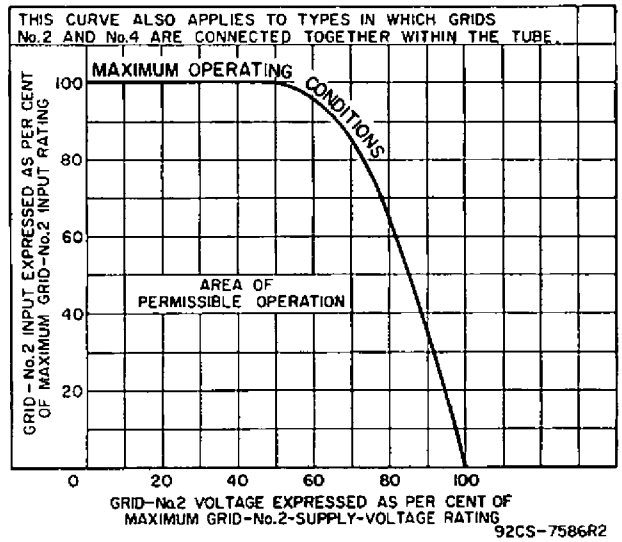
[c] The dc component must not exceed 100 volts.

[d] Without external shield.

[e] This value can be measured by a method involving a recurrent wave form such that the maximum ratings of the tube will not be exceeded.

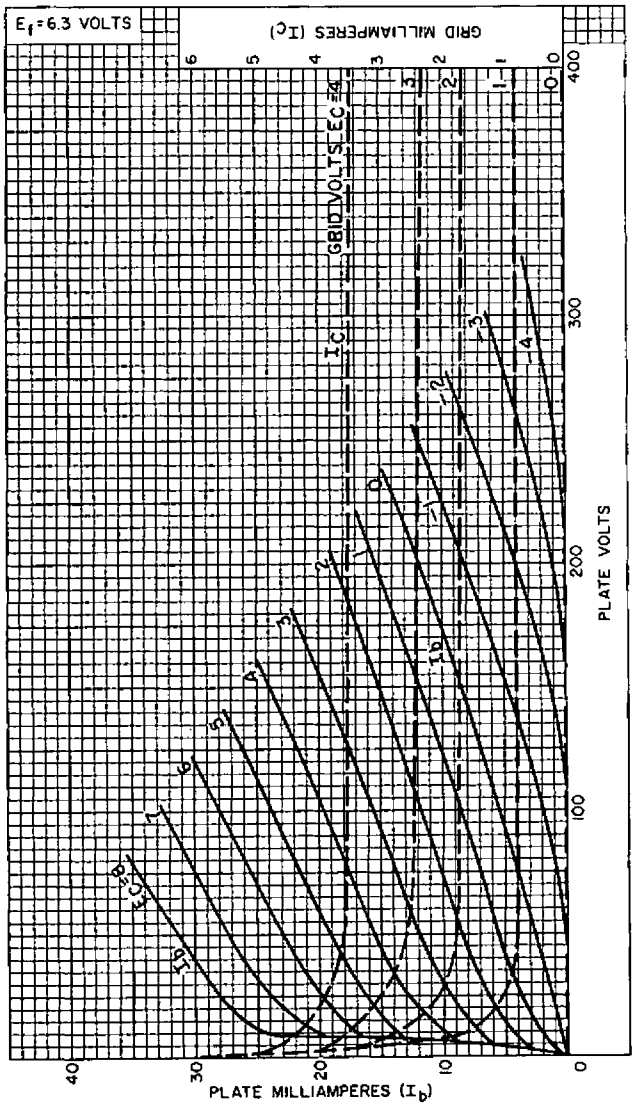
[f] A *Class A Amplifier* is an amplifier in which the grid bias and varying grid voltages are such that plate current flows at all times. The subscript *1* added to the class letter denotes that *grid current* does not flow during any part of the input cycle. The subscript 2 denotes that *grid current* flows during some part of the cycle.

GRID-No.2-INPUT RATING CHART

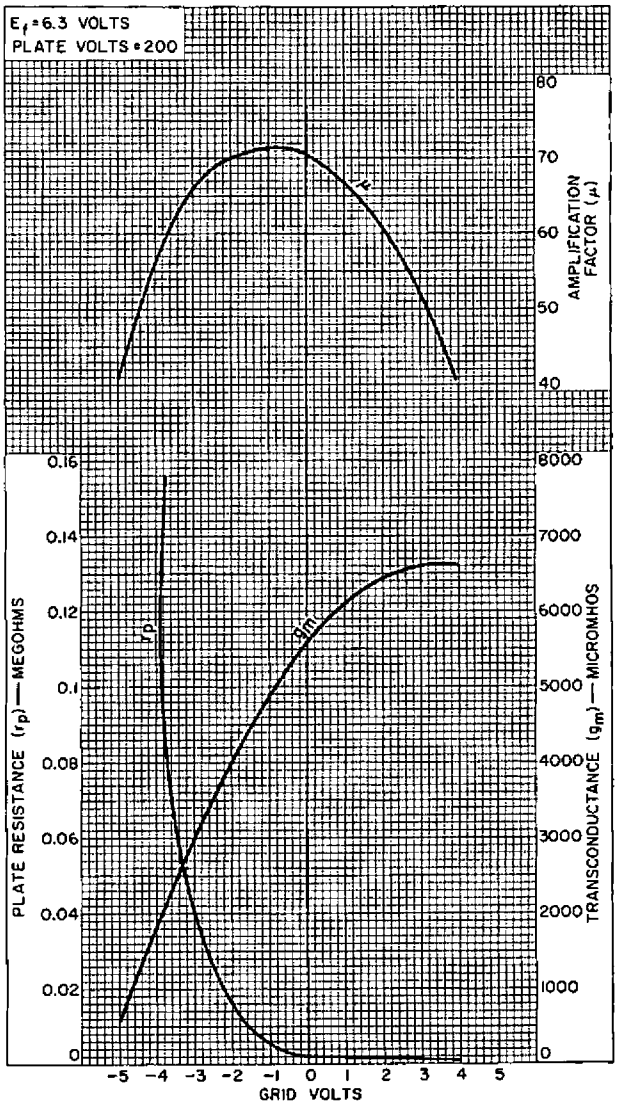


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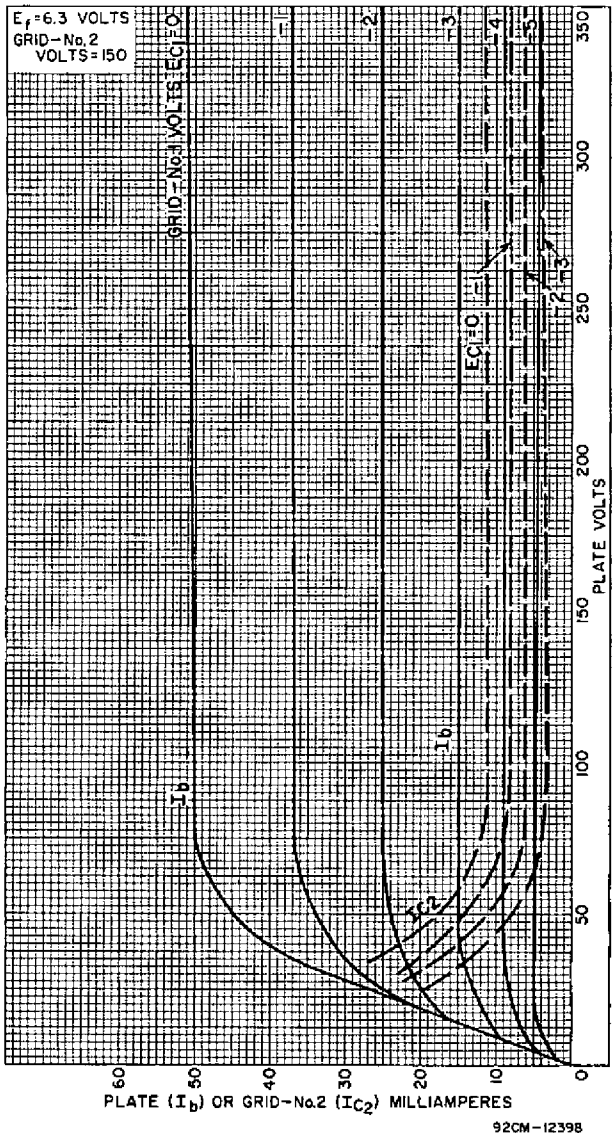
AVERAGE CHARACTERISTICS
Triode Unit



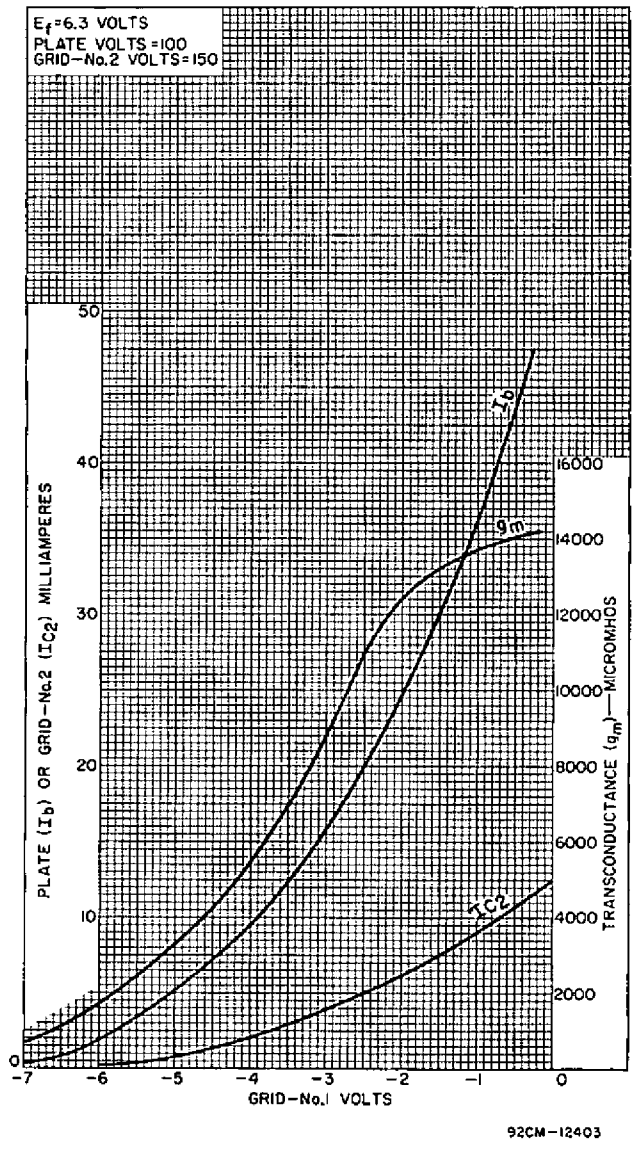
AVERAGE CHARACTERISTICS
Triode Unit



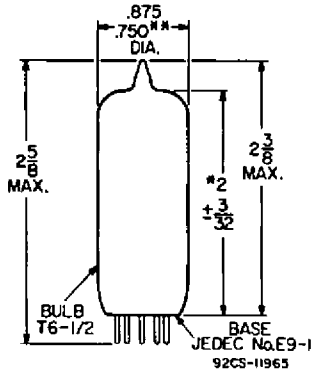
AVERAGE CHARACTERISTICS
Pentode Unit



AVERAGE CHARACTERISTICS
Pentode Unit



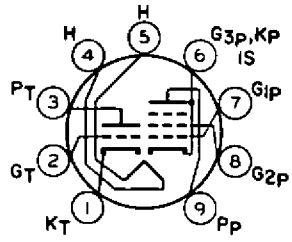
DIMENSIONAL OUTLINE JEDEC No. 6-3
Dimensions in Inches



* Measured from base seat to bulb-top line as determined by ring gauge of 7/16" inside diameter.

** Applies in zone starting 0.375" from base seat.

TERMINAL DIAGRAM
Bottom View



JEDEC 9DX

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, Internal Shield
Pin 7 - Pentode Grid No.1
Pin 8 - Pentode Grid No.2
Pin 9 - Pentode Plate

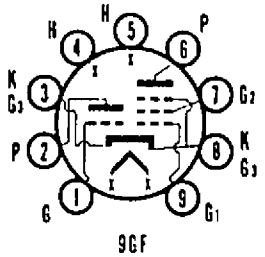
RECEIVING TUBES

SYLVANIA

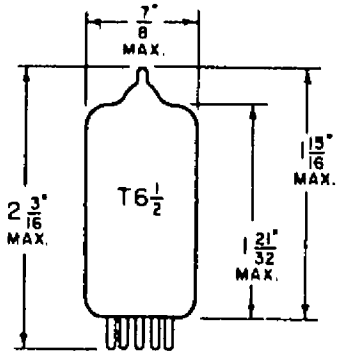
VHF OSCILLATOR AND MIXER

6LJ8, 5LJ8, 4LJ8

- COLOR TV TYPE
- MEDIUM MU TRIODE
- SHARP CUTOFF PENTODE
- MULTI-SECTION
- LOW B+ OPERATION
- FRAME GRID PENTODE
- T-6½ ENVELOPE
- 9 PIN BASE



9GF



DESCRIPTION

Sylvania Types 6LJ8, 5LJ8 and 4LJ8 have a medium mu triode and sharp cutoff pentode contained in a T-6½ envelope. They are designed for service as VHF oscillators and mixers.

Types 5LJ8 and 4LJ8 have controlled heater warm-up time for series connected circuits.

MECHANICAL DATA

Envelope	T-6½
Base	E9-1
Outline Drawing	6-2
Max. Diameter	0.875"
Max. Seated Height	1.938"
Max. Overall Length	2.188"
Cathode	Coated Unipotential
Operating Position	Any
Basing Diagram	9GF

Pin No. 1 - Triode Grid	Pin No. 6 - Pentode Plate
Pin No. 2 Triode Plate	Pin No. 7 - Pentode Grid No. 2
Pin No. 3 - Cathode & Grid No. 3	Pin No. 8 - Cathode & Grid No. 3
Pin No. 4 - Heater	Pin No. 9 - Pentode Grid No. 1
Pin No. 5 - Heater	

ELECTRICAL DATA

HEATER CHARACTERISTICS AND RATINGS (Design Maximum Rating System)(1)

	4LJ8	5LJ8	6LJ8	
Heater Operation	Series(2)	Series(2)	Parallel(3)	
Heater Voltage	4.3	5.6	6.3 ± 0.6(4)	Volts
Heater Current	.600 ± .040(4)	.450 ± .030(4)	.400(5)	Amperes
Heater Warm-up Time(6)	11	11	-	Seconds

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

Triode Section

Grid to Plate	1.4	pf
Input: gl to (k+Pg3+IS+h)	2.4	pf
Output: p to (k+Pg3+IS+h)	2.0	pf

Pentode Section

Grid No. 1 to Plate	0.015	pf Max.
Input: gl to (k+g3+IS+g2+h)	5.5	pf
Output: p to (k+g3+IS+g2+h)	3.4	pf

RATINGS (Design Maximum Rating System)(1)

	Triode Section	Pentode Section	
Plate Voltage	280	280	Volts Max.
Grid No. 2 Supply Voltage	-	280	Volts Max.
Grid No.2 Voltage	See Rating Chart		
Cathode Current	20	20	Ma Max.
Plate Dissipation	2.0	2.0	Watts Max.
Grid No.2 Dissipation	-	0.5	Watt Max.
Positive Grid No. 1 Voltage	0	0	Volt Max.
Maximum Grid No. 1 Circuit Resistance			
Self Bias	0.5	0.25	Megohm
Fixed Bias	1.0	0.5	Megohm

Control grid to cathode spacing of the pentode section of this type 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.

CHARACTERISTICS AND TYPICAL OPERATION

Class Al Amplifier (7)

	Triode Section	Pentode Section	
Plate Voltage	125	125	Volts
Grid No. 2 Voltage	-	125	Volts
Grid No. 1 Voltage	0	0	Volt
Cathode Bias Resistor	68	33	Ohms
Plate Current	13	12	Ma
Grid No. 2 Current	-	3.5	Ma
Transconductance	8000	13,000	µmhos
Amplification Factor	40	-	
Plate Resistance (Approx.)	5000	125,000	Ohms
Ec1 for Ib = 30 µa (Approx.)	-6.5	-4	Volts

NOTES:

(1) Design Maximum Ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by the published 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.

(2) Operated with the heater in series with the heaters of other tubes having the same bogey current.

(3) Operated with the heater in parallel with the heaters of other tubes having the same bogey heater voltage.

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

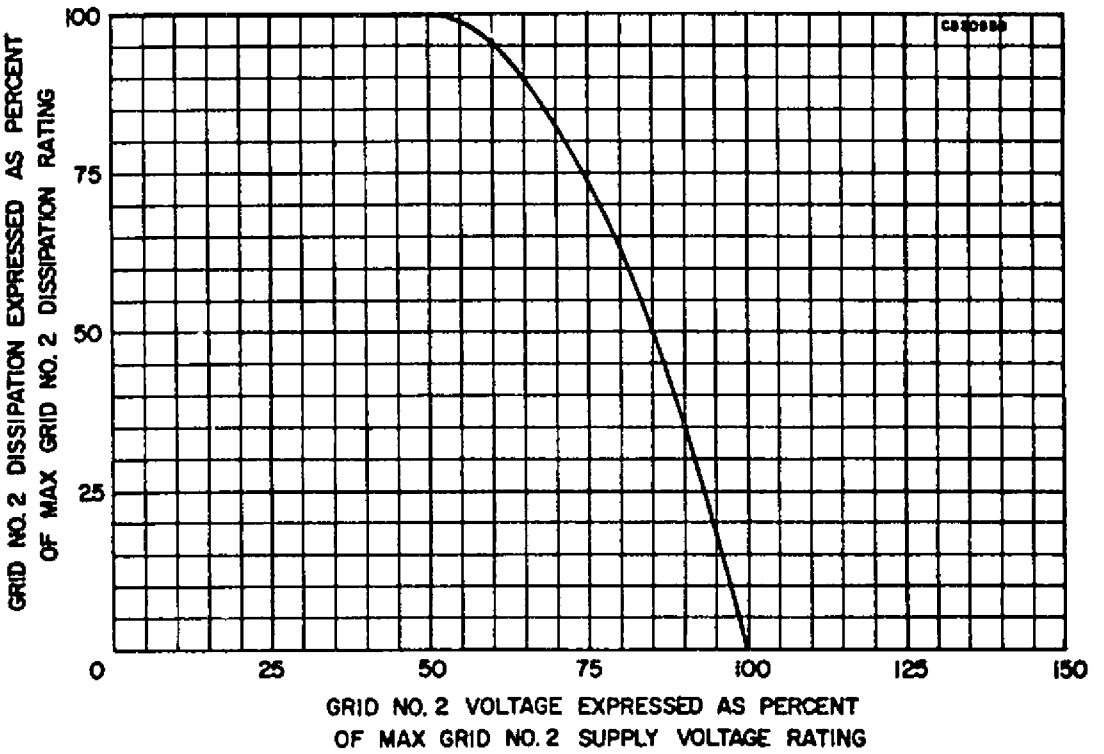
(5) Heater current of a bogey tube at Ef = 6.3 volts.

NOTES: (Cont'd)

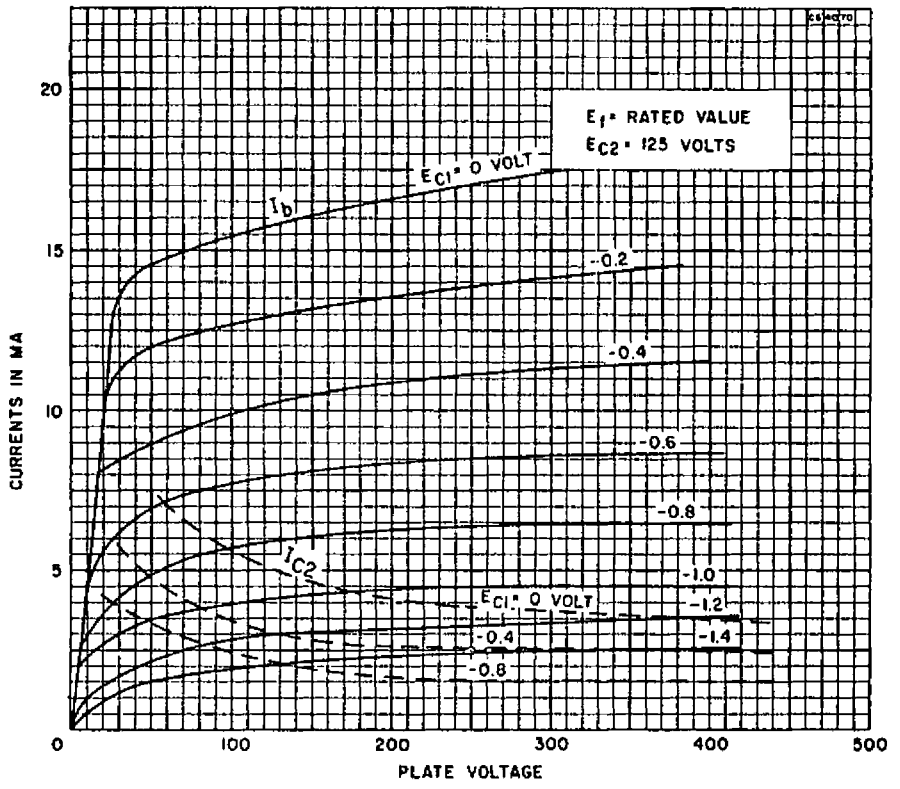
(6) Heater warm-up time is defined as the time required for the voltage across the heater to reach 80% of the rated heater voltage after applying four (4) times rated heater voltage to a circuit consisting of the heater in series with a resistance equal to three (3) times the rated heater voltage divided by the bogey heater current.

(7) "Each tube section measured separately and with cathode bias resistor indicated. Section not under test is floating."

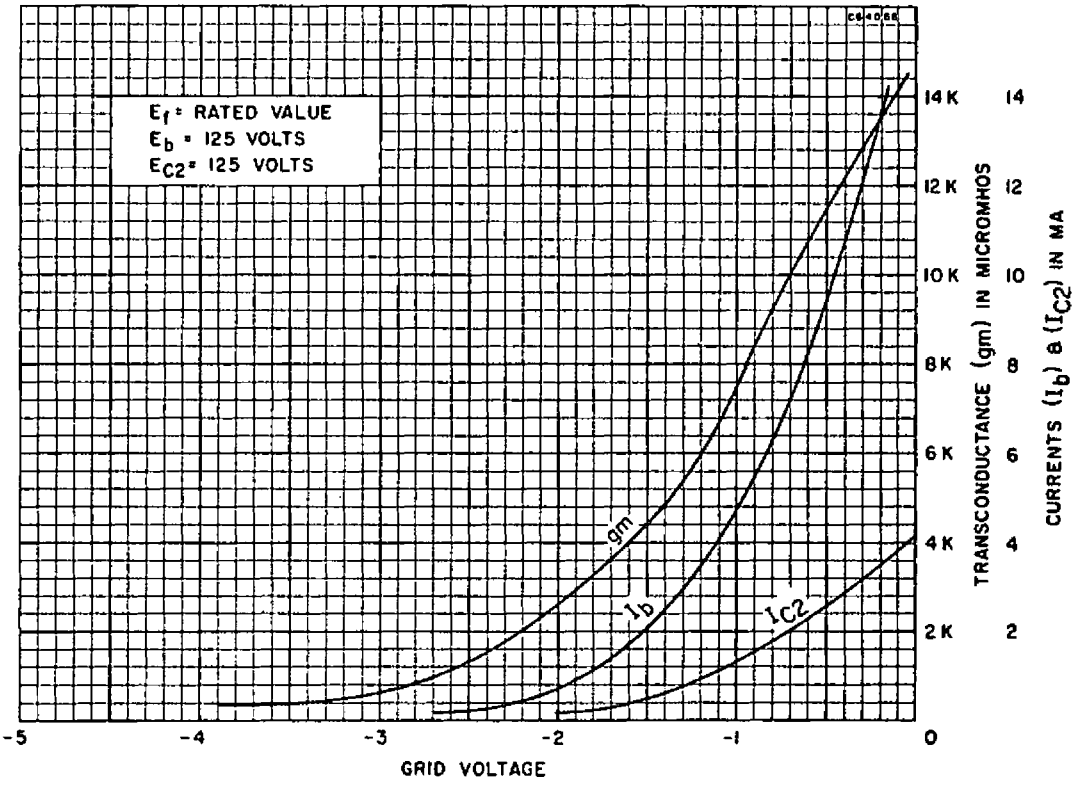
RATING CHART



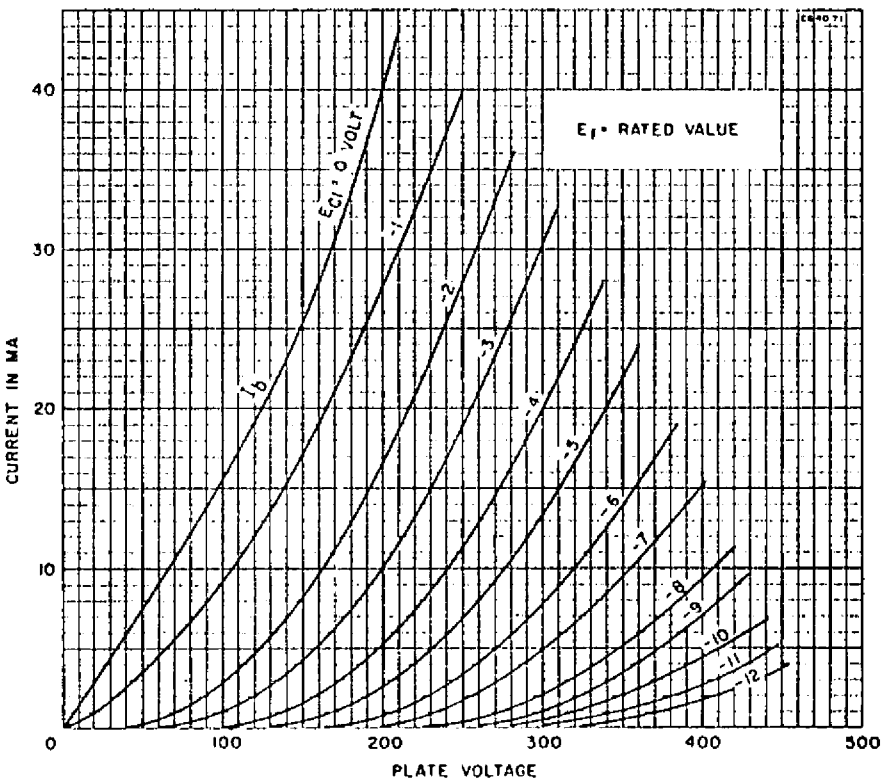
AVERAGE PLATE CHARACTERISTICS
(Pentode Section)



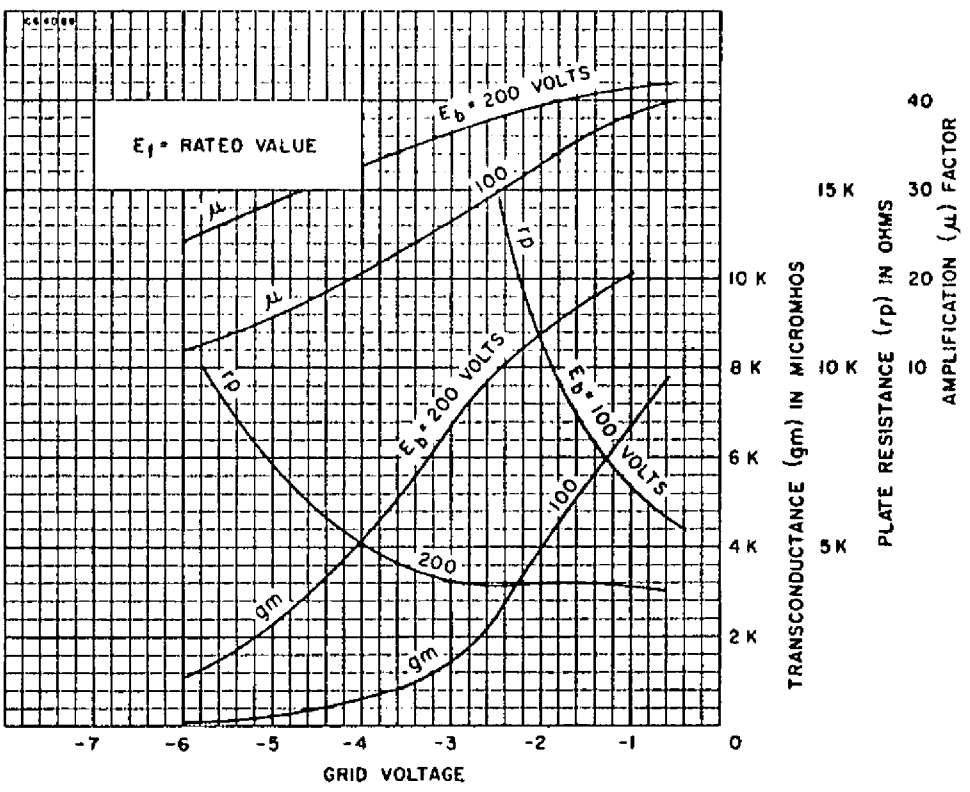
AVERAGE TRANSFER CHARACTERISTICS
(Pentode Section)



AVERAGE PLATE CHARACTERISTICS
(Triode Section)



AVERAGE TRANSFER CHARACTERISTICS
(Triode Section)



from JEDEC release #4711, May 25, 1964

RCA-6LM8

MEDIUM-MU TRIODE—SEMIREMOTE-CUTOFF PENTODE

Triode μ = 46
RCA Dark Heater

9-PIN MINIATURE TYPE

E_{c1} Volts for 10 μa I_b = 14

RCA-6LM8 is a multiunit tube of the nine-pin miniature type containing a medium-mu triode and a semiremote-cutoff pentode in one envelope. This tube is useful in a wide variety of circuit applications in color and black-and-white TV receivers.

The pentode unit features a high value of plate current and is particularly suited for use in the burst-amplifier circuit of color-TV receivers. The triode unit may be used as a general-purpose amplifier tube.

The 6LM8 has an internal shield to reduce interaction between units, and separate base-pin connections for the cathodes of the triode and pentode units. This basing arrangement permits use of this type in a variety of circuit configurations. In addition, the 6LM8 utilizes the RCA Dark Heater for long life and dependable performance.

GENERAL DATA

Electrical:

Heater Characteristics and Ratings:			
Voltage (AC or DC)	6.3 ± 0.6		volts
Current at 6.3 volts	0.450		amp
Peak heater-cathode voltage (Each unit):			
Heater negative with respect to cathode	200	max.	volts
Heater positive with respect to cathode	200[a]	max.	volts
Direct Interelectrode Capacitances (With external shield JEDEC No.315):[b]			
Triode Unit:			
Grid to Plate	1.8		pf
Input: G_T to (K_T,Kp+G3p+IS,H)	3.2		pf
Output: P_T to (K_T,Kp+G3p+IS,H)	1.9		pf
Pentode Unit:			
Grid to Plate	0.015	max.	pf
Input: Glp to (Kp+G3p+IS,G2p,H)	5.5		pf
Output: Pp to (Kp+G3p+IS,G2p,H)	3.8		pf
Heater to Cathode (Each unit)	3.2		pf

Characteristics, Class A_1 Amplifier:

	Triode Unit	*Pentode Unit*	
Plate Voltage	125	125	volts
Grid-No.2 Voltage	-	125	volts
Grid-No.1 Voltage	-1	-2	volts
Amplification Factor	46	-	
Plate Resistance (Approx.)	5400	150,000	ohms
Transconductance	8500	6000	μmhos
Plate Current	13.5	12	ma
Grid-No.2 Current	-	4	ma
Grid-No.1 Voltage (Approx.) for plate μa = 10	-8	-14	volts

Mechanical:

Operating Position	Any
Type of Cathode	Coated Unipotential
Maximum Overall Length	2-3/16"
Maximum Seated Length	1-15/16"
Length from Base Seat to Bulb Top (Excluding tip)	1-9/16" ± 3/32"
Diameter	0.750" to 0.875"
Dimensional Outline	JEDEC No.6-2
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)
Basing Designation	9AE

AMPLIFIER – Class A_1

Maximum Ratings, *Design-Maximum Values:*

	Triode Unit	*Pentode Unit*	
Plate Voltage	330 max.	350 max.	volts
Grid-No.2 (Screen-Grid) Supply Voltage	-	330 max.	volts
Grid-No.2 Voltage	-	See GRID-No.2 INPUT RATING CHART	
Grid-No.1 (Control-Grid) Voltages:			
Positive-bias value	0 max.	0 max.	volts
Grid-No.2 Input:			
For grid-No.2 voltages up to 165 volts	-	0.55 max.	watt
For grid-No.2 voltages between 165 and 330 volts	-	See GRID-No.2 INPUT RATING CHART	
Plate Dissipation	2.5 max.	2.5 max.	watts

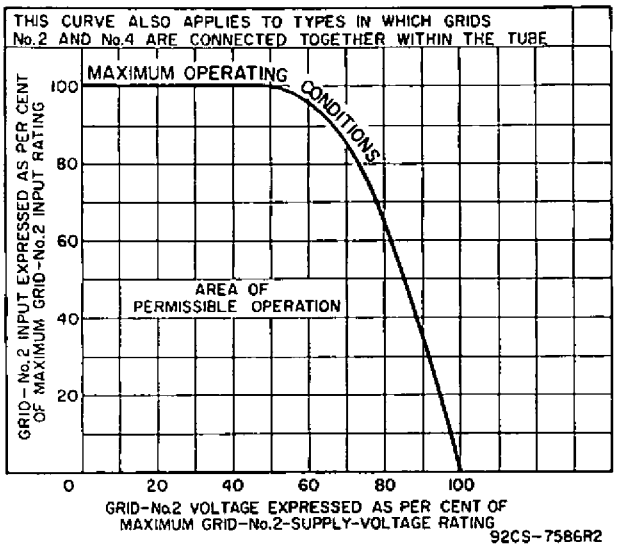
Maximum Circuit Values:

Grid-No.1-Circuit Resistance:			
For fixed-bias operation	0.5 max.	0.25 max.	megohm
For cathode-bias operation	1.0 max.	0.5 max.	megohm

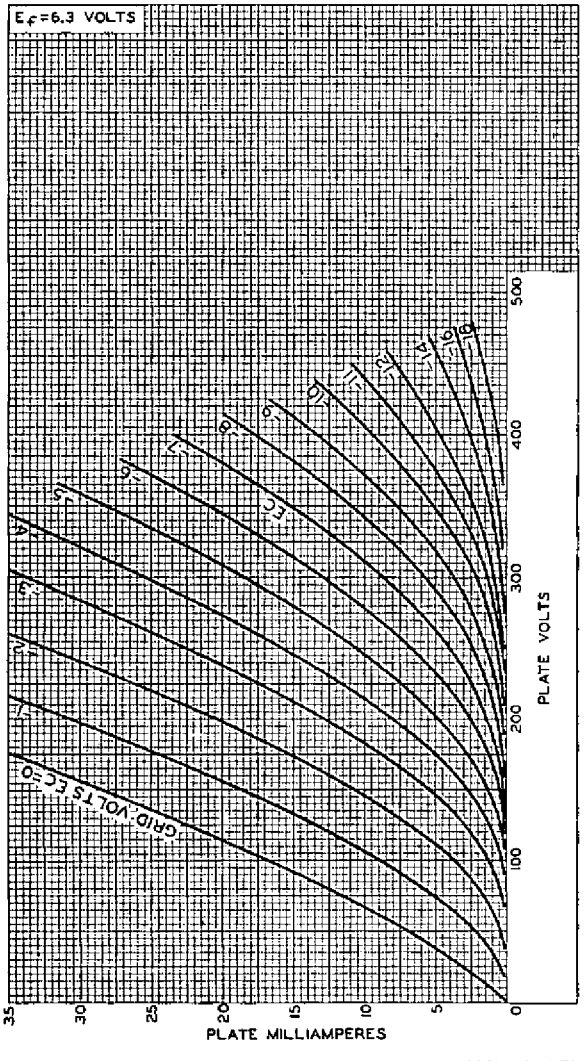
[a] The dc component must not exceed 100 volts.

[b] Measured in accordance with EIA Standard RS-191-A.

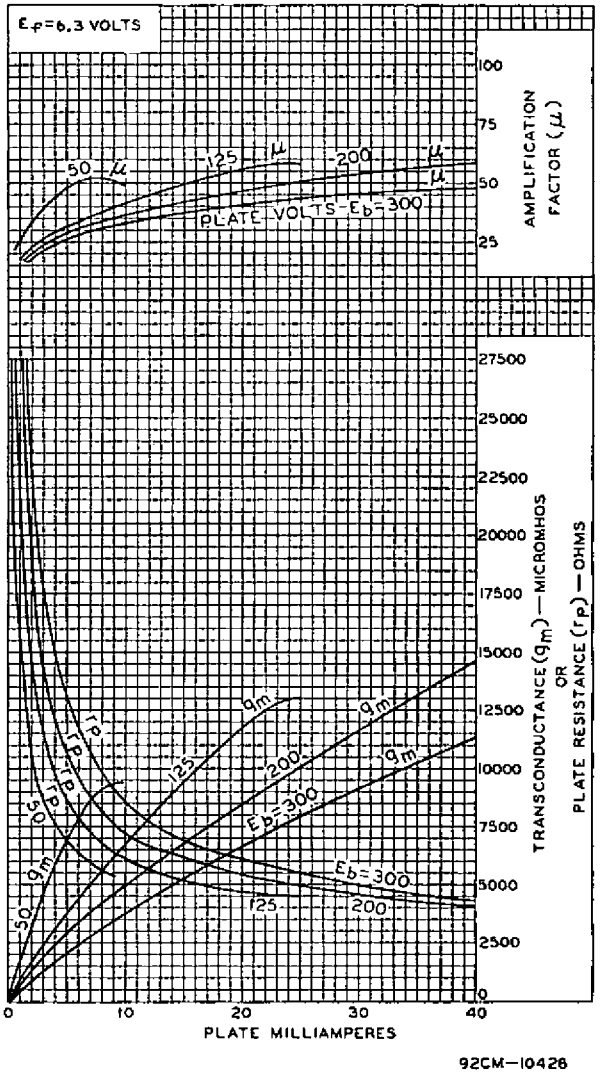
GRID-No.2 INPUT RATING CHART



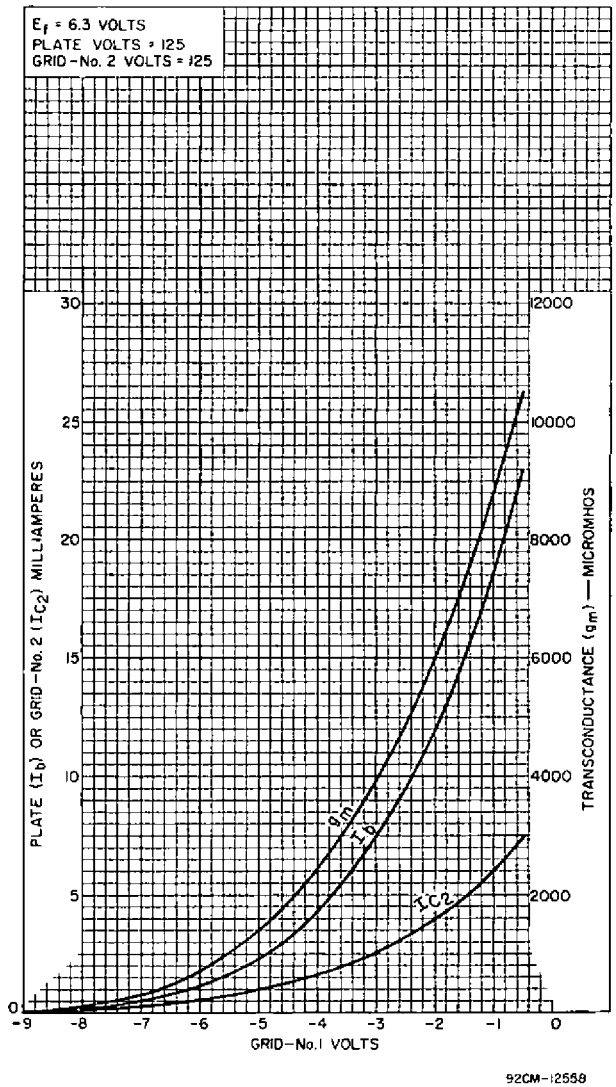
AVERAGE PLATE CHARACTERISTICS TRIODE UNIT

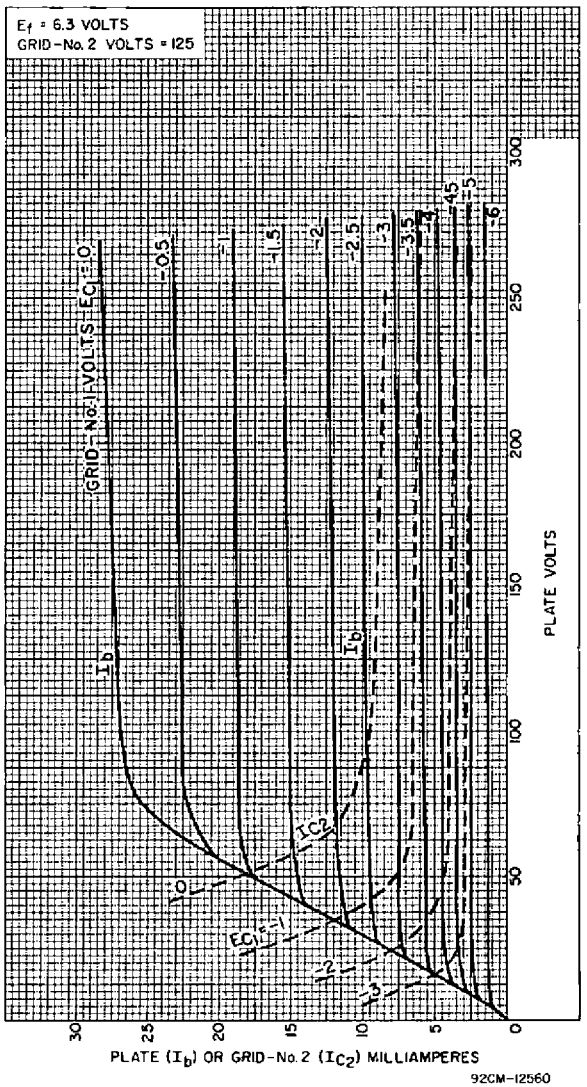


AVERAGE CHARACTERISTICS TRIODE UNIT



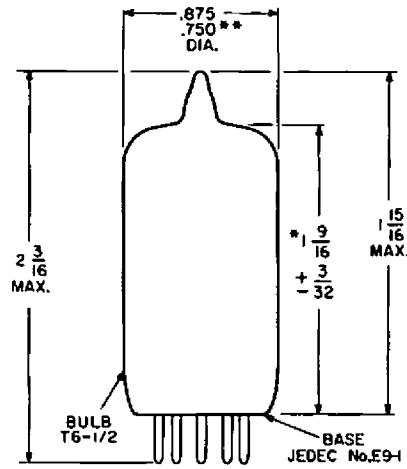
AVERAGE CHARACTERISTICS
PENTODE UNIT





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DIMENSIONAL OUTLINE



Dimensions In Inches

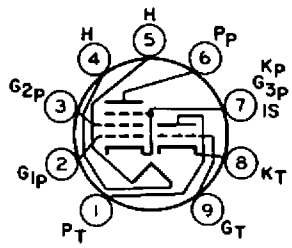
* MEASURED FROM BASE SEAT TO BULB-TOP LINE AS DETERMINED BY RING GAUGE OF 7/16" I.D.

** APPLIES IN ZONE STARTING 0.375" FROM BASE SEAT.

TERMINAL DIAGRAM

Bottom View

Pin 1 – Triode Plate
Pin 2 – Pentode Grid No.1
Pin 3 – Pentode Grid No.2
Pin 4 – Heater
Pin 5 – Heater



Pin 6 – Pentode Plate
Pin 7 – Pentode Cathode, Pentode Grid No.3, and Internal Shield
Pin 8 – Triode Cathode
Pin 9 – Triode Grid

9AE

AMPEREX TUBE TYPE 6LN8

The Amperex 6LN8 has the same electrical characteristics as the Amperex 6BL8 except that it is designed for 450 ma controlled warm-up series string operation.

The heater characteristics are:

Heater Voltage	6.0 volts
Heater Current	450 ma

from JEDEC release #4870, Dec. 7, 1964

from JEDEC release #4759E,
Feb. 14, 1966

6LQ8, 11LQ8

MEDIUM-MU TRIODE–SHARP-CUTOFF PENTODES

9-Pin Miniature Types

For Use in Low-B+ Black-and-White TV Receivers Having Low-Voltage Power Supplies

Triode μ = 46
Pentode gm = 21000 μmho

High Operating Efficiency
RCA Dark Heater

RCA-6LQ8* and 11LQ8 are multiunit tubes of the 9-pin miniature type, each containing a medium-mu triode and a sharp-cutoff pentode in one envelope. These types are especially useful in black-and-white television receivers operating at low-B+ voltages.

The triode unit of the 6LQ8 and 11LQ8 can be used in sync-separator and sound-if circuits and in general-purpose voltage-amplifier applications. The pentode unit is especially suited for use as a video output tube. The use of frame-grid construction in the pentode unit results in an exceptionally high value of transconductance. The pentode unit also has a plate current characteristic with controlled knee to provide good linearity at relatively low plate voltage. High operating efficiency is achieved in these tubes through advanced design of the tube electrode geometry.

Each unit of the 6LQ8 and 11LQ8 has its own cathode with an individual base-pin terminal, to provide flexibility of circuit connections. The heater of the 11LQ8 has controlled warm-up time for use in series-heater-string arrangements.

* Formerly Developmental Type A55244.

ELECTRICAL CHARACTERISTICS—Bogey Values[a]

		6LQ8	*11LQ8*	
Heater Voltage, ac or dc	E_h	6.3	10.9	V
Heater Current	I_h	775	450	mA
Heater Warm-up Time	t_h	-	11	s
Direct Interelectrode Capacitances:[b]				
Triode Unit:				
Grid to plate	c_{g-p}	2.8		pF
Input: GT to (KT, KP + G3P + IS, H)	c_i	4.2		pF
Output: PT to (KT, KP + G3P + IS, H)	c_o	2.4		pF
Pentode Unit:				
Grid No.1 to plate	c_{g1-p}	0.12 max.		pF
Input: G1P to (KP + G3P + IS, G2P, H)	c_i	14		pF
Output: PP to (KP + G3P + IS, G2P, H)	c_o	4.8		pF
Triode grid to pentode plate	-	0.015 max.		pF
Pentode plate to triode plate	-	0.17 max.		pF

For the following characteristics, see Conditions below:

		Triode Unit	*Pentode Unit*		
Amplification Factor	μ	46	-	-	
Plate Resistance (Approx.)	r_p	4400	55000	75000	Ω
Transconductance	g_m	10400	21000	23000	μmho
DC Plate Current	I_b	15	16.5	20	mA
DC Grid-No.2 Current	I_{c2}	-	3.1	3.5	mA
Cutoff DC Grid-No.1 Voltage for I_b = 100 μA	$E_{c1(co)}$	-6	-4.2	-4.2	V
Conditions:					
Heater Voltage	E_h	Bogey value			V
DC Plate Supply Voltage	E_{bb}	125	125	200	V
DC Grid-No.2 Supply Voltage	E_{cc2}	-	125	125	V
Grid No.1	-	Connected to negative end of R_k			
Cathode Resistor	R_k	68	82	68	Ω

MECHANICAL CHARACTERISTICS

Maximum Overall Length . . . . . 2.625 in
Maximum Seated Length . . . . . 2.375 in
Maximum Diameter . . . See *Dimensional Outline* . . . 0.875 in
Envelope . . . . . JEDEC Designation T6-1/2
Base . . Small-Button Noval 9-Pin (JEDEC Designation E9-1)
Dimensional Outline . . . . . JEDEC Designation 6-3
Terminal Diagram . . . . . JEDEC Designation 9DX
Type of Cathodes . . . . . Coated Unipotential
Operating Position . . . . . Any

MAXIMUM RATINGS—Design-Maximum Values[c]

For operation as a Class A1 Amplifier Tube

		Triode Unit	*Pentode Unit*	
DC Plate Voltage	E_b	300	300	V
DC Grid-No.2 (Screen-Grid) Supply Voltage	E_{cc2}	-	300	V
DC Grid-No.2 Voltage	E_{c2}	-	See GRID-No.2-INPUT RATING CHART	
DC Grid-No.1 (Control-Grid) Voltage:				
Positive-bias value	E_{c1}	0	0	V

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Marca(s) Registrada(s)

Heater-Cathode Voltage:				
Peak	e_{hkm}	±200		V
Average[d]	$E_{hk(av)}$	100		V
Heater Voltage, ac or dc *(6LQ8)*	E_h	5.7 to 6.9		V
Heater Current *(11LQ8)*	I_h	420 to 480		mA
Grid-No.2 Input:	P_{g2}			
For $E_{c2} \leq$ 150 V	-	-	1	W
For $E_{c2} >$ 150 V and $\leq$ 300 V	-	-	See GRID-No.2-INPUT RATING CHART	
Plate Dissipation	P_b	2	5	W

MAXIMUM CIRCUIT VALUES

		Triode Unit	*Pentode Unit*	
Grid-No.1 Circuit Resistance:	$R_{g1(ckt)}$			
For fixed-bias operation	-	0.5	0.1	MΩ
For cathode-bias operation	-	1	0.25	MΩ

[a] Unless otherwise specified.

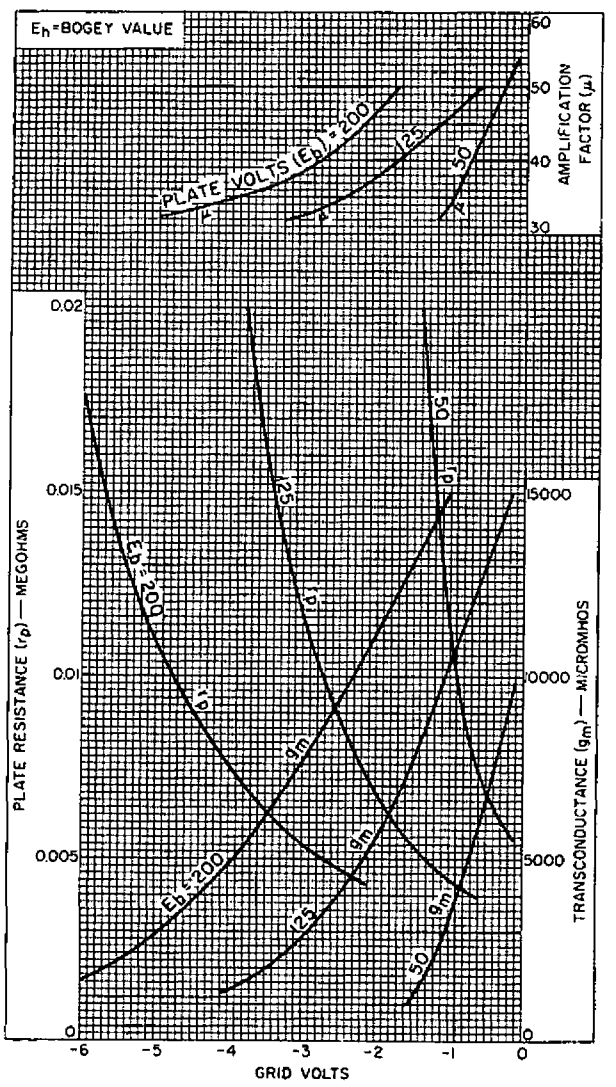
[b] Measured without external shield in accordance with the current issue of EIA Standard RS-191.

[c] As defined in the current issue of EIA Standard RS-239.

[d] Measured with a dc meter.

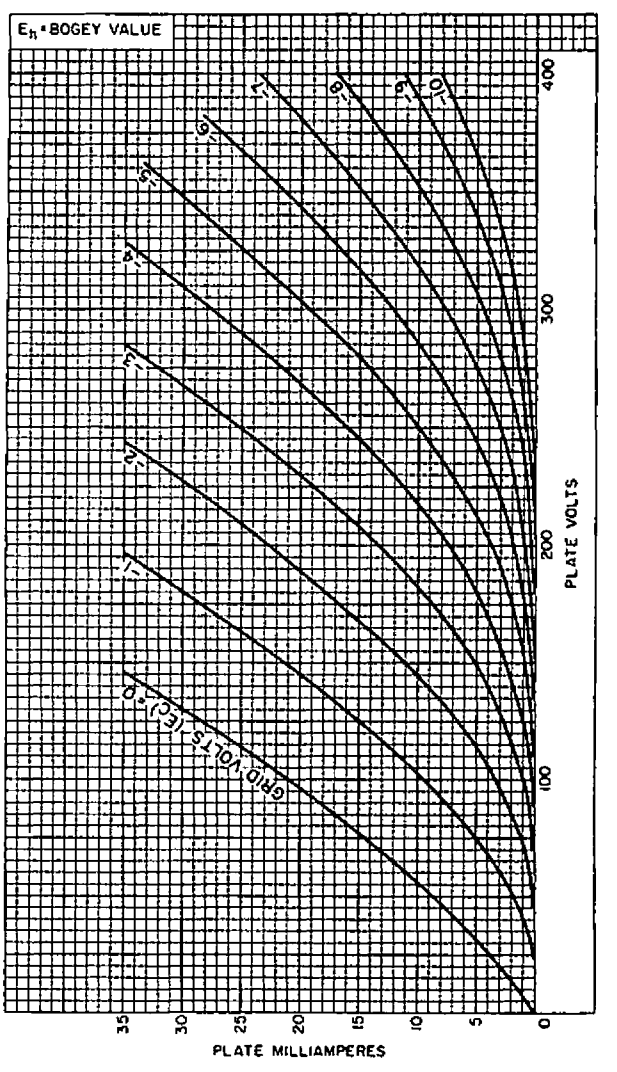
TYPICAL CHARACTERISTICS

Triode Unit



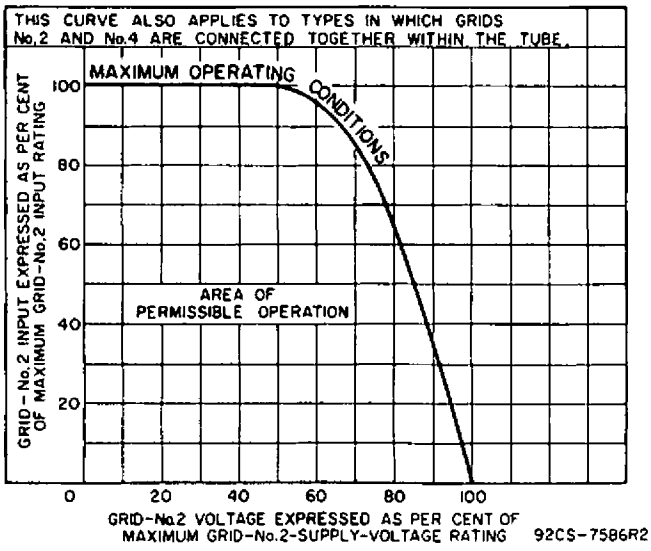
TYPICAL PLATE CHARACTERISTICS

Triode Unit



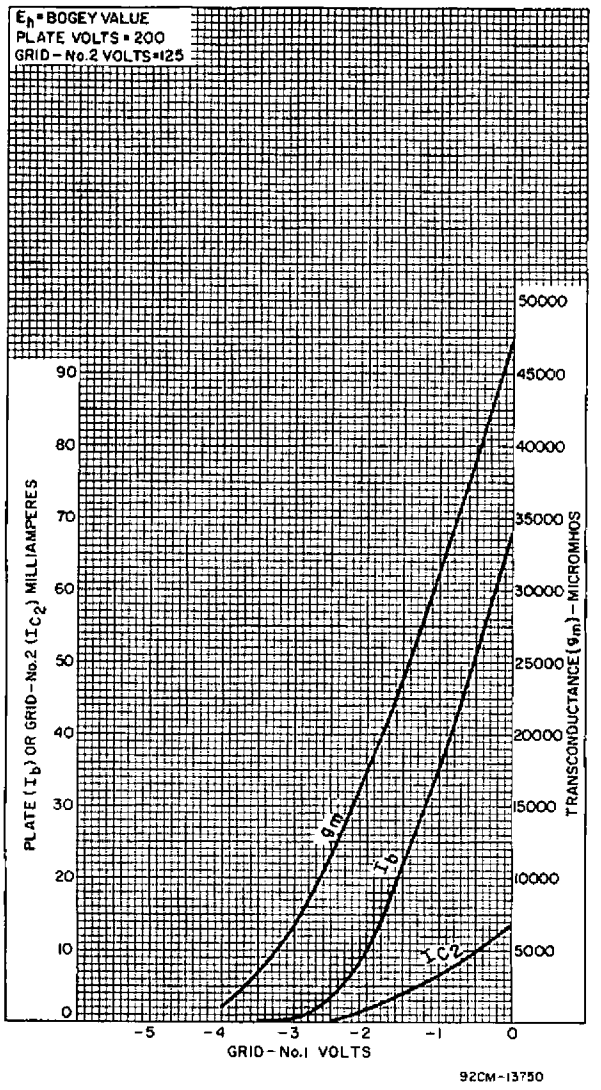
GRID-No.2-INPUT RATING CHART

Pentode Unit



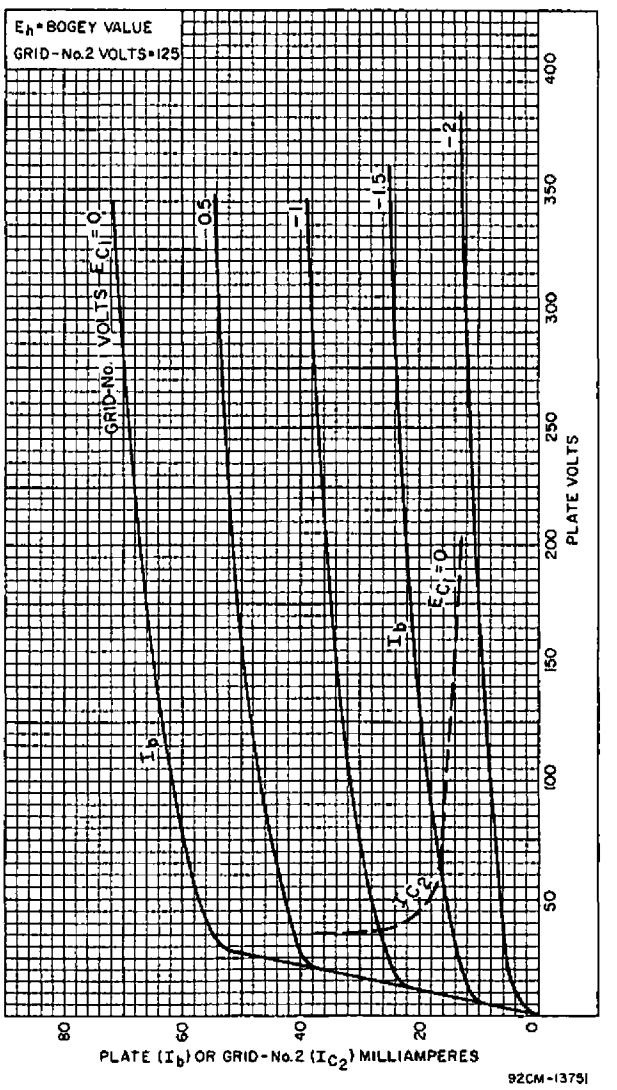
TYPICAL CHARACTERISTICS

Pentode Unit

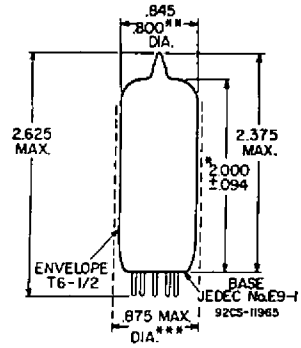


TYPICAL PLATE CHARACTERISTICS

Pentode Unit



DIMENSIONAL OUTLINE JEDEC 6-3



Dimensions in Inches

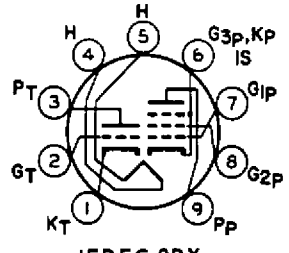
* Measured from base seat to bulb-top line as determined by ring gauge of 0.437" inside diameter.

** Major diameter as checked by ring gauges of 0.25" thickness. The maximum gauge should clear the bulb above 0.38" from the base seat and the minimum gauge should not.

*** The diameter of the boundary cylinder as defined by the barriers of the pin alignment gauge (Gauge No.GE9-1, Sheet 30, Section 3 of EIA Standard RS-209A).

TERMINAL DIAGRAM

Bottom View



JEDEC 9DX

Pin 1 - Triode Cathode
Pin 2 - Triode Grid
Pin 3 - Triode Plate
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode Grid No.3, Pentode Cathode, Internal Shield
Pin 7 - Pentode Grid No.1
Pin 8 - Pentode Grid No.2
Pin 9 - Pentode Plate

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AMPEREX TUBE TYPE 6LX8

The Amperex 6LX8 has the same electrical characteristics as the Amperex 6JW8 except that it is designed for 450 ma controlled warm-up series string operation.

The heater characteristics are:

Heater Voltage	6.0 volts
Heater Current	450 ma

from JEDEC release #4870, Dec. 7, 1964

Television Picture Tube

PHILCO - LANSDALE DIVISION

CATHODE RAY TUBE

DATA SHEET

Tentative

Description

The 19DUP4 is a 19" - 114° direct view rectangular glass picture tube having an aluminized screen, spherical faceplate, non ion trap gun, internal shielding and is designed to operate with electrostatic focus and magnetic deflection.

It is a "HiGm" tube designed to operate in cathode drive service under low G2 voltage conditions. The tube base is short and provides straight through leads oriented by an indexing lug. The tube has banded implosion protection.

Electrical Data

Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angle, approximate	
Horizontal	102 Degrees
Vertical	85 Degrees
Diagonal	114 Degrees
Direct Interelectrode Capacitance, approximate	
Cathode to All	4.0uuf
Grid #1 to All	5.0uuf
External Coating Capacitance	1150 Min. uuf
	1550 Max. uuf
Heater Voltage	6.3 Volts
Heater Current at 6.3 Volts	0.45±5% Amperes
Heater Warm-up Time (Note 1)	11 Seconds

Optical Data

Phosphor Number	Aluminized P4
Fluorescent Color	White
Persistence	Medium Short
Faceplate	
Light Transmission at Center, approximate	48.5 Percent

Mechanical Data

Overall Length	11 3/4+7/32-3/16 Inches
Neck Length	4 1/2+3/23-1/16 Inches
Greatest Dimensions of tube	
Diagonal	18.868 Inches
Width	16.644 Inches
Height	13.924 Inches
Minimum Useful Screen Dimensions (maximum assured dimensions)	172 Sq. Inches
Diagonal	17 9/16 Inches
Width	15 1/8 Inches
Height	12 Inches
Bulb	J149F1
Base	B7-208
Basing	8HR
Anode Contact	J1-21
Anode Contact Aligns with Pin #8	±30°

CATHODE DRIVE SERVICE

Voltages are positive with respect to Grid #1 unless indicated otherwise.

Maximum Ratings (Design Maximum Values)

Anode Voltage (Note 2)	22,000 Volts DC
Grid #4 Voltage	-550 Min. to +1100 Max. Volts DC
Grid #2 Voltage	80 Volts DC
Cathode Voltage	
Positive-Bias Value	154 Max. Volts DC
Positive-Peak Value	220 Max. Volts
Negative-Bias Value	0 Max. Volts DC
Negative-Peak Value	2 Max. Volts
Peak-Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
During Warm-up Period not to exceed 15 seconds	450 Max. Volts
After Equipment Warm-up Period	200 Max. Volts
Heater Positive with Respect to Cathode	200 Max. Volts

Typical Operating Conditions

Anode Voltage	16,000 Volts DC
Grid #4 Voltage for Focus	-200 Volts to +200 Volts DC
Grid #2 Voltage	50 Volts DC
Cathode Voltage (Note 3)	+33 to +45 Volts DC

Maximum Circuit Values

Grid #1 Circuit Resistance	1.5 Max. Megs.

Notes

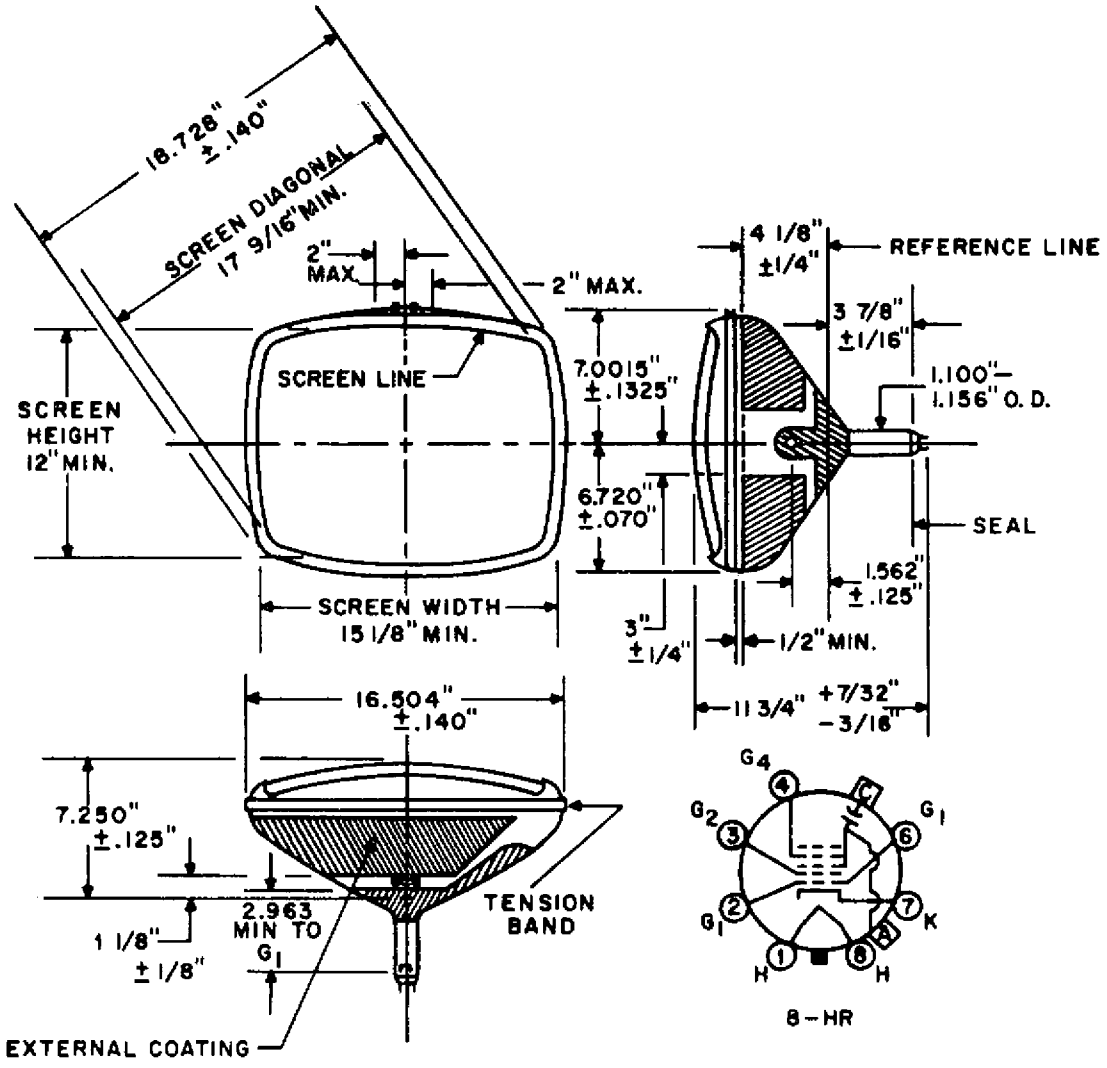
1. Heater warm-up time is defined as the time required for the voltage across the heater to reach 80% of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

2. Anode, Grid #3, and Grid #5 are connected together within the tube and are referred to herein as anode.

3. For visual extinction of the focused raster. For cutoff of undeflected focus spot, the absolute value of the bias between cathode and grid will increase by about 4 volts.

PHILCO CORPORATION - LANSDALE DIVISION

Outline Drawing
19DUP4
Television Picture Tube



MECHANICAL NOTES

1. The reference line is determined by reference line gauge JEDEC #126.
2. The area around the button is covered with an insulating coating.
3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of the base wafer will fall within a circle concentric with bulb axis and having a diameter of 1¾".

WARNING

X-ray radiation shielding may be necessary to protect against possible danger of personal injury from prolonged exposure at close range if this tube is operated at anode voltages higher than 16,000 volts.

The information, diagrams, or any other data included herein are believed to be accurate and reliable. However, the Philco Corporation, Lansdale Division, assumes no responsibility or liability whatsoever for the application, interpretation or use made of such information, diagrams or data especially insofar as the use of said information, diagrams or data affects any patent, trademark or proprietary data rights.

19DVP4
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 19DVP4 is a 19-inch - 114° HW rectangular aluminized picture tube with the anode bulb contact J1-21 located on the long side of the bulb. It features a short neck, 6.3 V, 450 ma heater and 150 volt G-2 for cathode drive design.

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	450 ± 23 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 #4667, April 13, 1964

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	J149A1A
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	20,000 volts
Minimum Anode Voltage	13,000 volts
Maximum Grid 4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid 2 Voltage	100 volts
Maximum Grid 2 Voltage	250 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	16,000 volts DC
Grid #4 Voltage (Focusing Electrode, Note 2)	-250 to +150 volts DC
Grid #2 Voltage	150 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:

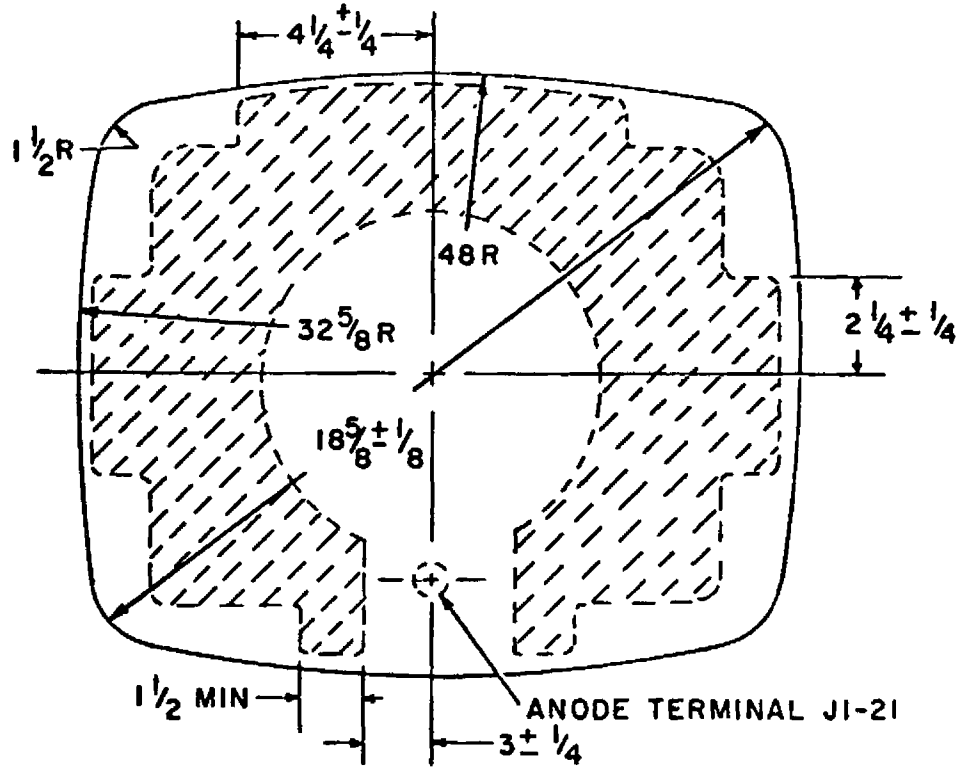
1. Visual extinction of focused raster.

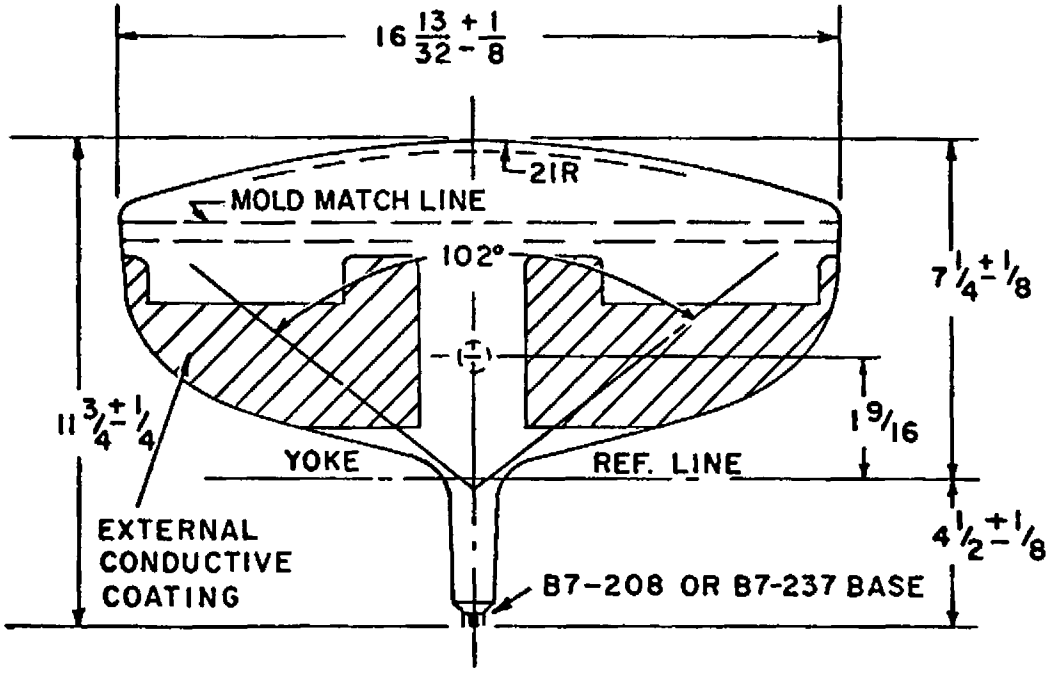
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 microamperes on a 15 1/8 x 11 15/16" pattern from RCA 2F21 monoscope or equivalent.

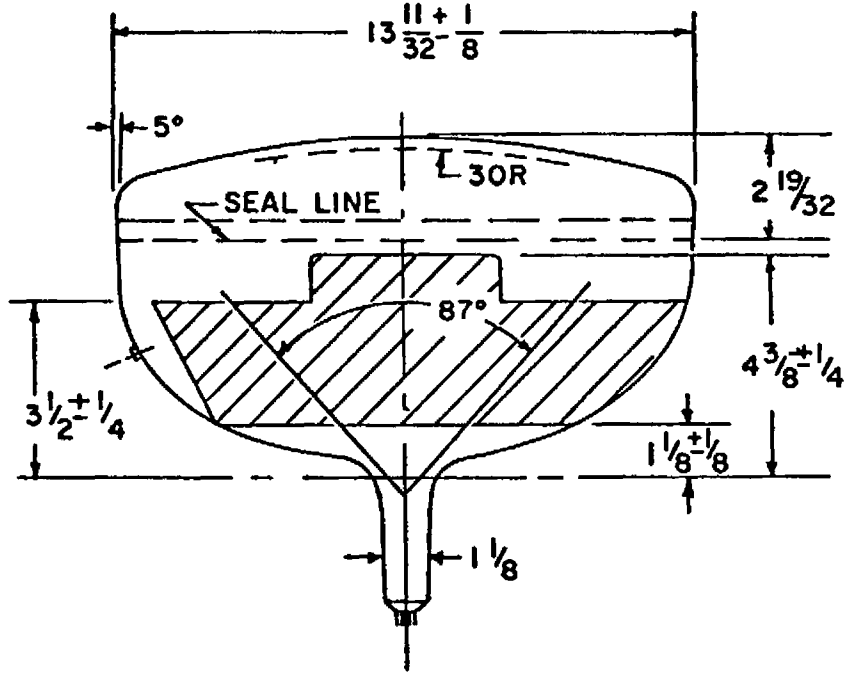
19DVP4

SCREEN DIMENSIONS

DIAGONAL	17-9/16
WIDTH	15-1/8
HEIGHT	12
AREA	172 SQ. IN.







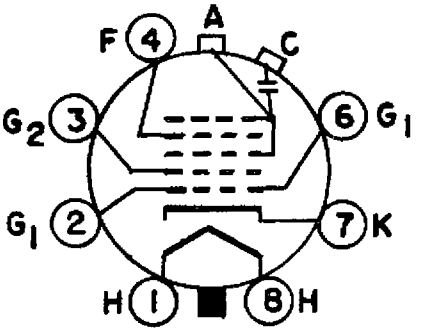
OUTLINE NOTES

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 degrees.

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.

19DZP4
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 19DZP4 is a 19-inch - 114° HW rectangular aluminized picture tube with the anode bulb contact J1-21 located on the long side of the bulb. It features a short neck, 6.3V, 450 ma heater and 150 volt G-2 for cathode drive design.

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	450 ± 23 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 #4667, April 13, 1964

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	J149A1A
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	18,000 volts
Minimum Anode Voltage	10,000 volts
Maximum Grid 4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid 2 Voltage	100 volts
Maximum Grid 2 Voltage	250 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, Note 2)	-250 to +150 volts DC
Grid #2 Voltage	150 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:

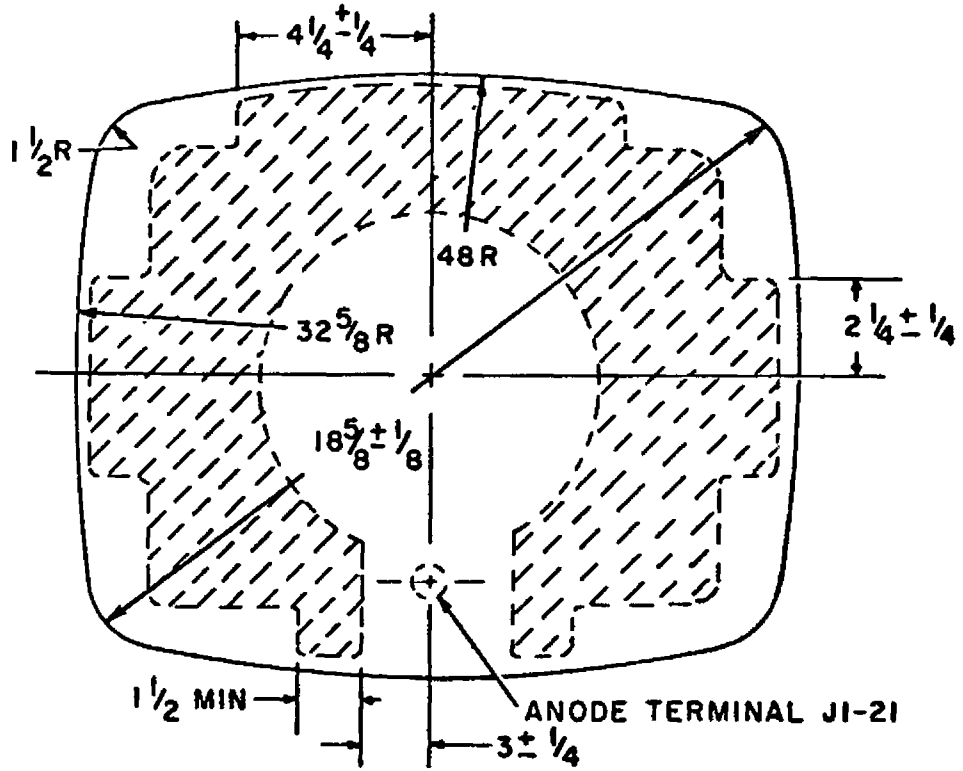
1. Visual extinction of focused raster.

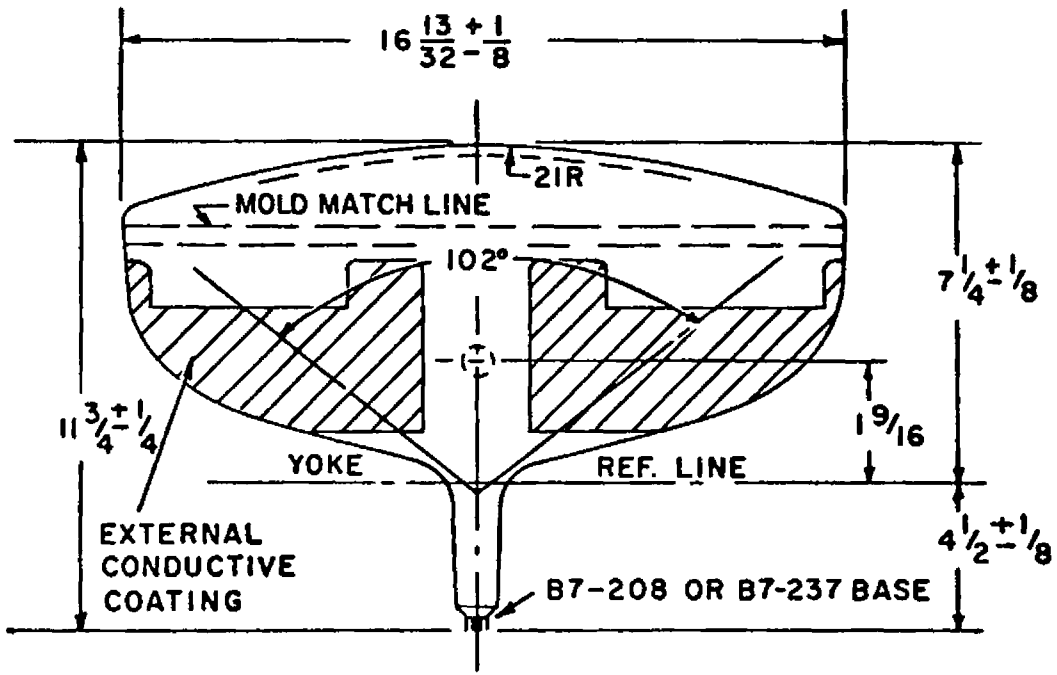
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 microamperes on a 15 1/8 x 11 15/16" pattern from RCA 2F21 monoscope or equivalent.

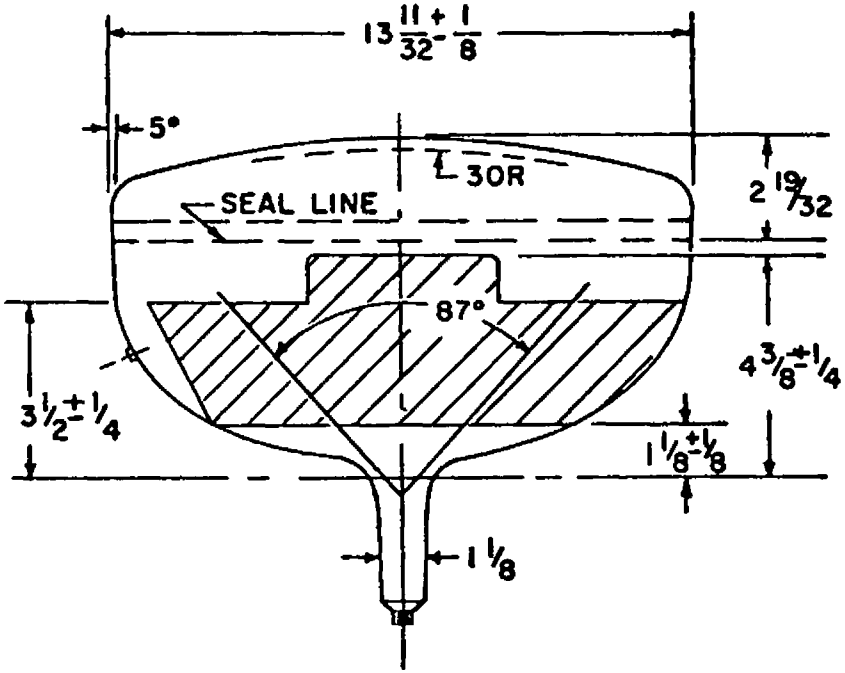
19DZP4

SCREEN DIMENSIONS

DIAGONAL	17-9/16
WIDTH	15-1/8
HEIGHT	12
AREA	172 SQ. IN.







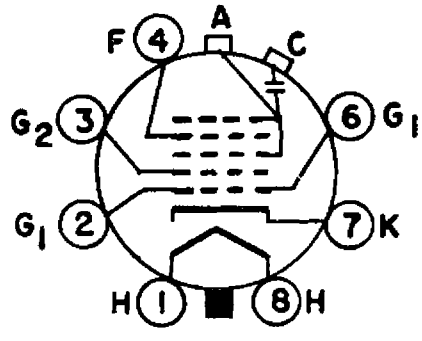
OUTLINE NOTES

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 degrees.

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.

National Video Corporation
4300 W. 47TH STREET CHICAGO 32, ILLINOIS
CLIFFSIDE 4-5600

The 19EBP4 is a 19"-114° cathode ray tube with filled rim implosion protection and a 4 3/8" neck length. This tube has a straight gun which requires no ion trap and a 600 milliampere 6.3 volt filament.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angles (Approximate)	
Diagonal	114 Degrees
Horizontal	102 Degrees
Vertical	85 Degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approximate)	5 uuf
Grid No. 1 to all other electrodes (approximate)	6 uuf
External conductive coating to anode (Note 1)	1,500 max. uuf 1,000 min. uuf
Resistance Between External Conductive Coating and Implosion Protection Hardware	50 min. megohms
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 (Approximate)	49 Per cent

MECHANICAL DATA

Over-all Length	11 5/8 ±1/4 Inches
Neck Length	4 3/8±1/8 Inches
Greatest Dimensions of Shell	
Diagonal	20 7/8 ±3/32 Inches
Width	17 1/8 ±1/16 Inches
Height	14 5/64 ±1/16 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
Implosion Protection	Filled Rim
Bulb JEDEC Designation	J-149-F1
Bulb Contact JEDEC Designation	J1-21
Base JEDEC Designation	B7-208
Basing JEDEC Designation	8HR

Bulb Contact Alignment	
J1-21 contact aligns with Pin Position No. 4	± 30 Degrees

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	23,000 Volts
Minimum Anode Voltage	12,000 Volts
Maximum Grid No. 4 (Focusing Electrode) Voltage	+1,000 -500 Volts
Maximum Grid No. 2 Voltage	550 Volts
Minimum Grid No. 2 Voltage	220 Volts
Grid No. 1 Voltage	
Maximum negative value	154 Volts dc
Maximum negative peak value	220 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 seconds	450 Volts
After equipment warm-up period	200 Volts
Heater positive with respect to cathode	200 Volts

GRID DRIVE SERVICE

Unless otherwise specified, all voltage values are positive with respect to cathode.

Anode Voltage	16,000 Volts dc
Grid No. 4 Voltage (Focusing Electrode) (Notes 3 and 4)	0 to +400 Volts dc
Grid No. 2 Voltage	400 Volts dc
Grid No. 1 Voltage (Note 2)	-39 to -94 Volts dc

MAXIMUM CIRCUIT VALUES

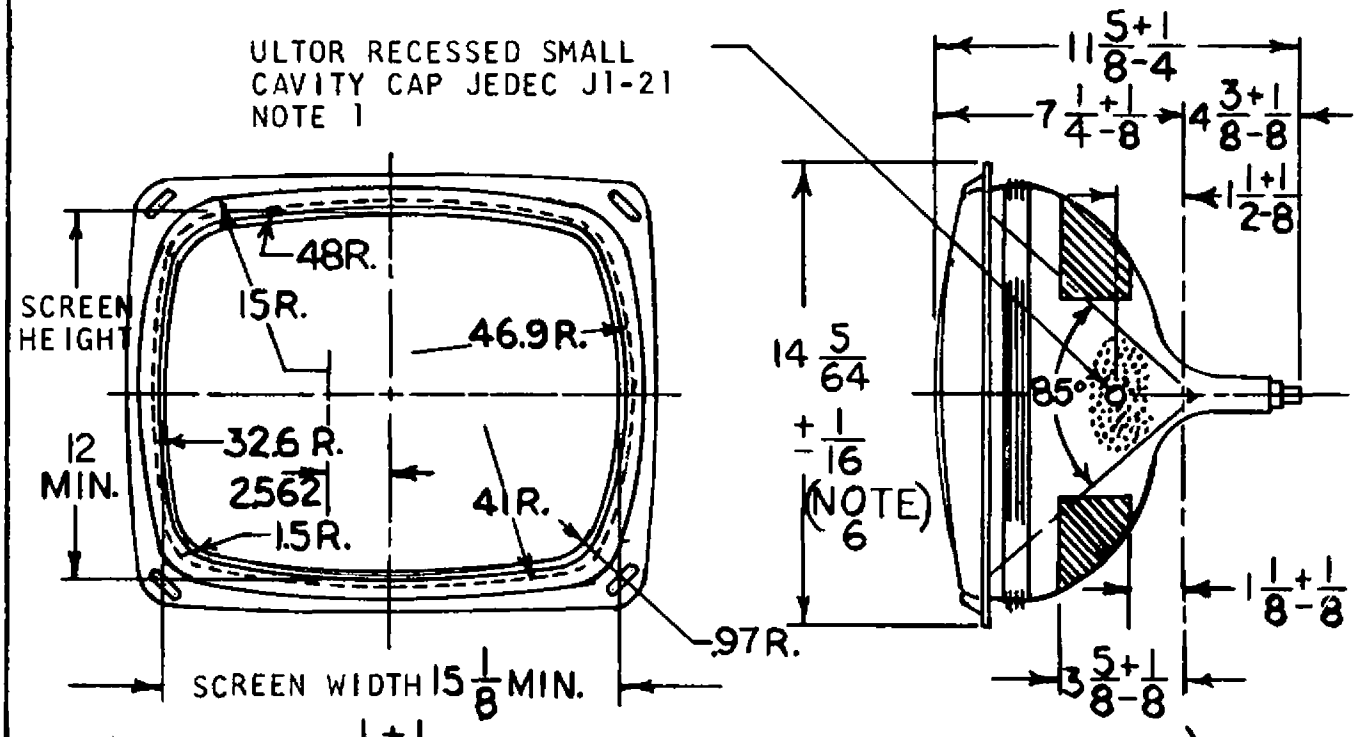
Maximum Grid No. 1 Circuit Resistance	1.5 megohms

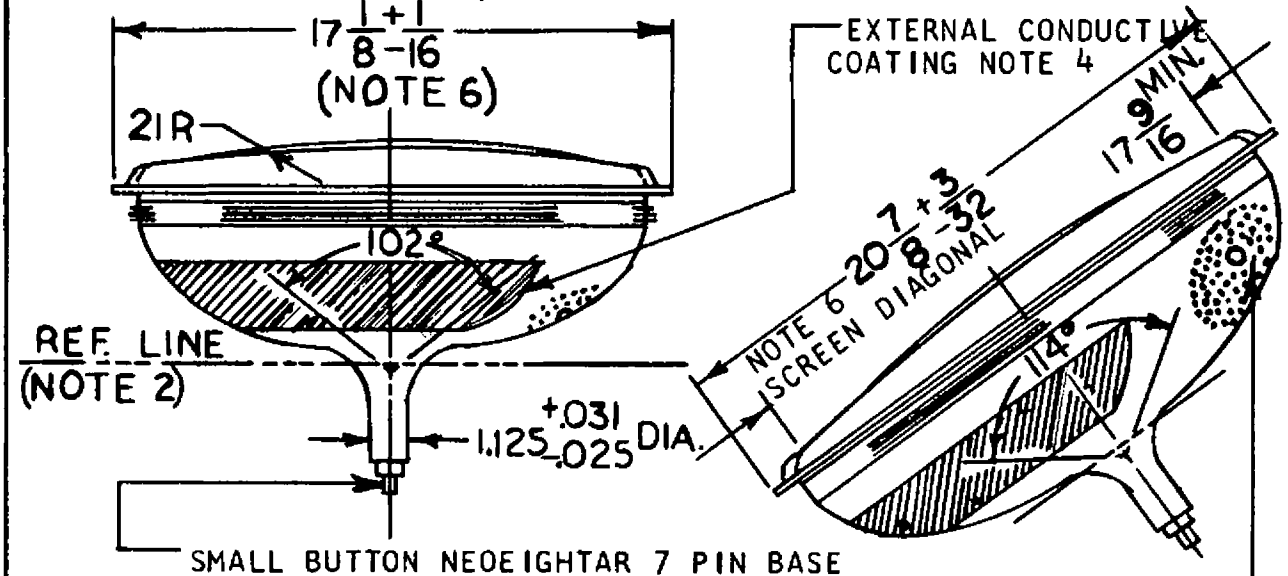
GRAPHS AND DRAWINGS

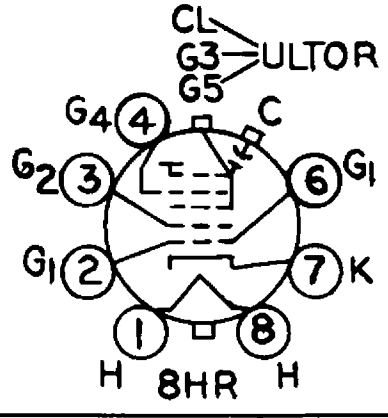
Tube Outline with Essential Dimensions and Tolerances

Pin Connections

Pin 1	Heater	Pin 6	Grid #1
Pin 2	Grid #1	Pin 7	Cathode
Pin 3	Grid #2	Pin 8	Heater
Pin 4	Grid #4		







PIN 1: HEATER
PIN 2: GRID NO.1
PIN 3: GRID NO.2
PIN 4: GRID NO.4
PIN 6: GRID NO.1
PIN 7: CATHODE
PIN 8: HEATER
CAP: ULTOR(GRID NO.3 GRID NO. 5 COLLECTOR)
C: EXTERNAL CONDUCTIVE COATING.

DRAWN BY	SCALE	EFFECTIVE	DISTRIBUTION	DRAWING NO.
W. C. GRAF		12-5-63		19EBP4

NOTES

1. Measured with implosion protection hardware (if any) connected to external coating.

2. Visual extinction of focused raster.

3. With the combined Grid No. 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 15 1/8" by 12" pattern from RCA 2F21 monoscope or equivalent.

4. Individual tubes will have satisfactory focus at some value between 0 and +400 volts.

NOTES FOR DIMENSIONAL OUTLINE

1. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance (measured about the tube axis) of $\pm 30^{\circ}$. Ultor terminal is on same side as Pin No. 4.

2. With tube neck inserted through flared end of reference-line gauge JEDEC No. G-126 and with tube seated in gauge, the reference-line is determined by the intersection of the Plane CC' of the gauge with the glass funnel.

3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

4. External conductive coating must be grounded.

5. To clean this area, wipe only with soft dry lint-less cloth.

6. Measured at O.D. of shell.

19ECP4
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 19ECP4 is a 19-inch rectangular glass picture tube employing banded type implosion protection. Outstanding features include a non-ion-trap gun, a 450 ma. heater and a small neck diameter. 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.

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	450 ± 23 ma.
Heater Warm Up Time	11 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center Approx.	47 percent

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC

Syracuse, N. Y.

from JEDEC release #4667, April 13, 1964

MECHANICAL DATA

Overall Length	11 3/4 ± 1/4 inches
Greatest Dimensions of Tube	
Diagonal	18 3/4 ± 1/8 inches
Width	16 17/32 ± 1/8 inches
Height	13 19/32 ± 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 F1
Bulb Contact	JETEC No. J1-21
Base	JETEC No. B7-237 or B7-208
Basing	8 HR
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	20,000 volts
Minimum Anode Voltage	13,000 volts
Maximum Grid 4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid 2 Voltage	100 volts
Maximum Grid 2 Voltage	250 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	16,000 volts DC
Grid #4 Voltage (Focusing Electrode, Notes 2)	-250 to +150 volts DC
Grid #2 Voltage	150 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:

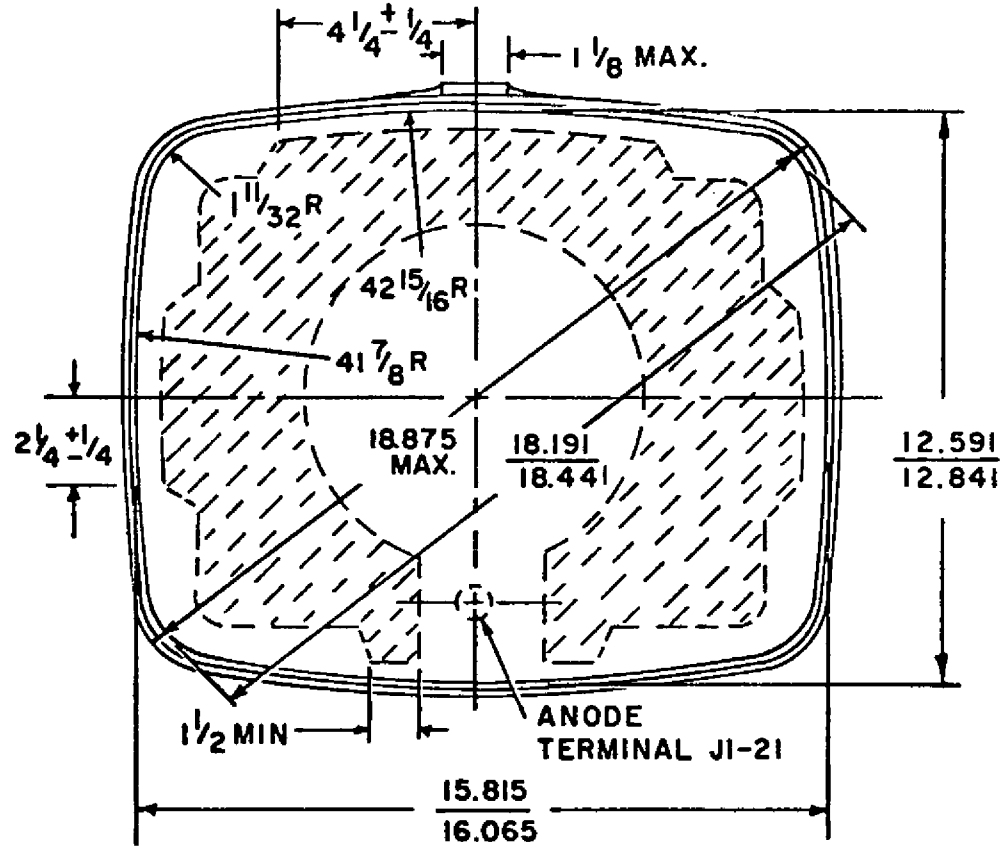
1. Visual extinction of focused raster.

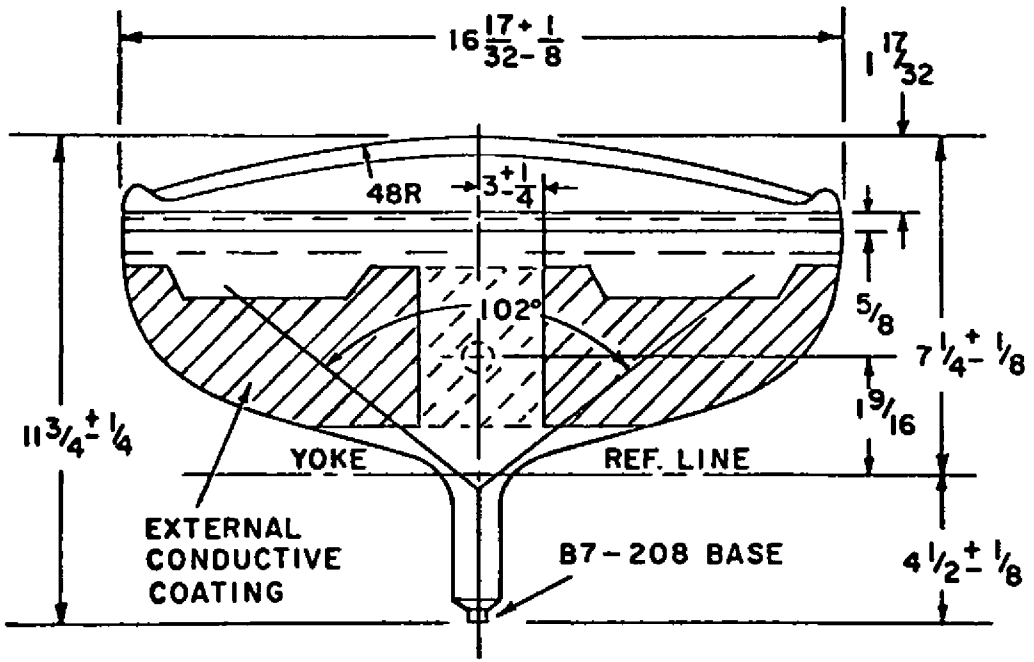
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 microamperes on a 15 1/8 x 11 15/16" pattern from RCA 2F21 monoscope or equivalent.

19ECP4

SCREEN DIMENSIONS

DIAGONAL	17-9/16
WIDTH	15-1/8
HEIGHT	12
AREA	172 SQ. IN.





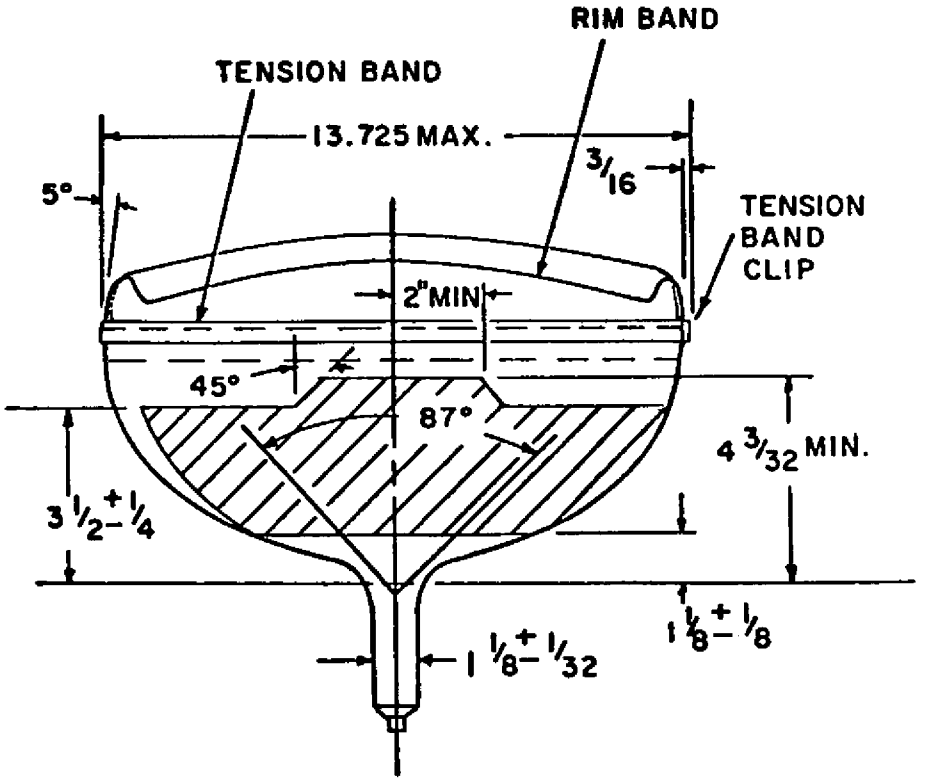


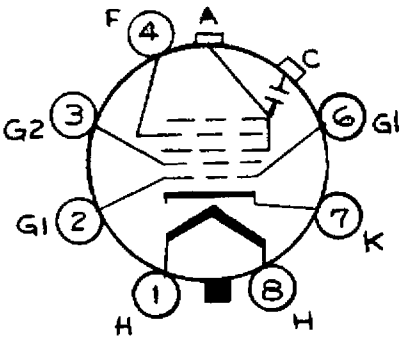
Diagram Notes

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.

National Video Corporation
4300 W. 47TH STREET CHICAGO 32, ILLINOIS
CLIFFSIDE 4-5600

The 19EFP4 is a 19"-114° banded cathode ray tube without coated funnel. This tube has a 4 3/8" neck length, a straight gun which requires no ion trap, 600 milliampere 6.3 volt filament, and 50 volt G_2 for cathode drive design.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Method	
Deflection Angles (Approximate)	
Diagonal	114 Degrees
Horizontal	102 Degrees
Vertical	86 Degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approx.)	5 uuf
Grid No. 1 to all other electrodes (approx.)	6 uuf
External conductive coating to anode (Note 1)	1,500 max. uuf
	1,000 min. uuf
Resistance Between External Conductive Coating and Implosion Protection Hardware	50 min. megohms
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 (Approximate)	49 Percent

MECHANICAL DATA

Overall Length	11 5/8 ±1/4 Inches
Neck Length	4 3/8 ±1/8 Inches
Greatest Dimensions of Tube	
Diagonal	18 7/8 max. Inches
Width	16 11/16 max. Inches
Height	13 39/64 max. 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
Implosion Protection	Banded

from JEDEC release #4657, April 6, 1964

MECHANICAL DATA (CONT.)

Bulb	JEDEC Designation	J-149-F1
Bulb Contact	JEDEC Designation	J1-21
Base	JEDEC Designation	B7-208
Basing	JEDEC Designation	8HR

Bulb Contact Alignment
J1-21 contact aligns with Pin Position No. 4 ±30°.

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to Grid No. 1.

Maximum Anode Voltage	20,000 volts
Minimum Anode Voltage	10,000 volts
Maximum Grid No. 4 (Focusing Electrode) Voltage	+1,100 -500 volts
Maximum Grid No. 2 Voltage	60 volts
Minimum Grid No. 2 Voltage	25 volts
Cathode Voltage	
Maximum negative value	0 volts dc
Maximum negative peak value	2 volts
Maximum positive value	100 volts dc
Maximum positive peak value	150 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.8 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 seconds	450 volts
After equipment warm-up period	200 volts
Heater positive with respect to cathode	200 volts

TYPICAL OPERATING CONDITIONS

CATHODE DRIVE SERVICE

Unless otherwise specified, all voltage values are positive with respect to Grid No. 1.

Anode Voltage	16,000 volts dc
Grid No. 4 Voltage (Focusing Electrode) (Note 3 & 4)	250 volts dc
Grid No. 2 Voltage	50 volts dc
Cathode Voltage (Note 2)	35 to 55 volts dc

MAXIMUM CIRCUIT VALUES

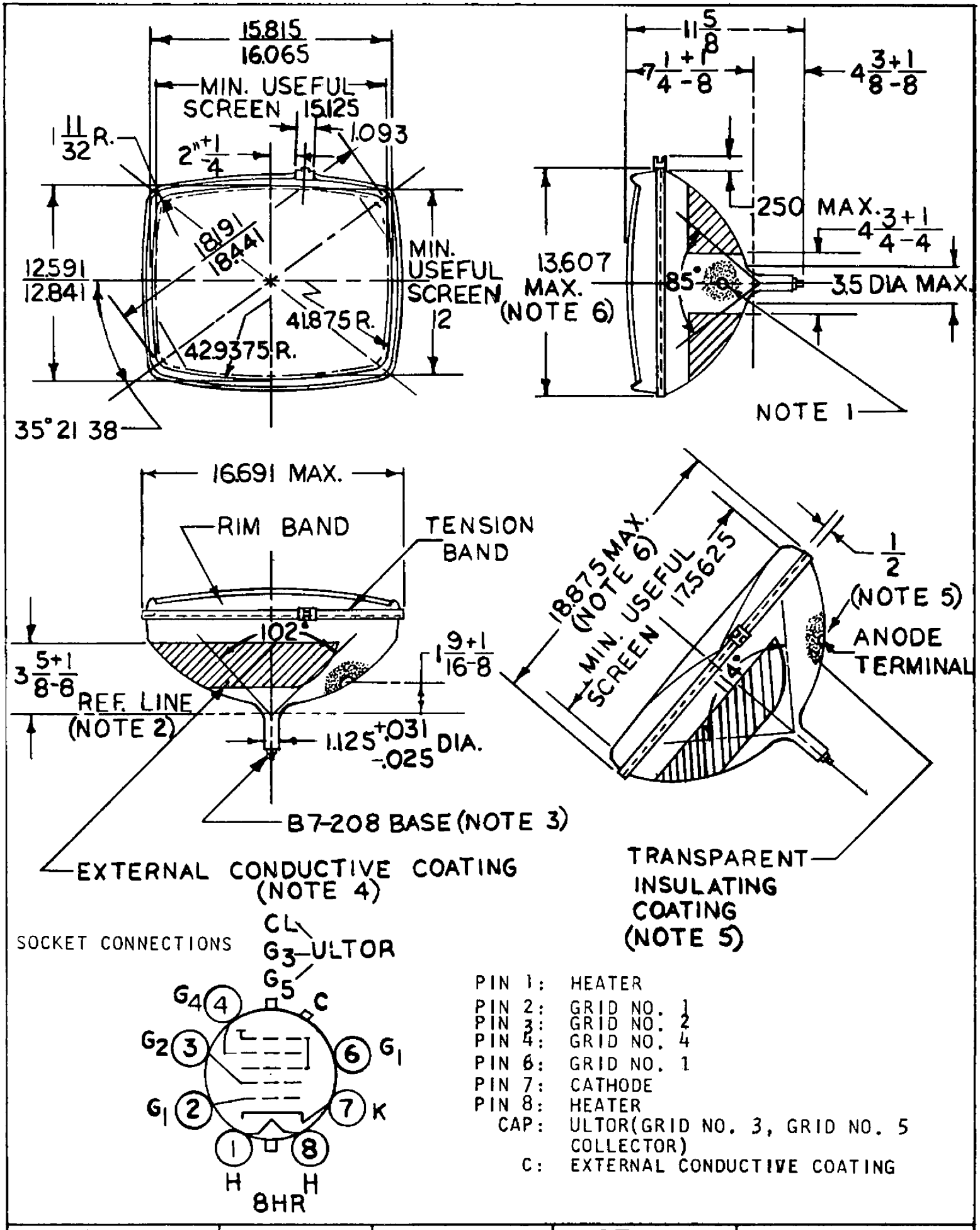
Maximum Grid No. 1 Circuit Resistance	1.5 megohms

GRAPHS AND DRAWINGS

Tube Outline with Essential Dimensions and Tolerances

Pin Connections

Pin 1	Heater	Pin 6	Grid #1
Pin 2	Grid #1	Pin 7	Cathode
Pin 3	Grid #2	Pin 8	Heater
Pin 4	Grid #4		



PIN 1: HEATER
PIN 2: GRID NO. 1
PIN 3: GRID NO. 2
PIN 4: GRID NO. 4
PIN 6: GRID NO. 1
PIN 7: CATHODE
PIN 8: HEATER
CAP: ULTOR(GRID NO. 3, GRID NO. 5 COLLECTOR)
C: EXTERNAL CONDUCTIVE COATING

DRAWN BY	SCALE	EFFECTIVE	DISTRIBUTION	DRAWING NO.
W. C. GRAF		3-3-64		19EFP4

NOTES

1. Measured with implosion protection hardware connected to external coating.

2. Visual extinction of focused raster.

3. With the combined Grid No. 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 15 1/8" by 12" pattern from RCA 2F21 monoscope or equivalent.

4. Individual tubes will have satisfactory focus at some value between 0 and +400 volts.

NOTES FOR DIMENSIONAL OUTLINE

1. With tube neck inserted through flared end of reference-line gauge JEDEC No. G-126 and with tube seated in gauge, the reference-line is determined by the intersection of the Plane CC' of the gauge with the glass funnel.

2. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance (measured about the tube axis) of $\pm 30^{\circ}$. Ultor terminal is on the same side as Pin No. 4.

3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

4. External conductive coating must be grounded.

5. To clean this area, wipe only with soft dry lint-less cloth.

6. Measured to include rimband and tension strap.

from JEDEC release #4597, Feb. 17, 1964

National Video Corporation
4300 W. 47TH STREET CHICAGO 32, ILLINOIS
CLIFFSIDE 4-5600

The 19EGP4 is a 19"-114° cathode ray tube with filled rim implosion protection and a 4 3/8" neck length. This tube has a straight gun which requires no ion trap, a 450 milliampere 6.3 volt filament and 50 volt G_2 for cathode drive design.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angles (Approximate)	
Diagonal	114 Degrees
Horizontal	102 Degrees
Vertical	85 Degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approximate)	5 uuf
Grid No. 1 to all other electrodes (approximate)	6 uuf
External conductive coating to anode (Note 1)	1,500 max. uuf 1,000 min. uuf
Resistance Between External Conductive Coating and Implosion Protection Hardware	50 min. megohms
Heater Current at 6.3 Volts	450 ±20 ma
Heater Warm-up Time	11 Seconds

OPTICAL DATA

Phosphor Number	P-4 Aluminized
Light Transmittance at Center (Approximate)	49 per cent
Antireflection Treatment	No

MECHANICAL DATA

Over-all Length	11 5/8 ±1/4 Inches
Neck Length	4 3/8 ±1/8 Inches
Greatest Dimensions of Shell	
Diagonal	20 7/8 ±3/32 Inches
Width	17 1/8 ±1/16 Inches
Height	14 5/64 ±1/16 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
Implosion Protection	Filled Rim

MECHANICAL DATA (Cont.)

Bulb	JEDEC Designation	J-149-F1
Bulb Contact	JEDEC Designation	J1-21
Base	JEDEC Designation	B7-208
Basing	JEDEC Designation	8HR
Bulb Contact Alignment		
J1-21 contact aligns with Pin Position No. 4		$\pm 30^{o}$

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to Grid #1.

Maximum Anode Voltage	21,000 Volts
Minimum Anode Voltage	12,000 Volts
Maximum Grid No. 4 (Focusing Electrode) Voltage	+1,000 -500 Volts
Maximum Grid No. 2 Voltage	60 Volts
Minimum Grid No. 2 Voltage	25 Volts
Cathode Voltage	
Maximum Negative Value	0 Volts dc
Maximum Negative Peak Value	2 Volts
Maximum Positive Value	100 Volts dc
Maximum Positive Peak Value	150 Volts
Maximum Heater Voltage	6.9 Volts
Minimum Heater Voltage	5.8 Volts
Heater negative with respect to cathode	
During warm-up period not to exceed 15 seconds	450 Volts
After equipment warm-up period	200 Volts
Heater positive with respect to cathode	200 Volts

CATHODE DRIVE SERVICE

Unless otherwise specified, all voltage values are positive with respect to Grid No. 1.

Anode Voltage	16,000 Volts dc
Grid No. 4 Voltage (Focusing Electrode) (Notes 3 & 4)	250 Volts dc
Grid No. 2 Voltage	50 Volts dc
Cathode Voltage (Note 2)	35 to 55 Volts dc

MAXIMUM CIRCUIT VALUES

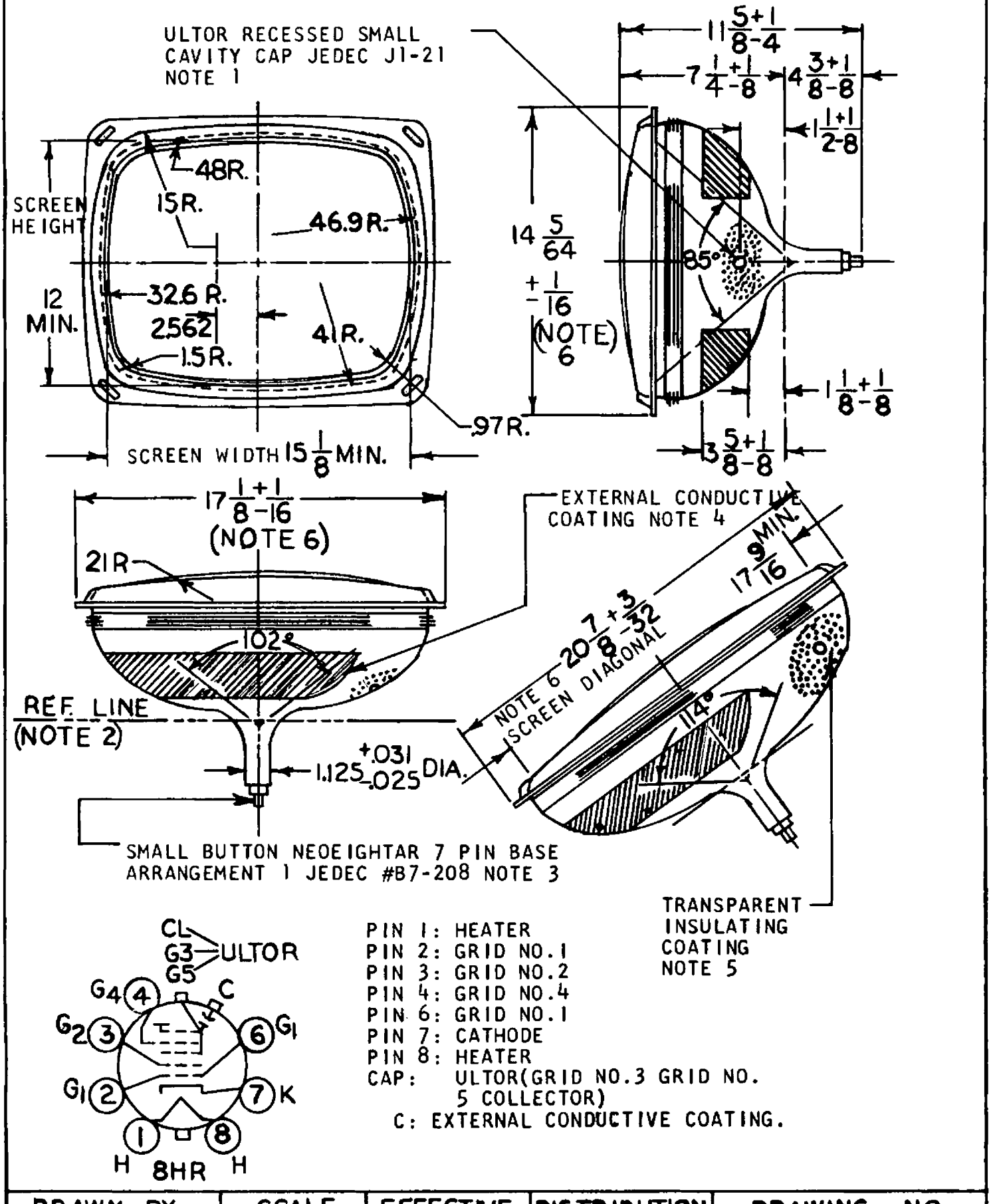
Maximum Grid No. 1 Circuit Resistance	1.5 Megohms

GRAPHS AND DRAWINGS

Tube Outline with Essential Dimensions and Tolerances

Pin Connections:

Pin 1	Heater	Pin 6	Grid #1
Pin 2	Grid #1	Pin 7	Cathode
Pin 3	Grid #2	Pin 8	Heater
Pin 4	Grid #4		



PIN 1: HEATER
PIN 2: GRID NO.1
PIN 3: GRID NO.2
PIN 4: GRID NO.4
PIN 6: GRID NO.1
PIN 7: CATHODE
PIN 8: HEATER
CAP: ULTOR(GRID NO.3 GRID NO. 5 COLLECTOR)
C: EXTERNAL CONDUCTIVE COATING.

DRAWN BY	SCALE	EFFECTIVE	DISTRIBUTION	DRAWING NO.
W. C. GRAF		1-16-64		19E6P4

NOTES:

1. Measured with implosion protection hardware (if any) connected to external coating.

2. Visual extinction of focused raster.

3. With the combined Grid No. 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 15 1/8" by 12" pattern from RCA 2F21 monoscope or equivalent.

4. Individual tubes will have satisfactory focus at some value between 0 and +400 volts.

NOTES FOR DIMENSIONAL OUTLINE

1. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance (measured about the tube axis) of $\pm 30^{\circ}$. Ultor terminal is on same side as Pin No. 4.

2. With tube neck inserted through flared end of reference-line gauge JEDEC No. G-126 and with tube seated in gauge, the reference-line is determined by the intersection of the Plane CC' of the gauge with the glass funnel.

3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

4. External conductive coating must be grounded.

5. To clean this area, wipe only with soft dry lint-less cloth.

6. Measured at O.D. of shell.

THE Rauland CORPORATION
5600 WEST JARVIS AVENUE CHICAGO 48, ILLINOIS
TELEPHONE MULBERRY 5-5000
TELETYPE 312-265-1293

from JEDEC release #4875, Dec. 7, 1964

19EKP4

DESCRIPTION

19" Direct View	Filled Rim Implosion Protection
Rectangular Glass Envelope	114° Magnetic Deflection
Gray Filter Glass	Electrostatic Focus
Aluminized Screen	External Conductive Coating
6.3 Volts, 450 Ma. Heater	No Ion Trap
Cathode Drive Design	Low G_2 Voltage (45V)
Rim Provides	Mounting Holes

SPECIAL CHARACTERISTICS-Anode Penetration Current 150ua Max. (Note 4)

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angles (approx.)	
Horizontal	103 Degrees
Vertical	86 Degrees
Diagonal	114 Degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approx)	5 uuf
Grid #1 to all other electrodes (approx)	6 uuf
External Conductive Coating to Anode (Including implosion protection hardware)	1,500 max. uuf 1,000 min. uuf
Heater Current at 6.3 Volts	450 ± 5% Ma.
Heater Warm-up time	11 Seconds

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center (approx.)	49%

MECHANICAL DATA

Overall Length	11 5/8" ± 1/4"
Greatest Dimensions of Tube (Metal Rim)	
Diagonal	20 13/16" ± 3/32"
Width	17 5/32" ± 1/16"
Height	14 3/32" ± 1/16"
Minimum Useful Screen Dimensions (Projected)	
Diagonal	17 9/16"
Horizontal Axis	15 1/8"
Vertical Axis	12"
Area	172 Sq. in.
Neck Length	4 3/8" ± 1/8"
Bulb	J149F1
Bulb Contact	J1-21
Base	B6-214
Basing	7FA
Bulb Contact Alignment	
J1-21 contact aligns with pin position #7 ± 30 Degrees	

RATINGS (Design Maximum System)
Unless otherwise specified, voltage values are positive and measured with respect to Grid #1

Maximum Anode Voltage	19,800 Volts
Minimum Anode Voltage	12,000 Volts
Maximum Grid #4 (Focusing Electrode) Voltage	+1100-500
Maximum Grid #2 Voltage	55 Volts
Minimum Grid #2 Voltage	30 Volts
Cathode Voltage	100 Volts
Maximum Heater Voltage	7 Volts
Minimum Heater Voltage	5.8 Volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up time 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	16,000 Volts DC
Grid #4 (Focusing Electrode) voltage (Notes 2 and 3)	250 Volts DC
Grid #2 Voltage	45 Volts DC
Cathode Voltage (Note 1)	35 to 50 Volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 circuit resistance	1.5 Megohms

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 12" pattern from RCA 2F21 Monoscope or equivalent.

3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

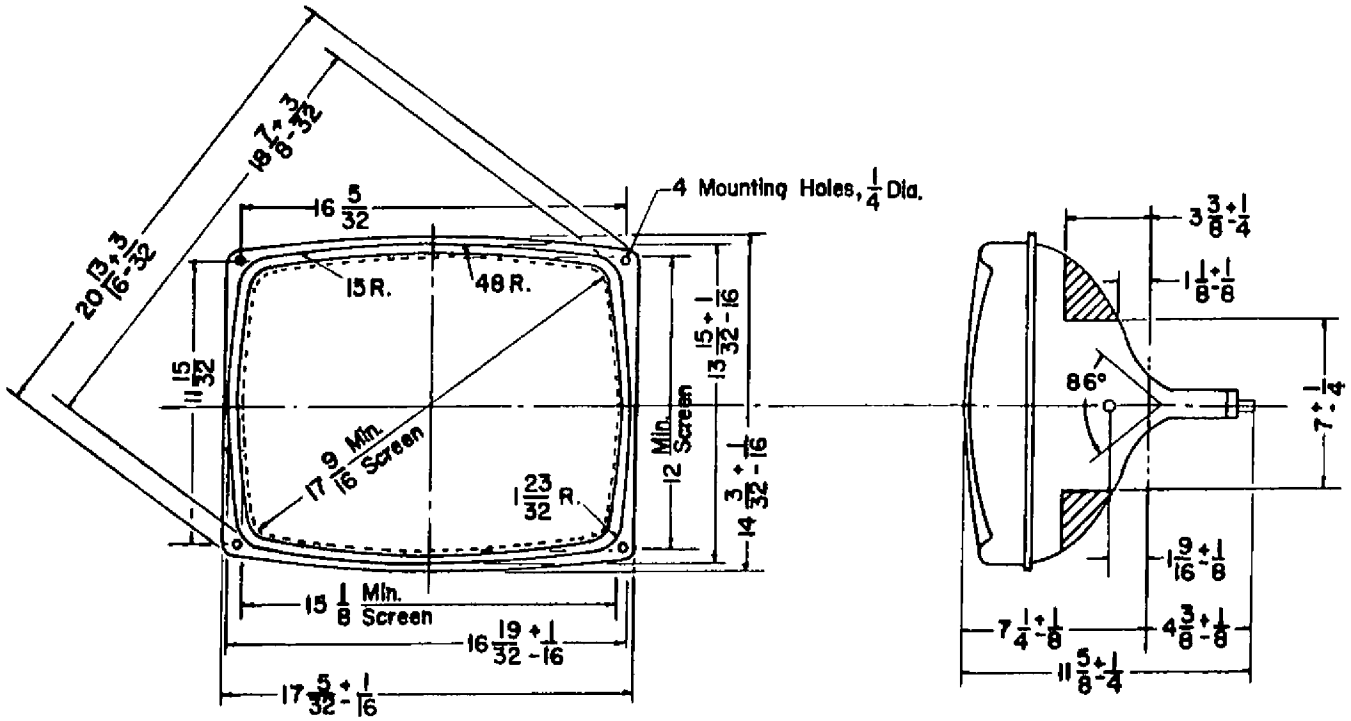
4. This is the maximum beam current with 19,800 volts (design max.) applied to Anode, zero voltage applied to Cathode, Grid #1, and Grid #2, all other elements to have nominal voltages.

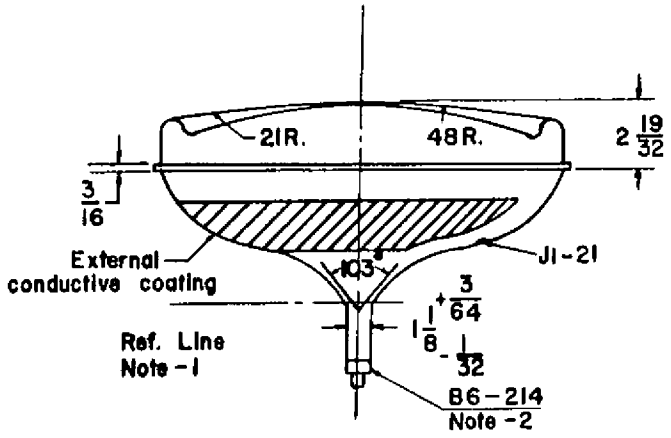
THE Rauland CORPORATION

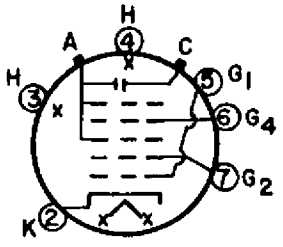
5600 WEST JARVIS AVENUE CHICAGO 48, ILLINOIS

TELEPHONE MULBERRY 5-5000
TELETYPE 312-265-1293

19EKP4







7FA

NOTE

1. Reference line as determined by plane C – C' of J.E.D.E.C. Reference Line Gauge no. 126.
2. Base pin no. 7 aligns with anode contact within 30°.

National Video Corporation

4300 W. 47TH STREET CHICAGO 32, ILLINOIS
CLIFFSIDE 4-5600

The 19ENP4 is a 19"-114° banded tube without cloth. This tube has a 4 3/8" neck length, a straight gun which requires no ion trap, a 450 milliampere 6.3 volt filament and 50 volt G_2 for cathode drive design.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angles (Approximate)	
Diagonal	114 degrees
Horizontal	102 degrees
Vertical	85 degrees
Direct Interelectrode capacitances	
Cathode to all other electrodes (approx.)	5 uuf
Grid No. 1 to all other electrodes (approx.)	6 uuf
External conductive coating to anode (Note 1)	1,500 max. uuf
	1,000 min. uuf
Resistance Between External Conductive Coating and implosion protection hardware	50 min. megohms
Heater Current at 6.3 Volts	450 ±20 ma
Heater Warm-up Time	11 seconds
Electron Gun	
Ion Trap	No
Focus Lens	Unipotential

OPTICAL DATA

Phosphor Number	P4 - Aluminized
Light Transmittance at Center (Approximate)	49
Antireflection Treatment	No

MECHANICAL DATA

Overall Length	11 5/8 ±1/4 inches
Neck Length	4 3/8 ±1/8 inches
Greatest Dimensions of Tube	
Diagonal	18 7/8 max. inches
Width	16 11/16 max. inches
Height	13 39/64 max. 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

Implosion Protection		Banded
Bulb	JEDEC Designation	J1-149-F1
Bulb Contact	JEDEC Designation	J1-21
Base	JEDEC Designation	B7-208
Basing	JEDEC Designation	8HR

Bulb Contact Alignment:
J1-21 contact aligns with Pin Position No. 4 $\pm 30^{\circ}$

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to Grid No. 1.

Maximum Anode Voltage	21,000 volts
Minimum Anode Voltage	12,000 volts
Maximum Grid No. 4 (Focusing Electrode) Voltage	+1,000 -500 volts
Maximum Grid No. 2 Voltage	60 volts
Minimum Grid No. 2 Voltage	25 volts
Cathode Voltage	
Maximum negative value	0 volts dc
Maximum negative peak value	2 volts
Maximum positive value	100 volts dc
Maximum positive peak value	150 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.8 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 seconds	450 volts
After equipment warm-up period	200 volts
Heater positive with respect to cathode	200 volts

TYPICAL OPERATING CONDITIONS

CATHODE DRIVE SERVICE

Unless otherwise specified, all voltage values are positive with respect to Grid No. 1.

Anode Voltage	16,000 volts dc
Grid No. 4 Voltage (Focusing Electrode) (Note 3 and 4)	250 volts dc
Grid No. 2 Voltage	50 volts dc
Cathode Voltage (Note 2)	32 to 50 volts dc

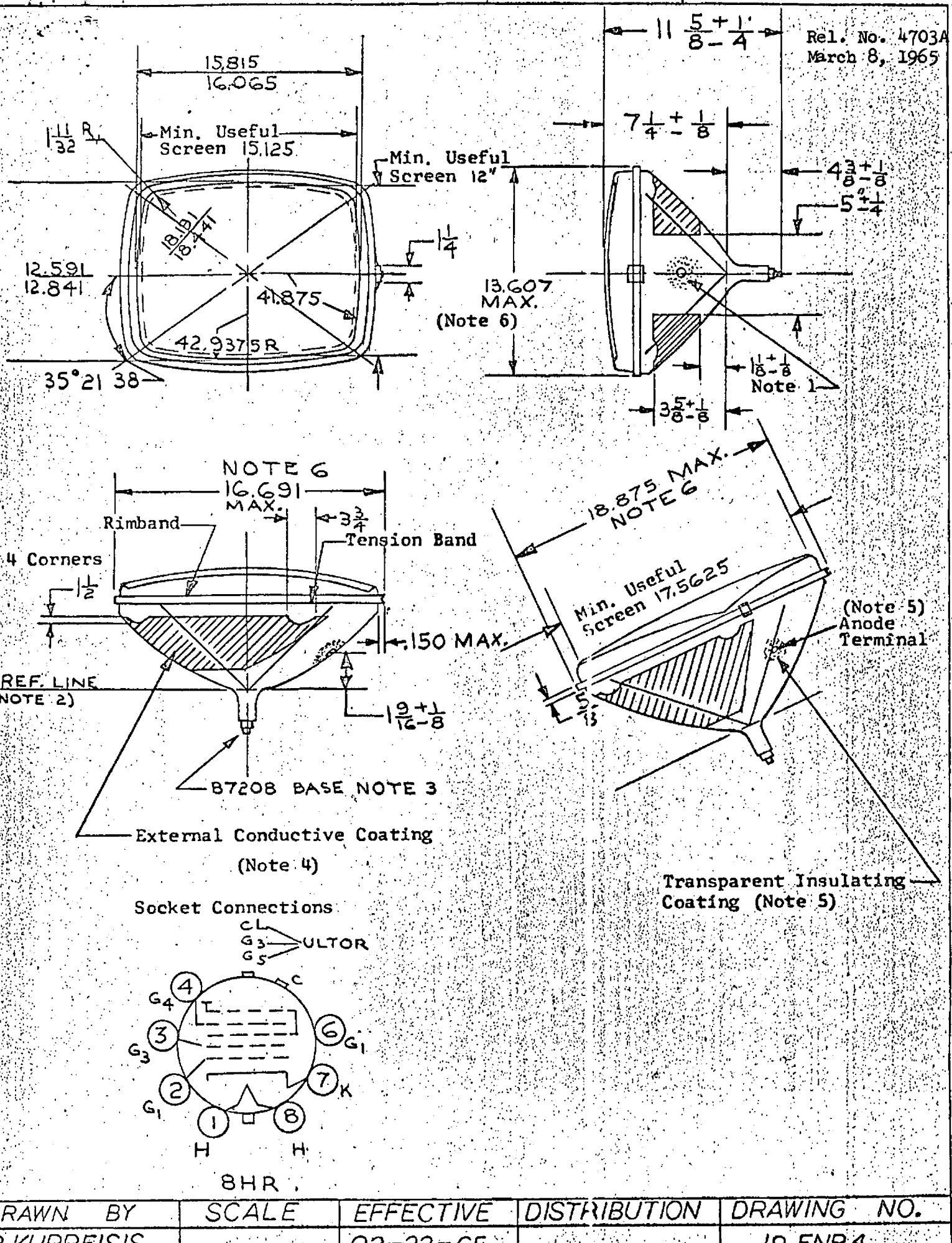
MAXIMUM CIRCUIT VALUES

Maximum Grid No. 1 Circuit Resistance	1.5 megohms

GRAPHS AND DRAWINGS

Tube Outline with Essential Dimensions and Tolerances

Rel. No. 4703A
March 8, 1965



DRAWN BY	SCALE	EFFECTIVE	DISTRIBUTION	DRAWING NO.
R KUPREISIS		02-22-65		19 ENP 4

GRAPHS AND DRAWINGS (Cont.)

Pin Connection:

Pin 1	Heater	Pin 6	Grid #1
Pin 2	Grid #1	Pin 7	Cathode
Pin 3	Grid #2	Pin 8	Heater
Pin 4	Grid #4		

NOTES

1. Measured with implosion protection hardware connected to external coating.

2. Visual extinction of focused raster.

3. With the combined Grid No. 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 15 1/8" by 12" pattern from RCA 2F21 monoscope or equivalent.

4. Individual tubes will have satisfactory focus at some value between 0 and +400 volts.

NOTES FOR DIMENSIONAL OUTLINE

1. With tube neck inserted through flared end of reference-line gauge JEDEC No. G-126 and with tube seated in gauge, the reference-line is determined by the intersection of the Plane CC' of the gauge with the glass funnel.

2. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance (measured about the tube axis) of $\pm 30^{\circ}$. Ultor terminal is on the same side as Pin No. 4.

3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

4. External conductive coating must be grounded.

5. To clean this area, wipe only with soft dry lint-less cloth.

6. Measured to include rim band and tension strap.

from JEDEC release #4767,July 27, 1964

National Video Corporation
4300 W. 47TH STREET CHICAGO 32, ILLINOIS
CLIFFSIDE 4-5600

The 19ETP4 is a 19"-114° banded tube with mounting lugs and a 4 3/8" neck length. This tube has a straight gun which requires no ion trap, a 450 milliampere 6.3 volt filament and 50 volt G_2 for cathode drive design.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angles (Approximate)	
Diagonal	114 degrees
Horizontal	102 degrees
Vertical	85 degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes (approx.)	5 uuf
Grid No. 1 to all other electrodes (approx.)	6 uuf
External conductive coating to anode (note 1)	1,500 max. uuf
	1,000 min. uuf
Resistance Between External Conductive Coating and Implosion Protection Hardware	50 min. megohms
Heater Current at 6.3 Volts	450 ±20 ma
Heater Warm-up Time	11 seconds
Electron Gun	
Ion Trap	None
Focus Lens	Unipotential

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center (Approximate)	49 Percent
Antireflection Treatment	No

MECHANICAL DATA

Overall Length	11 5/8 ±1/4 inches
Neck Length	4 3/8 ±1/8 inches
Greatest Dimensions of Tube	
Diagonal	18 7/8 max. inches
Width	16 11/16 max. inches
Height	13 39/64 max. 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
Implosion Protection (Note 3 of Instructions)	Banded - Without Cloth

Bulb	JEDEC Designation	J-149-F1
Bulb Contact	JEDEC Designation	J1-21
Base	JEDEC Designation	B7-208
Basing	JEDEC Designation	8HR

Bulb Contact Alignment

J1-21 contact aligns with Pin Position No. 4 $\pm 30^{o}$.

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to Grid No. 1.

Maximum Anode Voltage	21,000 volts
Minimum Anode Voltage	12,000 volts
Maximum Grid No. 4 (Focusing Electrode) Voltage	+1,000 -500 volts
Maximum Grid No. 2 Voltage	60 volts
Minimum Grid No. 2 Voltage	25 volts
Cathode Voltage	
Maximum Negative value	0 volts dc
Maximum Negative peak value	2 volts
Maximum Positive value	100 volts dc
Maximum Positive peak value	150 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.8 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 seconds	450 volts
After equipment warm-up period	200 volts
Heater positive with respect to cathode	200 volts

TYPICAL OPERATING CONDITIONS

CATHODE DRIVE SERVICE

Unless otherwise specified, all voltage values are positive with respect to Grid No. 1.

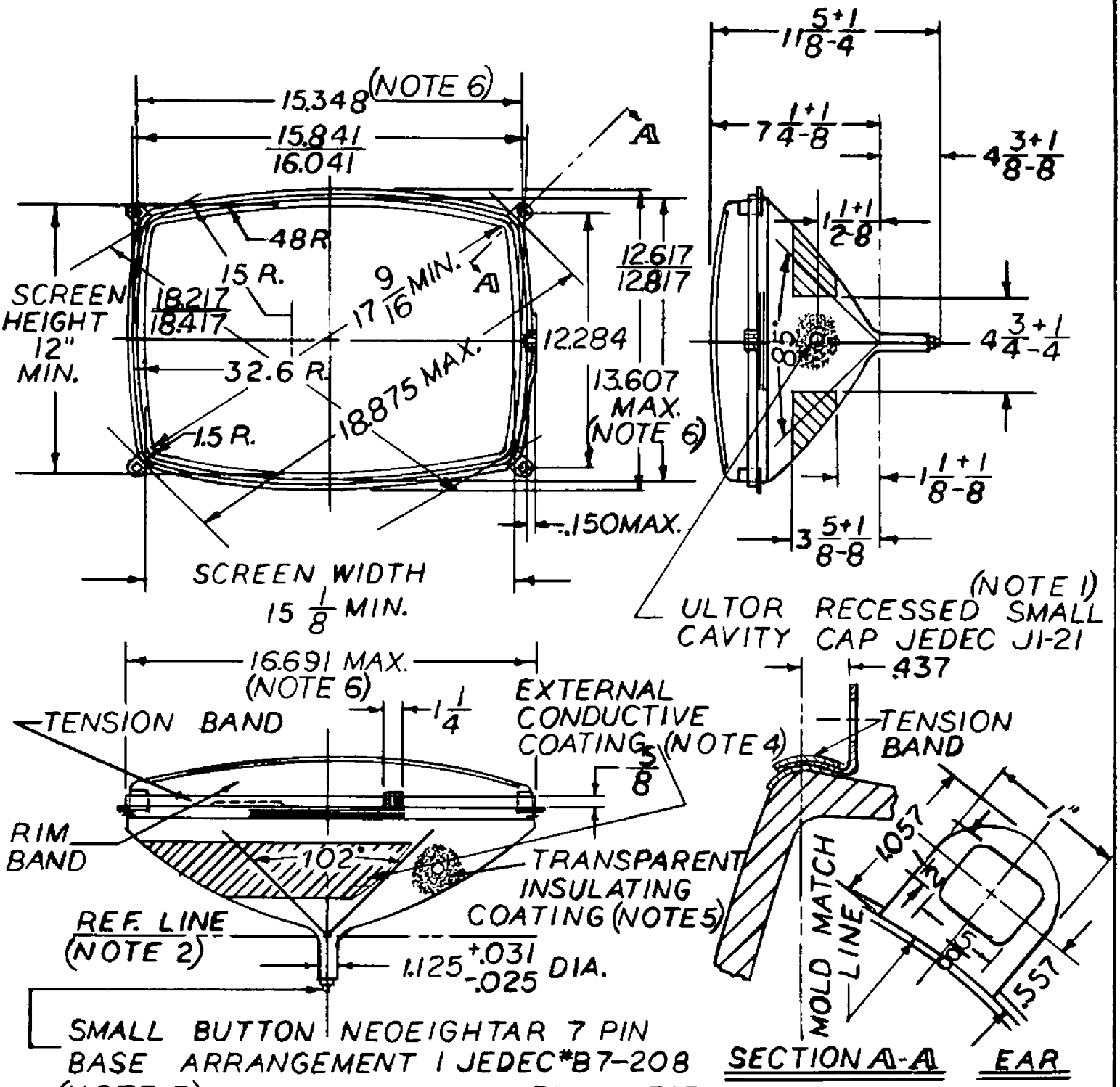
Anode Voltage	16,000 volts dc
Grid No. 4 Voltage (Focusing Electrode) (Note 3 & 4)	250 volts dc
Grid No. 2 Voltage	50 volts dc
Cathode Voltage (Note 2)	32 to 50 volts dc

MAXIMUM CIRCUIT VALUES

Maximum Grid No. 1 Circuit Resistance	1.5 megohms

GRAPHS AND DRAWINGS

Tube Outline with essential dimensions and tolerances



PIN 1: HEATER
PIN 2: GRID NO.1
PIN 3: GRID NO.2
PIN 4: GRID NO.4
PIN 6: GRID NO.1
PIN 7: CATHODE
PIN 8: HEATER
CAP: ULTOR GRID NO.3 GRID 5 COLLECTOR
C: EXTERNAL CONDUCTIVE COATING.

DRAWN BY	SCALE	EFFECTIVE	DISTRIBUTION	DRAWING NO.
W. C. GRAF		6-24-64		19 ETP4

GRAPHS AND DRAWINGS (Cont.)

Pin Connections:

Pin 1	Heater	Pin 6	Grid #1
Pin 2	Grid #1	Pin 7	Cathode
Pin 3	Grid #2	Pin 8	Heater
Pin 4	Grid #4		

NOTES

1. Measured with implosion protection hardware connected to external coating.

2. Visual extinction of focused raster.

3. With the combined Grid No. 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 15 1/8" by 12" pattern from RCA 2F21 monoscope or equivalent.

4. Individual tubes will have satisfactory focus at some value between 0 and +400 volts.

NOTES FOR DIMENSIONAL OUTLINE

1. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance (measured about the tube axis) of $\pm 30^{o}$. Ultor terminal is on same side as Pin No. 4.

2. With tube neck inserted through flared end of reference-line gauge JEDEC No. G-126 and with tube seated in gauge, the reference-line is determined by the intersection of the Plane CC' of the gauge with the glass funnel.

3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

4. External conductive coating must be grounded.

5. To clean this area, wipe only with soft dry lint-less cloth.

6. Measured to include rimband and tension strap.

THE Rauland CORPORATION
5600 WEST JARVIS AVENUE CHICAGO 48, ILLINOIS
TELEPHONE MULBERRY 5-5000
TELETYPE 312-265-1293

from JEDEC release #4888, Dec. 21, 1964

19EZP4

DESCRIPTION

19" Direct View	Filled Rim Implosion Protection
Rectangular Glass Envelope	114° Magnetic Deflection
Gray Filter Glass	Electrostatic Focus
Aluminized Screen	External Conductive Coating
6.3 Volts, 450 Ma. Heater	No Ion Trap
Cathode Drive Design	Low G_2 Voltage (45V.)

Rim Provides Mounting Holes

SPECIAL CHARACTERISTICS-Anode Penetration Current 150 ua Max. (Note 4)

ELECTRICAL DATA	
Focusing Method	Electrostatic
Deflection Angles (approx.)	
Horizontal	103 Degrees
Vertical	86 Degrees
Diagonal	114 Degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approx.)	5 uuf
Grid #1 to all other electrodes (approx.)	6 uuf
External Conductive Coating to Anode	1,500 max. uuf
(Including implosion protection hardware)	1,000 min. uuf
Heater Current at 6.3 Volts	450 ± 5% Ma.
Heater Warm-up time	11 Seconds

OPTICAL DATA	
Phosphor Number	P4 Aluminized
Light Transmittance at Center (approx.)	49%

MECHANICAL DATA	
Overall Length	11 5/8" ± 1/4"
Greatest Dimensions of Tube (Metal Rim)	
Diagonal	20 7/16" ± 3/32"
Width	16 7/8" ± 1/16"
Height	13 13/16" ± 1/16"
Minimum Useful Screen Dimensions (projected)	
Diagonal	17 9/16"
Horizontal Axis	15 1/8"
Vertical Axis	12"
Area	172 Sq. inches
Neck Length	4 3/8" ± 1/8"
Bulb	J149F1
Bulb Contact	J1-21
Base	B6-214
Basing	7FA
Weight (approx.)	15 lb. 8 oz.

Bulb Contact Alignment
J1-21 contact aligns with pin position #7 ± 30 Degrees

RATINGS (Design Maximum System)
Unless otherwise specified, voltage values are positive and measured with respect to Grid #1

Maximum Anode Voltage	19,800 Volts
Minimum Anode Voltage	12,000 Volts
Maximum Grid #4 (Focusing Electrode) Voltage	+1100 -500
Maximum Grid #2 Voltage	55 Volts
Minimum Grid #2 Voltage	30 Volts
Cathode Voltage	100 Volts
Maximum Heater Voltage	7 Volts
Minimum Heater Voltage	5.8 Volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up time 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	16,000 Volts DC
Grid #4 (Focusing Electrode) voltage (Notes 2 and 3)	250 Volts DC
Grid #2 Voltage	45 Volts DC
Cathode Voltage (Note 1)	35 to 50 Volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 circuit resistance	1.5 Megohms

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 12" pattern from RCA 2F21 Monoscope or equivalent.

3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

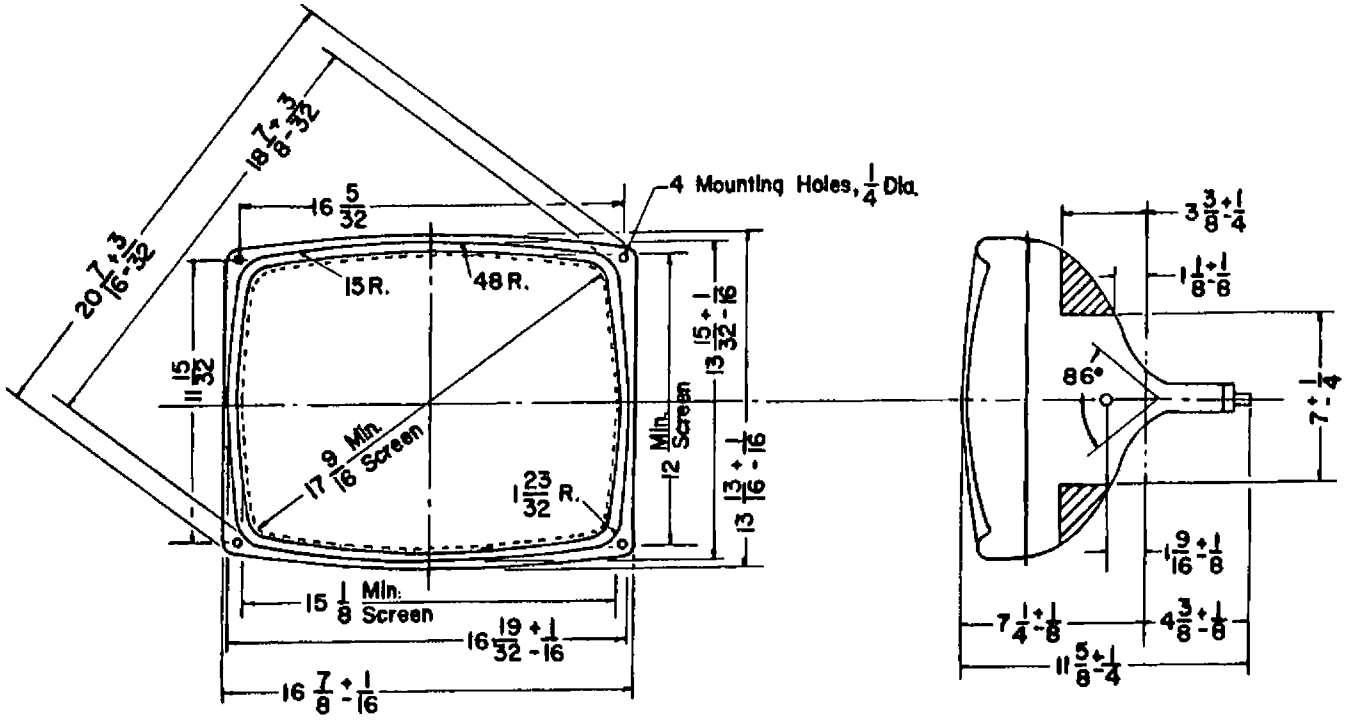
4. This is the maximum beam current with 19,800 volts (design max.) applied to Anode, zero voltage applied to Cathode, Grid #1, and Grid #2, all other elements to have nominal voltages.

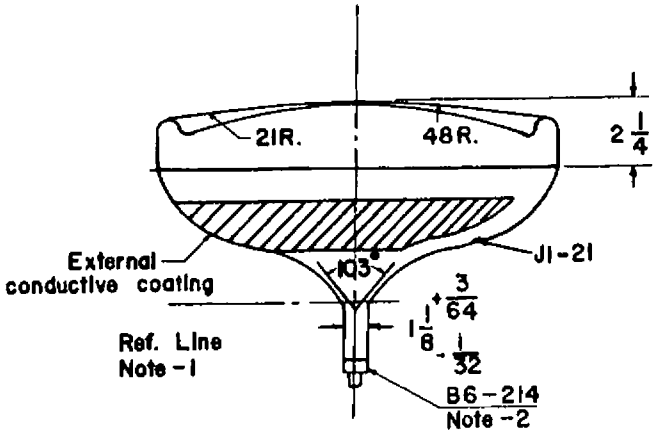
THE Rauland CORPORATION

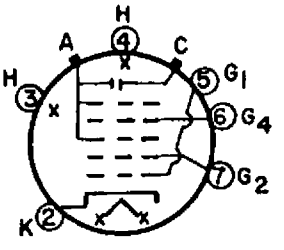
5600 WEST JARVIS AVENUE CHICAGO 48, ILLINOIS

TELEPHONE MULBERRY 5-5000
TELETYPE 312-265-1293

19EZP4







7 FA

NOTE

1. Reference line as determined by plane C – C' of J.E.D.E.C. Reference Line Gauge no. 126.
2. Base pin no. 7 aligns with anode contact within 30°.

JOINT ELECTRON DEVICE ENGINEERING COUNCIL

JEDEC Type Administration Section
Electronic Industries Association
32 Green Street
Newark 2, New Jersey

E. I. F.
REGISTR[illegible]N
FI[illegible]

Announcement

of

Electron Device Type Registration

Release No. 4880

December 14, 1964

The Joint Electron Device Engineering Council announces the registration of the following electron device designation

19FJP4 *

on the application of

Sylvania Electric Products, Inc.
Ottawa, Ohio

* Type 19FJP4 is identical to Type 19EHP4 as registered in Release No. 4766, dated July 27, 1964, except for the following:

Heater current 0.45 ± 5% ampere at 6.3 volts

Toshiba

TOSHIBA ELECTRON TUBE 21JS6A

RECEIVING TUBE

The 21JS6A is a beam-power pentode designed for use as the horizontal-deflection amplifier in color television receivers.

Except for heater characteristics and ratings, the 21JS6A is identical to the 6JS6A.



ELECTRICAL DATA

Heater Characteristics and Ratings

Heater Voltage (AC or DC)	21.0	Volts
Heater Current	0.6±6%	Amperes
Heater Warm-up Time (Average)	11	Seconds

from JEDEC release #4790B, Oct. 19, 1970

ELECTRONIC INNOVATIONS IN ACTION

21JV6
COMPACTRON BEAM PENTODE
FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 21JV6 is a compactron beam-power pentode designed for use as the horizontal-deflection amplifier in television receivers.

Except for heater characteristics and ratings, the 21JV6 is identical to the 33JV6.

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.

from JEDEC release #4712A, May 24, 1965

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.

JOINT ELECTRON DEVICE ENGINEERING COUNCIL

JEDEC Type Administration Section
Electronic Industries Association
32 Green Street
Newark 2, New Jersey

E. I. A.
REGISTRATION
FILE

Announcement

of

Electron Device Type Registration

Release No. 4869A

December 7, 1964

The Joint Electron Device Engineering Council announces the registration of the following electron device designation

21KA6 *

on the application of

General Electric Company
Owensboro, Kentucky

* Type 21KA6 is similar to Type 16KA6 as registered in Release No. 4869, dated November 30, 1964, except for the following:

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

** 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 read 80 per cent 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.

DU MONT

CATHODE-RAY TUBE

TYPE 22GP-

The Du Mont Type 22GP- is a 22-inch, metal envelope, magnetic deflection and electrostatic focus cathode-ray tube suitable for radar applications. This tube features an almost completely flat faceplate, minimizing parallax error. The screen is aluminized to increase light output and prevent build-up of spurious screen charges.

GENERAL CHARACTERISTICS

Electrical Data

Focusing Method	Electrostatic	
Deflection 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 Data

Phosphor Number	2	
Fluorescence	Yellow-Green	
Phosphorescence	Green	
Persistence	Medium	
Faceplate	Clear	

Mechanical Data

Overall Length	23 3/4	Max. Inches
Greatest Diameter of Envelope	21 3/4 ± 1/8	Inches
Minimum Useful Screen Diameter	20	Inches
Envelope Contact	Metal Cone Lip	
Base	B7-51	
Basing	12M	

DUMONT

CATHODE-RAY TUBE

TYPE 22GP-

RATINGS (Absolute Maximum Values)

Heater Voltage	6.3	Volts
Heater Current at 6.3 Volts	0.6 ± 10%	Ampere
Accelerator Voltage	24,000	Max. Volts DC
Accelerator Input	6	Max. Watts
Focusing Electrode Voltage	-1500 to +1500	Max. Volts DC
Grid No. 2 Voltage	800	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

Accelerator Voltage	18,000	Volts DC
Grid No. 2 Voltage	400	Volts DC
Grid No. 1 Voltage [1]	-45 to -70	Volts DC
Focusing Voltage [2, 3]	0 to 400	Volts DC
Resolution [3]		
Modulation [2]	35	Volts Max.
Spot Position [4]	20	MM

MAXIMUM CIRCUIT VALUES

Grid No. 1 Circuit Resistance	1.5	Max. Megohms

Allen B. Du Mont Laboratories
Divisions of Fairchild Camera and Instrument Corp.
Clifton, New Jersey

DUMONT

CATHODE-RAY TUBE

TYPE 22GP-

NOTES

1. Visual extinction of the undeflected, focused spot.

2. Drive voltage from cutoff to a light output of 100 foot lamberts, measured with a 20-inch square focused raster and using 840 (minimum) active lines. Measure anywhere within the usable tube diameter. Weston 759 Foot-Lambert Meter (or equivalent) used. Cathode current will not exceed 300 μA.

3. a. With optimum focus, 840 active lines will be resolved by the eye (without dynamic focusing).

   b. A sine wave voltage is applied to the grid such that the frequency represents 500 (minimum) white dots across the central horizontal axis. The peak voltage of the sine wave is such that it establishes the same grid-cathode voltage relationship required for Note 2, above. Under these conditions the dots will be resolvable by the eye at any and all points within the usable surface area without refocusing. Peak-to-peak amplitude of the sine wave is to be 45 volts or less.

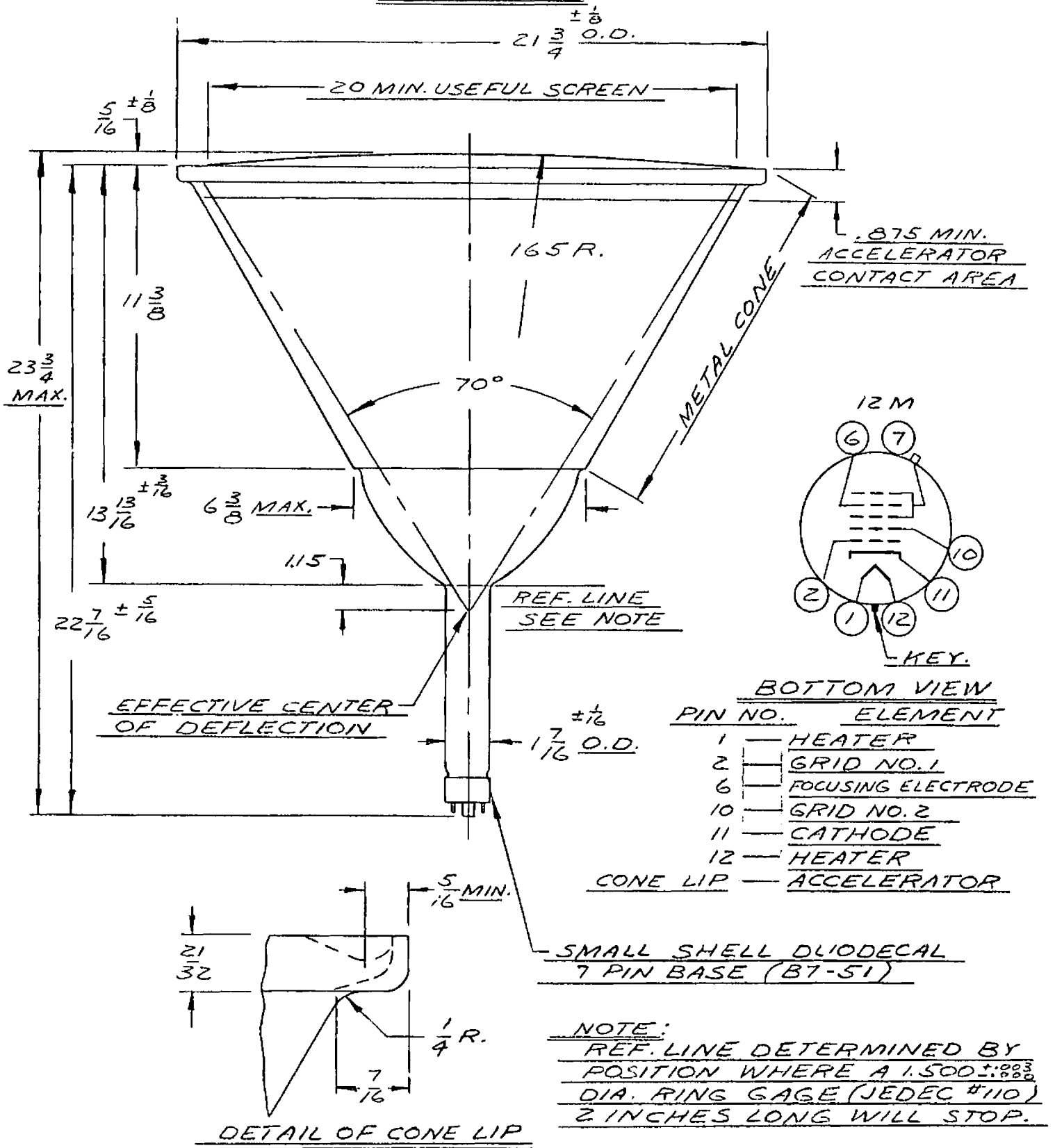
   c. Tests made using a uniform field uncorrected yoke.

4. The center of the undeflected, focused spot will fall within a 20-mm radius circle concentric with the tube face center.

Allen B. Du Mont Laboratories
Divisions of Fairchild Camera and Instrument Corp.
Clifton, New Jersey

DU MONT

CATHODE-RAY TUBE
TYPE 22GP-



BOTTOM VIEW

PIN NO.	ELEMENT
1	HEATER
2	GRID NO. 1
6	FOCUSING ELECTRODE
10	GRID NO. 2
11	CATHODE
12	HEATER
CONE LIP	ACCELERATOR

NOTE:
REF. LINE DETERMINED BY POSITION WHERE A 1.500 +.0003 -.0000 DIA. RING GAGE (JEDEC #110) 2 INCHES LONG WILL STOP.

Allen B. Du Mont Laboratories, Inc.
Divisions of Fairchild Camera and Instrument Corp.
Clifton, New Jersey

DE-6261-4
11-4-63
FORM 609 -M1-5-60-SH

JOINT ELECTRON DEVICE ENGINEERING COUNCILS

JEDEC Electron Tube Council JEDEC Solid State Products Council

2001 Eye Street NW
Washington D. C. 20006



Announcement

of

Electron Device Type Registration

Release No. 4865C

April 12, 1971

The Joint Electron Device Engineering Council announces the registration of the following electron device designation

22VARP4

on the application of

GTE Sylvania Electronic Tube Div.
Ottawa, Ohio

Type 22VARP4 is similar to Type 23GWP4 as registered in Release No. 4865 and 4865A dated November 30, 1964 and December 26, 1967 except that the following statement regarding X-radiation replaces the X-radiation warning shown on page 4 of the 23GWP4 registration sheets.

"X-Radiation Characteristics:"

"The X-radiation emitted from this picture tube, as measured in accordance with the procedure of JEDEC Publication No. 64A, will not exceed 0.5 mR/h throughout the useful life of the tube when operated below the Isodose Rate Limit Curve No. XM-6 (see Release No. 6148).

Operation above those values shown by the curve may result in failure of the television receiver to comply with the Federal Performance Standard for Television Receivers, Sub-Part C of Part 78 of Title 42, Code of Federal Regulations (PL-90-602), as published in the Federal Register, Volume 34, No. 247, of Thursday, December 25, 1969.

X-radiation as a function of anode voltage, at constant beam current, is limited by X-Radiation Limit Curve XM-5 (see Release No. 6148)."

TELEVISION PICTURE TUBE TYPE 23CGP4

92° Magnetic Deflection
Rectangular Glass
Aluminized Screen
Gray Filter Glass

6.3 Volt, 450 Ma. Heater
Electrostatic Focus
5½" Neck Length

External Conductive Coating
Spherical Faceplate
No Ion Trap
15-1/8" × 19-1/4" Screen Size

ELECTRICAL

Focusing Method	Electrostatic	
Deflection Angles (Approx.)		
Horizontal	80	Degrees
Vertical	65	Degrees
Diagonal	92	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
	1700 min.	μμf
Heater Current at 6.3 Volts	450 ± 5%	Ma.
Heater Warm-up Time (Note 1)	11	Seconds

OPTICAL

Phosphor Number	Aluminized P4	
Light Transmittance at Center, (Approx.)	78	Percent

MECHANICAL

Overall Length	18 ± 3/8	Inches
Greatest Dimensions of Tube:		
Diagonal	23-25/64 ± 1/8	Inches
Width	20-1/2 ± 1/8	Inches
Height	16-1/2 ± 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	J187C1	
Bulb Contact	J1-21	
Base	B6-203	
Basing	12L	
Weight	27	Pounds

RATINGS

Design Maximum System
Unless Otherwise Specified, Voltage Values are Positive and Measured with Respect to Grid 1.

Maximum Anode Voltage (Note 2)	22000	Volts
Minimum Anode Voltage (Note 2)	11000	Volts
Maximum Grid 4 Voltage	+1200 −400	Volts
Maximum Grid 2 Voltage	700	Volts
Cathode Voltage:		
Maximum Negative Bias Value	0	Volts
Maximum Negative Peak Value	2	Volts
Maximum Positive Bias Value	154	Volts
Maximum Positive Peak Value	220	Volts
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During warm-up period not to exceed 15 seconds	450	Volts
After Equipment Warm-up Period	200	Volts
Heater Positive with Respect to Cathode	200	Volts

TYPICAL OPERATING CONDITIONS

Cathode Drive Service
Unless otherwise specified, all voltage values are positive with respect to Grid 1.

Anode Voltage	16000	Volts DC
Grid 4 Voltage (Focusing Electrode)	0 to 400	Volts DC
Grid 2 Voltage (Note 3)	500	Volts DC
Cathode Voltage for Raster Cutoff	45 to 95	Volts DC

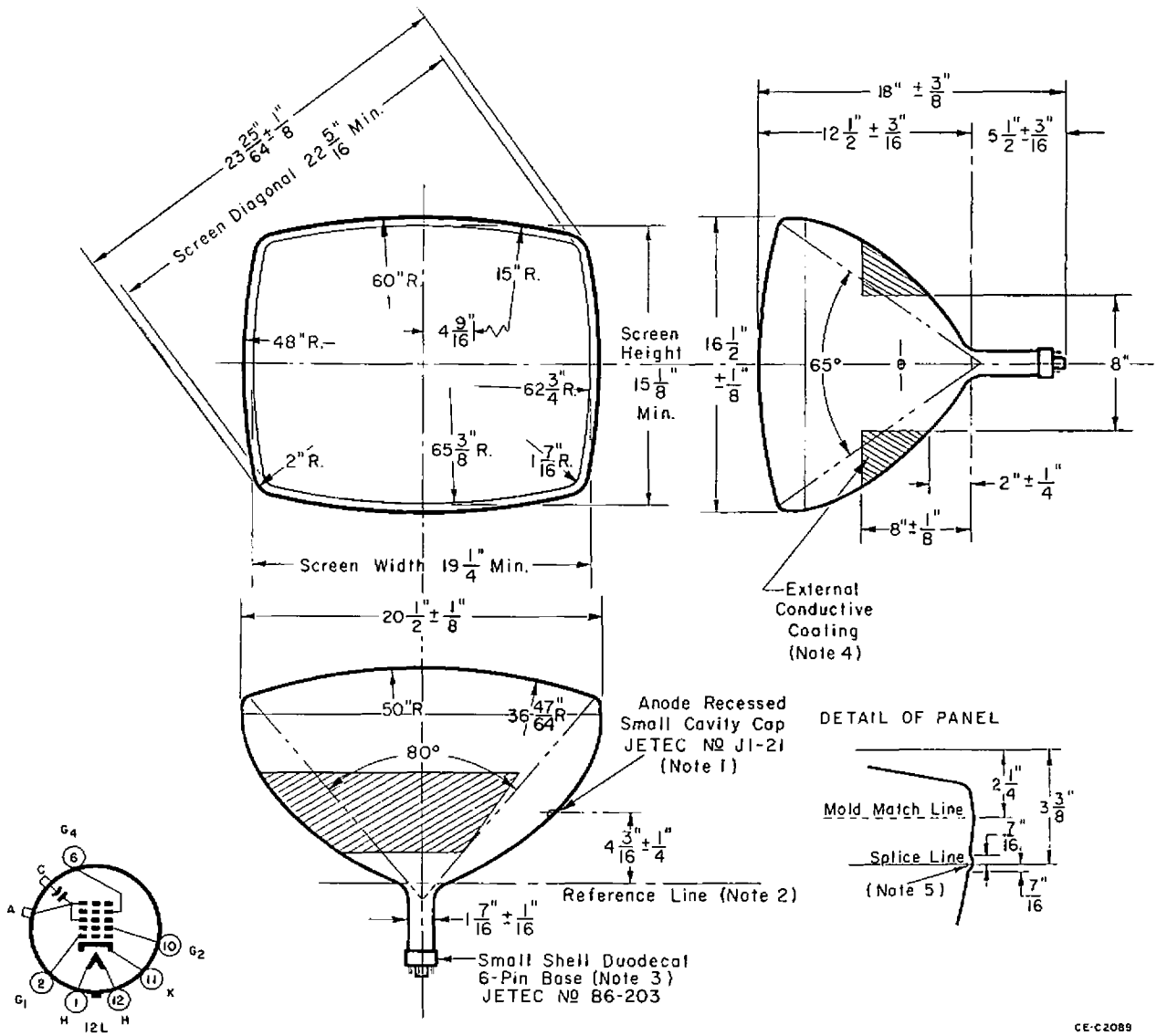
LIMITING CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5	Megohms
Minimum Grids 2 & 4 Circuit Resistance (Note 4)	.10000	Ohms

NOTES

1. Heater warm-up time is defined as the time required for the voltage across the heater to reach 80% 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 rated heater voltage divided by rated heater current.
2. Operation with voltages in excess of 16KV may require shielding to limit radiation of very soft x-rays. Brilliance and definition decrease with decreasing anode voltage. Operation with anode voltage less than 11000 volts is not recommended.
3. It is recommended that not less than 300 volts on grid 2 be used as resolution is affected at lower voltages.
4. Protective resistance in the grid 2 and grid 4 (focus electrode) circuit is advisable to prevent damage.

from JEDEC release #4627, March 9, 1964



1. Anode terminal alignment with pin 6 has angular tolerance about tube axis of ±30°.
2. Yoke Reference Line is determined by plane surface of flared end of JEDEC Reference-Line Gauge No. 116 when seated on funnel of tube. With a minimum neck length tube, the PM centering magnet (0 to 8 gauss) should extend no more than 2-3/4" from Yoke Reference Line.
3. Lateral strains on the base pins must be avoided. The socket should have flexible leads permitting free movement. The perimeter of the base wafer will be inside a 2-3/4" diameter circle concentric with tube axis.
4. External conductive coating forms supplementary filter capacitor and must be grounded.
5. Splice-line seal bulge may protrude a maximum of 1/16" from dimension surface at any point around the seal.

The information contained herein is supplied without assuming responsibility for infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Westinghouse Electric Corporation.

JOINT ELECTRON DEVICE ENGINEERING COUNCIL

JEDEC Type Administration Section
Electronic Industries Association
32 Green Street
Newark 2, New Jersey

Announcement

of

Electron Device Type Registration

Release No. 4650

March 30, 1964

E. I. A.
REGISTRATION
FILE

The Joint Electron Device Engineering Council announces the registration of the following electron device designations

23DVP4A *

23FWP4A **

according to the following on the application of

The Rauland Corporation
Chicago, Illinois

* The 23DVP4A is the same as the 23DVP4, as registered in Release No. 4232, dated April 22, 1963, except for the following:

No protective funnel coating

5/8" Wide tension band

Tension band seal: 1 1/4" Long x 1/4" (Seal position unchanged)

** The 23FWP4A is the same as the 23FWP4, as registered in Release No. 4597, dated February 17, 1964, except for the following:

5/8" Wide tension band

Tension band seal: 1 1/4" Long x 1/4" (Seal position unchanged)

THE Rauland CORPORATION
5600 WEST JARVIS AVENUE CHICAGO 48, ILLINOIS
TELEPHONE MULBERRY 5-5000
TELETYPE 312-265-1293

23ECP4

DESCRIPTION

23" Direct View	Bonded Implosion Panel
Rectangular Glass Envelope	92° Magnetic Deflection
Gray Filter Glass	Electrostatic Focus
Aluminized Screen	External Conductive Coating
6.3 Volts, 600 Ma. Heater	No Ion Trap
Cathode Drive Design	Low G_2 Voltage (35V)

SPECIAL CHARACTERISTICS-Anode Penetration Current 150 ua max. (Note 4)

ELECTRICAL DATA	
Focusing Method	Electrostatic
Deflection Angles (Approximate)	
Horizontal	81 Degrees
Vertical	66 Degrees
Diagonal	92 Degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approx)	5 uuf
Grid #1 to all other electrodes (approx)	6 uuf
External Conductive Coating to Anode	2,500 max. uuf 2,000 min. uuf
Heater Current at 6.3 Volts	600 ± 10% Ma.
Heater Warm-up Time	11 Seconds
OPTICAL DATA	
Phosphor Number	P4 Aluminized
Light Transmittance at Center (approx.)	46 Percent
MECHANICAL DATA	
Overall Length	18 5/16" ± 7/16"
Greatest Dimensions of Tube	
Diagonal	23 7/16" ± 1/8"
Width	20 1/2" ± 1/8"
Height	16 1/2" ± 1/8"
Minimum Useful Screen Dimensions (Projected)	
Diagonal	22 5/16"
Horizontal Axis	19 5/16"
Vertical Axis	15 1/4"
Area	282 Sq. Inches
Neck Length	5 5/8" ± 3/16"
Bulb	J187D1
Implosion Panel	FP187B2
Bulb Contact	J1-21
Base	B6-203
Basing	12L
Bulb Contact Alignment	
J1-21 contact aligns with pin position #6 ± 30 degrees	

RATINGS (Design Maximum System)
Unless otherwise specified, voltage values are positive and measured with respect to Grid #1

Maximum Anode Voltage	25,000 Volts
Minimum Anode Voltage	16,000 Volts
Maximum Grid #4 (Focusing Electrode) Voltage	+1100-500
Maximum Grid #2 Voltage	60 Volts
Minimum Grid #2 Voltage	25 Volts
Cathode Voltage	100 Volts
Maximum Heater Voltage	7 Volts
Minimum Heater Voltage	5.8 Volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During Warm-up time 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	20,000 Volts DC
Grid #4 (Focusing Electrode) voltage (Notes 2 and 3)	250 Volts DC
Grid #2 Voltage	35 Volts DC
Cathode Voltage (Note 1)	25 to 50 Volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 circuit resistance	1.5 Megohms

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 200 micro-amperes on a 19 5/16" 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.

4. This is the maximum beam current with 25,000 volts (design max.) applied to Anode, zero voltage applied to cathode, Grid #1, and Grid#2, all other elements to have nominal voltages.

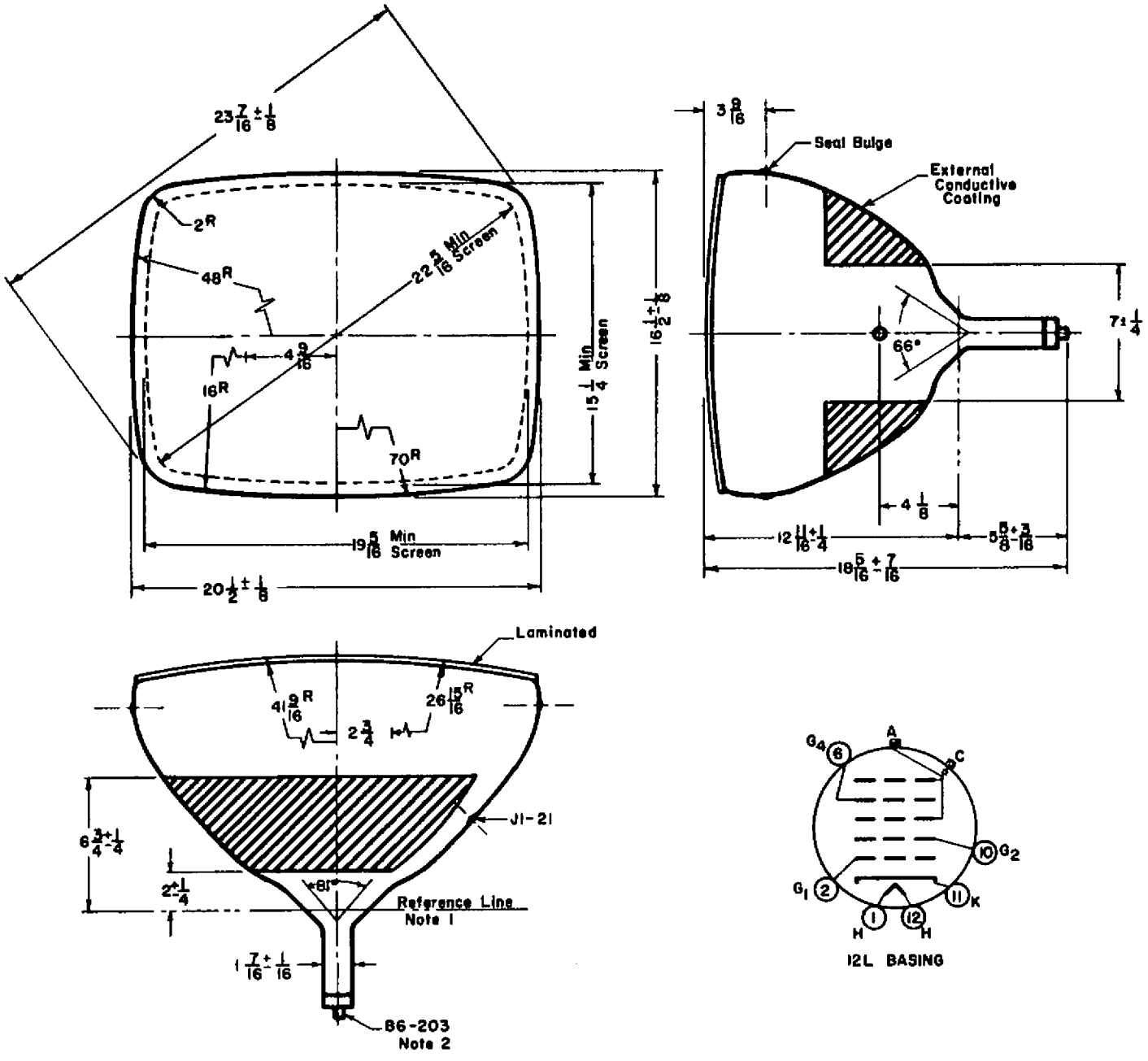
THE Rauland CORPORATION

5600 WEST JARVIS AVENUE CHICAGO 48, ILLINOIS

TELEPHONE MULBERRY 5-5000

TELETYPE 312-265-1293

23ECP4



NOTES:

1. Reference Line determined by Plane C-C' of J.E.D.E.C. Reference Line Gauge no. 116.
2. Base pin no. 6 aligns with anode contact within 30°.

THE Rauland CORPORATION
5600 WEST JARVIS AVENUE CHICAGO 48, ILLINOIS
TELEPHONE MULBERRY 5-5000
TELETYPE 312-265-1293

23EDP4

DESCRIPTION

23" Direct View	Bonded Implosion Panel
Rectangular Glass Envelope	92° Magnetic Deflection
Gray Filter Glass	Electrostatic Focus
Aluminized Screen	External Conductive Coating
6.3 Volts, 600 Ma. Heater	No Ion Trap

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angles (Approximate)	
Horizontal	81 Degrees
Vertical	66 Degrees
Diagonal	92 Degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approx.)	5 uuf
Grid #1 to all other electrodes (approx.)	6 uuf
External Conductive Coating to Anode	2,500 max. uuf 2,000 min. uuf
Heater Current at 6.3 volts	600+ 10% Ma
Heater Warm-up time	11 Seconds

OPTICAL DATA

Phosphor Number	P4 Aluminized'
Light Transmittance at Center (approx.)	46 Percent

MECHANICAL DATA

Overall Length	18 3/16 ± 7/16 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
Minimum Useful Screen Dimensions (Projected)	
Diagonal	22 5/16 inches
Horizontal Axis	19 5/16 inches
Vertical Axis	15 1/4 inches
Area	282 Sq. Inches
Neck Length	5 1/2 ± 3/16 inches
Bulb	J187D1
Implosion Panel	FP187B2
Bulb Contact	J1-21
Base	B6-203
Basing	12L
Bulb Contact Alignment	
J1-21 contact aligns with pin position #6 ± 30 degrees	

from JEDEC release #4821, Oct. 5, 1964

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	25,000 Volts
Minimum Anode Voltage	16,000 Volts
Maximum Grid #4 (Focusing Electrode) voltage	+1100-550
Maximum Grid #2 Voltage	550 Volts
Minimum Grid #2 Voltage	200 Volts
Grid #1 Voltage	
Maximum Negative Value	155 Volts DC
Maximum Negative Peak Value	200 Volts
Maximum Positive Value	0 Volts
Maximum Positive Peak Value	2 Volts
Maximum Heater Voltage	7 Volts
Minimum Heater Voltage	5.8 Volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up time no to exceed 15 seconds	450 Volts
After equipment warm-up period	200 Volts
Heater positive with respect to cathode	200 Volts

TYPICAL OPERATING CONDITIONS

GRID DRIVE SERVICE

Unless otherwise specified, all voltage values are positive with respect to cathode.

Anode Voltage	20,000 Volts DC
Grid #4 (Focusing Electrode) voltage (Notes 2 and 3)	250 Volts DC
Grid #2 Voltage	300 Volts DC
Grid #1 Voltage (Note 1)	-35 to -72 Volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 circuit resistance	1.5 Megohms

NOTES

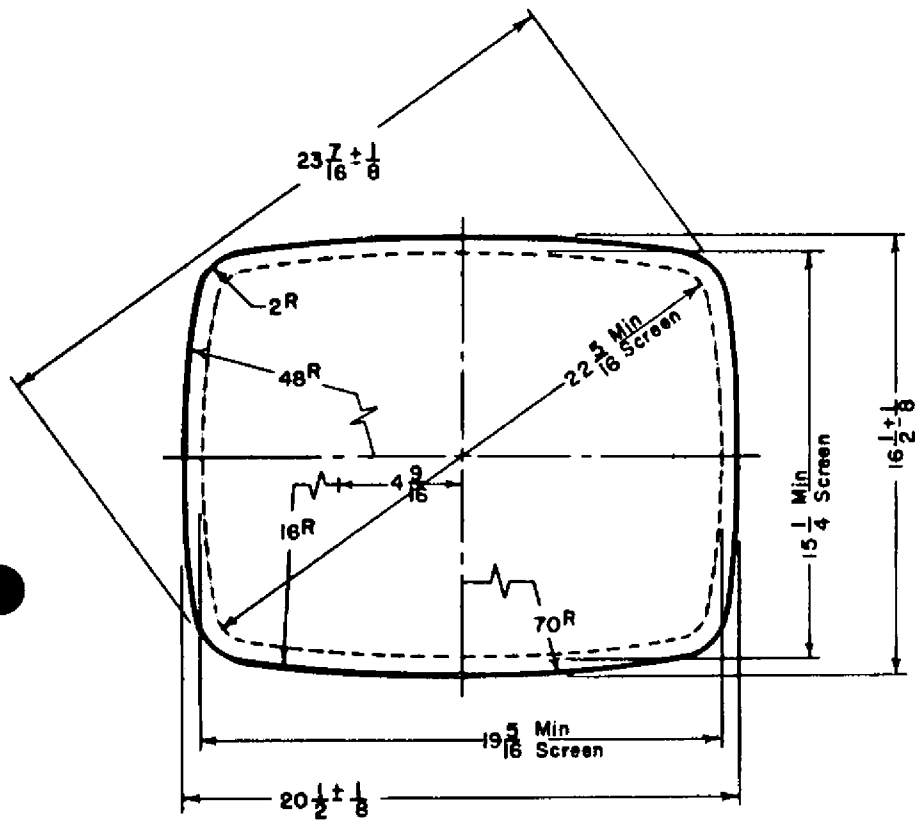
1. Visual extinction of focused raster.

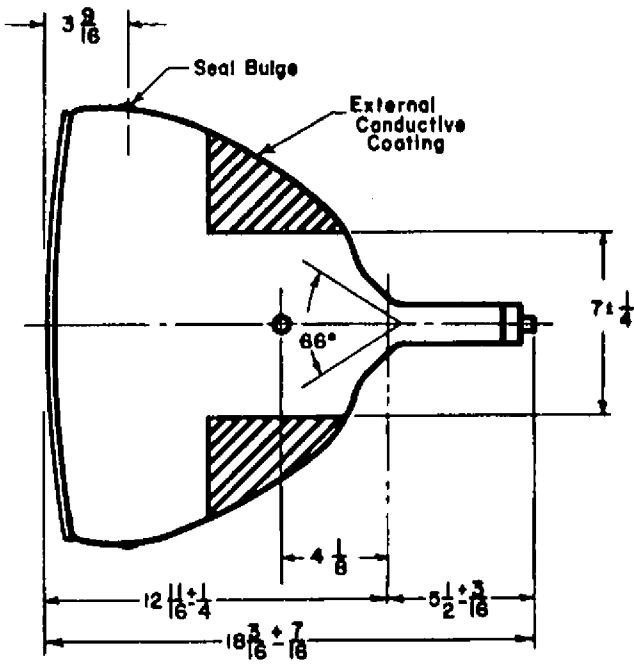
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 200 micro-amperes on a 19 5/16" x 15 1/4" pattern from RCA 2F21 Monoscope or equivalent.

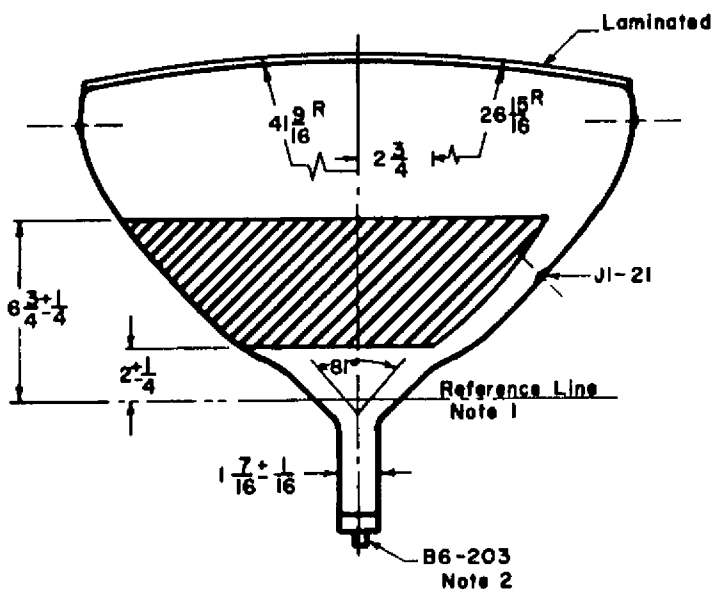
3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts

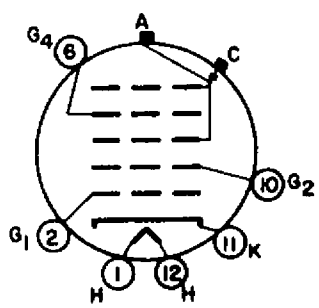
THE Rauland CORPORATION
5600 WEST JARVIS AVENUE CHICAGO 48, ILLINOIS
TELEPHONE MULBERRY 5-5000
TELETYPE 312-265-1293

23EDP4









12L BASING

NOTES:

1. Reference Line determined by Plane C-C' of J.E.D.E.C. Reference Line Gauge no. 116.
2. Base pin no. 6 aligns with anode contact within 30°

National Video Corporation

4300 W. 47TH STREET CHICAGO 32, ILLINOIS
CLIFFSIDE 4-5600

The 23EGP22 is a 23"-92° rectangular bonded picture tube used in color receivers. This tube has a 7 7/32" neck length and is capable of producing either a full color or black and white picture with a projected area of approximately 282 sq. in.

ELECTRICAL DATA

Electron Guns, Three	Red, Blue, Green
Heater Current at 6.3 Volts	1.35 amp
Focusing Method	Electrostatic
Focus Lens	Bipotential
Convergence Method	Magnetic
Deflection Method	Magnetic
Deflection Angles (Approx.)	
Diagonal	92 degrees
Horizontal	80 degrees
Vertical	68 degrees
Direct Interelectrode Capacitance (Approx.)	
Grid No. 1 of any gun to all other electrodes	16 pf
Cathodes of all guns (parallel connected) to all other electrodes	10 pf
Focusing Electrode (Grid No. 3) to all other electrodes	12 pf
External conductive coating to anode	2,500 pf max. 2,000 pf min.

OPTICAL DATA

Screen on Inner Surface of Faceplate:	
Type	Aluminized, Tricolor Phosphor Dot
Phosphor (three separate phosphors, collectively)	P-22 All Sulfide
Spacing between centers of adjacent dot trios (Approx.)	.028 inches

Light Transmission at Center (Approx.)	41 per cent
Antireflection Treatment	Yes

MECHANICAL DATA

Tube Dimensions:

Overall Length		19 31/32 ±1/4 inches
Neck Length		7 7/32 ±1/8 inches
Greatest Dimensions of Tube:		
Diagonal		23 11/32 +3/32 inches -1/8 inches
Width		20 1/2 ±1/8 inches
Height		16 1/2 ±1/8 inches
Useful Screen Dimensions (Projected)		
Diagonal		22 3/8 inches
Horizontal Axis		19 17/32 inches
Vertical Axis		15 3/8 inches
Area		282 sq. inches
Bulb:		
Funnel	JEDEC Designation	J 186 3/4-A1
Panel	JEDEC Designation	J 187-C1
Implosion Protection		Intergal Protective Window
Base	JEDEC Designation	B-12-245
Basing	JEDEC Designation	14 BE
Bulb Contact	JEDEC Designation	J1-21
Pin Position Alignment:		
Pin No. 9 aligns with anode bulb contact		10 ± degrees
Operating Position		Horizontal Blue Gun Uppermost

Maximum and Minimum Ratings, Design-Maximum Values:
Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	27,500 max. volts
	20,000 min. volts
Total Anode Current, Long-Term Average	1,250 max. ua
Focusing Electrode (Grid-No. 3) Voltage	6,000 max. volts
Peak Grid-No. 2 Voltage, Including Video Signal Voltage	650 max. volts
Grid-No. 1 Voltage:	
Negative bias value	400 max. volts
Negative operating cut-off value	175 max. volts

Positive bias value	0 max. volts
Positive peak value	2 max. volts
Heater Voltage (ac or dc)	6.9 max. volts 5.7 min. volts
Peak Heater-Cathode Voltage:	
Heater negative with respect to cathode:	
During equipment warm-up period not exceeding 15 seconds	450 max. volts
After equipment warm-up period	200 max. volts
Heater positive with respect to cathode	200 max. volts

Equipment Design Ranges:

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltage between 20,000 and 27,500 volts

Focusing Electrode (Grid-No. 3 Voltage)	16.7% to 21.6% of anode volts
Control Voltage for Visual Cut-off of Focused Raster	See CUT-OFF DESIGN CHART
Maximum Ratio of Spot Cut-off Voltages, Highest Gun to Lowest Gun in Any Tube (at $E_{c_2}k$ of 200 volts)	1.5
Focusing Electrode (Grid-No. 3) Current (Total)	-45 to +45 ua
Grid-No. 2 Current	-25 to +25 ua

To produce White of 9300°K ±27 M.P.C.D. (CIE Coordinates x = 0.281, y = 0.311):

	Red	Blue	Green	
Percentage of total anode current supplied by each gun	39	32	29	per cent

	Red to Green			Red to Blue		
	Min.	Ave.	Max.	Min.	Ave.	Max.
Ratio of cathode currents	.9	1.3	1.8	.8	1.2	1.7

Displacements, Measured at center of screen:

Raster displacement:	
Horizontal	-7/8 to +7/8 inch
Vertical	-7/8 to +7/8 inch
Beam trio displacement in any direction with respect to associated phosphor-dot trio	0 to .005 inch
Lateral convergence displacement of blue beam with respect to red and green beams	-1/4 to +1/4 inch
Radial convergence displacement excluding effects of dynamic convergence (each beam)	-5/8 to +5/8 inch

LIMITING CIRCUIT VALUES:

High Voltage Circuit (Note 1)
Low Voltage Circuit (Note 2)

DRAWINGS:

1. Cut-off design chart.

2. Tube outline with essential dimensions and tolerances

Pin Connections:

Pin 1	Heater
Pin 2	Cathode of Red Gun
Pin 3	Grid No. 1 of Red Gun
Pin 4	Grid No. 2 of Red Gun
Pin 5	Grid No. 2 of Green Gun
Pin 6	Cathode of Green Gun
Pin 7	Grid No. 1 of Green Gun
Pin 9	Grid No. 3
Pin 11	Cathode of Blue Gun
Pin 12	Grid No. 1 of Blue Gun
Pin 13	Grid No. 2 of Blue Gun
Pin 14	Heater
Bulb Contact	Ultor (Grid No. 4 and Grid No. 5)

NOTES:

1. High Voltage Circuits:

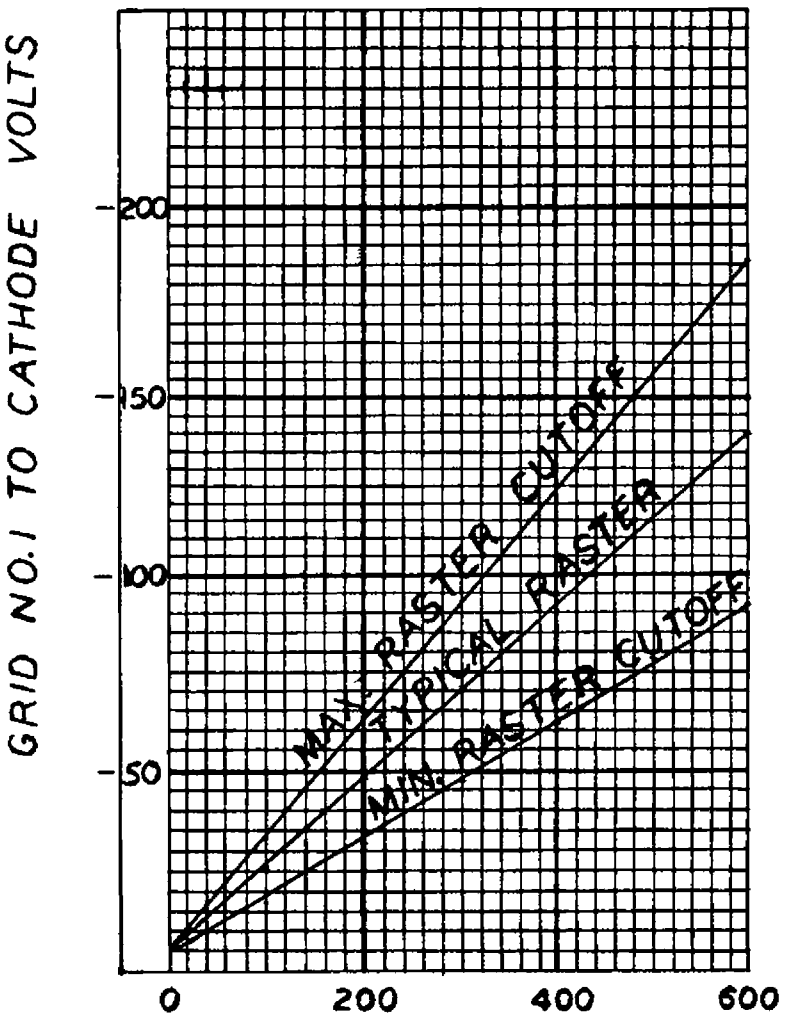
   To minimize possibility of damage from internal arc, it is recommended that high voltage and Grid No. 3 power supplies be of limited energy type.
   Grid No. 3 Circuit Resistance; (each gun) ..... 7.5 megohms, max.

2. Low Voltage Circuits:

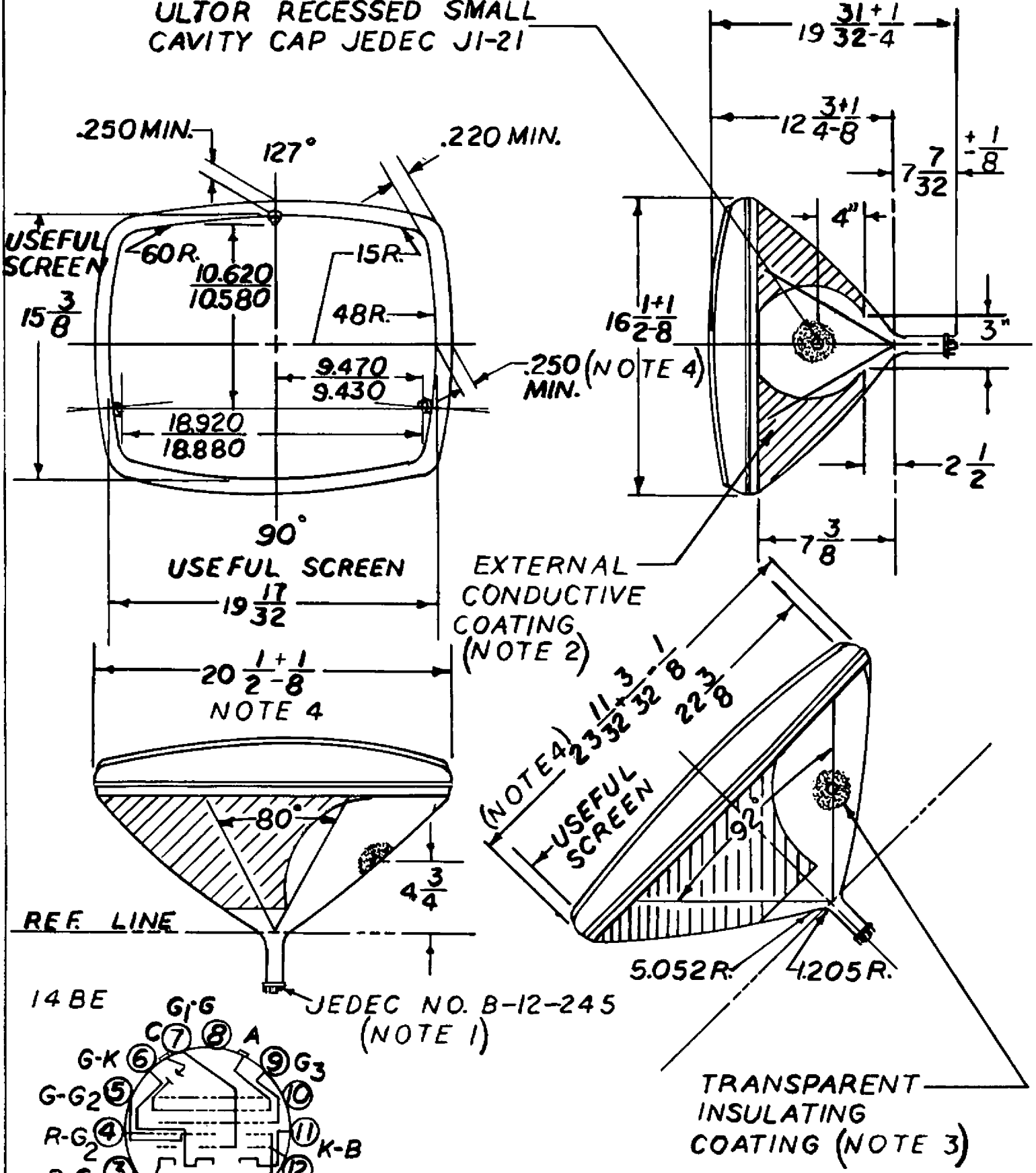
   Effective Grid No. 1 to Cathode
   Circuit Resistance (each gun) --- .75 megohms, max.

   The Grid No. 2 to heater circuit, the Grid No. 1 to heater circuit, and the cathode to heater circuit should each have an impedance such that their respective power sources in combination will not supply a continuous short circuit current in excess of 300 milliamperes total. This limitation will prevent heater burn-out in case of internal tube arc.

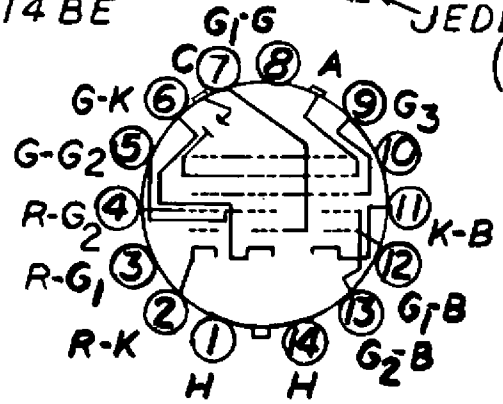
CUTOFF DESIGN CHART



ULTOR RECESSED SMALL CAVITY CAP JEDEC J1-21



14 BE



JEDEC NO. B-12-245 (NOTE 1)

DRAWN BY	SCALE	EFFECTIVE	DISTRIBUTION	DRAWING NO.
W.C. GRAF		4-16-64		23 EG P22

NOTES FOR DIMENSIONAL OUTLINE

1. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

2. External conductive coating must be grounded.

3. To clean this area, wipe only with soft dry lint-less cloth.

4. Measured at the mold-match line.

ELECTRONIC INDUSTRIES ASSOCIATION

2001 EYE STREET, N. W.
WASHINGTON, D. C. 20006

TELEPHONE: (202) 457-4900
CABLES: ELECTRON WASHINGTON DC

Announcement

of

Electron Device Type Registration

Release No. 4703C

October 3, 1978

E. I. A.
REGISTRATION
FILE

The Joint Electron Device Engineering Council announces the registration of the following electron device designation

23EGP22A

Type 23EGP22A is similar to type 23EGP22 as registered in Release No. 4703, dated May 18, 1964, except for the following:

1/ P22 rare earth (red) phosphor

2/ 1800 pt (min) external conductive coating compacitance

3/ Equipment Design Ranges:

To produce white of 9300°K +27 M.P.C.D. (CIE Coordinates $\bar{x}$ = 0.281, y = 0.311): Percentage of total anode current supplied by each gun

Red	Blue	Green
42%	25%	33%

Ratio fo cathode currents

Red to Green			Red to Blue		
Min.	Avg.	Max.	Min.	Avg.	Max.
1.0	1.3	1.8	1.0	1.7	2.0

4/ X-Radiation data not available.

from JEDEC release #4649, March 30, 1964

RCA-23EKP4

PAN-O-PLY

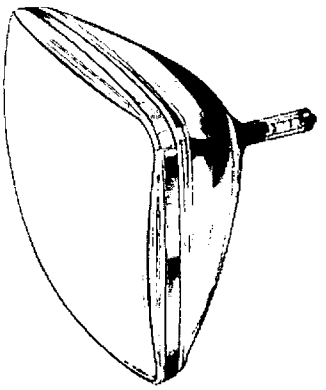
PICTURE TUBE

Initial Data

RCA-23EKP4 is a black-and-white pan-o-ply picture tube which eliminates the need for either an integral protective window or a separate safety-glass window and its companion dust seal in the receiver. As a result internal reflections are reduced, and picture contrast is improved. Integral implosion protection in the pan-o-ply picture tube is provided by means of a formed rim band and a welded tension band around the periphery of the tube panel. The 23EKP4 is a rectangular glass picture tube having an aluminized screen with nearly straight sides and slightly rounded corners.

Features of the 23EKP4 include:

- PAN-O-PLY—Integral Implosion Protection
- 92° Magnetic Deflection
- Low-Voltage Electrostatic Focus
- Aluminized Screen
- Electron Gun Requiring No Ion-Trap Magnet
- 18.375" Max. Overall Length
- 5.500" Neck Length
- 15.125" x 19.250" Screen
- 6.3 Volt/450 Ma Heater
- 25 kv Max. Anode Voltage



GENERAL DATA

Electrical:

Focusing Method	Electrostatic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Diagonal	92°	
Horizontal	80°	
Vertical	65°	
Direct Interelectrode Capacitances:		
Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode[a]	2500 max.	pf
	1700 min.	pf
Heater Current at 6.3 volts	450 ± 20	ma
Heater Warm-Up Time (Average)	11	seconds

Heater warm-up time is defined as the time required in the test circuit shown in *Fig.1* for the voltage (E) across the heater terminals to increase from zero to 0.8 of rated heater voltage.

Electron Gun . . . . Type Requiring No Ion-Trap Magnet

Optical:

Phosphor . . . . . P4—Sulfide Type, Aluminized
Faceplate . . . . . Filterglass
Light Transmission at Center (Approx.) 42%

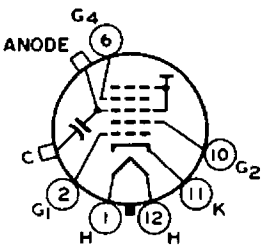
Mechanical:

Weight (Approx.) . . . . . 29 lbs

Tube Dimensions:

Overall length	18.000" ± .375"
Neck length	5.500" ± .188"
Diagonal	23.500" ± .125"
Greatest width	20.650" ± .125"
Greatest height	16.650" ± .125"
Minimum Screen Dimensions (Projected):	
Diagonal	22.312"
Greatest width	19.250"
Greatest height	15.125"
Area	282 sq. in.
Bulb Designation	J187 J
Cap Designation	Recessed Small Cavity (JEDEC No.J1-21)
Base Designation	Short Small-Shell Duodecal 6-Pin, (JEDEC Group 4, No.B6-203)
Basing Designation	12L

Pin 1: Heater
Pin 2: Grid No.1
Pin 6: Grid No.4
Pin 10: Grid No.2
Pin 11: Cathode
Pin 12: Heater
Cap: Anode (Grid No.3, Grid No.5, Screen, Collector)
C: External Conductive Coating



BOTTOM VIEW

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

Trademark(s) ® Registered
Marca(s) Registrada(s)

Maximum and Minimum Ratings, *Design-Maximum Values:*[b]

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	25,000 max.	volts
	11,000 min.	volts
Grid-No. 4 Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No. 2 Voltage	550 max.	volts
	200 min.	volts
Grid-No. 1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage[c]	6.9 max.	volts
	5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC & DC Voltage	200 max.	volts
DC Component	100 max.	volts

Typical Operating Conditions for Cathode-Drive[d] Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	20,000	volts
Grid-No. 4 Voltage[e]	200	volts
Grid-No. 2 Voltage	400	volts
Cathode Voltage for visual extinction of focused raster (See *Fig. 2*)	36 to 78	volts
Field Strength of required adjustable Centering Magnet[f]	0 to 12	gauss

Maximum Circuit Value:

Grid-No. 1 Circuit Resistance	1.5 max.	megohms

---

[a] Includes implosion protection hardware.

[b] The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Design-Maximum Rating System* for rating electron tubes.

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.

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

[c] Measured between the heater terminals.

[d] Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No. 1 and the other electrodes.

[e] The grid-No. 4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No. 1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

[f] Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4 inches. The specified centering magnet compensates only for the effect which mechanical tube tolerances may have on the location of the undeflected, focused spot with respect to the center of the tube face. Maximum field strength of the adjustable centering magnet equals

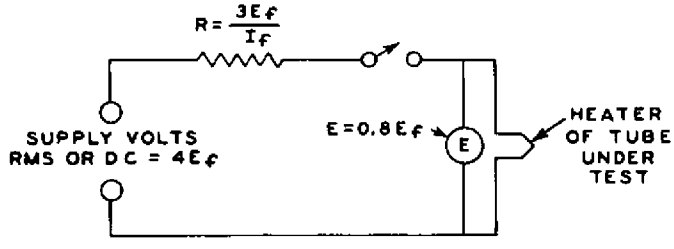
$$\sqrt{\frac{\text{Anode volts}}{16000 \text{ volts}}} \times 10 \text{ gauss}$$

The equipment manufacturer must determine and supply additional compensation for the effects of the earth's magnetic field and extraneous fields due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

OPERATING CONSIDERATIONS

X-Radiation Warning. When operated at anode voltages up to 16 kilovolts, this picture tube does not produce any harmful X-radiation. However, because the rating of this type permits operation at voltages as high as 25 kilovolts (design-maximum value), shielding of the tube for X-radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

TEST CIRCUIT FOR DETERMINING HEATER WARM-UP TIME



Ef = RATED HEATER VOLTAGE OF TUBE UNDER TEST.
If = RATED HEATER CURRENT OF TUBE UNDER TEST.
92CS-8503

Fig. 1

Information furnished by RCA is believed to be accurate and reliable. However, no responsibility is assumed by RCA for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of RCA.

RASTER CUTOFF CHART

For Cathode-Drive Service

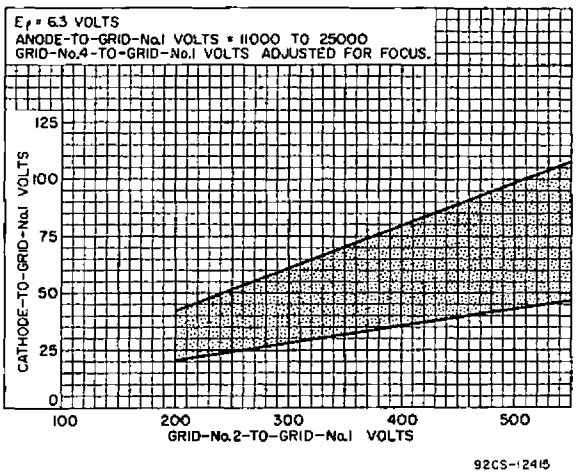
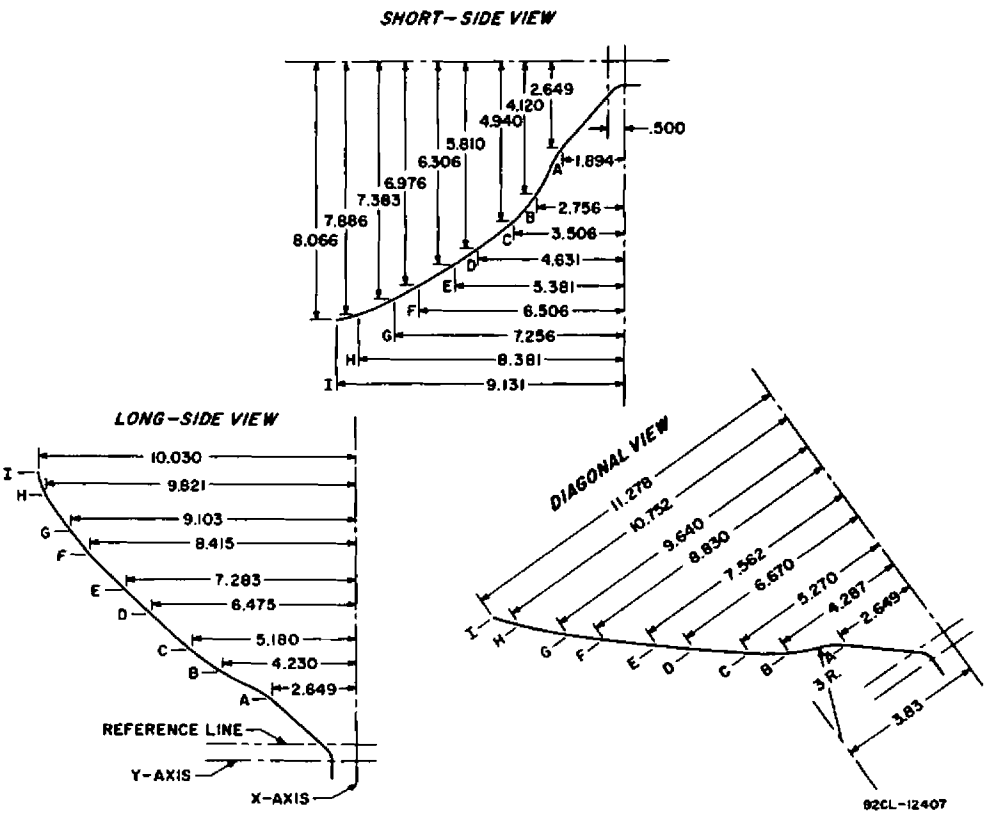


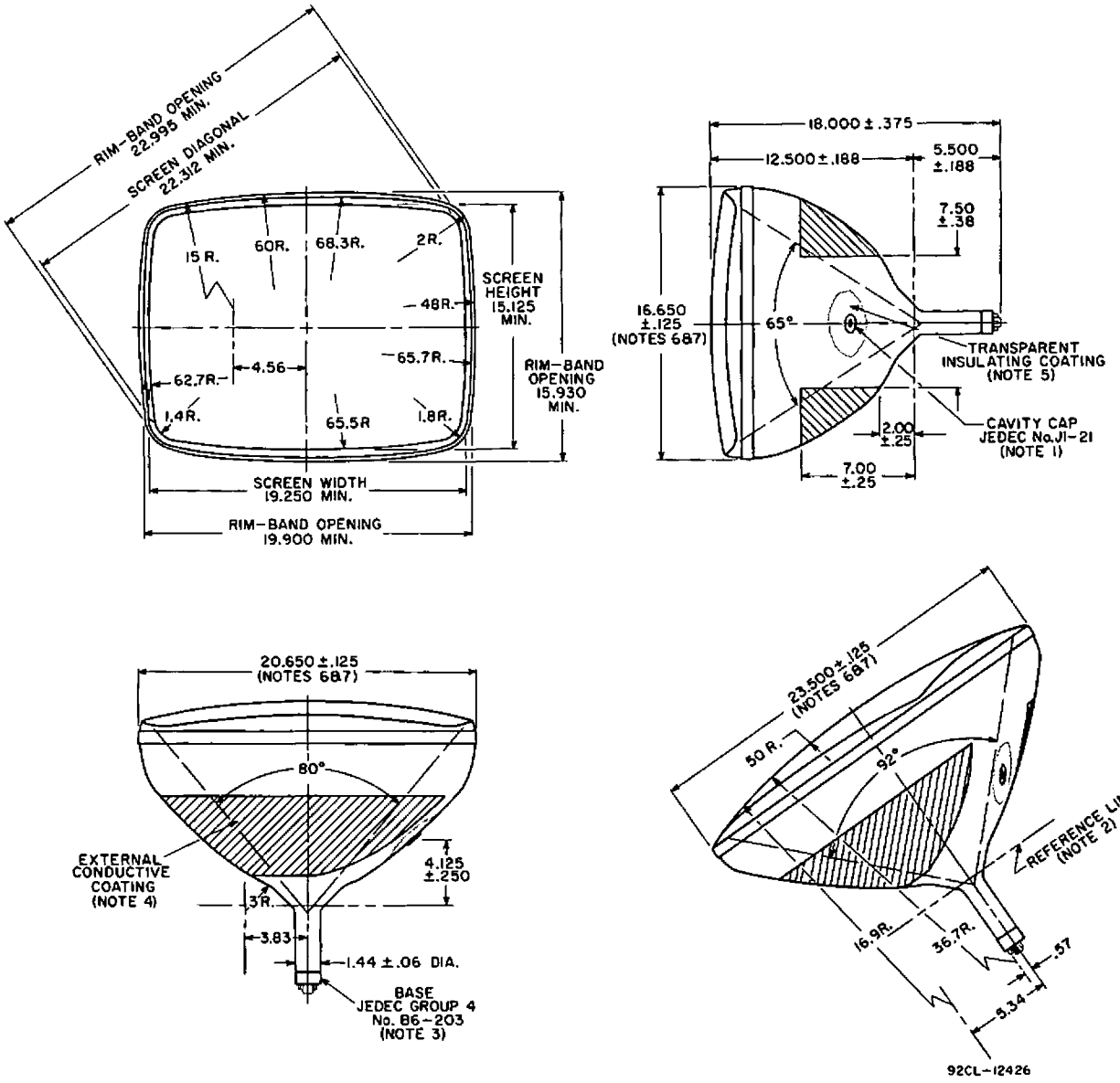
Fig. 2

BULB-CONTOUR DIMENSIONS

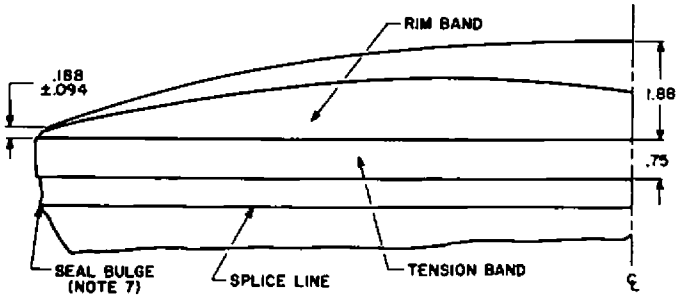


PLANES A THROUGH I ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE Y AXIS. THESE COORDINATES DESCRIBE THE BOGIE BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.

DIMENSIONAL OUTLINE



DETAIL OF PANEL
(Diagonal View)



DIMENSIONS IN INCHES

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN No.6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ±30°. ANODE TERMINAL IS ON SAME SIDE AS PIN No.6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No.G-116 AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING AND IMPLOSION PROTECTION HARDWARE MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: MEASURED FROM THE TENSION BAND.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8".

This bulletin also applies to RCA-23FBP4 which is identical with RCA-23ENP4 except for its faceplate which is treated to reduce specular reflection.

23FBP4

from JEDEC release #4649, March 30, 1964

RCA-23ENP4

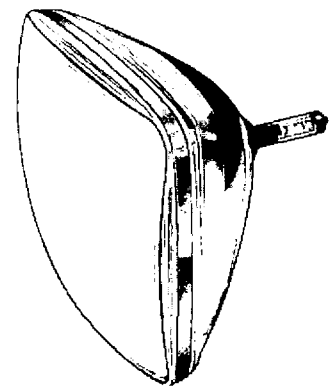
PAN-O-PLY PICTURE TUBE

Initial Data

RCA-23ENP4 is a black-and-white pan-o-ply picture tube which eliminates the need for either an integral protective window or a separate safety-glass window and its companion dust seal in the receiver. As a result internal reflections are reduced, and picture contrast is improved. Integral implosion protection in the pan-o-ply picture tube is provided by means of a formed rim band and a welded tension band around the periphery of the tube panel. The 23ENP4 is a rectangular glass picture tube having an aluminized screen with nearly straight sides and slightly rounded corners.

Features of the 23ENP4 include:

- PAN-O-PLY—Integral Implosion Protection
- 92° Magnetic Deflection
- Low-Voltage Electrostatic Focus
- Aluminized Screen
- Electron Gun Requiring No Ion-Trap Magnet
- 18.500" Max. Overall Length
- 5.625" Neck Length
- 15.125" x 19.250" Screen
- 6.3 Volt/600 Ma Heater
- Low Grid-No.2 Voltage—
  For Cathode-Drive Service
- 25 kv Max. Anode Voltage



GENERAL DATA

Electrical:

Focusing Method	Electrostatic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Diagonal	92°	
Horizontal	80°	
Vertical	65°	
Direct Interelectrode Capacitances:		
Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode[a]	2500 max. / 1700 min.	pf / pf
Heater Current at 6.3 volts	600 ± 30	ma
Heater Warm-Up Time (Average)	11	seconds

Heater warm-up time is defined as the time required in the test circuit shown in *Fig.1* for the voltage (E) across the heater terminals to increase from zero to 0.8 of rated heater voltage.

Electron Gun . . . . Type Requiring No Ion-Trap Magnet

Optical:

Phosphor . . . . . P4—Sulfide Type, Aluminized
Faceplate . . . . . Filterglass
Light transmission at center (Approx.) 42%

Mechanical:

Weight (Approx.) . . . . . 29 lbs

Tube Dimensions:

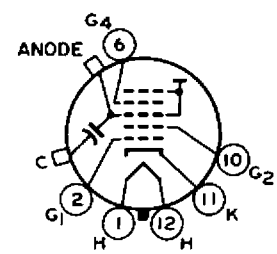
Overall length	18.125" ± .375"
Neck length	5.625" ± .188"
Diagonal	23.500" ± .125"
Greatest width	20.650" ± .125"
Greatest height	16.650" ± .125"

Minimum Screen Dimensions (Projected):

Diagonal	22.312"
Greatest width	19.250"
Greatest height	15.125"
Area	282 sq. in.

Bulb Designation . . . . . J187 J
Cap Designation . . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base Designation . . . . . Short Small-Shell Duodecal 6-Pin, (JEDEC Group 4, No.B6-203)
Basing Designation 12L

Pin 1: Heater
Pin 2: Grid No.1
Pin 6: Grid No.4
Pin 10: Grid No.2
Pin 11: Cathode
Pin 12: Heater
Cap: Anode (Grid No.3, Grid No.5, Screen, Collector)
C: External Conductive Coating



BOTTOM VIEW

Maximum and Minimum Ratings, *Design-Maximum Values:*[b]

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	25,000 max.	volts
	11,000 min.	volts
Grid-No.4 Voltage:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
Grid-No.2 Voltage	70 max.	volts
	40 min.	volts
Cathode Voltage:		
Negative peak value	2 max.	volts
Negative bias value	0 max.	volts
Positive bias value	100 max.	volts
Positive peak value	150 max.	volts
Heater Voltage[c]	6.9 max.	volts
	5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max.	volts
DC Component	100 max.	volts

Typical Operating Conditions for Cathode-Drive[d] Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	20,000	volts
Grid-No.4 Voltage[e]	200	volts
Grid-No.2 Voltage	50	volts
Cathode Voltage for visual extinction of focused raster (See *Fig.2*)	36 to 54	volts
Field Strength of required adjustable Centering Magnet[f]	0 to 12	gauss

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max.	megohms

[a] Includes implosion protection hardware.

[b] The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Design-Maximum Rating System* for rating electron tubes.

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.

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

[c] Measured between the heater terminals.

[d] Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

[e] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

[f] Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4 inches. The specified centering magnet compensates only for the effect which mechanical tube tolerances may have on the location of the undeflected, focused spot with respect to the center of the tube face. Maximum field strength of adjustable centering magnet equals

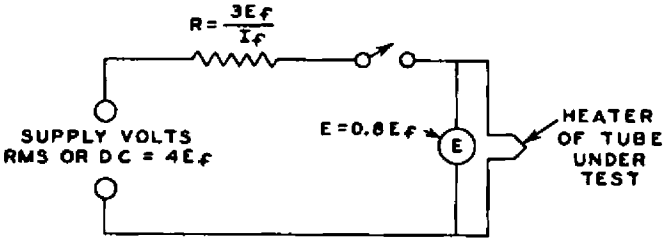
$$\sqrt{\frac{\text{Anode volts}}{16000 \text{ volts}}} \times 10 \text{ gauss}$$

The equipment manufacturer must determine and supply additional compensation for the effects of the earth's magnetic field and extraneous fields due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

OPERATING CONSIDERATIONS

X-Radiation Warning. When operated at anode voltages up to 16 kilovolts, this picture tube does not produce any harmful X-radiation. However, because the rating of this type permits operation at voltages as high as 25 kilovolts (design-maximum value), shielding of the tube for X-radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

TEST CIRCUIT FOR DETERMINING HEATER WARM-UP TIME



Ef = RATED HEATER VOLTAGE OF TUBE UNDER TEST.
If = RATED HEATER CURRENT OF TUBE UNDER TEST.
92CS-8503

Fig.1

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RASTER CUTOFF CHART

For Cathode-Drive Service

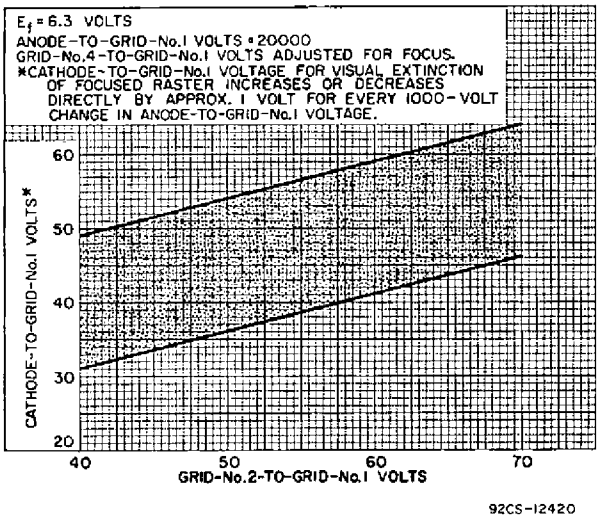
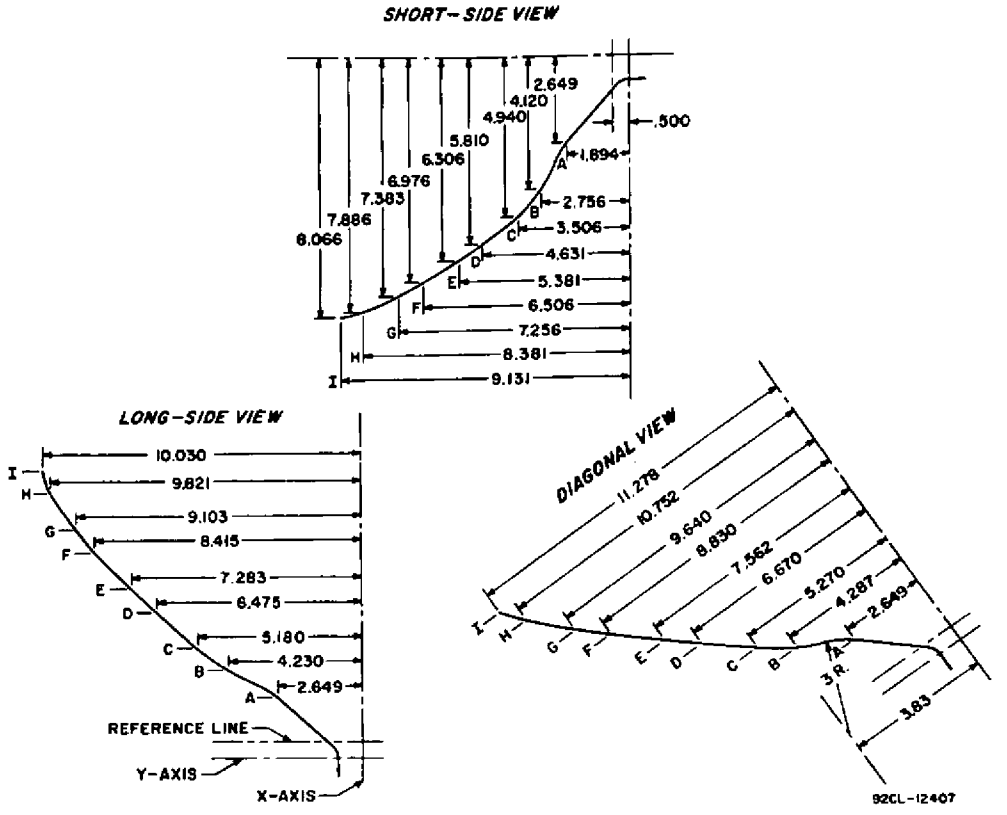


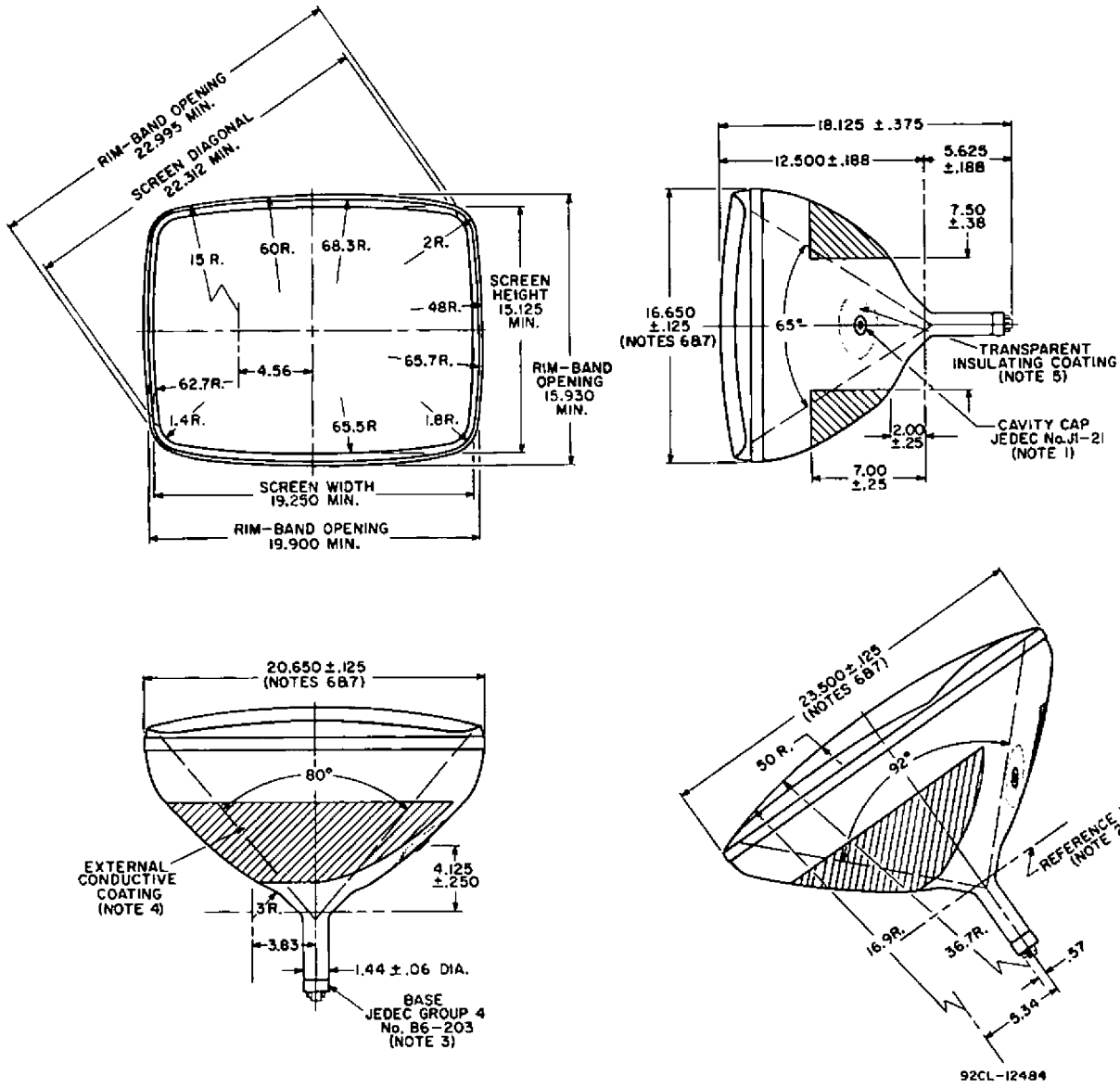
Fig.2

BULB-CONTOUR DIMENSIONS

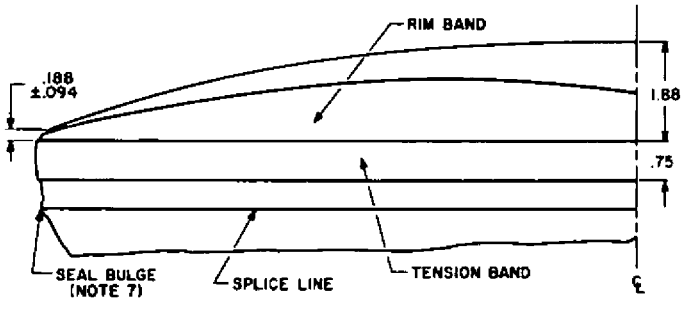


PLANES A THROUGH I ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE Y AXIS. THESE COORDINATES DESCRIBE THE BOGIE BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.

DIMENSIONAL OUTLINE



DETAIL OF PANEL
(Diagonal View)



DIMENSIONS IN INCHES

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN No.6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ±30°. ANODE TERMINAL IS ON SAME SIDE AS PIN No.6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No.G-116 AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING AND IMPLOSION PROTECTION HARDWARE MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: MEASURED FROM THE TENSION BAND.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8".

from JEDEC release #4649, March 30, 1964

RCA-23EQP4

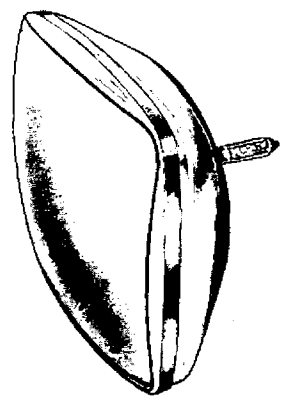
PAN-O-PLY
PICTURE TUBE

Initial Data

RCA-23EQP4 is a black-and-white pan-o-ply picture tube which eliminates the need for either an integral protective window or a separate safety-glass window and its companion dust seal in the receiver. As a result internal reflections are reduced, and picture contrast is improved. Integral implosion protection in the pan-o-ply picture tube is provided by means of a formed rim band and a welded tension band around the periphery of the tube panel. The 23EQP4 is a rectangular glass picture tube having an aluminized screen with nearly straight sides and slightly rounded corners.

Features of the 23EQP4 include:

- PAN-O-PLY—Integral Implosion Protection
- 114° Magnetic Deflection
- Low-Voltage Electrostatic Focus
- Aluminized Screen
- Electron Gun Requiring No Ion-Trap Magnet
- 14.812" Max. Overall Length
- 5.125" Neck Length
- 15.125" x 19.250" Screen
- 6.3 Volt/450 Ma Heater
- 23 kv Max. Anode Voltage



GENERAL DATA

Electrical:

Focusing Method	Electrostatic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Diagonal	114°	
Horizontal	102°	
Vertical	85°	
Direct Interelectrode Capacitances:		
Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode[a]	2500 max.	pf
	1700 min.	pf
Heater Current at 6.3 volts	450 ± 20	ma
Heater Warm-Up Time (Average)	11	seconds

Heater warm-up time is defined as the time required in the test circuit shown in *Fig.1* for the voltage (E) across the heater terminals to increase from zero to 0.8 of rated heater voltage.

Electron Gun. . . . .Type Requiring No Ion-Trap Magnet

Optical:

Phosphor. . . . . P4—Sulfide Type, Aluminized
Faceplate . . . . . .Filterglass
Light Transmission at Center (Approx.). 42%

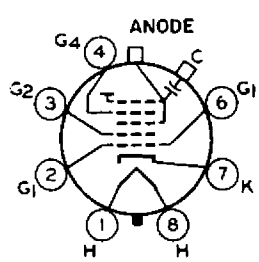
Mechanical:

Weight (Approx.). . . . . 28 lbs

Tube Dimensions:

Overall length	14.531" ± .281"
Neck length	5.125" ± .125"
Diagonal	23.500" ± .125"
Greatest width	20.650" ± .125"
Greatest height	16.650" ± .125"
Minimum Screen Dimensions (Projected):	
Diagonal	22.312"
Greatest width	19.250"
Greatest height	15.125"
Area	282 sq. in.
Bulb Designation	J187 L
Cap Designation	Recessed Small Cavity (JEDEC No.J1-21)
Base Designation	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation	8HR

Pin 1: Heater
Pin 2: Grid No.1
Pin 3: Grid No.2
Pin 4: Grid No.4
Pin 6: Grid No.1
Pin 7: Cathode
Pin 8: Heater
Cap: Anode(Grid No.3, Grid No.5, Screen, Collector)
C: External Conductive Coating



BOTTOM VIEW

Maximum and Minimum Ratings, *Design-Maximum Values:*[b]

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	23,000 max.	volts
	11,000 min.	volts
Grid-No.4 Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	550 max.	volts
	200 min.	volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage[c]	6.9 max.	volts
	5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC & DC Voltage	200 max.	volts
DC Component	100 max.	volts

Typical Operating Conditions for Cathode-Drive[d] Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	18,000	volts
Grid-No.4 Voltage[e]	200	volts
Grid-No.2 Voltage	300	volts
Cathode Voltage for visual extinction of focused raster (See *Fig.2*)	28 to 62	volts
Field Strength of required adjustable Centering Magnet[f]	0 to 12	gauss
Maximum Circuit Value:		
Grid-No.1 Circuit Resistance	1.5 max.	megohms

[a] Includes implosion protection hardware.

[b] The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Design-Maximum Rating System* for rating electron tubes.

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.

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

[c] Measured between the heater terminals.

[d] Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

[e] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

[f] Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4 inches. The specified centering magnet compensates only for the effect which mechanical tube tolerances may have on the location of the undeflected, focused spot with respect to the center of the tube face. Maximum field strength of adjustable centering magnet equals

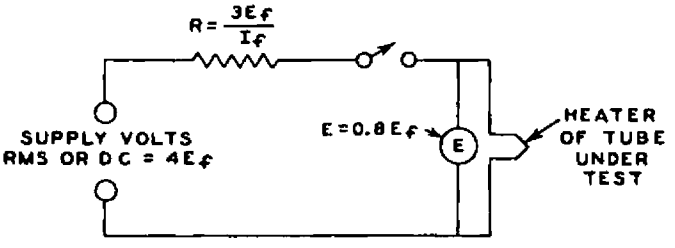
$$\sqrt{\frac{\text{Anode volts}}{16000 \text{ volts}}} \times 10 \text{ gauss}$$

The equipment manufacturer must determine and supply additional compensation for the effects of the earth's magnetic field and extraneous fields due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

OPERATING CONSIDERATIONS

X-Radiation Warning. When operated at anode voltages up to 16 kilovolts, this picture tube does not produce any harmful X-radiation. However, because the rating of this type permits operation at voltages as high as 23 kilovolts (design-maximum value), shielding of the tube for X-radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

TEST CIRCUIT FOR DETERMINING HEATER WARM-UP TIME



Ef = RATED HEATER VOLTAGE OF TUBE UNDER TEST.
If = RATED HEATER CURRENT OF TUBE UNDER TEST.
92CS-8503

Fig. 1

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RASTER CUTOFF CHART

For Cathode-Drive Service

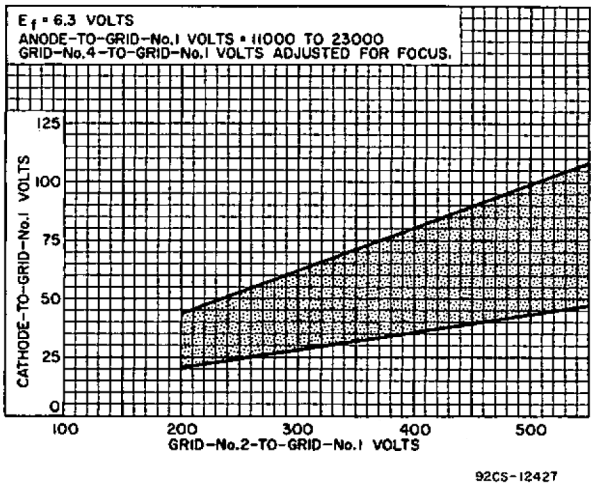
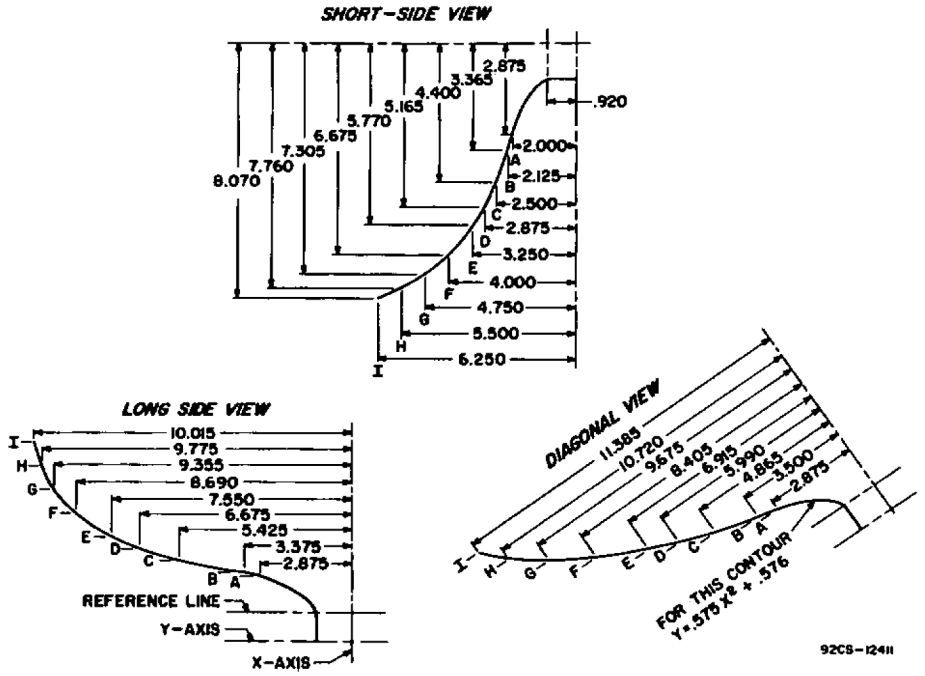


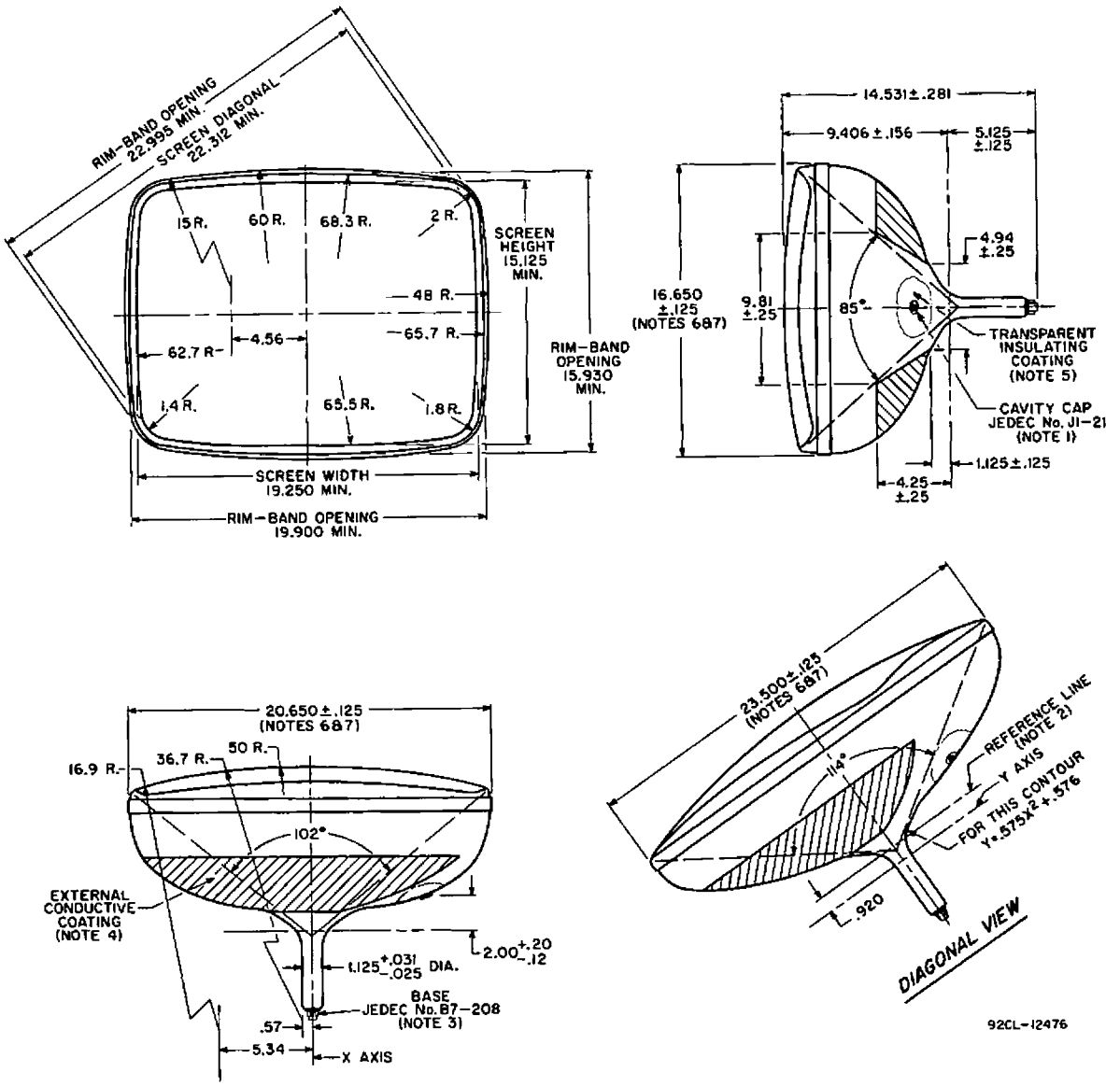
Fig.2

BULB-CONTOUR DIMENSIONS

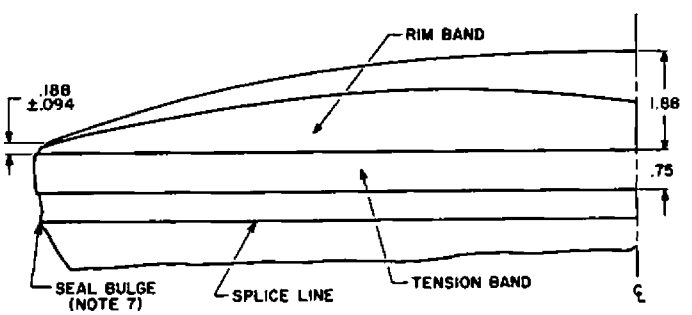


PLANES A THROUGH I ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE Y AXIS. THESE COORDINATES DESCRIBE THE BOGIE BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.

DIMENSIONAL OUTLINE



DETAIL OF PANEL
(Diagonal View)



DIMENSIONS IN INCHES

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN No.4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ±30°. ANODE TERMINAL IS ON SAME SIDE AS PIN No.4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-126 AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING AND IMPLOSION PROTECTION HARDWARE MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: MEASURED FROM THE TENSION BAND.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8".

This bulletin also applies to RCA-23FMP4 which is identical with RCA-23ETP4 except for its heater current rating of 450 ± 20 ma.

23FMP4

RCA-23ETP4
PAN-O-PLY
PICTURE TUBE

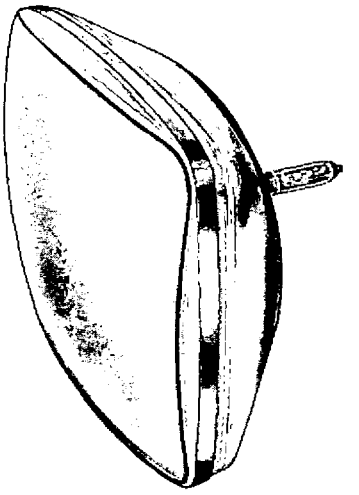
from JEDEC release #4668, April 13, 1964

Initial Data

RCA-23ETP4 is a black-and-white pan-o-ply picture tube which eliminates the need for either an integral protective window or a separate safety-glass window and its companion dust seal in the receiver. As a result internal reflections are reduced, and picture contrast is improved. Integral implosion protection in the pan-o-ply picture tube is provided by means of a formed rim band and a welded tension band around the periphery of the tube panel. The 23ETP4 is a rectangular glass picture tube having an aluminized screen with nearly straight sides and slightly rounded corners.

Features of the 23ETP4 include:

- PAN-O-PLY—Integral Implosion Protection
- 110° Magnetic Deflection
- Low-Voltage Electrostatic Focus
- Aluminized Screen
- Electron Gun Requiring No Ion-Trap Magnet
- 15.156" Max. Overall Length
- 5.125" Neck Length
- 15.125" x 19.250" Screen
- 6.3 Volt/600 Ma Heater
- 23 kv Max. Anode Voltage



GENERAL DATA

Electrical:

Focusing Method	Electrostatic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Diagonal	110°	
Horizontal	99°	
Vertical	82°	
Direct Interelectrode Capacitances:		
Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode[a]	2500 max. / 1700 min.	pf
Heater Current at 6.3 volts	600 ± 30	ma
Heater Warm-Up Time (Average)	11	seconds

Heater warm-up time is defined as the time required in the test circuit shown in *Fig.1* for the voltage (E) across the heater terminals to increase from zero to 0.8 of rated heater voltage.

Electron Gun. . . . .Type Requiring No Ion-Trap Magnet

Optical:

Phosphor. . . . . P4—Sulfide Type, Aluminized
Faceplate . . . . . .Filterglass
Light Transmission at Center (Approx.). 42%

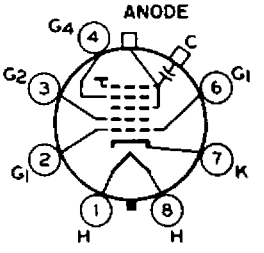
Mechanical:

Weight (Approx.). . . . . 28 lbs

Tube Dimensions:

Overall length	14.875" ± .281"
Neck length	5.125" ± .125"
Diagonal	23.500" ± .125"
Greatest width	20.650" ± .125"
Greatest height	16.650" ± .125"
Minimum Screen Dimensions (Projected):	
Diagonal	22.312"
Greatest width	19.250"
Greatest height	15.125"
Area	282 sq. in.
Bulb Designation	J187 K
Cap Designation	Recessed Small Cavity (JEDEC No.J1-21)
Base Designation	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation	8HR

Pin 1: Heater
Pin 2: Grid No.1
Pin 3: Grid No.2
Pin 4: Grid No.4
Pin 6: Grid No.1
Pin 7: Cathode
Pin 8: Heater
Cap: Anode (Grid No.3, Grid No.5, Screen, Collector)
C: External Conductive Coating



BOTTOM VIEW

Maximum and Minimum Ratings, *Design-Maximum Values:*[b]

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	23,000 max.	volts
	11,000 min.	volts
Grid-No.4 Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	550 max.	volts
	200 min.	volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage[c]	6.9 max.	volts
	5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC & DC Voltage	200 max.	volts
DC Component	100 max.	volts

Typical Operating Conditions for Cathode-Drive[d] Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	18,000	volts
Grid-No.4 Voltage[e]	200	volts
Grid-No.2 Voltage	300	volts
Cathode Voltage for visual extinction of focused raster (See *Fig.2*)	28 to 62	volts
Field Strength of required adjustable Centering Magnet[f]	0 to 12	gauss

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max.	megohms

---

[a] Includes implosion protection hardware.

[b] The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Design-Maximum Rating System* for rating electron tubes.

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.

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

[c] Measured between the heater terminals.

[d] Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

[e] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

[f] Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4 inches. The specified centering magnet compensates only for the effect which mechanical tube tolerances may have on the location of the undeflected, focused spot with respect to the center of the tube face. Maximum field strength of adjustable centering magnet equals

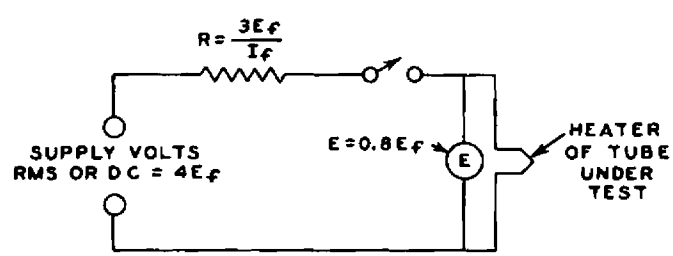
$$\sqrt{\frac{\text{Anode volts}}{16000 \text{ volts}}} \times 10 \text{ gauss}$$

The equipment manufacturer must determine and supply additional compensation for the effects of the earth's magnetic field and extraneous fields due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

OPERATING CONSIDERATIONS

X-Radiation Warning. When operated at anode voltages up to 16 kilovolts, this picture tube does not produce any harmful X-radiation. However, because the rating of this type permits operation at voltages as high as 23 kilovolts (design-maximum value), shielding of the tube for X-radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

TEST CIRCUIT FOR DETERMINING HEATER WARM-UP TIME



Ef = RATED HEATER VOLTAGE OF TUBE UNDER TEST.
If = RATED HEATER CURRENT OF TUBE UNDER TEST.
92CS-8503

Fig.1

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RASTER CUTOFF CHART

For Cathode-Drive Service

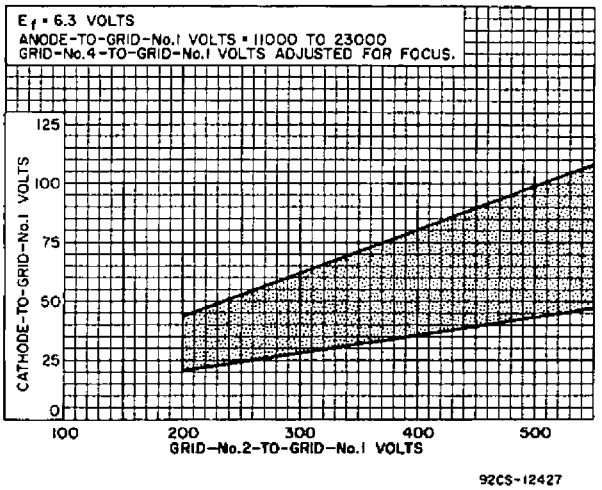
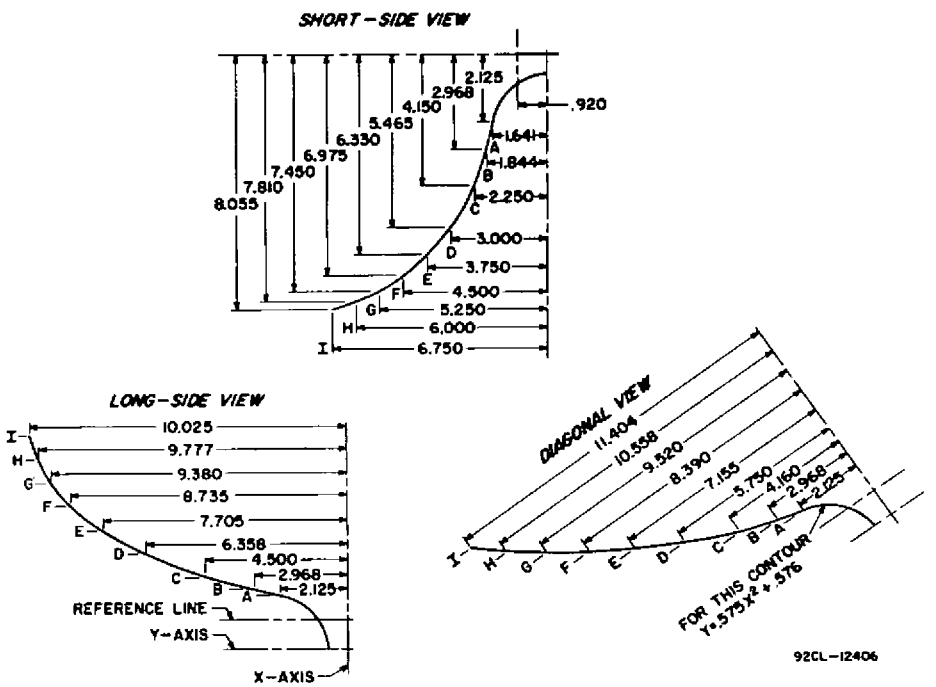


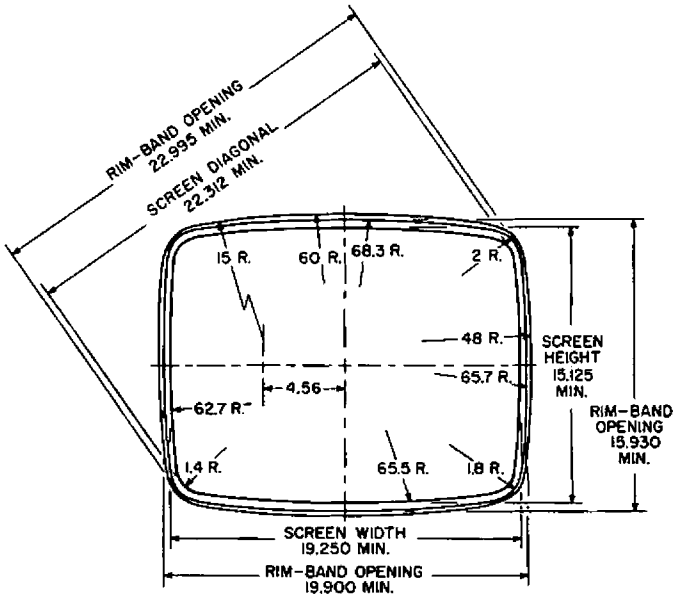
Fig.2

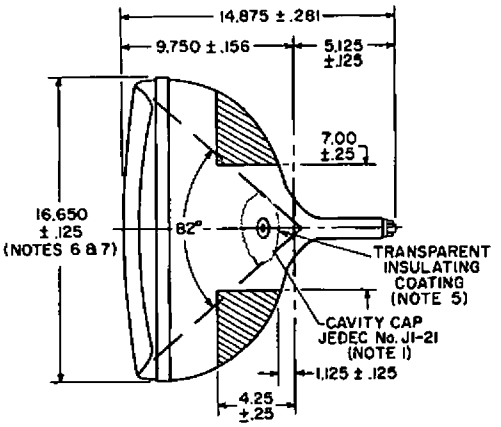
BULB-CONTOUR DIMENSIONS

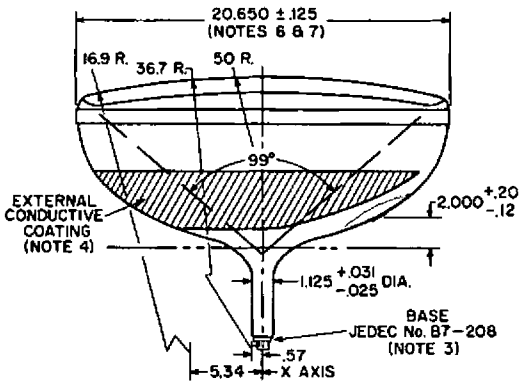


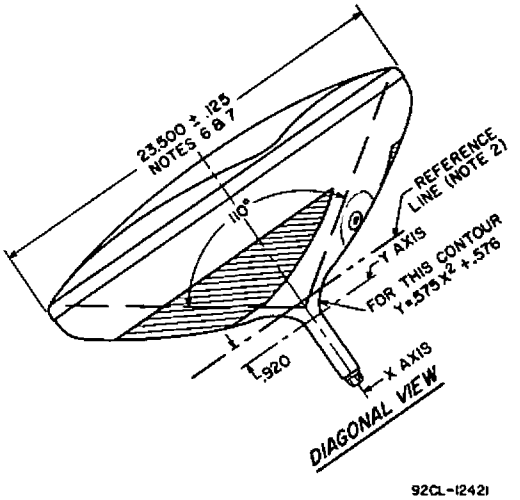
PLANES A THROUGH I ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE Y AXIS. THESE COORDINATES DESCRIBE THE BOGIE BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.

DIMENSIONAL OUTLINE



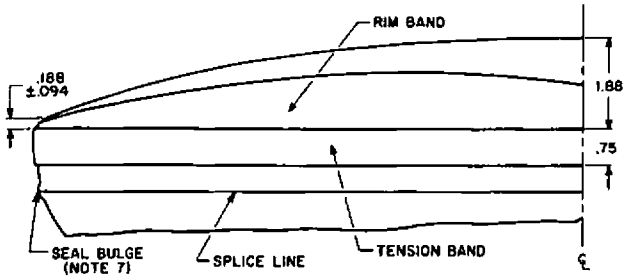






92CL-12421

DETAIL OF PANEL
(Diagonal View)



DIMENSIONS IN INCHES

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN No.4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ±30°. ANODE TERMINAL IS ON SAME SIDE AS PIN No.4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No.G-126 AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING AND IMPLOSION PROTECTION HARDWARE MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: MEASURED FROM THE TENSION BAND.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8".

THE Rauland CORPORATION
5600 WEST JARVIS AVENUE CHICAGO 48, ILLINOIS
TELEPHONE MULBERRY 5-5000
TELETYPE 312-265-1293

23EYP4

DESCRIPTION

23" Direct View	Filled Rim Implosion Protection
Rectangular Glass Envelope	92° Magnetic Deflection
Gray Filter Glass	Electrostatic Focus
Aluminized Screen	External Conductive Coating
6.3 Volts, 600 Ma. Heater	No Ion Trap
Cathode Drive Design	Low G_2 Voltage (35 V)

SPECIAL CHARACTERISTICS-Anode Penetration Current(Note 4)150 ua Max.

ELECTRICAL DATA	
Focusing Method	Electrostatic
Deflection Angles (Approx.)	
Horizontal	81 Degrees
Vertical	66 Degrees
Diagonal	92 Degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approx.)	5 uuf
Grid #1 to all other electrodes (approx.)	6 uuf
External Conductive Coating to Anode	2,500 max. uuf
(Including implosion protection hardware)	2,000 min. uuf
Heater Current at 6.3 Volts	600 + 10% Ma.
Heater Warm-up time	11 Seconds
OPTICAL DATA	
Phosphor Number	P4 Aluminized
Light Transmittance at Center (approx.)	42 1/2%
MECHANICAL DATA	
Overall Length	18 1/8 ± 3/8 in.
Greatest Dimensions of Tube (Metal Rim)	
Width	21 5/8 ± 1/16 in.
Height	18 9/16 ± 1/16 in.
Minimum Useful Screen Dimensions (Projected)	
Diagonal	22 5/16 in.
Horizontal Axis.	19 1/4 in.
Vertical Axis	15 1/8 in.
Area	282 Sq. in.
Neck Length	5 5/8 ± 3/16 in.
Bulb	J187-J1
Bulb Contact	J1-21
Base	B6-203
Basing	12L
Bulb Contact Alignment	
J1-21 contact aligns with pin position #6 ± 30 degrees	

from JEDEC release #4848, Nov. 9, 1964

A SUBSIDIARY OF ZENITH RADIO CORPORATION—CHICAGO

RATINGS (Design Maximum System)
Unless otherwise specified, voltage values are positive and measured with respect to Grid #1

Maximum Anode Voltage	25,000 Volts
Minimum Anode Voltage	16,000 Volts
Maximum Grid #4 (Focusing Electrode) voltage	+1100-550
Maximum Grid #2 Voltage	60 Volts
Minimum Grid #2 Voltage	25 Volts
Cathode Voltage	100 Volts
Maximum Heater Voltage	7 Volts
Minimum Heater Voltage	5.8 Volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up time 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	20,000 Volts DC
Grid #4 (Focusing Electrode) voltage (Notes 2 and 3)	250 Volts DC
Grid #2 Voltage	35 Volts DC
Cathode Voltage (Note 1)	25 to 50 Volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 circuit resistance	1.5 Megohms

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 200 micro-amperes 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

4. This is the maximum beam current with 25,000 volts (design max.) applied to Anode, zero voltage applied to Cathode, Grid #1, and Grid #2, all other elements to have nominal voltages.

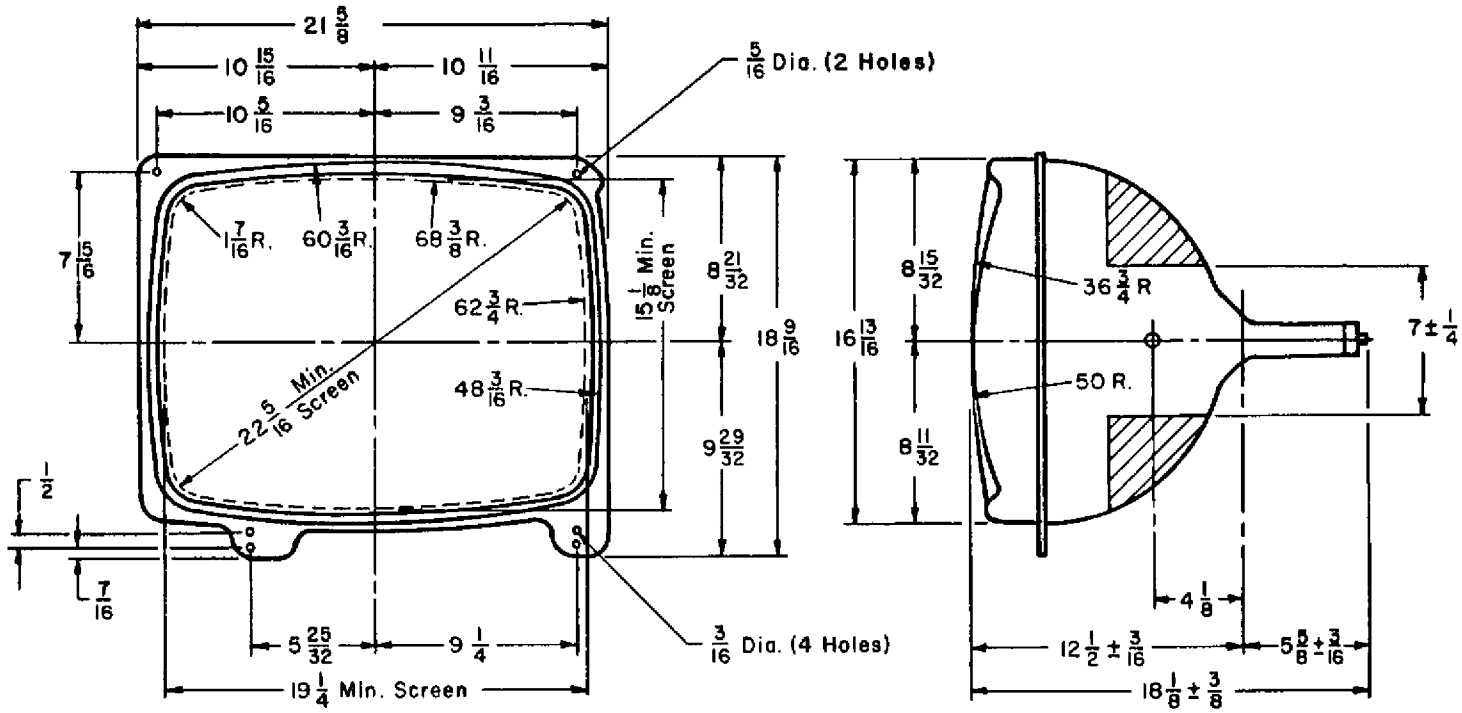
THE Rauland CORPORATION

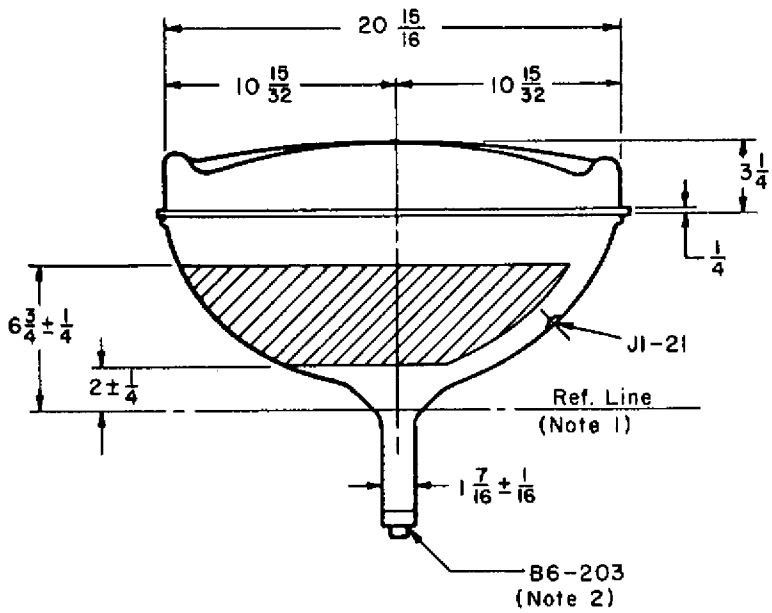
5600 WEST JARVIS AVENUE CHICAGO 48, ILLINOIS

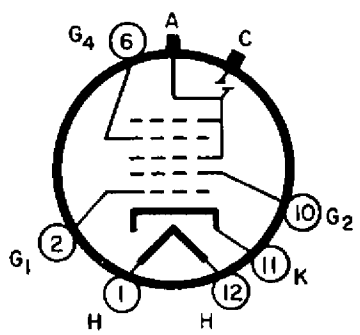
TELEPHONE MULBERRY 5-5000

TELETYPE 312-265-1293

23EYP4







12L Basing

NOTE:—

1. Reference line determined by plane C-C of J.E.D.E.C reference line gauge No. 116.
2. Base pin No. 6 aligned with anode contact within 30°

from JEDEC release #4649, March 30, 1964

RCA-23FDP4

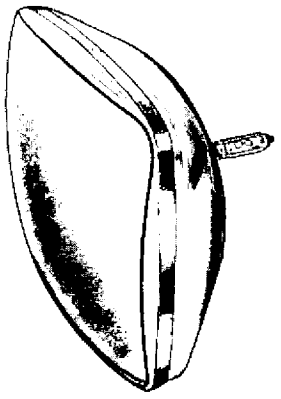
PAN-O-PLY
PICTURE TUBE

Initial Data

RCA-23FDP4 is a black-and-white pan-o-ply picture tube which eliminates the need for either an integral protective window or a separate safety-glass window and its companion dust seal in the receiver. As a result internal reflections are reduced, and picture contrast is improved. Integral implosion protection in the pan-o-ply picture tube is provided by means of a formed rim band and a welded tension band around the periphery of the tube panel. The 23FDP4 is a rectangular glass picture tube having an aluminized screen with nearly straight sides and slightly rounded corners.

Features of the 23FDP4 include:

- PAN-O-PLY—Integral Implosion Protection
- 110° Magnetic Deflection
- Low-Voltage Electrostatic Focus
- Aluminized Screen
- Electron Gun Requiring No Ion-Trap Magnet
- 15.156" Max. Overall Length
- 5.125" Neck Length
- 15.125" x 19.250" Screen
- 6.3 Volt/450 Ma Heater
- Low Grid-No.2 Voltage—
  For Cathode-Drive Service
- 23 kv Max. Anode Voltage



GENERAL DATA

Electrical:

Focusing Method	Electrostatic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Diagonal	110°	
Horizontal	99°	
Vertical	82°	
Direct Interelectrode Capacitances:		
Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode[a]	2500 max. 1700 min.	pf pf
Heater Current at 6.3 volts	450 ± 20	ma
Heater Warm-Up Time (Average)	11	seconds

Heater warm-up time is defined as the time required in the test circuit shown in *Fig.1* for the voltage (E) across the heater terminals to increase from zero to 0.8 of rated heater voltage.

Electron Gun. . . . .Type Requiring No Ion-Trap Magnet

Optical:

Phosphor. . . . . P4—Sulfide Type, Aluminized
Faceplate . . . . . Filterglass
Light transmission at center (Approx.). 42%

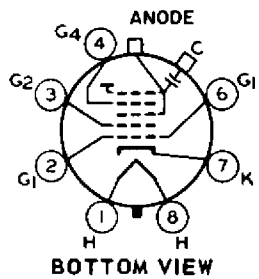
Mechanical:

Weight (Approx.). . . . . 28 lbs

Tube Dimensions:

Overall length	14.875" ± .281"
Neck length	5.125" ± .125"
Diagonal	23.500" ± .125"
Greatest width	20.650" ± .125"
Greatest height	16.650" ± .125"
Minimum Screen Dimensions (Projected):	
Diagonal	22.312"
Greatest width	19.250"
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Area	282 sq. in.
Bulb Designation	J187 K
Cap Designation	Recessed Small Cavity (JEDEC No.J1-21)
Base Designation	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation	8HR

Pin 1: Heater
Pin 2: Grid No.1
Pin 3: Grid No.2
Pin 4: Grid No.4
Pin 6: Grid No.1
Pin 7: Cathode
Pin 8: Heater
Cap: Anode (Grid No.3, Grid No.5, Screen, Collector)
C: External Conductive Coating



BOTTOM VIEW

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

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Maximum and Minimum Ratings, *Design-Maximum Values:*[b]

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	23,000 max.	volts
	11,000 min.	volts
Grid-No.4 Voltage:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
Grid-No.2 Voltage	70 max.	volts
	40 min.	volts
Cathode Voltage:		
Negative peak value	2 max.	volts
Negative bias value	0 max.	volts
Positive bias value	100 max.	volts
Positive peak value	150 max.	volts
Heater Voltage[c]	6.9 max.	volts
	5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max.	volts
DC Component	100 max.	volts

Typical Operating Conditions for Cathode-Drive[d] Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	18,000	volts
Grid-No.4 Voltage[e]	200	volts
Grid-No.2 Voltage	50	volts
Cathode Voltage for visual extinction of focused raster (See *Fig.2*)	34 to 52	volts
Field Strength of required adjustable Centering Magnet[f]	0 to 12	gauss
Maximum Circuit Value:		
Grid-No.1 Circuit Resistance	1.5 max.	megohms

[a] Includes implosion protection hardware.

[b] The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Design-Maximum Rating System* for rating electron tubes.

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[c] Measured between the heater terminals.

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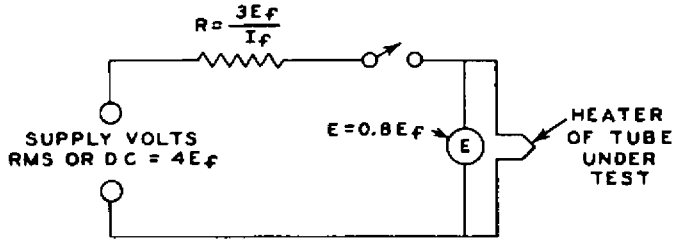
$$\sqrt{\frac{\text{Anode volts}}{16000 \text{ volts}}} \times 10 \text{ gauss}$$

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OPERATING CONSIDERATIONS

X-Radiation Warning. When operated at anode voltages up to 16 kilovolts, this picture tube does not produce any harmful X-radiation. However, because the rating of this type permits operation at voltages as high as 23 kilovolts (design-maximum value), shielding of the tube for X-radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

TEST CIRCUIT FOR DETERMINING HEATER WARM-UP TIME



Ef = RATED HEATER VOLTAGE OF TUBE UNDER TEST.
If = RATED HEATER CURRENT OF TUBE UNDER TEST.
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Fig.1

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RASTER CUTOFF CHART

For Cathode-Drive Service

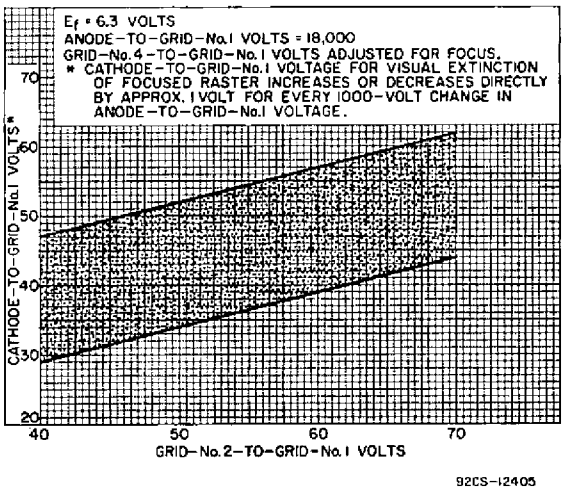
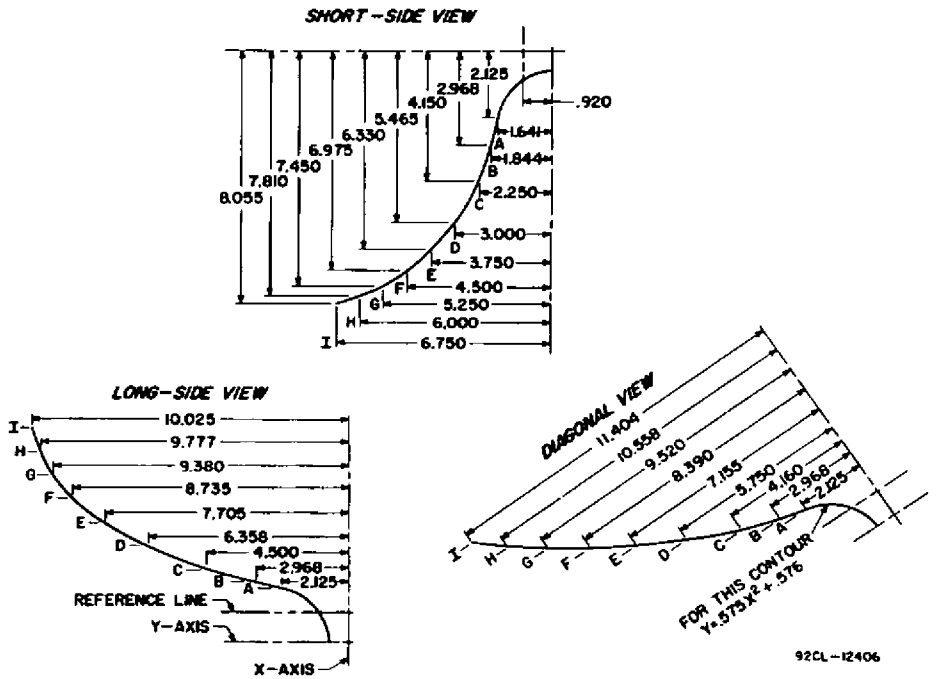


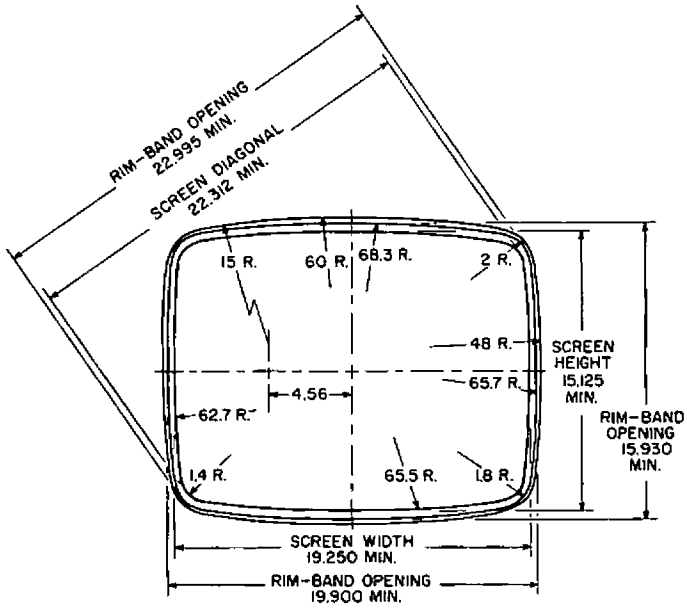
Fig.2

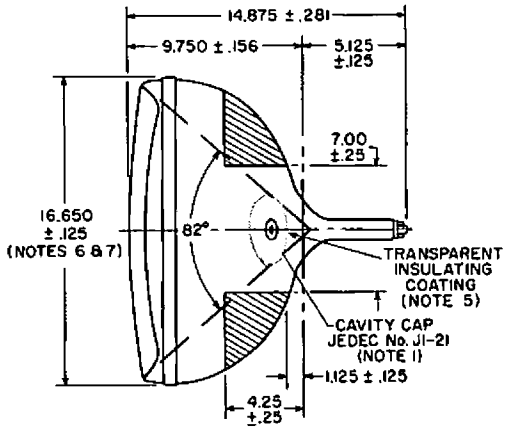
BULB-CONTOUR DIMENSIONS

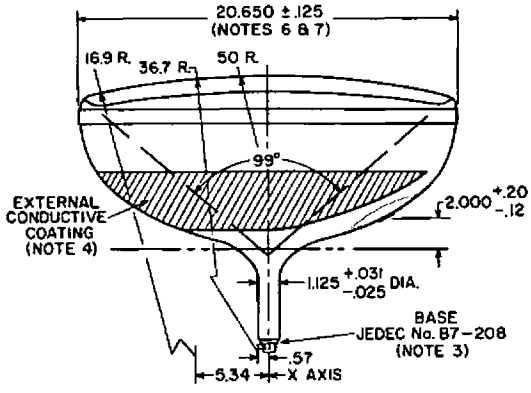


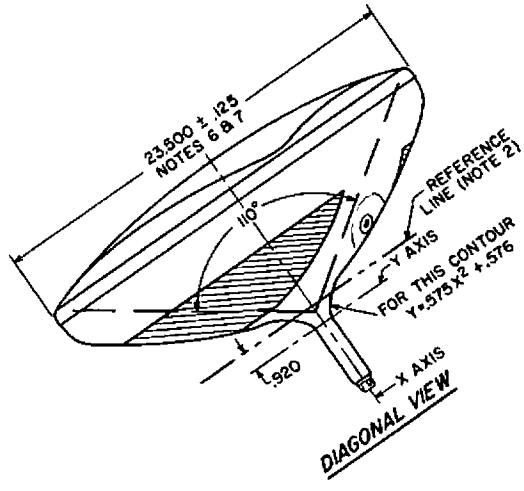
PLANES A THROUGH I ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE Y AXIS. THESE COORDINATES DESCRIBE THE BOGIE BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.

DIMENSIONAL OUTLINE



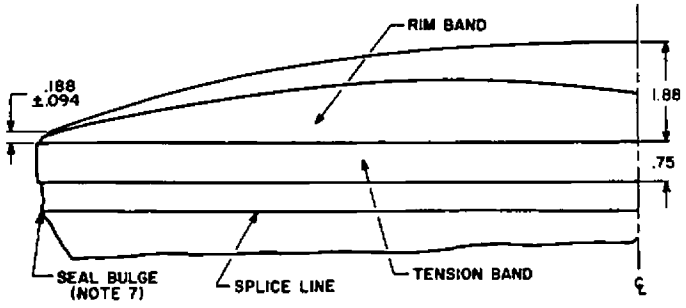






92CL-12421

DETAIL OF PANEL
(Diagonal View)



DIMENSIONS IN INCHES

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN No.4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ±30°. ANODE TERMINAL IS ON SAME SIDE AS PIN No.4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No.G-126 AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING AND IMPLOSION PROTECTION HARDWARE MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: MEASURED FROM THE TENSION BAND.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8"

THE Rauland CORPORATION

5600 WEST JARVIS AVENUE CHICAGO 48, ILLINOIS

TELEPHONE MULBERRY 5-5000
TELETYPE 312-265-1293

23FNP4

DESCRIPTION

23" Direct View
Rectangular Glass Envelope
Gray Filter Glass
Aluminized Screen
6.3 Volts, ~~600~~ 450 Ma. Heater
Filled Rim Implosion Protection
92° Magnetic Deflection
Electrostatic Focus
External Conductive Coating
No Ion Trap
Rim Provides Mounting Holes

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angles (approx.)	
Horizontal	81 Degrees
Vertical	66 Degrees
Diagonal	92 Degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approx.)	5 uuf
Grid #1 to all other electrodes (approx.)	6 uuf
External Conductive Coating to Anode	2,500 max. uuf
(Including implosion protection hardware)	2,000 min. uuf
Heater Current at 6.3 Volts	600 ± 10% Ma.
Heater Warm-up time	11 Seconds

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center (approx.)	42 1/2%

MECHANICAL DATA

Overall Length	18 ± 3/8"
Greatest Dimensions of Tube (Metal Rim)	
Width	21 5/8 ± 1/16"
Height	18 9/16 ± 1/16"
Minimum Useful Screen Dimensions (Projected)	
Diagonal	22 5/16"
Horizontal Axis.	19 1/4"
Vertical Axis	15 1/8"
Area	282 Sq. in.
Neck Length	5 1/2 ± 3/16"
Bulb	J187-J1
Bulb Contact	J1-21
Base	B6-203
Basing	12L

Bulb Contact Alignment
J1-21 contact aligns with pin position #6 ± 30 degrees

from JEDEC release #4875, Dec. 7, 1964

A SUBSIDIARY OF ZENITH RADIO CORPORATION—CHICAGO

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	25,000 Volts
Minimum Anode Voltage	16,000 Volts
Maximum Grid #4 (Focusing Electrode) voltage	+1100 -550
Maximum Grid #2 Voltage	550 Volts
Minimum Grid #2 Voltage	200 Volts
Grid #1 Voltage	
Maximum Negative Value	155 Volts DC
Maximum Negative Peak Value	200 Volts
Maximum Positive Value	0 Volts
Maximum Positive Peak Value	2 Volts
Maximum Heater Voltage	7 Volts
Minimum Heater Voltage	5.8 Volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up time 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

GRID DRIVE SERVICE

Unless otherwise specified, all voltage values are positive with respect to cathode.

Anode Voltage	20,000 Volts DC
Grid #4 (Focusing Electrode) voltage (Notes 2 and 3)	250 Volts DC
Grid #2 Voltage	300 Volts DC
Grid #1 Voltage (Note 1)	-35 to -72 Volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 circuit resistance	1.5 Megohms

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 200 micro-amperes on a 19 1/4" X 15 1/8" pattern from RCA 2F21 Monoscope or equivalent.

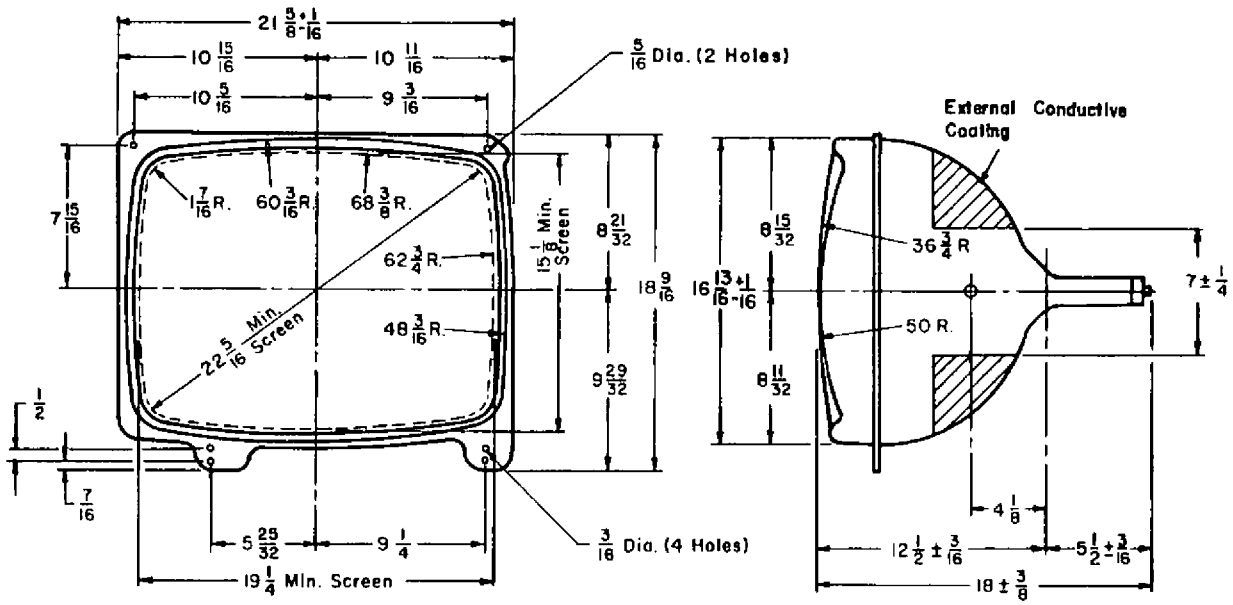
3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

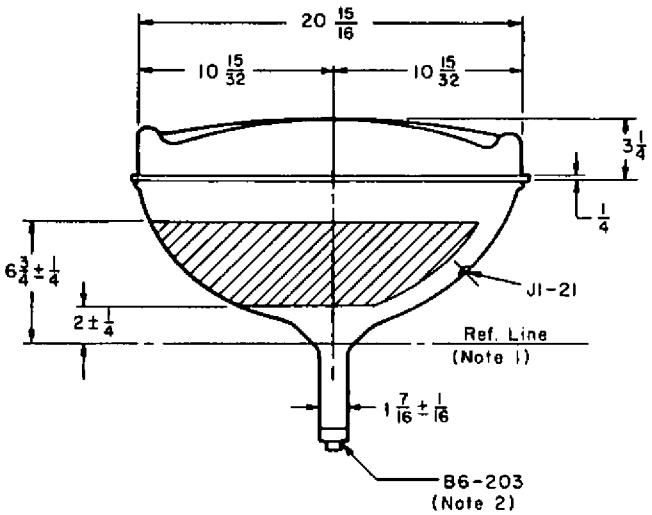
THE Rauland CORPORATION

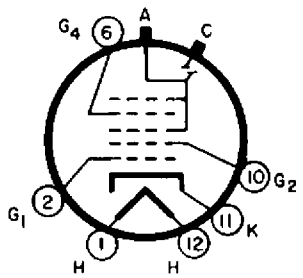
5600 WEST JARVIS AVENUE CHICAGO 48, ILLINOIS

TELEPHONE MULBERRY 5-5000
TELETYPE 312-265-1293

23FNP4







12L Basing

NOTE:—

1. Reference line determined by plane C–C' of J.E.D.E.C reference line gauge No. 116.
2. Base pin No. 6 aligned with anode contact within 30°

National Video Corporation
4300 W. 47TH STREET CHICAGO 32, ILLINOIS
CLIFFSIDE 4-5600

The 23FRP4 is a 23"-110° cathode ray tube with filled rim and a 4 1/2" neck length. This tube has a 450 milliampere 6.3 volt filament, a straight gun which requires no ion trap and 50 volt G_2 for cathode drive design.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Method	
Deflection Angles (Approximate)	
Diagonal	110 Degrees
Horizontal	99 Degrees
Vertical	82 Degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approximate)	5 uuf
Grid No. 1 to all other electrodes (approximate)	6 uuf
External conductive coating to anode (Note 1)	2,500 max. uuf
	1,700 min. uuf
Resistance Between External Conductive Coating and Implosion Protection Hardware	50 min. megohms
Heater Current at 6.3 Volts	450 ± 20 ma
Heater Warm-up Time	11 Seconds

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light transmittance at center (approximate)	43 Per cent
Antireflection Treatment	No

MECHANICAL DATA

Over-all Length	14 1/4 ±1/4 Inches
Neck Length	4 1/2 ±1/8 Inches
Greatest Dimensions of Tube	
Diagonal	25 31/32 ±3/32 Inches
Width	21 17/64 ±1/16 Inches
Height	17 21/64 ±1/16 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
Implosion Protection	6 - Filled Rim

from JEDEC release #4637, March 16, 1964

MECHANICAL DATA (CONT.)

Bulb	JEDEC Designation	J-187-K1
Bulb Contact	JEDEC Designation	J1-21
Base	JEDEC Designation	B7-208
Basing	JEDEC Designation	8HR

Bulb Contact Alignment
J1-21 contact aligns with Pin Position No. 4 ± 30°

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to Grid No. 1.

Maximum Anode Voltage	23,000 Volts
Minimum Anode Voltage	12,000 Volts
Maximum Grid No. 4 (Focusing Electrode) Voltage	+1,000 -500 Volts
Maximum Grid No. 2 Voltage	60 Volts
Minimum Grid No. 2 Voltage	25 Volts
Cathode Voltage	
Maximum negative value	0 Volts dc
Maximum negative peak value	2 Volts
Maximum positive value	100 Volts dc
Maximum positive peak value	150 Volts
Maximum Heater Voltage	6.9 Volts
Minimum Heater Voltage	5.8 Volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 seconds	450 Volts
After equipment warm-up period	200 Volts
Heater positive with respect to cathode	200 Volts

TYPICAL OPERATING CONDITIONS

CATHODE DRIVE SERVICE

Unless otherwise specified, all voltage values are positive with respect to Grid No. 1

Anode Voltage	16,000 Volts dc
Grid No. 4 Voltage (Focusing Electrode) (Notes 3 & 4)	250 Volts dc
Grid No. 2 Voltage	50 Volts dc
Cathode Voltage (Note 2)	35 to 55 Volts dc

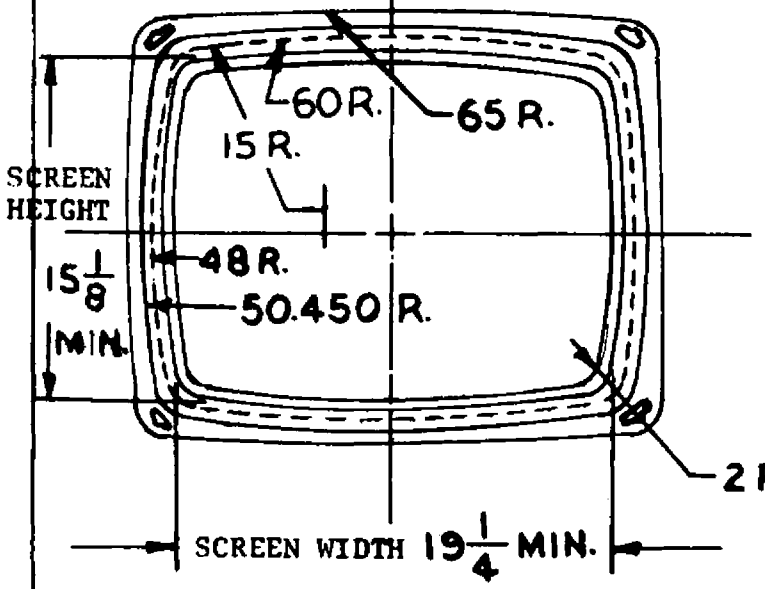
MAXIMUM CIRCUIT VALUES

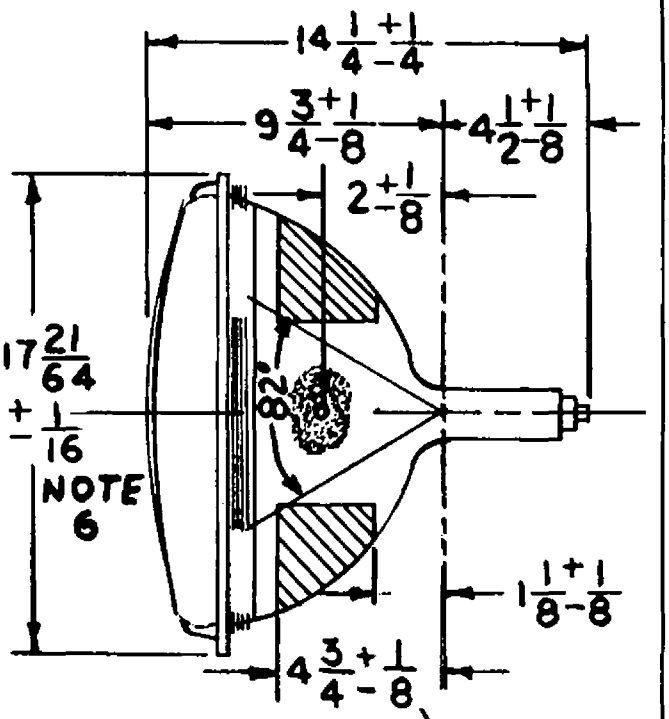
Maximum Grid No. 1 Circuit Resistance	1.5 Megohms

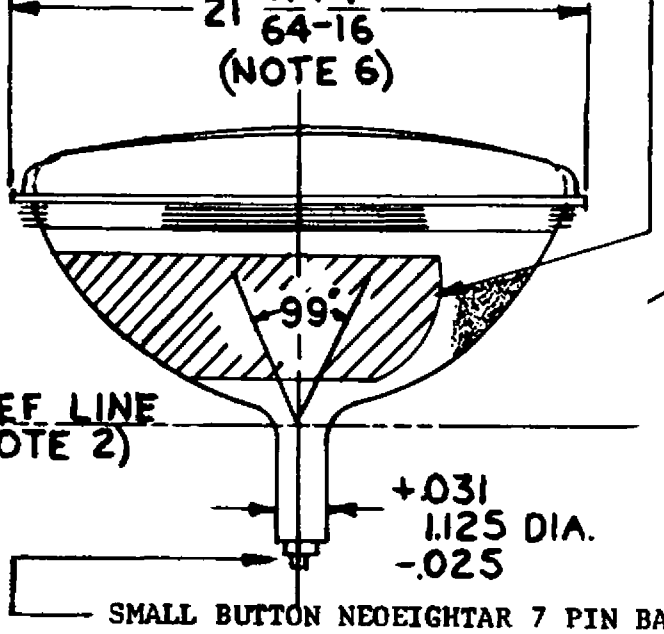
GRAPHS AND DRAWINGS

Tube Outline with Essential Dimensions and Tolerances

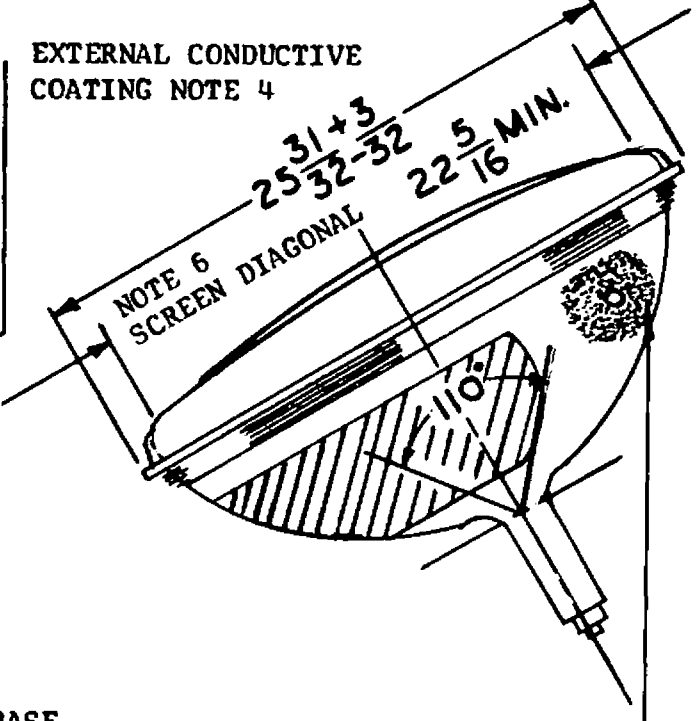
ULTOR RECESSED SMALL CAVITY CAP JEDEC J1-21 NOTE 1



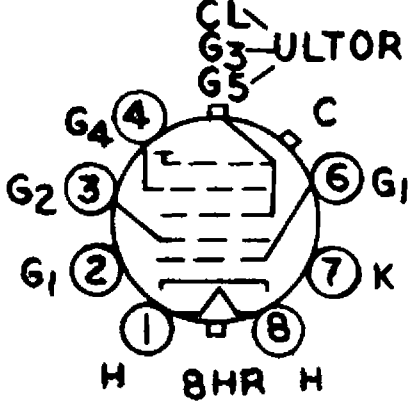




EXTERNAL CONDUCTIVE COATING NOTE 4



TRANSPARENT INSULATING COATING NOTE 5



PIN 1: HEATER
PIN 2: GRID NO. 1
PIN 3: GRID NO. 2
PIN 4: GRID NO. 4
PIN 6: GRID NO. 1
PIN 7: CATHODE
PIN 8: HEATER
CAP: ULTOR (GRID NO. 3 GRID NO. 5 COLLECTOR)
C: EXTERNAL CONDUCTIVE COATING

DRAWN BY	SCALE	EFFECTIVE	DISTRIBUTION	DRAWING NO
W.C. GRAF		2-12-64		23 FRP4

GRAPHS AND DRAWINGS (CONT.)

Pin Connections:

Pin 1	Heater	Pin 6	Grid No. 1
Pin 2	Grid No. 1	Pin 7	Cathode
Pin 3	Grid No. 2	Pin 8	Heater
Pin 4	Grid No. 4		

NOTES

1. Measured with implosion protection hardware connected to external coating.

2. Visual extinction of focused raster.

3. With the combined Grid No. 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 19 1/4" by 15 1/8" pattern from RCA 2F21 monoscope or equivalent.

4. Individual tubes will have satisfactory focus at some value between 0 and +400 volts.

NOTES FOR DIMENSIONAL OUTLINE

1. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance (measured about the tube axis) of $\pm 30^{o}$. Ultor terminal is on same side as Pin No. 4.

2. With tube neck inserted through flared end of reference-line gauge JEDEC No. G-126 and with tube seated in gauge, the reference-line is determined by the intersection of the Plane CC' of the gauge with the glass funnel.

3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

4. External conductive coating must be grounded.

5. To clean this area, wipe only with soft dry lint-less cloth.

6. Measured at O.D. of shell.

National Video Corporation
4300 W. 47TH STREET CHICAGO 32, ILLINOIS
CLIFFSIDE 4-5600

The 23FSP4 is a 23"-110° cathode ray tube with filled rim implosion protection and a 5 1/8" neck length. This tube has a straight gun which requires no ion trap and a 600 milliampere 6.3 volt filament.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Method	
Deflection Angles (Approximate)	
Diagonal	110 Degrees
Horizontal	99 Degrees
Vertical	82 Degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approximate)	5 uuf
Grid No. 1 to all other electrodes (approximate)	6 uuf
External conductive coating to anode (Note 1)	2,500 max. uuf
	1,700 min. uuf
Resistance Between External Conductive Coating and Implosion Protection Hardware	50 min. megohms
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 (Approximate)	42 Per cent
Antireflection Treatment	No

MECHANICAL DATA

Overall Length	14 7/8 ±1/4 Inches
Neck Length	5 1/8 ±1/8 Inches
Greatest Dimensions of Shell	
Diagonal	25 31/32 ±3/32 Inches
Width	21 17/64 ±1/16 Inches
Height	17 21/64 ±1/16 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

MECHANICAL DATA (Cont.)

Implosion Protection		Filled Rim
Bulb	JEDEC Designation	J-187-K1
Bulb Contact	JEDEC Designation	J1-21
Base	JEDEC Designation	B7-208
Basing	JEDEC Designation	8HR

Bulb Contact Alignment
J1-21 contact aligns with Pin Position No. 4 $\pm 30^{o}$.

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	23,000 volts
Minimum Anode Voltage	12,000 volts
Maximum Grid No. 4 (Focusing Electrode) Voltage	+1,000 -500 volts
Maximum Grid No. 2 Voltage	500 volts
Minimum Grid No. 2 Voltage	200 volts
Grid No. 1 Voltage	
Maximum negative value	154 volts dc
Maximum negative peak value	220 volts
Maximum positive value	0 volts dc
Maximum positive peak value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.8 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 seconds	450 volts
After equipment warm-up period	200 volts
Heater positive with respect to cathode	200 volts

TYPICAL OPERATING CONDITIONS

GRID DRIVE SERVICE

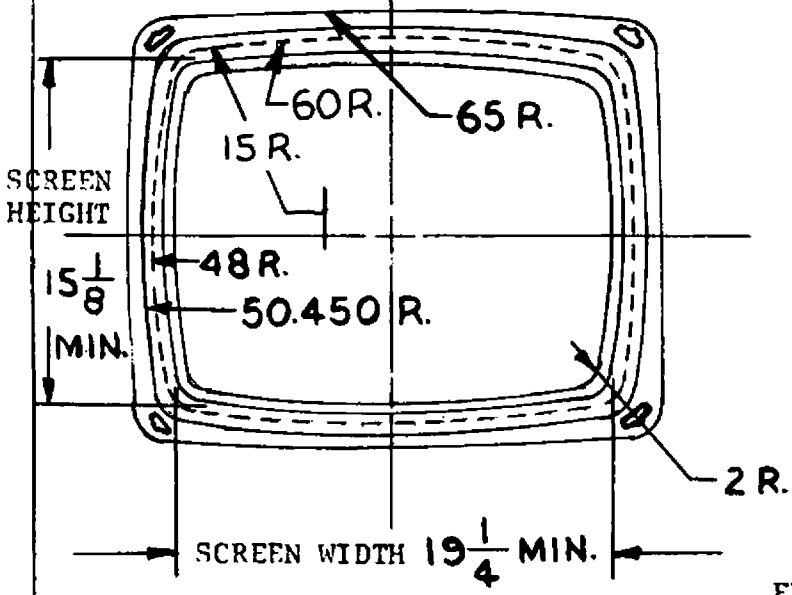
Unless otherwise specified, all voltage values are positive with respect to cathode.

Anode Voltage	16,000 volts dc
Grid No. 4 Voltage (Focusing Electrode) (Notes 3 and 4)	0 to +400 volts dc
Grid No. 2 Voltage	400 volts dc
Grid No. 1 Voltage (Note 2)	39 to 94 volts dc

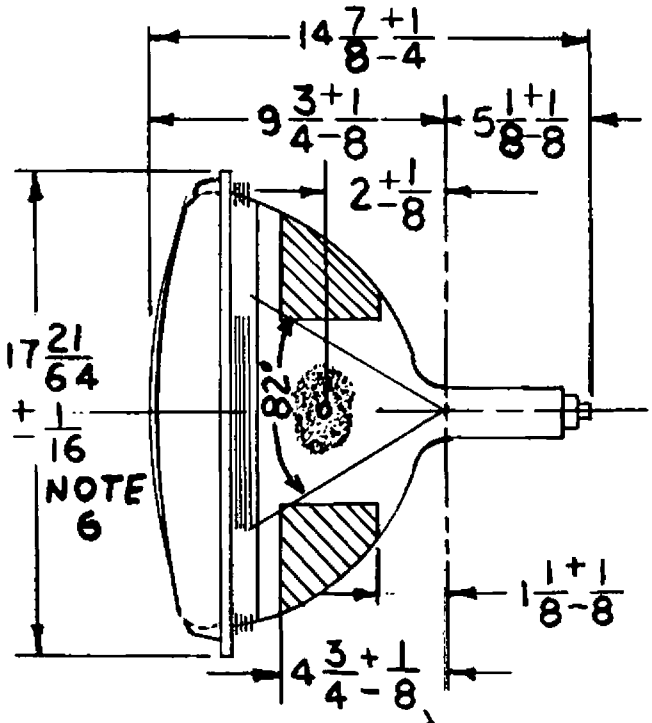
MAXIMUM CIRCUIT VALUES

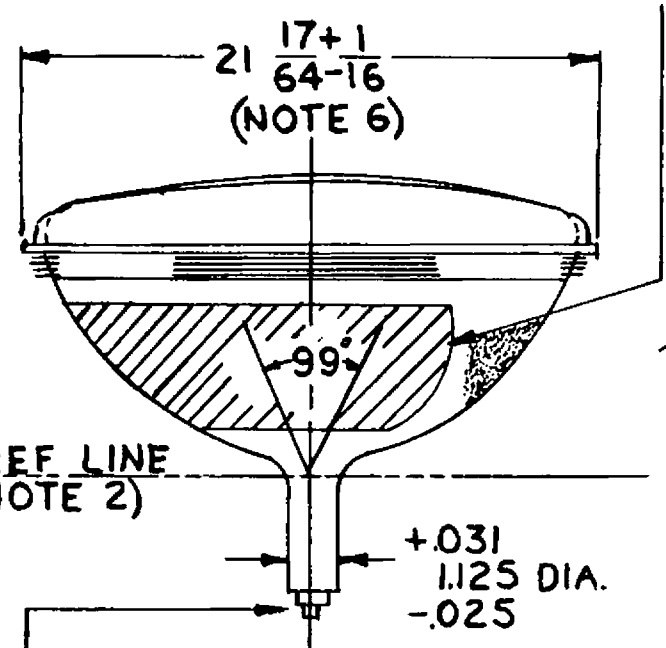
Maximum Grid No. 1 Circuit Resistance	1.5 megohms

ULTOR RECESSED SMALL
CAVITY CAP JEDEC J1-21
NOTE 1

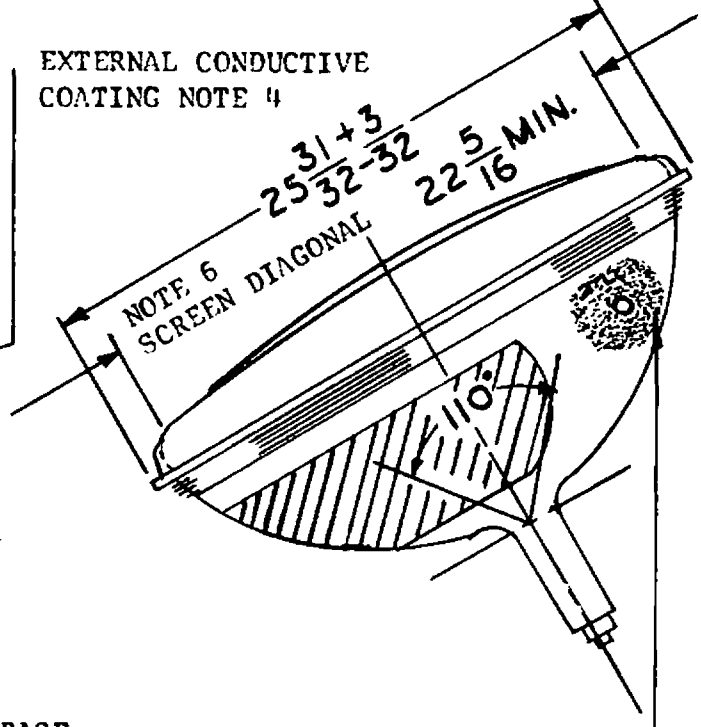


SCREEN WIDTH $19\frac{1}{4}$ MIN.

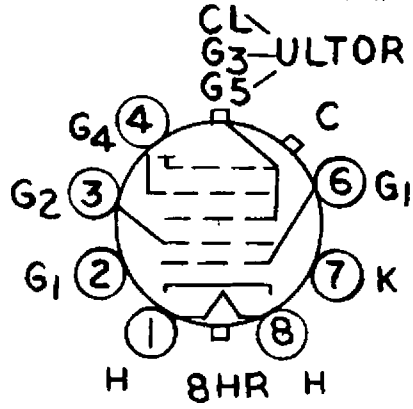




EXTERNAL CONDUCTIVE
COATING NOTE 4



SMALL BUTTON NEOEIGHTAR 7 PIN BASE
ARRANGEMENT 1 JEDEC #B7-208 NOTE 3



PIN 1: HEATER
PIN 2: GRID NO. 1
PIN 3: GRID NO. 2
PIN 4: GRID NO. 4
PIN 6: GRID NO. 1
PIN 7: CATHODE
PIN 8: HEATER
CAP: ULTOR (GRID NO. 3 GRID NO. 5 COLLECTOR)
C: EXTERNAL CONDUCTIVE COATING

TRANSPARENT INSULATING COATING NOTE 5

DRAWN BY	SCALE	EFFECTIVE	DISTRIBUTION	DRAWING NO.
W.C. GRAF		2-12-64		23 FSP4

GRAPHS AND DRAWINGS

Tube Outline with Essential Dimensions and Tolerances

Pin Connections:

Pin 1	Heater	Pin 6	Grid #1
Pin 2	Grid #1	Pin 7	Cathode
Pin 3	Grid #2	Pin 8	Heater
Pin 4	Grid #4		

NOTES

1. Measured with implosion protection hardware connected to external coating.

2. Visual extinction of focused raster.

3. With the combined Grid No. 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 19 1/4" by 15 1/8" pattern from RCA 2F21 monoscope or equivalent.

4. Individual tubes will have satisfactory focus at some value between 0 and +400 volts.

NOTES FOR DIMENSIONAL OUTLINE

1. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance (measured about the tube axis) of $\pm 30^{\circ}$. Ultor terminal is on same side as Pin No. 4.

2. With tube neck inserted through flared end of reference-line gauge JEDEC No. G-126 and with tube seated in gauge, the reference-line is determined by the intersection of the Plane CC' of the gauge with the glass funnel.

3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

4. External conductive coating must be grounded.

5. To clean this area, wipe only with soft dry lint-less cloth.

6. Measured at O.D. of shell.

23FVP4

CATHODE RAY TUBE

23 INCH, RECTANGULAR, GLASS

FACEPLATE--SPHERICAL GRAY

FOCUS--ELECTROSTATIC

NON ION TRAP GUN

DEFLECTION--MAGNETIC

ALUMINIZED SCREEN

110-DEGREE DEFLECTION ANGLE

EXTERNAL CONDUCTIVE COATING

BANDED TYPE IMPLOSION PROTECTION

----------DESCRIPTION AND RATING----------

The 23FVP4 is a 23-inch electrostatic-focus and magnetic-deflection glass light weight picture tube equipped with banded tube type integral implosion protection. Outstanding features include a short overall 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 uuf
Grid #1 to all other electrodes, approx.	6 uuf
External Conductive Coating to Anode	2500 max. uuf
(including implosion protection hardware)	2000 min. uuf
Heater Current at 6.3 volts	450 ± 22 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 #4804, Sept. 21, 1964

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.

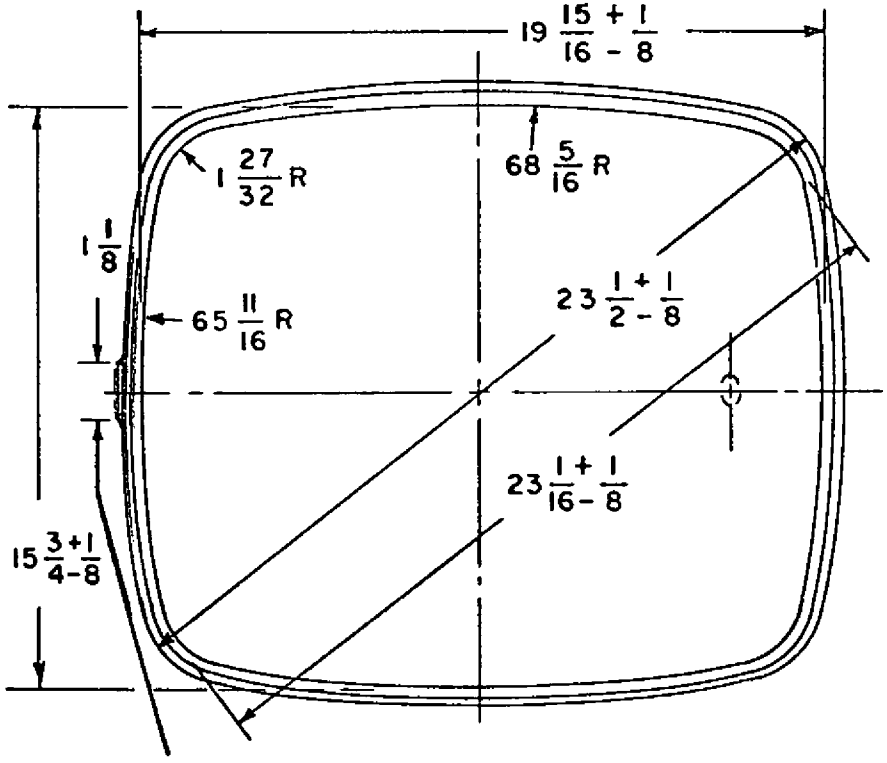
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 μa on a 19-1/4" x 15-1/8" pattern from RCA 2F21 monoscope or equivalent.

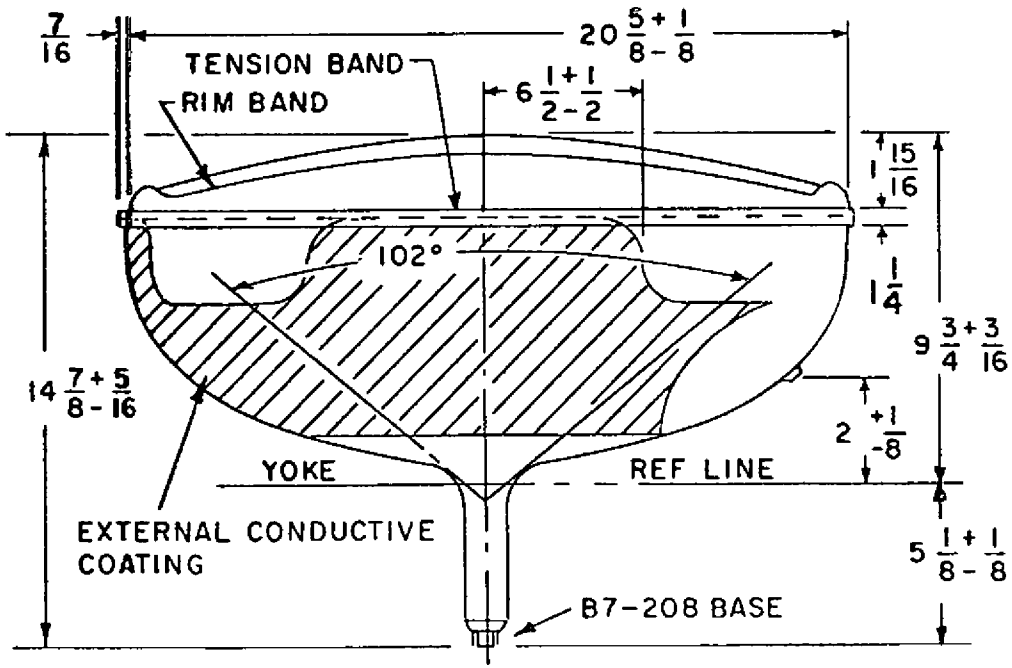
3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

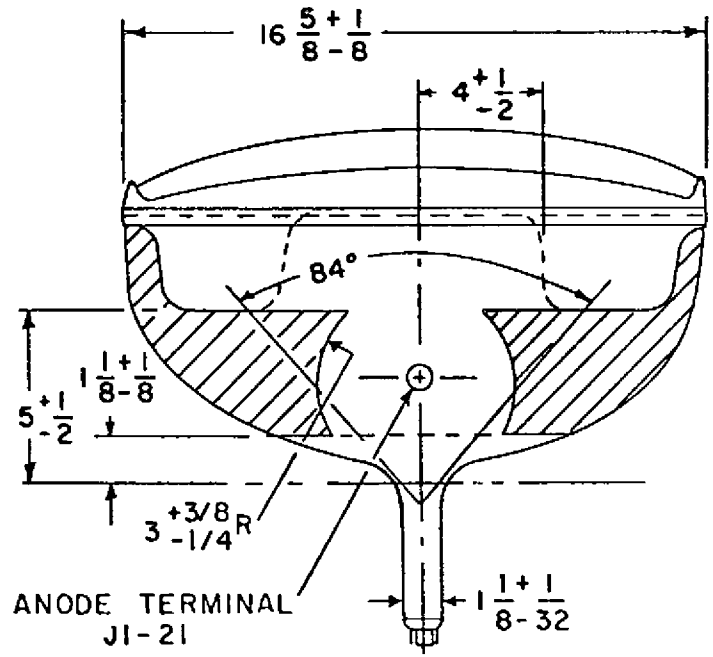
23FVP4

SCREEN DIMENSIONS

DIAGONAL	22 5/16
WIDTH	19 1/4
HEIGHT	15 1/8
AREA	282 SQ IN.







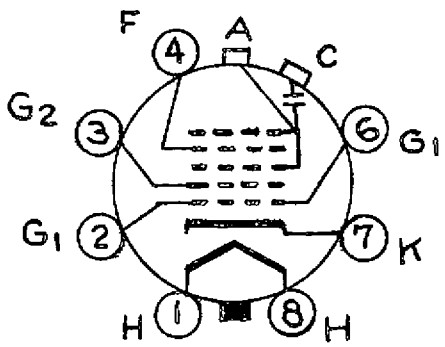
OUTLINE NOTES

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

JOINT ELECTRON DEVICE ENGINEERING COUNCIL

JEDEC Type Administration Section
Electronic Industries Association
32 Green Street
Newark 2, New Jersey

E. I. A.
REGISTRATION
FILE

Announcement

of

Electron Device Type Registration

Release No. 4597

February 17, 1964

The Joint Electron Device Engineering Council announces the registration of the following electron device designations

19EGP4

23FWP4 *

according to the ratings and characteristics found on the attached data sheet on the application of

National Video Corporation
Chicago, Illinois

* The 23FWP4 is similar to the 23DLP4, as registered in Release No. 3895, except for the following:

Heater Current at 6.3 volts	0.450 amp

Without bulb funnel coating.

National Video Corporation
4300 W. 47TH STREET CHICAGO 32, ILLINOIS
CLIFFSIDE 4-5600

The 23GBP4 is a 23"-110° banded picture tube without cloth. This tube has a 5 1/8" neck length, a straight gun which requires no ion trap and a 450 milliampere 6.3 volt filament.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angles (Approximate)	
Diagonal	110 Degrees
Horizontal	99 Degrees
Vertical	82 Degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes (approx.)	5 uuf
Grid No. 1 to all other electrodes (approx.)	6 uuf
External conductive coating to anode (Note 1)	2,500 max. uuf
	1,700 min. uuf
Resistance Between External Conductive Coating and Implosion Protection Hardware	50 min. megohms
Heater Current at 6.3 Volts	450 ±20 ma
Heater Warm-up Time	11 seconds

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center (Approximate)	42 Per cent
Antireflection Treatment	No

MECHANICAL DATA

Over-all Length	14 7/8 ±1/4 Inches
Neck Length	5 1/8 ±1/8 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
Implosion Protection	Banded

from JEDEC release #4683, April 27, 1964

MECHANICAL DATA (Cont.)

Bulb	JEDEC Designation	J-187-K1
Bulb Contact	JEDEC Designation	J1-21
Base	JEDEC Designation	B7-208
Basing	JEDEC Designation	8HR

Bulb Contact Alignment

J1-21 contact aligns with Pin Position No. 4 $\pm 30^{\circ}$.

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	23,000 Volts
Minimum Anode Voltage	12,000 Volts
Maximum Grid No. 4 (Focusing Electrode) Voltage	+1,000 -500 Volts
Maximum Grid No. 2 Voltage	500 Volts
Minimum Grid No. 2 Voltage	200 Volts
Grid No. 1 Voltage	
Maximum negative value	154 Volts dc
Maximum negative peak value	220 Volts
Maximum positive value	0 Volts dc
Maximum positive peak value	2 Volts
Maximum Heater Voltage	6.9 Volts
Minimum Heater Voltage	5.9 Volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 seconds.	450 Volts
After equipment warm-up period.	200 Volts
Heater positive with respect to cathode	200 Volts

TYPICAL OPERATING CONDITIONS

GRID DRIVE SERVICE

Unless otherwise specified, all voltage values are positive with respect to cathode.

Anode Voltage	16,000 Volts dc
Grid No. 4 Voltage (Focusing Electrode) (Notes 3 & 4)	0 to +400 Volts dc
Grid No. 2 Voltage	400 Volts dc
Grid No. 1 Voltage (Note 2)	39 to 94 Volts dc

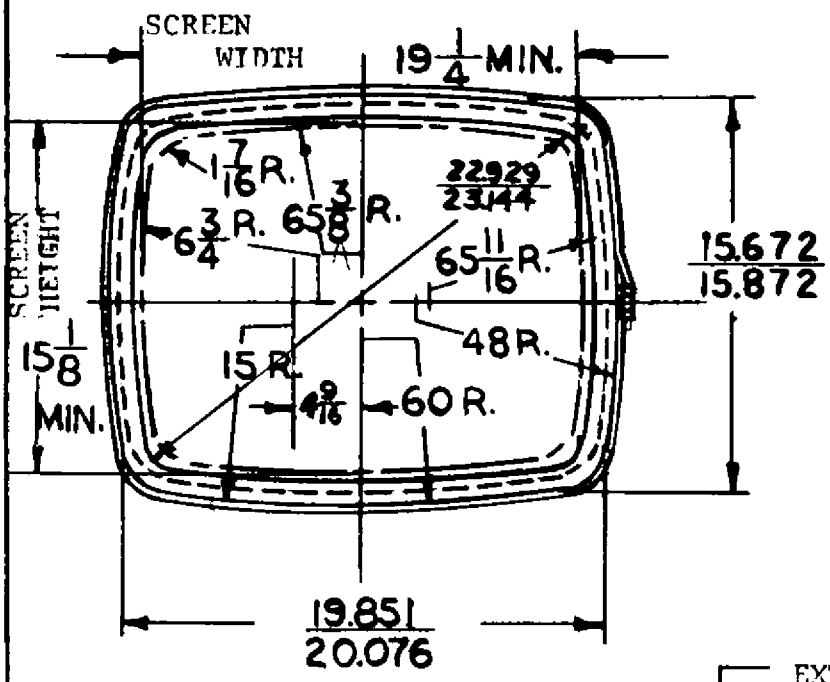
MAXIMUM CIRCUIT VALUES

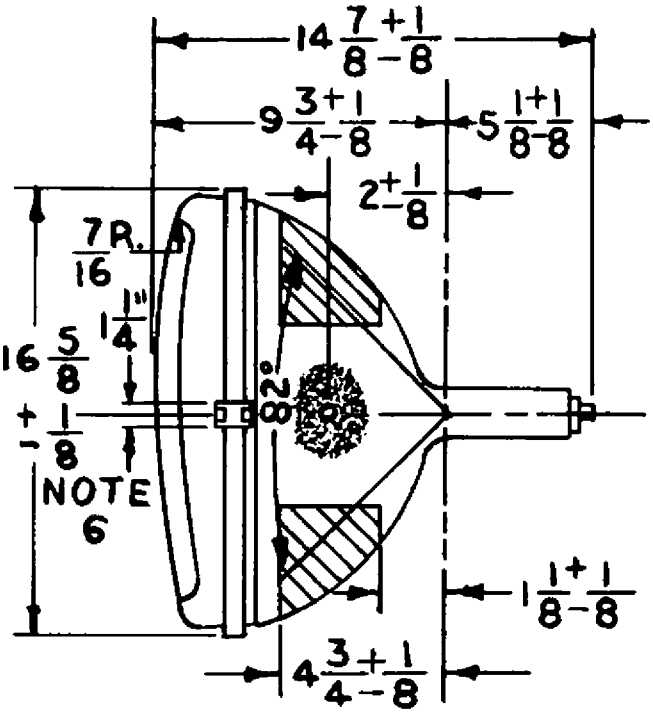
Maximum Grid No. 1 Circuit Resistance	1.5 megohms

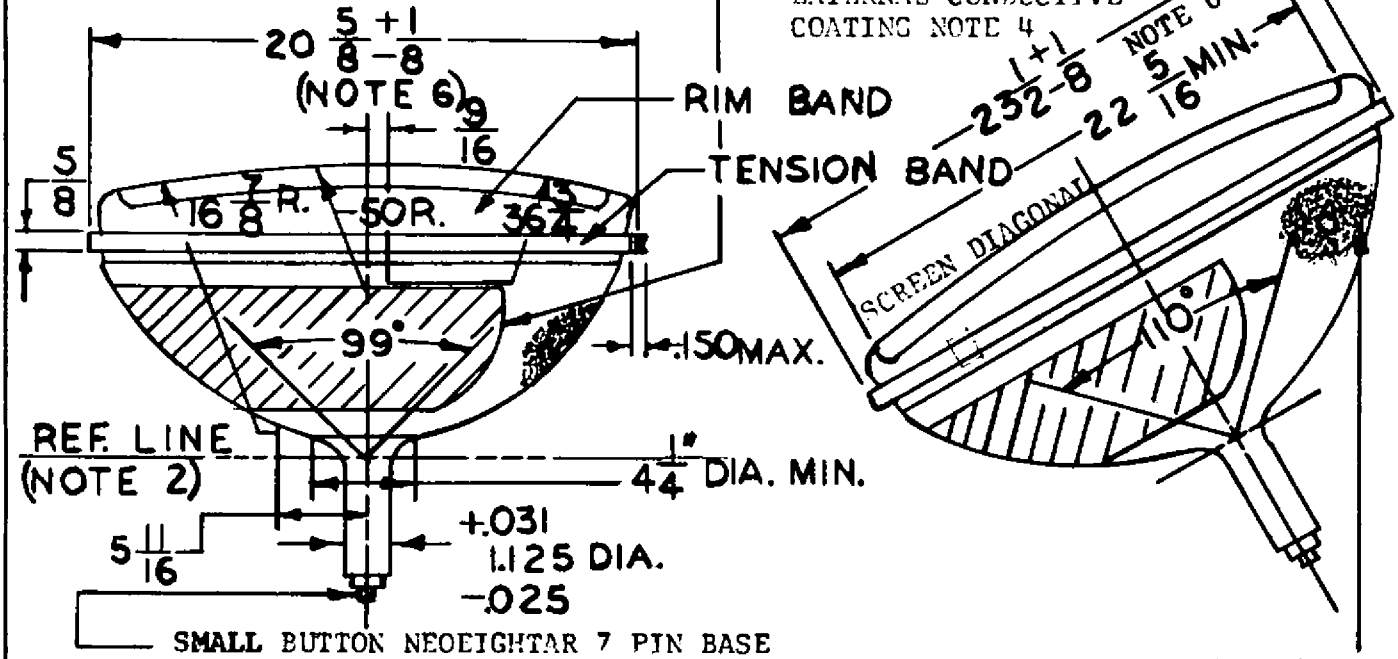
GRAPHS AND DRAWINGS

Tube Outline with Essential Dimensions and Tolerances

ULTOR RECESSED SMALL
CAVITY CAP JEDEC J1-21
NOTE 1

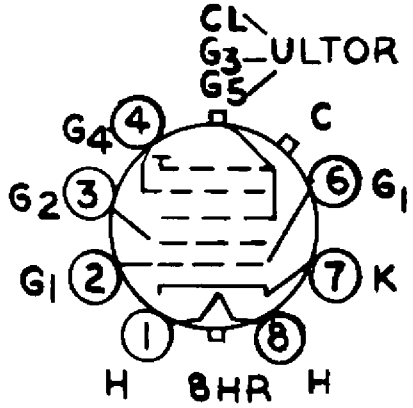






SMALL BUTTON NEOEIGHTAR 7 PIN BASE
ARRANGEMENT 1 JEDEC #B7-208 Note 3

TRANSPARENT INSULATING COATING NOTE 5



PIN 1: HEATER
PIN 2: GRID NO. 1
PIN 3: GRID NO. 2
PIN 4: GRID NO. 4
PIN 6: GRID NO. 1
PIN 7: CATHODE
PIN 8: HEATER
CAP: ULTOR (GRID NO. 3 GRID NO. 5 COLLECTOR)
C: EXTERNAL CONDUCTIVE COATING

DRAWN BY	SCALE	EFFECTIVE	DISTRIBUTION	DRAWING NO.
W.C. GRAF		3-30-64		23 GBP4

GRAPHS AND DRAWINGS (Cont.)

Pin Connections:

Pin 1	Heater	Pin 6	Grid #1
Pin 2	Grid #1	Pin 7	Cathode
Pin 3	Grid #2	Pin 8	Heater
Pin 4	Grid #4		

NOTES

1. Measured with implosion protection hardware connected to external coating.

2. Visual extinction of focused raster.

3. With the combined Grid No. 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 micramperes on a 19 1/4" by 15 1/8" pattern from RCA 2F21 monoscope or equivalent.

4. Individual tubes will have satisfactory focus at some value between 0 and +400 volts.

NOTES FOR DIMENSIONAL OUTLINE

1. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance (measured about the tube axis) of $\pm 30^{\circ}$. Ultor terminal is on same side as Pin No. 4.

2. With tube neck inserted through flared end of reference-line gauge JEDEC No. G-126 and with tube seated in gauge, the reference-line is determined by the intersection of the Plane CC' of the gauge with the glass funnel.

3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

4. External conductive coating must be grounded.

5. To clean this area, wipe only with soft dry lint-less cloth.

6. Measured to include rimband and tension strap.

National Video Corporation
4300 W. 47TH STREET CHICAGO 32, ILLINOIS
CLIFFSIDE 4-5600

The 23GJP4 is a 23"-110° banded tube with a 4 1/2" neck length, this has a straight gun which requires no ion trap. A 450 milliampere 6.3 volt filament and 50 volt G_2 for cathode drive design.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angles (Approximate)	
Diagonal	110 Degrees
Horizontal	99 Degrees
Vertical	82 Degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approx.)	5 uuf
Grid No. 1 to all other electrodes (approx.)	6 uuf
External conductive coating to anode (Note 1)	2,500 max. uuf
	1,700 min. uuf
Resistance Between External Conductive Coating and Implosion Protection Hardware	50 min. megohms
Heater Current at 6.3 Volts	450 ±20 ma
Heater Warm-up Time	11 seconds
Electron Gun	
Ion Trap	None
Focus Lens	Unipotential

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center (approximate)	42 Percent
Antireflection Treatment	None

MECHANICAL DATA

Overall Length	14 1/4 ±1/4 Inches
Neck Length	4 1/2 ±1/8 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

from JEDEC release #4742, June 29, 1964

MECHANICAL DATA (Cont.)

Implosion Protection		Banded - Without Cloth
Bulb	JEDEC Designation	J-187-K1
Bulb Contact	JEDEC Designation	J1-21
Base	JEDEC Designation	B7-208
Basing	JEDEC Designation	8HR

Bulb Contact Alignment
J1-21 contact aligns with Pin Position No. 4 $\pm 30^{o}$.

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 No. 4 (Focusing Electrode) Voltage	+1,250 -400 volts
Maximum Grid No. 2 Voltage	70 volts
Minimum Grid No. 2 Voltage	40 volts
Cathode Voltage	
Maximum negative value	0 volts dc
Maximum negative peak value	2 volts
Maximum positive value	154 volts dc
Maximum positive peak value	220 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 seconds	450 volts
After equipment warm-up period	200 volts
Heater positive with respect to cathode	200 volts

TYPICAL OPERATING CONDITIONS

CATHODE DRIVE SERVICE

Unless otherwise specified, all voltage values are positive with respect to Grid No. 1.

Anode Voltage	18,000 volts dc
Grid No. 4 Voltage (Focusing Electrode) (note 3 & 4)	200 volts dc
Grid No. 2 Voltage	50 volts dc
Cathode Voltage (Note 2)	32 to 50 volts dc

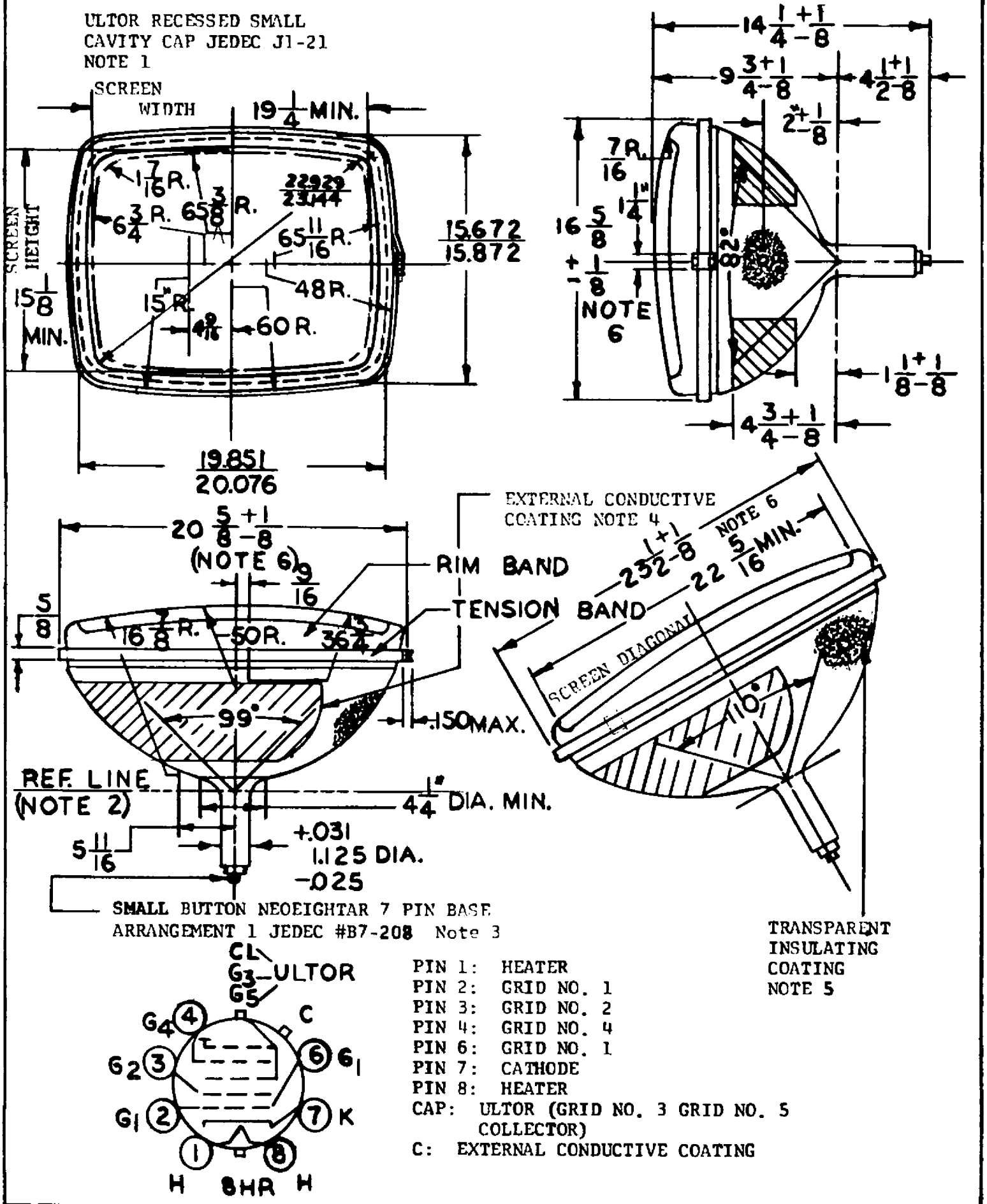
MAXIMUM CIRCUIT VALUES

Maximum Grid No. 1 Circuit Resistance	1.5 megohms

GRAPHS AND DRAWINGS

Tube Outline with Essential Dimensions and Tolerances

ULTOR RECESSED SMALL
CAVITY CAP JEDEC J1-21
NOTE 1



PIN 1: HEATER
PIN 2: GRID NO. 1
PIN 3: GRID NO. 2
PIN 4: GRID NO. 4
PIN 6: GRID NO. 1
PIN 7: CATHODE
PIN 8: HEATER
CAP: ULTOR (GRID NO. 3 GRID NO. 5 COLLECTOR)
C: EXTERNAL CONDUCTIVE COATING

DRAWN BY	SCALE	EFFECTIVE	DISTRIBUTION	DRAWING NO.
W.C. GRAF		3-20-64		23 GJP4

GRAPHS AND DRAWINGS (CONT.)

Pin Connections:

Pin 1	Heater	Pin 6	Grid No. 1
Pin 2	Grid No. 1	Pin 7	Cathode
Pin 3	Grid No. 2	Pin 8	Heater
Pin 4	Grid No. 4		

NOTES:

1. Measured with implosion protection hardware connected to external coating.

2. Visual extinction of focused raster.

3. With the combined Grid No. 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 19 1/4" by 15 1/8" pattern from RCA 2F21 monoscope or equivalent.

4. Individual tubes will have satisfactory focus at some value between 0 and +400 volts.

NOTES FOR DIMENSIONAL OUTLINE

1. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance (measured about the tube axis) of $\pm 30^{\circ}$. Ultor terminal is on same side as Pin No. 4.

2. With tube neck inserted through flared end of reference-line gauge JEDEC No. G-126 and with tube seated in gauge, the reference-line is determined by the intersection of the Plane CC' of the gauge with the glass funnel.

3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

4. External conductive coating must be grounded.

5. To clean this area, wipe only with soft dry lint-less cloth.

6. Measured to include a rimband and tension strap.

PHILCO CORPORATION

23GWP4

A SUBSIDIARY OF Ford Motor Company

Television Picture Tube

LANSDALE DIVISION

CATHODE RAY TUBE

DATA SHEET

Description

The 23GWP4 is a 23" - 110° direct view rectangular Cathode Ray Tube employing banded implosion protection. The tube incorporates internal shielding, an aluminized screen, non ion trap gun and is designed to operate with electrostatic focus and magnetic deflection.

This is a "HiGm" tube designed to operate in cathode drive service under low G2 voltage conditions. The tube base is short and provides straight through leads oriented by an indexing lug.

Electrical Data

Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angles (approximate)	
Horizontal	99 Degrees
Vertical	82 Degrees
Diagonal	110 Degrees
Direct Interelectrode Capacitances	
Cathode to All (approximate)	4 uuf
Grid #1 to All (approximate)	5 uuf
External Coating Capacitance (Note 1)	2000 Min. uuf 2500 Max. uuf
Resistance between external conductive coating and implosion protection hardware	.50 Megohms Min.
Heater Current at 6.3 Volts	450 ±5% ma
Heater Warm-up Time (Note 2)	11 Seconds
Electron Gun	
Ion Trap	none
Focus Lens	Unipotential

Optical Data

Phosphor Number	Aluminized P4
Light Transmission at Center (approximate)	42 Percent
Antireflection Treatment	none

from JEDEC release #4865, Nov. 30, 1964

Mechanical Data

Overall Length	14.375 ±.406 Inches
Neck Length	4.625 ±.250 Inches
Greatest Dimensions of Tube	
Diagonal	23.640 Inches
Width	21.255 Inches
Height	16.750 Inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	22.312 Inches
Horizontal Axis	19.250 Inches
Vertical Axis	15.125 Inches
Area	282 Sq. Inches
Implosion Protection	Banded Tube
Bulb	J187K1
Bulb Contact	J1-21
Base	B7-208
Basing	8HR

Bulb Contact Aligns with Pin #8 ±30°

Minimum and Maximum Ratings (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Anode Voltage (Note 3)	(22,000 Max. Volts DC (11,000 Min. Volts DC
Grid No. 4 (Focusing Electrode) Voltage	
Positive Value	+1250 Max. Volts DC
Negative Value	-400 Min. Volts DC
Grid No. 2 Voltage	(80 Max. Volts DC (40 Min. Volts DC
Grid No. 1 Voltage	
Maximum Negative Value	154 Max. Volts DC
Maximum Negative Peak Value	220 Max. Volts
Maximum Positive Value	0 Max. Volts DC
Maximum Positive Peak Value	.2 Max. Volts
Heater Voltage	(6.9 Max. Volts (5.7 Min. Volts
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
During Warm-up Period not to exceed 15 seconds	450 Max. Volts
After Equipment Warm-up Period	300 Max. Volts
Heater Positive with Respect to Cathode	300 Max. Volts

Typical Operating Conditions

Cathode Drive Service

Unless otherwise specified, all voltage values are positive with respect to Grid No. 1.

Anode Voltage	18,000 Volts DC
Grid No. 4 Voltage for Focus (Notes 4 & 5)	150 Volts DC
Grid No. 2 Voltage	50 Volts DC
Cathode Voltage (Note 6)	+33 to +45 Volts DC

Maximum Circuit Values

Grid No. 1 Circuit Resistance	1.5 Max. Megohms

Notes

1. Measured with implosion protection hardware connected to external coating.

2. Heater warm-up time is defined as the time required for the voltage across the heater to reach 80% 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.

3. Anode, Grid No. 3 and Grid No. 5 are connected together within the tube and are referred to herein as anode.

4. With the combined Grid No. 1 bias voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 15" by 19" pattern from RCA 2F21 monoscope or equivalent.

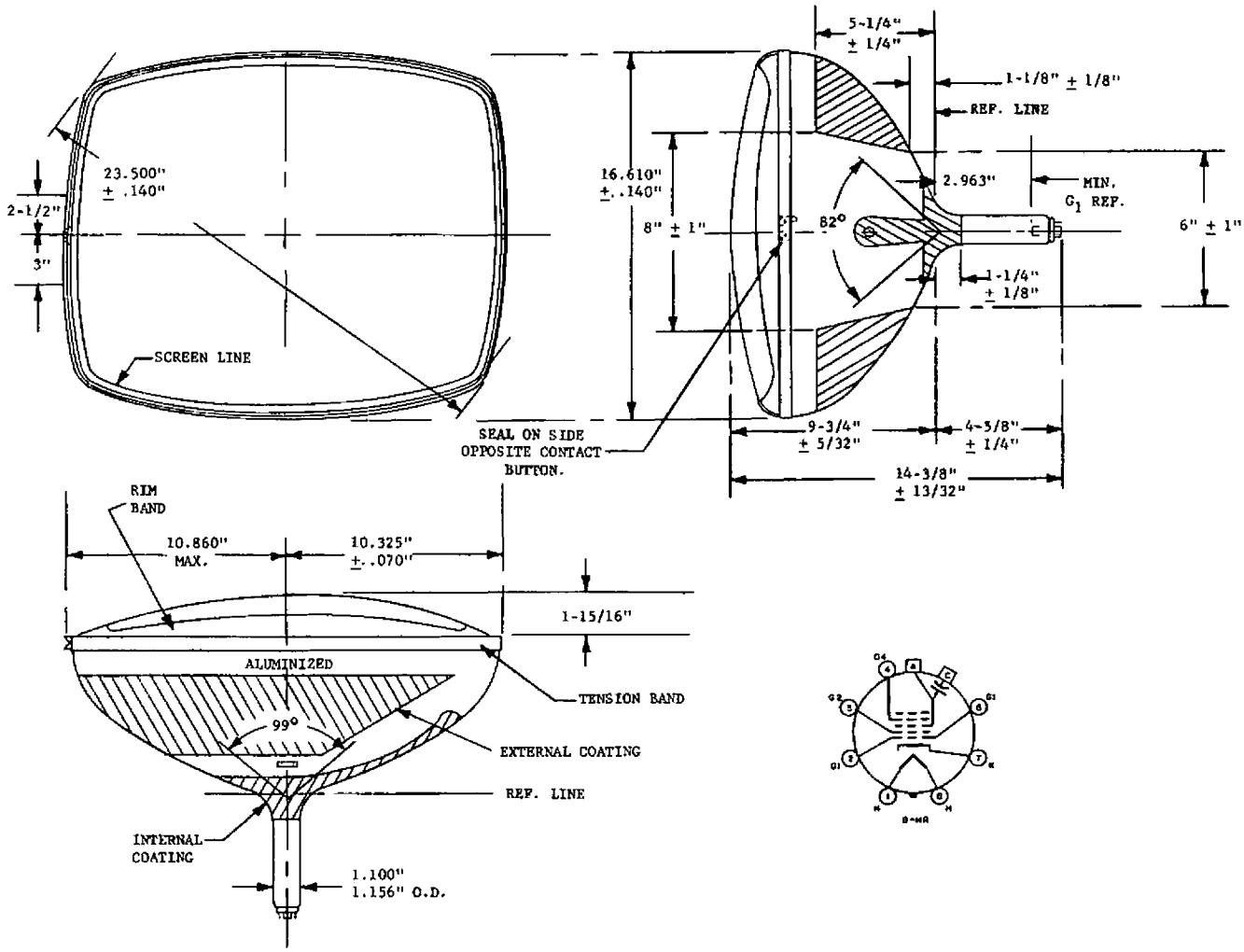
5. Individual tubes will have satisfactory focus at some value between -50 and +350 volts.

6. For visual extinction of the focused raster. For cutoff of undeflected focus spot, the absolute value of the bias between cathode and grid will increase by about 4 volts.

OUTLINE DRAWING

23GWP4

Television Picture Tube



MECHANICAL NOTES

1. The reference line is determined by reference line gauge JEDEC #126.
2. The area around the button is covered with an insulating coating.
3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of the base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

WARNING

X-ray radiation shielding may be necessary to protect against possible danger of personal injury from prolonged exposure at close range if this tube is operated at anode voltages higher than 16,000 volts.

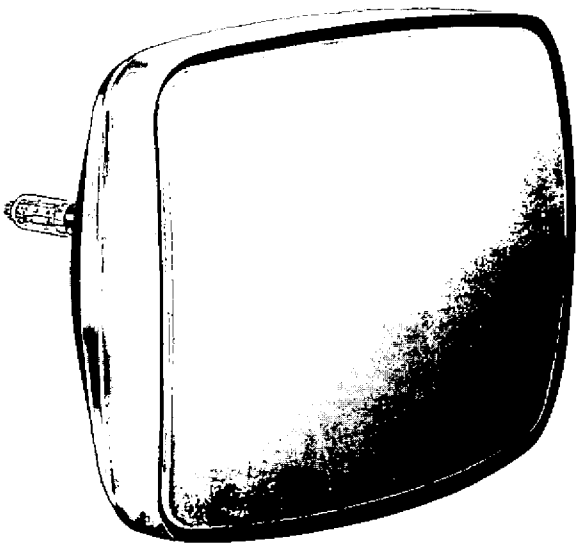
The information, diagrams, or any other data included herein are believed to be accurate and reliable. However, the Philco Corporation, Lansdale Division, assumes no responsibility or liability whatsoever for the application, interpretation or use made of such information, diagrams or data especialy insofar as the use of said information, diagrams or data affects any patent, trademark or proprietary data rights.

from JEDEC release #4887, Dec. 21, 1964

25AP22

90° RECTANGULAR COLOR PICTURE TUBE

RCA-25AP22 is a directly viewed, 25-inch rectangular glass picture tube of the triple-gun, shadow-mask type for use in color television receivers. The screen has nearly straight sides with sharply rounded corners. It is capable of producing a full color or black-and-white picture.



Features of the 25AP22 include:

- 90° Magnetic Deflection
- 295 Sq. In. (Min.) Rectangular Screen Area — 19.844" x 15.562" (Min.)
- 1.438" Neck Diameter
- 21.3" Max. Overall Length
- 6.3 Volt/800 Ma Heater
- 27.5 Kv Max. Anode Voltage
- Aluminized Tricolor Phosphor-Dot Screen
- Electrostatic Focus
- Magnetic Convergence
- Integral Filterglass Protective Window

The smaller neck diameter of the 25AP22 makes possible the use of a high sensitivity deflecting yoke. This combination permits the wide angle deflection with approximately the same power required to scan a color picture tube having 70° deflection angle and 2" neck diameter.

The 25AP22 utilizes an improved, close-spaced, triple-beam electron-gun assembly featuring a unitized cathode construction supported by glass beads. The heaters are also supported from the same glass beads. These design innovations provide a structure having high stability for all operating parameters throughout tube life. Another feature is an integral glass-button base having straight-through leads fitted with a keyed wafer.

The 25AP22 has an integral Filterglass protective window which is sealed to the faceplate of the tube with a clear resin. This construction eliminates the need for a separate safety-glass window and its companion dust seal in the receiver. Internal reflections are thereby reduced with a consequent improvement in picture contrast and color saturation. The surface of the protective window is treated to minimize specular reflection.

OPERATING PRINCIPLES

The electron-gun assembly of the 25AP22 consists of three electrostatic-focus guns. A view of the electron-gun assembly is shown in *Fig.1*.

The three guns are spaced 120° apart with their axes tilted toward the tube axis to facilitate convergence of the three beams at the phosphor-dot screen. The different angles at which the beams from the three guns reach a certain aperture in the shadow mask determines the particular phosphor dot which is energized by each beam. The phosphor dots are deposited on the screen in three separate arrays, one array for each of the primary colors. Relative orientation of shadow-mask apertures and phosphor-dot arrays is such that the beam from any one gun will energize only one of the primary colors no matter which part of the phosphor-dot screen is being scanned. Therefore, three color signals controlling the three beams produce independent pictures in the primary colors. These primary color pictures are superimposed resulting in a full-color or black-and-white picture.

Convergence is accomplished by magnetic fields generated by two external components. Radial conver-

gence displacement of each beam is provided by action of magnetic fields from a radial-converging assembly coupled into the associated internal radial-converging pole pieces. Lateral convergence displacement of the blue beam relative to the red and green beams is provided by action of the magnetic fields from a lateral-converging device.

ELECTRON-GUN ASSEMBLY

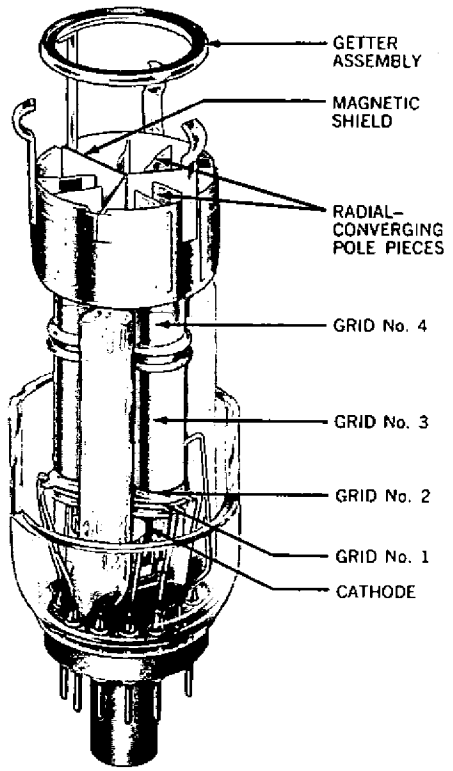


Fig. 1

Focusing of the three beams is accomplished electrostatically by adjustment of the voltage applied to the three No.3 grids which are interconnected within the tube and have a common base-pin terminal.

A deflecting yoke is required for deflecting the electron beams simultaneously after they pass between the respective radial-converging pole pieces. A magnetic-metal shield and a purifying magnet are also required to minimize the effects of extraneous magnetic fields, the earth's magnetic field and other causes which may affect register.

GENERAL DATA

Electrical:

Electron Guns, Three with Axes Tilted Toward Tube Axis	Red, Blue, Green	
Heater, of Each Gun Series Connected within Tube with Each of the Other Two Heaters:		
Current at 6.3 volts[a]	800	ma
Focusing Method	Electrostatic	
Focus Lens	Bipotential	
Convergence Method	Magnetic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Diagonal	89	deg.
Horizontal	78	deg.
Vertical	63	deg.
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 of any gun to all other electrodes	6	pf
All cathodes to all other electrodes	15	pf
Grid No.3 to all other electrodes	6.5	pf
External conductive coating to anode	2500 max.	pf
	2000 min.	pf

Optical:

Faceplate and Protective Window	Filterglass
Light transmission at center (Approx.)	41%
Surface of Protective Window	Treated to minimize specular reflection
Screen, on Inner Surface of Faceplate:	
Type	Aluminized, Tricolor, Phosphor-Dot
Phosphor (three separate phosphors, collectively)	P22—All-Sulfide Type
Fluorescence and phosphorescence of separate phosphors, respectively	Red, Blue, Green
Persistence of group phosphorescence	Medium Short
Dot Arrangement	Triangular group consisting of red dot, blue dot, and green dot
Spacing between centers of adjacent dot trios (Approx.)	0.029"

Mechanical:

Tube Dimensions:	
Overall length	20.924" ± .375"
Neck length	6.693" ± .188"
Diagonal	24.566" ± .125"
Greatest width	21.500" ± .125"
Greatest height	17.263" ± .125"
Minimum Screen Dimensions (Projected):	
Diagonal	23.031"
Greatest width	19.844"
Greatest height	15.562"
Area	295 sq. in.
Base Designation	Small-Button Diheptar 12-pin (JEDEC No.B12-244)
Basing Designation	JEDEC No.14BE
Bulb Contact Designation	Recessed Small Cavity (JEDEC No.J1-21)
Pin Position Alignment	Pin No.12 Aligns Approx. with Anode Bulb Contact
Operating Position	Anode Bulb Contact on Top
Weight (Approx.)	40 lbs.

Maximum and Minimum Ratings, *Design-Maximum Values:*[b]

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	27,500 max. 20,000 min.	volts volts
Total Anode Current, Long-Term Average	1000 max.	μa
Grid-No.3 (Focusing Electrode) Voltage	6000 max.	volts
Peak Grid-No.2 Voltage, Including Video Signal Voltage	1000 max.	volts
Grid No.1 Voltage:		
Negative bias value	400 max.	volts
Negative operating cutoff value	200 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage (ac or dc)[a]	6.9 max. 5.7 min.	volts volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Equipment Design Ranges:

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20,000 and 27,500 volts

Grid-No.3 (Focusing Electrode) Voltage	16.8% to 20% of Anode volts	
Grid-No.2 and Grid-No.1 Voltages for Visual Extinction of Focused Spot	See *CUTOFF DESIGN CHART* in Fig.2	
Maximum Ratio of Grid-No.2 Voltages, Highest Gun to Lowest Gun in Any Tube (At grid-No.1 spot cutoff voltage of -100 volts)	1.86	
Grid-No.3 Current (Total)	-45 to +15	μa
Grid-No.2 Current	-5 to +5	μa

To Produce White of 9300° K +27 M.P.C.D. (CIE Coordinates x = 0.281, y = 0.311):

	Red	Blue	Green	
Percentage of total anode current supplied by each gun (average)	42	28	30	%

	Red to Blue			Red to Green		
	Min.	Avg.	Max.	Min.	Avg.	Max.
Ratio of cathode currents	1.00	1.50	2.00	1.00	1.40	1.80

Displacements, Measured at Center of Screen:

Raster centering displacement:		
Horizontal	-0.47 to +0.47	inch
Vertical	-0.45 to +0.45	inch
Lateral convergence displacement of blue beam with respect to converged red and green beams	-0.25 to +0.25	inch
Radial convergence displacement excluding effects of dynamic convergence (each beam)	-0.37 to +0.37	inch
Maximum Required Correction for Register[c] (Including Effect of Earth's Magnetic Field when Using Recommended Components) as Measured at the Center of the Screen in any Direction	.005 max.	inch

Examples of Use of Design Ranges:

Unless otherwise specified, voltage values are for each gun and are positive with respect to cathode

Anode Voltage	25,000	volts
Grid-No.3 (Focusing Electrode) Voltage	4200 to 5000	volts
Grid-No.2 Voltage when circuit design utilizes grid-No.1 voltage of -150 volts for visual extinction of focused spot	285 to 685	volts
Grid-No.1 Voltage for visual extinction of focused spot when circuit design utilizes grid-No.2 voltage of 400 volts	-95 to -190	volts

Limiting Circuit Values:

High-Voltage Circuits

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *high-voltage power supply* and the *grid-No.3 power supply* be of the limited-energy type.

Grid-No.3 circuit resistance	7.5 max.	megohms

Low-Voltage Circuits

Effective grid-No.1-to-cathode-circuit resistance (each gun)	0.75 max.	megohm

The low voltage circuits should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the grid-No.2-to-heater circuit, the grid-No.1-to-heater circuit, and the cathode-to-heater circuits of all other tubes operating from the same heater winding as the color picture tube and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous short circuit current of more than 750 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the color picture tube.

---

[a] For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.

[b] The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Design-Maximum Ratings System* for rating electron devices.

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.

The device manufacturer chooses these values to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in device 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 device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, signal variation, and environmental conditions.

[c] Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

GENERAL CONSIDERATIONS

X-Radiation Warning. Because the 25AP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 25AP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

CUTOFF DESIGN CHART

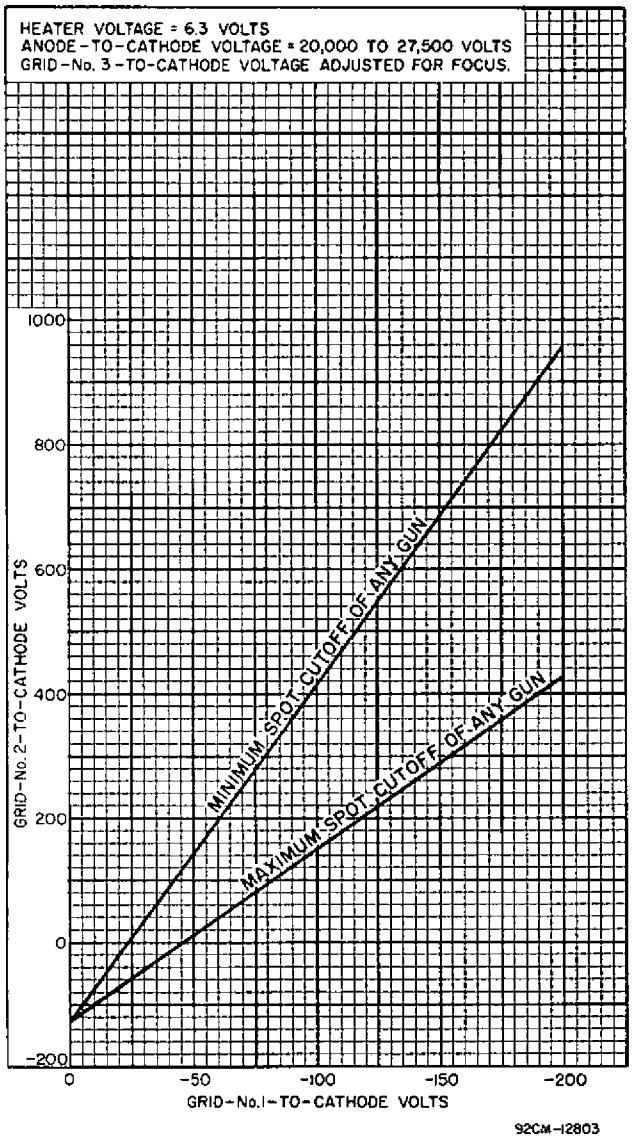


Fig.2

Tube Handling. The 25AP22 should be handled carefully as required by any glass picture tube. Particular care should be taken to prevent damage to the seal area and the edge of the protective window.

Orientation. The 25AP22 must be operated with tube axis in a horizontal position and with the blue gun uppermost (i.e., the anode contact button on top). This is the operating position for which the beam-displacement and register correction values shown in this bulletin apply.

Support for the 25AP22 may be provided by a mounting system which supports the tube in the area in front of the seal line together with a pull-up ring or similar support on the tube funnel. The mounting system should not place mechanical stress on or cause abrasion of the tube particularly in the seal area and the edge of the protective window.

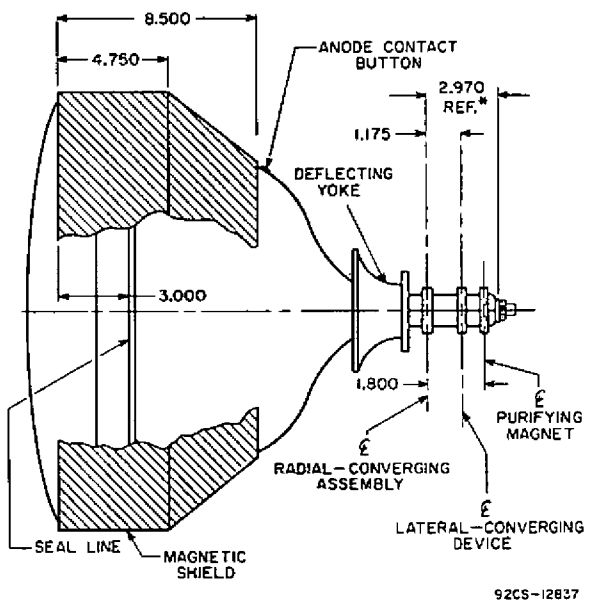
The color receiver mounting system should incorporate sufficient cushioning so that under normal conditions of shipment or handling an impact force is never applied to the 25AP22 of more than 35g parallel to the tube axis or more than 30g perpendicular to the tube axis.

Contact to the **external conductive coating** should be made by multiple fingers to prevent possible damage to the tube from localized overheating due to poor contact.

COMPONENT CONSIDERATIONS

The **Deflecting Yoke** should not be used for supporting the picture tube. The yoke and tube axes must coincide and the yoke must be free to move along the neck for a distance of approximately 1/2 inch from its most forward position for adjustment purposes. The yoke mount should also provide for a small amount of rotational adjustment. Centering of the raster on the screen may be accomplished by passing direct current of the required value through each pair of deflecting coils. Pincushion correction, if desired, may be accomplished by adding the necessary current waveforms to the deflecting current waveforms.

RELATIVE PLACEMENT OF TYPICAL COMPONENTS



* ℄ of Radial Converging Assembly Core directly over ℄ of internal pole pieces.

Dimensions in Inches

Fig.3

The **Purifying Magnet** is used to compensate for the effects of uniform extraneous magnetic fields and other causes which may affect register. It should be positioned on the neck in the plane determined by the three cathodes as shown in *Fig.3*. The devices should provide a magnetic field perpendicular to the tube axis. The field should be adjustable in magnitude and direction to cause a change of register. The purifying magnet must be capable of supplying correction for register from zero to the maximum value specified.

A **Magnetic-Metal Shield** is used to provide compensation for the effect of the earth's magnetic field. The recommended shield is constructed of .030" cold-rolled steel and is mounted on the tube as shown in *Fig.3*. This shield minimizes the effect on tangential register near the edge of the screen caused by the component of the earth's field parallel to the tube axis. It also minimizes the effect of the component of the earth's field perpendicular to the tube axis. To be effective, the shield must be degaussed as described under *Adjustment Procedures*.

The **Radial-Converging Assembly** and associated circuits provide the magnetic fields necessary to converge dynamically the three electron beams as they traverse the screen of the picture tube, and together with the lateral-converging device the radial-converging assembly provides the magnetic fields necessary for static convergence. The assembly is mounted on the neck of the picture tube with the three electromagnets centered over the three pairs of internal converging pole pieces as shown in *Fig.3*. The necessary horizontal and vertical current waveforms are passed through the windings for maintaining dynamic convergence of the deflected beams. Static magnetic fields for converging the three beams at the center of the screen are produced by passing direct current through the windings or by permanent magnets variably coupled through the cores of the electromagnets to the converging pole pieces in the tube. The magnetic field strength should be adjustable to provide movements, as shown in *Fig.4*, ranging from zero to the specified maximum distance in either direction.

The **Lateral-Converging Device** supplements the correction supplied by the radial-converging assembly for statically converging the three electron beams at the center of the screen. The device is mounted on the neck of the picture tube between the purifying magnet and the radial-converging assembly as shown in *Fig.3*. The magnetic field should cause a lateral (horizontal) movement of the blue beam opposite to the movement of the converged red and green beams, as shown in *Fig.5*. The magnetic field strength should be adjustable to provide movement of the blue beam relative to the converged red and green beams ranging from zero to the specified maximum distance in either direction.

RADIAL-CONVERGING SYSTEM

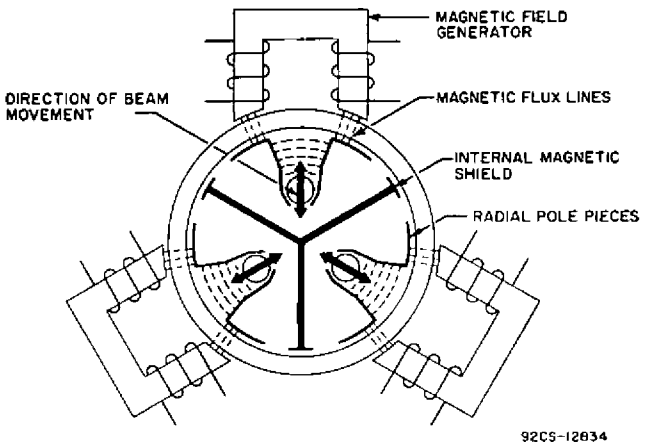


Fig.4

LATERAL-CONVERGING SYSTEM

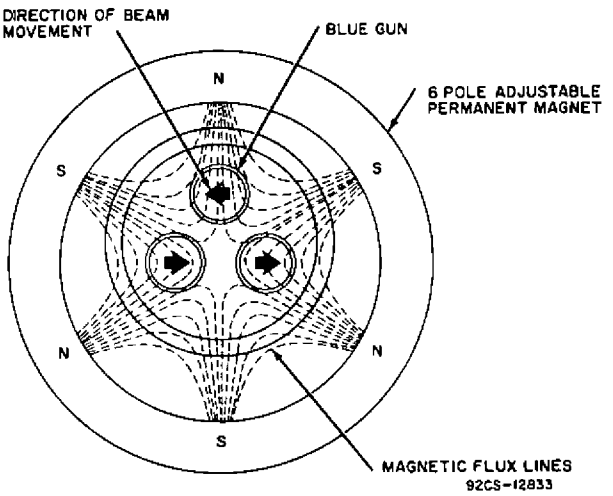


Fig.5

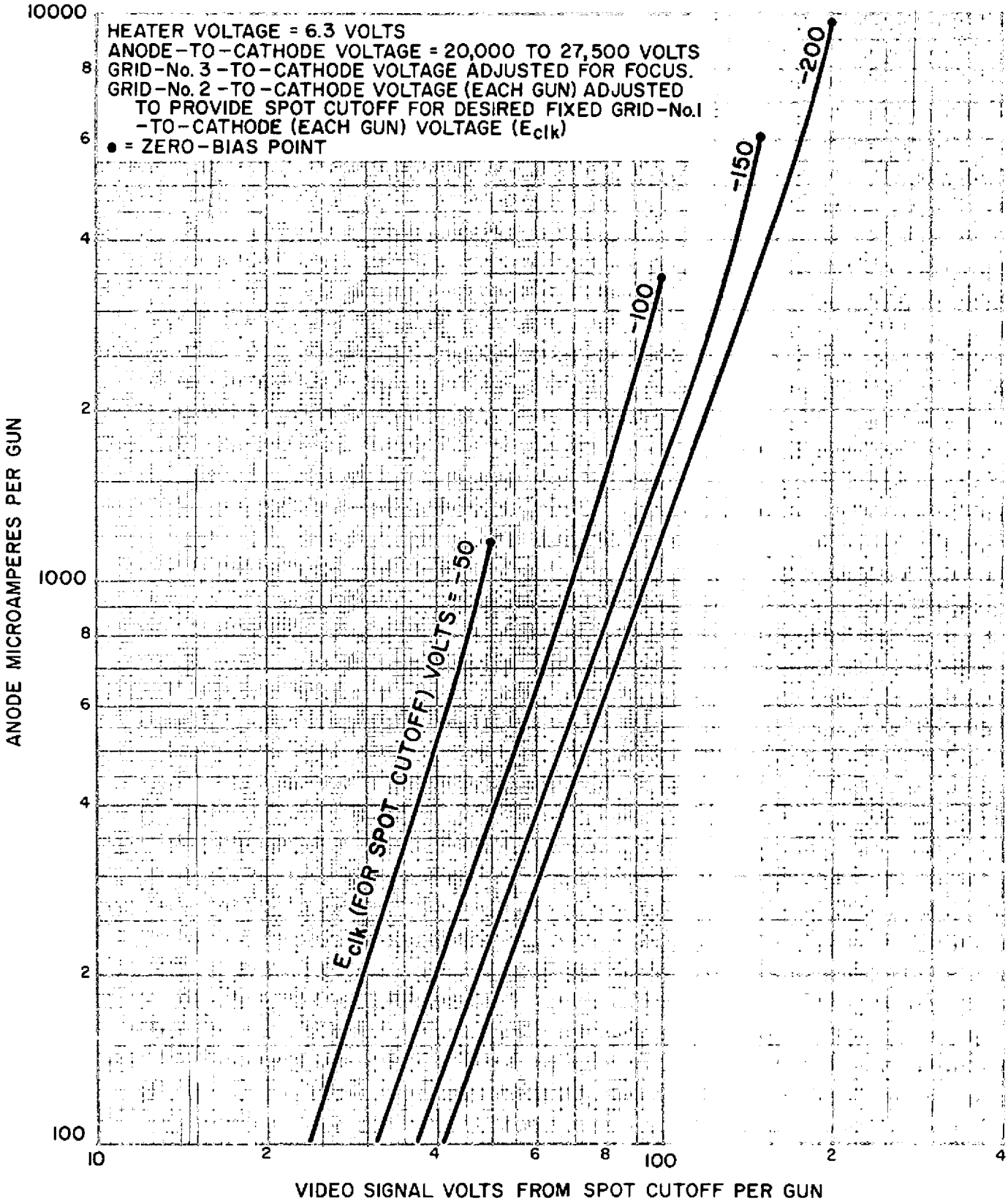
OPERATING CHARACTERISTICS

Cutoff Considerations. Grid-No.2 voltage in each of the guns may be used to compensate for the normal variation to be expected in the grid-No.1 cutoff voltage in each of the guns of any one tube and from tube to tube. In tracking systems utilizing equal cutoff operation and variable video drive, the grid-No.2 voltage of each gun may be adjusted for the design value of cutoff, within maximum rated values, for all three guns. In other tracking systems, the voltage applied to grid No.2 in any one gun may be adjusted, with due consideration to its maximum rated value, to fix the corresponding grid-No.1 cutoff voltage at a value to obtain the desired drive characteristics for each gun driven from a fixed-drive-ratio system.

The **Cutoff Design Chart**, shown in *Fig.2*, shows the relationship between the grid-No.1 voltage for a tube having a gun with maximum cutoff and for a tube having

TYPICAL DRIVE CHARACTERISTICS

Grid-Drive Service

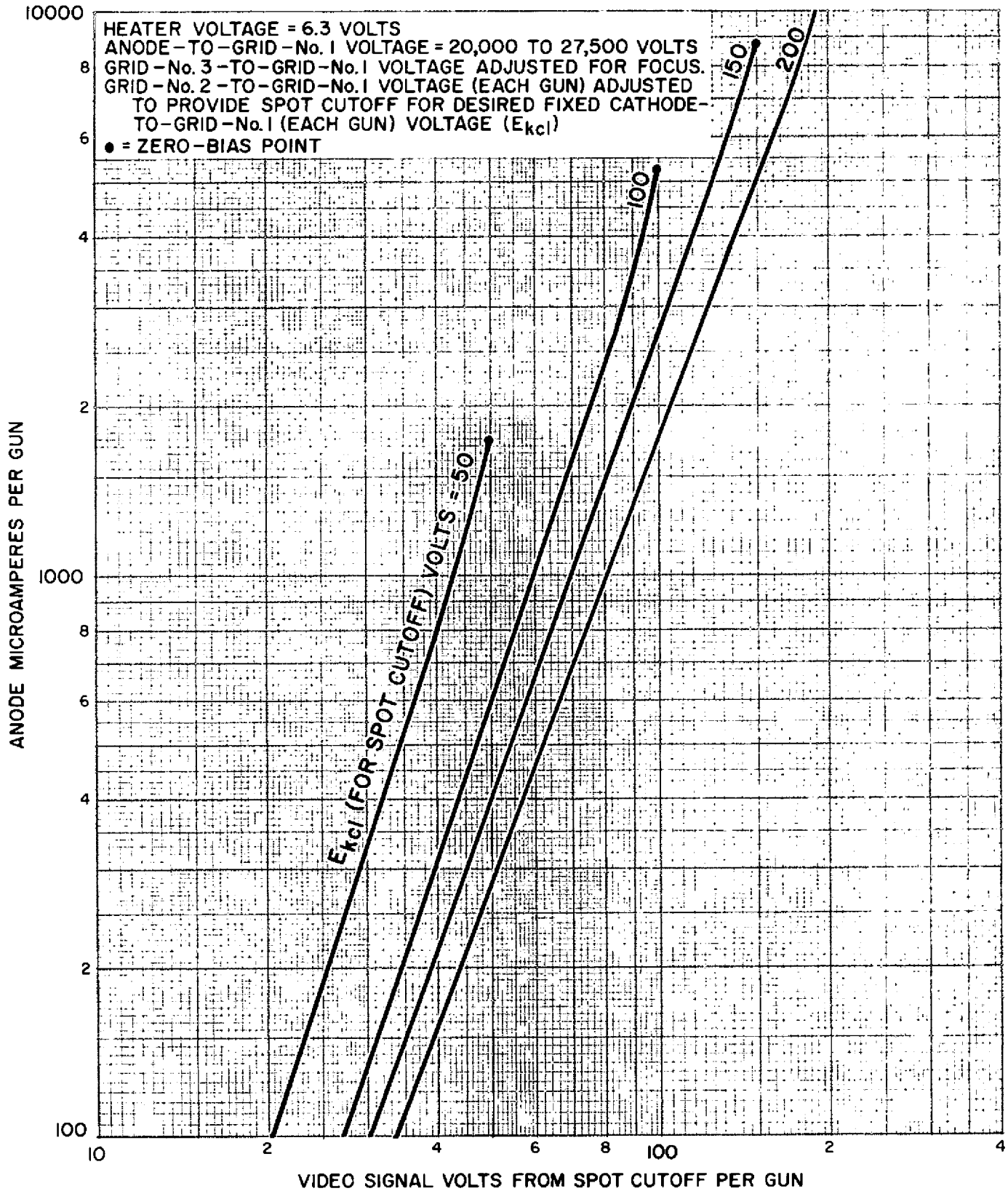


92CM-12807

Fig.6

TYPICAL DRIVE CHARACTERISTICS

Cathode-Drive Service



92CM-12806

Fig. 7

a gun with minimum cutoff versus grid-No.2 voltage. This figure illustrates characteristics of limit guns. These characteristics cannot be applied simultaneously to the three guns in any one tube because of the 1.86 value for "Maximum Ratio of Grid-No.2 Spot Cutoff Voltages" listed under *Equipment Design Ranges*. The characteristics for a particular tube can be determined and plotted on *Fig.2* by operating at a particular grid-No.2 voltage and determining the grid-No.1 voltage for spot cutoff for each of the guns. New curves can then be drawn through these points from the same origin—grid-No.2-to-cathode volts of -125 and grid-No.1-to-cathode volts of 0.

Drive requirements for the 25AP22 are more complicated than the drive requirements for a conventional black-and-white picture tube. In practice, video information (color and/or black-and-white) may be applied to both the No.1 grids and the cathodes. Typical drive characteristics of the 25AP22 are shown in *Figs.6 and 7*.

For satisfactory performance of the 25AP22 in reproducing black-and-white pictures, it is essential that there be no color shift with variation in intensity of light output. Since the phosphors show negligible current saturation in the range of current densities used, the necessary constancy of color temperature requires that the percentage of total anode current supplied by each gun be held constant over the desired brightness range to prevent color tinting of the highlights and shadows.

Equal-Cutoff-Variable-Video-Drive Tracking System. In tracking systems utilizing equal cutoff operation and variable video drive, the video drive is varied directly to obtain the necessary current ratios. The required video-drive ratios may be determined by applying the design operating cutoff voltage to the appropriate drive chart, *Fig.6 or Fig.7*, and from the "Percentage of Total Anode Current Supplied by Each Gun" listed under *Equipment Design Ranges*.

Fixed-Video-Drive Tracking System. It will be seen from *Figs.6 and 7* that a low value of grid-No.1 cutoff voltage allows a particular value of anode current to be obtained with reduced drive. For this condition, however, the maximum anode current which may be obtained at zero bias is relatively low as indicated by the upper termination of the drive-characteristic line. It is possible, therefore, to utilize a lower operating cutoff, obtained by a low grid-No.2 voltage, for use with a lower-efficiency phosphor thereby increasing the anode current and maintaining the proper current balance between guns. The opposite would be true for a high grid-No.1 voltage. This characteristic of drive adjustment may be used to compensate for phosphor-efficiency variations as listed under *Equipment Design Ranges*—"Percentage of Total Anode Current Supplied by Each Gun."

The **Typical Light-Output Characteristics** of the 25AP22 are shown in *Fig.8*. **Spectral-Energy Emission Characteristic** of the group phosphor P22—all-sulfide type is shown in *Fig.9*.

ADJUSTMENT PROCEDURES

The following procedures are suggested to provide color purity and optimum convergence of the three beams over the entire area of the screen.

A pattern of white horizontal and vertical bars is particularly suitable for convergence adjustments and can be helpful in linearity adjustments as well. Commercial dot-pattern generators, such as the RCA WR-64A Color-Bar/Dot/Crosshatch Generator, are available which are very useful for both convergence and linearity adjustments.

Proper adjustment requires that the beams be focused and that all three beams properly converge at the phosphor-dot screen. Each of the beams is brought to a focus by a separate electrostatic lens in the appropriate gun. All of these focusing lenses are adjusted by a common voltage applied to the focusing electrodes through base pin No.9. The three beams are adjusted for proper convergence by the use of magnetic fields acting on each beam. Proper convergence is established when the three color images produced by the application of the same video signal to all three guns appear superimposed upon one another.

Placement of Components. The Magnetic Shield, Deflecting Yoke, Radial-Converging Assembly, Lateral-Converging Device, and Purifying Magnet are placed on the tube as shown in *Fig.3*. It is important that proper orientation be maintained between the external components and the gun pole pieces as shown in *Figs. 3, 4, and 5*.

Degaussing Treatment. Before making the *Preliminary Adjustments*, "degauss" the tube and shield as indicated below. This treatment will correct for localized areas of color impurity resulting from any magnetization of the metal shield and internal metal tube parts. It also minimizes the effect of the earth's magnetic field on the tube.

After a receiver (with automatic degaussing) has been transported or changed in location, the 25AP22 should be "degaussed" without removing it from the receiver. Minor readjustments may be required to insure optimum white uniformity and color purity in the new location.

A suitable degaussing coil may be made by winding 425 turns of No.20 enameled wire on a 12-inch diameter form about 3/4-inch wide. The coil is connected to a 120-volt, 60-cps supply and moved over the top and sides as well as over the faceplate of the tube. After a few seconds, the voltage supplied to the coil should be

slowly reduced to zero or the coil should be slowly moved away from the faceplate to a distance of at least six feet before disconnecting from the power source.

Automatic degaussing of the color picture tube and magnetic shield may be accomplished with an appropriate component, used in conjunction with the magnetic shield, and associated circuitry. Normally the tube is "degaussed" each time the receiver is turned on to compensate for changes in instrument orientation with respect to the earth's magnetic field. Degaussing from an external source is required, when the receiver is initially set up, to degauss the chassis and other ferrous parts of the instrument. External degaussing is also required if the chassis etc. should become magnetized. This procedure is required since automatic degaussing coils used in conjunction with the magnetic shield normally degauss the tube and shield only.

Color-Purity and Convergence Adjustments. The normal sequence involves first the dc convergence adjustment, next the purifying-magnet adjustment, and then adjustment of the axial position of the deflecting yoke. The procedures are described below.

The convergence at the center of the screen should be adjusted by means of the static-radial-convergence controls and by adjustment of the lateral-converging device.

With the red beam on, the purifying magnet should be adjusted until a uniform red field appears at the center of the screen. Rotational adjustment of the puri-

TYPICAL LIGHT-OUTPUT CHARACTERISTIC

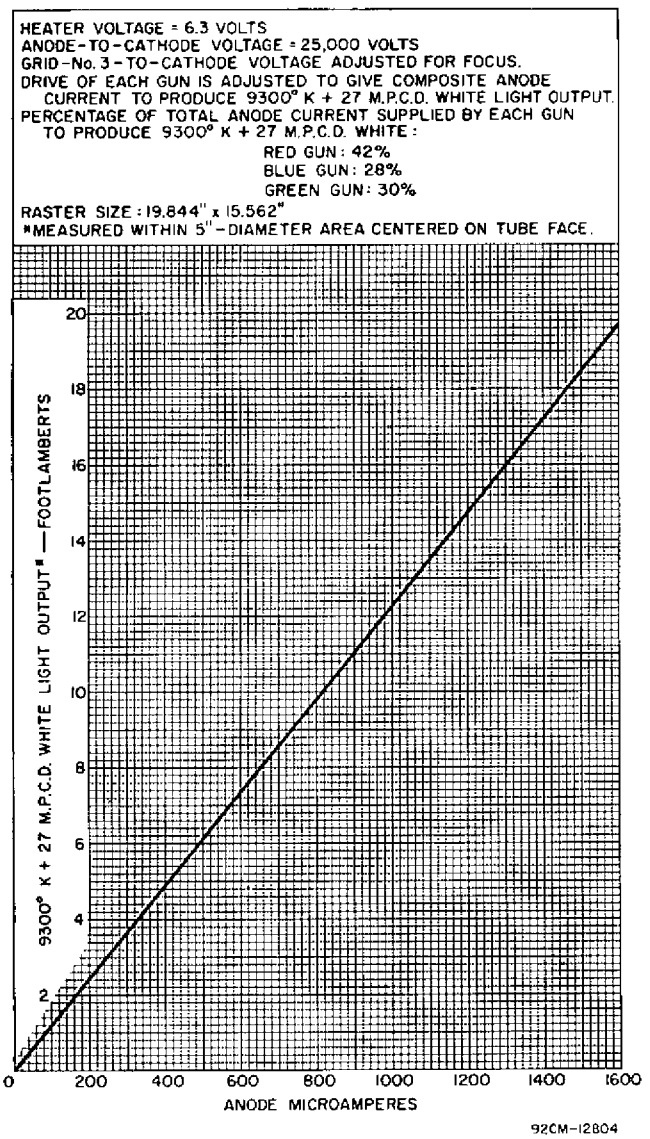


Fig.8

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF GROUP PHOSPHOR P22 – ALL-SULFIDE TYPE

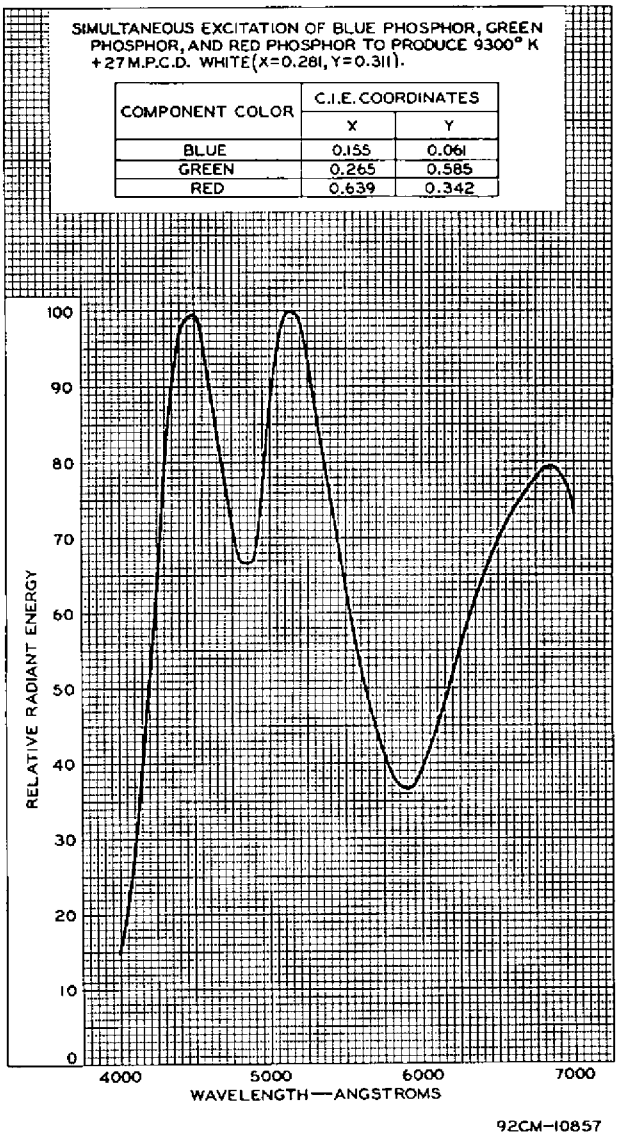


Fig.9

fying magnet affects, as illustrated in *Fig.10*, the direction in which the excited areas move, while adjustment of its field strength moves the beams in that direction. The purifying magnet should be adjusted in the above manner until the beam trio is centered on the phosphor-dot trio at the center of the screen.

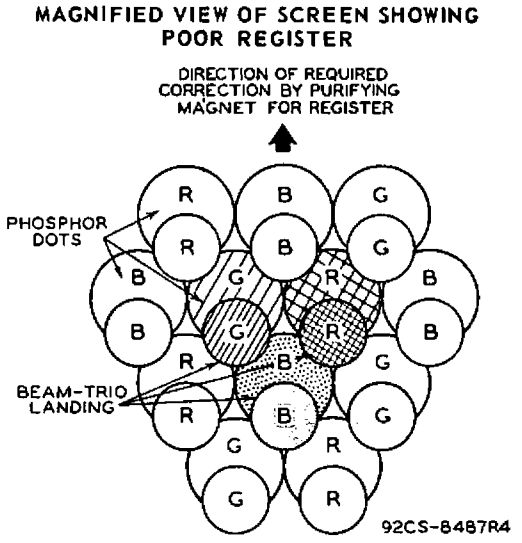


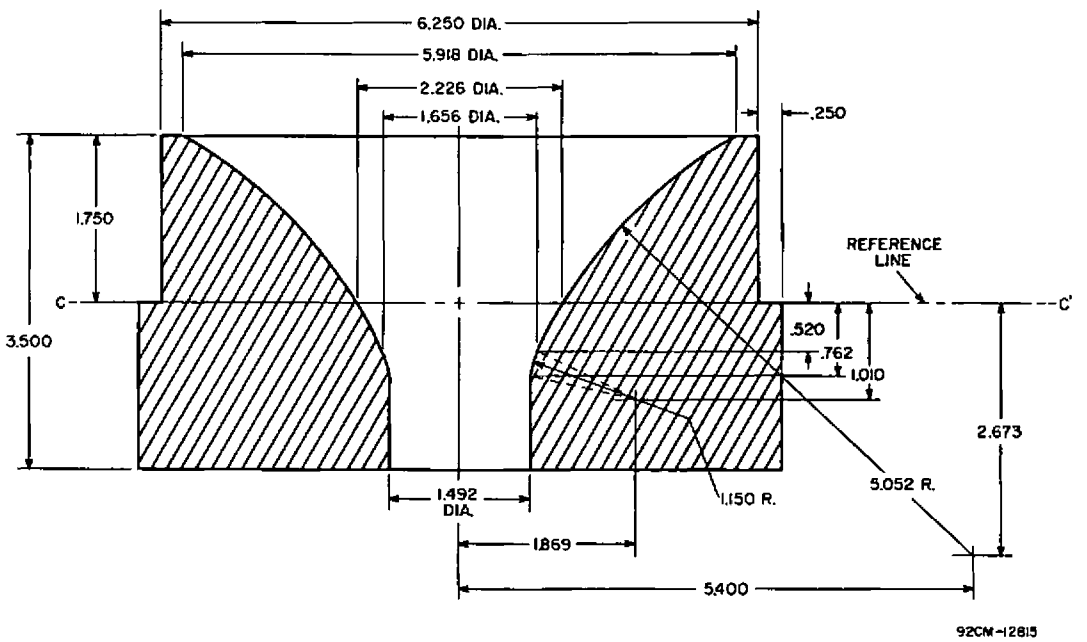
Fig.10

Slide the deflecting yoke axially on its supports to produce the most uniform red field. The blue field and the green field should now be checked separately for color purity. A compromise in adjustment settings should be made if necessary to give the best red, blue, and green field purity. Center convergence should be checked before and after each purity adjustment.

Adjustment of Dynamic Convergence. After the initial adjustments for color purity and convergence are completed, a white-bar or dot-pattern signal should be applied to the three guns and adjusted so that each color is of approximately the same intensity. The raster should then be centered by use of the horizontal and vertical centering controls. The initial adjustment of center convergence should be checked and readjusted if necessary by adjusting the three static-convergence controls and the lateral-converging control. *Figs.4 and 5* show the direction of movement of each beam produced by its associated magnetic-field controls. The exact sequence of dynamic-convergence adjustments is dependent upon the convergence-circuit arrangement used.

Purity of the three fields should now be checked and the yoke as well as the purifying magnet should be readjusted as outlined under *Color-Purity and Convergence Adjustments.*

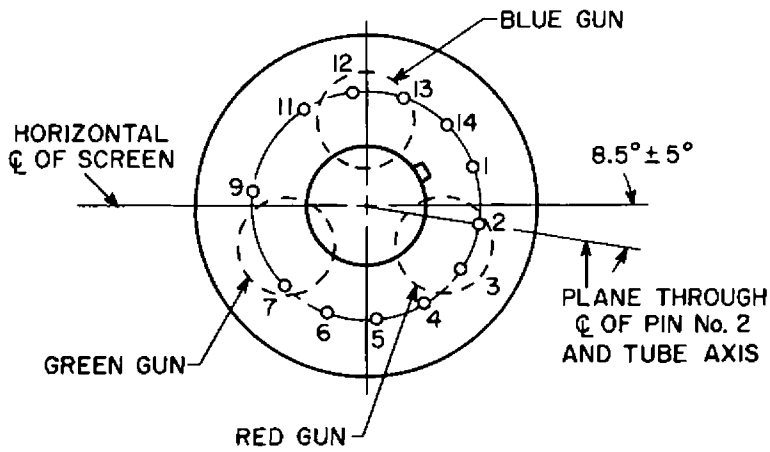
REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE



Reference Line is determined by plane C-C' when gauge is seated.

Dimensions in Inches

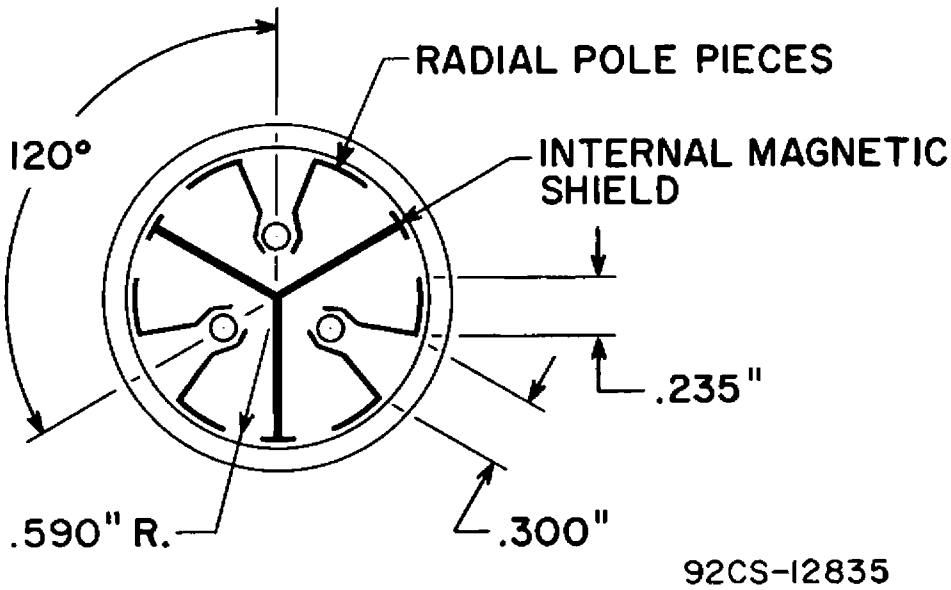
BOTTOM VIEW OF BASE



92CS-12816

BASE SPECIFICATION
14BE

PIN 1 - HEATER
PIN 2 - CATHODE OF RED GUN
PIN 3 - GRID No.1 OF RED GUN
PIN 4 - GRID No.2 OF RED GUN
PIN 5 - GRID No.2 OF GREEN GUN
PIN 6 - CATHODE OF GREEN GUN
PIN 7 - GRID No.1 OF GREEN GUN
PIN 9 - GRID No.3
PIN 11 - CATHODE OF BLUE GUN
PIN 12 - GRID No.1 OF BLUE GUN
PIN 13 - GRID No.2 OF BLUE GUN
PIN 14 - HEATER
CAP - ANODE (Grid No.4, Grid No.5, Screen, Collector)
C - EXTERNAL CONDUCTIVE COATING



Location of radial-converging pole pieces viewed from screen end of guns

NOTES FOR DIMENSIONAL OUTLINE

NOTE 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (shown on page 10) and with tube seated in gauge, the reference line is determined by the intersection of the plane CC' of the gauge with the glass funnel.

NOTE 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a circle concentric with bulb axis and having a diameter of 2.

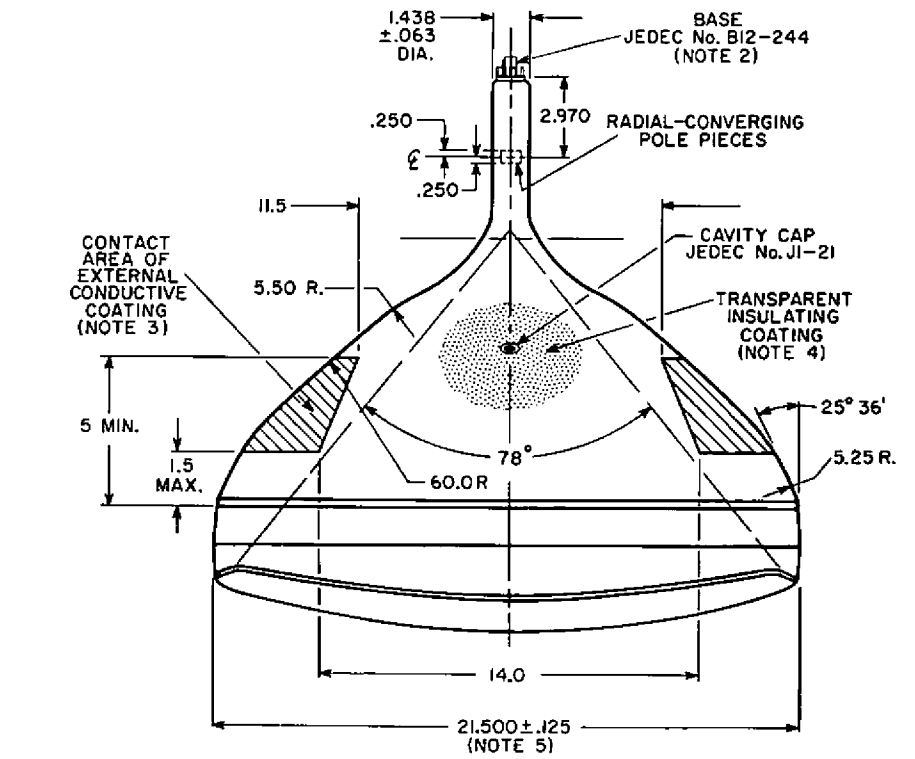
NOTE 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

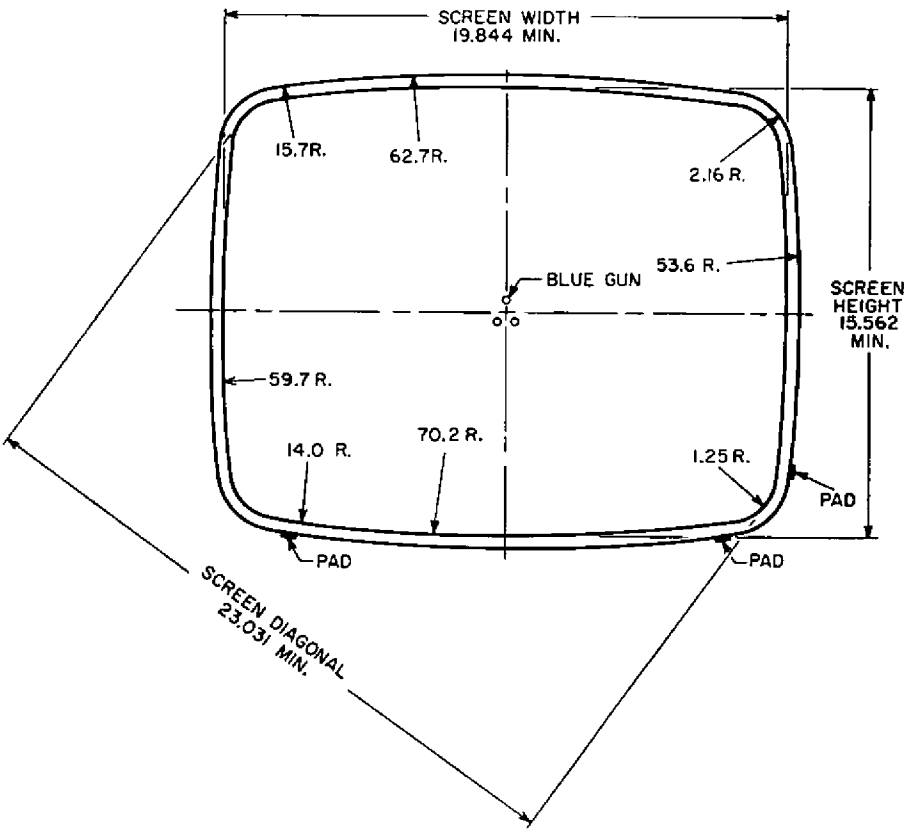
NOTE 4: To clean this area, wipe only with soft dry lintless cloth.

NOTE 5: Measured from the mold-match line.

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DIMENSIONAL OUTLINE

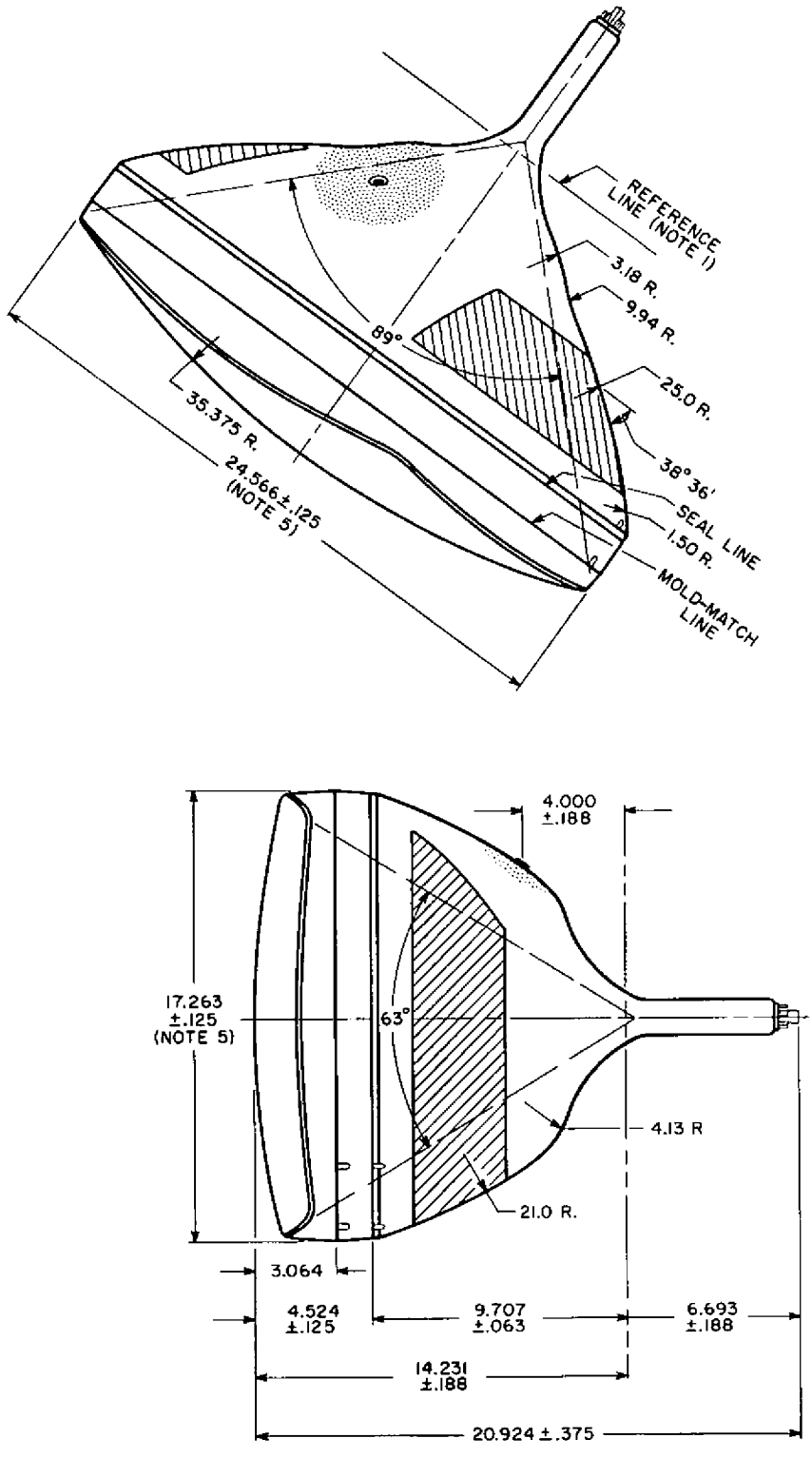




Dimensions in Inches Unless Otherwise Shown

For Notes, see *page 11.*

DIMENSIONAL OUTLINE



Dimensions in Inches Unless Otherwise Shown

For Notes, see *page 11*.

This bulletin is to be used in conjunction with bulletin for RCA-25AP22

25BP22

90° RECTANGULAR COLOR PICTURE TUBE

RCA-25BP22 is a directly viewed, 25-inch rectangular picture tube which is identical to RCA-25AP22 except that it does not have an integral protective window sealed to the faceplate.

It is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of the 25BP22 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

For description, operating principles, general data, maximum and minimum ratings, equipment design ranges, examples of use of design ranges, limiting circuit values, general considerations, component considerations, operating characteristics, and adjustment procedures of the 25BP22; refer to the technical bulletin for the 25AP22, except as noted below.

Ignore all reference to the integral protective window.

Faceplate	Filterglass
Light transmission (Approx.)	69%

Tube Dimensions:

Overall length	20.732" ± .375"
Weight (Approx.)	35 lbs.

TYPICAL LIGHT-OUTPUT CHARACTERISTIC

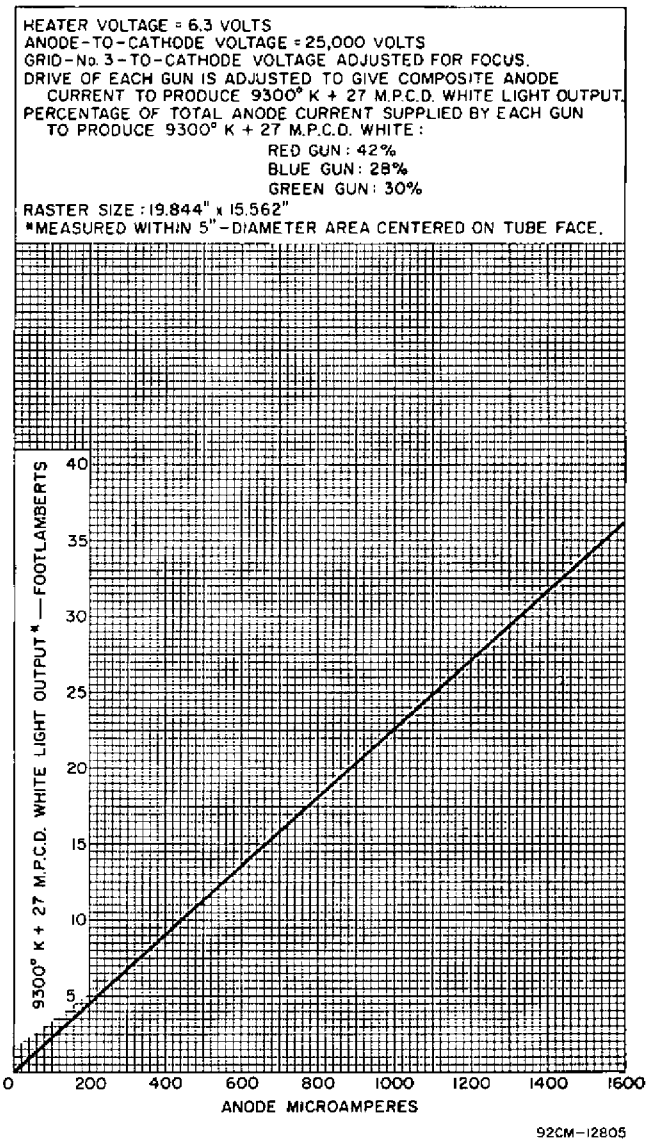


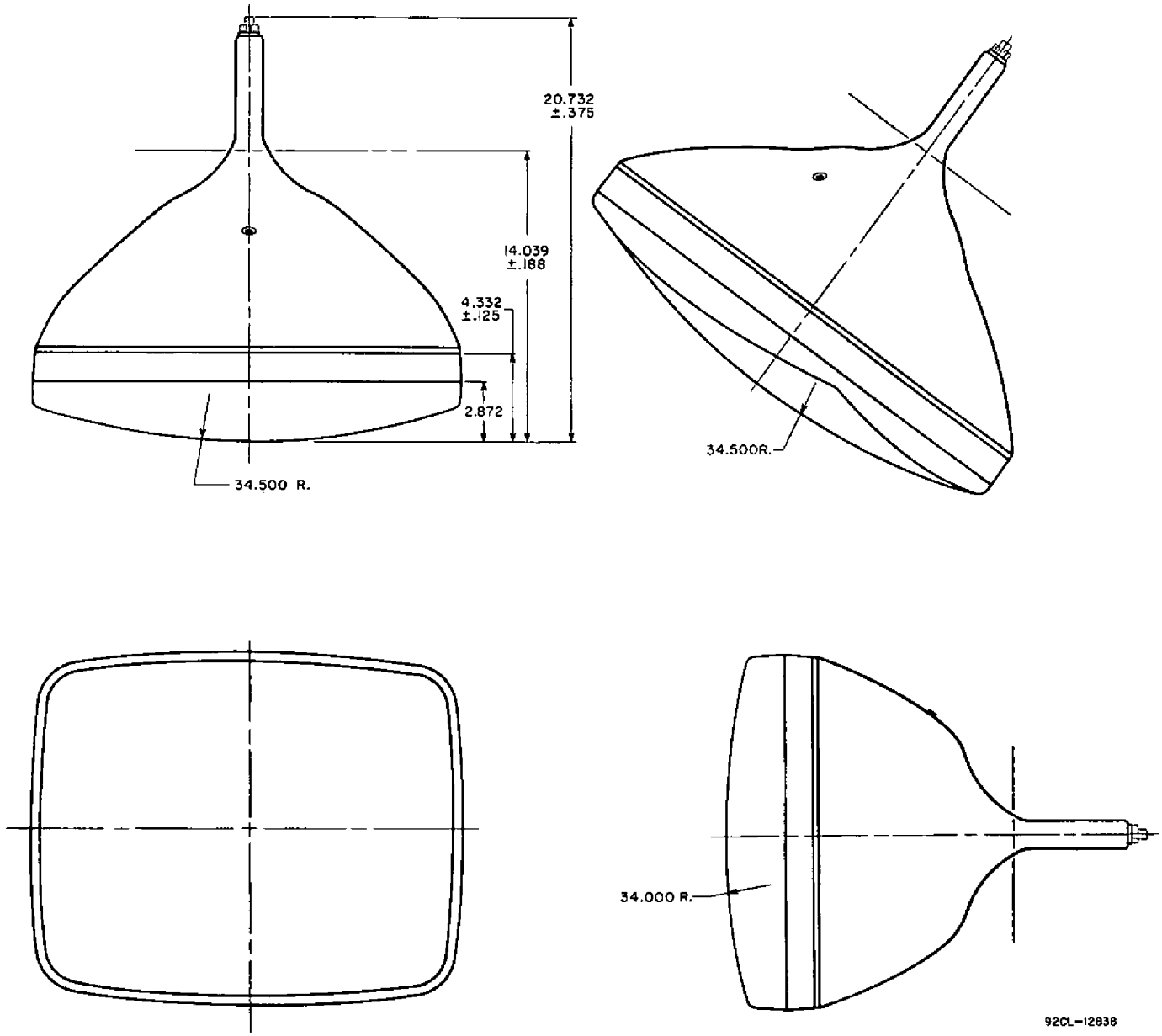
Fig.8

from JEDEC release #4887, Dec. 21, 1964

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DIMENSIONAL OUTLINE

Dimensions shown are only those which are different from the corresponding dimensions for the 25AP22



Dimensions in Inches

National Video Corporation
4300 W. 47TH STREET CHICAGO 32, ILLINOIS
CLIFFSIDE 4-5600

The 25HP4 is a 25"-110° cathode ray tube with filled rim and a 5 1/8" neck length. This tube has a 450 milliampere 6.3 volt filament, a straight gun which requires no ion trap, and 50 volt G2 for cathode drive design.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angles (Approximate)	
Diagonal	110 degrees
Horizontal	99 degrees
Vertical	82 degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes (approx.)	5 uuf
Grid No. 1 to all other electrodes (approx.)	6 uuf
External conductive coating to anode (Note 1)	2,500 max. uuf 2,000 min. uuf
Resistance Between External Conductive Coating and Implosion Protection Hardware	50 min. megohms
Heater Current at 6.3 Volts	450 ±20 ma
Heater Warm-up Time	11 seconds

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center (Approximate)	42 percent
Antireflection Treatment	None

MECHANICAL DATA

Overall Length	15 7/8 ±1/4 inches
Neck Length	5 1/8 ±1/8 inches
Greatest Dimensions of Tube (Metal Rim)	
Diagonal	28 1/8 ±3/32 inches
Width	23 1/4 ±1/16 inches
Height	18 9/16 ±1/16 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	24 1/4 inches
Horizontal Axis	20 15/16 inches
Vertical Axis	16 7/16 inches
Area	327 sq. inches

from JEDEC release #4822, Oct. 5, 1964

Implosion Protection		Filled Rim
Bulb	JEDEC Designation	J-204-A1
Bulb Contact	JEDEC Designation	J1-21
Base	JEDEC Designation	B7-208
Basing	JEDEC Designation	8HR

Bulb Contact Alignment
J1-21 contact aligns with Pin Position No. 4 $\pm 30^{\circ}$.

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to Grid #1.

Maximum Anode Voltage	23,000 volts
Minimum Anode Voltage	12,000 volts
Maximum Grid 4 (Focusing Electrode) Voltage	+1,000 -500 volts
Maximum Grid #2 Voltage	60 volts
Minimum Grid #2 Voltage	25 volts
Cathode Voltage	
Maximum negative value	0 volts dc
Maximum negative peak value	2 volts
Maximum positive value	100 volts dc
Maximum positive peak value	150 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.8 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 seconds	450 volts
After equipment warm-up period	200 volts
Heater positive with respect to cathode	200 volts

TYPICAL OPERATING CONDITIONS

CATHODE DRIVE SERVICE

Unless otherwise specified, all voltage values are positive with respect to Grid No. 1

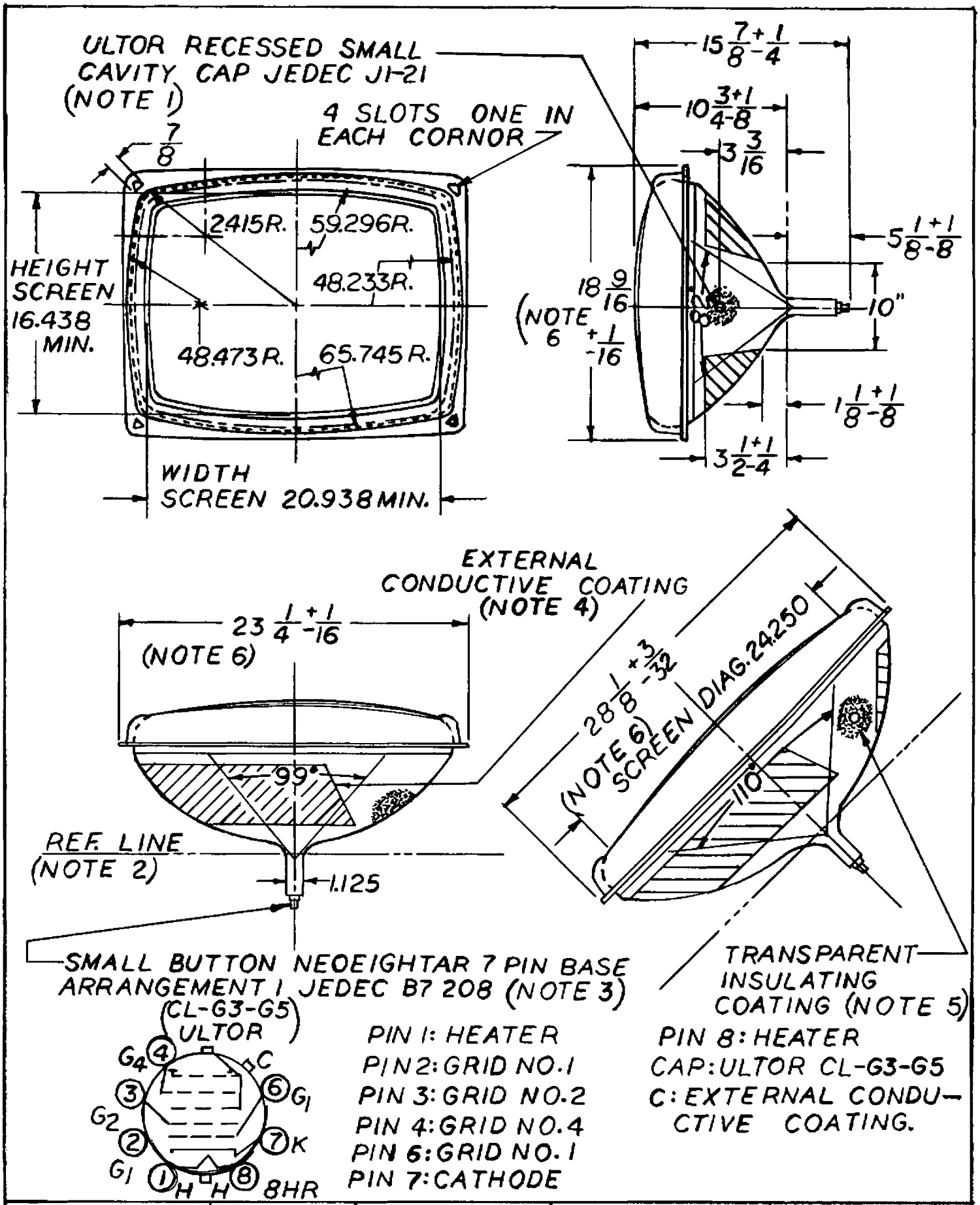
Anode Voltage	16,000 volts dc
Grid No. 4 Voltage (Focusing Electrode) (Note 3 and 4)	250 volts dc
Grid No. 2 Voltage	50 volts dc
Cathode Voltage (Note 2)	35 to 55 volts dc

MAXIMUM CIRCUIT VALUES

Maximum Grid No. 1 Circuit Resistance	1.5 megohms

GRAPHS AND DRAWINGS

Tube Outline with Essential Dimensions and Tolerances



DRAWN BY	SCALE	EFFECTIVE	DISTRIBUTION	DRAWING NO.
W.C. GRAF		9-1-64		25HP4

GRAPHS AND DRAWINGS (CONT.)

Pin Connections:

Pin 1	Heater	Pin 6	Grid #1
Pin 2	Grid #1	Pin 7	Cathode
Pin 3	Grid #2	Pin 8	Heater
Pin 4	Grid #4		

NOTES

1. Measured with implosion protection hardware connected to external coating.

2. Visual extinction of focused raster.

3. With the combined Grid No. 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 20 15/16" by 16 7/16" pattern from RCA 2F21 monoscope or equivalent.

4. Individual tubes will have satisfactory focus at some value between 0 and +400 volts.

NOTES FOR DIMENSIONAL OUTLINE

1. With tube neck inserted through flared end of reference-line gauge JEDEC No. G-126 and with tube seated in gauge, the reference-line is determined by the intersection of the Plane CC' of the gauge with the glass funnel.

2. The plane through the tube axis and Pin No. 4 may vary from the plane through the tube axis and ultor terminal by angular tolerance (measured about the tube axis) of $\pm 30^{o}$. Ultor terminal is on the same side as Pin No. 4.

3. Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The design of the socket should be such that the circuit wiring cannot impress lateral strains through the socket contacts on the base pins. Bottom circumference of base wafer will fall within a circle concentric with bulb axis and having a diameter of 1 3/4".

4. External conductive coating must be grounded.

5. To clean this area, wipe only with soft dry lint-less cloth.

6. Measured at O.D. of shell.

ELECTRONIC INNOVATIONS IN ACTION

31JS6-A
COMPACTRON BEAM PENTODE
FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 31JS6-A 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 31JS6-A is identical to the 6JS6-A.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	31.5	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.

from JEDEC release #4790A, March 29, 1965

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from JEDEC release #4764E, Nov. 16, 1970

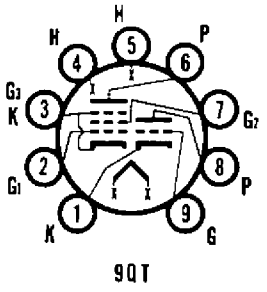
SYLVANIA

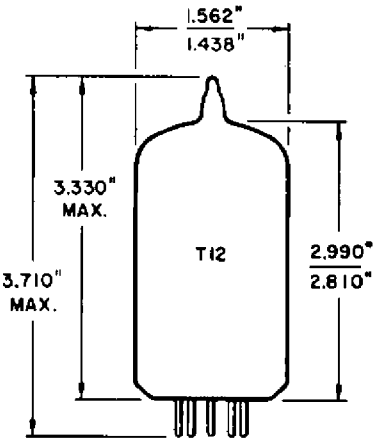
RECEIVING TUBES

Vertical Deflection Oscillator and Amplifier

31LR8

- COLOR TELEVISION TYPE
- BEAM POWER PENTODE AMPLIFIER
- HIGH MU TRIODE OSCILLATOR
- MULTISECTION
- T-12 ENVELOPE
- 9 PIN BASE (LARGE DIAMETER)





DESCRIPTION

The Sylvania Type 31LR8 is a high mu triode and beam power pentode contained in a T-12 bulb using a 9-pin base. The triode section is intended for service as a vertical oscillator and the pentode section is designed for vertical deflection amplifier service. Except for heater characteristics, the 31LR8 is identical to types 6LR8 and 21LR8 as registered in EIA release 4764 and 4764-B respectively.

ELECTRICAL DATA

HEATER CHARACTERISTICS AND RATINGS

Heater Circuit	Series (1)
Heater Voltage (AC or DC)	31.5 Volts
Heater Current(2)	0.300 ± 0.02 Amperes
Heater Warm-up Time (3)	11 Seconds

NOTES:

(1) Operated with the heater in series with the heaters of other tubes having the same bogey heater current.

(2) 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.

(3) Heater warm-up time is defined as the time required for the voltage across the heater to reach 80% of the rated heater voltage after applying four (4) times rated heater voltage to a circuit consisting of the heater in series with a resistance equal to three (3) times the rated heater voltage by the bogey heater current.

HITACHI ELECTRON TUBE

33HE7

DUODECAR TYPE DIODE - PENTODE

DESCRIPTION

The 33HE7 is a duodecar type 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, the 33HE7 is identical to Types 6HE7, 12HE7, 38HE7 and 58HE7 described in JEDEC Release numbers 4656B, 4656A, 4656 and 4656D respectively.

ELECTRICAL DATA

Cathode	Coated Unipotential	
Heater Characteristics and Ratings		
Heater Voltage, AC and DC (Note 1)	33.6	Volts
Heater Current (Note 2)	0.45±0.03	Amperes
Heater Warm-up Time, Average (Note 3)	11	Seconds

NOTES

1. Heater voltage for a bogey tube at If=0.45 amperes.
2. 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.
3. The time required for the voltage across the heater to reach 80 per cent 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 #4656E, Oct. 14, 1968

ELECTRONICS

33JV6
COMPACTRON BEAM PENTODE
FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 33JV6 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*	33	Volts
Heater Current‡	0.3±0.02	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.)	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

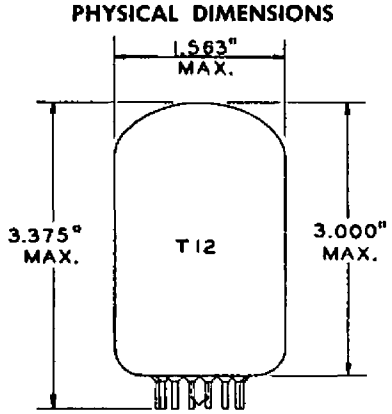
MAXIMUM RATINGS

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

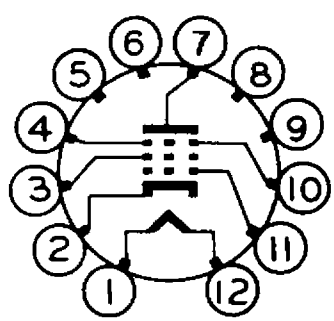


EIA 12-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - 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	6000	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	60	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	---	---	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

* Heater voltage for a bogey value 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.

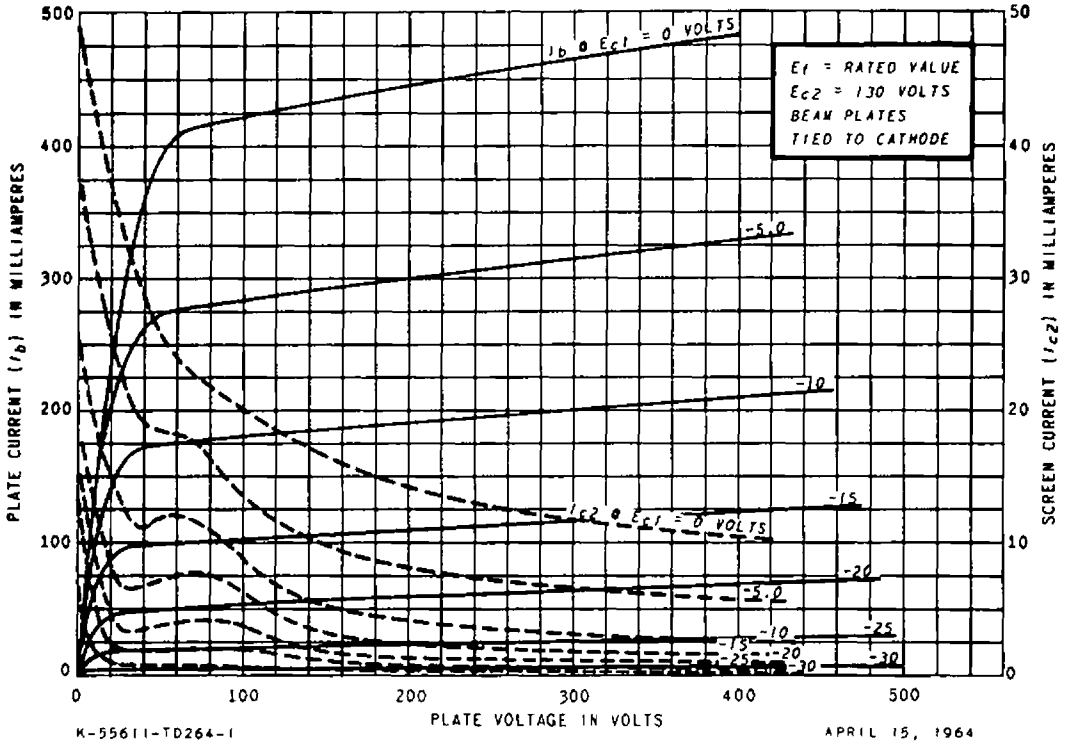
\# For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

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.

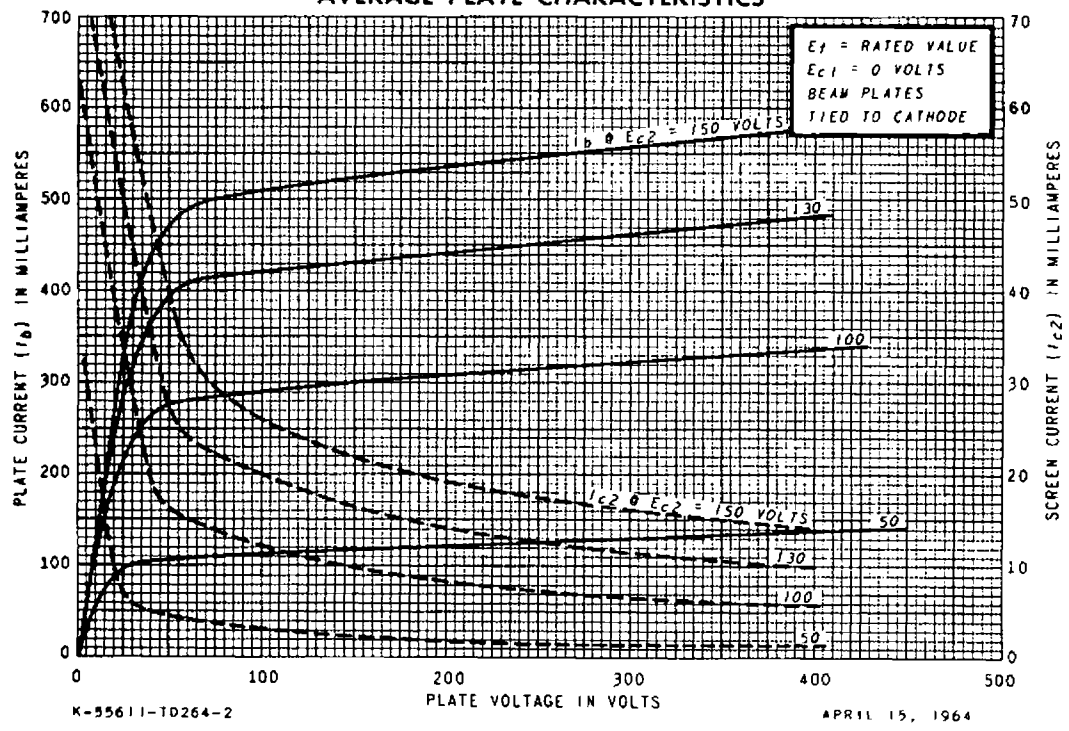
** Applied for short interval (two seconds maximum) so as not to damage tube.

‡‡ Triode connection (screen tied to plate) with Eb = Ec2 = 130 volts and Ec1 = -20 volts.

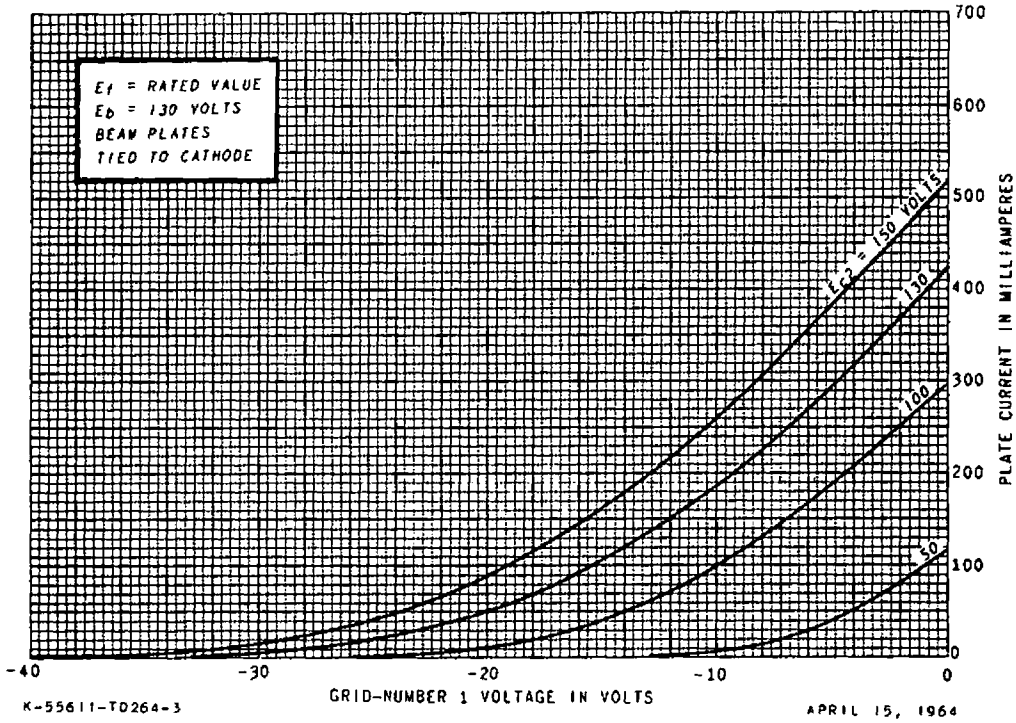
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



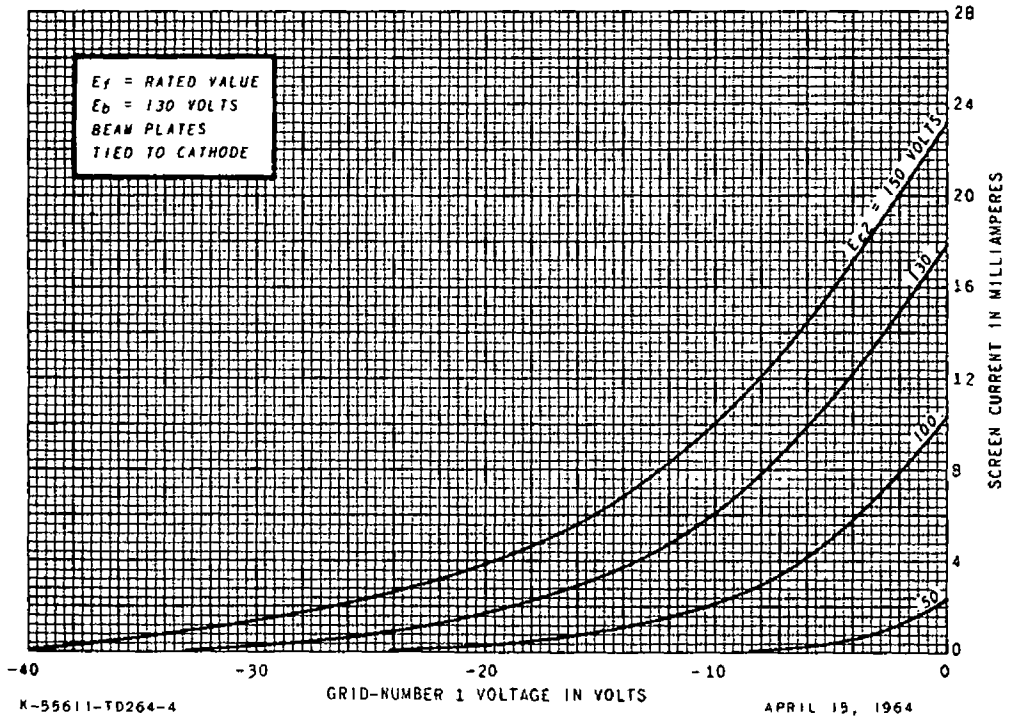
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD264-3

APRIL 15, 1964

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD264-4

APRIL 15, 1964

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

BEAM-POWER AMPLIFIER TYPE 50HN5

The 50HN5 is a high perveance 9-Pin miniature beam power pentode designed for service as the output stage in low cost audio amplifiers. Its special feature is very high power sensitivity, resulting in low drive required for full power output.

ELECTRICAL

Cathode	Coated Unipotential	
Heater:		
Voltage (ac or dc)	50	Volts
Current	0.15	Ampere

MECHANICAL

Bulb	T-6½
Base	9-Pin Miniature (JEDEC E9-1)
Outline	6-4
Basing	9QW
Mounting Position	Any

MAXIMUM RATINGS

Design Maximum Values

Plate Voltage	330 max.	Volts
Grid 2 Voltage (Screen)	250 max.	Volts
Plate Dissipation	12 max.	Watts
Grid 2 Dissipation (Note 1)	2.5 max.	Watts
DC Cathode Current	120 max.	Ma.
Heater-Cathode Voltage:		
Heater Negative with Respect to Cathode		
Total DC + Peak	200 max.	Volts
Heater Positive with Respect to Cathode		
DC Component	100 max.	Volts
Total DC + Peak	200 max.	Volts

MAXIMUM CIRCUIT VALUES

Grid 1 Circuit Resistance		
For Fixed Bias	0.1 max.	Megohm
For Cathode Bias	0.3 max.	Megohm

CHARACTERISTICS

Plate Voltage	130	Volts
Grid 2 Voltage	130	Volts
Bypassed Cathode Bias Resistor	56	Ohms
Plate Current	70	Ma.
Grid 2 Current	5	Ma.
Plate Resistance (Approx.)	7500	Ohms
Transconductance	17000	μmhos
Triode Amplification Factor	13	–
Grid 1 Cutoff Bias (Note 2)	–33	Volts

TYPICAL CLASS A AMPLIFIER OPERATION

	Cathode Bias (Note 3)	Cathode Bias (Note 4)	Fixed Bias	
Plate Voltage	130	140	140	Volts
Grid 2 Voltage	130	140	140	Volts
Grid 1 Voltage	–	–	–5.7	Volts
RMS A.F. Grid 1 Voltage	3.3	7.3	4.0	Volts
Cathode Bias Resistor	56	68	–	Ohms
Zero Signal Plate Current	70	72	71	Ma.
Zero Signal Grid 2 Current	5	4	4	Ma.
Max. Signal Plate Current	68	67	68.5	Ma.
Max. Signal Grid 2 Current	15	13.5	14.5	Ma.
Load Resistance	2000	2000	1700	Ohms
Power Output	3.0	3.5	4	Watts
Total Harmonic Distortion	8	8	9	Per Cent

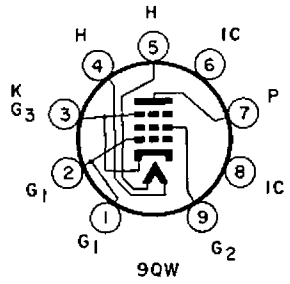
TYPICAL CLASS AB1 PUSH-PULL OPERATION

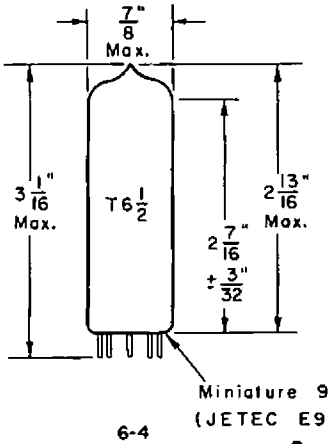
(Values are for 2 Tubes)

Plate Voltage	260	Volts
Grid 2 Voltage	130	Volts
Cathode Bias Resistor (Bypassed)	69	Ohms
Peak AF Grid 1-to-Grid 1 Voltage	16.5	Volts
Zero Signal Plate Current	90	Ma.
Zero Signal Grid 2 Current	3	Ma.
Max. Signal Plate Current	106	Ma.
Max. Signal Grid 2 Current	15	Ma.
Plate-to-Plate Load Resistance	5500	Ohms
Power Output	16.5	Watts
Total Harmonic Distortion	1.5	Per Cent

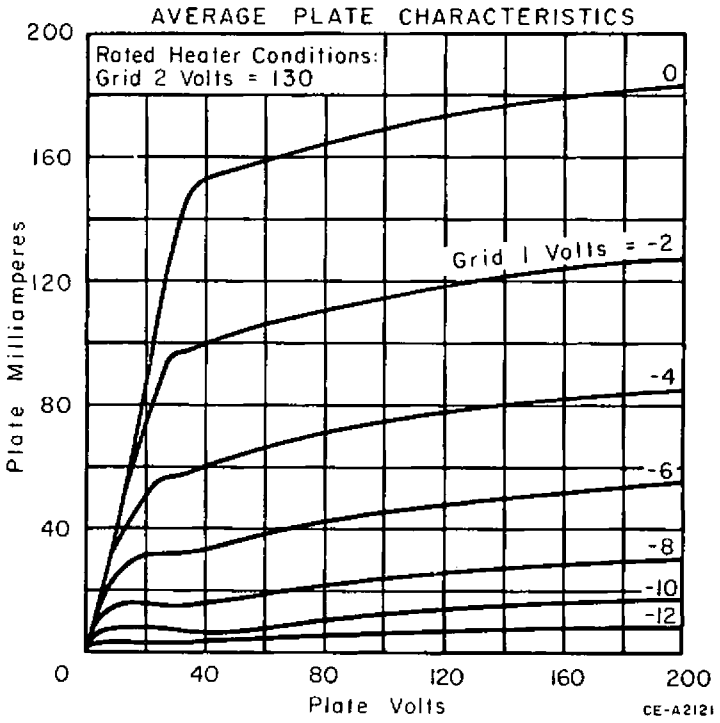
NOTES

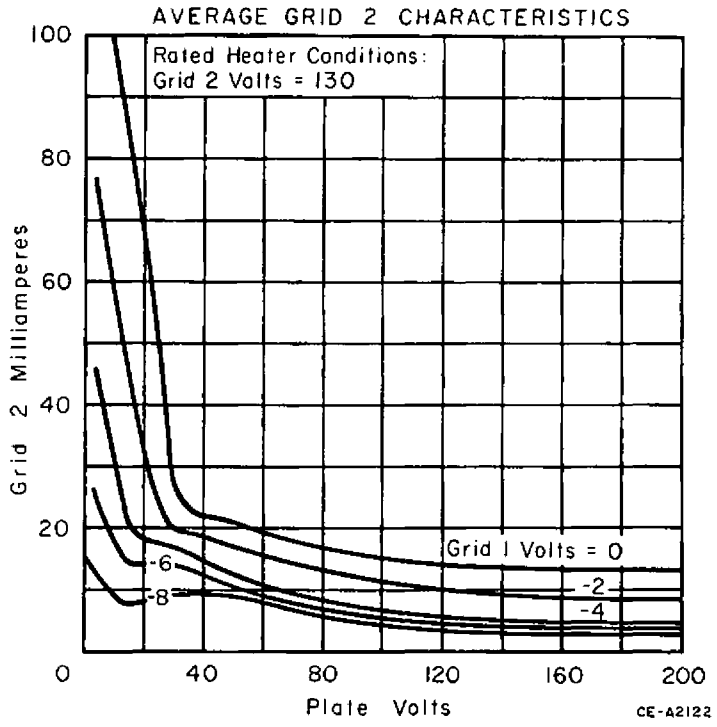
1. Screen dissipation may be permitted to reach 4-watts during the periods of maximum input of speech and music signals.
2. For plate current of 100 microamperes.
3. Cathode resistor bypassed.
4. Cathode resistor not bypassed.

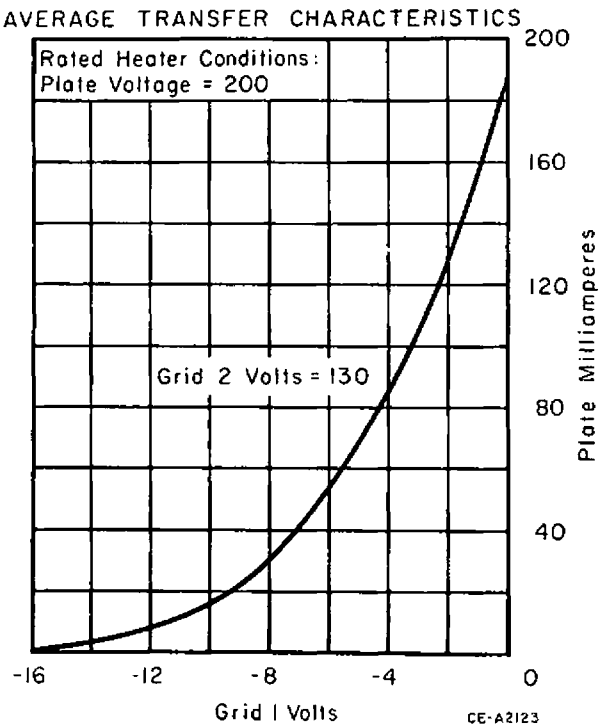




Westinghouse







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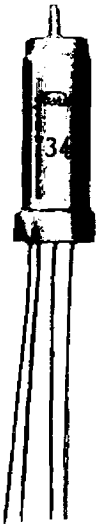
from JEDEC release #4702,
May 18, 1964

Toshiba

TOSHIBA ELECTRON TUBE 5734A

MECHANO-ELECTRONIC TRANSDUCER

The Toshiba 5734A is a heater-cathode type medium-mu triode of micro metal miniature construction with metal shell and ceramic stem designed primarily for use as mechano-electronic transducer in many industrial applications. The 5734A features an actuating stylus which related to the plate shaft, and the angular displacement of the plate shaft changes the distance between the fixed grid and the plate and results in a change in the plate current.



GENERAL DATA

ELECTRICAL :

Cathode: Coated unipotential		
Heater voltage (AC or DC)	6.3	V
Heater current	0.15	A

MECHANICAL :

Maximum over all length (excluding flexible lead)	0.925"
Maximum diameter	0.328"
Bulb	Metal shell
Operating position	Any

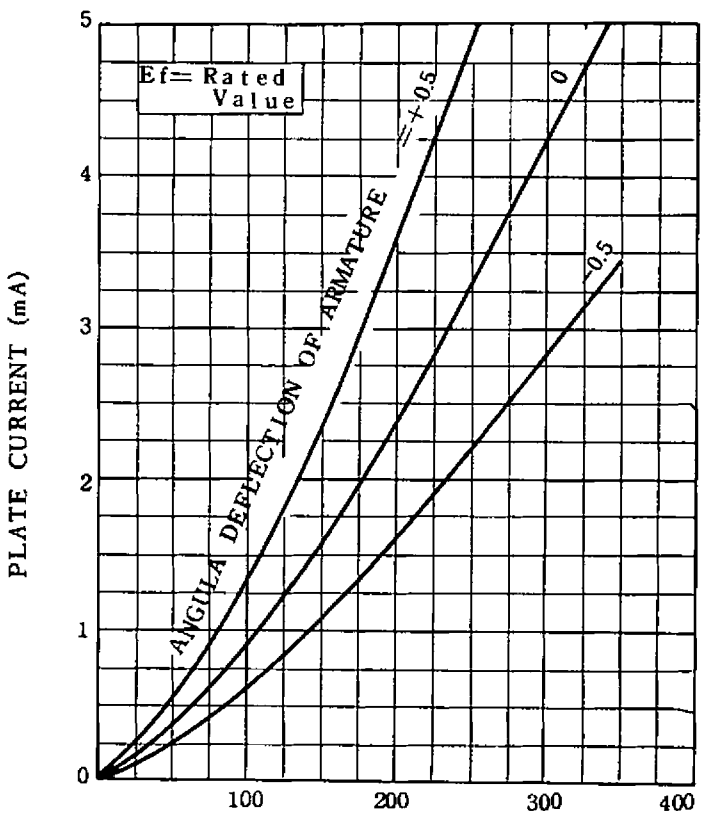
MAXIMUM RATINGS; Design-center values:

DC plate supply voltage	300 max.	V
DC plate current	5 max.	mA
Plate dissipation	0.4 max.	W
Heater-cathode voltage		
Heater positive, total dc and peak	90 max.	V
Heater negative, total dc and peak	90 max.	V
Angular deflection of plate shaft	±0.5 max.	Degree
Bulb temperature at hottest point on bulb surface	300 max.	°C

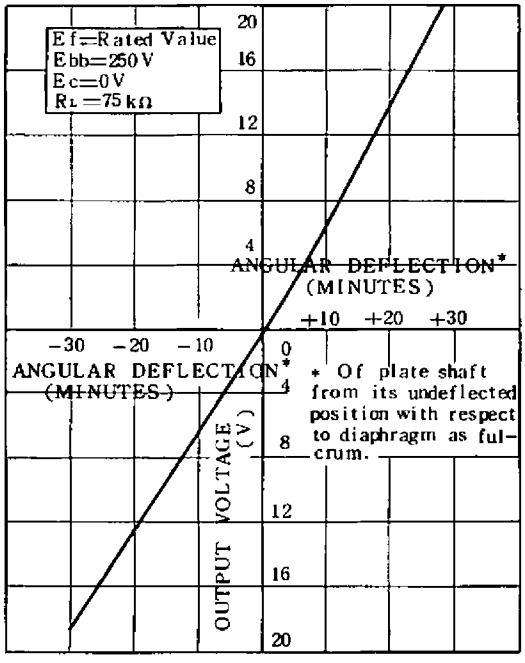
TYPICAL OPERATION AND CHARACTERISTICS:

DC plate supply voltage	300	V
DC grid voltage	0	V
Amplification factor	20	
Plate resistance	72	KΩ
Transconductance	275	μU
DC plate current	1.5	mA
Load resistance	75	KΩ
Deflection sensitivity	40	V/degree
	2300	V/radian
Moment of inertia of plate	3.4	milligram cm
Rotational compliance of diaphragm	0.013×10^{-3}	radian/dyne cm
	0.075	degree/gram cm

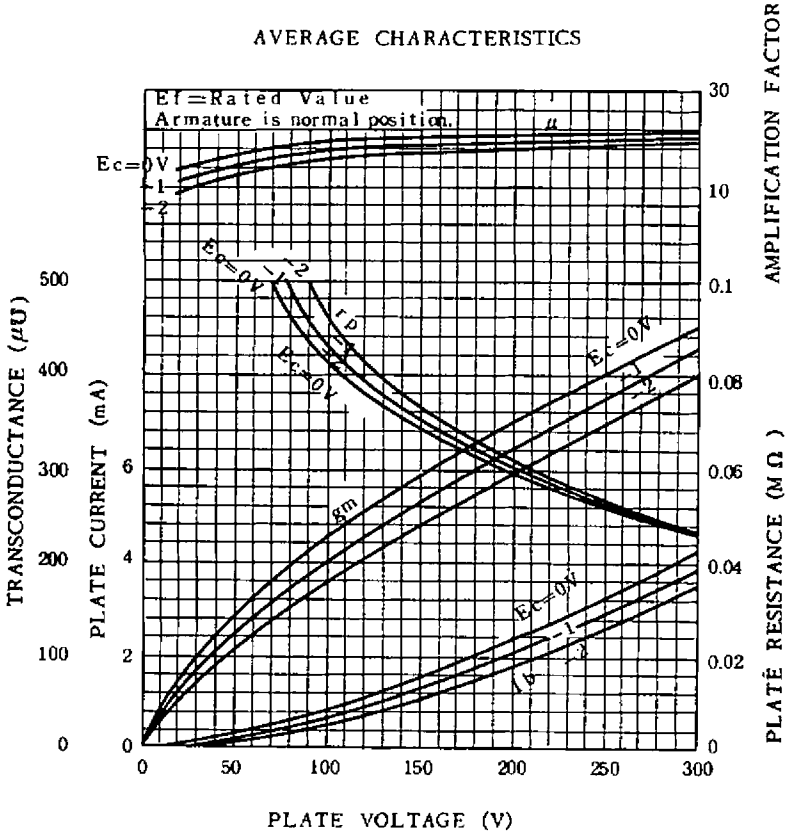
AVERAGE CHARACTERISTICS



AVERAGE CHARACTERISTICS



AVERAGE CHARACTERISTICS

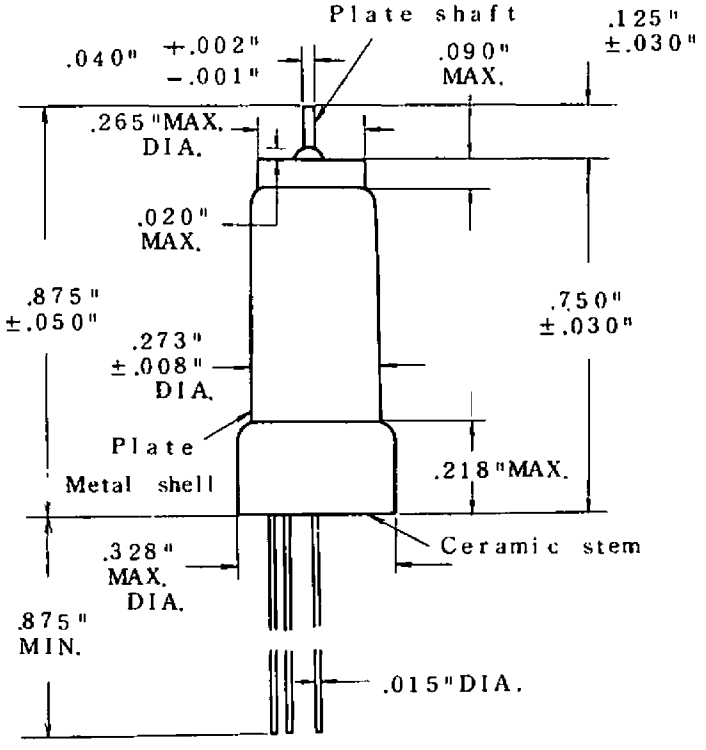


Toshiba

TOSHIBA ELECTRON TUBE

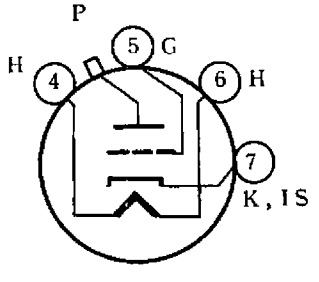
5734A
DIMENSIONAL OUTLINE:

Dimensions in Inches



5734A
BASING DIAGRAM:

Bottom View



Pin 4: Heater
Pin 5: Grid
Pin 6: Heater
Pin 7: Cathode: Internal Shield
P : Plate

All inquiries as to the data should be addressed to Tube and Semiconductor Division, Tokyo Shibaura Electric Co., Ltd., 12, 1-chome, Yuraku-cho, Chiyoda-ku, Hibiya Mitsui Building, Tokyo, Japan.

JOINT ELECTRON DEVICE ENGINEERING COUNCIL

JEDEC Type Administration Section
Electronic Industries Association
32 Green Street
Newark 2, New Jersey

E. I. A.
REGISTRATION
FILE

Announcement

of

Electron Device Type Registration

Release No. 4886

December 21, 1964

The Joint Electron Device Engineering Council announces the registration of the following electron device designation

5847A *

on the application of

Amperex Electronic Corporation
Hicksville, Long Island, New York

* Type 5847A is identical to Type 5847 as registered in Release No. 813 except for the addition of the following characteristics:

CHARACTERISTICS AND TYPICAL OPERATION *

Plate Voltage	150	150	volts
Screen Grid Voltage	150	150	volts
Cathode Bias Resistance	4000	4000	ohms
Control Grid Voltage	+2.5	+20	volts
Plate Current	1.1	4.4	ma
Screen Grid Current	0.3	1.2	ma
Transconductance	3000	8500	micromhos

* Operating conditions to minimize gain variations due to supply voltage fluctuations.

from JEDEC release
#4599, Feb. 17, 1964

Burroughs Corporation
ELECTRONIC COMPONENTS DIVISION
PLAINFIELD, NEW JERSEY

6702

Bulletin No. 1051

October 15, 1963

(BD-401) Wide Band Noise Generating High Vacuum Electron Tube

The 6702 (BD-401) is a wide-band noise-generating high-vacuum electron tube with an external permanent magnet. It is capable of producing a minimum of .08 mW of wide-band noise over a frequency range of 200 to 400 MC.

ELECTRICAL CHARACTERISTICS

RATINGS, ABSOLUTE MAX.	VALUE	NOTES
Target Voltage (Eta)	300 Vdc	
Beam Forming Voltage (Ebf)	300 Vdc Max. −150 Vdc Min.	
Anode Voltage (Ebb)	300 Vdc	
Heater Cathode Voltage (Ehk)	±100 V.	
Individual Target Dissipation (P/ta)	1 W	
Heater Voltage (Ef)	6.3V ± 5%	
Cathode Current (Ik)	42 mA	

ENVIRONMENTAL CHARACTERISTICS

Shock	G=350,1 ± .5 msec. duration; half sine wave pulse	3
Vibration	10-50-10 cps .08 total excursion; tube not operating	4, 5
Altitude	60,000 ft.	

MECHANICAL CHARACTERISTICS

Outline	See Figure 1
Envelope Connection	See Figures 2, 3
Mounting Position	Any
Weight	7.5 oz.

TEST CONDITIONS AND TEST LIMITS

The 6702 (BD-401) is tested in the circuit shown in figure 4 with the components mounted as closely as possible to the tube socket consistent with good high frequency packaging techniques.

TEST CONDITIONS	VALUE	NOTES
Target Resistance (Rta)	5 Kohm 1% 7.5 W	
Target Voltage (Eta)	200 Vdc	
Beam Forming Spade Voltage (Ebf)	−100 Vdc	
Anode Voltage (Ebb)	200 Vdc	
Heater Voltage (Ef)	6.3 V	
Frequency	200 to 400 MC	2

TEST LIMITS	VALUE	NOTES
Noise Output	0.08 mW min.	1
Target Current (Ita)		
Maximum	33 mAdc	
Minimum	22 mAdc	
Anode Current (Ib)	7.0 mAdc max.	

NOTES:

1. Noise output is measured with a Hewlett-Packard Power Meter, Model 431A and Thermistor Mount Model 478A, and an arrangement of attenuator pads, low and high pass filters to give a band pass characteristic, of 200 to 400 Mc. See Figure 5.

2. In order to avoid possible operational changes in the characteristics of this tube, do not place the tube in close proximity (less than 6") to magnetic fields, and (less than 4") to ferrous materials.

3. Each tube shall be subjected to a total of 20 shocks; that is, five shocks in each of positions X-1, X-2, Y-1, and Y-2 in any sequence.

4. Magnet only is to be held rigidly. Socket must float in order not to disturb the magnetic field alignment of the tube.

5. The tube shall be vibrated in positions X-1, and X-2 for 5 minutes in each plane.

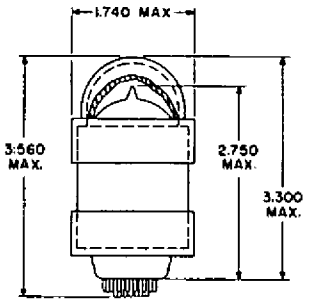


FIG. 1. OUTLINE DRAWING

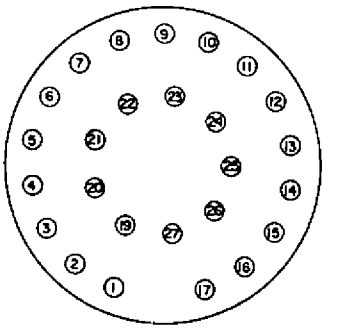
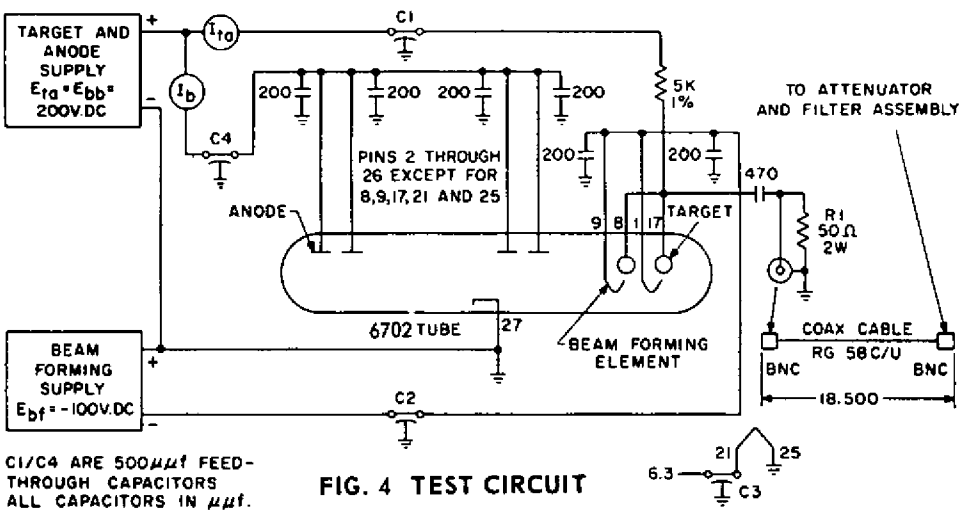


FIG. 2. PIN NUMBERING DIAGRAM

Pin Number	Element	Pin Number	Element
1	Beam Form 1	14	Anode
2	Anode	15	Anode
3	Anode	16	Anode
4	Anode	17	Target-1
5	Anode	19	Anode
6	Anode	20	Anode
7	Anode	21	Heater
8	Target 2	22	Anode
9	Beam Form 2	23	Anode
10	Anode	24	Anode
11	Not Used	25	Heater
12	Anode	26	Anode
13	Anode	27	Cathode

FIG. 3 PIN CONNECTION CHART



C1/C4 ARE 500$\mu\mu$f FEED-THROUGH CAPACITORS
ALL CAPACITORS IN $\mu\mu$f.

FIG. 4 TEST CIRCUIT

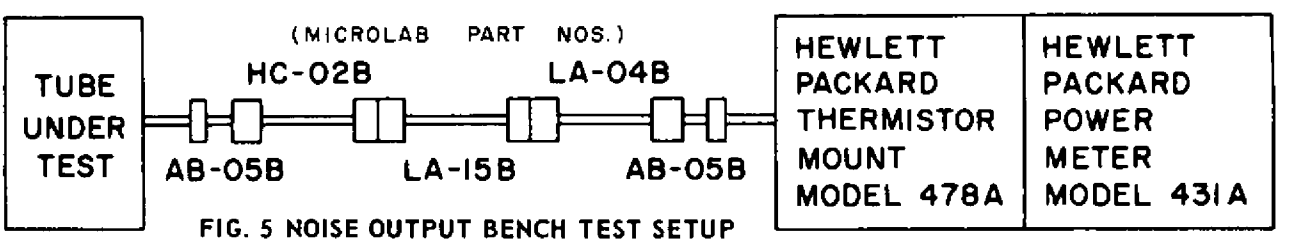


FIG. 5 NOISE OUTPUT BENCH TEST SETUP

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from JEDEC release
#4599, Feb. 17, 1964

Burroughs Corporation

ELECTRONIC COMPONENTS DIVISION

PLAINFIELD, NEW JERSEY

Bulletin No. 1048

6713

October 15, 1963

(BX–1203) Wide Band Noise Generating High Vacuum Electron Tube

The 6713 (BX–1203) is a wide band noise generating high vacuum electron tube containing internal permanent magnets. It is capable of producing wide band noise in excess of 95 db above 1 uV/Mc over the frequency range of .150 Mc to 30 Mc.

ELECTRICAL CHARACTERISTICS

RATINGS, ABSOLUTE MAX.	VALUE
Target Voltage (Eta)	200 Vdc
Beam Forming Spade Voltage (Ebf)	±100 Vdc
Lagging Spade Voltage (Els)	0-60 Vdc
Anode Voltage (Ebb)	150 Vdc
Heater Cathode Voltage (Ehk)	±100 V
Individual Target Dissipation (P/ta)	0.8W
Heater Voltage (Ef)	6.3 V±5%
Cathode Current (Ik)	10 ma
Frequency (F)	0.150 - 30 Mc

ENVIRONMENTAL CHARACTERISTICS

		NOTES
Shock	G = 30, 11±1 msec duration; half sine wave	5
Vibration	50 cps, 10 G's	6
Altitude	60,000 ft.	

MECHANICAL CHARACTERISTICS

Outline	See Figure 1	
Envelope Connection	See Figures 2, 3	
Mounting Position	Any	2
Weight	1.75 oz.	

TEST CONDITIONS AND TEST LIMITS

The 6713 (BX–1203) is tested in the circuit shown in Figure 4. Although the tube is tested only at particular frequencies within the specified band, indications are that it will produce a minimum of 95 db above 1 μV/Mc over complete spectrum from .150 Mc to 30 Mc.

TEST CONDITIONS	VALUE	NOTES
Target Resistance (Rta)	50 ohm 1% 2W carbon	
Target Voltage (Eta)	125 Vdc	4
Beam Forming Spade Voltage (Ebf)	-6.0 Vdc	4
Anode Voltage (Ebb)	125 Vdc	4
Heater Voltage (Ef)	6.3 V	
Lagging Space Voltage (Els)	0 to 60 Vdc	3
Frequency (F)	.150 Mc to 30 Mc	2

TEST LIMITS	VALUE	NOTES
Noise Output F = .150 Mc	95 db above 1 uV/Mc min.	1
F = .500 Mc	95 db above 1 uV/Mc min.	
F = 1.0 Mc	95 db above 1 uV/Mc min.	
F = 5.0 Mc	95 db above 1 uV/Mc min.	
F = 10 Mc	95 db above 1 uV/Mc min.	
F = 20 Mc	95 db above 1 uV/Mc min.	
F = 30 Mc	95 db above 1 uV/Mc min.	
Cathode Current (Ik)	8 mAdc max.	
Heater Current (If)	150 ma ± 10%	

NOTES:

1. Noise output measurements are taken with Empire Devices' Noise and Field Intensity Measuring Receiver, Model NF–105, Plug-In Tuning Unit T–A/NF105 .15 to 30 Mc, and Switching Unit SU–105, using the following procedure: Set switching unit to READ. Set receiver function switch to PEAK. Set SINE WAVE OSC–OFF–IMPULSE GEN switch to OFF. Switch SIGNAL INPUT ATTENUATOR control to get approximately mid-scale reading on the large meter, keeping the IF GAIN control below its halfway mark. Adjust IF GAIN control to read 10 db on the large meter. The IF GAIN control should not be advanced more than 180° from its extreme counterclockwise position. Then flip the Switching unit to CALIBRATE position. Set SINE WAVE OSC–OFF–IMPULSE GEN switch to IMPULSE GEN. Adjust IMPULSE GENERATOR OUTPUT ATTENUATOR to get reading on large meter, and with ADD TO IMPULSE GENERATOR OUTPUT control adjust large meter to 10 db. Then read noise output on IMPULSE GENERATOR OUTPUT ATTENUATOR plus small meter. If the reading is above 97 db then it is necessary to switch the SIGNAL INPUT ATTENUATOR control down to the next lower setting (20 db lower). Adjust IMPULSE GENERATOR OUTPUT ATTENUATOR to get reading on large meter, and with ADD TO IMPULSE GENERATOR OUTPUT control adjust large meter to 10 db. Then read noise output on IMPULSE GENERATOR OUTPUT ATTENUATOR plus 20 db plus small meter. This represents the noise output of the tube in db above 1 microvolt per megacycle.
2. In order to avoid possible operational changes in the characteristics of this tube, do not place the tube in close proximity (less than 3.5") to magnetic materials and fields.
3. Adjust the lagging Spade (Els) voltage for optimum noise output.
4. To insure optimum noise output in the frequency spectrum specified it is recommended that the target supply voltage (Eta), anode supply voltage (Ebb), and the beam form supply voltage (Ebf) be regulated within ± 2%.
5. Each tube shall be subjected to a total of 20 shocks, i.e.; five shocks in each of positions X1, X2, Y1, and Y2 in any sequence.
6. Each tube shall be vibrated for 1 minute in each of positions X1, and X2.

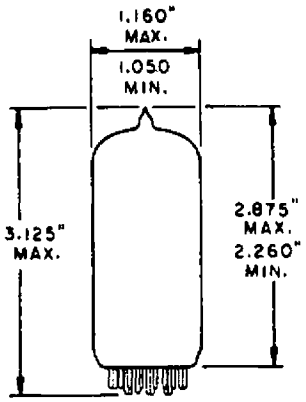


FIG. 1 OUTLINE DRAWING

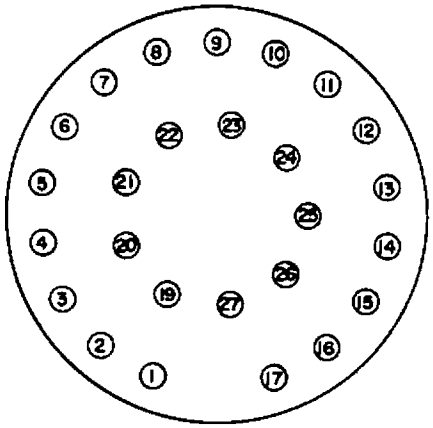


FIG. 2 PIN NUMBERING DIAGRAM

Pin Number	Element	Pin Number	Element
1	Beam Form-1	14	Anode
2	Anode	15	Anode
3	Anode	16	Anode
4	Anode	17	Target-1
5	Anode	19	Lagging Spade
6	Anode	20	Anode
7	Anode	21	Heater
8	Target-2	22	Anode
9	Beam Form-2	23	Lagging Spade
10	Anode	24	Anode
11	Anode	25	Heater
12	Anode	26	Anode
13	Anode	27	Cathode

FIG. 3 PIN CONNECTION CHART

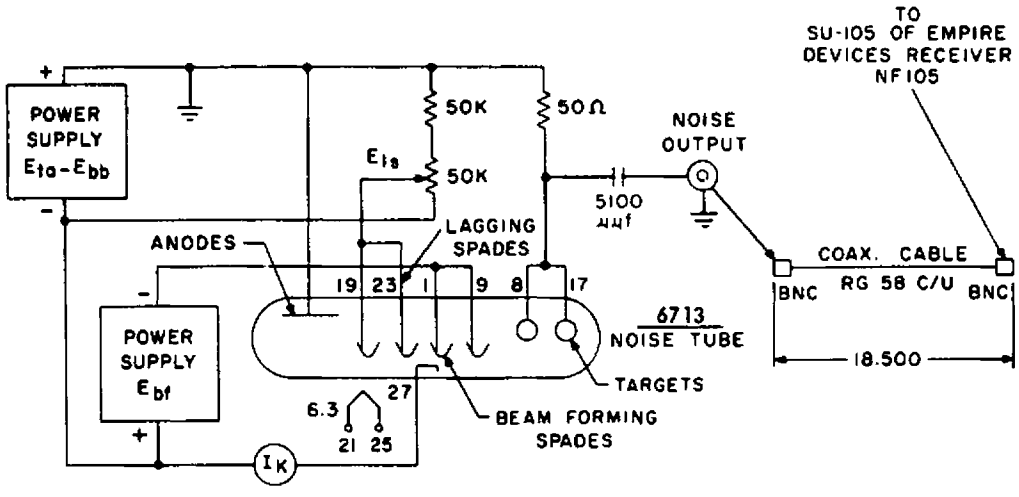


FIG. 4 TEST CIRCUIT

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from JETEC release #1658A, Feb. 3, 1958

6861

TRAVELING-WAVE TUBE

6.5 db Noise Figure — **Low-Noise Amplifier Type for Receiver Applications 2700 to 3500 Mc** — **25 db Gain**

TENTATIVE DATA

RCA-6861 is a low-noise, low-level traveling-wave amplifier tube of the helix-transmission-line type. Operating in the frequency range from 2700 to 3500 megacycles per second, the 6861 is intended for use in the input stage of radar, scatter propagation, and other microwave receivers, and in if amplifier service. Characteristics of the 6861 include a noise figure of 6.5 db and a gain of approximately 25 db.



Featured in the design of the 6861 is a special type of electron gun. This gun deamplifies noise generated in the electron beam with the result that a low noise figure is obtained over the entire operating frequency range of the tube without readjustment of tube operating conditions. In addition, the use of a metal shell allows the rf-input and rf-output transducers to be permanently set in position during manufacture of the tube for optimum performance.

PRINCIPLES OF OPERATION

The structural arrangement of the 6861, shown in Fig. 1, incorporates an electron gun which produces an electron beam; a helix transmission line (slow-wave structure) which propagates a microwave signal in a manner that permits interaction between the beam and the signal; a collector which removes the unused beam energy; transducers which introduce and remove the signal; and an attenuator which isolates the input and output sections of the slow-wave structure to prevent oscillations. All of the components mentioned above, with the exception of the transducers, are contained within an evacuated glass envelope. The input and output transducers, with their semirigid 50-ohm coaxial lines, are adjusted and locked in position within the metal shell to insure proper location with respect to the helix. The metal shell also facilitates mounting of the tube in the magnetic field required to focus the electron beam. The magnetic field may be provided by a permanent magnet, or by a solenoid as illustrated in Fig. 1.

The amplification provided by a traveling-wave tube is produced by interaction of the electron beam and the signal on the slow-wave structure (helix) in the following manner. The velocity of the electron beam entering the helix from the gun is determined by the dc helix voltage. A strong magnetic field whose axis coincides with the axis of the helix confines the electrons to a cylindrical beam whose diameter approaches the inside diameter of the helix. A signal wave introduced onto the helix at the end nearest the gun travels circumferentially along the helix at approximately the velocity of light, although its velocity in the axial, or beam, direction is reduced by the pitch-to-circumference ratio of the helix. When the helix voltage is properly adjusted, the velocity of the beam electrons is made slightly greater than the axial velocity of the rf signal.

The electric field produced by the rf signal moving along the helix affects the velocity of the electrons in the beam in such a manner that beam velocity is slightly reduced by the time the beam reaches the end of the helix. This deceleration of the beam is accompanied by a transfer of beam energy to rf electric-field energy, with the result that the signal is amplified.

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	5.0 ± 5%	volts
Current at 5 volts	0.65	amp
Starting Current: The maximum instantaneous starting current must never exceed 4.0 amperes even momentarily.		
Cathode Heating Time	1 min.	minute
Frequency Range	2700 to 3500	Mc
Cold Insertion Loss	80	db

Mechanical:

Mounting Position	Any
Cooling	Natural
Maximum Overall Length	19-3/8"

TMK ®, Marca Registrada
Printed in U.S.A

Shell Diameter	1.375" ± 0.005"
Base	Octal 8-Pin
Collector Connector	Birnbach No.403 Banana Jack
RF Connectors:	
Input	Type N UG-188/U Plug
Output	Type N UG-188/U Plug
Weight	1-1/2 lbs

Maximum and Minimum Ratings, *Absolute Values*:

DC COLLECTOR VOLTAGE	500 max.	volts
DC HELIX VOLTAGE	500 max.	volts
DC GRID-No.4 VOLTAGE	500 max.	volts
DC GRID-No.3 VOLTAGE	300 max.	volts
DC GRID-No.2 VOLTAGE	75 max.	volts
DC GRID-No.1 VOLTAGE	20 max.	volts
DC COLLECTOR CURRENT	500 max. ▲	μamp
DC HELIX CURRENT	5 max.	μamp
MAGNETIC FIELD STRENGTH	800 min. ●	gausses
PEAK RF POWER INPUT	100 max.	watts
AVERAGE RF POWER INPUT	0.4 max.	watt
METAL-SHELL TEMPERATURE (At hottest point)	175 max.	°C

Typical Operation at 3100 Mc:

DC Collector Voltage	400	volts
DC Helix Voltage	375	volts
DC Grid-No.4 Voltage	200	volts
DC Grid-No.3 Voltage	40	volts
DC Grid-No.2 Voltage (Approx.)	20	volts
DC Grid-No.1 Voltage	0	volts
DC Collector Current	150	μamp
DC Helix Current	0.5	μamp
DC Grid-No.4 Current DC Grid-No.3 Current DC Grid-No.2 Current DC Grid-No.1 Current	each less than 1 μamp	
Magnetic Field Strength†	525 ± 5%	gausses
Gain (Low Level)	25	db
Power Output (Saturated)	1.0	mw
Noise Figure	6.5	db

Characteristics Range Values for Equipment Design:

	Note	*Min.*	*Max.*	
Heater Current	1	0.45	0.85	amp
Input VSWR (Non-operating)	2	-	1.7	
Output VSWR (Non-operating)	2	-	2.0	
DC Helix Voltage	3	350	390	volts
DC Grid-No.4 Voltage	3	160	275	volts
DC Grid-No.3 Voltage	3	20	50	volts
Saturated Power Output	3	0.25	-	mw
Gain	3	20	-	db
Noise Figure	3	-	7.0	db

Note 1: With heater voltage of 5.0 volts.

Note 2: Measured at specified connector over the frequency range of 2700 to 3500 Mc.

Note 3: Adjusted for optimum noise figure with a magnetic field of 525 gausses, signal frequency of 3100 Mc, and heater voltage of 5 volts.

▲ During alignment of the tube in the magnetic focusing field, the helix current may exceed this value for short periods, but should never exceed 25 μamp.

● This value of field strength will focus the electron beam, but noise figure will not be optimum.

† For RCA Solenoid, Type MW-4900.

OPERATING CONSIDERATIONS

The *maximum ratings* shown in the tabulated data are limiting values above which the serviceability of the 6861 may be impaired from the viewpoint of life and satisfactory performance. Therefore, in order not to exceed these absolute ratings, the equipment designer has the responsibility of determining an average design value for each rating below the absolute value of that rating by an amount such that the absolute values will never be exceeded under any usual condition of supply-voltage variation, load variation, or manufacturing variation in the equipment itself.

The *rated values for collector voltage, helix voltage, grid-No.4 voltage, and grid-No.3 voltage are high enough to be dangerous to the user.* Care should be taken during adjustment of circuits, especially when exposed circuit parts are at high dc potential.

The *power supply* for the 6861 should be capable of holding ripple voltage sufficiently low to prevent phase distortion, and should have adequate regulation to prevent a change in operating conditions which might increase the noise figure. A suggested power-supply circuit for use with the 6861 is shown in Fig.2. Provision should be made for monitoring helix current, collector current, and cathode current.

The rated *heater voltage* of 5.0 volts should be applied for at least 1 minute to allow the cathode to reach normal operating temperature before voltages are applied to the other electrodes.

The *magnetic field* required for focusing the electron beam of the 6861 may be obtained from a solenoid or permanent magnet capable of providing a uniform field of 525 gausses over the length of the tube axis starting 2 inches from the groove near the base end of the metal shell and continuing for at least 9 inches along the tube axis.

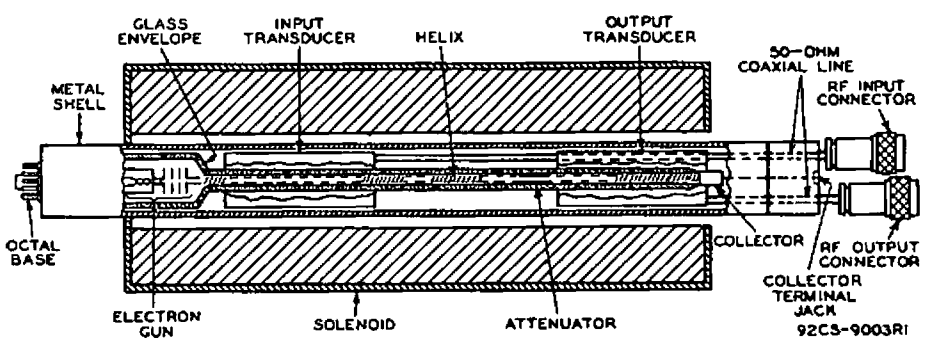
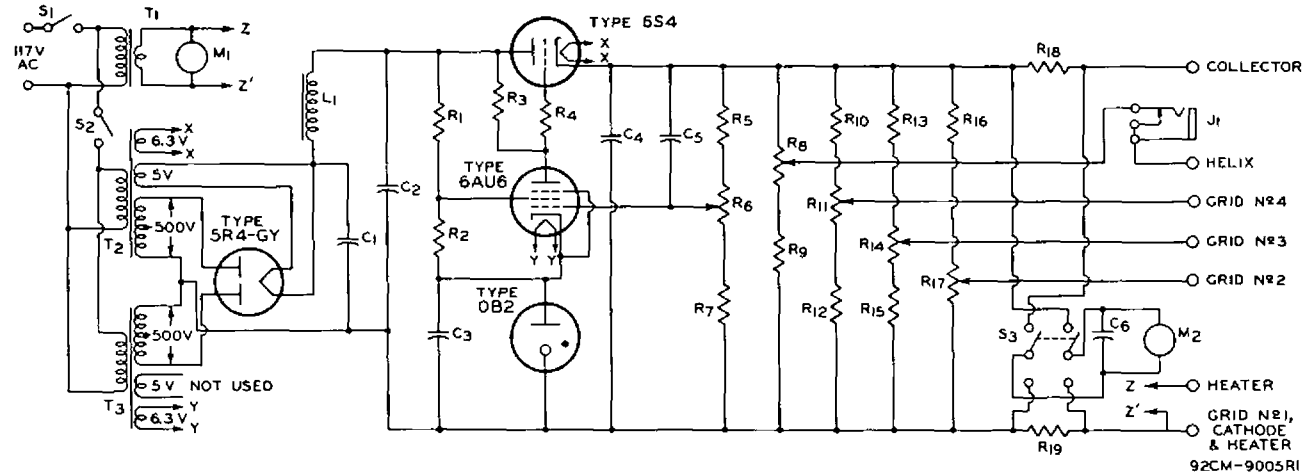


Fig.1 - Schematic Arrangement of Type 6861 with Associated Solenoid.



C1 C2: 8 μf, electrolytic, 800 volts
C3: 0.5 μf, 600 volts
C4: 8 μf, electrolytic, 600 volts
C5: 0.05 μf, 600 volts
C6: 25 μf, 50 volts
J: Closed-circuit jack (for helix-current meter)
L: 12 henries at 80 ma; Thordarson T20C53, or equivalent
M1: AC voltmeter, 0-10 volts
M2: DC microammeter, 0-500 μa
R1: 25000 ohms, 25 watts
R2: 10000 ohms, 10 watts
R3: 1 megohm, 1 watt
R4: 100 ohms, 1 watt
R5: 390000 ohms, 2 watts
R6: 100000-ohm potentiometer, 2 watts
R7: 100000 ohms, 2 watts
R8: 50000-ohm potentiometer, 2 watts
R9: 200000 ohms, 2 watts
R10: 82000 ohms, 2 watts
R11: 100000-ohm potentiometer, 2 watts
R12: 100000 ohms, 2 watts
R13: 100000 ohms, 10 watts
R14: 15000-ohm potentiometer, 2 watts
R15: 4700 ohms, 1 watt
R16: 100000 ohms, 10 watts
R17: 10000-ohm potentiometer, 2 watts
R18 R19: Meter shunt for 1 ma full scale
S1: SPST switch (heater circuit)
S2: SPST switch (high-voltage supply)
S3: DPDT switch
T1: Filament transformer, 5.0v, 3a
T2 T3: Power transformer, Thordarson T22R00, or equivalent

Fig. 2 - Suggested Power-Supply Circuit for Type 6861.

Mounting. The magnetic focusing device used with the 6861 should provide means both for centering the tube in the magnetic field and for locking the tube in position. Provision should be made for natural circulation of air around the tube.

The circumferential groove in the metal shell near the base end of the 6861 is designed to receive a resilient ring used with a clamping device to hold the tube longitudinally in its magnetic focusing field.

A keyway is provided to permit accurate angular location of the 6861 in its magnetic focusing field, and locking the tube against rotation.

After the tube has been inserted in the magnetic focusing field and locked in position, attach an octal socket to the tube base and make connections to the collector jack and to the rf-input and rf-output connectors.

The *base pins* of the 6861 fit a standard octal 8-contact socket. Connection to the *collector terminal jack* may be made with a standard-size banana-type plug. Both *rf-input and rf-output terminals* of the 6861 employ semirigid 50-ohm coaxial lines having type N UG-188/U connectors.

Initial Alignment Procedure

Apply rated heater voltage to the 6861 for one minute. Then connect operating voltages as shown under *Typical Operation* to all other tube electrodes except grid No. 2. Grid-No. 2 voltage may then be applied, and increased until cathode current reaches approximately 50 microamperes.

If the tube is incorrectly aligned within the magnetic field, some of the beam current will be drawn to the helix and increase the helix current. The axial alignment of the 6861 within the magnetic focusing field should then be adjusted to produce a minimum value of helix current. Grid-No. 2 voltage should then be increased until collector current is approximately 150 microamperes. Readjust alignment of the tube and magnetic focusing field until a minimum value of helix current is again obtained. Helix current of the 6861 when properly aligned in the magnetic focusing field is usually less than one microampere. Collector current should be checked to see if it is essentially the same as cathode current. Such a condition is another indication that the tube is properly aligned in the magnetic field. If a solenoid is used to supply the magnetic focusing field, check the solenoid current and readjust it, if necessary, to obtain the specified field-strength value.

The above alignment procedure need not be repeated so long as the adjustments are not disturbed.

Lowest-Noise-Figure Adjustment Procedure

In order to operate the 6861 at the lowest noise figure, it is necessary to adjust the electrode voltages as follows: With the 6861 connected in its circuit, and with either noise input or signal input, adjust the helix voltage to give maximum output at the operating frequency. This value of helix voltage simultaneously produces optimum tube gain and lowest noise figure. Next, with no input signal, vary dc grid-No.3 and grid-No.4 supply voltages alternately until the receiver output reaches a minimum value. The voltages are now adjusted to operate the 6861 at its lowest noise figure for the particular frequency to which the equipment is tuned. If the strength of the magnetic focusing field changes, it will be necessary to repeat the above adjustment procedure with regard to grid-No.3 and grid-No.4 voltage.

Noise-Figure Characteristics

Noise-figure characteristics of the 6861 for different electrode voltages are shown in Figs.3 through 5. The effect of collector-current value on noise figure is shown in Fig.6. The effect of magnetic-focusing field-strength value on noise figure is given in Fig.7, while typical noise-figure variation over the operating frequency range of the 6861 is shown in Fig.8.

Noise Figure

Noise figure (sometimes called noise factor) of an amplifier or a tube is fundamentally a measure of the noise added to the signal by the amplifier or tube, i.e., the ratio of the total noise power delivered by the device to its output termination to the portion thereof arising from noise developed by the input termination.

The noise figure (F) expressed as a power ratio may be written as

$$F = \frac{\frac{S_i}{N_i}}{\frac{S_o}{N_o}} \text{ or } \frac{S_i}{S_o} \cdot \frac{N_o}{N_i} \qquad (1)$$

where S_i = signal input power to device

S_o = signal output power delivered by device

N_i = noise power developed by input termination of device

N_o = noise power delivered by device to output termination

Since $\frac{S_o}{S_i}$ is equal to the gain (G) of the device, Eq.(1) becomes

$$F = \frac{1}{G} \cdot \frac{N_o}{N_i} \qquad (2)$$

The values for G and N_o can be measured. The value for N_i is calculated from the relation

$$N_i = kTB$$

where k = 1.38×10^{-23} joules/°K (Boltzman's constant)

T = absolute temperature of noise signal source in °K

B = bandwidth of device in cycles/second

Determination of Noise Figure

The noise-figure values in this bulletin were determined using the equipment arrangement of Fig.9, in the following manner:

The operating conditions of the 6861 were adjusted to provide lowest noise figure. Then, with the gas-tube noise source operating and with approximately 40 db of rf attenuation inserted between the noise source and the 6861, the receiver gain was adjusted to provide a convenient value of output. Next, the 40 db of rf attenuation between the noise source and the 6861 was removed and the precision if attenuator was adjusted to add attenuation until the receiver output reached its previous value with 40 db of rf attenuation. The power ratio equivalent to the if attenuation thus added is inversely proportional to the noise generated in the traveling-wave tube.

The power ratio corresponding to the added if attenuation, the effective noise-temperature ratio of the noise source, the insertion loss of the noise source, and the circuit loss between the noise source and the input to the traveling-wave tube all enter into the measurement of noise figure, as follows:

$$F = \frac{\left(\frac{T_B}{T_o} - 1\right)\left(\frac{L-1}{L}\right)}{(A)(Y-1)} \qquad (3)$$

where $\frac{T_B}{T_o}$ = effective noise-temperature ratio of gas-tube noise source

L = the power ratio corresponding to the noise-source insertion loss

A = the power ratio equivalent to the circuit loss between noise source and 6861

Y = power ratio corresponding to the attenuation added in precision if attenuator

The value of the first term in the numerator of Eq.(3) is equivalent to 15.28 db for an argon-bulb waveguide-type noise source. This type does not require any temperature compensation. The values of A and L for the equipment used are equivalent to 0.54 db and 15 db, respectively.

Converting these db values into power ratios and substituting them in Eq.(3) gives

$$F = \frac{28.9}{(Y-1)} \qquad (4)$$

To express Eq.(4) in decibels, it is necessary to take 10 times the common logarithm of the power ratio. Hence,

$$F \text{ (in db)} = 10 \log_{10}\left(\frac{28.9}{Y-1}\right) \qquad (5)$$

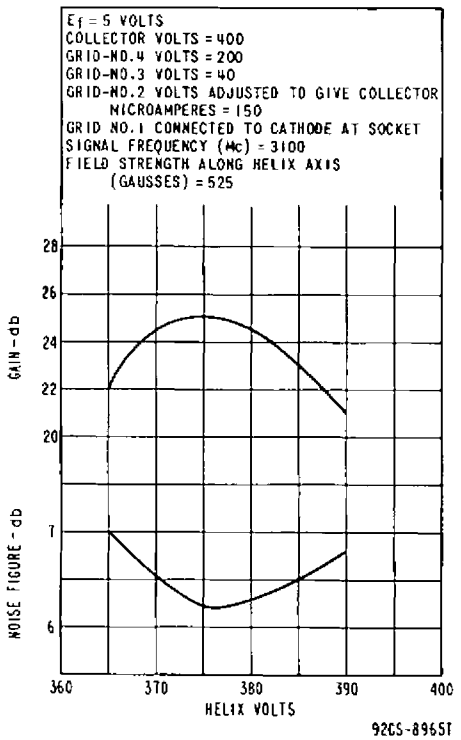


Fig. 3

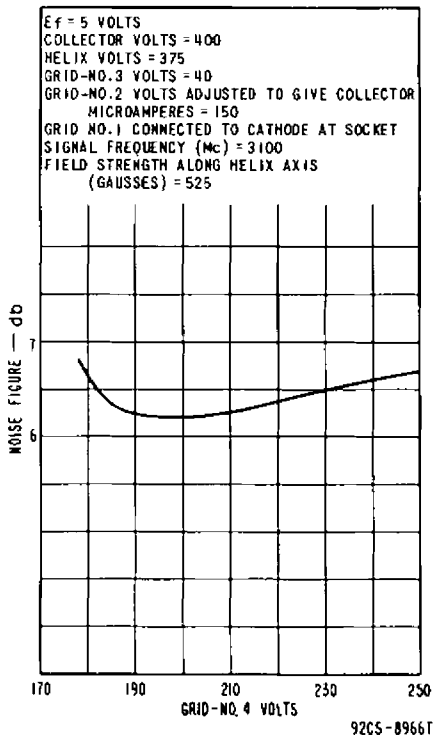


Fig. 4

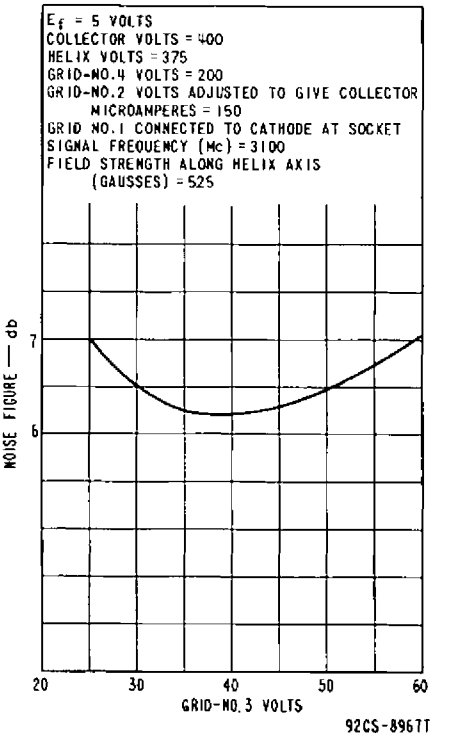


Fig. 5

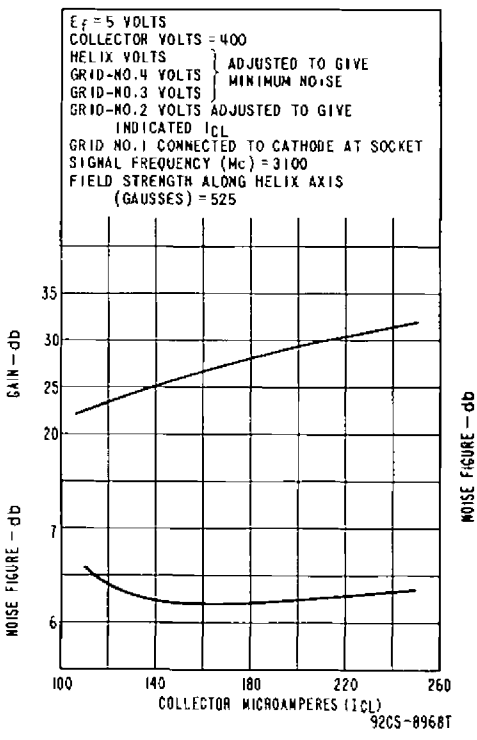


Fig. 6

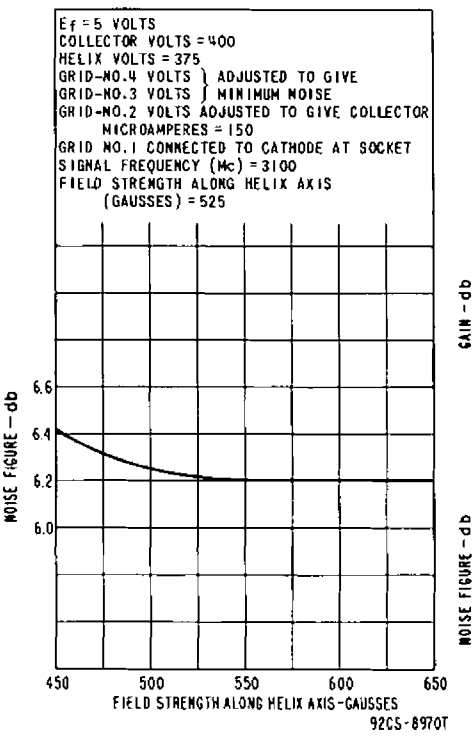


Fig. 7

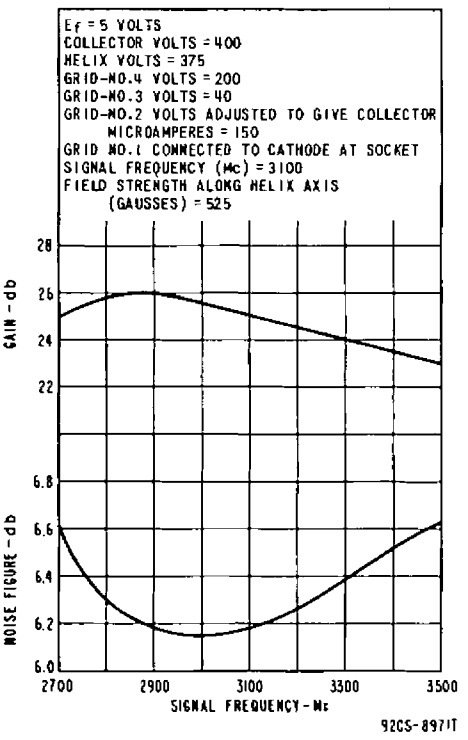


Fig. 8

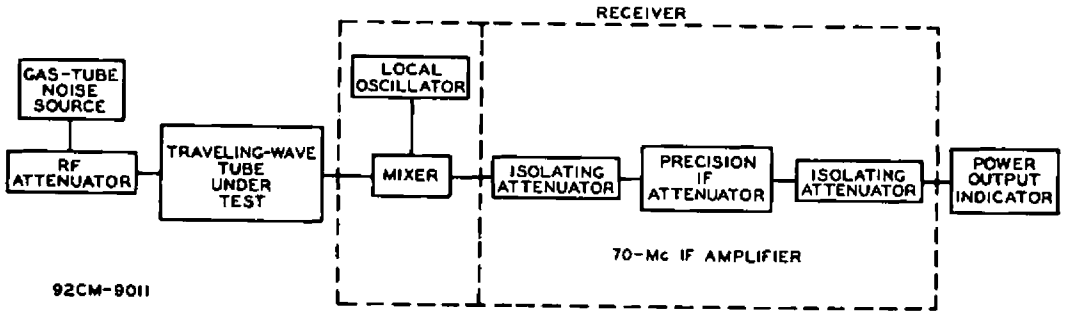


Fig. 9 - Block Diagram for Noise-Figure Measurements of Type 6861.

The value determined from Eq. (5) includes both tube noise and receiver noise. The relative effect due to receiver noise can be determined from

$$F_{1,2} = F_1 + \frac{F_2 - 1}{G_1} \qquad (6)$$

where $F_{1,2}$ is noise figure of two networks in cascade

F_1 is noise figure of first network (consisting of traveling-wave tube)

F_2 is noise figure of second network

G_1 is the gain of the first network

In this equation, all values are expressed as power ratios.

If F_2 is small or if G_1 is large, the value of the second term becomes so small that it can be neglected. In measurements on the 6861, F_2 was equal to a power ratio of 20, and G_1 was equal to a power gain of 315. Consequently, the second term in Eq. (6) was equal to a power ratio of 0.06 as compared to a power ratio of about 4.5 for F_1. Hence, the contribution by the second network to the measured noise figure is negligible.

Similarly, in terms of decibels, the contribution by the second network to the measured noise figure is less than 0.06 db.

Preamplifier in Radar Receivers

In the usual type of radar system, a portion of the transmitter pulse leaks through the TR tube to the crystal mixer in the receiver, overloads the crystal, and gradually impairs its performance. If, however, the crystal is preceded by the 6861 in a preamplifier stage, the traveling-wave tube serves as a crystal-protection device because of its saturation characteristic shown in Fig. 10. From this curve, it will be noted that the saturated power output of the 6861 is about 1 milliwatt which will not harm the crystal. Therefore, the spike-leakage limit of the TR tube can be eased and thus eliminate the need for supplying "keep-alive" voltage to the TR tube. Furthermore, the ability of the 6861 to withstand an rf peak power input of as much as 250 watts or an average power input of as much as 1 watt makes it possible to employ a TR tube with lower attenuation.

Additional advantages offered by the 6861 in a preamplifier stage include: (1) reduction of the overall noise figure of the radar receiver; (2) improved receiver recovery time; (3) better TR tube life, and (4) reduction of local oscillator radiation. All of these advantages contribute to improved radar-system operation.

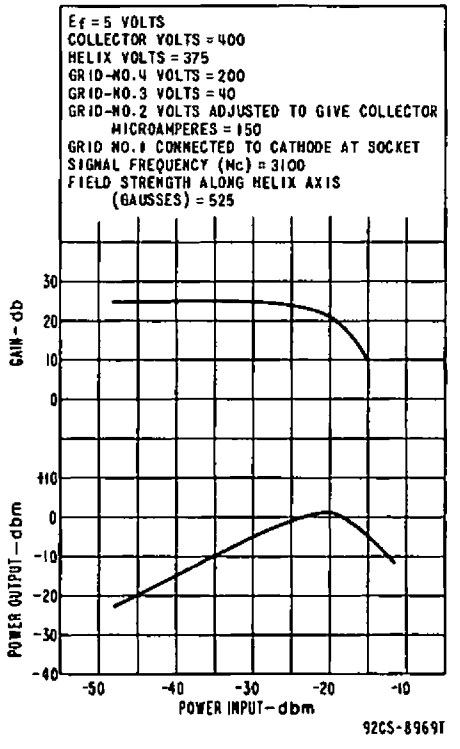


Fig. 10 - Saturation Characteristics of Type 6861.

Phase-Sensitive Applications

When the 6861 is used in a phase-sensitive radar system or in a microwave relay system where frequency-modulated information is amplified, even a small amount of phase distortion can

adversely affect performance. The following table shows for each tube electrode the values of rms ripple voltage which will cause a peak-to-peak change in rf phase of approximately 1 degree.

Tube Electrode	Typical Operating DC Volts	Approx. RMS Ripple Volts For Peak-to-Peak Phase Shift of 1°
Grid No. 1	0	0.1
Grid No. 2	20	0.1
Grid No. 3	40	0.5
Grid No. 4	200	3.5
Helix	375	0.024
Collector	400	6.7

For the RCA Solenoid Type MW-4900 operated at 100 volts dc, a peak-to-peak change in rf phase of approximately 1° will be caused by an rms ripple voltage of 7.7 volts.

Input Matching Considerations

In general, the *voltage standing wave ratio* (VSWR) will increase as the electron-beam current of the tube is increased. This "hot VSWR" is a direct function of gain and can be attributed to reflections of the amplified wave at a discontinuity along the slow-wave structure. In contrast, the VSWR with no voltages applied to the tube, is referred to as the "cold VSWR". This "cold VSWR" determines the transfer of input signal energy to the helix and, therefore,

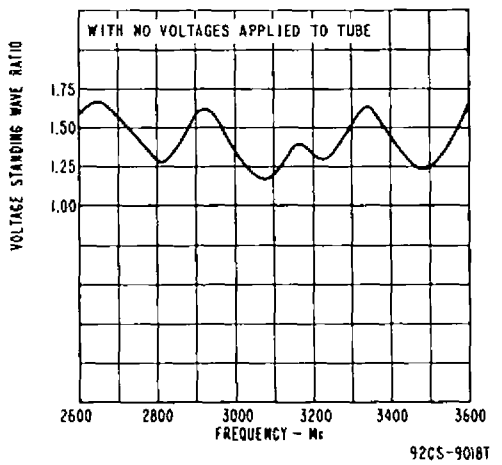


Fig. 11 - Input-Matching Characteristic of Type 6861.

the noise figure of the 6861 is not degraded by the "hot VSWR". In general, it will be found that when the input to the 6861 is adjusted for optimum matching under "cold" conditions, the same adjustment will provide optimum matching under "hot" conditions. Fig. 11 shows a typical input-matching characteristic of the 6861 under "cold" conditions.

Amplifier-Design Considerations

Amplifier design requires consideration not only of the amplification obtained at each fre-

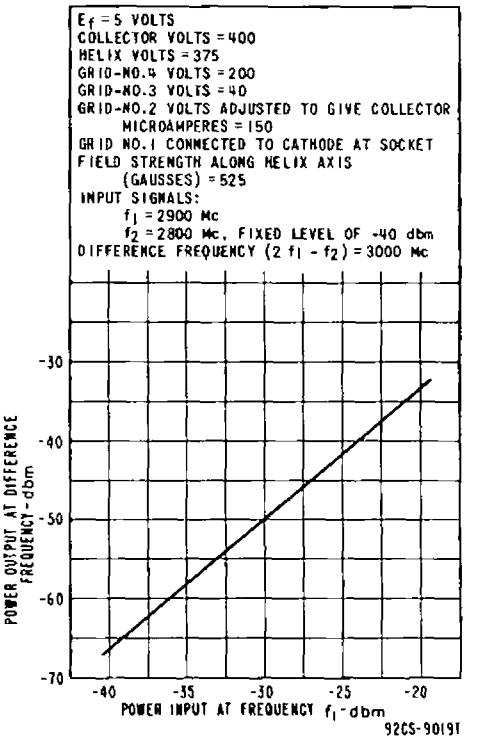


Fig. 12 - Intermodulation Characteristic of Type 6861.

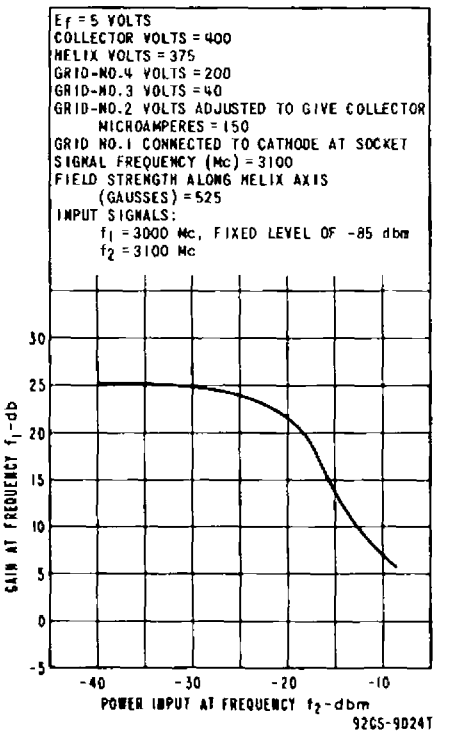


Fig. 13 - Cross-Modulation Characteristic of Type 6861.

quency in the band, but also of such factors as linearity of response at high signal levels (see Fig. 10); intermodulation (see Fig. 12); and cross-modulation (see Fig. 13). At low levels of input signal, the second harmonic output is relatively low. When the input to the 6861 is increased toward its saturation level, the non-linear response increases until the tube output at the second harmonic exceeds the input at the fundamental frequency. Under such conditions, the tube operates as a frequency doubler.

Notes On Associated Microwave Circuitry

A low-noise traveling-wave tube used in a superheterodyne circuit will cause a 3 db degradation in noise figure unless a filter is used at the output of the traveling-wave tube to remove noise generated at the image frequency.

Whenever the output of the 6861 is connected to a filter, signals in the reject band of the filter are reflected back into the tube. As these signals travel back through the tube, they suffer little attenuation until they are absorbed by the attenuator. Should there be appreciable reflection from the attenuator or another discontinuity inside the traveling-wave tube, oscillations may occur, depending on the gain within the tube from the attenuator or discontinuity to the output end of the tube.

The 6861 is designed to be short-circuit stable, i.e., the power reflected from a short-circuited output termination will be insufficient to cause oscillation when the 6861 is operating at a normal value of beam current. If the beam current is increased sufficiently above this value, the gain of the tube will increase until oscillation takes place.

When a high-gain microwave amplifier tube such as the traveling-wave tube is employed, special care must be taken to prevent distortion or oscillations resulting from feedback through circuitry external to the tube. Some types of filters may show satisfactory attenuation characteristics in and near the frequency band of interest. However, oscillations can still occur due to "holes" in the filter characteristic at frequencies outside the band of interest. Attenuation of filters should therefore be checked over wide bands and the holes, if any, can then be filled by supplementary, simple filters.

Our engineers are ready to assist you in the circuit applications of the RCA-6861. For further information, write to Commercial Engineering, RCA, Harrison, New Jersey, giving complete details as to the proposed service.

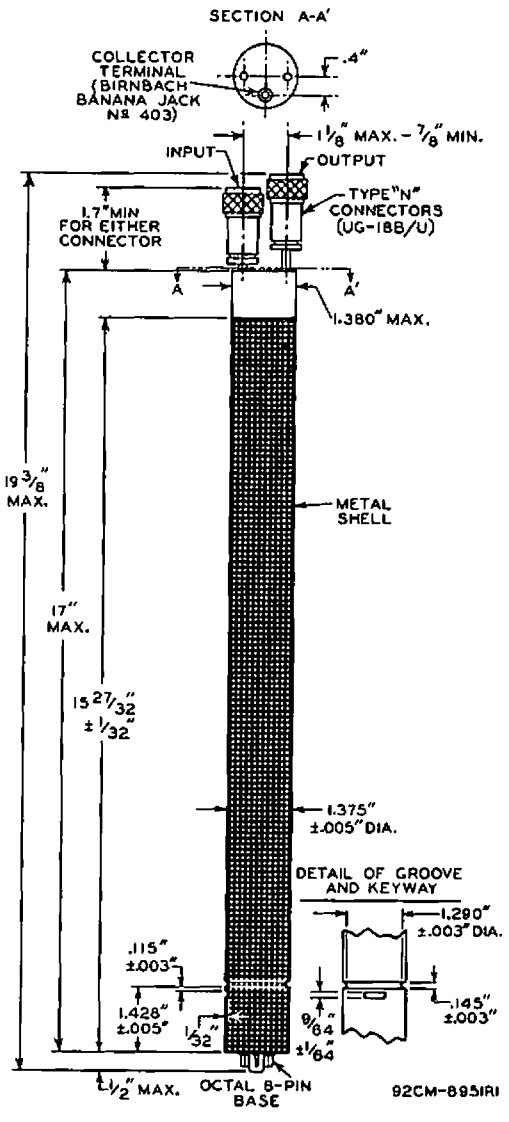
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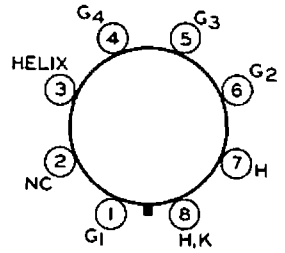
W. W. Mumford, *"A Broad-Band Microwave Noise Source"*, Bell System Technical Journal, October, 1949.

DIMENSIONAL OUTLINE



SOCKET CONNECTIONS

Bottom View



PIN 1: GRID No.1	PIN 5: GRID No.3
PIN 2: NO CONNECTION	PIN 6: GRID No.2
PIN 3: HELIX	PIN 7: HEATER
PIN 4: GRID No.4	PIN 8: HEATER, CATHODE

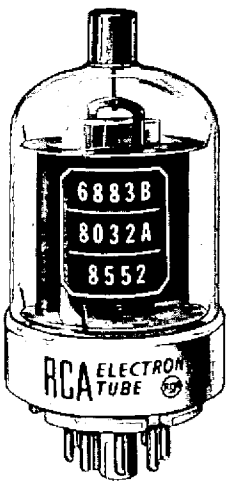
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from JEDEC release #4635, March 16, 1964

RCA-6883B/8032A/8552

BEAM POWER TUBE

Controlled Zero-Bias Plate Current	85 Watts CW Output (ICAS) at 60 Mc	3-13/16" Max. Length
Controlled Power Output at Reduced Heater Voltage	50 Watts CW Output (ICAS) at 175 Mc	1-21/32" Max. Diameter
	RCA "Dark Heater" with 10- to 16-volt Range	Octal 8-Pin Base
		Small, Sturdy Structure



RCA-6883B/8032A/8552 is a small, sturdy, beam power tube having high efficiency and high power sensitivity for use in mobile and stationary equipment. It is rated as an af power amplifier and modulator, a linear rf power amplifier, and a Class C rf power amplifier and oscillator

The 6883B features a heater designed to operate over a voltage range of 12 to 15 volts and which will take excursions from 10 to 16 volts in battery operation. The heater design insures dependable performance in mobile equipment under operating conditions during battery charging and discharging. See *Special Performance Data* on page 4 for information covering heater overvoltage and undervoltage operation.

Controlled zero-bias plate current is offered in the 6883B to insure more dependable performance as a Class AB_1 linear rf amplifier for single-sideband suppressed-carrier service. See *Test No.3* of *Characteristics Range Values*.

Also featured in the design of the 6883B is the new RCA "Dark Heater", which functions efficiently at operating temperatures 350° K below those of the heaters in conventional tube types. The dark surface of the new heater radiates heat more efficiently and improves the transfer of heat to the cathode so that optimum cathode temperature may be attained with the heater operating at approximately 1350° K.

The low operating temperature of the "Dark Heater" results in (1) lower internal stresses in the heater wire and smaller thermal change during heater warmup, (2) cooler operation of the heater which minimizes changes in heater shape and reduces the possibility of heater damage and heater shorts, (3) extremely stable heater current characteristics throughout life, and (4) significant reduction in effects of ac heater leakage.

Small in size for its power-output capability, the 6883B has a rugged button-stem construction with short internal leads, a T12 bulb, triple base-pin connections for grid No.3 and cathode (both joined to internal shield inside the tube) to permit effective rf grounding, and an octal base with short metal sleeve having its own base-pin terminal. The sleeve shields the input to the tube and isolates it from the output circuit so completely that no other external shielding is required. Separation of input and output circuits is accomplished by bringing the plate lead out of the bulb to a cap opposite the base.

The 6883B/8032A/8552 is unilaterally interchangeable with the 6883, 6883A, and 8032.

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	12.6	volts
Current at 12.6 volts	0.562	amp
Minimum heating time	60	sec

See Special Performance Data on page 4 for heater operation in stationary equipment and in mobile equipment.

Transconductance, for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100	7000	μmhos
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100.	4.5	
Direct Interelectrode Capacitances (Approx.):[a]		
Grid No.1 to plate	0.24 max.	pf
Grid No.1 to cathode & grid No.3 & internal shield, base sleeve, grid No.2, and heater	13	pf
Plate to cathode & grid No.3 & internal shield, base sleeve, grid No.2, and heater	8.5	pf

Mechanical:

Operating Position	Any
Maximum Overall Length	3-13/16"
Seated Length	3-1/8" ± 1/8"
Maximum Diameter	1-21/32"
Bulb	T12
Cap	Small (JEDEC No.C1-1)
Base	Small-Wafer Octal 8-Pin with Sleeve (JEDEC Group 1, No.B8-150), or Small-Wafer Octal 8-Pin with External Barriers and Sleeve (JEDEC Group 1, No.B8-159)
Bulb Temperature (At hottest point)	260 max. °C
Weight (Approx.)	2.3 oz

AF POWER AMPLIFIER & MODULATOR – Class AB_1

Maximum Ratings, *Absolute-Maximum Values:*	CCS	ICAS	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[b]	175 max.	220 max.	ma
MAX.-SIGNAL PLATE INPUT[b]	90 max.	120 max.	watts

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	CCS	ICAS	
MAX.-SIGNAL GRID-No.2 INPUT[b]	3 max.	3 max.	watts
PLATE DISSIPATION[b]	27 max.	35 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage[c]	200	200	volts
DC Grid-No.1 Voltage:			
With fixed-bias source	-47	-48	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage[d]	94	96	volts
Zero-Signal DC Plate Current	48	50	ma
Max.-Signal DC Plate Current	250	250	ma
Max.-Signal DC Grid-No.2 Current	14.8	12.6	ma
Effective Load Resistance (Plate to plate)	5600	7200	ohms
Max.-Signal Driving Power (Approx.)	0	0	watts
Max.-Signal Power Output (Approx.)	96	124	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance under Any Condition:[e]

With fixed bias . . . . . 0.1 max. megohm

With cathode bias . . . . . Not recommended

AF POWER AMPLIFIER & MODULATOR – Class AB_2

Maximum Ratings, *Absolute-Maximum Values:*

	CCS	ICAS	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[b]	175 max.	220 max.	ma
MAX.-SIGNAL PLATE INPUT[b]	90 max.	120 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[b]	3 max.	3 max.	watts
PLATE DISSIPATION[b]	27 max.	35 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts

Typical CCS Operation:

Values are for 2 tubes

DC Plate Voltage	500	600	volts
DC Grid-No.2 Voltage[c]	200	200	volts
DC Grid-No.1 Voltage:			
From fixed-bias source	-46	-48	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	108	106	volts
Zero-Signal DC Plate Current	50	40	ma
Max.-Signal DC Plate Current	308	270	ma
Max.-Signal DC Grid-No.2 Current	26	27	ma
Max.-Signal DC Grid-No.1 Current	2.7	1.3	ma
Effective Load Resistance (Plate to plate)	3620	5200	ohms
Max.-Signal Driving Power (Approx.)[f]	0.2	0.7	watt
Max.-Signal Power Output (Approx.)	100	110	watts

Typical ICAS Operation:

Values are for 2 tubes

DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage[c]	200	150	volts
DC Grid-No.1 Voltage:			
From fixed-bias source	-47	-39	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	114	110	volts
Zero-Signal DC Plate Current	50	40	ma
Max.-Signal DC Plate Current	328	294	ma
Max.-Signal DC Grid-No.2 Current	26	28	ma
Max.-Signal DC Grid-No.1 Current	3.4	7.6	ma
Effective Load Resistance (Plate to plate)	4160	6050	ohms
Max.-Signal Driving Power (Approx.)[f]	0.2	0.5	watt
Max.-Signal Power Output (Approx.)	130	148	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance:[g]

With fixed bias . . . . . 30,000 max. ohms

With cathode bias . . . . . Not recommended

LINEAR RF POWER AMPLIFIER, Class AB_1

Single-Sideband Suppressed-Carrier Service

Peak envelope conditions for a signal having a minimum peak-to-average power ratio of 2

	CCS	ICAS	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
DC PLATE CURRENT AT PEAK OF ENVELOPE	175 max.	220 max.	ma
PLATE DISSIPATION	27 max.	35 max.	watts
GRID-No.2 DISSIPATION	3 max.	3 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts

Typical Operation with "Two-Tone Modulation":

At 30 Mc

DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage[h]	200	200	volts
DC Grid-No.1 Voltage[h]	-47	-48	volts
Zero-Signal DC Plate Current	24	25	ma
Effective RF Load Resistance	2800	3600	ohms
DC Plate Current at Peak of Envelope	125	125	ma
Average DC Plate Current	86	86	ma

	CCS	ICAS	
DC Grid-No.2 Current at Peak of Envelope	7.4	6.3	ma
Average DC Grid-No.2 Current	5.0	3.9	ma
Distortion Products Level:[i]			
Third order	24	26	db
Fifth order	30	31	db
Useful Power Output (Approx.):			
Average	24.5	30.5	watts
Peak envelope	49	61	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under Any Condition:		
With fixed bias	30,000 max.	ohms

PLATE-MODULATED RF POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0; at frequencies up to 60 Mc

	CCS	ICAS	
Maximum Ratings, *Absolute-Maximum Values:*			
DC PLATE VOLTAGE	480 max.	600 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
DC GRID-No.1 VOLTAGE	-150 max.	-150 max.	volts
DC PLATE CURRENT	145 max.	180 max.	ma
DC GRID-No.1 CURRENT	3.5 max.	4.0 max.	ma
PLATE INPUT	60 max.	85 max.	watts
GRID-No.2 INPUT	2 max.	2 max.	watts
PLATE DISSIPATION	18 max.	23 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
Typical Operation:			
DC Plate Voltage	475	600	volts
DC Grid-No.2 Voltage[j]	165	175	volts
DC Grid-No.1 Voltage[k]	-86	-92	volts
From a grid resistor of	26,000	27,000	ohms
Peak RF Grid-No.1 Voltage	106	114	volts
DC Plate Current	125	140	ma
DC Grid-No.2 Current	8.5	9.5	ma
DC Grid-No.1 Current (Approx.)	3.3	3.4	ma
Driving Power (Approx.)	0.4	0.5	watt
Power Output (Approx.)	42	62	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance[n]	30,000 max.	ohms

RF POWER AMPLIFIER & OSC. – Class C Telegraphy and RF POWER AMPLIFIER – Class C FM Telephony

	CCS	ICAS	
Maximum Ratings, *Absolute-Maximum Values up to 60 Mc:*			
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
DC GRID-No.1 VOLTAGE	-150 max.	-150 max.	volts
DC PLATE CURRENT	175 max.	220 max.	ma
DC GRID-No.1 CURRENT	3.5 max.	4.0 max.	ma
PLATE INPUT	90 max.	120 max.	watts
GRID-No.2 INPUT	3 max.	3 max.	watts
PLATE DISSIPATION	27 max.	35 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
Typical Operation as Amplifier up to 60 Mc:			
DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage[l]	200	200	volts
DC Grid-No.1 Voltage[m]	-70	-77	volts
From a grid-No.1 resistor of	24,000	28,000	ohms
Peak RF Grid-No.1 Voltage	90	95	volts
DC Plate Current	150	160	ma
DC Grid-No.2 Current	10	10	ma
DC Grid-No.1 Current (Approx.)	2.8	2.7	ma
Driving Power (Approx.)	0.3	0.3	watt
Power Output (Approx.)	63	85	watts

Typical Operation as Amplifier at 175 Mc:

DC Plate Voltage	320	400	435	volts
DC Grid-No.2 Voltage[l]	210	220	230	volts
DC Grid-No.1 Voltage[m]	-52	-55	-56	volts
From a grid resistor of	26,000	30,000	24,000	ohms
Peak RF Grid-No.1 Voltage	65	67	73	volts
DC Plate Current	170	180	210	ma
DC Grid-No.2 Current	12	12	11	ma
DC Grid-No.1 Current (Approx.)	2	1.9	2.3	ma
Driving Power (Approx.)	2	2	3	watts
Power Output (Approx.)	29	40	50	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance[n]	30,000 max.	ohms

CHARACTERISTICS RANGE VALUES

	Note	Min.	Max.	
1. Direct Interelectrode Capacitances:				
Grid No.1 to plate	1	-	0.24	pf
Grid No.1 to cathode & grid No.3 & internal shield, base sleeve, grid No.2, and heater	1	12.0	15.0	pf
Plate to cathode & grid No.3 & internal shield, base sleeve, grid No.2, and heater	1	7.3	9.5	pf
2. Plate Current	2	46	94	ma
3. Zero-Bias Plate Current	3	330	-	ma
4. Grid-No.2 Current	2	-	5.5	ma

Note 1: With no external shield.

Note 2: With heater voltage of 13.5 volts, dc plate voltage of 400 volts, dc grid-No.2 voltage of 200 volts, and dc grid-No.1 voltage of -34 volts.

Note 3: With heater voltage of 13.5 volts, dc plate voltage of 100 volts, dc grid-No.2 voltage of 200 volts, and dc grid-No.1 voltage of -100 volts. Grid No.1 is square-wave pulsed at 1000 kc to zero volts. Limit value is peak-pulse current.

SPECIAL PERFORMANCE DATA ON HEATER OPERATION

Stationary Equipment Operation:

Heater, for Unipotential Cathode:

	Min.	Design Center	Max.	
Voltage (AC or DC)[a]	-	12.6	-	volts
Current at 12.6 volts	0.525	-	0.600	amp
Useful Power Output[b]	59	-	-	watts

[a] It is recommended that the design-center heater voltage be 12.6 volts; the heater power supply should not fluctuate more than 10% to insure long life.

[b] In a single-tube, self-excited oscillator circuit, and with ac heater voltage of 12.6 volts, dc plate voltage of 600 volts, dc grid-No.2 voltage of 200 volts, grid-No.1 resistor of 24,000 ± 10% ohms, dc plate current of 150 max. ma., dc grid-No.1 current of 2.5 to 3 ma., and frequency of 15 Mc.

Mobile Equipment Operation:

Heater, for Unipotential Cathode:

	Min.	Design Range	Max.	
Voltage (AC or DC)[a]	-	12-15	-	volts
Current at 13.5 volts	0.550	-	0.620	amp
Useful Power Output I[b]	59	-	-	watts
Useful Power Output II	See *Note c*			

Overvoltage Heater Life Tests:

Continuous heater life tests are performed periodically on sample lots of tubes with 16 volts on the heater, all other electrodes "floating". Intermittent heater life tests are performed periodically on sample lots of tubes with 22 volts on the heater, a cycle of 1 minute "ON" and 4 minutes "OFF". After 1000 hours of the continuous heater life test and after 48 hours of the intermittent heater life test, the following tests are performed:

With heater voltage of 13.5 volts and ± 100 dc volts between cathode and heater, the heater-cathode leakage current will not exceed 100 microamperes.

With ac or dc heater voltage of 13.5 volts, grid-No.1 volts = -200 and cathode, grid No.2, and plate grounded, the minimum grid-No.1 leakage resistance will be 10 megohms.

With ac or dc heater voltage of 13.5 volts, plate volts = -200, and cathode grid No.1 and grid No.2 grounded, the minimum plate leakage resistance will be 10 megohms.

[a] It is recommended that the heater voltage operate within the range of 12.0 to 15.0 volts and within excursions from 10 to 16 volts in battery operation. See *Useful Power Output Test II* and *Overvoltage Tests*.

[b] In a single-tube, self-excited oscillator circuit, and with ac heater voltage of 12.6 volts, dc plate voltage of 600 volts, dc grid-No.2 voltage of 200 volts, grid-No.1 resistor of 24,000 ± 10% ohms, dc plate current of 150 max. ma., dc grid-No.1 current of 2.5 to 3 ma., and frequency of 15 Mc.

[c] With conditions in note b above, reduce heater voltage to 10 volts. Useful power output will be at least 90% of the power output at heater voltage of 12.6 volts.

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[a] With no external shield.

[b] Averaged over any audio-frequency cycle of sine-wave form.

[c] Obtained preferably from a separate source or from the plate voltage supply with a voltage divider.

[d] The driver stage should be capable of supplying the No.1 grids of the class AB_1 stage with the specified driving voltage at low distortion.

[e] The type of input coupling network used should not introduce too much resistance in the grid-No.1 circuit. Transformer or impedance coupling devices are recommended.

[f] Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the AB_2 stage.

[g] To minimize distortion, the effective resistance per grid-No.1 circuit of the AB_2 stage should be held at a low value. For this purpose the use of transformer coupling is recommended. In no case, however, should the total dc grid-No.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-No.1-circuit resistance may be as high as 100,000 ohms.

[h] Obtained preferably from a separate, well-regulated source.

[i] Referenced to either of the two tones and without the use of feedback to enhance linearity.

[j] Obtained preferably from a separate source modulated with the plate supply, or from the modulated plate supply through a series resistor.

[k] Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

[l] Obtained preferably from separate source, or from the plate-supply voltage with a voltage divider, or through a series resistor. A series grid-No.2 resistor should be used only when the tube is used in a circuit which is not keyed. Grid-No.2 voltage must not exceed 435 volts under key-up conditions.

[m] Obtained from fixed-supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

[n] When grid No.1 is driven positive and the tube is operated at maximum ratings, the total dc grid-No.1-circuit resistance should not exceed the specified value of 30,000 ohms. If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply. For operations at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100,000 ohms.

DEFINITIONS

AB_1 - The subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

AB_2 - The subscript 2 indicates that grid-No.1 current flows during some part of the input cycle.

CCS - Continuous Commercial Service.

ICAS - Intermittent Commercial and Amateur Service.

Ratings System - The *maximum ratings* in the tabulated data are established in accordance with the following defination of the *Absolute-Maximum Rating System* for rating electron devices.

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, taking no responsibility for equipment variations, environment variations, and effects of changes in operating conditions due to variations in device characteristics.

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 device characteristics.

Two-Tone Modulation - Two-Tone Modulation operation refers to that class of amplifier service in which the input consists of two monofrequency rf signals having equal peak amplitude.

MAXIMUM RATINGS vs. OPERATING FREQUENCY
In Class C Telegraphy Service

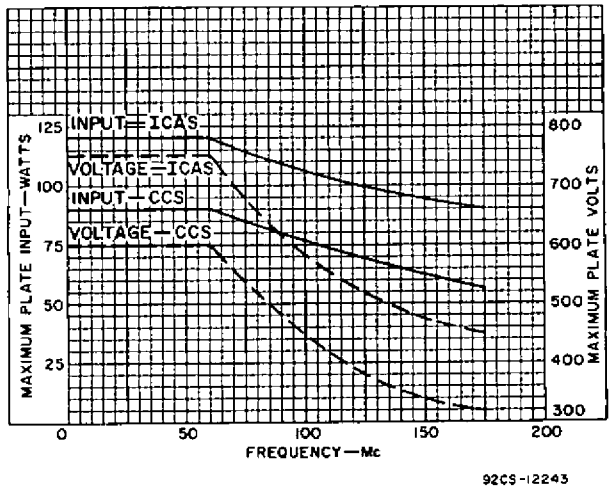


Fig.1A

MAXIMUM RATINGS vs. OPERATING FREQUENCY
In Class C Telephony Service

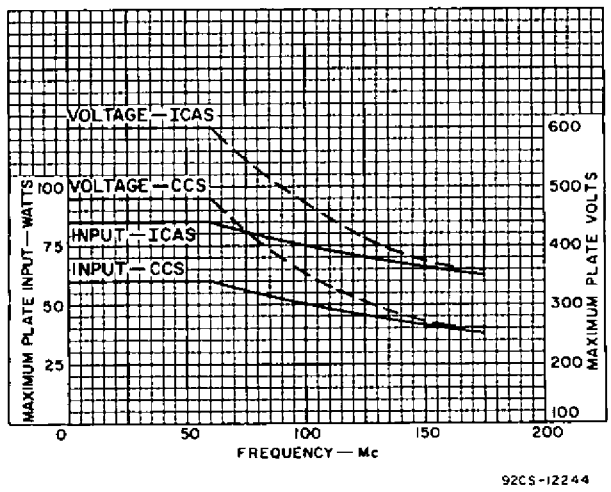


Fig.1B

GENERAL CONSIDERATIONS

Temperature

The maximum bulb temperature of 260° C is a tube rating and is to be observed in the same manner as other ratings. The temperature may be measured with temperature-sensitive paint, such as Tempilaq. The latter is made by the Tempil Corporation, 132 W. 22nd Street, New York 11, N. Y.

MECHANICAL CONSIDERATIONS

Plate Circuit

Heavy leads and conductors together with suitable insulation should be used in all parts of the rf plate tank circuit so that losses due to rf voltages and currents may be kept at a minimum. At the higher frequencies, it is essential that short, heavy leads be used for circuit connections in order to minimize lead inductance and losses.

TYPICAL PLATE CHARACTERISTICS

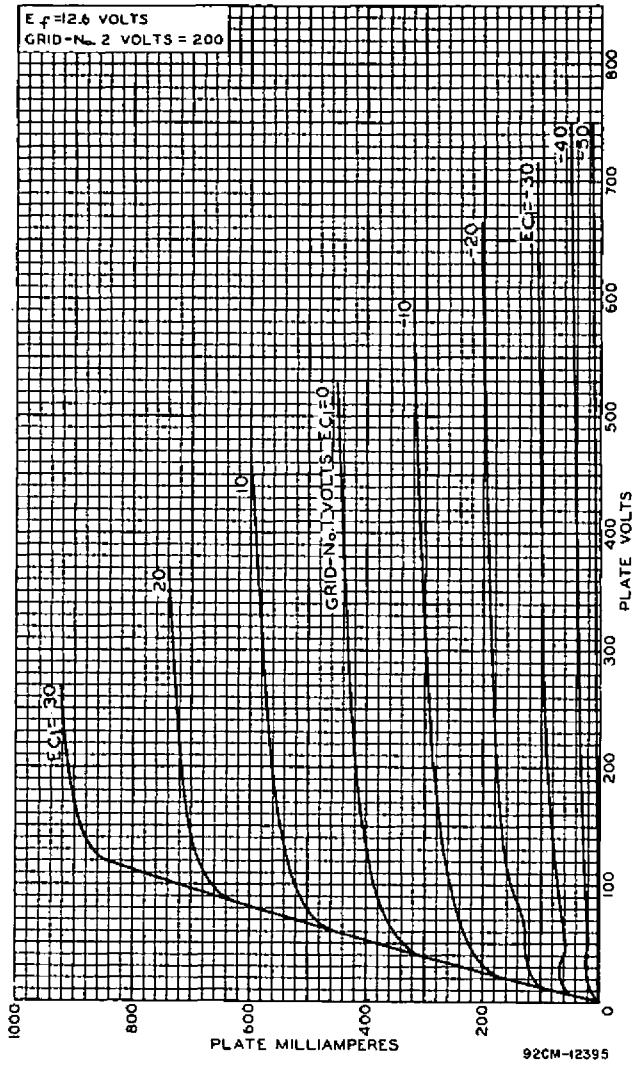


Fig.2

TYPICAL CHARACTERISTICS

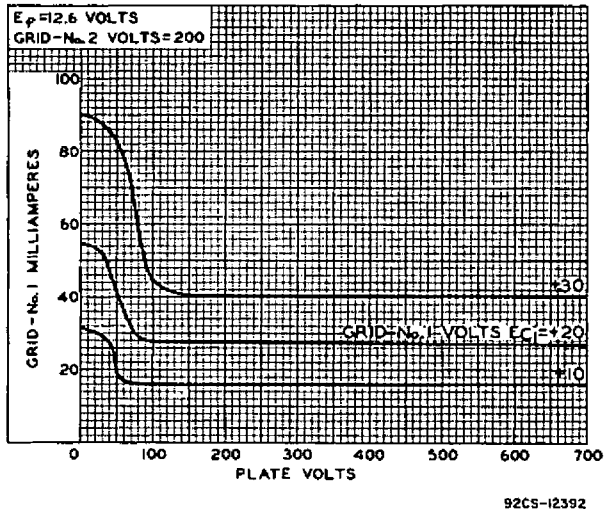


Fig.3

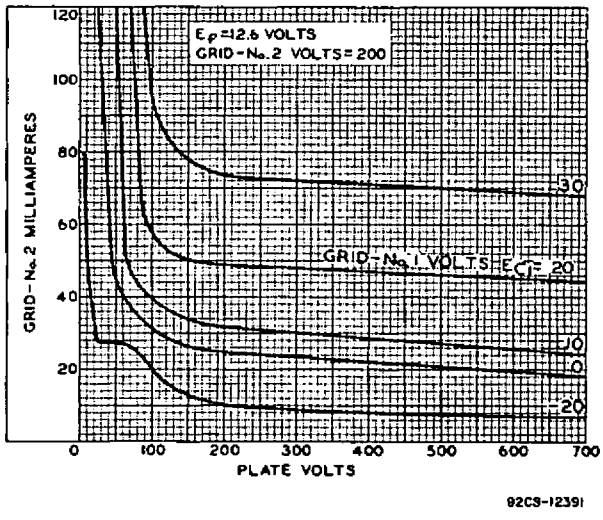


Fig. 4

To insure adequate cooling it is essential that free circulation of air be provided around the tube. In most cases, no additional air is required.

Plate Color

The plate shows no color when the 6883B is operated at full ratings under either CCS or ICAS conditions.

Connections to the plate should be made with a flexible lead to prevent any strain on the seal at the cap.

ELECTRICAL CONSIDERATIONS

Plate and Grid No.2

When a new circuit is tried or when adjustments are made, it is advisable to reduce the plate

voltage and grid-No. 2 voltage. If the 6883B is operated at maximum-ratings and grid-No. 2 voltage is obtained through a series dropping resistor, the use of a 2500-ohm protective resistor in the high-voltage supply lead is recommended. When a separate grid-No. 2 voltage supply is used, a 10,000-ohm protective resistor should be connected in the grid-No. 2 supply lead.

The grid-No. 2 current is a very sensitive indication of plate-circuit loading and grid-No. 2 current rises excessively (often to the point of damaging the tube) when the amplifier is operated without load. Therefore, care should be taken when tuning a 6883B under no-load conditions in order to prevent exceeding the grid-No. 2 input rating of the tube.

TYPICAL PLATE CHARACTERISTICS

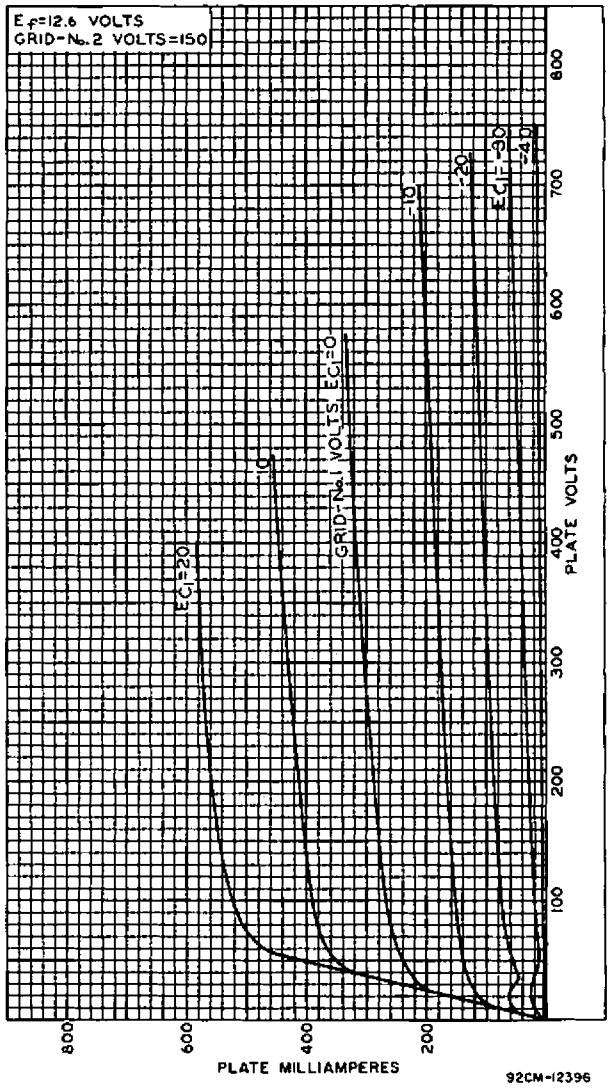


Fig.5

TYPICAL CHARACTERISTICS

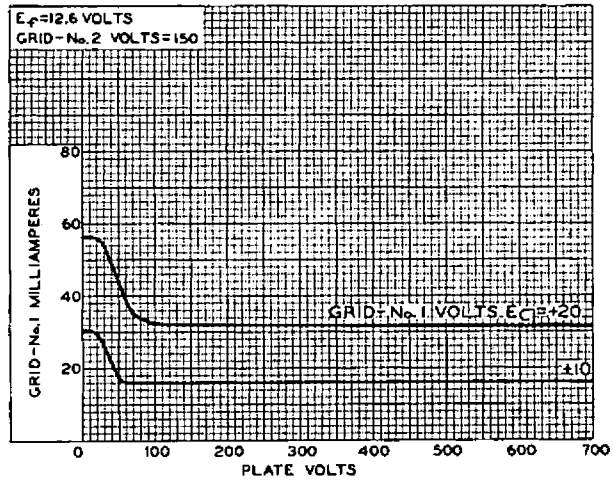


Fig.6

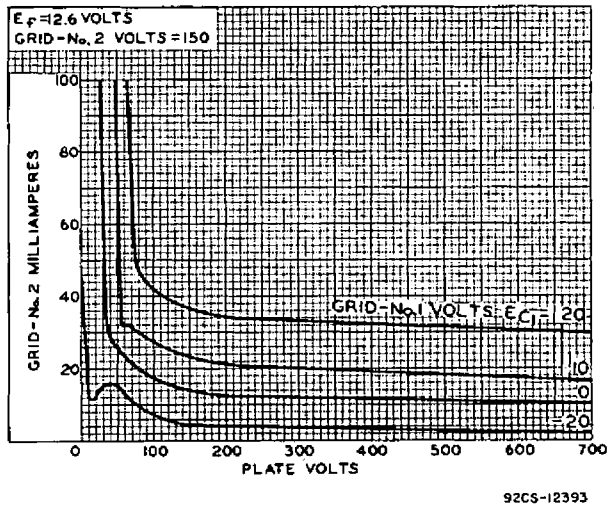


Fig.7

The plate voltage should be applied before or simultaneously with the grid-No. 2 voltage; otherwise, with voltage on grid No. 2 only, its current may be large enough to cause excessive grid-No. 2 dissipation. A dc milliammeter should be used in the grid-No. 2 circuit so that its current may be measured and the dc power input determined.

Driver

The driver stage for the 6883B in either class C telephony or telegraphy service should have considerably more output capability than the typical driving power shown in the tabulated data in order to permit considerable range of adjustment, and also to provide for losses in the grid-No. 1 circuit

and the coupling circuits. This recommendation is particularly important near the maximum-rated frequency where there are other losses of driving power, such as circuit losses, radiation losses, and transit-time losses.

Efficiency

Highest operating efficiency in high-frequency service, and therefore maximum power output, will be obtained when the 6883B is operated under load conditions such that the maximum rated plate current flows at the plate voltage which will give maximum rated input.

Class C Telephony

In plate-modulated class C amplifier service, the 6883B can be modulated 100 per cent. The grid-No. 2 voltage must be modulated simultaneously with the plate voltage so that the ratio of grid-No. 2 voltage to plate voltage remains constant. Modulation of the grid-No. 2 voltage can be accomplished either by connecting grid No. 2 through a separate winding on the modulation transformer to the fixed grid-No. 2 voltage supply, or by connecting grid No. 2 through an audio-frequency choke of suitable impedance for low audio frequencies to the fixed grid-No. 2 supply voltage. The supply end of the choke should be well bypassed to ground.

Circuit Arrangements

Push-pull or parallel circuit arrangements can be used when more radio-frequency power is required than can be obtained from a single 6883B. Two 6883B's in parallel or push-pull will give approximately twice the power output of one tube. The parallel connection requires no increase in exciting voltage necessary to drive a single tube.

With either connection, the driving power required is approximately twice that for a single tube. The push-pull arrangement has the advantage of simplifying the balancing of high-frequency circuits.

When two or more tubes are used in the circuit, precautions should be taken to insure that each tube draws the same plate current.

Standby Operation

During standby periods in intermittent operation, the heater voltage may be maintained at normal operating value for most applications.

In those applications which require maximum reliability, it is recommended that the heater voltage be maintained at normal operating value when the period is less than 15 minutes; that it be reduced to 80 per cent of normal when the period is between 15 minutes and 2 hours; and that for longer periods, the heater voltage should be turned off.

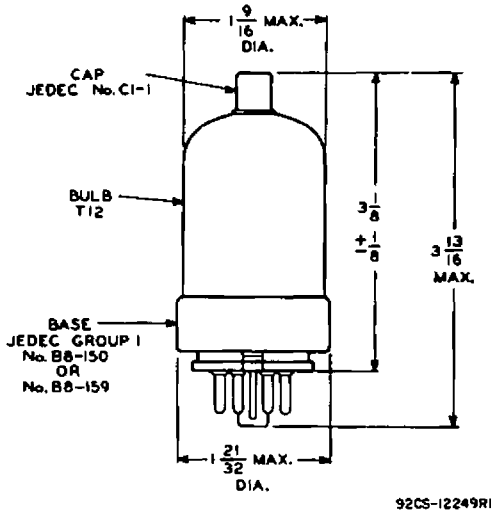
Protective Devices

Protective devices should be used to protect not only the plate but also grid No. 2 against overload. In order to prevent excessive plate current flow and resultant overheating of the tube, the common ground lead of the plate circuit should be connected in series with the coil of an instantaneous overload relay. This relay should be adjusted to remove the dc plate and grid-No. 2 voltage when the average value of plate current reaches a value slightly higher than normal plate current. A protective device in the grid-No. 2 supply should remove the grid-No. 2 voltage when the dc grid-No. 2 current reaches a value slightly higher than normal.

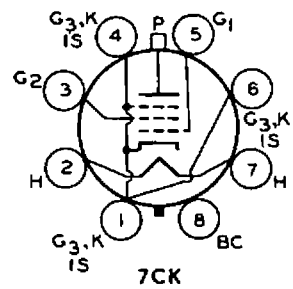
Precautions

The rated plate and grid-No. 2 voltages of this tube are extremely dangerous. Great care should be taken during the adjustment of circuits. The tube and its associated apparatus, especially all parts which may be at high potential above ground, should be housed in a protective enclosure. The protective housing should be designed with interlocks so that personnel can not possibly come in contact with any high-potential point in the electrical system. The interlock devices should function to break the primary circuit of the high-voltage supplies when any gate or door on the protective housing is opened, and should prevent the closing of the primary circuit until the door is again locked.

DIMENSIONAL OUTLINE



TERMINAL CONNECTIONS
Bottom View



7CK

PIN 1:	CATHODE, GRID No. 3, INTERNAL SHIELD	PIN 5:	GRID No. 1
PIN 2:	HEATER	PIN 6:	SAME AS PIN 1
PIN 3:	GRID No. 2	PIN 7:	HEATER
PIN 4:	SAME AS PIN 1	PIN 8:	BASE SLEEVE
		CAP:	PLATE

ITT ELECTRON TUBE DIVISION
BOX 100 EASTON, PA. 18043
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

7178 HYDROGEN DIODE

DESCRIPTION

The 7178 is a glass envelope hydrogen filled diode designed for Pulse Transformer Back swing Clipper Applications. The indirectly heated cathode, the internal hydrogen reservoir, and the rugged anode design of the 7178 combine to produce reliable service and long life.

ELECTRICAL DATA, GENERAL

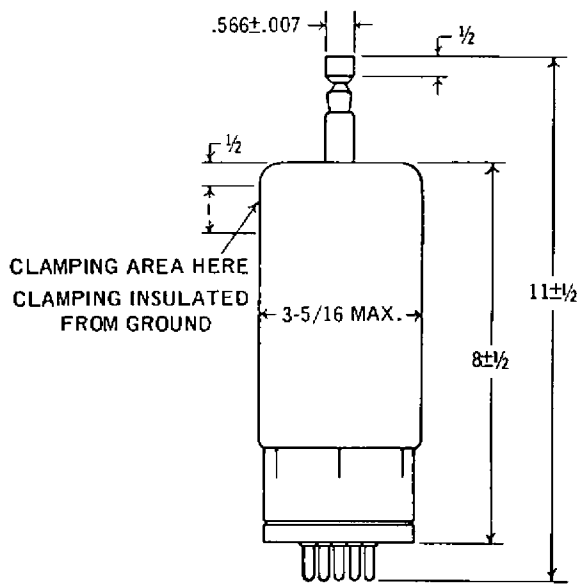
	Nom.	Min.	Max.					
Heater Voltage	5.0	4.7	5.3	Volts AC	Reservoir Current (at 5.0 volts)	2.0	5.0	Amperes
Heater Current (at 5.0 volts)		14.0	24.0	Amperes	Minimum Heating Time		10	Minutes
Reservoir Voltage	5.0	4.7	5.3	Volts AC				

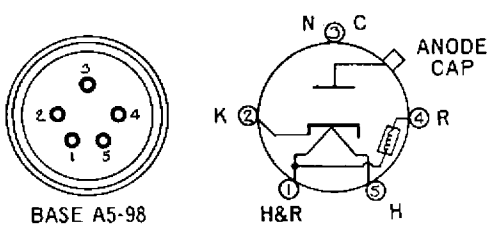
MECHANICAL DATA, GENERAL

Mounting Position	Any	Net Weight	1.5 Pounds
Base (Per outline)		Dimensions (Per outline)	
Cooling (Note 1)			

RATINGS (Note 2)

Max. Peak Anode Voltage, Inverse, Transient (Note 3)	30.0 KV	Max. R.M.S. Anode Current (Note 4)	15.0 Amps.
Max. Peak Anode Voltage, Inverse, Operating	16.0 KV	Min. Anode Voltage	500.0 Volts
Max. Peak Anode Current	500.0 Amps.	Ambient Temperature	-50° to + 75° C
Max. Average Anode Current	0.50 Amps.		





NOTE 1

Cooling of the Anode lead is permissible, but there shall be no Air blast directly on the bulb.

NOTE 2

Maximum ratings should not occur simultaneously. In special cases maximum ratings may be exceeded. Consult Applications Department.

NOTE 3

The 7173 will withstand transient, overvoltage conditions of epx – 30 KV for (1) per cent of its rated life.

NOTE 4

The Root Mean Square Anode Current shall be computed as the square root of the product of the peak and the average current.

from JEDEC release #4735, June 22, 1964

from JEDEC release #4690, May 4, 1964

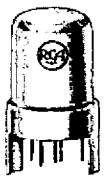
RCA-7586, 8393

MEDIUM-MU TRIODES

Nuvistor Types

RCA Dark Heater | **For Industrial Applications** | **All-Ceramic-and-Metal Construction**

RCA-7586 and 8393 are medium-mu general-purpose nuvistor triodes, capable of providing high gain with low noise in amplifier service and excellent stability in oscillator applications over a wide range of frequencies extending into the uhf region.



The 7586 and 8393 are identical except for heater ratings and interelectrode capacitance values. Heater ratings for the two types are: type 7586 = 0.135 ampere at 6.3 volts; type 8393 = 0.060 ampere at 13.5 volts.

These types are particularly suitable for use in equipment in which compactness, the ability to withstand severe mechanical shock and vibration, and exceptional uniformity of characteristics are primary requirements. The 7586 and 8393 feature all-ceramic-and-metal construction, a cantilever-supported cylindrical electrode structure, and the RCA Dark Heater for long life and dependable performance.

GENERAL DATA

Electrical:

	7586	*8393*	
Heater Characteristics and Ratings:			
Voltage (AC or DC)	6.3 ± 0.6	13.5 ± 1.4	volts
Current at center heater voltage	0.135	0.060	amp
Peak heater-cathode voltage:			
Heater negative with respect to cathode	100 max.	100 max.	volts
Heater positive with respect to cathode	100 max.	100 max.	volts
Direct Interelectrode Capacitances (Approx.):			
Grid to plate	2.2	2.4	pf
Input: G to (K,S,H)	4.2	4.4	pf
Output: P to (K,S,H)	1.6	1.6	pf
Cathode to plate	0.26	0.26	pf
Heater to cathode	1.4	1.7	pf

Characteristics, Class A_1 Amplifier:

Plate Supply Voltage	-	-	75	volts
Plate Voltage	26.5	40	-	volts
Grid Supply Voltage	0	0	0	volts
Cathode Resistor	-	-	100	ohms
Grid Resistor	0.5	0.5	-	megohm
Amplification Factor	31	35	35	
Plate Resistance (Approx.)	4400	3000	3000	ohms
Transconductance	7000	11500	11500	μmhos
Plate Current	2.8	7.5	10.5	ma
Grid Voltage (Approx.) for plate μa = 10	-	-	-7	volts

Mechanical:

Operating Position	Any
Weight (Approx.)	1.9 grams
Maximum Overall Length	0.800"
Maximum Seated Length	0.625"
Maximum Diameter	0.440"
Envelope	Metal Shell MT4
Dimensional Outline	JEDEC No.4-4
Socket	See SOCKET INFORMATION
Base	Medium Ceramic-Wafer Twelvar 5-Pin (JEDEC No.E5-65)

INDUSTRIAL SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

For operation at any altitude

Plate Supply Voltage	330 max.	volts
Plate Voltage	110 max.	volts
Grid Voltage:		
Negative-bias value	55 max.	volts
Peak-positive value	4 max.	volts
Grid Current	2 max.	ma
Cathode Current	15 max.	ma
Plate Dissipation	1 max.	watt

Maximum Circuit Values:

Grid-Circuit Resistance:[a]		
For fixed-bias operation	0.5 max.	megohm
For cathode-bias operation	1 max.	megohm

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current *(7586)*	1	0.125	0.145	amp
(8393)	2	0.055	0.065	amp
Direct Interelectrode Capacitances:				
Grid to plate *(7586)*	3	1.8	2.6	pf
(8393)	3	2.0	2.8	pf
Input: G to (K,S,H) *(7586)*	3	3.8	4.6	pf
(8393)	3	4.0	4.8	pf
Output: P to (K,S,H)	3	1.4	1.8	pf
Cathode to plate	3	0.20	0.32	pf
Heater to cathode *(7586)*	3	1.1	1.7	pf
(8393)	3	1.4	2.0	pf
Plate Current (1)	1,2,4	9.0	12.5	ma
Plate Current (2)	1,2,5	-	50	μa
Transconductance (1)	1,2,4	10000	13000	μmhos
Transconductance (2)	4,6,7	9000	-	μmhos

[a] For operation at metal-shell temperature of 150° C. For operation at other metal-shell temperatures, see GRID-CIRCUIT RESISTANCE RATING CHART. Metal-shell temperatures are measured in Zone "A" (See DIMENSIONAL OUTLINE).

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

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Transconductance Change:				
Difference between Transconductance (1) and Transconductance (2), expressed in per cent of Transconductance (1). . .	-	-	15	%
Reverse Grid Current. . . .	1,2,8	-	0.1	μa
Amplification Factor. . . .	1,2,4	28	42	
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode. . .	1,2,9	-	5	μa
Heater positive with respect to cathode. . .	1,2,9	-	5	μa
Leakage Resistance:				
Between grid and all other electrodes tied together	1,2,10	1000	-	megohms
Between plate and all other electrodes tied together	1,2,11	1000	-	megohms

Note 1: With ac or dc heater volts = 6.3 *(Type 7586)*.

Note 2: With ac or dc heater volts = 13.5 *(Type 8393)*.

Note 3: Measured in accordance with EIA Standard RS-191-A.

Note 4: With dc plate supply volts = 75, dc grid supply volts = 0, cathode resistor (ohms) = 100, cathode-bypass capacitor (μf) = 1000, and metal shell connected to ground.

Note 5: With dc plate volts = 75, dc grid volts = -7, and metal shell connected to ground.

Note 6: With ac or dc heater volts = 5.7 *(Type 7586)*.

Note 7: With ac or dc heater volts = 12.0 *(Type 8393)*.

Note 8: With dc plate volts = 80, dc grid supply volts = -1.2, grid resistor (megohm) = 0.5, and metal shell connected to ground.

Note 9: With dc heater-cathode volts = 100.

Note 10: With grid 100 volts negative with respect to all other electrodes tied together, and metal shell connected to ground.

Note 11: With plate 300 volts negative with respect to all other electrodes tied together, and metal shell connected to ground.

SPECIAL TESTS

Shock:

Peak Impact Acceleration. . . . 1000 g

This test is performed on a sample lot of tubes to determine the ability of the tube to withstand the specified Peak Impact Acceleration. Tubes are held rigid in each of four positions (X_1, X_2, Y_1, and Y_2) in a Navy Type, High-Impact (Flyweight) Shock Machine, and, with tube electrode voltages applied, are subjected to 20 blows (5 in each position) at the specified Peak Impact Acceleration.

At the end of this test, tubes are criticized for Shorts and Continuity, Change in Transconductance (1), Reverse Grid Current, Heater-Cathode Leakage Current, and Variable-Frequency Vibration.

Fatigue Vibration:

Peak Vibrational Acceleration . 2.5 max. g

This test is performed on a sample lot of tubes to determine the ability of the tube to withstand the specified Peak Vibrational Acceleration. Tubes are held rigid, supplied with center heater voltage only, and subjected for 48 hours to 2.5 g Peak Vibrational Acceleration at 60 cycles per second in the X_1 position.

At the end of this test, tubes are criticized for Shorts and Continuity, Change in Transconductance (1), Reverse Grid Current, Heater-Cathode Leakage Current, and Variable-Frequency Vibration.

Variable-Frequency Vibration:

This test is performed on a sample lot of tubes operated under the conditions specified in CHARACTERISTICS RANGE VALUES for Transconductance (1), with the addition of a plate-load resistor of 2000 ohms. During operation, tube is vibrated in the X_1 position through the frequency range of 3000 to 15000 cycles per second with a constant vibrational acceleration of 1 g. During the test, tube must not show an rms output voltage across the plate-load resistor in excess of:

25 millivolts over the frequency range of 3000 to 6000 cps

500 millivolts over the frequency range of 6000 to 15000 cps

Post-Impact and Post-Fatigue Vibration limits:

35 millivolts over the frequency range of 3000 to 6000 cps

700 millivolts over the frequency range of 6000 to 15000 cps

Low-Pressure Voltage Breakdown:

This test is performed on a sample lot of tubes to determine the ability of the tube to withstand high-altitude (low-air-pressure) conditions. Tubes are operated with 250 rms volts applied between the plate and all other electrodes and metal shell connected together. The tubes must not break down or show evidence of corona when subjected to air pressure equivalent to an altitude of 100,000 feet (8.0 ± 0.5 mm Hg).

Shorts and Continuity:

This test is performed on a sample lot of tubes from each production run. Tubes are subjected to the Thyratron-Type Shorts Test described in MIL-E-1D, Amendment 2, Paragraph 4.7.7, except that tapping is done by hand with a soft rubber tapper (Specification for this tapper will be supplied upon request). The areas of acceptance and rejection for this test are shown in the accompanying graph, SHORTS-TEST ACCEPTANCE LIMITS. Tubes are criticized for permanent or temporary shorts and open circuits

Heater-Cycling Life:

Intermittent Operation. . . . 2000 cycles

This test is performed on a sample lot of tubes under the following conditions: heater volts = 8.5 *(Type 7586)* or 18.0 *(Type 8393)* cycled one minute on and 2 minutes off; heater 180 volts negative with respect to cathode; grid, plate, and metal shell connected to ground.

At the end of this test, tubes are criticized for Open Heaters, Heater-Cathode Shorts, Open Cathode Circuits, and Heater-Cathode Leakage current.

Early-Hour Stability Life (20 hours):

This test is performed on a sample lot of tubes from each production run to assure that tubes are properly stabilized. Tubes are operated at center heater voltage and maximum rated plate dissipation.

Tubes are criticized at 2 hours and 20 hours for per cent change in Transconductance (1). A tube is rejected if its Transconductance (1) after 2 or 20 hours of operation has changed more than 10 per cent from the 0-hour value.

Survival-Rate Life (100 hours):

This test is performed on a sample lot of tubes to assure a minimum of early-hour inoperatives. Tubes are operated with center heater voltage cycled 100 minutes on and 20 minutes off, and maximum rated plate dissipation.

Tubes are criticized at 100 hours for Shorts and Continuity, Transconductance (1), and Reverse Grid Current. Tubes must then show Transconductance (1) of not less than 8300 micromhos and Reverse Grid Current no greater than 0.2 microampere.

Intermittent Conduction Life (1000 hours):

This test is performed on a sample lot of tubes from each production run to assure the high quality of individual tubes and to prevent epidemic failures due to excessive changes in tube characteristics. Tubes are operated with center heater voltage cycled 110 minutes on and 10 minutes off, and maximum rated plate dissipation, at a shell temperature of 150° C.

Tubes are criticized at 500 and 1000 hours for Inoperatives,[b] Reverse Grid Current, Heater-Cathode Leakage Current, and Leakage Resistance. In addition, a tube is rejected if its Transconductance (1) after 500 hours has changed more than 20 per cent or after 1000 hours has changed more than 25 per cent from the 0-hour value. The average change in Transconductance (1) of the lot from the 0-hour value must not exceed 15 per cent at 500 hours and 20 per cent at 1000 hours.

Standby Life (1000 hours):

This test is performed on a sample lot of tubes from each production run. Tubes are operated with only the center heater voltage applied.

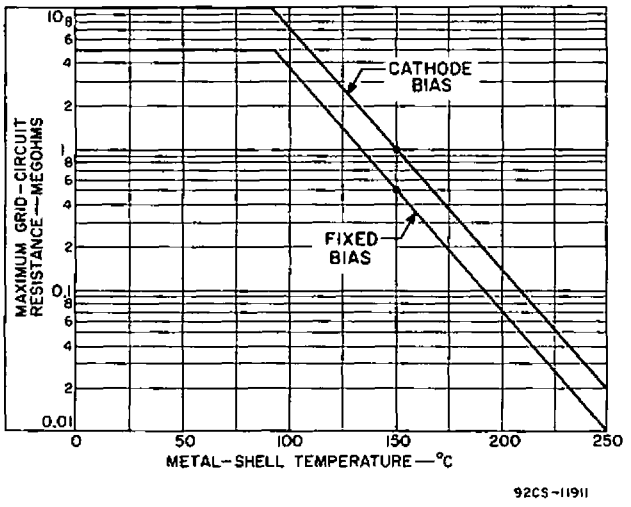
At 500 and 1000 hours the tubes are criticized for Leakage Resistance, Reverse Grid Current, the change in Transconductance (1) of individual tubes from the 0-hour values, and for cathode interface resistance greater than 25 ohms. Interface resistance is measured by Method B of ASTM specification F300-61T.

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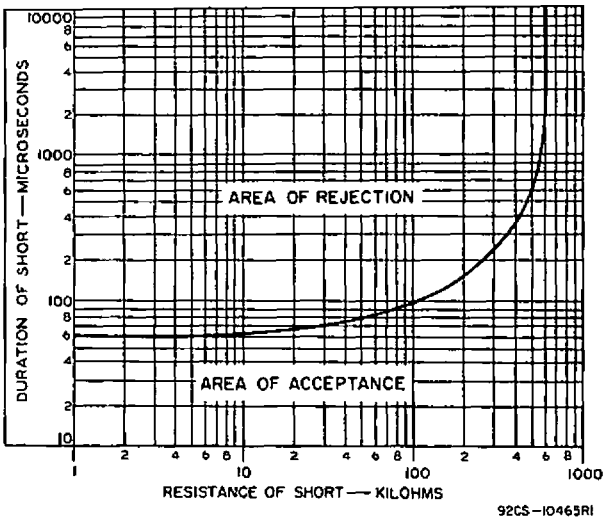
[b] An inoperative is defined as a tube having a discontinuity, permanent short, or air leak.

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GRID-CIRCUIT-RESISTANCE RATING CHART



SHORTS-TEST ACCEPTANCE LIMITS



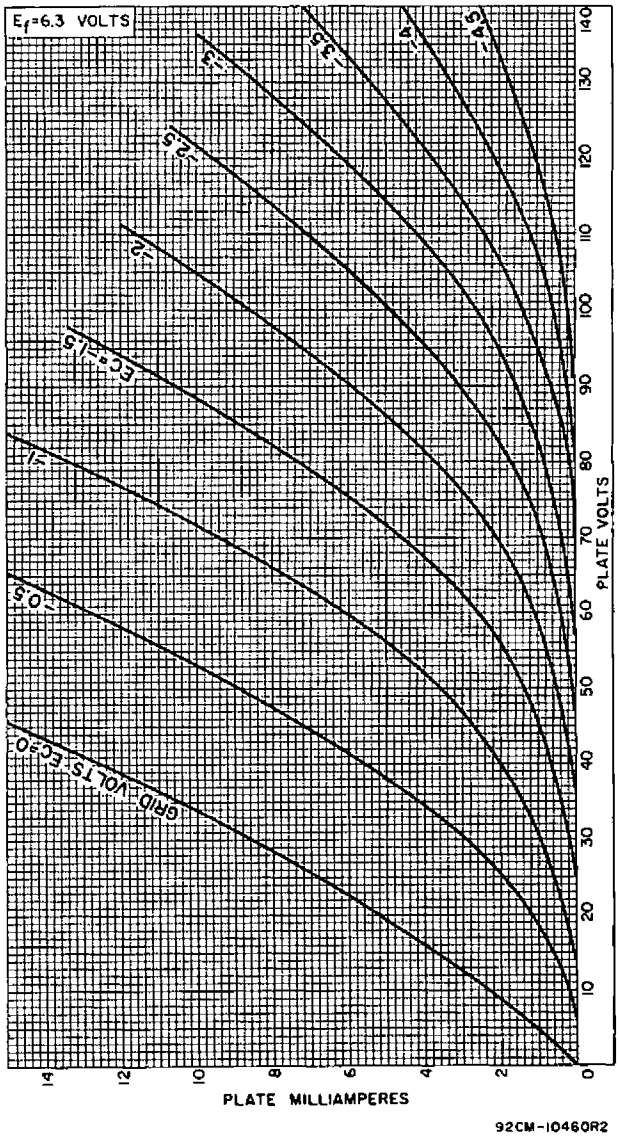
SOCKET INFORMATION

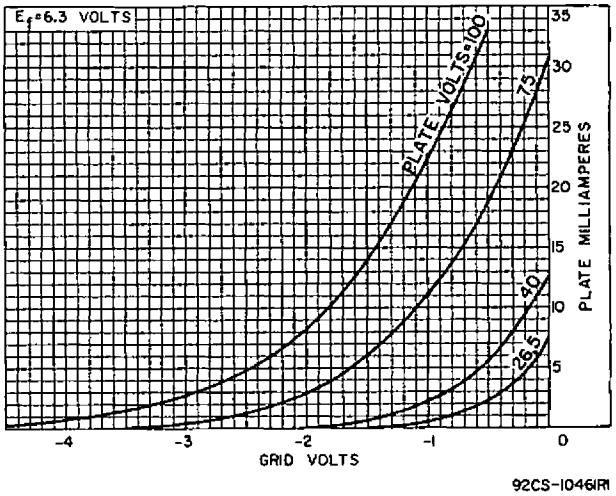
Information about the casting materials, contact materials, and finishes of the sockets listed below and of other available sockets for this nuvistor tube may be obtained from the manufacturers shown on this chart. Nuvistor sockets may also be available from other component manufacturers.

Description		Manufacturer or Distributor and Part No.		
Application	Mounting	Cinch Mfg. Co.[c]	Cinch-Jones Sales Division[d] Distributors	Industrial Electronic Hardware Corp.[e]
General Purpose Type	Crimp mounting	133 65 10 001	5NS	MSN 0905-1 MSN 0905-2 MSN 0905-3
		133 65 91 034[f] 133 65 92 025[g]	- -	- -
	Flange mounting	133 65 10 003	5NS-1	-
	Printed Board ("Stand-off")	133 65 10 009	5NS-2	-
Heat-Dissipating Type	Crimp mounting	133 65 10 041	5NS-3	-

[c] 1026 South Homan Avenue, Chicago 24, Illinois.
[d] Cinch-Jones Sales Division of Cinch Mfg. Co.
[e] 109 Prince Street, New York 12, N.Y.
[f] Low rf loss, high temperature TEFLON socket.
[g] Diall. socket for space applications.

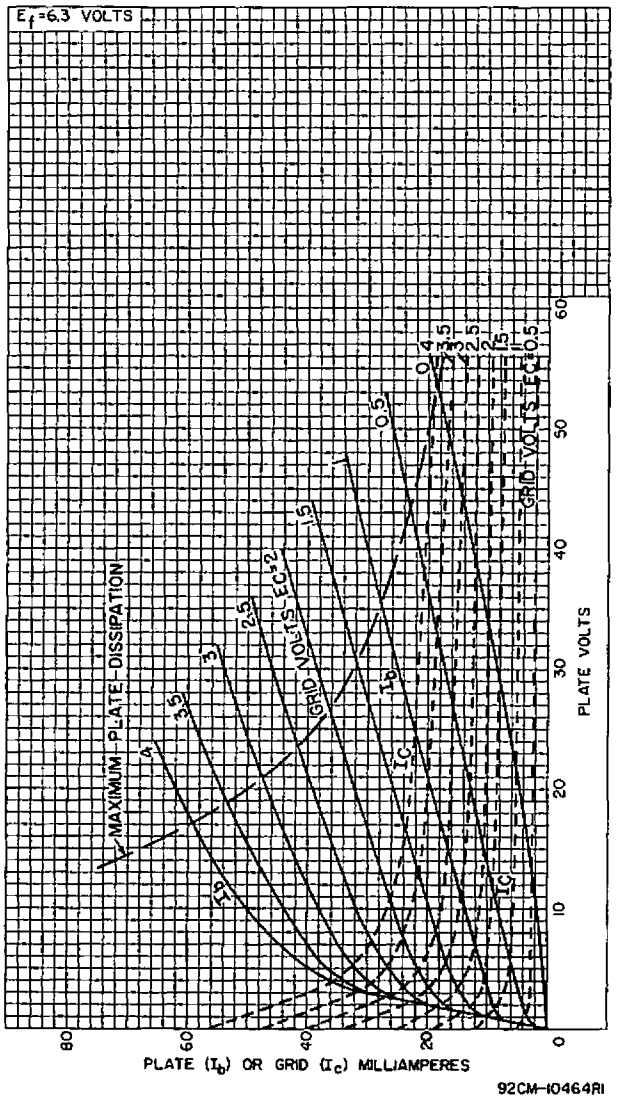
AVERAGE PLATE CHARACTERISTICS

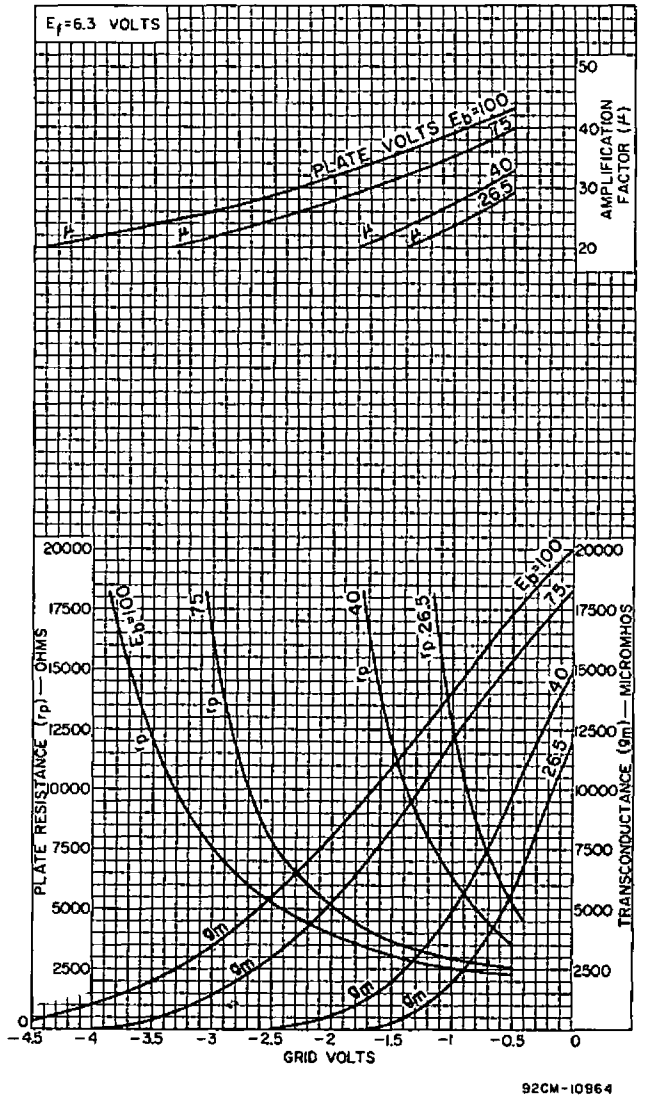




For Type 7586, and for Type 8393 (E_f = 13.5 V).

AVERAGE CHARACTERISTICS

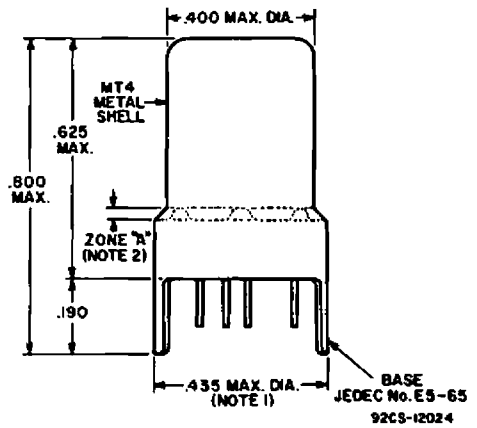




For Type 7586, and for Type 8393 (E_f = 13.5 V).

DIMENSIONAL OUTLINE JEDEC No.4-4

Dimensions in Inches

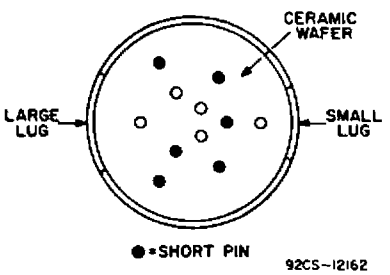


NOTE 1: MAXIMUM OUTSIDE DIAMETER OF 0.440" IS PERMITTED ALONG 0.190" LUG LENGTH.

NOTE 2: METAL-SHELL TEMPERATURE SHOULD BE MEASURED IN ZONE "A".

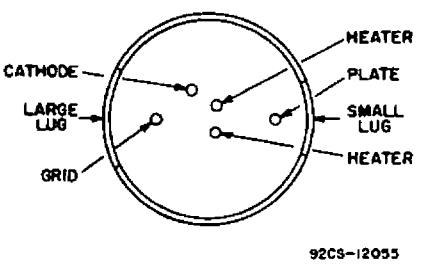
BOTTOM VIEW

Showing Arrangement of All 11 Base Pins



MODIFIED BOTTOM VIEW

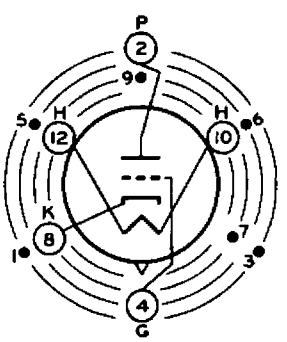
With Element Connections Indicated and Short Pins Not Shown



TERMINAL DIAGRAM

Bottom View

Pin 1§ - Do Not Use
Pin 2 - Plate
Pin 3§ - Do Not Use
Pin 4 - Grid
Pin 5§ - Do Not Use
Pin 6§ - Do Not Use



Pin 7§ - Do Not Use
Pin 8§ - Cathode
Pin 9§ - Do Not Use
Pin 10 - Heater
Pin 11 - Omitted
Pin 12 - Heater

INDEX=LARGE LUG
●=SHORT PIN; IC-DO NOT USE

JEDEC 12AQ

§ Pins 1, 3, 5, 6, 7, and 9 are of a length such that their ends do not touch the socket insertion plane.

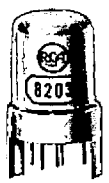
from JEDEC release #4690, May 4, 1964

RCA-8203
POWER TRIODE

Nuvistor

RCA Dark Heater | **For Class C Service in Commercial and Military Equipment** | **All-Ceramic-and-Metal Construction**

RCA-8203 is a power triode of the nuvistor type, especially useful in Class C rf power amplifier and oscillator service, dc pulse-amplifier applications, and as a frequency-multiplier tube. The 8203 is particularly suitable for use in equipment in which ability to withstand severe mechanical shock and vibration, compactness, and exceptional uniformity of characteristics are primary requirements.



The 8203 features all-ceramic-and-metal construction, a cantilever-supported cylindrical electrode structure, and the RCA Dark Heater for long life and dependable performance.

GENERAL DATA

Electrical:

Heater Characteristics and Ratings:			
Voltage (AC or DC)	6.3 ± 0.6		volts
Current at 6.3 volts	0.160		amp
Peak heater-cathode voltage (CCS[a] or ICAS[b] conditions):			
Heater negative with respect to cathode	100	max.	volts
Heater positive with respect to cathode	100	max.	volts
Direct Interelectrode Capacitances (Approx.):			
Grid to plate	2.2		pf
Input: G to (K,S,H)	4.2		pf
Output: P to (K,S,H)	1.6		pf
Cathode to plate	0.26		pf
Heater to cathode	1.5		pf

Characteristics, Class A_1 Amplifier:

DC Plate Supply Voltage	75	150	volts
Grid Supply Voltage	0	0	volts
Cathode Resistor	100	560	ohms
Amplification Factor	35	30	
Plate Resistance (Approx.)	2700	5000	ohms
Transconductance	13000	6000	μmhos
Plate Current	11.5	7	ma
Grid Voltage (Approx.) for plate μa = 10	-6.5	-15	volts

Mechanical:

Operating Position	Any
Weight (Approx.)	1.9 grams
Maximum Overall Length	0.800"
Maximum Seated Length	0.625"
Maximum Diameter	0.440"
Envelope	Metal Shell MT4
Dimensional Outline	JEDEC No. 4-4
Socket	See SOCKET INFORMATION
Base	Medium Ceramic-Wafer Twelvar 5-Pin (JEDEC No. E5-65)

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy[c] and RF POWER AMPLIFIER – Class C FM Telephony

Maximum Ratings, *Absolute-Maximum Values:*

For operation at frequencies up to 250 Mc

	CCS		ICAS		
DC Plate Supply Voltage	400[d]	max.	400[d]	max.	volts
DC Plate Voltage	250[d]	max.	300[d]	max.	volts
DC Grid Voltage:					
Negative-bias value	100	max.	100	max.	volts
Positive-bias value	0	max.	0	max.	volts
Peak-Positive Grid Voltage	5	max.	5	max.	volts
DC Cathode Current	25	max.	30	max.	ma
DC Grid Current	5	max.	6	max.	ma
Plate Dissipation	1.5	max.	1.8	max.	watts

Typical CCS Operation:

As rf power amplifier in cathode-drive circuit at 160 Mc

DC Plate-to-Grid Voltage	155	volts
DC Cathode-to-Grid Voltage	14	volts
From a grid resistor of	2700	ohms
DC Cathode Current	21	ma
DC Grid Current	5	ma
Driver Power Output (Approx.)	0.4	watt
Useful Power Output (Approx.)	1.55[e]	watts

As rf oscillator at 160 Mc

DC Plate Voltage	100	volts
DC Grid Voltage	-3.4	volts
From a grid resistor of	1500	ohms
DC Cathode Current	18	ma
DC Grid Current	2.5	ma
Useful Power Output (Approx.)	0.8[e]	watt

Maximum Circuit Values:

Grid-Circuit Resistance (CCS or ICAS conditions):[f]

For fixed-bias or cathode-bias operation	50000	max.	ohms

FREQUENCY MULTIPLIER

Maximum Ratings, *Absolute-Maximum Values:*

For operation at frequencies up to 250 Mc

	CCS		ICAS		
DC Plate Supply Voltage	400[d]	max.	400[d]	max.	volts
DC Plate Voltage	250[d]	max.	250[d]	max.	volts
DC Grid Voltage:					
Negative-bias value	200	max.	200	max.	volts
Positive-bias value	0	max.	0	max.	volts
Peak-Positive Grid Voltage	5	max.	5	max.	volts
DC Cathode Current	20	max.	24	max.	ma
DC Grid Current	3	max.	4	max.	ma
Plate Dissipation	1.3	max.	1.5	max.	watts

Typical CCS Operation:

As a doubler from 80 to 160 Mc

DC Plate Voltage	125	volts
DC Grid Voltage	-70	volts
From a grid resistor of	18000	ohms
DC Cathode Current	22	ma
DC Grid Current	4	ma
Driver Power Output (Approx.)	0.25	watt
Useful Power Output (Approx.)	0.85[e]	watt

Maximum Circuit Values:

Grid-Circuit Resistance (CCS or ICAS conditions):[f]

For fixed-bias or cathode-bias operation	50000	max.	ohms

DC PULSE AMPLIFIER

Maximum Ratings, *Absolute-Maximum Values*

Peak Positive-Pulse Plate Voltage	500[d]	max.	volts
DC Plate Voltage	250[d]	max.	volts
DC Grid Voltage:			
Negative-bias value	100	max.	volts
Positive-bias value	0	max.	volts
Peak Positive Grid Voltage	5	max.	volts
DC Grid Current	5	max.	ma
DC Cathode Current	18	max.	ma
Peak Cathode Current:			
For duty factors up to 1 per cent	250	max.	ma
For duty factors between 1 and 50 per cent	See PULSE RATING CHART		
Plate Dissipation	1	max.	watt

Maximum Circuit Values:

Grid-Circuit Resistance:[f]

For fixed-bias operation	0.5	max.	megohm
For cathode-bias operation	1	max.	megohm

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	0.150	0.170	amp
Direct Interelectrode Capacitances:				
Grid to plate	2	1.8	2.6	pf
Input: G to (K,S,H)	2	3.8	4.6	pf
Output: P to (K,S,H)	2	1.4	1.8	pf
Cathode to plate	2	0.20	0.32	pf
Heater to cathode	2	1.2	1.8	pf
Plate Current (1)	1,3	5.0	9.5	ma
Plate Current (2)	1,4	-	50	μa
Transconductance	1,3	4000	8000	μmhos
Reverse Grid Current	1,5	-	0.1	μa
AC Emission	6,7	10	-	ma
Amplification Factor	1,3	20	40	
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,8	-	5	μa
Heater positive with respect to cathode	1,8	-	5	μa
Leakage Resistance:				
Between grid and all other electrodes tied together	1,9	1000	-	megohms
Between plate and all other electrodes tied together	1,10	1000	-	megohms
Useful Power Output	1,11	0.9	-	watt
Peak Cathode Emission Current (Pulsed)	1,12	250	-	ma

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[a] Continuous Commercial Service.

[b] Intermittent Commercial and Amateur Service. No operating or "ON" period exceeds 5 minutes and every "ON" period is followed by an "OFF" or stand-by period of the same or greater duration.

[c] Key-down conditions per tube without amplitude modulation. Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

[d] Under no circumstances should this absolute-maximum value be exceeded. For high-altitude operation the maximum permissible plate supply voltage and plate voltage for the 8203 are dependent on atmospheric pressure. See graph of LOW-PRESSURE VOLTAGE-BREAKDOWN CHARACTERISTICS OF NUVISTOR TRIODE BASE.

[e] Measured at load of output circuit.

[f] For operation at metal-shell temperature of 150° C. For operation at other metal-shell temperatures, see GRID-CIRCUIT RESISTANCE RATING CHART. Metal-shell temperatures are measured in Zone "A" (See DIMENSIONAL OUTLINE).

Note 1: With ac or dc heater volts = 6.3.

Note 2: Measured in accordance with EIA Standard RS-191-A.

Note 3: With dc plate supply volts = 150, dc grid supply volts = 0, cathode resistor (ohms) = 560, cathode-bypass capacitor (μf) = 1000, and metal shell connected to ground.

Note 4: With dc plate volts = 150, dc grid volts = -15, and metal shell connected to ground.

Note 5: With dc plate supply volts = 100, dc grid supply volts = -1.7, grid-circuit resistance (megohm) ≤ 1 (the internal resistance of the current meter used for this measurement), and metal shell connected to ground.

Note 6: With ac or dc heater volts = 5.5.

Note 7: With dc plate supply volts = 50, dc grid supply volts = -5.7, 60-cps grid-signal volts (rms) = 7.5, dc resistance of transformer secondary winding in grid circuit ≤ 2 ohms, grid-voltage-supply bypass capacitor (μf) = 1000, and metal shell connected to ground. AC emission is measured as the dc component of plate current at these conditions.

Note 8: With dc heater-cathode volts = 100.

Note 9: With grid 100 volts negative with respect to all other electrodes tied together, and metal shell connected to ground.

Note 10: With plate 300 volts negative with respect to all other electrodes tied together, and metal shell connected to ground.

Note 11: Measured at load in 250-Mc rf amplifier circuit with dc plate supply volts = 150, grid resistor (ohms) = 4700, driver power output (milliwatts) = 350, and plate milliamperes = 20.

Note 12: With dc plate supply volts = 250 and dc grid supply volts = -20. The grid is driven with pulse voltage, as follows: peak volts between grid and negative end of cathode resistor = 5, pulse repetition rate = 1000, pulse duration = 10 μs, pulse rise time $\leq$ 1 μs, and time of fall $\leq$ 1 μs. Peak cathode current is measured with a high impedance oscilloscope or equivalent device connected across a 1-ohm cathode resistor.

SPECIAL TESTS

Shock:

Peak Impact Acceleration . . . . . 1000 g

This test is performed on a sample lot of tubes to determine the ability of the tube to withstand the specified Peak Impact Acceleration. Tubes are held rigid in each of four positions (X_1, X_2, Y_1, and Y_2) in a Navy Type, High-Impact (Flyweight) Shock Machine, and, with tube electrode voltages applied, are subjected to 20 blows (5 in each position) at the specified Peak Impact Acceleration.

At the end of this test, tubes are criticized for Shorts and Continuity, Change in Transconductance, Reverse Grid Current, Heater-Cathode Leakage Current, and Variable-Frequency Vibration.

Variable-Frequency Vibration:

This test is performed on a sample lot of tubes operated under the conditions specified in CHARACTERISTICS RANGE VALUES for Transconductance, with the addition of a plate-load resistor of 2000 ohms. During operation, tube is vibrated in the X_1 position through the frequency range of 3000 to 15000 cycles per second with a constant vibrational acceleration of 1g. During the test, tube must not show an rms output voltage across the plate-load resistor in excess of:

25 millivolts over the frequency range of 3000 to 6000 cps

500 millivolts over the frequency range of 6000 to 15000 cps

Post-Impact and Post-Sweep-Frequency Fatigue Vibration limits:

35 millivolts over the frequency range of 3000 to 6000 cps

700 millivolts over the frequency range of 6000 to 15000 cps

Sweep-Frequency Fatigue Vibration:

This test is performed on a sample lot of tubes with only heater voltage of 6.3 volts applied. During operation, the tube is rigidly mounted and is vibrated through the frequency range of 5 to 500 cps and back to 5 cps. One such vibration sweep cycle takes approximately 15 minutes. The tubes are vibrated for a period of 3 hours along each of 3 mutually perpendicular axes for a total of 9 hours. The longitudinal axis of the tube is coincident with one of the 3 axes. The vibrations are applied as follows:

a From 5 to 50 cps with a constant peak-to-peak displacement of 0.080 inch.

b From 50 to 500 cps with a constant acceleration of 10 g.

c From 500 to 50 cps and then to 5 cps follows the procedure shown in *a* and *b*, but in reverse.

At the end of this test, tubes are criticized for Shorts and Continuity, Change in Transconductance, Reverse Grid Current, Heater-Cathode Leakage Current, and Variable-Frequency-Vibration.

Low-Pressure Voltage Breakdown:

This test is performed on a sample lot of tubes to determine the ability of the tube to withstand high-altitude (low-air-pressure) conditions. Tubes are operated with 250 rms volts applied between the plate and all other electrodes and metal shell connected together. The tubes must not break down or show evidence of corona when subjected to air pressure equivalent to an altitude of 100,000 feet (8.0 $\pm$ 0.5 mm Hg).

Shorts and Continuity:

This test is performed on a sample lot of tubes from each production run. Tubes are subjected to the Thyratron-Type Shorts Test described in MIL-E-1D, Amendment 2, Paragraph 4.7.7, except that tapping is done by hand with a soft rubber tapper (Specifications for this tapper will be supplied on request). The areas of acceptance and rejection for this test are shown in the accompanying graph, SHORTS-TEST ACCEPTANCE LIMITS. Tubes are criticized for permanent or temporary shorts and open circuits.

Intermittent Conduction Life (1000 hours):

This test is performed on a sample lot of tubes from each production run to assure the high quality of individual tubes and to prevent epidemic failures due to excessive changes in tube characteristics. Tubes are operated with heater voltage of 6.3 volts cycled 110 minutes on and 10 minutes off, and plate dissipation = 1.5 watts (approx.), at a shell temperature of 150° C.

Tubes are criticized at 2 hours, 20 hours, and 100 hours for Inoperatives[9] and Transconductance, and at 500 hours and 1000 hours for Inoperatives[9] and Useful Power Output at 250 Mc.

Oscillator Life (1000 hours):

This test is performed on a sample lot of tubes to assure satisfactory operation of the tube as a 250-Mc oscillator. Tubes are operated with heater volts = 6.3 and plate dissipation = 1.4 watts.

Tubes are criticized at 500 and 1000 hours for Inoperatives[g] and Useful Power Output at 250 Mc.

Grid Pulse Life (1000 hours):

This test is performed on a sample lot of tubes from each production lot. Tubes are operated with heater voltage of 6.3 volts cycled 110 minutes on and 10 minutes off, dc plate supply volts = 300, dc grid supply volts = -20, grid resistor (ohms) = 47, and plate-load resistor (ohms) = 330. The grid is driven with pulse voltage, as follows: peak grid-to-cathode volts = 5, pulse repetition rate = 1000, pulse duration = 10 μs, pulse rise time $\leq$ 1 μs, and time of fall $\leq$ 2 μs.

Tubes are tested at 500 hours and 1000 hours for Inoperatives[g] and Peak Cathode Emission Current (Pulsed).

---

[g] An inoperative is defined as a tube having a discontinuity, permanent short, or air leak.

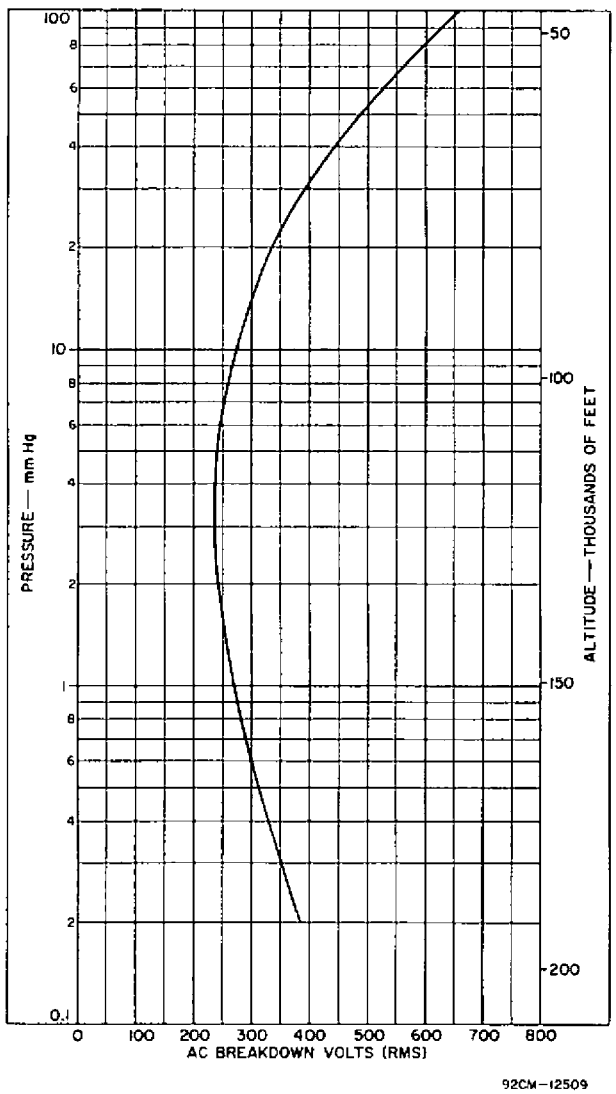
SOCKET INFORMATION

Information about the casting materials, contact materials, and finishes of the sockets listed below and of other available sockets for this nuvistor tube may be obtained from the manufacturers shown on this chart. Nuvistor sockets may also be available from other component manufacturers.

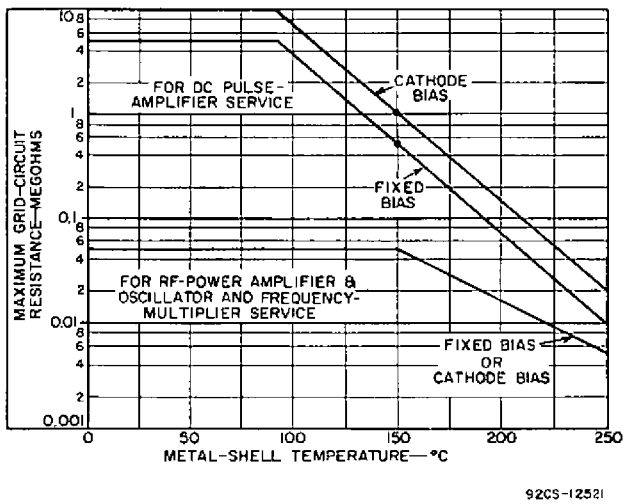
Description		Manufacturer or Distributor and Part No.		
Application	Mounting	Cinch Mfg. Co.[h]	Cinch-Jones Sales Division[j] Distributors	Industrial Electronic Hardware Corp.[k]
General Purpose Type	Crimp mounting	133 65 10 001	5NS	MSN 0905-1 MSN 0905-2 MSN 0905-3
		133 65 91 034[m] 133 65 92 025[n]	- -	- -
	Flange mounting	133 65 10 003	5NS-1	-
	Printed Board ("Stand-off")	133 65 10 009	5NS-2	-
Heat Dissipating Type	Crimp mounting	133 65 10 041	5NS-3	-

[h] 1026 South Homan Avenue, Chicago 24, Illinois.
[j] Cinch-Jones Sales Division of Cinch Mfg. Co.
[k] 109 Prince Street, New York 12, N.Y.
[m] Low rf loss, high temperature, TEFLON socket.
[n] Diall. socket for space applications.

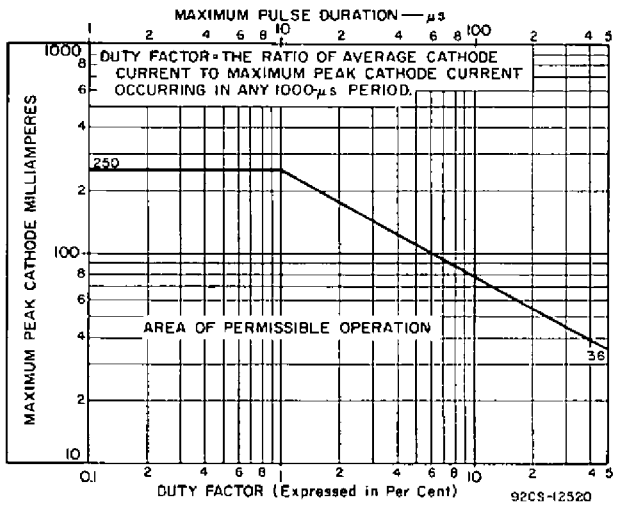
LOW-PRESSURE VOLTAGE-BREAKDOWN CHARACTERISTICS OF NUVISTOR TRIODE BASE



GRID-CIRCUIT-RESISTANCE RATING CHART

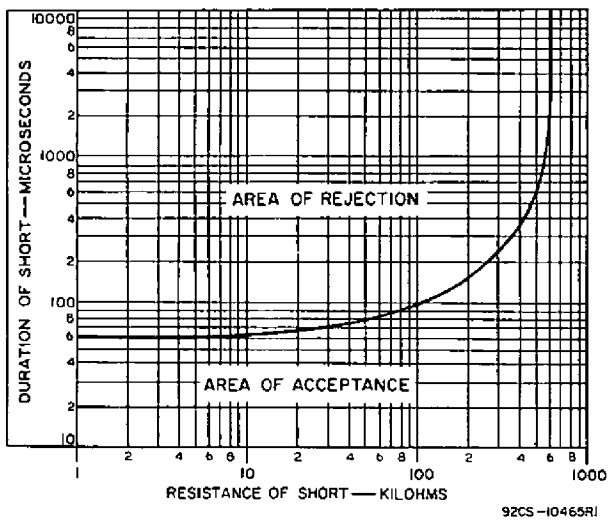


PULSE RATING CHART

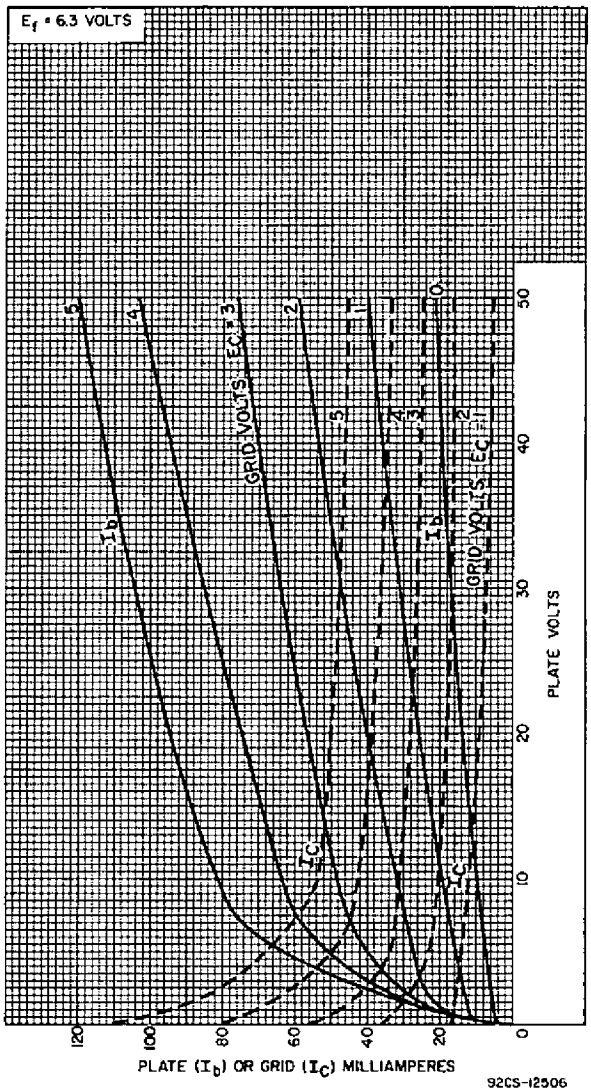


This chart is based on the Typical Pulse Rating Chart shown in "A Guide for Pulse Rating Low Power Vacuum Tubes", JEDEC Publication No.41, dated September, 1963.

SHORTS-TEST ACCEPTANCE LIMITS

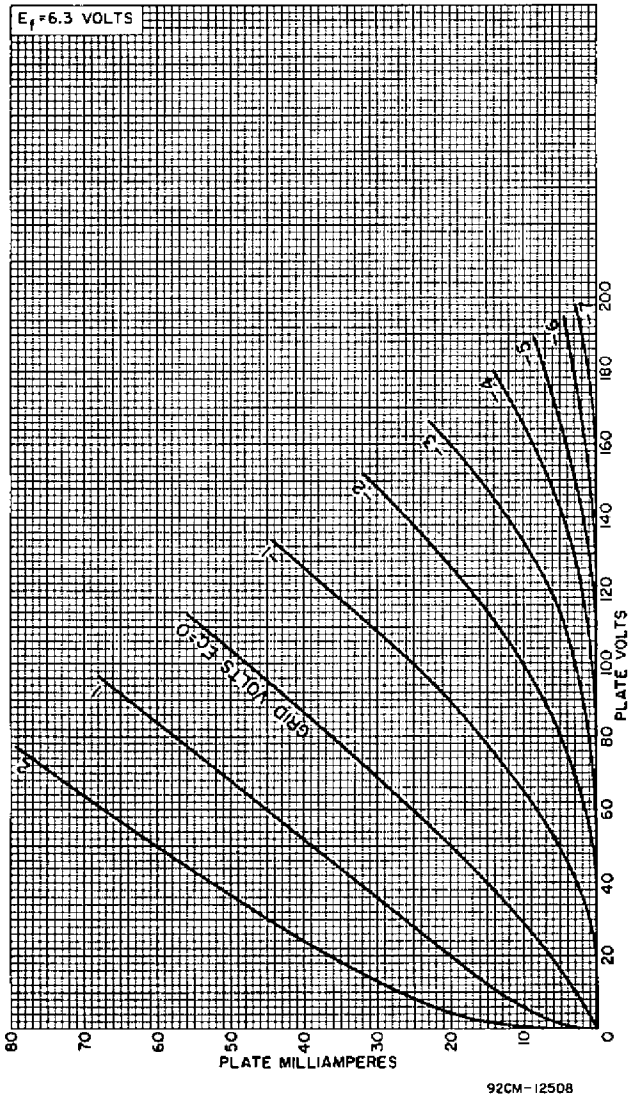


AVERAGE CHARACTERISTICS

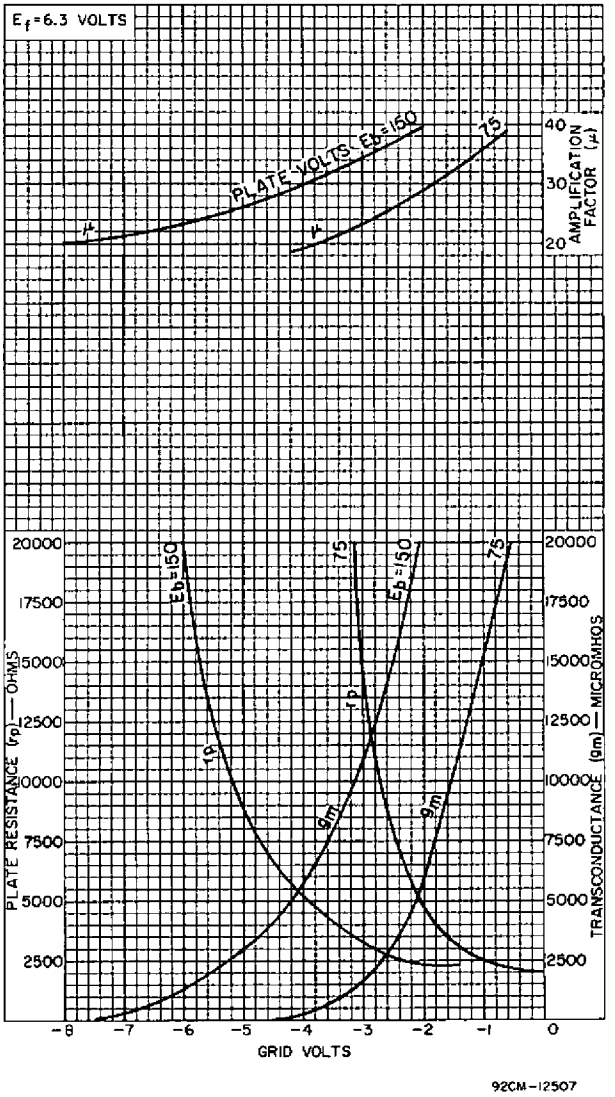


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AVERAGE PLATE CHARACTERISTICS

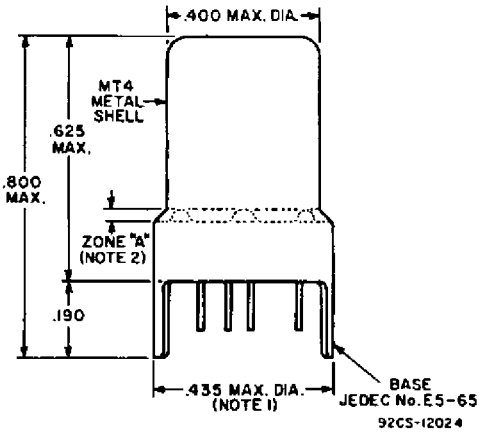


AVERAGE CHARACTERISTICS



DIMENSIONAL OUTLINE JEDEC No. 4-4

Dimensions in Inches

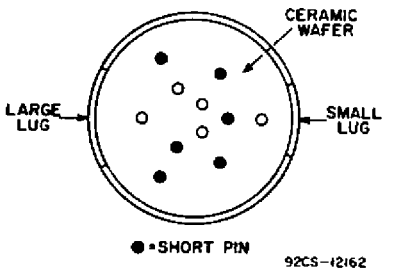


NOTE 1: MAXIMUM OUTSIDE DIAMETER OF 0.440" IS PERMITTED ALONG 0.190" LUG LENGTH.

NOTE 2: METAL-SHELL TEMPERATURE SHOULD BE MEASURED IN ZONE "A".

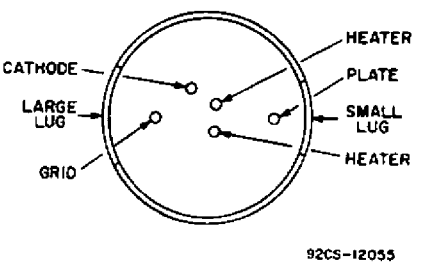
BOTTOM VIEW

Showing Arrangement of All 11 Base Pins



MODIFIED BOTTOM VIEW

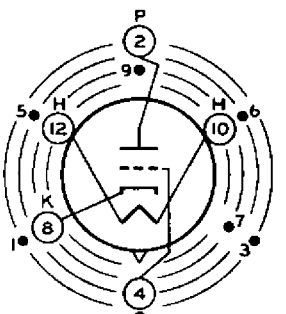
With Element Connections Indicated and Short Pins Not Shown



TERMINAL DIAGRAM

Bottom View

Pin 1§ – Do Not Use
Pin 2 – Plate
Pin 3§ – Do Not Use
Pin 4 – Grid
Pin 5§ – Do Not Use
Pin 6§ – Do Not Use



Pin 7§ – Do Not Use
Pin 8 – Cathode
Pin 9§ – Do Not Use
Pin 10 – Heater
Pin 11 – Omitted
Pin 12 – Heater

INDEX=LARGE LUG
●=SHORT PIN; IC–DO NOT USE

JEDEC 12AQ

§ Pins 1, 3, 5, 6, 7, and 9 are of a length such that their ends do not touch the socket insertion plane.

ELECTRON TUBE, TRAVELING WAVE AMPLIFIER

HUGGINS LABORATORIES, INC.

TYPE 8225

DESCRIPTION: 10 MILLIWATT, SOLENOID FOCUSED, TRAVELING WAVE TUBE (FORWARD WAVE), CW AMPLIFIER FOR OPERATION FROM 2000 TO 4000 MEGACYCLES.

ELEMENT OR TEST	LIMITS MIN.	LIMITS MAX.	UNITS
ELECTRICAL SPECIFICATIONS			
HEATER VOLTAGE	6.17	6.34	V_{RMS}
HEATER CURRENT	0.7	1.0	AMPS
CATHODE CURRENT	2.0	3.5	mA_{DC}
HELIX VOLTAGE	400	500	V_{DC}
HELIX CURRENT	--	0.2	mA_{DC}
ANODE VOLTAGE	0	350	V_{DC}
ANODE CURRENT	--	0.1	mA_{DC}
COLLECTOR VOLTAGE *	570	630	V_{DC}
COLLECTOR CURRENT	2.0	3.5	mA_{DC}
VOLTAGES ARE REFERENCED TO THE CATHODE			
R.F. SPECIFICATIONS			
SMALL SIGNAL GAIN	30	--	DB
SATURATED POWER OUTPUT	10	--	DBM
SATURATED GAIN	20	--	DB
NOISE FIGURE	--	25	DB
V.S.W.R (INPUT/OUTPUT)	--	2:1	--
R.F. LEAKAGE BELOW OUTPUT SIGNAL	50	--	DB
CATHODE PRE-HEATING TIME	60	--	SEC.
DUTY CYCLE	--	1.0	--

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE (OPERATING) - -10°C TO +52°C.
RELATIVE HUMIDITY (OPERATING) - UP TO 80%.
BAROMETRIC PRESSURE (OPERATING) - FROM 28 TO 20.4 INCHES OF MERCURY, (0 TO 10,000 FT).
TEMPERATURE (STORAGE) - -54°C TO +71°C.
RELATIVE HUMIDITY (NON-OPR) - UP TO 80%.
BAROMETRIC PRESSURE (NON-OPR) - FROM 28 TO 7.0 INCHES OF MERCURY, (0 TO 35,000 FT).
SHOCK (NON-OPR) - FORCE OF 5G WITH A TIME DURATION OF 11 ±1 MILLISECONDS.
VIBRATION (NON-OPR) - 2G, 10 TO 500 CPS. 0.04 INCHES DA, 5 TO 10 CPS.

MECHANICAL DATA, GENERAL

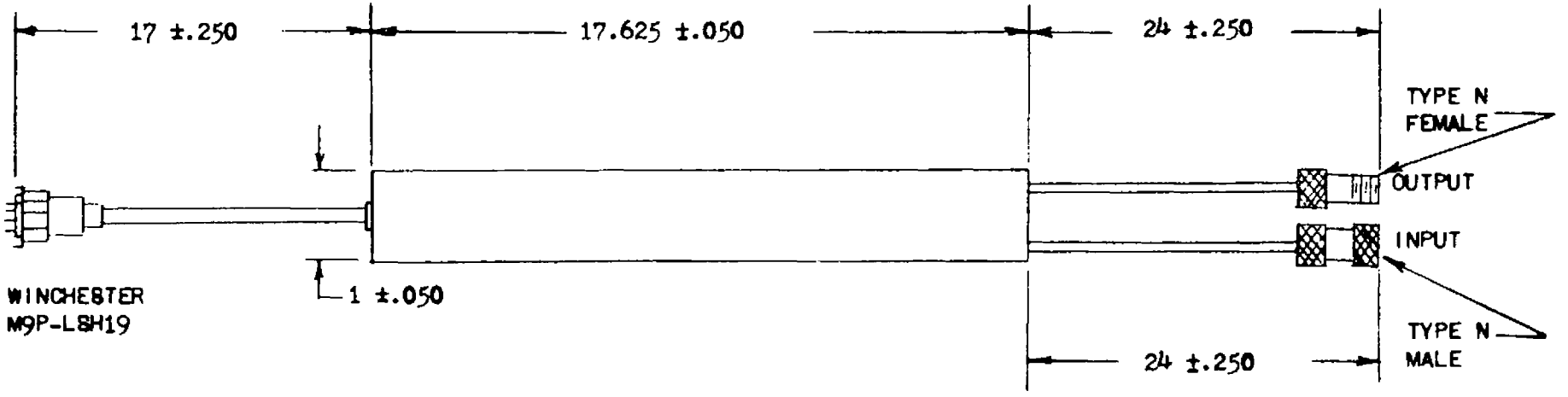
PHYSICAL DIMENSIONS	-	SEE FIGURE 1
MOUNTING POSITION	-	ANY
COOLING	-	NOT REQUIRED
INPUT/OUTPUT IMPEDANCE (RF)	-	50 OHMS
RF CONNECTORS	-	TYPE N FEMALE
WEIGHT (APPROX.)	-	1 POUND

* THE COLLECTOR IS INSULATED; HENCE, ANY ELECTRODE MAY BE OPERATED AT SYSTEM GROUND POTENTIAL.

from JEDEC release #4754, July 13, 1964

FIGURE 1

8225



POWER CONNECTIONS

PIN A - COLLECTOR

C - CAPSULE-GROUND

D - HELIX

E - HEATER

F - HEATER

H - CATHODE

GRID CONNECTED INTERNALLY TO CATHODE

MATERIALS AND FINISHES

CAPSULE --- BLACK ANODIZED ALUMINUM

END CAPS -- BLACK ANODIZED ALUMINUM

MARKING

HEATER VOLTAGE, HELIX VOLTAGE, AND CATHODE CURRENT PERMANENTLY MARKED ON THE TUBE CAPSULE.

IN AND OUT PERMANENTLY MARKED ON RF END CAP.

MANUFACTURERS NAME, TRADEMARK OR CODE SYMBOL , AND PART NUMBER.

ELECTRON TUBE, TRAVELING WAVE PULSED AMPLIFIER

HUGGINS LABORATORIES, INC.

TYPE 8258

DESCRIPTION: 2 WATT, BEAM PULSED, PERIODIC PERMANENT MAGNET FOCUSED, TRAVELING WAVE (FORWARD WAVE), TUBE AMPLIFIER FOR OPERATING FROM 2320 TO 2680 MEGACYCLES.

ELEMENT OR TEST	LIMITS		UNITS
	MIN.	MAX.	
HEATER VOLTAGE	6.86	7.14	VRMS
HEATER CURRENT	--	1.2	AMPS
CATHODE CURRENT	--	40.0	MADC
HELIX VOLTAGE	900	1000	VDC
HELIX CURRENT	--	10.0	MADC
ANODE VOLTAGE	50	300	VDC
ANODE CURRENT	--	0.1	MADC
COLLECTOR VOLTAGE *	900	1000	VDC
COLLECTOR CURRENT	--	40.0	MADC
GRID VOLTAGE	50	125	VDC
GRID CURRENT	--	15.0	MADC
GRID VOLTAGE (CUT-OFF)	--	-20	VDC
ALL VOLTAGES ARE REFERENCED TO THE CATHODE. ALL CURRENTS ARE SPECIFIED AT PEAK VALUES.			
R.F. SPECIFICATIONS			
POWER OUTPUT (PEAK)	33	--	DBM
SMALL SIGNAL GAIN	30	--	DB
SATURATED GAIN	30	--	DB
OUTPUT SIGNAL ATTENUATION (CUT-OFF)	70	--	DB
V.S.W.R. (INPUT/OUTPUT)	--	2:1	--
NOISE FIGURE	--	30	DB
INPUT R.F. POWER	--	1	WATT
CATHODE PRE-HEATING	60	--	SEC
DUTY CYCLE	--	0.1	--

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE (OPERATING) - 0°C TO +50°C
RELATIVE HUMIDITY (OPERATING) - UP TO 80%, DUE TO CONDENSATION AND TO TEMPERATURE CHANGE
BAROMETRIC PRESSURE (OPERATING)- FROM 28 TO 20.4 INCHES OF MERCURY, (0 TO 10,000 FEET)
TEMPERATURE (STORAGE) - -35°C TO +70°C
RELATIVE HUMIDITY (NON-OPR.)- SAME AS FOR OPERATING CONDITION.
BAROMETRIC PRESSURE (NON-OPR.) - FROM 28 TO 7.0 INCHES OF MERCURY, (0 TO 35,000 FEET)
SHOCK (NON-OPR.) - FORCE OF 10G, WITH A TIME DURATION OF 11 ±1 MILLISECONDS.
VIBRATION (NON-OPR.) - 2G, 10 TO 500 CPS. 0.40 INCHES DA, 5 TO 10 CPS.

MECHANICAL DATA, GENERAL

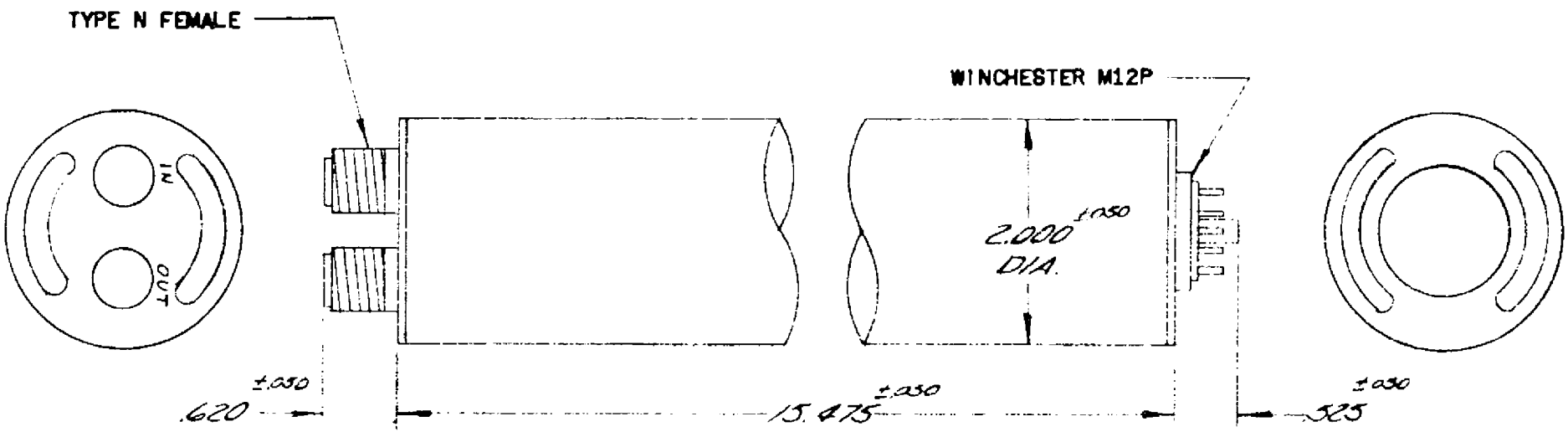
PHYSICAL DIMENSIONS	-	SEE FIGURE 1
MOUNTING POSITION	-	ANY
COOLING	-	NOT REQUIRED
INPUT/OUTPUT IMPEDANCE (RF)	-	50 OHMS
R.F. CONNECTORS	-	TYPE N FEMALE
WEIGHT (APPROX.)	-	6 POUNDS

* THE COLLECTOR IS CONNECTED INTERNALLY TO THE TUBE CAPSULE AND MUST BE GROUNDED FOR SAFE OPERATION.

from JEDEC release #4754,
July 13, 1964

FIGURE 1

8258



POWER CONNECTIONS

PIN B - GRID

D - CAPSULE COLLECTOR GROUND

F - HEATER CATHODE

H - HEATER

J - CATHODE

L - HELIX

N - ANODE

MATERIALS AND FINISHES

CAPSULE --- BRUSH CHROME PLATED STEEL

END CAPS -- BLACK ANODIZED ALUMINUM

MARKING

ANODE VOLTAGE, HELIX VOLTAGE, PEAK GRID VOLTAGE, AND CATHODE CURRENT PERMANENTLY MARKED ON THE TUBE CAPSULE. IN AND OUT ARE PERMANENTLY MARKED ON THE R.F. END CAP.

MANUFACTURERS NAME, TRADEMARK OR CODE SYMBOL, AND PART NUMBER.

ELECTRON TUBE, TRAVELING WAVE AMPLIFIER

HUGGINS LABORATORIES, INC.

TYPE 8279

DESCRIPTION 11 TO 16 DBM POWER OUTPUT, PERIODIC PERMANENT MAGNET FOCUSED, TRAVELING WAVE (FORWARD WAVE), CW AMPLIFIER FOR OPERATION FROM 2300 TO 2700 MEGACYCLES.

ELEMENT OR TEST	LIMITS		UNITS
	MIN.	MAX.	
ELECTRICAL SPECIFICATIONS			
HEATER VOLTAGE	6.0	6.6	V_{RMS}
HEATER CURRENT	0.8	1.2	AMPS
CATHODE CURRENT	1.0	4.0	MADC
HELIX VOLTAGE	400	525	VDC
HELIX CURRENT	--	0.5	MADC
ANODE VOLTAGE	110	350	VDC
ANODE CURRENT	--	0.05	MADC
COLLECTOR VOLTAGE *	400	525	VDC
COLLECTOR CURRENT	1.0	4.0	MADC
VOLTAGES ARE REFERENCED TO THE CATHODE			
R.F. SPECIFICATIONS			
POWER OUTPUT (RF)	11	16	DBM
POWER INPUT (PF)	-14	-7	DBM
Δ POWER OUTPUT OVER A 30 MIN. PERIOD	--	±0.25	DBM
NOISE FIGURE	--	20	DB
V.S.W.R. (INPUT/OUTPUT)	--	2:1	--
CATHODE PRE-HEATING PERIOD	60	--	SEC.
DUTY CYCLE	--	1.0	--

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE (OPERATING) - -10°C TO +52°C.
RELATIVE HUMIDITY (OPERATING) - UP TO 100%.
BAROMETRIC PRESSURE (OPERATING) - FROM 28 TO 20.4 INCHES OF MERCURY, (0 TO 10,000 FT).
TEMPERATURE (STORAGE) - -54°C TO +71°C.
RELATAVE HUMIDITY (NON-OPR.) - UP TO 100%
BAROMETRIC PRESSURE (NON-OPR.) - FROM 28 TO 7.0 INCHES OF MERCURY, (0 TO 35,000 FT).
SHOCK (NON-OPR.) - FORCE OF 15 G, WITH A TIME DURATION OF 11 ± 1 MILLISECONDS.
VIBRATION (NON-OPR.) - 2G, 10 TO 500 CPS. 0.04 INCHES DA, 5 TO 10 CPS.

MECHANICAL DATA, GENERAL

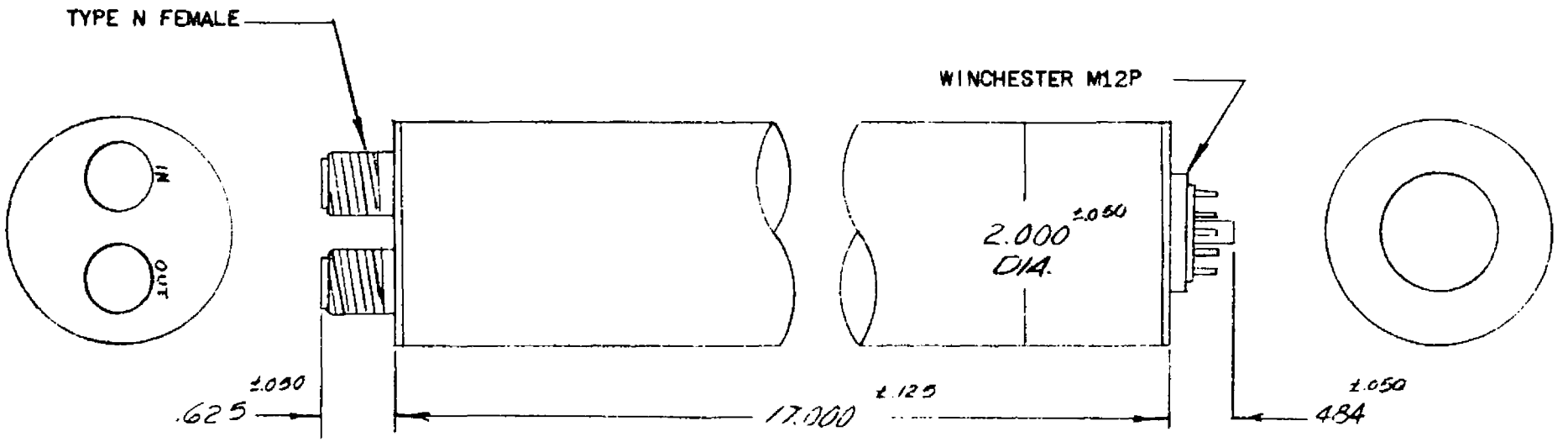
PHYSICAL DIMENSIONS - SEE FIGURE 1
MOUNTING POSITION - ANY
COOLING - NOT REQUIRED
INPUT/OUTPUT IMPEDANCE (RF) - 50 OHMS
RF CONNECTORS - TYPE N FEMALE
WEIGHT (MAX.) - 4 POUNDS

* THE COLLECTOR IS CONNECTED INTERNALLY TO THE TUBE CAPSULE AND MUST BE GROUNDED FOR SAFE OPERATION.

from JEDEC release #4754,
July 13, 1964

FIGURE 1

8279



POWER CONNECTIONS

PIN D - CAPSULE-COLLECTOR-GROUND

F - HEATER-CATHODE

H - HEATER

J - CATHODE

L - HELIX

N - ANODE

GRID CONNECTED INTERNALLY TO CATHODE.

MATERIALS AND FINISHES

CAPSULE - - BRUSH CHROME PLATED STEEL

END CAPS - - BLACK ANODIZED ALUMINUM

MARKING

MANUFACTURERS NAME, TRADEMARK OR CODE SYMBOL, AND PART NUMBER.

LABEL ON TUBE TO CONTAIN CATHODE VOLTAGE,* CATHODE CURRENT AND HEATER VOLTAGE.

IN AND OUT ARE PERMANENTLY MARKED ON THE RF END CAP.

* HELIX TO GROUND VOLTAGE.

ELECTRON TUBE, TRAVELING WAVE AMPLIFIER

HUGGINS LABORATORIES, INC.

TYPE 8280

DESCRIPTION: 30 TO 35 DBM POWER OUTPUT, PERIODIC PERMANENT MAGNET FOCUSED, TRAVELING WAVE (FORWARD WAVE), CW AMPLIFIER FOR OPERATION FROM 2100 TO 2500 MEGACYCLES.

ELEMENT OR TEST	LIMITS		UNITS
	MIN.	MAX.	
ELECTRICAL SPECIFICATIONS			
HEATER VOLTAGE	6.9	7.5	VRMS
HEATER CURRENT	0.8	1.2	AMPS
CATHODE CURRENT	15.0	25.0	MADC
HELIX VOLTAGE	800	1100	VDC
HELIX CURRENT	--	2.0	MADC
ANODE VOLTAGE	160	450	VDC
ANODE CURRENT	--	0.05	MADC
COLLECTOR VOLTAGE *	800	1100	VDC
COLLECTOR CURRENT	15.0	25.0	MADC
VOLTAGES ARE REFERENCED TO THE CATHODE			
R.F. SPECIFICATIONS			
POWER OUTPUT (RF)	30	35	DBM
POWER INPUT (RF)	-11	-1	DBM
Δ POWER OUTPUT OVER A 30 MIN. PERIOD	--	±0.25	DBM
NOISE FIGURE	--	30	DB
V.S.W.R (INPUT/OUTPUT)	--	2 1	--
CATHODE PRE-HEATING TIME	90	--	SEC.
DUTY CYCLE	--	1.0	--

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE (OPERATING) - -10°C TO +52°C.
RELATIVE HUMIDITY (OPERATING) - UP TO 100%.
BAROMETRIC PRESSURE (OPERATING) - FROM 28 TO 20.4 INCHES OF MERCURY, (0 TO 10,000 FT).
TEMPERATURE (STORAGE) - -54°C TO +71°C.
RELATIVE HUMIDITY (NON-OPR.) - UP TO 100%
BAROMETRIC PRESSURE (NON-OPR.) - FROM 28 TO 7 INCHES OF MERCURY, (0 TO 35,000 FT).
SHOCK (NON-OPR) - FORCE OF 15 G, WITH A TIME DURATION OF 11 ±1 MILLISECONDS.
VIBRATION (NON-OPR.) - 2G, 10 TO 500 CPS. 0.04 INCHES DA, 5 TO 10 CPS

MECHANICAL DATA, GENERAL

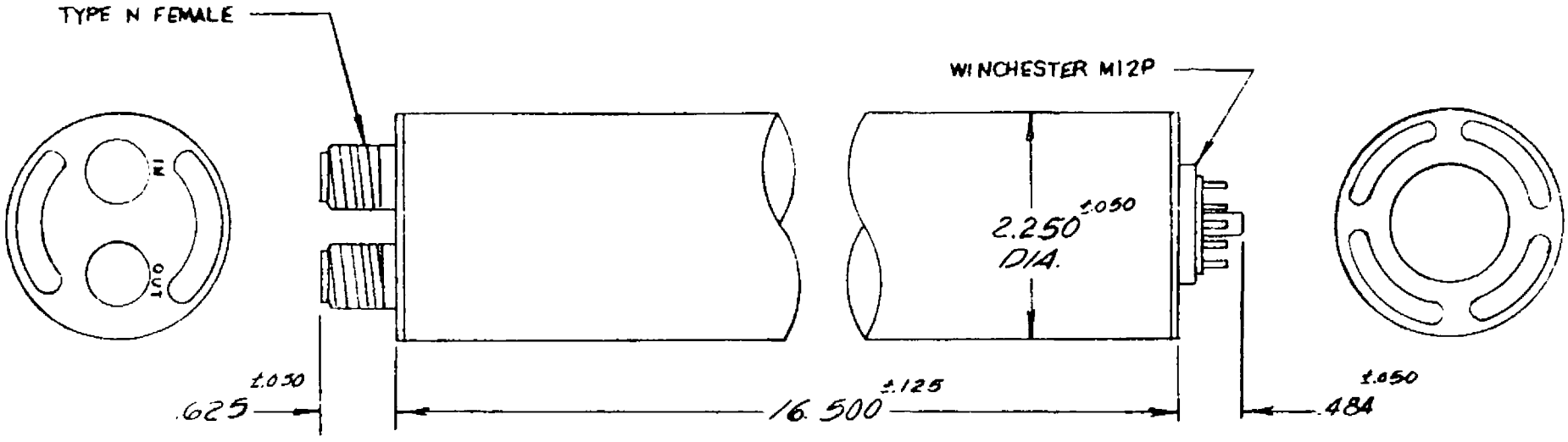
PHYSICAL DIMENSIONS	-	SEE FIGURE 1
MOUNTING POSITIONS	-	ANY
COOLING	-	FORCED AIR
INPUT/OUTPUT IMPEDANCE (RF)	-	50 OHMS
RF CONNECTORS	-	TYPE N FEMALE
WEIGHT (APPROX.)	-	6.5 POUNDS

* THE COLLECTOR IS CONNECTED INTERNALLY TO THE TUBE CAPSULE AND MUST BE GROUNDED FOR SAFE OPERATION.

from JEDEC release #4754,
July 13, 1964

FIGURE 1

8280



POWER CONNECTIONS

PIN D - CAPSULE-COLLECTOR-GROUND

F - HEATER CATHODE

H - HEATER

J - CATHODE

L - HELIX

N - ANODE

GRID CONNECTED INTERNALLY TO CATHODE.

MATERIALS AND FINISHES

CAPSULE - - BRUSH CHROME PLATED STEEL

END CAPS - - BLACK ANODIZED ALUMINUM

MARKING

MANUFACTURERS NAME, TRADEMARK OR CODE SYMBOL, AND PART NUMBER.

LABEL ON TUBE TO CONTAIN CATHODE VOLTAGE*, CATHODE CURRENT AND HEATER VOLTAGE.

IN AND OUT ARE PERMANENTLY MARKED ON THE RF END CAP.

* HELIX TO GROUND VOLTAGE.

8294
Bendix Red Bank Type TK—110

REFLEX KLYSTRON

(MECHANICALLY TUNED)

DESCRIPTION

The 8294 (Bendix Type TK-110) is a ruggedized, low voltage, mechanically tuned, X-band reflex klystron designed for use as a CW oscillator over the frequency range of 8.5 to 9.66 Gc/sec.



Although different in design and physical appearance, the 8294 is an exact electrical and mechanical retrofit for the 2K25 and has equivalent or superior performance in all operating characteristics. It may be used interchangeably in existing 2K25 sockets with no equipment modification.

Of particular interest is the mechanical tuner design. As with the 2K25, tuning is accomplished by rotation of the drive nut located in the center of the tuner bows. However, unlike the 2K25, this motion is transmitted to the resonant cavity through a highly flexible diaphragm in the wall of the vacuum envelope, and there is no overstressing of the structure. Mechanical stops at both extremes of the tuning range prevent accidental damage to the structure by exceeding the mechanical tuning range. This design approach results in greatly extended tuning life, ability to operate in applications requiring repetitive tuning, low temperature coefficient, reduced frequency variation with changes in ambient pressure, and minimal mechanical tuning hysteresis (repeatability of frequency vs. tuner setting).

The coaxial output of the tube is coupled into a standard 1" x ½" waveguide through a transducer, or launching section, such as that defined by Military Drawing 227-JAN or equivalent. The use of teflon as the coaxial insulator eliminates insulator breakage and removes the limitation on maximum coaxial line ambient temperature when using polystyrene.

A detailed description of the 8294 design features is available in Bendix Engineering Data Release Issue 44, File No. M-9.

APPLICATION NOTES

Cooling: Convection cooling is normally sufficient. If the tube is to be operated in a small enclosure, care should be taken to insure adequate ventilation to prevent excessive bulb temperature that will decrease the normal life of the tube.

Output Load: The tube has been designed for operation into a matched load. When operation into a reactive load is necessary, adequate attenuation should be inserted between the load and the tube to limit the SWR at the tube and thus prevent impairment of performance.

Repeller Modes: The tube is designed for optimum operation in the repeller voltage mode defined in this data sheet, however, other modes exist at other repeller voltages and these may be used when desired. In design of AFC circuits these other modes must be considered to assure lock-in on the desired mode.

Safety Precautions: (1) Repeller voltage must always be negative, relative to the cathode. (2) Bulb should be at ground potential whenever the application permits. (3) Resonator voltage should not be applied without repeller voltage.

MAXIMUM RATINGS

(ABSOLUTE VALUES)

Resonator Voltage	350 Vdc
Reflector Voltage	−350 Vdc
Filament Voltage	6.3V ± 8%
Cathode Current	37 ma D.C.
Heater-Cathode Voltage	100 Vdc

PHYSICAL CHARACTERISTICS

Dimensions:	Refer to outline drawing
Base:	Fits standard octal socket with #4 pin enlarged to 3/16"
Coupling to Waveguide:	Coaxial output fits standard 227-JAN tube mount or equivalent
Cooling:	Convection
Mounting Position:	Any
Cavity:	Integral
Bulb:	Metal

THE Bendix CORPORATION
Red Bank DIVISION, EATONTOWN, NEW JERSEY

Publication No. RT41-25

from JEDEC release #4684, April 27, 1964

Printed in U.S.A.

REFLEX KLYSTRON
(MECHANICALLY TUNED)

8294
Bendix Red Bank Type TK—110

ELECTRICAL CHARACTERISTICS & TEST CONDITIONS

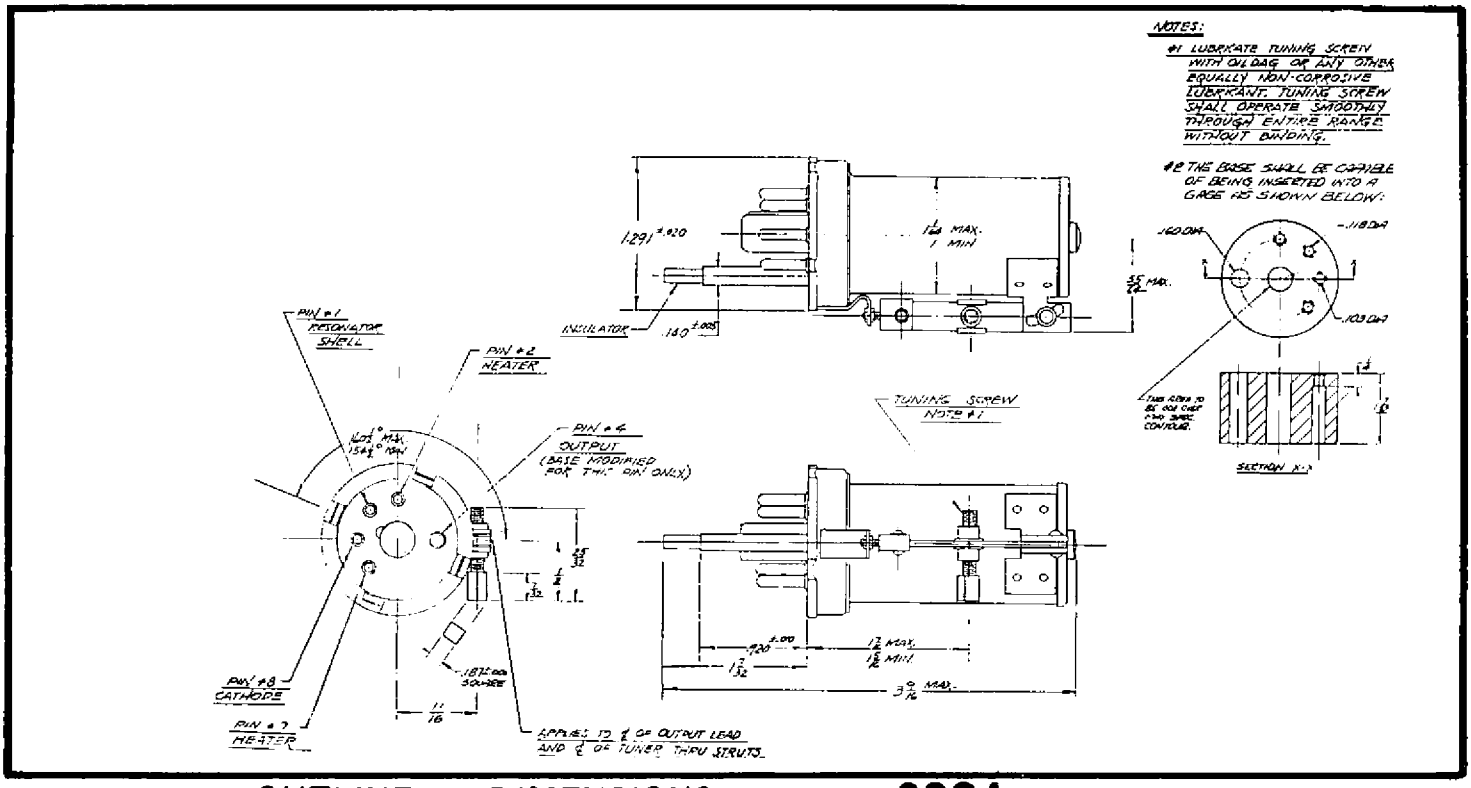
Test Conditions and Specification Limits

TEST PRODUCTION TESTS:	CONDITIONS	SYMBOL	LIMITS		UNITS
			Min.	Max.	
Cathode Current		Ik	-	32	mAdc
Change in Cathode Current	Ef=6.3 to 5.8V; t = 120;	ΔIk/Ik	-	10	%
Power Output(1)	Er/(Mode A) Max Po; F =8500 to 9660 Mc	Po	20	-	mW
Reflector Voltage(1):	Mode A; F =9660 ±0.3% Mc	Er	-143	-200	Vdc
Mode Continuity	Er/Max Po; σ 8db (min);	-	-	-	-
Total Reflector Current	Er = −150 Vdc	Ir	-	7.0	μAdc
Reflector Lkg. Current:	Er = −150 Vdc	Ir	-	5.0	μAdc
Reflector Gas Current:	Er = −150 Vdc	Ir	-	2.0	μAdc
Dimensions:	See Outline Drawing				
DESIGN TESTS:					
Heater Cathode Lkg.	Ehk = ± 45Vdc	Ihk:	-	100	μAdc
Heater Current	Ef = 6.3V.	If	410	470	mA
Insulation of Electrodes:	300Vdc; Tube Cold	Rkrs:	2.0	-	Megs
		Rhrs:	2.0	-	Megs
Power Output (2)	Er/(Mode B); F = 9370Mc ± 0.3%	Po:	15	-	mW
Bump	Er/Max Po (Mode A)	ΔPo/Po	-	± 10	%
Reflector Voltage (3):	Mode B; F = 9370Mc ± 0.3%	Er	-75	-120	Vdc
Electronic Tuning (1):	Mode A; 50% Max Po; F = 9370Mc ±0.3%	ΔF	35	-	Mc
Electronic Tuning (2):	Mode A; 2.5% of max Po; F = 9370Mc ± 0.3%	ΔF	-	145	Mc
Hysteresis: (1)	Er/Max Po	Ratio	-	.25	-

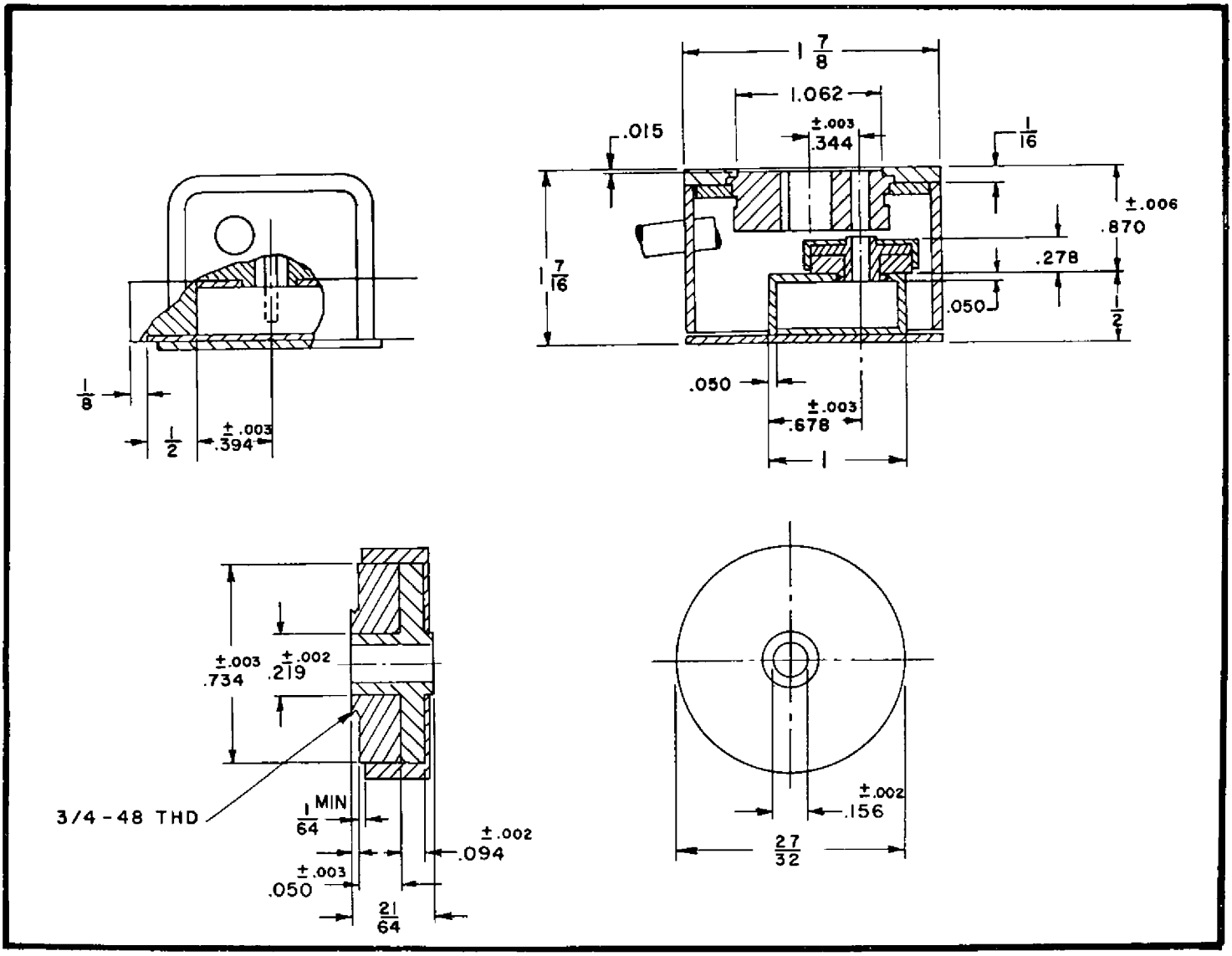
COMPARISON OF SPECIFIED* OPERATING CHARACTERISTICS AND ABSOLUTE MAXIMUM RATINGS TYPE 8294 AND 2K25

		8294		2K25	
RATING	UNITS	MIN	MAX	MIN	MAX
Heater-Cathode Voltage	Vdc	-	100	-	50
Altitude	Feet	-	50,000	-	10,000
TEST					
Power Output (3)	mW	5	-	3	-
Electronic Tuning (3)	Mc	35	-	28	-
Temperature Coefficient	Mc/°C	0.00	0.10	0.00	0.20
Tuner Mechanical Fatique	Cycles	10,000	-	NOT SPECIFIED	
Life Test	Hours	1000	-	500	-
Life Test End Point	mW	15	-	10	-

*2K25 Specification MIL-E-1/982 dated 18 June 1957
8294 Specification Bendix TS-TK-110 dated 15 August 1963
NOTE: All other specification parameters identical for both tubes.



OUTLINE DIMENSIONS — **8294**



BROADBAND COAX TO WAVEGUIDE TRANSDUCER

REFLEX KLYSTRON
(MECHANICALLY TUNED)

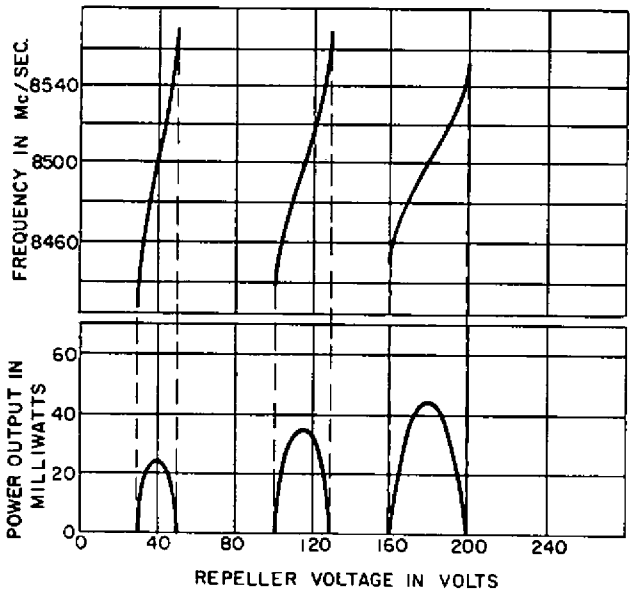
8294

Bendix Red Bank Type TK-110

AVERAGE CHARACTERISTICS

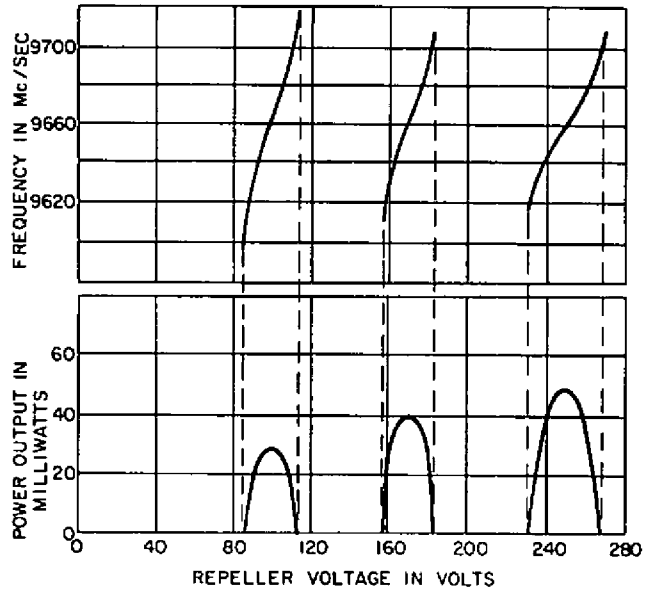
POWER OUTPUT AND FREQUENCY
VS REPELLER VOLTAGE

8294

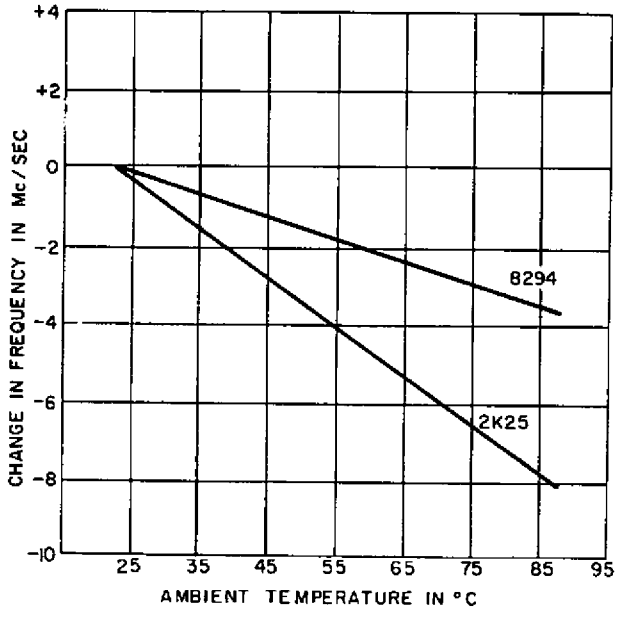


POWER OUTPUT AND FREQUENCY
VS REPELLER VOLTAGE

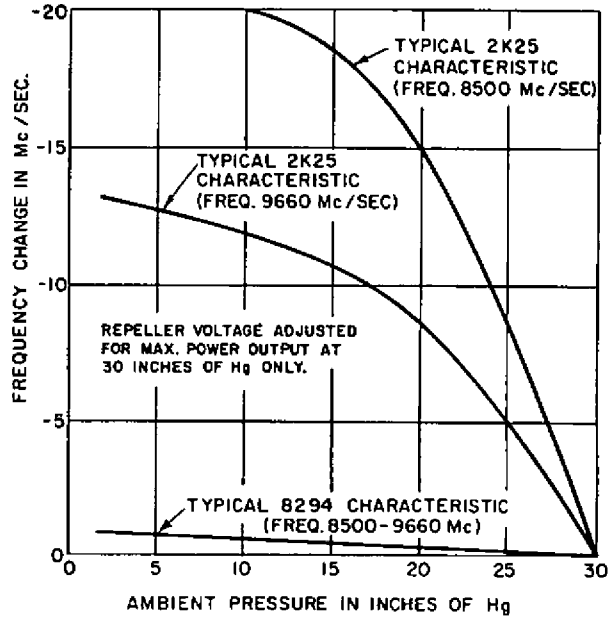
8294



COMPARATIVE
FREQUENCY CHANGE
VS AMBIENT TEMPERATURE
(MEASUREMENT MADE AT 9370 Mc/SEC)



COMPARATIVE
FREQUENCY CHANGE
VS AMBIENT PRESSURE



from JEDEC release #4866, Nov. 30, 1964

8332

VARIAN associates

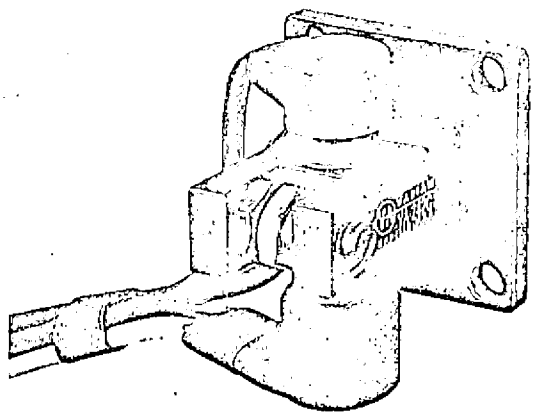
REFLEX KLYSTRON

DATA SHEET

VA-242G/ 8332

9.7 - 9.9 Gc

JEDEC TYPE 8332



DESCRIPTION

The VA-242G/8332 is an extremely rugged, long-life, reflex klystron which produces an output of 500 milliwatts or more between 9.7 and 9.9 gigacycles. The tube is an ideal pump tube for parametric amplifiers. It is equally well suited to any application requiring excellent frequency stability under severe environmental conditions, including airborne doppler radar or navigator service. Exceptional frequency stability can be achieved by using this tube in combination with stalo cavities. Each tube is trimmable ±100 megacycles.

FEATURES

- Small frequency deviation under vibration.
- Low temperature coefficient.
- Molded base for high altitude operation.
- Meets extreme environmental specifications.

GENERAL CHARACTERISTICS

ELECTRICAL

Frequency	9.7 to 9.9 Gc
Output, minimum	500 mW
Beam Voltage	500 Vdc
Beam Current	55 mAdc
Heater Voltage	6.3 V
Heater Current, typical	1.2 A

PHYSICAL

Dimensions	See Outline Drawing
Weight, maximum	8 oz
Mounting Position	Any
Cathode	Oxide coated, unipotential
Cooling[1]	Forced Air or Conduction

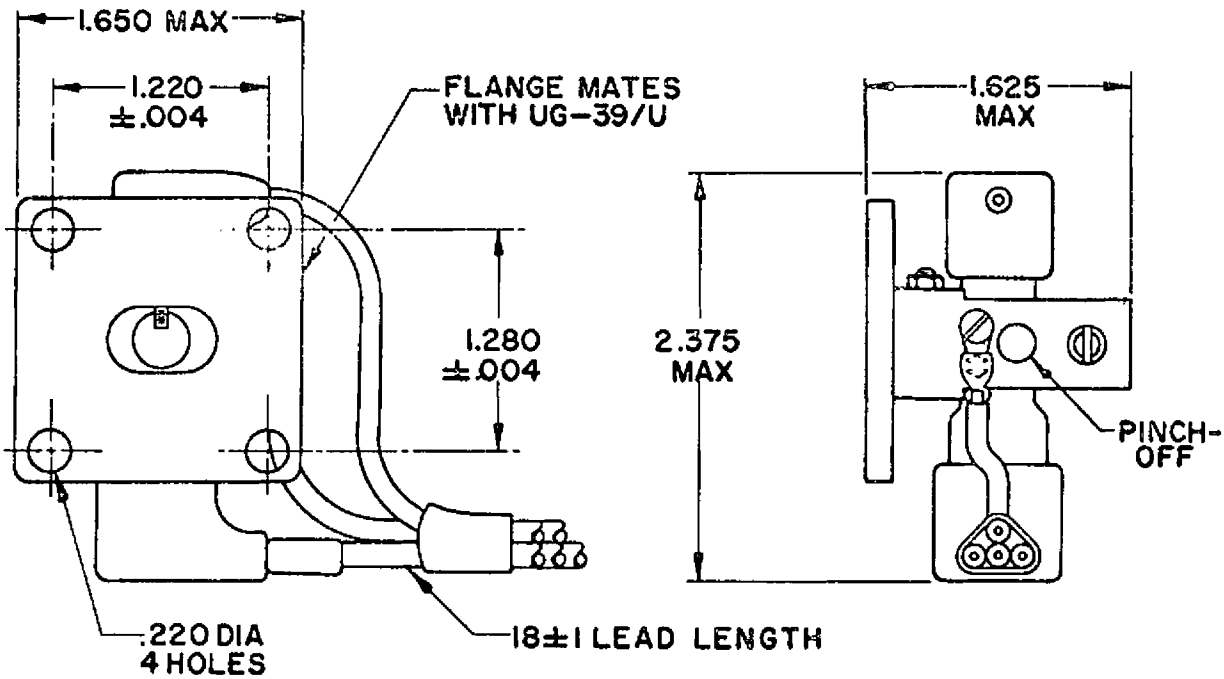
OPERATING CONDITIONS AND RATINGS

	Typical Operation[2]	Range Values for Equipment Design[3] Min	Max	Absolute Ratings[4] Min	Max	
Frequency	9.80	---	---	---	---	Gc
Output, matched load	870	500	---	---	---	mW
Output, optimum load	915	500	---	---	---	mW
Beam Voltage	500	---	---	---	525	Vdc
Beam Current at 500 volts	55	45	66	---	---	mAdc
Electronic Tuning Range, 3 db[5]	55	40	---	---	---	Mc
Reflector Voltage[6]	−315	−270	−350	−20	−1000	Vdc
Reflector Voltage Modulation Coefficient	0.64	0.5	1.5	---	---	Mc/V
Temperature Coefficient	−100	---	±150	---	---	kc/°C
FM Frequency Deviation:						
Vibration (10G, 10-1000 cps)	0.05	---	0.250	---	---	Mc(p-p)
Shock (150G)	0.05	---	2.0	---	---	Mc
Heater Voltage	6.3	5.7	7.0	5.7	7.0	V
Heater Current at 6.3 volts	1.2	1.08	1.32	---	---	A

Read Operating Instructions before installing tube.

VA-242G/8332

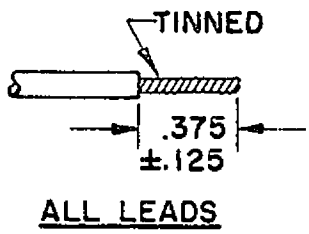
OUTLINE DRAWING

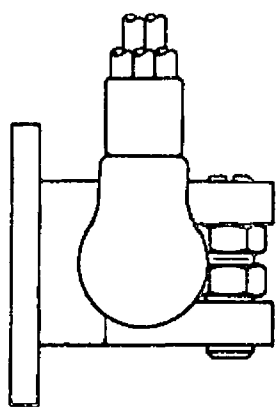


LEAD CONNECTIONS	
YELLOW	HEATER
⊕ GREEN	CATHODE
⊕ WHITE	HEATER
GRAY	REFLECTOR
BROWN	BODY

⊕ INTERNALLY CONNECTED

DIMENSIONS ARE IN INCHES





NOTES:

1. Maximum allowable surface temperature is 200°C. For maximum tube life, the temperature of the tube should not exceed 100°C. When cooling by conduction, a heat sink is required to maintain the flange temperature at or below 100°C.
2. Although values are for the VA-242G/8332, they are representative of the VA-242 series.
3. These values are acceptance limits for VA-242G/8332 tubes when operated at a beam voltage of 500 Vdc. Equipment design should allow for these variations.
4. Ratings should not be exceeded under continuous or transient conditions. A single rating may be the limitation and simultaneous operation at more than one rating may not be possible. Equipment design should limit voltage and environmental variations so that ratings will never be exceeded.
5. Measured between half-power points.
6. Reflector must always be at least 20 volts negative with respect to the cathode.

ENGLISH ELECTRIC

from JEDEC release
#4625, March 9, 1964

JEDEC Designation 8356

INTRODUCTION

The 8356 is a forced-air cooled multi-resonator pulse operated Magnetron with a peak input power rating of 64kW and operates at a fixed frequency within the limits of 9345 and 9405Mc/s, when used under the conditions specified below.

The valve has a packaged integral magnet. It is fitted with flying leads and the output waveguide is sealed with a vacuum-tight window to allow operation at high altitude without pressurising.

The waveguide output flange is designed for coupling directly to waveguide No. 16, 0·900 inch ×0·400 inch internal dimensions (22·86mm × 10·16mm), by means of coupler type UG-40A/U (Z830051).

It is necessary to keep all magnetic material as far as possible (at least 2 inches —50mm approx.) from the magnet and mounting plate.

GENERAL DATA

Electrical

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage (*See Note* 1)	6·3	V
Heater Current	0·5	A
Heater Starting Current:		
Peak Value, not to be exceeded	3	A
Cathode Heating Time (Minimum)	*See Note* 2	

Mechanical

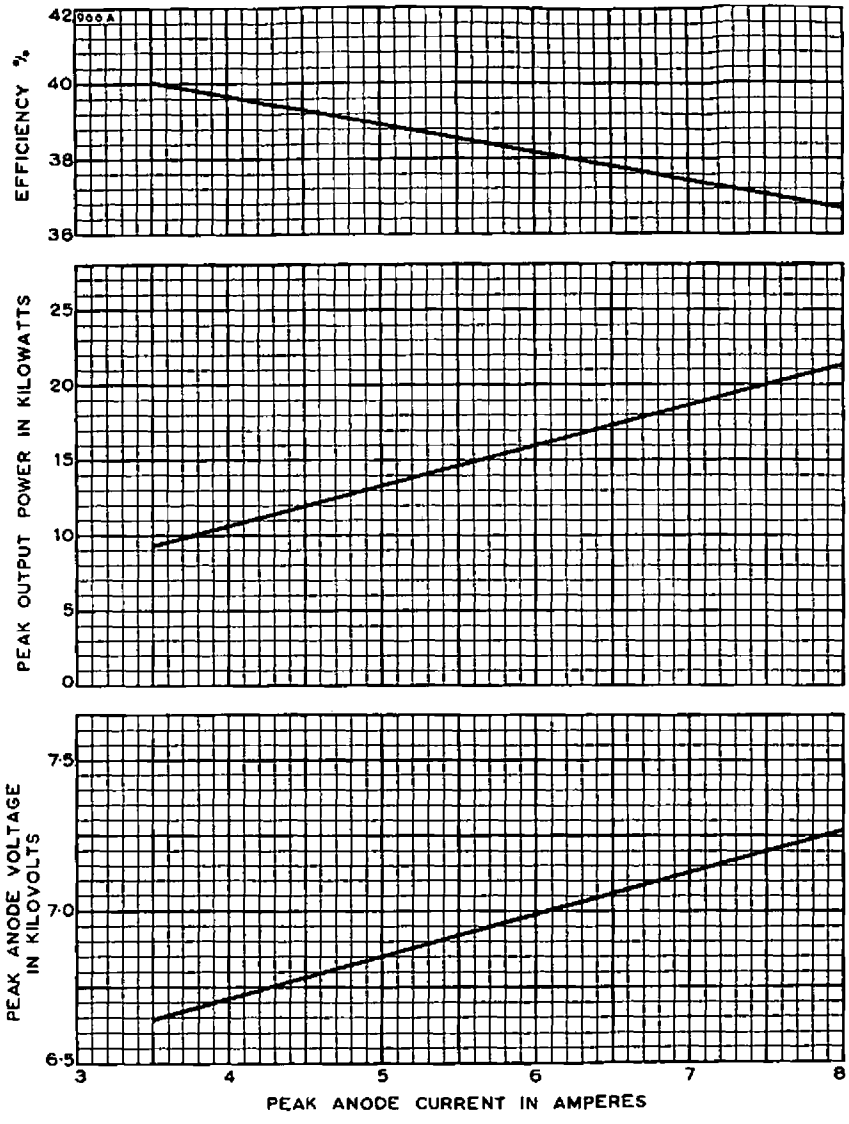
Overall Dimensions	5·38 × 4·47 × 3·31 inches	Max
	137 × ·114 × 84·1 mm	Max
Net Weight	3¼ pounds (1·5 kg)	Approx
Mounting Position		Any

The valve is vibration tested to ensure that it will withstand normal conditions of service.

Cooling .. .. *See Note* 3

ENGLISH ELECTRIC

PERFORMANCE CHART



ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

ENGLISH ELECTRIC

MAXIMUM AND MINIMUM RATINGS

(Absolute Values)

These ratings cannot necessarily be used simultaneously, and no individual rating should be exceeded.

	Min	*Max*	
Heater Voltage (*See Note* 1)	5·7	6·9	V
Heater Current at heater voltage 6·3V	0·43	0·60	A
Anode Voltage (Peak)	6·0	8·0	kV
Anode Current (Peak)	3·5	8·0	A
Input Power (Peak)	21	64	kW
Input Power (Mean)	—	80	W
Duty Cycle	—	0·0025	
Pulse Length (*See Note* 4)	—	2·5	μsec
Rate of Rise of Voltage Pulse (*See Note* 5)	—	100	kV/μsec
Anode Temperature	—	120	°C
Frequency Change with Anode Temperature Change (after warming)	—	−0·25	Mc/s/°C
Altitude:			
Output System (See Note 6)	—	45 000	feet
	—	13·5	km
Input Terminals	—	60 000	feet
	—	18·3	km
V.S.W.R. at the output coupler	—	1·5:1	

TYPICAL OPERATION

Operational Conditions		
Heater Voltage	4·5	V
Anode Current (Peak)	7·5	A
Pulse Length	2·5	μsec
Pulse Repetition Rate	400	p.p.s.
Typical Performance		
Anode Voltage (Peak)	7·2	kV
Output Power (Peak)	20	kW
Output Power (Mean)	20	W

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Chelmsford 3491

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TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions

	Oscillation 1	*Oscillation* 2	
Heater Voltage (for test)	6·3	4·5 (*See Note* 7)	V
Anode Current (Mean)	7·5	7·5	mA
Duty Cycle	0·001	0·001	
Pulse Length (*See Note* 4)	1·0	2·5	μsec
V.S.W.R. at the output coupler (Maximum)	1·15:1	1·15:1	
Rate of Rise of Voltage Pulse (*See Note* 5)	100	100	kV/μsec

Limits

	Min	*Max*	*Min*	*Max*	
Anode Voltage (Peak)	6·4	7·4	—	—	kV
Output Power (Mean)	18	—	18	—	W
Frequency (*See Note* 8)	9345	9405	—	—	Mc/s
R.F. Bandwidth at ½ Power (*See Note* 9)	—	2·5	—	1·0	Mc/s
Frequency Pulling (V.S.W.R. not less than 1·5:1)	—	15	—	—	Mc/s
Stability (*See Note* 10)	—	0·25	—	0·25	%

LIFE TEST

The quality of all production is monitored by the random selection of valves which are then life-tested under Oscillation 2 conditions. If the valve is to be run continuously under different conditions, the English Electric Valve Co. Ltd. should be consulted to verify that the life of the valve will not be impaired.

END OF LIFE CRITERIA

(under Test Conditions Oscillation 1)

Output Power (Mean)	13·5 W Min
R.F. Bandwidth at ½ Power	1·2Mc/sMax
Frequency: Must be within Test Limits above, Oscillation 1	
Stability (*See Note* 10)	1·0 % Max

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

ENGLISH ELECTRIC

NOTES

1. With no anode input power.
   For average pulse input powers greater than 25 watts the heater voltage shall be reduced within 3 seconds after the application of h.t. according to the following schedule:

$$V_h = 6{\cdot}3\left(1 - \frac{P_I}{180}\right) \text{volts}$$

   where P_I = mean input power in watts.
   The valve heater shall be protected against arcing by the use of a minimum capacitance of 4000pF shunted across the heater directly at the input terminals; in some cases a capacitance as high as 2μF may be necessary depending on the equipment design.
2. The minimum cathode heating time for ambient temperatures above −55°C is 20 seconds from the heater voltage reaching 5·7 volts. If the valve has been stored for six months or more without h.t. being applied, a longer initial cathode heating time may be required.
3. Convection cooling is usually adequate but at high ambient temperatures and in confined surroundings a degree of forced-air cooling may be necessary.
4. Tolerance ±10%.
5. The rate of rise of voltage is the slope of the steepest tangent to the leading edge of the voltage pulse above 80% amplitude. Any capacitance used in the viewing system must not exceed 6·0pF.
6. This rating applies when the magnetron is operated at the maximum power input and pulse length into a mismatched load of V.S.W.R. 1·5:1 at the worst phase for breakdown, via a coupler UG-40A/U of standard manufacture.
7. The heater voltage shall be reduced to 4·5 volts three seconds after applying the h.t.
8. Temperature of anode block 40 ±5°C, measured at the point indicated on the outline drawing.
9. The bandwidth in Mc/s is given by 2·5/pulse length in microseconds.
10. With the valve operating into a V.S.W.R. of 1·5:1 phased to give maximum instability. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal energy level in the frequency range 9345 to 9405Mc/s. Missing pulses are expressed as a percentage of the number of input pulses applied during any consecutive 5 minute interval of a 15 minutes test period.

ENGLISH ELECTRIC

NOTES FOR OUTLINE

1. Reference plane A contains the mounting surface of the valve as shown.
2. Reference plane B passes through the centres of the two holes of the mounting plate as shown, and is perpendicular to plane A.
3. Reference plane C passes through the centre of the lower right hole of the mounting plate as shown, and is perpendicular to planes A and B.
4. With the valve resting on a plane surface, the flatness of the mounting plate will be such that a feeler gauge 0·015 inch (0·38mm) thick and 0·125 inch (3·18mm) wide will not enter more than 0·125 inch (3·18mm) at any point.
5. The anode temperature to be measured at this point which is on the centre-line of the anode and at 45° to the horizontal (approximately).
6. The north seeking pole of the magnet will be adjacent to the cathode leads.
7. These holes will be within 0·005 inch (0·13mm) of the indicated centres. The clearance between the centre line of the holes and the magnet will be 0·165 inch (4·19mm) minimum.
8. The axis of the heater lead cover will be perpendicular to reference plane C within 5°.
9. The position of the waveguide and fixing holes will be such that the valve operates into coupler type UG-40A/U.
10. The centre of this hole will lie within 0·004 inch (0·102mm) of the reference plane C.

OUTLINE DIMENSIONS

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	4·453 ± 0·015	113·11 ± 0·38	N	0·187 Max	4·75 Max
B	3·313 Max	84·15 Max	P	6·000	152·4
C	2·187 Max	55·55 Max	Q	0·500	12·70
D	3·187 Max	80·95 Max	R	0·375 Max	9·53 Max
E	1·220 ± 0·004	30·988 ± 0·102	S	2·000 Min	50·80 Min
F	4·103 ± 0·004	104·2 ± 0·102	T	0·125	3·18
G	4·000 Max	101·6 Max	U	1·187 Max	30·15 Max
H	2·937 ± 0·250	74·60 ± 6·35	V	0·875	22·23
J	1·000 Max	25·40 Max	W	0·218 Max	5·54 Max
K	1·811 Min	46·00 Min	X	1·625	41·28
L	1·280 ± 0·004	32·512 ± 0·102	Y	0·175 ± 0·003	4·445 ± 0·076
M	0·170 ± 0·003	4·318 ± 0·076			

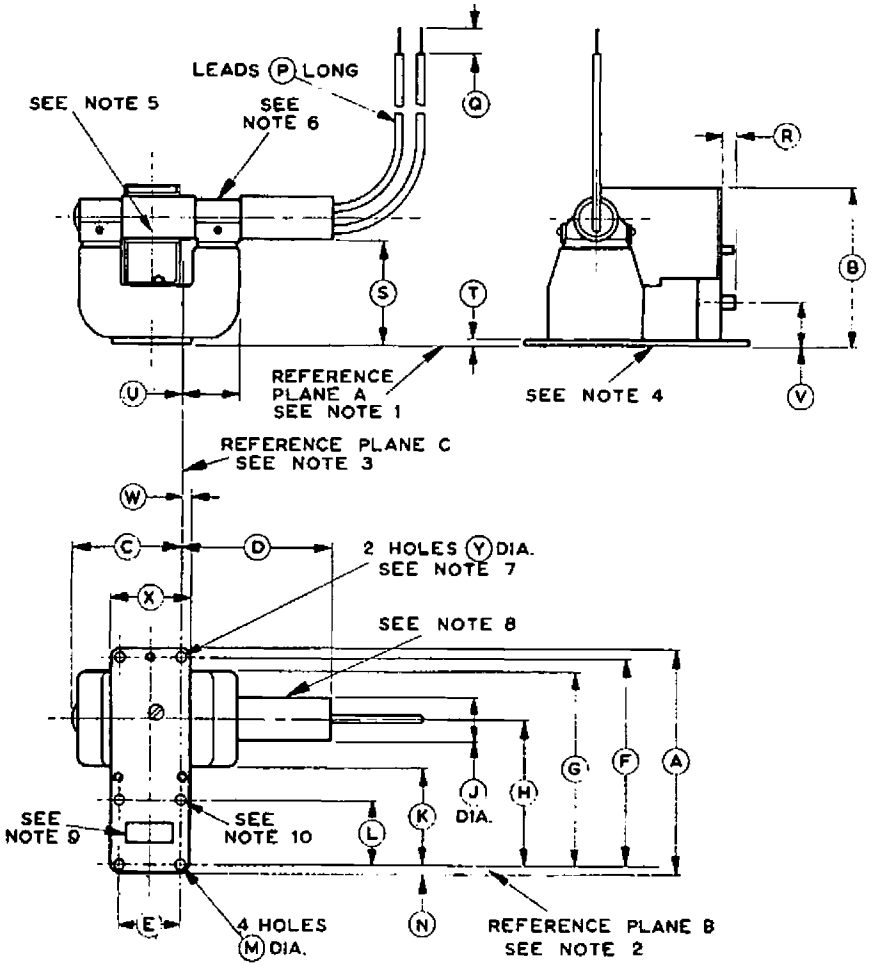
Millimetre dimensions have been derived from inches

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ENGLISH ELECTRIC

OUTLINE

719C



COLOUR	ELEMENT
GREEN	HEATER
YELLOW	CATHODE & HEATER

LEAD CONNECTIONS

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from JEDEC release #4775,
Aug. 3, 1964

JEDEC Designation 8357

ABRIDGED DATA

Fixed Frequency Pulse Magnetron for use with ferrite isolator in airborne radars.

Frequency Range	9345 to 9405	Mc/s
Typical Peak Output Power	25	kW
Magnet		Integral
Output		No. 16 Waveguide
Coupler		UG-40A/U (Z830051)
Cooling (*See Note* 3)		Convection or Forced-air

GENERAL DATA

Electrical

Cathode		Indirectly Heated
Heater Voltage (*See Note* 1)	6·3	V
Heater Current	0·5	A
Heater Starting Current (Peak)	3·0	A Max
Cathode Heating Time (Minimum)		*See Note* 2

Mechanical

Overall Dimensions	5·375 × 4·468 × 3·562 inches	Max
	136·5 × 113·5 × 90·47 mm	Max
Net Weight	3¼ pounds (1·5 kg)	Approx
Mounting Position		Any
Connections		Flying Leads

The magnet of this valve is preset during manufacture to ensure correct operation; a permanent deterioration in the performance of the magnetron may result if any magnetic material is allowed to approach the magnet. English Electric Valve Company Limited should be consulted to verify that the design of any magnetic screening or supporting structure does not impair the operation of the valve.

The valve is vibration tested to ensure that it will withstand normal conditions of service.

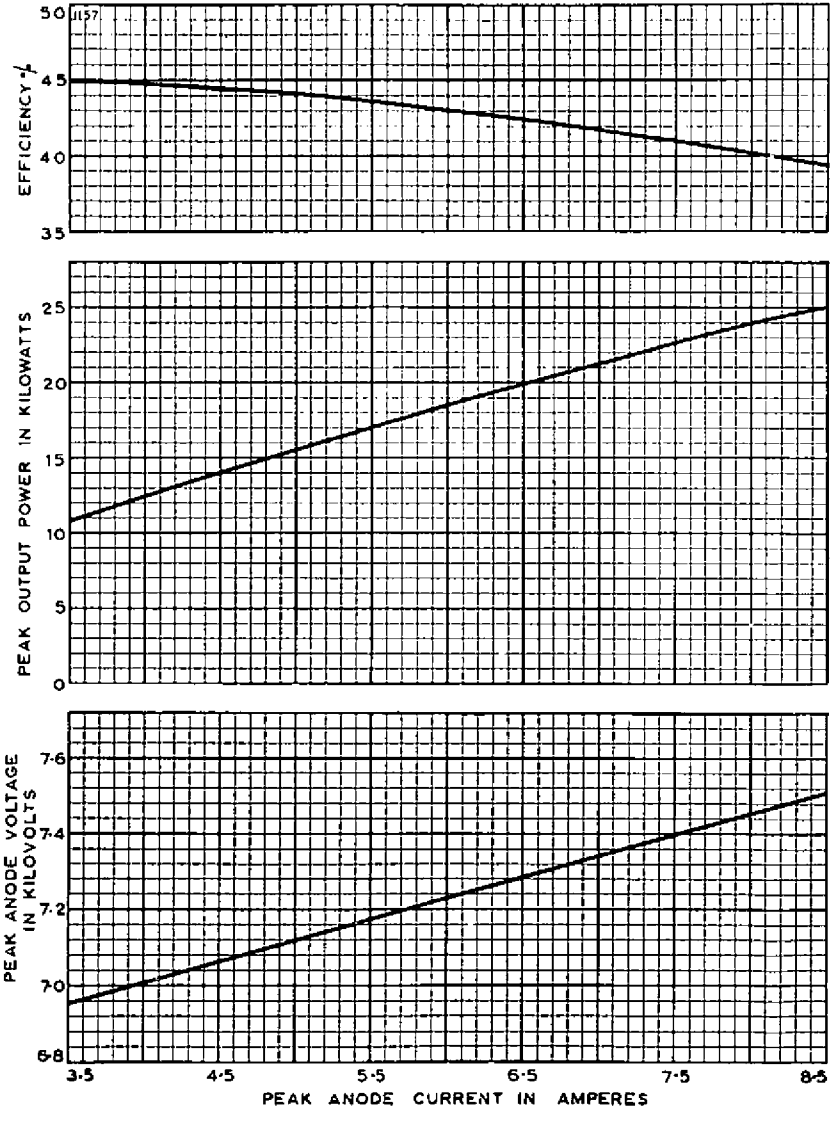
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PERFORMANCE CHART



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MAXIMUM AND MINIMUM RATINGS

(Absolute Values)

The maximum pulse length and peak current ratings may be used simultaneously; all other ratings cannot necessarily be used simultaneously, and no individual rating should be exceeded.

	Min	*Max*	
Heater Voltage (*See Note* 1)	5·7	6·9	V
Heater Starting Current (Peak)	—	3·0	A
Anode Voltage (Peak)	6·0	8·0	kV
Anode Current (Peak)	3·5	8·5	A
Input Power (Peak)	21	68	kW
Input Power (Mean)	—	80	W
Duty Cycle	—	0·0025	
Pulse Length	—	2·5	μsec
Rate of Rise of Voltage Pulse (*See Note* 4)	—	100	kV/μsec
Anode Temperature (*See Note* 3)	—	120	°C
Frequency Change with Anode Temperature Change (after warming)	—	−0·25	Mc/s/°C
Altitude:			
Output System (*See Note* 5)	—	40 000	feet
	—	12·2	km
Input Terminals	—	60 000	feet
	—	18·3	km
V.S.W.R. at the output coupler	—	1·25 : 1	

TYPICAL OPERATION

Operational Conditions		
Heater Voltage	6·3	V
Anode Current (Peak)	8·5	A
Pulse Length	2·2	μsec
Pulse Repetition Rate	400	p.p.s.
Typical Performance		
Anode Voltage (Peak)	7·5	kV
Output Power (Peak)	25	kW
Output Power (Mean)	22	W

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TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification.

Test Conditions

Heater Voltage (for test)	6·3	V
Anode Current (Mean)	8·5	mA
Duty Cycle	0·001	
Pulse Length (*See Note* 6)	2·5	μsec
V.S.W.R. at the output coupler (Maximum)	1·15 : 1	
Rate of Rise of Voltage Pulse (*See Note* 4)	100	kV/μsec

Limits

	Min	*Max*	
Heater Current (*See Note* 7)	0·43	0·60	A
Anode Voltage (Peak)	7·0	8·0	kV
Output Power (Mean)	23	—	W
Frequency (*See Note* 8)	9345	9405	Mc/s
R.F. Bandwidth at ½ Power (*See Note* 9)	—	1·0	Mc/s
Frequency Pulling (V.S.W.R. not less than 1·5 : 1)	—	25	Mc/s
Stability (*See Note* 10)	—	0·25	%

LIFE TEST

The quality of all production is monitored by the random selection of valves which are then life-tested under the oscillation conditions given above. If the valve is to be run continuously under different conditions, English Electric Valve Company Ltd. should be consulted to verify that the life of the valve will not be impaired.

END OF LIFE CRITERIA

(under Test Conditions above)

Output Power (Mean)	18·5	W Min
R.F. Bandwidth at ½ Power	1·5	Mc/s Max
Frequency: Must be within Test Limits above		
Stability (*See Note* 10)	1·0	% Max

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NOTES

1. With no anode input power.

   The heater voltage may have to be reduced during operation if the mean input power exceeds 40 watts. The reduction should be confirmed with English Electric Valve Company Ltd.

   The valve heater shall be protected against arcing by the use of a minimum capacitance of 4000pF shunted across the heater directly at the input terminals; in some cases a capacitance as high as 2μF may be necessary depending on the equipment design.

2. The minimum cathode heating time for ambient temperatures above −55°C is 20 seconds from the heater voltage reaching 5·7 volts. If the valve has been stored for six months or more without h.t. being applied, a longer initial cathode heating time may be required.

3. Convection cooling is usually adequate but at high ambient temperatures and in confined surroundings a degree of forced-air cooling may be necessary.

4. The rate of rise of voltage is the slope of the steepest tangent to the leading edge of the voltage pulse above 80% amplitude. Any capacitance used in the viewing system must not exceed 6·0pF.

5. This rating applies when the magnetron is operated at the maximum input power and pulse length into a mismatched load of V.S.W.R. 1·25 : 1 at the worst phase for breakdown, via a coupler UG-40A/U of standard manufacture.

6. Tolerance ±10%.

7. Measured with heater voltage of 6·3V and no anode input power.

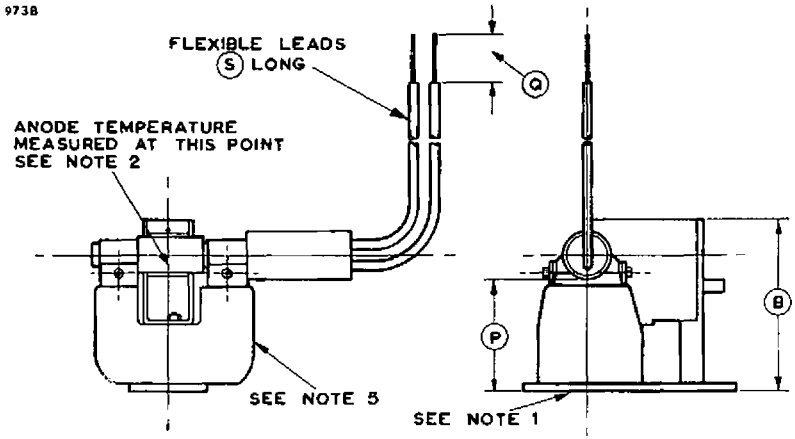
8. Temperature of anode block 40°±5°C, measured at the point indicated on the outline drawing.

9. The bandwidth in Mc/s is given by 2·5/pulse length in microseconds.

10. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal energy level in the frequency range of 9345 to 9405Mc/s. Missing pulses are expressed as a percentage of the number of input pulses applied during any consecutive 5 minute interval of a 15 minute test period.

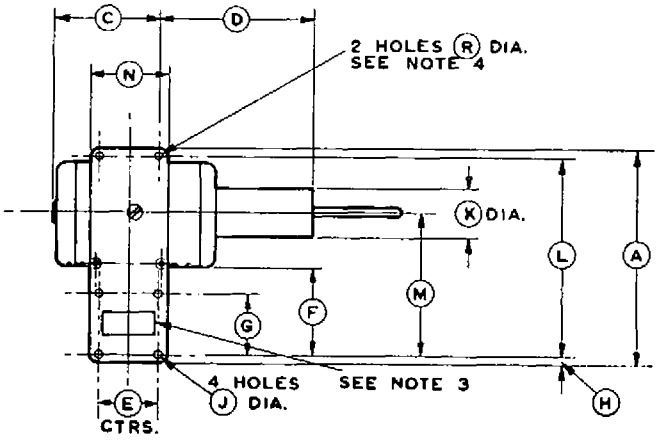
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OUTLINE



COLOUR	ELEMENT
GREEN	HEATER
YELLOW	CATHODE & HEATER

Flexible Lead Connections



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NOTES FOR OUTLINE

1. With the valve resting on a plane surface, the flatness of the mounting plate will be such that a feeler gauge 0·015 inch (0·38mm) thick and 0·125 inch (3·18mm) wide will not enter more than 0·125 inch (3·18mm) at any point.
2. The anode temperature to be measured at this point which is on the centre-line of the anode and at 45° to the horizontal (approximately).
3. The position of the waveguide and fixing holes will be such that the valve operates into coupler type UG-40A/U.
4. The clearance between the centre line of these holes and the magnet will be 0·165 inch (4·19mm) minimum.
5. The north seeking pole of the magnet will be adjacent to the cathode leads.

OUTLINE DIMENSIONS

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	4·453±0·015	113·11±0·38	K	1·000 Max	25·40 Max
B	3·562 Max	90·47 Max	L	4·103±0·004	104·216±0·102
C	2·187 Max	55·55 Max	M	2·937±0·250	74·60±6·35
D	3·187 Max	80·95 Max	N	1·625±0·015	41·28±0·38
E	1·220±0·004	30·988±0·102	P	2·000 Min	50·80 Min
F	1·811 Min	46·00 Min	Q	0·500 Nom	12·70 Nom
G	1·280±0·004	32·512±0·102	R	0·175±0·003	4·445±0·076
H	0·172±0·015	4·37±0·38	S	6·0	152·4
J	0·169±0·003	4·293±0·076			

Millimetre dimensions have been derived from inches.

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Printed in England

from JEDEC release #4561, Jan. 13, 1964

RCA-8379

TRAVELING-WAVE TUBE

4.5 db Noise Figure | **Low-Noise Amplifier Type for Receiver Applications 2320 to 2680 Mc** | **31 db Gain**

RCA-8379 is a low-noise, low-level traveling-wave amplifier tube of the helix-transmission-line type. Operating in the frequency range from 2320 to 2680 Mc, the 8379 is intended for use in the input stage of radar, scatter propagation, and other microwave receivers, and in if amplifier service. Characteristics of the 8379 include a noise figure of 4.5 db and a gain of approximately 31 db.



Featured in the design of the 8379 is a special type of electron gun. This gun deamplifies noise generated in the electron beam with the result that a low noise figure is obtained over the entire operating frequency range of the tube without readjustment of tube operating conditions. In addition, the use of a metal shell allows the rf-input and rf-output transducers to be permanently set in position during manufacture of the tube for optimum performance.

PRINCIPLES OF OPERATION

The structural arrangement of the 8379, shown in Fig. 1, incorporates an electron gun which produces an electron beam; a helix transmission line (slow-wave structure) which propagates a microwave signal in a manner that permits interaction between the beam and the signal; a collector which removes the unused beam energy; transducers which introduce and remove the signal; and an attenuator which isolates the input and output sections of the slow-wave structure to prevent oscillations. All of the components mentioned above, with the exception of the transducers, are contained within an evacuated glass envelope. The input and output transducers, with their semirigid 50-ohm coaxial lines, are adjusted and locked in position within the metal shell to insure proper location with respect to the helix. The metal shell also facilitates mounting of the tube in the magnetic field required to focus the electron beam. The magnetic field may be provided by a permanent magnet, or by a solenoid as illustrated in Fig. 1.

The amplification provided by a traveling-wave tube is produced by interaction of the electron beam and the signal on the slow-wave structure (helix) in the following manner. The velocity of the electron beam entering the helix from the gun is determined by the dc helix voltage. A strong magnetic field whose axis coincides with the axis of the helix confines the electrons to a cylindrical beam whose diameter approaches the inside diameter of the helix. A signal wave introduced onto the helix at the end nearest the gun travels circumferentially along the helix at approximately the velocity of light, although its velocity in the axial, or beam, direction is reduced by the pitch-to-circumference ratio of the helix. When the helix voltage is properly adjusted, the velocity of the beam electrons is made slightly greater than the axial velocity of the rf signal.

The electric field produced by the rf signal moving along the helix affects the velocity of the electrons in the beam in such a manner that beam velocity is slightly reduced by the time the beam reaches the end of the helix. This deceleration of the beam is accompanied by a transfer of beam energy to rf electric-field energy, with the result that the signal is amplified.

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	5.0 ± 5%	volts
Current at 5 volts	0.65	amp
Starting Current: The maximum instantaneous starting current must never exceed 4.0 amperes even momentarily.		
Cathode Heating Time	1 min.	minute
Frequency Range	2320-2680	Mc
Cold Insertion Loss	60 min.	db

Mechanical:

Mounting Position	Any
Cooling	Natural
Maximum Overall Length	19.50"
Shell Diameter	1.375" ± 0.005"
Base	Octal 8-Pin
Collector Connector	Special Banana Jack

(See page 3)

SCHEMATIC ARRANGEMENT OF TYPE 8379
WITH ASSOCIATED SOLENOID

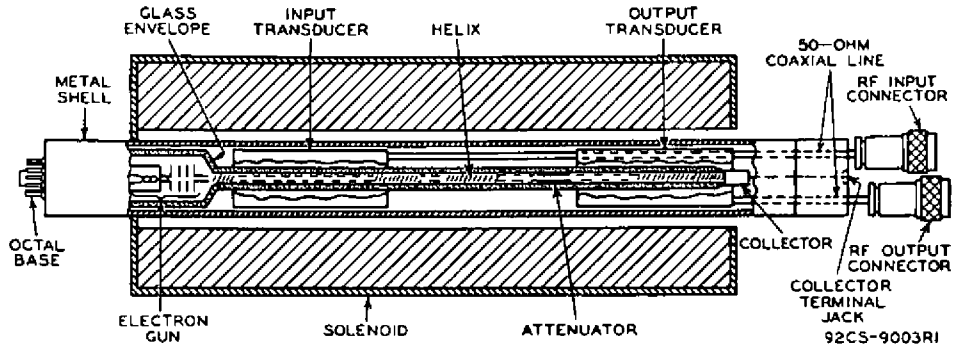


Fig.1

RF Connectors:
- Input . . . . . .Type N Plug (UG-18 B/U)
- Output. . . . . .Type N Plug (UG-18 B/U)

Weight. . . . . 1-1/2 lbs

Maximum and Minimum Ratings, *Absolute-Maximum Values:*[a]

DC Collector Voltage.	800	max.	volts
DC Helix Voltage.	500	max.	volts
DC Grid-No.4 Voltage.	500	max.	volts
DC Grid-No.3 Voltage.	300	max.	volts
DC Grid-No.2 Voltage.	75	max.	volts
DC Grid-No.1 Voltage.	20	max.	volts
DC Collector Current.	500	max.	μa
DC Helix Current.	5[b]	max.	μa
DC Cathode Current.	500	max.	μa
Magnetic Field Strength	650[c]	min.	gauss
RF Power Input:			
Peak.	500	max.	watts
Average	1.0	max.	watts
Metal-Shell Temperature (At hottest point).	175	max.	°C

Typical Operation at 2500 Mc:

DC Collector Voltage.	600	volts
DC Helix Voltage.	375	volts
DC Grid-No.4 Voltage.	325	volts
DC Grid-No.3 Voltage.	70	volts
DC Grid-No.2 Voltage (Approx.). . .	10	volts
DC Grid-No.1 Voltage.	10	volts
DC Collector Current.	150	μa
DC Helix Current.	0.5	μa
DC Grid-No.4 Current DC Grid-No.3 Current DC Grid-No.2 Current DC Grid-No.1 Current	each less than 1	μa
Magnetic Field Strength	850[d]	gauss
Gain (Low Level).	31	db
Power Output (Saturated).	1.0	mw
Noise Figure.	4.5	db

Characteristics Range Values for Equipment Design:

	Note	*Min.*	*Max.*	
Heater Current.	1	0.45	0.85	amp
Input VSWR:				
Non-Operating	2,3	-	1.3	
Operating	1,4	-	1.5	
Output VSWR:				
Non-Operating	2	-	1.5	
Operating	1,4	-	3	
DC Helix Voltage.	1,4	335	405	volts
DC Grid-No.4 Voltage.	1,4	150	400	volts
DC Grid-No.3 Voltage.	1,4	25	100	volts
Saturated Power Output. . . .	1,4	1.0	-	mw
Small-Signal Gain	1,4	28	34	db
Noise Figure.	1,4	-	5.0	db

Note 1: With heater voltage of 5.0 volts.

Note 2: With no electrode voltages applied.

Note 3: Any tube having a non-operating input VSWR higher than 1.3 but less than 1.5 may be considered acceptable if the operating VSWR is less than 1.5.

Note 4: With electrode voltages and magnetic focusing field adjusted for minimum noise figure at 2500 Mc.

[a] The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Absolute-Maximum Rating System* for rating electron devices.

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, taking no responsibility for equipment variations, environment variations, and the effects of changes in operating conditions due to variations in device characteristics.

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 device characteristics.

[b] During alignment of the tube in the magnetic focusing field, the helix current may exceed this value for short periods, but should never exceed 10 μa.

[c] This value of field strength will focus the electron beam, but noise figure will not be optimum.

[d] Typical peak value for RCA Solenoid, Type MW4901 (See Fig.2).

OPERATING CONSIDERATIONS

The *rated values for collector voltage, helix voltage, grid-No.4 voltage, and grid-No.3 voltage are high enough to be dangerous to the user.* Care should be taken during adjustment of circuits,

especially when exposed circuit parts are at high dc potential.

The *power supply* for the 8379 should be capable of holding ripple voltage sufficiently low to prevent phase distortion, and should have adequate regulation to prevent a change in operating conditions which might increase the noise figure. Provision should be made for monitoring helix current, collector current, and cathode current.

The rated *heater voltage* of 5.0 volts should be applied for at least 1 minute to allow the cathode to reach normal operating temperature before voltages are applied to the other electrodes.

The *magnetic field* required for focusing the electron beam of the 8379 may be obtained from a solenoid such as the RCA-MW4901 or equivalent. The field must have a distribution as shown in Fig. 2. A uniform field provided by a solenoid or

CHARACTERISTICS OF RCA-MW4901 SOLENOID

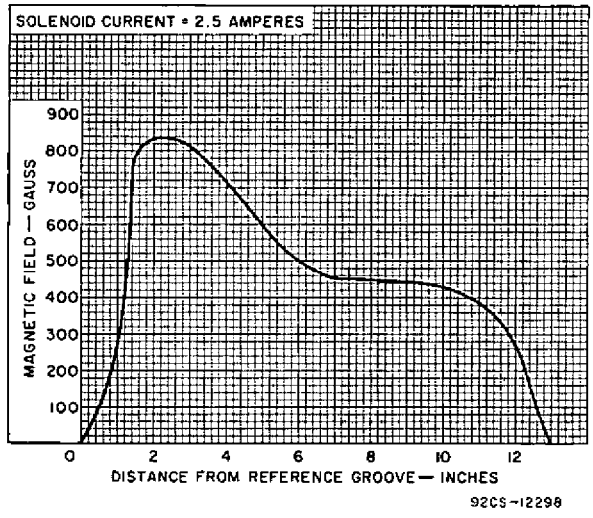


Fig. 2

permanent magnet of at least 800 gauss starting 2 inches from the groove near the base end of the metal shell and continuing for at least nine inches along the tube axis can provide equivalent focusing.

Mounting. The magnetic focusing device used with the 8379 should provide means both for centering the tube in the magnetic field and for locking the tube in position. Provision should be made for natural circulation of air around the tube.

The circumferential groove in the metal shell near the base end of the 8379 is designed to receive a resilient ring used with a clamping device to hold the tube longitudinally in its magnetic focusing field.

A keyway is provided to permit accurate angular location of the 8379 in its magnetic focusing field, and locking the tube against rotation.

After the tube has been inserted in the magnetic focusing field and locked in position, attach an octal socket to the tube base and make connections to the collector jack and to the rf-input and rf-output connectors.

The *base pins* of the 8379 fit a standard octal 8-contact socket. Connection to the *collector terminal connector* may be made with a banana-type plug similar to a Raytheon Test Jack 27-1594G21 fitted with an insulator from an HH Smith Type 211 banana plug. Both *rf-input and rf-output terminals* of the 8379 employ semirigid 50-ohm coaxial lines having type N UG-18B/U connectors.

Initial Alignment Procedure

Apply rated heater voltage to the 8379 for one minute. Then connect operating voltages as shown under *Typical Operation* to all other tube electrodes except grid No. 2. Grid-No. 2 voltage may then be applied, and increased until cathode current reaches approximately 50 microamperes.

If the tube is incorrectly aligned within the magnetic field, some of the beam current will be drawn to the helix and increase the helix current. The axial alignment of the 8379 within the magnetic focusing field should then be adjusted to produce a minimum value of helix current. Grid-No. 2 voltage should then be increased until collector current is approximately 150 microamperes. Readjust alignment of the tube and magnetic focusing field until a minimum value of helix current is again obtained. Helix current of the 8379 when properly aligned in the magnetic focusing field is usually less than one microampere. Collector current should be checked to see if it is essentially the same as cathode current. Such a condition is another indication that the tube is properly aligned in the magnetic field. If a solenoid is used to supply the magnetic focusing field, check the solenoid current and readjust it, if necessary, to obtain the specified field-strength value.

The above alignment procedure need not be repeated so long as the adjustments are not disturbed.

Lowest-Noise-Figure Adjustment Procedure

In order to operate the 8379 at the lowest noise figure, it is necessary to adjust the electrode voltages as follows: With the 8379 connected in its circuit, and with either noise input or signal input, adjust the helix voltage to give maximum output at the operating frequency. This value of helix voltage simultaneously produces optimum tube gain and lowest noise figure. Next, with no input signal, vary dc grid-No. 1, grid-No. 3, and grid-No. 4 supply voltages alternately until the receiver output reaches a minimum value. The voltages are now adjusted to operate the 8379 at its lowest noise figure for the particular frequency to which the equipment is tuned. If the strength of the magnetic focusing field changes, it will be necessary to repeat the above adjustment procedure with regard to grid-No. 1, grid-No. 3, and grid-No. 4 voltage.

Noise Figure

Noise figure of an amplifier or a tube is fundamentally a measure of the noise added to the signal by the amplifier or tube, i.e., the ratio of the total noise power delivered by the device to its output termination to the portion thereof arising from noise developed by the input termination.

NOISE AND GAIN CHARACTERISTICS

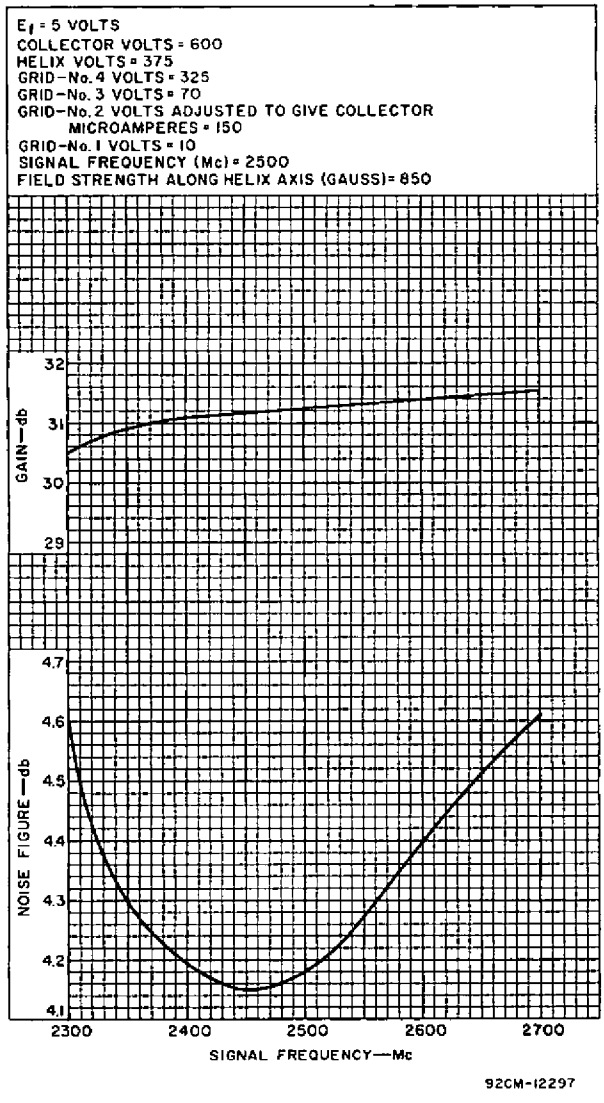


Fig.3

The noise figure (F) expressed as a power ratio may be written as

$$F = \frac{\frac{S_i}{N_i}}{\frac{S_o}{N_o}} \text{ or } \frac{S_i}{S_o} \cdot \frac{N_o}{N_i} \qquad (1)$$

where S_i = signal input power to device

S_o = signal output power delivered by device

N_i = noise power developed by input termination of device

N_o = noise power delivered by device to output termination

Since $\frac{S_o}{S_i}$ is equal to the gain (G) of the device, Eq. (1) becomes

$$F = \frac{1}{G} \cdot \frac{N_o}{N_i} \qquad (2)$$

The values for G and N_o can be measured. The value for N_i is calculated from the relation

$$N_i = kTB$$

where $k = 1.38 \times 10^{-23}$ joules/°K (Boltzman's constant)

T = absolute temperature of noise signal source in °K

B = bandwidth of device in cycles/second

Determination of Noise Figure

The noise-figure values in this bulletin were determined using the equipment arrangement of Fig. 4, in the following manner:

The operating conditions of the 8379 were adjusted to provide lowest noise figure. Then, with the gas-tube noise source operating and with approximately 40 db of rf attenuation inserted between the noise source and the 8379, the receiver gain was adjusted to provide a convenient value of output. Next, the 40 db of rf attenuation between the noise source and the 8379 was removed and the precision if attenuator was adjusted to add attenuation until the receiver output reached its previous value with 40 db of rf attenuation. The power ratio equivalent to the if attenuation thus added is inversely proportional to the noise generated in the traveling-wave tube.

The power ratio corresponding to the added if attenuation, the effective noise-temperature ratio of the noise source, the insertion loss of the noise source, and the circuit loss between the noise source and the input to the traveling-wave tube all enter into the measurement of noise figure, as follows:

$$F = \frac{\left(\frac{T_B}{T_o} - 1\right)\left(\frac{L-1}{L}\right)}{(A)(Y-1)} \qquad (3)$$

where $\frac{T_B}{T_o}$ = effective noise-temperature ratio of gas-tube noise source

L = the power ratio corresponding to the noise-source insertion loss

A = the power ratio equivalent to the circuit loss between noise source and 8379

Y = power ratio corresponding to the attenuation added in precision if attenuator

The value of the first term in the numerator of Eq. (3) is equivalent to 15.28 db for an argon-bulb waveguide-type noise source. This type does

BLOCK DIAGRAM FOR NOISE-FIGURE MEASUREMENTS

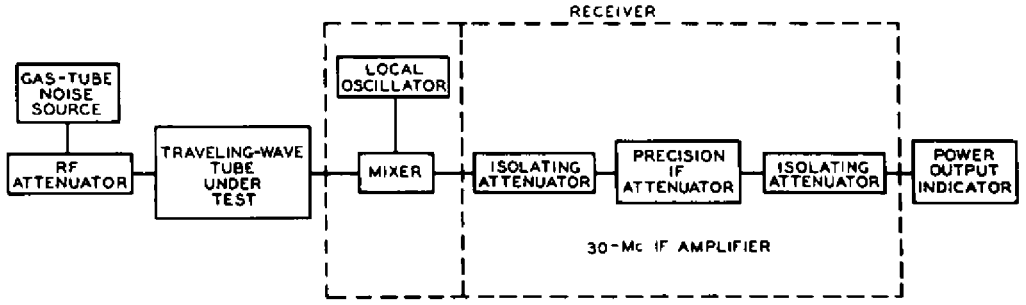


Fig.4

not require any temperature compensation. The values of A and L for the equipment used are equivalent to 0.54 db and 15 db, respectively.

Converting these db values into power ratios and substituting them in Eq.(3) gives

$$F = \frac{28.9}{(Y-1)} \qquad (4)$$

To express Eq.(4) in decibels, it is necessary to take 10 times the common logarithm of the power ratio. Hence,

$$F \text{ (in db)} = 10 \log_{10} \left(\frac{28.9}{Y-1} \right) \qquad (5)$$

The value determined from Eq.(5) includes both tube noise and receiver noise. The relative effect due to receiver noise can be determined from

$$F_{1,2} = F_1 + \frac{F_2 - 1}{G_1} \qquad (6)$$

where $F_{1,2}$ is noise figure of two networks in cascade

F_1 is noise figure of first network (consisting of traveling-wave tube)

F_2 is noise figure of second network

G_1 is the gain of the first network

In this equation, all values are expressed as power ratios.

If F_2 is small or if G_1 is large, the value of the second term becomes so small that it can be neglected. In measurements on the 8379 F_2 was equal to a power ratio of 20, and G_1 was equal to a power gain of 1000. Consequently, the second term in Eq.(6) was equal to a power ratio of 0.02 as compared to a power ratio of about 2.8 for F_1. Hence, the contribution by the second network to the measured noise figure is negligible.

Similarly, in terms of decibels, the contribution by the second network to the measured noise figure is less than 0.02 db.

Preamplifier in Radar Receivers

In the usual type of radar system, a portion of the transmitter pulse leaks through the TR tube to the crystal mixer in the receiver, overloads the crystal, and gradually impairs its performance. If, however, the crystal is preceded by the 8379 in a preamplifier stage, the traveling-wave tube serves as a crystal-protection device because of its saturation characteristic shown in Fig.5. From this curve, it will be

SATURATION CHARACTERISTICS

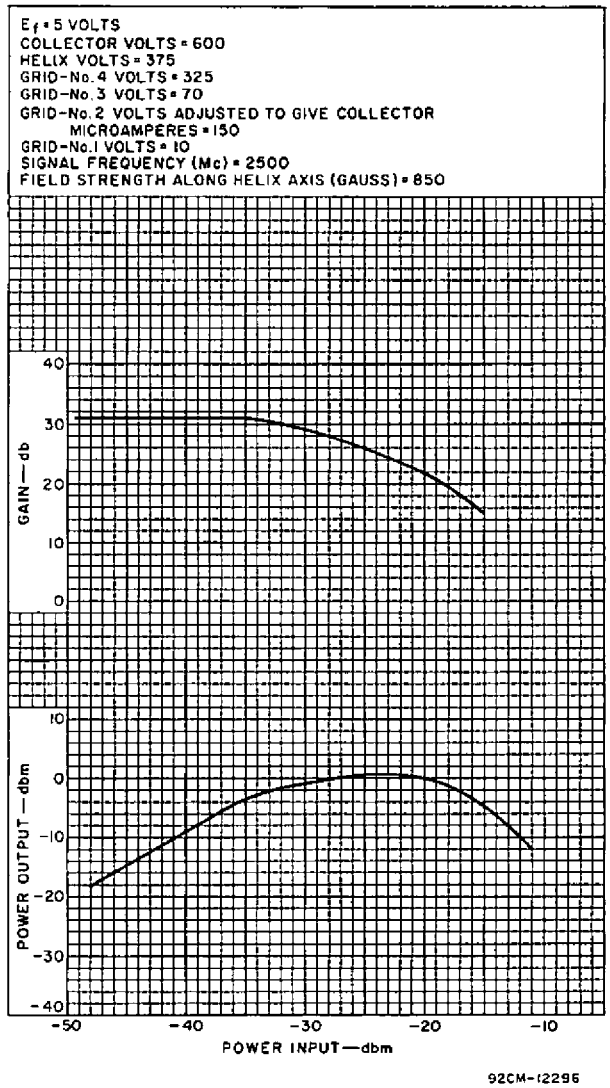


Fig.5

noted that the saturated power output of the 8379 is about 1milliwatt which will not harm the crystal. Therefore, the spike-leakage limit of the TR tube can be eased and thus eliminate the need for supplying "keep-alive" voltage to the TR tube. Furthermore, the ability of the 8379 to withstand an rf peak power input of as much as 500 watts or an average power input of as much as 1 watt makes it possible to employ a TR tube with lower attenuation.

Additional advantages offered by the 8379 in a preamplifier stage include: (1) reduction of the overall noise figure of the radar receiver; (2) improved receiver recovery time; (3) better TR tube life, and (4) reduction of local oscillator radiation. All of these advantages contribute to improved radar-system operation.

Phase-Sensitive Applications

When the 8379 is used in a phase-sensitive radar system or in a microwave relay system where frequency-modulated information is amplified, even a small amount of phase distortion can adversely affect performance. The following table shows for each tube electrode the values of rms ripple voltage which will cause a peak-to-peak change inrf phase of approximately 1 degree.

Tube Electrode	Typical Operating DC Volts	Approx. RMS Ripple Volts For Peak-to-Peak Phase Shift of 1°
Grid No.1	10	0.1
Grid No.2	10	0.1
Grid No.3	70	0.5
Grid No.4	325	3.5
Helix	375	0.024
Collector	600	6.7

For the RCA Solenoid Type MW4901 operated at 90 volts dc, a peak-to-peak change in rf phase of approximately 1° will be caused by an rms ripple voltage of 7.7 volts.

Input Matching Considerations

In general, the *voltage standing wave ratio* (VSWR) will increase as the electron-beam current of the tube is increased. This "hot VSWR" is a direct function of gain and can be attributed to reflections of the amplified wave at a discontinuity along the slow-wave structure. In contrast, the VSWR with no voltages applied to the tube, is referred to as the "cold VSWR". This "cold VSWR" determines the transfer of input signal energy to the helix and, therefore, the noise figure of the 8379 is not degraded by the "hot VSWR". In general, it will be found that when the input to the 8379 is adjusted for optimum matching under "cold" conditions, the same adjustment will provide optimum matching under "hot" conditions. Fig.6 shows a typical input-matching characteristic of the 8379 under "cold" conditions.

INPUT-MATCHING CHARACTERISTIC

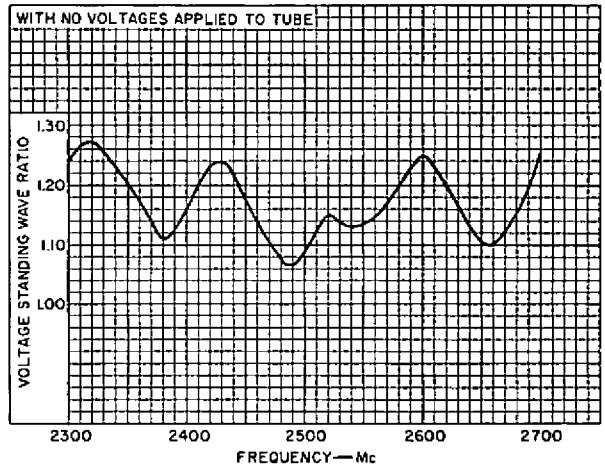


Fig.6

Notes On Associated Microwave Circuitry

A low-noise traveling-wave tube used in a superheterodyne circuit will cause a 3 db degradation in noise figure unless a filter is used at the output of the traveling-wave tube to remove noise generated at the image frequency.

Whenever the output of the 8379 is connected to a filter, signals in the reject band of the filter are reflected back into the tube. As these signals travel back through the tube, they suffer little attenuation until they are absorbed by the attenuator. Should there be appreciable reflection from the attenuator or another discontinuity inside the traveling-wave tube, oscillations may occur, depending on the gain within the tube from the attenuator or discontinuity to the output end of the tube.

The 8379 is designed to be short-circuit stable, i.e., the power reflected from a short-circuited output termination will be insufficient to cause oscillation when the 8379 is operating at a normal value of beam current. If the beam current is increased sufficiently above this value, the gain of the tube will increase until oscillation takes place.

When a high-gain microwave amplifier tube such as the traveling-wave tube is employed, special care must be taken to prevent distortion or oscillations resulting from feedback through circuitry external to the tube. Some types of filters may show satisfactory attenuation characteristics in and near the frequency band of interest. However, oscillations can still occur due to "holes" in the filter characteristic at frequencies outside the band of interest. Attenuation of filters should therefore be checked over wide bands and the holes, if any, can then be filled by supplementary, simple filters.

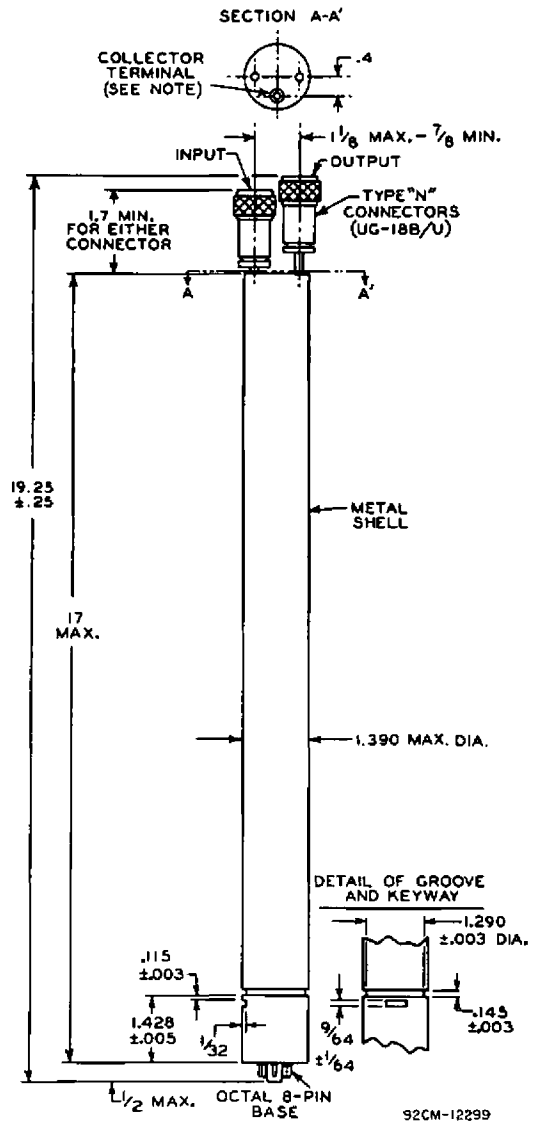
REFERENCES

J. R. Pierce, *"Traveling-Wave Tubes"*, D. Van Nostrand Co., Inc.

R. W. Peter, *"Low-Noise Traveling-Wave Amplifier"*, RCA Review, September, 1952.

W. W. Mumford, *"A Broad-Band Microwave Noise Source"*, Bell System Technical Journal, October, 1949.

DIMENSIONAL OUTLINE

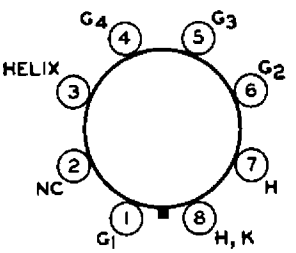


Dimensions in Inches

NOTE: SPECIAL BANANA JACK—MATES WITH RAYTHEON TEST JACK 27-1594G21 FITTED WITH AN INSULATOR FROM AN HH SMITH TYPE 211 BANANA PLUG.

SOCKET CONNECTIONS

Bottom View



Pin 1 – Grid No. 1
Pin 2 – No Connection
Pin 3 – Helix
Pin 4 – Grid No. 4
Pin 5 – Grid No. 3
Pin 6 – Grid No. 2
Pin 7 – Heater
Pin 8 – Heater, Cathode

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ITT ELECTRON TUBE DIVISION
BOX 100 EASTON, PA. 18043
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

KUTHE
8424 *
HYDROGEN
THYRATRON

DESCRIPTION:

THE 8424 IS A UNIPOTENTIAL CATHODE, 3 ELEMENT HYDROGEN FILLED THYRATRON DESIGNED FOR NETWORK DISCHARGE SERVICE. IN SUCH SERVICE, IT IS SUITABLE FOR PRODUCING PULSE OUTPUTS OF MORE THAN 1.5 MEGAWATTS AT AN AVERAGE POWER LEVEL OF MORE THAN 1.2 KW.

THE 8424 IS EQUIPPED WITH RESERVOIR FOR LONG STABLE LIFE AND IS ESPECIALLY ADAPTED TO OPERATION AT HIGH PULSE REPETITION RATES.

ELECTRICAL DATA, GENERAL:	NOM.	MIN.	MAX.	
HEATER VOLTAGE	6.3	5.9	6.7	VOLTS A.C.
HEATER CURRENT (AT 6.3 VOLTS)		9.6	11.6	AMPERES
MINIMUM HEATING TIME			5	MINUTES

MECHANICAL DATA, GENERAL:

MOUNTING POSITION	ANY
BASE	SUPER JUMBO 4-PIN WITH BAYONET A4-18 WITH CERAMIC INSERT
ANODE CAP	C1-43, MEDIUM, WITH CORONA SHIELD
COOLING (NOTE 1)	
NET WEIGHT	12 OUNCES
DIMENSIONS	SEE OUTLINE

* FORMERLY OUR KU-25

5-63

from JEDEC release #4735, June 22, 1964

RATINGS:

Max. Peak Anode Voltage, Forward	12.0	Kilovolts
Max. Peak Anode Voltage, Inverse (Note 2)	12.0	Kilovolts
Min. Anode Supply Voltage	3.5	Kilovolts d.c.
Max. Peak Anode Current	300	Amperes
Max. Average Anode Current	200	Milliamperes
Max. RMS Anode Current (Note 3)	7.75	Amperes a.c.
Max. epy x ib x prr	3.8×10^9	
Max. Anode Current Rate of Rise	1250	Amperes/μSecond
Peak Trigger Voltage (Note 4)		
Max. Peak Inverse Trigger Voltage	200	Volts
Max. Anode Delay Time (Note 5)	0.65	Microsecond
Max. Anode Delay Time Drift	0.10	Microsecond
Max. Time Jitter (Note 6)	0.005	Microsecond
Ambient Temperature	-50° to +90°	Cent.
Shock Rating	13°	Navy (Flyweight) Shock Machine

TYPICAL OPERATION AS PULSE MODULATOR, DC RESONANT CHARGING:

Peak Network Voltage	12.0	Kilovolts
Pulse Repetition Rate	2500	Pulses/Second
Pulse Length	0.4	Microsecond
Pulse Forming Network Impedance	48	Ohms
Trigger Voltage	200	Volts
Peak Power Output (Resistive Load 92% Zn)	736	Kilowatts
Peak Anode Current	130	Amperes
Average Anode Current	0.13	Amperes d.c.
Grid Bias	-50	Volts D.C.

Note 1:

Cooling permitted. However, there shall be no air blast directly on the bulb.

Note 2:

During the first 25 microseconds after conduction, the peak inverse anode voltage shall not exceed 5.0 KV.

Note 3:

The root mean square anode current shall be computed as the square root of the product of the peak current and the average current.

NOTE 4:

THE PULSE PRODUCED BY THE DRIVER CIRCUIT SHALL HAVE THE FOLLOWING CHARACTERISTICS WHEN VIEWED AT THE 8424 SOCKET WITH THE GRID OF THE TUBE DISCONNECTED:

A.	VOLTAGE	200-300 VOLTS
B.	DURATION	2 MICROSECONDS (AT 70% POINTS MIN.)
C.	RATE OF RISE	200 VOLT/MICROSECOND (MIN.)
D.	IMPEDANCE	50-500 OHMS (MAX.)

THE LIMITS OF ANODE TIME DELAY AND ANODE TIME JITTER ARE BASED ON THE MINIMUM TRIGGER. USING THE HIGHEST PERMISSIBLE TRIGGER VOLTAGE AND LOWEST TRIGGER SOURCE IMPEDANCE MATERIALLY REDUCES THESE VALUES BELOW THE LIMITS SPECIFIED.

NOTE 5:

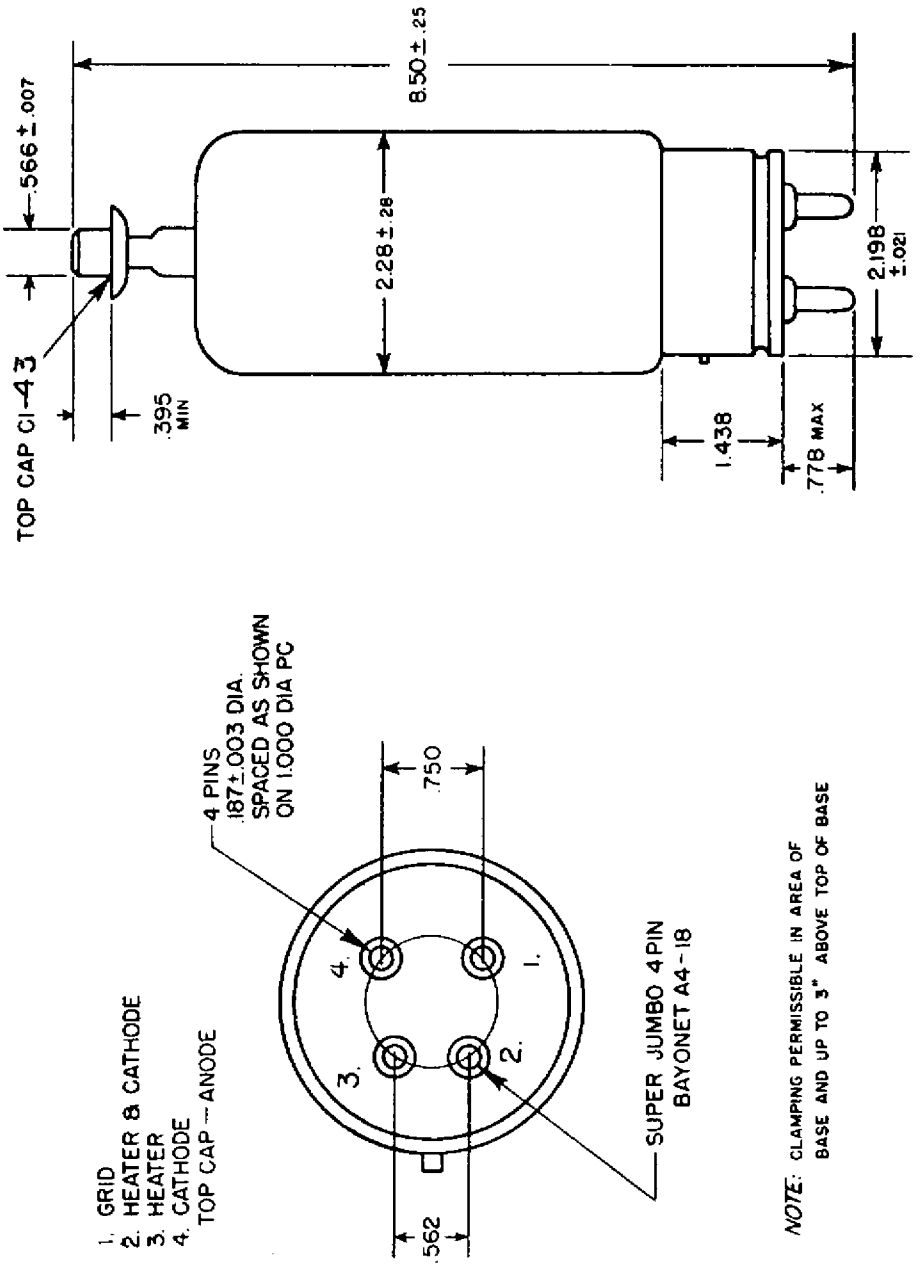
THE TIME OF ANODE DELAY IS MEASURED BETWEEN THE 26 PERCENT POINT ON THE RISING PORTION OF THE UNLOADED GRID VOLTAGE PULSE AND THE POINT AT WHICH EVIDENCE OF ANODE CONDUCTION FIRST APPEARS ON THE LOADED GRID PULSE.

NOTE 6:

TIME JITTER IS MEASURED AT THE 50 PERCENT POINT ON THE ANODE CURRENT PULSE.

ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE

ELECTRON TUBE APPLICATIONS SECTION
ITT ELECTRON TUBE DIVISION
POST OFFICE BOX 104
CLIFTON, NEW JERSEY



OUTLINE 8424

8460

REFLEX KLYSTRON

(MECHANICALLY TUNED)

DESCRIPTION



The 8460 (Bendix Type TK-106) is a ruggedized, low voltage, mechanically tuned, X-band reflex klystron oscillator designed for use in pulse or CW applications over the frequency range of 8.5 to 9.66 Gc/sec.

Although different in design and physical appearance, the 8460 is an exact electrical and mechanical retrofit for the 2K25 and in addition to its pulse capabilities, has equivalent or superior performance in all CW operating characteristics. It may be used interchangeably in existing 2K25 sockets with no equipment modification.

Of particular interest is the mechanical tuner design. As with the 2K25, tuning is accomplished by rotation of the drive nut located in the center of the tuner bows. However, unlike the 2K25, this motion is transmitted to the resonant cavity through a highly flexible diaphragm in the wall of the vacuum envelope, and there is no overstressing of the structure. Mechanical stops at both extremes of the tuning range prevent accidental damage to the structure by exceeding the mechanical tuning range. This design approach results in greatly extended tuning life (Specified tuner life 10,000 cycles minimum), ability to operate in applications requiring repetitive tuning, low temperature coefficient, reduced frequency variation with changes in ambient pressure, and minimal mechanical tuning hysteresis (repeatability of frequency vs. tuner setting).

The coaxial output of the tube is coupled into a standard 1" x ½" waveguide through a transducer, or launching section, such as that defined by Military Drawing 227-JAN or equivalent. The use of teflon as the coaxial insulator eliminates insulator breakage and removes the limitation on maximum coaxial line ambient temperature when using polystyrene.

A detailed description of the 8460 design features is available in Bendix Engineering Data Release Issue 44, File No. M-9, which describes the similar CW Bendix type TK-99/8294.

APPLICATION NOTES

Cooling: Convection cooling is normally sufficient. If the tube is to be operated in a small enclosure, care should be taken to insure adequate ventilation to prevent excessive bulb temperature that will decrease the normal life of the tube.

Output Load: The tube has been designed for operation into a matched load. When operation into a reactive load is necessary, adequate attenuation should be inserted between the load and the tube to limit the SWR at the tube and thus prevent impairment of performance.

Repeller Modes: The tube is designed for optimum operation in the repeller voltage mode defined in this data sheet, however, other modes exist at other repeller voltages and these may be used when desired. In design of AFC circuits these other modes must be considered to assure lock-in on the desired mode.

Safety Precautions: (1) Repeller voltage must always be negative, relative to the cathode. (2) Bulb should be at ground potential whenever the application permits. (3) Resonator voltage should not be applied without repeller voltage.

MAXIMUM RATINGS

(ABSOLUTE VALUES)

Resonator Voltage	350 Vdc
Reflector Voltage	—350 Vdc
Filament Voltage	6.3V ±8%
Cathode Current	37 ma D.C.
Heater-Cathode Voltage	100 Vdc

PHYSICAL CHARACTERISTICS

Dimensions:	Refer to outline drawing
Base:	Fits standard octal socket with #4 pin enlarged to 3/16"
Coupling to Waveguide:	Coaxial output fits standard 227-JAN tube mount or equivalent
Cooling:	Convection
Mounting Position:	Any
Cavity:	Integral
Bulb:	Metal

THE Bendix CORPORATION
Red Bank DIVISION, EATONTOWN, NEW JERSEY

Publication No. RT45-26

Printed in U.S.A.

from JEDEC release #4744, June 29, 1964

REFLEX KLYSTRON
(MECHANICALLY TUNED)

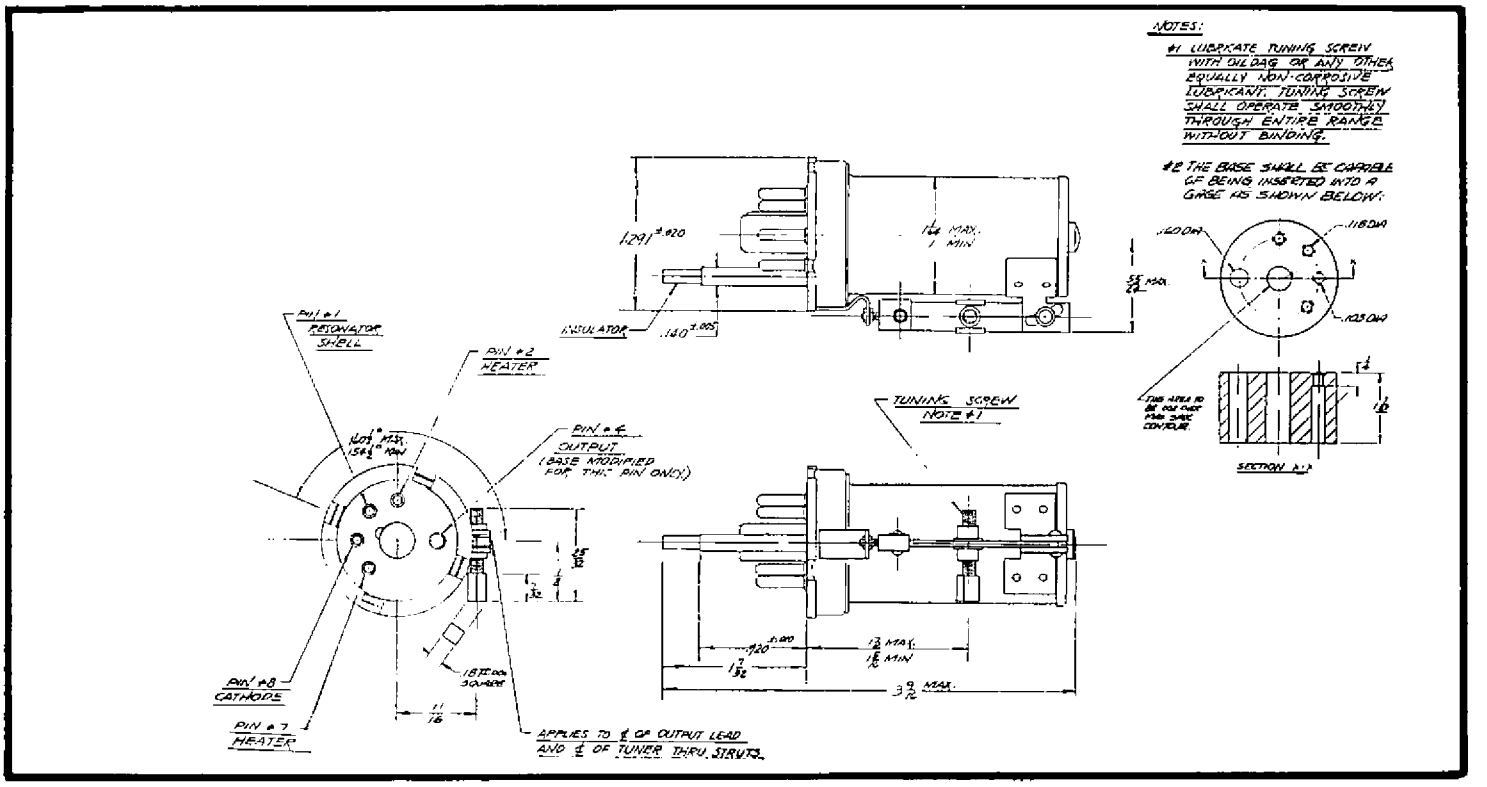
8460

Bendix Red Bank Type TK -- 106

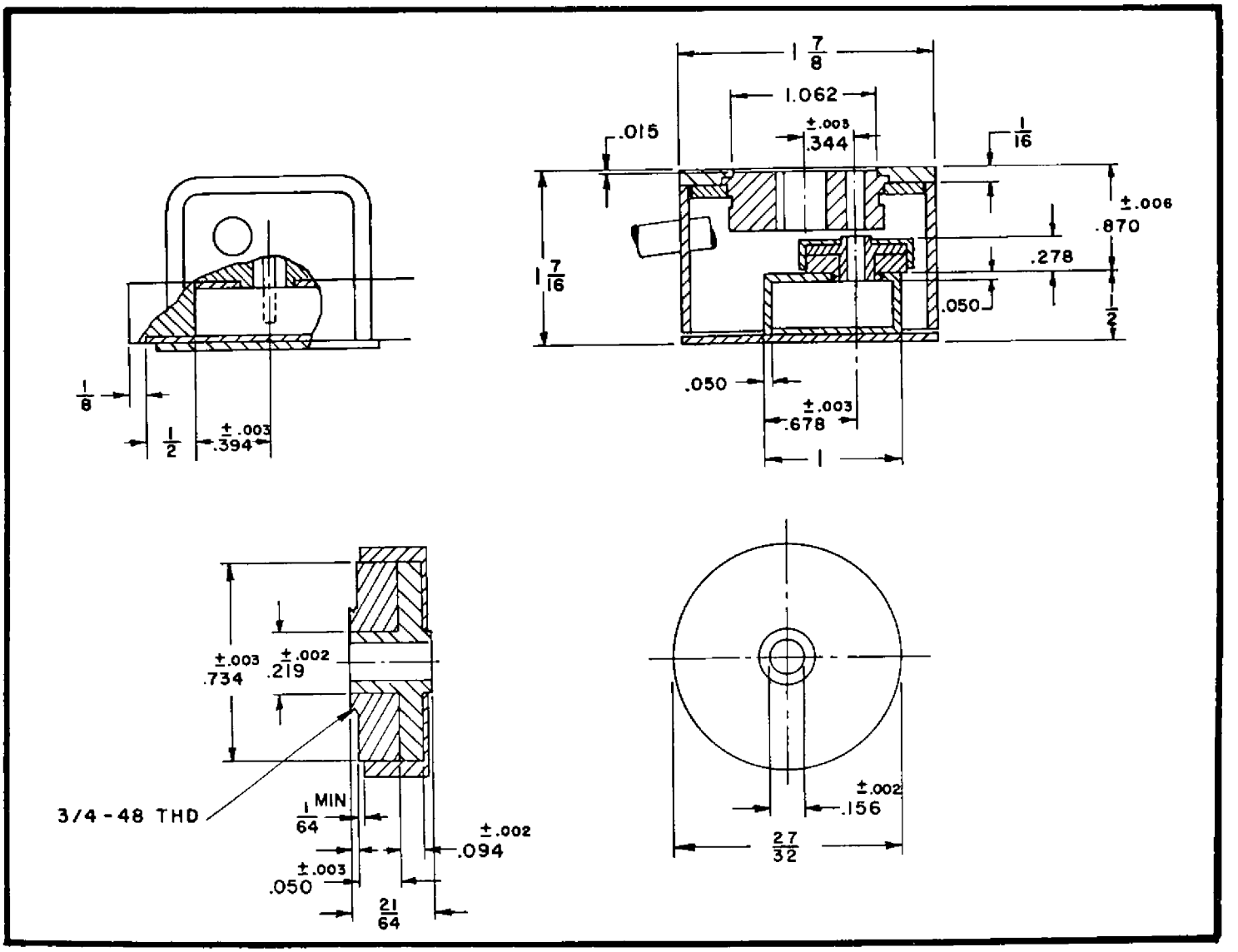
ELECTRICAL CHARACTERISTICS & TEST CONDITIONS

Test Conditions and Specification Limits

TEST PRODUCTION TESTS:	CONDITIONS	SYMBOL	LIMITS MIN.	LIMITS MAX.	UNITS
Cathode Current		Ik	–	32	mAdc
Change in Cathode Current	Ef=6.3 to 5.8V; t=120;	Δ Ik/Ik	–	15	%
Power Output	Er/Max Po; F=8500 to 9660 Mc	Po	20	–	mW
Reflector Voltage (1):	Mode A; F=9660 ± 0.3% Mc	Er	–143	–200	Vdc
Total Reflector Current	Er= –150 Vdc	Ir	–	7.0	μAdc
Reflector Lkg. Current:	Er= –150 Vdc	Ir	–	5.0	μAdc
Reflector Gas Current:	Er= –150 Vdc	Ir	–	2.0	μAdc
Dimensions:	See Outline Drawing				
DESIGN TESTS:					
Heater Cathode Lkg.	Ehk= ±45 Vdc	Ihk:	–	100	μAdc
Heater Current	Ef= 6.3 V.	If	410	470	mA
Insulation of Electrodes:	300 Vdc; Tube Cold	Rkrs:	2.0	–	Megs
		Rhrs:	2.0	–	Megs
Bump	Er/Max Po	Δ Po/Po	–	± 10	%
Electronic Tuning:	Er/±50% Max Po; F=9370 Mc ± 0.3%	Δ F	35	–	Mc
Hysteresis: (1)	Er/Max Po	Ratio		.25	
PULSED OPERATION:					
Output Pulse Duration	Er/Max Po; F=8900 ± .03% Mc Input tp=.27 μsec; prr=2000; eo=30 mv	tp	.22	–	μsec
Output Pulse Delay	Er/Max Po; F=8900 ± .03% Mc Input tp=.27 μsec; prr=2000; eo=30 mv	td	–	.07	μsec
QUALIFICATION APPROVAL TESTS:					
Tuner Mechanical Fatigue	F=8500–9660–8500 Mc		10,000	–	Cycles



OUTLINE DIMENSIONS — 8460



BROADBAND COAX TO WAVEGUIDE TRANSDUCER

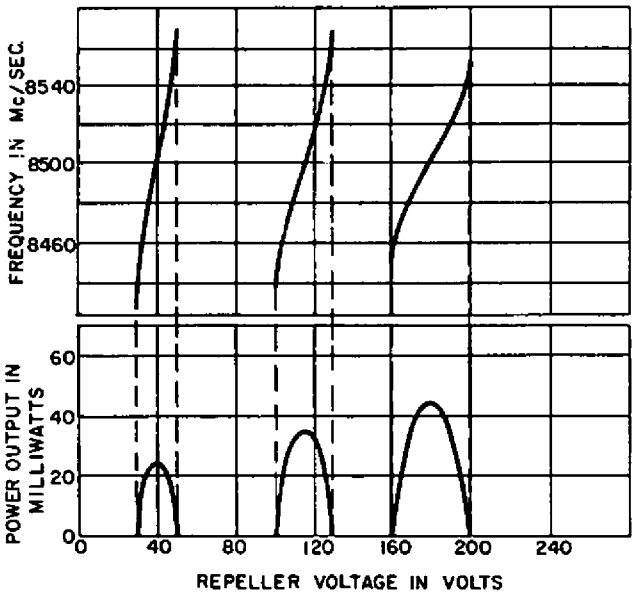
REFLEX KLYSTRON
(MECHANICALLY TUNED)

8460
Bendix Red Bank Type TK -- 106

AVERAGE CHARACTERISTICS

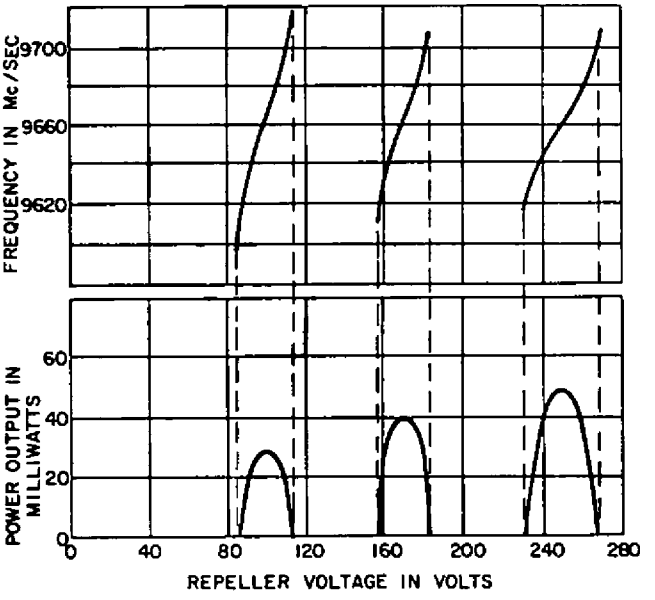
POWER OUTPUT AND FREQUENCY
VS REPELLER VOLTAGE

8460

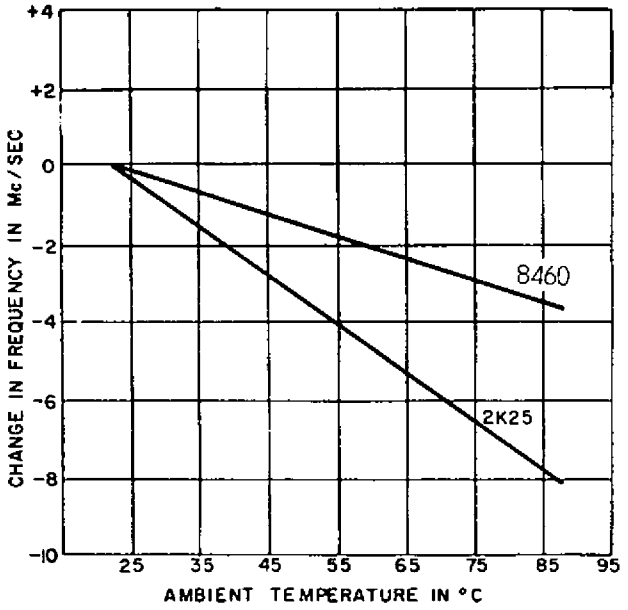


POWER OUTPUT AND FREQUENCY
VS REPELLER VOLTAGE

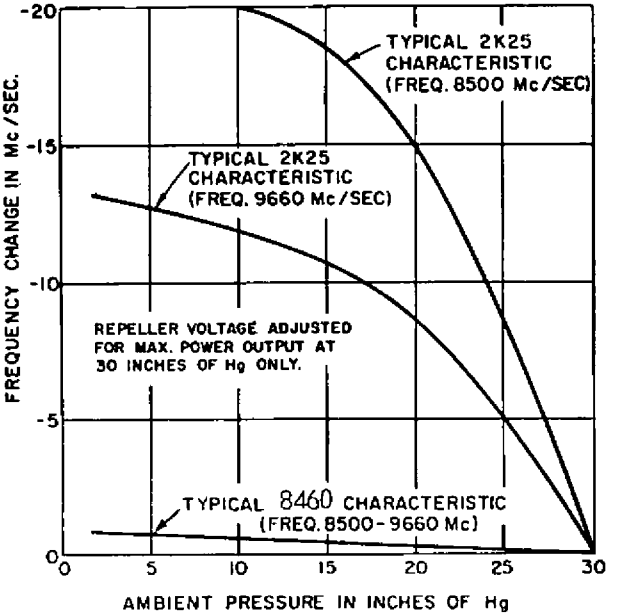
8460



COMPARATIVE
FREQUENCY CHANGE
VS AMBIENT TEMPERATURE
(MEASUREMENT MADE AT 9370 Mc/SEC)



COMPARATIVE
FREQUENCY CHANGE
VS AMBIENT PRESSURE



ADVANCE DATA

MECHANICAL DATA

Mounting Position	Any
Weight	.8 Lbs. (Approx.)
Cooling	Forced Air
Output Pressurization	60 psia
Minimum Magnet Isolation	4 Inches
Output Coupling	Mates with Modified UG-541/U Flange (holes drilled to clear No. 6-32 screw)
Tuner Drive Mechanism	Rotating Shaft
Tuner Torque	10 In. Oz. (Approx.)
Vibration	0.245" Amplitude, 10-20 cps, 5 G, 20-500 cps
Shock	15 G, 11 ms

ELECTRICAL DATA

HEATER CHARACTERISTICS

Voltage	12.6 Volts
Current	2.6 A
Minimum Preheat Time	180 Seconds

RATINGS (Absolute Maximum)[1]

Heater Voltage	14.0 Volts
Heater Surge Current	10.0 A
Peak Anode Voltage	18.0 kv
Average Power Input	272 Watts
Anode Temperature	150 °C
Voltage Standing Wave Ratio	1.5:1
Duty Cycle	0.001
Pulse Width	3.3 μs

TYPICAL OPERATION

	Osc. 1	Osc. 2	
Duty Cycle	0.001	0.001	
Pulse Width	0.5	1.0	μs
Rate of Rise of Voltage	180	180	kv/μs
Average Anode Current	16	16	mAdc
Peak Anode Voltage	15 to 17	15 to 17	kv
Average Power Output	75	75	Watts
Pulling Factor	8.0	8.0	Mc
Pushing Factor	0.1	0.1	Mc/a

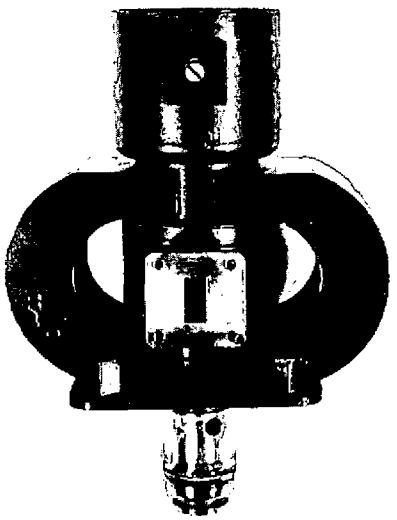
NOTES:

1. *If the independent absolute ratings are exceeded, serviceability of the tube may be impaired. Refer to MIL-E-1D, para. 6.5.*
2. *Dependable operation and maximum magnetron life can be realized only if the complete system is designed with the magnetron characteristics clearly in mind. This data sheet is intended to acquaint the reader with the basic characteristics of the magnetron and should not be used as an absolute guide. Additional information and assistance with specific applications may be obtained by contacting Sylvania Microwave Device Division, Williamsport, Pa.*

from JEDEC release #4610, Feb. 24, 1964

QUICK REFERENCE DATA

Ku Band Symmetrically
Loaded External Cavity
Magnetron
Tunable 16.0 to 17.0 kMc
90 kw Peak Power Output
Integral magnets
Suitable for Airborne Systems



SYLVANIA ELECTRIC PRODUCTS INC.

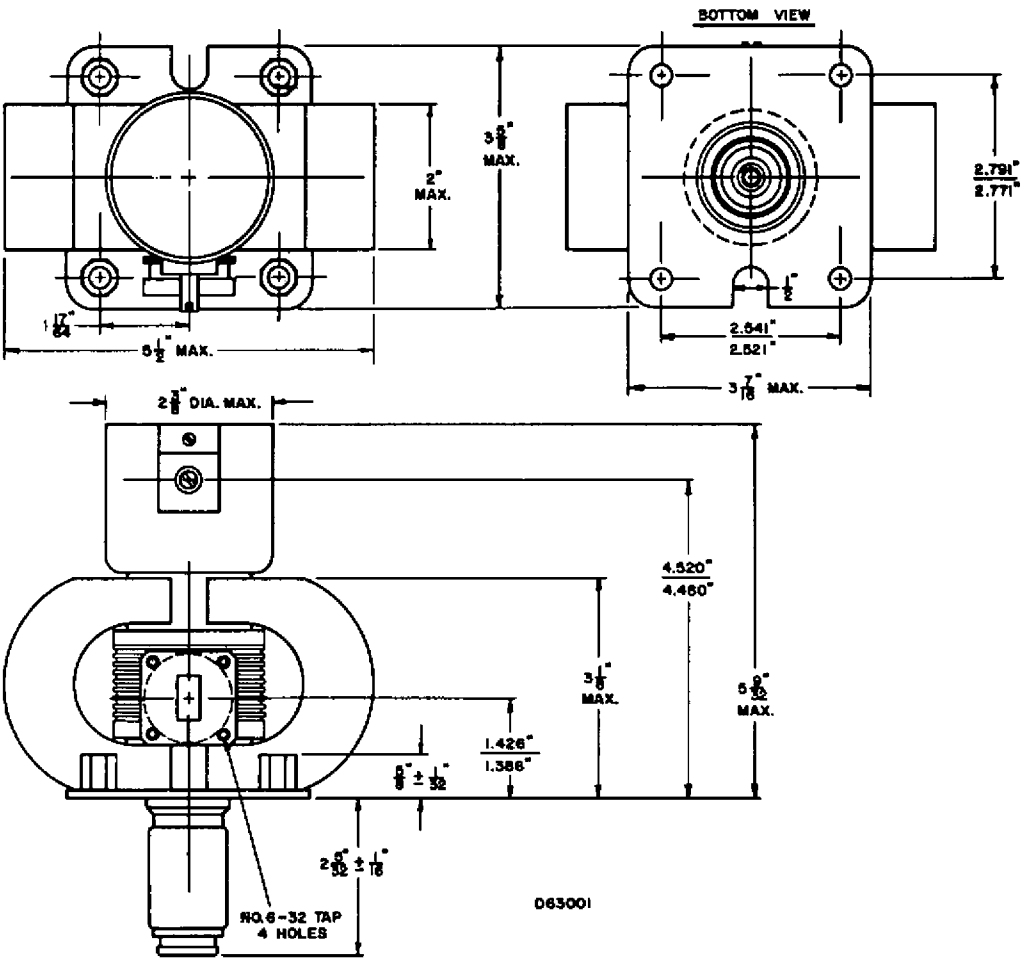
MICROWAVE DEVICE DIVISION

WILLIAMSPORT, PA.

Prepared and Released By The TECHNICAL PUBLICATIONS SECTION EMPORIUM, PENNSYLVANIA

January 27, 1964

OUTLINE


BOTTOM VIEW
2" MAX.
3⅜" MAX.
2.791"
2.771"
½"
2.641"
2.621"
3 7/16" MAX.
1 17/64"
5½" MAX.
2⅜" DIA. MAX.
4.520"
4.460"
3⅛" MAX.
5 9/32" MAX.
1.426"
1.386"
⅜" ± 1/32"
2 9/32" ± 1/16"
NO.6-32 TAP
4 HOLES
063001

GENERAL DATA

Spectral Response	See Curve
Wavelength of Max. Response	6100 ± 400 Angstroms
Sensitive Material	Cadmium-Sulfide
Sensitive Area	Viewed from End
Construction	Hermetically Sealed in Glass with Flexible Leads
Outline	See Drawing
Operating Position	Any

ELECTRICAL DATA

RATINGS (Absolute Maximum Values)

Breakdown Voltage[2]	150	Volts
Dissipation (See Curve)		
T-amb = 25°C	50	mW
T-amb = 70°C	5	mW
Ambient Temperature Range	-40 to +70	°C
Illumination	Note 3	

CHARACTERISTICS

Cell Resistance[4]		
Illumination 2 FC		
Color Temperature 2870°C	1500	Ohms
Dark Resistance[5]	150,000	Ohms Min.

NOTES:

1. Minute increases in relative humidity will produce change in color.

2. Measured with cell in complete darkness at a pulse rate of 100 pps, 100 μ sec. duration. Voltage in excess of the rated value may damage the cell. Max. DC or AC peak voltage is limited by max. dissipation and min. dark resistance rating.

3. Care should be exercised to prevent localized overheating of the sensitive surface when the cell is used with a lens system.

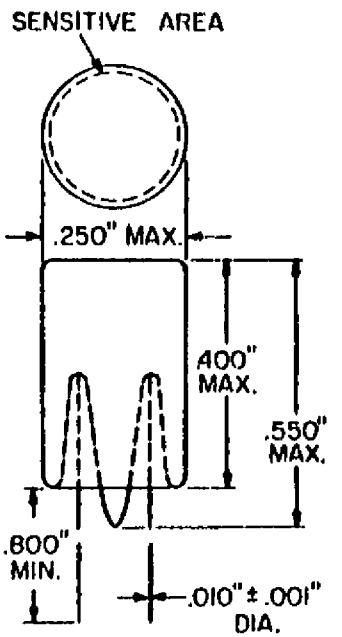
4. Measured after 60 minutes minimum exposure to approximately 50 FC illumination (ambient room light).

5. Measured in complete darkness, 10 seconds after removal of 2 FC illumination.

from JEDEC release #4791, Aug. 31, 1964

QUICK REFERENCE DATA

The Sylvania Type 8474 is a miniature cadmium-sulfide photoconductive cell featuring high sensitivity and hermetically sealed-in-glass construction. The cell is gaseous back-filled for a high dissipation safety factor and includes a blue-dot compound which turns pink[1] if the cell envelope becomes damaged. The 8474 is designed for use in a wide variety of industrial applications.



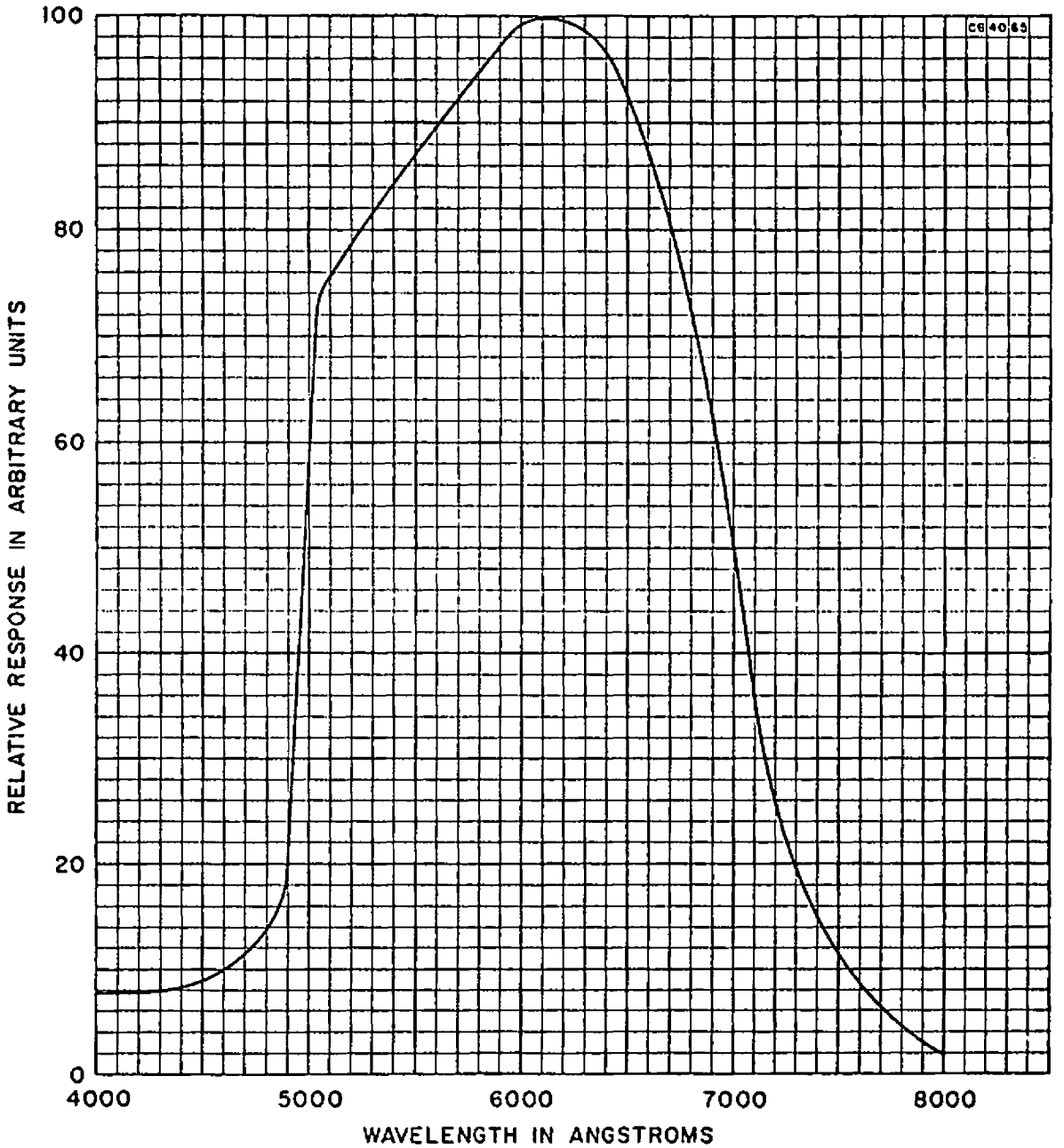
SYLVANIA ELECTRIC PRODUCTS INC.

Electronic Components Group
ELECTRONIC TUBE DIVISION
EMPORIUM, PA.

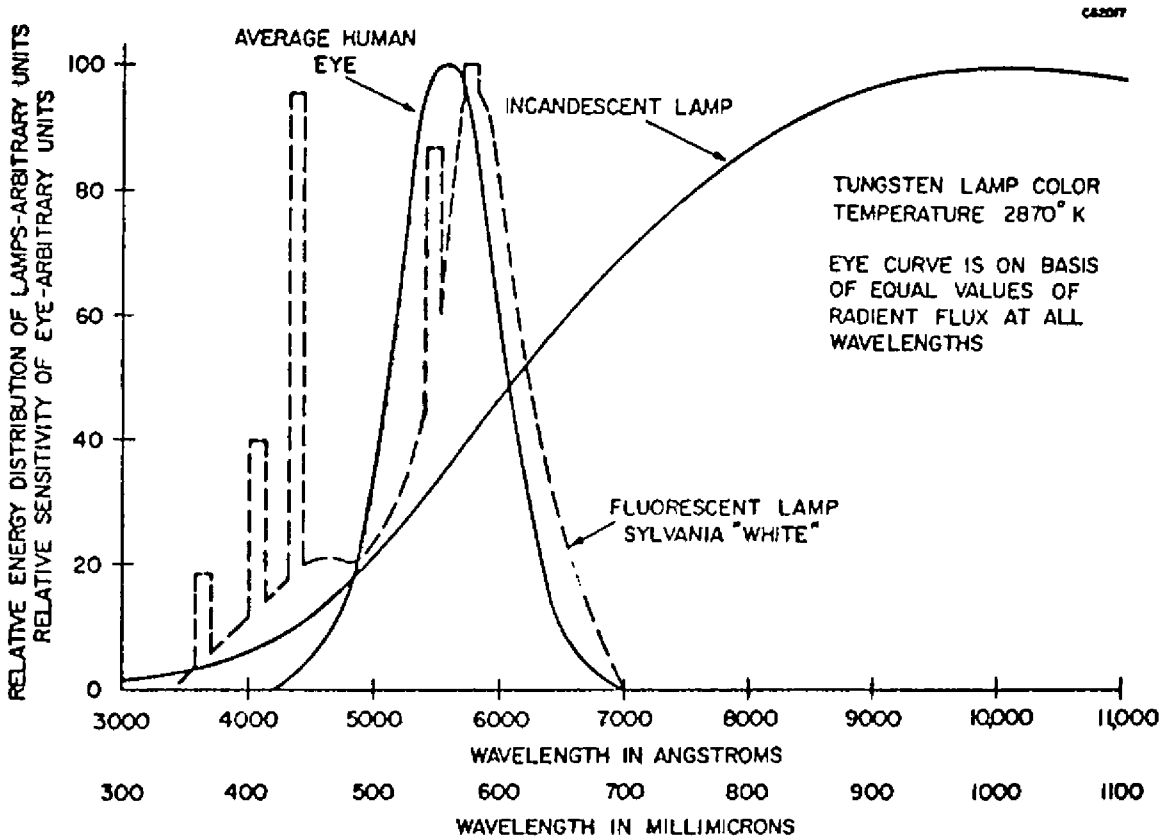
A Technical Publication

July 9, 1964

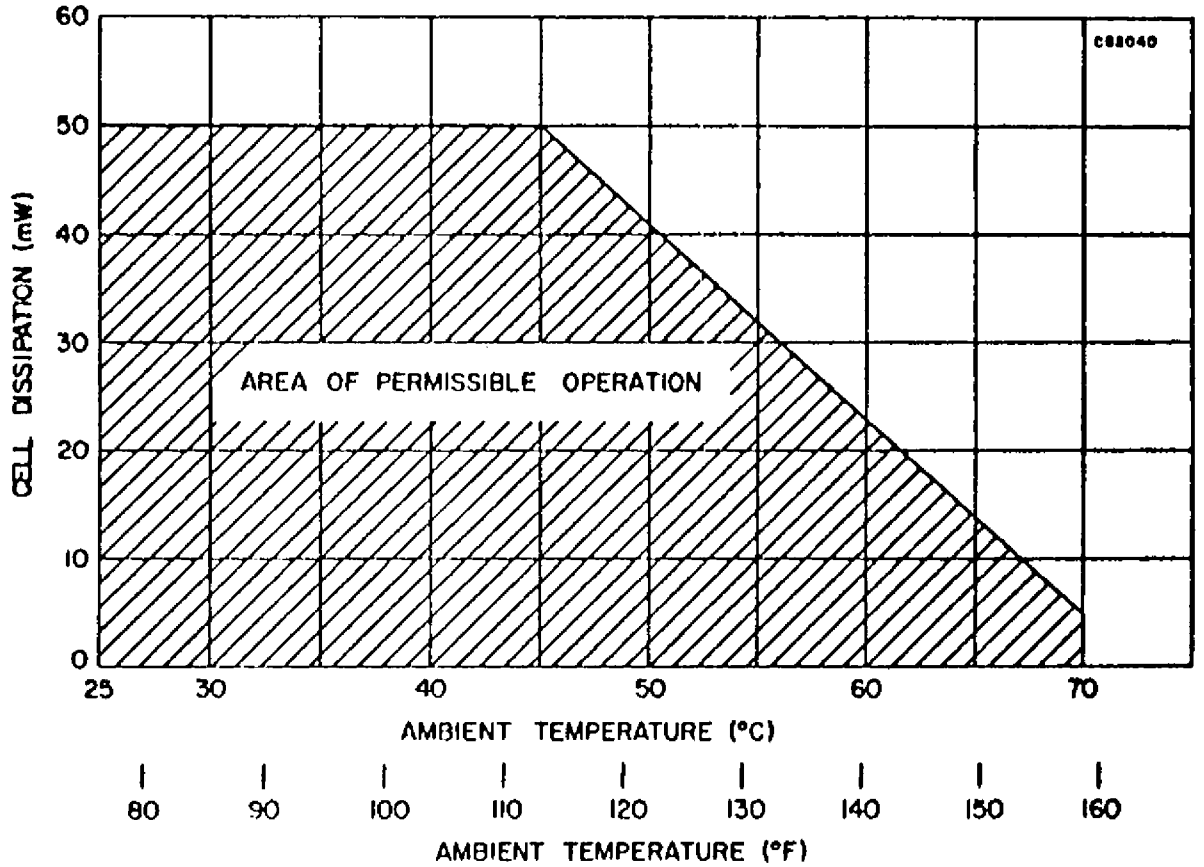
SPECTRAL RESPONSE



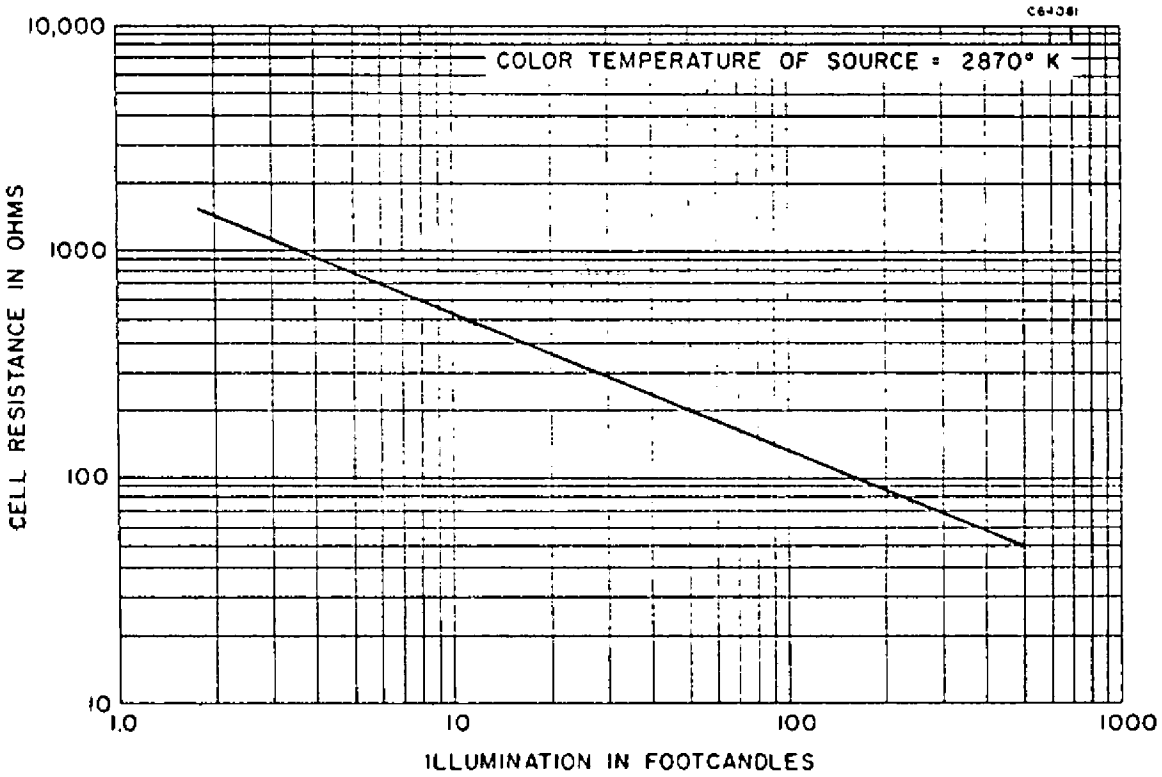
SPECTRAL CHARACTERISTIC OF HUMAN EYE,
TUNGSTEN AND FLUORESCENT LAMPS



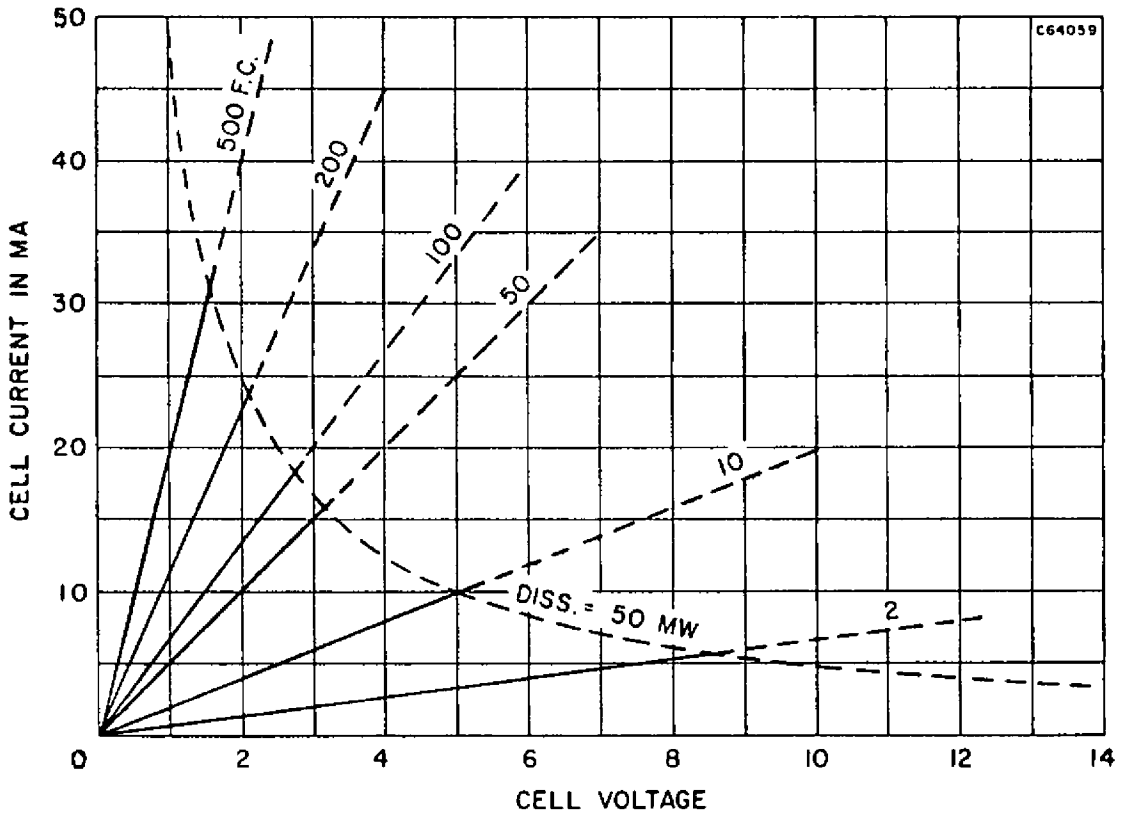
PERMISSIBLE DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



CELL RESISTANCE VS ILLUMINATION



CELL CURRENT AND DISSIPATION VS VOLTAGE



GENERAL DATA

Spectral Response	See Curve
Wavelength of Max. Response	6100 ± 400 Angstroms
Sensitive Material	Cadmium-Sulfide
Sensitive Area	Viewed from End
Construction	Hermetically Sealed in Glass with Flexible Leads
Outline	See Drawing
Operating Position	Any

ELECTRICAL DATA

RATINGS (Absolute Maximum Values)

Breakdown Voltage[2]	200	Volts
Dissipation (See Curve)		
T-amb = 25°C	50	mW
T-amb = 70°C	5	mW
Ambient Temperature Range	-40 to +70	°C
Illumination	Note 3	

CHARACTERISTICS

Cell Resistance[4]		
Illumination 2 FC		
Color Temperature 2870°K	3000	Ohms
Dark Resistance[5]	300,000	Ohms Min.

NOTES:

1. Minute increases in relative humidity will produce change in color.

2. Measured with cell in complete darkness at a pulse rate of 100 pps, 100 μ sec. duration. Voltage in excess of the rated value may damage the cell. Max. DC or AC peak voltage is limited by max. dissipation and min. dark resistance rating.

3. Care should be exercised to prevent localized overheating of the sensitive surface when the cell is used with a lens system.

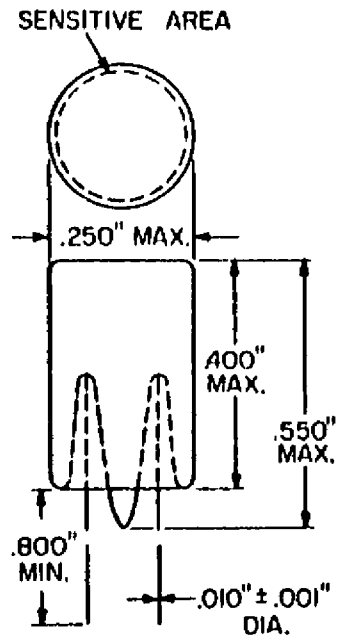
4. Measured after 60 minutes minimum exposure to approximately 50 FC illumination (ambient room light).

5. Measured in complete darkness, 10 seconds after removal of 2 FC illumination.

from JEDEC release #4791, Aug. 31, 1964

QUICK REFERENCE DATA

The Sylvania Type 8475 is a miniature cadmium-sulfide photoconductive cell featuring high sensitivity and hermetically sealed-in-glass construction. The cell is gaseous back-filled for a high dissipation safety factor and includes a blue-dot compound which turns pink[1] if the cell envelope becomes damaged. The 8475 is designed for use in a wide variety of industrial applications.



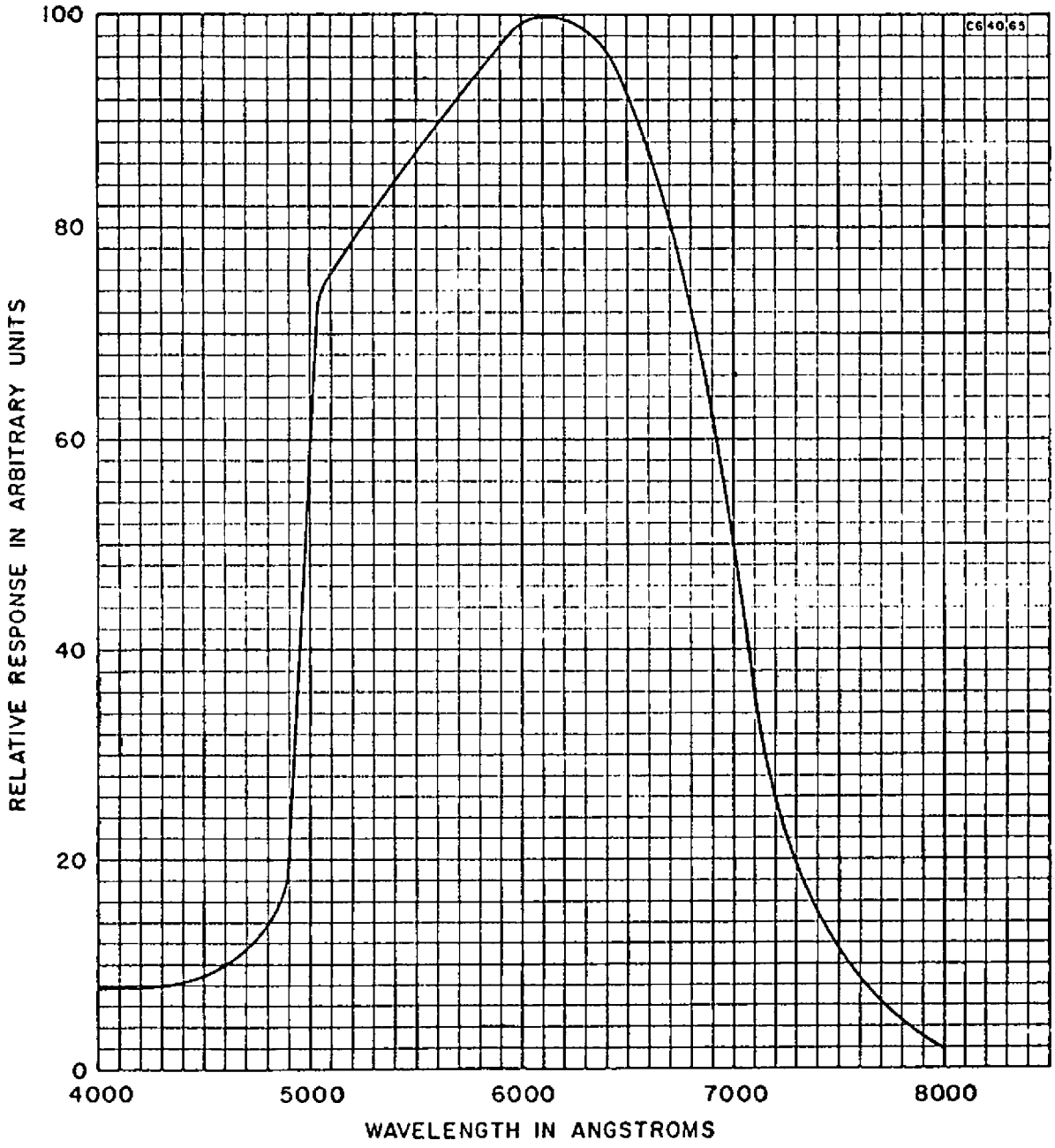
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EMPORIUM, PA.

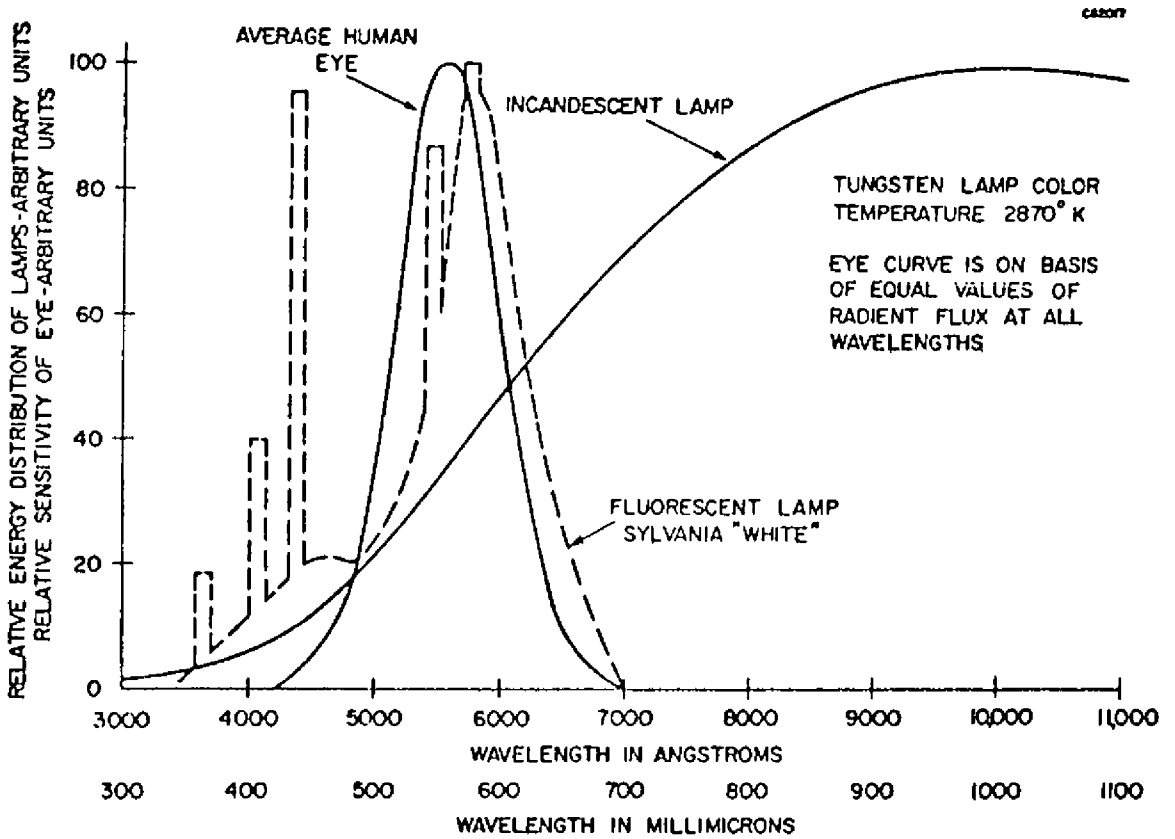
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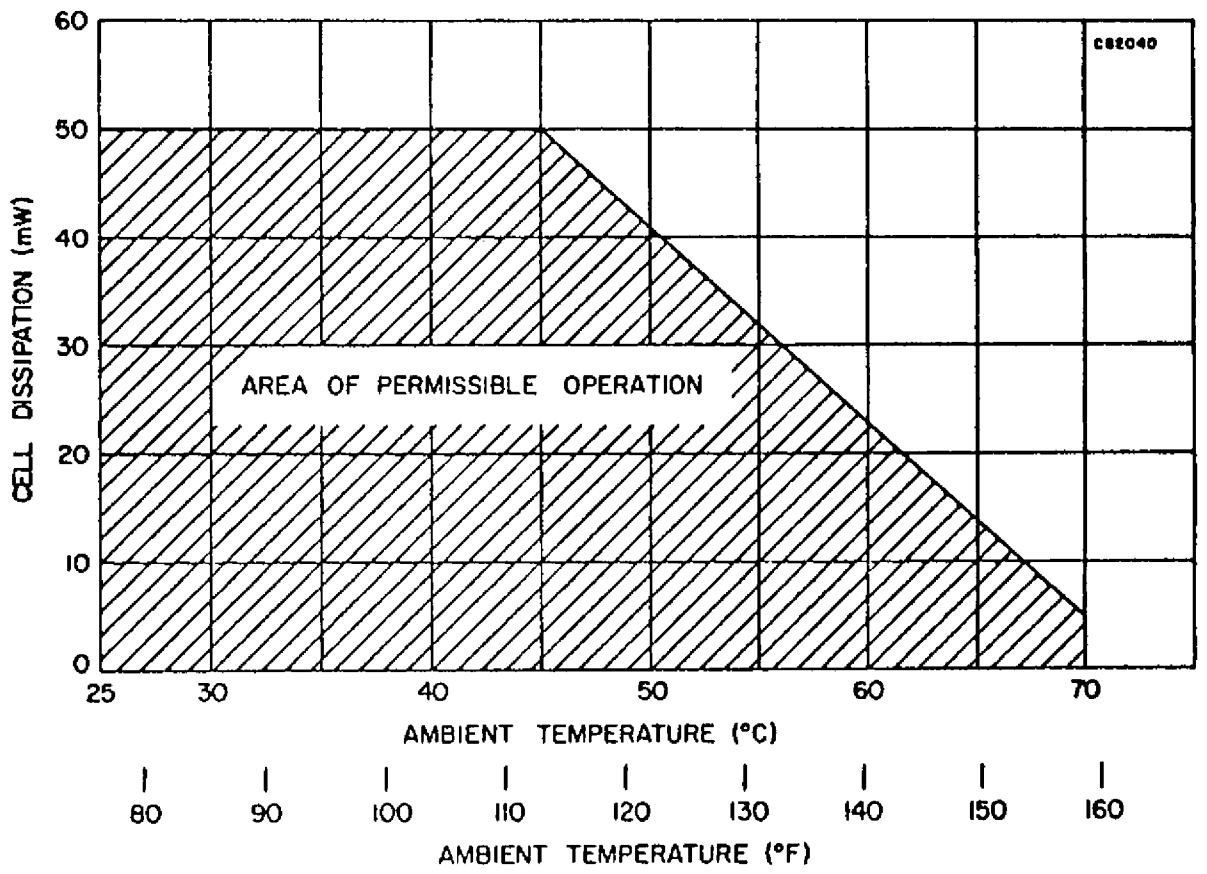
SPECTRAL RESPONSE



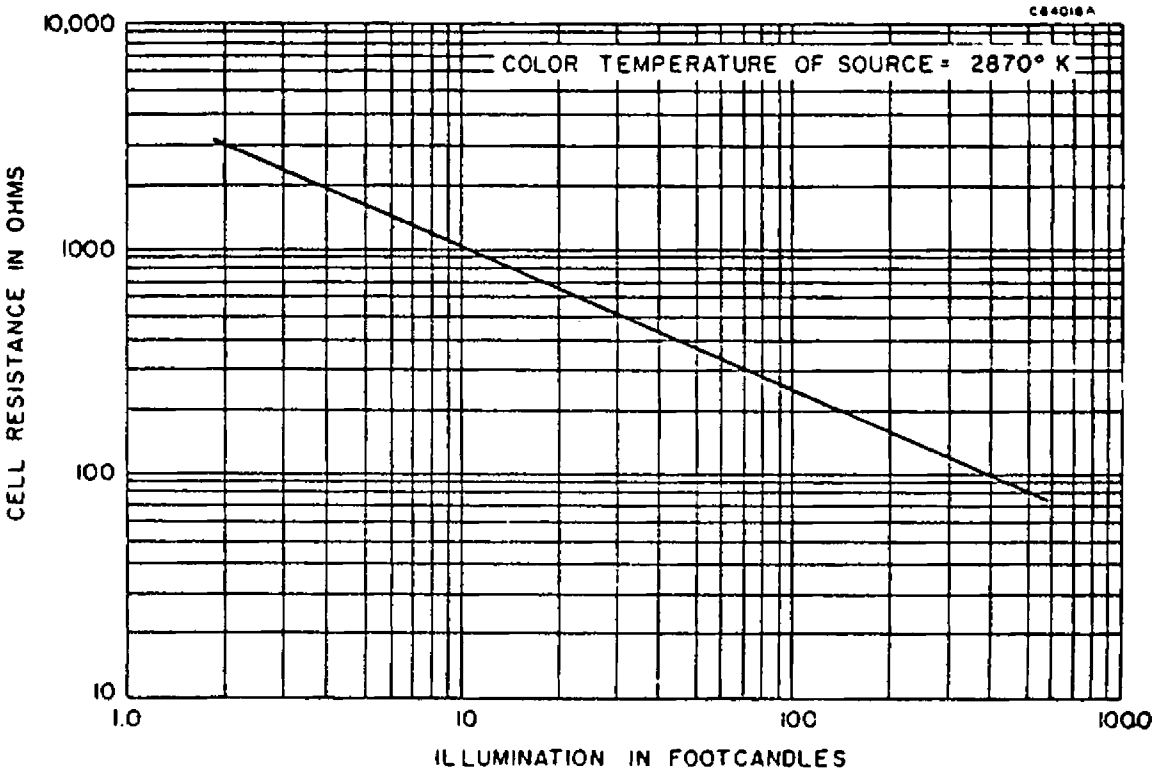
SPECTRAL CHARACTERISTIC OF HUMAN EYE,
TUNGSTEN AND FLUORESCENT LAMPS



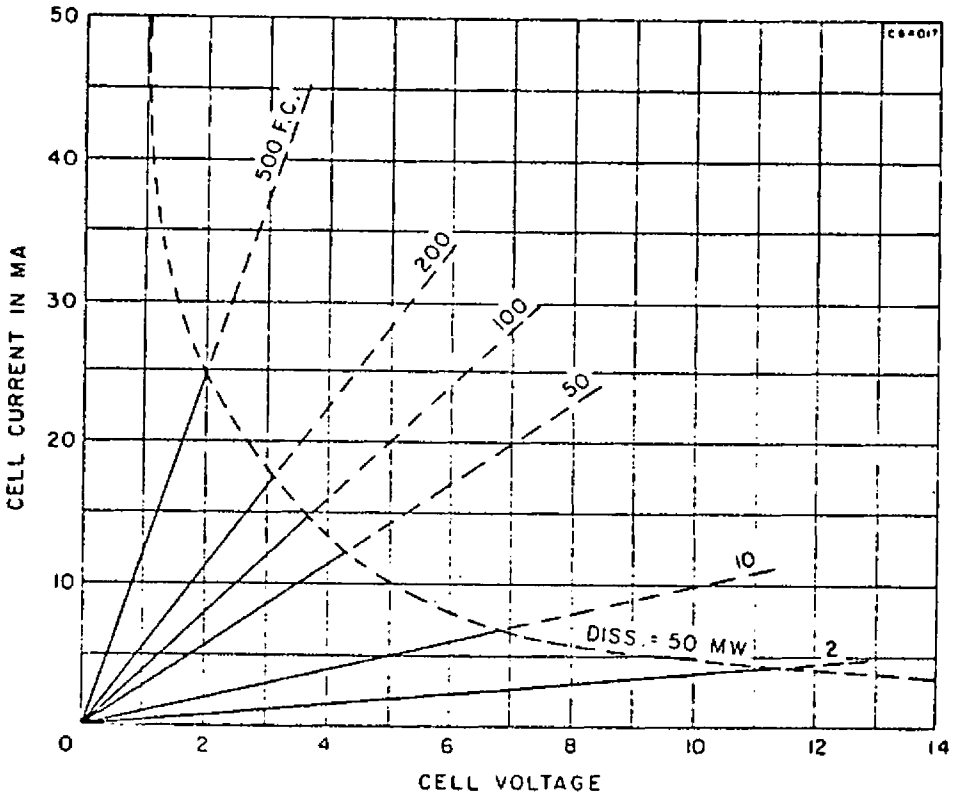
PERMISSIBLE DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



CELL RESISTANCE VS ILLUMINATION



CELL CURRENT AND DISSIPATION VS VOLTAGE



GENERAL DATA

Spectral Response	See Curve
Wavelength of Max. Response	6100 ± 400 Angstroms
Sensitive Material	Cadmium-Sulfide
Sensitive Area	Viewed from End
Construction	Hermetically Sealed in Glass with Flexible Leads
Outline	See Drawing
Operating Position	Any

ELECTRICAL DATA

RATINGS (Absolute Maximum Values)

Breakdown Voltage[2]	300	Volts
Dissipation (See Curve)		
T-amb = 25°C	50	mW
T-amb = 70°C	5	mW
Ambient Temperature Range	-40 to +70	°C
Illumination	Note 3	

CHARACTERISTICS

Cell Resistance[4]		
Illumination 2 FC		
Color Temperature 2870°K	6000	Ohms
Dark Resistance[5]	600,000	Ohms Min.

NOTES:

1. Minute increases in relative humidity will produce change in color.

2. Measured with cell in complete darkness at a pulse rate of 100 pps, 100 μ sec. duration. Voltage in excess of the rated value may damage the cell. Max. DC or AC peak voltage is limited by max. dissipation and min. dark resistance rating.

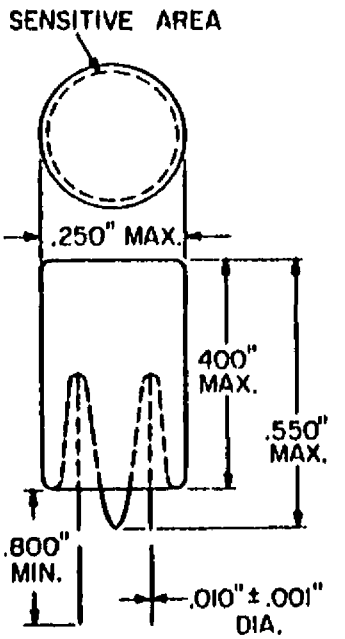
3. Care should be exercised to prevent localized overheating of the sensitive surface when the cell is used with a lens system.

4. Measured after 60 minutes minimum exposure to approximately 50 FC illumination (ambient room light).

5. Measured in complete darkness, 10 seconds after removal of 2 FC illumination.

QUICK REFERENCE DATA

The Sylvania Type 8476 is a miniature cadmium-sulfide photoconductive cell featuring high sensitivity and hermetically sealed-in-glass construction. The cell is gaseous back-filled for a high dissipation safety factor and includes a blue-dot compound which turns pink[1] if the cell envelope becomes damaged. The 8476 is designed for use in a wide variety of industrial applications.



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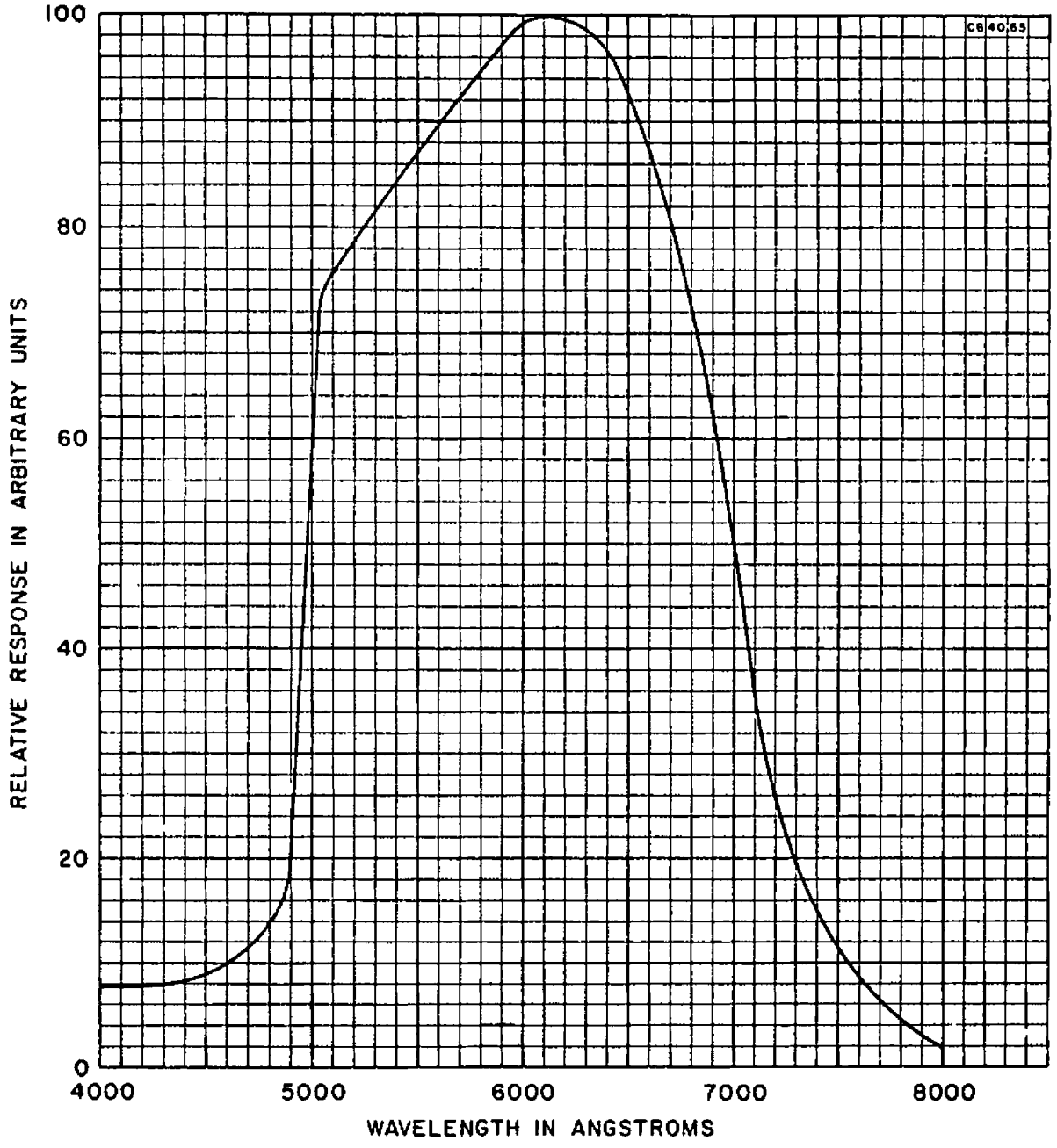
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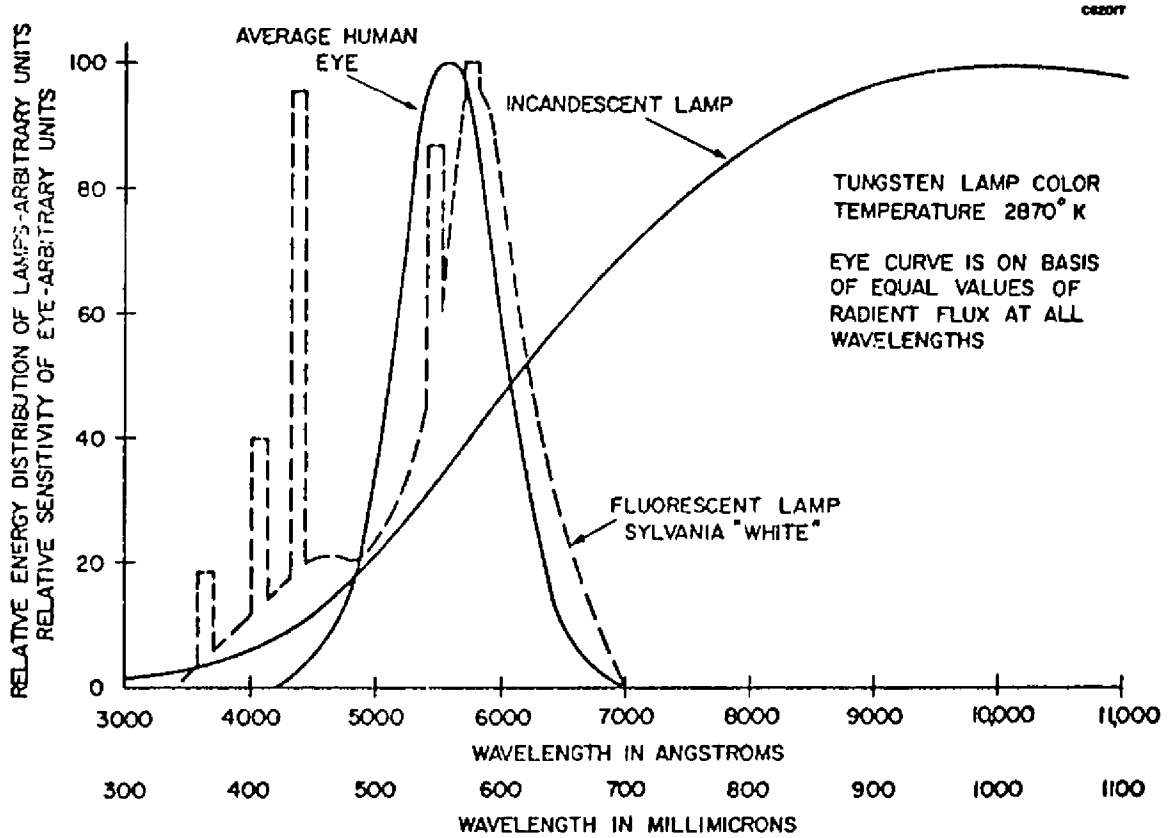
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from JEDEC release #4791, Aug. 31, 1964

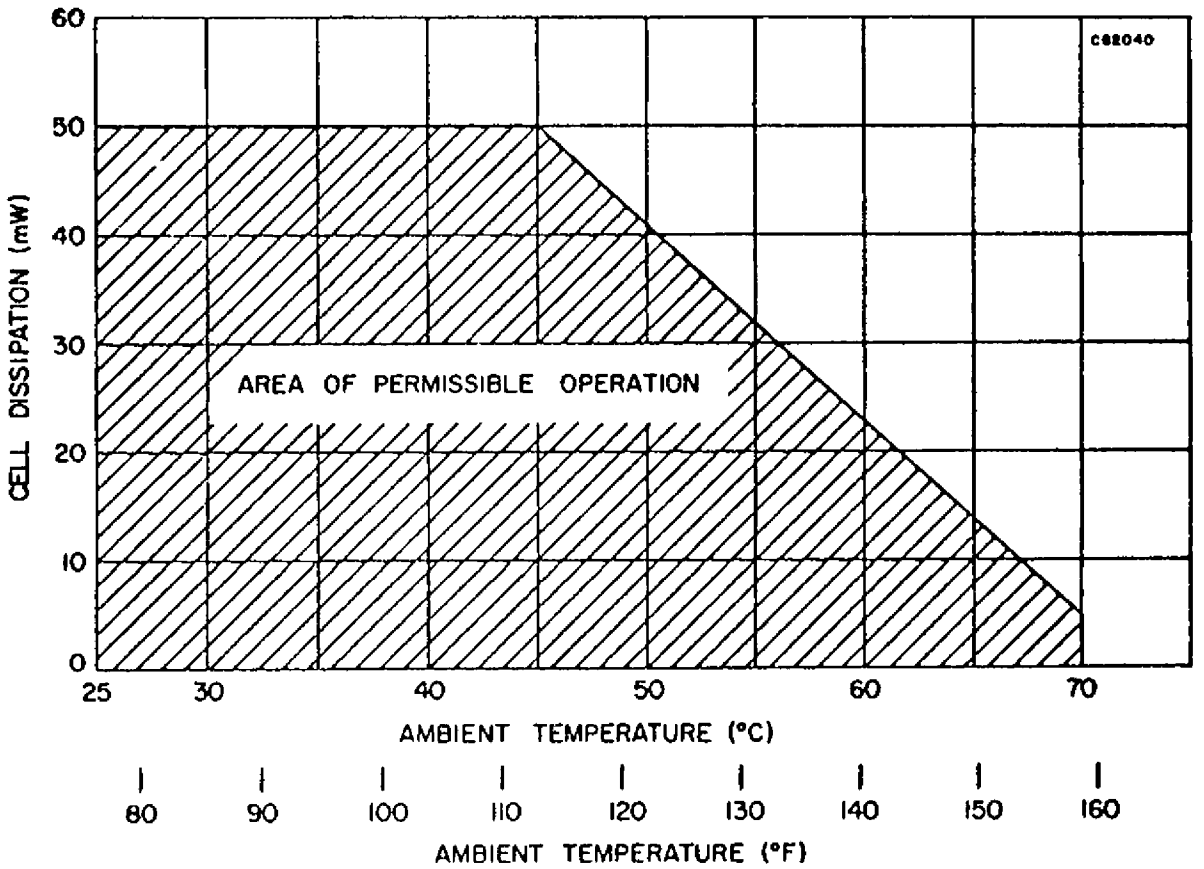
SPECTRAL RESPONSE



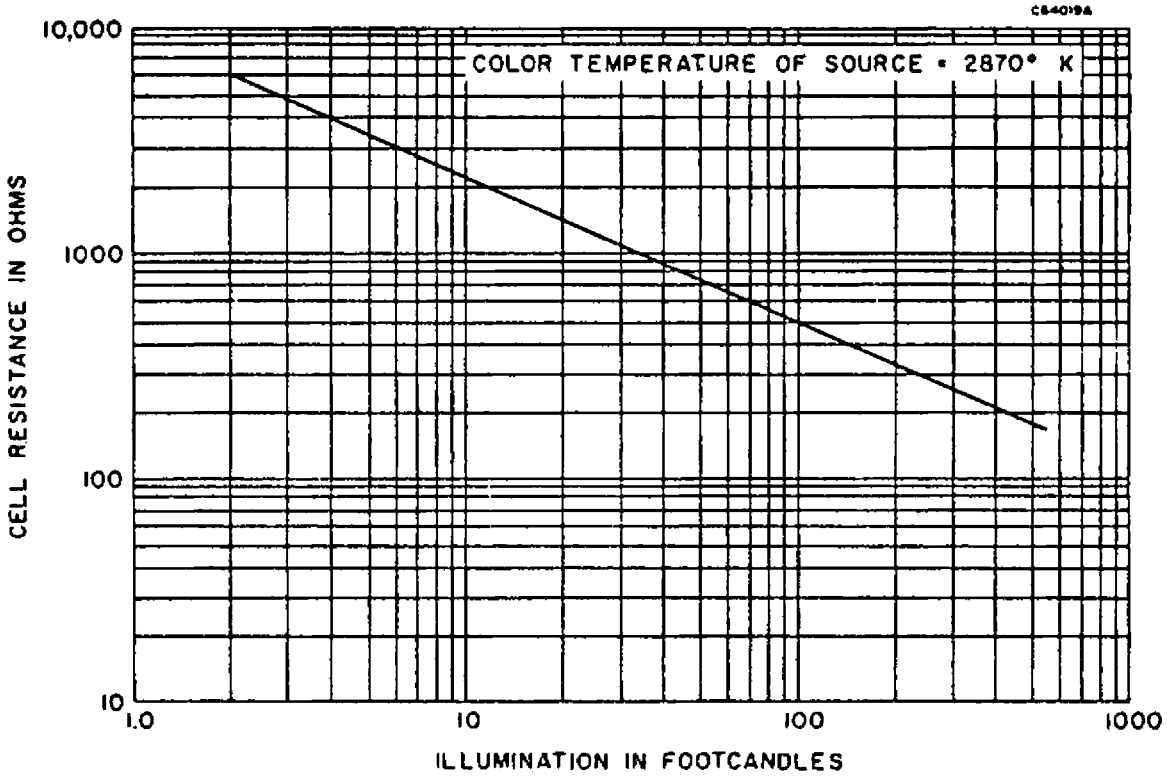
SPECTRAL CHARACTERISTIC OF HUMAN EYE,
TUNGSTEN AND FLUORESCENT LAMPS



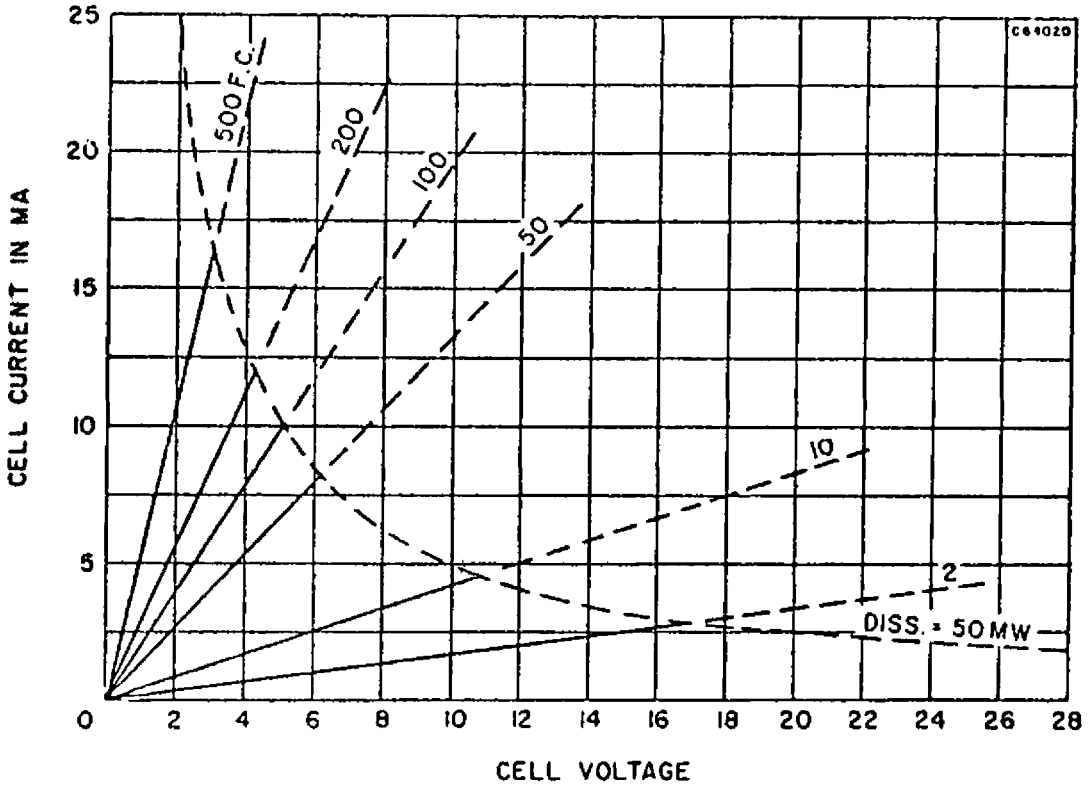
PERMISSIBLE DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



CELL RESISTANCE VS ILLUMINATION



CELL CURRENT AND DISSIPATION VS VOLTAGE



GENERAL DATA

Spectral Response	See Curve
Wavelength of Max. Response	6100 ± 400 Angstroms
Sensitive Material	Cadmium-Sulfide
Sensitive Area	Viewed from End
Construction	Hermetically Sealed in Glass with Flexible Leads
Outline	See Drawing
Operating Position	Any

ELECTRICAL DATA

RATINGS (Absolute Maximum Values)

Breakdown Voltage[2]	300	Volts
Dissipation (See Curve)		
T-amb = 25°C	50	mW
T-amb = 70°C	5	mW
Ambient Temperature Range	-40 to +70	°C
Illumination	Note 3	

CHARACTERISTICS

Cell Resistance[4]		
Illumination 2 FC		
Color Temperature 2870°C	12,000	Ohms
Dark Resistance[5]	1.2	Megohms Min.

NOTES:

1. Minute increases in relative humidity will produce change in color.

2. Measured with cell in complete darkness at a pulse rate of 100 pps, 100 μ sec. duration. Voltage in excess of the rated value may damage the cell. Max. DC or AC peak voltage is limited by max. dissipation and min. dark resistance rating.

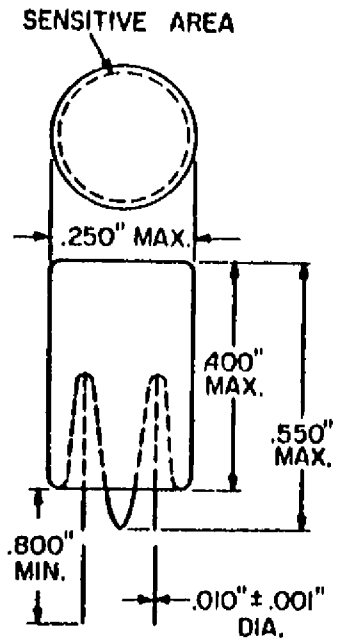
3. Care should be exercised to prevent localized overheating of the sensitive surface when the cell is used with a lens system.

4. Measured after 60 minutes minimum exposure to approximately 50 FC illumination (ambient room light).

5. Measured in complete darkness, 10 seconds after removal of 2 FC illumination.

QUICK REFERENCE DATA

The Sylvania Type 8477 is a miniature cadmium-sulfide photoconductive cell featuring high sensitivity and hermetically sealed-in-glass construction. The cell is gaseous back-filled for a high dissipation safety factor and includes a blue-dot[1] compound which turns pink[1] if the cell envelope becomes damaged. The 8477 is designed for use in a wide variety of industrial applications.



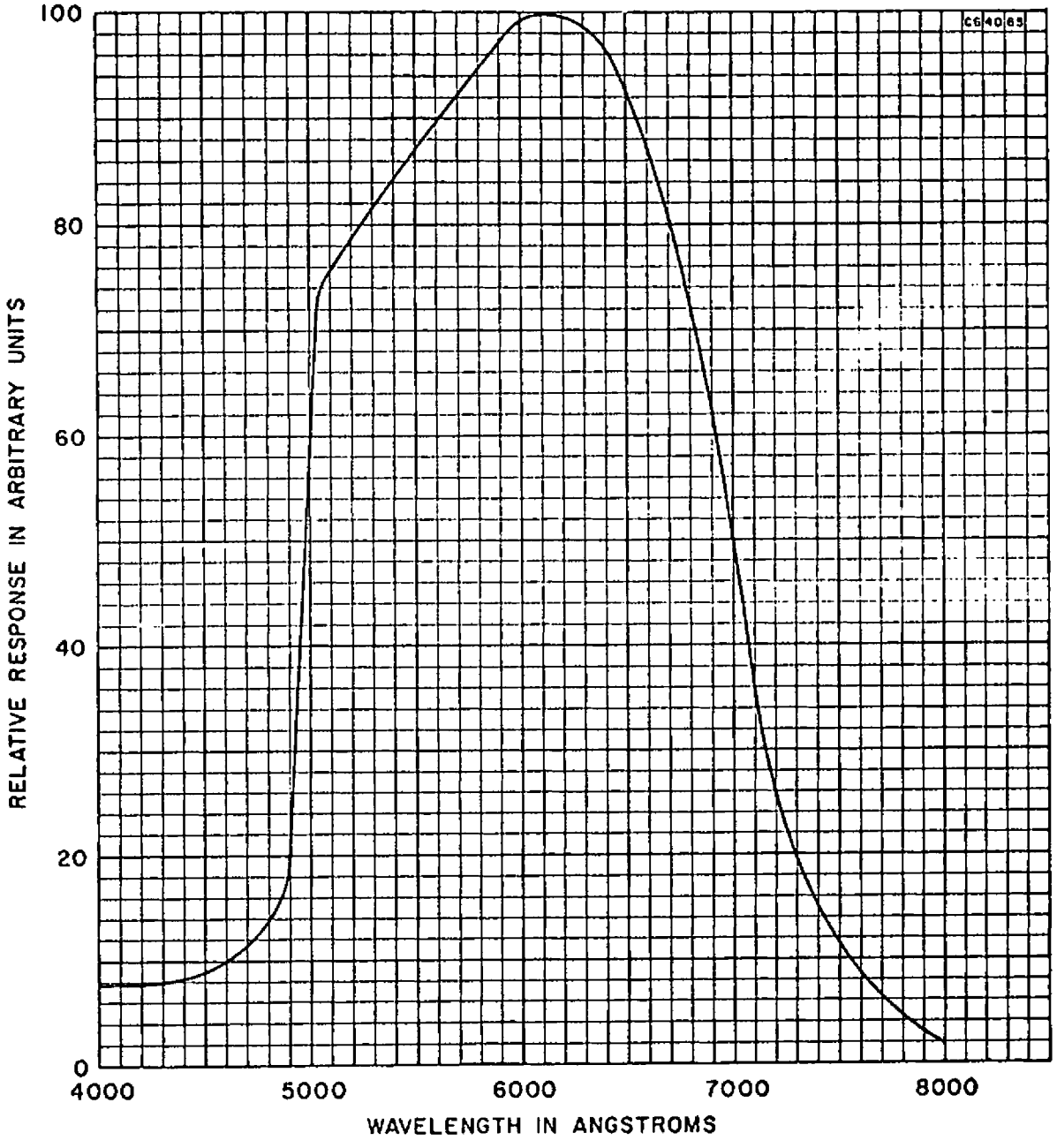
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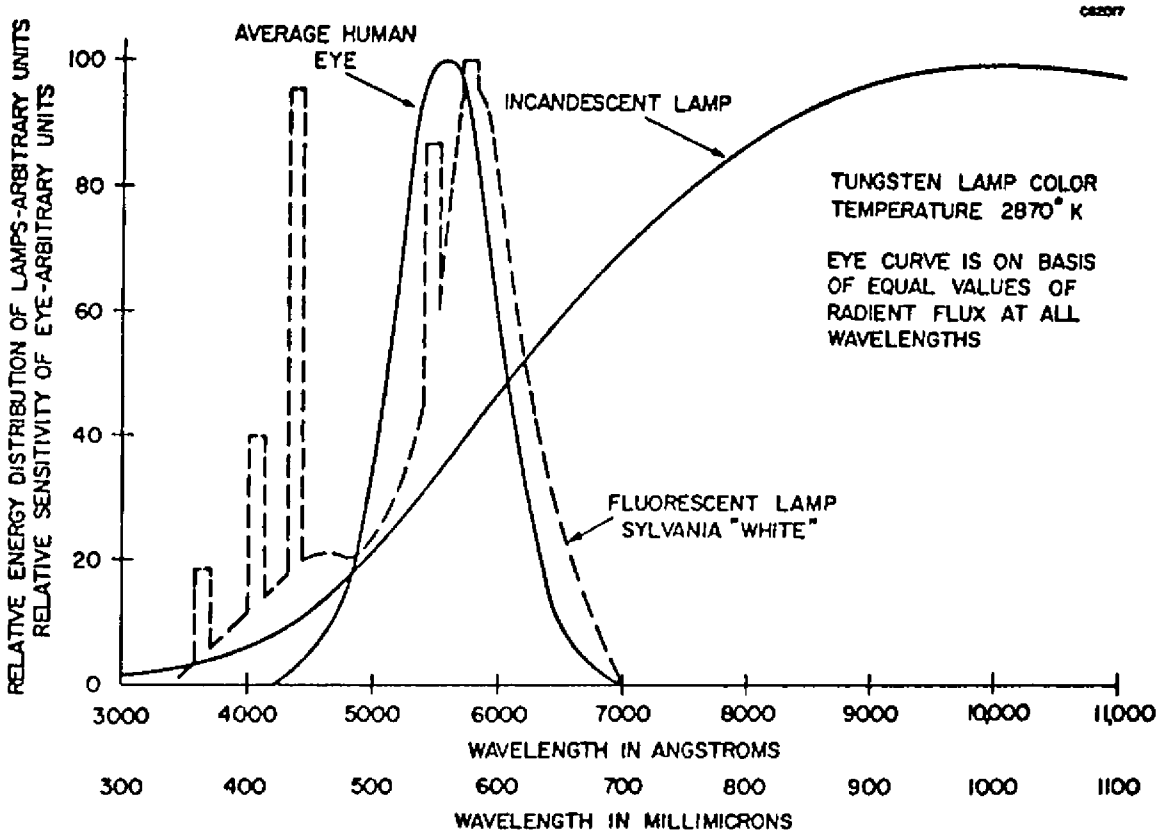
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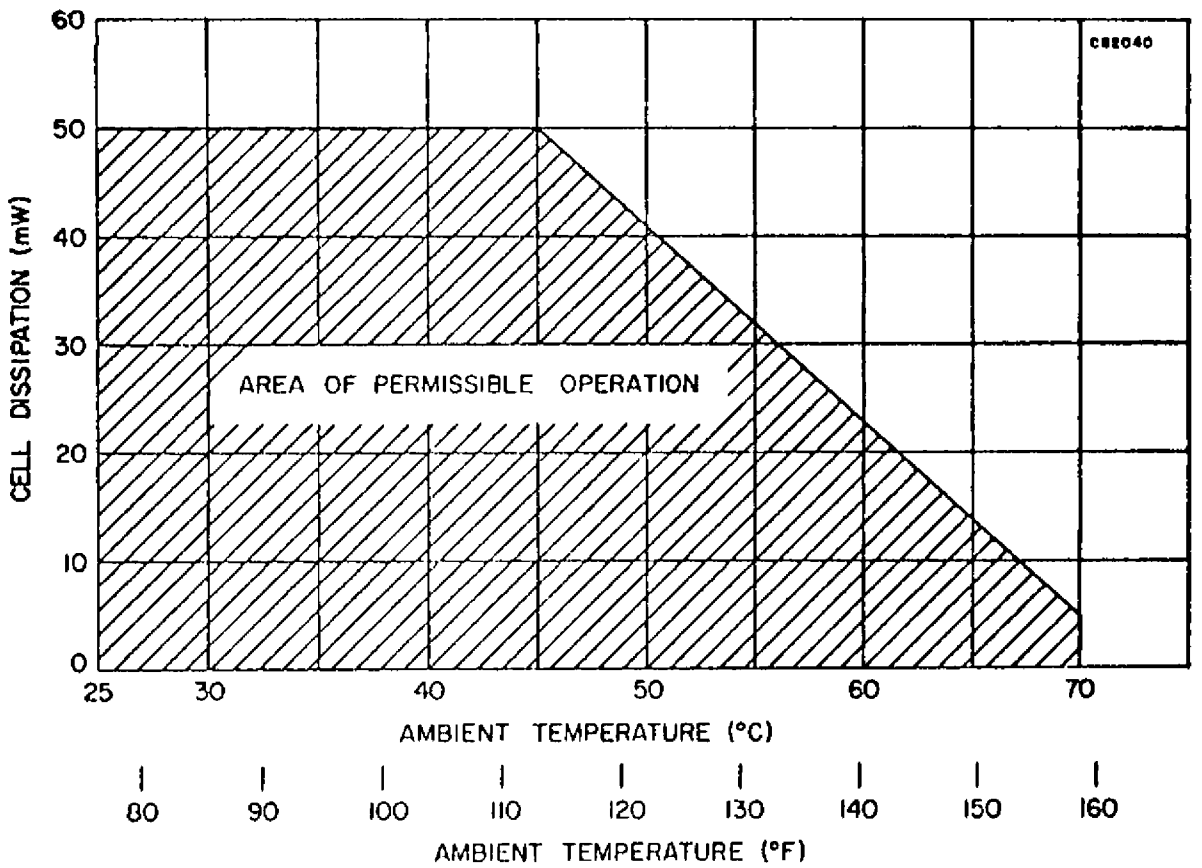
SPECTRAL RESPONSE



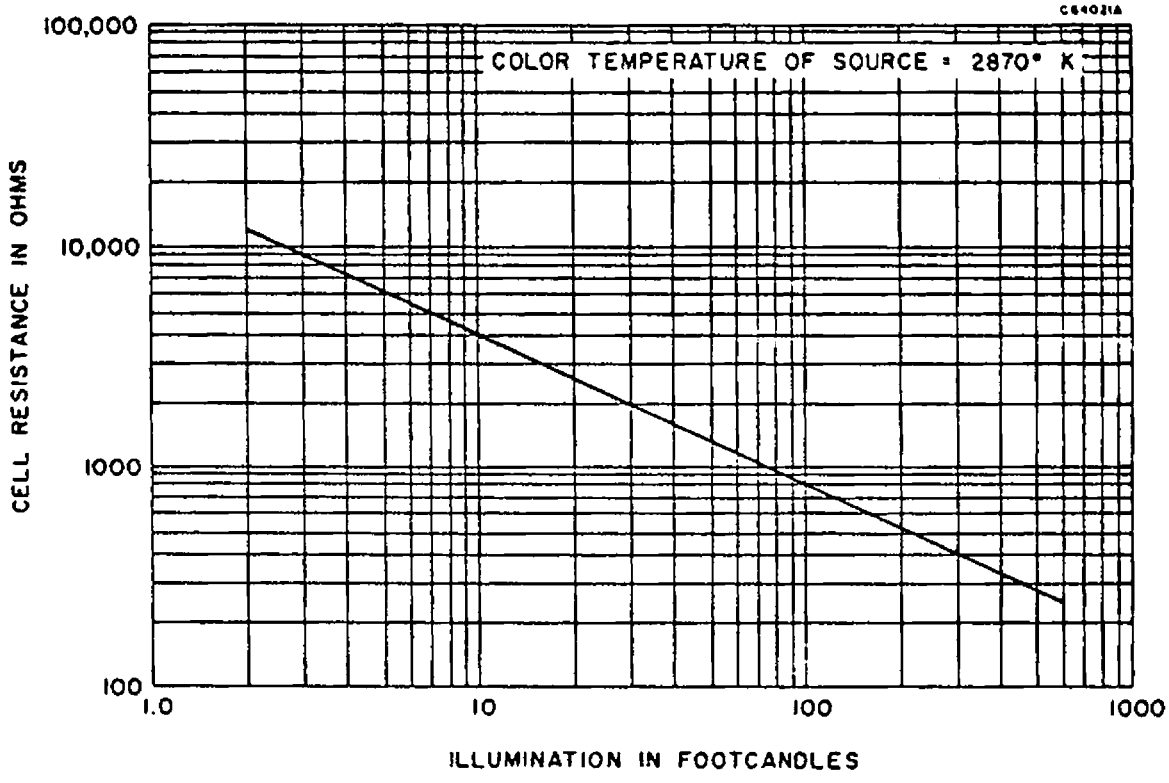
SPECTRAL CHARACTERISTIC OF HUMAN EYE,
TUNGSTEN AND FLUORESCENT LAMPS



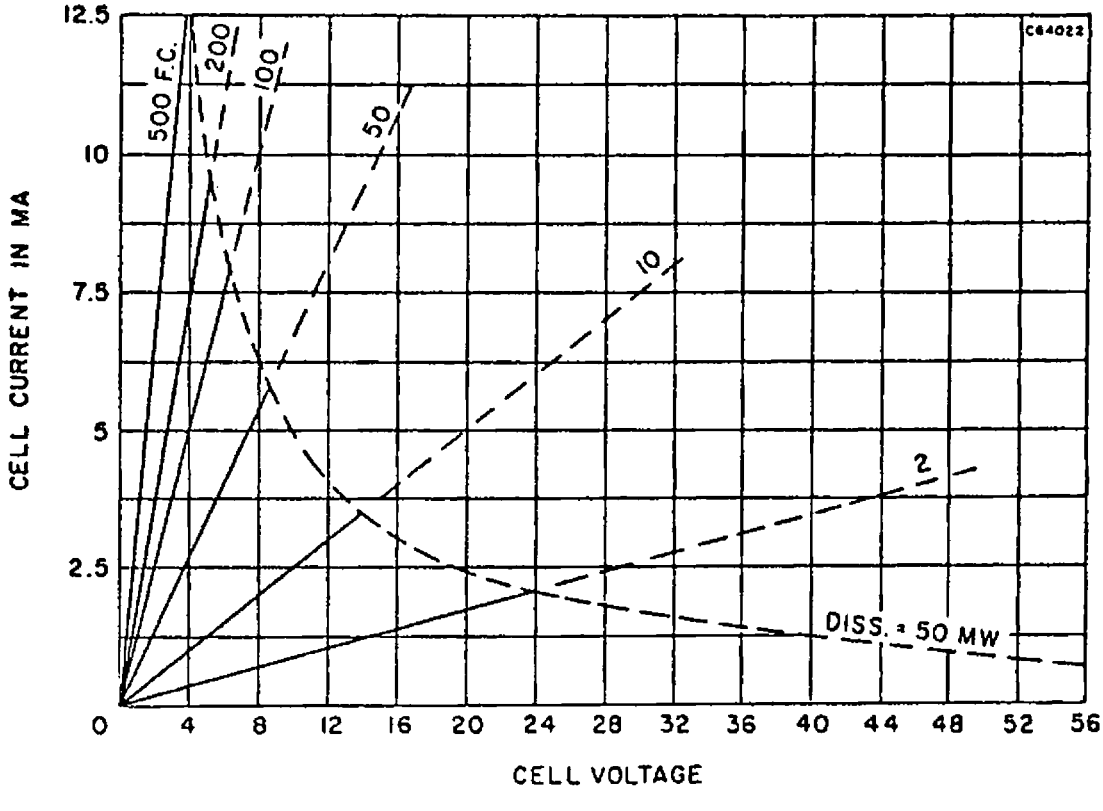
PERMISSIBLE DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



CELL RESISTANCE VS ILLUMINATION



CELL CURRENT AND DISSIPATION VS VOLTAGE



GENERAL DATA

Spectral Response	See Curve
Wavelength of Max. Response	6100 ± 400 Angstroms
Sensitive Material	Cadmium-Sulfide
Sensitive Area	Viewed from End
Construction	Hermetically Sealed in Glass with Flexible Leads
Outline	See Drawing
Operating Position	Any

ELECTRICAL DATA

RATINGS (Absolute Maximum Values)

Breakdown Voltage[2]	300	Volts
Dissipation (See Curve)		
T-amb = 25°C	50	mW
T-amb = 70°C	5	mW
Ambient Temperature Range	-40 to +70	°C
Illumination	Note 3	

CHARACTERISTICS

Cell Resistance[4]		
Illumination 2 FC		
Color Temperature 2870°K	24,000	Ohms
Dark Resistance[5]	2.4	Megohm Min.

NOTES:

1. Minute increased in relative humidity will produce change in color.

2. Measured with cell in complete darkness at a pulse rate of 100 pps, 100 μ sec. duration. Voltage in excess of the rated value may damage the cell. Max. DC or AC peak voltage is limited by max. dissipation and min. dark resistance rating.

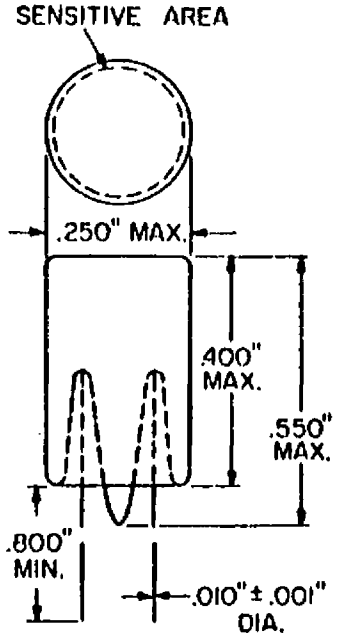
3. Care should be exerised to prevent localized overheating of the sensitive surface when the cell is used with a lens system.

4. Measured after 60 minutes minimum exposure to approximately 50 FC illumination (ambient room light).

5. Measured in complete darkness, 10 seconds after removal of 2 FC illumination.

QUICK REFERENCE DATA

The Sylvania Type 8478 is a miniature cadmium-sulfide photoconductive cell featuring high sensitivity and hermetically sealed-in-glass construction. The cell is gaseous back-filled for a high dissipation safety factor and includes a blue dot compound which turns pink[1] if the cell envelope become damaged. The 8478 is designed for use in a wide variety of industrial applications.



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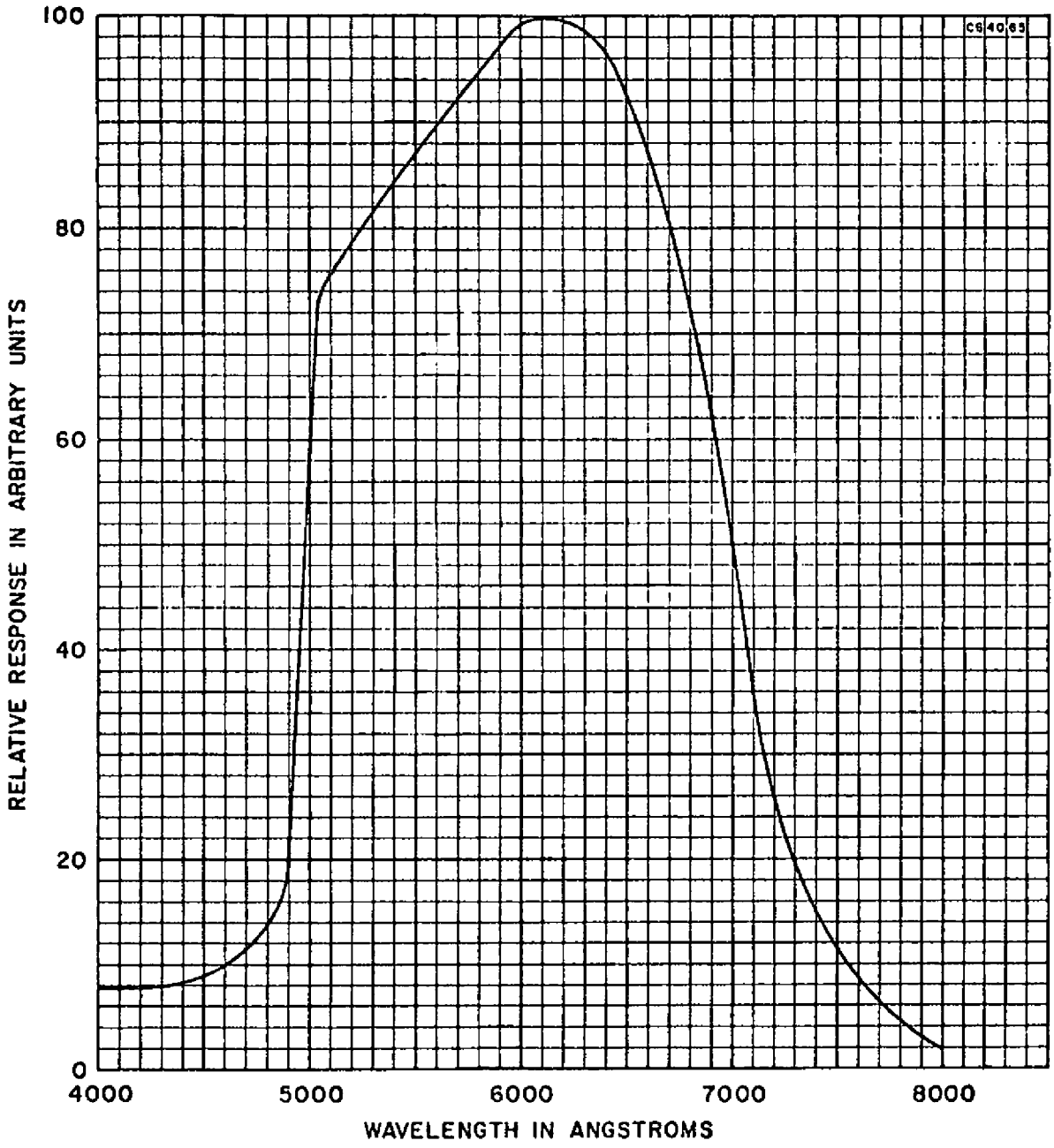
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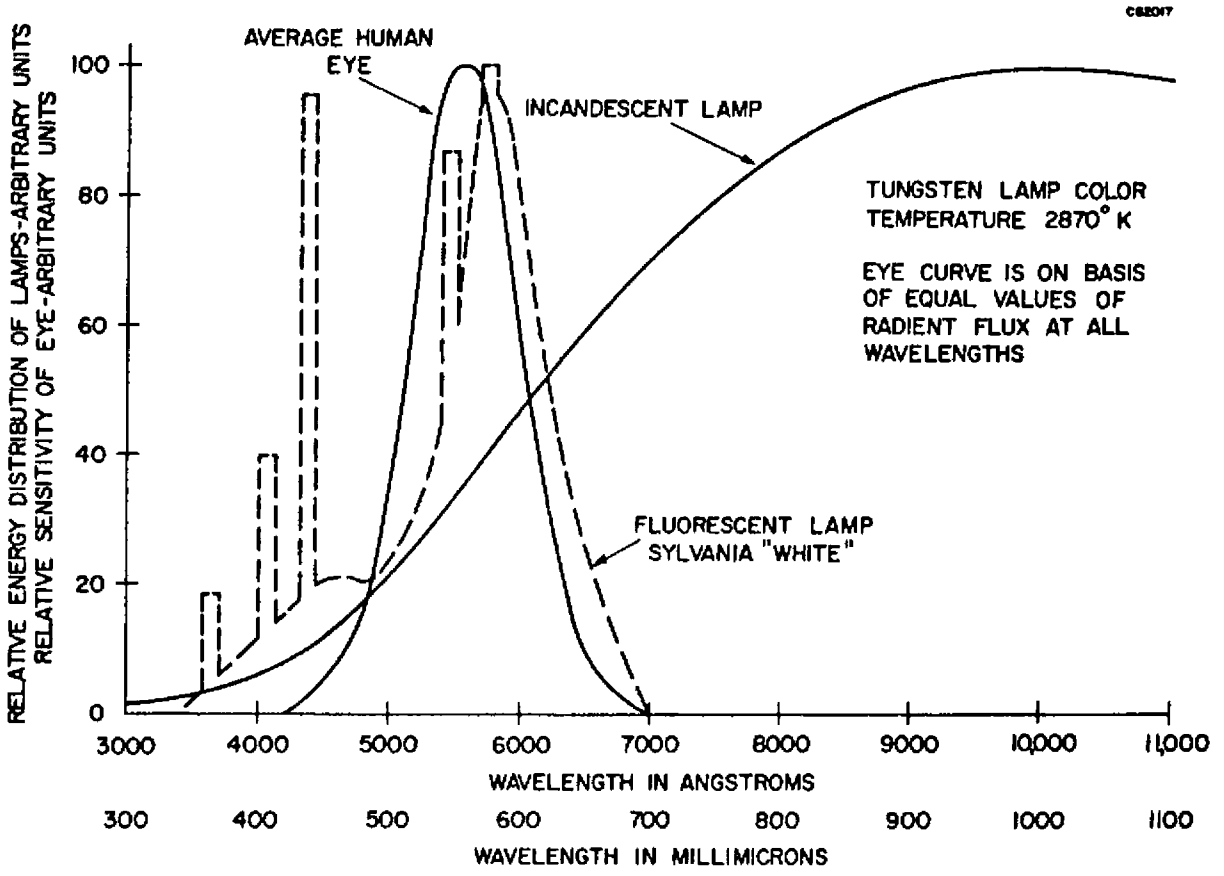
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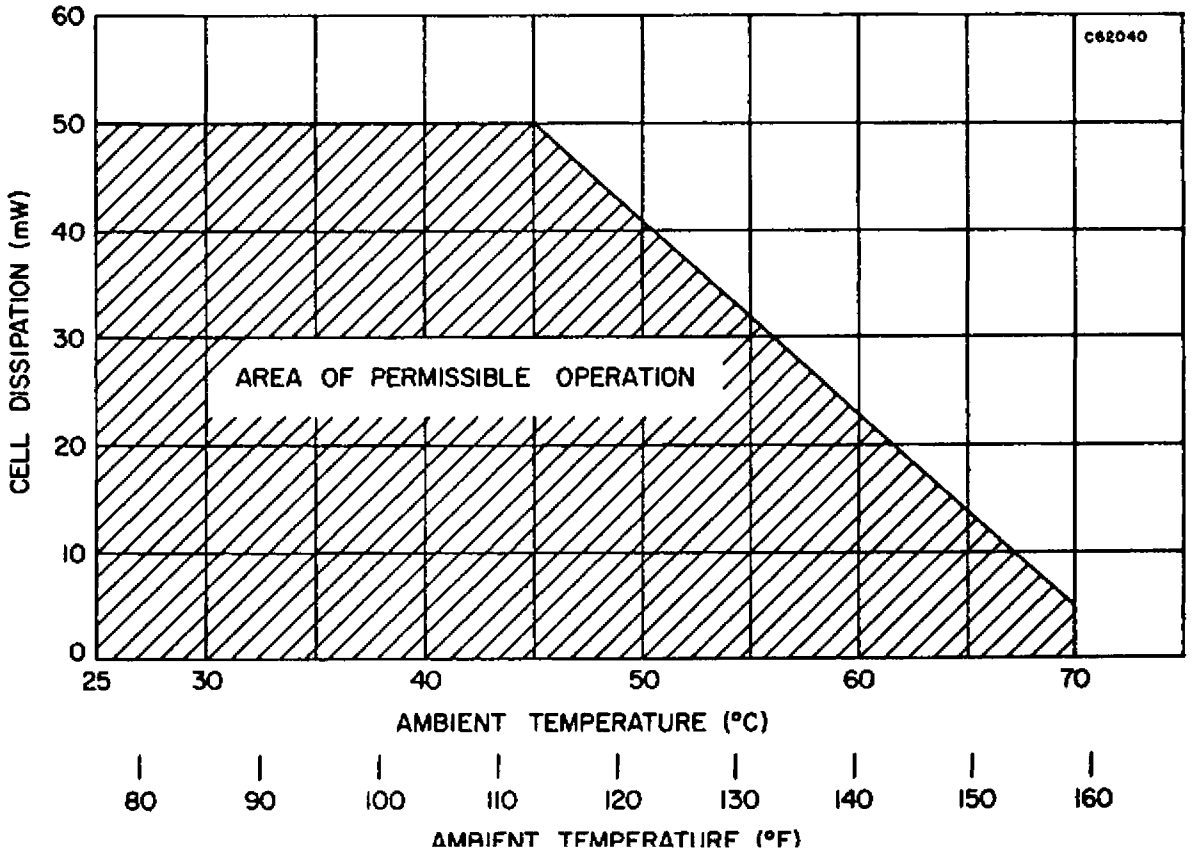
SPECTRAL RESPONSE



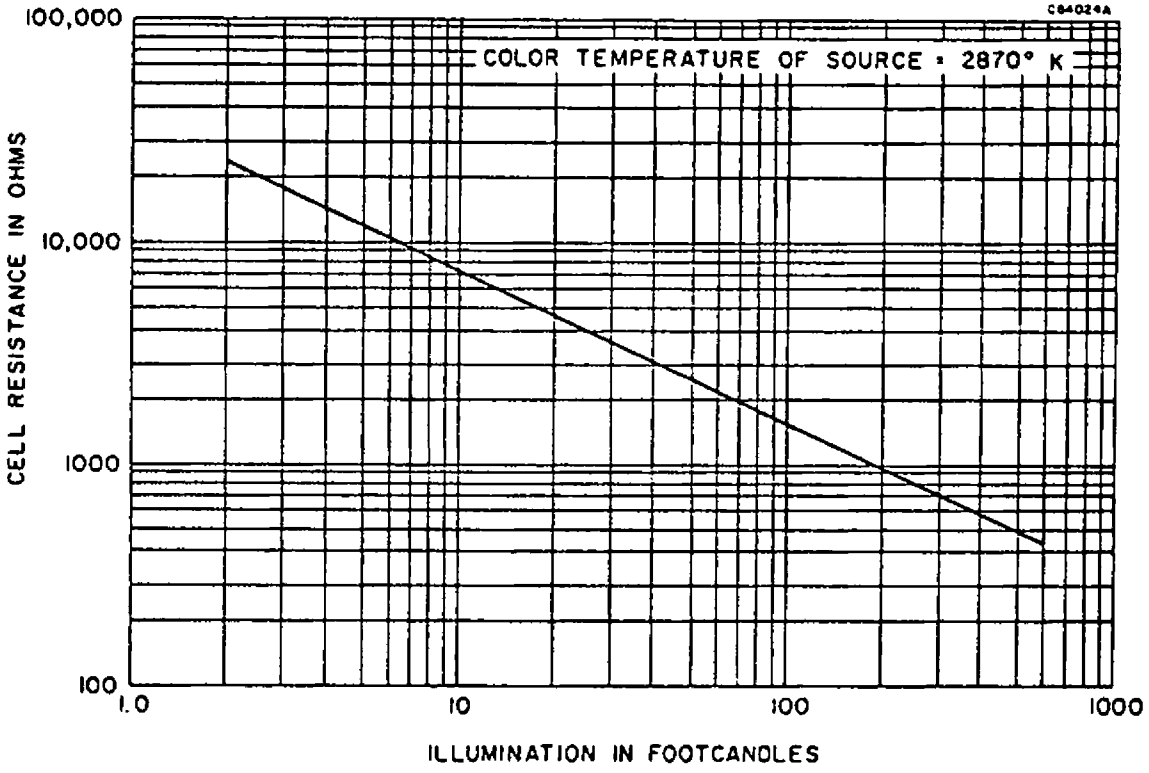
SPECTRAL CHARACTERISTIC OF HUMAN EYE,
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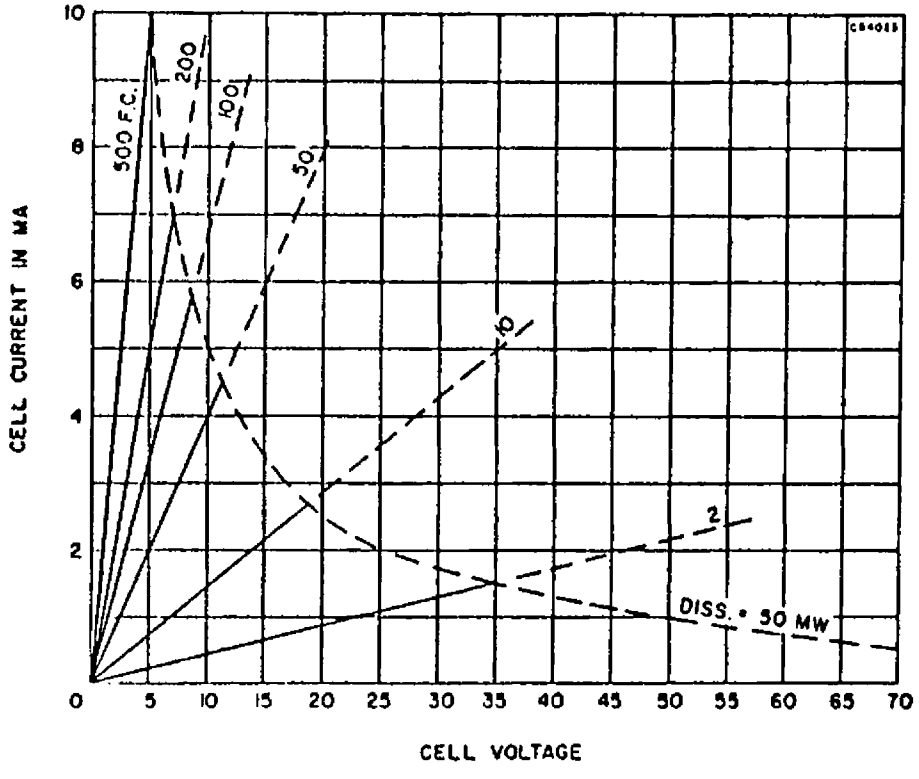
PERMISSIBLE DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



CELL RESISTANCE VS ILLUMINATION



CELL CURRENT AND DISSIPATION VS VOLTAGE



ELECTRON TUBE DIVISION
BOX 100 EASTON, PA. 18043
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

HYDROGEN THYRATRON 8488

DESCRIPTION:

The 8488 is a unipotential cathode, three element hydrogen filled thyratron designed for network discharge service. In such service, it is suitable for producing pulse outputs of more than 2 megawatts at an average power level of more than 1.6 KW.

The 8488 features a patented hollow anode connector design which provides direct exposure of the anode to the atmosphere. This permits "battle short" starts without catastrophic failure.

Other features of the 8488 include an internal hydrogen reservoir connected across the filament and capable of producing and maintaining the hydrogen pressure throughout the useful life of the tube. Further features are the high peak voltage and current ratings and the ruggedized construction.

ELECTRICAL DATA, GENERAL:

	Nom.	Min.	Max.			
Heater Voltage	6.3	5.9	6.7	Volts AC	Minimum Heating Time	3 Minutes (Note 7)
Heater Current. E_h = 6.3 volts		9.0	11.0	Amperes		

MECHANICAL DATA, GENERAL:

Mounting Position	Any	Anode Cap	Medium Metal, C1-5 with modification.
Base	Super Jumbo 4-pin with Bayonet A4-18 with ceramic insert	Cooling	Note 1
		Net Weight	10 Ounces

DIMENSIONS:

See Outline Drawing.

RATINGS:

Max. Peak Anode Voltage, Forward	16.0 Kilovolts	Max. RMS Anode Current (Note 3)	6.3 Amperes AC
Max. Peak Anode Voltage, Inverse (Note 2)	16.0 Kilovolts	Max. epy x Ib x prr	3.9 x 10^9
		Max. Anode Current Rate of Rise	1500 Amperes/μ second
Min. Anode Supply Voltage	3.5 Kilovolts DC	Peak Trigger Voltage	Note 4
Max. Peak Average Anode Current	325 Amperes	Max. Peak Inverse Trigger Voltage	200 Volts
Max. Average Anode Current	225 Milliamperes		

	Initial Limit	End of Life Limit		
Max. Anode Delay Time (Note 5)	0.6	0.6	Microsecond	Ambient Temperature: −50° to + 90° Cent.
Max. Anode Delay Time Drift	0.1	0.1	Microsecond	Shock Rating: 26° Navy (Flyweight) Shock Machine
Max. Time Jitter (Note 6)	0.0005	0.01	Microsecond	

Note 1:

Cooling permitted. However, there shall be no air blast directly on the bulb.

from JEDEC release #4735, June 22, 1964

Note 2:

The peak inverse anode voltage shall not exceed 5.0 KV during the first 25 microseconds after the pulse.

Note 3:

The root mean square anode current shall be computed as the square root of the product of the peak current and the average current.

Note 4:

The driver pulse, measured at the tube socket with the thyratron grid disconnected, shall have the following characteristics:

A.	Voltage	200-300 Volts
B.	Duration	2 Microseconds (at 70% points)
C.	Rate of Rise	200 Volts/microsecond (min.)
D.	Impedance	50-500 Ohms

The limits of anode time delay and anode time jitter are based on the minimum trigger. Using the highest permissible trigger voltage and lowest trigger source impedance materially reduces these values below the limits specified.

Note 5:

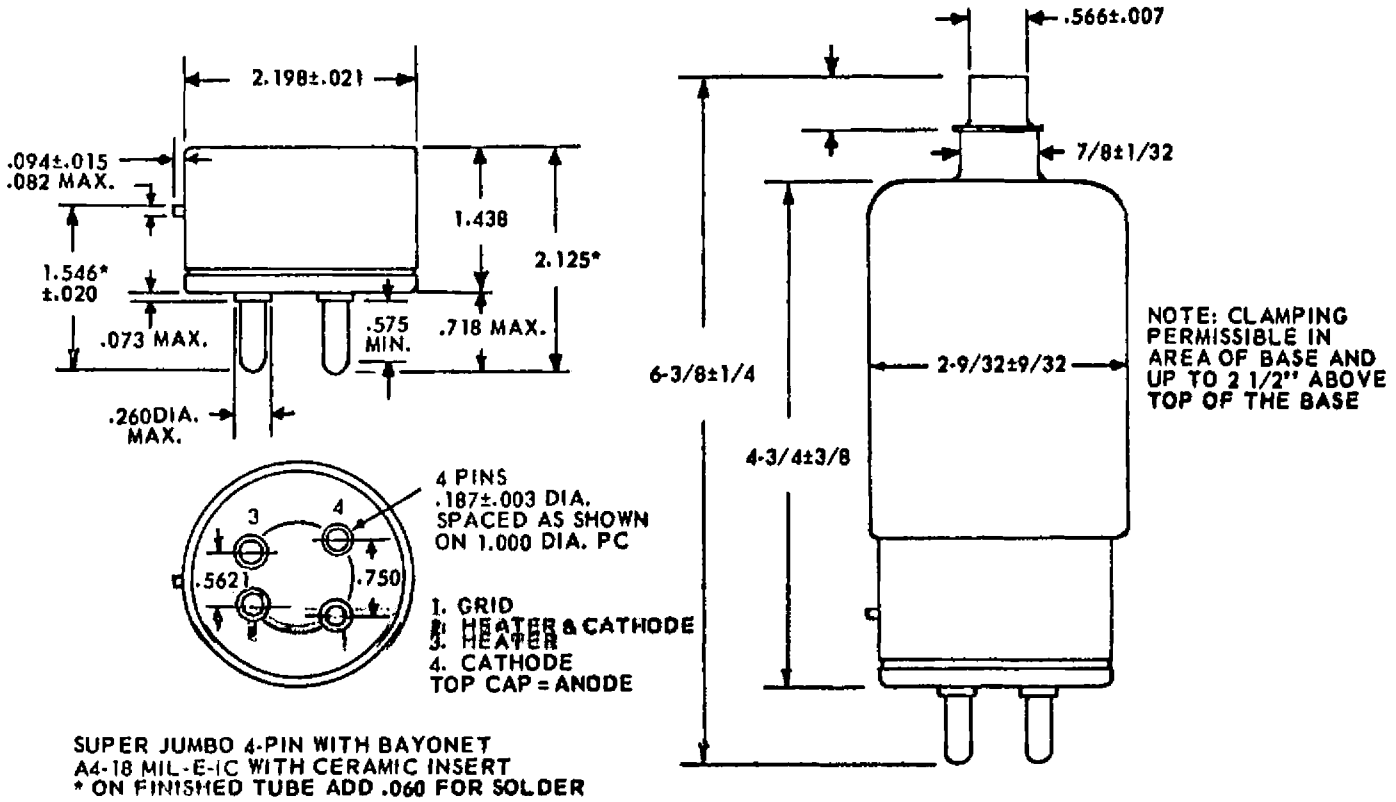
The time of anode delay is measured between the 26 percent point on the rising portion of the unloaded grid voltage pulse and the point at which evidence of anode conduction first appears on the loaded grid pulse.

Note 6:

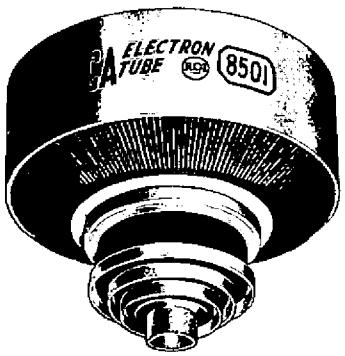
Time jitter is measured at the 50 percent point on the anode current pulse.

Note 7:

The 8488 will normally begin to operate in approximately 90 seconds. No damage will ensue on a cold start on this basis if anode power is restricted to 75% of ratings. However, the manufacturer should be consulted if this type of operation is contemplated.



SUPER JUMBO 4-PIN WITH BAYONET
A4-18 MIL-E-IC WITH CERAMIC INSERT
* ON FINISHED TUBE ADD .060 FOR SOLDER



CERMOLOX®
Thoriated-tungsten Mesh Filament
Forced-Air Cooled
5500 Watts UHF TV Output at 890 Mc
5500 Watts CW Output at 900 Mc
High Gain-Bandwidth Products

from JEDEC release #4660.
April 6, 1964

RCA-8501
BEAM POWER TUBE

RCA-8501▲ is a forced-air-cooled beam power tube designed especially for use in uhf television service in stationary and portable equipment. It is rated as an rf power amplifier in Class B television service, an rf power amplifier and oscillator in Class C telegraphy service, and an rf power amplifier in Class C FM telephony service.

The 8501 and variants of its basic design may also be useful in applications such as af power amplifiers or modulators, plate-modulated rf power amplifiers in Class C telephony service, AM or single-sideband linear rf power amplifiers, hard-tube modulators, pulsed-rf amplifiers, regulators, or other special services. Variations in cooling structure or other parameters are also possible. For information on variants, contact your RCA field representative, or the nearest District Sales Office.

Features of the 8501 include the Cermolox construction, a thoriated-tungsten mesh filament, and an integral louvered-fin radiator. Details of these features are described in the **Application Guide for RCA Power Tubes**, 1CE-300.

▲ Formerly Dev. No.A2751C.

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III. GENERAL APPLICATIONS	
This bulletin is to be used in conjunction with the publication **Application Guide for RCA Power Tubes**, 1CE-300. For a copy, write RCA, Commercial Engineering, Harrison, N.J.	

GENERAL DATA

Electrical:

Filamentary Cathode, Thoriated-Tungsten Mesh Type:		
Voltage (ac or dc)	4.5 typical 5.0 max.	volts volts
Current:		
Typical value at 4.5 volts	125	amp
Maximum value for starting, even momentarily	300	amp
Cold Resistance	0.005	ohm
Minimum heating time	15	sec

See further information on the filament in **Application Guide for RCA Power Tubes**, 1CE-300; *Section V.A.3,* **Filament or Heater**.

Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 1200, grid-No.2 volts = 900, and plate amp. = 8	16	
Direct Interelectrode Capacitances:		
Grid No.1 to plate[a]	0.32 max.	pf
Grid No.1 to filament	65	pf
Plate to filament[ab]	0.040 max.	pf
Grid No.1 to grid No.2	70	pf
Grid No.2 to plate	13	pf
Grid No.2 to filament[b]	2.0 max.	pf

Mechanical:

Operating Position	Vertical, either end up
Overall Length	5.65" max.
Greatest Diameter	6.17" max.
Terminal Connections	*See Dimensional Outline*
Radiator	Integral part of tube
Weight (Approx.)	10 lbs.

Thermal:

Terminal Temperature (Plate, grid No.2, grid No.1, cathode-filament and filament)	250 max.	°C
Plate-Core Temperature	250 max.	°C

See Dimensional Outline for temperature-measurement points

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8501 3-64
Printed in U.S.A.

RF POWER AMPLIFIER --
Class B Television Service[c]

Synchronizing-level conditions per tube unless otherwise specified

Maximum CCS Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	7000 max.	volts
DC GRID-No.2 VOLTAGE	1500 max.	volts
DC PLATE CURRENT	4 max.	amp
PLATE DISSIPATION	10,000 max.	watts
GRID-No.2 INPUT	150 max.	watts
GRID-No.1 INPUT	100 max.	watts

Typical CCS Operation:

In a cathode-drive circuit at 890 Mc and bandwidth of 8.5 Mc

DC Plate Voltage	5700	volts
DC Grid-No.2 Voltage	1000	volts
DC Grid-No.1 Voltage	-40	volts
DC Plate Current:		
Synchronizing level	2.9	amp
Pedestal level	2.2	amp
DC Grid-No.2 Current:		
Synchronizing level	0.015	amp
Pedestal level	0.011	amp
DC Grid-No.1 Current:		
Synchronizing level	0.375	amp
Pedestal level	0.275	amp
Driver Power Output:		
Synchronizing level	600	watts
Pedestal level	335	watts
Output Circuit Efficiency	80	%
Useful Power Output:		
Synchronizing level	5500	watts
Pedestal level	3100	watts

RF POWER AMPLIFIER & OSCILLATOR -- Class C Telegraphy[c]
and
RF POWER AMPLIFIER -- Class C FM Telephony[c]

Maximum CCS Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	7000 max.	volts
DC GRID-No.2 VOLTAGE	1500 max.	volts
DC GRID-No.1 VOLTAGE	-100 max.	volts
DC PLATE CURRENT	3 max.	amp
DC GRID-No.1 CURRENT	0.65 max.	amp
GRID-No.1 INPUT[d]	100 max.	watts
GRID-No.2 INPUT[e]	150 max.	watts
PLATE DISSIPATION	10,000 max.	watts
Maximum Circuit Values:		
Grid-No.1-Circuit Resistance	5,000 max.	ohms
Grid-No.2-Circuit Impedance	See Note d	
Plate-Circuit Impedance	See Note f	

Typical CCS Operation:

In Cathode-Drive Circuit at 900 Mc

DC Plate Voltage	5700	volts
DC Grid-No.2 Voltage	1000	volts
DC Grid-No.1 Voltage	-85	volts
DC Plate Current	2.7	amp
DC Grid-No.2 Current	0.025	amp
DC Grid-No.1 Current	0.200	amp
Driver Power Output	900	watts
Output-Circuit Efficiency	72	%
Useful Power Output	5500	watts

FOOTNOTES

[a] With external flat metal shield 8" in diameter having a center hole 3" in diameter. Shield is located in plane of the grid-No.2 terminal, perpendicular to the tube axis, and is connected to grid No.2.

[b] With external flat metal shield 8" in diameter having a center hole 2-3/8" in diameter. Shield is located in plane of the grid-No.1 terminal, perpendicular to the tube axis, and is connected to grid No.1.

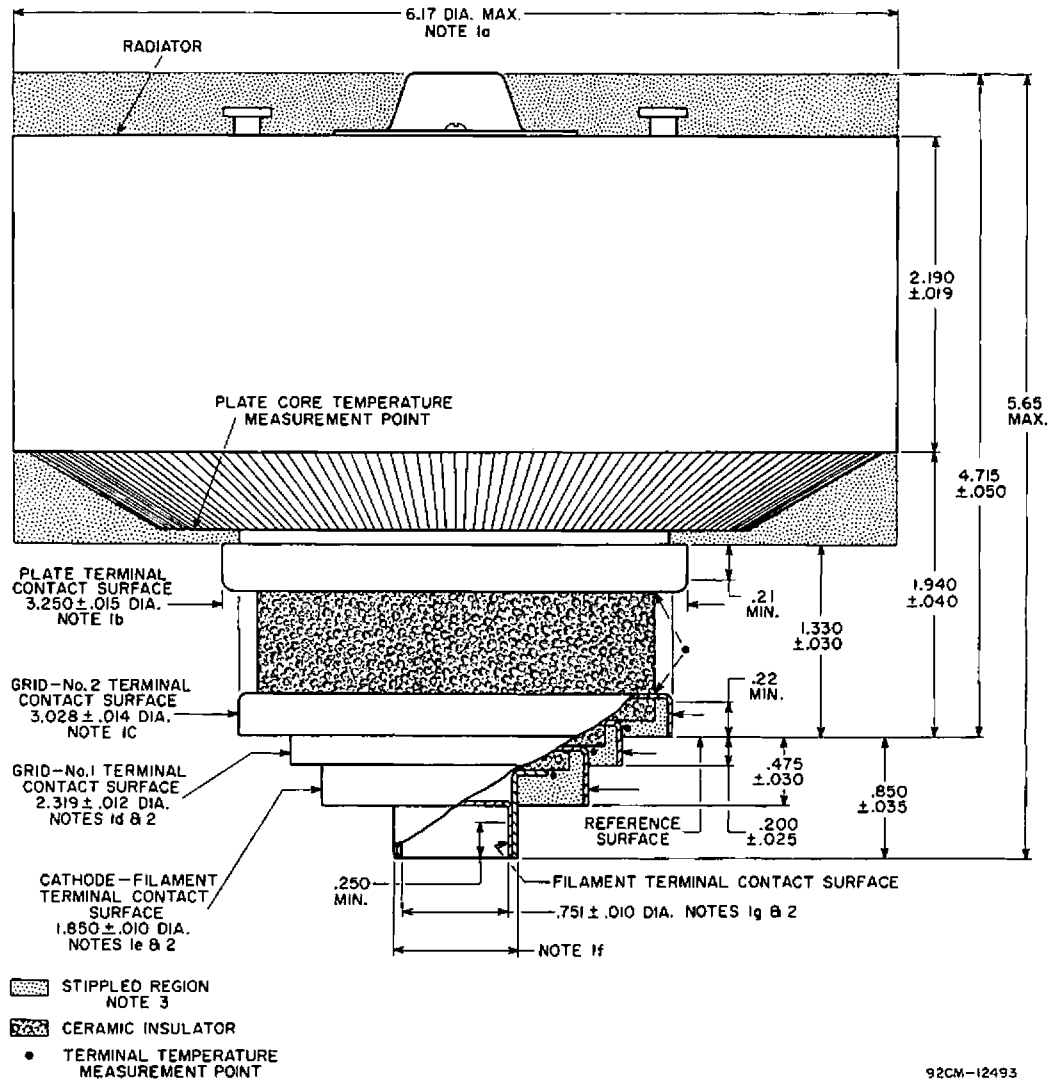
[c] See Section V.C. of 1CE-300.

[d] See Section V.B.2 of 1CE-300.

[e] See Section V.B.3 of 1CE-300.

[f] See Section V.B.1 of 1CE-300.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

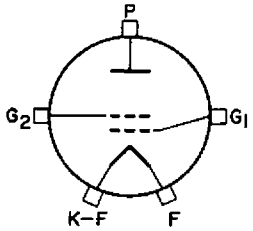
NOTE 1: CONCENTRICITY BETWEEN THE VARIOUS DIAMETERS IS SUCH THAT THE TUBE WILL ENTER A GAUGE HAVING SUITABLY SPACED CONCENTRIC APERTURES AND POSTS OF THE FOLLOWING DIAMETERS:

a. Radiator - 6.240
b. Plate Terminal - 3.288
c. Grid-No.2 Terminal - 3.061
d. Grid-No.1 Terminal - 2.338
e. Cathode-Filament Terminal - 1.878
f. Filament Terminal (OD) - 0.908
g. Filament Terminal (ID) - 0.722

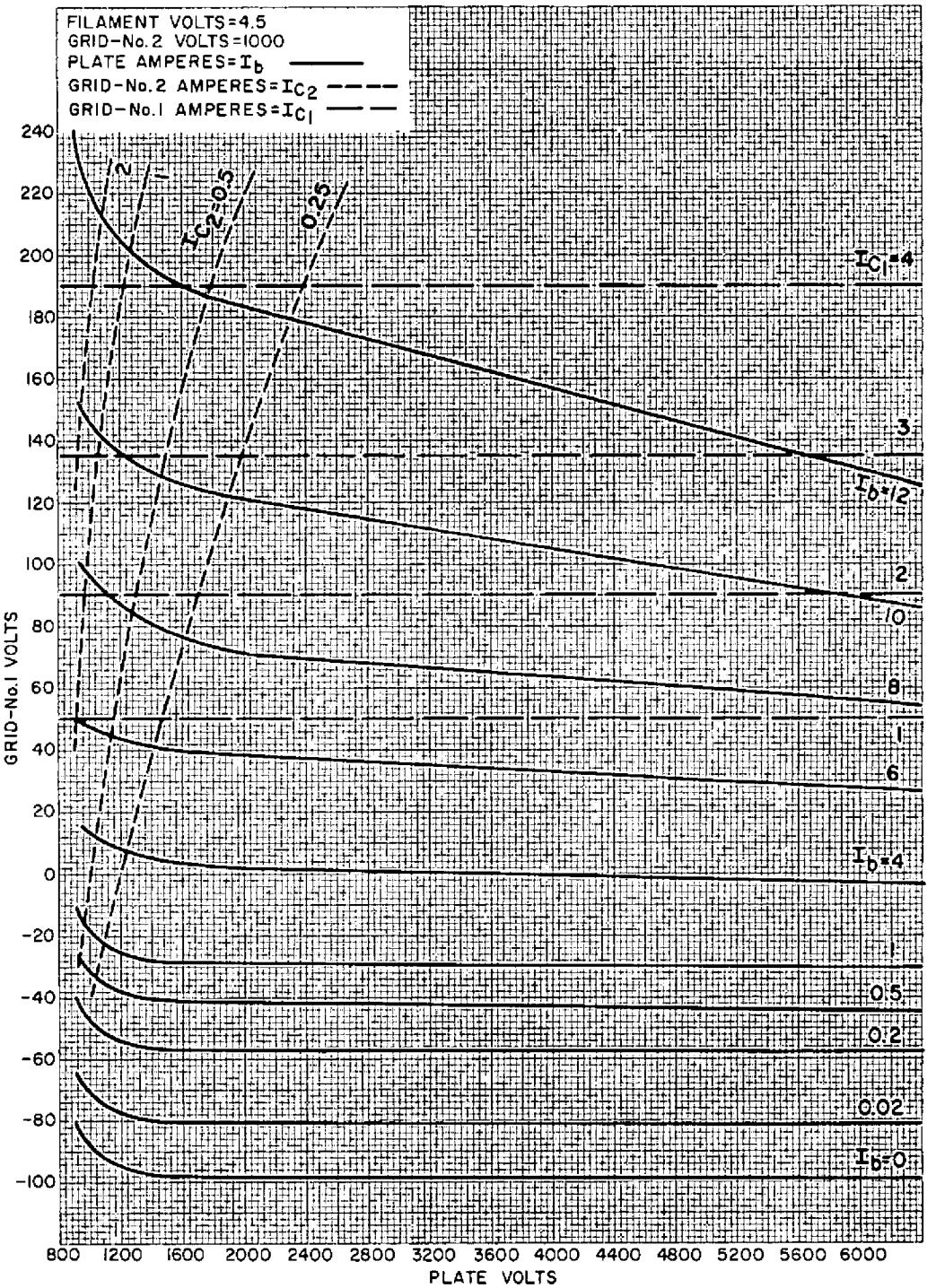
NOTE 2: THE DIAMETER OF THE TERMINAL IS HELD TO THE INDICATED VALUE ONLY OVER THE CONTACT SURFACE LENGTH. THE CONTACT SURFACE LENGTH OF THE FILAMENT, CATHODE-FILAMENT, AND GRID-No.1 TERMINALS EXTENDS FROM THE EDGE OF ITS TERMINAL TO THE PLANE COINCIDENT WITH THE EDGE OF THE ADJACENT LARGER TERMINAL.

NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR REGIONS.

TERMINAL DIAGRAM

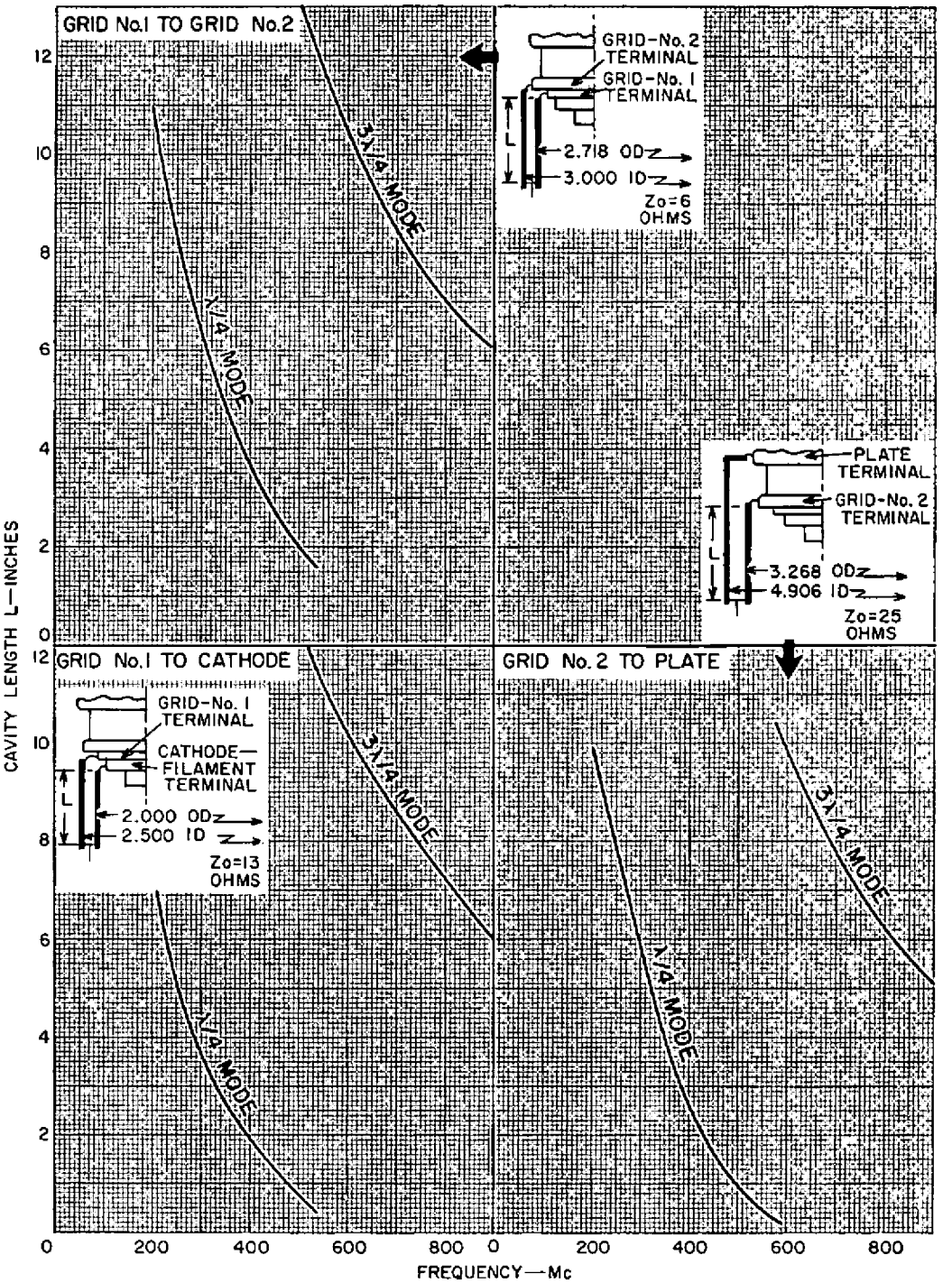


TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-12500

CAVITY TUNING CHARACTERISTICS



92CM-12492

FORCED-AIR COOLING

Air Flow:

Through radiator -- Adequate air flow to limit the plate-core temperature to 250° C should be delivered by a blower through the radiator before and during the application of filament, plate, grid-No.2, and grid-No.1 voltages.

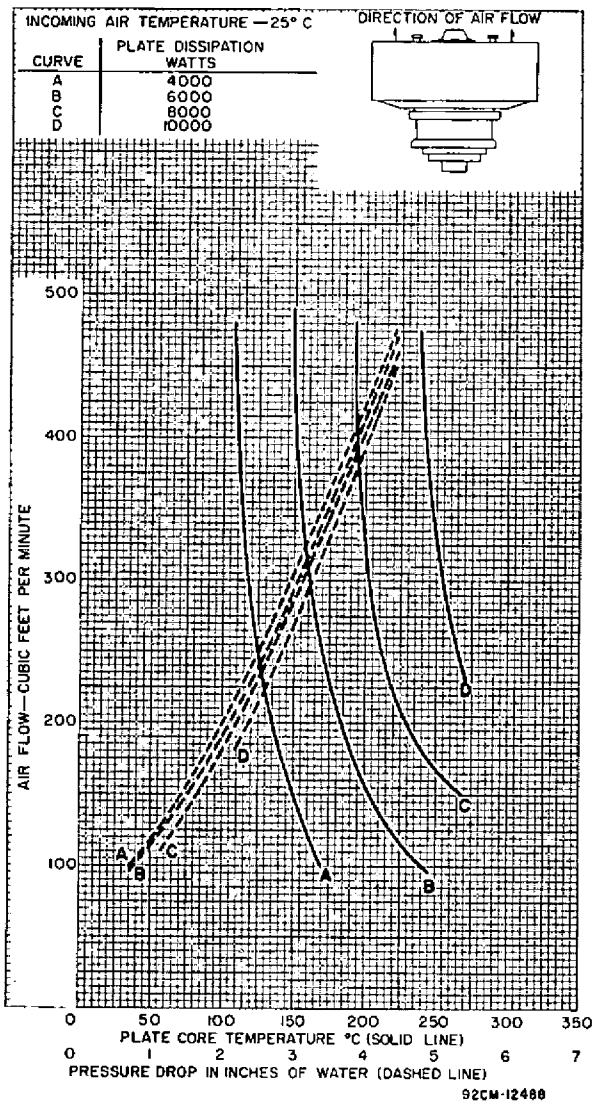
To Plate, Grid-No.2, Grid-No.1, Cathode-Filament, and Filament Terminals -- A sufficient quantity of air should be allowed to flow past each of these terminals so that their temperature does not exceed the specified maximum value of 250° C.

During Standby Operation -- Cooling air is required when only filament voltage is applied to the tube.

During Shutdown Operation -- Air flow should continue for a few minutes after all electrode power is removed.

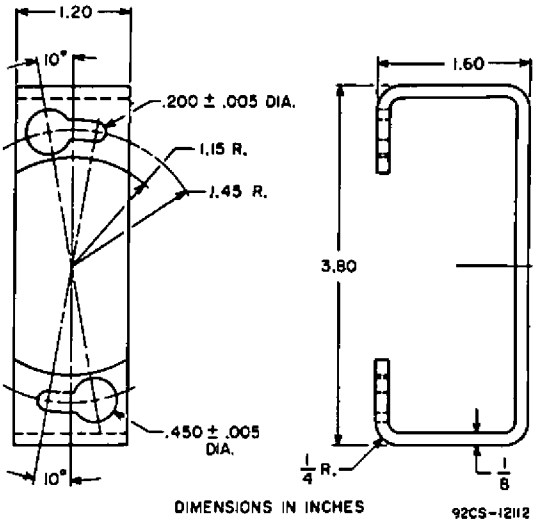
For further information on forced-air cooling, see section IV.C of 1CE-300.

TYPICAL COOLING CHARACTERISTICS



TUBE EXTRACTOR

Suggested Design

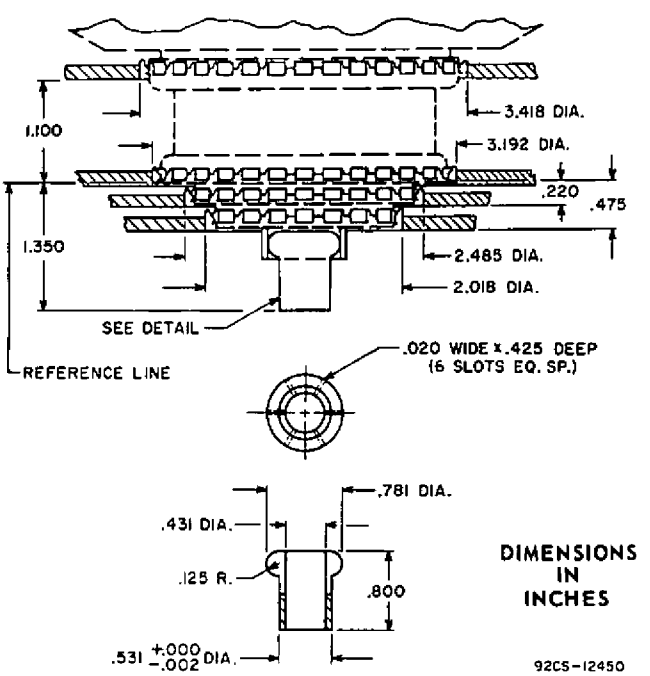


NOTE 1: MATERIAL 1/8" THICK COLD ROLLED STEEL.
NOTE 2: SLOT BETWEEN HOLES.
NOTE 3: ROUND ALL EDGES.

Mounting

See the preferred mounting arrangement below. For other arrangements, cavity-type mounting for multiple-ring terminal-type tubes, such as the 8501 may be constructed by using either fixed or adjustable contact rings of finger contact strips in the transverse plane as described in section III.C.3 of 1CE-300.

PREFERRED MOUNTING ARRANGEMENT



NOTE: ALL FINGER STOCK No.97-380, MADE BY INSTRUMENT SPECIALTIES Co., LITTLE FALLS, N.J.

from JEDEC release
#4599, Feb. 17, 1964

Burroughs Corporation

ELECTRONIC COMPONENTS DIVISION

PLAINFIELD, NEW JERSEY

NUMERICAL INDICATOR

Bulletin No. 1049

8502

October 15, 1963

B-4021 Low Voltage NIXIE Tube

The 8502 (B-4021) is a gas filled cold cathode, miniature size numerical indicating tube containing a common anode and ten metallic cathodes. The cathodes are formed in the shape of numerals (0 through 9). The tube is intended for use, as a direct in-line readout device in applications where a low (120 volt DC) ionization voltage is required.

ELECTRICAL DATA

ABSOLUTE RATINGS

Ionization Voltage	120 Vdc max.
Supply Voltage	120 Vdc min.
Cathode Current	2.0 mA max.

TEST CONDITIONS (FIGURE 1)

Supply Voltage (Ebb)	120 Vdc
Series Resistor (Rp)	20 K

TEST LIMITS (NOTES 1 & 3)

Cathode Current (Ik)	
(minimum)	0.7 mA
(maximum)	1.4 mA
Ionization Voltage (Ebb)	120 Vdc max.

MECHANICAL DATA (Note 2)

Outline	See Figure 2
Pin Connection	See Figure 3
Mounting Position	See Figure 3
Weight	0.2 oz.

ENVIRONMENTAL DATA

Temperature	−65°C to +85°C (Note 1)
Altitude	70,000 ft. max.
Vibration	(1) 10-50 cps .08" excursion (2) 50-500-50 cps 10 G's acceleration t = 15 minutes (Note 4)
Shock	(1) 250 G's 1±.5 msec. duration 50 G's 11±1 msec. duration (Notes 5 and 6)

NOTES:

1. At temperatures above and below 25°C, changes in cathode current can be expected.
2. This tube is available with nominal 1.40 inch pin leads; it is then designated as Type B-4021L.
3. Glow on any tube part other than the numeral under test constitutes a failure of this test.
4. For this test, tubes are mounted in each of three planes, X-1, X-2, and Y-1, for one-third of the total excitation time. On each plane, the ten cathodes are energized sequentially at the test conditions.
5. Shock test may be performed on any shock machine capable of producing a half sine wave shock form of the specified duration and amplitude.
6. Each tube is subjected to a total of 20 shocks, 5 shocks in each of positions X-1, X-2, Y-1, and Y-2, in any sequence.

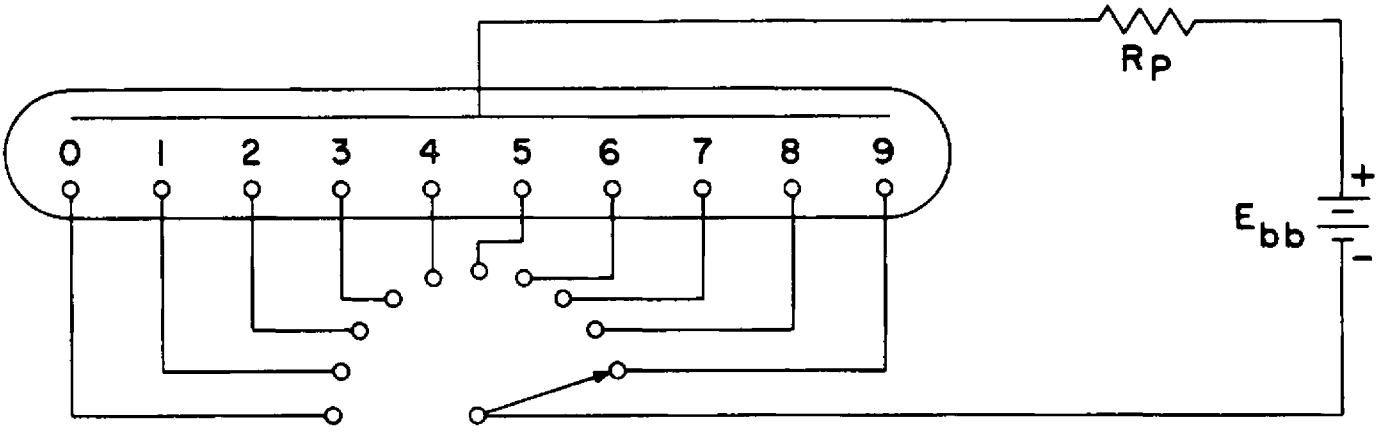


FIG. 1. TEST CIRCUIT

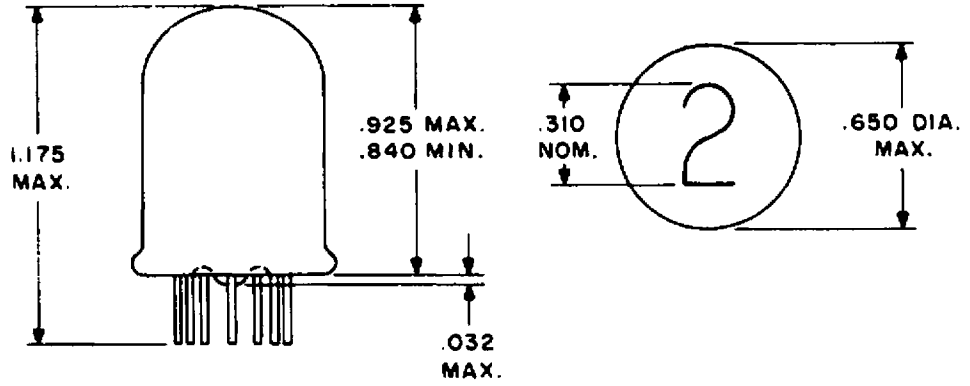
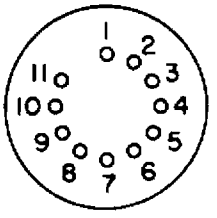


FIG. 2. OUTLINE DRAWING

PIN NO.	CHARACTER
1	NUMERAL 1
2	NUMERAL 2
3	NUMERAL 3
4	NUMERAL 4
5	NUMERAL 5
6	NUMERAL 6
7	NUMERAL 7
8	NUMERAL 8
9	NUMERAL 9
10	NUMERAL 0
11	ANODE



BOTTOM VIEW

FOR PROPER VIEWING, TUBE SHOULD BE MOUNTED WITH PINS 1 AND 7 VERTICALLY ALIGNED WITH PIN 7 AT THE TOP.

Fig. 3. Pin Connections

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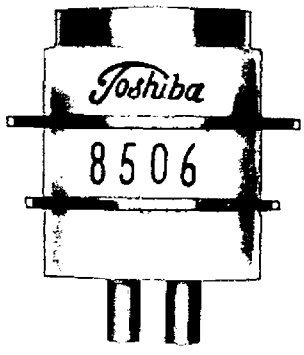
from JEDEC release #4607,
Feb. 24, 1964

Toshiba

TOSHIBA ELECTRON TUBE 8506

METAL-CERAMIC TRIODE

The Toshiba 8506 is a triode of ceramic and metal planar construction designed for use as a radio-frequency power amplifier in the uhf range.



GENERAL DATA

ELECTRICAL:

Cathode: Coated Unipotential		
Heater voltage	6.3±5%	V
Heater current	0.4	A
Direct interelectrode capacitances*		
Grid to Plate	2.5	PF
Grid to Cathode	4.8	PF
Plate to Cathode	0.025	PF

MECHANICAL:

Operating Position ..... Any

See Outline Drawing for dimensions and electrical connections.

MAXIMUM RATINGS
DESIGN-MAXIMUM VALUES

Plate Voltage	300	V
Positive DC Grid Voltage	0	V
Negative DC Grid Voltage	50	V
Peak Negative Grid Voltage	50	V
Plate Dissipation	5.0	W
DC Grid Current	2.0	mA
DC Cathode Current	40	mA
Heater-Cathode Voltage		
Heater Positive; Total DC and Peak	50	V
DC	50	V
Heater Negative; Total DC and Peak	50	V
DC	50	V
Grid Circuit Resistance	0.25	MΩ
Envelope Temperature (at hottest point)	250	°C

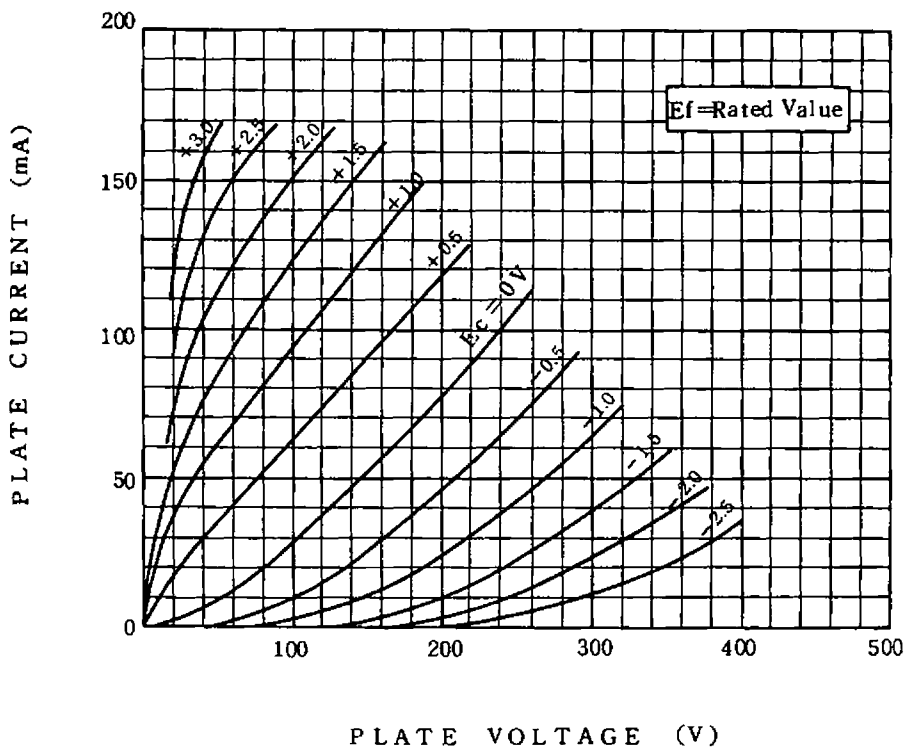
AVERAGE CHARACTERISTICS

Plate Voltage	200	V
Cathode Resistor	40	Ω
Amplification Factor	110	
Transconductance	29000	μU
Plate Current	25	mA
Grid Voltage for Ib=50μA	-3.5	V

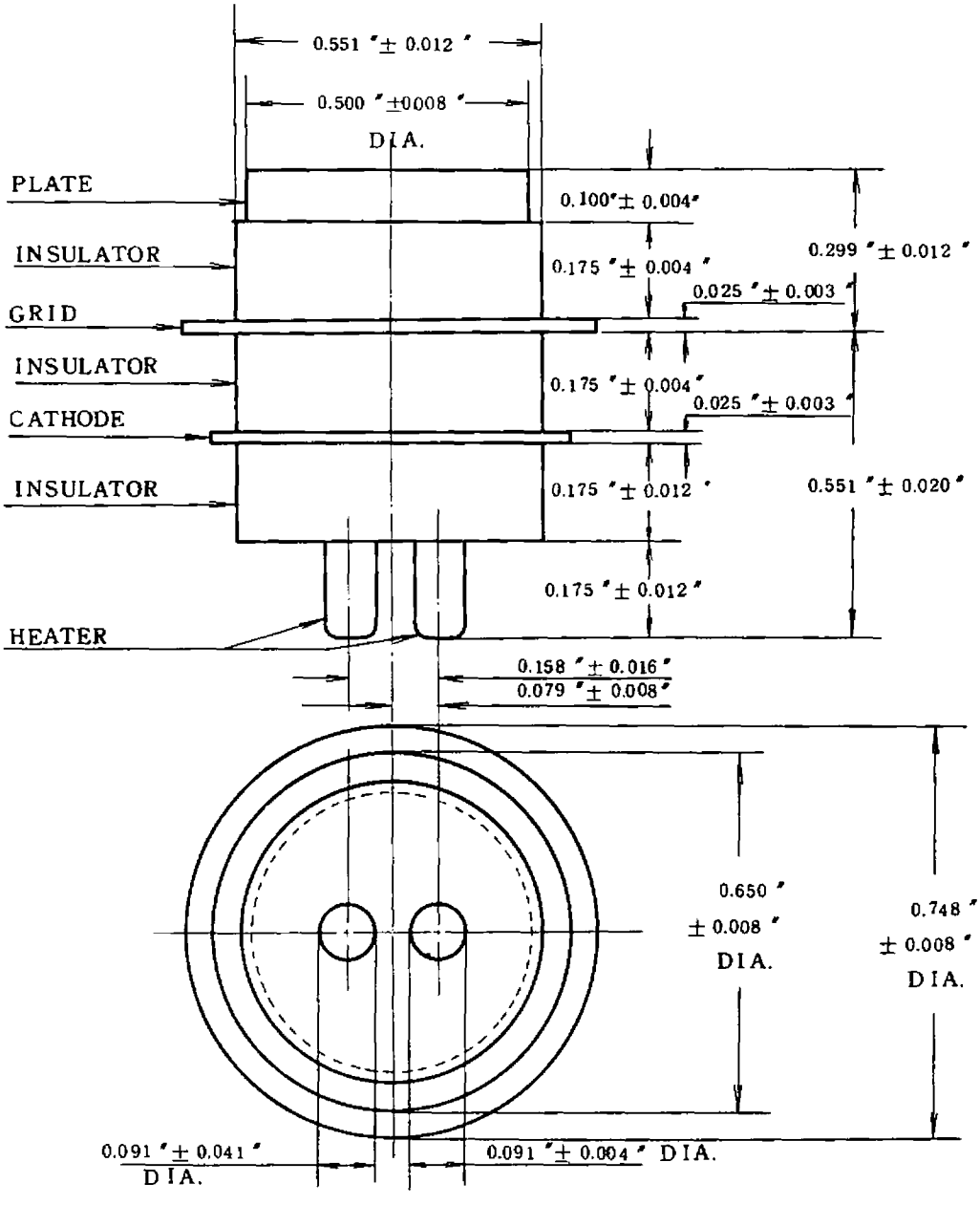
* : Measured using a grounding adaptor that provides shielding between external terminals of tube.

** : For application where long life is a primary consideration it is recommended that the envelope temperature be maintained below 175 °C.

8506 AVERAGE PLATE CHARACTERISTICS



8506
DIMENSIONAL OUTLINE



from JEDEC release #4636, March 16, 1964

RCA-8521

VIDICON

Magnetic Focus
Magnetic Deflection

1-1/2" Diameter,
High-Resolution, High-Sensitivity
Type for Industrial TV Pickup Service

1.5" - Diameter
7.75" - Length

RCA-8521 is a 1-1/2"-diameter vidicon type of camera tube featuring high sensitivity and high resolution capability. It is designed especially for black-and-white television pickup in industrial closed-circuit TV systems where a limiting resolution of more than 1200 TV lines is required. The sensitivity of the photoconductive surface employed in this tube is sufficient to produce high-quality pictures under normal room-lighting conditions or under the lighting conditions normally encountered in industrial areas.



The 8521 incorporates in its design precision construction, a mesh electrode with separate external connection, and a photoconductive surface having uniform thickness. The electrically isolated mesh electrode permits operation of the 8521 with high values of beam current without excessive loss in resolution and simplifies operational and set-up procedures. With proper adjustment of the mesh and grid-No.3 voltages, the 8521 will provide a uniform signal output from the entire scanned area with a minimum of "porthole" and geometric distortion.

Other design features of the 8521 are non-magnetic materials in the front end, and an extremely flat faceplate free from optical distortion.

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:[a]		
Target to all other electrodes	8.0	pf
Spectral Response	See *Fig.5*	
Photoconductive Layer:		
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)	1.0	inch

Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the axis and short index pin. The masking is for orientation only and does not define the proper scanned area of the photoconductive layer. Final orientation should be such that the image also fits inside of any internal mask of the mesh assembly.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	7.75" ± 0.25"
Greatest Diameter	1.59" ± 0.01"
Bulb Diameter	1.50" ± 0.01"
Bulb	T12
Base	Small-Button Super-Ditetrar 8-Pin (JEDEC No.E8-78)
Socket	Alden[b] No.208-SBSDC, or equivalent
Focusing-Alignment Assembly	Cleveland Electronics[c] No.15-VFA-259, or equivalent
Deflecting Yoke[d]	Cleveland Electronics[c] No.15-VY-258, or equivalent
Operating Position	Any
Weight (Approx.)	5.25 oz

Maximum Ratings, *Absolute-Maximum Values:*[e]

For scanned area of 0.6" x 0.8"

Grid-No.4 Voltage	1500 max.	volts
Grid-No.3 Voltage	1500 max.	volts
Grid-No.2 Voltage	550 max.	volts
Grid-No.1 Voltage:		
Negative bias value	300 max.	volts
Positive bias value	0 max.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
Target Voltage	100 max.	volts
Dark Current	0.25 max.	μa
Peak Target Current[f]	0.60 max.	μa
Faceplate:		
Illumination	1000 max.	fc
Temperature	71 max.	°C

Typical Operation and Performance Data:

For scanned area of 0.6" x 0.8"
Faceplate temperature of 28° to 34° C

Grid-No.4 (Decelerator) Voltage[g]	1400	volts
Grid-No.3 (Beam-Focus Electrode[h]) Voltage	800 to 1000	volts
Grid-No.2 (Accelerator) Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff[i]	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for Signal-Output Current between 0.02 and 0.6 μa	0.65	

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8521 2-64
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Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1 . . .	75	volts
When applied to cathode	20	volts
Lag—Per Cent of Initial Value of Signal-Output Current 1/20 Second after Illumination is Removed:[k]		
Maximum value	45	%
Typical value	30	%
Limiting Resolution:		
At center of picture—		
Typical value	1500	TV lines
Minimum value	1200	TV lines
At corners of picture—		
Typical value	900	TV lines
Amplitude Response to a 400 TV Line Square-Wave Test Pattern at Center of Picture:		
Minimum value	60	%
Field Strength at Center of Focusing Coil (Approx.)	46	gauss
Field Strength of Adjustable Alignment Coil[m]	0 to 4	gauss
Peak Deflecting-Coil Current for Specified Deflecting Yoke:		
Horizontal.	240	ma
Vertical.	50	ma
Maximum-Sensitivity Operation — 0.1 Footcandle on Faceplate		
Faceplate Illumination (Highlight)	0.1	fc
Target Voltage[np].	30 to 60	volts
Dark Current[q]	0.1	μa
Signal-Output Current:[r]		
Typical	0.2	μa
Average-Sensitivity Operation — 1.0 Footcandle on Faceplate		
Faceplate Illumination (Highlight)	1.0	fc
Target Voltage[np].	17 to 35	volts
Dark Current[q]	0.02	μa
Signal-Output Current:[r]		
Typical	0.20	μa
Minimum	0.15	μa
High-Light Level Operation — 10 Footcandles on Faceplate		
Faceplate Illumination (Highlight)	10	fc
Target Voltage[np].	10 to 20	volts
Dark Current[q]	0.005	μa
Signal-Output Current:[r]		
Typical	0.3	μa

[a] This capacitance, which effectively is the output impedance of the 8521, is increased when the tube is mounted in the deflecting yoke and focusing-alignment assembly. The resistive component of the output impedance is in order of 100 megohms.

[b] Made by Alden Products Co., 9140 North Main Street, Brockton 64, Mass.

[c] Made by Cleveland Electronics Inc., 1974 East 61st Street, Cleveland, Ohio.

[d] For minimum geometric distortion, the deflecting yoke should be located in its proper axial position 3/4-inch from the face of the tube.

[e] The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Absolute-Maximum Rating System* for rating electron devices.

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, taking no responsibility for equipment variations, environment variations, and the effects of changes in operating conditions due to variations in device characteristics.

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 device characteristics.

[f] Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[g] Grid-No.4 voltage must always be greater than grid-No.3 voltage. For minimum "porthole" effect, grid-No.4 voltage should be adjusted to approximately 1.6 times the grid-No.3 voltage value, and the focusing-alignment assembly and deflecting yoke positioned as shown in Fig.1.

[h] Beam focus is obtained by the combined effect of grid-No.3 voltage, which should be adjustable over indicated range, and a focusing coil having an average field strength of 46 gauss.

[j] With no blanking voltage on grid No.1.

[k] For initial signal-output current of 0.2 μa and a dark current of 0.02 μa.

[m] The alignment coil should be located on the tube so that its center is at a distance of 6 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

[n] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[p] The target voltage for each 8521 must be adjusted to that value which gives the desired operating dark current.

[q] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[r] Defined as the component of the highlight target current after the dark-current component has been subtracted.

REFERENCE

Otto H. Schade, *"A New System of Measuring and Specifying Image Definition"*, National Bureau of Standards Circular 526, April 29, 1954.

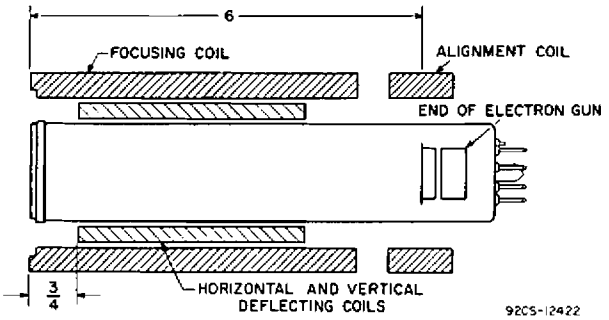
OPERATING CONSIDERATIONS

The *target connection* may be made by a suitable spring-finger contact bearing against the edge of the metal ring at the face end of the tube.

The *front end of the deflecting yoke* should be positioned 3/4-inch to the rear of the tube faceplate as shown in Fig.1. Positioning the yoke further to the rear of the tube faceplate increases deflection sensitivity but impairs corner focus.

Provisions should be made in the camera installation to hold the faceplate temperature of the 8521 at a steady value within the recommended range. Dark current increases with increasing temperature. It is highly desirable to operate the 8521 at a steady temperature to maintain dark current at a preselected value. This mode of operation ensures both optimum and stable day-to-day performance. If such provisions cannot be made, changes in target voltage may be required from time to time to maintain the desired picture quality.

COMPONENT LOCATIONS



DIMENSIONS IN INCHES

Fig.1

As *target voltage* is increased, dark current also increases. The range of target voltage for various dark current levels of different 8521's is shown in Fig.2. The exact value of target

RANGE OF DARK CURRENT

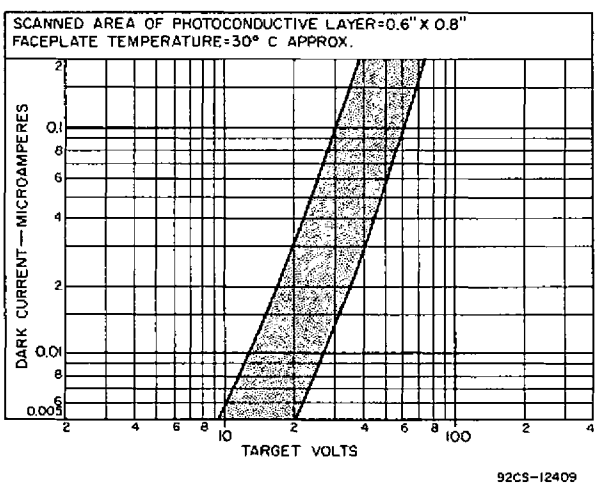


Fig.2

voltage to give the required dark current will depend on the individual tube and on the temperature at which its faceplate is operated. It is important that the tube be allowed to reach a stable operating temperature before the operating dark current is determined; otherwise, the dark current will change as the temperature of the tube changes. It should be noted that individual 8521's will *have substantially the same transfer characteristics (Fig.4) when operated with the same value of dark current.* For proper adjustment of the target voltage to obtain the desired operating characteristics for each 8521 see **SET-UP PROCEDURE** on page 5.

The *temperature of the faceplate* should not exceed 71° C (160° F), either during operation or storage of the 8521. Operation with a faceplate temperature in the range from about 28° to 34° C (82° to 93° F) is recommended. The temperature of the faceplate is determined by ambient temperature and the combined heating effects of the incident illumination on the faceplate, the associated components, and the tube itself. To reduce these heating effects and permit operation in the preferred temperature range, under conditions of extremely high light levels, the use of

TYPICAL PERSISTENCE CHARACTERISTICS

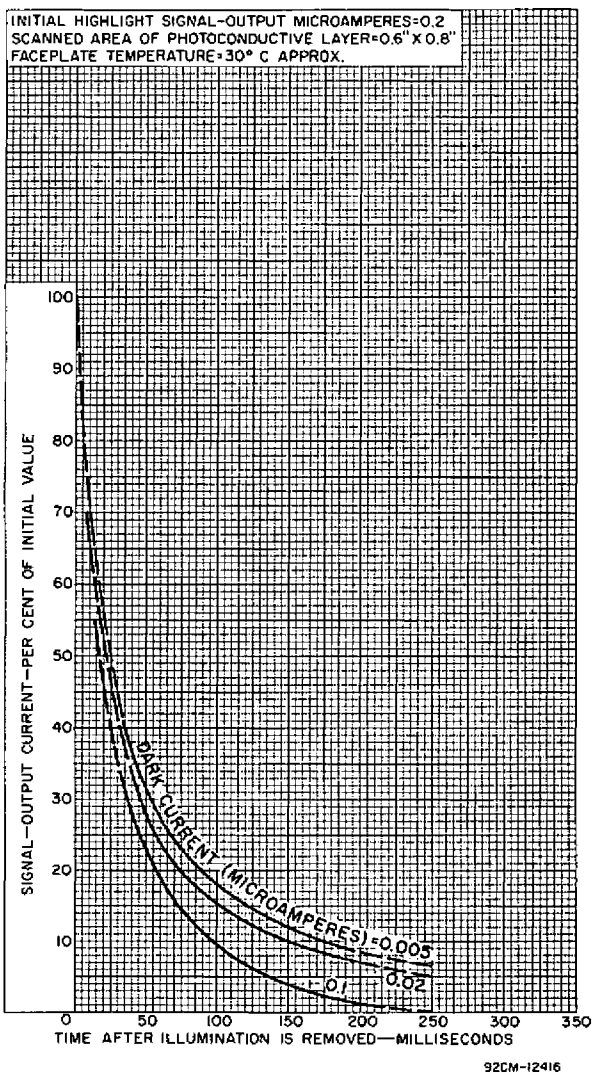


Fig.3

an infrared filter between the object and the camera lens is recommended.

Persistence or lag of the photoconductive layer is given in Fig.3 for several values of dark current. Each curve shows the decay in signal-output current from an initial value of 0.2 microampere after the illumination is cut off.

Signal Output and Light Transfer Characteristics. Typical signal output as a function of uniform 2870° K tungsten illumination on the photoconductive layer for different values of

dark current is shown in Fig.4. For an illumination level of 1 footcandle on the faceplate, operation at a dark current of 0.02 microampere will usually provide a satisfactory signal level. If an illumination of 10 footcandles on the faceplate is available, the dark current level may be reduced to 0.005 μa or less, and at lower light levels—less than 50 footcandles on the scene—higher values of dark current and higher target voltages can usually be employed.

Proper-size scanning of the photoconductive target area should always be used. Both overscanning and underscanning impair performance. Overscanning, which produces a smaller-than-normal picture on the monitor, adversely effects corner resolution, signal uniformity, and geometrical accuracy. Underscanning, which produces a larger-than-normal picture on the monitor, should never be permitted as it may cause a permanent change in sensitivity and dark current of the under-

LIGHT TRANSFER CHARACTERISTICS

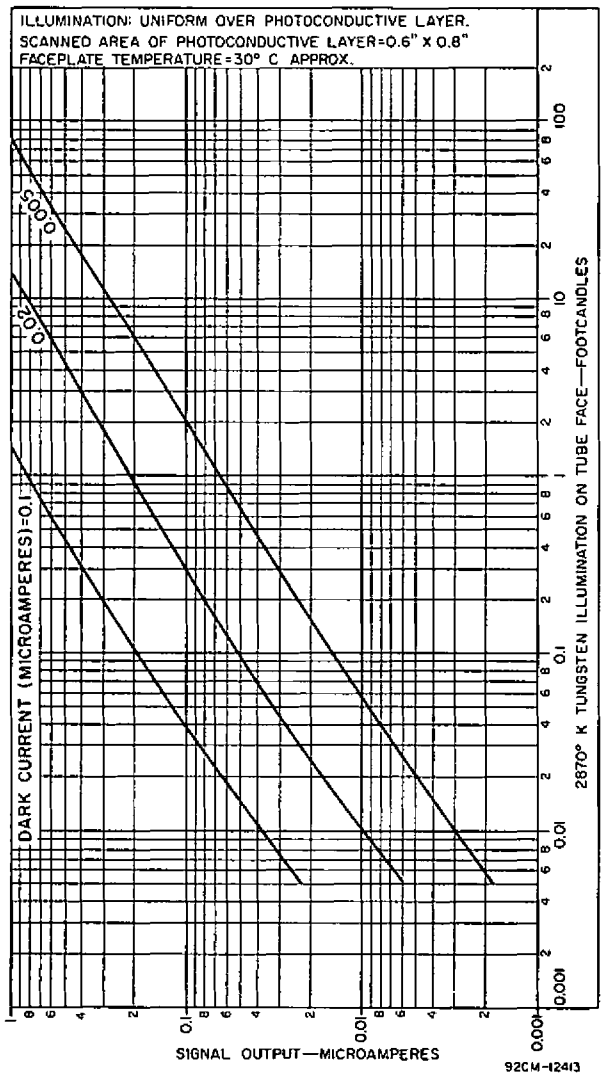


Fig.4

TYPICAL SPECTRAL SENSITIVITY CHARACTERISTIC

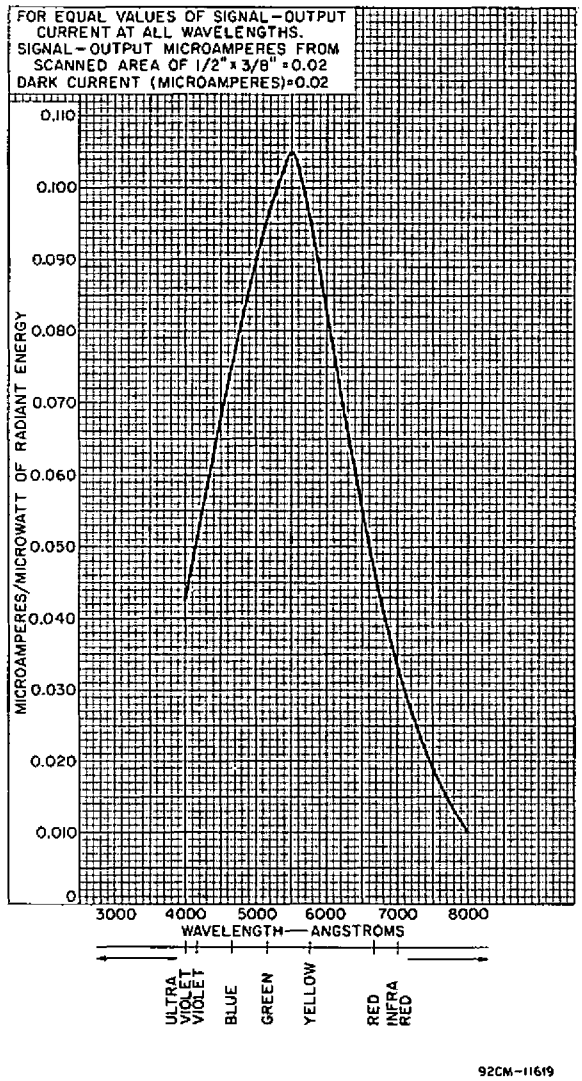


Fig.5

The average "gamma", or slope, of the light transfer characteristic curves shown in Fig.4 is approximately 0.65. This value is relatively constant and is applicable for the light levels required to obtain signal currents in the 0.02 μa to 0.6 μa range at dark current values of 0.005 μa to 0.02 μa. Because its transfer characteristic is approximately the complement of the transfer characteristic of a picture tube, the 8521 can produce a picture having proper tone rendition.

The *spectral response* of the 8521 is shown in Fig.5.

scanned area with a resulting loss in resolution and sensitivity. An underscanned area showing such a change will be visible when proper-size scanning is restored.

Failure of scanning even for a few seconds may permanently damage the photoconductive layer. The damaged area shows up as a spot or line in the picture during subsequent operation. To avoid damaging the 8521 during scanning failure, it is necessary to prevent the scanning beam from reaching the layer.

The scanning beam can conveniently be prevented from reaching the layer by increasing the grid-No.1 voltage to cutoff, biasing the target negatively, or removing the grid-No.4, grid-No.3, and grid-No.2 electrode voltages. Circuits should be incorporated to perform one or more of these functions automatically the instant scanning power fails or is reduced, at any time, to an abnormally low value.

HORIZONTAL PEAK-TO-PEAK RESPONSE TO A SQUARE-WAVE TEST PATTERN AT CENTER OF PICTURE WITHOUT APERTURE CORRECTION - PER CENT

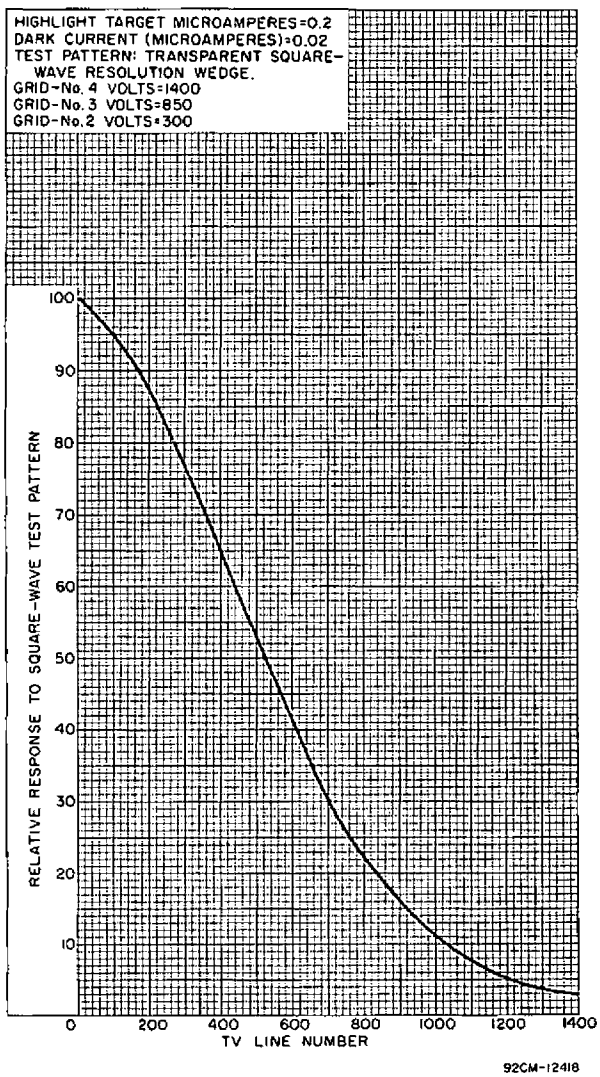


Fig.6

The *lens of the camera should always be capped* when the camera is not in use or is being transported to avoid the inadvertent exposure of the photoconductive layer to an image of the sun or other very intense source of illumination. The focusing of the image of a very bright light source on the tube face can cause permanent damage to the photoconductive layer.

SET-UP PROCEDURE

The sequence of adjustments for operating the 8521 is as follows: With Grid-No.1 Voltage Control set for maximum negative bias (beam cutoff), Target-Voltage Control set for the minimum voltage shown under *Typical Operation*, and Deflection Controls set for maximum overscan, apply other voltages to the 8521 as indicated under *Typical Operation*.

Next, with a 0.6" x 0.8" mask centered on the face of the tube, and with the iris set for minimum opening, decrease the grid-No.1 bias to just discharge the highlight details of the picture on the monitor. If the picture signal is very low with normal amplifier gain settings, increase the target voltage and/or the lens opening to obtain a usable signal level. Adjust the Beam-Focus Voltage Control and the optical focus to obtain the picture which has best resolution. Reduce the horizontal and vertical scanning so that the edges of the image extend just outside of the scanned area on the monitor. Then adjust the alignment field so that the center of the picture does not move as the beam-focus voltage is varied. Some readjustment of each operating control is often necessary after adjustment of the individual controls to obtain final optimum operating conditions.

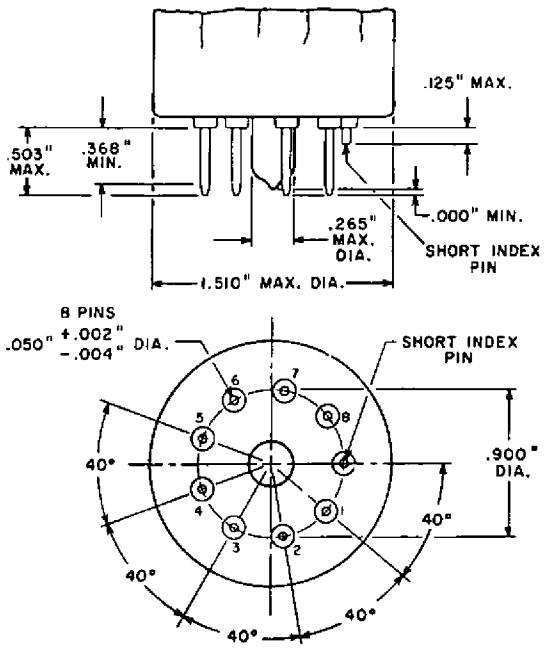
For *Maximum-Sensitivity Operation* of the 8521 where the light level is very restricted, the following procedure is recommended: With no illumination on the face of the tube, increase the target voltage until non-uniformities in the dark-current signal become objectionable. Next uncap the lens and adjust the iris to obtain a picture of the desired quality and depth of focus. Adjust the grid-No.1 bias voltage to just discharge the highlights. If the beam current is higher than necessary, a picture of poor resolution and distorted half-tones may result. If the highlights cannot be discharged or the picture quality is unsatisfactory, it may be an indication that the light level on the tube is higher than that required. The target voltage should then be reduced to a value corresponding to that shown under *Average Sensitivity Operation* and the grid-No.1 bias readjusted to just discharge the highlights.

Proper adjustment of the target voltage and iris opening to give the lowest value of dark current consistent with necessary signal-output current will result in a picture of good quality with minimum lag or smear of moving objects.

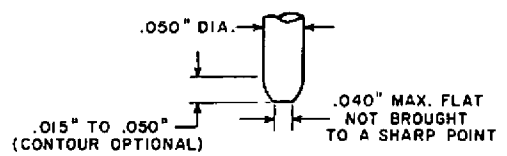
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BASE DRAWING

SMALL-BUTTON SUPER-DITETRAR
8-PIN BASE
JEDEC No. E8-78



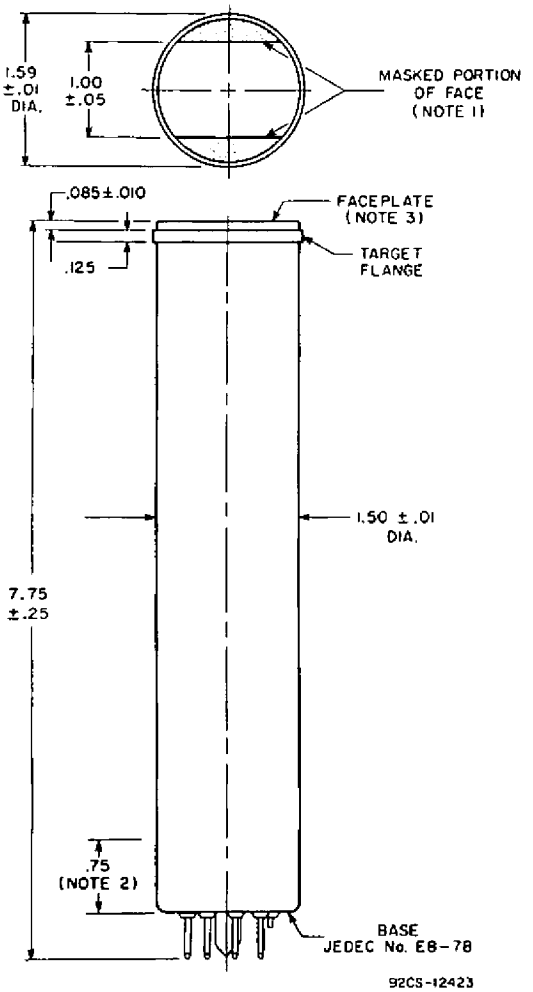
PIN CONTOUR



92CM-11158

BASE-PIN POSITIONS ARE HELD TO TOLERANCES SUCH THAT ENTIRE LENGTH OF PINS WILL, WITHOUT UNDUE FORCE, PASS INTO AND DISENGAGE FROM A FLAT-PLATE GAUGE HAVING A THICKNESS OF 1/4" AND NINE HOLES WITH DIAMETERS OF 0.0700" ± 0.0005" SO LOCATED ON A 0.9000" ± 0.0005" DIAMETER CIRCLE THAT THE DISTANCE ALONG THE CHORD BETWEEN ANY TWO ADJACENT HOLE CENTERS IS 0.3078" ± 0.0005". GAUGE IS ALSO PROVIDED WITH A HOLE HAVING DIAMETER OF 0.300" ± 0.001" CONCENTRIC WITH THE PIN CIRCLE.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

NOTE 1: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT INDEX PIN.

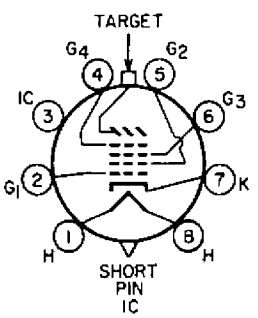
NOTE 2: WITHIN THIS AREA THE MINIMUM BULB DIAMETER DIMENSION DOES NOT APPLY.

NOTE 3: FACEPLATE THICKNESS IS 0.135" ± 0.005".

BASING DIAGRAM

Bottom View

PIN 1 – HEATER
PIN 2 – GRID No. 1
PIN 3 – INTERNAL CONNECTION— DO NOT USE
PIN 4 – GRID No. 4
PIN 5 – GRID No. 2
PIN 6 – GRID No. 3



PIN 7 – CATHODE
PIN 8 – HEATER
FLANGE – TARGET
SHORT INDEX PIN – INTERNAL CONNECTION— MAKE NO CONNECTION

DIRECTION OF LIGHT:
INTO FACE END OF TUBE

8LB

from JEDEC release #4702,
May 18, 1964

Toshiba

TOSHIBA ELECTRON TUBE 8524

SHARP-CUTOFF PENTODE

The Toshiba 8524 is a heater-cathode type sharp-cutoff pentode of micro metal miniature construction with metal shell and ceramic stem to adapt standard 8-pin subminiature socket.
It is designed particularly for use including gated amplifier circuits, delay circuits, mixer circuits at frequencies up to 400 Mc/s, and gain controlled amplifier circuits in military and critical industrial applications which may be subjected to severe shock and vibration.
In on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.



GENERAL DATA

ELECTRICAL :

Cathode: Coated unipotential		
Heater voltage	6.3	V
Heater current	0.15	A
Direct interelectrode capacitances:		
No. 1 grid to plate	0.015 max.	PF
No. 1 grid to all other electrodes	4	PF
No. 1 grid to No. 3 grid	0.15 max.	PF
No. 3 grid to all other electrodes	4	PF
No. 3 grid to plate	1.1 max.	PF
Plate to all other electrodes	3.4	PF

MECHANICAL :

Operating position	Any
Maximum overall length	1.082"
Maximum seated length	0.867"
Maximum diameter	0.434"
Bulb	Metal shell
Base	E8-9 (ceramic)

MAXIMUM RATINGS; Absolute maximum values:
Class A1 amplifier

Plate voltage	165 max.	V
Positive No. 3 grid voltage	30 max.	V
No. 2 grid voltage	155 max.	V
No. 1 grid voltage		
Positive bias value	0 max.	V
Negative bias value	55 max.	V
Plate current	11 max.	mA
No. 2 grid current	7 max.	mA
Plate dissipation	0.55 max.	W
No. 2 grid input	0.45 max.	W
Heater-cathode voltage		
Heater negative	200 max.	V
Heater positive	200 max.	V
No. 1 grid circuit resistance		
For cathode bias operation	1.1 max.	MΩ
Bulb temperature at hottest point on bulb surface	220 max.	°C
Altitude	60000 max.	Feet

TYPICAL OPERATION AND CHARACTERISTICS:
Class A1 amplifier

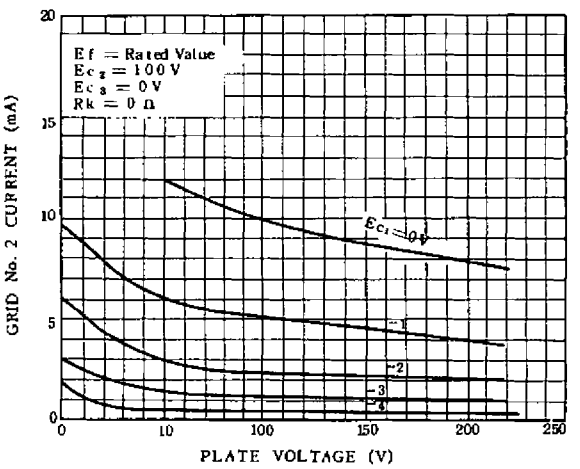
Plate Voltage	100	100	V
No. 3 grid	connected to cathode	---	
No. 3 grid voltage	---	-1	V
No. 2 grid voltage	100	100	V
Cathode resistor	150	150	Ω
Plate resistance (Approx.)	0.11	0.05	MΩ
Transconductance			
No. 1 grid to plate	3200	1950	μʊ
No. 3 grid to plate	500	950	μʊ
Plate current	5.3	4	mA
No. 2 grid current	3.6	5.8	mA
No. 1 grid voltage for Ib = 10 μA (Approx.)	-7.5	---	V
No. 3 grid voltage for Ib = 10 μA (Approx.)	---	-8	V
Noise output voltage (Max.) *	60	---	mVac

Mixer operation

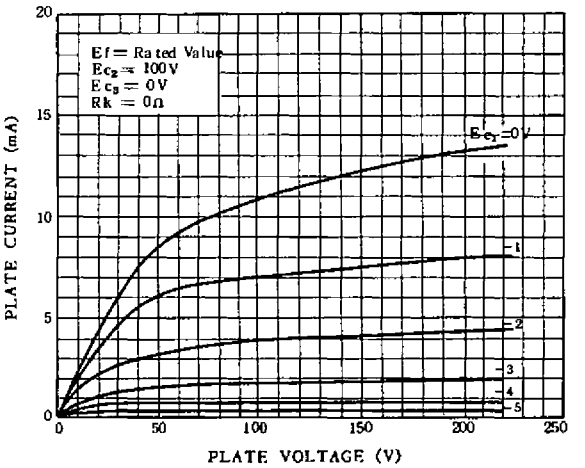
Plate voltage	100	V
No. 3 grid voltage DC	0	V
AC	15	V
No. 2 grid voltage	100	V
Cathode resistor	150	Ω
Plate resistance (Approx.)	0.32	MΩ
Conversion transconductance	1280	μU
Plate current	3.5	mA
No. 2 grid current	5.7	mA

* Across to plate resistor of 10 KΩ, with applied vibrational acceleration of 15 G. at no cycles per second.

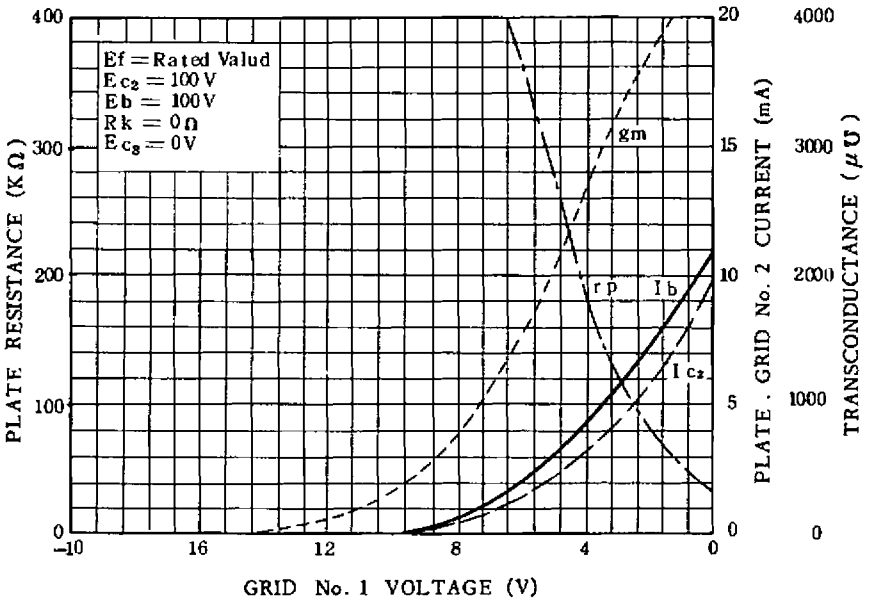
AVERAGE PLATE CHARACTERISTICS



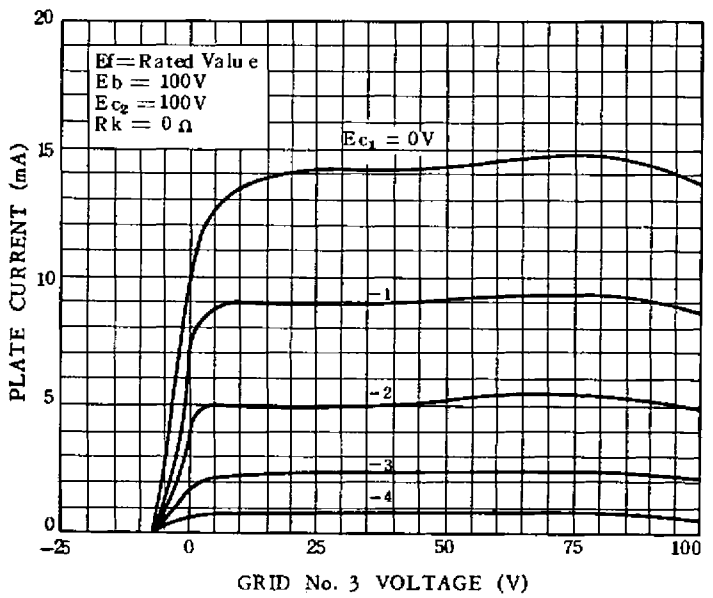
AVERAGE PLATE CHARACTERISTICS



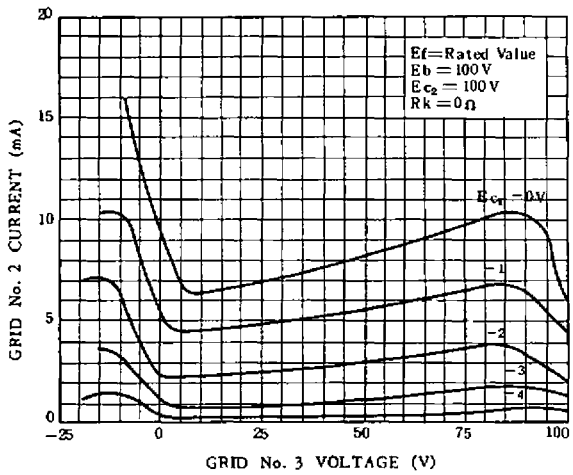
AVERAGE GRID CHARACTERISTICS



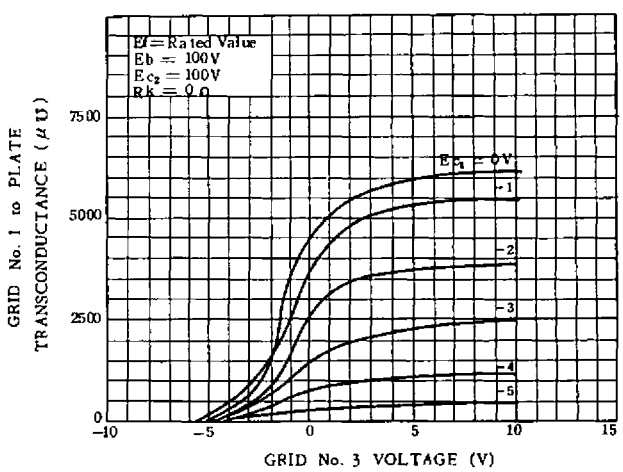
AVERAGE GRID CHARACTERISTICS



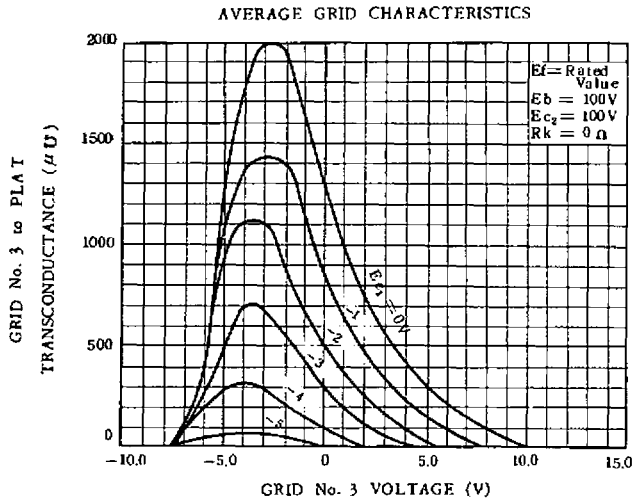
AVERAGE GRID CHARACTERISTICS



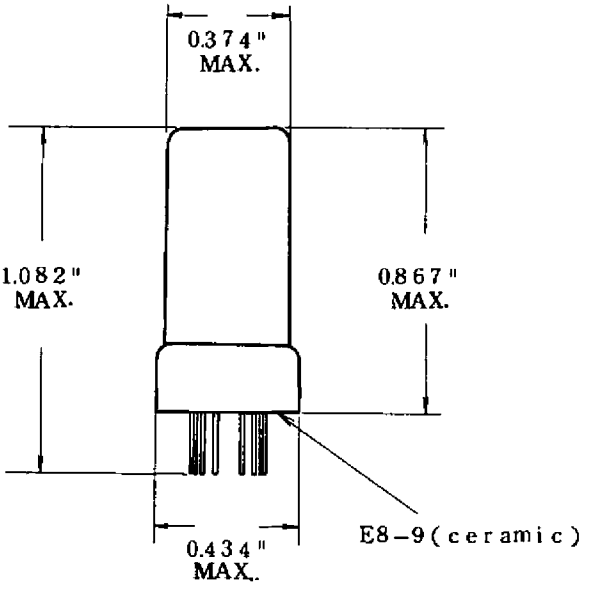
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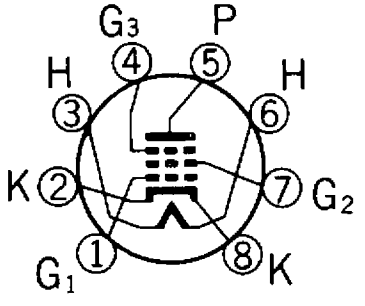
AVERAGE GRID CHARACTERISTICS



8524
DIMENSIONAL OUTLINE:
Dimensions in Inches



8524
BASING DIAGRAM:
Bottom View



8DC

Pin 1: No. 1 Grid
Pin 2: Cathode
Pin 3: Heater
Pin 4: No. 3 Grid
Pin 5: Plate
Pin 6: Heater
Pin 7: No. 2 Grid
Pin 8: Cathode

All inquiries as to the data should be addressed to Tube and Semiconductor Division, Tokyo Shibaura Electric Co., Ltd., 12, 1-chome, Yuraku-cho, Chiyoda-ku, Hibiya Mitsui Building, Tokyo, Japan.

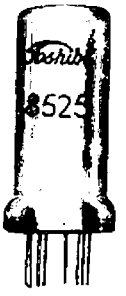
from JEDEC release #4702,
May 18, 1964

Toshiba

TOSHIBA ELECTRON TUBE 8525

TWIN TRIODE

The Toshiba 8525 is a heater-cathode type medium-mu twin triode of micro metal miniature construction to adapt standard 8-pin subminiature socket.
The tube may be used at frequencies in the uhf region, permitting applications such as vhf oscillators and mixers.
It is especially suited for use in industrial and military airborne equipment which may be subjected to severe shock and vibration.



GENERAL DATA

ELECTRICAL :

Cathode: Coated unipotential		
Heater voltage	6.3	V
Heater current	0.3	A
Direct interelectrode capacitances:		
Grid to plate (each section)	1.4	PF
Input (each section)	2.1	PF
Output (section 1)	1.3	PF
Output (section 2)	1.4	PF
Coupling:		
Grid to grid	0.011 max.	PF
Plate to plate	0.33 max.	PF

MECHANICAL :

Operating position	Any
Maximum overall length	1.082"
Maximum seated length	0.867"
Maximum diameter	0.434"
Bulb	Metal shell
Base	E8-9 (ceramic)

MAXIMUM RATINGS; Absolute maximum values:

Class A1 amplifier (Each section)

Plate voltage	165 max.	V
Grid voltage		
Positive bias value	0 max.	V
Negative bias value	55 max.	V

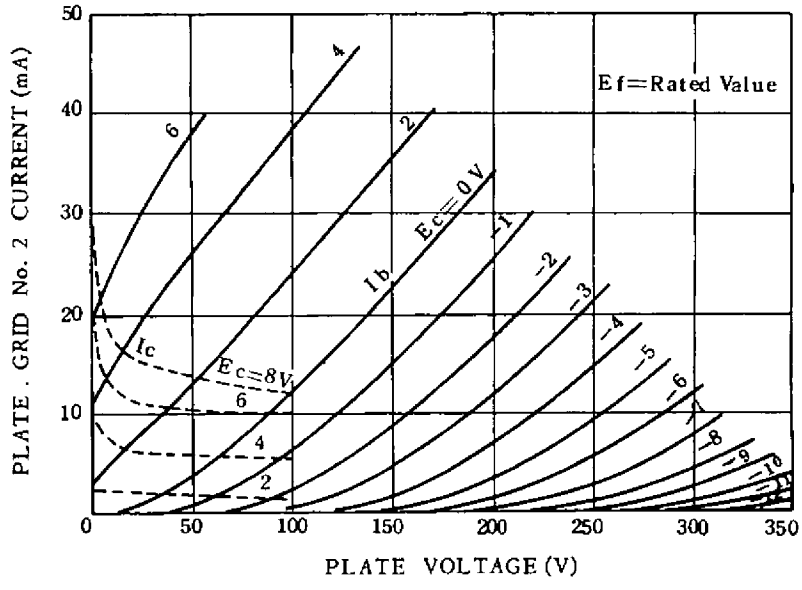
Plate current	22 max.	mA
Grid current	5.5 max.	mA
Plate dissipation	0.7 max.	W
Heater-cathode voltage		
Heater positive, total dc and peak	200 max	V
Heater negative, total dc and peak	200 max.	V
Bulb temperature at hottest point on bulb surface	220 max.	°C
Altitude	60000 max.	Feet
Grid circuit resistance		
For cathode bias operation	1.1 max.	MΩ

CHARACTERISTICS:

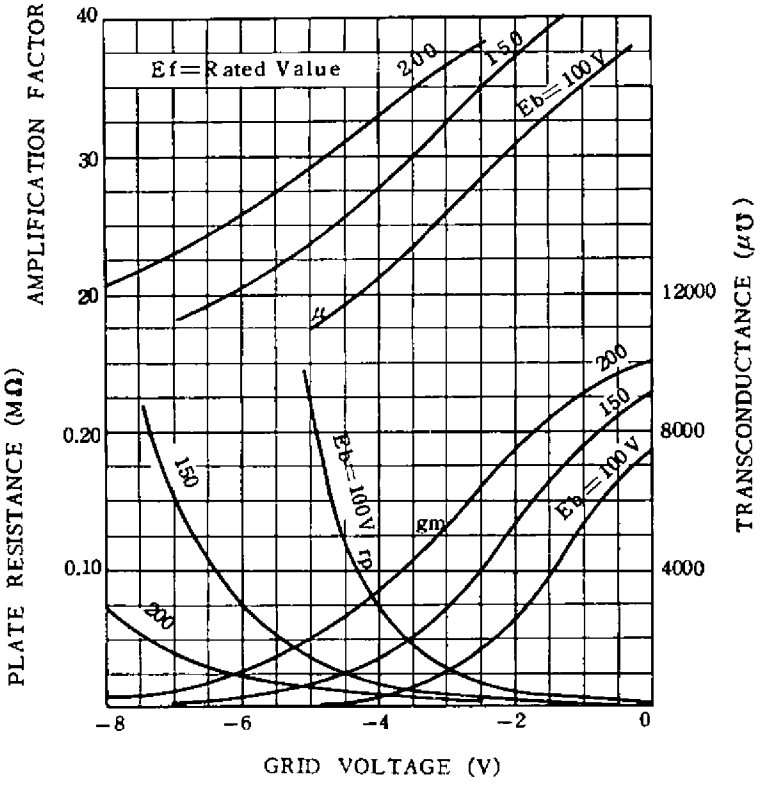
Class A1 amplifier (Each section)

Plate voltage	100	V
Cathode resistor	150	Ω
Amplification factor	35	
Plate resistance (Approx.)	6500	Ω
Transconductance	5400	μ℧
Plate current	6.5	mA
No. 1 grid voltage (Approx.) for plate current of 10 μA	-6.5	V

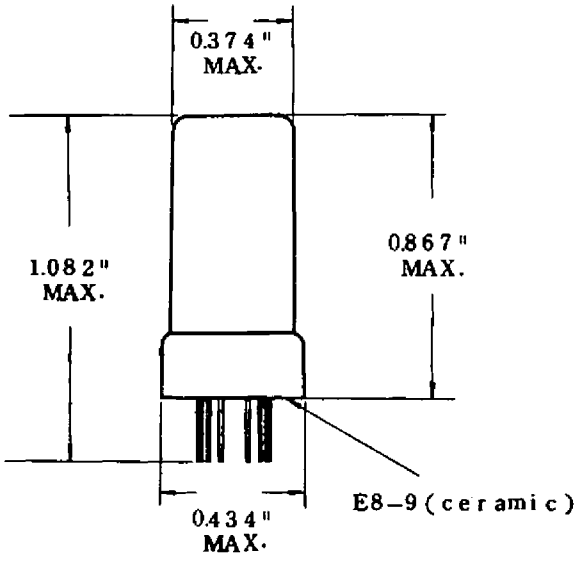
AVERAGE GRID CHARACTERISTICS



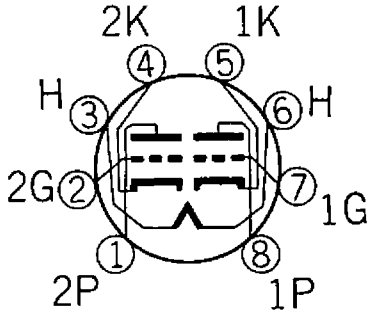
AVERAGE GRID CHARACTERISTICS



8525
DIMENSIONAL OUTLINE:
Dimensions in Inches



8525
BASING DIAGRAM:
Bottom View



8DG

Pin 1: Section 2 Plate
Pin 2: Section 2 Grid
Pin 3: Heater
Pin 4: Section 2 Cathode
Pin 5: Section 1 Plate
Pin 6: Heater
Pin 7: Section 1 Grid
Pin 8: Section 1 Plate

All inquiries as to the data should be addressed to Tube and Semiconductor Division, Tokyo Shibaura Electric Co., Ltd., 12, 1-chome, Yuraku-cho, Chiyoda-ku, Hibiya Mitsui Building, Tokyo, Japan.

from JEDEC release #4702,
May 18, 1964

Toshiba

TOSHIBA ELECTRON TUBE 8526

MEDIUM-MU TWIN TRIODE

The Toshiba 8526 is a heater-cathode type medium-mu twin triode of micro metal miniature construction with metal shell and ceramic stem to adapt standard 8-pin sub-miniature socket.
The 8526 is designed for use in general purpose amplifier applications.
It is may also be used as a combined oscillator and mixer in high frequency up to VHF range circuit. In on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.



GENERAL DATA

ELECTRICAL :

Cathode: Coated unipotential		
Heater voltage	6.3	V
Heater current	0.3	A
Direct interelectrode capacitances:		
Grid to plate (each section)	1.4	PF
Input (each section)	2.1	PF
Output (section 1)	1.3	PF
Output (section 2)	1.4	PF
Coupling:		
Grid to grid	0.010	PF
Plate to plate	0.3	PF

MECHANICAL :

Operating position	Any
Maximum overall length	1.082"
Maximum seated length	0.867"
Maximum diameter	0.434"
Bulb	Metal shell
Base	E8-9 (ceramic)

MAXIMUM RATINGS; Absolute maximum values:

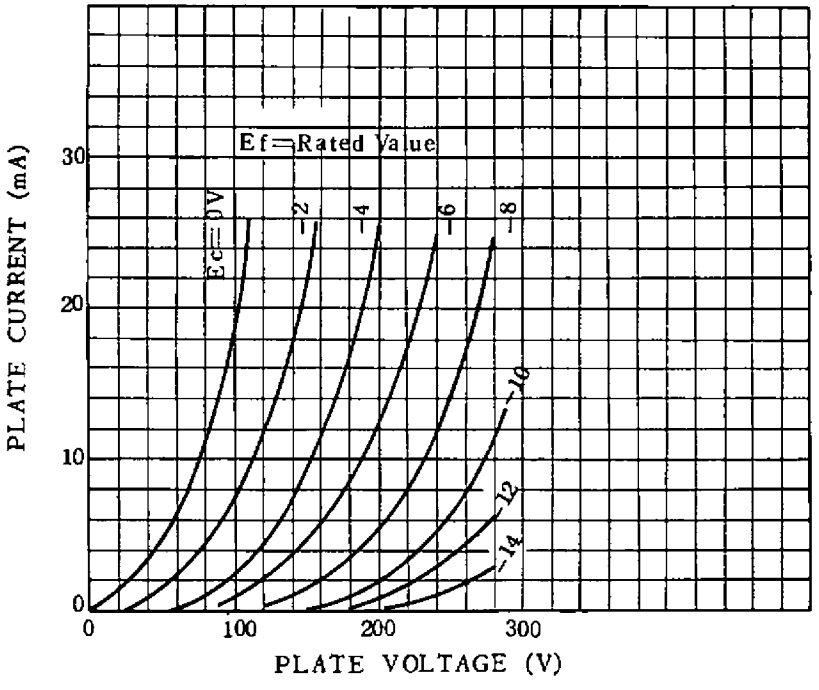
Plate voltage	165 max.	V
Negative dc grid voltage	55 max.	V
Plate dissipation	0.95 max.	W

DC plate current	22 max.	mA
DC grid current	5.5 max.	mA
Heater-cathode voltage		
Heater positive, total dc and peak	200 max.	V
Heater negative, total dc and peak	200 max.	V
Grid circuit resistance	1.1 max.	MΩ
Bulb temperature at hottest point on bulb surface	220 max.	°C
Altitude	60000 max.	Feet

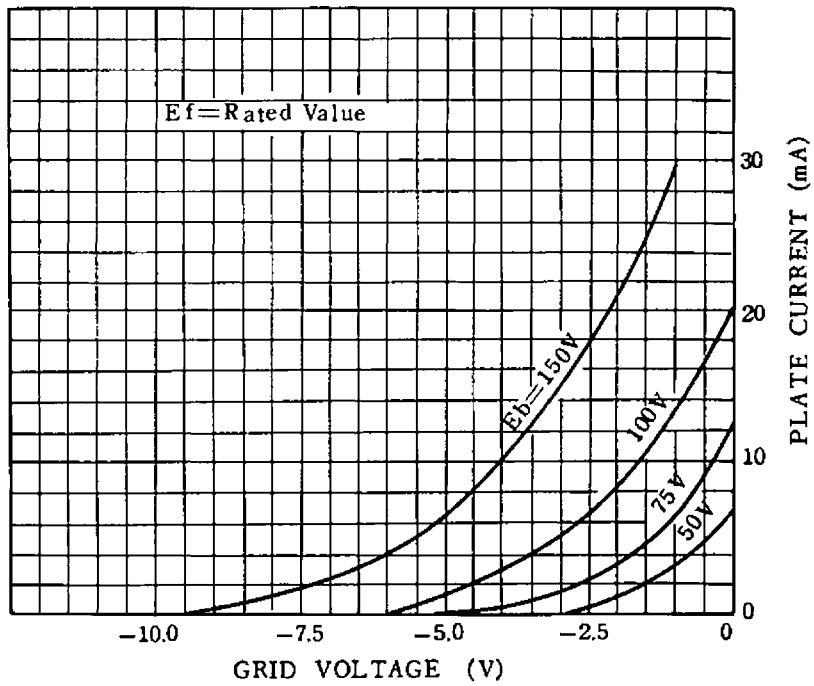
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: (Each section)

Plate voltage	100	V
Cathode bias resistor	220	Ω
Amplification factor	20	
Plate resistance, (Approx.)	4000	Ω
Transconductance	5000	μʊ
Plate current	8.5	mA
Grid voltage (Approx.) for plate current of 10μA	-9.0	V

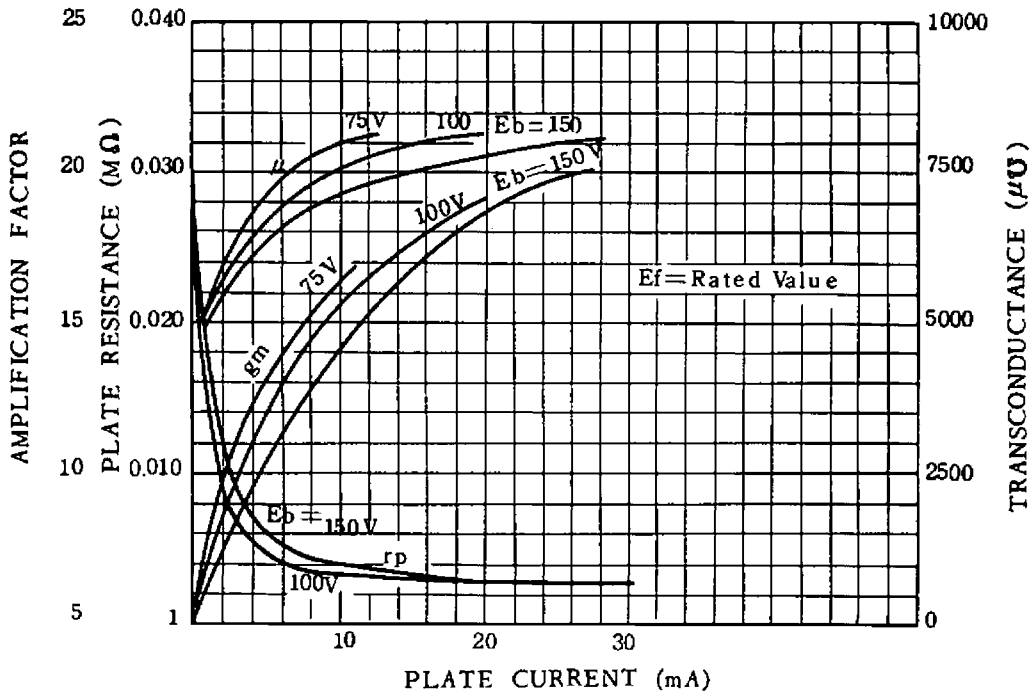
AVERAGE PLATE CHARACTERISTICS



AVERAGE GRID CHARACTERISTICS

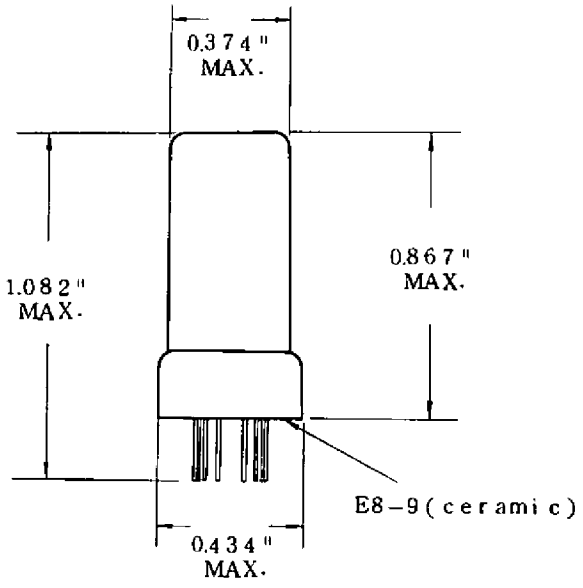


AVERAGE PLATE CHARACTERISTICS

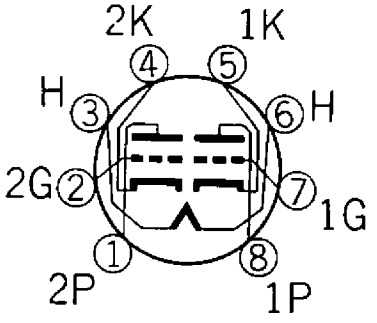


TOSHIBA ELECTRON TUBE

8526
DIMENSIONAL OUTLINE:
Dimensions in Inches



8526
BASING DIAGRAM:
Bottom View



8DG

Pin 1: Section 2 Plate
Pin 2: Section 2 Grid
Pin 3: Heater
Pin 4: Section 2 Cathode
Pin 5: Section 1 Cathode
Pin 6: Heater
Pin 7: Section 1 Grid
Pin 8: Section 1 Plate

All inquiries as to the data should be addressed to Tube and Semiconductor Division, Tokyo Shibaura Electric Co., Ltd., 12, 1-chome, Yuraku-cho, Chiyoda-ku, Hibiya Mitsui Building, Tokyo, Japan.

from JEDEC release #4702,
May 18, 1964

Toshiba

TOSHIBA ELECTRON TUBE 8527

MEDIUM-MU TRIODE

The Toshiba 8527 is a heater-cathode type medium-mu triode of micro metal miniature construction with metal shell and ceramic stem to adapt standard 8-pin subminiature socket.
It is designed for use including RF or IF amplifier, and oscillator of high frequency up to 500 Mc/s in industrial and military airbone equipment which may be subjected to severe shock and vibration.



GENERAL DATA

ELECTRICAL :

Cathode: Coated unipotential		
Heater voltage	6.3	V
Heater current	0.15	A
Direct interelectrode capacitances:		
Grid to plate	1.3	PF
Input	2.4	PF
Output	2.4	PF

MECHANICAL:

Operating position	Any
Maximum overall length	1.082"
Maximum seated length	0.867"
Maximum diameter	0.434"
Bulb	Metal shell
Base	E8-9 (ceramic)

MAXIMUM RATINGS; Absolute maximum values:

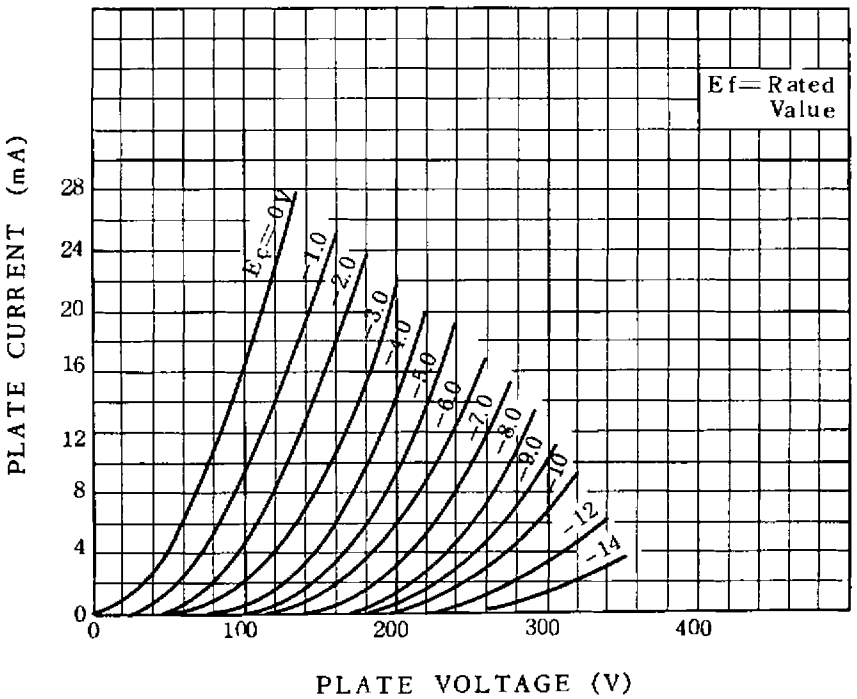
Plate voltage	165 max.	V
Grid voltage		
Positive bias value	0 max.	V
Negative bias value	55 max.	V
DC plate current	22 max.	mA
DC grid current	5.5 max.	mA
Plate dissipation	3.3 max.	W
Heater-cathode voltage		
Heater positive, total dc and peak	200 max.	V
Heater negative, total dc and peak	200 max.	V

Grid circuit resistance	1.2 max.	MΩ
Bulb temperature at hottest point on bulb surface	220 max.	°C
Altitude	80000 max.	Feet

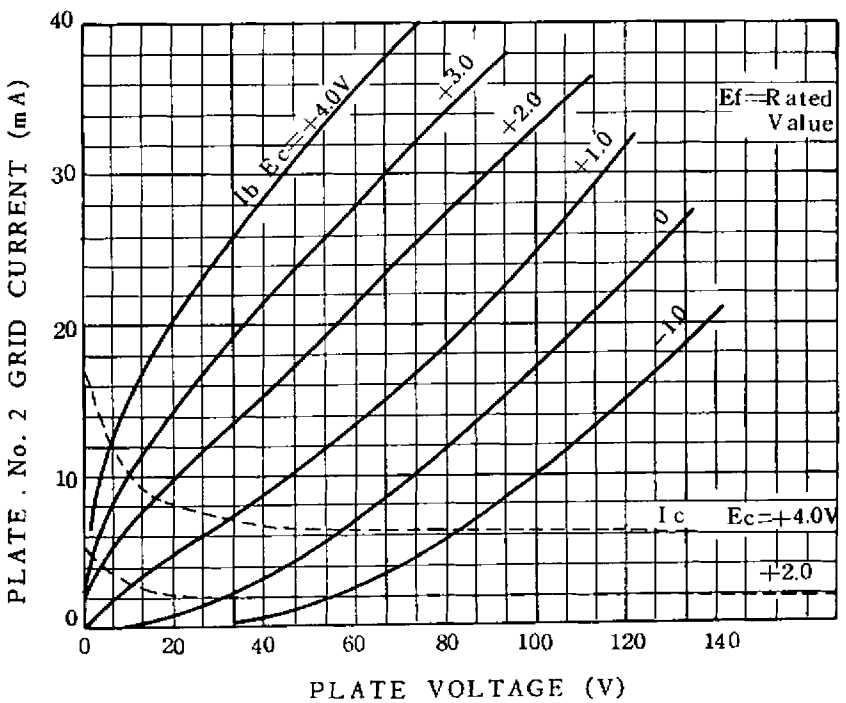
CHARACTERISTICS; Class A1 amplifier

Plate voltage	100	150	V
Cathode resistor	150	180	Ω
Amplification factor	27	27	
Plate resistance (Approx)	4650	4150	Ω
Transconductance	5800	6500	μʊ
Plate current	8.5	13.0	mA
Grid voltage (Approx.) for Ib=10 μA	-7	-11	V

AVERAGE PLATE CHARACTERISTICS

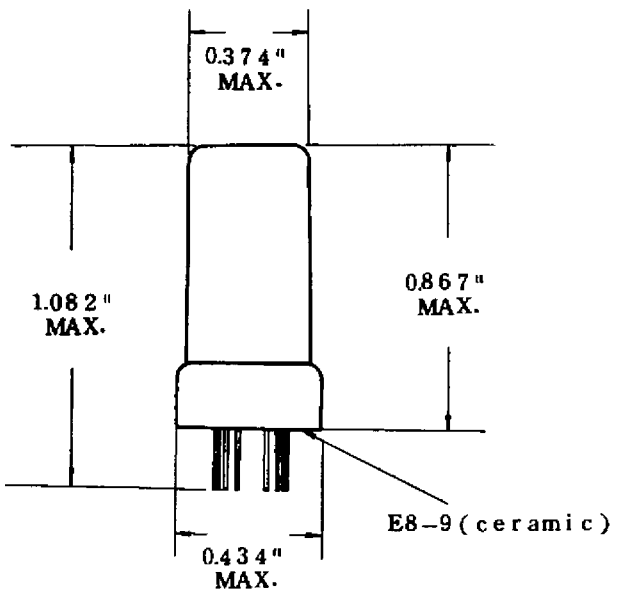


AVERAGE PLATE CHARACTERISTICS

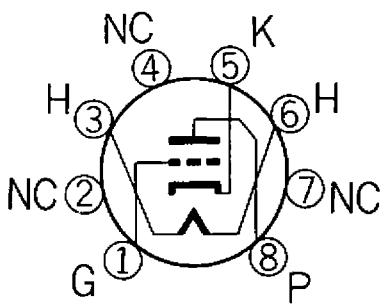


TOSHIBA ELECTRON TUBE

8527
DIMENSIONAL OUTLINE:
Dimensions in Inches



8527
BASING DIAGRAM:
Bottom View



8DK

Pin 1: Grid
Pin 2: No Connection
Pin 3: Heater
Pin 4: No Connection
Pin 5: Cathode
Pin 6: Heater
Pin 7: No Connection
Pin 8: Plate

All inquiries as to the data should be addressed to Tube and Semiconductor Division, Tokyo Shibaura Electric Co., Ltd., 12, 1-chome, Yuraku-cho, Chiyoda-ku, Hibiya Mitsui Building, Tokyo, Japan.

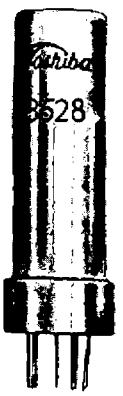
from JEDEC release #4702,
May 18, 1964

Toshiba

TOSHIBA ELECTRON TUBE 8528

BEAM-POWER PENTODE

The Toshiba 8528 is a heater-cathode type beam power pentode of micro metal miniature construction with metal shell and ceramic stem to adapt standard 8-pin subminiature socket.
It is designed for use as an audio power amplifier with low plate supply voltages, and is capable of approximately one watt output in the audio range. It is suitable for use in industrial and military airbone equipment which may be subjected to severe shock and vibration.
In on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.



GENERAL DATA

ELECTRICAL:

Cathode: Coated unipotential		
Heater voltage	6.3	V
Heater current	0.45	A
Direct interelectrode capacitances:		
No. 1 grid to plate	0.11	PF
Input	6.5	PF
Output	7.5	PF

MECHANICAL:

Operating position	Any
Maximum overall length	1.436"
Maximum seated length	1.221"
Maximum diameter	0.434"
Bulb	Metal shell
Base	E8-9 (ceramic)

MAXIMUM RATINGS; Absolute maximum values:

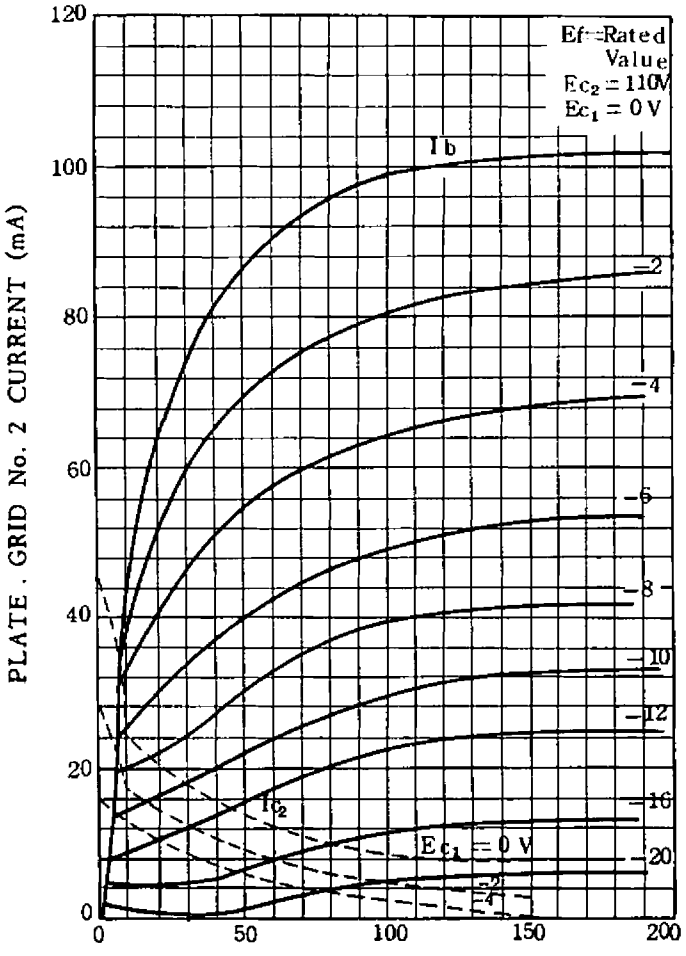
Plate voltage	165 max.	V
No. 2 grid voltage	155 max.	V
No. 1 grid voltage		
Positive bias value	0 max.	V
Negative bias value	55 max.	V

Cathode current	50 max.	mA
Plate dissipation	3.7 max.	W
No. 2 grid dissipation	0.4 max.	W
Heater-cathode voltage		
Heater negative	200 max.	V
Heater positive	200 max.	V
No. 1 grid circuit resistance	0.55 max.	MΩ
Bulb temperature at hottest point on bulb surface	220 max.	°C
Altitude	60000 max.	Feet

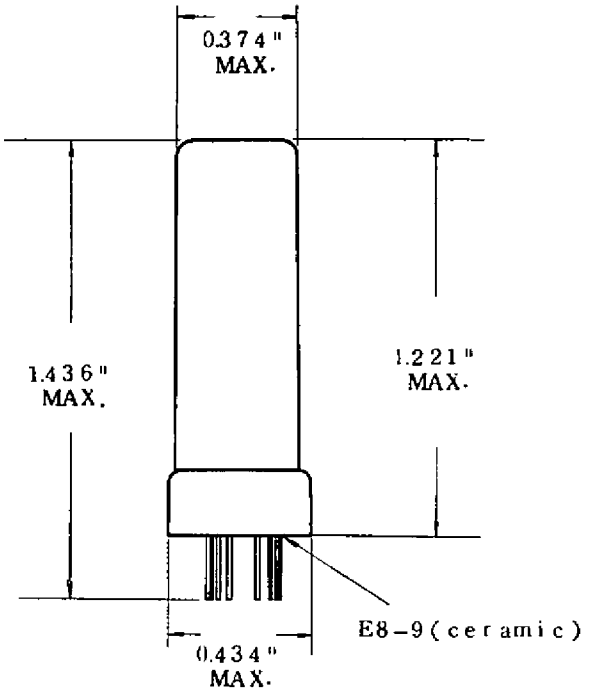
TYPICAL OPERATION AND CHARACTERISTICS:

Plate voltage	110	V
No. 2 grid voltage	110	V
No. 1 grid voltage	0	V
Cathode resistor	270	Ω
Plate resistance (Approx.)	15	KΩ
Transconductance	4200	μʊ
Plate current	30	mA
No. 2 grid current	2.2	mA
Peak AF No. 1 grid voltage	6.4	V r.m.s
Load resistance	3	KΩ
Power output	1	W

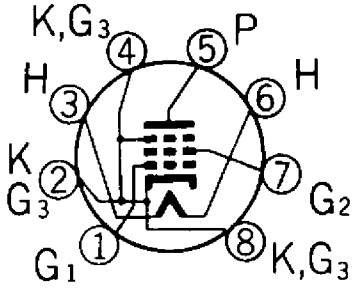
AVERAGE PLATE CHARACTERISTICS



8528
DIMENSIONAL OUTLINE:
Dimensions in Inches



8528
BASING DIAGRAM:
Bottom View



8DE

Pin 1: No. 1 Grid
Pin 2: No. 3 Grid, Cathode
Pin 3: Heater
Pin 4: No. 3 Grid, Cathode
Pin 5: Plate
Pin 6: Heater
Pin 7: No. 2 Grid
Pin 8: No. 3 Grid, Cathode

All inquiries as to the data should be addressed to Tube and Semiconductor Division, Tokyo Shibaura Electric Co., Ltd., 12, 1-chome, Yuraku-cho, Chiyoda-ku, Hibiya Mitsui Building, Tokyo, Japan.

from JEDEC release #4702,
May 18, 1964

Toshiba

TOSHIBA ELECTRON TUBE 8529

SEMI-REMOTE-CUTOFF PENTODE

The Toshiba 8529 is a heater-cathode type semi-remote-cutoff pentode of micro metal miniature construction with metal shell and ceramic stem to adapt standard 8-pin subminiature socket.
It is designed particularly for use including wide-band, high-frequency amplifier, and AGC amplifier. It is suitable for use in industrial and military airbone equipment which may be subjected to severe shock and vibration. In on-off control applications, the tube will maintain its capabilities after long periods of operation under cutoff conditions.



GENERAL DATA

ELECTRICAL :

Cathode: Coated unipotential		
Heater voltage	6.3	V
Heater current	0.15	A
Direct interelectrode capacitances:		
No. 1 grid to plate	0.015 max.	PF
Input	4.2	PF
Output	3.4	PF

MECHANICAL :

Operating position	Any
Maximum overall length	1.082"
Maximum seated length	0.867"
Maximum diameter	0.434"
Bulb	Metal shell
Base	E8-9 (ceramic)

MAXIMUM RATINGS; Absolute maximum values:

Plate voltage	165 max.	V
No. 2 grid voltage	155 max.	V
Negative dc No. 1 grid voltage	55 max.	V
Plate dissipation (Design-maximum value)	0.85 max.	W
No. 2 grid dissipation (Design-maximum value)	0.25 max.	W
DC cathode current	16.5 max.	mA

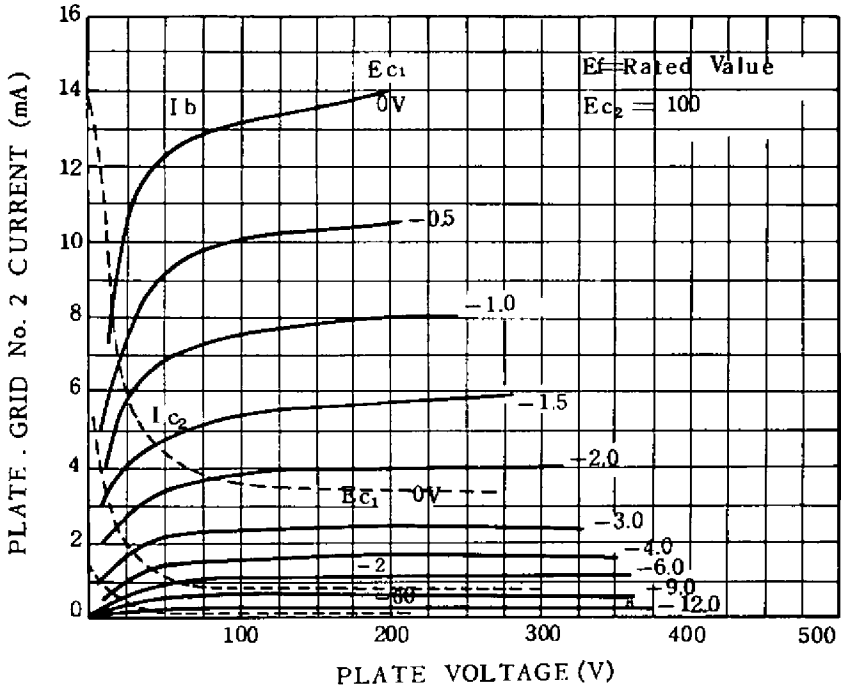
Heater-cathode voltage		
Heater positive, total dc and peak	200 max.	V
Heater negative, total dc and peak	200 max.	V
Bulb temperature at hottest point on bulb surface	220 max.	°C
No. 1 grid circuit resistance	1.1 max.	MΩ
Altitude	80000 max.	Feet

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS:

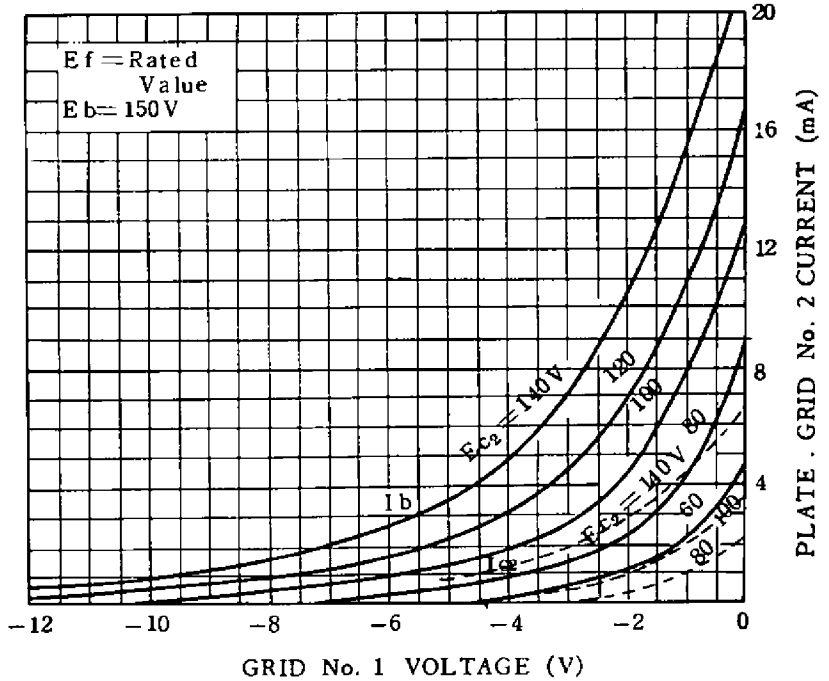
Class A1 amplifier

Plate voltage	100	V
No. 2 grid voltage	100	V
Cathode-bias resistor	120	Ω
Plate resistance (Approx.)	0.26	MΩ
Transconductance	4500	μ℧
Plate current	7.2	mA
No. 2 grid current	2.0	mA
No. 1 grid voltage (Approx.) for gm = 25 μ℧	-14	V

AVERAGE PLATE CHAEACTERISTICS



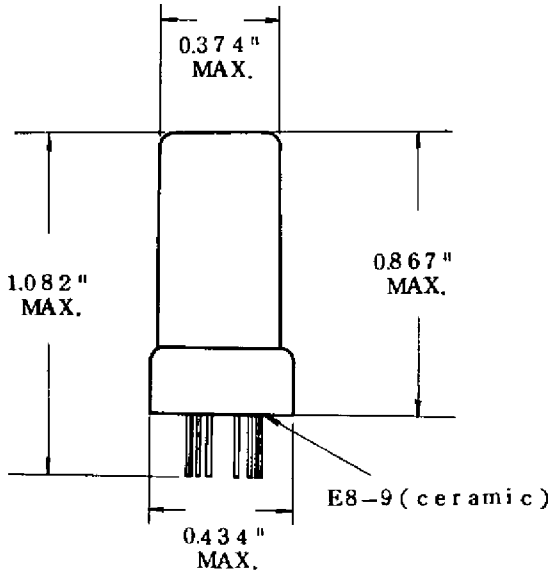
AVERAGE PLATE CHARACTERISTICS



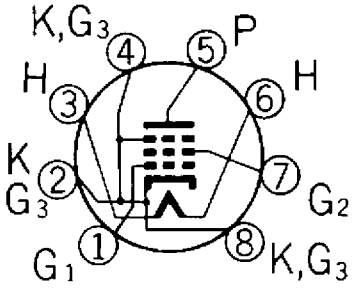
Toshiba

TOSHIBA ELECTRON TUBE

8529
DIMENSIONAL OUTLINE:
Dimensions in Inches



8529
BASING DIAGRAM:
Bottom View



8DE

Pin 1: No. 1 Grid
Pin 2: No. 3 Grid, Cathode
Pin 3: Heater
Pin 4: No. 3 Grid, Cathode
Pin 5: Plate
Pin 6: Heater
Pin 7: No. 2 Grid
Pin 8: No. 3 Grid, Cathode

All inquiries as to the data should be addressed to Tube and Semiconductor Division, Tokyo Shibaura Electric Co., Ltd., 12, 1-chome, Yuraku-cho, Chiyoda-ku, Hibiya Mitsui Building, Tokyo, Japan.

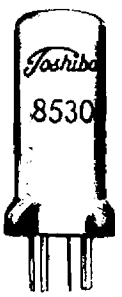
from JEDEC release #4702,
May 18, 1964

Toshiba

TOSHIBA ELECTRON TUBE 8530

SHARP-CUTOFF PENTODE

The Toshiba 8530 is a heater-cathode type sharp-cutoff pentode of micro metal miniature construction with metal shell and ceramic stem to adapt standard 8-pin subminiature socket.
It is designed primarily for use as an RF or IF amplifier in high-frequency up to 400 Mc broad-band circuits of industrial and military airbone equipment which may be subjected to severe shock and vibration.
In on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.



GENERAL DATA

ELECTRICAL :

Cathode: Coated unipotential

Heater voltage	6.3	V
Heater current	0.15	A
Direct interelectrode capacitances:		
No. 1 grid to plate	0.015	PF
Input	4.2	PF
Output	3.4	PF

MECHANICAL:

Operating position	Any
Maximum overall length	1.082"
Maximum seated length	0.867"
Maximum diameter	0.434"
Bulb	Metal shell
Base	E8-9 (ceramic)

MAXIMUM RATINGS; Absolute maximum values:

Class A1 amplifier

Plate voltage	165 max.	V
No. 3 grid voltage	22 max.	V
No. 2 grid voltage	155 max.	V
Negative dc No. 1 grid voltage	55 max.	V
Positive dc No. 1 grid voltage	0 max.	V
Plate dissipation	1.1 max.	W
No. 2 grid dissipation	0.55 max.	W
DC cathode current	16.5 max.	mA

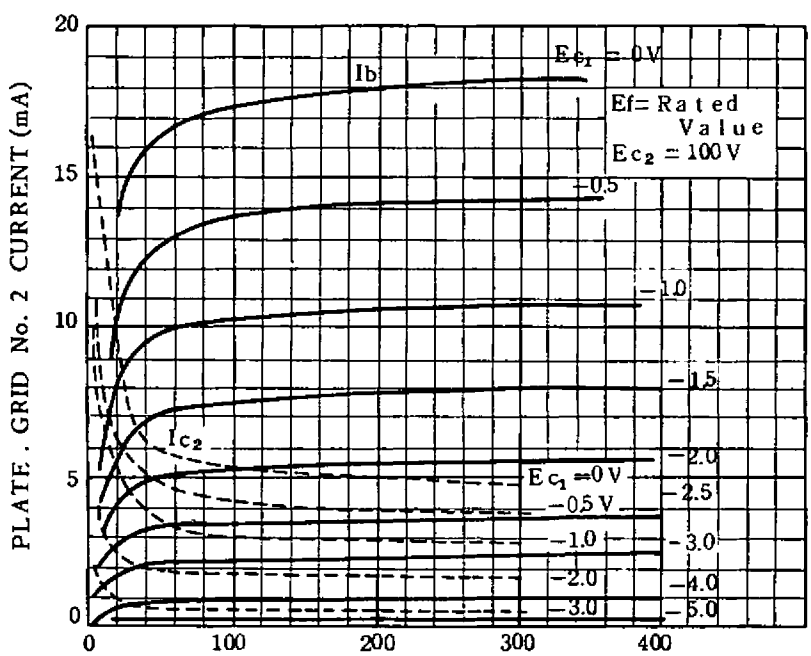
Heater-cathode voltage		
Heater positive, total dc and peak	200 max.	V
Heater negative, total dc and peak	200 max.	V
Bulb temperature at hottest point on bulb surface	220 max.	°C
No. 1 grid circuit resistance		
For cathode bias operation	1.1 max.	MΩ
Altitude	80000 max.	Feet

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS:

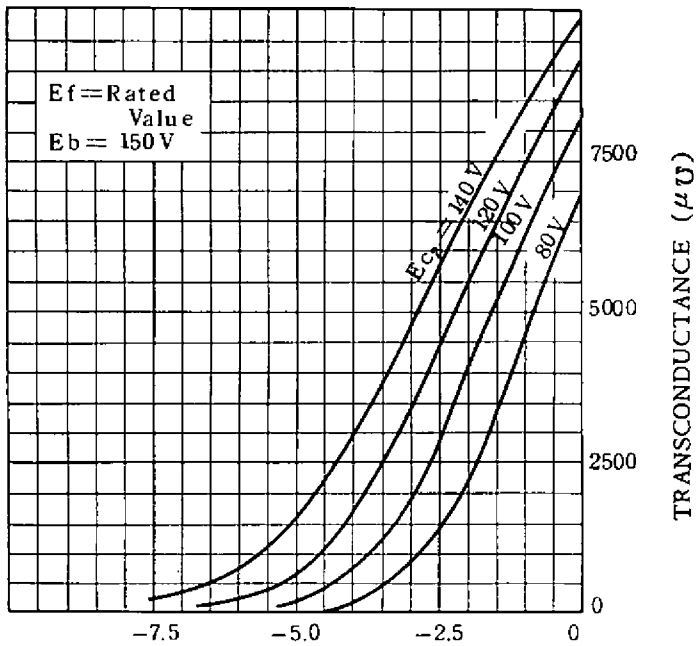
Class A1 amplifier

Plate voltage	100	V
No. 2 grid voltage	100	V
Cathode bias resistor	150	Ω
Plate resistance, (Approx.)	0.26	MΩ
Transconductance	5000	μU
Plate current	7.5	mA
No. 2 grid current	2.4	mA
No. 1 grid voltage, (Approx., for plate current of 10 μA	-9.0	V

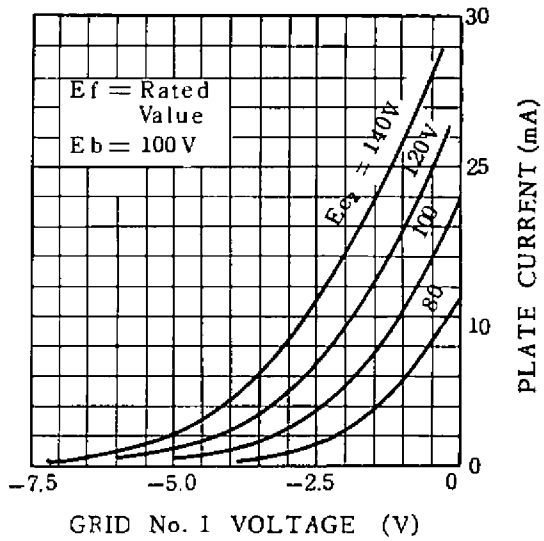
AVERAGE PLATE CHARACTERISTICS



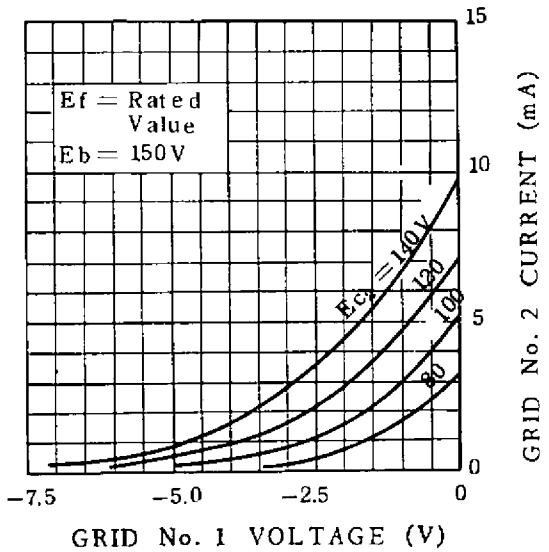
AVERAGE GRID CHARACTERISTICS



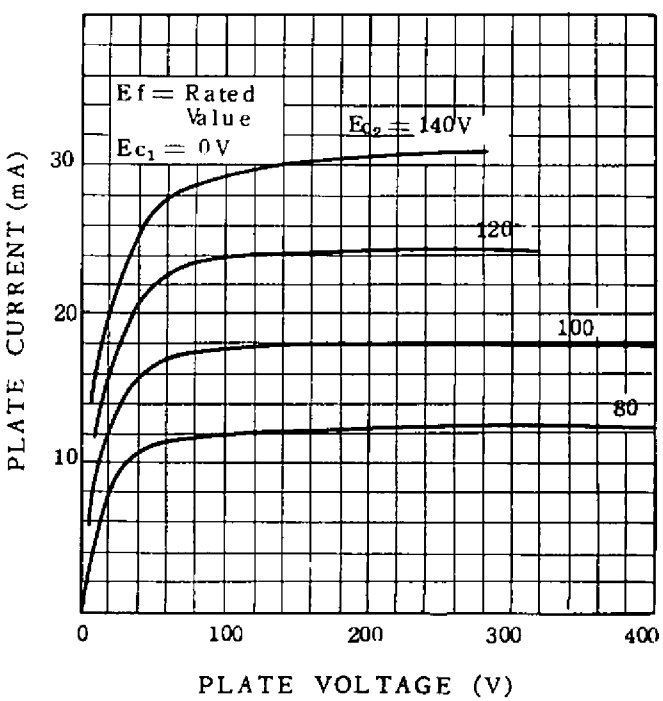
AVERAGE GRID CHARACTERISTICS



AVERAGE GRID CHARCTERISTICS



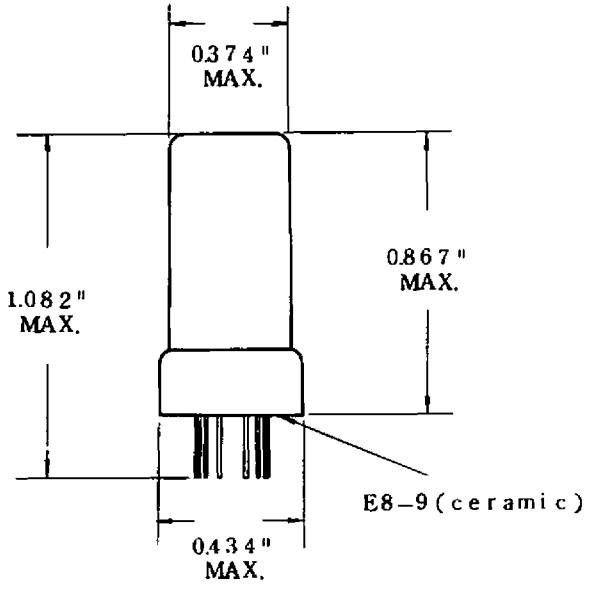
AVERAGE PLATE CHARACTERISTICS



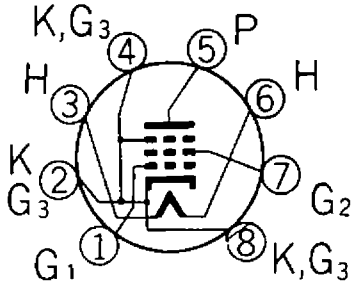
Toshiba

TOSHIBA ELECTRON TUBE

8530
DIMENSIONAL OUTLINE:
Dimensions in Inches



8530
BASING DIAGRAM:
Bottom View



8DE

Pin 1: No. 1 Grid
Pin 2: No. 3 Grid, Cathode
Pin 3: Heater
Pin 4: No. 3 Grid, Cathode
Pin 5: Plate
Pin 6: Heater
Pin 7: No. 2 Grid
Pin 8: No. 3 Grid, Cathode

All inquiries as to the data should be addressed to Tube and Semiconductor Division, Tokyo Shibaura Electric Co., Ltd., 12, 1-chome, Yuraku-cho, Chiyoda-ku, Hibiya Mitsui Building, Tokyo, Japan.

from JEDEC release #4690, May 4, 1964

RCA-8532

HIGH-MU TRIODE

"Premium" Version of 6J4

7-PIN MINIATURE, FRAME-GRID TYPE

For Cathode-Drive UHF Amplifier Applications (up to 500 Mc/s) in Equipment Requiring Exceptional Stability and Reliability under Severe Environmental Conditions

Transconductance 11,000 μmhos
Amplification Factor 52.5

Can also be supplied to meet Military Specification MIL-E-1/1527 (EL)

RCA-8532 is a high-mu triode of the 7-pin miniature type for cathode-drive-amplifier applications at frequencies up to 500 Mc/s. This "Premium" version of the 6J4 features frame-grid construction and Special Tests for long life and stability of characteristics in critical industrial applications under conditions of severe shock, vibration, and high altitude.



An internal shield connected to the grid reduces the cathode-to-plate capacitance, and thus minimizes undesirable feedback effects when the tube is operated as a cathode-drive amplifier.

Three base-pin terminals are provided for the grid. At uhf frequencies, these terminals may all be connected to ground to minimize the effects of grid-lead inductance.

An RCA Dark Heater, rated at 6.3 volts/0.400 ampere, is utilized for long life and dependable performance.

The 8532 is unilaterally interchangeable with types 6J4, 6J4WA, and 6J4WB and may be used to replace these types in existing equipment.

For military applications, the 8532 can also be supplied to meet Military Specification MIL-E-1/1527 (EL) dated 24 February 1964, a copy of which may be obtained from: Specification Division, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pa. 19120.

GENERAL DATA

Electrical:

Heater Ratings and Characteristics:		
Voltage (AC or DC)	6.3 ± 0.3	volts
Current at 6.3 volts	0.400	amp
Peak heater-cathode voltage:		
Heater negative with respect to cathode	100 max.	volts
Heater positive with respect to cathode	100 max.	volts
Direct Interelectrode Capacitances:[a]		
Cathode to plate	0.2 max.	pf
Input (Cathode-drive operation): K to (G + IS, H)[b]	7.5	pf
Output (Cathode-drive operation): P to (G + IS, H)[b]	5.0 max.	pf
Grid and internal shield to plate	2.8	pf
Heater to cathode	2.8	pf

Characteristics, Class A$_1$ Amplifier:

Plate Supply Voltage	150	volts
Grid	*Connected to negative end of cathode resistor*	
Cathode Resistor	100	ohms
Amplification Factor	52.5	
Plate Resistance (Approx.)	4800	ohms
Transconductance	11000	μmhos
Plate Current	13.5	ma
Grid Voltage (Approx.) for plate μa = 60	-15	volts

Mechanical:

Operating Position	Any
Type of Cathode	Coated Unipotential
Maximum Overall Length	2-1/8"
Maximum Seated Length	1-7/8"
Maximum Diameter	0.750"
Dimensional Outline	JEDEC No. 5-2
Bulb	T5-1/2
Base	Small-Button Miniature 7-Pin (JEDEC No. E7-1)

AMPLIFIER — Class A$_1$

Maximum Ratings, *Absolute-Maximum Values:*

For operation at altitudes up to 80,000 feet and frequencies up to 500 Mc/s

Plate Voltage	150 max.	volts
Grid Voltage:		
Negative-bias value	55 max.	volts
Positive-bias value	0 max.	volts
Cathode Current	20 max.	ma
Plate Dissipation	2.5 max.	watts
Bulb Temperature (At hottest point on bulb surface)	120 max.	°C

[a] With external shield JEDEC No. 316 connected to ground except as noted.

[b] With external shield JEDEC No. 316 connected to grid.

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Electronic Components and Devices
Harrison, N. J.

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8532 4-64
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Maximum Circuit Values:

Grid-Circuit Resistance:
For grid-resistor-bias operation. 0.25 max. megohm

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	0.375	0.425	amp
Direct Interelectrode Capacitances:	2			
Cathode to plate	3	-	0.2	pf
Input (Cathode-drive operation): K to (G + IS, H)	4	5.5	9.5	pf
Output (Cathode-drive operation): P to (G + IS, H)	4	-	5.0	pf
Grid and internal shield to plate	3	2.3	3.3	pf
Heater to cathode	3	1.0	4.5	pf
Plate Current (1)	1,5	9	18	ma
Plate Current (2)	1,6	-	60	μa
Transconductance (1)	1,5	8800	13200	μmhos
Transconductance (2) for an individual tube expressed as a per cent of Transconductance (1)	5,7	-	15	%
Reverse Grid Current	1,8	0	0.5	μa
Amplification Factor	1,5	40	65	
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,9	-	10	μa
Heater positive with respect to cathode	1,9	-	10	μa
Leakage Resistance:				
Between grid and all other elements connected together	1,10	500	-	megohms
Between plate and all other elements connected together	1,11	500	-	megohms

Note 1: With ac or dc heater volts = 6.3.

Note 2: Measured in accordance with EIA Standard RS-191-A.

Note 3: With external shield JEDEC No.316 connected to ground.

Note 4: With external shield JEDEC No.316 connected to grid.

Note 5: With dc plate-supply volts = 150, grid connected to negative end of cathode resistor, cathode resistor (ohms) = 100, and cathode-bypass capacitor (μf) = 1000.

Note 6: With dc plate volts = 150 and dc grid volts = -15.

Note 7: With ac or dc heater volts = 5.7.

Note 8: With dc plate supply volts = 175, grid-circuit resistance (megohms) = 0.25, and cathode resistor (ohms) = 150.

Note 9: With dc heater-cathode volts = 100.

Note 10: With grid 100 volts negative with respect to all other elements connected together.

Note 11: With plate 300 volts negative with respect to all other elements connected together.

SPECIAL TESTS

High-Impact, Short-Duration Shock:

Peak Impact Acceleration	450	g
Duration of half-sine-wave mechanical-shock pulse	1	ms

This test is performed on sample tubes from each production lot to determine the ability of the tubes to withstand the specified acceleration for a short time interval. Tubes are rigidly mounted in each of four different positions (X_1, X_2, Y_1, and Y_2) in a Navy-Type High-Impact (Flyweight) Shock Machine and, with heater volts = 6.3, dc plate supply volts = 150, dc grid volts = -1.5, grid resistor (megohms) = 0.1, dc heater-cathode volts = 100, are subjected to 20 blows (5 in each position) at a hammer angle of 30°.

Tubes are then criticized for changes in Transconductance (1), Reverse Grid Current, and Heater-Cathode Leakage Current under the conditions specified in the CHARACTERISTICS RANGE VALUES and are subjected to the Constant-Frequency Vibration Test and the Continuity and Shorts Test described below.

Fatigue Vibration:

Peak Vibrational Acceleration	5	g
Vibration Frequency, a constant value within the range of	25 to 60	c/s
Duration of Test	96	h

This test is performed on sample tubes from each production lot to determine the ability of the tubes to withstand the specified acceleration at a constant vibration frequency for an extended time interval. Tubes are rigidly mounted on a platform vibrating with simple harmonic motion at a constant vibration frequency within the range of 25 to 60 c/s and, with heater volts = 6.3, are subjected to the specified acceleration for 96 hours (32 hours in each of three different positions X_1, X_2, and Y_1).

Tubes are then criticized for changes in Transconductance (1), Reverse Grid Current, and Heater-Cathode Leakage Current under the conditions specified in the CHARACTERISTICS RANGE VALUES and are subjected to the Constant-Frequency Vibration Test and the Continuity and Shorts Test described below.

Constant-Frequency Vibration:

Peak Vibrational Acceleration	10	g
Vibration Frequency	40	c/s
RMS Voltage across plate load resistor	150 max.	mv

This test is performed on sample tubes from each production lot to determine if loose parts or mechanical resonance are present at the specified acceleration and vibration frequency. Tubes are rigidly mounted on a platform vibrating with simple harmonic motion at a constant frequency of

40 c/s and, with the tubes operating under the conditions specified in the CHARACTERISTICS RANGE VALUES for Transconductance (1) with the addition of a plate load resistor of 2000 ohms, are subjected to the specified acceleration. During this test, with a 60-c/s ac grid signal voltage, the rms voltage across the plate load resistor must not exceed 150 millivolts.

Variable-Frequency Vibration:

Peak Vibrational Acceleration . .	10	g
Vibration-Frequency Range	50 to 500	c/s
RMS Voltage across plate load resistor	100 max.	mv

This test is performed periodically on sample tubes to determine if mechanical resonance is present at the specified acceleration over the specified frequency range. Tubes are rigidly mounted on a platform vibrating with simple harmonic motion over a frequency range of 50 to 500 c/s and, with the tubes operating under the conditions specified in the CHARACTERISTICS RANGE VALUES for Transconductance (1) with the addition of a plate load resistor of 2000 ohms, are subjected to the specified acceleration in each of two different positions, X_1 and X_2. The acceleration over the frequency range is within ±20 per cent of the reference acceleration at 100 c/s. The frequency is increased from 50 to 500 c/s with approximately logarithmic progression and 4 to 5 minutes are required to traverse the frequency range. During this test, with a 60-c/s ac grid signal voltage, the rms voltage across the plate load resistor must not exceed 100 millivolts.

High-Altitude Voltage Breakdown:

Effective Altitude.	80000	ft
Air Pressure.	21 ± 2	mm Hg
Ambient Temperature	25 ± 5	°C
RMS Voltage between plate base pin and adjacent pins. . .	500	volts

This test is performed on sample tubes from each production lot to determine the ability of the tubes to withstand high-altitude (low-air-pressure) conditions. In this test at an ambient temperature of 25° ± 5° C, while the tubes are subjected to a reduced air pressure of 21 ± 2 mm Hg corresponding to an altitude of 80,000 feet, a 60-c/s, ac rms voltage of 500 volts is applied between the plate base pin and adjacent pins. Tubes must not break down (arc over) or show evidence of corona.

Continuity and Shorts:

This test is performed on sample tubes from each production lot to determine the presence of open circuits, temporary or permanent shorts, or air leaks. Tubes are subjected to the Thyratron-Type Shorts Test described in Military Specification MIL-E-1D, Amendment 5, Paragraph 4.7.7.

Heater-Cycling Life:

Duration of Test. . . . . 2000 cycles

This test is performed on sample tubes from each production lot with heater volts = 7.0 cycled 1 minute ON and 4 minutes OFF for 2000 cycles, dc heater-cathode volts = 100 continuously ON, and no voltages applied to the plate or grid. After 2000 cycles, tubes are criticized for changes in Heater-Cathode Leakage Current and Leakage Resistance, and for Open Heaters, Open Cathode Circuits, and Heater-Cathode Shorts.

Stability Life (20 Hours):

This test is performed at room temperature on sample tubes from each production lot to determine if the tubes are properly stabilized. After 2 hours and again after 20 hours of operation under the conditions specified in the CHARACTERISTICS RANGE VALUES for Transconductance (1) with the addition of a grid resistor of 0.25 megohm and with dc heater-cathode volts = 100, tubes are criticized for the change in Transconductance (1).

Early-Hour Survival-Rate Life (100 Hours):

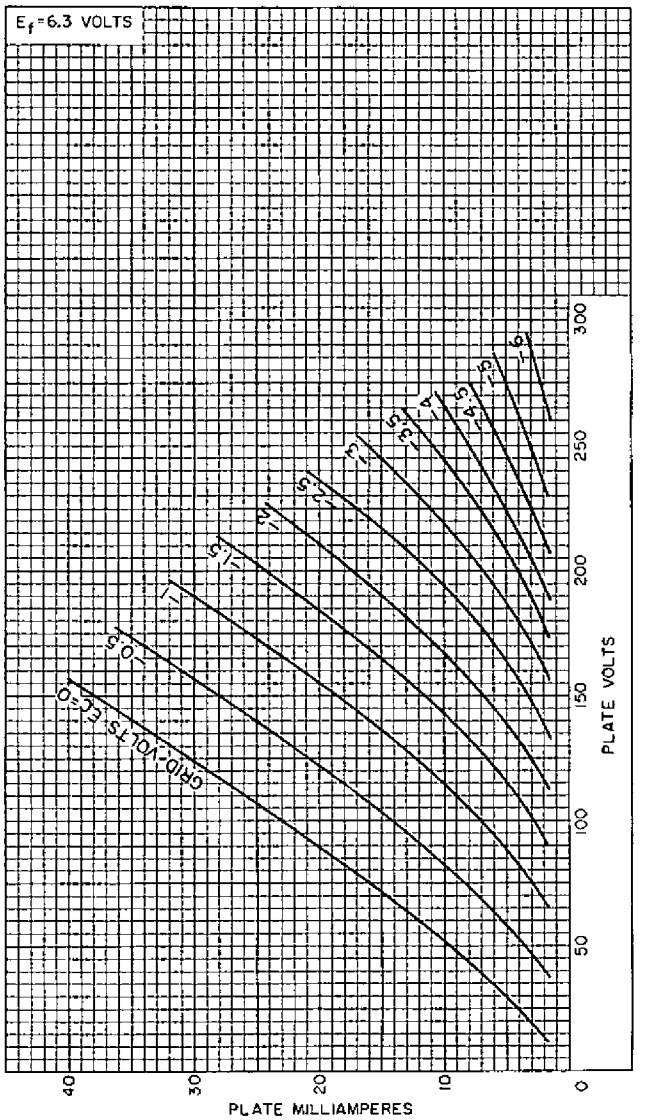
This test is performed on sample tubes from each production lot to assure a high early-hour survival rate. After 100 hours of operation under the conditions specified for the Stability Life Test above, tubes are criticized for the change in Transconductance (1) and are then subjected to the Continuity and Shorts Test.

Intermittent-Conduction Life (1000 Hours):

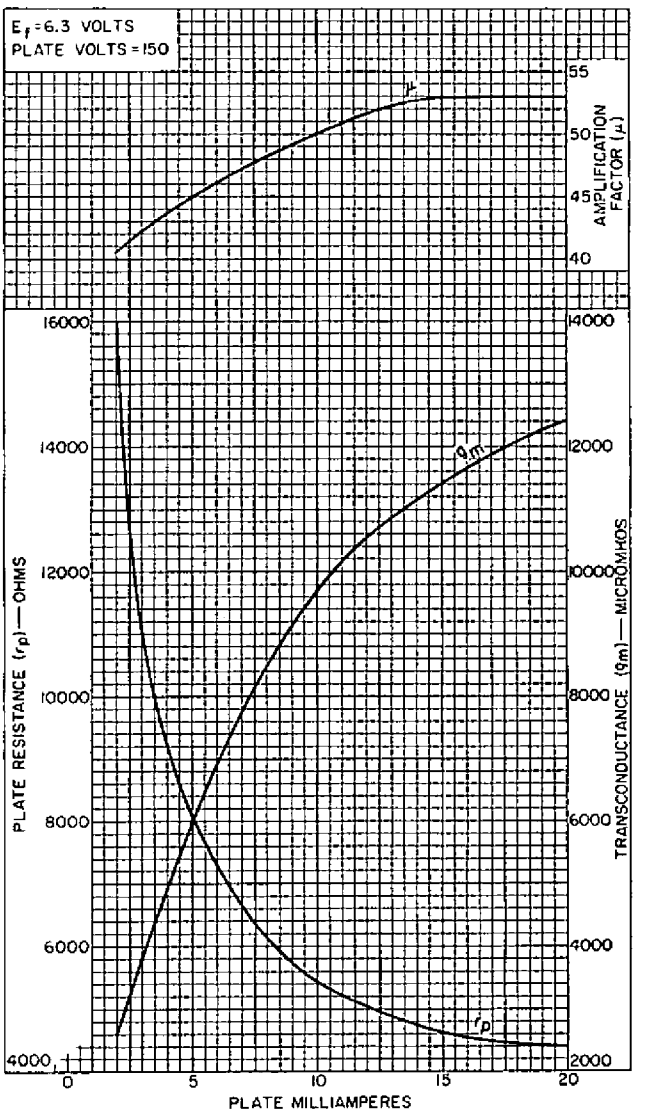
This test is performed on sample tubes from each production lot to assure the high quality of individual tubes and to guard against epidemic failures due to excessive changes in any of the characteristics specified below. After 500 hours of operation under the conditions specified for the Stability Life Test above and, in addition, with heater voltage cycled 110 minutes ON and 10 minutes OFF, and bulb temperature = 120° C, tubes are criticized for changes in Heater Current, Transconductance (1), Transconductance (2), Reverse Grid Current, Heater-Cathode Leakage Current, Leakage Resistance, and for Open Circuits, Permanent Shorts, Air Leaks, and Total Defectives. After 1000 hours of operation, tubes are again criticized for all of the preceding defects with the exception of the change in Transconductance (2).

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AVERAGE PLATE CHARACTERISTICS

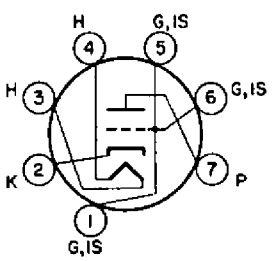


AVERAGE CHARACTERISTICS



TERMINAL DIAGRAM

Bottom View

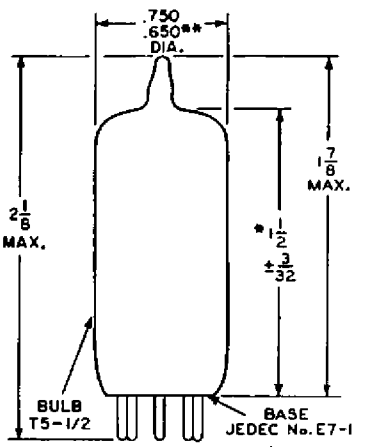


JEDEC 7BQ

Pin 1 - Grid, Internal Shield
Pin 2 - Cathode
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Same as Pin 1
Pin 6 - Same as Pin 1
Pin 7 - Plate

DIMENSIONAL OUTLINE JEDEC No.5-2

Dimensions in Inches



* Measured from base seat to bulb-top line as determined by a ring gauge of 7/16" inside diameter.

** The minimum applies in the zone starting 0.375" from the base seat.

SYLVANIA engineering data service

SYLVANIA

8543

ADVANCE DATA

MECHANICAL DATA

Mounting Position	Any	
Weight	3.75 Lbs. Max.	
Cooling	Convection	
Output Pressurization	45 psia Max.	
Minimum Magnet Isolation	2 Inches	
Output Coupling	Couples to UG-39/U	
Vibration	5G, 5-500 cps	
Altitude	55,000	Ft. Max.

ELECTRICAL DATA

HEATER CHARACTERISTICS

Voltage, Preheat	6.3	V
Current	1.1	A
Minimum Preheat Time	2.0	Minutes

RATINGS (Absolute Maximum)[1]

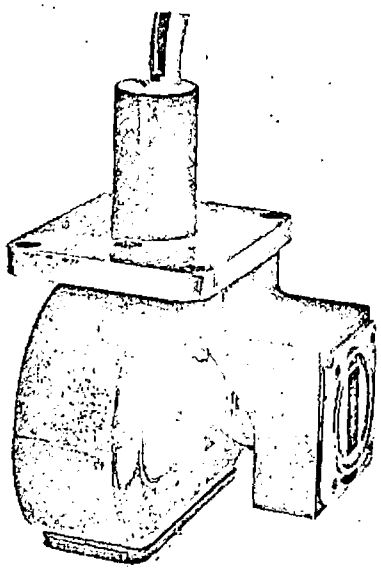
Peak Anode Voltage	9.0	kv
Heater Voltage	7.0	V
Heater Surge Current	4.0	A
Average Power Input	83.0	W
Anode Temperature	150	°C
Voltage Standing Wave Ratio	1.5:1	
Duty Cycle	0.001	
Pulse Width	2.2	μs
Rate of Rise of Voltage	100	kv/μs

TYPICAL OPERATION

Duty Cycle	0.001	
Pulse Width	2.1	μs
Time of Rise of Voltage	0.1	μs
Average Anode Current	8.25	mAdc
Peak Anode Voltage	8.0	kv
Average Power Output	30	W
Pulling Factor	16	Mc
Pushing Factor	0.2	Mc/a Max.
Thermal Factor	0.20	Mc/°C
Stability	0.5	%
Bandwidth	1.0	Mc
Minor Lobes	6	db
Heater Voltage, Radiate	4.5	V

QUICK REFERENCE DATA

X-Band Magnetron
Fixed Frequency
9375 ± 30 Mc
Pulsed Operation
24 kw Minimum Peak Power Output
Convection Air Cooled
Integral Magnets
Ruggedized for Airborne Weather Radar Systems



SYLVANIA ELECTRIC PRODUCTS INC.

Electronic Components Group
MICROWAVE DEVICE DIVISION
WILLIAMSPORT, PA.

A Technical Publication

May 13, 1964

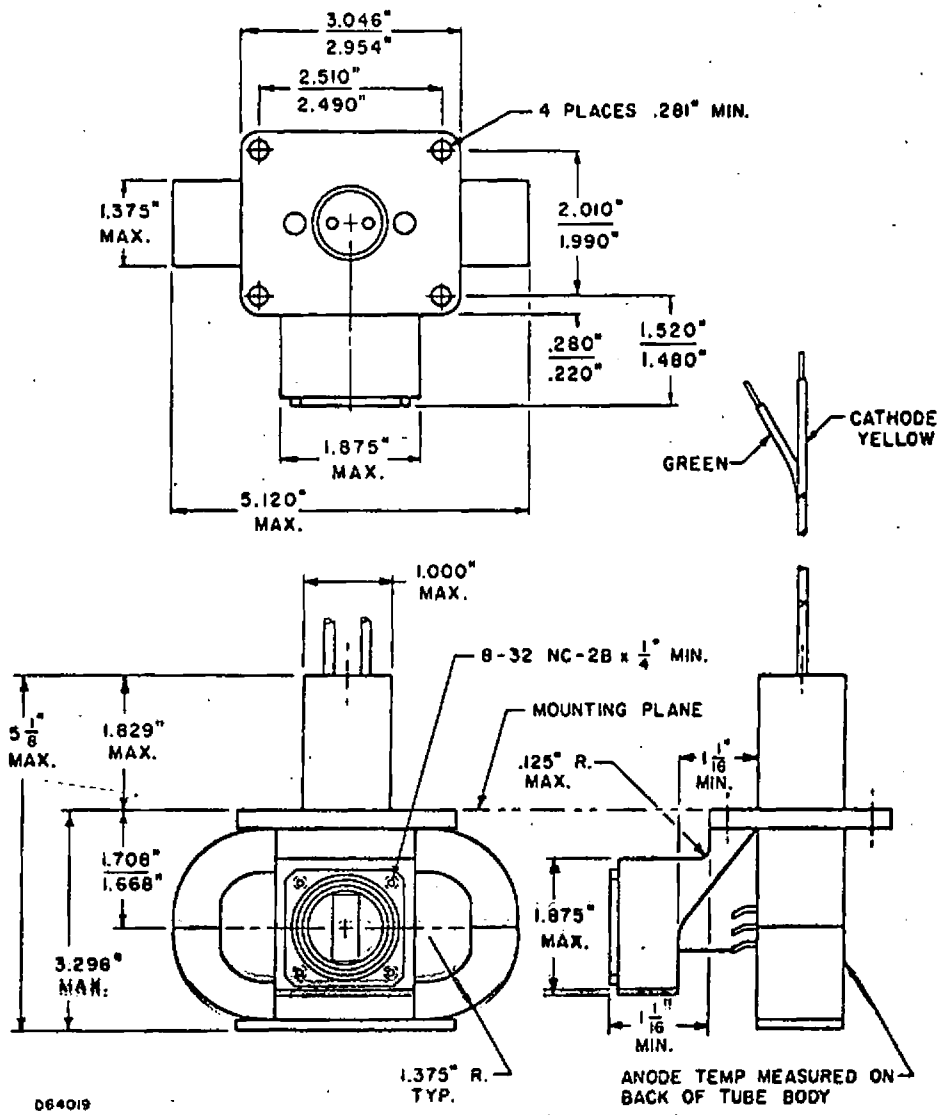
from JEDEC release #4748, July 6, 1964

NOTES:

1. If the independent absolute ratings are exceeded, serviceability of the tube may be impaired. Refer to MIL-E-1D, para. 6.5.

2. Dependable operation and maximum magnetron life can be realized only if the complete system is designed with the magnetron characteristics clearly in mind. This data sheet is intended to acquaint the reader with the basic characteristics of the magnetron and should not be used as an absolute guide. Additional information and assistance with specific applications may be obtained by contacting Sylvania Microwave Device Division, Williamsport, Pa.

OUTLINE



from JEDEC release #4704A, Aug. 5, 1968

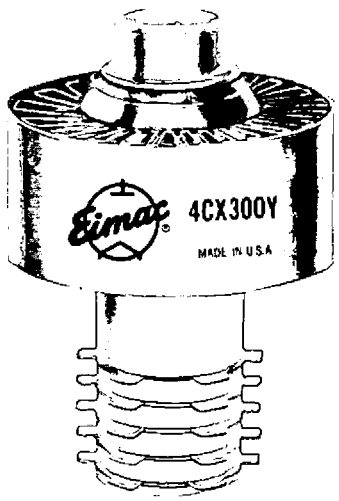
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SAN CARLOS
CALIFORNIA

8561
4CX300Y
CERAMIC POWER TETRODE

The EIMAC 4CX300Y is a compact integral-finned external-anode power tetrode having a maximum plate-dissipation rating of 400 watts. The 4CX300Y may be operated at maximum ratings to 110 MHz.

The all-ceramic-and-metal construction and the internally-unitized electrode structure combine to make the 4CX300Y especially durable and free from mechanically-induced noise under conditions of severe acceleration caused by shock or vibration.



GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Cathode: Oxide-Coated, Unipotential				
Heating Time	30	60		seconds
Cathode-to-Heater Potential			±150	volts
Heater: Voltage (See "Application")		6.0		volts
Current (E_f=6.0 volts)	3.0		3.85	amperes
Amplification Factor (Grid to Screen)	4.0		5.6	
Transconductance (I_b=200 ma.)		12,000		μmhos

Direct Interelectrode Capacitances, Grounded Cathode:	Min.	Nom.	Max.	
Input	30		38	μμf
Output	3.9		5.0	μμf
Feedback			0.07	μμf
Direct Interelectrode Capacitances, Grounded Grid and Screen:				
Input		18		μμf
Output	3.9		5.0	μμf
Feedback		0.01		μμf
Frequency for Maximum Ratings			110	MHz

MECHANICAL

Base	Special, breechblock terminal surfaces
Recommended Socket	EIMAC SK-700 Series
Operating Position	Any
Maximum Operating Temperatures:	
Ceramic-to-Metal Seals	250°C
Anode Core	250°C
Cooling	Forced Air
Maximum Over-All Dimensions:	
Height	2.5 inches
Diameter	1.65 inches
Net Weight	4 ounces
Shipping Weight (Approximate)	1 pound

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Printed in U.S.A.

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions)

MAXIMUM RATINGS

DC PLATE VOLTAGE	2000 VOLTS
DC SCREEN VOLTAGE	300 VOLTS
DC GRID VOLTAGE	—250 VOLTS
DC PLATE CURRENT	400 MA
PLATE DISSIPATION	400 WATTS
SCREEN DISSIPATION	8 WATTS
GRID DISSIPATION	1 WATT

TYPICAL OPERATION

DC Plate Voltage	1000	1500	2000 volts
DC Screen Voltage	250	250	250 volts
DC Grid Voltage	—90	—90	—90 volts
DC Plate Current	0.38	0.4	0.4 amps
DC Screen Current*	31	26	26 mA
DC Grid Current*	32	33	33 mA
Peak RF Grid Voltage*	110	110	110 volts
Driving Power*	3.5	3.8	3.8 watts
Plate Input Power	380	600	800 watts
Plate Output Power	240	425	600 watts

*Approximate values

AUDIO-FREQUENCY AMPLIFIER OR MODULATOR

Class-AB_1

MAXIMUM RATINGS (per tube)

DC PLATE VOLTAGE	2000 VOLTS
DC SCREEN VOLTAGE	400 VOLTS
DC PLATE CURRENT	400 MA
PLATE DISSIPATION	400 WATTS
SCREEN DISSIPATION	8 WATTS
GRID DISSIPATION	1 WATT

TYPICAL OPERATION (Sinusoidal wave, two tubes unless noted)

DC Plate Voltage	1000	1500	2000 volts
DC Screen Voltage	400	400	400 volts
DC Grid Voltage[1]	—60	—70	—70 volts
Zero-Signal DC Plate Current	400	200	200 mA
Max-Signal DC Plate Current	800	790	750 mA
Max-Signal DC Screen Current	24	16	4 mA
Effective Load, Plate to Plate	2060	3000	5100 ohms
Peak AF Grid Input Voltage (per tube)*	55	65	60 volts
Driving Power	0	0	0 watts
Max-Signal Plate Output Power	340	800	890 watts

*Approximate values
[1]Adjust grid bias to obtain listed zero-signal plate current.

RADIO-FREQUENCY LINEAR AMPLIFIER

Class-AB_1 (Carrier conditions)

MAXIMUM RATINGS

DC PLATE VOLTAGE	2000 VOLTS
DC SCREEN VOLTAGE	400 VOLTS
DC PLATE CURRENT	400 MA
PLATE DISSIPATION	400 WATTS
SCREEN DISSIPATION	8 WATTS
GRID DISSIPATION	1 WATT

TYPICAL OPERATION

DC Plate Voltage	1000	1500	2000 volts
DC Screen Voltage	400	400	400 volts
DC Grid Voltage[1]	—60	—70	—70 volts
Zero-Signal DC Plate Current	200	100	100 mA
DC Plate Current	280	210	205 mA
DC Screen Current*	—5	—5	—5 mA
Peak RF Grid Voltage*	28	33	30 volts
Plate Output Power	52	110	115 watts

*Approximate values.
[1]Adjust grid bias to obtain listed zero-signal plate current.

RADIO-FREQUENCY LINEAR AMPLIFIER

Class-AB_1 (Single-Sideband Suppressed-Carrier Operation)

MAXIMUM RATINGS

DC PLATE VOLTAGE	2000 VOLTS
DC SCREEN VOLTAGE	400 VOLTS
DC PLATE CURRENT	400 MA
PLATE DISSIPATION	400 WATTS
SCREEN DISSIPATION	8 WATTS
GRID DISSIPATION	1 WATT

TYPICAL OPERATION (Peak-envelope conditions except where noted)

DC Plate Voltage	1000	1500	2000 volts
DC Screen Voltage	400	400	400 volts
DC Grid Voltage[1]	—60	—70	—70 volts
Zero-Signal DC Plate Current	200	100	100 mA
Peak RF Grid Voltage*	55	65	60 volts
DC Plate Current	400	395	375 mA
DC Screen Current*	12	8	2 mA
Plate Input Power	400	590	750 watts
Plate Output Power	170	400	415 watts
Two-Tone Average DC Plate Current			
Two-Tone Average DC Screen Current			

*Approximate values.
[1]Adjust grid bias to obtain listed zero-signal plate current.

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions)

MAXIMUM RATINGS

DC PLATE VOLTAGE	1500 VOLTS
DC SCREEN VOLTAGE	300 VOLTS
DC GRID VOLTAGE	—250 VOLTS
DC PLATE CURRENT	300 MA
PLATE DISSIPATION	250 WATTS
SCREEN DISSIPATION	8 WATTS
GRID DISSIPATION	1 WATT

TYPICAL OPERATION

DC Plate Voltage	1000	1500	volts
DC Screen Voltage	250	250	volts
DC Grid Voltage	—130	—130	volts
DC Plate Current	285	300	mA
DC Screen Current*	24	18	mA
DC Grid Current*	17	17	mA
Peak RF Grid Input Voltage*	148	148	volts
Driving Power*	1.7	1.7	watts
Plate Input Power	285	500	watts
Plate Output Power	165	300	watts

*Approximate values.

NOTE: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves. No allowance has been made for circuit losses. Adjustment of the rf grid drive to obtain the specified plate current at the specified grid bias, screen voltage, and plate voltage is assumed. If this procedure is followed, there will be little variation in output power when tubes are changed, even though there may be some variation in grid and screen currents. The grid and screen currents which result when the desired plate current is obtained are incidental and vary from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf driving voltage is applied.

APPLICATION

MECHANICAL

Mounting — The 4CX300Y may be operated in any position. Recommended sockets for the 4CX300Y are the EIMAC Air-System Sockets type SK-700 (ungrounded cathode) or type SK-710 (cathode and one heater contact grounded). Both sockets provide connections to all electrodes except the anode and each incorporates a screen by-pass capacitor of approximately 1100 $\mu\mu$f. The SK-606 chimney is recommended for use with the SK-700 and SK-710 sockets.

Other sockets suitable for use with the 4CX300Y include the SK-740, SK-760, and SK-770. These sockets do not incorporate screen by-pass capacitors. The SK-760 and SK-770 incorporate integral air chimneys. Screen contacts are connected to the mounting flange in the SK-770 and are, therefore, grounded when the socket is installed in the usual manner.

Cooling — The maximum rated ceramic-to-metal seal temperature for the 4CX300Y is 250°C. Adequate forced-air cooling must be provided to assure that this maximum temperature rating is not exceeded. Air-flow requirements to maintain seal temperatures at 200°C in 50°C ambient air are tabulated below.

Plate Dissipation (Watts)	SEA LEVEL		10,000 FEET	
	Air Flow (CFM)	Pressure Drop (Inches of Water)	Air Flow (CFM)	Pressure Drop (Inches of Water)
100	2.2	0.065	3.2	0.095
150	3.4	0.14	4.9	0.21
200	4.6	0.26	6.7	0.37
250	5.9	0.40	8.6	0.58
300	7.2	0.58	10.5	0.85
350	8.7	0.82	12.7	1.2
400	10.3	1.12	15.0	1.6

A new, more efficient cooling fin design is incorporated in the 4CX300Y which results in lower air-flow requirements. This is reflected in the table above (which assumes the use of an EIMAC SK-700 or SK-710 socket and SK-606 chimney).

At high altitudes and high ambient temperatures the flow rate must be increased to obtain equivalent cooling. The flow rate and corresponding pressure differential must be determined individually in such cases, using the maximum rated temperature as the criterion for satisfactory cooling.

Cooling effectiveness should also be determined on an individual basis if the 4CX300Y is operated immersed in an insulating fluid such as silicone oil, again using the maximum rated temperature as the criterion.

ELECTRICAL

Heater Operation — The rated heater voltage for the 4CX300Y is 6.0 volts.

The heater voltage must be maintained within ±5% of the selected operating voltage if variations in circuit performance are to be minimized and best tube life obtained.

Cathode Operation — The 4CX300Y employs a cylindrical indirectly-heated oxide-coated unipotential cathode. The minimum warm-up time is 30 seconds when rated heater voltage is applied.

Grid Operation — The 4CX300Y control grid has a maximum dissipation rating of 1.0 watt, and precautions should be observed to avoid exceeding this rating. The grid bias and driving power should be kept near the values shown in the Typical Operation sections of the data sheet whenever possible.

In class-A and class AB_1 amplifiers, where no grid current flows, the grid bias voltage may be applied through a resistor. The maximum permissible series resistance per tube is 100,000 ohms.

Screen Operation — The maximum rated screen dissipation for the 4CX300Y is 8 watts. The maximum rated dc screen supply voltage is 300 volts when the tube is operated in class-C amplifier or oscillator service, and 400 volts when the tube is operated in class-AB_1 or class-B amplifier service.

Under certain operating conditions the screen current of a tetrode may reverse. This makes it dangerous to rely on a screen-dropping resistor or a series regulator to supply the screen voltage unless a bleeder or regulator tube is connected from screen to cathode. This bleeder should draw at least 15 milliamperes for each tube connected to the screen supply.

The power input to the screen can be calculated from the voltage and current whenever the screen-to-cathode potential does not vary. Screen modulation or cathode driving of tetrode amplifiers can lead to errors in measurement of screen input when the effective voltage and current exceed the indicated dc values. When there is reason to suspect that the screen input exceeds the indicated power, it is advisable to maintain the indicated screen power input below approximately 75% of the rated screen dissipation.

A screen by-pass capacitor of approximately 1100 $\mu\mu$f is incorporated in the body of the EIMAC SK-700 and SK-710 Air-System Sockets and is adequate for normal amplifier operation at high and ultra-high radio frequencies. Operation at low radio frequencies or audio frequencies may require that additional capacitance be connected externally. In the latter case, the screen by-pass capacitance within the socket helps to eliminate the high-frequency parasitic oscillations occasionally encountered in tetrode amplifiers.

The self-neutralizing frequency of the 4CX300Y is above the useful high-frequency limit for the tube when either of the sockets with integral screen by-pass capacitors is used.

Plate Operation—The 4CX300Y has a finned external anode for forced-air cooling. Connection to the anode may be made at the top cap or cylindrical cooler shell. The latter is usually used

when the tube is installed in coaxial lines or cavities.

The absolute maximum plate-dissipation rating for the 4CX300Y is 400 watts, which is also the rated maximum dissipation for class-C amplifier or oscillator applications and for class-B or class-AB_1 amplifier applications. When the 4CX300Y is used in plate-modulated amplifier applications, the plate-dissipation rating is 250 watts under carrier conditions, rising to 400 watts under 100% sine-wave modulation. Plate dissipation may be permitted to exceed the maximum rated value for brief periods, such as may occur while tuning.

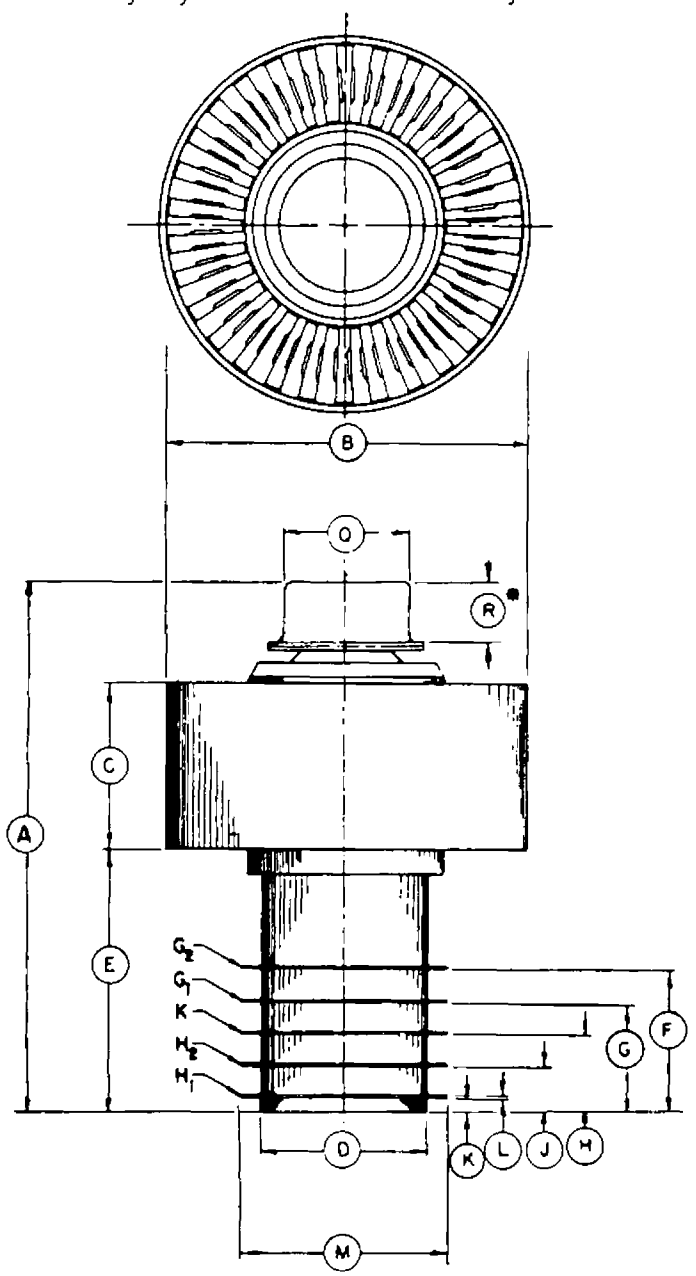
The maximum rated plate voltage for class-AB_1 operation is 2000 volts. In class-C telegraphy and plate-modulated service the maximum rated plate voltage is 2000 and 1500 volts respectively.

Modulation — The 4CX300Y can be modulated by any of the methods commonly used with tetrode tubes. Its large reserve plate dissipation makes it especially suited for use in screen-modulated and linear amplifiers in which the plate efficiency is low.

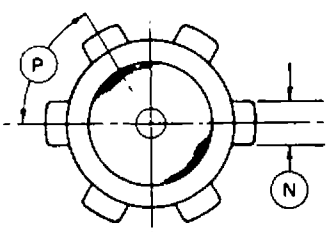
Plate modulation can be applied to the 4CX300Y when it is operated as a class-C amplifier. To obtain 100% modulation with minimum distortion the screen supply voltage should be modulated in phase with the modulation applied to the plate supply voltage. Screen voltage modulation factors between 0.75 and 1.00 may be used.

"Self-modulation" of the screen by means of a resistor in series with the screen supply line is not recommended because of the effects which require a bleeder from screen to cathode as described under "Screen Operation" above.

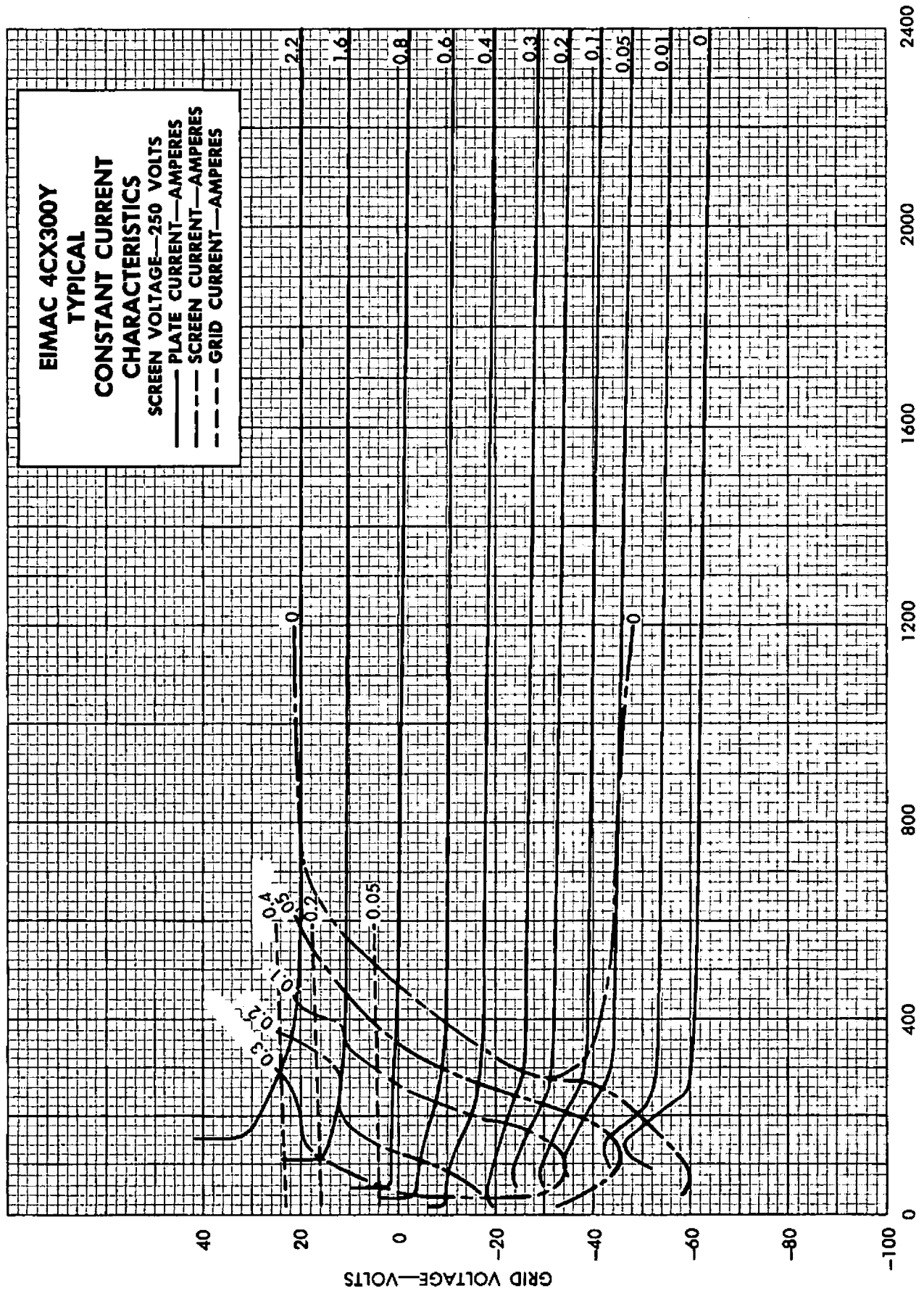
Special Applications—If it is desired to operate this tube under conditions widely different from those given here, write to EIMAC, Division of Varian, 301 Industrial Way, San Carlos, California, for information and recommendations.

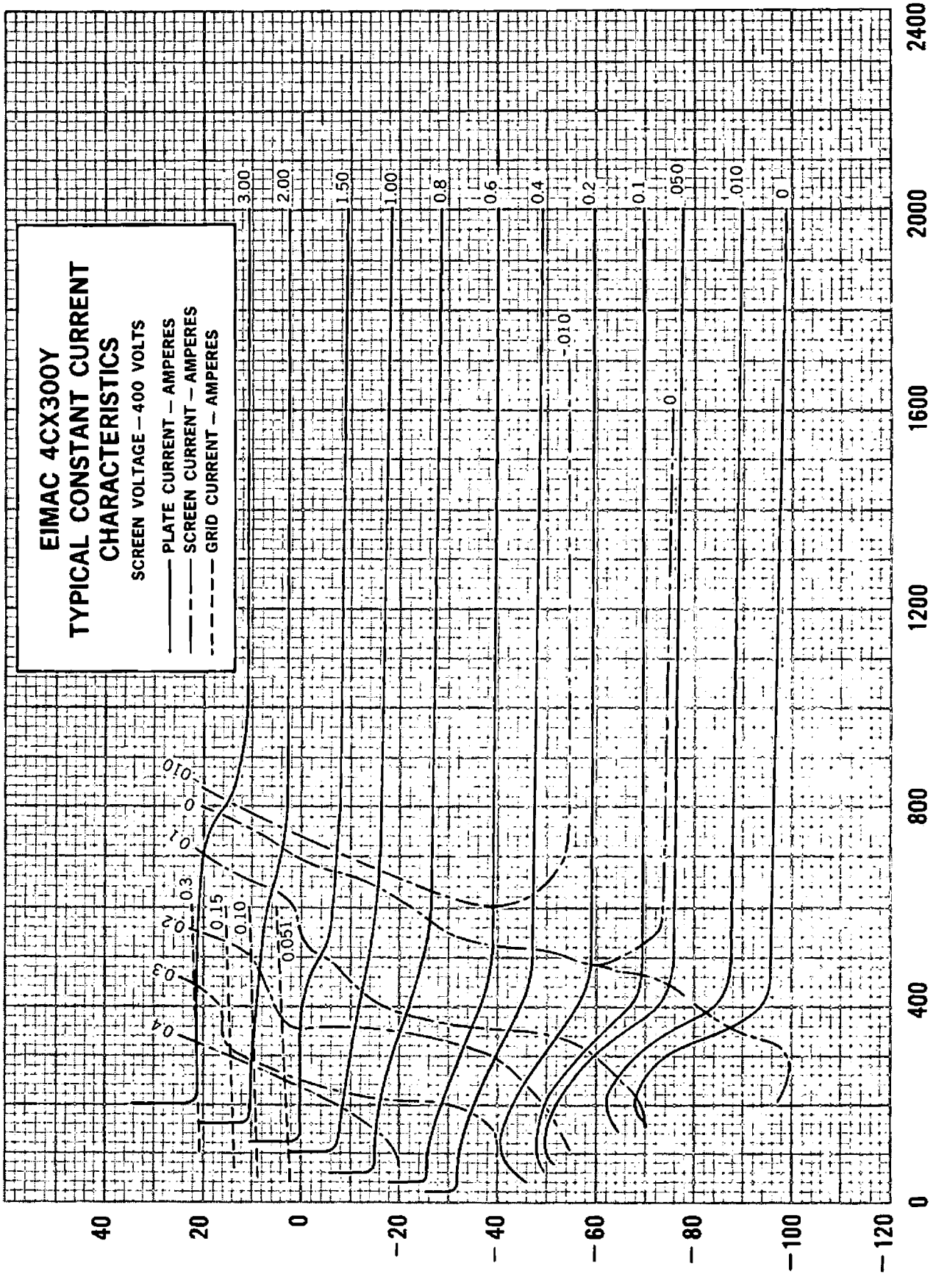


DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
A		2.300	2.500
B		1.610	1.640
C		.710	.790
D		.740	.770
E		1.133	1.195
F		.602	.642
G		.470	.500
H		.329	.359
J		.193	.213
K		.050	.072
L		.010	.020
M		.936	.956
N		.170	.185
P	60°		
Q		.559	.573
R		.240	.280



● CONTACT SURFACE


EIMAC 4CX300Y
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE—250 VOLTS
PLATE CURRENT—AMPERES
SCREEN CURRENT—AMPERES
GRID CURRENT—AMPERES
2.2
1.6
0.8
0.6
0.4
0.3
0.2
0.1
0.05
0.01
0
0.4
0.5
0.2
0.05
0.1
0.2
0.3
0
0
40
20
0
-20
-40
-60
-80
-100
GRID VOLTAGE—VOLTS
0
400
800
1200
1600
2000
2400
PLATE VOLTAGE—VOLTS


EIMAC 4CX300Y
TYPICAL CONSTANT CURRENT CHARACTERISTICS
SCREEN VOLTAGE — 400 VOLTS
PLATE CURRENT — AMPERES
SCREEN CURRENT — AMPERES
GRID CURRENT — AMPERES
3.00
2.00
1.50
1.00
0.8
0.6
0.4
0.2
0.1
.050
.010
0
-.010
0
0.1
0.2
0.3
0.4
.010
0.05
0.10
0.15
0.2
0.3
40
20
0
−20
−40
−60
−80
−100
−120
0
400
800
1200
1600
2000
2400
GRID VOLTAGE — VOLTS
PLATE VOLTAGE — VOLTS

EMI ELECTRONICS LTD

Serving Science and Industry

VALVE DIVISION

EMI HIGH RESOLUTION VIDICON JEDEC TYPE 8566

The EMI High Resolution Vidicon JEDEC type 8566 has been designed for use in studio broadcast television cameras and in high quality industrial television cameras. The 8566 has the latest separate mesh electrode structure and a very uniform target layer. This has resulted in a vidicon with excellent signal uniformity over a wide range of target voltages and an exceptionally high resolution capability.

An important feature of the 8566 vidicon is its ability to operate at high beam currents and low target voltages without loss of picture quality.

The low heater wattage (0.6W) of the 8566 makes it very suitable for use in transistorised cameras and in cameras where heat dissipation must be kept to a minimum.

CHARACTERISTICS

General

Scanned area	12.8 mm x 9.6 mm (½ in x ⅜ in)
Length	158.75 ± 3.30 mm (6.25 ± 0.130 in)
Max. diameter	28.58 ± 0.20 mm (1.125 ± 0.008 in)
Bulb diameter	25.91 ± 0.64 mm (1.020 ± 0.030 in)
Focusing method	Magnetic
Deflection method	Magnetic
Alignment method	Magnetic
Orientation of image	The horizontal scan should be parallel to a plane passing through the tube axis and the short index pin.
Signal electrode capacitance to all other electrodes	4.5 pF
Spectral response	See fig. 2.
Operating position	Any (see note 5)
Socket	Small-Button Ditetrar 8 pin (Jedec type 8ME)

Cathode

The heater supply should be designed to give nominal 6.3 V and should be kept within the limits 5.7 V to 6.9 V. Under no circumstances should the heater voltage be allowed to exceed 9.5 V. If this figure is likely to be exceeded on switching on a surge limiting device must be incorporated.

Maximum Ratings (All potentials are relative to the cathode)

Modulator G1 negative bias	-150 V	
positive bias	0 V	
Limiter G2	750 V	(These maximum ratings are
Wall anode G3	750 V	limiting values above which
Mesh G4	1000 V	the life of the tube may be
Signal electrode voltage	100 V	impaired).
Dark current	0.6 μA	
Target illumination	10000 lx	
Target temperature	70°C	
Adjustable transverse alignment field	± 4 gauss	

from JEDEC release #4890, Dec. 21, 1964

TYPICAL OPERATING CONDITIONS

Modulator G1	-35 to -75 V
Cut-off voltage	-60 to -100 V
Limiter G2	300 V
Wall anode G3	280 to 300 V
Mesh G4	420 to 450 V
Minimum blackout pulses when applied to G1	-75 V
Minimum blackout pulses when applied to cathode	+10 V
Axial magnetic field	40 gauss

STUDIO OPERATION

Target illumination (High lights)	6 foot candles
Signal electrode voltage	25 to 40 V
Dark current	0.01 μA
Signal current	0.25 μA to 0.3 μA

INDUSTRIAL OPERATION

Target illumination (Highlights)	2 foot candles
Signal electrode voltage	30 to 60 V
Dark current	0.01 μA
Signal current	0.2 μA peak

FILM PICK-UP OPERATION

Average highlight for one frame	50 to 100 foot candles
Signal electrode voltage	10 to 20 V
Dark current	< 0.005 μA
Signal current	0.25 to 0.30 μA

LEAKAGE SPECIFICATION

between pin No.	and pin No.	Test potential	Leakage current
2, 3, 5, 6, 7,	1 and 8 (negative)	100 V	100 μA max.
1, 3, 5, 6, 7, 8,	2 (negative)	150 V	15 μA max.
1, 2 3, 6, 7, 8,	5 (positive)	500 V	50 μA max.
1, 2, 3, 5, 7, 8,	6 (positive)	500 V	5 μA max.
1, 2, 5, 6, 7, 8, and signal plate	3 (positive)	500 V	5 μA max.

OPERATING NOTES

1. Resolution

For optimum resolution and beam landing at a given wall anode voltage the mesh should be kept at approximately 1.5 times the wall anode voltage. Under these conditions the percentage modulation at 5 Mc/s on a 625 line system is double that of a normal vidicon and the scanning current has only to be increased by approximately 20%. From fig. 3 it can be seen that an appreciable increase in depth of modulation can be obtained when the mesh is only a few volts positive to the wall anode and under these conditions negligible increase in scanning current is required.

T413/2J
DS.318/2

EMI

EMI Electronics Ltd Valve Division

Hayes Middlesex England *(Controlled by Electric & Musical Industries Limited)*

Telephone: *Hayes 3888 Extension 2165* Cables: *Emidata, London* Telex: *London 22417*

The resolution can be further increased by increasing the wall anode voltage and the corresponding mesh voltage, but this will require additional focus current and scan power (see fig.4). To operate the 8566 in a standard camera the mesh should be connected to the limiter by joining pin 3 (mesh) to pin 5 (limiter) provided the limiter is positive with respect to the wall anode.

On no account should the mesh be operated at a lower voltage than the wall anode since, under these conditions, an ion spot may be observed.

The increased vertical resolution obtained with a 8566 vidicon will give an obvious increase in picture sharpness compared with a standard tube since the relatively poor vertical resolution of a standard tube cannot be corrected by aperture correction.

The increased horizontal resolution of the 8566 compared with the standard tube (see fig.4) enables aperture correction in the head amplifier to be reduced, with corresponding increase in signal to noise ratio. If the 8566 is being fitted into a standard camera and the aperture correction is not reduced, high frequency "ringing" may occur.

2. Beam

The setting of the beam current in the 8566 is less critical than with a standard vidicon provided the mesh is positive with respect to the wall anode. The 8566 can be over-beamed without loss of resolution, thus the beam can be preset to discharge the peak highlights, no further adjustment being required.

Beam landing is considerably improved as the mesh voltage is increased to the optimum of 1.5 times the wall anode voltage. Under these conditions the "porthole effect" which occurs at low target voltages is eliminated.

Rotation of the picture, when the wall anode is varied, about electrical focus is considerably reduced when the mesh is 20 volts or more positive with respect to the wall anode.

3. Sensitivity

The uniform target layer of the 8566 ensures that when the target voltage is increased the dark current and sensitivity increase uniformly over the target area.

The dark current should not, however, be allowed to exceed 0.6 μA or a burnt-in picture may result.

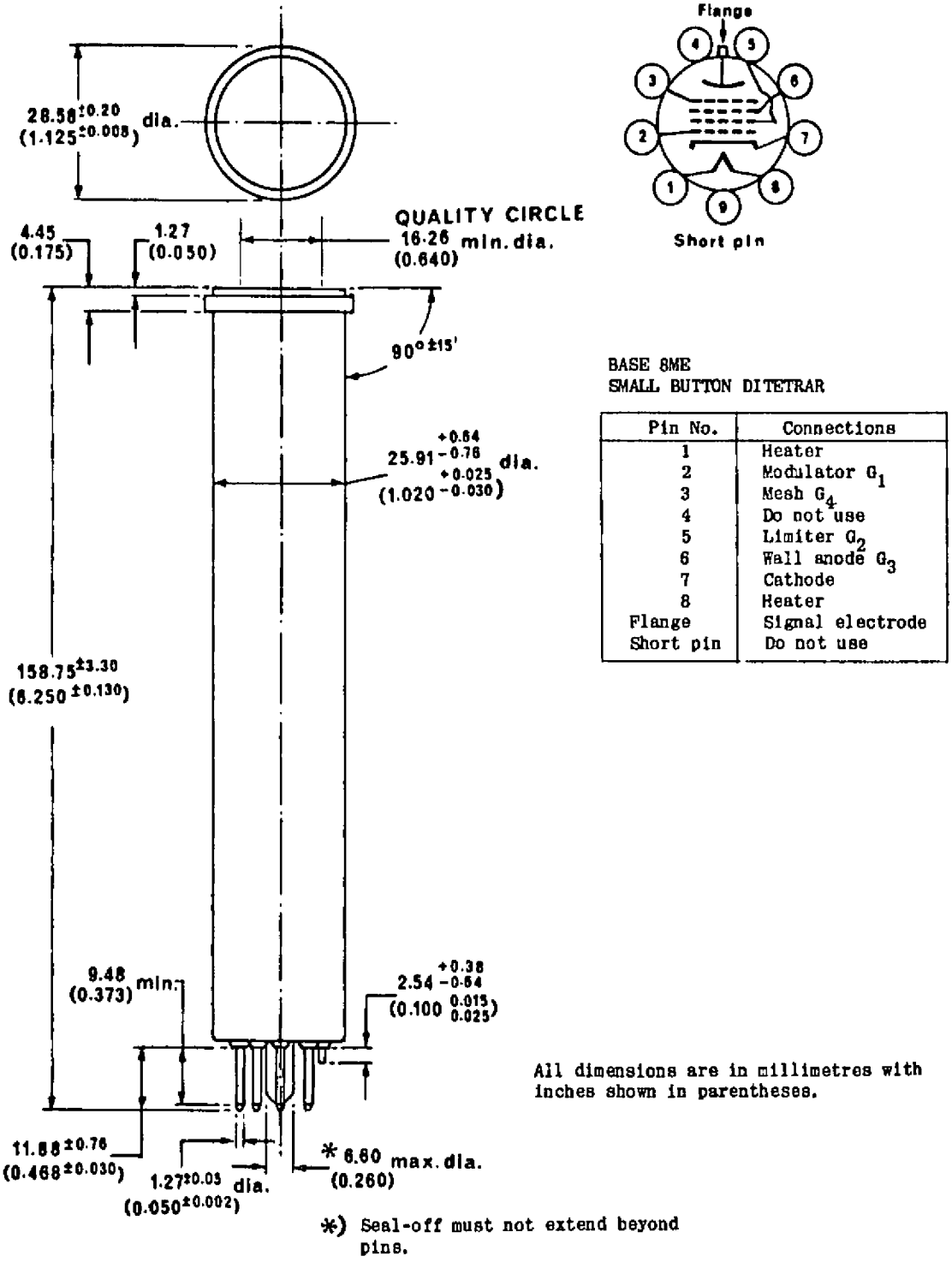
4. Scanned area

The tube should be operated with the target area 12.8 mm x 9.6 mm (½ in x ⅜ in) completely scanned to obtain the best signal to noise ratio and resolution. Small changes in sensitivity and dark current occur in the scanned area over a long period of time so that it is important to use the same scanned area throughout the life of the tube.

5. Operating position

When the 8566 is operated vertically with its face downwards care should be taken to avoid undue mechanical shock.

EMI VIDICON CAMERA TUBE JEDEC TYPE 8566 (continued)



BASE 8ME
SMALL BUTTON DITETRAR

Pin No.	Connections
1	Heater
2	Modulator G_1
3	Mesh G_4
4	Do not use
5	Limiter G_2
6	Wall anode G_3
7	Cathode
8	Heater
Flange	Signal electrode
Short pin	Do not use

All dimensions are in millimetres with inches shown in parentheses.

*) Seal-off must not extend beyond pins.

FIGURE 1

RELATIVE SPECTRAL RESPONSE

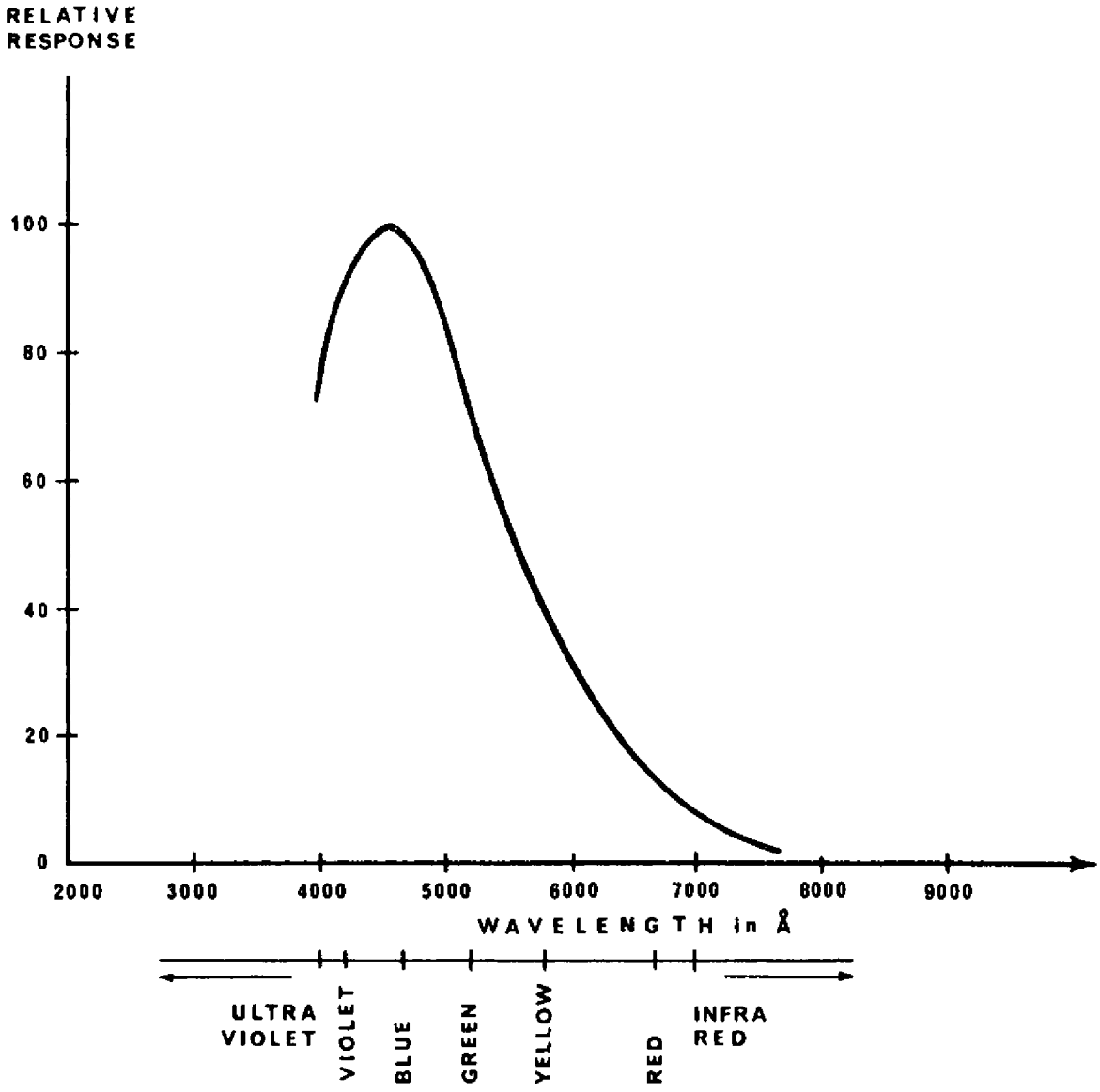


FIGURE 2

TYPICAL DISCONTINUITY IN MODULATION CURVE

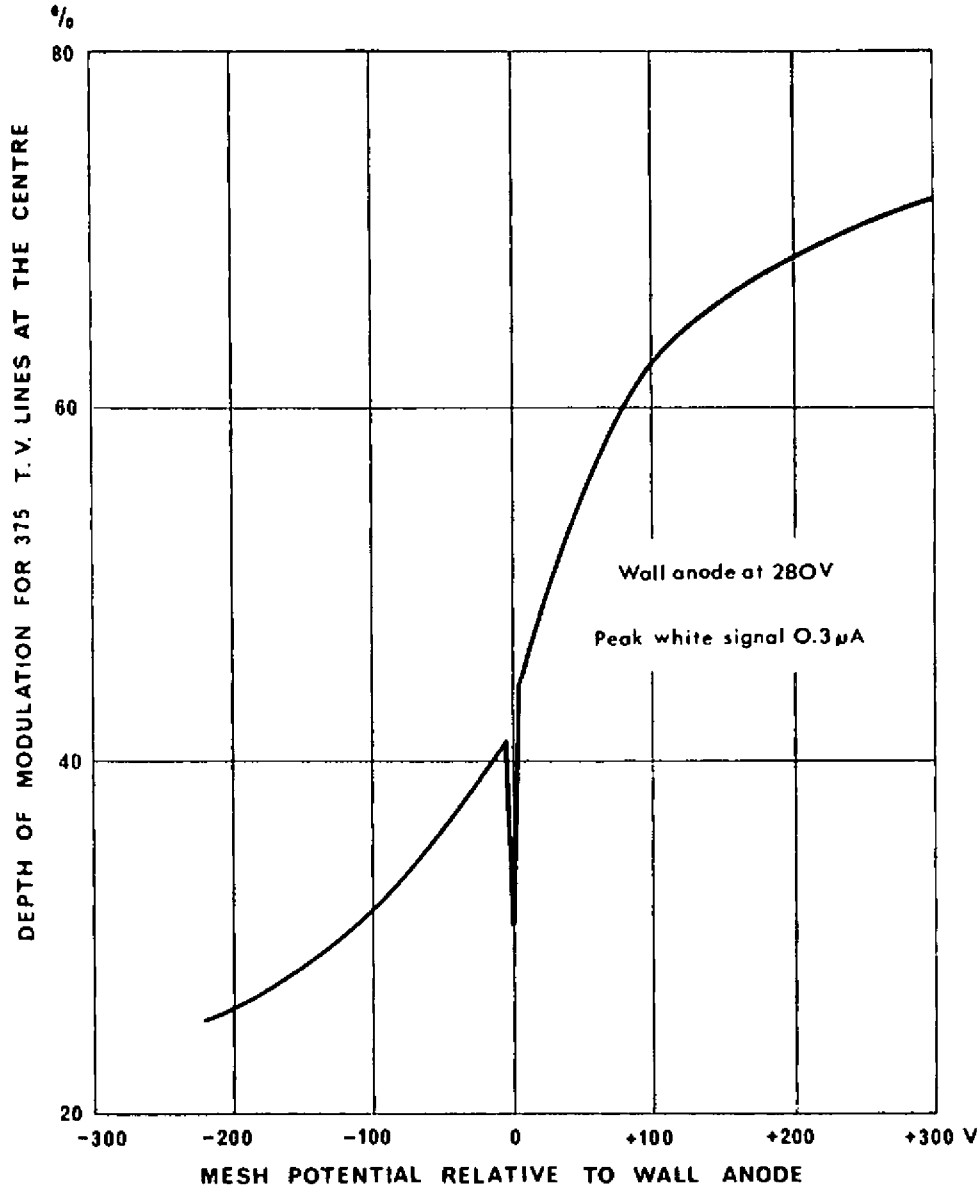


FIGURE 3

TYPICAL RESOLUTION CHARACTERISTICS

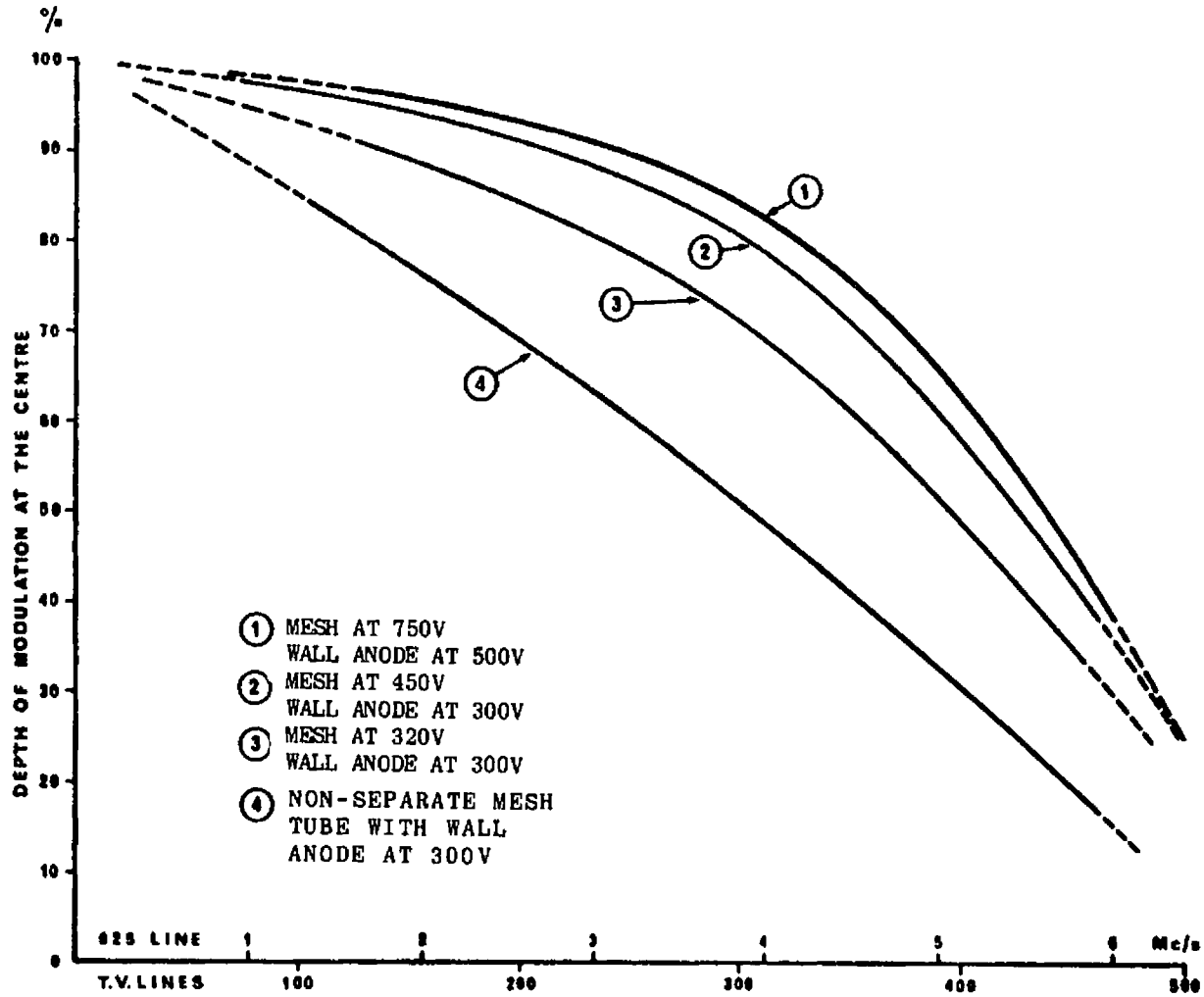


FIGURE 4

ILLUMINATION vs TARGET VOLTS TO GIVE 0.25 μA SIGNAL CURRENT

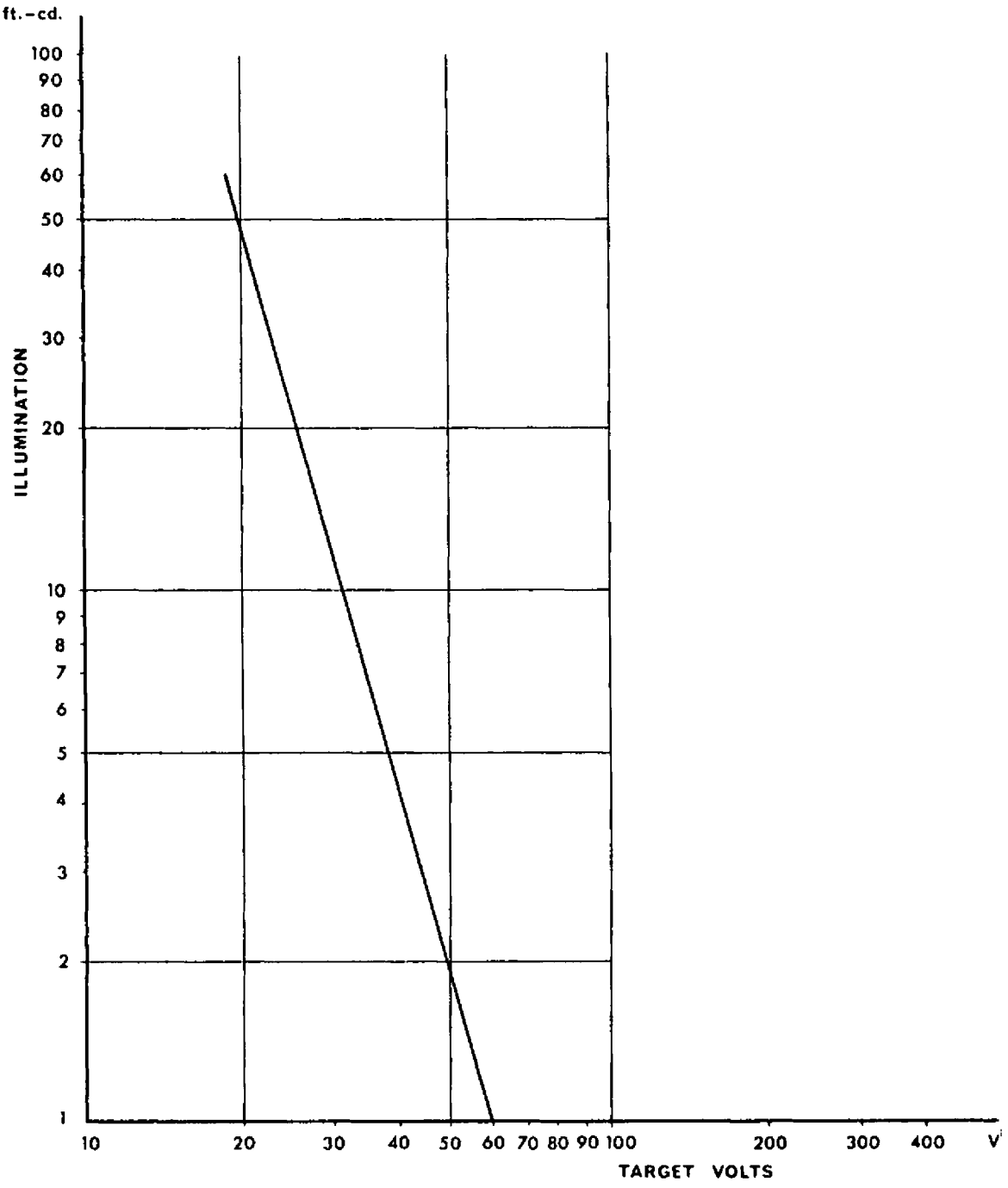


FIGURE 5

AVERAGE LAG CURVES

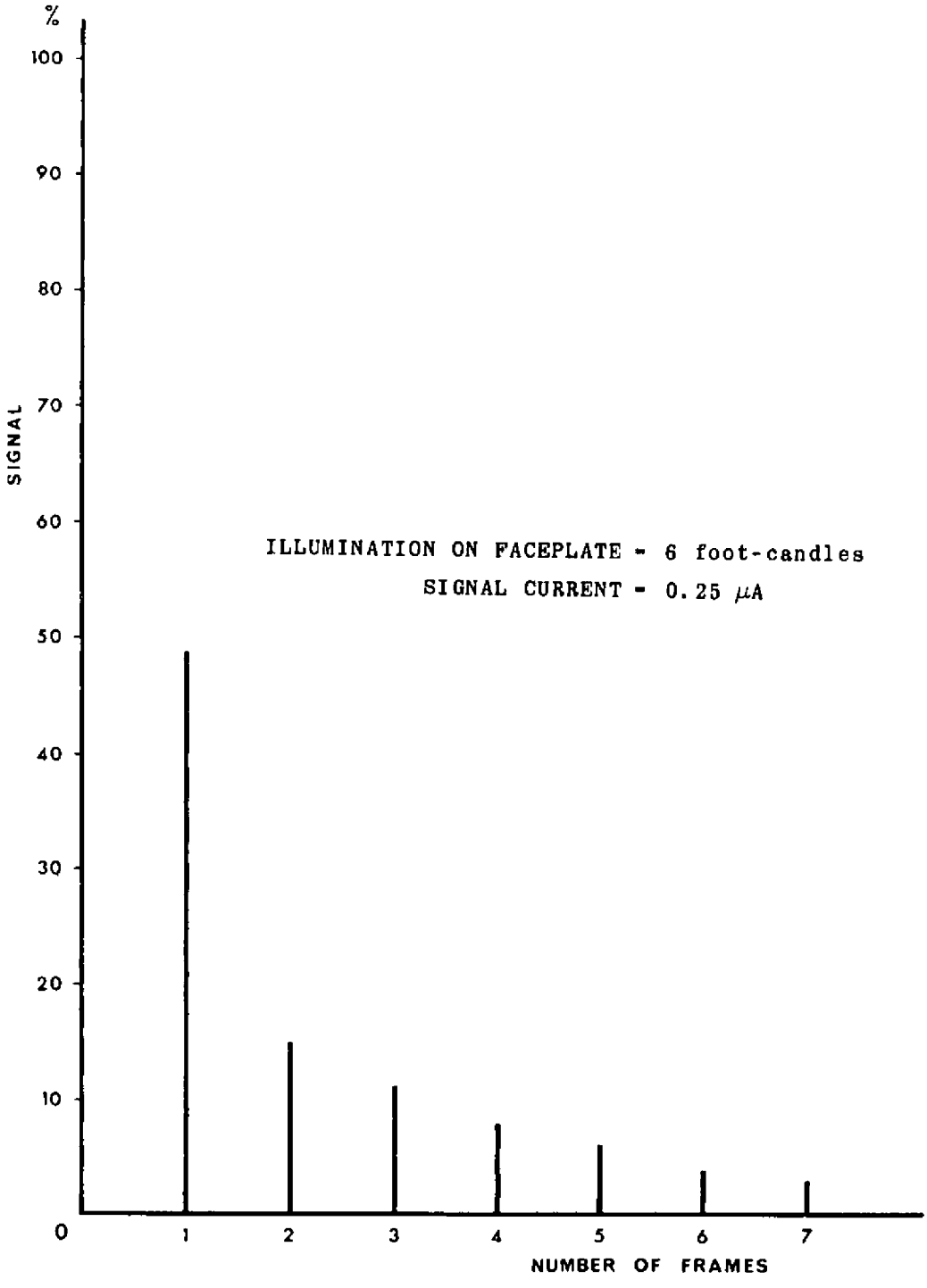


FIGURE 6

SIGNAL CURRENT vs TARGET VOLTS

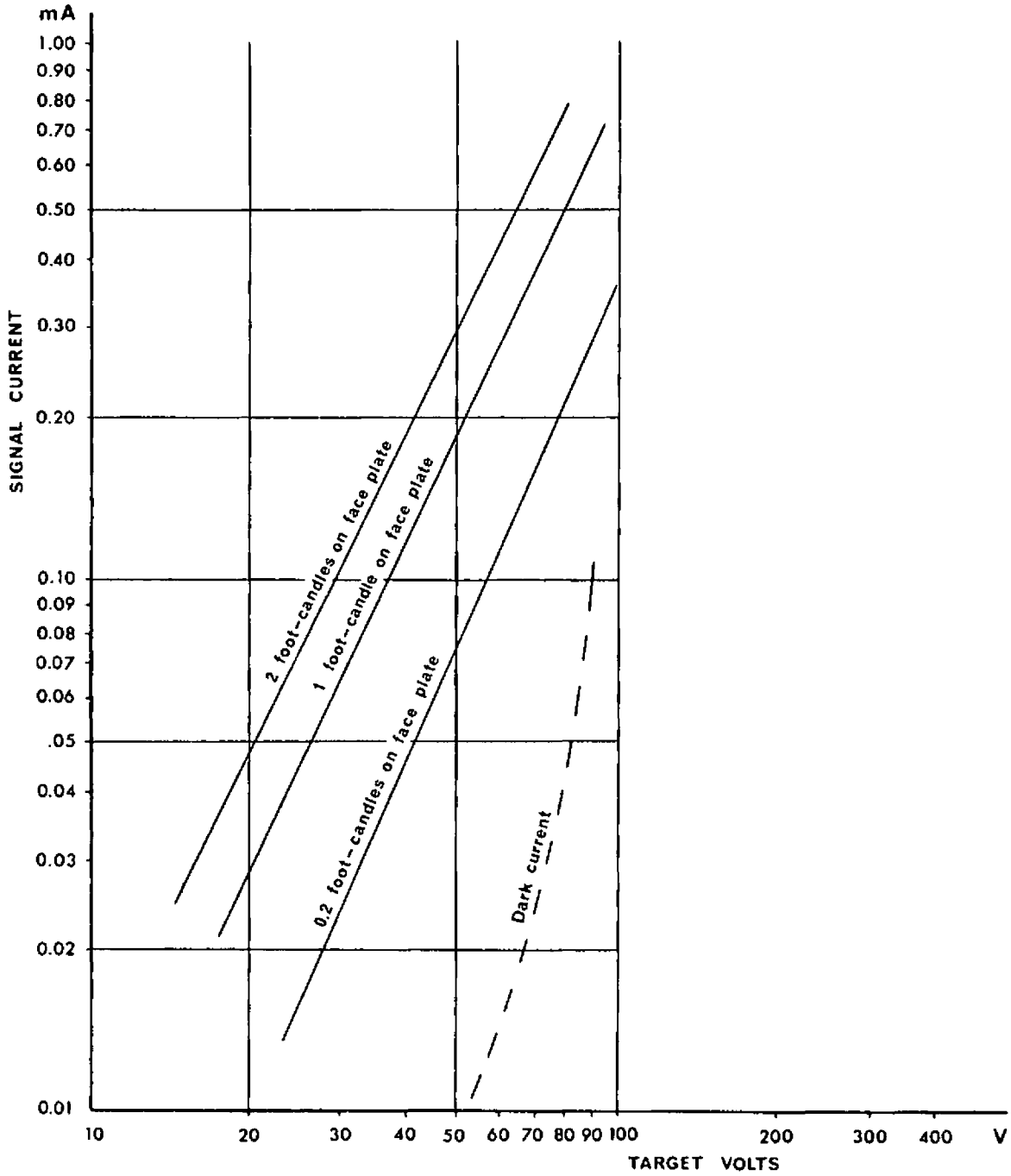


FIGURE 7

from JEDEC release #4705, May 18, 1964

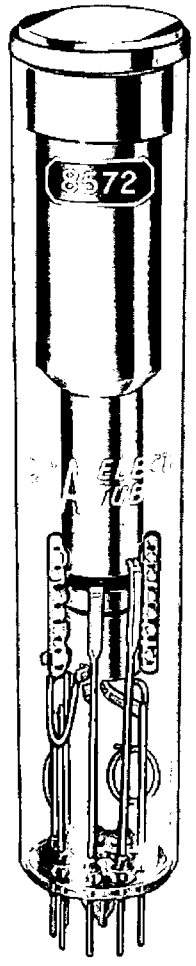
RCA-8572
VIDICON

Magnetic Focus
Magnetic Deflection

For High-Resolution Film Pickup With
Color or Black-and-White TV Cameras

1"-Diameter
6.25" Length

RCA-8572 is a small vidicon-type camera tube designed especially for film pickup in either color or black-and-white TV cameras. It features separate connections for grid No.4 and grid No.3. The 8572 provides higher resolution, more uniform resolution, and more uniform signal output when operated at high voltage than other similarly-sized vidicons employed in film-pickup service which do not utilize such separate electrode connections.



The 8572 may also be used in live-pickup service although higher sensitivity vidicons are usually recommended in such applications.

The 8572 may be operated in a number of voltage modes although recommended operation requires that in each case grid-No.3 voltage is 0.6 of grid-No.4 voltage, and that correct positioning of associated deflecting components is observed. This operating procedure results in increases in both the center resolution and the uniformity of resolution from center to edge of the scanned target area. The resolution capability of the 8572 at the center of the picture is about 1000 TV lines and about 700 TV lines at the corner. This high resolution is obtained when the 8572 is operated with a grid-No.4 voltage of 750 volts and a grid-No.3 voltage of 450 volts. When the 8572 is operated at a lower grid-No.4 voltage of 500 volts and a grid-No.3 voltage of 300 volts, its resolution will be about 900 TV lines at the center and 600 TV lines at the corner of the picture.

The 8572 utilizes a sensitive photoconductive surface of uniform thickness. Because of this uniform thickness, a constant voltage gradient and uniform dark current is obtained across the entire scanned area. The resulting picture background that is produced is free of "flare", and other unwanted signals. The uniform thickness of the photoconductive surface of the 8572 also results in substantially uniform sensitivity over the entire scanned area. Therefore, the 8572 exhibits a degree of uniformity of characteristics from tube to tube that makes it possible to obtain excellent color uniformity and balance when used in vidicon color cameras.

Featured in the design of the 8572 are non-magnetic materials in the front end and an extremely flat faceplate free from optical distortion. The elimination of magnetic materials from the front end and the use of an optically flat faceplate make it easier to register multiple pictures when these tubes are used in vidicon color cameras.

Full advantage of the uniformity of the photoconductive layer in the 8572 is realized only when the associated deflecting and focusing components do not introduce scanning beam-landing errors. If the 8572 is used with components which introduce such errors, compensation may be effected by applying to the cathode, grid No.1, and grid No.2 a modulating voltage of mixed parabolic waveform containing components of both the vertical and horizontal scanning frequencies.

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:[a]		
Target to all other electrodes	4.6	pf
Spectral Response	See *Fig.4*	
Photoconductive Layer:		
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)	0.62	inch

Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short index pin. The masking is for orientation only and does not define the proper scanned area of the photoconductive layer.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	6.250" ± 0.125"
Greatest Diameter	1.125" ± 0.010"
Bulb	T8
Base	Small-Button Ditetrar 8-Pin, (JEDEC No.E8-11)
Socket	Cinch[b] No.54A18088, or equivalent

Focusing Coil. . Cleveland Electronics[cd]	No. VF-115-12, or equivalent
Deflecting Yoke. .Cleveland Electronics[cd]	No. VY-111-3, or equivalent
Alignment Coil . . .Cleveland Electronics[cd]	No. VA-118, or equivalent
Operating Position	Any
Weight (Approx.)	2 oz

Maximum Ratings, *Absolute-Maximum Values:*[e]

For scanned area of 1/2" x 3/8"

Grid-No.4 Voltage.	1000 max.	volts
Grid-No.3 Voltage.	1000 max.	volts
Grid-No.2 Voltage.	750 max.	volts
Grid-No.1 Voltage:		
Negative bias value.	300 max.	volts
Positive bias value.	0 max.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
Target Voltage	125 max.	volts
Dark Current	0.25 max.	μa
Peak Target Current[f]	0.55 max.	μa
Faceplate:		
Illumination	1000 max.	fc
Temperature.	71 max.	°C

Typical Operation and Performance Data:

For scanned area of 1/2" x 3/8" — Faceplate temperature of 30° to 35° C	*Low-Voltage Operation*	*High-Voltage Operation*	
Grid-No.4 (Decelerator) Voltage.	500	750	volts
Grid-No.3 (Beam-Focus Electrode) Voltage[g]. .	300[h]	450[h]	volts
Grid-No.2 (Accelerator) Voltage.	300	300	volts
Grid-No.1 Voltage for Picture Cutoff[j]. . . .	-45 to -100	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa	0.65	0.65	
Visual Equivalent Signal-to-Noise Ratio (Approx.)[k]	300:1	300:1	
Lag—Per Cent of Initial Value of Signal-Output Current 1/20 Second After Illumination is Removed:[m]			
Typical value for minimum lag operation.	7.5	7.5	%
Minimum Peak-to-Peak Blanking Voltage:			
When applied to grid No.1.	75	75	volts
When applied to cathode.	20	20	volts
Limiting Resolution:			
At center of picture .	900	1000	TV lines
At corner of picture .	600	700	TV lines
Amplitude Response to a 400 TV Line Square-Wave Test Pattern at Center of Picture. . .	35	45	%

Field Strength at Center of Focusing Coil[g]. . .	41 ± 4	52 ± 4	gauss
Peak Deflecting-Coil Current:			
Horizontal	180	220	ma
Vertical	33	40	ma
Field Strength of Adjustable Alignment Coil[n].	0 to 4	0 to 4	gauss

Average-Sensitivity Operation (Live-Scene Pickup)
10 Footcandles on Faceplate

Faceplate Illumination (Highlight).	10	fc
Target Voltage[pq]	25 to 60	volts
Dark Current[r].	0.02	μa
Signal-Output Current:[s]		
Typical.	0.3	μa

Minimum-Lag Operation (Film Pickup)
100 Footcandles on Faceplate

Faceplate Illumination (Highlight).	100	fc
Target Voltage[pq]	12 to 30	volts
Dark Current[r].	0.004	μa
Signal-Output Current:[s]		
Typical.	0.3	μa

---

[a] This capacitance, which effectively is the output impedance of the 8572, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

[b] Made by Cinch Manufacturing Corporation, 1026 S. Homan Avenue, Chicago 24, Illinois.

[c] Made by Cleveland Electronics Inc., 1974 East 61st Street, Cleveland, Ohio.

[d] These components are chosen to provide tube operation with minimum beam-landing error when mounted in the recommended position along the tube axis as shown in Fig. 1.

[e] The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Absolute-Maximum Rating System* for rating electron devices. 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, taking no responsibility for equipment variations, environment variations, and the effects of changes in operating conditions due to variations in device characteristics.

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 device characteristics.

[f] Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[g] Beam focus is usually attained by varying the focus-coil current to obtain a field-strength value within the range shown under *Typical Operation and Performance Data.* If the field strength of the focus coil is fixed, beam focus is obtained within a ± 10 per cent range of the grid-No.4 and grid-No.3 voltages. However, the recommended ratio of 0.6 between grid No.3 and grid No.4 must be maintained as these voltages are varied.

h In general, grid No.3 should be operated above 250 volts and be 0.6 of grid-No.4 voltage.

j With no blanking voltage on grid No.1

k Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc and a peak signal-output current of 0.35 microampere. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to rms noise current, multiplied by a factor of 3.

m For initial signal-output current of 0.3 microampere and a dark current of 0.004 microampere.

n The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

p The target voltage for each 8572 must be adjusted to that value which gives the desired operating dark current.

q Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

r The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

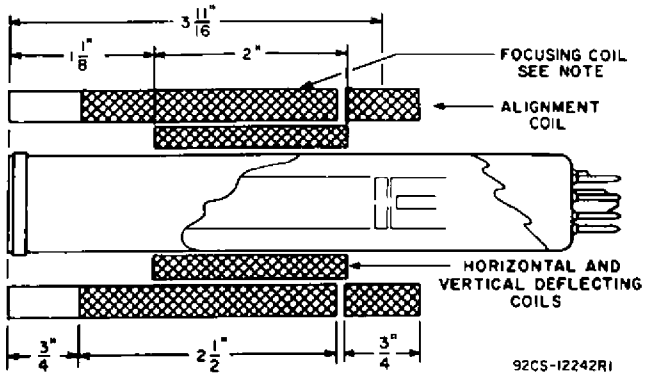
s Defined as the component of the highlight target current after the dark-current component has been subtracted.

OPERATING CONSIDERATIONS

The *target connection* is made by a suitable spring contact bearing against the edge of the metal ring at the face end of the tube. This spring contact may conveniently be provided as part of the focusing-coil design.

The *deflecting yoke and focusing coil* used with the 8572 are designed to cause the scanning beam to land perpendicularly to the target at all points of the scanned area with minimum beam-landing error and resultant superior uniformity of sensitivity and focus over the scanned area. The recommended location of these components is shown in Fig.1.

COMPONENT LOCATIONS



NOTE: CROSS-HATCHING INDICATES WOUND PORTION OF FOCUSING COIL.

Recommended Location and Length of Deflecting, Focusing, and Alignment Components to obtain Minimum Beam-Landing Error.

Fig. 1

The polarity of the focusing coil 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 *temperature of the faceplate* should not exceed 71° C (160° F), either during operation or storage of the 8572. Operation with a faceplate temperature in the range from about 25° to 35° C (77° to 95° F) is recommended. The temperature of the faceplate is determined by the combined heating effects of the incident illumination on the faceplate, the associated components, and the tube itself. To reduce these heating effects and permit operation in the preferred temperature range under conditions of extremely high light levels, the use of an infrared filter between the object and the camera lens as well as a blast of cooling air directed across the faceplate from a blower is recommended.

Provisions should also be made in the camera installation to hold the faceplate temperature of the 8572 at a *steady value* within the recommended range. Dark current increases with increasing temperature. It is highly desirable to operate the 8572 at a steady temperature to maintain dark current at a preselected value. This mode of operation ensures both optimum and stable day-to-day performance. If such provisions cannot be made, changes in target voltage may be required from time to time to maintain the desired picture quality.

As *target voltage* is increased, dark current also increases. The range of target voltage for various dark current levels of different 8572's is shown in Fig.2. It should be noted that the range of target voltage to produce a given dark current, and therefore a given sensitivity, is very narrow for the 8572. Individual 8572's will therefore *have substantially identical performance characteristics when operated with an identical value of dark current.* For proper adjustment of the target voltage on each 8572 see SET-UP PROCEDURE on pages 6 and 7.

RANGE OF DARK CURRENT

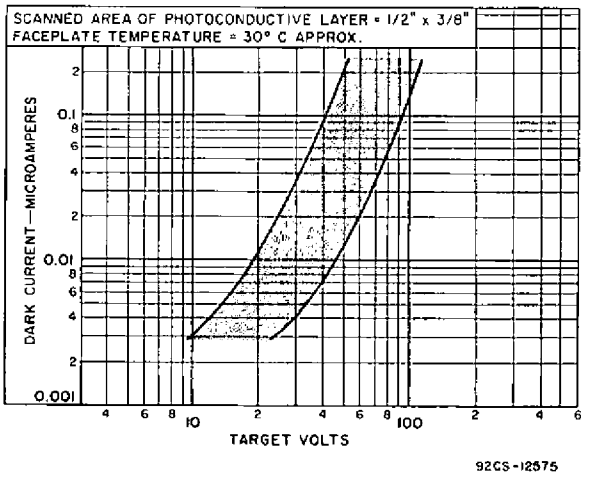


Fig. 2

Persistence or lag of the photoconductive layer is given in Fig.3 for three values of dark current. Each curve shows the decay in signal-output current from an initial value of 0.3 microampere after the illumination is cut off.

TYPICAL PERSISTENCE CHARACTERISTICS

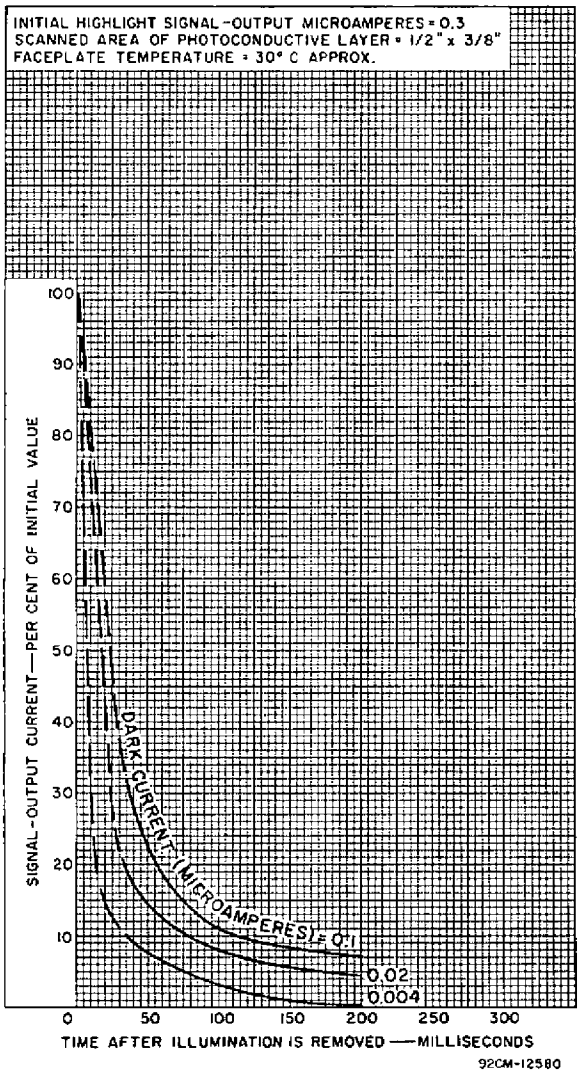


Fig.3

The *spectral response* of the 8572 is shown in Fig.4.

As shown in Fig.5, a substantial increase in both limiting resolution and amplitude response of the 8572 may be obtained by increasing the operating voltages on grid No.4 and grid No.3. The focusing-coil field strength must be increased and more deflecting power is required at higher electrode voltages as indicated under *Typical Operation and Performance Data*. Very little additional beam-landing error is introduced at the higher voltages provided the recommended operating voltages are used and the associated components are positioned as shown in Fig.1.

When the 8572 is used with illumination levels of 10 footcandles on the faceplate, a dark current of 0.02 microampere or less is

TYPICAL SPECTRAL SENSITIVITY CHARACTERISTIC

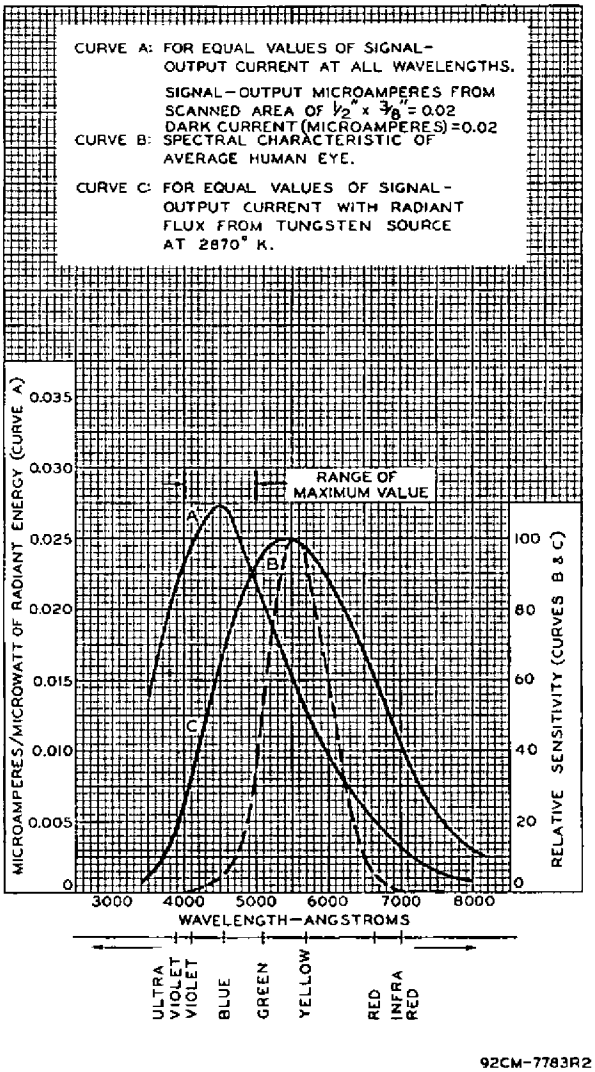


Fig.4

usually required. This value will be obtained for a target voltage within the range of 25 to 60 volts.

For film pickup where illumination on the faceplate will usually exceed 50 footcandles, a target voltage within the range of 12 to 30 volts will normally be employed for low dark current and maximum signal uniformity.

The exact value of target voltage to give the required dark current will depend on the individual tube and on the temperature at which its faceplate is operated. It is important that the tube be allowed to reach a stable operating

temperature before the operating dark current is determined; otherwise the dark current will change as the temperature of the tube changes.

Signal Output and Light Transfer Characteristics. Typical signal output as a function of uniform 2870° K tungsten illumination on the photoconductive layer for different values of dark current is shown in Fig. 6. It is to be noted that these curves are for a typical 8572 under the conditions indicated. However, the target voltage needed to give average sensitivity operation at a particular dark current may vary over the given range. It is therefore essential that the proper operating target voltage be determined for each 8572. From these curves, it will also be noted that the illumination must be increased about 50 times to produce an increase of 10 times in signal-output current for any given value of dark current.

UNCOMPENSATED HORIZONTAL SQUARE-WAVE RESPONSE

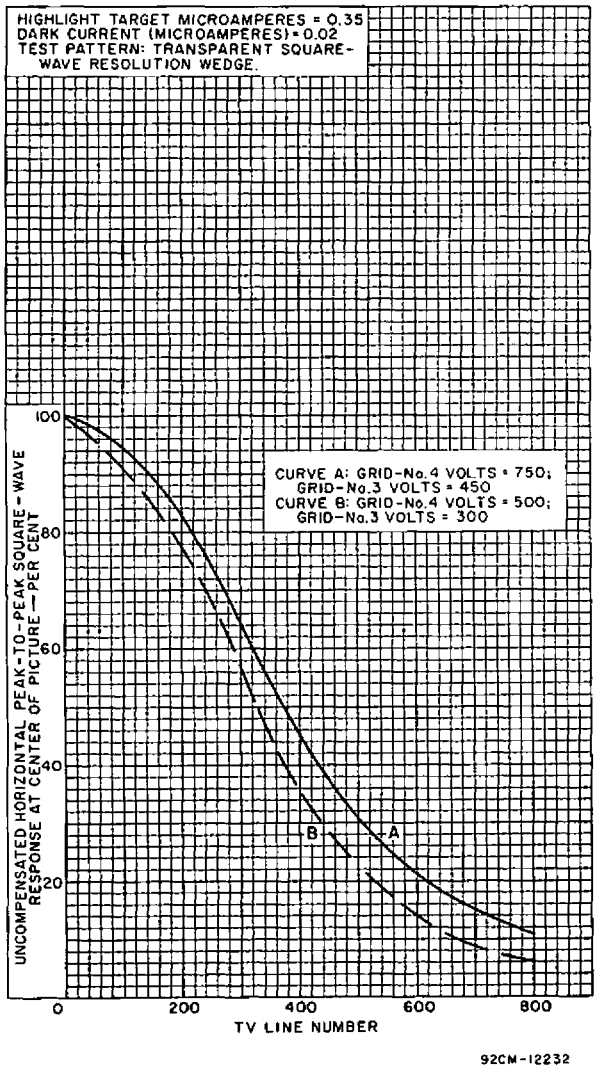


Fig. 5

The average "gamma", or slope, of the light transfer characteristic curves shown in Fig. 6 is approximately 0.65. This value is relatively constant over an adjustment range of 4 to 1 in target voltage, or 50 to 1 in dark current, for a signal-output current range between 0.01 and 0.3 microampere. Close uniformity in the value of gamma between individual 8572's is maintained to insure satisfactory operation of color cameras in which the signal-output currents of the 8572's must match closely over a wide range of scene illumination. Because its transfer characteristic is approximately the complement of the transfer characteristic of a picture tube, the 8572 can produce a picture having proper tone rendition.

LIGHT TRANSFER CHARACTERISTICS

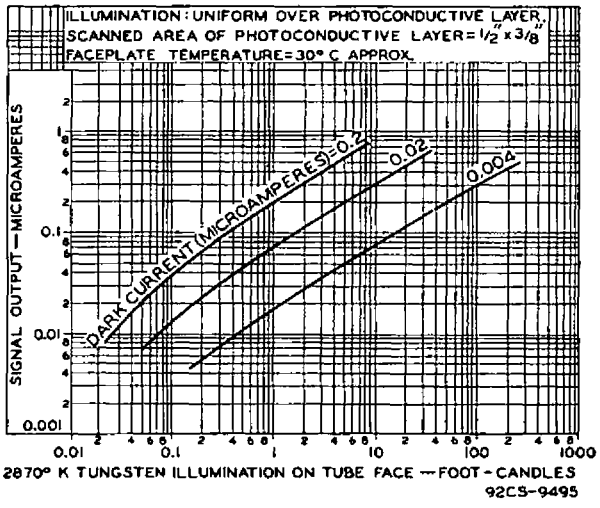


Fig. 6

Because uniformity of sensitivity of the photoconductive layer in the 8572 is excellent, uniform signal output over the scanned area can be obtained if the 8572 is operated with a deflecting-yoke and focusing-coil system designed so that no beam-landing errors are produced in the vidicon. If the 8572 is to be utilized with designs of focusing and deflecting systems which introduce such errors, uniform sensitivity over the scanned area of the 8572 can be achieved by compensating for the beam-landing errors thus introduced. Without compensation for these errors, variations in sensitivity over the scanned area will occur. These variations resulting from beam-landing errors are in the form of lower signal from the edges of the scanned area than from the center. However, because of the uniformity of the photoconductive layer, these variations in sensitivity are the same from tube to tube. Compensation for the beam-landing errors to achieve uniform sensitivity can be obtained by supplying a modulating voltage of a suitable waveform to the cathode of the 8572. The desired waveform is parabolic in shape and of such a polarity that the cathode voltage is lowered as the beam approaches the edges

of the scanned area. The modulating waveform should contain parabolic components of both the horizontal and vertical scanning frequencies. The horizontal component should have the greater amplitude and will be the most effective in obtaining uniform sensitivity.

TYPICAL CHARACTERISTIC

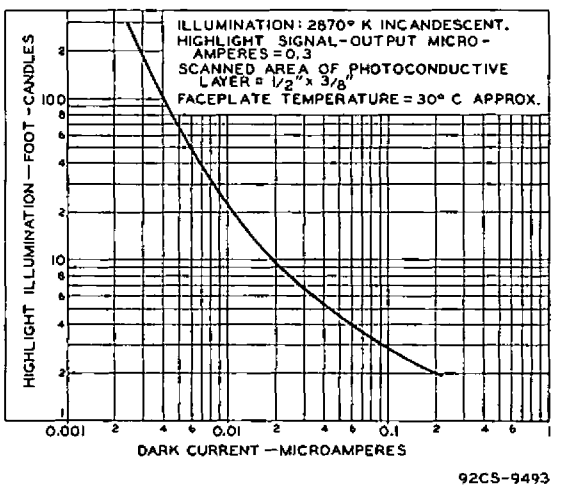


Fig.7

A satisfactory value of this mixed parabolic waveform signal for compensation of beam-landing errors is approximately 4 volts peak-to-peak. This modulating voltage is applied to grid No.1 and grid No.2 as well as to the cathode to prevent modulation of the scanning beam.

Full-size scanning of the 1/2" x 3/8" area of the photoconductive layer should always be used. This condition can be assured by first adjusting the deflection circuits to overscan the photoconductive layer sufficiently so that the edges of the sensitive area can be seen on the monitor. Then, after centering the image on the sensitive area (see Fig.8), reduce scanning until the edges of the image just disappear. In this way, the maximum signal-to-noise ratio and maximum resolution can be obtained. It should be noted that overscanning the photoconductive layer produces a smaller-than-normal picture on the monitor.

Underscanning of the photoconductive layer, i.e., scanning an area of the layer less than 1/2" x 3/8", should never be permitted. This condition which produces a larger-than-normal picture on the monitor, not only causes sacrifice in signal-to-noise ratio and resolution, but also may cause permanent change in sensitivity and dark current of the underscanned area. An underscanned area showing such a change will be visible in the picture when full-size scanning is restored.

Failure of scanning even for a few seconds may permanently damage the photoconductive layer. The damaged area shows up as a spot or line in the picture during subsequent operation. To avoid damaging the 8572 during scanning failure, it is necessary to prevent the scanning beam from reaching the layer.

SET-UP PROCEDURE

The *sequence of adjustments* in operating the 8572 is as follows: With the Grid-No.1 Voltage Control set for maximum negative bias (beam cutoff), Target Voltage Control set for the minimum voltage shown under *Typical Operation*, and Deflection Controls set for maximum overscan, apply other voltages to the 8572 as indicated under *Typical Operation*.

Next, with a 1/2" x 3/8" mask centered on the face of the tube, and with the iris set for minimum opening, decrease the grid-No.1 bias to just bring out the highlight details of the picture on the monitor. Adjust the Beam-Focus Voltage Control, the lens stop, and the optical focus to obtain the best picture. Reduce horizontal and vertical scanning so that the edges of the image extend just outside the scanned area on the monitor. Then adjust the alignment field so that the center of the picture does not move as the beam-focus voltage is varied. Some readjustment of horizontal and vertical centering may be necessary after alignment.

Next, open the lens and adjust the aperture to give a peak signal-output current of 0.2 to 0.3 microampere. A good procedure for doing this is to focus the camera on a uniform white area having the same brightness as the highlights in the scene to be televised. The image of this white area must at least cover the scanned area of the tube face. The current read on the microammeter will be the dark current plus the peak signal-output current, i.e., highlight target current.

PROPER POSITIONING OF IMAGE ON THE FACE OF THE VIDICON

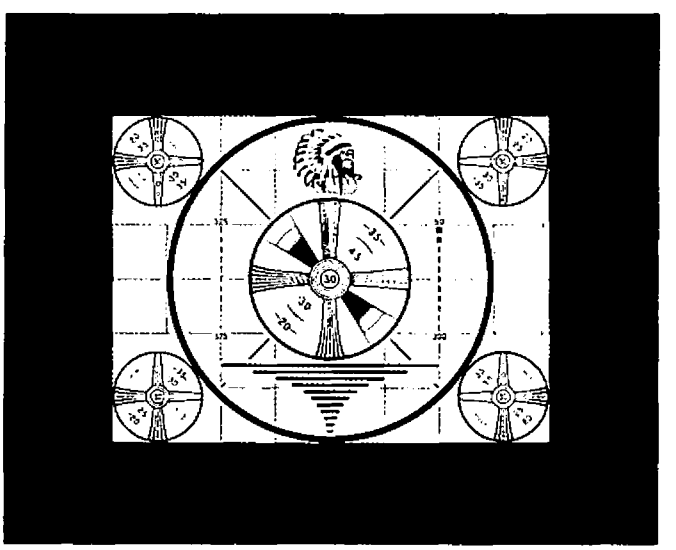


Fig.8

A waveform-oscilloscope monitor can be used to compare the peak signal-output current produced by any scene to the peak value measured with the microammeter when the camera is focused on a uniformly bright scene. When a camera is adjusted in this manner, video gain should be kept constant and the light level on the tube face should be controlled to maintain the constant predetermined value of peak signal as observed on the oscilloscope.

After adjusting the light level to obtain the correct signal-output current, the grid-No.1-bias voltage should be adjusted to just discharge the highlights. Too much current will result in poor resolution and poor picture quality. After the grid-No.1 bias is properly adjusted, it will be necessary to check and readjust the dark current and the peak signal-output current.

Proper adjustment of the dark current, the peak signal-output current, and the grid-No.1 bias, will result in a picture of good quality with minimum smearing of moving objects.

For average-sensitivity operation of the 8572 the target voltage should be adjusted to produce a dark current of 0.02 microampere.

For film-pickup operation of the 8572 the target voltage should be adjusted to produce a dark current of 0.004 microampere and the peak signal-output current should be adjusted to the desired value by controlling the light level on the faceplate of the tube.

In setting up 8572's in a color camera, particular attention must be given to proper alignment, best obtainable focus, and identical centering of scanned areas on the photoconductive layers. For best color balance and color tracking over a wide range of light levels, the light level in each color channel should be controlled so that each of the 8572's develops the same value of peak signal output for white portions of a scene. Observation of these operating conditions will assure good registration and good color balance.

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"Part III — Electro-Optical Characteristics of Camera Systems", RCA Review, September, 1948;

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R.G. Neuhauser, *"Vidicon for Film Pickup"*, Jour. of S.M.P.T.E., Vol.62, No.2, February, 1954.

H.N. Kozanowski, *"Vidicon Film-Reproduction Cameras"*, Jour. of S.M.P.T.E., Vol.62, No.2 February, 1954.

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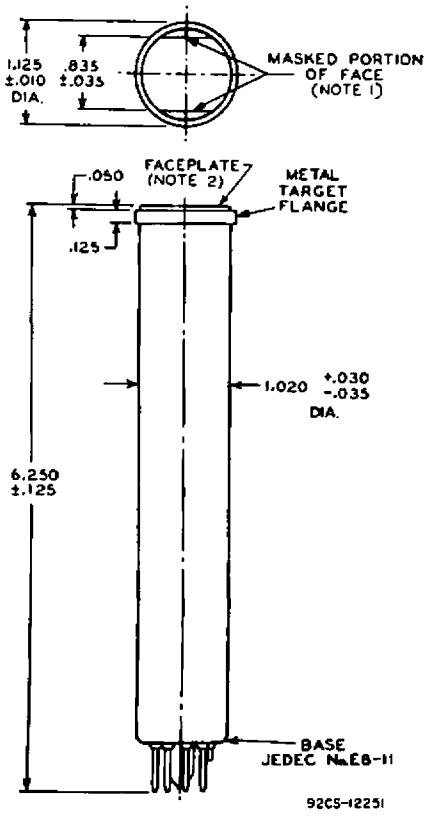
L.D. Miller and B.H. Vine, *"An Improved Developmental One-Inch Vidicon for Television Cameras"*, Jour. of S.M.P.T.E., Vol.67, March, 1958.

J. Castleberry and B.H. Vine, *"An Improved Vidicon Focusing-Deflecting Unit"*, Jour. of S.M.P.T.E., Vol.68, April, 1959.

R.G. Neuhauser, *"Sensitivity & Motion Capturing Ability of Television Camera Tubes"*, Jour. of S.M.P.T.E., Vol.68, No.7, July, 1959.

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DIMENSIONAL OUTLINE



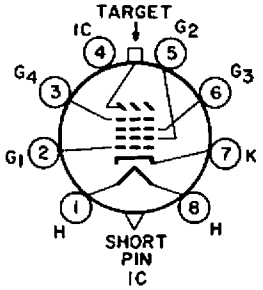
NOTE 1: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT INDEX PIN.

NOTE 2: FACEPLATE THICKNESS IS 0.094" ± 0.012".

BASING DIAGRAM

Bottom View

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.4
Pin 4 – Internal Connection—Do Not Use
Pin 5 – Grid No.2



Pin 6 – Grid No.3
Pin 7 – Cathode
Pin 8 – Heater
Flange – Target
Short Index Pin – Internal Connection—Make No Connection

DIRECTION OF LIGHT:
INTO FACE END OF TUBE

8ME

from JEDEC release #4705, May 18, 1964

RCA-8573

VIDICON

For Live-Scene Pickup in Industrial Closed-Circuit TV In Compact Transistorized TV Cameras

Magnetic Focus
Magnetic Deflection

High Resolution in Conjunction with High Sensitivity and Low Lag

1"-Diameter Bulb
5.12" Length

RCA-8573 is a small vidicon-type camera tube designed especially for use in compact, transistorized television cameras. It is intended for either black-and-white or color cameras televising live scenes in industrial and other closed-circuit TV applications.



It features separate connections for grid No.4 and grid No.3. The 8573 provides higher resolution, more uniform resolution, and more uniform signal output when operated at high voltage than other high-sensitivity, low-lag vidicons of similar size not having separate grid-No.4 and grid-No.3 connections.

Its use in compact transistorized cameras is facilitated by its low-power "dark heater" which requires only 0.6 watt and its short overall length of only 5-1/8".

The high sensitivity of the photoconductive surface employed by the 8573 is sufficient to produce high-quality pictures under the lighting conditions ordinarily encountered in industrial areas and in broadcast studios. The sensitivity of the 8573 can be equivalent to photographic film having an ASA exposure index of 1200.

The 8573 may be operated in a number of voltage modes although recommended operation requires that in each case grid-No.3 voltage is 0.6 of grid-No.4 voltage, and that correct positioning of associated deflecting components is observed. This operating procedure results in increases in both the center resolution and the uniformity of resolution from center to edge of the scanned target area. The resolution capability of the 8573 at the center of the picture is about 1000 TV lines and about 700 TV lines at the corner. This high resolution is obtained when the 8573 is operated with a grid-No.4 voltage of 750 volts and a grid-No.3 voltage of 450 volts. When the 8573 is operated at a lower grid-No.4 voltage of 500 volts and grid-No.3 voltage of 300 volts, its resolution will be about 900 TV lines at the center and 600 TV lines at the corner of the picture.

The 8573 utilizes a highly-sensitive low-lag photoconductive surface of uniform thickness. Because of this uniform thickness, a constant voltage gradient and uniform dark current is obtained across the entire scanned area. The resulting picture background that is produced is free of "flare", and other unwanted signals. The uniform thickness of the photoconductive surface of the 8573 also results in substantially uniform sensitivity over the entire scanned area. Therefore, the 8573 exhibits a degree of uniformity of characteristics from tube to tube that makes it possible to obtain excellent color uniformity and balance when used in vidicon color cameras.

Featured in the design of the 8573 are non-magnetic materials in the front end and an extremely flat faceplate free from optical distortion. The elimination of magnetic materials from the front end and the use of an optically flat faceplate make it easier to register multiple pictures when these tubes are used in vidicon color cameras.

Full advantage of the uniformity of the photoconductive layer in the 8573 is realized only when the associated deflecting and focusing components do not introduce scanning beam-landing errors. If the 8573 is used with components which introduce such errors, compensation may be effected by applying to the cathode, grid No.1, and grid No.2 a modulating voltage of mixed parabolic waveform containing components of both the vertical and horizontal scanning frequencies.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Lancaster, Pa.

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8573 5-64
Printed in U.S.A.

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.095	amp
Direct Interelectrode Capacitance:[a]		
Target to all other electrodes	4.6	pf
Spectral Response	See *Fig.4*	
Photoconductive Layer:		
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)	0.62	inch

Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short index pin. The masking is for orientation only and does not define the proper scanned area of the photoconductive layer.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	5.12" ± 0.06"
Greatest Diameter	1.125" ± 0.010"
Bulb	T8
Base	Small-Button Ditetrar 8-Pin, (JEDEC No.E8-11)
Socket	Cinch[b] No.54A18088, or equivalent
Focusing Coil	Cleveland Electronics[cd] No.VF-115-12, or equivalent
Deflecting Yoke	Cleveland Electronics[cd] No.VY-111-3, or equivalent
Alignment Coil	Cleveland Electronics[cd] No.VA-118, or equivalent
Operating Position	Any
Weight (Approx.)	2 oz

Maximum Ratings, *Absolute-Maximum Values:*[e]

For scanned area of 1/2" x 3/8"

Grid-No.4 Voltage	1000 max.	volts
Grid-No.3 Voltage	1000 max.	volts
Grid-No.2 Voltage	750 max.	volts
Grid-No.1 Voltage:		
Negative bias value	300 max.	volts
Positive bias value	0 max.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
Target Voltage	100 max.	volts
Dark Current	0.25 max.	μa
Peak Target Current[f]	0.55 max.	μa
Faceplate:		
Illumination	1000 max.	fc
Temperature	71 max.	°C

Typical Operation and Performance Data:

For scanned area of 1/2" x 3/8" — Faceplate temperature of 30° to 35° C	*Low-Voltage Operation*	*High-Voltage Operation*	
Grid-No.4 (Decelerator) Voltage	500	750	volts
Grid-No.3 (Beam-Focus Electrode) Voltage[g]	300[h]	450[h]	volts
Grid-No.2 (Accelerator) Voltage	300	300	volts
Grid-No.1 Voltage for Picture Cutoff[j]	-45 to -100	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa	0.65	0.65	
Visual Equivalent Signal-to-Noise Ratio (Approx.)[k]	300:1	300:1	
Lag — Per Cent of Initial Value of Signal-Output Current 1/20 Second After Illumination is Removed:[m]			
Typical value	20	20	%
Minimum Peak-to-Peak Blanking Voltage:			
When applied to grid No.1	75	75	volts
When applied to cathode	20	20	volts
Limiting Resolution:			
At center of picture	900	1000	TV lines
At corner of picture	600	700	TV lines
Amplitude Response to a 400 TV Line Square-Wave Test Pattern at Center of Picture	35	45	%
Field Strength at Center of Focusing Coil[g]	41 ± 4	52 ± 4	gauss
Peak Deflecting-Coil Current:			
Horizontal	180	220	ma
Vertical	33	40	ma
Field Strength of Adjustable Alignment Coil[n]	0 to 4	0 to 4	gauss

Maximum-Sensitivity Operation - 0.1 Footcandle on Faceplate

Faceplate Illumination (Highlight)	0.1	fc
Target Voltage[pq]	35 to 70	volts
Dark Current[r]	0.2	μa
Signal-Output Current:[s]		
Typical	0.14	μa

Intermediate-Sensitivity Operation - 0.5 Footcandle on Faceplate

Faceplate Illumination (Highlight)	0.5	fc
Target Voltage[pq]	30 to 60	volts
Dark Current[r]	0.10	μa
Signal-Output Current:[s]		
Typical	0.27	μa

Average-Sensitivity Operation - 1.0 Footcandle on Faceplate

Faceplate Illumination (Highlight)	1.0	fc
Target Voltage[pq]	20 to 40	volts
Dark Current[r]	0.02	μa
Signal-Output Current:[s]		
Typical	0.20	μa
Minimum	0.15	μa

High-Light Level Operation - 10 Footcandles on Faceplate

Faceplate Illumination (Highlight)	10	fc
Target Voltage[pq]	10 to 22	volts
Dark Current[r]	0.005	μa
Signal-Output Current:[s]		
Typical	0.3	μa

[a] This capacitance, which effectively is the output impedance of the 8573, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

[b] Made by Cinch Manufacturing Corporation, 1026 S. Homan Avenue, Chicago 24, Illinois.

[c] Made by Cleveland Electronics Inc., 1974 East 61st Street, Cleveland, Ohio.

[d] These components are chosen to provide tube operation with minimum beam-landing error when mounted in the recommended position along the tube axis as shown in Fig. 1.

[e] The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Absolute-Maximum Rating System* for rating electron devices. 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, taking no responsibility for equipment variations, environment variations, and the effects of changes in operating conditions due to variations in device characteristics.

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 device characteristics.

[f] Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[g] Beam focus is usually attained by varying the focus-coil current to obtain a field-strength value within the range shown under *Typical Operation and Performance Data*. If the field strength of the focus coil is fixed, beam focus is obtained within a ± 10 per cent range of the grid-No. 4 and grid-No. 3 voltages. However, the recommended ratio of 0.6 between grid No. 3 and grid No. 4 must be maintained as these voltages are varied.

[h] In general, grid No. 3 should be operated above 250 volts and be 0.6 of grid-No. 4 voltage.

[j] With no blanking voltage on grid No. 1.

[k] Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc and a peak signal-output current of 0.35 microampere. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to rms noise current, multiplied by a factor of 3.

[m] For initial signal-output current of 0.2 microampere and a dark current of 0.02 microampere.

[n] The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

[p] The target voltage for each 8573 must be adjusted to that value which gives the desired operating dark current.

[q] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[r] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

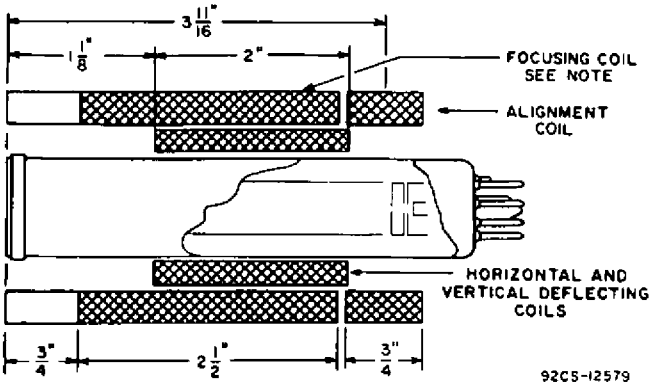
[s] Defined as the component of the highlight target current after the dark-current component has been subtracted.

OPERATING CONSIDERATIONS

The *target connection* is made by a suitable spring contact bearing against the edge of the metal ring at the face end of the tube. This spring contact may conveniently be provided as part of the focusing-coil design.

The *deflecting yoke and focusing coil* used with the 8573 are designed to cause the scanning beam to land perpendicularly to the target at all points of the scanned area with minimum beam-landing error and resultant superior uniformity of sensitivity and focus over the scanned area. The recommended location of these components is shown in Fig. 1.

COMPONENT LOCATIONS



NOTE: CROSS-HATCHING INDICATES WOUND PORTION OF FOCUSING COIL.

Recommended Location and Length of Deflecting, Focusing, and Alignment Components to obtain Minimum Beam-Landing Error.

Fig. 1

The polarity of the focusing coil 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 *temperature of the faceplate* should not exceed 71° C (160° F), either during operation or storage of the 8573. Operation with a faceplate temperature in the range from about 25° to 35° C (77° to 95° F) is recommended. The temperature of the faceplate is determined by the combined heating effects of the incident illumination on the faceplate, the associated components, and the tube itself. To reduce these heating effects and permit operation in the preferred temperature range under conditions of extremely high light levels, the use of an infrared filter between the object and the camera lens as well as a blast of cooling air directed across the faceplate from a blower is recommended.

Provisions should also be made in the camera installation to hold the faceplate temperature of the 8573 at a *steady value* within the recommended range. Dark current increases with increasing temperature. It is highly desirable to operate the 8573 at a steady temperature to maintain dark current at a preselected value. This mode of operation ensures both optimum and stable day-to-day performance. If such provisions cannot be

made, changes in target voltage may be required from time to time to maintain the desired picture quality.

As *target voltage* is increased, dark current also increases. The range of target voltage for various dark current levels of different 8573's is shown in Fig. 2. It should be noted that the range of target voltage to produce a given dark current, and therefore a given sensitivity, is very narrow for the 8573. Individual 8573's will therefore *have substantially identical performance characteristics when operated with an identical value of dark current.* For proper adjustment of the target voltage on each 8573 see SET-UP PROCEDURE on pages 6 & 7.

Persistence or lag of the photoconductive layer is given in Fig. 3 for two values of dark current. Each curve shows the decay in signal-output current from an initial value of 0.2 microampere after the illumination is cut off.

The *spectral response* of the 8573 is shown in Fig. 4.

RANGE OF DARK CURRENT

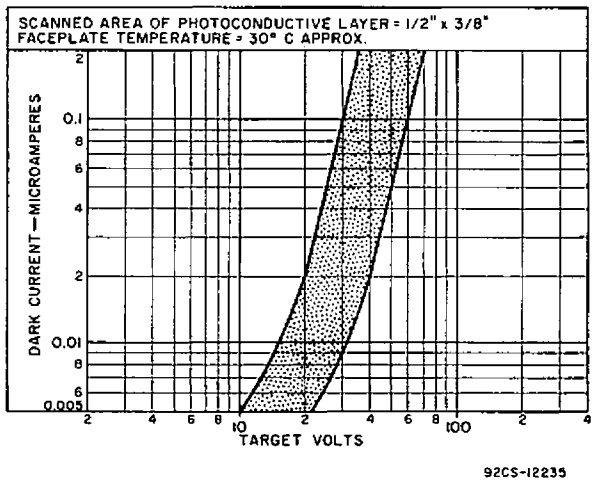


Fig.2

As shown in Fig. 5, a substantial increase in both limiting resolution and amplitude response of the 8573 may be obtained by increasing the operating voltages on grid No. 4 and grid No. 3. The focusing-coil field strength must be increased and more deflecting power is required at higher electrode voltages as indicated under *Typical Operation and Performance Data.* Very little additional beam-landing error is introduced at the higher voltages provided the recommended operating voltages are used and the associated components are positioned as shown in Fig. 1.

For *live pickup involving low illumination levels,* a good picture can be obtained with a highlight illumination of less than 0.1 footcandle on the faceplace of the 8573. Such a low illumination level, however, requires maximum-sensitivity operation of the 8573. For this type of operation, a dark current of 0.2 microampere is required. This value will be obtained for a target voltage within the range of 35 to 70 volts. Under such low-level illumination conditions, the lag will be somewhat greater and the black-level uniformity will be somewhat poorer than that attainable with higher faceplate illumination and lower dark current.

When the 8573 is used with illumination levels of 1 to 5 footcandles on the faceplate, a dark current of 0.02 microampere or less is required. This value will be obtained for a target voltage within the range of 20 to 40 volts.

For film pickup where illumination on the faceplate will usually exceed 5 footcandles, a target voltage within the range of 10 to 22 volts will normally be employed for low dark current and maximum signal uniformity.

TYPICAL PERSISTENCE CHARACTERISTICS

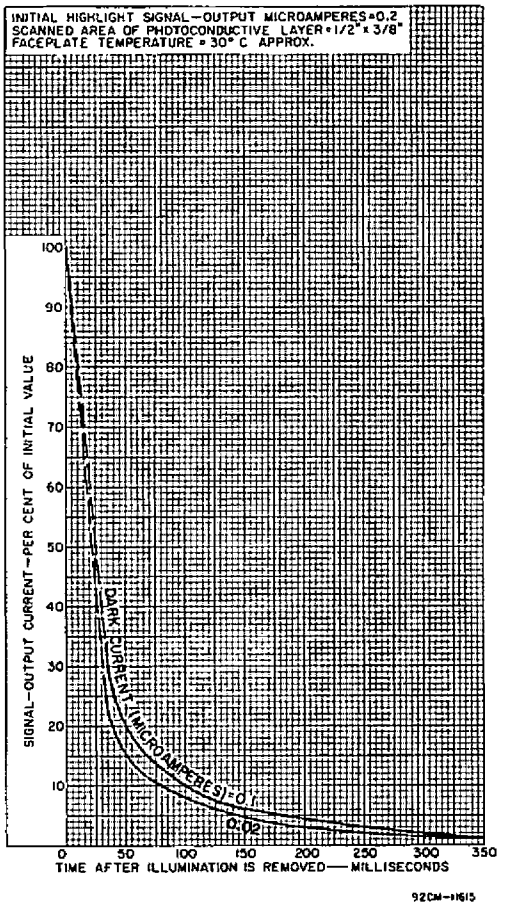


Fig.3

The exact value of target voltage to give the required dark current will depend on the individual tube and on the temperature at which its faceplate is operated. It is important that the tube be allowed to reach a stable operating temperature before the operating dark current is determined; otherwise the dark current will change as the temperature of the tube changes.

Signal Output and Light Transfer Characteristics. Typical signal output as a function of uniform 2870° K tungsten illumination on the photoconductive layer for different values of dark current is shown in Fig. 6. It is to be noted that these curves are for a typical 8573 under the conditions indicated. Because the target voltage

needed to give maximum sensitivity at a dark current of 0.2 microampere may range between 35 and 70 volts, it is essential that the best operating target voltage be determined for each 8573. From these curves, it will also be noted that the illumination must be increased about 50 times to produce an increase of 10 times in signal-output current for any given value of dark current.

The average "gamma", or slope, of the light transfer characteristic curves shown in Fig.6 is approximately 0.65. This value is relatively constant over an adjustment range of 4 to 1 in target voltage, or 50 to 1 in dark current, for a signal-output current range between 0.01 and 0.3 microampere. Close uniformity in the value of gamma between individual 8573's is maintained to insure satisfactory operation of color cameras in which the signal-output currents of the 8573's must match closely over a wide range of scene illumination. Because its transfer characteristic is approximately the complement of the transfer characteristic of a picture tube, the 8573 can produce a picture having proper tone rendition.

TYPICAL SPECTRAL SENSITIVITY CHARACTERISTIC

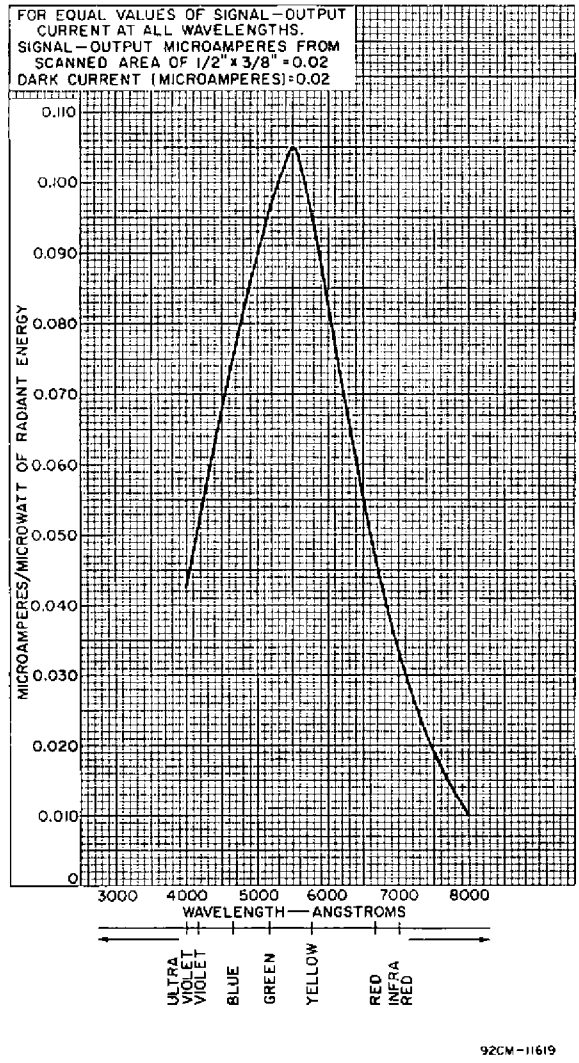


Fig.4

Because uniformity of sensitivity of the photoconductive layer in the 8573 is excellent, uniform signal output over the scanned area can be obtained if the 8573 is operated with a deflecting-yoke and focusing-coil system designed so that no beam-landing errors are produced in the vidicon. If the 8573 is to be utilized with designs of focusing and deflecting systems which introduce such errors, uniform sensitivity over the scanned area of the 8573 can be achieved by compensating for the beam-landing errors thus introduced. Without compensation for these errors, variations in sensitivity over the scanned area will occur. These variations resulting from beam-landing errors are in the form of lower signal from the edges of the scanned area than from the center. However, because of the uniformity of the photoconductive layer, these variations in sensitivity are the same from tube to tube. Compensation for the beam-landing errors to achieve uniform sensitivity can be obtained by supplying a modulating voltage of a suitable waveform to the cathode of the 8573. The desired waveform is parabolic in shape and of such a polarity that the cathode voltage is lowered as the beam approaches the edges

UNCOMPENSATED HORIZONTAL SQUARE-WAVE RESPONSE

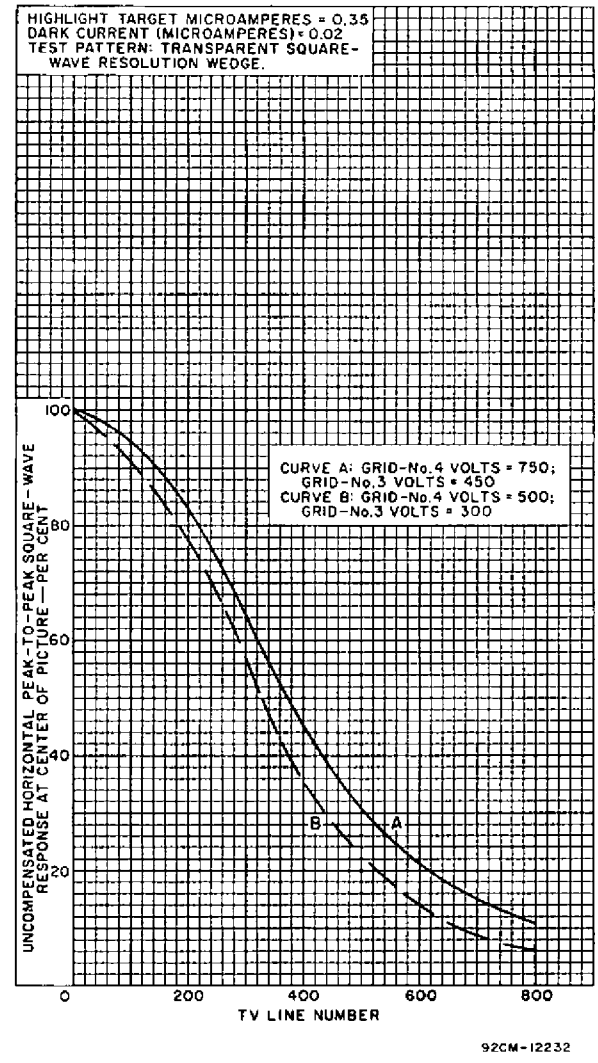


Fig.5

of the scanned area. The modulating waveform should contain parabolic components of both the horizontal and vertical scanning frequencies. The horizontal component should have the greater amplitude and will be the most effective in obtaining uniform sensitivity.

A satisfactory value of this mixed parabolic waveform signal for compensation of beam-landing errors is approximately 4 volts peak-to-peak. This modulating voltage is applied to grid No. 1 and grid No. 2 as well as to the cathode to prevent modulation of the scanning beam.

LIGHT TRANSFER CHARACTERISTICS

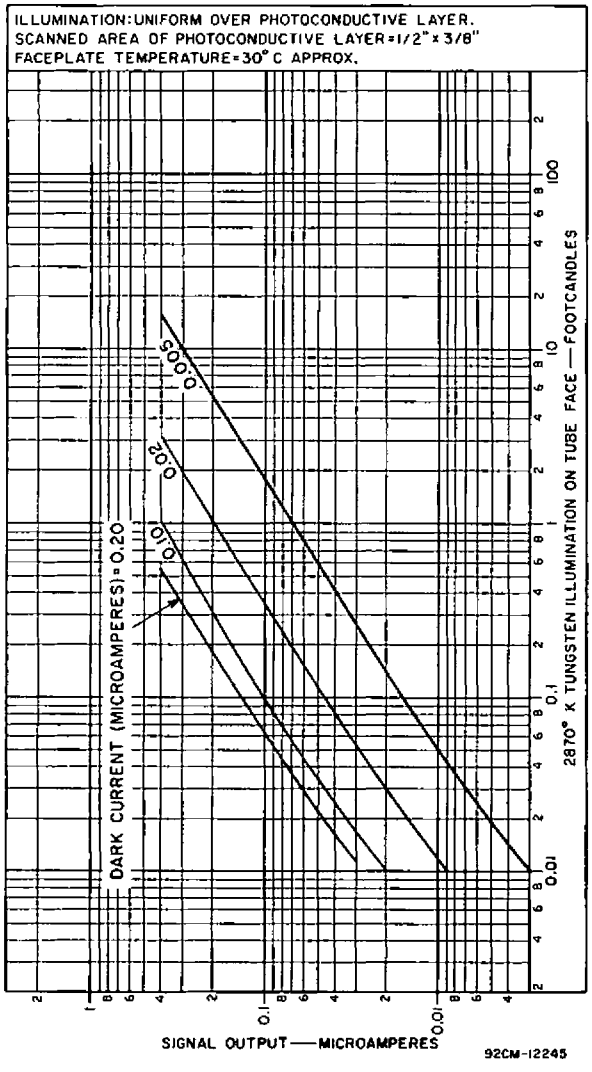


Fig.6

Full-size scanning of the 1/2" x 3/8" area of the photoconductive layer should always be used. This condition can be assured by first adjusting the deflection circuits to overscan the photoconductive layer sufficiently so that the edges of the sensitive area can be seen on the monitor. Then, after centering the image on the sensitive area (see Fig. 8), reduce scanning until the edges of the image just disappear. In this way, the maximum signal-to-noise ratio and maximum resolution can be obtained. It should be noted that overscanning the photoconductive layer produces a smaller-than-normal picture on the monitor.

Underscanning of the photoconductive layer, i.e., scanning an area of the layer less than 1/2" x 3/8", should never be permitted. This condition which produces a larger-than-normal picture on the monitor, not only causes sacrifice in signal-to-noise ratio and resolution, but also may cause permanent change in sensitivity and dark current of the underscanned area. An underscanned area showing such a change will be visible in the picture when full-size scanning is restored.

Failure of scanning even for a few seconds may permanently damage the photoconductive layer. The damaged area shows up as a spot or line in the picture during subsequent operation. To avoid damaging the 8573 during scanning failure, it is necessary to prevent the scanning beam from reaching the layer.

TYPICAL CHARACTERISTIC

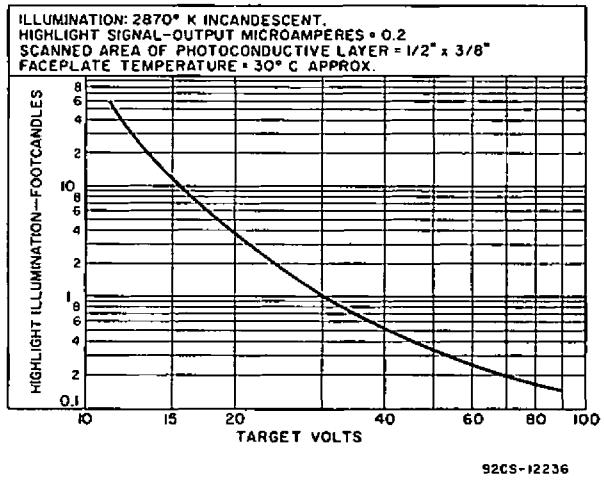


Fig.7

The scanning beam can conveniently be prevented from reaching the layer by increasing the grid-No. 1 voltage to cutoff, biasing the target negatively, or removing the grid-No. 4, grid-No. 3, and grid-No. 2 electrode voltages. Circuits should be incorporated to perform one or more of these functions automatically the instant scanning power fails or is reduced, at any time, to an abnormally low value.

SET-UP PROCEDURE

The *sequence of adjustments* in operating the 8573 for live pickup is as follows: With the Grid-No. 1 Voltage Control set for maximum negative bias (beam cutoff), Target-Voltage Control set for the minimum voltage shown under *Typical Operation*, and Deflection Controls set for maximum overscan, apply other voltages to the 8573 as indicated under *Typical Operation*.

Next, with a 1/2" x 3/8" mask centered on the face of the tube, and with the iris set for minimum opening, decrease the grid-No. 1 bias to just bring out the highlight details of the picture on the monitor. Adjust the Beam-Focus Control, the lens stop, and the optical focus to obtain the best picture. Reduce horizontal and vertical scanning so that the edges of the image extend just outside the scanned area of the monitor. Then adjust the alignment field so that the center of the picture does not move as the beam-focus voltage is varied. Some readjustment of horizontal and vertical centering may be necessary after alignment.

For maximum-sensitivity operation of the 8573 the following procedure should be used: with no illumination on the face of the tube, increase the target voltage until non-uniformities in dark current become objectionable. Then reduce the target voltage slightly until the dark current becomes uniform.

Next, open the lens and adjust the aperture to obtain a picture of the desired quality and depth of focus. Adjust the grid-No. 1 bias voltage so that the highlights are just discharged. If the beam current is too high, a picture of poor resolution and poor quality will result. If the highlights cannot be discharged or the picture quality is unsatisfactory, it may be an indication that the target voltage is too high. In this case, the target voltage should be reduced and the grid-No. 1 bias voltage again adjusted until the highlights are just discharged.

For average-sensitivity operation of the 8573 where more than the usual amount of room lighting is available, the adjustments are the same as those used for maximum-sensitivity operation except that target voltage is increased with the lens capped until the background picture viewed on the monitor just begins to become bright. This method of operating the 8573 results in decreased lag in the picture.

For operation at high light level—such as from a film projector or bright sunlight—the camera adjustments are similar to those shown for average-sensitivity operation. The target voltage is decreased so that scene highlights are just discharged and a picture of satisfactory quality is obtained.

Proper adjustment of the dark current, the peak signal-output current, and the grid-No. 1 bias, will result in a picture of good quality with minimum smearing of moving objects.

PROPER POSITIONING OF IMAGE ON THE FACE OF THE VIDICON

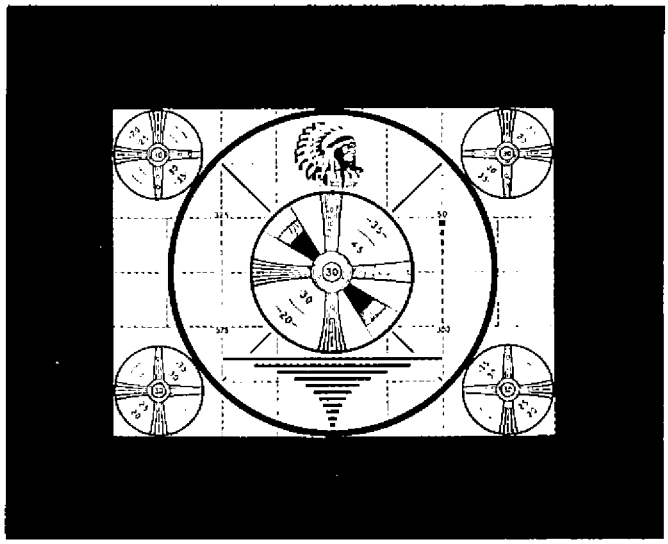


Fig. 8

In setting up 8573's in a color camera, particular attention must be given to proper alignment, best obtainable focus, and identical centering of scanned areas on the photoconductive layers. For best color balance and color tracking over a wide range of light levels, the light level in each color channel should be controlled so that each of the 8573's develops the same value of peak signal output for white portions of a scene. Observation of these operating conditions will assure good registration and good color balance.

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REFERENCES

Otto H. Schade, *"Electro-Optical Characteristics of Television Systems; Introduction and*

"Part I — Characteristics of Vision and Visual Systems", RCA Review, March, 1948;

"Part II — Electro-Optical Specifications for Television Systems", RCA Review, June, 1948;

"Part III — Electro-Optical Characteristics of Camera Systems", RCA Review, September, 1948;

"Part IV — Correlation and Evaluation of Electro-Optical Characteristics of Imaging Systems", RCA Review, December, 1948.

R.G. Neuhauser, *"Vidicon for Film Pickup"*, Jour. of S.M.P.T.E., Vol.62, No.2, February, 1954.

H.N. Kozanowski, *"Vidicon Film-Reproduction Cameras"*, Jour. of S.M.P.T.E., Vol.62, No.2, February, 1954.

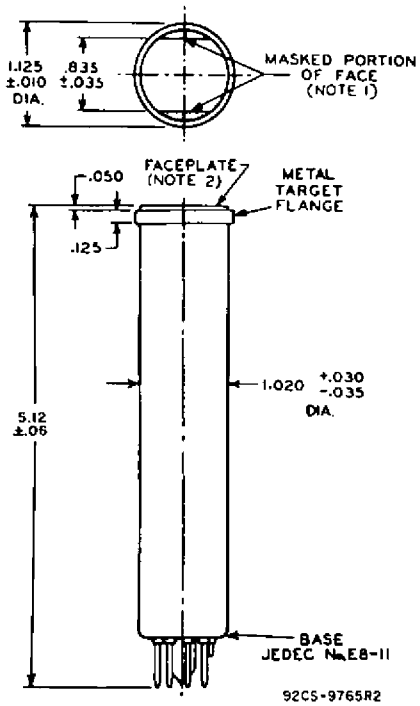
R.G. Neuhauser and L.D. Miller, *"Beam-Landing Errors and Signal-Output Uniformity of Vidicons"*, Jour. of S.M.P.T.E., Vol.67, March, 1958.

L.D. Miller and B.H. Vine, *"An Improved Developmental One-Inch Vidicon for Television Cameras"*, Jour. of S.M.P.T.E., Vol.67, March, 1958.

J. Castleberry and B.H. Vine, *"An Improved Vidicon Focusing-Deflecting Unit"*, Jour. of S.M.P.T.E., Vol.68, April, 1959.

R.G. Neuhauser, *"Sensitivity & Motion Capturing Ability of Television Camera Tubes"*, Jour. of S.M.P.T.E., Vol.68, No.7, July, 1959.

DIMENSIONAL OUTLINE



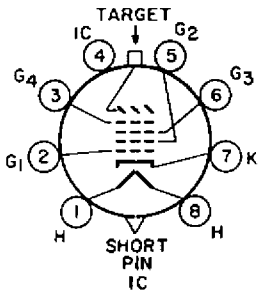
DIMENSIONS IN INCHES

NOTE 1: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT INDEX PIN.

NOTE 2: FACEPLATE THICKNESS IS 0.094" ± 0.012".

BASING DIAGRAM

Bottom View



DIRECTION OF LIGHT: INTO FACE END OF TUBE

8ME

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.4
Pin 4 – Internal Connection— Do Not Use
Pin 5 – Grid No.2
Pin 6 – Grid No.3
Pin 7 – Cathode
Pin 8 – Heater
Flange – Target
Short Index Pin – Internal Connection— Make No Connection

JETEC TYPE DESIGNATION REGISTRATION FORM TR TUBES

Date: 3-25-64

JETEC Designation: 8574

Manufacturer: METCOM, INC., Salem, Mass.

General Characteristics

The 8574 is a broad band TR tube designed to effectively decouple the receiver from a common transmitting and receiving antenna during a period of transmission. It's operational band is from 8500 to 9600 megacycles.

Special Feature:

Low Loss, Low Noise, and a long life.

Electrical Data - Typical Values

Operational Band VSWR Max. 1.25	8500 to 9600 Mc/s
Ignitor Ignition Time	1.00 sec.
Ignitor Voltage Drop at Ii=100uAdc	-200 to -400 volts
Spike Leakage Energy at 8900Mc, 200kw, -55 to +85°C	0.30 ergs
Flat Leakage Power at 8900Mc, 20 kw, -55 to +85°C	100 mw
Insertion Loss at 8500 to 9600Mc, Ii=0	0.20 db
Ignitor Interaction at 8500-9600Mc, Ii=100uAdc	0.10 db
Recovery Time at 20 kw peak, 3 db down	3.00 usec
Minimum Breakdown Power at 8900Mc, 0 to +85°C	200 mw
Noise Figure Change at 8900Mc	0.40 db
Life Test at 8900Mc, 20 kw	1000 hours

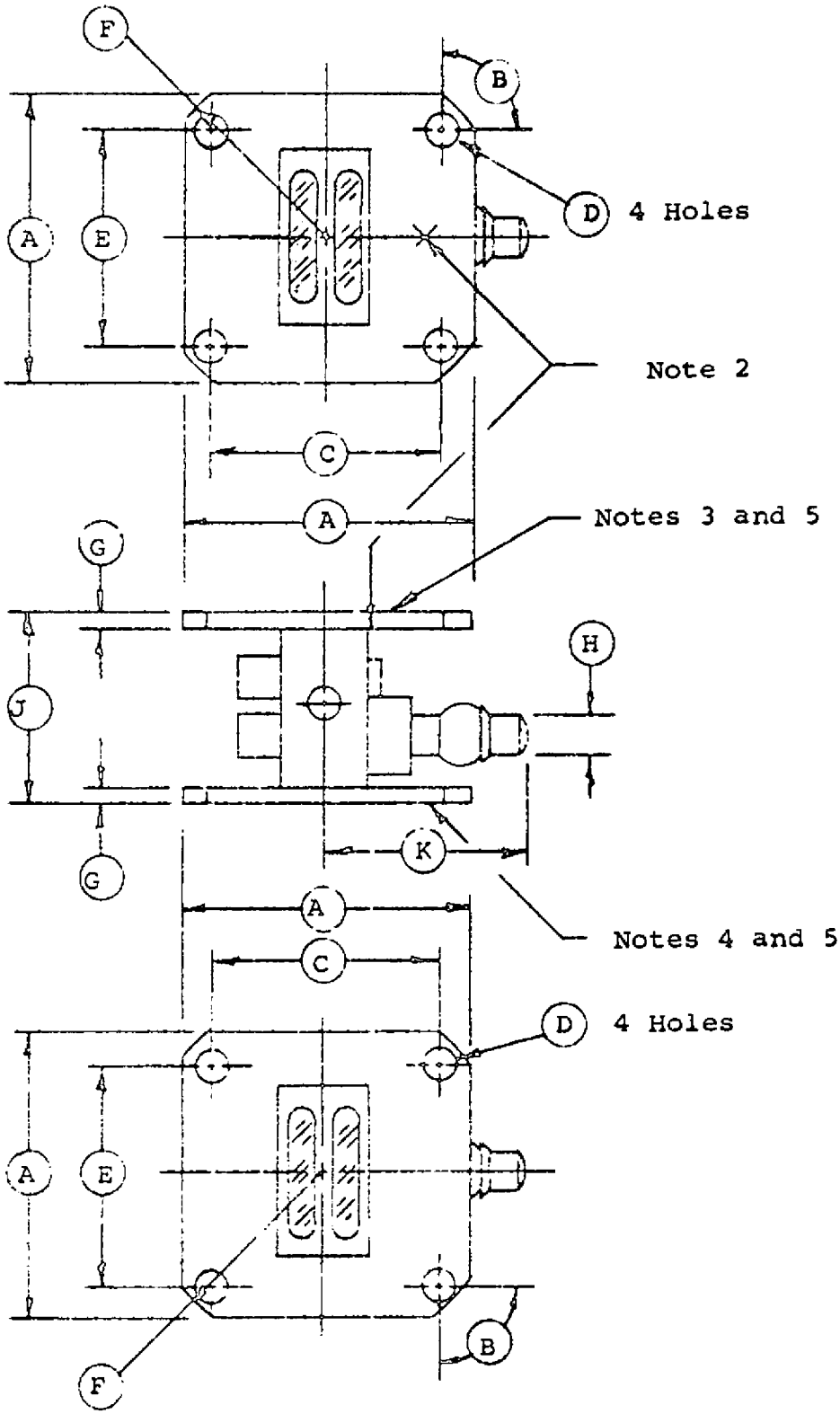
8574

Mechanical Data - General

Dimensions	See Outline dated 9-16-63
Mounting Position	Any
Mates with	UG-136A/U
Weight, Approximately	3.2 oz.

Absolute Maximum Ratings

Transmitter Peak Power	20 kw
Open Circuit Ignitor Voltage	-700 Vdc
Ignitor Current	100 to 150 uAdc
Ambient Temperature	$-55^{\circ}C$ to $+85^{\circ}C$



Page 1 of 2	SPECIFICATION SHEET OUTLINE	METCOM, INC. 76 LAFAYETTE ST. SALEM, MASS. 9-16-63

DIM.	AQL %	INSPECTION LEVEL	LIMITS	
			MIN.	MAX.
QUALIFICATION TESTS				
A	---	---	1.57	1.65
F	---	---	1.03R	1.09R
H	---	---	.240 Dia.	.260 Dia.
ACCEPTANCE INSPECTION PART 1				
B	1.0	I	$89^{\circ}30'$	$90^{\circ}30'$
D			.164	.174
J			1.066	1.074
ACCEPTANCE INSPECTION PART 2				
C	6.5	1.6	1.276	1.284
E			1.216	1.224
G			.146	.156
K			--	1.38

NOTES:

1. Flange to mate with UG136A/2 (2 places).

2. Measure temperature at this point.

3. Input Flange.

4. Output Flange.

5. End flanges shall be parallel planes, and shall be flat within 0.006 in the area bounded by the concentric circles of 1.25 and 1.56 diameter. The area outside the ring shall be flat within +.001, -.005 of the area within the ring. The finish on the flanges shall be silver plated, 100 MSI, or equivalent.

6. All dimensions (exceptB) in inches.

7. Exhaust tube shall not extend beyond flange.

JETEC TYPE DESIGNATION REGISTRATION FORM TR TUBES

Manufacturer's Designation: 8578 Date: 4-13-64

JETEC Designation: 8578

Manufacturer: Metcom, Inc., Salem, Mass.

General Characteristics:

The 8578 is a dual broad band TR tube designed to effectively decouple the receiver from a common transmitting and receiving antenna during a period of transmission. Its operational band is from 2700 to 2900 megacycles.

Special Feature:

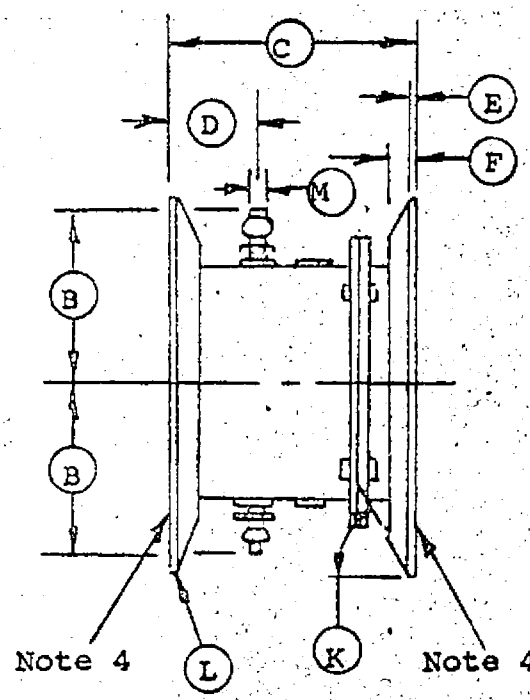
Total Leakage Energy 0.3 erg max. and Ignitor Noise Ratio less than 1.1.

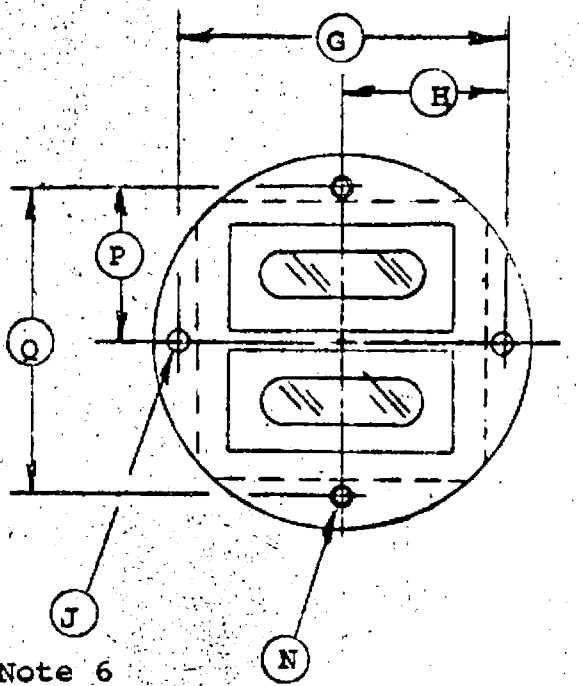
Electrical Data - Typical Values

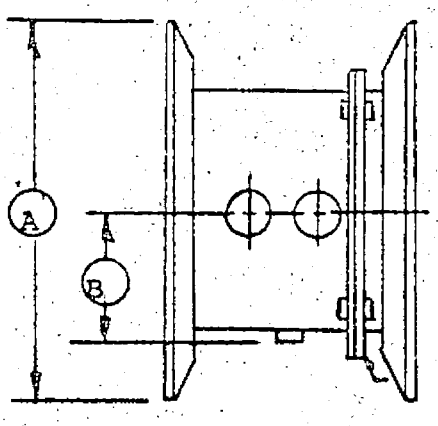
Operational Band VSWR max. 1.2	2700 to 2900 Mc/s
Isolation, Ii=0 uAdc	20 db min.
Ignitor Ignition Time	5 sec. Max.
Ignitor Voltage Drop at Ii=200uAdc	-250 to -400 volts
Spike Leakage Energy at 2800Mc, po=200 kw	0.1 ergs max.
Flat Leakage Energy at 2800Mc, po=200 kw	0.2 ergs max.
Duplexer Loss at Ii=200 uAdc	0.8 db max.
Arc Loss at 2800Mc, po = 20 kw	0.6 db max.
Recovery Time at 600 kw peak, 3 db down	10 usec max.
High Level VSWR	1.15 max.

Mechanical Data - General	8578
Dimensions	See Outline dated 2-3-64
Mounting Position	Any
Mates with	Special Flange
Weight, approximately	41 oz.

Absolute Maximum Ratings	
Transmitter Peak Power	1 MW
Ignitor Current	100 to 200 uAdc
Operating Temperature	-29 to +52°C
Operating Altitude	15,000 Ft. min.
Ignitor Open Circuit Supply Voltage	-500 to -700 Vdc







Page 1 of 2	SPECIFICATION SHEET OUTLINE 8578	METCOM, INC. 76 LAFAYETTE ST. SALEM, MASS. 2-3-64

Ref.	Dimension In Inches
A**	5.000±.005 Dia. Typ.
B*	2.450 Max.
C	3.312±.015
D*	1-1/8 Ref.
E**	0.085±.010 Typ.
F**	0.250±.015 Typ.
G*	3.750±.002 Typ.
H*	1.875±.002 Typ.
J	0.256+.003-.000(4) Holes
K**	$70^{\circ}\pm1^{\circ}$ Typ.
L**	0.03 Rad. Max. Typ.
M	0.250 Dia. Nom.
N	1/4-20NC 2 Holes
P*	1.810±.005
Q*	3.620±.005

Note 1: No part of the tube shall extend beyond 5.000 Dia. cylinder formed by the flanges.

Note 2: No part of window shall extend beyond the flange faces.

Note 3: Cadmium plated per Fed. Spec. QQ-P-416, Class I, Type I, bright finish. All of flange to be free from paint.

Note 4: These surfaces to be parallel with each other within .005 TIR.

Note 5: O.D. of flanges must be concentric with .010 TIR.

Note 6: 4 holes, location ±.003 from vertical centerline.

Note 7: Both flanges shall be flat within .001 TIR.

GENERAL DATA

Spectral Response	See Curve
Wavelength of Max. Response	6100 ± 400 Angstroms
Sensitive Material	Cadmium-Sulfide
Sensitive Area	Viewed from End
Construction	Hermetically Sealed in Glass with Flexible Leads
Outline	See Drawing
Operating Position	Any

ELECTRICAL DATA

RATINGS (Absolute Maximum Values)

Breakdown Voltage[2]	300	Volts
Dissipation (See Curve)		
T-amb = 25°C	50	mW
T-amb = 70°C	5	mW
Ambient Temperature Range	-40 to +70	°C
Illumination	Note 3	

CHARACTERISTICS

Cell Resistance[4]		
Illumination 2 FC		
Color Temperature 2870°K	100,000	Ohms
Dark Resistance[5]	10.0	Megohms Min.

NOTES:

1. Minute increases in relative humidity will produce change in color.

2. Measured with cell in complete darkness at a pulse rate of 100 pps, 100 μ sec. duration. Voltage in excess of the rated value may damage the cell. Max. DC or AC peak voltage is limited by max. dissipation and min. dark resistance rating.

3. Care should be exercised to prevent localized overheating of the sensitive surface when the cell is used with a lens system.

4. Measured after 60 minutes minimum exposure to approximately 50 FC illumination (ambient room light).

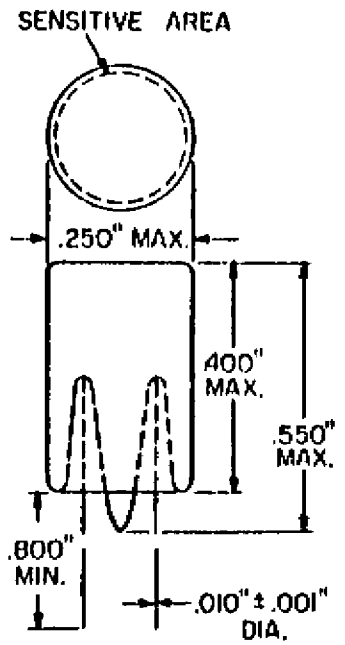
5. Measured in complete darkness, 10 seconds after removal of 2 FC illumination.

from JEDEC release #4809, Sept. 28, 1964

146 (10-58)

QUICK REFERENCE DATA

The Sylvania Type 8582 is a miniature cadmium-sulfide photoconductive cell featuring high sensitivity and hermetically sealed-in-glass construction. The cell is gaseous back-filled for a high dissipation safety factor and includes a blue dot compound which turns pink[1] if the cell envelope becomes damaged. The 8582 is designed for use in a wide variety of industrial applications.



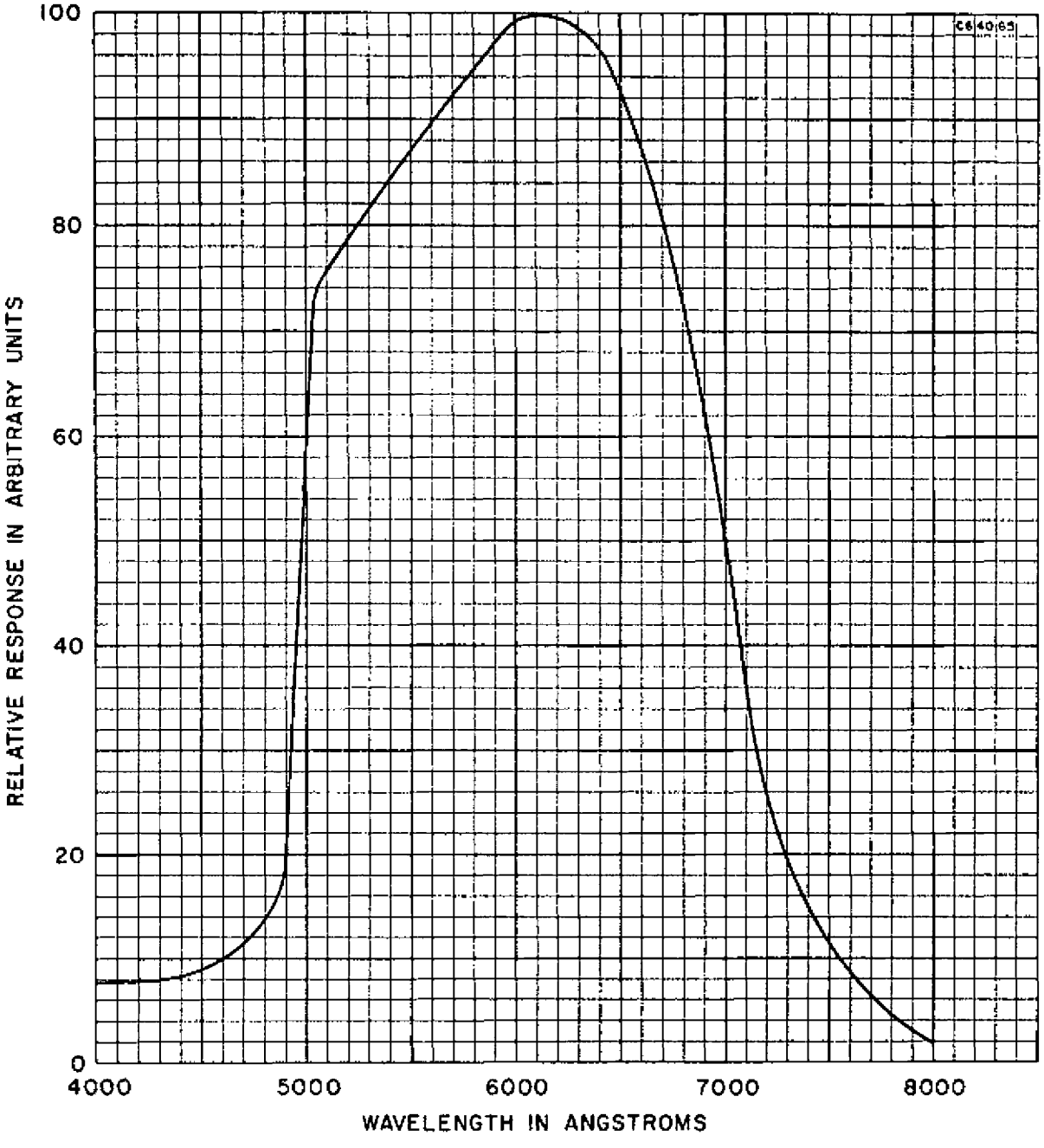
SYLVANIA ELECTRIC PRODUCTS INC.

Electronic Components Group
ELECTRONIC TUBE DIVISION
EMPORIUM, PA.

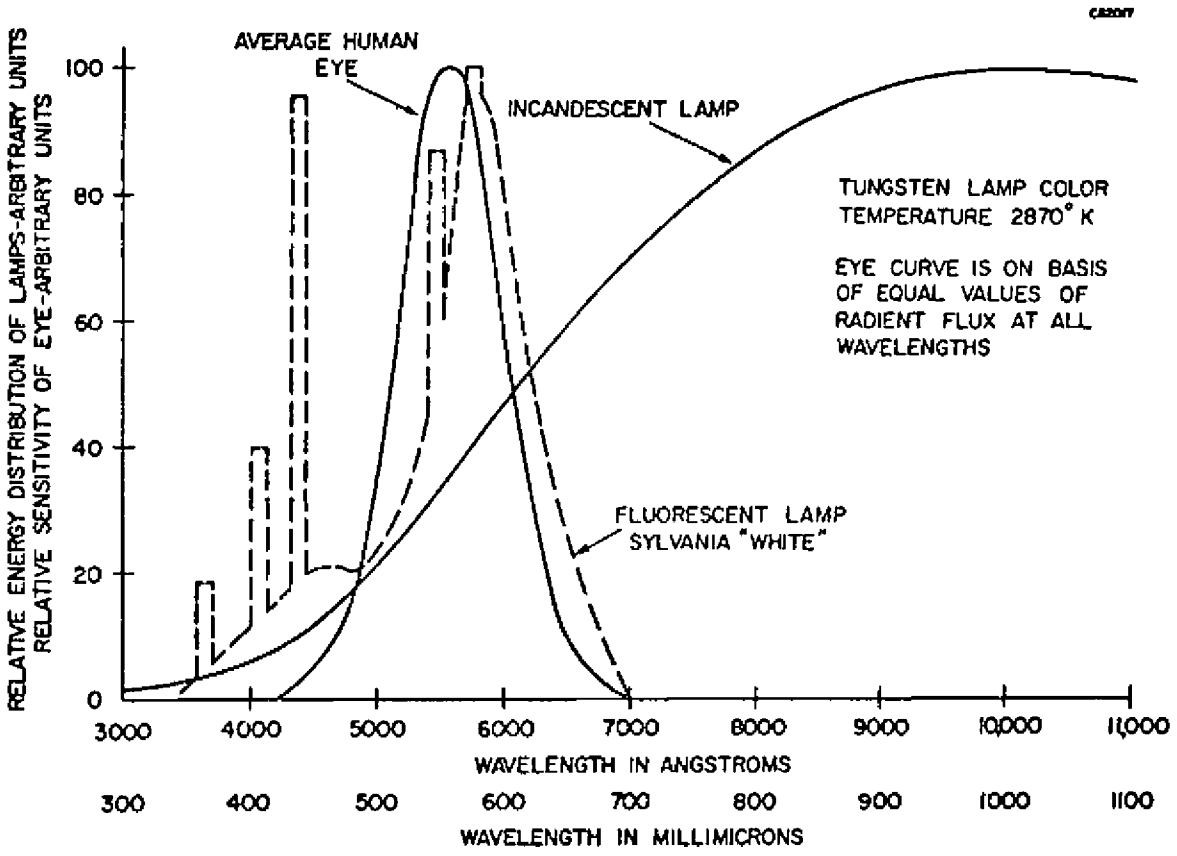
A Technical Publication

August 26, 1964

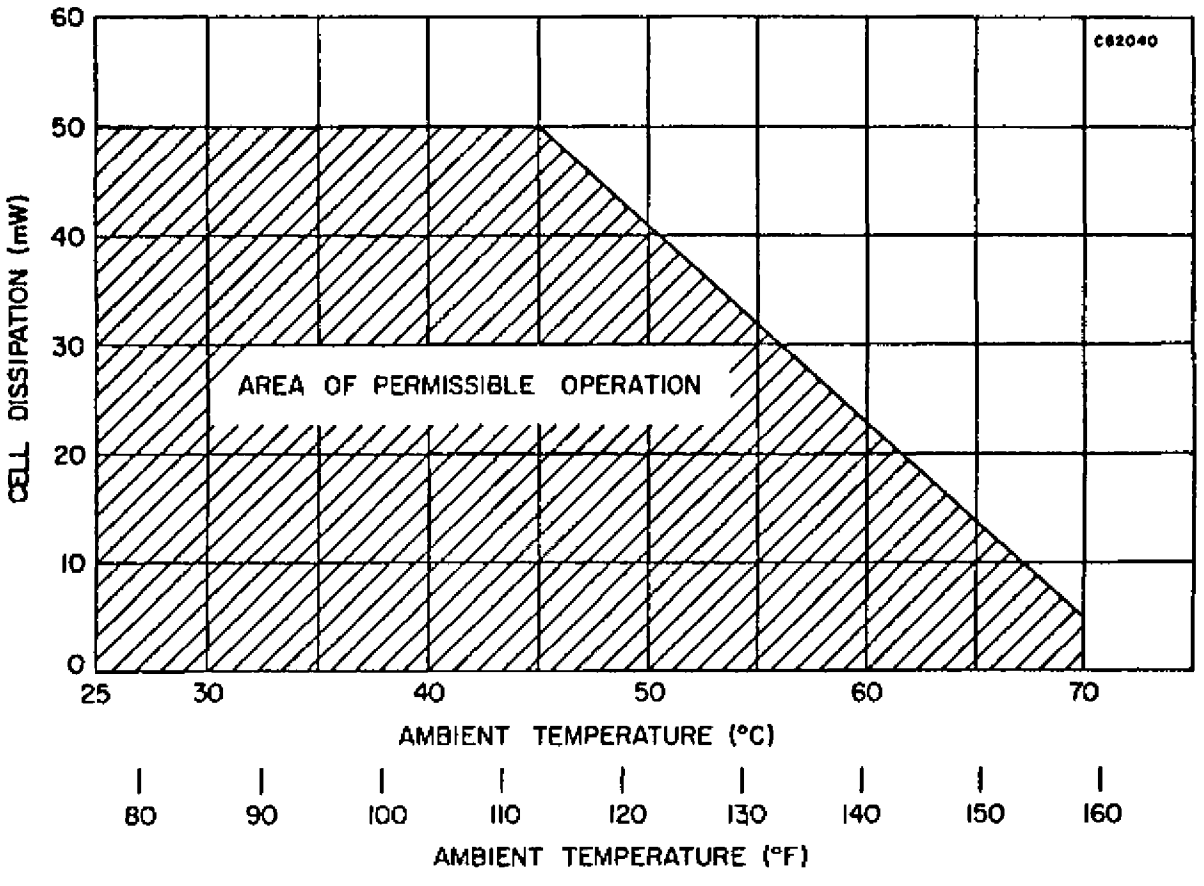
SPECTRAL RESPONSE



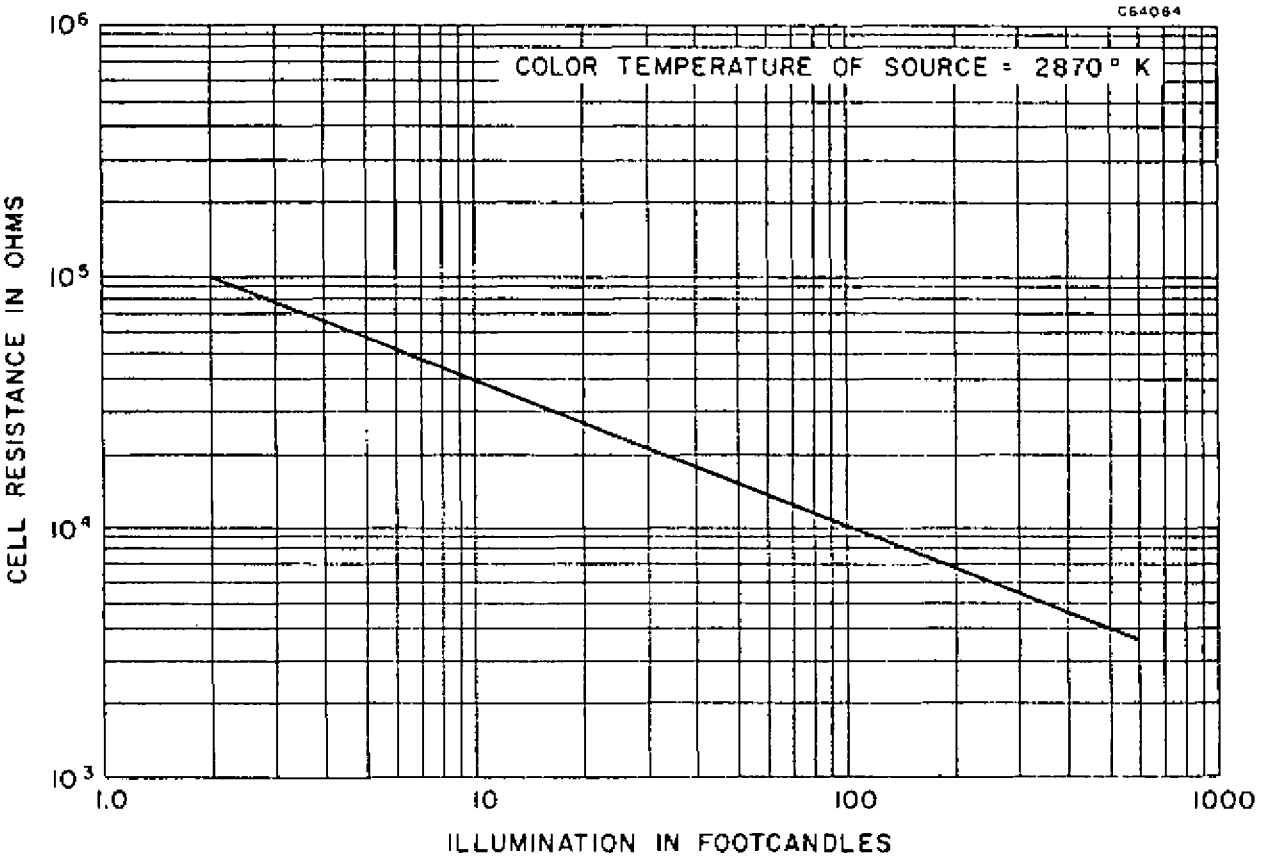
SPECTRAL CHARACTERISTICS OF HUMAN EYE,
TUNGSTEN AND FLUORESCENT LAMPS



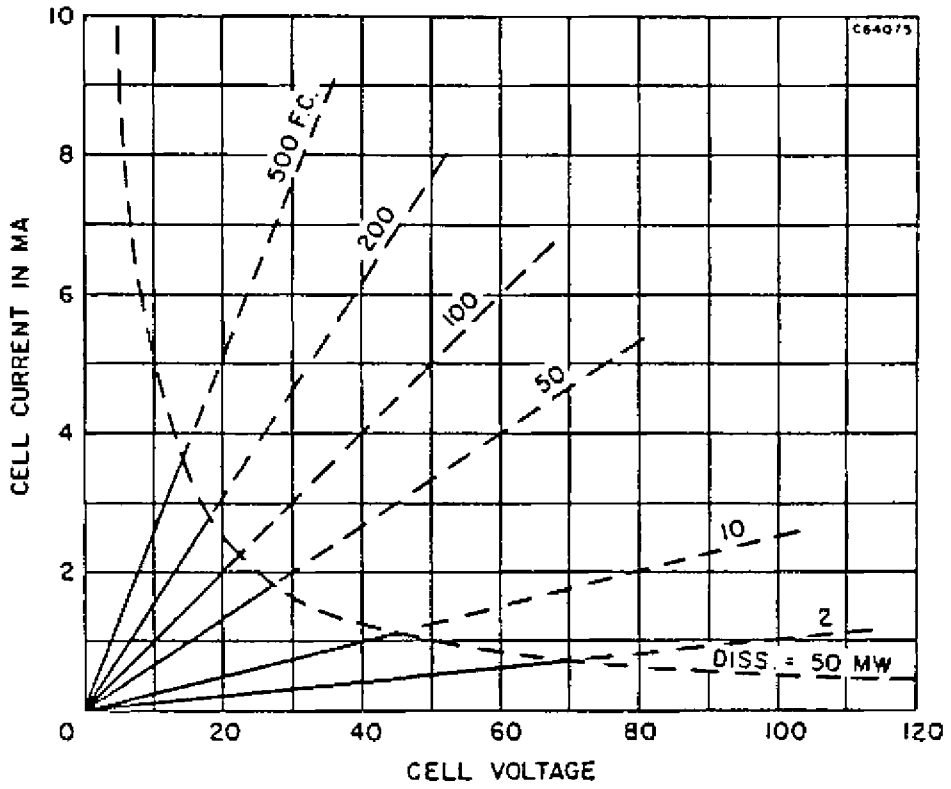
PERMISSABLE DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



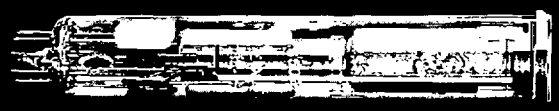
CELL RESISTANCE VS ILLUMINATION



CELL CURRENT AND DISSIPATION VS VOLTAGE



11/1/64



GENERAL ELECTRIC

INDUSTRIAL AND COMMERCIAL SEPARATE FIELD MESH VIDICONS

8507
8541
8572
8604

General Electric offers these new vidicons which feature a "separate field mesh". . . .for better center-to-edge uniformity and reduced beam-landing error. . . .to provide superior characteristics of. . . .
EXTENDED RESOLUTION AND HIGH AMPLITUDE RESPONSE

As a result improved picture quality is obtained for
STUDIO. . . .REMOTE. . . .and INDUSTRIAL APPLICATIONS

Additional General Electric Vidicons also available – See Data Folder ETR-3786

8507 — FOR STUDIO AND REMOTE PICKUP

Features high sensitivity and low lag similar to 7735A . . . provides very high quality pictures with extended resolution capability and higher amplitude response.

8541 — LOW HEATER POWER — FOR STUDIO AND REMOTE PICKUP

Designed for transistorized cameras . . . similar to 8507 except with lower heater power rating of 0.6 watt . . . with same high sensitivity, low lag characteristics . . . and extended resolution plus high amplitude response.

8572 — FOR FILM PICKUP

Features minimum lag and sensitivity characteristics of 7038 . . . designed specifically for film pickup applications . . . black and white or color.

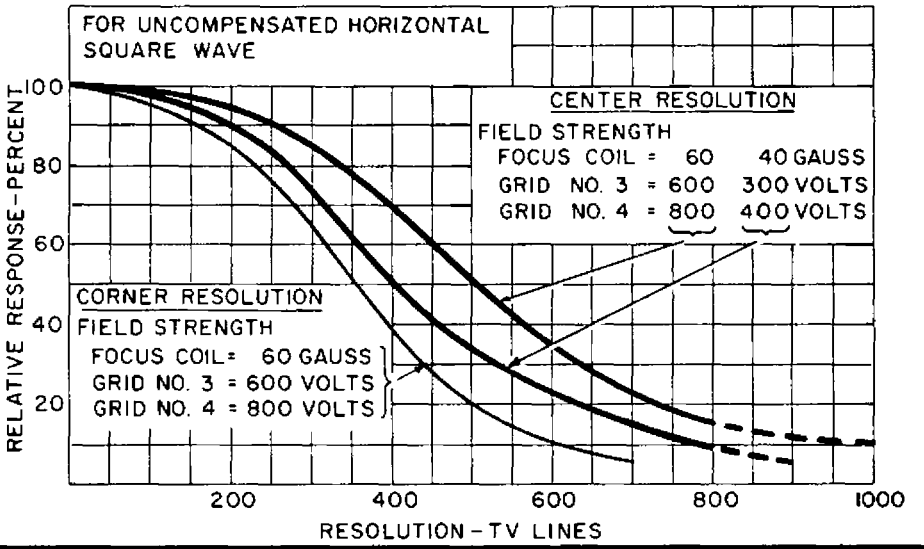
8604 — LOW HEATER POWER — FOR FILM PICKUP

Designed for transistorized film cameras . . . same as 8572 except with lower heater power rating of 0.6 watt.

SIGNIFICANT ADVANTAGES OF SEPARATE FIELD MESH VIDICONS

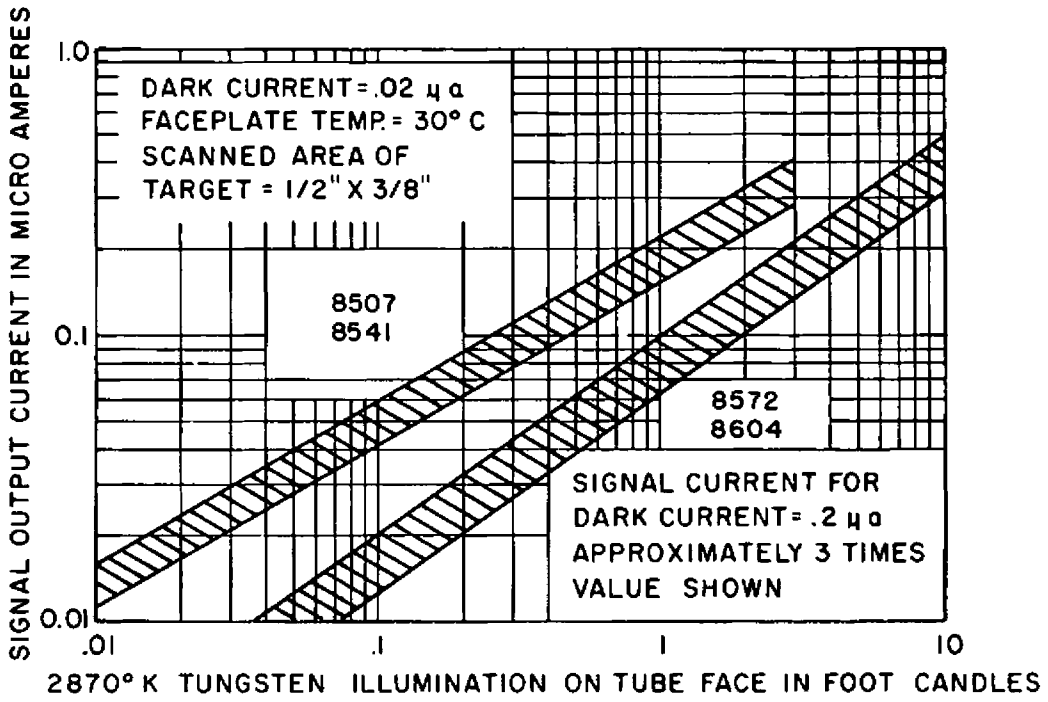
- Extended resolution . . . 1000 TV lines.
- Higher amplitude response . . . 70% @ 400 TV lines.
- Can be over-beamed without loss of resolution . . . allows presetting of beam for discharge of peak highlights without further adjustment . . . excellent feature for automatic target control cameras.
- Excellent signal uniformity over wide range of target voltages.
- Can be operated at lower target voltages without loss of picture quality.

TYPICAL AMPLITUDE RESPONSES

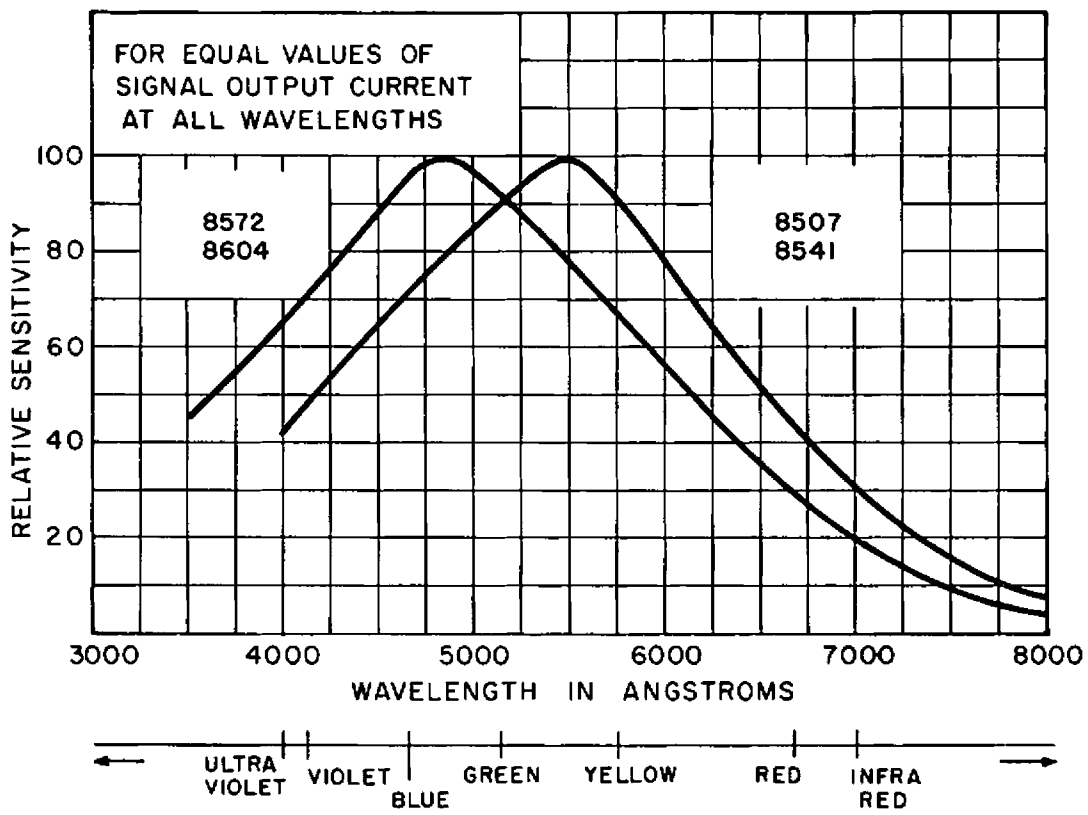


from JEDEC release #4853, Nov. 16, 1964

LIGHT TRANSFER CHARACTERISTICS



SPECTRAL SENSITIVITY CHARACTERISTICS



ESSENTIAL SPECIFICATIONS AND RATINGS

ELECTRICAL–ALL TYPES

Cathode–unipotential
Heater voltage, AC or DC . . . . . 6.3±10% volts
Heater current
8507, 8572 . . . . . 0.6 ampere
8541, 8604 . . . . . 0.09 ampere
Focus and deflection method . . . . . Magnetic
Direct interelectrode capacitance
Anode to all other electrodes . . . . . 3.6 pf

Photoconductive Layer
Spectral response . . . . . See page 2
Rectangular image, 4 × 3 aspect ratio, max useful diagonal . . . . . 0.62 inch
Orientation–horizontal scan should be essentially parallel to a plane passing through the tube axis and short index pin.

MECHANICAL–ALL TYPES

Overall length . . . . . 6.25±.25 inches
Greatest diameter . . . . . 1.125±.01 inches
Weight, approximate . . . . . 2 ounces
Operating position . . . . . any

Bulb T8
Base . . . . . Small button ditetrar 8 pin (JEDEC No. E8-11)
Socket . . . . . Cinch No. 54A18088 or equivalent
Focus-deflection-alignment coil assembly
Cleveland Electronics . . . . . VYFA-261 or equivalent

MAXIMUM RATINGS–ABSOLUTE VALUES–ALL TYPES

Faceplate, scanned area . . . . . 1/2×3/8 inch
Illumination . . . . . 1000 foot-candles
Temperature . . . . . 71° centigrade
Target voltage . . . . . 100 volts
Target current, peak . . . . . 0.60 ua
Dark current . . . . . 0.25 ua
Grid No. 4 voltage . . . . . 1000 volts
Grid No. 3 voltage . . . . . 1000 volts

Grid No. 2 voltage . . . . . 750 volts
Grid No. 1 voltage
Negative bias value . . . . . 300 volts
Positive bias value . . . . . 0 volts
Peak heater-cathode voltage
Heater negative with respect to cathode . . . . . 125 volts
Heater positive with respect to cathode . . . . . 10 volts

TYPICAL OPERATION–AVERAGE VALUES–ALL TYPES

Faceplate, scanned area . . . . . 1/2×3/8 inch
Illumination . . . . . See light transfer curves P. 2
Temperature . . . . . 30° to 35° centigrade
Resolution-limiting, Amplitude response . . . . . See P.1 and special ratings
Field strength at center of focus coil . . . . . See special ratings
Field strength of adjustable alignment coil . . . . . 0 to 4 gauss

Minimum peak-to-peak blanking voltage
When applied to Grid No. 1 . . . . . 75 volts
When applied to cathode . . . . . 20 volts
Grid No. 1 voltage for picture cutoff . . . . . −45 to −100 volts
Grid No. 2 voltage . . . . . 300 volts
Grid No. 3 voltage, Grid No. 4 voltage . . . . . See special ratings

	8507, 8541		8572, 8604	
Sensitivity	Average	Maximum	Average (Live)	Min. Log (Film)
Faceplate Illumination	1 ft-c	.1 ft-c	15 ft-c	100 ft-c
Target Voltage	20 to 40 Volts	35 to 70 Volts	30 to 50 Volts	10 to 30 Volts
@ dark current	0.02 μa	0.2 μa	0.02 μa	0.004 μa
Signal Output	See Page 2	See Page 2	See Page 2	0.3 μa

SPECIAL RATINGS FOR HIGH RESOLUTION PERFORMANCE

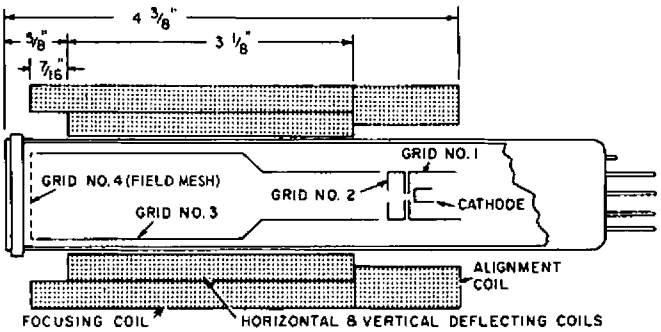
	AVERAGE PERFORMANCE	HIGH PERFORMANCE
Grid No. 3 voltage (a) (Beam focus)	300 volts	600 volts
Grid No. 4 voltage (b) (field mesh)	400 volts	800 volts
Focus coil-field strength at center	40±4 gauss	60±4 gauss
Resolution		
Center	900 TV lines	1000 TV lines
Corner	600 TV lines	700 TV lines
Amplitude response at 400 TV lines:		
Center	50%	70%
Peak deflecting coil current:		
Horizontal	170 ma	250 ma
Vertical	20 ma	30 ma

FOOT NOTES

a) Beam focus (grid No. 3) voltages shown under Special Ratings are attained by providing the focus coil field strength indicated: If a different operating voltage for grid No. 3 is desired, then an appropriate change in focus coil current will be needed to establish the correct field strength. Additionally, with a higher focus coil field strength, a corresponding increase in horizontal and vertical sweep power will be required.

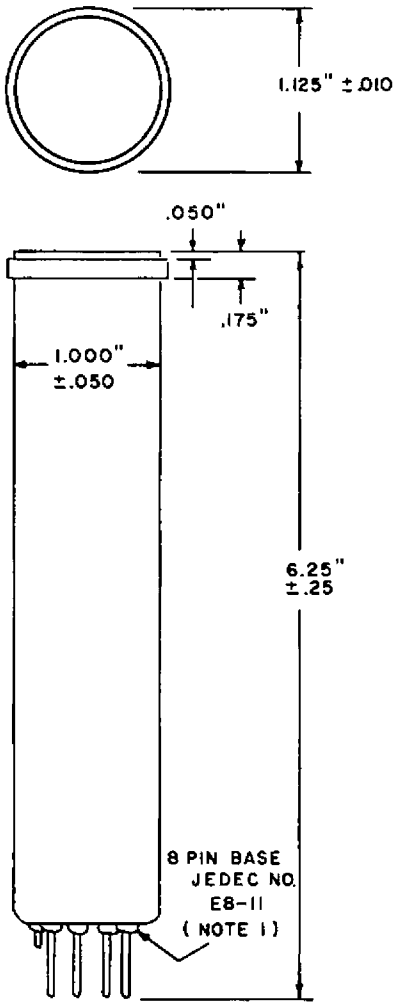
b) Exact ratio of grid No. 4 (field mesh) to grid No. 3 voltages shown is not critical providing range is from 1.3 to 1.6.

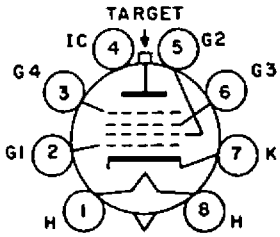
COMPONENT SCHEMATIC



RELATIVE LOCATION OF VIDICON WITHIN ASSOCIATED FOCUS, DEFLECTION AND ALIGNMENT COIL ASSEMBLY FOR OPTIMUM RESOLUTION AND AMPLITUDE RESPONSE.

OUTLINE SPECIFICATIONS





8ME
DIRECTION OF LIGHT
INTO FACEPLATE OF TUBE

PIN 1: HEATER
PIN 2: GRID NO. 1
PIN 3: GRID NO. 4 – FIELD MESH
PIN 4: INTERNAL CONNECTION – – DO NOT USE
PIN 5: GRID NO. 2
PIN 6: GRID NO. 3 – BEAM FOCUS
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: TARGET
SHORT INDEX PIN: INTERNAL CONNECTION DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550(±0.0005) inch Dia. equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000(±0.005) inch Dia., plus a center hole, 0.300(±0.001) inch Dia., concentric with 9-hole circle.

FOR COMPLETE INFORMATION AND AVAILABILITY:

In the United States:

General Electric Company

Pickup Tube Operation
Syracuse, New York
Tel. 456-3210

Chicago, Illinois
3800 N. Milwaukee Ave.
Tel. SP 7-1600

Clifton, New Jersey
200 Main Ave.
Tel. GR 2-8100

Los Angeles, California
11840 W. Olympic Blvd.
Tel. BR 2-8566 or GR 9-7765

or: Local General Electric Broadcast Tube Distributor

In Canada: Canadian General Electric Company, Ltd.
189 Dufferin Street
Toronto, Ontario
LE 4-6311

Outside U.S.A. and Canada: International General Electric Company
Electronic Component Sales
159 Madison Avenue
New York 16, N. Y., U.S.A.

Printed in U.S.A.

JOINT ELECTRON TUBE ENGINEERING COUNCIL

J2-C1-5
11/23/64

ELECTRON TUBE TYPE - 8612

The 8612 is a two electrode gas filled cold cathode tube primarily for use in voltage regulator applications operating in the corona mode.

Maximum Ratings, Absolute Values

Maximum dc Cathode Current - peak pulse	900	µa
Minimum dc Cathode Current	50	µa
Ambient Temperature Limits and/or Bulb Temperature Limits	-65 to +125	°C

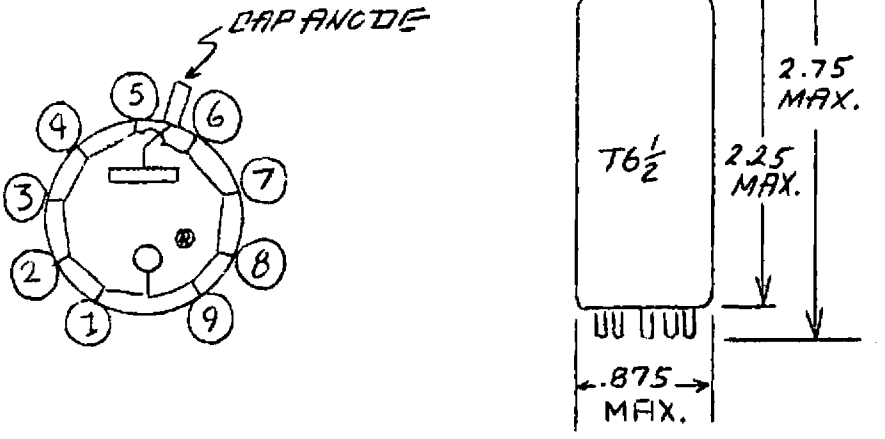
Electrical Data Throughout Life

	Min.	Bogey	Max.	
Anode Voltage Drop at 100µa	5825	6000	6175	Volts
Anode Breakdown Voltage (1) in Darkness			6600	Volts
(2) in Light			6600	Volts
Regulation 50 to 500µa			55	Volts
Temperature Coefficient of Voltage Drop(Note 3) -65°C to +125°C Ambient		475		mV/°C
Repeatability Note 1 and 2			60	Volts

Mechanical Data

Mounting Position - any
Net Weight, Maximum - .62 oz.

Outline



E.I.A. Outline 6-7 except C1-3 Cap

Basing

Top Cap - anode, pins - cathode

Note 1: Tube operated at 100µa of current at 25°C ambient temperature.
Note 2: Maximum change of Tube Voltage Drop, as measured before and after a seven-day non-operating hold period.
Note 3: Tube operated at 100µa.

from JEDEC release #4891, Dec. 21, 1964
sponsor: The Victoreen Instrument Co., Cleveland, Ohio

ITT Electron Tube Division
BOX 104 CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-8386
F-8387
F-8388
POWER
TRIODES

DESCRIPTION

The F-8386, F-8387 and F-8388 tubes are general purpose metal and ceramic triodes for use as amplifiers, oscillators or Class B modulators under CW or pulsed conditions. The cathode is a thoriated tungsten filament. The F-8386 has a heavy wall anode capable of dissipating 100 Kw with circulating water. The F-8387 has a forced-air cooled copper anode-radiator assembly of brazed construction capable of dissipating 45 Kw. The F-8388 has a grooved, heavy walled anode capable of dissipating 100 Kw when evaporation cooled by water. Maximum CW ratings apply up to 30 mc.

ELECTRICAL

Filament Voltage	14.5	volts
Filament Current	330	amperes
Filament Starting Current	1,000	amperes
Filament Heating Time, minimum	15	seconds
Filament Cold Resistance	.006	ohms
Amplification Factor	20	
Inter-electrode Capacitance		
Grid-Plate	85	μμf
Grid-Filament	120	μμf
Plate-Filament	6.0	μμf

MECHANICAL

Mounting Position — Vertical, Anode down

	F-8386	F-8387	F-8388	
Plate Dissipation	100	45	100	kilowatts
Water Flow	30	-	-	gpm
Air Flow	-	1,700	-	cfm
Static Air Pressure	-	6.5	-	inches of water
Max. Outgoing Water Temperature	70	-	-	°C
Max. Water Pressure	80	-	-	psi
Max. Incoming Air Temperature	-	45	-	°C
Max. Ceramic & Seal Temperature	250	250	250	°C
Evaporation Rate	-	-	.75	gpm
Net Weight, approx.	36	75	71	lbs.

from JEDEC release #4713, May 25, 1964

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio-Frequency Power Amplifier and Modulator - Class B

Maximum Ratings, Absolute Values

D-C Plate Voltage	17,000	volts
Max. Signal D-C Plate Current *	16	amperes
Max. Signal Plate Input *	250	kw
Plate Dissipation *		
Refer to Plate Dissipation ratings on page 1		

Typical Operation
(Unless otherwise specified, values are for two tubes)

D-C Plate Voltage	12,000	volts
D-C Grid Voltage	-480	volts
Peak A-F Grid-to-Grid Voltage	1,660	volts
Zero Signal D-C Plate Current	2	amperes
Max. Signal D-C Plate Current	22.3	amperes
Effective Load Resistance, Plate-to-Plate	1,075	ohms
Max. Signal Driving Power, approx.	550	watts
Max. Signal Power Output, approx.	165	kw

*Averaged over any audio frequency cycle of sine-wave form.

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	13,000	volts
D-C Grid Voltage	-3,000	volts
D-C Plate Current	16	amperes
D-C Grid Current	3.5	amperes
Plate Input	190	kw
Plate Dissipation		
67% of rated Plate Dissipation referenced on page 1		

Typical Operation

D-C Plate Voltage	12,000	volts
D-C Grid Voltage	-1,400	volts
Peak R-F Grid Voltage	2,100	volts
Peak R-F Plate Voltage	10,000	volts
D-C Plate Current	15	amperes
D-C Grid Current	2.2	amperes
Driving Power, approx.	4.6	kw
Power Output, approx.	136	kw

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	17,000	volts
D-C Grid Voltage	-3,000	volts
D-C Plate Current	19	amperes
D-C Grid Current	3.5	amperes
Plate Input	250	kw
Plate Dissipation		
Refer to Plate Dissipation ratings on page 1		

Typical Operation

	Cathode Drive	Grid Drive		
D-C Plate Voltage	11,000	12,000	15,500	volts
D-C Grid Voltage	-1,300	-1,500	-1,800	volts
Peak R-F Grid Voltage	2,000	2,200	2,500	volts
Peak R-F Plate Voltage	9,500	9,300	12,500	volts
D-C Plate Current	14.4	15.5	17.0	amperes
D-C Grid Current	2.6	1.7	1.5	amperes
R-F Load Resistance	437	325	415	ohms
Driving Power, approx.	32,000	3,800	3,800	watts
Power Output, approx.	150	135	135	kw

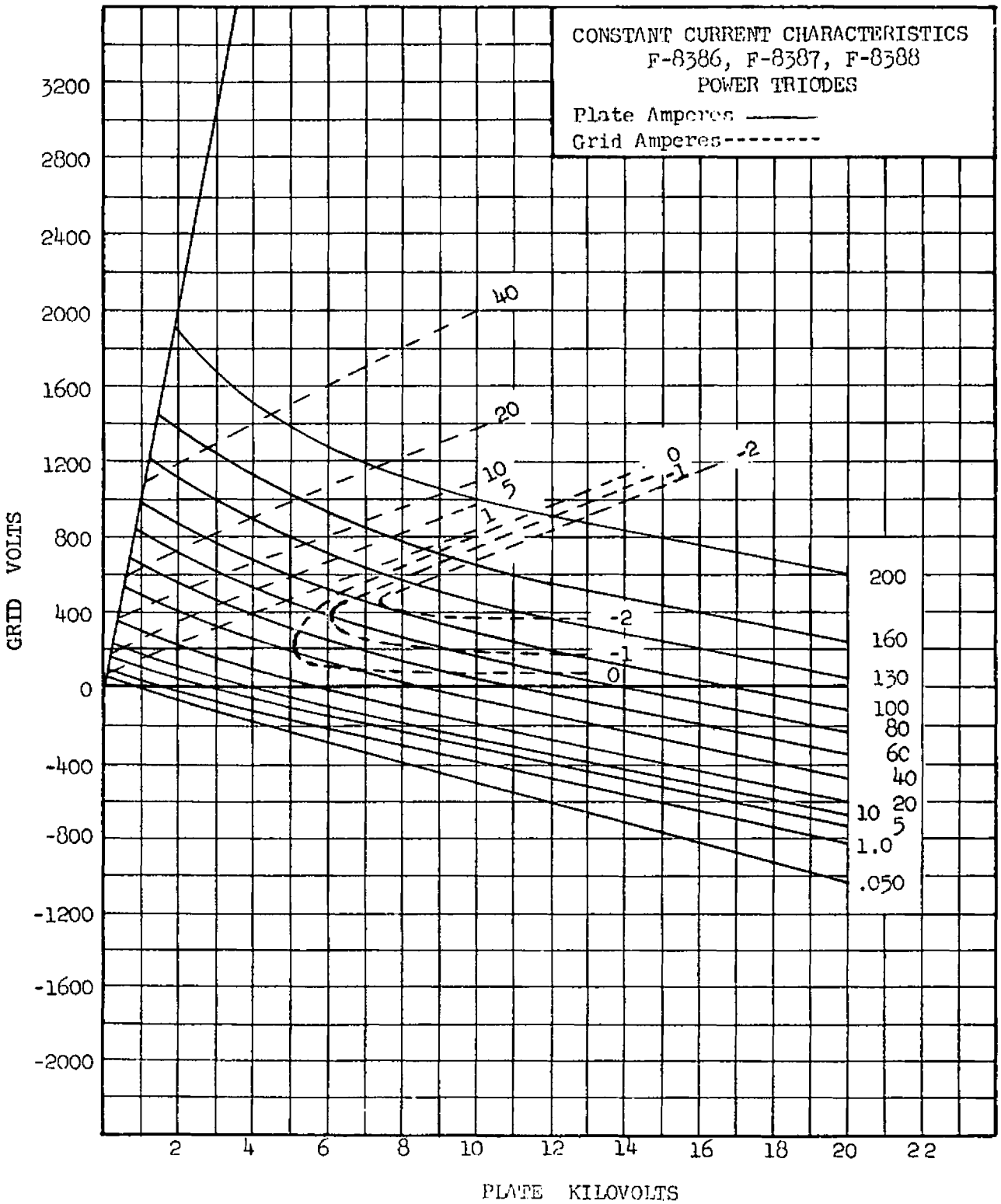
+Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

PULSE SERVICE OPERATIONS

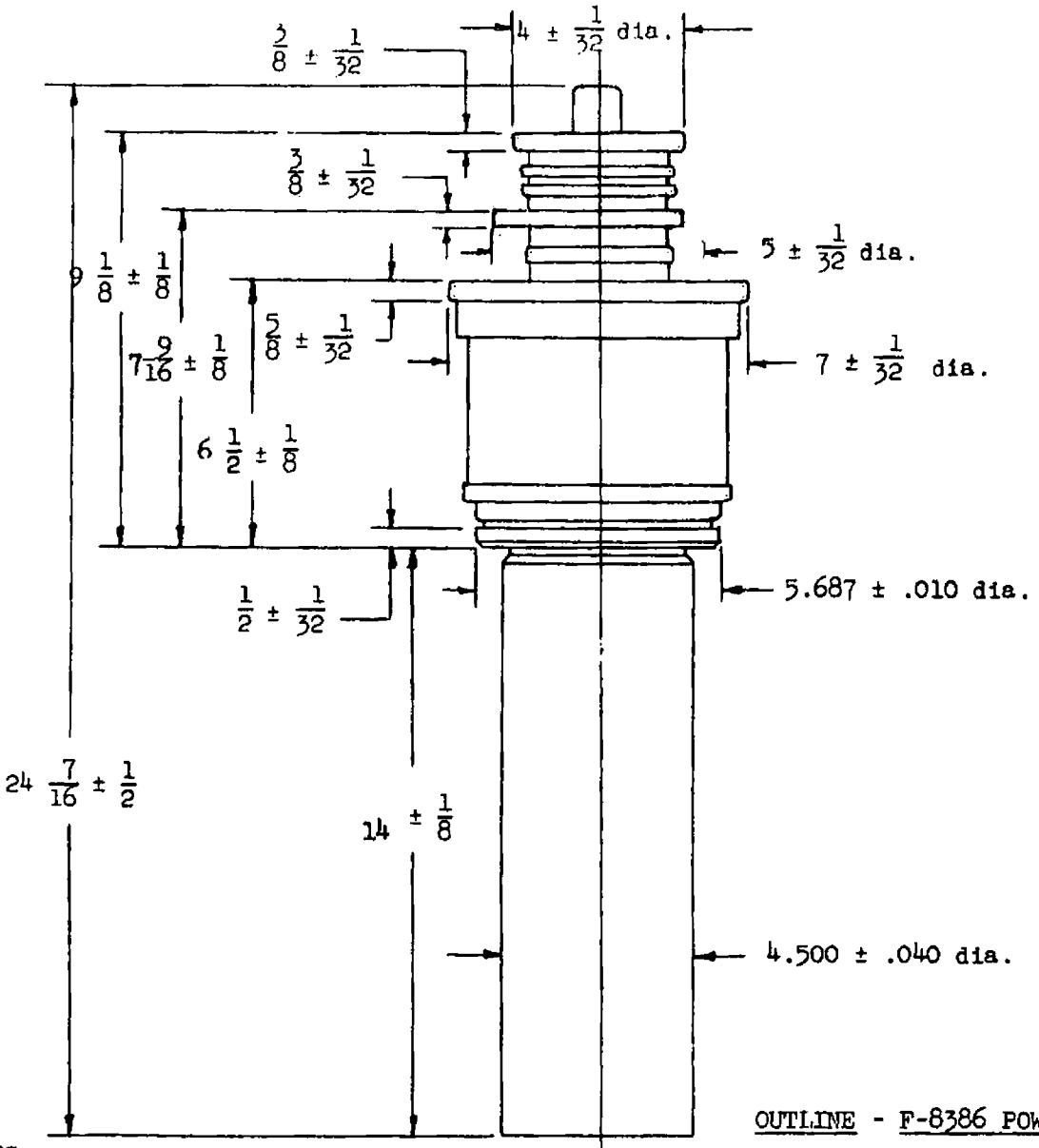
In pulse r-f amplifier service, it is possible to operate the tube under conditions not permissible in CW operation. Because of the wide variety of operating conditions, it is advisable that tube operation recommendations be obtained from our Engineering Department for specific conditions.

Additional information for specific applications can be obtained from the:

ITT Electron Tube Division
Applications Section
P.O. Box 104
Clifton, New Jersey


CONSTANT CURRENT CHARACTERISTICS
F-8386, F-8387, F-8388
POWER TRIODES
Plate Amperes ——
Grid Amperes--------
GRID VOLTS
3200
2800
2400
2000
1600
1200
800
400
0
-400
-800
-1200
-1600
-2000
2
4
6
8
10
12
14
16
18
20
22
PLATE KILOVOLTS
40
20
10
5
1
0
-1
-2
200
160
130
100
80
60
40
20
10
5
1.0
.050

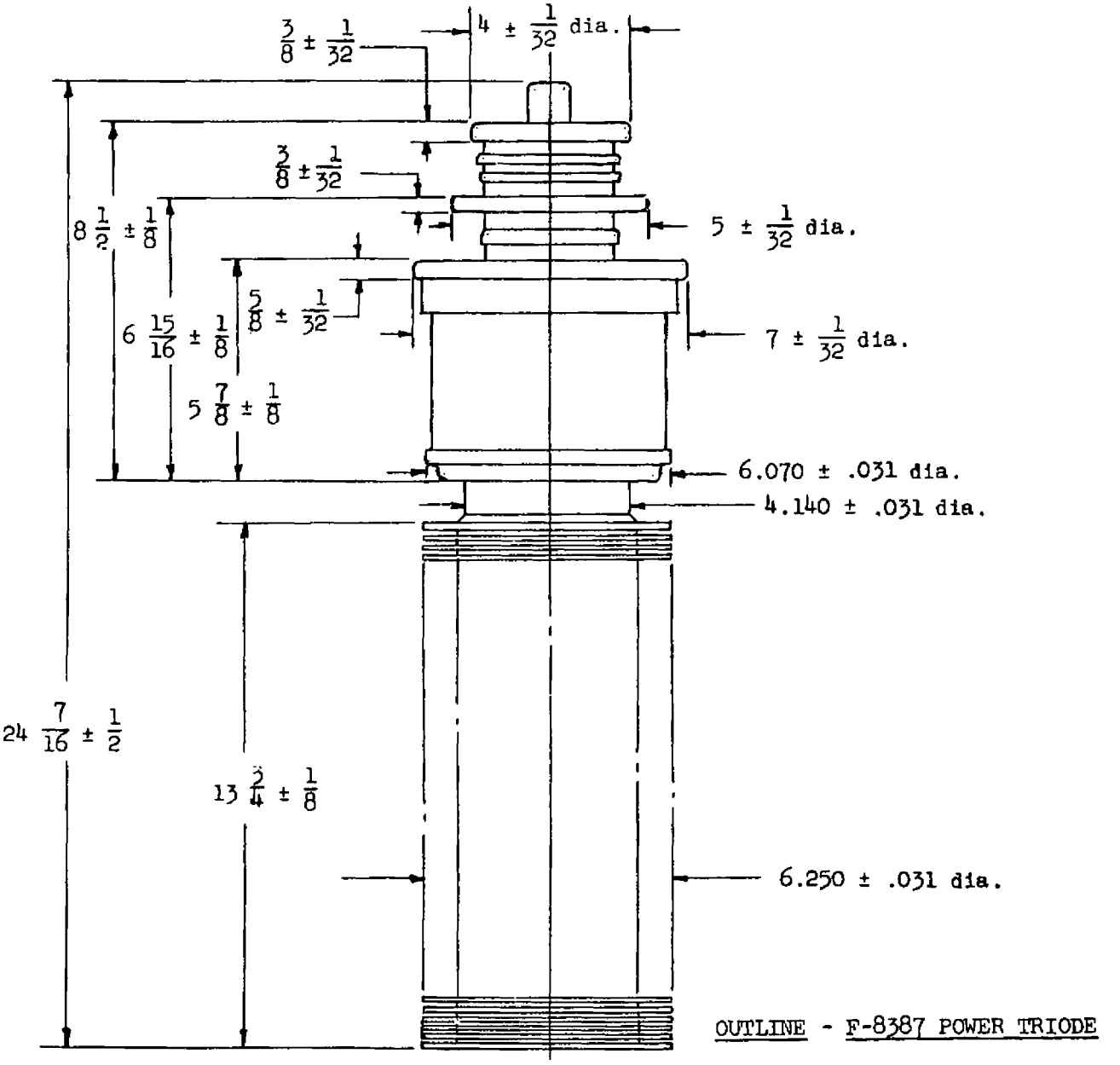
8-63



OUTLINE - F-8386 POWER TRIODE

ACCESSORIES

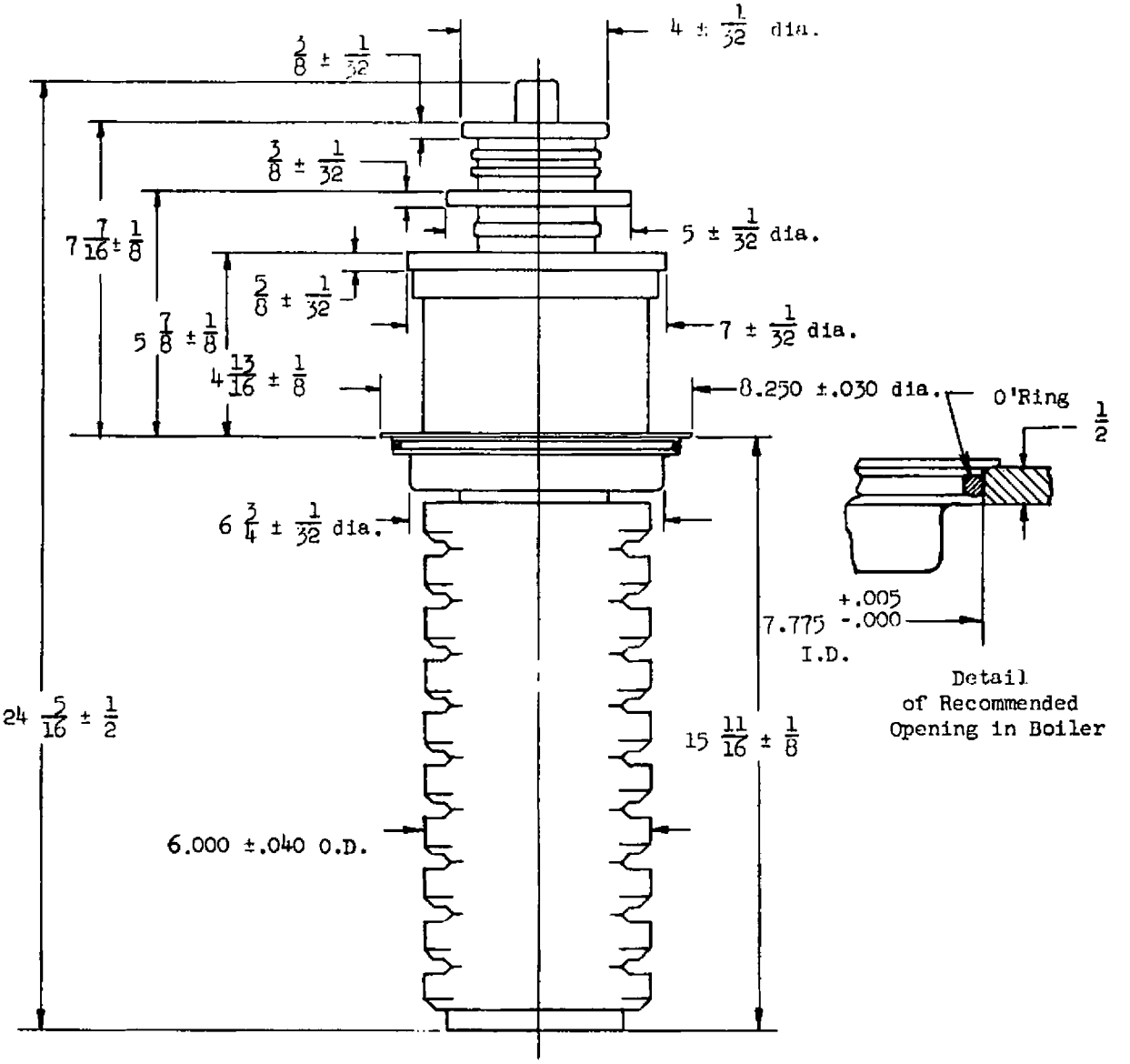
Water Jacket	- RT-54319	"Type D"
Grid Conn. Assy.	- RT-55464	
Conn. Fil. #1 Assy.	- RT-55476	
Conn. Fil. #2 Assy.	- RT-55469	
Corona Ring Assy.	- RT-54002	
Ball Gap-Anode Assy.	- RT-55472	



OUTLINE - F-8387 POWER TRIODE

ACCESSORIES

Air Distributor	-	RT-55397
Tube Support	-	RT-55398
Grid Conn. Assy.	-	RT-55464
Conn. Fil. #1 Assy.	-	RT-55476
Conn. Fil. #2 Assy.	-	RT-55469
Corona Ring Assy.	-	RT-55532
Ball Gap-Anode Assy.	-	RT-55472

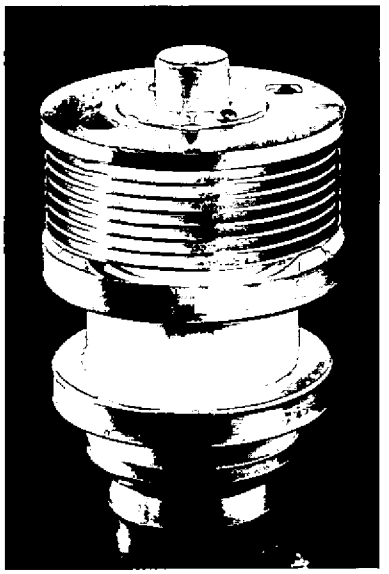


ACCESSORIES:

Grid Conn. Assy.	-	RT-55464
Conn. Fil. 1 Assy.	-	RT-55476
Conn. Fil. 2 Assy.	-	RT-55469
Corona Ring Assy.	-	RT-54002
Ball Gap-Anode Assy.	-	RT-55472
O'Ring K-K	-	RT-53836
Cooling Boiler	-	RT-55314, RT-55355 or RT-55574

OUTLINE - F-8388 Power Triode

8-63



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	—	$\mu\mu f$
Input, G_2 tied to G_1	—	19.5	—	$\mu\mu f$
Output, G_2 tied to G_1♦	—	6.4	—	$\mu\mu f$

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

from JEDEC release #4719, 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 POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

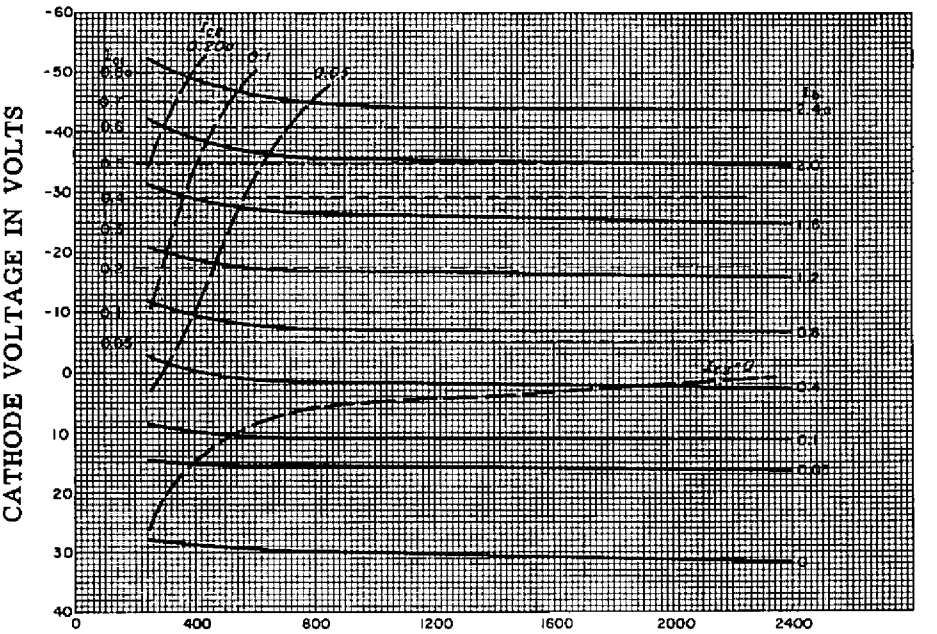
Key-down conditions per tube without amplitude modulation△

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

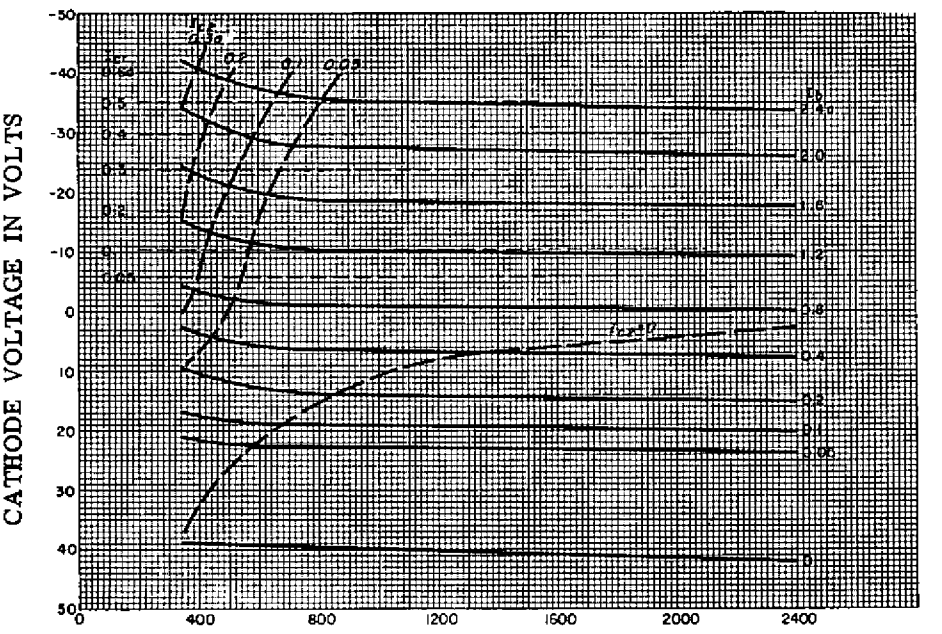
* Because the temperature of the cathode is increased by back bombardment of electrons at UHF, required heater voltage for optimum life decreases with increasing frequency. The amount of heater-voltage reduction is dependent on operating conditions. However, this voltage should not be less than 5.5 volts.
† 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

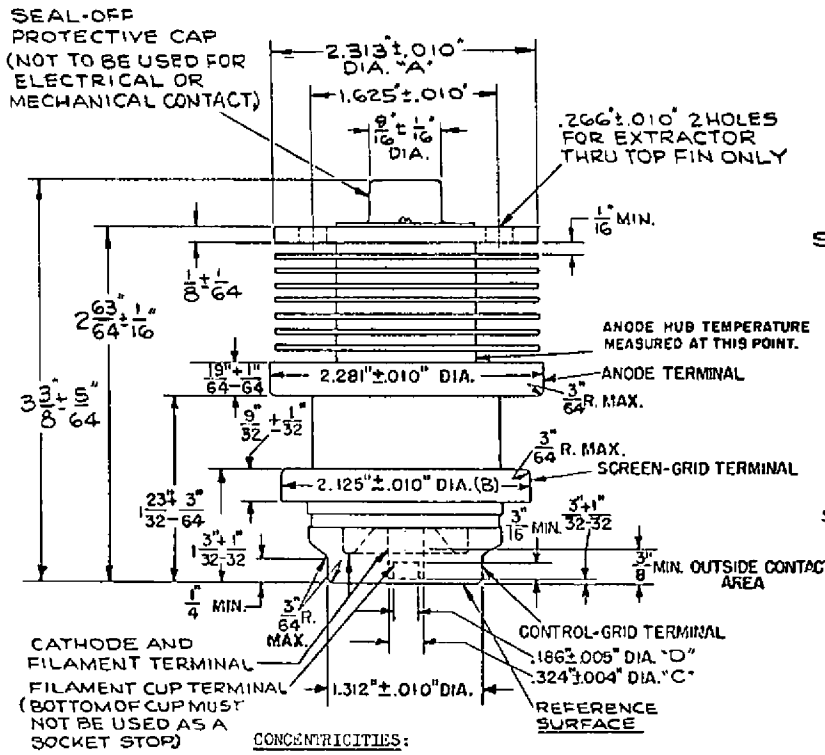


A69087 - 72B67 1-30-63

CONSTANT CURRENT CHARACTERISTIC
SCREEN VOLTAGE = 350 VOLTS
ALL VOLTAGES REFERENCED TO CONTROL GRID



A69087 - 72B68 1-30-63

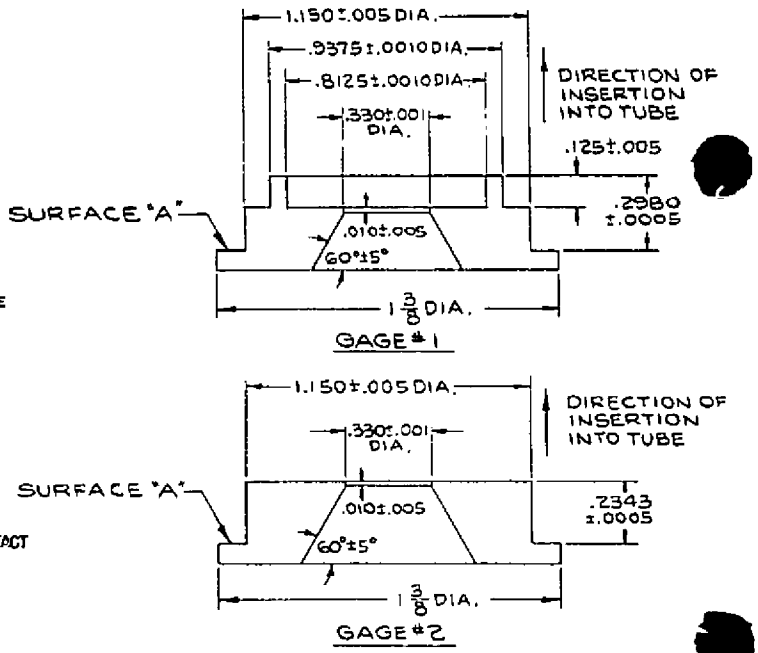


CONCENTRICITIES:

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.



ZP-1030
CATHODE AND FILAMENT TERMINAL GAGES

When inserted over the cathode and filament terminal, gage #1 shall not contact the tube REFERENCE SURFACE at gage SURFACE "A".

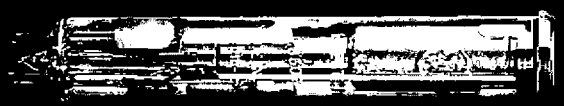
When inserted over the cathode and filament terminal, gage #2 shall contact the tube REFERENCE SURFACE at gage SURFACE "A".

A-69087 - 72B58

12-31-62

TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky

4/1/64



GENERAL ELECTRIC

INDUSTRIAL AND COMMERCIAL
SEPARATE FIELD MESH
VIDICONS

GL8507

GL8541

General Electric offers these new vidicons which feature a "separate field mesh". . . .for better center-to-edge uniformity and reduced beam-landing error. . . .to provide superior characteristics of. . . .
EXTENDED RESOLUTION AND HIGH AMPLITUDE RESPONSE

As a result improved picture quality is obtained for
STUDIO. . . .REMOTE. . . .and INDUSTRIAL APPLICATIONS

Additional General Electric Vidicons also available – See Data Folder ETR-3786

GL-8507

Features high sensitivity and low lag similar to GL7735A. . . .For studio and remote pickup. . . . provides very high quality pictures with extended resolution capability and higher amplitude response.

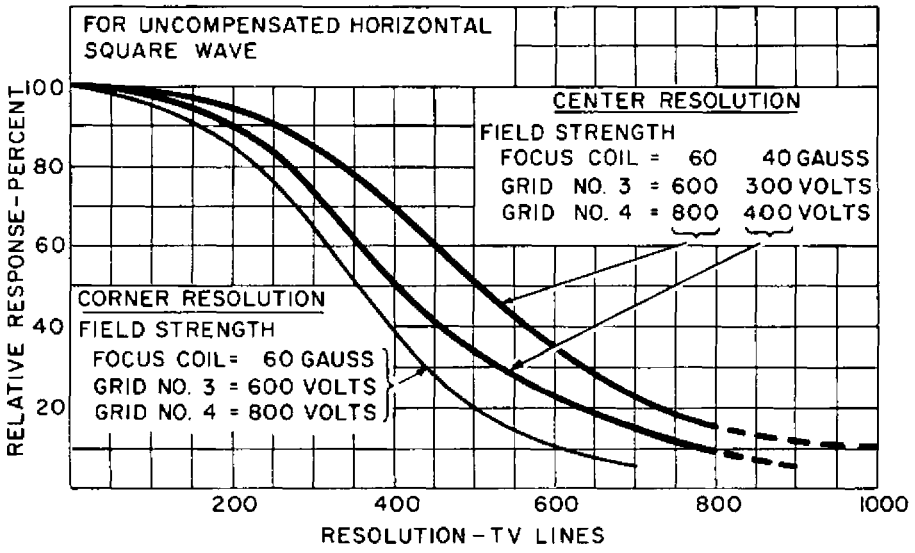
GL-8541 LOW HEATER POWER

Designed for transistorized cameras. . . .similar to GL8507 except with lower heater power rating of 0.6 watt. . . .with same high sensitivity, low lag characteristics. . . .and extended resolution plus high amplitude response.

SIGNIFICANT ADVANTAGES OF SEPARATE FIELD MESH VIDICONS

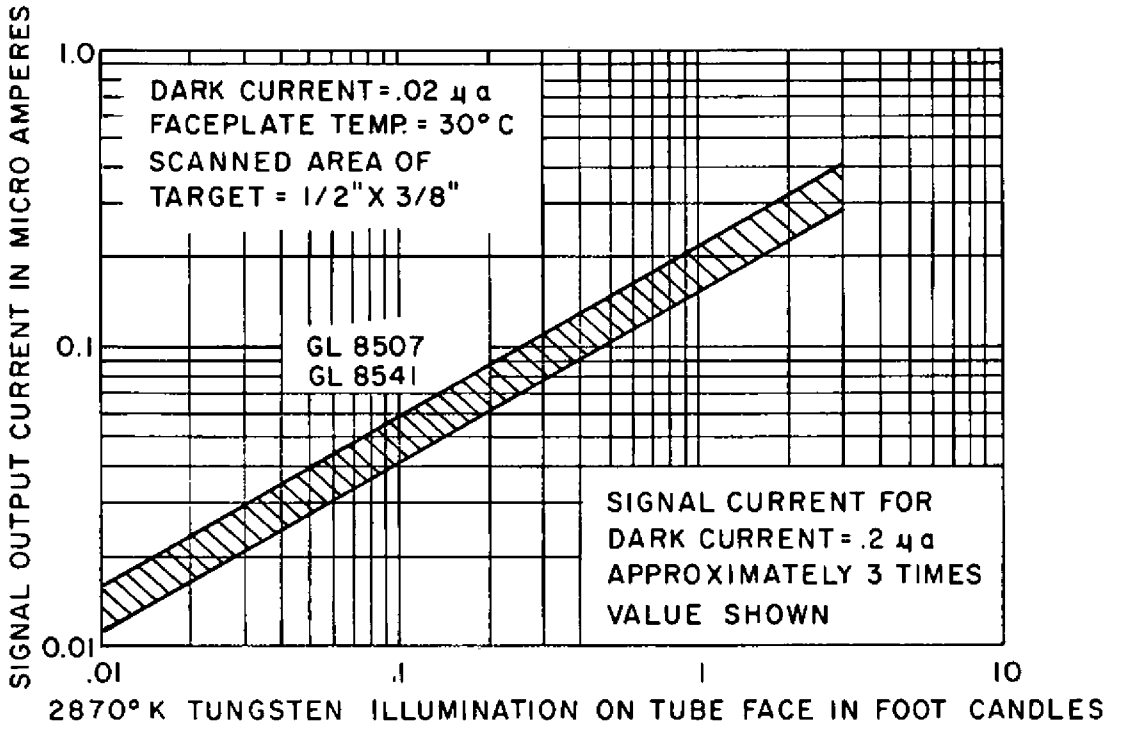
- Extended resolution. . . .1000 TV lines
- Higher amplitude response. . . .70% @ 400 TV lines
- Can be over-beamed without loss of resolution. . . .allows presetting of beam for discharge of peak highlights without further adjustment . . . .excellent feature for automatic target control cameras.
- Excellent signal uniformity over wide range of target voltages.
- Can be operated at lower target voltages without loss of picture quality.

TYPICAL AMPLITUDE RESPONSES

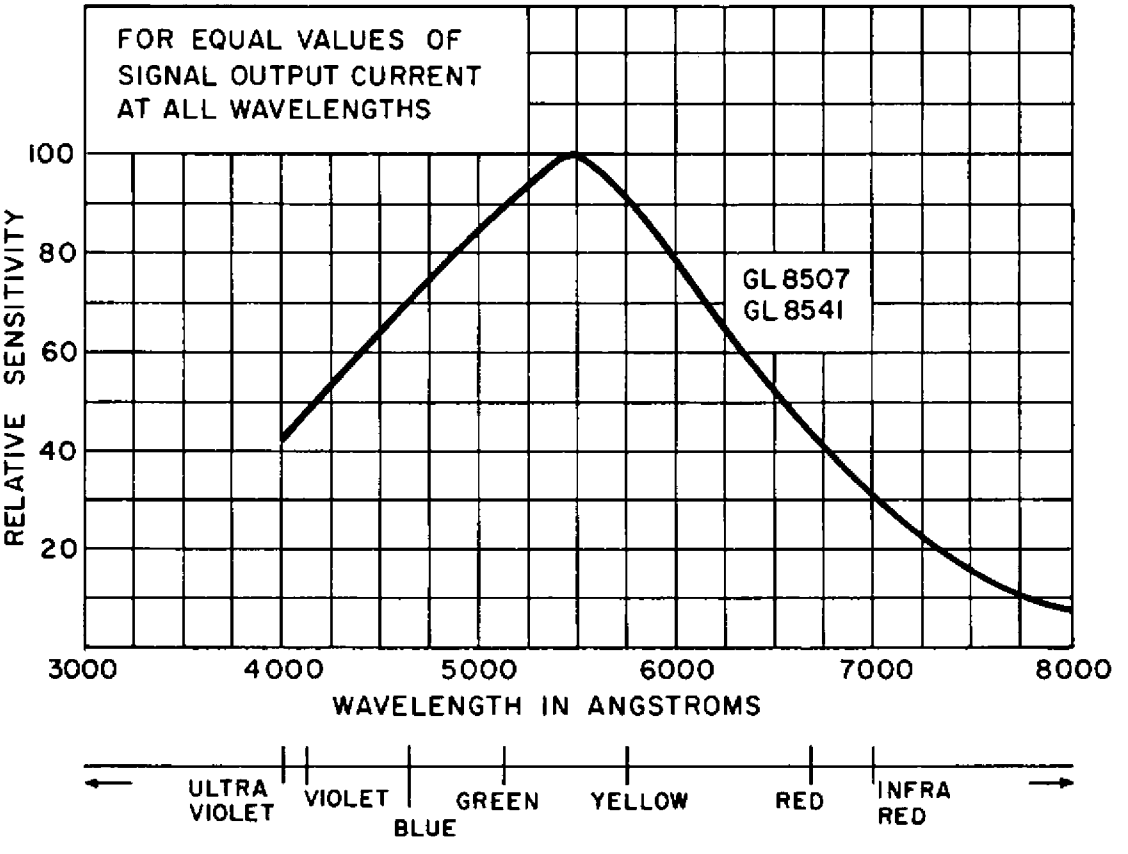


from JEDEC release #4676, April 20, 1964

LIGHT TRANSFER CHARACTERISTICS



SPECTRAL SENSITIVITY CHARACTERISTICS



ESSENTIAL SPECIFICATIONS AND RATINGS

ELECTRICAL–BOTH TYPES

Cathode–unipotential
Heater voltage, AC or DC ..... 6.3±10% volts
Heater current
GL-8507 ..... 0.6 ampere
GL-8541 ..... 0.09 ampere
Focus and deflection method ..... Magnetic
Direct interelectrode capacitance
Anode to all other electrodes ..... 3.6 pf

Photoconductive Layer
Spectral response ..... See page 2
Rectangular image, 4 × 3 aspect ratio, max useful diagonal ..... 0.62 inch
Orientation–horizontal scan should be essentially parallel to a plane passing through the tube axis and short index pin.

MECHANICAL–BOTH TYPES

Overall length ..... 6.25±.25 inches
Greatest diameter ..... 1.125±.01 inches
Weight, approximate ..... 2 ounces
Operating position ..... any

Bulb T8
Base ..... Small button ditetrar 8 pin (JEDEC No. E8-11)
Socket ..... Cinch No. 54A18088 or equivalent
Focus-deflection-alignment coil assembly
Cleveland Electronics ..... VYFA-261 or equivalent

MAXIMUM RATINGS–ABSOLUTE VALUES–BOTH TYPES

Faceplate, scanned area ..... 1/2×3/8 inch
Illumination ..... 1000 foot-candles
Temperature ..... 71° centigrade
Target voltage ..... 100 volts
Target current, peak ..... 0.60 ua
Dark current ..... 0.25 ua
Grid No. 4 voltage ..... 1000 volts
Grid No. 3 voltage ..... 1000 volts

Grid No. 2 voltage ..... 750 volts
Grid No. 1 voltage
Negative bias value ..... 300 volts
Positive bias value ..... 0 volts
Peak heater-cathode voltage
Heater negative with respect to cathode ..... 125 volts
Heater positive with respect to cathode ..... 10 volts

TYPICAL OPERATION–AVERAGE VALUES–BOTH TYPES

Faceplate, scanned area ..... 1/2 × 3/8 inch
Illumination ..... See light transfer curves P.2
Temperature ..... 30° to 35° centigrade
Average sensitivity
Faceplate illumination ..... 1.0 ft.c
Target voltage ..... 20 to 40 volts
@ dark current ..... 0.02 a
Signal output ..... See P.2
Maximum sensitivity
Faceplate illumination ..... 0.1 ft.c
Target voltage ..... 35 to 70 volts
@ dark current ..... 0.2 a

Minimum peak-to-peak blanking voltage
When applied to Grid No. 1 ..... 75 volts
When applied to cathode ..... 20 volts
Grid No. 1 voltage for picture cutoff ..... −45 to −100 volts
Grid No. 2 voltage ..... 300 volts
Grid No. 3 voltage, Grid No. 4 voltage ..... See special ratings
Resolution-limiting, Amplitude response ..... See P.1 and special ratings
Field strength at center of focus coil ..... See special ratings
Field strength of adjustable alignment coil ..... 0 to 4 gauss

SPECIAL RATINGS FOR HIGH RESOLUTION PERFORMANCE

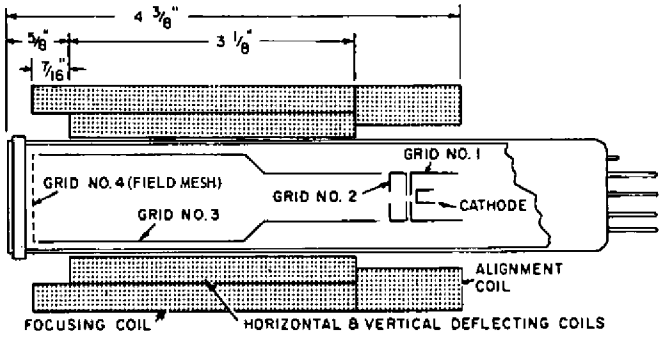
	AVERAGE PERFORMANCE	HIGH PERFORMANCE
Grid No. 3 voltage (a) (Beam focus)	300 volts	600 volts
Grid No. 4 voltage (b) (field mesh)	400 volts	800 volts
Focus coil-field strength at center	40±4 gauss	60±4 gauss
Resolution		
Center	900 TV lines	1000 TV lines
Corner	600 TV lines	700 TV lines
Amplitude response at 400 TV lines:		
Center	50%	70%
Peak deflecting coil current:		
Horizontal	170 ma	250 ma
Vertical	20 ma	30 ma

FOOT NOTES

a) Beam focus (grid No. 3) voltages shown under Special Ratings are attained by providing the focus coil field strength indicated: If a different operating voltage for grid No. 3 is desired, then an appropriate change in focus coil current will be needed to establish the correct field strength. Additionally, with a higher focus coil field strength, a corresponding increase in horizontal and vertical sweep power will be required.

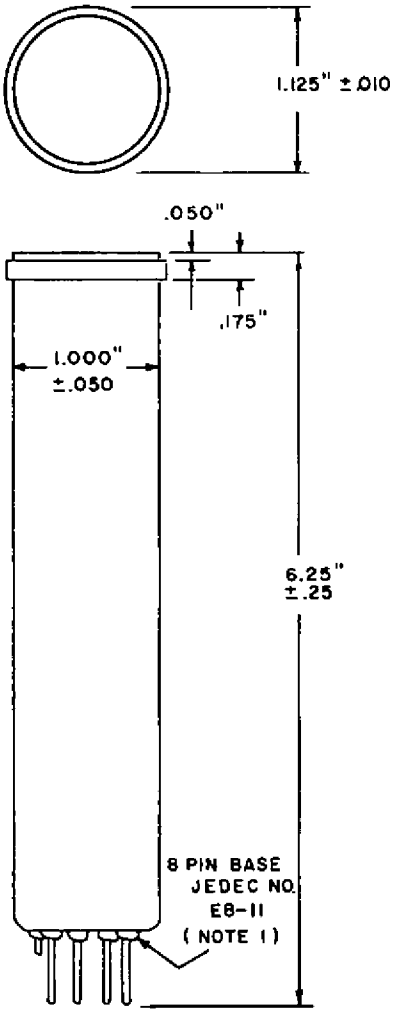
b) Exact ratio of grid No. 4 (field mesh) to grid No. 3 voltages shown is not critical providing range is from 1.3 to 1.6.

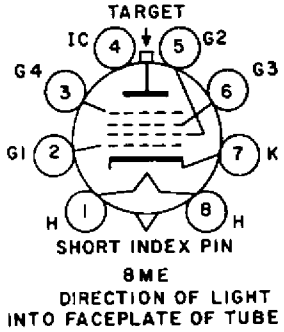
COMPONENT SCHEMATIC



RELATIVE LOCATION OF VIDICON WITHIN ASSOCIATED FOCUS, DEFLECTION AND ALIGNMENT COIL ASSEMBLY FOR OPTIMUM RESOLUTION AND AMPLITUDE RESPONSE.

OUTLINE SPECIFICATIONS





PIN 1: HEATER
PIN 2: GRID NO. 1
PIN 3: GRID NO. 4 – FIELD MESH
PIN 4: INTERNAL CONNECTION – – DO NOT USE
PIN 5: GRID NO. 2
PIN 6: GRID NO. 3 – BEAM FOCUS
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: TARGET
SHORT INDEX PIN: INTERNAL CONNECTION DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550(±0.0005) inch Dia. equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000(±0.005) inch Dia., plus a center hole, 0.300(±0.001) inch Dia., concentric with 9-hole circle.

FOR COMPLETE INFORMATION AND AVAILABILITY:

In the United States:

General Electric Company

Pickup Tube Operation
Syracuse, New York
Tel. 456-3210

Chicago, Illinois
3800 N. Milwaukee Ave.
Tel. SP 7-1600

Clifton, New Jersey
200 Main Ave.
Tel. GR 2-8100

Los Angeles, California
11840 W. Olympic Blvd.
Tel. BR 2-8566 or GR 9-7765

or: Local General Electric Broadcast Tube Distributor

In Canada: Canadian General Electric Company, Ltd.
189 Dufferin Street
Toronto, Ontario
LE 4-6311

Outside U.S.A. and Canada: International General Electric Company
Electronic Component Sales
159 Madison Avenue
New York 16, N. Y., U.S.A.

Printed in U.S.A.



GENERAL ELECTRIC
INDUSTRIAL AND COMMERCIAL
VIDICONS

GL-7038
GL-7226
GL-7262a
GL-7263a
GL-7325
GL-7697
GL-7735a
GL-8511

General Electric offers this full line of vidicons to meet a wide variety of television requirements and are specifically designed for . . .

. . . STUDIO . . . REMOTE . . . AND INDUSTRIAL APPLICATIONS

GL-8507 and GL-8541 High Resolution Vidicons Also Available—See Data Folder ETR-3837

GL-7038

Primarily designed and recommended for film pickup applications . . . also for televising live scenes under well lighted conditions . . . for monochrome or color . . . a direct replacement for the 6198a.

GL-7325

Provides higher sensitivity recommended for live pickup applications . . . features lower lag characteristics at low light levels . . . ideally suited for live pickup of industrial areas.

GL-7735a

Highest sensitivity . . . provides very high quality pictures . . . for studio and remote pickup . . . features lowest lag at low light level operation.

GL-7697

Designed for cameras with automatic sensitivity control where low values of target voltage are required . . . similar to GL 7735a in sensitivity and low lag characteristics . . . for industrial television applications.

GL-7226 LOW HEATER POWER

A short vidicon designed for transistorized cameras . . . similar to GL 7325 in sensitivity . . . for televising live scenes under normal room lighting in industrial applications . . . features low heater power cathode of 0.9 watt.

GL-8511 LOW HEATER POWER

A short vidicon designed for transistorized cameras . . . similar to GL 7226 except with lower heater power rating of 0.6 watt . . . high sensitivity photoconductor affords low lag characteristics at low light levels.

GL-7262a LOW HEATER POWER

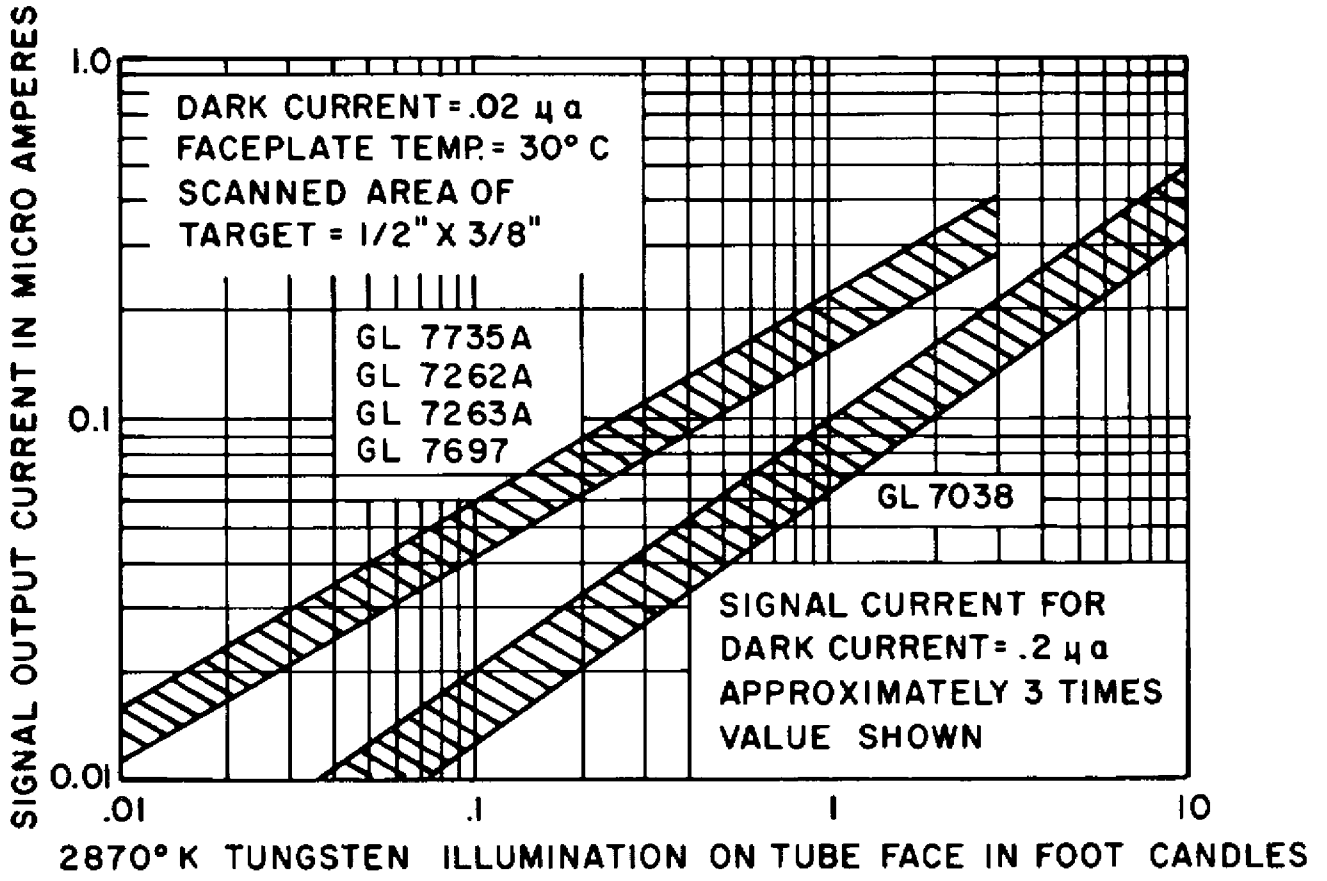
A short vidicon designed for transistorized cameras . . . low heater power rating of 0.6 watt . . . sensitivity and lag characteristics similar to GL 7735A . . . recommended for industrial applications requiring high quality picture at normal lighting levels.

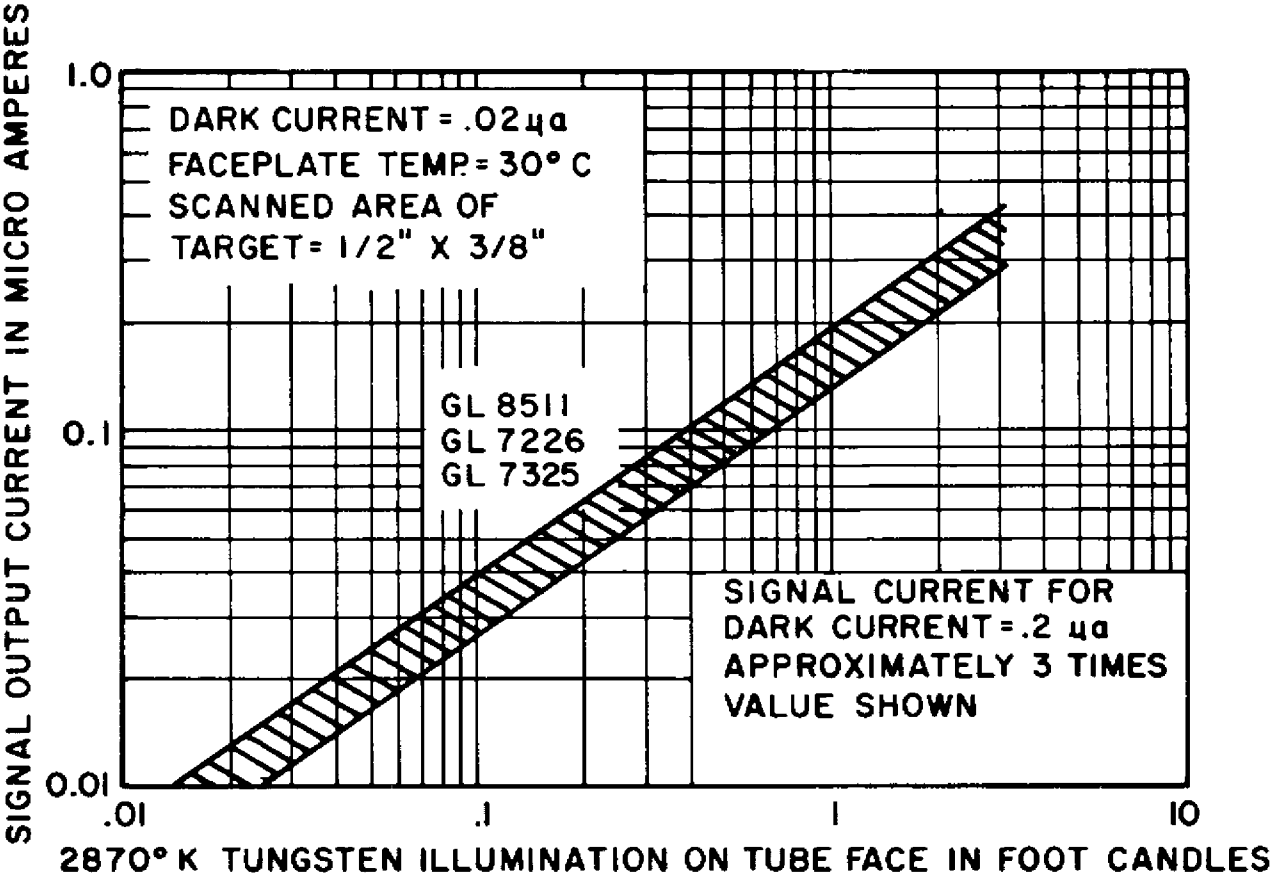
GL-7263a RUGGEDIZED

This type has all the features of the GL 7262A and is designed to operate under severe shock, vibration and humidity conditions listed on page 3.

from JEDEC release #4676, April 20, 1964

LIGHT TRANSFER CHARACTERISTICS





ESSENTIAL SPECIFICATIONS AND RATINGS

ELECTRICAL–ALL TYPES

Cathode–unipotential
Heater voltage, AC or DC ..... 6.3±10% volts
Heater current
GL-7735a, GL-7325, GL-7697, GL-7038 ..... 0.6 amperes
GL-7226 ..... 0.15 amperes
GL-8511, GL-7262a, GL-7263a ..... 0.09 amperes
Focus and deflection method ..... Magnetic
Direct interelectrode capacitance
Anode to all other electrodes ..... 3.6 pf

Photoconductive layer
Spectral response ..... See page 5
Rectangular image, 4 × 3 aspect ratio useful size, max. diagonal ..... 0.62 inch
Orientation–horizontal scan should be essentially parallel to a plane passing through the tube axis and short index pin.

MECHANICAL–ALL TYPES

Overall length
GL-7735a, GL-7325, GL-7697, GL-7038 ..... 6.25±.25 inches
GL-8511, GL-7226, GL-7262a, GL-7263a ..... 5.125±.125 inches
Greatest diameter ..... 1.125±.010 inches
Weight, approximate ..... 2 ounces

Bulb T8
Base ..... Small button ditetrar 8 pin (JEDEC No. E8-11)
Socket ..... Cinch No. 54A18088 or equivalent
Operating position ..... Any

MAXIMUM RATINGS–ABSOLUTE VALUES–ALL TYPES

Faceplate, scanned area ..... 1/2×3/8 inch
Illumination ..... 1000 foot-candles
Temperature ..... 71° centigrade
Target voltage ..... 100 volts
Target current, peak ..... 0.60 ua
Dark current ..... 0.25 ua
Grid No. 3 and Grid No. 4 voltage ..... 750 volts

Grid No. 2 voltage ..... 750 volts
Grid No. 1 voltage
Negative bias value ..... 300 volts
Positive bias value ..... 0 volts
Peak heater-cathode voltage
Heater negative with respect to cathode ..... 125 volts
Heater positive with respect to cathode ..... 10 volts

TYPICAL OPERATION–AVERAGE VALUES–ALL TYPES

Faceplate, scanned area ..... 1/2 × 3/8 inch
Illumination ..... See light transfer curves p. 2
Temperature ..... 30° to 35° centigrade
Target voltage ..... See special ratings
Grid No. 3 and Grid No. 4 voltage ..... 250 to 300 volts
Grid No. 2 voltage ..... 300 volts
Grid No. 1 voltage for picture cutoff ..... −45 to −100 volts

Minimum peak-to-peak blanking voltage
When applied to Grid No. 1 ..... 75 volts
When applied to cathode ..... 20 volts
Field strength at center of focus coil ..... 40 gauss
Field strength of alignment coil ..... 0 to 4 gauss
Resolution–minimum at center ..... 600 TV lines
Amplitude response ..... See page 5

SPECIAL RATINGS–AVERAGE VALUES BY TYPE

	GL-7735a, GL-7262a, GL-7263a	GL-7325, GL-7226, GL-8511	GL-7697	GL-7038
Average sensitivity				
Faceplate illumination	1 ft-c	1 ft-c	1 ft-c	15 ft-c
Target voltage	20 to 40 volts	30 to 50 volts	10 to 30 volts	30 to 50 volts
@ dark current	0.02 ua	0.02 ua	0.02 ua	0.02 ua
Signal output	See page 2	See page 2	See page 2	See page 2
Maximum sensitivity				
Faceplate illumination	0.1 ft-c	0.2 ft-c	0.5 ft-c	2.0 ft-c
Target voltage	35 to 70 volts	40 to 100 volts	35 to 70 volts	60 to 100 volts
@ dark current	0.2 ua	0.2 ua	0.2 ua	0.2 ua
Average gamma	0.57	0.65	0.57	0.65

ENVIRONMENTAL SPECIFICATIONS FOR GL-7263a

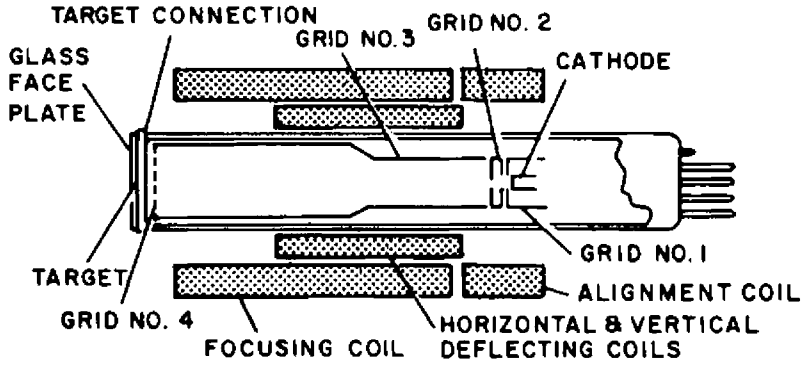
SHOCK: Per specification MIL-E-5400 (1/1/56) Paragraphs 3.2.21.2.1
18 impact shocks of 15G consisting of 3 shocks in opposite directions along each of 3 mutually perpendicular axes of the tube with shock pulse duration of 11±1 millisecond, with no voltages applied.

VIBRATION: Per specification MIL-E-5272b (6/5/57) Paragraphs 4.7.1, 4.7.1.1, 4.7.1.2
Vibration for 1 hour at +25°C, 15 minutes at 0°C, and 15 minutes at +55°C.

ALTITUDE: Per specification MIL-E-5400 (1/1/56) Paragraphs 3.2.20, 3.2.20.1, 3.2.20.1.1
At temperatures from 0°C to +55°C at corresponding barometric pressures equivalent to sea level to 50,000 feet.

TEMPERATURE: HUMIDITY Per specification MIL-E-5400 (1/1/56) Paragraph 3.2.20.2B
At temperatures up to +55°C and at relative humidity up to 95 percent, with no voltages applied.

FUNDAMENTALS OF OPERATION



SCHEMATIC OF VIDICON AND ASSOCIATED
FOCUS, DEFLECTION AND ALIGNMENT COILS

The photoconductive layer of the vidicon tube is made up of many small elements, each of which is essentially an insulator in the dark, but conductive when illuminated. The target (signal electrode) ring makes contact with the front side of the layer and is maintained at a positive potential. A beam of electrons from the electron gun scans the rear side of the layer, and the scene to be televised is focused on the front. Each element on the rear side of the layer will rise in voltage toward the positive target voltage in proportion to the amount of the illumination from the scene. Thus, a positive voltage pattern corresponding to the focused scene is deposited on the rear side of the layer. The electron beam produced by the electron gun scans this voltage pattern and deposits enough electrons on the back side of the photoconductor layer to reduce them to the vidicon cathode potential.

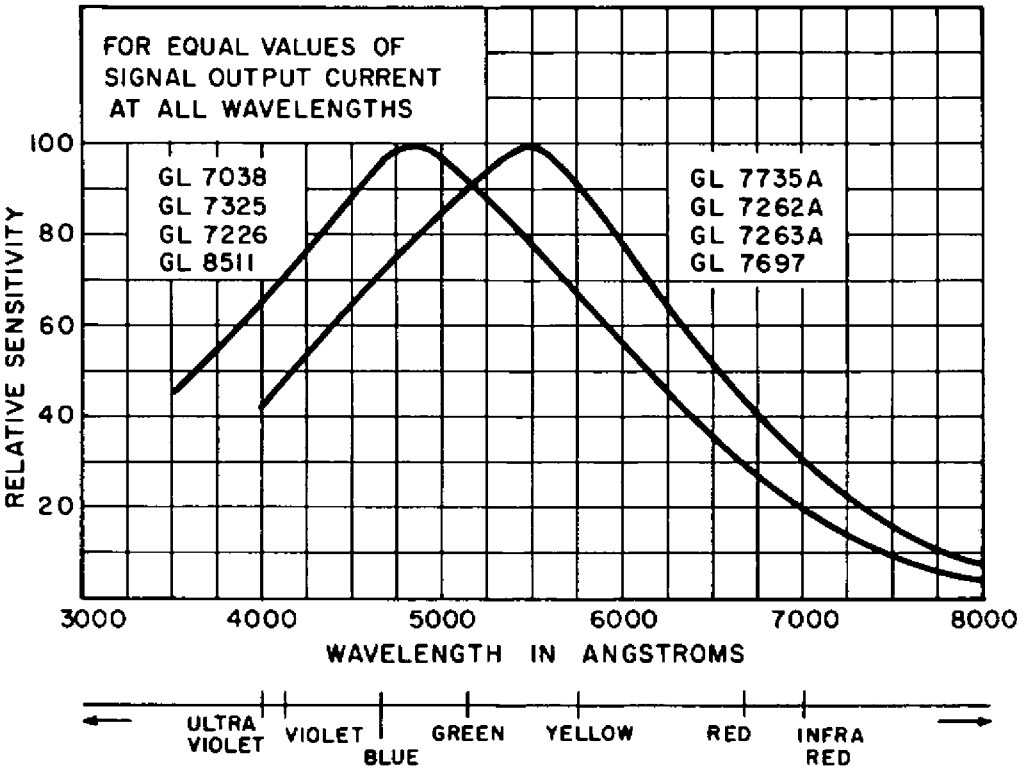
Each photoconductor element may be considered as a capacitor with one plate connected to the positive target voltage and the other plate grounded. Each plate contains internal resistance proportional to the amount of illumination striking it. Since the two sides of the photoconductive layer are connected by the external target circuit and the electron beam, a capacitive video signal current is produced. Increasing or decreasing the target voltage or the illumination of the vidicon tube will cause a corresponding increase or decrease in the video output signal from the vidicon tube.

GENERAL ELECTRIC IMAGE ORTHICONS AVAILABLE
(DATA ON REQUEST)

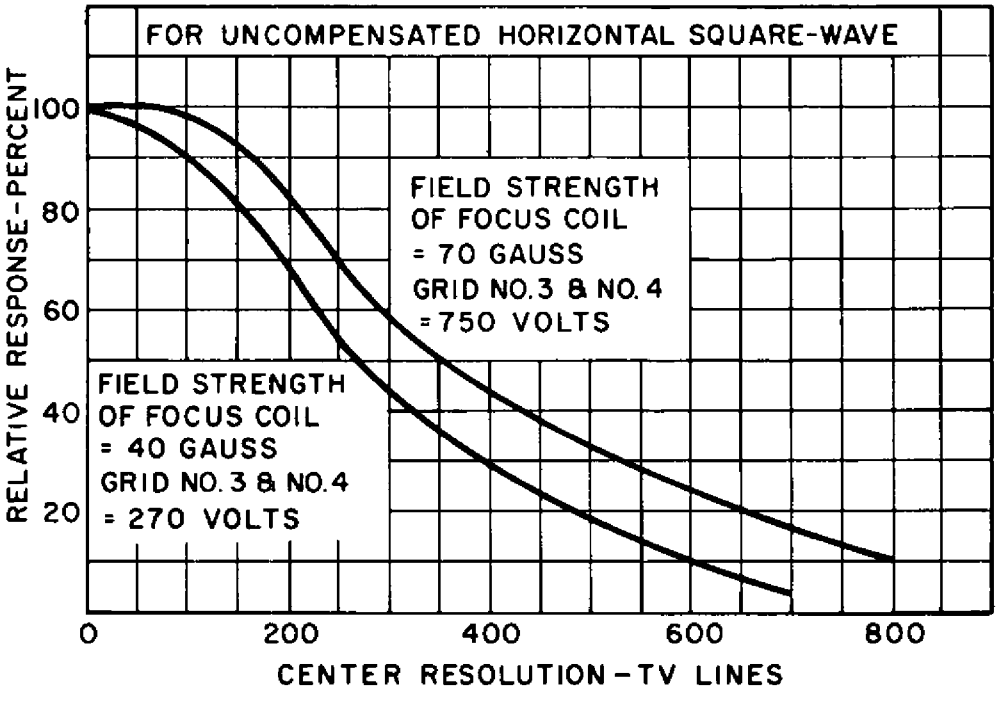
COMMERCIAL BROADCAST • NETWORK • EDUCATIONAL				
GL-7629a	high reliability very long life low light level sensitivity semiconductor target	3200–6950 Å S-10	‡equivalent ASA rating 32,000–64,000	remote black/white as low as 1 ft-c scene illumination remote color–as low as 5 ft-c scene illumination long life studio service
GL-8092a	same as GL-7629a plus: field mesh flatter fields improved corner resolution		32,000–64,000	studio color 40 to 100 ft-c illumination remote color
GL-5820a	glass target good gray scale stable performance		8000–16,000 (new tube)	studio black/white 100 ft-c scene illumination educational TV
GL-7293	same as GL-5820a plus: field mesh flatter fields improved corner resolution		8000–16,000 (new tube)	studio black/white high quality monochrome educational TV
GL-8093	same as GL-7293 plus: very high signal: noise ratio for video tape recording and color		5000–10,000 (new tube)	high quality video tape recording high quality color educational TV

‡ Equivalent ASA ratings based on exposure at knee of transfer characteristic curve and frame time of 1/30 sec.

SPECTRAL SENSITIVITY CHARACTERISTICS



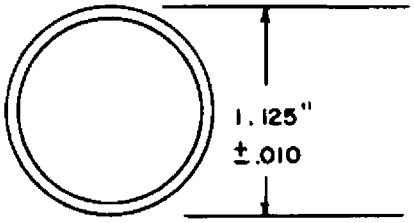
TYPICAL AMPLITUDE RESPONSE

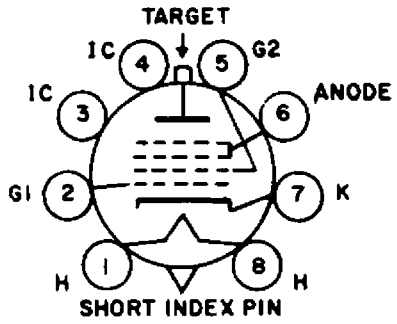


As indicated in the above comparison, both amplitude response and the limiting resolution for these vidicons may be significantly improved by:

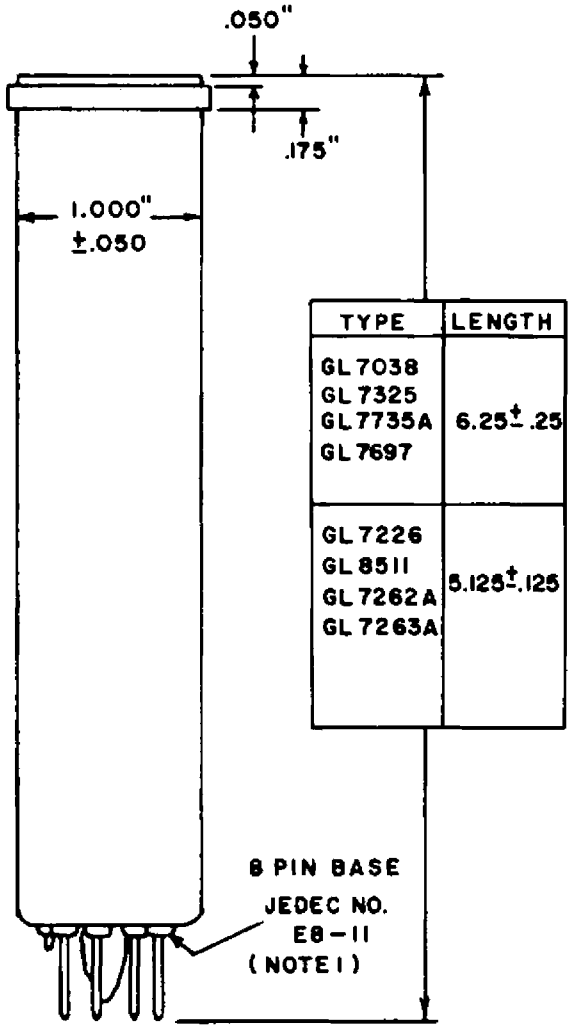
1. Increasing Grid No. 3 and Grid No. 4 voltage to 750 volts.
2. Increasing the field strength of the focus coil to 70 gauss.
3. Increasing the deflection power to a sufficient value to maintain proper scanning.
4. Providing adequate provisions for cooling due to increased power requirements.

OUTLINE SPECIFICATIONS





8HM
DIRECTION OF LIGHT
INTO FACEPLATE OF TUBE



TYPE	LENGTH
GL7038 GL7325 GL7735A GL7697	6.25±.25
GL7226 GL8511 GL7262A GL7263A	5.125±.125

PIN 1: HEATER

PIN 2: GRID No. 1

PIN 3: INTERNAL CONNECTION --DO NOT USE

PIN 4: INTERNAL CONNECTION --DO NOT USE

PIN 5: GRID No.2

PIN 6: GRID No. 3 and No. 4

PIN 7: CATHODE

PIN 8: HEATER

FLANGE: TARGET

SHORT INDEX PIN: INTERNALCONNECTION DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550(±0.0005) inch Dia. equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch Dia. plus a center hole, 0.300 (±0.001) in. Dia., concentric with 9-hole circle

2. All dimensions are shown in inches.

FOR COMPLETE INFORMATION AND AVAILABILITY:

In the United States:

General Electric Company

Pickup Tube Operation
Syracuse, New York
Tel. 456-3210

Chicago, Illinois
3800 N. Milwaukee Ave.
Tel. SP 7-1600

Clifton, New Jersey
200 Main Ave.
Tel. GR 2-8100

Los Angeles, California
11840 W. Olympic Blvd.
Tel. BR 2-8566 or GR 9-7765

or: Local General Electric Broadcast Tube Distributor

In Canada: Canadian General Electric Company, Ltd.
189 Dufferin Street
Toronto, Ontario
LE 4-6311

Outside U.S.A. and Canada: International General Electric Company
Electronic Component Sales
159 Madison Avenue
New York 16, N. Y., U.S.A.

Printed in U.S.A.

GL-8559

Except for the following ratings the GL-8559 is the same as the GL-7390:

SHOCK

Position	Intensity	Duration
Vertical, Base Down	80 g	11 Milliseconds
Horizontal	60 g	11 Milliseconds per MIL-STD-202B, Method 205B

VIBRATION

Vertical, Base Down	10–55 Cps, 0.060 Inch Total Displacement
Horizontal	10–55 Cps, 0.060 Inch Total Displacement

Per MIL-STD-202B, Method 201A

GENERAL ELECTRIC

from JEDEC release #4719, June 1, 1964