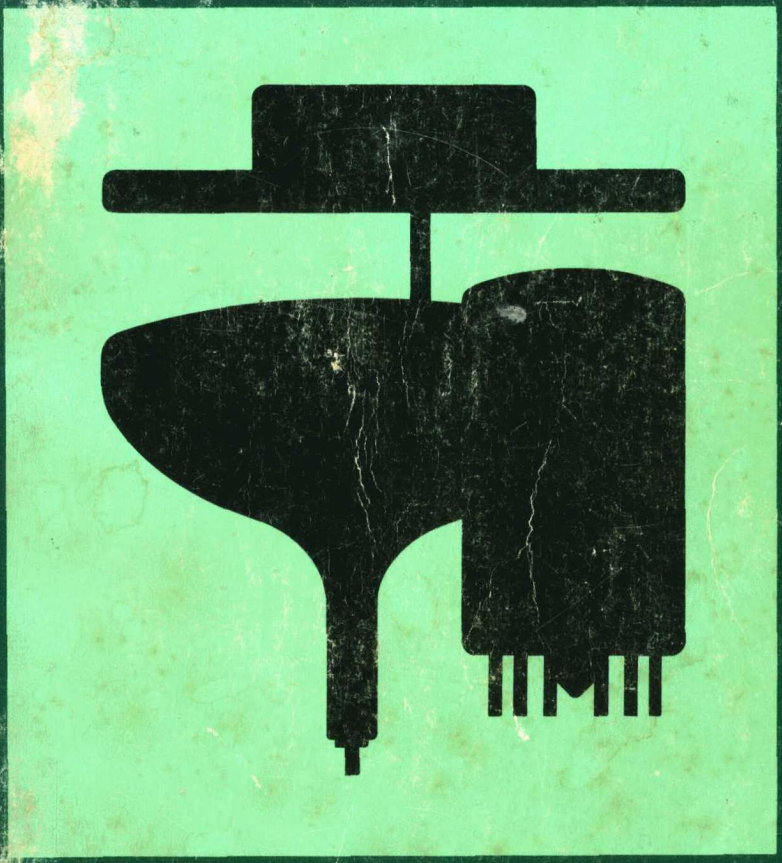
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technical manual



Receiving Tubes • Picture Tubes • ECG Semiconductors

SYLVANIA

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TECHNICAL MANUAL

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1970

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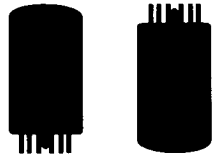
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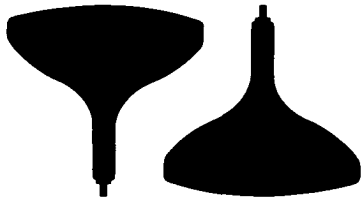
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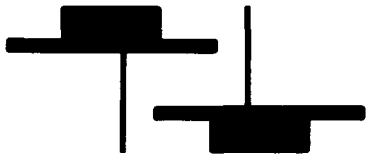
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Introduction

The 14th Edition Sylvania Technical Manual is completely revised and updated. A replacement guide for Semiconductors has been added, as well as technical data on the latest receiving and television picture tubes. The semiconductor guide provides replacement information for more than 28,000 types.

Industry—wide in scope, the manual is prepared primarily for the service technician engaged in the trouble-shooting and repair of home entertainment equipment. The engineer, industrial technician, student of electronics and home experimenter will also find it a valuable addition to their technical library.

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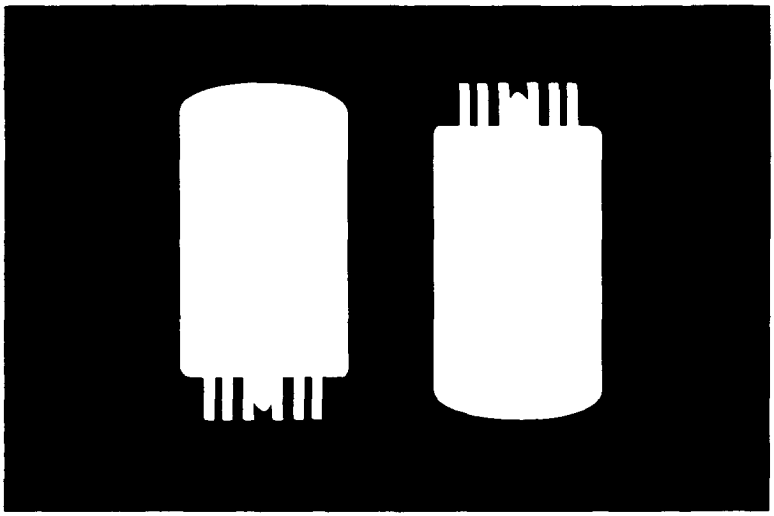
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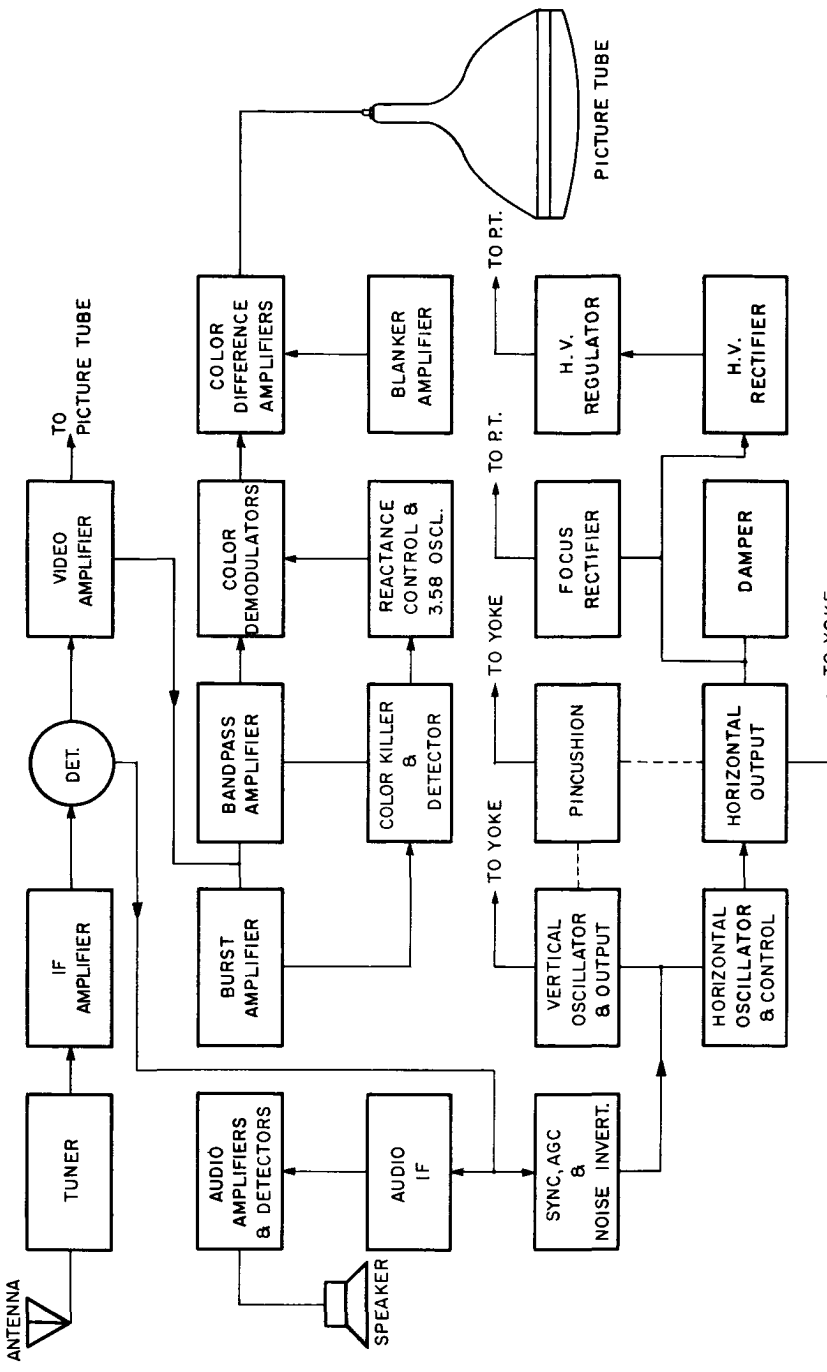
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TYPICAL COLOR RECEIVER (simplified block diagram)



FULL WAVE GAS RECTIFIER

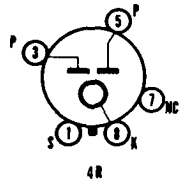
0Z4

0Z4A, 0Z4G

Cold Cathode Diode

Construction
- 0Z4, 0Z4A ..... Metal MT8
- 0Z4G ..... Glass T-7

Base ..... Octal
Basing 4R
Outline
- Maximum Diameter ..... 1.031 In.
- Maximum Seated Height ..... 2.063 In.
- Maximum Overall Height ..... 2.625 In.



4R



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage ..... None Required

RATINGS (Design Center Rating System)

	0Z4, 0Z4G	0Z4A
Peak Starting Plate Supply Voltage (Min.)	300	300 Volts
Peak Inverse Plate Voltage	880	880 Volts
Peak Plate Current	270	330 Ma
DC Output Current (Max.)	90	110 Ma
DC Output Current (Min.)	30	30 Ma

CHARACTERISTICS AND TYPICAL OPERATION

	0Z4, 0Z4G	0Z4A
Peak Plate Voltage (Per Plate)	380	440 Volts
Filter Input Condenser	8	8 μf
Total Effective Plate Supply Impedance (Per Plate)	800	600 Ohms
Voltage Drop for Ib = 110 Ma (Per Plate)	—	24 Volts
Voltage Drop for Ib = 90 Ma (Per Plate)	24	— Volts
DC Output Current	65	110 Ma
DC Output Voltage	275	310 Volts

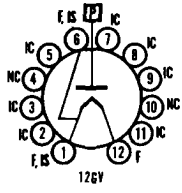
Color Television Type

HIGH VOLTAGE RECTIFIER

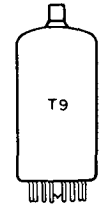
1AD2

Filamentary Diode

Construction ..... Compactron T-9
Base ..... Button 12 Pin, E12-70
Top Cap ..... Small, C1-34
Basing(3) 12GV
Outline 9-98
- Maximum Diameter ..... 1.188 In.
- Maximum Seated Height ..... 2.750 In.
- Maximum Overall Height ..... 3.125 In.



12GV



ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage(1)	1.25 Volts
Filament Current	200 Ma

DIRECT INTERELECTRODE CAPACITANCES

Plate to Filament	1.6 Pf

RATINGS (Design Maximum Rating System)

Pulse Rectifier Service(2)

Peak Inverse Plate Voltage (Max.)	26,000 Volts
Peak Plate Current (Max.)	50 Ma
Average Plate Current (Max.)	0.5 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 7.0 Ma	225 Volts

NOTES:

(1) Under no circumstance should voltage fall below 1.05 volts or exceed 1.45 volts.

(2) 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 horizontal scanning cycle.

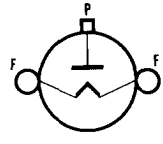
(3) *Terminals 4 and 10 may be used as tie points for components at or near filament potential.*

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

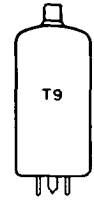
1AY2 — HIGH VOLTAGE RECTIFIER

Filamentary Diode

Construction T-9
Base .....Button 2 Pin, E2-92
Top Cap .....Small, C1-34
Basing.....Special 2 Pin
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.680 In.
Maximum Overall Height .....3.060 In.



1AY2



ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage(1)	1.25 Volts
Filament Current	200 Ma
DIRECT INTERELECTRODE CAPACITANCES	
Plate to Filament	1.4 Pf
RATINGS (Design Maximum Rating System)	
Pulse Rectifier Service(2)	
Peak Inverse Plate Voltage (Max.)	26,000 Volts
Peak Plate Current (Max.)	50 Ma
Average Plate Current (Max.)	0.5 Ma
CHARACTERISTICS AND TYPICAL OPERATION	
Tube Voltage Drop for Ib = 7 Ma	75 Volts

NOTES:

(1) Under no circumstances should voltage fall below 1.05 volts or exceed 1.45 volts.

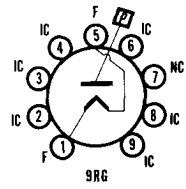
(2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

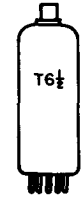
X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

1BC2 — HIGH VOLTAGE RECTIFIER

Filamentary Diode

Construction .....Miniature T-6½
Base .....Small Button 9 Pin, E9-1
Top Cap C1-45
Basing(3) 9RG
Outline 6-18
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.250 In.
Maximum Overall Height .....2.531 In.





ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage[1]	1.25 Volts
Filament Current	200 Ma
DIRECT INTERELECTRODE CAPACITANCES	
Plate to Filament	1.0 Pf
RATINGS (Design Maximum Rating System)	
Pulse Rectifier Service[2]	
Peak Inverse Plate Voltage (Max.)	15,000 Volts
Peak Plate Current (Max.)	45 Ma
Average Plate Current (Max.)	0.5 Ma
CHARACTERISTICS AND TYPICAL OPERATION	
Tube Voltage Drop for Ib = 7 Ma	80 Volts

NOTES:

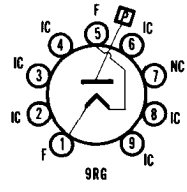
(1) Under no circumstances should voltage fall below 1.05 volts or exceed 1.45 volts.
(2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
(3) Pin No. 7 may be used as tie-point for filament resistor or tied directly to filament. Do not connect to any other circuit.

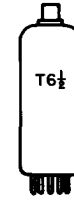
X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

HIGH VOLTAGE RECTIFIER — 1BH2

Filamentary Diode

Construction .....Miniature T-6½
Base .....Small Button 9 Pin, E9-99
With Solders Lugs on Pins 1 and 5
Top Cap C1-45
Basing 9RG
Outline
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.250 In.
Maximum Overall Height .....2.716 In.





ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage[1]	1.25 Volts
Filament Current	200 Ma
DIRECT INTERELECTRODE CAPACITANCES	
Plate to Filament	1.0 Pf
RATINGS (Design Maximum Rating System)	
Pulse Rectifier Service[2]	
Peak Inverse Plate Voltage (Max.)	18,000 Volts
Peak Plate Current (Max.)	45 Ma
Average Plate Current (Max.)	0.5 Ma
CHARACTERISTICS AND TYPICAL OPERATION	
Tube Voltage Drop for Ib = 7 Ma	80 Volts

NOTES:

(1) Under no circumstances should voltage fall below 1.05 volts or exceed 1.45 volts.
(2) 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 horizontal scanning cycle.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

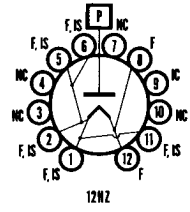
1BY2

Color Television Type

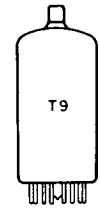
HIGH VOLTAGE RECTIFIER

Filamentary Diode

Construction	T-9
Base	E12-70
Top Cap	C1-1 or C1-34
Basing(3)	12HZ
Outline	9-98
Maximum Diameter	1.188 In.
Maximum Seated Height	2.750 In.
Maximum Overall Height	3.125 In.



12HZ



ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage(1)	1.25 Volts
Filament Current	200 Ma

DIRECT INTERELECTRODE CAPACITANCES

	Without Shield
Plate to Filament and Internal Shield	1.6 pf

RATINGS (Design Maximum Rating System)

Pulse Rectifier Service(2)

Peak Inverse Plate Voltage

Total DC and Peak (Absolute Max.)	26,000 Volts
DC Component (Absolute Max.)	22,000 Volts
Steady State Peak Plate Current (Design Max.)	50 Ma
Average Plate Current (DC Output) (Design Max.)	0.5 Ma

AVERAGE CHARACTERISTICS

Instantaneous Tube Drop (Approx.) for Ib = 7.0 Ma	225 Volts

X-RADIATION CHARACTERISTICS

Maximum X-Radiation ..... 25.0 mR/h

X-Radiation is measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," dated February 1968 and quality controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation Emitted from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

Lot acceptance sampling procedures for the manufacturer's initial and life tests for X-Radiation are based upon MIL-STD-105, "Military Standard Sampling Procedures and Tables for Inspection by Attributes." Lot acceptance and life control limits are established substantially below the X-Radiation Characteristic Maximum.

NOTES:

(1) Under no circumstances should voltage fall below 1.05 volts or exceed 1.45 volts.

(2) 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 horizontal scanning cycle.

(3) Only pins 4 and 10 may be used as tie points at or near filament potential. Pins 3, 7 and 9 are not to be used as tie points for external components. Pins 1 and 2 are to be utilized as the high voltage output filament terminal. Pins 8 or 12 are to be utilized as the low side filament terminal. Good high voltage practice dictates that a minimum of one half inch be maintained between the tube envelope and the filament and/or DC output leads.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

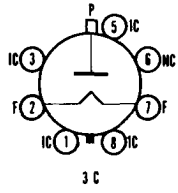
Color Television Type

HIGH VOLTAGE RECTIFIER

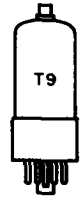
1G3GT/1B3GT

Filamentary Diode

Construction .....Octal T-9
Base[1].....B5-82, B6-8, B6-60, B6-144
B7-166, B7-211, B8-6 or B8-58
Top Cap.....Small, C1-34
Basing[2] 3C
Outline .....9-51 or 9-52
Maximum Diameter .....1.188 In.
Maximum Seated Height.....3.312 In.
Maximum Overall Height.....4.062 In.



3 C



ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage[3]	1.25 Volts
Filament Current	200 Ma

DIRECT INTERELECTRODE CAPACITANCES

Plate to Filament and Internal Shield	1.3 Pf

RATINGS (Design Maximum Rating System)

Pulse Rectifier Service[4]

Peak Inverse Plate Voltage	
Total DC and Peak (Max.)	26,000 Volts
DC (Max.)	22,000 Volts
Peak Plate Current (Max.)	50 Ma
Average Plate Current (Max.)	0.5 Ma

RF Voltage Rectifier

Peak Inverse Plate Voltage (Max.)	33,000 Volts
Peak Plate Current (Max.)	35 Ma
Average Plate Current (Max.)	1.1 Ma
Frequency of Supply Voltage (Max.)	100 KHz
(Min.)	1.5 KHz

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 7.0 Ma (Approx.)	100 Volts

NOTES:

(1) On the 5 pin bases, Pins 1, 4, and 6 are omitted. On the 6 pin bases, Pins 4 and 6 are omitted. On 7 pin bases, Pin 4 is omitted.
(2) Socket terminals 1, 3, 4, 5, 6, and 8 may be connected to terminal 7 or to a corona shield which connects to terminal 7. Terminals 4 and 6 may be used as tie points for components at or near filament potential.
(3) Under no circumstances should the filament voltage be less than 1.05 volts or more than 1.45 volts.
(4) 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 horizontal scanning cycle.

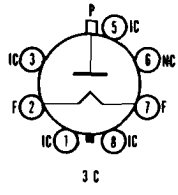
X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

HIGH VOLTAGE RECTIFIER

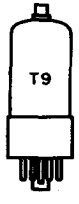
1K3/1J3

Filamentary Diode

Construction .....Octal T-9
Base[1] .....B6-8 or B6-60
Top Cap .....Small, C1-34
Basing[2] 3C
Outline[3] .....9-53 or 9-54
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.000 In.
Maximum Overall Height .....3.562 In.



3 C



ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage[4]	1.25 Volts
Filament Current	200 Ma

DIRECT INTERELECTRODE CAPACITANCES

Plate to Filament and Internal Shield (Approx.)	1.6 Pf

RATINGS (Design Maximum Rating System)

Pulse Rectifier Service[5]

Peak Inverse Plate Voltage

Total DC and Peak (Max.)	26,000 Volts
DC (Max.)	22,000 Volts
Peak Plate Current (Max.)	50 Ma
Average Plate Current (Max.)	0.5 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 7 Ma (Approx.)	225 Volts

NOTES:

(1) Bases B6-8 and B6-60, Pins 4 and 6 removed.

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

(3) Outline 9-53 applies with Short Intermediate Shell Octal Base (B6-60). Outline 9-54 applies with Intermediate Shell Octal Base (B6-8).

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

(5) 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 horizontal scanning cycle.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

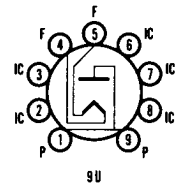
1V2

Color Television Type

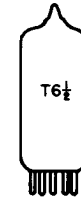
HIGH VOLTAGE RECTIFIER (Focus Rectifier)

Filamentary Diode

Construction	Miniature T-6½
Base	Small Button 9 Pin, E9-1
Basing[1]	9U
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.



9U



ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage[2]	0.625 Volts
Filament Current	300 Ma

DIRECT INTERELECTRODE CAPACITANCES

Plate to Filament (Approx.)	0.8 Pf

RATINGS (Design Maximum Rating System)

Pulse Rectifier Service[3]

Peak Inverse Plate Voltage

Total DC and Peak (Max.)	8250 Volts
DC (Max.)	7000 Volts
Peak Plate Current (Max.)	11 Ma
Average Plate Current (Max.)	0.6 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 7 Ma (Approx.)	135 Volts

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 0.525 volts or more than 0.725 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 horizontal scanning cycle.

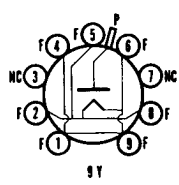
Color Television Type

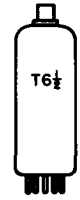
HIGH VOLTAGE RECTIFIER

1X2B

Filamentary Diode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Top Cap ..Skirted Miniature C1-2 or C1-33
Basing[1].....9Y
Outline
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.563 In.
Maximum Overall Height .....2.844 In.





ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage	1.25 Volts
Filament Current	200 Ma

DIRECT INTERELECTRODE CAPACITANCES

Plate to Filament and Internal Shield	1.0 Pf

RATINGS (Design Maximum Rating System)

Pulse Rectifier Service[2]

Peak Inverse Plate Voltage	
Total DC and Peak (Max.)	22,000 Volts
DC (Max.)	18,000 Volts
Peak Plate Current (Max.)	45 Ma
Average Plate Current (Max.)	0.5 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Positive Peak Plate Voltage	18,000 Volts
Negative Peak Plate Voltage	2000 Volts
DC Output Voltage (Approx.)	18,000 Volts
DC Output Current (Approx.)	100 μa
Peak Plate Current	35 Ma
Tube Voltage Drop With Ib = 7 Ma (Approx.)	100 Volts

NOTES:

(1) Pins 3 and 7 can be used as a tie point for the filament dropping resistor and high voltage resistor. Do not connect to the low voltage circuits.

(2) 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 horizontal scanning cycle.

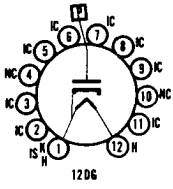
X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

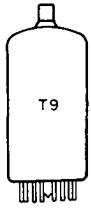
HIGH VOLTAGE RECTIFIER

2AH2

Heater-Cathode Diode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Top Cap .....Small, C1-34
Basing[1,2].....12DG
Outline 9-91
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.000 In.
Maximum Overall Height .....3.375 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage[3]	2.5 Volts
Heater Current	300 Ma

DIRECT INTERELECTRODE CAPACITANCES

Plate to Heater, Cathode, and Internal Shield (Approx.)	1.4 Pf

RATINGS (Design Maximum Rating System)

Pulse Rectifier Service(4)

Peak Inverse Plate Voltage	
Total DC and Peak (Max.)	30,000 Volts
DC (Max.)	24,000 Volts
Peak Plate Current (Max.)	80 Ma
Average Plate Current (Max.)	1.5 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 7 Ma	100 Volts

NOTES:

(1) Pins designated Internal Connection (IC) may or may not have connections to internal elements depending on manufacturer. To maintain interchangeability do not use these pins for external connections.
(2) Pins 4 and 10 may be used as tie points for components at or near filament potential.
(3) Under no circumstances should voltage fall below 2.1 volts or exceed 2.9 volts.
(4) 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 horizontal scanning cycle.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

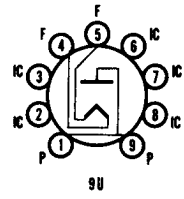
2AV2

Color Television Type

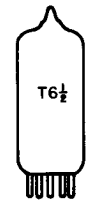
HIGH VOLTAGE RECTIFIER

Filamentary Diode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing(1)	9U
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.938 In.
Maximum Overall Height	2.188 In.



9U



ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage(2)	1.8 Volts
Filament Current	225 Ma

DIRECT INTERELECTRODE CAPACITANCES

Plate to Filament	0.8 Pf

RATINGS (Design Maximum Rating System)

Pulse Rectifier Service(3)

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

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 1 Ma	20 Volts

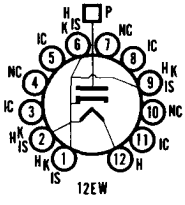
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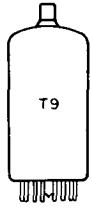
(1) Socket terminals 2, 3, 7, and 8 shall not be used. Terminal 6 may be used as a tie point for components at or near filament potential.
(2) Under no circumstances should the filament voltage be less than 1.53 volts or more than 2.07 volts.
(3) For operation in a 525-line, 30-frame system as described 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 horizontal scanning cycle.

HIGH VOLTAGE RECTIFIER — 2BU2/2AS2A

Heater-Cathode Diode

Construction .....Compactron T-9
Base .....Button 12 Pin, E12-70
Top Cap .....Small, C1-34
Basing[1],[4] 12EW
Outline 9-100
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.625 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage[2]	2.5 Volts
Heater Current	330 Ma

DIRECT INTERELECTRODE CAPACITANCES

Plate to Heater, Cathode, and Internal Shield	1.4 Pf

RATINGS (Design Maximum Rating System)

Pulse Rectifier Service[3]

Peak Inverse Plate Voltage (Max.)	30,000 Volts
Peak Plate Current (Max.)	90 Ma
Average Plate Current (Max.)	1.7 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 7 Ma	75 Volts

X-RADIATION CHARACTERISTIC

Maximum X-Radiation ..... 25.0 mR/h

X-Radiation is measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," dated February 1968 and quality controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation Emitted from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

Lot acceptance sampling procedures for the manufacturer's initial and life tests for X-Radiation are based on MIL-STD-105, "Military Standard Sampling Procedures and Tables for Inspection by Attributes." Lot acceptance and life control limits are established substantially below the X-Radiation Characteristic Maximum.

NOTES:

(1) Pins designated Internal Connection (IC) may or may not have connections to internal elements depending on manufacturer. To maintain interchangeability do not use these pins for external connections.
(2) Under no circumstances should voltage fall below 2.1 volts or exceed 2.9 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 horizontal scanning cycle.
(4) Pins 4, 7 and 10 may be used as tie points for components at or near heater potential.

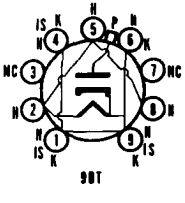
X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

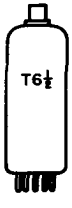
Color Television Type

HIGH VOLTAGE RECTIFIER — 3A2

Heater-Cathode Diode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Top Cap .....Skirted Miniature C1-2
Basing 9DT
Outline 6-7
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.437 In.
Maximum Overall Height .....2.844 In.





ELECTRICAL DATA
HEATER OPERATION

Heater Voltage[1]	3.15 Volts
Heater Current	220 Ma
DIRECT INTERELECTRODE CAPACITANCES	
Plate to Heater, Cathode, and Internal Shield	1.0 Pf
RATINGS (Design Maximum Rating System)	
Pulse Rectifier Service[2]	
Peak Inverse Plate Voltage (Max.)	18,000 Volts
Peak Plate Current (Max.)	80 Ma
Average Plate Current (Max.)	1.5 Ma

NOTES:
(1) Under no circumstance should voltage fall below 2.65 volts or exceed 3.65 volts.
(2) 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 horizontal scanning cycle.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

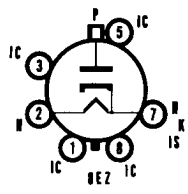
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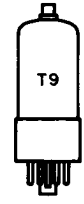
Color Television Type

HIGH VOLTAGE RECTIFIER

Heater-Cathode Diode

Construction	Octal T-9
Base	Octal 6 Pin, B6-8 or B6-60
Top Cap	Small, C1-1 or C1-34
Basing	8EZ
Outline	
Maximum Diameter	1.281 In.
Maximum Seated Height	3.250 In.
Maximum Overall Height	3.812 In.





ELECTRICAL DATA
HEATER OPERATION

Heater Voltage[1]	3.15 Volts
Heater Current	220 Ma
DIRECT INTERELECTRODE CAPACITANCES	
Plate to Heater, Cathode, and Internal Shield	1.5 Pf
RATINGS (Design Maximum Rating System)	
Pulse Rectifier Service[2]	
Peak Inverse Plate Voltage (Max.)	30,000 Volts
Peak Plate Current (Max.)	100 Ma
Average Plate Current (Max.)	2 Ma
CHARACTERISTICS AND TYPICAL OPERATION	
Tube Voltage Drop for Ib = 7 Ma	100 Volts

X-RADIATION CHARACTERISTIC

Maximum X-Radiation	25.0 mR/h

X-Radiation is measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," dated February 1968 and quality controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation Emitted from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

Lot acceptance sampling procedures for the manufacturer's initial and life tests for X-Radiation are based on MIL-STD-105, "Military Standard Sampling Procedures and Tables for Inspection by Attributes." Lot acceptance and life control limits are established substantially below the X-Radiation Characteristic Maximum.

NOTES:
(1) Under no circumstance should voltage fall below 2.65 volts or exceed 3.65 volts.
(2) For operation in a 525 line, 30 frame system as described in "Standard of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

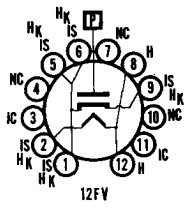
Color Television Type

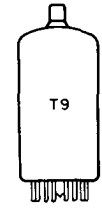
HIGH VOLTAGE RECTIFIER

3AT2A

Heater-Cathode Diode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Top Cap .....Small, C1-34
Basing 12FV
Outline 9-100
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.625 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage(1)	3.15 Volts
Heater Current	220 Ma

DIRECT INTERELECTRODE CAPACITANCES

Plate to Heater, Cathode, and Internal Shield	1.5 Pf

RATINGS (Design Maximum Rating System)

Pulse Rectifier Service(2)

Peak Inverse Plate Voltage (Max.)	30,000 Volts
Peak Plate Current (Max.)	88 Ma
Average Plate Current (Max.)	1.7 Ma

X-RADIATION CHARACTERISTIC

Maximum X-Radiation ..... 25.0 mR/h

X-Radiation is measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," dated February 1968 and quality controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation Emitted from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

Lot acceptance sampling procedures for the manufacturer's initial and life tests for X-Radiation are based on MIL-STD-105, "Military Standard Sampling Procedures and Tables for Inspection by Attributes." Lot acceptance and life control limits are established substantially below the X-Radiation Characteristic Maximum.

NOTES:

(1) Under no circumstance should voltage fall below 2.65 volts or exceed 3.65 volts.
(2) 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 horizontal scanning cycle.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

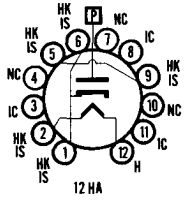
Color Television Type

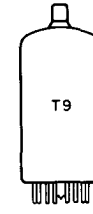
HIGH VOLTAGE RECTIFIER

3AW2A

Heater-Cathode Diode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Top Cap .....Small, C1-34
Basing 12HA
Outline 9-100
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.625 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage(1)	3.15 Volts
Heater Current	350 Ma

DIRECT INTERELECTRODE CAPACITANCES
Plate to Heater, Cathode, and Internal Shield ..... 1.6 Pf
RATINGS (Design Maximum Rating System)
Pulse Rectifier Service(2)
Peak Inverse Plate Voltage
Total DC and Peak (Max.) ..... 38,000 Volts
DC (Max.) ..... 30,000 Volts
Peak Plate Current (Max.) ..... 110 Ma
Average Plate Current (Max.) ..... 2.2 Ma
CHARACTERISTICS AND TYPICAL OPERATION
Tube Voltage Drop for Ib = 7 Ma ..... 60 Volts

X-RADIATION CHARACTERISTIC

Maximum X-Radiation ..... 25.0 mR/h

X-Radiation is measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," dated February 1968 and quality controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation Emitted from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

Lot acceptance sampling procedures for the manufacturer's initial and life tests for X-Radiation are based on MIL-STD-105, "Military Standard Sampling Procedures and Tables for Inspection by Attributes." Lot acceptance and life control limits are established substantially below the X-Radiation Characteristic Maximum.

NOTES:

(1) Under no circumstance should voltage fall below 2.65 volts or exceed 3.65 volts.
(2) 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 horizontal scanning cycle.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

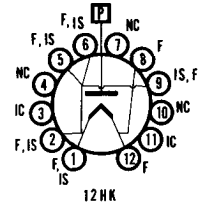
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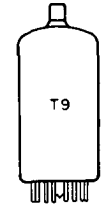
Color Television Type

HIGH VOLTAGE RECTIFIER POSTED FILAMENT DESIGN

Filamentary Diode

Construction ..... Compactron T-9
Base ..... Button 12 Pin, E12-70
Top Cap ..... Small, C1-34
Basing(1,2,3,4) 12HK
Outline 9-100
Maximum Diameter ..... 1.188 In.
Maximum Seated Height ..... 3.250 In.
Maximum Overall Height ..... 3.625 In.





ELECTRICAL DATA

FILAMENT OPERATION
Filament Voltage(5) ..... 3.3 Volts
Filament Current ..... 285 Ma
DIRECT INTERELECTRODE CAPACITANCES
Plate to Filament and Internal Shield ..... 1.5 Pf
RATINGS (Design Maximum Rating System)
Pulse Rectifier Service(6)
Peak Inverse Plate Voltage (Max.) ..... 33,000 Volts
Peak Plate Current (Max.) ..... 100 Ma
Average Plate Current (Max.) ..... 2.0 Ma
CHARACTERISTICS AND TYPICAL OPERATION
Tube Voltage Drop for Ib = 7 Ma ..... 50 Volts

X-RADIATION CHARACTERISTIC

Maximum X-Radiation ..... 25.0 mR/h

X-Radiation is measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," dated February 1968 and quality controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation Emitted from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

Lot acceptance sampling procedures for the manufacturer's initial and life tests for X-Radiation are based on MIL-STD-105, "Military Standard Sampling Procedures and Tables for Inspection by Attributes." Let acceptance and life control limits are established substantially below the X-Radiation Characteristic Maximum.

NOTES:
(1) Pins designated Internal Connection (IC) may or may not have connections to internal elements depending on the manufacturer. To maintain interchangeability do not use these pins for external connection.
(2) Use Pin No. 4 as tie point for series resistor in 2nd anode lead for the picture tube.
(3) Use Pin No. 10 as tie point for series filament resistor.
(4) Either Pins 1, 2, 5, 6, or 9—use as high voltage output connection.
(5) Under no circumstance should voltage fall below 3.02 or exceed 4.18 volts.
(6) 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 horizontal scanning cycle.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

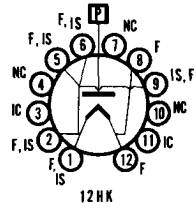
Color Television Type

HIGH VOLTAGE RECTIFIER POSTED FILAMENT DESIGN

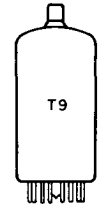
3BM2A

Filamentary Diode

Construction.....Compactron T-9
Base .....Button 12-Pin, E12-70
Top Cap .....Small, C1-34
Basing[1,2,3,4] 12HK
Outline 9-100
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.625 In.



12HK



ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage[5]	3.0 Volts
Filament Current	300 Ma

DIRECT INTERELECTRODE CAPACITANCES

Plate to Filament and Internal Shield	1.5 Pf

RATINGS (Design Maximum Rating System)
Pulse Rectifier Service[6]

Peak Inverse Plate Voltage (Max.)	33,000 Volts
Peak Plate Current (Max.)	100 Ma
Average Plate Current (Max.)	2.0 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 7 Ma	50 Volts

X-RADIATION CHARACTERISTIC

Maximum X-Radiation	25.0 mR/h

X-Radiation is measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," dated February 1968 and quality controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation Emitted from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

Lot acceptance sampling procedures for the manufacturer's initial and life tests for X-Radiation are based on MIL-STD-105, "Military Standard Sampling Procedures and Tables for Inspection by Attributes." Lot acceptance and life control limits are established substantially below the X-Radiation Characteristic Maximum.

NOTES:
(1) Pins designated Internal Connection (IC) may or may not have connections to internal elements depending on the manufacturer. To maintain interchangeability do not use these pins for external connection.
(2) Use Pin No. 4 as tie point for series resistor in 2nd anode lead for the picture tube.
(3) Use Pin No. 10 as tie point for series filament resistor.
(4) Either Pins 1, 2, 5, 6, or 9—use as high voltage output connection.
(5) Under no circumstance should voltage fall below 2.5 or exceed 3.5 volts.
(6) 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 horizontal scanning cycle.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

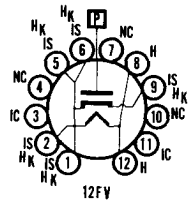
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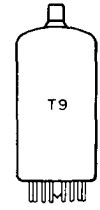
Color Television Type

HIGH VOLTAGE RECTIFIER

Heater-Cathode Diode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Top Cap .....Small, C1-34
Basing 12FV
Outline 9-100
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.625 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage(1)	3.15 Volts
Heater Current	300 Ma
Operational Warm-up Time	4 Sec.

DIRECT INTERELECTRODE CAPACITANCES

Plate to Heater, Cathode, and Internal Shield	1.5 Pf

RATINGS (Design Maximum Rating System)

Pulse Rectifier Service(2)

Peak Inverse Plate Voltage	
Total DC and Peak (Max.)	30,000 Volts
DC (Max.)	27,000 Volts
Peak Plate Current (Max.)	88 Ma
Average Plate Current (Max.)	1.7 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 7 Ma	150 Volts

X-RADIATION CHARACTERISTIC

Maximum X-Radiation	25.0 mR/h

X-Radiation is measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," dated February 1968 and quality controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation Emitted from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

Lot acceptance sampling procedures for the manufacturer's initial and life tests for X-Radiation are based on MIL-STD-105, "Military Standard Sampling Procedures and Tables for Inspection by Attributes." Lot acceptance and life control limits are established substantially below the X-Radiation Characteristic Maximum.

NOTES:

(1) Under no circumstance should voltage fall below 2.65 or exceed 3.65 volts.
(2) 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 horizontal scanning cycle.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

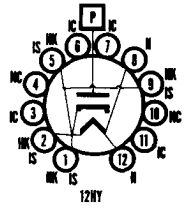
3BS2A

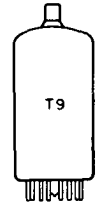
Color Television Type

HIGH VOLTAGE RECTIFIER

Heater-Cathode Diode

Construction.....Compactron T-9
Base E12-70
Top Cap .....Small C1-34
Basing(2) 12HY
Outline 9-100
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.625 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	3.15 Volts
Heater Current	480 Ma
Heater Warm-up Time	4 Seconds

DIRECT INTERELECTRODE CAPACITANCES

	Without Shield
Plate to Heater, Cathode and Internal Shield	1.6 pf

RATINGS (Design Maximum Rating System)

Pulse Rectifier Service(1)

Peak Inverse Plate Voltage	
Total DC and Peak (Absolute Max.)	38,000 Volts
DC Component (Absolute Max.)	30,000 Volts
Steady State Peak Plate Current (Design Max.)	110 Ma
Average Plate Current (DC Output) (Design Max.)	2.2 Ma

AVERAGE CHARACTERISTICS

Instantaneous Tube Drop (Approx.) for Ib = 7.0 Ma	60 Volts

NOTES:

(1) For operation as a pulsed rectifier 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 horizontal scanning cycle.

(2) Pins 4, 7, and 10 may be used as tie points for components at or near heater potential.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

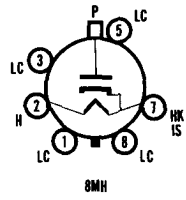
Color Television Type

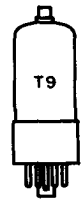
HIGH VOLTAGE RECTIFIER

3CA3

Heater-Cathode Diode

Construction	Octal T-9
Base	Octal 6 Pin, B6-8 or B6-60
Top Cap	Small, C1-34
Basing(1)	8MH
Outline	
Maximum Diameter	1.188 In.
Maximum Seated Height	3.500 In.
Maximum Overall Height	4.063 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage(2)	3.6 Volts
Heater Current	225 Ma

DIRECT INTERELECTRODE CAPACITANCES

Plate Heater, Cathode, and Internal Shield	1.6 Pf

RATINGS (Design Maximum Rating System)

Pulse Rectifier Service(3)

Peak Inverse Plate Voltage (Max.)	30,000 Volts
Peak Plate Current (Max.)	100 Ma
Average Plate Current (Max.)	2 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 11 Ma	100 Volts

NOTES:

(1) Socket Pins No. 1, 3, 4, 5, 6, and 8 may be connected to Pin No. 7 or a corona shield which connects to Pin 7. Pins 4 and 6 may be used as tie points at or near cathode potential, otherwise do not use.

(2) Under no circumstances should voltage fall below 3.02 or exceed 4.18 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 horizontal scanning cycle.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

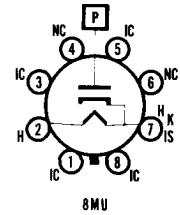
3CN3A
2CN3B

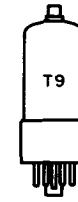
Color Television Type

HIGH VOLTAGE RECTIFIER

Heater-Cathode Diode

Construction .....Octal T-9
Base .....Octal 8 Pin, B8-6, B8-42, B8-58 or B8-251
Top Cap.....Small, C1-1 or C1-34
Basing(1) 8MU
Outline
Maximum Diameter .....1.281 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.812 In.





ELECTRICAL DATA

	2CN3B	3CN3A
HEATER OPERATION		
Heater Voltage(2)	1.8	3.15 Volts
Heater Current	900	480 Ma
DIRECT INTERELECTRODE CAPACITANCES		
Plate to Heater, Cathode, and Internal Shield		1.6 Pf
RATINGS (Design Maximum Rating System)		
Pulse Rectifier Service(3)		
Peak Inverse Plate Voltage		
Total DC and Peak (Abs. Max.)		38,000 Volts
DC (Abs. Max.)		30,000 Volts
Peak Plate Current (Design Max.)		110 Ma
Average Plate Current (Design Max.)		2.2 Ma
CHARACTERISTICS AND TYPICAL OPERATION		
Tube Voltage Drop for Ib = 7 Ma		60 Volts

2CN3B Only

X-RADIATION CHARACTERISTIC

Maximum X-Radiation ..... 25.0 mR/h

X-Radiation is measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," dated February 1968 and quality controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation Emitted from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

Lot acceptance sampling procedures for the manufacturer's initial and life tests for X-Radiation are based on MIL-STD-105, "Military Standard Sampling Procedures and Tables for Inspection by Attributes." Lot acceptance and life control limits are established substantially below the X-Radiation Characteristic Maximum.

NOTES:

(1) Socket Pins No. 1, 3, 5, and 8 may be connected to Pin No. 7 or a corona shield which connects to Pin No. 7, otherwise do not use.
(2) Under no circumstances should voltage fall below 2.65 or exceed 3.65 volts (3CN3A only).
(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 horizontal scanning cycle.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

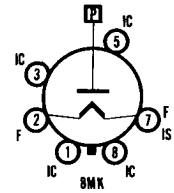
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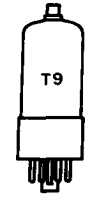
Color Television Type

HIGH VOLTAGE RECTIFIER

Filamentary Diode

Construction .....Octal T-9
Base....B6-8, B6-48, B6-60, B8-251 or B6-253
Top Cap .....C1-34 or C1-50
Basing(1),(2),(3) 8MK
Outline
Maximum Diameter .....1.281 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.812 In.





ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage	3.15 Volts
Filament Current	280 Ma

DIRECT INTERELECTRODE CAPACITANCES

	Without Shield
Plate to Filament and Internal Shield	1.5 pf

RATINGS (Design Maximum Rating System)

Pulse Rectifier Service(4)

Peak Inverse Plate Voltage

Total DC and Peak (Absolute Max.)	38,000 Volts
DC Component (Absolute Max.)	30,000 Volts
Steady State Peak Plate Current (Design Max.)	100 Ma
Average Plate Current (DC Output) (Design Max.)	2.0 Ma

AVERAGE CHARACTERISTICS

Instantaneous Tube Drop (Approx.) for Ib = 7.0 Ma	50 Volts

X-RADIATION CHARACTERISTIC

Maximum X-Radiation	25.0 mR/h

X-Radiation is measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," dated February 1968 and quality controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation Emitted from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

Lot acceptance sampling procedures for the manufacturer's initial and life tests for X-Radiation are based on MIL-STD-105, "Military Standard Sampling Procedures and Tables for Inspection by Attributes." Lot acceptance and life control limits are established substantially below the X-Radiation Characteristic Maximum.

NOTES:

(1) Pins designated Internal Connection (IC) may or may not have connections to internal elements depending on manufacturer. To maintain interchangeability do not use these pins for external socket connections.
(2) Pin connections 4 and 6 may be used as tie points.
(3) Use Pin 7 as high voltage output connection.
(4) 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 horizontal scanning cycle.
(5) Good high voltage practice dictates that a minimum of ½ inch be maintained between the tube envelope and the filament and/or DC output leads.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

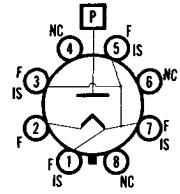
Color Television Type

HIGH VOLTAGE RECTIFIER

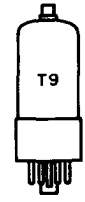
3DC3

Filamentary Diode

Construction	Octal T-9
Base	B8-6, B8-58, B8-142, B8-251
Basing(2),(3)	8MZ
Outline	
Maximum Diameter	1.281 In.
Maximum Seated Height	3.250 In.
Maximum Overall Height	3.812 In.



8MZ



ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage	3.15 Volts
Filament Current	280 Ma

DIRECT INTERELECTRODE CAPACITANCES

	Without Shield
Plate to Filament and Internal Shield	1.5 pf

RATINGS (Design Maximum Rating System)
Pulse Rectifier Service(4)

Peak Inverse Plate Voltage	
Total DC and Peak (Absolute Max.)	38,000 Volts
DC Component (Absolute Max.)	30,000 Volts
Steady State Peak Plate Current (Design Max.)	110 Ma
Average Plate Current (DC Output) (Design Max.)	2.2 Ma
AVERAGE CHARACTERISTICS	
Instantaneous Tube Drop (Approx.) for Ib = 7.0 Ma.	50 Volts

X-RADIATION CHARACTERISTIC

Maximum X-Radiation ..... 25.0 mR/h

X-Radiation is measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," dated February 1968 and quality controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation Emitted from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

Lot acceptance sampling procedures for the manufacturer's initial and life tests for X-Radiation are based upon MIL-STD-105, "Military Standard Sampling Procedures and Tables for Inspection by Attributes." Lot acceptance and life control limits are established substantially below the X-Radiation Characteristic Maximum.

NOTES:

(1) Good high voltage practice dictates that a minimum of ½ inch be maintained between the tube envelope and the filament and/or DC output leads.
(2) Socket connections 4, 6 and 8 may be used as tie points.
(3) Use Pin 7 as high voltage output connection.
(4) For operation as a pulsed rectifier 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 horizontal scanning cycle.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

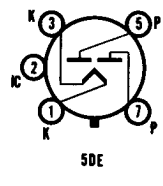
3DG4

Color Television Type

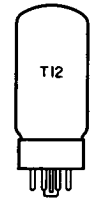
FULL-WAVE POWER RECTIFIER

Filamentary Twin Diode

Construction	Octal T-12
Base	Octal 5 Pin
Basing	5DE
Outline	12-16
Maximum Diameter	1.563 In.
Maximum Seated Height	4.063 In.
Maximum Overall Height	4.625 In.



5DE



ELECTRICAL DATA

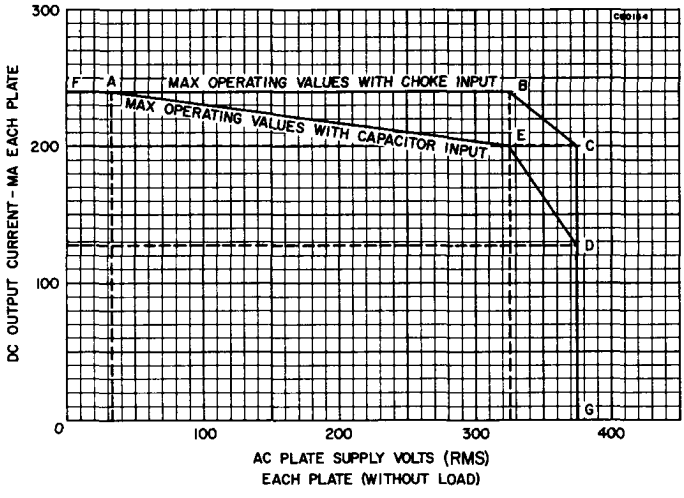
FILAMENT OPERATION

Filament Voltage	3.3 Volts
Filament Current	3800 Ma
RATINGS (Design Maximum Rating System)	
Rectifier Service(1)	
Peak Inverse Plate Voltage (Max.)	1050 Volts
AC Plate Supply Voltage (Each Plate, RMS) (Max.)	375 Volts
DC Output Current (Max.)	400 Ma
Steady State Peak Plate Current (Each Plate) (Max.)	1200 Ma
Transient Peak Plate Current (Each Plate) (Max.)	6500 Ma
Bulb Temperature at Hottest Point (Max.)	200 °C
CHARACTERISTICS AND TYPICAL OPERATION	
Full Wave Rectifier—Capacitor Input Filter	
AC Plate Supply Voltage (Each Plate, RMS)(2)	275 Volts
Filter Input Capacitor	40 μf
Effective Plate-Supply Resistance (Each Plate)	32 Ohms
DC Output Current	350 Ma
DC Output Voltage at Filter Input	300 Volts
Tube Voltage Drop for Ib = 350 Ma (Each Plate)	25 Volts

NOTES:

(1) For use with sinusoidal supply voltages within the frequency range of 25 to 1000 Hertz.
(2) AC plate voltage is measured without load.

RATING CHART (3DG4)

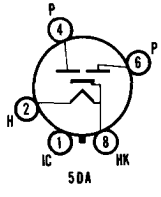


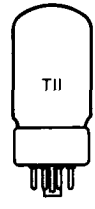
FULL-WAVE POWER RECTIFIER

5AR4/GZ34

Heater-Cathode Twin Diode

Construction .....Octal T-11
Base .....Octal 5 Pin
Basing 5DA
Outline
Maximum Diameter .....1.313 In.
Maximum Seated Height .....2.875 In.
Maximum Overall Height .....3.438 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	5.0 Volts
Heater Current	1900 Ma

RATINGS (Design Center Rating System)

Rectifier Service(1)

Peak Inverse Plate Voltage (Max.)	1500 Volts
Peak Plate Current (Max.)	750 Ma
AC Plate Supply Voltage (Each Plate, RMS) (Max.)	550 Volts
Steady State DC Output Current (Max.)	250 Ma
Condenser Input to Filter (Max.)	60 μf

CHARACTERISTICS AND TYPICAL OPERATION

Full-Wave Rectifier—Capacitor Input Filter

AC Plate Supply Voltage (Each Plate, RMS)(2)	300	350	400	450	500	550 Volts
DC Output Current	250	250	250	250	200	160 Ma
DC Output Voltage	330	380	430	480	560	640 Volts
Limiting Resistor (Per Plate)	75	100	125	150	175	200 Ohms

Full-Wave Rectifier—Choke Input Filter

AC Plate Supply Voltage (Each Plate, RMS)(2)	300	350	400	450	500	550 Volts
DC Output Current	250	250	250	250	250	225 Ma
DC Output Voltage	250	290	330	375	420	465 Volts
Limiting Resistor (Per Plate)	0	0	0	0	0	0 Ohm
Filter Input Choke	10	10	10	10	10	10 Henrys

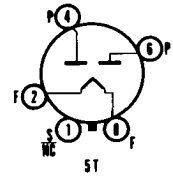
NOTES:

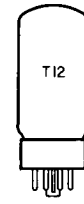
(1) For use with sinusoidal supply voltages within the frequency range of 25 to 1000 Hertz.
(2) AC plate voltage is measured without load.

5AS4A — FULL-WAVE POWER RECTIFIER

Filamentary Twin Diode

Construction .....Octal T-12
Base .....B5-121 or B8-118
Basing[1].....5T
Outline 12-15
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.688 In.
Maximum Overall Height .....4.250 In.





ELECTRICAL DATA

FILAMENT OPERATION

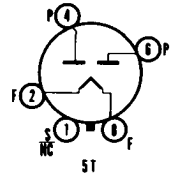
Filament Voltage		5.0 Volts
Filament Current		3000 Ma
RATINGS (Design Center Rating System)		
Rectifier Service[2]		
Peak Inverse Plate Voltage (Max.)		1550 Volts
AC Plate Supply Voltage (Each Plate, RMS) (Max.)		550 Volts
DC Output Current (Each Plate) (Max.)		87.5 Ma
Steady State Peak Plate Current (Each Plate) (Max.)		1000 Ma
Transient Peak Plate Current (Each Plate) (Max.)		4600 Ma
CHARACTERISTICS AND TYPICAL OPERATION		
Full-Wave Rectifier—Capacitor Input Filter		
AC Plate Supply Voltage (Each Plate, RMS)[3]	300	450 Volts
Filter Input Capacitor	40	40 μf
Effective Plate-Supply Resistance (Each Plate)	21	67 Ohms
DC Output Current	300	275 Ma
DC Output Voltage at Filter Input	290	460 Volts
Full-Wave Rectifier—Choke Input Filter		
AC Plate Supply Voltage (Each Plate, RMS)[3]		550 Volts
Filter Input Choke		10 Henrys
DC Output Current		275 Ma
DC Output Voltage at Filter Input		420 Volts
Tube Voltage Drop for Ib = 275 Ma (Each Plate)		50 Volts
300 Ma (Each Plate)		54 Volts

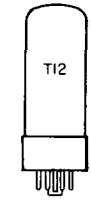
NOTES:
(1) Horizontal Operation is permitted if Pins 1 and 4 are in a vertical plane.
(2) For use with Sinusoidal supply voltages within the frequency range of 25 to 1000 Hertz.
(3) AC plate voltage is measured without load.

5AU4 — FULL-WAVE POWER RECTIFIER

Filamentary Twin Diode

Construction .....Octal T-12
Base .....B8-114 or B8-118
Basing[1].....5T
Outline 12-26
Maximum Diameter .....1.563 In.
Maximum Seated Height .....4.063 In.
Maximum Overall Height .....4.625 In.





ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage	5.0 Volts
Filament Current	3750 Ma
RATINGS (Design Center Rating System)	
Rectifier Service[2]	
Peak Inverse Plate Voltage (Max.)	1400 Volts
AC Plate Supply Voltage (Each Plate, RMS) (Max.)	500 Volts

DC Output Current (Each Plate) (Max.)		105 Ma
Steady State Peak Plate Current (Each Plate) (Max.)		1075 Ma
Transient Peak Plate Current (Each Plate) (Max.)(3)		525 Ma
CHARACTERISTICS AND TYPICAL OPERATION		
Full-Wave Rectifier—Capacitor Input Filter		
AC Plate Supply Voltage (Each Plate, RMS)(4)	300	400 Volts
Filter Input Capacitor	40	40 μf
Effective Plate Supply Resistance (Each Plate)	30	50 Ohms
DC Output Current	350	325 Ma
DC Output Voltage at Filter Input	275	395 Volts
Full-Wave Rectifier—Choke Input Filter		
AC Plate Supply Voltage (Each Plate, RMS)(4)		500 Volts
Filter Input Choke		10 Henrys
DC Output Current		325 Ma
DC Output Voltage at Filter Input		395 Volts
Tube Voltage Drop for Ib = 350 Ma Each Plate		50 Volts

NOTES:

(1) Horizontal operation is permitted if Pins 2 and 4 are in a vertical plane.
(2) For use with sinusoidal supply voltages within the frequency range of 25 to 1000 Hertz.
(3) Maximum duration 0.2 second.
(4) AC plate voltage is measured without load.

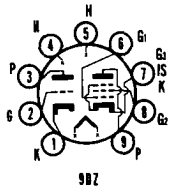
Color Television Type

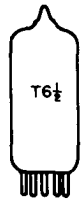
IF/VIDEO/AGC AMP (Triode) OSC/SYNC SEP. (Pentode)

5AV8

Medium Mu Triode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin
Basing	9DZ
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.





ELECTRICAL DATA

HEATER OPERATION	
Heater Voltage	4.7 Volts
Heater Current	600 Ma
Heater Warm-up Time	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 (Unshielded)	
Triode Section	
Grid to Plate	1.5 Pf
Input: g to (h + k)	2.0 Pf
Output: p to (h + k)	0.34 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.04 Pf
Input: g1 to (h + k + g2 + g3 + I.S.)	7.0 Pf
Output: p to (h + k + g2 + g3 + I.S.)	3.0 Pf
Coupling	
Triode Grid to Pentode Plate (Max.)	0.02 Pf
Pentode Grid No. 1 to Triode Plate (Max.)	0.02 Pf
Pentode Plate to Triode Plate (Max.)	0.15 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Grid No. 1 Voltage		
Positive Bias Value (Max.)	0	0 Volt
Plate Dissipation (Max.)	2.8	2.3 Watts

Grid No. 2 Input (Max.)	—	0.55 Watts
Grid No. 1 Circuit Resistance[1]		
Fixed Bias (Max.)	0.5	0.25 Megohms
Cathode Bias (Max.)	1.0	1.0 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Supply Voltage	150	125 Volts
Grid No. 2 Supply Voltage	—	125 Volts
Grid No. 1 Voltage	-3	— Volts
Cathode Bias Resistor	—	56 Ohms
Plate Current	15	12 Ma
Grid No. 2 Current	—	3.8 Ma
Transconductance	4500	7800 μmhos
Amplification Factor	21	—
Plate Resistance (Approx.)	4700	170,000 Ohms
Ec1 for Ib = 20 μa (Approx.)	-17	-6 Volts
Ib with Ec1 = -3 Volts, RK = 0	—	1.6 Ma

NOTE:

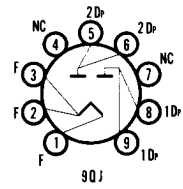
(1) If either section is operating at maximum rated conditions, the grid No. 1 circuit resistance for both sections should not exceed the stated values.

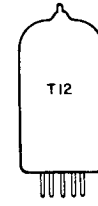
5BC3

FULL-WAVE POWER RECTIFIER

Filamentary Twin Diode

Construction .....Novar T-12
Base .....Large Button 9-Pin, E9-76
Basing[1,2] 9QJ
Outline
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.780 In.
Maximum Overall Height .....4.160 In.





ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage	5.0 Volts
Filament Current	3000 Ma

RATINGS (Design Maximum Rating System)
Rectifier Service[3]

Peak Inverse Plate Voltage (Max.)	1700 Volts
AC Plate Supply Voltage (Each Plate, RMS) (Max.)	600 Volts
Steady State Peak Plate Current (Each Plate) (Max.)	1000 Ma
Transient Peak Plate Current (Each Plate) (Max.)	5000 Ma

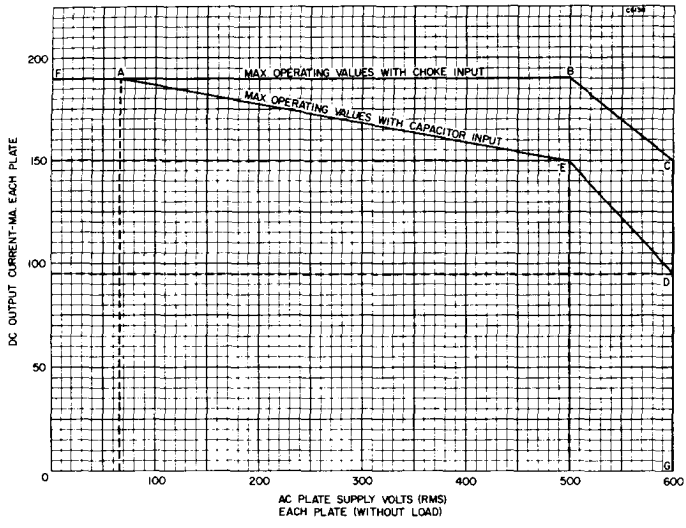
CHARACTERISTICS AND TYPICAL OPERATION

Full-Wave Rectifier—Capacitor Input Filter			
AC Plate Supply Voltage (Each Plate, RMS)[4]	300	450	550 Volts
Filter Input Capacitor	40	40	40 μf
Effective Plate Supply Resistance (Each Plate)	21	67	97 Ohms
DC Output Current	150-300	137.5-275	81-162 Ma
DC Output Voltage at Filter Input	335-290	520-460	680-630 Volts
Full-Wave Rectifier—Choke Input Filter			
AC Plate Supply Voltage (Each Plate, RMS)[4]		450	550 Volts
Filter Input Choke		10	10 Henrys
DC Output Current		174-348	137.5-275 Ma
DC Output Voltage at Filter Input		355-340	455-440 Volts
Tube Voltage Drop for Ib = 275 Ma		—	47 Volts

NOTES:

(1) Horizontal operation is permitted if Pins 2 and 7 are in a vertical plane.
(2) Pins 4 and 7 may be used as tie points for AC line providing peak value does not exceed 200 volts.
(3) For use with sinusoidal supply voltages within the frequency range of 25 to 1000 hertz.
(4) AC plate voltage is measured without load.

RATING CHART (5BC3)

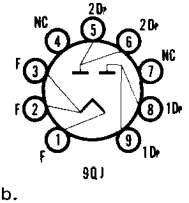


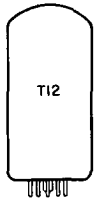
FULL-WAVE POWER RECTIFIER — 5BC3A

Filamentary Twin Diode

Construction	Novar T-12
Base	Large Button 9 Pin, E9-88 (Exhaust Tip on Base)
Basing	9QJ
Outline	12-99
Maximum Diameter	1.563 In.
Maximum Seated Height	3.500 In.
Maximum Overall Height	3.880 In.

The 5BC3A is identical to the 5BC3 except for base with exhaust tip at bottom and shorter bulb.

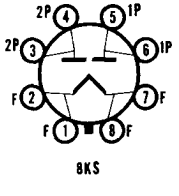


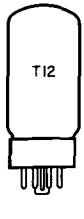


FULL-WAVE POWER RECTIFIER — 5DJ4

Filamentary Twin Diode

Construction	Octal T-12
Base	Octal 8 Pin, B8-118
Basing[1]	8KS
Outline	12-16
Maximum Diameter	1.563 In.
Maximum Seated Height	4.063 In.
Maximum Overall Height	4.625 In.





ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage	5.0 Volts
Filament Current	3000 Ma

RATINGS (Design Maximum Rating System)
Rectifier Service(2)

Peak Inverse Plate Voltage (Max.)		1700 Volts
AC Plate Supply Voltage (Each Plate, RMS) (Max.)		600 Volts
Steady State Peak Plate Current (Each Plate) (Max.)		1000 Ma
Transient Peak Plate Current (Each Plate) (Max.)		5000 Ma

CHARACTERISTICS AND TYPICAL OPERATION
Full-Wave Rectifier—Capacitor Input Filter

AC Plate Supply Voltage (Each Plate, RMS)(3)	300	450 Volts
Filter Input Capacitor	40	40 μf
Effective Plate-Supply Resistance (Each Plate)	21	67 Ohms
DC Output Current	300	275 Ma
DC Output Voltage at Filter Input	290	460 Volts

Full-Wave Rectifier—Choke Input Filter

AC Plate Supply Voltage (Each Plate, RMS)(3)	550 Volts
Filter Input Choke	10 Henrys
DC Output Current	275 Ma
DC Output Voltage at Filter Input	420 Volts
Tube Voltage Drop for Ib = 225 Ma (Each Plate)	44 Volts
275 Ma (Each Plate)	50 Volts
300 Ma (Each Plate)	54 Volts

NOTES:
(1) Horizontal operation is permitted if Pins 2 and 4 are in a vertical plane.
(2) For use with sinusoidal supply voltages within the frequency range of 25 to 1000 Hertz.
(3) AC plate voltage is measured without load.

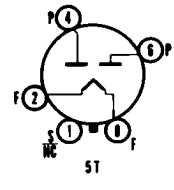
5U4GB

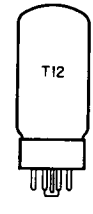
Color Television Type

FULL-WAVE POWER RECTIFIER

Filamentary Twin Diode

Construction	Octal T-12
Base	B5-121, B5-127 or B8-118
Basing(1)	5T
Outline	12-16
Maximum Diameter	1.563 In.
Maximum Seated Height	4.063 In.
Maximum Overall Height	4.625 In.





ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage	5.0 Volts
Filament Current	3000 Ma

RATINGS (Design Center Rating System)
Rectifier Service(2)

Peak Inverse Plate Voltage (Max.)	1550 Volts
AC Plate Supply Voltage (Each Plate, RMS) (Max.)	550 Volts
Steady State Peak Plate Current (Each Plate) (Max.)	1.0 Amperes
Transient Peak Plate Current (Each Plate) (Max.)	4.6 Amperes

CHARACTERISTICS AND TYPICAL OPERATION
Full-Wave Rectifier—Capacitor Input Filter

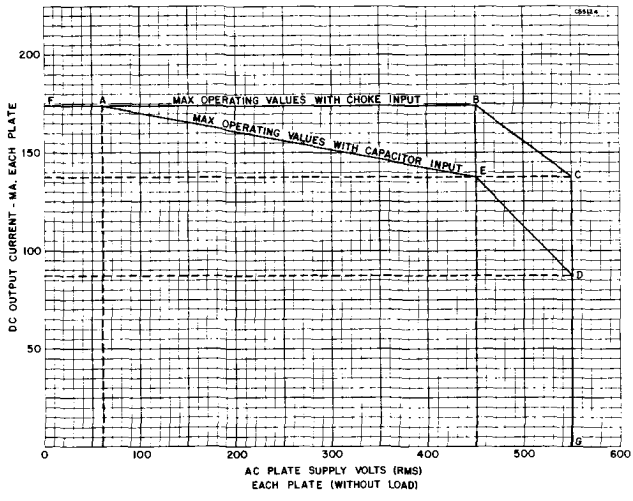
AC Plate Supply Voltage (Each Plate, RMS)(3)	300	450 Volts
Filter Input Capacitor	40	40 μf
Effective Plate-Supply Resistance (Each Plate)	21	67 Ohms
DC Output Current	300	275 Ma
DC Output Voltage at Filter Input	290	460 Volts

Full-Wave Rectifier—Choke Input Filter

AC Plate Supply Voltage (Each Plate, RMS)(3)	550 Volts
Filter Input Choke	10 Henrys
DC Output Current	275 Ma
DC Output Voltage at Filter Input	420 Volts
Tube Voltage Drop for Ib = 225 Ma (Each Plate)	44 Volts
275 Ma (Each Plate)	50 Volts
300 Ma (Each Plate)	54 Volts

NOTES:
(1) Horizontal operation is permitted if Pins 1 and 4 are in a vertical plane.
(2) For use with sinusoidal supply voltages within the frequency range of 25 to 1000 Hertz.
(3) AC plate voltage is measured without load.

RATING CHART (5U4GB)



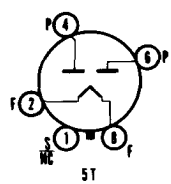
Color Television Type

FULL-WAVE POWER RECTIFIER

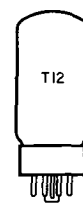
5V3A

Filamentary Twin Diode

Construction .....Octal T-12
Base .....B8-110, B5-121 or B8-118
Basing(1).....5T
Outline 12-16
Maximum Diameter .....1.563 In.
Maximum Seated Height .....4.063 In.
Maximum Overall Height .....4.625 In.



5T



ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage		5.0 Volts
Filament Current		3000 Ma

RATINGS (Design Maximum Rating System)

Rectifier Service(2)

Peak Inverse Plate Voltage (Max.)		1550 Volts
AC Plate Supply Voltage (Each Plate RMS) (Max.)		550 Volts
DC Output Current (Condenser Input) (Max.)		415 Ma
Steady State Peak Plate Current (Each Plate) (Max.)		1400 Ma
Transient Peak Plate Current (Each Plate) (Max.)		6600 Ma
Bulb Temperature at Hottest Point		240 °C

CHARACTERISTICS AND TYPICAL OPERATION

Full-Wave Rectifier—Capacitor Input Filter

AC Plate Supply Voltage (Each Plate RMS)(3)	300	425 Volts
Filter Input Capacitor	40	40 μf
Effective Plate Supply Resistance (Each Plate)	20	50 Ohms
DC Output Current	380	350 Ma
DC Output Voltage at Filter Input	300	440 Volts

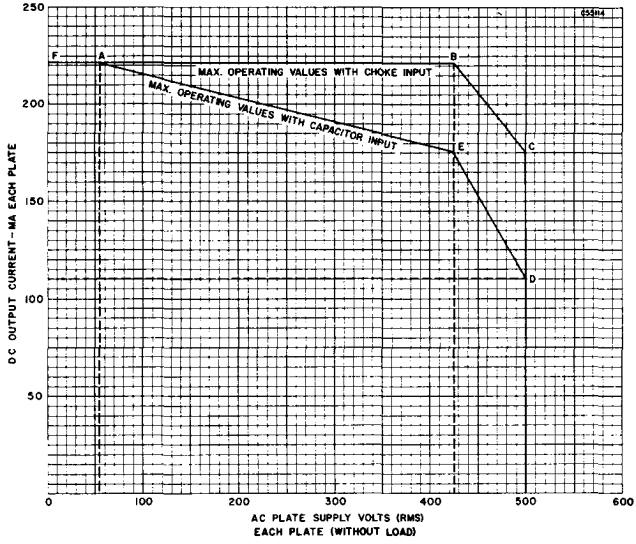
Full-Wave Rectifier—Choke Input Filter

AC Plate Supply Voltage (Each Plate RMS)(3)		500 Volts
Filter Input Choke		10 Henrys
DC Output Current		350 Ma
DC Output Voltage at Filter Input		390 Volts
Tube Voltage Drop for Ib = 350 Ma (Each Plate)		42 Volts

NOTES:

(1) Horizontal operation is permitted if Pins 2 and 4 are in a vertical plane.
(2) For use with sinusoidal supply voltages within the frequency range of 25 to 1000 Hertz.
(3) AC plate voltage is measured without load.

RATING CHART (5V3A)

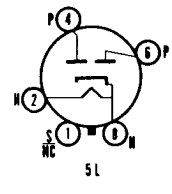


5V4GA

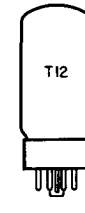
FULL-WAVE POWER RECTIFIER

Heater-Cathode Twin Diode

Construction	Octal T-12
Base	5 Pin, B5-15
Basing	5L
Outline	12-14
Maximum Diameter	1.563 In.
Maximum Seated Height	3.313 In.
Maximum Overall Height	3.875 In.



5L



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	5.0 Volts
Heater Current	2000 Ma

RATINGS (Design Maximum Rating System)

Rectifier Service(1)

Peak Inverse Plate Voltage (Max.)	1400 Volts
Steady State Peak Plate Current (Each Plate) (Max.)	525 Ma
Transient Peak Plate Current (Each Plate) (Max.)	3500 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Full-Wave Rectifier—Capacitor Input Filter

AC Plate Supply Voltage (Each Plate RMS)(2)	375 Volts
Filter Input Capacitor	10 μf
Effective Plate Supply Resistance (Each Plate)	100 Ohms
DC Output Current	175 Ma
DC Output Voltage at Filter Input	410 Volts

Full-Wave Rectifier—Choke Input Filter

AC Plate Supply Voltage (Each Plate RMS)(2)	500 Volts
Filter Input Choke (Min.)	4 Henrys
DC Output Current	175 Ma
DC Output Voltage at Filter Input	410 Volts
Tube Voltage Drop for Ib = 175 Ma (Each Plate)	25 Volts

NOTES:

(1) For use with sinusoidal supply voltages within the frequency range of 25 to 1000 Hertz.
(2) AC plate voltage is measured without load.

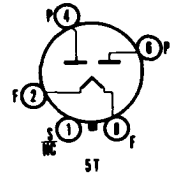
Color Television Type

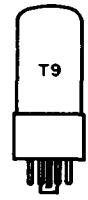
FULL-WAVE POWER RECTIFIER

5Y3GT

Filamentary Twin Diode

Construction .....Octal T-9
Base.....5 Pin, B5-10 or B5-62
Basing(1).....5T
Outline .....9-13 or 9-42
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.813 In.
Maximum Overall Height .....3.375 In.





ELECTRICAL DATA

FILAMENT OPERATION

Filament Voltage	5.0 Volts
Filament Current	2000 Ma

RATINGS (Design Maximum Rating System)

Rectifier Service(2)

Peak Inverse Plate Voltage (Max.)	1400 Volts
AC Plate Supply Voltage (Each Plate) (Max.)(2)	500 Volts
DC Output Current (Each Plate) (Condenser Input) (Max.)	42 Ma
Steady State Peak Plate Current (Each Plate) (Max.)	400 Ma
Transient Peak Plate Current (Each Plate) (Max.)	2.2 Amperes
Tube Voltage Drop for Ib = 125 Ma (Each Plate)	60 Volts

CHARACTERISTICS AND TYPICAL OPERATION

Full-Wave Rectifier Service—Capacitor Input Filter

AC Plate Supply Voltage (Each Plate RMS)(3)	350 Volts
Input Capacitor	10 μf
Effective Plate Supply Impedance (Each Plate)	50 Ohms
DC Output Current	125 Ma
DC Output Voltage	350 Volts

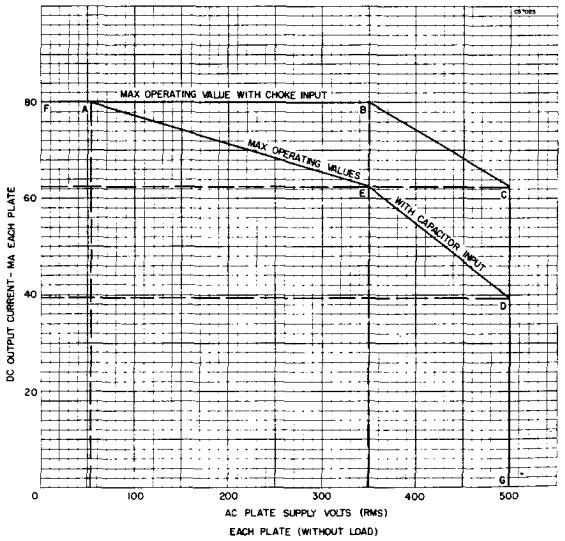
Full-Wave Rectifier Service—Choke Input Filter

AC Plate Supply Voltage (Each Plate RMS)(3)	500 Volts
Input Choke	10 Henrys
DC Output Current	125 Ma
DC Output Voltage	390 Volts

NOTES:

(1) Horizontal operation permitted if Pins 2 and 4 are in a vertical plane.
(2) For use with sinusoidal supply voltages within the frequency range of 25 to 1000 Hertz.
(3) AC plate voltage is measured without load.

RATING CHART

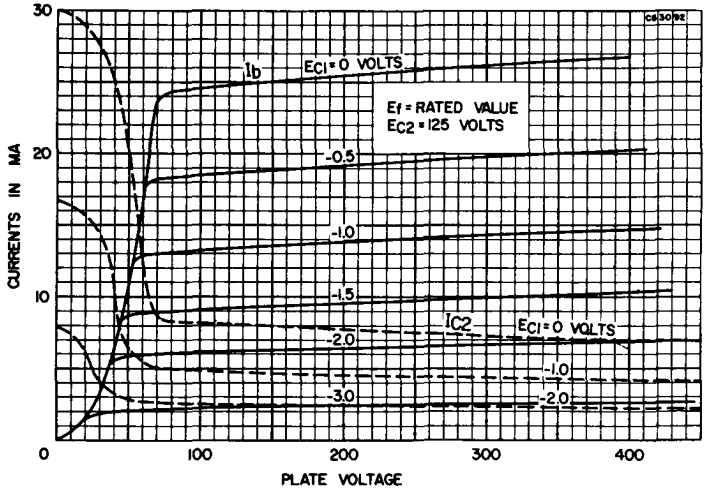


Positive Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	2.5 Watts
Grid No. 2 Dissipation (Max.)	0.55 Watt
Grid No. 1 Circuit Resistance	
Self Bias (Max.)	1.0 Megohm
Fixed Bias (Max.)	0.25 Megohm
Diode Section (Each Diode)	
Continuous Diode Current (Max.)	5.0 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Pentode Section	
Plate Voltage	125 Volts
Grid No. 2 Voltage	125 Volts
Grid No. 1 Voltage	−1 Volt
Plate Current	12 Ma
Grid No. 2 Current	4.5 Ma
Transconductance	10,000 μmhos
Plate Resistance (Approx.)	150,000 Ohms
Grid No. 1 Voltage for Ib = 20 μa (Approx.)	−7 Volts
Diode Section (Each Diode)	
Tube Voltage Drop for Ib = 50 Ma	10 Volts

AVERAGE PLATE CHARACTERISTICS



6AC10

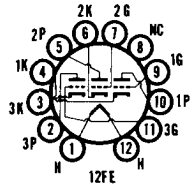
8AC10

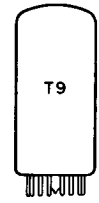
Color Television Type

COLOR MATRIX AMPLIFIER

Medium Mu Triple Triode

Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12FE
Outline	9-59
Maximum Diameter	1.188 In.
Maximum Seated Height	2.000 In.
Maximum Overall Height	2.375 In.





ELECTRICAL DATA

HEATER OPERATION	**8AC10 Series**	**6AC10 Parallel**	**6AC10 Series**
Heater Voltage	8.4	6.3 ± 0.6	6.3 Volts
Heater Current	450	0.6	600 Ma
Heater Warm-up Time	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 (Unshielded)

	Section No. 1	Section No. 2	Section No. 3
Grid to Plate	1.3	1.2	1.2 Pf
Input	2.4	2.6	2.6 Pf
Output	0.22	0.30	0.44 Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	330 Volts
Plate Dissipation (Max.)	2.0 Watts
Grid Circuit Resistance (Max.)	0.5 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	200 Volts
Cathode-Bias Resistor	150 Ohms
Amplification Factor	62
Plate Resistance (Approx.)	10,700 Ohms
Transconductance	5800 μmhos
Plate Current	9.0 Ma
Grid Voltage for Ib = 100 μa	−5 Volts

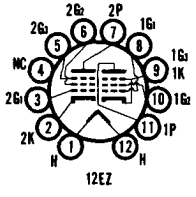
Color Television Type

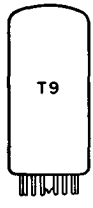
AUDIO POWER AMPLIFIER FM DETECTOR

6AD10

Beam Pentode and Sharp Cutoff Pentode

Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12EZ
Outline	9-59
Maximum Diameter	1.188 In.
Maximum Seated Height	2.000 In.
Maximum Overall Height	2.375 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1050 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 (Power Amplifier)

Grid to Plate	0.26 Pf
Input: g to (h + 1k + 1g2 + 1g3 + IS)	11.0 Pf
Output: p to (h + 1k + 1g2 + 1g3 + IS)	11.0 Pf

Section No. 2 (FM Detector)

Grid No. 1 to Plate (Max.)	0.024 Pf
Grid No. 3 to Plate	3.4 Pf
Grid No. 1 to (h + 2k + 2g2 + 2g3 + IS)	8.0 Pf
Grid No. 3 to (h + 2k + 2g1 + 2g2 + 2p + IS)	9.5 Pf
Grid No. 1 to Grid No. 3	0.12 Pf
Plate No. 1 to Plate No. 2	0.34 Pf

RATINGS (Design Maximum Rating System)

Section No. 1 (Power Amplifier)

Plate Voltage	275 Volts
Screen Voltage	275 Volts
Plate Dissipation	10 Watts
Screen Dissipation	2.0 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias	0.25 Megohm
Cathode Bias	0.5 Megohm

Section No. 2 (FM Detector)

Plate Voltage	300 Volts

Suppressor Voltage	-100 to +25 Volts
Screen Supply Voltage	300 Volts
Positive DC Grid Voltage	0 Volt
Plate Dissipation	1.7 Watts
Screen Dissipation	1.0 Watt
Grid No. 3 Dissipation	0.1 Watt
Grid No. 3 Circuit Resistance	0.68 Megohm
Grid No. 1 Circuit Resistance	
Fixed Bias	0.22 Megohm
Cathode Bias	0.47 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Section No. 1 (Power Amplifier)

Class A1 Amplifier

Plate Voltage	250 Volts
Screen Voltage	250 Volts
Grid No. 1 Voltage	-8.0 Volts
Peak AF Grid Voltage	8.0 Volts
Plate Resistance (Approx.)	100,000 Ohms
Transconductance	6500 μmhos
Zero Signal Plate Current	35 Ma
Maximum Signal Plate Current	39 Ma
Zero Signal Screen Current	2.5 Ma
Maximum Signal Screen Current	7.0 Ma
Load Resistance	5000 Ohms
Total Harmonic Distortion (Approx.)	10 Percent
Maximum Signal Power Output	4.2 Watts

Section No. 2 (FM Detector)

Plate Voltage	150 Volts
Suppressor Voltage	0 Volt
Screen Voltage	100 Volts
Cathode Resistor	180 Ohms
Plate Resistance (Approx.)	110,000 Ohms
Transconductance (G1)	3400 μmhos
Transconductance (G3)	600 μmhos
Plate Current	2.8 Ma
Screen Current	3.4 Ma
Ec1 for Ib = 20 μa	-4.5 Volts
Ec3 for Ib = 20 μa	-7 Volts

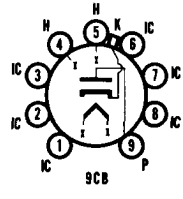
6AF3

12AF3

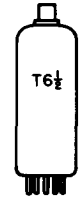
DAMPER

Heater-Cathode Diode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Top Cap	C1-1
Basing	9CB
Outline	6-8
Maximum Diameter	0.875 In.
Maximum Seated Height	3.000 In.
Maximum Overall Height	3.281 In.



9CB



ELECTRICAL DATA

HEATER OPERATION

	12AF3 Series	6AF3 Parallel
Heater Voltage	12.6	6.3 Volts
Heater Current	600	1200 Ma
Heater Warm-up Time	11	— Seconds
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
DC		1000 Volts
Total DC and Peak		4500 Volts
Heater Positive with Respect to Cathode		
DC		100 Volts
Total DC and Peak		300 Volts

DIRECT INTERELECTRODE CAPACITANCES

Heater to Cathode	2.8 Pf
Plate to Cathode and Heater	6.0 Pf
Cathode to Plate and Heater	9.0 Pf

RATINGS (Design Maximum Rating System)
Damper Service

Peak Inverse Plate Voltage (Max.)(1)	4500 Volts
Plate Dissipation (Max.)	6.0 Watts
Steady State Peak Current (Max.)	750 Ma
DC Plate Current (Max.)	185 Ma
Bulb Temperature (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 350 Ma	25 Volts

NOTE:
(1) 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 horizontal scanning cycle.

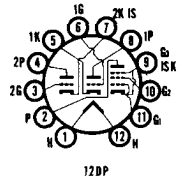
AGC KEYER, SYNC SEPARATOR AND VIDEO AMPLIFIER

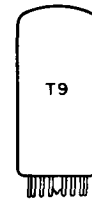
6AF11

10AF11, 12AF11, 15AF11

Hi Mu Triode, Medium Mu Triode and Sharp Cutoff Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12DP
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.250 In.
Maximum Overall Height .....2.625 In.





ELECTRICAL DATA

HEATER OPERATION

	15AF11 Series	12AF11 Series	10AF11 Series	6AF11 Parallel	
Heater Voltage	14.7	12.6	9.8	6.3	Volts
Heater Current	450	450	600	1050	Ma
Heater Warm-up Time	11	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 (Unshielded)

Triode No. 1		
Grid to Plate	1.9	Pf
Input: 1Tg1 to (1Tk + 2Tk + Pk + Pg3 + h + IS)	3.0	Pf
Output: 1Tp to (1Tk + 2Tk + Pk + Pg3 + h + IS)	2.2	Pf
Triode No. 2		
Grid to Plate	3.6	Pf
Input: 2Tg1 to (2Tk + Pk + Pg3 + h + IS)	2.4	Pf
Output: 2Tp to (2Tk + Pk + Pg3 + h + IS)	3.8	Pf
Pentode		
Grid to Plate	0.12	Pf
Input: Pg1 to (2Tk + Pk + Pg2 + Pg3 + h + IS)	10.0	Pf
Output: Pp to (2Tk + Pk + Pg2 + Pg3 + h + IS)	4.5	Pf
Coupling		
Pentode Plate to Triode No. 2 Plate (Max.)	0.045	Pf
Triode No. 1 Plate to Triode No. 2 Plate (Max.)	0.06	Pf

RATINGS (Design Maximum Rating System)

Triode No. 1		
Plate Voltage (Max.)	330	Volts
Positive DC Grid Voltage (Max.)	0	Volt
Plate Dissipation (Max.)	1.1	Watts
Grid Circuit Resistance		
Fixed Bias (Max.)	0.5	Megohm
Cathode Bias (Max.)	1.0	Megohm
Triode No. 2		
Plate Voltage (Max.)	330	Volts
Positive DC Grid Voltage (Max.)	0	Volt
Plate Dissipation (Max.)	2.0	Watts

Grid Circuit Resistance	
Fixed Bias (Max.)	0.5 Megohm
Cathode Bias (Max.)	1.0 Megohm
Pentode	
Plate Voltage (Max.)	330 Volts
Screen Supply Voltage (Max.)	330 Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)
Positive DC Grid No. 1 Voltage	0 Volt
Plate Dissipation	5.0 Watts
Screen Dissipation	1.25 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias	0.25 Megohm
Cathode Bias	1.0 Megohm
CHARACTERISTICS AND TYPICAL OPERATION	
Triode No. 1	
Plate Voltage	200 Volts
Grid Voltage	−2.0 Volts
Amplification Factor	68
Plate Resistance (Approx.)	12,400 Ohms
Transconductance	5500 μmhos
Plate Current	7.0 Ma
Grid Voltage (Approx.)	
Ib = 10 μa	−5.5 Volts
Triode No. 2	
Plate Voltage	200 Volts
Cathode-Bias Resistor	220 Ohms
Amplification Factor	41
Plate Resistance (Approx.)	9400 Ohms
Transconductance	4400 μmhos
Plate Current	9.2 Ma
Grid Voltage (Approx.)	
Ib = 10 μa	−6.5 Volts

Pentode Section		
Plate Voltage	50	200 Volts
Screen Voltage	150	150 Volts
Grid No. 1 Voltage	0	— Volts
Cathode-Bias Resistor	—	100 Ohms
Plate Resistance (Approx.)	—	68,000 Ohms
Transconductance	—	11,000 μmhos
Plate Current	55	24 Ma
Screen Current	18	4.8 Ma
Grid No. 1 Voltage (Approx.)		
Ib = 100 μa	—	−10 Volts

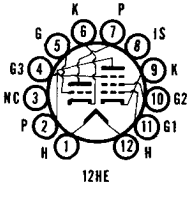
6AG9

Color Television Type

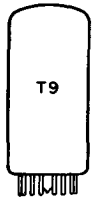
AGC AMPLIFIER AND VIDEO AMPLIFIER

Triode and Frame Grid Pentode

Construction	*Compactron T-9*
Base	Button 12 Pin, E12-70
Basing	12HE
Outline	9-59
Maximum Diameter	1.188 In.
Maximum Seated Height	2.250 In.
Maximum Overall Height	2.625 In.



12HE



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	*820 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)

Triode	
Grid to Plate	2.8 Pf
Input: Tg to (h + Tk + IS)	3.6 Pf
Output: Tp to (h + Tk + IS)	2.2 Pf

Pentode

Grid No. 1 to Plate	0.16 Pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + IS)	17 Pf
Output: Pp to (h + Pk + Pg2 + Pg3 + IS)	6.5 Pf

RATINGS (Design Maximum Rating System)

	Pentode Section	Triode Section
Plate Voltage (Max.)	330	330 Volts
Screen Voltage (Max.)	200	— Volts
Positive DC Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	10	1.1 Watts
Screen Dissipation (Max.)	1.5	— Watts
Grid No. 1 Circuit Resistance		
With Fixed Bias (Max.)	0.1	0.5 Megohm
With Cathode Bias (Max.)	0.25	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Pentode Section		Triode Section
Plate Voltage	55	250	150 Volts
Screen Voltage	125	150	— Volts
Grid No. 1 Voltage	0	—	— Volt
Cathode-Bias Resistor	—	56	350 Ohms
Amplification Factor	—	—	39
Plate Resistance (Approx.)	—	40,000	8500 Ohms
Transconductance	—	30,000	4600 μmhos
Plate Current	56	28	6.2 Ma
Screen Current	21	5.6	— Ma
Grid No. 1 Voltage (Approx.)			
Ib = 20 μa	—	—	-7 Volts
Grid No. 1 Voltage (Approx.)			
Ib = 100 μa	—	-5.4	— Volts

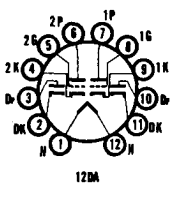
FM STEREO MULTIPLEXER

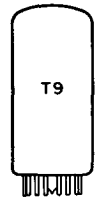
6AG11

30AG11

Double Diode, Twin Triode

Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12DA
Outline	9-56
Maximum Diameter	1.188 In.
Maximum Seated Height	1.500 In.
Maximum Overall Height	1.875 In.





ELECTRICAL DATA

HEATER OPERATION

	30AG11 Series	6AG11 Parallel
Heater Voltage	30	6.3 Volts
Heater Current	150	750 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)

Triode (Each Section)

Grid to Plate	1.8 Pf
Input: g to (h + k)	3.8 Pf
Output: p to (h + k)	0.24 Pf

Diode (Each Section)

Plate to Cathode and Heater	2.2 Pf
Cathode to Plate and Heater	5.5 Pf

Coupling

Triode Grid to Diode Plate (Max.)	0.1 Pf
No. 1 Triode Grid to No. 2 Triode Grid (Max.)	0.01 Pf
No. 1 Triode Plate to No. 2 Triode Plate	0.5 Pf

RATINGS (Design Maximum Rating System)

Triode (Each Section)

Plate Voltage (Max.)	330 Volts
Plate Dissipation (Max.)	2.0 Watts

Diode (Each Section)

Diode Current (Continuous Operation) (Max.)	5.0 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Triode (Each Section)

Plate Voltage	125 Volts
Grid Voltage	−1.0 Volt
Amplification Factor	66
Plate Resistance	8500 Ohms
Transconductance	7800 μmhos
Plate Current	7.5 Ma
Grid Voltage for Ib = 30 μa	−5 Volts

Diode (Each Section)

Average Diode Current for Eb = 5 Volts	18 Ma

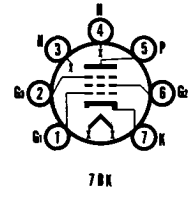
6AH6

Color Television Type

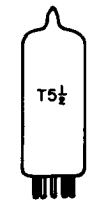
RF/IF/AMPLIFIER

Sharp Cutoff Pentode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7BK
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7BK



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 Ma
Maximum Heater-Cathode Voltage	
Heater Negative With Respect to Cathode	
Total DC and Peak	100 Volts
Heater Positive With Respect to Cathode	
Total DC and Peak	100 Volts

DIRECT INTERELECTRODE CAPACITANCES (Shielded)

Grid No. 1 to Plate (Max.)	0.02 Pf
Input: g1 to (h + k + g2 + g3)	10 Pf
Output: p to (h + k + g2 + g3)	3.6 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	300 Volts
Grid No. 2 Supply Voltage (Max.)	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	3.2 Watts
Grid No. 2 Dissipation (Max.)	0.4 Watt
Cathode Current (Max.)	13 Ma

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Conn.	Pentode Conn.
Plate Voltage	150	300 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket	
Grid No. 2 Voltage	—	150 Volts
Cathode Bias Resistor	160	160 Ohms
Plate Current	12.5	10 Ma
Grid No. 2 Current	—	2.5 Ma
Transconductance	11,000	9000 μmhos
Amplification Factor	40	—
Plate Resistance (Approx.)	3600	500K Ohms
Ec1 for Ib = 10 μa (Approx.)	−7	−7

Color Television Type

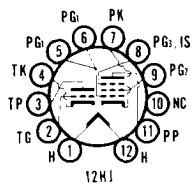
VIDEO AMPLIFIER AND COLOR BLANKER

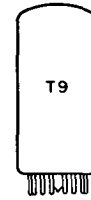
6AH9

9AH9

Medium Mu Triode and Sharp Cutoff Frame Grid Pentode

Construction.....Compactron T-9
Base E12-70
Basing 12HJ
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.





ELECTRICAL DATA

HEATER OPERATION	9AH9	6AH9
Heater Voltage	8.8	6.3 Volts
Heater Current	600	900 Ma
Heater Warm-up Time	—	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 (Without Shield)

Pentode Section	
Grid 1 to Plate: (g1 to P)	0.15 pf
Input: g1 to (h + k + g2 + g3, I.S.)	15.0 pf
Output: p to (h + k + g2 + g3, I.S.)	6.0 pf
Triode Section	
Grid to Plate: (g to p)	3.7 pf
Input: g to (h + k)	2.4 pf
Output: p to (h + k)	0.4 pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
DC Plate Voltage (Max.)	330	400 Volts
Positive DC Grid 3 Voltage (Max.)	—	0 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive DC Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	2.0	10.0 Watts
Grid No. 2 Dissipation (Max.)	—	1.0 Watt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	1.0	0.1 Megohm
Self Bias (Max.)	—	0.25 Megohm

Note: Control grid to cathode spacing on 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 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

	Triode Section	Pentode Section	
Plate Supply Voltage	250	250	50 Volts
Grid No. 2 Supply Voltage	—	150	125 Volts
Grid No. 1 Voltage	−9	0	0 Volts
Grid No. 3 Voltage (Referred to Negative end of Rk)	—	0	0 Volt
Cathode Resistor (Bypassed)	—	122	0 Ohms
Plate Current	8	25	76 Ma
Grid No. 2 Current	—	6	32(1) Ma
Transconductance (Grid No. 1 to Plate)	2750	21,000	— μmhos
Plate Resistance (Approx.)	7300	55,000	— Ohms
Amplification Factor	20	—	—
Grid No. 1 Voltage, Approx. for Ib = 100 μa (Rk = 0)	−18	−7.2	— Volts

NOTE:

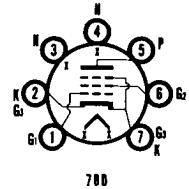
(1) Current drawn only for short intervals so as not to damage the tube.

6AK5/EF95

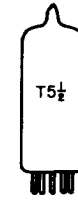
RF AMPLIFIER

Sharp Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin
Basing 7BD
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.500 In.
Maximum Overall Height .....1.750 In.



7BD



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	175 Ma
Maximum Heater-Cathode Voltage	90 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded(1)	Unshielded
Grid to Plate	0.02	0.03 Pf
Input	4.0	4.0 Pf
Output	2.8	2.1 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	180 Volts
Plate Dissipation (Max.)	1.7 Watts
Screen Voltage (Max.)	140 Volts
Screen Dissipation (Max.)	0.5 Watt
Screen Supply Voltage (Max.)	180 Volts
Positive Control Grid Voltage (Max.)	0 Volt
Cathode Current (Max.)	18 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	120	180 Volts
Screen Voltage	120	120 Volts
Cathode Bias Resistor(2)	180	180 Ohms
Plate Current	7.5	7.7 Ma
Screen Current	2.5	2.4 Ma
Transconductance	5000	5100 μmhos
Plate Resistance (Approx.)	0.30	0.50 Megohm

NOTES:

(1) Shield No. 316 connected to cathode.
(2) Fixed bias operation is not recommended.

6AK10

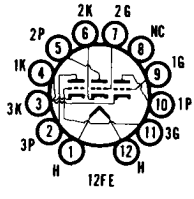
9AK10

Color Television Type

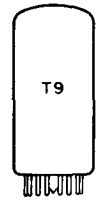
COLOR DIFFERENCE AMPLIFIER

Triple Triode

Construction .....Compactron T-9
Base E12-70
Basing 12FE
Outline 9-59
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.250 In.
Maximum Overall Height .....2.625 In.



12FE



ELECTRICAL DATA

HEATER OPERATION

	9AK10	6AK10
Heater Voltage	9.5	6.3 Volts
Heater Current	600	900 Ma
Heater Warm-up Time	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 (Unshielded)

	Section 1	Section 2	Section 3
Grid to Plate	3.2	3.0	3.0 pf
Input: (G to K and H)	4.2	4.2	4.2 pf
Output: (P to K and H)	0.3	0.4	0.54 pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage	330 Volts
Grid Voltage	
Positive Bias Value	0 Volt
Plate Dissipation	2 Watts
Grid Circuit Resistance	
Fixed Bias	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION (Each Section)

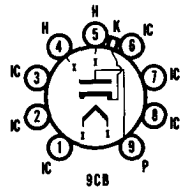
Plate Voltage	200 Volts
Plate Current	10 Ma
Amplification Factor	53
Plate Resistance (Approx.)	7500 Ohms
Transconductance	7000 μmhos
Ec1 for Ib = 100 μa	−7 Volts

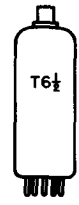
DAMPER

6AL3/EY88

Heater-Cathode Diode

Construction .....Miniature T-6½
Base E9-1
Top Cap C1-2
Basing 9CB
Outline 6-101
Maximum Diameter .....0.875 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.500 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1550 Ma
Maximum Heater-Cathode Voltage	6600 Volts

DIRECT INTERELECTRODE CAPACITANCES

Plate to All Other Elements	8.6 Pf
Cathode to Heater	2.0 Pf

RATINGS (Design Center Rating System)

Damper Service(1)

Peak Inverse Plate Voltage (Absolute Max.)	7500 Volts
Peak Plate Current	550 Ma
DC Plate Current	220 Ma
Plate Dissipation	5 Watts

NOTE:

(1) 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 not to exceed 15% of a horizontal scanning cycle.

Color Television Type

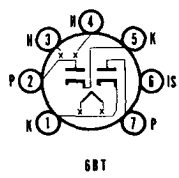
FM or TV DETECTOR

6AL5

3AL5, 12AL5

High Perveance Twin Diode

Construction .....Miniature T-5½
Base .....Button 7 Pin
Basing 6BT
Outline 5-1
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.500 In.
Maximum Overall Height .....1.750 In.





ELECTRICAL DATA

HEATER OPERATION

	3AL5	6AL5	12AL5
Heater Voltage	3.15	6.3	12.6 Volts
Heater Current	600	300	150 Ma
Heater Warm-up Time	11	—	— Seconds
Maximum Heater-Cathode Voltage	200	330	330 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded (1)	Unshielded
Plate Input (Each Section)	3.2	2.5 Pf
Plate to Plate	0.026	0.068 Pf
Cathode Input (Each Section)	3.6	3.4 Pf

RATINGS (Design Maximum Rating System)

Peak Inverse Plate Voltage (Max.)	330 Volts
Peak Plate Current Each Plate (Max.)	54 Ma
DC Output Current Each Plate (Max.)	9.0 Ma
AC Plate Voltage (Per Plate) (Max.)	117 Volts
Effective Plate Supply Impedance (Each Plate) (Min.)	300 Ohms

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 60 Ma	10 Volts

NOTE:
(1) Shield No. 316 connected to Pin No. 6.

6AL9

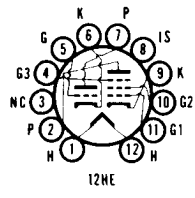
8AL9

Color Television Type

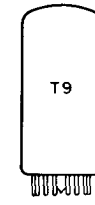
GENERAL PURPOSE AMPLIFIER (T) VIDEO AMPLIFIER (P)

High Mu Triode and Sharp Cutoff Pentode

Construction.....Compactron T-9
Base E12-70
Basing 12HE
Outline 9-59
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.250 In.
Maximum Overall Height .....2.625 In.



12HE



ELECTRICAL DATA

HEATER OPERATION

	6AL9	8AL9
Heater Voltage	6.3	8.6 Volts
Heater Current	820	600 Ma
Heater Warm-up Time	—	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 (Unshielded)

Triode Section	
Grid to Plate	2.8 pf
Input: g to (h + Tk + Pk, g3, I.S.)	3.6 pf
Output: p to (h + Tk + Pk, g3, I.S.)	2.2 pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.16 pf
Input: g1 to (h + Pk, g3, I.S. + g2)	17 pf
Output: p to (h + Pk, g3, I.S. + g2)	6.4 pf

RATINGS (Design Maximum Values)

	Triode Section	Pentode Section
Plate Voltage	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	200 Volts
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid No. 2 Dissipation (Max.)	—	1.5 Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.1 Megohm
Cathode Bias (Max.)	1.0	0.25 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section	
Plate Voltage	200	55	250 Volts
Grid No. 1 Voltage	—	0	— Volt
Grid No. 2 Voltage	—	125	150 Volts
Cathode Bias Resistor	270	—	56 Ohms
Plate Current	7.6	56	28 Ma
Grid No. 2 Current	—	21	5.6 Ma
Transconductance	6300	—	30,000 μmhos
Amplification Factor	59	—	—
Plate Resistance (Approx.)	9200	—	40,000 Ohms
Ec1 for Ib = 100 μa (Approx.)	−63	—	−5.4 Volts

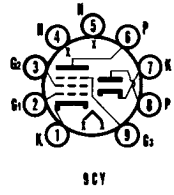
VIDEO DETECTOR AND IF AMPLIFIER

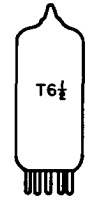
6AM8A

5AM8

Diode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9CY
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.938 In.
Maximum Overall Height .....2.188 In.





ELECTRICAL DATA

HEATER OPERATION

	5AM8 Series	6AM8A Parallel
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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 (Shielded)(1)		
Pentode		
Grid to Plate (Max.)		0.015 Pf
Input		6.0 Pf
Output		3.4 Pf
Diode		
Input: p to (h + k)		2.3 Pf
Cathode to (h + p)		3.0 Pf
Coupling		
Diode Plate to Pentode Plate		0.035 Pf
Diode Plate to Pentode Grid No. 1		0.005 Pf
Diode Cathode to Pentode Plate		0.15 Pf
RATINGS (Design Center Rating System)		
Pentode		
Plate Voltage (Max.)		330 Volts
Plate Dissipation (Max.)		3.2 Watts
Grid No. 2 Voltage		See Rating Chart (Gen. Info. Sec.)
Grid No. 2 Supply Voltage (Max.)		330 Volts
Grid No. 2 Dissipation (Max.)		0.55 Watt
Positive Grid No. 1 Voltage (Max.)		0 Volt
Grid No. 3 Voltage (Max.)		0 Volt
Grid No. 1 Circuit Resistance		
Cathode Bias (Max.)		1.0 Megohm
Fixed Bias (Max.)		0.25 Megohm
Diode		
Diode Current for Continuous Operation (Max.)		5.0 Ma
CHARACTERISTICS AND TYPICAL OPERATION		
Pentode		
Plate Voltage		125 Volts
Grid No. 2 Voltage		125 Volts
Cathode Resistor		56 Ohms

Plate Current	12.5 Ma
Grid No. 2 Current	3.2 Ma
Transconductance	7800 μmhos
Plate Resistance (Approx.)	0.3 Megohm
Grid No. 1 Voltage for Ib = 20 μa	-6 Volts
Ib at Ec1 = -3 Volts, Rk = 0	2.0 Ma
Diode	
Diode Plate Voltage for Diode Current of 50 Ma(2)	10 Volts

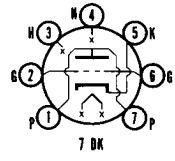
NOTES:
(1) Shield No. 315.
(2) Test condition only. Operating conditions must not exceed the design center rating.

6AN4

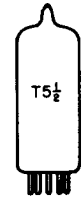
UHF MIXER OR AMPLIFIER

High Mu Triode

Construction .....Miniature T-5½
Base .....Button 7 Pin
Basing 7DK
Outline 5-1
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.500 In.
Maximum Overall Height .....1.750 In.



7 DK



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	225 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

	Shielded(1)	Unshielded
Grid to Plate	1.7	1.7 Pf
Input	3.3	2.9 Pf
Output	1.8	0.25 Pf
Heater to Cathode(2)	2.9	3.0 Pf
Grid to Cathode(2)	2.6	2.6 Pf
Plate to Cathode(2)	0.18	0.20 Pf
Grounded Grid Operation		
Input	5.7	5.5 Pf
Output	3.4	1.8 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	4 Watts
Cathode Current (Max.)	30 Ma
Grid Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	
Plate Voltage	200 Volts
Cathode Bias Resistor	100 Ohms
Plate Current	13 Ma
Transconductance	10,000 μmhos
Amplification Factor	70
Grid Voltage for Ib = 20 μa	-7 Volts
Mixer Service	
Plate Voltage	125 Volts
Cathode Bias Resistor	270 Ohms
Plate Current	7 Ma
Oscillator Injection Voltage (RMS)	1.4 Volts
Conversion Conductance	2900 μmhos

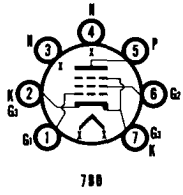
NOTES:
(1) Shield No. 316.
(2) Measured between specified elements only. When external shield is used, it shall be grounded.

VIDEO AMPLIFIER

6AN5

Beam Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7BD
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage		6.3 Volts
Heater Current		450 Ma
Maximum Heater-Cathode Voltage		90 Volts

DIRECT INTERELECTRODE CAPACITANCES

Grid No. 1 to Plate		0.075 Pf
Input		9.0 Pf
Output		4.8 Pf

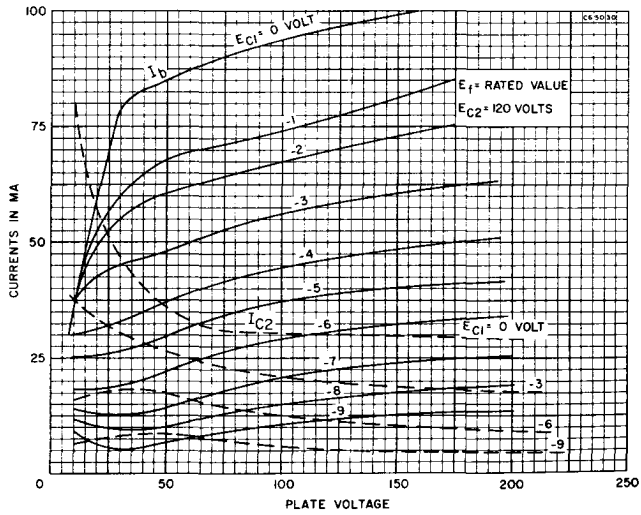
RATINGS (Design Center Rating System)

Plate Voltage (Max.)	120	300 Volts
Grid No. 2 Voltage (Max.)	120	300 Volts
Cathode Current (Max.)	50	20 Ma
Plate Dissipation (Max.)	4.2	1.7 Watts
Grid No. 2 Dissipation (Max.)	1.4	0.56 Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.1	0.1 Megohm
Cathode Bias (Max.)	0.1	0.1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	120 Volts
Grid No. 2 Voltage	120 Volts
Cathode Resistor	120 Ohms
Plate Current	35 Ma
Grid No. 2 Current	12 Ma
Plate Resistance	12,500 Ohms
Transconductance	8000 μmhos
Load Resistance	2500 Ohms
Power Output (Approx.)	1.3 Watts
Plate Current for Ib = 1 Ma	−20 Volts

AVERAGE PLATE CHARACTERISTICS



6AN8A

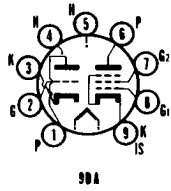
5AN8

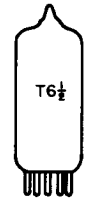
Color Television Type

OSC./SYNC SEP./SYNC CLIPPER (T) IF/VIDEO/AGC AMPLIFIER (P)

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DA
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.938 In.
Maximum Overall Height .....2.188 In.





ELECTRICAL DATA

HEATER OPERATION

	5AN8 Series	6AN8A Series
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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	1.5 Pf
Input: gto (h + k)	2.0 Pf
Output: p to (h + k)	0.26 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.04 Pf
Input: g1 to (h + k + g2 + g3 + IS)	7.0 Pf
Output: p to (h + k + g2 + g3 + IS)	2.4 Pf
Coupling	
Triode Grid to Pentode Plate (Max.)	0.02 Pf
Pentode Grid No. 1 to Triode Plate (Max.)	0.02 Pf
Pentode Plate to Triode Plate (Max.)	0.15 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Grid No. 1 Voltage		
Positive Bias Value (Max.)	0	0 Volt
Plate Dissipation (Max.)	2.8	2.3 Watts
Grid No. 2 Input (Max.)	—	0.55 Watt
Grid No. 1 Circuit Resistance(1)		
Fixed Bias (Max.)	0.5	0.25 Megohm
Cathode Bias (Max.)	1.0	1.0 Megohm

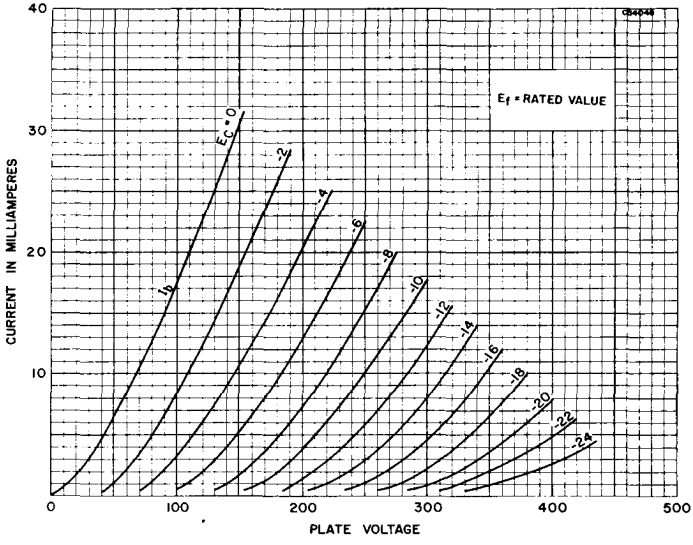
CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Supply Voltage	150	125 Volts
Grid No. 2 Supply Voltage	—	125 Volts
Grid No. 1 Voltage	-3	— Volts
Cathode Bias Resistor	—	56 Ohms
Plate Current	15	12 Ma
Grid No. 2 Current	—	3.8 Ma
Transconductance	4500	7800 μmhos
Amplification Factor	21	—
Plate Resistance (Approx.)	4700	170,000 Ohms
Ec1 for Ib = 20 μa (Approx.)	-17	-6 Volts
Ib with Ec1 = -3 Volts, Rk = 0	—	1.6 Ma

NOTE:

(1) If either section is operating at maximum rated conditions, the Grid No. 1 circuit resistance for both sections should not exceed the stated values.

AVERAGE PLATE CHARACTERISTICS
(Triode Section)



Color Television Type

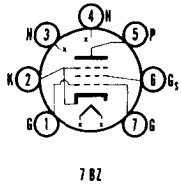
AUDIO POWER AMPLIFIER or VERTICAL DEFLECTION AMP.

6AQ5A

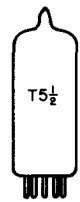
5AQ5, 12AQ5, 19AQ5

Beam Power Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7BZ
Outline 5-3
Maximum Diameter .....0.750 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



7 BZ



ELECTRICAL DATA

HEATER OPERATION

	19AQ5	12AQ5	5AQ5	6AQ5A
Heater Voltage	18.9	12.6	4.7	6.3 Volts
Heater Current	150	225	600	450 Ma
Heater Warm-up Time	—	—	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				
Grid to Plate				0.4 Pf
Input: g1 to (h + k + g2 + g3)				8.0 Pf
Output: p to (h + k + g2 + g3)				8.5 Pf
RATINGS (Design Maximum Rating System)				
Class A1 Amplifier				
Plate Voltage (Max.)				275 Volts
Grid No. 2 Voltage (Max.)				275 Volts
Plate Dissipation (Max.)				12 Watts
Grid No. 2 Dissipation (Max.)				2 Watts
Grid No. 1 Circuit Resistance				
Fixed Bias (Max.)				0.1 Megohm
Cathode Bias (Max.)				0.5 Megohm
Bulb Temperature (At Any Point) (Max.)				250 °C

Vertical Deflection Amplifier(1)—Triode Connected(2)

Plate Voltage (Max.)	275 Volts
Peak Positive Plate Voltage (Abs. Max.)	1100 Volts
Plate Dissipation (Max.)(3)	10 Watts
Peak Negative Grid No. 1 Voltage (Max.)	275 Volts
Average Cathode Current (Max.)	40 Ma
Peak Cathode Current (Max.)	115 Ma
Grid No. 1 Circuit Resistance	
Cathode Bias (Max.)	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Conn.	Pentode Conn.	
Class A1 Amplifier			
Plate Voltage	250	180	250 Volts
Grid No. 2 Voltage	—	180	250 Volts
Grid No. 1 Voltage	−12.5	−8.5	−12.5 Volts
Peak AF Grid No. 1 Voltage	—	8.5	12.5 Volts
Zero-Signal Plate Current	49.5	29	45 Ma
Maximum Signal Plate Current	—	30	47 Ma
Zero-Signal Grid No. 2 Current	—	3	4.5 Ma
Maximum Signal Grid No. 2 Current	—	4	7.0 Ma
Plate Resistance (Approx.)	1970	58,000	52,000 Ohms
Transconductance	4800	3700	4100 μmhos
Load Resistance	—	5500	5000 Ohms
Maximum Signal Power Output	—	2.0	4.5 Watts
Total Harmonic Distortion (Approx.)	—	8	8 Percent
Ec1 for Ib = 0.5 Ma (Approx.)	−37	—	— Volts

NOTES:

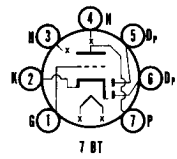
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
(2) Grid No. 2 connected to plate.
(3) 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.

6AQ6

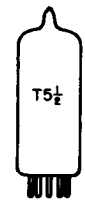
AF AMPLIFIER AND DETECTOR

Double Diode and High Mu Triode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7BT
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7 BT



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	150 Ma
Maximum Heater Cathode Voltage	90 Volts

DIRECT INTERELECTRODE CAPACITANCES (Shielded)(1)

Grid to Plate	1.8 Pf
Input	1.7 Pf
Output	1.5 Pf

RATINGS (Design Center Rating System)

Triode

Plate Voltage (Max.)	300 Volts
Positive Grid No. 1 Voltage (Max.)	0 Volt

Diode

Diode Operating Current Per Plate (Max.)	0.9 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier		
Plate Voltage	100	250 Volts
Grid No. 1 Voltage(2)	−1	−3 Volts
Plate Resistance (Approx.)	61,000	58,000 Ohms
Transconductance	1150	1200 μmhos
Plate Current	0.8	1.0 Ma

NOTES:

(1) Shield No. 316 connected to cathode.
(2) Diode biasing of the triode section is not recommended.

Color Television Type

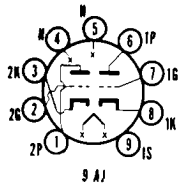
RF AMPLIFIER AND MIXER

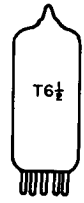
6AQ8/ECC85

9AQ8

High Mu Twin Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing[1,2] 9AJ
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION	9AQ8	6AQ8/ECC85
Heater Voltage	9.0	6.3 Volts
Heater Current	300	435 Ma
Maximum Heater-Cathode Voltage	90	90 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Section No. 1	Section No. 2
Grid to Plate	1.5	1.5 Pf
Input: g to (k + h + IS)	3.0	3.0 Pf
Output: p to (k + h + IS)	1.2	1.2 Pf

RATINGS (Design Center Rating System) (Each Section)

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	2.5 Watts
Cathode Current (Max.)	15 Ma
Negative Grid Voltage (Max.)	100 Volts
Grid Circuit Resistance (Max.)	1.0 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	R-F Amp		Autodyne Osc/Mixer
Plate Supply Voltage	—	250	250 Volts
Plate Dropping Resistor	—	1800	12,000 Ohms
Plate Voltage	250	230	— Volts
Grid Voltage	−2.3	−2.0	— Volts
Cathode Resistor	—	200	— Ohms
Grid Leak Resistor	—	—	1.0 Megohms
Oscillator Voltage (RMS)	—	—	3 Volts
Plate Current	10	10	5.2 Ma
Transconductance	5900	6000	— μmhos
Conversion Transconductance	—	—	2300 μmhos
Amplification Factor	57	—	—
Plate Resistance	—	9700	22,000 Ohms
Input Resistance at 100 MHz	—	6000	15,000 Ohms
Equivalent Noise Resistance	—	500	— Ohms

NOTES:
(1) Section No. 1 connects to Pins 6, 7, and 8.
(2) An internal shield is connected to Pin No. 9 to provide isolation between the two sections.

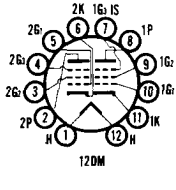
IF AMPLIFIER

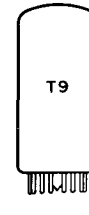
6AR11

8AR11, 11AR11

Twin Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12DM
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.





ELECTRICAL DATA

HEATER OPERATION

	11AR11	8AR11	6AR11
Heater Voltage	11.2	8.4	6.3 Volts
Heater Current	450	600	800 Ma
Heater Warm-up Time	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 (Shielded)(1)

Section 1	
Grid-Number 1 to Plate	0.026 Pf
Input: 1g1 to (1k + 1g2 + 1g3 + h + IS)	10 Pf
Output: 1p to (1k + 1g2 + 1g3 + h + IS)	2.8 Pf
Section 2	
Grid-Number 1 to Plate	0.026 Pf
Input: 2g1 to (2k + 2g2 + 2g3 + 1g3 + h + IS)	10 Pf
Output: 2p to (2k + 2g2 + 2g3 + 1g3 + h + IS)	3.0 Pf
Plate to Plate (Max.)	0.016 Pf
Grid-Number 1, Section 1 to Plate, Section 2:(Max.)	0.002 Pf
Grid-Number 1, Section 2 to Plate, Section 1: (Max.)	0.004 Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	330 Volts
Suppressor Voltage (Max.)	0 Volt
Screen-Supply Voltage (Max.)	330 Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)
Positive DC Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	3.1 Watts
Screen Dissipation (Max.)	0.65 Watt

CHARACTERISTICS AND TYPICAL OPERATION (Each Section)

Plate Voltage	125 Volts
Suppressor	Connected to Cathode at Socket
Screen Voltage	125 Volts
Cathode-Bias Resistor	56 Ohms
Plate Resistance (Approx.)	0.2 Megohms
Transconductance	10,500 μmhos
Plate Current	11 Ma
Screen Current	3.5 Ma
Grid No. 1 Voltage (Approx.)	
Gm = 50 μmhos	−15 Volts

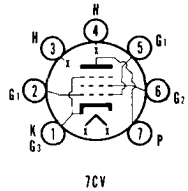
NOTE:
(1) With external shield (EIA 309) connected to cathode of section under test.

6AS5

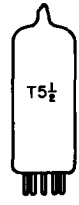
AUDIO POWER AMPLIFIER

Beam Pentode

Construction	Miniature T-5½
Base	Button 7 Pin
Basing	7CV
Outline	5-3
Maximum Diameter	0.750 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



7CV



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	800 Ma
Maximum Heater-Cathode Voltage	100 Volts

DIRECT INTERELECTRODE CAPACITANCES

Grid to Plate	0.6 Pf
Input	12 Pf
Output	9.0 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	150 Volts
Grid No. 2 Voltage (Max.)	117 Volts
Plate Dissipation (Max.)	5.5 Watts
Grid No. 2 Dissipation (Max.)	1.0 Watt
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	150 Volts
Grid No. 2 Voltage	110 Volts
Grid No. 1 Voltage	8.5 Volts
Peak AF Grid No. 1 Voltage	8.5 Volts
Plate Current (Zero Signal)	35 Ma
Plate Current (Maximum Signal)	36 Ma
Grid No. 2 Current (Zero Signal)	2 Ma
Grid No. 2 Current (Maximum Signal)	6.5 Ma
Transconductance	5600 μmhos
Load Resistance	4500 Ohms
Total Harmonic Distortion	10 Percent
Maximum Signal Power Output	2.2 Watts

Color Television Type

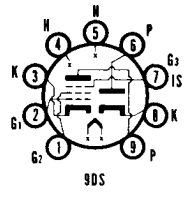
AUDIO/VIDEO DETECTOR or DC RESTORER (D) IF/VIDEO/AGC AMPLIFIER (P)

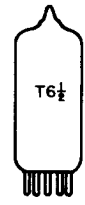
6AS8

5AS8

High Perveance Diode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9DS
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	5AS8 Series	6AS8 Parallel
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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 (Unshielded)

Pentode Section	
Grid No. 1 to Plate (Max.)	0.03 Pf
Input: g1 to (h + k + g2 + g3)	7.0 Pf
Output: p to (h + k + g2 + g3)	2.4 Pf
Coupling	
Pentode Grid to Diode Plate (Max.)	0.005 Pf
Pentode Plate to Diode Cathode (Max.)	0.15 Pf
Pentode Plate to Diode Plate (Max.)	0.10 Pf
Diode Section	
Plate to Heater, Cathode and Internal Shield	3.0 Pf

RATINGS (Design Center Rating System)

Pentode Section	
Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	2.5 Watts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Grid No. 2 Supply Voltage (Max.)	300 Volts
Grid No. 2 Dissipation (Max.)	0.5 Watt
Positive Grid No. 1 Voltage (Max.)	0 Volt
Grid No. 3 Voltage (Max.)	0 Volt

Grid No. 1 Circuit Resistance	
Cathode Bias (Max.)	1.0 Megohm
Fixed Bias (Max.)	0.25 Megohm
Diode Section	
Peak Inverse Plate Voltage (Max.)	330 Volts
Peak Plate Current (Max.)	50 Ma
DC Plate Current (Max.)	5 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

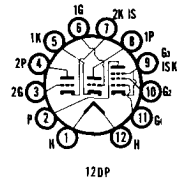
Plate Supply Voltage	200 Volts
Grid No. 2 Supply Voltage	150 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Cathode Resistor	180 Ohms
Plate Current	9.5 Ma
Grid No. 2 Current	3.0 Ma
Transconductance	6200 μmhos
Plate Resistance (Approx.)	0.3 Megohm
Grid No. 1 Voltage for Ib = 10 μa (Approx.)	−8 Volts

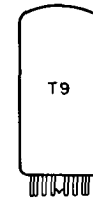
6AS11

AF/IF AMPLIFIER (1T)
SYNC SEPARATOR (2T)
VIDEO AMPLIFIER (P)

Medium Mu Triode, High Mu Triode and Sharp Cutoff Pentode

Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12DP
Outline	9-58
Maximum Diameter	1.188 In.
Maximum Seated Height	2.000 In.
Maximum Overall Height	2.375 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1050 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

Triode (Section 1)	
Grid to Plate	1.9 Pf
Input: T1g to (T1k + T2k + Pk + Pg3 + IC + IS)	3.0 Pf
Output: T1p to (T1k + T2k + Pk + Pg3 + IC + IS)	2.2 Pf
Triode (Section 2)	
Grid to Plate	3.6 Pf
Input: T2g to (T2k + Pk + Pg3 + IC + IS)	2.4 Pf
Output: T2p to (T2k + Pk + Pg3 + IC + IS)	3.8 Pf
Pentode	
Grid 1 to Plate	0.11 Pf
Input: Pg1 to (T2k + Pk + Pg2 + Pg3 + IC + IS)	9.5 Pf
Output: Pp to (T2k + Pk + Pg2 + Pg3 + IC + IS)	4.4 Pf
Coupling	
Pentode Plate to Triode Plate (Section 2) (Max.)	0.044 Pf
Triode Plate (Section 1) to Triode Plate (Section 2) (Max.)	0.06 Pf

RATINGS (Design Maximum Rating System)

Triode (Section 1)	
Plate Voltage (Max.)	330 Volts
Positive DC Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	1.5 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.5 Megohm
Cathode Bias (Max.)	1.0 Megohm

Triode (Section 2)	
Plate Voltage (Max.)	330 Volts
Positive DC Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	2.0 Watts
Grid 1 Circuit Resistance	
Fixed Bias (Max.)	0.5 Megohm
Cathode Bias (Max.)	1.0 Megohm
Pentode Section	
Plate Voltage (Max.)	330 Volts
Screen Supply Voltage (Max.)	330 Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)
Positive DC Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	5.0 Watts
Screen Dissipation (Max.)	1.1 Watts
Grid 1 Circuit Resistance	
Fixed Bias (Max.)	0.25 Megohm
Cathode Bias (Max.)	1.0 Megohm
CHARACTERISTICS AND TYPICAL OPERATION	
Triode (Section 1)	
Plate Voltage	200 Volts
Grid Voltage	−2.0 Volts
Plate Current	7.0 Ma
Transconductance	5500 μmhos
Plate Resistance (Approx.)	12,400 Ohms
Amplification Factor	68
Grid Voltage for Ib = 10 μa	−5.5 Volts
Triode (Section 2)	
Plate Voltage	200 Volts
Cathode Bias Resistor	220 Ohms
Plate Current	9.2 Ma
Transconductance	4400 μmhos
Plate Resistance (Approx.)	9400 Ohms
Amplification Factor	41
Grid Voltage for Ib = 100 μa	−6.5 Volts
Pentode Section	
Plate Voltage	200 Volts
Screen Voltage	125 Volts
Cathode Bias Resistor	68 Ohms
Plate Current	24 Ma
Screen Current	5.2 Ma
Transconductance	10,500 μmhos
Plate Resistance (Approx.)	70,000 Ohms
Grid 1 Voltage for Ib = 10 μa	−8 Volts

Color Television Type

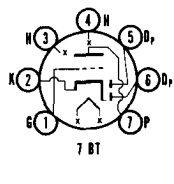
AF AMPLIFIER AND DETECTOR

6AT6

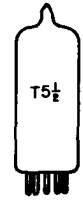
12AT6

Double Diode and High Mu Triode

Construction	Miniature T-5½
Base	Button 7 Pin
Basing	7BT
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7 BT



ELECTRICAL DATA

HEATER OPERATION

	12AT6	6AT6
Heater Voltage	12.6	6.3 Volts
Heater Current	150	300 Ma
Maximum Heater-Cathode Voltage	90	90 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded (1)	Unshielded
Grid to Plate	2.0	2.0 Pf
Input: g to (h + k)	2.2	2.2 Pf
Output: p to (h + k)	1.2	0.8 Pf
Diode Plate No. 2 to Grid (Max.)	0.04	0.04 Pf

RATINGS (Design Maximum Rating System)

Triode

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	0.5 Watt
Positive-Grid Voltage (Max.)	0 Volt

Diode

Diode Current (Each Section) (Max.)	1.0 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	100	250 Volts
Grid Voltage	−1	−3 Volts
Plate Current	0.8	1.0 Ma
Transconductance	1300	1200 μmhos
Amplification Factor	70	70
Plate Resistance	54,000	58,000 Ohms
Average Diode Current at 10 Volts DC(2)	2.0	2.0 Ma

NOTES:

(1) Shield No. 316 connected to cathode.
(2) Test condition only.

6AT8A

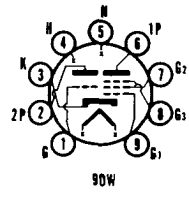
5AT8

Color Television Type

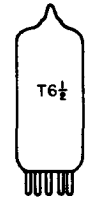
VHF OSCILLATOR AND MIXER

Medium Mu Triode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9DW
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.938 In.
Maximum Overall Height	2.188 In.



9DW



ELECTRICAL DATA

HEATER OPERATION

	5AT8	6AT8A
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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

	Shielded(1)	Unshielded
Triode Section		
Grid to Plate	1.5	1.5 Pf
Input	2.4	2.0 Pf
Output	1.0	0.5 Pf
Pentode Section		
Grid No. 1 to Plate (Max.)	0.016	0.025 Pf
Input	4.7	4.5 Pf
Output	1.6	0.9 Pf
Pentode Section Triode Connected(2)		
Grid No. 1 to Plate	1.3	1.3 Pf
Input	3.3	3.0 Pf
Output	2.5	1.7 Pf
Coupling		
Pentode Grid No. 1 to Triode Plate (Max.)	0.04	0.05 Pf
Pentode Plate to Triode Plate (Max.)	0.007	0.05 Pf
Heater to Cathode	6.5(3)	6.5 Pf

RATINGS (Design Center Rating System)

	Triode Section as Oscillator	Pentode Section as Mixer
Converter Service		
Plate Voltage (Max.)	250	250 Volts
Grid No. 3 Voltage (Max.)	—	0 Volt
Grid No. 2 Supply Voltage (Max.)	—	250 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Grid No. 1 Voltage		
Negative Bias Value (Max.)	40	40 Volts
Positive Bias Value (Max.)	0	0 Volt
Plate Dissipation (Max.)	1.5	2.0 Watts
Grid No. 2 Input (Max.)	—	0.4 Watt
Grid No. 1 Input (Max.)	0.5	— Watt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	—	0.1 Megohm
Self Bias (Max.)	—	0.5 Megohm

Pentode Section as Triode Connected Mixer[2]

Plate Voltage (Max.)	250 Volts
Negative Grid No. 1 Voltage (Max.)	40 Volts
Positive Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	2.4 Watts

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	100	250 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket	
Grid No. 2 Voltage	—	150 Volts
Cathode Bias Resistor	100	200 Ohms
Plate Current	8.5	7.7 Ma
Grid No. 2 Current	—	1.6 Ma
Transconductance	5800	4600 μmhos
Amplification Factor	40	—
Plate Resistance (Approx.)	6900	750,000 Ohms
Ec1 for Ib = 10 μa (Approx.)	-10	-10 Volts

	Triode Section as 250 MHz Oscillator[4]	Pentode Section as Mixer[5]
Plate Voltage	150	150 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket	
Grid No. 2 Voltage	—	150 Volts
Mixer Grid No. 1 Supply Voltage	—	-3.5 Volts
Plate Current	13	6.2 Ma
Grid No. 2 Current	—	1.8 Ma
Conversion Transconductance	—	2100 μmhos
Mixer Grid No. 1 Circuit Resistance	—	120,000 Ohms
Oscillator Voltage at Mixer Grid No. 1 (RMS)	—	2.6 Volts
Oscillator Grid Resistor	2700	— Ohms
Grid No. 1 Current	3.6	— Ma
Grid No. 1 Current	—	2.0 μa
Oscillator Power Output (Approx.)[3]	0.5	— Watt

Pentode Section as Triode Connected Mixer[2]

Plate Voltage	150 Volts
Grid No. 1 Supply Voltage	-3.5 Volts
Plate Current	7.8 Ma
Conversion Transconductance	2800 μmhos
Oscillator Voltage at Grid No. 1 (RMS)	2.6 Volts
Grid No. 1 Current	2.0 μa
Grid No. 2 Circuit Resistance	120,000 Ohms

NOTES:

(1) External Shield No. 315 connected to cathode.
(2) Grid No. 3 connected to cathode; Grid No. 2 connected to plate.
(3) Shield No. 315 connected to ground.
(4) In TV or FM receivers, it is generally desirable to operate the oscillator with less power input than shown in the tabulation data in order to avoid over excitation and excessive oscillator radiation.
(5) With separate excitation and triode unit grounded.

6AU4GTA

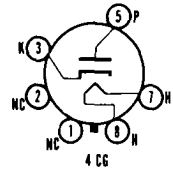
19AU4GTA

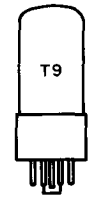
Color Television Type

DAMPER

Heater-Cathode Diode

Construction .....Octal T-9
Base[1] ....Octal 5 or 6 Pin, B5-85 or B6-60
Basing[1] 4CG
Outline 9-44
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.813 In.





ELECTRICAL DATA

HEATER OPERATION

	19AU4GTA	6AU4GTA
Heater Voltage	18.9	6.3 Volts
Heater Current	600	1800 Ma
Heater Warm-up Time	11	— Seconds
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
DC		900 Volts
Total DC and Peak		4500 Volts
Heater Positive with Respect to Cathode		
DC		100 Volts
Total DC and Peak		300 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Heater to Cathode	4.0 Pf
Plate to Cathode and Heater	8.5 Pf
Cathode to Plate and Heater	11.5 Pf

RATINGS (Design Maximum Rating System)

Damper Diode[2]

Peak Inverse Plate Voltage (Abs. Max.)	4500 Volts
DC Plate Current (Max.)	190 Ma
Steady State Peak Plate Current (Max.)	1150 Ma
Plate Dissipation (Max.)	6.0 Watts

CHARACTERISTICS AND TYPICAL OPERATION

Damper Service—90° Deflection Scan System

Peak Inverse Plate Voltage	3.65 Kv
Peak Heater-Cathode Voltage	3.9 Kv
Average Cathode Current	120 Ma
Peak Cathode Current	500 Ma
Boosted B+ Voltage	640 Volts
Plate Dissipation	2.8 Watts
Average Tube Voltage Drop for Ib = 350 Ma	25 Volts

NOTES:

(1) May be either 5 or 6 pin. Socket terminals No. 1 (if used), 2, 4, and 6 shall not be used as tie points. Pin No. 1 may be omitted on 5 pin base.
(2) For operation in a 525-line, 30-frame system, the duty cycle of the horizontal voltage pulse must not exceed 15% of one horizontal scanning cycle. Power rectification service is not recommended.

6AU6A

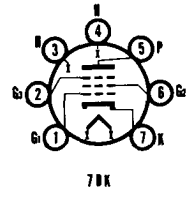
3AU6, 4AU6, 12AU6

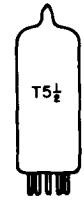
Color Television Type

RF AMPLIFIER

Sharp Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7BK
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.





ELECTRICAL DATA

HEATER OPERATION

	3AU6	4AU6	12AU6	6AU6A
Heater Voltage	3.15	4.2	12.6	6.3 Volts
Heater Current	600	450	150	300 Ma
Heater Warm-up Time	11	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 (Unshielded)				
Grid to Plate (Max.)				0.0035 Pf
Input				5.5 Pf
Output				5.0 Pf
RATINGS (Design Maximum Rating System)				
Plate Voltage (Max.)				330 Volts
Grid No. 2 Supply Voltage (Max.)				330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)			
Plate Dissipation (Max.)				3.5 Watts
Grid No. 2 Dissipation (Max.)				0.75 Wtats
Positive Grid No. 1 Voltage (Max.)				0 Volt
CHARACTERISTICS AND TYPICAL OPERATION				
Plate Voltage	100	250	250 Volts	
Grid No. 3 Voltage	Connected to Cathode at Socket			
Grid No. 2 Voltage	100	125	150 Volts	
Cathode Bias Resistor	150	100	68 Ohms	
Plate Current	5.0	7.6	10.6 Ma	
Grid No. 2 Current	2.1	3.0	4.3 Ma	
Transconductance	3900	4500	5200 μmhos	
Plate Resistance (Approx.)	0.5	1.5	1.0 Megohm	
Grid No. 1 Voltage for Ib = 10 μa	-4.2	-5.5	-6.5 Volts	

Color Television Type

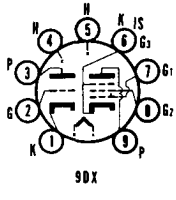
SYNC SEPARATOR (T) VIDEO AMPLIFIER (P)

6AU8A

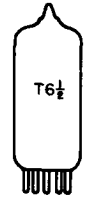
8AU8A

Medium Mu Triode and Sharp Cutoff Pentode

Construction ..... Miniature T-6½
Base ..... Button 9 Pin, E9-1
Basing 9DX
Outline 6-3
Maximum Diameter ..... 0.875 In.
Maximum Seated Height ..... 2.375 In.
Maximum Overall Height ..... 2.625 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

	6AU8A	8AU8A
Heater Voltage	6.3	8.4 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	11	11 Seconds
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
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)		
Triode Section		
Grid to Plate		2.2 Pf
Input		*2.6 Pf*
Output		0.34 Pf
Pentode Section		
Grid to Plate		0.06 Pf
Input		7.5 Pf
Output		3.4 Pf
Coupling		
Pentode Grid No. 1 to Triode Plate (Max.)		0.006 Pf
Triode Grid to Pentode Plate (Max.)		0.022 Pf
Pentode Plate to Triode Plate (Max.)		0.12 Pf

RATINGS (Design Center Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage (Max.)	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	2.8	3.3 Watts
Grid No. 2 Dissipation (Max.)	—	1.0 Watt
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Self Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Class A1 Amplifier		
Plate Voltage	150	200 Volts
Grid No. 2 Voltage	—	125 Volts
Cathode Bias Resistor	150	82 Ohms
Plate Current	9.5	17 Ma
Grid No. 2 Current	—	3.4 Ma
Transconductance	5300	8000 μmhos
Amplification Factor	43	—
Plate Resistance (Approx.)	8100	100,000 Ohms
Grid No. 1 Voltage (Approx.) for Ib = 100 ma	-6.5	-7.5 Volts dc

6AV5GA

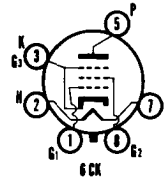
12AV5GA, 17AV5GA, 25AV5GA

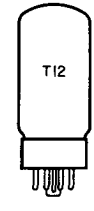
Color Television Type

HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Octal T-11 or T-12
Base.....Octal 6 Pin, B6-112 or B6-120
Basing 6CK
Outline
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.688 In.
Maximum Overall Height .....4.250 In.





ELECTRICAL DATA

HEATER OPERATION

	25AV5GA	17AV5GA	12AV5GA	6AV5GA
Heater Voltage	25	16.8	12.6	6.3 Volts
Heater Current	300	450	600	1200 Ma
Heater Warm-up Time	—	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 (Unshielded)

Grid to Plate ..... 0.5 Pf
Input ..... 14 Pf
Output ..... 7.0 Pf

RATINGS (Design Center Rating System)
Horizontal Deflection Amplifier[1]

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.) ..... 550 Volts
Peak Positive Plate Voltage (Abs. Max.) ..... 5500 Volts
Peak Negative Plate Voltage (Max.) ..... 1250 Volts
DC Grid No. 2 Voltage (Max.) ..... 175 Volts
Peak Negative Grid No. 1 Voltage (Max.) ..... 300 Volts
Plate Dissipation (Max.)[2] ..... 11 Watts
Grid No. 2 Dissipation (Max.) ..... 2.5 Watts
Average Cathode Current (Max.)..... 110 Ma
Peak Cathode Current (Max.) ..... 400 Ma
Grid No. 1 Circuit Resistance (Max.) ..... 0.47 Megohm
Bulb Temperature (At Hottest Point) (Max.) ..... 210 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage ..... 250 Volts

Grid No. 2 Voltage	150 Volts
Grid No. 1 Voltage	–22.5 Volts
Plate Current	57 Ma
Grid No. 2 Current	2.1 Ma
Plate Resistance (Approx.)	14,500 Ohms
Transconductance	5900 μmhos
Triode Amplification Factor(3)	4.3
Grid No. 1 Voltage (Approx.) for Ib = 1 Ma	–43 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 60 V, Ec2 = 150 V, and Ec1 = 0 V;
Ib = 260 Ma; and Ic2 = 26 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) 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.
(3) Triode connection (screen tied to plate) with Eb = Ec2 = 150 Volts and Ec1 = –22.5 Volts.

Color Television Type

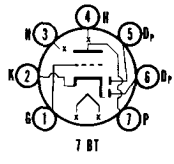
DETECTOR and AF AMPLIFIER

6AV6

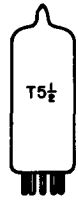
3AV6, 4AV6, 12AV6

Double Diode and High Mu Triode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7BT
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7 BT



ELECTRICAL DATA

HEATER OPERATION

	3AV6	4AV6	12AV6	6AV6
Heater Voltage	3.15	4.2	12.6	6.3 Volts
Heater Current	600	450	150	300 Ma
Heater Warm-up Time	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

	Shielded(1)	Unshielded
Triode Grid to Plate	2.0	2.0 Pf
Triode Input	2.2	2.2 Pf
Triode Output	1.2	0.8 Pf
Grid to Diode No. 2 Plate (2) (Max.)	0.04	0.04 Pf

RATINGS (Design Maximum Rating System)

Triode	
Plate Voltage (Max.)	330 Volts
Plate Dissipation (Max.)	0.55 Watt
Positive Grid Voltage (Max.)	0 Volt
Diode	
Diode Plate Current Each Diode	1.0 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Triode		
Class A1 Amplifier		
Plate Voltage	100	250 Volts
Grid Voltage	–1	–2 Volt
Plate Current	0.5	1.2 Ma
Plate Resistance	80,000	62,500 Ohms
Transconductance	1250	1600 μmhos
Amplification Factor	100	100
Diode (Each Section)		
Tube Voltage Drop for Ib = 1.2 Ma		10 Volts

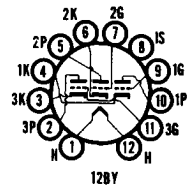
NOTES:
(1) Shield No. 316 connected to cathode.
(2) Diode plate No. 2 connects to Pin No. 5. Diode plate No. 1 connects to Pin No. 6.

6AV11

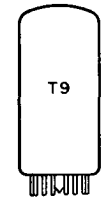
Color Television Type

AMPLIFIER, PHASE INVERTER or OSCILLATOR

Triple Medium Mu Triode



12BY



Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12BY
Outline	9-56
Maximum Diameter	1.188 In.
Maximum Seated Height	1.500 In.
Maximum Overall Height	1.875 In.

ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	600 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 1	Section 2	Section 3
Grid to Plate (g to p)	1.2	1.2	1.2 Pf
Input: g to (h + k + IS)	1.9	1.9	1.9 Pf
Output: p to (h + k + IS)	1.8	0.7	2.0 Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	330 Volts
Plate Dissipation (Max.)	2.75 Watts
Total Plate Dissipation (All Plates) (Max.)	6.0 Watts
DC Cathode Current (Max.)	20 Ma
Grid Circuit Resistance	
With Fixed Bias (Max.)	0.25 Megohm
With Cathode Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION (Each Section)

Plate Voltage	100	250 Volts
Grid Voltage	0	−8.5 Volts
Amplification Factor	20	17
Plate Resistance (Approx.)	6500	7700 Ohms
Transconductance	3100	2200 μmhos
Plate Current	11.8	10.5 Ma
Grid Voltage (Approx.)		
$Ib = 10\ \mu a$	—	−24 Volts

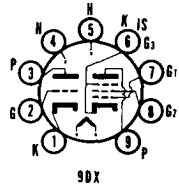
6AW8A

8AW8A

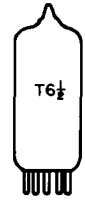
Color Television Type

SYNC SEPARATOR (T) VIDEO AMPLIFIER (P)

High Mu Triode and Sharp Cutoff Pentode



9DX



Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9DX
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.

ELECTRICAL DATA

HEATER OPERATION

	8AW8A	6AW8A
Heater Voltage	8.4	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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

	Shielded(1)	Unshielded
Triode		
Grid to Plate: (g to p)	2.2	2.2 Pf
Input: g to (h + k)	3.4	3.2 Pf
Output: p to (h+Tk+Pk+Pg3+IS)	3.0	1.8 Pf
Pentode		
Grid to Plate: (g1 to p) (Max.)	0.05	0.06 Pf
Input: g1 to (g + k + g2 + g3 + IS)	10.0	10.0 Pf
Output: p to (h + k + g2 + g3 + IS)	4.5	3.6 Pf
Coupling		
Pentode Grid No. 1 to Triode Plate (Max.)	*0.005*	*0.008* Pf
Pentode Plate to Triode Grid	0.006	0.016 Pf
Pentode Plate to Triode Plate (Max.)	0.025	0.150 Pf

RATINGS (Design Maximum Rating System)

	Triode	Pentode
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	1.1	3.75 Watts
Grid No. 2 Dissipation (Max.)	—	1.1 Watt
Negative Grid No. 1 Voltage (Max.)	—	50 Volts
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Self Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

	Triode	Pentode
Plate Voltage	200	150 Volts
Grid No. 2 Voltage	—	150 Volts
Grid No. 1 Voltage	-2	0 Volts
Cathode Bias Resistor	—	150 Ohms
Plate Current	4.0	15 Ma
Grid No. 2 Current	—	3.5 Ma
Transconductance	4000	9500 μmhos
Amplification Factor	70	—
Plate Resistance (Approx.)	—	0.20 Megohm
Grid No. 1 Voltage (Approx.)		
for Ib = 20 μa	-5	-8 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 65 V, Ec2 = 150 V, and Ec1 = 0 V;
Ib = 46 Ma; and Ic2 = 15 Ma

NOTE:
(1) Shield No. 315 ties to Pins 4 and 5.

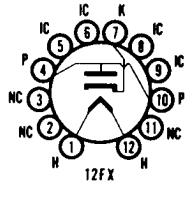
DAMPER

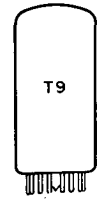
6AX3

12AX3, 17AX3

Heater-Cathode Diode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12FX
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.250 In.
Maximum Overall Height .....2.596 In.





ELECTRICAL DATA
HEATER OPERATION

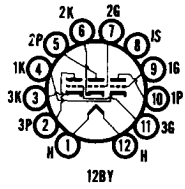
	17AX3	12AX3	6AX3
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	11	11	— Seconds

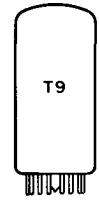
6AV11

Color Television Type

AMPLIFIER, PHASE INVERTER or OSCILLATOR

Triple Medium Mu Triode





Construction ..... Compactron T-9
Base ..... Button 12 Pin, E12-70
Basing 12BY
Outline 9-56
Maximum Diameter ..... 1.188 In.
Maximum Seated Height ..... 1.500 In.
Maximum Overall Height ..... 1.875 In.

ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	600 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 1	Section 2	Section 3
Grid to Plate (g to p)	1.2	1.2	1.2 Pf
Input: g to (h + k + IS)	1.9	1.9	1.9 Pf
Output: p to (h + k + IS)	1.8	0.7	2.0 Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	330 Volts
Plate Dissipation (Max.)	2.75 Watts
Total Plate Dissipation (All Plates) (Max.)	6.0 Watts
DC Cathode Current (Max.)	20 Ma
Grid Circuit Resistance	
With Fixed Bias (Max.)	0.25 Megohm
With Cathode Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION (Each Section)

Plate Voltage	100	250 Volts
Grid Voltage	0	−8.5 Volts
Amplification Factor	20	17
Plate Resistance (Approx.)	6500	7700 Ohms
Transconductance	3100	2200 μmhos
Plate Current	11.8	10.5 Ma
Grid Voltage (Approx.)		
Ib = 10 μa	—	−24 Volts

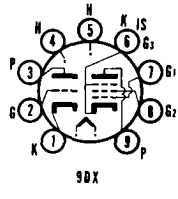
6AW8A

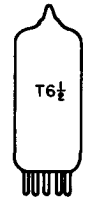
8AW8A

Color Television Type

SYNC SEPARATOR (T) VIDEO AMPLIFIER (P)

High Mu Triode and Sharp Cutoff Pentode





Construction ..... Miniature T-6½
Base ..... Button 9 Pin, E9-1
Basing 9DX
Outline 6-3
Maximum Diameter ..... 0.875 In.
Maximum Seated Height ..... 2.375 In.
Maximum Overall Height ..... 2.625 In.

ELECTRICAL DATA

HEATER OPERATION

	8AW8A	6AW8A
Heater Voltage	8.4	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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

	Shielded(1)	Unshielded
Triode		
Grid to Plate: (g to p)	2.2	2.2 Pf
Input: g to (h + k)	3.4	3.2 Pf
Output: p to (h+Tk+Pk+Pg3+IS)	3.0	1.8 Pf
Pentode		
Grid to Plate: (g1 to p) (Max.)	0.05	0.06 Pf
Input: g1 to (g + k + g2 + g3 + IS)	10.0	10.0 Pf
Output: p to (h + k + g2 + g3 + IS)	4.5	3.6 Pf
Coupling		
Pentode Grid No. 1 to Triode Plate (Max.)	0.005	0.008 Pf
Pentode Plate to Triode Grid	0.006	0.016 Pf
Pentode Plate to Triode Plate (Max.)	0.025	0.150 Pf

RATINGS (Design Maximum Rating System)

	Triode	Pentode
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	1.1	3.75 Watts
Grid No. 2 Dissipation (Max.)	—	1.1 Watt
Negative Grid No. 1 Voltage (Max.)	—	50 Volts
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Self Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

	Triode	Pentode
Plate Voltage	200	150 Volts
Grid No. 2 Voltage	—	150 Volts
Grid No. 1 Voltage	-2	0 Volts
Cathode Bias Resistor	—	150 Ohms
Plate Current	4.0	15 Ma
Grid No. 2 Current	—	3.5 Ma
Transconductance	4000	9500 μmhos
Amplification Factor	70	—
Plate Resistance (Approx.)	—	0.20 Megohm
Grid No. 1 Voltage (Approx.) for Ib = 20 μa	-5	-8 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 65 V, Ec2 = 150 V, and Ec1 = 0 V;
Ib = 46 Ma; and Ic2 = 15 Ma

NOTE:
(1) Shield No. 315 ties to Pins 4 and 5.

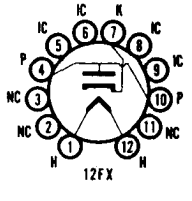
DAMPER

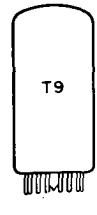
6AX3

12AX3, 17AX3

Heater-Cathode Diode

Construction ..... Compactron T-9
Base ..... Button 12 Pin, E12-70
Basing 12FX
Outline
Maximum Diameter ..... 1.188 In.
Maximum Seated Height ..... 2.250 In.
Maximum Overall Height ..... 2.596 In.





ELECTRICAL DATA
HEATER OPERATION

	17AX3	12AX3	6AX3
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	11	11	— Seconds

Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
DC	900 Volts
Total DC and Peak	5000 Volts
Heater Positive with Respect to Cathode	
DC	100 Volts
Total DC and Peak	300 Volts
DIRECT INTERELECTRODES CAPACITANCES (Unshielded)	
Cathode to Plate and Heater	7.5 Pf
Plate to Cathode and Heater	5.5 Pf
Heater to Cathode	2.8 Pf
RATINGS (Design Maximum Rating System)	
Damper Service(1)	
Peak Inverse Plate Voltage (Max.)	5000 Volts
Plate Dissipation (Max.)	5.3 Watts
Steady State Peak Plate Current (Max.)	1000 Ma
DC Output Current (Max.)	165 Ma
CHARACTERISTICS AND TYPICAL OPERATION	
Tube Voltage Drop for Ib = 250 Ma	32 Volts

NOTE:
(1) 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 horizontal scanning cycle.

6AX4GTB

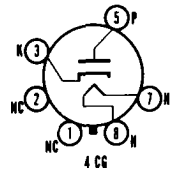
12AX4GTB, 17AX4GTA/17DM4A

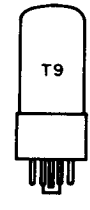
Color Television Type

DAMPER

Heater-Cathode Diode

Construction	Octal T-9
Base	Octal 5 Pin, B5-82
Basing(1)	4CG
Outline	9-11
Maximum Diameter	1.188 In.
Maximum Seated Height	2.750 In.
Maximum Overall Height	3.313 In.





ELECTRICAL DATA

HEATER OPERATION	**17AX4GTA/ 17DM4A**	**12AX4GTB**	**6AX4GTB**
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
DC			900 Volts
Total DC and Peak			5000 Volts
Heater Positive with Respect to Cathode			
DC			100 Volts
Total DC and Peak			300 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)			
Cathode to Plate and Heater			8.5 Pf
Plate to Cathode and Heater			5.0 Pf
Heater to Cathode			4.0 Pf
RATINGS (Design Maximum Rating System)			
Damper Service(2)			
Peak Inverse Voltage (Max.)			5000 Volts
Plate Dissipation (Max.)			5.3 Watts
DC Plate Current (Max.)			165 Ma
Steady State Peak Current (Max.)			1000 Ma
CHARACTERISTICS AND TYPICAL OPERATION			
Tube Voltage Drop for Ib = 250 Ma			32 Volts

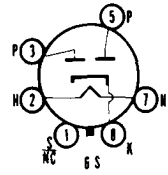
NOTES:
(1) Pins 1, 2, 4, and 6 shall not be used as tie points.
(2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

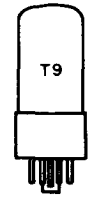
FULL-WAVE POWER RECTIFIER

6AX5GT

Heater-Cathode Twin Diode

Construction .....Octal T-9
Base .....Octal 6 Pin
Basing.....6S
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.750 In.
Maximum Overall Height .....3.313 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1200 Ma
Maximum Heater-Cathode Voltage	450 Volts

RATINGS (Design Maximum Rating System)

Rectifier Service(1)

Peak Inverse Plate Voltage (Max.)	1250 Volts
Peak Plate Current (Each Plate) (Max.)	375 Ma
AC Plate Voltage (Each Plate, RMS) (Max.)	450 Volts
Steady State DC Output Current (Max.)	75 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Full-Wave Rectifier—Choke Input to Filter		
AC Plate to Plate Supply Voltage (RMS)	700	900 Volts
Filter Input Choke	10	10 Henrys
DC Output Voltage at Input to Filter		
At Half Load Current of 150 Ma	270	— Volts
At Half Load Current of 125 Ma	—	365 Volts
At Full Load Current of 75 Ma	250	— Volts
At Full Load Current of 62.5 Ma	—	350 Volts
Voltage Regulation (Half Load to Full Load)	20	15 Volts
Full-Wave Rectifier—Capacitor Input to Filter		
AC Plate to Plate Supply Voltage (RMS)	700	900 Volts
Filter Input Capacitor	10	10 μf
Effective Plate Supply Impedance (Each Plate)	50	105 Ohms
DC Output Voltage at Input to Filter		
At Half Load Current of 62.5 Ma	395	— Volts
At Half Load Current of 40 Ma	—	540 Volts
At Full Load Current of 125 Ma	350	— Volts
At Full Load Current of 80 Ma	—	490 Volts
Voltage Regulation (Half Load to Full Load)	45	50 Volts

NOTE:
(1) For use with sinusoidal supply voltages within the frequency range of 25 to 1000 hertz.

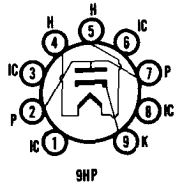
DAMPER

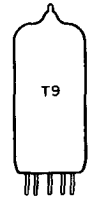
6AY3

12AY3, 17AY3

Heater-Cathode Diode

Construction .....Novar T-9
Base .....Novar Button 9 Pin, E9-75
Basing(1) 9HP
Outline 9-86
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.030 In.
Maximum Overall Height .....3.410 In.





ELECTRICAL DATA

HEATER OPERATION

	17AY3	12AY3	6AY3
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	11	11	— Seconds

Maximum Heater-Cathode Voltage

Heater Negative with Respect to Cathode

DC	900 Volts
Total DC and Peak	5000 Volts
Heater Positive with Respect to Cathode	
DC	100 Volts
Total DC and Peak	300 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Heater to Cathode	2.8 Pf
Plate to Cathode and Heater	6.5 Pf
Cathode to Plate and Heater	9.0 Pf

RATINGS (Design Maximum Rating System)

Damper Service(2)

Peak Inverse Plate Voltage (Max.)	5000 Volts
Plate Dissipation (Max.)	6.3 Watts
Steady State Peak Current (Max.)	1100 Ma
DC Plate Current (Max.)	175 Ma

NOTES:

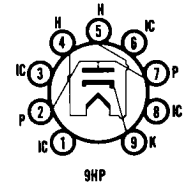
(1) Pins 1, 3, 6, and 8 should not be used as tie points.
(2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

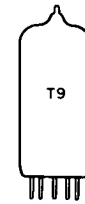
6AY3A

DAMPER

Heater-Cathode Diode

Construction .....Novar T-9
Base .....Novar Button 9 Pin, E9-75
Basing 9HP
Outline 9-85
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.730 In.
Maximum Overall Height .....3.110 In.
6AY3A is identical to 6AY3 except for shorter bulb.





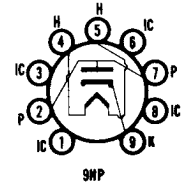
6AY3B

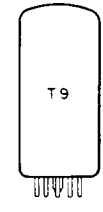
12AY3A, 17AY3A

DAMPER

Heater-Cathode Diode

Construction .....Novar T-9
Base .....Novar Button 9 Pin, E9-89
(Exhaust Tip on Base)
Basing 9HP
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.625 In.
Maximum Overall Height .....3.005 In.
6AY3B, 12AY3A, 17AY3A are identical to 6AY3, 6AY3A, 12AY3, 17AY3 except for base with exhaust tip at bottom and shorter bulb.



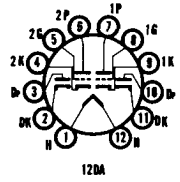


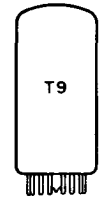
Color Television Type

FM DETECTOR AF AMPLIFIER

6AY11

Double Diode and Double High Mu Triode





Construction ..... Compactron T-9
Base ..... Button 12 Pin, E12-70
Basing 12DA
Outline 9-56
Maximum Diameter ..... 1.188 In.
Maximum Seated Height ..... 1.500 In.
Maximum Overall Height ..... 1.875 In.

ELECTRICAL DATA

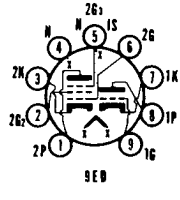
HEATER OPERATION	
Heater Voltage	6.3 Volts
Heater Current	690 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
Total DC and Peak	200 Volts
Heater Positive with Respect to Cathode	
DC	100 Volts
Total DC and Peak	200 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)	
Triode (Each Section)	
Grid to Plate	2.2 Pf
Input	2.0 Pf
Output	0.22 Pf
Diode (Each Section)	
Plate to Cathode and Heater	2.0 Pf
Cathode to Heater and Plate	5.5 Pf
Coupling	
Triode Grid to Diode Plate (Max.)	0.08 Pf
Triode Grid (Sec. 1) to Triode Grid (Sec. 2) (Max.)	0.01 Pf
Triode Plate (Sec. 1) to Triode Plate (Sec. 2)	0.48 Pf
RATINGS (Design Maximum Rating System)	
Triode (Each Section)	
Plate Voltage (Max.)	330 Volts
Positive DC Grid Voltage (Max.)	0 Volt
Negative DC Grid Voltage (Max.)	50 Volts
Plate Dissipation (Max.)	1.0 Watts
Diode (Each Section)	
Diode Current for Continuous Operation	5.0 Ma
CHARACTERISTICS AND TYPICAL OPERATION	
Triode (Each Section)	
Plate Voltage	250 Volts
Grid Voltage	–2.0 Volts
Amplification Factor	100
Plate Resistance (Approx.)	52,700 Ohms
Transconductance	1900 μmhos
Plate Current	1.2 Ma
Diode (Each Section)	
Average Diode Current with 5.0 Voltage DC Applied	18 Ma

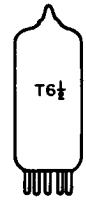
Color Television Type

SYNC SEPARATOR/CLIPPER(T) IF/VIDEO/AGC AMPLIFIER(P)

6AZ8

Medium Mu Triode and Sharp Cutoff Pentode





Construction ..... Miniature T-6-½
Base ..... Button 9 Pin, E9-1
Basing 9ED
Outline 6-2
Maximum Diameter ..... 0.875 In.
Maximum Seated Height ..... 1.938 In.
Maximum Overall Height ..... 2.188 In.

ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 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

Triode	
Grid to Plate	1.7 Pf
Grid to Cathode, Heater, Pentode Grid No. 3 and Internal Shield	2.0 Pf
Plate to Cathode, Heater, Pentode Grid No. 3 and Internal Shield	1.7 Pf
Pentode	
Grid No. 1 to Plate (Max.)	0.02 Pf
Grid No. 1 to Cathode, Heater, Grid No. 2, Grid No. 3 and Internal Shield	6.5 Pf
Plate to Cathode, Heater, Grid No. 2, Grid No. 3 and Internal Shield	2.2 Pf
Coupling	
Triode Grid to Pentode Plate (Max.)	0.027 Pf
Pentode Grid No. 1 to Triode Plate (Max.)	0.020 Pf
Pentode Plate to Triode Plate (Max.)	0.045 Pf

RATINGS (Design Center Rating System)

	Triode	Pentode
Plate Voltage (Max.)	300	300 Volts
Grid No. 2 Supply Voltage (Max.)	—	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Grid No. 1 Voltage (Positive Bias) (Max.)	0	0 Volt
Plate Dissipation (Max.)	2.6	2 Watts
Grid No. 2 Input		
For Grid No. 2 Voltage up to 150 Volts (Max.)	—	0.5 Watt
For Grid No. 2 Voltage Between 150 and 300 Volts	See Rating Chart (Gen. Info. Sec.)	
Maximum Circuit Values		
Grid No. 1 Circuit Resistance		
Fixed Bias	0.5	0.25 Megohm
Cathode Bias	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode	Pentode
Plate Supply Voltage	200	200 Volts
Grid No. 2 Voltage	—	150 Volts
Grid No. 1 Voltage	– 6	— Volts
Cathode Bias Resistor	—	180 Ohms
Plate Resistance	5750	300,000 Ohms
Transconductance	3300	6000 μmhos
Grid No. 1 Voltage for Ib = 10 μa	–19	— Volts
Grid No. 1 Voltage for Gm = 10 μmhos	—	–12.5 Volts
Plate Current	13	9.5 Ma
Grid No. 2 Current	—	3 Ma

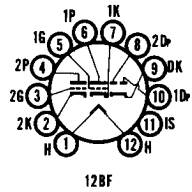
6B10

8B10

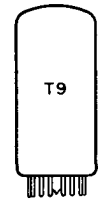
HORIZONTAL PHASE DETECTOR (D) HORIZONTAL OSCILLATOR (T)

Double Diode and Medium Mu Twin Triode

Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12BF
Outline	
Maximum Diameter	1.188 In.
Maximum Seated Height	1.500 In.
Maximum Overall Height	1.846 In.



12BF



ELECTRICAL DATA

HEATER OPERATION

	8B10	6B10
Heater Voltage	8.5	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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 (Unshielded)	
Triode No. 1	
Grid to Plate	1.5 Pf
Input: 1Tg to (h + 1Tk + IS)	1.7 Pf
Output: 1Tp to (h + 1Tk + IS)	1.6 Pf
Triode No. 2	
Grid to Plate	1.5 Pf
Input: 2Tg to (h + 2Tk + IS)	1.8 Pf
Output: 2Tp to (h + 2Tk + IS)	0.6 Pf
Diode No. 1	
Plate to Cathode, Heater and Internal Shield	1.9 Pf
Diode No. 2	
Plate to Cathode, Heater, and Internal Shield	1.8 Pf
Coupling	
Triode Plate to Triode Plate	0.9 Pf
Diode Plate to Diode Plate	0.7 Pf
Triode No. 1 Grid to Diode No. 1 Plate	1.015 Pf
Triode No. 2 Grid to Diode No. 1 Plate	0.005 Pf
Triode No. 1 Grid to Diode No. 2 Plate	0.02 Pf
Triode No. 2 Grid to Diode No. 2 Plate	0.005 Pf
RATINGS (Design Maximum Rating System)	
Triode (Each Section)	
Plate Voltage	330 Volts
Plate Dissipation	2.5 Watts
DC Cathode Current	20 Ma
Grid Circuit Resistance	
Fixed Bias	0.25 Megohm
Cathode Bias	1.0 Megohm
Diode (Each Section)	
Average Diode Current for Eb = 5 Volts	20 Ma
CHARACTERISTICS AND TYPICAL OPERATION	
Triode (Each Section)	
Plate Voltage	250 Volts
Grid Voltage	–9.5 Volts
Plate Current	7.0 Ma
Amplification Factor	18
Plate Resistance	9750 Ohms
Transconductance	1850 μmhos
Grid Voltage for Ib = 50 μa	–20 Volts
Diode (Each Section)	
Average Diode Current for Eb = 5 Volts	20 Ma

Color Television Type

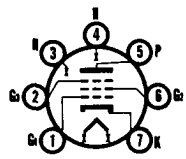
RF/IF AMPLIFIER

6BA6/EF93

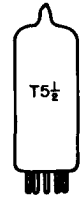
3BA6, 4BA6, 12BA6

Semi-Remote Cutoff Pentode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7BK
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7BK



ELECTRICAL DATA

HEATER OPERATION

	3BA6	4BA6	12BA6	6BA6/EF93
Heater Voltage	3.15	4.2	12.6	6.3 Volts
Heater Current	600	450	150	300 Ma
Heater Warm-up Time	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

	Shielded (1)	Unshielded
Grid No. 1 to Plate (Max.)	0.0035	0.0035 Pf
Input	5.5	5.5 Pf
Output	5.5	5.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	330 Volts
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	3.4 Watts
Grid No. 2 Dissipation (Max.)	0.7 Watt
Negative Grid No. 1 Voltage (Max.)	55 Volts
Positive Grid No. 1 Voltage (Max.)	0 Volt

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	100	250 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket	
Grid No. 2 Voltage	100	100 Volts
Cathode Bias Resistor	68	68 Ohms
Plate Resistance (Approx.)	0.25	1.0 Megohm
Transconductance	4300	4200 μmhos
Plate Current	10.8	11.0 Ma
Grid No. 2 Current	4.4	4.2 Ma
Grid No. 1 Voltage for Gm = 40 μmhos	−20	−20 Volts

NOTE:
(1) External Shield No. 316 Connected to Pin 7 (cathode).

6BA8A

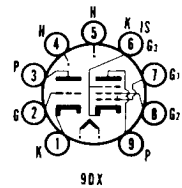
8BA8A

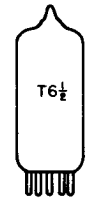
Color Television Type

SYNC SEPARATOR/CLIPPER (T) VIDEO AMPLIFIER (P)

Medium Mu Triode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9DX
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.





ELECTRICAL DATA

HEATER OPERATION

	8BA8A	6BA8A
Heater Voltage	8.4	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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

	Shielded (1)	Unshielded
Grid to Plate: (g to p)	2.2	2.2 Pf
Input: g to (h + k)	2.7	2.5 Pf
Output: p to (h + k)	1.9	0.4 Pf

Pentode

Grid to Plate: (g1 to p) (Max.)	0.05	0.06 Pf
Input: g1 to (h + k + g2 + g3 + IS)	10.0	10.0 Pf
Output: p to (h + k + g2 + g3 + IS)	4.5	3.6 Pf

Coupling

Pentode Grid No. 1 to Triode Plate (Max.)	0.003	0.006 Pf
Pentode Plate to Triode Grid (Max.)	0.006	0.016 Pf
Pentode Plate to Triode Plate (Max.)	0.023	0.150 Pf

RATINGS (Design Center Rating System)

	Triode	Pentode
Plate Voltage (Max.)	300	300 Volts
Grid No. 2 Supply Voltage (Max.)	—	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	2.0	3.25 Watts
Grid No. 2 Dissipation (Max.)	—	1.0 Watt
Negative Grid No. 1 Voltage (Max.)	—	50 Volts

Positive Grid No. 1 Voltage (Max.)	—	0 Volt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Self Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

	Triode	Pentode
Plate Voltage	200	200 Volts
Grid No. 2 Voltage	—	150 Volts
Grid No. 1 Voltage	−8	0 Volts
Cathode Bias Resistor	—	180 Ohms
Plate Current	8.0	13 Ma
Grid No. 2 Current	—	3.5 Ma
Transconductance	2700	9000 μmhos
Amplification Factor	18	—
Plate Resistance (Approx.)	6700	400,000 Ohms
Grid No. 1 Voltage for Ib = 10 μa (Approx.)	−16	−10 Volts

INSTANTANEOUS PLATE KNEE VALUES

Eb = 65 V, Ec2 = 150 V, and Ec1 = 0 V;
Ib = 42 Ma; and Ic2 = 12.5 Ma

NOTE:

(1) Shield No. 315 ties to cathode base pin of section under test.

Color Television Type

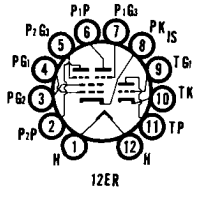
VERTICAL DEFLECTION OSC. (T) SYNC/AGC AMPLIFIER (P)

6BA11

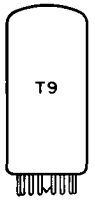
8BA11

Medium Mu Triode and Twin Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12ER
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.



12ER



ELECTRICAL DATA

HEATER OPERATION

	8BA11	6BA11
Heater Voltage	8.4	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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 (Unshielded)

Pentode Section	
Grid No. 3 to Plate (Each Pentode)	2.0 Pf
Grid No. 1 to All	6.0 Pf
Grid No. 3 (Each Pentode to All)	3.6 Pf
Plate (Each Pentode to All)	3.0 Pf
Grid No. 3 (Pentode 1) to Grid No. 3 (Pentode 2) (Max.)	0.026 Pf
Triode Section	
Grid to Plate	2.0 Pf
Input: g1 to (k + h)	2.0 Pf
Output: p to (k + h + IS)	1.9 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage	300	300 Volts
Grid No. 2 Voltage	—	150 Volts
Positive DC Grid No. 3 Voltage	—	3.0 Volts
Negative DC Grid No. 3 Voltage	—	50 Volts
Peak Positive Grid No. 3 Voltage	—	50 Volts

Negative DC Grid No. 1 Voltage	—	50 Volts
Plate Dissipation (Each Plate)	1.5	1.1 Watts
Grid No. 2 Dissipation	—	0.75 Watt
DC Cathode Current	20	12 Ma
Grid No. 3 Circuit Resistance (Each Grid)	—	0.5 Megohm
Grid No. 1 Circuit Resistance		
Fixed Bias	0.25	0.5 Megohm
Cathode Bias	1.0	0.5 Megohm

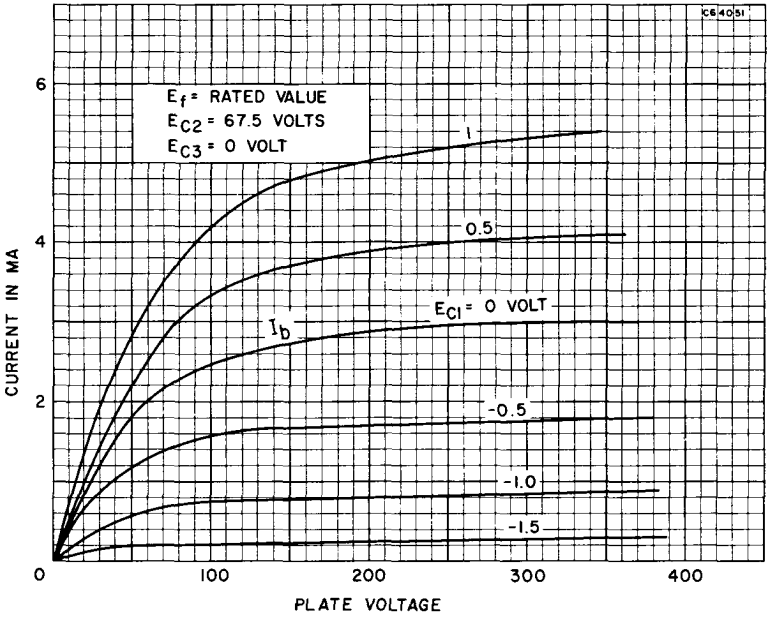
CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode: Each Section Separately[2]		Pentode: Both Sections Operating[3]	
Plate Voltage	250	100	100	100	100 Volts
Grid No. 2 Voltage	—	67.5	67.5	67.5	67.5 Volts
Grid No. 3 Voltage	—	0	0	−10	0 Volts
Grid No. 1 Voltage	−11	0	Note 1	Note 1	Note 1 Volts
Plate Current	5.0	—	2.5	0	2.5 Ma
Grid No. 2 Current	—	—	—	7.0	4.4 Ma
Grid No. 1 Transconductance	1800	1700	—	—	— μmhos
Amplification Factor	18	—	—	—	—
Grid No. 3 Transconductance	—	—	450	—	— μmhos
Grid No. 1 Voltage Ib = 100 μa	−18	2.3	—	—	— Volts
Grid No. 3 Voltage (Approx.) For Ib = 100 μa	—	—	−3.2	—	— Volts

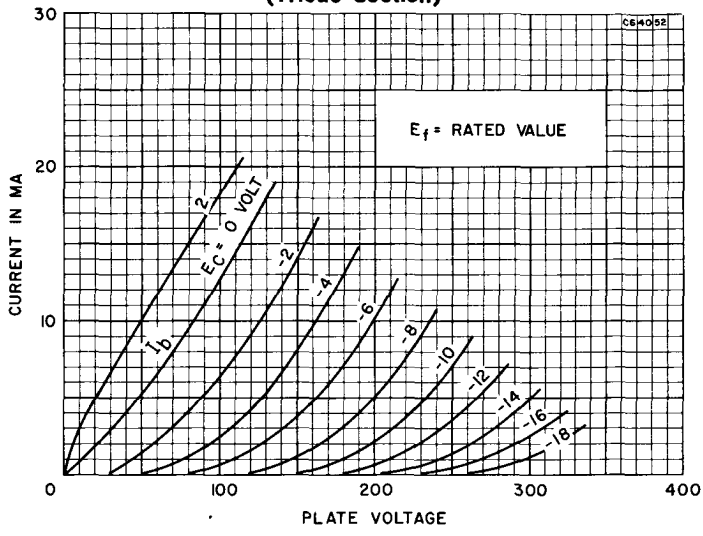
NOTES:

(1) Grid current adjusted for 100 μa DC.
(2) Plate and Grid No. 3 of opposite section grounded.
(3) Voltages and plate current apply to each section.

AVERAGE PLATE CHARACTERISTICS
(Pentode Section)
(with Opposite Grid No. 3 and Plate Grounded)



AVERAGE PLATE CHARACTERISTICS
(Triode Section)

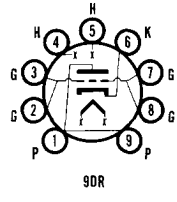


RF AMPLIFIER

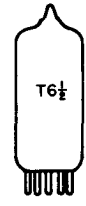
6BC4

Medium Mu Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DR
Outline 6-1
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.500 In.
Maximum Overall Height .....1.750 In.



9DR



ELECTRICAL DATA

HEATER OPERATION	
Heater Voltage	6.3 Volts
Heater Current	225 Ma
Maximum Heater-Cathode Voltage	75 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)	
Grid to Plate	1.6 Pf
Grid to Cathode and Heater	2.9 Pf
Plate to Cathode and Heater	0.26 Pf
Heater to Cathode	2.7 Pf
RATINGS (Design Center Rating System)	
Plate Voltage (Max.)	250 Volts
Plate Dissipation (Max.)	2.5 Watts
Cathode Current (Max.)	25 Ma
Grid Circuit Resistance	
Fixed Bias	Not recommended
Cathode Bias (Max.)	0.5 Megohm
CHARACTERISTICS AND TYPICAL OPERATION	
Class A1 Amplifier	
Plate Supply Voltage	150 Volts
Cathode Bias Resistor	100 Ohms
Amplification Factor	48
Plate Resistance	4800 Ohms
Transconductance	10,000 μmhos
Grid Bias for Ib = 10 μa	−10 Volts
Plate Current	14.5 Ma

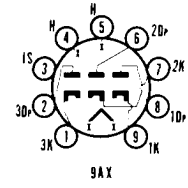
6BC7

Color Television Type

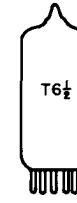
DC RESTORER or FM DISCRIMINATOR or AM DETECTOR

Triple Diode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9AX
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.938 In.
Maximum Overall Height .....2.188 In.



9AX



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 Ma
Maximum Heater-Cathode Voltage	200 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Plate Diode No. 1 to All Other Elements	3.5 Pf
Plate Diode No. 2 to All Other Elements	5.5 Pf
Plate Diode No. 3 to All Other Elements	3.5 Pf

RATINGS (Design Center Rating System) (Each Section)

Peak Inverse Plate Voltage (Max.)	330 Volts
DC Output Current (Max.)	12 Ma
Peak Plate Current (Max.)	54 Ma

6BC8

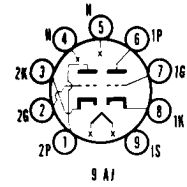
4BC8

Color Television Type

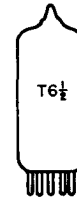
VHF CASCODE AMPLIFIER

Medium Mu, Semi-Remote Cutoff Twin Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9AJ
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.938 In.
Maximum Overall Height .....2.188 In.



9 AJ



ELECTRICAL DATA

HEATER OPERATION

	4BC8	6BC8
Heater Voltage	4.2	6.3 Volts
Heater Current	600	400 Ma
Heater Warm-up Time	11	— Seconds
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode[1]		
Total DC and Peak		200 Volts
Heater Positive with Respect to Cathode		
DC		100 Volts
Total DC and Peak		200 Volts

DIRECT INTERELECTRODE CAPACITANCES (Shielded)[2]

	Section 1		Section 2
Grid to Plate	1.2		1.2 Pf
Input	2.6		5.5 Pf
Output	1.3		2.4 Pf
Heater to Cathode	2.8		2.8 Pf
Plate Section No. 1 to Plate Section No. 2		0.02	Pf
Grid Section No. 1 to Grid Section No. 2 (Max.)		0.04	Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)[1]	250 Volts
Plate Dissipation (Max.)	2.2 Watts
Cathode Current (Max.)	22 Ma
Grid Circuit Resistance (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION (Each Section)

Class A1 Amplifier

Plate Voltage	150 Volts

Grid Voltage	0 Volt
Cathode Bias Resistor	220 Ohms
Plate Current	10 Ma
Transconductance	6200 μmhos
Plate Resistance	5300 Ohms
Amplification Factor	35
Grid Voltage for Gm = 50 μmhos (Approx.)	−13 Volts

NOTES:
(1) This rating may be as high as 300 volts max. under cutoff conditions when the tube is used as a cascode amplifier and the two sections are connected in series.
(2) Shield No. 315.

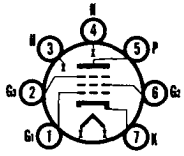
RF/IF AMPLIFIER

6BD6

12BD6

Remote Cutoff Pentode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7BK
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7BK



ELECTRICAL DATA

HEATER OPERATION

	12BD6	6BD6
Heater Voltage	12.6	6.3 Volts
Heater Current	150	300 Ma
Maximum Heater-Cathode Voltage		90 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded (1)	Unshielded
Grid to Plate (Max.)	0.005	0.004 Pf
Input	4.3	4.3 Pf
Output	5.0	5.0 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	300 Volts
Grid No. 2 Voltage (Max.)	125 Volts
Plate Dissipation (Max.)	4.0 Watts
Grid No. 2 Dissipation (Max.)	0.4 Watt
Cathode Current (Max.)	14 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	100	250 Volts
Grid No. 3 Voltage	(Connected to Cathode at Socket)	
Grid No. 2 Voltage	100	100 Volts
Grid No. 1 Voltage	−1	−3 Volts
Plate Current	13	9 Ma
Grid No. 2 Current	5	3.5 Ma
Transconductance	2350	2000 μmhos
Plate Resistance	0.12	0.7 Megohm
Ec1 for Gm = 10 μmhos (Approx.)	−35	−35 Volts

NOTE:
(1) With external Shield No. 316 connected to pin 7 (cathode).

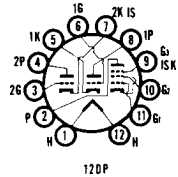
GENERAL PURPOSE AMPLIFIER (T)
SYNC SEPARATOR (T)
VIDEO AMPLIFIER (P)

6BD11

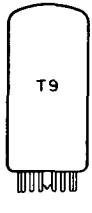
15BD11, 15BD11A

High Mu Triode, Medium Mu Triode and Sharp Cutoff Pentode

Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12DP
Outline	9-58
Maximum Diameter	1.188 In.
Maximum Seated Height	2.000 In.
Maximum Overall Height	2.375 In.



12DP



ELECTRICAL DATA

HEATER OPERATION	15BD11 15BD11A	6BD11
Heater Voltage	14.7	6.3 Volts
Heater Current	450	1050 Ma
Heater Warm-up Time	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 Component		100 Volts
Total DC and Peak		200 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)		
Triode (Section 1)		
Grid to Plate		1.9 Pf
Input: T1g to (1Tk + 2Tk + Pk + Pg3 + h + IS)		3.0 Pf
Output: T1p to (1Tk + 2Tk + Pk + Pg3 + h + IS)		2.2 Pf
Triode (Section 2)		
Grid to Plate		3.6 Pf
Input: T2g to (2Tk + Pk + Pg3 + h + IS)		2.4 Pf
Output: T2p to (2Tk + Pk + Pg3 + h + IS)		3.8 Pf
Pentode		
Grid No. 1 to Plate		0.13 Pf
Input: Pg1 to (2Tk + Pk + Pg2 + Pg3 + h + IS)		11 Pf
Output: Pp to (2Tk + Pk + Pg2 + Pg3 + h + IS)		4.6 Pf
Coupling		
Pentode Plate to Triode Plate (Section 2) (Max.)		0.045 Pf
Triode Plate (Section 1) to Triode Plate (Section 2) (Max.)		0.075 Pf
RATINGS (Design Maximum Rating System)		
Triode No. 1		
Plate Voltage (Max.)		330 Volts
Positive DC Grid Voltage (Max.)		0 Volt
Plate Dissipation (Max.)		1.5 Watts
Grid Circuit Resistance		
With Fixed Bias (Max.)		0.5 Megohm
With Cathode Bias (Max.)		1.0 Megohm
Triode No. 2		
Plate Voltage (Max.)		330 Volts
Positive DC Grid Voltage (Max.)		0 Volt
Plate Dissipation (Max.)		2.0 Watts
Grid Circuit Resistance		
With Fixed Bias (Max.)		0.5 Megohm
With Cathode Bias (Max.)		1.0 Megohm
Pentode Section		
Plate Voltage (Max.)		330 Volts
Screen-Supply Voltage (Max.)		330 Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive DC Grid No. 1 Voltage (Max.)		0 Volt
Plate Dissipation (Max.)		4.0 Watts
Screen Dissipation (Max.)	(15BD11A = 1.5)	1.1 Watts
Grid No. 1 Circuit Resistance		
With Fixed Bias (Max.)		1.0 Megohm
With Cathode Bias (Max.)		1.0 Megohm
CHARACTERISTICS AND TYPICAL OPERATION		
Triode No. 1		
Plate Voltage		200 Volts
Grid Voltage		−2.0 Volts
Amplification Factor		68
Plate Resistance (Approx.)		12,400 Ohms
Transconductance		5500 μmhos
Plate Current		7.0 Ma
Grid Voltage (Approx.)		
Ib = 100 μa		−5.5 Volts
Triode No. 2		
Plate Voltage		200 Volts
Cathode-Bias Resistor		220 Ohms
Amplification Factor		41
Plate Resistance (Approx.)		9400 Ohms
Transconductance		4400 μmhos
Plate Current		9.2 Ma
Grid Voltage (Approx.)		
Ib = 100 μa		−6.5 Volts
Pentode Section		
Plate Voltage	35	135 Volts
Screen Voltage	135	135 Volts
Grid No. 1 Voltage(1)	0	— Volt
Cathode Bias Resistor	—	100 Ohms

Plate Resistance (Approx.)	—	45,000 Ohms
Transconductance	—	10,400 μmhos
Plate Current	34	17 Ma
Screen Current	13	4.0 Ma
Grid No. 1 Voltage (Approx.)		
Ib = 100 μa	—	-6 Volts

NOTE:
(1) Applied for short interval (two seconds maximum) so as not to damage tube.

Color Television Type

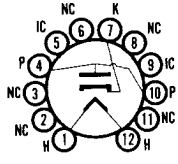
DAMPER

6BE3A

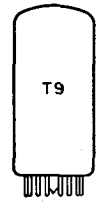
12BE3A, 17BE3A

Heater-Cathode Diode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12GA
Outline 9-60
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.500 In.
Maximum Overall Height .....2.875 In.



12GA



ELECTRICAL DATA

HEATER OPERATION

	17BE3A	12BE3A	6BE3A
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
DC			900 Volts
Total DC and Peak			5000 Volts
Heater Positive with Respect to Cathode			
DC			100 Volts
Total DC and Peak			300 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Heater to Cathode	3.4 Pf
Plate to Cathode and Heater	8.0 Pf
Cathode to Plate and Heater	10 Pf

RATINGS (Design Maximum Rating System)
Damper Service

Peak Inverse Plate Voltage(1) (Max.)	5000 Volts
Plate Dissipation (Max.)	6.5 Watts
Steady State Peak Current (Max.)	1200 Ma
DC Plate Current (Max.)	200 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 350 Ma DC	22.5 Volts

NOTE:
(1) 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 horizontal scanning cycle.

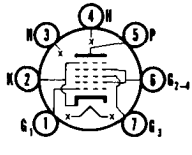
AM/FM PENTAGRID CONVERTER

6BE6

3BE6, 4BE6, 12BE6

Heptode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CH
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7 CH



ELECTRICAL DATA

HEATER OPERATION

	3BE6	4BE6	12BE6	6BE6
Heater Voltage	3.15	4.2	12.6	6.3 Volts
Heater Current	600	450	150	300 Ma
Heater Warm-up Time	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

	Shielded (2)	Unshielded
Grid No. 3 to Plate (Max.)	0.25	0.30 Pf
Grid No. 3 to Grid No. 1 (Max.)	0.15	0.15 Pf
Grid No. 3 Input: g3 to (h+k+g1+g2+g4+g5+p)	7.0	7.0 Pf
Grid No. 1 Input: g1 to (h+k+g2+g4+g3+g5+p)	5.5	5.5 Pf
Output: p to (h+k+g1+g2+g4+g3+g5)	13.0	8.0 Pf
Grid No. 1 to Cathode	3.0	3.0 Pf
Grid No. 1 to Plate	0.05	0.1 Pf
Cathode to All Electrodes Except Grid No. 1	20.0	15.0 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	1.0 Watt
Grid No. 2 Voltage (Max.)	100 Volts
Grid No. 2 Supply Voltage (Max.)	300 Volts
Grid No. 2 Dissipation (Max.)	1.0 Watt
Positive Grid No. 3 Voltage (Max.)	0 Volt
Negative Grid No. 3 Voltage (Max.)	50 Volts
Cathode Current (Max.)	14 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Separate Excitation (2)		
Plate Voltage	100	250 Volts
Grid No. 2 Voltage	100	100 Volts
Grid No. 3 Voltage	−1.5	−1.5 Volts
Grid No. 1 Resistance	20,000	20,000 Ohms
Grid No. 1 Current	0.5	0.5 Ma
Conversion Transconductance	455	475 μmhos
Plate Resistance (Approx.)	0.4	1.0 Megohm
Plate Current	2.6	2.9 Ma
Grid No. 2 Current	7.0	6.8 Ma
Cathode Current	10.1	10.2 Ma
Grid No. 3 Voltage (Approx.) for Gc = 10 μmhos	−30	−30 Volts
Oscillator Section Characteristics (non-Oscillating)		
Grid No. 3 Voltage		0 Volt
Grid No. 1 Voltage		0 Volt
Grid No. 2 Connected to Plate		100 Volts
Cathode Current		25 Ma
Transconductance Between Grid No. 1 and Grid No. 2 Connected to Plate		7250 μmhos
Amplification Factor		20
Grid No. 3 Voltage (Approx.) for Ib = 10 μa		−11 Volts

NOTES:

(1) Shield No. 316 connected to cathode.

(2) Data for self-excitation in a zero bias circuit corresponds very closely to that for separate excitation.

6BF11

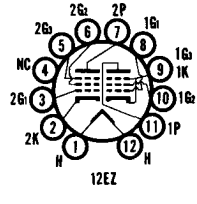
12BF11, 17BF11, 24BF11

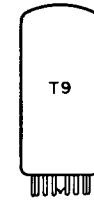
Color Television Type

AUDIO POWER AMPLIFIER FM DETECTOR

Beam Pentode and Sharp Cutoff Pentode

Construction ..... Compactron T-9
Base ..... Button 12 Pin, E12-70
Basing 12EZ
Outline 9-59
Maximum Diameter ..... 1.188 In.
Maximum Seated Height ..... 2.250 In.
Maximum Overall Height ..... 2.625 In.





ELECTRICAL DATA

HEATER OPERATION

	24BF11	17BF11	12BF11	6BF11
Heater Voltage	24.2	16.8	12.6	6.3 Volts
Heater Current	315	450	600	1200 Ma
Heater Warm-up Time	11	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 (Unshielded)

Section No. 1 (Power Amplifier)

Grid to Plate	0.24 Pf
Input: g to (h + 1k + 1g2 + 1g3 + IS)	13.0 Pf
Output: p to (h + 1k + 1g2 + 1g3 + IS)	10.0 Pf

Section No. 2 (FM Detector)

Grid No. 1 to Plate (Max.)	0.036 Pf
Grid No. 3 to Plate	3.2 Pf
Grid No. 1 to (h + 2k + 2g2 + 2g3 + IS)	6.5 Pf
Grid No. 3 to (h + 2k + 2g2 + 2g3 + 2p + IS)	8.0 Pf
Grid No. 1 to Grid No. 3	0.11 Pf
Plate No. 1 to Plate No. 2	0.13 Pf

RATINGS (Design Maximum Rating System)

Section No. 1 (Power Amplifier)

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

Section No. 2 (FM Detector)

Plate Voltage (Max.)	330 Volts
Suppressor Voltage (Max.)	28 Volts
Screen Supply Voltage (Max.)	330 Volts
Positive DC Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	1.7 Watts
Screen Dissipation (Max.)	1.1 Watts

CHARACTERISTICS AND TYPICAL OPERATION

Section No. 1

Class A1 Amplifier (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 Percent
Maximum Signal Power Output	2.4 Watts

Section No. 2 (FM Detector)

Plate Voltage	150 Volts
Suppressor Voltage	0 Volt
Screen Voltage	100 Volts
Cathode Resistor	560 Ohms
Plate Resistance (Approx.)	150,000 Ohms
Transconductance (G1)	1000 μmhos
Transconductance (G3)	400 μmhos
Plate Current	1.3 Ma
Screen Current	2.1 Ma
Ec1 for Ib = 30 μa	–4.5 Volts
Ec3 for Ib = 50 μa	–4.5 Volts

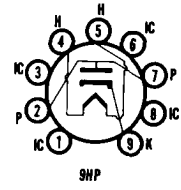
6BH3

17BH3, 22BH3

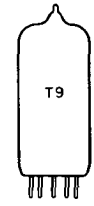
DAMPER

Heater-Cathode Diode

Construction .....Novar T-9
Base .....Button 9 Pin, E9-75
Basing(1) 9HP
Outline 9-86
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.030 In.
Maximum Overall Height .....3.410 In.



9HP



ELECTRICAL DATA

HEATER OPERATION

	22BH3	17BH3	6BH3
Heater Voltage	22.4	17	6.3 Volts
Heater Current	450	600	1600 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
DC			900 Volts
Total DC and Peak			5500 Volts
Heater Positive with Respect to Cathode			
DC			100 Volts
Total DC and Peak			300 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Heater to Cathode	2.8 Pf
Plate to Cathode and Heater	6.5 Pf
Cathode to Plate and Heater	9.0 Pf

RATINGS (Design Maximum Rating System)
Damper Service

Peak Inverse Plate Voltage (Max.)(2)	5500 Volts
Plate Dissipation (Max.)	6.5 Watts
Steady State Peak Current (Max.)	1100 Ma
DC Plate Current (Max.)	180 Ma

NOTES:

(1) Pins 1, 3, 6, and 8 should not be used as tie points.
(2) 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 horizontal scanning cycle.

6BH3A

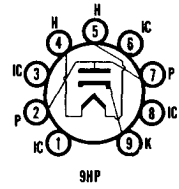
17BH3A, 22BH3A

DAMPER

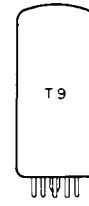
Heater-Cathode Diode

Construction .....Novar T-9
Base .....Button 9 Pin, E9-89
Basing 9HP
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.625 In.
Maximum Overall Height .....3.005 In.

6BH3A, 17BH3A, and 22BH3A are identical to 6BH3, 17BH3, and 22BH3 except for base with exhaust tip at bottom and shorter bulb.



9HP

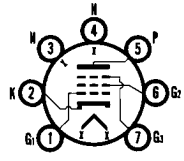


RF AMPLIFIER

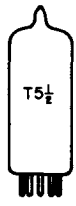
6BH6

Sharp Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CM
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.865 In.
Maximum Overall Height .....2.125 In.



7CM



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	150 Ma
Maximum Heater-Cathode Voltage	90 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded	Unshielded
Grid to Plate (Max.)	0.0035	0.0035 Pf
Input (Max.)	5.4	5.4 Pf
Output (Max.)	4.4	4.4 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	300 Volts
Grid No. 2 Supply Voltage (Max.)	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	3 Watts
Grid No. 2 Dissipation (Max.)	0.5 Watt
Negative Grid No. 1 Voltage (Max.)	50 Volts
Positive Grid No. 1 Voltage (Max.)	0 Volt

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	100	250 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket	
Grid No. 2 Voltage	100	150 Volts
Grid No. 1 Voltage	−1.0	−1.0 Volt
Cathode Bias Resistor	200	95 Ohms
Plate Current	3.6	7.4 Ma
Grid No. 2 Current	1.4	2.9 Ma
Transconductance	3400	4600 μmhos
Plate Resistance (Approx.)	0.7	1.4 Megohms
Grid No. 1 Voltage for Ib = 10 μa	−5.0	−7.7 Volts

Color Television Type

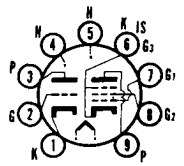
SYNC SEP./CLIPPER/AMP. or SWEEP OSC. (T) VIDEO AMPLIFIER (P)

6BH8

8BH8

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DX
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

	8BH8	6BH8
Heater Voltage	8.4	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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 (Unshielded)

Triode

Grid to Plate	2.4 Pf
Input	2.6 Pf
Output	0.38 Pf

Pentode

Grid to Plate	0.046 Pf
Input	7.0 Pf
Output	2.4 Pf

Coupling

Pentode Grid No. 1 to Triode Plate	0.004 Pf
Triode Grid to Pentode Plate	0.016 Pf
Pentode Plate to Triode Plate	0.095 Pf

RATINGS (Design Center Rating System)

	Triode	Pentode
Plate Voltage (Max.)	300	300 Volts
Grid No. 2 Supply Voltage (Max.)	—	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	2.5	3.0 Watts
Grid No. 2 Dissipation (Max.)	—	1.0 Watt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Self Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

	Triode	Pentode
Plate Voltage	150	200 Volts
Grid No. 2 Voltage	—	125 Volts
Grid No. 1 Voltage	-5	— Volts
Cathode Bias Resistor	—	82 Ohms
Amplification Factor	17	—
Plate Resistance (Approx.)	5150	150,000 Ohms
Transconductance	3300	7000 μmhos
Plate Current	9.5	15 Ma
Grid No. 2 Current	—	3.4 Ma
Grid No. 1 Voltage (Approx.)		
For Ib = 100 μa	-14	-8 Volts

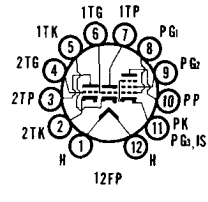
6BH11

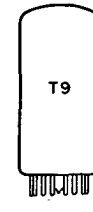
Color Television Type

TWO GENERAL PURPOSE TRIODES HORIZONTAL DEFLECTION OSCILLATOR

Double Medium Mu Triode and Sharp Cutoff Pentode

Construction ..... Compactron T-9
Base ..... Button 12 Pin, E12-70
Basing 12FP
Outline 9-58
- Maximum Diameter ..... 1.188 In.
- Maximum Seated Height ..... 2.000 In.
- Maximum Overall Height ..... 2.375 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	800 Ma

Maximum 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

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Triode (Section 1)	
Grid to Plate: (T1g to T1p)	1.7 Pf
Input: T1g to (T1k + Pk + Pg3 + IS)	3.2 Pf
Output: T1p to (T1k + Pk + Pg3 + IS)	1.4 Pf
Triode (Section 2)	
Grid to Plate: (T2g to T2p)	1.8 Pf
Input: T2g to (T2k + Pk + Pg3 + IS)	3.0 Pf
Output: T2p to (T2k + Pk + Pg3 + IS)	0.6 Pf
Pentode Section	
Grid No. 1 to Plate: (Pg2 to Pp)	0.11 Pf
Input: Pg1 to (Pk + Pg2 + Pg3 + IS)	5.5 Pf
Output: Pp to (Pk + Pg2 + Pg3 + IS)	2.2 Pf

RATINGS (Design Maximum Rating System)

	Pentode Section Horiz. Osc. Service[1]	Each Triode Section
DC Plate Voltage (Max.)	350	330 Volts
Screen Supply Voltage (Max.)	330	— Volts
Screen Voltage (Max.)	See Rating Chart (Gen. Info. Sec.)	
Positive DC Grid No. 1 Voltage (Max.)	0	0 Volt
Peak Negative Grid No. 1 Voltage (Max.)	175	— Volts
Plate Dissipation (Max.)	2.5	2.5 Watts
Screen Dissipation (Max.)	0.55	— Watt
DC Cathode Current (Max.)	20	— Ma
Peak Cathode Current (Max.)	300	— Ma
Grid No. 1 Circuit Resistance		
With Fixed Bias (Max.)	2.2	2.2 Megohms
With Cathode Bias (Max.)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Pentode Section	Each Triode Section
Plate Voltage	125	125 Volts
Screen Voltage	125	— Volts
Grid No. 1 Voltage	−1.0	−1.0 Volt
Amplification Factor	—	46
Plate Resistance (Approx.)	200,000	5400 Ohms
Transconductance	7500	8500 μmhos
Plate Current	12	13.5 Ma
Screen Current	4.0	— Ma
Grid No. 1 Voltage (Approx.)		
Ib = 10 μa	−8	−8 Volts

NOTE:

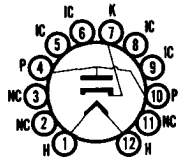
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

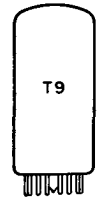
DAMPER

6BJ3

Heater-Cathode Diode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing[1] 12BL
Outline 9-59
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.250 In.
Maximum Overall Height .....2.625 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1200 Ma
Maximum Heater Cathode Voltage	
Heater Negative with Respect to Cathode	
DC	600 Volts
Total DC and Peak	3300 Volts
Heater Positive with Respect to Cathode	
DC	100 Volts
Total DC and Peak	300 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Heater to Cathode	2.7 Pf
Plate to Cathode and Heater	5.5 Pf
Cathode to Plate and Heater	8.0 Pf

RATINGS (Design Maximum Rating System)

Damper Service

Peak Inverse Plate Voltage(2) (Max.)	3300 Volts
Plate Dissipation (Max.)	4 Watts
Steady State Peak Current (Max.)	840 Ma
DC Plate Current (Max.)	140 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 250 Ma	21 Volts

NOTES:

(1) Pin 5, 6, 8, and 9 should not be used as tie points.

(2) 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 horizontal scanning cycle.

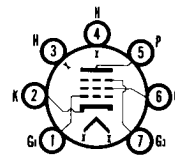
6BJ6

6BJ6A

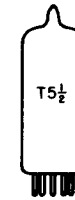
RF/IF AMPLIFIER

Remote Cutoff Pentode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7CM
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7CM



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	150 Ma
Maximum Heater-Cathode Voltage	90 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded(1)	Unshielded
Grid No. 1 to Plate (Max.)	0.0035	0.0035 Pf
Input: g1 to (h + k + g2 + g3 + IS)	4.5	4.5 Pf
Output: p to (h + k + g2 + g3 + IS)	5.5	5.5 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	300 Volts
Grid No. 2 Supply Voltage (Max.)	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Positive Grid No. 1 Voltage (Max.)	0 Volt
Negative Grid No. 1 Voltage (Max.)	50 Volts
Plate Dissipation (Max.)	3.0 Watts
Grid No. 2 Dissipation (Max.)	0.6 Watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	100	250 Volts
Grid No. 2 Voltage	100	100 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket	
Grid No. 1 Voltage	−1.0	−1.0 Volt
Plate Current	9	9.2 Ma
Grid No. 2 Current	3.5	3.3 Ma
Transconductance	3650	3600 μmhos
Plate Resistance	0.25	1.3 Megohms
Ec1 for Gm = 10 μmhos (Approx.)	−20	−20 Volts

NOTE:

(1) Shield No. 306 connected to Pins 2 and 7.

6BJ6A (only)

The 6BJ6A, except for controls on formation of interface impedance, is identical to Type 6BJ6. The interface impedance control consists of a life test conducted for 500 hours with the filament operating with 6.9 volts imposed. The other tube elements are unconnected simulating operation at cutoff conditions. Following life test the sample tubes are measured at conditions Ef = 5.7 V; Eb = Ec2 = Ec3 = 70 V DC; and Ec1 adjusted for Ib = 4.0 Ma DC. The maximum allowable value for interface impedance is 70 Ohms.

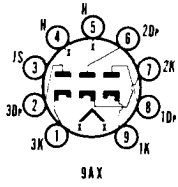
Color Television Type

DC RESTORER

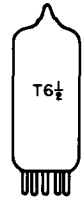
6BJ7

Triple Diode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9AX
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9AX



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 Ma
Maximum Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	100 Volts
Heater Negative with Respect to Cathode	330 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Plate No. 1 to Cathode No. 1, Heater and Internal Shield	3.0 Pf
Plate No. 2 to Cathode No. 2, Heater and Internal Shield	2.6 Pf
Plate No. 3 to Cathode No. 3, Heater and Internal Shield	2.6 Pf
Cathode No. 1 to Plate No. 1, Heater and Internal Shield	4.0 Pf
Cathode No. 2 to Plate No. 2, Heater and Internal Shield	3.8 Pf
Cathode No. 3 to Plate No. 3, Heater and Internal Shield	4.0 Pf
Plate No. 1 to Plate No. 2	0.055 Pf
Plate No. 2 to Plate No. 3	0.036 Pf
Plate No. 3 to Plate No. 1	0.036 Pf

RATINGS (Design Center Rating System)
Television DC-Restorer Service

Peak Inverse Plate Voltage (Max.)	330 Volts
Peak Plate Current Per Plate (Max.)	10 Ma
DC Output Current Per Plate (Max.)	1.0 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop (Each Section) for Ib = 10 Ma DC	2.7 Volts

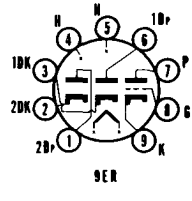
Color Television Type

PHASE SPLITTER/COMPARATOR VERTICAL DEFLECTION AMPLIFIER

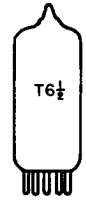
6BJ8

Double Diode and Medium Mu Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9ER
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9ER



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	600 Ma
Heater Warm-up Time	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 (Unshielded)
Diode Section

No. 1 Diode Plate to No. 1 Diode Cathode + Heater	1.9 Pf

No. 2 Diode Plate to No. 2 Diode Cathode + Heater	1.9 Pf
No. 1 Diode Cathode to No. 1 Diode Plate + Heater	4.6 Pf
No. 2 Diode Cathode to No. 2 Diode Plate + Heater	4.6 Pf
Triode Section	
Grid to Plate	2.6 Pf
Input: g to (h + Tk)	2.8 Pf
Output: p to (h + Tk)	0.31 Pf
Coupling	
No. 1 Diode Plate to Triode Grid (Max.)	0.070 Pf
No. 2 Diode Plate to Triode Grid (Max.)	0.11 Pf
No. 1 Diode Cathode to All: 1 Dk to (h + Tk + 2Dk + Tp + 1Dp + Tg + 2Dp)	4.8 Pf
No. 2 Diode Cathode to All: 2DK to (h + Tk + 1Dk + Tp + 1Dp + 2Dp + Tg)	4.8 Pf
No. 1 Diode Plate to No. 2 Diode Plate (Max.)	0.060 Pf
No. 1 Diode Plate to All: 1DP to (h + Tk + 1Dk + 2Dk + Tp + 2Dp + Tg)	3.0 Pf
No. 2 Diode Plate to All: 2DP to (h + Tk + 1Dk + 2Dk + Tp + 1Dp + Tg)	3.0 Pf

RATINGS (Design Maximum Rating System)

	Class A1 Amplifier	Vert. Def. Amplifier(1)
Triode Section		
Plate Voltage (Max.)	330	330 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	—	1200 Volts
Peak Negative Pulse Grid Voltage (Max.)	—	275 Volts
Positive DC Grid Voltage (Max.)	0	— Volt
Maximum Plate Dissipation(2) (Max.)	4.0	4.0 Watts
Average Cathode Current (Max.)	22	22 Ma
Peak Cathode Current (Max.)	—	77 Ma
Grid Circuit Resistance		
Self Bias (Max.)	1.0	2.2 Megohms
Fixed Bias (Max.)	1.0	— Megohms
Diode Section		
Peak Plate Current (Each Plate) (Max.)	—	54 Ma
DC Current (Each Plate) (Max.)	—	9 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Triode Section		
Class A1 Amplifier		
Plate Voltage	90	250 Volts
Grid Voltage	0	−9 Volts
Plate Current	13.5	8.0 Ma
Transconductance	4700	2800 μmhos
Amplification Factor	22	20
Plate Resistance (Approx.)	4700	7150 Ohms
Plate Current at Ec = −12.5 Volts DC	—	1.7 Ma
Diode Section		
Average Current Each Plate at 10 Volts DC(3)		50 Ma
Voltage Drop Each Section at Ib = 9 Ma DC		2.6 Volts

NOTES:

(1) 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 horizontal scanning cycle.

(2) 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.

(3) Test conditions only.

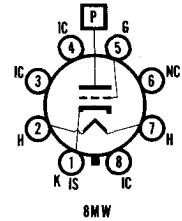
6BK4C/6EL4A

Color Television Type

SHUNT VOLTAGE REGULATOR

Sharp Cutoff Beam Pentode

Construction	Octal T-12
Base	B8-71 or B8-118
Top Cap	Small C1-1 or C1-34
Basing	8MW
Outline	12-36
Maximum Diameter	1.720 In.
Maximum Seated Height	4.438 In.
Maximum Overall Height	5.000 In.



8MW



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	200 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	450 Volts
Heater Positive with Respect to Cathode	Not Recommended

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid to Plate	1.0 Pf
Input	2.6 Pf
Output (Max.)	1.0 Pf

RATINGS (Design Maximum Rating System)

Voltage Control Service

DC Plate Voltage (Abs. Max.)	27,000 Volts
Unregulated DC Supply Voltage (Abs. Max.)	60,000 Volts
Grid Voltage	
DC (Max.)	−135 Volts
Peak (Max.)(1)	−440 Volts
DC Plate Current (Abs. Max.)	1.6 Ma
Plate Dissipation (Max.)	40 Watts
Grid Circuit Resistance (Abs. Max.)(2)	3 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Shunt Voltage Regulator

Unregulated Supply	
DC Voltage	36,000 Volts
Equivalent Resistance	11 Megohms
Voltage Divider Values	
R1 (5 Watts)	220 Megohms
R2 (2 Watts)	1 Megohm
R3 (½ Watt)	0.82 Megohm
Reference Voltage Supply	
DC Value	200 Volts
Equivalent Resistance	1000 Ohms
Effective Grid-Plate Transconductance	200 μmhos
DC Plate Current	
For Load Current of 0 Ma	1000 μa
For Load Current of 1 Ma	45 μa
Regulated DC Output Voltage	
For Load Current of 0 Ma	25,000 Volts
For Load Current of 1 Ma	24,500 Volts
Amplification Factor	2000

X-RADIATION CHARACTERISTIC

Maximum X-Radiation ..... 25.0 mR/h

X-Radiation is measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," dated February 1968 and quality controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation Emitted from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

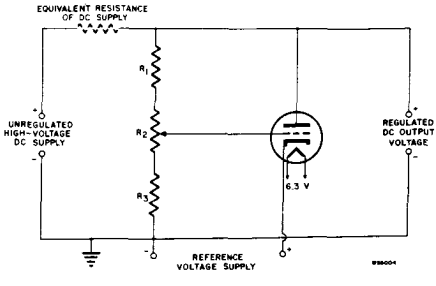
Lot acceptance sampling procedures for the manufacturer's initial and life tests for X-Radiation are based on MIL-STD-105, "Military Standard Sampling Procedures and Tables for Inspection by Attributes." Lot acceptance and life control limits are established substantially below the X-Radiation Characteristic Maximum.

NOTES:

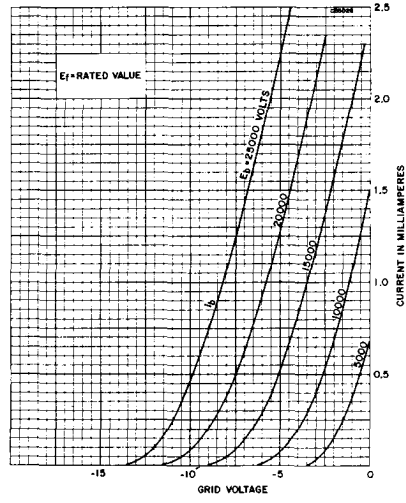
(1) Peak value for maximum of 20 seconds during equipment warm-up.
(2) With flyback transformer high voltage supply.

X-RADIATION WARNING: The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.

SHUNT REGULATOR CIRCUIT



TRANSFER CHARACTERISTICS (6BK4C/6EL4A)



6BK7B

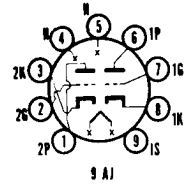
5BK7A

Color Television Type

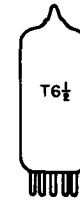
VHF CASCODE AMPLIFIER

Twin Medium Mu Triodes

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9AJ
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9 AJ



ELECTRICAL DATA

HEATER OPERATION

	5BK7A	6BK7B
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	11	11 Seconds
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
Total DC and Peak[1]		200 Volts
Heater Positive with Respect to Cathode		
DC		100 Volts
Total DC and Peak		200 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

	Section 1[2]	Section 2[2]
Grid to Plate	1.8	1.8 Pf
Input	3.0	3.0 Pf
Output	1.0	0.9 Pf
Heater to Cathode	2.8	3.0 Pf
Grid to Grid (Max.)	0.004	Pf
Plate to Plate (Max.)	0.075	Pf
Grounded Grid Operation		
Plate to Cathode	0.22	0.22 Pf
Input	6.0	6.0 Pf
Output	2.4	2.4 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	300 Volts

Negative DC Grid Voltage (Max.)	50 Volts
Plate Dissipation (Each Section) (Max.)	2.7 Watts

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier (Each Section)

Plate Voltage	150 Volts
Cathode Bias Resistor	56 Ohms
Plate Current	18 Ma
Transconductance	9300 μmhos
Amplification Factor	43
Plate Resistance	4600 Ohms
Grid Voltage for Ib = 10 μa	−11 Volts

NOTES:
(1) When operated as a cascode amplifier and the two sections are connected in series, the heater-cathode voltage of the grounded grid stage may be as high as 300 volts maximum with the heater negative with respect to the cathode.
(2) Section 1 connects to Pins 6, 7, and 8. Section 2 connects to Pins 1, 2, and 3.

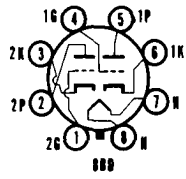
Color Television Type

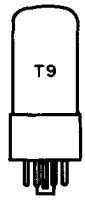
VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER

6BL7GTA

Twin Triode

Construction	Octal T-9
Base	8 Pin, B8-58
Basing	8BD
Outline	9-41
Maximum Diameter	1.188 In.
Maximum Seated Height	2.750 In.
Maximum Overall Height	3.313 In.





ELECTRICAL DATA
HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1500 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	Section No. 2
Grid to Plate	6.0	6.0 Pf
Input	4.2	4.6 Pf
Output	0.9	0.9 Pf

RATINGS (Design Center Rating System)
Vertical Deflection Oscillator and Amplifier(1,2)

	Oscillator	Amplifier
Plate Voltage (Max.)	500	500 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	3	2000 Volts
Plate Dissipation (Each Plate) (Max.)(3)	10	10 Watts
Total Plate Dissipation (Both Plates) (Max.)	12	12 Watts
Peak Negative Pulse Grid Voltage (Max.)	400	250 Volts
Average Cathode Current (Max.)	60	60 Ma
Peak Cathode Current (Max.)	210	210 Ma
Grid Circuit Resistance (Max.)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION (Each Section)

Plate Voltage	250 Volts
Grid Voltage	−9 Volts
Plate Current	40 Ma
Transconductance	7000 μmhos
Amplification Factor	15
Plate Resistance (Approx.)	2150 Ohms
Plate Current at Ec = −17 Volts	4.0 Ma
Ec1 for Ib = 50 μa (Approx.)	−23 Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS
Eb = 150 V and Ec1 = 0 V
Ib = 65 Ma

NOTES:

(1) 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 horizontal scanning cycle.
(2) Section No. 1 is recommended for vertical oscillator service, and Section No. 2 is recommended for vertical deflection amplifier service.
(3) In stages operating with grid leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.

6BL8/ECF80

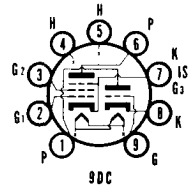
4BL8/XCF80, 6LN8

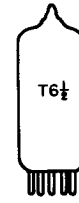
Color Television Type

VHF OSCILLATOR AND MIXER

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DC
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.938 In.
Maximum Overall Height .....2.188 In.





ELECTRICAL DATA

HEATER OPERATION

	4BL8/XCF80	6LN8	6BL8/ECF80
Heater Voltage	4.6	6.0	6.3 Volts
Heater Current	600	450	430 Ma
Heater Warm-up Time	—	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	1.5 Pf
Input: g1 to (k + Pg3 + IS + h)	2.5 Pf
Output: p to (k + Pg3 + IS + h)	1.8 Pf
Pentode Section	
Grid No. 1 to Plate	0.025 Pf
Input: g1 to (k + g3 + IS + g2 + h)	5.2 Pf
Output: p to (k + g3 + IS + g2 + h)	3.4 Pf
Coupling	
Pentode Plate to Triode Plate	0.07 Pf
Pentode Plate to Triode Grid	0.02 Pf
Pentode Grid No. 1 to Triode Plate	0.16 Pf

RATINGS (Design Maximum Rating System)

Pentode Section	
Plate Supply Voltage (Max.)	600 Volts
Plate Voltage (Max.)	275 Volts
Plate Dissipation (Max.)	1.9 Watts
Screen Supply Voltage (Max.)	600 Volts
Screen Voltage (Ik = 14 Ma) (Max.)	175 Volts
Screen Voltage (Ik = 10 Ma) (Max.)	200 Volts
Screen Dissipation (Max.)(1)	0.55 Watt
Cathode Current (Max.)	16.5 Ma
Grid Series Resistance (Cathode Bias) (Max.)	1 Megohm
Grid Series Resistance (Fixed Bias) (Max.)	0.5 Megohm
Negative Grid Voltage (Ig1 = 0.3 μa) (Max.)(2)	1.3 Volts
Triode Section	
Plate Supply Voltage (Max.)	600 Volts
Plate Voltage (Max.)	275 Volts
Plate Dissipation (Max.)	1.7 Watts
Cathode Current (Max.)	16.5 Ma
Grid Series Resistance (Max.)	0.5 Megohm
Negative Grid Voltage (Ig = 0.3 μa) (Max.)(2)	1.3 Volts

CHARACTERISTICS AND TYPICAL OPERATION

Pentode Section		
Plate Voltage		170 Volts
Screen Voltage		170 Volts
Grid Voltage		−2 Volts
Plate Current		10 Ma
Screen Current		2.8 Ma
Transconductance		6200 μmhos
Amplification Factor		47
Plate Resistance		0.4 Megohm
Input Resistance (F = 50 MHz)		10,000 Ohms
Equivalent Noise Resistance		1500 Ohms
Triode Section		
Plate Voltage		100 Volts
Grid Voltage		−2 Volts
Plate Current		14 Ma
Transconductance		5000 μmhos
Amplification Factor		20
Converter Service(3)		
Plate Voltage	170	170 Volts
Screen Voltage	170	170 Volts
Grid Resistance	0.1	0.1 Megohm
Cathode Resistor	330	820 Ohms
Oscillator Voltage	3.5	3.5 Volts
Plate Current	6.5	5.2 Ma
Screen Current	2.0	1.5 Ma
Grid Current	20	0 μa
Conversion Conductance	2200	2100 μmhos
Internal Resistance	0.8	0.87 Megohm

NOTES:

(1) If the plate dissipation is less than 1.2 watts, the maximum value of the screen dissipation may be increased to 0.75 watts.
(2) Grid voltage must not be more positive than this value.
(3) The triode should be used in Colpitts rather than a Hartley type oscillator circuit.

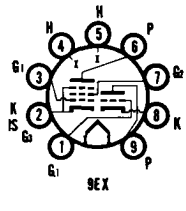
Color Television Type

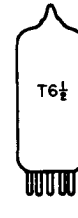
AF AMPLIFIER or OSCILLATOR AUDIO POWER AMPLIFIER

6BM8/ECL82

Triode and Power Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9EX
Outline	6-4
Maximum Diameter	0.875 In.
Maximum Seated Height	2.813 In.
Maximum Overall Height	3.063 In.





ELECTRICAL DATA

HEATER OPERATION	
Heater Voltage	6.3 Volts
Heater Current	780 Ma
Maximum Heater-Cathode Voltage	100 Volts
DIRECT INTERELECTRODE CAPACITANCES	
Triode	
Grid to All Other Elements Except Plate	2.7 Pf
Plate to All Other Elements Except Grid	4.0 Pf
Plate to Grid	4.0 Pf
Grid to Heater (Max.)	0.1 Pf
Pentode	
Grid No. 1 to All Other Elements	9.3 Pf
Plate to All Other Elements	8 Pf
Grid No. 1 to Plate (Max.)	0.3 Pf
Grid to. 1 to Heater (Max.)	0.3 Pf
Coupling	
Triode Plate to Pentode Grid No. 1 (Max.)	0.02 Pf
Triode Grid to Pentode Plate (Max.)	0.02 Pf
Triode Grid to Pentode Grid No. 1 (Max.)	0.025 Pf
Triode Plate to Pentode Plate (Max.)	0.25 Pf

RATINGS (Design Center Rating System)

	Triode	Pentode
Plate Supply Voltage (Max.)	550	900 Volts
Plate Voltage (Max.)	300	600 Volts
Grid No. 2 Supply Voltage (Max.)	—	550 Volts
Grid No. 2 Voltage (Max.)	—	300 Volts
Cathode Current (Max.)	15	50 Ma
Plate Dissipation (Max.)	1	7 Watts
Grid No. 2 Input (Max.)	—	1.8 Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	1	1 Megohm
Cathode Bias (Max.)	2	2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Triode	Pentode
Plate Voltage	100	200 Volts
Grid No. 2 Voltage	—	200 Volts
Grid No. 1 Voltage	0	−16 Volts
Amplification Factor	70	9.5(1)
Plate Resistance	—	20,000 Ohms
Transconductance	2500	6400 μmhos
Plate Current	3.5	35 Ma
Grid No. 2 Current	—	7 Ma

NOTE:

(1) Grid No. 1 to Grid No. 2.

6BN4A

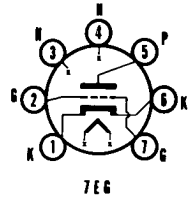
2BN4A, 3BN4A

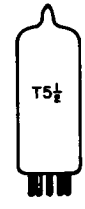
Color Television Type

VHF AMPLIFIER

Medium Mu Triode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7EG
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.





ELECTRICAL DATA

HEATER OPERATION

	2BN4A	3BN4A	6BN4A
Heater Voltage	2.35	3.0	6.3 Volts
Heater Current	600	450	200 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			100 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Unshielded	Shielded
Grid to Plate	1.1	1.2 Pf
Input: g to (h + k)	2.9	3.2 Pf
Output: p to (h + k)	0.7	1.4 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	275 Volts
Plate Dissipation (Max.)	2.2 Watts
Positive DC Grid Voltage (Max.)	0 Volt
DC Cathode Current (Max.)	22 Ma
Grid Circuit Resistance (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	150 Volts
Cathode Bias Resistor	220 Ohms
Plate Current	9.0 Ma
Transconductance	7700 μmhos
Amplification Factor	43
Plate Resistance (Approx.)	5400 Ohms
Ec for Ib = 100 μa (Approx.)	−6 Volts

Color Television Type

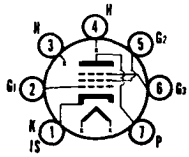
GATED BEAM DISCRIMINATOR

6BN6/6KS6

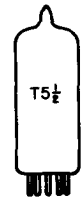
3BN6, 4BN6, 12BN6

Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7DF
Outline 5-3
Maximum Diameter .....0.750 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



7DF



ELECTRICAL DATA

HEATER OPERATION

	3BN6	4BN6	12BN6	6BN6/6KS6
Heater Voltage	3.16	4.2	12.6	6.3 Volts
Heater Current	600	450	150	300 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to All Other Electrodes	4.2 Pf
Grid No. 3 to All Other Electrodes	3.3 Pf
Grid No. 1 to Grid No. 3 (Max.)	0.004 Pf

RATINGS (Design Center Rating System)

Plate Supply Voltage (Max.)	300 Volts
Grid No. 2 Voltage (Accelerator) (Max.)	100 Volts
Peak Positive Grid No. 1 Voltage (Limiter) (Max.)	55 Volts
Total Cathode Current (Max.)	11.5 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Limiter-Discriminator Service

Plate Supply Voltage	85	285	270 Volts
Plate Voltage	63	122	121 Volts
Grid No. 2 Voltage	55	100	100 Volts
Cathode Bias Resistor (Variable)(1)	200-400	200-400	200-400 Ohms
Plate Current	0.25	0.49	0.44 Ma
Grid No. 2 Current	4.1	9.8	10.0 Ma
Plate Load Resistor	85,000	330,000	330,000 Ohms
Plate Linearity Resistor	470	1500	1000 Ohms
Integrating Capacitor	0.002	0.001	0.001 μf
Coupling Capacitor	0.25	0.01	0.25 μf
Input Signal Center Frequency	10.7	10.7	4.5 Millihertz
Frequency Deviation	±75	±75	±25 Kilohertz
Minimum Signal Voltage for Limiting Action (RMS)(2)	1.25	1.25	1.25 Volts
Input Signal Level for AM Rejection Adjustment(1)	1.25	2.0	2.0 Volts
AM Rejection at Esig = 2.0 Volts (RMS)	31	20	25 Decibels
AM Rejection at Esig = 3.0 Volts (RMS)	30	29	30 Decibels
Total Harmonic Distortion	2.0	1.6	1.8 Percent
Peak Audio Output Voltage	6.0	16.6	16.8 Volts

NOTES:

(1) 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.

(2) At signal levels above specified value, limiting is within ±2 decibels.
Adequate shielding between components of the limiter grid and the quadrature grid must be used to insure proper phasing of the voltage developed 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 Pf. The capacitance may be composed of tube input capacitance, stray capacitance, and distributed capacitance, as well as physical capacitance.

6BN8

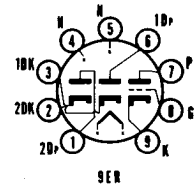
8BN8

Color Television Type

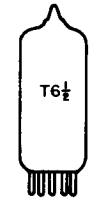
PHASE/RATIO DETECTOR OR DISCRIMINATOR AF/BURST AMPLIFIER OR OSCILLATOR

Double Diode and High Mu Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9ER
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9ER



ELECTRICAL DATA

HEATER OPERATION

	8BN8	6BN8
Heater Voltage	8.4	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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 (Unshielded)

Triode	
Grid to Plate	2.5 Pf
Input: g to (h + Tk)	3.6 Pf
Output: p to (h + Tk)	0.25 Pf
Diodes	
No. 1 Diode Plate to No. 1 Diode Cathode + Heater	1.9 Pf
No. 2 Diode Plate to No. 2 Diode Cathode + Heater	1.9 Pf
No. 1 Diode Cathode to No. 1 Diode Plate + Heater	4.8 Pf
No. 2 Diode Cathode to No. 2 Diode Plate + Heater	4.8 Pf
Coupling	
No. 1 Diode Plate to Triode Grid (Max.)	0.060 Pf
No. 2 Diode Plate to Triode Grid (Max.)	0.10 Pf
No. 1 Diode Cathode to All:	
1Dk to (h + Tk + 2Dk + Tp + 1Dp + Tg + 2Dp)	5.0 Pf
No. 2 Diode Cathode to All:	
2 Dk to (h + Tk + 1Dk + Tp + 1Dp + 2DP + Tg)	5.0 Pf
No. 1 Diode Plate to No. 2 Diode Plate (Max.)	0.070 Pf
No. 1 Diode Plate to All:	
1DP to (h + Tk + 1Dk + 2Dk + Tp + 2Dp + Tg)	3.0 Pf
No. 2 Diode Plate to All:	
2DP to (h + Tk + 1Dk + 2Dk + Tp + 1Dp + Tg)	3.0 Pf

RATINGS (Design Maximum Rating System)

Triode Section	
Plate Voltage (Max.)	330 Volts
Positive DC Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	1.7 Watts
Grid Circuit Resistance (Max.)	1.0 Megohm
Diode Section	
Peak Plate Current (Each Plate) (Max.)	54 Ma
DC Current (Each Plate) (Max.)	9 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Triode Section, Class A1 Amplifier		
Plate Voltage	100	250 Volts
Grid Voltage	−1	−3 Volts
Plate Current	1.5	1.6 Ma
Transconductance	3500	2500 μmhos
Amplification Factor	75	70
Plate Resistance (Approx.)	21,000	28,000 Ohms
Grid Voltage (Approx.) for Ib = 10 μa	−2.5	−5.5 Volts
Diode Section		
Average Current Each Plate at 10 Volts DC(1)		50 Ma
Voltage Drop Each Section at Ib = 9 Ma DC		2.6 Volts

NOTE:
(1) Test conditions only.

Color Television Type

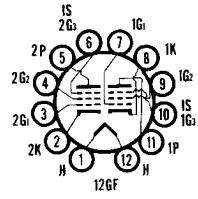
IF AMPLIFIER

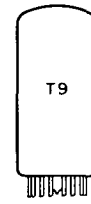
6BN11

8BN11

Double Sharp Cutoff Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12GF
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.





ELECTRICAL DATA

HEATER OPERATION

	8BN11	6BN11
Heater Voltage	8.4	6.3 Volts
Heater Current	600	800 Ma
Heater Warm-up Time	11	— Sec.
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 (Shielded)(1)

Section 1

Grid No. 1 to Plate	0.04 Pf
Input: 1g1 to (1k + 1g2 + 2g3 + h + IS)	12 Pf
Output: 1p to (1k + 1g2 + 2g3 + h + IS)	2.8 Pf

Section 2

Grid No. 1 to Plate	0.03 Pf
Input: 2g1 to (2k + 2g2 + 2g3 + 1g3 + h + IS)	12 Pf
Output: 2p to (2k + 2g2 + 2g3 + 1g3 + h + IS)	2.8 Pf
Plate to Plate: (1p to 2p) (Max.)	0.01 Pf
Grid No. 1, Section 1 to Plate, Section 2 (Max.)	0.02 Pf
Grid No. 1, Section 2 to Plate, Section 1: (2g1 to 1p) (Max.)	0.003 Pf
Cathode, Section 1 to Cathode, Section 2 (Max.)(2)	0.02 Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	330 Volts
Screen Supply Voltage (Max.)	330 Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)
Positive DC Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	3.1 Watts
Screen Dissipation (Max.)	0.65 Watt
Grid No. 1 Circuit Resistance (Cathode Bias)	0.25 Megohm

CHARACTERISTICS AND TYPICAL OPERATION (Each Section)

Plate Voltage	125 Volts
Suppressor	Connected to Cathode at Socket
Screen Voltage	125 Volts
Cathode-Bias Resistor	56 Ohms
Plate Resistance (Approx.)	0.2 Megohm
Transconductance	13,000 μmhos
Plate Current	11 Ma
Screen Current	3.8 Ma
Grid No. 1 Voltage (Approx.)	
Ib = 20 μa	-3 Volts

NOTES:

(1) With external shield (EIA 309) connected to cathode of section under test.
(2) With external shield (EIA 309) connected to ground.

6BQ5/EL84

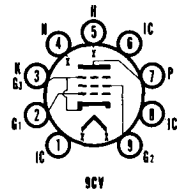
8BQ5, 10BQ5

Color Television Type

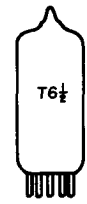
AUDIO POWER AMPLIFIER

Beam Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9CV
Outline 6-4
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.812 In.
Maximum Overall Height .....3.062 In.



9CV



ELECTRICAL DATA

HEATER OPERATION

	10BQ5	8BQ5	6BQ5/EL84
Heater Voltage	10.6	8.0	6.3 Volts
Heater Current	450	600	760 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater Cathode Voltage			100 Volts

DIRECT INTERELECTRODE CAPACITANCES

Grid No. 1 to Plate (Max.)	0.5 Pf
Input	10.8 Pf
Output	6.5 Pf
Grid No. 1 to Heater (Max.)	0.25 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)(1)	300 Volts
Grid No. 2 Voltage (Max.)(1)	300 Volts
Negative Grid No. 1 Voltage (Max.)	100 Volts
Plate Dissipation (Max.)	12 Watts
Grid No. 2 Dissipation (Max.)	2 Watts
Cathode Current (Max.)	65 Ma
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.3 Megohm
Cathode Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Operation(2) Class A1 Single Tube	Class AB1 Push-pull		Pentode Operation Class A1 Single Tube	Class AB1 Push-pull		
Plate Voltage	250	250	300	250	250	300	Volts
Grid No. 2 Voltage	—	—	—	250	250	300	Volts
Grid No. 1 Voltage	—	—	—	-7.3	—	—	Volts
Cathode Resistor(3)	270	270	270	135	130	130	Ohms
Grid Voltage (RMS)(4)	6.7	8.4	10	4.3	8	10	Volts
Plate Current							
(Zero-Signal)	34	40	48	48	62	72	Ma
(Maximum Signal)	36	53.4	52	49.5	75	92	Ma
Grid No. 2 Current							
(Zero Signal)	—	—	—	5.5	7.0	8	Ma
(Maximum Signal)	—	—	—	10.8	15	22	Ma
Transconductance	—	—	—	11.3K	—	—	μmhos
Amplification Factor(1)	—	—	—	19	—	—	
Plate Resistance	—	—	—	38K	—	—	Ohms
Load Resistance	3.5K	—	—	5.2K	—	—	Ohms
Load Resistance							
(Plate to Plate)	—	10K	10K	—	8K	8K	Ohms
Maximum-Signal Power Output	1.95	3.4	5.2	5.7	11	17	Watts
Total Harmonic Distortion(1)	9	2.5	2.5	10	3.0	4.0	Percent

CLASS AB1 ULTRA-LINEAR CONNECTION(5)

Plate Voltage	300 Volts
Cathode Resistor (Per Tube)	270 Ohms
Grid Voltage (RMS)	8 Volts
Cathode Current (Zero Signal)	80 Ma
Cathode Current (Max. Signal)	90 Ma
Load Resistance (P1 to P1)	8000 Ohms
Power Output	11 Watts

NOTES:

(1) When the heater and positive voltages are obtained from a storage battery by means of a vibrator, the maximum values of the plate and Grid No. 2 voltage is 250 volts and the plate dissipation is 9 watts.

(2) Grid No. 2 connected to plate.
(3) Common cathode resistor for push-pull applications.
(4) Per grid.
(5) Measured from grid No. 2 to plate.
(6) For Pentode Operation—Class A Amplifier Service, the maximum signal power output and total distortion are measured at fixed bias and therefore represses the power output available during the reproduction of speech and music. When a sustained sine wave is applied to the control grid the bias across the cathode resistor will readjust itself as a result of the increased plate and screen grid currents. This will result in approximately 10 percent reduction in power output.
(7) Measured with fixed bias.
(8) Grid No. 2 taps located at 43% of primary winding.

Color Television Type

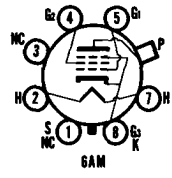
HORIZONTAL DEFLECTION AMPLIFIER

6BQ6GTB/6CU6

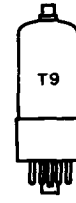
12BQ6GTB/12CU6
17BQ6GTB
25BQ6GTB/25CU6

Beam Power Pentode

Construction .....Octal T-9
Base(1)..B5-187, B6-81, B6-84, B7-7, or B7-59
Top Cap.....*C1-2, C1-3, or C1-33*
Basing 6AM
Outline .....9-49 or 9-50
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.313 In.
Maximum Overall Height .....3.875 In.



6AM



ELECTRICAL DATA

HEATER OPERATION

	25BQ6GTB/ 25CU6	17BQ6GTB	12BQ6GTB/ 12CU6	6BQ6GTB/ 6CU6
Heater Voltage	25	16.8	12.6	6.3 Volts
Heater Current	300	450	600	1200 Ma
Heater Warm-up Time	—	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 (Unshielded)

Grid No. 1 to Plate	0.6 Pf
Input	15 Pf
Output	7.5 Pf

RATINGS (Design Center Rating System)
Horizontal Deflection Amplifier(2)

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	600 Volts
Peak Positive Plate Voltage (Abs. Max.)	6000 Volts
Peak Negative Plate Voltage (Max.)	1250 Volts
Plate Dissipation (Max.)(3)	11 Watts
Peak Negative Grid No. 1 Voltage (Max.)	300 Volts
Grid No. 2 Voltage (Max.)	200 Volts
Grid No. 2 Dissipation (Max.)	2.5 Watts
Average Cathode Current (Max.)	110 Ma
Peak Cathode Current (Max.)	400 Ma
Grid No. 1 Circuit Resistance (Max.)	0.47 Megohm
Bulb Temperature (At Hottest Point) (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	250 Volts
Grid No. 2 Voltage	150 Volts
Grid No. 1 Voltage	-22.5 Volts
Plate Current	57 Ma
Grid No. 2 Current	2.1 Ma
Transconductance	5900 μmhos
Plate Resistance	14,500 Ohms
Amplification Factor (Eb and Ec2 = 150 V, Ec1 = -22.5 V)	4.3
Ec1 for Ib = 1.0 Ma (Approx.)	-43 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 60 V; Ec2 = 150 V and Ec1 = 0
Ib = 260 Ma, and Ic2 = 26 Ma

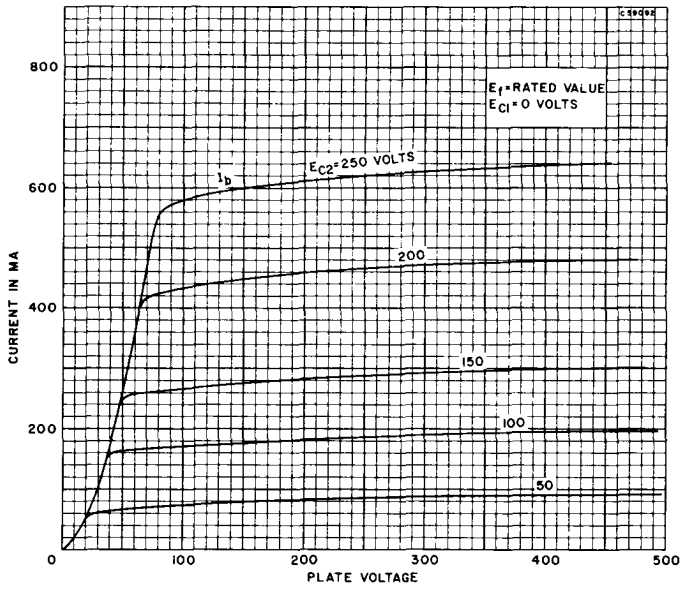
NOTES:

(1) Pin No. 1 omitted on Base No. B6-81 and B6-84.

(2) 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 horizontal scanning cycle.

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

AVERAGE PLATE CHARACTERISTICS



6BQ7A/6BZ7

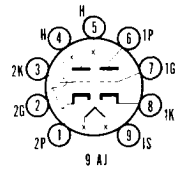
4BQ7A/4BZ7, 5BQ7A, 5BZ7

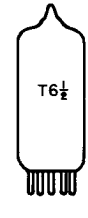
Color Television Type

VHF CASCODE AMPLIFIER

Twin Medium Mu Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9AJ
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.938 In.
Maximum Overall Height .....2.188 In.





ELECTRICAL DATA

HEATER OPERATION

	4BQ7A/ 4BZ7	5BQ7A 5BZ7	6BQ7A/ 6BZ7
Heater Voltage	4.2	5.6	6.3 Volts
Heater Current	600	450	400 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
Total DC and Peak(1)			200 Volts
Heater Positive with Respect to Cathode			
DC			100 Volts
Total DC and Peak			200 Volts

DIRECT INTERELECTRODE CAPACITANCES (Shielded)[2]

	Section 1[3]		Section 2[3]
Grid to Plate	1.2		1.2 Pf
Input: g to (h + k + IS)	2.6		5.0[4] Pf
Output: p to (h + k + IS)	1.2		2.2[4] Pf
Plate to Cathode (Max.)	0.12		0.12 Pf
Heater to Cathode	2.6		2.6 Pf
Plate Section 1 to Plate Section 2 (Max.)		0.010	Pf
Plate Section 2 to Plate and Grid Section 1 (Max.)		0.024	Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)[1]	250 Volts
Plate Dissipation (Max.)	2 Watts
Cathode Current (Max.)	20 Ma
Grid Circuit Resistance (Max.)	0.5 Megohm

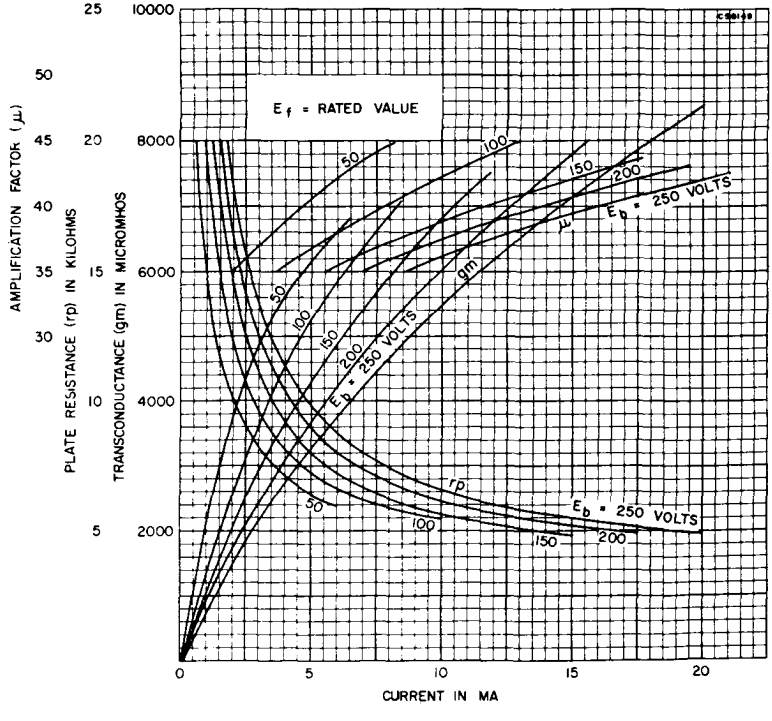
CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier (Each Section)

Plate Voltage	150 Volts
Cathode Bias Resistor	220 Ohms
Plate Current	9 Ma
Transconductance	6400 μmhos
Plate Resistance	5900 Ohms
Amplification Factor	38
Grid Voltage for Ib = 100 μa (Approx.)	−6.5 Volts

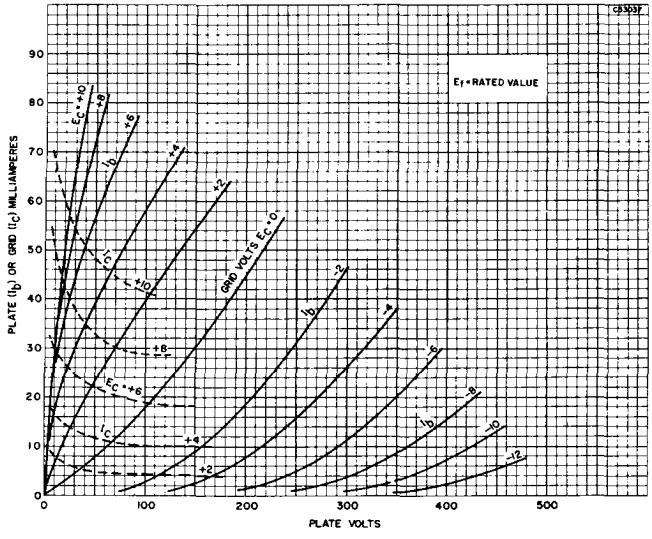
NOTES:

(1) Under cutoff conditions, in rf grounded grid circuits with direct coupled drive, this voltage may be as high as 300 volts.
(2) EIA shield No. 315 connected to Pin No. 9.
(3) Section No. 1 connects to Pins 6, 7, and 8. Section No. 2 connects to Pins 1, 2, and 3.
(4) Read as grounded grid amplifier.

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



6BR8A

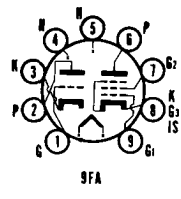
5BR8

Color Television Type

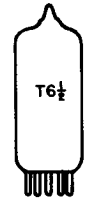
VHF OSCILLATOR AND MIXER

Medium Mu Triode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9FA
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.938 In.
Maximum Overall Height	2.188 In.



9FA



ELECTRICAL DATA

HEATER OPERATION

	5BR8	6BR8A
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	11	11 Seconds
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
Total DC and Peak		250 Volts
Heater Positive with Respect to Cathode		
DC		100 Volts
Total DC and Peak		200 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded(1)	Unshielded
Triode Section		
Grid to Plate	1.8	1.8 Pf
Triode Input	2.8	2.8 Pf
Triode Output	2.0	1.5 Pf
Heater to Cathode	2.4	2.4 Pf
Pentode Section		
Grid No. 1 to Plate (Max.)	0.010	0.020 Pf
Input	4.6	4.6 Pf
Output	3.2	2.4 Pf
Heater to Cathode	2.4	2.4 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Grid No. 2 Supply Voltage (Max.)	330	330 Volts
Positive Grid Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	2.5	3.0 Volts
Grid No. 2 Dissipation (Max.)	—	0.55 Watt

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Class A1 Amplifier		
Plate Voltage	125	125 Volts
Grid No. 2 Voltage	—	110 Volts
Grid No. 1 Voltage	-1.0	-1.0 Volts
Plate Current	13.5	9.5 Ma
Grid No. 2 Current	—	3.5 Ma
Transconductance	7500	5000 μmhos
Amplification Factor	40	—
Plate Resistance (Approx.)	—	200,000 Ohms
Zero Bias Transconductance (with Eb = 100 V, Ec2 = 70 V)	—	6000 μmhos

NOTE:
(1) With external EIA No. 315 shield connected to cathode of section under test.

Color Television Type

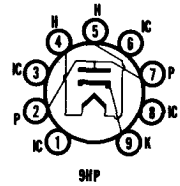
DAMPER

6BS3

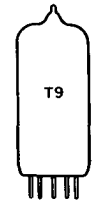
12BS3, 17BS3

Heater-Cathode Diode

Construction .....Novar T-9
Base .....Button 9 Pin, E9-75
Basing(1) 9HP
Outline 9-86
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.030 In.
Maximum Overall Height .....3.410 In.



9HP



ELECTRICAL DATA

HEATER OPERATION

	17BS3	12BS3	6BS3
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
DC			900 Volts
Total DC and Peak			5000 Volts
Heater Positive with Respect to Cathode			
DC			100 Volts
Total DC and Peak			300 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Heater to Cathode	2.8 Pf
Plate to Cathode and Heater	6.5 Pf
Cathode to Plate and Heater	9.0 Pf

RATINGS (Design Maximum Rating System)
Damper Service

Peak Inverse Plate Voltage (Max.)(2)	5000 Volts
Plate Dissipation (Max.)	6.0 Watts
Steady State Peak Current (Max.)	1100 Ma
DC Plate Current (Max.)	200 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 140 Ma	12 Volts

NOTES:
(1) Pins 1, 3, 6, and 8 should not be used as tie points.
(2) 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 horizontal scanning cycle.

6BS3A

12BS3A, 17BS3A

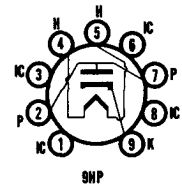
Color Television Type

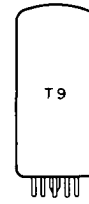
DAMPER

Heater-Cathode Diode

Construction .....Novar T-9
Base .....Button 9 Pin, E9-89
Basing 9HP
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.625 In.
Maximum Overall Height .....3.005 In.

The 6BS3A, 12BS3A, and 17BS3A are identical to the 6BS3, 12BS3, and 17BS3 except for base with exhaust tip at bottom and shorter bulb.





6BS8

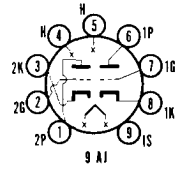
5BS8, 4BS8

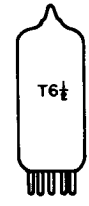
Color Television Type

VHF CASCODE AMPLIFIER

Medium Mu Twin Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9AJ
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.938 In.
Maximum Overall Height .....2.188 In.





ELECTRICAL DATA

HEATER OPERATION

	4BS8	5BS8	6BS8
Heater Voltage	4.5	5.6	6.3 Volts
Heater Current	600	450	400 Ma
Heater Warm-up Time	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 (Shielded)(1)

	Section 1	Section 2
Grid to Plate	1.15	1.15 Pf
Input	2.6	— Pf
Output	1.2	— Pf
Heater to Cathode	2.6	2.6 Pf
Plate to Cathode (Max.)	0.15	0.15 Pf
Coupling		
Plate to Plate (Max.)	0.01	Pf
Plate of Section 2 to Plate and Grid of Section 1 (Max.)	0.024	Pf
Grounded Grid Operation		
Input	5.0	5.0 Pf
Output	2.2	2.2 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	150 Volts
Plate Dissipation (Each Section) (Max.)	2.0 Watts
DC Cathode Current (Max.)	20 Ma
Grid Circuit Resistance (Each Section) (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier (Each Section)

Plate Voltage	150 Volts
Cathode Bias Resistor	220 Ohms
Plate Current	10 Ma
Transconductance	7200 μmhos
Amplification Factor	36
Plate Resistance	5000 Ohms
Grid Voltage for Ib = 10 μa (Section 2 only)	−7 Volts

Cascode Amplifier

Plate Supply Voltage	250 Volts
Plate Current	16 Ma
Grid Voltage	−1 Volt
Transconductance	10,000 μmhos
Ec1 for gm = 50 μmhos (Approx.)	−6 Volts

NOTES:
(1) External shield No. 315.
(2) Section 2 (Pins 1, 2, and 3) is intended as the input section of the cascode circuit.

Color Television Type

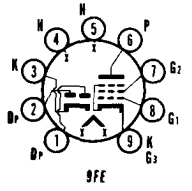
AFC or DETECTOR (D) IF/VIDEO/AGC AMPLIFIER (P)

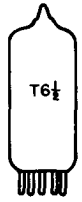
6BT8

5BT8

Double Diode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9FE
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.938 In.
Maximum Overall Height .....2.188 In.





ELECTRICAL DATA
HEATER OPERATION

	5BT8	6BT8
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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 (Unshielded)		
Pentode Section		
Grid No. 1 to Plate (Max.)		0.04 Pf
Input		7.0 Pf
Output		2.3 Pf
Diode (Each Section)		
Plate to (h + k)		1.3 Pf
Cathode to (h + p)		3.0 Pf
Coupling		
Pentode Grid No. 1 to Diode Plate		0.005 Pf
Pentode Plate to Diode Plate		0.020 Pf
RATINGS (Design Center Rating System)		
Plate Voltage (Max.)		300 Volts
Grid No. 2 Supply Voltage (Max.)		300 Volts
Grid No. 2 Voltage		See Rating Chart (Gen. Info. Sec.)
Positive Grid No. 1 Voltage (Max.)		0 Volt
Plate Dissipation (Max.)		2.0 Watts
Grid No. 2 Input (Max.)		0.5 Watt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max)		0.25 Megohm
Self Bias (Max.)		1.0 Megohm
CHARACTERISTICS AND TYPICAL OPERATION		
Pentode		
Plate Voltage		200 Volts

Grid No. 2 Voltage	150 Volts
Cathode Bias Resistor	180 Ohms
Plate Current	9.5 Ma
Grid No. 2 Current	2.8 Ma
Transconductance	6200 μmhos
Plate Resistance (Approx.)	300,000 Ohms
Grid No. 1 Voltage for Ib = 10 μa (Approx.)	−8 Volts
Diode	
Average Diode Current with 10 Volts DC Applied (Each Section)	*8.0 Ma*

6BV11

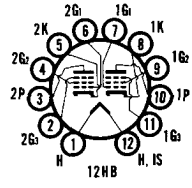
12BV11

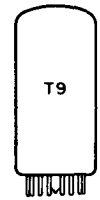
Color Television Type

COLOR DEMODULATOR

Twin Dual Control Sharp Cutoff Pentode

Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12HB
Outline	9-59
Maximum Diameter	1.188 In.
Maximum Seated Height	2.250 In.
Maximum Overall Height	2.625 In.





ELECTRICAL DATA

HEATER OPERATION

	12BV11	6BV11
Heater Voltage	12.6	6.3 Volts
Heater Current	450	900 Ma
Heater Warm-up Time	11	— Seconds

NOTE: *To obtain the unique characteristics of this tube, an internal shield is tied to the heater Pin No. 12. To assure proper operation Pin No. 12 must be tied directly to ground.*

DIRECT INTERELECTRODE CAPACITANCES (Unshielded) (Each Section)

Grid No. 1 to Plate	0.10 Pf
Grid No. 3 to Plate	3.2 Pf
Input: g1 to (h + k + g2 + g3 + IS)	7.0 Pf
Grid No. 3 to All	8.5 Pf
Grid No. 1 to Grid No. 3	0.08 Pf

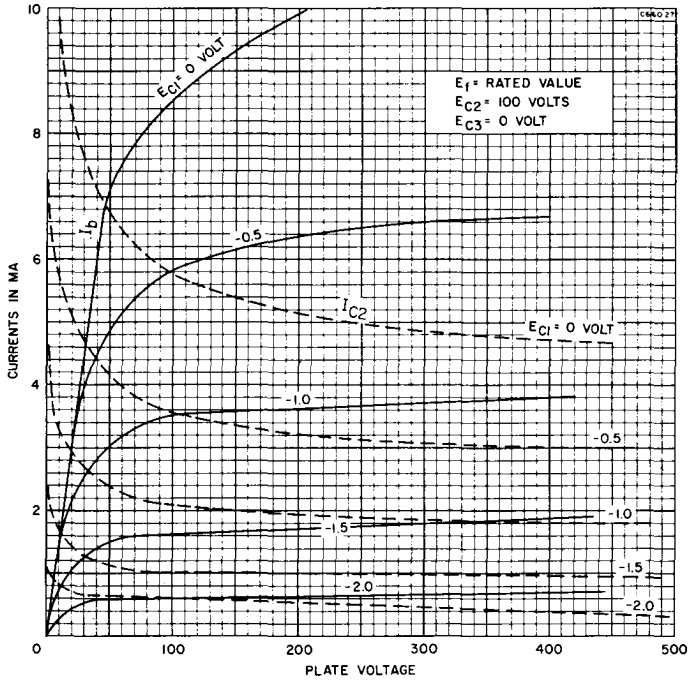
RATINGS (Design Maximum Rating System) (Each Section)

DC Plate Voltage (Max.)	300 Volts
Positive Grid No. 3 Voltage (DC and Peak) (Max.)	25 Volts
Negative Grid No. 3 Voltage (DC and Peak) (Max.)	100 Volts
DC Grid No. 2 Supply Voltage (Max.)	300 Volts
DC Grid No. 2 Voltage (Max.)	See Rating Chart (Gen. Info. Sec.)
Positive Grid No. 1 Voltage (Max.)	0 Volt
Negative Grid No. 1 Voltage (Max.)	50 Volts
Plate Dissipation (Max.)	1.7 Watts
Grid No. 3 Input (Max.)	0.1 Watt
Grid No. 2 Input (Ec2 up to 150 V) (Max.)	1.0 Watt
Grid No. 2 Input (Ec2 Between 150 V to 300 V)	See Rating Chart (Gen. Info. Sec.)
Grid No. 3 Circuit Resistance (Max.)	0.68 Megohm
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.22 Megohm
Self Bias (Max.)	0.47 Megohm

CHARACTERISTICS AND TYPICAL OPERATION (Each Section)

Plate Supply Voltage	150 Volts
Grid No. 3 Voltage	0 Volt
Grid No. 2 Supply Voltage	100 Volts
Cathode Resistor	180 Ohms
Plate Current	3.1 Ma
Grid No. 2 Current	2.4 Ma
Grid No. 1 Transconductance	3200 μmhos
Grid No. 3 Transconductance	390 μmhos
Plate Resistance (Approx.)	0.17 Megohm
Ec1 for Ib = 75 μa (Approx.)	−3.5 Volts
Ec3 for Ib = 85 μa (Approx.)	−5.5 Volts
Amplification Factor (g3-P)	67

AVERAGE PLATE CHARACTERISTICS
(Each Section)



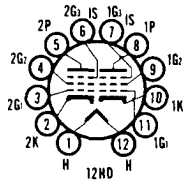
Color Television Type

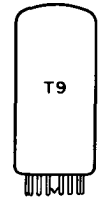
GENERAL PURPOSE AMPLIFIER VIDEO AMPLIFIER

6BW11

Double Dissimilar Pentode

Construction	Compactron T-9
Base	E12-70
Basing	12HD
Outline	9-58
Maximum Diameter	1.188 In.
Maximum Seated Height	2.000 In.
Maximum Overall Height	2.375 In.





ELECTRICAL DATA

HEATER OPERATION	
Heater Voltage	6.3 Volts
Heater Current	800 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(1)	
Section No. 1	
Grid to Plate	0.03 pf
Input: g to (h + 1K + 1g2 + 1g3 + IS)	7.5 pf
Output: p to (h + 1K + 1g2 + 1g3 + IS)	2.8 pf
Section No. 2	
Grid to Plate (Max.)	0.03 pf
Input: g to (h + 1K + 1g2 + 1g2 + IS)	12.0 pf
Output: p to (h + 1K + 1g2 + 1g3 + IS)	2.8 pf

Coupling

Cathode Section 1, to Cathode Section 2: (1K to 2K), Maximum(2)	0.003 pf
Grid No. 1 Section 1, to Plate Section 2: (1g1 to 2p) Maximum	0.004 pf
Grid No. 1 Section 2, to Plate Section 1: (2g1 to 1p), Maximum	0.003 pf
Plate Section 1, to Plate Section 2: (1p to 2p), Maximum	0.018 pf

RATINGS (Design Maximum Rating System)

Section No. 1

Plate Voltage	330 Volts
Screen Supply Voltage	330 Volts
Plate Dissipation	4.0 Watts
Screen Dissipation	0.8 Watts
Grid No. 1 Circuit Resistance with Cathode Bias	0.25 Megohms

Section No. 2

Plate Voltage	330 Volts
Screen Supply Voltage	330 Volts
Positive DC Grid Voltage	0 Volt
Plate Dissipation	3.1 Watts
Screen Dissipation	0.65 Watts

AVERAGE CHARACTERISTICS

Section No. 1

Plate Voltage	125 Volts
Screen Voltage	125 Volts
Cathode Resistor	56 Ohms
Plate Resistance (Approx.)	120,000 Ohms
Transconductance	8500 μmhos
Plate Current	22 Ma
Screen Current	4.8 Ma
Ec1 for Ib = 20 μa	9.5 Volts

Section No. 2

Plate Voltage	125 Volts
Screen Voltage	125 Volts
Cathode Resistor	56 Ohms
Plate Resistance (Approx.)	200,000 Ohms
Transconductance (G1)	13,000 μmhos
Plate Current	11 Ma
Screen Current	3.8 Ma
Ec1 for Ib = 20 μa	−3 Volts

NOTES:

(1) With external shield No. 309 connected to cathode of section under test unless otherwise indicated.

(2) With external shield No. 309 connected to ground.

6BY6

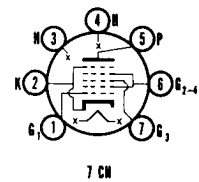
3BY6

Color Television Type

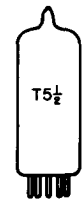
SYNC SEPARATOR and CLIPPER

Heptode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CH
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7 CH



ELECTRICAL DATA

HEATER OPERATION

	3BY6	6BY6
Heater Voltage	3.15	6.3 Volts
Heater Current	600	300 Ma
Heater Warm-up Time	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

Grid No. 1 to Plate (Max.)	0.08 Pf
Grid No. 3 to Plate (Max.)	0.35 Pf
Grid No. 1 to Grid No. 3 (Max.)	0.22 Pf
Grid No. 1 to All Other Electrodes	5.4 Pf
Grid No. 3 to All Other Electrodes	6.9 Pf
Plate to All Other Electrodes	7.6 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	330 Volts
Grid No. 2 and Grid No. 4 Voltage	See Rating Chart (Gen. Info. Sec.)
Grid No. 2 and Grid No. 4 Supply Voltage (Max.)	330 Volts
Grid No. 3 Voltage	
Negative Bias Value (Max.)	-55 Volts
Positive Bias Value (Max.)	0 Volt
Positive Peak Value (Max.)	27 Volts
Grid No. 1 Voltage (Negative Bias Value) (Max.)	-100 Volts
Plate Dissipation (Max.)	2.3 Watts
Grid No. 3 Input (Max.)	0.1 Watt
Grid No. 1 and Grid No. 4 Input	
Up to 165 Volts (Max.)	1.1 Watts
165 to 330 Volts	See Rating Chart (Gen. Info. Sec.)
Grid No. 1 Input (Max.)	0.1 Watt
Grid No. 1 or Grid No. 3 Circuit Resistance	
Fixed Bias	0.5 Megohm
Cathode Bias	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Sync Separator and Clipper

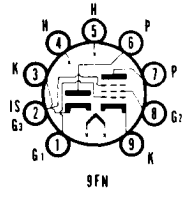
Plate Voltage	10 Volts
Grid No. 3 Voltage	0 Volt
Grid No. 2 and Grid No. 4 Voltage	25 Volts
Grid No. 1 Voltage	0 Volt
Plate Current	1.4 Ma
Grid No. 2 and Grid No. 4 Current	3.5 Ma
Eg3 for Eb = Eg2 = Eg4 = 25 V, Eg1 = 0 V and Ib = 50 μa	-2.5 Volts
Eg1 for Eb = Eg2 = Eg4 = 25 V, Eg3 = 0 V and Ib = 50 μa	-2.3 Volts

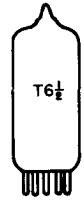
LIMITER or DETECTOR (D) RF or IF AMPLIFIER (P)

6BY8

High Perveance Diode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9FN
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	600 Ma
Heater Warm-up Time	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 (Shielded)(1)

Grid to Plate (Max.)	0.0035 Pf
Input: g1 to (h + k + g2 + g3 + IS)	5.5 Pf
Output: p to (h + k + g2 + g3 + IS)	5.0 Pf
Diode Plate to All: Dp to (h + Dk + k + g1 + g2 + g3 + p + IS)	4.8 Pf

RATINGS (Design Center Rating System)

Pentode Section

Plate Voltage (Max.)	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Grid No. 2 Supply Voltage (Max.)	300 Volts
Negative Grid No. 1 Voltage (Max.)	50 Volts
Positive Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	3 Watts
Grid No. 2 Dissipation (Max.)	0.65 Watt

Diode Section

Peak Inverse Plate Voltage (Max.)	430 Volts
Peak Plate Current (Max.)	180 Ma
DC Plate Current (Max.)	45 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	100	250	250 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket		
Grid No. 2 Voltage	100	125	150 Volts
Cathode Resistor	150	100	68 Ohms
Plate Current	5.0	7.6	10.6 Ma
Grid No. 2 Current	2.1	3.0	4.3 Ma
Transconductance	3900	4500	5200 μmhos
Plate Resistance (Approx.)	0.5	1.5	1.0 Megohms
Ec1 for Ib = 10 μa (Approx.)	−4.2	−5.5	−6.5 Volts
Average Diode Current with 10 Volts DC Applied (Test Condition Only)			60 Ma

NOTE:

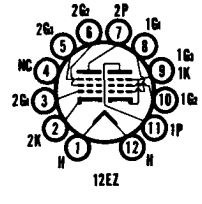
(1) External Shield No. 315 connected to Pentode Cathode.

6BY11

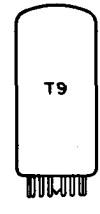
AUDIO OUTPUT AMPLIFIER FM DETECTOR

Power Pentode and Dual-Control Pentode

Construction	Compactron T-9
Base	E12-70
Basing	12EZ
Outline	9-59
Maximum Diameter	1.188 In.
Maximum Seated Height	2.000 In.
Maximum Overall Height	2.250 In.



12EZ



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1200 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

	Without Shield
Section No. 1	
Grid to Plate	0.28 pf
Input: g to (h + 1k + 1g2 + 1g3 + IS)	12.0 pf
Output: p to (h + 1k + 1g2 + 1g3 + IS)	7.0 pf
Section No. 2	
Grid No. 1 to Plate (Max.)	0.40 pf
Grid No. 3 to Plate	3.2 pf
Grid No. 1 to (h + 2k + 2g2 + 2g3 + IS)	7.0 pf
Grid No. 3 to (h + 2k + 2g2 + 2g3 + 2p + IS)	8.0 pf
Grid No. 1 to Grid No. 3	0.15 pf
Plate No. 1 to Plate No. 2	0.18 pf

RATINGS (Design Maximum Rating System)

Section No. 1	
Plate Voltage	200 Volts
Screen Voltage	150 Volts
Plate Dissipation	10 Watts
Screen Dissipation	1.8 Watts
DC Cathode Current	65 Ma
Grid No. 1 Circuit Resistance	
Cathode Bias	1.0 Megohms
Section No. 2	
Plate Voltage	300 Volts
Suppressor Voltage	25 Volts
Screen Supply Voltage	300 Volts
Positive DC Grid Voltage	0 Volt
Plate Dissipation	1.7 Watts
Screen Dissipation	1.0 Watts

AVERAGE CHARACTERISTICS

Section No. 1, Class A1 Amplifier	
Plate Voltage	170 Volts
Screen Voltage	140 Volts
Grid No. 1 Voltage	−3.0 Volts
Peak AF Grid Voltage	15 Volts
Plate Resistance (Approx.)	33,000 Ohms
Transconductance	4900 μmhos
Zero Signal Plate Current	74 Ma
Maximum Signal Plate Current	76 Ma
Zero Signal Screen Current	3.9 Ma
Maximum Signal Screen Current	8.3 Ma
Load Resistance	2500 Ohms
Total Harmonic Distortion (Approx.)	10 Percent
Maximum Signal Power Output	4.0 Watts
Section No. 2	
Plate Voltage	150 Volts
Suppressor Voltage	0 Volt
Screen Voltage	100 Volts
Cathode Resistor	180 Ohms
Plate Resistance (Approx.)	110,000 Ohms
Transconductance (G1)	2500 μmhos
Transconductance (G3)	850 μmhos
Plate Current	1.3 Ma
Screen Current	2.1 Ma
Ec1 for Ib = 20 μa	−4.0 Volts
Ec3 for Ib = 50 μa	−3.0 Volts

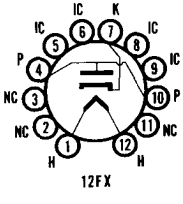
DAMPER

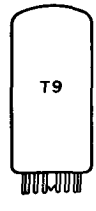
6BZ3

17BZ3

Heater-Cathode Diode

Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12FX
Outline	9-60
Maximum Diameter	1.188 In.
Maximum Seated Height	2.500 In.
Maximum Overall Height	2.875 In.





ELECTRICAL DATA

HEATER OPERATION

	17BZ3	6BZ3
Heater Voltage	16.8	6.3 Volts
Heater Current	450	1200 Ma
Heater Warm-up Time	11	— Seconds
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
DC		900 Volts
Total DC and Peak		4500 Volts
Heater Positive with Respect to Cathode		
DC		100 Volts
Total DC and Peak		300 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)		
Cathode to Plate and Heater		11 Pf
Plate to Cathode and Heater		8.5 Pf
Heater to Cathode		3.4 Pf
RATINGS (Design Maximum Rating System)		
Damper Service(1)		
Peak Inverse Plate Voltage (Max.)		4500 Volts
Plate Dissipation (Max.)		6.5 Watts
Steady State Peak Plate Current (Max.)		1200 Ma
DC Output Current (Max.)		200 Ma
CHARACTERISTICS AND TYPICAL OPERATION		
Tube Voltage drop for Ib = 350 Ma		21 Volts

NOTE:

(1) 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 horizontal scanning cycle.

6BZ6

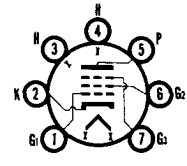
3BZ6, 4BZ6, 12BZ6

Color Television Type

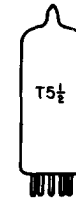
AGC/IF AMPLIFIER

Semi-Remote Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CM
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7CM



ELECTRICAL DATA

HEATER OPERATION

	3BZ6	4BZ6	12BZ6	6BZ6
Heater Voltage	3.15	4.2	12.6	6.3 Volts
Heater Current	60	450	150	300 Ma
Heater Warm-up Time	11	11	—	— Seconds
Maximum Heater-Cathode Voltage				
Heater Negative with Respect to Cathode				
Total DC and Peak	300	200	200	200 Volts
DC	200	200	200	200 Volts
Heater Positive with Respect to Cathode				
DC	100	100	100	100 Volts
Total DC and Peak	200	200	200	200 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded(1)	Unshielded
Grid No. 1 to Plate (Max.)	0.015	0.025 Pf
Input: g1 to (h + k + g2 + g3 + IS)	7.0	7.0 Pf
Output: p to (h + k + g2 + g3 + IS)	3.0	2.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	330 Volts
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	2.3 Watts
Grid No. 2 Dissipation (Max.)	0.55 Watt
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.25 Megohm
Cathode Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

Plate Voltage	125 Volts
Grid No. 2 Voltage	125 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Cathode Bias Resistor	56 Ohms
Plate Current	14 Ma
Grid No. 2 Current	3.6 Ma
Transconductance	8000 μmhos
Plate Resistance (Approx.)	260,000 Ohms
Ec1 for Gm = 50 μmhos (Approx.)	−19 Volts
Gm with Ec1 = −4.5 V, RK = 0	700 μmhos

NOTE:
(1) External Shield No. 316 connected to Pin No. 2 (cathode) at socket.

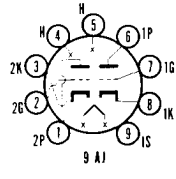
VHF CASCODE AMPLIFIER

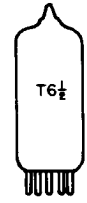
6BZ8

4BZ8

Medium Mu-Semi-remote Cutoff Double Triode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9AJ
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.





ELECTRICAL DATA
HEATER OPERATION

	4BZ8	6BZ8
Heater Voltage (AC or DC)	4.2	6.3 Volts
Heater Current	600	400 Ma
Heater Warm-up Time	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 (Shielded)

Cascode Operation	Section No. 1	Section No. 2
Grid to Plate	1.15	— Pf
Plate to Cathode	—	0.15 Pf
Triode No. 1 Plate to Triode No. 2 Plate	0.010	— Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	250 Volts
Plate Dissipation (Max.)	2.2 Watts
Cathode Current (Max.)	20 Ma
Grid Circuit Resistance (Max.)	0.1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION (Each Section)
Class A1 Amplifier

Plate Voltage	125 Volts
Cathode Resistor	100 Ohms
Plate Current	10 Ma
Transconductance	8000 μmhos
Amplification Factor	45
Plate Resistance	5600 Ohms
Grid Voltage (Approx.) for Gm = 50 μmhos	−13 Volts
Cascode Operation at Eb = 250 Volts, Ec1 = −0.5 Volts	
Transconductance	10,000 μmhos
Plate Current	15 Ma

NOTE:
(1) Use external shield No. 315.

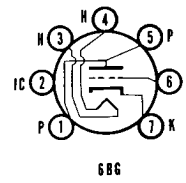
6C4

Color Television Type

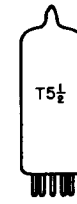
RF OSCILLATOR, AMPLIFIER, or DETECTOR

Medium Mu Triode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 6BG
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



6BG



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	150 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

	Shielded(1)	Unshielded
Grid to Plate	1.4	1.6 Pf
Input: (g to h + k)	1.8	1.8 Pf
Output: (p to h + k)	2.5	1.3 Pf

RATINGS (Design Center Rating System)

	Class A1 Amplifier	Class C Telegraphy
Plate Voltage (Max.)	300	300 Volts
Plate Dissipation (Max.)	3.5	5.0 Watts
Plate Current (Max.)	—	25 Ma
Negative DC Grid Voltage (Max.)	—	-50 Volts
DC Grid Current (Max.)	—	8 Ma
Grid Circuit Resistance		
Fixed Bias (Max.)	0.25	0.25 Megohm
Cathode Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	100	250 Volts
Grid Voltage(2)	0	-8.5 Volts
Plate Current	11.8	10.5 Ma
Plate Resistance (Approx.)	6250	7700 Ohms
Transconductance	3100	2200 μmhos
Amplification Factor	19.5	17
Grid Voltage (Approx.) for Ib = 10 μa	-10	-25 Volts

Class C Telegraphy(3)

Plate Voltage	300 Volts
Grid Voltage	-27 Volts
Plate Current	25 Ma
Grid Current (Approx.)	7 Ma
Grid Driving Power (Approx.)	0.35 Watt
Power Output (Approx.)	5.5 Watts

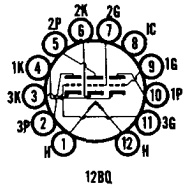
NOTES:

(1) Shield No. 316 connected to cathode.
(2) Transformer or impedance-type input coupling devices are recommended to minimize resistance in the grid circuit.
(3) Approximately 2.5 watts output can be obtained when the 6C4 is used at 150 megacycles as an oscillator with a grid resistor of 10,000 Ohms and with maximum rated input.

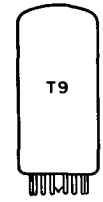
AMPLIFIER, PHASE INVERTER — 6C10

Triple High Mu Triode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12BQ
Outline 9-56
Maximum Diameter .....1.188 In.
Maximum Seated Height .....1.500 In.
Maximum Overall Height .....1.875 In.



12BQ



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	600 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 1	Section 2	Section 3
Grid to Plate (g to p)	1.7	1.7	1.7 Pf
Input: g to (h + k + IS)	1.6	1.6	1.6 Pf
Output: p to (h + k + IS)	0.30	0.24	0.34 Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	330 Volts
Plate Dissipation (Max.)	1.0 Watt
Total Plate Dissipation (All Plates) (Max.)	3.0 Watts
Positive DC Grid No. 1 Voltage	0 Volt
Negative DC Grid No. 1 Voltage	50 Volts
Grid Circuit Resistance	
With Fixed Bias (Max.)	0.25 Megohm
With Cathode Bias (Max.)	1.0 Megohm

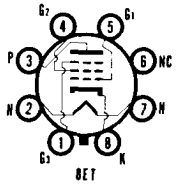
CHARACTERISTICS AND TYPICAL OPERATION (Each Section)

Class A1 Amplifier		
Plate Voltage	100	250 Volts
Grid Voltage	−1.0	−2.0 Volts
Amplification Factor	100	100
Plate Resistance (Approx.)	80,000	62,500 Ohms
Transconductance	1250	1600 μmhos
Plate Current	0.5	1.2 Ma

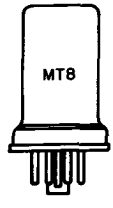
AUDIO POWER AMPLIFIER — 6CA7/EL34

Beam Pentode

Construction .....Octal, Metal
Base .....Octal 8 Pin
Basing 8ET
Outline
Maximum Diameter .....1.500 In.
Maximum Seated Height .....3.875 In.
Maximum Overall Height .....4.438 In.



8ET



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1500 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)

Grid No. 1 to Plate	1.0 Pf
Input	15.5 Pf
Output	7.2 Pf

RATINGS (Design Center Rating System)

	Triode Conn.	Pentode Conn.
Plate Voltage (Max.)	500	800 Volts
Grid No. 2 Voltage (Max.)	—	425 Volts
Plate Dissipation (Max.)	30	25 Watts
Grid No. 2 Dissipation (Max.)	—	8.0 Watts
Cathode Current (Max.)	—	150 Ma
Grid No. 1 Circuit Resistance Cathode Bias (Max.)(1)	0.7	0.7 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Operation Push-Pull	Pentode Operation Single Tube	
Plate Voltage	400	265	300 Volts
Grid No. 2 Voltage	—	250	300 Volts
Cathode Resistor	220	—	190 Ohms
Grid No. 1 Voltage	—	-13.5	— Volts
A-F Grid Voltage (RMS)	—	8.7	8.2 Volts
Zero Signal Plate Current	130	100	83 Ma
Max. Signal Plate Current	142	—	— Ma
Zero Signal Grid No. 2 Current	—	15	13 Ma
Transconductance	—	11K	— μmhos
Plate Resistance	—	15K	— Ohms
Load Resistance	5K	2K	3.5K Ohms
Power Output	16.5	11	11 Watts
Total Harmonic Distortion	3	10	10 Percent
Class AB1 Push-Pull (Pentode Operation)			
Plate Voltage	375	450	400 Volts
Grid No. 2 Voltage	375	450	400 Volts
Grid No. 2 Resistor	470	1000	800 Ohms
Grid No. 1 Voltage	—	—	-36 Volts
Cathode Resistor	130	232	— Ohms
A-F Grid Voltage (RMS)	20	27	25 Volts
Zero Signal Plate Current	150	120	60 Ma
Maximum Signal Plate Current	188	143	221 Ma
Zero Signal Grid No. 2 Current	25	20	9 Ma
Maximum Signal Grid No. 2 Current	39	44	46 Ma
Load Resistance (P to P)	3.5K	6.5K	3.5K Ohms
Power Output	35	40	54 Watts
Total Harmonic Distortion	1.7	5.1	1.6 Percent
Class AB1 Push-Pull (Ultra-Linear Operation)			
Grid No. 2 at 43% of Primary Winding			
Plate Voltage		430	430 Volts
Cathode Resistor		235	235 Ohms
A-F Grid Voltage (RMS)		17.5	25 Volts
Zero Signal Plate Current		125	125 Ma
Maximum Signal Plate Current		130	140 Ma
Zero Signal Grid No. 2 Current		20	20 Ma
Maximum Signal Grid No. 2 Current		20.4	28 Ma
Load Resistance (P to P)		6K	6K Ohms
Power Output		20	34 Watts
Total Harmonic Distortion		0.35	2.5 Percent

NOTE:

(1) The maximum permissible limit for Grid No. 1 Resistor in a Class B Circuit is 0.5 Megohm.

Color Television Type

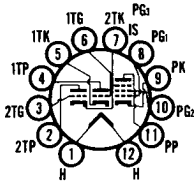
VIDEO AMPLIFIER CATHODE FOLLOWER

6CA11

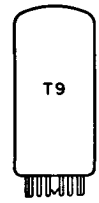
11CA11

Dissimilar-Double-Triode Pentode

Construction.....Compactron T-9
Base E12-70
Basing.....12HN
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.



12HN



ELECTRICAL DATA

HEATER OPERATION

	11CA11	6CA11
Heater Voltage	10.7	6.3 Volts
Heater Current	600	1020 Ma
Heater Warm-up Time	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 Component		100 Volts
Total DC and Peak		200 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Triode (Section 1)	
Grid to Plate	2.7 pf
Input: 1Tg to (1Tk+2Tk+Pk+Pg3+h+IS)	4.7 pf
Output: 1Tp to (1Tk+2Tk+Pk+Pg3+h+IS)	4.0 pf
Triode (Section 2)	
Grid to Plate	2.1 pf
Input: 2Tg to (2Tk+Pk+Pg3+h+IS)	2.8 pf
Output: 2Tp to (2Tk+Pk+Pg3+h+IS)	2.0 pf
Pentode	
Grid No. 1 to Plate	0.13 pf
Input: Pg1 to (2Tk+Pk+Pg2+Pg3+h+IS)	12.3 pf
Output: Pp to (2Tk+Pk+Pg2+Pg3+h+IS)	4.6 pf
Coupling	
Pentode Plate to Triode Plate (Section 2) (Max.)	0.045 pf
Triode Plate (Section 1) to Triode Plate (Section 2) (Max.)	0.100 pf

RATINGS (Design Maximum Rating System)

Triode No. 1	
Plate Voltage (Max.)	330 Volts
Positive DC Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	1.5 Watts
Grid Circuit Resistance	
With Fixed Bias (Max.)	0.5 Megohm
With Cathode Bias (Max.)	1.0 Megohm
Triode No. 2	
Plate Voltage (Max.)	330 Volts
Positive DC Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	1.5 Watts
Grid Circuit Resistance	
With Fixed Bias (Max.)	0.5 Megohm
With Cathode Bias (Max.)	1.0 Megohm
Pentode Section	
Plate Voltage (Max.)	330 Volts
Screen-Supply Voltage (Max.)	330 Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)
Positive DC Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	5.0 Watts
Screen Dissipation (Max.)	1.0 Watts
Grid No. 1 Circuit Resistance	
With Fixed Bias (Max.)	10,000 Ohms
With Cathode Bias (Max.)	10,000 Ohms

CHARACTERISTICS AND TYPICAL OPERATION

Triode No. 1	
Plate Voltage	200 Volts
Cathode Bias Resistor	270 Ohms

Grid Voltage		-2.0 Volts
Amplification Factor		63
Plate Resistance (Approx.)		10,000 Ohms
Transconductance		6300 μmhos
Plate Current		7.1 Ma
Grid Voltage (Approx.)		
Ib + 100 μa		-6.3 Volts
Triode No. 2		
Plate Voltage		200 Volts
Cathode-Bias Resistor		270 Ohms
Amplification Factor		69
Plate Resistance (Approx.)		12,400 Ohms
Transconductance		5500 μmhos
Plate Current		7.1 Ma
Grid Voltage (Approx.)		
Ib = 100 μa		-5.5 Volts
Pentode Section		
Plate Voltage	40	200 Volts
Screen Voltage	120	120 Volts
Grid No. 1 Voltage	0	— Volt
Cathode Bias Resistor	—	65 Ohms
Plate Resistance (Approx.)	—	490,000 Ohms
Transconductance	—	21,200 μmhos
Plate Current	68	27.5 Ma
Screen Current	17.6	4.9 Ma
Grid No. 1 Voltage (Approx.)		
Ib = 100 μa	—	-5.0 Volts

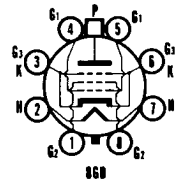
6CB5A

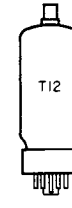
Color Television Type

HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction	Octal T-12
Base	Octal 8 Pin
Top Cap	C1-1
Basing	8GD
Outline	12-21
Maximum Diameter	1.563 In.
Maximum Seated Height	4.250 In.
Maximum Overall Height	5.000 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	2500 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)

Grid to Plate	0.4 Pf
Input	22 Pf
Output	10 Pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier(1)

Plate Supply Voltage (DC and Boost) (Max.)	800 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	6800 Volts
Plate Dissipation (Max.)	23 Watts
Peak Negative Pulse Plate Voltage (Max.)	-1650 Volts
DC Grid No. 2 Voltage (Max.)	220 Volts
DC Grid No. 1 Voltage (Max.)	-55 Volts
Grid No. 2 Dissipation (Max.)	4 Watts
Peak Negative Pulse Grid No. 1 Voltage (Max.)	220 Volts
DC Plate Current (Max.)	240 Ma
Grid No. 1 Circuit Resistance (Max.)	0.47 Megohm
Bulb Temperature (At Hottest Point) (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	175 Volts
Grid No. 2 Voltage	175 Volts
Grid No. 1 Voltage	-30 Volts
Plate Current	90 Ma
Grid No. 2 Current	6.0 Ma
Transconductance	8800 μmhos
Plate Resistance	5000 Ohms
Triode Amplification Factor	3.8
Ec1 for Ib = 1 Ma	-60 Volts

PLATE KNEE CHARACTERISTICS

Eb = 75 V, Ec2 = 150 V, Ec1 = 0 V
Ib = 460 Ma, Ic2 = 42 Ma

NOTE:

(1) 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 horizontal scanning cycle.

Color Television Type

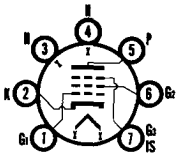
RF/IF AMPLIFIER

6CB6A

4CB6, 3CB6/3CF6

Sharp Cutoff Pentode

Construction	Miniature T-5½
Base	Button 7 Pin
Basing	7CM
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7CM



ELECTRICAL DATA

HEATER OPERATION

	3CB6/3CF6	4CB6	6CB6A
Heater Voltage	3.15	4.2	6.3 Volts
Heater Current	600	450	300 Ma
Heater Warm-up Time	11	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

	Shielded(1)	Unshielded
Grid No. 1 to Plate (Max.)	0.015	0.025 Pf
Input: g1 to (h + k + g2 + g3 + IS)	6.5	6.5 Pf
Output: p to (h + k + g2 + g3 + IS)	3.0	2.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	330 Volts
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	2.3 Watts
Grid No. 2 Dissipation (Max.)	0.55 Watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	125 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Grid No. 2 Voltage	125 Volts
Cathode Bias Resistor	56 Ohms
Plate Current	13.0 Ma
Grid No. 2 Current	3.7 Ma
Transconductance	8000 μmhos
Plate Resistance (Approx.)	0.28 Megohm
Grid No. 1 Voltage for Ib = 20 μa (Approx.)	-6.5 Volts

NOTE:

(1) External Shield No. 316 connected to Pin 2.

6CD6GA

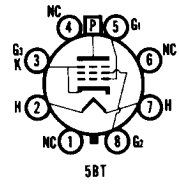
25CD6GB, 35CD6GA

Color Television Type

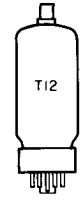
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Octal T-12
Base .....5 or 8 Pin, B5-123 or B8-110
Top Cap C1-1
Basing[1] 5BT
Outline 12-21
Maximum Diameter .....1.563 In.
Maximum Seated Height .....4.250 In.
Maximum Overall Height .....5.000 In.



5BT



ELECTRICAL DATA

HEATER OPERATION

	35CD6GA	25CD6GB	6CD6GA
Heater Voltage	35	25	6.3 Volts
Heater Current	450	600	2500 Ma
Heater Warm-up Time	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

Grid No. 1 to Plate	1.1 Pf
Input	22 Pf
Output	8.5 Pf

RATINGS (Design Center Rating System)

Horizontal Deflection Amplifier[2]

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	700 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	7000 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
Peak Negative Grid No. 1 Voltage (Max.)	200 Volts
DC Grid No. 2 Voltage (Max.)	175 Volts
Plate Dissipation (Max.)[3]	20 Watts
Grid No. 2 Dissipation (Max.)	3.0 Watts
Average Cathode Current (Max.)	200 Ma
Peak Cathode Current (Max.)	700 Ma
Grid No. 1 Circuit Resistance (Max.)	0.47 Megohm
Bulb Temperature (At Hottest Point) (Max.)	225 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	175 Volts
Grid No. 2 Voltage	175 Volts
Grid No. 1 Voltage	-30 Volts
Plate Current	75 Ma
Grid No. 2 Current	5.5 Ma
Transconductance	7700 μmhos
Amplification Factor[4]	3.9
Plate Resistance	7200 Ohms
Ec1 for Ib = 1.0 Ma (Approx.)	-55 Volts

INSTANTANEOUS PLATE KNEE VALUES

Eb = 60 V, Ec2 = 100 V, and Ec1 = 0 V
Ib = 230 Ma and Ic2 = 21 Ma

NOTES:

(1) Horizontal operation permitted if plane of Pins 2 and 7 is vertical.
(2) 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 horizontal scanning cycle.
(3) 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.
(4) Amplification factor with tube operation as a triode with 175 Volts on the plate and Grid No. 2 and -30 Volts on Grid No. 1.

Color Television Type

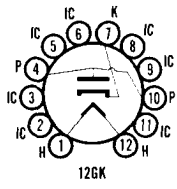
DAMPER

6CE3/6CD3

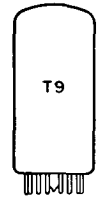
34CE3, 34CD3

Heater-Cathode Diode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12GK
Outline 9-62
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.000 In.
Maximum Overall Height .....3.375 In.



12GK



ELECTRICAL DATA

HEATER OPERATION

	34CE3, 34CD3	6CE3/6CD3
Heater Voltage	34.5	6.3 Volts
Heater Current	450	2500 Ma
Heater Warm-up Time	11	— Seconds
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
DC		900 Volts
Total DC and Peak		5000 Volts
Heater Positive with Respect to Cathode		
DC		100 Volts
Total DC and Peak		300 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Cathode to Plate and Heater	18.0 Pf
Plate to Cathode and Heater	13.0 Pf
Heater to Cathode	5.5 Pf

RATINGS (Design Maximum Rating System)

Damper Service

Peak Inverse Plate Voltage (Max.)	5000 Volts
Plate Dissipation (Max.)	11 Watts
Steady State Peak Plate Current (Max.)	1500 Ma
DC Plate Current (Max.)	350 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 680 Ma	20 Volts

NOTE:

(1) 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 horizontal scanning cycle.

Color Television Type

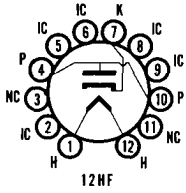
DAMPER

6CG3

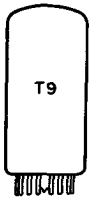
19CG3, 25CG3

Heater-Cathode Diode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing[1] 12HF
Outline 9-62
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.000 In.
Maximum Overall Height .....3.375 In.



12HF



ELECTRICAL DATA

HEATER OPERATION

	19CG3	25CG3	6CG3
Heater Voltage	19.0	25.0	6.3 Volts
Heater Current	600	450	1800 Ma
Heater Warm up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
DC			900 Volts
Total DC and Peak			5000 Volts

Heater Positive with Respect to Cathode	
DC	100 Volts
Total DC and Peak	300 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)	
Cathode to Plate and Heater	16.0 Pf
Plate to Cathode and Heater	13.0 Pf
Heater to Cathode	4.0 Pf
RATINGS (Design Maximum Rating System)	
Damper Service(2)	
Peak Inverse Plate Voltage (Max.)	5000 Volts
Plate Dissipation (Max.)	6.5 Watts
Steady State Peak Plate Current (Max.)	2100 Ma
DC Plate Current (Max.)	350 Ma
CHARACTERISTICS AND TYPICAL OPERATION	
Tube Voltage Drop for Ib = 700 Ma	20 Volts

NOTES:

(1) Pins designated Internal Connection (IC) may or may not have connections to internal elements depending on the manufacturer. To maintain interchangeability do not use these pins for external connection.

(2) 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 horizontal scanning cycle.

6CG7/6FQ7

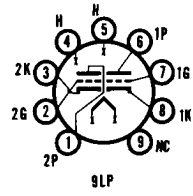
8CG7/8FQ7, 12FQ7

Color Television Type

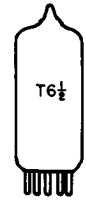
HORIZONTAL and VERTICAL DEFLECTION OSCILLATOR

Medium Mu Twin Triodes

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9LP
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



9LP



ELECTRICAL DATA

HEATER OPERATION

	12FQ7	8CG7/8FQ7	6CG7/6FQ7
Heater Voltage	12.6	8.4	6.3 Volts
Heater Current	300	450	600 Ma
Heater Warm-up Time	11	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 (Unshielded)

	Section No. 1	Section No. 2
Grid to Plate	3.6	3.8 Pf
Input: g to (h + k)	2.4	2.4 Pf
Output: p to (h + k)	0.34	0.26 Pf
Plate of Section No. 1 to Plate of Section No. 2	1.0	Pf

RATINGS (Design Maximum Rating System)

	Class A1 Amplifier	Horiz. Defl. Oscillator(1)	Vert. Defl. Oscillator(1)
DC Plate Voltage (Max.)	330	330	330 Volts
Peak Negative Pulse Grid Voltage (Max.)	—	660	440 Volts
Positive Grid Voltage (Max.)	0	—	— Volt
Plate Dissipation(2)			
Each Plate (Max.)	4	4	4 Watts
Both Plates (Max.)	5.7	5.7	5.7 Watts
Average Cathode Current (Max.)	22	22	22 Ma
Peak Cathode Current (Max.)	—	330	77 Ma
Grid Circuit Resistance			
Fixed Bias (Max.)	1.0	—	— Megohm
Self Bias (Max.)	—	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	90	250 Volts
Grid No. 1 Voltage	0	-8 Volts
Plate Current	10	9 Ma
Transconductance	3000	2600 μmhos
Amplification Factor	20	20
Plate Resistance (Approx.)	6700	7700 Ohms
Grid Voltage for Ib = 10 μa (Approx.)	-7	-18 Volts
Plate Current at Ec = -12.5 Vdc.	—	1.3 Ma

NOTES:

(1) 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 horizontal scanning cycle.

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

Color Television Type

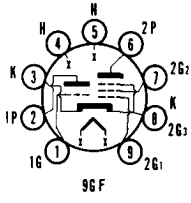
VHF OSCILLATOR and MIXER

6CG8A

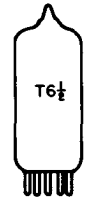
5CG8

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9GF
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9GF



ELECTRICAL DATA

HEATER OPERATION

	5CG8	6CG8A
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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

	Shielded(1)	Unshielded
Triode Section		
Grid to Plate	1.5	1.5 Pf
Input: g to (h + k)	2.4	2.0 Pf
Output: p to (h + k)	1.0	0.5 Pf
Pentode Section		
Grid No. 1 to Plate (Max.)	0.02	0.04 Pf
Input: g1 to (k + g3 + g2 + h)	4.8	4.6 Pf
Output: p to (k + g3 + g2 + h)	1.6	0.9 Pf
Coupling		
Pentode Grid No. 1 to Triode Plate (Max.)	0.04	0.05 Pf
Pentode Plate to Triode Plate (Max.)	0.008	0.05 Pf
Heater to Cathode	5.5(2)	5.5 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Converter Service		
Plate Voltage (Max.)	275	275 Volts
Grid No. 2 Supply Voltage (Max.)	—	275 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	1.7	2.3 Watts

Grid No. 2 Dissipation:	
For Grid No. 2 Voltages up to 137.5 Volts	0.45 Watt
For Grid No. 2 Voltages between 137.5 and 275 Volts	See Rating Chart (Gen. Info. Sec.)
Grid No. 1 Input	0.5 Watt Max.
Positive Grid No. 1 Voltage (Max.)	0 Volt
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Self Bias (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	125	125 Volts
Grid No. 2 Voltage	—	125 Volts
Cathode Bias Resistor	100	200 Ohms
Plate Current	8.5	7.7 Ma
Grid No. 2 Current	—	1.6 Ma
Transconductance	6500	5500 μmhos
Amplification Factor	40	—
Plate Resistance (Approx.)	6000	300,000 Ohms
Ec1 for Ib = 10 μa (Approx.)	−7	−6.5 Volts

NOTES:
(1) Shield No. 315 connected to cathode.
(2) Shield No. 315 connected to ground.

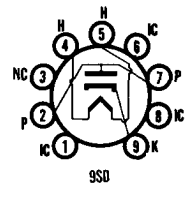
6CH3

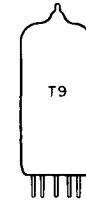
Color Television Type

DAMPER

Heater-Cathode Diode

Construction	Novar T-9
Base	Button 9 Pin, E9-75
Basing	9SD
Outline	9-87
Maximum Diameter	1.188 In.
Maximum Seated Height	3.330 In.
Maximum Overall Height	3.710 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	2500 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
DC	900 Volts
Total DC and Peak	5000 Volts
Heater Positive with Respect to Cathode	
DC	100 Volts
Total DC and Peak	300 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Cathode to Plate and Heater	17.0 Pf
Plate to Cathode and Heater	13.0 Pf
Heater to Cathode	4.4 Pf

RATINGS (Design Maximum Rating System)
Damper Service(1)

Peak Inverse Plate Voltage (Max.)	5000 Volts
Plate Dissipation (Max.)	11 Watts
Steady State Peak Plate Current (Max.)	1500 Ma
DC Plate Current (Max.)	350 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 680 Ma	20 Volts

NOTE:
(1) 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 horizontal scanning cycle.

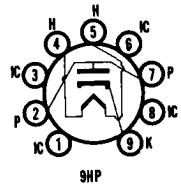
DAMPER

6CK3

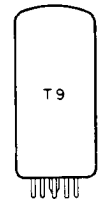
12CK3, 17CK3, 25CK3

Heater-Cathode Diode

Construction .....Novar T-9
Base .....Novar Button 9 Pin, E9-89
(Exhaust Tip on Base)
Basing 9HP
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.625 In.
Maximum Overall Height .....3.005 In.



9HP



ELECTRICAL DATA

HEATER OPERATION

	25CK3	17CK3	12CK3	6CK3
Heater Voltage	25.2	16.8	12.6	6.3 Volts
Heater Current	300	450	600	1200 Ma
Heater Warm-up Time	11	11	11	— Seconds

Maximum Heater-Cathode Voltage
Heater Negative with Respect to Cathode
DC ..... 900 Volts
Total DC and Peak ..... 5200 Volts
Heater Positive with Respect to Cathode
DC ..... 100 Volts
Total DC and Peak ..... 300 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Heater to Cathode ..... 3.0 Pf
Plate to Cathode and Heater ..... 6.5 Pf
Cathode to Plate and Heater ..... 9.0 Pf

RATINGS (Design Maximum Rating System)

Damper Service(1)

Peak Inverse Plate Voltage (Max.) ..... 5200 Volts
Plate Dissipation (Max.) ..... 6.5 Watts
Steady State Peak Current (Max.) ..... 1200 Ma
DC Plate Current (Max.) ..... 250 Ma
Bulb Temperature at Hottest Point ..... 220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 350 Ma ..... 16 Volts

NOTE:

(1) 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 horizontal scanning cycle.

Color Television Type

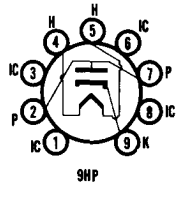
DAMPER

6CL3

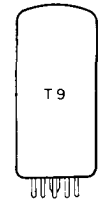
12CL3, 17CL3

Heater-Cathode Diode

Construction .....Novar T-9
Base .....Novar Button 9 Pin, E9-89
(Exhaust Tip on Base)
Basing(1) 9HP
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.625 In.
Maximum Overall Height .....3.005 In.



9HP



ELECTRICAL DATA

HEATER OPERATION

	17CL3	12CL3	6CL3
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	11	11	— Seconds

Maximum Heater-Cathode Voltage
Heater Negative with Respect to Cathode
DC ..... 900 Volts
Total DC and Peak ..... 5000 Volts

Heater Positive with Respect to Cathode	
DC	100 Volts
Total DC and Peak	300 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)	
Heater to Cathode	3.0 Pf
Plate to Cathode and Heater	6.5 Pf
Cathode to Plate and Heater	9.0 Pf
RATINGS (Design Maximum Rating System)	
Damper Service(2)	
Peak Inverse Plate Voltage (Max.)	5500 Volts
Plate Dissipation (Max.)	8.5 Watts
Steady State Peak Current (Max.)	1300 Ma
DC Plate Current (Max.)	250 Ma
Bulb Temperature at Hottest Point	220 °C
CHARACTERISTICS AND TYPICAL OPERATION	
Tube Voltage Drop for Ib = 350 Ma	16 Volts

NOTES:

(1) Pins 1, 3, 6, and 8 should not be used as tie points.

(2) 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 horizontal scanning cycle.

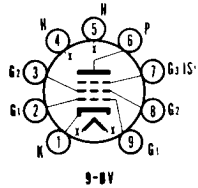
6CL6

Color Television Type

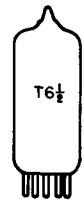
VIDEO AMPLIFIER

Beam Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9BV
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



9-8V



ELECTRICAL DATA	
HEATER OPERATION	
Heater Voltage	6.3 Volts
Heater Current	650 Ma
Maximum Heater-Cathode Voltage	100 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)	
Grid No. 1 to Plate	0.12 Pf
Input	11 Pf
Output	5.5 Pf
RATINGS (Design Center Rating System)	
Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	7.5 Watts
Grid No. 2 Voltage (Max.)	150 Volts
Grid No. 2 Input (Max.)	1.7 Watts
Grid No. 3 Voltage (Max.)	0 Volt
Grid No. 1 Voltage	
Negative Bias Value (Max.)	50 Volts
Positive Bias Value (Max.)	0 Volt
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.5 Megohm
Bulb Temperature (At Hottest Point) (Max.)	200° C
CHARACTERISTICS AND TYPICAL OPERATION	
Plate Voltage	250 Volts
Grid No. 2 Voltage	150 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Grid No. 1 Bias Voltage	−3 Volts
Peak AF Grid No. 1 Signal Voltage	3 Volts
Zero Signal DC Plate Current	30 Ma
Maximum Signal DC Plate Current	31 Ma
Zero Signal DC Grid No. 2 Current	7 Ma
Maximum Signal DC Grid No. 2 Current	7.2 Ma
Transconductance	11,000 μmhos
Plate Resistance (Approx.)	90,000 Ohms
Grid No. 1 Voltage for Plate Current of 10 μa (Approx.)	−14 Volts
Load Resistance	7500 Ohms

Total Harmonic Distortion	8 Percent
Maximum Signal Power Output	2.8 Watts
4 MHz Bandwidth Video Amplifier	
Plate Supply Voltage	300 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Grid No. 2 Supply Voltage	300 Volts
Grid No. 1 Bias Voltage	−2 Volts
Peak-to-Peak Signal Voltage Grid No. 1	3 Volts
Grid No. 2 Resistor	24,000 Ohms
Grid No. 1 Resistor	0.1 Megohm
Plate Load Resistor	3900 Ohms
Zero Signal Plate Current	30 Ma
Zero Signal Grid No. 2 Current	7.0 Ma
Peak-to-Peak Voltage Output	132 Volts

Color Television Type

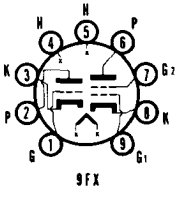
VHF OSCILLATOR and MIXER

6CL8A

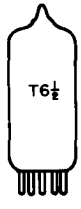
5CL8A, 19CL8A

Medium Mu Triode and Semi-Remote Cutoff Tetrode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9FX
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.



9FX



ELECTRICAL DATA

HEATER OPERATION

	19CL8A	5CL8A	6CL8A
Heater Voltage	18.9	4.7	6.3 Volts
Heater Current	150	600	450 Ma
Heater Warm-up Time	—	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

	Shielded(1)	Unshielded
Triode Section		
Grid to Plate	1.8	1.8 Pf
Input: g to (h + k)	2.7	2.7 Pf
Output: p to (h + k)	1.2	0.4 Pf
Tetrode Section		
Grid No. 1 to Plate (Max.)	0.010	0.020 Pf
Input: g1 to (h + k + g2)	5.0	5.0 Pf
Output: p to (h + k + g2)	3.4	2.4 Pf

RATINGS (Design Center Rating System)

	Triode Section	Tetrode Section
Plate Voltage (Max.)	300	300 Volts
Grid No. 2 Supply Voltage (Max)	—	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	2.7	2.8 Watts
Grid No. 2 Dissipation (Max.)	—	0.5 Watts
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Self Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Tetrode Section
Class A1 Amplifier		
Plate Voltage	125	125 Volts
Grid No. 2 Voltage	—	125 Volts

	Triode Section	Tetrode Section
Grid No. 1 Voltage	0	-1.0 Volt
Cathode Bias Resistor	56	— Ohms
Plate Current	15	12 Ma
Grid No. 2 Current	—	4.0 Ma
Transconductance	8000	6400 μmhos
Amplification Factor	40	—
Plate Resistance	5000	100K Ohms
Grid No. 1 Voltage for Ib = 10 μa (Approx.)	-9	-10 Volts

NOTE:
(1) Shield No. 315.

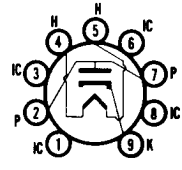
6CM3

25CM3, 34CM3

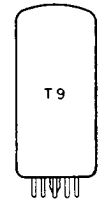
DAMPER

Heater-Cathode Diode

Construction .....Novar T-9
Base E9-89
Basing 9HP
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.625 In.
Maximum Overall Height .....3.005 In.



9HP



ELECTRICAL DATA

HEATER OPERATION

	6CM3	25CM3	34CM3
Heater Voltage	6.3	25.0	33.5 Volts
Heater Current	2.4	0.600	0.450 Amp.
Heater Warm-up Time	—	11	11 Seconds

Maximum Heater-Cathode Voltage
Heater Negative with Respect to Cathode
DC ..... 900 Volts
Total DC and Peak ..... 5500 Volts
Heater Positive with Respect to Cathode
DC ..... 100 Volts
Total DC and Peak ..... 300 Volts

DIRECT INTERELECTRODE CAPACITANCES (Without Shield)

Cathode to Plate and Heater ..... 18.0 pf
Plate to Cathode and Heater ..... 20.0 pf
Heater to Cathode ..... 4.0 pf

RATINGS (Design Maximum Rating System)

Damper Service(1)

Peak Inverse Plate Voltage (Max.) ..... 5500 Volts
Plate Dissipation (Max.) ..... 12 Watts
Steady State Peak Plate Current (Max.) ..... 1700 Ma
DC Plate Current (Max.) ..... 400 Ma

AVERAGE CHARACTERISTICS

Tube Voltage Drop (Ib = 350 Ma) ..... 10 Volts

NOTE:
(1) 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 one horizontal scanning cycle.

6CM6

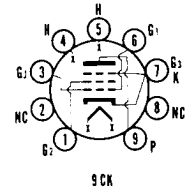
5CM6, 12CM6

Color Television Type

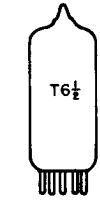
AUDIO POWER AMPLIFIER or VERTICAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9CK
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9CK



ELECTRICAL DATA

HEATER OPERATION	12CM6	5CM6	6CM6
Heater Voltage	12.6	4.7	6.3 Volts
Heater Current	225	600	450 Ma
Heater Warm-up Time	—	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 (Unshielded)

Grid to Plate	0.7 Pf
Input: g1 to (h + k + g2 + g3)	8.0 Pf
Output: p to (h + k + g2 + g3)	8.5 Pf

RATINGS (Design Center Rating System)

Class A1 Amplifier

Plate Voltage (Max.)	315 Volts
Plate Dissipation (Max.)	12 Watts
Grid No. 2 Voltage (Max.)	285 Volts
Grid No. 2 Dissipatiom (Max.)	2 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.5 Megohm

Vertical Deflection Amplifier(1)	Pent. Conn.	Tri. Conn.
Plate Voltage (Max.)	315	315 Volts
Peak Positive Plate Voltage (Abs. Max.)	2000	2000 Volts
Plate Dissipation (Max.)(2)	8	9 Watts
Grid No. 2 Voltage	285	— Volts
Grid No. 2 Dissipation(2)	1.75	— Watts
Peak Negative Grid Voltage (Max.)	250	250 Volts
Average Cathode Current (Max.)	40	40 Ma
Peak Cathode Current (Max.)	120	120 Ma
Grid No. 1 Circuit Resistance		
Cathode Bias (Max.)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier	Tri. Conn.	Single Tube			Push-Pull	
Plate Voltage	250	180	250	315	250	285 Volts
Grid No. 2 Voltage	—	180	250	225	250	285 Volts
Grid No. 1 Voltage	-12.5	-8.5	-12.5	-13.0	-15	-19 Volts
Peak AF Grid No. 1 Voltage	—	8.5	12.5	13.0	30	38 Volts
Zero Signal Plate Current	49.5	29	45	34	70	70 Ma
Maximum Signal Plate Current	—	30	47	35	90	92 Ma
Zero Signal Grid No. 2 Current	—	3.0	4.5	2.2	5	4 Ma
Max. Signal Grid No. 2 Current	—	4.0	7.0	6.0	13	13.5 Ma
Plate Resistance (Approx.)	1960	50,000	50,000	80,000	—	— Ohms
Transconductance	5000	3700	4100	3750	—	— μmhos
Amplification Factor	9.8	—	—	—	—	—
Load Resistance	—	5500	5000	8500	10,000	8000 Ohms
Maximum Signal Power Output	—	2.0	4.5	5.5	10	14 Watts
Total Harmonic Distortion	—	8	8	12	5	3.5 Percent
Ec1 for Ib = 0.5 Ma (Approx.)	-37	—	-37	—	—	— Volts

NOTES:

(1) 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 horizontal scanning cycle.

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

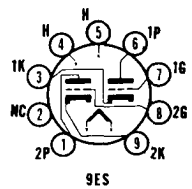
VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

6CM7

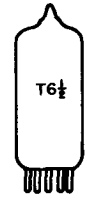
8CM7

Dissimilar Double Triode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9ES
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



9ES



ELECTRICAL DATA

HEATER OPERATION

	8CM7	6CM7
Heater Voltage	8.4	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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 (Unshielded)

	Section 1(1)	Section 2
Grid to Plate	3.8	3.0 Pf
Input: g to (k + h)	2.0	3.5 Pf
Output: p to (k + h)	0.5	0.4 Pf

RATINGS (Design Center Rating System)

Vertical Deflection Oscillator and Amplifier(2)

	Section 1(1) (Oscillator)	Section 2 (Amplifier)
DC Plate Voltage (Max.)	500	500 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	—	2200 Volts
Plate Dissipation (Max.)(3)	1.25	5.5 Watts
Peak Negative Pulse Grid Voltage (Max.)	200	200 Volts
Average Cathode Current (Max.)	15	20 Ma
Peak Cathode Current (Max.)	70	70 Ma
Grid Circuit Resistance		
Fixed Bias (Max.)	2.2	1.0 Megohms
Cathode Bias (Max.)	2.2	2.5 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Section 1(1) (Oscillator)	Section 2 (Amplifier)
Plate Voltage	200	250 Volts
Grid Voltage	−7	−8 Volts
Plate Current	5	20 Ma
Transconductance	2000	4400 μmhos
Amplification Factor	21	18
Plate Resistance	10,500	4100 Ohms
Plate Current at Ec = −10 Volts	1.0	— Ma
Grid Voltage for Ib = 10 μa	−14	— Volts

NOTES:

(1) Section 1 connects to pins 3, 6, and 7. Section 2 connects to pins 1, 8, and 9.

(2) 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 horizontal scanning cycle.

(3) 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.

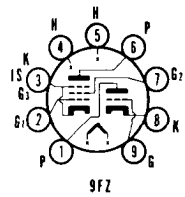
6CM8

5CM8

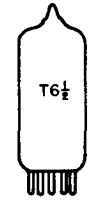
GENERAL PURPOSE AMPLIFIER (T) IF/VIDEO/AGC AMPLIFIER (P)

High Mu Triode and Sharp Cutoff Pentode

Construction ..... Miniature T-6½
Base ..... Button 9 Pin, E9-1
Basing 9FZ
Outline 6-2
Maximum Diameter ..... 0.875 In.
Maximum Seated Height ..... 1.937 In.
Maximum Overall Height ..... 2.187 In.



9FZ



ELECTRICAL DATA

HEATER OPERATION

	5CM8	6CM8
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section

Grid to Plate	1.9 Pf
Input: g to (h + k)	1.6 Pf
Output: p to (h + k)	0.22 Pf

Pentode Section

Grid No. 1 to Plate (Max.)	0.04 Pf
Input: g1 to (h + k + g2 + g3 + IS)	6.0 Pf
Output: p to (h + k + g2 + g3 + IS)	2.6 Pf

Coupling

Pentode Plate to Triode Grid (Max.)	0.01 Pf
Pentode Grid No. 1 to Triode Plate (Max.)	0.15 Pf
Pentode Plate to Triode Plate (Max.)	0.10 Pf

RATINGS (Design Center Rating System)

	Triode	Pentode
Plate Voltage (Max.)	300	300 Volts
Grid No. 2 Supply Voltage (Max.)	—	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	1.0	2.0 Watts
Grid No. 2 Dissipation (Max.)	—	0.5 Watt
Grid No. 1 Circuit Resistance		
Self Bias (Max.)	—	1.0 Megohm
Fixed Bias (Max.)	—	0.25 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

	Triode	Pentode
Plate Supply Voltage	250	200 Volts
Grid No. 2 Voltage	—	150 Volts
Grid No. 1 Voltage	−2	0 Volts
Cathode Bias Resistor	—	180 Ohms
Plate Current	1.8	9.5 Ma
Grid No. 2 Current	—	2.8 Ma
Amplification Factor	100	—
Plate Resistance (Approx.)	50,000	600,000 Ohms
Transconductance	2000	6200 μmhos
Grid No. 1 Voltage for Ib = 10 μa (Approx.)	—	−8 Volts

Color Television Type

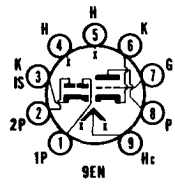
REACTANCE TUBE or SYNC SEP/AMP (T); PHASE DETECTOR (D)

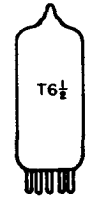
6CN7

8CN7

Double Diode and High Mu Triode

Construction ..... Miniature T-6½
Base ..... Button 9 Pin, E9-1
Basing 9EN
Outline 6-2
- Maximum Diameter ..... 0.875 In.
- Maximum Seated Height ..... 1.937 In.
- Maximum Overall Height ..... 2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	8CN7	6CN7
Heater Voltage Series/Parallel	8.4/4.2	6.3/3.15 Volts
Heater Current	225/450	300/600 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Grid to Plate	1.8 Pf
Triode Input	1.5 Pf
Triode Output	0.5 Pf
Grid to Each Diode Plate	0.006 Pf
Diode p1 to (dk + h)	3.6 Pf
Diode p2 to (dk + h)	3.6 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	330 Volts
Positive DC Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	1.1 Watt
Diode Current for Continuous Operation	
Each Diode (Max.)	5.5 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	100	250 Volts
Grid Voltage	−1.0	−3.0 Volts
Amplification Factor	70	70
Plate Resistance (Approx.)	54,000	58,000 Ohms
Transconductance	1300	1200 μmhos
Plate Current	0.8	1.0 Ma
Average Diode Current, Each Diode with 5.0 Volts DC Applied	—	20 Ma

6CQ8

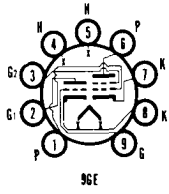
5CQ8

Color Television Type

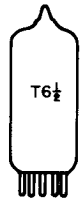
VHF OSCILLATOR and MIXER

Medium Mu Triode and Sharp Cutoff Tetrode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9GE
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.



9GE



ELECTRICAL DATA

HEATER OPERATION

	5CQ8	6CQ8
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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

	Shielded(1)	Unshielded
Triode Section		
Grid to Plate	1.8	1.8 Pf
Input: g to (h + k)	2.7	2.7 Pf
Output: p to (h + k)	0.4	1.2 Pf
Pentode Section		
Grid No. 1 to Plate (Max.)	0.019	0.015 Pf
Input: g1 to (h + k + g2 + IS)	5	5 Pf
Output: p to (h + k + g2 + IS)	2.5	3.3 Pf
Coupling		
Triode Plate to Tetrode Plate (Max.)	0.07	0.01 Pf

RATINGS (Design Maximum Rating System)

	Triode Section (Oscillator)	Tetrode Section (Mixer)
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Positive Grid Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	3.1	3.2 Watts

Grid No. 2 Input (Up to 150 Volts) (Max.)	—	0.7 Watt
Grid No. 2 Input (150 Volts to 300 Volts) (Max.) .See Rating Chart (Gen. Info. Sec.)		
Grid Input	0.55	— Watt
Grid Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Cathode Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

	Triode Section	Tetrode Section
Plate Voltage	125	125 Volts
Grid No. 2 Voltage	—	125 Volts
Grid No. 1 Voltage	—	-1.0 Volt
Cathode Resistor	56	— Ohms
Plate Current	15	12 Ma
Grid No. 2 Current	—	4.2 Ma
Transconductance	8000	5800 μmhos
Amplification Factor	40	—
Plate Resistance (Approx.)	5000	140,000 Ohms
Ec1 for Ib = 100 μa (Approx.)	-7	-7 Volts

NOTE:
(1) With external JEDEC No. 315 shield connected to cathode of section under test.

Color Television Type

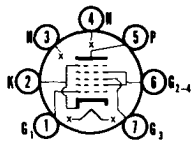
SYNC SEPARATOR and CLIPPER

6CS6

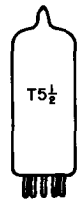
3CS6, 4CS6, 12CS6

Dual Control Heptode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CH
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7 CN



ELECTRICAL DATA

HEATER OPERATION

	12CS6	4CS6	3CS6	6CS6
Heater Voltage	12.6	4.2	3.15	6.3 Volts
Heater Current	150	450	600	300 Ma
Heater Warm-up Time	—	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 (Unshielded)

Grid No. 1 to Plate (Max.)	0.05 Pf
Grid No. 3 to Plate (Max.)	0.36 Pf
Grid No. 1 Input: g1 to (k + h + g2 + g3 + g5)	5.5 Pf
Grid No. 3 Input: g3 to (k + h + g1 + g2 + g5)	7.0 Pf
Output: p to (k + h + g1 + g2 + g3 + g5)	7.5 Pf
Coupling (g1 to g3) (Max.)	0.15 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	1.0 Watt
Grid No. 2 Voltage (Max.)	100 Volts
Grid No. 2 Supply Voltage (Max.)	300 Volts
Grid No. 2 Dissipation (Max.)	1.0 Watt
Cathode Current (Max.)	14 Ma
Grid No. 1 Circuit Resistance (Max.)	0.47 Megohm
Grid No. 3 Circuit Resistance (Max.)	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	10	100	100 Volts
Grid No. 2 Voltage	30	30	30 Volts

Grid No. 1 Voltage	0	0	−1.0 Volt
Grid No. 3 Voltage	0	−1.0	0 Volt
Plate Current	1.2	0.8	0.75 Ma
Grid No. 2 Current	4.1	4.0	1.1 Ma
Transconductance			
Grid No. 1	—	—	950 μmhos
Grid No. 3	—	1250	— μmhos
Plate Resistance (Approx.)	—	0.7	1.0 Megohm
Grid Voltage for Ib = 50 μa			
Grid No. 1	—	—	−2.5 Volts
Grid No. 3	—	−2.2	— Volts

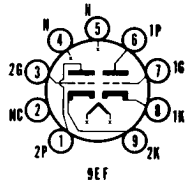
6CS7

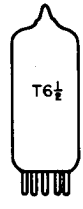
8CS7

VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

Double Dissimilar Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9EF
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.





ELECTRICAL DATA

HEATER OPERATION

	8CS7	6CS7
Heater Voltage	8.4	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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 (Unshielded)

	Section 1(1)	Section 2
Grid to Plate	2.6	2.6 Pf
Input: g to (k + h + IS)	1.8	3.0 Pf
Output: p to (k + h + IS)	0.5	0.5 Pf

RATINGS (Design Center Rating System)

Vertical Deflection Oscillator and Amplifier(2)

	Section 1(1) (Oscillator)	Section 2 (Amplifier)
DC Plate Voltage (Max.)	500	500 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	—	2200 Volts
Plate Dissipation (Max.)(3)	1.25	6.5 Watts
Peak Negative Pulse Grid Voltage (Max.)	400	250 Volts
Average Cathode Current (Max.)	20	30 Ma
Peak Cathode Current (Max.)	70	105 Ma
Grid Circuit Resistance (Max.)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Section 1(1)	Section 2
Plate Voltage	250	250 Volts
Grid Voltage	−8.5	−10.5 Volts
Plate Current	10.5	19.0 Ma

Transconductance	2200	4500 μmhos
Amplification Factor	17.0	15.5
Plate Resistance	7700	3450 Ohms
Plate Current at Ec = −16 Volts	—	3.0 Ma
Grid Voltage for Ib = 10 μa	−24	— Volts
Grid Voltage for Ib = 50 μa	—	−22 Volts

NOTES:

(1) Section 1 connects to Pins 6, 7, and 8. Section 2 connects to Pins 1, 3, and 9.

(2) 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 horizontal scanning cycle.

(3) 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.

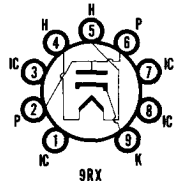
DAMPER

6CT3

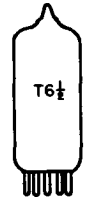
17CT3

Heater-Cathode Diode

Construction .....Miniature T-6½
Base E9-1
Basing[2] 9RX
Outline
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.875 In.
Maximum Overall Height .....3.125 In.



9RX



ELECTRICAL DATA

HEATER OPERATION

	6CT3	17CT3
Heater Voltage	6.3	16.8 Volts
Heater Current	1200	450 Ma
Heater Warm-up Time	—	11 Seconds
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
DC		900 Volts
Total DC and Peak		5000 Volts
Heater Positive with Respect to Cathode		
DC		100 Volts
Total DC and Peak		300 Volts

DIRECT INTERELECTRODE CAPACITANCES (Without Shield)

Cathode to Plate and Heater	9.5 pf
Plate to Cathode and Heater	12.0 pf
Heater to Cathode	2.8 pf

RATINGS (Design Maximum Rating System)

Damper Service[1]

Peak Inverse Plate Voltage	5000 Volts
Plate Dissipation	4.75 Watts
Steady State Peak Plate Current	1200 Ma
DC Plate Current	250 Ma

AVERAGE CHARACTERISTICS

Tube Voltage Drop (Ib = 350 Ma)	16 Volts

NOTES:

(1) 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.

(2) Pins designated Internal Connection (IC) may or may not connect to internal elements depending on the manufacturer. To maintain interchangeability do not use these pins for external connection.

6CU5

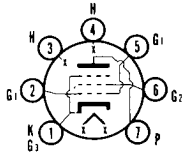
12C5/12CU5, 17C5/17CU5, 25C5, 50C5

Color Television Type

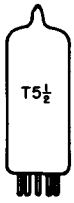
AUDIO POWER AMPLIFIER

Beam Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CV
Outline 5-3
Maximum Diameter .....0.750 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



7CV



ELECTRICAL DATA

HEATER OPERATION

	50C5	25C5	17C5/17CU5	12C5/12CU5	6CU5
Heater Voltage	50	25	16.8	12.6	6.3 Volts
Heater Current	150	300	450	600	1200 Ma
Heater Warm-up Time	—	—	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 (Unshielded)

Grid to Plate ..... 0.6 Pf
Input ..... 13 Pf
Output ..... 8.5 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.) ..... 150 Volts
Grid No. 2 Voltage (Max.) ..... 130 Volts
Plate Dissipation (Max.) ..... 7.0 Watts
Grid No. 2 Dissipation (Max.) ..... 1.4 Watts
Positive Grid No. 1 Voltage (Max.) ..... 0 Volt
Grid No. 1 Circuit Resistance
Fixed Bias (Max.) ..... 0.1 Megohm
Cathode Bias (Max.) ..... 0.5 Megohm
Bulb Temperature (Hottest Point) (Max.) ..... 220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

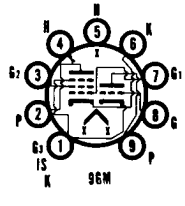
Plate Voltage ..... 120 Volts
Grid No. 2 Voltage ..... 110 Volts
Grid No. 1 Voltage ..... −8 Volts
Peak AF Grid No. 1 Voltage ..... 8 Volts
Zero-Signal Plate Current ..... 49 Ma
Maximum-Signal Plate Current ..... 50 Ma
Zero-Signal Grid No. 2 Current ..... 4.0 Ma
Maximum-Signal Grid No. 2 Current ..... 8.5 Ma
Transconductance ..... 7500 μmhos
Plate Resistance (Approx.) ..... 10,000 Ohms
Load Resistance ..... 2500 Ohms
Maximum-Signal Power Output ..... 2.3 Watts
Total Harmonic Distortion (Approx.) ..... 10 Percent

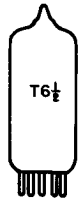
6CU8

IF/VIDEO/AGC AMP. (T) OSC./SYNC SEP. or CLIPPER (P)

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9GM
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section	
Grid to Plate	1.6 Pf
Grid to (k + h + g3 + IS)	1.9 Pf
Plate to (k + h + g3 + IS)	1.6 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.025 Pf
Grid No. 1 to (k and g3 + g2 + h + Tk + IS)	7.0 Pf
Plate to (k and g3 + g2 + h + Tk + IS)	2.4 Pf
Coupling	
Pentode Grid No. 1 to Triode Plate (Max.)	0.03 Pf
Pentode Plate to Triode Plate (Max.)	0.07 Pf

RATINGS (Design Center Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	2.8	2.3 Watts
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid No. 2 Input:		
For Grid No. 2 Voltages Up to 150 Volts (Max.)	—	0.55 Watt
For Grid No. 2 Voltages Between 150 Volts and 300 Volts	See Rating Chart (Gen. Info. Sec.)	
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Self Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	125	125 Volts
Grid No. 2 Voltage	—	125 Volts
Grid Voltage	-1.0	— Volt
Cathode Bias Resistor	—	56 Ohms
Plate Current	17	12 Ma
Grid No. 2 Current	—	3.8 Ma
Transconductance	5800	7800 μmhos
Amplification Factor	24	—
Plate Resistance	4100	170,000 Ohms
Ec1 for Ib = 10 μa (Approx.)	-12	-6 Volts
Ib at Ec1 = -3 Volts, RK = 0	—	1.6 Ma

Color Television Type

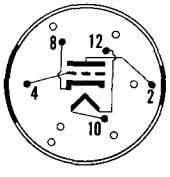
VHF AMPLIFIER

6CW4

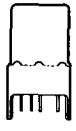
2CW4, 13CW4

High Mu Triode

Construction	Nuvistor, Metal
Base	Medium Ceramic Wafer Twelvar 5 Pin, E5-65
Basing	12AQ
Outline	
Maximum Diameter	0.440 In.
Maximum Seated Height	0.625 In.
Maximum Overall Height	0.800 In.



12AQ



ELECTRICAL DATA

HEATER OPERATION

	13CW4	2CW4	6CW4
Heater Voltage	13.5	2.0	6.3 Volts
Heater Current	60	450	130 Ma

Heater Warm-up Time	—	11	— Seconds
Maximum Heater-Cathode Voltage			100 Volts
DIRECT INTERELECTRODE CAPACITANCES (Shielded)			
Grid to Plate			0.92 Pf
Input: g to (h + k + Shell)			4.3 Pf
Output: p to (h + k + Shell)			1.8 Pf
Heater to Cathode			1.3 Pf
Plate to Cathode			0.18 Pf
RATINGS (Design Maximum Rating System)			
Plate Supply Voltage (Max.)			300 Volts
Plate Voltage (Max.)			135 Volts
Plate Dissipation (Max.)			1.0 Watt
DC Cathode Current (Max.)			15 Ma
Nagative Grid Voltage (Max.)			55 Volts
Grid Circuit Resistance			
Self Bias (Max.)			2.2 Megohms
Fixed Bias (Max.)			0.5 Megohms
CHARACTERISTICS AND TYPICAL OPERATION			
Class A1 Amplifier			
Plate Voltage	70		110 Volts
Grid Resistor	47,000		— Ohms
Cathode Resistor	—		130 Ohms
Plate Current	7.2		7 Ma
Transconductance	12,500		9800 μmhos
Amplification Factor	68		65
Plate Resistance (Approx.)	5440		6600 Ohms
Ec for Ib = 10 μa (Approx.)	—		−4 Volts

6CW5/EL86

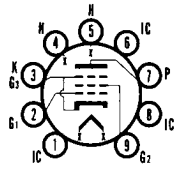
8CW5A, 10CW5/LL86
15CW5/PL84, 30CW5

Color Television Type

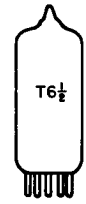
AUDIO POWER AMPLIFIER

Beam Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9CV
Outline 6-4
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.813 In.
Maximum Overall Height .....3.063 In.



9CV



ELECTRICAL DATA

HEATER OPERATION

	30CW5	15CW5/ PL84	10CW5/ LL86	8CW5A	6CW5/EL86
Heater Voltage	30	15	10.6	8.0	6.3 Volts
Heater Current	150	300	450	600	760 Ma
Heater Warm-up Time	—	—	11	11	— Seconds

Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
DC	220 Volts
Total DC and Peak	330 Volts
Heater Positive with Respect to Cathode	
DC	220 Volts
Total DC and Peak	330 Volts
DIRECT INTERELECTRODE CAPACITANCES	
Grid No. 1 to All Other Electrodes Except Plate	1.3 Pf
Plate to All Other Electrodes Except Grid No. 1	6.8 Pf
Plate to Grid No. 1 (Max.)	0.6 Pf
Grid No. 1 to Heater (Max.)	0.25 Pf
RATINGS (Design Maximum Rating System)	
Class A1 Amplifier	
Plate Voltage (Max.)	275 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Plate Dissipation (Max.)	14 Watts
Grid No. 2 Dissipation (Max.)	2.1 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Vertical Deflection Amplifier[1]—Triode Connected[2]	
Plate Voltage (Max.)	275 Volts
Peak Positive Plate Voltage (Abs. Max.)	2200 Volts

Plate Dissipation (Max.)(3)	12 Watts
Peak Negative Grid No. 1 Voltage (Max.)	250 Volts
Average Cathode Current (Max.)	110 Ma
Peak Cathode Current (Max.)	240 Ma
Grid No. 1 Circuit Resistance	
Cathode Bias (Max.)	2.2 Megohms
CHARACTERISTICS AND TYPICAL OPERATION	
Plate Voltage	170 Volts
Grid No. 2 Voltage	170 Volts
Grid No. 1 Voltage	−12.5 Volts
Plate Current	70 Ma
Grid No. 2 Current	3.5 Ma
Transconductance	11,000 μmhos
Amplification Factor (g1 to g2)	8
Plate Resistance	26,000 Ohms

NOTES:

(1) 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 horizontal scanning cycle.
(2) Grid No. 2 connected to plate.
(3) 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.

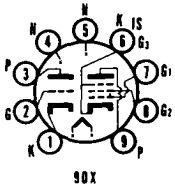
LOW FREQUENCY OSC. or AMP. (T) VIDEO AMPLIFIER (P)

6CX8

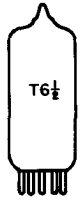
8CX8

Medium Mu Triode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9DX
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

	8CX8	6CX8
Heater Voltage	8.0	6.3 Volts
Heater Current	600	750 Ma
Heater Warm-up Time	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 (Unshielded)		
Triode Section		
Grid to Plate		4.4 Pf
Input		2.2 Pf
Output		0.38 Pf
Pentode Section		
Grid No. 1 to Plate		0.06 Pf
Input		9.0 Pf
Output		4.4 Pf
Coupling		
Pentode Grid No. 1 to Triode Plate (Max.)		0.005 Pf
Pentode Plate to Triode Grid (Max.)		0.018 Pf
Pentode Plate to Triode Plate (Max.)		0.17 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts

Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	2.0	5.0 Watts
Grid No. 2 Dissipation (Max.)	—	1.1 Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Cathode Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier	**Triode Section**	**Pentode Section**
Plate Voltage	150	200 Volts
Grid No. 2 Voltage	—	125 Volts
Cathode Bias Resistor	150	68 Ohms
Plate Current	9.2	24 Ma
Grid No. 2 Current	—	5.2 Ma
Transconductance	4600	10,000 μmhos
Amplification Factor	40	—
Plate Resistance (Approx.)	8700	70,000 Ohms
Grid No. 1 Voltage for Ib = 100 μa (Approx.)	-5.0	-8.5 Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS
Eb = 40 V, Ec2 = 125 V, Ec1 = 0 V
Ib = 40 Ma, Ic2 = 15.5 Ma

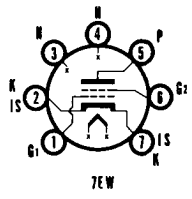
6CY5

2CY5, 3CY5, 4CY5

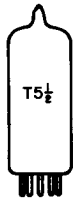
VHF AMPLIFIER

Sharp Cutoff Tetrode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing.....7EW
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7EW



ELECTRICAL DATA

HEATER OPERATION

	2CY5	3CY5	4CY5	6CY5
Heater Voltage	2.4	2.9	4.5	6.3
Heater Current	600	450	300	200 Ma
Heater Warm-up Time	11	11	11	— Seconds
Maximum Heater-Cathode Voltage				100 Volts

DIRECT INTERELECTRODE CAPACITANCES (Shielded)(1)

Grid No. 1 to Plate	0.03 Pf
Input	4.5 Pf
Output	3.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	180 Volts
Grid No. 2 Supply Voltage (Max.)	180 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	2.0 Watts
Grid No. 2 Dissipation (Max.)	0.5 Watt
Positive Grid No. 1 Voltage (Max.)	0 Volt
Cathode Current (Max.)	20 Ma
Grid Circuit Resistance (Max.)	0.5 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	125 Volts
Grid No. 2 Voltage	80 Volts
Grid No. 1 Voltage	-1 Volt
Plate Current	10 Ma
Grid No. 2 Current	1.5 Ma
Transconductance	8000 μmhos
Plate Resistance	0.1 Megohm
Grid No. 1 Voltage for Ib = 20 μa	-6 Volts

NOTE:
(1) Shield No. 316 connected to cathode.

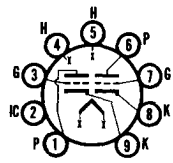
VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

6CY7

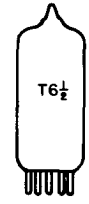
8CY7, 11CY7

Double Dissimilar Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9LG
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9LG



ELECTRICAL DATA

HEATER OPERATION

	11CY7	8CY7	6CY7
Heater Voltage	11	7.9	6.3 Volts
Heater Current	450	600	750 Ma
Heater Warm-up Time	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 (Unshielded)

	Section No. 1	Section No. 2
Grid to Plate	1.8	4.4 Pf
Input: g to (h + k)	1.5	5.0 Pf
Output: p to (h + k)	0.30	1.0 Pf

RATINGS (Design Maximum Rating System)

	Vertical Defl. Osc.(1) Section No. 1	Vertical Defl. Amp.(1) Section No. 2
DC Plate Voltage (Max.)	350	350 Volts
Peak Positive Pulse Plate Voltage (Max.)	—	1800 Volts
Peak Negative Pulse Grid Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.)(2)	1.0	5.5 Watts
DC Cathode Current (Max.)	—	35 Ma
Peak Cathode Current (Max.)	—	120 Ma
Grid Circuit Resistance		
Cathode Bias (Max.)	2.2	2.2 Megohms
Fixed Bias (Max.)	2.2	— Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Section No. 1	Section No. 2
Plate Voltage	250	150 Volts
Grid Voltage	-3.0	— Volts
Cathode Bias Resistor	—	620 Ohms
Plate Current	1.2	30 Ma
Transconductance	1300	5400 μmhos
Amplification Factor	68	5
Plate Resistance (Approx.)	52,000	920 Ohms
Grid Voltage for Ib = 200 μa (Approx.)	—	-40 Volts
Grid Voltage for Ib = 10 μa (Approx.)	-5.5	— Volts
Plate Current at Ec = -30 VDC (Approx.)	—	3.5 Ma

INSTANTANEOUS PLATE KNEE CHARACTERISTICS

Eb = 60 V, Ec1 = 0 V, Ib = 80 Ma

NOTES:

(1) 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 horizontal scanning cycle.

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

6CZ5

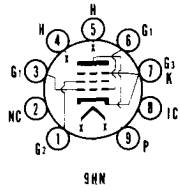
5CZ5

Color Television Type

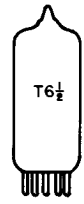
AUDIO POWER AMP. or VERTICAL DEFLECTION AMP.

Beam Power Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing.....9HN
Outline 6-4
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.812 In.
Maximum Overall Height .....3.062 In.



9HN



ELECTRICAL DATA

HEATER OPERATION

	5CZ5	6CZ5
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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

Grid No. 1 to Plate (Max.)	0.4 Pf
Input: g1 to (k + h + g3 + g2)	9.0 Pf
Output: p to (k + h + g3 + g2)	6.0 Pf

RATINGS (Design Maximum Rating System)

	Vertical Deflection Amp.	Class A1 Power Amp.
DC Plate Voltage (Max.)	350	350 Volts
Peak Positive Plate Voltage (Abs. Max.)	2200(2)	— Volts
DC Grid No. 2 Voltage (Max.)	315	285 Volts
Peak Negative Grid No. 1 Voltage (Max.)	275	— Volts
Plate Dissipation (Max.)(1)	10	12 Watts
Grid No. 2 Input (Max.)	2	2 Watts
Average Cathode Current (Max.)	45	— Ma
Peak Cathode Current (Max.)	155	— Ma
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.1 Megohm
Cathode Bias (Max.)	1	1 Megohm
Bulb Temperature (At Hottest Point) (Max.)	250	250 °C

CHARACTERISTICS AND TYPICAL OPERATION

AF Power Amplifier	Single Tube Class A1	Push Pull Class AB1
Plate Voltage	250	350 Volts
Grid No. 2 Voltage	250	280 Volts
Grid No. 1 Voltage	−14	−23.5 Volts
Peak AF Grid No. 1 Voltage	13	— Volts
Peak AF Grid to Grid Voltage(3,4)	—	47 Volts
Zero Signal Plate Current	46	46 Ma
Maximum Signal Plate Current	48	103 Ma
Zero Signal Grid No. 2 Current	4.6	3 Ma
Maximum Signal Grid No. 2 Current	8	13 Ma
Transconductance	4800	— μmhos
Load Resistance	5000	— Ohms
Load Resistance (Plate to Plate)	—	7500 Ohms
Power Output	5.4	21.5 Watts
Total Harmonic Distortion	10	1 Percent

INSTANTANEOUS PLATE KNEE VALUES

Eb = 70 V, Ec2 = 250 V, Ec1 = 0 V
Ib = 130 Ma, Ic2 = 16 Ma

NOTES:

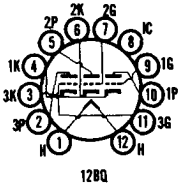
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the pulse must not exceed 15% of one horizontal scanning cycle.
(2) Under no circumstances should this absolute value be exceeded.
(3) No Grid No. 1 Current should flow during any part of the input cycle.
(4) Low resistance is required by the Grid No. 1 Circuit such as transformer or impedance coupling devices.

OSCILLATOR, MIXER AMPLIFIER or AFC

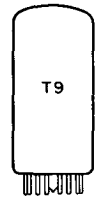
6D10

High Mu Triple Triode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12BQ
Outline 9-56
Maximum Diameter .....1.188 In.
Maximum Seated Height .....1.500 In.
Maximum Overall Height .....1.875 In.



12BQ



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 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) (Each Section)

Grid to Plate	1.5 Pf
Input	2.2 Pf
Output	0.5 Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	330 Volts
Plate Dissipation (Each Plate) (Max.)	2.0 Watts
Plate Dissipation (Plates 1, 2, and 3) (Max.)	6.0 Watts
Positive Grid Voltage (Max.)	0 Volt
Negative Grid Voltage (Max.)	50 Volts

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier—Each Section

Plate Voltage	125 Volts
Grid Voltage	−1.0 Volt
Plate Current	4.2 Ma
Plate Resistance	13,600 Ohms
Transconductance	4200 μmhos
Amplification Factor	57
Ec for Ib = 20 μa	−4 Volts

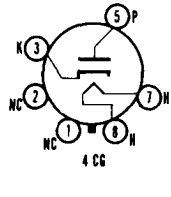
DAMPER

6DA4A/6DM4A

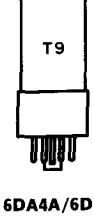
12D4A, 17D4A

Heater-Cathode Diode

Construction .....Octal T-9
Base .....Octal 5 Pin, B5-85
Basing[1] 4CG
Outline 9-41
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.750 In.
Maximum Overall Height .....3.313 In.



4 CG



ELECTRICAL DATA

HEATER OPERATION

	17D4A	12D4A	6DA4A/6DM4A
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
DC			1000 Volts
Total DC and Peak			5000 Volts

Heater Positive with Respect to Cathode	
DC	100 Volts
Total DC and Peak	300 Volts
DIRECT INTERELECTRODE CAPACITANCES	
Heater to Cathode	3.0 Pf
Plate to Cathode and Heater	9.0 Pf
Cathode to Plate and Heater	7.0 Pf
RATINGS (Design Maximum Rating System)	
Damper Service(2)	
Peak Inverse Plate Voltage (Max.)	5000 Volts
Plate Dissipation (Max.)	8.0 Watts
Steady State Peak Current (Max.)	900 Ma
DC Plate Current (Max.)	185 Ma
CHARACTERISTICS AND TYPICAL OPERATION	
Tube Voltage Drop for Ib = 340 Ma	30 Volts

NOTES:
(1) Pins 1, 2, 4, and 6 should not be used as tie points.
(2) 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 horizontal scanning cycle.

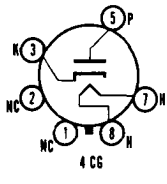
6DE4

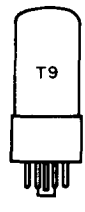
17DE4, 22DE4

DAMPER

Heater-Cathode Diode

Construction	Octal T-9
Base(1)	Octal 5 Pin, B5-85
Basing(2)	4CG
Outline	9-44
Maximum Diameter	1.188 In.
Maximum Seated Height	3.250 In.
Maximum Overall Height	3.813 In.





ELECTRICAL DATA

HEATER OPERATION

	22DE4	17DE4	6DE4
Heater Voltage	22.4	17	6.3 Volts
Heater Current	450	600	1600 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
DC			900 Volts
Total DC and Peak			5500 Volts
Heater Positive with Respect to Cathode			
DC			100 Volts
Total DC and Peak			300 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)			
Heater to Cathode			4 Pf
Plate to Cathode and Heater			8.5 Pf
Cathode to Plate and Heater			11.5 Pf
RATINGS (Design Maximum Rating System)			
Damper Service			
Peak Inverse Plate Voltage (Max.)(3)			5500 Volts
Plate Dissipation (Max.)			6.5 Watts
Steady State Peak Current (Max.)			1100 Ma
DC Plate Current (Max.)			180 Ma
CHARACTERISTICS AND TYPICAL OPERATION			
Tube Voltage Drop for Ib = 350 Ma			34 Volts

NOTES:
(1) On some base arrangements Pins 1, 4, and 6 are omitted.
(2) Pins 1, 2, 4, and 6 should not be used as tie points.
(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 horizontal scanning cycle.

Color Television Type

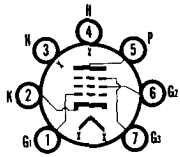
IF AMPLIFIER

6DE6

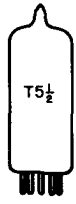
4DE6

Sharp Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CM
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7CM



ELECTRICAL DATA

HEATER OPERATION

	4DE6	6DE6
Heater Voltage	4.2	6.3 Volts
Heater Current	450	300 Ma
Heater Warm-up Time	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

	Shielded	Unshielded
Grid No. 1 to Plate	0.015	0.025 Pf
Input: g1 to (h + k + g2 + g3 + IS)	6.5	6.5 Pf
Output: p to (h + k + g2 + g3 + IS)	3.0	2.0 Pf

RATINGS (Design Maximum Rating System)

Class A1 Amplifier

Plate Voltage (Max.)	330 Volts
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	2.3 Watts
Grid No. 2 Input (Max.)	0.55 Watt
Positive Grid No. 1 Voltage (Max.)	0 Volt

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	125 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Grid No. 2 Voltage	125 Volts
Cathode Bias Resistor	56 Ohms
Plate Current	15.5 Ma
Grid No. 2 Current	4.2 Ma
Transconductance	8000 μmhos
Plate Resistance (Approx.)	0.25 Megohm
Transconductance with Ec1 = −5.5, Rk = 0	700 μmhos
Ec1 for Ib = 20 μa	−9 Volts

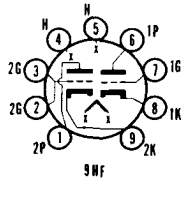
VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

6DE7

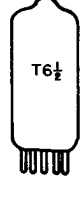
10DE7, 13DE7, 19DE7

Dissimilar Double Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9HF
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9HF



ELECTRICAL DATA

HEATER OPERATION

	19DE7	13DE7	10DE7	6DE7
Heater Voltage	19.4	13.0	9.7	6.3 Volts
Heater Current	300	450	600	900 Ma
Heater Warm-up Time	11	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 (Unshielded)

	Section No. 1	Section No. 2
Grid to Plate	4.0	8.5 Pf
Input: g to (h + k)	2.2	5.5 Pf
Output: p to (h + k)	0.52	1.0 Pf

RATINGS (Design Maximum Rating System)

Vertical Deflection Oscillator and Amplifier (1)

	Section No. 1 Oscillator	Section No. 2 Amplifier
DC Plate Voltage (Max.)	330	275 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	—	1500 Volts
Peak Negative Pulse Grid Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.) (2)	1.5	7.0 Watts
Average Cathode Current (Max.)	22	50 Ma
Peak Cathode Current (Max.)	77	175 Ma
Grid Circuit Resistance (Self Bias) (Max.)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Section No. 1	Section No. 2
Plate Voltage	250	150 Volts
Grid No. 1 Voltage	-11	-17.5 Volts
Plate Current	5.5	35 Ma
Transconductance	2000	6500 μmhos
Amplification Factor	17.5	6.0
Plate Resistance (Approx.)	8750	925 Ohms
Grid Voltage for Ib = 10 μa	-20	— Volts
Grid Voltage for Ib = 50 μa	—	-44 Volts
Plate Current at Ec = -24 Vdc	—	10 Ma
Zero Bias Plate Current		
Eb = 60 V; Ec = 0 (Instantaneous Values)	—	80 Ma

NOTES:

(1) 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 horizontal scanning cycle.

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

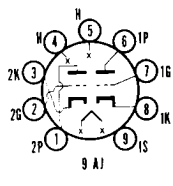
6DJ8

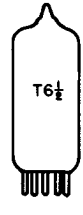
7DJ8, 12DJ8

VHF CASCODE AMPLIFIER

Double Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9AJ
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	12DJ8	7DJ8	6DJ8
Heater Voltage	12.6	7.0	6.3 Volts
Heater Current	180	300	365 Ma
Maximum Heater-Cathode Voltage			
RMS, Voltage Between Cathode and Heater (Grounded Cathode Section)	50	80	50 Volts

DC Component of Cathode to Heater Voltage (Grounded Grid Section)	130	130	130 Volts
Peak Voltage Between Cathode and Heater; Cathode Positive with Respect to Heater (Grounded Grid Section)	150	180	150 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Unshielded	Shielded
Grounded-Cathode Section(1)		
Grid to All Elements Except Plate	3.3	3.3 Pf
Plate to All Elements Except Grid	1.8	2.5 Pf
Plate to Grid	1.4	1.4 Pf
Grid to Heater	0.13	0.13 Pf
Grounded-Grid Section(1)		
Cathode to All Elements Except Plate	6.0	6.0 Pf
Plate to All Elements Except Cathode	2.8	3.7 Pf
Plate to Grid	1.4	1.4 Pf
Cathode to Heater	2.7	2.7 Pf
Plate to Cathode	0.18	0.16 Pf
Plate (Grounded-Grid Section) to Plate (Grounded-Cathode Section) (Max.)	0.045	0.15 Pf
Grid (Grounded-Cathode Section) to Plate (Grounded-Grid Section) (Max.)	0.005	0.005 Pf

RATINGS (Design Center Rating System) (Each Section)

Plate Supply Voltage (Ib = 0 Ma) (Max.)	550 Volts
Plate Voltage (Max.)(2)	130 Volts
Plate Dissipation (Max.)	1.8 Watts
Cathode Current (Max.)	25 Ma
Negative Grid Voltage (Max.)	50 Volts
Grid Circuit Resistance (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier (Each Section)

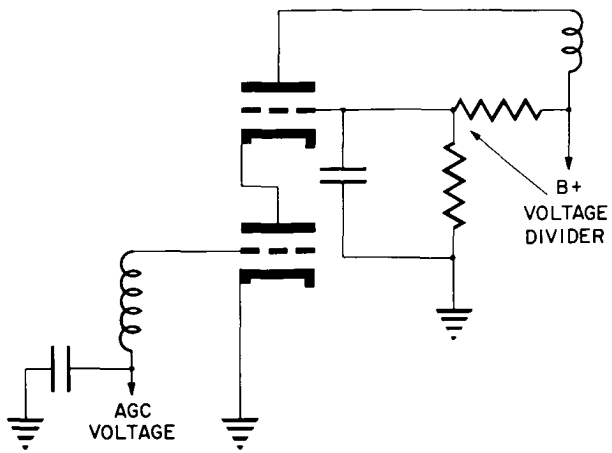
Plate Voltage	90 Volts
Grid Voltage	−1.3 Volts
Plate Current	15 Ma
Transconductance	12,500 μmhos
Amplification Factor	33
Equivalent Noise Resistance	300 Ohms

NOTES:

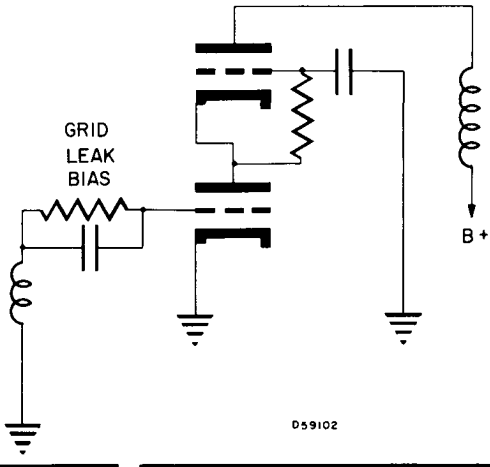
(1) Grounded-cathode section (Section No. 1) connects to Pins 6, 7, and 8. Grounded-grid section (Section No. 2) connects to Pins 1, 2, and 3.

(2) In order not to exceed the maximum permissible plate voltage when the cascode amplifier has AGC voltage applied to it, a voltage divider is recommended for the grid of the grounded-grid section (Circuit A).
With grid current biasing for the grounded-cathode section, the plate voltage across this section should not exceed 75 volts when an AGC voltage is not utilized (Circuit B).

CIRCUIT A



CIRCUIT B



6DK6

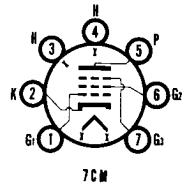
3DK6, 4DK6, 12DK6

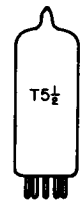
Color Television Type

IF AMPLIFIER

Sharp Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CM
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.





ELECTRICAL DATA

HEATER OPERATION

	12DK6	4DK6	3DK6	6DK6
Heater Voltage	12.6	4.2	3.15	6.3 Volts
Heater Current	150	450	600	300 Ma
Heater Warm-up Time	—	11	11	— Seconds
Maximum Heater-Cathode Voltage				
Heater Negative with Respect to Cathode				
DC Component	—	200	200	— Volts
Total DC and Plate	200	300	300	200 Volts
Heater Positive with Respect to Cathode				
DC	100	100	100	100 Volts
Total DC and Peak	200	200	200	200 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid No. 1 to Plate (Max.)	0.025 Pf
Input	6.3 Pf
Output	1.9 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	330 Volts
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	2.3 Watts
Grid No. 2 Dissipation (Max.)	0.55 Watt
Positive Grid No. 1 Voltage (Max.)	0 Volt

CHARACTERISTICS AND TYPICAL OPERATION

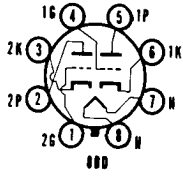
Plate Voltage	125 Volts
Grid No. 3 Voltage (Suppressor)	Connected to Cathode at Socket
Grid No. 2 Voltage	125 Volts
Cathode Bias Resistor	56 Ohms
Plate Current	12.0 Ma
Grid No. 2 Current	3.8 Ma
Transconductance	9800 μmhos
Plate Resistance	0.35 Megohm
Grid No. 1 Bias for Ib of 20 μa (Approx.)	–6.5 Volts

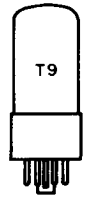
VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

6DN7

Double Dissimilar Triode

Construction .....Octal T-9
Base .....Octal 8 Pin, B8-142
Basing 8BD
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.438 In.
Maximum Overall Height .....3.000 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	900 Ma
Maximum 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

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

	Section 1	Section 2
Grid to Plate	4.0	5.5 Pf
Input	2.2	4.6 Pf
Output	0.7	1.0 Pf

RATINGS (Design Maximum Rating System)

	Vertical Oscillator Service (Section 1)(1)	Vertical Deflection Service (Section 2)(1)
DC Plate Voltage (Max.)	350	550 Volts
Peak Positive Pulse Plate Voltage (Max.)	—	2500 Volts
Peak Negative Grid Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.)	1.0	10(2) Watts
DC Cathode Current (Max.)	—	50 Ma
Peak Cathode Current (Max.)	—	150 Ma
Grid Circuit Resistance		
With Fixed Bias (Max.)	2.2	2.2 Megohms
With Cathode Bias (Max.)	2.2	— Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Section 1 (Oscillator)	Section 2 (Amplifier)	
Plate Voltage	250	150	250 Volts
Grid Voltage	-8.0	0(3)	-9.5 Volts
Amplification Factor	22.5	—	15.4
Plate Resistance (Approx.)	9000	—	2000 Ohms
Transconductance	2500	—	7700 μmhos
Plate Current	8.0	68	41 Ma
Grid Voltage (Approx.)			
Ib = 10 μa	-18	—	-22 Volts
Ib = 50 μa	—	—	-23 Volts

NOTES:

(1) 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 horizontal scanning cycle.
(2) 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.
(3) Applied for short interval (two seconds maximum) so as not to damage tube.

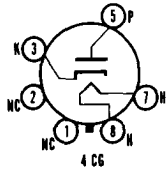
6DQ4

12DQ4, 17DQ4

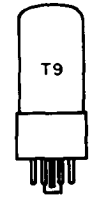
DAMPER

Heater-Cathode Diode

Construction ..... Octal T-9
Base .....Octal 5 Pin
Basing 4CG
Outline 9-15
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.875 In.
Maximum Overall Height .....3.438 In.



4 CG



ELECTRICAL DATA

HEATER OPERATION

	17DQ4	12DQ4	6DQ4
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
DC			900 Volts
Total DC and Peak			5500 Volts
Heater Positive with Respect to Cathode			
DC			100 Volts
Total DC and Peak			300 Volts
DIRECT INTERELECTRODE CAPACITANCES			
Heater to Cathode			4.0 Pf
Plate to Cathode and Heater			5.0 Pf
Cathode to Plate and Heater			8.5 Pf
RATINGS (Design Maximum Rating System)			
Peak Inverse Plate Voltage (Max.)			5500 Volts
Steady State Peak Plate Current (Max.)			1000 Ma
DC Output Current (Max.)			175 Ma
Plate Dissipation (Max.)			6.0 Watts
CHARACTERISTICS AND TYPICAL OPERATION			
Tube Voltage Drop for Ib = 250 Ma			32 Volts

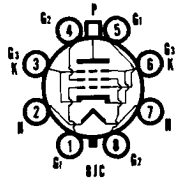
6DQ5

Color Television Type

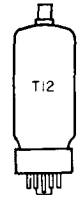
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Octal T-12
Base .....Octal 8 Pin, B8-118
Top Cap C1-1
Basing 8JC
Outline 12-21
Maximum Diameter .....1.563 In.
Maximum Seated Height .....4.250 In.
Maximum Overall Height .....5.000 In.



8JC



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	2500 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)	
Grid No. 1 to Plate	0.5 Pf
Input	23 Pf
Output	11 Pf

RATINGS (Design Maximum Rating System)
Horizontal Deflection Amplifier(1)

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	900 Volts
Peak Positive Pulse Plate Voltage (Max.)	7000 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
Grid No. 2 Voltage (Max.)	175 Volts
Peak Negative Grid No. 1 Voltage (Max.)	200 Volts
Plate Dissipation (Max.)(2)	24 Watts
Grid No. 2 Dissipation (Max.)	3.2 Watts
Average Cathode Current (Max.)	285 Ma
Peak Cathode Current (Max.)	1000 Ma
Grid No. 1 Circuit Resistance (Max.)	0.47 Megohm
Temperature (At Hottest Point) (Max.)	240 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	175 Volts
Grid No. 2 Voltage	125 Volts
Grid No. 1 Voltage	–25 Volts
Plate Current	110 Ma
Grid No. 2 Current	5 Ma
Transconductance	10,500 μmhos
Plate Resistance (Approx.)	5500 Ohms
Amplification Factor(3)	3.3
Ec1 for Ib = 1.0 Ma	–75 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 70 V, Ec2 = 125 V, and Ec1 = 0 V
Ib = 550 Ma, and Ic2 = 42 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) 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.
(3) Triode connected with Eb and Ec2 = 125 V and Ec1 = –25 V.

Color Television Type

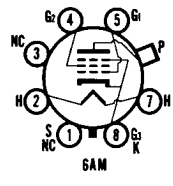
HORIZONTAL DEFLECTION AMPLIFIER

6DQ6B/6GW6

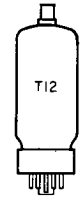
12DQ6B/12GW6
17DQ6B/17GW6

Beam Power Pentode

Construction	Octal T-12
Base	5, 6 or 7 Pin, B5-190, B6-122 B6-148, B7-111 or B7-119
Top Cap	C1-2 or C1-3
Basing	6AM
Outline	12-19
Maximum Diameter	1.563 In.
Maximum Seated Height	3.688 In.
Maximum Overall Height	4.250 In.



6AM



ELECTRICAL DATA
HEATER OPERATION

	17DQ6B/ 17GW6	12DQ6B/ 12GW6	6DQ6B/ 6GW6
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate	0.5 Pf
Input	15.0 Pf
Output	7.0 Pf

RATINGS (Design Maximum Rating System)
Horizontal Deflection Amplifier(1)

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Pulse Plate Voltage	6500 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Grid No. 1 Voltage (Max.)	–55 Volts

Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Plate Dissipation (Max.)(2)	18 Watts
Grid No. 2 Input (Max.)	3.6 Watts
Average Cathode Current (Max.)	175 Ma
Peak Cathode Current (Max.)	610 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature (At Hottest Point) (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	250 Volts
Grid No. 2 Voltage	150 Volts
Grid No. 1 Voltage	−22.5 Volts
Plate Current	65 Ma
Grid No. 2 Current	1.8 Ma
Transconductance	7300 μmhos
Amplification Factor(3)	4.4
Plate Resistance	18,000 Ohms
Ec1 for Ib = 1.0 Ma (Approx.)	−42 Volts

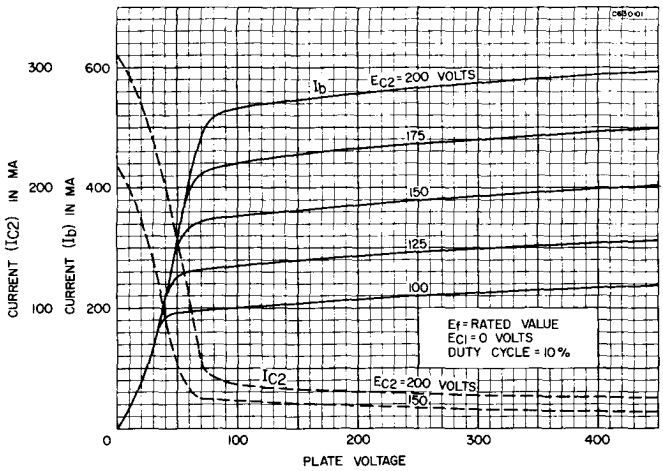
INSTANTANEOUS PLATE KNEE VALUES

Eb = 60 V, Ec2 = 150 V and Ec1 = 0 V
Ib = 345 Ma, and Ic2 = 27 Ma

NOTES:

(1) 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 horizontal scanning cycle.
(2) In stages operating with grid leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.
(3) Amplification factor with tube operating as a triode with 150 volts on the plate and Grid No. 2 and −22.5 volts on Grid No. 1.

AVERAGE PLATE CHARACTERISTICS



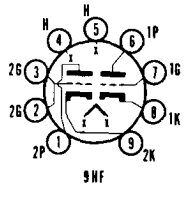
6DR7

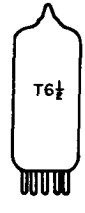
10DR7, 13DR7

VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

Double Dissimilar Triode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9HF
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.





ELECTRICAL DATA

HEATER OPERATION

	13DR7	10DR7	6DR7
Heater Voltage	13	9.7	6.3 Volts
Heater Current	450	600	900 Ma
Heater Warm-up Time	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 (Unshielded)

	Section No. 1	Section No. 2
Grid to Plate	4.5	8.5 Pf
Input: g to (h + k)	2.2	5.5 Pf
Output: p to (h + k)	0.34	1.0 Pf

RATINGS (Design Maximum Rating System)

Vertical Deflection Oscillator and Amplifier(1)

	Section No. 1 Oscillator	Section No. 2 Amplifier
Plate Voltage (Max.)	330	275 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	—	1500 Volts
Peak Negative Pulse Grid Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.)(2)	1.0	7.0 Watts
Average Cathode Current (Max.)	20	50 Ma
Peak Cathode Current (Max.)	70	175 Ma
Grid Circuit Resistance Self Bias	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Section No. 1	Section No. 2
Plate Voltage	250	150 Volts
Grid No. 1 Voltage	-3	-17.5 Volts
Plate Current	1.4	35 Ma
Transconductance	1600	6500 μmhos
Amplification Factor	68	6.0
Plate Resistance (Approx.)	40,000	925 Ohms
Ec for Ib = 10 μa (Approx.)	-5.5	— Volts
Ec for Ib = 50 μa (Approx.)	—	-44 Volts
Ib at Ec = -24 Vdc (Approx.)	—	10 Ma

INSTANTANEOUS PLATE KNEE VALUES (Section No. 2)

Eb = 60 V; Ec = 0

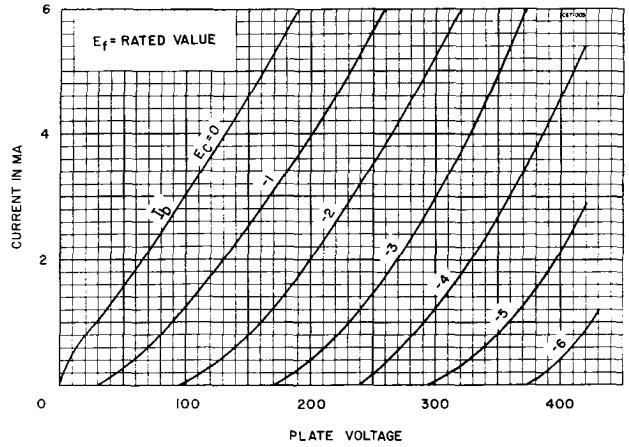
Ib = 80 Ma

NOTES:

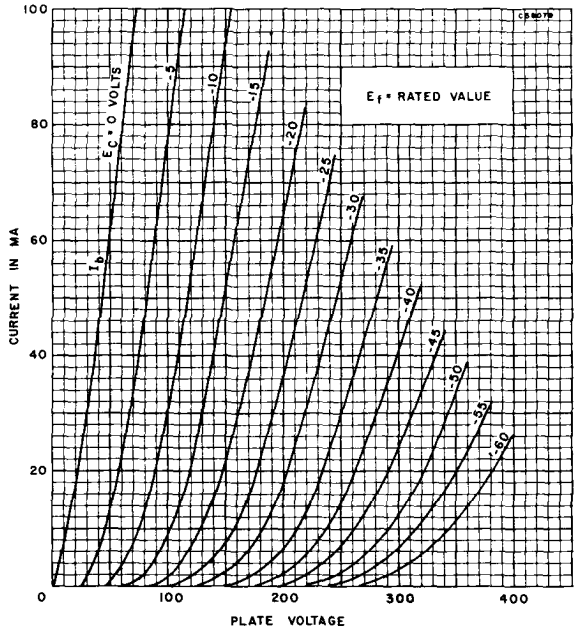
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

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

AVERAGE PLATE CHARACTERISTICS
(Section No. 1)



AVERAGE PLATE CHARACTERISTICS
(Section No. 2)



6DS4

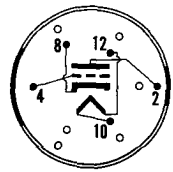
2DS4

Color Television Type

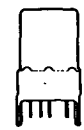
VHF AMPLIFIER

High Mu Triode

Construction .....Nuvistor, Metal
Base..Ceramic Wafer Twelvar 5 Pin, E5-65
Basing 12AQ
Outline
Maximum Diameter .....0.440 In.
Maximum Seated Height .....0.625 In.
Maximum Overall Height .....0.800 In.



12AQ



ELECTRICAL DATA

	2DS4	6DS4
HEATER OPERATION		
Heater Voltage	2.1	6.3 Volts
Heater Current	450	135 Ma
Heater Warm-up Time	8	— Seconds
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
Total DC and Peak		100 Volts
Heater Positive with Respect to Cathode		
Total DC and Peak		100 Volts
DIRECT INTERELECTRODE CAPACITANCES		
Grid to Plate		0.92 Pf
Input: g to (h + Shell)		4.3 Pf
Output: p to (h + k + Shell)		1.8 Pf
Heater to Cathode		1.6 Pf
Plate to Cathode		0.18 Pf
***RATINGS* (Design Maximum Rating System)**		
Plate Supply Voltage (Max.)		300 Volts
Plate Voltage (Max.)		135 Volts

Plate Dissipation (Max.)	1 Watt
DC Cathode Current (Max.)	15 Ma
Negative Grid Voltage (Max.)	55 Volts
Positive Grid Voltage (Max.)	0 Volt
Grid Circuit Resistance	
Fixed Bias (Max.)	0.5 Megohm
Self Bias (Max.)	2.2 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	70	110 Volts
Grid Resistor	47,000	— Ohms
Cathode Resistor	—	130 Ohms
Plate Current	7	6.5 Ma
Transconductance	12,500	9000 μmhos
Amplification Factor	68	63
Plate Resistance (Approx.)	5440	7000 Ohms
Ec for Ib = 100 μa (Approx.)	—	-5 Volts
Ec for Ib = 10 μa (Approx.)	—	-6.8 Volts

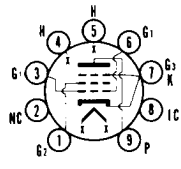
VERTICAL DEFLECTION AMPLIFIER

6DT5

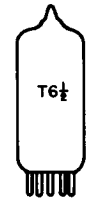
12DT5, 25DT5

Beam Power Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing.....9HN
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9HN



ELECTRICAL DATA

HEATER OPERATION

	25DT5	12DT5	6DT5
Heater Voltage	25	12.6	6.3 Volts
Heater Current	300	600	1200 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate	0.57 Pf
Input: g1 to (h + k)	12.5 Pf
Output: p to (h + k)	4.9 Pf

RATINGS (Design Maximum Rating System)

Vertical Deflection Amplifier(1)

Plate Voltage (Max.)	315 Volts
Grid No. 2 Voltage (Max.)	285 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	2200 Volts
Peak Negative Pulse Grid Voltage (Max.)	250 Volts
Plate Dissipation (Max.)(2)	9.0 Watts
Grid No. 2 Dissipation (Max.)(2)	2.0 Watts
Average Cathode Current (Max.)	55 Ma
Peak Cathode Current (Max.)	190 Ma
Grid Circuit Resistance	
Fixed Bias (Max.)	0.5 Megohm
Cathode Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	250 Volts
Grid No. 2 Voltage	250 Volts
Grid No. 1 Voltage	-16.5 Volts
Plate Current	38 Ma
Grid No. 2 Current	2.0 Ma
Transconductance	6200 μmhos
Ec1 for Ib = 100 μa (Approx.)	-35 Volts

INSTANTANEOUS PLATE KNEE VALUES

Zero Bias: With Eb = 60 V and Ec2 = 150 V	
Plate Current	100 Ma
Grid No. 2 Current	15 Ma

NOTES:

(1) 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 horizontal scanning cycle.

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

6DT6A

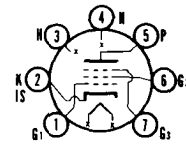
3DT6A, 4DT6A

Color Television Type

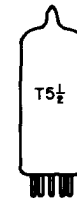
FM DETECTOR

Sharp Cutoff Pentode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7EN
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7EN



ELECTRICAL DATA

HEATER OPERATION

	3DT6A	4DT6A	6DT6A
Heater Voltage	3.15	4.2	6.3 Volts
Heater Current	600	450	300 Ma
Heater Warm-up Time	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 (Shielded)(1)

Grid No. 1 to Plate	0.02 Pf
Grid No. 1 to Grid No. 3	0.1 Pf
Grid No. 3 to All Other Electrodes	6.1 Pf
Grid No. 1 to Grid No. 2, Grid No. 3, Heater, and Internal Shield and Cathode	5.8 Pf
Grid No. 3 to Plate	1.7 Pf

RATINGS (Design Maximum Rating System)

FM Detector Service

Plate Voltage (Max.)	330 Volts
Plate Dissipation (Max.)	1.7 Watts
Grid No. 3 Voltage (Max.)	28 Volts
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Grid No. 1 Voltage (Positive Bias) (Max.)	0 Volt
Grid No. 2 Input	
For Eb2 up to 165 Volts (Max.)	1.1 Watts
For Eb2 Between 165 and 330 Volts	See Rating Chart (Gen. Info. Sec.)

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Supply Voltage	150 Volts
Grid No. 3 Supply Voltage	0 Volt
Grid No. 2 Supply Voltage	100 Volts
Cathode Bias Resistor	560 Ohms
Plate Current	1.55 Ma
Grid No. 2 Current	1.80 Ma
Transconductance	
Grid No. 1 to Plate	1350 μmhos
Grid No. 3 to Plate	515 μmhos
Plate Resistance (Approx.)	0.15 Megohm
Grid No. 1 Voltage for Ib = 10 μa	-5.2 Volts
Grid No. 3 Voltage for Ib = 10 μa	-4.2 Volts

NOTE:

(1) Shield No. 316 connected to cathode.

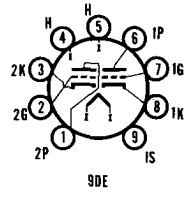
RF AMPLIFIER or OSCILLATOR and MIXER

6DT8

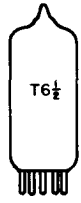
12DT8

High Mu Twin Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing[1] 9DE
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9DE



ELECTRICAL DATA

HEATER OPERATION

	12DT8	6DT8
Heater Voltage	12.6	6.3 Volts
Heater Current	150	300 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 (Shielded)

	Section No. 1[1]	Section No. 2
Grid to Plate	1.6	1.6 Pf
Input: g to (k + h + IS)	2.7	2.7 Pf
Output: p to (k + h + IS)	1.6	1.6 Pf
Heater to Cathode	3.0	3.0 Pf
Grounded Grid Operation		
Input: k to (g + h + IS)		5.3 Pf
Output: p to (g + h + IS)		2.8 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	2.5 Watts
Negative Grid Voltage (Max.)	50 Volts
Grid Circuit Resistance	
Fixed Bias (Max.)	0.25 Megohm
Self Bias (Max.)	1.0 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier—Each Section

Plate Voltage	100	250 Volts
Cathode Bias Resistor	270	200 Ohms
Plate Current	3.7	10.0 Ma
Transconductance	4000	5500 μmhos
Amplification Factor	60	60
Plate Resistance	15,000	10,900 Ohms
Ec for Ib = 10 μa (Approx.)	-5	-12 Volts

NOTES:

(1) Section No. 1 connects to Pins 6, 7, and 8.
(2) An internal shield is connected to Pin No. 9 to provide isolation between the two sections.

Color Television Type

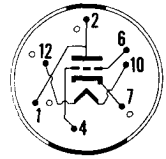
UHF OSCILLATOR

6DV4

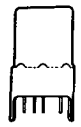
2DV4

Medium Mu Triode

Construction .....Nuvistor, Metal
Base..Ceramic Wafer, Twelvar 7 Pin, E7-83
Basing 12EA
Outline
Maximum Diameter .....0.440 In.
Maximum Seated Height .....0.625 In.
Maximum Overall Height .....0.800 In.



12EA



ELECTRICAL DATA

HEATER OPERATION

	2DV4	6DV4
Heater Voltage	2.1	6.3 Volts
Heater Current	450	135 Ma
Heater Warm-up Time	8	— Seconds
Maximum Heater-Cathode Voltage	—	100 Volts

DIRECT INTERELECTRODE CAPACITANCES

Grid to Plate	1.8 Pf
Grid to Cathode, Heater, and Shell	4.4 Pf
Plate to Cathode, Heater, and Shell	1.9 Pf
Plate to Cathode	0.25 Pf
Heater to Cathode	1.4 Pf
Grid to Cathode	3.7 Pf

RATINGS (Design Maximum Rating System)

Class A1 Amplifier

Plate Supply Voltage (Max.)(1)	300 Volts
Plate Voltage (Max.)	125 Volts
Grid Voltage	
Negative Bias (Max.)	-55 Volts
Peak Positive Bias (Max.)	2 Volts
Plate Dissipation (Max.)	1 Watt
Cathode Current (Max.)	15 Ma
Grid Circuit Resistance(2)	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.2 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Plate Supply Voltage	75 Volts
Cathode Bias Resistor	100 Ohms
Amplification Factor	35
Plate Resistance (Approx.)	3100 Ohms
Transconductance	11,500 μmhos
Grid Voltage for Ib = 10 μa	-7 Volts
Plate Current	10.5 Ma

Oscillator at 950 MHz

Plate Voltage	60 Volts
Grid Voltage	-2 Volts
Grid Resistor	5600 Ohms
Plate Current	8 Ma
Grid Current	350 μa

NOTES:

(1) A plate supply voltage of 300 volts may be used provided that a sufficiently large resistor is used in the plate circuit to limit the plate dissipation to one watt under any condition of operation.

(2) For operation at shell temperatures up to 135° C.

6DW4A

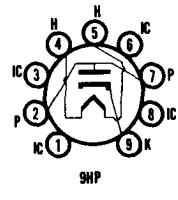
12DW4A, 17DW4A

Color Television Type

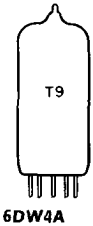
DAMPER

Heater-Cathode Diode

Construction ..... Novar T-9
Base ..... Novar Button 9 Pin, E9-75
Basing(1) 9HP
Outline
Maximum Diameter ..... 1.188 In.
Maximum Seated Height ..... 3.030 In.
Maximum Overall Height ..... 3.410 In.



9HP



ELECTRICAL DATA

HEATER OPERATION

	17DW4A	12DW4A	6DW4A
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
DC			900 Volts
Total DC and Peak			5500 Volts
Heater Positive with Respect to Cathode			
DC			100 Volts
Total DC and Peak			300 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Heater to Cathode	2.8 Pf
Plate to Cathode and Heater	6.5 Pf
Cathode to Plate and Heater	9.0 Pf

RATINGS (Design Maximum Rating System)

Damper Service

Peak Inverse Plate Voltage (Max.)(2)	5500 Volts
Plate Dissipation (Max.)	8.5 Watts
Steady State Peak Current (Max.)	1300 Ma
DC Plate Current (Max.)	250 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 350 Ma	25 Volts

NOTES:

(1) Pins 1, 3, 6, and 8 should not be used as tie points.

(2) 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 horizontal scanning cycle.

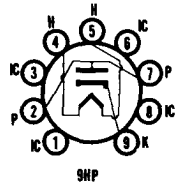
Color Television Type

DAMPER

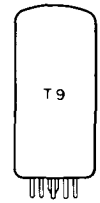
6DW4B

Heater-Cathode Diode

Construction .....Novar T-9
Base .....Novar Button 9-Pin, E9-89
(Exhaust Tip on Base)
Basing 9HP
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.625 In.
Maximum Overall Height .....3.005 In.
The 6DW4B is identical to the 6DW4A except for base with exhaust tip at bottom and shorter bulb.



9HP



Color Television Type

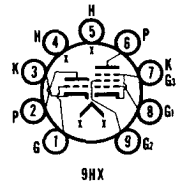
KEYED AGC, SYNC SEP./AMP. (T) VIDEO AMPLIFIER (P)

6DX8/ECL84

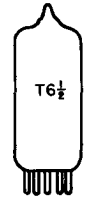
10DX8/LCL84

Triode and Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9HX
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9HX



ELECTRICAL DATA

HEATER OPERATION	10DX8/LCL84	6DX8/ECL84
Heater Voltage	10.2	6.3 Volts
Heater Current	450	720 Ma
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
DC and Peak		200 Volts
Heater Positive with Respect to Cathode		
DC and Peak		200 Volts

DIRECT INTERELECTRODE CAPACITANCES

Pentode Section

G1 to All Elements (Except Plate)	9.0 Pf
Plate to All Elements (Except Grid No. 1)	4.5 Pf
Plate to Grid No. 1 (Max.)	0.1 Pf
Grid No. 1 to Heater (Max.)	0.1 Pf

Triode Section

G1 to All Elements (Except Plate)	4.0 Pf
Plate to All Elements (Except Grid No. 1)	2.3 Pf
Plate to Grid No. 1	2.7 Pf
Grid to Heater (Max.)	0.1 Pf
Coupling	
Triode Plate to Pentode Grid No. 1 (Max.)	0.01 Pf
Triode Grid No. 1 to Pentode Grid No. 1 (Max.)	0.01 Pf

RATINGS (Design Center Rating System)

Pentode Section

Plate Supply Voltage (Max.)	550 Volts
Plate Voltage (Max.)	300 Volts
Grid No. 2 Supply Voltage (Max.)	550 Volts
Grid No. 2 Voltage (Max.)	300 Volts
Cathode Current (Max.)	40 Ma
Plate Dissipation (Max.)	4 Watts
Grid No. 2 Dissipation (Max.)	1.7 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	1 Megohm
Cathode Bias (Max.)	2 Megohms

Triode Section

Plate Supply Voltage (Max.)	550 Volts
Plate Voltage (Max.)	300 Volts
Cathode Current (Max.)	12 Ma
Plate Dissipation (Max.)	1 Watt
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	1 Megohm
Cathode Bias (Max.)	3 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Pentode Section

Plate Voltage	170	200	220 Volts
Grid No. 2 Voltage	170	200	220 Volts
Grid No. 1 Voltage	−2.1	−2.9	−3.4 Volts
Plate Current	18	18	18 Ma
Grid No. 2 Current	3	3	3 Ma
Transconductance	11,000	10,400	10,000 μmhos
Plate Resistance	100,000	130,000	150,000 Ohms
Amplification Factor (Grid No. 1 to Grid No. 2)	36	36	36

Triode Section

Plate Voltage	200 Volts
Grid No. 1 Voltage	−1.7 Volts
Plate Current	3 Ma
Transconductance	4000 μmhos
Amplification Factor	65

6DZ4/6AF4A

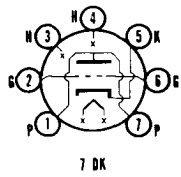
2DZ4/2AF4B
3DZ4/3AF4B

Color Television Type

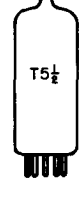
UHF OSCILLATOR

Medium Mu Triode

Construction ..... Miniature T-5½
Base ..... Button 7 Pin, E7-1
Basing 7DK
Outline 5-1
Maximum Diameter ..... 0.750 In.
Maximum Seated Height ..... 1.500 In.
Maximum Overall Height ..... 1.750 In.



7 DK



ELECTRICAL DATA

HEATER OPERATION

	2DZ4/2AF4B	3DZ4/3AF4B	6DZ4/6AF4A
Heater Voltage	2.35	3.2	6.3 Volts
Heater Current	600	450	225 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
Total DC and Peak	180	180	50 Volts
Heater Positive with Respect to Cathode			
DC	100	100	25 Volts
Total DC and Peak	180	180	50 Volts

DIRECT INTERELECTRODE CAPACITANCES (Shielded)

Grid to Plate	1.8 Pf
Input: g to (h + k + ES)	2.2 Pf
Output: p to (h + k + ES)	1.3 Pf

RATINGS (Design Maximum Rating System)

UHF Oscillator Service

Plate Voltage (Max.)	135 Volts
Plate Dissipation (Max.)	2.3 Watts
Negative Grid Voltage (Max.)	50 Volts
Grid Current (Max.)	2 Ma
Cathode Current (Max.)	20 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Supply Voltage	80 Volts
Plate Resistor	2700 Ohms
Plate Current	15 Ma
Transconductance	6700 μmhos
Amplification Factor	14
Plate Resistance (Approx.)	2000 Ohms
Ec for Ib = 20 μa (Approx.)	−11 Volts

Oscillator at 1000 MHz(1)

Plate Supply Voltage	135 Volts
Plate Resistor	2700 Ohms
Grid Resistor	10,000 Ohms
Plate Current	15.5 Ma
Grid Current (Approx.)	800 μa

NOTE:

(1) Measured in JEDEC Standard Oscillator No. 400.

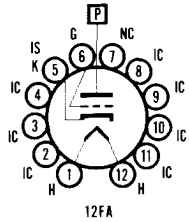
Color Television Type

SHUNT REGULATOR

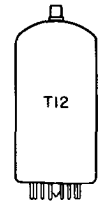
6EA4

Beam Triode

Construction	Compactron T-12
Base	Button 12 Pin, E12-74
Top Cap	C1-34
Basing	12FA
Outline	12-90
Maximum Diameter	1.563 In.
Maximum Seated Height	4.000 In.
Maximum Overall Height	4.375 In.



12FA



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	200 Ma
Maximum Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	Not Recommended
Heater Negative with Respect to Cathode	200 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid to Plate	0.036 Pf
Input: g to (h + k)	1.9 Pf
Output: p to (h + k)	0.63 Pf

RATINGS (Design Maximum Rating System)

Plate-Supply Voltage, Unregulated (Max.)	60,000 Volts
Plate Voltage (Max.)	27,000 Volts
Negative DC Grid Voltage (Max.)	135 Volts
Peak Negative Grid Voltage (Max.)(1)	440 Volts
Plate Dissipation (Max.)	30 Watts
DC Plate Current (Max.)	1.6 Ma
Grid Circuit Resistance (Max.)(2)	3.0 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Shunt Voltage Regulator Service

Unregulated DC Supply Voltage	36,000 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 μmhos
DC Plate Current for Zero Load Current	1000 μa

DC Plate Current for Load Current of 1 Ma	45 μa
Regulated DC Output Voltage at Zero Load Current	25,000 Volts
Regulated DC Output Voltage at Load Current of 1 Ma	24,500 Volts

NOTES:
(1) Peak value for duration of 20 seconds maximum during equipment warm-up.
(2) With flyback transformer high-voltage supply.

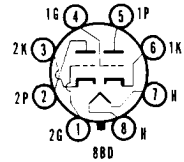
WARNING:
X-ray radiation shielding may be necessary to protect against possible danger of personal injury from prolonged exposure at close range if this tube is operated higher than 16,000 volts.

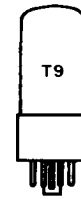
6EA7
15EA7

VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

Double Dissimilar Triode

Construction	T-9
Base	B8-6 or B8-251
Basing	8BD
Outline	9-5
Maximum Diameter	1.281 In.
Maximum Seated Height	2.439 In.
Maximum Overall Height	3.000 In.





ELECTRICAL DATA

HEATER OPERATION

	15EA7	6EA7
Heater Voltage	14.8	6.3 Volts
Heater Current	450	1050 Ma
Heater Warm-up Time	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 (Unshielded)

	Section No. 1(3)	Section No. 2
Grid to Plate	4.0	8 Pf
Input: g to (h + k)	2.2	6 Pf
Output: p to (h + k)	0.6	1.3 Pf

RATINGS (Design Maximum Rating System)
Vertical Deflection Oscillator and Amplifier(1)

	Section No. 1(3) Oscillator	Section No. 2 Amplifier
DC Plate Voltage (Max.)	350	550 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	—	1500 Volts
Peak Negative Pulse Grid Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.)(2)	1.0	10 Watts
Average Cathode Current (Max.)	22	50 Ma
Peak Cathode Current (Max.)	77	175 Ma
Grid Circuit Resistance		
Fixed Bias (Max.)	1.0	1.0 Megohm
Self Bias (Max.)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Section No. 1(3)	Section No. 2
Plate Voltage	250	175 Volts
Grid No. 1 Voltage	-3	-25 Volts
Plate Current	2.0	40 Ma
Transconductance	2200	6000 μmhos
Amplification Factor	66	5.5
Plate Resistance (Approx.)	30,000	920 Ohms
Ec for Ib = 20 μa (Approx.)	-5.3	— Volts
Ec for Ib = 200 μa (Approx.)	—	-45 Volts

INSTANTANEOUS ZERO BIAS PLATE VALUES (Section No. 2)
Eb = 60 V, Ec = 0
Ib = 100 Ma

NOTES:

(1) 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 horizontal scanning cycle.
(2) In stages operating with grid-leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.
(3) Section No. 1 connects to Pins 4, 5, and 6.

Color Television Type

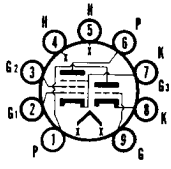
VHF OSCILLATOR and MIXER or GENERAL PURPOSE AMPLIFIER

6EA8/6GH8A

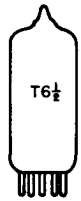
5EA8, 5GH8, 5GH8A, 9EA8, 9GH8A, 19EA8

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9AE
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9AE



ELECTRICAL DATA

HEATER OPERATION

	19EA8	9EA8 9GH8A	5EA8 5GH8 5GH8A	6EA8/6GH8A
Heater Voltage	18.9	9.5	4.7	6.3 Volts
Heater Current	150	300	600	450 Ma
Heater Warm-up Time	11	11	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 (Shielded)

Triode Section	
Grid to Plate	1.7 Pf
Input	3.2 Pf
Output	1.9 Pf
Heater to Cathode	3.0 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.01 Pf
Input	5.0 Pf
Output	3.4 Pf
Heater to Cathode	3.0 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section	Pentode Section Horiz. Defl. Osc.(1)
Plate Voltage (Max.)	330	330	350 Volts
Grid No. 2 Supply Voltage (Max.)	—	330	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)		
Positive Grid No. 1 Voltage (Max.)	—	0	0 Volt
Peak Negative Pulse Grid Voltage (Max.)	0	—	175 Volts
Average Cathode Current (Max.)	—	—	20 Ma
Peak Cathode Current (Max.)	—	—	300 Ma
Plate Dissipation (Max.)	2.5	3.1	2.5 Watts
Grid No. 2 Dissipation (Max.)	—	0.55	0.55 Watt
Maximum Grid No. 1 Circuit Resistance			
Fixed Bias	2.2	—	2.2 Megohms
Self Bias	2.2	—	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

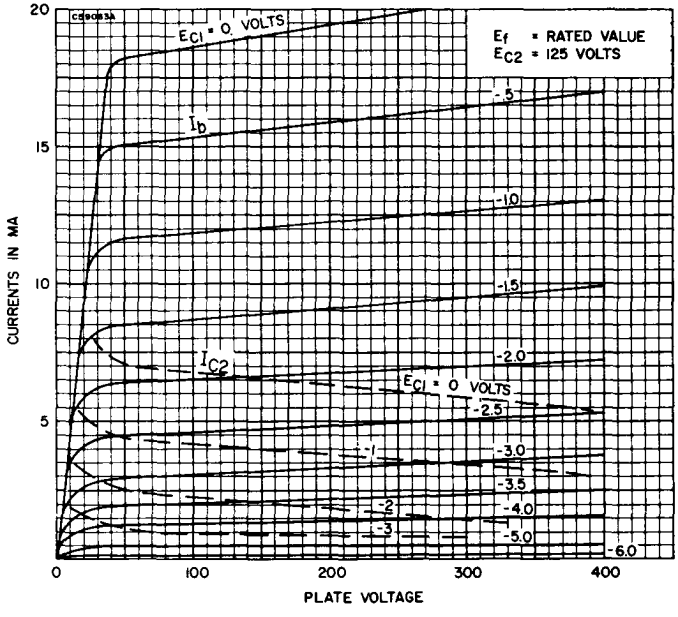
Class A1 Amplifier	Triode Section	Pentode Section
Plate Voltage	150	125 Volts
Grid No. 2 Voltage	—	125 Volts
Grid No. 1 Voltage	—	-1.0 Volts
Cathode Bias Resistor	56	— Ohms
Plate Current	18	12 Ma
Grid No. 2 Current	—	4 Ma

Transconductance	8500	6400 μmhos
Amplification Factor	40	—
Plate Resistance (Approx.)	5000	200,000 Ohms
Ec1 for Ib = 10 μa (Approx.)	−12	−9 Volts

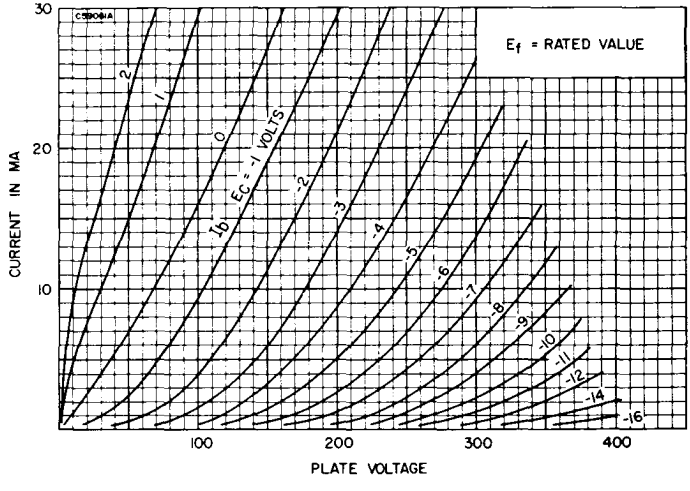
NOTE:

(1) 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 horizontal scanning cycle.

AVERAGE PLATE CHARACTERISTICS
(Pentode Section)



AVERAGE PLATE CHARACTERISTICS
(Triode Section)



Color Television Type

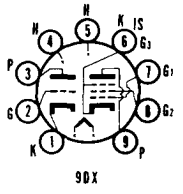
SYNC SEP./CLIPPER (T) VIDEO AMPLIFIER (P)

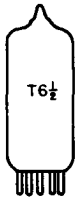
6EB8

8EB8, 10EB8

High Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DX
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.





ELECTRICAL DATA

HEATER OPERATION

	10EB8	8EB8	6EB8
Heater Voltage	10.5	8.0	6.3 Volts
Heater Current	450	600	750 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section	
Grid to Plate	4.4 Pf
Input: g to (h + k)	2.4 Pf
Output: p to (h + k)	0.36 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.1 Pf
Input: g1 to (h + k + g2 + g3 + IS)	11 Pf
Output: p to (h + k + g2 + g3 + IS)	4.2 Pf
Coupling	
Triode Grid to Pentode Plate (Max.)	0.018 Pf
Pentode Grid No. 1 to Triode Plate (Max.)	0.005 Pf
Pentode Plate to Triode Plate (Max.)	0.17 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	1.0	5.0 Watts
Grid No. 2 Dissipation (Max.)	—	1.1 Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Cathode Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	250	200 Volts
Grid No. 2 Voltage	—	125 Volts
Grid No. 1 Voltage	−2	— Volts
Cathode Bias Resistor	—	68 Ohms
Plate Current	2	25 Ma
Grid No. 2 Current	—	7 Ma
Transconductance	2700	12,500 μmhos
Amplification Factor	100	—
Plate Resistance (Approx.)	37,000	75,000 Ohms
Ec1 for Ib = 100 μa (Approx.)	—	−9 Volts
Ec1 for Ib = 20 μa (Approx.)	−5	— Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS (Pentode Section)

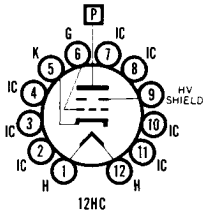
Eb = 45 Volts, Ec2 = 125 Volts and Ec1 = 0 Volt
Ib = 40 Ma and Ic2 = 15 Ma

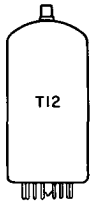
6EF4

SHUNT REGULATOR

Beam Power Triode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Top Cap C1-34
Basing 12HC
Outline 12-90
Maximum Diameter .....1.563 In.
Maximum Seated Height .....4.000 In.
Maximum Overall Height .....4.375 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	200 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode(1)	450 Volts
Heater Positive with Respect to Cathode	Not Recommended

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid to Plate	0.03 Pf
Input: g to (h + k)	2.0 Pf
Output: p to (h + k)	0.8 Pf

RATINGS (Design Maximum Rating System)

Plate-Supply Voltage (Unregulated)	60,000 Volts
Plate Voltage	27,000 Volts
Negative DC Grid Voltage	135 Volts
Peak Negative Grid Voltage(2)	440 Volts
Plate Dissipation	40 Watts
DC Plate Current	1.6 Ma
Grid-Circuit Resistance(3)	3.0 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Shunt Voltage Regulator Service

Unregulated DC Supply Voltage	36,000 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 μmhos
DC Plate Current for Zero Load Current	1000 μa
DC Plate Current for Load Current of 1 Ma	45 μa
Regulated DC Output Voltage at Zero Load Current	25,000 Volts
Regulated DC Output Voltage at Load Current of 1 Ma	24,500 Volts

NOTES:

(1) Sufficient impedance (1000 Ohms is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions to 450 Ma. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.
(2) Peak value for duration of 20 seconds maximum during equipment warm-up.
(3) With flyback transformer high-voltage supply.

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 higher than 16,000 volts.

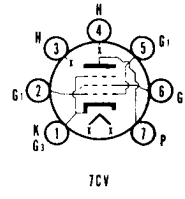
6EH5

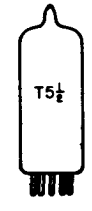
12EH5, 25EH5, 35EH5A, 50EH5A

AUDIO POWER AMPLIFIER

Beam Power Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CV
Outline 5-3
Maximum Diameter .....0.750 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.





ELECTRICAL DATA
HEATER OPERATION

	50EH5A	35EH5A	25EH5	12EH5	6EH5
Heater Voltage	50	35	25	12.6	6.3 Volts
Heater Current	150	150	300	600	1200 Ma
Heater Warm-up Time	17	17	—	11	— Seconds
Maximum Heater-Cathode Voltage					
Heater Negative with Respect to Cathode					
Total DC and Peak	200	200	200	300	200 Volts
Heater Positive with Respect to Cathode					
DC	100	100	100	100	100 Volts
Total DC and Peak	200	200	200	200	200 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid No. 1 to Plate	0.65 Pf
Input: g1 to (k + g3 + g2 + h)	17 Pf
Output: p to (k + g3 + g2 + h)	9 Pf

RATINGS (Design Maximum Rating System)
Class A1 Amplifier

Plate Voltage (Max.)	150 Volts
Grid No. 2 Voltage (Max.)	130 Volts
Positive Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	5.5 Watts
Grid No. 2 Input (Max.)	2.00 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohms
Cathode Bias (Max.)	0.5 Megohms
Bulb Temperature at Hottest Point (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION	Push-Pull AB1 Amp.	A1 Amp.
Plate Voltage	140	110 Volts
Grid No. 2 Voltage	120	115 Volts
Cathode Resistor	68	62 Ohms
Peak AF Grid No. 1 Voltage	4.7	3 Volts
Zero Signal Plate Current	47	42 Ma
Maximum Signal Plate Current	51	42 Ma
Zero Signal Grid No. 2 Current	11	11.5 Ma
Maximum Signal Grid No. 2 Current	17.7	14.5 Ma
Transconductance	—	14,600 μmhos
Plate Resistance (Approx.)	—	11,000 Ohms
Load Resistance	6000(1)	3000 Ohms
Maximum Signal Power Output	3.8	1.4 Watts
Total Harmonic Distortion	5	7 Percent

NOTE:
(1) Plate to Plate.

Color Television Type

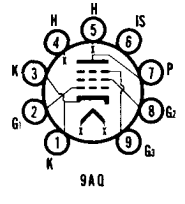
VHF/IF AMPLIFIER

6EH7/EF183

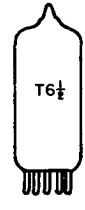
3EH7/XF183, 4EH7

Semi-Remote Cutoff Pentode

Construction ..... Miniature T-6½
Base ..... Button 9 Pin, E9-1
Basing 9AQ
Outline
Maximum Diameter ..... 0.875 In.
Maximum Seated Height ..... 2.156 In.
Maximum Overall Height ..... 2.406 In.



9AQ



ELECTRICAL DATA
HEATER OPERATION

	3EH7/XF183	4EH7	6EH7/EF183
Heater Voltage	3.4	4.4	6.3 Volts
Heater Current	600	450	300 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
Total DC and Peak			150 Volts
Heater Positive with Respect to Cathode			
Total DC and Peak			150 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid No. 1 to Plate (Max.)	0.005 Pf
Input: g1 to (h + k + g2 + g3 + IS)	9 Pf
Output: p to (h + k + g2 + g3 + IS)	3 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage with Ib = 0 Ma (Max.)	550 Volts
Plate Voltage (Max.)	275 Volts
Grid No. 2 Voltage with Ic2 = 0 Ma (Max.)	550 Volts
Grid No. 2 Voltage (Max.)	275 Volts
Plate Dissipation (Max.)	2.8 Watts
Grid No. 2 Dissipation (Max.)	0.75 Watt
Cathode Current (Max.)	22 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm

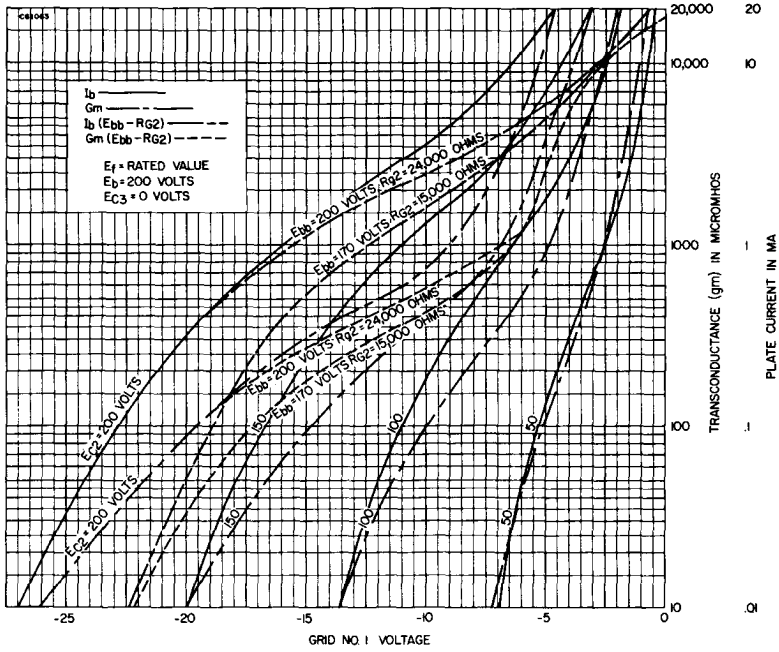
CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage				200 Volts
Grid No. 3 Voltage				0 Volt
Grid No. 2 Voltage				90 Volts
Grid No. 1 Voltage				–2 Volts
Plate Current				12 Ma
Grid No. 2 Current				4.5 Ma
Transconductance				12,500 μmhos
Plate Resistance (Approx.)				0.5 Megohm
Grid No. 1 Impedance at 40 MHz[1]				30,000 Ohms
Plate Voltage				200 Volts
Grid No. 3 Voltage				0 Volt
Grid No. 2 Supply Voltage				200 Volts
Grid No. 2 Series Resistor				22,000 Ohms
Grid No. 1 Voltage	–19.5	–9.5	–6.5	–2 Volts
Transconductance	125	625	1250	12,500 μmhos
Ec1 for a Cross Mod. Factor of 1%	450	160	100	— Mv rms

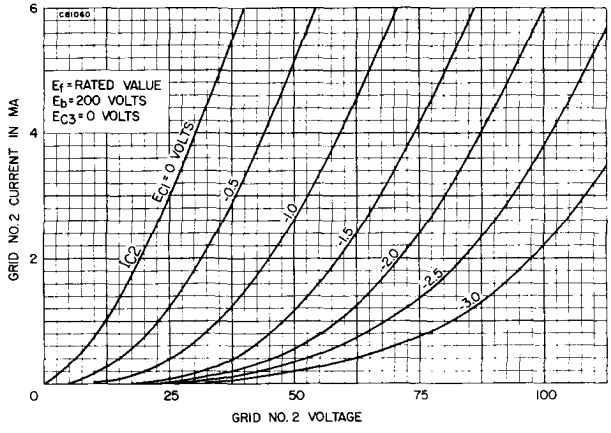
NOTE:

(1) Input damping of tube and typical ceramic socket with both cathode leads returned directly to ground is about 11,000 Ohms.

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



Color Television Type

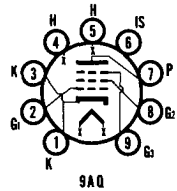
IF AMPLIFIER

6EJ7/EF184

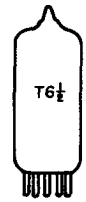
3EJ7/XF184, 4EJ7

Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9AQ
Outline
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.156 In.
Maximum Overall Height .....2.406 In.



9AQ



ELECTRICAL DATA

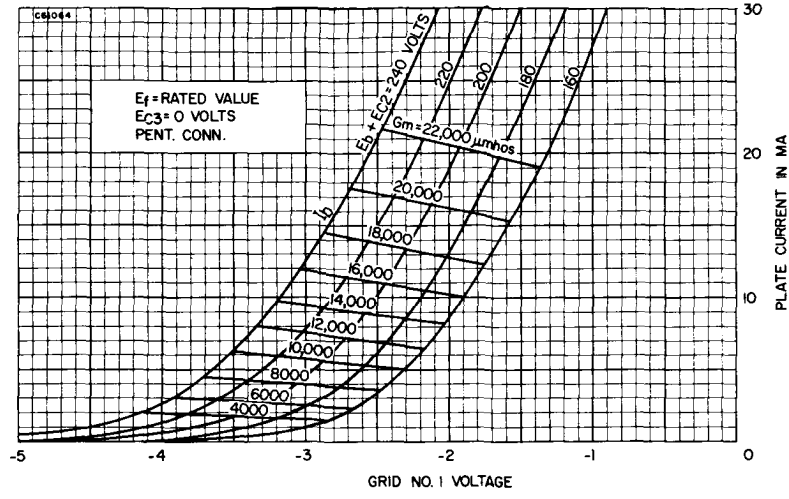
HEATER OPERATION

	3EJ7/XF184	4EJ7	6EJ7/EF184
Heater Voltage	3.4	4.4	6.3 Volts
Heater Current	600	450	300 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
Total DC and Peak			150 Volts
Heater Positive with Respect to Cathode			
Total DC and Peak			150 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)			
Grid No. 1 to Plate (Max.)			0.005 Pf
Input: g1 to (h + k + g2 + g3 + IS)			10 Pf
Output: p to (h + k + g2 + g3 + IS)			3 Pf
RATINGS (Design Maximum Rating System)			
Plate Voltage with Ib = 0 Ma (Max.)			550 Volts
Plate Voltage (Max.)			275 Volts
Grid No. 2 Voltage with Ic2 = 0 Ma (Max.)			550 Volts
Grid No. 2 Voltage (Max.)			275 Volts
Plate Dissipation (Max.)			2.8 Watts
Grid No. 2 Dissipation (Max.)			1.0 Watt
Cathode Current (Max.)			27 Ma
Grid No. 1 Circuit Resistance (Max.)			1.0 Megohm
CHARACTERISTICS AND TYPICAL OPERATION			
Class A1 Amplifier			
Plate Voltage			200 Volts
Grid No. 3 Voltage			0 Volt

Grid No. 2 Voltage	200 Volts
Grid No. 1 Voltage	−2.5 Volts
Plate Current	10 Ma
Grid No. 2 Current	4.1 Ma
Transconductance	15,000 μmhos
Amplification Factor (G2 to G1)	60
Plate Resistance (Approx.)	0.35 Megohm
Grid No. 1 Impedance at 40 MHz(1)	30,000 Ohms

NOTE:
(1) Input damping of tube and typical ceramic socket with both cathode leads tied directly to ground is about 10,000 Ohms.

AVERAGE TRANSFER CHARACTERISTICS



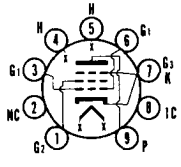
6EM5

8EM5

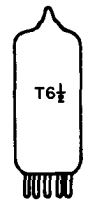
VERTICAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9HN
Outline	6-4
Maximum Diameter	0.875 In.
Maximum Seated Height	2.812 In.
Maximum Overall Height	3.062 In.



9HN



ELECTRICAL DATA

HEATER OPERATION

	8EM5	6EM5
Heater Voltage	8.4	6.3 Volts
Heater Current	600	800 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate (Max.)	0.7 Pf
Input: g1 to (h + k + g2 + g3)	10 Pf
Output: p to (h + k + g2 + g3)	5.1 Pf

RATINGS (Design Center Rating System)
Vertical Deflection Amplifier(1)

Plate Voltage (Max.)	315 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	2200 Volts
Grid No. 2 Voltage (Max.)	285 Volts
Peak Negative Pulse Grid Voltage (Max.)	250 Volts
Plate Dissipation (Max.)(2)	10.0 Watts
Grid No. 2 Input (Max.)(2)	1.5 Watts
Average Cathode Current (Max.)	60 Ma
Peak Cathode Current (Max.)	210 Ma
Bulb Temperature (Max.)	250 °C
Grid Circuit Resistance	
Fixed Bias (Max.)	2.2 Megohms
Cathode Bias (Max.)	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	250 Volts
Grid No. 2 Voltage	250 Volts
Grid No. 1 Voltage	−18.0 Volts
Plate Current	40 Ma
Grid No. 2 Current	3.0 Ma
Transconductance	5100 μmhos
Amplification Factor(3)	8.7
Ec1 Voltage for Ib = 0.2 Ma (Approx.)	−37 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 60 V; Ec2 = 250 V; Ec1 = 0 V;
Ib = 180 Ma and Ic2 = 30 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) In stages operating with grid-leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.
(3) Amplification factor measured from Grid No. 1 to Grid No. 2.

Color Television Type

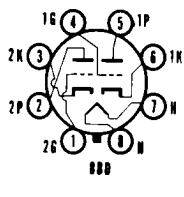
VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

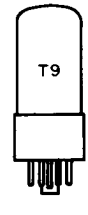
6EM7

10EM7, 13EM7

Dissimilar Double Triode

Construction	Octal T-9
Base	Octal 8 Pin, B8-58
Basing	8BD
Outline	9-37
Maximum Diameter	1.188 In.
Maximum Seated Height	2.313 In.
Maximum Overall Height	2.875 In.





ELECTRICAL DATA
HEATER OPERATION

	13EM7	10EM7	6EM7
Heater Voltage	13	9.7	6.3 Volts
Heater Current	450	600	925 Ma
Heater Warm-up Time	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 (Unshielded)

	Section No. 1	Section No. 2
Grid to Plate	4.8	10 Pf
Input: g to (h + k)	2.2	7.0 Pf
Output: p to (h + k)	0.6	1.8 Pf

RATINGS (Design Maximum Rating System)
Vertical Deflection Oscillator and Amplifier(1)

	Section No. 1 Oscillator	Section No. 2 Amplifier
DC Plate Voltage (Max.)	330	330 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	—	1500 Volts
Peak Negative Pulse Grid Voltage (Max.)	400	250 Volts

Plate Dissipation (Max.)(2)	1.5	10 Watts
Average Cathode Current (Max.)	22	50 Ma
Peak Cathode Current (Max.)	77	175 Ma
Grid Circuit Resistance (Self Bias)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Section No. 1(3)	Section No. 2
Plate Voltage	250	150 Volts
Grid No. 1 Voltage	-3	-20 Volts
Plate Current	1.4	50 Ma
Transconductance	1600	7200 μmhos
Amplification Factor	68	5.4
Plate Resistance (Approx.)	40,000	750 Ohms
Ec for Ib = 10 μa (Approx.)	-5.5	— Volts
Ec for Ib = 100 μa (Approx.)	—	-45 Volts
Ib at Ec = -28 Vdc (Approx.)	—	10 Ma

INSTANTANEOUS PLATE KNEE VALUES (Section No. 2)
Eb = 60 V; Ec = 0
Ib = 95 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) In stages operating with grid-leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.
(3) Section No. 1 connects to pins 4, 5, and 6.

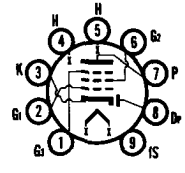
6EQ7

12EQ7, 20EQ7

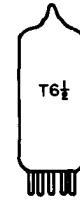
DETECTOR (D) IF AMPLIFIER (P)

Diode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9LQ
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9LQ



ELECTRICAL DATA

HEATER OPERATION

	20EQ7	12EQ7	6EQ7
Heater Voltage	20	12.6	6.3 Volts
Heater Current	100	150	300 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)
Pentode Section
Grid No. 1 to Plate (Max.) ..... 0.002 Pf
Input: g1 to (h + Pk, g3, IS + g2) ..... 5.5 Pf
Output: p to (h + Pk, g3, IS + g2) ..... 5.0 Pf
Coupling
Pentode Grid No. 1 to Diode Plate (Max.) ..... 0.0015 Pf
Pentode Plate to Diode Plate (Max.) ..... 0.095 Pf

RATINGS (Design Maximum Rating System)
Plate Voltage (Max.) ..... 300 Volts
Grid No. 3 Voltage (Positive or Negative) (Max.) ..... 300 Volts
Grid No. 2 Supply Voltage (Max.) ..... 300 Volts
Grid No. 2 Voltage .....See Rating Chart (Gen. Info. Sec.)
Positive Grid No. 1 Voltage (Max.) ..... 0 Volt
Negative Grid No. 1 Voltage (Max.) ..... 50 Volts
Plate Dissipation (Max.) ..... 3.0 Watts
Grid No. 3 Input (Max.) ..... 0.2 Watt
Grid No. 2 Input (Max.) ..... 0.6 Watt
Diode Plate Current (Max.) ..... 3.0 Ma

CHARACTERISTICS AND TYPICAL OPERATION
Pentode—Class A1 Amplifier

Plate Voltage	100 Volts
Grid No. 3 and Internal Shield	Tied to Cathode
Grid No. 2 Voltage	100 Volts
Grid No. 1 Voltage (1)	
Grid No. 1 Resistor	2.2 Megohms
Plate Current	9.0 Ma
Grid No. 2 Current	3.5 Ma
Transconductance	3800 μmhos
Plate Resistance (Approx.)	250,000 Ohms
Ec1 for gm = 40 μmhos (Approx.)	−20 Volts
Average Diode Current with 10 Volts DC Applied (Test Condition ONLY)	2.0 Ma

NOTE:
(1) Average contact potential bias developed across specified grid resistor.

Color Television Type

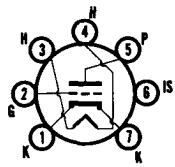
VHF AMPLIFIER

6ER5

2ER5, 3ER5

Semi-Remote Cutoff Triode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7FP
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7FP



ELECTRICAL DATA

HEATER OPERATION

	2ER5	3ER5	6ER5
Heater Voltage	2.3	2.8	6.3 Volts
Heater Current	600	450	180 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

	Shielded	Unshielded
Grid to Plate	0.36	0.38 Pf
Input	4.4	4.4 Pf
Output	4.0	3.0 Pf
Heater to Cathode	2.8	2.8 Pf
Grid to Cathode	3.1	3.1 Pf
Plate to Cathode	0.2	0.24 Pf
Grid to Heater (Max.)	0.28	0.28 Pf

RATINGS (Design Center Rating System)

Supply Voltage (Max.)	550 Volts
Plate Voltage (Max.)	250 Volts
Plate Dissipation (Max.)	2.2 Watts
Cathode Current (Max.)	20 Ma
Negative Grid Voltage (Max.)	50 Volts
Grid Circuit Resistance Cathode Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	200 Volts
Grid Voltage	−1.2 Volts
Plate Current	10 Ma
Transconductance	10,500 μmhos
Amplification Factor	80
Plate Resistance	8000 Ohms
Ec1 for Gm = 500 μmhos	−3.8 Volts
Ec1 for Gm = 100 μmhos	−5.6 Volts

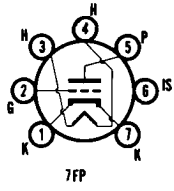
6ES5

2ES5, 3ES5

VHF AMPLIFIER

High Mu Triode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7FP
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7FP



ELECTRICAL DATA

HEATER OPERATION

	2ES5	3ES5	6ES5
Heater Voltage	2.35	3.0	6.3 Volts
Heater Current	600	450	200 Ma
Heater Warm-up Time	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

	Shielded(1)	Unshielded
Grid to Plate: g to p (Max.)	0.5	0.5 Pf
Input: g to (h + k + IS)	3.2	3.2 Pf
Output: p to (h + k + IS)	4.0	3.2 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.) ..... 250 Volts
Positive Grid Voltage (Max.) ..... 0 Volt
Plate Dissipation (Max.) ..... 2.2 Watts
DC Cathode Current (Max.) ..... 22 Ma
Grid Circuit Resistance (Max.) ..... 1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

Plate Voltage ..... 200 Volts
Grid Voltage ..... −1.0 Volt
Plate Resistance (Approx.) ..... 8000 Ohms
Transconductance ..... 9000 μmhos
Amplification Factor 75
Plate Current ..... 10 Ma
Grid Voltage (Approx.) for 100 μa Plate Current ..... −6.0 Volts

NOTE:
(1) With external shield No. 316 connected to Pin 1.

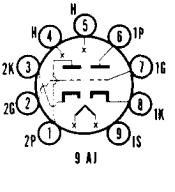
6ES8/ECC189

4ES8, 5ES8

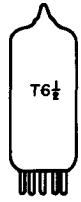
VHF CASCODE AMPLIFIER

Semi-Remote Cutoff Twin Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing(1) 9AJ
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9 AJ



ELECTRICAL DATA

HEATER OPERATION

	4ES8	5ES8	6ES8/ECC189
Heater Voltage	4.0	5.6	6.3 Volts
Heater Current	600	450	365 Ma
Heater Warm-up Time	11	11	— Seconds

Maximum Heater Cathode Voltage	
RMS, Voltage Between Cathode and Heater (Grounded Cathode Section)	50 Volts
RMS, Voltage Between Cathode and Heater (Grounded Grid Section)	50 Volts
Cathode Positive with Respect to Heater (Grounded Grid Section)	130 Volts

DIRECT INTERELECTRODE CAPACITANCES (Each Section)

	Unshielded	Shielded
Grid to Plate	1.85	1.85 Pf
Plate to Cathode	0.18	0.17 Pf
Heater to Cathode	3.0	3.0 Pf
Plate Section No. 1 to Plate Section No. 2 (Max.)	0.040	0.015 Pf
Plate Section No. 2 to Grid Section No. 1 (Max.)	0.003	0.003 Pf
Grid Section No. 1 to Cathode Section No. 2 (Max.)	0.002	0.002 Pf

RATINGS (Design Center Rating System) (Each Section)

Plate Supply Voltage (Ib = 0 Ma) (Max.)	550 Volts
Plate Voltage (Max.)	130 Volts
Plate Dissipation (Max.)	1.8 Watts
Cathode Current (Max.)	22 Ma
Negative Grid Voltage (Max.)	50 Volts
Grid Circuit Resistance (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier (Each Section)

Plate Voltage	90 Volts
Grid Voltage	−1.2 Volts
Plate Current	15 Ma
Transconductance	12,500 μmhos
Amplification Factor	34
Cascode Amplifier(2)	
Supply Voltage	180 Volts
Plate Current	15 Ma
Transconductance	12,500 μmhos
Noise Figure(3)	6.5 db
Ec for gm = 125 μa (Approx.)	−9.0 Volts
Input Voltage for Cross Modulation Factor of 1% at gm = 125 μmhos	500 Mv

NOTES:

(1) Section No. 1 (grounded cathode input section) connects to Pins 6, 7, and 8. Section No. 2 (grounded grid output section) connects to Pins 1, 2, and 3.
(2) The grid of the output section, Section No. 2, is connected to a potentiometer.
(3) Noise figure measurements taken with tube operating in a TV tuner.

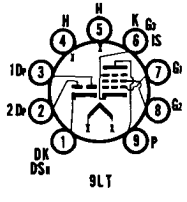
HORIZONTAL PHASE DETECTOR (D) VIDEO AMPLIFIER (P)

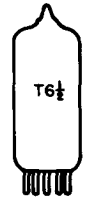
6ET7

8ET7

Double Diode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9LT
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.





ELECTRICAL DATA

HEATER OPERATION

	8ET7	6ET7
Heater Voltage	8.0	6.3 Volts
Heater Current	600	750 Ma
Heater Warm-up Time	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 (Unshielded)

Pentode Section

Grid No. 1 to Plate (Max.)	0.1 Pf
Input: g1 to (h + Pk, g3, IS + g2 + Dk, Dsh)	10 Pf

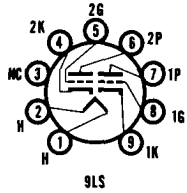
Output: p to (h + Pk, g2, IS + g2 + Dk, Dsh)	4.2 Pf
Diode Section (Each Diode)	
Diode Plate to (h + Dk, Dsh + Pk, g3, IS)	1.5 Pf
Diode Cathode; Diode Shield to (h + Dp + Pk, g3, IS)	7.5 Pf
Coupling	
Pentode Grid No. 1 to Diode Plate (Each Diode) (Max.)	0.005 Pf
Pentode Plate to Diode Plate (Each Diode) (Max.)	0.02 Pf
RATINGS (Design Maximum Rating System)	
Plate Voltage (Max.)	330 Volts
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Positive Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	5.0 Watts
Grid No. 2 Dissipation (Max.)	1.1 Watts
Grid No. 1 Circuit Resistance	
Cathode Bias (Max.)	0.25 Megohms
Fixed Bias (Max.)	0.1 Megohm
CHARACTERISTICS AND TYPICAL OPERATION	
Pentode—Class A1 Amplifier	
Plate Voltage	200 Volts
Grid No. 2 Voltage	150 Volts
Cathode Bias Resistor	100 Ohms
Plate Current	25 Ma
Grid No. 2 Current	5.5 Ma
Transconductance	11,500 μmhos
Plate Resistance (Approx.)	60,000 Ohms
Ec1 for Ib = 100 μa (Approx.)	−10 Volts
Average Diode Current with 10 Volts DC Applied (Each Diode)	1.5 Ma
INSTANTANEOUS PLATE KNEE VALUES	
Eb = 60 V, Ec2 = 150 V, Ec1 = 0 V;	
Ib = 55 Ma and Ic2 = 18 Ma	

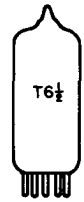
6EU7

AF AMPLIFIER or PHASE INVERTER

High Mu Twin Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9LS
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION		
Heater Voltage		6.3 Volts
Heater Current		300 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 1**	**Section 2**
Grid to Plate	1.5	1.5 Pf
Input: g to (h + k)	1.6	1.6 Pf
Output: p to (h + k)	0.2	0.2 Pf
RATINGS (Design Maximum Rating System) (Each Section)		
Plate Voltage (Max.)		330 Volts
Plate Dissipation (Max.)		1.2 Watts
Positive Grid Voltage (Max.)		0 Volt
Negative Grid Voltage (Max.)		55 Volts
CHARACTERISTICS AND TYPICAL OPERATION		
Class A1 Amplifier (Each Section)		
Plate Voltage	100	250 Volts
Grid Voltage	−1	−2 Volts
Plate Current	0.5	1.2 Ma
Transconductance	1250	1600 μmhos
Amplification Factor	100	100

Plate Resistance	80,000	62,500 Ohms
Equivalent Noise and Hum Voltage (Referenced to Grid—Each Unit) Average Value(1) (RMS)	—	1.8 μVolts

NOTE:
(1) Measured under the following conditions: Ef = 6.3 Vac, center-tap of heater transformer grounded; Ebb = 250 Vdc; Rb = 0.1 Megohm; Rk = 2700 Ohms; Ck = 100 μf; Rg = 0; F = 25 to 10,000 Hz.

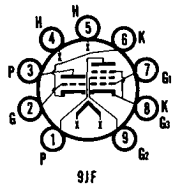
OSCILLATOR (T) MIXER (P)

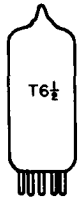
6EU8

5EU8

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing.....9JF
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	5EU8	6EU8
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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

	Shielded	Unshielded
Pentode Section		
Grid No. 1 to Plate: (g1 to p) (Max.)	0.10	0.02 Pf
Input: g1 to (h + k)	5.0	5.0 Pf
Output: p to (h + k)	3.4	2.6 Pf
Triode Section		
Grid to Plate: (g to p)	1.7	1.7 Pf
Input: g to (h + k)	3.2	3.0 Pf
Output: p to (h + k + s)	1.1	1.6 Pf
Cathode to Heater (Each Section): (k to h)	3.60	3.60 Pf

RATINGS (Design Center Rating System)

	Triode	Pentode
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Positive DC Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	3.0	3.1 Watts
Grid No. 2 Dissipation (Max.)	—	0.55 Watts
Grid No. 1 Resistance (Max.)	100	100 Kilohms

CHARACTERISTICS AND TYPICAL OPERATION

	Triode	Pentode
Plate Voltage	150	125 Volts
Grid No. 2 Voltage	—	125 Volts
Cathode Resistor	56	— Ohms
Grid No. 1 Voltage	—	-1.0 Volt
Amplification Factor	40.0	—
Transconductance	8500	6400 μmhos
Plate Resistance (Approx.)	5000	80,000 Ohms
Plate Current	18.0	12.0 Ma
Grid No. 2 Current	—	4.0 Ma
Grid No. 1 Voltage (Approx.) for Ib = 10 μa	-12.0	-9.0 Volts
Cathode Warm-up Time(1)	35	— Seconds

NOTE:
(1) Cathode Warm-up Time is defined as the time required for transconductance to reach 6500 μmhos when a tube is operated from a cold start at a plate potential of 100 volts dc, zero grid bias, and at a constant heater current of 560 milliamperes for 5EU8 or a heater potential of 5.5 volts for the 6EU8.

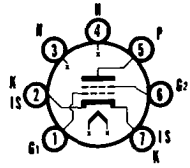
6EV5

2EV5, 3EV5

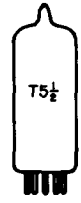
VHF AMPLIFIER

Sharp Cutoff Tetrode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing.....7EW
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7EW



ELECTRICAL DATA

HEATER OPERATION

	2EV5	3EV5	6EV5
Heater Voltage	2.4	2.9	6.3 Volts
Heater Current	600	450	200 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
Total DC and Peak			100 Volts
Heater Positive with Respect to Cathode			
DC			50 Volts
Total DC and Peak			100 Volts

DIRECT INTERELECTRODE CAPACITANCES (Shielded)(1)

Grid No. 1 to Plate (Max.)	0.035 Pf
Input	4.5 Pf
Output	2.9 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	275 Volts
Grid No. 2 Supply Voltage (Max.)	180 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	3.25 Watts
Grid No. 2 Dissipation (Max.)	0.2 Watt
Positive Grid No. 1 Voltage (Max.)	0 Volt
Cathode Current (Max.)	20 Ma
Grid Circuit Resistance (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	250 Volts
Grid No. 2 Voltage	80 Volts
Grid No. 1 Voltage	–1 Volt
Plate Current	11.5 Ma
Grid No. 2 Current	0.9 Ma
Transconductance	8800 μmhos
Plate Resistance	0.150 Megohm
Ec1 for Gm = 100 μmhos (Approx.)	–4.5 Volts

NOTE:
(1) Shield No. 316 connected to cathode.

6EW6

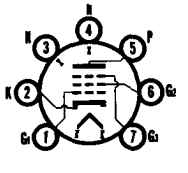
4EW6, 5EW6, 15EW6

Color Television Type

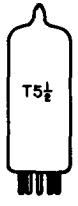
IF AMPLIFIER

Sharp Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CM
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7CM



ELECTRICAL DATA

HEATER OPERATION

	15EW6	5EW6	4EW6	6EW6
Heater Voltage	15.0	5.6	4.2	6.3 Volts
Heater Current	150	450	600	400 Ma
Heater Warm-up Time	—	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

	Shielded(1)	Unshielded
Grid No. 1 to Plate (Max.)	0.03	0.04 Pf
Input: g1 to (h + k + g2 + g3 + IS)	10.0	10.0 Pf
Output: p to (h + k + g2 + g3 + IS)	3.4	2.4 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.) ..... 330 Volts
Grid No. 2 Supply Voltage (Max.) ..... 330 Volts
Grid No. 2 Voltage ..... See Rating Chart (Gen. Info. Sec.)
Positive Grid No. 1 Voltage (Max.) ..... 0 Volt
Plate Dissipation (Max.) ..... 3.1 Watts
Grid No. 2 Dissipation (Max.) ..... 0.65 Watts

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage ..... 125 Volts
Grid No. 3 ..... Tied to Cathode
Grid No. 2 Voltage ..... 125 Volts
Cathode Bias Resistor ..... 56 Ohms
Plate Current ..... 11 Ma
Grid No. 2 Current ..... 3.2 Ma
Transconductance ..... 14,000 μmhos
Plate Resistance (Approx.) ..... 0.2 Megohm
Grid No. 1 Voltage for Ib = 20 μa (Approx.) ..... −3.5 Volts

NOTE:
(1) Shield No. 316 tied to cathode.

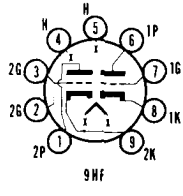
VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

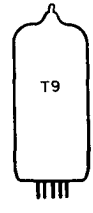
6EW7

10EW7, 15EW7, 19EW7, 20EW7

Dissimilar Double Triode

Construction 9T-9
Base ..... Button 9 Pin, E9-68
Basing(1) 9HF
Outline 9-70
Maximum Diameter ..... 1.188 In.
Maximum Seated Height ..... 2.620 In.
Maximum Overall Height ..... 2.930 In.





ELECTRICAL DATA

HEATER OPERATION

	20EW7	19EW7	15EW7	10EW7	6EW7
Heater Voltage	20.5	18.9	14.8	9.7	6.3 Volts
Heater Current	300	300	450	600	900 Ma
Heater Warm-up Time	11	11	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 (Unshielded)

	Section(1) No. 1	Section(1) No. 2
Grid to Plate	4.2	9.0 Pf
Input: g to (h + k)	2.2	7.0 Pf
Output: p to (h + k)	0.4	1.2 Pf

RATINGS (Design Maximum Rating System)
Vertical Deflection Oscillator and Amplifier[2]

	Section[1] No. 1 Oscillator	Section[1] No. 2 Amplifier
Plate Voltage (Max.)	330	330 Volts
Peak Positive Pulse Plate Voltage (Max.)	—	1500 Volts
Peak Negative Pulse Grid Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.)[3]	1.5	10 Watts
Average Cathode Current (Max.)	22	50 Ma
Peak Cathode Current (Max.)	77	175 Ma
Grid Circuit Resistance		
Self Bias (Max.)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Section[1] No. 1	Section[1] No. 2
Plate Voltage	250	150 Volts
Grid No. 1 Voltage	−11	−17.5
Plate Current	5.5	45 Ma
Transconductance	2000	7500 μmhos
Amplification Factor	17.5	6.0
Plate Resistance (Approx.)	8750	800 Ohms
Ec for Ib = 10 μa (Approx.)	−20	— Volts
Ec for Ib = 100 μa (Approx.)	—	−40 Volts
Ib at Ec = −25 Vdc	—	8 Ma
Ib with Eb = 60 V and Ec = 0 V (Instantaneous Values)	—	95 Ma

NOTES:
(1) Section No. 1 connects to Pins 6, 7 and 8. Section No. 2 connects to Pins 1, 2, 3 and 9.
(2) 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 horizontal scanning cycle.
(3) In stages operating with grid leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.

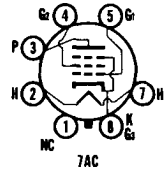
6EZ5

Color Television Type

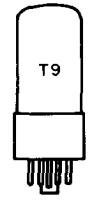
VERTICAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Octal T-9
Base .....Octal 6 Pin, B6-81
Basing 7AC
Outline 9-15
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.875 In.
Maximum Overall Height .....3.438 In.



7AC



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	800 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)

Grid No. 1 to Plate	0.6 Pf
Input	9.0 Pf
Output	7.0 Pf

RATINGS (Design Maximum Rating System)
Vertical-Deflection-Amplifier Service[1]

DC Plate Voltage (Max.)	350 Volts
Peak Pulse Plate Voltage (Max.)	2500 Volts
Screen Voltage (Max.)	300 Volts
Plate Dissipation (Max.)[2]	12 Watts
Screen Dissipation (Max.)[2]	2.75 Watts
DC Cathode Current (Max.)	75 Ma
Peak Cathode Current (Max.)	260 Ma

Grid No. 1 Circuit Resistance		
With Cathode Bias (Max.)		2.2 Megohms
With Fixed Bias (Max.)		1.0 Megohm
Bulb Temperature at Hottest Point (Max.)		200 °C
CHARACTERISTICS AND TYPICAL OPERATION		
Plate Voltage	60	250 Volts
Screen Voltage	250	250 Volts
Grid No. 1 Voltage	0(3)	-20 Volts
Plate Resistance (Approx.)	—	50,000 Ohms
Transconductance	—	4100 μmhos
Plate Current	180	43 Ma
Screen Current	26	3.5 Ma
Grid No. 1 Voltage (Approx.)		
Ib = 100 μa	—	-50 Volts

NOTES:

(1) 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 horizontal scanning cycle.

(2) 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.

(3) Applied for short interval (two seconds maximum) so as not to damage tube.

Color Television Type

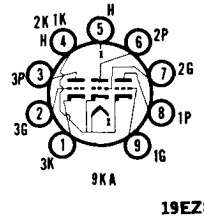
VHF AMPLIFIER or OSCILLATOR and MIXER

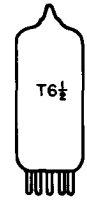
6EZ8

19EZ8

Triple Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing(1) 9KA
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	19EZ8	6EZ8
Heater Voltage	18.9	6.3 Volts
Heater Current	150	450 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

	Shielded	Unshielded
Grid to Plate (Each Section)	1.5	1.5 Pf
Input (Each Section)	2.6	2.4 Pf
Output (Section No. 1)	1.4	0.21 Pf
Output (Section No. 2)	1.2	0.4 Pf
Output (Section No. 3)	1.2	0.36 Pf
Heater to Cathode (Section No. 3)	0.15	0.17 Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Each Plate) (Max.)	2.0 Watts
Plate Dissipation (Plates 1, 2 and 3) (Max.)	5.0 Watts
Positive Grid Voltage (Max.)	0 Volt
Negative Grid Voltage (Max.)	50 Volts

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier—Each Section

Plate Voltage	125 Volts
Grid Voltage	-1.0 Volt
Plate Current	4.2 Ma
Plate Resistance	13,600 Ohms
Transconductance	4200 μmhos
Amplification Factor	57
Ec for Ib = 20 μa	-4 Volts

NOTE:

(1) Section No. 1 connects to Pins 4, 8 and 9. Section No. 2 connects to Pins 4, 6 and 7. Section No. 3 connects to Pins No. 1, 2 and 3.

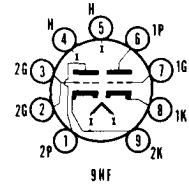
6FD7

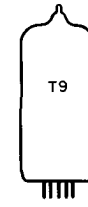
10FD7, 13FD7

VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

Dissimilar Double Triode

Construction 9T-9
Base .....Button 9 Pin, E9-68
Basing[1] 9HF
Outline .....9-70 or 9-77
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.620 In.
Maximum Overall Height .....2.900 In.





ELECTRICAL DATA

HEATER OPERATION

	13FD7	10FD7	6FD7
Heater Voltage	13.0	9.7	6.3 Volts
Heater Current	450	600	925 Ma
Heater Warm-up Time	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 (Unshielded)

	Section[1] No. 1	Section[1] No. 2
Grid to Plate	4.5	10 Pf
Input: g to (h + k)	2.2	6.5 Pf
Output: p to (h + k)	0.40	1.2 Pf

RATINGS (Design Maximum Rating System)

Vertical Deflection Oscillator and Amplifier[2]

	Section[1] No. 1 Oscillator	Section[1] No. 2 Amplifier
Plate Voltage (Max.)	330	330 Volts
Peak Positive Pulse Plate Voltage (Max.)	—	1500 Volts
Peak Negative Pulse Grid Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.)[3]	1.5	10 Watts
Average Cathode Current (Max.)	20	50 Ma
Peak Cathode Current (Max.)	70	175 Ma
Grid Circuit Resistance		
Self Bias	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Section[1] No. 1	Section[1] No. 2
Plate Voltage	250	150 Volts
Grid No. 1 Voltage	−3	−17.5 Volts
Plate Current	1.4	40 Ma
Transconductance	1600	7500 μmhos
Amplification Factor	64	6.0
Plate Resistance (Approx.)	40,000	800 Ohms
Ec for Ib = 10 μa (Approx.)	−5.5	— Volts
Ec for Ib = 100 μa (Approx.)	—	−40 Volts
Gm at Ib = 1.0 Ma	—	500 μmhos
Ib at Ec = −25 Vdc (Approx.)	—	6 Ma
Ib with Eb = 60 V and Ec = 0 V (Instantaneous Values)	—	95 Ma

NOTES:

(1) Section No. 1 connects to Pins 6, 7 and 8. Section No. 2 connects to Pins 1, 2 and 9.
(2) 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 horizontal scanning cycle.
(3) In stages operating with grid leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.

Color Television Type

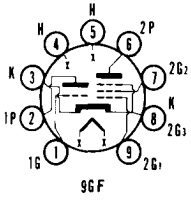
VHF OSCILLATOR and MIXER

6FG7

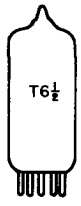
5FG7

Medium Mu Triode and Semi-Remote Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9GF
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9GF



ELECTRICAL DATA

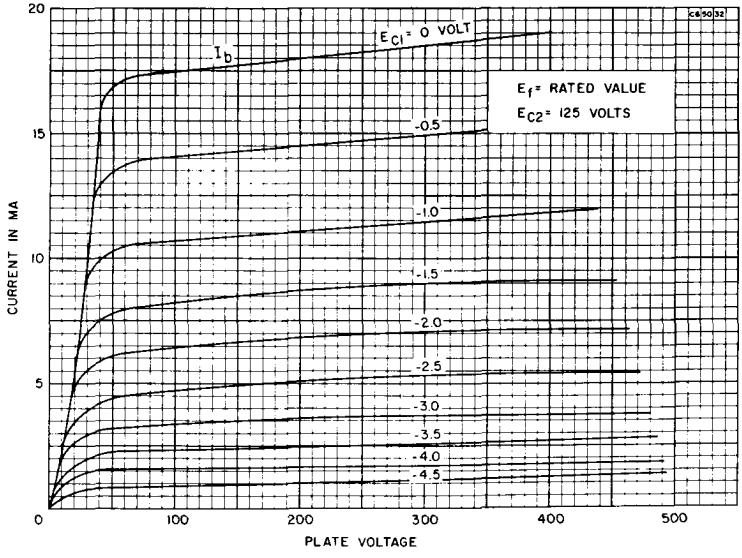
HEATER OPERATION

	5FG7	6FG7
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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

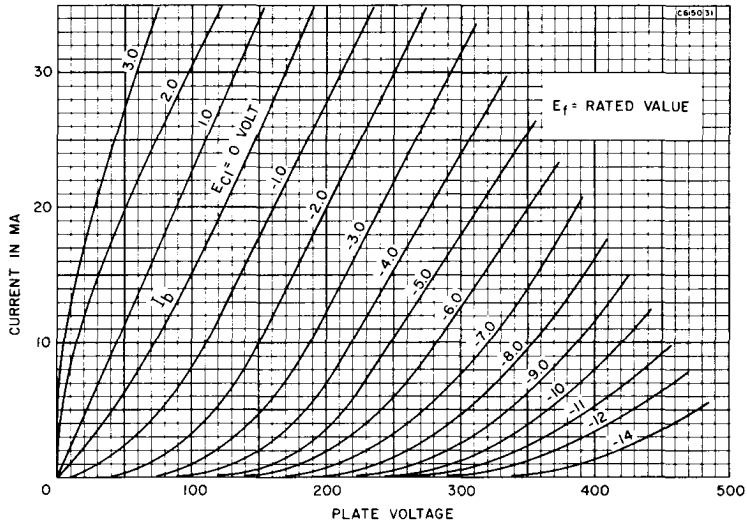
DIRECT INTERELECTRODE CAPACITANCES

	Shielded(1)	Unshielded
Triode Section		
Grid to Plate	1.8	1.8 Pf
Input: g to (h + k)	3.0	3.0 Pf
Output: p to (h + k)	1.9	1.3 Pf
Pentode Section		
Grid No. 1 to Plate (Max.)	0.01	0.020 Pf
Input: g1 to (h + k + g2)	5.0	5.0 Pf
Output: p to (h + k + g2)	3.4	2.4 Pf

AVERAGE PLATE CHARACTERISTICS
(Pentode Section)



AVERAGE PLATE CHARACTERISTICS
(Triode Section)



RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	2.5	3.0 Watts
Grid No. 2 Dissipation (Max.)	—	0.55 Watt
Positive Grid No. 1 Voltage (Max.)	0	0 Volt

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

	Triode Section	Pentode Section	
Plate Voltage	125	125	100 Volts
Grid No. 2 Voltage	—	125	100 Volts
Grid No. 1 Voltage	-1.0	-1.0	0 Volt
Plate Current	13	11	— Ma
Grid No. 2 Current	—	4.0	— Ma
Transconductance	7500	6000	7400 μmhos
Amplification Factor	43	—	—
Plate Resistance	5700	180K	— Ohms
Grid No. 1 Voltage for Ib = 30 μa (Approx.)	-6.5	-7.5	— Volts

NOTE:

(1) Shield No. 315 connected to cathode of section under test.

6FH5

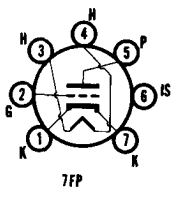
2FH5, 3FH5

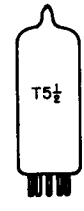
Color Television Type

VHF AMPLIFIER

High Mu Triode

Construction ..... Miniature T-5½
Base ..... Button 7 Pin, E7-1
Basing 7FP
Outline 5-2
Maximum Diameter ..... 0.750 In.
Maximum Seated Height ..... 1.875 In.
Maximum Overall Height ..... 2.125 In.





ELECTRICAL DATA

HEATER OPERATION

	2FH5	3FH5	6FH5
Heater Voltage	2.35	3.0	6.3 Volts
Heater Current	600	450	200 Ma
Heater Warm-up Time	11	11	— Seconds
Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
Total DC and Peak			100 Volts
Heater Positive with Respect to Cathode			
Total DC and Peak			100 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded	Unshielded
Grid to Plate (Max.)	0.6	0.6 Pf
Input: g to (h + k + IS)	3.2	3.2 Pf
Output: p to (h + k + IS)	4.0	3.2 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	150 Volts
Plate Dissipation (Max.)	2.2 Watts
Cathode Current (Max.)	22 Ma
Positive Grid Voltage (Max.)	0 Volt
Grid Circuit Resistance (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

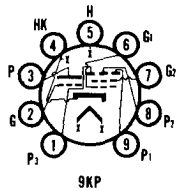
Plate Voltage	135 Volts
Grid Voltage	−1.0 Volt
Plate Current	11 Ma
Transconductance	9000 μmhos
Amplification Factor	50
Plate Resistance (Approx.)	5600 Ohms
Ec for Ib = 100 μa (Approx.)	−5.5 Volts

HARMONIC GENERATOR

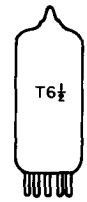
6FH8

Medium Mu Triode
Sharp Cutoff Tetrode (3 Plates)

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9KP
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.



9KP



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 Ma

DIRECT INTERELECTRODE CAPACITANCES (Shielded)(1)

Triode Unit

Grid to Plate	1.4 Pf
Grid to Cathode and Heater	2.6 Pf
Plate to Cathode and Heater	1 Pf

Tetrode Unit

Grid No. 1 to Plate No. 1 (Max.)	0.060 Pf
Grid No. 1 to Cathode, Heater, Grid No. 2, Plate No. 2, and Plate No. 3	4.5 Pf
Plate No. 1 to Cathode, Heater, Grid No. 2, Plate No. 2, and Plate No. 3	1.4 Pf
Tetrode Grid No. 1 to Triode Plate (Max.)	0.35 Pf
Tetrode Plate No. 1 to Triode Plate (Max.)	0.008 Pf

RATINGS (Design Maximum Rating System)

Harmonic Generator Service

	Triode Unit	Tetrode Unit
Plate Voltage (Max.)	275	— Volts
Plate No. 1 Voltage (Max.)	—	275 Volts
Plate No. 2 Voltage (Max.)	—	200 Volts
Plate No. 3 Voltage (Max.)	—	200 Volts

Grid No. 2 Supply Voltage (Max.)	—	275 Volts
Grid No. 2 (Screen-Grid) Voltage	See Rating Chart (Gen. Info. Sec.)	
Grid No. 1 (Control-Grid) Voltage		
Negative Bias Value (Max.)	40	40 Volts
Positive Bias Value (Max.)	0	0 Volt
Plate Dissipation (Max.)	1.7	— Watts
Plate No. 1 Dissipation (Max.)	—	2.3 Watts
Plate No. 2 Dissipation (Max.)	—	0.3 Watt
Plate No. 3 Dissipation (Max.)	—	0.3 Watt
Grid No. 2 Input		
For Grid No. 2 Voltages Up to 137.5 Volts (Max.)	—	0.45 Watt
For Grid No. 2 Voltages Between 137.5 and 275 Volts	See Rating Chart (Gen. Info. Sec.)	
Grid No. 1 Circuit Resistance		
For Fixed Bias Operation (Max.)	0.5	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier	
Triode Unit	
Plate Voltage	100 Volts
Grid Voltage	−1 Volt
Amplification Factor	40
Plate Resistance (Approx.)	7400 Ohms
Transconductance	5400 μmhos
Plate Current	7.9 Ma
Grid Voltage (Approx.) for Plate Current of 100 μa	−7 Volts
Tetrode Unit with Plates No. 2 and No. 3 Connected to Cathode	
Plate No. 1 Voltage	250 Volts
Grid No. 2 Voltage	250 Volts
Grid No. 1 Voltage	−2 Volts
Plate No. 1 Resistance (Approx.)	750,000 Ohms
Transconductance, Grid No. 1 to Plate No. 1	4400 μmhos
Plate No. 1 Current	7.3 Ma
Grid No. 2 Current	1.4 Ma
Grid No. 1 Voltage (Approx.) for Plate No. 1 Current of 100 μa	−7 Volts
Typical Operation with Separate Plate Operation	
Plates No. 1, No. 2, and No. 3 Voltage	100 Volts
Grid No. 2 Voltage	50 Volts
Grid No. 1 Voltage	−1 Volt
Plate No. 1 Current	1.6 Ma
Plate No. 2 Current	0.04 Ma
Plate No. 3 Current	0.04 Ma
Grid No. 2 Current	0.3 Ma
Transconductance (Approx.)	
Grid No. 1 to Plate No. 1	2500 μmhos
Grid No. 1 to Plate No. 2	70 μmhos
Grid No. 1 to Plate No. 3	70 μmhos

NOTE:
(1) Shield No. 315 connected to cathode.

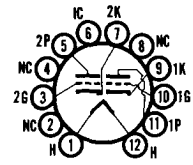
6FJ7

Color Television Type

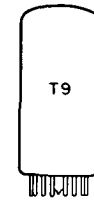
VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

Double Dissimilar Triode

Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12BM
Outline	9-58
Maximum Diameter	1.188 In.
Maximum Seated Height	2.000 In.
Maximum Overall Height	2.375 In.



12BM



ELECTRICAL DATA

HEATER OPERATION	
Heater Voltage	6.3 Volts
Heater Current	900 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 1	Section 2
Grid to Plate: (g to p)	3.8	5.0 Pf
Input: g to (h + k)	2.2	4.0 Pf
Output: p to (h + k)	0.48	0.54 Pf

RATINGS (Design Maximum Rating System)

	Vertical Oscillator Service[1] (Section 1)	Vertical Deflection Amplifier[1] (Section 2)
DC Plate Voltage (Max.)	350	550 Volts
Peak Positive Pulse Plate Voltage (Max.)	—	2500 Volts
Peak Negative Grid Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.)	1.0	10[2] Watts
DC Cathode Current (Max.)	—	50 Ma
Peak Cathode Current (Max.)	—	150 Ma
Grid Circuit Resistance		
With Fixed Bias	2.2	2.2 Megohms
With Cathode Bias	2.2	— Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Section 1 (Oscillator)	Section 2 (Amplifier)	
Plate Voltage	250	150	250 Volts
Grid Voltage	-8.0	0[3]	-9.5 Volts
Amplification Factor	22.5	—	15.4
Plate Resistance (Approx.)	9000	—	2000 Ohms
Transconductance	2500	—	7700 μmhos
Plate Current	8.0	68	41 Ma
Grid Voltage (Approx.) Ib = 10 μa	-18	—	— Volts
Grid Voltage (Approx.) Ib = 50 μa	—	—	-23 Volts

NOTES:

(1) 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 horizontal scanning cycle.

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

(3) Applied for short interval (two seconds maximum) so as not to damage device.

Color Television Type

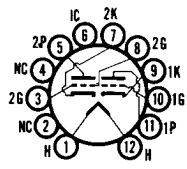
VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

6FM7

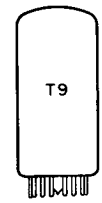
13FM7, 15FM7

Double Dissimilar Triode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12EJ
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.



12EJ



ELECTRICAL DATA

HEATER OPERATION

	15FM7	13FM7	6FM7
Heater Voltage	14.8	13.0	6.3 Volts
Heater Current	450	450	1005 Ma
Heater Warm-up Time	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

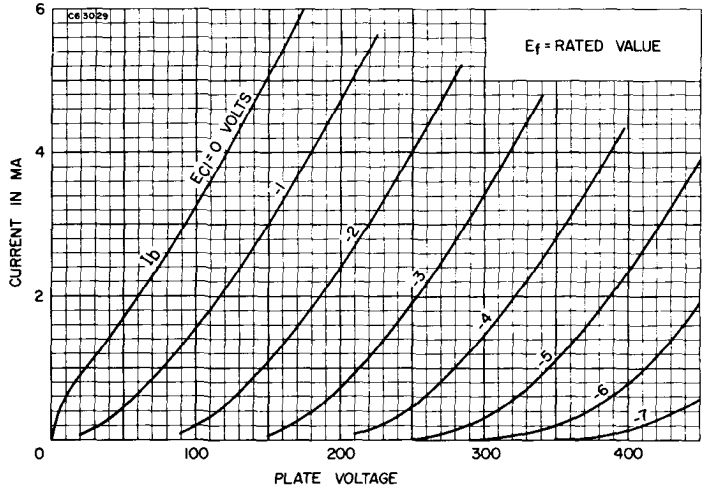
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

	Section No. 1	Section No. 2
Grid to Plate	4.0	7.0 Pf
Input: g to (h + k)	2.4	7.0 Pf
Output: p to (h + k)	0.40	1.1 Pf

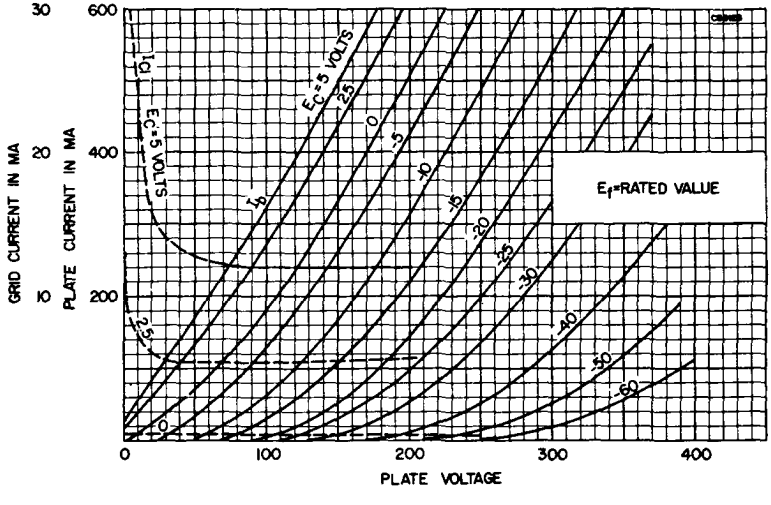
RATINGS (Design Maximum Rating System)
Vertical Deflection Oscillator and Amplifier[1]

	Section[2] No. 1 Oscillator	Section[2] No. 2 Amplifier
Plate Voltage (Max.)	350	550 Volts
Peak Positive Pulse Plate Voltage (Max.)	—	1500 Volts
Peak Negative Pulse Grid Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.)[3]	1.0	10 Watts
Average Cathode Current (Max.)	—	50 Ma
Peak Cathode Current (Max.)	—	175 Ma
Grid Circuit Resistance, Self Bias (Max.)	2.2	2.2 Megohms

AVERAGE PLATE CHARACTERISTICS
(Section No. 1)



AVERAGE PLATE CHARACTERISTICS
(Section No. 2)



CHARACTERISTICS AND TYPICAL OPERATION

	Section No. 1	Section No. 2
Plate Voltage	250	175 Volts
Grid No. 1 Voltage	-3	-25 Volts
Plate Current	2.0	40 Ma
Transconductance	2200	6000 μmhos
Amplification Factor	66	5.5
Plate Resistance (Approx.)	30,000	920 Ohms
Ec for Ib = 20 μa (Approx.)	-5.3	— Volts
Ec for Ib = 200 μa (Approx.)	—	-45 Volts

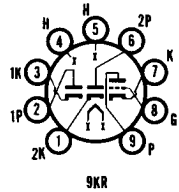
NOTES:
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse not to exceed 15% of one horizontal scanning cycle.
(2) Section No. 1 connects to Pins 6, 7 and 8. Section No. 2 connects to Pins 1, 2, 3, and 9.
(3) In stages operating with grid leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.

FM DETECTOR AF AMPLIFIER

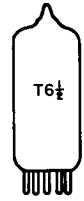
6FM8

Double Diode and High Mu Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9KR
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9KR



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 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)	
Triode	
Grid to Plate	1.8 Pf
Input: g to (h + Tk)	1.5 Pf
Output: p to (h + Tk)	0.16 Pf
Diodes	
No. 1 Diode Plate to Grid	0.05 Pf
No. 2 Diode Plate to Grid	0.04 Pf
No. 1 Diode Cathode to All	4.6 Pf
No. 2 Diode Cathode to All	4.8 Pf
No. 1 Diode Input	2.4 Pf
No. 2 Diode Input	2.2 Pf
RATINGS (Design Maximum Rating System)	
Triode	
Plate Voltage (Max.)	330 Volts
Positive DC Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	1.1 Watts
Diodes (Continuous Operation)	
DC Current, Each Plate (Max.)	5 Ma
CHARACTERISTICS AND TYPICAL OPERATION	
Triode: Class A1 Amplifier	
Plate Voltage	250 Volts
Grid Voltage	-3 Volts
Plate Current	1.0 Ma
Transconductance	1200 μmhos
Amplification Factor	70
Plate Resistance (Approx.)	58,000 Ohms
Diodes	
Average Current Each Plate at 5 Volts DC(1)	20 Ma

NOTE:
(1) Test condition only.

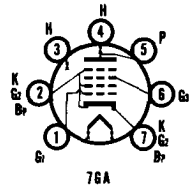
6FS5

2FS5, 3FS5

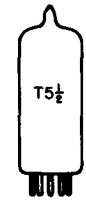
VHF AMPLIFIER

Shadow-Grid Beam Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7GA
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7GA



ELECTRICAL DATA

HEATER OPERATION

	2FS5	3FS5	6FS5
Heater Voltage	2.4	2.9	6.3 Volts
Heater Current	600	450	200 Ma
Heater Warm-up Time	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

	Shielded(1)	Unshielded
Grid No. 1 to Plate: (g1 to p)	0.016	0.03 Pf
Input: g1 to (h + k + g2 + g3 + b.p.)	4.8	4.8 Pf
Output: p to (h + k + g2 + g3 + b.p.)	2.8	2.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	300 Volts
Screen Voltage (Max.)	150 Volts
Positive DC Grid-No. 1 Voltage (Max.)	0 Volt
Negative DC Grid-No. 1 Voltage (Max.)	50 Volts
Plate Dissipation (Max.)	3.25 Watts
Screen Dissipation (Max.)	0.15 Watt
DC Cathode Current (Max.)	20 Ma
Grid No. 1 Circuit Resistance	
Fixed Bias	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	275 Volts
Screen Voltage	135 Volts
Grid No. 1 Voltage	–0.2 Volt
Plate Resistance (Approx.)	0.24 Megohm
Transconductance	10,000 μmhos
Plate Current	9 Ma
Screen Current	0.17 Ma
Grid No. 1 Voltage (Approx.)	
Gm = 100 μmhos	–5 Volts

NOTE:
(1) With external shield (EIA 316) connected to pin 7.

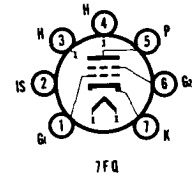
6FV6

2FV6

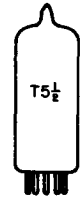
VHF AMPLIFIER

Sharp Cutoff Tetrode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7FQ
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7FQ



ELECTRICAL DATA

HEATER OPERATION

	2FV6	6FV6
Heater Voltage	2.4	6.3 Volts
Heater Current	600	200 Ma
Heater Warm-up Time	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 (Shielded)(1)

Grid No. 1 to Plate (Max.)	0.03 Pf
Input	4.5 Pf
Output	3.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	275 Volts
Grid No. 2 Supply Voltage (Max.)	180 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Positive Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	2.0 Watts
Grid No. 2 Input (Max.)	0.5 Watt
Cathode Current (Max.)	20 Ma
Grid No. 1 Circuit Resistance (Self Bias) (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	125 Volts
Grid No. 2 Voltage	80 Volts
Grid No. 1 Voltage	−1 Volt
Plate Current	10 Ma
Grid No. 2 Current	1.5 Ma
Transconductance	8000 μmhos
Plate Resistance	0.1 Megohm
Grid No. 1 Voltage for Ib = 20 μa	−6 Volts

NOTE:
(1) Shield No. 316 connected to cathode.

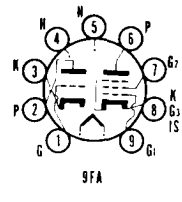
VERTICAL DEFLECTION OSC. (T) IF/GEN. PURPOSE AMP. (P)

6FV8A

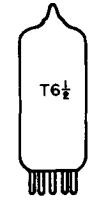
5FV8

Medium Mu Triode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9FA
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.



9FA



ELECTRICAL DATA

HEATER OPERATION

	5FV8	6FV8A
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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

	Shielded(1)	Unshielded
Triode Section		
Grid to Plate	1.8	1.8 Pf
Input: g to (h + Tk + IS)	2.8	2.8 Pf
Output: p to (h + Tk + IS)	2.0	1.5 Pf
Pentode Section		
Grid No. 1 to Plate (Max.)	0.010	0.020 Pf
Input: g1 to (h + Pk + g2 + g3 + IS)	5.0	5.0 Pf

Output: p to (h + Pk + g2 + g3 + IS)	3.0	2.0 Pf
Pentode Plate to Triode Plate (Max.)	0.03	0.15 Pf

RATINGS (Design Maximum Rating System)

	Tri. Sec. Vert. Defl. Osc.(2)	Pent. Sec. Class A Amp.
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 1 Voltage (Max.)	—	0 Volt
Peak Negative Pulse Grid Voltage (Max.)	250	— Volts
Average Cathode Current (Max.)	20	— Ma
Peak Cathode Current (Max.)	70	— Ma
Plate Dissipation (Max.)(3)	2.0	2.3 Watts
Grid No. 2 Dissipation (Max.)	—	0.55 Watt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	—	0.25 Megohm
Self Bias (Max.)	3.0(3)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	125	125 Volts
Grid No. 2 Voltage	—	125 Volts
Grid No. 1 Voltage	−1.0	−1.0 Volt
Transconductance	8000	6500 μmhos
Plate Current	12.0	12.0 Ma
Grid No. 2 Current	—	4.0 Ma
Plate Resistance (Approx.)	5600	200,000 Ohms
Amplification Factor	45	—
Ec1 for Ib = 20 μa (Approx.)	−7.5	−9 Volts

NOTES:

(1) Shield No. 315 tied to Pin No. 4.

(2) 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 horizontal scanning cycle.

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

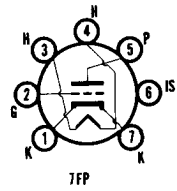
6FY5

2FY5, 3FY5

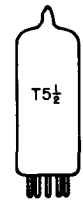
VHF AMPLIFIER

High Mu Triode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7FP
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7FP



ELECTRICAL DATA

HEATER OPERATION

	2FY5	3FY5	6FY5
Heater Voltage	2.4	3.1	6.3 Volts
Heater Current	600	450	200 Ma
Maximum Heater Cathode Voltage			100 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Unshielded	Shielded
Input	4.75	4.75 Pf
Output	3.3	4.3 Pf
Grid to Heater (Max.)	0.28	0.28 Pf
Plate to Cathode	0.25	0.21 Pf
Grid to Cathode	3.2	3.2 Pf
Cathode to Heater	2.5	2.5 Pf
Plate to Grid	0.50	0.48 Pf

RATINGS (Absolute Maximum Rating System)

Plate Voltage (Max.)	200 Volts
Plate Voltage (Zero Plate Current) (Max.)	550 Volts
Plate Dissipation (Max.)	2.2 Watts

Cathode Current (Max.)				20 Ma
Negative Grid Voltage (Max.)				50 Volts
Grid Circuit Resistance (Max.)				1 Megohm
Cathode-Heater Circuit Resistance (Max.)				20,000 Ohms
CHARACTERISTICS AND TYPICAL OPERATION				
Plate Voltage	135	135	135	135 Volts
Negative Grid Bias	1	3.1	5	4.5 Volts
Plate Current	11	—	—	0.1 Ma
Transconductance	13,000	625	125	— μmhos
Amplification Factor	70	—	—	—

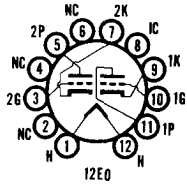
VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

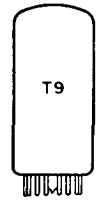
6FY7

11FY7, 15FY7

Double Dissimilar Triode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12EO
Outline 9-60
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.500 In.
Maximum Overall Height .....2.875 In.





ELECTRICAL DATA

HEATER OPERATION

	15FY7	11FY7	6FY7
Heater Voltage	14.7	11.0	6.3 Volts
Heater Current	450	600	1050 Ma
Heater Warm-up Time	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 (Unshielded)

	Section 1	Section 2
Grid to Plate: (g to p)	4.4	9.5 Pf
Input: g to (h + k)	2.2	6.5 Pf
Output: p to (h + k)	0.4	1.2 Pf

RATINGS (Design Maximum Rating System)

	Vertical Oscillator Service(1) (Section 1)	Vertical Deflection Amplifier(1) (Section 2)
DC Plate Voltage (Max.)	330	275 Volts
Peak Positive Pulse Plate Voltage (Max.)	—	2000 Volts
Peak Negative Grid Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.)	1.0	7.0(2) Watts
DC Cathode Current (Max.)	20	50 Ma
Peak Cathode Current (Max.)	70	175 Ma
Grid Circuit Resistance (Max.)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Section 1 (Oscillator)	Section 2 (Amplifier)	
Plate Voltage	250	60	150 Volts
Grid Voltage	-3.0	0(3)	-17.5 Volts
Amplification Factor	65	—	6.0
Plate Resistance (Approx.)	40,500	—	920 Ohms
Transconductance	1600	—	6500 μmhos
Plate Current	1.4	95	35 Ma
Plate Current (Approx.) Ec = -25 Volts	—	—	6 Ma
Grid Voltage (Approx.) Ib = 30 μa	-5.5	—	— Volts
Grid Voltage (Approx.) Ib = 50 μa	—	—	-36 Volts

NOTES:

(1) 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 horizontal scanning cycle.

(2) 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.

(3) Applied for short interval (two seconds maximum) so as not to damage tube.

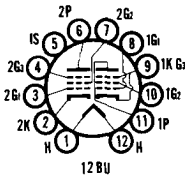
6G11

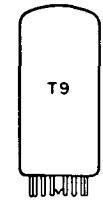
12G11

FM DETECTOR AUDIO POWER AMPLIFIER

Double Dissimilar Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12BU
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.





ELECTRICAL DATA

HEATER OPERATION

	12G11	6G11
Heater Voltage	12.6	6.3 Volts
Heater Current	600	1200 Ma
Heater Warm-up Time	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 (Unshielded)

Section 1

Grid No. 1 to Plate	0.26 Pf
Input: 1g1 to (h + 1k + 1g2 + bp + IS)	12 Pf
Output: 1p to (h + 1k + 1g2 + bp + IS)	12 Pf

Section 2

Grid No. 1 to Plate	0.034 Pf
Grid No. 3 to Plate	2.8 Pf
Grid No. 1 to All Except Plate: 2g1 to (h + 2k + 2g2 + 2g3 + IS)	6.5 Pf
Grid No. 3 to All: 2g3 to (h + 2k + 2g1 + 2g2 + 2p + IS)	7.5 Pf
Grid No. 1 to Grid No. 3	0.24 Pf
Plate, Section 1 to Plate, Section 2	0.12 Pf

RATINGS (Design Maximum Rating System)

Section 1

Plate Voltage	150 Volts
Screen Voltage	135 Volts
Plate Dissipation	6.5 Watts
Screen Dissipation	1.8 Watts
DC Cathode Current	65 Ma

Section 2

Plate Voltage	330 Volts
Suppressor Voltage	28 Volts
Screen Supply Voltage	330 Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)
Positive DC Grid No. 1 Voltage	0 Volt
Plate Dissipation	1.7 Watts
Screen Dissipation	1.1 Watts

CHARACTERISTICS AND TYPICAL OPERATION

Section 1

Class A1 Amplifier

Plate Voltage	120 Volts
Screen Voltage	110 Volts
Grid No. 1 Voltage	−8.0 Volts
Peak AF Grid No. 1 Voltage	8.0 Volts
Plate Resistance (Approx.)	10,000 Ohms
Transconductance	7500 μmhos
Zero Signal Plate Current	49 Ma
Maximum Signal Plate Current	50 Ma
Zero Signal Screen Current	4.0 Ma
Maximum Signal Screen Current	8.5 Ma
Load Resistance	2500 Ohms
Total Harmonic Distortion (Approx.)	10 Percent
Maximum Signal Power Output	2.3 Watts

Section 2

Plate Voltage	150 Volts
Suppressor Voltage	0 Volt
Screen Voltage	100 Volts
Cathode Bias Resistor	560 Ohms
Plate Resistance (Approx.)	0.15 Megohm
Grid No. 1 Transconductance	1000 μmhos
Grid No. 3 Transconductance	400 μmhos
Plate Current	1.3 Ma
Screen Current	2.0 Ma
Grid No. 1 Voltage (Approx.) Ib = 10 μa	−4.5 Volts
Grid No. 3 Voltage (Approx.) Ib = 10 μa	−4.5 Volts

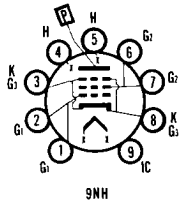
HORIZONTAL DEFLECTION AMPLIFIER

6GB5/EL500

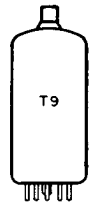
13GB5/XL500, 18GB5, 27GB5/PL500, 28GB5

Beam Power Pentode

Construction .....Magnoval T-9
Base .....Button 9 Pin E9-23
Top Cap C1-2
Basing.....9NH
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.750 In.
Maximum Overall Height .....4.125 In.



9NH



ELECTRICAL DATA

HEATER OPERATION	28GB5	27GB5 /PL500	18GB5	13GB5 /XL500	6GB5 /EL500
Heater Voltage	28	28	18	13	6.3 Volts
Heater Current	300	300	450	600	1380 Ma
Maximum Heater-Cathode Voltage					
Heater Negative with Respect to Cathode					
DC					125 Volts
Total DC and Peak					250 Volts
Heater Positive with Respect to Cathode					
DC					125 Volts
Total DC and Peak					250 Volts
RATINGS (Design Maximum Rating System)					
DC Plate Voltage (Max.)					275 Volts
Peak Positive Pulse Plate Voltage (Max.)					7700 Volts
Screen-Grid Voltage (Max.)					275 Volts
Average Cathode Current (Max.)					275 Ma
Plate Dissipation (Max.)					17 Watts
Screen-Grid Dissipation (Max.)					5 Watts
Control-Grid Circuit Resistance					2.2 Megohms
CHARACTERISTICS AND TYPICAL OPERATION					
Supply Voltage			170	200	230 Volts
Minimum Value of Screen-Grid Resistor(1)			1.2	1.5	2.2 Kilohms
Screen-Grid Voltage			130	150	180 Volts
Plate Voltage at End of Scan(2)			55	59	65 Volts
Control-Grid Voltage at End of Scan(3)			−10	−10	−10 Volts
Peak Plate Current			210	270	360 Ma
Non-Stabilized Circuits (Drive Below the Knee)					
Supply Voltage			170	200	230 Volts
Minimum Value of Screen-Grid Resistor			2.2	2.2	2.2 Kilohms
Control-Grid Voltage at End of Scan(3)			+1	+1	+1 Volt
Peak Plate Current(4)			200	250	320 Ma

INSTANTANEOUS PLATE KNEE VALUES
Eb = 75 V, Ec2 = 200 V and Ec1 = −10 V
Ib = 440 Ma and Ic2 = 37 Ma

NOTES:
(1) The quoted values are the minimum values of Rg2 which are required to prevent an excessive screen-grid dissipation during the warm-up period.
(2) These values refer to nominal line voltage. At a line voltage 10% below nominal the tube will still operate above the knee.
(3) The minimum required control-grid voltage for cut-off during the flyback is −120 volts.
(4) To allow for tube spread, deterioration during the life and line voltage 10% below nominal, the specified values for peak plate current should not be exceeded at the specified conditions for a nominal line voltage.

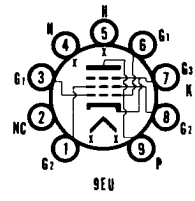
6GC5

Color Television Type

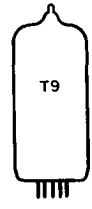
AUDIO POWER AMPLIFIER

Beam Power Pentode

Construction 9T-9
Base .....*Button 9 Pin, E9-68*
Basing 9EU
Outline 9-71
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.920 In.
Maximum Overall Height .....3.230 In.



9EU



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1200 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)

Grid No. 1 to Plate	0.9 Pf
Input: g1 to (h + k, g3 + g2)	18 Pf
Output: p to (h + k, g3 + g2)	7 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	220 Volts
Grid No. 2 Voltage (Max.)	140 Volts
Plate Dissipation (Max.)	12 Watts
Grid No. 2 Dissipation (Max.)	1.4 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier (Single Tube)

Plate Voltage	110	200 Volts
Grid No. 2 Voltage	110	125 Volts
Grid No. 1 Voltage	−7.5	— Volts
Cathode Resistor	—	180 Ohms
Peak AF Grid No. 1 Voltage	7.5	8.5 Volts
Zero Signal Plate Current	49	46 Ma
Maximum Signal Plate Current	50	47 Ma
Zero Signal Grid No. 2 Current	4	2.2 Ma
Maximum Signal Grid No. 2 Current	10	8.5 Ma
Transconductance	8000	8000 μmhos
Plate Resistance (Approx.)	13,000	28,000 Ohms
Load Resistance	2000	4000 Ohms
Maximum Signal Power Output	2.1	3.8 Watts
Total Harmonic Distortion (Approx.)	10	10 Percent

6GE5

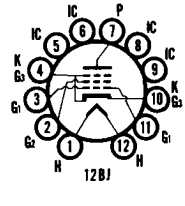
12GE5, 17GE5

Color Television Type

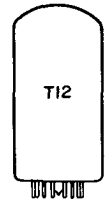
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Basing 12BJ
Outline 12-56
Maximum Diameter .....1.563 In.
Maximum Seated Height .....2.500 In.
Maximum Overall Height .....2.875 In.



12BJ



ELECTRICAL DATA

HEATER OPERATION

	17GE5	12GE5	6GE5
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	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 (Unshielded)			
Grid No. 1 to Plate			0.34 Pf
Input			16 Pf
Output			7 Pf
RATINGS (Design Maximum Rating System)			
Horizontal Deflection Amplifier(1)			
DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)			770 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)			6500 Volts
Peak Negative Pulse Plate Voltage (Max.)			1500 Volts
Plate Dissipation (Max.)(2)			17.5 Watts
Peak Negative Grid No. 1 Voltage (Max.)			330 Volts
Grid No. 2 Voltage (Max.)			220 Volts
Grid No. 2 Dissipation (Max.)			3.5 Watts
Average Cathode Current (Max.)			175 Ma
Peak Cathode Current (Max.)			550 Ma
Grid No. 1 Circuit Resistance (Max.)			1.0 Megohm
Bulb Temperature (At Hottest Point) (Max.)			220 °C
CHARACTERISTICS AND TYPICAL OPERATION			
Plate Voltage		5000	250 Volts
Grid No. 2 Voltage		150	150 Volts
Grid No. 1 Voltage		—	-22.5 Volts
Plate Current		—	65 Ma
Grid No. 2 Current		—	1.8 Ma
Transconductance		—	7300 μmhos
Plate Resistance		—	18,000 Ohms
Amplification Factor(3)		—	4.4
Ec1 for Ib = 1.0 Ma (Approx.)		-100	-42 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 60 V; Ec2 = 150 V and Ec1 = 0
Ib = 345 Ma, and Ic2 = 27 Ma

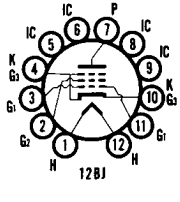
NOTES:
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse is not to exceed 15% of one horizontal scanning cycle.
(2) In stages operating with grid leak bias, an adequate cathode bias resistor or other suitable means is required to protect the tube in the absence of excitation.
(3) Amplification factor with tube operating as a triode with 150 volts on the plate and Grid No. 2 and -22.5 volts on Grid No. 1.

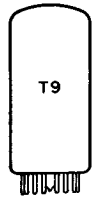
HORIZONTAL DEFLECTION AMPLIFIER

6GF5

Beam Power Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12BJ
Outline 9-60
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.500 In.
Maximum Overall Height .....2.875 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1200 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)	
Grid No. 1 to Plate	0.2 Pf
Input: g1 to (h + k + g2 + b.p.)	16 Pf
Output: p to (h + k + g2 + b.p.)	7.5 Pf
RATINGS (Design Maximum Rating System)	
Horizontal-Deflection Amplifier Service(1)	
DC Plate-Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Pulse Plate Voltage (Max.)	5000 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
Screen Voltage (Max.)	220 Volts
Negative DC Grid No. 1 Voltage (Max.)	55 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Plate Dissipation (Max.)(2)	9.0 Watts
Screen Dissipation (Max.)	2.5 Watts
DC Cathode Current (Max.)	160 Ma
Peak Cathode Current (Max.)	500 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature at Hottest Point (Max.)	200 °C
CHARACTERISTICS AND TYPICAL OPERATION	
Plate Voltage	250 Volts
Screen Voltage	150 Volts
Grid No. 1 Voltage	−26.5 Volts
Plate Resistance (Approx.)	260,000 Ohms
Transconductance	4700 μmhos
Plate Current	34 Ma
Screen Current	1.6 Ma
Grid No. 1 Voltage (Approx.) Ib = 1.0 Ma	−46 Volts
Triode Amplification Factor(4)	4.2

INSTANTANEOUS PLATE KNEE VALUES(3)
Eb = 60 V, Ec2 = 150 V, and Ec1 = 0 V
Ib = 345 Ma and Ic2 = 27 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) 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.
(3) Applied for short interval (two seconds maximum) so as not to damage tube.
(4) Triode connection (screen tied to plate) with Eb = Ec2 = 150 volts and Ec1 = −26.5 volts.

6GF7

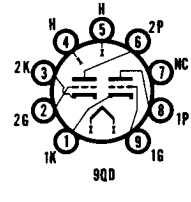
10GF7, 13GF7

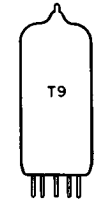
Color Television Type

VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

Double Dissimilar Triode

Construction .....Novar T-9
Base .....Novar Button 9 Pin, E9-75
Basing 9QD
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.620 In.
Maximum Overall Height .....3.000 In.





ELECTRICAL DATA

HEATER OPERATION

	13GF7	10GF7	6GF7
Heater Voltage	13.0	9.7	6.3 Volts
Heater Current	450	600	985 Ma
Heater Warm-up Time	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 (Unshielded)

	Section No. 1	Section No. 2
Grid to Plate	4.6	9.0 Pf
Input: g to (h + k)	2.4	6.5 Pf
Output: p to (h + k)	0.26	1.4 Pf

RATINGS (Design Maximum Rating System)
Vertical Deflection Oscillator and Amplifier(1)

	Section No. 1 Oscillator	Section No. 2 Amplifier
DC Plate Voltage (Max.)	330	330 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	—	1500 Volts
Peak Negative Pulse Grid Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.)(2)	1.5	10 Watts
Average Cathode Current (Max.)	22	50 Ma
Peak Cathode Current (Max.)	77	175 Ma
Grid Circuit Resistance (Self Bias) (Max.)	2.2	2.2 Megohms

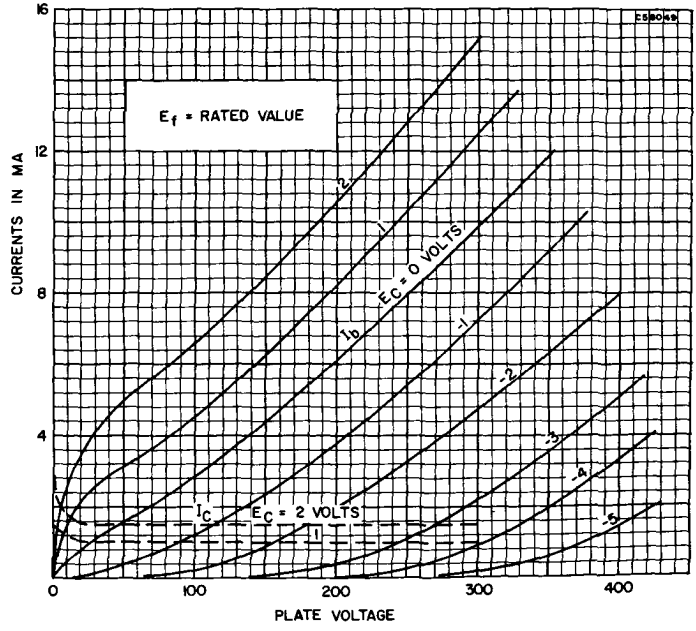
CHARACTERISTICS AND TYPICAL OPERATION

	Section No. 1(3)	Section No. 2(3)
Plate Voltage	250	150 Volts
Grid No. 1 Voltage	−3	−20 Volts
Plate Current	1.4	50 Ma
Transconductance	1600	7200 μmhos
Amplification Factor	64	5.4
Plate Resistance (Approx.)	40,000	750 Ohms
Ec for Ib = 10 μa (Approx.)	−5.5	— Volts
Ec for Ib = 100 μa (Approx.)	—	−45 Volts
Ib at Ec = −28 Vdc (Approx.)	—	10 Ma

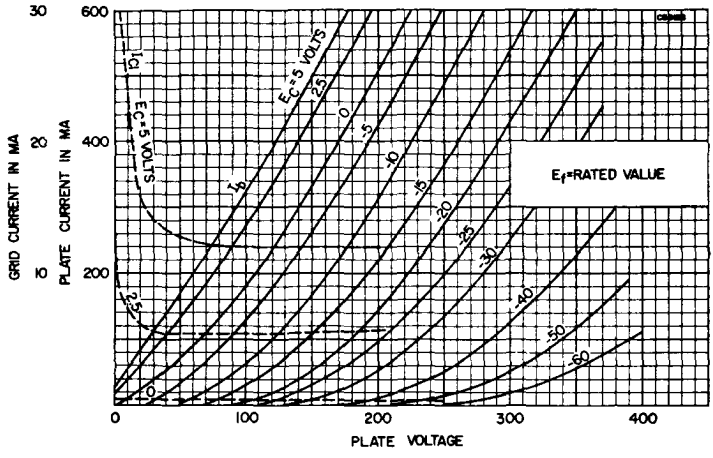
INSTANTANEOUS PLATE KNEE VALUES (Section No. 2)
Eb = 60 V; Ec = 0; Ib = 95 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) In stages operating with grid-leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.
(3) Section No. 1 connects to Pins 4, 5, and 6.

AVERAGE PLATE CHARACTERISTICS
(Section No. 1)



AVERAGE PLATE CHARACTERISTICS
(Section No. 2)



6GF7A

10GF7A, 13GF7A

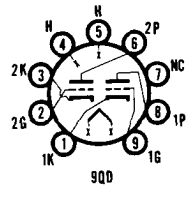
Color Television Type

VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

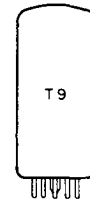
Double Dissimilar Triode

Construction .....Novar T-9
Base .....Novar Button 9 Pin, E9-89
(Exhaust Tip on Base)
Basing 9QD
Outline 9-107
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.380 In.

The 6GF7A, 10GF7A, and 13GF7A are identical to the 6GF7, 10GF7, and 13GF7 except for base with exhaust tip at bottom and shorter bulb.



9QD



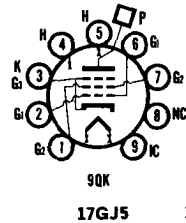
6GJ5

12GJ5, 17GJ5

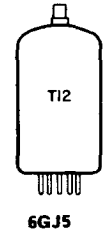
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Novar T-12
Base .....Novar Button 9 Pin, E9-76
Top Cap .....C1-2, C1-3 or C1-33
Basing 9QK
Outline 12-70
Maximum Diameter .....1.562 In.
Maximum Seated Height .....3.170 In.
Maximum Overall Height .....3.550 In.



9QK



ELECTRICAL DATA
HEATER OPERATION

	17GJ5	12GJ5	6GJ5
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	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 (Unshielded)	
Grid to Plate	0.26 Pf
Input: g1 to (k + g3 + g2 + h)	15 Pf
Output: p to (k + g3 + g2 + h)	6.5 Pf
RATINGS (Design Maximum Rating System)	
Horizontal Deflection Amplifier(1)	
DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Plate Voltage (Max.)	6500 Volts
Peak Negative Plate Voltage (Max.)	1500 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Negative Grid No. 1 Voltage (Max.)	−55 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Plate Dissipation (Max.)(2)	17.5 Watts
Grid No. 2 Input (Max.)	3.5 Watts
Average Cathode Current (Max.)	175 Ma
Peak Cathode Current (Max.)	550 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature (At Hottest Point) (Max.)	240 °C
CHARACTERISTICS AND TYPICAL OPERATION	
Plate Voltage	250 Volts
Grid No. 2 Voltage	150 Volts
Grid No. 1 Voltage	−22.5 Volts
Plate Current	70 Ma
Grid No. 2 Current	2.1 Ma
Transconductance	7100 μmhos
Amplification Factor(3)	4.4
Plate Resistance	15,000 Ohms
Ec1 for Ib = 1 Ma (Approx.)	−42 Volts
INSTANTANEOUS PLATE KNEE VALUES	
Eb = 60 V, Ec2 = 150 V and Ec1 = 0 V;	
Ib = 390 Ma; and Ic2 = 32 Ma	

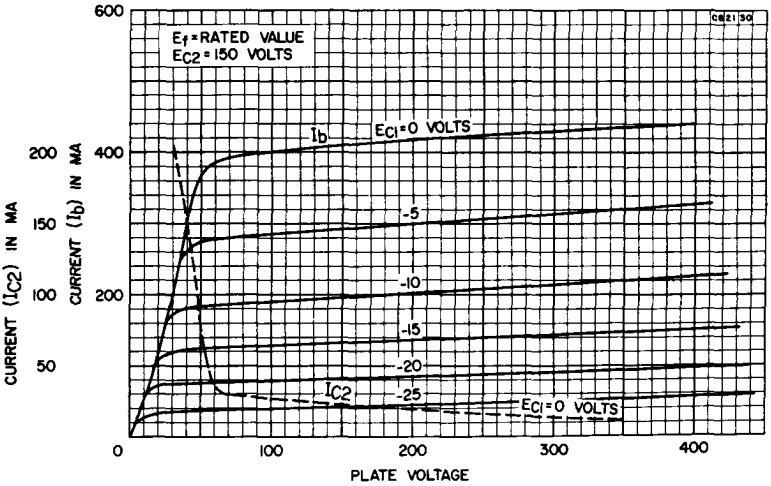
NOTES:

(1) 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 horizontal scanning cycle.*

(2) 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.

(3) Amplification factor with tube operating as a triode with 150 volts on the plate and Grid No. 2 and −22.5 volts on Grid No. 1.

AVERAGE PLATE CHARACTERISTICS



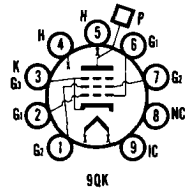
6GJ5A

12GJ5A, 17GJ5A

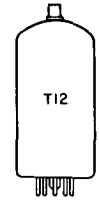
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Novar T-12
Base .....Novar Button 9 Pin, E9-88
(Exhaust Tip on Base)
Top Cap .....C1-2, C1-3 or C1-33
Basing 9QK
Outline
Maximum Diameter .....1.562 In.
Maximum Seated Height .....3.125 In.
Maximum Overall Height .....3.505 In.
The 6GJ5A, 12GJ5A, and 17GJ5A are identical to the 6GJ5, 12GJ5, and 17GJ5 except for base with exhaust tip at bottom and shorter bulb.



9QK



6GJ7/ECF801

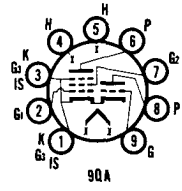
4GJ7, 5GJ7, 8GJ7/PCF801

Color Television Type

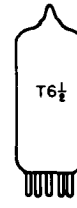
VHF OSCILLATOR and MIXER

Triode and Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9QA
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9QA



ELECTRICAL DATA

HEATER OPERATION

	4GJ7	5GJ7	8GJ7/PCF801	6GJ7/ECF801
Heater Voltage	4.1	5.6	8.0	6.3 Volts
Heater Current	600	450	300	410 Ma
Maximum Heater-Cathode Voltage				
Heater Positive with Respect to Cathode				
Total DC and Peak				110 Volts
Heater Positive with Respect to Cathode				
Total DC and Peak				110 Volts

DIRECT INTERELECTRODE CAPACITANCES

Triode Section	
Plate to Grid	1.8 Pf
Grid to Cathode and Heater	3.3 Pf
Plate to All Except Grid	1.7 Pf
Pentode Section (Shielded)	
Input	6.2 Pf
Output	3.5 Pf
Plate to Grid No. 1	0.009 Pf
Grid No. 1 to Grid No. 2	1.5 Pf
Coupling	
Triode Plate to Pentode Plate (Max.)	0.025 Pf
Pentode Plate to Triode Grid (Max.)	0.01 Pf
Triode Plate to Pentode Grid No. 1 (Max.)	0.01 Pf
Triode Grid to Pentode Grid No. 1 (Max.)	0.01 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Supply Voltage (Max.)	600	600 Volts
Plate Voltage (Max.)	140	275 Volts
Grid No. 2 Supply Voltage (Max.)	—	600 Volts
Grid No. 2 Voltage (Max.)	—	275 Volts
Grid No. 1 Voltage (Max.)	—	-50 Volts

Cathode Current (Max.)	22	20 Ma
Plate Dissipation (Max.)	1.8	2.4 Watts
Grid No. 2 Dissipation (Max.)	—	0.55 Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	2.2 Megohms
Cathode Bias (Max.)	0.5	1 Megohm
CHARACTERISTICS AND TYPICAL OPERATION		
Triode as Oscillator		
DC Plate Supply Voltage	200	200 Volts
Plate Load Resistance	8200	12,000 Ohms
External Grid to Cathode Resistance	10,000	10,000 Ohms
Plate Current	16	12 Ma
Oscillator Voltage (Effective)	4.5	3.3 Volts
Transconductance (Effective)	3700	3700 μmhos
Pentode Section as Mixer		
Plate Supply Voltage	200	200 Volts
Plate Load Resistance	2700	4700 Ohms
DC Grid No. 2 Supply Voltage	200	200 Volts
Grid No. 2 Resistance	27,000	27,000 Ohms
DC Grid No. 1 Supply Voltage	−1.2	0 Volts
Grid No. 1 Resistance	0.1	1 Megohm
Oscillator Voltage (Effective)	1.6	1.6 Volts
Plate Current	10	9 Ma
DC Grid No. 2 Current	3	2.8 μa
DC Grid No. 1 Current	10	2.3 μa
Conversion Transconductance	5000	4700 μmhos
Input Resistance at 200 Hz	600	600 Ohms
Pentode Section as an If Amplifier		
Plate Supply Voltage	200	200 Volts
Plate Load Resistance	2700	4700 Ohms
Grid No. 2 Resistance	27,000	27,000 Ohms
Grid No. 1 Resistance	0.1	1 Megohm
DC Grid No. 1 Supply Voltage	−1.2	0 Volts
Plate Current	10	12.5 Ma
DC Grid No. 2 Current	3	3.7 Ma
Transconductance	11,000	14,000 μmhos
DC Grid No. 1 Voltage for Gm/100	−12	−15 Volts
Input Resistance at 50 Hz	10,000	10,000 Ohms
DC Grid No. 2 Supply Voltage	200	200 Volts

Color Television Type

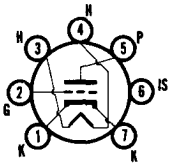
VHF AMPLIFIER

6GK5/6FQ5A

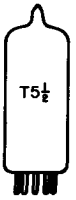
2GK5/2FQ5A, 3FQ5A, 3GK5, 4GK5

Gain Controlled Triode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7FP
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7FP



ELECTRICAL DATA

HEATER OPERATION

	2GK5/2FQ5A	3FQ5A 3GK5	4GK5	6GK5/6FQ5A
Heater Voltage	2.3	2.8	4.0	6.3 Volts
Heater Current	600	450	300	180 Ma
Heater Warm-up Time	11	11	11	— Seconds
Maximum Heater-Cathode Voltage				
Heater Negative with Respect to Cathode				
Total DC and Peak				100 Volts
Heater Positive with Respect to Cathode				
Total DC and Peak				100 Volts
DIRECT INTERELECTRODE CAPACITANCES (Shielded)				
Grid to Plate				0.52 Pf
Input: g to (h + k + IS + ES)				5.0 Pf
Output: p to (h + k + IS + ES)				3.5 Pf
Heater to Cathode				2.5 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	200 Volts
Plate Dissipation (Max.)	2.5 Watts
DC Cathode Current (Max.)	22 Ma
Negative Grid Voltage (Max.)	50 Volts
Grid Circuit Resistance (Self Bias) (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

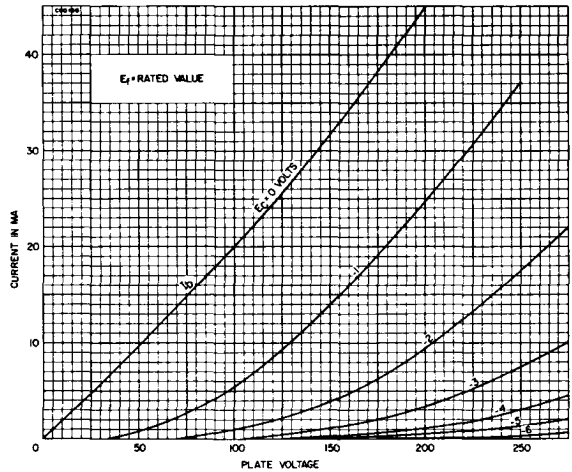
Plate Voltage	135 Volts
Grid Voltage	−1.0 Volts
Plate Current	11.5 Ma
Transconductance	15,000 μmhos
Amplification Factor	78
Plate Resistance (Approx.)	5400 Ohms
Ec for Gm = 150 μmhos (Approx.)	−4.2 Volts
Ec for Gm = 1500 μmhos (Approx.)	−2.5 Volts
Input Resistance (200 Hz)(1)	275 Ohms
Input Capacitance (200 Hz)(1)	11.2 Pf
Noise Figure (200)Hz(2)	4.7 db

NOTES:

(1) Measured under grounded plate conditions.

(2) Optimized neutralized triode RF amplifier stage, noise matched.

AVERAGE PLATE CHARACTERISTICS



6GK6

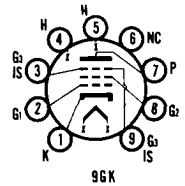
10GK6, 16GK6

Color Television Type

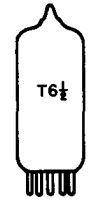
AUDIO POWER AMPLIFIER or VIDEO AMPLIFIER

Beam Power Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9GK
Outline	6-4
Maximum Diameter	0.875 In.
Maximum Seated Height	2.812 In.
Maximum Overall Height	3.062 In.



9GK



ELECTRICAL DATA

HEATER OPERATION

	16GK6	10GK6	6GK6
Heater Voltage	*16.0*	*10.0*	6.3 Volts
Heater Current	300	450	760 Ma
Heater Warm-up Time	11	11	— Seconds

Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
Total DC and Peak	100 Volts
Heater Positive with Respect to Cathode	
Total DC and Peak	100 Volts
DIRECT INTERELECTRODE CAPACITANCES	
Grid No. 1 to Plate (Max.)	0.14 Pf
Input	10 Pf
Output	7 Pf
RATINGS (Design Maximum Rating System)	
Plate Voltage (Max.)(1)	330 Volts
Grid No. 2 Voltage (Max.)(1)	330 Volts
Negative Grid No. 1 Voltage (Max.)	100 Volts
Plate Dissipation (Max.)	13.2 Watts
Grid No. 2 Dissipation (Average) (Max.)	2 Watts
Grid No. 2 Dissipation (Peak) (Max.)	4 Watts
Cathode Current (Max.)	65 Ma
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.3 Megohm
Cathode Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

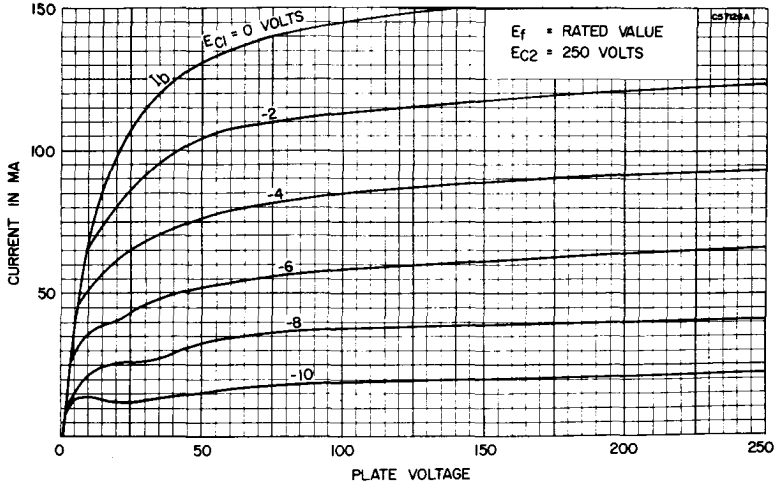
	Pentode Section		
	Single Tube Class A1	Class AB1 Push-Pull	
Plate Voltage	250	250	300 Volts
Grid No. 2 Voltage	250	250	300 Volts
Grid No. 1 Voltage	−7.3	—	— Volts
Cathode Resistor	135	130	130 Ohms
Grid Voltage (RMS) Per Grid	4.3	8	10 Volts
Plate Current (Zero Signal)	48	62	72 Ma
Plate Current (Max. Signal)	49.5	75	92 Ma
Grid No. 2 Current (Zero Signal)	5.5	7.0	8 Ma
Grid No. 2 Current (Max. Signal)	10.8	15	22 Ma
Transconductance	11.3K	—	— μmhos
Amplification Factor(2)	19	—	—
Plate Resistance	38K	—	— Ohms
Load Resistance	5.2K	—	— Ohms
Load Resistance (Plate to Plate)	—	8K	8K Ohms
Maximum Signal Power Output	5.7	11	17 Watts
Total Harmonic Distortion	10	3.0	4.0 Percent

NOTES:

(1) When the heater and positive voltages are obtained from a storage battery by means of a vibrator, the maximum values of the plate and Grid No. 2 voltages are 275 volts and that of the plate dissipation 9.9 watts.

(2) Measured from Grid No. 2 to Plate.

AVERAGE PLATE CHARACTERISTICS



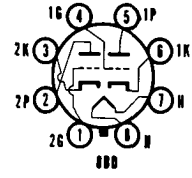
6GL7

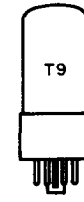
Color Television Type

VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

Double Dissimilar Triode

Construction .....Octal T-9
Base .....8 Pin, B8-6
Basing 8BD
Outline 9-5
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.438 In.
Maximum Overall Height .....3.000 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1050 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	Section No. 2
Grid to Plate	4.0	8.0 Pf
Input	2.2	6.0 Pf
Output	0.6	1.3 Pf

RATINGS (Design Maximum Rating System)

Vertical Deflection Oscillator and Amplifier(1,2)

	Oscillator	Amplifier
Plate Voltage (Max.)	350	550 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	—	1500 Volts
Plate Dissipation (Each Plate) (Max.)(3)	1.0	10 Watts
Total Plate Dissipation (Both Plates) (Max.)	12	12 Watts
Peak Negative Pulse Grid Voltage (Max.)	400	250 Volts
Average Cathode Current (Max.)	—	*50 Ma*
Peak Cathode Current (Max.)	—	175 Ma
Grid Circuit Resistance		
Fixed Bias (Max.)	1.0	1.0 Megohm
Cathode Bias (Max.)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Oscillator		Amplifier
Plate Voltage	250	275	175 Volts
Grid Voltage	-3.0	—	-25 Volts
Plate Current	2.0	13	46 Ma
Transconductance	2200	1600	6400 μmhos
Amplification Factor	66	—	5
Plate Resistance (Approx.)	30,000	—	780 Ohms
Grid Voltage for Ib = 20 μa	5.3	—	— Ma
Grid Voltage for Ib = 200 μa	—	—	-60 Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS (Section No. 2)

Eb = 60 V, and Ec1 = 0 V
Ib = 100 Ma

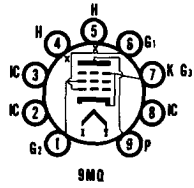
NOTES:

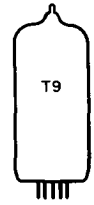
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
(2) Section No. 1 is recommended for vertical oscillator service, and Section No. 2 is recommended for vertical deflection amplifier service.
(3) In stages operating with grid leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.

AUDIO POWER AMPLIFIER — 6GM5

Beam Power Pentode

Construction 9-T9
Base .....Button 9 Pin, E9-68
Basing 9MQ
Outline 9-71
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.920 In.
Maximum Overall Height .....3.230 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	800 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)

Grid No. 1 to Plate	0.13 Pf
Input	9.0 Pf
Output	4.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	550 Volts
Grid No. 2 Voltage (Max.)	440 Volts
Plate Dissipation (Max.)	19 Watts
Grid No. 2 Dissipation (Max.)(1)	3.3 Watts
Cathode Current (Max.)	85 Ma
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.3 Megohm
Self Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Pentode Operation S.T.—Class A1 Amp.	Ultra-Linear Operation(2) Class AB1—Push-Pull	
Plate Voltage	300	400	425 Volts
Grid No. 2 Voltage	300	Note 2	Note 2 Volts
Grid No. 1 Voltage	-10	-20.5	— Volts
Cathode Resistor	—	—	185 Ohms
Peak A-F Grid Voltage	10	41	42 Volts
Zero-Signal Plate Current	60	80	88 Ma
Maximum-Signal Plate Current	75	138	104 Ma
Zero-Signal Grid No. 2 Current	8	11.5	13 Ma
Maximum Signal Grid No. 2 Current	15	26.4	17.5 Ma
Transconductance	10.2K	—	— μmhos
Plate Resistance (Approx.)	29K	—	— Ohms
Load Resistance	3K	—	— Ohms
Load Resistance (PL to PL)	—	6600	6600 Ohms
Power Output	11	32	26 Watts
Total Harmonic Distortion	13	1.0	2 Percent

Pentode Operation (Class AB1 Push-Pull Amp)

Plate Voltage	300	350	400	450	450	450 Volts
Grid No. 2 Voltage	300	350	350	350	400	400 Volts
Grid No. 1 Voltage	-12.5	-15.5	-16	-16.5	-21	— Volts
Cathode Resistor	—	—	—	—	—	200 Ohms
Peak A-F Grid Voltage	25	31	32	33	42	28 Volts
Zero-Signal Plate Current	86	92	85	77	66	82 Ma
Maximum-Signal Plate Current	116	130	143	153	144	94 Ma
Zero-Signal Grid No. 2 Current	12.6	13	11	9.6	9.4	11.5 Ma
Maximum-Signal Grid No. 2 Current	26	28.6	27	27	30	22 Ma
Load Resistance (PL to PL)	6600	6600	6600	6600	6600	9000 Ohms
Power Output	23	30	37	43	45	28 Watts
Total Harmonic Distortion	2.5	2	1.5	1.5	1.5	2 Percent

NOTES:

(1) Grid No. 2 dissipation may be permitted to reach 6 watts during the periods of maximum input of speech and music signals.
(2) Grid No. 2 tapped at 40% of the primary winding.

6GM6

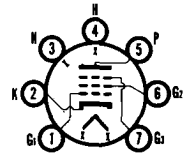
4GM6, 5GM6

Color Television Type

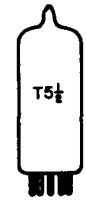
IF AMPLIFIER

Semi-Remote Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CM
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7CM



ELECTRICAL DATA

HEATER OPERATION

	4GM6	5GM6	6GM6
Heater Voltage	4.2	5.6	6.3 Volts
Heater Current	600	450	400 Ma
Heater Warm-up Time	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

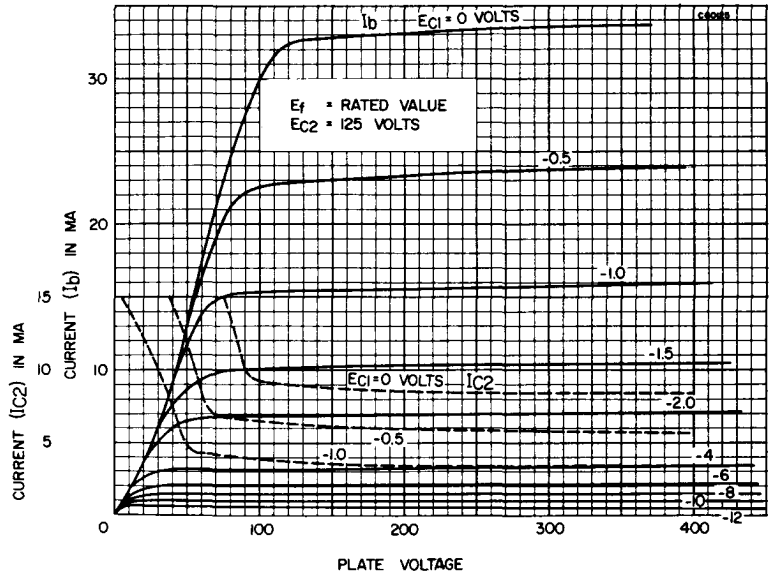
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid No. 1 to Plate (Max.) ..... 0.036 Pf
Input: g1 to (h + k + g2 + g3 + IS) ..... 10.0 Pf
Output: p to (h + k + g2 + g3 + IS) ..... 2.4 Pf

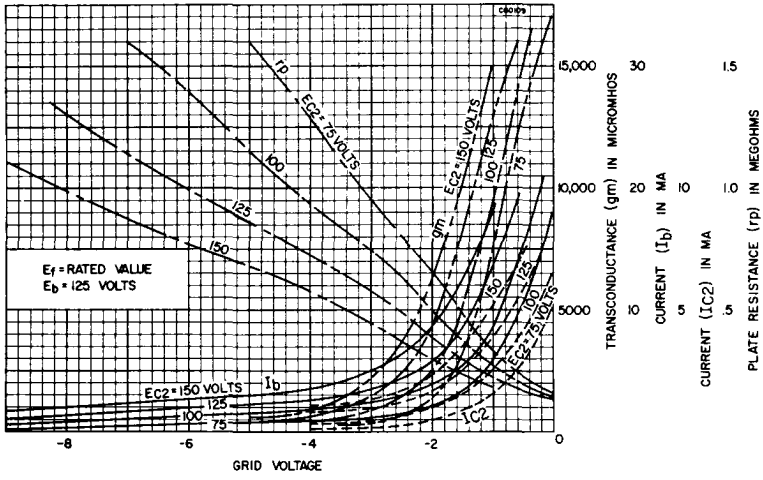
RATINGS (Design Maximum Rating System)

Plate Voltage (Max.) ..... 330 Volts
Grid No. 2 Supply Voltage (Max.) ..... 330 Volts
Grid No. 2 Voltage .....See Rating Chart (Gen. Info. Sec.)
Positive Grid No. 1 Voltage (Max.) ..... 0 Volt
Plate Dissipation (Max.) ..... 3.1 Watts
Grid No. 2 Input (Max.) ..... 0.65 Watts

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	125 Volts
Grid No. 3	Tied to Cathode
Grid No. 2 Voltage	125 Volts
Cathode Bias Resistor	56 Ohms
Plate Current	14 Ma
Grid No. 2 Current	3.4 Ma
Transconductance	13,000 μmhos
Plate Resistance (Approx.)	0.2 Megohm
Ec1 for Gm = 60 μmhos (Approx.)	−15 Volts

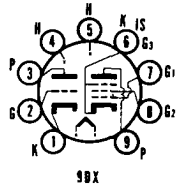
SYNC SEP. or VOLTAGE AMP. (T) VIDEO AMPLIFIER (P)

6GN8

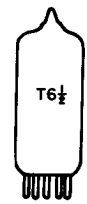
8GN8, 10GN8

High Mu Triode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9DX
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



9BX



ELECTRICAL DATA

HEATER OPERATION

	10GN8	8GN8	6GN8
Heater Voltage	10.5	8.0	6.3 Volts
Heater Current	450	600	750 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section

Grid to Plate	4.4 Pf
Input: g to (h + k)	2.4 Pf
Output: p to (h + k)	0.36 Pf

Pentode Section

Grid No. 1 to Plate (Max.)	0.1 Pf
Input: g1 to (h + k + g2 + g3 + IS)	11 Pf
Output: p to (h + k + g2 + g3 + IS)	4.2 Pf

Coupling

Triode Grid to Pentode Plate (Max.)	0.018 Pf
Pentode Grid No. 1 to Triode Plate (Max.)	0.005 Pf
Pentode Plate to Triode Plate (Max.)	0.17 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage (Max.)	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	1.0	5.0 Watts
Grid No. 2 Dissipation	—	1.1 Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Cathode Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	250	200 Volts
Grid No. 2 Voltage	—	150 Volts
Grid No. 1 Voltage	−2	— Volts
Cathode Bias Resistor	—	100 Ohms
Plate Current	2	25 Ma
Grid No. 2 Current	—	5.5 Ma
Transconductance	2700	11,500 μmhos
Amplification Factor	100	—
Plate Resistance	37,000	60,000 Ohms
Ec1 for Ib = 100 μa (Approx.)	—	−10 Volts
Ec1 for Ib = 200 μa (Approx.)	−5	— Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS (Pentode Section)

Eb = 60 Volts, Ec2 = 150 Volts and Ec1 = 0 Volts
Ib = 55 Ma and Ic2 = 18 Ma.

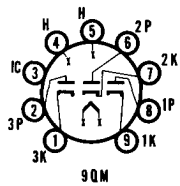
6GQ7
19GQ7

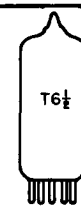
Color Television Type

AM or FM DETECTOR

Triple Diode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9QM
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	19GQ7	6GQ7
Heater Voltage	18.9	6.3 Volts
Heater Current	150	450 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)

Plate Input: p to (k + h) (Each Section)	2.05 Pf
Cathode Input: k to (p + h) (Each Section)	3.10 Pf
1p to 2p	0.47 Pf
1p to 3p	0.47 Pf
2p to 3p	0.05 Pf

RATINGS (Design Maximum Rating System) (Each Section)

Peak Inverse Plate Voltage (Max.)	330 Volts
AC Plate Voltage (RMS) (Max.)	117 Volts
Peak Plate Current (Max.)	54 Ma
DC Output Current (Max.)	9 Ma
Total Effective Supply Impedance (Min.)	300 Ohms

CHARACTERISTICS AND TYPICAL OPERATION (Each Section)
Half Wave Rectifier
Diode Current at Eb = 10 Volts DC..... 60 Ma

Color Television Type

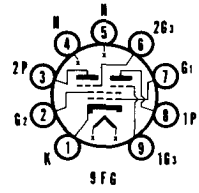
SYNC SEPARATOR/CLIPPER and AGC TUBE

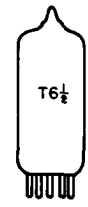
6GS8

6BU8, 3GS8/3BU8, 4GS8/4BU8

Double Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing[1] .....9LW or 9FG
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.





ELECTRICAL DATA

HEATER OPERATION

	3GS8/3BU8	4GS8/4BU8	6BU8 6GS8
Heater Voltage	3.15	4.2	6.3 Volts
Heater Current	600	450	300 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 3 to Plate (Each Section)	1.9 Pf
Grid No. 1 to All	6.0 Pf
Grid No. 3 (Each Section) to All	3.6 Pf
Plate (Each Section) to All	3.0 Pf
Grid No. 3 (Section 1) to Grid No. 3 (Section 2) (Max.)	0.015 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Each Section) (Max.)	300 Volts
Grid No. 2 Voltage (Max.)	150 Volts
Positive DC Grid No. 3 Voltage (Each Section) (Max.)	3.0 Volts
Negative DC Grid No. 3 Voltage (Each Section) (Max.)	50 Volts
Peak Positive Grid No. 3 Voltage (Each Section) (Max.)	50 Volts
Negative DC Grid No. 1 Voltage (Max.)	50 Volts
Plate Dissipation (Each Section) (Max.)	1.1 Watts
Grid No. 2 Dissipation (Max.)	0.75 Watt
DC Cathode Current (Max.)	12 Ma
Grid No. 1 Circuit Resistance (Max.)	0.5 Megohm
Grid No. 3 Circuit Resistance (Each Section) (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Both Sections Operating		
Plate Voltage (Each Section)	100	100 Volts
Grid No. 2 Voltage	67.5	67.5 Volts
Grid No. 3 Voltage (Each Section)	−10	0 Volts
Grid No. 1 Voltage	Note 2	Note 2
Plate Current (Each Section)	—	2.2 Ma
Grid No. 2 Current	6.5	3.3 Ma
Cathode Current	6.6	7.8 Ma
Each Section Separately with Plate and Grid No. 3 of Opposite Section Grounded		
Plate Voltage	100	100 Volts
Grid No. 2 Voltage	67.5	67.5 Volts
Grid No. 3 Voltage	0	0 Volt
Grid No. 1 Voltage	0	Note 2
Plate Current	—	2.2 Ma
Grid No. 3 Transconductance	—	180 μmhos
Grid No. 1 Transconductance	1500	11 μmhos
Grid No. 3 Voltage (Approx.) for Ib = 100 μa	—	−4.5 Volts
Grid No. 1 Voltage (Approx.) for Ib = 100 μa	—	−2.3 Volts

NOTES:
(1) Basing 9LW has Internal Shield tied to Cathode.
Basing 9FG has Internal Shield tied to Grid No. 2.
(2) Grid Current adjusted for 100 μa DC.

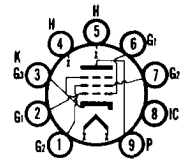
6GT5

12GT5, 17GT5

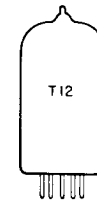
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Novar T-12
Base .....Novar Button 9 Pin, E9-76
Basing 9NZ
Outline 12-64
Maximum Diameter .....1.562 In.
Maximum Seated Height .....3.050 In.
Maximum Overall Height .....3.410 In.



9NZ



ELECTRICAL DATA

HEATER OPERATION

	17GT5	12GT5	6GT5
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	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 (Unshielded)

Grid to Plate	0.26 Pf
Input: g1 to (h + k + g2 + g3)	15 Pf
Output: p to (h + k + g2 + g3)	6.5 Pf

RATINGS (Design Maximum Rating System)
Horizontal Deflection Amplifier[1]

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Plate Voltage (Max.)	6500 Volts
Peak Negative Plate Voltage (Max.)	1500 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Negative Grid No. 1 Voltage (Max.)	−55 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Plate Dissipation (Max.)[2]	17.5 Watts
Grid No. 2 Input (Max.)	3.5 Watts
Average Cathode Current (Max.)	175 Ma
Peak Cathode Current (Max.)	550 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature (At Hottest Point) (Max.)	240 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	250 Volts
Grid No. 2 Voltage	150 Volts
Grid No. 1 Voltage	−22.5 Volts
Plate Current	70 Ma
Grid No. 2 Current	2.1 Ma
Transconductance	7100 μmhos
Amplification Factor[3]	4.4
Plate Resistance	15,000 Ohms
Ec1 for Ib = 1 Ma (Approx.)	−42 Volts

INSTANTANEOUS PLATE KNEE VALUES

Eb = 60 V, Ec2 = 150 V, and Ec1 = 0 V;
Ib = 390 Ma; and Ic2 = 32 Ma

NOTES:

(1) 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 horizontal scanning cycle.
(2) 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.
(3) Amplification factor with tube operation as a triode with 150 volts on the plate and Grid No. 2 and −22.5 volts on Grid No. 1.

HORIZONTAL DEFLECTION AMPLIFIER

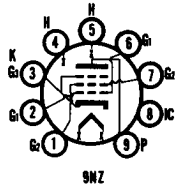
6GT5A

12GT5A, 17GT5A

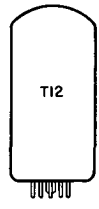
Beam Power Pentode

Construction .....Novar T-12
Base .....Novar Button 9 Pin, E9-88
(Exhaust Tip on Base)
Basing 9NZ
Outline 12-95
Maximum Diameter .....1.562 In.
Maximum Seated Height .....2.500 In.
Maximum Overall Height .....2.880 In.

The 6GT5A, 12GT5A, and 17GT5A are identical to the 6GT5, 12GT5, and 17GT5 except for base with exhaust tip at bottom and shorter bulb.



9NZ



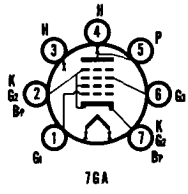
VHF AMPLIFIER

6GU5

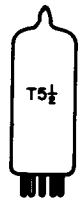
2GU5, 3GU5

Shadow Grid Beam Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7GA
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7GA



ELECTRICAL DATA

HEATER OPERATION

	2GU5	3GU5	6GU5
Heater Voltage	2.4	3.1	6.3 Volts
Heater Current	600	450	220 Ma
Heater Warm-up Time	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 (Unshielded)			
Grid No. 1 to Plate			0.018 Pf
Input: g1 to (h + k + g2 + g3 + bp)			7.0 Pf
Output: p to (h + k + g2 + g3 + bp)			3.2 Pf
RATINGS (Design Maximum Rating System)			
Plate Voltage (Max.)			300 Volts
Screen Voltage (Max.)			150 Volts
Positive DC Grid No. 1 Voltage (Max.)			0 Volt
Negative DC Grid No. 1 Voltage (Max.)			50 Volts
Plate Dissipation (Max.)			3.0 Watts
Screen Dissipation (Max.)			0.15 Watt
DC Cathode Current (Max.)			20 Ma
Grid No. 1 Circuit Resistance			
With Fixed Bias (Max.)			0.5 Megohm
CHARACTERISTICS AND TYPICAL OPERATION			
Plate Voltage	135		275 Volts
Screen Voltage	135		135 Volts
Grid No. 1 Voltage	–0.4		–0.4 Volt
Plate Resistance (Approx.)	0.67		0.165 Megohm
Transconductance	15,000		15,500 μmhos
Plate Current	9.0		10 Ma
Screen Current	0.25		0.17 Ma
Noise Figure			
Measured at 200 Hz	5.9		5.7 *Decibels*
Grid No. 1 Voltage (Approx.)			
Gm = 100 μmhos	–6.2		–6.5 Volts

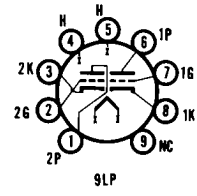
6GU7
8GU7

Color Television Type

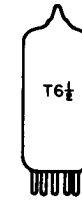
VERTICAL/HORIZONTAL OSC. or CHROMA AMPLIFIER

Medium Mu Twin Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9LP
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9LP



ELECTRICAL DATA

HEATER OPERATION

	8GU7	6GU7
Heater Voltage	8.4	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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 (Unshielded)

	Section No. 1	Section No. 2
Grid to Plate	3.0	3.0 Pf
Input: g to (h + k)	3.4	3.6 Pf
Output: p to (h + k)	0.44	0.34 Pf
Plate of Section No. 1 to Plate of Section No. 2	1.0	Pf

RATINGS (Design Maximum Rating System)

DC Plate Voltage (Max.)(1)	330 Volts
Positive Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)(2)	3 Watts
Grid Circuit Resistance	
Fixed Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	250 Volts
Grid No. 1 Voltage	−10.5 Volts
Plate Current	11.5 Ma
Transconductance	3100 μmhos
Amplification Factor	17
Plate Resistance (Approx.)	5500 Ohms
Grid Voltage for Ib = 50 μa (Approx.)	−23 Volts
Plate Current at Ec = −14 Vdc	4 Ma

NOTES:

(1) 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 horizontal scanning cycle.

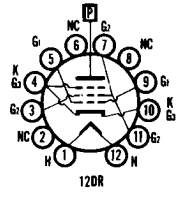
(2) In stages operating with grid leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.

6GV5
17GV5

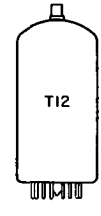
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Top Cap C1-3
Basing 12DR
Outline 12-79
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.625 In.



12DR



ELECTRICAL DATA

HEATER OPERATION

	17GV5	6GV5
Heater Voltage	16.8	6.3 Volts
Heater Current	450	1200 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate	0.6 Pf
Input	16 Pf
Output	7 Pf

RATINGS (Design Maximum Rating System)
Horizontal Deflection Amplifier[1]

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Pulse Plate Voltage	6500 Volts
Peak Negative Pulse Plate Voltage	1500 Volts
Plate Dissipation (Max.)[2]	17.5 Watts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Grid No. 2 Dissipation (Max.)	3.5 Watts
Average Cathode Current (Max.)	175 Ma
Peak Cathode Current (Max.)	550 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature (At Hottest Point) (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	5000	250 Volts
Grid No. 2 Voltage	150	150 Volts
Grid No. 1 Voltage	—	-22.5 Volts
Plate Current	—	65 Ma
Grid No. 2 Current	—	1.8 Ma
Transconductance	—	7300 μmhos
Plate Resistance	—	18,000 Ohms
Amplification Factor[3]	—	4.4
Ec1 for Ib = 1.0 Ma (Approx.)	-100	-42 Volts

INSTANTANEOUS PLATE KNEE VALUES

Eb = 60 V; Ec2 = 150 V and Ec1 = 0
Ib = 345 Ma, and Ic2 = 27 Ma

NOTES:

(1) 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 horizontal scanning cycle.
(2) 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.
(3) Amplification factor with tube operating as a triode with 150 volts on the plate and Grid No. 2 and -22.5 volts on Grid No. 1.

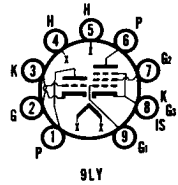
VERTICAL DEFLECTION AMPLIFIER

6GV8

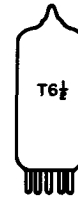
9GV8, 18GV8

Triode and Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9LY
Outline	
Maximum Diameter	0.875 In.
Maximum Seated Height	2.812 In.
Maximum Overall Height	3.062 In.



9LY



ELECTRICAL DATA

HEATER OPERATION

	18GV8	9GV8	6GV8
Heater Voltage	18	9.5	6.3 Volts
Heater Current	300	600	900 Ma
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			200 Volts
Heater Positive with Respect to Cathode			220 Volts

RATINGS (Absolute Maximum Rating System)

Pentode Section

Plate Voltage, Cut-off Condition (Max.)	550 Volts
Plate Voltage (Max.)	250 Volts
Peak Plate Voltage (Max.)(1)	2000 Volts
Plate Dissipation (Max.)	7 Watts
Screen Grid Voltage, Cut-off Condition (Max.)	550 Volts
Screen Grid Voltage (Max.)	250 Volts
Screen Grid Dissipation (Max.)	2 Watts
Cathode Current (Max.)	75 Ma
Series Grid Resistor (Fixed Bias) (Max.)	1 Megohm
Series Grid Resistor (Automatic Bias) (Max.)	2.2 Megohms
Heater-Cathode Resistance (Max.)	20,000 Ohms

Triode Section

Plate Supply Voltage (Max.)	550 Volts
Plate Voltage (Max.)	250 Volts
Plate Dissipation (Max.)	0.5 Watt
Cathode Current (Max.)	15 Ma
Peak Cathode Current (Max.)(2)	200 Ma
Series Grid Resistor (Fixed Bias) (Max.)	1 Megohm
Series Grid Resistor (Automatic Bias) (Max.)	3.3 Megohm
Heater-Cathode Resistance (Max.)	20,000 Ohms

CHARACTERISTICS AND TYPICAL OPERATION

Pentode Section

Plate Voltage	170 Volts
Screen Grid Voltage	170 Volts
Plate Current	41 Ma
Screen Grid Current	2.7 Ma
Negative Control Grid Voltage	15 Volts
Transconductance	7500 μmhos
Amplification Factor—Grid No. 1 to Grid No. 2	7
Internal Plate Resistance	25,000 Ohms

Pentode Section
Knee Current of Average Tube

Plate Voltage	50	65 Volts
Screen Grid Voltage	170	210 Volts
Plate Current	200	240 Ma
Screen Grid Current	40	50 Ma
Negative Control Grid Voltage	1	1 Volt

Triode Section

Plate Voltage	100 Volts
Plate Current	5 Ma
Negative Grid Voltage	0.8 Volt
Transconductance	6500 μmhos
Amplification Factor	50
Internal Plate Resistance	7600 Ohms

Pentode Section(3)

Plate Voltage at End of the Scan (Min.)	55(4)	55(4)	75(5) Volts
Screen Grid Voltage	170	200	210 Volts
Negative Control Grid Voltage at End of the Scan(3)	6	9.5	11 Volts
Peak Plate Current	135	135	125 Ma
Nominal Screen Grid Dissipation	1.1	1.4	1.35 Watts

NOTES:

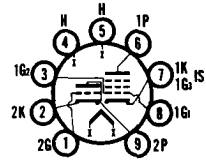
(1) Maximum pulse duration 5% of a cycle with a maximum of 1 Msec.
(2) Maximum pulse duration 200 μsec. If a larger flyback is required Peak Cathode Current = 100 Ma with a maximum pulse duration of 400 μsec.
(3) If the vertical sweep circuit is designed so that full deflection is obtained at the nominal line voltage, and Eb minimum, Ec2 and Ib have their specified values, full deflection can still be obtained, with an end of life tube at the lower limit of the spread in characteristics, provided Ec1 at the end of the scan is -1V. This even holds for a line voltage that is 10% below its nominal value.
(4) Non-stabilized circuits.
(5) Stabilized circuits.
(6) For an average tube.

AF VOLTAGE AMPLIFIER and AUDIO POWER AMPLIFIER

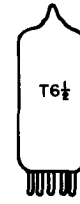
6GW8/ECL86

Triode and Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9LZ
Outline 6-4
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.812 In.
Maximum Overall Height .....3.062 In.



9LZ



ELECTRICAL DATA

HEATER OPERATION	
Heater Voltage	6.3 Volts
Heater Current	700 Ma
Maximum Heater-Cathode Voltage	100 Volts
DIRECT INTERELECTRODE CAPACITANCES	
Pentode Section	
Control Grid to All Other Elements except Plate	10 Pf
Plate to All Other Elements except Control Grid	9.5 Pf
Plate to Control Grid (Max.)	0.5 Pf
Control Grid to Heater (Max.)	0.2 Pf
Triode Section	
Grid to All Other Elements except Plate	2 Pf
Plate to All Other Elements except Control Grid	1.8 Pf
Plate to Grid	1.6 Pf
Grid to Heater (Max.)	0.04 Pf
Coupling	
Plate of Triode to Control Grid of Pentode (Max.)	0.2 Pf
Grid of Triode to Plate of Pentode (Max.)	0.02 Pf
Grid of Triode to Control Grid of Pentode (Max.)	0.02 Pf
Plate of Triode to Plate of Pentode (Max.)	0.2 Pf
RATINGS (Design Center Rating System)	
Pentode Section	
Plate Voltage (Zero Plate Current) (Max.)	550 Volts
Plate Voltage (Max.)	300 Volts
Screen Grid Voltage (Zero Grid Current) (Max.)	550 Volts
Screen Grid Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	9 Watts
Screen Grid Dissipation (Max.)	1.5 Watts
Peak Screen Grid Dissipation (Max.)	3 Watts
Cathode Current (Max.)	55 Ma
External Resistance Between Control Grid and Ground (Self Bias) (Max.)	1 Megohm
Negative Control Grid Voltage (Control Grid Current = 0.3 μa) (Max.)	1.3 Volts
Cathode-Heater Resistance (Max.)	20,000 Ohms
Triode Section	
Plate Voltage (Zero Plate Current) (Max.)	550 Volts
Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	0.5 Watts
Cathode Current (Max.)	8 Ma
External Resistance Between Grid and Ground (Self Bias) (Max.)	2 Megohms
External Resistance Between Grid and Ground (Grid Leak Bias) (Max.)	10 Megohms
Negative Grid Voltage (Grid Current = 0.3 μa) (Max.)	1.3 Volts
Cathode-Heater Resistance (Max.)	20,000 Ohms
Cathode-Heater Resistance (Max.) (In Phase Splitting Circuits) (Max.)	120,000 Ohms
CHARACTERISTICS AND TYPICAL OPERATION	
Triode Section	
Plate Voltage	250 Volts
Negative Grid Voltage	1.7 Volts
Plate Current	1.2 Ma
Transconductance	1600 μmhos
Amplification Factor	100
Pentode Section	
Plate Voltage	250 Volts
Screen Grid Voltage	250 Volts
Negative Control Grid Voltage	7 Volts
Plate Current	36 Ma

Screen Grid Current	5.5 Ma
Transconductance	10,000 μmhos
Internal Plate Resistance	45,000 Ohms
Amplification Factor—Grid No. 1 to Grid No. 2	21

6GX7

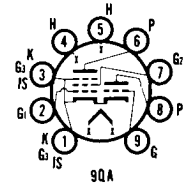
4GX7, 5GX7, 8GX7

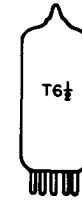
Color Television Type

VHF OSCILLATOR and MIXER

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9QA
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	4GX7	5GX7	8GX7	6GX7
Heater Voltage	4.2	5.6	7.7	6.3 Volts
Heater Current	600	450	300	400 Ma
Heater Warm-up Time	11	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 (Shielded)(1)

Triode Section	
Grid to Plate	1.2 Pf
Input: g1 to (k + Pg3 + IS + h)	2.3 Pf
Output: p to (k + Pg3 + IS + h)	1.9 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.005 Pf
Input: g1 to (k + g3 + IS + g2 + h)	5.4 Pf
Output: p to (k + g3 + IS + g2 + h)	3.3 Pf
Grid No. 1 to Grid No. 2	1.6 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	275	275 Volts
Grid No. 2 Supply Voltage (Max.)	—	275 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Cathode Current (Max.)	20	20 Ma
Plate Dissipation (Max.)	1.5	2.2 Watts
Grid No. 2 Dissipation (Max.)	—	0.45 Watt
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Maximum Grid No. 1 Circuit Resistance		
Self Bias (Max.)	1.0	0.5 Megohm
Fixed Bias (Max.)	0.5	0.25 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 A1 Amplifier

	Triode Section		Pentode Section	
Plate Voltage	100	125	120	125 Volts
Grid No. 2 Voltage	—	—	90	125 Volts
Grid No. 1 Voltage	—	-1.0	—	-1.0 Volt
Cathode Bias Resistor	0.1	—	0.1	— Megohm
Plate Current	12.5	13	8.5	8 Ma
Grid No. 2 Current	—	—	2.8	2.5 Ma
Transconductance	8700	8500	13,000	11,000 μmhos
Amplification Factor	—	40	—	—
Plate Resistance (Approx.)	—	4700	—	200,000 Ohms
Ec1 for Ib = 20 μa (Approx.)	-6.0	—	-2.5	— Volts

NOTE:

(1) Shield connected to cathode.

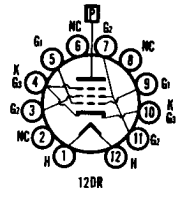
HORIZONTAL DEFLECTION AMPLIFIER

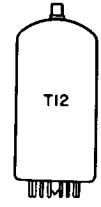
6GY5

16GY5, 21GY5

Beam Power Pentode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Top Cap C1-3
Basing 12DR
Outline 12-79
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.625 In.





ELECTRICAL DATA

HEATER OPERATION

	21GY5	16GY5	6GY5
Heater Voltage	21	15.8	6.3 Volts
Heater Current	450	600	1500 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate	0.7 Pf
Input: g1 to (h + k + g3)	22 Pf
Output: p to (h + k + g2 + g3)	9 Pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier[1]

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Pulse Plate Voltage	6500 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
Plate Dissipation (Max.)[2]	18 Watts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Grid No. 2 Dissipation (Max.)	3.5 Watts
Average Cathode Current (Max.)	230 Ma
Peak Cathode Current (Max.)	800 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature (At Hottest Point) (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	5000	130 Volts
Grid No. 2 Voltage	130	130 Volts
Grid No. 1 Voltage	—	-20 Volts
Plate Current	—	50 Ma
Grid No. 2 Current	—	1.75 Ma
Transconductance	—	9100 μmhos
Plate Resistance	—	11,000 Ohms
Amplification Factor[3]	—	4.7
Ec1 for Ib = 1.0 Ma (Approx.)	-66	-33 Volts

INSTANTANEOUS PLATE KNEE VALUES

Eb = 60 V; Ec2 = 130 V and Ec1 = 0
Ib = 410 Ma; and Ic2 = 26 Ma

NOTES:

(1) 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 horizontal scanning cycle.
(2) 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.
(3) Amplification factor with tube operating as a triode with 130 volts on the plate and Grid No. 2 and -20 volts on Grid No. 1.

6GY6/6GX6

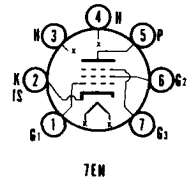
5GX6

Color Television Type

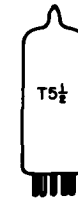
GATED AGC AMP. and NOISE INVERTER or FM DETECTOR

Sharp Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7EN
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7EN



ELECTRICAL DATA

HEATER OPERATION

	5GX6	6GY6/6GX6
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate	0.026 Pf
Grid No. 3 to Plate	1.6 Pf
Input: g1 to (k & IS + g3 + g2 + h)	8 Pf
Input: g3 to (k & IS + p + g2 + g1 + h)	6.5 Pf
Grid No. 1 to Grid No. 2	0.12 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	300 Volts
Peak Positive Pulse Plate Voltage (Max.)(1)	600 Volts
Positive Grid No. 3 Voltage (Max.)	0 Volt
Negative Grid No. 3 Voltage (Max.)	100 Volts
Grid No. 2 Supply Voltage (Max.)	300 Volts
Positive Grid No. 1 Voltage (Max.)	0 Volt
Negative Grid No. 1 Voltage (Max.)	50 Volts
Plate Dissipation (Max.)	1.7 Watts
Grid No. 2 Input	
For Grid No. 2 Voltage to 150 Volts (Max.)	1.0 Watt
For Grid No. 2 Voltages Between 150 to 300 Volts	See Rating Chart (Gen. Info. Sec.)
Grid No. 3 Circuit Resistance (Max.)	0.68 Megohm
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.22 Megohm
Self Bias (Max.)	0.47 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	150 Volts
Grid No. 3 Voltage	0 Volt
Grid No. 2 Voltage	100 Volts
Cathode Resistor	180 Ohms
Plate Current	3.7 Ma
Grid No. 2 Current	3 Ma
Transconductance (G1 to P)	3700 μmhos
Transconductance (G3 to P)	750 μmhos
Plate Resistance	140,000 Ohms
Ec1 for Ib = 20 μa (Approx.)	-4.5 Volts
Ec3 for Ib = 20 μa (Approx.)	-7 Volts

NOTE:

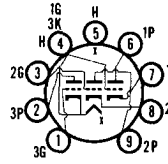
(1) The duration of the pulse must not exceed 15% of one horizontal scanning cycle. In a 525-line, 30-frame system, 15% of one horizontal scanning cycle is 10 μsec.

RF AMPLIFIER; AUTODYNE MIXER and AFC in FM RECEIVERS

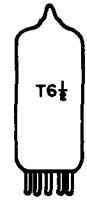
6GY8

Triple Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9MB
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9MB



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	100 Volts
Heater Positive with Respect to Cathode	100 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Section 1(1)		Section 2(1)		Section 3(1)	
	Unsh.	Sh.	Unsh.	Sh.	Unsh.	Sh.
Grid to Plate	1.6	1.5	1.4	1.4	1.5	1.5 Pf
Input	5.0	5.0	2.4	2.6	2.2	2.4 Pf
Output	1.6	2.4	0.4	1.4	0.2	1.0 Pf
Heater to Cathode	5.0	5.0	2.8	2.8	—	— Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	330 Volts
Plate Dissipation (Each Plate) (Max.)	2.0 Watts
Plate Dissipation (Plates 1, 2, and 3) (Max.)	5.0 Watts
Positive Grid Voltage (Max.)	0 Volt

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

	Section 1(1)	Section 2 & 3(1)
Plate Voltage	125	125 Volts
Grid Voltage	—	-1.0 Volts
Cathode Resistor	220	— Ohms
Plate Current	4.5	4.5 Ma
Plate Resistance	14,000	14,000 Ohms
Transconductance	4500	4500 μmhos
Amplification Factor	63	63
Ec for Ib = 20 μa (Approx.)	—	-4 Volts

NOTE:

(1) Section 1 connects to pins 4, 6, and 7. Section 2 connects to pins 3, 8, and 9. Section 3 connects to pins 1, 2, and 4.

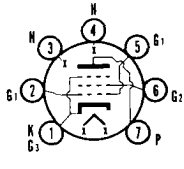
AUDIO POWER AMPLIFIER

6GZ5

4GZ5

Power Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CV
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7CV



ELECTRICAL DATA

HEATER OPERATION

	4GZ5	6GZ5
Heater Voltage	4.0	6.3 Volts
Heater Current	600	380 Ma
Heater Warm-up Time	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 (Unshielded)	
Grid No. 1 to Plate	0.24 Pf
Input: g1 to (h + k + g2)	8.5 Pf
Output: p to (h + k + g2)	3.8 Pf
RATINGS (Design Maximum Rating System)	
Plate Voltage (Max.)	300 Volts
Grid No. 2 Voltage (Max.)	300 Volts
Positive DC Grid No. 1 Voltage (Max.)	0 Volts
Plate Dissipation (Max.)	4.8 Watts
Grid No. 2 Dissipation—Continuous (Max.)	1.1 Watts
Cathode Current—Average (Max.)	30 Ma
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.5 Megohm
Cathode Bias (Max.)	1.0 Megohm
Bulb Temperature (Max.)	200 °C

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Audio Amplifier

Plate Supply Voltage	250	250 Volts
Grid No. 2 Supply Voltage	250	250 Volts
Cathode Resistor	270	270 Ohms
Peak Audio Grid No. 1 Voltage	9.8	2.0 Volts
Zero Signal Plate Current	16	16 Ma
Maximum Signal Plate Current	16	16 Ma
Zero Signal Grid No. 2 Current	2.7	2.7 Ma
Maximum Signal Grid No. 2 Current	5.0	5.0 Ma
Transconductance	—	8400 μmhos
Plate Resistance (Approx.)	—	0.15 Megohm
Load Resistance	15,000	15,000 Ohms
Total Harmonic Distortion	10	10 Percent
Power Output	1.8	1.1 Watts

6HA5/6HM5

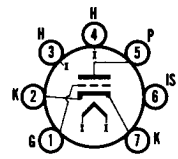
4HA5/PC900, 4HM5, 3HA5/3HM5, 2HA5, 2HM5

Color Television Type

VHF AMPLIFIER

Shielded Triode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7GM
Outline 5-1
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.500 In.
Maximum Overall Height .....1.750 In.



7GM



ELECTRICAL DATA

HEATER OPERATION

	2HA5 2HM5	3HA5/ 3HM5	4HA5/PC900 4HM5	6HA5/ 6HM5
Heater Voltage	2.4	2.9	4.0	6.3 Volts
Heater Current	600	450	300	185 Ma
Heater Warm-up Time	11	11	11	— Seconds

Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
Total DC and Peak	100 Volts
Heater Positive with Respect to Cathode	
Total DC and Peak	100 Volts
DIRECT INTERELECTRODE CAPACITANCES (Shielded)(1)	
Output	3.0 Pf
Input	4.5 Pf
Plate to Grid	0.34 Pf
Cathode to Heater	2.5 Pf
RATINGS (Design Maximum Rating System)	
Plate Voltage (Max.)	200 Volts
Grid Voltage (Max.)	-50 Volts
Cathode Current (Max.)	20 Ma
Plate Dissipation (Max.)	2.6 Watts
Grid Circuit Resistance	1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	120	135 Volts
Grid Voltage	0	−1 Volt
Plate Current	15.0	12.5 Ma
Transconductance	18,000	14,500 μmhos
Amplification Factor	82	78
Grid Cutoff Bias		
GM = 150 μmhos	−5.1	−5.7 Volts
GM = 1500 μmhos	—	−2.7 Volts
Grid Resistance	0.1	0 Megohm
Hot Input Resistance(2)	—	1000 Ohms
Hot Input Capacitance(2)	—	8.5 Pf
Noise Figure(3)	4.0	4.2 db

NOTES:
(1) With JEDEC Shield No. 316 connected to Pin No. 2.
(2) Measured at 200 MHz with plate at signal ground Ec1 = −1.5 volts.
(3) In a 200 MHz noise matched, optimized, neutralized grounded cathode, triode amplifier stage.

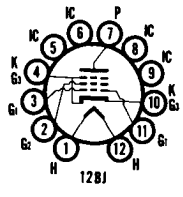
HORIZONTAL DEFLECTION AMPLIFIER

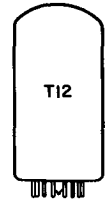
6HB5

21HB5

Beam Power Pentode

Construction	*Compactron T-12*
Base	Button 12 Pin, E12-74
Basing	12BJ
Outline	12-58
Maximum Diameter	1.563 In.
Maximum Seated Height	3.000 In.
Maximum Overall Height	3.375 In.





ELECTRICAL DATA

HEATER OPERATION

	21HB5	6HB5
Heater Voltage	21	6.3 Volts
Heater Current	450	1500 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate: (g1 to p)	0.4 Pf
Input: g1 to (h + k + g2 + bp)	22 Pf
Output: p to (h + k + g2 + bp)	9.0 Pf

RATINGS (Design Maximum Rating System)
Horizontal-Deflection Amplifier Service(1)

DC Plate-Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Pulse Plate Voltage (Max.)	6000 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
Screen Voltage (Max.)	220 Volts
Negative DC Grid No. 1 Voltage (Max.)	55 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Plate Dissipation (Max.)(2)	18 Watts
Screen Dissipation (Max.)	3.5 Watts
DC Cathode Current (Max.)	230 Ma
Peak Cathode Current (Max.)	800 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature at Hottest Point (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	5000	60	130 Volts
Screen Voltage	130	130	130 Volts
Grid No. 1 Voltage	—	0(3)	−20 Volts
Plate Resistance (Approx.)	—	—	11,000 Ohms
Transconductance	—	—	9100 μmhos
Plate Current	—	410	50 Ma

Screen Current	—	24	1.75 Ma
Grid No. 1 Voltage (Approx.)			
Ib = 1.0 Ma	-66	—	-33 Volts
Triode Amplification Factor(4)	—	—	4.7

NOTES:

(1) 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 horizontal scanning cycle.
(2) 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.
(3) Applied for short interval (two seconds maximum) so as not to damage tube.
(4) Triode connection (screen tied to plate) with Eb = Ec2 = 130 volts and Ec1 = -20 volts.

6HB6

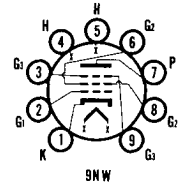
15HB6

Color Television Type

VERTICAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9NW
Outline 6-4
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.812 In.
Maximum Overall Height .....3.062 In.





ELECTRICAL DATA

HEATER OPERATION

	15HB6	6HB6
Heater Voltage	14.7	6.3 Volts
Heater Current	300	760 Ma
Heater Warm-up Time	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

Grid No. 1 to Plate	0.18 Pf
Input	13 Pf
Output	8 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	350 Volts
Peak Positive Plate Voltage (Max.)	2500 Volts
Grid No. 2 Voltage (Max.)	300 Volts
Grid No. 1 Voltage (Max.)	-100 Volts
Plate Dissipation (Max.)	10 Watts
Grid No. 2 Dissipation (Max.)	2 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	1.0 Megohm
Cathode Bias (Max.)	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	250	250 Volts
Grid No. 2 Voltage	125	250 Volts
Plate Current	40	40 Ma
Grid No. 2 Current	4.2	6.2 Ma
Cathode Resistor	3.3	100 Ohms
Amplification Factor (G1 to G2)	—	33
Transconductance	24,000	20,000 μmhos
Plate Resistance	28,000	24,000 Ohms
G1 Voltage for Ib = 100 μa	-6.4	-13 Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS

Eb = 60 Volts; Ec2 = 250 Volts; Ec1 = 0 Volt;
Ib = 150 Ma; Ic2 = 37 Ma

Color Television Type

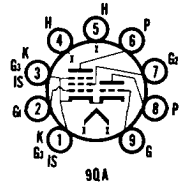
VHF OSCILLATOR and MIXER

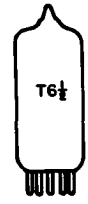
6HB7

5HB7

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9QA
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

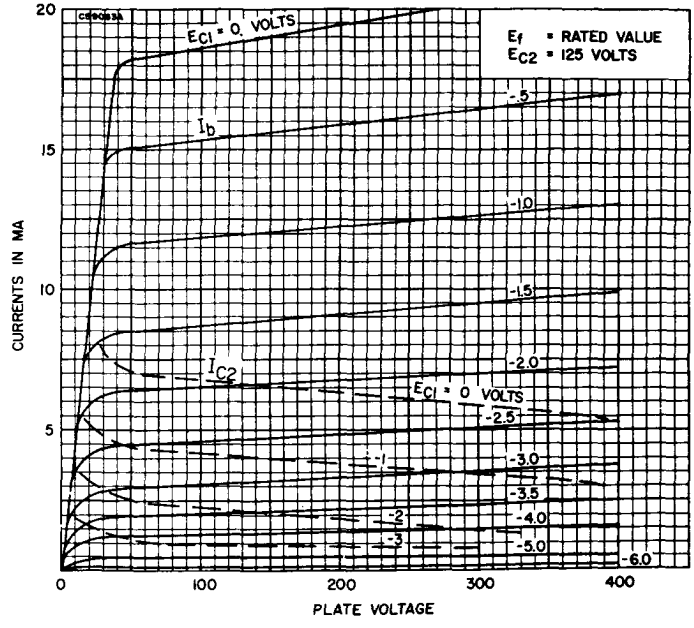
HEATER OPERATION

	5HB7	6HB7
Heater Voltage	4.7	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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

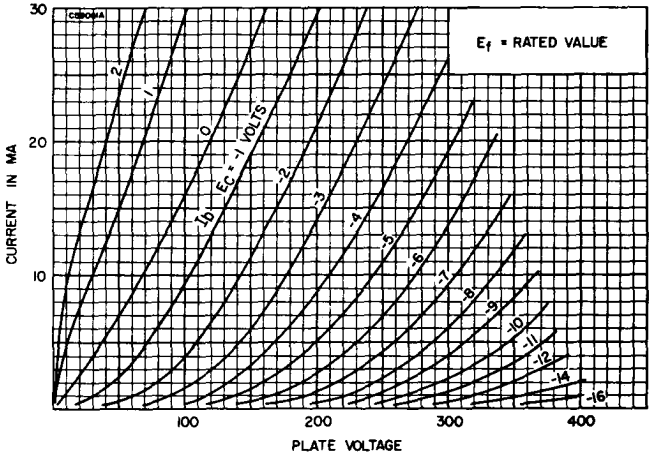
DIRECT INTERELECTRODE CAPACITANCES (Shielded)

Triode Section	
Grid to Plate	1.9 Pf
Input	3.0 Pf
Output	1.9 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.01 Pf
Input	5.0 Pf
Output	3.4 Pf

AVERAGE PLATE CHARACTERISTICS
(Pentode Section)



AVERAGE PLATE CHARACTERISTICS
(Triode Section)



RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	2.5	3.1 Watts
Grid No. 2 Dissipation (Max.)	—	0.55 Watt
Positive Grid No. 1 Voltage (Max.)	0	0 Volt

CHARACTERISTICS AND TYPICAL OPERATION

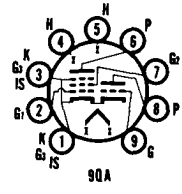
	Triode Section	Pentode Section
Class A1 Amplifier		
Plate Voltage	150	125 Volts
Grid No. 2 Voltage	—	125 Volts
Grid No. 1 Voltage	—	-1.0 Volts
Cathode Bias Resistor	56	— Ohms
Plate Current	18	12 Ma
Grid No. 2 Current	—	4 Ma
Transconductance	8500	6400 μmhos
Amplification Factor	40	—
Plate Resistance (Approx.)	5000	200,000 Ohms
Ec1 for Ib = 10 μa (Approx.)	-12	-9 Volts

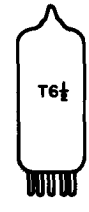
6HD7

VHF OSCILLATOR and MIXER

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9QA
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA
HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 Ma
Heater Warm-up Time	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 (Shielded)(1)

Triode:	
Grid to Plate	1.35 Pf
Input	2.45 Pf
Output	0.8 Pf
Pentode:	
Grid 1 to Plate	0.008 Pf
Input	4.6 Pf
Output	1.8 Pf
Grid 1 to Grid 2	1.3 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	275	275 Volts
Grid 2 Supply Voltage (Max.)	—	275 Volts
Grid 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	1.5	2.2 Watts
Grid 2 Dissipation (Max.)	—	0.45 Watts
Positive Grid 1 Voltage (Max.)	0	0 Volts
Negative Grid 1 Voltage (Max.)	40	40 Volts
Cathode Current (Max.)	20	20 Ma
Grid 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Cathode Resistor Bias	1.0	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Triode Unit:		
Plate Voltage	100	125 Volts
Grid Voltage	—	-1.0 Volt
Grid Circuit Resistance	0.1	— Megohm
Amplification Factor	40	—
Plate Resistance	4880	— Ohms
Transconductance	8200	9500 μmhos
Plate Current	14	19 Ma
Grid Cutoff Voltage(2)	-5.0	-6.0 Volts
Pentode Unit:		
Plate Voltage	120	125 Volts
Grid 2 Voltage	90	125 Volts
Grid 1 Voltage	—	-1.0 Volt
Grid 1 Circuit Resistance	0.1	— Megohm
Plate Resistance	70,000	— Ohms
Transconductance	8000	7000 μmhos
Plate Current	10.5	12 Ma
Grid 2 Current	3.0	3.5 Ma
Grid 1 Cutoff Voltage(2)	-2.5	-6.5 Volts

NOTES:
(1) With external shield connected to cathode.
(2) For a plate current of 20 μa.

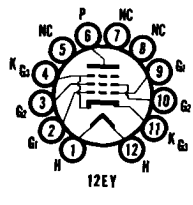
Color Television Type

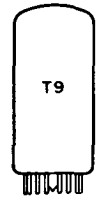
VERTICAL DEFLECTION AMPLIFIER

6HE5

Beam Power Pentode

Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12EY
Outline	9-60
Maximum Diameter	1.188 In.
Maximum Seated Height	2.500 In.
Maximum Overall Height	2.875 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	800 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)	
Grid No. 1 to Plate (Max.)	0.54 Pf
Input: g1 to (h + k + g2 + g3)	9.5 Pf
Output: p to (h + k + g2 + g3)	7.0 Pf
RATINGS (Design Maximum Rating System)	
Vertical Deflection Amplifier(1)	
Plate Voltage (Max.)	350 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)	*2500* Volts
Grid No. 2 Voltage (Max.)	300 Volts
Plate Dissipation (Max.)(2)	12 Watts
Grid No. 2 Input (Max.)(2)	2.75 Watts
Average Cathode Current (Max.)	75 Ma
Peak Cathode Current (Max.)	260 Ma
Bulb Temperature (Max.)	200 °C
Grid Circuit Resistance	
Fixed Bias (Max.)	1.0 Megohm
Cathode Bias (Max.)	2.2 Megohms
CHARACTERISTICS AND TYPICAL OPERATION	
Plate Voltage	250 Volts
Grid No. 2 Voltage	250 Volts
Grid No. 1 Voltage	−20 Volts
Plate Current	43 Ma
Grid No. 2 Current	3.5 Ma
Transconductance	4100 μmhos
Plate Resistance (Approx.)	5000 Ohms
Ec1 Voltage for Ib = 100 μa (Approx.)	−50 Volts

INSTANTANEOUS PLATE KNEE VALUES

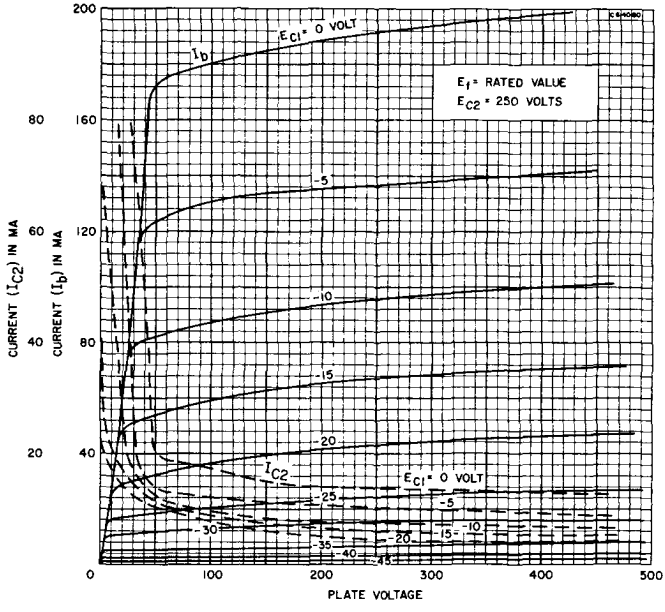
Eb = 60 V; Ec2 = 250 V; Ec1 = 0 V;
Ib = 180 Ma and Ic2 = 20 Ma

NOTES:

(1) 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 horizontal scanning cycle.

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

AVERAGE PLATE CHARACTERISTICS

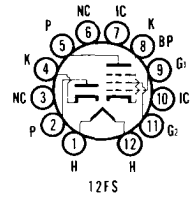


DAMPER and HORIZONTAL DEFLECTION AMPLIFIER

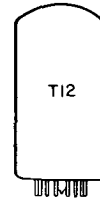
6HE7

12HE7, 33HE7, 38HE7, 58HE7

High Perveance Diode and Beam Power Pentode



12FS



Construction	Compactron T-12
Base	Button 12 Pin, E12-74
Basing	12FS
Outline	12-57
Maximum Diameter	1.562 In.
Maximum Seated Height	2.750 In.
Maximum Overall Height	3.125 In.

ELECTRICAL DATA

HEATER OPERATION

	58HE7	38HE7	33HE7	12HE7	6HE7
Heater Voltage	58	37.8	33.6	12.6	6.3 Volts
Heater Current	300	450	450	1350	2700 Ma
Heater Warm-up Time	11	11	11	—	— Seconds

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 + bp)	19 Pf
Output: p to (h + k + g2 + bp)	8.0 Pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier Service(1)	
Pentode Section	
DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	500 Volts
Peak Positive Pulse Plate Voltage (Max.)	5000 Volts
Peak Negative Pulse Plate Voltage (Max.)	0 Volt
Screen Voltage (Max.)	150 Volts
Negative DC Grid No. 1 Voltage (Max.)	55 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Plate Dissipation (Max.)(2)	10.0 Watts
Screen Dissipation (Max.)	3.5 Watts
Screen Dissipation (With Plate Dissipation Limited to 9 Watts) (Max.)	4.0 Watts
DC Cathode Current (Max.)	230 Ma
Peak Cathode Current (Max.)	800 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
TV Damper Service(1)	
Diode Section	
Peak Inverse Plate Voltage (Max.)	4200 Volts
Steady State Peak Plate Current (Max.)	1200 Ma
DC Output Current (Max.)	200 Ma
Bulb Temperature at Hottest Point (Max.)	200 °C

CHARACTERISTICS AND TYPICAL OPERATION

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 μmhos
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(3)	—	—	4.2
Diode Section			
Tube Voltage Drop			
Ib = 250 Ma DC			21 Volts

NOTES:
(1) 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 horizontal scanning cycle.
(2) 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.
(3) 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.

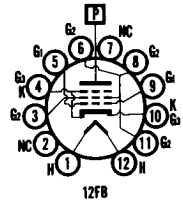
6HF5

Color Television Type

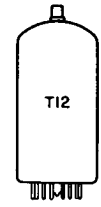
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Top Cap C1-1
Basing 12FB
Outline 12-89
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.750 In.
Maximum Overall Height .....4.125 In.



12FB



ELECTRICAL DATA

HEATER OPERATION	
Heater Voltage	6.3 Volts
Heater Current	2250 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)	
Grid to Plate	0.56 Pf
Input: g1 to (h + k + g2 + g3)	24 Pf
Output: p to (h + k + g2 + g3)	10 Pf
RATINGS (Design Maximum Rating System)	
Horizontal Deflection Amplifier(1)	
DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	990 Volts
Peak Positive Plate Voltage (Max.)	7500 Volts
Peak Negative Plate Voltage (Max.)	1100 Volts
Grid No. 2 Voltage (Max.)	190 Volts
Peak Negative Grid No. 1 Voltage (Max.)	250 Volts
Plate Dissipation (Max.)(2)	28 Watts
Grid No. 2 Input (Max.)	5.5 Watts
Average Cathode Current (Max.)	315 Ma
Peak Cathode Current (Max.)	1100 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature (at Hottest Point) (Max.)	225 °C
CHARACTERISTICS AND TYPICAL OPERATION	
Plate Voltage	175 Volts
Grid No. 2 Voltage	125 Volts
Grid No. 1 Voltage	–25 Volts
Plate Current	125 Ma
Grid No. 2 Current	4.5 Ma
Transconductance	11,300 μmhos
Amplification Factor(3)	3
Plate Resistance	5600 Ohms
Ec1 for Ib = 1 Ma (Approx.)	–54 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 70 V; Ec2 = 125 V and Ec1 = 0 V;
Ib = 570 Ma; and Ic2 = 34 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) 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.
(3) Amplification factor with tube operating as a triode with 125 volts on the plate and Grid No. 2, and –25 volts on Grid No. 1.

Color Television Type

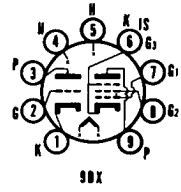
SYNC SEP. or VOLTAGE AMP. (T) VIDEO AMPLIFIER (P)

6HF8

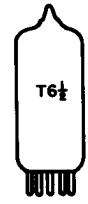
10HF8

High Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DX
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

	10HF8	6HF8
Heater Voltage	10.5	6.3 Volts
Heater Current	450	750 Ma
Heater Warm-up Time	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 (Unshielded)

Triode

Grid to Plate	3.5 Pf
Input: g to (Tk, Pk + G3 + IS, h)	2.8 Pf
Output: p to (Tk, Pk + G3 + IS, h)	2.6 Pf

Pentode

Grid No. 1 to Plate (Max.)	0.1 Pf
Input: g1 to (k + IS + g3, g2, h)	10 Pf
Output: p to (k + IS + g3, g2, h)	4.2 Pf

Coupling

Triode Grid to Pentode Plate (Max.)	0.015 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	1.0	5 Watts
Grid No. 2 Dissipation (Max.)	—	1.1 Watts
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Self Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

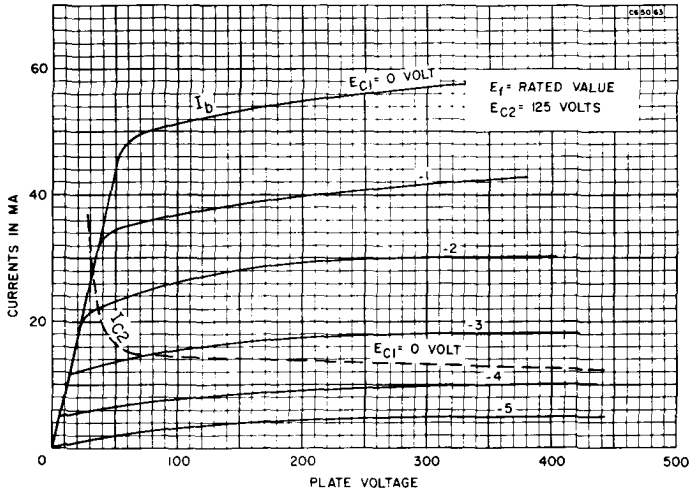
Class A1 Amplifier

	Triode Section	Pentode Section
Plate Voltage	200	200 Volts
Grid No. 2 Voltage	—	125 Volts
Grid No. 1 Voltage	-2	— Volts
Cathode Bias Resistor	—	68 Ohms
Plate Current	4	25 Ma
Grid No. 2 Current	—	7 Ma
Transconductance	4000	12,500 μmhos
Amplification Factor	70	—
Plate Resistance (Approx.)	17,500	75,000 Ohms
Ec for Ib = 20 μa (Approx.)	-6	— Volts
Ec1 for Ib = 100 μa (Approx.)	—	-9 Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS

Eb = 45 V; Ec2 = 125 V; and Ec1 = 0 V
Ib = 40 Ma (Approx.) and Ic2 = 15 Ma (Approx.)

AVERAGE PLATE CHARACTERISTICS
(Pentode Section)

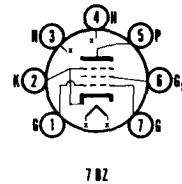


6HG5

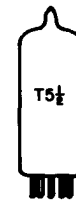
AUDIO POWER AMPLIFIER

Beam Power Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7BZ
Outline 5-3
Maximum Diameter .....0.750 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



7BZ



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 Ma
Heater Warm-up Time(1)	14 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

Grid to Plate	0.4 Pf
Input: g1 to (h + k + g2 + g3)	8.0 Pf
Output: p to (h + k + g2 + g3)	8.5 Pf

RATINGS (Design Maximum Rating System)
Class A1 Amplifier

Plate Voltage (Max.)	275 Volts
Grid No. 2 Voltage (Max.)	275 Volts
Plate Dissipation (Max.)	12 Watts
Grid No. 2 Dissipation (Max.)	2 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.5 Megohm
Bulb Temperature (At Any Point) (Max.)	250 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	180	250 Volts
Grid No. 2 Voltage	180	250 Volts
Grid No. 1 Voltage	-8.5	-12.5 Volts
Peak AF Grid No. 1 Voltage	8.5	12.5 Volts
Zero-Signal Plate Current	29	45 Ma
Maximum Signal Plate Current	30	47 Ma
Zero-Signal Grid No. 2 Current	3	4.5 Ma
Maximum Signal Grid No. 2 Current	4	7.0 Ma
Plate Resistance (Approx.)	58,000	52,000 Ohms
Transconductance	3700	4100 μmhos
Load Resistance	5500	5000 Ohms
Maximum Signal Power Output	2.0	4.5 Watts
Total Harmonic Distortion (Approx.)	8	8 Percent

NOTE:
(1) The time interval between the instant all electrode voltages are applied and the instant a current of 1 Ma flow in the plate circuit. Ef = 6.3, Eb and Ec2 = 250 V, Rk = 680 Ohms.

Color Television Type

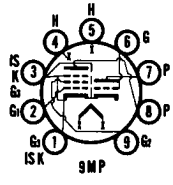
VHF OSCILLATOR and MIXER

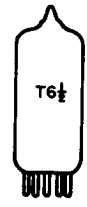
6HG8/ECF86

4HG8, 5HG8/LCF86, 7HG8/PCF86, 8HG8

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9MP
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	8HG8	7HG8/PCF86	5HG8/LCF86	4HG8	6HG8/ECF86
Heater Voltage	8.0	7.2	5.3	4.5	6.3 Volts
Heater Current	300	300	450	600	340 Ma
Heater Warm-up Time	—	—	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 (Unshielded)

Triode Section

Grid to Plate	2.0 Pf
Input: g to (h + k, Pk, Pg3, IS)	2.4 Pf
Output: p to (h + k, Pk, Pg3, IS)	1.1 Pf

Pentode Section

Grid No. 1 to Plate (Max.)	0.020 Pf
Input: g1 to (h + k, Tk, g3, IS + g2)	6.0 Pf
Output: p to (h + k, Pk, Pg3, IS + g2)	3.5 Pf
Grid No. 1 to Grid No. 2	1.7 Pf

Coupling

Triode Grid to Pentode Plate (Max.)	0.014 Pf
Pentode Grid No. 1 to Triode Plate (Max.)	0.01 Pf
Pentode Plate to Triode Plate (Max.)	0.14 Pf
Pentode Grid No. 1 to Triode Grid (Max.)	0.01 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	125	250 Volts
Grid No. 2 Supply Voltage (Max.)	—	250 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	1.9	2.2 Watts
Grid No. 2 Dissipation (Max.)	—	0.55 Watts
Cathode Current (Max.)	16.5	20 Ma

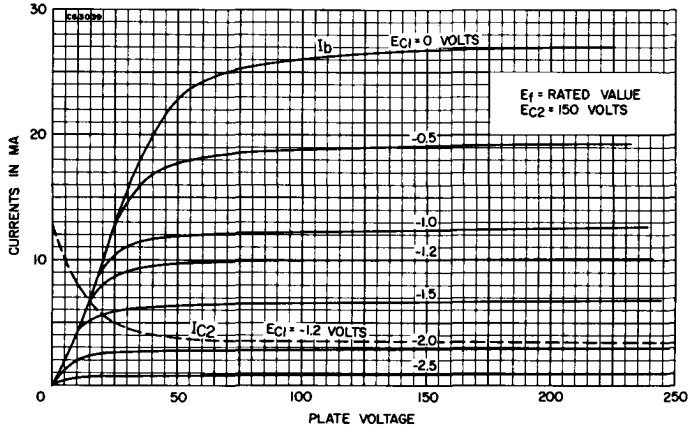
Grid No. 1 Circuit Resistance (Max.)	0.5	— Megohm
Fixed Bias (Max.)	—	0.25 Megohm
Cathode Bias (Max.)	—	0.5 Megohm

The spacing between the control grids and cathodes are of such a low order of magnitude as to preclude the use of excessive voltages between these elements in commercial tube checkers and shorts indicating devices, particularly where the tube is mechanically excited. The DC or peak AC voltage applied between each sections control grid and cathode must not exceed 30 volts for the triode or 50 volts for the triode.

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	100	170 Volts
Grid No. 2 Voltage	—	150 Volts
Grid No. 1 Voltage	-3	-1.2 Volts
Plate Current	14	10 Ma
Grid No. 2 Current	—	3.3 Ma
Transconductance	5500	12,000 μmhos
Amplification Factor (g1 to g2)	17	70
Plate Resistance	3100	350,000 Ohms

AVERAGE PLATE CHARACTERISTICS
(Pentode Section)



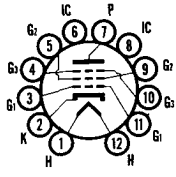
6HJ5

21HJ5, 30HJ5

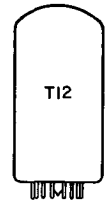
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction	Compactron T-12
Base	Button 12 Pin, E12-74
Basing	12FL
Outline	12-87
Maximum Diameter	1.563 In.
Maximum Seated Height	3.250 In.
Maximum Overall Height	3.625 In.



12FL



ELECTRICAL DATA

HEATER OPERATION

	30HJ5	21HJ5	6HJ5
Heater Voltage	30	21.5	6.3 Volts
Heater Current	450	600	2250 Ma
Heater Warm-up Time	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

RATINGS (Design Maximum Rating System)
Horizontal Deflection Amplifier(1)

Plate Voltage (boost + DC power supply) (Max.)	770 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Plate Dissipation (Max.)	24 Watts
Grid No. 2 Dissipation (Max.)	6.0 Watts
Grid No. 2 Dissipation (warm up surge) (Max.)(2)	12 Watts
Average Cathode Current (Max.)	280 Ma
Peak Cathode Current (Max.)	1000 Ma
Peak Positive Plate Voltage (Max.)	7000 Volts
Peak Negative Plate Voltage (Max.)	1500 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature (at Hottest Point) (Max.)	240 °C
DC Grid No. 3 Voltage (Max.)	70 Volts

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	20	40	60	135 Volts
Grid No. 2 Voltage	110	110	135	135 Volts
Grid No. 1 Voltage	0	0	0	−22 Volts
Grid No. 3 Voltage	—	—	—	0 Volt
Plate Current	240(3)	400(3)	540(3)	80 Ma
Grid No. 2 Current	160(3)	42(3)	48(3)	5.5 Ma
Triode Amplification Factor	—	—	—	4.2
Transconductance	—	—	—	10,000 μmhos
Plate Resistance	—	—	—	5000 Ohms
Grid No. 1 Voltage (Approx.) for Ib = 1 Ma (Ep = 4.5 KV)				−70 Volts

NOTES:
(1) For operating 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 horizontal scanning cycle.
(2) Surge not to exceed 15 seconds duration.
(3) Instantaneous Values.

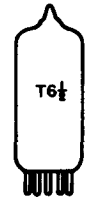
DETECTOR or DC RESTORER and IF/AGC AMPLIFIER

6HJ8

High Perveance Diode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9CY
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 Ma
Heater Warm-up Time	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 (Shielded)(1)

Pentode	
Grid to Plate (Max.)	0.015 Pf
Input: g1 to (h+k+g2+g3+IS)	7.0 Pf
Output: p to (h+k+g2+g3+IS)	3.2 Pf
Diode	
Input: p to (h + k)	2.4 Pf
Output: k to (h + p)	3.0 Pf
Coupling	
Diode Plate to Pentode Plate (Max.)	0.035 Pf
Diode Plate to Grid No. 1 (Max.)	0.005 Pf
Diode Cathode to Pentode Plate (Max.)	0.015 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Grid No. 2 Supply Voltage (Max.)	330 Volts
Plate Dissipation (Max.)	3.2 Watts
Grid No. 2 Dissipation (Max.)	0.55 Watt
Positive Grid No. 1 Voltage (Max.)	0 Volt
Grid No. 1 Circuit Resistance	
Cathode Bias (Max.)	1.0 Megohm
Fixed Bias (Max.)	0.25 Megohm
Diode Current for Continuous Operation (Max.)	5.0 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	125 Volts
Grid No. 2 Voltage	125 Volts
Grid No. 3 Voltage	0 Volts
Cathode Resistor	56 Ohms
Plate Current	11.5 Ma
Grid No. 2 Current	3.6 Ma
Transconductance	9300 μmhos
Plate Resistance (Approx.)	0.2 Megohm
Grid No. 1 Voltage for Ib = 20 μa (Approx.)	−6 Volts
Diode Plate Voltage for Diode Current of 50 Ma(2)	10 Volts

NOTES:
(1) Shield No. 315.
(2) Test condition only.

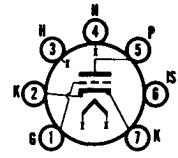
6HK5

2HK5, 3HK5, 4HK5

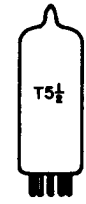
VHF AMPLIFIER

Gain Controlled Triode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7GM
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7GM



ELECTRICAL DATA

HEATER OPERATION

	2HK5	3HK5	4HK5	6HK5
Heater Voltage	2.3	2.9	4.0	6.3 Volts
Heater Current	600	450	300	190 Ma
Heater Warm-up Time	11	11	—	— Seconds

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

DIRECT INTERELECTRODE CAPACITANCES (Shielded)(1)

Grid to Plate	0.29 Pf
Input: g to (h + k + IS + E.S.)	4.4 Pf
Output: p to (h + k + IS + E.S.)	2.6 Pf
Heater to Cathode	2.5 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	200 Volts
Plate Dissipation (Max.)	2.3 Watts
DC Cathode Current (Max.)	22 Ma
Negative Grid Voltage (Max.)	50 Volts
Grid Circuit Resistance (Self Bias) (Max.)	1.0 Megohm

Control grid to cathode spacing on this type is of such low order of magnitude as to preclude the use of voltage between these elements of more than 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 A1 Amplifier

Plate Voltage	135 Volts
Grid Voltage	−1.0 Volt
Plate Current	12.5 Ma

Transconductance	15,000 μmhos
Amplification Factor	75
Plate Resistance (Approx.)	5000 Ohms
Ec for Gm = 150 μmhos (Approx.)	−5.0 Volts
Ec for Gm = 1500 μmhos (Approx.)	−2.6 Volts
Input Resistance (200 MHz)(2)	600 Ohms
Input Capacitance (200 MHz)(2)	9.0 Pf
Noise Figure (200 MHz)(3)	4.2 db

NOTES:
(1) Shield No. 316.
(2) Measured under grounded plate conditions.
(3) Optimized neutralized triode RF amplifier stage, noise matched.

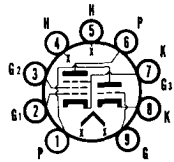
Color Television Type

SYNC SEPARATOR or VOLTAGE AMP. (T) VIDEO/IF/AGC AMPLIFIER (P)

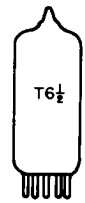
6HL8

Medium Mu Triode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9AE
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.



9AE



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	600 Ma
Heater Warm-up Time	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

	Shielded	Unshielded
Triode Section		
Grid to Plate	2.8	2.8 Pf
Input: g to (h + k + Pk, g3, IS)	3.0	2.8 Pf
Output: p to (h + k + Pk, g3, IS)	2.4	1.6 Pf
Pentode Section		
Grid No. 1 to Plate (Max.)	0.025	0.03 Pf
Input: g1 to (h + k, g3, IS + g2)	7.5	7.5 Pf
Output: p to (h + k, g3, IS + g2)	3.0	2.3 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 1 Voltage (Max.)	—	0 Volt
Plate Dissipation (Max.)	2.5	2.5 Watts
Grid No. 2 Dissipation (Max.)	—	0.55 Watt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	1.0	— Megohm
Self Bias (Max.)	1.0	— Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	125	125 Volts
Grid No. 2 Voltage	—	125 Volts
Grid No. 1 Voltage	−1.0	−1.0 Volt
Transconductance	7000	10,000 μmhos
Plate Current	12.5	12.0 Ma
Grid No. 2 Current	—	4.5 Ma
Plate Resistance (Approx.)	5000	150,000 Ohms
Amplification Factor	40	—
Ec1 for Ib = 20 μa (Approx.)	—	−7 Volts

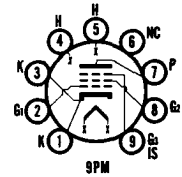
6HM6

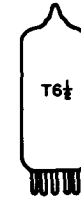
3HM6, 4HM6

IF AMPLIFIER

Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9PM
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	3HM6	4HM6	6HM6
Heater Voltage	3.15	4.2	6.3 Volts
Heater Current	600	450	300 Ma
Heater Warm-up Time	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
Total DC and Peak ..... 200 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded	Unshielded
Grid No. 1 to Plate	0.024	0.031 Pf
Input	8.70	8.70 Pf
Output	3.00	2.15 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.) ..... 250 Volts
Grid No. 2 Voltage (Supply) (Max.) ..... 250 Volts
Grid No. 2 Voltage .....See Rating Chart (Gen. Info. Sec.)
Grid No. 1 Voltage (Neg.) (Max.) ..... 50 Volts
Cathode Current (Max.) ..... 25 Ma
Plate Dissipation (Max.) ..... 2.5 Watts
Grid No. 2 Dissipation (Max.) ..... 0.6 Watt
Grid No. 1 Circuit Resistance
Cathode Bias (Max.) ..... 1 Megohm
Fixed Bias (Max.) ..... 0.25 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage ..... 125 Volts
Grid No. 3 .....(Tied to Cathode)
Grid No. 2 Voltage ..... 125 Volts
Grid No. 1 Voltage ..... −3.0 Volts
Plate Current ..... 13 Ma
Grid No. 2 Current ..... 3.2 Ma
Cathode Resistor ..... 56 Ohms
Plate Resistance ..... 156,000 Ohms
Transconductance ..... 15,000 μmhos

6HQ5

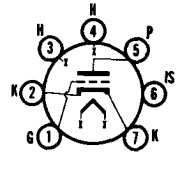
2HQ5, 3HQ5, 4HQ5

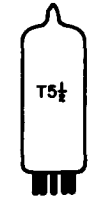
Color Television Type

VHF AMPLIFIER

Sharp Cutoff Triode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7GM
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.





ELECTRICAL DATA

HEATER OPERATION

	2HQ5	3HQ5	4HQ5	6HQ5
Heater Voltage	2.4	3.0	4.2	6.3 Volts
Heater Current	600	450	300	200 Ma
Heater Warm-up Time	11	11	11	— Seconds

Maximum Heater-Cathode Voltage
- Heater Negative with Respect to Cathode
  - Total DC and Peak ..... 100 Volts
- Heater Positive with Respect to Cathode
  - Total DC and Peak ..... 100 Volts

DIRECT INTERELECTRODE CAPACITANCES (Shielded)

Grid to Plate	0.52 Pf
Input: g to (h + k + IS + E.S.)	5.0 Pf
Output: p to (h + k + IS + E.S.)	3.5 Pf
Heater to Cathode	2.5 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	200 Volts
Plate Dissipation (Max.)	2.5 Watts
DC Cathode Current (Max.)	22 Ma
Negative Grid Voltage (Max.)	50 Volts
Grid Circuit Resistance (Self Bias) (Max.)	1.0 Megohm

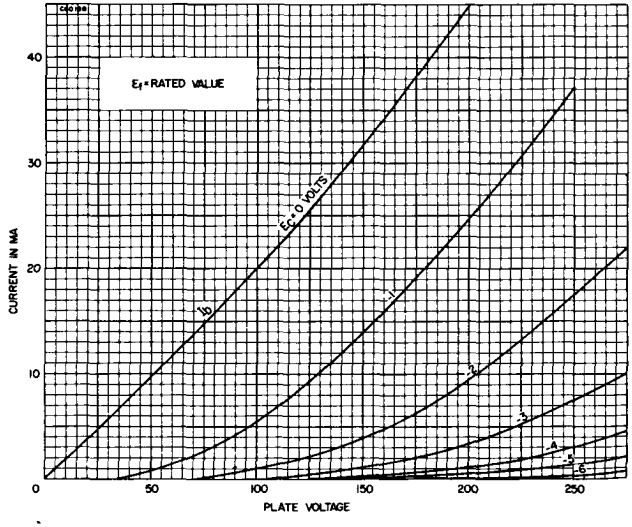
CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

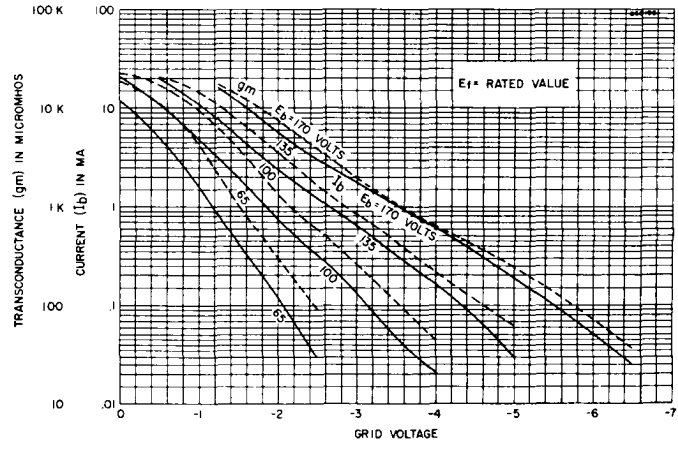
Plate Voltage	135 Volts
Grid Voltage	−1.0 Volt
Plate Current	11.5 Ma
Transconductance	15,000 μmhos
Amplification Factor	78
Plate Resistance (Approx.)	5400 Ohms
Ec for Gm = 150 μmhos (Approx.)	−4.2 Volts
Ec for Gm = 1500 μmhos (Approx.)	−2.5 Volts
Input Resistance (200 MHz)(1)	275 Ohms
Input Capacitance (200 MHz)(1)	11.2 Pf
Noise Figure (200 MHz)(2)	4.7 db

NOTES:
(1) Measured under grounded plate conditions.
(2) Optimized neutralized triode RF amplifier stage, noise matched.

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

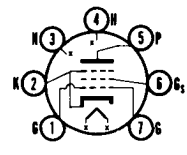


6HR5

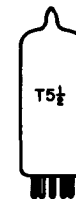
VERTICAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7BZ
Outline 5-3
Maximum Diameter .....0.750 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



7BZ



ELECTRICAL DATA

HEATER OPERATION		
Heater Voltage		6.3 Volts
Heater Current		450 Ma
Heater Warm-up Time		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 (Unshielded)		
Grid 1 to Plate		0.35 Pf
Input		8.3 Pf
Output		8.2 Pf
RATINGS (Design Maximum Rating System)		
Vertical Deflection Amplifier[3]		
Plate Voltage (Max.)		260 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.)		1500 Volts
Grid 2 Voltage (Max.)		270 Volts
Peak Negative Pulse Grid 1 Voltage (Max.)		150 Volts
Plate Dissipation (Max.)		8 Watts
Grid 2 Dissipation (Max.)		2 Watts
Cathode Current:		
Average (Max.)		35 Ma
Peak (Max.)		125 Ma
Grid 1 Circuit Resistance (Max.)		2.2 Megohms
CHARACTERISTICS AND TYPICAL OPERATION		
Plate Voltage	50	260 Volts
Grid 2 (Screen) Voltage	250	270 Volts
Grid 1 Voltage	0[1]	-19 Volts
Transconductance	—	3600 μmhos
Plate Current	105	30 Ma

Grid 2 Current	25	2.3 Ma
Grid 1 Cutoff Voltage(2)	—	−43 Volts

NOTES:
(1) Applied for short interval (maximum of 2 seconds) so as not to damage tube.
(2) For plate current of 100 μa.
(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 horizontal scanning cycle.

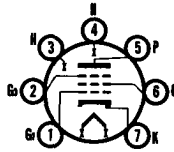
IF AMPLIFIER

6HR6

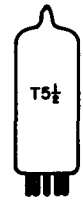
19HR6

Semi-Remote-Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7BK
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7BK



ELECTRICAL DATA

HEATER OPERATION

	19HR6	6HR6
Heater Voltage	18.9	6.3 Volts
Heater Current	150	450 Ma
Heater Warm-up Time	17	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 (Unshielded)

Grid No. 1 to Plate (Max.)	0.006 Pf
Grid No. 1 to Cathode, Grid No. 3 and Internal Shield, Grid No. 2, and Heater	8.8 Pf
Plate to Cathode, Grid No. 3 and Internal Shield, Grid No. 2, and Heater	5.2 Pf

RATINGS (Design Maximum Rating System)

Class A1 Amplifier

Plate Supply Voltage (Max.)	300 Volts
Grid No. 3 (Suppressor-Grid)	Connect to Cathode at Socket
Grid No. 2 (Screen-Grid) Supply Voltage (Max.)	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Grid No. 1 (Control-Grid) Voltage:	
Positive Bias Value (Max.)	0 Volt
Negative Bias Value (Max.)	50 Volts
Plate Dissipation (Max.)	3 Watts
Grid No. 2 Input:	
For Grid No. 2 Voltages up to 150 Volts (Max.)	1 Watt
For Grid No. 2 Voltages between 150 and 300 Volts	*See Rating Chart* (Gen. Info. Sec.)
Maximum Circuit Values:	
Grid No. 1 Circuit Resistance:	
For Fixed Bias Operation (Max.)	0.5 Megohm
For Cathode Bias Operation (Max.)	1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

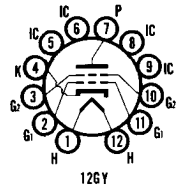
Class A1 Amplifier

Plate Supply Voltage	200 Volts
Grid No. 3	Connected to Cathode at Socket
Grid No. 2 Supply Voltage	115 Volts
Grid No. 1 Supply Voltage	0 Volt
Cathode Resistor	68 Ohms
Plate Resistance (Approx.)	0.5 Megohm
Transconductance	8500 μmhos
Plate Current	13.2 Ma
Grid No. 2 Current	4.3 Ma
Grid No. 1 Voltage (Approx.) for Transconductance = 60 μmhos	−15 Volts

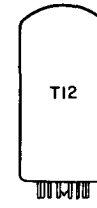
6HS5 — HIGH VOLTAGE REGULATOR

Beam Triode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Basing 12GY
Outline 12-60
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.500 In.
Maximum Overall Height .....3.875 In.



12GY



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1500 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
Total DC and Peak	450 Volts
Heater Positive with Respect to Cathode	
DC	100 Volts
Total DC and Peak	200 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid to Plate	1.6 Pf
Input: g to (h + k + bp)	24 Pf
Output: p to (h + k + bp)	6.5 Pf

RATINGS (Design Maximum Rating System)

High-Voltage Regulator Service(1)

Peak Plate Voltage	5500 Volts
Plate Dissipation	30 Watts
Peak Plate Current	325 Ma
Grid-Circuit Resistance(2)	0.1 Megohm
Bulb Temperature at Hottest Point	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Pulse Plate Voltage(3)	3500 Volts
Beam Plate Connected to Cathode at Socket	
Negative DC Grid Voltage	4.4 Volts
Peak Plate Current	300 Ma
Amplification Factor	300
Transconductance	65,000 μmhos
Plate Resistance, (Approx.)	4600 Ohms
Grid Voltage, (Approx.)	
Eb = 3500 Volts, Ib = 1.0 Ma	−13 Volts

NOTES:

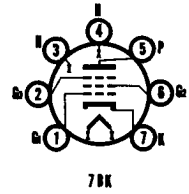
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
(2) Larger values of grid-circuit resistance may be used if provisions are made to protect the tube.
(3) Duty cycle of the pulse must be less than 2.5%.

6HS6 — IF AMPLIFIER

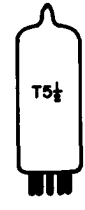
19HS6

Sharp Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7BK
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7BK



ELECTRICAL DATA

HEATER OPERATION

	19HS6	6HS6
Heater Voltage	18.9	6.3 Volts
Heater Current	150	450 Ma
Heater Warm-up Time	17	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 CAPACITANCE (Unshielded)

Grid No. 1 to Plate (Max.)	0.006 Pf
Grid No. 1 to Cathode, Grid No. 3 and Internal Shield, Grid No. 2, and Heater	8.8 Pf
Plate to Cathode, Grid No. 3 and Internal Shield, Grid No. 2, and Heater	5.2 Pf

RATINGS (Design Maximum Rating System)

Class A1 Amplifier

Plate Supply Voltage (Max.)	300 Volts
Grid No. 3 (Suppressor Grid)	Connect to Cathode at Socket
Grid No. 2 (Screen Grid) Supply Voltage (Max.)	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Grid No. 1 (Control Grid) Voltage:	
Positive Bias Value (Max.)	0 Volts
Negative Bias Value (Max.)	50 Volts
Plate Dissipation (Max.)	3 Watts
Grid No. 2 Input:	
For Grid No. 2 Voltages up to 150 Volts (Max.)	1 Watt
For Grid No. 2 Voltages Between 150 and 300 Volts	See Rating Chart (Gen. Info. Sec.)
Maximum Circuit Values:	
Grid No. 1 Circuit Resistance:	
For Fixed Bias Operation (Max.)	0.5 Megohm
For Cathode Bias Operation (Max.)	1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Supply Voltage	75	150 Volts
Grid No. 3	Connected to Cathode at Socket	
Grid No. 2 Supply Voltage	75	75 Volts
Grid No. 1 Supply Voltage	0	0 Volts
Cathode Resistor	68	68 Ohms
Amplification Factor	50	—
Plate Resistance (Approx.)	—	0.5 Megohm
Transconductance	—	9500 μmhos
Plate Current	—	8.8 Ma
Grid No. 2 Current	—	2.8 Ma
Grid No. 1 Voltage (Approx.) for Plate Current of 20 μa	—	−4 Volts

Color Television Type

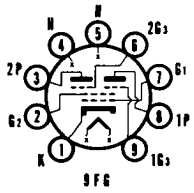
SYNC SEPARATOR/CLIPPER and AGC

6HS8

3HS8, 4HS8

Double Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9FG
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.





ELECTRICAL DATA

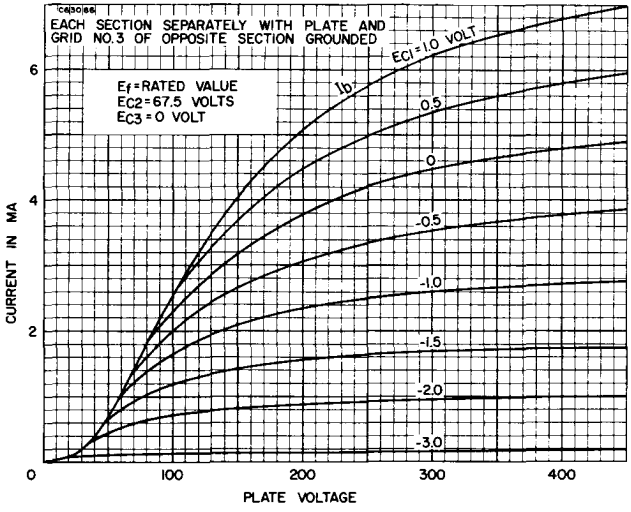
HEATER OPERATION

	3HS8	4HS8	6HS8
Heater Voltage	3.15	4.2	6.3 Volts
Heater Current	600	450	300 Ma
Heater Warm-up Time	11	11	— Seconds

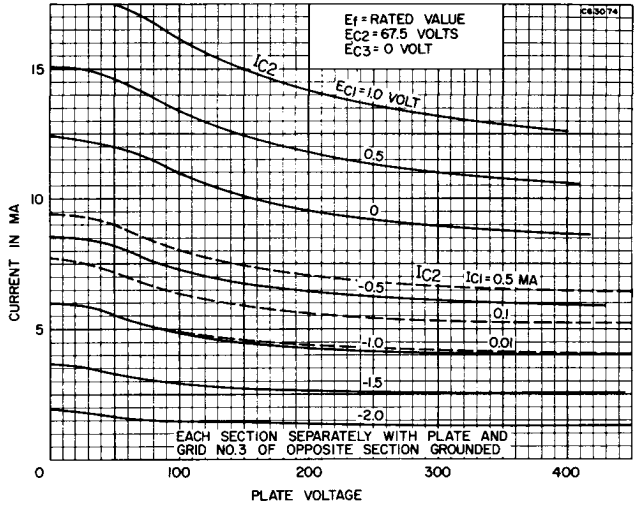
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
Total DC and Peak		200 Volts
Heater Positive with Respect to Cathode		
DC		100 Volts
Total DC and Peak		200 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)		
Grid No. 3 to Plate (Each Section)		2.0 Pf
Grid No. 1 to All		6.0 Pf
Grid No. 3 (Each Section) to All		3.6 Pf
Plate (Each Section) to All		3.0 Pf
Grid No. 3 (Section 1) to Grid No. 3 (Section 2) (Max.)		0.015 Pf
RATINGS (Design Maximum Rating System)		
Plate Voltage (Each Section) (Max.)		300 Volts
Grid No. 2 Voltage (Max.)		150 Volts
Positive DC Grid No. 3 Voltage (Each Section) (Max.)		3.0 Volts
Negative DC Grid No. 3 Voltage (Each Section) (Max.)		50 Volts
Peak Positive Grid No. 3 Voltage (Each Section) (Max.)		50 Volts
Negative DC Grid No. 1 Voltage (Max.)		50 Volts
Plate Dissipation (Each Section) (Max.)		1.1 Watts
Grid No. 2 Dissipation (Max.)		0.75 Watt
DC Cathode Current (Max.)		12 Ma
Grid No. 1 Circuit Resistance (Max.)		0.5 Megohm
Grid No. 3 Circuit Resistance (Each Section) (Max.)		0.5 Megohm
CHARACTERISTICS AND TYPICAL OPERATION		
Both Sections Operating		
Plate Voltage (Each Section)	100	100 Volts
Grid No. 2 Voltage	67.5	67.5 Volts
Grid No. 3 Voltage (Each Section)	−10	0 Volts
Grid No. 1 Voltage	Note 1	Note 1
Plate Current (Each Section)	—	2.0 Ma
Grid No. 2 Current	7.0	4.4 Ma
Cathode Current	7.1	8.5 Ma
Each Section Operating Separately with Plate and Grid No. 3 of Opposite Section Grounded		
Plate Voltage	100	100 Volts
Grid No. 2 Voltage	67.5	67.5
Grid No. 3 Voltage	0	0 Volt
Grid No. 1 Voltage	0	— Volt
Plate Current	—	2.0 Ma
Grid No. 3 Transconductance	—	450 μmhos
Grid No. 1 Transconductance	1100	— μmhos
Ec3 for Ib = 100 μa (Approx.)	—	−3.5 Volts
Ec1 for Ib = 100 μa (Approx.)	—	−2.3 Volts

NOTE:
(1) Grid current adjusted for 100 μa dc.

AVERAGE PLATE CHARACTERISTICS



AVERAGE SCREEN CHARACTERISTICS



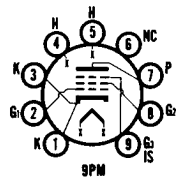
IF AMPLIFIER

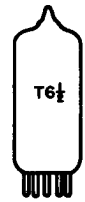
6HT6

3HT6, 4HT6

Semi-remote Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9PM
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	3HT6	4HT6	6HT6
Heater Voltage	3.15	4.2	6.3 Volts
Heater Current	600	450	300 Ma
Heater Warm-up Time	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

	Shielded(1)	Unshielded
Grid 1 to Plate	0.024	0.031 Pf
Input	8.70	8.70 Pf
Output	3.00	2.15 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.) ..... 250 Volts
Grid 2 Supply Voltage (Max.) ..... 250 Volts
Grid 2 Voltage .....See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.) ..... 2.5 Watts
Grid 2 Dissipation (Max.) ..... 0.6 Watts
Grid 1 Negative Voltage (Max.) ..... 50 Volts
Cathode Current (Max.) ..... 25 Ma
Grid 1 Circuit Resistance:
Cathode Resistor Bias (Max.) ..... 1 Megohm
Fixed Bias (Max.) ..... 0.25 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	125 Volts
Grid 3 (Suppressor)	Connected to Cathode at Socket
Grid 2 Voltage	125 Volts
Cathode Bias Resistor	56 Ohms
Plate Resistance	0.143 Megohm
Transconductance	14,000 μmhos
Plate Current	15 Ma
Grid 2 Current	4.0 Ma
Grid 1 Cutoff Bias(2)	-6.7 Volts
Cutoff Transconductance:	
For Grid 1 Volts = -1.5	12,000 μmhos
For Grid 1 Volts = -3.5	300 μmhos
For Grid 1 Volts = -4.5	100 μmhos
Hot Input Resistance(3)	12,700 Ohms
Hot Input Capacitance(3)	7.45 Pf

NOTES:
(1) With JEDEC Shield No. 315 connected to ground.
(2) For transconductance of 50 μmhos.
(3) Measured at 44 MHz with unbypassed 56 Ohm cathode resistance.

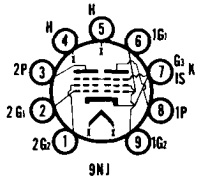
6HU8/ELL80

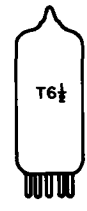
12HU8/PLL80

AF AMPLIFIER

Double Pentode

Construction	T-6½
Base	E9-1
Basing	9NJ
Outline	6-4
Maximum Diameter	0.875 In.
Maximum Seated Height	2.812 In.
Maximum Overall Height	3.062 In.





ELECTRICAL DATA

HEATER OPERATION

	6HU8/ELL80	12HU8/PLL80
Heater Voltage	6.3	12 Volts
Heater Current	550	300 Ma

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

	Section 1	Section 2
Grid to Plate	0.20	1.5 pf
Input: g to (h + g2 + g3 + IS)	7.0	7.0 pf
Output: p to (h + k + g2 + g3 + IS)	4.5	4.5 pf

RATINGS (Design Maximum Values) Each Section

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	6 Watts
Positive Grid No. 1 Voltage (Max.)	0 Volts
Negative Grid No. 1 Voltage (Max.)	100 Volts

CHARACTERISTICS AND TYPICAL OPERATION

Power Amplifier Section

Plate Voltage	250 Volts
Grid No. 2 Voltage	250 Volts
Plate Current	26 Ma
Transconductance	6000 μmhos
Amplification Factor	100
Load Resistance	10,000 Ohms
Power Output	3 Watts

Class B Amplifier—Push-Pull

Plate Voltage	250 Volts
Grid No. 2 Voltage	250 Volts
Plate Current (Zero Signal)	11 Ma
Total Distortion	5 Percent
Load Resistance	10,000 Ohms

Color Television Type

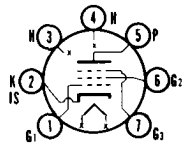
FM DETECTOR

6HZ6

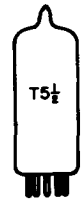
5HZ6

Sharp Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7EN
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7EN



ELECTRICAL DATA

HEATER OPERATION

	5HZ6	6HZ6
Heater Voltage	4.75	6.3 Volts
Heater Current	600	450 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate (Max.)	0.023 Pf
Grid No. 3 to Plate	1.6 Pf
Input: g1 to (h + k + g2 + g3 + IS)	8.2 Pf
Input: g3 to (h + k + g1 + g2 + p + IS)	7.2 Pf
Grid No. 1 to Grid No. 3	0.09 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	300 Volts
Positive Grid No. 3 Voltage (DC and Peak) (Max.)	25 Volts
Negative Grid No. 3 Voltage (DC and Peak) (Max.)	100 Volts
Grid No. 2 Supply Voltage (Max.)	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Positive Grid No. 1 Voltage (Max.)	0 Volt
Negative Grid No. 1 Voltage (Max.)	50 Volts
Plate Dissipation (Max.)	1.7 Watts
Grid No. 3 Input (Max.)	0.1 Watt
Grid No. 2 Input (Ec2 up to 150 V) (Max.)	1.0 Watt
Grid No. 2 Input (Ec2 Between 150 V to 300 V)	See Rating Chart (Gen. Info. Sec.)
Grid No. 3 Circuit Resistance (Max.)	0.68 Megohm
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.22 Megohm
Self Bias (Max.)	0.47 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

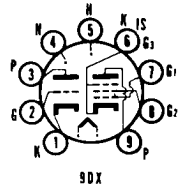
Plate Voltage	150 Volts
Grid No. 3 Voltage	0 Volt
Grid No. 2 Voltage	100 Volts
Cathode Resistor	180 Ohms
Plate Current	3.2 Ma
Grid No. 2 Current	3.2 Ma
Grid No. 1 Transconductance	3400 μmhos
Grid No. 3 Transconductance	600 μmhos
Plate Resistance (Approx.)	0.11 Megohm
Ec1 for Ib = 20 μa (Approx.)	−4.5 Volts
Ec3 for Ib =20 μa (Approx.)	−7 Volts

6HZ8

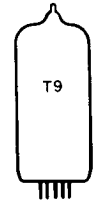
SYNC/VOLTAGE AMPLIFIER (T) VIDEO AMPLIFIER (P)

High Mu Triode and Sharp Cutoff Pentode

Construction 9T-9
Base .....Button 9 Pin
Basing 9DX
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.770 In.
Maximum Overall Height .....3.080 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1125 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)

Triode Section	
Grid to Plate	5.0 Pf
Input: g to (h + Tk)	3.8 Pf
Output: p to (h + Tk)	0.4 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.1 Pf
Input: g1 to (h + Pk, g3, IS + g2)	12 Pf
Output: p to (h + Pk, g3, IS + g2)	5.0 Pf
Coupling	
Pentode Grid No. 1 to Triode Plate (Max.)	0.005 Pf
Triode Grid to Pentode Plate (Max.)	0.04 Pf
Pentode Plate to Triode Plate (Max.)	0.20 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	300	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Plate Dissipation (Max.)	1.0	8.0 Watts
Grid No. 2 Dissipation (Max.)	—	2.0 Watts
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid Circuit Resistance		
Self Bias (Max.)	1.0	1.0 Megohm
Fixed Bias (Max.)	0.5	0.25 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	200	250 Volts
Grid No. 2 Voltage	—	170 Volts
Grid No. 1 Voltage	-2	— Volts
Cathode Resistor	—	100 Ohms
Plate Current	3.5	29 Ma
Grid No. 2 Current	—	6 Ma
Transconductance	4000	12,600 μmhos
Amplification Factor	70	—
Plate Resistance (Approx.)	—	14,000 Ohms
Ec for Ib = 10 μa (Approx.)	-5.0	-11.5 Volts

INSTANTANEOUS PLATE KNEE VALUES (Pentode Section)

Eb = 60 V; Ec2 = 170 V; and Ec1 = 0 V
Ib = 90 Ma (Approx.) and Ic2 = 22.5 Ma (Approx.)

Color Television Type

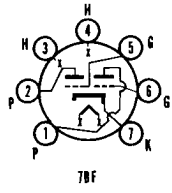
HIGH FREQUENCY OSCILLATOR, AMPLIFIER or MIXER

6J6A

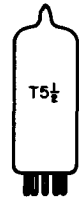
5J6, 19J6

Double Triode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7BF
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7BF



ELECTRICAL DATA

HEATER OPERATION

	19J6	5J6	6J6A
Heater Voltage	18.9	4.7	6.3 Volts
Heater Current	150	600	450 Ma
Heater Warm-up Time	—	11	11 Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
Total DC and Peak			100 Volts
Heater Positive with Respect to Cathode			
Total DC and Peak			100 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid to Plate	1.6 Pf
Grid to Cathode	2.2 Pf
Plate to Cathode	0.4 Pf

RATINGS (Design Center Rating System) (Each Section)

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	1.5 Watts
Plate Current (Max.)	15 Ma
Grid Voltage (Max.)	–40 Volts
Grid Current (Max.)	8.0 Ma

CHARACTERISTICS AND TYPICAL OPERATION (Each Section)

Class A1 Amplifier

Plate Voltage	100 Volts
Self Bias Resistor(1,2)	50 Ohms
Plate Current	8.5 Ma
Transconductance	5300 μmhos
Amplification Factor	38
Plate Resistance	7100 Ohms

Class C Oscillator or RF Amplifier (Push-Pull)

Plate Voltage	150 Volts
Grid Voltage(3)	–10 Volts
Plate Current	30 Ma
Grid Current	16 Ma
Driving Power	0.35 Watt
Power Output	3.5 Watts

Mixer Service

Plate Voltage	150 Volts
Cathode Bias Resistor(2)	820 Ohms
Oscillator Peak Voltage	3 Volts
Plate Current	4.8 Ma
Plate Resistance	10,000 Ohms
Conversion Transconductance	1900 μmhos

NOTES:

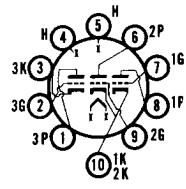
(1) Value is for both sections operating as specified.
(2) Under rated maximum conditions, total grid circuit resistance should not exceed 0.5 megohm. Fixed bias operation is not recommended.
(3) Obtained by a grid resistor of 625 ohms or a cathode resistor of 220 ohms.

6J9

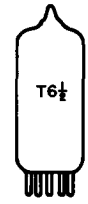
VHF AMPLIFIER, OSCILLATOR and MIXER

Triple Triode

Construction .....Miniature T-6½
Base .....Button 10 Pin, E10-73
(Center Pin Added to 9 Pin Base)
Basing[1] 10G
Outline 6-13
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.940 In.
Maximum Overall Height .....2.190 In.



10 G



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 Ma
Heater Warm-up Time	11 Seconds
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
Total DC and Peak	100 Volts
Heater Positive with Respect to Cathode	
Total DC and Peak	100 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded[2]	Unshielded
Grid to Plate (Section 1 and 3)	1.6	1.6 Pf
Grid to Plate (Section 2)	1.5	1.5 Pf
Input (Each Section)	2.6	2.4 Pf
Output (Section No. 1)	1.1	0.28 Pf
Output (Section No. 2)	1.5	0.44 Pf
Output (Section No. 3)	1.1	0.26 Pf
Heater to Cathode (Section No. 3)	3.2	3.2 Pf
Heater to Cathode (Sections 1 and 2)	6.2	6.2 Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	330 Volts
Plate Dissipation (Each Plate) (Max.)	2.0 Watts
Plate Dissipation (Plates 1, 2, and 3) (Max.)	5.0 Watts
Positive Grid Voltage (Max.)	0 Volt
Negative Grid Voltage (Max.)	50 Volts

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier (Each Section)

Plate Voltage	125 Volts
Grid Voltage	–1.0 Volts
Plate Current	6.0 Ma
Plate Resistance	11,000 Ohms
Transconductance	5200 μmhos
Amplification Factor	57
Ec for Ib = 20 μa (Approx.)	–5.4 Volts

NOTES:

(1) Section No. 1 connects to Pins 7, 8, and 10; Section No. 2 connects to Pins 6, 9, and 10; Section No. 3 connects to Pins 1, 2, and 3.
(2) Shield No. 315 ties to cathode of triode under test.

6J10

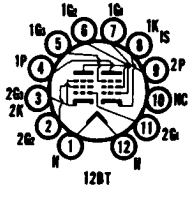
13J10/13Z10

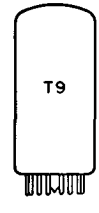
Color Television Type

FM DISCRIMINATOR and AUDIO POWER AMPLIFIER

Double Dissimilar Pentodes

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12BT
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.





ELECTRICAL DATA

HEATER OPERATION

	13J10/13Z10	6J10
Heater Voltage	13.2	6.3 Volts
Heater Current	450	950 Ma
Heater Warm-up Time	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 (Unshielded)

Section No. 1

Grid No. 1 to All	4.0 Pf
Grid No. 3 to All	3.2 Pf
Grid No. 1 to Grid No. 3	0.01 Pf

Section No. 2

Grid to Plate	0.2 Pf
Input	11.0 Pf
Output	7.0 Pf

RATINGS (Design Maximum Rating System)

Section No. 1

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

Section No. 2

Plate Voltage (Max.)	275 Volts
Screen Voltage (Max.)	275 Volts
Plate Dissipation (Max.)	10.0 Watts
Screen Dissipation (Max.)	2.0 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.25 Megohms
Cathode Bias (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Section No. 1

Gated Beam Discriminator Section—Limiter/Discriminator Service

Input Signal Center Frequency	10.7	10.7	4.5 MHz
Frequency Deviation	±75	±75	±25 KHz
Plate Supply Voltage	85	285	270 Volts
Plate Voltage	62	122	121 Volts
Accelerator Voltage	55	100	100 Volts
Cathode Bias Resistor—Variable[1]	200-400	200-400	200-400 Ohms
Plate Load Resistor	0.085	0.330	0.330 Megohms
Plate Linearity Resistor	470	1500	1000 Ohms
Integrating Capacitor	0.002	0.001	0.001 Pf
Coupling Capacitor	0.25	0.01	0.25 Pf
Minimum Signal Voltage for Limiting Action, rms[2]	1.25	1.25	1.25 Volts
DC Plate Current	0.25	0.49	0.44 Ma
Accelerator Current	4.1	9.8	10 Ma
Input Signal Level for AM Rejection Adjustment[1]	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	250 Volts
Screen Voltage	250 Volts
Grid No. 1 Voltage	-8.0 Volts
Peak AF Grid Voltage	8.0 Volts
Plate Resistance (Approx.)	100,000 Ohms
Transconductance	6500 μmhos
Zero Signal Plate Current	35 Ma
Maximum Signal Plate Current	39 Ma
Zero Signal Screen Current	2.5 Ma
Maximum Signal Screen Current	7.0 Ma
Load Resistance	5000 Ohms
Total Harmonic Distortion (Approx.)	10 Percent
Maximum Signal Power Output	4.2 Watts

NOTES:

(1) 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.

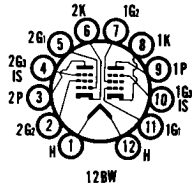
(2) At signal levels above specified value, limiting is within ±3 decibels. Adequate shielding between components of the limiter grid and the quadrature grid must be used to insure proper phasing of the voltage developed at the quadrature grid. Standard de-emphasis requirements for FM are included. The 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 Pf. The capacitance may be composed of tube input capacitance, stray capacitance, and distributed capacitance, as well as physical capacitance.

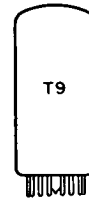
6J11

IF AMPLIFIER

Double Sharp Cutoff Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12BW
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	800 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 (Shielded)(1)

Section 1	
Grid No. 1 to Plate (Max.)	0.04 Pf
Input: 1g1 to (h + 1k + 1g2 + 1g3 + 2g3 + IS)	11 Pf
Output: 1p to (h + 1k + 1g2 + 1g3 + 2g3 + IS)	2.8 Pf
Section 2	
Grid No. 1 to Plate (Max.)	0.04 Pf
Input: 2g1 to (h + 2k + 2g2 + 2g3 + 1g3 + IS)	11 Pf
Output: 2p to (h + 2k + 2g2 + 2g3 + 1g3 + IS)	3.2 Pf
Cathode Section 1 to Cathode, Section 2 (Max.)	0.02 Pf
Grid No. 1, Section 1 to Plate, Section 2 (Max.)	0.003 Pf
Grid No. 1, Section 2 to Plate, Section 1 (Max.)	0.003 Pf
Plate, Section 1 to Plate, Section 2 (Max.)	0.03 Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	330 Volts
Screen-Supply Voltage (Max.)	330 Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)
Positive DC Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	3.1 Watts
Screen Dissipation (Max.)	0.65 Watts
Grid No. 1 Circuit Resistance with Cathode Bias (Max.)	0.25 Megohm

CHARACTERISTICS AND TYPICAL OPERATION (Each Section)

Plate Voltage	125 Volts
Suppressor	Connected to Cathode at Socket
Screen Voltage	125 Volts
Cathode-Bias Resistor	56 Ohms
Plate Resistance (Approx.)	0.2 Megohm
Transconductance	13,000 μmhos
Plate Current	11 Ma
Screen Current	3.8 Ma
Grid No. 1 Voltage, (Approx.)	
Ib = 20 μa	−3 Volts

NOTE:

(1) Shield No. 309 connected to cathode of section under test.

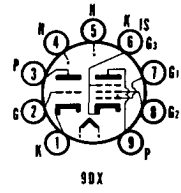
SYNC SEPARATOR/CLIPPER, PHASE INVERTER (T) VIDEO AMPLIFIER (P)

6JA8

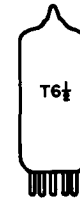
10JA8

High Mu Triode and Beam Power Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DX
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

	10JA8	6JA8
Heater Voltage	10.5	6.3 Volts
Heater Current	450	750 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section	
Grid to Plate	4.0 Pf
Input: g to (h + Tk + Pk, g3, IS)	2.6 Pf
Output: p to (h + Tk + Pk, g3, IS)	2.6 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.1 Pf
Input: g1 to (h + Pk, g3, IS + g2)	11 Pf
Output: p to (h + Pk, g3, IS + g2)	4.4 Pf
Coupling	
Triode Grid to Pentode Plate (Max.)	0.005 Pf
Pentode Grid No. 1 to Triode Plate (Max.)	0.018 Pf
Pentode Plate to Triode Plate (Max.)	0.17 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	300	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	1.0	5.0 Watts
Grid No. 2 Dissipation (Max.)	—	1.5 Watts
Grid No. 1 Circuit Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Cathode Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section		Pentode Section	
Plate Voltage	135	200	135	200 Volts
Grid No. 2 Voltage	—	—	135	135 Volts
Grid No. 1 Voltage	−2	−2	−1.5	−1.5 Volts
Plate Current	1.0	3.5	17	18 Ma
Grid No. 2 Current	—	—	4.2	4.0 Ma
Transconductance	1550	3700	12,000	14,000 μmhos
Amplification Factor	60	70	—	—
Plate Resistance (Approx.)	39,000	19,000	66,000	70,000 Ohms
Ec1 for Ib = 100 μa (Approx.)	—	—	−5	−5 Volts
Ec1 for Ib = 10 μa (Approx.)	−4.8	−7.0	—	— Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS (Pentode Section)

Eb = 30 V, Ec2 = 135 V and Ec1 = 0 V
Ib = 32 Ma and Ic2 = 14 Ma

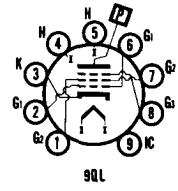
6JB6

12JB6, 17JB6

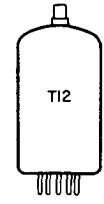
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Novar T-12
Base .....Button 9 Pin, E9-76
Top Cap .....C1-2 or C1-3
Basing 9QL
Outline
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.170 In.
Maximum Overall Height .....3.550 In.



9QL



ELECTRICAL DATA

HEATER OPERATION

	17JB6	12JB6	6JB6
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	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 (Unshielded)

Grid to Plate	0.2 Pf
Input: g1 to (h + k + g2 + g3)	15 Pf
Output: p to (h + k + g2 + g3)	6.0 Pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier(1)

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Plate Voltage (Max.)	6500 Volts
Peak Negative Plate Voltage (Max.)	1500 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Plate Dissipation (Max.)(2)	17.5 Watts
Grid No. 2 Input (Max.)	3.5 Watts
Average Cathode Current (Max.)	175 Ma
Peak Cathode Current (Max.)	550 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature (At Hottest Point) (Max.)	240 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	250 Volts
Grid No. 2 Voltage	150 Volts
Grid No. 1 Voltage	−22.5 Volts
Plate Current	70 Ma
Grid No. 2 Current	2.1 Ma
Transconductance	7100 μmhos
Amplification Factor(3)	4.4
Plate Resistance	15,000 Ohms
Ec1 for Ib = 1 Ma (Approx.)	−42 Volts

INSTANTANEOUS PLATE KNEE VALUES

Eb = 60 V, Ec2 = 150 V, and Ec1 = 0 V;
Ib = 390 Ma; and Ic2 = 32 Ma

NOTES:

(1) 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 horizontal scanning cycle.*

(2) 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.

(3) Amplification factor with tube operating as a triode with 150 volts on the plate and Grid No. 2 and −22.5 volts on Grid No. 1.

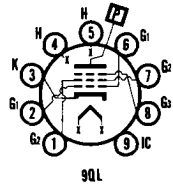
HORIZONTAL DEFLECTION AMPLIFIER

6JB6A

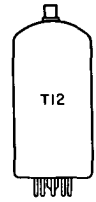
12JB6A, 17JB6A

Beam Power Pentode

Construction .....Novar T-12
Base .....Button 9 Pin, E9-88
Top Cap .....C1-2 or C1-3
Basing 9QL
Outline
  Maximum Diameter .....1.563 In.
  Maximum Seated Height .....3.125 In.
  Maximum Overall Height .....3.505 In.
The Types 6JB6A, 12JB6A, and 17JB6A are identical to Types 6JB6, 12JB6, and 17JB6 except for base with exhaust tip at bottom and shorter bulb.



9QL



Color Television Type

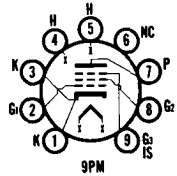
IF AMPLIFIER

6JC6

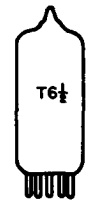
3JC6, 4JC6

Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9PM
Outline 6-2
  Maximum Diameter .....0.875 In.
  Maximum Seated Height .....1.938 In.
  Maximum Overall Height .....2.188 In.



9PM



ELECTRICAL DATA

HEATER OPERATION

	3JC6	4JC6	6JC6
Heater Voltage	3.5	4.5	6.3 Volts
Heater Current	600	450	300 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate	0.019 Pf
Input: g1 to (h + k + g2 + g3 + IS)	8.2 Pf
Output: p to (h + k + g2 + g3 + IS)	3.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	330 Volts
Grid No. 3 Voltage (Max.)	0 Volt
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage (Max.)	See Rating Chart (Gen. Info. Sec.)
Grid No. 1 Voltage	
Positive Bias Value (Max.)	0 Volt
Grid No. 2 Input	
Ec2 up to 165 Volts (Max.)	0.6 Watts
Ec2 = 165 to 330 Volts (Max.)	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	2.5 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.25 Megohm
Cathode Bias (Max.)	1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

Plate Supply Voltage	125 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Grid No. 2 Supply Voltage	125 Volts
Cathode Resistor	56 Ohms
Plate Current	13 Ma
Grid No. 2 Current	3.2 Ma
Transconductance	15,000 μmhos
Plate Resistance (Approx.)	180,000 Ohms
Grid No. 1 Voltage for Ib = 100 μa	−3 Volts

6JC6A

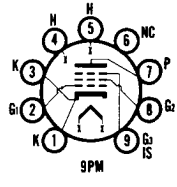
3JC6A, 4JC6A

Color Television Type

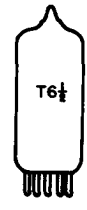
IF AMPLIFIER

Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9PM
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.938 In.
Maximum Overall Height	2.188 In.



9PM



ELECTRICAL DATA

HEATER OPERATION

	3JC6A	4JC6A	6JC6A
Heater Voltage	3.5	4.5	6.3 Volts
Heater Current	600	450	300 Ma
Heater Warm-up Time	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 CAPACITANCE (Unshielded)

Grid No. 1 to Plate	0.019 Pf
Input: g1 to (h + k + g2 + g3 + IS)	8.5 Pf
Output: p to (h + k + g2 + g3 + IS)	3.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	330 Volts
Grid No. 3 Voltage (Max.)	0 Volt
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Grid No. 1 Voltage (Positive Bias Value)	0 Volt
Grid No. 2 Input	
Ec2 up to 165 Volts (Max.)	0.7 Watts
Ec2 = 165 to 330 Volts	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	3.1 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.25 Megohm
Cathode Bias (Max.)	1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

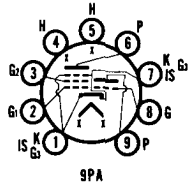
Plate Supply Voltage	125 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Grid No. 2 Supply Voltage	125 Volts
Cathode Resistor	56 Ohms
Plate Current	14 Ma
Grid No. 2 Current	3.4 Ma
Transconductance	16,000 μmhos
Plate Resistance (Approx.)	180,000 Ohms
Grid No. 1 Voltage for Ib = 100 μa	−3 Volts

VHF OSCILLATOR and MIXER

6JC8

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9PA
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9PA



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 Ma
Heater Warm-up Time	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

	Shielded	Unshielded
Triode Section		
Grid to Plate	1.2	1.3 Pf
Input: g to (h + k)	3.2	2.8 Pf
Output: p to (h + k)	0.90	0.44 Pf
Pentode Section		
Grid No. 1 to Plate (Max.)	0.018	0.038 Pf
Input: g1 to (k + g3 + g2 + h)	5.0	4.8 Pf
Output: p to (k + g3 + g2 + h)	1.6	0.9 Pf
Coupling		
Pentode Grid No. 1 to Triode Plate (Max.)	0.036	0.05 Pf
Pentode Plate to Triode Plate (Max.)	0.012	0.075 Pf
Heater to Cathode	6.5(2)	6.5 Pf

RATINGS (Design Maximum Rating System)

Converter Service	Triode Section	Pentode Section
Plate Voltage (Max.)	275	275 Volts
Grid No. 2 Supply Voltage (Max.)	—	275 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	1.7	2.3 Watts
Grid No. 2 Input:		
For Grid No. 2 Voltages up to 138 Volts (Max.)	—	0.45 Watt
For Grid No. 2 Voltages Between 138 and 275 Volts	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	—	0.1 Megohm
Self Bias (Max.)	—	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	125	125 Volts
Grid No. 3	Connected to Pin No. 3 at Socket	
Grid No. 2 Voltage	—	125 Volts
Grid No. 1 Voltage	-1.0	-1.0 Volt
Plate Current	12	9.0 Ma
Grid No. 2 Current	—	2.2 Ma
Transconductance	6500	5500 μmhos
Amplification Factor	40	—
Plate Resistance (Approx.)	6000	300,000 Ohms
Ec1 for Ib = 20 μa (Approx.)	-7	-6.5 Volts
Gm with Eb = 100 V, Ec2 = 70 V and Ec1 = 0 V	—	5700 μmhos

NOTES:
(1) Shield No. 315 connected to Pin No. 3.
(2) Shield No. 315 connected to Pin No. 6.

6JD6

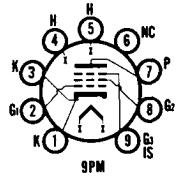
3JD6, 4JD6

Color Television Type

IF AMPLIFIER

Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9PM
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	3JD6	4JD6	6JD6
Heater Voltage	3.5	4.5	6.3 Volts
Heater Current	600	450	300 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate (Max.)	0.019 Pf
Grid No. 1 to Cathode, Grid No. 3 and Internal Shield, Grid No. 2 and Heater	8.2 Pf
Plate to Cathode, Grid No. 3 and Internal Shield, Grid No. 2 and Heater	3.0 Pf

RATINGS (Design Maximum Rating System)

Class A1 Amplifier

Plate Voltage (Max.)	330 Volts
Grid No. 3 (Suppressor-Grid) Voltage: Positive Value (Max.)	0 Volt
Grid No. 2 (Screen-Grid) Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Grid No. 1 (Control Grid) Voltage: Positive-Bias Value (Max.)	0 Volt
Grid No. 2 Input:	
For Grid No. 2 Voltages up to 165 Volts (Max.)	0.6 Watt
For Grid No. 2 Voltages between 165 and 330 Volts	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	2.5 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.25 Megohm
Cathode Bias (Max.)	1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Supply Voltage	125 Volts
Grid No. 3 Voltage	0 Volt
Grid No. 2 Supply Voltage	125 Volts
Grid No. 1 Supply Voltage	0 Volt
Cathode Resistor	56 Ohms
Plate Resistance (Approx.)	160,000 Ohms
Transconductance	14,000 μmhos
Plate Current	15 Ma
Grid No. 2 Current	4 Ma
Grid No. 1 Voltage (Approx.) for Transconductance (μmhos) = 600	-4.5 Volts

Color Television Type

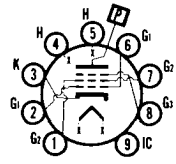
HORIZONTAL DEFLECTION AMPLIFIER

6JE6C/6LQ6

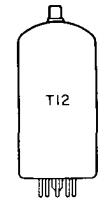
24JE6A, 24LQ6, 31LQ6

Beam Power Pentode

Construction .....Novar T-12
Base .....Button 9 Pin, E9-88 or E9-76
Top Cap C1-1
Basing 9QL
Outline 12-116
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.750 In.
Maximum Overall Height .....4.130 In.



9QL



ELECTRICAL DATA

HEATER OPERATION

	31LQ6	24JE6A 24LQ6	6JE6C/6LQ6
Heater Voltage	31	24	6.3 Volts
Heater Current	450	600	2500 Ma
Heater Warm-up Time	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 (Unshielded)

Grid to Plate	0.56 Pf
Input: g1 to (h + k + g2 + g3)	22 Pf
Output: p to (h + k + g2 + g3)	11 Pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier(1)

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	990 Volts
Peak Positive Plate Voltage (Max.)	7500 Volts
Peak Negative Plate Voltage (Max.)	1200 Volts
Grid No. 3 Voltage (Max.)	75 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Plate Dissipation (Max.)(2)	30 Watts
Grid No. 2 Input (Max.)	5 Watts
Average Cathode Current (Max.)	350 Ma
Peak Cathode Current (Max.)	1200 Ma
Grid No. 1 Circuit Resistance (Max.)(2)	0.47 Megohms
Plate Pulsed	10 Megohms
Bulb Temperature (At Hottest Point)	250 °C

AVERAGE CHARACTERISTICS

Plate Voltage	175	60 Volts
Grid No. 2 Voltage	125	125 Volts
Grid No. 1 Voltage	−25	0 Volts
Grid No. 3 Voltage	0	0 Volts
Plate Current	130	600 Ma
Grid No. 2 Current	2.8	30 Ma
Transconductance	10,500	— μmhos
Triode Amplification Factor (Grid No. 2 Connected to Plate) (Eb = Ec2 = 125 Volts; Ec1 = −25 Volts)	3.0(3)	—
Plate Resistance (Approx.)	5500	— Ohms
Grid No. 1 Voltage for Ib = 1 Ma (Approx.)	−54	— Volts

SPECIAL TESTS AND RATINGS

Primary Beam—Plate Emission(8)

Initial Maximum	100 μa
After 1000 Hours of Operation Within Ratings (Max.)	100 μa

NOTES:

(1) 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 horizontal scanning cycle.
(2) 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.
(3) Amplification factor with tube operating as a triode with 125 volts on the plate and Grid No. 2 and −25 volts on Grid No. 1.

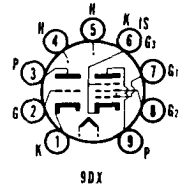
6JE8

8JE8, 11JE8

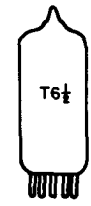
SYNC SEPARATOR or VOLTAGE AMP. (T) VIDEO AMPLIFIER (P)

High Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DX
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

	11JE8	8JE8	6JE8
Heater Voltage	10.9	8.2	6.3 Volts
Heater Current	450	600	780 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section

Grid to Plate	4.2 Pf
Input: g to (h + k)	2.4 Pf
Output: p to (h + k)	0.4 Pf

Pentode Section

Grid No. 1 to Plate (Max.)	0.1 Pf
Input: g1 to (h + k + g2 + g3 + IS)	10 Pf
Output: p to (h + k + g2 + g3 + IS)	3.6 Pf

Coupling

Pentode Grid No. 1 to Triode Plate (Max.)	0.005 Pf
Triode Grid to Pentode Plate (Max.)	0.018 Pf
Pentode Plate to Triode Plate (Max.)	0.17 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	300	330 Volts
Grid No. 2 Supply Voltage	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	1.0	5(1) Watts
Grid No. 2 Dissipation (Max.)	—	2(1) Watts
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Self Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Class A1 Amplifier		
Plate Voltage	200	250 Volts
Grid No. 2 Voltage	—	170 Volts
Grid No. 1 Voltage	-2	0 Volts
Cathode Bias Resistor	—	82 Ohms
Plate Current	4.5	22 Ma
Grid No. 2 Current	—	4.0 Ma
Transconductance	4200	12,000 μmhos
Amplification Factor	70	—
Plate Resistance (Approx.)	—	140,000 Ohms
Ec1 for Ib = 10 μa (Approx.)	-5	-10 Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS

Eb = 60 V; Ec2 = 170 V, and Ec1 = 0 V
Ib = 48 Ma (Approx.) and Ic2 = 12 Ma (Approx.)

NOTE:

(1) These are design maximum dissipation ratings for television video amplifier applications. The two watts maximum Grid No. 2 Dissipation should not occur simultaneously with the five watts maximum plate dissipation. The two watts maximum Grid No. 2 Dissipation may be operated simultaneously with a Plate Dissipation of 4.0 Watts or 1.5 Watts Maximum Grid No. 2 Dissipation may be operated simultaneously with a Plate Dissipation of 5.0 Watts.

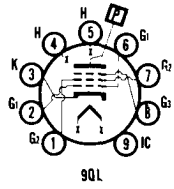
HORIZONTAL DEFLECTION AMPLIFIER

6JF6

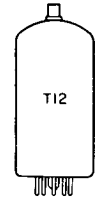
22JF6

Beam Power Pentode

Construction .....Novar T-12
Base .....Button 9 Pin, E9-88
Top Cap .....C1-2 or C1-3
Basing 9QL
Outline
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.170 In.
Maximum Overall Height .....3.550 In.



9QL



ELECTRICAL DATA

HEATER OPERATION

	22JF6	6JF6
Heater Voltage	22	6.3 Volts
Heater Current	450	1600 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate	1.2 Pf
Input: g1 to (k, g3, g2, H)	22.0 Pf
Output: p to (k, g3, g2, H)	9.0 Pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier(1)

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Pulse Plate Voltage (Max.)	6500 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
Grid No. 3 Voltage (Max.)	75 Volts
Plate Dissipation (Max.)(2)	100 Watts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Grid No. 2 Dissipation (Max.)	3.5 Watts
Average Cathode Current (Max.)	275 Ma
Peak Cathode Current (Max.)	950 Ma
Grid No. 1 Circuit Resistance (Max.)	2.2 Megohms
Bulb Temperature (At Hottest Point) (Max.)	240 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	130 Volts
Grid No. 2 Voltage	125 Volts
Grid No. 1 Voltage	-20 Volts
Plate Current	80 Ma
Grid No. 2 Current	2.5 Ma
Transconductance	10,000 μmhos
Plate Resistance	12,000 Ohms
Amplification Factor(3)	4.1
Ec1 for Ib = 1.0 Ma (Approx.)	-40 Volts

INSTANTANEOUS PLATE KNEE VALUES

Eb = 50 V; Ec2 = 125 V and Ec1 = 0 V
Ib = 525 Ma, and Ic2 = 32 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) 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.
(3) Amplification factor with tube operating as a triode with 125 volts on the plate and Grid No. 2 and –20 volts on Grid No. 1.

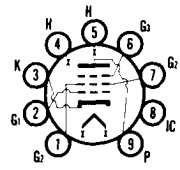
6JG6A

17JG6A, 22JG6A

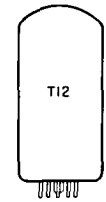
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Novar T-12
Base .....Button 9 Pin, E9-88
Basing 9QU
Outline 12-96
Maximum Diameter .....1.563 In.
Maximum Seated Height .....2.750 In.
Maximum Overall Height .....3.125 In.



9QU



ELECTRICAL DATA

HEATER OPERATION

	22JG6A	17JG6A	6JG6A
Heater Voltage	22	16.8	6.3 Volts
Heater Current	450	600	1600 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate	0.7 Pf
Input	22 Pf
Output	9.0 Pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier(1)

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Pulse Plate Voltage (Max.)	6500 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
Grid No. 3 Voltage (Max.)	75 Volts
Plate Dissipation (Max.)	17 Watts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Grid No. 2 Dissipation (Max.)	3.5 Watts
Average Cathode Current (Max.)	275 Ma
Peak Cathode Current (Max.)	950 Ma
Grid No. 1 Circuit Resistance (Max.)	2.2 Megohms
Bulb Temperature (At Hottest Point) (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	130 Volts
Grid No. 2 Voltage	125 Volts
Grid No. 1 Voltage (2)	–20 Volts
Plate Current	80 Ma
Grid No. 2 Current	2.5 Ma
Transconductance	10,000 μmhos
Plate Resistance	12,000 Ohms
Amplification Factor(3)	4.1
Ec1 for Ib = 10 Ma (Approx.)	–40 Volts

INSTANTANEOUS PLATE KNEE VALUES

Eb = 50 V; Ec2 = 125 V and Ec1 = 0 V
Ib = 525 Ma, and Ic2 = 32 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) 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.
(3) Amplification factor with tube operating as a triode with 125 volts on the plate and Grid No. 2 and –20 volts on Grid No. 1.

Color Television Type

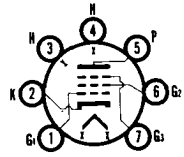
AGC/IF AMPLIFIER

6JH6

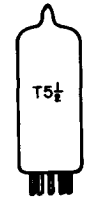
4JH6

Semi-Remote Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CM
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7CM



ELECTRICAL DATA

HEATER OPERATION

	4JH6	6JH6
Heater Voltage	4.2	6.3 Volts
Heater Current	450	300 Ma
Heater Warm-up Time	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

	Shielded(1)	Unshielded
Grid No. 1 to Plate (Max.)	0.015	0.025 Pf
Input: g1 to (h + k + g2 + g3 + IS)	7.0	7.0 Pf
Output: p to (h + k + g2 + g3 + IS)	3.0	2.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	300 Volts
Grid No. 2 Supply Voltage (Max.)	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	2.3 Watts
Grid No. 2 Dissipation (Max.)	0.55 Watt
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.25 Megohm
Cathode Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	125 Volts
Grid No. 2 Voltage	125 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Cathode Bias Resistor	56 Ohms
Plate Current	14 Ma
Grid No. 2 Current	3.6 Ma
Transconductance	8000 μmhos
Plate Resistance (Approx.)	260,000 Ohms
Ec1 for gm = 50 μmhos (Approx.)	−19 Volts
Gm with Ec1 = −4.5 V, Rk = 56 Ohms	400 to 900 μmhos

NOTE:
(1) External Shield No. 316 connected to Pin No. 2 (cathode) at socket.

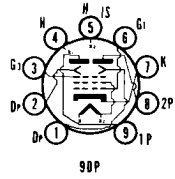
Color Television Type

SYNCHRONOUS DETECTOR

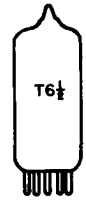
6JH8

Double Plate Sheet Beam Tube

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing(1) 9DP
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9DP



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	300 Ma

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Deflector No. 1 to All	4.8 Pf
Deflector No. 2 to All	4.8 Pf
G1 to All (Except Plates)	7.5 Pf
Plate No. 1 to All	5.0 Pf
Plate No. 2 to All	5.0 Pf
G1 to Deflector No. 1 (Max.)	0.04 Pf
G1 to Deflector No. 2 (Max.)	0.07 Pf
Plate No. 1 to Plate No. 2	0.40 Pf
Deflector No. 1 to Deflector No. 2	0.38 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Each Plate) (Max.)	330 Volts
Accelerator Voltage (Max.)	330 Volts
Peak Positive Deflector Voltage (Max.)	165 Volts
Peak Negative Deflector Voltage (Max.)	165 Volts
Positive DC G1 Voltage (Max.)	0 Volt
Plate Dissipation (Each Plate) (Max.)	3.0 Watts
Accelerator Dissipation (Max.)	1.0 Watts
DC Cathode Current (Max.)	33 Ma
G1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.25 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Deflector Grounded(3)

Plate No. 1 Voltage	250 Volts
Plate No. 2 Voltage (Tied to Plate No. 1)	250 Volts
Accelerator Voltage	250 Volts
Deflector No. 1 Voltage	0 Volt
Deflector No. 2 Voltage	0 Volt
Cathode Resistor	220 Ohms
Plate Current (Total)	14 Ma
Accelerator Current	1.5 Ma
Transconductance	4400 μmhos
G1 Voltage for Ib = 10 μa	−13 Volts

AVERAGE DEFLECTOR CHARACTERISTICS(3)

Plate No. 1 Voltage	250 Volts
Plate No. 2 Voltage	250 Volts
Accelerator Voltage	250 Volts
Cathode Resistor	220 Ohms
Deflector Switching Voltage (Max.)(2)	20 Volts
Deflector-Bias for Minimum Deflector Switching Voltage	−14 Volts
Voltage Difference Between Deflectors for Ib1 = Ib2 (Approx.)	0 Volt
Plate No. 1 Current (Ed1 = −15 Volts; Ed2 = +15 Volts) (Max.)	0.7 Ma
Plate No. 2 Current (Ed1 = +15 Volts; Ed2 = −15 Volts) (Max.)	0.7 Ma
Deflector No. 1 Current (Ed1 = +25 Volts; Ed2 = −25 Volts) (Max.)	0.1 Ma
Deflector No. 2 Current (Ed1 = −25 Volts; Ed2 = +25 Volts) (Max.)	0.1 Ma

NOTES:

(1) Pin No. 5 should be tied directly to ground.

(2) Deflector switching voltage is defined as the total voltage change on either deflector with an equal and opposite change on the other deflector required to switch the plate current from one plate to the other.

(3) The 6JH8 should not be located so as to subject it to stray magnetic fields.

6JK6

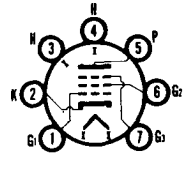
4JK6, 5JK6

Color Television Type

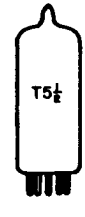
IF AMPLIFIER

Sharp Cutoff Pentode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7CM
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7CM



ELECTRICAL DATA

HEATER OPERATION

	4JK6	5JK6	6JK6
Heater Voltage	3.7	4.9	6.3 Volts
Heater Current	600	450	350 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate (Max.)	0.02 Pf
Input: g1 to (h + k + g2 + g3 + IS)	9.5 Pf
Output: p to (h + k + g2 + g3 + IS)	2.7 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	275 Volts
Grid No. 2 Supply Voltage (Max.)	275 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	2.5 Watts
Grid No. 2 Dissipation (Max.)	0.6 Watt
Cathode Current (Max.)	22 Ma
Grid No. 1 Circuit Resistance (Self Bias) (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	125 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Grid No. 2 Voltage	125 Volts
Cathode Bias Resistor	68 Ohms
Plate Current	11.5 Ma
Grid No. 2 Current	3.9 Ma
Transconductance	18,000 μmhos
Plate Resistance (Approx.)	0.15 Megohm
Grid No. 1 Voltage for Ib = 20 μa (Approx.)	-3.5 Volts
R Input at 44 MHz	4000 Ohms

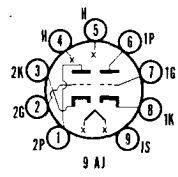
RF AMPLIFIER OSCILLATOR and MIXER

6JK8

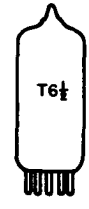
8JK8, 17JK8

Double Dissimilar Triode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9AJ
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.



9 AJ



ELECTRICAL DATA

HEATER OPERATION

	17JK8	8JK8	6JK6
Heater Voltage	16.8	8.4	6.3 Volts
Heater Current	150	300	400 Ma
Heater Warm-up Time	17	—	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
Total DC and Peak			100 Volts
Heater Positive with Respect to Cathode			
Total DC and Peak			100 Volts

DIRECT INTERELECTRODE CAPACITANCES (Shielded)

	Section No. 1	Section No. 2
Grid to Plate	1.4	0.60 Pf
Input: g to (h + k + IS + E.S.)	3.0	5.0 Pf
Output: p to (h + k + IS + E.S.)	1.0	4.0 Pf
Heater to Cathode	2.8	2.8 Pf

Grid to Grid (Max.)	0.003	Pf
Plate to Plate (Max.)	0.009	Pf

RATINGS (Design Maximum Rating System)

	Oscillator Section No. 1	R-F Amp. Section No. 2	
Plate Voltage (Max.)	165	200	Volts
Plate Dissipation (Max.)	1.0	2.0	Watts
DC Cathode Current (Max.)	22	22	Ma
Negative Grid Voltage (Max.)	50	50	Volts
Grid Circuit Resistance (Self Bias) (Max.)	1.0	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Oscillator Section No. 1	R-F Amp. Section No. 2	
Class A1 Amplifier			
Plate Voltage	100	135	Volts
Grid Voltage	−1.0	−1.2	Volts
Plate Current	5.3	10	Ma
Transconductance	6800	13,000	μmhos
Amplification Factor	55	70	
Plate Resistance (Approx.)	8000	5400	Ohms
Ec for Ib = 20 μa (Approx.)	−4.4	—	Volts
Ec for Gm = 150 μmhos (Approx.)	—	−5.5	Volts
Ec for Gm = 1500 μmhos (Approx.)	—	−2.8	Volts

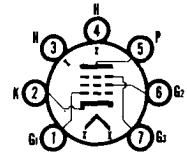
6JL6

4JL6, 5JL6

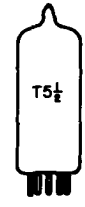
AGC/IF AMPLIFIER

Semi-Remote Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CM
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7CM



ELECTRICAL DATA

HEATER OPERATION

	4JL6	5JL6	6JL6	
Heater Voltage	3.7	4.9	6.3	Volts
Heater Current	600	450	350	Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate (Max.)	0.02 Pf
Input: g1 to (h + k + g2 + g3 + IS)	9.3 Pf
Output: p to (h + k + g2 + g3 + IS)	2.7 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	275 Volts
Grid No. 2 Supply Voltage (Max.)	275 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	2.5 Watts
Grid No. 2 Dissipation (Max.)	0.6 Watt
Cathode Current (Max.)	22 Ma
Grid No. 1 Circuit Resistance (Self Bias) (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier	
Plate Voltage	125 Volts
Grid No. 2 Voltage	60 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Cathode Bias Resistor(1)	68 Ohms

Plate Current	12.5 Ma
Grid No. 2 Current	4.0 Ma
Transconductance	15,500 μmhos
Plate Resistance (Approx.)	120,000 Ohms
Ec1 for gm = 1500 μmhos (Approx.)	−2.7 Volts
Ec1 for gm = 150 μmhos (Approx.)	−5.5 Volts

NOTE:
(1) Optimized unbypassed cathode resistor for gain controlled IF Service is 33 Ohms.

Color Television Type

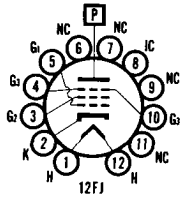
HORIZONTAL DEFLECTION AMPLIFIER

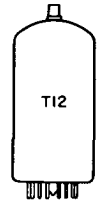
6JM6

17JM6

Beam Power Pentode

Construction	Compactron T-12
Base	Button 12 Pin, E12-74
Top Cap	C1-3
Basing	12FJ
Outline	12-79
Maximum Diameter	1.563 In.
Maximum Seated Height	3.250 In.
Maximum Overall Height	3.625 In.





ELECTRICAL DATA

HEATER OPERATION

	17JM6	6JM6
Heater Voltage	16.8	6.3 Volts
Heater Current	450	1200 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate	0.6 Pf
Input	16 Pf
Output	7 Pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier(1)

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Pulse Plate Voltage	6500 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
Positive DC Beam Plate Voltage	70 Volts
Plate Dissipation (Max.)(2)	17.5 Watts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Grid No. 2 Dissipation (Max.)	3.5 Watts
Average Cathode Current (Max.)	175 Ma
Peak Cathode Current (Max.)	550 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature (at Hottest Point) (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	5000	250 Volts
Grid No. 2 Voltage	150	150 Volts
Grid No. 1 Voltage	—	−22.5 Volts
Plate Current	—	65 Ma
Grid No. 2 Current	—	1.8 Ma
Transconductance	—	7300 μmhos
Plate Resistance	—	18,000 Ohms
Amplification Factor(3)	—	4.4
Ec1 for Ib = 1.0 Ma (Approx.)	−100	−42 Volts

INSTANTANEOUS PLATE KNEE VALUES

Eb = 60 V; Ec2 = 150 V and Ec1 = 0 V
Ib = 345 Ma, and Ic2 = 27 Ma

NOTES:
(1) 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 horizontal scanning cycle.

(2) 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.
(3) Amplification factor with tube operating as a triode with 150 volts on the plate and Grid No. 2 and –22.5 volts on Grid No. 1.

6JM6A

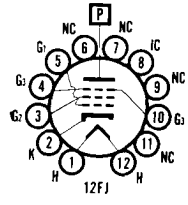
17JM6A

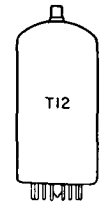
Color Television Type

HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Top Cap C1-3
Basing.....12FJ
Outline 12-79
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.625 In.





ELECTRICAL DATA

HEATER OPERATION

	17JM6A	6JM6A
Heater Voltage	16.8	6.3 Volts
Heater Current	450	1200 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate	0.6 Pf
Input	16 Pf
Output	7 Pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier(1)

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Pulse Plate Voltage (Max.)	6500 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
Positive DC Beam Plate Voltage (Max.)	70 Volts
Plate Dissipation (Max.)(2)	17.5 Watts
Negative DC Grid No. 1 Voltage (Max.)	55 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Grid No. 2 Dissipation (Max.)	3.5 Watts
Average Cathode Current (Max.)	175 Ma
Peak Cathode Current (Max.)	550 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature (At Hottest Point) (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

	5000	250 Volts
Plate Voltage		
Grid No. 2 Voltage	150	150 Volts
Grid No. 1 Voltage	—	–22.5 Volts
Plate Current	—	70 Ma
Grid No. 2 Current	—	2.4 Ma
Transconductance	—	7300 μmhos
Plate Resistance	—	15,000 Ohms
Amplification Factor(3)	—	4.4
Ec1 for Ib = 1.0 Ma (Approx.)	–100	–42 Volts

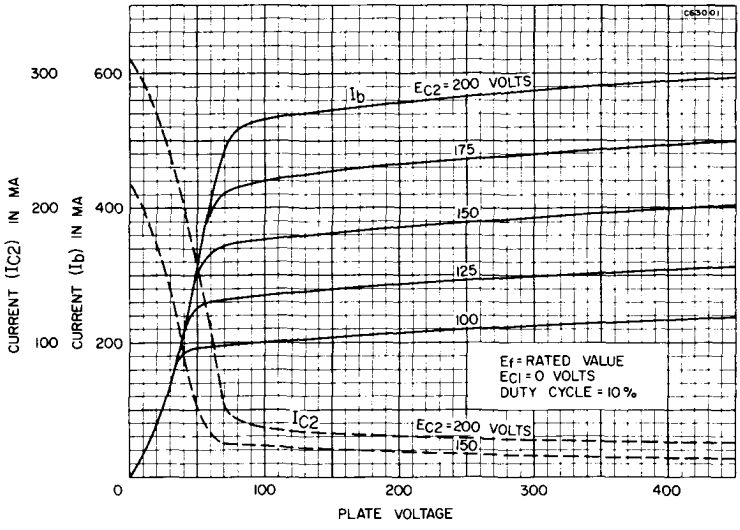
INSTANTANEOUS PLATE KNEE VALUES

Eb = 55 V; Ec2 = 150 V and Ec1 = 0 V
Ib = 345 Ma, and Ic2 = 30 Ma

NOTES:

(1) 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 horizontal scanning cycle.
(2) 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.
(3) Amplification factor with tube operating as a triode with 150 volts on the plate and Grid No. 2 and –22.5 volts on Grid No. 1.

AVERAGE PLATE CHARACTERISTICS



Color Television Type

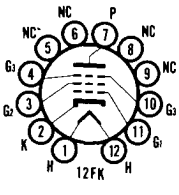
HORIZONTAL DEFLECTION AMPLIFIER

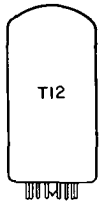
6JN6

12JN6, 17JN6

Beam Power Pentode

Construction	Compactron T-12
Base	Button 12 Pin, E12-74
Basing	12FK
Outline	12-56
Maximum Diameter	1.563 In.
Maximum Seated Height	2.500 In.
Maximum Overall Height	2.875 In.





ELECTRICAL DATA

HEATER OPERATION

	17JN6	12JN6	6JN6
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate	0.34 Pf
Input	16 Pf
Output	7 Pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier(1)

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Pulse Plate Voltage	6500 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
Positive DC Beam Plate Voltage (Max.)	70 Volts
Plate Dissipation (Max.)(2)	17.5 Watts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Grid No. 2 Dissipation (Max.)	3.5 Watts

Average Cathode Current (Max.)		175 Ma
Peak Cathode Current (Max.)		550 Ma
Grid No. 1 Circuit Resistance (Max.)		1.0 Megohm
Bulb Temperature (At Hottest Point) (Max.)		220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	5000	250 Volts
Grid No. 2 Voltage	150	150 Volts
Grid No. 1 Voltage	—	-22.5 Volts
Plate Current	—	65 Ma
Grid No. 2 Current	—	1.8 Ma
Transconductance	—	7300 μmhos
Plate Resistance	—	18,000 Ohms
Amplification Factor(3)	—	4.4
Ec1 for Ib = 1.0 Ma (Approx.)	-100	-42 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 60 V; Ec2 = 150 V, and Ec1 = 0 V
Ib = 345 Ma, and Ic2 = 27 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) 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.
(3) Amplification factor with tube operating as a triode with 150 volts on the plate and Grid No. 2 and -22.5 volts on Grid No. 1.

6JN6A

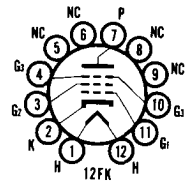
12JN6A, 17JN6A

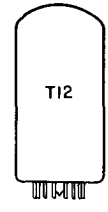
Color Television Type

HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Basing 12FK
Outline 12-56
Maximum Diameter .....1.563 In.
Maximum Seated Height .....2.500 In.
Maximum Overall Height .....2.875 In.





ELECTRICAL DATA

HEATER OPERATION

	17JN6A	12JN6A	6JN6A
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate	0.34 Pf
Input	16 Pf
Output	7 Pf

RATINGS (Design Maximum Rating System)
Horizontal Deflection Amplifier(1)

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Pulse Plate Voltage	6500 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
Positive DC Beam Plate Voltage	70 Volts
Plate Dissipation (Max.)(2)	17.5 Watts
Negative DC Grid No. 1 Voltage (Max.)	55 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Grid No. 2 Dissipation (Max.)	3.5 Watts
Average Cathode Current (Max.)	175 Ma
Peak Cathode Current (Max.)	550 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature (At Hottest Point) (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	5000	250 Volts
Grid No. 2 Voltage	150	150 Volts
Grid No. 1 Voltage	—	-22.5 Volts
Plate Current	—	70 Ma
Grid No. 2 Current	—	2.4 Ma
Transconductance	—	7300 μmhos
Plate Resistance	—	150,000 Ohms
Amplification Factor(3)	—	4.4
Ec1 for Ib = 1.0 Ma (Approx.)	-100	-42 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 55 V; Ec2 = 150 V and Ec1 = 0 V
Ib = 345 Ma, and Ic2 = 30 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) 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.
(3) Amplification factor with tube operating as a triode with 150 volts on the plate and Grid No. 2 and -22.5 volts on Grid No. 1.

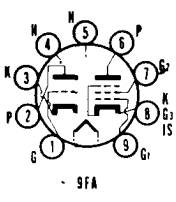
HORIZONTAL DEFLECTION OSC. and GENERAL PURPOSE TRIODE

6JN8

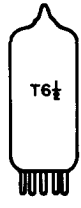
12JN8, 19JN8

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9FA
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9FA



ELECTRICAL DATA

HEATER OPERATION

	19JN8	12JN8	6JN8
Heater Voltage	18.9	12.6	6.3 Volts
Heater Current	150	225	450 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 (Shielded)(1)

Pentode Section	
Grid No. 1 to Plate (Max.) (g1 to p)	0.01 Pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + IS)	5.5 Pf
Output: Pp to (h + Pk + Pg2 + Pg3 + IS)	3.4 Pf
Triode Section	
Grid to Plate (g to p)	1.7 Pf
Input: g to (h + Tk + Pk + Pg3 + IS)	3.2 Pf
Output: p to (h + Tk + Pk + Pg3 + IS)	2.2 Pf

RATINGS (Design Maximum Rating System)

	Pentode Section	Triode Section
Plate Voltage (Max.)	300	300 Volts
Screen Supply Voltage (Max.)	300	— Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive DC Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	2.5	2.5 Watts
Screen Dissipation (Max.)	0.55	— Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	2.2	2.2 Megohms
Cathode Bias (Max.)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Pentode Section	Triode Section
Plate Voltage	125	125 Volts
Screen Voltage	125	— Volts
Grid No. 1 Voltage	-1.0	-1.0 Volts
Amplification Factor	—	46
Plate Resistance (Approx.)	200,000	5400 Ohms
Transconductance	7500	8500 μmhos
Plate Current	12	13.5 Ma
Screen Current	4.0	— Ma
Grid No. 1 Voltage (Approx.) Ib = 10 μa	-8	-8 Volts

NOTE:
(1) With external shield (EIA 315) connected to cathode of section under test.

6JS6C

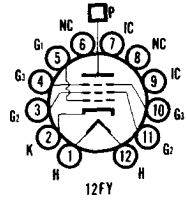
12JS6, 23JS6A, 31JS6C

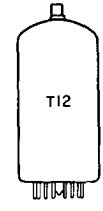
Color Television Type

HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Top Cap C1-1
Basing 12FY
Outline 12-89
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.750 In.
Maximum Overall Height .....4.125 In.





ELECTRICAL DATA

HEATER OPERATION

	12JS6	31JS6C	23JS6A	6JS6C
Heater Voltage	12.6	31.5	23.6	6.3 Volts
Heater Current	1125	450	600	2250 Ma
Heater Warm-up Time	—	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 (Unshielded)

Grid to Plate	0.7 Pf
Input: g1 to (h + k + g2 + bp)	24 Pf
Output: p to (h + k + g2 + bp)	10 Pf

RATINGS (Design Maximum Rating System)
Horizontal Deflection Amplifier(1)

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	990 Volts
Peak Positive Plate Voltage (Max.)	7500 Volts
Peak Negative Plate Voltage (Max.)	1200 Volts
Positive DC Beam Plate Voltage (Max.)	75 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Plate Dissipation (Max.)(2)	30 Watts
Grid No. 2 Input (Max.)	5.5 Watts
Average Cathode Current (Max.)	350 Ma
Peak Cathode Current (Max.)	1200 Ma
Grid No. 1 Circuit Resistance (Max.)(2)	0.47 Megohms
Grid No. 1 Circuit Resistance(4)	10.0 Megohms
Bulb Temperature (At Hottest Point) (Max.)	225 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	175 Volts
Beam Plate Voltage	Connected to Cathode at Socket
Grid No. 2 Voltage	125 Volts
Grid No. 1 Voltage	-25 Volts

Plate Current	130 Ma
Grid No. 2 Current	2.8 Ma
Transconductance	11,500 μmhos
Amplification Factor(3)	3
Plate Resistance	5500 Ohms
Ec1 for Ib = 1 Ma (Approx.)	-54 Volts

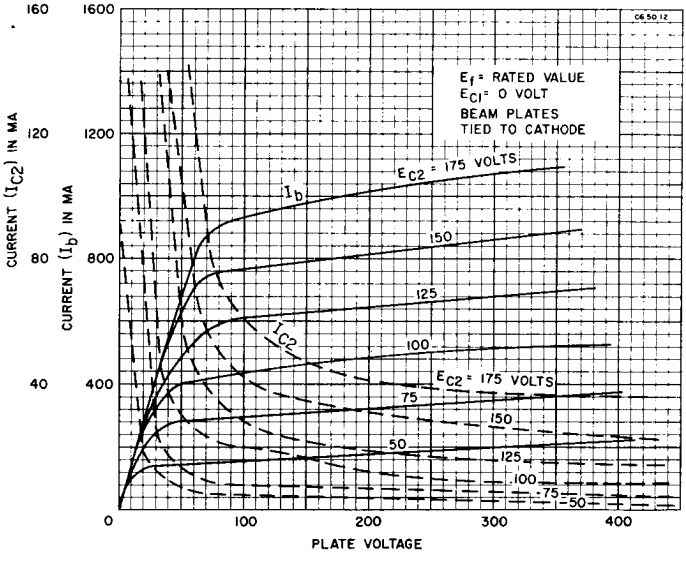
INSTANTANEOUS PLATE KNEE VALUES

Eb = 62 V, Ec2 = 125 V and Ec1 = 0 V; Eb = 70 V (12JS6)
Ib = 570 Ma; and Ic2 = 34 Ma

NOTES:

(1) 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 horizontal scanning cycle.
(2) With Grid Bias Feedback HV Regulation.
(3) Amplification factor with tube operation as a triode with 125 volts on the plate and Grid No. 2 and -25 volts on Grid No. 1.
(4) With DC or Pulse Shunt HV Regulation.

AVERAGE PLATE CHARACTERISTICS



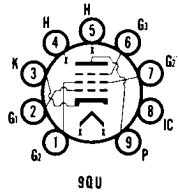
HORIZONTAL DEFLECTION AMPLIFIER

6JT6

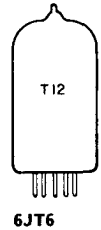
12JT6, 17JT6

Beam Power Pentode

Construction	Novar T-12
Base	Button 9 Pin, E9-76
Basing	9QU
Outline	
Maximum Diameter	1.563 In.
Maximum Seated Height	2.800 In.
Maximum Overall Height	3.180 In.



9QU



ELECTRICAL DATA

HEATER OPERATION

	17JT6	12JT6	6JT6
Heater Voltage	16.8	12.6	6.3 Volts
Heater Current	450	600	1200 Ma
Heater Warm-up Time	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 (Unshielded)

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

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier(1)

DC Plate Supply Voltage (Max.)	770 Volts
Peak Positive Pulse Plate Voltage (Max.)	6500 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
DC Grid No. 3 Voltage (Max.)	70 Volts
DC Grid No. 2 Voltage (Max.)	220 Volts
DC Grid No. 1 Voltage (Max.)	55 Volts
Peak Negative Pulse Grid No. 1 Voltage	330 Volts
Cathode Current	
Peak (Max.)	550 Ma
Average (Max.)	175 Ma
Grid No. 2 Input (Max.)	3.5 Watts
Plate Dissipation (Max.)(2)	17.5 Watts
Bulb Temperature (At Hottest Point) (Max.)	240 °C
Grid No. 1 Circuit Resistance	
For Grid-Resistor-Bias Operation (Max.)	1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	250 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Grid No. 2 Voltage	150 Volts
Grid No. 1 Voltage	-22.5 Volts
Amplification Factor	4.4
Plate Resistance (Approx.)	15,000 Ohms
Transconductance	7100 μmhos
Plate Current	70 Ma
Grid No. 2 Current	2.1 Ma
Grid No. 1 Voltage for Ib = 1 Ma	-42 Volts

INSTANTANEOUS PLATE KNEE VALUES

Eb = 60 V, Ec2 = 150 V, and Ec1 = 0 V
Ib = 390 Ma and Ic2 = 32 Ma

NOTES:

(1) 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 horizontal scanning cycle.
(2) 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.
(3) Amplification factor with tube operating as a triode with 150 volts on the plate and Grid No. 2 and -22.5 volts on Grid No. 1.

6JT6A

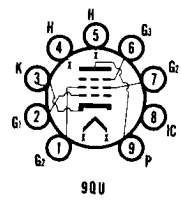
12JT6A, 17JT6A

HORIZONTAL DEFLECTION AMPLIFIER

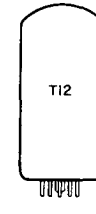
Beam Power Pentode

Construction	Novar T-12
Base	Button 9 Pin, E9-88
Basing	9QU
Outline	12-95
Maximum Diameter	1.563 In.
Maximum Seated Height	2.500 In.
Maximum Overall Height	2.880 In.

The Types 6JT6A, 12JT6A, and 17JT6A are identical to the Types 6JT6, 12JT6, and 17JT6 except for base with exhaust tip on bottom and shorter bulb.



9QU



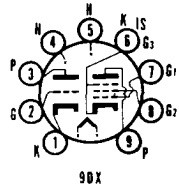
Color Television Type

VOLTAGE AMP. or SYNC SEP. (T) VIDEO AMPLIFIER (P)

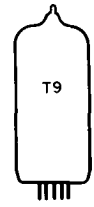
6JT8

8JT8, 10JT8

High Mu Triode and Sharp Cutoff Pentode



90X



Construction 9T-9
Base .....Button 9 Pin, E9-68
Basing 9DX
Outline 9-69
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.320 In.
Maximum Overall Height .....2.630 In.

ELECTRICAL DATA

HEATER OPERATION

	10JT8	8JT8	6JT8
Heater Voltage	10.2	7.7	6.3 Volts
Heater Current	450	600	725 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section	
Grid to Plate	3.2 Pf
Input: g to (h + Tk + Pk, g3, IS)	1.7 Pf
Output: p to (h + Tk + Pk, g3, IS)	1.6 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.10 Pf
Input: g1 to (h + Pk, g3, IS + g2)	12 Pf
Output: p to (h + Pk, g3, IS + g2)	3.0 Pf
Coupling	
Triode Grid to Pentode Plate (Max.)	0.02 Pf
Pentode Grid No. 1 to Triode Plate (Max.)	0.004 Pf
Pentode Plate to Triode Plate (Max.)	0.13 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	1.0	4.0 Watts
Grid No. 2 Dissipation (Max.)	—	1.1 Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Cathode Bias (Max.)	1.0	1.0 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 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

	Triode Section	Pentode Section
Plate Voltage	250	200 Volts
Grid No. 2 Voltage	—	100 Volts
Grid No. 1 Voltage	−2	0 Volts
Cathode Bias Resistor	—	82 Ohms
Plate Current	1.5	17 Ma
Grid No. 2 Current	—	3.5 Ma
Transconductance	2700	20,000 μmhos
Amplification Factor	100	—
Plate Resistance (Approx.)	37,000	50,000 Ohms
Ec1 for Ib = 100 μa (Approx.)	—	−5 Volts
Ec for Ib = 20 μa (Approx.)	−5.3	— Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS (Pentode Section)

Eb = 50 V, Ec2 = 100 V and Ec1 = 0 V
Ib = 55 Ma, and Ic2 = 18 Ma

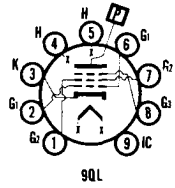
6JU6

22JU6

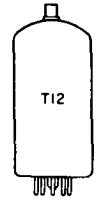
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Novar T-12
Base .....Button 9 Pin, E9-76 or E9-88
Top Cap .....C1-2, C1-33 or C1-3
Basing 9QL
Outline
Maximum Diameter .....1.562 In.
Maximum Seated Height .....3.170 In.
Maximum Overall Height .....3.550 In.



9QL



ELECTRICAL DATA

HEATER OPERATION

	22JU6	6JU6
Heater Voltage	22.0	6.3 Volts
Heater Current	450	1600 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate	1.2 Pf
Input: g1 to (k, g3, g2, H)	22 Pf
Output: p to (k, g3, g2, H)	9.0 Pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier

DC Plate Supply Voltage (Max.)	770 Volts
Peak Positive Pulse Plate Voltage (Max.)(4)	6500 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
DC Grid No. 3 Voltage(5)	75 Volts
DC Grid No. 2 Voltage	220 Volts
DC Grid No. 1 Voltage (Negative Bias Value)	55 Volts
Peak Negative Pulse Grid No. 1 Voltage	330 Volts
Cathode Current	
Peak	950 Ma
Average	275 Ma
Grid No. 2 Input	3.5 Watts
Plate Dissipation(6)	17 Watts
Envelope Temperature (At Hottest Point)	240 °C
Grid No. 1 Circuit Resistance	
Grid Bias Operation	0.47 Megohms
Plate Pulse Operation (Horizontal Deflection Circuit Only)	10 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Peak Positive Pulse Plate Voltage(3)	6500	—	—	— Volts
DC Plate Voltage	—	50	125	130 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket			
DC Grid No. 2 Voltage	125	125	125	125 Volts
DC Grid No. 1 Voltage	—	0	-20	-20 Volts
Amplification Factor (Triode Connection)(1)	—	—	4.7	—
Plate Resistance (Approx.)	—	—	—	18 Kilohms
Transconductance	—	—	—	7000 μmhos
DC Plate Current	—	470(2)	—	45 Ma
DC Grid No. 2 Current	—	32(2)	—	1.5 Ma
Cutoff DC Grid No. 1 Voltage for Ib = 1 Ma	-75	—	—	-32 Volts

NOTES:

(1) With grid No. 2 connected to Plate at socket.
(2) This value can be measured by a method involving a recurrent waveform such that the Maximum Ratings of the tube will not be exceeded.
(3) Under pulse-duration condition specified in Footnote No. 4.
(4) This rating is applicable where the duration of the voltage pulse do not exceed 15% of one horizontal scanning cycle. In a 525-line, 30-frame system, 15% of one horizontal scanning cycle is 10 μs.
(5) 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.
(6) An adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.

Color Television Type

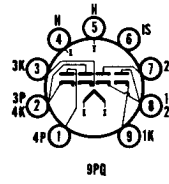
PHASE DETECTOR COLOR KILLER

6JU8A

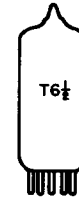
8JU8A

Quadruple Diode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9PQ
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9PQ



ELECTRICAL DATA

HEATER OPERATION

	8JU8A	6JU8A
Heater Voltage	8.4	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	11	— Sec.
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		300 Volts
Heater Positive with Respect to Cathode		300 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)		
K (Unit 1) to P (Unit 1) and K (Unit 2)		1.8 Pf
P (Unit 2) to P (Unit 1) and K (Unit 2)		2.2 Pf
P (Unit 2) to Heater and IS		0.62 Pf
K (Unit 3) to P (Unit 3) and K (Unit 4)		1.9 Pf
P (Unit 4) to P (Unit 3) and K (Unit 4)		2.2 Pf
P (Unit 4) to Heater and IS		0.94 Pf
K (Unit 1) to Heater and IS		1.8 Pf
K (Unit 3) to Heater and IS		1.9 Pf
RATINGS (Design Maximum Rating System) (Each Section)		
Peak Inverse Plate Voltage (Max.)		300 Volts
DC Output Current (Max.)		9 Ma
Peak Plate Current (Max.)		54 Ma
CHARACTERISTICS AND TYPICAL OPERATION		
Plate Current at Eb = 10 Volts		60 Ma

Color Television Type

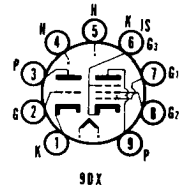
VOLTAGE AMP. or SYNC SEP. (T) VIDEO AMPLIFIER (P)

6JV8

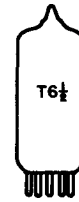
8JV8,

High Mu Triode and Sharp Cutoff Pentode

Construction .....*Miniature T-6½*
Base .....Button 9 Pin, E9-1
Basing 9DX
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

	8JV8	6JV8
Heater Voltage	8.5	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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 (Unshielded)		
Triode Section		
Grid to Plate		2.2 Pf
Input: g to (h + k)		3 Pf
Output: p to (h + k)		2 Pf

Pentode Section

Grid No. 1 to Plate (Max.)	0.08 Pf
Input: g1 to (h + k + g2 + g3 + IS)	8 Pf
Output: p to (h + k + g2 + g3 + IS)	3.2 Pf

Coupling

Pentode Grid No. 1 to Triode Plate (Max.)	0.012 Pf
Pentode Plate to Triode Plate (Max.)	0.24 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	300	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	1.1	4 Watts
Grid No. 2 Dissipation (Max.)	—	1.7 Watts
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Self Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section	
Class A1 Amplifier			
Plate Voltage	200	200	125 Volts
Grid No. 2 Voltage	—	200	125 Volts
Grid No. 1 Voltage	−2	−2.9	−1 Volts
Plate Current	4	22	22 Ma
Grid No. 2 Current	—	4.0	4 Ma
Transconductance	4000	10,700	11,500 μmhos
Amplification Factor	70	—	—
Plate Resistance (Approx.)	17,500	150,000	100,000 Ohms
Ec1 for Ib = 20 μa (Approx.)	−5	−9	−5.5 Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS
Eb = 60 V; Ec2 = 200 V and Ec1 = 0 V
Ib = 51 Ma (Approx.) and Ic2 = 14 Ma (Approx.)

6JW8/ECF802

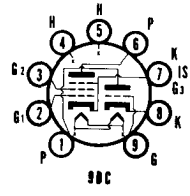
9JW8

Color Television Type

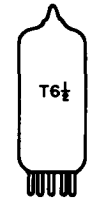
HORIZONTAL OSCILLATOR (P) REACTANCE TUBE (T)

Triode and Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DC
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9DC



ELECTRICAL DATA

HEATER OPERATION

	9JW8	6JW8/ECF802
Heater Voltage	9.3	6.3 Volts
Heater Current	450	430 Ma
Maximum Heater-Cathode Voltage	100	100 Volts

DIRECT INTERELECTRODE CAPACITANCES

Pentode Section

Grid No. 1	5.4 Pf
Plate to Grid No. 1	0.060 Pf
Grid No. 1 to Filament	0.1 Pf

Triode Section

Grid	2.4 Pf
Plate to Grid	1.5 Pf
Grid to Filament	0.1 Pf

RATINGS (Design Center Rating System)

Pentode Section

Plate Voltage, Zero Plate Current (Max.)	550 Volts
Plate Voltage (Max.)	250 Volts
Plate Dissipation (Max.)	1.2 Watts
Grid No. 2 Voltage, Zero Plate Current (Max.)	550 Volts
Grid No. 2 Voltage (Max.)	250 Volts
Grid No. 2 Dissipation (Max.)	0.8 Watt

Grid No. 1 Circuit Resistance (Fixed Bias) (Max.)	0.56 Megohm
Grid No. 1 Circuit Resistance (Self Bias) (Max.)	1.0 Megohm
Cathode Current (Max.)	15 Ma
Peak Cathode Current (Max.)(1)	50 Ma
Input Impedance at 60 Hertz (Max.)	300 K Ohms
Triode Section	
Plate Voltage, Zero Plate Current (Max.)	550 Volts
Plate Voltage (Max.)	250 Volts
Plate Dissipation (Max.)	1.4 Watts
Grid No. 1 Circuit Resistance (Max.)	3 Megohms
Cathode Current (Max.)	10 Ma
Input Impedance at 60 Hertz (Max.)	50 K Ohms
CHARACTERISTICS AND TYPICAL OPERATION	
Pentode Section	
Plate Voltage	100 Volts
Grid No. 2 Voltage	100 Volts
Grid No. 1 Voltage	−1 Volt
Plate Current	6 Ma
Grid No. 2 Current	1.7 Ma
Transconductance	5500 μmhos
Input Resistance	0.4 Megohm
Amplification Factor (Grid No. 1 to Grid No. 2)	47
Plate Current (Eg1 = 0 V)	12.5 Ma
Grid No. 2 Current (Eg1 = 0 V)	3.5 Ma
Grid No. 1 Voltage (Eb = Eg2 = 200 V, Ib = 10 μa)	−16 Volts
Grid No. 1 Voltage (Ic1 = +0.3 μa)	−1.3 Volts
Triode Section	
Plate Voltage	200 Volts
Grid Voltage	−2 Volts
Plate Current	3.5 Ma
Transconductance	3500 μmhos
Input Resistance	20 K Ohms
Amplification Factor	70
Plate Current (Ic = 10 μa)	10 Ma
Grid Voltage (Ic = +0.3 μa)	−1.3 Volts

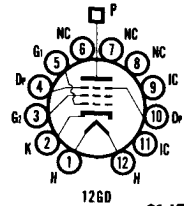
NOTE:
(1) Duty cycle 30% maximum; pulse time 30 μsec. maximum.

HORIZONTAL DEFLECTION AMPLIFIER

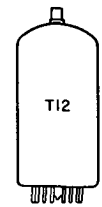
6JZ6
21JZ6

Beam Power Pentode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Top Cap C1-3
Basing 12GD
Outline 12-79
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.625 In.



12GD



ELECTRICAL DATA

HEATER OPERATION	21JZ6	6JZ6
Heater Voltage	21.0	6.3 Volts
Heater Current	450	1500 Ma
Heater Warm-up Time	11	— Sec.
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)		
Grid No. 1 to Plate		0.34 Pf
Input: g1 to (h + k + g2 + b.p.)		24 Pf
Output: p to (h + k + g2 + b.p.)		8.5 Pf
RATINGS (Design Maximum Rating System)		
Horizontal Deflection Amplifier Service(1)		
DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)		770 Volts
Peak Positive Pulse Plate Voltage (Max.)		6500 Volts
Peak Negative Pulse Plate Voltage (Max.)		1500 Volts
Positive DC Beam Plate Voltage (Max.)		70 Volts

Screen Voltage (Max.)	220 Volts
Negative DC Grid No. 1 Voltage (Max.)	55 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Plate Dissipation (Max.)(2)	18 Watts
Screen Dissipation (Max.)	3.5 Watts
DC Cathode Current (Max.)	230 Ma
Peak Cathode Current (Max.)	800 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature at Hottest Point (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	5000	50	130 Volts
Beam Plates	Connected to Cathode at Socket		
Screen Voltage	130	130	130 Volts
Grid No. 1 Voltage	—	0(3)	-20 Volts
Plate Resistance (Approx.)	—	—	9900 Ohms
Transconductance	—	—	9000 μmhos
Plate Current	—	450	46 Ma
Screen Current	—	29	1.8 Ma
Grid No. 1 Voltage (Approx.) Ib = 1.0 Ma	-64	—	-32 Volts
Triode Amplification Factor(4)	—	—	4.8

NOTES:

(1) 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 horizontal scanning cycle.
(2) In stages operating with grid-leak bias, an adequate cathode bias resistor of other suitable means is required to protect the tube in the absence of excitation.
(3) Applied for short interval (two seconds maximum) so as not to damage tube.
(4) Triode connection (screen tied to plate) with Eb = Ec2 = 130 V and Ec1 = -20 V.

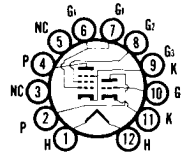
6JZ8

13JZ8, 17JZ8, 24JZ8, 25JZ8

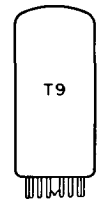
VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

Medium Mu Triode and Sharp Cutoff Pentode

Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12DZ
Outline	9-58
Maximum Diameter	1.188 In.
Maximum Seated Height	2.000 In.
Maximum Overall Height	2.375 In.



12DZ



ELECTRICAL DATA

HEATER OPERATION

	25JZ8	24JZ8	13JZ8	17JZ8	6JZ8
Heater Voltage	25.2	24.2	12.7	17.5	6.3
Heater Current	300	315	600	450	1200 Ma
Heater Warm-up Time	11	11	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 (Unshielded)

Triode Section	
Grid to Plate	3.6 Pf
Input: g to (h + Tk)	2.2 Pf
Output: p to (h + Tk)	0.7 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.34 Pf
Input: g1 to (h + Pk + Pp + g2)	11 Pf
Output: p to (h + Pk + Pp + g2)	7 Pf

RATINGS (Design Maximum Rating System)
Vertical Deflection Oscillator and Amplifier[1]

	Tri. Osc.	Pent. Amp.
Plate Voltage (Max.)	250	250 Volts
Grid No. 2 Voltage (Max.)	—	200 Volts
Peak Positive Pulse Plate Voltage (Max.)	—	2000 Volts
Peak Negative Grid No. 1 Voltage (Max.)	400	150 Volts
Plate Dissipation (Max.)[2]	1.0	7 Watts
Grid No. 2 Dissipation (Max.)[2]	—	1.8 Watts
Average Cathode Current (Max.)	20	70 Ma
Peak Cathode Current (Max.)	70	245 Ma
Grid Circuit Resistance		
Self Bias (Max.)	2.2	2.2 Megohms
Fixed Bias (Max.)	1.0	1.0 Megohm

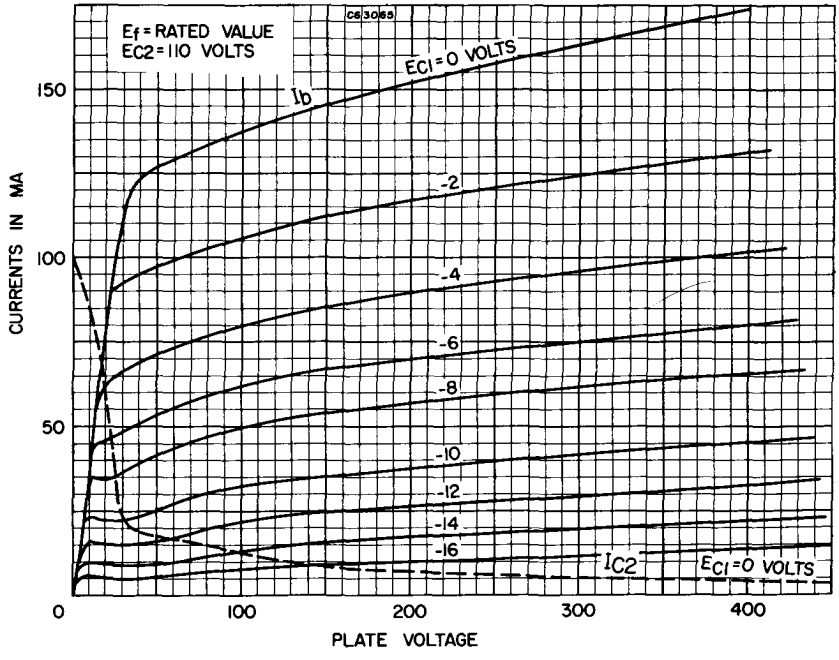
CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	150	120 Volts
Grid No. 2 Voltage	—	110 Volts
Grid No. 1 Voltage	-5	-8 Volts
Plate Current	5.5	46 Ma
Grid No. 2 Current	—	3.5 Ma
Transconductance	2350	7100 μmhos
Amplification Factor	20	—
Plate Resistance (Approx.)	8500	11,700 Ohms
Ec for Ib = 10 μa (Approx.)	-11	— Volts
Ec for Ib = 100 μa (Approx.)	—	-25 Volts

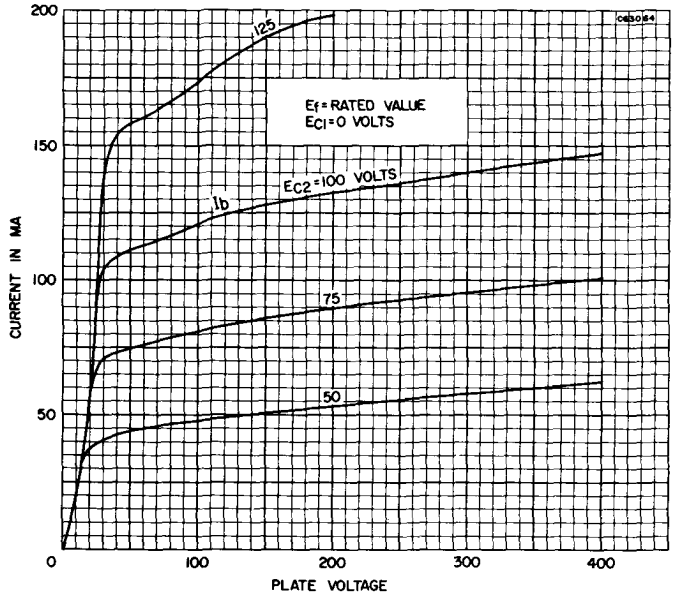
INSTANTANEOUS PLATE KNEE VALUES
Eb = 45 V; Ec2 = 110 V; and Ec = 0 V
Ib = 122 Ma, and Ic2 = 16.5 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) In stages operating with grid leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.

AVERAGE PLATE CHARACTERISTICS
(Pentode Section)



AVERAGE PLATE CHARACTERISTICS
(Triode Section)

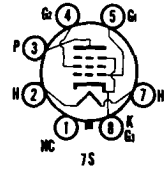


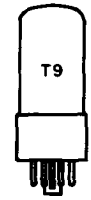
6K6GT

AUDIO POWER AMPLIFIER

Power Pentode

Construction .....Octal T-9
Base .....Octal 6 or 7 Pin
Basing.....7S
Outline .....9-11 or 9-41
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.750 In.
Maximum Overall Height .....3.313 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	400 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)

Control Grid to Plate	0.5 Pf
Input	5.5 Pf
Output	6.0 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	315 Volts
Plate Dissipation (Max.)	8.5 Watts
Screen Voltage (Max.)	285 Volts
Screen Dissipation (Max.)	2.8 Watts
Positive Control Grid Voltage (Max.)	0 Volt

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	100	250	315 Volts
Screen Voltage	100	250	250 Volts
Control Grid Bias Voltage(1)	−7	−18	−21 Volts
Peak AF Grid Voltage	7	18	21 Volts
Zero Signal Plate Current	9	32	25.5 Ma
Zero Signal Screen Current	1.6	5.5	4.0 Ma
Maximum Signal Plate Current	9.5	33	28 Ma
Maximum Signal Screen Current	3	10	9 Ma
Transconductance	1500	2300	2100 μmhos
Plate Resistance (Approx.)	104,000	90,000	110,000 Ohms
Load Resistance	12,000	7600	9000 Ohms
Power Output	0.35	3.4	4.5 Watts
Total Harmonic Distortion	11	11	15 Percent

Push-Pull Class A1 Amplifier (Values for Two Tubes)

	Fixed Bias	Self Bias
Plate Voltage	285	285 Volts
Screen Voltage	285	285 Volts
Control Grid Bias Voltage(1)	−25.5	— Volts
Cathode Bias Resistor	—	400 Ohms
Peak AF Grid to Grid Voltage	51	51 Volts
Zero Signal Plate Current	55	55 Ma
Zero Signal Screen Current	9	9 Ma
Maximum Signal Plate Current	72	61 Ma
Maximum Signal Screen Current	17	13 Ma
Load Resistance (Plate to Plate)	12,000	12,000 Ohms
Maximum Signal Power Output	10.5	9.8 Watts
Total Harmonic Distortion	6	4 Percent

NOTE:

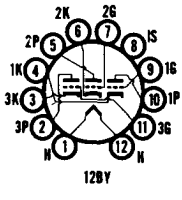
(1) The DC resistance in the grid circuit under rated maximum conditions should not exceed 0.5 megohm for self-bias operation, and 0.1 megohm for fixed-bias operation.

AGC, SYNC CLIPPER and NOISE INVERTER

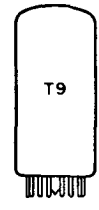
6K11/6Q11

Two High Mu Triodes and One Medium Mu Triode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12BY
Outline 9-56
Maximum Diameter .....1.188 In.
Maximum Seated Height .....1.500 In.
Maximum Overall Height .....1.846 In.



12BY



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	600 Ma
Heater Warm-up Time	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 (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 + IS)	1.9	1.8	1.8 Pf
Output: p to (h + k + IS)	1.8	0.7	1.8 Pf

RATINGS (Design Maximum Rating System)

	Section No. 1	Section No. 2 and No. 3
Plate Voltage (Max.)	330	330 Volts
Plate Dissipation (Max.)	2.75	0.3 Watts
Cathode Current (Max.)	20	— Ma
Positive Grid Voltage (Max.)	0	0 Volt
Negative Grid Voltage (Max.)	50	50 Volts

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

	Section No. 1	Section No. 2 and No. 3
Plate Voltage	250	250 Volts
Grid Voltage	–8.5	–2.0 Volts
Plate Current	10.5	1.2 Ma
Plate Resistance	7700	62,500 Ohms
Transconductance	2200	1600 μmhos
Amplification Factor	17	100
Ec for Ib = 10 μa	–24	— Volts

6KA8

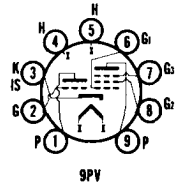
8KA8

Color Television Type

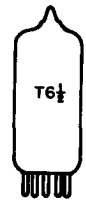
SYNC SEPARATOR (T) AGC AMP and NOISE INVERTER (P)

High Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9PV
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9PV



ELECTRICAL DATA
HEATER OPERATION

	8KA8	6KA8
Heater Voltage	8.4	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section	
Grid to Plate	2.2 Pf
Input: g to (k + h + IS)	2.8 Pf
Output: p to (k + h + IS)	2.2 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.1 Pf
Input: g1 to (h + k + g2 + g3 + IS)	9.5 Pf
Grid No. 3 to (h + k + g2 + g1 + IS)	7 Pf
Grid No. 1 to Grid No. 3	0.5 Pf
Grid No. 3 to Plate	2.2 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	300	300 Volts
Peak Positive Pulse Plate Voltage (Max.)(1)	—	600 Volts
Grid No. 2 Supply Voltage (Max.)	—	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 3 Voltage (Max.)	—	0 Volt
Negative Grid No. 3 Voltage (Max.)	—	100 Volts
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Negative Grid No. 1 Voltage (Max.)	50	50 Volts
Plate Dissipation (Max.)	1.1	2.0 Watts
Grid No. 2 Input (Max.)	—	1.1 Watt
Grid No. 1 Circuit Resistance		
Self Bias (Max.)	1.0	1.0 Megohm
Fixed Bias (Max.)	0.25	0.5 Megohm
Grid No. 3 Circuit Resistance (Max.)	—	0.68 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

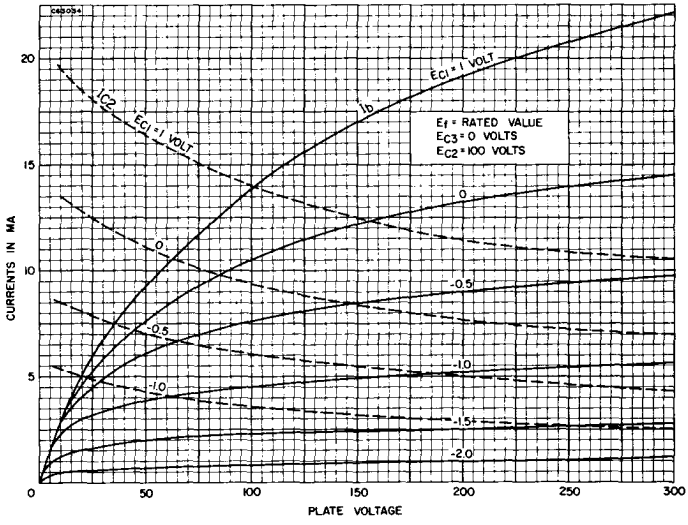
	Triode Section	Pentode Section
Plate Supply Voltage	200	150 Volts
Grid No. 2 Voltage	—	100 Volts

Grid No. 1 Voltage	−2	0 Volts
Cathode Bias Resistor	—	180 Ohms
Plate Current	4	4 Ma
Grid No. 2 Current	—	2.8 Ma
Amplification Factor	70	—
Plate Resistance (Approx.)	17,500	100,000 Ohms
Transconductance (G1 to P)	4000	4400 μmhos
Transconductance (G3 to P)	—	600 μmhos
Ec3 for Ib = 20 μa (Approx.)	—	−7 Volts
Ec1 for Ib = 10 μa (Approx.)	−5	— Volts
20 μa (Approx.)	—	−4 Volts

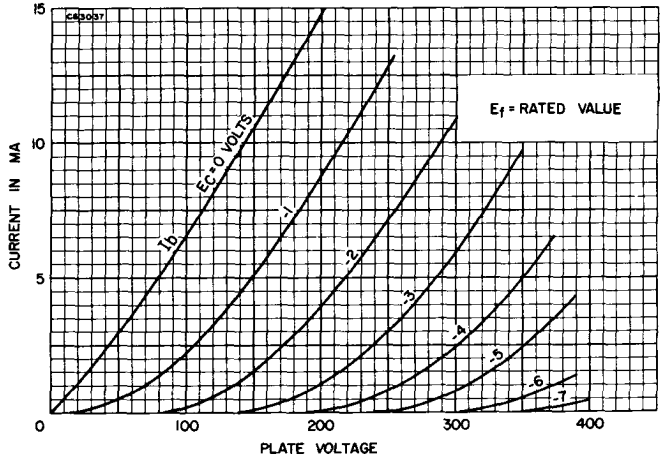
NOTE:

(1) The duration of the voltage pulse must not exceed 15% of one horizontal scanning cycle. In a 525-line, 30-frame system, 15% of one horizontal scanning cycle is 10 μsec.

AVERAGE PLATE CHARACTERISTICS
(Pentode Section)



AVERAGE PLATE CHARACTERISTICS
(Triode Section)



6KD6

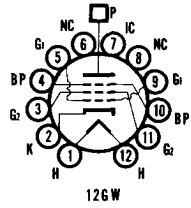
30KD6, 36KD6, 40KD6

Color Television Type

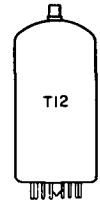
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Top Cap C1-2
Basing[1] 12GW
Outline 12-118
Maximum Diameter .....1.563 In.
Maximum Seated Height .....4.250 In.
Maximum Overall Height .....4.625 In.



126W



ELECTRICAL DATA

HEATER OPERATION

	40KD6	36KD6	30KD6	6KD6
Heater Voltage	40	36	30	6.3 Volts
Heater Current	450	450	600	2850 Ma
Heater Warm-up Time	11	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 (Unshielded)

Grid to Plate ..... 0.8 Pf
Input: g1 to (h + k + g2 + bp) ..... 40 Pf
Output: p to (h + k + g2 + bp) ..... 16 Pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier[2]

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.) ..... 990 Volts
Peak Positive Plate Voltage (Max.) ..... 7000 Volts
Peak Negative Plate Voltage (Max.) ..... 1100 Volts
Beam Plate Voltage (Max.) ..... 20 Volts
Grid No. 2 Voltage (Max.) ..... 200 Volts
Peak Negative Grid No. 1 Voltage (Max.) ..... 250 Volts
Plate Dissipation (Max.)[3] ..... 33 Watts
Grid No. 2 Dissipation (Max.) ..... 5.0 Watts
Average Cathode Current (Max.) ..... 400 Ma
Peak Cathode Current (Max.) ..... 1400 Ma
Grid No. 1 Circuit Resistance (Max.)[3] ..... 2.2 Megohm
Bulb Temperature (At Hottest Point) (Max.) ..... 225 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage ..... 150 Volts
Grid No. 2 Voltage ..... 110 Volts
Grid No. 1 Voltage ..... -22.5 Volts
Beam Plate Voltage .....Tied to Cathode
Plate Current ..... 100 Ma
Grid No. 2 Current ..... 2.0 Ma
Transconductance ..... 14,000 μmhos
Amplification Factor[4] 4.0
Plate Resistance ..... 6000 Ohms
Ec1 for Ib = 1 Ma (Approx.) ..... -40 Volts

INSTANTANEOUS PLATE KNEE VALUES

Eb = 60 V, Ec2 = 100 V and Ec1 = 0 V;
Ib = 750 Ma; and Ic2 = 42 Ma

NOTES:

(1) Pins designated Internal Connection (IC) may or may not be connected to an internal element, depending on manufacturer. To maintain interchangeability, these pins should not be used as tie points.
(2) 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 horizontal scanning cycle.
(3) In stages operating with grid leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.
(4) Amplification factor with tube operating as a triode with 150 volts on the plate and Grid No. 2 and -22.5 volts on Grid No. 1.

Color Television Type

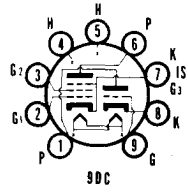
VHF OSCILLATOR and MIXER

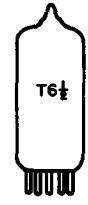
6KE8

5KE8, 4KE8

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DC
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	4KE8	5KE8	6KE8
Heater Voltage	4.5	5.6	6.3 Volts
Heater Current	600	450	400 Ma
Heater Warm-up Time	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 (Shielded)

Triode Section

Grid to Plate ..... 1.3 Pf
Input: g1 to (k + Pk + Pg3 + IS + h) ..... 2.4 Pf
Output: p to (Tk + Pk + Pg3 + IS + h) ..... 2.0 Pf

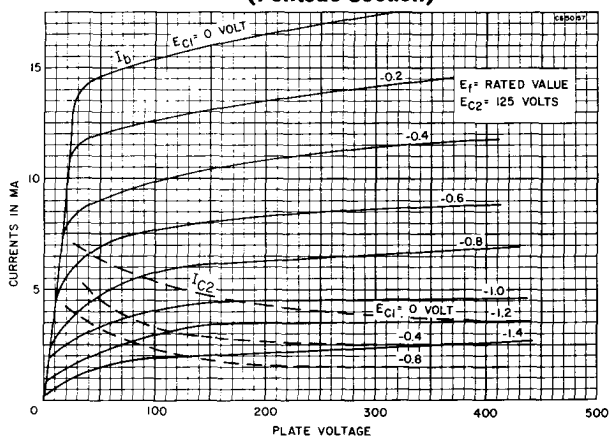
Pentode Section

Grid No. 1 to Plate (Max.) ..... 0.015 Pf
Input: g1 to (k + g3 + IS + g2 + h) ..... 5.0 Pf
Output: p to (k + g3 + IS + g2 + h) ..... 3.4 Pf

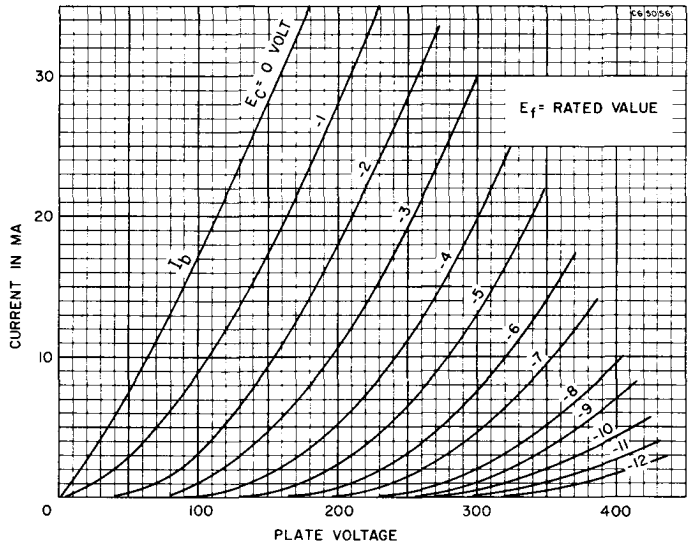
RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	280	280 Volts
Grid No. 2 Supply Voltage (Max.)	—	280 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Cathode Current (Max.)	20	20 Ma
Plate Dissipation (Max.)	2.0	2.0 Watts
Grid No. 2 Dissipation (Max.)	—	0.5 Watt
Positive Grid No. 1 Voltage (Max.)	0	0 Volt

AVERAGE PLATE CHARACTERISTICS
(Pentode Section)



AVERAGE PLATE CHARACTERISTICS
(Triode Section)



CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

	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	10 Ma
Grid No. 2 Current	—	2.8 Ma
Transconductance	8000	12,000 μmhos
Amplification Factor	40	—
Plate Resistance (Approx.)	5000	125,000 Ohms
Ec1 for Ib = 100 μa (Approx.)	-5	— Volts
Ec1 for Ib = 50 μa (Approx.)	—	-3 Volts

6KM6

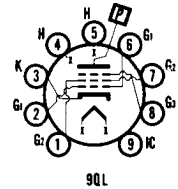
22KM6

Color Television Type

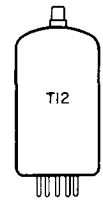
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction	Novar T-12
Base	Button 9 Pin, E9-88 or E9-76
Top Cap	C1-2, C1-33 or C1-3
Basing[4]	9QL
Outline	12-70
Maximum Diameter	1.562 In.
Maximum Seated Height	3.170 In.
Maximum Overall Height	3.550 In.



9QL



ELECTRICAL DATA
HEATER OPERATION

	22KM6	6KM6
Heater Voltage	22.0	6.3 Volts
Heater Current	450	1600 Ma
Heater Warm-up Time	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 (Unshielded)		
Grid to Plate		1.2 Pf
Input		22.0 Pf
Output		9.0 Pf
RATINGS (Design Maximum Rating System)		
Horizontal Deflection Amplifier(1) (Sections in Parallel)		
DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)		770 Volts
Peak Positive Pulse Plate Voltage		6500 Volts
Peak Negative Pulse Plate Voltage (Max.)		1500 Volts
Plate Dissipation (Max.)(2)		20 Watts
Peak Negative Grid No. 1 Voltage (Max.)		330 Volts
Grid No. 2 Voltage (Max.)		220 Volts
Grid No. 2 Dissipation (Max.)		3.5 Watts
Average Cathode Current (Max.)		275 Ma
Peak Cathode Current (Max.)		950 Ma
Grid No. 1 Circuit Resistance (Max.)		10.0 Megohms
Bulb Temperature (At Hottest Point)		240 °C
CHARACTERISTICS AND TYPICAL OPERATION		
Plate Voltage	6500	140 Volts
Grid No. 2 Voltage	140	140 Volts
Grid No. 1 Voltage	—	-24.5 Volts
Grid No. 3 Voltage	30	30 Volts
Plate Current	—	80 Ma
Grid No. 2 Current	—	2.4 Ma
Transconductance	—	9500 μmhos
Plate Resistance	—	6000 Ohms
Amplification Factor(3)	—	4.0
Ec1 for Ib = 1.0 Ma (Approx.)	-110	-42 Volts

INSTANTANEOUS PLATE KNEE VALUES (Sections in Parallel)
Eb = 60 V; Ec2 = 140 V; Ec3 = 30 V; and Ec1 = 0 V
Ib = 560 Ma; and Ic2 = 81 Ma

NOTES:

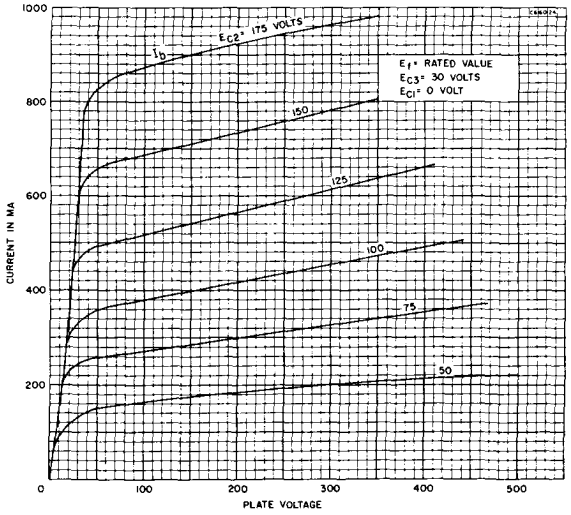
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

(2) 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.

(3) Amplification factor with tube operating as a triode with 140 volts on the plate and Grid No. 2 and -24.5 volts on Grid No. 1. Grid No. 3 tied to cathode at socket.

(4) Pins designated internal connection (IC) may or may not be internally connected to elements depending on the manufacturer. To maintain interchangeability these pins should not be used as tie points.

AVERAGE PLATE CHARACTERISTICS

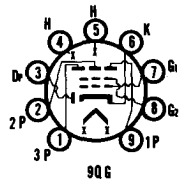


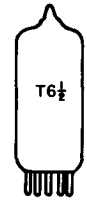
6KM8

"Key" for VIBRATO CIRCUIT (D) FREQUENCY DIVIDER or COMPLEX WAVE GEN. (TT)

Diode and Sharp Cutoff Triple Plate Tetrode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9QG
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	300 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)

Tetrode Unit:

Grid No. 1 to Plate 1A (Max.)	0.02 Pf
Grid No. 1 to Plate 1B (Max.)	0.02 Pf
Grid No. 1 to Plate 2 (Max.)	0.06 Pf
Grid No. 1 to Cathode and Internal Shield, Grid No. 2, and Heater	5.5 Pf
Plate 1A to Cathode and Internal Shield, Grid No. 2, and Heater	1.2 Pf
Plate 1B to Cathode and Internal Shield, Grid No. 2, and Heater	1.3 Pf
Plate 2 to Cathode and Internal Shield, Grid No. 2, and Heater	1.8 Pf
Tetrode Grid No. 1 to Diode Plate (Max.)	0.024 Pf
Tetrode Plate 1A to Diode Plate	0.18 Pf
Tetrode Plate 1B to Diode Plate	0.024 Pf
Tetrode Plate 2 to Diode Plate	0.013 Pf

RATINGS (Design Maximum Rating System)

Tetrode Unit
Frequency-Divider and Complex-Wave-Generator Service

Plate Voltage:	
Plate 1A (Max.)	330 Volts
Plate 1B (Max.)	330 Volts
Plate 2 (Max.)	330 Volts
Grid No. 2 (Screen Grid) Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Grid No. 1 (Control Grid) Voltage:	
Negative Bias Value (Max.)	50 Volts
Positive Bias Value (Max.)	0 Volt
Grid No. 2 Input:	
For Grid No. 2 Voltages up to 165 Volts (Max.)	0.65 Watt
For Grid No. 2 Voltages Between 165 and 330 Volts	See Rating Chart (Gen. Info. Sec.)
Plate 1A Dissipation (Max.)	1 Watt
Plate 1B Dissipation (Max.)	1 Watt
Plate 2 Dissipation (Max.)	1 Watt
Grid No. 1 Circuit Resistance:	
For Grid No. 1 Resistor Bias Operation (Max.)	2.2 Megohms

Diode Unit

Plate Current (Max.)	1 Ma
Plate Current for Plate Volts = 10 (Instantaneous Test Condition)	2 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier (Tetrode Unit)
(Plates 1A, 1B, and 2 connected together at socket)

Plate Voltage	100 Volts
Grid No. 2 Voltage	100 Volts
Grid No. 1 Supply Voltage	0 Volts
Grid No. 1 Resistor (Bypassed)	2.2 Megohms
Plate Resistance (Approx.)	30,000 Ohms
Transconductance	3400 μmhos

Plate Current	4.2 Ma
Grid No. 2 Current	1.7 Ma
Grid No. 1 Voltage for Plate μa = 20 (Approx.)	−4 Volts
Triode Connection	
Grid No. 2 Connected to Plates 1A, 1B, and 2 at Socket	
Plate Voltage	100 Volts
Grid No. 1 Supply Voltage	0 Volt
Grid No. 1 Resistor (Bypassed)	2.2 Megohms
Transconductance	4500 μmhos
Amplification Factor	45
Plate Current	5.5 Ma
Separate Plate Operation (Plates Not Under Test Grounded)	
Plate Voltage:	
Plate 1A	100 Volts
Plate 1B	100 Volts
Plate 2	100 Volts
Grid No. 2 Voltage	100 Volts
Grid No. 1 Supply Voltage	0 Volt
Grid No. 1 Resistor (Bypassed)	2.2 Megohms
Transconductance:	
Grid No. 1 to Plate 1A	2000 μmhos
Grid No. 1 to Plate 1B	2000 μmhos
Grid No. 1 to Plate 2	1800 μmhos
Plate Resistance (Approx.):	
Plate 1A	0.1 Megohm
Plate 1B	0.1 Megohm
Plate 2	0.12 Megohm
Plate Current:	
Plate 1A	2.3 Ma
Plate 1B	2.3 Ma
Plate 2	2.1 Ma
Grid No. 2 Current:	
For Plate 1A Volts = 100	3.8 Ma
For Plate 1B Volts = 100	3.8 Ma
For Plate 2 Volts = 100	3.3 Ma

Color Television Type

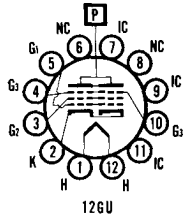
HORIZONTAL DEFLECTION AMPLIFIER

6KN6

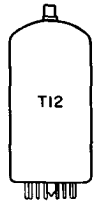
42KN6

Beam Power Pentode
(2 Sections in Parallel)

Construction	Compactron T-12
Base	Button 12 Pin, E12-74
Top Cap	C1-2 or C1-3
Basing	12GU
Outline	12-82
Maximum Diameter	1.562 In.
Maximum Seated Height	4.000 In.
Maximum Overall Height	4.375 In.



12GU



ELECTRICAL DATA

HEATER OPERATION

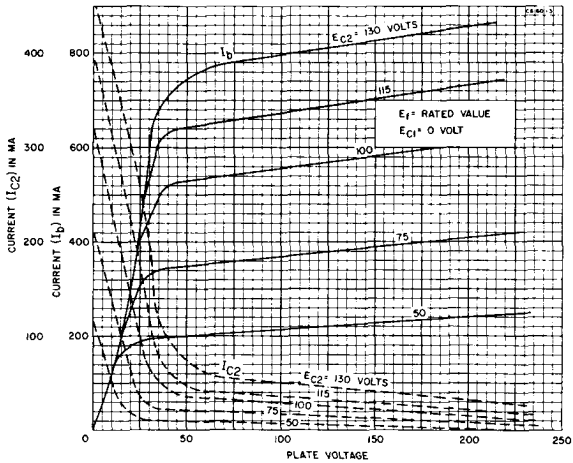
	42KN6	6KN6
Heater Voltage	42	6.3 Volts
Heater Current	450	3000 Ma
Heater Warm-up Time	11	— Seconds
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
Total DC and Peak		200 Volts
Heater Positive with Respect to Cathode		
DC		100 Volts
Total DC and Peak		200 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)		
Grid to Plate		1.0 Pf
Input		44.0 Pf
Output		18.0 Pf
RATINGS (Design Maximum Rating System)		
Horizontal Deflection Amplifier (Sections in Parallel)(1)		
DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)		770 Volts
Peak Positive Pulse Plate Voltage		6500 Volts
Peak Negative Pulse Plate Voltage (Max.)		1500 Volts

Plate Dissipation (Max.)(2)		30 Watts
Peak Negative Grid No. 1 Voltage (Max.)		330 Volts
Grid No. 2 Voltage (Max.)		220 Volts
Grid No. 2 Dissipation (Max.)		5.0 Watts
Average Cathode Current (Max.)		400 Ma
Peak Cathode Current (Max.)		1500 Ma
Grid No. 1 Circuit Resistance (Max.)		1.0 Megohm
Bulb Temperature (At Hottest Point)		260 °C
CHARACTERISTICS AND TYPICAL OPERATION (Sections in Parallel)		
Plate Voltage	5500	130 Volts
Grid No. 2 Voltage	125	130 Volts
Grid No. 1 Voltage	—	-20 Volts
Plate Current	—	100 Ma
Grid No. 2 Current	—	4.0 Ma
Transconductance	—	16,000 μmhos
Plate Resistance	—	4000 Ohms
Amplification Factor(3)	—	4.5
Ec1 for Ib = 1.0 Ma (Approx.)	—	-33 Volts
Ec1 for Ib = 75 μa (Approx.)	100	— Volts

INSTANTANEOUS PLATE KNEE VALUES (Sections in Parallel)
Eb = 60 V, Ec2 = 125 V, and Ec1 = 0 V
Ib = 800 Ma; and Ic2 = 50 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) In stages operating with grid leak bias, an adequate cathode bias resistor or other suitable means is necessary to protect the tube in the absence of excitation.
(3) Amplification factor with tube operating as a triode with 130 volts on the plate and Grid No. 2 and -20 volts on Grid No. 1.

AVERAGE PLATE CHARACTERISTICS



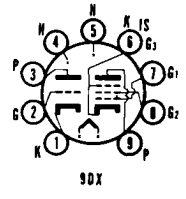
6KR8

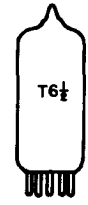
8KR8, 10KR8

GENERAL PURPOSE AMPLIFIER (T) VIDEO AMPLIFIER (P)

Medium Mu Triode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9DX
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.





ELECTRICAL DATA

HEATER OPERATION

	8KR8	10KR8	6KR8
Heater Voltage	8.0	10.5	6.3 Volts
Heater Current	600	450	750 Ma
Heater Warm-up Time	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 (Unshielded)

Pentode Section

Grid No. 1 to Plate (Pg1 to Pp)	0.075 Pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + IS)	13 Pf
Output: Pp to (h + Pk + Pg2 + Pg3 + IS)	4.4 Pf

Triode Section

Grid to Plate: (Tg to Tp)	2.6 Pf
Input: Tg to (h + Tk + Pk + Pg3 + IS)	4.2 Pf
Output: Tp to (h + Tk + Pk + Pg3 + IS)	3.0 Pf

RATINGS (Design Maximum Rating System)

	Pentode Section	Triode Section
Plate Voltage (Max.)	330	330 Volts
Screen Supply Voltage (Max.)	330	— Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive DC Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	5.0	2.0 Watts
Screen Dissipation (Max.)	1.1	— Watts
Grid No. 1 Circuit Resistance		
With Fixed Bias (Max.)	0.01	0.5 Megohms
With Cathode Bias (Max.)	0.01	1.0 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Pentode Section		Triode Section
Plate Voltage	35	200	125 Volts
Screen Voltage	100	100	— Volts
Grid No. 1 Voltage	0	—	— Volt
Cathode-Bias Resistor	—	82	68 Ohms
Amplification Factor	—	—	46
Plate Resistance (Approx.)	—	60,000	4400 Ohms
Transconductance	—	20,000	10,400 μmhos
Plate Current	54	19.5	15 Ma
Screen Current	13.5	3.0	— Ma
Grid No. 1 Voltage (Approx.) Ib = 10 μa	—	—	-8 Volts
Grid No. 1 Voltage (Approx.) Ib = 100 μa	—	-6.3	— Volts

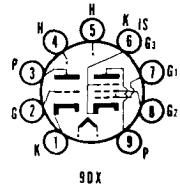
GENERAL PURPOSE AMPLIFIER (T) VIDEO AMPLIFIER (P)

6KR8A

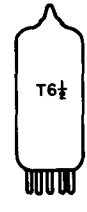
Medium Mu Triode and Sharp Cutoff Pentode

Construction ..... Miniature T-6½
Base ..... Button 9 Pin, E9-1
Basing 9DX
Outline 6-3
Maximum Diameter ..... 0.875 In.
Maximum Seated Height ..... 2.375 In.
Maximum Overall Height ..... 2.625 In.

The Type 6KR8A is identical to the 6KR8 except for Screen Dissipating Rating of 1.5 Watts.



9DX



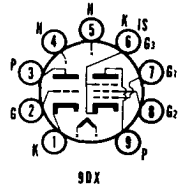
6KS8

8KS8

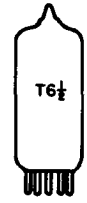
SYNC SEPARATOR (T) VIDEO AMPLIFIER (P)

High Mu Triode and Semi-Remote Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DX
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

	8KS8	6KS8
Heater Voltage	8.4	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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

	Shielded(1)	Unshielded
Triode Section		
Grid to Plate	2.2	2.2 Pf
Input: g to (h + Tk + Pk, g3, IS)	3.4	3.2 Pf
Output: p to (h + Tk + Pk, g3, IS)	3.0	1.8 Pf
Pentode Section		
Grid No. 1 to Plate (Max.)	0.04	0.05 Pf
Input: g1 to (h + Tk + Pk, g3, IS + g2)	10	10 Pf
Output: p to (h + Tk + Pk, g3, IS + g2)	4.5	3.6 Pf
Coupling		
Pentode Plate to Triode Plate (Max.)	0.025	0.150 Pf
Pentode Grid No. 1 to Triode Plate (Max.)	0.005	0.008 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	1.1	3.75 Watts
Grid No. 2 Dissipation (Max.)	—	1.1 Watt
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Self Bias (Max.)	1.0	1.0 Megohm

Control grid to cathode spacing of the pentode section is of such low order of magnitude as to preclude the use of voltage between these elements of more than 100 volts DC and Peak AC in commercial tube checkers and shorts indicating devices, particularly where mechanical excitation of the tube is employed.

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Class A1 Amplifier		
Plate Voltage	200	150 Volts
Grid No. 2 Voltage	—	150 Volts
Grid No. 1 Voltage	−2	0 Volts
Cathode Bias Resistor	—	150 Ohms
Plate Current	4.0	20 Ma
Grid No. 2 Current	—	4.5 Ma
Transconductance	4000	9500 μmhos
Amplification Factor	70	—
Plate Resistance (Approx.)	17,500	150,000 Ohms
Ec1 for Ib = 100 μa (Approx.)	—	−10 Volts
Ec1 for Ib = 20 μa (Approx.)	−5	— Volts

PLATE KNEE CHARACTERISTICS
Eb = 65 V, Ec2 = 150 V, Ec1 = 0 and Ib = 60 Ma, Ic2 = 20 Ma

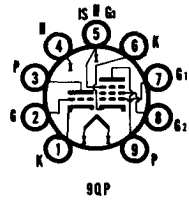
NOTE:
(1) External shield No. 315 connected to Pins 4 and 5.

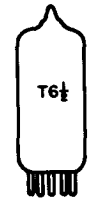
Color Television Type

SYNC SEP. or VOLTAGE AMP. (T) IF AMPLIFIER (P)

6KT8

High Mu Triode and High Gm Pentode





Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing(2)	9QP
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.

ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	600 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

	Shielded(1)	Unshielded
Triode Section		
Grid to Plate	3.0	3.0 Pf
Input: g to (h + Pg3, IS + k)	3.2	3.2 Pf
Output: p to (h + Pg3, IS + k)	2.4	1.6 Pf
Pentode Section		
Grid No. 1 to Plate (Max.)	0.03	0.03 Pf
Input: g1 to (h, g3, IS + g2 + k)	7.5	7.5 Pf
Output: p to (h, g3, IS + g2 + k)	2.8	2.2 Pf
Coupling		
Triode Grid to Pentode Plate (Max.)	0.003	0.018 Pf
Pentode Grid No. 1 to Triode Plate (Max.)	0.002	0.006 Pf

RATINGS (Design Maximum Rating System)

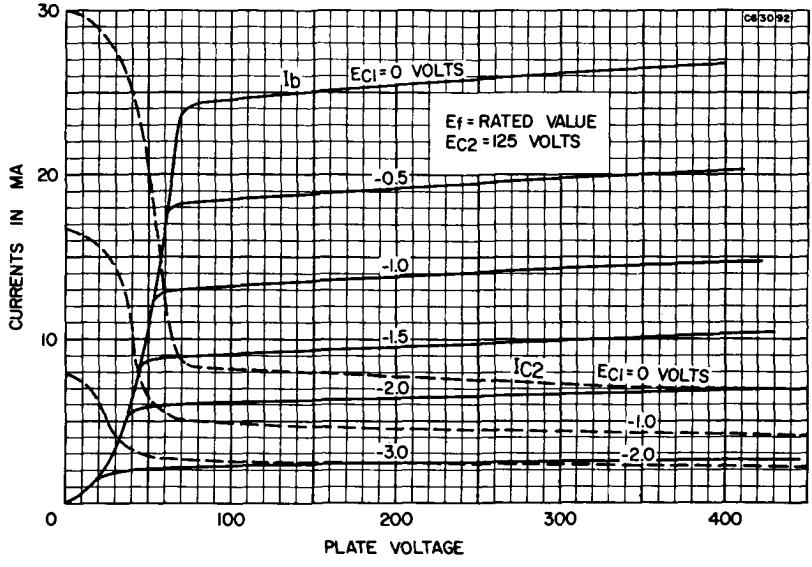
	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	1.0	2.5 Watts
Grid No. 2 Dissipation (Max.)	—	0.55 Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Cathode Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

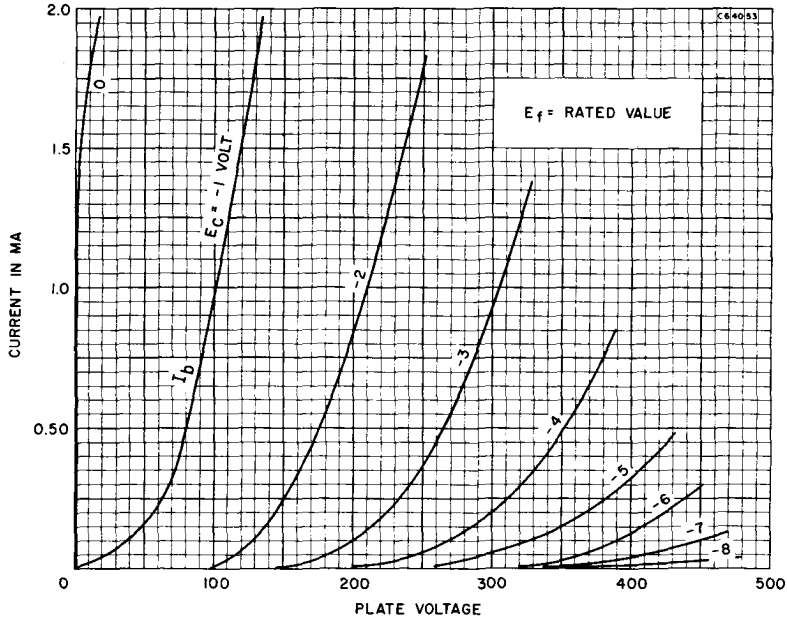
	Triode Section	Pentode Section
Plate Voltage	250	125 Volts
Grid No. 2 Voltage	—	125 Volts
Grid No. 1 Voltage	-2	-1 Volts
Plate Current	1.8	12 Ma
Grid No. 2 Current	—	4.5 Ma
Transconductance	3200	10,000 μmhos
Amplification Factor	100	—
Plate Resistance (Approx.)	31,500	150,000 Ohms
Ec1 for Ib = 20 μa (Approx.)	-3.5	-7 Volts

NOTES:
(1) External Shield No. 315 connected to Pins 4 and 5.
(2) Due to the unique element connections, this tube is designed that Pin No. 5 be operated at or near ground potential. Pentode section Grid No. 3, Internal Shield and one side of the heater all connect to Pin No. 5. Should instantaneous total cathode to Grid No. 3 voltage exceed + 20 Volts, undesirable changes in tube characteristics may result.

AVERAGE PLATE CHARACTERISTICS
(Pentode Section)



AVERAGE PLATE CHARACTERISTICS
(Triode Section)



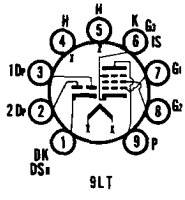
HORIZONTAL PHASE DETECTOR (D) VIDEO AMPLIFIER (P)

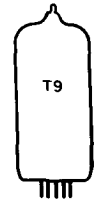
6KU8

10KU8

Double Diode and Sharp Cutoff Pentode

Construction 9T-9
Base .....Button 9 Pin, E9-68
Basing 9LT
Outline 9-69
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.320 In.
Maximum Overall Height .....2.630 In.





ELECTRICAL DATA

HEATER OPERATION

	10KU8	6KU8
Heater Voltage	10.2	6.3 Volts
Heater Current	450	725 Ma
Heater Warm-up Time	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 (Unshielded)

Pentode	
Grid No. 1 to Plate: Pg1 to Pp (Max.)	0.10 Pf
Input: Pg1 to (h + Pk, g3 + IS + g2 + Dk + IS)	12.0 Pf
Output: Pp to (h + Pk, g3 + IS + g2 + Dk + IS)	3.0 Pf
Diodes	
No. 1 Plate to All: No. 1 Dp to (h + Dk + IS + Pk + g3 + IS)	1.1 Pf
No. 2 Plate to All: No. 2 Dp to (h + Dk + IS + Pk + g3 + IS)	1.1 Pf
Cathode to No. 1 Plate: Dk to (h + 1 Dp + Pk + g3 + IS)	0.8 Pf
Cathode to No. 2 Plate: Dk to (h + 2 Dp + Pk + g3 + IS)	0.9 Pf
Coupling	
Pentode Grid No. 1 to No. 1 Diode Plate (Max.)	0.003 Pf
Pentode Grid No. 1 to No. 2 Diode Plate (Max.)	0.003 Pf
Pentode Plate to No. 1 Diode Plate (Max.)	0.008 Pf
Pentode Plate to No. 2 Diode Plate (Max.)	0.008 Pf

RATINGS (Design Maximum Rating System)

	Pentode Section
Plate Voltage (Max.)	330 Volts
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Positive Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	4.0 Watts
Grid No. 2 Dissipation (Max.)	1.1 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.25 Megohm
Cathode Bias (Max.)	1.0 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 50 volts DC and Peak AC in commercial tube checkers and shorts indicating devices, particularly where mechanical excitation of the tube is employed.

CHARACTERISTICS AND TYPICAL OPERATION

	Pentode Section
Plate Voltage	200 Volts
Grid No. 2 Voltage	100 Volts
Grid No. 1 Voltage	0 Volt
Cathode Bias Resistor	82 Ohms
Plate Current	17 Ma
Grid No. 2 Current	3.5 Ma
Transconductance	20,000 μmhos
Plate Resistance (Approx.)	50,000 Ohms
Ec1 for Ib = 100 μa (Approx.)	−5 Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS (Pentode Section)
Eb = 50 V, Ec2 = 100 V and Ec1 = 0 V
Ib = 55 Ma, and Ic2 = 18 Ma

DIODE CHARACTERISTICS (Each Diode)

Average Current with 10 Vdc Applied	2.0 Ma

6KV6A

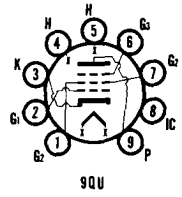
17KV6A, 22KV6A

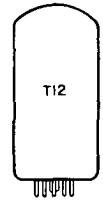
Color Television Type

SHUNT REGULATOR

Beam Power Pentode

Construction .....Novar T-12
Base .....Button 9 Pin, E9-88
(Exhaust Tip on Bottom)
Basing 9QU
Outline 12-96
Maximum Diameter .....1.562 In.
Maximum Seated Height .....3.000 In.
Maximum Overall Height .....3.380 In.





ELECTRICAL DATA

HEATER OPERATION

	22KV6A	17KV6A	6KV6A
Heater Voltage	22.0	16.8	6.3 Volts
Heater Current	450	600	1600 Ma
Heater Warm-up Time	11	11	— Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
Total DC and Peak			500 Volts
Heater Positive with Respect to Cathode			
DC			100 Volts
Total DC and Peak			200 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid No. 1 to Plate	0.6 Pf
Input: G1 to (K, g3, g2, h)	22 Pf
Output: p to (K, g3, g2, h)	9.0 Pf

RATINGS (Design Maximum Rating System)

DC Plate Supply Voltage (Ib = 0 Ma) (Max.)	900 Volts
Peak Positive Pulse Plate Voltage (Max.)(3)	6500 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
DC Grid No. 3 Voltage (Max.)	75 Volts
DC Grid No. 2 Screen Grid Voltage (Max.)	220 Volts
Grid No. 1 Control Grid Voltage	
Peak Negative Pulse Value (Max.)	330 Volts
Negative DC Bias Value (Max.)	250 Volts
Cathode Current	
Peak (Max.)	950 Ma
Average (Max.)(4)	275 Ma
Grid No. 2 Input (Max.)	2.0 Watts
Plate Dissipation (Max.)(5)	28 Watts
Envelope Temperature (At Hottest Point)	240 °C
Grid No. 1 Circuit Resistance	
For Grid No. 1 Resistor Bias Operation	1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

DC Plate Voltage	100	140 Volts
DC Grid No. 3 Voltage	0	0 Volt
DC Grid No. 2 Voltage	140	140 Volts
DC Grid No. 1 Voltage	0	-24.5 Volts
Amplification Factor (Triode Connection)(1)	—	4
Plate Resistance (Approx.)	—	6000 Ohms
Transconductance	—	10,000 μmhos
DC Plate Current	440(2)	40 Ma
DC Grid No. 2 Current	30(2)	2.4 Ma
Cutoff DC Grid No. 1 Voltage for Ib = 1 Ma	—	-42 Volts

NOTES:

(1) With Grid No. 3 and Grid No. 2 connected, respectively, to cathode and plate at socket.
(2) This value can be measured by a method involving a recurrent waveform such that the Maximum Ratings of the tube will not be exceeded.
(3) 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.
(4) Measured with a DC meter.
(5) Adequate circuit precautions must be taken to protect the tube in the absence of Grid No. 1 bias.
(6) Plate dissipations up to 24 W maximum are permissible for short periods of time (up to 10 seconds maximum) provided the maximum envelope temperature rating is not exceeded.

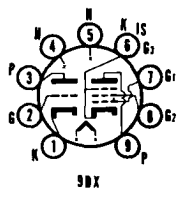
SYNC SEPARATOR, SOUND IF/VOLTAGE AMP. (T) VIDEO AMPLIFIER (P)

6KV8

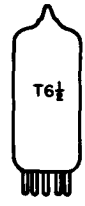
11KV8

High Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DX
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

	11KV8	6KV8
Heater Voltage	10.9	6.3 Volts
Heater Current	450	775 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section	
Grid to Plate	3.7 Pf
Input: g to (h + Tk + Pk, g3, IS)	2.5 Pf
Output: p to (h + Tk + Pk, g3, IS)	2.4 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.12 Pf
Input: g1 to (h + Pk, g3, IS + g2)	13 Pf
Output: p to (h + Pk, g3, IS + g2)	4.8 Pf
Coupling	
Triode Grid to Pentode Plate (Max.)	0.015 Pf
Pentode Plate to Triode Plate (Max.)	0.17 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	300	300 Volts
Grid No. 2 Supply Voltage (Max.)	—	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	1.0	5.0 Watts
Grid No. 2 Dissipation		
Up to 150 Voltage (Max.)	—	1.1 Watts
150 to 300 Volts	See Rating Chart (Gen. Info. Sec.)	
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.1 Megohm
Cathode Bias (Max.)	1.0	0.25 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 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

	Triode Section	Pentode Section	
Plate Voltage	200	125	200 Volts
Grid No. 2 Voltage	—	125	125 Volts
Grid No. 1 Voltage	−2	0	0 Volts
Cathode Bias Resistor	—	82	68 Ohms
Plate Current	4	16.5	20 Ma
Grid No. 2 Current	—	3.1	3.5 Ma
Transconductance	4000	21,000	23,000 μmhos
Amplification Factor	70	—	—
Plate Resistance (Approx.)	17,500	55,000	75,000 Ohms
Ec1 for Ib = 100 μa (Approx.)	−4.5	−4.2	−4.2 Volts

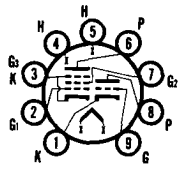
6KY8

15KY8

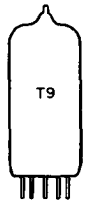
VERTICAL DEFLECTION OSCILLATOR (T) and AMPLIFIER (P)

High Mu Triode and Beam Power Pentode

Construction .....Novar T-9
Base .....Button 9 Pin, E9-75
Basing 9QT
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.730 In.
Maximum Overall Height .....3.110 In.



9QT



ELECTRICAL DATA

HEATER OPERATION

	15KY8	6KY8
Heater Voltage	15.0	6.3 Volts
Heater Current	450	1100 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section	
Grid to Plate	0.44 Pf
Input: g to (h + Tk)	15.0 Pf
Output: p to (h + Tk)	7.0 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.048 Pf
Input: g1 to (h + Pk, g2, g3)	2.6 Pf
Output: p to (h + Pk, g2, g3)	0.28 Pf

RATINGS (Design Maximum Rating System)
Vertical Deflection Oscillator and Amplifier(1)

	Tri. Osc.	Pent. Amp.
Plate Voltage (Max.)	330	300 Volts
Grid No. 2 Voltage (Max.)	—	150 Volts
Peak Positive Pulse Plate Voltage (Max.)	—	2000 Volts
Peak Negative Grid No. 1 Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.)(2)	1.5	12 Watts
Grid No. 2 Dissipation (Max.)(2)	—	1.9 Watts
Average Cathode Current (Max.)	22	70 Ma
Peak Cathode Current (Max.)	77	200 Ma
Grid Circuit Resistance		
Self Bias (Max.)	2.2	2.2 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	250	135 Volts
Grid No. 2 Voltage	—	120 Volts
Grid No. 1 Voltage	-3	-10 Volts
Plate Current	1.4	39 Ma
Grid No. 2 Current	—	3 Ma
Transconductance	1600	8400 μmhos
Amplification Factor	64	—
Plate Resistance (Approx.)	40,000	18,000 Ohms
Ec for Ib = 1 Ma (Approx.)	—	-24 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 50 V; Ec2 = 120 V; and Ec = 0 V
Ib = 170 Ma, and Ic2 = 20 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) 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.

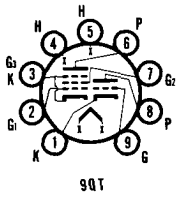
VERTICAL DEFLECTION OSCILLATOR (T) and AMPLIFIER (P)

6KY8A

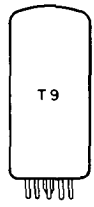
15KY8A

High Mu Triode and Beam Power Pentode

Construction .....Novar T-9
Base .....Button 9 Pin, E9-89
(Exhaust Tip on Base)
Basing 9QT
Outline 9-107
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.380 In.
The 6KY8A and 15KY8A are identical to the 6KY8 and 15KY8 except for Base with exhaust tip on bottom and shorter bulb.



9QT



Color Television Type

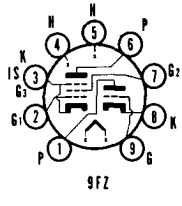
VHF OSCILLATOR and MIXER

6KZ8

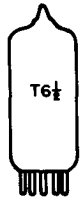
5KZ8, 9KZ8

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9FZ
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9FZ



ELECTRICAL DATA

HEATER OPERATION

	9KZ8	5KZ8	6KZ8
Heater Voltage	9.45	4.7	6.3 Volts
Heater Current	300	600	450 Ma
Heater Warm-up Time	11	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 (Shielded)(1)

Triode Section	
Grid to Plate	1.6 Pf
Input: g to (Tk + Pk + g3 + h + IS)	3.2 Pf
Output: p to (Tk + Pk + g3 + h + IS)	1.8 Pf
Heater to Cathode	3.2(2) Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.01 Pf
Input: g1 to (k + g3 + g2 + h + IS)	5.5 Pf
Output: p to (k + g3 + g2 + h + IS)	3.4 Pf
Heater to Cathode	3.2(2) Pf

RATINGS (Design Maximum Rating System)

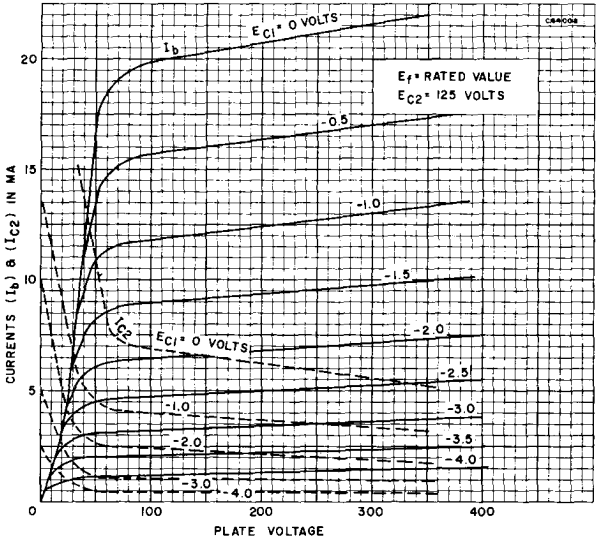
	Triode Section	Pentode Section
Converter Service		
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	2.5	2.5 Watts
Screen Dissipation (Max.)	—	0.55 Watt
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.25	0.25 Megohm
Self Bias (Max.)	0.5	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

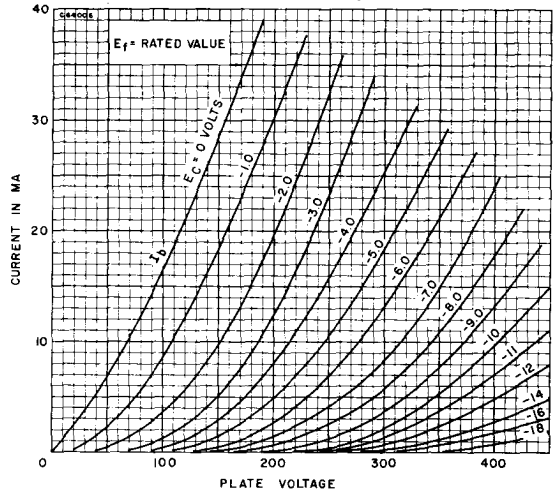
	Triode Section	Pentode Section
Plate Voltage	125	125 Volts
Grid No. 2 Voltage	—	125 Volts
Grid No. 1 Voltage	−1	−1 Volt
Plate Current	13.5	12 Ma
Grid No. 2 Current	—	4.0 Ma
Transconductance	8500	7500 μmhos
Amplification Factor	46	—
Plate Resistance (Approx.)	5400	200,000 Ohms
Ec1 for Ib = 10 μa (Approx.)	−8	−8 Volts

NOTES:
(1) Shield No. 315 connected to cathode.
(2) Shield No. 315 connected to ground.

AVERAGE PLATE CHARACTERISTICS
(Pentode Section)



AVERAGE PLATE CHARACTERISTICS
(Triode Section)

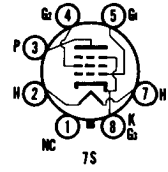


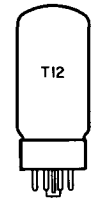
AUDIO POWER AMPLIFIER

6L6GC

Beam Power Pentode

Construction .....Octal T-12
Base .....6 or 7 Pin, B6-122, B6-148
B7-12, B7-111 or B7-119
Basing.....7S
Outline 12-15
Maximum Diameter .....1.562 In.
Maximum Seated Height .....3.688 In.
Maximum Overall Height .....4.250 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	900 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)

Grid No. 1 to Plate	0.6 Pf
Input	10 Pf
Output	6.5 Pf

RATINGS (Design Maximum Rating System)

Class AB1 Pentode Operation

	Triode Conn.	Pentode Conn.
Plate Voltage (Max.)	450	500 Volts
Grid No. 2 Voltage (Max.)	—	450(1) Volts
Plate Dissipation (Max.)	30	30 Watts
Grid No. 2 Dissipation (Max.)	—	5.0 Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.1	0.1 Megohm
Cathode Bias (Max.)	0.5	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Pentode Operation (Class A1 Amp.)

	Single Tube			Push-Pull	
Plate Voltage	250	300	250	250	270 Volts
Grid No. 2 Voltage	250	200	250	250	270 Volts
Grid No. 1 Voltage	−14	−12.5	−18	−16	−17.5 Volts
Peak AF Grid Voltage	14	12.5	18	16	17.5 Volts
Zero Signal Plate Current	72	48	54	120	134 Ma
Maximum Signal Plate Current	79	55	66	140	155 Ma
Zero Signal Grid No. 2 Current	5.0	2.5	2.5	10	11 Ma
Maximum Signal Grid No. 2 Current	7.3	4.7	7.0	16	17 Ma
Transconductance	6K	5.3K	5.2K	—	— μmhos
Plate Resistance (Approx.)	22.5K	35K	33K	—	— Ohms
Load Resistance	2.5K	4.5K	4.2K	—	— Ohms
Load Resistance (PL to PL)	—	—	—	5K	5K Ohms
Power Output	6.5	6.5	10.8	14.5	17.5 Watts
Total Harmonic Distortion	10	11	15	2	2 Percent

Pentode Operation

	Class AB2 Push-Pull		Class AB1 Push-Pull	
Plate Voltage	360	360	360	450 Volts
Grid No. 2 Voltage	225	270	270	400 Volts
Grid No. 1 Voltage	−18	−22.5	−22.5	−37 Volts
Peak AF Grid Voltage	26	36	22.5	35 Volts
Zero Signal Plate Current	78	88	88	116 Ma
Maximum Signal Plate Current	142	205	132	210 Ma
Zero Signal Grid No. 2 Current	3.5	5.0	5.0	5.6 Ma
Maximum Signal Grid No. 2 Current	11	16	15	22 Ma
Load Resistance (PL to PL)	6000	3800	6600	5600 Ohms
Power Output	31	47	26.5	55 Watts
Total Harmonic Distortion	2	2	2	1.8 Percent

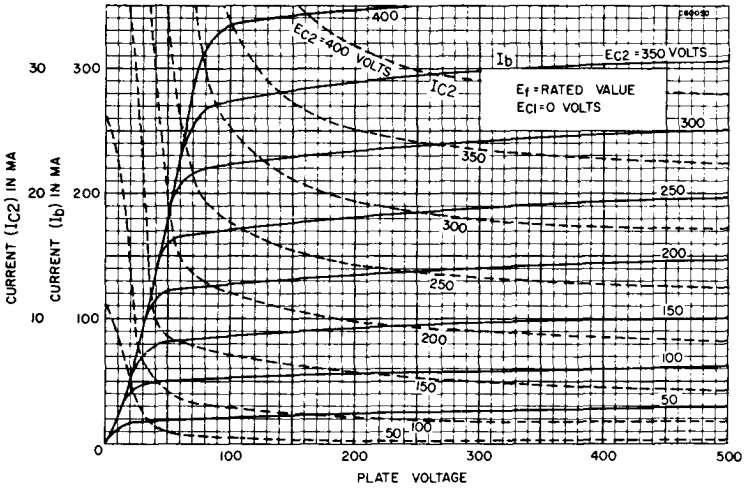
Triode Operation

	Class A1 Amp. Single Tube	Class AB1 Amp. Push-Pull
Plate Voltage	250	400 Volts
Grid No. 1 Voltage	−20	−40 Volts
Peak AF Grid No. 1 Voltage	20	40 Volts
Zero Signal Plate Current	40	95 Ma
Maximum Signal Plate Current	44	140 Ma
Transconductance	4700	— μmhos
Amplification Factor	8	—
Plate Resistance	1700	— Ohms
Load Resistance	5000	— Ohms
Load Resistance (PL to PL)	—	4500 Ohms
Power Output	1.4	12.5 Watts
Total Harmonic Distortion	5	3.5 Percent

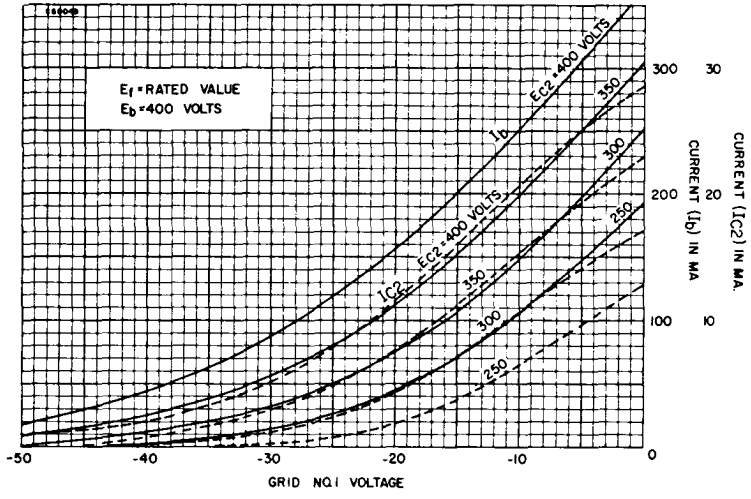
NOTE:

(1) The maximum Grid No. 2 voltage rating is 500 volts in push-pull circuits where Grid No. 2 of each tube is connected to a tap on the plate winding of the output transformer.

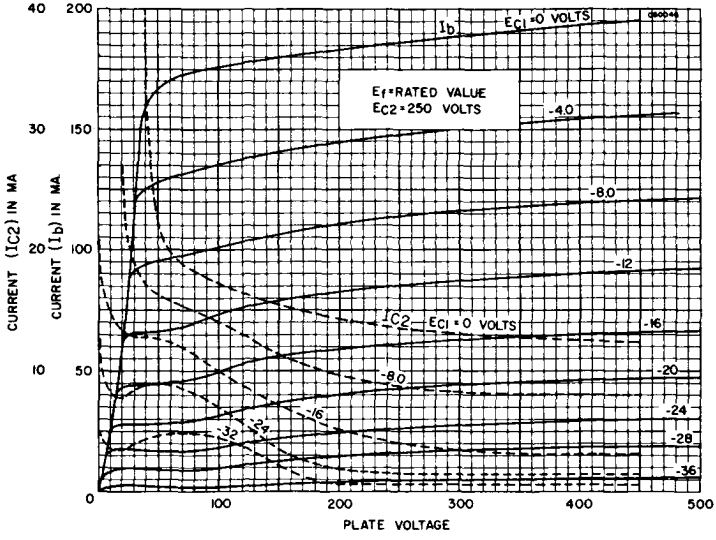
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



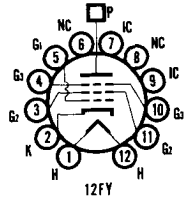
Color Television Type

HORIZONTAL DEFLECTION AMPLIFIER

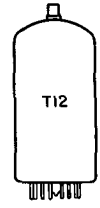
6LB6

Beam Power Pentode

Construction	Compactron T-12
Base	Button 12 Pin, E12-74
Top Cap	C1-1
Basing	12FY
Outline	12-90
Maximum Diameter	1.563 In.
Maximum Seated Height	4.000 In.
Maximum Overall Height	4.375 In.



12FY



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	2250 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)

Grid No. 1 to Plate	0.44 Pf
Input: g1 to (h + k + g2 + bp)	33 Pf
Output: p to (h + k + g2 + bp)	18 Pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier Service(1)

DC Plate-Supply Voltage (Boost + DC Power Supply) (Max.)	990 Volts
Peak Positive Pulse Plate Voltage (Absolute Maximum Value)	7000 Volts
Peak Negative Pulse Plate Voltage (Max.)	100 Volts
Positive DC Beam Plate Voltage (Max.)	0 Volt
Screen Voltage (Max.)	200 Volts
Peak Negative Grid No. 1 Voltage (Max.)	300 Volts
Plate Dissipation (Absolute Maximum Value)(2)	30 Watts
Screen Dissipation (Max.)	5.0 Watts

DC Cathode Current (Max.)				315 Ma
Peak Cathode Current (Max.)				1100 Ma
Grid No. 1 Circuit Resistance				
With Feedback-Type High Voltage Regulation (Max.)				1.2 Megohms
With Shunt-Type High Voltage Regulation (Switching Mode) (Max.)				10.0 Megohms
Beam Plate Circuit Resistance (Max.)				0 Ohms
Bulb Temperature (Max.)(3)				200 °C
CHARACTERISTICS AND TYPICAL OPERATION				
Plate Voltage	5000	45	50	150 Volts
Beam Plates	Connected to Cathode at Socket			
Screen Voltage	110	160	110	110 Volts
Grid No. 1 Voltage	—	0	—	−20 Volts
Plate Resistance (Approx.)	—	—	—	6600 Ohms
Transconductance	—	—	—	13,400 μmhos
Plate Current	—	900(4)	560(4)	105 Ma
Screen Current	—	110(4)	46(4)	2.0 Ma
Grid No. 1 Voltage (Approx.)				
Ib = 1.0 Ma	−125	—	—	−40 Volts
Triode Amplification Factor(5)	—	—	—	4.0

NOTES:

(1) 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 horizontal scanning cycle.

(2) 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.

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

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

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

6LB8

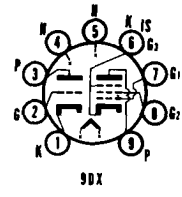
10LB8

Color Television Type

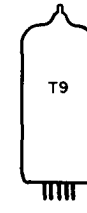
VOLTAGE AMPLIFIER (T)
VIDEO AMPLIFIER (P)

Medium Mu Triode and Sharp Cutoff Pentode

Construction 9T-9
Base .....Button 9 Pin, E9-68
Basing 9DX
Outline 9-69
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.320 In.
Maximum Overall Height .....2.630 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

	10LB8	6LB8
Heater Voltage	10.2	6.3 Volts
Heater Current	450	725 Ma
Heater Warm-up Time	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 (Unshielded)		
Triode Section		
Grid to Plate		2.8 Pf
Input: g to (h + Tk + Pk, g3, IS)		1.9 Pf
Output: p to (h + Tk + Pk, g3, IS)		1.8 Pf
Pentode Section		
Grid No. 1 to Plate (Max.)		0.10 Pf
Input: g1 to (h + Pk, g3, IS + g2)		12 Pf
Output: p to (h + Pk, g3, IS + g2)		3.0 Pf
Coupling		
Triode Grid to Pentode Plate (Max.)		0.02 Pf
Pentode Grid No. 1 to Triode Plate (Max.)		0.004 Pf
Pentode Plate to Triode Plate (Max.)		0.13 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)(2)	2.0	4.0 Watts
Grid No. 2 Dissipation (Max.)	—	1.1 Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Cathode Bias (Max.)	1.0	1.0 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 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

	Triode Section	Pentode Section
Plate Voltage	125	200 Volts
Grid No. 2 Voltage	—	100 Volts
Grid No. 1 Voltage	0	0 Volt
Cathode Bias Resistor	68	82 Ohms
Plate Current	13	17 Ma
Grid No. 2 Current	—	3.5 Ma
Transconductance	5000	20,000 μmhos
Amplification Factor	30	—
Plate Resistance (Approx.)	6000	50,000 Ohms
Ec1 for Ib = 100 μa (Approx.)	—	-5 Volts
Ec for Ib = 20 μa (Approx.)	-10	— Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS (Pentode Section)(1)
Eb = 50 V, Ec2 = 100 V and Ec1 = 0 V
Ib = 55 Ma and Ic2 = 18 Ma

NOTES:
(1) Applied for short interval (2 Sec. Max.) so as not to damage tube.
(2) Maximum total plate dissipation, both plates, should not exceed 5.0 watts.

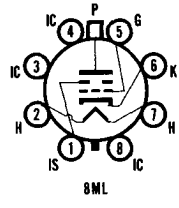
Color Television Type

SHUNT REGULATOR

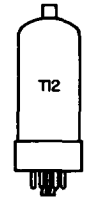
6LC6

Beam Power Triode

Construction .....Octal T-12
Base.....Octal 8 Pin, B8-70 or B8-118
Top Cap .....C1-1 or C1-34
Basing(1) 8ML
Outline 12-36
Maximum Diameter .....1.562 In.
Maximum Seated Height .....4.438 In.
Maximum Overall Height .....5.000 In.



8ML



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	200 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode(3)	450 Volts
Heater Positive with Respect to Cathode	Not Recommended

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid to Plate: (g to P)	1.0 Pf
Input: g to (h + k)	2.6 Pf
Output: p to (h + k)	1.0 Pf

RATINGS (Design Maximum Rating System)

Plate Supply Voltage, Unregulated (Max.)	60,000 Volts
Plate Voltage (Max.)	27,000 Volts
Negative DC Grid Voltage (Max.)	135 Volts
Peak Negative Grid Voltage (Max.)(2)	440 Volts
Plate Dissipation (Max.)	40 Watts
DC Plate Current (Max.)	1.6 Ma
Grid Circuit Resistance (Max.)	3.0 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Unregulated DC Supply Voltage	36,000 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 μmhos
DC Plate Current for Zero Load Current	1000 μa
DC Plate Current for Load Current of 1 Ma	45 μa
Regulated DC Output Voltage at Zero Load Current	25,000 Volts
Regulated DC Output Voltage at Load Current of 1 Ma	24,500 Volts

NOTES:

(1) Shield connected directly to ground to minimize the effects of a momentary arc within the tube.
(2) Peak value for duration of 20 seconds maximum during equipment warm-up.
(3) Sufficient impedance (1000 ohms is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions to 450 Ma. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.
(4) With flyback transformer high-voltage supply.

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 higher than 16,000 volts.

6LC8

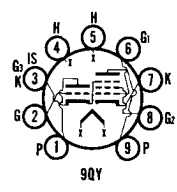
8LC8

Color Television Type

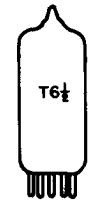
SYNC SEPARATOR (T) GATED AGC AMPLIFIER (P)

High Mu Triode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9QY
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



9QY



ELECTRICAL DATA

HEATER OPERATION

	8LC8	6LC8
Heater Voltage	8.4	6.3 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section	
Grid to Plate	2.2 Pf
Input: g to (k + h + IS + g3)	2.8 Pf
Output: p to (k + h + IS + g3)	2.2 Pf
Pentode Section	
Grid No. 1 to Plate	0.1 Pf
Plate to (g3 + Tk + IS)	3.4 Pf
Grid No. 1 to (g3 + Tk + IS)	0.36 Pf
Grid No. 3, Triode Cathode and IS to (Pp + Pk + g2 + Pg1 + h)	12.5 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	300	300 Volts
Peak Positive Pulse Plate Voltage (Max.)(1)	—	600 Volts
Grid No. 2 Supply Voltage (Max.)	—	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 3 Voltage (Max.)	—	0 Volt
Negative Grid No. 3 Voltage (Max.)	—	100 Volts
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Negative Grid No. 1 Voltage (Max.)	50	50 Volts

Plate Dissipation (Max.)	1.1	2.0 Watts
Grid No. 2 Input (Max.)	—	1.1 Watt
Grid No. 1 Circuit Resistance		
Self Bias (Max.)	1.0	1.0 Megohm
Fixed Bias (Max.)	0.25	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

	Triode Section	Pentode Section
Plate Supply Voltage	200	150 Volts
Grid No. 2 Voltage	—	100 Volts
Grid No. 1 Voltage	−2	0 Volt
Cathode Bias Resistor	—	180 Ohms
Plate Current	4	4 Ma
Grid No. 2 Current	—	2.8 Ma
Amplification Factor	70	—
Plate Resistance (Approx.)	17,500	100,000 Ohms
Transconductance (G1 to P)	4000	4400 μmhos
Transconductance (G3 to P)	—	600 μmhos
Ec3 for Ib = 20 μa (Approx.)	—	−7 Volts
Ec1 for Ib = 10 μa (Approx.)	−5	— Volts
20 μa (Approx.)	—	−4 Volts

NOTE:
(1) 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 horizontal scanning cycle.

Color Television Type

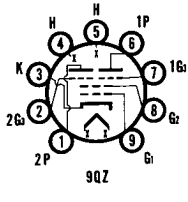
COLOR DEMODULATOR

6LE8

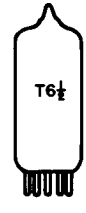
8LE8, 10LE8, 15LE8

Twin Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9QZ
Outline 6-4
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.812 In.
Maximum Overall Height .....3.062 In.



9QZ



ELECTRICAL DATA
HEATER OPERATION

	15LE8	10LE8	8LE8	6LE8
Heater Voltage	15.0	10.0	8.0	6.3 Volts
Heater Current	300	450	600	760 Ma
Heater Warm-up Time	11	11	11	— Seconds

Maximum Heater-Cathode Voltage
Heater Negative with Respect to Cathode
Total DC and Peak ..... 300 Volts
Heater Positive with Respect to Cathode
DC ..... 100 Volts
Total DC and Peak ..... 200 Volts

DIRECT INTERELECTRODE CAPACITANCES

Grid No. 3 to Plate (Each Section)	2.7 Pf
Grid No. 1 to All	15.5 Pf
Grid No. 3 to All (Each Section)	6.0 Pf
Plate to All (Each Section)	3.7 Pf
Grid No. 3 (Section 1) to Grid No. 3 (Section 2)	0.1 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Each Section) (Max.)	300 Volts
Grid No. 2 Voltage (Max.)	150 Volts
Plate Dissipation (Each Section) (Max.)	2 Watts
Grid No. 2 Dissipation (Max.)	2 Watts

CHARACTERISTICS AND TYPICAL OPERATION (Each Section)
Grid No. 1 Control

Plate Voltage	100 Volts
Grid No. 2 Voltage	100 Volts
Grid No. 1 Voltage	−2.5 Volts
Grid No. 3 Voltage	0 Volt
Plate Current (Approx.)	8.0 Ma
Grid No. 2 Current (Approx.)	15.0 Ma
Transconductance (Approx.)	5800 μmhos

Plate Resistance (Approx.)	50,000 Ohms
Grid No. 1 Voltage for Ib = 20 μa	−7.2 Volts
Grid No. 1 Voltage for Ib = 100 μa	−6.3 Volts

Grid No. 3 Control

Plate Voltage	100 Volts
Grid No. 2 Voltage	100 Volts
Grid No. 1 Voltage	−2.5 Volts
Grid No. 3 Voltage	0 Volt
Plate Current	7.5 Ma
Grid No. 2 Current	14.5 Ma
Transconductance	350 μmhos
Plate Resistance	50,000 Ohms
Grid No. 3 Voltage for Ib = 20μa(1)	−17.4 Volts
Grid No. 3 Voltage for Ib = 100 μa(1)	−16.5 Volts

NOTE:

(1) Measured with −3.0 volts on Grid No. 1 to maintain Grid No. 2 within dissipation rating.

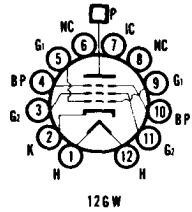
6LF6

Color Television Type

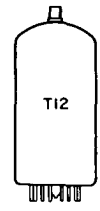
HORIZONTAL DEFLECTION AMPLIFIER

Beam Pentode

Construction.....Compactron T-12
Base E12-74
Top Cap C1-1
Basing 12GW
Outline
Maximum Diameter .....1.563 In.
Maximum Seated Height .....4.570 In.
Maximum Overall Height .....4.950 In.



12GW



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	2.0 Amp.

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid to Plate	3.0 pf
Input: g1 to (h + k + g2 + bp)	37 pf
Output: p to (h + k + g2 + bp)	18.5 pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier

DC Plate Supply Voltage at Zero Current (Max.)	990 Volts
Peak Positive Plate Voltage(1) (Max.)	8000 Volts
Beam Plate Voltage (Max.)	50 Volts
Grid No. 2 Voltage (Max.)	275 Volts
Peak Negative Grid No. 1 Voltage (Max.)	550 Volts
Plate Dissipation (Max.)	40 Watts
Peak Cathode Current (Max.)	1400 Ma
Beam Plate Circuit Resistance (Max.)	0.01 Megohms
Bulb Temperature (At Hottest Point) (Max.)	300 °C

AVERAGE CHARACTERISTICS (Measured Under Pulse Conditions)

	Max.	Min.	During Flyback
Plate Voltage	160	50	7000 Volts
Grid No. 2 Voltage	160	175	175 Volts
Grid No. 1 Voltage	0	−10	−185 Volts
Beam Plate Voltage	Tied to Cathode		
Plate Current	1400	800	<0.05 Ma
Grid No. 2 Current	45	70	— Ma

NOTE:

(1) Maximum pulse duration is 22% of a cycle, maximum 18 μsec.

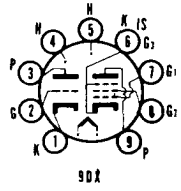
Color Television Type

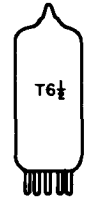
VIDEO AMPLIFIER (T) GENERAL PURPOSE AMPLIFIER (P)

6LF8

High Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DX
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	600 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section	
Grid to Plate	2.2 Pf
Input: g to (h + Tk + Pk, g3, IS)	3.2 Pf
Output: p to (h + Tk + Pk, g3, IS)	1.8 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.06 Pf
Input: g1 to (h + Pk, g3, IS + g2)	10 Pf
Output: p to (h + Pk, g3, IS + g2)	3.6 Pf
Coupling	
Pentode Plate to Triode Plate (Max.)	0.150 Pf
Pentode Grid No. 1 to Triode Plate (Max.)	0.008 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	1.1	3.75 Watts
Grid No. 2 Dissipation (Up to Ec2 = 165 V) (Max.)	—	1.1 Watt
Above 165 V	See Rating Chart (Gen. Info. Sec.)	
Positive Grid No. 1 Voltage (Max.)	4	0 Volts
Negative Grid No. 1 Voltage (Max.)	55	55 Volts
Grid No. 1 Current	8	0 Ma
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Self Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

	Triode Section	Pentode Section	
Plate Voltage	200	40	100 Volts
Grid No. 2 Voltage	—	—	150 Volts
Grid No. 1 Voltage	−2	3	2.5 Volts
Plate Current	4.0	11	20 Ma
Grid No. 2 Current	—	—	5.0 Ma
Grid No. 1 Current	0	2.7	0 Ma
Transconductance	4000	4000	11,000 μmhos
Amplification Factor	70	40	—
Plate Resistance (Approx.)	17,500	10,000	200,000 Ohms
Ec for Ib = 20 μa (Approx.)	−5	—	8 Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS

Eb = 65 V, Ec2 = 150 V, Ec1 = 0 V
Ib = 60 Ma, Ic2 = 20 Ma

6LJ8

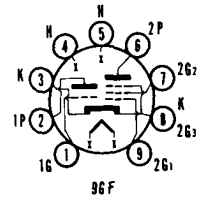
5LJ8, 4LJ8

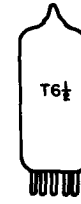
Color Television Type

VHF OSCILLATOR and MIXER

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9GF
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.938 In.
Maximum Overall Height .....2.188 In.





ELECTRICAL DATA

HEATER OPERATION

	4LJ8	5LJ8	6LJ8
Heater Voltage	4.3	5.6	6.3 Volts
Heater Current	600	450	400 Ma
Heater Warm-up Time	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: g1 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 (Max.)	0.015 Pf
Input: g1 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)

	Tri. Sec.	Pent. Sec.
Plate Voltage (Max.)	280	280 Volts
Grid No. 2 Supply Voltage (Max.)	—	280 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Cathode Current (Max.)	20	20 Ma
Plate Dissipation (Max.)	2.0	2.0 Watts
Grid No. 2 Dissipation (Max.)	—	0.5 Watt
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Maximum Grid No. 1 Circuit Resistance		
Self Bias (Max.)	0.5	0.25 Megohm
Fixed Bias (Max.)	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

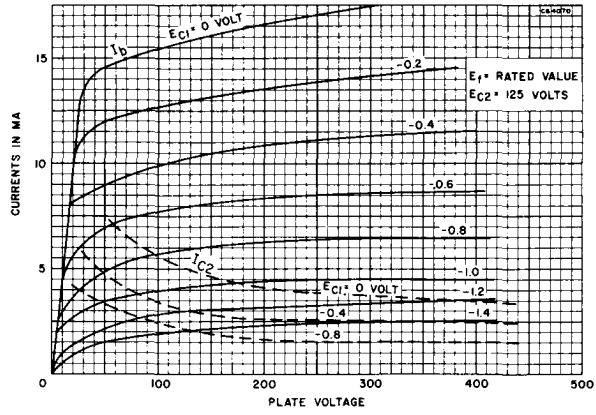
Class A1 Amplifier

	Tri. Sec.	Pent. Sec.
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

NOTE:

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

AVERAGE PLATE CHARACTERISTICS (Pentode Section)



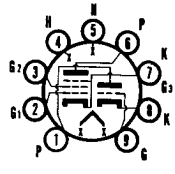
Color Television Type

BURST AMPLIFIER (P) GENERAL PURPOSE AMPLIFIER (T)

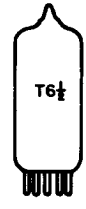
6LM8

Medium Mu Triode and Semi-Remote Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9AE
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9AE



ELECTRICAL DATA

HEATER OPERATION

	Series	Parallel
Heater Voltage	6.3	6.3 Volts
Heater Current	450	450 Ma
Heater Warm-up Time	11	— Sec.
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 (Shielded)(1)

Triode Section	
Grid to Plate	1.8 Pf
Input: Tg to (Tk, Pk + Pg3 + IS, H)	3.2 Pf
Output: Tp to (Tk, Pk + Pg3 + IS, H)	1.9 Pf
Pentode Section	
Grid to Plate (Max.)	0.015 Pf
Input: Pg1 to (Pk + Pg3 + IS, Pg2, H)	5.5 Pf
Output: Pp to (Pk + Pg3 + IS, Pg2, H)	3.8 Pf
Heater to Cathode (Each Section)	3.2 Pf

RATINGS (Design Maximum Rating System)

Class A1 Amplifier

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	350 Volts
Grid No. 2 (Screen-Grid) Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Grid No. 1 (Control-Grid) Voltages:		
Positive-Bias Value (Max.)	0	0 Volt

Grid No. 2 Input:		
For Grid No. 2 Voltages up to 165 Volts (Max.)	—	0.55 Watt
For Grid No. 2 Voltages Between 165 and 330 Volts	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	2.5	2.5 Watts
Grid No. 1 Circuit Resistance		
For Fixed Bias Operation (Max.)	0.5	0.25 Megohm
For Cathode Bias Operation (Max.)	1.0	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

	Triode Section	Pentode Section
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

NOTE:
(1) Shield No. 315.

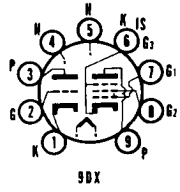
6LQ8

11LQ8

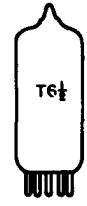
SYNC SEP. or SOUND IF AMP. VIDEO AMPLIFIER

Medium Mu Triode and Sharp Cutoff Pentode

Construction ..... Miniature T-6½
Base ..... Button 9 Pin, E9-1
Basing 9DX
Outline 6-3
Maximum Diameter ..... 0.875 In.
Maximum Seated Height ..... 2.375 In.
Maximum Overall Height ..... 2.625 In.



9DX



ELECTRICAL DATA
HEATER OPERATION

	11LQ8	6LQ8
Heater Voltage	10.9	6.3 Volts
Heater Current	450	775 Ma
Heater Warm-up Time	11	— Seconds
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)

Triode Section	
Grid to Plate	2.8 Pf
Input: Tg to (Tk, Pk + Pg3 + IS + H)	4.2 Pf
Output: Tp to (Tk, Pk + Pg3 + IS + H)	2.4 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.12 Pf
Input: Pg1 to (Pk + Pg3 + IS, Pg2, H)	14 Pf
Output: Pp to (Pk + Pg3 + IS, Pg2, H)	4.8 Pf
Triode Grid to Pentode Plate (Max.)	0.015 Pf
Pentode Plate to Triode Plate (Max.)	0.17 Pf

RATINGS (Design Maximum Rating System)
Class A1 Amplifier

	Triode Section	Pentode Section
DC Plate Voltage	300	300 Volts
DC Grid No. 2 Supply Voltage	—	300 Volts
DC Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
DC Grid No. 1 Voltage:		
Positive Bias Value	0	0 Volt

Grid No. 2 Input:		
For Ec2 up to 150 V	—	1 Watt
For Ec2 from 150 V to 300 V	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation	2	5 Watts
Grid No. 1 Circuit Resistance		
Fixed Bias	0.5	0.1 Megohm
Cathode Bias	1	0.25 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section	
DC Plate Supply Voltage	125	125	200 Volts
DC Grid No. 2 Supply Voltage	—	125	125 Volts
Grid No. 1	Connected to Negative End of Rk		
Cathode Resistor	68	82	68 Ohms
Amplification Factor	46	—	—
Plate Resistance (Approx.)	4400	55,000	75,000 Ohms
Transconductance	10,400	21,000	23,000 μmhos
DC Plate Current	15	16.5	20 Ma
DC Grid No. 2 Current	—	3.1	3.5 Ma
Cutoff DC Grid No. 1 Voltage for Ib = 100 μa	–6	–4.2	–4.2 Volts

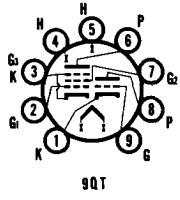
VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

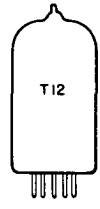
6LR8

21LR8

High Mu Triode and Beam Power Pentode

Construction .....Novar T-12
Base .....Button 9 Pin, E9-76
Basing 9QT
Outline 12-65
Maximum Diameter .....1.562 In.
Maximum Seated Height .....3.330 In.
Maximum Overall Height .....3.710 In.





ELECTRICAL DATA

HEATER OPERATION

	21LR8	6LR8
Heater Voltage	21	6.3 Volts
Heater Current	450	1500 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section	
Grid to Plate	6.0 Pf
Input	6.5 Pf
Output	1.6 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.70 Pf
Input	16.0 Pf
Output	9.0 Pf
Coupling	
Pentode Grid No. 1 to Triode Plate (Max.)	0.12 Pf
Pentode Plate to Triode Plate (Max.)	0.32 Pf

RATINGS (Design Maximum Rating System)

Vertical Deflection Oscillator and Amplifier(1)

	Triode Osc.	Pentode Amp.
Plate Voltage (Max.)	400	400 Volts
Grid No. 2 Voltage (Max.)	—	300 Volts
Peak Positive Pulse Plate Voltage (Max.)	—	2500 Volts
Peak Negative Grid No. 1 Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.)(2)	2.5	14 Watts
Grid No. 2 Dissipation (Max.)(2)	—	2.75 Watts
Average Cathode Current (Max.)	30	75 Ma
Peak Cathode Current (Max.)	105	260 Ma

Peak Power Output (Max.)	2.5	— Watts
Grid Circuit Resistance		
Self Bias (Max.)	2.2	2.2 Megohms
Fixed Bias (Max.)	—	1.0 Megohm
Bulb Temperature	—	210 °C

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	250	135 Volts
Grid No. 2 Voltage	—	120 Volts
Grid No. 1 Voltage	-4	-10 Volts
Plate Current	2.3	56 Ma
Grid No. 2 Current	—	3 Ma
Transconductance	3600	9300 μmhos
Amplification Factor	58	6.5(3)
Plate Resistance (Approx.)	16,000	12,000 Ohms
Ec for Ib = 10 μa	-6.6	— Volts
Ec for Ib = 1 Ma (Approx.)	—	-26 Volts
Ec for Ib = 100 μa	—	-30 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 45 V; Ec2 = 125 V; and Ec = 0 V
Ib = 200 Ma, and Ic2 = 20 Ma

NOTES:
(1) 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 horizontal scanning cycle.
(2) 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.
(3) Measured with Eb = 120 V, Ec2 = 120 V and Ec1 = -10 V.

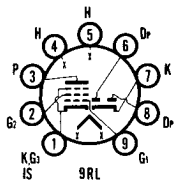
6LT8

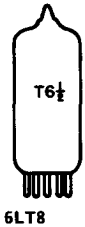
8LT8, 11LT8

HORIZONTAL OSCILLATOR and AFC

Double Diode and Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9RL
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.





ELECTRICAL DATA
HEATER OPERATION

	11LT8	8LT8	6LT8
Heater Voltage	11.4	8.1	6.3 Volts
Heater Current	315	450	600 Ma
Heater Warm-up Time	11	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 (Unshielded)
Pentode Section

Grid No. 1 to Plate	0.065 Pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + IS)	11 Pf
Output: Pp to (h + Pk + Pg2 + Pg3 + IS)	3.6 Pf
Diode Sections	
Plate (Section 1) to Cathode	1.4 Pf
Plate (Section 2) to Cathode	1.4 Pf
Plate to Plate	1.4 Pf

RATINGS (Design Maximum Rating System)
Pentode Section

Plate Voltage	330 Volts
Screen Supply Voltage	330 Volts
Screen Voltage	See Rating Chart (See Info. Sec.)
Positive DC Grid No. 1 Voltage	0 Volt
Plate Dissipation	3.1 Watts
Screen Dissipation	0.65 Watts
Grid No. 1 Circuit Resistance (Cathode Bias)	1.0 Megohm

Diode Section	
Diode Current for Continuous Operation (Each Diode)	5.0 Ma
CHARACTERISTICS AND TYPICAL OPERATION	
Pentode Section	
Plate Voltage	125 Volts
Screen Voltage	125 Volts
Cathode-Bias Resistor	56 Ohms
Plate Resistance (Approx.)	200,000 Ohms
Transconductance	13,000 μmhos
Plate Current	10 Ma
Screen Current	3.4 Ma
Grid No. 1 Voltage (Approx.) Ib = 20 μa	-3.5 Volts
Diode Section	
Average Diode Current Each Diode with 5 Volts DC Applied	20 Ma

Color Television Type

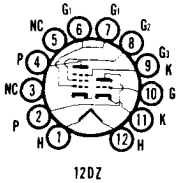
VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

6LU8

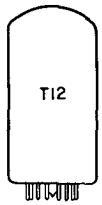
16LU8, 21LU8

High Mu Triode and Beam Power Pentode

Construction .....Compactron T-12
Base .....Button 12 Pin, E12-74
Basing 12DZ
Outline 12-57
Maximum Diameter .....1.562 In.
Maximum Seated Height .....2.750 In.
Maximum Overall Height .....3.125 In.



12DZ



ELECTRICAL DATA

HEATER OPERATION

	21LU8	16LU8	6LU8
Heater Voltage	21	15.8	6.3 Volts
Heater Current	450	600	1500 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section	
Grid to Plate: tg to tp	6.0 Pf
Input: tg to (h + Tk)	7.0 Pf
Output: tp to (h + Tk)	2.0 Pf
Pentode Section	
Grid No. 1 to Plate: pg1 to pp	0.5 Pf
Input: pg1 to (h + Pk + Pg2)	16 Pf
Output: pp to (h + Pk + Pg2)	9.0 Pf
Coupling	
Pentode Grid No. 1 to Triode Plate (Max.)	0.13 Pf
Pentode Plate to Triode Plate (Max.)	0.40 Pf

RATINGS (Design Maximum Rating System)

Vertical Deflection Oscillator and Amplifier(1)

	Triode Osc.	Pentode Amp.
Plate Voltage (Max.)	400	400 Volts
Grid No. 2 Voltage (Max.)	—	300 Volts
Peak Positive Pulse Plate Voltage (Max.)	—	2500 Volts
Peak Negative Grid No. 1 Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.)(2)	2.5	14 Watts
Grid No. 2 Dissipation (Max.)	—	2.75 Watts
Average Cathode Current (Max.)	30	75 Ma
Peak Cathode Current (Max.)	105	260 Ma
Grid Circuit Resistance		
Self Bias (Max.)	2.2	2.2 Megohms
Fixed Bias (Max.)	—	1.0 Megohm
Bulb Temperature (Max.)	—	210 °C

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	250	135 Volts
Grid No. 2 Voltage	—	120 Volts
Grid No. 1 Voltage	-4	-10 Volts
Plate Current	2.3	56 Ma
Grid No. 2 Current	—	3 Ma
Transconductance	3600	9300 μmhos
Amplification Factor	58	6.5(3)
Plate Resistance (Approx.)	16,000	12,000 Ohms
Ec for Ib = 10 μa	-6.6	— Volts
Ec for Ib = 1 Ma (Approx.)	—	-26 Volts
Ec for Ib = 100 μa	—	-30 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 45 V; Ec2 = 125 V; and Ec = 0 V
Ib = 200 Ma, and Ic2 = 20 Ma

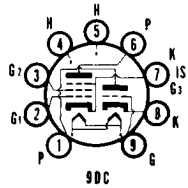
NOTES:
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
(2) In stages operating with grid leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.
(3) Measured with Eb = 120 V, Ec2 = 120 V, and Ec1 = -10 V.

6LX8/LCF802

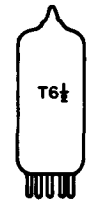
HORIZONTAL OSCILLATOR (P) REACTANCE TUBE (T)

Triode and Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DC
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9DC



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.0 Volts
Heater Current	450 Ma
Heater Warm-up Time	11 Seconds
Maximum Heater-Cathode Voltage	100 Volts

DIRECT INTERELECTRODE CAPACITANCES

Pentode Section	
Grid No. 1	5.4 Pf
Plate to Grid No. 1	0.060 Pf
Grid No. 1 to Filament	0.1 Pf
Triode Section	
Grid	2.4 Pf
Plate to Grid	1.5 Pf
Grid to Filament	0.1 Pf

RATINGS (Design Center Rating System)

Pentode Section	
Plate Voltage, Zero Plate Current (Max.)	550 Volts
Plate Voltage (Max.)	250 Volts
Plate Dissipation (Max.)	1.2 Watts
Grid No. 2 Voltage, Zero Plate Current (Max.)	550 Volts
Grid No. 2 Voltage (Max.)	250 Volts
Grid No. 2 Dissipation (Max.)	0.8 Watt
Grid No. 1 Circuit Resistance (Fixed Bias) (Max.)	0.56 Megohm
Grid No. 1 Circuit Resistance (Self Bias) (Max.)	1.0 Megohm
Cathode Current (Max.)	15 Ma
Peak Cathode Current (Max.)(1)	50 Ma
Input Impedance at 60 Hertz (Max.)	300 K Ohms
Triode Section	
Plate Voltage, Zero Plate Current (Max.)	550 Volts
Plate Voltage (Max.)	250 Volts
Plate Dissipation (Max.)	1.4 Watts

Grid No. 1 Circuit Resistance (Max.)	3 Megohms
Cathode Current (Max.)	10 Ma
Input Impedance at 60 Hertz (Max.)	50 K Ohms

CHARACTERISTICS AND TYPICAL OPERATION

Pentode Section	
Plate Voltage	100 Volts
Grid No. 2 Voltage	100 Volts
Grid No. 1 Voltage	−1 Volt
Plate Current	6 Ma
Grid No. 2 Current	1.7 Ma
Transconductance	5500 μmhos
Input Resistance	0.4 Megohm
Amplification Factor (Grid No. 1 to Grid No. 2)	47
Plate Current (Eg1 = 0 V)	12.5 Ma
Grid No. 2 Current (Eg1 = 0 V)	3.5 Ma
Grid No. 1 Voltage (Eb = Eg2 = 200 V, Ib = 10 μa)	−16 Volts
Grid No. 1 Voltage (Ic1 = +0.3 μa)	−1.3 Volts
Triode Section	
Plate Voltage	200 Volts
Grid Voltage	−2 Volts
Plate Current	3.5 Ma
Transconductance	3500 μmhos
Input Resistance	20 K Ohms
Amplification Factor	70
Plate Current (Ic = 10 μa)	10 Ma
Grid Voltage (Ic = +0.3 μa)	−1.3 Volts

NOTE:
(1) Duty cycle 30% maximum; pulse time 30 μsec. maximum.

Color Television Type

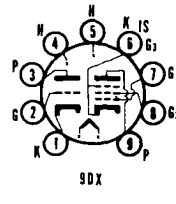
VIDEO AMPLIFIER (P) GENERAL PURPOSE AMPLIFIER (T)

6LY8

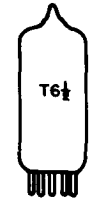
10LY8

High Mu Triode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9DX
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

	10LY8	6LY8
Heater Voltage	10.5	6.3 Volts
Heater Current	450	750 Ma
Heater Warm-up Time	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 (Unshielded)

Pentode Section	
Grid No. 1 to Plate	0.075 Pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + IS)	13 Pf
Output: Pp to (h + Pk + Pg2 + Pg3 + IS)	4.4 Pf
Triode Section	
Grid to Plate	3.8 Pf
Input: Tg to (h + Tk + Pk + Pg3 + IS)	2.6 Pf
Output: Tp to (h + Tk + Pk + Pg3 + IS)	2.8 Pf

RATINGS (Design Maximum Rating System)

	Pentode Section	Triode Section
Plate Voltage (Max.)	330	330 Volts
Screen Supply Voltage (Max.)	330	— Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive DC Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	5.0	1.0 Watts
Screen Dissipation (Max.)	1.1	— Watts

Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.5 Megohm
Cathode Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Pentode Section		Triode Section
Plate Voltage	35	200	250 Volts
Screen Voltage	100	100	— Volts
Grid No. 1 Voltage	0	—	-2.0 Volts
Cathode Bias Resistor	—	82	— Ohms
Amplification Factor	—	—	100
Plate Resistance (Approx.)	—	60,000	59,000 Ohms
Transconductance	—	20,000	1700 μmhos
Plate Current	54	19.5	1.0 Ma
Screen Current	13.5	3.0	— Ma
Grid Voltage (Approx.) Ib = 10 μa	—	—	-5 Volts
Grid No. 1 Voltage (Approx.) Ib = 100 μa	—	-6.3	— Volts

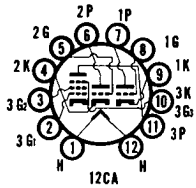
6M11

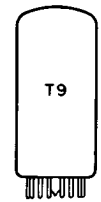
Color Television Type

SYNC SEP. and AGC AMP. (T) IF AMPLIFIER (P)

Double High Mu Triode and Sharp Cutoff Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12CA
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	750 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)

Triode (Each Section)	
Grid to Plate	1.8 Pf
Input: Tg to (Tk + Pk + Pg3 + h + IS)	3.8 Pf
Output: Tp to (Tk + Pk + Pg3 + h + IS)	1.1 Pf
Pentode Section	
Grid No. 1 to Plate	0.028 Pf
Input: Pg1 to (Pk + Pg2 + Pg3 + IS)	11.5 Pf
Output: Pp to (Pk + Pg2 + Pg3 + IS)	2.8 Pf

RATINGS (Design Maximum Rating System)

	Pentode Section	Each Triode Section
Plate Voltage (Max.)	330	330 Volts
Screen Supply Voltage (Max.)	330	— Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive DC Grid No. 1 Voltage	0	0 Volt
Plate Dissipation (Max.)	3.1	2.25 Watts
Screen Dissipation (Max.)	0.65	— Watts
Grid Circuit Resistance		
Cathode Bias (Max.)	1.0	0.68 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Pentode Section	Each Triode Section
Plate Voltage	125	125 Volts
Screen Voltage	125	— Volts
Cathode Bias Resistor	56	120 Ohms

Amplification Factor	—	58
Plate Resistance (Approx.)	200,000	7250 Ohms
Transconductance	13,000	8000 μmhos
Plate Current	11	8.0 Ma
Screen Current	3.4	— Ma
Grid No. 1 Voltage (Approx.) Ib = 20 μa	-3.5	— Volts
Grid No. 1 Voltage (Approx.) Ib = 50 μa	—	-4.5 Volts

Color Television Type

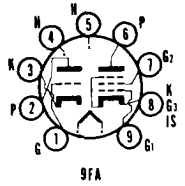
BURST AMPLIFIER (P) VIDEO AMPLIFIER (T)

6MB8

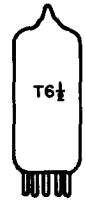
5MB8

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9FA
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.938 In.
Maximum Overall Height .....2.185 In.



9FA



ELECTRICAL DATA

HEATER OPERATION

	5MB8	6MB8
Heater Voltage	4.5	6.3 Volts
Heater Current	450	400 Ma
Heater Warm-up Time	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 (Shielded)

Triode Section	
Grid to Plate	1.4 Pf
Input: g1 to (Tk + Pk + Pg3 + IS + h)	2.2 Pf
Output: p to (Tk + Pk + Pg3 + IS + h)	1.9 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.015 Pf
Input: g1 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)

	Triode Section	Pentode Section
Plate Voltage (Max.)	280	280 Volts
Grid No. 2 Supply Voltage (Max.)	—	280 Volts
Grid No. 2 Pulse Voltage (Max.)(1)	—	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Cathode Current (Max.)	20	20 Ma
Plate Dissipation (Max.)	2.0	2.0 Watts
Grid No. 2 Dissipation (Max.)	—	0.5 Watt
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Maximum Grid No. 1 Circuit Resistance		
Self Bias (Max.)	0.5	0.25 Megohm
Fixed Bias (Max.)	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 and peak AC in commercial tube checkers and shorts indicating devices, particularly where mechanical excitation of the tube is employed.

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

	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	10 Ma
Grid No. 2 Current	—	2.8 Ma

Transconductance	8000	12,000 μmhos
Amplification Factor	40	—
Plate Resistance (Approx.)	5000	125,000 Ohms
Ec1 for Ib = 100 μa	-5	— Volts
Ec1 for Ib = 50 μa	—	-3 Volts

NOTE:
(1) Rating determined at television horizontal deflection sweep frequency of 15,750 Hertz.

6MD8

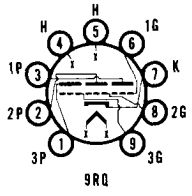
12MD8

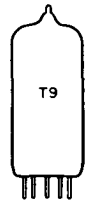
Color Television Type

CHROMA MATRIXING AMPLIFIER

Triple Triode

Construction .....Novar T-9
Base .....Button 9 Pin, E9-75 or E9-89
Basing 9RQ
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.580 In.
Maximum Overall Height .....2.960 In.





ELECTRICAL DATA

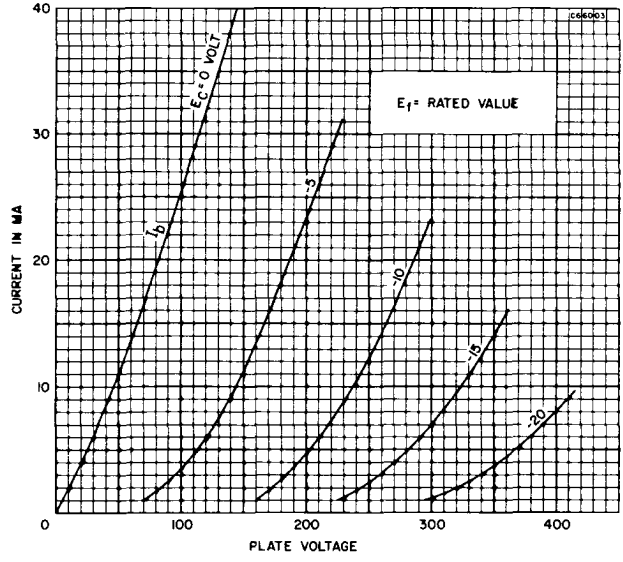
HEATER OPERATION

	12MD8	6MD8
Heater Voltage	12.6	6.3 Volts
Heater Current	450	900 Ma
Heater Warm-up Time	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 (Unshielded)

	Section 1	Section 2	Section 3
Grid to Plate	3.0	3.0	3.0 Pf
Input (G to K and H)	3.6	3.6	3.4 Pf
Output (P to K and H)	0.48	0.48	0.36 Pf

AVERAGE PLATE CHARACTERISTICS



RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage	330 Volts
Grid Voltage (Positive Bias Value)	0 Volt
Plate Dissipation	3 Watts
Grid Circuit Resistance (Fixed Bias)	1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier (Each Section)

Plate Voltage	250 Volts
Grid Voltage	−10.5 Volts
Plate Current	11.5 Ma
Amplification Factor	17
Plate Resistance (Approx.)	5500 Ohms
Transconductance	3100 μmhos
Ib for Ec1 = −14 Volts	4 Ma
Ec1 for Ib = 50 μa	−23 Volts

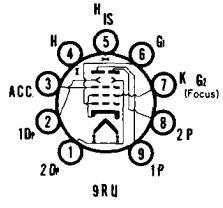
Color Television Type

SYNCHRONOUS DETECTOR

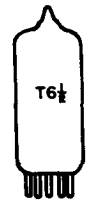
6ME8

Sheet Beam Tube (Double Plate)

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing[1]	9RU
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



9RU



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	300 Ma

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Deflector No. 1 to All	6.0 Pf
Deflector No. 2 to All	6.0 Pf
Grid No. 1 to All Except Plates	7.5 Pf
Plate No. 1 to All	6.0 Pf
Plate No. 2 to All	6.0 Pf
Grid No. 1 to Deflector No. 1 (Max.)	0.07 Pf
Grid No. 1 to Deflector No. 2 (Max.)	0.1 Pf
Plate No. 1 to Plate No. 2	0.4 Pf
Deflector No. 1 to Deflector No. 2	0.4 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	400 Volts
Accelerator Voltage (Max.)	400 Volts
Deflector Voltage (Max.)	100 Volts
Peak Deflector Voltage	
Positive (Max.)	200 Volts
Negative (Max.)	200 Volts
Positive DC Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation, Each Plate (Max.)	2.0 Watts
Accelator Dissipation (Max.)	2.0 Watts
DC Cathode Current (Max.)	30 Ma
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.25 Megohm

CHARACTERISTICS AND TYPICAL OPERATION[3]

Plate Voltage (Plates 1 and 2 Connected Together)	250 Volts
Accelator Voltage	350 Volts
Deflector No. 1 Voltage	75 Volts
Deflector No. 2 Voltage	75 Volts
Cathode Bias Resistor	390 Ohms
Total Plate Current	14.5 Ma
Accelerator Current	0.7 Ma
Grid No. 1 Transconductance	4400 μmhos
Grid No. 1 Voltage (Approx.)	
Ib (total) = 10 μa	−16 Volts
Deflector Switching Voltage (Max.)[2]	30 Volts
Voltage Difference between Deflectors for Ib1 = Ib2 (Approx.)	0 Volt
Plate No. 1 Current (Max.) Ed1 = 55 V, Ed2 = 95 V	1.3 Ma
Plate No. 2 Current, (Max.) Ed1 = 95 V, Ed2 = 55 V	1.3 Ma

Deflector No. 1 Current (Max.) Ed1 = 125 V, Ed2 = 25 V	0.04 Ma
Deflector No. 2 Current (Max.) Ed1 = 25 V, Ed2 = 125 V	0.04 Ma

NOTES:

(1) Pin 5 should be connected directly to ground.

(2) Deflector switching voltage is defined as the total voltage change from +75 Volts on either deflector with an equal and opposite change on the other deflector required to switch the plate current from one plate to the other.

(3) The 6ME8 should be so located in the equipment that it is not subjected to stray magnetic fields.

6MF8

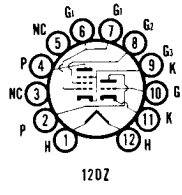
15MF8

Color Television Type

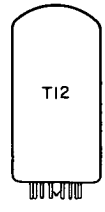
VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

High Mu Triode and Beam Power Pentode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Basing 12DZ
Outline 12-57
Maximum Diameter .....1.562 In.
Maximum Seated Height .....2.750 In.
Maximum Overall Height .....3.125 In.



12DZ



ELECTRICAL DATA

HEATER OPERATION

	15FM8	6MF8
Heater Voltage	14.7	6.3 Volts
Heater Current	600	1400 Ma
Heater Warm-up Time	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 (Unshielded)

Triode Section	
Grid to Plate	6.0 Pf
Input	6.5 Pf
Output	1.6 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.54 Pf
Input	9.5 Pf
Output	7.0 Pf
Coupling	
Pentode Grid No. 1 to Triode Plate (Max.)	0.12 Pf
Pentode Plate to Triode Plate (Max.)	0.32 Pf

RATINGS (Design Maximum Rating System)

Vertical Deflection Oscillator and Amplifier(1)

	Tri. Osc.	Pent. Amp.
Plate Voltage (Max.)	400	400 Volts
Grid No. 2 Voltage (Max.)	—	300 Volts
Peak Positive Pulse Plate Voltage (Max.)	—	2500 Volts
Peak Negative Grid No. 1 Voltage (Max.)	400	— Volts
Plate Dissipation (Max.)(2)	2.5	12 Watts
Grid No. 2 Dissipation (Max.)(2)	—	2.75 Watts
Average Cathode Current (Max.)	30	75 Ma
Peak Cathode Current (Max.)	105	260 Ma
Peak Power Output (Max.)	2.5	— Watts
Grid Circuit Resistance		
Self Bias (Max.)	2.2	2.2 Megohms
Fixed Bias (Max.)	—	1.0 Megohm
Bulb Temperature (Max.)	—	200 °C

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Plate Voltage	250	250 Volts
Grid No. 2 Voltage	—	250 Volts
Grid No. 1 Voltage	-4	-20 Volts
Plate Current	2.6	50 Ma
Grid No. 2 Current	—	3.5 Ma

Transconductance	4100	4100 μmhos
Amplification Factor	58	—
Plate Resistance (Approx.)	14,000	5000 Ohms
Ec for Ib = 10 μa	-6.6	— Volts
Ec for Ib = 100 μa	—	-65 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 60 V; Ec2 = 250 V; and Ec = 0 V
Ib = 200 Ma, and Ic2 = 20 Ma

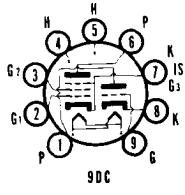
NOTES:
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
(2) In stages operating with grid leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.

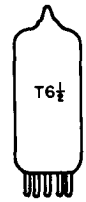
HORIZONTAL DEFLECTION OSC. SYNC SEP. or AGC AMPLIFIER

6MG8

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DC
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 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 (Shielded)

Triode Section	
Grid to Plate	1.5 Pf
Input: Tg1 to (Tk, H, Pk, Pg3 and IS)	2.9 Pf
Output: Tp to (Tk, H, Pk, Pg3 and IS)	1.6 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.025 Pf
Input: Pg1 to (Pk, H, Pg2, Pg3 and IS)	5.5 Pf
Output: Pp to (Pk, H, Pg2, Pg3 and IS)	3.8 Pf

RATINGS (Design Maximum Rating System)	**Triode Section**	**Pentode Section**
Plate Voltage (Max.)	330	330 Volts
Plate Dissipation (Max.)	2.5	2.0 Watts
Grid No. 2 Supply Voltage (Max.)	—	300 Volts
Grid No. 2 Dissipation		
At Plate Dissipation More Than 1.2 Watts (Max.)	—	0.5 Watts
At Plate Dissipation Less Than 1.2 Watts (Max.)	—	0.75 Watts
Cathode Current (Max.)	14	14 Ma
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.5 Megohm
Cathode Bias (Max.)	0.5	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION	**Triode Section**	**Pentode Section**
Plate Voltage	150	170 Volts
Grid No. 2 Voltage	—	170 Volts
Grid No. 1 Voltage	—	-2.0 Volts
Cathode Bias Resistor	56	— Ohms
Plate Current	18.0	10 Ma
Grid No. 2 Current	—	2.8 Ma
Transconductance	8500	6200 μmhos
Plate Resistance (Approx.)	5.0	400 K Ohms
Amplification Factor	40	47 (G2-G1)
Grid No. 1 Voltage (Ib = 10 μa)	-12	— Volts

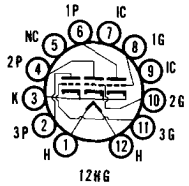
6MJ8

Color Television Type

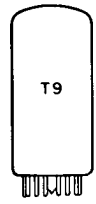
CHROMA MATRIXING AMPLIFIER

Triple Triode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12HG
Outline 9-60
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.500 In.
Maximum Overall Height .....2.875 In.



12HG



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	900 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)

	Sec. 1	Sec. 2	Sec. 3
Grid to Plate	3.0	3.0	3.0 Pf
Input (g to k and H)	3.6	3.6	3.4 Pf
Output (P to k and H)	*0.48*	*0.48*	*0.36 Pf*

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	330 Volts
Grid Voltage Positive Bias Value (Max.)	0 Volt
Plate Dissipation (Max.)	3 Watts
Grid Circuit Resistance	
Fixed Bias (Max.)	1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier (Each Section)

Plate Voltage	250 Volts
Grid Voltage	-10.5 Volts
Plate Current	11.5 Ma
Amplification Factor	17
Plate Resistance (Approx.)	5500 Ohms
Transconductance	3100 μmhos
Ib for Ec1 = -14 Volts	4 Ma
Ec1 for Ib = 50 μa	-23 Volts

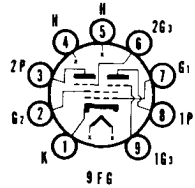
6MK8

4MK8

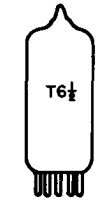
SYNC SEP., CLIPPER, AGC AMP. LOW LEVEL COLOR DEMODULATOR

Double Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9FG
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9FG



ELECTRICAL DATA

HEATER OPERATION

	4MK8	6MK8
Heater Voltage	4.2	6.3 Volts
Heater Current	450	300 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 3 to Plate (Each Section)	2.0 Pf
Grid No. 1 to All	6.0 Pf
Grid No. 3 (Each Section) to All	3.6 Pf
Plate (Each Section) to All	3.0 Pf
Grid No. 3 (Section 1) to Grid No. 3 (Section 2) (Max.)	0.015 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Each Section) (Max.)	300 Volts
Grid No. 2 Voltage (Max.)	150 Volts
Positive DC Grid No. 3 Voltage (Each Section) (Max.)	3.0 Volts
Negative DC Grid No. 3 Voltage (Each Section) (Max.)	50 Volts
Peak Positive Grid No. 3 Voltage (Each Section) (Max.)	50 Volts
Negative DC Grid No. 1 Voltage (Max.)	50 Volts
Plate Dissipation (Each Section) (Max.)	1.1 Watts
Grid No. 2 Dissipation (Max.)	0.75 Watt
DC Cathode Current (Max.)	12 Ma
Grid No. 1 Circuit Resistance (Max.)	0.5 Megohm
Grid No. 3 Circuit Resistance (Each Section) (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Both Sections Operating		
Plate Voltage (Each Section)	100	100 Volts
Grid No. 2 Voltage	67.5	67.5 Volts
Grid No. 3 Voltage (Each Section)	−10	0 Volt
Grid No. 1 Voltage	Note 1	Note 1
Plate Current (Each Section)	—	2.0 Ma
Grid No. 2 Current	7.0	4.4 Ma
Cathode Current	7.1	8.5 Ma
MAXIMUM PLATE CURRENT RATIO (Balance)		
Eb = 100 V, Ec2 = Ec1 = 67.5 V, Ec3 = 0, Rg1 = 0.68 Megohms		1.3 to 1
Each Section Operating Separately with Plate and Grid No. 3 of Opposite Section Grounded		
Plate Voltage	100	100 Volts
Grid No. 2 Voltage	67.5	67.5 Volts
Grid No. 3 Voltage	0	0 Volt
Grid No. 1 Voltage	0	Note 1
Plate Current	—	2.0 Ma
Grid No. 3 Transconductance	—	450 μmhos
Grid No. 1 Transconductance	1100	— μmhos
Ec3 for Ib = 100 μa (Approx.)	—	−3.5 Volts
Ec1 for Ib = 100 μa (Approx.)	—	−2.3 Volts

NOTE:
(1) Grid current adjusted for 100 μa dc.

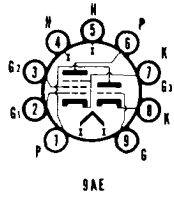
BURST AMPLIFIER and GENERAL PURPOSE AMPLIFIER

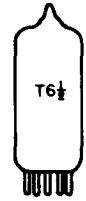
6MU8

8MU8

Medium Mu Triode and Semi-Remote Cutoff Pentode

Construction	Miniature T-6½
Base	E9-1
Basing	9AE
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.





ELECTRICAL DATA

HEATER OPERATION

	6MU8	6MU8	8MU8	
Heater Voltage	6.3	6.3	8.4	Volts
Heater Current	600	600	450	Ma
Heater Warm-up Time	—	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

	With Shield	Without Shield
Triode Section		
Grid to Plate	2.2	2.2 pf
Input: g1 to (Tk + Pk + Pg3 + IS + h)	3.2	3.0 pf
Output: p to (Tk + Pk + Pg3 + IS + h)	3.4	2.2 pf
Pentode Section		
Grid No. 1 to Plate (Max.)	0.05	0.05 pf
Input: g1 to (k + g3 + IS + g2 + h)	9.0	9.0 pf
Output: p to (k + g3 + IS + g2 + h)	4.4	3.6 pf
Heater to Cathode (Triode Section)	4.8	4.4 pf
Heater to Cathode (Pentode Section)	7.5	5.5 pf
Pentode Grid No. 1 to Triode Plate (Pg1 to Tp) (Max.)	0.20	0.170 pf
Pentode Plate to Triode Plate (Pp to Tp) (Max.)	0.008	0.090 pf

RATINGS (Design Maximum Rating System)
Class A1 Amplifier

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 (Screen-Grid) Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Grid No. 1 (Control-Grid) Voltage: Positive Bias (Max.)	0	0 Volt
Grid No. 2 Dissipation (Max.)	—	1.1 Watts
Plate Dissipation (Max.)	2.5	3.75 Watts
Maximum Grid No. 1 Circuit Resistance		
Fixed-Bias	0.5	0.25 Megohm
Cathode-Bias	1.0	1.0 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 A1 Amplifier

	Triode Section	Pentode Section
Plate Voltage	125	150 Volts
Grid No. 2 Voltage	—	150 Volts
Grid No. 1 Voltage	-1	— Volts
Cathode Bias Resistor	—	150 Ohms
Plate Current	11.5	19 Ma
Grid No. 2 Current	—	4.2 Ma
Transconductance	6000	9000 μmhos
Amplification Factor	35	—
Plate Resistance (Approx.)	5800	165,000 Ohms
Ec1 for Ib = 10 μa (Approx.)	-5.8	— Volts
Ec1 for Ib = 20 μa (Approx.)	—	-9.5 Volts

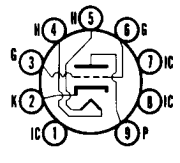
6S4A

Color Television Type

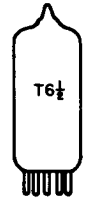
VERTICAL DEFLECTION AMPLIFIER

Medium Mu Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9AC
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9 AC



ELECTRICAL DATA
HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	600 Ma
Heater Warm-up Time	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 (Unshielded)

Grid to Plate	2.6 Pf
Input: g1 to (h + k)	4.2 Pf
Output: p to (h + k)	0.9 Pf

RATINGS (Design Center Rating System)

Vertical Deflection Amplifier(1)

Plate Voltage (Max.)	500 Volts
Peak Positive Plate Voltage (Abs. Max.)	2200 Volts
Plate Dissipation (Max.)(2)	7.5 Watts
Peak Negative Grid Voltage (Max.)	250 Volts
Average Cathode Current (Max.)	30 Ma
Peak Cathode Current (Max.)	105 Ma
Grid Circuit Resistance	
Cathode Bias (Max.)	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	250 Volts
Grid Voltage	−8 Volts
Plate Current	26 Ma
Transconductance	4500 μmhos
Amplification Factor	16
Plate Resistance	3600 Ohms
Plate Current at Ec = −15 V	4.5 Ma
Grid Voltage for Ib = 50 μa	−23 Volts

Vertical Deflection Amplifier
70° Picture Tube—15 Kv 2nd Anode Voltage

Plate Supply Voltage	435 Volts
Plate Output Voltage	
Peak to Peak	900 Volts
Sawtooth Component	320 Volts
Grid Input Voltage	
Peak to Peak	60 Volts
Sawtooth Component	40 Volts
Average Cathode Current	16 Ma
Peak Cathode Current	40 Ma
Cathode Resistor	1200 Ohms

NOTES:

(1) 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 horizontal scanning cycle.

(2) 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.

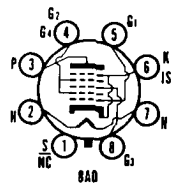
AM CONVERTER

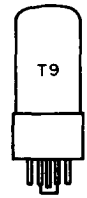
6SA7GT

12SA7GT

Heptode

Construction	Octal T-9
Base	Octal 8 Pin, B8-6 or B8-58
Basing	8AD
Outline	9-11 or 9-41
Maximum Diameter	1.188 In.
Maximum Seated Height	2.750 In.
Maximum Overall Height	3.312 In.





ELECTRICAL DATA

HEATER OPERATION

	12SA7GT	6SA7GT
Heater Voltage	12.6	6.3 Volts
Heater Current	150	300 Ma
Maximum Heater-Cathode Voltage	90	90 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded	Unshielded
Mixer Grid No. 3 to Plate (Max.)	0.5	0.7 Pf
RF Input: g3 to (h + k + g1 + g2 + g4 + g5 + p)	9.5	9.5 Pf
Mixer Output: p to (h + k + g1 + g2 + g4 + g3 + g5)	9.5	6.5 Pf
Oscillator Grid to Cathode and Grid No. 5	3.5	3.0 Pf
Oscillator Input: g1 to (h + k + g2 + g4 + g3 + g5 + p)	8.0	8.0 Pf
Oscillator Output: k + g5 to (h + g2 + g4 + g3 + p)	20	14 Pf
Coupling		
Oscillator Grid to Plate (Max.)	0.4	0.5 Pf
Mixer Grid No. 3 to Oscillator Grid	0.4	0.4 Pf
Oscillator Grid to All Except Cathode and Grid No. 5	5.0	5.0 Pf
RATINGS (Design Center Rating System)		
Plate Voltage (Max.)		300 Volts
Grid No. 2 and Grid No. 4 Supply Voltage (Max.)		300 Volts
Grid No. 2 and Grid No. 4 Voltage (Max.)		100 Volts
Negative Grid No. 3 Voltage (Max.)		50 Volts
Positive Grid No. 3 Voltage (Max.)		0 Volt
Plate Dissipation (Max.)		1.0 Watt
Grid No. 2 and Grid No. 4 Dissipation (Max.)		1.0 Watt
Cathode Current (Max.)		14 Ma
CHARACTERISTICS AND TYPICAL OPERATION		
Plate Voltage	100	250 Volts
Grid No. 2 and Grid No. 4 Voltage	100	100 Volts
Grid No. 3 Voltage	−2	−2 Volts
Oscillator Grid No. 1 Voltage (RMS)	10	10 Volts
Oscillator Grid No. 1 Resistance	20,000	20,000 Ohms
Oscillator Grid Current	0.5	0.5 Ma
Plate Current	3.3	3.5 Ma
Grid No. 2 and Grid No. 4 Current	8.5	8.5 Ma
Conversion Transconductance	425	450 μmhos
Plate Resistance (Approx.)	0.5	1.0 Megohm
Cathode Current	12.3	12.5 Ma
Ec3 for Gm = 10 μmhos (Approx.)	−25	−25 Volts
Ec3 for Gm = 100 μmhos (Approx.)	−9	−9 Volts
OSCILLATOR CHARACTERISTICS (Non-Oscillating)		
Grid No. 2 and Grid No. 4 Voltage(1)		100 Volts
Grid No. 3 Voltage		0 Volt
Grid No. 1 Voltage		0 Volt
Transconductance between Grid No. 1 to Grid No. 2 and Grid No. 4(1)		4500 μmhos
Amplification Factor between Grid No. 1 and Grid No. 2 and Grid No. 4(1)		14
Cathode Current		25 Ma
Ec1 for Ib = 10 μa (Approx.)		−14 Volts

NOTE:
(1) Connected to plate.

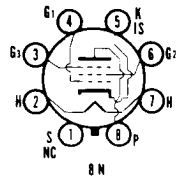
6SJ7GT

12SJ7GT

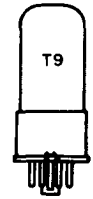
RF or AF AMPLIFIER

Sharp Cutoff Pentode

Construction .....Octal T-9
Base .....Octal 8 Pin, B8-26
Basing 8N
Outline 9-12
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.750 In.
Maximum Overall Height .....3.312 In.



8 N



ELECTRICAL DATA
HEATER OPERATION

	12SJ7GT	6SJ7GT
Heater Voltage	12.6	6.3 Volts
Heater Current	150	300 Ma
Maximum Heater-Cathode Voltage	90	90 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)		
Grid No. 1 to Plate (Max.)		0.005 Pf
Input: g1 to (h + k + g2 + g3)		7.0 Pf
Output: p to (h + k + g2 + g3)		7.0 Pf
RATINGS (Design Center Rating System)		
Plate Voltage (Max.)		300 Volts
Grid No. 3 Voltage		Connected to Cathode at Socket
Grid No. 2 Supply Voltage (Max.)		300 Volts

Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	2.5 Watts
Grid No. 2 Dissipation (Max.)	0.7 Watts
Positive Grid No. 1 Voltage (Max.)	0 Volt
Grid Circuit Resistance (Self Bias) (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	100	250 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket	
Grid No. 2 Voltage	100	100 Volts
Grid No. 1 Voltage	−3	−3 Volts
Plate Current	2.9	3 Ma
Grid No. 2 Current	0.9	0.8 Ma
Transconductance	1575	1650 μmhos
Plate Resistance (Approx.)	0.7	1.0 Megohm
Ec1 for Ib = 10μa (Approx.)	−8	−8 Volts

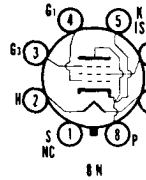
RF or IF AMPLIFIER

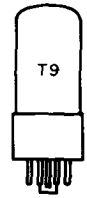
6SK7GT

12SK7GT

Remote Cutoff Pentode

Construction	Octal T-9
Base	Octal 8 Pin, B8-6
Basing	8N
Outline	9-11
Maximum Diameter	1.188 In.
Maximum Seated Height	2.750 In.
Maximum Overall Height	3.312 In.





ELECTRICAL DATA

HEATER OPERATION

	12SK7GT	6SK7GT
Heater Voltage	12.6	6.3 Volts
Heater Current	150	300 Ma
Maximum Heater-Cathode Voltage	90	90 Volts

DIRECT INTERELECTRODE CAPACITANCES (Shielded)

Grid No. 1 to Plate (Max.)	0.005 Pf
Input: g1 to (H + k + g2 + g3)	6.5 Pf
Output: p to (H + k + g2 + g3)	7.5 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	300 Volts
Grid No. 2 Supply Voltage (Max.)	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Positive Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	4.0 Watts
Grid No. 2 Dissipation (Max.)	0.4 Watt

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	100	250 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket	
Grid No. 2 Voltage	100	100 Volts
Grid No. 1 Voltage	−1	−3 Volts
Plate Current	13	9.2 Ma
Grid No. 2 Current	4.0	2.6 Ma
Transconductance	2350	2000 μmhos
Plate Resistance (Approx.)	120,000	800,000 Ohms
Ec1 for Gm = 10 μmhos (Approx.)	−35	−35 Volts

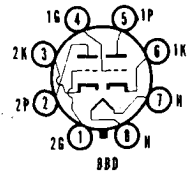
AF VOLTAGE AMPLIFIER

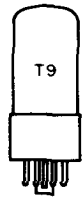
6SL7GT

12SL7GT

High Mu Twin Triode

Construction	Octal T-9
Base	Octal 8 Pin, B8-6 or B8-58
Basing	8BD
Outline	9-11 or 9-41
Maximum Diameter	1.188 In.
Maximum Seated Height	2.750 In.
Maximum Overall Height	3.312 In.





ELECTRICAL DATA

HEATER OPERATION	**12SL7GT**	**6SL7GT**
Heater Voltage	12.6	6.3 Volts
Heater Current	150	300 Ma
Maximum Heater-Cathode Voltage	90	90 Volts

DIRECT INTERELECTRODE CAPACITANCES (Shielded)(1)

	Section No. 1(2)	**Section No. 2**(2)
Grid to Plate	2.8	2.8 Pf
Grid to Cathode	3.0	3.4 Pf
Plate to Cathode	3.8	3.2 Pf
Coupling		
Plate to Plate	0.4	Pf
Grid to Grid	0.65	Pf
Grid Section No. 2 to Plate Section No. 1	0.13	Pf

RATINGS (Design Center Rating System) (Each Section)

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	1.0 Watt
Positive Grid Voltage (Max.)	0 Volt

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier (Each Section)

Plate Voltage	250 Volts
Grid Voltage	−2 Volts
Cathode Bias Resistor	870 Ohms
Plate Current	2.3 Ma
Transconductance	1600 μmhos
Amplification Factor	70
Plate Resistance	44,000 Ohms

NOTES:

(1) Standard 1¼" diameter shield (EIA Std. M8-308) connected to cathode.
(2) Section No. 1 connects to pins 4, 5, and 6. Section No. 2 connects to pins 1, 2, and 3.

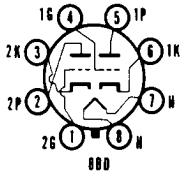
6SN7GTB

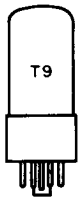
8SN7GTB, 12SN7GTA

HORIZONTAL MULTIVIBRATOR, PHASE INVERTER, or VERTICAL OSC. and AMP.

Medium Mu Double Triode

Construction .....Octal T-9
Base.....Octal 8 Pin, B8-6 or B8-58
Basing 8BD
Outline .....9-11 or 9-41
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.750 In.
Maximum Overall Height .....3.312 In.





ELECTRICAL DATA

HEATER OPERATION

	12SN7GTA	**8SN7GTB**	**6SN7GTB**
Heater Voltage	12.6	8.4	6.3 Volts
Heater Current	300	450	600 Ma
Heater Warm-up Time	—	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 (Unshielded)

	Section 1(1)	**Section 2**(1)
Grid to Plate	4.0	3.8 Pf
Input	2.2	2.6 Pf
Output	0.7	0.7 Pf

RATINGS (Design Center Rating System)

	Class A1 Amplifier	**Vertical**(2) **Deflection Amplifier**
Plate Voltage (Max.)	450	450 Volts
Peak Positive Plate Voltage (Abs. Max.)	—	1500 Volts
Plate Dissipation		
Each Plate (Max.)	5.0	5.0 Watts
Both Plates (Max.)	7.5	7.5 Watts

Peak Negative Grid Voltage (Max.)	—	250 Volts
Cathode Current (Max.)	20	20 Ma
Peak Cathode Current (Max.)	—	70 Ma
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	1.0	— Megohm
Cathode Bias (Max.)	1.0	2.2 Megohm
	Vertical[2] Deflection Oscillator	**Horizontal[2] Deflection Oscillator**
Plate Voltage (Max.)	450	450 Volts
Plate Dissipation		
Each Plate (Max.)	5.0	5.0 Watts
Both Plates (Max.)	7.5	7.5 Watts
Peak Negative Grid Voltage (Max.)	400	600 Volts
Average Cathode Current (Max.)	20	20 Ma
Peak Cathode Current (Max.)	70	300 Ma
Grid Circuit Resistance (Max.)	2.2	2.2 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier (Each Section)

Plate Voltage	90	250 Volts
Grid Voltage	0	-8.0 Volts
Plate Current	10	9.0 Ma
Transconductance	3000	2600 μmhos
Amplification Factor	20	20
Plate Resistance (Approx.)	6700	7700 Ohms
Plate Current at Ec = 12.5 Volts	—	1.3 Ma
Grid Voltage for Ib = 10 μa (Approx.)	-7.0	-18 Volts

NOTES:
(1) Section No. 1 connects to pins 4, 5 and 6. Section No. 2 connects to pins 1, 2 and 3.
(2) 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 horizontal scanning cycle.

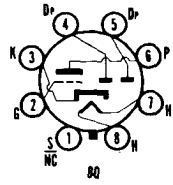
AUDIO DETECTOR and AMPLIFIER

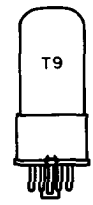
6SQ7GT

12SQ7GT

Double Diode and High Mu Triode

Construction .....Octal T-9
Base .....Octal 8 Pin, B8-26
Basing 8Q
Outline 9-12
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.750 In.
Maximum Overall Height .....3.312 In.





ELECTRICAL DATA

HEATER OPERATION

	12SQ7GT	6SQ7GT
Heater Voltage	12.6	6.3 Volts
Heater Current	150	300 Ma
Maximum Heater-Cathode Voltage	90	90 Volts

DIRECT INTERELECTRODE CAPACITANCES (Shielded)

Diode Plate No. 1 to Heater and Cathode	1.8 Pf
Diode Plate No. 2 to Heater and Cathode	1.8 Pf
Diode Plate No. 1 to Grid (Max.)	0.1 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	0.5 Watts
Positive Grid Voltage (Max.)	0 Volt
Diode Current for Continuous Operation (Each Diode) (Max.)	1.0 Ma

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

Plate Voltage	100	250 Volts
Grid Voltage	-1	-2 Volts
Plate Current	0.5	1.1 Ma

Transconductance	925	1175 μmhos
Amplification Factor	100	100
Plate Resistance	110,000	85,000 Ohms
Average Diode Current with 10 Volts DC Applied (Each Diode)(1)	2.0	2.0 Ma

NOTE:
(1) Test condition only.

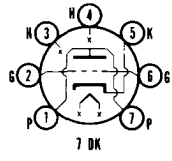
6T4
2T4

Color Television Type

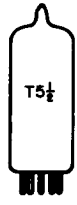
UHF OSCILLATOR

Low Mu Triode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7DK
Outline 5-1
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.500 In.
Maximum Overall Height .....1.750 In.



7 DK



ELECTRICAL DATA

HEATER OPERATION

	2T4	6T4
Heater Voltage	2.35	6.3 Volts
Heater Current	600	225 Ma
Heater Warm-up Time	11	— Seconds
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
Total DC and Peak		50 Volts
Heater Positive with Respect to Cathode		
DC		25 Volts
Total DC and Peak		50 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded(1)	Unshielded
Grid to Plate	1.7	1.7 Pf
Input	3.3	2.9 Pf
Output	1.8	0.25 Pf
Heater to Cathode(2)	2.9	3.0 Pf
Grid No Cathode(2)	2.6	2.6 Pf
Plate to Cathode(2)	0.18	0.20 Pf
Grounded Grid Operation		
Input	5.7	5.5 Pf
Output	3.4	1.8 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	200 Volts
Plate Dissipation (Max.)	3.5 Watts
Grid Current (Max.)	8.0 Ma
Cathode Current (Max.)	30 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	80 Volts
Cathode Resistor	150 Ohms
Plate Current	18 Ma
Transconductance	7000 μmhos
Amplification Factor	13
Plate Resistance	1860 Ohms
Grid Voltage for Ib = 50 μa	−15 Volts
Oscillator at 950 MHz	
Plate Voltage	80 Volts
Grid Voltage (Self Bias)	−4 Volts
Grid Resistor	10,000 Ohms
Plate Current	18 Ma
Grid Current (Approx.)	400 μa

NOTES:
(1) Shield No. 316.
(2) Measured between specified elements only. When external shield is used, it shall be grounded.

Color Television Type

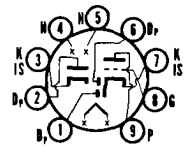
CLAMPER or DETECTOR VOLTAGE AMPLIFIER

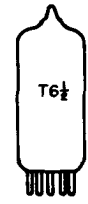
6T8A

5T8, 19T8

Triple Diode and High Mu Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing.....9E
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	19T8	5T8	6T8A
Heater Voltage	18.9	4.7	6.3 Volts
Heater Current	150	600	450 Ma
Heater Warm-up Time	—	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 (Unshielded)

Grid to Plate	1.7 Pf
Input	1.6 Pf
Output	1.2 Pf
Grid to Any Diode Plate (Max.)	0.034 Pf
Diode No. 1 Input	3.8 Pf
Diode No. 2 Input	3.8 Pf
Diode No. 3 Input	3.4 Pf
Diode No. 2 Cathode to All	7.5 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	1.0 Watt
Positive Grid Voltage (Max.)	0 Volt
Diode Current for Continuous Operation (Each Plate) (Max.)	5.0 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate Voltage	100	250 Volts
Grid Voltage	-1.0	-3.0 Volts
Plate Current	0.8	1.0 Ma
Transconductance	1300	1200 μmhos
Amplification Factor	70	70
Plate Resistance	54,000	58,000 Ohms
Average Diode Current with 5 Volt DC Applied (Each Plate)	—	20 Ma

Color Television Type

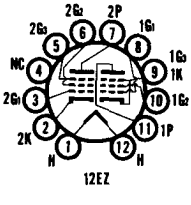
AUDIO OUTPUT and FM DETECTOR

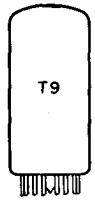
6T10

12T10

Double Dissimilar Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, 12-70
Basing 12EZ
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.





ELECTRICAL DATA

HEATER OPERATION

	12T10	6T10
Heater Voltage	12.6	6.3 Volts
Heater Current	450	950 Ma
Heater Warm-up Time	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 (Unshielded)

Section No. 1

Grid to Plate	0.22 Pf
Input: g to (h + 1k + 1g2 + 1g3 + IS)	11.0 Pf
Output: p to (h + 1k + 1g2 + 1g3 + IS)	10.0 Pf

Section No. 2

Grid No. 1 to Plate	0.032 Pf
Grid No. 3 to Plate	3.0 Pf
Grid No. 1 to (h + 2k + 2g2 + 2g3 + IS)	6.5 Pf
Grid No. 3 to (h + 2k + 2g1 + 2g2 + 2p + IS)	7.5 Pf
Grid No. 1 to Grid No. 3	0.12 Pf
Plate No. 1 to Plate No. 2	0.13 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	275 Volts
Screen Voltage (Max.)	275 Volts
Plate Dissipation (Max.)	10.0 Watts
Screen Dissipation (Max.)	2.0 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.25 Megohm
Cathode Bias (Max.)	0.5 Megohm

Section No. 2

Plate Voltage (Max.)	330 Volts
Suppressor Voltage (Max.)	28 Volts
Screen Supply Voltage (Max.)	330 Volts
Positive DC Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	1.7 Watts
Screen Dissipation (Max.)	1.1 Watts

CHARACTERISTICS AND TYPICAL OPERATION

Section No. 1

Class A1 Amplifier

Plate Voltage	250 Volts
Screen Voltage	250 Volts
Grid No. 1 Voltage	–8.0 Volts
Peak AF Grid Voltage	8.0 Volts
Plate Resistance (Approx.)	100,000 Ohms
Transconductance	6500 μmhos
Zero Signal Plate Current	35 Ma
Maximum Signal Plate Current	39 Ma
Zero Signal Screen Current	2.5 Ma
Maximum Signal Screen Current	7.0 Ma
Load Resistance	5000 Ohms
Total Harmonic Distortion (Approx.)	10 Percent
Maximum Signal Power Output	4.2 Watts

Section No. 2

Plate Voltage	150 Volts
Suppressor Voltage	0 Volt
Screen Voltage	100 Volts
Cathode Resistor	560 Ohms
Plate Resistance (Approx.)	150,000 Ohms
Transconductance (G1)	1000 μmhos
Transconductance (G3)	400 μmhos
Plate Current	1.3 Ma
Screen Current	2.1 Ma
Ec1 for Ib = 30 μa	–4.5 Volts
Ec3 for Ib = 50 μa	–4.5 Volts

Color Television Type

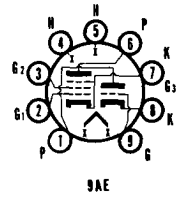
HORIZONTAL OSC. and REACTANCE TUBE or VHF OSC. and MIXER

6U8A/6KD8

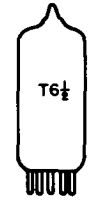
5U8, 5KD8, 9U8A

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9AE
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9AE



ELECTRICAL DATA

HEATER OPERATION

	9U8A	5KD8	5U8	6U8A/6KD8
Heater Voltage	9.45	5.6	4.7	6.3 Volts
Heater Current	300	450	600	450 Ma
Heater Warm-up Time	11	11	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

	Shielded (1)	Unshielded
Pentode Section		
Grid No. 1 to Plate (Max.)	0.007	0.015 Pf
Input: g1 to (h + k + g2 + g3 + IS)	5.0	5.0 Pf
Output: p to (h + k + g2 + g3 + IS)	3.5	2.6 Pf
Cathode to Heater	3.0	3.0 Pf
Triode Section		
Grid to Plate	1.8	1.8 Pf
Input: g to (h + Pk + Tk + g3 + IS)	2.8	2.8 Pf
Output: p to (h + Pk + Tk + g3 + IS)	2.0	1.5 Pf
Cathode to Heater	3.0	3.0 Pf
Coupling		
Pentode Grid No. 1 to Triode Plate (Max.)	0.2	0.2 Pf
Pentode Plate to Triode Plate (Max.)	0.02	0.1 Pf

RATINGS (Design Maximum Rating System)

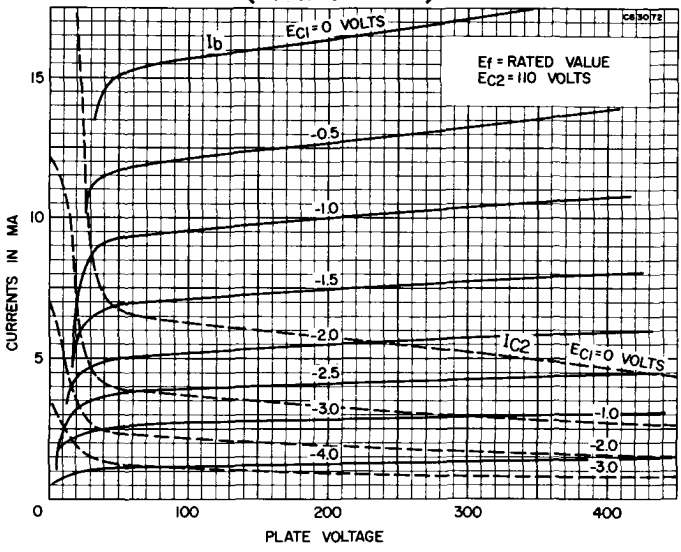
	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive DC Grid No. 1 Voltage	0	0 Volt
Plate Dissipation (Max.)	2.5	3.0 Watts
Grid No. 2 Dissipation (Max.)	0	0.55 Watt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	—	0.5 Megohm
Self Bias (Max.)	—	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

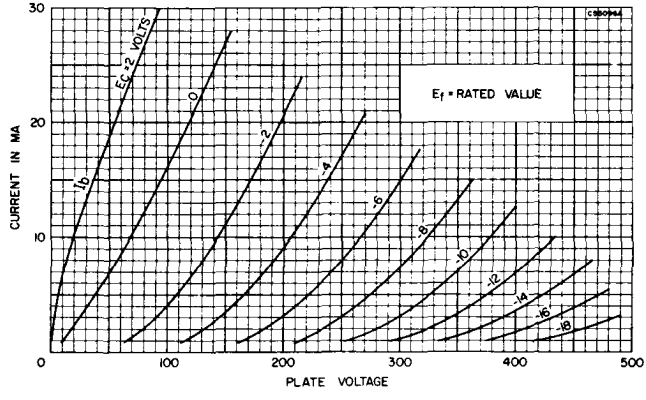
	Triode Section	Pentode Section
Plate Voltage	125	125 Volts
Grid No. 2 Voltage	—	110 Volts
Grid No. 1 Voltage	-1.0	-1.0 Volts
Plate Current	13.5	9.5 Ma
Grid No. 2 Current	—	3.5 Ma
Transconductance	7500	5000 μmhos
Amplification Factor	40	—
Plate Resistance (Approx.)	—	0.2 Megohm
Ec1 for Ib = 20 μa (Approx.)	-9	-8 Volts

NOTE:
(1) External shielded No. 315 connected to cathode of section under test.

AVERAGE PLATE CHARACTERISTICS
(Pentode Section)



AVERAGE PLATE CHARACTERISTICS
(Triode Section)



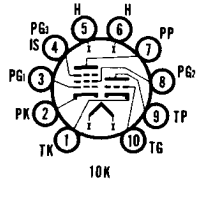
6U9

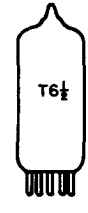
5U9/LCF201, 8U9

IF AMPLIFIER (P)
SYNC SEPARATOR or OSC. (T)

Triode and Pentode

Construction	Miniature T-6½
Base	Button 10 Pin
Basing	10K
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	8U9	5U9/LCF201	6U9
Heater Voltage	8.0	5.9	6.3 Volts
Heater Current	300	450	410 Ma
Maximum Heater-Cathode Voltage	165	110	165 Volts

DIRECT INTERELECTRODE CAPACITANCES

Pentode Section	
Plate to All Other Elements (Except Grid No. 1)	3.5 Pf
Grid No. 1 to All Other Elements (Except Plate)	6.5 Pf
Grid No. 1 to Cathode	4.0 Pf
Plate to Grid No. 1	0.0065 Pf
Grid No. 1 to Grid No. 2	1.8 Pf
Triode Section	
Plate to All Other Elements (Except Grid)	3.0 Pf
Grid to All Other Elements (Except Plate)	2.5 Pf
Plate to Grid	2.0 Pf
Between Pentode and Triode Section	
Plate of Pentode to Plate of Triode	0.015 Pf
Control Grid of Pentode to Plate of Triode	0.0012 Pf
Control Grid of Pentode to Grid of Triode	0.0015 Pf

RATINGS (Absolute Maximum Rating System)

Pentode Section	
Plate Voltage (Zero Plate Current)	600 Volts
Plate Voltage	275 Volts
Plate Dissipation	2.4 Watts
Grid No. 2 Voltage (Zero Grid Current)	600 Volts
Grid No. 2 Voltage	275 Volts
Grid No. 2 Dissipation	0.8 Watt
Cathode Current	20 Ma
Grid No. 1 Resistor	1 Megohm
Triode Section	
Plate Voltage (Zero Plate Current)	600 Volts
Plate Voltage	275 Volts
Plate Dissipation	1.75 Watts
Cathode Current	20 Ma
Peak Cathode Current	55 Ma
Grid Resistor	1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Pentode Section	
Plate Voltage	160 Volts
Grid No. 2 Voltage	110 Volts
Grid No. 3 Voltage	0 Volt
Grid No. 1 Voltage	−1.4 Volts
Plate Current	13 Ma
Grid No. 2 Current	5 Ma
Transconductance	12,000 μmhos
Amplification Factor (Grid No. 1 to Grid No. 2)	45
Triode Section	
Plate Voltage	100 Volts
Grid Voltage	−2 Volts
Plate Current	14 Ma
Transconductance	5000 μmhos
Amplification Factor	17

OPERATING CHARACTERISTICS

Pentode Section—Video IF Amplifier			
Supply Voltage	135	230	250 Volts
Grid No. 3 Voltage	0	0	0 Volt
Plate Resistance	0	5.6	6.8 K Ohms
Grid No. 2 Resistor	5.1	24	27 K Ohms
Cathode Resistor	78	78	74 Ohms
Plate Current	13	13	13.5 Ma
Grid No. 2 Current	5	5	5.2 Ma
Transconductance	12,000	12,000	12,300 μmhos
Grid No. 1 Circuit Resistance (40 MHz)	7.4	7.4	7.4 K Ohms
Triode Section—Line Blocking Oscillator			
Plate Voltage			30 Volts
Grid Voltage			1.5 Volts
Peak Cathode Current			40 Ma
Peak Plate Current			25 Ma
Peak Grid Current			15 Ma
Triode Section—Sync Separator			
Plate Voltage			130-150 Volts
Plate Resistance			33 K Ohms
Grid Current			1 μa
Plate Current			72 Ma

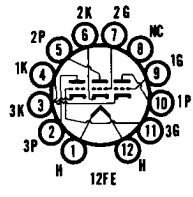
6U10

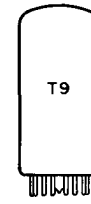
Color Television Type

GENERAL PURPOSE AMPLIFIER

Two Medium Mu Triodes and One High Mu Triode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12FE
Outline 9-56
Maximum Diameter .....1.188 In.
Maximum Seated Height .....1.500 In.
Maximum Overall Height .....1.875 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	600 Ma
Heater Warm-up Time	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

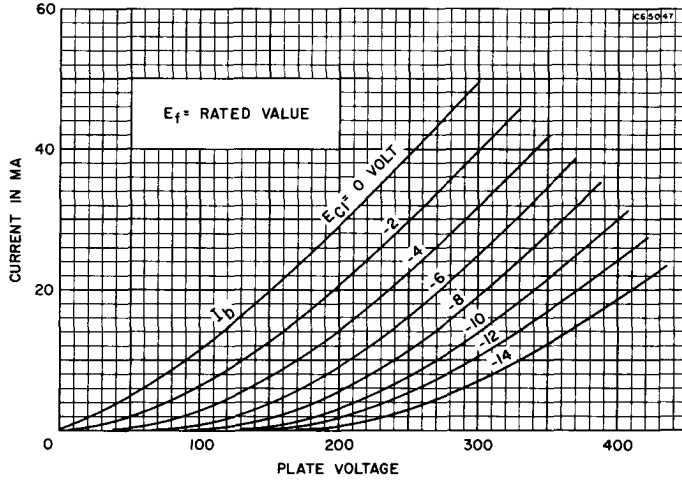
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

	Section No. 1	Section No. 2	Section No. 3
Grid to Plate	1.3	1.3	1.2 Pf
Input: g to (h + k)	1.7	1.5	1.8 Pf
Output: p to (h + k)	0.26	0.28	0.9 Pf

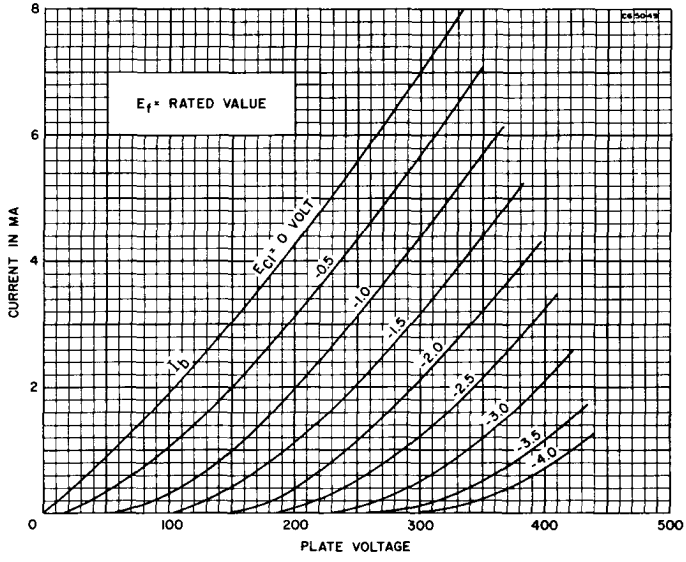
RATINGS (Design Maximum Rating System)

	Sections No. 1 and 3	Section No. 2
Plate Voltage (Max.)	330	330 Volts
Plate Dissipation (Max.)	2.0	1.0 Watts
Cathode Current (Max.)	20	— Ma
Positive Grid Voltage (Max.)	0	0 Volt
Negative Grid Voltage (Max.)	50	50 Volts
Grid Circuit Resistance		
Fixed Bias (Max.)	1.0	0.5 Megohm
Cathode Bias (Max.)	2.2	1.0 Megohms

AVERAGE PLATE CHARACTERISTICS
(Sections 1 and 3)



AVERAGE PLATE CHARACTERISTICS
(Section No. 2)



CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

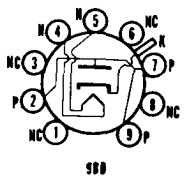
	Sections No. 1 and 3	Section No. 2
Plate Voltage	200	200 Volts
Grid Voltage	-6.0	-1.5 Volts
Plate Current	9.6	1.2 Ma
Plate Resistance	7700	61,000 Ohms
Transconductance	2300	1600 μmhos
Amplification Factor	17.5	98
Ec for Ib = 100 μa	-15	— Volts
Ec for Ib = 35 μa	—	-3 Volts

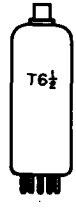
DAMPER

6V3A

Heater Cathode Diode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Top Cap C1-2
Basing 9BD
Outline 6-101
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.625 In.
Maximum Overall Height .....3.125 In.





ELECTRICAL DATA
HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1750 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
DC	750 Volts
Total DC and Peak	6750 Volts
Heater Positive with Respect to Cathode	
DC	100 Volts
Total DC and Peak	300 Volts

RATINGS (Design Center Rating System)
Damper Service[2]

Peak Inverse Plate Voltage (Abs. Max.)[1]	6000 Volts
Plate Dissipation	2.7 Watts
Steady State Peak Plate Current	800 Ma
DC Output Current	135 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop Ib = 250 Ma DC	19 Volts

NOTES:
(1) Should not be exceeded under any condition of high line voltage or misadjustment.
(2) 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 horizontal scanning cycle.

6V6GTA

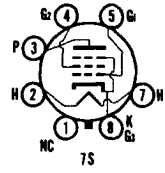
5V6GT, 12V6GT

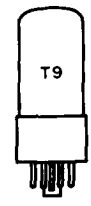
Color Television Type

AUDIO POWER AMPLIFIER or VERTICAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Octal T-9
Base .....Octal 6 or 7 Pin, B6-81
B6-84, B7-7 or B7-59
Basing.....7S
Outline .....9-11 or 9-41
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.750 In.
Maximum Overall Height .....3.312 In.





ELECTRICAL DATA

HEATER OPERATION

	12V6GT	5V6GT	6V6GTA
Heater Voltage	12.6	4.7	6.3 Volts
Heater Current	225	600	450 Ma
Heater Warm-up Time	—	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

Grid No. 1 to Plate	0.7 Pf
Input: g1 to (h + k + g2 + g3)	9.0 Pf
Output: p to (h + k + g2 + g3)	7.5 Pf

RATINGS (Design Maximum Rating System)
Class A1 Amplifier

Plate Voltage (Max.)	350 Volts
Grid No. 2 Voltage (Max.)	315 Volts
Plate Dissipation (Max.)	14 Watts
Grid No. 2 Dissipation (Max.)	2.2 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.5 Megohm

Vertical Deflection Amplifier[1]—Triode Connected

Plate Voltage (Max.)	350 Volts
Peak Positive Plate Voltage (Abs. Max.)	1200 Volts
Plate Dissipation[2]	10 Watts
Peak Negative Grid Voltage	275 Volts
Average Cathode Current	40 Ma
Peak Cathode Current	115 Ma
Grid No. 1 Circuit Resistance (Cathode Bias) (Max.)	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier (Single Tube)

	Triode Conn.		Pentode Conn.	
Plate Voltage	250	180	250	315 Volts
Grid No. 2 Voltage	—	180	250	225 Volts
Grid No. 1 Voltage	-12.5	-8.5	-12.5	-13.0 Volts
Peak AF Grid No. 1 Voltage	—	8.5	12.5	13.0 Volts
Zero Signal Plate Current	49.5	29	45	34 Ma

Maximum Signal Plate Current	—	30	47	35 Ma
Zero Signal Grid No. 2 Current	—	3	4.5	2.2 Ma
Maximum Signal Grid No. 2 Current	—	4	7.0	6 Ma
Transconductance	5000	3700	4100	3750 μmhos
Amplification Factor	9.8	—	—	—
Plate Resistance (Approx.)	1960	50,000	50,000	80,000 Ohms
Load Resistance	—	5500	5000	8500 Ohms
Maximum Signal Power Output	—	2.0	4.5	5.5 Watts
Total Harmonic Distortion (Approx.)	—	8	8	12 Percent
Ec1 for Ib = 0.5 Ma (Approx.)	-36	—	—	— Volts

NOTES:

(1) 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 horizontal scanning cycle.

(2) 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.

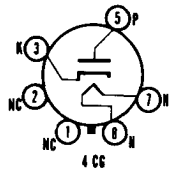
DAMPER

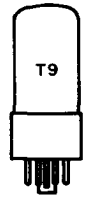
6W4GT

25W4GT

Heater-Cathode Diode

Construction .....Octal T-9
Base .....Octal 5 or 6 Pin, B5-82
B5-85, B6-8 or B6-60
Basing(1) 4CG
Outline .....9-11 or 9-41
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.750 In.
Maximum Overall Height .....3.312 In.





ELECTRICAL DATA

HEATER OPERATION

	25W4GT	6W4GT
Heater Voltage	25	6.3 Volts
Heater Current	300	1200 Ma
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
DC (Abs. Max.)	500	500 Volts
Total DC and Peak (Abs. Max.)	2300	— Volts
Heater Positive with Respect to Cathode		
DC	100	100 Volts
Total DC and Peak	300	200 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

	6W4GT	25W4GT
Heater to Cathode	7.0	11 Pf
Plate to Cathode and Heater	6.0	6.0 Pf
Cathode to Plate and Heater	13	17 Pf

RATINGS (Design Center Rating System)

Damper Service(2)

Peak Inverse Plate Voltage (Abs. Max.)	3850 Volts
Plate Dissipation (Max.)	3.5 Watts
Steady State Peak Current (Max.)	750 Ma
DC Plate Current (Max.)	125 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 250 Ma	21 Volts

NOTES:

(1) Pins 1, 2, 4, and 6 should not be used as tie points. Pin 1 omitted on bases B5-82 and B5-85.

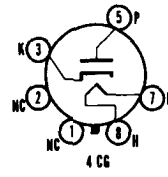
(2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

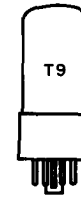
6W4GTA

DAMPER

Heater Cathode Diode

Construction .....Octal T-9
Base .....Octal 5 Pin, B5-82
Basing 4CG
Outline 9-11
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.750 In.
Maximum Overall Height .....3.312 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1200 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
DC	800 Volts
Total DC and Peak	3950 Volts
Heater Positive with Respect to Cathode	
DC	100 Volts
Total DC and Peak	300 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Cathode to Plate and Heater	8.0 Pf
Plate to Cathode and Heater	6.0 Pf
Heater to Cathode	3.0 Pf

RATINGS (Design Maximum Rating System)

Damper Service(1)

Peak Inverse Plate Voltage (Abs. Max.)	3950 Volts
Plate Dissipation (Max.)	4.0 Watts
Steady State Peak Current (Max.)	840 Ma
DC Plate Current (Max.)	140 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop for Ib = 250 Ma	21 Volts

NOTE:

(1) 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 horizontal scanning cycle.

6W6GT

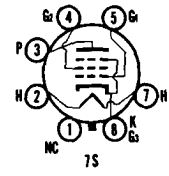
12W6GT, 17W6GT, 25W6GT

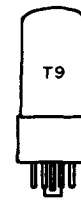
Color Television Type

AUDIO POWER AMPLIFIER or VERTICAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Octal T-9
Base .....Octal 6 or 7 Pin, B6-81
B6-84, B7-7 or B7-59
Basing 7S
Outline .....9-11 or 9-41
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.750 In.
Maximum Overall Height .....3.312 In.





ELECTRICAL DATA

HEATER OPERATION

	25W6GT	17W6GT	12W6GT	6W6GT
Heater Voltage	25	16.8	12.6	6.3 Volts
Heater Current	300	450	600	1200 Ma
Heater Warm-up Time	—	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

Grid to Plate	0.8 Pf
Input	15 Pf
Output	9.0 Pf

RATINGS (Design Maximum Rating System)

Class A1 Amplifier

Plate Voltage (Max.)	330 Volts
Grid No. 2 Voltage (Max.)	165 Volts
Plate Dissipation (Max.)	12 Watts
Grid No. 2 Dissipation (Max.)	1.35 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.5 Megohm

Vertical Deflection Amplifier—Triode Connected(1)

DC Plate Voltage (Max.)	330 Volts
Peak Positive Plate Voltage (Abs. Max.)	1200 Volts
Plate Dissipation (Max.)	8.5 Watts
Peak Negative Grid Voltage (Max.)	275 Volts
Average Cathode Current (Max.)	65 Ma
Peak Cathode Current (Max.)	195 Ma
Grid No. 1 Circuit Resistance Cathode Bias (Max.)	2.2 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	110	200 Volts
Grid No. 2 Voltage	110	125 Volts
Grid No. 1 Voltage	-7.5	— Volts
Cathode Bias Resistor	—	180 Ohms
Peak AF Grid No. 1 Voltage	7.5	8.5 Volts
Plate Current (Zero-Signal)	49	46 Ma
Plate Current (Maximum Signal)	50	47 Ma
Grid No. 2 Current (Zero Signal)	4.0	2.2 Ma
Grid No. 2 Current (Maximum Signal)	10	8.5 Ma
Plate Resistance (Approx.)	13,000	28,000 Ohms
Transconductance	8000	8000 μmhos
Load Resistance	2000	4000 Ohms
Maximum Signal Power Output	2.1	3.8 Watts
Total Harmonic Distortion (Approx.)	10	10 Percent

Triode Connected

Plate Voltage	225 Volts
Grid No. 1 Voltage	-30 Volts
Plate Current	22 Ma
Transconductance	3800 μmhos
Amplification Factor	6.2
Plate Resistance	1600 Ohms
Grid No. 1 Voltage (Approx.) for Ib = 0.5 Ma	-42 Volts

NOTES:

(1) 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 horizontal scanning cycle.

(2) 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.

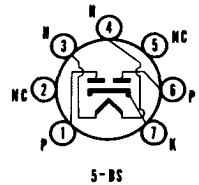
FULL-WAVE POWER RECTIFIER

6X4

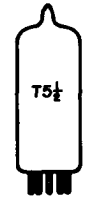
12X4

Heater-Cathode Twin Diode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	5BS
Outline	5-3
Maximum Diameter	0.750 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



5-BS



ELECTRICAL DATA

HEATER OPERATION

	12X4	6X4
Heater Voltage	12.6	6.3 Volts
Heater Current	300	600 Ma

Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	450 Volts
Heater Positive with Respect to Cathode	100 Volts
RATINGS (Design Center Rating System)	
Peak Inverse Plate Voltage	1250 Volts
AC Plate Supply Voltage (RMS) with DC Output Current of 35 Ma Per Plate	325 Volts
Steady State Peak Plate Current	210 Ma
Rectification Efficiency to keep within Steady State Peak Current Rating at 35 Ma Per Plate	67.5 Percent
Transient Peak Plate Current Per Plate (1)	1.0 Ampere
Minimum Plate Supply Resistance Per Plate for 325 Volt RMS Supply	325 Ohms
Tube Voltage Drop (70 Ma Per Plate)	22 Volts
DC Output Current Each Plate with 325 Volts AC Plate Supply Voltage (RMS)	
Capacitor Input to Filter	35 Ma
Choke Input to Filter	42 Ma

CHARACTERISTICS AND TYPICAL OPERATION
Full Wave Rectifier

	Input to Filter Capacitor	Choke
AC Plate Supply Voltage Per Plate (RMS)	325	450 Volts
Filter Input Capacitor (2)	10	— μf
Filter Input Choke (Minimum)	—	10 Henrys
Total Effective Plate Supply Impedance (Per Plate) (2)	525	— Ohms
DC Output Current	70	70 Ma
DC Output Voltage at Filter Input (Approx.)		
For DC Cathode Current of 35 Ma	365	395 Volts
For DC Cathode Current of 70 Ma	310	385 Volts
Difference (Voltage Regulation)	55	10 Volts
Percentage Regulation	15	2.5 Percent

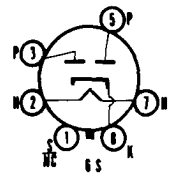
NOTES:
(1) If capacitor input circuits are to be used, protect the circuits against the possibility of hot-switching and do not exceed a maximum peak current value of one (1) ampere during the initial cycles of the hot-switching transient.
(2) When a filter capacitor larger than 10 μf is used, it may be necessary to add additional plate supply impedance to limit the hot-switching transient plate current to rated maximum.

6X5GT

FULL-WAVE POWER RECTIFIER

Heater-Cathode Twin Diode

Construction	Octal T-9
Base	Octal 6 Pin
Basing	6S
Outline	9-11
Maximum Diameter	1.188 In.
Maximum Seated Height	2.750 In.
Maximum Overall Height	3.212 In.





ELECTRICAL DATA
HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	600 Ma
Maximum Heater-Cathode Voltage	450 Volts
RATINGS (Design Center Rating System)	
Peak Inverse Voltage (Max.)	1250 Volts
Steady State Peak Plate Current (Each Plate) (Max.)	210 Ma
Tube Voltage Drop (70 Ma Per Plate) (Max.)	22 Volts
CHARACTERISTICS AND TYPICAL OPERATION	
Capacitor Input to Filter	
Plate Voltage (Each Plate—RMS)	325 Volts
DC Output Current	70 Ma
Effective Plate Supply Impedance (Each Plate) (1)	150 Ohms
Choke Input to Filter	
Plate Voltage (Each Plate—RMS)	450 Volts
DC Output Current	70 Ma
Input Choke Value (Min.)	10 Henrys

NOTE:
(1) Additional impedance may be required when a filter of more than 40 μf is used.

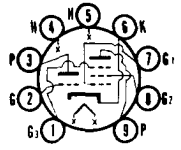
Color Television Type

VHF OSCILLATOR and MIXER

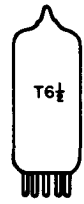
6X8A

5X8, 9X8, 19X8

Medium Mu Triode and Sharp Cutoff Pentode



9 AK



Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9AK
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.

ELECTRICAL DATA

HEATER OPERATION	19X8	9X8	5X8	6X8A
Heater Voltage	18.9	9.5	4.7	6.3 Volts
Heater Current	150	300	600	450 Ma
Heater Warm-up Time	—	11	11	11 Seconds
Maximum Heater-Cathode Voltage				
Heater Negative with Respect to Cathode				
Total DC and Peak	100	200	200	100 Volts
Heater Positive with Respect to Cathode				
DC	100	100	100	100 Volts
Total DC and Peak	100	200	200	100 Volts

DIRECT INTERELECTRODE CAPACITANCES	Shielded[1]	Unshielded
Triode Section		
Grid to Plate	1.4	1.4 Pf
Input	2.6	2.0 Pf
Output	1.0	0.5 Pf
Pentode Section		
Grid No. 1 to Plate (Max.)	0.06	0.09 Pf
Input	4.5	4.3 Pf
Output	1.4	0.7 Pf
Coupling		
Pentode Grid No. 1 to Triode Plate (Max.)	0.035	0.045 Pf
Pentode Plate to Triode Plate (Max.)	0.008	0.040 Pf

RATINGS (Design Center Rating System)

	Triode Section as Osc.	Pentode Section as Mixer
Converter Service		
Plate Voltage (Max.)	250	250 Volts
Grid No. 2 Supply Voltage (Max.)	—	250 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Grid No. 1 Voltage		
Negative Bias (Max.)	40	40 Volts
Positive Bias (Max.)	0	0 Volt
Plate Dissipation (Max.)	1.5	2.0 Watts
Grid No. 2 Input (Max.)	—	0.4 Watt
Grid No. 1 Input (Max.)	0.5	— Watt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.1	0.1 Megohm
Cathode Bias (Max.)	0.5	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section as 250 MHz Osc.	Pentode Section as Mixer[2]
Plate Voltage	150	150 Volts
Grid No. 3	Connected to Cathode at Socket	
Grid No. 2 Voltage	—	150 Volts
Mixer Grid No. 1 Supply Voltage	—	-3.5 Volts
Oscillator Voltage at Mixer Grid No. 1 (RMS)	—	2.6 Volts
Mixer Grid No. 1 Circuit Resistance	—	120,000 Ohms
Oscillator Grid Resistor	2700	— Ohms
Conversion Transconductance	—	2100 μmhos
Plate Current	13	6.0 Ma
Grid No. 2 Current	—	1.8 Ma
Grid No. 1 Current	3.6	— Ma
Grid No. 1 Current	—	2.0 μa
Oscillator Power Output (Approx.)	0.5[3]	— Watt

NOTES:
(1) External shield No. 315 tied to cathode.
(2) With separate excitation and triode unit grounded.
(3) In TV or FM receivers, it is generally desirable to operate the oscillator with less power input than shown in the tabulated data in order to avoid overexcitation and excessive oscillator radiation.

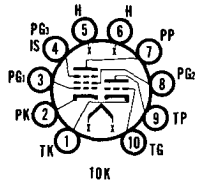
6X9/ECF200

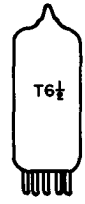
5X9, 8X9

SOUND IF or VIDEO AMP. (P) SYNC SEP., AGC AMP. SOUND IF (T)

Triode and Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 10K
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

	8X9	5X9	6X9/ECF200
Heater Voltage	8.0	5.9	6.3 Volts
Heater Current	300	450	410 Ma
Maximum Heater-Cathode Voltage			
Pentode Section			165 Volts
Triode Section			
Cathode Negative			
6X9, 8X9			165 Volts
5X9			110 Volts
Cathode Positive			
6X9, 8X9			220 + 165 Volts RMS
5X9			220 + 110 Volts RMS

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Pentode Section	
Plate to All Other Elements (Except Grid No. 1)	3.5 Pf
Grid No. 1 to All Other Elements (Except Plate)	6.5 Pf
Grid No. 1 to Cathode	4.0 Pf
Plate to Grid No. 1	0.0065 Pf
Grid No. 1 to Grid No. 2	1.8 Pf
Triode Section	
Plate to All Other Elements (Except Grid)	3.0 Pf
Grid to All Other Elements (Except Plate)	2.5 Pf
Plate to Grid	2.0 Pf
Between Pentode and Triode Section	
Plate of Pentode to Plate of Triode	0.015 Pf
Control Grid of Pentode to Plate of Triode	0.0012 Pf
Control Grid of Pentode to Grid of Triode	0.0015 Pf

RATINGS (Absolute Maximum Rating System)

Pentode Section	
Plate Voltage (Zero Plate Current)	600 Volts
Plate Voltage	275 Volts
Plate Dissipation	2.4 Watts
Grid No. 2 Voltage (Zero Grid Current)	600 Volts
Grid No. 2 Voltage	275 Volts
Grid No. 2 Dissipation	0.8 Watts
Cathode Current	20 Ma
Grid No. 1 Resistor	1 Megohm
Triode Section	
Peak Plate Voltage (Ib = 0.1 Ma)(1)	660 Volts
Plate Voltage (Zero Plate Current)	600 Volts
Plate Voltage	275 Volts
Plate Dissipation	1.75 Watts
Cathode Current	20 Ma
Grid Resistor	1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Pentode Section	
Plate Voltage	160 Volts
Grid No. 2 Voltage	135 Volts
Grid No. 1 Voltage	−1.7 Volts
Grid No. 3 Voltage	0 Volt

Plate Current			13 Ma
Grid No. 2 Current			5 Ma
Transconductance			14,000 μmhos
Amplification Factor (Grid No. 1 to Grid No. 2)			55
Triode Section			
Plate Voltage			170 Volts
Grid Voltage			−1.0 Volt
Plate Current			8.5 Ma
Transconductance			4800 μmhos
Amplification Factor			55
Pentode Section—Sound or Video Amplifier			
Supply Voltage	135	230	250 Volts
Grid No. 3 Voltage	0	0	0 Volt
Plate Resistance	0	5.6	6.8 K Ohms
Grid No. 2 Resistor	0	18	22 K Ohms
Cathode Resistor	95	100	100 Ohms
Plate Current	13	13.3	13.3 Ma
Grid No. 2 Current	4.8	4.9	4.9 Ma
Transconductance	14,000	14,000	14,000 μmhos
Grid No. 1 Resistance (40 MHz)	6.6	6.6	6.6 K Ohms
Triode Section—Sync Separator			
Plate Voltage			130-150 Volts
Plate Resistance			33 K Ohms
Grid No. 1 Current			1 μa
Plate Current			2 Ma

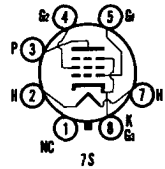
NOTE:
(1) 18 μsec. Maximum, 18% of 1 cycle.

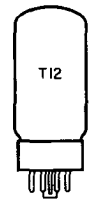
AUDIO POWER AMPLIFIER

6Y6GA

Beam Power Pentode

Construction .....Octal T-12
Base.....Octal 7 Pin, B7-12 or B7-119
Basing.....7S
Outline 12-14
Maximum Diameter .....1.562 In.
Maximum Seated Height .....3.312 In.
Maximum Overall Height .....3.875 In.





ELECTRICAL DATA

HEATER OPERATION			
Heater Voltage			6.3 Volts
Heater Current			1250 Ma
Maximum Heater-Cathode Voltage			180 Volts
DIRECT INTERELECTRODE CAPACITANCES			
Grid No. 1 to Plate			0.66 Pf
Input			12.0 Pf
Output			7.5 Pf
RATINGS (Design Center Rating System)			
Plate Voltage (Max.)			200 Volts
Plate Dissipation (Max.)			12.5 Watts
Grid No. 2 Supply Voltage (Max.)			200 Volts
Grid No. 2 Voltage			See Rating Chart (Gen. Info. Sec.)
Grid No. 2 Dissipation (Max.)			1.75 Watts
Grid No. 1 Circuit Resistance			
Fixed Bias (Max.)			0.1 Megohm
Cathode Bias (Max.)			0.5 Megohm
CHARACTERISTICS AND TYPICAL OPERATION			
Class A1 Amplifier			
Plate Voltage	135		200 Volts
Grid No. 2 Voltage	135		135 Volts
Grid No. 1 Voltage	−13.5		−14 Volts
Peak AF Grid No. 1 Voltage	13.5		14 Volts
Zero Signal Plate Current	58		61 Ma
Maximum Signal Plate Current	60		66 Ma
Zero Signal Grid No. 2 Current	3.5		2.2 Ma
Maximum Signal Grid No. 2 Current	11.5		9 Ma
Plate Resistance (Approx.)	9300		18,300 Ohms
Transconductance	7000		7100 μmhos
Load Resistance	2000		2600 Ohms
Maximum Signal Power Output	3.6		6 Watts
Total Harmonic Distortion (Approx.)	10		10 Percent

6Y9

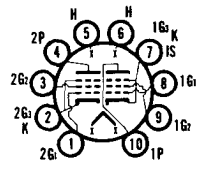
11Y9/LFL200, 17Y9

Color Television Type

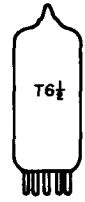
VIDEO AMPLIFIER, SOUND IF, AGC AMP. or SYNC SEP.

Double Dissimilar Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 10L
Outline
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.625 In.
Maximum Overall Height .....2.875 In.



10L



ELECTRICAL DATA

HEATER OPERATION

	17Y9	11Y9/LFL200	6Y9
Heater Voltage	17.0	11.0	6.3 Volts
Heater Current	300	450	800 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)

Pentode No. 1	
Plate to All Other Elements (Except Grid No. 1)	7 Pf
Grid No. 1 to All Other Elements (Except Plate)	12 Pf
Plate to Grid No. 1	0.095 Pf
Pentode No. 2	
Plate to All Other Elements (Except Grid No. 1)	11 Pf
Grid No. 1 to All Other Elements (Except Plate)	10 Pf
Plate to Grid No. 1	0.140 Pf
Grid No. 1 to Heater	0.100 Pf
Between Pentode No. 1 and Pentode No. 2	
Plate to Plate	0.150 Pf
Grid to Grid	0.010 Pf
Plate of Pentode No. 1 to Control Grid of Pentode No. 2	0.100 Pf
Plate of Pentode No. 2 to Control Grid of Pentode No. 2	0.005 Pf

RATINGS (Absolute Maximum Rating System)

Pentode No. 1	
Plate Voltage (Zero Plate Current)	600 Volts
Plate Voltage	275 Volts
Grid No. 2 Voltage (Zero Grid Current)	600 Volts
Grid No. 2 Voltage	275 Volts
Plate Dissipation	5.8 Watts
Grid No. 2 Dissipation(1)	2.9 Watts
Cathode Current(2)	66 Ma
Grid No. 1 Resistance	1 Megohm
Pentode No. 2	
Plate Voltage (Zero Plate Current)	600 Volts
Plate Voltage	275 Volts
Grid No. 2 Voltage (Zero Grid Current)	600 Volts
Grid No. 2 Voltage	275 Volts
Plate Dissipation	1.75 Watts
Grid No. 2 Dissipation	0.6 Watt
Cathode Current	16.5 Ma
Grid No. 1 Resistance	1 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Pentode No. 1	Pentode No. 2
Plate Voltage	170	150 Volts
Grid No. 2 Voltage	170	150 Volts
Grid No. 1 Voltage	−2.6	−2.3 Volts
Plate Current	30	10 Ma
Grid No. 2 Current	6.5	3.0 Ma
Transconductance	21,000	8500 μmhos
Amplification Factor (Grid No. 1 to Grid No. 2)	38	35
Internal Resistance	40	160 K Ohms

Pentode No. 1—Video Output					
Supply Voltage	135	135	230	250	250 Volts
Supply Series Resistor	0	0	820	1200	0 Ohms
Voltage at Ebb	—	—	190	190	0 Volts
Plate Resistance	2.2	4.7	2	3.9	3.3 K Ohms
Grid No. 2 Resistor	0	0	1	1	3.9 K Ohms
Cathode Resistor	6.8	6.8	6.8	6.8	15 Ohms
Peak to Peak Input Signal	2.5	1.4	3.6	1.8	5.5 Volts
Peak to Peak Output Signal	90	90	100	100	160 Volts

Pentode No. 2—Sync Separator		
Supply Voltage	100-140	200-250 Volts
Plate Resistance	50	50 K Ohms
Grid No. 2 Voltage	75	75 Volts
Grid No. 1 Resistor	1	1 Megohm
Grid No. 1 Voltage	-2.6	-2.7 Volts
Plate Current	0.1	0.1 Ma
Transconductance	250	200 μmhos

Pentode No. 2	**AGC Amplifier**	**IF Amplifier**	
Plate Voltage	100-150	135	150 Volts
Grid No. 2 Voltage	60	135	150 Volts
Grid No. 1 Voltage	-1.3	-1.9	-2.3 Volt
Plate Current	1.0	10	10 Ma
Transconductance	2500	8700	8500 μmhos

NOTES:
(1) For short periods, cathode current = 85 Ma (Max.)
(2) For short periods, cathode current = 93 Ma (Max.)

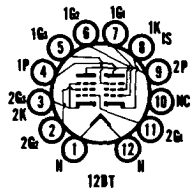
LIMITER/DISCRIMINATOR and AUDIO POWER AMPLIFIER

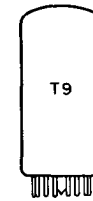
6Z10

10Z10

Gated Beam Pentode and Beam Power Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12BT
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.





ELECTRICAL DATA

HEATER OPERATION

	10Z10	6Z10
Heater Voltage	10.0	6.3 Volts
Heater Current	600	950 Ma
Heater Warm-up Time	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		
Gated-Beam Discriminator Section No. 1		
Grid No. 1 to Grid No. 3		0.009 Pf
Grid No. 1 to All		4.4 Pf
Grid No. 3 to All		3.2 Pf
Pentode Section No. 2		
Grid No. 1 to Plate		0.22 Pf
Input		11 Pf
Output		7.5 Pf
RATINGS (Design Maximum Rating System)		
Gated Beam Discriminator Section No. 1		
Plate Supply Voltage (Max.)		330 Volts
Accelerator-Supply Voltage (Max.)		330 Volts
Peak Positive Grid No. 1 Voltage (Max.)		60 Volts
DC Cathode Current (Max.)		13 Ma
Pentode Section No. 2		
Plate Voltage (Max.)		275 Volts
Screen Voltage (Max.)		275 Volts

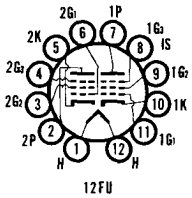
Plate Dissipation (Max.)			10 Watts
Screen Dissipation (Max.)			2.0 Watts
Grid No. 1 Circuit Resistance			
With Fixed Bias (Max.)			0.25 Megohm
With Cathode Bias (Max.)			0.5 Megohm
CHARACTERISTICS AND TYPICAL OPERATION			
Gated Beam Discriminator Section			
Plate Voltage	135	135	135 Volts
Accelerator Voltage	75	—	— Volts
Accelerator-Supply Voltage	—	280	280 Volts
Accelerator Resistor	—	33,000	33,000 Ohms
Grid No. 1 Voltage	0	0	0 Volt
Grid No. 3 Voltage	+4.0	+4.0	0 Volts
Plate Current	—	5.0	— Ma
Accelerator Current	4.5	—	— Ma
Grid No. 1 Transconductance	—	—	360 μmhos
Grid No. 3 Transconductance	—	—	700 μmhos
Grid No. 1 Voltage (Approx.) Ib = 20 μa	—	—	−4 Volts
Grid No. 3 Voltage (Approx.) Ib = 20 μa	—	—	−4 Volts
Pentode Section			
Plate Voltage			250 Volts
Screen Voltage			250 Volts
Grid No. 1 Voltage			−8.0 Volts
Peak AF Grid No. 1 Voltage			8.0 Volts
Plate Resistance (Approx.)			100,000 Ohms
Transconductance			6500 μmhos
Zero-Signal Plate Current			35 Ma
Maximum-Signal Plate Current			39 Ma
Zero-Signal Screen Current			3.0 Ma
Maximum-Signal Screen Current			13 Ma
Load Resistance			5000 Ohms
Total Harmonic Distortion (Approx.)			8.5 Percent
Maximum-Signal Power Output			4.2 Watts

8BM11

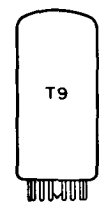
IF AMPLIFIER

Semi-Remote Cutoff Pentode and Sharp Cutoff Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12FU
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.



12FU



ELECTRICAL DATA

HEATER OPERATION	
Heater Voltage	8.4 Volts
Heater Current	450 Ma
Heater Warm-up Time	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 (Shielded)(1)	
Section 1	
Grid No. 1 to Plate	0.016 Pf
Input: 1g1 to (h + 1k + 1g2 + 1g3 + IS)	6.5 Pf
Output: 1p to (h + 1k + 1g2 + 1g3 + IS)	2.4 Pf
Section 2	
Grid No. 1 to Plate	0.015 Pf
Input: 2g1 to (h + 2k + 2g2 + 2g3 + 1g3 + IS)	7.5 Pf
Output: 2p to (h + 2k + 2g2 + 2g3 + 1g3 + IS)	2.6 Pf
Coupling	
Grid No. 1 (Section 1) to Plate (Section 2): (1g1 to 2p) (Max.)	0.001 Pf
Grid No. 1 (Section 2) to Plate (Section 1): (2g1 to 1p) (Max.)	0.10 Pf
Grid No. 1 (Section 1) to Grid No. 1 (Section 2): (1g1 to 2g1) (Max.)	0.001 Pf
Plate (Section 1) to Plate (Section 2): (1p to 2p) (Max.)	0.002 Pf

RATINGS (Design Maximum Rating System)

Section 1	
Plate Voltage	160 Volts
Suppressor Voltage	0 Volt
Screen Voltage	160 Volts
Positive DC Grid No. 1 Voltage	0 Volt
Plate Dissipation	2.2 Watts
Screen Dissipation	0.55 Watt
Grid No. 1 Circuit Resistance	
Cathode Bias	1.0 Megohm
Section 2	
Plate Voltage	160 Volts
Suppressor Voltage	0 Volt
Screen Voltage	160 Volts
Positive DC Grid No. 1 Voltage	0 Volt
Plate Dissipation	2.2 Watts
Screen Dissipation	0.55 Watt
Grid No. 1 Circuit Resistance	
Cathode Bias	0.25 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Section 1	
Plate Voltage	125 Volts
Suppressor	Connected to Cathode at Socket
Screen Voltage	125 Volts
Cathode-Bias Resistor	56 Ohms
Plate Resistance (Approx.)	220,000 Ohms
Transconductance	8800 μmhos
Plate Current	14 Ma
Screen Current	3.6 Ma
Grid No. 1 Voltage (Approx.) Gm = 50 μmhos	−16.5 Volts
Section 2	
Plate Voltage	125 Volts
Suppressor	Connected to Cathode at Socket
Screen Voltage	125 Volts
Cathode-Bias Resistor	120 Ohms
Plate Resistance (Approx.)	300,000 Ohms
Transconductance	8500 μmhos
Plate Current	9.0 Ma
Screen Current	2.5 Ma
Grid No. 1 Voltage (Approx.) Ib = 20 μa	−5.5 Volts

NOTE:
(1) With external shield (EIA 309) connected to cathode of section under test.

Color Television Type

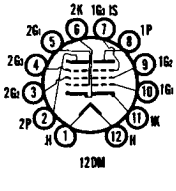
IF AMPLIFIER

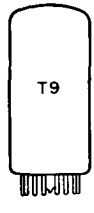
8BQ11

11BQ11

Remote Cutoff Pentode and Sharp Cutoff Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12DM
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.





ELECTRICAL DATA

HEATER OPERATION

	11BQ11	8BQ11
Heater Voltage	11.2	8.4 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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 (Shielded)(1)

Section 1	
Grid No. 1 to Plate	0.022 Pf

Input: 1g1 to (1k + 1g2 + 1g3 + h + IS)	10 Pf
Output: 1p to (1k + 1g2 + 1g3 + h + IS)	2.8 Pf
Section 2	
Grid No. 1 to Plate	0.024 Pf
Input: 2g1 to (2k + 2g2 + 2g3 + 1g3 + h + IS)	11 Pf
Output: 2p to (2k + 2g2 + 2g3 + 1g3 + h + IS)	2.8 Pf
Coupling	
Plate to Plate (Max.)	0.015 Pf
Grid No. 1 (Section 1) to Plate (Section 2) (Max.)	0.002 Pf
Grid No. 1 (Section 2) to Plate (Section 1) (Max.)	0.008 Pf
Grid No. 1 (Section 1) to Grid No. 1 (Section 2) (Max.)	0.002 Pf
RATINGS (Design Maximum Rating System)	
Section 1	
Plate Voltage	330 Volts
Suppressor Voltage	0 Volt
Screen-Supply Voltage	330 Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)
Positive DC Grid No. 1 Voltage	0 Volt
Plate Dissipation	3.1 Watts
Screen Dissipation	0.65 Watts
Grid No. 1 Circuit Resistance	
Cathode Bias	1.0 Megohm
Section 2	
Plate Voltage	330 Volts
Suppressor Voltage	0 Volt
Screen-Supply Voltage	330 Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)
Positive DC Grid No. 1 Voltage	0 Volt
Plate Dissipation	3.1 Watts
Screen Dissipation	0.65 Watts
Grid No. 1 Circuit Resistance	
Cathode Bias	0.25 Megohm
CHARACTERISTICS AND TYPICAL OPERATION	
Section 1	
Plate Voltage	125 Volts
Suppressor	Connected to Cathode at Socket
Screen Voltage	125 Volts
Cathode-Bias Resistor	56 Ohms
Plate Resistance (Approx.)	0.2 Megohm
Transconductance	10,500 μmhos
Plate Current	11 Ma
Screen Current	3.5 Ma
Grid No. 1 Voltage (Approx.)	
Gm = 50 μmhos	−15 Volts
Section 2	
Plate Voltage	125 Volts
Suppressor	Connected to Cathode at Socket
Screen Voltage	125 Volts
Cathode-Bias Resistor	56 Ohms
Plate Resistance (Approx.)	0.2 Megohm
Transconductance	13,000 μmhos
Plate Current	11 Ma
Screen Current	3.8 Ma
Grid No. 1 Voltage (Approx.)	
Ib = 20 μa	−3 Volts

NOTE:
(1) With external shield (EIA 309) connected to cathode of section under test.

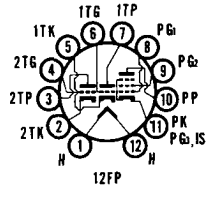
8BU11

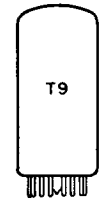
Color Television Type

GENERAL PURPOSE AMPLIFIER

Double Medium Mu Triode and Sharp Cutoff Pentode

Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12FP
Outline	9-59
Maximum Diameter	1.188 In.
Maximum Seated Height	2.250 In.
Maximum Overall Height	2.625 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	7.8 Volts
Heater Current	600 Ma
Heater Warm-up Time	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 (Unshielded)

Triode (Section 1)

Grid to Plate	1.7 Pf
Input: T1g to (T1k + Pk + Pg3 + h + IS)	3.2 Pf
Output: T1p to (T1k + Pk + Pg3 + h + IS)	2.0 Pf

Triode (Section 2)

Grid to Plate	1.8 Pf
Input: T2g to (T1k + T2k + Pk + Pg3 + h + IS)	3.0 Pf
Output: T2p to (T1k + T2k + Pk + Pg3 + h + IS)	1.7 Pf

Pentode Section

Grid No. 1 to Plate	0.11 Pf
Input: Pg1 to (T1k + Pk + Pg2 + Pg3 + h + IS)	5.0 Pf
Output: Pp to (T1k + Pk + Pg2 + Pg3 + h + IS)	2.4 Pf

RATINGS (Design Maximum Rating System)

Pentode Section

Plate Voltage	330 Volts
Screen Supply Voltage	330 Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)
Positive DC Grid No. 1 Voltage	0 Volt
Plate Dissipation	2.5 Watts
Screen Dissipation	0.55 Watt
Grid No. 1 Circuit Resistance	
Fixed Bias	0.5 Megohm
Cathode Bias	1.0 Megohm

Each Triode Section

Plate Voltage	330 Volts
Positive DC Grid Voltage	0 Volt
Plate Dissipation	1.8 Watts
Grid Circuit Resistance	
Fixed Bias	0.5 Megohm
Cathode Bias	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Pentode Section

Plate Voltage	125 Volts
Screen Voltage	125 Volts
Grid No. 1 Voltage	−1.0 Volt
Plate Resistance (Approx.)	200,000 Ohms
Transconductance	7500 μmhos
Plate Current	12 Ma
Screen Current	4.0 Ma
Grid No. 1 Voltage (Approx.)	
Ib = 30 μa	−8 Volts

Each Triode Section

Plate Voltage	125 Volts
Cathode Bias Resistor	68 Ohms
Amplification Factor	43
Plate Resistance (Approx.)	5000 Ohms
Transconductance	8600 μmhos
Plate Current	13.5 Ma
Grid Voltage (Approx.)	
Ib = 100 μa	−8 Volts

9A8/PCF80

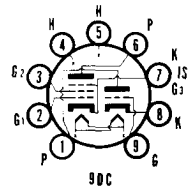
8A8, 17A8

Color Television Type

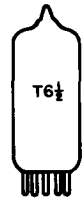
VHF OSCILLATOR and MIXER

Triode and Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DC
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9DC



ELECTRICAL DATA

HEATER OPERATION

	17A8	8A8	9A8/PCF80
Heater Voltage	16.8	8.4	9.0 Volts
Heater Current	150	300	300 Ma
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
Total DC and Peak			100 Volts
Heater Positive with Respect to Cathode			
DC			120 Volts
Total DC and Peak			200 Volts

DIRECT INTERELECTRODE CAPACITANCES

Pentode Section	
Input Capacitance	5.5 Pf
Output Capacitance	3.8 Pf
Plate to Grid No. 1 (Max.)	0.025 Pf
Triode Section	
Input Capacitance	2.5 Pf
Output Capacitance	1.8 Pf
Plate to Grid	1.5 Pf
Between Pentode and Triode Sections	
Pentode Plate to Triode Plate (Max.)	0.07 Pf
Pentode Plate to Triode Grid (Max.)	0.02 Pf
Pentode Grid to Triode Plate (Max.)	0.16 Pf

RATINGS (Design Center Rating System)

Pentode Section	
Plate Voltage (Max.)	250 Volts
Plate Voltage (without current) (Max.)	550 Volts
Plate Dissipation (Max.)	1.7 Watts
Grid No. 2 Voltage at a Cathode Current of 14 Ma (Max.)	175 Volts
Grid No. 2 Voltage at a Cathode Current less than 10 Ma (Max.)	200 Volts
Grid No. 2 Dissipation at a Plate Dissipation more than 1.2 Watts (Max.)	0.5 Watt
Grid No. 2 Dissipation at a Plate Dissipation less than 1.2 Watts (Max.)	0.75 Watt
Grid No. 1 Circuit Resistance with Automatic Bias (Max.)	1 Megohm
Grid No. 1 Circuit Resistance with Fixed Bias (Max.)	0.5 Megohm
Cathode Current (Max.)	14 Ma
Triode Section	
Plate Voltage (Max.)	250 Volts
Plate Voltage (without current) (Max.)	550 Volts
Plate Dissipation (Max.)	1.5 Watts
Grid Circuit Resistance (Max.)	0.5 Megohm
Cathode Current (Max.)	14 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Pentode Section	
Plate Voltage	170 Volts
Grid No. 2 Voltage	170 Volts
Grid No. 1 Bias	−2 Volts
Plate Current	10 Ma
Grid No. 2 Current	2.8 Ma
Transconductance	6200 μmhos
Plate Resistance	0.4 Megohm
Amplification Factor of Grid No. 2 with Respect to Grid No. 1	47
Input Resistance at 50 MHz	10,000 Ohms
Equivalent Noise Resistance	1500 Ohms
Triode Section	
Plate Voltage	100 Volts
Grid Voltage	−2 Volts
Plate Current	14 Ma
Transconductance	5000 μmhos
Amplification Factor	20

OPERATING CHARACTERISTICS FOR USE AS MIXER

Plate Voltage	170	170 Volts
Grid No. 2 Voltage	170	170 Volts
Grid No. 1 Circuit Resistance	0.1	0.1 Megohm
Cathode Resistor	330	820 Ohms
Oscillator Voltage (RMS)	3.5	3.5 Volts
Plate Current	6.5	5.2 Ma
Grid No. 2 Current	2.0	1.5 Ma
Grid No. 1 Current	25	0 μa
Conversion Conductance	2200	2100 μmhos
Plate Resistance	0.8	0.87 Megohm

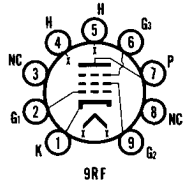
Color Television Type

CHROMA BANDPASS AMPLIFIER COLOR DEMODULATOR or VIDEO AMPLIFIER

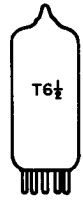
9KC6

Frame Grid Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9RF
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9RF



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	8.7 Volts
Heater Current	450 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate (g1 to p)	0.20 Pf
Grid No. 3 to Plate (g3 to p)	2.2 Pf
Grid No. 1 to All g1 to (h + k + g2 + g3 + p)	16.5 Pf
Grid No. 2 to All g2 to (h + k + g1 + g3 + p)	9.5 Pf
Grid No. 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 No. 1 to Grid No. 2 (g1 to g2)	4.7 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage	400 Volts
Grid No. 2 Supply Voltage	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Positive Grid No. 3 Voltage	0 Volt
Negative Grid No. 3 Voltage	100 Volts
Positive Grid No. 1 Voltage	0 Volt
Plate Dissipation	7.0 Watts
Grid No. 2 Dissipation	1.5 Watts
Grid No. 1 Circuit Resistance	
Self Bias	0.5 Megohm
Fixed Bias	0.25 Megohm
Grid No. 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.

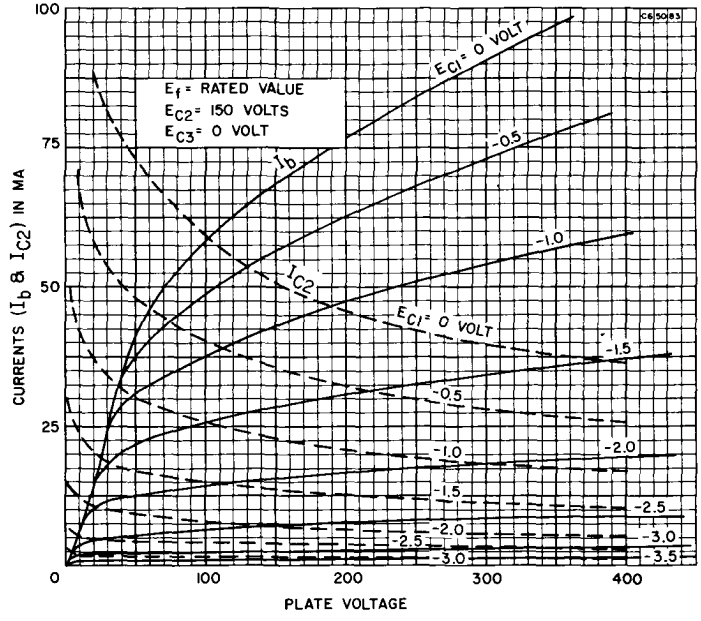
CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	250	250 Volts
Grid No. 2 Voltage	150	100 Volts
Grid No. 1 Voltage	0	−1.0 Volt
Grid No. 3 Voltage (Referred to Negative End of Rk)	0	−25 Volts
Cathode Resistor	56	0 Ohms
Plate Current	18	1.0 Ma
Grid No. 2 Current	9	13.0 Ma
Transconductance (Grid No. 1 to Plate)	24,000	— μmhos
Transconductance (Grid No. 3 to Plate)	500	— μmhos
Plate Resistance (Approx.)	55,000	— Ohms
Grid No. 1 Voltage for Ib = 100 μa (Rk = 0)	−4.1	— Volt

INSTANTANEOUS PLATE KNEE CHARACTERISTICS(1)
Eb = 50 V, Ec2 = 100 V, and Ec1 = 0 V
Ib = 25 Ma, and Ic2 = 25 Ma

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

AVERAGE PLATE CHARACTERISTICS



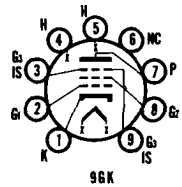
9KX6

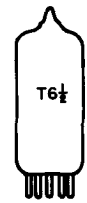
Color Television Type

VIDEO AMPLIFIER

Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9GK
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.





ELECTRICAL DATA

HEATER OPERATION	
Heater Voltage	8.7 Volts
Heater Current	450 Ma
Heater *Warm-up Time*	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 (Unshielded)	
Grid No. 1 to Plate (g1 to p)	0.12 Pf
Input: g1 to (k + g3 + IS + g2 + h)	17.5 Pf
Output: p to (k + g3 + IS + g2 + h)	4.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	400 Volts
Positive DC Grid No. 3 Voltage (Max.)	0 Volt
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Positive DC Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	11.5 Watts
Grid No. 2 Dissipation (Max.)	1.5 Watt
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.25 Megohm

Control grid to cathode spacing on this type is of such low order of magnitude as to preclude the use of voltage between these elements of more than 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 Volts
Grid No. 2 Supply Voltage	150 Volts
Grid No. 1 Voltage	0 Volt
Grid No. 3 Voltage (Referred to Negative End of Rk)	0 Volt
Cathode Resistor (Bypassed)	56 Ohms
Plate Current	28 Ma
Grid No. 2 Current	6.5 Ma
Transconductance (Grid No. 1 to Plate)	36,000 μmhos
Plate Resistance (Approx.)	50,000 Ohms
Grid No. 1 Voltage, Approx. for Ib = 100 μa	-5.7 Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS

Eb = 50 V, Ec2 = 125 V, Ec1 = 0 V, and Ec3 = 0 V
Ib = 70 Ma, and Ic2 = 24 Ma

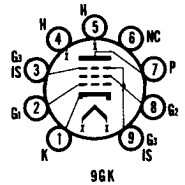
Color Television Type

VIDEO AMPLIFIER

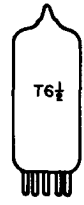
9LA6

Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9GK
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



9GK



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	8.7 Volts
Heater Current	450 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate (g1 to p)	0.15 Pf
Input: g1 to (k + g3 + IS + g2 + h)	15.0 Pf
Output: p to (k + g3 + IS + g2 + h)	6.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	400 Volts
Positive DC Grid No. 3 Voltage (Max.)	0 Volt
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Positive DC Grid No. 1 Voltage	0 Volt
Plate Dissipation (Max.)	10.0 Watts
Grid No. 2 Dissipation (Max.)	1.0 Watt
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.25 Megohm

Control grid to cathode spacing on this type is of such low order of magnitude as to preclude the use of voltage between these elements of more than 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 Volts
Grid No. 2 Supply Voltage	150 Volts
Grid No. 1 Voltage	0 Volt
Grid No. 3 Voltage (Referred to Negative End of Rk)	0 Volt
Cathode Resistor (Bypassed)	122 Ohms
Plate Current	25 Ma
Grid No. 2 Current	6 Ma
Transconductance (Grid No. 1 to Plate)	21,000 μmhos
Plate Resistance (Approx.)	55,000 Ohms
Grid No. 1 Voltage (Approx.) for Ib = 100 μa (Rk = 0)	-7.2 Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS

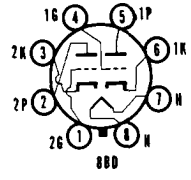
Eb = 50 V, Ec2 = 125 V, Ec1 = 0 V, and Ec3 = 0 V
Ib = 76 Ma, and Ic2 = 32 Ma

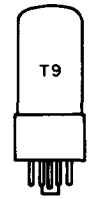
10EG7

VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

Double Dissimilar Triode

Construction	Octal T-9
Base	Octal 8 Pin, B8-58
Basing	8BD
Outline	9-38
Maximum Diameter	1.188 In.
Maximum Seated Height	2.437 In.
Maximum Overall Height	3.000 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	9.7 Volts
Heater Current	600 Ma
Heater Warm-up Time	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 (Unshielded)

	Section No. 1	Section No. 2
Grid to Plate	4.4	9.5 Pf
Input: g to (h + k)	2.2	7.0 Pf
Output: p to (h + k)	0.6	1.6 Pf

RATINGS (Design Maximum Rating System)
Vertical Deflection Oscillator and Amplifier[1]

	Section No. 1 Oscillator	Section No. 2 Amplifier
Plate Voltage (Max.)	330	330 Volts
Peak Positive Pulse Plate Voltage (Max.)	—	1500 Volts
Peak Negative Pulse Grid Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.)[2]	1.5	10 Watts
Average Cathode Current (Max.)	22	50 Ma
Peak Cathode Current (Max.)	77	175 Ma
Grid Circuit Resistance Self Bias (Max.)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Section No. 1[3]	Section No. 2[3]
Plate Voltage	250	150 Volts
Grid No. 1 Voltage	-11	-17.5 Volts
Plate Current	5.5	45 Ma
Transconductance	2000	7500 μmhos
Amplification Factor	17.5	6.0
Plate Resistance (Approx.)	8750	800 Ohms
Ec for Ib = 10 μa (Approx.)	-20	— Volts
Ec for Ib = 100 μa (Approx.)	—	-40 Volts
Ib at Ec = -25 Vdc	—	8 Ma
Ib with Eb = 60 V and Ec = 0 V	—	95 Ma

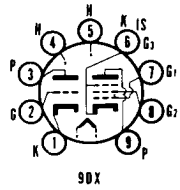
NOTES:
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
(2) In stages operating with grid leak bias, an adequate bias resistor or other suitable means is required to protect the tube in the absence of excitation.
(3) Section No. 1 connects to Pins 4, 5 and 6. Section No. 2 connects to Pins 1, 2 and 3.

SYNC SEPARATOR or VOLTAGE AMP. (T) VIDEO AMPLIFIER (P)

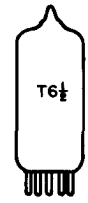
10JY8

Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9DX
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	10.5 Volts
Heater Current	450 Ma
Heater Warm-up Time	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	2.8 Pf
Input: g to (h + Tk + Pk + g3 + IS)	4.2 Pf
Output: p to (h + Tk + Pk + g3 + IS)	3.2 Pf
Pentode Section	
Grid No. 1 to Plate	0.08 Pf
Input: g1 to (h + k + g2 + g3 + IS)	10 Pf
Output: p to (h + k + g2 + g3 + IS)	4.6 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	2.0	5 Watts
Grid No. 2 Dissipation (Max.)	—	1.1 Watt
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Self Bias (Max.)	1.0	1.0 Megohm

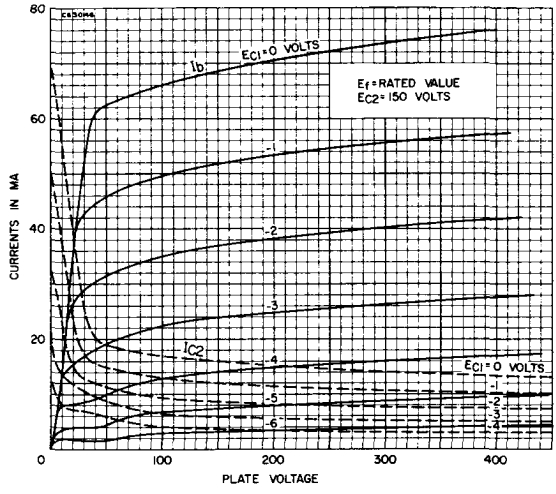
CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

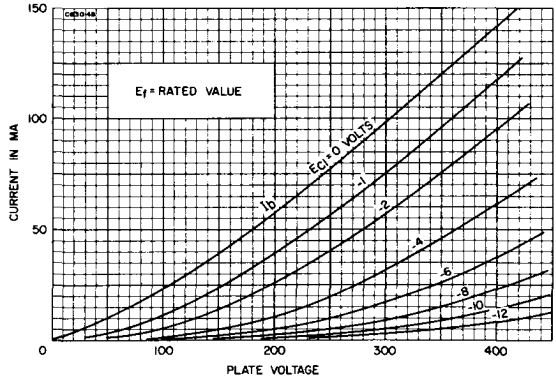
	Triode Section	Pentode Section
Plate Voltage	125	200 Volts
Grid No. 2 Voltage	—	150 Volts
Cathode Bias Resistor	68	100 Ohms
Plate Current	15	24 Ma
Grid No. 2 Current	—	4.8 Ma
Transconductance	10,400	11,000 μmhos
Amplification Factor	46	—
Plate Resistance (Approx.)	4400	55,000 Ohms
Ec1 for Ib = 10 μa (Approx.)	−8	−10 Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS
Eb = 50 V; Ec2 = 150 V; and Ec1 = 0 V
Ib = 60 Ma (Approx.) and Ic2 = 18 Ma (Approx.)

AVERAGE PLATE CHARACTERISTICS
(Pentode Section)



AVERAGE PLATE CHARACTERISTICS
(Triode Section)

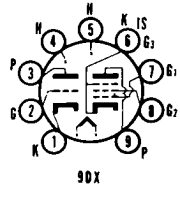


10LW8

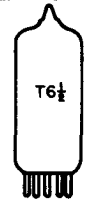
VIDEO AMPLIFIER (P)
GENERAL PURPOSE (T)

High Mu Triode and
Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9DX
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	10.5 Volts
Heater Current	450 Ma
Heater Warm-up Time	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 (Unshielded)

Pentode Section	
Grid No. 1 to Plate	0.08 Pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + IS)	12 Pf
Output: Pp to (h + Pk + Pg2 + Pg3 + IS)	4.4 Pf
Triode Section	
Grid to Plate	3.6 Pf
Input: Tg to (h + Tk + Pk + Pg3 + IS)	2.8 Pf
Output: Tp to (h + Tk + Pk + Pg3 + IS)	3.0 Pf

RATINGS (Design Maximum Rating System)

	Pentode Section	Triode Section
Plate Voltage (Max.)	330	330 Volts
Screen Supply Voltage (Max.)	330	— Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive DC Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	4.0	1.5 Watts
Screen Dissipation (Max.)	1.5	— Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.5 Megohm
Cathode Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

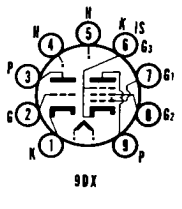
	Pentode Section		Triode Section
Plate Voltage	35	200	200 Volts
Screen Voltage	100	100	— Volts
Grid No. 1 Voltage	0	—	-2.0 Volts
Cathode-Bias Resistor	—	82	— Ohms
Amplification Factor	—	—	75
Plate Resistance (Approx.)	—	60,000	18,700 Ohms
Transconductance	—	19,000	4000 μmhos
Plate Current	48	16.5	2.6 Ma
Screen Current	12.5	2.8	— Ma
Grid Voltage (Approx.) Ib = 30 μa	—	—	-4 Volts
Grid No. 1 Voltage (Approx.) Ib = 500 μa	—	-5.5	— Volts

VIDEO AMPLIFIER and GENERAL PURPOSE TRIODE

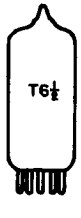
10LZ8

High Mu Triode and
Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9DX
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



9DX



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	10.5 Volts
Heater Current	450 Ma
Heater Warm-up Time	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 (Unshielded)

Pentode Section

Grid No. 1 to Plate (Pg1 to Pp)	0.075 Pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + IS)	9.5 Pf
Output: Pp to (h + Pk + Pg2 + Pg3 + IS)	4.4 Pf

Triode Section

Grid to Plate (Tg to Tp)	3.8 Pf
Input: Tg to (h + Tk + Pk + Pg3 + IS)	2.6 Pf
Output: Tp to (h + Tk + Pk + Pg3 + IS)	3.0 Pf

RATINGS (Design Maximum Rating System)

	Pentode Section	Triode Section
Plate Voltage (Max.)	225	300 Volts
Screen Voltage (Max.)	160	— Volts
Positive DC Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	4.5	1.0 Watts
Screen Dissipation (Max.)	2.0	— Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.5 Megohm
Cathode Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Pentode Section			Triode Section
Plate Voltage	30	30	200	250 Volts
Screen Voltage	140	140	140	— Volts
Grid No. 1 Voltage	0	−1.0	−2.0	−2.0 Volts
Amplification Factor	—	—	—	110
Plate Resistance (Approx.)	—	—	150,000	52,000 Ohms
Transconductance	—	11,000	9500	2100 μmhos
Plate Current	30	16	12	1.1 Ma
Screen Current	13.5	9.5	2.5	— Ma
Grid Voltage (Approx.) Ib = 10 μa	—	—	—	−3.6 Volts
Grid No. 1 Voltage (Approx.) Ib = 500 μa	—	−4	−4.2	— Volts

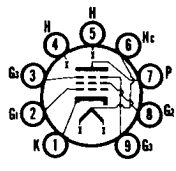
11HM7

Color Television Type

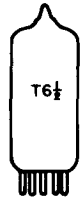
VIDEO AMPLIFIER

Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9BF
Outline	6-3
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



9BF



ELECTRICAL DATA

HEATER OPERATION

	Series	Parallel
Heater Voltage	11.0	5.5 Volts
Heater Current	300	600 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)

Grid No. 1 to Plate (Max.)	0.16 Pf
Input: g1 to (k, g3 + IS, g2, h)	14 Pf
Output: p to (k, g3 + IS, g2, h)	5.0 Pf

RATINGS (Design Maximum Rating System)

Class A1 Amplifier

Plate Voltage (Max.)	330 Volts
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Grid No. 1 Voltage:	
Positive Bias Value (Max.)	0 Volt
Plate Dissipation (Max.)	7 Watts

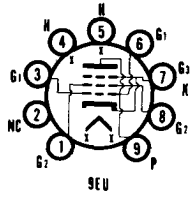
Grid No. 2 Input:	
Ec2 up to 165 V (Max.)	1 Watt
Ec2 from 165 V to 330 V	See Rating Chart (Gen. Info. Sec.)
Grid No. 1 Circuit Resistance:	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.25 Megohm
CHARACTERISTICS AND TYPICAL OPERATION	
Plate Supply Voltage	200 Volts
Grid No. 3 Voltage	0 Volt
Grid No. 2 Supply Voltage	135 Volts
Grid No. 1 Supply Voltage	0 Volt
Cathode Resistor	47 Ohms
Plate Resistance (Approx.)	40 K Ohms
Transconductance	30,000 μmhos
DC Plate Current	30 Ma
DC Grid No. 2 Current	5.2 Ma
Cutoff DC Grid No. 1 Voltage for Ib = 100 μa	−4.5 Volts

AUDIO OUTPUT AMPLIFIER

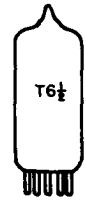
12AB5

Beam Power Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9EU
Outline	*6-3*
Maximum Diameter	0.875 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



9EU



ELECTRICAL DATA

HEATER OPERATION	
Heater Voltage(1)	12.6 Volts
Heater Current	200 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)	
Grid to Plate	0.7 Pf
Input: g1 to (h + k + g2 + g3)	8.0 Pf
Output: p to (h + k + g2 + g3)	8.5 Pf
RATINGS (Design Center Rating System)	
Class A1 Amplifier	
Plate Voltage (Max.)	315 Volts
Plate Dissipation (Max.)	12 Watts
Grid No. 2 Voltage (Max.)	285 Volts
Grid No. 2 Dissipation (Max.)	2 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION			
Class A1 Amplifier (Single Tube)			
Plate Voltage	180	250	250 Volts
Grid No. 2 Voltage	180	200	250 Volts
Grid No. 1 Voltage	−8.5	—	−12.5 Volts
Cathode Bias Resistor	—	270	— Ohms
Peak AF Grid No. 1 Voltage	8.5	10.5	12.5 Volts
Zero Signal Plate Current	29	33.5	45 Ma
Maximum Signal Plate Current	30	36.0	47 Ma
Zero Signal Grid No. 2 Current	3.0	1.6	4.5 Ma
Maximum Signal Grid No. 2 Current	4.0	3.2	7.0 Ma
Plate Resistance (Approx.)	50,000	—	50,000 Ohms
Transconductance	3700	4000	4100 μmhos
Load Resistance	5500	6000	5000 Ohms
Maximum Signal Power Output	2.0	3.3	4.5 Watts
Total Harmonic Distortion	8	12	8 Percent

Class A1 Push-Pull Amplifier (Values are for Two Tubes)

Plate Voltage	250 Volts
Grid No. 2 Voltage	250 Volts
Grid No. 1 Voltage	−15 Volts
Peak AF Grid No. 1 Voltage	30 Volts
Zero Signal Plate Current	70 Ma
Maximum Signal Plate Current	79 Ma
Zero Signal Grid No. 2 Current	5 Ma
Maximum Signal Grid No. 2 Current	13 Ma
Plate to Plate Load Resistance	10,000 Ohms
Maximum Signal Power Output	10 Watts
Total Harmonic Distortion	5 Percent

NOTE:

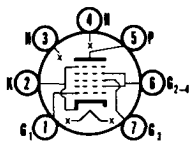
(1) This tube is intended to be used in automotive service from a nominal 12 volt battery source. The heater is therefore designed to operate over the 10.0 to 15.9 voltage range encountered in this service. The maximum ratings of the tube provide for an adequate safety factor such that the tube will withstand the wide variation in supply voltages.

12AD6

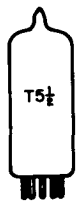
OSCILLATOR and MIXER

Pentagrid Converter

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7CH
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7 CH



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage(1)	12.6 Volts
Heater Current	150 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	30 Volts
Heater Positive with Respect to Cathode	30 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded(2)	Unshielded
Grid No. 3 to Plate (Max.)	0.26	0.30 Pf
Grid No. 3 to Grid No. 1 (Max.)	0.15	0.15 Pf
RF Input: g3 to (h + k + g1 + g2 and g4 + g5 + p)	7.0	7.0 Pf
Oscillator Input: g1 to (h + k + g1 + g2 and g4 + g3 + g5)	3.2	3.2 Pf
Mixer Output: p to (h + k + g1 + g2 and g4 + g3 + g5)	12.0	7.0 Pf
Oscillator Output: k to (h + g2 and g4 + g3 + p)	11	11 Pf
Oscillator Grid No. 1 to Plate (Max.)	2.2	2.2 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	16 Volts
Grid No. 2 and No. 4 Voltage (Max.)	16 Volts
Grid No. 2 and No. 4 Supply Voltage (Max.)	16 Volts
Negative DC Grid No. 3 Voltage (Max.)	16 Volts
Positive DC Grid No. 3 Voltage (Max.)	0 Volt
Cathode Current (Max.)	20 Ma
Grid No. 3 Circuit Resistance (Max.)	10 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Converter—Self Excitation

Plate Voltage	12.6 Volts
Grid No. 2 and 4 Voltage	12.6 Volts
Grid No. 3 Voltage(3)	0 Volt
Grid No. 3 Resistor	2.2 Megohms
Plate Voltage	350 μa
Grid No. 1 Resistor (Oscillator Grid)	33,000 Ohms
Grid No. 1 Voltage (Oscillator Grid) Pk to Pk	4.5 Volts
Grid No. 1 Current (Oscillator Grid)	60 μa
Conversion Transconductance	320 μmhos
Plate Resistance (Approx.)	0.4 Megohm
Cathode Current	1600 μa
Grid No. 3 Voltage for Gc = 5 μmhos (Approx.)	−3 Volts
Grid No. 3 Voltage for Gc = 0.5 μmhos (Approx.)	−4 Volts

Oscillator—Not Oscillating

Plate Voltage	12.6 Volts
Grid No. 2 and 4 Voltage(4)	12.6 Volts
Grid No. 3 Voltage	0 Volt
Grid No. 1 Voltage	0 Volt
Transconductance	3600 μmhos
Amplification Factor	9.4
Cathode Current	4.5 Ma
Grid No. 1 Voltage for Ib = 10 μa (Approx.)	−3.7 Volts

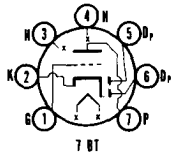
NOTES:
(1) This tube is intended for use in automobile radios operated from a nominal 12 volt battery. Design of the tube is such that the heater will operate satisfactorily over the range 10.0 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered with the type of supply.
(2) External shield No. 316 connected to Pin 2.
(3) Average contact potential is developed across the specified grid resistor.
(4) Connected to plate.

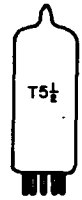
DETECTOR and AF AMPLIFIER

12AE6A

Double Diode and Medium Mu Triode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7BT
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage(1)	12.6 Volts
Heater Current	150 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	30 Volts
Heater Positive with Respect to Cathode	30 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid to Plate	2.0 Pf
Input	1.8 Pf
Output	1.1 Pf
Diode to Diode	0.9 Pf

RATINGS (Design Center Rating System)
Class A1 Amplifier

Plate Voltage (Max.)	30 Volts
Cathode Current (Max.)	20 Ma
Grid Circuit Resistance (Max.)	10 Megohms

Diode Section

Average Diode Current (Max.)	1 Ma

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier
Triode Section

Plate Voltage	12.6	12.6 Volts
Grid Voltage	0	— Volt
Grid Resistor	0	10 Megohms
Plate Current	1.0	0.32 Ma
Transconductance	1300	715 μmhos
Plate Resistance	13	20 K Ohms
Amplification Factor	16.7	14.3

Diode Section

Average Diode Current with 10 Volts Applied (Each Diode)	2.0 Ma

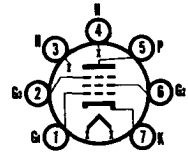
NOTE:
(1) This tube is intended for use in automobile radios operated from a nominal 12 Volt battery. Design of the tube is such that the heater will operate satisfactorily over the range 10.0 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered with this type of supply.

12AF6

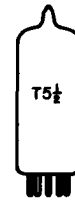
RF/IF AMPLIFIER

Remote Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7BK
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.



7BK



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage(1)	12.6 Volts
Heater Current	150 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	16 Volts
Heater Positive with Respect to Cathode	16 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid to Plate	0.006 Pf
Input	5.5 Pf
Output	4.8 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	16 Volts
Grid No. 2 Voltage (Max.)	16 Volts
Positive DC Grid No. 1 Voltage (Max.)	0 Volt
Grid No. 1 Circuit Resistance (Max.)	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	12.6 Volts
Grid No. 3 Voltage	0 Volt
Grid No. 2 Voltage	12.6 Volts
Grid No. 1 Supply Voltage	0 Volt
Plate Current	1.1 Ma
Grid No. 2 Current	0.45 Ma
Transconductance	1500 μmhos
Plate Resistance (Approx.)	0.35 Megohm
Grid No. 1 Resistor (Bypassed)	2.2 Megohm
Grid No. 1 Voltage(2) (Approx.) for Gm = 10 μmhos	−3.5 Volts

NOTES:

(1) This tube is intended for use in automobile radios operated from a nominal 12 volt battery. Design of the tube is such that the heater will operate satisfactorily over the range 10.0 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered with this type of supply.

(2) Grid No. 1 tied to Grid No. 3.

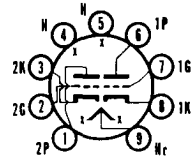
12AT7/ECC81

Color Television Type

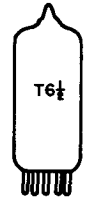
GROUNDED GRID AMPLIFIER

Double High Mu Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9A
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9A



ELECTRICAL DATA

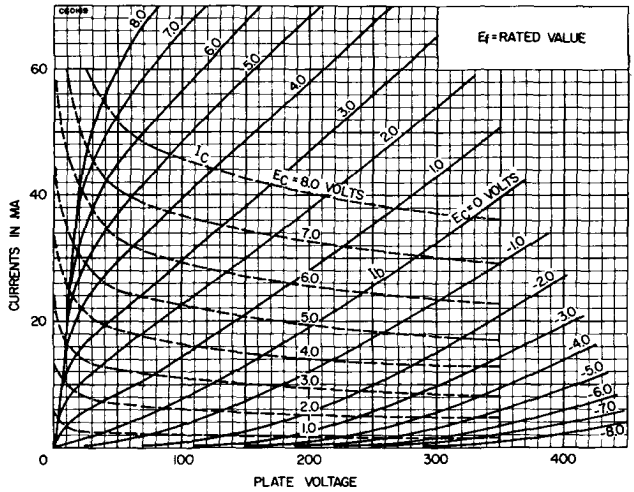
HEATER OPERATION

Heater Voltage	12.6/6.3 Volts
Heater Current	150/300 Ma
Maximum Heater-Cathode Voltage	90 Volts

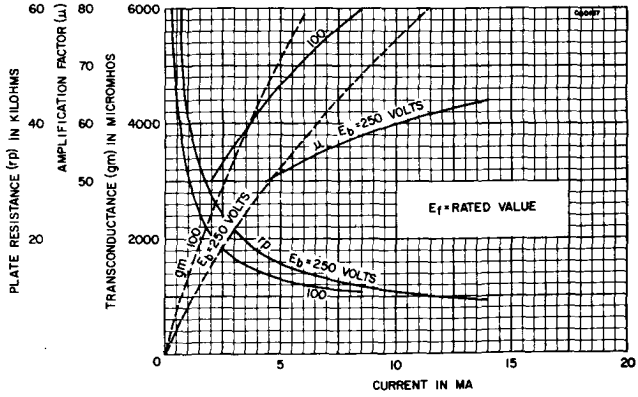
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

	Section 1		Section 2
Grid to Plate	1.5		1.5 Pf
Input	2.2		2.2 Pf
Output	0.5		0.4 Pf
Grid to Grid (Max.)		.005	Pf
Plate to Plate (Max.)		0.4	Pf
Heater to Cathode	2.4		2.4 Pf
Grounded Grid Section			
Plate to Cathode	0.2		0.2 Pf
Input	4.6		4.6 Pf
Output	1.8		1.8 Pf
RATINGS (Design Center Rating System) (Each Section)			
Plate Voltage (Max.)			300 Volts
Plate Dissipation (Max.)			2.5 Watts
CHARACTERISTICS AND TYPICAL OPERATION			
Class A1 Amplifier (Each Section)			
Grid Voltage	100	180	250 Volts
Grid Voltage	−1	−1	−2 Volts
Cathode Bias Resistor	270	90	200 Ohms
Plate Current	3.7	11.0	10.0 Ma
Plate Resistance	15,000	9400	10,900 Ohms
Transconductance	4000	6000	5500 μmhos
Amplification Factor	60	62	60
Ec for Ib = 10 μa (Approx.)	−5	−8	−12 Volts

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



12AU7A/ECC82

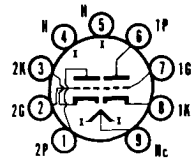
7AU7, 9AU7

Color Television Type

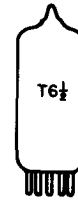
VERTICAL or HORIZ. DEFLECTION OSCILLATOR and AMPLIFIER

Double Medium Mu Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing[2] 9A
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9A



ELECTRICAL DATA

HEATER OPERATION

	7AU7	9AU7	12AU7/ECC82
Heater Voltage	7.0/3.5	9.4/4.7	12.6/6.3 Volts
Heater Current	300/600	450/225	150/300 Ma
Heater Warm-up Time	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

	Shielded[1]	Unshielded
Grid to Plate: Section 1	1.5	1.5 Pf
Section 2	1.5	1.5 Pf
Input: g to (h + k) Section 1 and 2	1.8	1.6 Pf
Output: p to (h + k) Section 1	2.0	0.40 Pf
Section 2	2.0	0.32 Pf

RATINGS (Design Maximum Rating System) (Each Section)

	Class A1 Amplifier	Vertical[3] Deflection Amplifier
Plate Voltage (Max.)	330	330 Volts
Peak Positive Plate Voltage (Abs. Max.)	—	1200 Volts
Plate Dissipation[4] Each Plate (Max.)	2.75	2.75 Watts
Both Plates (Max.)	5.5	5.5 Watts
Peak Negative Grid Voltage (Max.)	—	275 Volts
Average Cathode Current (Max.)	22	22 Ma
Peak Cathode Current (Max.)	—	66 Ma
Grid Circuit Resistance		
Fixed Bias (Max.)	0.25	— Megohm
Cathode Bias (Max.)	1.0	2.2 Megohms

RATINGS (Design Center Rating System)

	Vertical[3] Deflection Oscillator	Horizontal[3] Deflection Oscillator
Plate Voltage (Max.)	330	330 Volts
Plate Dissipation[4]		
Each Plate (Max.)	2.75	2.75 Watts
Both Plates (Max.)	5.5	5.5 Watts
Peak Negative Grid Voltage (Max.)	440	660 Volts
Average Cathode Current (Max.)	22	22 Ma
Peak Cathode Current (Max.)	66	330 Ma
Grid Circuit Resistance (Max.)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

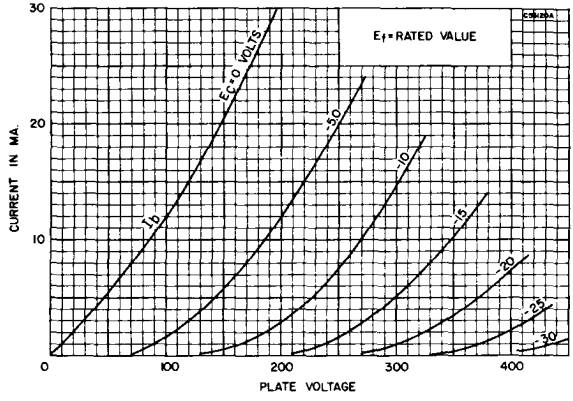
Class A1 Amplifier (Each Section)

Plate Voltage	100	250 Volts
Grid Voltage	0	-8.5 Volts
Plate Current	11.8	10.5 Ma
Plate Resistance (Approx.)	6500	7700 Ohms
Transconductance	3100	2200 μmhos
Amplification Factor	20	17
Grid Voltage for Ib = 10 μa (Approx.)	—	-24 Volts

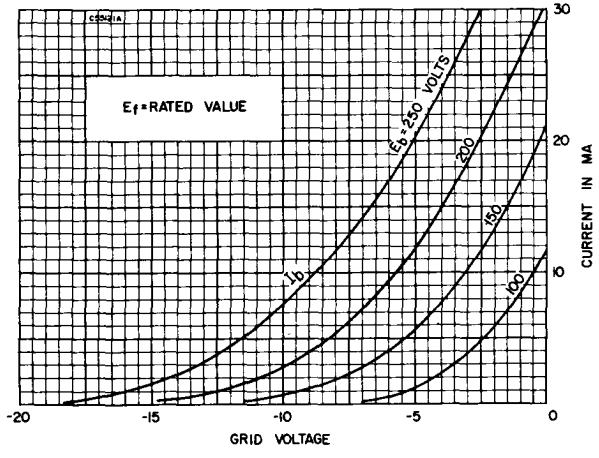
NOTES:

(1) External shield No. 315 connected to cathode of section under test.
(2) Section No. 1 connects to pins 6, 7, and 8. Section No. 2 connects to pins 1, 2, and 3.
(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 horizontal scanning cycle.
(4) In stages operating with grid leak bias, an adequate cathode bias resistor or other suitable means is required to protect the tube in the absence of excitation.

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



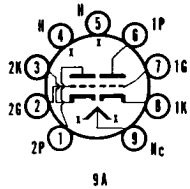
Color Television Type

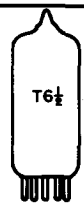
GROUNDED GRID AMPLIFIER

12AV7

Double Medium Mu Triode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing[2]	9A
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	12.6/6.3 Volts
Heater Current	225/450 Ma
Maximum Heater-Cathode Voltage	90 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded[1]	Unshielded
Grid to Plate (Each Section)	1.9	1.9 Pf
Input (Each Section)	3.2	3.1 Pf
Output (Section 1)	1.3	0.5 Pf
(Section 2)	1.6	0.4 Pf
Heater to Cathode (Each Section)	4.0	3.8 Pf
Grounded Grid Operation		
Input (Each Section)	7.0	6.9 Pf
Output (Section 1)	2.8	2.0 Pf
(Section 2)	3.2	2.0 Pf
Plate to Cathode (Each Section)	0.23	0.24 Pf

RATINGS (Design Center Rating System) (Each Section)

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	2.7 Watts
Negative Grid Voltage (Max.)	50 Volts

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier (Each Section)

Plate Voltage	100	150 Volts
Cathode Bias Resistor	120	56 Ohms
Plate Current	9.0	18 Ma
Transconductance	6100	8500 μmhos
Amplification Factor	37	41
Plate Resistance	6100	4800 Ohms
Grid Voltage for Ib = 10 μa	−9	−12 Volts

NOTES:

(1) Shield No. 315 connected to cathode.

(2) Section 1 connects to Pins 6, 7, and 8. Section 2 connects to Pins 1, 2, and 3.

12AX7A/ECC83

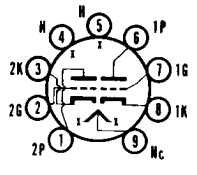
6AX7

Color Television Type

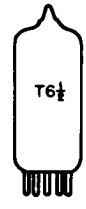
AF AMPLIFIER or PHASE INVERTER

Double High Mu Triode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing[1]	9A
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.



9A



ELECTRICAL DATA

HEATER OPERATION

	6AX7	12AX7/ECC83
Heater Voltage	6.3/3.15	12.6/6.3 Volts
Heater Current	300/600	150/300 Ma
Heater Warm-up Time[3]	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

	Section 1[1]		Section 2[1]	
	Shielded	Unshielded	Shielded[2]	Unshielded
Grid to Plate	1.7	1.7	1.7	1.7 Pf
Input (g to h + k)	1.8	1.6	1.8	1.6 Pf
Output (p to h + k)	1.9	0.46	1.9	0.34 Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	330 Volts
Plate Dissipation (Max.)	1.0 Watt
Positive DC Grid Voltage (Max.)	0 Volt
Negative DC Grid Voltage (Max.)	−55 Volts

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier (Each Section)

Plate Voltage	100	250 Volts
Grid Voltage	−1	−2 Volts
Plate Current	0.5	1.2 Ma
Plate Resistance	80,000	62,500 Ohms
Transconductance	1250	1600 μmhos
Amplification Factor	100	100

NOTES:
(1) Section No. 1 connects to Pins 6, 7, and 8. Section No. 2 connects to Pins 1, 2, and 3.
(2) External Shield No. 315 connected to cathode of section under test.
(3) Controlled Heater Warm-up Time applies to parallel connection only.

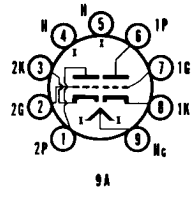
Color Television Type

GROUNDED GRID AMPLIFIER

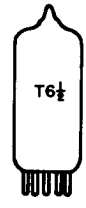
12AZ7A

Double High Mu Triode

Construction ..... Miniature T-6½
Base ..... Button 9 Pin, E9-1
Basing 9A
Outline 6-2
Maximum Diameter ..... 0.875 In.
Maximum Seated Height ..... 1.937 In.
Maximum Overall Height ..... 2.187 In.



9A



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	12.6/6.3 Volts
Heater Current	225/450 Ma
Heater Warm-up Time	11 Seconds
Maximum Heater-Cathode Voltage	90 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded	Unshielded
Grid to Plate (Each Section)	1.9	1.9 Pf
Input (Each Section)	3.2	3.1 Pf
Output (Section 1)(2)	1.3	0.5 Pf
Output (Section 2)	1.6	0.4 Pf
Grounded Grid Operation		
Input (Each Section)	7.0	6.9 Pf
Output (Section 1)(2)	2.8	2.0 Pf
(Section 2)	3.2	2.0 Pf
Plate to Cathode	0.23	0.24 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	2.5 Watts
Negative Grid Voltage (Max.)	50 Volts
Grid Circuit Resistance	
Fixed Bias (Max.)	0.25 Megohm
Self Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier (Each Section)

Plate Voltage	100	250 Volts
Cathode Bias Resistor	270	200 Ohms
Plate Current	3.7	10 Ma
Transconductance	4000	5500 μmhos
Amplification Factor	60	60
Plate Resistance	15,000	10,900 Ohms
Ec1 for Ib = 10 μa (Approx.)	−5	−12 Volts

NOTES:
(1) Shield No. 315.
(2) Section 1 connects to pins 6, 7, and 8.

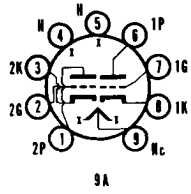
12BH7A

Color Television Type

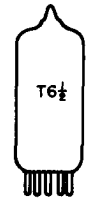
VERTICAL or HORIZ. DEFLECTION OSCILLATOR and AMPLIFIER

Double Low Mu Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing(2) 9A
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9A



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	12.6/6.3 Volts
Heater Current	300/600 Ma
Heater Warm-up Time(1)	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 (Unshielded)

	Section 1(2)	Section 2
Grid to Plate	2.6	2.6 Pf
Input	3.2	3.2 Pf
Output	0.5	0.4 Pf
Plate to Plate	0.8	Pf

RATINGS (Design Center Rating System)

	Vertical Deflection Amplifier	Class A1 Amplifier
Plate Voltage (Max.)	450	300 Volts
Peak Positive Plate Voltage (Abs. Max.)	1500	— Volts
Plate Dissipation (Each Plate) (Max.)	3.5	3.5 Watts
Peak Negative Pulse Grid Voltage (Max.)	250	— Volts
Average Cathode Current (Each Section)	20	20 Ma
Peak Cathode Current (Max.)	70	— Ma
Grid Circuit Resistance		
Fixed Bias (Max.)	—	0.25 Megohm
Cathode Bias (Max.)	2.2	1.0 Megohms

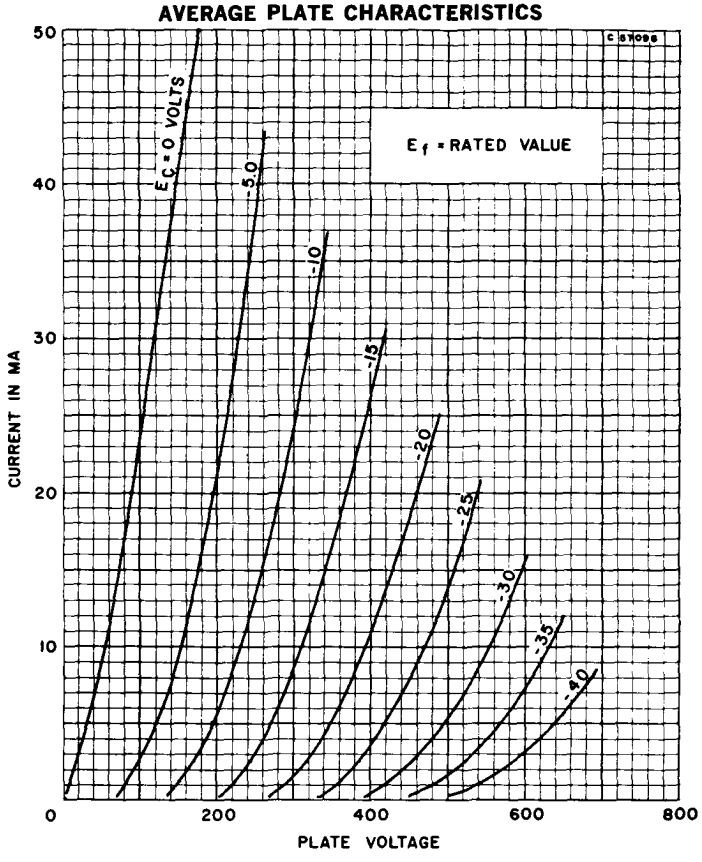
	Vertical(3) Deflection Oscillator	Horizontal(3) Deflection Oscillator
DC Plate Voltage (Max.)	450	450 Volts
Plate Dissipation		
Each Plate (Max.)	3.5	3.5 Watts
Both Plates (Max.)	7.0	7.0 Watts
Peak Negative Grid Voltage (Max.)	400	600 Volts
Average Cathode Current (Max.)	20	20 Ma
Peak Cathode Current (Max.)	70	300 Ma
Grid Circuit Resistance (Max.)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

Plate Voltage	250 Volts
Grid Voltage	−10.5 Volts
Plate Current	11.5 Ma
Transconductance	3100 μmhos
Amplification Factor	16.5
Grid Voltage for Ib = 50 μa	−23 Volts
Plate Resistance (Approx.)	5300 Ohms

NOTES:

(1) Applies to parallel connection only.
(2) Section 1 connects to pins 6, 7, and 8.
(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 horizontal scanning cycle.

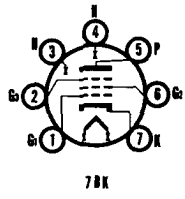


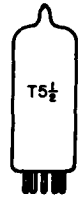
RF/IF AMPLIFIER

12BL6

Semi-Remote Cutoff Pentode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7BK
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.





ELECTRICAL DATA

HEATER OPERATION	
Heater Voltage(1)	12.6 Volts
Heater Current	150 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	30 Volts
Heater Positive with Respect to Cathode	30 Volts
DIRECT INTERELECTRODE CAPACITANCES (Shielded)	
Grid No. 1 to Plate (Max.)	0.006 Pf
Input	5.5 Pf
Output	4.8 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	30 Volts
Grid No. 2 Voltage (Max.)	30 Volts
Cathode Current (Max.)	20 Ma
Grid No. 1 Circuit Resistance (Max.)	10 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	12.6 Volts
Grid No. 3 Voltage(2)	0 Volt
Grid No. 2 Voltage	12.6 Volts
Grid No. 1 Voltage(3)	-0.65 Volts
Plate Current	1350 μa
Grid No. 2 Current	500 μa
Transconductance(4)	1350 μmhos
Plate Resistance (Approx.)	0.5 Megohm
Grid No. 1 Voltage for Gm = 10 μmhos (Approx.)	-6.0 Volts
Grid No. 1 and No. 3 Voltage for Gm = 10 μmhos (Approx.)	-5.0 Volts

NOTES:

(1) This tube is intended for use in automobile radios operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range 10.0 volts to 15.9 volts, and the maximum ratings provide a safety factor for the wide voltage variation encountered with this type of supply.
(2) Connected to Cathode at socket.
(3) Average contact potential bias developed across a 2.2 megohm grid resistor.
(4) From Grid No. 1 to plate.

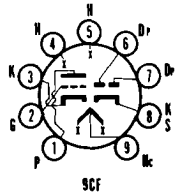
12BR7

9BR7

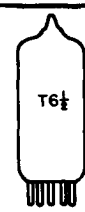
DETECTOR GENERAL PURPOSE AMPLIFIER

Double Diode and High Mu Triode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9CF
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.



9CF



ELECTRICAL DATA

HEATER OPERATION

	9BR7	12BR7
Heater Voltage	9.4/4.7	12.6/6.3 Volts
Heater Current	300/600	225/450 Ma
Heater Warm-up Time	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 (Shielded)(1)

Triode Grid to Plate	1.9 Pf
Triode Input	2.8 Pf
Triode Output	1.0 Pf
Diode Input (Each Diode)	2.0 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Triode) (Max.)	300 Volts
Plate Dissipation (Triode) (Max.)	2.5 Watts
Peak Inverse Diode Voltage (Max.)	300 Volts
Peak Diode Current (Max.)	60 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	100	250 Volts
Cathode Bias Resistor	270	200 Ohms
Amplification Factor	60	60
Plate Resistance (Approx.)	15,000	10,900 Ohms
Transconductance	4000	5500 μmhos
Plate Current	3.7	10 Ma
Grid Voltage (Approx.) for Ib = 10 μa	-5	-12 Volts
Average Diode Current		
Each Diode with 5.0 volts DC applied	—	17 Ma

NOTE:

(1) Shield No. 315.

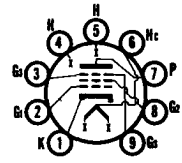
Color Television Type

VIDEO AMPLIFIER

12BY7A

High Transconductance Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9BF
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9BF



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	12.6/6.3 Volts
Heater Current	300/600 Ma
Heater Warm-up Time(1)	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 (Unshielded)

Grid No. 1 to Plate	0.063 Pf
Input	10.2 Pf
Output	3.5 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	300 Volts
Plate Dissipation (Max.)	6.5 Watts
Grid No. 2 Voltage (Max.)	180 Volts
Grid No. 2 Dissipation (Max.)	1.1 Watts
Grid No. 1 Voltage	
Negative (Max.)	50 Volts
Positive (Max.)	0 Volt
Grid No. 1 Resistance	
Fixed Bias (Max.)	0.25 Megohm
Cathode Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	250 Volts
Grid No. 2 Voltage	180 Volts
Cathode Bias Resistor	100 Ohms
Plate Current	26 Ma
Grid No. 2 Current	5.75 Ma
Transconductance	11,000 μmhos
Plate Resistance	93,000 Ohms
Amplification Factor	1035
Grid No. 1 Voltage for Ib = 20 μa	-11.6 Volts
Amplification Factor (Triode Connected)	28.5

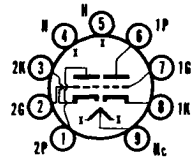
NOTE:
(1) Applies to parallel connection only.

SYNC SEPARATOR and AMPLIFIER

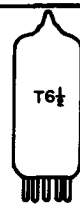
12BZ7

Double High Mu Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9A
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9A



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	12.6/6.3 Volts
Heater Current	300/600 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	180 Volts
Heater Positive with Respect to Cathode	180 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Section No. 1	Section No. 2
Grid to Plate	2.5	2.5 Pf
Grid to Cathode and Heater	6.5	6.5 Pf
Plate to Cathode and Heater	0.7	0.55 Pf
Plate (Section 1) to Plate (Section 2)	1.3	Pf

RATINGS (Design Center Rating System)

Class A1 Amplifier (Each Section)

Plate Voltage (Max.)	300 Volts
Grid Voltage	
Negative Bias Value (Max.)	-50 Volts
Positive Bias Value (Max.)	0 Volt
Plate Dissipation (Max.)	1.5 Watts

CHARACTERISTICS AND TYPICAL OPERATION

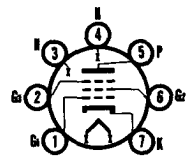
Plate Voltage	250 Volts
Grid Voltage	-2 Volts
Amplification Factor	100
Plate Resistance (Approx.)	31,800 Ohms
Transconductance	3200 μmhos
Plate Current	2.5 Ma
Grid Circuit Resistance (Contact Bias Operation)	5 Megohms

12EK6

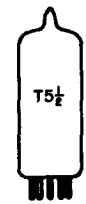
RF/IF AMPLIFIER

Sharp Cutoff Pentode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7BK
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7BK



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage(1)	12.6 Volts
Heater Current	200 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	16 Volts
Heater Positive with Respect to Cathode	16 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid to Plate (Max.)	0.032 Pf
Input: g1 to (h + k + g2 + g3)	10 Pf
Output: p to (h + k + g2 + g3)	5.5 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	16 Volts
Grid No. 2 Voltage (Max.)	16 Volts
Positive DC Grid No. 1 Voltage	0 Volt
Grid No. 1 Circuit Resistance (Max.)	10 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	12.6 Volts
Grid No. 2 Voltage	12.6 Volts
Grid No. 1 Voltage(2)	— Volt
Grid No. 1 Resistor	2.2 Megohms
Plate Current	4.4 Ma
Grid No. 2 Current	2.0 Ma
Transconductance	4200 μmhos
Plate Resistance (Approx.)	40,000 Ohms
Grid No. 1 Voltage for Ib = 10 μa	-4 Volts

NOTES:

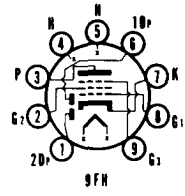
(1) This tube is intended for use in automobile radios operated from a nominal 12 volt battery. Design of the tube is such that the heater will operate satisfactorily over the range

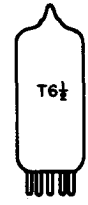
from 10.0 to 15.9 V, and that the maximum ratings provide a safety factor for the wide voltage variations encountered in this type of supply system.
(2) Average contact potential bias developed across specified grid resistor.

DETECTOR and AF AMPLIFIER — 12F8

Double Diode and Remote Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9FH
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage(1)	12.6 Volts
Heater Current	150 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	30 Volts
Heater Positive with Respect to Cathode	30 Volts

DIRECT INTERELECTRODE CAPACITANCES

Grid to Plate	0.06 Pf
Input: g1 to (g2 + g3 + h + k)	4.5 Pf
Output: p to (g2 + g3 + h + k)	3.0 Pf
Diode to Diode	0.3 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	30 Volts
Grid No. 2 Voltage (Max.)	30 Volts
Positive DC Grid No. 1 Voltage (Max.)	0 Volt
Grid No. 1 Circuit Resistance (Max.)	10 Megohms
Average Diode Current (Max.)	1.0 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	12.6 Volts
Grid No. 2 Voltage	12.6 Volts
Grid No. 1 Voltage	0 Volt
Plate Current	1.0 Ma
Grid No. 2 Current	0.38 Ma
Transconductance	1000 μmhos
Plate Resistance (Approx.)	0.33 Megohm
Grid No. 1 Voltage (Approx.) for Gm = 10 μmhos	−5 Volts
Average Diode Current with 10 Volts DC Applied (Test Condition Only)	2 Ma

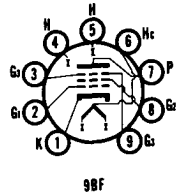
NOTE:
(1) This tube is intended for use in automobile radios operated from a nominal 12 volt battery. Design of the tube is such that the heater will operate satisfactorily over the range of 10.0 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered with this type of supply.

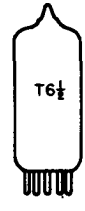
Color Television Type

VIDEO AMPLIFIER — 12GN7A/12HG7

Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9BF
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.





ELECTRICAL DATA

HEATER OPERATION	Parallel	Series
Heater Voltage	12.6	6.3 Volts
Heater Current	300	600 Ma
Heater Warm-up Time(1)	—	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 (Unshielded)	
Grid No. 1 to Plate	0.12 Pf
Input: g1 to (h + k, g3, IS + g2)	17.5 Pf
Output: p to (h + k, g3, IS + g2)	4.0 Pf

RATINGS (Design Maximum Rating System)	
Plate Voltage (Max.)	400 Volts
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Positive Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	11.5 Watts
Grid No. 2 Dissipation (Max.)	1.5 Watts
Grid No. 1 Circuit Resistance (Max.)	0.25 Megohm

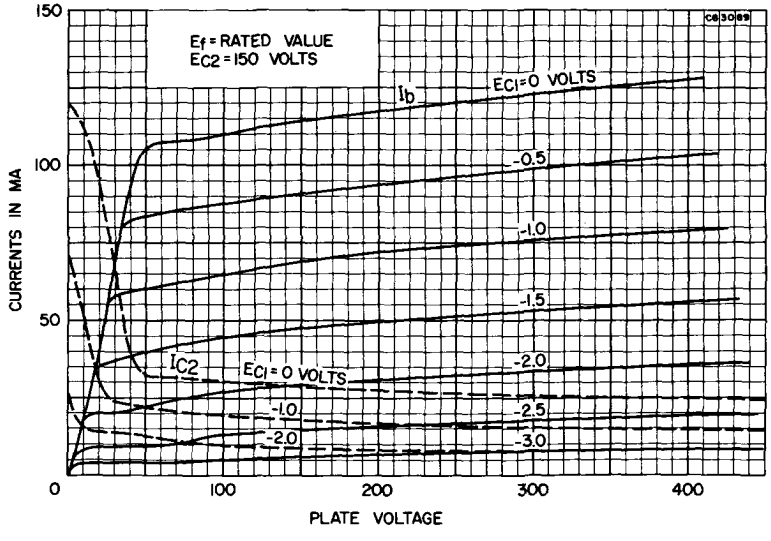
Control grid to cathode spacing of this type is of such low order of magnitude as to preclude the use of voltage between these elements of more than 50 volts DC or peak AC in commercial tube checkers and shorts indicating devices, particularly where mechanical excitation of the tube is employed.

CHARACTERISTICS AND TYPICAL OPERATION	
Plate Voltage	250 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 μmhos
Plate Resistance (Approx.)	50,000 Ohms
Ec1 for Ib = 100 μa (Approx.)	−5.7 Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS(2)
Eb = 50 V, Ec2 = 125 V, and Ec1 = 0 V
Ib = 70 Ma, and Ic2 = 24 Ma

NOTES:
(1) Applies to 6.3/600 Ma only.
(2) Applied for short interval (2 Sec. Max.) so as not to damage tube.

AVERAGE PLATE CHARACTERISTICS



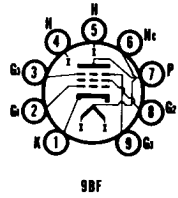
Color Television Type

VIDEO AMPLIFIER

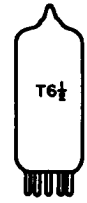
12HL7

Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9BF
Outline 6-3
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



9BF



ELECTRICAL DATA

HEATER OPERATION	Parallel	Series
Heater Voltage	12.6	6.3 Volts
Heater Current	300	600 Ma
Heater Warm-up Time(1)	—	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 (Unshielded)

Grid No. 1 to Plate	0.15 Pf
Input: g1 to (k + g3 + IS + g2 + h)	15.0 Pf
Output: p to (k + g3 + IS + g2 + h)	6.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	400 Volts
Positive DC Grid No. 3 Voltage (Max.)	0 Volt
Grid No. 2 Supply Voltage (Max.)	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Positive DC Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	10.0 Watts
Grid No. 2 Dissipation (Max.)	1.0 Watt
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.25 Megohm

Control grid to cathode spacing on this type is of such low order of magnitude as to preclude the use of voltage between these elements of more than 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 Volts
Grid No. 2 Supply Voltage	150 Volts
Grid No. 1 Voltage	0 Volt
Grid No. 3 Voltage (Referred to Negative End of Rk)	0 Volt
Cathode Resistor (Bypassed)	122 Ohms
Plate Current	25 Ma
Grid No. 2 Current	6 Ma
Transconductance (Grid No. 1 to Plate)	21,000 μmhos
Plate Resistance (Approx.)	55,000 Ohms
Grid No. 1 Voltage (Approx.) for Ib = 100 μa (Rk = 0)	−7.2 Volts

INSTANTANEOUS PLATE KNEE CHARACTERISTICS(2)

Eb = 50 V, Ec2 = 125 V, Ec1 = 0 V and Ec3 = 0 V
Ib = 76 Ma, and Ic2 = 32 Ma

NOTES:

(1) Applies to 6.3 volt connection only.

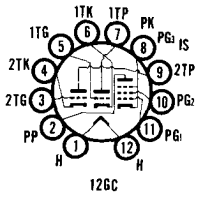
(2) Current drawn only for short intervals so as not to damage the tube.

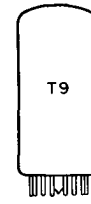
14BL11

VIDEO AMPLIFIER (P) GENERAL PURPOSE AMPLIFIERS(T)

High Mu Triode, Medium Mu Triode and Sharp Cutoff Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12GC
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	14.2 Volts
Heater Current	450 Ma
Heater Warm-up Time	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 (Unshielded)

Triode (Section 1)

Grid to Plate	1.9 Pf
Input: 1Tg to (1Tk + Pk + Pg3 + h + IS)	3.0 Pf
Output: 1Tp to (1Tk + Pk + Pg3 + h + IS)	2.4 Pf

Triode (Section 2)

Grid to Plate	2.6 Pf
Input: 2Tg to (2Tk + Pk + Pg3 + h + IS)	4.4 Pf
Output: 2Tp to (2Tk + Pk + Pg3 + h + IS)	4.0 Pf

Pentode Section

Grid No. 1 to Plate	0.12 Pf
Input: Pg1 to (Pk + Pg2 + Pg3 + h + IS)	12 Pf
Output: P to (Pk + Pg2 + Pg3 + h + IS)	4.4 Pf

Coupling

Pentode Plate to Triode Plate (Section 2)	0.05 Pf
Triode Plate (Section 1) to Triode Plate (Section 2)	0.12 Pf

RATINGS (Design Maximum Rating System)

Pentode Section

Plate Voltage (Max.)	250 Volts
Screen Voltage (Max.)	125 Volts
Positive DC Grid No. 1 Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	2.5 Watts
Screen Dissipation (Max.)	1.25 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.25 Megohm

Triode (Section 1)

Plate Voltage (Max.)	330 Volts
Positive DC Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	1.5 Watts
Grid Circuit Resistance	
Fixed Bias (Max.)	0.5 Megohm
Cathode Bias (Max.)	1.0 Megohm

Triode (Section 2)

Plate Voltage (Max.)	330 Volts
Positive DC Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	2.0 Watts
Grid Circuit Resistance	
Fixed Bias (Max.)	0.5 Megohm
Cathode Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

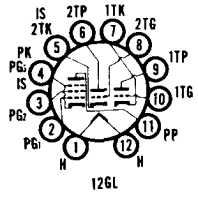
Pentode Section		
Plate Voltage	35	200 Volts
Screen Voltage	100	100 Volts
Grid No. 1 Voltage	0	— Volts
Cathode Bias Resistor	—	82 Ohms
Plate Resistance (Approx.)	—	70,000 Ohms
Transconductance	—	19,000 μmhos
Plate Current	40	16 Ma
Screen Current	13	3.0 Ma
Grid No. 1 Voltage (Approx.) Ib = 100 μa	—	-5.5 Volts
Triode (Section 1)		
Plate Voltage		200 Volts
Cathode Bias Resistor		270 Ohms
Amplification Factor		69
Plate Resistance (Approx.)		12,500 Ohms
Transconductance		5500 μmhos
Plate Current		7.1 Ma
Grid Voltage (Approx.) Ib = 50 μa		-5.5 Volts
Triode (Section 2)		
Plate Voltage		200 Volts
Cathode-Bias Resistor		470 Ohms
Amplification Factor		40
Plate Resistance (Approx.)		7600 Ohms
Transconductance		5300 μmhos
Plate Current		7.2 Ma
Grid Voltage (Approx.) Ib = 100 μa		-8 Volts

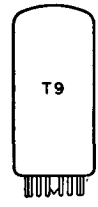
VIDEO AMPLIFIER (P)
GENERAL PURPOSE AMPLIFIER (T)
SYNC SEPARATOR (T)

14BR11

High Mu Triode, Medium Mu Triode and Sharp Cutoff Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12GL
Outline 9-59
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.250 In.
Maximum Overall Height .....2.625 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	14.2 Volts
Heater Current	450 Ma
Heater Warm-up Time	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 (Unshielded)

Triode (Section 1)	
Grid to Plate	1.9 Pf
Input: 1Tg to (1 Tk + 2TK + Pk + Pg3 + h + IS)	2.4 Pf
Output: 1Tp to (1Tk + 2Tk + Pk + Pg3 + h + IS)	2.2 Pf
Triode (Section 2)	
Grid to Plate	3.8 Pf
Input: 2Tg to (2Tk + Pk + Pg3 + h + IS)	2.8 Pf
Output: 2Tp to (2Tk + Pk + Pg3 + h + IS)	3.8 Pf
Pentode Section	
Grid No. 1 to Plate	0.13 Pf
Input: Pg1 to (2Tk + Pk + Pg2 + Pg3 + h + IS)	10 Pf
Output: Pp to (2Tk + Pk + Pg2 + Pg3 + h + IS)	4.6 Pf
Coupling	
Pentode Plate to Triode Plate (Section 2) (Max.)	0.16 Pf
Triode Plate (Section 1) to Triode Plate (Section 2)	0.2 Pf

RATINGS (Design Maximum Rating System)

Pentode Section	
Plate Voltage	330 Volts
Screen Supply Voltage	330 Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)
Positive DC Grid No. 1 Voltage	0 Volt
Plate Dissipation	4.0 Watts
Screen Dissipation	1.1 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias	1.0 Megohm
Cathode Bias	1.0 Megohm
Triode (Section 1)	
Plate Voltage	330 Volts
Positive DC Grid Voltage	0 Volt
Plate Dissipation	1.5 Watts
Grid Circuit Resistance	
Fixed Bias	0.5 Megohm
Cathode Bias	1.0 Megohm
Triode (Section 2)	
Plate Voltage	330 Volts
Positive DC Grid Voltage	0 Volt
Plate Dissipation	2.0 Watts
Grid Circuit Resistance	
Fixed Bias	0.5 Megohm
Cathode Bias	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

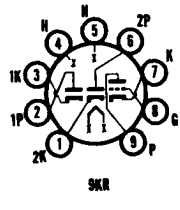
Pentode Section		
Plate Voltage	35	135 Volts
Screen Voltage	135	135 Volts
Grid No. 1 Voltage	0	— Volt
Cathode Bias Resistor	—	100 Ohms
Plate Resistance (Approx.)	—	45,000 Ohms
Transconductance	—	10,400 μmhos
Plate Current	34	17 Ma
Screen Current	13	4.0 Ma
Grid No. 1 Voltage (Approx.)		
Ib = 100 μa	—	-6 Volts
Triode (Section 1)		
Plate Voltage		200 Volts
Grid Voltage		-2.0 Volts
Amplification Factor		68
Plate Resistance (Approx.)		12,400 Ohms
Transconductance		5500 μmhos
Plate Current		7.0 Ma
Grid Voltage (Approx.)		
Ib = 100 μa		-5.5 Volts
Triode (Section 2)		
Plate Voltage		200 Volts
Cathode Bias Resistor		220 Ohms
Amplification Factor		41
Plate Resistance (Approx.)		9400 Ohms
Transconductance		4400 μmhos
Plate Current		9.2 Ma
Grid Voltage (Approx.)		
Ib = 100 μa		-6.5 Volts

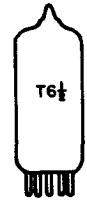
14GT8A

FM DETECTOR AF AMPLIFIER

Double Diode and High Mu Triode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9KR
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	14 Volts
Heater Current	150 Ma
Heater Warm-up Time	17 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 (Unshielded)

Triode Section	
Grid to Plate	1.8 Pf
Input: g to (h + tk)	1.6 Pf
Output: p to (h + tk)	0.24 Pf
Diode Section	
Diode No. 1 Input	2.4 Pf
Diode No. 2 Input	2.4 Pf
Diode No. 1 Cathode to All	6.5 Pf
Diode No. 2 Cathode to All	6.5 Pf
Coupling	
Grid to Diode Plate No. 1 (Max.)	0.09 Pf
Grid to Diode Plate No. 2 (Max.)	0.07 Pf

RATINGS (Design Maximum Rating System)

Triode	
Plate Voltage (Max.)	330 Volts
Positive DC Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	1.1 Watts
Diodes	
DC Current (Each Plate) (Max.)	5.0 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier	
Plate Voltage	250 Volts
Grid Voltage	−3 Volts
Plate Current	0.7 Ma
Transconductance	1000 μmhos
Amplification Factor	72
Plate Resistance (Approx.)	72,000 Ohms
Diodes	
Average Current Each Plate with 5 Volts DC Applied(1)	18 Ma

NOTE:

(1) Test condition only.

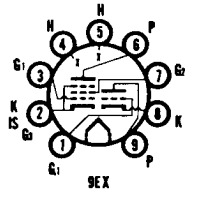
OSCILLATOR (T) AUDIO POWER AMPLIFIER (P)

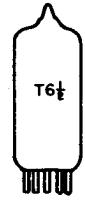
16A8/PCL82

8B8, 11BM8

Triode and Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9EX
Outline	6-4
Maximum Diameter	0.875 In.
Maximum Seated Height	2.812 In.
Maximum Overall Height	3.062 In.





ELECTRICAL DATA

HEATER OPERATION

	8B8	11BM8	16A8/PCL82
Heater Voltage	8	10.7	16 Volts
Heater Current	600	450	300 Ma
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			200 Volts
Heater Positive with Respect to Cathode			200 Volts

DIRECT INTERELECTRODE CAPACITANCES

Triode Section

Grid to All Other Elements Except Plate	2.7 Pf
Plate to All Other Elements Except Grid	4.3 Pf
Plate to Grid	4.2 Pf
Grid to Heater (Max.)	0.02 Pf

Pentode Section

Grid No. 1 to All Other Elements Except Plate	9.3 Pf
Plate to All Other Elements Except Grid No. 1	8.0 Pf
Plate to Grid No. 1 (Max.)	0.3 Pf
Grid No. 1 to Heater (Max.)	0.3 Pf

Coupling

Triode Plate to Pentode Grid No. 1 (Max.)	0.02 Pf
Triode Grid to Pentode Plate (Max.)	0.02 Pf
Triode Grid to Pentode Grid No. 1 (Max.)	0.025 Pf
Triode Plate to Pentode Plate (Max.)	0.25 Pf

RATINGS (Design Center Rating System)

Pentode Section

Plate Voltage Without Plate Current (Max.)	550 Volts
Plate Voltage (Max.)	250 Volts
Peak Plate Voltage (Max.)(1)	2500 Volts
Peak Inverse Plate Voltage (Max.)	500 Volts
Plate Dissipation (Max.)	5 Watts
Peak Plate Dissipation (Max.)	7 Watts
Grid No. 2 Voltage Without Current (Max.)	550 Volts
Grid No. 2 Voltage (Max.)	250 Volts
Grid No. 2 Dissipation (Max.)	1.8 Watts
Peak Grid No. 2 Dissipation (Max.)	3.2 Watts
Cathode Current (Max.)	50 Ma
Grid No. 1 Circuit Resistance With Automatic Bias (Max.)	2 Megohms
Grid No. 1 Circuit Resistance With Fixed Bias (Max.)	1 Megohm
Circuit Resistance Between Heater and Cathode (Max.)	20,000 Ohms

Triode Section

Plate Voltage Without Plate Current (Max.)	550 Volts
Plate Voltage (Max.)	250 Volts
Peak Plate Voltage (Max.)(1)	600 Volts
Plate Dissipation (Max.)	1 Watt
Cathode Current (Max.)	15 Ma
Grid Circuit Resistance With Automatic Bias (Max.)	3 Megohms
Grid Circuit Resistance With Fixed Bias (Max.)	1 Megohm
Voltage Between Heater and Cathode (Max.)	200 Volts
Circuit Resistance Between Heater and Cathode (Max.)	20,000 Ohms
Grid Circuit Impedance (Freq. = 50 Hz) (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Pentode Section

Plate Voltage	100	170	200	200 Volts
Grid No. 2 Voltage	100	170	200	200 Volts
Grid No. 1 Bias	−6.0	−11.5	−12.5	−16 Volts
Plate Current	26	41	35	35 Ma
Grid No. 2 Current	5.0	8.0	6.5	7.0 Ma
Transconductance	6800	7500	6800	6400 μmhos
Plate Resistance	15,000	16,000	20,500	20,000 Ohms
Amplification Factor of Grid No. 2 With Respect to Grid No. 1	10	9.5	9.5	9.5

Triode Section

Plate Voltage	100 Volts
Grid Voltage	0 Volt
Plate Current	3.5 Ma
Transconductance	2500 μmhos
Amplification Factor	70

NOTE:

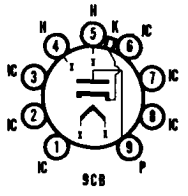
(1) Maximum pulse duration 4% of one cycle with a maximum of 0.8 millisecond.

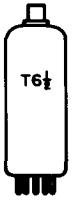
DAMPER

16AQ3/XY88

Heater-Cathode Diode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Top Cap C1-2
Basing 9CB
Outline
Maximum Diameter .....0.875 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.500 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	16.4 Volts
Heater Current	600 Ma
Maximum Heater-Cathode Voltage (Peak)	6600 Volts

DIRECT INTERELECTRODE CAPACITANCES

Plate to All Other Elements	8.6 Pf
Cathode to Heater	2.0 Pf

RATINGS (Design Center Rating System)

Supply Voltage (Without Current) (Max.)	550 Volts
Supply Voltage (Max.)	250 Volts
Plate Current (Max.)	220 Ma
Peak Plate Current (Max.)	550 Ma
Plate Dissipation (Max.)	5 Watts
Peak Negative Plate Voltage(1),(2) (Max.)	6000 Volts

NOTES:

(1) Maximum pulse duration 22% of a cycle with a maximum of 18 μsec.
(2) Absolute maximum ratings 7500 volts.

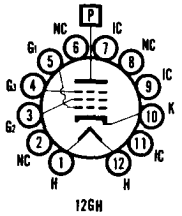
HORIZONTAL DEFLECTION AMPLIFIER

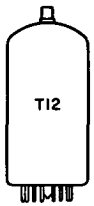
16KA6

21KA6

Beam Power Pentode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Top Cap C1-3
Basing 12GH
Outline 12-79
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.250 In.
Maximum Overall Height .....3.625 In.





ELECTRICAL DATA

HEATER OPERATION

	21KA6	16KA6
Heater Voltage	21	15.8 Volts
Heater Current	450	600 Ma
Heater Warm-up Time	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 (Unshielded)

Grid No. 1 to Plate	0.6 Pf
Input: g1 to (h + k + g3)	23 Pf
Output: p to (h + k + g2 + g3)	8.5 Pf

RATINGS (Design Maximum Rating System)

Horizontal Deflection Amplifier(1)

DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Pulse Plate Voltage (Max.)	6500 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
Plate Dissipation (Max.)(2)	18 Watts
Negative Grid No. 1 Voltage (Max.)	55 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Grid No. 2 Dissipation (Max.)	3.5 Watts
Positive DC Grid No. 3 Voltage (Max.)	70 Volts
Average Cathode Current (Max.)	230 Ma
Peak Cathode Current (Max.)	800 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature (At Hottest Point) (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	5000	130 Volts
Grid No. 3 Voltage	0	0 Volt
Grid No. 2 Voltage	130	130 Volts
Grid No. 1 Voltage	—	–20 Volts
Plate Current	—	50 Ma
Grid No. 2 Current	—	1.75 Ma
Transconductance	—	9100 μmhos
Plate Resistance	—	11,000 Ohms
Amplification Factor(3)	—	4.7
Ec1 for Ib = 1.0 Ma (Approx.)	–66	–33 Volts

INSTANTANEOUS PLATE KNEE VALUES

Eb = 60 V; Ec2 = 130 V, Ec1 = 0 V and Ec3 = 0 V
Ib = 410 Ma; and Ic2 = 24 Ma
Eb = 60 V; Ec2 = 130 V, Ec1 = 0 V and Ec3 = +25 V
Ib = 410 Ma; Ic2 = 23 Ma and Ic3 = 2 Ma

NOTES:

(1) 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 horizontal scanning cycle.
(2) 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.
(3) Amplification factor with tube operating as a triode with 130 volts on the plate and Grid No. 2 and –20 volts on Grid No. 1.

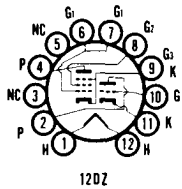
16LU8A

Color Television Type

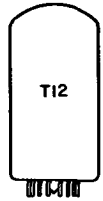
VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

High Mu Triode and Beam Power Pentode

Construction	Compactron T-12
Base	E12-74
Basing	12DZ
Outline	12-56
Maximum Diameter	1.562 In.
Maximum Seated Height	2.500 In.
Maximum Overall Height	2.875 In.



12DZ



ELECTRICAL DATA

HEATER OPERATION

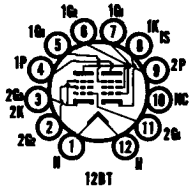
Heater Voltage	16 Volts
Heater Current	600 Ma
Heater Warm-up Time	11 Seconds

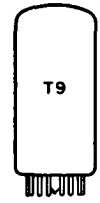
The 16LU8A is identical to the 6LU8 except for shorter bulb length and Heater Characteristic

FM LIMITER/DISCRIMINATOR AUDIO POWER AMPLIFIER

17AB10

Double Dissimilar Pentode





Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12BT
Outline	9-58
Maximum Diameter	1.188 In.
Maximum Seated Height	2.000 In.
Maximum Overall Height	2.375 In.

ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	16.8 Volts
Heater Current	450 Ma
Heater Warm-up Time	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 (Unshielded)

Gated-Beam Discriminator Section No. 1	
Grid No. 1 to Grid No. 3	0.01 Pf
Grid No. 1 to All	4.4 Pf
Grid No. 3 to All	3.2 Pf
Audio Amplifier Section No. 2	
Grid No. 1 to Plate	0.22 Pf
Input	12 Pf
Output	7.5 Pf

RATINGS (Design Maximum Rating System)

Gated-Beam Discriminator Section No. 1	
Plate-Supply Voltage	330 Volts
Accelerator-Supply Voltage	330 Volts
Peak Positive Grid No. 1 Voltage	60 Volts
DC Cathode Current	13 Ma
Audio Amplifier 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 Megohm
Cathode Bias	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Gated-Beam Discriminator Section No. 1			
Plate Voltage	135	135	135 Volts
Accelerator Voltage	75	—	— Volts
Accelerator-Supply Voltage	—	280	280 Volts
Accelerator Resistor	—	33,000	33,000 Ohms
Grid No. 1 Voltage	0	0	0 Volt
Grid No. 3 Voltage	+4.0	+4.0	0 Volts
Plate Current	—	5.0	— Ma
Accelerator Current	4.5	—	— Ma
Grid No. 1 Transconductance	—	—	360 μmhos
Grid No. 3 Transconductance	—	—	700 μmhos
Grid No. 1 Voltage (Approx.) Ib = 20 μa	—	—	−4 Volts
Grid No. 3 Voltage (Approx.) Ib = 20 μa	—	—	−4 Volts
Audio Amplifier Section No. 2			
Plate Voltage			145 Volts
Screen Voltage			110 Volts
Grid No. 1 Voltage			−6.0 Volts
Peak AF Grid No. 1 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 Percent
Maximum Signal Power Output	2.4 Watts

17BF11A

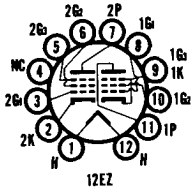
Color Television Type

AUDIO POWER AMPLIFIER FM DETECTOR

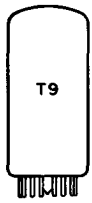
Beam Pentode and Sharp Cutoff Pentode

Construction	*Compactron T-9*
Base	Button 12 Pin, E12-70
Basing	12EZ
Outline	
Maximum Diameter	1.188 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	*2.250 In.*

The 17BF11A is identical to the 17BF11 except for shorter bulb.



12EZ

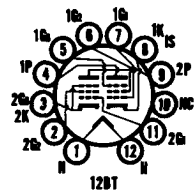


17X10

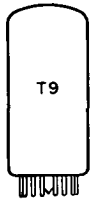
FM LIMITER/DISCRIMINATOR AUDIO POWER AMPLIFIER

Double Dissimilar Pentode

Construction	Compactron T-9
Base	Button 12 Pin, E12-70
Basing	12BT
Outline	9-59
Maximum Diameter	1.188 In.
Maximum Seated Height	2.250 In.
Maximum Overall Height	2.625 In.



12BT



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	16.8 Volts
Heater Current	450 Ma
Heater Warm-up Time	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 (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 Rating System)

Section No. 1

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

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 Megohm
Cathode Bias			0.5 Megohm
CHARACTERISTICS AND TYPICAL OPERATION			
Section 1			
Gated Beam Discriminator Section—Limiter/Discriminator Service			
Input Signal Center Frequency	10.7	10.7	4.5 MHz
Frequency Deviation	±75	±75	±25 KHz
Plate Supply Voltage	85	285	270 Volts
Plate Voltage	62	122	121 Volts
Accelerator Voltage	55	100	100 Volts
Cathode Bias Resistor-Variable(1)	200-400	200-400	200-400 Ohms
Plate Load Resistor	0.085	0.330	0.330 Megohm
Plate Linearity Resistor	470	1500	1000 Ohms
Integrating Capacitor	0.002	0.001	0.001 μf
Coupling Capacitor	0.25	0.01	0.25 μf
Minimum Signal Voltage for Limiting Action, RMS(2)	1.25	1.25	1.25 Volts
DC Plate Current	0.25	0.49	0.44 Ma
Accelerator Current	4.1	9.8	10 Ma
Input Signal Level for AM Rejection Adjustment(1)	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 Percent
Maximum Signal Power Output			2.4 Watts

NOTES:

(1) 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.

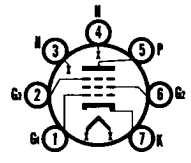
(2) At signal levels above specified value, limiting is within ±3 decibels. Adequate shielding between components of the limiter grid and the quadrature grid must be used to insure proper phasing of the voltage developed at the quadrature grid. Standard de-emphasis requirements for FM are included. The 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 10Pf. The capacitance may be composed of tube input capacitance, stray capacitance, and distributed capacitance, as well as physical.

RF/IF AMPLIFIER

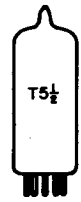
18FW6A

Semi-Remote Cutoff Pentode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7BK
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7BK



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	18 Volts
Heater Current	100 Ma
Heater Warm-up Time	20 Seconds

Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
Total DC and Peak	100 Volts
Heater Positive with Respect to Cathode	
Total DC and Peak	100 Volts
DIRECT INTERELECTRODE CAPACITANCES (Shielded)(1)	
Grid No. 1 to Plate (Max.)	0.0035 Pf
Input	5.5 Pf
Output	5.0 Pf
RATINGS (Design Maximum Rating System)	
Plate Voltage (Max.)	150 Volts
Grid No. 2 Supply Voltage (Max.)	150 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	2.5 Watts
Grid No. 2 Dissipation (Max.)	0.6 Watt
CHARACTERISTICS AND TYPICAL OPERATION	
Plate Voltage	100 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Grid No. 2 Voltage	100 Volts
Cathode Bias Resistor	68 Ohms
Plate Current	11 Ma
Grid No. 2 Current	4.4 Ma
Transconductance	4400 μmhos
Plate Resistance (Approx.)	0.25 Megohm
Grid No. 1 Voltage for gm = 25 μmhos	−20 Volts

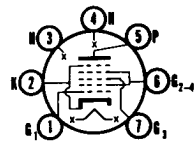
NOTE:
(1) External shield No. 316 connected to Pin No. 7 (cathode).

18FX6A

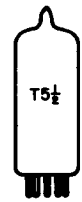
CONVERTER/AMPLIFIER

Pentagrid Type

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7CH
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7 CH



ELECTRICAL DATA

HEATER OPERATION	
Heater Voltage	18 Volts
Heater Current	100 Ma
Heater Warm-up Time	20 Seconds
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
Total DC and Peak	100 Volts
Heater Positive with Respect to Cathode	
Total DC and Peak	100 Volts

DIRECT INTERELECTRODE CAPACITANCES	**Shielded**(1)	**Unshielded**
Grid No. 3 to Plate (Max.)	0.25	0.30 Pf
Grid No. 3 to Grid No. 1 (Max.)	0.15	0.15 Pf
Grid No. 3 Input:		
g3 to (h + k + g1 + g2 + g4 + g5 + p)	7.0	7.0 Pf
Grid No. 1 Input:		
g1 to (h + k + g2 + g4 + g3 + g5 + p)	5.5	5.5 Pf
Output: p to (h + k + g1 + g2 + g4 + g3 + g5)	13.0	8.0 Pf
Grid No. 1 to Cathode	3.0	3.0 Pf
Cathode to All Electrodes Except Grid No. 1	20.0	15.0 Pf
Grid No. 1 to Plate	0.05	0.1 Pf

RATINGS (Design Maximum Rating System)	
Plate Voltage (Max.)	150 Volts
Grid No. 2 and Grid No. 4 Supply Voltage (Max.)	150 Volts
Grid No. 2 and Grid No. 4 Voltage (Max.)	110 Volts
Plate Dissipation (Max.)	1.0 Watt
Grid No. 2 and Grid No. 4 Dissipation (Max.)	1.2 Watts
CHARACTERISTICS AND TYPICAL OPERATION	
Separate Excitation(2)	
Plate Voltage	100 Volts
Grid No. 2 Voltage	100 Volts

Grid No. 3 Voltage	−1.5 Volts
Grid No. 1 Resistance	20,000 Ohms
Grid No. 1 Current	0.5 Ma
Plate Current	2.3 Ma
Grid No. 2 Current	6.2 Ma
Conversion Transconductance	480 μmhos
Plate Resistance (Approx.)	0.4 Megohm
Cathode Current	9 Ma
Grid No. 3 Voltage (Approx.) for Gc = 10 μmhos	−21 Volts
Oscillator Section Characteristics (Non-Oscillating)	
Grid No. 3 Voltage	0 Volt
Grid No. 1 Voltage	0 Volt
Grid No. 2 Connected to Plate	100 Volts
Cathode Current	24 Ma
Transconductance Between Grid No. 1 and Grid No. 2 and Grid No. 4 Connected to Plate	7000 μmhos
Amplification Factor Between Grid No. 1 and Grid No. 2 and Grid No. 4 Connected to Plate	22
Grid No. 1 Voltage (Approx.) for Ib = 20 μa	−9.2 Volts

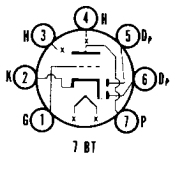
NOTES:
(1) Shield No. 316 connected to cathode.
(2) Data for self-excitation in a zero bias circuit corresponds closely to that for separate excitation.

DETECTOR AF AMPLIFIER

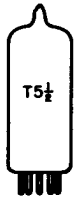
18FY6A

Double Diode and High Mu Triode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7BT
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.



7 BT



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	18 Volts
Heater Current	100 Ma
Heater Warm-up Time	20 Seconds
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
Total DC and Peak	100 Volts
Heater Positive with Respect to Cathode	
Total DC and Peak	100 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded(1)	Unshielded
Grid to Plate	1.8	1.8 Pf
Input	2.4	2.4 Pf
Output	0.2	0.22 Pf
Grid to Diode No. 2 Plate (Max.)	0.2	0.2 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	150 Volts
Plate Dissipation (Max.)	0.5 Watt
Positive Grid Voltage (Max.)	0 Volt
Diode Plate Current (Each Diode) (Max.)	1.0 Ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A1 Amplifier

Plate Voltage	100 Volts
Grid Voltage	−1 Volt
Plate Current	0.6 Ma
Plate Resistance	77,000 Ohms
Transconductance	1300 μmhos
Amplification Factor	100
Average Diode Current, Each Diode with 10 Volts DC Applied(2)	2.0 Ma

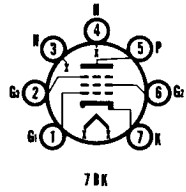
NOTES:
(1) Shield No. 316 connected to Pin No. 2.
(2) Test condition only.

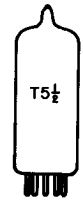
18GD6A

RF/IF AMPLIFIER

Sharp Cutoff Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7BK
Outline 5-2
Maximum Diameter .....0.750 In.
Maximum Seated Height .....1.875 In.
Maximum Overall Height .....2.125 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	18 Volts
Heater Current	100 Ma
Heater Warm-up Time	20 Seconds
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
Total DC and Peak	100 Volts
Heater Positive with Respect to Cathode	
Total DC and Peak	100 Volts
DIRECT INTERELECTRODE CAPACITANCES (Shielded)(1)	
Grid No. 1 to Plate (Max.)	0.0035 Pf
Input: g1 to (h + k + g2 + g3 + IS)	6.0 Pf
Output: p to (h + k + g2 + g3 + IS)	5.0 Pf
RATINGS (Design Maximum Rating System)	
Plate Voltage Max.)	150 Volts
Grid No. 2 Supply Voltage (Max.)	150 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)
Plate Dissipation (Max.)	2.5 Watts
Grid No. 2 Dissipation (Max.)	0.6 Watts
CHARACTERISTICS AND TYPICAL OPERATION	
Plate Voltage	100 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Grid No. 2 Voltage	100 Volts
Cathode Bias Resistor	150 Ohms
Plate Current	5 Ma
Grid No. 2 Current	2.0 Ma
Transconductance	4300 μmhos
Plate Resistance (Approx.)	0.5 Megohm
Ec1 for Ib = 10 μa (Approx.)	−4.7 Volts

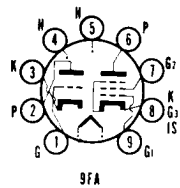
NOTE:
(1) External Shield No. 316 connected to Pin No. 7 (cathode).

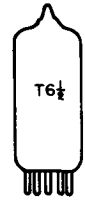
19HV8

IF AMPLIFIER (P)
AF AMPLIFIER (T)

High Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9FA
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	18.9 Volts
Heater Current	150 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

	Shielded(1)	Unshielded
Pentode Section		
Grid No. 1 to Plate	—	0.016 Pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + IS)	5.5	5.5 Pf
Output: Pp to (h + Pk + Pg2 + Pg3 + IS)	3.4	2.4 Pf
Heater to Cathode	2.8(2)	2.8 Pf
Triode Section		
Grid to Plate	0.9	0.9 Pf
Input: Tg to (Tk + h + Pk + Pg3 + IS)	1.9	1.7 Pf
Output: Tp to (Tk + h + Pk + Pg3 + IS)	2.6	1.7 Pf
Heater to Cathode	2.8(2)	2.8 Pf

RATINGS (Design Maximum Rating System)

	Pentode Section	Triode Section
Plate Voltage	330	330 Volts
Screen Supply Voltage	330	— Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive DC Grid No. 1 Voltage	0	0 Volt
Plate Dissipation	3.0	0.55 Watts
Screen Dissipation	0.55	— Watt
Grid No. 1 Circuit Resistance		
Fixed Bias	0.25	0.5 Megohm
Cathode Bias	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Pentode Section	Triode Section
Plate Voltage	125	100 Volts
Screen Voltage	125	— Volts
Grid No. 1 Voltage	−1.0	−1.0 Volt
Amplification Factor	—	70
Plate Resistance (Approx.)	200,000	54,000 Ohms
Transconductance	6500	1300 μmhos
Plate Current	12	0.8 Ma
Screen Current	4.0	— Ma
Grid No. 1 Voltage (Approx.) Ib = 50 μa	—	−1.5 Volts
Grid No. 1 Voltage (Approx.) Ib = 20 μa	−9	— Volts

NOTES:

(1) With external shield (EIA 315) connected to cathode of section under test unless otherwise indicated.

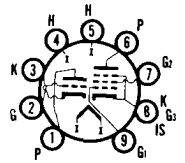
(2) With external shield (EIA 315) connected to ground.

OSCILLATOR and MIXER

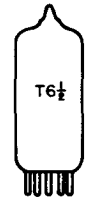
19KG8

Medium Mu Triode and Sharp Cutoff Pentode

Construction	Miniature T-6½
Base	Button 9 Pin, E9-1
Basing	9LY
Outline	6-2
Maximum Diameter	0.875 In.
Maximum Seated Height	1.937 In.
Maximum Overall Height	2.187 In.



9LY



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	18.9 Volts
Heater Current	150 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 (Shielded)(1)

Pentode Section	
Grid No. 1 to Plate (Max.)	0.01 Pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + IS)	5.5 Pf
Output: Pp to (h + Pk + Pg2 + Pg3 + IS)	3.4 Pf
Triode Section	
Grid to Plate	1.7 Pf
Input: g to (h + Tk + Pk + Pg3 + IS)	3.2 Pf
Output: p to (h + Tk + Pk + Pg3 + IS)	2.2 Pf

RATINGS (Design Maximum Rating System)

	Pentode Section	Triode Section
Plate Voltage (Max.)	300	300 Volts
Screen Supply Voltage (Max.)	300	— Volts
Screen Voltage	See Rating Chart (Gen. Info. Sec.)	
Positive DC Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	2.5	2.5 Watts
Screen Dissipation (Max.)	0.55	— Watt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	2.2	2.2 Megohms
Cathode Bias (Max.)	2.2	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

	Pentode Section	Triode Section
Plate Voltage	125	125 Volts
Screen Voltage	125	— Volts
Grid No. 1 Voltage	-1.0	-1.0 Volt
Amplification Factor	—	46
Plate Resistance (Approx.)	200,000	5400 Ohms
Transconductance	7500	8500 μmhos
Plate Current	12	13.5 Ma
Screen Current	4.0	— Ma
Grid No. 1 Voltage (Approx.)		
Ib = 10 μa	-8	-8 Volts

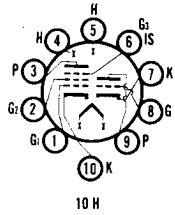
NOTE:
(1) With external shield (EIA 315) connected to cathode of section under test.

1909

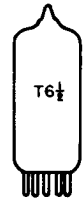
RF AMPLIFIER and AUTODYNE MIXER

Medium Mu Triode and *Semi-Remote Cutoff Pentode*

Construction ..... Miniature T-6½
Base ..... Button 10 Pin, E9-1
With Center Pin Added
Basing 10H
Outline 6-13
Maximum Diameter ..... 0.875 In.
Maximum Seated Height ..... 1.940 In.
Maximum Overall Height ..... 2.190 In.



10 H



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	18.9 Volts
Heater Current	150 Ma
Heater Warm-up Time	17 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

	Shielded(1)	Unshielded
Triode Section		
Grid to Plate	1.7	1.7 Pf
Input: g to (h + k + Pk + IS)	3.2	3.2 Pf
Output: p to (h + k + Pk + IS)	1.9	1.1 Pf
Heater to Cathode	3.0	3.0 Pf

Pentode Section		
Grid No. 1 to Plate (Max.)	0.035	0.050 Pf
Input: g1 to (h + k + g2 + Pk + IS)	5.0	5.0 Pf
Output: p to (h + k + g2 + Pk + IS)	3.3	2.4 Pf
Heater to Cathode	3.0(2)	3.0 Pf
Coupling		
Pentode g1 to Triode Plate (Max.)	0.030	0.035 Pf
Pentode Plate to Triode Plate (Max.)	0.030	0.13 Pf
Triode Grid to Pentode Plate (Max.)	0.002	0.009 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	Pentode Section
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	2.5	3.0 Watts
Grid No. 2 Dissipation (Max.)	—	0.55 Watt
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Self Bias (Max.)	1.0	1.0 Megohm

Control grid to cathode spacing in the triode section of this type is of such order to magnitude as to preclude the use of voltage between these elements of more than 100 volts dc or peak ac in commercial tube checkers and shorts indicating devices, particularly where mechanical excitation of the tube is employed.

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	Pentode Section
Class A1 Amplifier		
Plate Voltage	125	125 Volts
Grid No. 2 Voltage	—	125 Volts
Grid No. 1 Voltage	-1.0	-1.0 Volt
Plate Current	14	12 Ma
Grid No. 2 Current	—	4.0 Ma
Transconductance	8000	6500 μmhos
Amplification Factor	40	—
Plate Resistance	5000	200 K Ohms
Grid No. 1 Voltage for Ib = 20 μa (Approx.)	-9	-9
Gm with Ec1 = 0 V, Eb = 100 V and Ec2 = 70 V	—	7000 μmhos

NOTES:

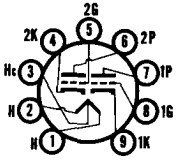
(1) Shield No. 315 connected to Pin No. 4.
(2) Shield No. 315 connected to Pin No. 3.

AF AMPLIFIER

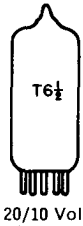
20EZ7

Twin High Mu Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9PG
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9PG



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	20/10 Volts
Heater Current	100/200 Ma
Heater Warm-up Time	20 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 (Unshielded)

	Section No. 1	Section No. 2
Grid to Plate	1.5	1.5 Pf
Grid to Cathode and Heater	1.6	1.6 Pf
Plate to Cathode and Heater	0.2	0.3 Pf

RATINGS (Design Maximum Rating System) (Each Section)

Plate Voltage (Max.)	330 Volts
Grid Voltage	
Negative Bias Value (Max.)	55 Volts
Positive Bias Value (Max.)	0 Volt
Plate Dissipation (Max.)	1.2 Watts

CHARACTERISTICS AND TYPICAL OPERATION (Each Section)

Plate Voltage	100	250 Volts
Grid Voltage	−1	−2 Volts
Amplification Factor	100	100
Plate Resistance	80,000	62,500 Ohms
Transconductance	1250	1600 μmhos
Plate Current	0.5	1.2 Ma

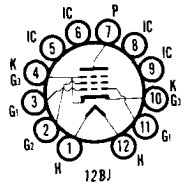
21HB5A

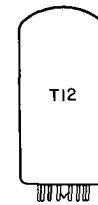
HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Basing 12BJ
Outline 12-58
Maximum Diameter .....1.563 In.
Maximum Seated Height .....3.000 In.
Maximum Overall Height .....3.375 In.

The 21HB5A is identical to the 21HB5 except for Rp = 9900 Ohms, Gm = 9000 μmhos, *Ib = 46 Ma, Ic2 = 1.8 Ma, Ec1 (for Ib = 1 Ma)* −32 V and Triode amplification factor = 4.8.





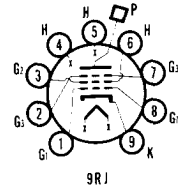
21KQ6

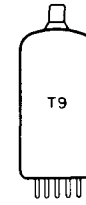
29KQ6

HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction T-9
Base .....Button 9 Pin, E9-23
Top Cap C1-1
Basing 9RJ
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.760 In.
Maximum Overall Height .....4.133 In.





ELECTRICAL DATA

HEATER OPERATION

	29KQ6	21KQ6
Heater Voltage	29	21.5 Volts
Heater Current	300	450 Ma
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
DC		240 Volts
Total DC and Peak		240 Volts
Heater Positive with Respect to Cathode		
DC		240 Volts
Total DC and Peak		240 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid No. 1 to Plate	1.5 Pf
Input: g1 to (h + k + g2 + g3)	27 Pf
Output: p to (h + k + g2 + g3)	11 Pf
Grid No. 1 to Heater	0.12 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	275 Volts
Plate Voltage without Plate Current (Max.)	600 Volts

Peak Positive Pulse Plate Voltage (Max.)(1)	6500 Volts
Peak Negative Pulse Plate Voltage (Max.)(1)	1650 Volts
Grid No. 3 Voltage (Max.)	70 Volts
Grid No. 2 Voltage (Max.)	275 Volts
Grid No. 2 Voltage without Grid No. 2 Current (Max.)	600 Volts
Peak Negative Pulse Grid No. 1 Voltage (Max.)	330 Volts
Plate Dissipation (Max.)	17 Watts
Grid No. 2 Dissipation	See Rating Chart (Gen. Info. Sec.)
Cathode Current DC (Max.)	275 Ma
Grid No. 1 Circuit Resistance (Max.)	0.5 Megohm
Grid No. 1 Circuit Resistance for Horizontal Deflection Amplifier Circuit Only (Max.)	2.2 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	40	50 Volts
Grid No. 3 Voltage(3)	0	0 Volt
Grid No. 2 Voltage	135	200 Volts
Grid No. 2 Circuit Resistance(2)	820	0 Ohms
Grid No. 1 Voltage	0	−12 Volts
Plate Current	450	550(4) Ma
Grid No. 2 Current	35	50(4) Ma

NOTES:

(1) For application in horizontal deflection amplifiers circuits where the maximum pulse duration is 22% of a cycle with a maximum of 18 μsec.

(2) To prevent an excessive maximum grid No. 2 dissipation value, during the heating-up period the following minimum values of grid No. 2 circuit resistance are required:

Grid No. 2 Supply Voltage (Volts)	Grid No. 2 Circuit Resistance (Ohms)
135	820
170	1200
230	2200

(3) In case that an optimum suppression of Barkhausen oscillations and/or snivets is required the Grid No. 3 may be connected to a positive voltage of about 15 to 40 volts. It should, however, be noted that the current to Grid No. 3 is dependent upon the plate load of tube and may vary between 1 and 4 Ma.

(4) This value can be measured by a method involving a recurrent waveform such that the maximum ratings of the tube will not be exceeded.

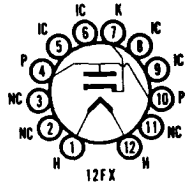
DAMPER

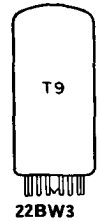
22BW3

6BW3, 17BW3

Heater-Cathode Diode

Construction.....Compactron T-9
Base ..... Button 12 Pin E12-70
Basing 12FX
Outline 9-60
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.500 In.
Maximum Overall Height .....2.875 In.





ELECTRICAL DATA

HEATER OPERATION	6BW3	17BW3	22BW3
Heater Voltage	6.3	16.8	22.4 Volts
Heater Current	1600	600	450 Ma
Heater Warm-up Time	—	11	11 Seconds

Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
DC	900 Volts
Total DC and Peak	5000 Volts
Heater Positive with Respect to Cathode	
DC	100 Volts
Total DC and Peak	300 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)	
Heater to Cathode	3.8 Pf
Plate to Cathode and Heater	6.0 Pf
Cathode to Plate and Heater	8.5 Pf
RATINGS (Design Maximum Rating System)	
Damper Service	
Peak Inverse Plate Voltage (Max.)(1)	5000 Volts
Plate Dissipation (Max.)	6.5 Watts
Steady State Peak Current (Max.)	1100 Ma
DC Plate Current (Max.)	175 Ma

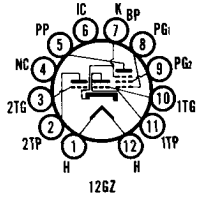
NOTE:
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

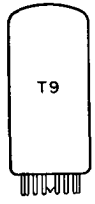
23Z9

VERTICAL DEFLECTION AMP. (P)
VERTICAL DEFLECTION OSC. (T)
GENERAL PURPOSE AMPLIFIER (T)

Medium Mu Triode, High Mu Triode and Beam Power Pentode

Construction.....Compactron T-9
Base .....Button 12 Pin, E12-70
Basing 12GZ
Outline 9-58
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.000 In.
Maximum Overall Height .....2.375 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	23 Volts
Heater Current	450 Ma
Heater Warm-up Time	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 (Unshielded)

Triode (Section 1)	
Grid to Plate	3.0 Pf
Input: 1Tg to (h + k + Pbp)	3.0 Pf
Output: 1Tp to (h + k + Pbp)	0.4 Pf
Triode (Section 2)	
Grid to Plate	3.8 Pf
Input: 2Tg to (h + k + Pbp)	2.0 Pf
Output: 2Tp to (h + k + Pbp)	0.44 Pf

RATINGS (Design Maximum Rating System)

Pentode Section—Vertical Deflection Amplifier Service(1)	
DC Plate Voltage (Max.)	250 Volts
Peak Pulse Plate Voltage (Max.)	2000 Volts
Screen Voltage (Max.)	200 Volts
Peak Negative Grid No. 1 Voltage (Max.)	150 Volts
Plate Dissipation (Max.)	7.0 Watts
Screen Dissipation (Max.)	1.8 Watts
Total DC Plate and Screen Current (Max.)	70 Ma
Total Peak Plate and Screen Current (Max.)	245 Ma
Grid No. 1 Circuit Resistance	
Fixed Bias	1.0 Megohm
Triode Section 1	
Plate Voltage (Max.)	330 Volts
Positive DC Grid Voltage (Max.)	0 Volt
Plate Dissipation (Max.)	1.25 Watts
Grid Circuit Resistance	
Fixed Bias (Max.)	0.5 Megohm
Triode Section 2—Vertical Oscillator Service(1)	
DC Plate Voltage (Max.)	250 Volts
Peak Negative Grid Voltage (Max.)	400 Volts
Plate Dissipation (Max.)	1.0 Watt
DC Plate Current (Max.)	20 Ma
Peak Plate Current (Max.)	70 Ma
Grid Circuit Resistance	
Fixed Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Pentode Section		
Plate Voltage	45	120 Volts
Screen Voltage	110	110 Volts

Grid No. 1 Voltage	0(2)	−8.0 Volts
Plate Resistance (Approx.)	—	11,700 μmhos
Transconductance	—	7100 Ma
Plate Current	122	46 Ma
Screen Current	16.5	3.5 Ma
Grid No. 1 Voltage (Approx.)		
Ib = 100 μa	—	−25 Volts
Triode Section 1		
Plate Voltage		150 Volts
Grid Voltage		−2.0 Volts
Amplification Factor		43
Plate Resistance (Approx.)		11,000 Ohms
Transconductance		3900 μmhos
Plate Current		5.4 Ma
Grid Voltage (Approx.) Ib = 10 μa		−5.7 Volts
Triode Section 2		
Plate Voltage		150 Volts
Grid Voltage		−5.0 Volts
Amplification Factor		20
Plate Resistance (Approx.)		8500 Ohms
Transconductance		2350 μmhos
Plate Current		5.5 Ma
Grid Voltage (Approx.) Ib = 10 μa		−11 Volts

NOTES:

(1) 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 horizontal scanning cycle.

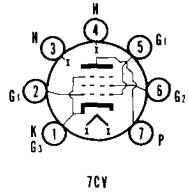
(2) Applied for short interval (two seconds maximum) so as not to damage tube.

AUDIO POWER AMPLIFIER

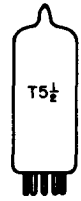
32ET5A

Beam Power Pentode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7CV
Outline	5-3
Maximum Diameter	0.750 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



7CV



ELECTRICAL DATA

HEATER OPERATION	
Heater Voltage	32 Volts
Heater Current	100 Ma
Heater Warm-up Time	20 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 (Unshielded)	
Grid No. 1 to Plate	0.6 Pf
Input: g to (h + k + g2 + g3)	12 Pf
Output: p to (h + k + g2 + g3)	6.0 Pf
RATINGS (Design Maximum Rating System)	
Plate Voltage (Max.)	150 Volts
Grid No. 2 Voltage (Max.)	130 Volts
Plate Dissipation (Max.)	5.4 Watts
Grid No. 2 Dissipation (Max.)	1.2 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.5 Megohm
CHARACTERISTICS AND TYPICAL OPERATION	
Class A1 Amplifier	
Plate Voltage	110 Volts
Grid No. 2 Voltage	110 Volts
Grid No. 1 Voltage	−7.5 Volts
Peak AF Grid No. 1 Voltage	7.5 Volts
Zero-Signal Plate Current	30 Ma

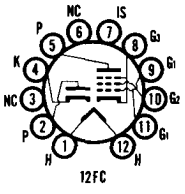
Zero-Signal Grid No. 2 Current	2.8 Ma
Transconductance	5500 μmhos
Plate Resistance (Approx.)	21,000 Ohms
Load Resistance	2800 Ohms
Maximum Signal Power Output	1.2 Watts
Total Harmonic Distortion (Approx.)	10 Percent

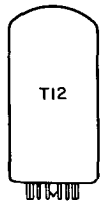
33GT7

DAMPER HORIZONTAL DEFLECTION AMPLIFIER

Diode and Beam Power Pentode

Construction	Compactron T-12
Base	Button 12 Pin, E12-74
Basing	12FC
Outline	12-56
Maximum Diameter	1.562 In.
Maximum Seated Height	2.500 In.
Maximum Overall Height	2.875 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage		33.6 Volts
Heater Current		450 Ma
Heater Warm-up Time		11 Seconds
Maximum Heater-Cathode Voltage	**Pentode**	**Diode**
Heater Negative with Respect to Cathode		
DC	—	400 Volts
Total DC and Peak	200	2500 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 k to (p + h)	8.5 Pf
Plate to Cathode and Heater p to (k + h)	5.5 Pf
Heater to Cathode (h to k)	3.2 Pf
Pentode Section	
Grid No. 1 to Plate: (g1 to p)	0.2 Pf
Input: g1 to (h + k + g2 + bp)	17 Pf
Output: p to (h + k + g2 + bp)	7.0 Pf

RATINGS (Design Maximum Rating System)

Pentode Section—Horizontal Deflection Amplifier Service(1)	
DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	400 Volts
Peak Positive Pulse Plate Voltage (Max.)	3500 Volts
Peak Negative Pulse Plate Voltage (Max.)	0 Volt
Screen Voltage (Max.)	150 Volts
Negative DC Grid No. 1 Voltage (Max.)	55 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Plate Dissipation (Max.)(2)	9.0 Watts
Screen Dissipation (Max.)	2.5 Watts
DC Cathode Current (Max.)	140 Ma
Peak Cathode Current (Max.)	490 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Diode Section—TV Damper Service	
Peak Inverse Plate Voltage (Max.)	2500 Volts
Plate Dissipation (Max.)	3.5 Watts
Steady State Peak Plate Current (Max.)	750 Ma
DC Output Current (Max.)	125 Ma
Bulb Temperature at Hottest Point (Max.)	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Pentode Section			
Plate Voltage	3500	60	130 Volts
Screen Voltage	130	130	130 Volts
Grid No. 1 Voltage	—	0(3)	-22.5 Volts
Plate Resistance (Approx.)	—	—	10,000 Ohms
Transconductance	—	—	6500 μmhos
Plate Current	—	320	48 Ma
Screen Current	—	22	2.9 Ma
Grid No. 1 Voltage (Approx.) Ib = 1.0 Ma	-60	—	-40 Volts
Triode Amplification Factor(4)	—	—	4.0

Diode Section
Tube Voltage Drop
Ib = 250 Ma DC ..... 21 Volts

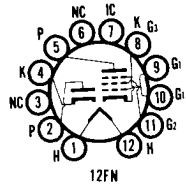
NOTES:
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
(2) In stages operating with grid leak bias, an adequate cathode bias resistor or other suitable means is required to protect the tube in the absence of excitation.
(3) Applied for short interval (two seconds maximum) so as not to damage tube.
(4) Triode connection (screen tied to plate) with Eb = Ec2 = 130 volts and Ec1 = -22.5 volts.

DAMPER HORIZONTAL DEFLECTION AMPLIFIER

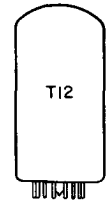
33GY7A

Diode and Beam Power Pentode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Basing 12FN
Outline 12-56
Maximum Diameter .....1.563 In.
Maximum Seated Height .....2.500 In.
Maximum Overall Height .....2.875 In.



12FN



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage		33.6 Volts
Heater Current		450 Ma
Heater Warm-up Time		11 Seconds
Maximum Heater-Cathode Voltage	**Pentode**	**Diode**
Heater Negative with Respect to Cathode		
DC	—	400 Volts
Total DC and Peak	200	4200 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: k to (p + h)	8.5 Pf
Plate to Cathode and Heater: p to (k + h)	5.2 Pf
Heater to Cathode: (h to k)	3.2 Pf

Pentode Section

Grid No. 1 to Plate: (g1 to p)	0.2 Pf
Input: g1 to (h + k + g2 + bp)	17 Pf
Output: p to (h + k + g2 + bp)	7.0 Pf

RATINGS (Design Maximum Rating System)

Horizontal-Deflection Amplifier Service(1)

	Pentode Section
DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	400 Volts
Peak Positive Pulse Plate Voltage (Max.)	5000 Volts
Peak Negative Pulse Plate Voltage (Max.)	0 Volt
Screen Voltage (Max.)	150 Volts
Negative DC Grid No. 1 Voltage (Max.)	55 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Plate Dissipation (Max.)	9.0 Watts
Screen Dissipation (Max.)(2)	3.0 Watts
DC Cathode Current (Max.)	155 Ma
Peak Cathode Current (Max.)	540 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm

TV Damper Service(1)

	Diode Section
Peak Inverse Plate Voltage	4200 Volts
Plate Dissipation	3.8 Watts
Steady State Peak Plate Current	810 Ma
DC Output Current	135 Ma
Bulb Temperature at Hottest Point	200 °C

CHARACTERISTICS AND TYPICAL OPERATION

Pentode Section			
Plate Voltage	5000	60	130 Volts
Screen Voltage	130	130	130 Volts
Grid No. 1 Voltage	—	0	-22.5 Volts
Plate Resistance (Approx.)	—	—	10,000 Ohms
Transconductance	—	—	6500 μmhos
Plate Current	—	320	48 Ma
Screen Current	—	22	2.9 Ma
Grid No. 1 Voltage (Approx.)			
Ib = 1.0 Ma	-80	—	-40 Volts
Triode Amplification Factor(3)	—	—	4.0
Diode Section			
Tube Voltage Drop			
Ib = 250 Ma DC	—	—	21 Volts

NOTES:

(1) 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 horizontal scanning cycle.

(2) 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.

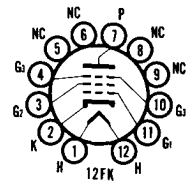
(3) Amplification factor with tube operating as a triode with 130 volts on the plate and Grid No. 2 and -22.5 volts on Grid No. 1.

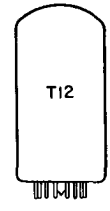
33JV6

HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction.....Compactron T-12
Base .....Button 12 Pin, E12-74
Basing 12FK
Outline 12-58
Maximum Diameter .....1.562 In.
Maximum Seated Height .....3.000 In.
Maximum Overall Height .....3.375 In.





ELECTRICAL DATA

HEATER OPERATION	
Heater Voltage	33 Volts
Heater Current	300 Ma
Heater Warm-up Time	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 (Unshielded)	
Grid No. 1 to Plate	0.4 Pf
Input	22 Pf
Output	9.0 Pf
RATINGS (Design Maximum Rating System)	
Horizontal Deflection Amplifier(1)	
DC Plate Supply Voltage (Boost + DC Power Supply) (Max.)	770 Volts
Peak Positive Pulse Plate Voltage (Max.)	6000 Volts
Peak Negative Pulse Plate Voltage (Max.)	1500 Volts
Positive DC Beam Plate Voltage (Max.)	70 Volts
Plate Dissipation (Max.)	18 Watts
Negative DC Grid No. 1 Voltage	55 Volts
Peak Negative Grid No. 1 Voltage (Max.)	330 Volts
Grid No. 2 Voltage (Max.)	220 Volts
Grid No. 2 Dissipation (Max.)(2)	3.5 Watts
Average Cathode Current (Max.)	230 Ma
Peak Cathode Current (Max.)	800 Ma
Grid No. 1 Circuit Resistance (Max.)	1.0 Megohm
Bulb Temperature (at Hottest Point) (Max.)	220 °C
CHARACTERISTICS AND TYPICAL OPERATION	
Plate Voltage	130 Volts
Grid No. 2 Voltage	130 Volts
Grid No. 1 Voltage	-20 Volts

Plate Current	50 Ma
Grid No. 2 Current	1.75 Ma
Transconductance	9100 μmhos
Plate Resistance	11,000 Ohms
Amplification Factor(3)	4.7
Ec1 for Ib = 1.0 Ma (Approx.)	-33 Volts

INSTANTANEOUS PLATE KNEE VALUES
Eb = 60 V; Ec2 = 130 V and Ec1 = 0 V
Ib = 410 Ma, and Ic2 = 24 Ma

NOTES:

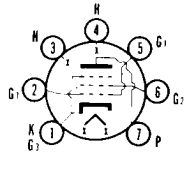
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
(2) In stages operating with grid leak bias, an adequate cathode bias resistor or other suitable means is required to protect the tube in the absence of excitation.
(3) Amplification factor with tube operation as a triode with 130 volts on the plate and Grid No. 2 and -20 volts on Grid No. 1.

AUDIO OUTPUT AMPLIFIER

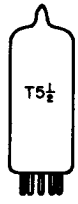
34GD5A

Beam Power Pentode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7CV
Outline	5-3
Maximum Diameter	0.750 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



7CV



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	34 Volts
Heater Current	100 Ma
Heater Warm-up Time	20 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 (Unshielded)

Grid No. 1 to Plate	0.6 Pf
Input: g1 to (h + k + g2 + g3)	12 Pf
Output: p to (h + k + g2 + g3)	9.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	150 Volts
Grid No. 2 Voltage (Max.)	130 Volts
Plate Dissipation (Max.)	5.0 Watts
Grid No. 2 Dissipation (Max.)	1.1 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	*0.1 Megohm*
Cathode Bias (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

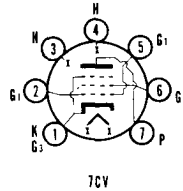
Plate Voltage	110 Volts
Grid No. 2 Voltage	110 Volts
Grid No. 1 Voltage	-7.5 Volts
Peak AF Grid No. 1 Voltage	7.5 Volts
Zero-Signal Plate Current	35 Ma
Zero-Signal Grid No. 2 Current	3.0 Ma
Transconductance	5700 μmhos
Plate Resistance (Approx.)	13,000 Ohms
Load Resistance	2500 Ohms
Maximum Signal Power Output	1.4 Watts
Total Harmonic Distortion (Approx,)	10 Percent

35C5
11C5

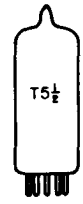
AUDIO POWER AMPLIFIER

Beam Power Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7CV
Outline 5-3
Maximum Diameter .....0.750 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



7CV



ELECTRICAL DATA

HEATER OPERATION

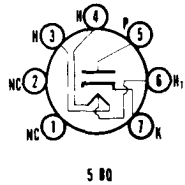
	11C5	35C5
Heater Voltage	11.6	35 Volts
Heater Current	450	150 Ma
Maximum Heater-Cathode Voltage	200	200 Volts
DIRECT INTERELECTRODE CAPACITANCES (Unshielded)		
Grid No. 1 to Plate		0.6 Pf
Input: g1 to (h + k + g2 + g3)		12 Pf
Output: p to (h + k + g2 + g3)		9 Pf
RATINGS (Design Maximum Rating System)		
Plate Voltage (Max.)		150 Volts
Screen Voltage (Max.)		130 Volts
Plate Dissipation (Max.)		5.2 Watts
Screen Dissipation (Max.)		1.1 Watts
Control Grid Circuit Resistance		
Fixed Bias (Max.)		0.1 Megohm
Cathode Bias (Max.)		0.5 Megohm
CHARACTERISTICS AND TYPICAL OPERATION		
Class A1 Amplifier		
Plate Voltage		110 Volts
Screen Voltage		110 Volts
Control Grid Voltage		−7.5 Volts
Peak AF Control Grid Voltage		7.5 Volts
Zero Signal Plate Current		40 Ma
Maximum Signal Plate Current		41 Ma
Zero Signal Screen Current		3 Ma
Maximum Signal Screen Current		7 Ma
Plate Resistance (Approx.)		13,000 Ohms
Transconductance		5800 μmhos
Load Resistance		2500 Ohms
Maximum Signal Power Output		1.5 Watts
Total Harmonic Distortion (Approx.)		10 Percent

35W4

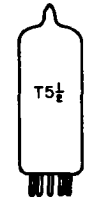
HALF WAVE RECTIFIER

Heater-Cathode Diode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E9-1
Basing 5BQ
Outline 5-3
Maximum Diameter .....0.750 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



5 BQ



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	32 Volts
Heater Current	150 Ma
Maximum Heater-Cathode Voltage	360 Volts
RATINGS (Design Maximum Rating System)	
Peak Inverse Plate Voltage (Max.)	360 Volts

Peak Plate Current (Max.)	660 Ma
DC Output Current with Panel Lamp	
No Shunting Resistor (Max.)	66 Ma
With Shunting Resistor (Max.)	100 Ma
Without Panel Lamp (Max.)	110 Ma
Panel Lamp Section Voltage (Panel Lamp Open) (Max.)	17 Volts
Tube Voltage Drop at 200 Ma Plate Current (Max.)	18 Volts

CHARACTERISTICS AND TYPICAL OPERATION (Half-Wave Rectifier Service)

Capacitor Input to Filter				
Panel Lamps No. 40 or 47 and C Input = 40 μf				
Heater Voltage	32	32	32	32 Volts
Heater Current	150	150	150	150 Ma
Plate Supply (RMS)	117	117	117	117 Volts
Minimum Effective Plate Supply Impedance	11	15	15	15 Ohms
Panel Lamp Shunting Resistor	—	300	150	100 Ohms
DC Output Current	60	70	80	90 Ma

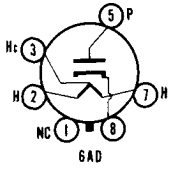
Without Panel Lamp and C Input = 40 μf	
Heater Voltage	35 Volts
Heater Current	150 Ma
Plate Supply Voltage (RMS)	117 Volts
Minimum Effective Plate Supply Impedance	15 Ohms
DC Output Current	100 Ma
Maximum Value of Panel Lamp Shunting Resistor	
70 Ma Output	800 Ohms
80 Ma Output	400 Ohms
90 Ma Output	250 Ohms

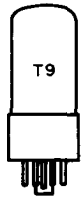
HALF-WAVE POWER RECTIFIER

35Z5GT

Heater-Cathode Diode

Construction	Octal T-9
Base	Octal 6 Pin, B6-8, or B6-60
Basing	6AD
Outline	9-11 or 9-41
Maximum Diameter	1.188 In.
Maximum Seated Height	2.750 In.
Maximum Overall Height	3.312 In.





ELECTRICAL DATA

HEATER OPERATION

	Without Panel Lamp	With No. 40 or 47 Panel Lamp
Heater Voltage		
Entire Heater (Pins 2 and 7)	35	35 Volts
Panel Lamp Section (Pins 2 and 3)	7.5	5.5 Volts
Heater Current		
Between Pins 2 and 7	150	— Ma
Between Pins 3 and 7	—	150 Ma
Maximum Heater-Cathode Voltage (DC)	350	350 Volts

CHARACTERISTICS AND TYPICAL OPERATION

Half-Wave Rectifier with No. 40 or 47 Panel Lamp Capacitor Input to Filter					
AC Plate Supply Voltage (RMS)	117	117	117	117	235 Volts
Filter Input Capacitance	40	40	40	40	40 Pf
Minimum Total Effective Plate Supply Impedance	15	15	15	15	100 Ohms
Panel Light Shunting Resistor	—	300	150	100	— Ohms
DC Output Current	60	70	80	90	60 Ma

Half-Wave Rectifier Without Panel Lamp Capacitor Input to Filter		
AC Plate Supply Voltage (RMS)	117	235 Volts
Filter Input Capacitance	40	40 Pf
Minimum Total Effective Plate Supply Impedance	15	100 Ohms
DC Output Voltage at Input to Filter (Approx.)		
At 50 Ma (Half Load)	140	280 Volts
At 100 Ma (Full Load)	120	235 Volts
Percent Regulation	14	16 *Percent*
DC Output Current	100	100 Ma

NOTE:

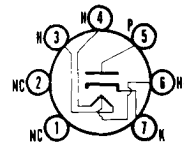
(1) Plate Current must not flow through tap section (Pins 2 and 3).

36AM3B

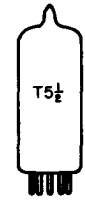
HALF-WAVE RECTIFIER

Heater Cathode Diode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 5BQ
Outline 5-3
Maximum Diameter .....0.750 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



5 BQ



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage (Pins 3 and 4)(1)	36 Volts
Heater Voltage (Pins 3 and 6)(1)	32 Volts
Heater Current	100 Ma
Heater Warm-up Time (Pins 3 and 4)	20 Seconds
Maximum Heater Cathode Voltage	
Heater Negative with Respect to Cathode	
Total DC and Peak	350 Volts
Heater Positive with Respect to Cathode	
DC	100 Volts
Total DC and Peak	200 Volts

RATINGS (Design Maximum Rating System)

Peak Inverse Voltage (Max.)	365 Volts
Steady State Peak Plate Current (Max.)	580 Ma
Voltage (RMS) of Panel Lamp Section	
When Panel Lamp Fails (Max.)	10 Volts
DC Output Current	
Without Panel Lamp Per Circuit 1 (Max.)	82 Ma
With Panel Lamp Per Circuit 2 and No Shunting Resistor (Max.)	68 Ma
With Panel Lamp Per Circuit 2 and Shunting Resistor (Max.)	82 Ma

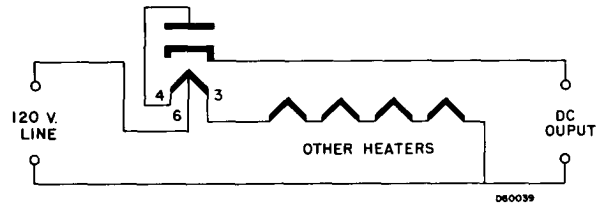
CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop with Plate Current = 150 Ma	16 Volts

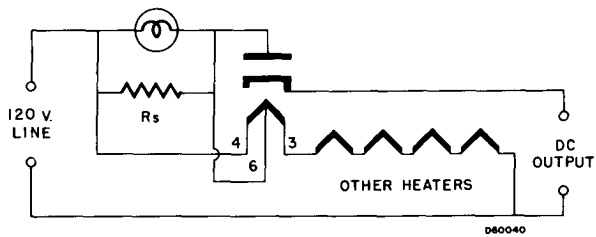
NOTE:

(1) The heater section between pins 3 and 6 is the tube heater proper. The section between pins 4 and 6 may be used either as a limiting resistance in the rectifier plate circuit, or as a panel lamp shunt.

CIRCUIT 1



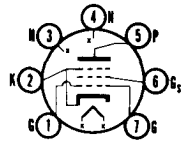
CIRCUIT 2



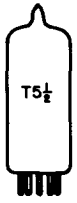
AUDIO POWER AMPLIFIER — 50B5

Beam Power Pentode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 7BZ
Outline 5-3
Maximum Diameter .....0.750 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



7B2



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	50 Volts
Heater Current	150 Ma
Maximum Heater-Cathode Voltage	180 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid to Plate	0.64 Pf
Input	13 Pf
Output	6.5 Pf

RATINGS (Design Center Rating System)

Plate Voltage (Max.)	135 Volts
Grid No. 2 Voltage (Max.)	117 Volts
Plate Dissipation (Max.)	5.5 Watts
Grid No. 2 Dissipation (Max.)	1.25 Watts
Control Grid Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

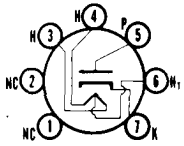
Class A1 Amplifier

Plate Voltage	110 Volts
Grid No. 2 Voltage	110 Volts
Grid No. 1 Voltage	–7.5 Volts
Peak AF Grid No. 1 Voltage	7.5 Volts
Zero-Signal Plate Current	49 Ma
Maximum-Signal Plate Current	50 Ma
Zero-Signal Grid No. 2 Current	4.0 Ma
Maximum-Signal Grid No. 2 Current	8.5 Ma
Plate Resistance (Approx.)	10,000 Ohms
Transconductance	7500 μmhos
Load Resistance	2500 Ohms
Maximum Signal Power Output	1.9 Watts
Total Harmonic Distortion (Approx.)	9.0 Percent

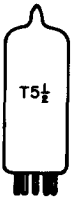
HALF-WAVE RECTIFIER — 50DC4

Heater-Cathode Diode

Construction .....Miniature T-5½
Base .....Button 7 Pin, E7-1
Basing 5BQ
Outline 5-3
Maximum Diameter .....0.750 In.
Maximum Seated Height .....2.375 In.
Maximum Overall Height .....2.625 In.



5 BQ



ELECTRICAL DATA

HEATER OPERATION (Without Panel Lamp)

Heater Voltage (AC or DC)	50 Volts
Heater Tap Voltage	7.5 Volts
Heater Current	150 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	330 Volts
Heater Positive with Respect to Cathode	330 Volts

RATINGS (Design Maximum Rating System)
Rectifier Service

Peak Inverse Plate Voltage (Max.)	330 Volts
Steady State Peak Plate Current (Max.)	720 Ma
DC Output Current	
Without Panel Lamp (Max.)	120 Ma
With Panel Lamp and Shunting Resistor (Max.)	110 Ma
Without Panel Lamp and No Shunting Resistor (Max.)	70 Ma
Heater-Tap Voltage When Panel Lamp Fails, RMS (Max.)	16.5 Volts

CHARACTERISTICS AND TYPICAL OPERATION
Half-Wave Rectifier with Panel Lamp Number 40 or Number 47

Heater Voltage (Pin 3 to Pin 4)	45	45	45	45 Volts
Heater-Tap Voltage (Pin 4 to Pin 6)	5.5	5.5	5.5	5.5 Volts
Heater Current (Between Pins 3 and 6)	150	150	150	150 Ma
AC Plate-Supply Voltage, RMS	117	117	117	117 Volts
Filter Input Capacitor	40	40	40	40 μf
Total Effective Plate-Supply Impedance	15	15	15	15 Ohms
Panel-Lamp Shunting Resistor	450	200	100	75 Ohms
DC Output Current	70	80	90	100 Ma

Half-Wave Rectifier without Panel Lamp

Heater Voltage (Pin 3 to Pin 4)	50 Volts
Heater-Tap Voltage (Pin 4 to Pin 6)	7.5 Volts
Heater Current (Between Pins 3 and 4)	150 Ma
AC Plate Supply Voltage, RMS	117 Volts
Filter Input Capacitor	40 μf
Total Effective Plate Supply Impedance	15 Ohms
DC Output Current	110 Ma
DC Output Voltage at Filter Input (Approx.)	
For DC Output Current of 55 Ma	130 Volts
For DC Output Current of 110 Ma	110 Volts

Tube Voltage Drop

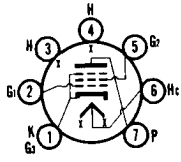
For Ib = 240 Ma DC	21 Volts

50HC6

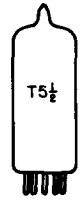
AUDIO POWER AMPLIFIER

Beam Power Pentode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7FZ
Outline	5-3
Maximum Diameter	0.750 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



7FZ



ELECTRICAL DATA
HEATER OPERATION

Heater Voltage	50 Volts
Heater Current	150 Ma
Heater Tap Voltage	7.0 Volts
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)

Grid No. 1 to Plate	0.5 Pf
Input: g1 to (h + k + g2 + g3)	17 Pf
Output: p to (h + k + g2 + g3)	9.0 Pf

RATINGS (Design Maximum Rating System)

Heater-Tap Voltage when Panel Lamp Fails, RMS (Max.)	14 Volts
Plate Voltage (Max.)	150 Volts
Screen Voltage (Max.)	130 Volts
Plate Dissipation (Max.)	5.5 Watts
Screen Dissipation (Max.)	2.0 Watts

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

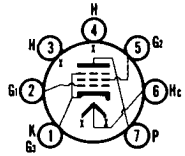
Plate Voltage	110 Volts
Screen Voltage	115 Volts
Cathode-Bias Resistor	62 Ohms
Peak AF Grid No. 1 Voltage	3.0 Volts
Plate Resistance (Approx)	11,000 Ohms
Transconductance	14,600 μmhos
Zero-Signal Plate Current	42 Ma
Maximum-Signal Plate Current	42 Ma
Zero-Signal Screen Current	11.5 Ma
Maximum-Signal Screen Current	14.5 Ma
Load Resistance	3000 Ohms
Total Harmonic Distortion (Approx.)	7 Percent
Maximum-Signal Power Output	1.4 Watts

AUDIO POWER AMPLIFIER

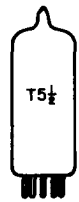
50HK6

Beam Power Pentode

Construction	Miniature T-5½
Base	Button 7 Pin, E7-1
Basing	7FZ
Outline	5-3
Maximum Diameter	0.750 In.
Maximum Seated Height	2.375 In.
Maximum Overall Height	2.625 In.



7FZ



ELECTRICAL DATA
HEATER OPERATION

Heater Voltage	50 Volts
Heater Current	150 Ma
Heater Tap Voltage (Without Panel Lamp)	7 Volts
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)

Grid No. 1 to Plate	0.5 Pf
Input	14.0 Pf
Output	9.0 Pf

RATINGS (Design Maximum Rating System)

Heater Tap Voltage When Panel Lamp Fails, RMS (Max.)	14 Volts
Plate Voltage (Max.)	150 Volts
Screen Voltage (Max.)	130 Volts
Plate Dissipation (Max.)	5.5 Watts
Screen Dissipation (Max.)	1.1 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.5 Megohm

CHARACTERISTICS AND TYPICAL OPERATION
Class A1 Amplifier

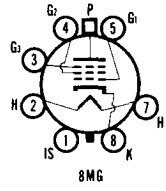
Plate Voltage	110 Volts
Screen Voltage	110 Volts
Grid No. 1 Voltage	−7.5 Volts
Peak AF Grid No. 1 Voltage	7.5 Volts
Plate Resistance (Approx.)	10,000 Ohms
Transconductance	7500 μmhos
Zero-Signal Plate Current	49 Ma
Maximum-Signal Plate Current	50 Ma
Zero-Signal Screen Current	4.0 Ma
Maximum-Signal Screen Current	8.5 Ma
Load Resistance	2500 Ohms
Total Harmonic Distortion (Approx.)	9 Percent
Maximum-Signal Power Output	1.9 Watts

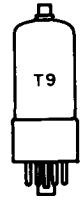
50JY6

HORIZONTAL DEFLECTION AMPLIFIER

Beam Power Pentode

Construction .....Octal T-9
Base .....Octal 7 or 8 Pin, B7-59 or B8-58
Top Cap .....C1-2 or C1-3
Basing 8MG
Outline
Maximum Diameter .....1.188 In.
Maximum Seated Height .....3.740 In.
Maximum Overall Height .....4.331 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	50 Volts
Heater Current	150 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
DC	250 Volts
Total DC and Peak	250 Volts
Heater Positive with Respect to Cathode	
DC	200 Volts
Total DC and Peak	250 Volts

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid No. 1 to Plate (Max.)	1.1 Pf
Input: g1 to (h + k + g2 + g3)	17.5 Pf
Output: p to (h + k + g2 + g3)	8 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	275 Volts
Plate Voltage Without Plate Current (Max.)	600 Volts
Peak Positive Pulse Plate Voltage (Max.)(1)	7700 Volts
Peak Negative Pulse Plate Voltage (Max.)(1)	1650 Volts
Grid No. 3 Voltage (Max.)(2)	70 Volts
Grid No. 2 Voltage (Max.)	275 Volts
Peak Negative Pulse Grid No. 1 Voltage (Max.)	1100 Volts
Grid No. 2 Voltage Without Grid No. 2 Current (Max.)	600 Volts
Plate Dissipation (Max.)	13 Watts
Grid No. 2 Dissipation (Max.)	5.5 Watts
DC Cathode Current (Max.)	220 Ma
Grid No. 1 Circuit Resistance (Max.)	0.5 Megohm
Grid No. 1 Circuit Resistance For Line Output Tube Application Only (Max.)	2.2 Megohms
Circuit Resistance Between Heater Cathode (Max.)	20,000 Ohms

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	100 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Grid No. 2 Voltage	100 Volts
Grid No. 1 Voltage	-8.2 Volts
Plate Current	100 Ma
Grid No. 2 Current	7 Ma
Transconductance	14,000 μmhos
Plate Resistance (Approx.)	5000 Ohms
Amplification Factor(3)	5.6

NOTES:

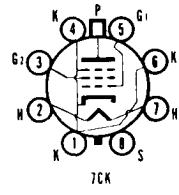
(1) Valid for application in horizontal deflection amplifiers circuits where the maximum pulse duration is 22% of a cycle with a maximum of 18 μsec.
(2) In horizontal deflection amplifier service, a positive voltage may be applied to grid No. 3 to reduce interference from snivets which may occur in both VHF and UHF television receivers. A typical value for this voltage is 30 volts.
(3) With Grid No. 2 connected to plate at socket.

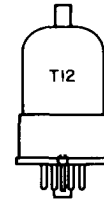
AUDIO POWER AMPLIFIER MODULATOR or RF POWER AMP.

6146B/8298A

Beam Power Pentode

Construction .....Octal T-12
Base.....Octal 8 Pin, B8-150 or B8-159
Top Cap C1-1
Basing 7CK
Outline
Maximum Diameter .....1.562 In.
Maximum Seated Height .....3.125 In.
Maximum Overall Height .....3.687 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	1125 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	135 Volts
Heater Positive with Respect to Cathode	135 Volts

MAINTENANCE OF POWER CAPABILITY

With heater voltage reduced to 5.0 Volts, the power output obtained under the classes of service contained in these defining data will not be reduced by more than ten percent from that obtained at rated heater voltage. Plate input power for the classes of service would be maintained at that obtained using rated heater voltage.

DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid No. 1 to Plate (Max.)	0.22 Pf
Input	13.0 Pf
Output	8.5 Pf

RATINGS (Absolute Maximum Rating System)

AF Amplifier and Modulator

	Class AB1		Class AB2	
	CCS	ICAS	CCS	ICAS
Plate Voltage	600	750	600	750 Volts
Grid No. 2 Voltage	250	250	250	250 Volts
Plate Current (Max. Signal)(1)	175	220	175	220 Ma
Plate Input (Max. Signal)(1)	90	120	90	120 Watts
Plate Dissipation(1)	27	35	27	35 Watts
Grid No. 2 Input (Max. Signal)(1)	3	3	3	3 Watts
Grid No. 1 Circuit Resistance(4,5)	0.1	0.1	0.03	0.03 Megohm

Linear RF Amplifier—Class AB1 (Single Sideband Suppressed Carrier)

	CCS	ICAS
Plate Voltage	600	750 Volts
Grid No. 2 Voltage	250	250 Volts
Plate Current (Max. Signal)	175	220 Ma
Plate Dissipation	27	35 Watts
Grid No. 2 Dissipation	3	3 Watts

RF Amplifier Service—Class C

	Telephony(1)		Telegraphy or F. M. Telephony	
	CCS	ICAS	CCS	ICAS
Plate Voltage	480	600	600	750 Volts
Grid No. 2 Voltage	250	250	250	250 Volts
Grid No. 1 Voltage	−150	−150	−150	−150 Volts
Plate Current	145	180	175	220 Ma
Grid No. 1 Current	3.5	4.0	3.5	4.0 Ma
Plate Input	60	85	90	120 Watts
Plate Dissipation	18	23	27	35 Watts
Grid No. 2 Input	2	2	3	3 Watts
Grid No. 1 Circuit Resistance(13)	0.03	0.03	0.03	0.03 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	200 Volts
Grid No. 2 Voltage	200 Volts
Plate Current	100 Ma
Transconductance	7000 μmhos
Amplification Factor (G1 to G2)	4.5

AF Power Amplifier—Class AB1 (2 Tubes)

	CCS	CCS
Plate Voltage	600	750 Volts
Grid No. 2 Voltage(2)	200	200 Volts
Grid No. 1 Voltage	−47	−48 Volts
Peak AF G1 to G1 Voltage(3)	94	96 Volts
Plate Current (Zero Signal)	48	50 Ma
Plate Current (Max. Signal)	250	250 Ma
Grid No. 2 Current (Max. Signal)	14.8	12.6 Ma
Load Resistance (P1 to P1)	5.6	7.2 K Ohms
Power Output	96	124 Watts

AF Power Amplifier—Class AB2 (2 Tubes)

	CCS	CCS	ICAS	ICAS
Plate Voltage	500	600	600	750 Volts
Grid No. 2 Voltage(2)	200	200	200	150 Volts
Grid No. 1 Voltage	−46	−48	−47	−39 Volts
Peak AF G1 to G1 Voltage	108	106	114	110 Volts
Plate Current (Zero Signal)	50	40	50	40 Ma
Plate Current (Max. Signal)	308	270	328	294 Ma
Grid No. 2 Current (Max. Signal)	26	27	26	28 Ma
	CCS	**CCS**	**ICAS**	**ICAS**
Grid No. 1 Current (Max. Signal)	2.7	1.3	3.4	7.6 Ma
Load Resistance (P1 to P1)	3620	5200	4160	6050 Ohms
Driving Power (Max. Signal)(3)	0.2	0.7	0.2	0.5 Watt
Power Output (Max. Signal)	100	110	130	148 Watts

Linear RF Amplifier (At 30 MHz)

	CCS	ICAS
Plate Voltage	600	750 Volts
Grid No. 2 Voltage(7)	200	200 Volts
Grid No. 1 Voltage(7)	−47	−48 Volts
Plate Current (Zero Signal)	24	25 Ma
Load Resistance	2800	3600 Ohms
Plate Current (Max. Signal)	125	125 Ma
Average Plate Current	86	86 Ma
Grid No. 2 Current (Max. Signal)	7.4	6.3 Ma
Average Grid No. 2 Current	5.0	3.9 Ma
Distortion Level(8)		
Third Order	24	26 db
Fifth Order	30	31 db
Useful Power Output		
Average	24.5	30.5 Watts
Peak-Envelope	49	61 Watts

RF Power Amplifier—Class C Telephony (Up to 60 MHz)

	CCS	ICAS
Plate Voltage	475	600 Volts
Grid No. 2 Voltage(9)	165	175 Volts
Grid No. 1 Voltage(10)	−86	−92 Volts
Grid No. 1 Resistor	26K	27K Ohms
Peak RF Grid No. 1 Voltage	106	114 Volts
Grid No. 1 Current	3.3	3.4 Ma
Plate Current	125	140 Ma
Grid No. 2 Current	8.5	9.5 Ma
Driving Power (Approx.)	0.4	0.5 Watts
Power Output (Approx.)	42	62 Watts

RF Power Amplifier—Class C Telegraphy—F. M. Telephony

	Up to 60 MHz		Up to 175 MHz		
	CCS	ICAS	CCS	ICAS	ICAS
Plate Voltage	600	750	320	400	435 Volts
Grid No. 2 Voltage(11)	200	200	210	220	230 Volts
Grid No. 1 Voltage(12)	−70	−77	−52	−55	−56 Volts
Grid No. 1 Resistor	24K	28K	26K	30K	24K Ohms
Peak RF Grid No. 1 Voltage	90	95	65	67	73 Volts
Grid No. 1 Current	2.8	2.7	2	1.9	2.3 Ma
Plate Current	150	160	170	180	210 Ma
Grid No. 2 Current	10	10	12	12	11 Ma
Driving Power (Approx.)	0.3	0.3	2	2	3 Watts
Power Output	63	85	29	40	50 Watts

NOTES:

(1) Averaged over any audio-frequency cycle of sinewave form.

(2) Obtained preferably from a separate source or from the plate voltage supply with a voltage divider.

(3) The driver stage should be capable of supplying the No. 1 grids of the Class AB1 stage with the specified driving voltage at low distortion.

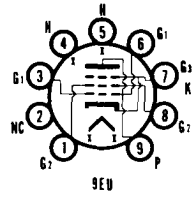
(4) The type of input coupling network used should not introduce too much resistance in the Grid No. 1 circuit. Transformer or impedance coupling devices are recommended.

(5) Driver stage should be capable of supplying the specified driving power at low distortion to the No. 1 grids of the AB2 stage.
(6) To minimize distortion, the effective resistance per Grid No. 1 circuit of the AB2 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 less than maximum ratings, the dc Grid No. 1 circuit resistance may be as high as 100,000 ohms.
(7) Obtained preferably from a separate, well-regulated source.
(8) Referenced to either of the two tones and without the use of feedback to enhance linearity.
(9) Obtained preferably from a separate source modulated with the plate supply, or from the modulated plate supply through a series resistor.
(10) Obtained from Grid No. 1 resistor or from a combination of Grid No. 1 resistor with either fixed supply or cathode resistor.
(11) 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.
(12) Obtained from fixed supply, by Grid No. 1 resistor, by cathode resistor, or by combination methods.
(13) 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 operation at less than maximum ratings, the dc Grid No. 1 circuit resistance may be as high as 100,000 ohms.

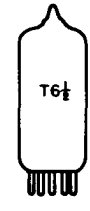
AUDIO POWER AMPLIFIER — 6973

Beam Power Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9EU
Outline 6-4
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.812 In.
Maximum Overall Height .....3.062 In.



9EU



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 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)

Grid No. 1 to Plate	0.4 Pf
Input	9.0 Pf
Output	6.0 Pf

RATINGS (Design Maximum Rating System)

	Ultra-Linear Conn.	Pentode Conn.
Plate and Grid No. 2 Voltage (Max.)	410	— Volts
Plate Voltage (Max.)	—	440 Volts
Grid No. 2 Voltage (Max.)	—	330 Volts
Plate Dissipation (Max.)	12	12 Watts
Grid No. 2 Input (Max.)	1.75	2 Watts
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.5	0.5 Megohm
Self Bias (Max.)	1.0	1.0 Megohm
Bulb Temperature (Max.)	250	250 °C

CHARACTERISTICS AND TYPICAL OPERATION

	S. T. Class A	P-P Class AB Fixed Bias			P-P Class AB Self Bias	
Plate Voltage	250	250	350	400	300	310 Volts
Grid No. 2 Voltage	250	250	280	290	300	310 Volts
Grid No. 1 Voltage	−15	−15	−22	−25	—	— Volts
Cathode Resistor	—	—	—	—	230	270 Ohms
Peak AF Grid No. 1 Voltage	—	15	22	25	24	22.5 Volts
Plate Current (Zero Signal)	46	92	58	50	80	77 Ma
Plate Current (Max. Signal)	—	105	106	107	96	92 Ma
Grid No. 2 Current (Zero Signal)	3.5	7	3.5	2.5	6	5 Ma
Grid No. 2 Current (Max. Signal)	—	16	14	13.7	14	14 Ma
Transconductance	4.8K	—	—	—	—	— μmhos
Plate Resistance	73K	—	—	—	—	— Ohms
Load Resistance (P to P)	—	8K	7.5K	8K	5.5K	6K Ohms
Power Output	—	12.5	20	24	15	17 Watts
Total Harmonic Distortion	—	2	1.5	2	2	4 Percent
Ec1 for Ib = 100 μa	−40	—	—	—	—	— Volts

Class AB Ultra-Linear Conn.		
Plate Supply Voltage	375(1)	370(2) Volts
Grid No. 1 Voltage	−33.5	— Volts
Cathode Resistor	—	355 Ohms
Peak AF Grid No. 1 Voltage	33.5	31 Volts
Cathode Current (Zero Signal)	62	74 Ma
Cathode Current (Maximum Signal)	95	84 Ma
Load Resistance (P to P)	12.5K	13K Ohms
Power Output	18.5	15 Watts
Total Harmonic Distortion	1.5	1.2 Percent

NOTES:

(1) Obtained from taps on the primary winding of the output transformer. The taps are located on each side of the center tap so as to apply 50 percent of the plate signal voltage to Grid No. 2 of each output tube.

(2) Obtained from taps on the primary winding of the output transformer. The taps are located on each side of the center tap so as to supply 43 percent of the plate signal voltage to Grid No. 2 of each output tube.

7025

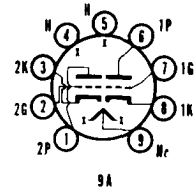
Color Television Type

AF AMPLIFIERS or PHASE INVERTERS

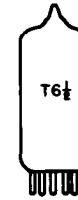
Double High Mu Triode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9A
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.

The Type 7025 is identical to the Type 12AX7/ECC83 except for improved noise and hum characteristics.



9A

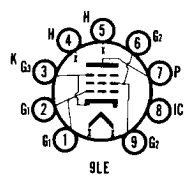


7189A

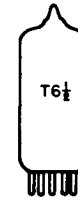
AUDIO POWER AMPLIFIER

Beam Power Pentode

Construction .....Miniature T-6½
Base ..... Button 9 Pin, E9-1
Basing 9LE
Outline 6-4
Maximum Diameter .....0.875 In.
Maximum Seated Height .....2.812 In.
Maximum Overall Height .....8.062 In.



9LE



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	760 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	100 Volts
Heater Positive with Respect to Cathode	100 Volts

DIRECT INTERELECTRODE CAPACITANCES

Grid No. 1 to Plate (Max.)	0.5 Pf
Input	10.8 Pf
Output	6.5 Pf
Grid No. 1 to Heater (Max.)	0.25 Pf

RATINGS (Design Maximum Rating System)

	Class AB Pentode Conn.	Class AB Ultra-linear Conn.
Plate Voltage (Max.)	440	415 Volts
Grid No. 2 Voltage (Max.)(1)	400	415 Volts
Plate Dissipation (Max.)	13.2	13.2 Watts
Grid No. 2 Dissipation (Zero Signal) (Max.)	2.2	2.2 Watts
Grid No. 2 Dissipation (Max. Signal) (Max.)	4.4	4.4 Watts
Cathode Current (Max.)	72	72 Ma
Grid No. 1 Circuit Resistance		
Fixed Bias (Max.)	0.3	0.3 Megohm
Cathode Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Pentode Conn. Single Tube Class A1	Pentode Conn. Class AB Push-Pull	Ultra-linear Conn. Class AB Push-Pull
Plate Voltage	250	400	375 Volts
Grid No. 2 Voltage	250	300	Note 1 Volts
Grid No. 1 Voltage	−7.3	−15	— Volts
Cathode Resistor	—	—	220 Ohms
Grid Voltage (RMS)(2)	—	10.5	12.5 Volts
Plate Current (Zero Signal)	48	30	70 Ma
Plate Current (Max. Signal)	—	105	81 Ma
Grid No. 2 Current (Zero Signal)	5.5	1.6	— Ma
Grid No. 2 Current (Max. Signal)	—	25	— Ma
Transconductance	11.3K	—	— μmhos
Amplification Factor(3)	19.5	—	—
Plate Resistance	40K	—	— Ohms
Load Resistance (P to P)	—	8K	11K Ohms
Maximum Signal Power Output	—	24	16.5 Watts
Total Harmonic Distortion	—	4.0	3 Percent

NOTES:

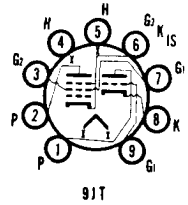
(1) Grid No. 2 voltage is obtained from taps located at 43 percent of the output transformer windings.
(2) Per grid
(3) Measured from Grid No. 1 to Grid No. 2.

PREAMPLIFIER (P) PHASE INVERTER (T)

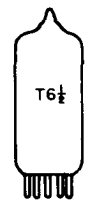
7199

Medium Mu Triode and Sharp Cutoff Pentode

Construction .....Miniature T-6½
Base .....Button 9 Pin, E9-1
Basing 9JT
Outline 6-2
Maximum Diameter .....0.875 In.
Maximum Seated Height .....1.937 In.
Maximum Overall Height .....2.187 In.



9JT



ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	450 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)

Triode Section	
Grid to Plate	2.0 Pf
Input: g to (h + k)	2.3 Pf
Output: p to (h + k)	0.3 Pf
Pentode Section	
Grid No. 1 to Plate (Max.)	0.06 Pf
Input: g1 to (h + k + g2 + g3 + IS)	5.0 Pf
Output: p to (h + k + g2 + g3 + IS)	2.0 Pf

RATINGS (Design Maximum Rating System)

	Triode Section	*Pentode Section*
Plate Voltage (Max.)	330	330 Volts
Grid No. 2 Supply Voltage (Max.)	—	330 Volts
Grid No. 2 Voltage	*See Rating Chart (Gen. Info. Sec.)*	
Positive Grid No. 1 Voltage (Max.)	0	0 Volt
Plate Dissipation (Max.)	2.4	3.0 Watts
Grid No. 2 Dissipation (Max.)	—	0.6 Watt
Grid Circuit Resistance		
Fixed Bias (Max.)	0.5	0.25 Megohm
Cathode Bias (Max.)	1.0	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Section	*Pentode Section*	
Plate Voltage	215	100	220 Volts
Grid No. 2 Voltage	—	50	130 Volts
Grid No. 1 Voltage	8.5	—	— Volts
Cathode Bias Resistor	—	1000	62 Ohms
Plate Current	9.0	1.1	12.5 Ma
Grid No. 2 Current	—	0.35	3.5 Ma
Transconductance	2100	1500	7000 μmhos
Amplification Factor	17	—	—
Plate Resistance	0.0081	1.0	0.4 Megohm
Ec1 for Ib = 10 μa (Approx.)	40	4	— Volts

Equivalent Noise and Hum Voltage (Referenced to Grid)

	Triode Section(1)	Pentode Section(2)
Average Value	10	15 μ Volts rms
Maximum Value	50	35 μ Volts rms

NOTES:

(1) Measured under the following conditions: Ef = 6.3 Vac; center-tap of heater transformer grounded; Ebb = 250 Vdc; R_L = 0.1 Megohm; Rk = 1500 ohms; Rg = 50,000 ohms; F = 25 to 10,000 Hertz.

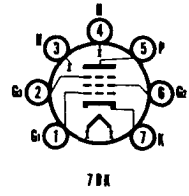
(2) Measured under the following conditions: Ef = 6.3 Vac; center tap of heater transformer grounded; Ebb = 250 Vdc; RL = 0.22 Megohm; Ecc2 = 250 Vdc; Rg2 = 330,000 ohms; Cg2 = 0.1 μf; Rk = 680 ohms; Rg1 = 0.27 Megohms; F = 25 to 10,000 Hertz.

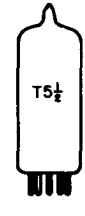
7543

AF AMPLIFIER

Sharp Cutoff Pentode

Construction	Miniature T-5½
Base	*Button 7 Pin, E7-1*
Basing	7BK
Outline	5-2
Maximum Diameter	0.750 In.
Maximum Seated Height	1.875 In.
Maximum Overall Height	2.125 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	300 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

	Shielded(1)	Unshielded
Pentode Connection		
Grid No. 1 to Plate (Max.)	0.0035	0.0035 Pf
Input: g1 to (h + k + g2 + g3 + IS)	5.5	5.5 Pf
Output: p to (h + k + g2 + g3 + IS)	5.0	5.0 Pf
Triode Connection(2)		
Grid to Plate: g1 to (p + g2 + g3 + IS)	2.6	2.6 Pf
Input: g1 to (h + k)	3.2	3.2 Pf
Output: p + g2 + g3 + IS to (h + k)	8.5	1.2 Pf

RATINGS (Design Center Rating System)

	Triode Conn.(2)	Pentode Conn.
Plate Voltage (Max.)	250	300 Volts
Grid No. 2 Supply Voltage (Max.)	—	300 Volts
Grid No. 2 Voltage	See Rating Chart (Gen. Info. Sec.)	
Plate Dissipation (Max.)	3.2	3.0 Watts
Grid No. 2 Dissipation (Max.)	—	0.65 Watt
Positive Grid No. 1 Voltage (Max.)	0	0 Volt

CHARACTERISTICS AND TYPICAL OPERATION

	Triode Conn.(2)	Pentode Connected		
Plate Voltage	250	100	250	250 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket			
Grid No. 2 Voltage	—	100	125	150 Volts
Cathode Bias Resistor	330	150	100	68 Ohms
Plate Current	12.2	5.0	7.6	10.6 Ma
Grid No. 2 Current	—	2.1	3.0	4.3 Ma
Transconductance	4800	3900	4500	5200 μmhos
Amplification Factor	36	—	—	—
Plate Resistance (Approx.)	—	0.5	1.5	1.0 Megohms
Ec1 for Ib = 10 μa (Approx.)	—	–4.2	–5.5	–6.5 Volts

NOTES:

(1) Shield No. 316 connected to Cathode Pin No. 7.

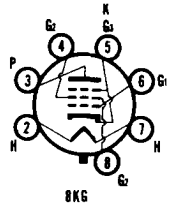
(2) When operated as a triode Grid No. 2 and Grid No. 3 should be tied to the plate.

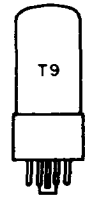
AUDIO POWER AMPLIFIER

7591A

Beam Power Pentode

Construction .....Octal T-9
Base.....Octal 7 Pin, B7-233 or B8-142
Basing 8KG
Outline 9-11
Maximum Diameter .....1.188 In.
Maximum Seated Height .....2.750 In.
Maximum Overall Height .....3.312 In.





ELECTRICAL DATA

HEATER OPERATION

Heater Voltage	6.3 Volts
Heater Current	800 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)

Grid No. 1 to Plate	0.25 Pf
Input	10 Pf
Output	5.0 Pf

RATINGS (Design Maximum Rating System)

Plate Voltage (Max.)	550 Volts
Grid No. 2 Voltage (Max.)	440 Volts
Plate Dissipation (Max.)	19 Watts
Grid No. 2 Dissipation (Max.)(1)	3.3 Watts
Cathode Current (Max.)	85 Ma
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.)	0.3 Megohm
Self Bias (Max.)	1.0 Megohm

CHARACTERISTICS AND TYPICAL OPERATION

	Pentode Operation S. T.– Class A1 Amp.	Ultra-Linear Operation(2) Class AB1 - Push-Pull	
Plate Voltage	300	400	425 Volts
Grid No. 2 Voltage	300	Note 2	Note 2 Volts
Grid No. 1 Voltage	–10	–20.5	— Volts
Cathode Resistor	—	—	185 Ohms
Peak AF Grid Voltage	10	20.5	21 Volts
Zero Signal Plate Current	60	80	88 Ma
Max. Signal Plate Current	75	138	104 Ma
Zero Signal Grid No. 2 Current	8	11.5	13 Ma
Max. Signal Grid No. 2 Current	15	26.4	17.5 Ma
Transconductance	10.2K	—	— μmhos
Plate Resistance (Approx.)	29K	—	— Ohms
Load Resistance	3K	—	— Ohms
Load Resistance (PL to PL)	—	6600	6600 Ohms
Power Output	11	32	26 Watts
Total Harmonic Distortion	13	1.0	2 Percent

Pentode Operation (Class AB1 Push-Pull Amp.)

Plate Voltage	300	350	400	450	450	450 Volts
Grid No. 2 Voltage	300	350	350	350	400	400 Volts
Grid No. 1 Voltage	–12.5	–15.5	–16	–16.5	–21	— Volts
Cathode Resistor	—	—	—	—	—	200 Ohms
Peak AF Grid to Grid Voltage	25	31	32	33	42	28 Volts
Zero Signal Plate Current	86	92	85	77	66	82 Ma
Max. Signal Plate Current	116	130	143	153	144	94 Ma
Zero Signal Grid No. 2 Current	12.6	13	11	9.6	9.4	11.5 Ma
Max. Signal Grid No. 2 Current	26	28.6	27	27	30	22 Ma
Load Resistance (PL to PL)	6600	6600	6600	6600	6600	9000 Ohms
Power Output	23	30	37	43	45	28 Watts
Total Harmonic Distortion	2.4	2	1.5	1.5	1.5	2 Percent

NOTES:

(1) Grid No. 2 Dissipation may be permitted to reach 6 watts during the periods of maximum input of speech and music signals. For efficient operation of Grid No. 2, the two Grid No. 2 connections, Pins 4 and 8, should be externally tied together.

(2) Grid No. 2 tapped at 40% of the primary winding.

RECEIVING TUBES
CONDENSED DATA

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
OA2 GB-OA2WA (3)	T-5½	Diode	5BO	....	....	Voltage Regulator with Starting Voltage at 185, Operating Voltage 150, Operating Current 5 to 30 Ma.											
OA3 OA3A	ST-12 T-9	Diode	4AJ	....	....	Voltage Regulator with Starting Voltage at 165, Operating Voltage 75, Operating Current 5 to 40 Ma.											
OA4G	ST-12	Gas Triode	4V	....	....	Relay Tube Peak Cathode Ma. = 100 D.C. Cathode Ma. = 25 Max. Starter Anode Drop = 60 V. Approx. Anode Drop = 70 V. Approx.											
OA5	T-5½	Gas Pentode	OA5	....	....	Switching	....	750	Trigger Grid Voltage = +90 Volts. Trigger Pulse Voltage = 160 Volts. Keep Alive Current = 50 μa.								
OB2 GB-OB2WA (3)	T-5½	Diode	5BO	....	....	Voltage Regulator with Starting Voltage at 115, Operating Voltage 105, Operating Current 5 to 30 Ma.											
OB3 OB3A	ST-12 T-9	Diode	4AJ	....	....	Voltage Regulator with Starting Voltage at 125, Operating Volts 90, Operating Current 5 Ma. Min., 30 Ma. Max.											
OC2	T-5½	Diode	5BO	....	....	Voltage Regulator with Starting Voltage at 105, Operating Voltage 75, Operating Current 5 Ma. Min., 30 Ma. Max.											
OC3 OC3A	ST-12 T-9	Diode	4AJ	....	....	Voltage Regulator with Starting Voltage at 135, Operating Volts 105, Operating Current 5 Ma. Min., 40 Ma. Max.											
OD3 OD3A	ST-12 T-9	Diode	4AJ	....	....	Voltage Regulator with Starting Voltage at 180, Operating 150 Volts, Operating Current 5 Ma. Min., 40 Ma. Max.											
OY4 OY4G	Metal T-7	Gas Diode	4BU	Ionic	....	H-W Rect.	....	117 A.C. Volts Per Plate, RMS, 75 Ma. Max., 40 Ma. Min. Output Current. Starter Anode Connects to Anode thru 10 Megohms By-Passed with .002 pf.									
1A3	T-5½	Diode	5AP	1.4	0.150	Detector	....	Half Wave Cathode Type Rectifier for H. F. Use.									
1A5GT	T-9	Power Pent.	6X	1.4♦	0.050	Power Amp.	....	85 90	4.5 4.5	85 90	3.5 4.0	0.7 0.8	300000 300000	800 850	....	25000 25000	100 115
1A7GT	T-9	Heptode	7Z	1.4♦	0.050	Converter	....	90	0.0	90	0.6	1.2	600000	250[4]	(Ga = 90 V. Max. 1.2 Ma.)		
1AC5	T-3	Pentode	8CP	1.25♦	0.040	Power Amp.	....	30 45 67.5	2.0 3.0 4.5	30 45 67.5	0.5 1.0 2.0	0.1 0.2 0.4	200000 170000 150000	450 600 750	....	50000 40000 25000	5 15 50
1AD5	T-3	Pentode	8CP	1.25♦	0.040	R-F Amp.	....	30 45 67.5	0 0 0	30 45 67.5	0.45 0.9 1.85	0.16 0.35 0.75	700000 700000 700000	430 580 735	....	....	....
1AE4	T-5½	Pentode	6AR	1.25♦	0.100	R-F Amp.	....	90	0	90	3.5	1.2	500000	1550	....	....	....
1AF4	T-5½	Pentode	6AR	1.4♦	0.025	R-F Amp.	....	67.5 90	0 0	67.5 90	1.2 1.8	0.32 0.55	2.2 Meg. 1.8 Meg.	925 1050	....	....	....
1AF5	T-5½	Diode Pent.	6AU	1.4♦	0.025	Det. Amp.	....	67.5 90	0 0	67.5 90	0.7 1.1	0.25 0.4	2.8 Meg. 2.0 Meg.	550 600	....	....	....
1AG4	T-2X3	Pentode	1AG4	1.25♦	0.040	Power Amp.	....	41.4	3.6	41.4	2.4	0.6	180000	1000	....	12000	35
1AG5	T-2X3	Diode Pent.	1AG5	1.25♦	0.030	Det. Amp.	....	45	2.0	45	0.28	0.12	2.5 Meg.	250	....	....	....
1AH4	T-2X3	Pentode	1AH4	1.25♦	0.040	R-F Amp.	....	45 67.5	5 Meg.[4] 5 Meg.[4]	45 67.5	0.75 0.75	0.2 0.2	1.5 Meg. 2.0 Meg.	750 750	....	....	....
1AJ2	Comp. T-9	Diode	12EL	1.25♦	0.200	Flyback H-W Rect.	....	Maximum Peak Inverse Plate Voltage = 26,000 Volts. Maximum Peak Plate Current = 50 Ma. Maximum Average Plate Current = 0.5 Ma.									
1AJ5	T-2X3	Diode Pent.	1AJ5	1.25♦	0.040	Det. Amp.	....	45	0	45	1.0	0.3	300000	425	....	....	....

1AK4	T-2X3	Pentode	1AK4	1.25♦	0.020	Class A1 Amp.	....	45 67.5	0 0	45	0.75 0.75	0.2 0.2	1500000 2000000	750 750	(Screen Supply = 67.5 Volts Thru .11 Meg. Res.)		
1AK5	T-2X3	Diode Pent.	1AK5	1.25♦	0.020	Det. Amp.	....	45	0	45	0.5	0.2	400000	280	....	....	....
1AN5	T-5½	Pentode	7ES	1.4♦	0.025	I-F Amp.	....	90	0	62	1.7	0.7	450000	940	G1 to G2 = 20	....	....
1AU2	T-6½	Diode	9U	1.10♦	0.190	Focus H-W Rect.	....	Maximum Peak Inverse Plate Voltage = 8250 Volts. Maximum Peak Plate Current = 11 Ma. Maximum Average Plate Current = 0.6 Ma.									
1AU3	T-12	Diode	3C	1.25♦	0.200	Flyback H-W Rect.	....	Maximum Peak Inverse Plate Voltage = 30,000 Volts. Maximum Peak Plate Current = 50 Ma. Maximum Average Plate Current = 0.5 Ma.									
1AX2	T-6½	Diode	9Y	1.4♦	0.650	Flyback H-W Rect.	....	Maximum Peak Inverse Plate Voltage = 25,000 Volts. Maximum Peak Plate Current = 45 Ma. Maximum Average Current = 0.5 Ma.									
1BK2/1RK41	T-6½	Diode	9Y	1.4♦	0.550	Flyback H-V Rect.	....	Maximum Peak Inverse Plate Voltage = 24,000 Volts. Maximum Peak Plate Current = 44 Ma. Maximum Average Plate Current = 0.88 Ma.									
1BL2	T-6½	Diode	Pins-Fil. Cap-Pl.	1.25♦	0.200	Flyback H-V Rect.	....	Maximum Peak Inverse Plate Voltage = 22,000 Volts. Maximum Peak Plate Current = 45 Ma. Maximum Average Plate Current = 0.5 Ma.									
1BV2	T-6½	Diode	1BV2	1.25	0.200	H-W Rect.	....	Max. Peak Inverse Plate Voltage = 18,000 Volts. Max. Peak Plate Current = 45 Ma. Max. Avg. Plate Current = 0.5 Ma.									
1DK29	T-3	Diode	....	0.9	0.200	HV Rect.	....	Max. Peak Inverse Plate Voltage = 9000 Volts. Max. Peak Plate Current = 4.0 Ma. Max. Avg. Plate Current = 0.2 Ma.									
1DN5	T-5½	Diode Pent.	6BW	1 4♦	0.050	Det. Amp.	....	67.5	0	67.5	2.1	0.55	.6 Meg.	630	....	....	....
1DY4A	T-5½	Triode	7DK	1.6	0.600	UHF Osc.	1.5	Characteristics Same as Type 6DY4A									
1H2	T-6½	Diode	9LX	1.4	0.550	Flyback H-W Rect.	....	Maximum Peak Inverse Plate Voltage = 24,000 Volts. Maximum Peak Plate Current = 50 Ma. Maximum Average Plate Current = 0.5 Ma.									
1H5GT	T-9	Diode Triode	5Z	1.4♦	0.050	Det. Amp.	....	90	0.0	....	0.15	...	240000	275	65	....	....
1J3A	T-9	Diode	3C	1.25♦	0.200	Flyback H-W Rect.	....	Maximum Peak Inverse Volts = 28,000 Volts. Maximum Peak Plate Current = 50 Ma. Maximum Average Plate Current = 0.5 Ma.									
1L4	T-5½	Pentode	6AR	1.4♦	0.050	R-F Amp.	....	90 90	0 0	67.5 90	2.9 4.5	1.2 2.0	600000 350000	925 1025	....	....	....
1L6	T-5½	Heptode	7DC	1.4♦	0.050	Converter	....	90	0	45	0.5	0.6	650000	300▲	(Ga = 90 V., 1.2 Ma.)		
1LA4	Lock-in	Power Pent.	5AD	1.4♦	0.050	Power Amp.	....	85 90	4.5 4.5	85 90	3.5 4.0	0.7 0.8	300000 300000	800 850	....	25000 25000	100 115
1LA6	Lock-in	Heptode	7AK	1.4♦	0.050	Converter	....	90	0.0	45	0.55	0.6	750000	250▲	(Ga = 90 V. Max., 1.2 Ma.)		
1LB4	Lock-in	Power Pent.	5AD	1.4♦	0.050	Power Amp.	....	45 67.5 90	4.5 6.0 9.0	45 67.5 90	1.6 3.8 5.0	0.3 0.8 1.0	400000 300000 250000	650 875 925	....	20000 16000 12000	35 100 200
1LC5	Lock-in	Pentode	7AO	1.4♦	0.050	R-F Amp.	....	45 90	0.0 0.0	45 45	1.1 1.15	0.35 0.30	700000 1.5 Meg.	750 775	....	....	....
1LC6	Lock-in	Heptode	7AK	1.4♦	0.050	Converter	....	45 90	0.0 0.0	35 35	0.7 0.75	0.75 0.7	300000 650000	250▲ 275▲	(Ga = 45 V. Max., 1.4 Ma.) (Ga = 45 V. Max., 1.4 Ma.)		
1LD5	Lock-in	Diode Pent.	6AX	1.4♦	0.050	Amplifier	....	45 90	0.0 0.0	45 45	0.55 0.6	0.12 0.1	750000 750000	550 575	....	....	....
1LE3	Lock-in	Triode	4AA	1.4♦	0.050	Amplifier	....	90 90	0.0 3.0	....	4.5 1.4	... ...	11200 19000	1300 760	14.5 14.5	....	....
1LG5	Lock-in	Pentode	7AO	1.4♦	0.050	R-F Amp.	....	45 90 90	0 0 1.5	45 45 90	1.5 1.7 3.7	0.45 0.4 0.9	350000 1000000 500000	800 800 1050	....	....	....
1LH4	Lock-in	Diode Triode	5AG	1.4♦	0.050	Det. Amp.	....	90	0.0	....	0.15	...	240000	275	65	....	....

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
1LN5	Lock-in	Pentode	7AO	1.4♦	0.050	R-F Amp.	....	90	0.0	90	1.6	0.35	1.1 Meg.	800	....	....	....
1N2A	T-12	Diode	3C	1.25♦	0.200	Flyback H-W Rect.	....	Maximum Peak Inverse Plate Voltage = 28,000 Volts. Max. Peak Plate Current = 50 Ma. Maximum Average Plate Current = 0.5 Ma.									
1N5GT	T-9	Pentode	5Y	1.4♦	0.050	R-F Amp.	....	90	0.0	90	1.2	0.3	1.5 Meg.	750	....	....	....
1R4	Lock-in	H. F. Diode	4AH	1.4♦	0.150	Detector	....	Half Wave Cathode Type Rectifier for High Frequency Use.									
1R5	T-5½	Heptode	7AT	1.4♦	0.050	Converter	....	45	0.0	45	0.7	2.1	500000	210▲	....	....	....
								90	0.0	67.5	1.5	3.5	400000	280▲	....	....	....
1S2A/DY87	T-6½	Diode	9DT	1.4	0.550	HV Rectifier	....	Max. Peak Plate Voltage = 22,000 Volts. Max. Peak Plate Current = 40 Ma.									
1S4	T-5½	Power Pent.	7AV	1.4♦	0.100	Power Amp.	....	45	4.5	45	3.8	0.8	100000	1250	....	8000	65
								90	7.0	67.5	7.4	1.4	100000	1575	....	8000	270
1S5	T-5½	Diode Pent.	6AU	1.4♦	0.050	Det. Amp.	....	67.5	0.0	67.5	1.6	0.4	600000	625	....	....	....
1S6	T-3	Diode Pent.	8DA	1.25♦	0.040	Det. Amp.	....	30	0	30	0.33	0.1	500000	330	....	....	....
								45	0	45	0.75	0.21	500000	475	....	....	....
								67.5	0	67.5	1.6	0.4	400000	600	....	....	....
1T4	T-5½	Pentode	6AR	1.4♦	0.050	R-F Amp.	....	45	0.0	45	1.7	0.7	350000	700	....	....	....
								90	0.0	67.5	3.5	1.4	500000	900	....	....	....
1U4	T-5½	Pentode	6AR	1.4♦	0.050	R-F Amp.	....	90	0	90	1.6	0.45	1.6 Meg.	900	....	....	....
1U5	T-5½	Diode Pent.	6BW	1.4♦	0.050	Det. Amp.	....	Characteristics Same as Type 1S5.									
1U6	T-5½	Heptode	7DC	1.4♦	0.025	Converter	....	67.5	0	45	0.5	0.7	500000	260▲	(Ga = 67.5 V., 1.0 Ma.)		
								90	0	45	0.6	0.6	500000	275▲	(Ga = 90 V., 1.1 Ma.)		
1V6	T-2x3	Tri. Pentode	1V6	1.25♦	0.040	R-F Osc.	....	45	1 Meg.[4]	....	0.4	IG1 = 12 μa		....	....	....	....
						R-F Amp.	....	45	5 Meg.[4]	45	0.4	0.15	Conv. = 1.0 Meg.	200▲	....	....	....
2A3	ST-16	Triode	4D	2.5♦	2.500	S.T. A1 Amp.	16.5	250	45.0	....	60.0	....	800	5250	4.2	2500	3500
						P.P.AB1 Amp.		300	62.0	....	80-147†. Push Pull, Fixed Bias					3000¶	15000
2AZ2	T-6½	Diode	9Y	2.1♦	0.275	Flyback H-W Rect.	....	Maximum Peak Inverse Plate Voltage = 22,000 Volts. Maximum Peak Plate Current = 45 Ma. Maximum Average Plate Current = 0.5 Ma.									
2B3	T-9	Diode	8HC	1.75♦	0.250	H-W Rect.	....	Television Service. Flyback Supplies. Peak Inverse Volts = 22 KV. Output = 0.5 Ma.									
2BA2	T-6½	Diode	9U	1.8♦	0.300	Flyback H-W Rect.	....	Maximum Peak Inverse Plate Voltage = 8250 Volts. Maximum Peak Plate Current = 50 Ma. Maximum Average Plate Current = 0.6 Ma.									
2BJ2	T-6½	Diode	9RT	2.3	0.300	Flyback H-W Rect.	....	Maximum Peak Inverse Plate Voltage = 20,000 Volts. Maximum Peak Plate Current = 80 Ma. Maximum Average Plate Current = 1.0 Ma.									
2C21	ST-12	Duotriode	7BH	6.3	0.600	Amplifier	2.3	250	16.5	....	8.3	...	7600	1375	10.4	20000	....
						Power Amp.	....	250	60.0	....	20.0	...	....	....	....	....	3500
2C22	T-9	Triode	4AM	6.3	0.300	Amplifier	3.3	300	10.5	....	11.0	...	6600	3000	20.0	....	....
2C50	T-9	Duotriode	8BD	12.6	0.300	Amplifier	3.85	200	11	....	18	...	3450	2900	10	....	....
2C51	T-6½	Duotriode	8CJ	6.3	0.300	Amplifier	1.65	150	240■	....	8.2	...	6500	5500	35	....	....
2C52	T-9	Duotriode	8BD	12.6	0.300	Amplifier	1.65	250	2.0	....	1.3	...	....	1900	100	....	....
2D21	T-5½	Gas Tetrode	7BN	6.3	0.600	Relay Tube	....	400	5	Average Cathode Current = 100 Max. Ma., Averaged over any 30 Sec. Interval.							

2DF4	T-6½	Pentode	9JL	1.25♦ 2.50♦	0.345 0.690	Class "C" Power Amp.	4.5	120	3.6	120	37	3.5	....	6850	....	....	....
2DX4	T-5½	Triode	7DK	2.4	0.600	UHF Osc.	2.2	Characteristics Same as Type 6DX4.									
2DY4	T-5½	Triode	7DK	2.05	0.450	UHF Osc.	1.5	Characteristics Same as Type 6DY4.									
2E26	T-9	Beam Pent.	7CK	6.3	0.800	Class C Amp.	10	500	40.0	185	60.0	11.0	Driving Power = 0.12 Watts. D.C. Grid No. 1 Current = 3.0 Ma.				2000
2EA5	T-5½	Tetrode	7EW	2.4	0.600	VHF Amp.	3.25	Characteristics Same as Type 6EA5.									
2EG4	Nuvistor	Triode	12AQ	1.7	0.600	VHF Amp.	1.5	110	130■	....	6.5	...	7000	12500	68	....	....
2EN5	T-5½	Duodiode	7FL	2.1	0.450	Phase- Comparator	....	*Diode Current for Continuous Operation (Each Plate)* = 20 Ma. Diode Characteristics with 5.0 Volts Applied. Ib = 20 Ma. (Each Plate—Test Condition Only.)									
2GW5	T-5½	Triode	7GK	2.45	0.600	VHF Amp.	2.5	Characteristics Same as Type 6GW5.									
2HR8	T-6½	Pentode	9BJ	2.5	0.600	Amplifier	1.0	250	2	140	3	0.6	2500	2000	38	....	....
2X2 2X2A(3)	ST-12	Diode	4AB	2.5♦	1.750		....	Maximum Inverse Plate Voltage = 12,500 Volts, Maximum Peak Current = 60 Ma. Maximum Average Current = 7.5 Ma., Maximum RMS Supply Voltage = 5500 Volts.									
3A4	T-5½	Pentode	7BB	1.4♦ 2.8♦	0.200 0.100	Power Amp.	2.5	135 150	7.5 8.4	90 90	14.8 13.3	2.6 2.2	90000 100000	1900 1900	....	8000 8000	600 700
3A5	T-5½	Duotriode	7BC	1.4♦ 2.8♦	0.220 0.110	Amplifier	0.55	90 135	2.5 20.0	....	3.7 30.0	... Push-Pull	8300 Class C R.F. Amp.	1800	15	....	 2000
3AF4A	T-5½	Triode	7DK	3.2	0.450	UHF Osc.	2.5	Characteristics Same as Type 6AF4A.									
3AW3	T-9	Diode	8EZ	3.15♦	0.220	Flyback H-W Rect.	....	Maximum Peak Inverse Volts = 30,000 Volts. Maximum Peak Plate Current = 88 Ma. Maximum Average Plate Current = 1.7 Ma.									
3B2	T-12	Diode	8GH	3.15	0.220	H-W Rect.	....	TV Service. Pulsed Rectifier Service. Max. Peak Inverse Volts = 35 Kv, Output = 1.1 Ma.									
3B7	Lock-in	Duotriode	7BE	2.8♦ 1.4♦	0.110 0.220	Power Amp. Oscillator	2.97	135 180	0 0	....	22.0 25.0	(Class AB2) (Class C)	.... R.F. Pwr. Amp. 2800 mw at 25 mc, 1400 mw at 125 mc.	1900	20	16000	1500
3BC5/3CE5	T-5½	Pentode	7BD	3.15	0.600	VHF Amp.	2.3	Characteristics Same as Type 6BC5/6CE5.									
3BF2	T-9	Diode	12GQ	3.6	0.225	Flyback H-W Rect.	....	Maximum Peak Inverse Plate Voltage = 35,000 Volts. Maximum Peak Plate Current = 115 Ma. Maximum Average Plate Current = 2.2 Ma.									
3BX6	T-6½	Pentode	9AQ	3.4	0.600	VHF Amp.	2.5	Characteristics Same as Type 6BX6.									
3BY7	T-6½	Pentode	9AQ	3.4	0.600	VHF Amp.	2.7	100 250	1.1 2.0	57 100	5.5 10	1.6 2.5	250000 600000	5000 6000	....	....	....
3CF6/3CB6	T-5½	Pentode	7CM	3.15	0.600	VHF Amp.	2.3	Characteristics Same as Type 6CF6.									
3CV3	T-9	Diode	8EZ	3.15♦	0.250	Flyback H-V Rect.	....	Maximum Peak Inverse Plate Voltage = 35,000 Volts. Maximum Peak Plate Current = 100 Ma. Maximum Average Plate Current = 1.9 Ma.									
3CX3	T-9	Diode	8MT	3.15♦	0.480	Flyback H-V Rect.	....	Maximum Peak Inverse Plate Voltage = 38,000 Volts. Maximum Peak Plate Current = 110 Ma. Maximum Average Plate Current = 2.2 Ma.									
3CZ3	T-9	Diode	8EZ	3.15♦	0.480	Flyback H-V Rect.	....	Maximum Peak Inverse Plate Voltage = 38,000 Volts. Maximum Peak Plate Current = 110 Ma. Maximum Average Plate Current = 2.2 Ma.									
3D6	Lock-in	Beam Pent.	6BA	2.8♦ 1.4♦	0.110 0.220	Power Amp.	4.95	150 150	4.5 20.0	90 135	10.2 23.0	1.8 6.0	(Class A) (Class C)	2400 R.F. Power Amp. at 50 mc.	....	14000	600 1400
3DA3	T-9	Diode	8MY	3.15	0.480	HV Rect.	....	Max. Peak Inverse Plate Voltage = 38,000 Volts. Max. Peak Plate Current = 110 Ma. Max. Avg. Plate Current = 2.2 Ma.									
3DB3	T-9	Diode	8MX	3.15	0.245	HV Rect.	....	Max. Peak Inverse Plate Voltage = 38,000 Volts. Max. Peak Plate Current = 100 Ma. Max. Avg. Plate Current = 2.0 Ma.									
3DHH13	T-3	Twin Triode	8LK	3.5	0.600	Cascode Amp.	1.7	Characteristics Same as Type 6DHH13.									

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
3DT6	T-5½	Gated Beam	7EN	3.15	0.600	Quad F. M. Det.	1.65	Characteristics Same as Type 6DT6.									
3DX4	T-5½	Triode	7DK	3.0	0.450	UHF Osc.	2.2	Characteristics Same as Type 6DX4.									
3DY4A	T-5½	Triode	7DK	2.9	0.300	UHF Osc.	1.5	Characteristics Same as Type 6DY4A.									
3EA5	T-5½	Tetrode	7EW	2.9	0.450	VHF Amp.	3.25	Characteristics Same as Type 6EA5.									
3FW7	T-3	Twin Triode	8LM	3.5	0.600	VHF Osc.-Mixer	....	Characteristics Same as Type 6FW7.									
3FX7/3DHH13	T-3	Twin Triode	8LK	3.5	0.600	VHF Amp.	1.7	Characteristics Same as Type 6FX7.									
3GW5	T-5½	Triode	7GK	3.0	0.450	VHF Amp.	2.5	Characteristics Same as Type 6GW5.									
3KF8	T-6½	Twin Pentode	9FG	3.15	0.600	Sync. AGC	1.1	Characteristics Same as Type 6KF8.									
3KT6	T-6½	Pentode	9PM	3.5	0.600	IF Amp.	3.1	Characteristics Same as Type 6KT6.									
3LF4	Lock-in	Beam Pent.	6BA	1.4♦ 2.8♦	0.100 0.050	Power Amp.	....	Characteristics Same as Type 3Q5GT.									
3MP26	T-5½	Beam Pent.	6CC	3.5	0.600	A-F Out Amp.	4.2	110	10	110	32	1.5	16000	4250	....	2800	1400
3Q4	T-5½	Power Pent.	7BA	1.4♦ 2.8♦	0.100 0.050	Power Amp.	....	85 90 90	5.0 4.5 4.5	85 90 90	6.9 9.5 7.7	1.5 2.1 1.7	120000 100000 120000	1975 2150 2000	....	10000 10000 10000	250 270 240
3Q5GT	T-9	Beam Pent.	7AP	1.4♦ 2.8♦	0.100 0.050	Power Amp.	....	90 90	4.5 4.5	90 90	9.5 8.0	1.3 1.0	90000 80000	2200 2000	....	8000 8000	270 230
3S4	T-5½	Power Pent.	7BA	1.4♦ 2.8♦	0.100 0.050	Power Amp.	....	90 90	7.0 7.0	67.5 67.5	7.4 6.1	1.4 1.1	100000 100000	1575 1425	....	8000 8000	270 235
3V4	T-5½	Power Pent.	6BX	1.4♦ 2.8♦	0.100 0.050	Power Amp.	....	Characteristics Same as Type 3Q4.									
3Z4	T-5½	Power Pent.	7BA	1.4♦ 2.8♦	0.050 0.025	Power Amp.	....	67.5	7.0	67.5	6.5	1.3	100000	1450	....	8000	210
4BC5	T-5½	Pentode	7BD	4.2	0.450	VHF Amp.	2.2	Characteristics Same as Type 6BC5/6CE5.									
4BN4	T-5½	Triode	7EG	4.2	0.300	VHF Amp.	2.42	Characteristics Same as Type 6BN4A.									
4BX8	T-6½	Duotriode	9AJ	4.5	0.600	VHF Amp.	2.0	Characteristics Same as Type 6BX8.									
4CE5	T-5½	Pentode	7BD	4.2	0.450	VHF Amp.	2.2	Characteristics Same as Type 6BC5/6CE5.									
4CM4	T-6½	Triode	9KG	3.8	0.300	VHF Amp.	1.1	Characteristics Same as Type 6CM4.									
4CX7	T-6½	Duotriode	9FC	4.2	0.600	Amplifier	2.2	Characteristics Same as Type 6CX7.									
4DT6	T-5½	Gated Beam	7EN	4.2	0.450	Quad F. M. Det.	1.65	Characteristics Same as Type 6DT6.									
4GS7	T-6½	Tri. Pentode	9GF	4.0	0.600	VHF Amp.	1.5 2.2	Characteristics Same as Type 7GS7.									
4GW5	T-5½	Triode	7GK	4.2	0.300	VHF Amp.	2.5	Characteristics Same as Type 6GW5.									
4HA7/4HC7	Comp. T-9	Double Tri.	12FQ	4.2	0.600	Phase Inverter Voltage Amp.	2.75 0.30	250 250	8.5 2.0	....	10.5 1.2	... ...	7700 62500	2200 1600	17 100	....	....
4HR8	T-6½	Pentode	9BJ	4.5	0.300	Amplifier	1.0	250	2	140	3	0.6	2500	2000	38	....	....

4KF8	T-6½	Twin-Pentode	9PG	4.2	0.450	Sync. AGC	1.1	Characteristics Same as Type 6KF8.										
4KT6	T-6½	Pentode	9PM	4.5	0.450	IF Amp.	....	Characteristics Same as Type 6KT6.										
4MP12	T-5½	Beam Pent.	6CC	4.7	0.600	A-F Pwr. Amp. Ver. Defl. Amp	8.5	180	6.0	180	25	5.0	....	5500	....	6000	2000	
4MP26	T-5½	Beam Pent.	6CC	4.5	0.450	A-F Pwr. Amp. Ver. Defl. Amp	....	Characteristics Same as Type 3MP26.										
4RHH8/4KN8	T-6½	Twin Triode	9AJ	4.2	0.600	VHF Amp.	2.2	Characteristics Same as Type 6RHH8/6KN8.										
5AF4A	T-5½	Triode	7DK	4.7	0.300	UHF Osc.	2.5	Characteristics Same as Type 6DZ4/6AF4A.										
5AT4	ST-16	Duodiode	5L	5.0♦	5.500	F-W Rect.	....	550 A.C. Volts Per Plate, RMS, 800 Ma. Output Current. Condenser Input to Filter.										
5AW4	T-12	Duodiode	5T	5.0♦	4.000	F-W Rect.	....	450 A.C. Volts Per Plate, RMS, 250 Ma. Output Current. Condenser Input to Filter. Peak Current = 750 Ma. Per Plate.										
5AX4GT	T-9	Duodiode	5T	5.0♦	2.250	F-W Rect.	....	350 A.C. Volts Per Plate, RMS, 150 Ma. D.C. Output Current. Condenser Input to Filter. 500 A.C. Volts Per Plate, RMS, 150 Ma. D.C. Output Current. Choke Input to Filter.										
5AZ3	Comp. T-12	Duodiode	12BR	5.0♦	3.000	F-W Rect.	....	300 A.C. Volts Per Plate, RMS, 300 Ma. Output Current. Condenser Input to Filter. 450 A.C. Volts Per Plate, RMS, 275 Ma. Output Current. Condenser Input to Filter.										
5AZ4	Lock-in	Duodiode	5T	5.0♦	2.000	F-W Rect.	....	Characteristics Same as Type 5Y3GT.										
5B8	T-6½	Tri. Pentode	9EC	4.7	0.600	Tri. Amp. Pent. Amp.	2.2 2.75	200 200	6 180■	 150	13 9.5	... 2.8	5750 300000	3300 6200	19	....	....	
5BE8	T-6½	Tri. Pentode	9EG	4.7	0.600	Tri. Osc. Converter	2.75 3.0	Characteristics Same as Type 6U8A/6KD8.										
5BW8	T-6½	Duodi. Pent.	9HK	4.7	0.600	R-F or I-F Amplifier	3.0	Characteristics Same as Type 6BW8.										
5CG4	T-9	Duodiode	5L	5.0	2.0	F-W Rect.	....	350 A.C. Volts Per Plate, RMS, 125 Ma. Max. D.C. Output Current.										
5CR8	T-6½	Tri. Pentode	9GJ	4.7	0.600	Tri. Amp. Pent. Amp.	2.75 2.3	Characteristics Same as Type 6CR8.										
5CU4	T-12	Duodiode	8KD	5.0♦	3.300	H-W Rect.	....	260 Volts A.C. Per Plate, RMS, 385 Ma. Output Current. Condenser Input to Filter.										
5DH8	T-6½	Tri. Pentode	9EG	5.2	0.600	Vert. Osc. Video Amp.	2.0 2.2	250 125	390■ 56■	 125	7.3 13.5	... 3.8	12000 150000	4400 8600	53	....	....	
5EH8	T-6½	Tri. Pentode	9JG	4.7	0.600	VHF Osc. VHF Amp.	2.75 3.0	Characteristics Same as Type 6EH8.										
5GS7	T-6½	Tri. Pentode	9GF	5.4	0.450	IF Amp.	1.5 2.2	Characteristics Same as Type 7GS7.										
5HA7	Comp. T-9	Double Tri.	12FQ	5.6	0.450	Phase Inverter Voltage Amp.	2.75 0.30	250 250	8.5 2.0	....	10.5 1.2	... ...	7700 62500	2200 1600	17 100	....	....	
5HC7	Comp. T-9	Double Tri.	12FR	5.6	0.450	Sync. Clipper	3.0 1.2	150 150	1 1	....	18 1	... ...	5200 53000	4400 1900	23 100	....	....	
5MK9	T-5½	Diode	....	5.0	0.600	H-W Rect.	....	Max. Peak Inverse Plate Voltage = 1000 Volts. Max. Peak Plate Current = 360 Ma. Max. Avg. Plate Current = 60 Ma.										
5MQ8	T-6½	Triode Pent.	9AE	5.6	0.600	Pentode Amp. Triode Amp.	....	Characteristics Same as 6MQ8.										
5R4GYB	ST-16 T-12	Duodiode	5T	5.0♦	2.000	F-W Rect.	....	900 Volts, RMS Per Plate, 150 Ma. D.C. Output. Condenser Input to Filter. 950 Volts, RMS Per Plate, 175 Ma. D.C. Output. Choke Input to Filter.										
5RK16	T-6½	Diode	....	5.0	1.200	F-W Rect.	....	Max. Peak Inverse Plate Voltage = 1000 Volts. Max. Peak Plate Current = 450 Ma. Max. Avg. Plate Current = 150 Ma (each plate).										
5T4	Metal	Duodiode	5T	5.0♦	2.000	Rectifier	....	450 A.C. Volts Per Plate, RMS, 225 Ma. Output Current. Condenser Input to Filter. 550 A.C. Volts Per Plate, RMS, 225 Ma. Output Current. Choke Input to Filter.										

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
5U4G	ST-16	Duodiode	5T	5.0♦	3.000	F-W Rect.	....	450 A.C. Volts Per Plate, RMS, 225 Ma. Output Current. Condenser Input to Filter.									
5U4GA	T-11	Duodiode	5T	5.0♦	3.000	F-W Rect.	....	450 A.C. Volts Per Plate, RMS, 250 Ma. Output Current. Condenser Input to Filter. Peak Current = 900 Ma. Per Plate.									
5U4WG(3)	T-12	Duodiode	5T	5.0♦	3.000	F-W Rect.	....	Characteristics Same as Type 5U4GB.									
5V3	T-12	Duodiode	5T	5.0♦	3.800	F-W Rect.	....	425 A.C. Volts Per Plate, RMS, 350 Ma. Output Current. Condenser Input to Filter. 500 A.C. Volts Per Plate, RMS, 350 Ma. Output Current. Choke Input to Filter.									
5Y3GA GB-5Y3WGTA(3)	T-9 T-12	Duodiode	5T	5.0♦	2.000	F-W Rect.	....	350 A.C. Volts Per Plate, RMS, 125 Ma. Output Current. Condenser Input to Filter. 500 A.C. Volts Per Plate, RMS, 125 Ma. Output Current. Choke Input to Filter.									
5Y4GT	T-9	Duodiode	5Q	5.0♦	2.000	F-W Rect.	....	Characteristics Same as Type 5Y3GT.									
5Z3	ST-16	Duodiode	4C	5.0♦	3.000	F-W Rect.	....	450 A.C. Volts Per Plate, RMS, 225 Ma. Output Current. Condenser Input to Filter.									
5Z4GT	Metal T-9	Duodiode	5L	5.0	2.000	F-W Rect.	....	350 A.C. Volts Per Plate, RMS, 125 Ma. Output Current. Condenser Input to Filter.									
6A3	ST-16	Power Triode	4D	6.3♦	1.000	S.T. A1 Amp.	16.5	250	45.0	....	60.0	...	800	5250	4.2	2500	3200
						P.P.AB1 Amp.	....	325	68.0	....	80-147† (Push Pull, Fixed Bias)				....	3000¶	15000
						P.P.AB1 Amp.	....	325	...	....	80-100† (Push Pull, Self Bias Resistor 850 Ohms)					5000¶	10000
6A7	ST-12	Heptode	7C	6.3	0.300	Converter	1.1	Characteristics Same as Type 6A8G, Except Capacitances.									
6A8GT	T-9	Heptode	8A	6.3	0.300	Converter	1.1	100	1.5	50	1.1	1.3	600000	360▲	(Ga = 100V.)		
								250	3.0	100	3.5	2.7	360000	550▲	(Ga = 250 V. thru 20 K. Ohm)		
6AB7	Metal	Pentode	8N	6.3	0.450	Amplifier	4.12	300	3.0	200	12.5	3.2	700000	5000	3500	....	....
6AB8/ECL80	T-6½	Tri. Pentode	6AB8	6.3	0.300	A-F Amp.	1.0	100	2.3	....	4	...	12500	1400	17	....	....
						S.T.A1 Amp.	....	170	6.3	170	15	2.8	150000	3300	....	11000	1000
6AB9	T-6½	Twin Tetrode	10N	6.3	0.365	VHF Amp.	2.0	125	1	80	8	2	110,000	10000	....	....	....
6AC7	Metal	Pentode	8N	6.3	0.450	Video Amp.	3.3	300	160■	150	10.0	2.5	1.0 Meg.	9000	6750	....	....
6AD4	T-3	Triode	8DK	6.3	0.150	Osc. Amp.	0.33	100	820■	....	1.4	...	35000	2000	70	....	....
6AD6G	T-9	Electron Ray	7AG	6.3	0.150	Indicator	....	100 (Ray Control Volts = 45 Approx. For 0° Shadow, Approx. = 23 Volts for 135° Shadow.) 150 (Ray Control Volts = 75 Approx. For 0° Shadow, Approx. = 50 Volts for 135° Shadow.)									
6AF6G	T-9	Twin Elec. Ray	7AG	6.3	0.150	Indicator	....	100 (Ray Control Volts = Approx. 60 for 0° Shadow, Approx. Zero Volts for 100° Shadow.) 135 (Ray Control Volts = Approx. 81 for 0° Shadow, Approx. Zero Volts for 100° Shadow.)									
6AF10	Comp. T-9	Double Pent.	12GX	6.3	1.200	Sound IF	3.0	200	2	150	10	2.5	.....	10000	....	....	....
						Video Amp.	5.0	200	68■	125	22	4	75000	23000	....	....	....
6AG5	T-5½	Pentode	7BD	6.3	0.300	R-F Amp.	2.0	100	180■	100	4.5	1.4	600000	4500	....	....	....
								125	100■	125	7.2	2.1	500000	5100	....	....	....
								250	180■	150	6.5	2.0	800000	5000	....	....	....
6AG7	Metal	Pentode	8Y	6.3	0.650	Video Amp.	9.9	300	3	150	30.0	7.0	130000	11000	....	10000	3000
6AG10	Comp. T-9	Twin Hex.	12GT	6.3	0.750	Color Demod.	2.0	40	120■	25	5	0.5	....	10000	G4 = 10 V. with G3 = 100 V.		
6AH4GT	T-9	Triode	8EL	6.3	0.750	Defl. Amp.	7.5	250	23	....	30	...	1780	4500	8	....	....
6AJ4	T-6½	Triode	9BX	6.3	0.225	UHF Amp.	2.2	125	68■	....	16	...	4200	10000	42	....	....
6AJ5	T-5½	Pentode	7BD	6.3	0.175	R-F Amp.	1.87	28	1.0	28	2.7	1.0	100000	2500	....	....	....
6AK4	T-3	Triode	8DK	6.3	0.125	UHF Amp.	3.3	200	680■	....	9.5	...	5300	3800	20	....	....

6AK6	*T-5½*	*Power Pent.*	*7BK*	*6.3*	*0.150*	*Power Amp.*	*3.0*	*180*	*9.0*	*180*	*15.0*	*2.5*	*200000*	*2300*	....	*10000*	*1100*	
6AK8/EABC80	T-6½	Triple Diode Triode	9E	6.3	0.450	Det. Amp.	1.0	250	3	....	1	....	58000	1.2	70	....	....	
								Average Diode Current Sec. 1 (1 Ma), Sec. 2 (10 Ma), Sec. 3 (10 Ma).										
6AK9	Comp. T-12	Double Triode Pent.	12GZ	6.3	1.600	Pent. Vert.	....	Maximum Peak Positive Plate Voltage = 2,500 Volts. Maximum D.C. Cathode Current = 80 Ma.										
						Defl. Amp.	10.0	150	14.0	150	49.0	3.5	16400	6200	....	....	....	
						Tri.#2 Ver. Osc.	1.0	150	5.0	....	5.5	....	8500	2350	20	....	....	
						Tri.#1 Syn. Clip	1.25	150	2.0	....	-5.4	....	11000	3900	43	....	....	
6AL7GT	T-9	*Electron Ray*	8CH	6.3	*0.150*	*Indicator*	....	*315*	*Grid Volt. for Fluorescent C.O. = −7.0 (App.). Deflection Sens = 1.0 MM. Per Volt (App.)*									
6AL11	Comp. T-9	Duo. Pentode	12BU	6.3	0.900	FM Detector	1.7	150	560■	100	1.3	2.1	150000	G1-1000 G3-400	....	....	....	
						S.T.A1 Amp.	10	250	8.0	250	35	2.5	100000	6500	....	5000	4200	
6AM4	T-6½	Triode	9BX	6.3	0.225	UHF Amp.	2.0	200	100■	....	10	....	8700	9800	85	....	....	
6AN6	T-5½	Quadruple Di.	7BJ	6.3	0.200	Rectifier	....	75 Volts RMS Per Plate, 8 Ma. D-C Output Per Plate.										
6AQ7GT	T-9	Duodiode Tri.	8CK	6.3	0.300	Det. Amp.	1.1	250	2.0	....	2.3	....	44000	1600	70	....	....	
6AR5	T-5½	Power Pent.	6CC	6.3	0.400	Power Amp.	9.35	250	16.5	250	34	5.7	65000	2400	....	7000	3.2	
								250	18.0	250	32	5.5	68000	2300	....	7600	3.4	
6AS6	T-5½	Pentode	7CM	6.3	0.175	R-F Amp.	1.87	120	2.0	120	5.2	3.5	110000	3200	....	....	....	
6AS7GB	T-12	Duo-Power Triode	8BD	6.3	2.500	Passing Tube	14.3	135	250■	....	125	....	280	70000	2	....	....	
						for VR Service	14	Controlled Zero Bias Plate Current.										
6AU5GT	T-9	Beam Pent.	6CK	6.3	1.250	Horiz. Defl. Amp.	10	Max. Peak Positive Pulse Plate Voltage = 5500 Volts. Max. D.C. Plate Current = 110 Ma.										
GB-6AU6WB (3)	T-5½	Pentode	7BK	6.3	0.300	R-F Amp.	3.5	100	150■	100	5.0	2.1	500000	3900	....	....	....	
								250	100■	125	7.6	3.0	1.5 Meg.	4500	....	....	....	
								250	68■	150	10.6	4.3	1.0 Meg.	5200	....	....	....	
6AX8	T-6½	Tri. Pentode	9AE	6.3	0.450	Sync. Sep.	2.97	150	56■	....	18	....	5000	8500	40	....	....	
						Video Amp.	3.0	250	120■	110	10	3.5	400000	4800	....	....	....	
6AZ5	T-3	Duodiode	8DF	6.3	0.150	Rectifier	....	Plate Supply Voltage = 50 Volts, RMS, Each Plate. D.C. Output Current = 4 Ma. Each Plate. Capacitor Input to Filter.										
6B3	T-6½	Diode	9BD	6.3	1.200	T.V. Damper	....	Maximum Peak Inverse Plate Voltage = 4400 Volts. Maximum D.C. Plate Current = 150 Ma.										
6B4G	ST-16	Triode	5S	6.3♦	1.000	Power Amp.	16.5	Characteristics Same as Type 6A3.										
6B8	Metal	Duodi. Pent.	8E	6.3	0.300	Det. Amp.	3.3	Characteristics Same as Type 6B7, Except Capacitances.										
6BA3	T-9	Diode	9HP	6.3	1.200	T.V. Damper	5.3	Maximum Peak Inverse Plate Voltage = 5000 Volts. Maximum D.C. Output Current = 165 Ma.										
6BA5	T-3	Pentode	8DY	6.3	0.150	A-F Amp.	0.77	100	270■	100	5.5	2.0	175000	2150	....	....	....	
6BA7	T-6½	Heptode	8CT	6.3	0.300	Converter	2.2	100	1.0	100	3.6	10.2	500000	900▲	....	....	....	
								250	1.0	100	3.8	10.0	1 Meg.	950▲	....	....	....	
6BC5/6CE5	T-5½	Pentode	7BD	6.3	0.300	Tri. Amp.	2.75	250	820■	....	6.0	....	9000	4400	40	....	....	
								180	330■	....	8.0	....	6000	6000	42	....	....	
						Pent. Amp.	2.2	100	180■	100	4.7	1.4	600000	4900	....	....	....	
								125	100■	125	8.0	2.4	500000	6100	....	....	....	
								250	180■	150	7.5	2.1	800000	5700	....	....	....	
6BD4A	T-12	Beam Triode	8FU	6.3	0.600	Hi-Volt. Reg.	27.5	27000 Max. D.C. Plate Volts. 125 Max. D.C. Grid Volts. 1.5 Ma. Max. D.C. Plate Current.										
6BD5GT	T-9	Beam Pent.	6CK	6.3	0.900	Horiz. Defl. Amp.	11	Max. Peak Positive Pulse Plate Voltage = 4000 Volts. Max. D.C. Cathode Current = 100 Ma.										
6BE8A	T-6½	Tri. Pentode	9EG	6.3	0.450	VHF Osc.	2.75	150	56■	....	18.0	....	5000	8500	40	....	....	
						VHF Amp.	3.0	250	68■	110	10.0	3.5	400000	5200	....	....	....	
6BF5	T-5½	Pentode	7BZ	6.3	1.200	S.T.A1 Amp.	5.5	110	7.5	110	36	4	12000	7500	....	2500	1900	

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
6BF6	T-5½	Duodiode Tri.	7BT	6.3	0.300	Det. Amp.	2.75	250	9.0	....	9.5	...	8500	1900	16	10000	300
6BF7W (3)	T-3	Duotriode	8DG	6.3	0.300	R-F Amp.	1.1	100 100	100■ 100■	....	8.0 8.0	... ...	7000 7000	4800 4800	35 35	....	....
6BF8	T-6½	Sextuple Diode	9NX	6.3	0.450	Shunt Detector	....	Maximum Peak Inverse Plate Voltage = 165 Volts. Maximum Peak Plate Current, Per Plate = 11 Ma., Maximum D.C. Output Current = 2.2 Ma.									
6BG6GA	T-12	Beam Pent.	5BT	6.3	0.900	Horiz. Defl. Amp.	22	Maximum Peak Positive Plate Voltage = 6600 Volts. Maximum D.C. Cathode Current = 110 Ma									
6BJ5	T-5½	Pentode	6CH	6.3	0.640	Power Amp.	9.9	250	5.0	250	3.5	5.5	40000	10500	450	7000	4000
6BK5	T-6½	Beam Pent.	9BQ	6.3	1.200	Power Amp.	9.9	250	5.0	250	35	3.5	0.1 Meg.	8500	....	6500	3500
6BK11	Comp. T-9	Triple Triode	12BY	6.3	0.600	VHF Amp.	0.4	250 250	2.5 2.0	....	1.6 1.2	... ...	45000 62000	1550 1600	70 100	....	....
6BL4	T-12	Diode	8GB	6.3	3.000	T.V. Damper	8.8	P.I.V. = 4500 Volts Abs. Max. D.C. Plate Current = 200 Ma. Max.									
GB6BQ7A (3)	T-6½	Twin Triode	9AJ	6.3	0.400	Amplifier	2.3	150	220■	....	9	...	5900	6400	38	....	....
6BU4	T-12	Triode	8GC	6.3	0.450	H.V. Reg.	27.5	25000	8.4	....	1.0	...	8.2 Meg.	185	1515	....	....
6BU5	T-11	Beam Power Pentode	8FP	6.3	0.150	H.V. Reg.	20	20K 20K	3.4 2.4	70 70	0.6 1.0	... 0.5	....	....	....	....	....
6BU8A	T-6½	Duo Pentode	9FG	6.3	0.300	Sync. Sep.	1.1	100 100	0 Grid 1 ...	67.5 67.5	... 2.2	... ...	....	180 Gr. 3 1500 Gr. 1	Grid No. 3 Volts = −4.5 Grid No. 1 Volts = −2.3		
6BV8	T-6½	Duodiode Tri.	9FJ	6.3	0.600	Det. Amp.	2.7	200	330■	....	11.0	...	5900	5600	33	....	....
6BW4	T-6½	Duodiode	9DJ	6.3	0.900	F-W Rect.	....	325 A.C. Volts Per Plate, RMS, 100 Ma. Output Current. Capacitor Input to Filter. 450 A.C. Volts Per Plate, RMS, 100 Ma. Output Current. Choke Input to Filter.									
6BW8	T-6½	Duodi. Pent.	9HK	6.3	0.450	R-F or I-F Amplifier	3.0	250	68■	110	10.0	3.5	250000	5200	....	....	....
6BX6/EF80	T-6½	Pentode	9AQ	6.3	0.300	R-F/I-F Amp.	2.75	170	2.0	170	10	2.5	400000	7200	....	....	....
6BX7GT	T-9	Duotriode	8BD	6.3	1.500	Vert. Amp. Vert. Osc.	11 13.2	Max. Peak Positive Pulse Plate Volts = 2000 Volts. Max. D.C. Cathode Current = 60 Ma. 250	 390■		 42	 ...	 1300	 7600	 10		 ....
6BX8	T-6½	Duotriode	9AJ	6.3	0.400	VHF Amp.	2.0	65	1.0	....	9	...	....	6700	25	....	....
6BY5GA	T-12	Duodiode	6CN	6.3	1.600	T.V. Damper	....	P.I.V. = 3000 Volts Abs. Max. D.C. Plate Current = 175 Ma. Max. Each Plate.									
6C5GT	T-9	Triode	6Q	6.3	0.300	Amplifier	2.75	250	8.0	....	8.0	...	10000	2000	20	....	....
6C6	ST-12	Pentode	6F	6.3	0.300	Amplifier	.825	100 250	3.0 3.0	100 100	2.0 2.0	0.5 0.5	1 Meg. 1 Meg.>	1185 1225	....	....	....
6C8G	ST-12	Duotriode	8G	6.3	0.300	Amplifier Inverter	1.1	250 250	4.5 3.0	.... Plate Load 100,000 Ohms, Self-Bias Resistor 1500 Ohms, Voltage Amplification 48. Output Volts 80, RMS for Inverter Service.	3.2	...	22500	1600	36	(One Section)	
6C9	T-6½	Duotetrode	10F	6.3	0.400	VHF Amp.	2.5	125	1.0	80	10	1.5	100000	8000	....	....	....
6CA4	T-6½	Duodiode	9M	6.3	1.000	F-W Rect.	....	350 A.C. Volts Per Plate, RMS, 150 Ma. Output Current.									
6CA5	T-5½	Beam Pent.	7CV	6.3	1.200	Power Amp.	5.5	110 125	4.0 4.5	110 125	32 37	3.5 4.0	16000 15000	8100 9200	....	3500 4500	1100 1500
6CF6	T-5½	Pentode	7CM	6.3	0.300	VHF Amp.	2.3	125	56■	125	12.5	3.7	0.3 Meg.	7800	....	....	....

6CH7	T-6½	Duotriode	9FC	6.3	0.400	Amplifier	2.2	150	220■	....	10	...	5300	6800	36	....	....
6CH8	T-6½	Tri. Pentode	9FT	6.3	0.450	Tri. Amp.	2.82	200	....	....	13.0	...	5750	3300	19	....	....
						Pent. Amp.	2.2	200	180■	150	9.5	2.8	300000	6200	....	....	....
6CJ3	Novar T-9	Diode	9HP	6.3	1.800	T.V. Damper	6.5	Max. Peak Inverse Plate Voltage = 5500 Volts. Max. DC Plate Current = 350 Ma.									
6CK4	T-9	Power Triode	8JB	6.3	1.250	Vert. Defl. Amp.	12	Max. Peak Positive Pulse Plate Voltage = 2000 Volts. Max. D.C. Cathode Current = 100 Ma.									
								250	28	....	40	...	1200	5500	6.6	....	....
6CL5	T-12	Beam Pent.	8GD	6.3	2.500	Horiz. Defl. Amp.	27.5	7000 Maximum Peak Positive Pulse Plate Volts. 25 Watts Maximum Plate Dissipation. 4.0 Watts Maximum Screen Dissipation.									
6CM4	T-6½	Triode	9KG	6.3	0.170	VHF Amp.	2.2	175	1.5	....	12	...	....	14000	68	....	....
6CM5	T-9	Beam Pent.	8GT	6.3	1.250	Horiz. Defl. Amp.	11	Maximum Peak Positive Plate Voltage = 7000 Volts. Maximum D.C. Cathode Current = 200 Ma.									
								100	7.7	100	100	7.0	5300	14000	....	....	....
6CQ4	T-9	Diode	4CG	6.3	1.600	T.V. Damper	6.5	Max. Peak Inverse Plate Voltage = 5500 Volts. Max. D.C. Plate Current = 190 Ma.									
6CR4	T-6½	Triode	9BX	6.3	0.370	UHF Amp.	....	130	1.0	....	16	...	....	15000	60	....	....
6CR6	T-5½	Diode Pent.	7EA	6.3	0.300	Det.-Audio Amplifier	2.75	250	2.0	100	9.5	3.0	200000	1950	....	....	....
6CR8	T-6½	Tri. Pentode	9GJ	6.3	0.450	Tri. Amp.	2.75	125	2.0	....	12.0	...	5500	4000	22	....	....
						Pent. Amp.	2.3	125	56■	125	13.0	3.0	300000	7700	....	....	....
6CS8	T-6½	Tri. Pentode	9FZ	6.3	0.450	Tri. Amp.	2.75	125	2.0	....	12.0	...	5500	4000	22	....	....
						Pent. Amp.	2.3	125	56■	125	13.0	3.0	300000	7700	....	....	....
6CX7	T-6½	Duotriode	9FC	6.3	0.400	Amplifier	2.2	150	220■	....	9.0	...	....	6400	39	....	....
GB-6CY5 (3)	T-5½	Tetrode	7EW	6.3	0.200	VHF Amp.	2.0	125	1	80	10	2.3	100000	8000	....	....	....
6D4	T-5½	Gas Triode	5AY	6.3	0.250	Relay Tube	....	350	50	Peak Cathode Current = 100 Ma. Cathode Current = 25 Ma. Approx. Volt Drop at 25 Ma. = 16 Volts.							
6D6	ST-12	Pentode	6F	6.3	0.300	Amplifier	2.47	100	3.0	100	8.0	2.2	250000	1500	....	....	....
								250	3.0	100	8.2	2.0	800000	1600	....	....	....
6DA7	T-6½	Duotriode	9EF	6.3	1.000	Sect. 2 Vert. Defl. Amp.	2.2	Max. Peak Positive Pulse Plate Voltage = 1800 Volts. Max. D.C. Cathode Current = 40 Ma.									
								150	17.5	....	40.0	...	1100	5700	6.3	....	....
						Sect. 1 Vert. Osc.	6.6	250	8.0	....	9.0	...	7700	2600	20	....	....
6DB5	T-6½	Beam Pent.	9GR	6.3	1.200	Vert. Defl. Amp.	11	Max. Peak Positive Pulse Plate Voltage = 2000 Volts. Max. D.C. Cathode Current = 55 Ma.									
								200	180■	125	46.0	2.2	28000	8000	....	....	....
6DB6	T-5½	Pentode	7CM	6.3	0.300	Color Demod.	3.3	150	1.0	150	5.8	6.6	50000	2050 μmhos when Eg3 = −3 Volts.			
6DC6	T-5½	Pentode	7CM	6.3	0.300	Amplifier	2.2	200	180■	150	9.0	3.0	500000	5500	Semi-Remote Cutoff.		
6DC8	T-6½	Duodi. Pent.	9HE	6.3	0.300	R-F Amp.	2.47	200	1.5	100	11	3.3	.6 Meg.	4500	....	....	....
6DG6GT	T-9	Beam Pent.	7S	6.3	1.200	Power Amp.	11	110	7.5	110	49	4.0	13000	8000	....	2000	2100
								200	180■	125	46	2.2	28000	8000	....	4000	3800
6DG7	T-6½	Pentode	9BA	6.3	0.300	R-F or I-F Amplifier	3.3	100	68■	100	10.8	4.4	250000	4300	....	....	....
								250	68■	100	11.0	4.2	1 Meg.	4400	....	....	....
6DHH13	T-3	Twin Triode	8LK	6.3	0.300	R-F Cascode Amp.	1.7	90	1.0	....	9.0	...	3800	9500	36	....	....
GB-6DJ8	T-6½	Double Triode	9AJ	6.3	0.365	VHF Amp.	2.1	90	1.3	....	15	...	....	12500	33	....	....
6DL4/EC88	T-6½	Triode	6DL4	6.3	0.165	UHF Amp.	2.0	160	100■	....	12.5	...	....	13500	65	....	....
6DN6	T-12	Beam Pent.	5BT	6.3	2.500	Horiz.Defl. Amp.	16.5	Max. Peak Positive Pulse Plate Voltage = 6600 Volts. Max. D.C. Cathode Current = 200 Ma.									
								125	18	125	70	6.3	4000	9000	....	....	....
6DR4	T-5½	Triode	6BG	6.3	0.150	A-F Amp.	1.2	100	1.0	....	0.5	...	80000	1250	100	....	....
								250	2.0	....	1.2	...	62500	1600	100	....	....

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
6DS5	T-5½	Beam Pent.	7BZ	6.3	0.800	Power Amp.	9.0	200 250	180■ 270■	200 200	34.5 27	3.5 3	28000 28000	6000 5800	....	6000 8000	2800 3600
6DT4	T-9	Diode	4CG	6.3	1.200	T.V. Damper	7.5	Max. Peak Inverse Plate Voltage = 5500 Volts. Max. D.C. Plate Current = 235 Ma.									
6DW5	T-6½	Beam Pent.	9CK	6.3	1.200	Vert. Defl. Amp.	11	Max. Peak Positive Pulse Plate Voltage = 2200 Volts. Max. D.C. Cathode Current = 65 Ma. 200	22.5	150	55	2.0	15000	5500	4.3	....	....
6DX4	T-5½	Triode	7DK	6.3	0.200	UHF Osc.	2.2	85	150■	....	10.0	...	2700	11000	30	....	....
6DY4A	T-5½	Triode	7DK	6.3	0.125	UHF Osc.	1.5	90	180■	....	10.4	...	.....	11000	28	....	....
6DY5	T-6½	Beam Pent.	9CV	6.3	0.800	S.T. A1 Amp. P.P. A1 Amp.	10	200 200	13.9 135■	190 200	45 90-104†	8.5 17-38†	24000	7600	....	4000 4000¶	4200 12000
6DZ7	T-12	Double Beam Pent.	8JP	6.3	1.520	P.P. AB1 Amp. P.P. AB1 Amp.	13.2	400 300	11 120■	250 250	40-100† 66-80†	4-13† 7-15†	....	....	....	9000 9000	18000 12000
6DZ8	T-6½	Tri. Beam Pent.	9EX	6.3	0.900	A-F Triode Volt. Amp. and Pent. Power Amp.	.825 7.15	120 145	1500■ 180■	 120	0.8 45	... 6	71000 2500	1400 7500	100	 2500	 2000
6E5	T-9	Electron Ray	6R	6.3	0.300	Indicator	....	100 250	(Series Plate Resistor 0.5 Meg. Target Current 1.0 Ma. Grid Bias = 3.3 for 90° Shadow.) (Series Plate Resistor 1.0 Meg. Target Current 4.0 Ma. Grid Bias = 8.0 for 90° Shadow.)								
6EA5	T-5½	Tetrode	7EW	6.3	0.200	VHF Amp.	3.25	250	1.0	140	10	0.95	150000	8000	....	....	....
6EB5	T-5½	Duodiode	6BT	6.3	0.300	Low Current Volt./Doubler	....	Max. Peak Inverse Plate Voltage = 550 Volts. Plate Current = 5.5 Ma.									
6EH4	Comp. T-12	Beam Triode	12FA	6.3	0.200	Hi-Volt. Reg.	30	Maximum D.C. Plate Voltage = 27,000 Volts. Maximum D.C. Grid Voltage = -135 Volts. Maximum D.C. Plate Current = 1.6 Ma.									
6EH8	T-6½	Tri. Pentode	9JG	6.3	0.450	VHF Osc. VHF Amp.	2.5 2.8	125 125	1.0 1.0	 125	13.5 12	... 4	 170000	7500 6000	40	....	....
6EJ4	Comp. T-12	Beam Triode	12HC	6.3	0.200	Hi-Volt. Reg.	40	Maximum D.C. Plate Voltage = 27,000 Volts. Maximum D.C. Grid Voltage = -135 Volts. Maximum D.C. Current = 1.6 Ma.									
6EL7	T-6½	Pentode	9AQ	6.3	0.300	VHF Amp.	3.0	170	150■	170	10	2.6	....	9200	....	....	.
6EV7	T-6½	Duotriode	9LP	6.3	0.600	Relay *Control Tube*	2.5	250	2.0	....	9.2	...	11500	5200	60	....	....
6EX6	T-12	Beam Pent.	5BT	6.3	2.250	Horiz. Defl. Amp.	22	Max. Peak Positive Pulse Plate Voltage = 7000 Volts. Max. D.C. Cathode Current = 220 Ma. 175	30	175	67	3.3	8500	7700	....	....	....
6EY6	T-9	Beam Pent.	7S	6.3	0.680	Vert. Defl. Amp.	11	Max. Peak Positive Pulse Plate Voltage = 2500 Volts. Max. D.C. Cathode Current = 60 Ma. 250	17.5	250	44	3	60000	4400	....	....	....
6F5 6F5GT	Metal T-9	Triode	5M	6.3	0.300	A-F Amp.	....	250	2.0	....	0.9	...	66000	1500	100	....	....
6F6GT	T-9	Power Pent.	7S	6.3	0.700	Power Amp. S.T.A1 Amp. P.P.A1 Amp. P.P.AB2 Amp.	12.1	250 285 315 375	16.5 20.0 24.0 26.0	250 285 285 250	34.0 38.0 62-80† 34-82†	6.5 7.0 12-19.5† 5-19.5†	80000 78000 (Current & Output, 2 Tubes) (Current & Output, 2 Tubes)	2500 2550	....	7000 7000 10000¶ 10000¶	3200 4800 11000 18000
6FA7	T-6½	Diode Duo Plate Tet.	9MR	6.3	0.300	Frequency Divider	1.5 1.5	100	2.2 Meg[4]	100	3.8	1.7	90000	3200	....	....	....
6FC7	T-6½	Duotriode	9DD	6.3	0.340	VHF Amp.	1.9	90	1.2	....	15	...	.....	12000	....	....	....
6FD6	T-5½	Pentode	7BK	6.3	0.330	R-F Amp.	....	12.6	2.2 Meg[4]	12.6	1.4	0.5	500000	1450	....	....	....

6FE5	T-6½	Beam Pent.	8KB	6.3	1.200	S.T.A1 Amp. P.P.AB1 Amp.	14.5	130 130	120■ 75■	130 130	82-94† 150-154†	4-15† 7.2-17†	....	....	....	1000 1600¶	3500 7000
6FG5	T-5½	Shadow Grid Pent.	7GA	6.3	0.200	VHF Amp.	2.7	250	0.2	250	9	0.42	250000	9500	....	....	....
6FG6/EM84	T-6½	Ind. Tube Triode	6FG6	6.3	0.270	Tuning Ind. Amplifier	0.5	250	Rg1 = 3 Meg. Ec1 = 0 to −22 V. Ib = 0.450 to 0.06 Ma. Target Current = 1.1 to 1.6 Ma. With Deflection Electrode Tied to Triode Plate.									
6FR7	9-T9	Duotriode	9HF	6.3	0.925	Vert. Defl. Amplifier Vert. Osc.	10 1.5	Max. Peak Positive Pulse Plate Voltage = 1500 Volts. Max. D.C. Cathode Current = 50 Ma. 150 250	20 3.0	....	50 1.4	... ...	750 40000	7200 1600	5.4 68	....	....
6FW5	T-12	Beam Pent.	6CK	6.3	1.200	Horiz. Defl. Amplifier	18	Max. Peak Positive Plate Voltage = 6500 Volts. Max. D.C. Cathode Current = 175 Ma. 250	22.5	150	65	1.8	18000	7300	....	....	....
6FW7	T-3	Twin Triode	8LM	6.3	0.300	VHF Osc. VHF Mixer	....	90 90	1 1	....	7.0 9.0	... ...	6000 3800	6000 9500	36 36	....	....
6FW8	T-6½	Duotriode	9AJ	6.3	0.400	VHF Amp.	2.2	100	1.2	....	15	...	2500	13000	33	....	....
6FX7/6DHH13	T-3	Twin Triode	8LK	6.3	0.300	VHF Amp.	1.7	90	1	....	9.0	...	3800	9500	36	....	....
6GA7	T-12	Diode Pent.	12EB	6.3	2.260	T.V. Damper Horiz. Amp.	5.0 15.0	Max. Peak Inverse Plate Voltage = 5500 Volts. Max. D.C. Plate Current = 140 Ma. Max. Peak Positive Pulse Plate Voltage = 6500 Volts. Max. D.C. Cathode Current = 150 Ma. 250	22.5	150	75	2.4	20000	6600	4.1	....	....
6GC6	T-12	Beam Pent.	8JX	6.3	1.200	Power Amp.	17.5	250	22.5	150	75	2.4	20000	6600	....	....	....
6GD7	T-6½	Triode Pent.	9GF	6.3	0.380	VHF Osc. VHF Mixer	2.2 2.2	125 170	1 82■	 150	15 10	... 3.3	4700 350000	10000 12000	47 70	....	....
6GE8	T-6½	Tri. Pentode	9LC	6.3	0.900	Passing and Control Tube For V.R. Use	7.0 1.0	150 150	21 2.0	 150	70 5.5	... 1.7	1080 340000	5000 3200	5.4	....	....
6GJ8	T-6½	Tri. Pentode	9AE	6.3	0.600	Gen. Purpose Horiz. Osc.	2.5 2.5	125 125	1.0 1.0	 125	13.5 12	... 4.5	5000 150000	8500 7500	40	....	....
6GK7	T-6½	Pentode	9AQ	6.3	0.300	T.V. I-F Amp.	2.8	135	82■	135	7	3.5	275	9500	....	....	....
6GM8	T-6½	Duotriode	9AJ	6.3	0.330	R-F Amp. Osc. Mixer	.66	12.6 12.6	0.1 Meg⁴ 0.22 Meg⁴ Oscillator Volts = 1.0 Volt.	....	2.5 1.0 Plate Circuit Res. = 500 Ohms.	... ...	3400 8000	4600 1300▲	....	....	....
6GN6	T-5½	Pentode	7FW	6.3	0.300	R-F Amp.	3.3	100 250	68■ 68■	100 100	10.8 11	4.4 4.2	250000 1 Meg.	4300 4400	....	....	....
6GS7	T-6½	Triode Pentode	9GF	6.3	0.365	Oscillator Mixer	1.5 2.0	100 170	3.0 1.2	 150	14 10	... 3.3	3100 350000	5500 12000	17	....	....
6GV7	T-6½	Triode Pent.	9KN	6.3	0.350	VHF Osc. VHF Mixer	T2.0 P2.0	100 125	3 1.5	 125	14 10	... 3.1	....	5.5 Ma/V 11 Ma/V	17 50	....	....
6GW5	T-5½	Triode	7GK	6.3	0.190	VHF Amp.	2.5	135	1	....	12.5	...	5800	15000	70	....	....
6H6, 6H6GT	T-9	Duodiode	7Q	6.3	0.300	Rectifier	....	117 A.C. Volts Per Plate, RMS, 8.0 Ma. Output Current Per Plate.									
6HA6	T-6½	Pentode	9NW	6.3	0.710	Video Amp.	8.0	150	33■	100	28	3.5	20000	20000	31	....	....
6HC8	9-T9	Tri. Pentode	9EX	6.3	1.200	Vert. Defl. Amplifier Vert. Osc.	1.0 11	Max. Peak Positive Pulse Plate Voltage = 2200 Volts. Max. D.C. Cathode Current = 65 Ma. 250 250	18 3	250	38 1.4	3 ...	55000 34000	5100 2000	 68	....	....
6HD5	Comp. T-12	Beam Pent.	12ES	6.3	2.250	Horiz. Defl. Amp.	24	Max. Peak Positive Pulse Plate Voltage = 7000 Volts. Max. Cathode Current = 280 Ma. 135	22	135	65	4	5000	10000	4.2	....	....
6HL5	T-6½	Beam Pent.	9QW	6.3	0.950	Power Amp.	12.0	140	5.7	140	68.5	14.5	....	....	....	1700	4000
6HQ6	T-5½	Pentode	6HQ6	6.3	0.300	VHF Amp.	2.4	125	56■	125	15	3.8	220000	10500	....	....	....
6HU6/EM87	T-6½	Electron Ray	9GA	6.3	0.300	Indicator	0.6	250	(Control Voltage = 10 Volts (to Close Light Pattern)								

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
6HV5	Comp. T-12	Beam Triode	12GY	6.3	1.8	Hi-Volt. Reg.	30	Maximum Peak Plate Voltage = 5500 Volts. Maximum Peak Plate Current = 325 Ma.									
								3500 Pulse	4.4	....	300 Peak	...	4600	65000	300	....	....
6HW8	T-6½	Duo. Plate Sheet Beam	9NQ	6.3	0.300	Duo. Plate Sheet Beam	2.0	250	270■	250	13	1.4	....	4000	....	....	....
								Defl. Switching Voltage = 40 Volts Max. Defl. Bias Volts for Min. Switching = 12 Volts.									
6J4 GB-6J4WA (3)	T-5½	Triode	7BQ	6.3	0.400	Amplifier	2.5	150	100■	....	15.0	...	4500	12000	55	....	....
6J5GT	T-9	Triode	6Q	6.3	0.300	Amplifier	2.75	250	8.0	....	9.0	....	7700	2600	20	....	....
6J6WA (3)	T-5½	Duotriode	7BF	6.3	0.450	VHF Osc.	1.65	150	10.0	....	30.0	...	Push-Pull Class C Operation			....	3500
				6.3	0.450	VHF Amp.		100	50■	....	8.5	...	7100	5300	38		
						Mixer		150	820■	....	4.8	...	10000	1900▲	....	....	....
6J7GT	T-9	Pentode	7R	6.3	0.300	A-F Amp.	1.92	250	3.0	100	2.0	0.5	1.0 Meg<	1225	....	....	....
6JG6	T-12 Novar	Beam Pent.	9QU	6.3	1.600	Horiz. Defl. Amp.	17	Characteristics Same as Type 6JG6A Except for Bulb Construction.									
6JL8	T-6½	Triode Pent.	9DX	6.3	0.750	Voltage Amp.	2.0	150	150■	....	10	...	7500	4700	35	....	....
						Power Amp.	5.0	300	3.5	150	30	7.5	60000	11500	....	5000	1800
6JQ6	T-6½	Beam Pent. Diode	9RA	6.3	1.200	Vertical Defl. Amplifier	10.0	Maximum Peak Positive Plate Voltage = 2000 Volts. Maximum D.C. Cathode Current = 70 Ma.									
								140	18.0	140	35.0	2.5	10500	4200	....	....	....
6JR6	Novar T-12	Beam Pent.	9QU	6.3	1.6	Horiz. Defl. Amplifier	 17	Maximum Peak Positive Plate Voltage = 6500 Volts. Maximum D.C. Cathode Current = 275 Ma.									
								130	20	125	45	1.5	18000	7000	4.7	....	....
6JU8	T-6½	Quadruple Diode	9PQ	6.3	0.600	Color Det., FM Multiplex Det.	....	Characteristics Same as Type 6JU8A Except for Bulb Construction.									
6JY8	T-6½	Triode Pentode	9DX	6.3	0.750	Sync. Sep.	....	125	68■	....	15	...	4400	10400	46	....	....
						Video Amp.	....	200	100■	150	24	4.8	55000	11000	....	....	....
6K7	Metal	Pentode	7R	6.3	0.300	R-F Amp.	3.0	100	1.0	100	9.5	2.7	150000	1650	....	....	....
								250	3.0	100	7.0	1.7	800000	1450	....	....	....
								250	3.0	125	10.5	2.6	600000	1650	....	....	....
6K8	Metal	Tri. Hexode	8K	6.3	0.300	Mixer Osc.	.825	250	3.0	100	2.5	6.0	600000	350▲	(Hexode Section)		
								100	Grid Res. 50,000 Plate Current 3.8 Ma., Mutual Con. 3000 (Triode Section not Oscillating)								
6KE6	Comp. T-12	Beam Pent.	12GM	6.3	1.500	Horiz. Defl. Amplifier	18.0	130	20	130	50	1.75	11000	9100	4.7	....	....
6KF8	T-6½	Double Pent.	9FG	6.3	0.300	Sync. Sep.	1.1	100	G3=-10	67.5	...	8.4	Ik = 8.5 Ma.			....	....
						AGC Amp.	1.1	100	G3= 0	67.5	2.8	3.8	Ik = 9.5 Ma.			....	....
6KL8	T-6½	Diode Pent.	9LQ	6.3	0.300	Detector	....	Voltage Drop at Ib = 2 Ma. = 10 Volts.									
						R-F I-F Amp.	3.0	100	2.2 Meg.[4]	100	5.5	2.2	550000	4300	....	....	....
6KT6	T-6½	Pentode	9PM	6.3	0.300	IF Amp.	3.1	125	56■	125	17	4.2	160000	18000	....	....	....
6KV6	T-12 Novar	Beam Pent.	9QU	6.3	1.600	Shunt Reg.	20	Max. DC Plate = 6500 Volts. Max. DC Grid Voltage = 75 Volts. Max. DC Cathode Current = 275 Ma.									
6KY6	T-6½	Pentode	9GK	6.3	0.520	Video Amp.	9.0	200	47■	135	30	5.2	40000	30000	....	....	....
6L7	Metal	Heptode	7T	6.3	0.300	Mixer Amp.	1.65	250	6.0	150	3.3	9.2	1 Meg.<	350▲	(G3 = Neg. 15 Volts)		
						Amplifier		250	3.0	100	5.3	6.5	600000	1100	(G3 = Neg. 3.0 Volts)		

6LG6, A	Comp. T-12	Beam Pent.	12HL	6.3	2.0	Horiz. Defl. Amplifier	.... 28.0	Maximum Peak Positive Plate Voltage = 7500. Maximum D.C. Cathode Current = 315 Ma. 175	23	125	90	1.7	7500	11500	3.6	....	....
6LJ6A/6LH6A	T-12	Beam Triode	8MQ	6.3	0.20	Hi-Volt. Reg.	40	Maximum D.C. Plate Voltage = 27,000 Volts. Maximum D.C. Grid Voltage = −135 Volts. Maximum D.C. Plate Current = 1.6 Ma.										
6LP8	T-6½ Pentode	Triode	9DX	6.3	0.600	Gen. Purpose Video Amp.	1.1 3.75	200 100	2 2.5	 150	4 20	 5	17000 200000	4000 11000	70	....	....
6LQ6	Novar T-12	Beam Pent.	9QL	6.3	2.300	Horiz. Defl. Amplifier	.... 30.0	Maximum Peak Positive Plate Voltage = 7500 Volts. Maximum D.C. Cathode Current = 350 Ma. 175	35	145	95	2.4	7000	7500	2.8	....	....
6LR6	Comp. T-12	Beam Pent.	12FY	6.3	2.500	Horiz. Defl. Amplifier	 30	Maximum Peak Positive Plate Voltage = 7500 Volts. Maximum D.C. Cathode Current = 375 Ma. 175	20	110	140	2.4	5300	16000	3.5	....	....
6LV6	Comp. T-12	Beam Pent.	12GW	6.3	2.000	Horiz. Defl. Amp.	40	Max. Peak Positive Plate Voltage = 800 Volts.										
6ML8	T-6½	Triple Triode	9RQ	6.3	0.675	Color Dif. Amplifier	5.0 Tot. 2.0 ea.	125	1.0	....	11.0	...	6400	6700	43	....	....
6MN8	Comp. T-9	Triple Triode	12HU	6.3	0.900	Chroma Matrix Amplifier	3.0	125 200	1.0 4.0	....	11.0 4.8	... ...	6250 10000	7500 4000	47 40	....	....
6MQ8	T-6½	Triode Pent.	9AE	6.3	0.535	Pentode Amp. Triode Amp.	2.5 2.7	125 150	62■ 56■	125	12.0 18.0	4.5 ...	150000 5000	10000 8500	 40	....	....
6N7GT	T-9	Duotriode	8B	6.3	0.800	Power Amp. Driver	1.1	300 250 294	0.0 5.0 6.0	....	17.5-35† Per Pl., Cl. B Push-Pull Oper., Zero Sig. 6.0 Sections 7.0 Paralled		11300 11000	3100 3200	35 35	8000¶ (Class A Driver) (Class A Driver)	10000
6Q7GT	T-9	Duodiode Tri.	7V	6.3	0.300	Det. Amp.	0.55	100 250	1.5 3.0	....	0.8 1.1	... ...	58000 58000	1200 1200	70 70	....	....
6R7	Metal	Duodiode Tri.	7V	6.3	0.300	Det. Amp.	2.75	250	9.0	....	9.5	...	8500	1900	16	....	....
6RA6	T-6½	Triode	....	6.3	0.900	A-F Pre-Amp.	10	250	12	....	21	...	2200	7200	16	....	....
6RAL1	T-6½	Twin Triode	9HF	6.3	0.860	Vert. Defl. Osc.	1.5 8.0	250 250	11 10.5	Sec. 1 Sec. 2	5.0 2.2	... .	....	2000 6700	17.5 16.5	....	....
6RHH8/6KN8	T-6½	Twin Triode	9AJ	6.3	0.400	VHF Amp.	2.2	110	1	....	16	....	2800	16000	45	....	....
6RK19/6BR3	T-6½	Diode	9CB	6.3	1.200	T.V. Damper	6.5	Max. Peak Inverse Plate Voltage = 5500 Volts. Max. D.C. Plate Current = 200 Ma.										
6RP15	T-6½	Beam Pent.	....	6.3	0.750	A-F Amp.	13.5	250	8	250	54	6.8	32000	11000	....	4000	68000
6RP22	T-6½	Beam Pent.	9BV	6.3	0.650	Video Amp.	7.5	250	3	150	22	8.5	55000	8500	....	....	....
6SA7 6SA7GTY	Metal T-9	Heptode	8R 8AD	6.3	0.300	Converter	1.1	100 250 Low Loss Base.	2.0 2.0	100 100	3.3 3.5	8.5 8.5	500000 1.0 Meg.	425▲ 450▲	....	....	....
6SB7Y	Metal	Heptode	8R	6.3	0.300	Converter	2.2	250	1.5	100	4.0	8.5	....	880▲	....	....	....
6SC7	Metal	Duotriode	8S	6.3	0.300	Amplifier	....	250	2.0	....	2.0	...	53000	1325	70	(Each Triode)	
6SF5	Metal	Triode	6AB	6.3	0.300	A-F Amp.	....	250	2.0	....	0.9	...	66000	1500	100	....	....
6SF7	Metal	Diode Pent.	7AZ	6.3	0.300	Det. Amp.	3.85	100 250	1.0 1.0	100 100	12 12.4	3.4 3.3	200000 700000	1975 2050	....	....	....
6SG7	Metal	Pentode	8BK	6.3	0.300	R-F Amp.	3.3	100 250 250	1.0 1.0 2.5	100 125 150	8.2 11.8 9.2	3.2 4.4 3.4	250000 900000 1 Meg.	4100 4700 4000	....	....	....
6SH7	Metal	Pentode	8BK	6.3	0.300	R-F Amp.	3.3	100 250	1.0 1.0	100 150	5.3 10.8	2.1 4.1	350000 900000	4000 4900	....	....	....
6SJ7WGT (3) GB-6SJ7WGT(3)	T-9	Pentode	8N	6.3	0.300	A-F Amp.	2.8	100 250 Ruggedized Version. Low Loss Base.	3.0 3.0	100 100	2.9 3.0	0.9 0.8	700000 1.0 Meg<	1575 1650	....	....	....

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
GB-6SL7WGT(3)	T-9	Duotriode	8BD	6.3	0.300	Amplifier	1.1	250	2.0	....	2.3	...	44000	1600	70	....	....
GB-6SN7WGTA (3)	T-9	Duotriode	8BD	6.3	0.600	Amplifier	2.75	90 250	0 8.0	....	10.0 9.0	... ...	6700 7700	3000 2600	20 20	....	....
6SR7	Metal	Duodiode Tri.	8Q	6.3	0.300	Det. Amp.	2.75	250	9.0	....	9.5	...	8500	1900	16	....	....
6SS7	Metal	Pentode	8N	6.3	0.150	R-F Amp.	2.5	100 250	1.0 3.0	100 100	12.2 9.0	3.1 2.0	120000 1000000	1950 1850	....	....	....
6T9	Comp. T-9	Triode Pent.	12FM	6.3	0.930	A-F Volt. Amp. A-F Pwr. Amp.	1.5 12.0	250 250	2 8	 250	1.5 39.0	... 7.0	45000 100000	2100 6500	95	 5000	 4200
6U5	T-9	Electron Ray	6R	6.3	0.300	Indicator	....	100 250	(Series Plate Res. 0.5 Meg., Target Current 1.0 Ma., Grid Bias—8.0 for 0° Shadow.) (Series Plate Res. 1.0 Meg., Target Current 4.0 Ma., Grid Bias—22.0 for 0° Shadow.)									
6U6GT	T-9	Beam Pent.	7S	6.3	0.750	Power Amp.	12.1	110 200	10.5 14.0	110 135	44.0 55.0	4.0 3.0	10000 20000	5600 6200	....	2000 3000	2000 5500
6V4/EZ80	T-6½	Duodiode	9M	6.3	0.600	F-W Rect.	....	350 Volts A.C. Per Plate (RMS), 90 Ma Output Current. (Condenser Input to Filter.)									
6V8	T-6½	Triple Diode Triode	9AH	6.3	0.450	Det. Amp.	1.1	100 250	1.0 3.0	....	0.8 1.0	... ...	54000 58000	1300 1200	70 70	....	....
GB-6X4WA (3)	T-5½	Duodiode	5BS	6.3	0.600	F-W Rect.	....	400 Volts RMS Per Plate, 55 Ma. D.C. Output Condenser Input to Filter.									
6X5WGT (3) GB-6X5WGT(3)	T-9	Duodiode	6S	6.3	0.600	F-W Rect.	....	325 A.C. Volts Per Plate, RMS, 70 Ma. Output Current. Condenser Input to Filter. 450 A.C. Volts Per Plate, RMS, 70 Ma. Output Current. Choke Input to Filter.									
6Z4/84	ST-12	Duodiode	5D	6.3	0.500	F-W Rect.	....	325 A.C. Volts Per Plate, RMS, 60 Ma. Output Current. Condenser Input to Filter. 450 A.C. Volts Per Plate, RMS, 60 Ma. Output Current. Choke Input to Filter.									
7A4/XXL	Lock-in	Triode	5AC	6.3	0.300	Amplifier	2.75	90 250	0.0 8.0	....	10.0 9.0	... ...	6700 7700	3000 2600	20 20	....	....
7A5	Lock-in	Beam Pent.	6AA	6.3	0.750	Power Amp.	6.0	110 125	7.5 9.0	110 125	40.0 44.0	3.0 3.3	16000 17000	5800 6000	....	2500 2700	1500 2200
7A6	Lock-in	Duodiode	7DX	6.3	0.150	Det. Rect.	....	150 A.C. Volts Per Plate, RMS, 8 Ma. Current Output Per Plate.									
7A7	Lock-in	Pentode	8V	6.3	0.300	R-F Amp.	4.4	100 250	1.0 3.0	100 100	13.0 9.2	4.0 2.6	120000 800000	2350 2000	....	....	....
7A8	Lock-in	Octode	8U	6.3	0.150	Converter	1.1	100 250	3.0 3.0	75 100	1.8 3.0	2.7 3.2	650000 700000	375▲ 550▲	(Ga = 100 V., 2.8 Ma.) (Ga = 250 V thru 20K Ohms.)		
7AF7	Lock-in	Duotriode	8AC	6.3	0.300	Amplifier (per unit)	2.75	100 100 250	0 3.0 10	....	10.8 5.0 9.0	... ...	6500 8400 7600	2600 1900 2100	17 16 16	....	....
7AG7	Lock-in	Pentode	8V	6.3	0.150	R-F Amp.	2.2	250	250■	250	6.0	2.0	1.0 Meg<	4200	....	....	....
7AK7 GB-7AK7 (3)	Lock-in	Pentode	8V	6.3	0.800	R-F Amp.	9.35	150 150 150	0 11 0	90 90 90	40 2.5 Max. 2.0 Max.	21 0.45 60 Max.	11500	6000	....	....	....
7B4	Lock-in	Triode	5AC	6.3	0.300	Amplifier	....	100 250	1.0 2.0	....	0.4 0.9	... ...	85000 66000	1150 1500	100 100	....	....

7B5	Lock-in	Power Pent.	6AE	6.3	0.400	Power Amp.	9.35	100	7.0	100	9.0	1.6	104000	1500	....	12000	350
								250	18.0	250	32.0	5.5	68000	2300	....	7600	3400
								315	21.0	250	25.5	4.0	75000	2100	....	9000	4500
7B6	Lock-in	Duodiode Tri.	8W	6.3	0.300	Det. Amp.	0.55	100	1.0	....	0.4	...	110000	900	100	....	....
								250	2.0	....	0.9	...	91000	1100	100	....	....
7B7	Lock-in	Pentode	8V	6.3	0.150	R-F Amp.	2.47	100	3.0	100	8.2	1.8	300000	1675	....	....	....
								250	3.0	100	8.5	1.7	750000	1750	....	....	....
7B8	Lock-in	Heptode	8X	6.3	0.300	Converter	1.1	100	1.5	50	1.1	1.3	600000	360▲	(Ga = 100 V., 2.0 Ma.)		
								250	3.0	100	3.5	2.7	360000	550▲	....	....	....
7C5	Lock-in	Beam Pent.	6AA	6.3	0.450	Power Amp. Class A1	13.2	180	8.5	180	29.0	3.0	58000	3700	....	5500	2000
								250	12.5	250	45.0	4.5	52000	4100	....	5000	4500
								315	13.0	225	34.0	2.2	77000	3750	....	8500	5500
						Class AB1		250	15.0	250	70-79†	5-13†	(Class AB1 Two Tubes)			10000¶	10000
								285	19.0	285	70-92†	4-13.5†	(Class AB1 Two Tubes)			8000¶	14000
7C6	Lock-in	Duodiode Tri.	8W	6.3	0.150	Det. Amp.	0.66	100	0.0	....	1.0	...	100000	850	85	....	....
								250	1.0	....	1.3	...	100000	1000	100	....	....
7C7	Lock-in	Pentode	8V	6.3	0.150	R-F Amp.	1.1	100	3.0	100	1.8	0.4	1.2 Meg.	1225	....	....	....
								250	3.0	100	2.0	0.5	2.0 Meg.	1300	....	....	....
7ES8	T-6½	Duotriode	9AJ	7.2	0.300	VHF Amp.	1.8	90	1.4	....	15	...	2500	12500	....	....	....
7EY6	T-9	Beam Pent.	7S	7.2	0.600	Vert. Defl. Amplifier	11	Max. Peak Positive Pulse Plate Voltage = 2500 Volts. Max. D.C. Cathode Current = 60 Ma. Characteristics Same as Type 6EY6.										
								250	17.5	250	44	3.0	60000	4400	....	....	....
7F7	Lock-in	Duotriode	8AC	6.3	0.300	A-F Amp.	1.1	100	1.0	....	0.65	...	62000	1125	70	....	....
								250	2.0	....	2.3	...	44000	1600	70	....	....
7F8	Lock-in	Duotriode	8BW	6.3	0.300	Osc. Amp.	3.85	250	500■	....	6.0	...	....	3300	48	....	....
GB-7F8W (3)	Lock-in	Duotriode	8BW	6.3	0.300	Osc. Amp.	3.5	250	200■	....	11.0	...	....	5200	50	....	....
7FC7	T-6½	Duotriode	9DD	7.2	0.300	VHF Amp.	1.9	Characteristics Same as Type 6FC7.									
7G7	T-9	Pentode	8V	6.3	0.450	Amplifier	....	250	2.0	100	6.0	2.0	800000	4500	....	....	....
7GS7	T-6½	Tri. Pent.	9GF	7.6	0.300	IF Amp.	1.5	100	3	....	14	...	....	5500	17	....	....
							2.2	170	1.2	150	10	3.3	350000	12000	....	....	....
7GV7	T-6½	Triode Pent.	9KN	7.4	0.300	VHF Osc. VHF Mixer	2.0 2.0	Characteristics Same as Type 6GV7.									
7H7	Lock-in	Pentode	8V	6.3	0.300	R-F Amp.	2.75	100	1.5	100	7.5	2.6	350000	4000	....	....	....
								250	180■	150	10.0	3.2	800000	4000	....	....	....
7J7	Lock-in	Tri. Heptode	8BL	6.3	0.300	Hep. Mixer	0.55	100	3.0	100	1.5	2.6	500000	280▲	....	....	....
								250	3.0	100	1.4	2.8	1.5 Meg.	290▲	....	....	....
						Tri. Osc.	1.74	100	0.05 Meg.		3.2	(Triode Grid Current 0.3 Ma.)			....	....	....
								250	0.05 Meg.		5.0	(Triode Grid Current 0.4 Ma.)			....	....	....
7K7	Lock-in	Duodiode Tri.	8BF	6.3	0.300	Det. Amp.	1.1	250	2.0	....	2.3	...	44000	1600	70	....	....
7KY6	T-6½	Pentode	9GK	7.3	0.450	Video Amp.	....	Characteristics Same as 6KY6.									
7KZ6	T-6½	Pentode	9GK	7.3	0.450	Video Amp.	9.0	250	75■	115	25.0	3.6	45000	24000	....	....	....
7L7	Lock-in	Pentode	8V	6.3	0.300	R-F Amp.	4.4	100	1.0	100	5.5	2.4	100000	3000	....	....	....
								250	1.5	100	4.5	1.5	1.0 Meg.	3100	....	....	....
7MP18	T-5½	Beam Pent.	7BZ	7.5	0.600	Power Amp.	7.5	200	5	180	35	5.5	24000	11000	....	5000	3200
7N7	Lock-in	Duotriode	8AC	6.3	0.600	Amplifier	2.75	90	0.0	....	10.0	...	6700	3000	20	....	....
								250	8.0	....	9.0	...	7700	2600	20	....	....

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
7Q7	Lock-in	Heptode	8AL	6.3	0.300	Converter	1.1	100 250	2.0 2.0	100 100	3.3 3.5	8.5 8.5	500000 1.0 Meg.	525▲ 550▲	(Osc. Grid Resistor 20000) (Osc. Grid Current 0.5 Ma.)		
7R7	Lock-in	Duodi. Pent.	8AE	6.3	0.300	Det. Amp.	2.2	100 100 250 250	2.0 1.0 2.0 1.0	100 100 100 100	3.4 5.5 3.5 5.7	1.0 2.2 1.0 2.1	500000 350000 1800000 1000000	2100 3000 2200 3200	....	....	....
7S7	Lock-in	Tri. Heptode	8BL	6.3	0.300	Hep. Mixer	0.66	100 250	2.0 2.0	100 100	1.9 1.8	3.0 3.0	500000 1.25 Meg.	500▲ 525▲	....	....	....
						Tri. Osc.		100 250	0.05 Meg. 0.05 Meg.		3.0 5.0	(Triode Grid Current 0.3 Ma.) (Triode Grid Current 0.4 Ma.)			....	....	....
7V7	Lock-in	Pentode	8V	6.3	0.450	R-F Amp.	4.4	300	160■	150	10.0	3.9	300000	5800	....	....	....
7W7	Lock-in	Pentode	8BJ	6.3	0.450	R-F Amp.	4.4	Characteristics Same as Type 7V7, Except Capacitances.									
7X7	Lock-in	Duodiode Tri.	8BZ	6.3	0.300	Det. Amp.	0.55	100 250	0 1.0	....	1.2 1.9	... ...	85000 67000	1000 1500	85 100	....	....
7Y4	Lock-in	Duodiode	5AB	6.3	0.500	F-W Rect.	....	325 A.C. Volts Per Plate, RMS, 70 Ma. Output Current. Condenser Input to Filter. 450 A.C. Volts Per Plate, RMS, 70 Ma. Output Current. Choke Input to Filter.									
7Z4	Lock-in	Duodiode	5AB	6.3	0.900	F-W Rect.	....	325 A.C. Volts Per Plate, RMS, 100 Ma. Output Current. Condenser Input to Filter. 450 A.C. Volts Per Plate, RMS, 100 Ma. Output Current. Choke Input to Filter.									
8JL8	T-6½	Triode Pent.	9DX	8.0	0.600	Voltage Amp. Power Amp.	2.0 5.0	Characteristics Same as Type 6JL8.									
8LS6	T-6½	Pentode	9GK	7.7	0.450	Video Amp.	5.0	110	65■	110	14.0	3.2	54000	11,000	....	....	....
9BJ11	Comp. T-9	Double Pent.	12FU	9.6	0.450	IF Amp.	2.8 2.2	110 125	Rg1 = 100K 120■	 120	5.8 8.5	6.8 2.5	40000 400000	7500 9600	....	....	....
9BR8	T-6½	Tri. Pentode	9FA	9.45	0.300	VHF Osc. VHF Amp.	2.97 3.0	150 250	56■ 68■	 110	18 10	... 3.5	5000 400000	8500 5200	40	....	....
9CG8A	T-6½	Triode Pent.	9GF	9.5	0.300	Osc. Mixer	1.7 2.3	Characteristics Same as Type 6CG8A.									
9CL8	T-6½	Tri. Tetrode	9FX	9.5	0.300	VHF Osc. VHF Amp.	2.97 3.0	Characteristics Same as Type 6CL8A.									
9DZ8	T-6½	Triode Beam Pent.	9EX	9.0	0.600	A-F Voltage Amp. and Power Amp.	.82 7.15	Characteristics Same as Type 6DZ8.									
9EF6	T-9	Beam Pent.	7S	9.4	0.600	Vert. Defl. Amplifier	11	Characteristics Same as Type 6EF6.									
9MHH3	T-5½	Twin Triode	7BF	9.5	0.300	Hi Freq. Osc., Amp. or Mixer	1.65	100	1.0	....	11	...	5100	7500	38	....	....
9MN8	Comp. T-9	Triple Triode	12HU	9.5	0.600	Chroma Mat. Amp.	3.0	Characteristics Same as Type 6MN8.									
9MP12	T-5½	Beam Pent.	6CC	9.4	0.300	A-F Pwr. Amp. Ver. Defl. Amp	8.5	180	6.0	180	25	5.0	....	5500	....	6000	2000
9RA6	T-6½	Triode	....	9.5	0.600	A-F Pre-Amp.	10	Characteristics Same as Type 6RA6.									
9RAL1	T-6½	Twin Triode	9HF	9.0	0.600	Vert. Defl. Osc.	1.5 8.0	Characteristics Same as Type 6RAL1.									

10AL11	Comp. T-9	Duo. Pentode	12BU	9.8	0.600	FM Det. ST A1 Amp.	1.7 10	Characteristics Same as Type 6AL11.									
10C8	T-6½	Tri. Pentode	9DA	10.5	0.300	Tri. Amp. Pent. Amp.	2.0 2.2	250 135	390■ 100■	 135	7.3 11.5	... 3.2	12000 190000	4400 8000	53	....	....
10DA7	T-6½	Duotriode	9EF	10.5	0.600	Vert. Osc. Vert. Defl. A.	2.2 6.6	Characteristics Same as Type 6DA7.									
10FR7	9-T9	Duotriode	9HF	9.7	0.600	Vert. Defl. Amp./Osc.	1.5 10	Characteristics Same as Type 6FR7.									
10HA6	T-6½	Pentode	9NW	10.4	0.450	Video Amp.	8.0	Characteristics Same as Type 6HA6.									
11BM8	T-6½	Triode Pentode	9EX	10.7	0.450	Osc. and Audio Amp.	1.0 7.0	Characteristics Same as Type 6BM8/ECL82.									
11BT11	Comp. T-9	Double Tri. Pentode	12GS	10.7	0.600	Video Amp.	1.5 2.0 3.5	200 200 150	270■ 470■ 82■	 100	7.1 7.2 17.4	... ... 3.2	12500 7600 51000	5500 5300 19000	69 40	....	....
11CF11	Comp. T-9	Dble. Triode Pentode	12HW	10.7	0.600	Cath. Foll., Video Amp. Frame Grid Video Amp.	2.0 1.5 5.0	200 200 200	5.5 6.3 5.0	 120	7.1 7.6 27.5	... ... 4.9	12400 9200 490000	5500 6300 21200	69 59	....	....
11DS5	T-5½	Beam Pent.	7BZ	11.2	0.450	A-F Output	9.0	Characteristics Same as Type 6DS5.									
11MS8	T-6½	Triode Beam Pent.	9LY	11.6	0.450	Tri. Vert. Osc. Pent. Vert.— Defl. Amp.	0.5 6.0	100 120	0.85 10	 110	5 50	... 3.0	11000 13000	5500 8500	60 5.8	....	....
12A6	Metal	Beam Pent.	7S	12.6	0.150	Power Amp.	8.25	250	12.5	250	30	3.5	70000	3000	....	7500	3400
12A8GT	T-9	Heptode	8A	12.6	0.150	Converter	1.1	Characteristics Same as Type 6A8GT.									
12AC6	T-5½	Pentode	7BK	12.6	0.150	R.F. Amp.	....	12.6	0	12.6	550μa	200μa	0.5 Meg.	730	....	....	....
12AD5	T-6½	Pentode	9AZ	12.6	0.100	R-F Amp.	2.2	100	2.5	100	6.0	1.75	600000	2200	....	....	....
12AD7	T-6½	Duotriode	9A	12.6/ 6.3	0.225/ 0.450	A-F Amp.	1.1	250	2	....	1.25	...	62500	1600	100	....	....
12AE7	T-6½	Duotriode	9A	12.6	0.450	Dis. Triodes Voltage Amp. Pwr. Amp. Dr.	1.0 1.0	12.6 12.6	1.5 Meg[4] 1.0 Meg[4]	....	1.9 7.5	... ...	3150 985	4000 6500	13 6.4	....	....
12AE10	Comp. T-9	Double Pent.	12EZ	12.6	0.450	FM-Det. Audio Output	6.0 1.7	145 150	7.0 560■	110 100	39 1.3	9.3 2.0	33000 150000	5600 1000	....	2500	1450 ....
12AG6	T-5½	Heptode	7CH	12.6	0.150	Converter	....	12.6	0.85	12.6	0.55	1.4	....	300▲	G1 = 20000 Ohms; G1 = 0.050 Ma.		....
12AJ6	T-5½	Duodiode Tri.	7BT	12.6	0.150	Det. Amp.	....	12.6	0	....	.075	...	45000	1200	55	....	....
12AL8	T-6½	Tri. Tetrode	9GS	12.6	0.550	Tri. Amp. Tet. Amp.	....	12.6 12.6	0.9[4] G2=0.5[4] G1=12.6 Designed for Space-Charge Grid Operation.	 40	0.5 75	... ...	13000 480	1000 15000	13	....	....
12AL11	Comp. T-9	Duo. Pent.	12BU	12.6	0.450	FM Det. S.T. A1 Amp.	1.7 10	Characteristics Same as Type 6AL11.									
12AS5	T-5½	Beam Pent.	7CV	12.6	0.400	S.T. A1 Amp.	6.0	Characteristics Same as Type 6AS5.									
12AT7WA (3)	T-6½	Duotriode	9A	6.3 12.6	0.300 0.150	VHF Amp.	2.5	100 250	270■ 200■	....	3.7 10.0	... ...	15000 10900	4000 5500	60 60	....	....
12AW6	T-5½	Pentode	7CM	12.6	0.150	R-F Amp.	2.2	250 125 100	200■ 100■ 100■	150 125 100	7.0 7.2 5.5	2.0 2.1 1.6	0.8 Meg. 0.5 Meg. 0.3 Meg.	5000 5100 4750	....	....	....

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transcon-ductance Micros.	Ampli-fication Factor	Ohms Load for Stated Power Output	Power Output Milli-watts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
12AY7	T-6½	Duotriode	9A	12.6	0.150	Audio Amp.	1.65	250	4.0	....	3.0	...	....	1750	40	....	....
12B3	T-6½	Diode	9BD	12.6	0.600	T.V. Damper	....	Characteristics Same as Type 6B3.									
12B4A	T-6½	Triode	9AG	6.3/ 12.6	0.600/ 0.300	Vert. Defl. Amplifier	6.0	Max. Peak Pos. Pulse Plate Voltage = 1000 Volts Max. D.C. Cathode Current = 30 Ma. (12B4A Designed for Series String Receivers.)									
								150	17.5	....	35	...	....	6500	6.5	....	....
12BA7	T-6½	Heptode	8CT	12.6	0.150	Converter	2.2	Characteristics Same as Type 6BA7.									
12BF6	T-5½	Duodiode Tri.	7BT	12.6	0.150	Det. Amp.	2.75	250	9.0	....	9.5	...	8500	1900	16	10000	300
12BJ3	Comp. T-9	Diode	12BL	12.6	0.450	T.V. Damper	5.3	Max. Peak Inverse Plate Voltage = 3300 Volts. Max. Cathode Current = 165 Ma.									
12BK5	T-6½	Beam Amp.	9BQ	12.6	0.600	Power Amp.	9.9	Characteristics Same as Type 6BK5.									
12BT3	Comp. T-9	Diode	12BL	12.6	0.450	Damper	....	Max. Peak Inverse Plate Voltage = 3300 Volts Max. DC Output Current = 165 Ma.									
12BV7	T-6½	Pentode	9BF	12.6/ 6.3	0.300/ 0.600	Video Amp.	6.87	250	68■	150	27	6.0	85000	13000	1000	....	....
12BW4	T-6½	Duodiode	9DJ	12.6	0.450	F-W Rect.	....	Characteristics Same as Type 6BW4									
12BX6	T-6½	Pentode	9AQ	12.6	0.150	VHF Amp.	2.5	Characteristics Same as Type 6BX6.									
12BY3	T-6½	Diode	9CB	12.6	0.450	Damper	4	Max. Peak Inverse Plate Voltage = 4500 Volts Max. DC Output Current = 140 Ma.									
12C8	Metal	Duodi. Pent.	8E	12.6	0.150	Det. Amp.	2.47	Characteristics Same as Type 6B8.									
12CA5	T-5½	Beam Pent.	7CV	12.6	0.600	Power Amp.	5.5	Characteristics Same as Type 6CA5.									
12CN5	T-5½	Pentode	7CV	12.6	0.450	I-F Amp.	....	12.6	2.2 Meg[4]	12.6	4.5	0.35	40000	3800	....	....	....
12CR6	T-5½	Diode Pent.	7EA	12.6	0.150	Audio Amp.	2.75	250	2	100	9.6	2.6	800000	2200	....	....	....
12CT8	T-6½	Tri. Pentode	9DA	12.6	0.300	Sync. Amp.	2.5	150	150■	....	9.0	...	8200	4900	40	....	....
						Video Amp.	2.75	200	82■	125	15.0	3.4	150000	7000	....	....	....
12CX6	T-5½	Pentode	7BK	12.6	0.150	R-F Amp.	....	12.6	2.2 Meg[4]	12.6	3.0	1.4	40000	3100	....	....	....
12CY6	T-5½	Pentode	7BK	12.6	0.200	R-F Amp.	....	12.6	2.2 Meg[4]	12.6	1.6	0.4	140000	3250	....	....	....
12D4	T-9	Diode	4CG	12.6	0.600	T.V. Damper	5.5	Max. Inverse Peak Plate Voltage = 4400 Volts. Max. D.C. Plate Current = 155 Ma.									
12DB5	T-6½	Beam Pent.	9GR	12.6	0.600	Vert. Defl. Amplifier	11	Characteristics Same as Type 6DB5.									
12DE8	T-6½	Diode Pent.	12DE8	12.6	0.200	R-F or I-F Amplifier	....	12.6	0.8[4]	12.6	1.3	0.5	300000	1500	....	....	....
12DF5	T-6½	Duodiode	9BS	12.6	0.450	F-W Rect.	....	325 A.V. Volts Per Plate, RMS, 100 Ma. Output Current. Condenser Input.									
				6.3	0.900			450 A.C. Volts Per Plate, RMS, 100 Ma. Output Current. Choke Input.									
12DF7	T-6½	Duotriode	9A	12.6	0.150	Audio Amp.	1.1	Characteristics Same as Type 12AX7A/ECC83. (Special Low Noise.)									
				6.3	0.300												
12DK5	T-6½	Pentode	9GT	12.6	0.300	R-F Amp.	....	12.6	2.2 Meg[4]	12.6	2.0	0.65	100000	3300	....	....	....
12DK7	T-6½	Duodiode Tetrode	9HZ	12.6	0.500	Det. Power Amp. Driver	0.55	12.6	2.2 Meg[4]	12.6	6.0	1.0	4000	5000	....	3500	10
12DL8	T-6½	Duodiode Tetrode	9HR	12.6	0.550	Det. Power Amp. Driver	....	12.6 (Space-Charge Grid Operation.)	G2 = 2	G1 = 12.6	8	75	480	15000	....	800	40
12DM4A	T-9	Diode	4CG	12.6	0.600	T.V. Damper	6.5	Characteristics Same as Type 6DA4A/6DM4A.									
12DM5	T-5½	Beam Pent.	7CV	12.6	0.450	Power Amp.	6.0	110	7.5	110	49.0	4.0	14000	7500	....	2500	1900

12DM7	T-6½	Duotriode	9A	6.3 12.6	0.260 0.130	A-F Amp.	1.1	Low Noise and Low Microphonism Version of Type 12AX7A/ECC83.									
12DQ7	T-6½	Pentode	9BF	12.6/ 6.3	0.300 0.600	Video Amp.	6.5	200	68■	125	26	5.6	53000	10500	....	....	....
12DS7 12DS7A	T-6½	Duodiode Tetrode	9JU	12.6	0.400	Det. Power Driver	....	12.6	2.2 Meg[4]	G1 = 12.6	35-15†	80	....	....	....	700	45
12DT6	T-5½	Gated Beam	7EN	12.6	0.150	Quad FM Det.	1.7	Characteristics Same as Type 6DT6A.									
12DT7	T-6½	Duotriode	9A	6.3 12.6	0.300 0.150	A-F Amp.	1.1	Characteristics Same as Type 12AX7. Controlled for Hum and Noise.									
12DU7	T-6½	Duodiode Tetrode	9JX	12.6	0.250	Det. Power Amp. Driver	....	12.6	2.2 Meg[4]	12.6	12	1.5	6000	6200	....	2700	25
12DV7	T-6½	Duodiode Tri.	9JY	12.6	0.150	Det. Amp.	....	12.6	2.2 Meg[4]	....	0.4	...	19000	750	14	....	....
12DV8	T-6½	Duodiode Tetrode	9HR	12.6	0.375	Detector, Pwr. Amp. Dr.	....	12.6 and 4.7 Meg[4]	18 Ohm■	G1 = 12.6	6.8 (Space Charge Grid Operation.)	54	900	8500	7.6	1250	5
12DW5	T-6½	Beam Pent.	9CK	12.6	0.600	Vert. Defl. Amplifier	11	Max. Peak Positive Plate Voltage = 2200 Volts. Max. D.C. Cathode Current = 65 Ma. 200		22.5	150	55	2.0	15000	5500	....	....	....
12DW7	T-6½	Duotriode	9A	6.3 12.6	0.300 0.150	Sect. 1 A-F Voltage Amp. Sect. 2 A-F Phase Inverter	1.2 3.3	100 250 100 250	1.0 2.0 0 8.5	....	0.5 1.2 11.8 10.5	... ...	80000 62500 6500 7700	1250 1600 3100 2200	100 100 20 17	....	....
12DW8	T-6½	Diode- Duo-Triode	9JC	12.6	0.450	Dissimilar Tri's Voltage Amp. Pwr. Amp. Dr.	0.5 0.5	12.6 12.6	1.5 Meg[4] 1.0 Meg[4]	....	1.9 7.5	... ...	3520 970	2700 6500	9.5 6.4	....	....
12DY8	T-6½	Triode Tetrode	9JD	12.6	0.350	Relay Service	....	12.6 12.6	0 2.2[4]	.... 12.6	1.2 14.0	... 2	10000 5000	2000 6000	20	....	....
12DZ6	T-5½	Pentode	7BK	12.6	0.190	R-F Amp.	....	12.6	G1 = 10 Meg[4] G3 = 0	12.6	4.5	2.2	25000	3800	....	....	....
12DZ8	T-6½	Tri. Beam Pentode	9EX	12	0.450	A-F Voltage Amp. and Power Amp.	.825 7.15	Characteristics Same as Type 6DZ8.									
12EA6	T-5½	Pentode	7BK	12.6	0.190	I-F Amp.	....	12.6	G1 = 10 Meg G3 = 0	[4]12.6	3.2	1.4	32000	3800	....	....	....
12EC8	T-6½	Tri. Pentode	9FA	12.6	0.225	FM Osc. FM Amp.	....	12.6 12.6	0 0	.... 12.6	2.4 0.66	... 0.28	6000 750000	4700 2000	25	....	....
12ED5	T-5½	Pentode	7CV	12.6	0.450	S.T. A1 Amp.	6.25	110 125	4.0 4.5	110 125	32 37	4 7	14000 14000	8100 8500	....	4500 4500	1100 1500
12EF6	T-9	Beam Pent.	7S	12.6	0.450	Vert. Defl. Amplifier	11	Characteristics Same as Type 6EF6.									
12EG6	T-5½	Heptode	7CH	12.6	0.150	Mixer Oscillator	....	12.6 12.6 Volts Grid No. 4 and 2.2 Megohms Grid No. 1 (Osc. Grid).	0.8[4]	12.6	.04	2.47	150000	800	....	....	....
12EL6	T-5½	Duodiode Tri.	7FB	12.6	0.150	Det. Amp.	....	12.6	1.0 Meg[4]	....	.75	...	45000	1200	55	....	....
12EM6	T-6½	Diode Tetrode	9HV	12.6	0.500	Det. Power Amplifier	0.55	12.6	15 Meg[4]	12.6	6.0	1.0	4000	5000	....	3500	10
12EN6	T-9	Beam Pent.	7S	12.6	0.600	Vert. Defl. Amplifier	7.0	Max. Peak Positive Pulse Plate Voltage = 1200 Volts. Max. D.C. Cathode Currents = 50 Ma. 200	9.5	110	50	2.2	28000	8000	....	....	....
12EZ6	T-5½	Pentode	7BK	12.6	0.175	R-F or I-F Amplifier	....	12.6	0.7 2.2 Meg[4]	12.6	1.9	0.7	400000	2700	....	....	....

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
12F5GT	T-9	Triode	5M	12.6	0.150	Amplifier	....	Characteristics Same as Type 6F5GT.									
12FA6	T-5½	Heptode	7CH	12.6	0.150	Converter	....	12.6	0.5	12.6	.45	1.0	800000	320[4]	....	....	....
								2.2 Meg.[4] Osc. Grid Values = 2.5 Volts RMS across 33000 Ohm Res.									
12FB5	T-6½	Beam Pent.	9CV	12.6	0.300	S.T. A1 Amp.	6.6	170	10.3	180	31	7.3	....	....	....	5000	2250
12FK6	T-5½	Duodiode Tri.	7BT	12.6	0.150	Det. Amp.	....	12.6	2.2 Meg[4]	....	1.3	...	6200	1200	74	....	....
12FM6	T-5½	Duodiode Tri.	7BT	12.6	0.150	Det. Amp.	....	12.6	2.2 Meg[4]	....	1.0	...	7700	1300	10	....	....
12FQ8	T-6½	Twin, Double-Plate Triode	9KT	12.6	0.150	Sect. 1 Double Plate Triode	0.5	250	1.5	....	1.5	...	76000	1250	95	....	....
						Sect. 2 Double Plate Triode	0.5	250	1.5	....	1.5	...	76000	1250	95	....	....
12FR8	T-6½	Tri. Pentode Diode	9KU	12.6	0.320	Det. Amp.	....	12.6	2.2 Meg[4]	....	1.0	...	.....	1200	10	....	....
						R-F Amp.		12.6	2.2 Meg[4]	12.6	1.9	0.8	400000	2700	....	....	....
12FT6	T-5½	Duodiode Triode	7BT	12.6	0.150	Det. Power Amp. Driver	....	12.6	2.2 Meg[4]	....	0.6	...	13000	1000	14	....	....
12FV7	T-6½	Duotriode	9A	6.3/12.6	0.900/0.450	Relay Control Tube	2.5	100	2.0	....	16	...	2250	9600	....	....	....
12FX5	T-5½	Pentode	7CV	12.6	0.450	Power Amp.	5.5	110	62[5]	115	35	12	17500	13500	....	3000	1300
12FX8A	T-6½	Tri. Heptode	9KV	12.6	0.270	R-F Amp.	....	12.6	2.2 Meg[4]	....	1.3	...	....	1400	10	....	....
						Converter		12.6	G3=2.2M[4]	12.6	0.29	1.25	....	300[4]	EC1 = 1.6 V (RMS) Rg1 = 33 K Ohms		
12G8	T-6½	Duotriode	9CZ	12.6	0.400	Amplifier	....	12.6	0	Input Tri.	3.0	...	....	....	....	....	....
								12.6	...	Output Tri.	7.2	...	8500	2600	22	2000	25
12GA6	T-5½	Heptode	7CH	12.6	0.150	Converter	....	12.6	G3=2.2 M[4]	12.6	0.3	0.8	1.0 Meg.	140	....	....	....
								EC1 = 1.6 Volts (RMS), Rg1 = 33000 Ohms, IC1 = .06 Ma.									
12GB3	T-9	Beam Pent.	8GT	12.6	0.600	Horiz. Amp.	14	100	7.7	100	100	7	5300	14000	6.0	....	....
12GC6	T-12	Beam Pent.	8JX	12.6	0.600	Horiz. Defl. Amplifier	17.5	Characteristics Same as Type 6GC6.									
12GN6	T-5½	Pentode	7FW	12.6	0.150	R-F Amp.	3.3	Characteristics Same as Type 6GN6.									
12H6	Metal	Duodiode	7Q	12.6	0.150	Rectifier	....	Characteristics Same as Type 6H6.									
12HL5	T-6½	Beam Pent.	9QW	12.6	0.450	Power Amp.	12.0	Characteristics Same as Type 6HL5.									
12J5GT	T-9	Triode	6Q	12.6	0.150	Amplifier	2.75	Characteristics Same as Type 6J5GT.									
12J7GT	T-9	Pentode	7R	12.6	0.150	R-F Amp.	.825	Characteristics Same as Type 6J7G.									
12J8	T-6½	Duodiode Tet.	9GC	12.6	0.300	Det. Amp.	....	12.6	2.2 Meg[4]	12.6	12	1.5	6000	5500	....	2700	20
12JQ6	T-6½	Beam Pent. Diode	9RA	12.6	0.600	Vertical Defl. Amplifier	....	Characteristics Same as Type 6JQ6.									
12K5	T-5½	Tetrode	7EK	12.6	0.400	Power Amp. Driver	....	12.6	G2=2	G1=12.6	8	75	480	15000	7.2	800	40
								(Designed for Space-Charge Grid Operation.)									
12K7GT	T-9	Pentode	7R	12.6	0.150	R-F Amp.	3.0	Characteristics Same as Type 6K7G.									
12K8	Metal	Tri. Hexode	8K	12.6	0.150	Mixer Osc. Converter	3.0	Characteristics Same as Type 6K8GT.									

12KL8	T-6½	Diode Pent.	9LQ	12.6	0.150	Detector R-F I-F Amp.	.... 3.0	Characteristics Same as Type 6KL8.											
12L6GT	T-9	Beam Pent.	7S	12.6	0.600	Power Amp.	11	Characteristics Same as Type 25L6GT											
12Q7GT	T-9	Duodiode Tri.	7V	12.6	0.150	Det. Amp.	0.55	Characteristics Same as Type 6Q7GT.											
12R5	T-5½	Beam Pent.	7CV	12.6	0.600	Vert. Defl. Amplifier	4.95	Max. Peak Positive Pulse Plate Voltage = 1500 Volts. Max. D.C. Cathode Current = 45 Ma. 110	8.5	110	40.0	3.3	13000	7000	....	....	....		
12RK19/12BR3	T-6½	Diode	9CB	12.6	0.600	T.V. Damper	6.5	Characteristics Same as Type 6RK19/6BR3.											
12SC7	Metal	Duotriode	8S	12.6	0.150	A-F Amp.	3.85	Characteristics Same as Type 6SC7.											
12SF5GT	T-9	Triode	6AB	12.6	0.150	A-F Amp.	....	Characteristics Same as Type 6SF5.											
12SF7	Metal	Diode Pent.	7AZ	12.6	0.150	Det. Amp.	3.85	Characteristics Same as Type 6SF7.											
12SG7	Metal	Pentode	8BK	12.6	0.150	R-F Amp.	3.3	Characteristics Same as Type 6SG7.											
12SH7	Metal	Pentode	8BK	12.6	0.150	R-F Amp.	3.3	Characteristics Same as Type 6SH7.											
12SJ7	Metal	Pentode	8N	12.6	0.150	A-F Amp.	2.75	Characteristics Same as Type 6SJ7GT.											
12SK7	Metal	Pentode	8N	12.6	0.150	R-F Amp.	4.4	Characteristics Same as Type 6SK7GT.											
12SR7	Metal	Duodiode Tri.	8Q	12.6	0.150	Det. Amp.	2.75	Characteristics Same as Type 6SR7.											
12U7	T-6½	Duotriode	9A	12.6	0.150	Class A1 Amp.	....	12.6	0	....	1.0	...	12500	1600	20	....	....		
13FR7	9-T9	Duotriode	9HF	13.0	0.450	Vert. Defl. Amp./Osc.	1.5 10	Characteristics Same as Type 6FR7.											
13V10	Comp. T-9	Double Pent.	12EZ	13.2	0.450	FM-Det. Audio Output	1.7 6.5	150 145	560■ 6	100 125	1.3 36	2.0 5.5	150000 58000	1000 6400	....	 3000	.... 1.5		
14A7	Lock-in	Pentode	8V	12.6	0.150	R-F Amp.	4.4	Characteristics Same as Type 7A7.											
14AF7/XXD	Lock-in	Duotriode	8AC	12.6	0.150	Amplifier	2.75	Characteristics Same as Type 7AF7.											
14B6	Lock-in	Duodiode Tri.	8W	12.6	0.150	Det. Amp.	0.55	Characteristics Same as Type 7B6.											
14C5	Lock-in	Beam Pent.	6AA	12.6	0.225	Power Amp.	13.2	Characteristics Same as Type 7C5.											
14C7	Lock-in	Pentode	8V	12.6	0.150	R-F Amp.	1.1	100 250	1.0 3.0	100 100	5.7 2.2	1.8 0.7	400000 1.0 Meg.	2275 1575	....	....	....		
14F7	Lock-in	Duotriode	8AC	12.6	0.150	A-F Amp.	1.1	Characteristics Same as Type 7F7.											
14F8	Lock-in	Duotriode	8BW	12.6	0.150	Osc. Amp.	3.85	Characteristics Same as Type 7F8.											
14JG8	T-6½	Duodiode Triode	9KR	14	0.150	FM Det./ A-F Amp.	1.1	250	2.0	....	2	...	41000	2200	90	....	....		
14Q7	Lock-in	Heptode	8AL	12.6	0.150	Converter	1.1	Characteristics Same as Type 7Q7.											
14R7	Lock-in	Duodi. Pent.	8AE	12.6	0.150	Det. Amp.	2.2	Characteristics Same as Type 7R7.											
15AB9	T-6½	Twin Tetrode	10N	15.0	0.150	VHF Amp.	2.0	Characteristics Same as Type 6AB9.											
15DQ8	T-6½	Triode Pent.	9HX	15.0	0.300	Tri. Sync. Sep. Pent. Vid. Amp.	1.0 4.0	200 220	1.7 3.4	 220	3.0 18	... 3.0	 150000	4000 10000	65	....	....		
15HA6	T-6½	Pentode	9NW	15.0	0.300	Video Amp.	8.0	Characteristics Same as Type 6HA6.											
16AK9	Comp. T-12	Double Triode Pent.	12GZ	16.4	0.600	Pen.-Ver. Defl. Amplifier Tri.#2 Ver. Osc. Tri.#1 Syn. Clip.	....	Characteristics Same as Type 6AK9.											
16BX11	Comp. T-9	Double Triode Pent.	12CA	16.0	0.315	Pent. Vid. Amp. Tri. #1 Amp. Tri. #2 Amp.	3.0 2.0 1.5	125 150 150	56■ 150■ 220■	125	12.0 11.0 7.6	3.8	100000 6800 8400	11300 6200 6800	.... 42 57	....	....		
17AB9	T-6½	Twin Tetrode	10N	16.8	0.150	VHF Amp.	2.0	Characteristics Same as Type 6AB9.											
17BB14	T-9	Beam Pent.	9NH	16.8	0.450	Horiz. Amp.	13	100	7.7	100	100	7	5300	14000	6.0	....	....		

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
17BR3/17RK19	T-6½	Diode	9CB	16.8	0.450	T.V. Damper	6.5	Characteristics Same as Type 6BR3.									
17C8	T-6½	Duodi. Pent.	9T	17	0.100	Det. R-F Amp.	1.65	200	295■	60	5	1.75	1 Meg.	2200	....	....	....
17C9, 17C9A	T-6½	Duotetrode	10F	16.8	0.150	VHF Amp.	2.5	Characteristics Same as Type 6C9.									
17CA5	T-5½	Beam Pent.	7CV	16.8	0.450	Power Amp.	5.5	Characteristics Same as Type 12CA5.									
17EW8/HCC85	T-6½	Twin Triode	9AJ	17.5	0.150	RF Amp. and Mixer	2.5	200	2.1	....	10	...	....	5800	48	....	....
17H3	T-6½	Diode	9FK	17.5	0.300	T.V. Damper	3.0	Maximum Peak Inverse Plate Voltage = 2000 Volts. Maximum D.C. Output Current = 75 Ma.									
17HB25	T-9	Beam Pent.	....	16.8	0.450	Horiz. Amp.	13	100	7.7	100	100	7	5300	14000	6.0	....	....
17HC8	9-T9	Tri. Pentode	9EX	16.8	0.450	Vert. Defl. Osc./Amp.	1.0 11	Characteristics Same as Type 6HC8.									
17JG6	T-12 Novar	Beam Pent.	9QU	16.8	0.600	Horiz. Defl. Amp.	17.0	Characteristics Same as Type 6JG6.									
17JQ6	T-6½	Beam Pent. Diode	9RA	17.0	0.450	Vertical Defl. Amplifier	....	Characteristics Same as Type 6JQ6.									
17JR6	Novar T-12	Beam Pent.	9QU	16.8	0.600	Horiz. Defl. Amplifier	....	Characteristics Same as Type 6JR6.									
17KV6	T-12 Novar	Beam Pent.	9QU	16.8	0.600	Shunt Reg.	20.0	Characteristics Same as Type 6KV6.									
									200-	Acc.		Acc.					
17L6GT	T-9	Beam Pent.	7S	16.8	0.450	Power Amp.	11	Characteristics Same as Type 25L6GT.									
17LD8	T-9	Tri. Pentode	9QT	16.8	0.450	Vert. Osc. Vert. Defl. Amp.	1.0 7.0	150 120	5 8	 100	3.3 46.0	... 4	11300 11700	1900 7100	21.5	....	....
17R5	T-5½	Beam Pent.	7CV	16.8	0.450	Vert. Defl. Amplifier	4.95	Characteristics Same as Type 12R5.									
17Z3	T-6½	Diode	9CB	17	0.300	Damper	....	Max. Peak Inverse Plate Voltage = 4500 Volts. Max. Peak Plate Current = 450 Ma; Max. Avg. Plate Current = 150 Ma.									
18A5	T-9	Beam Pent.	6CK	18.5	0.300	Horiz. Defl. Amplifier	9.0	Max. Peak Positive Pulse Plate Voltage = 3000 Volts. Max. D.C. Cathode Current = 90 Ma.									
								200	17.0	125	40.0	1.1	27000	4800	....	....	....
18AJ10	Comp. T-9	Power Pent. Dual Cont. Pentode	12EZ	18.0	0.315	A-F Pwr. Amp. F-M Detector	6.0 1.7	145 150	7.0 180■	110 100	34-39† 2.8	6.5-9.3† 3.5	33000 180000	5600 G1-2400 G3-750	....	2500	1450 ....
18DZ8	T-6½	Tri. Beam Pentode	9EX	18.0	0.300	A-F Voltage Amp. and Power Amp.	.825 7.15	Characteristics Same as Type 6DZ8.									
18GE6A	T-5½	Duodiode Tri.	7BT	18.0	0.100	Det. Amp.	0.5	100	1.0	....	1.0	...	40000	1700	70	....	....
18HB8	T-6½	Triode Beam Pentode	9ME	18	0.300	Voltage Amp. S.T. A1 Amp.	.75 6.5	115 115	410■ 150■	 115	2.5 33	... 7.5	....	3900 6250	74	 3500	 1000
18RAL1	T-6½	Twin Triode	9HF	18	0.300	Vert. Defl. Osc.	1.5 8.0	.... Characteristics Same as Type 6RAL1.									
19BG6GA	T-12	Beam Pent.	5BT	18.9	0.300	Horiz. Defl. Amplifier	22	Characteristics Same as Type 6BG6GA.									

19C8	T-6½	Triple Dio. Tri.	9E	18.9	0.150	Det. Amp.	1.1	100	1.0	....	0.5	....	80000	1250	100	....	....
19DE3	Comp. T-9	Diode	12HX	19	0.600	Damper	....	Max. Peak Inverse Plate Voltage = 5000 Volts. Max. Peak Plate Current = 1050 Ma; Max. Avg. Plate Current = 350 Ma.									
19V8	T-6½	Triple Diode Triode	9AH	18.9	0.150	Det. Amp.	1.1	100 250	1.0 3.0	....	0.8 1.0	....	54000 58000	1300 1200	70 70	....	....
21EX6	T-12	Beam Pent.	5BT	21.5	0.600	Horiz. Defl. Amplifier	22	Characteristics Same as Type 6EX6.									
21HD5	Comp. T-12	Beam Pent.	12ES	21.5	0.600	Horiz. Defl. Amp.	24	Characteristics Same as Type 6HD5.									
21LG6	Comp. T-12	Beam Pent.	12HL	21.0	0.600	Horiz. Defl. Amplifier	....	Characteristics Same as Type 6LG6.									
22JG6	Novar T-12	Beam Pent.	9QU	22.0	0.450	Horiz. Defl. Amp.	17	Characteristics Same as Type 6JG6 and 6JG6A.									
22JR6	Novar T-12	Beam Pent.	9QU	22.0	0.450	Horiz. Defl. Amplifier	....	Characteristics Same as Type 6JR6.									
25AX4GT	T-9	Diode	4CG	25.0	0.300	T.V. Damper	5.28	P.I.V. = 4000 Volts Max. D.C. Plate Current = 125 Ma. Max.									
25BB14	T-9	Beam Pent.	9NH	25	0.300	Horiz. Amp.	13	100	7.7	100	100	7	5300	14000	6.0	....	....
25BK5	T-6½	Beam Pent.	9BQ	25.0	0.300	Power Amp.	9.9	Characteristics Same as Type 6BK5.									
25BR3	T-6½	Diode	9CB	25.0	0.300	T.V. Damper	6.5	Characteristics Same as Type 6BR3.									
25CA5	T-5½	Beam Pent.	7CV	25.0	0.300	Power Amp.	5.5	Characteristics Same as Type 6CA5.									
25DK4	T-5½	Diode	5BQ	25	0.150	H-W Rect.	....	117 A.C. Volts, RMS, 90 Ma. D.C. Output. (Condenser Input to Filter.)									
25DN6	T-12	Beam Pent.	5BT	25.0	0.600	Horiz. Defl. Amplifier	16.5	Peak Positive Pulse Plate Voltage = 6600 Volts Max. D.C. Cathode Current = 200 Ma.									
25DQ6A	T-12	Beam Pent.	6AM	25	0.300	Horiz. Defl. Amplifier	16.5	Characteristics Same as Type 6DQ6A.									
25E5	T-9	Beam Pent.	8GT	25	0.300	Horiz. Defl. Amp.	...	100	8.2	100	100	7	5000	14000	5.6	....	....
25EC6	T-12	Beam Pent.	5BT	25.0	0.600	Horiz. Defl. Amp.	10.0	Max. Peak Positive Pulse Plate Voltage = 7000 Volts. Max. Cathode Current = 200 Ma. 135	22.5	135	70	4.5	4700	7500	....	....	....
25F5A	T-5½	Beam Pent.	7CV	25.0	0.150	Power Amp.	5.0	110	7.5	110	45.0	7.3	13000	6400	....	2500	1500
25JQ6	T-6½	Beam Pent. Diode	9RA	25.2	0.300	Vert. Defl. Amplifier	....	Characteristics Same as Type 6JQ6.									
25L6GT	T-9	Beam Pent.	7S	25.0	0.300	Power Amp. P-PA[1] Amp.	11	110 200	7.5 180■	110 125	49.0 46	4.0 2.2	13000 28000	8000 8000	....	2000 4000	2100 3800
25Z5	ST-12	Duodiode	6E	25.0	0.300	Doubler	....	Characteristics Same as Type 25Z6GT.									
25Z6GT	T-9	Duodiode	7Q	25.0	0.300	Doubler H-W Rect.	....	117 A.C. Volts Per Plate, RMS, 75 Ma. Output Current. 235 A.C. Volts, RMS, 75 Ma. Output Current Per Plate.									
26HU5	T-12	Beam Pent.	8NB	26	0.600	Horiz. Defl. Amp.	33	175	21	110	125	3.3	6000	14000	4.0	....	....
28D7 28D7W (3) GB-28D7W (3)	Lock-in	Duo. Beam Pentode	8BS	28.0	0.400	Amplifier (per section) P.P. A2 Total	3.0	28 28 28	390■ 3.5 0	28 28 28	9.0 12.5 64.0	0.7 1.0 4.0	.... 4200	 3400		4000 4000 1500¶	80 100 600
28HA6	T-6½	Pentode	9NW	28.6	0.150	Video Amp.	8.0	Characteristics Same as Type 6HA6.									
28HD5	Comp. T-12	Beam Pent.	12ES	28.0	0.450	Horiz. Defl. Amp.	24.0	Characteristics Same as Type 6HD5.									
30HD5	Comp. T-12	Beam Pent.	12ES	30.0	0.450	Horiz. Defl. Amp.	24.0	Characteristics Same as Type 6HD5.									

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
31AL10	Comp. T-9	Double Tri. Pentode	12HR	31.5	0.315	Pent.-Vert	....	Maximum Peak Positive Plate Voltage = 2000 Volts. Maximum D.C. Cathode Current = 70 Ma.									
						Defl. Amp.	7.0	120	8.0	110	46	3.5	11700	7100	....	....	....
						Sec.#2 Ver. Osc	1.0	150	5.0	....	5.5	...	8500	2350	20	....	....
						Sec.#1 Syn. Clip	1.25	150	2.0	....	5.4	...	11000	3900	43	....	....
32HQ7	Comp. T-12	Diode Pent.	12HT	32.6	0.315	Damper Diode	3.8	Maximum Peak Inverse Plate Voltage = 3300 Volts. Maximum D.C. Plate Current = 120 Ma.									
						Horiz. Defl. Amplifier	7.0	Maximum Peak Positive Plate Voltage = 4000 Volts. Maximum D.C. Cathode Current = 125 Ma. 110	22.5	110	42	2.4	8000	4500	3.2	....	....
34R3	T-6½	Diode	9CB	34	0.150	Damper	....	Max. Peak Heater Cathode Voltage = 4500 Volts (Heater Negative). Max. Peak Cathode Plate Voltage = 4500 Volts (Cathode Positive).									
35A5	Lock-in	Beam Pent.	6AA	35.0	0.150	Power Amp.	9.35	110	7.5	110	40.0	3.0	14000	5800	....	2500	1500
								200	180■	110	43.0	2.0	34000	6100	....	5000	3000
35B5	T-5½	Beam Pent.	7BZ	35.0	0.150	Power Amp.	4.95	110	7.5	110	40.0	3.0	....	5800	....	2500	1500
35DZ8	T-6½	Tri. Beam Pentode	9EX	35	0.150	A-F Voltage Amp. and Power Amp.	.825 7.15	Characteristics Same as Type 6DZ8.									
35EH5	T-5½	Beam Pent.	7CV	35	0.150	A-F Pwr. Amp.	5.5	Characteristics Same as Type 6EH5.									
35GL6	T-5½	Beam Pent.	7FZ	35	0.150	S.T. A1 Amp.	5.5	110	7.5	110	45-47†	3-9†	12000	7500	....	2500	1800
35HB8	T-6½	Triode Beam Pent.	9ME	35	0.150	Voltage Amp. S.T. A1 Amp.	.75 6.5	Characteristics Same as Type 18HB8.									
35L6GT	T-9	Beam Pent.	7S	35.0	0.150	Power Amp.	9.35	110	7.5	110	40.0	3.0	14000	5800	....	2500	1500
								200	8.0	110	43.0	2.0	34000	6100	....	5000	3000
35LR6	Comp. T-12	Beam Pent.	12FY	35.0	0.450	Horiz. Defl. Amplifier	....	Characteristics Same as Type 6LR6.									
35Y4	Lock-in	Diode	5AL	35.0	0.150	H-W Rect.	....	235 Max. A.C. Volts, RMS, 60 Ma. Output Current with Panel Lamp. 235 Max. A.C. Volts, RMS, 100 Ma. Output Current without Panel Lamp.									
35Z3	Lock-in	Diode	4Z	35.0	0.150	H-W Rect.	....	235 Max. A.C. Volts Per Plate, RMS, 100 Ma. Output Current. Condenser Input to Filter.									
38HK7	Comp. T-12	Diode Pent.	12FS	37.8	0.450	Horiz. Amp. Damper	10.0	130	22	130	60	2.8	6200	8800	....	....	....
								Diode Current for Eb = 16 Volts is 350 Ma.									
40A1	T-9	Ballast	8ES	....	....	Horiz. Reg.	....	Avg. Operating Current—0 Ma. at 20 Volts; 150 Ma. at 40 Volts; 155 Ma. at 60 Volts.									
40B2	T-9	Ballast	8ES	....	....	Horiz. Reg.	....	Avg. Operating Current—140 Ma. at 20 Volts; 150 Ma. at 40 Volts; 155 Ma. at 60 Volts.									
40FR5	T-5½	Power Pent.	7CV	40	0.100	A-F Power Amplifier	5.2	110	7.5	110	32	3	20000	6000	....	2800	1500
								115	180■	115	34	7	....	....	....	3200	1300
41	ST-12	Power Pent.	6B	6.3	0.400	Power Amp.	9.35	Characteristics Same as Type 6K6GT.									
42	ST-14	Power Pent.	6B	6.3	0.700	Power Amp.	12.1	Characteristics Same as Type 6F6G.									
43	ST-14	Power Pent.	6B	25.0	0.300	Power Amp.	5.83	Characteristics Same as Type 25A6GT.									
45	ST-14	Triode	4D	2.5♦	1.500	Power Amp.	11	180	31.5	....	31.0	...	1650	2125	3.5	2700	830
								250	50.0	....	34.0	...	1610	2175	3.5	3900	1600
								275	56.0	....	36.0	...	1700	2050	3.5	4600	2000
45B5	T-6½	Pentode	9CV	45.0	0.100	Audio Output	14	170	12.5	170	70	3.5	26000	11000	....	....	....
50A1	T-6½	Ballast	9CM	....	....	Fil. Ballast	....	Avg. Operating Current—59 Ma. at 30 Volts; 54 Ma. at 50 Volts; 56 Ma. at 65 Volts.									

50A5	Lock-in	Beam Pent.	6AA	50.0	0.150	Power Amp.	11	110 200	7.5 8.0	110 110	49.0 50.0	4.0 1.5	13000 28000	8000 8000	....	2000 4000	2100 3800
50AX6G	ST-14	Duodiode	7Q	50.0	0.300	F-W Rect.	....	Characteristics Same as Type 6AX6G.									
50BK5	T-6½	Beam Pent.	9BQ	50.0	0.150	Power Amp.	9.9	250	5.0	250	35	3.5	0.1 Meg.	8500	....	6500	3500
50BM8	T-6½	Tri. Pentode	9EX	50	0.100	A-F Tri. Amp. Power Amp.	1.1 7.7	100 100 200	0 6 16	.... 100 200	3.5 26 35	... 5 7	28000 15000 20000	2500 6800 6400	70	.... 3900 5600	.... 1050 3500
50EH5	T-5½	Beam Pent.	7CV	50	0.150	S.T. A1 Amp.	5.5	Characteristics Same as Type 6EH5.									
50FA5	T-5½	Beam Pent.	7CV	50	0.150	S.T. A1 Amp.	5.2	110	7.5	110	40	3	13000	5800	....	2500	1500
50FE5	T-6½	Beam Pent.	8KB	50	0.150	S.T. A1 Amp. P.P. AB1 Amp.	14.5	Characteristics Same as Type 6FE5.									
50FK5	T-5½	Power Pent.	7CV	50	0.100	S.T. A1 Amp.	5.0	110	62■	110	32	8.5	14000	12800	....	3000	1200
50FY8	T-6½	Tri. Beam Pentode	9EX	50	0.150	Tri. Volt. Amp. Pent. S.T.A1 A. Pent. P.P.A1 A.	1.0 1.0	125 125 125	1.5 120■ 62■	.... 125 125	2.5 70-66† Output Obtained in Simplex Circuit.	... 10-19†	17000 5000	2700 7500	46	.... 2000 4000¶	.... 3000 6000
50HN5	T-6½	Beam Pent.	9QW	50.0	0.150	Audio Output	12	130	56■	130	70	5	7500	17000	13	....	....
50L6GT	T-9	Beam Pent.	7S	50.0	0.150	Power Amp.	11	Characteristics Same as Type 25L6GT.									
50X6	Lock-in	Duodiode	7DX	50.0	0.150	H-W Rect. Doubler	....	235 Volts RMS Per Plate, 75 Ma. D.C. Output Per Plate. 117 Volts RMS Per Plate, 75 Ma. D.C. Output.									
50Y6GT	T-9	Duodiode	7Q	50.0	0.150	F-W Rect.	....	Characteristics Same as Type 25Z6GT.									
50Y7GT	T-9	Duodiode	8AN	46.0	0.150	Doubler H-W Rect.	....	117 A.C. Volts, RMS, 65 Ma. Output with Panel Lamp. 150 A.C. Volts, RMS, 65 Ma. Output Per Plate with Panel Lamp. 235 A.C. Volts, RMS, 65 Ma. Output Per Plate with Panel Lamp.									
53HK7	Comp. T-12	Diode Pent.	12FS	53.2	0.315	Damper Horiz. Amplifier	....	Characteristics Same as Type 38HK7.									
56R9	Comp. T-9	Tri. Pentode	12EN	Tri. 14.0 Pent. 42.0	0.150 0.150	A-F Amp. Power Amp.	1.0 6.5	100 120	1500■ 8.0	 110	0.6 50.0	... 8.5	55500 10000	1800 7500	100	 2500	 2300
60E3	T-5½	Diode	60E3	60	0.150	H-W Rect.	....	117 Volts, RMS, 110 Ma. D.C. Output. Condenser Input.									
60FX5	T-5½	Pentode	7CV	60	0.100	S.T. A1 Pwr. Amplifier	5.5	110	62■	115	36-35	10-12	17500	13500	....	3000	1300
60HL5	T-6½	Beam Pent.	9QW	60.0	0.100	Power Amp.	12	Characteristics Same as Type 6HL5.									
KT66	Curved Bulb	Beam Pent.	7S	6.3	1.270	S.T.A1 Amp. P.P.AB1 Amp.	....	250 450	15 250■	250 415	85 105-125†	6.3 5-18†	22500	6300	....	2200 8000¶	7250 30000
75	ST-12	Duodiode Tri.	6G	6.3	0.300	Det. Amp.	....	250	2.0	....	0.9	...	91000	1100	100	....	....
78	ST-12	Pentode	6F	6.3	0.300	R-F Amp.	3.0	90 180 250	3.0 3.0 3.0	90.0 75.0 100	5.4 4.0 7.0	1.3 1.0 1.7	300000 1 Meg. 800000	1275 1100 1450	....	....	....
80	ST-14	Duodiode	4C	5.0	2.000	F-W Rect.	....	350 A.C. Volts Per Plate, RMS, 125 Ma. Output Current. Condenser Input to Filter. 500 A.C. Volts Per Plate, RMS, 125 Ma. Output Current. Choke Input to Filter.									
83	ST-16	Duodiode	4C	5.0	3.00	F-W Rect.	....	450 A.C. Volts Per Plate, RMS, 225 Ma. Output Current. Condenser Input to Filter.									
84/6Z4	ST-12	Duodiode	5D	6.3	0.500	F-W Rect.	....	325 A.C. Volts Per Plate, RMS, 60 Ma. Output Current. Condenser Input to Filter.									
KT88	ST-16	Beam Pent.	7S	6.3	1.800	P.P.AB1 Amp.	....	450	65	450	100-240† (Plate and Grid No. 2 Current.) Ultra-Linear Circuit					3800¶	65000
VR-90-105-150	Now Listed as OB3, OC3 and OD3.																

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
117L7/M7GT	T-9	Diode Beam Pentode	8AO	117	0.090	H-W Rect. Power Amp.	6.6	117 A.C. Volts, RMS, 75 Ma. Output Current. Condenser Input to Filter. 105	5.2	105	43	4.0	17000	5300	....	4000	850
117Z3	T-5½	Diode	4CB	117	0.040	H-W Rect.	....	117 Volts Per Plate (RMS), 90 Ma. DC Output.									
117Z6GT	T-9	Duodiode	7Q	117	0.075	Voltage Dblr.	....	117 A.C. Volts Per Plate, RMS, 60 Ma. Output Current.									
407A GB-407A (3)	T-6½	Duotriode	407A	40 20	0.050 0.100	Amplifier	1.35	150	240■	....	8.2	...	6370	5500	....	....	....
408A GB-408A (3)	T-5½	Pentode	7BD	20	0.050	Amplifier	1.7	120	200■	120	7.0	2.2	340000	5000	....	....	....
417A	T-6½	Triode	9V	6.3	0.300	UHF R-F Amp.	4.0	Characteristics Same as Type 5842.									
807 807W (3)	ST-16 T-12	Beam Pent.	5AW	6.3	0.900	P.P.AB1 Amp. P.P.AB2 Amp. P.P.AB2 Amp.	25	400 400 600	45 25 30	.... 300 300	60-140† 90-240† 60-200†	.... 2.15† 0.7-16†	(Current, Output for 2 Tubes) (Current, Output for 2 Tubes) (Current, Output for 2 Tubes)			3000 3200 6400	15000 55000 80000
884	ST-12	Gas Triode	6Q	6.3	0.600	Relay Tube	....	300	30	....	75	For Relay Operation Limit Time to 30 Secs. 300 Ma. Pe Current. 16 Volt Tube Drop.					
FM1000	Lock-in	Heptode	FM 1000	6.3	0.300	F-M Det.	....	....	....	....	....	....	....	....	....	....	....
1216 (3) GB-1216 (3)	T-5½	Duotriode	7BF	6.3	0.300	Computer	0.55	100 150 150	470■ 0 10	....	4.8 4.8 Min. 0.1 Max.	... Plate Res. = 20K Ohms. Plate Res. = 20K Ohms.	7950 Grid Res. = 47K Ohms. Grid Res. = 47K Ohms.	3400	27	....	....
1217 (3) GB-1217 (3)	T-5½	Heptode	7CH	6.3	0.300	Dual-Control Computer	1.0	67.5 67.5 150	0 4 0	67.5 67.5 75	Grid No. 3 = 0 Volts Grid No. 3 = 0 Volts 5.8	9	2400 1700 Rb=20K, RG3=47K, RG1=47K, RG2-4=470 Ohms	....	....	....	....
1218A	T-5½	Triode	7DK	6.3	0.225	UHF Amp.	4	200	100■	....	18	...	....	10750	55	....	....
GB1220/5654(3)	T-5½	Pentode	7BD	6.3	0.175	VHF Amp.	1.65	120	2	120	7.5	2.5	300000	5000	....	....	....
1221	ST-12	Pentode	6F	6.3	0.300	Amplifier	.825	Special Non-Microphonic Tube, Characteristics Same as Type 6C6.									
1222A	ST-14	Beam Pent.	1222	6.3	0.900	Power Amp.	20.9	Characteristics Similar to Type 6L6GA.									
1223	ST-12	Pentode	7R	6.3	0.300	Amplifier	.825	"G" Equivalent of Type 1221 Above.									
1229	ST-12	Tetrode	4K	2.0♦	0.060		....	Special Type 32. Made for Low Grid Current Application.									
1230	T-9	Triode	4D	2.0♦	0.060		....	Special Type 30. Made for Low Grid Current Applications.									
1231	Lock-in	Pentode	8V	6.3	0.450	R-F Amp. Tet. Amp.	....	300 300	200■ 200■	150 150	10.0 12.0	2.5 0.5	700000 540000	5500 6500	3850 3500	....	....
1232	Now Known as Type 7G7.																
1236A	T-9	Diode	1236A	1.9♦	0.450	Regulator	....	Plate Voltage = 330 Volts (Abs. Max.). D.C. Current = 0.8 Ma. (Abs. Max.). Plate Current = 0.63 Ma. Plate Load Resistance = 0.25 Meg.									
1238	Lock-in	Duo. Beam Amplifier	8BS	28.0	0.400	Amplifier	3.3	Characteristics Similar to 28D7.									
1247	T-3	Diode	1247	0.7♦	0.065	R-F Probe	....	300 A.C. Volts RMS, 0.4 Ma. D.C. Plate Current.									
GB1252/6U8A(3)	T-6½	Tri. Pentode	9AE	6.3	0.450	VHF Osc. VHF Amp.	2.5 3.0	125 125	1 1	 110	13.5 9.5	... 3.5	 200000	7500 5000	40	....	....
1265	ST-12	Diode	4AJ	....	....	Voltage Reg.	....	Starting Voltage = 135, Operating Voltage = 90, Operating Current = 5 to 30 Ma.									

1266	T-9	Diode	4AJ No Jumper	....	....	Regulator	....	Voltage Regulator Similar to Type OB3/VR-90-30, Except Regulating at 70 Volts.									
1267	T-9	Gas Triode	4V	....	....	Relay Tube	....	Similar to Type OA4G.									
1273	Lock-in	Pentode	8V	6.3	0.300	Amplifier	1.1	Characteristics Same as Type 7C7 (Special Non-Microphonic Tube).									
1274	T-9	Duodiode	6S	6.3	0.600	F-W Rect.	....	Characteristics Same as Type 7Y4.									
1275	ST-16	Duodiode	4C	5.0♦	1.750	F-W Rect.	....	Similar to Type 5Z3.									
1276	ST-16	Triode	4D	4.5♦	1.140	Power Amp.	16.5	Similar to Type 6A3.									
1280	Lock-in	Pentode	8V	12.6	0.150	Amplifier	1.1	Characteristics Same as Type 14C7 (Special Non-Microphonic Tube).									
1284	Lock-in	Pentode	8V	12.6	0.150	R-F Amp.	....	250	3	100	9.0	2.5	800000	200	....	....	....
1291	Now Known as Type 3B7.																
1293	Lock-in	Triode	4AA	1.4♦	0.110	Oscillator	....	90 90	0 20	....	5.2 13.25	....	....	1500 120 Mc. Oscillator Rg = 10000 Ohms.	15	....	....
1294	Now Known as Type 1R4																
1299	Now Known as Type 3D6.																
1612	Metal	Heptode	7T	6.3	0.300	Mixer Amp.	1.65	Characteristics Same as Type 6L7.									
1614	T-10 Sp.	Beam Pent.	7S	6.3	0.900	P.P.AB1 Amp.	21	360 530	22.5 36	270 340	88-132† 60-160†	15† 20†	....	....	....	6600 7200	26500 50000
1625	ST-16	Beam Pent.	5AZ	12.6	0.450	P.P.AB1 Amp. P.P.AB2 Amp.	25	Characteristics Same as Type 807.									
2050A	ST-12	Gas Tetrode	6BS	6.3	0.600	Relay Tube	....	400 220	5.0 4.0	0 0	100 75	For Relay Operation Limit Time to 30 Seconds. 1 Amp. Peak Current, 8 Volts Tube Drop.					
5636 (3)	T-3	Pentode	8DC	6.3	0.150	Mixer	1.1	100	150■	100	3.6	5.3	320000	1280▲	....	....	....
5639 (3)	T-3	Beam Pent.	8DL	6.3	0.450	Power Amp.	4.0	150	100■	100	21	4	50000	9000	....	....	1000
5641 (3)	T-3	Diode	6CJ	6.3	0.450	H-W Rect.	....	117 A.C. Volts Per Plate, RMS, 48 Ma. D.C. Output. Condenser Input to Filter. 235 A.C. Volts Per Plate, RMS, 45 Ma. D.C. Output. Condenser Input to Filter.									
5642	T-3	Diode	5642	1.25♦	0.200	H-W Rect.	....	Pulse Type Rectifier for Television Service, 10000 Volts Peak Inverse.									
5643 (3)	T-3	Gas Tetrode	8DD	6.3	0.15	Relay Tube	....	150	5 A.C.	0	16	(Grid Bias Voltage 180°, Out of Phase with Anode Voltage.)					
5644 (3)	T-3	Gas Diode	4CN	....	....	Voltage Reg.	....	Starting Voltage at 130, Operating Voltage 95, Operating Current 5 to 25 Ma.									
5647 (3)	T-1	Diode	5647	6.3	0.150	Detector	....	117 Volts, RMS Plate, 9 Ma. D.C. Output.									
5651 5651WA (3)	T-5½	Gas Diode	5BO	....	....	Volt. Ref.	....	Starting Voltage = 115 Volts Max. Operating Voltage = 92 Volts Max. Operating Current = 3.5 Ma. Max.									
5654/6AK5W(3) 5654/6AK5W/6096 GB-5654(3)	T-5½	Pentode	7BD	6.3	0.175	VHF Amp.	1.65	120	200■	120	7.5	2.5	340000	5000	....	....	....
5670(3) GB-5670(3) 5670WA(3)	T-6½	Duotriode	8CJ	6.3	0.350	VHF Amp.	1.35	150	240■	....	8.2	....	6370	5500	35	....	....
5686	T-6½	Beam Pent.	9G	6.3	0.350	Power Amp.	8.25	250	12.5	250	27	5.0	....	3100	....	9000	2700
5687 (3) GB-5687 (3)	T-6½	Duotriode	9H	6.3 12.6	0.900 0.450	Amplifier	4.2	250 180	12.5 7.0	....	12 23	....	3000 2000	5400 8500	16 17	....	....
5691	T-9	Duotriode	8BD	6.3	0.600	A-F Amp.	1.0	250	2	....	2.3	....	44000	1600	70	....	....
5692	T-9	Duotriode	8BD	6.3	0.600	A-F Amp.	1.75	250	9	....	6.5	....	9100	2200	20	....	....
5693	Metal	Pentode	8N	6.3	0.300	A-F Amp.	2.0	250	3	100	3.0	0.85	....	1650	....	....	....

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
5702 5702WA (3) 5702WB (3)	T-3	Pentode	5702	6.3	0.200	VHF Amp.	....	120	200■	120	7.5	2.5	340000	5000	....	....	....
5703 5703WA (3) 5703WB (3)	T-3	Triode	5703	6.3	0.200	VHF Osc.	3.3	120	220■	....	9.0	...	....	5000	25	....	....
5704 (3)	T-2	Diode	5704	6.3	0.150	VHF Det.	3.3	150 Volts, RMS Plate, 9 Ma. D.C. Output Current.									
5718 (3)	T-3	Triode	8DK	6.3	0.150	UHF Amp.	3.3	100 150	150■ 180■	....	8.5 13.0	... ...	4650 4150	5800 6500	27 27	....	....
5719 (3)	T-3	Triode	8DK	6.3	0.150	UHF Amp.	.055	150	680■	....	1.85	...	30500	2300	70	....	....
5722 (3)	T-5½	Diode	5CB	4.9♦	1.600	Noise Diode	....	200	For Noise Generator Service Ib 35 Ma. Max.								
5725 (3) GB-5725 (3) 5725/6AS6W(3)	T-5½	Pentode	7CM	6.3	0.175	Mixer	1.65	120	2	120	5.2	3.5	3200	....	....	....	....
5726/6AL5W(3) GB-5726 (3) 5726/6AL5W/6097(3)	T-5½	Duodiode	6BT	6.3	0.300	Rectifier	....	117 Volts, RMS Plate, 9 Ma. D.C. Output Current Per Plate.									
GB5727 (3)	T-5½	Tetrode	7BN	6.3	0.600	Thyratron	....	Characteristics Same as Type 5727/2D21W.									
5744	T-3	Triode	5744	6.3	0.200	A-F Amp.	....	250	500■	....	4	...	....	4000	70	....	....
5749/6BA6W(3) GB-5749	T-5½	Pentode	7BK	6.3	0.300	R-F Amp.	3.3	100 250	68■ 68■	100 100	10.8 11.0	4.4 4.2	250000 1.0 Meg.	4300 4400	....	....	....
5750 (3) 5750/6BE6W(3) GB-5750 (3)	T-5½	Heptode	7CH	6.3	0.300	Converter	1.1	Characteristics Same as Type 6BE6.									
5751 (3) 5751WA (3) GB-5751 (3)	T-6½	Duotriode	9A	6.3 12.6	0.350 0.175	A-F Amp.	0.8	Characteristics Same as Type 12AX7/ECC83.									
5763	T-6½	Beam Pent.	9K	6.0	0.750	RF Amp.	13.5 12.0	350 300	37 37.5	250 250	48.5 50	6.2 6.6	....	....	....	....	10300 12000
5783	T-3	Gas Diode	5783	....	....	Voltage Reg.	....	Starting Voltage at 115 Volts. Operating Voltage 85. Operating Current 1.5 to 3.5 Ma.									
5784	T-3	Pentode	5784	6.3	0.200	Amplifier	1.87	120	2	120	5.2	3.5	....	3200	....	....	....
5785	T2x3	Diode	5785	1.25♦	0.015	H-W Rect.	....	1235 Volts, RMS Plate, 100 μa D.C. Output Current.									
5787	T-3	Gas Diode	5783	....	....	Voltage Reg.	....	Starting Voltage at 135 Volts. Operating Voltage 100. Operating Current 5 to 25 Ma.									
5814 (3) GB-5814A (3) 5814WA (3)	T-6½	Duotriode	9A	6.3/ 12.6	0.350/ 0.175	Class A Amplifier	3.0	100 250	0 8.5	....	11.8 10.5	... ...	6250 7700	3100 2200	19.5 17.0	....	....
5823	T-5½	Gas Triode	4CK	....	....	Relay Tube	....	Peak Cathode Ma. = 100 Max. D.C. Cathode Ma. = 25 Max. Starter Anode Volt Drop = 61 Volts. Anode Drop = 62 Volts.									
5824 (3)	ST-14	Beam Pent.	7S	25.0	0.300	Power Amp.	13.7	135	22	135	61	2.5	15000	5000	....	1700	4300
5840 (3)	T-3	Pentode	8DL	6.3	0.150	R-F Amp.	1.1	100	150■	100	7.5	2.4	260000	5000	....	....	....
5842 (3)	T-6½	Triode	9V	6.3	0.300	UHF R-F Amplifier	4.0	150	62■	....	26	...	1800	24000	43	....	....

5844 (3) GB-5844 (3)	T-5½	Duotriode	7BF	6.3	0.300	Computer	1.0	100	470■	....	4.8	...	7550	3700	28	....	....
5845	T-5½	Duodiode	5CA	5.0♦	0.435	Control Diode	....	300max.	....	....	2.0max.	...	....	....	....	....	....
5847A (3)	T-6½	Pentode	9X	6.3	0.300	RF Amp.	3.3	150 150	4000■ 4000■	150 150	1.1 4.4	0.3 1.2	....	3000 8500	....	....	....
5851	T-3	Pentode	6CL	1.25♦ 2.50♦	0.110 0.055	R-F Amp.	1.65	125 180	7.5 7.0	125 135	5.5 ...	0.9 ...	175000	1600	....	....	 650
5871	T-9	Beam Pent.	7S	6.3	0.450	Power Amp.	13.2	Characteristics Same as Type 6V6GT.									
5879	T-6½	Pentode	9AD	6.3	0.150	A-F Amp.	1.37	250 250	3 8	100	1.8 Triode Connected	0.4	2000000 13700	1000 1530	 21	....	....
5881	T-11	Beam Pent.	7S	6.3	0.900	Power Amp.	25.3	Characteristics Same as Type 6L6G.									
5889	T-3	Pentode	5889	1.25♦	7.5 Ma	Amplifier	....	12	2.0	....	.005	.005	1.8 Meg. (For Low Grid Current Applications.)				
5896 (3)	T-3	Duodiode	8DJ	6.3	0.300	F-W Rect.	....	150 Volts, RMS Per Plate, 18 Ma. D.C. Output Current.									
5899 (3)	T-3	Pentode	8DL	6.3	0.150	R-F Amp.	1.1	100	120■	100	7.2	2.2	260000	4500	....	....	....
5902 (3)	T-3	Pentode	8DL	6.3	0.450	Power Amp.	4.0	110	270■	110	30	2.2	15000	4200	....	....	1000
5903 (3)	T-3	Duodiode	8DJ	26.5	0.075	UHF Det.	....	PIV = 460 Volts, PKIb = 60 Ma., Ib = 10 Ma. and EHK = 360 Volts.									
5904 (3)	T-3	Triode	8DK	26.5	0.045	UHF Osc./ Amp.	....	26.5	2.2 Meg[4]	....	3.0	...	4000	5000	20	....	....
5905 (3)	T-3	Pentode	8DL	26.5	0.045	UHF Amp.	....	26.5	2.2 Meg[4]	26.5	2.1	0.75	150000	2850	....	....	....
5906 (3)	T-3	Pentode	8DL	26.5	0.045	UHF Amp.	1.1	100	150■	100	7.5	2.4	260000	5000	....	....	....
5907 (3)	T-3	Pentode	8DL	26.5	0.045	UHF Amp.	....	26.5	2.2 Meg[4]	26.5	2.7	1.1	100000	3000	....	....	....
5908 (3)	T-3	Pentode	8DC	26.5	0.045	UHF Amp.	....	26.5	2.2 Meg[4]	26.5	3.3	2.0	31000	2200	....	....	....
5910 (3)	T-5½	Pentode	6AR	1.4♦	0.050	R-F Amp.	....	90	0	90	1.6	0.45	1500000	900	....	....	....
5915 (3) 5915A (3) GB-5915A (3)	T-5½	Dual Control Heptode	7CH	6.3	0.300	Computer	1.0	150 150 150	0 10.0 0	75 75 75	5.8 0 0	9.0 0 14.0	Grid No. 3 Voltage = 0 Rb = 20K Ohms Grid No. 3 Voltage = 0 Grid No. 3 Voltage = −10				
5916 (3)	T-3	Pentode	8DC	26.5	0.045	Dual-Control Mixer	1.1	100	150■	100	5.3	3.6	110000	3200	....	....	....
5931 (3) GB-5931 (3)	T-12	Duodiode	5T	5.0♦	3.000	F-W Rect.	....	Characteristics Same as Type 5U4G.									
5932 (3) GB-5932 (3)	T-12	Beam Pent.	7S	6.3	0.900	Power Amp.	21	Characteristics Same as Type 6L6G.									
5933 (3) 5933WA (3) GB-5933 (3)	T-12	Beam Pent.	5AW	6.3	0.900	Power Amp.	25	Characteristics Same as Type 807W.									
5963 (3) GB-5963 (3)	T-6½	Duotriode	9A	6.3 12.6	0.300 0.150	Computer	2.5	67.5 150	0 0	....	8.5 5.4	... ...	6600 (Rb = 20000 Ohms)	3200	21	....	....
5964 (3) GB-5964 (3)	T-5½	Duotriode	7BF	6.3	0.450	Computer	1.5	100 150	50■ 0	....	9.5 5.0	... ...	6500 (Rb = 20000 Ohms)	6000	39	....	....
5965A GB-5965 (3)	T-6½	Duotriode	9A	6.3/ 12.6	0.450/ 0.225	Computer	2.4	150	220■	....	8.5	...	7000	6700	47	....	....
5968	T-3	Duotriode	8DQ	1.25♦	0.120	VHF Mixer	....	45	0	....	0.7	...	....	1300	50	....	....
5969	T-3	Duotetrode	8DR	1.25♦	0.200	VHF Amp. or VHF Osc.	0.96	135 Class A Ratings	3.0	45	6.0	0.6	....	1700	....	....	....
5970	T-3	Duo. Pentode	8DS	1.25♦	0.160	VHF Amp.	....	45	5 Meg.[4]	45	3.0	0.9	170000	1850	....	....	....
5977 (3)	T-3	Triode	8DK	6.3	0.150	Amplifier	3.3	100	270■	....	10.0	...	3650	4500	16	....	....

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
5987 (3)	T-3	Triode	8DM	6.3	0.450	Amplifier	4.0	100	18	....	9.0	...	....	1850	4.1	....	....
5998A	T-12	Duotriode	8BD	6.3	2.400	Passing Tube for V.R. Serv.	15	110	105■	....	100	...	350	15500	5.4	....	....
6000	T-11	Beam Pent.	6CK	26.5	0.280	Class "C" Amp./Osc.	25	400 600	60 60	200 225	125 100	16 18	RG = 12000 Ohms, PK R-F = 75 V, IG1 = 5 Ma, Driving Power = 0.4 Watt, RG = 20K Ohms, PK. R-F = 75 V, IG1 = 3 Ma., Driving Pwr. = 0.23 Watts				28
6005 (3) GB-6005 (3) 6005/6AQ5W/6095(3) 6005/6AQ5W (3)	T-5½	Beam Pent.	7BZ	6.3	0.450	S.T. Class A1 S.T. Class A1 P.P. Class AB1	11	180 250 250	8.5 12.5 15	180 250 250	29. 45. 70-79†	3.0 4.5 5-13†	58000 52000 Current, Output for 2 Tubes	3700 4100	....	5500 5000 10000¶	2000 4500 10000
6021 (3)	T-3	Duotriode	8DG	6.3	0.300	UHF Amp.	1.1	100	150■	....	6.5	...	6480	5400	35		
6028	T-5½	Pentode	7BD	20	0.050	Amplifier	1.87	120	180■	120	7.5	2.5	300000	5000	....	....	....
6080 GB-6080	T-12	Duotriode	8BD	6.3	2.500	Passing Tube for V.R. Service	13	135	250■	....	200	...	280	7000	2	....	....
6082A	T-12	Duo Power Triode	8BD	26.5	0.600	Power Amp.	13	135	250■	....	125	...	280	7000	2	....	....
6095 (3)	T-5½	Beam Pent.	7BZ	6.3	0.450	Power Amp.	13.2	Characteristics Same as Type 6AQ5.									
6096 (3)	T-5½	Beam Pent.	7BD	6.3	0.450	Power Amp.	13.2	Characteristics Same as Type 5554.									
6097	T-5½	Duodiode	6BT	6.3	0.300	F-W Rect.	....	Characteristics Same as Type 5726/6AL5W.									
6098 (3)	T-12	Beam Tet.	6098	6.3	1.200	Oscilloscope Defl. Amp.	21.0	Characteristics Same as Type 6AR6.									
6099 (3)	T-5½	Duotriode	7BF	6.3	0.450	VHF Osc. VHF Amp.	1.6	Characteristics Same as Type 6101 Except Plate Current Difference Between Units Shall Not Exceed 0.25 Ma. Initially or 1.0 Ma. After 500 Hours.									
6100 (3)	T-5½	Triode	6BG	6.3	0.150	R-F Osc. R-F Amp.	5.5 3.85	Characteristics Same as Type 6C4.									
6101 (3) GB-6101	T-5½	Duotriode	7BF	6.3	0.450	VHF Osc./ Amp.	1.6	Characteristics Same as Type 6J6.									
6110 (3)	T-3	Duodiode	8DJ	6.3	0.150	UHF Det.	....	Peak Inverse Voltage = 460 Volts. Peak Anode Current = 26.4 Ma. Per Plate.									
6111 (3)	T-3	Duotriode	8DG	6.3	0.300	Med. Mu Amplifier	1.1	100	220■	....	8.5	...	4200	4750	20	....	....
6112 (3)	T-3	Duotriode	8DG	6.3	0.300	High Mu Amplifier	0.55	100 150	1500■ 820■	....	0.8 1.75	... ...	38900 28000	1800 2500	70 70	....	....
6118 (3)	Metal	Duodiode Tri.	7V	6.3	0.300	Det. Amp.	....	100 250	1.0 3.0	....	0.8 1.0	... ...	58000 58000	1200 1200	70 70	....	....
6135 (3) GB-6135 (3)	T-5½	Triode	6BG	6.3	0.170	VHF Osc./ Amp.	3.8	Characteristics Same as Type 6C4.									
GB-6136 (3)	T-5½	Pentode	7BK	6.3	0.300	VHF Osc.	3.1	250	68■	150	10.6	4.3	1 Meg.	5200	....	....	....
6145 GB-6145 (3)	Lock-in	Pentode	8V	6.3	0.600	Computer	11	150	0	100	34	8.0	0.1 Meg.	9700	....	....	....

6147	T-3	Power Pent.	6CL	1.25♦	0.125	VHF Power Amplifier	1.5	125	7.5	125	5.5	0.9	175000	1600	....	....	....
6159B	T-12	Beam Pent.	7CK	26.5	0.300	Power Amp.	....	Characteristics Same as Type 6146B/8298A.									
6186 6186 (3) 6186/6AG5WA(3) GB-6186 (3)	T-5½	Pentode	7BD	6.3	0.300	VHF Amp.	2.5	250	200■	150	7	2	....	5000	....	....	....
6187	T-5½	Pentode	6187	6.3	0.175	VHF Amp.	1.6	120	2.0	120	5.2	3.5	....	3200	....	....	....
6188	T-9	Duotriode	8BD	6.3	0.300	D.C. Amp.	1.1	250	2.0	....	2.3	...	44000	1600	70	....	....
6189 (3) 6189/12AU7WA(3) GB-6189 (3)	T-6½	Duotriode	9A	6.3 12.6	0.300 0.150	Osc./Amp.	3.0	Characteristics Same as Type 12AU7.									
6197	T-6½	Beam Pent.	9BV	6.3	0.650	Computor Applications	7.5	250	3	150	30	7	90000	11000	22	....	....
6201 (3) GB-6201 (3)	T-6½	Duotriode	9A	6.3 12.6	0.300 0.150	VHF Amp.	2.5	Characteristics Same as Type 12AT7.									
6205 (3)	T-3	Pentode	8DC	6.3	0.150	UHF Amp.	1.1	100	150■	100	7.5	2.4	0.26 Meg.	5000	....	....	....
6206 (3)	T-3	Pentode	8DC	6.3	0.150	UHF Amp.	1.1	100	120■	100	7.5	2.0	0.26 Meg.	4500			
6211A	T-6½	Duotriode	9A	12.6/ 6.3	0.150/ 0.300	Computer	1.3	100	2.0	....	6.6	...	6500	4700	31	....	....
6216	T-6½	Beam Pent.	9CE	6.3	1.200	Voltage Reg.	10.0	100	3	100	72	3	18500	12500	....	....	....
6267	T-6½	Pentode	9CQ	6.3	0.200	A-F Amp.	1.1	250	2.0	140	3.0	0.6	2.5 Meg.	1800	....	....	....
6308 (3)	T-3	Gas Diode	8EX	....	....	Voltage Reg.	....	Starting Voltage at 115 Volts. Operating Voltage at 87 Volts and Current at 3.5 Ma. Max.									
6336A	TT-16	Duo Power Triode	8BD	6.3	5.000	Passing Tube for V.R. Serv.	30	190 RK = 200 Ohm Per Section, RG = 500 Ohm Per Section.	200■	....	182	...	300	13500	2.7	....	....
6350 (3) GB-6350 (3)	T-6½	Duotriode	9CZ	6.3 12.6	0.600 0.300	Computer	3.85	150	5.0	....	11.0	...	3900	4600	18	....	....
6352 (3)	T-3	Duodiode	8EY	3.0♦ Series	0.360 Series	Regulator	....	Temperature Limited Diode. Max. Ef. = 4.0. Max. Eb. = 275. Max. Ib. = 1.1 Ma.									
6354	T-5½	Diode	7DU	....	....	Voltage Reg.	....	Starting Voltage at 180. Operating Volts 150. Operating Current 5 Ma. Min., 30 Ma. Max.									
6394A	TT-16	Duo Power Triode	8BD	26.5	1.300	Passing Tube for V.R. Serv.	30	Characteristics Same as Type 6336A.									
6418	T-2	Pentode	6418	1.25♦	0.010	Power Amp.	....	22.5	1.2	22.5	.24	.60	420000	300	....	100000	2200
6463	T-6½	Duotriode	9CZ	6.3 12.6	0.600 0.300	Computer	4.4	200 250	11.0 620■	....	1.0 14.5	... ...	 3850	 5200	 20	....	....
6483	T-3	Gas Tetrode	6483	....	....	Switching	....	450	Trigger Grid Voltage = 0 Volts. Trigger Pulse Voltage = 300 Volts. Keep Alive Current = 45 μa.									
6486A	T-6½	Pentode	9DV	6.3	0.250	Dual Control Pentode	2.0	120	2	120	3.5	3.3	....	3250	....	....	....
6516	T-5½	Beam Pent.	6CH	6.3	0.200	VHF/AF Power Amp.	5.2	250	13.5	250	16.0	2.25	150000	2550	....	16000	1400
6520	T-16	Duo Power Triode	8BD	6.3	2.500	Passing Tube for V.R. Serv.	15.4	Characteristics Same as Type 6AS7G.									
6528	ST-16	Duo Power Triode	8BD	6.3	5.000	Passing Tube for V.R. Serv.	30	100	4	....	185	...	245	37000	9	....	....
6550	ST-16	Beam Pent.	7AC	6.3	1.800	S.T. A1 Amp. P.P.AB1 Amp.	42.0	400 600	23 32.5	270 300	170-225† 100-270†	9-35† 5-33†	15000 (Current, Output for 2 Tubes)	11000	....	3500 5000¶	60000 100000
6582A	T-6½	Pentode	9EJ	6.3	0.250	R-F Pent.	2.0	120	2	120	7.5	2.5	.5 Meg.	4500	....	....	....

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
6611	T-2x3	Pentode	6611	1.25♦	0.020	VHF Amp.	0.1	30 45	5 Meg.[4] 5 Meg.[4]	30 45	1.0 1.0	0.35 0.35	400000 400000	1000 1000	....	....	....
6612	T-2x3	Pentode	6612	1.25♦	0.080	VHF Amp.	0.2	30 45	2 Meg.[4] 2 Meg.[4]	30 45	3.0 3.0	1.0 1.0	180000 180000	3000 3000	....	....	....
6626	T-5½	Gas Diode	5BO	....	....	Voltage Reg.	....	Starting Voltage = 165. Operating Voltage = 148. Operating Current = 5 to 30 Ma.									
6627	T-5½	Gas Diode	5BO	....	....	Voltage Reg.	....	Starting Voltage = 130. Operating Voltage = 108. Operating Current = 5 to 30 Ma.									
6660/6BA6	T-5½	Pentode	7BK	6.3	0.300	R-F/I-F Amp.	3.3	100 250	68■ 68■	100 100	10.8 11	4.4 4.2	250000 1 Meg.	4300 4200	....	....	....
6661/6BH6	T-5½	Pentode	7CM	6.3	0.150	R-F/I-F Amp.	3.3	100 250	200■ 95■	100 100	3.6 7.4	1.4 2.9	700000 1.4 Meg.	3400 4600	....	....	....
6662/6BJ6	T-5½	Pentode	7CM	6.3	0.150	R-F/I-F Amp.	3.3	100 250	80■ 80■	100 100	9 9.2	3.5 3.3	250000 1.3 Meg.	3650 3600	....	....	....
6663/6AL5	T-5½	Duodiode	6BT	6.3	0.300	Detector	....	A.C. Voltage Per Plate = 117 Volts. D.C. Output Current = 9.0 Ma.									
6664/6AB4	T-5½	Triode	5CE	6.3	0.150	VHF Amp./ Osc.	2.9	Characteristics Same as Type 6AB4.									
6669/6AQ5	T-5½	Beam Pent.	7BZ	6.3	0.450	A-F Pwr. Amp.	12	250	12.5	250	45	4.5	52000	4100	....	5000	4500
6676/6CB6A	T-5½	Pentode	7CM	6.3	0.300	VHF Amp.	2.3	Characteristics Same as Type 6CB6.									
6677/6CL6	T-6½	Beam Pent.	9BV	6.3	0.650	R-F Osc./ Amp.	8.5	250	3.0	150	30	7	150000	11000	....	7500	2800
6678/6U8A	T-6½	Tri. Pentode	9AE	6.3	0.450	VHF Osc./ Amp.	3.0 3.0	150 250	56■ 68■	 110	18 10	... 3.5	5000 400000	8500 5200	40	....	....
6679/12AT7	T-6½	Duotriode	9A	6.3/ 12.6	0.300/ 0.150	VHF Osc./ Amp.	2.8	100 250	270■ 270■	....	3.7 10	... ...	15000 10900	4000 5500	60 60	....	....
6680/12AU7A	T-6½	Duotriode	9A	6.3/ 12.6	0.300/ 0.150	Gen. Purpose	3.0	100 250	0 8.5	....	11.8 10.5	... ...	6500 7700	3100 2200	20 17	....	....
6681/12AX7	T-6½	Duotriode	9A	6.3/ 12.6	0.300/ 0.150	A-F Amp.	1.1	100 250	1.0 2.0	....	0.5 1.2	... ...	80000 62500	1250 1600	100 100	....	....
6690 (3)	T-3	Duotriode	8GQ	6.3	0.300	Video Amp.	1.1	100	100■	....	8.0	...	....	4800	35	....	....
6788 (3)	T-3	Pentode	8DL	6.3	0.175	Audio Amp.	0.5	100	1500■	100	0.7	0.1	1.2 Meg.	1100	....	....	....
GB-6814 (3)	T-3	Triode	8DK	6.3	0.150	Computer	2.2	100	0	....	10	...	4800	6000	29	....	....
6832	T-3	Duotriode	8DG	6.3	0.400	D.C. Amp.	0.1	100	3000■	....	0.8	...	....	1050	....	....	....
6840	T-6½	Duotriode	9CZ	12.6 6.3	0.400 0.800	Computer	4.0	250	620■	....	14	...	3400	7100	20	....	....
6851	T-6½	Duotriode	9A	6.3	0.250	Amplifier	1.0	250	3100■	....	1.0	...	60000	1200	70	....	....
6853 (3)	T-9	Diode	8HE	5.0	1.700	F-W Rect.	....	350 Vac Per Plate RMS 500 Vac Per Plate RMS			125 Ma. Output Current Condenser Input to Filter. 125 Ma. Output Current Choke Input to Filter.						
6854	T-6½	Duotriode	9FV	6.3	0.500	Amplifier	1.65	150	240■	....	8.2	...	6500	5225	35	....	....
6870	T-6½	Beam Pent.	9BF	6.3 12.6	0.600 0.300	VHF Power Amplifier	6.9	250	120■	250	25.0	3.5	230	8500	....	....	....
6872	T-3	Pentode	6872	6.3	0.200	VHF Amp.	1.1	120	200■	120	7.75	2.7	340000	....	....	4100	....
6877	T-6½	Power Triode	9GB	6.3	0.800	Power Amp.	....	150	12	....	75	...	2000	6500	3.75	....	12000

6883 (3)	T-12	Beam Pent.	7CK	12.6	0.625	Power Amp.	20	Characteristics Same as Type 6146.									
6893	T-9	Beam Pent.	7CK	12.6	0.400	Power Amp.	10	Characteristics Same as Type 2E26.									
6900	T-6½	Duotriode	9H	6.3	1.000	Pulse Amp.	4.25	120	2	....	36	...	1700	11500	18.5	....	....
6919	T-5½	Duodiode	6BT	6.3	0.200	F-W Rect. Computer	....	Maximum Inverse Peak Plate Voltage = 300 Volts. Maximum Peak Plate Current = 30 Ma. Maximum D.C. Output Current = 10 Ma. (Design Max. Values.)									
6922	T-6½	Duotriode	9AJ	6.3	0.300	VHF Amp.	1.65	90	120■	....	12	...	2800	11500	33	....	....
6939	T-6½	Duotetrode	9HL	6.3	0.600	P.P.A1 Amp.	3.0	150	3.5	150	27-31.6	3.6-12.2	....	7000	....	10560	1750
				12.6	0.300	P.P.A1 Amp.		200	3.5	150	28-31.6	6-15.4	....	7500	....	17400	2660
6943 (3)	T-3	Pentode	8DC	6.3	0.175	R-F Amp.	1.0	100	150■	100	8	2.3	300000	3600	....	....	....
6944 (3)	T-3	Pentode	8DC	6.3	0.175	R-F Amp.	1.0	100	150■	100	7	2.1	280000	3200	....	....	....
6945 (3)	T-3	Beam Pent.	8DL	6.3	0.350	Power Amp.	3.0	100	270■	100	25	1.5	20000	3500	....	3000	800
6946 (3)	T-3	Triode	8DK	6.3	0.175	Amplifier	1.5	100	270■	....	9.0	...	....	3800	16.5	....	....
6947 (3)	T-3	Duotriode	8DG	6.3	0.350	Amplifier	0.75	150	270■	....	6.5	...	....	4000	35	....	....
6948 (3)	T-3	Duotriode	8DG	6.3	0.350	Amplifier	0.50	100	1500■	....	0.8	...	....	1650	70	....	....
6954	T-5½	Pentode	7CM	6.3	0.300	Dual-Control Computer	3.3	150	1.0	150	5.8	6.6	50000	2050	Grid No. 3 = −3.0 Volts.		
6955	T-6½	Duotriode	9A	6.3	0.350	Amplifier	3.0	100	0	....	13.0	...	5800	3500	21.3	....	....
				12.6	0.175			250	8.5	....	11.5	...	7000	2350	16.5	....	....
6968	T-5½	Pentode	7BD	6.3	0.175	VHF Amp.	1.81	Characteristics Same as Type 6AK5.									
6977	T-1	Triode	6977	1.0	0.030	Indicator	....	50	0-3	....	.005-.585	...	....	....	....	....	....
7001	T-5½	Beam Tetrode	7EJ	6.3	0.450	Power Amp.	5.5	120	250■	120	35	4	....	4800	....	....	....
7025A	T-6½	Duotriode	9A	12.6	0.150	Audio Amp.	1.1	Characteristics Same as Type 12AX7/ECC83 except Controlled for Noise and Hum.									
				6.3	0.300												
7027A	T-12	Beam Pent.	8HY	6.3	0.900	P.P.AB1 Amp.	27.5	330	24	330	122-184†	5.6-18.5†	....	....	....	4500¶	31500
								400	25	300	102-152†	6-17†	....	....	....	6600¶	34000
								450	30	350	95-194†	3.4-19.2†	....	....	....	6000¶	50000
								400	200■	300	112-128†	7-16†	....	....	....	6600¶	32000
								380	*180■*	*380*	*138-170†*	5.6-20†	....	....	....	4500¶	36000
								410	220■	410	134-155†	(Cathode Current) Ultra-Linear Circuit.				8000¶	24000
7032	T-5½	Heptode	7CH	6.3	0.300	Computer	1.1	150	G1+3=0	75	3.5	6.0	G3+1=470K	1400	G1 = Control Grid		
								150	G1+3=0	75	3.5	6.0	G3+1=470K	650	G3 = Control Grid		
								150	6.0	75	<0.1	<0.3	G3+1=470K		G3 = 0 Volts		
								150	0	75	<0.1	8.8	G3+1=470K		G3 = −6 Volts		
7036	T-5½	Heptode	7CH	6.3	0.300	Dual Control Computer	0.9	Characteristics Same as Type 5915A.									
7044 GB-7044 (3)	T-6½	Duotriode	9H	6.3	0.900	Computer	4.5	120	2.0	....	36	...	1750	12000	21	....	....
				12.6	0.450												
7054	T-6½	Power Pent.	7054	13.5	0.275	S.T.A1 Amp.	5.0	250	120■	150	19	3.5	100000	11500	....	....	....
						Class "C" Amplifier		300	12	175	26	5.5	Peak R-F (Ec1) = 16 Volts, IC2 = 1 Ma. *Driving Power* = 15 MW.				4000
7055	T-5½	Duodiode	6BT	13.5	0.155	Detector	....	117 A.C. Volts Per Plate, RMS, 9 Ma. Output Current. 300 Ohms Min. Effective Plate Supply Imp.									
7056	T-5½	Pentode	7CM	13.5	0.150	VHF Amp.	2.0	200	180■	150	9.5	2.8	600000	6200	....	....	....
7057	T-6½	Duotriode	9AJ	13.5	0.180	VHF Amp.	2.2	150	220■	....	10	....	5300	6800	36	....	....
7058	T-6½	Duotriode	9A	13.5	0.155	A-F Amp.	1.0	250	2	....	1.25	...	61000	1650	100	....	....

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
7059	T-6½	Tri. Pentode	9AE	13.5	0.195	VHF Osc. VHF Amp.	2.5 2.8	150 250	56■ 68■	 110	18 10	... 3.5	4700 400000	8500 5200	40	....	....
7060	T-6½	Tri. Pentode	9DX	13.5	0.280	VHF Osc. VHF Amp.	2.5 3.0	150 200	150■ 82■	 125	9 15	... 3.4	8200 150000	4900 7000	40	....	....
7061	T-6½	Beam Pent.	9EU	13.5	0.210	S.T.A1 Amp.	9.0	200	10	200	35.5	9	60000	4200	....	5000	3000
7077	Ceramic and Metal	Triode	7077	6.3	0.240	UHF R-F Amplifier	1.0	250 EB = 250 Volts Through 18000 Ohm Resistor.	82■	....	6.4	...	8900	9000	80	....	....
7105	T-12	Duo Power Triode	8BD	12.6	1.250	Passing Tube for V.R. Serv.	13.2	Characteristics Same as Type 6080WA.									
7119	T-6½	Duotriode	9H	6.3 12.6	0.640 0.320	Computer	4.5	120 150	2.0 14	....	36 0.2	... ...	....	15000	24	....	....
7137 GB-7137 (3)	T-5½	Triode	7BQ	6.3	0.225	VHF Amp.	2.25	150	100■	....	13.5	...	....	8500	40	....	....
7150	Spec. Base T-9	Tetrode	9JH	6.3	0.450	VHF Amp.	4.0	135	G1 = +8V 135 RK = 260 Ohms		27.5	8.5	30000	35800	....	....	....
7167	T-5½	Tetrode	7EW	13.5	0.090	VHF Amp.	2.0	250 Similar to Type 6CY5, Except Designed for Mobile Applications.	1.0	80	10	1.4	125000	8000	....	....	....
7189	T-6½	Beam Pent.	9CV	6.3	0.760	S.T.A1 Amp. P.P.AB1 Amp. P.P.AB1 Amp.	13.2	250 400 375	7.3 15 220■	250 300 375	48 15-105† 75-81†	5.5 1.6-25† (Cathode Current)	40000	11300 .... (Ultra-Linear Conn.)	19.5	(G1 to G2)	 24000 16500
7212	T-12	Beam Pent.	8EC	6.3	1.250	P.P.AB1 Amp. P.P.AB1 Amp. P.P.AB2 Amp.	20	600 500 600	45 40 44	180 185 165	26-200† 57-215† 22-207†	1-23† 2-25† 0.6-17†	....	....	....	7000 5500 6800	82000 70000 90000
7227	T-6½	Pentode	9BA	27.5	0.175	Power Amp.	2.2	27.5	2.5	27.5	11	1.1	8000	5500	4	....	70
7233	T-6½	Triode	9FR	6.3	1.250	Passing Tube for V.R. Serv.	7.5	50	22■	....	120	...	230	17500	4	....	....
7236	T-12	Duotriode	8BD	6.3	2.400	Passing Tube for V.R. Serv.	15	120	14	....	100	...	....	12500	4.8	....	....
7239	T-6½	Beam Pent.	9KH	6.3	0.300	Pulse Amp. and Shunt Reg.	4.0	300 100	5.0 ...	100 100	10.5 43	2.6 13.5	300000 Grid No. 1 = 400 μa. (Applied for Short Intervals—2 Sec. Max.)	4200	....	....	....
7241	TT-18	Triode	7241	6.3	7.500	Passing Tube for V.R. Serv.	100	190 RG = 500 Ohms	200■	....	550	....	67	40000	2.7	....	....
7242	TT-18	Triode	7241	6.3	7.500	Passing Tube for V.R. Serv.	100	100 RG = 500 Ohms	4	....	555	...	82	111000	9.0	....	....
7244A	T-5½	Duotriode	7BF	6.3	0.450	Amplifier	1.1	100	50■	....	9.0	...	6300	6000	38	....	....
7245	T-5½	Triode	7BQ	6.3	0.400	VHF Amp.	2.25	150	100■	....	13.5	...	4500	11000	50	....	....
7246	T-2x3	Triode	7246	1.25♦	0.150	VHF Amp./ Osc./Det.	0.7	105	2.5	....	4.5	...	....	2700	22	....	....
7258	T-6½	Tri. Pentode	9DA	13.5	0.210	Gen. Amp. VHF Amp.	2.8 2.3	150 125 (Designed for Mobile Operation.)	3 56■	 125	15 12	... 3.8	4700 170000	4500 7800	21	....	....

7308	T-6½	Twin Triode	9AJ	6.0	0.335	VHF Amp.	1.65	90	120■	....	12	...	....	11500	....	....	....
								100	680■	....	15	...	....	12500	33	....	....
7316	T-6½	Duotriode	9A	6.3	0.300	Computer	2.7	250	8.5	....	10.5	...	7700	2200	17	....	....
				12.6	0.150			100	0	....	11.8	...	6250	3100	19.5	....	....
7318	T-6½	Duotriode	9A	6.3	0.350	Pulse Amp.	1.35	100	0	....	13	...	5800	3500	21.3	....	....
				12.6	0.175			250	8.5	....	11.5	...	7000	2350	16.5	....	....
7320	T-6½	Beam Pent.	9CV	6.3	0.760	Power Amp.	12	Characteristics Same as Type 6BQ5.									
7327 (3)	T-3	Duotriode	8DG	6.3	0.300	Pulse Amp.	0.95	150	25	Pulse Applied to Grid = 40 Volts at Tp = 10 μsec., Prr. = 1000 Pps.,							
						Blocking Osc.				Tr. = 0.2 μsec. Max., Tf. = 0.2 μsec. Max.,—PEAK Plate Current = 400 Ma. Min.							
7355	T-9	Beam Pent.	8KN	6.3	0.800	S.T.A1 Amp.	18	250	15	225	62-74†	3.2-16.5†	42000	7600	....	2500	9000
						P.P.AB1 Amp.		300	21	250	100-185†	5.5-24†	....	....	....	4000¶	28500
						P.P.AB1 Amp.		400	34	300	56-175†	3.5-24†	....	....	....	5000¶	40000
7358	T-12	Pentode	8EC	6.3	1.250	Pulse Mod.	10	200	...	200	100	...	....	7000	4.2 (G2 to G1)		
								3000	175	300	15	4	IC1 = 2.5 Ma., RL = 100 Watts.				
													1500 Ohm-Non Ind. Res.				
7360	T-6½	Beam Defl. Tube	9KS	6.3	0.350	Balanced	1.5	150	1200■	175	1.5	0.75	....	....	....	5000¶	....
						Mod. Dble. Sideband	1.5	25 Volts = Defl. Electrode Voltage, PK to PK A-F Defl. Electrode Volts = 2.8 Volts. PK to PK R-F Grid No. 1 Volts = 10 Volts, Push-Pull Double Sideband Output Voltage = 4 Volts.								
						Balanced		150	1200■	175	1.5	0.75	....	....	....	10000¶	....
						Mixer Single Sideband		25 Volts = Defl. Electrode Voltage, PK to PK Single Sideband Defl. Electrode Volts = 8 Volts. PK to PK R-F Grid No. 1 Volts = 10 Volts, Push-Pull PK to PK Single Sideband Output Voltage = 40 Volts.								
7370	T-6½	Duotriode	9H	20/	0.260/	Computer	4.75	120	2.0	....	36	...	1560	11500	18	....	....
				40	0.130			250	12.5	....	12	...	3000	5400	16	....	....
7382	T-5½	Triode	7382	6.3	0.300	A-F Amp.	0.55	Characteristics Same as Type 12AX7, except Controlled for Noise and Hum.									
7408	T-9	Beam Pent.	7S	6.3	0.450	A-F Pwr. Amp.	14	Characteristics Same as Type 6V6GT.									
7430	Special	Pentode	7430	6.3	0.200	R-F Amp.	1.87	120	2.0	120	7.5	2.5	300000	5000	....	....	....
								180	2.0	120	7.7	2.4	500000	5100	....	....	....
7489	T-6½	Duotriode	9A	6.3/	0.300/	A-F Amp.	3.0	250	8.5	....	10.5	...	7700	2200	17	....	....
				12.6	0.150												
7490	T-6½	Duotriode	9A	6.3/	0.600/	A-F/D.C. Amp.	5.0	250	4.6	....	6.0	...	....	2350	32	....	....
				12.6	0.300												
7492	T-6½	Duotriode	9DA	6.3/	0.300/	R-F Amp. and	2.8	250	200■	....	10	...	....	5500	60	....	....
				12.6	0.150	Computer											
7494	T-6½	Duotriode	9A	12.6/	0.150/	A-F Amp.	1.1	250	2	....	1.25	...	59000	1600	95	....	....
				6.3	0.300												
7495	T-6½	Beam Tetrode	9K	6.0	0.750	VHF Power Amplifier	12	250	7.5	250	45	7 Max.	....	7000	G1 to G2 = 16.		....
7496	T-5½	Pentode	7BK	6.3	0.300	R-F Amp.	3.3	250	68■	100	11	4.2	1 Meg.	4400	....	....	....
7498	T-5½	Pentode	7DB	6.3	0.300	R-F Amp.	3.0	250	160■	250	9.85	2.6	....	7620	75	....	....
7499	T-6½	Pentode	9BA	6.3	0.750	Video Amp.	12	250	4.5	250	40	6.0	....	11000	26	....	....
7500	T-6½	Beam Tetrode	9AH	6.3	0.450	A-F Power Amplifier	13	250	12.5	250	45	5.5	50000	4100	....	....	....
7502	T-5½	Heptode	7CH	6.3	0.300	Converter	1.1	250	1.5	100	3.0	7.5	1.0 Meg.	7250	....	....	....
7550 (3) GB-7550	T-3	Duotriode	8DG	6.3	0.525	Pulse Amp.	2.0	300	30	....	1400	....	....	....	....	....	....
								Pulse Applied to Grid = +40 V at tp = 10μ sec., prr = 1000 pps, tr = 0.8μ sec. max., tf = 1.0μ sec. max								
7551	T-6½	Pentode	9LK	12-15	0.360	RF Amp.	12	300	55	250	80	5.1	....	....	....	....	10000
								300	42	200	70	3.7	....	....	....	....	8500
7558	T-6½	Pentode	9LK	6.3	0.800	RF Amp.	....	Characteristics Same as Type 7551.									

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
7561	T-9	Beam Pent.	7561	25	0.300	S.T.A1 Amp.	13	115	8.0	115	55	2.5	8000	10000	....	....	....
						S.T.A1 Amp.		250	15	150	48-51†	1-7†	....	....	....	5000	6000
						S.T.AB1 Amp.		250	18	150	50-110†	.8-14†	....	....	....	3000	17000
7576	T-3	Triode	7576	6.3	0.450	VHF Amp.	4.1	200	0	....	15.5	...	....	10700	46	....	....
								Designed to be Used as a Grounded Grid Amplifier.									
7581A	T-12	Beam Pent.	7S	6.3	0.900	S.T.A1 Amp.	35	250	14	250	72	5	22500	6000	....	2500	6500
						P.P.AB1 Amp.		360	22.5	270	88-132†	5-15†	....	....	....	6600¶	26500
						P.P.AB1 Amp.		450	37	400	116-210†	5.6-22†	....	....	....	5600¶	55000
7586	M-N	Triode	12AQ	6.3	0.140	VHF Amp.	1.0	75	100■	....	10.5	...	3000	11500	35	....	....
7587	M-N	Tetrode	12AS	6.3	0.150	VHF Amp.	2.2	125	68■	50	10	2.7	200000	10600	....	....	....
7591	T-9	Beam Pent.	8KG	6.3	0.800	S.T.A1 Amp.	19	300	10	300	55-65†	7-16†	29000	10200	....	4000	11000
						P.P.AB1 Amp.		300	12.5	300	86-116†	12-26†	....	....	....	6600¶	23000
						P.P.AB1 Amp.		350	15.5	350	92-130†	13-29†	....	....	....	6600¶	30000
						P.P.AB1 Amp.		400	16	350	85-143†	11-27†	....	....	....	6600¶	37000
						P.P.AB1 Amp.		450	16.5	350	77-153†	10-27†	....	....	....	6600¶	43000
						P.P.AB1 Amp.		450	21	400	66-144†	9.4-30†	....	....	....	6600¶	45000
						P.P.AB1 Amp.		450	200■	400	82-94†	11.5-22†	....	....	....	9000¶	28000
						P.P.AB1 Amp.		400	20.5	....	80-138†	11.5-26†	Ultra-Linear Conn. 40%			6600¶	32000
						P.P.AB1 Amp.		425	185■	....	88-104†	13-17.5†	Ultra-Linear Conn. 40%			6600¶	26000
7631	T-5½	Duodiode	6BT	6.3	0.300	Detector	....	Max. Peak Inverse Plate Voltage = 360 Volts. Max. Peak Plate Current = 10 Ma. Max. Surge Plate Current = 350 Ma.									
7643	T-6½	Tri. Pent.	9AE	6.3	0.330	VHF Amp./	1.7	100	120■	....	14	...	....	5000	18	....	....
						Osc.	2.1	170	155■	170	10	2.8	400000	6200	40	....	....
7687	T-6½	Tri. Pentode	9AE	6.3	0.500	A-F Amp.	2.4	215	8.5	....	7.5	...	7200	2500	18	....	....
							3.0	220	62■	130	10	3.4	500000	5800	....	....	....
7688	Special Base T-7½	Triple Triode	12BA	6.3	0.450	A-F Amp.	3.0	Characteristics Same as Type 12AU7.									
7689	Special Base T-7½	Triple Triode	12BA	6.3	0.450	A-F Amp.	1.1	Characteristics Same as Type 12AX7.									
7690	Special Base T-7½	Triple Triode	12BA	6.3	0.450	A-F Amp.	2.8	Characteristics Same as Type 12AT7.									
7693	T-5½	Pentode	7EN	6.3	0.150	R-F Amp.	2.6	250	100■	150	7.4	2.9	1.3 Meg.	4600	G1 to G2=48		....
7694	T-5½	Pentode	7EN	6.3	0.150	R-F Amp.	3.3	250	80■	100	9.2	3.3	1.0 Meg.	3800	G1 to G3=25		....
7695	9-T9	Pentode	9PX	50	0.150	S.T.A1 Amp.	16	130	11	130	100	5-14†	7000	11000	....	1100	4500
						P.P.AB1 Amp.		140	50■	140	210-220†	9-20†	....	....	....	1500¶	10000
7701	T-6½	Beam Pent.	9MS	13.6	0.160	VHF Class C Amplifier	9.0	250	12.5	250	28	3.1	31000	3600	....	....	....
7716	T-6½	Tri. Pentode	9DX	13.6	0.350	High Mu	1.0	125	1.0	....	1.5	...	35000	2900	102	....	....
						High GM	5.0	200	68■	125	24	5.2	70000	10000	....	....	....
7717	T-5½	Tetrode	7EW	6.3	0.200	VHF Amp.	2.0	125	1.0	80	10	1.4	125000	8000	....	....	....
7719	T-6½	Triode	9MX	12.6/ 6.3	0.225/ 0.450	Computer	6.0	300	10.5	....	4	...	7100	3500	25	....	....

7720	Ceramic and Metal	Triode	7720	6.3	0.240	VHF Amp.	1.0	150	82■	....	7.5	...	....	10500	90	....	....
7721	T-6½	Pentode	9EQ	6.3	0.320	VHF Amp.	4.0	190	400■	160	22	6.0	120000	35000	....	....	....
7722	T-6½	Pentode	9EQ	6.3	0.320	VHF Amp.	4.0	190	370■ G1 = +8 Volts.	160	20	6.0	100000	26000	....	....	....
7724	T-6½	Duodiode Tri.	9KR	14	0.150	A-F Amp.	....	250	3.0	....	0.7	...	72000	1000	72	....	....
7728	T-6½	Duotriode	9A	6.3/ 12.6	0.300/ 0.150	VHF Amp.	2.8	Characteristics Same as Type 12AT7.									
7729	T-6½	Duotriode	9A	6.3/ 12.6	0.300/ 0.150	A-F Amp.	1.1	Characteristics Same as Type 12AX7.									
7730	T-6½	Duotriode	9A	6.3/ 12.6	0.300/ 0.150	Gen. Purpose	3.0	Characteristics Same as Type 12AU7.									
7731	T-6½	Tri. Pent.	9AE	6.3	0.450	VHF Osc. VHF Amp.	3.0 3.0	Characteristics Same as Type 6U8.									
7732	T-5½	Pentode	7CM	6.3	0.300	VHF Amp.	2.3	Characteristics Same as Type 6CB6.									
7733	T-6½	Pentode	9BF	6.3/ 12.6	0.600 0.300	Video Amp.	6.5	Characteristics Same as Type 12BY7A.									
7734	T-6½	Tri. Pentode	9LC	6.3	0.900	V.R. Voltage Control Tube	7.0 1.0	150 150	21 2.0	 150	35 5.5	... 1.7	1080 340000	5000 3200	5.4	....	....
7737 (3)	T-6½	Pentode	9MZ	6.3	0.320	Amplifier	3.0	180	100■	150	11.5	2.9	....	15900	....	....	....
7738	T-5½	Triode	7DK	6.3	0.225	VHF Class C Amplifier	5.0	200	100■	....	12	...	....	9500	80	....	....
7751	T-9	Beam Pent.	7S	6.3	1.200	Pulse Amp.	10	100	8.2	100	100	7	5000	14000	G1 to G2 = 5.6		....
7754	9-T9	Beam Pent.	9PX	6.3	1.200	A-F Power Amplifier	16	Characteristics Same as Type 7695.									
7759	T-3	Duotriode	8DG	26.5	0.090	VHF Amp./ Osc.	1.1	100	150■	....	6.5	...	....	5400	35	....	....
7760	T-3	Duotriode	8DG	26.5	0.090	VHF Amp./ Osc.	....	26.5	2.2 Meg[4]	....	3	...	....	5000	20	....	....
7761	T-3	Pentode	8DL	26.5	0.110	Video Amp.	4.0	150	100■	100	21	4	50000	9000	....	....	....
7762	T-3	Beam Pent.	8DL	26.5	0.110	S.T. A1 Amp.	4.0	110	270■	110	30	2.2	15000	4200	....	3000	1000
7763 (3)	T-6½	Sheet Beam Tube	9NF	6.3	0.300	I-F Amp. Limiter	0.75	135	Acc. and Screen = 300 Volts. Deflection Electrode = 135 Volts.				Total Plate Current = 4.2 Ma. Acc. and Screen Current = 4.0 Ma.				
7768	Ceramic and Metal	Triode	7768	6.3	0.400	VHF Amp.	5.5	200	270■ G1 = +6 Volts	....	24	...	4500	50000	225	....	....
7803	T-6½	Duotriode	9AJ	6.3	0.365	VHF Osc. Doubler	3.5	90 160	1.3 70	....	15 26	...	....	12500	33	....	....
								Rg1 = 33K Ohms (Class "C" Doubler to 175 Mc) Ig1 = 2.5 Ma. PK R-F Grid Volts = 77								1000
7841	Ceramic and Metal	Diode	7841	6.3	0.215	Detector	....	Max. Peak Inverse Plate Voltage = 350 Volts. Max. D.C. Output Current = 5.0 Ma.									
7861	T-6½	Duotriode	8CJ	12.6	0.175	Gen. Purpose	1.3	150	240■	....	8.2	...	6400	5500	35	....	....
7867	T-12	Beam Pent.	5BT	6.3	2.500	S.T. A1 Amp. P.P.AB1 Amp. P.P.AB1 Amp.	24	250 250 250	120■ 200■ 35	90 150 150	80 114-128† 58-210†	1.0 2-17† 1.4-26†	12000	10000	....	3000 6000¶ 5000¶	7500 28000 65000

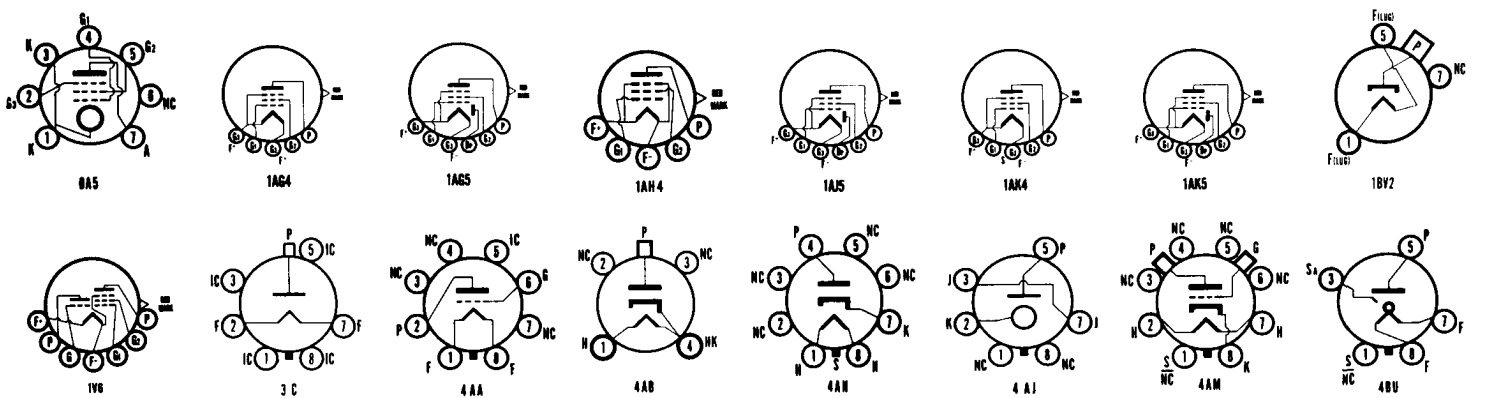
TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
7868	Novar T-9	Beam Pent.	9NZ	6.3	0.800	S.T. A1 Amp. P.P.AB1 Amp. P.P. AB1 Amp.	19	300 300 400	10 12.5 16	300 300 350	60 74-116† 64-135†	8 10-28† 8-28†	29000	10200	....	3000 6600¶ 6600¶	11000 24000 34000
7887	T-3	Duotriode	8DG	26.5	0.090	Osc./Amp.	1.1	100	220■	....	8.5	...	....	5000	20	....	....
7888	T-3	Triode	8DK	26.5	0.045	UHF Osc.	1.0	100 150	150■ 180■	....	8.5 13	... ...	....	5800 6000	27 27	....	....
7889	T-3	Duotriode	8DG	26.5	0.090	A-F Amp.	0.55	100 150	1500■ 820■	....	0.8 1.75	... ...	....	1800 2500	70 70	....	....
7898	T-6½	Duotriode	9EP	13.5	0.150	VHF Osc./ Amp.	2.75	250	200■	....	10	...	10900	5500	60	....	....
7905	T-6½	Beam Pent.	9PB	6.3	0.650	VHF Class "C" Power Amp.	10	200 300	6 39	185 185	36 60	2.5 4	.... RG1=18 K Ohms, Driving Pwr.=1 Watt Pk R-F Grid Volts = 43 Volts	6700	....	....	 7000
7984	T-12	Beam Pent.	12CN	13.5	0.580	Class "C" Amp. 175 Mc.	35	200 750	7.5 150	125 250	125 180	4.5 12	.... Driving Pwr. = 2 Watts at 2.5 Ma.	13500	....	....	 46000
7994	T-3	Triode	8KM	6.3	0.250	VHF Amp.	2.0	100	82■	....	13.0	...	2200	18000	41	....	....
7995	T-3	Pentode	8KZ	6.3	0.250	R-F I-F Amp.	1.6	150	160■	150	8.0	2.0	85000	13000	....	....	....
8056	M-N	Triode	12AQ	6.3	0.135	VHF Amp.	0.45	24	100■	....	8.7	...	1530	7500	11.5	....	....
8058	M-N	Triode	12CT	6.3	0.135	UHF Amp.	1.5	110	47■	....	10	...	5600	12400	70	....	....
8064	T-3	Beam Pent.	8DL	26.5	0.045	VHF Amp.	0.75	100	120■	100	7.2	2	275000	4500	....	....	....
8068	T-12	Beam Pent.	8LC	6.3	0.900	Series Reg.	35	3500 600	30 7.5	100 125	1.0 36	... 1.0	 54500	 5200	....	....	....
8070	T-3	Triode	8LD	6.3	0.125	UHF Amp.	1.0	110	130■	....	7.5	...	....	11000	58	....	....
8071 (3)	T-3	Triode	8LE	6.3	0.125	UHF Amp.	2.0	150	100■	....	11.5	...	....	12000	56	....	....
8084 (3)	T-5½	Pentode	7CM	13.5	0.160	VHF Freq. Multiplier	2.3	125	1	80	7.0	1.7	....	10500	....	....	....
8102 (3)	T-6½	Tri. Pentode	9PJ	13.5	0.230	Gen. Purpose Amp.	2.5 2.5	125 125	1 1	 125	13.5 12.0	... 4.0	5400 200000	8500 7500	46	....	....
8103 (3)	T-3	Double Tri.	8DG	26.5	0.075	UHF Amp. UHF Osc.	....	26.5	2.2 Meg.[4]	....	5.5	...	....	11000	26	....	....
8106 (3)	T-6½	Pentode	9PL	13.5	0.250	Frequency Multiplier	6.0	300	3.5	150	16.0	3.2	90000	9000	....	....	....
8113 (3)	T-5½	Tetrode	7EW	6.3	0.200	R-F Amp.	2.0	120	2.0	120	10.0	2.3	20000	7000	....	....	....
8136	T-5½	Pentode	7CM	6.3	0.300	VHF Amp.	2.2	125	56■	125	10.8	2.9	....	9800	....	....	....
8149	Comp. T-12	Beam Pent.	12DT	6.5 13.0	1.200 0.600	R-F Power Amp.	35.0	420	24	180	165	9.0	....	7500	4.5	....	....
8150	Comp. T-12	Beam Pent.	12DU	6.5 13.0	1.200 0.600	R-F Power Amp.	35.0	Characteristics Same as Type 8149. (8150 has Top Cap Construction.)									
8156	Comp. T-9	Beam Pent.	12EU	13.5	0.300	R-F Pwr. Amp.	15.0	200	9	125	75	3.5	....	7600	....	....	....
8185 (3)	T-3	Triode	8KM	6.3	0.300	R-F Pwr. Amp.	4.25	200	220■	...	17.0	...	....	19000	42	....	....

8186 (3)	T-3	Triode	8KM	26.5	0.075	R-F Pwr. Amp.	4.25	Characteristics Same as Type 8185.									
8210 (3)	T-3	Pentode	8LS	6.3	0.125	VHF Mixer VHF Amp.	1.1	100	100■	100	7.5	2.5	260000	8500	....	....	....
8211 (3)	T-3	Pentode	8DL	6.3	0.360	Video Amp.	4.0	150	62■	100	17.0	4.2	65000	15500	....	....	....
8212 (3)	T-6½	Triode	9PY	6.3 12.6	0.460 0.230	Cathode Follower	10.0	105	75■	....	25.0	...	965	29000	28	....	....
8213 (3)	T-3	Triode	8LT	6.3 12.6	0.380 0.190	Cathode Follower	5.0	105	75■	....	23.0	...	1348	23000	31	....	....
8223 (3)	T-6½	Twin Triode	9AJ	6.3	0.475	A-F R-F Amp.	3.0	60	80■	....	15	...	1850	14000	25	....	....
8233 (3)	T-9	Pentode	9PZ	6.3	0.600	Power Amp.	10.0	125	3	125	50	5.5	20000	45000	30	....	....
8254 (3)	T-3	Triode	8LW	6.3	0.185	High Freq. Probe Tube	1.5	80	2	....	14	...	....	14500	24	....	....
8278 (3)	Novar T-9	Tetrode	9QB	6.3	1.200	Power Amp.	25.0	250	12.5	250	100	8.0	7300	24000	14	....	....
8319 (3)	T-3	Triode	8LD	6.3	0.150	I-F R-F Amp.	1.0	100	160■	....	7.5	...	....	14000	55	....	....
8334 (3)	T-5½	Triode	7DK	6.3	0.225	UHF Amp.	4.4	200	100■	....	18	...	....	10750	55	....	....
8358	T-6½	Twin Beam Pent.	9QR	1.9	3.150	R-F Osc. R-F Pwr. Amp.	7.5	180	20	180	50	11.5	....	10000	30	....	4500
8380	M-N	Tetrode	12AS	6.0 to 8.5	....	Freq. Doubler R-F Osc.	1.6	100	68■	50	11	2.6	....	11000	....	....	....
8382	M-N	Triode	12AQ	6.0 to 8.5	....	Class C Amp. R-F Osc.	2.0	75	100■	....	15	...	2200	12800	28	....	....
8414 (3)	T-3	Pentode	8DC	26.5	0.045	VHF Amp.	....	26.5	2.2 Meg.[4]	26.5	4.5	1.5	50000	5000	....	....	....
8417	T-12	Beam Pent.	7S	6.3	1.600	Power Amp.	35.0	300	12	300	100	5.5	16000	23000	165	....	....
8425 (3)	T-5½	Pentode	7BK	6.3	0.300	I-F R-F Amp.	3.5	250	68■	150	10.5	4.1	1100000	6200	....	....	....
8426 (3)	T-5½	Pentode	7BK	12.6	0.150	I-F R-F Amp.	3.5	Characteristics Same as Type 8425.									
8431	T-6½	Double Tri.	9AJ	12.6	0.180	Class C Amp.	3.5	90	1.3	....	15	...	....	12500	33	....	....
8441	M-N	Triode	12AQ	6.0 to 8.5	....	Amplifier	1.0	110	150■	....	7	...	6800	9400	64	....	....
8444 (3)	T-3	Pentode	8DC	6.3	0.125	VHF Amp.	1.1	100	100■	100	8.5	2.8	260000	9000	....	....	....
8445 (3)	T-6½	Triode Pent.	9AE	6.75	0.440	Gen. Purpose Amp.	2.0 1.7	100 170	1 2	 170	12.5 10.0	... 2.5	 400000	7000 6200	43	....	....
8446 (3)	T-6½	Triode Pent.	9FA	6.75	0.440	Gen. Purpose Amplifier	2.0 1.7	Characteristics Same as Type 8445.									
8447 (3)	T-6½	Double Diode Triode	9CF	6.75 13.5	0.380 0.190	Det. Amp.	.... 2.5	Diode Voltage Drop for Ib = 17 Ma = 50 Volts. 250	200■	....	10	...	10900	5500	60	....	....
8448 (3)	T-6½	Pentode	9BF	6.75 13.5	0.520 0.260	Power Amp.	6.5	250	100■	180	26	5.7	93000	11000	28.6	....	....
8456 (3)	M-N	Triode	12AQ	6.0 to 8.5	....	Cathode Follower	0.45	24	100■	....	8.7	...	1530	7500	11.5	....	....
8489 (3)	T-6½	Tri. Pentode	9DA	6.3	0.450	Amplifier	2.8 2.3	150 125	3 1	 125	15.0 12.0	... 3.8	4700 170000	4500 7000	21	....	....
8532	T-5½	Triode	7BQ	6.3	0.400	UHF Amp.	2.5	150	100■	....	13.5	...	4800	11000	52.5	....	....
8632	T-9	Triode	....	6.3	0.300	Shunt Reg. Pulse Amp.	18	Max. Anode Voltage = 18,000 Volts. Max. Negative Grid Voltage = 200 Volts; Max. Peak Plate Current = 100 Ma.									
9001	T-5½	Pentode	7BD	6.3	0.150	VHF Amp.	0.55	250	3.0	100	2.0	0.7	1 Meg.>	1400	....	....	....

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts[2]	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag.[1]	Volts	Amps.												
9002	T-5½	Triode	7BS	6.3	0.150	Amplifier	1.76	250	7.0	....	6.3	...	11400	2200	25	....	....
9003	T-5½	Pentode	7BD	6.3	0.150	VHF Amp.	1.87	250	3.0	100	6.7	2.7	700000	1800	....	....	....
XXD	Now Listed as 14AF7/XXD																
XXFM	Now Known as Type 7X7																
XXL	Now Known as Type 7A4																

NOTES: (1) See Basing Diagram Section. (2) Design Maximum Values. (3) Has Special Mechanical and/or Life Characteristics. (4) Average Contact Potential Bias Developed Across Specified Grid Resistor. † Maximum Signal. ♦ Filamentary Type. ■ Cathode Resistor (ohms). ▲ Conversion Transconductance. ¶ Plate to Plate.

BASING DIAGRAMS FOR RECEIVING TUBE CONDENSED DATA CHART



4C
4Z
5AT
5CE
4GB
5AB
5AZ
5D
4GS
5AC
5BQ
5L
4CX
5AD
5-BR
5M
4CH
5AG
5-BS
5Q
4B
5AL
5BT
5S
4K
5AP
5CA
5T
4V
5AW
5CB
5Y

5Z
6AX
6AA
6AB
6AE
6ABB
6AM
6AR
6AU
6F
6C
6A
6CM
6CJ
6A
6S
6CK
6CL
6CN
6BT
6S
6BX
6-BW
6DL4
6S
6F
6G
6HG6
6G
6FG6
6E
6X
6N
6AU

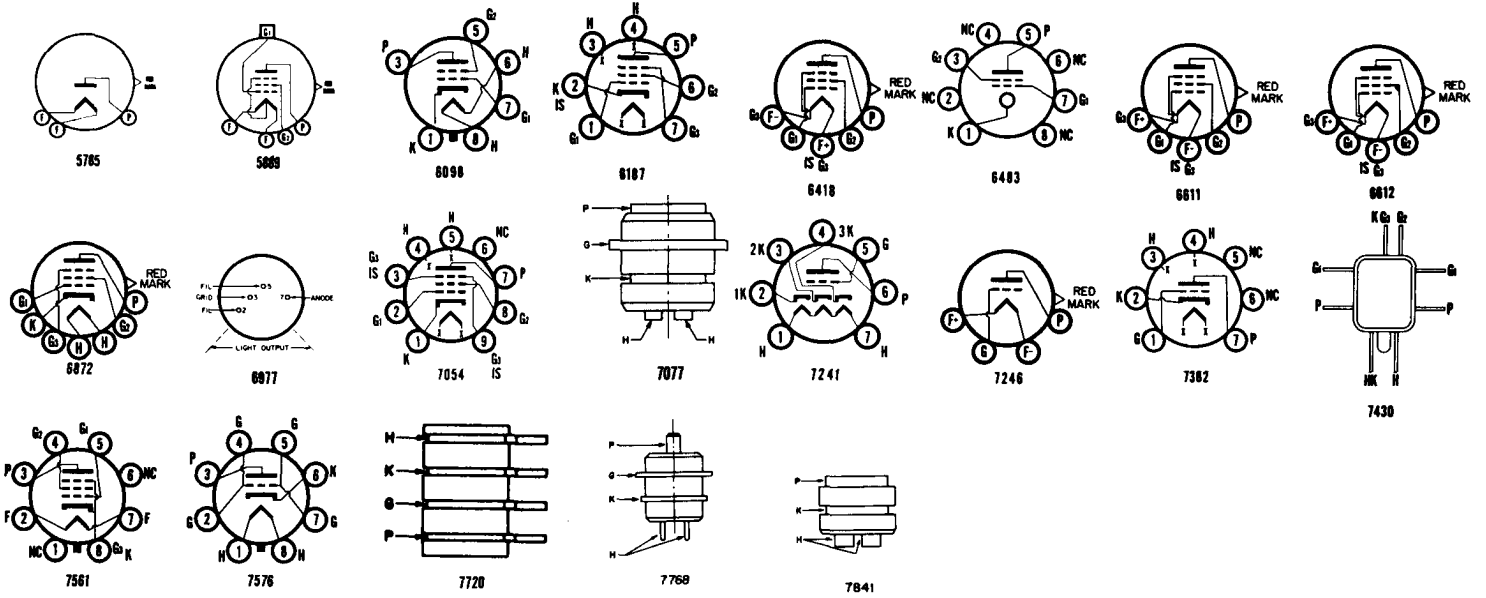
7AC
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7AO
7AP
7AT
7AV
7AZ
7-BA
7BD
7BC
7BD
7BE
7BF
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7BK
7BM
7BN
7BQ
7BS
7BT
7BZ
7C
7CH
7CK
7CM
7CV
7DB
7DC
7DK
7DU
7DX

6AY8
6AE
6HC
6S7
6G8
6GN8
6GD
6GC
6J8
8KM
8KG
8KD
8KB
8LK
8LE
8LD
8LC
8KZ
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8LT
8LS
8LM
8KB
8N
8MY
8MX
8MQ
8MT
8JP
8JX
8K
8KN
8JB
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8HY
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6Y
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9AZ
9AQ
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12GY
12GZ
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12HL
12HR
12HT
12K4
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12HW
12NX
60E3
407A
FM1000
5704
5783
12NW
5702
5703
5642
5647



BASING DIAGRAM SYMBOLS

A — Anode
Dp — Diode Plate
F — Filament
Fc — Filament Center Tap
G — Grids numbered according to their position from the cathode
H — Heater
Hc — Heater Center Tap
Ht — Heater Tap
IC — Internal Connection
IS — Internal Shield
J — Jumper
K — Cathode
NC — No Connection
P — Plate
S — Metal Shell
SA — Starter Anode
T — Target
XS — External Shield
□ — Top Cap
■ — Locating Key

GENERAL DATA — Receiving Tubes

SCREEN VOLTAGE RATINGS*

The voltage for the screen of a tube may be obtained from either a fixed source or through a screen dropping resistor. A voltage source is considered "fixed" if the regulation is such that no significant change in voltage takes place with variations in current.

The tube data sheets may show a maximum screen voltage, or a maximum screen supply voltage. When a maximum screen voltage is shown, the voltage measured at the screen terminal should not exceed such value under any circuit operating condition. When a maximum screen supply voltage is shown the screen voltage may be permitted to reach the rated supply voltage provided that the screen dissipation (screen current in amperes multiplied by the voltage appearing directly at the screen terminal) is held within certain specified values as indicated in Chart A

The chart represents the maximum permissible screen dissipation (as a percent of the maximum screen dissipation rating) at any screen voltage operating point. The chart shows that full rated screen dissipation is permissible up to 50% of the maximum rated screen supply voltage. From the 50% point to the full value of rated supply voltage the decrease in the allowable screen dissipation follows a curve of the parabolic form. The chart is of universal use for cases where either a fixed screen voltage or a series screen dropping resistor is used.

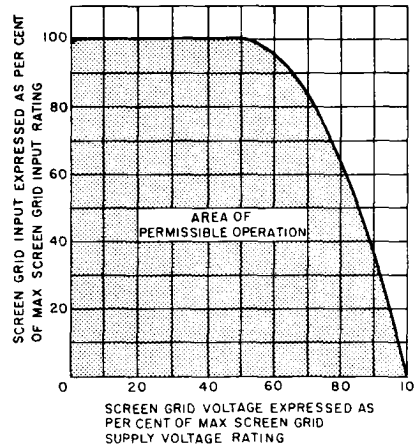
In the case where fixed screen applied voltage is desired it is necessary only to determine that the screen dissipation is within the boundary of the chart at the screen voltage to be used. In the case where a screen voltage dropping resistor is to be used it is necessary to determine the resistor value such that the dissipation in the screen grid is again within the same boundary of the chart. It is to be noted that the minimum value of the voltage dropping resistor is given by the factor.

$$\frac{E_{cc_2}^2}{4\,P_{g2}}$$

where E_{cc2} is the selected screen supply voltage and P_{g2} is the maximum screen dissipation rating for the type.

To illustrate the use of the chart, let it be assumed that the tube data for a type stipulate ratings of 300 volts maximum screen supply voltage, and 1.0 watt maximum screen dissipation. If it is desired

CHART A
Grid No. 2 Rating Chart



to operate the tube at 200 volts (66⅔% of the maximum screen supply voltage rating) applied directly to the screen, the maximum allowable screen dissipation at this point (refer to Chart A) is 88% of the maximum screen dissipation, or 0.88 watt.

On the other hand, if it is desired to operate the same tube with a screen dropping resistor, the maximum screen voltage must not exceed the 300 volt rating, and the dropping resistor must be selected to hold the dissipation within the safe ratings. To assure that the tube will operate within the rating curve the dropping resistor can be determined from the formula

$$R_{c2} \geq \frac{E_{cc_2}^2}{4\,P_{g2}}$$

where

R_{c2} is the screen dropping resistor (ohms),

E_{cc2} is the selected screen supply voltage (volts),

P_{g2} is the maximum screen dissipation rating (watts).

For example, if a screen supply voltage of 250 volts were selected for the above cited tube type

$$R_{c2} \geq \frac{250^2}{4 \times 1.0} = \frac{62500}{4} = 15625 \text{ ohms}$$

**This material was formulated by the Committee on Receiving Tubes of the Joint Election Tube Engineers Council and approved by the Council as JEDEC Data.*

RECEIVING TUBE REPLACEMENT GUIDES

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Sylvania Double/Brand Replacement Guide

TUBE TYPE	SYLVANIA DOUBLE/BRAND
1B3GT 1G3GT	1G3GT/1B3GT
1J3 1K3	1K3/1J3
1S2A	1S2A/DY87
2AF4 2AF4A 2AF4B	2DZ4/2AF4B
2AS2A 2BU2	2BU2/2AS2A
2DZ4	2DZ4/2AF4B
2FQ5A 2GK5	2GK5/2FQ5A
3AF4 3AF4A 3AF4B	3DZ4/3AF4B
3BC5	3BC5/3CE5
3BU8	3GS8/3BU8
3CB6	3CB6/3CF6
3CE5	3BC5/3CE5
3CF6	3CB6/3CF6
3DHH13	3FX7/3DHH13
3DZ4	3DZ4/3AF4B
3EH7	3EH7/XF183
3FX7	3FX7/3DHH13
3EJ7	3EJ7/XF184
3GS8	3GS8/3BU8
3HA5 3HM5	3HA5/3HM5
4BL8	4BL8/XCF80
4BQ7 4BQ7A	4BQ7A/4BZ7
4BU8	4GS8/4BU8
4BZ7	4BQ7A/4BZ7
4GS8	4GS8/4BU8
4HA5	4HA5/PC900
4HA7 4HC7	4HA7/4HC7
4KN8	4RHH8/4KN8
4RHH2	4BQ7A/4BZ7
4RHH8	4RHH8/4KN8
5AR4	5AR4/GZ34
5HG8	5HG8/LCF86
5U9	5U9/LCF201
6AB8	6AB8/ECL80
6AF4 6AF4A	6DZ4/6AF4A
6AK5	6AK5/EF95
6AK8	6AK8/EABC80
6AL3	6AL3/EY88
6AQ8	6AQ8/ECC85
6BA6	6BA6/EF93
6BC5	6BC5/6CE5
6BK4C	6BK4C/6EL4A
6BL8	6BL8/ECF80
6BM8	6BM8/ECL82
6BN6	6BN6/6KS6
6BQ5	6BQ5/EL84
6BQ6GT 6BQ6GTA 6BQ6GTB	6BQ6GTB/6CU6
6BQ7 6BQ7A	6BQ7A/6BZ7
6BX6	6BX6/EF80
6BR3	6RK19/6BR3
6BZ7	6BQ7A/6BZ7
6CA7	6CA7/EL34
6CD3 6CE3	6CE3/6CD3
6CE5	6BC5/6CE5
6CG7	6CG7/6FQ7
6CU6	6BQ6GTB/6CU6
6CW5	6CW5/EL86
6DA4 6DA4A 6DM4 6DM4A	6DA4A/6DM4A
6DQ6 6DQ6A 6DQ6B	6DQ6B/6GW6
6DHH13	6FX7/6DHH13
6DX8	6DX8/ECL84
6DZ4	6DZ4/6AF4A
6EH7	6EH7/EF183
6EJ7	6EJ7/EF184
6EL4A	6BK4C/6EL4A
6ES8	6ES8/ECC189
6FG6	6FG6/EM84
6FQ5 6FQ5A	6GK5/6FQ5A
6FQ7	6CG7/6FQ7
6FX7	6FX7/6DHH13
6GB3A	6BQ6GTB/6CU6
6GB5	6GB5/EL500
6GB6	6DQ6B/6GW6
6GH8 6GH8A	6EA8/6GH8A
6GJ7	6GJ7/ECF801
6GK5	6GK5/6FQ5A
6GW6	6DQ6B/6GW6
6GW8	6GW8/ECL86
6GX6 6GY6	6GY6/6GX6
6HA5	6HA5/6HM5
6HG8	6HG8/ECF86
6HM5	6HA5/6HM5
6HU6	6HU6/EM87
6HU8	6HU8/ELL80
6JE6C	6JE6C/6LQ6
6JW8	6JW8/ECF802
6K11	6K11/6Q11
6KD8	6U8A/6KD8
6KN8	6RHH8/6KN8
6KS6	6BN6/6KS6
6LH6A 6LJ6 6LJ6A	6LJ6A/6LH6A
6LQ6	6JE6C/6LQ6
6LX8	6LX8/LCF802
6Q11	6K11/6Q11
6RHH8	6RHH8/6KN8
6RK19	6RK19/6BR3

TUBE TYPE	SYLVANIA DOUBLE/BRAND
6U8 6U8A	6U8A/6KD8
6V4	6V4/EZ80
6X9	6X9/ECF200
7HG8	7HG8/PCF86
8CG7 8FQ7	8CG7/8FQ7
8GJ7	8GJ7/PCF801
9A8	9A8/PCF80
10CW5	10CW5/LL86
10DX8	10DX8/LCL84
11Y9	11Y9/LFL200
12AT7	12AT7/ECC81
12AU7 12AU7A	12AU7A/ECC82
12AX7 12AX7A	12AX7A/ECC83
12BQ6GT 12BQ6GTA 12BQ6GTB	12BQ6GTB/12CU6
12BR3	12RK19/12BR3
12C5 12CU5	12C5/12CU5
12CU6	12BQ6GTB/12CU6
12DQ6 12DQ6A 12DQ6B 12GB7 12GW6	12DQ6B/12GW6
12GN7A 12HG7	12GN7A/12HG7
12RK19	12RK19/12BR3
13GB5	13GB5/XL500
13J10 13Z10	13J10/13Z10
15CW5	15CW5/PL84
16A8	16A8/PCL82
16AQ3	16AQ3/XY88
17AX4GT 17AX4GTA	17AX4GTA/17DM4A
17BR3	17BR3/17RK19
17C5 17CU5	17C5/17CU5

TUBE TYPE	SYLVANIA DOUBLE/BRAND
17DM4 17DM4A	17AX4GTA/17DM4A
17DQ6 17DQ6A 17DQ6B	17DQ6B/17GW6
17EW8	17EW8/HCC85
17GW6	17DQ6B/17GW6
17RK19	17BR3/17RK19
25BQ6G 25BQ6GA 25BQ6GT 25BQ6GTB 25CU6	25BQ6GTB/25CU6
27GB5	27GB5/PL500
DY87	1S2A/DY87
EABC80	6AK8/EABC80
ECC81	12AT7/ECC81
ECC82	12AU7A/ECC82
ECC83	12AX7A/ECC83
ECC85	6AQ8/ECC85
ECC189	6ES8/ECC189
ECF80	6BL8/ECF80
ECF86	6HG8/ECL86
ECF200	6X9/ECF200
ECF801	6GJ7/ECF801
ECF802	6JW8/ECF802
ECL80	6AB8/ECL80
ECL82	6BM8/ECL82
ECL84	6DX8/ECL84
ECL86	6GW8/ECL86
EF80	6BX6/EF80
EF93	6BA6/EF93
EF95	6AK5/EF95
EF183	6EH7/EF183
EF184	6EJ7/EF184

TUBE TYPE	SYLVANIA DOUBLE/BRAND
EL34	6CA7/EL34
EL84	6BQ5/EL84
EL86	6CW5/EL86
EL500	6GB5/EL500
ELL80	6HU8/ELL80
EM84	6FG6/EM84
EM87	6HU6/EM87
EY88	6AL3/EY88
EZ80	6V4/EZ80
GZ34	5AR4/GZ34
HCC85	17EW8/HCC85
LCF86	5HG8/LCF86
LCF201	5U9/LCF201
LCF802	6LX8/LCF802
LCL84	10DX8/LCL84
LFL200	11Y9/LFL200
LL86	10CW5/LL86
PC900	4HA5/PC900
PCF80	9A8/PCF80
PCF86	7HG8/PCF86
PCF801	8GJ7/PCF801
PCL82	16A8/PCL82
PL84	15CW5/PL84
PL500	27GB5/PL500
XCF80	4BL8/XCF80
XF183	3EH7/XF183
XF184	3EJ7/XF184
XL500	13GB5/XL500
XY88	16AQ3/XY88

Foreign - American Receiving Tube Replacement Guide

Foreign Type Number	American Direct Replacement	American Similar Types
1C1	1R5	—
1C2	1AC6	—
1C3	1AB6	—
1D13	1A3	—
1F1	1AJ4	1T4
1F2	1L4	—
1F3	1T4	—
1FD1	1AH5	1S5
1FD9	1S5	—
1H35	1AB6	—
1M1	—	1M3
1N5VG	—	1N5GT
1P1	3C4	—
1P10	3S4	—
1P11	3V4	—
1R5SF	1AQ5	1R5
1RK23	1S2	—
1S5SF	1AR5	1S5
1T4SF	1AM4	1T4
1U5SF	1AS5	1U5
3A4T	—	3A4
3D-HH13	3FX7/3DHH13	—
3M-R24	3DK6	3CB6
3M-V7	3BZ6	—
3S4SF	3W4	3S4
4R-HH2	4BQ7A/4BZ7	4BQ7/4BZ7 4BS8
4R-HH8	4RHH8/4KN8	—
4Y25	807	—
5B/250A	807	—
5M-HH3	5J6	—
5P-29	6CN6	—
5RHP1	4BL8/XCF80	—
5S1	807	—
5Y3GB	—	5Y3GT
5Z10	5U4GB	—
6AT7N	6DT8	—
6B8EG	—	6B8
6B32	6AL5	—
6BC32	6AV6	—
6BS4	—	6DZ4/6AF4A
6C12	6AJ8	—
6C16	6BL8/ECF80	—
6C18	6GV7	—
6CC31	6J6A	—
6D1	6DR4	—
6D2	6AL5	—
6D-HH13	6FX7/6DHH13	—
6E8	6A8	—
6F10	6AC7	—
6F12	6AM6	6BH6
6F16	6CJ5	—
6F18	6EC7	—
6F19	6BY7	—
6F21	6CQ6	6BJ6, A
6F22	EF86/6267	5879
6F23	6EL7	—
6F24	—	6EJ7/EF184
6F25	—	6EH7/EF183
6F26	6BY7	—

Foreign Type Number	American Direct Replacement	American Similar Types
6F29	6EH7/EF183	—
6F30	6EJ7/EF184	—
6F31	6BA6/EF93	—
6F33	6AS6	—
6F35	6AJ5	—
6F36	6AH6	—
6FD12	6DC8	—
6FX4	6AV4	—
6G-B3A	6BQ6GTB/6CU6	—
6G-B9	6DQ6B/6GW6	—
6G-B6	6BQ6GTB/6CU6	6DQ6B/6GW6
6G-K17	6AU4GTA	—
6H31	6BE6	—
6J6L	—	6J6A
6J6R	—	6J6A
6J8EG	—	6J8G
6J8GA	—	6J8G
6L10	6AG7	—
6L12	6AQ8/ECC85	—
6L13	12AX7A/ECC83, 7025	12AX7/ECC83 —
6L31	6AQ5A	—
6L34	6AQ4	—
6L43	6CL6	—
6LD3	6CV7	—
6LD12	6AK8/EABC80	6T8A
6LD13	6BD7	—
6LP12	6BM8/ECL82	—
6M1	—	6U5
6M2	6CD7	—
6M-H1	6J4	—
6M-HH3	6J6A	—
6P9	6BM5	—
6P15	6BQ5/EL84	—
6P17	6AM5	—
6P25	6AG6	—
6Q8	6A8, G, GT	—
6R-HH1	—	6DJ8, 6922
6R-HH2	6BZ8	—
6R-HH8	6RHH8/6KN8	—
6R-K19	6RK19/6BR3	—
6Z31	6X4	—
7D9	6AM5	—
7D10	6CH6	6BQ5/EL84
7F16	6CJ5	—
8D3	6AM6	6BA6/EF93
8D4	—	6W7
8D5	6BR7	5879
8D6	6BW7	—
8D7	6BS7	5879
8D8	—	EF86/6267
8R-HP1	8B8	—
9BR8	—	9U8A
9D6	6CQ6	6BJ6, A
9M-HH3	9J6	—
9P9	9BM5	—
9R-AL1	6FD7	—
10C14	19D8, 19AJ8	—
10F18	13EC7	—

Foreign - American Receiving Tube Replacement Guide (cont'd)

Foreign Type Number	American Direct Replacement	American Similar Types
10L14	26AQ8	—
10LD3	14L7	—
10LD12	28AK8	—
10P18	45B5	—
10PL12	50BM8	—
11L6	—	6L6, 6L6GC
12AU7R	—	12AU7A/ECC82
12AX7R	—	12AX7/ECC83 12AX7A/ECC83 7025
12BC32	12AV6	—
12F31	12BA6	—
12G-B3	—	12DQ6B/12GW6
12G-B6	12BQ6B/12CU6	—
12G-B7	12DQ6B/12GW6	—
12G-K17	—	12D4, A
12H31	12BE6	—
12R-K19	12RK19/12BR3	12AF3
12R-LL3	12AV7	—
13D2	6SN7GTB	—
15FM7	—	13FM7
17N8	17C8	—
17R-HH2	—	17EW8/HCC85
17RK19	17BR3/17RK19	—
19AJ8	19D8	—
19BD	19X3	—
19M-R9	18FW6A	—
19M-R10	18ED6 18GD6	—
19SU	19Y3	—
19U3	19X3	—
19W3	19X3	—
20D3	12AH8	—
20D4	6AJ8	—
24/76	—	6P5G, GT
24/78	—	6K7, GT
25G-B6	25BQ6GTB/25CU6	—
30C1	9A8/PCF80	9U8A
30C15	9EN7	—
30C18	7GV7	—
30F5	7ED7	—
30FL1	9GB8	—
30L1	7AN7	—
30L15	7EK7	—
30P4	25GF6	25BQ6GTB/25CU6
30P12	12FB5	—
30P16	16A5	—
30P18	15CW5/PL84	—
30P19	25GF6	—
30PL1	13GC8	—
30PL12	16A8/PCC82	—
30PL13	16GK8	—
41E	—	41
41M	—	6K6GT
42E	—	42
52KU	5Z4G	5V4GA
53KU	—	5V4GA
62DDT	6CV7	—
62TH	6CU7	7J7
62VP	6CJ5	—
63ME	—	6U5
63T1	6AB8A	6AB8/ECL80
63TP	6AB8/ECL80	—
64ME	6CD7	—
64SPT	6BX6/EF80	—
65ME	6BR5	—

Foreign Type Number	American Direct Replacement	American Similar Types
66KU	6BT4	—
67PT	6CK5	—
77E	—	6C6
77M	—	6J7, G, GT
80S	—	5Z4, GT
85A1	OE3	—
85A2	OG3	5651, A
85A3	5783	—
86M	—	6P5, GT
88M	—	6SK7, GT
89RS	—	6B8, G
108C1	OB2	—
121VP	12AC5	—
141DDT	14L7	—
141TH	14K7	—
150B2	6354	—
150C1	OA2	—
150C2	OA2	—
150C3	OD3, OD3A	—
150C4	—	OA2
163 Pen	16A5	—
171DDP	17C8	—
	17N8	—
213 Pen	21A6	—
311SU	31A3	—
451PT	45A5	—
A676	—	76
A678	—	78
A863	—	6J7, G, GT
A1834	6AS7G, GA, GYB	—
	6080	—
AA91E	5726	—
	5726/6AL5W	—
AD	6Z3	—
AG5209	OG3	5651, A
AG5210	—	OB2, OB2WA
AG5211	—	OA2, OA2WA
ASG512	2D21	—
B36	12SN7GTA	—
B63	6A6	—
B65	6SN7GTB	—
B139	7AN7	—
B152	12AT7/ECC81	—
B309	12AT7/ECC81	—
B319	—	7AN7
B329	12AU7A/ECC82	—
B339	12AX7/ECC83 7025	—
B719	—	6AQ8/ECC85
B739	—	12AT7/ECC81
B749	—	12AU7A/ECC82
B759	—	12AX7/ECC83, 7025
BF61	6CK5	6CL6
BF451	45A5	—
BPMO4	6AQ5A	—
CC81E	12AT7WA 6201	12AT7/ECC81 —
CCa	6922	—
D1C	957	—
D2C	958A	—
D2M9	6AL5	—
D3F	959	—
D61	—	6CT7
D63	—	6H6
D77	6AL5	—

Foreign - American Receiving Tube Replacement Guide (cont'd)

Foreign Type Number	American Direct Replacement	American Similar Types
D152	6AL5	—
D717	—	6AL5
DA90	1A3	—
DAC32	1H5GT	—
DAF91	1S5	—
DAF92	1U5	—
DAF96	1AH5	1S5
DAF191	—	1S5
DC70	6375	1E3
DC80	1E3	—
DCC90	3A5	—
DCF60	—	1V6
DD6	—	6AL5
DD7	6AM5	—
DDR7	6AM5	—
DF33	1N5GT	—
DF60	5678	—
DF62	1AD4	—
DF91	1T4	—
DF92	1L4	—
DF96	1AJ4	1T4
DF97	1AN5	—
DF652	1AD4	—
DF904	1U4	—
DH63	6Q7, GT	—
DH63M	—	6Q7, GT
DH74	12Q7GT	—
DH76	—	12Q7, GT
DH77	6AT6	—
DH81	—	7B6
DH118	—	14L7
DH142	—	14L7
DH147	—	6Q7, GT
DH149	7C6	—
DH150	6CV7	—
DH718	6CV7	—
DH719	6T8A	6AK8/EABC80
DH817	6CV7	—
DK32	1A7GT	—
DK91	1R5	—
DK92	1AC6	—
DK96	1AB6	—
DK97	1AB6	—
DL29	3D6	—
DL31	1A5GT	—
DL33	3Q5GT	—
DL35	1C5GT	—
DL36	1Q5GT	—
DL63	—	6R7
DL67	6007	—
DL70	6373	—
DL74M	—	12Q7GT
DL82	—	7B6
DL91	1S4	—
DL92	3S4	—
DL93	3A4	—
DL94	3V4	—
DL95	3Q4	—
DL96	3C4	3V4
DL98	3B4	3B4WA
DL193	—	3A4
DL620	5672	—
DM70	1M3	—
DM71	1N3	—
DM160	6977	—

Foreign Type Number	American Direct Replacement	American Similar Types
DP61	6AK5/EF95	—
DS77	—	6AL5
DY30	—	1G3GT/1B3GT
DY70	5642	—
DY80	—	1X2B
DY86	1S2	1H2
DY87	1S2A/DY87	1H2
E1F	954	—
E2F	956	—
E55L	8233	—
E80CC	6085	—
E80CF	7643	—
E80F	6084	—
E80L	6227	—
E80T	6218	—
E81CC	12AT7WA	12AT7/ECC81
	6201	—
E81L	6686	—
E82CC	6189/12AU7WA	12AU7A
		12AU7/ECC82
E83CC	6181/12AX7A	12AX7A/ECC83
		12AX7/ECC83
E83F	6689	—
E84L	7320	6BQ5/EL84
E88CC	6922	—
E90CC	5920	—
E90F	7693	6BH6
		6661/6BH6
E90Z	6X4	—
E91AA	5726	6AL5
	5726/6AL5W	—
E91H	6687	5915
		6BY6
E91N	5727	—
E95F	5654	6AK5/EF95
E99F	7694	6BJ6, A
E130L	7534	—
E180CC	7062	—
E180F	6688A	—
E182CC	7119	7044
E182F	5847/404A	—
E186F	7737	—
E188CC	7308	6922
E280F	7722	—
E902	6X4	—
E288CC	8223	—
EA52	6923	—
EA76	6489	—
EAA91	6AL5	—
EAA171	—	6AL5
EAA901	5726	6AL5
	5726/6AL5W	—
EAA901S	5726	6AL5
	5726/6AL5W	—
EABC80	6AK8/EABC80	6T8A
EAF42	6CT7	—
EB34	—	6H6
EB91	6AL5	—
EBC33	—	6Q7, GT
		6R7
EBC41	6CV7	—
EBC80	6BD7	—
EBC81	6BD7A	—
EBC90	6AT6	—
EBC91	6AV6	—

Foreign - American Receiving Tube Replacement Guide (cont'd)

Foreign Type Number	American Direct Replacement	American Similar Types
EBF32	—	6B8
EBF80	6N8	—
EBF81	6AD8	—
EBF83	6DR8	—
EBF89	6DC8	—
EBF171	—	6N8
EBF175	—	6DC8
EC70	5718	—
EC71	5718	—
EC80	6Q4	6BC4
EC81	6R4	—
EC84	6AJ4	—
EC86	6CM4	—
EC88	6DL4/EC88	—
EC90	6C4	—
EC91	6AQ4	—
EC92	6AB4	—
EC93	6BS4	6DZ4/6AF4A
EC94	6DZ4/6AF4A	—
EC95	6ER5	6ES5
EC97	6FY5	6GK5/6FQ5A
EC900	6HA5/6HM5	—
EC1000	8254	—
ECC32	—	6SN7GTB
ECC33	—	6SN7GTB
ECC35	—	6SL7GT
ECC40	—	6N7, GT
ECC70	6021	—
ECC81	12AT7/ECC81	—
ECC82	12AU7/ECC82	—
ECC83	12AX7A/ECC83	—
	7025	—
ECC84	6CW7	6BQ7A/6BZ7
ECC85	6AQ8/ECC85	—
ECC86	6GM8	—
ECC88	6DJ8	6922
ECC89	6FC7	6ES8/ECC189
ECC91	6J6A	—
ECC180	6BQ7A/6BZ7	—
ECC186	7316	—
	12AU7A/ECC82	—
ECC189	6ES8/ECC189	—
ECC230	6080	—
ECC801	12AT7WA	12AT7/ECC81
	6201	—
ECC801S	12AT7WA	12AT7/ECC81
	6201	—
ECC802	6189	12AU7A/ECC82
ECC802S	6189	12AU7A/ECC82
ECC803	12AX7A/ECC83	12AX7/ECC83
	7025	—
ECC803S	12AX7A/ECC83	12AX7/ECC83
	7025	—
ECC804	6GA8	—
ECC960	5920	—
ECF80	6BL8/ECF80	—
ECF82	6U8A/6KD8	—
ECF86	6HG8/ECF86	—
ECF200	6X9/ECF200	—
ECF201	6U9	—
ECF801	6GJ7/ECF801	—
ECF802	6JW8/ECF802	—
ECH3G	—	6K8
ECH35	—	6E8G, 6K8
ECH42	6CU7, 6C9	7J7
ECH80	6AN7	—

Foreign Type Number	American Direct Replacement	American Similar Types
ECH81	6AJ8	—
ECH83	6DS8	—
ECH113	6CU7	7J7
ECH171	—	6AJ8
ECH200	6V9	—
ECL80	6AB8/ECL80	—
ECL82	6BM8/ECL82	—
ECL83	—	6BM8/ECL82
ECL84	6DX8/ECL84	—
ECL85	6GV8	—
ECL86	6GW8/ECL86	—
ED2	6AL5	—
EF5	6DA6	—
EF9	—	6K7, GT
EF13	6DA6	—
EF22	7G7	7B7
		7A7
EF36	6J7, GT	—
EF37, A	—	6J7, GT
EF39	—	6K7, G, G7
EF40	—	5879
EF41	6CJ5	—
EF42	—	6EW6
EF70	6487	—
EF71	5899	—
EF72	5840	—
EF73	6488	—
EF74	6391	—
EF80	6BX6/EF80	—
EF81	6BH5	—
EF82	6CH6	6BQ5/EL84
EF83	6BK8	—
EF85	6BY7	—
EF86	6267	5879
	6CF8	—
EF89	6DA6	—
EF89F	6DG7	—
EF91	6AM6	—
EF92	6CQ6	—
EF93	6BA6/EF93	—
EF94	6AU6A	—
EF95	6AK5/EF95	—
EF96	6AG5	6BC5/6CE5
EF97	6ES6	—
EF98	6ET6	—
EF174	—	6BX6/EF80
EF175	—	6BY7
EF183	6EH7/EF183	—
EF184	6EJ7/EF184	—
EF190	6CB6A	—
EF730	5636	—
EF731	5899	—
EF732	5840	—
EF734	6205	—
EF811	—	6EH7/EF183
EF812	6EL7	—
EF814	—	6EJ7/EF184
EF861	6688A	—
EF905	5654	6AK5/EF95
	5654/6AK5W	—
EFL200	6Y9	—
EH90	6CS6	6BY6
EH900	—	5915
EH900S	—	5915
EK32	—	6A8, G, GT
EK90	6BE6	—

Foreign - American Receiving Tube Replacement Guide (cont'd)

Foreign Type Number	American Direct Replacement	American Similar Types
EL32	—	6V6GTA
EL33	—	6V6, 6V6GTA
EL34	6CA7/EL34	7027A
EL35	—	6Y6GA
		6Y6G
EL36	6CM5	—
EL37	—	6L6GC
		7027A
EL38	6CN6	—
EL41	6CK5	6CL6
EL71	5902	—
EL80	6M5	6BQ5/EL84
EL81	6CJ6	—
EL82	6DY5	—
EL83	6CK6	6CL6
EL84	6BQ5/EL84	—
EL85	6BN5	—
EL86	6CW5/EL86	—
EL90	6AQ5A	—
EL91	6AM5	—
EL95	6DL5	—
EL180	12BY7A	—
EL360	—	6CM5
EL500	6GB5/EL500	—
EL803	—	6CK6
EL821	6CH6	6BQ5/EL84
EL822	6CH6	6BQ5/EL84
EL861	6686	—
ELL80	6HU8/ELL80	—
EM34	6CD7	—
EM80	6BR5	—
EM81	6DA5	—
EM84	6FG6/EM84	—
EM85	6DG7	—
EM87	6HU6/EM87	—
EM840	6FG6/EM84	—
EN32	2050	—
	2050A	—
EN91	2D21	—
EN92	5696	—
EN93	6D4	—
EQ80	6BE7	—
EY51	6X2	—
EY80	6U3	—
EY81	6R3	6AF3
EY81F	6V3	—
EY82	6N3	—
EY83	—	6S2
		6AL3/EY88
EY84	—	6374
EY86	6S2	—
EY87	6S2A	—
EY88	6AL3/EY88	—
EY500	6EC4	—
EZ3	6V4/EZ80	6CA4
EZ4	6CA4	—
EZ11	6V4/EZ80	6CA4
EZ35	6X5GT	—
EZ40	6BT4	—
EZ80	6V4/EZ80	6CA4
EZ81	6CA4	—
EZ90	6X4	—
EZ91	6AV4	—
GZ30	5Z4, GT	—
GZ31	—	5U4GB
GZ32	5V4GA	—

Foreign Type Number	American Direct Replacement	American Similar Types
GZ33	—	5V4GB
		5AR4/GZ34
GZ34	5AR4/GZ34	5U4GB
H63	6F5, GT	—
HAA91	12AL5	—
HABC80	19T8	—
HBC90	12AT6	—
HBC91	12AV6	—
HCC85	17EW8/HCC85	—
HCH81	12AJ7	—
HD14	1H5G, GT	—
HD30	3B4, 3B4WA	—
HD51	OA2	—
HD52	OB2	—
HD93	1X2B	—
HD94	6BQ6GTB/6CU6	—
HD96	25BQ6GTB/25CU6	—
HF61	6CJ5	—
HF93	12BA6	—
HF94	12AU6	—
HF121	12AC5	—
HK90	12BE6	—
HL90	19AQ5	—
HL92	50C5	—
HL94	30A5	35C5
HMO4	6BE6	—
HP6	6AM6	—
HY90	35W4	—
HZ90	12X4	—
KD21	OA3, OA3A	—
KD24	OC3, OC3A	—
KD25	OD3, OD3A	—
KL35	—	1F5G
KT32	—	25L6GT
KT61	6AG6G	6V6, 6V6GTA
		6M6G
KT63	6F6, G, GT	—
KT66	—	7027A
		6L6GC
		5881
		807
KT71	—	50L6GT
KT77	6CA7/EL34	7027A
KT81	—	7C5
KTW61	—	6S7
KTW63	—	6K7, G, GT
KTW74M	—	12K7GT
KTZ63	—	6J7, G, GT
L63	6C5	—
	6J5, GT	—
L63B	6C5	—
	6J5, GT	—
L77	6C4	—
LC900	3HM5/3HA5	—
LCF80	6LN8	—
LCF86	5HG8/LCF86	—
LCF200	5X9	—
LCF201	5U9/LCF201	—
LCF801	5GJ7	—
LCF802	6LX8/LCF802	—
LCH200	5V9	—
LCL84	10DX8/LCL84	—
LCL200	11Y9/LCL200	—
LF183	4EH7	—
LF184	4EJ7	—
LFL200	11Y9/LFL200	—

Foreign - American Receiving Tube Replacement Guide (cont'd)

Foreign Type Number	American Direct Replacement	American Similar Types
LL86	10CW5/LL86	—
LN119	50BM8	—
LN152	6AB8/ECL80	—
LN319	13GC8	—
LY88	20AQ3	—
LY500	28EC4	—
LZ319	8A8	9A8/PCF80
		9U8A
LZ329	9A8/PCF80	9U8A
M8079	5726	6AL5
M8080	—	6C4
M8081	6101	6J6A
	6101/6J6WA	—
M8082	—	6AM5
M8083	—	6AM6
M8096	5763	—
M8098	—	0G3, 5651A
M8100	5654	6AK5/EF95
	5654/6AK5W	—
M8121	5840	—
M8136	6189/12AU7WA	12AU7AECC82
M8137	12AX7A/ECC83	12AX7/ECC83
	7025	—
M8161	6065	—
M8162	12AT7WA	12AT7/ECC81
	6201	—
M8190	—	5783
M8196	5725	6AS6
M8204	5727	2D21
M8212	5726	6AL5
M8214	—	12AX7A/ECC83
		12AX7/ECC83
		7025
M8223	OA2WA	OA2
M8224	OB2WA	OB2
M8232	6J4WA	6J4
	8532/6J4WA	—
M8245	6005	6AQ5A
N14	1C5GT	—
N15	3Q5GT	—
N16	3Q5GT	—
N17	3S4	—
N18	3Q4	—
N19	3V4	—
N25	3C4	—
N77	—	6AM5
		6AL5
N78	6BJ5	—
N119	45B5	—
N142	45A5	—
N144	6AM5	—
N147	6AG6G	6V6
		6V6GTA
N148	—	7C5
N150	6CK5	6CL6
N152	21A6	—
N153	15A6	—
N154	16A5	—
N155	6BN5	—
N308	—	25E5
N309	15A6	—
N329	16A5	—
N359	21A6	—
N369	16A8/PCL82	—
N379	15CW5/PL84	—
N707	—	6BQ5/EL84

Foreign Type Number	American Direct Replacement	American Similar Types
N709	6BQ5/EL84	—
N727	6AQ5A	—
OBC3	12SQ7, GT	—
OF1	—	6S7
OH4	12A8GT	—
OM4	—	6Q7, GT
OM6	—	6K7, GT
OM10	—	6K8
OSW2190	—	6AC7
OSW2192	—	6AG7
OSW2600	—	6AC7
OSW2601	6AG7	—
OSW3104	—	6SA7, GT
OSW3105	—	6SQ7, GT
OSW3106	—	6V6, GT
OSW3109	—	6H6
OSW3110	6E5	—
OSW3111	—	6SK7, GT
OSW3112	—	6J5
P17A	807	—
PABC80	9AK8	—
PC86	4CM4	—
PC95	4GK5	—
PC97	3FY5	—
PC900	4HA5/PC900	—
PCC84	7AN7	—
PCC85	9AQ8	—
PCC88	7DJ8	—
PCC89	7FC7	—
PCC189	7ES8	—
PCC805	7EK7	—
PCE800	9GB8	—
PCF80	9A8/PCF80	9U8A
PCF82	9U8A	—
PCF86	7HG8/PCF86	8HG8
PCF800	9EN7	—
PCF801	8GJ7/PCF801	—
PCF805	7GV7	—
PCL82	16A8/PCL82	—
PCL84	15DQ8	—
PCL85	18GV8	—
PCL800	16GK8	—
PF9	—	6K7
PH4	6A8, G, GT	—
PL21	2D21	—
PL36	25E5	—
PL81	21A6	—
PL82	16A5	—
PL83	15A6	—
PL84	15CW5/PL84	—
PL500	27GB5/PL500	—
PL820	—	21A6
PL1267	0A4G	—
PLL80	12HU8	—
PM04	6BA6/EF93	—
PM05	—	6AK5/EF95
PM07	6AM6	—
PY80	19X3	—
PY81	17Z3	—
PY82	19Y3	—
PY83	—	17Z3
PY88	30AE3	—
QA2400	6065	6CQ6
QA2401	—	6C4
QA2402	—	6AM5
QA2403	—	6AM6

Foreign - American Receiving Tube Replacement Guide (cont'd)

Foreign Type Number	American Direct Replacement	American Similar Types
QA2404	—	6AL5
QA2406	—	12AT7/ECC81
QA2407	—	6X4, 6X4W
QA2408	5692	6SN7GTB
QB65	—	6SN7GTB
QB309	—	12AT7/ECC81
QE03/10	5763	—
QE05/40	6146	—
QE05/40H	6159	—
QE06/50	—	807
		5933
QL77	6C4	—
QQE02/5	6939	—
QQE03/12	6360	—
QQE03/20	6252	—
QQV02-6	6939	—
QQV03-10	6360	—
QS83-3	—	0G3
QS150/40	0D3, 0D3A	—
QS1205	0A3, 0A3A	—
QS1206	0C3, 0C3A	—
QS1207	0A2	—
QS1208	0B2	—
QS1209	5651A	0G3
QS1210	0A2WA	0A2
QS1211	0B2WA	0B2
QS1212	—	0G3
		5651A
		5651WA
QS2404	5726	6AL5
QS2406	12AT7WA	12AT7/ECC81
	6201	—
QV03-12	5763	—
QV05/25	—	807
QV06/20	6146	—
R3	1W4	—
R12	6X2	—
R12A	6X2	—
R16	1T2	—
R17	—	6N3
R19	—	1X2B
R52	5Z4, GT	—
R144	6AM6	—
REL39	—	6AC7
RL21	2D21	—
RL1267	0A4G	—
RS1029	6360	—
S6F12	6AM6	—
S856	0A2	—
S860	0B2	—
SM150-30	0A2	—
SP6	6AM6	—
SR2	0G3	5651A
SR3	0B2	—
STR85/10	0G3	5651A
STR108/30	0B2	—
STR150/30	0A2	—
STV85/10	0G3	5651A
STV108/30	0B2	—
STV150/30	0A2	—
SU61	6X2	—
T2M05	6J6A	—
TM12	—	6J4
TS51	—	6AK5/EF95
		5654
TXM100	—	2D21
		5727
U17	—	1T4
U26	6S2	—
U37	1T2	—
U41	—	1G3GT/1B3GT
U43	6X2	—
U49	6S2	—
U50	5Y3GT	—
U52	5U4G	—
	5U4GB	—
U70	—	6X5GT
U74	—	35Z4GT
U76	35Z4GT	—
U78	6X4	—
U82	—	7Y4
U119	38A3	—
U142	31A3	—
U145	31A3	—
U147	6X5GT	—
U149	7Y4	—
U150	6BT4	—
U151	6X2	—
U152	19X3	—
U153	17Z3	—
U154	19Y3	—
U191	19CS4	—
U192	19Y3	—
U193	17Z3	—
U309	—	19X3
U319	—	19Y3
U381	38A3	—
U404	—	31A3
U707	6X4	—
U709	—	6CA4
UAVC80	28AK8	—
UAF42	12S7	—
UBC41	14L7	—
UBC80	14G6	—
UBF80	17C8	—
	17N8	—
UC92	9AB4	—
UCC85	26AQ8	—
UCH42	14K7	—
UCH80	14Y7	—
UCH81	19D8	—
	19AJ8	—
UCL82	50BM8	—
UF6A7	—	6A7
UF41	12AC5	—
UF89	12AD6	—
UL41	45A5	—
UL84	45B5	—
UQ80	12BE7	—
UU9	6BT4	—
UU12	6CA4	—
UY24B	—	24A
UY27	—	27
UY27A	—	27
UY35B	—	35
UY36	—	36
UY36A	—	36
UY37	—	37
UY37A	—	37
UY41	31A3	
UY47	—	47

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Foreign Type Number	American Direct Replacement	American Similar Types
UY76	—	76
UY82	55N3	—
UY85	38A3	—
UY224	—	24A
V2M70	6X4	—
V61	6BT4	—
V177	6CQ6	—
V311	—	31A3
V741	6C4	—
V884	6CQ6	6BJ6, A
V886	6AM5	—
VP6	6CQ6	6BJ6, A
VP12D	12C8	—
W17	1T4	—
W25	1AJ4	1T4
W61	—	6K7, GT
W63	—	6K7, GT
W76	—	12K7GT
W77	6CQ6	6BJ6, A
W81	—	7H7
W142	12AC5	—
W143	—	7B7
W147	—	6K7, GT
W148	—	7H7
W149	7B7	—
W150	6CJ5	—
W719	6BY7	—
W727	6BA6/EF93	—
W729	—	6BY7
W739	6EC7	6DA6
WD142	12S7	—
WD150	6CT7	—
WD709	6N8	—
WT294	0D3	—
X14	1A7GT	—
X17	1R5	—
X18	1AC6	—
X20	1AC6	—
X25	1AB6	—
X63 (M)	—	6A8, G, GT
X64	—	6L7
X77	6BE6	—
X79	6AE8	—
X81	—	7S7
X119	19D8	—
X142	14K7	—
X144	—	1A7GT
X147	6E8G	6K8
X148	7S7	—
X150	—	6CU7
X155	6BZ8	—
X719	6AJ8	—
X727	6BE6	—
XC95	2ER5	—
XC97	2FY5	—
XCC82	7AU7	—
XCC189	4ES8	—
XCF80	4BL8/XCF80	—
XCH81	3AJ8	—
XCL82	8B8	—
XCL85	9GV8	—
XF80	3BX6	—
XF85	3BY7	—
XF86	2HR8	—
XF183	3EH7/XF183	—
XF184	3EJ7/XF184	—
XFR1	—	1AD4
XFR2	—	5678
XFR5	—	5678
XFY14	—	5672
XFY15	—	5672
XL36	13CM5	—
XL84	8BQ5	—
XL86	8CW5	—
	8CW5A	—
XL500	13GB5/XL500	—
XY88	16AQ3/XY88	—
Y25	1N3	—
Y61	—	6U5
Y63	—	6U5
YC95	3ER5	—
YC97	3FY5	—
YCC189	5ES8	—
YF183	4EH7	—
YF184	4EJ7	—
YL1370	6146B/8298A	6146
YL1371	6883	—
	8032	—
	8552	—
YL1372	6159B	—
Z14	1N5GT	—
Z63	6J7, G, GT	—
Z77	6AM6	—
Z152	6BX6/EF80	—
Z300T	0A4G	—
Z329	—	6BX6/EF80
Z719	6BX6/EF80	—
Z729	6267	5879
	6CF8	—
Z900T	5823	—
ZD17	1S5	—
ZD25	1AH5	1S5
ZD152	6N8	—

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BROADCAST EQUIPMENT

Original Type	SYLVANIA REPLACEMENTS	
	Premium[1]	Standard
0A2	GB-0A2WA	0A2
0B2	GB-0B2WA	0B2
0B3	—	0B3
0C3	—	0C3
0D3	—	0D3
1B3/1G3GT	—	1G3GT/1B3GT
1X2B	—	1X2B
2C51	GB-5670	2C51
2D21	GB-5727	2D21
2X2A	—	2X2A
5R4	—	5R4GYB
5U4	GB-5931	5U4GB
5V4	—	5V4GA
5Y3GT	GB-5Y3WGTA	5Y3GT
6AF4	—	6DZ4/6AF4A
6AG5	GB-6186	6AG5
6AG7	—	6AG7
6AK5; EL90	GB-5654	6AK5/EF95
6AL5; EB91	GB-5726	6AL5
6AN4	—	6AN4
6AN5	—	6AN5
6AN8	—	6AN8A
6AQ5	GB-6005	6AQ5A
6AS5	—	6AS5
6AS6	GB-5725	6AS6
6AS7G	GB-6080	6AS7GA
6AS8	—	6AS8
6AT6; EBC90	—	6AT6
6AU4	—	6AU4GTA
6AU6; EF94	GB-6136; 7543[2]	6AU6A
6AU8	—	6AU8A
6AV6; EBC91	—	6AV6
6AW8	—	6AW8A
6AX4	—	6AX4GTB
6AX5GT	—	6AX5GT
6BA6	GB-5749	6BA6/EF93
6BC5	—	6BC5/6CE5
6BE6; EK90	GB-5750	6BE6
6BG6G	—	6BG6GA
6BH6	6661/6BH6[3]	6BH6
6BJ6	6662/6BJ6[3]	6BJ6
6BJ7	—	6BJ7
6BK7A	—	6BK7B
6BL7GT	—	6BL7GTA
6BL8; ECF80	—	6BL8/ECF80
6BN4	—	6BN4A
6BQ5; EL84	—	6BQ5/EL84
6BQ6	—	6BQ6GTB/6CU6
6BQ7A	GB-6BQ7A	6BQ7A/6BZ7
6BS8	—	6BS8

Original Type	SYLVANIA REPLACEMENTS	
	Premium[1]	Standard
6BZ6	—	6BZ6
6BZ7	—	6BQ7A/6BZ7
6C4; EC90	GB-6135	6C4
6CB6	6676/6CB6A[3]	6CB6A
6CD6G	—	6CD6GA
6CG7	—	6CG7/6FQ7
6CG8	—	6CG8A
6CL6	6677/6CL6[3]	6CL6
6CS6	—	6CS6
6CU8	—	6CU8
6CX8	—	6CX8
6CY5	GB-6CY5	6CY5
6DJ8	GB-6DJ8	6DJ8
6DQ6	—	6DQ6B/6GW6
6EA8	—	6EA8/6GH8A
6EH7; EF183	—	6EH7/EF183
6EJ7; EF184	—	6EJ7/EF184
6ER5; EC95	—	6ER5
6EU7	—	6EU7
6EV5	—	6EV5
6GK5	—	6GK5/6FQ5A
6HG8; ECF86	—	6HG8/ECF86
6J4	GB-6J4WA	6J4
6J6; ECC91	GB-6101	6J6A
6J7	—	6J7
6L6	GB-5932	6L6
6SL7GT	GB-6SL7WGT	6SL7GT
6SN7GT	GB-6SN7WGT	6SN7GTB
6T8	—	6T8A
6U8, A	GB-1252/6U8A	6U8A/6KD8
6V6	—	6V6
6W6GT	—	6W6GT
6X4	GB-6X4WA	6X4
6X5GT	GB-6X5WGT	6X5GT
6X8	—	6X8
6Y6G	—	6Y6GA
12AT7; ECC81	GB-6201	12AT7/ECC81
12AU7; ECC82	GB-5814A	12AU7A/ECC82
12AV6; HBC91	—	12AV6
12AX7; ECC83	GB-5751	12AX7A/ECC83
12BH7	—	12BH7A
12BY7	—	12BY7A
407A	GB-407A	—
408A	GB-408A	—
807	GB-5933	807
1218	—	1218A
5651	—	5651
5654	GB-5654	5654
5670	GB-5670	5670
5687	GB-5687	—

BROADCAST EQUIPMENT (cont'd)

Original Type	SYLVANIA REPLACEMENTS	
	Premium(1)	Standard
5693	—	5693
5725	GB-5725	5725
5726	GB-5726	5726
5749	GB-5749	5749
5763	—	5763
5814A	GB-5814A	5814A
5881	—	5881
6005/6AQ5	GB-6005	6005
6028	GB-408A	6028
6146, A	—	6146B/8298A
6201	GB-6201	—
6883	—	6883A

Original Type	SYLVANIA REPLACEMENTS	
	Premium(1)	Standard
6922; ECC88	7308	6922
6939	—	6939
7025	—	7025(2)

Notes:

(1) GB prefix—Sylvania GB Gold Brand Type—designed and manufactured for critical industrial and commercial applications.

(2) Controlled for low hum.

(3) Application tailored for rugged mobile service—features special heater controls.

COMMERCIAL AVIATION

Original Type	Standard Industrial	Premium Gold Brand
0A2	0A2WA	GB-0A2WA
0B2	0B2WA	GB-0B2WA
2D21, W	5727/2D21W	GB-5727
6AL5, W	5726	GB-5726
6AQ5, W	6005	GB-6005
6AS7G, GA	6080	GB-6080
6AU6	—	GB-6136
6SN7, GT	6SN7WGTA	GB-6SN7WGT
12AT7	—	GB-6201
12AU7, A	6189	GB-6189
	*5814A	*GB-5814A
5654	5654	GB-5654
5670	5070WA	GB-5670
		**GB-1219/5670

Original Type	Standard Industrial	Premium Gold Brand
5687	5687WA	GB-5687
5725	5725	GB-5725
5749	5749	GB-5749
5750	5750	GB-5750
5751	5751	GB-5751
6146, A, B	6146B/8298A	—
6159, A	6159A	—

Notes:

*Heater current is 15% higher than original 12AU7, A.

**Recommended replacement for original Type 5670 when GM at lower heater voltage is critical.

GENERAL AVIATION

Original Type	Application Tailored*
6AL5	6663/6AL5
6AQ5	6669/6AQ5A
6BA6	6660/6BA6
6BH6	6661/6BH6
6BJ6	6662/6BJ6
6CB6	6676/6CB6A
6U8, A	6678 6U8A
12AB5	7061
12AL5	7055
12AT7	6679/12AT7

Original Type	Application Tailored*
12AU7, A	6680/12AU7A
12AX7	6681/12AX7, **7058
12BY7A	7054

Notes:

*Designed to operate over wide heater excursions.

**13.5 volt heater rating instead of 12 volt nominal for 6681/12AX7.

MOBILE COMMUNICATIONS

Sylvania Mobile Type	Prototype	Description
6146A, 6146B/8298A	6146	Beam pentode af/rf power amplifier
6660/6BA6	6BA6	Pentode rf/if amplifier
6661/6BH6	6BH6	Pentode rf/if amplifier
6662/6BJ6	6BJ6	Pentode rf/if amplifier
6663/6AL5	6AL5	Duodiode Detector
6664/6AB4	6AB4	Triode rf amplifier
6669/6AQ5A	6AQ5A	Beam pentode audio power amplifier
6676/6CB6A	6CB6A	Pentode vhf amplifier
6677/6CL6	6CL6	Pentode rf power amplifier
6678/6U8A	6U8A	Triode pentode vhf oscillator/mixer
6679/12AT7	12AT7	Duotriode vhf oscillator/amplifier
6680/12AU7A	12AU7A	Duotriode amplifier/oscillator
6681/12AX7	12AX7	Duotriode af amplifier
6883A	6883	Beam pentode af/rf power amplifier (12-volt battery version of 6146A)
7054	12BY7	Pentode power amplifier
7055	12AL5	Duodiode Detector
7056	—	Pentode vhf amplifier (12-volt battery version of 6676/6CL6)
7057	—	Duotriode vhf amplifier (12-volt battery version of 6BZ7)
7058	12AX7	Duotriode af amplifier
7059	—	Triode pentode vhf oscillator/mixer
7060	—	Triode pentode vhf oscillator/mixer (12-volt battery version of 6AU8)
7061	12AB5	Beam pentode amplifier
7167	—	Tetrode vhf amplifier (12-volt battery version of 6CY5)
7258	—	Triode pentode vhf amplifier (12-volt battery version of 6AN8)
7551	—	Beam pentode amplifier (12-volt battery version of 7558)

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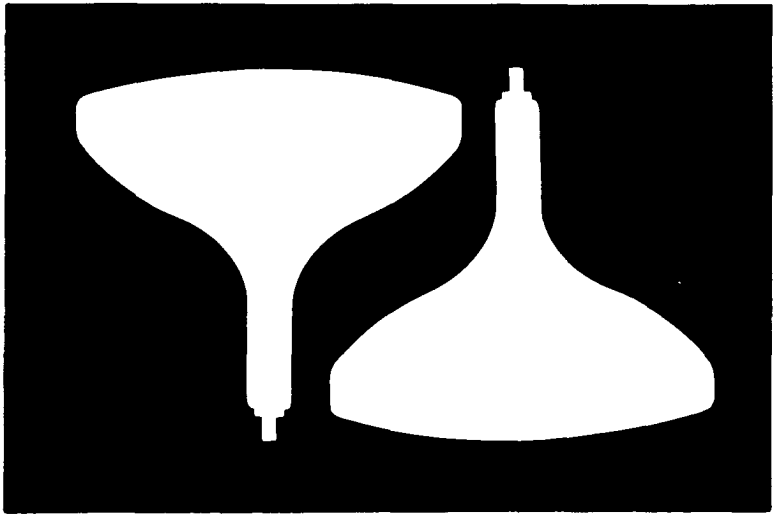
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X-RAY WARNING:

X-Ray radiation shielding may be necessary to protect against possible danger of personal injury from prolonged exposure at close range if a picture tube is operated at higher than the manufacturer's Maximum Rated Anode Voltage or in any case when operated at higher than 16,000 volts.

Precautions must be exercised during the servicing of equipment to assure that all shielding components are replaced to their intended positions before the equipment is operated.



Color TV Picture Tubes Data

Type	Defl. Angle and Neck Dia.◆	FACEPLATE Clear Tinted Alum. Shield* Anti-Refl.	OVERALL DIMENSIONS INCHES Faceplate Dimensions	Length	External Conductive Coating Capacitance (pf)	Base	Basing	Heater▲ Volts/Amps	DESIGN MAXIMUM Anode (Kv)	Convergence Electrode (Kv) Δ
11SP22	72	TA	9.88 x 8.13	14.92	600-800	B12-249	14BJ	13.8/.58	18	Magnetic
11WP22	72	TA-FW	9.87 x 8.12	14.91	600-800	B12-249	14BJ	13.8/.58	18	Magnetic
12DCP22	90	TA-TB	10.98 x 8.89	13.97	500-900	B12-246	14BH	6.3/.90	20	Magnetic
13GP22	90	TA-BF	11.81 x 9.70	13.59	500-1000	B12-246	14BH	6.3/.90	20	Magnetic
14BCP22	70	CA	13.06 x 10.56	19.28	500-1500	B12-131	14AU	6.3/1.8	22	Magnetic
15GP22	45	CA	14.62	26.12	1500-3000	B14-130	20A	6.3/1.8	22	12.1
15HP22	45	CA	14.62	26.12	1500-3000	B14-130	20A	6.3/1.8	22	12.1
15KP22	90	TA	12.90 x 10.39	15.0	550-1050	B12-244	14BH	6.3/.90	22.5	Magnetic
15LP22	90	TA-AR-BP	12.90 x 10.39	15.19	550-1050	B12-244	14BH	6.3/.90	22.5	Magnetic
15MP22	90	TA-AR-BP	12.90 x 10.39	15.83	750-1200	B12-244	14BK	6.3/1.35	24.0	Magnetic
15NP22	90	TA-TB	12.96 x 10.65	15.00	550-1050	B12-244	14BH	6.3/.90	22.5	Magnetic
15RP22	90	TA	12.90 x 10.39	14.72	550-1050	B12-246	14BH	6.3/.90	22.5	Magnetic
15SP22	90	TA-BF	13.53 x 11.02	14.72	550-1050	B12-246	14BH	6.3/.90	22.5	Magnetic
15WP22	90	TA-BP	12.90 x 10.39	14.72	550-1050	B12-246	14BH	6.3/.90	22.5	Magnetic
16CDP22	90	A	13.70 x 11.09	15.12	500-1000	B12-246	14BE	6.3/.90	20	Magnetic
16CSP22	90	TA-BP	13.81 x 11.21	15.12	700-1300	B12-246	14BE	6.3/.80	23	Magnetic
16CYP22	90	TA-BR	13.81 x 11.22	15.70	700-1300	B12-246	14BH	6.3/.90	23	Magnetic
16DAP22	90	TA-BR	13.81 x 11.22	15.12	700-1300	B12-246	14BE	6.3/.90	23	Magnetic
17EJP22	70	TA-BP	15.39 x 12.28	21.62	1000-2000	B12-131	14AU	6.3/1.8	22	Magnetic
17ENP22	70	TA-AR-BP	15.39 x 12.28	21.62	1000-2000	B12-131	14AU	6.3/1.8	22	Magnetic
19EXP22	90	TA	16.87 x 13.34	17.85	1500-2100	B12-244	14BE	6.3/.90	27.5	Magnetic
19EYP22	90	TA-AR-BP	16.85 x 13.65	18.04	1500-2100	B12-244	14BE	6.3/.90	27.5	Magnetic
19FMP22	90	TA-BP	16.87 x 13.65	18.04	1500-2000	B12-244	14BE	6.3/.80	27.5	Magnetic
19FXP22	90	TA-AR-BP	16.96 x 13.65	18.04	1500-2000	B12-244	14BE	6.3/1.35	27.5	Magnetic
19GSP22	90	TA-BP-AR	16.97 x 13.66	18.06	1500-2000	B12-245	14BE	6.3/1.35	27.5	Magnetic
19GVP22	90	TA	16.97 x 13.66	17.85	1400-1900	B12-244	14BE	6.3/.90	27.5	Magnetic
19GWP22	90	TA-AR-BP	16.97 x 13.66	18.04	1400-1900	B12-244	14BE	6.3/.90	27.5	Magnetic
19GYP22	90	TA	17.08 x 13.78	17.52	1000-2000	B12-246	14BE	6.3/.90	25.5	Magnetic
19HBP22	90	TA-BP	16.97 x 13.66	18.04	1400-1900	B12-244	14BE	6.3/.90	27.5	Magnetic
19HCP22	90	TA-BR	17.10 x 13.91	17.85	1500-2100	B12-244	14BE	6.3/.90	27.5	Magnetic
19HNP22	90	TA-BR	17.10 x 13.91	17.85	1500-2100	B12-244	14BA	6.3/.90	22.5	Magnetic
19HQP22	90	TA	16.97 x 13.66	17.57	1400-1900	B12-246	14BE	6.3/.90	27.5	Magnetic
19HRP22	90	TA-AR-BP	16.97 x 13.66	17.77	1400-1900	B12-246	14BE	6.3/.90	27.5	Magnetic
19HXP22	90	TA-BR	17.10 x 14.01	17.87	1500-2000	B12-245	14BE	6.3/1.35	27.5	Magnetic
19HYP22	90	TA-BR	17.10 x 13.91	17.85	1500-2100	B12-244	14BH	6.3/.90	22.5	Magnetic
19TP22	60	TA	19.31	24.75	1500-3000	B14-130	20A	6.3/1.8	24.2	13.2
19VP22	62	TA	19.31	26.43	1500-3000	B12-105	14W	6.3/1.8	29.7	Magnetic
21AXP22	70	TA	20.56	25.31	.....	B12-131	14W	6.3/1.8	27.5	Magnetic
21AXP22A	70	TA	20.56	24.93	.....	B12-131	14AH	6.3/1.8	27.5	Magnetic
21CYP22	70	TA	20.81	25.03	2000-2500	B12-131	14AL	6.3/1.8	27.5	Magnetic
21CYP22A	70	TA	20.81	25.03	2000-2500	B12-131	14AL	6.3/1.6	27.5	Magnetic
21FBP22	70	TA	20.81	25.03	2000-2500	B12-131	14AU	6.3/1.8	27.5	Magnetic
21FBP22A	70	TA	20.81	25.03	2000-2500	B12-131	14AU	6.3/1.8	27.5	Magnetic
21FJP22	70	TA-AR-BP	21.0	25.28	2000-2500	B12-131	14AU	6.3/1.8	27.5	Magnetic
21FJP22A	70	TA-BP	21.0	25.21	2000-2500	B12-131	14AU	6.3/1.8	27.5	Magnetic
21FKP22	70	TA-BP	21.0	25.21	2000-2500	B12-131	14AU	6.3/1.8	27.5	Magnetic
21GFP22	90	TA-AR-BP	18.81 x 15.13	19.45	1500-2000	B12-245	14BE	6.3/1.35	27.5	Magnetic
21GLP22	90	TA-BP-AR	18.81 x 15.56	19.45	1500-2000	B12-244	14BE	6.3/1.35	27.5	Magnetic
21GUP22	70	TA	20.81	25.03	2000-2500	B12-131	14AU	6.3/1.9	27.5	Magnetic
21GVP22	70	TA-AR-BP	21.0	25.21	2000-2500	B12-131	14AU	6.3/1.9	27.5	Magnetic
21GWP22	90	TA-AR-BP	18.81 x 15.13	19.45	1500-2000	B12-245	14BE	6.3/1.35	27.5	Magnetic
21GYP22	70	TA-BP	21.0	25.21	2000-2500	B12-131	14AU	6.3/1.9	27.5	Magnetic
22EP22	70	TA	21.65 x 17.56	25.75	1500-2800	B12-131	14W	6.3/1.8	27.5	Magnetic
22JP22	90	TA-AR-BP	18.95 x 15.23	19.20	1700-2200	B12-244	14BE	6.3/.80	27.5	Magnetic
22KP22	90	TA	18.95 x 15.23	19.01	1700-2200	B12-244	14BE	6.3/.80	27.5	Magnetic
22LP22	90	TA-BP	18.95 x 15.23	19.20	1700-2200	B12-244	14BE	6.3/.80	27.5	Magnetic
22QP22	90	TA-AR-BP	18.97 x 15.23	19.42	1700-2200	B12-244	14BE	6.3/0.9	27.5	Magnetic
22RP22	90	TA	18.97 x 15.23	19.23	1700-2200	B12-244	14BE	6.3/1.35	27.5	Magnetic
22SP22	90	TA-AR-BP	18.97 x 15.23	19.20	2000-2500	B12-244	14BE	6.3/1.35	27.5	Magnetic
22UP22	90	TA-BR	19.11 x 15.52	19.01	2000-2500	B12-244	14BE	6.3/.90	27.5	Magnetic
23EGP22	92	TA-BP	20.50 x 16.50	19.48	2000-2500	B12-245	14BE	6.3/1.35	27.5	Magnetic

Notes—Page 533 **Basings—Page 506**

RATINGS		TYPICAL OPERATION						
Focusing Electrode (Kv)	Screen Grid (G2) Volts	Anode (Kv)	Convergence Electrode (Kv) Δ	Focus Electrode (Kv)	Screen Grid (G2) Volts	Neg. Grid #1 or Positive Cathode Voltage for Raster Cutoff	REMARKS	Type
−.50 to +1.0	1000	15	Magnetic	− .25 to .50	200	30-50		11SP22
−.50 to +1.0	700	15	Magnetic	− .25 to .50	350	40-70	In Line Gun	11WP22
−.55 to +1.1	1000	16	Magnetic	−.075 to .40	390	61-110		12DCP22
−.55 to +1.1	1000	18	Magnetic	−.075 to .40	150-390	57-125	Blue Gun Down	13GP22
5.3	650	16	Magnetic	2.4 to 3.4	200	45-100		14BCP22
5.5	550	20	8.5 to 10.2	2.4 to 3.8	200 140-315	45-100 70		15GP22
5.5	550	20	9.3	3.1	200	45-100		15HP22
−.55 to +1.1	1000	20	Magnetic	−.075 to .400	150-390	57-125	Blue Gun Down	15KP22
−.55 to +1.1	1000	20	Magnetic	−.075 to .400	150-390	57-125	Blue Gun Down	15LP22
5.2	1000	20	Magnetic	3.3 to 4.3	300	50-80	In Line Gun	15MP22
−.55 to +1.1	1000	20	Magnetic	−.075 to .400	150-390	57-125	Blue Gun Down	15NP22
−.55 to +1.1	1000	20	Magnetic	−.075 to .40	150-390	57-125	Blue Gun Down	15RP22
−.55 to +1.1	1000	20	Magnetic	−.075 to .40	150-390	57-125	Blue Gun Down	15SP22
−.55 to +1.1	1000	20	Magnetic	−.075 to .40	150-390	57-125	Blue Gun Down	15WP22
4.8	650	18	Magnetic	3.0 to 3.6	200	45-100		16CDP22
4.8	650	16	Magnetic	2.5 to 3.2	200	45-100		16CSP22
1.1	1000	20	Magnetic	−.075 to 4.0	125-370	60-135		16CYP22
4.8	650	20	Magnetic	3.36 to 4.00	200	50-110	Blue Gun Down	16DAP22
5.3	650	18	Magnetic	2.7 to 3.8	200	45-100		17EJP22
5.3	650	18	Magnetic	2.7 to 3.8	200	45-100		17ENP22
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		19EXP22
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		19EYP22
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		19FMP22
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		19FXP22
6.0	1000	25	Magnetic	4.2 to 5.0	175-460	100		19GSP22
6.0	1000	25	Magnetic	4.2 to 5.0	285-685	95-190		19GVP22
6.0	1000	25	Magnetic	4.2 to 5.0	285-685	95-190		19GWP22
5.5	1000	23	Magnetic	3.8 to 4.6	130-300	50-105		19GYP22
6.0	1000	25	Magnetic	4.2 to 5.0	285-685	95-190		19HBP22
6.0	1000	25	Magnetic	4.2 to 5.0	285-685	95-190		19HCP22
−.55 to +1.1	1000	20	Magnetic	−.075 to .40	150-390	57-125		19HNP22
6.0	1000	25	Magnetic	4.2 to 5.0	285-685	95-190		19HQP22
6.0	1000	25	Magnetic	4.2 to 5.0	285-685	95-190		19HRP22
6.0	1000	25	Magnetic	4.2 to 5.0	175-460	100		19HXP22
−.55 to +1.1	1000	20	Magnetic	−.075 to .40	150-390	57-125	Blue Gun Down	19HYP22
4.4	550	20	8.5 to 10.2	1.95 to 3.25	200	42-78		19TP22
9.9	550	25	Magnetic	6.5 to 8.0	200 150-330	45-100 75		19VP22
6.6	660	25	Magnetic	3.8 to 5.3	200	45-100	Metal Bulb	21AXP22
6.6	660	25	Magnetic	3.8 to 5.3	130-370	70	Metal Bulb	21AXP22A
6.6	660	25	Magnetic	4.2 to 5.0	200	45-100		21CYP22
6.6	660	25	Magnetic	4.2 to 5.0	130-370	70		21CYP22A
6.0	650	25	Magnetic	1.2 to 5.0	200	45-100		21FBP22
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		21FBP22A
6.0	650	25	Magnetic	1.2 to 5.0	200	45-100		21FJP22
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		21FJP22A
6.0	1000	25	Magnetic	1.2 to 5.0	200 130-370	45-100 70		21FKP22
6.0	1000	25	Magnetic	4.12 to 5.00	300-600	150		21GFP22
6.0	1000	25	Magnetic	4.2 to 5.4	400	60-125		21GLP22
6.0	1000	25	Magnetic	4.3 to 4.7	400	90-190		21GUP22
6.0	1000	25	Magnetic	4.2 to 5.00	400	90-190		21GVP22
6.0	1000	25	Magnetic	4.3 to 4.7	300-600	150		21GWP22
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		21GYP22
6.6	880	25	Magnetic	4.0 to 5.1	200 50-225	55-105 60		22EP22
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		22JP22
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		22KP22
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		22LP22
6.0	1000	25	Magnetic	4.2 to 5.0	280-560	150		22QP22
6.0	1000	25	Magnetic	4.4 to 4.8	280-560	150		22RP22
6.0	1000	25	Magnetic	4.4 to 4.8	300-660	150		22SP22
6.0	1000	25	Magnetic	4.2 to 5.0	400	95-190		22UP22
6.0	650	25	Magnetic	4.2 to 5.4	400	60-125		23EGP22

Color TV Picture Tubes Data (cont'd)

Type	Defl. Angle and Neck Dia.◊	FACEPLATE: Clear Tinted Alum. Shield * Anti-Refl.	OVERALL DIMENSIONS INCHES: Faceplate Dimensions	OVERALL DIMENSIONS INCHES: Length	External Conductive Coating Capacitance (pf)	Base	Basing	Heater▲ Volts/Amps	DESIGN MAXIMUM: Anode (Kv)	DESIGN MAXIMUM: Convergence Electrode (Kv) Δ
23EGP22A	92	TA-BP	20.50 x 16.50	19.48	1800-2500	B12-245	14BE	6.3/1.35	27.5	Magnetic
25AP22	90	TA-AR-BP	21.50 x 17.26	20.92	2000-2500	B12-244	14BE	6.3/.90	27.5	Magnetic
25AP22A	90	TA-AR-BP	21.50 x 17.26	20.92	2000-2500	B12-244	14BE	6.3/.90	27.5	Magnetic
25ABP22	90	TA-BP	21.50 x 17.26	20.92	2000-2500	B12-244	14BE	6.3/.90	27.5	Magnetic
25AEP22	90	TA	21.50 x 17.26	20.96	2000-2500	B12-245	14BE	6.3/1.35	2.75	Magnetic
25AFP22	90	TA-AR-BP	21.50 x 17.26	21.16	2000-2500	B12-245	14BE	6.3/1.35	27.5	Magnetic
25AJP22	90	TA-BR	21.64 x 17.55	20.70	2000-2500	B12-244	14BE	6.3/.90	27.5	Magnetic
25AKP22	90	TA-BF	22.24 x 18.00	20.96	2000-2500	B12-245	14BE	6.3/1.35	27.5	Magnetic
25ALP22	90	TA-BF	21.89 x 17.74	20.73	2000-2500	B12-244	14BE	6.3/.90	27.5	Magnetic
25ANP22	90	TA-TB	21.50 x 17.26	20.73	2000-2500	B12-244	14BE	6.3/.90	27.5	Magnetic
25AQP22	90	TA-AR-BR	21.50 x 17.26	20.92	2000-2500	B12-245	14BE	6.3/1.35	27.5	Magnetic
25AWP22	90	TA-BR	21.64 x 17.62	20.72	2000-2500	B12-245	14BE	6.3/1.35	27.5	Magnetic
25AYP22	90	TA-BR	21.64 x 17.55	20.82	2000-2500	B12-244	14BE	6.3/1.35	27.5	Magnetic
25AZP22	90	TA-BR	21.64 x 17.55	20.70	2000-2500	B12-244	14BE	6.3/1.35	27.5	Magnetic
25BP22	90	TA	21.50 x 17.26	20.73	2000-2500	B12-244	14BE	6.3/.90	27.5	Magnetic
25BP22A	90	TA	21.50 x 17.26	20.73	2000-2500	B12-244	14BE	6.3/.90	27.5	Magnetic
25CP22	90	TA-BP	21.50 x 17.26	20.92	2000-2500	B12-244	14BE	6.3/.80	27.5	Magnetic
25FP22	90	TA	21.50 x 17.26	20.92	2000-2500	B12-244	14BE	6.3/1.35	27.5	Magnetic
25GP22	90	TA-AR-BP	21.50 x 17.26	20.12	2000-2500	B12-244	14BE	6.3/1.35	27.5	Magnetic
25WP22	90	TA-AR-BP	21.50 x 17.26	20.92	2000-2500	B12-244	14BE	6.3/1.35	27.5	Magnetic
25XP22	90	TA-AR-BP	21.50 x 17.26	20.92	2000-2500	B12-244	14BE	6.3/.90	27.5	Magnetic
25YP22	90	TA	21.50 x 17.26	20.73	2000-2500	B12-244	14BE	6.3/.90	27.5	Magnetic
25ZP22	90	TA-AR-BP	21.50 x 17.26	21.16	2000-2500	B12-245	14BE	6.3/1.35	27.5	Magnetic

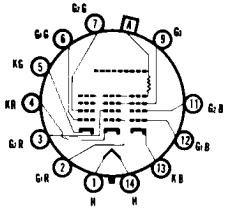
Notes—Page 533 **Basings—Page 506**

Color Check Tubes

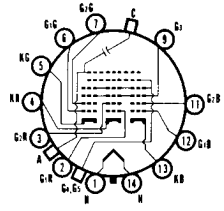
Type	▲ Heater: Ef/If Volts Amps	Face	Body: Metal or Glass	Body: External Coating Capacitance (pf)	Basing	Defl. Angle	Anode Volts ● KV Max.	Nominal Length (In.)
TT19	6.3/.80	□	G	1500/2000	14BE	90	27.5	21.625
TT19B	6.3/.90	□	G	1500/2100	14BE	90	27.5	18.048
TT21	6.3/1.8	○	G	2000/2500	14AU	70	27.5	25.031

These tubes are electrically equivalent to 19", 90° rectangular and 21", 70° round color picture tubes used by all major manufacturers. They can be adapted to check all popular color picture tubes. Additional technical information on these tubes and on their application in TV receiver servicing is available on request.

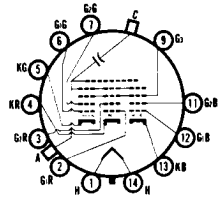
Basing Diagrams (color tubes)



14AH

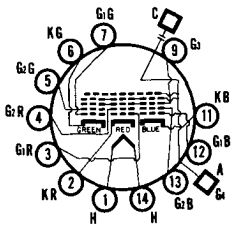


14AL

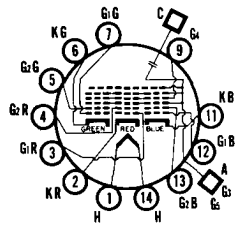


14AU

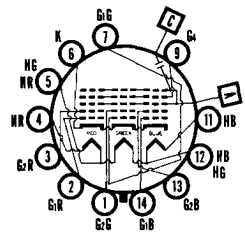
RATINGS		TYPICAL OPERATION					REMARKS	Type
Focusing Electrode (Kv)	Screen Grid (G2) Volts	Anode (Kv)	Convergence Electrode (Kv) Δ	Focus Electrode (Kv)	Screen Grid (G2) Volts	Neg. Grid −1 or Positive Cathode Voltage for Raster Cutoff		
6.0	650	25	Magnetic	4.2 to 5.4	400	60-125		**23EGP22A**
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		**25AP22**
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		**25AP22A**
6.0	1000	25	Magnetic	4.2 to 5.0	285-685	95-190		**25ABP22**
6.0	1000	25	Magnetic	4.5 to 4.9	350-650	150		**25AEP22**
6.0	1000	25	Magnetic	4.4 to 4.8	350-650	150		**25AFP22**
6.0	1000	25	Magnetic	4.2 to 5.0	285-685	95-190		**25AJP22**
6.0	1000	25	Magnetic	4.5 to 4.9	400-700	150		**25AKP22**
6.0	1000	25	Magnetic	4.2 to 5.0	285-685	95-190		**25ALP22**
6.0	1000	25	Magnetic	4.5 to 4.9	300-630	150		**25ANP22**
6.0	1000	25	Magnetic	4.2 to 5.0	174-460	100		**25AQP22**
6.0	1000	25	Magnetic	4.2 to 5.0	175-460	100		**25AWP22**
6.0	1000	25	Magnetic	4.5 to 4.9	380-1000	150		**25AYP22**
6.0	1000	25	Magnetic	4.2 to 5.0	285-685	95-190		**25AZP22**
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		**25BP22**
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		**25BP22A**
6.0	1000	25	Magnetic	4.2 to 5.0	400	90-190		**25CP22**
6.0	1000	25	Magnetic	4.2 to 4.6	350-1000	150		**25FP22**
6.0	1000	25	Magnetic	4.2 to 4.6	350-1000	150		**25GP22**
6.0	1000	25	Magnetic	4.5 to 4.9	300-630	150		**25WP22**
6.0	1000	25	Magnetic	4.2 to 5.0	285-685	95-190		**25XP22**
6.0	1000	25	Magnetic	4.2 to 5.0	285-685	95-190		**25YP22**
6.0	1000	25	Magnetic	4.5 to 4.9	400-700	150		**25ZP22**



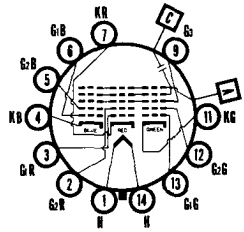
14BE



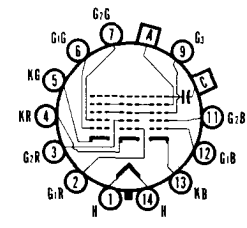
14BH



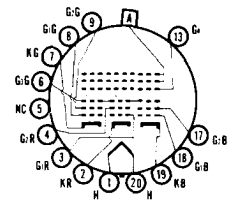
14BJ



14BK



14W



20A

basing diagram symbols

A–Anode **H**–Heater **B**–Blue Gun
C–Conductive Coating **K**–Cathode **G**–Green Gun
G1–Grid No. 1 ■–Locating Lug **R**–Red Gun
G2–Grid No. 2, etc. □–Bulb Terminal

Monochrome TV Picture Tubes Data

Type	Defl. Angle and Neck Dia. ◆	FACEPLATE: Clear Tinted Alum. Shield* Anti-Refl.	OVERALL DIMENSIONS INCHES: Faceplate Dimensions	OVERALL DIMENSIONS INCHES: Length	External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DESIG: Anode (Kv)
2EP4	30	A	2	8¼	300-500	N	B7-208	8JK	6.0/.145	11
5TP4	50	CA	5	11¾	100-500	N	B7-51	12C	6.3/.60	29.7
7DP4	50	C	7⅜	14⅛	400-1500	D	B7-51	12C	6.3/.60	8.8
7RP4	50	CA	7⅜	14⅛	.....	N	B5-57	12D	6.3/.60	13.2
8DP4	90	T	7⅞ x 6⅛	10⅝	250-350	S	B6-185	12AB	6.3/.60	8.8
8KP4	90	TA	7⅞ x 6⅛	11⅞	.....	N	B6-63	12M	6.3/.60	18
9ACP4	90	TA-TB	7⁴¹/₆₄x 6¹⁷/₆₄	8¹⁷/₆₄	300-750	N	E7-91	7GR	12.0/.065	12
9QP4	70	C	8²²/₃₂ x 6¹¹/₁₆	12¾	.....	S	B7-51	12AD	4.7/.30	7.5
9QP4A	70	T	8²²/₃₂ x 6¹¹/₁₆	12¾	.....	S	B7-51	12AD	4.7/.30	7.5
9SP4	90	A-BP	7⅛ x 6⅜	10½	300-500	N	B7-183	8HR	6.3/.60	18
9TP4	110	A-BF	8³¹/₆₄x 7³/₆₄	8⅜	350-600	N	B7-208	8HR	6.3/.45	15
9UP4	90	TA	7⅞ x 6¹³/₆₄	8¹⁷/₆₄	300-750	N	E7-91	7GR	12.6/.075	12
9VP4	90	TA	7⅞ x 6¹³/₆₄	7²⁵/₃₂	300-750	N	E7-91	7GR	12.6/.075	12
9WP4	90	TA-BR	7⁴¹/₆₄x 6¹⁷/₆₄	8²²/₃₂	300-750	N	E7-91	7GR	12.0/.075	12
9YP4	85	TA-TB	8¹³/₆₄x 6½	9¼	400-700	N	E7-91	7GR	12.6/.080	15
10ABP4	90	C	9½ x 7½	11⅞	400-850	S	B6-63	12L	6.3/.60	13.2
10ABP4A	90	CA	9¼ x 7½	11⅞	400-850	S	B6-63	12L	6.3/.60	13.2
10ABP4B	90	T	9¾ x 7½	11⅞	400-850	S	B6-63	12L	6.3/.60	13.2
10ABP4C	90	TA	9¾ x 7½	11⅞	400-850	S	B6-63	12L	6.3/.60	13.2
10ADP4	90	T	9¾ x 7½	11⅞	400-850	S	B6-63	12L	8.4/.45	13.2
10AEP4	90	T	9¾ x 7½	11⅞	400-850	S	B6-63	12L	6.3/.45	13.2
10ARP4	90	TA-TB	8¹⁵/₃₂x 6³⁵/₆₄	9²⁷/₆₄	300-750	N	B7-247	7GR	6.3/.30	13
10BP4	50	C	10½	17⅝	500-2500	D	B5-57	12N	6.3/.60	11
10BP4A	50	T	10½	17⅝	500-2500	D	B5-57	12N	6.3/.60	11
10BP4C	50	CA	10½	17⅝	500-2500	S	B5-57	12N	6.3/.60	11
10BP4D	50	TA	10½	17⅝	500-2500	S	B5-57	12N	6.3/.60	11
10FP4	50	CA	10½	17⅝	500-2500	N	B5-57	12N	6.3/.60	13.2
10FP4A	50	TA	10½	17⅝	500-2500	N	B5-57	12N	6.3/.60	13.2
10MP4	52	C	10½	17	500-2500	D	B5-57	12G	6.3/.60	11
10MP4A	52	T	10½	17	500-2500	D	B5-57	12G	6.3/.60	11
10RP4	50	CA	10½	16½	750-1500	N	B6-63	12L	6.3/.60	17.6
11AP4	110	TA-BL	9¹³/₁₆x 8⅛	8¹⅝	500-750	N	B7-208	8HR	6.3/.45	15
11BP4	110	TA	9¾ x 8	8¹⅝	400-700	N	B7-208	8HR	6.3/.45	15
11CP4	110	TA	9¾ x 8	8¹⅝	500-750	N	B7-208	8HR	6.3/.45	15
11DP4	110	TA	9¾ x 8	8¹⅝	500-750	N	B7-208	8HR	6.3/.45	15
11EP4	114	TA	8¾ x 7⁸/₁₀	8¹⁵/₃₂	300-500	N	B7-208	8HR	6.3/.60	14
11FP4	114	TA	8¾ x 7⁸/₁₀	8¹⁵/₃₂	300-500	N	B7-208	8HR	6.3/.45	14
11GP4	110	TA-BF	10⅜ x 8⅛	8¹⅜	400-600	N	B7-208	8HR	6.3/.45	15
11HP4	110	TA-BR	9³³/₆₄x 7⁴³/₆₄	8¹⅜	500-750	N	B7-208	8HR	6.3/.45	15
11HP4A	110	TA-BR	9³³/₆₄x 8¹/₆₄	8²⁵/₃₂	500-750	N	B7-208	8HR	6.3/.45	15
11JP4	110	TA-BF	10⅜ x 8⅛	8¹⅜	400-600	N	B7-208	8HR	6.3/.30	15
11KP4	110	TA-TB	9¹³/₆₄x 8¹/₆₄	8²⁵/₃₂	500-750	N	B7-208	8HR	6.3/.45	15
11MP4	110	TA-BF	10⅜ x 8⅛	8¹⅜	400-600	N	B7-208	8HR	6.3/.30	15
11QP4	90	TA	9⅞ x 7¹³/₁₆	9²⁹/₆₄	400-800	N	E7-91	7GR	12.6/.075	14
11RP4	90	TA-TB	9³³/₆₄x 7¼	9.0	400-750	N	E7-91	7GR	6.3/.45	15
11TP4	110	TA-TB	9³¹/₆₄x 8³/₆₄	8¹⅜	400-600	N	B7-208	8HR	6.3/.30	15
11UP4	104	TA-TB	9³³/₆₄x 7⁶³/₆₄	9	400-750	N	B7-247	7GR	6.3/.45	15
12AYP4	110	A	10²⁵/₃₂x 8¾	9⅝	400-900	N	B7-208	8HR	6.3/.45	14
12AZP4	110	A	10²⁵/₃₂x 8¾	9⅜	400-900	N	B7-208	8HR	6.3/.60	14
12BAP4	110	A	10²⁵/₃₂x 8¾	9⅜	400-900	N	B7-208	8HR	6.3/.30	14
12BEP4	110	TA-BF	11⅜ x 8³¹/₃₂	9⅝	500-900	N	B6-214	7FA	6.3/.45	16
12BFP4	110	TA	10³¹/₆₄x 8⁴³/₆₄	9²¹/₆₄	400-1200	N	E7-91	7GR	4.2/.45	14
12BGP4	110	TA-BF	11³¹/₃₂ x 9³/₆₄	9⅝	550-850	N	B7-208	8HR	6.3/.45	15
12BJP4	110	TA	10³¹/₆₄x 8⁴³/₆₄	9¹⁵/₆₄	400-900	N	B7-208	8HR	4.2/.45	13
12BKP4	110	TA-TB	10⁴³/₆₄x 8¹⁹/₃₂	9¹¹/₃₂	800-1000	N	B7-208	8HR	6.3/.45	15
12BLP4	110	TA-TB	10⁴³/₆₄x 8¹⁹/₃₂	9¹¹/₃₂	800-1000	N	B7-208	8HR	6.3/.45	16
12BMP4	104	TA-TB	11 x 8⅝	9⅛	500-750	N	E7-91	7GR	6.3/.45	15
12BNP4	110	TA-BR	10⁴³/₆₄x 8¹⁹/₃₂	9¹¹/₃₂	500-750	N	B7-208	8HR	6.3/.45	16
12BNP4A	110	TA-BR	10⁴³/₆₄x 8¹⁹/₃₂	9¹¹/₃₂	500-750	N	B7-208	8HR	6.3/.45	16
12BQP4	110	TA-BR	10⁴³/₆₄x 8¹⁹/₃₂	9¹¹/₃₂	600-900	N	B7-208	8HR	6.3/.45	16
12BRP4	90	TA-BR	11⅜ x 8³¹/₃₂	10²³/₃₂	600-1000	N	E9-94	9RS	12.6/.08	15
12BSP4	110	TA	10³¹/₆₄x 8¾	9¹⁵/₆₄	400-900	N	B7-208	8HR	6.3/.30	14
12BTP4	110	TA-BF	11³¹/₃₂ x 9³/₆₄	9¹¹/₃₂	550-850	N	B7-208	8HR	12.6/.15	15
12BUP4	110	TA-BR	10²⁹/₃₂x 8³⁵/₆₄	9¹⁵/₆₄	450-900	N	B7-208	8HR	6.3/.45	14
12BUP4A	110	TA-BR	10⅞ x 8³³/₆₄	9⅝	450-900	N	B7-208	8HR	6.3/.45	14

Notes—Page 533 **Basing Diagrams—Page 535**

MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	Type
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts / Magnet Coil Current in Ma.	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		
−.55 to +1.1	550	9	−50 to +350	300	20-30	Neck Diameter 1⅛ Inches	2EP4
+6.6m	385	27	4900	200	40-100	Projection Tube	5TP4
+2.6m	450	6	1430	250	25-65		7DP4
Magnetic	450	9	120 Ma.	250	27-63		7RP4
−.55 to +.55	330	8	60 to 360	200	22-51		8DP4
+.8	700	16	0-400	300	35-72		8KP4
−.50 to +1.1	250	10	0 to 300	100	+30 to +60▪	Welded Tension Band, .788" Neck Diameter	9ACP4
−.11 to +.55	330	5.5	0 to 400	200	33-77	4.7 Volt Heater	9QP4
−.11 to +.55	330	5.5	0 to 400	200	35-57	4.7 Volt Heater	9QP4A
−.55 to +1.1	450	14	0-400	300	33-77		9SP4
−.55 to +1.1	60	12	140	50	37-53		9TP4
−.55 to +1.1	250	9	60	100	+35 to +55▪	.788" Neck Diameter	9UP4
−.50 to +1.0	250	9	0 to 300	100	38-94	.788" Neck Diameter	9VP4
−.55 to +1.1	250	9	0 to 300	100	+32 to +50▪	.788" Neck Diameter	9WP4
−.50 to +.50	200	12	−200 to +200	100	+30 to +50▪	.788" Neck Diameter	9YP4
−.55 to +1.1	550	7.5	0 to 500	300	43-67		10ABP4
−.55 to +1.1	550	7.5	0 to 500	300	43-67		10ABP4A
−.55 to +1.1	550	7.5	0 to 500	300	43-67		10ABP4B
−.55 to +1.1	550	7.5	0 to 500	300	43-67		10ABP4C
−.55 to +1.1	550	7.5	0 to 500	300	43-77	8.4 Volt Heater	10ADP4
−.55 to +1.1	550	7.5	0 to 500	300	43-67		10AEP4
−.50 to +1.0	250	9	−250 to +150	140	+31 to +49▪	.840" Neck Diameter	10ARP4
Magnetic	450	9	100 Ma.	250	27-63		10BP4
Magnetic	450	9	110 Ma.	250	27-63		10BP4A
Magnetic	450	9	110 Ma.	250	27-63		10BP4C
Magnetic	450	9	110 Ma.	250	27-63		10BP4D
Magnetic	450	9	110 Ma.	250	27-63		10FP4
Magnetic	450	11	110 Ma.	250	27-63		10FP4A
Magnetic	...	9	.....	...	27-63		10MP4
Magnetic	...	9	.....	...	27-63		10MP4A
−.55 to +1.1	550	14	−55 to +300	300	33-77		10RP4
−.50 to +1.0	250	11	250	150	31-49		11AP4
−.50 to +1.0	250	11	200	150	31-49		11BP4
−.50 to +1.1	550	12	0-400	400	39-94		11CP4
−.50 to +1.0	60	11	−100 to +300	50	31-49		11DP4
−.55 to +1.1	550	10	0 to 400	400	36-94		11EP4
−.55 to +1.1	550	10	0 to 400	400	36-94		11FP4
−.50 to +1.0	200	11	−200 to +200	135	27-43		11GP4
−.50 to +1.0	250	11	0	150	31-49		11HP4
−.50 to +1.0	250	11	0	150	+31 to +49▪	Welded Tension Band	11HP4A
−.50 to +1.1	70	11	−200 to +200	50	27-43		11JP4
−.50 to +1.0	70	11	−100 to +300	50	+31 to +49▪		11KP4
−.50 to +1.1	200	11	−200 to +200	135	27-43		11MP4
−.50 to +1.1	250	10	0 to 300	100	32-50		11QP4
−.50 to +1.0	250	11	0	140	31-49		11RP4
−.50 to +1.0	550	10	0 to 400	400	+36 to +78▪		11TP4
−.50 to +1.0	250	11	0	140	+31 to +49▪	.788" Neck Diameter	11UP4
−.55 to +1.1	550	10	0 to 400	400	36-94		12AYP4
−.55 to +1.1	550	10	0 to 400	400	36-78		12AZP4
−.55 to +1.1	550	10	0 to 400	400	36-78		12BAP4
−.50 to +1.1	50	12	0 to 500	30	25-40		12BEP4
−.55 to +1.1	400	10	0 to 400	200	27-55	.788" Neck Diameter	12BFP4
−.50 to +1.1	60	12	0	50	35-55		12BGP4
−.55 to +1.1	600	10	0 to 400	350	30-60		12BJP4
−.55 to +1.1	70	12	0 to 400	50	35-55		12BKP4
−.55 to +1.1	60	12	0 to 400	30	30-45		12BLP4
−.50 to +1.0	250	11	0	140	31-49	.788" Neck Diameter	12BMP4
−.55 to +1.1	400	12	0 to 400	250	35-65		12BNP4
−.55 to +1.1	400	12	0 to 400	250	35-65	Welded Tension Band	12BNP4A
−.50 to +1.1	70	12	0 to 400	50	+30 to +50▪		12BQP4
−.35 to +.45	50	10	0 to 500	30	25-35	.855" Neck Diameter	12BRP4
−.55 to +1.1	600	10	0 to 400	500	50-93		12BSP4
−.55 to +1.1	60	12	0	50	35-55		12BTP4
−.55 to +1.1	70	12	0 to 400	50	37-49		12BUP4
−.55 to +1.1	70	12	0 to 400	50	+33 to +52▪		12BUP4A

Monochrome TV Picture Tubes Data (cont'd)

Type	Defl. Angle and Neck Dia. ◆	FACEPLATE	OVERALL DIMENSIONS INCHES		External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DESI
		Clear Tinted Alum. Shield* Anti-Refl.	Faceplate Dimensions	Length						Anode (Kv)
12BUP4B	110	TA-TB	10⅞ x 8⁵⁵/₆₄	9¹⁵/₆₄	450-900	N	B7-208	8HR	6.3/.45	14
12BVP4	110	TA-BR	10²⁵/₃₂x 8⁵⁵/₆₄	9²¹/₆₄	450-900	N	E7-91	7GR	12.6/.075	14
12BZP4	104	TA-BR	11 x 8⅝	9¹⁵/₃₂	500-750	N	E7-98	7GR	12/.157	15
12CBP4	110	TA-BR	11 x 9⅝	9⅝	500-900	N	B6-214	7FA	6.3/.45	16
12CDP4	104	TA-TB	11 x 8⅝	9¹⁵/₃₂	500-750	N	E7-98	7GR	6.3/.45	15
12CEP4	110	TA-BF	11²³/₆₄x 9³/₆₄	9¹/₆₄	600-900	N	E7-91	7GR	12.6/.15	15
12CFP4	110	TA-BR	10²⁵/₃₂x 8⁵⁵/₆₄	9²¹/₆₄	450-900	N	E7-91	7GR	4.2/.45	14
12CHP4	110	TA-BR	10²⁵/₃₂x 8⁵⁵/₆₄	9²¹/₆₄	450-900	N	E7-91	7GR	6.3/.45	14
12CNP4	110	TA-BR	10⅞ x 8¹³/₁₆	9¹⁵/₃₂	600-1200	N	E7-91	7GR	4.2/.45	14
12CNP4A	110	TA-TB	10⅞ x 8¹³/₁₆	9¹⁵/₃₂	600-1200	N	E7-91	7GR	4.2/.45	14
12CQP4	110	TA-BF	11¹³/₃₂x 9⅜	9⅝	400-900	N	B7-208	8HR	6.3/.45	15.4
12CSP4	90	TA-BF	11²⁵/₆₄x 9³/₆₄	10¹³/₁₆	600-900	N	E7-91	7GR	12.6/.15	15
12CTP4	110	TA-TB	10⁴³/₆₄x 8¹⁵/₃₂	9¹/₆₄	700-1000	N	E7-91	7GR	6.3/.45	15
12CVP4	100	TA-TB	11 x 8⅝	10¹/₃₂	500-750	N	B7-247	7GR	12.0/.157	15
12CWP4	100	TA-TB	11 x 8⅝	10¹/₃₂	500-750	N	B7-247	7GR	6.3/.45	15
12CZP4	110	TA-TB	10⅞ x 8¹³/₁₆	9²¹/₆₄	400-1200	N	E7-91	7GR	12.6/.075	14
12DEP4	110	TA-TB	10⁴³/₆₄x 8¹⁵/₃₂	9⅜	600-900	N	B7-247	7GR	6.3/.450	15
12DHP4	110	TA-TB	10²⁵/₆₄x 8¹³/₁₆	9¹⁵/₃₂	600-1200	N	B7-208	8HR	6.3/.450	16
12KP4	54	CA	12⅞	17⅝	500-2500	N	B5-57	12N	6.3/.60	13.2
12KP4A	54	TA	12⅞	17⅝	500-2500	N	B5-57	12N	6.3/.60	13.2
12LP4	54	C	12⅞	18¾	750-3000	D	B5-57	12N	6.3/.60	13.2
12LP4A	54	T	12⅞	18¾	750-3000	D	B5-57	12N	6.3/.60	13.2
12LP4C	54	TA	12⅞	18¾	750-3000	D	B5-57	12N	6.3/.60	13.2
12UP4	54	C	12⅞	18¾	.....	S	B5-57	12D	6.3/.60	13.2
12UP4A	54	T	12⅞	18¾	.....	S	B5-57	12D	6.3/.60	13.2
12UP4B	54	T, AR	12⅞	18¾	.....	S	B5-57	12D	6.3/.60	13.2
12VP4	54	C	12⅜	18	750-3000	D	B5-57	12G	6.3/.60	13.2
12VP4A	54	T	12⅜	18	750-3000	D	B5-57	12G	6.3/.60	13.2
12WP4	55	T	12⅞	17¾	750-2000	S	E9-1	9CH	6.3/.60	13.2
12YP4	54	C	12⅞	18¾	750-3000	S	B5-57	12N	6.3/.60	13.2
12ZP4	54	CA	12⅞	17⅝	500-2500	S	B5-57	12N	6.3/.60	13.2
12ZP4A	54	TA	12⅞	17⅝	500-2500	S	B5-57	12N	6.3/.60	13.2
13AP4	110	TA-BF	11¹³/₁₆x 9⅞	9¹³/₆₄	550-850	N	B7-208	8HR	6.3/.45	15
13DP4	110	TA-BF	11²³/₃₂x 9²¹/₆₄	9¹¹/₁₆	500-1000	N	B7-208	8HR	6.3/.45	16
14ACP4	90	TA	13¹/₁₆ x 10⁹/₁₆	14³/₁₆	800-1200	S	B6-63	12L	6.3/.60	15.4
14AEP4	90	TA	13¹/₁₆ x 10⁹/₁₆	13⁹/₁₆	800-1200	N	B6-63	12L	6.3/.60	15.4
14AJP4	110	TA	13⅜ x 10⅞	11⅞	500-850	S	B7-208	8HR	6.3/.60	12.1
14ARP4	90	TA	13 x 10⅝	13¾	800-1200	N	B6-63	12L	6.3/.60	15.4
14ASP4	110	TA	13⅜ x 10⅞	11⅜	500-850	N	B7-208	8HR	6.3/.60	15.4
14ATP4	90	TA	13¹/₁₆ x 10⁹/₁₆	13⁹/₁₆	500-1000	N	B6-63	12L	8.4/.45	15.4
14AUP4	90	TA	13¹/₁₆ x 10⁹/₁₆	13⁹/₁₆	1000-1500	N	B6-63	12L	6.3/.45	16.5
14AVP4	110	TA	13⅜ x 10⅞	11⅜	450-750	N	B7-183/B7-208	8HR	6.3/.60	15.4
14AWP4	90	TA	13¹/₁₆ x 10⁹/₁₆	13⁹/₁₆	800-1200	N	B6-63	12L	6.3/.45	15.4
14BP4	70	T	12½ x 9¹/₁₆	16¹³/₁₆	500-2500	S	B5-57	12N	6.3/.60	13.2
14BP4A	70	T, AR	12½ x 9¹/₁₆	16¹³/₁₆	500-2500	S	B5-57	12N	6.3/.60	13.2
14BAP4	70	TA	12¹⁷/₃₂x 9²³/₃₂	16²³/₃₂	750-2000	N	B6-63/B6-203	12L	6.3/.60	22
14BDP4	70	TA-BP	12¹⁷/₃₂x 9²³/₃₂	17	600-1000	N	B6-63	12L	6.3/.60	22
14CP4	70	T	12½ x 9¹/₁₆	16¾	750-2000	S	B5-57	12N	6.3/.60	15.4
14CP4A	70	TA	12½ x 9¹/₁₆	16¾	750-2000	S	B5-57	12N	6.3/.60	15.4
14CP4B	70	TA	12½ x 9¹/₁₆	16½	750-2000	N	B5-57	12N	6.3/.60	15.4
14DP4	70	T	12½ x 9¹/₁₆	16¾	.....	D	B5-57	12D	6.3/.60	15.4
14EP4	70	T	12¹⁷/₃₂x 9²³/₃₂	16¹⁵/₃₂	750-2000	S	B5-57	12N	6.3/.60	15.4
14GP4	70	T	12¹⁷/₃₂x 9²³/₃₂	16¹³/₁₆	750-2000	S	B6-63	12L	6.3/.60	15.4
14HP4	70	T	12½ x 9¹/₁₆	16¹³/₁₆	750-2000	S	B6-63	12L	6.3/.60	15.4
14NP4	90	T	13¹/₁₆ x 10⁹/₁₆	14³/₁₆	800-1200	S	B6-63	12L	6.3/.60	15.4
14NP4A	90	TA	13¹/₁₆ x 10⁹/₁₆	14³/₁₆	800-1200	S	B6-63	12L	6.3/.60	15.4
14QP4	70	T	12⅝ x 9¾	16³/₃₂	600-1000	S	B6-63	12L	6.3/.60	12.1
14QP4A	70	TA	12⅝ x 9¾	16³/₃₂	600-1000	S	B6-63	12L	6.3/.60	12.1
14QP4B	70	TA	12⅝ x 9¾	16³/₃₂	600-1000	N	B6-63	12L	6.3/.60	12
14RP4	90	T	13¹/₁₆ x 10⁹/₁₆	14³/₁₆	800-1200	S	B6-63	12L	6.3/.60	15.4
14RP4A	90	TA	13¹/₁₆ x 10⁹/₁₆	14³/₁₆	800-1200	S	B6-63	12L	6.3/.60	15.4
14SP4	90	TA	13¹/₁₆ x 10⁹/₁₆	14³/₁₆	900-1200	S	B6-63	12L	6.3/.60	15.4
14UP4	70	TA	12⅝ x 9¾	16³/₃₂	.....	N	B5-57	12D	6.3/.60	15.4
14WP4	90	TA	13¹/₁₆ x 10⁹/₁₆	13⁹/₁₆	800-1200	N	B6-63	12L	6.3/.60	15.4
14XP4	90	T	13¹/₁₆ x 10⁹/₁₆	14³/₁₆	1100-1500	S	B6-63	12L	6.3/.45	16.5

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MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts / Magnet Coil Current in Ma.	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		Type
−.50 to +1.1	70	12	0 to 400	50	+35 to +55▪		12BUP4B
−.55 to +1.1	70	12	0 to 400	50	37-49	.788" Neck Diameter	12BVP4
−.50 to +1.0	200	11	0	100	+31 to +49▪	.788" Neck Diameter	12BZP4
−.50 to +1.1	50	12	0 to 500	50	+30 to +50▪		12CBP4
−.50 to +1.0	250	11	0	140	+31 to +49▪	.788" Neck Diameter	12CDP4
−.50 to +.50	150	12	−200 to +200	100	+30 to +50▪	.788" Neck Diameter	12CEP4
−.55 to +1.1	400	10	0 to 300	200	+27 to +57▪	.788" Neck Diameter	12CFP4
−.55 to +1.1	550	10	0 to 400	300	30-72	.788" Neck Diameter	12CHP4
−.55 to +1.1	400	10	0 to 400	200	+25 to +55▪	.788" Neck Diameter	12CNP4
−.40 to +.55	400	10	0 to 400	200	+25 to +55▪	.788" Neck Diameter	12CNP4A
−.55 to +1.1	60	12	0 to 400	40	+30 to +50▪		12CQP4
−.50 to +.50	150	12	−200 to +200	100	+30 to +50▪	.788" Neck Diameter	12CSP4
−.50 to +.50	150	12	−200 to +200	100	+30 to +50▪	.788" Neck Diameter	12CTP4
−.50 to +1.0	200	11	0	100	+31 to +49▪	.840" Neck Diameter	12CVP4
−.50 to +1.0	250	11	0	140	+31 to +49▪	.840" Neck Diameter	12CWP4
−.55 to +1.1	250	12	0 to 400	100	+33 to +52▪	.788" Neck Diameter	12CZP4
−.50 to +.50	150	12	−200 to +200	100	+30 to +50▪	.840" Neck Diameter	12DEP4
−.55 to +1.1	80	12	0 to 400	50	+30 to +50▪		12DHP4
Magnetic	450	10	135 Ma.	250	27-63		12KP4
Magnetic	450	11	135 Ma.	250	27-63		12KP4A
Magnetic	450	11	110 Ma.	250	27-63		12LP4
Magnetic	450	11	110 Ma.	250	27-63		12LP4A
Magnetic	450	11	110 Ma.	250	27-63		12LP4C
Magnetic	450	11	110 Ma.	250	27-63	Metal Bulb	12UP4
Magnetic	450	11	110 Ma.	250	27-63	Metal Bulb	12UP4A
Magnetic	450	11	130 Ma.	250	27-63	Metal Bulb	12UP4B
Magnetic	...	13.2	.....	...	33-77		12VP4
Magnetic	...	13.2	.....	...	33-77		12VP4A
Magnetic	...	10	240 Gauss	...	27-63	.870" Neck Diameter	12WP4
Auto Es.	450	11	Auto. Es.	250	33-73		12YP4
Magnetic	450	11	135 Ma.	250	27-63		12ZP4
Magnetic	450	11	135 Ma.	250	27-63		12ZP4A
−.50 to +1.1	60	12	0 to 400	50	35-55		13AP4
−.50 to +1.1	50	12	0 to 250	50	+30 to +50▪		13DP4
−.55 to +.55	220	10	−50 to +350	125	45-85		14ACP4
−.55 to +1.1	220	10	−50 to +350	125	37-55		14AEP4
−.55 to +1.1	550	9	−100 to +400	250	29-69		14AJP4
+1.1	77	10	−50 to +350	50	50		14ARP4
−.55 to +1.1	550	12	−50 to +350	300	33-77		14ASP4
−.55 to +1.1	550	14	0 to 400	400	36-95	8.4 Volt Heater	14ATP4
−.55 to +1.1	70	12	0 to 350	50	35-55		14AUP4
−.55 to +1.1	550	12	−50 to +350	300	33-77		14AVP4
−.55 to +1.1	75	14	0 to 400	50	37-52		14AWP4
Magnetic	450	12	110 Ma.	250	33-77		14BP4
Magnetic	450	12	110 Ma.	250	33-77		14BP4A
+.8	700	18	0 to 400	300	33-77		14BAP4
−.50 to +.80	700	18	0 to 400	300	33-77		14BDP4
Magnetic	450	12	115 Ma.	300	33-77		14CP4
Magnetic	450	12	115 Ma.	300	33-77		14CP4A
Magnetic	450	12	115 Ma.	300	33-77		14CP4B
Magnetic	450	11	100 Ma.	250	27-63		14DP4
Magnetic	450	12	110 Ma.	300	33-77		14EP4
+5.5	450	12	2170 to 2940	300	33-77		14GP4
−.55 to +.55	450	12	−48 to +264	300	33-77		14HP4
−.55 to +1.1	550	12	−50 to +350	300	33-77		14NP4
−.55 to +1.1	550	12	−50 to +350	300	33-77		14NP4A
−.55 to +1.1	550	9	−50 to +250	250	29-69		14QP4
−.55 to +1.1	550	9	−50 to +250	250	29-69		14QP4A
−.55 to +1.1	550	9	−50 to +250	250	29-69		14QP4B
−.55 to +.55	440	14	70 to 470	300	31-75		14RP4
−.55 to +.55	440	14	70 to 470	300	31-75		14RP4A
−.55 to +1.1	550	12	−48 to +264	300	33-77		14SP4
Magnetic	550	12	105 Ma.	300	33-77		14UP4
−.55 to +1.1	550	12	−50 to +350	300	33-77		14WP4
−.55 to +1.1	440	12	−50 to +350	300	33-77		14XP4

Monochrome TV Picture Tubes Data (cont'd)

Type	Defl. Angle and Neck Dia. ◆	FACEPLATE: Clear Tinted Alum. Shield* Anti-Refl.	OVERALL DIMENSIONS INCHES: Faceplate Dimensions	OVERALL DIMENSIONS INCHES: Length	External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DESIG: Anode (Kv)
14XP4A	90	TA	13 1/16 x 10 7/16	14 3/16	1100-1500	S	B6-63	12L	6.3/.45	16.5
14ZP4	90	TA	13 1/16 x 10 7/16	13 3/16	800-1200	N	B6-63	12L	6.3/.60	15.4
15ADP4	110	TA-TB	12 5/8 x 10 3/16	10 3/4	700-1100	N	B7-208	8HR	6.3/.45	20
15JP4	110	TA-BF	13 1/16x 10 13/16	11 1/4	600-1000	N	B7-208	8HR	6.3/.45	15
16AP4	53	C	15 7/8	22 1/4	.....	D	B5-57	12D	6.3/.60	15.4
16AP4A	53	T	15 7/8	22 3/16m	.....	D	B5-57	12D	6.3/.60	15.4
16ABP4	70	T	14 3/4 x 11 1/8	18 3/4	750-1500	S	B5-57	12D	6.3/.60	17.6
16ACP4	60	C	15 7/8	20 7/8	2000m	S	B5-57	12D	6.3/.60	15.4
16AEP4	70	T	14 3/4 x 11 1/8	18 3/4	750-1500	S	B6-63	12L	6.3/.60	17.6
16ANP4	114	TA-BP	13 45/64 x 11 1/32	10 7/16	800-1200	N	B7-208	8HR	6.3/.60	18
16AQP4	114	TA-AR-BP	13 45/64 x 11 1/32	10 7/16	800-1200	N	B7-208	8HR	6.3/.60	18
16ASP4	114	TA-BP	13 45/64 x 11 1/32	10 13/32	1000-1500	N	B7-208	8HR	6.3/.60	20
16ATP4	114	TA-BL	13 3/4 x 11 1/32	10 1/8	1000-1500	N	B7-208	8HR	6.3/.45	18
16AUP4	114	TA	13 45/64 x 11 1/32	10 1/16	800-1500	N	B7-237 B7-208	8HR	6.3/.60	15.4
16AVP4	114	TA-BP	13 33/64 x 11 1/32	10 1/16	900-1400	N	B6-214	7FA	6.3/.45	17.6
16AWP4	114	TA-BL	13 3/4 x 11 1/32	10 1/8	1000-1500	N	B7-208/B7-237	8HR	6.3/.30	18
16AXP4	114	TA-BP	13 45/64 x 11 1/32	10 1/8	1000-1500	N	B7-208	8HR	6.3/.45	18
16AYP4	114	TA	13 45/64 x 11 3/64	10 5/16	800-1300	N	B7-208	8HR	6.3/.45	20
16AZP4	114	TA-BL	13 3/4 x 11 1/32	10 3/8	1000-1500	N	B7-208/B7-237	8HR	6.3/.45	18
16BAP4	114	TA-BP	13 45/64 x 11 1/32	10 1/16	1000-1500	N	B7-208	8HR	6.3/.60	18
16BDP4	114	TA	13 45/64 x 11 3/64	10 5/16	800-1300	N	B7-208	8HR	6.3/.60	20
16BEP4	114	TA-BP	13 45/64 x 11 1/32	10 1/16	800-1200	N	B7-208	8HR	6.3/.60	18
16BFP4	114	TA	13 45/64 x 11 1/32	10 1/16	800-1500	N	B7-208	8HR	6.3/.45	15.4
16BGP4	114	TA-BR	13 37/64 x 11 3/64	10 7/16	800-1300	N	B7-208	8HR	6.3/.45	20
16BMP4	114	TA	13 45/64 x 11 1/32	10 1/16	800-1500	N	B7-208	8HR	6.3/.45	15.4
16BNP4	114	TA	13 33/64 x 11 1/32	10 1/2	1000-1500	N	B7-208	8HR	6.3/.60	18
16BRP4	114	TA-BR	13 1/64 x 11 1/32	10 7/32	1000-1500	N	B7-208	8HR	6.3/.60	18
16BSP4	114	TA-BR	13 1/64 x 11 1/32	10 1/32	1000-1500	N	B7-208	8HR	6.3/.45	21
16BUP4	114	TA-BL	13 3/4 x 11 1/32	10 3/8	1000-1500	N	B7-208	8HR	6.3/.45	16
16BVP4	114	TA-TB	13 1/32 x 11 3/16	10 13/32	1050-1450	N	B7-208	8HR	6.3/.45	20
16BWP4	114	TA-BR	13 33/64 x 11 3/16	10 7/16	800-1300	N	B7-208	8HR	6.3/.45	20
16BXP4	114	TA-BF	14 3/8 x 11 3/4	10 7/16	900-1400	N	B6-214	7FA	6.3/.45	17.6
16BYP4	114	TA-BR	13 35/64 x 11 3/16	10 7/16	1000-1500	N	B7-208	8HR	6.3/.45	16
16CP4	52	C	15 7/8	21 1/2	.....	D	B5-57	12D	6.3/.60	16.5
16CAP4	114	TA-BR	13 1/64 x 11 1/32	10 1/32	1000-1500	N	B7-208	8HR	6.3/.45	18
16CEP4	114	TA-BR	13 1/64 x 11 1/32	10 1/32	1000-1500	N	B7-208	8HR	6.3/.45	18
16CFP4	104	TA-BR	13 1/64 x 11 1/32	11 3/64	1000-1500	N	E7-91	7GR	6.3/.45	15
16CHP4	114	TA-BR	13 33/64 x 11 13/64	10 7/16	1000-1500	N	B7-208	8HR	6.3/.45	20
16CHP4A	114	TA-TB	13 33/64 x 11 13/64	10 7/16	1000-1500	N	B7-208	8HR	6.3/.45	20
16CKP4	114	TA-BR	13 1/64 x 11 1/32	10 7/32	1000-1500	N	B7-208	8HR	6.3/.30	18
16CMP4	114	TA-BR	13 1/64 x 11 1/32	10 1/32	1000-1500	N	B7-208	8HR	6.3/.45	18
16CMP4A	114	TA-BR	13 37/64 x 11 7/64	10 7/16	1000-1500	N	B7-208	8HR	6.3/.45	18
16CNP4	104	TA-TB	13 33/64 x 11 7/32	11 3/64	1000-1500	N	E7-98	7GR	12/.157	15
16CQP4	104	TA-TB	13 33/64 x 11 7/32	11 3/64	1000-1500	N	E7-98	7GR	6.3/.45	15
16CTP4	114	TA-TB	13 33/64 x 11 7/32	10 7/32	800-1500	N	B7-208	8HR	6.3/.45	15.4
16CUP4	114	TA-TB	13 33/64 x 11 7/32	10 7/32	800-1500	N	B7-208	8HR	6.3/.45	15.4
16CWP4	100	TA-BR	13 33/64 x 11 7/32	11 43/64	1000-1500	N	B7-247	7GR	6.3/.45	15
16CXP4	100	TA-BR	13 33/64 x 11 7/32	11 43/64	1000-1500	N	B7-247	7GR	12.0/.157	15
16DP4	60	C	15 7/8	20 3/4	.....	D	B5-57	12D	6.3/.60	16.5
16DP4A	60	T	15 7/8	20 3/4	.....	D	B5-57	12D	6.3/.60	16.5
16DCP4A	100	TA-TB	13 3/4 x 11 7/64	11 37/64	1000-1500	N	B7-247	7GR	6.3/.45	15
16EP4	60	C	15 7/8	19 5/16	.....	D	B5-57	12D	6.3/.60	15.4
16EP4A	60	T	15 7/8	19 5/16	.....	D	B5-57	12D	6.3/.60	15.4
16EP4B	60	T, AR	15 7/8	19 5/16	.....	D	B5-57	12D	6.3/.60	15.4
16FP4	62	C	16 1/8	20 1/4	.....	S	B5-57	12D	6.3/.60	17.6
16GP4	70	T	15 7/8	17 11/16m	.....	S	B5-57	12D	6.3/.60	15.4
16GP4A	70	C	15 7/8	17 11/16m	.....	S	B5-57	12D	6.3/.60	15.4
16GP4B	70	T, AR	15 7/8	17 11/16m	.....	S	B5-57	12D	6.3/.60	15.4
16GP4C	70	C, AR	15 7/8	17 11/16m	.....	S	B5-57	12D	6.3/.60	15.4
16HP4	60	C	15 7/8	21 1/4	.....	D	B5-57	12N	6.3/.60	15.4
16HP4A	60	T	15 7/8	21 1/4	.....	D	B5-57	12N	6.3/.60	15.4
16JP4	60	C	16 1/8	20 3/4	750-2000	D	B5-57	12N	6.3/.60	15.4

Notes—Page 533 Basing Diagrams—Page 535

MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts / Magnet Coil Current in Ma.	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		Type
−.55 to +1.1	440	12	−50 to +350	300	33-77		**14XP4A**
−.55 to +1.1	500	12	0 to 450	300	33-77		**14ZP4**
−.50 to +1.15	70	16	−200 to +200	50	+33 to +52*		**15ADP4**
−.50 to +1.1	60	12	0 to 400	50	35-55		**15JP4**
Magnetic	450	12	80 Ma.	300	33-77	Metal Bulb	**16AP4**
Magnetic	450	12	80 Ma.	300	33-77	Metal Bulb	**16AP4A**
Auto. Es.	550	12	Auto Es.	300	33-77		**16ABP4**
Auto. Es.	450	12	Auto. Es.	250	33-68		**16ACP4**
−.55 to +1.1	450	12	−64 to +350	300	33-77		**16AEP4**
−.55 to +1.1	550	14	0 to 400	300	33-70		**16ANP4**
−.55 to +1.1	550	14	0 to 400	300	33-70		**16AQP4**
−.55 to +1.1	550	15	−100 to +300	300	43-70		**16ASP4**
−.50 to +1.0	100	15	0 to 500	50	31-49		**16ATP4**
−.55 to +1.1	550	12	0 to 400	400	36-94		**16AUP4**
−.50 to +1.1	60	15	0 to 500	35	25-50		**16AVP4**
−.50 to +1.0	300	15	0 to 500	150	31-49		**16AWP4**
−.50 to +1.0	550	15	0 to 500	300	40-72		**16AXP4**
−.55 to +1.1	550	16	−100 to +300	300	28-60		**16AYP4**
−.50 to +1.0	250	15	0 to 400	150	31-49		**16AZP4**
−.50 to +1.1	60	15	0 to 400	50	35-53		**16BAP4**
−.55 to +1.1	550	16	−100 to +300	300	28-60		**16BDP4**
−.40 to +1.25	70	14	0 to 400	50	30-48		**16BEP4**
−.50 to +1.1	550	12	0 to 400	400	36-94		**16BFP4**
−.55 to +1.1	550	16	−100 to +300	300	28-60		**16BGP4**
−.55 to +1.1	550	12	0 to 400	400	36-94		**16BMP4**
−.50 to +1.1	60	15	0 to 400	50	35-55		**16BNP4**
−.50 to +1.1	550	15	0 to 400	400	46-94		**16BRP4**
−.50 to +1.1	60	15	0 to 400	50	35-55		**16BSP4**
−.50 to +1.0	200	13	0	100	31-49		**16BUP4**
−.55 to +1.1	550	15	−200 to +200	300	43-70		**16BVP4**
−.55 to +1.1	550	16	−200 to +200	300	35-72		**16BWP4**
−.50 to +1.1	60	15	0 to 500	35	25-50		**16BXP4**
−.50 to +1.0	200	13	0	100	31-49		**16BYP4**
Magnetic	450	12	110 Ma.	250	27-63		**16CP4**
−.50 to +1.1	550	15	0 to 400	400	46-94		**16CAP4**
−.50 to +1.1	550	15	0 to 400	400	46-94		**16CEP4**
−.50 to +1.0	250	11	0	140	31-49		**16CFP4**
−.55 to +1.1	60	16	0 to 400	30	30-45		**16CHP4**
−.55 to +1.1	60	16	0 to 400	30	30-45	Welded Tension Band	**16CHP4A**
−.50 to +1.1	550	15	0 to 400	400	46-94		**16CKP4**
−.50 to +1.1	550	15	0 to 400	400	46-94		**16CMP4**
−.55 to +1.1	550	16	−100 to +300	300	+28 to +60*		**16CMP4A**
−.50 to +1.0	200	11	0	100	+31 to +49*	.788" Neck Diameter	**16CNP4**
−.50 to +1.0	250	11	0	140	+31 to +49*	.788" Neck Diameter	**16CQP4**
−.55 to +1.1	550	12	0 to 400	400	36-94		**16CTP4**
−.55 to +1.1	550	12	0 to 400	400	36-94		**16CUP4**
−.50 to +1.0	250	11	0	140	+31 to +49*	.840" Neck Diameter	**16CWP4**
−.50 to +1.0	200	11	0	100	+31 to +49*	.840" Neck Diameter	**16CXP4**
Magnetic	450	12	115 Ma.	250	27-63		**16DP4**
Magnetic	450	12	115 Ma.	250	27-63		**16DP4A**
−.50 to +1.0	250	11	−200 to +200	140	+31 to +49*	.840" Neck Diameter	**16DCP4A**
Magnetic	450	12	105 Ma.	300	33-77	Metal Bulb	**16EP4**
Magnetic	450	12	105 Ma.	300	33-77	Metal Bulb	**16EP4A**
Magnetic	450	12	105 Ma.	300	33-77	Metal Bulb	**16EP4B**
Magnetic	450	13	146 Ma.	250	27-63		**16FP4**
Magnetic	450	12	100 Ma.	300	33-77	Metal Bulb	**16GP4**
Magnetic	450	12	100 Ma.	300	33-77	Metal Bulb	**16GP4A**
Magnetic	450	12	100 Ma.	300	33-77	Metal Bulb	**16GP4B**
Magnetic	450	12	100 Ma.	300	33-77	Metal Bulb	**16GP4C**
Magnetic	450	12	110 Ma.	300	33-77		**16HP4**
Magnetic	450	12	110 Ma.	300	33-77		**16HP4A**
Magnetic	450	11	115 Ma.	250	27-63		**16JP4**

Monochrome TV Picture Tubes Data (cont'd)

Type	Defl. Angle and Neck Dia. ◆	FACEPLATE: Clear Tinted Alum. Shield* Anti-Refl.	OVERALL DIMENSIONS INCHES: Faceplate Dimensions	OVERALL DIMENSIONS INCHES: Length	External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DES: Anode (Kv)
16JP4A	60	T	16⅛	20¾	750-2000	D	B5-57	12N	6.3/.60	15.4
16KP4	70	T	14¾ x 11½	18¾	750-1500	S	B5-57	12N	6.3/.60	17.6
16KP4A	70	TA	14¾ x 11½	18¾	750-1500	S	B5-57	12N	6.3/.60	17.6
16LP4	52	C	15⅞	22¼	750-2000	D	B5-57	12N	6.3/.60	15.4
16LP4A	52	T	15⅞	22¼	750-2000	D	B5-57	12N	6.3/.60	15.4
16MP4	60	C	16⅛	21¾	1500-3500	D	B5-57	12N	6.3/.60	15.4
16MP4A	60	T	16⅛	21¾	1500-3500	D	B5-57	12N	6.3/.60	15.4
16QP4	70	T	14¾ x 11½	19⅛	.....	D	B5-57	12D	6.3/.60	17.6
16RP4	70	T	14¾ x 11½	18¾	750-1500	S	B5-57	12N	6.3/.60	17.6
16RP4A	70	TA	14¾ x 11½	18¾	750-1500	S	B5-57	12N	6.3/.60	17.6
16RP4B	70	TA	14¾ x 11½	18¾	750-1500	N	B5-57	12N	6.3/.60	17.6
16SP4	70	C	15⅞	17¾₆	1500-3500	D	B5-57	12N	6.3/.60	15.4
16SP4A	70	T	15⅞	17¾₆	1500-3500	D	B5-57	12N	6.3/.60	15.4
16TP4	70	T	14¾ x 11½	18⅛	750-2000	S	B5-57	12N	6.3/.60	15.4
16UP4	70	T	14¾ x 11½	18⅛	.....	S	B5-57	12D	6.3/.60	16.5
16VP4	70	T	15⅞	17¾₆	.....	S	B5-57	12D	6.3/.60	16.5
16WP4	70	T	15⅞	17¾	.....	D	B5-57	12D	6.3/.60	16.5
16WP4A	70	T	15⅞	17¾	750-1500	D	B5-57	12N	6.3/.60	17.6
16WP4B	70	TA	15⅞	17¾	750-1500	D	B5-57	12N	6.3/.60	17.6
16XP4	70	T	14¾ x 11⁷⁄₃₂	18¾	.....	D	B5-57	12D	6.3/.60	16.5
16YP4	70	T	15⅞	17¾₆	750-2000	S	B5-57	12N	6.3/.60	15.4
16ZP4	52	T	15⅞	22¼	750-1500	D	B5-57	12N	6.3/.60	17.6
17AP4	70	T	15⅜ x 12¼	18⅝	750-2000	S	B5-57	12N	6.3/.60	17.6
17ATP4	90	T	15⅜ x 12¼	15⅝	750-1500	S	B6-63	12L	6.3/.60	17.6
17ATP4A	90	TA	15⅜ x 12¼	15⅝	750-1500	S	B6-63	12L	6.3/.60	17.6
17AVP4	90	T	15⅜ x 12¼	15⅝	1200-1500	S	B6-63	12L	6.3/.60	17.6
17AVP4A	90	TA	15⅜ x 12¼	15⅝	1200-1500	S	B6-63	12L	6.3/.60	17.6
17BP4	70	T	15²³⁄₆₄x 12²⁵⁄₃₂	19¹⁄₁₆	.....	S	B5-57	12D	6.3/.60	17.6
17BP4A	70	T	15²³⁄₆₄x 12²⁵⁄₃₂	19¹⁄₁₆	750-1500	S	B5-57	12N	6.3/.60	17.6
17BP4B	70	TA	15²³⁄₆₄x 12²⁵⁄₃₂	19¹⁄₁₆	750-1500	S	B5-57	12N	6.3/.60	17.6
17BP4C	70	T, AR	15²³⁄₆₄x 12²⁵⁄₃₂	19¹⁄₁₆	750-1500	S	B5-57	12N	6.3/.60	17.6
17BP4D	70	TA	15²³⁄₆₄x 12²⁵⁄₃₂	19¹⁄₁₆	750-1500	N	B5-57	12N	6.3/.60	17.6
17BJP4	90	TA	15⅜ x 12²⁵⁄₃₂	15⅝	1000-1500	N	B6-63	12L	6.3/.60	17.6
17BKP4	90	T	15⅜ x 12²⁵⁄₃₂	15⅝	1200-1500	S	B6-63	12L	6.3/.45	17.6
17BKP4A	90	TA	15⅜ x 12²⁵⁄₃₂	15⅝	1200-1500	S	B6-63	12L	6.3/.45	17.6
17BMP4	90	TA	15⅜ x 12²⁵⁄₃₂	15⅝	750-1500	S	B6-63	12L	6.3/.60	19.8
17BNP4	90	TA	15⅜ x 12²⁵⁄₃₂	14⅝	750-1500	N	B6-63	12L	6.3/.60	19.8
17BRP4	110	TA	15⅝ x 12¾	12¹⁵⁄₁₆	1000-1500	S	B7-208	8HR	6.3/.60	16.5
17BSP4	90	TA	15⅜ x 12²⁵⁄₃₂	14⅝	1200-1500	N	B6-63	12L	6.3/.45	17.6
17BTP4	90	TA	15⅜ x 12¼	15⅝	900-1400	S	B7-51	12AJ	6.3/.30	19.8
17BUP4	90	TA	15⅜ x 12²⁵⁄₃₂	15¼	1200-1500	S	B6-63	12L	6.3/.60	19.8
17BVP4	110	TA	15⅝ x 12¾	13¼	1000-1500	S	B6-185	7FA	6.3/.60	17.6
17BWP4	110	TA	15⅝ x 12¾	12¾₆	1000-1500	N	B6-185	7FA	6.3/.60	17.6
17BYP4	110	TA	15⅝ x 12¾	12¾₆	1000-1500	N	B6-185	7FA	6.3/.45	17.6
17BZP4	110	TA	15⅝ x 12¾	12¹⁵⁄₁₆	1000-1500	N	B7-183	8HR	6.3/.60	17.6
17CP4	70	T, AR	15¹³⁄₁₆x 12¼	18⅝	.....	S	B5-57	12D	6.3/.60	17.6
17CP4A	70	T	15¹³⁄₁₆x 12¼	18⅝	.....	S	B5-57	12D	6.3/.60	17.6
17CAP4	110	TA	15⅝ x 12¾	12¹⁵⁄₁₆	1000-1500	N	B7-183/B7-208	8HR	6.3/.60	17.6
17CBP4	90	T	15⅜ x 12²⁵⁄₃₂	15¼	1000-1500	S	B6-63	12L	6.3/.60	19.8
17CDP4	110	TA	15⅝ x 12¾	12¹⁵⁄₁₆	800-1500	N	B7-183/B7-208	8HR	8.4/.45	17.6
17CEP4	90	TA	15⅝ x 12¾	15	1200-1500	N	B6-63	12L	6.3/.45	17.6
17CFP4	90	TA	15⅜ x 12¾	15	1200-1500	N	B6-63	12L	6.3/.60	17.6
17CGP4	70	TA	15⅜ x 12¼	17¹⁵⁄₁₆	500-750	N	B6-63	12L	6.3/.60	15.4
17CKP4	110	TA	15⅜ x 12¾	12¾₆	1000-1500	N	B7-183	8HR	6.3/.60	16.5
17CLP4	90	TA	15⅜ x 12²⁵⁄₃₂	15⅝	1800-2300	S	B6-63	12L	6.3/.60	17.6
17CMP4	90	TA	15⅜ x 12¼	14⅝	1000-1500	N	B6-63	12L	6.3/.60	17.6
17CNP4	90	TA	15⅜ x 12¾	15	1000-1500	N	B6-63	12L	6.3/.60	17.6
17CRP4	90	TA	15⅜ x 12²⁵⁄₃₂	14⅝	1700-2200	N	B6-63	12L	6.3/.45	17.6
17CSP4	110	TA	15⅜ x 12¾	12¾₆	900-1400	N	B6-185	7FA	6.3/.60	17.6
17CTP4	110	TA	15⅝ x 12¾	12¾₆	1000-1500	N	B7-208	8HR	6.3/.45	17.6
17CUP4	90	TA	15⅝ x 12¾	15	1200-1500	N	B6-63	12L	6.3/.30	17.6
17CVP4	110	TA	15⅝ x 12¾	12¾₆	1000-1500	N	B7-183/B7-208	8HR	6.3/.30	17.6
17CWP4	110	TA	15⅝ x 12¾	11⅝	1000-1500	N	B7-183	8HR	6.3/.60	17.6
17CXP4	90	TA	15⅜ x 12¼	14⅝	1000-1500	N	B6-63	12L	6.3/.45	17.6
17CYP4	90	TA	15⅝ x 12¾	14	1000-1500	N	B6-63	12L	6.3/.60	17.6

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MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	Type
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts / Magnet Coil Current in Ma.	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		
Magnetic	450	11	115 Ma.	250	27-63		16JP4A
Magnetic	450	14	90 Ma.	300	33-77		16KP4
Magnetic	450	14	90 Ma.	300	33-77		16KP4A
Magnetic	450	12	110 Ma.	300	33-77		16LP4
Magnetic	450	12	110 Ma.	300	33-77		16LP4A
Magnetic	450	12	110 Ma.	300	33-77		16MP4
Magnetic	450	12	110 Ma.	300	33-77		16MP4A
Magnetic	450	14	150 Ma.	250	27-63		16QP4
Magnetic	450	12	100 Ma.	300	33-77		16RP4
Magnetic	450	12	100 Ma.	300	33-77		16RP4A
Magnetic	450	12	100 Ma.	300	33-77		16RP4B
Magnetic	450	12	110 Ma.	300	33-77		16SP4
Magnetic	450	12	110 Ma.	300	33-77		16SP4A
Magnetic	450	12	115 Ma.	300	33-77		16TP4
Magnetic	450	12	100 Ma.	300	27-63		16UP4
Magnetic	450	12	110 Ma.	250	27-63		16VP4
Magnetic	450	12	110 Ma.	250	27-63		16WP4
Magnetic	450	12	110 Ma.	250	27-63		16WP4A
Magnetic	450	12	110 Ma.	250	27-63		16WP4B
Magnetic	450	12	100 Ma.	250	27-63		16XP4
Magnetic	450	12	100 Ma.	300	33-77		16YP4
Magnetic	450	12	110 Ma.	300	33-77		16ZP4
Magnetic	450	12	100 Ma.	300	33-77		17AP4
−.55 to +1.1	550	14	−55 to +300	300	33-77		17ATP4
−.55 to +1.1	550	14	−55 to +300	300	33-77		17ATP4A
−.55 to +1.1	550	14	−56 to +310	300	33-77		17AVP4
−.55 to +1.1	550	14	−56 to +310	300	33-77		17AVP4A
Magnetic	450	12	100 Ma.	300	33-77		17BP4
Magnetic	450	12	100 Ma.	300	33-77		17BP4A
Magnetic	450	12	100 Ma.	300	33-77		17BP4B
Magnetic	450	12	100 Ma.	300	33-77		17BP4C
Magnetic	450	12	100 Ma.	300	33-77		17BP4D
−.55 to +1.1	550	14	−55 to +300	300	33-77		17BJP4
−.55 to +1.1	550	14	−56 to +310	300	33-77		17BKP4
−.55 to +1.1	550	14	−56 to +310	300	33-77		17BKP4A
−.55 to +1.1	220	14	−55 to +300	110	+37 to +55▪		17BMP4
−.55 to +1.1	220	14	−50 to +350	110	+37 to +55▪		17BNP4
−.55 to +1.1	550	14	0 to 500	300	33-77		17BRP4
−.55 to +1.1	550	14	−50 to +350	300	33-77		17BSP4
−.55 to +.55	550	16	−75 to +235	300	40-80		17BTP4
−.55 to +.55	550	12	−48 to +264	300	33-77		17BUP4
−.55 to +1.1	550	14	−50 to +350	300	40-77		17BVP4
−.55 to +1.1	550	14	−50 to +350	300	40-77		17BWP4
−.55 to +1.1	550	14	0 to 400	300	40-77		17BYP4
−.55 to +1.1	550	14	0 to 400	300	33-77		17BZP4
Magnetic	450	14	104 Ma.	300	33-77	Metal Bulb	17CP4
Magnetic	450	14	104 Ma.	300	33-77	Metal Bulb	17CP4A
−.55 to +1.1	550	14	−50 to +350	300	40-77		17CAP4
−.55 to +1.1	550	12	−50 to +350	300	33-77		17CBP4
−.55 to +1.1	550	14	0 to 400	300	33-77	8.4 Volt Heater	17CDP4
−.55 to +1.1	550	14	−50 to +350	300	33-77	Light Weight Bulb	17CEP4
−.55 to +1.1	550	14	−50 to +350	300	33-77	Light Weight Bulb	17CFP4
−.55 to +1.1	550	11	−56 to +310	300	33-77		17CGP4
−.55 to +1.1	550	14	0 to 500	300	33-77		17CKP4
−.55 to +1.1	550	14	−48 to +264	300	40-77		17CLP4
−.55 to +1.1	70	14	0 to 400	50	+40 to +55▪		17CMP4
−.55 to +1.1	70	14	0 to 400	50	+40 to +55▪	Light Weight Bulb	17CNP4
−.55 to +1.1	70	14	0 to 350	50	+35 to +55▪		17CRP4
−.55 to +1.1	550	14	−50 to +350	300	40-77		17CSP4
−.55 to +1.1	550	14	0 to 400	300	40-77		17CTP4
−.55 to +1.1	550	14	−50 to +350	300	40-77	Light Weight Bulb	17CUP4
−.55 to +1.1	550	14	0 to 400	300	40-77		17CVP4
−.55 to +1.1	550	14	−50 to +350	400	41-97		17CWP4
−.55 to +1.1	75	14	−50 to +350	50	+37 to +52▪		17CXP4
−.55 to +1.1	550	14	−50 to +350	450	44-110	Light Weight Bulb	17CYP4

Monochrome TV Picture Tubes Data (cont'd)

Type	Defl. Angle and Neck Dia. ◆	FACEPLATE: Clear Tinted Alum. Shield* Anti-Refl.	OVERALL DIMENSIONS INCHES: Faceplate Dimensions	OVERALL DIMENSIONS INCHES: Length	External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DESI: Anode (Kv)
17CZP4	90	TA	15⅜ x 12¼	13⅝	1000-1500	N	B6-63	12L	6.3/.60	17.6
17DAP4	110	TA	15⅝ x 12¾	10¹¹⁄₁₆	900-1400	N	B7-208	8JK	2.68/.45	17.6
17DBP4	70	TA	15³¾₆₄x 12⁹⁄₃₂	19¾₆	750-1500	S	B6-63	12L	6.3/.30	17.6
17DCP4	90	TA	15⅜ x 12⁹⁄₃₂	14⅜	1000-1500	N	B6-63	12L	6.3/.30	17.6
17DEP4	110	TA	15⅝ x 12¾	10⁷⁄₁₆	900-1400	N	B7-208	8JN	2.35/.60	17.6
17DHP4	110	TA	15⅝ x 12¾	11¼	1000-1500	N	B7-208	8HR	6.3/.45	17.6
17DJP4	90	TA	15⅜ x 12⁹⁄₃₂	15⅝	1000-1500	S	B6-63	12L	6.3/.30	17.6
17DKP4	110	TA	15⅝ x 12¾	10¹¹⁄₁₆	1000-1500	N	B7-208	8JR	6.3/.60	23
17DLP4	110	TA	15⅝ x 12¾	11¾₆	1000-1500	N	B6-226/B7-237	8JS	6.3/.60	19.8
17DQP4	110	TA	15⅝ x 12¾	12⅛	1200-1700	N	B6-214	7FA	6.3/.45	17.6
17DRP4	110	TA	15⅝ x 12¾	10¹³⁄₁₆	900-1400	N	B7-208	8JK	2.68/.45	17.6
17DSP4	110	TA	15⅝ x 12¾	11¼	1000-1500	N	B7-183	8HR	6.3/.60	19.8
17DTP4	110	TA	15⅝ x 12¾	10¾	1000-1500	N	B7-208	8HR	6.3/.60	22
17DWP4	70	TA	15⅜ x 12⁹⁄₃₂	19¾₆	750-1500	N	B6-63	12L	6.3/.60	22
17DXP4	110	TA	15⅝ x 12¾	10¹¹⁄₁₆	1000-1500	N	B7-208	8JR	6.3/.45	17.6
17DZP4	110	TA	15⅝ x 12¾	10¹¹⁄₁₆	1000-1500	N	B7-208	8HR	6.3/.45	17.6
17EAP4	70	TA	15⅜ x 12¼	19¾₆	1000-1500	S	B5-57	12AT	6.3/.60	17.6
17EBP4	110	TA	15⅝ x 12¾	11¼	1100-1700	N	B7-208	8HR	6.3/.45	20
17EFP4	110	TA	15⅝ x 12¾	11¼	1000-1500	N	B7-183	8HR	6.3/.45	19.8
17EHP4	110	TA	15⅝ x 12¾	11½	1000-1500	N	B7-208	8HR	6.3/.60	20
17EKP4	70	TA-BP	15⅜ x 12⁹⁄₃₂	19⅞	600-1000	N	B6-63	12L	6.3/.60	22
17ELP4	114	TA-BF	15¹¹⁄₆₄x 12⁹⁄₃₂	11¾₆	1150-1650	N	B7-208	8HR	6.3/.45	15
17EMP4	114	TA-BR	14³¾₆₄x 12¹³⁄₆₄	11¾₆	1300-1700	N	B7-208	8HR	6.3/.45	22
17EQP4	114	TA-BF	15¾₆ x 12⁹⁄₃₂	11¼	900-1500	N	B7-208	8HR	6.3/.45	19.8
17ESP4	114	TA-BR	14⁴⁵⁄₆₄x 11³¹⁄₆₄	11¹³⁄₆₄	1000-1400	N	B7-208	8HR	6.3/.45	23
17FP4	70	T	15⅜ x 12¼	19¾₆	500-1500	S	B6-63	12L	6.3/.60	19.8
17FP4A	70	T	15⅜ x 12¼	19¾₆	750-2000	S	B6-63	12L	6.3/.60	19.8
17GP4	70	T, AR	15¹³⁄₁₆x 12¼	19¾₆m	.....	S	B6-63	12M	6.3/.60	17.6
17HP4	70	T	15²³⁄₆₄x 12⁹⁄₃₂	19¾₆	750-1500	S	B6-63	12L	6.3/.60	17.6
17HP4A	70	T, AR	15²³⁄₆₄x 12⁹⁄₃₂	19¾₆	750-1500	S	B6-63	12L	6.3/.60	17.6
17HP4B	70	TA	15²³⁄₆₄x 12⁹⁄₃₂	19¾₆	750-1500	S	B6-63	12L	6.3/.60	17.6
17HP4C	70	TA	15²³⁄₆₄x 12⁹⁄₃₂	19¾₆	750-1500	N	B6-63	12L	6.3/.60	17.6
17JP4	70	T	15²³⁄₆₄x 12⁹⁄₃₂	19¾₆	500-1500	S	B5-57	12N	6.3/.60	19.8
17KP4	70	T	15⅜ x 12¼	19¾₆	1000-1500	S	B6-63	12P	6.3/.60	17.6
17KP4A	70	TA	15⅜ x 12¼	19¾₆	1000-1500	S	B6-63	12P	6.3/.60	17.6
17LP4	70	T	15⅜ x 12¼	19¾₆	750-1500	S	B6-63	12L	6.3/.60	17.6
17LP4A	70	TA	15⅜ x 12¼	19¾₆	750-1500	S	B6-63	12L	6.3/.60	17.6
17LP4B	70	TA	15⅜ x 12¼	19¾₆	750-1500	N	B6-63	12L	6.3/.60	17.6
17QP4	70	T	15⅜ x 12¼	19¾₆	750-1500	S	B5-57	12N	6.3/.60	17.6
17QP4A	70	TA	15⅜ x 12¼	19¾₆	750-1500	S	B5-57	12N	6.3/.60	19.8
17QP4B	70	TA	15⅜ x 12¼	19¾₆	750-1500	N	B5-57	12N	6.3/.60	19.8
17RP4	70	T	15⅜ x 12¼	19¾₆	750-1500	S	B6-63	12L	6.3/.60	17.6
17RP4C	70	TA	15⅜ x 12¼	19¾₆	750-1500	S	B6-63	12L	6.3/.60	17.6
17SP4	70	T	15⅜ x 12¼	19¾₆	500-750	S	B5-57	12N	6.3/.60	15.4
17TP4	70	T, AR	15¹³⁄₁₆x 12¼	19¾₆	.....	S	B6-63	12M	6.3/.60	17.6
17UP4	70	T	15⅜ x 12¼	19¾₆	750-1500	S	B5-57	12N	6.3/.60	15.4
17VP4	70	T	15⅜ x 12⁹⁄₃₂	19¾₆	750-1500	S	B6-63	12L	6.3/.60	17.6
17VP4B	70	TA	15⅜ x 12⁹⁄₃₂	19¾₆	750-1500	S	B6-63	12L	6.3/.60	17.6
17YP4	70	T	15³¾₆₄x 12⁹⁄₃₂	19¾₆	500-1500	S	B5-57	12N	6.3/.60	19.8
19AP4	66	C	18⅝	21½	.....	S	B5-57	12D	6.3/.60	17.6
19AP4A	66	T	18⅝	21½	.....	S	B5-57	12D	6.3/.60	17.6
19AP4B	66	T, AR	18⅝	21½	.....	S	B5-57	12D	6.3/.60	17.6
19AP4C	66	TA	18⅝	21½	.....	S	B5-57	12D	6.3/.60	17.6
19AP4D	66	C, AR	18⅝	21½	.....	S	B5-57	12D	6.3/.60	17.6
19ABP4	114	TA	16¹³⁄₃₂x 13¹¹⁄₃₂	10¹³⁄₁₆	850-1400	N	B7-208	8JK	2.68/.45	20
19ACP4	114	TA	16¹³⁄₃₂x 13¹¹⁄₃₂	12⅜	1000-1500	N	B7-208	8HR	6.3/.60	20
19AEP4	114	TA	16¹³⁄₃₂x 13¹¹⁄₃₂	11⅝	1000-1500	N	B7-208	8HR	12.6/.15	17.6
19AFP4	114	BC, TA	17¹³⁄₁₆x 14³⁄₃₂	11⅜	1000-1500	N	B7-208	8HR	6.3/.60	20
19AHP4	114	TA	16¹³⁄₃₂x 13¹¹⁄₃₂	11⅜	1000-1500	N	B7-208	8HR	6.3/.45	17.6
19AJP4	114	TA	16¹³⁄₃₂x 13¹¹⁄₃₂	11⅜	1400-1900	N	B6-214	7FA	6.3/.45	19.8
19ALP4	114	TA	16¹³⁄₃₂x 13¹¹⁄₃₂	11⅜	1000-1500	N	B7-208	8HR	6.3/.30	22
19ANP4	114	TA	16¹³⁄₃₂x 13¹¹⁄₃₂	10¹³⁄₁₆	1000-1500	N	B7-208	8JR	6.3/.45	20
19AQP4	114	TA	16¹³⁄₃₂x 13¹¹⁄₃₂	11⅜	1000-1500	N	B7-208	8HR	6.3/.30	20
19ARP4	114	BC, TA	17¹³⁄₁₆x 14³⁄₃₂	12⅝	1000-1500	N	B7-208	8HR	6.3/.60	20
19ASP4	114	BC, TA	17¹³⁄₁₆x 14³⁄₃₂	12⅝	1000-1500	N	B7-208	8HR	6.3/.30	20

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MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	Type
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts / Magnet Coil Current in Ma.	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		
−.55 to +1.1	550	14	−50 to +350	450	44-110		**17CZP4**
−.7 to +.95	550	14	+100 to +500	300	40-77	2.68 Volt Heater	**17DAP4**
−.55 to +1.1	550	14	−50 to +300	300	40-77		**17DBP4**
−.55 to +1.1	550	14	−50 to +300	300	40-77		**17DCP4**
+.70	700	14	0 to 400	500	48-77	2.35 Volt Heater; Tri-Potential Focus	**17DEP4**
−.55 to +1.1	770	14	0 to 400	500	48-77	Spherical Face Plate	**17DHP4**
−.55 to +1.1	550	14	−50 to +300	300	40-77	Spherical Face Plate	**17DJP4**
+.70	600	14	0 to 400	500	48-83	Tri-Potential Es. Focus; Spherical Face Plate	**17DKP4**
−.55 to +1.1	770	17	0 to 400	450	33-77	Spherical Face Plate	**17DLP4**
−.55 to +1.1	70	14.5	−200 to +350	50	+40 to +55▪		**17DQP4**
−.7 to +.95	550	14	+100 to +500	300	40-77	2.68 Volt Heater	**17DRP4**
−.55 to +1.1	550	14	0 to 400	400	50-95		**17DSP4**
−.55 to +1.1	550	14	0 to 400	300	33-77		**17DTP4**
800	700	18	0 to 400	300	33-77		**17DWP4**
+.70	600	14	0 to 400	500	48-83	Non-Potential Electrostatic Focus	**17DXP4**
−.5 to +1.0	550	14	0 to 400	300	33-77		**17DZP4**
Auto. Es.	550	12	Auto. Es.	300	33-77		**17EAP4**
−.55 to +1.1	700	14	0 to 400	500	48-77		**17EBP4**
−.55 to +1.1	550	14	0 to 400	400	50-95		**17EFP4**
−.50 to +1.1	60	16	0 to 400	50	35-55		**17EHP4**
−.50 to +.80	700	18	0 to 400	300	33-77		**17EKP4**
−.50 to +1.1	60	12	0 to 400	50	35-55		**17ELP4**
−.40 to +1.25	60	16	0 to 400	50	33-45		**17EMP4**
−.55 to +1.1	550	16	0 to 500	400	+35 to +72▪		**17EQP4**
−.55 to +1.1	550	16	−200 to +200	300	35-72		**17ESP4**
+5.5	450	16	+3100 to +4100	300	33-77		**17FP4**
+5.5	450	16	+3100 to +4100	300	33-77		**17FP4A**
+5.5	550	14	+2200 to +3620	300	33-77	Metal Bulb	**17GP4**
−.55 to +1.1	550	14	−56 to +310	300	33-77		**17HP4**
−.55 to +1.1	550	14	−56 to +310	300	33-77		**17HP4A**
−.55 to +1.1	550	14	−56 to +310	300	33-77		**17HP4B**
−.55 to +1.1	550	14	−56 to +310	300	33-77		**17HP4C**
Magnetic	450	14	100 Ma.	300	33-77		**17JP4**
Auto. Es.	550	12	Auto. Es.	300	33-77		**17KP4**
Auto. Es.	550	12	Auto. Es.	300	33-77		**17KP4A**
−.55 to +1.1	550	14	−56 to +310	300	33-77	Cylindrical Faceplate	**17LP4**
−.55 to +1.1	550	14	−56 to +310	300	33-77	Cylindrical Faceplate	**17LP4A**
−.55 to +1.1	550	14	−56 to +310	300	33-77	Cylindrical Faceplate	**17LP4B**
Magnetic	450	12	100 Ma.	300	33-77	Cylindrical Faceplate	**17QP4**
Magnetic	450	14	95 Ma.	300	33-77	Cylindrical Faceplate	**17QP4A**
Magnetic	450	14	95 Ma.	300	33-77	Cylindrical Faceplate	**17QP4B**
−.55 to +1.1	550	14	−50 to +350	300	33-77		**17RP4**
−.55 to +1.1	550	14	−50 to +350	300	33-77		**17RP4C**
Auto. Es.	450	12	Auto. Es.	250	33-66	Cylindrical Faceplate	**17SP4**
−.55 to +1.1	550	16	−65 to +350	300	33-77	Metal Bulb	**17TP4**
Magnetic	450	13	110 Ma.	250	33-66	Cylindrical Faceplate	**17UP4**
−.55 to +1.1	550	14	−48 to +260	300	33-77	Cylindrical Faceplate	**17VP4**
−.55 to +1.1	550	14	−48 to +260	300	33-77	Cylindrical Faceplate	**17VP4B**
Magnetic	550	16	100 Ma.	300	33-77	Cylindrical Faceplate	**17YP4**
Magnetic	450	12	140 Ma.	300	33-77	Metal Bulb	**19AP4**
Magnetic	450	12	140 Ma.	300	33-77	Metal Bulb	**19AP4A**
Magnetic	450	12	140 Ma.	300	33-77	Metal Bulb	**19AP4B**
Magnetic	450	12	140 Ma.	300	33-77	Metal Bulb	**19AP4C**
Magnetic	450	12	140 Ma.	300	33-77	Metal Bulb	**19AP4D**
−.7 to +.95	550	16	100 to 500	300	40-77	2.68 Volt Heater	**19ABP4**
−.55 to +1.1	70	14	0 to 400	50	+40 to +55▪		**19ACP4**
−.20 to +.50	250	14	−100 to +100	100	32-47		**19AEP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**19AFP4**
−.55 to +1.1	650	14	0 to 400	500	+45 to +68▪		**19AHP4**
−.50 to +1.1	70	14.5	250	50	+36 to +54▪		**19AJP4**
−.55 to +1.1	700	14	0 to 400	500	+50 to +100▪	18 Sec. Heater Warm-up Time	**19ALP4**
−.35 to +.7	600	16	0 to 400	500	48-83	Tri-Potential Electrostatic Focus	**19ANP4**
−.50 to +1.0	550	16	0 to 400	300	38-72		**19AQP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**19ARP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**19ASP4**

Monochrome TV Picture Tubes Data (cont'd)

Type	Defl. Angle and Neck Dia. ◆	FACEPLATE: Clear Tinted Alum. Shield* Anti-Refl.	OVERALL DIMENSIONS INCHES: Faceplate Dimensions	OVERALL DIMENSIONS INCHES: Length	External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DES: Anode (Kv)
19ATP4	114	BC, TA	17 13/64 x 14 3/32	11 1/16	1000-1500	N	B7-208	8JR	6.3/.60	20
19AUP4	114	BC, TA, AR	17 13/64 x 14 3/32	11 3/16	1000-1500	N	B7-208	8HR	6.3/.60	20
19AVP4	114	TA	16 13/16 x 13 1/32	11 3/8	1000-1500	N	B7-208	8HR	6.3/.60	23
19AXP4	114	TA	16 13/32 x 13 1/32	11 3/8	1000-1500	N	B7-208	8HR	6.3/.45	20
19AYP4	114	TA	16 13/32 x 13 1/32	11 3/8	1000-1500	N	B7-208	8HR	6.3/.45	23
19BAP4	114	BC, TA	17 13/64 x 14 3/32	11 3/16	1000-1500	N	B7-208	8HR	6.3/.30	20
19BCP4	114	BC, TA, AR	17 13/64 x 14 3/32	11 5/8	1000-1500	N	B7-208	8HR	6.3/.30	20
19BDP4	92	TA	16 13/32 x 13 1/32	15 1/4	1500-2000	N	B6-63/B6-203	12L	6.3/.60	20
19BEP4	110	TA	16 13/32 x 13 1/32	11 13/16	1000-1500	N	B7-208	8HR	6.3/.30	20
19BFP4	92	TA	16 13/32 x 13 1/32	15 1/4	1500-2000	N	B6-203	12L	6.3/.60	20
19BHP4	114	TA	16 13/32 x 13 1/32	11 3/4	1000-1500	N	B7-237/B7-208	8HR	6.3/.60	22
19BLP4	114	TA	16 13/32 x 13 1/32	11 3/16	1300-1700	N	B7-208	8HR	6.3/.60	20
19BMP4	114	BC, TA	17 13/64 x 14 3/32	11 5/16	1300-1700	N	B7-208	8HR	6.3/.60	20
19BNP4	114	BC, TA	17 13/64 x 14 3/32	12 5/8	1000-1500	N	B7-208	8HR	6.3/.60	20
19BQP4	114	BC, TA, AR	17 13/64 x 14 3/32	12 5/8	1000-1500	N	B7-208	8HR	6.3/.60	20
19BRP4	114	TA-BP	16 13/32 x 13 1/32	11 13/16	1500-2000	N	B7-208	8HR	6.3/.60	23
19BSP4	110	TA	16 13/32 x 13 1/32	11 13/16	1000-1500	N	B7-208	8HR	6.3/.60	20
19BTP4	114	TA	16 13/32 x 13 1/32	10 13/16	1000-1500	N	B7-208	8JR	6.3/.60	23
19BUP4	114	TA	16 13/32 x 13 1/32	11 5/8	1300-1700	N	B7-208	8HR	2.2/.102	18.75
19BVP4	114	TA	16 13/32 x 13 1/32	11 3/4	1000-1500	N	B7-208	8HR	6.3/.60	23.5
19BWP4	114	TA	16 13/32 x 13 1/32	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	23.5
19CAP4	110	TA	16 13/32 x 13 1/32	11 1/8	1000-1500	N	B7-208	8JR	6.3/.60	20
19CDP4	114	TA	16 13/32 x 13 1/32	11 5/8	1400-1900	N	B6-214	7FA	6.3/.60	19.8
19CEP4	114	BC, TA, AR	17 13/64 x 14 3/32	11 5/8	1000-1500	N	B7-208	8HR	6.3/.30	20
19CFP4	114	TA	16 13/32 x 13 1/32	11 1/2	1000-1500	N	B7-237/B7-208	8HR	6.3/.60	17.5
19CGP4	92	BC, TA, AR	17 5/8 x 15 1/4	15 1/2	1400-1700	N	B6-203	12L	6.3/.60	20
19CHP4	114	TA	16 13/32 x 13 1/32	11 5/8	1000-1500	N	B7-208	8HR	6.3/.60	20
19CJP4	114	TA	16 13/32 x 13 1/32	11 3/16	1300-1700	N	B7-208	8HR	6.3/.60	20
19CKP4	114	TA	16 13/32 x 13 1/32	11 3/4	1000-1500	N	B7-237/B7-208	8HR	6.3/.60	22
19CLP4	92	TA	16 13/32 x 13 1/32	15 1/4	1500-2000	N	B6-203	12L	6.3/.60	19.8
19CMP4	114	TA	16 13/32 x 13 1/32	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	20
19CMP4A	114	TA	16 13/32 x 13 1/32	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	23.5
19CQP4	114	TA	16 13/32 x 13 1/32	11 5/8	1400-1900	N	B6-214	7FA	6.3/.60	19.8
19CRP4	92	TA	16 13/32 x 13 1/32	15 1/4	1500-2000	N	B6-203	12L	6.3/.60	22
19CUP4	114	TA	16 13/32 x 13 1/32	11 5/8	1300-1700	N	B7-208	8HR	6.3/.45	22
19CVP4	114	TA-BC	17 13/64 x 14 3/32	11 5/8	1700-2100	N	B7-208	8HR	6.3/.45	23
19CXP4	114	TA	16 13/32 x 13 1/32	11 5/8	1400-1900	N	B6-214	7FA	6.3/.60	19.8
19CYP4	114	TA	16 13/32 x 13 1/32	10 7/8	1000-1500	N	B7-208	8HR	6.3/.60	23
19CZP4	114	TA-BP	16 13/32 x 13 1/32	11 11/16	1000-1500	N	B7-208	8HR	6.3/.45	23
19DP4	66	C	18 5/8	21 1/2	750-2500	S	B5-57	12N	6.3/.60	18.7
19DP4A	66	T	18 5/8	21 1/2	750-2500	S	B5-57	12N	6.3/.60	18.7
19DAP4	114	TA-AR-BP	16 13/32 x 13 1/32	11 5/16	1000-1500	N	B7-208	8HR	6.3/.45	23
19DBP4	114	TA-BP	16 13/32 x 13 1/32	11 13/16	1400-1900	N	B6-214	7FA	6.3/.45	19.8
19DCP4	114	TA-BR	16 11/16 x 13 35/64	11 5/8	1000-1500	N	B7-208	8HR	6.3/.60	20
19DEP4	114	TA	16 13/32 x 13 1/32	11 7/8	1000-1500	N	B7-237/B7-208	8HR	6.3/.60	22
19DFP4	114	TA	16 3/4 x 13 1/32	11 11/16	1300-1700	N	B7-208	8HR	6.3/.60	22
19DHP4	114	TA-BR	16 11/16 x 13 35/64	11 5/8	1000-1500	N	B7-208	8HR	6.3/.60	20
19DJP4	110	TA	16 13/32 x 13 1/32	11 7/8	1000-1500	N	B7-208	8HR	6.3/.30	20
19DKP4	114	TA-BP	16 13/32 x 13 1/32	11 5/16	1000-1500	N	B7-208	8HR	6.3/.60	23
19DLP4	114	TA	16 13/32 x 13 1/32	11 5/8	1000-1500	N	B7-208	8HR	6.3/.60	20
19DNP4	114	TA-BP	16 13/32 x 13 1/32	11 9/16	1000-1500	N	B7-208	8HR	6.3/.60	18
19DQP4	114	TA-BR	16 3/4 x 13 1/2	11 3/8	1000-1500	N	B7-208	8HR	6.3/.45	23
19DRP4	114	TA-BR	16 35/64 x 13 1/2	11 5/8	1250-1750	N	B7-208	8HR	6.3/.60	23
19DSP4	114	TA-BR	16 3/4 x 13 1/2	11 5/8	1000-1500	N	B7-208	8HR	6.3/.60	20
19DUP4	114	TA-BR	16 3/4 x 13 25/64	11 3/4	1150-1550	N	B7-208	8HR	6.3/.45	22
19DVP4	114	TA	16 13/32 x 13 1/32	11 3/4	1000-1500	N	B7-237/B7-208	8HR	6.3/.45	20
19DWP4	114	TA-BR	16 9/16 x 13 13/32	11 3/8	1000-1500	N	B7-208	8HR	6.3/.45	23
19DYP4	114	TA-BC	17 13/64 x 14 3/32	11 5/8	1700-2100	N	B7-208	8HR	6.3/.45	23
19DZP4	114	TA	16 13/32 x 13 1/32	11 3/4	1000-1500	N	B7-237/B7-208	8HR	6.3/.45	18
19EP4	70	T	17 x 13 13/32	21 1/8	.....	N	B5-57	12D	6.3/.60	20.9

Notes—Page 533 **Basing Diagrams—Page 535**

MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts / Magnet Coil Current in Ma.	Accel. Grid (G2) Volts	Negative Grid No. 1 *or Positive* Cathode Voltage for Raster Cutoff		Type
+.70	600	16	0 to 400	500	48-83	Tri-Potential Electrostatic Focus	**19ATP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**19AUP4**
−.55 to +1.1	550	20	0 to 400	400	41-99		**19AVP4**
−.55 to +1.1	550	16	0 to 400	400	41-99		**19AXP4**
−.55 to +1.1	550	20	0 to 400	400	41-99		**19AYP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**19BAP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**19BCP4**
−.40 to +1.25	225	14.5	250	50	+36 to +54■		**19BDP4**
−.55 to +1.1	550	16	0 to 400	400	42-78		**19BEP4**
−.55 to +1.1	550	16	0 to 400	400	41-99		**19BFP4**
−.55 to +1.1	700	18.5	0 to 500	450	33-66		**19BHP4**
−.55 to +1.1	550	16	0 to 400	400	41-99		**19BLP4**
−.55 to +1.1	550	16	0 to 400	400	41-99		**19BMP4**
−.55 to +1.1	70	16	0 to 400	50	+37 to +55■		**19BNP4**
−.55 to +1.1	70	16	0 to 400	50	+37 to +55■		**19BQP4**
−.55 to +1.1	550	16	0 to 400	300	35-72		**19BRP4**
−.55 to +1.1	550	16	0 to 400	400	42-78		**19BSP4**
−.35 to +.70	600	16	0 to 400	500	48-83	Tri-Potential Electrostatic Focus	**19BTP4**
−.20 to +.50	250	14	0 to 400	100	45-60		**19BUP4**
−.55 to +1.1	700	20	250	500	+50 to +100■		**19BVP4**
−.55 to +1.1	700	20	250	500	+50 to +100■		**19BWP4**
−.35 to +.70	600	16	0 to 400	500	48-83	Tri-Potential Electrostatic Focus	**19CAP4**
−.50 to +1.1	70	16	0 to 500	50	35-50		**19CDP4**
−.55 to +1.1	550	16	0 to 400	300	40-77	18 Second Heater Warm-up Time	**19CEP4**
−.50 to +1.0	100	13	0	50	31-49		**19CFP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**19CGP4**
−.40 to +1.25	70	16	0 to 400	50	32-50		**19CHP4**
−.55 to +1.1	550	16	0 to 400	400	65-105		**19CJP4**
−.50 to +1.0	100	18	0 to 500	50	31-49		**19CKP4**
−.50 to +1.1	40	14.5	0 to 500	35	25-40		**19CLP4**
−.55 to +1.1	60	16	0 to 400	30	30-45		**19CMP4**
−.55 to +1.1	60	16	0 to 400	30	30-45		**19CMP4A**
−.50 to +1.1	60	16	0 to 500	50	25-50		**19CQP4**
−.50 to +1.1	60	16	0 to 500	35	25-50		**19CRP4**
−.55 to +1.1	80	16	−100 to +300	65	41-56		**19CUP4**
−.40 to +1.25	70	16	0 to 400	50	32-50		**19CVP4**
−.50 to +1.1	55	16	0 to 500	45	35-50		**19CXP4**
−.50 to +1.0	550	20	0 to 400	400	36-94		**19CYP4**
−.55 to +1.1	550	20	0 to 400	400	42-78		**19CZP4**
Magnetic	450	13	146 Ma.	250	26-63		**19DP4**
Magnetic	450	13	146 Ma.	250	26-63		**19DP4A**
−.55 to +1.1	550	20	0 to 400	400	42-78		**19DAP4**
−.50 to +1.1	60	16	0 to 500	40	35-50		**19DBP4**
−.50 to +1.0	550	16	0 to 400	400	39-94		**19DCP4**
−.50 to +1.0	500	18	0 to 500	300	36-54		**19DEP4**
−.55 to +1.1	80	16	−100 to +300	65	41-56		**19DFP4**
−.50 to +1.1	60	16	250	50	35-55		**19DHP4**
−.55 to +1.1	700	16	0 to 400	400	+42 to +78■	16 Second Heater Warm-up Time	**19DJP4**
−.55 to +1.1	550	20	0 to 400	400	46-94		**19DKP4**
−.50 to +1.1	60	16	250	50	35-55		**19DLP4**
−.55 to +1.1	550	16	0 to 400	300	35-72		**19DNP4**
−.55 to +1.1	550	16	−100 to +300	300	28-62		**19DQP4**
−.55 to +1.1	550	16	−100 to +300	300	28-62		**19DRP4**
−.40 to +1.25	70	16	−100 to +300	50	32-50		**19DSP4**
−.55 to +1.1	60	16	−200 to +200	50	33-45		**19DUP4**
−.50 to +1.0	250	16	−250 to +150	150	36-54		**19DVP4**
−.55 to +1.1	550	20	−200 to +200	400	50-98		**19DWP4**
−.40 to +1.25	70	16	0 to 400	50	32-50		**19DYP4**
−.50 to +1.0	250	13	−250 to +150	150	36-54		**19DZP4**
Magnetic	450	13	146 Ma.	250	26-63		**19EP4**

Monochrome TV Picture Tubes Data (cont'd)

Type	Defl. Angle and Neck Dia. ◆	FACEPLATE: Clear Tinted Alum. Shield* Anti-Refl.	OVERALL DIMENSIONS INCHES: Faceplate Dimensions	OVERALL DIMENSIONS INCHES: Length	External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DESIG: Anode (Kv)
19EAP4	114	TA-BR	16 3/4 x 13 1/2	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	20
19EBP4	114	TA-BF	17 1/8 x 14 5/64	11 5/8	1000-1500	N	B7-208	8HR	6.3/.60	23
19ECP4	114	TA	16 13/32 x 13 11/32	11 3/4	1000-1500	N	B7-237/ B7-208	8HR	6.3/.45	20
19EDP4	114	TA-BR	16 25/32 x 13 11/32	11 5/8	1000-1500	N	B7-208	8HR	6.3/.60	23
19EFP4	114	TA-BR	16 11/16 x 13 39/64	11 5/8	1000-1500	N	B7-208	8HR	6.3/.60	20
19EGP4	114	TA-BF	17 1/8 x 14 5/64	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	21
19EHP4	114	TA-BR	16 25/32 x 13 11/32	11 5/8	1000-1500	N	B7-208	8HR	6.3/.60	18
19EHP4A	114	TA-BR	16 25/32 x 13 11/32	11 5/8	1000-1500	N	B7-208	8HR	6.3/.60	18
19EJP4	114	TA-BR	16 3/4 x 13 1/16	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	20
19EKP4	114	TA-BF	17 1/32 x 14 1/32	11 5/8	1000-1500	N	B6-214	7FA	6.3/.45	19.8
19ELP4	114	TA	16 13/32 x 13 11/32	11 3/8	1000-1500	N	B7-208	8HR	6.3/.60	18
19ENP4	114	TA-BR	16 11/16 x 13 39/64	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	21
19ENP4A	114	TA-BR	16 11/16 x 13 39/64	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	21
19ESP4	114	TA-BR	16 3/4 x 13 7/16	11 5/8	1000-1500	N	B7-208	8HR	6.3/.60	20
19ETP4	114	TA-BR	16 11/16 x 13 39/64	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	21
19EUP4	114	TA-BR	16 13/32 x 13 11/32	11 5/8	1000-1500	N	B7-208	8HR	6.3/.60	23
19EZP4	114	TA-BF	16 7/8 x 13 13/16	11 5/8	1000-1500	N	B6-214	7FA	6.3/.45	19.8
19FP4	66	T	18 7/8	22	.....	D	B5-57	12D	6.3/.60	20.9
19FBP4	114	TA-BF	17 1/8 x 14 5/64	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	15
19FCP4	114	TA-BR	16 7/16 x 13 1/32	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	23
19FEP4	114	TA-BR	16 3/4 x 13 7/16	11 5/8	1250-1750	N	B7-208	8HR	6.3/.45	20
19FEP4A	114	TA-BR	16 3/4 x 13 7/16	11 5/8	1250-1750	N	B7-208	8HR	6.3/.45	23.5
19FEP4B	114	TA-TB	16 3/4 x 13 7/16	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	23.5
19FGP4	114	TA-BR	16 7/16 x 13 1/32	10 13/16	1000-1500	N	B7-208	8HR	6.3/.60	20
19FHP4	114	TA-BR	16 11/16 x 13 39/64	11 5/8	1000-1500	N	B7-208	8HR	6.3/.60	21
19FJP4	114	TA-BR	16 25/32 x 13 11/32	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	18
19FJP4A	114	TA-BR	16 3/4 x 13 1/2	11 5/8	1250-1750	N	B7-208	8HR	6.3/.45	18
19FKP4	110	TA-BF	17 1/8 x 14 5/64	11 13/16	1000-1500	N	B7-208	8HR	6.3/.30	20
19FLP4	114	TA-BR	16 3/4 x 13 1/2	11 5/8	1250-1750	N	B7-208	8HR	6.3/.45	23
19FNP4	114	TA-BR	16 3/4 x 13 1/2	11 5/8	1250-1750	N	B7-208	8HR	6.3/.60	23
19FRP4	114	TA-BR	16 3/4 x 13 1/2	11 3/8	1250-1750	N	B7-208	8HR	6.3/.30	23
19FTP4	114	TA-BR	16 11/16 x 13 39/64	11 1/2	1000-1500	N	B7-208	8HR	6.3/.45	21
19FWP4	114	TA	16 13/32 x 13 11/32	11 3/8	1000-1500	N	B7-208	8HR	4.2/.45	20
19FZP4	110	TA-BP	16 13/32 x 13 11/32	11 3/16	1000-1500	N	B7-208	8HR	6.3/.30	20
19GAP4	114	TA-BF	16 7/8 x 13 13/16	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	19.8
19GBP4	114	TA-BP	16 13/32 x 13 11/32	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	23
19GEP4	114	TA-BR	16 3/4 x 13 29/64	11 5/8	1250-1750	N	B7-208	8HR	6.3/.45	23
19GEP4A	114	TA-BR	16 3/4 x 13 29/64	11 5/8	1250-1750	N	B7-208	8HR	6.3/.45	23
19GHP4	114	TA-BR	16 43/64 x 13 61/64	11 3/4	1150-1550	N	B7-208	8HR	6.3/.45	22
19GJP4	114	TA-BR	16 7/16 x 13 31/64	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	23
19GJP4A	114	TA-BR	16 7/16 x 13 31/64	11 5/8	1000-1500	N	B7-208	8HR	6.3/.45	23
19GKP4	114	TA-BR	16 3/4 x 13 1/2	11 5/8	1250-1750	N	B7-208	8HR	6.3/.30	23
19GMP4	114	TA-BP	17 13/64 x 14 3/32	11 5/8	700-900	N	B7-208	8HR	6.3/.45	23
19HAP4	114	TA-BF	17 1/8 x 14 5/64	11 5/8	1000-1500	N	B7-208	8HR	6.3/.315	21
19HGP4	114	TA-BR	16 25/64 x 13 13/32	11 3/8	1000-1700	N	B7-208	8HR	6.3/.45	20
19XP4	114	TA	16 13/32 x 13 11/32	11 3/8	1000-1500	N	B7-208	8HR	6.3/.60	20
19YP4	114	TA	16 13/32 x 13 11/32	10 13/16	1000-1500	N	B7-208	8JR	6.3/.60	20
19ZP4	114	TA	16 13/32 x 13 13/32	11 1/2	1000-1500	N	B6-226/B7-237	8JS	6.3/.60	20
20ABP4	114	TA-BR	16 7/8 x 13 7/64	12 17/64	700-900	N	B7-208	8HR	6.3/.45	23
20ADP4	114	TA-TB	16 7/8 x 13 7/64	12 17/64	1500-2000	N	B7-208	8HR	6.3/.45	23
20AEP4	114	TA-TB	16 7/8 x 13 5/16	12 17/64	1500-2200	N	B7-208	8HR	6.3/.45	23.5
20CP4	70	T	18 1/16 x 14 13/16	21 7/16	.....	S	B5-57	12D	6.3/.60	19.8
20CP4A	70	T	18 1/16 x 14 13/16	21 7/16	500-1500	S	B5-57	12N	6.3/.60	19.8
20CP4B	70	TA	18 1/16 x 14 13/16	21 7/16	.....	S	B5-57	12D	6.3/.60	19.8
20CP4C	70	T, AR	18 1/16 x 14 13/16	21 7/16	.....	S	B5-57	12D	6.3/.60	19.8
20CP4D	70	TA	18 1/16 x 14 13/16	21 7/16	500-1500	S	B5-57	12N	6.3/.60	19.8
20DP4	70	T	18 1/16 x 14 13/16	21 3/4	.....	S	B5-57	12D	6.3/.60	19.8
20DP4A	70	T	18 1/16 x 14 13/16	21 3/4	500-1500	S	B5-57	12N	6.3/.60	19.8
20DP4B	70	TA	18 1/16 x 14 13/16	21 3/4	.....	S	B5-57	12D	6.3/.60	19.8
20DP4C	70	TA	18 1/16 x 14 13/16	21 3/4	500-1500	S	B5-57	12N	6.3/.60	19.8
20DP4D	70	TA	18 1/16 x 14 13/16	21 3/4	500-1500	N	B5-57	12N	6.3/.60	19.8
20FP4	70	T	18 1/16 x 14 13/16	21 3/4	.....	S	B6-63	12M	6.3/.60	19.8
20GP4	70	T	18 1/16 x 14 13/16	21 3/4	500-750	S	B6-63	12L	6.3/.60	19.8
20HP4	70	T	18 1/16 x 14 13/16	21 3/4	.....	S	B6-63/B6-203	12M	6.3/.60	17.6

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MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	Type
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts / Magnet Coil Current in Ma.	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		
−.40 to +1.25	70	16	−100 to +300	50	32-50		**19EAP4**
−.50 to +1.0	550	16	0 to 400	400	39-94		**19EBP4**
−.50 to +1.0	250	16	−250 to +150	150	36-54		**19ECP4**
−.55 to +1.1	550	20	0 to 400	400	46-94		**19EDP4**
−.50 to +1.1	60	16	250	50	35-55		**19EFP4**
−.50 to +1.0	60	16	250	50	35-55		**19EGP4**
−.55 to +1.1	550	16	0 to 400	300	35-72		**19EHP4**
−.55 to +1.1	550	16	0 to 400	300	35-72		**19EHP4A**
−.55 to +1.1	60	16	0 to 400	30	30-45		**19EJP4**
−.50 to +1.1	55	16	0 to 500	45	35-50		**19EKP4**
−.55 to +1.1	550	14	0 to 400	400	36-94		**19ELP4**
−.50 to +1.0	60	16	0 to 400	50	32-50		**19ENP4**
−.50 to +1.0	60	16	0 to 400	50	32-50	Welded Tension Band	**19ENP4A**
−.55 to +1.1	70	16	0 to 400	50	32-50		**19ESP4**
−.50 to +1.0	60	16	0 to 400	50	32-50		**19ETP4**
−.50 to +1.0	550	16	0 to 400	400	39-94		**19EUP4**
−.50 to +1.1	55	16	0 to 500	45	35-50		**19EZP4**
Magnetic	450	13	120 Ma.	250	27-63		**19FP4**
−.50 to +1.0	60	12	0 to 400	50	35-55		**19FBP4**
−.55 to +1.1	550	20	−200 to +200	400	50-98		**19FCP4**
−.55 to +1.1	60	16	0 to 400	30	30-45		**19FEP4**
−.55 to +1.1	60	16	0 to 400	30	30-45		**19FEP4A**
−.55 to +1.1	60	16	0 to +400	30	22-45		**19FEP4B**
−.35 to +.70	600	16	0 to 400	500	43-78		**19FGP4**
−.50 to +1.0	550	16	0 to 400	400	39-94		**19FHP4**
−.55 to +1.1	550	16	0 to 400	300	35-72		**19FJP4**
−.55 to +1.1	550	16	0 to 400	400	+40 to +76▪		**19FJP4A**
−.55 to +1.1	550	16	0 to +400	300	35-72		**19FKP4**
−.55 to +1.1	550	16	−100 to +300	300	28-62		**19FLP4**
−.55 to +1.1	550	16	0 to 400	300	28-62		**19FNP4**
−.55 to +1.1	550	16	−100 to +300	300	28-62		**19FRP4**
−.50 to +1.0	550	16	0 to 400	400	39-94		**19FTP4**
−.55 to +1.1	600	16	0 to 400	500	50-93		**19FWP4**
−.55 to +1.1	550	16	0 to 400	400	42-78		**19FZP4**
−.50 to +1.1	550	16	0 to 500	400	+35 to +72▪		**19GAP4**
−.50 to +1.1	550	20	0 to 500	400	+45 to +70▪		**19GBP4**
−.55 to +1.1	550	18	0 to 400	400	+36 to +78▪		**19GEP4**
−.55 to +1.1	550	18	0 to 400	400	+36 to +78▪	Welded Tension Band	**19GEP4A**
−.40 to +1.25	80	16	−200 to +200	50	+33 to +45▪		**19GHP4**
−.55 to +1.1	550	20	−200 to +200	400	50-98		**19GJP4**
−.55 to +1.1	550	20	−200 to +200	400	50-98	Welded Tension Band	**19GJP4A**
−.55 to +1.1	550	16	0 to 400	300	28-62		**19GKP4**
−.40 to +1.25	70	16	0 to 400	50	32-50		**19GMP4**
−.50 to +1.0	60	16	250	50	35-55		**19HAP4**
−.50 to +1.1	250	16	0 to 400	150	+38 to +62▪		**19HGP4**
−.55 to +1.1	550	16	0 to 400	400	41-99		**19XP4**
−.35 to +.70	600	16	0 to 400	500	48-83	Tri-Potential Electrostatic Focus	**19YP4**
−.50 to +1.0	700	16.5	0 to 500	450	33-77		**19ZP4**
−.40 to +1.25	70	16	−200 to +200	50	+32 to +52▪		**20ABP4**
−.40 to +1.25	60	16	−200 to +200	35	+30 to +42▪		**20ADP4**
−.55 to +1.1	60	16	0 to 400	30	+30 to +45▪		**20AEP4**
Magnetic	450	16	110 Ma.	300	33-77		**20CP4**
Magnetic	450	16	110 Ma.	300	33-77		**20CP4A**
Magnetic	450	16	110 Ma.	300	33-77		**20CP4B**
Magnetic	450	16	110 Ma.	300	33-77		**20CP4C**
Magnetic	450	16	110 Ma.	300	33-77		**20CP4D**
Magnetic	450	16	110 Ma.	300	33-77		**20DP4**
Magnetic	450	16	110 Ma.	300	33-77		**20DP4A**
Magnetic	450	16	110 Ma.	300	33-77		**20DP4B**
Magnetic	450	16	110 Ma.	300	33-77		**20DP4C**
Magnetic	450	16	110 Ma.	300	33-77		**20DP4D**
+5.5m	450	12	2300 to 3200	300	33-77		**20FP4**
+5.5m	450	16	3150 to 4270	300	33-77		**20GP4**
−.55 to +1.1	550	14	−56 to +310	300	33-77		**20HP4**

Monochrome TV Picture Tubes Data (cont'd)

Type	Defl. Angle and Neck Dia. ♦	FACEPLATE: Clear Tinted Alum. Shield* Anti-Refl.	OVERALL DIMENSIONS INCHES: Faceplate Dimensions	OVERALL DIMENSIONS INCHES: Length	External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DESI: Anode (Kv)
20HP4A	70	T	18 1/16 x 14 1/16	21 3/4	500-1500	S	B6-63/B6-203	12L	6.3/.60	17.6
20HP4B	70	T, AR	18 1/16 x 14 1/16	21 3/4	.....	S	B6-63/B6-203	12M	6.3/.60	17.6
20HP4C	70	TA	18 1/16 x 14 1/16	21 3/4	.....	S	B6-63/B6-203	12M	6.3/.60	17.6
20HP4D	70	TA	18 1/16 x 14 1/16	21 3/4	500-1500	S	B6-63/B6-203	12L	6.3/.60	17.6
20HP4E	70	TA	18 1/16 x 14 1/16	21 3/4	500-1500	N	B6-63/B6-203	12L	6.3/.60	17.6
20JP4	70	T	18 1/16 x 14 1/16	21 3/4	500-750	S	B5-57	12P	6.3/.60	19.8
20LP4	70	T	18 1/16 x 14 1/16	21 3/4	750-1500	S	B6-63	12L	6.3/.60	17.6
20MP4	70	T	18 1/16 x 14 1/16	21 3/4	500-1500	S	B6-63	12L	6.3/.60	17.6
20RP4	114	TA-BR	17 5/16 x 13 1/32	12 25/64	1600-2200	N	B7-208	8HR	6.3/.45	22
20SP4	114	TA-TB	16 33/64 x 13 5/8	12 17/64	1400-2000	N	B7-208	8HR	6.3/.45	23
20TP4	114	TA-TB	16 33/64 x 13 5/8	12 17/64	1400-2000	N	B7-208	8HR	6.3/.45	23
20UP4	114	TA-BF	17 17/64 x 13 33/64	12 5/16	1200-1700	N	B7-208	8HR	6.3/.45	23
20WP4	114	TA-BR	16 43/64 x 13 1/32	12 17/64	1600-2000	N	B7-208	8HR	6.3/.45	23
20XP4	114	TA-BR	16 7/8 x 13 7/64	12 17/64	1500-2000	N	B7-208	8HR	6.3/.45	23
20YP4	114	TA-BR	16 7/8 x 13 7/64	12 17/64	1500-2000	N	B7-208	8HR	6.3/.45	23
20ZP4	114	TA-BR	16 7/8 x 13 7/64	12 17/64	1500-2000	N	B7-208	8HR	6.3/.45	23
21AP4	70	T, AR	19 33/64 x 15 1/16	22 5/8	.....	S	B5-57	12D	6.3/.60	19.8
21ACP4	90	T	20 1/4 x 16 3/8	20	2000-2500	S	B5-57	12N	6.3/.60	22
21ACP4A	90	TA	20 1/4 x 16 3/8	20	2000-2500	S	B5-57	12N	6.3/.60	22
21AFP4	70	T	20 1/4 x 15 1/16	23	.....	S	B6-63	12M	6.3/.60	19.8
21ALP4	90	T	20 1/4 x 16 3/8	20	500-750	S	B6-63	12L	6.3/.60	19.8
21ALP4A	90	TA	20 1/4 x 16 3/8	20	500-750	S	B6-63	12L	6.3/.60	19.8
21ALP4B	90	TA	20 1/4 x 16 3/8	20	500-750	S	B6-63	12L	6.3/.60	22
21AMP4	90	T	20 1/4 x 16 3/8	20	500-750	S	B5-57	12N	6.3/.60	19.8
21AMP4A	90	TA	20 1/4 x 16 3/8	20	500-750	S	B5-57	12N	6.3/.60	19.8
21AMP4B	90	TA	20 1/4 x 16 3/8	20	500-750	N	B5-57	12N	6.3/.60	19.8
21ANP4	90	T	20 1/4 x 16 3/8	20	.....	S	B6-63	12M	6.3/.60	19.8
21ANP4A	90	TA	20 1/4 x 16 3/8	20	.....	S	B6-63	12M	6.3/.60	19.8
21AQP4	90	T	20 1/4 x 16 3/8	20	.....	S	B5-57	12D	6.3/.60	19.8
21AQP4A	90	TA	20 1/4 x 16 3/8	20	.....	S	B5-57	12D	6.3/.60	19.8
21ARP4	70	T	20 1/4 x 15 1/16	23 1/32	500-750	I	B5-57	12N	6.3/.60	22
21ARP4A	70	TA	20 1/4 x 15 1/16	23 1/32	500-750	I	B5-57	12N	6.3/.60	22
21ASP4	70	T	18 1/16 x 14 1/16	22 7/16	.....	S	B6-63	12M	6.3/.60	19.8
21ATP4	90	TA	20 1/4 x 16 3/8	20	1200-1500	S	B6-63	12L	6.3/.60	19.8
21ATP4A	90	TA	20 1/4 x 16 3/8	20	1200-1500	S	B6-63	12L	6.3/.60	22
21ATP4B	90	T	20 1/4 x 16 3/8	20	1200-1500	S	B6-63	12L	6.3/.60	19.8
21AUP4	72	T	20 1/4 x 16 3/8	23 1/32	2000-2500	S	B6-63	12L	6.3/.60	19.8
21AUP4A	72	TA	20 1/4 x 16 3/8	23 1/32	2000-2500	S	B6-63	12L	6.3/.60	19.8
21AUP4B	72	TA	20 1/4 x 16 3/8	23 1/32	2000-2500	S	B6-63	12L	6.3/.60	22
21AUP4C	72	TA	20 1/4 x 16 3/8	23 1/32	2000-2500	N	B6-63	12L	6.3/.60	22
21AVP4	72	T	20 1/4 x 16 3/8	23 1/32	2000-2500	S	B6-63/B6-203	12L	6.3/.60	19.8
21AVP4A	72	TA	20 1/4 x 16 3/8	23 1/32	2000-2500	S	B6-63/B6-203	12L	6.3/.60	19.8
21AVP4B	72	TA	20 1/4 x 16 3/8	23 1/32	2000-2500	S	B6-63/B6-203	12L	6.3/.60	22
21AVP4C	72	TA	20 1/4 x 16 3/8	23 1/32	2000-2500	N	B6-63/B6-203	12L	6.3/.60	22
21AWP4	72	TA	20 1/4 x 16 3/8	23 1/32	2000-2500	S	B5-57	12N	6.3/.60	19.8
21AWP4A	72	TA	20 1/4 x 16 3/8	23 1/32	2000-2500	N	B5-57	12N	6.3/.60	19.8
21AYP4	70	T	18 1/16 x 14 1/16	22 7/16	750-2500	S	B6-63	12L	6.3/.60	19.8
21BAP4	90	TA	20 1/4 x 16 3/8	20	2000-2500	N	B6-63	12L	6.3/.60	22
21BCP4	70	TA	20 1/4 x 16 7/16	23 1/32	500-750	N	B6-63	12L	6.3/.60	22
21BDP4	72	TA	20 1/4 x 16 3/8	23 1/32	500-750	N	B6-63	12L	6.3/.60	22
21BNP4	90	TA	20 1/4 x 16 3/8	20	2000-2500	N	B6-63	12L	6.3/.60	22
21BSP4	90	TA	20 1/4 x 16 3/8	20	2000-2500	S	B5-57	12N	6.3/.60	22
21BTP4	90	TA	20 1/4 x 16 3/8	20	2000-2500	S	B6-63	12L	6.3/.60	22
21CBP4	90	TA	20 1/4 x 16 3/8	18	2000-2500	N	B6-63	12L	6.3/.60	19.8
21CBP4A	90	TA	20 1/4 x 16 3/8	18	2000-2500	N	B6-63	12L	6.3/.60	22
21CBP4B	90	TA	20 1/4 x 16 3/8	18	2000-2500	N	B6-63	12L	6.3/.60	20
21CDP4	90	T	20 1/4 x 16 3/8	20	2000-2500	S	B6-63	12L	6.3/.45	22
21CDP4A	90	TA	20 1/4 x 16 3/8	20	2000-2500	S	B6-63	12L	6.3/.45	22
21CEP4	110	TA	20 1/4 x 16 3/8	14 7/16	2000-2500	N	B7-208	8HR	6.3/.60	19.8
21CEP4A	110	TA	20 1/4 x 16 3/8	14 7/16	2000-2500	N	B7-208	8HR	6.3/.60	22
21CGP4	90	TA	20 1/4 x 16 3/8	20	2000-2500	S	B6-63	12L	6.3/.60	22
21CHP4	90	TA	20 1/4 x 16 3/8	18	2000-2500	N	B6-63	12L	6.3/.60	22
21CKP4	90	TA	20 1/4 x 16 3/8	18	2000-2500	N	B6-63	12L	6.3/.45	22
21CLP4	90	TA	20 1/4 x 16 3/8	19	1250-1750	S	B7-51	12AJ	6.3/.30	19.8
21CMP4	90	TA	20 1/4 x 16 3/8	19	2000-2500	S	B6-63	12L	6.3/.60	22

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MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	Type
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts / Magnet Coil Current in Ma.	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		
−.55 to +1.1	550	14	−56 to +310	300	33-77		20HP4A
−.55 to +1.1	550	14	−56 to +310	300	33-77		20HP4B
−.55 to +1.1	550	14	−56 to +310	300	33-77		20HP4C
−.55 to +1.1	550	14	−56 to +310	300	33-77		20HP4D
−.55 to +1.1	550	14	−56 to +310	300	33-77		20HP4E
Auto. Es.	550	12	Auto. Es.	300	33-77		20JP4
−1.1 to +2.2	550	14	0	300	33-77		20LP4
−.55 to +1.1	550	14	−55 to +300	300	33-77		20MP4
−.40 to +1.25	60	16	0 to 400	50	+33 to +50■		20RP4
−.40 to +1.25	60	16	−100 to +300	30	+22 to +40■		20SP4
−.55 to +1.1	550	16	0 to +400	300	+28 to +62■		20TP4
−.55 to +1.1	550	16	0 to +500	400	+35 to +72■		20UP4
−.55 to +1.1	550	18	0 to 400	400	+36 to +78■		20WP4
−.55 to +1.1	550	20	−200 to +200	400	50-98		20XP4
−.40 to +1.25	70	16	−200 to +200	50	+32 to +52■		20YP4
−.40 to +1.25	70	16	−200 to +200	50	+32 to +52■		20ZP4
Magnetic	550	16	110 Ma.	300	33-77	Metal Bulb	21AP4
Magnetic	550	16	117 Ma.	300	33-77		21ACP4
Magnetic	550	16	117 Ma.	300	33-77		21ACP4A
−.55 to +1.1	550	16	−64 to +350	300	33-77		21AFP4
−.55 to +1.1	550	16	−64 to +350	300	33-77		21ALP4
−.55 to +1.1	550	16	−64 to +350	300	33-77		21ALP4A
−.55 to +1.1	550	16	−64 to +350	300	33-77		21ALP4B
Magnetic	550	16	102 Ma.	300	33-77		21AMP4
Magnetic	550	16	102 Ma.	300	33-77		21AMP4A
Magnetic	550	16	102 Ma.	300	33-77		21AMP4B
−.55 to +1.1	550	16	−64 to +350	300	33-77		21ANP4
−.55 to +1.1	550	16	−64 to +350	300	33-77		21ANP4A
Magnetic	550	16	102 Ma.	300	33-77		21AQP4
Magnetic	550	16	102 Ma.	300	33-77		21AQP4A
Int. Mag.	550	16	Int. Mag.	300	33-77	Internal Magnet for Focus	21ARP4
Int. Mag.	550	16	Int. Mag.	300	33-77		21ARP4A
−.55 to +1.1	550	16	−64 to +352	300	33-77		21ASP4
−.55 to +1.1	550	16	−64 to +350	300	33-77		21ATP4
−.55 to +1.1	550	16	−64 to +350	300	33-77		21ATP4A
−.55 to +1.1	550	16	−64 to +350	300	33-77		21ATP4B
−.55 to +1.1	550	16	−64 to +352	300	33-77		21AUP4
−.55 to +1.1	550	16	−64 to +352	300	33-77		21AUP4A
−.55 to +1.1	550	16	−64 to +352	300	33-77		21AUP4B
−.55 to +1.1	550	16	−64 to +352	300	33-77		21AUP4C
−.55 to +1.1	550	16	−64 to +352	300	33-77		21AVP4
−.55 to +1.1	550	16	−64 to +352	300	33-77		21AVP4A
−.55 to +1.1	550	16	−64 to +352	300	33-77		21AVP4B
−.55 to +1.1	550	16	−64 to +352	300	33-77		21AVP4C
Magnetic	550	16	108 Ma.	300	33-77		21AWP4
Magnetic	550	16	108 Ma.	300	33-77		21AWP4A
−.55 to +1.1	550	16	−64 to +352	300	33-77		21AYP4
−.55 to +1.1	550	16	0 to 500	300	33-77		21BAP4
−.55 to +1.1	550	16	+50 to +550	300	33-77		21BCP4
−.55 to +1.1	550	16	+50 to +550	300	33-77		21BDP4
−.55 to +1.1	550	16	0 to 500	300	33-77		21BNP4
Magnetic	550	16	116 Ma.	300	33-77		21BSP4
−.55 to +1.1	550	16	−64 to +350	300	33-77		21BTP4
−.55 to +1.1	550	18	−70 to +396	300	33-77		21CBP4
−.5 to +1.0	550	16	0 to 450	300	33-77		21CBP4A
−.50 to +1.0	550	16	−50 to +350	300	28-72		21CBP4B
−.55 to +1.1	550	16	−64 to +352	300	33-77		21CDP4
−.55 to +1.1	550	16	−64 to +352	300	33-77		21CDP4A
−.55 to +1.1	550	16	0 to 400	400	41-99		21CEP4
−.55 to +1.1	550	16	0 to 400	400	41-99		21CEP4A
−.55 to +1.1	220	18	−72 to +396	110	+37 to +55■		21CGP4
−.55 to +1.1	220	18	−50 to +350	110	+37 to +55■		21CHP4
−.55 to +1.1	550	16	−50 to +350	300	33-77		21CKP4
−.55 to +.55	550	16	−75 to +235	300	40-80		21CLP4
−.55 to +1.1	550	16	−64 to +352	300	33-77		21CMP4

Monochrome TV Picture Tubes Data (cont'd)

Type	Defl. Angle and Neck Dia. ◆	FACEPLATE: Clear Tinted Alum. Shield* Anti-Refl.	OVERALL DIMENSIONS INCHES: Faceplate Dimensions	OVERALL DIMENSIONS INCHES: Length	External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DESIG: Anode (Kv)
21CQP4	110	TA	20¼ x 16⅜	14⅞	2000-2500	N	B6-185	7FA	6.3/.60	19.8
21CSP4	110	TA	20¼ x 16⅜	14⅞	2000-2500	N	B6-185	7FA	6.3/.45	19.8
21CUP4	90	TA	20¼ x 16⅜	20	2000-2500	S	B5-57	12N	6.3/.60	22
21CVP4	90	TA	20¼ x 16⅜	20	2000-2500	N	B6-63	12L	6.3/.60	22
21CWP4	90	TA	22¼ x 16⅜	20	2000-2500	S	B6-63	12L	6.3/.60	22
21CXP4	90	TA	20¼ x 16⅜	18	2000-2500	N	B6-63	12L	6.3/.60	22
21CZP4	110	TA	20¼ x 16⅜	14¹⁵⁄₁₆	2000-2500	S	B7-183	8HR	6.3/.60	19.8
21DP4	70	T, AR	19³³⁄₃₂ x 15¹³⁄₁₆	22⅝m	.....	S	B6-63	12M	6.3/.60	19.8
21DAP4	110	TA	20¼ x 16⅜	14¹⁵⁄₁₆	2000-2500	N	B7-208	8HR	6.3/.60	19.8
21DEP4	110	TA	20¼ x 16⅜	14¹⁵⁄₁₆	2000-2500	N	B7-183/B7-208	8HR	6.3/.60	19.8
21DEP4A	110	TA	20¼ x 16⅜	14¹⁵⁄₁₆	2000-2500	N	B7-183/B7-208	8HR	6.3/.60	22
21DFP4	110	TA	20¼ x 16⅜	14⅞	1500-2200	N	B7-183/B7-208	8HR	6.3/.60	19.8
21DHP4	110	TA	20¼ x 16⅜	14¹⁵⁄₁₆	1700-2500	N	B7-183/B7-208	8HR	6.3/.45	19.8
21DJP4	90	TA	20¼ x 16⅜	18	2000-2500	N	B6-63	12L	6.3/.30	22
21DKP4	110	TA	20¼ x 16⅜	14¹⁵⁄₁₆	1700-2500	N	B7-183/B7-208	8HR	6.3/.30	19.8
21DKP4A	110	TA	20¼ x 16⅜	14¹⁵⁄₁₆	1700-2500	N	B7-183/B7-208	8HR	6.3/.30	19.8
21DLP4	90	TA	20¼ x 16⅜	17	2000-2500	N	B6-63	12L	6.3/.60	22
21DMP4	110	TA	20¼ x 16⅜	13¾	2000-2500	N	B7-183/B7-208	8HR	6.3/.60	22
21DNP4	90	TA	20¼ x 16⅜	19	1200-1500	S	B6-63	12L	6.3/.60	22
21DQP4	90	TA	20¼ x 16⅜	17½	2000-2500	N	B6-63	12L	6.3/.60	20
21DRP4	90	TA	20¼ x 16⅜	18¼	2000-2500	N	B6-63/B6-203	12L	6.3/.60	22
21DSP4	90	TA	20¼ x 16⅜	18	2000-2500	N	B6-63	12L	6.3/.60	22
21DVP4	90	TA	20¼ x 16⅜	20	500-750	S	B6-63	12L	6.3/.30	22
21DWP4	110	TA	20¼ x 16⅜	14⅞	2000-2500	N	B7-183/B7-208	8HR	6.3/.60	19.8
21EP4	70	T	20¼ x 15⅝	23	.....	S	B5-57	12D	6.3/.60	19.8
21EP4A	70	T	20¼ x 15⅝	23	500-750	S	B5-57	12N	6.3/.60	19.8
21EP4B	70	TA	20¼ x 15⅝	23	500-750	S	B5-57	12N	6.3/.60	19.8
21EP4C	70	TA	20¼ x 15⅝	23	500-750	N	B5-57	12N	6.3/.60	19.8
21EAP4	110	TA	20¼ x 16⅜	12¹³⁄₁₆	1500-2000	N	B7-208	8JK	2.35/.60	20
21ELP4	90	TA	20¼ x 16⅜	19	2000-2500	N	B6-63	12L	6.3/.30	22
21EMP4	110	TA	20¼ x 16⅜	13⅜	2000-2500	N	B7-183	8HR	6.3/.60	19.8
21ENP4	90	TA	20¼ x 16⅜	19	2000-2500	S	B6-63	12L	6.3/.30	22
21EQP4	110	TA	20¼ x 16⅜	12¾	2000-2500	N	B7-208	8JR	6.3/.60	20
21ERP4	110	TA, AR, BP	20¼ x 16⅜	12¹³⁄₁₆	1500-2000	N	B7-208	8JR	6.3/.60	20
21ESP4	110	TA	20¼ x 16⅜	13¾	2000-2500	N	B6-226/B7-208	8JS	6.3/.60	19.8
21EVP4	110	TA	20¼ x 16⅜	12¹³⁄₁₆	1500-2000	N	B7-208	8JK	2.68/.45	20
21EWP4	72	TA	20¼ x 16⅜	23½	.....	N	B5-57	12D	6.3/.60	22
21EXP4	110	TA	20¼ x 16⅜	12¾	2000-2500	N	B7-208	8JR	6.3/.30	20
21EYP4	72	TA	20¼ x 16⅜	23½	1200-1500	N	B6-63/B6-203	12L	6.3/.60	22
21EZP4	110	TA	20¼ x 16⅜	12¹³⁄₁₆	2000-2500	N	B7-208	8JR	6.3/.30	19.8
21FP4	70	T	20¼ x 15⅝	23½	.....	S	B6-63/B6-203	12M	6.3/.60	19.8
21FP4A	70	T	20¼ x 15⅝	23½	500-750	S	B6-63/B6-203	12L	6.3/.60	19.8
21FP4C	70	TA	20¼ x 15⅝	23½	500-750	S	B6-63/B6-203	12L	6.3/.60	19.8
21FP4D	70	TA	20¼ x 15⅝	23½	500-750	N	B6-63/B6-203	12L	6.3/.60	19.8
21FAP4	110	TA	19¼ x 16⅜	12¹³⁄₁₆	2000-2500	N	B7-208	8JR	6.3/.60	22
21FCP4	110	TA	20¼ x 16⅜	13½	2000-2500	N	B7-208	8HR	6.3/.30	18
21FDP4	110	TA	20¼ x 16⅜	13⅛	1500-2000	N	B7-208	8KW	6.3/.60	20
21FLP4	90	TA	20¼ x 16⅜	18	500-2500	N	B6-63	12L	6.3/.60	22
21FMP4	110	TA	20¼ x 16⅜	14⅜	2000-2500	N	B7-237/B7-208	8HR	6.3/.60	22
21FUP4	114	TA-BF	18³⁄₃₂ x 15¾	12¹³⁄₃₂	1700-2500	N	B7-208	8HR	6.3/.45	23
21FVP4	114	TA-BR	18¾ x 14⁴³⁄₆₄	12¹³⁄₃₂	1500-2300	N	B7-208	8HR	6.3/.45	23
21FWP4	114	TA-BR	18¾ x 14⁴³⁄₆₄	12¹³⁄₃₂	1500-2300	N	B7-208	8HR	6.3/.45	23
21FXP4	114	TA-BF	18³⁄₃₂ x 15³⁄₃₂	12¹³⁄₃₂	1500-2000	N	B7-208	8HR	6.3/.45	23
21FYP4	114	TA-BR	18¾ x 15³⁄₃₂	12¹⁵⁄₃₂	1900-2400	N	B7-208	8HR	6.3/.45	22
21FZP4	114	TA-BR	18¾ x 14⁴³⁄₆₄	12¹³⁄₃₂	1700-2500	N	B7-208	8HR	6.3/.45	23
21GAP4	114	TA-BR	18¹¹⁄₁₆ x 14¹⁵⁄₁₆	12¹³⁄₃₂	1300-2000	N	B7-208	8HR	6.3/.45	23.5
21GAP4A	114	TA-BR	18¹¹⁄₁₆ x 14¹⁵⁄₁₆	12¹³⁄₃₂	1300-2000	N	B7-208	8HR	6.3/.45	23.5
21GBP4	114	TA-BR	18¾ x 14²³⁄₃₂	12¹³⁄₃₂	1500-2300	N	B7-208	8HR	6.3/.45	20
21GCP4	114	TA-BR	18¾ x 14¹⁵⁄₁₆	12¹³⁄₃₂	1700-2500	N	B7-208	8HR	6.3/.45	23
21GHP4	114	TA	18³⁄₃₂ x 14³⁷⁄₆₄	12¹³⁄₃₂	1500-2300	N	B7-208	8HR	6.3/.45	23.5
21GJP4	114	TA-BR	18¾ x 14⁴³⁄₆₄	12⁶¹⁄₆₄	1500-2300	N	B7-183	8HR	6.3/.60	20
21GKP4	114	TA-BR	18¾ x 14¹⁵⁄₁₆	12¹³⁄₃₂	1700-2500	N	B7-208	8HR	6.3/.45	23
21GTP4	114	TA-BF	18³⁄₃₂ x 15¾	12¹³⁄₃₂	1700-2500	N	B7-208	8HR	6.3/.315	23
21JP4	70	T	20¼ x 15⅝	23½	500-750	I	B5-57	12N	6.3/.60	22
21JP4A	70	TA	20¼ x 15⅝	23½	500-750	I	B5-57	12N	6.3/.60	22

Notes—Page 533 **Basing Diagrams—Page 535**

MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts / Magnet Coil Current in Ma.	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		Type
−.55 to +1.1	550	16	−50 to +350	300	40-77	Light Weight Bulb	21CQP4
−.55 to +1.1	550	16	0 to 400	300	40-77	Light Weight Bulb	21CSP4
Magnetic	550	16	117 Ma.	300	33-77		21CUP4
−.55 to +1.1	550	16	−64 to +352	300	33-77		21CVP4
−.55 to +1.1	550	16	−64 to +352	300	33-77		21CWP4
−.55 to +1.1	70	18	0 to 350	50	+39 to +57▪		21CXP4
−.55 to +1.1	550	17	0 to 500	300	33-77	Light Weight Bulb	21CZP4
+5.5m	550	16	3150 to 4270	300	33-77	Metal Bulb	21DP4
−.55 to +1.1	550	16	0 to 400	400	41-99	Light Weight Bulb	21DAP4
−.55 to +1.1	550	17	0 to 500	300	33-77	Light Weight Bulb	21DEP4
−.55 to +1.1	550	17	0 to 500	300	33-77	Light Weight Bulb	21DEP4A
−.55 to +1.1	550	16	0 to 400	400	41-99		21DFP4
−.55 to +1.1	550	16	0 to 400	300	40-77	Light Weight Bulb	21DHP4
−.55 to +1.1	550	16	−50 to +350	300	40-77		21DJP4
−.55 to +1.1	550	16	0 to 400	300	40-77	Light Weight Bulb	21DKP4
−.55 to +1.1	550	16	0 to 400	300	40-77	Light Weight Bulb; 18 Sec. Heater Warm-up	21DKP4A
−.55 to +1.1	550	16	0 to 400	300	33-77		21DLP4
−.55 to +1.1	550	16	−50 to +350	400	41-97	Light Weight Bulb	21DMP4
−.55 to +1.1	550	16	−64 to +352	300	40-77		21DNP4
−.55 to +1.1	550	16	−50 to +350	300	40-77		21DQP4
−.55 to +1.1	550	16	0 to 450	300	33-77	Light Weight Bulb	21DRP4
−.55 to +1.1	70	16	0 to 400	50	+37 to +55▪		21DSP4
−.55 to +1.1	550	18	0 to 400	300	33-77		21DVP4
−.55 to +1.1	550	14	−50 to +350	450	50-110		21DWP4
Magnetic	550	16	95 Ma.	300	33-77	Cylindrical Faceplate	21EP4
Magnetic	550	16	95 Ma.	300	33-77	Cylindrical Faceplate	21EP4A
Magnetic	550	16	95 Ma.	300	33-77	Cylindrical Faceplate	21EP4B
Magnetic	550	16	95 Ma.	300	33-77	Cylindrical Faceplate	21EP4C
−.70 to +.95	550	16	100 to 500	300	40-77	Light Weight Bulb; 2.35 Volt Heater	21EAP4
−.55 to +1.1	550	16	0 to 400	450	50-110		21ELP4
−.55 to +1.1	550	16	0 to 400	450	50-110		21EMP4
−.55 to +1.1	550	16	−64 to +352	300	40-77		21ENP4
+.70m	600	16	0 to 400	500	48-77	Tri-Potential Electrostatic Focus	21EQP4
+.70m	600	16	0 to 400	500	48-77	Tri-Potential Focus; Formed Cover Plate	21ERP4
−.55 to +1.1	825	17	0 to 500	450	33-77	Light Weight Bulb	21ESP4
−.7 to +.95	550	16	100 to 500	300	40-77	Light Weight Bulb; 2.68 Volt Heater	21EVP4
Magnetic	1100	18	115 Ma.	300	33-75	Monitor Tube	21EWP4
+.70m	600	16	0 to 400	500	48-83	Tri-Potential Electrostatic Focus	21EXP4
800	700	18	0 to 400	300	33-77	Monitor Tube	21EYP4
+.715m	600	18	0 to 400	500	+46 to +74▪	Tri-Potential Focus	21EZP4
−.55 to +1.1	550	16	−64 to +350	300	33-77	Cylindrical Faceplate	21FP4
−.55 to +1.1	550	16	−64 to +350	300	33-77	Cylindrical Faceplate	21FP4A
−.55 to +1.1	550	16	−64 to +350	300	33-77	Cylindrical Faceplate	21FP4C
−.55 to +1.1	550	16	−64 to +350	300	33-77	Cylindrical Faceplate	21FP4D
+.70m	600	16	0 to 400	500	48-83	Light Weight Bulb; Tri-Potential Focus	21FAP4
−.55 to +1.1	550	16	0 to 400	300	+39 to +68▪		21FCP4
−.55 to +1.1	550	16	+100 to +500	300	40-77		21FDP4
−.50 to +1.0	550	16	0 to 450	300	33-77		21FLP4
−.50 to +1.0	100	18	0 to 500	50	31-49		21FMP4
−.50 to +1.0	60	16	0 to 400	50	35-55		21FUP4
−.55 to +1.1	550	20	−100 to +300	400	36-78		21FVP4
−.55 to +1.1	550	20	−100 to +300	400	36-78		21FWP4
−.55 to +1.1	550	16	0 to 500	400	35-72		21FXP4
−.40 to +1.2	60	16	0 to +400	50	+33 to +45▪		21FYP4
−.50 to +1.0	550	16	0 to 400	400	39-93		21FZP4
−.55 to +1.1	60	16	0 to 400	30	+30 to +45▪		21GAP4
−.55 to +1.1	60	16	0 to 400	30	+30 to +45▪		21GAP4A
−.50 to +1.0	70	16	0	50	36-54		21GBP4
−.55 to +1.1	550	16	0 to 400	400	+39 to +93▪		21GCP4
−.55 to +1.1	60	16	0 to 400	30	+30 to +45▪		21GHP4
−.55 to +1.1	550	16	0 to 400	400	36-94		21GJP4
−.55 to +1.1	60	16	0 to 400	50	+35 to +55▪		21GKP4
−.50 to +1.0	60	16	0 to 400	50	35-55		21GTP4
Int. Mag.	550	16	Int. Mag.	300	33-77	Cylindrical Faceplate	21JP4
Int. Mag.	550	16	Int. Mag.	300	33-77	Cylindrical Faceplate	21JP4A

Monochrome TV Picture Tubes Data (cont'd)

Type	Defl. Angle and Neck Dia. ◆	FACEPLATE: Clear Tinted Alum. Shield* Anti-Refl.	OVERALL DIMENSIONS INCHES: Faceplate Dimensions	OVERALL DIMENSIONS INCHES: Length	External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DESI: Anode (Kv)
21KP4	70	T	20¼ x 15⁹⁄₁₆	22⅞	.....	S	B5-57	12D	6.3/.60	19.8
21KP4A	70	T	20¼ x 15⁹⁄₁₆	22⅞	500-750	S	B5-57	12P	6.3/.60	19.8
21MP4	70	T, AR	19²³⁄₃₂x 15⅝	22⅝	.....	S	B6-63	12M	6.3/.60	17.6
21WP4	70	T	18¹¹⁄₁₆x 14¹³⁄₁₆	22⅞	500-750	S	B5-57	12N	6.3/.60	19.8
21WP4A	70	TA	18¹¹⁄₁₆x 14¹³⁄₁₆	22⅞	500-750	S	B5-57	12N	6.3/.60	19.8
21WP4B	70	TA	18¹¹⁄₁₆x 14¹³⁄₁₆	22⅞	500-750	N	B5-57	12N	6.3/.60	19.8
21XP4	70	T	18¹¹⁄₁₆x 14¹³⁄₁₆	22¾	2000-2500	S	B6-63/B6-203	12L	6.3/.60	19.8
21XP4A	70	TA	18¹¹⁄₁₆x 14¹³⁄₁₆	22¾	2000-2500	S	B6-63/B6-203	12L	6.3/.60	19.8
21XP4B	70	TA	18¹¹⁄₁₆x 14¹³⁄₁₆	22¾	2000-2500	N	B6-63/B6-203	12L	6.3/.60	19.8
21YP4	70	T	20¼ x 15⁹⁄₁₆	23½	500-750	S	B6-63/B6-203	12L	6.3/.60	19.8
21YP4A	70	TA	20¼ x 15⁹⁄₁₆	23½	500-750	S	B6-63/B6-203	12L	6.3/.60	19.8
21YP4B	70	TA	20¼ x 15⁹⁄₁₆	23½	500-750	N	B6-63/B6-203	12L	6.3/.60	19.8
21ZP4	70	T	20¼ x 15⁹⁄₁₆	23½	.....	S	B5-57	12D	6.3/.60	19.8
21ZP4A	70	T	20¼ x 15⁹⁄₁₆	23½	500-750	S	B5-57	12N	6.3/.60	19.8
21ZP4B	70	TA	20¼ x 15⁹⁄₁₆	23½	500-750	S	B5-57	12N	6.3/.60	19.8
21ZP4C	70	TA	20¼ x 15⁹⁄₁₆	23½	500-750	N	B5-57	12N	6.3/.60	19.8
22TP4	114	TA-BF	19²⁵⁄₃₂ x 15¹⁹⁄₃₂	13⅛	1700-2200	N	B7-208	8HR	6.3/.45	23
22ZP4	114	TA-BR	18⁴⁵⁄₆₄x 15⅛	13⅛	2000-2500	N	B7-208	8HR	6.3/.45	23
23ACP4	90	TA, BC	21⅜ x 17⅝	19¹⁵⁄₃₂	2000-2500	N	B6-63	12L	6.3/.60	18
23AFP4	92	TA, BC	21⅜ x 17¹³⁄₃₂	18¹³⁄₁₆	2000-2500	N	B6-203	12L	6.3/.60	25
23AHP4	92	TA	20½ x 16½	18	1700-2500	N	B6-203	12L	6.3/.60	22
23AKP4	114	TA	20½ x 16½	12⅞	2000-2500	N	B7-208	8JR	6.3/.60	22
23ALP4	114	TA	20½ x 16½	14¹⁵⁄₃₂	1700-2500	N	B7-208	8HR	6.3/.45	22
23AMP4	114	TA	20½ x 16½	14¹⁵⁄₃₂	1700-2500	N	B7-208	8HR	6.3/.30	22
23ANP4	92	TA, BC	21⅜ x 17¹³⁄₃₂	18⅛	2000-2500	N	B6-63/B6-203	12L	6.3/.60	25
23AQP4	114	TA	20½ x 16½	14⅜	1700-2500	N	B7-208	8HR	6.3/.30	19.8
23ARP4	110	TA	20½ x 16½	14⅞	1700-2500	N	B7-208	8HR	6.3/.60	22
23ASP4	92	TA	20½ x 16½	17	1700-2500	N	B6-203	12L	6.3/.60	22
23ATP4	92	TA, AR, BC	21⅜ x 17¹³⁄₃₂	18⅛	2000-2500	N	B6-203/B6-63	12L	6.3/.60	25
23AUP4	92	TA	20½ x 16½	18	1700-2500	N	B6-203	12L	6.3/.60	25
23AVP4	110	TA, AR, BC	21⅜ x 17¹³⁄₃₂	15¾	2000-2500	N	B7-208	8HR	6.3/.60	22
23AWP4	92	TA	20½ x 16½	18	1700-2500	N	B6-203	12L	6.3/.60	22
23AXP4	110	TA	20½ x 16½	14⅝	2000-2500	N	B7-208	8HR	6.3/.30	20
23AYP4	110	TA, AR, BC	21⅜ x 17¹³⁄₃₂	15¾	2000-2500	N	B7-208	8HR	6.3/.30	22
23AZP4	92	TA	20½ x 16½	18	1700-2500	N	B6-203	12L	6.3/.30	22
23BP4	110	TA, BC	21⅜ x 17⅝	14⅞	2000-2500	N	B7-208	8HR	6.3/.60	22
23BAP4	110	TA, AR, BC	21⅜ x 17⅝	14⅞	2000-2500	N	B7-208	8HR	6.3/.60	22
23BCP4	110	TA	20½ x 16½	14⅞	1700-2500	N	B7-208	8HR	6.3/.30	22
23BDP4	92	TA, AR, BC	21⅜ x 17⅝	18⅝	2000-2500	N	B6-203	12L	6.3/.60	22
23BEP4	110	TA, BC	21⅜ x 17¹³⁄₃₂	15¾	2000-2500	N	B7-208	8HR	6.3/.30	22
23BEP4A	110	TA-BC	21⅜ x 17¹³⁄₃₂	15¾	2000-2500	N	B7-208	8HR	6.3/.30	22
23BGP4	110	TA, BC	21⅜ x 17¹³⁄₃₂	15¾	1700-2500	N	B7-208	8HR	6.3/.60	22
23BHP4	110	TA, AR, BC	21⅜ x 17¹³⁄₃₂	15¾	1700-2500	N	B7-208	8HR	6.3/.60	22
23BJP4	92	TA	20½ x 16½	18⅛	1700-2500	N	B6-203	12L	6.3/.60	25
23BKP4	92	TA, BC	21⅜ x 17¹³⁄₃₂	18⅛	1700-2500	N	B6-203	12L	6.3/.60	25
23BLP4	92	TA, AR, BC	21⅜ x 17¹³⁄₃₂	18⅛	1700-2500	N	B6-203	12L	6.3/.60	25
23BMP4	92	TA, BC	21⅜ x 17¹³⁄₃₂	18⅛	1700-2500	N	B6-203	12L	6.3/.60	22
23BNP4	110	TA-BC	21⅜ x 17¹³⁄₃₂	15¾	2000-2500	N	B7-208	8HR	6.3/.60	22
23BQP4	110	TA, BC	21⅜ x 17¹³⁄₃₂	15¾	2000-2500	N	B7-208	8HR	6.3/.45	23
23BRP4	110	TA, AR, BC	21⅜ x 17⅝	13⅞	2000-2500	N	B7-208	8JR	6.3/.30	22
23BSP4	110	TA, AR, BC	21⅜ x 17¹³⁄₃₂	15¾	2000-2500	N	B7-208	8HR	6.3/.30	22
23BTP4	92	TA, BC	21⅜ x 17¹³⁄₃₂	18⅛	2000-2500	N	B6-203	12L	6.3/.60	25
23BVP4	92	TA, BC	21⅜ x 17¹³⁄₃₂	18¹³⁄₁₆	2000-2500	N	B6-203	12L	6.3/.60	25
23BXP4	92	TA-BP	20½ x 16½	18¼	2000-2500	N	B6-203	12L	6.3/.60	22
23BYP4	110	TA-BC	21⅜ x 17⅝	13⅞	2000-2500	N	B7-208	8JR	6.3/.30	22
23BZP4	92	TA	20½ x 16½	18	1700-2500	N	B6-203	12L	8.4/.45	22
23CP4	110	TA, BC	21⅜ x 17¹³⁄₃₂	15¾	2000-2500	N	B7-208	8HR	6.3/.60	22
23CP4A	110	TA, BC	21⅜ x 17¹³⁄₃₂	15¾	2000-2500	N	B7-208	8HR	6.3/.60	23.5
23CAP4	92	TA, BC	21⅜ x 17¹³⁄₃₂	18⅛	2000-2500	N	B6-203	12L	8.4/.45	22
23CBP4	110	TA, AR, BC	21⅜ x 17¹³⁄₃₂	15¾	2000-2500	N	B7-208	8HR	6.3/.45	23
23CDP4	92	TA, BC	21⅜ x 17¹³⁄₃₂	18¹⁄₁₆	2000-2500	N	B6-203	12L	6.3/.30	22
23CEP4	110	TA	20½ x 16½	14⅞	1700-2500	N	B7-208	8HR	6.3/.45	22
23CGP4	92	TA	20½ x 16½	18	1700-2500	N	B6-203	12L	6.3/.45	22
23CMP4	110	TA	20½ x 16½	14⅞	1700-2500	N	B7-208	8HR	6.3/.60	22
23CQP4	114	TA	20½ x 16½	13²³⁄₃₂	1700-2500	N	B7-208	8HR	6.3/.45	23.5

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MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	Type
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts / Magnet Coil Current in Ma.	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		
Auto. Es.	550	14	Auto. Es.	300	33-77	Cylindrical Faceplate	**21KP4**
Auto. Es.	550	14	Auto. Es.	300	33-77	Cylindrical Faceplate	**21KP4A**
−.55 to +1.1	550	16	−65 to +350	300	33-77	Metal Bulb	**21MP4**
Magnetic	550	16	100 Ma.	300	33-77		**21WP4**
Magnetic	550	16	100 Ma.	300	33-77		**21WP4A**
Magnetic	550	16	100 Ma.	300	33-77		**21WP4B**
−.55 to +1.1	550	16	−64 to +352	300	33-77		**21XP4**
−.55 to +1.1	550	16	−64 to +352	300	33-77		**21XP4A**
−.55 to +1.1	550	16	−64 to +352	300	33-77		**21XP4B**
−.55 to +1.1	550	16	−64 to +352	300	33-77		**21YP4**
−.55 to +1.1	550	16	−64 to +352	300	33-77		**21YP4A**
−.55 to +1.1	550	16	−64 to +352	300	33-77		**21YP4B**
Magnetic	550	12	95 Ma.	300	33-77		**21ZP4**
Magnetic	550	16	100 Ma.	300	33-77		**21ZP4A**
Magnetic	550	16	118 Ma.	300	33-77		**21ZP4B**
Magnetic	550	16	118 Ma.	300	33-77		**21ZP4C**
−.55 to +1.1	550	18	0 to 500	400	+35 to +72▪		**22TP4**
−.40 to +1.25	700	20	−200 to +200	400	+48 to +82▪		**22ZP4**
−.55 to +1.1	550	16	0 to 400	300	40-77	Low Anode Voltage	**23ACP4**
−.55 to +1.1	550	20	0 to 400	300	40-77		**23AFP4**
−.55 to +1.1	550	18	0 to 400	400	41-99		**23AHP4**
+.70m	600	16	0 to 400	500	48-83	Tri-Potential Electrostatic Focus	**23AKP4**
−.55 to +1.1	550	18	0 to 400	400	41-99		**23ALP4**
−.55 to +1.1	550	18	0 to 400	400	41-99		**23AMP4**
−.50 to +1.1	70	20	0 to 500	50	+40 to +55▪		**23ANP4**
−.50 to +1.0	550	18	0 to 400	400	49-99	18 Second Heater Warm-up Time	**23AQP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**23ARP4**
−.55 to +1.1	550	18	0 to 400	400	41-99		**23ASP4**
−.50 to +1.1	70	20	0 to 500	50	+40 to +55▪		**23ATP4**
−.55 to +1.1	550	18	0 to 400	400	41-99		**23AUP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**23AVP4**
−.45 to +1.25	225	20	0 to 400	50	+41 to +59▪		**23AWP4**
−.55 to +1.1	550	16	0 to 400	400	42-72		**23AXP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**23AYP4**
−.55 to +1.1	550	18	0 to 400	400	41-99		**23AZP4**
−.55 to +1.1	550	14	0 to 400	450	50-110		**23BP4**
−.55 to +1.1	550	14	0 to 400	450	50-110		**23BAP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**23BCP4**
−.55 to +1.1	700	16	0 to 400	500	+50 to +100▪		**23BDP4**
−.55 to +1.1	550	16	0 to 400	300	40-77	18 Second Heater Warm-up Time	**23BEP4**
−.55 to +1.1	550	16	0 to 400	300	40-77	18 Second Heater Warm-up Time	**23BEP4A**
−.55 to +1.1	70	16	0 to 400	50	+37 to +52▪		**23BGP4**
−.55 to +1.1	70	16	0 to 400	50	+37 to +52▪		**23BHP4**
−.45 to +1.25	70	20	0 to 400	50	+41 to +59▪		**23BJP4**
−.40 to +1.25	225	20	0 to 400	50	+41 to +59▪		**23BKP4**
−.40 to +1.25	225	20	0 to 400	50	+41 to +59▪		**23BLP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**23BMP4**
−.55 to +1.1	550	18	−100 to +300	400	60-110		**23BNP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**23BQP4**
+.70m	600	16	500	500	48-83	Tri-Potential Electrostatic Focus	**23BRP4**
−.55 to +1.1	550	16	0 to 400	300	40-77	18 Second Heater Warm-up Time	**23BSP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**23BTP4**
−.55 to +1.1	550	20	0 to 400	300	40-77	Internal Magnetic Shielding	**23BVP4**
−.55 to +1.1	550	16	0 to 400	300	35-72		**23BXP4**
+.70m	600	16	0 to 400	500	48-83	18 Sec. Heater Warm-up; Tri-Pot. Es. Focus	**23BYP4**
−.55 to +1.1	550	18	0 to 400	400	41-99		**23BZP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**23CP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**23CP4A**
−.55 to +1.1	550	16	0 to 400	300	40-77		**23CAP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**23CBP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**23CDP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**23CEP4**
−.40 to +1.2	700	16	0 to 400	500	45-95		**23CGP4**
−.55 to +1.1	550	16	0 to 400	300	40-77	18 Second Heater Warm-up Time	**23CMP4**
−.55 to +1.1	550	14	0 to 400	450	50-110		**23CQP4**

Monochrome TV Picture Tubes Data (cont'd)

Type	Defl. Angle and Neck Dia. ◆	FACEPLATE	OVERALL DIMENSIONS INCHES		External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DESIG Anode (Kv)
		Clear Tinted Alum. Shield* Anti-Refl.	Faceplate Dimensions	Length						
23CSP4	110	TA, AR, BC	21 5/16 x 17 5/16	13 3/8	2000-2500	N	B7-208	8JR	6.3/.30	22
23CTP4	92	TA, BC	21 5/16 x 17 13/32	18 1/16	2000-2500	N	B6-203	12L	6.3/.45	22
23CUP4	110	TA, AR, BC	21 3/4 x 17 3/16	13 3/8	2000-2500	N	B7-208	8JR	6.3/.60	22
23CVP4	114	TA	20 1/2 x 16 1/2	12 13/16	2000-2500	N	B7-208	8JR	6.3/.30	22
23CWP4	110	TA	20 1/2 x 16 1/2	13 3/4	2000-2500	N	B7-208	8JR	6.3/.60	22
23CXP4	110	TA	20 1/2 x 16 1/2	13 3/4	2000-2500	N	B7-208	8JR	6.3/.30	22
23CZP4	92	TA	20 1/2 x 16 1/2	18 1/2	2000-2500	N	B6-203	12L	6.3/.60	25
23DP4	110	TA, BC	21 3/4 x 17 3/16	13 3/8	2000-2500	N	B7-208	8JR	6.3/.60	22
23DAP4	94	TA	20 1/2 x 16 1/2	17 3/4	1700-2500	N	B7-208	8HR	6.3/.60	23
23DBP4	110	TA	20 1/2 x 16 1/2	14 7/8	2000-2500	N	B7-237/ B7-208	8HR	6.3/.60	22
23DCP4	94	TA	20 1/2 x 16 1/2	17 3/4	1700-2500	N	B7-208	8HR	6.3/.45	23.5
23DEP4	110	TA-BF	21 3/8 x 17 11/64	14	1500-2000	N	B7-208	8HR	6.3/.30	20
23DFP4	110	TA-BF	20 1/2 x 16 1/2	14	1500-2000	N	B7-208	8HR	6.3/.30	20
23DHP4	110	TA-BC	21 5/16 x 17 5/16	14 5/16	2000-2500	N	B7-208	8HR	6.3/.30	22
23DJP4	110	TA-BC	21 5/16 x 17 5/16	14 5/16	2000-2500	N	B7-208	8HR	6.3/.30	22
23DKP4	92	TA-BR	20 5/8 x 16 5/8	18	1700-2500	N	B6-203	12L	6.3/.60	22
23DLP4	92	TA-BR	20 5/8 x 16 5/8	18	1700-2500	N	B6-203	12L	6.3/.60	22
23DLP4A	92	TA-BR	20 5/8 x 16 5/8	18	1700-2500	N	B6-203	12L	6.3/.60	22
23DNP4	92	TA-BC	21 5/16 x 17 13/32	18 1/16	2000-2500	N	B6-203	12L	6.3/.60	25
23DQP4	92	TA-BC	21 5/16 x 17 1/2	18 11/16	2000-2500	N	B7-208	8HR	6.3/.60	25
23DSP4	92	TA-BR	21 1/4 x 16 3/4	18 3/8	2000-2500	N	B7-208	8HR	6.3/.60	25
23DSP4A	92	TA-BR	21 1/4 x 16 3/4	18 3/8	2000-2500	N	B7-208	8HR	6.3/.60	25
23DTP4	92	TA-BR	20 5/8 x 16 5/8	18 1/2	1700-2500	N	B6-203	12L	6.3/.60	25
23DVP4	114	TA-BR	20 5/8 x 16 5/8	14 7/8	1700-2500	N	B7-208	8HR	6.3/.60	22
23DVP4A	114	TA-BR	20 5/8 x 16 5/8	14 7/8	1700-2500	N	B7-208	8HR	6.3/.60	22
23DWP4	94	TA-BR	20 5/8 x 16 5/8	17 3/4	2000-2500	N	B7-208	8HR	6.3/.60	22
23DYP4	110	TA-BR	20 5/8 x 16 5/8	14 7/8	2000-2500	N	B7-208	8HR	6.3/.60	22
23DZP4	114	TA-BR	20 5/8 x 16 5/8	14 7/8	1700-2500	N	B7-208	8HR	6.3/.45	22
23EP4	110	TA, BC	21 5/16 x 17 13/32	15 5/16	1700-2500	N	B7-219	8KP	6.3/.60	22
23EAP4	92	TA-BC	21 5/16 x 17 13/32	18 1/16	2000-2500	N	B6-203	12L	6.3/.45	22
23ECP4	92	TA-BP	20 1/2 x 16 1/2	18 1/16	2000-2500	N	B6-203	12L	6.3/.60	25
23EDP4	92	TA-BP	20 1/2 x 16 1/2	18 1/16	2000-2500	N	B6-203	12L	6.3/.60	25
23EFP4	110	TA-BR	20 5/8 x 16 5/8	14 7/8	1700-2500	N	B7-208	8HR	6.3/.60	22
23EKP4	92	TA-BR	20 21/32 x 16 21/32	18	1700-2500	N	B6-203	12L	6.3/.45	25
23ENP4	92	TA-BR	20 21/32 x 16 21/32	18 1/8	1700-2500	N	B6-203	12L	6.3/.60	25
23EQP4	114	TA-BR	20 21/32 x 16 21/32	14 13/32	1700-2500	N	B7-208	8HR	6.3/.45	23
23ERP4	114	TA-BR	20 21/32 x 16 21/32	14 13/32	1700-2500	N	B7-208	8HR	6.3/.60	23
23ESP4	110	TA-AR-BR	20 5/8 x 16 5/8	14 7/8	2000-2500	N	B7-208	8HR	6.3/.45	22
23ESP4A	110	TA-AR-BR	20 5/8 x 16 5/8	14 7/8	2000-2500	N	B7-208	8HR	6.3/.45	22
23ETP4	110	TA-BR	20 21/32 x 16 13/32	14 7/8	1700-2500	N	B7-208	8HR	6.3/.60	23
23EWP4	114	TA-BR	20 5/8 x 16 5/8	14 7/8	1700-2500	N	B7-208	8HR	6.3/.45	22
23EWP4A	114	TA-BR	20 5/8 x 16 5/8	14 13/32	1700-2500	N	B7-208	8HR	6.3/.45	22
23EYP4	92	TA-BF	21 5/8 x 18 1/16	18 1/8	2000-2500	N	B6-203	12L	6.3/.60	25
23EZP4	94	TA-BR	20 21/32 x 16 35/64	17 3/64	1700-2500	N	B7-208	8HR	6.3/.45	23.5
23FP4	114	TA	20 1/2 x 16 1/2	13 11/16	1700-2500	N	B7-208	8HR	6.3/.60	22
23FP4A	114	TA	20 1/2 x 16 1/2	13 25/32	1700-2500	N	B7-208	8HR	6.3/.60	23.5
23FAP4	114	TA-BF	21 13/64 x 17 21/64	14 13/32	1700-2500	N	B7-208	8HR	6.3/.60	22
23FBP4	92	TA-AR-BR	20 21/32 x 16 21/32	18 1/8	1700-2500	N	B6-203	12L	6.3/.60	25
23FCP4	110	TA-BR	20 5/8 x 16 5/8	14 7/8	1700-2500	N	B7-208	8HR	6.3/.45	22
23FDP4	110	TA-BR	20 21/32 x 16 21/32	14 7/8	1700-2500	N	B7-208	8HR	6.3/.45	23
23FHP4	110	TA-BR	20 3/8 x 16 3/4	14 7/8	1700-2500	N	B7-208	8HR	6.3/.45	23.5
23FKP4	94	TA-BC	21 5/16 x 17 13/32	17 13/32	1700-2500	N	B7-208	8HR	6.3/.60	23.5
23FLP4	92	TA-BR	20 5/8 x 16 5/32	18	1700-2500	N	B6-203	12L	6.3/.45	25
23FMP4	110	TA-BR	20 21/32 x 16 17/32	14 7/8	1700-2500	N	B7-208	8HR	6.3/.45	23
23FNP4	92	TA-BF	21 5/8 x 18 5/16	18	2000-2500	N	B6-206	12L	6.3/.45	25
23FRP4	110	TA-BF	21 13/64 x 17 21/64	14 1/4	1700-2500	N	B7-208	8HR	6.3/.45	23
23FSP4	110	TA-BF	21 13/64 x 17 21/64	14 7/8	1700-2500	N	B7-208	8HR	6.3/.60	23
23FVP4	110	TA-BR	20 5/8 x 16 5/8	14 7/8	2000-2500	N	B7-208	8HR	6.3/.45	22
23FVP4A	110	TA-BR	20 5/8 x 16 5/8	14 7/8	2000-2500	N	B7-208	8HR	6.3/.45	22
23FWP4	92	TA-BR	20 5/8 x 16 5/8	18	1700-2500	N	B6-63	12L	6.3/.45	22
23FWP4A	92	TA-BR	20 5/8 x 16 5/8	18	1700-2500	N	B6-203	12L	6.3/.45	22
23GP4	110	TA, BC	21 5/16 x 17 13/32	15 5/16	2000-2500	N	B7-208	8HR	6.3/.60	22
23GBP4	110	TA-BR	20 5/8 x 16 5/8	14 7/8	1700-2500	N	B7-208	8HR	6.3/.45	23
23GDP4	114	TA-BR	20 5/8 x 16 5/8	14 1/2	2000-2500	N	B7-208	8HR	6.3/.60	22

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MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	Type
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts / Magnet Coil Current in Ma.	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		
+.70m	600	16	500	500	48-83	18 Sec. Heater Warm-up; Tri-Pot. Es. Focus	**23CSP4**
−.55 to +1.1	550	16	0 to 400	300	40-77		**23CTP4**
+.70m	600	16	500	500	48-83	Tri-Potential Electrostatic Focus	**23CUP4**
+.70m	600	16	0 to 400	500	48-83	18 Sec. Heater Warm-up; Tri-Pot. Es. Focus	**23CVP4**
+.70	600	16	0 to 400	500	43-78	Tri-Potential Focus	**23CWP4**
+.70	600	16	0 to 400	500	43-78	18 Sec. Heater Warm-up; Tri-Pot. Es. Focus	**23CXP4**
−.55 to +1.1	550	20	0 to 400	300	40 to 77		**23CZP4**
+.70m	600	16	0 to 400	500	48-83	Tri-Potential Electrostatic Focus	**23DP4**
−.55 to +1.1	70	18	−100 to +300	50	35-55		**23DAP4**
−.50 to +1.0	100	18	0 to 500	50	31-49		**23DBP4**
−.40 to +1.1	70	18	0 to 400	50	35-55		**23DCP4**
−.55 to +1.1	550	16	0 to 400	400	42-78		**23DEP4**
−.55 to +1.1	550	16	0 to 400	400	42-78		**23DFP4**
−.55 to +1.1	700	16	0 to 400	400	36-78		**23DHP4**
−.55 to +1.1	700	16	0 to 400	400	36-78		**23DJP4**
−.55 to +1.1	550	16	0 to 400	300	33-59		**23DKP4**
−.45 to +1.25	225	20	0 to 500	50	36-54		**23DLP4**
−.45 to +1.25	225	20	0 to 500	50	36-54	.023" x .625" Tension Band	**23DLP4A**
−.50 to +1.1	60	20	0 to 500	35	25-50		**23DNP4**
−.55 to +1.1	80	20	−100 to +300	65	41-56		**23DQP4**
−.55 to +1.1	80	18	−100 to +300	65	41-56	Coated Funnel	**23DSP4**
−.55 to +1.1	80	18	−100 to +300	65	41-56	No Funnel Coating	**23DSP4A**
−.55 to +1.1	550	20	0 to 400	300	40-76		**23DTP4**
−.55 to +1.1	550	18	0 to 400	400	46-94		**23DVP4**
−.55 to +1.1	550	18	0 to 400	400	46-94	No Funnel Coating. 5/8" Tension Band	**23DVP4A**
−.50 to +1.0	400	18	0 to 500	200	31-49		**23DWP4**
−.50 to +1.0	550	18	0 to 500	300	36-54		**23DYP4**
−.55 to +1.1	550	18	0 to 400	400	46-94		**23DZP4**
−.55 to +1.1	70	18	0 to 400	50	+39 to +57▪		**23EP4**
−.55 to +1.1	550	16	0 to 400	300	35-72		**23EAP4**
−.50 to +1.0	60	22	0 to 500	35	25-50		**23ECP4**
−.55 to +1.1	550	20	0 to 500	300	35-72		**23EDP4**
−.40 to +1.25	70	18	0 to 400	50	34-49		**23EFP4**
−.55 to +1.1	550	20	0 to 400	400	36-78		**23EKP4**
−.40 to +1.25	70	20	0 to 400	50	36-54		**23ENP4**
−.55 to +1.1	550	18	0 to 400	300	28-62		**23EQP4**
−.55 to +1.1	550	18	0 to 400	300	28-62		**23ERP4**
−.50 to +1.0	550	18	0 to 500	300	36-54		**23ESP4**
−.50 to +1.0	550	18	0 to 500	300	36-54		**23ESP4A**
−.55 to +1.1	550	18	0 to 400	300	28-62		**23ETP4**
−.55 to +1.1	550	18	0 to 400	400	46-94		**23EWP4**
−.55 to +1.1	550	18	−200 to +200	400	48-96		**23EWP4A**
−.55 to +1.1	60	20	0 to 500	35	25-50		**23EYP4**
−.55 to +1.1	70	18	0 to 400	50	35-55	Mounting Lugs	**23EZP4**
−.55 to +1.1	550	14	0 to 400	450	50-110		**23FP4**
−.55 to +1.1	550	14	0 to 400	450	50-110		**23FP4A**
−.55 to +1.1	550	18	−200 to +200	400	48-96		**23FAP4**
−.40 to +1.25	70	20	0 to 400	50	36-54		**23FBP4**
−.40 to +1.25	70	18	0 to 400	50	34-49		**23FCP4**
−.40 to +1.25	70	18	0 to 400	50	34-52		**23FDP4**
−.40 to +1.25	70	16	−200 to +200	50	32-50		**23FHP4**
−.55 to +1.1	650	16	0 to 500	500	45-95		**23FKP4**
−.55 to +1.1	550	18	−200 to +200	300	37-74		**23FLP4**
−.55 to +1.1	550	18	0 to 400	300	28-62		**23FMP4**
−.55 to +1.1	550	20	0 to 500	300	35-72		**23FNP4**
−.50 to +1.0	60	16	0 to 400	50	35-55		**23FRP4**
−.50 to +1.0	500	16	0 to 400	400	39-94		**23FSP4**
−.50 to +1.0	550	18	0 to 500	300	36-54		**23FVP4**
−.50 to +1.0	550	18	0	300	36-54		**23FVP4A**
−.45 to +1.25	225	20	0 to 500	50	36-54		**23FWP4**
−.45 to +1.25	225	20	0 to 500	50	36-54	5/8" Tension Band	**23FWP4A**
−.55 to +2.2	550	16	0 to 400	300	33-77		**23GP4**
−.50 to +1.0	500	16	0 to 400	400	39-94		**23GBP4**
−.55 to +1.1	550	18	0 to 400	400	36-94		**23GDP4**

Monochrome TV Picture Tubes Data (cont'd)

Type	Defl. Angle and Neck Dia. ◆	FACEPLATE: Clear Tinted Alum. Shield* Anti-Refl.	OVERALL DIMENSIONS INCHES: Faceplate Dimensions	OVERALL DIMENSIONS INCHES: Length	External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DESIGN: Anode (Kv)
23GHP4	94	TA-BR	20 31/32 x 16 5/8	16 13/16	2000-2500	N	B7-208	8HR	6.3/.45	23
23GJP4	110	TA-BR	20 5/8 x 16 5/8	14 1/4	1700-2500	N	B7-208	8HR	6.3/.45	22
23GJP4A	110	TA-BR	20 31/32 x 16 21/32	14 1/4	1700-2500	N	B7-208	8HR	6.3/.45	23
23GKP4	92	TA-BF	21 13/16 x 17	18 3/8	2000-2500	N	B6-203	12L	6.3/.60	22
23GRP4	92	TA-BF	21 13/16 x 17	18 3/8	2000-2500	N	B6-63	12L	6.3/.45	22
23GSP4	110	TA-BR	20 31/32 x 16 21/32	14 7/8	1700-2500	N	B7-208	8HR	6.3/.60	23
23GTP4	110	TA-BR	20 31/32 x 16 5/8	14 7/8	1700-2500	N	B7-208	8HR	6.3/.60	23
23GVP4	114	TA-BR	20 5/8 x 16 5/8	14 1/2	2000-2500	N	B7-208	8HR	6.3/.45	22
23GWP4	110	TA-BR	21 1/4 x 16 3/4	14 3/8	2000-2500	N	B7-208	8HR	6.3/.45	22
23GXP4	110	TA-BR	20 5/8 x 16 5/8	14 7/8	2000-2500	N	B7-208	8HR	6.3/.60	23
23HP4	110	TA, BC	21 3/16 x 17 3/16	15 1/2	2000-2500	N	B7-208/B7-183	8HR	6.3/.60	20
23HBP4	110	TA-BR	21 5/32 x 17 21/64	14	1700-2500	N	B7-208	8HR	6.3/.30	22
23HFP4	110	TA-BR	20 5/8 x 16 5/8	14 7/8	1700-2500	N	B7-208	8HR	6.3/.45	23
23HFP4A	110	TA-BR	20 31/32 x 16 21/32	14 7/8	1700-2500	N	B7-208	8HR	6.3/.45	23
23HGP4	110	TA-BR	20 31/32 x 16 21/32	14 7/8	1700-2500	N	B7-208	8HR	6.3/.45	23
23HKP4	110	TA-BF	21 7/64 x 17 21/64	14 7/8	1700-2500	N	B7-208	8HR	6.3/.60	23
23HMP4	110	TA-BR	20 31/32 x 16 5/8	14 3/4	1700-2500	N	B7-208	8HR	6.3/.30	23
23HQP4	110	TA-BR	20 5/8 x 16 5/8	14 3/4	1700-2500	N	B7-208	8HR	6.3/.45	23
23HRP4	110	TA-BR	20 31/32 x 16 39/64	14 3/8	2000-2500	N	B7-208	8HR	6.3/.45	23.5
23HTP4	110	TA-BP	20 1/2 x 16 1/2	14 5/16	2000-2500	N	B7-208	8HR	6.3/.30	20
23HUP4	110	TA-BR	20 31/32 x 16 21/32	14 1/8	1700-2500	N	B7-208	8HR	6.3/.45	23.5
23HUP4A	110	TA-BR	20 31/32 x 16 21/32	14 1/8	1700-2500	N	B7-208	8HR	6.3/.45	23.5
23HWP4	110	TA-BR	20 31/32 x 16 39/64	14 7/8	2000-2500	N	B7-208	8HR	6.3/.45	22
23HWP4A	110	TA-BR	20 31/32 x 16 39/64	14 7/8	2000-2500	N	B7-208	8HR	6.3/.45	22
23HXP4	110	TA-AR-BR	20 31/32 x 16 21/32	14 7/8	1700-2500	N	B7-208	8HR	6.3/.45	23
23HZP4	110	TA-BR	20 31/32 x 16 21/32	14 7/8	1700-2500	N	B7-208	8HR	6.3/.30	23
23JP4	110	TA, BC	21 3/16 x 17 3/16	15 7/16	2000-2500	N	B6-214	7FA	6.3/.45	22
23JAP4	110	TA-BR	20 31/32 x 16 21/32	14 7/8	1350-2150	N	B7-208	8HR	6.3/.30	23
23JBP4	110	TA-BF	21 17/64 x 17 21/64	14 1/8	1700-2500	N	B7-208	8HR	6.3/.60	23
23JEP4	110	TA-BR	20 31/32 x 16 39/64	14 7/8	1700-2500	N	B7-208	8HR	6.3/.45	23
23JFP4	110	TA-BF	21 17/64 x 17 21/64	14 1/4	1700-2500	N	B7-208	8HR	6.3/.315	23
23JGP4	110	TA-BR	20 31/32 x 16 21/32	14 1/8	1700-2500	N	B7-208	8HR	6.3/.45	23.5
23JLP4	110	TA-BR-AR	20 31/32 x 16 21/32	14 1/8	1700-2500	N	B7-208	8HR	6.3/.45	23.5
23KP4	114	TA, BC	20 1/2 x 16 1/2	13 1/2	2000-2500	N	B6-203/B7-208	8JS	6.3/.60	20
23KP4A	114	TA, BC	20 1/2 x 16 1/2	13 1/2	2000-2500	N	B6-204/B7-208	8JS	6.3/.60	22
23MP4	114	TA	20 1/2 x 16 1/2	14 17/32	1700-2500	N	B7-208	8HR	6.3/.60	22
23MP4A	114	TA	20 1/2 x 16 1/2	14 17/32	1700-2500	N	B7-208	8HR	6.3/.60	23.5
23NP4	114	TA	20 1/2 x 16 1/2	14 3/16	1700-2500	N	B7-208	8HR	6.3/.60	22
23RP4	110	TA, BC	21 3/16 x 17 3/16	13 5/8	2000-2500	N	B7-208	8JR	6.3/.30	22
23SP4	110	TA, BC	21 3/16 x 17 13/32	15 5/16	2000-2500	N	B7-208	8HR	6.3/.30	22
23TP4	90	TA, BC	21 3/16 x 17 3/16	19 11/32	1700-2500	N	B6-63/B6-203	12L	6.3/.60	22
23UP4	110	TA, BC	21 3/16 x 17 13/32	15 3/16	2000-2500	N	B7-208	8HR	6.3/.45	18
23VP4	114	TA, BC	20 1/2 x 16 1/2	13 5/8	2000-2500	N	B7-208	8HR	6.3/.30	22
23WP4	114	TA, BC	20 1/2 x 16 1/2	14 1/16	2000-2500	N	B7-208	8HR	6.3/.60	20
23XP4	92	TA, BC	21 3/16 x 17 13/32	18 3/16	2000-2500	N	B6-203	12L	6.3/.60	18
23YP4	92	TA, BC	21 3/16 x 17 13/32	18 3/16	2000-2500	N	B6-203	12L	6.3/.60	22
23ZP4	90	TA, BC	21 3/16 x 17 13/32	19 13/32	2000-2500	N	B6-63	12L	6.3/.60	22
24AP4	70	T	24	23 1/16	.....	S	B5-57	12D	6.3/.60	17.6
24AP4A	70	TA	24	23 1/16	.....	S	B5-57	12D	6.3/.60	17.6
24AP4B	70	C, AR	24	23 1/16	.....	S	B5-57	12D	6.3/.60	17.6
24ADP4	90	TA	22 1/16 x 18 7/16	21 1/8	2000-2500	S	B5-57	12N	6.3/.60	24.2
24AEP4	90	TA	22 1/16 x 18 7/16	19 1/8	2000-2500	N	B6-63	12L	6.3/.60	22
24AHP4	110	TA	22 1/16 x 18 1/2	15 7/8	2000-2500	N	B7-208	8HR	6.3/.60	22
24AJP4	90	TA	22 1/16 x 18 7/16	19 1/8	2000-2500	N	B6-63	12L	6.3/.60	22
24ALP4	110	TA	22 1/16 x 18 1/2	15 7/8	2000-2500	N	B7-183	8HR	6.3/.60	22
24AMP4	110	TA	22 1/16 x 18 1/2	15 5/8	2000-2500	N	B6-185	7FA	6.3/.60	22
24ANP4	90	TA	22 43/64 x 18 7/16	20 1/8	1700-2500	S	B6-63	12L	6.3/.60	22
24AQP4	110	TA	22 1/16 x 18 1/2	15 7/8	1700-2500	N	B7-183	8HR	6.3/.45	22
24ASP4	90	TA	22 43/64 x 18 7/16	19 1/8	1700-2500	N	B6-63	12L	6.3/.30	22
24ATP4	90	TA	22 1/16 x 18 7/16	19 1/8	2000-2500	N	B6-63	12L	6.3/.60	22
24AUP4	90	TA	22 43/64 x 18 7/16	18 1/2	1700-2500	N	B6-63	12L	6.3/.60	22
24AVP4	110	TA	22 1/16 x 18 1/2	14 13/16	1700-2500	N	B7-208	8JK	2.35/.60	20
24AWP4	110	TA	22 1/16 x 18 1/2	14 7/8	2000-2500	N	B7-183	8HR	6.3/.60	22
24AXP4	110	TA	22 1/16 x 18 1/2	15 7/8	1700-2500	N	B7-183/B7-208	8HR	6.3/.30	22
24BP4	70	T	22 1/4	24 1/2	.....	S	B6-63	12M	6.3/.60	17.6

Notes—Page 533 **Basing Diagrams—Page 535**

MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts / Magnet Coil Current in Ma.	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		Type
−.50 to +1.0	400	18	0 to 400	200	+31 to +49▪		23GHP4
−.40 to +1.25	70	18	0 to 400	50	+32 to +50▪		23GJP4
−.40 to +1.25	70	18	0 to 400	50	+32 to +50▪	Welded Tension Band	23GJP4A
−.55 to +1.1	550	16	0 to 400	300	35-72		23GKP4
−.55 to +1.1	550	16	0 to 400	300	35-72		23GRP4
−.55 to +1.1	550	18	0 to 400	300	28-62	Mounting Lugs	23GSP4
−.55 to +1.1	550	18	0 to 400	300	28-62		23GTP4
−.50 to +1.1	55	18	0 to 500	45	35-50		23GVP4
−.40 to +1.25	60	18	−50 to +350	50	33-45		23GWP4
−.55 to +1.1	550	16	0 to 400	300	35-72	Mounting Lugs	23GXP4
−.50 to +2.0	550	16	0 to 400	300	40-77		23HP4
−.55 to +1.1	550	16	0 to 400	300	35-72		23HBP4
−.50 to +1.0	500	16	0 to 400	400	39-94		23HFP4
−.55 to +1.1	550	18	0 to 400	300	28-62		23HFP4A
−.55 to +1.1	550	18	0 to 400	300	28-62		23HGP4
−.50 to +1.0	250	16	0 to 400	150	36-54		23HKP4
−.55 to +1.1	550	18	0 to 400	300	28-62		23HMP4
−.50 to +1.0	500	16	0 to 400	400	39-94	Mounting Lugs	23HQP4
−.55 to +1.1	60	18	0 to 400	30	+30 to +45▪		23HRP4
−.55 to +1.1	550	16	0 to 400	400	42-72		23HTP4
−.40 to +1.25	60	18	0 to 400	30	+22 to +45▪		23HUP4
−.40 to +1.25	60	18	0 to 400	30	+22 to +45▪	Welded Tension Band	23HUP4A
−.55 to +1.1	70	16	0 to 400	50	+35 to +55▪		23HWP4
−.55 to +1.1	70	16	0 to 400	50	+35 to +55▪	Welded Tension Band	23HWP4A
−.55 to +1.1	550	18	0 to 400	300	28-62		23HXP4
−.55 to +1.1	550	18	0 to 400	300	28-62		23HZP4
−.55 to +1.1	70	16	250	50	+40 to +55▪		23JP4
−.40 to +1.25	70	18	−200 to +200	50	+32 to +50▪		23JAP4
−.50 to +1.0	500	16	0 to 400	400	39-94		23JBP4
−.55 to +1.1	550	18	0 to 400	300	+28 to +62▪		23JEP4
−.50 to +1.0	60	16	0 to 400	50	35-55		23JFP4
−.40 to +1.25	60	18	0 to 400	30	+22 to +45▪		23JGP4
−.40 to +1.25	60	18	0 to 400	30	+22 to +45▪	Welded Tension Band	23JLP4
−.50 to +1.0	700	16.5	250	450	33-77		23KP4
−.50 to +1.0	700	18	250	450	33-77		23KP4A
−.55 to +1.1	550	18	0 to 400	400	41-99		23MP4
−.55 to +1.1	550	18	0 to 400	400	41-99		23MP4A
−.55 to +1.1	70	18	0 to 400	50	+39 to +54▪		23NP4
+.70m	600	16	0 to 400	500	48-83	Tri-Potential Electrostatic Focus	23RP4
−.55 to +1.1	550	16	0 to 400	300	40-77		23SP4
−.50 to +1.0	550	16	0 to 450	300	33-77		23TP4
−.55 to +1.1	550	16	0 to 400	300	40-77	Low Anode Voltage	23UP4
−.55 to +1.1	550	14	0 to 400	450	50-110	18 Second Heater Warm-up Time	23VP4
−.50 to +2.0	550	16	0 to 400	300	40-77		23WP4
−.55 to +1.1	550	16	0 to 400	300	40-77		23XP4
−.55 to +1.1	550	16	0 to 400	300	40-77		23YP4
−.50 to +1.1	70	18	0 to 500	50	+40 to +55▪		23ZP4
Magnetic	450	15	114 Ma.	300	33-77	Metal Bulb	24AP4
Magnetic	450	15	114 Ma.	300	33-77	Metal Bulb	24AP4A
Magnetic	450	15	114 Ma.	300	33-77	Metal Bulb	24AP4B
Magnetic	660	18	125 Ma.	300	33-77		24ADP4
−.55 to +1.1	550	18	−50 to +350	300	33-77		24AEP4
−.55 to +1.1	550	16	−50 to +350	300	33-77		24AHP4
−.55 to +1.1	70	18	0 to 350	50	35-50		24AJP4
−.55 to +1.1	550	17	0 to 500	300	33-77		24ALP4
−.55 to +1.1	550	16	0 to 400	300	40-77		24AMP4
−.55 to +1.1	550	18	−72 to +396	300	40-77		24ANP4
−.55 to +1.1	550	16	0 to 400	300	40-77		24AQP4
−.55 to +1.1	550	18	0 to 400	300	40-77		24ASP4
−.55 to +1.1	75	18	0 to 400	50	+39 to +57▪		24ATP4
−.55 to +1.1	550	18	−75 to +400	300	40-77		24AUP4
−.55 to +1.1	550	16	−100 to +300	300	40-77	2.35 Volt Heater	24AVP4
−.55 to +1.1	550	16	0 to 400	300	33-77		24AWP4
−.55 to +1.1	550	16	0 to 400	300	40-77		24AXP4
−.55 to +1.1	550	14	−56 to +310	300	33-77	Metal Bulb	24BP4

Monochrome TV Picture Tubes Data (cont'd)

Type	Defl. Angle and Neck Dia. ◆	FACEPLATE: Clear Tinted Alum. Shield* Anti-Refl.	OVERALL DIMENSIONS INCHES: Faceplate Dimensions	OVERALL DIMENSIONS INCHES: Length	External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DESIGN: Anode (Kv)
24BAP4	110	TA	22 1/16 x 18 1/2	15 7/8	1700-2500	N	B7-183/B7-208	8HR	6.3/.60	22
24BCP4	90	TA-BP	22 1/16 x 18 7/16	19 3/8	2000-2500	N	B6-203	12L	6.3/.60	22
24BEP4	110	TA	22 1/16 x 18 1/2	14 13/16	1700-2500	N	B7-208	8KW	6.3/.60	20
24CP4	90	T	22 1/16 x 18 7/16	21 1/8	2000-2500	S	B5-57	12N	6.3/.60	22
24CP4A	90	TA	22 1/16 x 18 7/16	21 1/8	2000-2500	S	B5-57	12N	6.3/.60	22
24CP4B	90	TA	22 1/16 x 18 7/16	21 1/8	2000-2500	N	B5-57	12N	6.3/.60	22
24DP4	90	T	22 1/16 x 18 7/16	21 1/8	2000-2500	S	B6-63	12L	6.3/.60	22
24DP4A	90	TA	22 1/16 x 18 7/16	21 1/8	2000-2500	S	B6-63	12L	6.3/.60	22
24QP4	90	T	22 1/16 x 18 7/16	21 1/8	500-750	S	B5-57	12N	6.3/.60	19.8
24TP4	90	TA	22 1/16 x 18 7/16	21 1/8	250-2500	S	B5-57	12N	6.3/.60	22
24VP4	90	T	22 43/64 x 18 7/16	21 1/8	2000-2500	S	B5-57	12N	6.3/.60	24.2
24VP4A	90	TA	22 43/64 x 18 7/16	21 1/8	2000-2500	S	B5-57	12N	6.3/.60	24.2
24XP4	90	T	22 1/16 x 18 7/16	21 1/8	.....	S	B5-57	12D	6.3/.60	22
24YP4	90	TA	22 43/64 x 18 7/16	21 1/8	2000-2500	S	B6-63	12L	6.3/.60	22
24ZP4	90	TA	22 43/64 x 18 7/16	21 1/8	2000-2500	N	B6-63	12L	6.3/.60	22
25DP4	110	TA-BF	23 1/4 x 18 31/32	15 1/16	2000-2500	N	B7-208	8HR	6.3/.30	22
25EP4	110	TA-BF	23 1/4 x 18 31/32	15 13/16	2000-2500	N	B7-208	8HR	6.3/.30	22
25HP4	110	TA-BF	23 1/4 x 18 7/16	15 7/8	2000-2500	N	B7-208	8HR	6.3/.45	23
25JP4	110	TA	22 3/8 x 18 1/16	15 13/16	2000-2500	N	B7-208	8HR	6.3/.30	22
25KP4	110	TA-AR-BP	22 3/8 x 18 1/16	16	2000-2500	N	B7-208	8HR	6.3/.30	22
25LP4	110	TA-BP	22 23/64 x 18 3/64	16 3/16	2000-2500	N	B7-183	8HR	6.3/.60	22
25TP4	110	TA-BR	22 1/2 x 18 1/4	15 13/16	2000-2500	N	B7-208	8HR	6.3/.60	22
27AP4	90	T, AR	25 1/4 x 19 13/16	21 5/8	.....	S	B6-63	12M	6.3/.60	19.8
27ABP4	110	TA-BP	25 9/32 x 20 7/32	17 1/8	2000-2500	N	B7-208	8HR	6.3/.60	22
27ACP4	90	TA-BP	25 9/32 x 20 7/32	21 13/16	2000-2500	N	B6-203	12L	6.3/.60	25
27ADP4	110	TA-BP	25 9/32 x 20 7/32	17 9/16	2000-2500	N	B7-208	8HR	6.3/.60	22
27AEP4	110	TA	25 9/32 x 20 7/32	17 1/8	2000-2500	N	B7-208	8HR	6.3/.30	22
27AFP4	110	TA-BP	25 9/32 x 20 7/32	17 9/16	2000-2500	N	B7-208	8HR	6.3/.30	22
27AGP4	110	TA-AR-BP	25 9/32 x 20 7/32	17 1/8	2000-2500	N	B7-208	8HR	6.3/.60	22
27EP4	90	TA	25 9/32 x 20 7/32	23 1/16	.....	S	B5-57	12D	6.3/.60	22
27GP4	90	T	25 9/32 x 20 7/32	23 1/4	.....	S	B5-57	12D	6.3/.60	24.8
27LP4	90	TA	25 9/32 x 20 7/32	24 23/64	200-400	S	B5-57	12N	6.3/.60	24.2
27MP4	90	TA, AR	25 1/4 x 19 13/16	22 3/16 m	.....	N	B5-57	12D	6.3/.60	19.8
27NP4	90	T	25 9/32 x 20 7/32	23	500-2500	S	B5-57	12N	6.3/.60	19.8
27RP4	90	TA	25 9/32 x 20 7/32	23 1/16	500-2500	S	B5-57	12N	6.3/.60	22
27RP4A	90	TA	25 9/32 x 20 7/32	23 1/16	500-2500	N	B5-57	12N	6.3/.60	20
27SP4	90	TA	25 9/32 x 20 7/32	23 1/16	500-750	S	B6-63	12L	6.3/.60	22
27UP4	90	T	25 9/32 x 20 7/32	23 1/16	500-750	S	B6-63	12L	6.3/.60	22
27VP4	90	TA	25 9/32 x 20 7/32	21 1/16	2000-2500	N	B6-63	12L	6.3/.60	19.8
27XP4	90	TA	25 9/32 x 20 7/32	20 1/16	1700-2500	N	B6-203	12L	6.3/.60	23
27YP4	90	TA-BP	25 9/32 x 20 7/32	21 1/16	2000-2500	N	B6-63	12L	6.3/.60	25
27ZP4	110	TA	25 9/32 x 20 7/32	17 1/8	2000-2500	N	B7-208	8HR	6.3/.60	22
30BP4	90	T	30 1/8	23 1/16	.....	S	B5-57	12D	6.3/.60	33

Notes—Page 533 **Basing Diagrams—Page 535**

Monochrome Check Tubes

Type	▲Heater: Ef/If Volts Amps	Face: Clear Anti-Refl. Alum. Tinted	Face: Round or Rect.	External Coating Capacitance (pf)	Focus	Defl. Angle and Neck Diam. ◆	Anode Volts ● (KV) Max.	Basing	Ion Trap Mag.	Nominal Length (In.)
5AXP4	6.3/.60	C	○	No	Auto	53	19.8	12S	N	10 5/8
8XP4	6.3/.60	T	□	No	Auto	90	22	12S	N	11 3/4
8YP4	6.3/.60	T	□	No	Auto	110	22	7FG	N	8 1/4
12DMP4	6.3/.60	TA, TB	□	No	Auto	110	22	8HR	N	9 1/2

These four types have self-focusing guns, do not require ion trap magnets, and have no external coating. One of them can be used as a TV receiver check tube for almost any of the listed picture tube types. Additional technical information on these tubes and on their application in TV receiver servicing is available upon request.

MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	Type
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts — Magnet Coil Current in Ma.	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		
−.55 to +1.1	70	20	0 to 400	64	+47 to +63▪		24BAP4
−.50 to +1.1	550	18	0 to 400	400	36-94		24BCP4
−.55 to +1.1	550	16	−100 to +300	300	40-77		24BEP4
Magnetic	550	18	100 Ma.	300	33-77		24CP4
Magnetic	550	18	100 Ma.	300	33-77		24CP4A
Magnetic	550	18	100 Ma.	300	33-77		24CP4B
−.55 to +1.1	550	18	−72 to +396	300	33-77		24DP4
−.55 to +1.1	550	18	−72 to +396	300	33-77		24DP4A
Magnetic	550	16	100 Ma.	300	33-77		24QP4
Magnetic	550	18	100 Ma.	300	33-77		24TP4
Magnetic	660	20	125 Ma.	300	33-77		24VP4
Magnetic	660	20	125 Ma.	300	33-77		24VP4A
Magnetic	550	18	125 Ma.	300	33-77		24XP4
−.55 to +1.1	550	18	−72 to +396	300	33-77		24YP4
−.55 to +1.1	550	16	0 to 500	300	33-77		24ZP4
−.55 to +1.1	700	16	−200 to +200	300	35-72	Short Neck	25DP4
−.55 to +1.1	700	16	−200 to +200	300	35-72		25EP4
−.50 to +1.0	60	16	0 to 400	50	35-55		25HP4
−.55 to +1.1	700	16	−200 to +200	300	35-72		25JP4
−.55 to +1.1	700	16	−200 to +200	300	35-72		25KP4
−.55 to +1.1	550	18	0 to 400	400	36-94		25LP4
−.55 to +1.1	550	18	0 to 400	400	36-94		25TP4
−.55 to +1.1	550	15	−60 to +300	300	33-77	Metal Bulb	27AP4
−.55 to +1.1	550	18	0 to 400	300	35-72		27ABP4
−.55 to +1.1	550	18	0 to 400	400	48-96		27ACP4
−.55 to +1.1	550	18	0 to 400	300	37-74		27ADP4
−.55 to +1.1	550	18	0 to 400	300	40-77		27AEP4
−.55 to +1.1	550	18	0 to 400	300	37-74		27AFP4
−.55 to +1.1	550	18	0 to 400	300	35-74		27AGP4
Magnetic	550	16	118 Ma.	300	33-77		27EP4
Magnetic	550	20	125 Ma.	300	33-77		27GP4
Magnetic	660	20	148 Ma.	300	33-77		27LP4
Magnetic	550	16	110 Ma.	300	42-78	Metal Bulb	27MP4
Magnetic	550	16	95 Ma.	300	33-77		27NP4
Magnetic	550	20	125 Ma.	300	33-77		27RP4
Magnetic	550	20	125 Ma.	300	33-77		27RP4A
−.55 to +1.1	550	18	−72 to +396	300	33-77		27SP4
−.55 to +1.1	550	16	0 to 396	300	33-77		27UP4
−.55 to +1.1	550	16	−72 to +396	300	33-77		27VP4
−.55 to +1.1	550	18	0 to 400	400	41-99		27XP4
−.55 to +1.1	550	18	0 to 450	300	28-72		27YP4
−.55 to +1.1	550	18	0 to 400	300	40-77		27ZP4
Magnetic	450	22	95 Ma.	300	33-77	Metal Bulb	30BP4

Notes:

♦ 94°, 110° and 114° types have a nominal neck diameter of 1⅛". All other magnetic deflection tube types have nominal neck diameter of 1¾". Color tubes listed have nominal neck diameter of 2" for the round types and 1⅛" for the rectangular types. Unless otherwise indicated in "Remarks" Column.

▲ All Sylvania television picture tubes (except as noted jn the Remarks Column) feature controlled heater warm-up time of 11 seconds for operation in receivers employing series heater strings.

■ Cathode drive service.

● Design Maximum Ratings are limiting values that should not be exceeded under the worst probable operating conditions.

** **Ion Trap**

N – No Magnet
S – Single Magnet
D – Double Magnet
I – Internal Magnet

Δ Does not include the dynamic convergence component.

m Maximum

notes continued on next page

Notes: (cont'd)

***IMPLOSION PROTECTION**

TB—Tension band

Employs a metal band which places the faceplate in proper compression. Currently used on small screen types for portable television sets.

BC—Bonded shield (contoured glass cap)

Features a permanently bonded-on wrap-around panel that provides added viewing safety. Mounting ears are located on the four corners of the bonded shield to allow mounting of the tube, thereby eliminating the use of complicated mounting devices. This design is currently available in the 19" and 23" sizes only.

BP—Bonded shield (glass plate)

This design is adaptable to any size and shape of bulb. The panel, which fits only over the frontal surface, is molded, cut to size, shaped, and then bonded to the tube by Sylvania. Currently popular tube sizes incorporating this type of Bonded Shield are 16, 19, 21, 23 and 27".

BF—Bonded metal frame (shelbond)

Features a resin-filled steel shell encasing the critical area of the picture tube. Integral mounting ears on the shell eliminate the need for additional brackets. Bonded Frame is availabie in 11, 12, 19, 23 and 25" designs. Other tube sizes utilizing this design may be adopted.

BR—Bonded metal rim plus tension band (Kimcode)

The new design employs a special heavy weight bulb with a rim band secured around the edge of the tube. A tension band, joined by a clamp, fits directly over the rim band, placing the faceplate in proper compression. This design is availabie in 16, 19, and 23" tube sizes, and other tube sizes utilizing this design may be adopted. There are versions in which the tension band is welded, and these are generally interchangeable with the clamped types.

Certain types employ mounting ears on the four corners of the rim to allow mounting of the tube, thereby eliminating the use of complicated mounting devices. Several versions of mounting brackets exist, and specific type numbers should be specified to assure correct interchangeability.

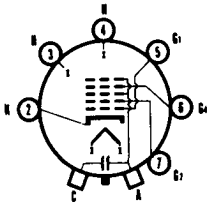
BL—Bonded laminated plastic shield

Incorporates a laminated plastic sheet which is coated with a plasticizer and vacuum-formed directly on the face and partly down the sides of the tube. Used only on a few small tubes for portables.

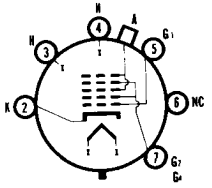
Nonbonded

Has a standard glass protective plate mounted in cabinet in front of the tube. This may allow moisture and dust particles to collect on the tube faceplate and inner surface of the safety panel. The protective plate gives the regular tube a total of four reflective surfaces compared to the bonded types which have only two reflective surfaces —a total of 50% more reflection in the regular tube and separate safety plate combination.

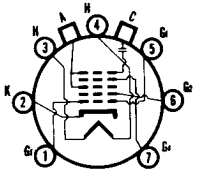
Basing Diagrams (monochrome tubes)



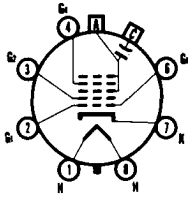
7FA



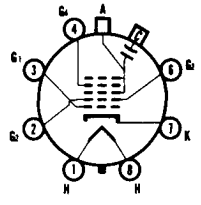
7FG



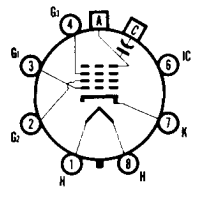
7GR



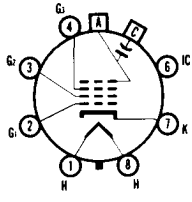
8HR



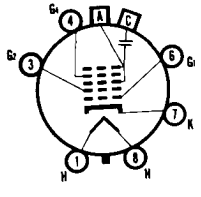
8JK



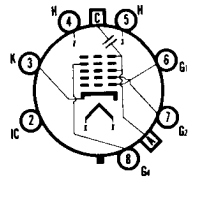
8JN



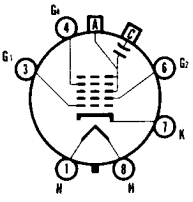
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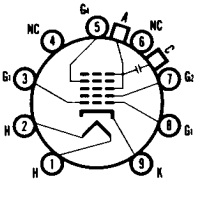
8JS



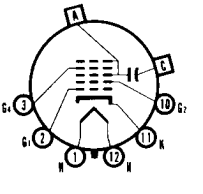
8KP



8KW

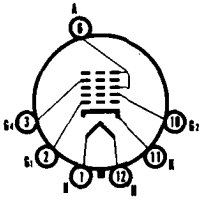


9RS

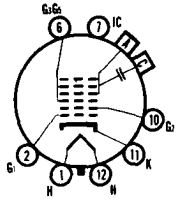


12AB

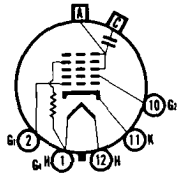
Basing Diagrams (continued)



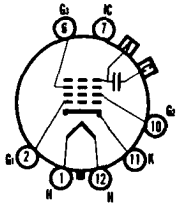
12AD



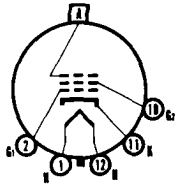
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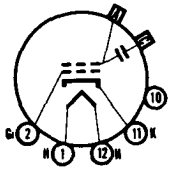
12AT



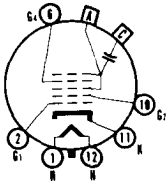
12C



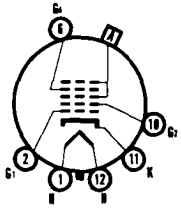
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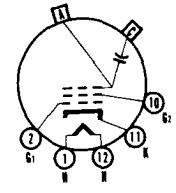
12G



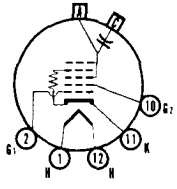
12L



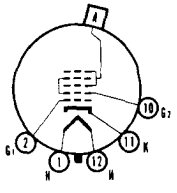
12M



12N



12P



12S

basing diagram symbols

A Anode
A1 First Anode
A2 Second Anode, etc.
C Conductive Coating
G1 Grid No. 1
G2 Grid No. 2, etc.
H Heater
IC Internal Connection *(Do Not Use)*
K Cathode
■ Locating Lug
□ Bulb Terminal

TV PICTURE TUBE REPLACEMENT GUIDES

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Replacement Notes 544

Installation and Handling of TV Picture Tubes and Large Cathode Ray Tubes. 545

TV Picture Tube Replacement Guides

COLOR PICTURE TUBES

Type	SYLVANIA* Replacement	Replacement Classification◆
11" Types		
11SP22, 11WP22	**11WP22**	Direct
15" Types		
15ACP22	**15ACP22**	Direct
RE15LP22, H15LP22, C15LP22, 15LP22	**15LP22**	Direct
RE15NP22, H15NP22, C15NP22, 15KP22, 15NP22, 15XP22	**15NP22**	Direct
19" Types		
RE19EXP22, C19EXP22, H19EXP22, AN19EXP22, OC19EXP22, 19EXP22	**19EXP22**	Direct
REA19EYP22, RE19EYP22, C19EYP22, H19EYP22, AN19EYP22, OC19EYP22, 19EYP22, 19GSP22	**19EYP22**	Direct
RE19FMP22	**19FMP22**	Direct
19FXP22	**19EYP22**	Direct
H19GVP22	**19EXP22**	G
H19GWP22	**19EYP22**	G
19GXP22	**19EXP22**	G, H
19GYP22	**19EXP22**	H
19GZP22	**19EYP22**	Direct
19HBP22	**19FMP22**	Direct
19HFP22	**19EYP22**	G
19HCP22, 19HJP22, 19HKP22	**19HCP22**	Direct
490AJB22	**19EYP22**	G
490EB22, 490FB22, 490GB22	**19EXP22**	G, H
19JBP22	**19EXP22**	Direct
490HB22, 490JB22, 490LB22	**19EXP22**	G, H
21" Types		
21AXP22A, C21AXP22A, 21CYP22, C21CYP22A	**21FBP22A**	B
RE21FBP22A, C21FBP22A, H21FBP22A, AN21FBP22A, OC21FBP22A, 21FBP22A	**21FBP22A**	Direct
H21GUP22	**21FBP22A**	G
H21GVP22	**21FJP22A**	G
RE21FJP22A, C21FJP22A, H21FJP22A, AN21FJP22A, OC21FJP22A, 21FJP22A, RE21FKP22, 21FKP22	**21FJP22A**	Direct
22" Types		
RE22JP22, C22JP22, 22JP22, REA22JP22, CA22JP22, H22JP22	**22JP22**	Direct
RE22LP22, C22LP22, 22LP22	**22LP22**	Direct
22QP22	**22JP22**	Direct
22RP22	**22KP22**	Direct
22SP22	**22JP22**	Direct
RE22KP22, C22KP22, 22KP22	**22KP22**	Direct
22UP22, 22XP22, 22ADP22, 22AGP22, 22AHP22	**22UP22**	Direct
22YP22	**22JP22**	Direct

Type	SYLVANIA* Replacement	Replacement Classification♦
23" Types		
23EGP22, 23EGP22A	**23EGP22A**	Direct
23EGP22, 23EGP22A	**25AP22A**	
25" Types		
25ABP22	**25CP22**	Direct
25ADP22, 25AGP22, 25BCP22	**25AJP22**	Direct
25AEP22	**25BP22A**	Direct
25AFP22, 25AQP22	**25AP22A**	Direct
25AJP22, 25ASP22	**25AJP22**	Direct
RE25AP22A, C25AP22A, H25AP22A, AN25AP22A, OC25AP22A, 25AP22A	**25AP22A**	Direct
RE25BP22A, C25BP22A, H25BP22A, AN25BP22A, OC25BP22A, 25BP22A	**25BP22A**	Direct
RE25CP22, C25CP22, 25CP22, REA25CP22, CA25CP22	**25CP22**	Direct
25FP22, 25FP22A	**25BP22A**	Direct
25GP22-1, 25GP22, 25GP22A	**25AP22A**	Direct
25RP22	**25BP22A**	Direct
25SP22	**25AP22A**	Direct
25ACP22, 25ALP22, 25AYP22, 25UP22/ A63-16X	**25UP22**	Direct
25AKP22, 25AMP22	**25UP22**	
25VP22, 25WP22	**25AP22A**	Direct
H25XP22	**25AP22A**	G
H25YP22	**25BP22A**	G
25ZP22	**25AP22A**	Direct

MONOCHROME PICTURE TUBES

Type	SYLVANIA* Replacement	Replacement Classification♦
9TP4	**9TP4**	Direct
9YP4	**9YP4**	Direct
11CP4	**11CP4**	Direct
11GP4	**11GP4**	Direct
11JP4	**11JP4**	Direct
12BEP4	**12BEP4**	Direct
12BGP4	**12BGP4**	Direct
12BKP4	**12BKP4**	Direct
12BLP4	**12BKP4**	Direct
12BMP4	**12CDP4**	Direct
12BNP4	**12CGP4**	Direct
12BQP4	**12BQP4**	Direct
12BTP4	**12BTP4**	Direct
12BUP4	**12BUP4**	Direct
12BZP4	**12BZP4**	Direct
12CBP4	**12CBP4**	Direct
12CDP4	**12CDP4**	Direct
12CEP4	**12CEP4**	Direct
12CGP4	**12CGP4**	Direct
12CSP4	**12CSP4**	Direct
12CTP4	**12CTP4**	Direct
12DKP4	**12DKP4**	Direct
12DQP4	**12DQP4**	Direct
13AP4	**13AP4**	Direct
13DP4	**13DP4**	Direct
14NP4	**14WP4**	A
14NP4A	**14WP4**	A
14RP4	**14WP4**	A
14RP4A	**14WP4**	A
14SP4	**14WP4**	A

TV PICTURE TUBE REPLACEMENT GUIDES (cont'd)

Type	SYLVANIA* Replacement	Replacement Classification♦
14WP4	**14WP4**	Direct
SG14WP4	**14WP4**	Direct
14XP4	**14XP4A**	Direct
14XP4A	**14XP4A**	Direct
14ZP4	**14WP4**	Direct
15ADP4	**15ADP4**	Direct
15JP4	**15JP4**	Direct
16ANP4	**16ANP4**	Direct
16AQP4	**16ANP4**	Direct
16ASP4	**16ASP4**	Direct
16ATP4	**16BSP4**	Direct
16AUP4	**16AUP4**	Direct
16AVP4	**16BCP4**	Direct
16AXP4	**16ASP4**	Direct
16AYP4	**16AYP4**	Direct
16BAP4	**16BAP4**	Direct
16BCP4	**16BCP4**	Direct
16BGP4	**16CEP4**	Direct
16BRP4	**16BRP4**	Direct
16BSP4	**16BSP4**	Direct
16BVP4	**16BVP4**	Direct
16BXP4	**16BXP4**	Direct
16CAP4	**16CEP4**	Direct
16CEP4	**16CEP4**	Direct
16CHP4	**16BSP4**	Direct
16CHP4A	**16BSP4**	Direct
16CJP4	**16CJP4**	Direct
16CMP4	**16CMP4**	Direct
16KP4	**16RP4B**	A
16KP4A	**16RP4B**	A
16QP4	**16RP4B**	A, D
16RP4	**16RP4B**	A
16RP4A	**16RP4B**	A
16RP4B	**16RP4B**	Direct
16TP4	**16RP4B**	A
16UP4	**16RP4B**	A, D
16XP4	**16RP4B**	A, D
17AP4	**17BP4B**	Direct
17ATP4	**17BJP4**	A
17ATP4A	**17BJP4**	A
17AVP4	**17BJP4**	A
17AVP4A	**17BJP4**	A
17BP4	**17BP4B**	D
17BP4A	**17BP4B**	Direct
17BP4B	**17BP4B**	Direct
17BP4C	**17BP4B**	Direct
17BJP4	**17BJP4**	Direct
SG17BJP4	**17BJP4**	Direct
17BRP4	**17DSP4**	A
17BWP4	**17BWP4**	Direct
17BUP4	**17BJP4**	A
17BVP4	**17BWP4**	A
17BZP4	**17DSP4**	Direct
17CAP4	**17DSP4**	Direct
17CBP4	**17BJP4**	A
17CDP4	**17CDP4**	Direct
17CFP4	**17CFP4**	Direct
17CKP4	**17DSP4**	Direct
17CLP4	**17BJP4**	A
17CNP4	**17CNP4**	Direct
17CRP4	**17CRP4**	Direct
17CSP4	**17BWP4**	D
17CTP4	**17CTP4**	Direct
17CWP4	**17DSP4**	Direct
17CXP4	**17CRP4**	Direct
17CZP4	**17BJP4**	Direct
17DAP4	**17DRP4**	Direct
17DHP4	**17DXP4**	Direct
17DKP4	**17DKP4**	Direct
17DLP4	**17DKP4**	Direct
17DQP4	**17DQP4**	Direct
17DRP4	**17DRP4**	Direct
17DSP4	**17DSP4**	Direct
17DTP4	**17DKP4**	Direct
17DXP4	**17DXP4**	Direct
17DZP4	**17DXP4**	Direct
17EAP4	**17HP4C**	F
17EBP4	**17DXP4**	D
17EFP4	**17DXP4**	Direct
17EHP4	**17EHP4**	Direct
17ELP4	**17ELP4**	Direct
17EMP4	**17EMP4**	Direct
17EQP4	**17EQP4**	Direct
17FP4	**17HP4C**	A
17FP4A	**17HP4C**	A
17HP4	**17HP4C**	A
17HP4A	**17HP4C**	A
17HP4B	**17HP4C**	A
SG17HP4B	**17HP4C**	Direct
17HP4C	**17HP4C**	Direct
17JP4	**17BP4B**	Direct
17KP4	**17HP4C**	A, F
17KP4A	**17HP4C**	A, F
17LP4	**17LP4B**	Direct
17LP4A	**17LP4B**	A
SG17LP4A	**17LP4B**	A
17LP4B	**17LP4B**	Direct
17QP4	**17QP4B**	A
17QP4A	**17QP4B**	A
SG17QP4A	**17QP4B**	A
17QP4B	**17QP4B**	Direct
17RP4	**17HP4C**	Direct
17RP4C	**17HP4C**	Direct
17SP4	**17LP4B**	A, F
17UP4	**17QP4B**	Direct
17VP4	**17LP4B**	Direct
17VP4B	**17LP4B**	Direct
17YP4	**17QP4B**	Direct
470ACB4	**19AYP4**	Direct
19ABP4	**19ABP4**	Direct

Type	SYLVANIA* Replacement	Replacement Classification
19ACP4	**19CHP4**	Direct
19AFP4	**19AFP4**	Direct
AR19AFP4	**19AFP4**	Direct
19AGP4	**19AVP4**	Direct
19AHP4	**19AHP4**	Direct
19AJP4	**19AJP4**	Direct
19ANP4	**19AYP4**	Direct
19ARP4	**19AFP4**	Direct
19AUP4	**19AFP4**	Direct
19AVP4	**19AVP4**	Direct
19AXP4	**19AYP4**	Direct
19AYP4	**19AYP4**	Direct
19BAP4	**19BAP4**	Direct
19BDP4	**19BDP4**	Direct
19BFP4	**19BFP4**	Direct
19BHP4	**19BTP4**	Direct
19BLP4	**19AVP4**	Direct
19BMP4	**19AFP4**	Direct
19BRP4	**19DKP4**	Direct
19BQP4	**19BQP4**	Direct
19BTP4	**19BTP4**	Direct
19BVP4	**19AVP4**	Direct
19BWP4	**19AYP4**	Direct
19CDP4	**19CDP4**	Direct
19CFP4	**19CHP4**	Direct
19CHP4	**19CHP4**	Direct
19CJP4	**19AVP4**	Direct
19CKP4	**19CHP4**	Direct
19CLP4	**19CRP4**	Direct
19CMP4	**19CMP4**	Direct
19CQP4	**19CDP4**	Direct
19CRP4	**19CRP4**	Direct
19CUP4	**19CUP4**	Direct
19CVP4	**19CVP4**	Direct
19CWP4	**19BAP4**	Direct
19CXP4	**19CXP4**	Direct
19CYP4	**19BTP4**	Direct
19CZP4	**19CZP4**	Direct
19DAP4	**19DAP4**	Direct
19DBP4	**19DBP4**	Direct
19DCP4	**19EDP4**	Direct
19DEP4	**19AVP4**	Direct
19DFP4	**19DFP4**	Direct
19DHP4	**19EFP4**	Direct
19DKP4	**19DKP4**	Direct
19DLP4	**19CHP4**	Direct
19DNP4	**19DKP4**	Direct
19DQP4	**19DWP4**	Direct
19DRP4	**19EDP4**	Direct
19DSP4	**19EFP4**	Direct
19DUP4	**19DUP4**	Direct
19DWP4	**19DWP4**	Direct
19DYP4	**19CVP4**	Direct
19DZP4	**19DVP4**	Direct
19EAP4	**19ENP4**	Direct
19EBP4	**19EBP4**	Direct
19ECP4	**19FTP4**	Direct
19EDP4	**19EDP4**	Direct
19EFP4	**19EFP4**	Direct
19EGP4	**19EGP4**	Direct
19EHP4	**19EDP4**	Direct
19EHP4A	**19EDP4**	Direct
19EJP4	**19FEP4A**	Direct
19EKP4	**19EKP4**	Direct
19ELP4	**19AVP4**	Direct
19EMP4	**19FGP4**	Direct
19ENP4	**19ENP4**	Direct
19ENP4A	**19ENP4**	Direct
19ERP4	**19EDP4**	Direct
19ESP4	**19EFP4**	Direct
19EUP4	**19EDP4**	Direct
19EVP4	**19FDP4**	Direct
19EWP4	**19FDP4**	Direct
19EZP4	**19EZP4**	Direct
19FBP4	**19EGP4**	Direct
19FCP4	**19DWP4**	Direct
19FDP4	**19FDP4**	Direct
19FEP4A	**19FEP4A**	Direct
19FEP4B	**19FEP4A**	Direct
19FGP4	**19FGP4**	Direct
19FHP4	**19FHP4**	Direct
19FJP4	**19FJP4**	Direct
19FLP4	**19FTP4**	Direct
19FSP4	**19ENP4**	Direct
19FTP4	**19FTP4**	Direct
19GAP4	**19GAP4**	Direct
19GFP4	**19GFP4**	Direct
19GJP4	**19GJP4**	Direct
19GMP4	**19GMP4**	Direct
19GTP4	**19GTP4**	Direct
19XP4	**19AVP4**	Direct
19YP4	**19BTP4**	Direct
19ZP4	**19AVP4**	Direct
20ADP4	**20ADP4**	Direct
20CP4	**20DP4D**	A, D
20CP4A	**20DP4D**	A
20CP4B	**20DP4D**	A, D
20CP4C	**20DP4D**	A, D
20CP4D	**20DP4D**	A
20DP4	**20DP4D**	A, D
20DP4A	**20DP4D**	A
20DP4B	**20DP4D**	A, D
20DP4C	**20DP4D**	A
20DP4D	**20DP4D**	Direct
SG20DP4D	**20DP4D**	Direct
20HP4	**20HP4D**	D
20HP4A	**20HP4D**	Direct
20HP4B	**20HP4D**	D
20HP4C	**20HP4D**	D
20HP4D	**20HP4D**	Direct

TV PICTURE TUBE REPLACEMENT GUIDES (cont'd)

Type	SYLVANIA* Replacement	Replacement Classification♦
20LP4	**20HP4D**	Direct
20MP4	**20HP4D**	Direct
20RP4	**20RP4**	Direct
20SP4	**20YP4**	Direct
20TP4	**20XP4**	Direct
20UP4	**20UP4**	Direct
20WP4	**20WP4**	Direct
20XP4	**20XP4**	Direct
500KB4	**20XP4**	Direct
20YP4	**20YP4**	Direct
20ZP4	**20ZP4**	Direct
21ACP4	**21AMP4B**	A
21ACP4A	**21AMP4B**	A
SG21ACP4A	**21AMP4B**	A
21AFP4	**21YP4A**	D
21ALP4	**21CBP4A**	A
21ALP4A	**21CBP4A**	A
21ALP4B	**21CBP4A**	A
21AMP4	**21AMP4B**	A
21AMP4A	**21AMP4B**	A
21AMP4B	**21AMP4B**	Direct
21ANP4	**21CBP4A**	A, D
21ANP4A	**21CBP4A**	A, D
21AQP4	**21AMP4B**	A, D
21AQP4A	**21AMP4B**	A, D
21ASP4	**21XP4B**	A
21ATP4	**21CBP4A**	A
21ATP4A	**21CBP4A**	A
21ATP4B	**21CBP4A**	A
21AUP4	**21AUP4C**	A
21AUP4A	**21AUP4C**	A
21AUP4B	**21AUP4C**	A
SG21AUP4B	**21AUP4C**	Direct
21AUP4C	**21AUP4C**	Direct
21AVP4	**21AUP4C**	A
21AVP4A	**21AUP4C**	A
21AVP4B	**21AUP4C**	A
21AVP4C	**21AUP4C**	Direct
21AWP4	**21AWP4A**	A
21AWP4A	**21AWP4A**	Direct
SG21AWP4A	**21AWP4A**	Direct
21AYP4	**21XP4B**	A
21BAP4	**21CBP4A**	Direct
21BCP4	**21YP4B**	Direct
21BDP4	**21AUP4C**	Direct
21BNP4	**21CBP4A**	Direct
21BSP4	**21AMP4B**	A
21BTP4	**21CBP4A**	A
21CBP4	**21CBP4A**	Direct
21CBP4A	**21CBP4A**	Direct
21CBP4B	**21CBP4A**	Direct
21CEP4	**21EMP4**	Direct
21CEP4A	**21EMP4**	Direct
21CMP4	**21CBP4A**	A
21CQP4	**21CQP4**	Direct
21CUP4	**21AMP4B**	Direct
21CVP4	**21CBP4A**	Direct
21CWP4	**21CBP4A**	A
21CXP4	**21DSP4**	Direct
21CZP4	**21DMP4**	A
21DAP4	**21DMP4**	Direct
21DEP4	**21DMP4**	Direct
21DEP4A	**21DMP4**	Direct
SG21DEP4A	**21DMP4**	Direct
21DFP4	**21EMP4**	Direct
21DHP4	**21DHP4**	Direct
21DLP4	**21DLP4**	Direct
21DMP4	**21DMP4**	Direct
21DNP4	**21CBP4A**	A
21DQP4	**21DLP4**	Direct
21DSP4	**21DSP4**	Direct
21EAP4	**21FDP4**	C
21EP4	**21EP4C**	A, D
21EP4A	**21EP4C**	A
21EP4B	**21EP4C**	A
SG21EP4B	**21EP4C**	Direct
21EP4C	**21EP4C**	Direct
21EMP4	**21EMP4**	Direct
21EQP4	**21EQP4**	Direct
21ESP4	**21EMP4**	Direct
21EVP4	**21FDP4**	C
21FP4	**21FP4D**	A, D
21FP4A	**21FP4D**	A
21FP4C	**21FP4D**	A
SG21FP4C	**21FP4D**	Direct
21FP4D	**21FP4D**	Direct
21FAP4	**21FAP4**	Direct
21FDP4	**21FDP4**	Direct
21FLP4	**21CBP4A**	Direct
21FUP4	**21FUP4**	Direct
21FVP4	**21FWP4**	Direct
21FWP4	**21FWP4**	Direct
21FXP4	**21FXP4**	Direct
21FYP4	**21FYP4**	Direct
21FZP4	**21FZP4**	Direct
21GCP4	**21GCP4**	Direct
21GTP4	**21GTP4**	Direct
21WP4	**21WP4B**	A
21WP4A	**21WP4B**	A
SG21WP4A	**21WP4B**	Direct
21WP4B	**21WP4B**	Direct
21XP4	**21XP4B**	A
21XP4A	**21XP4B**	A
SG21XP4A	**21XP4B**	Direct
21XP4B	**21XP4B**	Direct
21YP4	**21YP4B**	Direct
21YP4A	**21YP4B**	Direct
21YP4B	**21YP4B**	Direct
21ZP4	**21ZP4C**	A D
21ZP4A	**21ZP4C**	A

Type	SYLVANIA* Replacement	Replacement Classification
21ZP4B	**21ZP4C**	A
SG21ZP4B	**21ZP4C**	Direct
21ZP4C	**21ZP4C**	Direct
22AFP4	**22AFP4**	Direct
22ZP4	**22ZP4**	Direct
23ACP4	**23BTP4**	Direct
23AFP4	**23BTP4**	Direct
23ANP4	**23BKP4**	Direct
AR23ANP4	**23BKP4**	Direct
23AHP4	**23AHP4**	Direct
23ALP4	**23ALP4**	Direct
23ARP4	**23ARP4**	Direct
23ASP4	**23ASP4**	Direct
23ATP4	**23BKP4**	Direct
23AUP4	**23AHP4**	Direct
23AVP4	**23CP4A**	Direct
23AWP4	**23BJP4**	Direct
23BP4	**23BP4**	Direct
23BAP4	**23BP4**	Direct
23BDP4	**23BTP4**	Direct
23BGP4	**23BGP4**	Direct
23BHP4	**23BGP4**	Direct
23BJP4	**23BJP4**	Direct
23BKP4	**23BKP4**	Direct
23BLP4	**23BKP4**	Direct
23BMP4	**23BTP4**	Direct
23BNP4	**23CP4A**	Direct
23BQP4	**23BQP4**	Direct
23BTP4	**23BTP4**	Direct
23BVP4	**23BTP4**	Direct
23BWP4	**23BTP4**	Direct
23CP4	**23CP4A**	Direct
23CP4A	**23CP4A**	Direct
AR23CP4	**23CP4A**	Direct
23CBP4	**23BQP4**	Direct
23CGP4	**23CGP4**	Direct
23CQP4	**23ALP4**	Direct
23CZP4	**23AHP4**	Direct
23DKP4	**23DKP4**	Direct
23DLP4	**23DLP4A**	Direct
23DLP4A	**23DLP4A**	Direct
23DNP4	**23DNP4**	Direct
23DQP4	**23DQP4**	Direct
23DSP4A	**23DSP4A**	Direct
23DTP4	**23DKP4**	Direct
23DVP4A	**23GTP4**	Direct
23DYP4	**23GTP4**	Direct
23DZP4	**23EWP4A**	Direct
23ECP4	**23ECP4**	Direct
23EDP4	**23EDP4**	Direct
23EKP4	**23FLP4**	Direct
23ELP4	**23DKP4**	Direct
23EMP4	**23DKP4**	Direct
23ENP4	**23FEP4**	Direct
23EQP4	**23EWP4A**	Direct
23ESP4	**23GBP4**	Direct
23ETP4	**23GTP4**	Direct
23EWP4	**23EWP4A**	Direct
23EWP4A	**23EWP4A**	Direct
23EYP4	**23EYP4**	Direct
23EZP4	**23EZP4**	Direct
23EP4	**23EP4**	Direct
23FAP4	**23FAP4**	Direct
23FBP4	**23FEP4**	Direct
23FCP4	**23FHP4**	Direct
23FDP4	**23FHP4**	Direct
23FEP4	**23FEP4**	Direct
23FHP4	**23FHP4**	Direct
23FJP4	**23GTP4**	Direct
23FKP4	**23FKP4**	Direct
23FLP4	**23FLP4**	Direct
23FMP4	**23GBP4**	Direct
23FNP4	**23FNP4**	Direct
23FP4	**23FP4A**	Direct
23FP4A	**23FP4A**	Direct
23FRP4	**23FRP4**	Direct
23FSP4	**23FSP4**	Direct
23FVP4	**23HFP4**	Direct
23FWP4	**23FWP4**	Direct
23FXP4	**23FXP4**	Direct
23GP4	**23CP4A**	Direct
23GBP4	**23GBP4**	Direct
23GEP4	**23FEP4**	Direct
23GFP4	**23GFP4**	Direct
23GJP4	**23GJP4**	Direct
23GJP4A	**23GJP4**	Direct
23GSP4	**23HLP4**	Direct
23GTP4	**23GTP4**	Direct
23GWP4	**23GWP4**	Direct
23GXP4	**23HLP4**	Direct
23HP4	**23CP4A**	Direct
23HCP4	**23HCP4**	Direct
23HFP4	**23HFP4**	Direct
23HFP4A	**23HFP4**	Direct
23HGP4	**23HQP4**	Direct
23HLP4	**23HLP4**	Direct
23HQP4	**23HQP4**	Direct
23HRP4	**23HWP4**	Direct
23HSP4	**23HWP4**	Direct
23HUP4	**23HUP4**	Direct
23HUP4A	**23HUP4**	Direct
23HWP4	**23HWP4**	Direct
23HWP4A	**23HWP4**	Direct
23HXP4	**23GBP4**	Direct
23JP4	**23JP4**	Direct
23JEP4	**23JEP4**	Direct
23KP4	**23FP4A**	Direct
23KP4A	**23FP4A**	Direct
23MP4	**23FP4A**	Direct
23MP4A	**23FP4A**	Direct

TV PICTURE TUBE REPLACEMENT GUIDES (cont'd)

Type	SYLVANIA* Replacement	Replacement Classification♦
23NP4	**23NP4**	Direct
23TP4	**23BTP4**	Direct
23UP4	**23BQP4**	Direct
23WP4	**23FP4A**	Direct
23XP4	**23BTP4**	Direct
23YP4	**23BTP4**	Direct
23ZP4	**23ZP4**	Direct
24ADP4	**24CP4B**	A
24AEP4	**24AEP4**	Direct
24AHP4	**24AHP4**	Direct
24AJP4	**24AJP4**	Direct
24ALP4	**24AHP4**	Direct
24ANP4	**24AEP4**	A
24ATP4	**24AJP4**	Direct
24AUP4	**24AUP4**	Direct
24AVP4	**24BEP4**	E
24BEP4	**24BEP4**	Direct
24CP4	**24CP4B**	A
24CP4A	**24CP4B**	A
SG24CP4A	**24CP4B**	Direct
24CP4B	**24CP4B**	Direct
24DP4	**24AEP4**	A
24DP4A	**24AEP4**	A
24QP4	**24CP4B**	A, D
24TP4	**24CP4B**	A
24VP4	**24CP4B**	A
24VP4A	**24CP4B**	A
24XP4	**24CP4B**	A, D
24YP4	**24AEP4**	A
24ZP4	**24AEP4**	Direct
27ABP4	**27ADP4**	Direct
27ACP4	**27YP4**	Direct
27ADP4	**27ADP4**	Direct
27AGP4	**27ADP4**	Direct
27EP4	**27RP4**	D
27GP4	**27RP4**	D
27LP4	**27LP4**	Direct
27NP4	**27RP4**	Direct
27RP4	**27RP4**	Direct
27XP4	**27XP4**	Direct
27YP4	**27YP4**	Direct
27ZP4	**27ZP4**	Direct

REPLACEMENT CLASSIFICATION NOTES

* Replacement types available in "SRE" Color Bright 85; "RE" Color Bright 85 and Color Screen 85 lines.

Other Footnotes

♦ Replacement information is based primarily on electrical and mechanical similarity of the picture tube types covered. The technician should make certain that replacement is in accord with all safety precautions required by the TV receiver for picture tube insulation or mechanical mounting. For all applications, the external conductive coating must be grounded and care must be taken that the coating does not contact any support straps or brackets which might result in voltage appearing on trim or external hardware of the receiver.

A Replacement type does not require an external ion trap magnet.

B Requires slight modification in tube mounting. See article "Color Fidelity for Older Color Receivers" published in Summer-Fall 1965 issue of **Sylvania News.**

C The 21EAP4 has a 2.35 volt/600 milliampere heater, and type 21EVP4 employs a 2.68 v, 450 ma heater. The 21FDP4 has a 6.3 volt/600 milliampere heater. Instructions for necessary minor set modification are packaged with each replacement type 21FDP4.

D The high voltage filter condenser if any, must be removed from receiver since it is replaced by the capacitance of the tube.

E Type 24AVP4 has a 2.35 volt/600 ma heater. Type 24BEP4 has a 6.3 volt/600 ma heater. Instructions for minor set modifications are packaged with each 24BEP4.

F Connect pin No. 6 (G4) to pin No. 11 (K) at socket. Original type did not provide for focus control.

G The tube type shown is considered a direct replacement. In some cases, however, it may be necessary to reverse the red and green cathode leads at socket to achieve proper white balance.

H For some receivers, it may be necessary to modify the yoke mounting fixture to allow proper location of other neck components. In a few extreme cases, substitutions may not be feasible.

I Mounting hardware may have to be modified to accept substitution. For some small cabinet receivers, substitutions may not be feasible.

INSTALLATION AND HANDLING OF TELEVISION PICTURE TUBES AND LARGE CATHODE RAY TUBES

The installation and handling of television picture tubes and other large cathode ray tubes must be undertaken with considerable care. Picture tubes are large structures made up very largely of glass and enclosing an evacuated space. They should be handled carefully and protected from severe shock. The normal precautions used when working with any high voltage circuits should be observed. The proper procedures and precautions are presented below.

Mechanical Handling

1. Protective face shield or goggles and gloves should be worn, for personal safety, whenever handling large picture tubes.

2. Picture tubes should be removed from the shipping carton face up and supported by the sides of the large portion of the tube. Handling of large picture tubes by the neck is unsafe and should be avoided at all times. It is obviously the weakest part of the tube and most easily injured. Therefore, the neck should always be kept free of strain and protected from striking other objects.

3. Picture tubes should be inserted into sockets by supporting the tube at the large end and holding the neck only for guiding the base pins into the socket.

4. The tubes should be removed from their sockets in the same manner as they are inserted, supported at the large end.

5. When not installed in a television receiver or other equipment, picture tubes should be stored in shipping cartons with the covers closed.

6. Avoid placing picture tubes on a table or bench where there is any possibility of the tube rolling off. This is very important.

7. Scratching the surface of a picture tube weakens the glass and may be the cause of the tube imploding. If it is necessary to place a tube elsewhere than in its shipping carton, a piece of felt or other soft material should be placed under it.

8. Picture tubes should be used for display purposes only after the vacuum seal has been broken. Economy dictates that only wornout, or otherwise worthless, tubes be used for this purpose. The vacuum seal may be broken in the following manner.

A. Place the tube in a shipping carton, face down, with enough soft packing material underneath so that the base will extend above the closed cover.

B. Break off locating lug on based types.

C. Using a small file or cutting pliers, make a small hole at the tip of the exhaust tube. Care should be used to make a small hole in the tip so that air will enter the tube slowly and not disturb the screen coating. In tubes using a metal exhaust tube a small three-cornered file may be used to make a small hole. The bright getter deposit on the neck should change color almost immediately. As a precaution, some time after the small hole has been made, it is well to break off the tip completely. The tube cannot implode after the vacuum seal has been broken, but it should still be handled as carefully as any other glassware of equal weight.

9. Discretion should be exercised in the disposal of tubes which are no longer useful to avoid possible legal liability. A safe method of breaking up a tube for disposal is to place it in a carton, seal the carton, and drive a metal rod through the carton into the face of the side of the tube. The broken parts may then be disposed of in the usual manner.

10. If a tube does break causing small cuts in the skin, such cuts should be washed carefully to be certain that all dirt and other small particles are removed. While the materials used for coating Sylvania picture tubes are not

INSTALLATION AND HANDLING (cont'd)

considered to be toxic, there is the possibility of an unusual personal sensitivity or allergy in some persons.

Handling High Voltage Circuits

1. Stand on dry wood, a rubber mat, linoleum or other dry insulating material when working on any electrical circuit.

2. One hand should be kept in a pocket to reduce the effects of accidental shock.

3. Respect all safety interlock switches and be certain that they are in good working condition.

4. Be certain that high voltage condensers are discharged before working on the circuit. Bleeder resistors may be open.

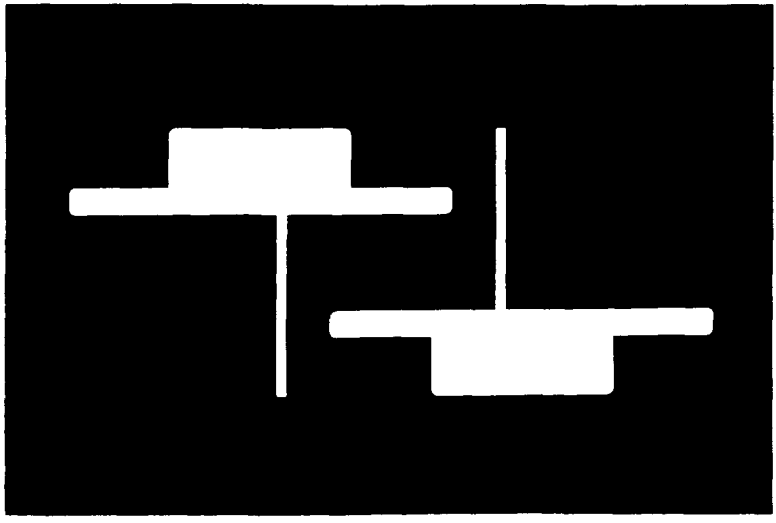
5. Some picture tubes have a conductive coating on both the inside and outside surfaces to form a condenser. This condenser should be discharged before the tube is handled. Even a slight unexpected shock might cause a tube to be dropped.

6. In circuits where the picture tube operates with a voltage on its second anode higher than 16,000 volts, it is possible that low intensity X-rays may be emitted. Therefore, X-ray radiation shielding may be necessary to protect against possible danger of personal injury from prolonged exposure at close range if the tube is operated at such high voltages.

7. Take the time to be safe.

ECG REPLACEMENT SEMICONDUCTORS

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ECG Replacement Semiconductors

INTRODUCTION

To alleviate the mushrooming proliferation of solid-state devices faced more all the time by service technicians, Sylvania has evolved a high-quality line of replacement transistors, diodes, and integrated circuits. The ECG line of semiconductors is designed to minimize replacement parts inventory for the technician and yet economically meet replacement needs of the wide variety of entertainment equipment which he encounters. Selective additions are made to the line from time to time to keep abreast of the many new types as they find their way into the field. This section provides replacement considerations, complete specifications and outline drawings of these ECG products, as well as a replacement guide which cross references approximately 28,000 JEDEC types and manufacturers' part numbers, including types by Canadian set manufacturers, to the 64 Sylvania ECG types which replace them.

Also available through Sylvania Electronic Tube Distributors is the ECG212 **Semiconductors Replacement Guide/Catalog,** from which this section is excerpted. This replacement guide is the **most comprehensive in the industry and is periodically revised** as the need arises.

The ECG line additionally includes a solid state repair kit, the ECG303, containing the most recent replacement guide and 24 of the most commonly used semiconductors from the line—packaged small enough to fit into a tube caddy and replacing over 20,000 types.

REPLACEMENT CONSIDERATIONS

The technical data given on the following pages are intended to show safe areas of ECG device operation and level of performance. They are not to be considered limits for new equipment designs. Sylvania Electric Products Inc. cannot guarantee that the listed items provide an exact replacement in all applications.

When replacing the original part with an ECG unit, certain mechanical and electrical requirements must be observed. Compare the lead or terminal arrangement of the original part with the ECG replacement. If necessary, bend the leads to the proper basing arrangement and insulate them to prevent possible shorts. For socketed devices, cut the leads on the replacement to proper length. Check the outline dimensions of the replacement if mounting space is a problem. Replacement in untuned stages can generally be made with a minimum of effort. In the case of tuned amplifiers, oscillators, etc., a check of the stage alignment may be in order to assure optimum performance. UHF, VHF and FM circuits are especially critical.

Replacement in high power audio stages should always be accompanied by a check on the transistor bias to prevent excessive dissipation and/or distortion. The equipment manufacturers recommended procedure should be followed.

When making replacements that require soldering of the ECG device leads, always use a small, hot iron and rosin core solder. If possible, a suitable heat sink, such as a pair of needle-nose pliers, should be positioned on the lead between the device and the solder joint. Do the soldering quickly.

In the case of power devices requiring the use of an insulating washer, apply silicone grease to both sides of the washer to insure maximum thermal efficiency.

Technical data / TRANSISTORS

MAXIMUM RATINGS AT 25° C AMBIENT UNLESS OTHERWISE NOTED

Type	Description	Applications	Collector-Base Voltage (BVCBO)	Collector-Emitter Voltage (BVCEO)	Base-Emitter Voltage (BVEBO)	Max. Collector Current	Max. Collector Dissipation	Frequency	Typical Current Gain (HFE)	Package
ECG 100	PNP-Germanium	RF Amp, Osc, Mixer, IF Amp of AM Radios	25V	20V (CER) Min.	20V	300 mA	150 mW	5 MHz(1)	40 (at 455 kHz)	TO-5 Fig. 1
ECG101	NPN-Germanium	RF Amp, Osc, Mixer, IF Amp of AM Radios	25V	20V (CER) Min.	20V	300 mA	150 mW	5 MHz(1)	40 (at 455 kHz)	TO-5 Fig. 1
ECG102	PNP-Germanium	Audio Driver, Pre-Amp, Power Output	30V	16V (CER) Min.	20V	250 mA	150 mW	2 MHz(1)	90 (at 1 kHz)	TO-5 Fig. 1
ECG102A	PNP-Germanium	Audio Driver, Pre-Amp, Power Output	32V	32V (CES)	10V	200 mA	900 mW	2.3 MHz	120	TO-1 Fig. 2
ECG103	NPN-Germanium	Audio Driver, Pre-Amp, Power Output	30V	16V (CER) Min.	20V	250 mA	150 mW	2 MHz(1)	90 (at 1 kHz)	TO-5 Fig. 1
ECG103A	NPN-Germanium	Audio Driver, Pre-Amp, Power Output	32V	32V (CES)	10V	500 mA	340 mW	2.5 MHz	105	TO-1 Fig. 2
ECG104 ECG104MP	PNP-Germanium Matched Pair of ECG104	Audio Power Output	50V	35V (CER) Min.	20V	7 A	90 W	10 KHz(1)	90	TO-3 Fig. 3
ECG105	PNP-Germanium	Audio Power Output	50V	35V (CER) Min.	20V	15 A	100 W	10 KHz(1)	90	TO-36 Fig. 4
ECG106	PNP-Silicon	RF Amp, Osc, Mixer, IF Amp, All Band and FM Radios	35V	15V Min.	1V	75 mA	250 mW	500 MHz(2)	20 Min.	TO-18 Fig. 5
ECG107	NPN-Silicon	RF Amp, Osc, Mixer, IF Amp in UHF, VHF	35V	15V Min.	1V	25 mA	250 mW	700 MHz(2)	20 Min	TO-92 Fig. 6

OUTLINES - Pages 553-554

TRANSISTORS (cont'd)

MAXIMUM RATINGS AT 25° C AMBIENT UNLESS OTHERWISE NOTED

Type	Description	Applications	Collector-Base Voltage (BVCBO)	Collector-Emitter Voltage (BVCEO)	Base-Emitter Voltage (BVEBO)	Max. Collector Current	Max. Collector Dissipation	Frequency	Typical Current Gain (HFE)	Package
ECG108	NPN-Silicon	RF Amp, Osc, Mixer, IF Amp in VHF, UHF, Video Amp	35V	15V Min	0.5V	75 mA	250 mW	800 MHz(2)	10 Min	RO-97A Fig. 7
ECG121 ECG121MP	PNP-Germanium Matched Pair of ECG121	Audio Power Output for Stereo and Hi-Fi, etc.	65V	45V (CER) Min	15V	7 A	90 W	22 KHz(1)	80	TO-3 Fig. 3
ECG123	NPN-Silicon	Audio Pre-Amp, Driver, Video Amp, Sync Separator	30V	20V	5V	500 mA	500 mW	50 MHz(2)	180	TO-5(3) Fig. 8
ECG123A	NPN-Silicon	Audio Amp, RF Amp	55V	40V	6V	600 mA	500 mW	200 MHz	200	TO-18(3) Fig. 5
ECG124	NPN-Silicon	High Voltage Audio Power Output for 120 VAC TV, Phono, Stereo, etc.	300V	300V	5.0V	400 mA	10 W	30 MHz(2)	140	TO-66 Fig. 9
ECG126	PNP-Germanium	RF Amp, Osc, Mixer, IF Amp for All Band Radios and VHF	25V	25V	2V	200 mA	200 mW	250 MHz(2)	60	TO-24 Fig. 10
ECG127	PNP-Germanium	Horiz. and Vert. Deflection Amps, Audio Power Output	350V	350V (CES)	2V	10A	56 W	1.0 MHz(2)	15 min	TO-3 Fig. 3
ECG128	NPN-Silicon	Audio Pre-Amp, Driver, Output, Video Amp.	100V	80V (CER)	7V	1 A	1 W	120 MHz(2)	90	TO-5 Fig. 1
ECG129	PNP-Silicon	Audio Pre-Amp, Driver, Output, Video Amp.	100V	80V (CER)	7V	1A	1 W	120 MHz(2)	90	TO-5 Fig. 1
ECG130 ECG130MP	NPN-Silicon Matched Pair of ECG130	Audio Power Amp.	80V	60V (CER)	5V	15 A	115 W	800 KHz(1)	40	TO-3 Fig. 3
ECG131 ECG131MP	PNP-Germanium Matched Pair of ECG131	Audio Pwr. Output for Auto Radio, Stereo Tape Players, etc.	32V	20V	10V	3 A Peak	6 W (63°C)	1 MHz	110	Similar TO-66 Fig. 9
ECG152	NPN-Silicon	Audio Power Output	60V	60V	5V	3 A	40 W	3 MHz(2)	60	"P-66" (Plastic) Fig. 12

ECG153	PNP-Silicon	Audio Power Output	60V	60V	5V	3 A	40 W	3 MHz(2)	60	"P-66" (Plastic) Fig. 12
ECG154	NPN-Silicon	Color/BW TV Video Output Amp.	300V	300V	7V	50 mA	1 W	40 MHz(2)	100	TO-39 Fig. 13
ECG155	NPN-Germanium	Audio Power Amp.	32V	20V	10V	3 A Peak	7.5 W	1 MHz	110	Similar to TO-66 Fig. 9
ECG157	NPN-Silicon	High Voltage Audio Power Amp.	300V	300V	3V	500 mA	20.8 W	10 MHz	30 min	Fig. 14

FIELD EFFECT TRANSISTORS—N—Channel Junction Types

Type	Application	Transconductance (μMhos)	Drain Source Voltage (VDS)	Current (mA DC)	Gate-Source Breakdown Voltage V (BR) GSS	Gate Reverse Current (IGSS)	Zero-Gate Voltage Drain-Current (IDSS)	Total Device Dissipation (mW)	Outline Drawing
ECG132	R.F. Amp and Mixer into VHF Region	2000 min at 100 MHz	25V	10 Ig	25V	2 nA DC	2-20 mA DC	200	Fig. 11
ECG133	General Purpose Audio Amp and Switch	4000 typ.	25V	10 Ig	25V	1 nA DC	0.5-15 mA DC	300	Fig. 11

NOTES:
(1) Frequency at which Common Emitter Gain is 70.7% of Low Frequency Gain
(2) Gain Bandwidth Product Minimum
(3) Collector Tied to Case Maximum Ratings at 25°C Ambient Unless Otherwise Noted

DIODES and RECTIFIERS

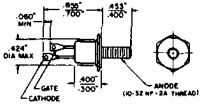
Type	Outline Drawing	Description
ECG109	Fig. 15	Germanium general purpose 75 volt P.R.V.
ECG110	Fig. 15	Germanium matched pair
ECG111	Fig. 16	Silicon UHF TV mixer diode

Type	Outline Drawing	Description
ECG112	Fig. 15	Silicon UHF TV mixer diode
ECG113	Fig. 17	Selenium dual diode, common cathode, TV horizontal AFC

DIODES and RECTIFIERS (cont'd)

Type	Outline Drawing	Description
ECG114	Fig. 17	Selenium dual diode, series connected, TV horizontal AFC
ECG115	Fig. 17	Selenium dual diode, common anode, TV horizontal AFC
ECG116	Fig. 18	Silicon rectifier, 600 P.R.V., 1A (DC resistive)
ECG117	Fig. 19	Silicon rectifier 600 P.R.V., 1A (DC resistive) max
ECG118	Fig. 20	Selenium color TV focus rectifier, 6500 P.R.V.

Type	Outline Drawing	Description
ECG119	Fig. 21	Selenium color TV boost rectifier, 800 P.R.V., DC output current—2mA resistive
ECG120	Fig. 22	Selenium color TV convergence rectifier, 18 P.R.V., RMS volts 12, output current 65 mA
ECG125	Fig. 23	Silicon rectifier, 1000 volt P.R.V. 1.0 amp (d.c. resistive)
ECG156	Fig. 18	Silicon rectifier 1000 volt P.R.V. 2.0 amp

ECG122	Silicon Controlled Rectifier (Shipped Complete With All Mounting Hardware) 	Continuous and Peak Forward and Reverse Blocking Voltage ..... 200 Volts Continuous Anode Forward Current at or Below 70°C Case Temp. ..... 7.0 Ampere Average Anode Forward Current (180 Conduction Angle) at or Below 70°C Case Temp. ..... 5.0 Ampere Peak Anode Surge Current (60 Hz—½ Sinewave) ..... 100 Ampere Gate Trigger Current (Max.) ..... 25 mA Gate Trigger Voltage (Max.) ..... 4.0 Volt Holding Current ..... 25 mA-Max.

ZENER DIODES (1 Watt = 10% Voltage Tolerance)

Type	Nom. Zener Voltage Vz at Izt	Test Current Izt (Ma)	Zener Impedance Zzt at Izt (Ω)	D.C. Zener Current Izm (Ma)	Outline Drawing
ECG134	3.6V	69	11.0	252	Fig. 23
ECG135	5.0V	50	8.0	182	Fig. 23
ECG136	5.6V	45	6.0	162	Fig. 23
ECG137	6.2	41	3.0	146	Fig. 23
ECG138	7.5V	33	6.0	120	Fig. 23
ECG139	9.1V	28	6.0	95	Fig. 23
ECG140	10.0V	25	7.0	85	Fig. 23
ECG141	11.5V	22	9.0	78	Fig. 23
ECG142	12.0V	21	10.0	76	Fig. 23

Type	Nom. Zener Voltage Vz at Izt	Test Current Izt (Ma)	Zener Impedance Zzt at Izt (Ω)	D.C. Zener Current Izm (Ma)	Outline Drawing
ECG143	12.8V	19	11.0	73	Fig. 23
ECG144	14.0V	18	13.0	65	Fig. 23
ECG145	15.0V	17	15.0	56	Fig. 23
ECG146	27.0V	9.5	36.0	30	Fig. 23
ECG147	33.0V	7.5	46.0	26	Fig. 23
ECG148	55.0V	4.5	110.0	16	Fig. 23
ECG149	62.0V	4.0	126.0	13	Fig. 23
ECG150	82.0V	3.0	200.0	10	Fig. 23
ECG151	110.0V	2.3	450.0	7.2	Fig. 23

Dimensional Outlines

TRANSISTORS

FIGURE 1

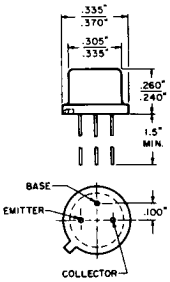


FIGURE 2

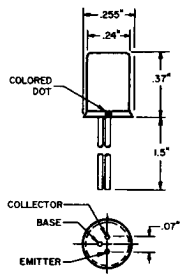


FIGURE 3

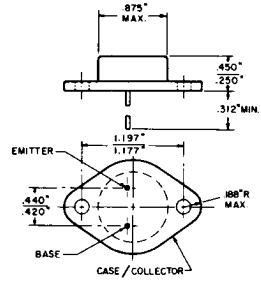


FIGURE 4

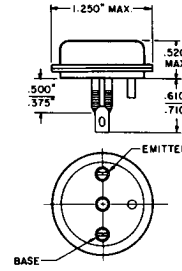


FIGURE 5

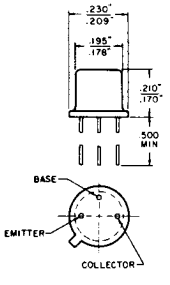


FIGURE 6

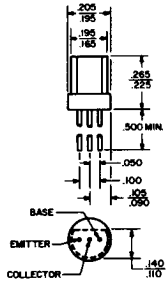


FIGURE 7

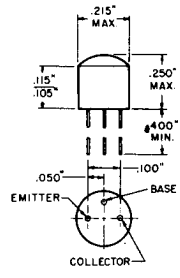


FIGURE 8

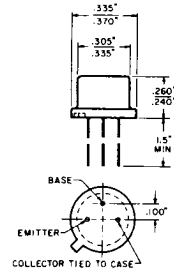


FIGURE 9

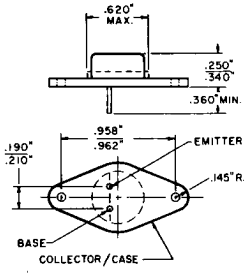


FIGURE 10

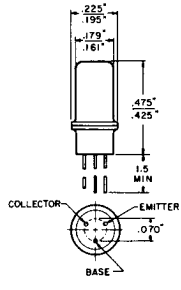


FIGURE 11

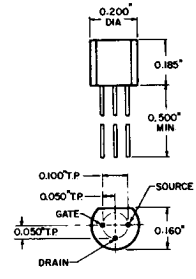


FIGURE 12

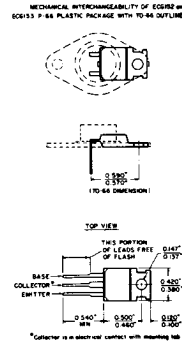


FIGURE 13

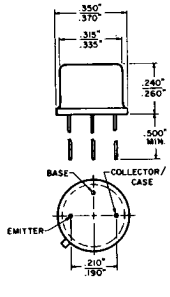
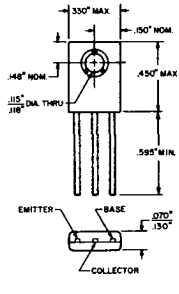
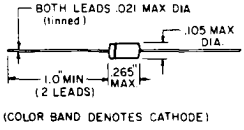


FIGURE 14



DIODES and RECTIFIERS

FIGURE 15



(COLOR BAND DENOTES CATHODE)

FIGURE 16

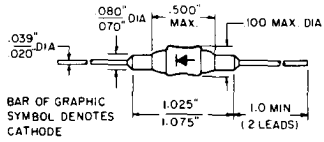


FIGURE 17

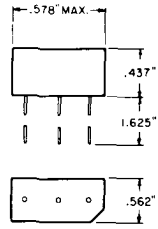


FIGURE 18

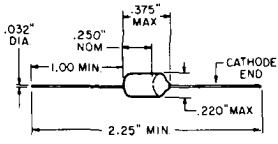
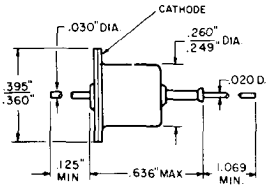
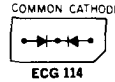


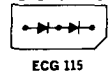
FIGURE 19



ECG 113
COMMON CATHODE



ECG 114
SERIES CONNECTED



ECG 115
COMMON ANODE

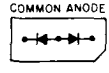


FIGURE 20

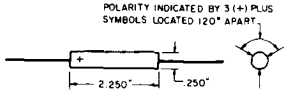


FIGURE 21

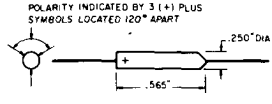


FIGURE 22

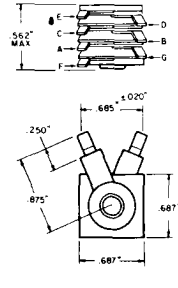
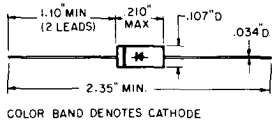


FIGURE 23



COLOR BAND DENOTES CATHODE

ECG303 SOLID STATE REPAIR KIT

Contains 95% of Most Common Replacement Needs

Quantity	Type	Quantity	Type	Quantity	Type
1	ECG100	1	ECG110	1	ECG124
1	ECG101	1	ECG113	4	ECG125
1	ECG102	1	ECG114	1	ECG126
1	ECG103	4	ECG116	1	ECG128
1	ECG104	1	ECG118	1	ECG129
1	ECG105	1	ECG119	1	ECG130
1	ECG106	1	ECG121	1	ECG131
2	ECG109	1	ECG123	1	ECG358

24 ECG Devices Replace Over 20,000 Types.

LINEAR INTEGRATED CIRCUITS

Type	Description
ECG370 AGC/Squelch Amplifier	Direct-coupled monolithic amplifier which utilizes an external DC voltage to control gain. In addition to communication system squelch and AGC applications, useful as a constant-amplitude audio oscillator, linear low frequency modulator, single-sideband automatic load control, and as a variable DC gain element in analog computation. 40 dB voltage gain to −80 dB gain reduction; operates on 4.5 to 24 VDC supply at low power dissipation. Provides differential inputs, with wide common-mode input range.
ECG371 RF/IF Amplifier	Monolithic RF-IF amplifier capable of emitter-coupled or cascode operation from DC to 250 MHz. Other applications of the circuit are as mixer, oscillator, detector, and modulator. Typical input signal is 10 mV rms; operates on 3 to 24 VDC. 100 MHz tuned power gains are 24.6 dB (emitter coupled) and 27.5 dB (cascode).
ECG372 AM IF Strip	Broadband AM receiver subsystem, including a high-gain amplifier, an active detector, and self-contained automatic gain control. It is intended for IF or TRF applications from 50 KHz to 2 MHz. AGC range is 60 dB; audio output is 0.8 V p-p for 80% modulated input at carrier level as low as 50 mV rms; operates on 6 to 24 VDC supply.

LINEAR INTEGRATED CIRCUITS (cont'd)

Type	Description
ECG703 RF/IF Amplifier, Oscillator, Mixer	Direct replacement for μA 703, μA 703E and 15-26-587 in FM IF amplifier stages. Limiting or nonlimiting amplifier, harmonic mixer, or oscillator useful to frequencies in excess of 100 MHz. Circuit applications include 10, 30, 100, and 200-MHz RF Amplifiers, 10.7-MHz FM IF amplifier, 10-MHz oscillator, color TV sound IF amplifier, and a 3.58-MHz injection-locked oscillator for color TV. Power gain is 41 dB unneutralized; transconductance is 30,000 μmhos; operates on 6-12 VDC supply.
ECG704 TV Sound—IF Amplifier and Detector	Direct replacement of TV sound IF stages. Circuit applications include IF amplifier, AM and noise limiter, FM detector, and audio preamplifier. Typical power gain at 4.5 MHz is 75 dB; AM rejection is over 50 dB at 4.5 MHz; operates on 5.5 to 10 VDC supply.
ECG705 Color TV Chroma Demodulator	Direct plug-in replacement for the μA 737E; demodulates Chroma subcarrier information contained in color TV video signal and provides color difference signals at the outputs. Low voltage drift of the DC output insures excellent performance in direct-coupled, Chrominance output circuitry. Operates on 28 VDC; minimum load: 3K ohm; P-P reference input voltage: 5V; P-P Chrominance input: 5V; internal power dissipation: 450 mW.
ECG716 Audio Amplifier	Audio amplifier capable of delivering up to 250 mW of power to an 8-ohm speaker or headset. Voltage gain of X10, X20, X100, or X200 can be chosen by selection of the appropriate circuit terminals. Frequency response is 50 Hz to 500 kHz; operates on 18-25 VDC.

ECG SEMICONDUCTOR REPLACEMENT GUIDES

	Page
Transistor Replacement Guide	558
Diodes and Rectifiers Replacement Guide	599
Color Oscillator Crystals Replacement Guide	622
For Canadian Receivers Replacement Guide	623

TRANSISTOR
replacement guide

Type To Be Replaced	Sylvania ECG Replacement
0000101	126
0000102	126
0000103	102
0000104	102
002-005100	102
002-006300	126
002-006500	123
002-006600	102
002-006800	102
002-006900	102
002-007000	104
002-007100	126
002-007200	126
002-007300	102
002-007400	126
002-008100	104
002-008400	100
002-008800	121
002-009100	124
002-009500	123
002-009501	123
002-009600	123
002-009701	121
002-009800	129
002-009900	123
002-010100	121
002-010300	129
002-010400	123
002-010500	129
002-010600	129
002-010700	128
002-010800	102
002-010900	129
002-011400	108
002-011500	108
002-011600	100
002-011700	103
002-011800	102
002-011900	102
002-012000	123
002-012100	129
002-012200	128
002-012500	128
002-012600	129
003-H03	102
004-8000	121
007-0074	152
011-H01	100
012-H02	100
0130	128
02P1B	128
019-003315	126
019-003317	103
019-003318	103
019-003319	103
019-003324	100
019-003342	100
019-003343	100
019-003349	108
019-003415	102
019-003416	102
019-003777	126
019-003778	126
0019-003485	152
022-006500	123
022-3504-040	102
022-3504-060	102
022-3505-910	102
022-5311-770	126
022-5311-780	126
022-5511-790	126
022-3516-380	126
022-3640-050	121
022-3640-080	108
025B	123
025-100003	108
025-100004	108
025-100009	108
025-1000012	108
025-1000013	108
025-1000014	128
025-100015	128
026-100003	121
026-100005	102
026-100012	102
026-100013	128
026-100017	123
026-100018	102
026-100020	121MP
03-0020-0	102
03-0022	102
03-0023-0	102
03-57-001	126
03-57-002	126
03-57-101	126
03-57-201	126
03-57-301	102
03-57-304	102
03-57-501	121
04-57-303	102
0573036	102
0573037	102
0573142	102
0573166	104
0573199	127
0573200	102
0573212	127
0573366	126
0573398	126
0573422	102
0573428	126
0573469	123
0573474	108
0573475	108
0573480	123
0573481	123
0573515	124
0573518	126
0573532	128
080001	126
080003	102
080004	102
080006	108
080021	108
080022	108
080023	108
080026	126
080027	126
080028	126
080041	108
080042	108
080043	108
080059	108
080060	108
080061	126
080071	126
080072	126
080073	102
080114	126
080206	126
080236	126
080244	126
080245	126
080253	126
080266	126
080267	126
080269	126
080274	100
080275	100
080276	100
080277	126
081001	102
081018	102
081019	102
081038	102
081046	102
081047	102
081048	102
081049	102
081050	102
081056	102
084001	129
087003	102
1G100	105
2A	126
2AC128	100
2AD140	121
2B	100
2C	100
2D	100
2E	126
2F	126
2G	126
2G101	100
2G102	100
2G103	126
2G104	126
2G106	126
2G108	100
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2G110	100
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2G319	100
2G320	100
2G321	102
2G322	102
2G323	102
2G324	102
2G339	103
2G339A	103
2G344	126
2G345	100
2G371	100
2G371A	100
2G374	100
2G374A	100
2G376	126
2G377	126
2G381	102
2G381A	102
2G382	162
2G383	100
2G384	102
2G385	102
2G386	102
2G387	102
2G394	100
2G395	100
2G396	100
2G397	100
2G401	102
2G402	102
2G403	102
2G404	102
2G413	102
2G414	102
2G415	102
2G416	102
2G417	102
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2G509	102
2G524	100
2G525	100
2G526	100
2G527	100
2G577	100
2G601	126
2G602	126
2G603	126
2G604	126
2G605	102
2G1024	100
2G1025	100
2G1026	100
2G1027	102
2H1254	106
2H1255	106
2H1256	106
2H1257	106
2H1258	106
2H1259	106
2J72	126
2J73	126
2K48	126
2MC	126
2N2J324	128
2N23	102
2N24	102
2N25	102
2N26	102
2N27	100
2N28	101
2N29	101
2N30	126
2N31	126
2N32	102
2N32A	102
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2N34A	102
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2N36	102
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2N38	102
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2N48	102
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2N49	102
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2N59	102
2N59A	102
2N59B	102
2N59C	102
2N59D	102
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2N60B	102
2N60C	102
2N60R	102
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2N61B	102
2N61C	102
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2N64	102
2N65	102
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2N74	102
2N75	126
2N76	102
2N77	102
2M78	101
2N78A	101
2N79	102
2N80	102
2N81	102
2N82	102
2N83	100
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2N86	126
2N87	126
2N88	126
2N89	126
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2N105	102
2N106	102
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2N108	102
2N109	102
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2N109YEL	102
2N109GRN	102
2N109BLU	102
2N109WHT	102
2N109M1	102
2N109M2	102
2N111	100
2N111A	100
2N111B	126
2N111M1	126
2N111M2	126
2N112	126
2N112A	100
2N112M1	126
2N113	100
2N114	100
2N117	123
2N118	123
2N118A	123
2N119	123
2N120	123
2N123	100
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2N126	101
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2N131	102
2N131A	102
2N132	102
2N132A	102
2N133	102
2N133A	102
2N135	100
2N136	100
2N137	100
2N138	102
2N138A	102
2N138B	102
2N139	100
2N140	100
2N140M1	100
2N140M2	100
2N145	101
2N146	101
2N147	101
2N148	123
2N148A	123
2N149	123
2N149A	123
2N150	101
2N150A	101
2N151	102

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
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2N156	104
2N157	121
2N157A	121
2N158	121
2N158A	121
2N159	102
2N160	123
2N160A	123
2N161	123
2N161A	123
2N162	123
2N162A	123
2N163	123
2N163A	123
2N164	101
2N164A	101
2N165	101
2N166	101
2N167	101
2N167A	101
2N168	101
2N168A	101
2N169	101
2N169A	101
2N170	101
2N172	101
2N173	105
2N174	105
2N174A	105
2N175	102
2N176	104
2N176A	104
2N176G	104
2N176W	104
2N176BLK	121
2N176RED	121
2N176GRN	121
2N176BLU	121
2N176 PUR	121
2N176WHT	121
2N176YEL	121
2N176-1	104
2N176-1YEL	121
2N176-1BLU	121
2N176-1WHT	121
2N176-3PUR	121
2N176-4PUR	121
2N176-5WHT	121
2N176-6WHT	121
2N178	104
2N179	104
2N180	102
2N181	102
2N182	101
2N183	101
2N184	101
2N185	102
2N185-BLU	102
2N186	102
2N186A	102
2N187	102
2N187A	102
2N188	102
2N188A	102
2N189	102
2N190	102
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2N215	102
2N216	101
2N217	102
2N217A	100
2N217RED	100
2N217YEL	100
2N217WHT	100
2N218	100
2N219	100
2N220	102
2N222	102
2N223	102
2N224	102
2N225	102
2N226	102
2N227	102
2N228	103
2N229	103
2N230	104
2N231	126
2N231YEL	100
2N231YEL-RED	100
2N231BLU	100
2N232	126
2N233	101
2N233A	101
2N234	121
2N234A	121
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2N235A	121
2N235B	121
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2N236A	121
2N236B	121
2N237	102
2N238	102
2N238D	102
2N238E	102
2N238F	102
2N238ORN	102
2N240	126
2N241	102
2N241A	102
2N242	104
2N247	126
2N247/33	126
2N248	126
2N249	100
2N250	104
2N250A	104
2N251	104
2N251A	121
2N252	100
2N253	101
2N254	101
2N255	104
2N255A	104
2N256	104
2N256A	104
2N257	104
2N257A	104
2N257B	104
2N257G	104
2N257W	104
2N262	100
2N263	108
2N264	108
2N265	102
2N266	102
2N267	100
2N268	121
2N268A	121
2N269	100
2N270	102
2N270A	102
2N270-5M	102
2N271	100
2N271A	100
2N272	102
2N273	100
2N274	126
2N274BLU	126
2N274WHT	126
2N275	126
2N276	126
2N277	105
2N278	105
2N279	102
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2N281	102
2N282	102
2N283	102
2N284	102
2N284A	102
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2N293	101
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2N297A	121
2N299	126
2N300	126
2N301	121
2N301A	121
2N301B	102
2N301G	102
2N301W	102
2N302	102
2N303	102
2N306	103
2N306A	103
2N307	121
2N307A	121
2N307B	121
2N308	100
2N309	100
2N310	102
2N311	100
2N312	101
2N313	101
2N314	101
2N315	100
2N315A	102
2N315B	102
2N316	100
2N316A	102
2N317	100
2N317A	100
2N318	126
2N319	102
2N320	102
2N321	102
2N322	102
2N323	102
2N324	102
2N325	104
2N327	100
2N327A	100
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2N328B	129
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2N329B	129
2N330	129
2N330A	129
2N331	126
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2N335B	123
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2N337A	108
2N338	123
2N338A	123
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2N346	126
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2N350A	121
2N351	121
2N351A	121
2N352	121
2N353	121
2N356	101
2N356A	101
2N357	101
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2N358	101
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2N362	102
2N362B	102
2N363	102
2N364	103
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2N370A	126
2N370/33	126
2N371	126
2N371/33	126
2N372	126
2N372/33	126
2N373	126
2N374	126
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2N376A	104
2N377	101
2N377A	101
2N378	104
2N379	121
2N380	104
2N381	102
2N382	102
2N383	102
2N384	126
2N384/33	126
2N385	101
2N385A	101
2N386	104
2N387	104
2N388	101
2N388A	101
2N392	104
2N393	126
2N394	100
2N394A	100
2N395	100
2N396	100
2N396A	100
2N397	100
2N398	102
2N398B	102
2N399	104
2N400	104
2N401	104
2N402	102
2N403	102
2N404	102
2N404A	102
2N405	102
2N406	102
2N406BRN	100
2N406RED	100
2N406ORN	100
2N406GRN	100
2N406BLU	100
2N406GRN-YEL	100
2N407	102
2N407BLK	102
2N407RED	102
2N407YEL	102
2N407GRN	102
2N407WHT	102
2N408	102
2N408WHT	102
2N409	100
2N410	100
2N411	100
2N412	100
2N413	100
2N413A	100
2N414	100
2N414A	100
2N414B	100
2N414C	100
2N415	100
2N415A	100
2N416	100
2N417	100
2N418	121
2N419	104
2N420	121
2N420A	121
2N422	102
2N422A	102
2N425	100
2N426	100
2N427	100
2N428	100
2N428A	100
2N431	123
2N432	123
2N433	123
2N438	101
2N438A	101
2N439	101
2N439A	101
2N440	101
2N440A	101
2N441	105
2N441BLU	105
2N442	105
2N443	101
2N444	103
2N444A	101
2N445	123
2N445A	101
2N446	103
2N446A	101
2N447	103
2N447A	103
2N447B	101
2N448	101
2N449	100
2N450	104
2N456	104
2N456A	

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
2N456B	104
2N457	104
2N457A	104
2N457B	104
2N458	104
2N458A	104
2N458B	121
2N459	121
2N459A	121
2N460	102
2N461	102
2N462	102
2N464	102
2N465	102
2N466	102
2N467	102
2N468	102
2N470	123
2N471	123
2N471A	123
2N472	123
2N472A	123
2N473	123
2N474	123
2N474A	123
2N475	108
2N475A	108
2N476	123
2N477	123
2N478	123
2N479	123
2N479A	123
2N480	123
2N480A	108
2N480B	123
2N481	100
2N482	100
2N483	100
2N483B	102
2N483-6M	102
2N484	100
2N485	100
2N486	100
2N486B	100
2N487	102
2N495	106
2N495/18	106
2N496	106
2N497	128
2N497A	128
2N498	128
2N499	126
2N499A	126
2N500	126
2N500RED	126
2N500BLU	126
2N500WHT	126
2N501	126
2N501A	126
2N501/18	126
2N502	126
2N502A	126
2N502B	126
2N503	126
2N504	126
2N505	126
2N506	102
2N507	103
2N508	102
2N508A	102
2N509	100
2N511	104
2N511A	104
2N511B	104
2N512	104
2N512A	104
2N512B	104
2N513	104
2N513A	104
2N513B	104
2N514	121
2N514A	121
2N514B	121
2N515	101
2N516	101
2N517	101
2N518	126
2N519	100
2N519A	100
2N520	100
2N520A	100
2N521	100
2N521A	100
2N522	102
2N522A	100
2N523	102
2N523A	100
2N524	102
2N524A	102
2N525	102
2N525A	102
2N526	102
2N526A	102
2N527	102
2N527A	102
2N529	126
2N530	100
2N531	100
2N532	100
2N533	100
2N534	126
2N535	102
2N535A	102
2N535B	102
2N536	102
2N537	126
2N538	121
2N538A	121
2N539	104
2N539A	104
2N540	104
2N540A	104
2N541	107
2N542	107
2N542A	123
2N543	108
2N543A	108
2N544	126
2N544/33	126
2N546	123
2N547	123
2N548	123
2N549	123
2N550	123
2N551	123
2N552	123
2N553	121
2N554	121
2N555	121
2N556	101
2N557	101
2N558	101
2N559	126
2N560	123
2N561	121
2N563	102
2N564	102
2N565	102
2N566	102
2N567	102
2N568	102
2N569	102
2N570	102
2N571	102
2N572	102
2N573	102
2N573BRN	102
2N573RED	102
2N573ORN	102
2N574	105
2N574A	105
2N575	105
2N575A	105
2N576	101
2N576A	101
2N578	100
2N579	100
2N580	100
2N581	100
2N582	102
2N583	100
2N584	102
2N585	101
2N586	100
2N587	101
2N588	126
2N588A	126
2N589	121
2N591	102
2N591A	102
2N591/5	102
2N591-6M	126
2N592	100
2N593	100
2N594	101
2N595	101
2N596	101
2N597	100
2N598	100
2N599	100
2N600	100
2N602	126
2N602A	126
2N603	126
2N603A	126
2N604	126
2N604A	126
2N605	126
2N606	126
2N607	126
2N608	126
2N609	102
2N610	102
2N611	102
2N612	102
2N613	102
2N614	100
2N615	100
2N616	100
2N617	100
2N618	121
2N619	108
2N620	108
2N621	108
2N622	108
2N623	126
2N624	126
2N625	103
2N627	121
2N628	121
2N629	121
2N630	121
2N631	102
2N632	102
2N633	102
2N633B	102
2N634	101
2N634A	101
2N635	101
2N635A	101
2N636	101
2N636A	101
2N637	104
2N637A	104
2N637B	104
2N638	104
2N638A	104
2N638B	104
2N639	104
2N639A	104
2N639B	104
2N640	126
2N641	126
2N641REDM/F	126
2N642	126
2N643	126
2N644	126
2N645	126
2N646	103
2N647	103
2N647/22	103
2N648	103
2N649	103
2N649/5	102
2N650	102
2N650A	102
2N651	102
2N651A	102
2N652	102
2N652A	102
2N653	102
2N654	102
2N655	102
2N655RED	102
2N655GRN	102
2N656	128
2N656A	128
2N657	100
2N658	100
2N659	100
2N660	100
2N661	100
2N662	100
2N663	121
2N665	121
2N669	121
2N672	100
2N674	100
2N677	121
2N677A	121
2N677B	121
2N677C	121
2N678	121
2N678A	121
2N678B	121
2N678C	121
2N679	101
2N680	126
2N694	126
2N695	126
2N696	123
2N697	123
2N697A	123
2N700	126
2N700A	126
2N700/18	126
2N700A/18	126
2N701	123
2N702	108
2N703	108
2N705	126
2N705A	126
2N706	108
2N706A	108
2N706B	108
2N706C	123
2N707	108
2N707A	123
2N708	108
2N708A	108
2N709	108
2N709A	108
2N709/52	108
2N710	126
2N710A	126
2N711	126
2N711A	126
2N711B	126
2N715	123
2N717	108
2N717A	108
2N718	108
2N718A	108
2N721	106
2N721A	106
2N722	106
2N722A	106
2N723	106
2N725	126
2N726	106
2N727	106
2N728	123
2N729	123
2N741	126
2N741A	126
2N742	123
2N742A	123
2N743	108
2N743A	108
2N744	108
2N745	123
2N746	123
2N747	123
2N748	123
2N749	123
2N750	123
2N751	123
2N752	108
2N753	108
2N754	123
2N756	108
2N756A	123
2N757	108
2N757A	123
2N758	108
2N758A	123
2N758B	123
2N759	108
2N759A	123
2N759B	123
2N760	108
2N760A	123
2N760B	123
2N761	108
2N762	108
2N768	126
2N769	126
2N770	123
2N771	123
2N772	123
2N773	123
2N774	123
2N775	123
2N776	123
2N777	123
2N778	123
2N779	126
2N779A	126
2N779B	126
2N780	108
2N781	102
2N782	102
2N783	108
2N784	108
2N784A	108
2N789	123
2N790	123
2N791	123
2N792	123
2N793	123
2N794	126
2N795	126
2N796	126
2N797	103
2N799	102
2N800	102
2N801	100
2N802	100
2N803	100
2N804	100

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
2N805	100
2N806	100
2N807	100
2N808	100
2N809	100
2N810	100
2N811	100
2N812	100
2N813	100
2N814	100
2N815	101
2N816	101
2N817	101
2N818	101
2N819	101
2N820	101
2N821	101
2N822	101
2N823	101
2N824	101
2N825	102
2N826	102
2N827	126
2N828	126
2N828A	126
2N829	126
2N834	108
2N834A	123
2N835	108
2N837	100
2N838	126
2N839	108
2N840	108
2N841	108
2N842	108
2N843	108
2N844	123
2N846	126
2N846A	126
2N846B	126
2N849	108
2N850	108
2N851	108
2N852	108
2N858	106
2N859	106
2N860	106
2N861	106
2N862	106
2N863	106
2N864	106
2N864A	106
2N865	106
2N865A	106
2N866	123
2N867	123
2N869	106
2N869A	106
2N909	123
2N913	108
2N914	108
2N914A	108
2N914/51	108
2N916	108
2N916A	108
2N917	108
2N917A	108
2N918	108
2N919	108
2N920	108
2N921	108
2N922	108
2N923	106
2N924	106
2N925	106
2N926	106
2N927	106
2N928	106
2N929	123
2N929A	*123*

Type To Be Replaced	Sylvania ECG Replacement
2N930	123
2N930A	108
2N933	126
2N934	126
2N935	123
2N936	123
2N937	123
2N938	123
2N939	123
2N940	123
2N941	123
2N942	123
2N943	123
2N944	123
2N945	123
2N946	123
2N947	123
2N955	101
2N955A	101
2N957	108
2N960	126
2N960/46	126
2N961	126
2N961/46	126
2N962	126
2N963	126
2N964	126
2N964A	126
2N964/46	126
2N965	126
2N966	126
2N967	126
2N968	126
2N969	126
2N970	126
2N971	126
2N972	126
2N973	126
2N974	126
2N975	126
2N976	126
2N977	126
2N978	126
2N979	126
2N980	126
2N981	126
2N982	126
2N983	126
2N984	126
2N985	126
2N986	126
2N987	126
2N988	108
2N989	108
2N990	126
2N991	126
2N992	126
2N993	100
2N994	126
2N995	106
2N995A	106
2N996	106
2N1000	101
2N1003	126
2N1004	126
2N1005	108
2N1006	128
2N1007	104
2N1008	102
2N1008A	102
2N1008B	102
2N1009	102
2N1010	102
2N1011	121
2N1012	101
2N1014	121
2N1017	101
2N1018	101
2N1020	121
2N1021	*121*

Type To Be Replaced	Sylvania ECG Replacement
2N1021A	121
2N1022	121
2N1022A	121
2N1023	126
2N1024	106
2N1025	106
2N1026	106
2N1026A	106
2N1027	106
2N1028	106
2N1029	121
2N1029A	121
2N1029B	121
2N1029C	121
2N1030	121
2N1030A	121
2N1030B	121
2N1030C	121
2N1031	121
2N1031A	121
2N1031B	121
2N1031C	121
2N1032	121
2N1032A	121
2N1032B	121
2N1032C	121
2N1033	121
2N1034	106
2N1035	106
2N1036	106
2N1037	106
2N1038	104
2N1040	104
2N1042	126
2N1043	126
2N1044	102
2N1045	102
2N1046	127
2N1046A	127
2N1046B	127
2N1051	123
2N1054	123
2N1056	102
2N1057	102
2N1058	101
2N1059	103
2N1060	108
2N1065	126
2N1066	126
2N1069	130
2N1070	130
2N1073	127
2N1073A	127
2N1073B	127
2N1078	121
2N1081	123
2N1082	123
2N1086	101
2N1086A	101
2N1087	101
2N1090	101
2N1091	101
2N1092	123
2N1093	126
2N1094	126
2N1095	103
2N1096	103
2N1097	102
2N1098	102
2N1099	105
2N1100	105
2N1101	103
2N1102	103
2N1102/5	101
2N1103	123
2N1104	123
2N1107	100
2N1108	100
2N1108RED	126
2N1109	*126*

Type To Be Replaced	Sylvania ECG Replacement
2N1110	100
2N1111	102
2N1111A	102
2N1111B	102
2N1111RED	126
2N1112	101
2N1114	101
2N1115	100
2N1115A	100
2N1116	123
2N1117	123
2N1118	126
2N1118A	126
2N1119	106
2N1120	121
2N1121	101
2N1122	100
2N1122A	100
2N1123	104
2N1124	102
2N1125	102
2N1126	102
2N1127	102
2N1128	102
2N1129	102
2N1130	102
2N1131	106
2N1131A	106
2N1132	106
2N1132A	106
2N1132B	129
2N1132/46	129
2N1135	129
2N1135A	129
2N1136	104
2N1136A	104
2N1136B	104
2N1137	104
2N1137A	121
2N1137B	121
2N1138	104
2N1138A	121
2N1138B	121
2N1141	100
2N1141A	100
2N1142	100
2N1142A	100
2N1143	100
2N1143A	100
2N1144	102
2N1145	102
2N1146	104
2N1146A	104
2N1146B	104
2N1146C	104
2N1147	104
2N1147A	104
2N1147B	104
2N1147C	104
2N1149	123
2N1150	123
2N1151	123
2N1152	123
2N1153	123
2N1157	105
2N1157A	105
2N1158	100
2N1159	121
2N1160	121
2N1162	104
2N1162A	104
2N1163	121
2N1163A	121
2N1164	104
2N1164A	104
2N1165	104
2N1165A	121
2N1166	104
2N1166A	121
2N1167	*104*

Type To Be Replaced	Sylvania ECG Replacement
2N1167A	121
2N1168	121
2N1169	103
2N1170	103
2N1171	100
2N1172	104
2N1173	103
2N1173W	103
2N1174	103
2N1175	102
2N1175A	102
2N1176	100
2N1176A	126
2N1176B	126
2N1177	126
2N1178	126
2N1179	126
2N1180	126
2N1182	121
2N1183	121
2N1183A	121
2N1183B	121
2N1184	121
2N1184A	121
2N1184B	121
2N1185	100
2N1186	100
2N1187	100
2N1188	100
2N1189	102
2N1190	102
2N1191	102
2N1192	102
2N1193	102
2N1194	102
2N1195	126
2N1198	103
2N1199A	128
2N1200	123
2N1201	123
2N1202	105
2N1203	105
2N1204	100
2N1204A	126
2N1205	123
2N1213	126
2N1214	126
2N1215	126
2N1216	126
2N1217	103
2N1218	121
2N219	106
2N1220	106
2N1221	106
2N1222	106
2N1223	106
2N1224	126
2N1225	126
2N1226	126
2N1227	104
2N1227A	104
2N1227-3	104
2N1227-4	104
2N1227-4R	104
2N1228	106
2N1229	106
2N1230	106
2N1231	106
2N1232	106
2N1233	106
2N1238	106
2N1239	106
2N1240	106
2N1241	106
2N1245	104
2N1246	104
2N1247	123
2N1248	123
2N1249	123
2N1251	*103*

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement
2N1252	128	2N1352	102	2N1435	105	2N1536A	121	2N1636	126
2N1253	128	2N1353	102	2N1436	126	2N1537	121	2N1637	126
2N1254	129	2N1354	100	2N1439	129	2N1537A	121	2N1638	126
2N1255	129	2N1355	100	2N1440	129	2N1538	121	2N1639	126
2N1256	129	2N1356	100	2N1441	129	2N1538A	121	2N1640	106
2N1257	129	2N1357	100	2N1442	129	2N1539	121	2N1641	106
2N1258	129	2N1358	105	2N1443	129	2N1539A	121	2N1642	106
2N1259	129	2N1358A	105	2N1446	102	2N1540	121	2N1643	106
2N1261	105	2N1358M	105	2N1447	102	2N1540A	121	2N1644	123
2N1262	105	2N1359	121	2N1448	102	2N1541	121	2N1644A	123
2N1263	105	2N1360	121	2N1449	102	2N1541A	121	2N1646	126
2N1264	126	2N1361	100	2N1450	102	2N1542	121	2N1651	121
2N1265	102	2N1361A	100	2N1451	102	2N1542A	121	2N1652	121
2N1265/5	102	2N1362	121	2N1452	102	2N1543	121	2N1653	121
2N1266	102	2N1363	121	2N1469	100	2N1543A	121	2N1663	128
2N1273	102	2N1364	121	2N1470	100	2N1544	121	2N1664	100
2N1273RED	102	2N1365	121	2N1471	100	2N1544A	121	2N1665	100
2N1273ORN	102	2N1366	101	2N1473	101	2N1545	121	2N1666	104
2N1273YEL	102	2N1367	101	2N1474	129	2N1545A	121	2N1667	121
2N1273GRN	102	2N1370	102	2N1474A	129	2N1546	121	2N1668	104
2N1273BLU	102	2N1371	102	2N1475	129	2N1546A	121	2N1669	104
2N1274	102	2N1372	102	2N1478	102	2N1547	121	2N1670	100
2N1274BRN	102	2N1373	102	2N1479	128	2N1547A	121	2N1672	103
2N1274RED	102	2N1374	102	2N1480	128	2N1548	121	2N1672A	103
2N1274ORN	102	2N1375	102	2N1481	128	2N1548A	121	2N1673	100
2N1274GRN	102	2N1376	102	2N1482	128	2N1549	121	2N1674	123
2N1274BLU	102	2N1377	102	2N1487	130	2N1549A	121	2N1676	106
2N1274PUR	102	2N1378	102	2N1488	130	2N1550	121	2N1677	106
2N1276	123	2N1379	102	2N1489	130	2N1550A	121	2N1678	126
2N1277	123	2N1380	102	2N1490	130	2N1551	121	2N1681	100
2N1278	123	2N1381	102	2N1491	123	2N1551A	121	2N1682	123
2N1279	123	2N1382	102	2N1492	123	2N1552	121	2N1683	100
2N1280	100	2N1383	102	2N1494	126	2N1552A	121	2N1684	100
2N1281	100	2N1384	126	2N1495	126	2N1553	121	2N1685	101
2N1282	100	2N1385	126	2N1499	126	2N1553A	121	2N1694	101
2N1284	100	2N1386	123	2N1499A	126	2N1554	121	2N1699	126
2N1285	100	2N1387	123	2N1499B	126	2N1554A	121	2N1700	128
2N1287	102	2N1388	123	2N1500	126	2N1555	121	2N1702	130
2N1287A	102	2N1389	123	2N1500/18	126	2N1555A	121	2N1704	123
2N1288	101	2N1391	103	2N1501	104	2N1556	121	2N1705	102
2N1289	101	2N1392	102	2N1502	104	2N1556A	121	2N1706	102
2N1291	104	2N1393	100	2N1505	108	2N1557	121	2N1707	102
2N1292	121	2N1395	126	2N1506	108	2N1557A	121	2N1708	123
2N1293	104	2N1396	126	2N1506A	108	2N1558	121	2N1708A	128
2N1294	121	2N1397	126	2N1507	108	2N1558A	121	2N1726	126
2N1295	104	2N1398	126	2N1510	101	2N1559	121	2N1727	126
2N1296	104	2N1399	126	2N1515	126	2N1559A	121	2N1728	126
2N1297	121	2N1400	126	2N1516	126	2N1560	121	2N1730	101
2N1299	101	2N1401	126	2N1517	126	2N1560A	121	2N1731	100
2N1300	100	2N1401A	126	2N1517A	126	2N1561	126	2N1732	101
2N1301	100	2N1402	126	2N1518	105	2N1562	126	2N1742	126
2N1302	101	2N1403	100	2N1519	105	2N1570	100	2N1743	126
2N1303	102	2N1404	102	2N1520	105	2N1581	100	2N1744	126
2N1304	101	2N1404A	126	2N1521	105	2N1583	100	2N1745	126
2N1305	100	2N1405	126	2N1522	105	2N1584	100	2N1746	126
2N1306	101	2N1406	126	2N1523	105	2N1585	101	2N1747	126
2N1307	100	2N1407	126	2N1524	126	2N1586	123	2N1748	126
2N1308	101	2N1408	126	2N1524-1	126	2N1587	123	2N1748A	126
2N1309	100	2N1409	126	2N1524-2	126	2N1589	123	2N1749	126
2N1309A	102	2N1410	126	2N1524/33	126	2N1590	123	2N1750	126
2N1310	101	2N1411	126	2N1525	126	2N1591	123	2N1752	126
2N1311	101	2N1412	105	2N1526	126	2N1592	123	2N1753	126
2N1312	102	2N1413	102	2N1526/33	126	2N1593	123	2N1754	100
2N1313	126	2N1414	102	2N1527	126	2N1594	123	2N1755	104
2N1314	104	2N1415	102	2N1528	123	2N1601	122	2N1756	104
2N1314R	104	2N1416	102	2N1529	121	2N1602	122	2N1757	104
2N1316	100	2N1417	123	2N1529A	121	2N1605	101	2N1758	104
2N1317	100	2N1418	123	2N1530	121	2N1605A	101	2N1759	104
2N1318	100	2N1419	104	2N1530A	121	2N1606	129	2N1760	104
2N1319	100	2N1420	128	2N1531	121	2N1607	129	2N1761	104
2N1338	123	2N1425	126	2N1531A	121	2N1608	129	2N1762	104
2N1343	100	2N1426	126	2N1532	121	2N1614	102	2N1763	123
2N1344	100	2N1427	126	2N1532A	121	2N1622	101	2N1764	128
2N1345	100	2N1428	129	2N1533	121	2N1623	129	2N1772	122
2N1346	100	2N1429	129	2N1534	121	2N1624	101	2N1773	122
2N1347	100	2N1430	121	2N1534A	121	2N1631	126	2N1774	122
2N1348	102	2N1431	103	2N1535	121	2N1632	126	2N1779	101
2N1349	100	2N1432	102	2N1535A	121	2N1633	126	2N1780	101
2N1350	100	2N1433	105	2N1535B	121	2N1634	126	2N1781	101
2N1351	100	2N1434	105	2N1536	121	2N1635	126	2N1782	100

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement
2N1783	100	2N1992	128	2N2105	129	2N2195A	108	2N2331	123
2N1784	100	2N1993	101	2N2106	128	2N2195B	108	2N2332	106
2N1785	126	2N1994	101	2N2107	128	2N2196	108	2N2333	129
2N1786	126	2N1995	101	2N2108	128	2N2197	108	2N2334	106
2N1787	126	2N1996	101	2N2137	104	2N2198	123	2N2335	106
2N1788	126	2N1997	100	2N2137A	104	2N2199	126	2N2336	106
2N1789	126	2N1998	100	2N2138	104	2N2200	128	2N2337	106
2N1790	126	2N1999	100	2N2138A	104	2N2204	124	2N2349	123
2N1808	101	2N2000	100	2N2139	104	2N2205	123	2N2353	123
2N1838	123	2N2001	100	2N2139A	104	2N2206	108	2N2353A	123
2N1839	123	2N2002	106	2N2140	104	2N2207	126	2N2354	103
2N1840	123	2N2003	106	2N2140A	104	2N2208	126	2N2357	121
2N1853	100	2N2004	106	2N2141	104	2N2209	126	2N2358	121
2N1854	102	2N2005	106	2N2141A	104	2N2210	105	2N2360	126
2N1858	103	2N2006	106	2N2142	104	2N2212	104	2N2361	126
2N1864	126	2N2007	106	2N2142A	104	2N2221	128	2N2362	126
2N1865	126	2N2017	128	2N2143	104	2N2222	128	2N2363	126
2N1866	126	2N2022	126	2N2143A	104	2N2225	100	2N2368	128
2N1867	126	2N2032	108	2N2144	104	2N2234	123	2N2369	128
2N1868	126	2N2038	123	2N2144A	104	2N2235	123	2N2369A	128
2N1891	101	2N2039	123	2N2145	104	2N2236	123	2N2370	106
2N1892	101	2N2040	123	2N2145A	104	2N2237	123	2N2371	106
2N1893	123	2N2041	123	2N2146	104	2N2238	126	2N2372	106
2N1905	121	2N2048	126	2N2146A	104	2N2240	123	2N2373	106
2N1906	121	2N2048A	102	2N2147	104	2N2241	123	2N2374	102
2N1907	121	2N2059	126	2N2148	121	2N2242	108	2N2375	102
2N1908	104	2N2061	104	2N2152	105	2N2244	108	2N2376	102
2N1917	106	2N2061A	121	2N2152A	105	2N2245	108	2N2377	106
2N1918	106	2N2062	104	2N2153	105	2N2246	108	2N2378	106
2N1919	106	2N2062A	104	2N2153A	105	2N2247	108	2N2381	126
2N1920	106	2N2063	104	2N2154	105	2N2248	108	2N2382	126
2N1921	106	2N2063A	104	2N2154A	105	2N2249	108	2N2387	123
2N1924	102	2N2064	104	2N2155	105	2N2250	108	2N2388	123
2N1925	102	2N2064A	104	2N2155A	105	2N2251	108	2N2389	123
2N1926	102	2N2065	104	2N2156	105	2N2252	108	2N2390	123
2N1931	122	2N2065A	104	2N2156A	105	2N2253	108	2N2393	106
2N1932	122	2N2066	104	2N2157	105	2N2254	108	2N2394	106
2N1933	122	2N2066A	104	2N2157A	105	2N2255	108	2N2395	106
2N1940	100	2N2067	104	2N2158	105	2N2256	108	2N2396	123
2N1944	108	2N2067B	104	2N2158A	105	2N2257	108	2N2397	123
2N1945	108	2N2067G	104	2N2159	105	2N2258	126	2N2398	126
2N1946	108	2N2067W	104	2N2159A	105	2N2259	126	2N2399	126
2N1947	108	2N2069	104	2N2161	123	2N2266	105	2N2400	126
2N1948	108	2N2070	104	2N2162	106	2N2267	105	2N2401	126
2N1949	108	2N2075	105	2N2163	106	2N2268	105	2N2402	126
2N1950	108	2N2075A	105	2N2164	106	2N2269	105	2N2411	106
2N1951	108	2N2076	105	2N2165	106	2N2271	102	2N2412	106
2N1952	108	2N2076A	105	2N2166	106	2N2272	123	2N2413	108
2N1953	123	2N2077	105	2N2167	106	2N2273	126	2N2415	126
2N1954	100	2N2077A	105	2N2168	126	2N2274	106	2N2416	126
2N1955	100	2N2078	105	2N2169	126	2N2275	106	2N2423	121
2N1956	100	2N2078A	105	2N2170	126	2N2276	106	2N2424	106
2N1957	100	2N2079	105	2N2171	100	2N2277	106	2N2425	106
2N1958	123	2N2079A	105	2N2172	100	2N2278	106	2N2426	103
2N1959	123	2N2080	105	2N2173	102	2N2280	106	2N2427	108
2N1960	100	2N2080A	105	2N2175	106	2N2281	106	2N2428	102
2N1960/46	100	2N2081	105	2N2176	106	2N2282	104	2N2429	102
2N1961	100	2N2081A	105	2N2177	106	2N2285	104	2N2430	101
2N1962	128	2N2082	105	2N2178	106	2N2286	104	2N2431	102
2N1963	128	2N2082A	105	2N2180	126	2N2287	121	2N2432	128
2N1964	128	2N2083	126	2N2181	129	2N2288	104	2N2446	121
2N1965	128	2N2084	126	2N2182	129	2N2289	121	2N2447	102
2N1969	100	2N2085	101	2N2183	129	2N2290	104	2N2448	102
2N1970	105	2N2089	126	2N2184	129	2N2291	121	2N2449	102
2N1971	104	2N2090	126	2N2185	129	2N2292	121	2N2450	102
2N1972	123	2N2091	126	2N2186	129	2N2293	121	2N2451	126
2N1973	123	2N2092	126	2N2187	129	2N2294	121	2N2455	126
2N1974	123	2N2093	126	2N2188	126	2N2295	121	2N2456	126
2N1975	123	2N2094	123	2N2189	126	2N2296	121	2N2466	106
2N1980	105	2N2094A	123	2N2190	126	2N2303	106	2N2468	102
2N1981	105	2N2095	123	2N2191	126	2N2305	130	2N2469	102
2N1982	105	2N2095A	123	2N2192	108	2N2309	123	2N2476	123
2N1983	123	2N2096A	128	2N2192A	108	2N2310	123	2N2477	123
2N1984	123	2N2097	126	2N2193	108	2N2312	123	2N2481	108
2N1985	123	2N2097A	128	2N2193A	108	2N2314	123	2N2482	103
2N1986	123	2N2098	126	2N2193B	108	2N2315	123	2N2483	128
2N1987	123	2N2099	126	2N2194	123	2N2318	106	2N2484	128
2N1988	123	2N2100	126	2N2194A	123	2N2319	123	2N2487	126
2N1989	108	2N2102	128	2N2194B	123	2N2320	123	2N2488	126
2N1991	106	2N2104	129	2N2195	108	2N2330	123	2N2489	126

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
2N2490	105
2N2491	105
2N2492	105
2N2493	105
2N2494	126
2N2495	126
2N2496	126
2N2501	108
2N2512	102
2N2520	123
2N2521	123
2N2522	123
2N2523	123
2N2524	123
2N2526	127
2N2527	127
2N2528	127
2N2529	123
2N2530	123
2N2531	123
2N2532	123
2N2533	123
2N2534	123
2N2539	128
2N2540	128
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2N2555	102
2N2564	102
2N2565	102
2N2569	128
2N2570	128
2N2571	128
2N2572	128
2N2586	128
2N2587	126
2N2588	126
2N2595	129
2N2596	129
2N2597	129
2N2601	129
2N2602	129
2N2603	129
2N2604	129
2N2605	129
2N2605A	129
2N2610	128
2N2612	104
2N2613	102
2N2614	102
2N2616	108
2N2617	123
2N2618	123
2N2621	100
2N2622	100
2N2623	100
2N2624	100
2N2625	100
2N2626	100
2N2627	100
2N2628	100
2N2629	100
2N2630	100
2N2635	126
2N2636	121
2N2637	121
2N2639	108
2N2640	108
2N2641	108
2N2642	108
2N2643	108
2N2644	108
2N2648	102
2N2651	108
2N2654	126
2N2656	128
2N2671	126
2N2672	126
2N2672A	100
2N2672BLK	100
2N2672GRN	100
2N2673	108
2N2674	108
2N2675	128
2N2676	128
2N2677	128
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2N2706	102
2N2707	103
2N2708	108
2N2709	129
2N2710	108
2N2711	108
2N2712	123
2N2713	123
2N2714	108
2N2715	108
2N2716	123
2N2717	126
2N2719	128
2N2728	105
2N2729	108
2N2730	105
2N2731	105
2N2732	105
2N2783	126
2N2784	108
2N2784/52	108
2N2786	100
2N2786A	100
2N2793	105
2N2795	126
2N2796	126
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2N2870	121
2N2873	126
2N2883	108
2N2884	108
2N2894	106
2N2894A	106
2N2904	106
2N2904A	106
2N2905	106
2N2905A	106
2N2906	106
2N2906A	129
2N2907	106
2N2907A	106
2N2921	128
2N2922	128
2N2923	128
2N2924	123
2N2925	123
2N2926	123
2N2926ORN	128
2N2926GRN	128
2N2926-6	128
2N2927	129
2N2928	126
2N2929	100
2N2930	121
2N2931	123
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2N2933	123
2N2934	123
2N2935	123
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2N2943	102
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2N2945A	129
2N2946	129
2N2946A	129
2N2949	128
2N2951	123
2N2952	128
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2N2955	126
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2N2997	126
2N2998	126
2N2999	126
2N3009	123
2N3010	108
2N3011	108
2N3012	106
2N3013	123
2N3014	123
2N3015	123
2N3035	108
2N3053	128
2N3054	152
2N3055	130
2N3058	106
2N3059	129
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2N3077	123
2N3078	123
2N3081	106
2N3082	107
2N3083	107
2N3115	108
2N3116	108
2N3117	123
2N3121	129
2N3122	123
2N3125	121
2N3132	121
2N3133	106
2N3134	106
2N3135	106
2N3136	106
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2N3217	106
2N3218	106
2N3219	106
2N3226	130
2N3227	108
2N3228	122
2N3232	130
2N3241	123
2N3241A	123
2N3242	123
2N3242A	123
2N3245	106
2N3246	128
2N3247	123
2N3248	129
2N3249	129
2N3250	129
2N3250A	129
2N3251	106
2N3251A	129
2N3261	123
2N3267	100
2N3268	123
2N3279	126
2N3280	126
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2N3546	106
2N3547	129
2N3548	129
2N3549	129
2N3550	129
2N3563	108
2N3563-1	108
2N3564	108

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
2N3565	123
2N3566	128
2N3567	128
2N3568	128
2N3569	128
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2N3571	108
2N3572	108
2N3576	106
2N3579	129
2N3580	129
2N3581	106
2N3582	106
2N3583	124
2N3588	126
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2S3220	129
2S3221	129

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement
2S3230	129	2SA77C	126	2SA138	126	2SA220	126	2SA288A	126
2S3240	129	2SA77D	126	2SA139	126	2SA221	126	2SA289	100
2SA12	100	2SA78	100	2SA141	126	2SA222	126	2SA290	100
2SA12A	126	2SA79	100	2SA141B	126	2SA223	126	2SA291	126
2SA12B	126	2SA80	126	2SA141C	126	2SA224	126	2SA292	126
2SA12C	126	2SA81	126	2SA142	126	2SA225	126	2SA293	126
2SA12D	126	2SA82	126	2SA142B	126	2SA226	100	2SA294	126
2SA13	100	2SA83	126	2SA142C	126	2SA227	126	2SA295	126
2SA14	100	2SA84	126	2SA143	126	2SA228	100	2SA296	100
2SA15	100	2SA85	126	2SA144	100	2SA229	126	2SA297	100
2SA15V	100	2SA86	100	2SA144C	100	2SA230	126	2SA298	126
2SA15Y	102	2SA87	126	2SA145	100	2SA233	126	2SA301	100
2SA16	100	2SA88	126	2SA145C	100	2SA233A	126	2SA302	100
2SA17	100	2SA89	126	2SA146	100	2SA233B	126	2SA303	126
2SA18	100	2SA90	126	2SA147	100	2SA233C	126	2SA304	126
2SA19	126	2SA92	126	2SA148	100	2SA234	126	2SA305	126
2SA20	126	2SA93	126	2SA149	100	2SA234A	126	2SA306	126
2SA21	126	2SA94	126	2SA150	126	2SA234B	126	2SA307	126
2SA26	100	2SA100	100	2SA151	100	2SA234C	126	2SA308	126
2SA28	100	2SA100B	102	2SA152	100	2SA235	126	2SA309	126
2SA29	126	2SA100C	102	2SA153	126	2SA335A	126	2SA310	126
2SA30	126	2SA101	126	2SA154	126	2SA235B	126	2SA311	126
2SA31	100	2SA101A	126	2SA155	126	2SA235C	126	2SA312	126
2SA32	126	2SA101AA	126	2SA156	126	2SA236	126	2SA313	126
2SA33	126	2SA101AY	126	2SA157	126	2SA237	126	2SA314	126
2SA35	100	2SA101B	126	2SA159	126	2SA238	126	2SA315	126
2SA36	100	2SA101BA	126	2SA160	100	2SA239	126	2SA316	126
2SA37	100	2SA101BB	126	2SA161	126	2SA240	126	2SA321	126
2SA38	100	2SA101BC	126	2SA162	126	2SA240A	126	2SA322	126
2SA39	100	2SA101BX	126	2SA163	126	2SA240B	126	2SA323	126
2SA40	100	2SA101C	126	2SA164	126	2SA240B2	126	2SA324	126
2SA41	100	2SA101CA	126	2SA165	126	2SA240BL	126	2SA325	102
2SA42	100	2SA101E	126	2SA166	126	2SA241	126	2SA326	102
2SA43	126	2SA101X	126	2SA167	100	2SA242	126	2SA327	126
2SA44	100	2SA101Y	126	2SA168	100	2SA243	126	2SA329	126
2SA49	100	2SA101Z	100	2SA168A	100	2SA244	126	2SA329A	126
2SA50	100	2SA102	126	2SA169	100	2SA245	126	2SA329B	126
2SA51	100	2SA102AA	126	2SA170	100	2SA246	126	2SA330	100
2SA52	100	2SA102BA	126	2SA171	100	2SA246V	126	2SA331	126
2SA53	100	2SA103	126	2SA172	100	2SA247	126	2SA332	100
2SA54	100	2SA103A	126	2SA172A	100	2SA248	100	2SA335	126
2SA55	100	2SA103B	126	2SA173	100	2SA250	126	2SA337	126
2SA56	100	2SA103C	126	2SA174	102	2SA251	126	2SA338	126
2SA57	126	2SA103CA	126	2SA175	126	2SA252	126	2SA339	126
2SA58	126	2SA103CG	126	2SA176	126	2SA253	126	2SA340	126
2SA59	126	2SA103DA	126	2SA180	100	2SA254	126	2SA341	126
2SA60	126	2SA104	126	2SA181	100	2SA255	100	2SA341-OA	126
2SA61	100	2SA104D	126	2SA182	100	2SA256	126	2SA341-OB	126
2SA64	126	2SA104P	126	2SA183	100	2SA257	126	2SA342	126
2SA65	100	2SA105	126	2SA188	100	2SA258	126	2SA342A	126
2SA66	100	2SA106	126	2SA189	100	2SA259	126	2SA343	126
2SA67	126	2SA107	126	2SA197	102	2SA260	126	2SA344	126
2SA69	126	2SA108	126	2SA198	100	2SA261	126	2SA345	126
2SA70	126	2SA109	126	2SA201	100	2SA262	126	2SA346	126
2SA70F	126	2SA110	126	2SA201A	100	2SA263	126	2SA347	126
2SA70L	126	2SA111	126	2SA201B	126	2SA264	126	2SA348	126
2SA70MA	126	2SA112	126	2SA202	100	2SA265	126	2SA349	126
2SA70OB	126	2SA113	126	2SA202A	100	2SA266	126	2SA350	126
2SA70OY	126	2SA114	126	2SA202B	100	2SA267	100	2SA350A	126
2SA71	126	2SA115	126	2SA202C	100	2SA268	126	2SA350R	126
2SA71A	126	2SA116	126	2SA202D	100	2SA269	100	2SA350T	126
2SA71AB	126	2SA117	126	2SA203	100	2SA270	126	2SA350TY	126
2SA71AC	126	2SA118	126	2SA203AA	100	2SA271	126	2SA350Y	126
2SA71B	126	2SA121	126	2SA203B	100	2SA272	126	2SA351	126
2SA71D	126	2SA122	126	2SA204	100	2SA273	126	2SA351A	126
2SA71BS	126	2SA123	126	2SA205	100	2SA274	126	2SA351B	126
2SA71Y	126	2SA124	126	2SA206	100	2SA275	126	2SA352	126
2SA72	126	2SA125	126	2SA207	100	2SA276	126	2SA352A	126
2SA72BRN	126	2SA126	126	2SA208	100	2SA277	100	2SA352B	126
2SA72ORN	126	2SA127	126	2SA209	100	2SA278	100	2SA353	126
2SA72BLU	126	2SA128	126	2SA210	100	2SA279	100	2SA353A	126
2SA72WHT	126	2SA129	126	2SA211	100	2SA280	100	2SA353C	126
2SA72BLU-BLU	126	2SA130	100	2SA212	100	2SA281	100	2SA354	126
2SA73	126	2SA131	100	2SA213	126	2SA282	100	2SA354B	126
2SA74	100	2SA132	100	2SA214	126	2SA283	100	2SA355	126
2SA75	100	2SA133	126	2SA215	126	2SA284	100	2SA356	126
2SA76	126	2SA134	126	2SA216	126	2SA285	126	2SA357	126
2SA77	126	2SA135	100	2SA217	100	2SA286	126	2SA358	126
2SA77A	126	2SA136	126	2SA218	100	2SA287	126	2SA359	126
2SA77B	126	2SA137	100	2SA219	126	2SA288	126	2SA360	126

TRANSISTORS (cont'd)

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2SB186BY	102
2SB186G	102
2SB186Y	102
2SB187	102
2SB187AA	102
2SB187B	102
2SB187C	102
2SB187G	102
2SB187R	102
2SB188	102
2SB189	102
2SB199	102
2SB200	102
2SB200A	102
2SB201	126
2SB202	102
2SB203AA	102
2SB215	127
2SB216	127
2SB216A	127
2SB217	121
2SB217A	121
2SB217G	121
2SB217U	121
2SB218	102
2SB219	102
2SB220	102
2SB220A	102
2SB221	102
2SB221A	102
2SB222	102
2SB223	102
2SB224	102
2SB225	102
2SB226	102
2SB227	102
2SB228	104
2SB229	121
2SB230	104
2SB231	127
2SB232	127
2SB233	104
2SB235	105
2SB236	105
2SB237	105
2SB237-12A	105
2SB237-12B	105
2SB238-12A	105
2SB238-12B	105
2SB238-12C	105
2SB239	121
2SB239A	121
2SB240	102
2SB240A	102
2SB241	102
2SB246	104
2SB247	121
2SB248	121
2SB248A	121
2SB249	104

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
2SB249A	104
2SB250	104
2SB250A	104
2SB251	127
2SB251A	127
2SB252	127
2SB252A	127
2SB253	127
2SB253A	127
2SB254	131
2SB255	131
2SB256	131
2SB257	102
2SB258	105
2SB259	105
2SB260	105
2SB261	102
2SB262	102
2SB263	102
2SB264	102
2SB265	102
2SB266	102
2SB266P	102
2SB266Q	102
2SB267	102
2SB268	102
2SB269	102
2SB270	102
2SB270B	102
2SB270C	102
2SB270D	102
2SB270E	102
2SB271	100
2SB272	100
2SB273	100
2SB274	127
2SB275	127
2SB276	127
2SB282	102
2SB283	121
2SB284	121
2SB285	121
2SB290	126
2SB291	100
2SB292	100
2SB292A	100
2SB293	102
2SB294	100
2SB295	121
2SB296	127
2SB299	100
2SB300	127
2SB301	127
2SB302	102
2SB303	102
2SB303A	102
2SB303B	102
2SB304	100
2SB304A	100
2SB309	127
2SB310	127
2SB311	127
2SB312	127
2SB314	100
2SB315	100
2SB316	100
2SB317	102
2SB318	127
2SB319	127
2SB320	127
2SB321	102
2SB322	102
2SB323	100
2SB324	102
2SB324A	102
2SB324B	102
2SB324N	102
2SB326	102
2SB327	102
2SB328	102
2SB329	102
2SB331	105
2SB332	105
2SB333	105
2SB334	105
2SB335	102
2SB336	102
2SB337	121
2SB337B	121
2SB338	121
2SB339	121
2SB340	121
2SB341	127
2SB341V	127
2SB342	127
2SB343	127
2SB345	100
2SB346	100
2SB347	102
2SB348	100
2SB349	126
2SB350	102
2SB351	105
2SB352	105
2SB353	105
2SB354	105
2SB355	104
2SB356	104
2SB358	127
2SB359	127
2SB360	127
2SB361	127
2SB362	127
2SB364	102
2SB365	102
2SB367	131
2SB367H	131
2SB368	131
2SB368A	131
2SB370	102
2SB370A	102
2SB371	100
2SB373	102
2SB375	127
2SB376	126
2SB377	126
2SB378	126
2SB379	102
2SB379-2	102
2SB380	102
2SB380A	102
2SB381	102
2SB382	102
2SB383	102
2SB383-1	102
2SB383-2	102
2SB384	126
2SB385	126
2SB387	100
2SB389	126
2SB390	127
2SB391	127
2SB392	100
2SB393	100
2SB394	100
2SB395	100
2SB396	100
2SB400	126
2SB401	100
2SB402	100
2SB403	100
2SB405	102
2SB405A	102
2SB405B	102
2SB405C	102
2SB407	104
2SB408	100
2SB413	104
2SB414	104
2SB415	102
2SB416	100
2SB417	100
2SB422	102
2SB423	102
2SB424	121
2SB425	121
2SB426	121
2SB426Y	121
2SB427	100
2SB428	100
2SB431	102
2SB432	127
2SB439	102
2SB439A	102
2SB440	102
2SB443	102
2SB443B	102
2SB445	131
2SB446	131
2SB447	127
2SB448	127
2SB449	104
2SB450	102
2SB450A	102
2SB452	102
2SB457	102
2SB457A	102
2SB458A	104
2SB459	102
2SB463	131
2SB463Y	131
2SB464	127
2SB465	127
2SB466	131
2SB467	131
2SB468	127
2SB468A	127
2SB468B	127
2SB468C	127
2SB470	102
2SB471	121
2SB471-2	121
2SB471B	121
2SB472	121
2SB473	131
2SB474	131
2SB475	102
2SB475B	102
2SB475F	102
2SB481	131
2SB486	102
2SB492	102
2SB496	102
2SB497	102
2SC11	101
2SC12	128
2SC13	101
2SC14	101
2SC15	106
2SC16	128
2SC16A	128
2SC17	108
2SC17A	108
2SC18	128
2SC19	128
2SC27	128
2SC28	123
2SC29	123
2SC30	123
2SC31	123
2SC32	108
2SC33	108
2SC34	101
2SC35	101
2SC36	101
2SC37	108
2SC38	108
2SC39	108
2SC39A	108
2SC40	108
2SC41	130
2SC45	108
2SC46	128
2SC47	123
2SC48	123
2SC49	123
2SC50	101
2SC50A	101
2SC52	123
2SC53	123
2SC54	108
2SC55	108
2S56	123
2SC58A	128
2SC60	101
2SC61	123
2SC62	108
2SC64	123
2SC67	124
2SC68	124
2SC71	101
2SC72	101
2SC73	101
2SC74	108
2SC75	101
2SC76	101
2SC77	101
2SC77C	102
2SC78	101
2SC79	108
2SC80	108
2SC81	123
2SC87	123
2SC88A	108
2SC89	101
2SC90	101
2SC91	101
2SC97	123
2SC98	108
2SC99	108
2SC100	123
2SC101	124
2SC101A	124
2SC102	105
2SC103	128
2SC103A	128
2SC104	128
2SC104A	128
2SC105	128
2SC108	123
2SC109	123
2SC115	128
2SC116	128
2SC116T	128
2SC117	128
2SC118	128
2SC119	128
2SC120	128
2SC121	128
2SC122	128
2SC123	128
2SC124	128
2SC125	100
2SC127	108
2SC128	101
2SC129	101
2SC131	128
2SC132	128
2SC133	128
2SC134	128
2SC135	128
2SC136	128
2SC137	128
2SC138	123
2SC138A	123
2SC139	123
2SC150	108
2SC150T	128
2SC151	108
2SC155	108
2SC156	108
2SC157	123
2SC158	123
2SC159	108
2SC160	108
2SC163	128
2SC166	108
2SC170	128
2SC171	128
2SC172	108
2SC172A	108
2SC173	101
2SC174	123
2SC174A	123
2SC175	101
2SC176	101
2SC177	101
2SC178	101
2SC179	101
2SC180	101
2SC181	101
2SC182	123
2SC183	108
2SC183E	108
2SC183J	108
2SC183K	108
2SC183L	108
2SC183M	108
2SC183P	108
2SC183Q	108
2SC184	108
2SC184H	108
2SC184J	108
2SC184L	108
2SC185	108
2SC185J	108
2SC185M	108
2SC185R	108
2SC185V	108
2SC186	128
2SC187	108
2SC188	123
2SC188A	108
2SC188AB	108
2SC189	123
2SC190	123
2SC191	123
2SC192	123
2SC193	123
2SC194	123
2SC195	123
2SC196	123
2SC197	123
2SC199	108
2SC200	123
2SC201	123
2SC202	123
2SC203	128
2SC204	128
2SC205	128
2SC206	128
2SC208	128
2SC210	123
2SC211	123
2SC214	123
2SC216	123
2SC217	123
2SC218	123
2SC220	123
2SC221	123
2SC222	123
2SC225	108
2SC226	123
2SC227	123
2SC228	123
2SC229	123
2SC230	108
2SC231	123
2SC232	123
2SC233	123

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement
2SC237	128	2SC394	108	2SC544	108	2SC772	108	2SD96	101
2SC238	128	2SC398	108	2SC545	108	2SC772C	108	2SD100	101
2SC239	128	2SC399	108	2SC545A	108	2SC772D	108	2SD100A	101
2SC241	130	2SC400	108	2SC545B	108	2SC772E	108	2SD101	101
2SC248	123	2SC401	123	2SC545C	108	2SC772K	108	2SD104	101
2SC249	123	2SC402	123	2SC545D	108	2SC772R	108	2SD105	101
2SC250	108	2SC403	128	2SC545E	108	2SC784	108	2SD120	128
2SC251	108	2SC403A	128	2SC558	130	2SC828	123	2SD121	128
2SC251A	108	2SC404	128	2SC561	108	2SC828A	123	2SD124	130
2SC252	108	2SC405	108	2SC562	108	2SC828Q	123	2SD124AH	130
2SC253	108	2SC406	108	2SC563	128	2SC829	108	2SD125	130
2SC263	108	2SC423F	123	2SC563A	128	2SC839	108	2SD125AH	130
2SC266	108	2SC429	108	2SC568	108	2SC840	124	2SD127	101
2SC267	108	2SC429J	108	2SC580	128	2SC856C	128	2SD127A	101
2SC268	108	2SC430	108	2SC582	124	2SCF1	108	2SD128	101
2SC268A	108	2SC430H	108	2SC594	123	2SCF5	128	2SD128A	103
2SC269	108	2SC440	123	2SC595	123	2SCF6	128	2SD134	123
2SC271	108	2SC441	123	2SC596	123	2SCS183E	123	2SD136	124
2SC272	108	2SC442	123	2SC601	108	2SCS184E	123	2SD137	124
2SC281	123	2SC443	128	2SC602	108	2SCS184J	108	2SD141	130
2SC281B	123	2SC454	128	2SC605	108	2SCS429J	108	2SD142	152
2SC281C	123	2SC454A	128	2SC606	108	2SCS430H	108	2SD143	152
2SC282	108	2SC454B	128	2SC608	128	2SCS461F	108	2SD146	130
2SC283	108	2SC454C	128	2SC608T	128	2SCS469F	108	2SD147	130
2SC284	108	2SC454LA	128	2SC609	128	2SD11	103	2SD150	130
2SC285	108	2SC455	128	2SC609T	128	2SD12	130	2SD151	130
2SC285A	108	2SC458	123	2SC611	108	2SD15	130	2SD157	124
2SC286	108	2SC458A	123	2SC612	108	2SD16	130	2SD158	124
2SC287	108	2SC458B	123	2SC621	128	2SD19	103	2SD159	124
2SC288	108	2SC458C	123	2SC622	128	2SD20	103	2SD161	101
2SC288A	108	2SC459	128	2SC629	128	2SD21	103	2SD162	101
2SC289	108	2SC460	128	2SC631	123	2SD22	103	2SD167	101
2SC291	128	2SC460A	128	2SC632	123	2SD23	103	2SD172	130
2SC292	128	2SC460B	128	2SC633	123	2SD24	124	2SD174	130
2SC293	128	2SC460C	128	2SC633-7	123	2SD25	103	2SD175	130
2SC299	123	2SC460D	128	2SC645	128	2SD26A	130	2SD178	102
2SC300	108	2SC461	128	2SC645A	128	2SD26B	130	2SD178A	102
2SC301	108	2SC461B	128	2SC650	123	2SD26C	130	2SD180	130
2SC302	108	2SC463	108	2SC650B	123	2SD28	152	2SD186	101
2SC306	123	2SC464	108	2SC657	128	2SD29	152	2SD187	101
2SC307	128	2SC464C	108	2SC658	128	2SD30	101	2SD187A	101
2SC313	108	2SC465	108	2SC658A	128	2SD31	101	2SD190	124
2SC316	108	2SC466	108	2SC659	108	2SD32	101	2SD191	101
2SC317C	123	2SC469	108	2SC662	108	2SD33	101	2SD192	101
2SC318	108	2SC469F	108	2SC668	108	2SD33C	101	2SD193	101
2SC319	123	2SC470	128	2SC668A	108	2SD34	101	2SD194	101
2SC320	123	2SC475	108	2SC668B	108	2SD36	101	2SD195	101
2SC323	123	2SC476	108	2SC668C	108	2SD37	101	2SD195A	101
2SC324	123	2SC477	108	2SC668D	108	2SD37A	101	2SE629	108
2SC324A	123	2SC478	128	2SC668E	108	2SD37B	101	2SE4002	101
2SC324H	123	2SC481	128	2SC682	108	2SD37C	101	2T11	102
2SC324HA	123	2SC482	128	2SC682A	108	2SD38	101	2T12	102
2SC352	108	2SC482Y	128	2SC683	108	2SD43	101	2T13	102
2SC356	124	2SC486	123	2SC684	108	2SD43A	101	2T14	102
2SC360	108	2SC486Y	123	2SC685	124	2SD44	101	2T14A	126
2SG361	108	2SC487	108	2SC685A	124	2SD49	152	2T15	102
2SC362	108	2SC490	152	2SC687	130	2SD50	130	2T16	102
2SC363	108	2SC494	130	2SC688	108	2SD51	130	2T17	102
2SC367	123	2SC503	123	2SC693	123	2SD53	130	2T20	102
2SC368	108	2SC504	123	2SC694	123	2SD56	152	2T21	102
2SC369	123	2SC513	128	2SC696	128	2SD61	103	2T22	102
2SC370	123	2SC514	124	2SC701	123	2SD62	103	2T23	102
2SC371	108	2SC515	124	2SC702	123	2SD63	103	2T24	102
2SC371B	108	2SC529	108	2SC708	128	2SD64	101	2T25	102
2SC372	123	2SC535	108	2SC708A	128	2SD65	103	2T26	102
2SC373	123	2SC535A	108	2SC709	108	2SD65-1	103	2T40	108
2SC374	108	2SC535B	108	2SC712	123	2SD66	103	2T41	108
2SC375	108	2SC535C	108	2SC715	123	2SD70	130	2T42	108
2SC376	108	2SC536	123	2SC717	108	2SD72	103	2T43	108
2SC379	128	2SC536D	123	2SC727	123	2SD72A	101	2T44	108
2SC380	108	2SC536F	123	2SC732	123	2SD72B	101	2T51	103
2SC381	108	2SC537	123	2SC733	123	2SD72C	101	2T52	101
2SC382	108	2SC537C	123	2SC735	123	2SD75	103	2T53	101
2SC382G	108	2SC537D	123	2SC735ORN	123	2SD75A	103	2T61	103
2SC382R	108	2SC537E	123	2SC735Y	123	2SD77	103	2T62	103
2SC384	108	2SC538	123	2SC738	108	2SD77A	103	2T63	103
2SC385	108	2SC538A	123	2SC739	108	2SD80	130	2T64	103
2SC386	108	2SC538Q	108	2SC762	108	2SD81	130	2T64R	103
2SC387	108	2SC539	123	2SC765	130	2SD82	130	2T65	103
2SC388	108	2SC540	108	2SC768	130	2SD91	124	2T65R	103

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
2T66	103
2T66R	103
2T67	101
2T69	103
2T71	101
2T72	101
2T73	101
2T73R	101
2T74	101
2T75	101
2T75R	101
2T76	101
2T76R	101
2T77	101
2T77R	101
2T78	101
2T78R	101
2T82	101
2T83	101
2T84	103
2T85	103
2T85A	103
2T86	103
2T89	103
2T201	126
2T202	123
2T203	126
2T204	126
2T204A	126
2T205	126
2T205A	126
2T230	102
2T231	102
2T311	102
2T312	102
2T313	102
2T314	102
2T315	102
2T321	102
2T322	102
2T323	102
2T324	102
2T383	102
2T402	123
2T403	108
2T404	108
2T513	101
2T520	101
2T521	101
2T522	103
2T523	103
2T524	101
2T551	101
2T552	103
2T650	101
2T681	103
2T682	103
2T918	108
2T919	107
2T2001	102
2T2708	108
2T2857	108
2T3011	104
2T3021	104
2T3022	104
2T3030	104
2T3031	104
2T3032	104
2T3033	104
2T3041	104
2T3042	104
2T3043	104
2TN15	100
2TN32	100
2TN45A	102
2TN48	100
2TN49	100
2TN52	100
2TN53	100
2TN56	102
2TN95	102
2TN95A	102
2V362	102
2V363	102
2V464	100
2V465	100
2V466	100
2V467	100
2V482	100
2V483	100
2V484	100
2V485	100
2V486	100
2V559	126
2V560	126
2V561	100
2V562	100
2V563	100
2V631	100
2V632	100
2V633	100
2-36	103
3B15	102
3B15-1	102
3L4-6001-01	130
3MC	126
3N22	101
3N23	101
3N23A	101
3N23B	101
3N23C	101
3N29	101
3N30	101
3N31	101
3N34	126
3N35	128
3N35A	128
3N36	101
3N37	101
3N49	105
3N50	105
3N51	105
3N52	105
3N71	107
3N72	107
3N73	107
3N90	129
3N91	129
3N92	129
3N93	129
3N94	129
3N95	129
3N112	106
3N113	106
3RC10	122
3RC10A	122
3RC15	122
3RC20	122
3RC20A	122
3S004	123
3T201	101
3T202	101
3T203	101
3TE120	130
3TE230	130
3TE240	130
3TX003	130
3TX004	130
4C28	123
4C29	123
4C30	123
4C31	123
4D20	123
4D21	123
4D22	123
4D24	123
4D25	123
4D26	123
4JD1A17	100
4JD1A73	102
4JD3B1	101
4JX1A520	102
4JX1A520B	102
4JX1A520C	102
4JX1A520D	100
4JX1A520E	100
4JX1A813	101
4JX1C850	102
4JX1C850A	100
4JX1E821	100
4JX1E850	103
4JX2A60	100
4JX2A601	103
4JX2A801	101
4JX2A816	103
4JX2A822	103
4JX8D404	121
4JX8P404	121
4JX8P409	121
4JX16A567	108
4JX16A667/G	107
4JX16A667/O	107
4JX16A667/R	107
4JX16A667/Y	107
4JX16A668/G	107
4JX16A668/O	107
4JX16A668/Y	107
4JX16A669/G	123
4JX16A669/Y	107
4JX16A670/G	123
4JX16B670/B	107
4JX16B670/G	123
4JX16B670/R	128
4JX16B670/Y	128
4JX2816	103
4JX2825	103
5-8	128
5RC10	122
5RC10G	122
5RC15	122
5RC15A	122
5RC20	122
5RC20A	122
5RCL10	122
5RCL15	122
5RCL20	122
6-4	128
6-04	123
6-04ORN	128
6-04GRN	128
6-04S1	128
6-04S2	128
6-05	123
6-05YEL	128
6-05F	128
6-11	128
6-13	128
6-19	128
6-30	128
6-31	102
6-53	102
6-53/63	102
6-53A	102
6-60	126
6-60B	126
6-60D	126
6-60P	126
6-61	126
6-61B	126
6-61D	126
6-61P	126
6-62	126
6-62A	126
6-62B	126
6-62D	126
6-62P	126
6-63	102
6-63A	126
6-69	126
6-69X	126
6-70	126
6-71	126
6-72	126
6-88	102
6-89	126
6-89X	126
6-90	123
6-93	123
6D122	100
6D122R	100
6D122V	100
6MC	126
7-4	108
7-6	108
7-7	108
7-8	108
7A30	107
7A31	107
7A32	107
7B1	124
7B2	124
7B13	124
7C1	124
7C2	124
7C3	124
7D1	124
7D2	124
7D3	124
7E1	124
7E2	124
7E3	124
7G1	124
7G2	124
7G3	124
7G4	124
8-0024-1	108
8-0024-2	108
8-0024-3	123
8-0062	102
8-723-650	103
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8E	126
8F	126
8H303	121
8L	126
8L201	121
8L201B	121
8L201R	121
8L201V	121
8L404	121
8P	126
8P40	104
8P404	104
8P404F	104
8P404R	121
8P404ORN	104
8P404T	121
8P404V	121
8P416C	121
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10B	126
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10B553	108
10B555	108
10B556	108
10B1051	108
10B1055	108
10C	126
10C573	108
10C574	108
10G1051	108
10G1052	108
10H551	108
10H553	108
10H1051	108
10H1053	108
10P1	129
11B551	108
11B552	108
11B554	108
11B555	108
11B1052	108
11B1055	108
11C3B1	124
11C551	108
11C553	108
11C557	108
11C1051	108
11C1053	108
11C1057	108
11C1536	128
11C1B1	124
11C3B3	124
11C5B1	124
11C7B1	124
11C10B1	124
11C11B1	124
12A6240	100
12A9275	102
12A9275-1	102
12M2	121
12MC	126
12MZ	126
12X047	108
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13-1032-5	108
13-10321-5	108
13-10321-6	108
13-10321-7	108
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13-10321-10	108
13-10321-11	108
13-10321-12	108
13-10321-14	108
13-10321-15	108
13-10321-16	108
13-10321-17	108
13-105698-1	128
13-14604-1	121MP
13-14735-1	121
13-14735A	121
13-14735-1	121
13-14778-1	121MP
13-14886-1	126
13-14887-1	126
13-14888-3	102
13-14889-1	126
13-15805-1	102
13-15808-1	123
13-15808-2	123
13-15809-1	128
13-15810-1	108
13-15833-1	128
13-15835-1	108
13-15836-1	102
13-15840-1	128
13-15840-2	128
13-15841-1	108
13-15842-1	103
13-16570-1	106
13-16592-1	127
13-16607-1	127
13-16608-1	127
13-17607B	127
13-17607-1	127
13-17608B	127
13-17608C	127
13-17608-1	127
13-17608-2	127
13-17609-1	127
13-18034	121
13-18034A	121
13-18034-1	121
13-18087-1	123
13-18087-2	123
13-18158-1	123
13-18198-1	121MP
13-18282	124
13-18282-1	124
13-18304-1	102

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13-18359	124
13-18359A	124
13-18359-1	124
13-18363	123
13-18363-1	123
13-18363-1A	123
13-18364-1	123
13-18365-1	123
13-18642	121
13-18642-1	121MP
13-18654-1	103
13-18927-1	128
13-18927-1A	128
13-18944-1	102
13-18946-1	126
13-18947-1	126
13-18948-1	126
13-18948-2	126
13-18950-1	108
13-18951-1	126
13-18951-2	126
13-21606-1	127
13-22581	123
13-22581-1	128
13-22582-1	129
13-22692-1	132
13-22739-1	121MP
13-22741	121
13-22741-1	121MP
13-23543-1	124
13-23594-1	128
13-23785-1	102
13-23822-1	108
13-23824-1	108
13-23825-1	123
13-23826-1	106
13-23826-2	106
13-23840-1	128
13-23916-1	128
13-25343-1	124
13-26009-1	108
13-26386-1	106
13-26576-1	108
13-26576-2	108
13-26577-1	108
13-26577-3	108
13-26666-1	128
13-27404-1	123
13-27443-1	128
13-86416-1	103
13-94096-2	102
14-3	128
14-573-10	105
14-574-10	121
14-575-10	103
14-577-10	102
14-578-10	104
14-581-01	126
14-583-01	103
14-600-01	126
14-600-02	126
14-600-04	126
14-600-10	126
14-600-16	126
14-600-19	126
14-601-01	105
14-601-03	104
14-601-05	121
14-601-06	104
14-601-08	121
14-602-01	123
14-602-02	128
14-602-03	123
14-602-05	102
14-602-05A	102
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14-602-29	123
14-602-30	123
14-602-31	108
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14-602-35	123
14-603-02	108
14-603-03	108
14-604-02	121
14-2002-1	121MP
15-2	128
15-4	106
15-5	129
15Z3	129
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16-21426	108
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16A2	103
16G2	108
16J1	108
16J2	108
16K1	108
16K2	108
16K3	108
16L2	108
16L3	108
16L5	108
16L22	108
16L23	108
16L42	108
16L43	108
16L44	108
16L62	108
16L63	108
16L64	108
16P3367	128
16X1	108
16X2	108
17A4422-1	121
19-020-031	126
19-020-032	126
19-020-033	100
19-020-034	102
19-020-035	102
19-020-036	102
19-020-037	108
19-020-048	108
19-020-44	108
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19A115129-2	103
19A115180-2	129
19A115249-1	108
19A115300-1	128
19A115300-2	128
19A115304-2	128
19A115342-1	108
19A115440-1	108
19A115441-1	108
19A115527	152
19A115561	121
19A115666-1	108
19A115720-1	123
19A115728-1	123
19A115786	123
19A115786A	123
19A123160-1	108
19A126813	130
19-3415	102
19-3416	102
20A0007	102
20A0009	102
20A0015	102
20A0017	121
20C71	102
20C72	102
20MC	126
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21-33	126
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21A015-001	102
21A015-004	108
21A015-005	103
21A015-006	102
21A015-013	123
21A038-000	102
21A048-000	126
21A049-000	126
21A050-000	126
21A050-001	126
21A053-000	102
21A054-000	102
21A055-000	102
21A062-000	126
21A064-000	121
21A074-000	102
21A097-000	121
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23-3	129
23B-210-025	121
23B-210-230-2	127
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24MW27	126
24MW28	102
24MW29	102
24MW34	126
24MW43	102
24MW44	126
24MW55	126
24MW59	126
24MW60	102
24MW61	126
24MW69	102
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24MW83	102
24MW84	102
24MW107	102
24MW111	126
24MW115	102
24MW116	102
24MW130	103
24MW132	102
24MW205	126
24MW263	102
24MW271	126
24MW303	126
24MW352	126
24MW353	126
24MW458	123
24T-002	108
24T-016	108
24T-016-001	108
24T-016-005	108
24T-016-013	108
25-100015	108
25A	108
25AM624	108
25B	108
25B378	100
25T1	102
26T1	102
27T401	100
27T402	100
27T403	102
27T404	102
27T405	102
27T406	121
27T407	105
27T408	101
27T409	123
27T410	103
27T411	123
27T412	126
29A4	129
29V008M01	100
29V011H01	100
29V012H01	100
29V0038H03	102
30-004-001	121
30-090	152
30V-H6	102
31-0015	126
31-0016	126
31-0017	102
31-0018	102
31-0035	102
31-0041	126
31-0042	126
31-0107	102
31-0108	126
31-0123	126
31-0124	126
31-0132	126
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31-0141	126
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31-0187	123
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31-0190	126
31-0191	126
31-0192	121
31-0196	127
31-0205	102
31-0217	126
31-025	102
31-0228	126
31-0229	102
31-0239	123
31-0240	131MP
31-0241	121
31-0241-1	121
32-16599	121MP
32-20738	123
32-20739	129
33-071	123
33-090	152
33-096	153
34-6	126
34-119	126
34-220	126
34-221	126
34-298	126
34-1000	130
34-1002	152
34-1003	153
34-6000-3	100
34-6000-10	126
34-6000-16	126
34-6000-18	100
34-6000-19	100
34-6000-62	126
34-6000-64	108
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34-6000-85	126
34-6001-16	102
34-6001-28	102
34-6001-33	102
34-6001-43	100
34-6001-44	100
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34-6001-52	128
34-6001-53	123
34-6001-54	123
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34-6001-71	123
34-6001-72	102
34-6001-73	123
34-6001-74	128
34-6001-76	102
34-6001-77	123
34-6002-17	104
34-6002-18	104
34-6002-18A	104
34-6002-19	104
34-6002-20	104
34-6002-21	124
34-6002-22	104
34-6002-22A	104
34-6002-26	124
34-6008	102
34-6009	102
34-6015-1	108
34-6015-2	123
34-6015-3	108
34-6015-4	108
34-6015-5	108
34-6015-6	108
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34-6015-11	108
34-6015-13	123
34-6015-14	123
34-6016-11	102
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34-6016-17	123
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36P1	102
36P1C	102
36P1F	102
36P2F	102
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36P5	102
36P5C	102

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36P7C	102
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36T1	102
37T1	126
38T1	102
38P1	102
39A9	102
39P1	121
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41B581014	128
41N1	108
41N2	108
41N2B	108
41N3	108
42-16599	121
42-17143	102
42-17444	123
42-18109	102
42-18111	123
42-18310	124
42-19642	128
42-19643	129
42-19644	123
42-19670	123
42-19671	102
42-19682	100
42-19683	108
42-19792	126
42-19840	123
42-19862	103
42-19862A	102
42-19863	102
42-19863A	102
42-19864	102
42-19864A	102
42-20738	123
42-20739	129
42-20960	152
42-20961	130
42-21401	108
42-21402	108
42-21403	100
42-21404	102
42-21405	103
42-21406	102
42-21407	123
42-21443	121MP
42-22008	129
42-22158	128
42-22778	126
42-22779	126
42-22780	126
42-22781	126
42-22784	126
42-22785	123
42-22786	123
42-22787	123
42-22809	123
42-22810	129
42-22811	123
42-22812	123
42-22834	121MP
42X210	103
42-230	102
42X233	102
42X308	102
42X309	102
42X310	103
42X311	102
43N3	123
43N6	123
43P1	100
43P2	102
43P3	100
43P4	102
43P4C	102
43P6	102
43P6A	102
43P6C	100
43P7	102
43P7A	102
43P7C	102
43X16A567	123
44-13	126
44A354637-001	152
44P1	126
45N1	103
45N2	103
45N2M	123
45N3	128
45N4	123
45NP	108
45X1A502C	102
45X2	100
46-8682-3	123
46-86143-3	123
47P1	121
47-2	108
48-21598B01	128
48A124315	102
48A134434	126
48C124246	121
48C125237	102
48K35P1	102
48K36P1	102
48K36P3	102
48K39P1	121
48K39P3	102
48K43P3	102
48K43P4	102
48K56P1	100
48K57B2	121
48K57B42	121
48K125230	104
48K134458	102
48K134494	126
48K134495	126
48K134496	126
48K134601	126
48K134796	126
48K134798	126
48K869001	100
48K86904GF	126
48K869228	128
48P1	102
48P63005A72	123
48P65112A65	108
48P65113A88	108
48P65118A64	108
48P65123A67	108
48P65123A95	108
48P65144A72	108
48P65146A61	108
48P65146A62	108
48P65146A63	108
48R134407	102
48R134573	102
48R134621	102
48R134632	102
48R134665	103
48R134666	123
48R134695	121
48R134722	121
48R859428	128
48R869138	128
48R869148	102
48R869170	128
48R869248	123
48R869249	102
48R869253	102
48R869254	103
48R869282	102
48R869283	103
48R869426	129
48R869464	128
48R869475	102
48R869475A	102
48R869476	103
48R869476A	103
48S10079A02	126
48S134405	123
48S134407	102
48S134408	102
48S134666	123
48S134695	126
48S134718	123
48S134719	123
48S134720	123
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48S134734A	123
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48S134797	108
48S134804	108
48S134805	108
48S134807	108
48S134809	123
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48S134811	123
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48S134843	123
48S134844	123
48S134845	108
48S134853	123
48S134854	123
48S134855	123
48S134857	108
48S134860	100
48S134861	100
48S134862	100
48S134872	130
48S134879	108
48S134894	108
48S134898	123
48S134899	123
48S134903	123
48S134904	108
48S134905	123
48S134906	123
48S134909	102
48S134910	129
48S134918	123
48S134919	128
48S134920	124
48S134932	108
48S134933	128
48S134935	123
48S134937	108
48S134941	123
48S134942	128
48S134943	129
48S134945	108
48S134946	108
48S134947	121
48S134948	108
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48S134956	126
48S134960	108
48S134970	108
48S134972	124
48S134979	108
48S134981	108
48S134992	128
48S137007	123
48S65123A67	108
48SP134804	123
48SP134826	108
48SP134837	108
48SP134855	123
48SP134857	108
48SP134894	123
48SP134897	123
48SP134903	123
48SP134904	108
48SP134905	123
48SP134906	123
48SP134933	123
48SP134937	108
48X134970	108
49P1C	121
50P2	126
50P3	126
51	128
51D170	102
51D188	100
51D189	100
51P2	126
51P4	126
53P151	123
53P153	121
53P157	102
53P158	123
53P159	123
53P161	123
53P162	123
53P163	123
53P165	123
53P166	129
53P169	128
53P170	129
54	128
54A	123
54B	123
54C	123
54D	123
54E	123
54BLK	128
54BRN	128
54RED	128
54ORN	128
54YEL	128
54GRN	128
54BLU	128
54WHT	128
55P2	126
55P3	126
55-1016	102
55-1026	123
55-1027	123
55-1029	102
55-1031	102
55-1032	123
55-1034	123
56P1	126
56P2	126
56P3	126
56P4	126
57A21-5	108
57B2-3	102
57B2-7	102
57B2-8	103
57B2-11	126
57B2-13	126
57B2-14	126
57B2-15	102
57B2-19	126
57B2-22	126
57B2-23	100
57B2-25	102
57B4-2	121
57B4-4	121
57B6	102
57B21	108
57B21-2	108
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57B101-4	108
57B102-4	108
57B103-4	108
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57B106-12	129
57B107-8	128
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57B109-9	128
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57B122-9	129
57B129-9	128
57B130-9	129
57B131-10	128
57B132-10	129
57B136-12	128
57B137-12	129
57B141-4	108
57B142-4	108
57B143-12	128
57B144-12	128
57B145-12	129
57B146-12	123
57B147-12	129
57B148-12	129
57B149-12	132
57B151-6	108
57B152-12	108
57B153-9	123
57B155-10	124
57B156-9	123
57B157-9	129
57B159-12	129
57C5	103
57C5-1	126
57C5-2	126
57C5-3	126
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57C6-6B	100
57C6-6C	100
57C6-7	123
57C6-8	121
57C6-9	123
57C6-10	124
57C6-11	123
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57C6-17	123
57C6-19	123
57C6-21	103
57C6-22	102
57C6-23	121
57C6-24	124
57C6-27	123
57C6-29	123
57C6-30	123
57C6-31	129
57C6-32	123
57C6-33	129
57C9-2	121
57C10-1	108
57C10-2	108
57C12-4	128
57C15-3	126
57C16	126
57C20-1	108
57C23-1	129
57C23-2	129
57C27-2	108
57D1-11	102
57D1-26	102
57D1-27	102
57D1-30	100
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57D1-56	102
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57D1-70	102
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57D1-89	100
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57D1-97	126
57D1-105	126
57D1-107	126
57D1-111	102
57D1-114	126
57D1-119	104
57D1-120	102
57D1-121	102
57D1-123	123
57D1-124	123
57D3-6	102
57D4-1	121
57D5-1	126
57D5-2	126
57D5-4	126
57D6-10	124
57D6-12	121
57D6-19	123
57D9-1	121
57D24-1	108
57D24-2	108
57D24-3	108
57D68	102
57D126	102
57D127	102
57D130	126
57D131	126
57D132	126
57D143	102
57D156	102
57D168	126
57D169	102
57D170	102
57D180	100
57D184	100
57D186	126
57D187	126
57D188	102
57D189	102
57D1127	102
57D1130	126
57D1131	126
57D1132	126
57D1143	102
57D1186	126
57P1	102
58B2-14	126
61C001-1	123
61C002-1	102
61C003-1	102
61C004-1	128
61C005-1	121
61P1	126
61P10	126
63P3	102
63-29459	121
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65B	106
65C	106
65D	106
65E	106
65F	106
65T1	100
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66-6025-00	102
66-6026-00	102
66-6027-00	102
66-6028-00	102
67P1	121
67P2	121
68P1	121
68P1B	121
69N1	108
70N1	123
70N2	123
71N1	124
71N2	124
72N1	108
72N1B	128
72N2	108
72N2B	128
73N1	108
73N1B	128
74	108
74P1	100
74N1	100
75N1	123
76	100
76-13570-39	108
76-13570-59	108
76-13866-17	108
76-13866-18	108
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76-13866-62	108
76N1	123
76N1B	128
76N2	123
76N2B	128
76N3B	128
77	100
77N1	123
77N2	123
77N2B	128
77N3	123
77N4	128
78N1	123
78BLK	100
78RED	100
78YEL	100
78GRN	100
78-5009	121
79P1	100
80P1	102
81T2	128
83P1B	129
83P2	123
83P2B	129
83P3	129
83P3B	129
83P3M	129
83-1056	121
84	121
84B	121
86A318	102
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86-158-2	123
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86-208-2	108
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86-250-2	123
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86-304-2	102
86-305-2	102
86-308-2	123
86-310-2	123
86-311-2	126
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86-336-2	128
86-339-2	123
86-340-2	129
86-342-2	123
86-344-2	152
86-345-2	153
86-348-2	100
86-367-2	126
86-368-2	126
86-370-2	121MP
86-373-2	126
86-374-2	126
86-389-2	123
86-390-2	123
86-391-2	123
86-396-2	153
86-399-2	123
86-403-2	123
86-512-2	105
86-1392	123
86-5042-2	102
86-5043-2	121
86-5067-2	102
86-5084-2	130
86-5943-2	121
86X0006-001	128
86X0007-004	123
86X0008-001	123
86X0009-001	121
86X0011-001	126
86X0012-001	123
86X0013-001	126
86X0014-001	100
86X0015-001	121
86X0017-001	102
86X0018-001	102
86X0022-001	123
86X0025-001	123
86X0028-001	124
86X0029-001	123
86X0030-001	121MP
86X0031-001	123
86X0031-002	123
86X0031-003	123
86X0033-001	131
86X0034-001	128
86X0035-001	123
86X0036-001	106
86X0037-001	103
86X0038-001	128
86X6-1	123
86X6-4-518	123
86X7-2	128
86X7-3	128

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86X8-3	123
86X34-1	128
90T2	107
91A	128
91B	128
91BGRN	128
91C	128
91D	128
91E	128
91F	128
91N1	108
92N1	108
92N1B	108
93A9	102
93A9-3	100
93A9-4	100
93C39-11	123
94N1	123
94N1B	128
94N1R	123
96N1	124
96XZ6051-28N	126
96XZ6051-35N	126
96XZ6051-36N	126
96XZ6053-09N	102
96XZ6053-10N	126
96XZ6053-24N	126
96XZ6053-27N	102
96-138-2	108
96-5143-01	121
96-5143-02	121
96-5165-01	128
96-5190-01	123
97N2	101
97P1	102
98P1	129
99AT6	102
99B5	102
99BA6	100
99BE6	100
99K7	101
99L6	103
99P1	129
99P1M	129
99P2	129
99SA7	101
99SK7	101
99SQ7	103
99S001	121
99S002	102
99S003	100
99S004	102
99S005	102
99S011	102
99S011A	102
99S012	123
99S012A	123
99S012E	123
99S014	121
99S015	121
99S016	108
99S017	108
99S018	108
99S019	108
99S019A	108
99S019B	108
99S020	123
99S022	703
99S025	123
99S031	108
99S032	108
99S033	128
99S034	128
99S035	128
99S036	128
99S037	108
100B63	102
100N1	108
100T2	130
100X6	130
101-12	100
101A	126
101B	126
101M	126
101P1	106
104	128
104-17	126
104-19	126
104-21	126
104H01	128
104T2	130
106KB0	129
106P1	104
107A	102
107B	102
107BRN	128
107M	102
108-1	126
108-2	126
108-3	126
108-4	126
108GRN	129
110P1	129
112-001	100
112-002	126
112-003	102
112-004	102
112-000172	126
112-000185	126
112-000187	121
112-000267	126
112-003	102
112-2	129
113-118	123
114-118	108
115-1	123
115-4	123
116-1	124
117-1	124
118-1	108
118-2	108
118-3	108
118-4	108
119	128
119-0077	128
120BLU	128
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120-2	128
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120-001192	100
120-001195	102
120-002013	102
120-00213	126
120-002213	126
120-002214	126
120-002216	126
120-002513	126
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121-399	102
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121-401	102
121-403	102
121-404	128
121-408	102
121-409	102
121-411	126
121-412	126

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121-413	102
121-414	126
121-415	126
121-417	129
121-418	121
121-419	129
121-422	123
121-425	102
121-426	126
121-427	126
121-428	126
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121-433	123
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121-471	108
121-472	108
121-480	108
121-481	108
121-482	108
121-483	108
121-488	126
121-490	102
121-491	100
121-492	100
121-493	100
121-494	100
121-495	106
121-496	106
121-497	129
121-497WHT	129
121-498	108
121-499	128
121-500	108
121-510	108
121-520	108
121-538	126
121-539	126
121-540	126
121-540B	126
121-541	126
121-541B	126
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121-544	102
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121-710	152
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121-713	124
121-714	126
121-722	128
121-726	130
121-730	128
121G3019	128
121G3020	128
121-830	100
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121-1134	121
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121-1410	101
122-229	100
122-1028	105
122-1625	121
122-1648	126
122-1962	103
122GRN	129
122YEL	129
122-1	123
122-2	123
124-1	121
127	128
127-7	101
128	108
128WHT	128
129	108
129WHT	128
129-4	102
129-5	121
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129-15	123
129-16	108
129-17	102
129-18	102
130	128
130-138	108
135ORN	128
136RED	128
145-T1B	126
146-T1	121
147-T1	121
154A3675-105	102
154A3676	126
154A3676-205	102
154A3677	126
154A3679	102
154A3679-5110	126
154A3680	121
154A5943	124
154A5943-1	124
154A8681	102
154-T1	126
154-T1A	126
154-T1B	126
155-T1	126
156-T1	126
156WHT	128
156-043	130
157-T1	126
157YEL	129
159-T1	126
160-T1	126
161-T1	126
161-T2	108
162-T1	126
162-T2	108
169-257	124
169-284	124
171-001-9-001	121
171-003-9-001	124
172-003-9-001	124
173A419-2	121
173A3936	121
173A3963	121
173A4419	121
173A4419-1	121
173A4419-2	121
173A4419-3	121
173A4420	121
173A4420-1	121
173A4420-5	121
173A4422-1	121
173A4424	102
173A4436	121
173A4469	121
173A4490-5	128
173A4491-2	130
174-25566-01	129
176-003-9-001	108
176-004-9-001	108
176-005-9-001	108
176-006-9-001	108
176-007-9-001	108
176-008-9-001	123
177-001-9-001	129
180T2	130
180T2A	130
180T2C	130
181T2A	130
181T2C	130
183P1	129
199-Power	121
200A	103
200-010	108
200-015	108
200-016	123
201A	126
201B	126
201M	126
201-254343-12	108
202A	103
207A	100
207A1	126
207A9	108
207A10	108
207B	100
207M	100
217-1	128
223	128
229-0180-32	108
229-0180-33	108
229-0180-34	108
229-0204-6	108
229-0204-23	108
235	100
248-38104-1	128
251M1	103
297V002M04	101
297V002M05	101
297V003H03	102
297V003H06	102
297V003H09	102
297V003M01	102
297V003M07	102
297V004H03	102
297V004H06	102
297V004H10	102
297V004H14	102
297V004H15	102
297V004H16	102
297V004M01	102
297V011H01	126
297V012H01	126
297V012H06	100
297V012H08	100
297V012H09	100
297V012H10	126
297V012H11	126
297V012H14	102
297VO12H15	126
297V025H02	102
297V025H04	102
297V025H05	102
297V025H15	102
297V026H01	126
297V026H03	100
297V027H01	102
297V032H01	102
297V033H01	102
297V034H01	126
297V035H01	126
297V036H01	126
297V036H02	126
297V037H01	102
297V037H02	102
297V038H01	100
297V038H02	100
297V038H03	100
297V038H04	102
297V038H05	100
297V038H06	126
297V038H07	102
297V038H09	100
297V038H10	100
297V038H11	100
297V038H12	100
297V040H01	102
297V040H08	102
297V040H10	102
297V040H11	102
297V040H12	102
297V040H13	102
297V040H15	121
297V040H16	102
297V041H01	102
297V041H02	121
297V041H03	121
297V041H04	121
297V041H05	104
297V041H06	121
297V041H07	104
297V042C01	102
297V042C02	102
297V042C03	102
297V042C04	102
297V042H01	102
297V042H02	102
297V042H03	126
297V042H04	126
297V043H01	102
297V045H01	126
297V045H02	126
297V049H01	123
297V049H03	123
297V049H04	123
297V050C02	100
297V050H01	102
297V050H02	102
297V050H03	102
297V051C03	102
297V051C04	102
297V051H01	102
297V051H02	102
297V051H03	102
297V051H04	100
297V052C01	102
297V052H01	102
297V052H02	102
297V053C01	102
297V053H01	102
297V053H02	102
297V054C01	100
297V054C02	100
297V054H01	100
297V054H02	100
297V055C01	100
297V055H01	100
297V057H01	102
297V057H02	102
297V059H01	123
297V059H02	123
297V059H03	123
297V060H01	124
297V060H02	124
297V060H03	124
297V061C01	130
297V061C02	130
297V061C03	123
297V061C04	123
297V061C05	128
297V061C06	123
297V061C07	123
297V062C01	121
297V062C05	121
297V062C06	128
297V063C01	126
297V064B01	126
297V065C01	126
297V065C02	126
297V065C03	126
297V070C01	126
297V070H49	108
297V071C03	124
297V072C01	108
297V072C03	108
297V072C04	123
297V072C05	128
297V072C06	123
297V073C01	129
297V073C02	129
297V073C03	129
297V074C02	123
297V074C03	123
297V074C04	123
297V074C06	123
297V074C07	123
297V074C08	123
297V074C09	108
297V074C10	128
297V074C11	129
297V074C12	128
297V076B01	102
297V076C01	102
297V077C01	126

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
297V078C01	128
297V078C02	128
297V080C01	129
297V081C01	102
297V082B01	128
297V082B02	129
297V082B03	129
299 Power	105
300	102
301	*102*
302	102
310	102
310-068	126
310-68	126
310-123	126
310-124	126
310-139	126
310-187	123
310-188	102
310-189	100
310-190	126
310-191	126
310-192	121
322T1	100
323T1	100
324	102
324T1	*100*
324-019	128
324-0029	102
324-0038	126
324-0041	102
324-0055	102
324-0056	102
324-0086	126
324-0088	102
324-0089	126
324-0090	126
324-0091	102
324-0092	102
324-0093	102
324-0098	126
324-0099	126
324-0106	126
324-0116	127
324-0121	126
324-0128	127
324-0129	126
324-0130	126
324-0131	126
324-0132	126
324-0133	102
324-0134	103
324-0136	126
324-0137	126
324-0138	126
324-0139	102
324-0140	102
324-0142	102
324-0143	102
324-0144	102
324-0145	126
324-0146	102
324-0149	108
324-0150	108
324-0151	123
324-0152	123
324-0154	123
324-144	102
324-6011	128
325T1	100
325-0031-303	123
325-0031-304	123
325-0031-305	123
325-0031-306	102
325-0042-351	123
325-0076-306	123
325-0076-307	123
325-0076-308	108
325-1442-8	102
325-1442-9	124
325-1446-26	123
325-1446-27	123
325-1446-28	123
325-1513-29	123
325-1513-30	123
325-1513-46	128
325-1771-15	123
325-1771-16	123
326T1	100
350	*100*
352	102
353	102
353-9001-001	126
353-9001-002	126
353-9001-003	126
353-9002-002	126
353-9301-001	128
353-9304-004	129
353-9306-001	123
353-9306-002	123
365T1	100
386-7118P1	108
386-7178P1	123
386-7183P1	130
386-7184P1	129
386-7188P1	108
394-3074-2	*102*
394-3074-5	102
394-3097-1	102
394-3097-2	102
394-3127-1	128
394-3127-2	128
394-3127-3	128
394-3135	130
396-7178P1	108
412	100
421-6	126
417-124	108
417-125	108
417-126	123
417-127	123
417-129	108
417-132	129
417-144	152
417-145	153
420T1	100
421T1	100
421-7	126
421-8	126
421-11	102
421-12	102
421-13	102
421-14	102
421-15	102
421-16	126
421-17	126
421-18	124
421-19	102
421-26	126
429-0093-69	126
429-0094-39	126
448A662	128
454A104	128
455-1	126
473A31	121
473B6-2	102
473B6-2A	102
473B6-4	102
473B6-5	102
473B6-7	102
491A948	128
501ES001M	108
501T1	100
503T1	100
504T1	126
505T1	126
506T1	126
507T1	126
508T1	126
511-515	123
511-519	123
512RED	128
515	123
515-521	108
515ORN	128
516	123
517-518	123
520T1	100
521T1	100
524WHT	*128*
576-003-009	126
576-0001-002	102
576-0001-003	102
576-0001-004	123
576-0001-005	123
576-0001-009	102
576-0002-002	104
576-0003-008	126
576-0003-009	126
576-0003-010	126
576-0003-013	126
576-0003-014	126
576-0003-015	126
576-0004-004	128
576-0004-005	128
576-0036-847	123
576-0036-918	*108*
576-0036-919	108
576-0036-920	108
576-0036-921	108
576-0040-051	121
576-2000-990	126
576-2000-993	126
605	123
614X1	126
614X2	126
614X3	126
614X4	126
614X5	102
614X6	102
614X7	102
614X8	103
614X9	102
614X10	102
630-076	123
642-152	104
642-206	104
650-105	102
650-106	102
650-107	102
650-108	102
650-109	103
660B	102
660-125	128
660-126	128
660-127	108
660-128	128
660-131	123
660-134	123
660-145	123
669	106
686-0012	128
686-0112	128
686-0130	128
686-0210	152
686-0243	130
686-143	130
690V02H69	108
690V010H40	108
690V010H41	108
690V010H42	100
690V028H28	108
690V028H48	108
690V028H69	108
690V028H89	108
690V034H29	126
690V034H30	102
690V034H31	102
690V034H39	102
690V040H56	126
690V040H57	126
690V040H58	126
690V040H59	126
690V040H60	126
690V040H61	102
690V040H62	102
690V043H62	102
690V043H63	102
690V047H54	126
690V047H55	*126*
690V047H56	100
690V047H57	100
690V047H58	102
690V047H60	102
690V049H81	108
690V052H23	102
690V052H24	102
690V054H21	102
690V056H89	126
690V056H90	102
690V057H25	126
690V057H27	102
690V057H28	102
690V057H59	126
690V057H62	126
690V060H58	108
690V060H59	*108*
690V061H98	102
690V061H99	102
690V063H14	126
690V063H15	126
690V063H16	102
690V063H17	102
690V063H51	102
690V066H44	126
690V066H45	126
690V066H46	102
690V066H47	102
690V066H89	126
690V068H29	126
690V068H30	102
690V068H31	102
690V070H49	108
690V070H98	108
690V073H59	126
690V073H85	126
690V077H34	126
690V077H35	126
690V077H36	126
690V077H37	102
690V080H36	108
690V080H37	126
690V080H38	128
690V080H39	102
690V080H40	126
690V080H41	123
690V080H42	127
690V080H43	127
690V080H44	102
690V080H45	130
690V081H07	108
690V084H94	108
690V084H95	108
690V084H96	108
690V086H39	102
690V086H86	129
690V086H87	108
690V086H88	128
690V086H89	129
690V086H90	128
694D	123
703B	128
720-35019	102
750-137	102
750-138	102
750-139	102
750-140	102
770-045	152
773RED	128
774ORN	128
775BRN	128
776GRN	128
779BLU	128
783RED	128
784ORN	128
785YEL	128
786	128
787BLU	128
791	128
792-286	*102*
792-287	102
792-288	102
792-289	102
792-290	102
800-196	104MP
800-250-102	123
800-501-00	123
800-502-00	102
800-503-00	103
800-504-00	126
800-505-00	100
800-506-00	102
800-507-00	121
800-509-00	123
800-510-01	130
800-516-000	129
800-521-01	*123*
800-521-02	123
800-522-01	123
800-522-02	128
800-523-01	123
800-523-02	123
800-524-02	130
800-526-00	123
800-527-00	129
800-528-00	103
800-529-00	123
800-53001	123
801B	108
815-181D	102
818WHT	128
822A	123
822ABLU	128
822B	123
823WHT	128
823B	128
827BRN	128
828GRN	128
829A	106
829B	106
829C	106
829D	106
829E	106
829F	106
830	100
833	129
847BLK	128
881-250-102	123
884-250-001	121
914F298-1	128
921-7	123
921-8	123
921-29B	106
94T1	100
955-1	126
955-2	126
955-3	126
964-19862	103
964-19863	102
964-19864	102
965T1	102
987T1	102
988T1	102
989T1	102
990T1	102
991T1	102
992T1	102
992-00271	130
992-008-890	121
1004	123

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Type To Be Replaced	Sylvania ECG Replacement
1004-17	108
1005	123
1005-17	102
1020-17	108
1023-17	102
1024-17	104
1030	129
1032	102
1033	102
1033-1	126
1033-2	126
1033-3	126
1033-4	126
1033-5	102
1033-6	103
1033-7	102
1034	102
1034-17	123
1035	102
1036	102
1124	121
1124A	121
1124B	121
1124C	104
1145	100
1146	100
1192	102
1241A	102
1248	102
1320	102
1329	102
1330	102
1340	100
1349-17	103
1350	100
1360	102
1390	100
1400	100
1410	100
1414-179	130
1414-180	152
1459	102
1524	123
1526	126
1567	123
1567-0	123
1567-2	123
1858	101
2007-01	121
2011	152
2015-00	126
2015-1	130
2015-2	130
2015-3	130
2020-00	126
2021-00	126
2028-00	108
2039-2	101
2057B2-4	102
2057B2-28	102
2057B2-29	102
2057B2-32	102
2057B2-34	102
2057B2-35	126
2057B2-38	123
2057B2-41	126
2057B2-42	126
2057B2-43	102
2057B2-44	102
2057B2-45	102
2057B2-46	103
2057B2-47	124
2057B2-48	126
2057B2-49	102
2057B2-50	126
2057B2-51	126
2057B2-57	102
2057B2-58	124
2057B2-59	123
2057B2-60	100
2057B2-61	102
2051B2-62	123
2057B2-63	123
2057B2-64	108
2057B2-65	126
2057B2-66	126
2057B2-67	126
2057B2-68	126
2057B2-70	126
2057B2-71	126
2057B2-72	102
2057B2-73	123
2057B2-77	126
2057B2-78	102
2057B2-79	126
2057B2-80	126
2057B2-83	102
2057B2-84	124
2057B2-85	108
2057B2-86	102
2057B2-87	108
2057B2-88	126
2057B2-89	126
2057B2-90	126
2057B2-93	126
2057B2-97	123
2057B2-101	108
2057B2-102	108
2057B2-104	126
2057B2-105	126
2057B100-7	102
2058	126
2295	124
2417	124
2427	128
2443	123
2445	108
2446	123
2447	108
2448	123
2450	108
2473	108
2474	128
2475	123
2476	108
2477	108
2482	100
2487B	100
2488A	100
2489A	100
2490A	102
2491B	124
2494	127
2495	128
2496	127
2500	127
2502	129
2546	128
2584	123
2634	108
2700	126
2780	121
2780-4	121
2780-5	121
2781	102
2787	123
2791	126
2797	126
2798	126
2799	126
2900-007	108
2901-010	121
2904-008	121
2904-016	126
2904-029	126
2904-033	108
2904-034	123
2904-035	123
3002	108
3011	128
3202-5H01	128
3227-E	108
3425	100
3434	100
3435	100
3458	100
3500	100
3504	100
3505	128
3506	128
3507	100
3508	128
3509	128
3510	108
3511	108
3512	121
3513	108
3514	121
3515	121
3516	121
3517	100
3518	128
3519	123
3520	124
3523	100
3524	108
3532-1	128
3533-1	129
3535	108
3537	108
3538	128
3540	129
3541	128
3543	128
3544	100
3545	128
3546	128
3547	128
3548	128
3551	126
3551A	126
3551AGRN	126
3551ABLU	126
3552	126
3553	126
3554	123
3555	123
3556	123
3558	128
3559	129
3560	123
3561	128
3562	129
3563	129
3564	130
3565	128
3566	128
3577	121
3600	102
3607	101
3609	101
3714H1	130
3746	100
3851	126
3852	100
3907	102
3907 2N404A	126
3961	126
3970	100
3999	128
4013	129
4021	123
4022	123
4057	128
4066	128
4085	128
4086	128
4087	129
4247	104
4313	102
4315	102
4348	102
4349	102
4363	126
4363ORN	126
4363GRN	126
4363BLU	126
4363WHT	126
4364	126
4365	126
4366	126
4367	126
4398	102
4450	102
4451	100
4454	126
4456	126
4457	126
4459	127
4462	102
4463	121
4464	123
4465	123
4466ORN	102
4468BRN	102
4469RED	102
4470	123
4470-31	123
4470-32	123
4470M-32	123
4470-33	123
4471ORN	102
4471YEL	102
4472GRN	102
4473	102
4473-1	128
4473-2	128
4473-3	128
4473-M3	128
4473-4	128
4473-5	128
4473-5X	128
4473-6	123
4473-7	128
4473-8	128
4473-9	128
4473-11	128
4473-12	128
4473-M-12	128
4473-N	128
4474YEL	102
4475GRN	102
4476BLU	102
4477PUR	102
4478	129
4483	128
4484	100
4485	100
4486	100
4501	126
4509	126
4510	102
4545	126
4545BLU	126
4545WHT	126
4553BRN	102
4553RED	102
4553ORN	102
4553YEL	102
4553GRN	102
4553BLU	102
4562	102
4563	102
4564	102
4565	102
4567	102
4570	121
4573	105
4582BRN	121
4583RED	121
4584GRN	121
4586	126
4587	108
4589	126
4590	106
4594	123
4595	126
4596	102
4597	105
4597 RED	105
4597 GRN	105
4603	126
4604	126
4605	126
4605RED	126
4607	102
4608	121
4619RED	121
4620GRN	121
4621	126
4622	126
4623	127
4624	123
4627	102
4630	123
4632	126
4648	128
4649	121
4652	127
4677	126
4689	128
4700	101
4701	130
4705	123
4714	123
4715	130
4722RED	121
4722ORN	121
4722YEL	121
4722GRN	121
4722BLU	121
4722PUR	121
4727	121
4730	121
4732	128
4733	128
4734	128
4737	123
4745	106
4756	108
4765	123
4768	128
4789	128
4801-1100-011	121
4815	129
4819	128
4820	108
4821	128
4825	128
4826	128
4837	108
4838	123
4839	128
4840	128
4841	128
4842	128
4843	128
4844	106
4845	128
4851	107
4852	128
4853	128
4854	123
4855	128
4857	108
4872	124
4882	130
4888A	121
4888B	121
5093	128

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
5226-1	106
5226-2	128
5253	104
5766-25	102
6100	102
6100-35	102
6154	126
6155	126
6158	108
6162	126
6181-1	128
6440	102
6445	100
6452	102
6651-486	128
7122	128
7123	128
7124	128
7125	128
7126	128
7127	128
7128	128
7129	128
7131	128
7132	128
7133	128
7134	128
7214	108
7215	108
7216	108
7217	108
7218	108
7219	108
7220	108
7221	108
7425	128
7426	128
7427	128
7428	128
7429	128
7430	128
7431	128
7432	128
7516	123
7810	128
7811	128
7812	128
7813	128
7814	128
7815	128
7816	128
7817	128
7818	128
8405	129
8540	129
9367-1	128
9390	102
9391	102
9600	128
10003	130
10032	102
10036	102
10037	102
10038	100
10039	100
12163	104
12178	104
12180	126
15024	121
15027	121
15809-1	123
15810-1	123
15835-1	123
15840-1	123
15841-1	123
16598	102
16599	121
16958	102
16959	121
17047-1	102
17142	102
17143	102
17144	123
17444	123
17887	121
17945	121
18109	102
18310	124
18493	126
18509	123
18529	100
18530	102
18540	100
18541	126
18555	123
18601	102
18611	102
18731	102
19278	124
19420	108
19645	123
20738	123
20739	129
22008	129
22158	128
30201	102
30202	102
30203	121
30204	102
30206	102
30207	102
30208	100
30208-2	102
30210	123
30211	121
30213	126
30214	126
30215	126
30216	102
30218	102
30219	123
30221	126
30222	126
30223	126
30224	123
30226	123
30227	123
30228	123
30229	123
30230	126
30231	100
30234	124
30235	123
30238	126
30239	126
30240	126
30241	123
30242	123
30243	123
30244	102
30245	124
30246	121
30246A	121
30247	126
30248	123
30254	152
30256	152
30257	124
30259	123
30268	128
30269	128
30270	106
30271	153
30272	152
30273	100
30274	126
30291	128 & 129 (CP)
30302	102
34022	121
34119	100
34219	100
34220	100
34221	100
34298	121
34315	121
35004	108
35044	121
35045	102
35084	104
35168	126
35169	126
35170	126
35201	104
35231	121
35260	104
35349	121
35449	108
35454	102
35454-1	102
35454-2	102
35454-3	102
35628	102
35677	126
35678	126
35728	121
35815	126
35816	126
35817	126
35818	126
35819	102
35820	102
35820-1	102
35820-2	102
35820-3	102
35824	126
35885A	121
35885B	121
35950	102
35951	121
35952	102
35953	102
35954	102
35955	102
36212V1	108
36303	121
36304	121
36477	121
36534	102
36557	102
36558	102
36559	126
36560	126
36563	126
36577	129
36578	108
36579	128
36580	123
36581	108
36582	132
36634	124
36816	100
36847	108
36917	128
36918	108
36919	108
37383	108
37384	108
37464	128
37584	124
37585	123
37694	128
37730	124
37800	128
38175	103
38176	102
38177	102
38178	123
38207	108
38208	108
38209	100
38920	108
38921	108
40004	126
40005	126
40006	126
40022	104
40050	104
40051	104
40051-2	121
40053	128
40080	123
40081	123
40217	123
40218	123
40219	123
40220	123
40221	123
40222	123
40231	123
40232	108
40233	108
40234	108
40235	108
40236	108
40237	108
40238	108
40239	108
40240	108
40242	108
40243	108
40244	108
40245	108
40246	108
40250	124
40251	104
40253	102
40254	104
40261	126
40262	126
40263	102
40264	124
40264-V1	124
40268	100
40269	100
40280	123
40283	123
40290	123
40294	108
40295	108
40309	123
40311	123
40314	128
40315	128
40316	130
40317	128
40320	128
40321	123
40322	124
40323	123
40326	123
40327	123
40328	124
40329	102
40347	128
40348	128
40350	128
40351	108
40352	108
40359	102
40395	102
40396N	103
40396P	102
40397	108
40398	108
40400	108
40411	130
40422	124
40423	124
40424	124
40425	124
40426	124
40427	124
40439	127
40440	127
40461	133
40461-2	128
40462	104
40464	130
40465	130
40466	130
40469	108
40470	108
40471	130
40472	108
40475	108
40476	123
40478	108
40479	104
40482	123
40487	102
40488	100
40491	124
40517	123
40518	123
40519	123
40546	124
40547	124
40578	128
40934-1	130
42396	133
43992-2	101
44616-1	102
44967-2	102
45495-2	101
46490-2	101
46590-2	103
46591-2	103
46592-2	103
46593-2	103
46631-2	101
46774-1	101
46775-2	101
46776-2	102
47394-2	102
47645-2	103
47737-2	102
48385-2	103
48937-2	126
48939-2	126
49058-2	103
49138-2	101
49139-2	102
50137-2	128
50447-4	121
51650	121
57000-5452	123
57000-5503	123
61003-4	102
64071-1	102
65804-62	126
65804-63	102
67193-85	102
67802	128
68504-62	126
68504-63	102
68895-13	102
69107-42	126
69107-44	126
69107-45	102
70231	108
70434	121
75960CH	102
77068-3170756	124
78331	106
79855	128
79856	128
80050	121
80416C	121
86452	102
86812	123

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
86822	123
86832	102
86842	102
90050	121
94008	102
94009	102
94017	102
94032	121
94050	128
94051	128
94052	128
95101	126
95102	126
95103	126
95107	126
95108	126
95110	126
95111	126
95112	101
95113	101
95114	101
95115	101
95116	126
95117	126
95118	126
95119	126
95120	126
95120A	100
95121	126
95122	126
95123	126
95124	126
95125	108
95126	108
95127	108
95128	108
95129	108
95130	108
95131	108
95201	102
95202	103
95203	102
95204	102
95208	102
95209	102
95211	101
95212	102
95213	102
95214	102
95216	123
95216YEL	123
95216RED	123
95217	102
95218	102
95219	102
95220	128
95221	123
95222-1	102
95222-2	103
95223	108
95224-1	102
95224-2	103
95225	123
95226-1	128
95226-2	123
95226-3	129
95226-4	128
95227	129
95228	133
95233	128
95250	121
95250-1	121
95251	121
95252	124
95252-1	124
95252-2	124
95252-3	124
95252-4	124
99101	100
99102	100
99103	100
99104	100
99105	126
99106	126
99107	126
99108	126
99109-1	123
99109-2	123
99120	126
99121	126
99201	102
99202	102
99203	102
99204	102
99205	102
99206-1	123
99206-2	123
99207-2	123
99217	102
99218	102
99250	121
99252	124
99252-1	124
99252-2	124
99252-3	124
99252-4	152
100678	126
100693	102
101078	126
101434	108
101678	101
101974	102
104009	126
104059	126
110263	101
110494	102
110495	103
110515	121
110669	128
110697	108
110699	128
111117	126
111118	126
111954	126
111955	126
111956	126
111957	102
111958	103
111959	102
112296	126
113398	108
113938	108
114267	108
114525	108
115063	104
115225	123
115227	126
115228	126
115229	126
115268	121
115269	121
115275	126
115281	121
115282	121
115283	121
115284	121
115875	123
115910	128
116068	127
116072	126
116073	108
116074	123
116075	124
116078	129
116079	108
116080	108
116081	128
116082	108
116083	108
116085	123
116086	127
116087	127
116088	127
116089	127
116091	102
116092	123
116093	121
116148	123
116198	108
116199	108
116200	108
116201	102
116202	126
116203	102
116206	102
116207	126
116208	126
116209	126
116279	124
116284	129
116588	123
116683	126
116684	126
116685	102
116686	102
116687	103
116756	126
116757	102
116875	123
116997	102
116998	102
117208	102
117209	102
117210	102
117616	100
117617	100
117618	126
117658	126
117724	126
117725	126
117726	126
117727	102
117728	102
117823	108
118279	124
118686	124
118713	123
118822	108
119013	126
119414	108
119526	126
119554	108
119555	108
119556	108
119557	108
119635	123
119636	123
119650	124
119722	127
119723	127
119982	123
119983	129
120073	123
120074	123
120075	102
120481	123
120482	123
120483	123
121151	102
121152	102
121153	100
121154	100
121243	129
121467	129
121655	123
121658	129
121659	129
121660	123
121661	128-129(CP)
121662	123
121663	123
121664	123
122244	102
122517	108
122518	108
122664	123
122665	123
122901	102
122902	108
122904	108
123274	123
123275	124
123791	102
123792	121MP
123877	131MP
123940	129
123941	128
124412	108
124623	129
124624	129
124625	126
124626	102
124753	123
124754	108
124755	129
124756	123
124757	108
125135	123
125137	108
125138	108
125139	123
125140	123
125141	123
125142	128
125143	123
125144	128
125263	108
125389	123
125390	108
125475	123
125972	126
125994	108
125995	108
126093	102
126093-1	102
126093-2	102
126093-4	102
126138	124
126150	123
126188	124
126334	123
126698	108
126699	128
126700	129
126701	128
126702	128
126703	128
126704	128
126705	128
126706	128
126707	129
126708	128
126711	123
126712	123
126713	123
126714	128
126715	129
126716	123
126717	128
126718	129
126719	129
126720	128
126721	128
126724	129
126725	128
126726	124
127214	132
127962	102
162002-033	121
162002-040	126
162002-041	126
162002-042	126
162002-062	121
162002A-062	121
162002-090	123
162002-095	121
162002-40	126
162002-41	126
170376	121
170376-1	121
170407-1	121
170479-1	121
170666-1	121
170668-1	121MP
170783-3	103
170850-1	121MP
171003	127
171004	127
171005	126
171016	126
171017	102
171018	102
171026	123
171027	123
171028	108
171029	108
171030	108
171038	108
171039	126
171040	123
171044	108
171045	108
171046	123
171048	108
171049	102
171052	108
171054	108
175006-181	126
175006-182	126
175006-183	126
175006-184	126
175006-185	126
175006-186	102
175006-187	108
186342A	128
190425	121
190425A	121
198039-0507	130
214396	121
216986	121
217119	105
217230	105
217892	121
218502	102
218503	102
219016	101
219301	121
219940	121
221600	123
221601	101
221602	121
221605	121
221856	100
221857	123
221918	123
221924	101
221940	121
221941	121
222915	121
223124	102
223365	121
223366	102
223367	101
223368	101
223369	126
223370	101
223371	102
223372	100
223473	100
223474	126

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
223475	100
223482	103
223483	102
223484	102
223485	102
223486	102
223487	126
223490	121
223576	121
223684	101
223810	102
224503	121
224584	100
224586	126
224587	126
224696	102
224820	103
224857	102
224873	121
225311	126
225593	102
225594	126
225594A	126
225595	121
225596	121
225600	126
225925	121
225927	121
226181	100
226338	100
226441	101
226634	121
226789	105
226791	103
226924	102
226999	121
227752	100
227804	121
228229	121
228230	121
228287	102
228558	121
228559	121
229045	105
229133	126
230208	121
230209	101
230214	128
230253	102
230256	101
230259	102
230523	121
230524	102
230525	102
231374	123
231588	102
231672	121
231797	121
232194	121
232359	130
232674	121
232675	121
232676	126
232680	126
232681	126
232840	108
232841	128
232949	101
233305	105
233307	105
233507	100
233508	105
233509	121
233945	100
234015	126
234076	102
234077	121
234078	105
234566	121
234612	123
234630	102
234631	126
235194	102
235200	126
235205	123
235206	123
235312	121
236251	108
236265	101
236285	123
236286	123
236706	108
236907	108
236935	121
237450	124
237452	121
238417	102
238418	102
297074C11	129
297240-1	102
300486	101
300536	101
300538	102
300540	102
300541	102
300542	101
300774	101
309421	102
310017	102
310030	126
310035	102
310132	126
310157	126
310158	126
310159	102
310160	102
310162	126
310201	102
310204	126
310221	126
310223	100
310224	126
310225	102
373003	102
373117	102
373119	102
551051	102
560004	121MP
5700005452	123
5700005503	123
570004-503	123
570005-452	123
570005-503	123
570009-01-504	123
573001	102
573005	102
573011	102
573012	102
573018	102
573022	102
573029	102
573101	108
573103	102
573117	102
573119	102
573125	102
573142	102
573152	102
573153	102
573166	121
573199	127
573200	102
573212	127
573303	126
573329	126
573330	126
573335	126
573336	126
573371	126
573398	126
573402	126
573405	126
573406	126
573422	102
573432	102
573469	128
573472	108
573475	108
573479	123
573480	123
573494	108
573495	108
573501	128
573518	126
573529	102
576001	102
576005	102
601040	126
601054	126
601065	103
601113	108
602032	121
602040	102
602075	126
602113	108
603020	126
603030	126
603031	121
603040	126
603113	108
603312	126
604030	126
604040	126
604080	126
604112	126
604113	108
605030	102
605112	803
605113	108
606020	102
607030	123
608112	121
609020	126
609112	123
610035	102
610035-1	102
610035-2	102
610036-1	102
610036-2	102
610036-3	102
610336-4	102
610036-5	102
610036-7	102
610036-8	102
610039-1	121
610040-1	102
610040-2	102
610041-2	108
610041-3	108
610042-1	108
610043-3	102
610043-4	100
610043-6	100
610043-7	102
610045-2	108
610045-3	123
610045-4	123
610050-1	126
610050-2	126
610050-3	126
610051-1	126
610051-2	126
610051-4	126
610052-1	100
610053-1	126
610053-2	126
610055	126
610055-1	126
610055-2	126
610055-3	126
610056-1	126
610056-2	126
610056-3	126
610056-4	126
610061-1	126
610064-1	121
610067-3	121MP
610068-1	104
610069-1	108
610070-1	123
610070-2	123
610071-1	124
610072-1	108
610072-2	108
610073-1	108
610074-1	129
610074-2	100
610075-1	123
610076-1	123
610076-2	123
610077-1	123
610077-2	123
610077-3	123
610078-1	123
610079-1	102
610080-1	102
610083	129
610083-1	129
610083-2	129
610083-3	129
610088-2	102
610091-1	108
610092-1	108
610094-1	123
610096-1	108
610099	129
610099-1	129
610099-2	129
610099-3	102
610100-1	108
610102-1	106
610106-1	104
610107-1	108
610107-2	128
610110-1	129
611020	100
612020	127
613112	108
660059	102
660060	102
660070	128
660072	102
660074	128
660082	102
660095	121
660103	121
670850-1	121MP
700080	130
700083	130
700230-00	123
700231-00	123
701584-00	129
701678-00	108
702407-00	128
702415-00	123
731009	102
815003	102
814044A	102
815015	102
815020	100
815020A	100
815020B	100
815021	100
815021A	100
815021B	100
815022	102
815022A	102
815022B	102
815023	102
815023A	102
815023B	102
815024	102
815024A	102
815024B	102
815025	100
815025A	100
815025B	100
815026	101
815026A	101
815026B	101
815026C	101
815026D	100
815027	100
815027A	100
815027B	100
815027C	100
815028	102
815028A	100
815028B	100
815028C	100
815029	102
815029A	102
815029B	102
815029C	102
815030	102
815030A	102
815030B	102
815031	102
815031A	102
815031B	102
815034	102
815034A	102
815034B	102
815034C	102
815036	100
815036A	100
815036B	100
815036C	100
815037	100
815037A	100
815037B	100
815037C	100
815038	102
815038A	102
815038B	102
815038C	102
815041	100
815041A	100
815041B	100
815041C	100
815043	100
815043A	100
815043B	100
815043C	100
815055	100
815056	100
815057	100
815058	102
815058A	102
815058B	102
815058C	102
815058X	102
815064	126
815064A	126
815064B	126
815064C	126
815065	100
815065A	100
815065B	100
815065C	100
815066	100
815066A	100
815066B	100
815066C	100
815067	126
815067A	126
815067B	126
815067C	126
815068	126
815068A	126

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
815068B	126
815068C	126
815069	102
815069A	102
815069B	102
815069C	102
815070	102
815070A	102
815070B	102
815070C	102
815070D	102
815074	102
815075	103
815076	103
815083	102
815101	100
815103	100
815104	102
815105	100
815107	100
815108	100
815109	100
815114	102
815115	100
815116	100
815117	100
815118	102
815120	102
815120A	102
815120B	102
815120C	102
815120D	102
815120E	102
815133	123
815134	123
815136	102
815137	121MP
815138	121
815139	102
815158	102
815160	102
815160A	102
815160B	102
815160C	102
815160D	102
815160E	102
815160F	102
815160H	102
815164	108
815165	108
815166	124
815166-4	124
815167-3	124
815170	108
815171	123
815171D	123
815172	108
815172A	108
815173	108
815173A	108
815173C	108
815173F	108
815174	123
815174L	123
815175	124
815175H	124
815177	102
815178	102
815179	102
815180-3	124
815180-4	124
815180-7	124
815181	102
815181A	102
815181B	102
815181C	102
815181D	102
815182	123
815183	123
815184	123
815184E	123
815185	129
815185E	129
815186	123
815186C	123
815186L	123
815189	102
815190	123
815191	123
815193	126
815195	102
815196	102
815197	126
815198	128
815199-6	129
815201	123
815202	128
815203-3	121MP
815206	108
815308A	100
816135	124
825065	100
910799	128
965632	108
965633	108
965634	108
980052	105
980132	121
980134	105
980135	105
980136	100
980138	108
980139	108
980140	126
980142	126
980144	102
980146	126
980147	123
980148	102
980149	102
980150	127
980153	102
980155	121
980372	126
980373	126
980374	126
980375	102
980376	102
980426	100
980432	100
980434	100
980435	126
980437	121
980438	100
980439	100
980440	123
980441	126
980462	105
980463	105
980505	126
980506	126
980507	126
980508	102
980509	126
980510	102
980511	102
980514A	126
980545A	126
980626	126
980636A	126
980833	126
980834	126
980835	126
980836	102
980837	102
980958	126
980959	126
980960	102
980961	102
981143	126
981144	126
981145	126
981146	126
981148	102
981203	126
981204	126
981206	102
981672	102
981673	102
981674	102
981675	102
981969	105
982150	126
982151	102
982152	102
983874	121
983945	105
983975	121
985036	121
985431	121
985432	105
985443	121
985447	121
985449	121
985453	121
985455	121
985686	121
988080	121
988336	121
988413	121
988414	105
988468	121
988977	105
989171	105
989387	121
989615	105
989692	105
989693	105
994634	108
995001	121
995002	102
995003	102
995014	121
995030	124
1473514-1	127
1810037	108
1810038	108
1810039	108
1944748	121
1956016	102
1960584	121
1960643	102
1961480	121
1961835	121
1961837	102
1965017	121
1966079	121
1967799	128
1967799-1	128
1967801	128
2000287-28	102
2000625-31	102
2000625-32	102
2000625-33	102
2000625-34	102
2000646-103	123
2000646-104	126
2000646-105	108
2000646-106	126
2000646-107	123
2000646-108	102
2000646-109	127
2000646-110	127
2000646-111	102
2000646-113	121
2000752-80	128
2000757-80	108
2000804-7	123
2000804-8	123
2000804-9	102
2001653-20	126
2001653-21	126
2001653-23	102
2001653-24	102
2001812-65	100
2002153-58	126
2002153-59	126
2002153-60	126
2002153-71	102
2002153-76	126
2002153-77	123
2002153-78	102
2002153-83	103
2002210-110	102
2002211-24	102
2002211-25	102
2002332-55	108
2002336-19	102
2002403-19	102
2002620-18	108
2002620-19	108
2002621-2	123
2003073-8	102
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2003073-10	123
2003073-11	126
2003073-12	126
2003073-13	126
2003073-14	102
2003073-15	102
2003073-16	103
2003073-91	130
2003168-135	123
2003168-136	123
2003779-22	108
2003779-23	108
2003779-24	108
2003779-25	108
2004746-87	124
2004746-114	108
2004746-115	108
2057013-0701	129
2057013-0702	129
2057013-0703	129
2076393	126
2076403	126
2076403-0703	126
2076945-0701	102
2090056-1	104
2090056-5	104
2090056-27	104
2090924B	102
2090924-008	102
2090924-0008	102
2090924-8	102
2090924-8A	102
2091211-0014	100
2091241-0005	126
2091241-0719	126
2091241-1	100
2091241-2	100
2091241-3	100
2091241-5A	126
2091241-7	100
2091241-0013	100
2091241-13	100
2091241-13A	100
2091241-0014	100
2091241-14	100
2091241-15	100
2091241-15A	100
2091241-0015	100
2091241-0018	102
2091260-1	103
2091260-2	103
2091260-3	101
2091578-0702	102
2091578-1	102
2091858-11	121
2091859-0711	108
2091859-0712	121
2091859-0713	104
2091859-0714	121
2091859-0715	104
2091859-0716	104
2091859-0717	104
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2091859-6	121
2091859-8	104
2091859-0008	121
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2091859-0011	121
2091859-11	121
2092417-0707	126
2092417-0708	126
2092417-0709	126
2092417-0710	126
2092417-0711	108
2092417-0712	108
2092417-0713	108
2092417-0715	108
2092417-0716	108
2092417-0717	126
2092417-1	126
2092417-2	126
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2092417-6	126
2092418-071	126
2092418-0710	126
2092418-0711	101
2092418-0712	126
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2092418-0716	108
2092418-0717	108
2092418-0719	108
2092418-0720	108
2092418-0721	108
2092418-0724	108
2092418-1	126
2092428-2	126
2092418-5	126
2092418-6	126
2092418-7	126
2092609-001	123
2092609-0001	123
2092609-0002	123
2092609-0022	123
2092609-0705	123
2092609-0706	123
2092609-0707	123
2092609-0713	123
2092609-0715	123
2092609-0718	123
2092609-0720	128
2092609-0721	123
2092609-1	101
2092609-2	101
2092609-3	123
2092609-5	101
2092693-0724	108
2092693-0725	108
2092693-1	102
2092693-2	126
2092693-3	126
2092693-4	126
2092693-8	102
2092693-9	126
2093308-070	108
2093308-0701	101
2093308-0702	101
2093308-0703	101
2093308-0704	123
2093308-0705	108
2093308-0706	108
2093308-0708	123

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
2093308-1	108
2093308-2	108
2093308-3	108
2097013-0702	128
2243255-1	102
2320031	108
2495012	100
2495013	100
2495014	102
2495166-1	108
2495166-2	123
2495166-4	123
2495166-8	123
2495166-9	123
2495200	100
2712080	123
3004856	102
3005861	123
3146977	130
3152170	130
3170757	128
3539307-001	108
3539307-002	108
4080187-0502	152
4813466	123
6100724-2	100
7026011	108
7026012	108
7026013	108
7026014	123
7026015	123
7026016	123
7026019	129
7026020	123
7274653	121
7276211	100
7276605	105
7278421	100
7278422	102
7278423	102
7279293	105
7279379	100
7279779	126
7279780	126
7279781	126
7279788	100
7279789	100
7279940	100
7279941	100
7281307	100
7281308	100
7281309	100
7281310	102
7281891	100
7282315	105
7284751	102
7285663	121
7292308	126
7294133	102
7295195	108
7295196	108
7296314	123
7570003-01	121
7570004	123
7570004-01	123
7570005	123
7570005-01	123
7570005-02	123
7570005-03	123
7570008	123
7570008-02	123
7570009-01	123
7570009-21	128
7570013-01	129
7570022-01	130
8000736	128
8000737	128
8020322	102
8020324	102
8020333	102
8020540	102
8020560	102
8021897	102
8021898	102
8022630	102
8023892	102
8024250	127
8024390	102
8538640	126
9100502	102
9100621	102
9100706	102
9100944	102
13020000	102
13020002	102
23114001	108
23114004	127
23114009	127
23114015	123
23114026	127
23114031	108
23114033	121
23114034	108
23114043	108
25114116	108
25114121	108
25114130	123
25114143	152
25114161	108
27125080	123
27125090	123
27125140	123
27125150	102
27125160	123
27125210	108
27125230	126
27125240	100
27125250	123
27125260	102
27126220	108
48134666	123
61260039	126
61260039A	126
570004503	123
5700045452	123
570005503	123
1522211011	102
1522210131	126
1522210300	126
1522210921	126
1522211021	126
1522211200	102
1522211328	102
1522214400	126
1522214411	126
1522214435	126
1522214821	126
1522216500	102
1522216600	126
1522217400	126
1522223720	123
3121004900	126
3121007744	126
3121024033	126
3121024044	126
3121047111	126
3122005400	102
5700045452	123
57000901504	123
A1A	123
A1B	123
A1E	108
A1F	123
A1G	108
A1G-1	128
A1H	123
A1J	128
A1K	108
A1L	123
A1M	128
A1M-1	128
A1N	124
A1P	128
A1P-1	128
A1P/4922	108
A1P/4923	108
A1R	128
A1R-1	128
A1R-2	128
A1R/4924	108
A1R-1/4925	108
A1R-2/4926	108
A1S	128
A1T	123
A1T-1	123
A1U	108
A1V	128
A1W	123
A1Z	108
A2A	128
A2B	128
A2C	108
A2D	108
A2E	130
A2EBLK	130
A2EBRN	130
A2F	108
A2FGRN	123
A2G	108
A2H	108
A2J	128
A2K	128
A2L	123
A2M	128
A2N	128
A2N-1	128
A2N-2	128
A2P	128
A2S	130
A2SB240A	104
A2SB242A	104
A2SB248A	104
A2T	128
A2U	124
A2V	108
A2W	128
A2Y	108
A2Z	128
A3E	128
A3F	128
A3G	128
A3K	128
A3M	128
A3N	128
A3T	123
A3U	130
A3W	128
A3Y	128
A3Z	128
A4A	128
A4B	128
A4F	128
A4G	108
A4H	128
A18	130
A24	108
A102	126
A104	123
A106	108
A107	128
A108	123
A111	123
A115	128
A122	126
A128	123
A128A	123
A132	128
A156	123
A158	123
A158B	123
A158C	123
A159B	123
A163	126
A168	123
A170	129
A301	108
A306	108
A307	108
A310	128
A311	128
A321	108
A344	108
A345	108
A346	108
A376	126
A415	108
A417	128
A418	128
A419	128
A420	128
A435	126
A466	128
A467	108
A473	108
A480	128
A482	128
A483	128
A484	128
A485	128
A490	128
A492	128
A494	123
A514-027662	102
A522	130
A567	123
A567A	123
A572	130
A667RED	108
A748	123
A749	123
A937-1	123
A937-3	123
A1016	129
A1109	108
A1170	108
A1220	126
A1243	100
A1314	128
A1341	128
A1377	100
A1378	100
A1379	128
A1380	123
A1383	126
A1384	126
A1462	108
A1518	108
A1519	108
A1520	108
A1521	108
A1567	123
A1567-1	123
A3011112	128
A403764-2	129
AA1	100
AA2	101
AA3	126
AA4	121
AA5	105
AC105	102
AC106	102
AC107	126
AC107M	126
AC108	102
AC109	102
AC110	102
AC113	102
AC113A	102
AC114	102
AC115	102
AC116	102
AC117	102
AC117P	102
AC120	102
AC121	102
AC122	102
AC122GRN	100
AC122RED	100
AC122YEL	100
AC123	102
AC124	100
AC125	100
AC126	100
AC127	103
AC127-132	103
AC128	100
AC129	126
AC130	101
AC131	102
AC132	102
AC134	126
AC135	100
AC136	100
AC137	102
AC138	102
AC141	101
AC141B	101
AC141K	101
AC150	102
AC150GRN	100
AC150YEL	100
AC151	100
AC151R	100
AC152	102
AC153	102
AC153K	102
AC154	102
AC155	102
AC156	102
AC157	103
AC160	126
AC160A	126
AC160B	126
AC160GRN	100
AC160RED	100
AC160YEL	100
AC161	102
AC162	102
AC163	102
AC164	126
AC165	102
AC166	102
AC167	102
AC168	102
AC169	126
AC170	100
AC171	100
AC172	101
AC175	103
AC175P	103
AC179	101
AC180	102
AC181	101
AC182	100
AC183	101
AC184	100
AC185	101
AC186	101
AC187	103
AC187/01	103
AC188	102
AC188/01	102
ACY17	102
ACY18	102
ACY19	102
ACY20	102
ACY21	102
ACY22	102
ACY23	100
ACY27	102

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
ACY28	102
ACY29	102
ACY30	102
ACY31	102
ACY32	102
ACY34	102
ACY35	102
ACY36	102
ACY38	100
ACY40	100
ACY41	102
ACY44	102
AD103	121
AD104	121
AD105	121
AD130	121
AD131	121
AD132	121
AD138	104
AD138/50	121
AD139	104
AD140	121
2-AD140	121
AD143	121
AD148	131
AD149	127
AD150	121
AD152	131
AD155	131
AD156	131
AD157	131
AD159	121
AD162	131
AD164	131
AD166	127
AD167	127
AD169	131
ADY22	121
ADY23	121
ADY24	121
ADY26	105
ADY27	121
ADZ11	105
ADZ12	105
AE50	102
AEX79846	130
AF101	100
AF102	126
AF105	126
AF105A	126
AF106	126
AF107	100
AF108	100
AF109	126
AF111	100
AF112	100
AF113	100
AF114	126
AF115	126
AF116	126
AF117	126
AF118	126
AF120	126
AF121	126
AF124	126
AF125	126
AF126	126
AF127	126
AF128	100
AF129	126
AF130	126
AF131	126
AF132	126
AF133	126
AF134	126
AF135	126
AF136	126
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AF139	126
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AF147	126
AF148	126
AF149	126
AF150	126
AF164	102
AF165	102
AF166	126
AF168	102
AF169	126
AF170	126
AF171	126
AF172	126
AF178	126
AF179	126
AF180	126
AF181	126
AF182	126
AF185	126
AF186	102
AF186G	106
AF186W	126
AF188	102
AF192	101
AF193	100
AF200	126
AF201	126
AF202	126
AF202S	102
AFY10	126
AFY11	126
AFY12	126
AFY14	126
AFY15	100
AFY16	126
AFY18	100
AFY34	102
AFY37	102
AFY39	102
AFY40	126
AFY40K	126
AFZ10	100
AFZ11	100
AFZ12	102
AFZ23	100
AG134	126
AL100	127
AL102	127
AL103	127
AL210	100
ALZ10	100
AM3235	130
AMF104	130
AMF105	130
AMF115	130
AMF116	130
AMF117	130
AMF117A	130
AMF118	130
AMF118A	130
AMF119	130
AMF119A	130
AMF120	130
AMF120A	130
AMF210	130
AMF210A	130
AO1	126
AO7	101
AQ2	128
AQ3	128
AQ4	123
AQ5	128
AQ6	123
AR4	104
AR5	104
AR6	104
AR7	104
AR8	104
AR8P404R	121
AR9	104
AR10	104
AR11	104
AR12	104
AR13	104
AR14	121
AR15	124
AR18	124
AR102	102
AR103	126
AR104	126
AR105	126
AR107	123
AR108	123
AR200	108
AR201	108
AR202	108
AS33867	102
AS33868	102
AS34280	103
ASY12-1	126
ASY12-2	126
ASY13-1	126
ASY13-2	126
ASY14	126
ASY14-1	126
ASY14-2	126
ASY14-3	126
ASY24	126
ASY26	100
ASY27	100
ASY28	101
ASY29	101
ASY30	126
ASY31	100
ASY32	100
ASY48	100
ASY49	126
ASY50	100
ASY51	100
ASY52	126
ASY53	101
ASY54	102
ASY55	126
ASY56	126
ASY57	126
ASY58	126
ASY59	126
ASY61	126
ASY62	101
ASY63	126
ASY67	126
ASY70	102
ASY71	126
ASY72	101
ASY73	101
ASY74	101
ASY75	101
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ASY77	100
ASY80	100
ASY86	101
ASY87	101
ASY88	101
ASY89	101
ASZ10	126
ASZ11	126
ASZ15	121
ASZ17	121
ASZ18	121
ASZ20	102
ASZ21	102
ASZ30	126
AT6	102
AT6A	102
AT10H	102
AT10M	102
AT10N	102
AT11	126
AT12	126
AT13	126
AT14	126
AT15	100
AT16	100
AT17	100
AT20H	102
AT20M	102
AT20N	102
AT30H	102
AT30M	102
AT30N	102
AT50	102
AT52	101
AT53	101
AT71	101
AT72	101
AT73R	101
AT74	101
AT75R	101
AT76R	101
AT77	101
AT100H	102
AT100M	100
AT100N	102
AT312	128
AT316	128
AT521	101
AT551	101
AT1856	130
AT5156	129
ATGP	102
AU101	127
AU102	127
AU105	127
AUY10	104
AUY19	121
AUY20	121
AUY21	104
AUY22	104
AUY28	127
AV105	121
AX91770	108
B2SB241	104
B2SB244	104
B5	102
B5A	102
B22-3	102
B22-4	102
B23	102
B23-1	102
B23-2	102
B24-1	102
B26	102
B49	102
B51	126
B131	152
B132	153
B134	121
B134A	121
B134C	121
B169	123
B177	121
B178	121
B179	121
B224	121
B1017	104
B1022	102
B1058	102
B1151	104
B1151A	104
B1151B	104
B1152	104
B1152A	104
B1152B	104
B1154	102
B1215	121
B1274	121
B1274A	121
B1274B	121
B1368	121
B1368A	121
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B1368D	121
B1368E	121
B1368F	121
B3746	128
B5000	152
B10064	104
B10069	104
B10142	127
B10142A	127
B10142B	127
B10143	127
B10143A	127
B10162	121
B10163	121
B10474	121
B10475	121
B10912	121
B10913	121
B170000	130
B170000BLK	130
B170000BRN	130
B170001	130
B170001BLK	130
B170001BRN	130
B170002	130
B170003	130
B170004	130
B170005	130
B170006	130
B170007	130
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B170020	130
B170021	130
B170022	130
B170024	130
B170025	130
B5493957-4	129
B5493957-5	129
B5493957-6	129
BA6	100
BA6A	100
BA67	128
BA71	128
BB71	128
BC71	128
BC107	123
BC107A	108
BC107B	108
BC108	123
BC108A	108
BC108B	108
BC108C	108
BC109	108
BC109B	108
BC109C	108
BC111	108
BC112	108
BC113	123
BC114	123
BC115	128
BC116	129
BC117	128
BC118	128
BC119	128
BC120	128
BC121	123

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Type To Be Replaced	Sylvania ECG Replacement
BC122	123
BC123	123
BC125	123
BC126	129
BC127	108
BC128	108
BC129	123
BC130	123
BC131	123
BC134	108
BC135	128
BC136	128
BC138	128
BC139	129
BC140	128
BC140A	128
BC140B	128
BC140C	128
BC140D	128
BC141	128
BC142	128
BC143	129
BC148	108
BC148C	123
BC149	123
BC153	129
BC154	106
BC155	128
BC180	108
BC442	108
BC1073	104
BC1073A	104
BC1274	104
BC1274A	104
BC1274B	104
BC6500	108
BCY10	106
BCY11	106
BCY12	106
BCY13	108
BCY15	123
BCY16	123
BCY17	106
BCY18	106
BCY19	106
BCY21	106
BCY22	106
BCY23	106
BCY24	106
BCY25	106
BCY26	106
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BCY30	106
BCY31	106
BCY32	106
BCY33	106
BCY34	106
BCY38	106
BCY39	106
BCY40	106
BCY42	128
BCY43	108
BCY49	106
BCY50	123
BCY51	128
BCY54	106
BCY56	108
BCY58	123
BCY59	123
BCY69	108
BCY70	129
BCY72	129
BCY443	128
BCZ10	106
BCZ11	106
BCZ12	129
BCZ13	106
BCZ14	106
BD71	129
BD111	130
BD112	130
BD113	130
BD115	123
BD116	130
BD118	130
BD119	124
BD120	124
BD121	130
BD132	153
BD153	123
BDY10	130
BDY11	130
BDY12	130
BDY13	130
BE6	100
BE6A	100
BE71	128
BF115	108
BF153	108
BF154	128
BF155	108
BF158	108
BF159	108
BF160	108
BF162	108
BF163	108
BF164	108
BF165	128
BF166	128
BF167	128
BF169	128
BF173	108
BF175	128
BF184	128
BF185	128
BF187	108
BF188	108
BF189	108
BF216	128
BF217	128
BF218	128
BFX12	106
BFX13	106
BFX17	128
BFX18	108
BFX19	108
BFX20	108
BFX21	108
BFX61	108
BFY10	128
BFY11	128
BFY12	128
BFY13	128
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BFY23A	128
BFY24	128
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BFY39	128
BFY39/1	128
BFY39/2	128
BFY39/3	128
BFY40	128
BFY43	128
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BFY56	128
BFY56A	128
BFY63	128
BFY64	128
BFY65	128
BFY66	128
BFY67	128
BFY67A	128
BFY67C	128
BFY68	128
BFY68A	128
BFY69	128
BFY69A	128
BFY69B	128
BFY70	128
BFY72	128
BFY74	128
BFY75	108
BFY76	123
BFY77	123
BFY78	108
BFY79	108
BFY90	108
BFY99	128
BG71	128
BH71	128
BI71	128
BIP7201	123
BLY10	130
BLY11	130
BLY12	130
BLY15	130
BLY47	130
BLY48	130
BLY49	130
BLY50	130
BLY61	128
BP67	128
BQ67	128
BR67	128
BS67	128
BS475	123
BSX12	108
BSX21	108
BSX22	128
BSX24	108
BSX25	108
BSX26	108
BSX27	108
BSX28	108
BSX29	106
BSX30	108
BSX35	106
BSX38	108
BSX53	128
BSX54	128
BSY10	128
BSY11	108
BSY17	108
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BSY19	108
BSY20	108
BSY21	128
BSY22	108
BSY23	128
BSY24	108
BSY25	123
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BSY27	108
BSY28	108
BSY29	108
BSY34	123
BSY38	128
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BSY44	124
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BSY81	128
BSY82	128
BSY83	128
BSY84	128
BSY85	128
BSY86	128
BSY87	128
BSY88	128
BSY90	123
BSY91	128
BSY92	128
BSY93	108
BSY95	108
BSY95A	108
BSY168	108
BT67	128
BT71	128
BU67	128
BU71	128
BUY10	130
BUY11	130
BV67	128
BV71	128
BW67	128
BW71	128
BX67	128
BX71	128
BY67	128
BY71	128
BZ67	128
BZ71	128
C50BA042	121
C63	128
C64	108
C73	100
C75	100
C76	100
C82S	108
C101	106
C102	106
C103	106
C106	106
C111B	108
C118	106
C119	106
C201	106
C202	106
C302	106
C313	108
C400	108
C401	106
C402	129
C407	106
C420	128
C424	108
C425	128
C426	128
C444	108
C450	108
C536E	123
C537F	123
C673	133
C674	133
C684	133
C684A	133
C685	133
C693E	123
C693G	123
C960	103
C1437	100
C1438	100
C9080	106
C9081	106
C9082	106
C9083	106
C9084	106
C9085	106
C10215-2	126
C10227	102
C10230-3	102
C10258	126
C10260	126
C10261	126
C10262	126
C10279-1	123
C10279-3	123
C11021	102
C36577	129
C36578	128
C36579	128
C36580	128
CB1F4	105
CD0000	123
CD0014	123
CD0021	123
CD8000	123
CD12000	123
CDC8021	128
CDC12077F	123
CDC13000-18	123
CDC13016A	123
CDQ10001	123
CDQ10002	108
CDQ10003	123
CDQ10004	108
CDQ10005	123
CDQ10006	108
CDQ10008	108
CDQ10009	123
CDQ10010	108
CDQ10011	128
CDQ10012	128
CDQ10014	128
CDQ10016	108
CDQ10017	108
CDQ10018	123
CDQ10019	108
CDQ10020	108
CDQ10021	123
CDQ10022	108
CDQ10023	108
CDQ10024	123
CDQ10026	108
CDQ10027	108
CDQ10032	108
CDQ10033	128
CDQ10035	108
CDQ10036	108
CDQ10037	128
CDQ10044	128
CDQ10045	128
CDQ10046	128
CDQ10047	128
CDQ10049	124

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
CDT1309	121
CDT1310	121
CDT1311	121
CDT1312	121
CDT1319	121
CDT1320	121
CDT1321	121
CDT1322	127
CDT1349	121
CDT1349A	121
CDT1350	121
CDT1350A	121
CIL511	108
CIL512	108
CIL513	108
CIL521	108
CIL522	108
CIL523	108
CIL531	108
CIL532	108
CIL533	108
CK4	126
CK4A	126
CK13	100
CK13A	100
CK14	100
CK14A	100
CK16	100
CK16A	100
CK17	100
CK17A	100
CK22	102
CK22A	102
CK22B	102
CK22C	102
CK25	100
CK25A	100
CK26	100
CK26A	100
CK27	100
CK27A	100
CK28	126
CK28A	126
CK64	102
CK64A	102
CK64B	102
CK64C	102
CK65	102
CK65A	102
CK65B	102
CK65C	102
CK66	102
CK66A	102
CK66B	102
CK66C	102
CK67	102
CK67A	102
CK67B	102
CK67C	102
CK261	101
CK262	101
CK419	128
CK422	128
CK474	128
CK475	128
CK476	108
CK477	108
CK661	100
CK662	100
CK721	102
CK722	102
CK725	102
CK727	102
CK751	102
CK754	102
CK759	100
CK759A	102
CK760	100
CK760A	102
CK761	100
CK762	126
CK766	100
CK766A	126
CK768	100
CK776	100
CK776A	100
CK790	102
CK791	102
CK793	102
CK794	102
CK870	102
CK871	126
CK872	102
CK875	102
CK878	102
CK879	102
CK882	102
CK888	102
CK891	102
CK892	102
CK942	129
CM0770	128
CM2550	121
CN2484	128
CP400	130
CP401	130
CP404	130
CP405	130
CP406	130
CP407	130
CP408	130
CQT940A	104
CQT940B	104
CQT940BA	104
CQT1075	104
CQT1076	104
CQT1077	104
CQT1110	121
CQT1110A	121
CQT1111	121
CQT1111A	121
CQT1112	121
CRT1544	104
CRT1545	104
CRT1552	104
CRT1553	104
CS360	123
CS1014	108
CS1018	108
CS1129E	128
CS1168E	123
CS1168F	108
CS1168G	123
CS1168H	123
CS1170F	129
CS1225E	128
CS1225F	128
CS1226	108
CS1226E	108
CS1226F	108
CS1226G	108
CS1227E	108
CS1227F	123
CS1227G	123
CS1229D	123
CS1229E	128
CS1229F	128
CS1229H	123
CS1236D	123
CS1237	129
CS1238	108
CS1243H	108
CS1244J	108
CS1245F	123
CS1245G	123
CS1245H	128
CS1245I	123
CS1250E	128
CS1251E	129
CS1255H	128
CS1255HF	128
CS1256HG	129
CS1258	123
CS1259	123
CS1286	123
CS1288	123
CS1289	123
CS1293	108
CS1303	129
CS1340E	108
CS1340G	108
CS1368C	123
CS1368D	123
CS1369	129
CS2711	128
CS2712	128
CS2713	128
CS2714	128
CS2715	128
CS2716	128
CS2923	128
CS2924	128
CS3393	128
CS3394	128
CS3396	128
CS3397	128
CS3398	128
CS3605	128
CS3606	128
CS3607	128
CS3707	128
CS3708	128
CS3709	128
CS3710	128
CS3711	128
CS3843	128
CS3844	128
CS3845	128
CS3859	128
CS3860	128
CST1739	104
CST1740	104
CST1741	104
CST1742	104
CST1743	121
CST1744	121
CST1745	121
CST1746	121
CT1122	104
CT1124	104
CT1124A	104
CT1124B	104
CT1300	108
CT1500	108
CTP1104	104
CTP1108	104
CTP1109	104
CTP1111	104
CTP1117	104
CTP1124	104
CTP1133	121
CTP1135	121
CTP1136	104
CTP1137	104
CTP1500	104
CTP1503	104
CTP1504	104
CTP1508	104
CTP1509	105
CTP1511	121
CTP1512	121
CTP1513	121
CTP1514	121
CTP1544	104
CTP1545	104
CTP1550	121
CTP1551	121
CTP1552	104
CTP1553	104
CTP1728	104
CTP1729	104
CTP1730	104
CTP1731	104
CTP1732	104
CTP1733	104
CTP1735	104
CTP1736	104
CTP1739	121
CTP3500	104
CTP3503	104
CTP3504	104
CTP3508	104
CTP3544	104
CTP3545	104
CTP3552	104
CTP3553	104
D019	100
D031	100
D038	100
D043	100
D063	126
D078	100
D079	126
D080	127
D081	121
D083	103
D085	103
D086	126
D087	108
D088	108
D1A	123
D1F	101
D-1R38	123
D-2R38	123
D4D24	123
D4D25	123
D4D26	123
D7A30	128
D7A31	128
D7A32	128
D10G1051	123
D10G1052	123
D11C1B1	108
D11C3B1	128
D11C5B1	108
D11C10B1	124
D11C11B1	124
D11C1F1	108
D11C3F1	128
D11C5F1	108
D11C10F1	124
D11C11F1	124
D11C201B20	123
D11C203B20	128
D11C205B20	108
D11C210B20	124
D11C211B20	124
D16E7	108
D16E9	108
D16K1	108
D16K2	108
D16K3	108
D24A3394	108
D26B1	128
D26B2	128
D26C1	128
D26E2	128
D26G1	128
D27C1	152
D27C2	152
D27C3	152
D27C4	152
D28A5	152
D28A6	152
D28A9	152
D28A10	152
D28A12	152
D28A13	152
D28D1	152
D28D2	152
D28D3	152
D28D4	152
D28D5	152
D28D7	152
D28D10	152
D29A4	128
D29A5	128
D30A1	129
D63	123
D64	103
D65	126
D66	126
D101B	102
D105B	102
D1101	133
D1102	133
D1301	133
D1302	133
D1303	133
D1666	108
DAT1A	126
DAT2	100
DS1	101
DS2	101
DS3	102
DS4	101
DS5	101
DS6	101
DS7	101
DS8	101
DS9	101
DS11	101
DS12	101
DS14	102
DS16	102
DS17	100
DS19	100
DS21	100
DS22	100
DS23	100
DS24	126
DS25	100
DS26	102
DS29	100
DS34	126
DS35	126
DS36	126
DS37	126
DS38	126
DS41	126
DS42	126
DS44	123
DS45	123
DS46	123
DS47	123
DS51	126
DS52	126
DS53	126
DS56	126
DS62	126
DS63	126
DS64	126
DS65	126
DS66	123
DS67	123
DS67W	123
DS71	123
DS72	123
DS73	108
DS74	108
DS75	123
DS76	123
DS77	123
DS78	108
DS81	108
DS83	129
DS85	108
DS501	105
DS502	105
DS503	104

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
DS504	105
DS505	105
DS506	105
DS509	130
DS520	104
DS525	105
DS570	105
DT41	104
DT80	105
DT100	105
DT161	123
DT401	104
DT1040	121
DT1110	128
DT1111	128
DT1112	128
DT1120	128
DT1121	128
DT1122	128
DT1311	128
DT1321	128
DT1510	128
DT1511	128
DT1512	123
DT1520	128
DT1521	128
DT1522	123
DT1602	123
DT1610	123
DT1612	123
DT4110	130
DT4111	130
DT4120	130
DT4121	130
DT6110	121
DTG110	104
DTG110B	104
DTG1011	104
DTG1040	104
DT1110	104
DTG1200	121
DTG2000	121
DTG2100	121
DTG2200	121
DTG2300	121
DTG2400	121
DU1	126
DU2	126
DU3	100
DU4	102
DU5	100
DU6	121
DU47	105
E-044A	102
E-065	126
E-066	126
E-067	126
E-068	126
E-070	102
E-102	126
E-105	126
E-132	126
E-158	102
E-241	100
E-214A	102
E-241B	102
E-2412	100
E-2427	103
E-2428	103
E-2429	103
E-2430	123
E-2431	123
E-2434	108
E-2435	108
E-2436	123
E-2438	126
E-2439	126
E-2440	126
E-2441	128
E-2444	123
E-2445	102
E-2447	103
E2448	102
E2449	128
E2450	123
E2451	100
E2452	123
E2453	102
E2454	123
E2455	123
E2459	123
E-2460	124
E-2461	123
E2462	126
E2464	103
E2465	102
E2466	101
E2467	102
E2474	126
E2475	126
E2476	102
E2477	126
E2478	126
E2479	126
E2480	102
E2481	102
E2482	100
EA0081	128
EA0086	129
EA0087	129
EA0090	128
EA0091	108
EA0092	123
EA0093	108
EA0094	108
EA0095	108
EA0002	126
EA0007	126
EA0009	126
EA0013	108
EA0053	126
EA15Y11	126
EA15X1	123
EA15X2	102
EA15X3	102
EA15X4	102
EA15X5	123
EA15X6	105
EA15X7	102
EA15X8	102
EA15X9	123
EA15X10	104
EA15X11	126
EA15X12	104
EA15X13	126
EA15X15	121
EA15X18	123
EA15X19	102
EA15X20	123
EA15X22	123
EA15X23	102
EA15X24	123
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EA15X50	108
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EA15X83	123
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EA15X86	123
EA15X88	121
EA15X94	123
EA15X96	123
EA15X100	130
EA1080	123
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EA1082	121
EA1128	123
EA1129	123
EA1135	123
EA1145	123
EA1337	126
EA1338	126
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EA1340	126
EA1341	104
EA1342	126
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EA1344	123
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EA1581	128
EA1628	123
EA1629	123
EA1630	123
EA1684	128
EA1696	128
EA1697	128
EA1698	128
EA1700	121
EA1703	128
EA1716	128
EA1718	128
EA1733	123
EA1735	128
EA1740	130
EA1778	128
EAI-380	152
EB0001	102
EB0003	102
ED51	126
ED52	100
ED53	100
ED54B	100
ED55	102
ED56	102
ED57	102
EK136	102
EK159	100
EN697	108
EN706	128
EN708	128
EN914	108
EN918	108
EN2894A	129
EN3009	123
EN3013	123
EN3014	123
EO44A	102
EO65	100
EO66	100
EO67	100
EO68	100
EO70	126
EO105	100
ER15X4	126
ER15X5	126
ER15X6	126
ER15X7	102
ER15X9	102
ER15X10	121
ER15X11	126
ER15X12	126
ER15X13	126
ER15X14	126
ER15X15	126
ER15X16	126
ER15X17	102
ER15X18	102
ER15X19	126
ER15X20	126
ER15X21	126
ER15X22	102
ER15X23	102
ER15X24	126
ER15X25	126
ER15X26	126
ES3	126
ES5	101
ES7	104
ES9	104
ES10	105
ES13	104
ES14	126
ES18	121
ES19	102
ES21	105
ES23	102
ES25	100
ES26	100
ES41	126
ES46	103
ES501	105
ES503	121
ES3110	126
ES3111	126
ES3112	126
ES3113	126
ES3114	126
ES3115	126
ES3116	126
ES3120	126
ES3121	126
ES3122	126
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ES3124	126
ES3125	126
ES3126	126
ES15X1	102
ES15X4	102
ES15X7	123
ES15X8	102
ES15X10	123
ES15X11	123
ES15X12	123
ES15X14	123
ES15X16	123
ES15X17	121
ES15X18	108
ES15X19	108
ES15X20	123
ES15X23	123
ES15X30	108
ES15X31	102
ES15X32	102
ES15X37	123
ES15X42	123
ES15X43	121
ES15X45	104
ESA213	126
ESA223	126
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ET2	100
ET3	102
ET4	102
ET5	102
ET6	104
ET7	105
ET8	101
ET9	101
ET10	103
ET11	103
ET12	126
ET15X1	102
ET15X3	108
ET15X4	121
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ET15X9	108
ET15X10	123
ET15X11	123
ET15X12	123
ET15X13	123
ET15X14	123
ET15X15	123
ET15X17	121
ET15X18	108
ET15X19	108
ET15X20	123
ET15X21	108
ET15X23	108
ET15X24	123
ET15X27	123
ET15X29	126
ET15X30	108
ET15X31	102
ET15X32	102
ET15X33	129
ET15X36	128
ET15X37	123
ET15X38	129
ET15X39	129
ET15X40	121
ET15X41	123
ET15X42	123
ET15X43	104
ET15X45	123
ET1511	102
ETS-003	130
ETT-CDC-12000	123
ETX18	123
EU15X1	108
EU15X2	108
EU15X27	128
EU15X34	128
EX15X25	102
F20-1001	108
F20-1002	108
F20-1003	108
F20-1004	108
F20-1005	108
F20-1006	102
F20-1007	102
F20-1008	102
F20-1009	102
F67E	121
F215-1001	108
F215-1002	108

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
F215-1003	108
F215-1004	108
F215-1005	108
F215-1006	102
F215-1007	102
F215-1008	102
F215-1009	102
F302-1	123
F302-2	123
F302-1532	123
F302-2532	123
F306-001	123
F306-022	123
F2427	108
F2443	123
F2448	123
F2450	108
F2584	123
F2633	108
F2634	108
F2636	108
F4706	108
F4709	128
F15810	108
F15835	108
F15840	123
F15840-1	123
F15841	108
FB401	126
FB402	126
FB403	126
FB420	102
FB421	102
FB440	126
FCS1168E641	108
FCS1168F813	128
FCS1168G704	123
FCS1227E814	108
FCS1227F743	108
FCS1227G810	108
FCS1229G	123
FCS9014B	108
FCS9016F	108
FCS9066	108
FE100	133
FE100A	133
FE102	133
FE102A	133
FE104A	133
FE400	133
FE402	133
FE402A	133
FE404A	133
FF400	133
FK914	108
FK918	108
FK2369A	108
FK2484	108
FK2894	106
FK3014	108
FK3299	108
FK3300	108
FM708	108
FM709	108
FM720A	108
FM870	108
FM871	108
FM910	108
FM911	108
FM914	108
FM1613	108
FM1711	108
FM1893	108
FM2368	108
FM2369	108
FM2846	108
FM2894	106
FM3014	108
FS1221	123
FS1331	128
FS1974	123
FS2299	126
FSE1001	108
FSE3001	108
FSE5002	108
FSP-1	108
FSP-42	108
FSP-42-1	108
FSP-164	108
FSP-165	108
FSP-166	108
FSP-166-1	108
FSP-215	108
FSP-242-1	123
FSP-270-1	108
FSP-289-1	108
FT025	128
FT34C	108
FT34D	108
FT40	108
FT45	108
FT001	123
FT002	123
FT003	108
FT004	108
FT004A	108
FT005	123
FT006	123
FT008	123
FT008A	123
FT015	108
FT026	108
FT027	108
FT052	123
FT053	108
FT300	124
FT709	124
FT1315	108
FT1341	108
FT1702	106
FT1746	106
FV914	108
FV918	108
FV2369A	108
FV2484	108
FV2747C	100
FV2894	106
FV3014	108
FV3299	108
FV3300	108
G11	100
G12	102
G13	126
G14	102
G19	121
G110	105
G101079	101
GA52829	100
GA53149	100
GA53242	100
GA53270	101
GC60	100
GC61	100
GC148	103
GC181	100
GC182	100
GC282	126
GC283	126
GC284	126
GC285	103
GC286	103
GC343	102
GC360	100
GC408	102
GC452	101
GC453	101
GC454	101
GC460	126
GC461	126
GC462	126
GC463	103
GC464	102
GC465	103
GC466	102
GC467	103
GC520	102
GC521	102
GC532	100
GC551	102
GC552	102
GC578	102
GC579	102
GC580	102
GC581	102
GC588	102
GC608	103
GC609	103
GC630A	103
GC639	102
GC640	102
GC641	121
GC680	102
GC682	102
GC856	102
GC864	102
GC1034	101
GC1035	101
GC1036	101
GC1092	126
GC1093X3	126
GC1134	102
GC1142	126
GC1143	102
GC1144	123
GC1146	126
GC1148	126
GC1149	126
GC1150	102
GC1159	100
GC1182	126
GC1183	102
GC1186	102
GC1187	102
GC1302	100
GC4022	100
GC4045	121
GC4062	121
GC4097	121
GC4144	102
GC4267-2	121
GC5000	102
GE-1	100
GE-2	102
GE-3	104
GE-4	105
GE-5	101
GE-6	101
GE-7	101
GE-8	103
GE-9	126
GE-10	123
GE-11	108
GE-12	124
GE-13	121MP
GE-14	130
GE-15	130MP
GE-16	121
GE-17	128
GE-18	128
GE-19	130
GE-20	128
GE-21	129
GE-22	129
GE-23	152
GE-24	152(2)
GE-25	127
GE-26	153
GE-208	126
GE-FET-1	133
GER-A	102
GER-A-D	126
GET103	102
GET113	102
GET113A	102
GET114	102
GET572	121
GET671	126
GET672	126
GET672A	126
GET673	126
GET691	126
GET692	126
GET693	126
GET871	100
GET872	100
GET873	126
GET873A	126
GET874	100
GET875	100
GET880	126
GET881	126
GET882	100
GET883	126
GET885	100
GET887	126
GET888	126
GET889	126
GET890	126
GET891	126
GET892	100
GET895	100
GET896	100
GET897	100
GET898	102
GET5116	126
GET5117	126
GEX8	101
GF20	102
GF21	102
GF32	102
GFT44	100
GFT45	100
GFT3008/40	102
GI1	100
GI2	102
GI3	126
GI4	102
GI5	101
GI6	101
GI7	101
GI8	103
GI9	121
GI10	105
GI2711	123
GI2921	123
GI2922	123
GI3708	123
GI3709	123
GI3710	123
GM0290	100
GM0378	100
GM0380	108
GM290	100
GM290A	100
GM308	108
GM378	100
GM378A	102
GM380	108
GM428	121
GM656A	100
GM770	108
GME0404	106
GME0404-1	106
GME0404-2	106
GME1001	128
GME1002	108
GME2001	128
GME2002	108
GME3001	108
GME3002	108
GME4001	108
GME4002	108
GME4003	108
GME6001	108
GME6002	108
GME6003	108
GME9001	108
GME9002	108
GME9021	108
GME9022	108
GMO375	126
GMO376	126
GMO377	126
GP1432	121
GPT16	121
GT11	100
GT12	100
GT13	100
GT14	102
GT14H	102
GT18	102
GT20	102
GT20H	102
GT20R	102
GT1202	101
GT31	102
GT32	102
GT33	102
GT34	102
GT34HV	102
GT34S	100
GT35	103
GT40	126
GT41	126
GT42	126
GT43	126
GT44	126
GT45	126
GT46	126
GT47	126
GT66	126
GT74	102
GT75	102
GT81	102
GT81H	102
GT81HS	102
GT81R	102
GT82	102
GT83	100
GT87	100
GT88	100
GT109	102
GT109R	102
GT122	102
GT123	102
GT132	102
GT153	100
GT167	103
GT210H	102
GT222	102
GT229	101
GT269	100
GT336	103
GT364	103
GT365	103
GT366	103
GT751	102
GT758	102
GT759	100
GT759R	100
GT760	100
GT760R	100
GT761	100
GT761R	100
GT762	100
GT762R	100
GT763	102
GT764	100
GT766	100
GT766A	102

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
GT792	101
GT832	100
GT903	103
GT904	101
GT905	101
GT905R	103
GT947	101
GT948	101
GT948R	101
GT949	103
GT949R	103
GT1200	101
GT1223	102
GT1604	100
GT1605	100
GT1606	100
GT1607	100
GT1608	101
GT1609	101
GT1644	106
GT1658	103
GT1665	102
GT2693	100
GT2694	100
GT2695	100
GT2696	102
GT2765	101
GT2766	101
GT2767	101
GT2768	103
GT2883	102
GT2884	101
GT2885	102
GT2886	101
GT2887	102
GT2888	101
GT2906	101
GT5116	126
GT5117	126
GT5148	102
GT5149	102
GT5151	126
GT5153	126
GTE1	100
GTE2	100
GTV	100
GTX2001	121
H10	102
H12	105
H12A	105
H1567	123
HA00052	100
HA00053	100
HA12	126
HA15	100
HA49	100
HA52	100
HA53	100
HA54	102
HA56	102
HA70	126
HA102	100
HA103	126
HA104	126
HA201	126
HA235	126
HA330	100
HA342	126
HA350	126
HA1040	126
HA1350	102
HA1360	102
HA2001	133
HA2010	133
HA2190	126
HA3210	126
HA3480	126
HA3670	126
HA4400	126
HA5001	101
HA5002	101
HA5003	101
HA5005	101
HA5009	101
HA5011	101
HA5012	101
HA5014	101
HA5016	101
HA5020	101
HA5021	101
HA5022	101
HA5023	101
HA5024	101
HA5025	101
HA5026	101
HA7520	106
HA7522	106
HA7523	106
HA7526	106
HA7527	106
HA7530	129
HA7531	129
HA7532	106
HA7533	106
HA7536	106
HA7537	106
HA7597	106
HA7598	106
HA7599	106
HA7630	129
HA7631	129
HA7632	129
HA7730	106
HA7732	106
HA7806	106
HA7807	106
HA7808	129
HA9048	106
HA9049	106
HB-00054	102
HB-00056	102
HB32	102
HB33	102
HB54	102
HB55	102
HB75	102
HB77	102
HB171	102
HB172	102
HB175	102
HB176	102
HB178	102
HB186	102
HB187	102
HB263	102
HC-00730	101
HC-01820	123
HC-01830	108
HC206	108
HC454	108
HC460	108
HC461	108
HC515	124
HC645	108
HC829	108
HEP1	126
HEP3	126
HEP50	128
HEP51	129
HEP52	129
HEP53	123
HEP54	123
HEP55	108
HEP56	108
HEP57	106
HEP200	104
HEP201	105
HEP230	121
HEP231	105
HEP232	121
HEP233	105
HEP234	127
HEP235	127
HEP240	124
HEP242	129
HEP243	128
HEP245	152
HEP246	153
HEP247	130
HEP250	102
HEP251	102
HEP252	100
HEP253	100
HEP254	102
HEP280	102
HEP281	100
HEP300	122
HEP302	122
HEP623	121
HEP624	121
HEP625	127
HEP626	127
HEP627	127
HEP628	127
HEP629	102
HEP630	102
HEP631	102
HEP632	102
HEP633	102
HEP634	102
HEP635	100
HEP636	100
HEP637	100
HEP638	100
HEP639	126
HEP640	126
HEP641	101
HEP704	130
HEP706	128
HEP708	106
HEP709	108
HEP710	129
HEP711	128
HEP712	128
HEP713	128
HEP714	128
HEP715	129
HEP716	106
HEP717	129
HEP718	108
HEP719	108
HEP720	108
HEP721	128
HEP722	128
HEP723	128
HEP724	128
HEP725	128
HEP726	128
HEP727	128
HEP728	128
HEP729	128
HEP730	128
HEP731	128
HEP732	128
HEP733	128
HEP734	128
HEP735	128
HEP736	128
HEP737	128
HEP738	128
HEP739	129
HEP801	133
HEP802	132
HF1	108
HF2	108
HF3	108
HF3H	126
HF3M	100
HF4	108
HF5	108
HF6	108
HF6H	100
HF6M	126
HF7	108
HF8	108
HF9	128
HF10	129
HF12H	126
HF12M	126
HF12N	126
HF20H	126
HF20M	126
HF50H	126
HF50M	126
HJ-15	102
HJ-15D	126
HJ-17	102
HJ-17D	102
HJ-22	100
HJ-22D	100
HJ-23	100
HJ-23D	100
HJ-32	126
HJ-34	126
HJ-34A	126
HJ-35	104
HJ-37	100
HJ-41	100
HJ-43	102
HJ-50	126
HJ-51	126
HJ-54	100
HJ-55	126
HJ-56	126
HJ-57	126
HJ-60	100
HJ-60A	100
HJ-60C	100
HJ-62	100
HJ-70	126
HJ-71	100
HJ-72	100
HJ-73	100
HJ-74	100
HJ-226	100
HJ-228	100
HJ-230	100
HJ-315	102
HJ-606	100
HJX2	100
HM-00049	100
HM-08014	102
HO300	127
HR-1	102
HR-2	102
HR-2A	102
HR-3	102
HR-4	100
HR-4A	100
HR-5	100
HR-6	100
HR-7	100
HR-7A	102
HR-8	100
HR-8A	100
HR-9	100
HR-9A	100
HR-11	123
HR-11A	123
HR-11B	123
HR-13	123
HR-13A	123
HR-14	123
HR-14A	123
HR-15	123
HR-15A	123
HR-16	123
HR-16A	123
HR-17	123
HR-17A	123
HR-18	123
HR-18A	123
HR-19	123
HR-19A	123
HR-20	126
HR-20A	126
HR-21	126
HR-21A	126
HR-22	126
HR-22A	126
HR-22B	126
HR-24	126
HR-24A	126
HR-25	126
HR-25A	126
HR-26	126
HR-26A	126
HR-27	126
HR-27A	126
HR28	128
HR-30	102
HR-36	123
HR-38	123
HR-39	102
HR40	126
HR42	126
HR43	126
HR44	126
HR45	126
HR46	126
HR-47	123
HR-48	123
HR50	126
HR51	126
HR52	126
HR53	102
HR-101	104
HR-101A	121
HR103	121
HR103A	121
HR105	121
HR105A	121
HR105B	121
HS5	102
HS-15	102
HS-17D	102
HS-22D	102
HS-23D	102
HS-29D	102
HS-102	102
HS-170	102
HT-100	106
HT-101	106
HT400	128
HT401	128
HT102341B	126
HT102341C	126
HT102351A	126
HT103501A	126
HT200771B	126
HT304581B	123
HT304581C	123
HV12	102
HV15	102
HV16	102
HV17	100
HV17B	102
HV19	102
HV23	123
HV23F	123
HV25	123
IE-850	123
IF-65	102
IG-100	105
IR1601	122
IR1602	122
IR1772	122
IR1774	122
IRFE-100	133
ISD-162	103

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
J5062	126
J5063	102
J5064	102
J24561	108
J24562	108
J24563	108
J24564	123
J24565	123
J24566	124
JC100	105
JEM-1	105
JEM-2	105
JEM-3	105
JEM-4	105
JEM-5	105
JP40	104
JR5	106
JR10	126
JR15	100
JR30	126
JR30X	126
JR40	104
JR100	126
JR200	126
K04774	104
K2001	108
K2501	107
K2502	107
K2503	107
K2509	107
K4002	107
KD2101	102
KD2102	123
KGS100	100
KT1017	121
KV1	102
KV2	102
KV4	102
L5021	102
L5022	102
L5022A	102
L5025	102
L5025A	102
L5108	126
L5121	126
L5122	126
L5181	126
L2091241-2	126
L2091241-3	126
LDA404	128
LDA405	128
LDA406	128
LDA408	128
LDA450	129
LDS200	128
LDS201	128
LS52	104
LU2N544	126
M1X	128
M2N168A	101
M24A	108
M24B	108
M25	108
M25A	108
M25B	108
M54	123
M54A	123
M54B	123
M54C	123
M54BLK	128
M54BRN	128
M54RED	128
M54ORN	128
M54YEL	128
M54GRN	128
M54BLU	128
M54WHT	128
M54D	128
M54E	128
M65A	106
M65B	106
M65C	106
M65D	106
M65E	106
M65F	106
M76	126
M77	126
M78	126
M78BLK	100
M78RED	100
M78YEL	100
M78GRN	100
M84	121
M84B	127
M91A	128
M91B	128
M91B GRN	128
M91C	108
M91CM624	123
M91D	128
M91E	128
M91F	128
M91FM624	123
M100	133
M101	133
M108	102
M351	126
M501	121
M652/PIC	129
M773RED	128
M774ORN	128
M775BRN	128
M776GRN	128
M779BLU	128
M780WHT	128
M783RED	128
M784ORN	128
M785YEL	128
M786	128
M787BLU	128
M791	128
M818WHT	128
M822	123
M822A	123
M822A BLU	128
M822B	123
M823WHT	128
M823B	128
M827BRN	128
M828GRN	128
M829A	106
M829B	106
M829C	106
M829D	106
M829E	106
M829F	106
M833	106
M847BLK	128
M3519	128
M4313	102
M4315	102
M4331	127
M4363	126
M4363ORN	126
M4363GRN	126
M4363BLU	126
M4363WHT	126
M4364	126
M4365	126
M4366	126
M4367	126
M4368	126
M4398	102
M4442	106
M4450	102
M4454	126
M4456	126
M4457	126
M4459	127
M4462	102
M4463	121
M4464	123
M4465	123
M4466ORN	102
M4468BRN	102
M4469RED	102
M4470ORN	102
M4471YEL	102
M4472GRN	102
M4473	102
M4474YEL	102
M4475GRN	102
M4476BLU	102
M4477PUR	102
M4478	129
M4484	100
M4485	100
M4486	100
M4501	126
M4509	126
M4510	102
M4545	126
M4545BLU	126
M4545WHT	126
M4553BRN	102
M4553RED	102
M4553ORN	102
M4553YEL	102
M4553GRN	102
M4553BLU	102
M4553PUR	105
M4562	102
M4563	102
M4564	102
M4565	102
M4567	102
M4570	121
M4573	105
M4582BRN	127
M4583RED	121
M4584GRN	121
M4586	126
M4589	126
M4590	106
M4594	123
M4595	126
M4596	102
M4597	105
M4597RED	105
M4597GRN	105
M4603	126
M4604	126
M4605	126
M4607	102
M4608	121
M4619RED	121
M4620GRN	121
M4621	126
M4622	105
M4623	127
M4624	123
M4627	102
M4630	123
M4632	126
M4648	128
M4649	104
M4652	127
M4689	128
M4697	126
M4709	108
M4714	123
M4715	130
M4722	121
M4722RED	121
M4722ORN	121
M4722YEL	121
M4722GRN	121
M4722BLU	121
M4722PUR	121
M4727	104
M4730	127
M4732	128
M4733	128
M4734	128
M4737	123
M4739	123
M4745	106
M4756	108
M4757	108
M4765	123
M4767	121
M4768	123
M4789	108
M4815	129
M4819	128
M4820	108
M4821	108
M4825	108
M4826	108
M4834	123
M4837	108
M4838	123
M4840	108
M4840A	108
M4841	123
M4842	128
M4842A	123
M4843	123
M4844	108
M4845	108
M4852	128
M4853	128
M4854	128
M4855	108
M4857	108
M4872	124
M4882	130
M4885	124
M4888A	121
M4888B	121
M4898	123
M8014	100
M8062A	102
M8062B	102
M8062C	102
M8105	123
M8116	126
M8120	101
M8124	126
M8640	102
M8640A	102
M9010	108
M9138	128
M9148	128
M9228	128
MA1	126
MA23	102
MA23B	102
MA25	102
MA100	100
MA112	100
MA113	100
MA114	100
MA115	100
MA116	102
MA117	102
MA206	102
MA240	102
MA286	100
MA287	100
MA288	100
MA393	102
MA393A	102
MA393B	102
MA393C	102
MA393E	102
MA393G	102
MA393R	102
MA815	102
MA881	100
MA882	102
MA883	102
MA884	102
MA885	100
MA886	100
MA887	102
MA888	102
MA889	102
MA890	100
MA891	100
MA892	100
MA893	100
MA894	100
MA895	100
MA896	100
MA897	100
MA898	100
MA899	100
MA900	100
MA901	100
MA902	100
MA903	100
MA904	100
MA909	102
MA910	102
MA1318	102
MA1702	100
MA1703	102
MA1704	100
MA1705	100
MA1706	102
MA1707	100
MA1708	102
MA4670	121
MAS20	126
MAS21	126
MAS22	126
MAS23	126
MC101	126
MC103	126
MD420	102
MD501	102
MD501B	102
MDS31	102
MDS32	102
MDS33	102
MDS33A	102
MDS33C	102
MDS33D	102
MDS34	102
MDS35	126
MDS36	100
MDS37	126
MDS38	102
MDS39	102
MDS40	102
ME0404	106
ME0404-2	106
ME213	123
ME213A	123
ME216	107
ME217	107
ME900	123
ME900A	123
ME901	123
ME901A	123
ME1001	123
ME1002	108
ME1075	128
ME1120	128
ME2001	128
ME2002	108
ME3001	108
ME3002	108
ME4001	123
ME4002	123
ME4003	123
ME5001	108
ME6001	128
ME6002	128

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
ME6003	123
ME8201	106
ME9001	108
ME9002	108
ME9021	128
ME9022	108
MF1161	107
MF1162	107
MF1163	107
MF1164	107
MF3304	106
MHM1001	108
MHM1101	108
MHT180	105
MHT181	105
MHT230	105
MHT1802	105
MHT1803	105
MHT1804	105
MHT1807	105
MHT1808	105
MHT1809	105
MHT2002	101
MHT2003	101
MHT2004	101
MHT2008	101
MHT2009	101
MHT2010	101
MHT2305	105
MHT2414	128
MHT2418	128
MHT4401	128
MHT4411	128
MHT4412	128
MHT4413	128
MHT4451	128
MHT4483	128
MHT4511	128
MHT4512	128
MHT4513	128
MHT5906	152
MHT7401	128
MHT7411	128
MHT7412	128
MHT7601	130
MHT7602	130
MHT7603	130
MHT7607	130
MHT7608	130
MHT7609	130
MHT9001	128
MHT9002	128
MHT9004	128
MHT9005	128
MHT18010	105
MJ480	130
MJ481	130
MJ2251	124
MJ2252	124
MJ2800	130
MJ2801	130
MJ3201	124
MJ3202	124
MJ4101	130
MJ5202	124
MJ5203	124
MJ5204	124
MJE370	153
MJE371	153
MJE520	152
MJE521	152
MM486	128
MM487	128
MM488	128
MM511	128
MM512	128
MM513	128
MM709	108
MM1139	100
MM1151	102
MM1152	102
MM1153	102
MM1154	102
MM1367/2SC684	108
MM1382	108
MM1387	108
MM1755	107
MM1756	108
MM1757	107
MM1758	108
MM1803	108
MM1941	123
MM1943	128
MM1945	108
MM2483	128
MM2484	128
MM2503	126
MM2550	100
MM2552	100
MM2554	100
MM2894	106
MM3000	128
MM3726	129
MM5000	100
MM5001	100
MM5002	100
MN22	121
MN23	121
MN24	104
MN25	104
MN26	104
MN29	104
MN29GRN	121
MN29BLK	121
MN29PUR	121
MN29WHT	121
MN32	104
MN46	104
MN48	121
MN49	121
MN52	102
MN53	102
MN53RED	102
MN53GRN	102
MN53BLU	102
MN60	102
MN61	127
MN63	127
MN64	127
MN73	104
MN73BLK	104
MN73WHT	104
MN194	127
MP500	105
MP500A	105
MP501	105
MP501A	105
MP502	105
MP502A	105
MP504	105
MP504A	105
MP505	105
MP505A	105
MP506	105
MP506A	105
MP507	105
MP507A	105
MP525	121
MP2060	121
MP2061	121
MP2062	121
MP2137A	121
MP2138A	121
MP2139A	121
MP2142A	121
MP2143A	121
MP2144A	121
MP3611	121
MP3612	121
MP3613	121
MP3614	121
MP3615	121
MP3617	121
MP3730	127
MP3731	127
MPF102	132
MPF103	133
MPF104	133
MPF105	133
MPS25	121
MPS404	129
MPS706	108
MPS834	123
MPS918	107
MPS1097	126
MPS2711	128
MPS2712	128
MPS2713	128
MPS2714	123
MPS2715	128
MPS2716	128
MPS2894	107
MPS2923	128
MPS2924	128
MPS2925	128
MPS2926	128
MPS2926BRN	128
MPS2926RED	128
MPS2926ORN	128
MPS3392	128
MPS3393	128
MPS3394	128
MPS3395	128
MPS3396	128
MPS3397	128
MPS3398	128
MPS3563	107
MPS3638	129
MPS3638A	129
MPS3639	106
MPS3640	106
MPS3646	108
MPS3693	128
MPS3694	128
MPS3702	106
MPS3703	106
MPS3704	128
MPS3705	128
MPS3706	128
MPS3707	128
MPS3708	128
MPS3709	128
MPS3710	128
MPS3711	128
MPS3721	128
MPS3826	128
MPS3827	128
MPS6507	108
MPS6511	108
MPS6512	128
MPS6513	128
MPS6514	108
MPS6515	128
MPS6516	129
MPS6517	129
MPS6518	106
MPS6519	106
MPS6520	128
MPS6521	108
MPS6522	106
MPS6523	106
MPS6528	128
MPS6530	128
MPS6531	128
MPS6532	128
MPS6533	106
MPS6534	106
MPS6535	106
MPS6539	108
MPS6541	108
MPS6542	108
MPS6543	108
MPS6546	108
MPS6547	108
MPS6548	108
MPS6552	123
MPS6553	123
MPS6554	123
MPS6555	123
MPS6573	123
MPS6574	123
MPS6575	123
MPS6576	123
MQ1	123
MQ2	123
MR3932	123
MR3933	128
MR3934	129
MST-10	128
MT100	108
MT101	108
MT102	108
MT106	108
MT107	108
MT3202	124
M2N168A	101
N1X	123
N2XA	123
NA20	101
NA30	103
NKT4	100
NKT5	100
NKT24	126
NKT25	126
NKT32	126
NKT33	126
NKT42	126
NKT43	126
NKT52	126
NKT53	126
NKT54	126
NKT62	126
NKT63	126
NKT64	126
NKT72	126
NKT73	126
NKT74	126
NKT102	100
NKT103	100
NKT104	100
NKT105	100
NKT106	100
NKT107	100
NKT108	102
NKT109	100
NKT121	126
NKT122	126
NKT123	126
NKT124	126
NKT125	126
NKT126	126
NKT127	126
NKT128	126
NKT129	100
NKT131	126
NKT132	126
NKT133	126
NKT141	126
NKT142	126
NKT143	126
NKT144	126
NKT151	126
NKT152	126
NKT153/25	126
NKT154/25	126
NKT162	126
NKT163	126
NKT163/25	102
NKT164	126
NKT164/25	126
NKT202	100
NKT203	100
NKT204	100
NKT205	100
NKT206	100
NKT207	100
NKT208	102
NKT211	126
NKT212	100
NKT213	100
NKT214	100
NKT215	100
NKT216	100
NKT217	100
NKT218	100
NKT221	126
NKT222	102
NKT222S1	100
NKT222S2	100
NKT223	102
NKT224	102
NKT225	102
NKT226	102
NKT227	102
NKT228	102
NKT231	102
NKT232	102
NKT242	126
NKT243	126
NKT244	102
NKT246	102
NKT247	102
NKT249	126
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NKT253	100
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NKT255	126
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NKT263	100
NKT264	126
NKT265	126
NKT270	126
NKT271	126
NKT272	126
NKT274	126
NKT275	126
NKT275A	126
NKT275E	126
NKT275J	126
NKT278	126
NKT303	102
NKT308	102
NKT401	121
NKT402	121
NKT403	121
NKT404	121
NKT405	121
NKT415	121
NKT416	121
NKT450	121
NKT451	121
NKT452	121
NKT452S1	121
NKT453	121
NKT454	121
NKT501	121
NKT503	121
NKT504	121
NKT618	126
NKT675	126
NKT676	126
NKT677	126
NKT701	103
NKT703	103
NKT713	103
NKT717	101
NKT734	101
NKT736	101

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
NKT751	103
NKT752	103
NKT753	101
NKT773	103
NKT781	101
NPC115	128
NPC187	128
NPC189	128
NR5	101
NR10	101
NR20	103
NR30	101
NS381	108
NS382	108
NS404	129
NS475	108
NS476	108
NS477	108
NS478	128
NS479	128
NS480	108
NS661	106
NS662	106
NS663	106
NS664	106
NS665	106
NS666	106
NS667	106
NS668	106
NS731	108
NS731A	108
NS732	108
NS732A	108
NS733	108
NS733A	108
NS734	108
NS734A	108
NS949	128
NS1000	106
NS1001	106
NS1356	108
NS1500	107
NS1510	107
NS1672	129
NS1673	129
NS1674	129
NS1861	129
NS1862	129
NS1863	129
NS1864	129
NS1972	108
NS1973	108
NS1974	108
NS1975	108
NS2100	128
NS2101	128
NS3039	107
NS3040	107
NS3041	107
NS3300	108
NS6062	106
NS6063	106
NS6064	106
NS6065	106
NS9400	128
NS9420	128
NS9500	128
NS9540	128
NS9710	108
NS9728	128
NS9729	128
NS9730	128
NS9731	128
OC16	104
OC19	121
OC20	121
OC22	104
OC23	104
OC24	104
OC25	104
OC26	104
OC27	104
OC28	104
OC29	104
OC30	131
OC30A	131
OC30B	131
OC34	102
OC35	104
OC36	104
OC38	102
OC41	100
OC42	126
OC43	126
OC44	100
OC45	100
OC46	126
OC47	126
OC53	102
OC54	102
OC55	102
OC56	102
OC57	126
OC58	126
OC59	126
OC60	126
OC65	126
OC66	126
OC70	126
OC71	126
OC71A	102
OC71N	102
OC72	102
OC73	102
OC74	102
OC75	102
OC75N	102
OC76	102
OC77	102
OC77M	102
OC79	102
OC80	102
OC81	102
OC81D	102
OC81DD	102
OC83	126
OC84	126
OC122	102
OC123	126
OC130	100
OC139	101
OC140	101
OC141	101
OC169	126
OC169R	126
OC170	126
OC170R	126
OC170V	126
OC171	126
OC171R	126
OC171V	126
OC200	106
OC201	106
OC202	106
OC203	106
OC204	106
OC205	129
OC206	106
OC207	129
OC303	126
OC304	102
OC304-1	126
OC304-2	126
OC304-3	126
OC305	126
OC305-1	126
OC305-2	126
OC306	126
OC306-1	102
OC306-2	126
OC306-3	126
OC307	126
OC307-1	126
OC307-2	126
OC307-3	126
OC308	126
OC309	102
OC309-1	100
OC309-2	100
OC309-3	100
OC318	102
OC330	102
OC331	126
OC340	102
OC341	126
OC342	126
OC343	126
OC350	102
OC351	126
OC360	102
OC361	126
OC362	126
OC363	126
OC364	102
OC390	126
OC410	100
OC430	106
OC430K	106
OC440	106
OC440K	106
OC443	106
OC443K	106
OC445	106
OC449	106
OC450	106
OC460	106
OC460K	106
OC463	106
OC463K	106
OC465	106
OC465K	106
OC466	106
OC466K	106
OC467	106
OC467K	106
OC468	106
OC468K	106
OC469	106
OC469K	106
OC470	106
OC470K	106
OC602	102
OC602SQ	102
OC603	102
OC604	102
OC604SP	102
OC612	126
OC613	126
OC614	126
OC615	126
OC700	106
OC700A	106
OC700B	106
OC702	106
OC702A	106
OC702B	106
OC704	106
OC711	102
OC740	106
OC740G	129
OC740M	106
OC740O	106
OC742	106
OC742G	129
OC742M	106
OC742O	106
OF129	102
ON174	126
P1A	121
P1B	102
P1C	129
P1D	129
P1G	121
P1H	129
P1J	129
P1K BLK	121
P1K BRN	121
P1K RED	121
P1K ORN	121
P1K YEL	121
P1K GRN	121
P1K BLU	121
P1L	126
P1L/4956	126
P1N	106
P1N-1	106
P1N-2	106
P1N-3	106
P1P	129
P1P-1	129
P1R	121
P1V	153
P1W	106
P1Y	127
P2A	106
P2D BRN	121
P2D RED	121
P2D ORN	121
P2D GRN	121
P2K	153
P3139	130
P5152	123
P5153	123
P8890	121
P8890A	121
P31898	121
P75534	121
PA1000	106
PA1001	106
PA10889-1	102
PA10889-2	102
PA10890	104
PA10890-1	121
PADT20	126
PADT21	126
PADT22	126
PADT23	126
PADT24	126
PADT25	126
PADT26	126
PADT27	126
PADT28	126
PADT30	126
PADT31	126
PADT35	126
PADT40	126
PADT50	104
PADT51	126
PAR12	121
PB110	121
PBE3014-1	102
PBE3014-2	102
PBE3020-1	102
PBE3020-2	103
PBE3162	102
PEP2	128
PEP-5	108
PEP-6	108
PEP-7	108
PEP-8	108
PEP9	128
PEP1001	128
PEP2001	128
PET4001	128
PET9021	128
PET9022	128
PMT1767	108
PQ27	126
PQ28	102
PQ29	102
PQ30	126
PQ31	121
PRC10A	122
PRC15A	122
PRC20A	122
Power 12	121
Power 25	121
Power 40	105
Power 60	105
Power 80	105
Power 99	121
Power 299	121
PS-1	121
PT2A	126
PT2S	126
PT3	121
PT3A	121
PT6	121
PT12	121
PT25	121
PT30	121
PT40	121
PT50	121
PT150	104
PT155	121
PT176	121
PT234	121
PT235	121
PT235A	104
PT236	104
PT236A	104
PT236B	121
PT236C	121
PT242	121
PT250	105
PT255	121
PT256	121
PT285	121
PT285A	121
PT301	121
PT301A	121
PT307	121
PT307A	121
PT501	105
PT515	105
PT530	100
PT530A	100
PT554	104
PT555	121
PT612	128
PT627	123
PT703	123
PT720	123
PT850	128
PT850A	128
PT851	123
PT855	126
PT856	126
PT886	123
PT887	128
PT888	128
PT896	128
PT897	128
PT898	128
PT1558	128
PT1559	128
PT1610	128
PT1835	128
PT1836	128
PT1837	128
PT1941	130
PT2040A	123
PT2760	123
PT3141	123
PT3141A	123
PT3501	123
PT3151A	108
PT3151B	128
PT3151C	128
PT3500	128

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
PT3502	128
PT4800	123
PT4816	107
PT4830	107
PTO-6	121
PTO139	102
PQ27	126
PQ28	102
PQ29	102
PQ30	126
PQ31	104
PXB103	102
PXB113	102
PXC101	102
PXC101A	102
PXC101AB	102
Q1-7C	102
Q2N406	102
Q2N1526	126
Q2N2613	102
Q34450	124
Q40359	126
QA-8	128
QA-11	129
QA-16	128
QG0074	104
QG0076	102
QG0254	123
QP-1	121
QP-1A	121
QP-2	121
QP-6	121
QP-7	121
QP-8	130
QR2378	102
QSE1001	108
QSE3001	108
QSE5020	108
QOV60526	102
QOV60527	103
QOV60528	102
QOV60529	123
QOV60530	123
QOV60537	103
QOV60538	102
R16	102
R24-1001	102
R24-1002	102
R24-1003	102
R24-1004	102
R33	101
R34	101
R35	102
R52	102
R56	102
R61	101
R62	101
R63	101
R64	102
R65	102
R66	102
R67	102
R79	101
R80	101
R83	102
R87	102
R98	102
R177	101
R119	100
R120	102
R125	101
R135	101
R136	101
R137	101
R152	102
R163	100
R164	102
R186	100
R202	101
R203	101
R227	100
R242	102
R244	100
R255	102
R258	100
R289	102
R290	102
R291	102
R324	102
R338	102
R339	102
R340	123
R341	102
R424	100
R424-1	102
R425	100
R428	102
R488	100
R497	126
R506	100
R515	126
R516	121
R530	102
R539	126
R558	100
R579	100
R592	101
R593	102
R608	102
R608A	102
R684	126
R714	126
R715	126
R1273	102
R1274	102
R1533	101
R2444	124
R2473	108
R2476	108
R2477	108
R2749	102
R2749M	102
R2964	127
R2982	130
R3293	103
R4369	130
RC1700	130
RC2270	130
RCA35953	102
RCA35954	102
RCA40231	103
RH120	123
RR7504	123
RS406	102
RS593	126
RS684	126
RS685	126
RS686	102
RS687	102
RS1049	123
RS1059	123
RS1192	102
RS1513	101
RS1524	103
RS1530	101
RS1531	101
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RS1533	103
RS1534	101
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RS3293	102
RS3299	102
RS3301	102
RS3306	101
RS3308	102
RS3309	100
RS3310	102
RS3316	102
RS3316-1	102
RS3316-2	102
RS3318	102
RS3322	126
RS3323	126
RS3324	126
RS3359-1	121
RS3717	102
RS3726	102
RS3857	102
RS3858-1	121
RS3862	126
RS3863	126
RS3864	126
RS3866	126
RS3867	100
RS3868	126
RS3880	102
RS3892	100
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RS3898	126
RS3900	126
RS3901	126
RS3902	126
RS3903	126
RS3904	102
RS3905	126
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RS3907	126
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RS3912	126
RS3913	126
RS3914	100
RS3915	100
RS3925	102
RS3926	102
RS3929	126
RS3931	103
RS3959-1	104
RS3986	126
RS3995	126
RS5008	102
RS5101	126
RS5102	102
RS5103	102
RS5104	100
RS5105	126
RS5106	100
RS5107	126
RS5108	126
RS5109	126
RS5201	126
RS5202	102
RS5203	102
RS5204	126
RS5205	126
RS5206	126
RS5207	126
RS5208	126
RS5209	126
RS5243-2	102
RS5301	126
RS5302	100
RS5303	100
RS5305	126
RS5306	126
RS5311	126
RS5312	126
RS5313	126
RS5314	126
RS5401	126
RS5402	100
RS5403	100
RS5406	102
RS5502	102
RS5503	102
RS5504	100
RS5505	102
RS5506	102
RS5507	102
RS5511	100
RS5530	102
RS5531	102
RS5532	102
RS5533	102
RS5534	102
RS5535	102
RS5536	102
RS5540	100
RS5541	102
RS5542	102
RS5543	102
RS5544	102
RS5545	102
RS5551	102
RS5552	102
RS5553	102
RS5554	102
RS5556	102
RS5557	102
RS5558	102
RS5563	102
RS5564	102
RS5565	102
RS5566	102
RS5567	102
RS5568	102
RS5602	102
RS5603	102
RS5605	102
RS5607	102
RS5608	102
RS5610	102
RS5612	121
RS5613	121
RS5614	121
RS5616	121
RS5704	102
RS5704-2	102
RS5708	102
RS5708-2	102
RS5709	102
RS5711	102
RS5717	102
RS5717-1	102
RS5717-3	102
RS5717-6	102
RS5720	102
RS5731	102
RS5732	102
RS5733	102
RS5734	102
RS5735	102
RS5736	102
RS5737	102
RS5738	102
RS5740-1	102
RS5742	102
RS5743	102
RS5743-1	102
RS5743-2	102
RS5743-3	102
RS5744	102
RS5744-3	102
RS5745	102
RS5746	102
RS5747	102
RS5748	102
RS5749	102
RS5750	102
RS5751	102
RS5753	126
RS5753-2	126
RS5754	126
RS5755	126
RS5756	126
RS5757	126
RS5758	126
RS5759	126
RS5760	126
RS5761	126
RS5762	126
RS5765	102
RS5766	102
RS5767	102
RS5768	102
RS5802	126
RS5818	126
RS5835	121
RS5851	123
RS5852	102
RS5853	123
RS5854	123
RS5855	121MP
RS5856	123

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
RS5857	123
RS6821	126
RS6822	126
RS6824	100
RS6840	102
RS6846	123
RS7101	108
RS7102	108
RS7103	123
RS7104	108
RS7105	123
RS7106	108
RS7107	108
RS7108	108
RS7109	108
RS7110	108
RS7112	108
RS7113	108
RS7114	108
RS7115	108
RS7116	123
RS7117	128
RS7118	108
RS7119	108
RS7120	108
RS7122	108
RS7123	108
RS7124	108
RS7125	108
RS7126	108
RS7127	108
RS7128	108
RS7129	128
RS7132	128
RS7133	128
RS7135	128
RS7136	123
RS7138	108
RS7142	108
RS7144	123
RS7201	108
RS7202	108
RS7209	108
RS7210	108
RS7212	108
RS7215	108
RS7217	108
RS7218	108
RS7219	108
RS7220	108
RS7311	124
RS7312	124
RS7315	124
RS7316	124
RS7317	124
RS7318	124
RS7320	124
RS7321	124
RS7327	124
RS7328	124
RS7329	124
RS7330	124
RS7407	123
RS7408	123
RS7410	123
RS7411	123
RS7412	123
RS7413	123
RS7504	123
RS7510	128
RS7511	123
RS7512	108
RS7513	123
RS7514	108
RS7515	108
RS7516	123
RS7517	108
RS7518	123
RS7519	128
RS7520	108
RS7522	108
RS7523	108
RS7525	123
RS7526	123
RS7527	123
RS7528	123
RS7529	123
RS7530	123
RS7532	108
RS7533	108
RS7542	123
RS7568	102
RS7606	123
RS7607	123
RS7609	123
RS7610	123
RS7611	123
RS7612	123
RS7613	123
RS7614	123
RS7620	128
RS7622	123
RS7623	123
RS7624	123
RS7625	123
RS7626	123
RS7627	123
RS7628	123
RS7638	123
RS7639	123
RS7665	129
RS8406	102
RS8407	103
RS57433	102
RS57042	102
RS57062	102
RT141	128
RT154	128
RT185	102
RT188	128
RT482	128
RT483	128
RT484	128
RT929H	123
RT930H	123
RT2016	123
RT2329	102
RT2330	102
RT2331	102
RT2332	123
RT2709	102
RT2914	123
RT2915	108
RT3063	128
RT3064	123
RT3065	128
RT3069	108
RT3070	108
RT3071	129
RT3095	108
RT3096	103
RT3097	102
RT3098	102
RT3361	126
RT3362	126
RT3363	102
RT3364	102
RT3365	102
RT3565	123
RT3566	102
RT3567	123
RT5151	128
RT5152	128
RT5230	129
RT5401	128
RT5402	128
RT5403	128
RT5404	128
RT7511	123
RT7514	123
RT7515	123
RT7517	123
RT7518	123
RT7528	123
RT7638	123
RT61014	100
RT61015	102
RT61016	102
S-39T	121
S-40T	121
S-40TB	121
S-41T	121
S-42T	121
S-43T	121
S-46T	121
S-48T	121
S-49T	121
S-55TB	126
S-58TB	121
S-70T	126
S-80T	126
S-87TB	126
S-88TB	126
S133-1	123
S305	130
S305A	130
S-873TB	126
S-874TB	126
S1009	108
S1019	108
S1037	108
S1041	108
S1044	108
S1058	108
S1059	108
S1060	108
S1061	123
S1062	108
S1065	123
S1066	123
S1068	123
S1069	123
S1076	123
S1078	123
S1079	123
S1080	123
S1128	123
S1142	108
S1143	123
S1153	108
S1221	123
S1221A	123
S1227	108
S1245	123
S1276	108
S1286	108
S1296	108
S1313	108
S1316	108
S1317	108
S1318	108
S1331	123
S1331N	123
S1331W	123
S1348	102
S1349	102
S1360	108
S1361	108
S1362	108
S1363	123
S1364	123
S1369	123
S1403	108
S1408	108
S1409	108
S1559	123
S1570	123
S1629	123
S1639	102
S1640	126
S1674	108
S1674A	108
S1682	108
S1835	123
S1891	123
S1891A	123
S1891B	123
S2020	108
S2059	124
S2172	108
S2590	123
S2617	108
S3019	108
S5327E	108
S5328E	108
S5670E	108
S15649	108
S15650	108
S15657	108
S15658	108
S15659	108
S95101	126
S95102	126
S95103	126
S95104	126
S95106	126
S95125	108
S95125A	108
S95126	108
S95126A	108
S95201	102
S95202	123
S95203	102
S95204	102
S95206	102
S95207	102
S95214	102
S95253	121
S95253-1	121
S99101	126
S99102	126
S99103	126
S99104	126
S99201	102
S99203	102
SA7	101
SA29	102
SA50	106
SA51	106
SA52	106
SA52A	106
SA52B	106
SA53	106
SA54	106
SA55	106
SA56	106
SA70	106
SA128	102
SA197	102
SA197-1	102
SA197-2	102
SA197-3	102
SA204	102
SA205BRN	102
SA205RED	102
SA205ORN	102
SA205YEL	102
SA205GRN	102
SA205BLU	102
SA205PUR	102
SA205WHT	102
SA240	102
SA310	106
SA311	106
SA312	106
SA313	106
SA314	106
SA315	106
SA316	106
SA410	106
SA411	106
SA412	106
SA413	106
SA414	106
SA415	106
SA416	106
SA495	106
SA495A	106
SA496	106
SA496A	106
SA496B	106
SA537	106
SA538	106
SA539	106
SA540	106
SAC40	106
SAC40A	106
SAC40B	106
SAC42	106
SAC42A	106
SAC42B	106
SAC44	106
SB100	126
SB168	102
SB169	102
SB200	126
SB5122	126
SC12	102
SC43	100
SC44	100
SC45	102
SC46	100
SC56	103
SC63	102
SC65	123
SC66	102
SC68	102
SC69	102
SC70	121
SC71	126
SC72	126
SC73	102
SC74	126
SC78	126
SC79	126
SC80	126
SC727	124
SC777	124
SC832	123
SC4004	124
SC4044	123
SC4131	124
SC4131-1	124
SC4167	124
SC4244	124
SCR02C	122
SDD420	123
SDD421	128
SDD820	108
SDD821	108
SDD1220	128
SDD3000	108
SDT9201	130
SE504	108
SE1001	108
SE1002	123
SE1010	123
SE1019	108
SE1044	108
SE1331	123
SE1419	108
SE2001	123
SE2002	128
SE3001	108
SE3002	108
SE3019	108
SE3030	130
SE3031	130
SE3032	130
SE3033	130

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
SE3035	130
SE3036	130
SE4001	123
SE4002	123
SE4010	123
SE5001	108
SE5002	108
SE5003	108
SE5004	108
SE5006	108
SE5020	108
SE5021	108
SE5022	108
SE5023	108
SE5024	108
SE5025	108
SE5050	108
SE5051	128
SE6001	123
SE6002	123
SE6006	128
SE7001	123
SE7002	128
SE7005	128
SE7006	124
SE7020	124
SE7030	124
SE8001	128
SE8002	128
SE8010	128
SE40022	121
SE50399	127
SEC1078	128
SEC1079	128
SEC1477	128
SEC1479	128
SF1713	103
SF1714	103
SF1726	123
SFT124	100
SFT125	102
SFT125P	102
SFT143	100
SFT144	102
SFT162	100
SFT163	100
SFT171	100
SFT172	100
SFT173	100
SFT174	100
SFT184	103
SFT186	128
SFT191	121
SFT212	121
SFT213	121
SFT214	121
SFT221	126
SFT222	100
SFT223	126
SFT226	126
SFT227	126
SFT228	126
SFT229	126
SFT237	126
SFT238	121
SFT239	121
SFT240	121
SFT241	100
SFT243	100
SFT250	121
SFT251	102
SFT252	100
SFT253	102
SFT259	101
SFT260	101
SFT261	101
SFT264	105
SFT265	105
SFT266	105
SFT267	105
SFT268	126
SFT288	126
SFT298	101
SFT306	126
SFT307	126
SFT308	126
SFT315	126
SFT316	126
SFT317	126
SFT318	126
SFT319	126
SFT320	126
SFT321	100
SFT322	102
SFT323	100
SFT327	102
SFT337	126
SFT351	100
SFT352	102
SFT353	102
SFT354	126
SFT357	126
SFT357P	100
SFT358	126
SFT377	101
SFT440	128
SFT443	128
SFT443A	128
SFT445	128
SFT526	100
SFT713	128
SFT714	123
SJ130	124
SJ570	123
SJ619	130
SJ619-1	130
SJ806	124
SJ1165	124
SJ1201	124
SJ1286	124
SJ1470	130
SJ3604	130
SJ8701	130
SJ9110	130
SJE100	152
SJE106	152
SJE108	153
SJE111	153
SJE112	153
SJE113	152
SJE114	153
SJE202	153
SJE203	152
SJE210	153
SJE211	152
SJE221	153
SJE222	152
SJE227	153
SJE228	152
SJE229	152
SJE237	152
SJE241	153
SJE242	152
SJE243	153
SJE244	152
SJE245	153
SJE246	152
SJE248	152
SJE253	152
SJE257	153
SJE261	152
SJE262	152
SJE265	153
SJE267	153
SJE271	152
SJE272	152
SJE273	153
SJE274	152
SJE275	153
SJE276	152
SJE277	153
SJE278	152
SJE279	153
SJE280	152
SJE305	152
SJE340	152
SJE408	153
SJE721	152
SJE736	153
SJE737	152
SJE769	152
SJE797	153
SJE799	153
SJE1518	153
SJE1519	152
SJE1520	152
SK7	101
SK1856	106
SK2604	106
SK3003	102
SK3004	102
SK3005	100
SK3006	126
SK3007	126
SK3008	126
SK3009	121
SK3010	103
SK3011	101
SK3012	105
SK3013	104MP
SK3014	121
SK3015	121MP
SK3015	104
SK3018	108
SK3019	108
SK3020	123
SK3021	124
SK3024	128
SK3025	129
SK3026	152
SK3027	130
SK3028	152(2)
SK3029	130MP
SK3034	127
SK3035	127
SK3036	130
SK3037	130MP
SK3041	152
SK3960	123
SK5184A	124
SK5915	123
SK7181	123
SKA4129	129
SL100	108
SL200	106
SL201	106
SL300	123
SM217	100
SM2700	123
SM2701	123
SM4508-B	123
SM5564	123
SM5643	123
SM6251	128
SM7815	123
SM7836	123
SM9135	123
SN60	123
SN80	108
SN166	128
SN167	128
SNT204	106
SO1	126
SO2	126
SO3	126
SO25	102
SO65	100
SO65A	126
SO88	102
SP39	127
SP62	127
SP148-3	121
SP334	121
SP404T	121
SP441	121
SP441D	104
SP441G	121
SP441S	104
SP485	121
SP485B	121
SP485W	104
SP485BLK	121
SP485BRN	121
SP485BLU	121
SP485WHT	121
SP486WHT	121
SP486	104
SP486W	121
SP634	121
SP649	121
SP649-1	121
SP834	121
SP875	121
SP880	104
SP880-1	121
SP880-3	121
SP891	104
SP891B	121
SP891W	104
SP891BLU	121
SP891G	121
SP891GRN	121
SP891WHT	121
SP1108	104
SP1137	104
SP1403	121
SP1481-1	121
SP1481-2	121
SP1481-3	104
SP1481-4	121
SP1482-2	121
SP1482-3	121
SP1482-4	121
SP1482-5	104
SP1482-6	121
SP1482-7	121
SP1483	121
SP1483-1	121
SP1483-2	121
SP1483-3	121
SP1484	121
SP1550-3	121
SP1556	121
SP1556-1	121
SP1556-2	121
SP1556-3	121
SP1556-4	121
SP1563-2	121
SP1603	121
SP1603-1	121
SP1603-2	121
SP1603-3	121
SP1651	104
SP1742	127
SP1950	121
SP2072	121
SP2076	121
SP2158	124
SP2361	127
SP8400	128
SP8401	128
SPC40	128
SPC42	128
SPC50	128
SPC51	128
SPC52	128
SPF024	133
SPS4	128
SPS20	128
SPS38	128
SPS43-1	128
SPS1097	129
SPS1523	106
SPS3003	108
SPS3015	128
SPS3724	106
SPS3735	128
SPS3900	128
SPS3907	128
SPS3908	128
SPS3909	128
SPS3923	128
SPS3924	129
SPS3925	128
SPS3926	128
SPS3927	129
SPS3929	108
SPS3930	128
SPS3931	106
SPS3936	128
SPS3937	128
SPS3938	128
SPS3940	128
SPS3948	128
SPS3951	128
SPS3952	128
SPS3957C	128
SPS3967	128
SPS3968	128
SPS3971	128
SPS3972	128
SPS3973	128
SPS3987	129
SPS3988	129
SPS3990	129
SPS3999	128
SPS4002	108
SPS4003	128
SPS4004	128
SPS4005	128
SPS4006	128
SPS4007	129
SPS4008	128
SPS4009	128
SPS4013	106
SPS4014	129
SPS4016	128
SPS4017	128
SPS4018	129
SPS4019	129
SPS4020	128
SPS4025	106
SPS4026	129
SPS4027	129
SPS4028	129
SPS4029	128
SPS4030	108
SPS4031	106
SPS4032	128
SPS4034	128
SPS4039	128
SPS4040	128
SPS4041	128
SPS4042	128
SPS4043	108
SPS4044	128
SPS4045	128
SPS4049	128
SPS4050	108
SPS4051	108
SPS4052	128
SPS4053	128
SPS4054	106
SPS4055	128
SPS4056	129
SPS4059	128
SPS4060	128
SPS4061	128
SPS4062	128
SPS4063	128

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement
SPS4064	129	ST29	108	ST905	108	SYL152	123	T76	123
SPS4066	128	ST30	108	ST910	108	SYL160	100	T77	102
SPS4067	128	ST31	108	ST1026	108	SYL792	100	T78	100
SPS4068	108	ST32	108	ST1050	108	SYL1182	103	T81	103
SPS4069	128	ST33	108	ST1051	108	SYL1279	101	T82	102
SPS4072	129	ST34	108	ST1242	123	SYL1297	103	T83	100
SPS4073	106	ST35	108	ST1243	123	SYL1310	101	T84	100
SPS4074	128	ST37C	100	ST1244	123	SYL1311	101	T87	100
SPS4075	128	ST37D	100	ST1290	123	SYL1312	101	T95	100
SPS4076	129	ST37E	100	ST1336	108	SYL1313	101	T99	126
SPS4077	128	ST40	108	ST1506	128	SYL1326	101	T100	126
SPS4078	129	ST41	108	ST1607	128	SYL1327	101	T101	100
SPS4079	128	ST42	108	ST1694	108	SYL1329	103	T102A	100
SPS4080	108	ST43	108	ST3030	108	SYL1380	101	T108	100
SPS4081	128	ST44	108	ST3031	108	SYL1396	103	T109	100
SPS4082	129	ST45	108	ST6110	123	SYL1454	101	T116	100
SPS4083	128	ST50	108	ST6120	108	SYL1524	103	T126	100
SPS4084	128	ST51	108	ST6573	123	SYL1536	103	T127	121
SPS4085	128	ST53	108	ST6574	123	SYL1537	101	T129	100
SPS4086	129	ST55	108	ST8014	106	SYL1538	103	T130	100
SPS4087	129	ST56	108	ST8033	106	SYL1539	103	T139	123
SPS4088	128	ST57	108	ST8034	106	SYL1547	103	T142	121
SPS4089	128	ST58	108	ST8035	106	SYL1583	102	T143	123
SPS4090	106	ST59	108	ST8036	106	SYL1588	100	T157	123
SPS4091	128	ST60	108	ST8065	106	SYL1591	101	T158	123
SPS4095	128	ST61	108	ST8190	106	SYL1608	100	T170	123
SPS4313	128	ST62	108	ST8500	106	SYL1617	101	T171	123
SPS4314	129	ST63	108	ST8509	106	SYL1665	102	T237	123
SPS4354	106	ST64	108	STC1080	130	SYL1668	102	T255	123
SPS4355	129	ST70	108	STC1081	130	SYL1690	100	T256	123
SPS4356	128	ST71	108	STC1082	130	SYL1697	100	T257	124
SPS4363	128	ST72	108	STC1083	130	SYL1717	100	T261	124
SPS4365	128	ST80	108	STC1084	130	SYL1750	101	T339	123
SPS4367	128	ST82	108	STC4252	130	SYL1987	101	T340	129
SPS4446	128	ST106	105	STC4253	130	SYL2120	100	T342	123
SPS4450	128	ST107	105	STC4254	130	SYL2130	101	T344	152
SPS4451	128	ST108	105	STC4255	130	SYL2131	101	T348	126
SPS4452	106	ST109	105	STC5610	129	SYL2132	101	T367	126
SPS4453	128	ST110	105	STC5611	129	SYL2134	103	T368	126
SPS4455	128	ST111	105	STC5612	129	SYL2135	103	T373	126
SPS4458	106	ST112	105	STX0011	129	SYL2136	103	T374	126
SPS4459	128	ST122	102	STX0014	130	SYL2189	126	T396	153
SPS4460	129	ST123	102	STX0015	124	SYL2245	101	T399	123
SPS4472	128	ST150	123	STX0027	130	SYL2246	101	T417	123
SPS4473	129	ST151	123	STX0028	128	SYL2247	100	T811	126
SPS4476	128	ST152	123	STX0032	130	SYL2248	102	T814	102
SPS4480	129	ST153	123	STX0033	126	SYL2249	100	T815	102
SPS4610	128	ST154	123	STX0034	126	SYL2250	100	T841	130
SPS5008	129	ST155	123	STX0036	100	SYL2300	102	T842	130
SPS6109	106	ST156	123	STX0085	100	SYL2650	103	T843	130
SPS7652	128	ST157	123	STX0087	100	SYL3613	102	T844	130
SQ-7	103	ST160	123	STX0089	100	SYL4131	108	T1000	102
SR-1	102	ST161	123	STX0090	100	SYL4315	103	T1001	102
SS155	126	ST162	123	STX0096	102	T0003	100	T1003	100
SS524	128	ST163	123	STX0099	102	T0004	100	T1004	102
SS2308	128	ST172	101	STX0104	102	T0005	100	T1005	102
SS2503	129	ST175	123	STX0105	102	T0012	100	T1006	102
SSA43	129	ST176	123	STX0110	102	T00014	102	T1007	102
SSA43A	129	ST177	123	STX0114	102	T0015	100	T1008	102
SSA46	129	ST178	123	STX0121	102	T0031	100	T1010	102
SSA48	129	ST180	123	STX0123	102	T0033	100	T1011	100
ST01	123	ST181	123	STX0224	102	T0038	100	T1012	100
ST02	123	ST182	123	STX0260	102	T0039	100	T1013	102
ST03	123	ST250	123	STX0263	102	T0040	100	T1023	102
ST04	123	ST251	123	STX0264	102	T0041	102	T1028	126
ST05	123	ST301	102	STX0265	102	T0051	100	T1032	126
ST06	123	ST302	102	STX0268	102	T23	100	T1033	126
ST9	108	ST303	102	STX0269	102	T-33Z1	126	T1034	126
ST10	108	ST304	102	SV31	102	T-33Z3	126	T1038	126
ST11	108	ST332	102	SX3711	123	T39	100	T1040	104
ST12	108	ST370	100	SX3826	128	T45	102	T1041	104
ST13	108	ST382	102	SYL101	101	T46	100	T1042	102
ST14	108	ST415	108	SYL102	101	T47	100	T1043	102
ST15	108	ST501	108	SYL103	103	T48	100	T1046	102
ST25A	123	ST502	108	SYL104	103	T50	102	T1047	102
ST25B	123	ST503	128	SYL105	100	T59	100	T1166	126
ST25C	123	ST504	128	SYL106	100	T60	100	T1167	121
ST28A	102	ST903	108	SYL107	102	T61	102	T1168	121
ST28B	102	ST904	108	SYL108	102	T72	102	T1202	100
ST28C	102	ST904A	108	SYL109	121	T74	102	T1203	100

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement	Type To Be Replaced	Sylvania ECG Replacement
T1224	126	T1904	100	T0-014	100	TC2484	108	T1482	128
T1225	126	T1961	100	T0-015	100	TCR13	122	T1483	128
T1232	100	T2015	126	T0-033	102	TCR18	122	T1484	123
T1233	100	T2016	126	T0-038	102	TCR23	122	T1485	108
T1250	126	T2017	126	T0-039	102	TCR28	122	T1492	123
T1251	100	T2019	126	T0-040	102	TCR1005	122	T1493	123
T1275	129	T2020	126	T0-041	102	TCR1505	122	T1494	123
T1276	129	T2021	126	T0-101	100	TCR2005	122	T1495	123
T1289	100	T2022	126	T0-102	100	TF30	102	T1496	123
T1291	100	T2024	126	T0-103	102	TF49	102	T13010	126
T1298	100	T2025	126	T0-104	102	TF65	126	T13011	126
T1299	100	T2026	126	TA-1	105	TF65M	102	T13012	121
T1300	102	T2028	126	TA-2	121	TF65/30	126	T13015	128
T1305	100	T2029	126	TA-3	105	TF66	102	T13016	108
T1306	100	T2030	126	TA-4	102	TF66/30	100	T13027	121
T1310	102	T2038	100	TA-5	126	TF66/60	100	T13028	121
T1312	100	T2039	100	TA-6	123	TF70	101	T13029	121
T1314	126	T2040	100	TA-7	108	TF71	101	T164213	128
T1322	100	T2091	100	TA1575	102	TF72	101	TIA01	102
T1326	100	T2122	100	TA1575B	100	TF75	102	TIA03	100
T1327	100	T2159	100	TA1614	121	TF77	102	TIA04	102
T1328	100	T2172	100	TA1620A	103	TF78	123	TIA05	100
T1334	100	T2173	100	TA1620B	103	TF78/30	100	TIP14	108
T1342	100	T2256	100	TA1628	126	TF78/30Z	121	TIS03	104
T1346	100	T2257	100	TA1650A	126	TF78/60	100	TIS04	105
T1352	102	T2258	100	TA1655B	100	TF80/30	121	TIS14	133
T1363	126	T2259	100	TA1658	126	TF80/302	121	TIS18	108
T1364	126	T2260	100	TA1659	126	TG48	102	TIS22	128
T1366	104	T2261	100	TA1660	126	T-H2SC313	108	TIS23	128
T1366A	104	T2322	126	TA1662	126	T-H2SC387	108	TIS24	108
T1367	104	T2323	126	TA1682	121	T-H2SC536	123	TIS34	132
T1367A	104	T2324	126	TA1682A	121	T-H2SC693	123	TIS37	129
T1368	104	T2357	106	TA1697	102	T-H2SC715	123	TIS38	129
T1368A	104	T2364	126	TA1704	100	TI338	126	TIS44	128
T1369	104	T2379	126	TA1705	121	TI363	100	TIS45	128
T1369A	104	T2384	126	TA1706	100	TI364	100	TIS46	128
T1370	104	T2439	100	TA1730	102	TI365	100	TIS47	128
T1370A	104	T2440	100	TA1731	126	TI366	104	TIS48	128
T1387	126	T2441	100	TA1755	126	TI366A	104	TIS49	128
T1388	126	T2446	123	TA1756	126	TI367	104	TIS51	128
T1389	126	T2788	100	TA1757	126	TI367A	104	TIS52	128
T1390	126	T2878	100	TA1759	101	TI368	104	TIS53	129
T1391	126	T2896	126	TA1763	100	TI368A	104	TIS54	129
T1400	126	T2945	126	TA1763A	100	TI369	104	TIS55	128
T1401	126	T2946	102	TA1765	121	TI369A	104	TIS56	128
T1403	126	T3005	100	TA1766	121	TI370	104	TIS57	128
T1415	123	T3321	102	TA1767	101	TI370A	104	TIS58	132
T1416	123	T3322	102	TA1771	101	TI387	126	TIS59	132
T1417	123	T50818	126	TA1772	101	TI388	126	TIS60	123
T1454	100	T6028	126	TA1773	121	TI389	126	TIS61	123
T1459	100	T6029	126	TA1778	100	TI390	126	TIS62	108
T1460	126	T6030	126	TA1782	100	TI391	126	TIS63	108
T1474	100	T6031	126	TA1783	100	TI393	100	TIS64	108
T1495	123	T6032	126	TA1794	121	TI395	100	TIS71	128
T1510	100	T10010	102	TA1796	126	TI396	100	TIS72	128
T1524BRN	126	T11618	100	TA1797	126	TI397	100	TIS83	128
T1524BRN/RED	126	T13000	102	TA1798	126	TI398	100	TIS84	108
T1546	102	T152148	100	TA1828	126	TI399	126	TIS85	108
T1548	126	T50339A	102	TA1829	126	TI400	126	TIX90	102
T1573	102	T50631	102	TA1830	126	TI401	126	TIX91	126
T1574	102	T50944	100	TA1846	126	TI402	126	TIX92	126
T1577	102	T52147	100	TA1847	126	TI403	126	TIX316	126
T1583	102	T52147Z	100	TA1860	126	TI407	108	TIX895	126
T1618	126	T52148Z	100	TA1861	126	TI408	108	TIX3016	108
T1642B	123	T52149	100	TA1881	121	TI409	108	TIX3016A	108
T1654	126	T52149Z	100	TA1890	121	TI410	108	TIX3024	100
T1654BLU	126	T52150	102	TA1891	121	TI411	108	TIX3032	100
T1657	126	T52150Z	102	TA1928A	127	TI415	123	TIXA01	100
T1690	126	T52151	102	TA2083	127	TI416	123	TIXA02	100
T1691	126	T52151Z	102	TA2188	127	TI417	108	TIXA03	100
T1692	126	T52159	102	TA2301	121	TI418	108	TIXA04	100
T1737	126	T59235A	123	TA2322	126	TI419	108	TIXA05	100
T1738	126	T59247	102	TA2503	108	TI420	128	TIXM01	126
T1740	102	T59249	102	TA2577A	130	TI422	128	TIXM02	126
T1788	126	T59276	123	TA6200	128	TI424	128	TIXM03	126
T1814	126	T59277	123	TAC047	123	TI430	128	TIXM04	126
T1831	126	T0-003	100	TC0914	108	TI431	108	TIXM05	126
T1877	100	T0-004	100	TC0918	108	TI432	128	TIXM06	126
T1902	100	T0-005	100	TC2369A	108	TI480	108	TIXM07	126
T1903	102	T0-012	100	TC2483	108	TI481	123	TIXM08	126

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
TIXM10	100
TIXM11	126
TIXM13	100
TIXM14	100
TIXM15	100
TIXM16	100
TIXM17	100
TIXM18	100
TIXM19	100
TIXM101	100
TIXM103	100
TIXM104	100
TIXM105	100
TIXM106	100
TIXM107	100
TIXM108	100
TIXM201	126
TIXM202	126
TIXM203	126
TIXM204	126
TIXM205	126
TIXM206	126
TIXM207	126
TIXS09	108
TIXS10	108
TIXS12	123
TIXS13	123
TIXS28	108
TIXS29	108
TIXS30	108
TISX31	108
TK23C	126
TK33C	101
TK40	102
TK40C	102
TK41	102
TK41C	126
TK42	102
TK42C	126
TK45C	126
TK49C	103
TMT696	108
TMT697	108
TMT839	108
TMT840	108
TMT841	108
TMT842	108
TMT843	108
TMT1543	123
TMT2427	108
TN53	128
TN55	128
TN56	128
TN59	128
TN60	128
TN61	128
TN62	128
TN63	128
TN64	128
TN237	128
TNJ60063	126
TNJ60064	126
TNJ60065	126
TNJ60066	108
TNJ60067	126
TNJ60068	126
TNJ60069	126
TNJ60070	102
TNJ60071	126
TNJ60073	126
TNJ60074	102
TNJ60075	127
TNJ60076	123
TNJ60077	126
TNJ60079	102
TNJ60080	102
TNJ60279	126
TNJ60280	126
TNJ60281	126
TNJ60282	102
TNJ60283	102
TNJ60362	126
TNJ60363	126
TNJ60364	126
TNJ60365	102
TNJ60604	108
TNJ60605	108
TNJ60606	108
TNJ60607	108
TNJ60608	100
TNJ60610	102
TNJ60611	102
TNJ60612	102
TNJ60728	102
TNT839	108
TNT840	108
TNT841	108
TNT843	108
TO-003	126
TO-004	126
TO-005	102
TO-012	121
TO-014	102
TO-015	121
TO-033	108
TO-038	108
TO-039	108
TO-040	108
TO-041	102
TO-101	102
TO-102	102
TO-103	102
TO-104	102
TQ1	128
TQ2	108
TQ3	108
TQ4	123
TQ5	108
TQ6	108
TQ7	108
TQ8	108
TQ9	108
TQ63	129
TQ63A	129
TQ64	129
TQ64A	129
TQ5020	100
TQ5021	126
TQ5022	126
TQ5023	102
TQ5025	102
TQ5026	102
TQ5027	102
TQ5028	121
TQ5031	101
TQ5032	101
TQ5034	126
TQ5035	126
TQ5036	121
TQ5038	125
TQ5039	101
TQ5049	108
TR01	121
TR-1R26	126
TR-1R35	108
TR02	104
TR-2R26	126
TR-2R35	108
TR03	105
TR-3R26	126
TR-3R35	108
TR-3R38	123
TR04	102
TR-4R26	126
TR-4R35	108
TR-4R38	129
TR05	102
TR-5R26	102
TR-5R35	123
TR-5R38	123
TR06	126
TR-6R26	102
TR-6R35	129
TR07	126
TR-7R35	123
TR08	101
TR-8R35	123
TR09	103
TR10	101
TR11	126
TR12	100
TR13	100
TR14	126
TR15	100
TR16	104
TR17	126
TR18	126
TR19	129
TR20	129
TR21	128
TR22	128
TR23	124
TR25	128
TR26	130
TR27	127
TR28	129
TR30	106
TR34	102
TR36	108
TR38	108
TR43	102
TR44	102
TR45	102
TR51	126
TR52	126
TR53	100
TR54	102
TR55	100
TR56	104
TR57	105
TR62	126
TR71	102
TR72	102
TR81	102
TR167	101
TR182	101
TR183	101
TR193	101
TR194	101
TR211	101
TR212	101
TR213	101
TR214	101
TR216	101
TR262-2	124
TR266-2	124
TR271TR26	130
TR320	102
TR320A	102
TR321	102
TR321 (HF6H1)	100
TR321A	102
TR323	126
TR323A	102
TR331	126
TR332	102
TR333	121
TR334	105
TR335	101
TR336	101
TR337	101
TR338	103
TR383 (H6FH-2)	102
TR482	100
TR482A	100
TR508	102
TR508A	102
TR650	102
TR653	100
TR721	102
TR722	102
TR760	126
TR761	126
TR762	126
TR763	102
TR1009	130
TR1490	130
TR1491	130
TR1492	130
TR1493	130
TR1512-80	108
TR1605LP	124
TR8001	126
TR8002	126
TR8003	126
TR8004	108
TR8005	124
TR8006	121
TR8007	102
TR310011	102
TR310012	102
TR310015	100
TR310017	102
TR310018	102
TR310019	126
TR310026	102
TR310065	126
TR310068	126
TR310069	126
TR310075	102
TR310107	102
TR310123	126
TR310124	126
TR310125	102
TR310136	102
TR310139	126
TR310147	126
TR310150	126
TR310153	102
TR310155	126
TR310156	126
TR310157	126
TR310158	126
TR310159	102
TR310160	103
TR310161	100
TR310164	102
TR310230	108
TR310231	108
TR310232	126
TR310235	102
TR310236	103
TRA-4	123
TRA-4A	123
TRA-4B	123
TRA-7R	121
TRA-7RM	121
TRA-8R	121
TRA-9R	123
TRA-10R	126
TRA-11R	126
TRA-12R	126
TRA-22	126
TRA-22A	126
TRA-22B	126
TRA-23	126
TRA-23A	126
TRA-23B	126
TRA-24	126
TRA-24A	126
TRA-24B	126
TRA32	102
TRA33	102
TRA34	123
TRA36	123
TRC44	100
TRC44A	100
TRC45	102
TRC45A	100
TRC70	102
TRC71	102
TRC72	102
TR-RR38	123
TRS1005	124
TRS1005LP	124
TRS1205	124
TRS1405	124
TRS1405LP	124
TRS1605	124
TRS1805	124
TRS1805LP	124
TRS2005	124
TRS2005LP	124
TRS2255	124
TRS2255LP	124
TRS2505	124
TRS2505LP	124
TRS2755	124
TRS2755LP	124
TRS3015LP	124
TRS3016LC	124
TRS4016LC	124
TRS5016LC	124
TRS6016LC	124
TR-TR38	123
TS-1	102
TS-2	102
TS-3	102
TS-13	102
TS-14	102
TS-15	102
TS-162	102
TS-163	102
TS-164	102
TS-165	102
TS-166	102
TS-173	121
TS-176	104
TS-601	100
TS-602	100
TS-603	102
TS-604	102
TS-609	105
TS-610	104
TS-612	104
TS-613	104
TS-614	104
TS-615	126
TS-616	100
TS-617	100
TS-618	100
TS-619	102
TS-620	126
TS-621	126
TS-627	102
TS-627A	100
TS-627B	100
TS-629	102
TS-630	100
TS-672A	100
TS-672B	100
TS-673A	100
TS-673B	100
TS-739	102
TS-739B	102
TS-740	102
TS-765	102
TS-1007	102
TS-1266	102
TS-1657	121
TS1727	102
TS1728	102
TT204	108
TT204A	108
TT204AB	108
TT204B	108
TT204C	108
TT1083	121
TT1097	123
TV2SB126	127

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECG Replacement
TV2SB448	127
TV15	108
TV15A	108
TV15B	108
TV16	108
TV17	108
TV18	108
TV19	128
TV20	108
TV44	100
TV115	108
TV116	108
TV1000	108
TV2403	108
TV2404	108
TV2455	126
TV24102	108
TV24137	126
TV24142	127
TV24143	103
TV24148	108
TV24152	100
TV24154	102
TV24156	102
TV24158	126
TV24160	108
TV24161	108
TV24162	127
TV24163	127
TV24166	126
TV24172	126
TV24189	102
TV24194	102
TV24229	126
TV24230	126
TV24239	126
TV24363	129
TV24372	108
TV24387	108
TV24453	128
TVS2SA71B	102
TVS2SA103	126
TVS2SA171	100
TVS2SA385	126
TVS2SA385A	126
TVS2SB126	121
TVS2SB171	102
TVS2SC208	108
TW135	106
TX100-1	123
TX100-2	123
TX100-3	124
TX100-4	128
TX100-5	124
TX101-8	124
TX101-9	128
TX101-11	124
TX101-12	123
TX102-1	123
TX102-2	123
TX102-4	124
TX103-1	104
TX104-3	102
TX106-1	102
TX107-1	123
TX107-3	123
TX107-4	123
TX107-5	123
TX107-6	123
TX107-10	123
TX107-12	123
TX107-13	124
TX108-1	123
TX111-1	124
TX112-1	123
TZ8	121
TZ10	102
U2N34	102
U2N96	102
U2N474A	123
U2S93	126
U2SB267	102
U2T85	103
U1177	133
U1178	133
U1180	133
U1181	133
U1285	133
U1322	133
U1323	133
U1324	133
U2848-1	123
U2091858-11	121
UBFY11	108
UC20	133
UC100	133
UC105	133
UC110	133
UC115	133
UC120	133
UC125	133
UC1100	106
UMT3202	124
UTRA-7RM	121
V6/2R	126
V6/2RC	100
V6/2RJ	126
V6/4R	126
V6/4RC	100
V6/4RJ	126
V6/8R	126
V6/8RJ	102
V6/RC	100
V10/1S	100
V10/1SJ	102
V10/2S	100
V10/2SJ	100
V10/15A	102
V10/30A	102
V10/50A	102
V13/11	100
V15/10DP	121
V15/20DP	121
V15/20R	126
V15/30DP	121
V30/10DP	121
V30/20DP	121
V60/10P	121
V60/20P	121
V60/30P	121
V120	126
V120PH	108
V120RH	128
V205	106
V220	123
V221	108
V222	123
V297	128
V405	108
V410	106
V435	108
VB-11	102
VD-13	102
VFG2745B	104
VFG-274513	104
VFL-2744K	126
VFP-2746C	104
VFP-6537C	121
VFQ-2745F	100
VFS5K	126
VFS-2745	100
VFS-2745J	100
VFT-2745H	102
VFU-2746B	121
VFW-27450	126
VFY-2745E	100
VL/8RJ	126
VM30203	121
VM30209	123
VM30233	124
VM30234	124
VM30241	123
VM30242	123
VM30244	102
VM30245	124
VS-CS1255H	128
VS-CS1256HG	129
VS2SA71	126
VS2SA71B	126
VS2SA103	126
VS2SA378	126
VS2SA379	126
VS2SA385	126
VS2SB126	127
VS2SB126F	127
VS2SB126V	127
VS2SB128V	127
VS2SB171	102
VS2SB172	102
VS2SB176	102
VS2SB178	102
VS2SB178A	102
VS2SB324	123
VS2SB448	127
VS2SC206	108
VS2SC208	108
VS2SC288A	108
VS2SC324H	123
VS2SC385L	126
VS2SC538	123
VS2SC563	108
VS2SC645	108
VS2SC645A	108
VS2SC684	108
VS2SC762	108
VSF2745	100
WC19862	103
WC19862A	102
WC19863	102
WC19864	102
WTV6-PWR	121
WTV12-PWR	121
WTV15MG	100
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1N527	109
1N530	117, 116
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1N542	109, 110
1N547	116, 117
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1N563	125
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1N604	116, 117
1N604A	116, 117
1N605	116, 117
1N605A	116, 117
1N606	117, 116
1N606A	117, 116
1N607	116, 117
1N607A	116, 117
1N608	116, 117
1N608A	116, 117

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Type To Be Replaced	Sylvania ECG Replacement
1N609	116, 117
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1N613	116, 117
1N613A	116, 117
1N614	116, 117
1N614A	116, 117
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1N631	109
1N632	109
1N636	109
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1N645	116, 117
1N645A	116, 117
1N645B	116, 117
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1N649	116, 117
1N658	116, 117
1N662	116, 117
1N663	116, 117
1N665	142
1N666	145
1N669	146
1N673	116, 117
1N675	137
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1N689	116, 117
1N695	109
1N695A	109
1N698	109
1N701	140
1N708	136
1N708A	136
1N709A	137
1N713	139
1N714	140
1N714A	140
1N716	142
1N716A	142
1N718	145
1N718A	145
1N724	146
1N724A	146
1N726	147
1N726A	147
1N733	149
1N733A	149
1N736	150
1N736A	150
1N739	151
1N739A	151
1N747	134
1N747A	134
1N752	136
1N752A	136
1N753	137
1N753A	137
1N757	139
1N757A	139
1N758	140
1N758A	140
1N759	142
1N759A	142
1N760	109
1N761	135
1N761A	135
1N761-2	135
1N765	142
1N765-1	100
1N766	143
1N766A	143
1N766-3	144
1N767-1	145
1N770	109
1N772A	109
1N773	109
1N773A	109
1N774	109
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1N776	109
1N777	109
1N781	109
1N788	109
1N805	109
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1N821	137
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1N825	137
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1N829	137
1N829A	137
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1N888	125
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1N941B	141
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1N945B	141
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1N960B	139
1N961	140
1N961A	140
1N961B	140
1N963	142
1N963A	142
1N963B	142
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1N965B	145
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1N971A	146
1N971B	146
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1N980A	149
1N980B	149
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1N983A	150
1N983B	150
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1N986A	151
1N986B	151
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1N1100	116, 117
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1N1104	116, 117
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1N1122A	116, 117
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1N1222A	117, 116
1N1222B	117, 116
1N1223	116, 117
1N1223A	116, 117
1N1223B	116, 117
1N1224	116, 117
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1N1225A	125
1N1225B	125
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1N1226A	125
1N1226B	125
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1N1260	125
1N1261	125
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1N1314	140
1N1314A	140
1N1315	142
1N1315A	142
1N1337-5	116, 117
1N1406	117, 116
1N1407	125
1N1408	125
1N1415	116, 117
1N1426	142
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1N1442	116, 117
1N1443	125
1N1443A	125
1N1485	137
1N1486	116, 117
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1N1492	117, 116
1N1509	136
1N1509A	136
1N1513	142
1N1513A	142
1N1514	145
1N1514A	145
1N1517	146
1N1517A	146
1N1520A	136
1N1524	142
1N1524A	142
1N1525	145
1N1525A	145
1N1528	146
1N1528A	146
1N1539	116, 117
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1N1730A	125
1N1735	137
1N1763	116, 117
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1N1764	116, 117
1N1764A	116, 117
1N1765	136
1N1765A	136
1N1766	137
1N1766A	137
1N1770	139
1N1770A	139
1N1773	142
1N1773A	142
1N1775	145
1N1775A	145
1N1781	146
1N1781A	146
1N1783	147
1N1783A	147

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Type To Be Replaced	Sylvania ECG Replacement
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1N1793A	150
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1N1796A	151
1N1820	136
1N1877	142
1N1877A	142
1N1878	145
1N1878A	145
1N1881	146
1N1881A	146
1N1882	147
1N1882A	147
1N1887	150
1N1887A	150
1N1907	116, 117
1N1908	116, 117
1N1909	116, 117
1N1910	116, 117
1N1911	116, 117
1N1912	116, 117
1N1913	116, 117
1N1914	125
1N1915	125
1N1916	125
1N1929	136
1N1929A	136
1N1929B	136
1N1932	140
1N1932A	140
1N1932B	140
1N1934	145
1N1934A	145
1N1934B	145
1N1937	146
1N1937A	146
1N1937B	146
1N1938	147
1N1938A	147
1N1938B	147
1N1943	150
1N1943A	150
1N1943B	150
1N1960	142
1N1960A	142
1N1960B	142
1N1964	146
1N1964A	146
1N1964B	146
1N1965	147
1N1965A	147
1N1965B	147
1N1983	136
1N1983A	136
1N1983B	136
1N1986	140
1N1986A	140
1N1986B	140
1N1988	145
1N1988A	145
1N1988B	145
1N1991	146
1N1991A	146
1N1991B	146
1N1992	147
1N1992A	147
1N1992B	147
1N2013	116, 117
1N2014	116, 117
1N2015	116, 117
1N2016	116, 117
1N2017	116, 117
1N2018	116, 117
1N2019	116, 117
1N2020	116, 117
1N2032	135
1N2036	116, 117
1N2037	143
1N2037-1	142
1N2037-3	144
1N2038-1	145
1N2041	135
1N2041-2	135
1N2046	143
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1N3019A	139
1N3019B	139
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1N3022A	142
1N3022B	142
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1N3024A	145
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1N3030B	146
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1N3032A	147
1N3032B	147
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1N3039A	149
1N3039B	149
1N3042	150
1N3042A	150
1N3042B	150
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1N3204	109
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1N3513	137
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1N3530	147
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1N3681	142
1N3681A	142
1N3681B	142
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1N3683B	145
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1N3704A	151
1N3704B	151
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1N3752	125
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1N3761	125
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1N3822	134
1N3826	135
1N3826A	135
1N3827	136
1N3827A	136
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1N4004	116, 117
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1N4007	125
1N4011	125
1N4043	116, 117
1N4044	147
1N4088	109
1N4089	116, 117
1N4095	135
1N4104	140
1N4108	144
1N4109	145

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Type To Be Replaced	Sylvania ECG Replacement
1N4118	146
1N4121	147
1N4129	149
1N4132	150
1N4161	139
1N4161A	139
1N4161B	139
1N4164	142
1N4164A	142
1N4164B	142
1N4166	145
1N4166A	145
1N4166B	145
1N4172	146
1N4172A	146
1N4172B	146
1N4174	147
1N4174A	147
1N4174B	147
1N4181	149
1N4181A	149
1N4181B	149
1N4184	150
1N4184A	150
1N4184B	150
1N4187	151
1N4187A	151
1N4187B	151
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1N4247	116, 117
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1N4250	125
1N4251	125
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1N4299A	141
1N4299B	141
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1N4300A	141
1N4300B	141
1N4303	141
1N4303A	141
1N4303B	141
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1N4304B	141
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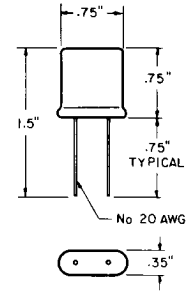
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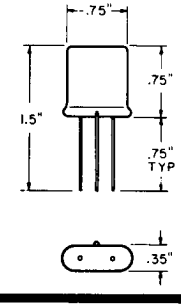
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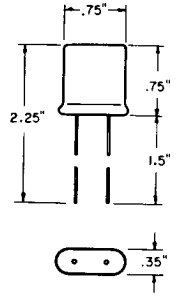
ECG 358
Color Oscillator



ECG 358A
Color Burst Filter



ECG 358B
Color Oscillator



CANADIAN RECEIVERS

replacement guide by Set Manufacturer

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SYLVANIA

GENERAL TELEPHONE & ELECTRONICS