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# technical manual



Receiving Tubes • Picture Tubes • ECG Semiconductors

# SYLVANIA

# SYLVANIA TECHNICAL MANUAL

FOURTEENTH EDITION

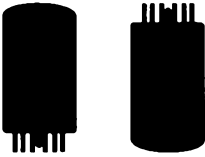
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SYLVANIA ELECTRONIC COMPONENTS

WALTHAM, MASS. 02154

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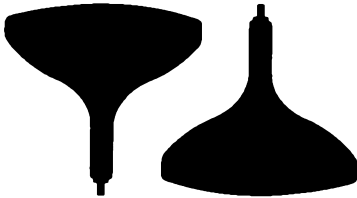
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## Introduction

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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6MU8	339	6Y9	362	8B8	397	9CG8A	450
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6S4A	340	7AK7	448	8CG7/8FQ7	134	9MHH3	450
6SA7	447	GB-7AK7	448	8CM7	141	9MN8	450
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9UBA	349	11BQ11	365	12AV6	75	12BZP4	510
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9VP4	508	11C5	418	12AW6	451	12C5/12CU5	148
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10ABP4B	508	11DS5	451	12AY3A	80	12CFP4	510
10ABP4C	508	11EP4	508	12AY7	452	12CHP4	510
10ADP4	508	11FP4	508	12AYPA	508	12CK3	137
10AEP4	508	11FY7	205	12AZ7A	385	12CL3	137
10AF11	51	11GP4	508	12AZP4	508	12CM6	140
10AL11	451	11HM7	376	12B3	452	12CN5	452
10ARP4	508	11HP4	508	12B4A	452	12DCP22	504
10BP4	508	11HP4A	508	12BA6	83	12CNP4	510
10BPA4	508	11JE8	272	12BA7	452	12CNPA4	510
10BP4C	508	11JP4	508	12BAP4	508	12CQP4	510
10BP4D	508	11KP4	508	12BD6	89	12CR6	452
10BQ5	110	11KV8	311	12BE3A	91	12CS6	145
10C8	451	11LQ8	326	12BE6	91	12CSP4	510
10CW5	150	11LT8	328	12BEP4	508	12CT8	452
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10DA7	451	11MS8	451	12BF11	92	12CU5	148
10DE7	157	11QP4	508	12BFP4	508	12CU6	111
10DR7	164	11RP4	508	12BGP4	508	12CVP4	510
10DX8	171	11SP22	504	12BH7A	386	12WHP4	510
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10EB8	177	11UP4	508	12BJP4	508	12CY6	452
10EG7	372	11WP22	504	12BK5	452	12CZP4	510
10EM7	183	11Y9	362	12BKP4	508	12D4	452
10EW7	191	11Y9/LFL200	362	12BL6	387	12DA4	155
10FD7	194	12A6	451	12BLP4	508	12DB5	452
10FP4	508	12A8GT	451	12BMP4	508	12DCP22	504
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10FR7	451	12AC6	451	12BNP4	508	12DEP4	510
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19AEP4	516	19DBP4	518	19FWP4	520	20HP4A	522
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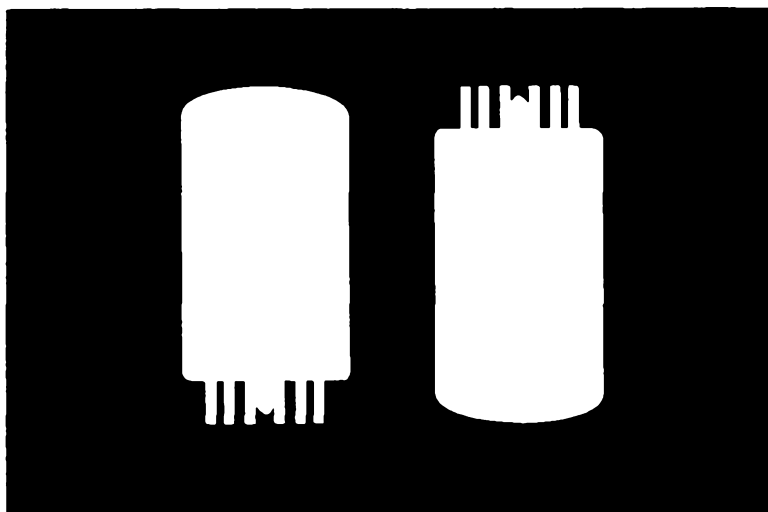


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6840	466	7308	469	7751	471	8446	473
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6853	466	7318	469	7759	471	8448	473
6854	466	7320	469	7760	471	8456	473
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6872	466	7355	469	7762	471	8532	473
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6939	467	7489	469	7868	472	EC88	443
6943	467	7490	469	7887	472	ECC81	380
6944	467	7492	469	7888	472	ECC82	382
6945	467	7494	469	7889	472	ECC83	384
6946	467	7495	469	7898	472	ECC85	65
6948	467	7496	469	7905	472	ECC189	186
6954	467	7498	469	7984	472	ECF80	104
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6968	467	7500	469	7995	472	ECF200	360
6973	427	7502	469	8056	472	ECF801	214
6977	467	7543	430	8058	472	ECF802	290
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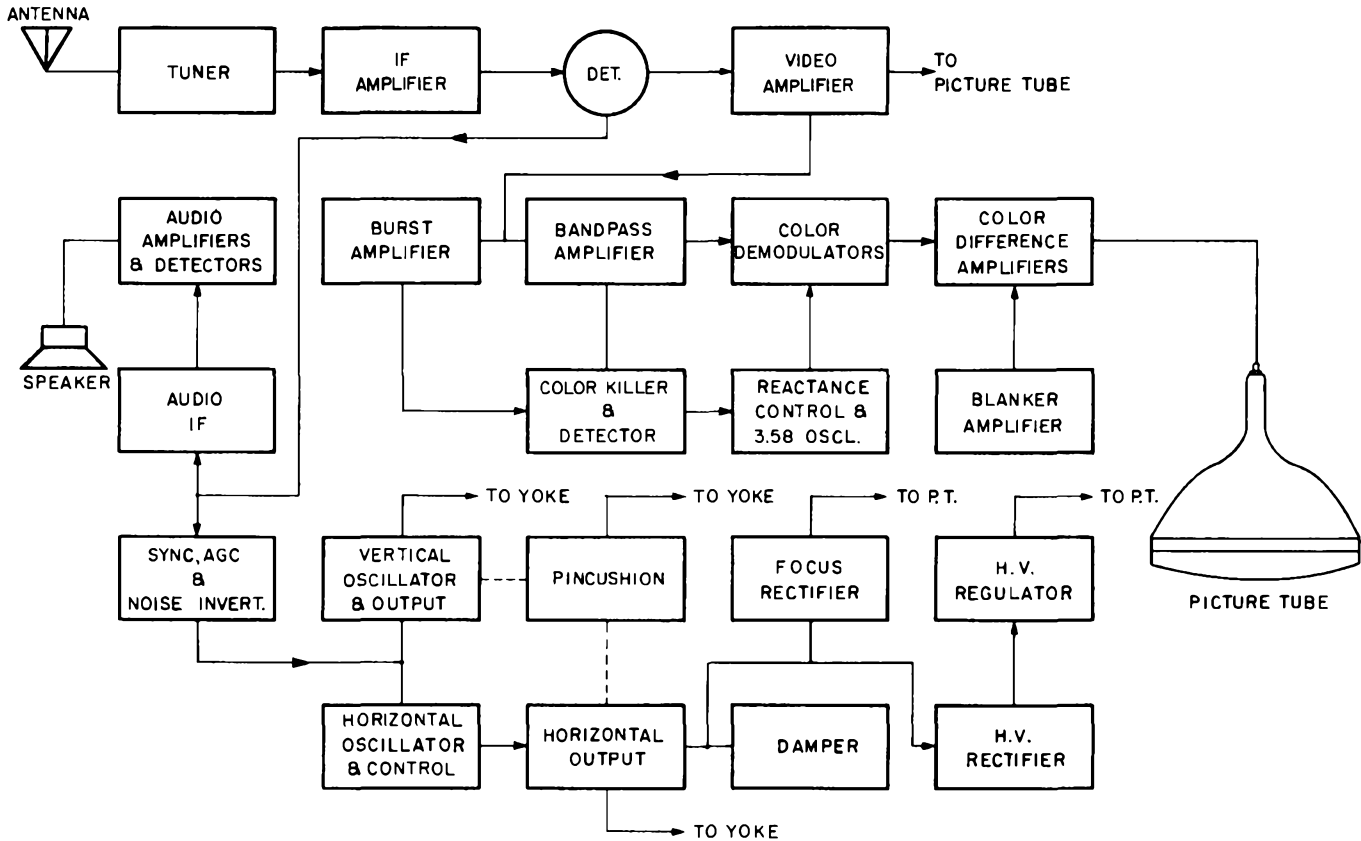
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# TYPICAL COLOR RECEIVER (simplified block diagram)



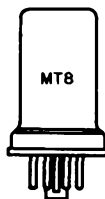
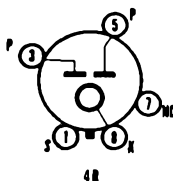
## FULL WAVE GAS RECTIFIER

# OZ4

OZ4A, OZ4G

### Cold Cathode Diode

Construction  
 OZ4, OZ4A.....Metal MT8  
 OZ4G.....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.



### ELECTRICAL DATA

#### HEATER OPERATION

Heater Voltage.....None Required

#### RATINGS (Design Center Rating System)

	OZ4, OZ4G	OZ4A
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

	OZ4, OZ4G	OZ4A
Peak Plate Voltage (Per Plate)	380	440 Volts
Filter Input Condenser	8	8 $\mu$ f
Total Effective Plate Supply Impedance (Per Plate)	800	600 Ohms
Voltage Drop for $I_b = 110$ Ma (Per Plate)	—	24 Volts
Voltage Drop for $I_b = 90$ Ma (Per Plate)	24	— Volts
DC Output Current	65	110 Ma
DC Output Voltage	275	310 Volts

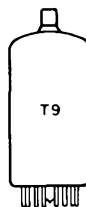
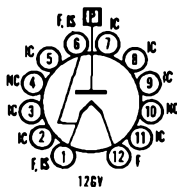
Color Television Type

## HIGH VOLTAGE RECTIFIER

# 1AD2

### Filamentary Diode

Construction.....Compactron T-9  
 Base.....Button 12 Pin, E12-70  
 Top Cap.....Small, C1-34  
 Basing<sup>(1)</sup>.....12GV  
 Outline  
 Maximum Diameter.....1.188 In.  
 Maximum Seated Height.....2.750 In.  
 Maximum Overall Height.....3.125 In.



### ELECTRICAL DATA

#### FILAMENT OPERATION

Filament Voltage<sup>(1)</sup>.....1.25 Volts  
 Filament Current.....200 Ma

#### DIRECT INTERELECTRODE CAPACITANCES

Plate to Filament.....1.6 Pf

#### RATINGS (Design Maximum Rating System)

##### Pulse Rectifier Service<sup>(2)</sup>

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  $I_b = 7.0$  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.

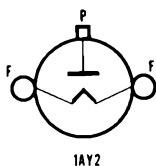
**X-RADIATION WARNING:** The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure 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.



### ELECTRICAL DATA

#### FILAMENT OPERATION

Filament Voltage<sup>(1)</sup> ..... 1.25 Volts  
 Filament Current ..... 200 Ma

#### DIRECT INTERELECTRODE CAPACITANCES

Plate to Filament ..... 1.4 Pf

#### RATINGS (Design Maximum Rating System)

**Pulse Rectifier Service<sup>(2)</sup>**  
 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  $I_b = 7 \text{ Ma}$  ..... 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.

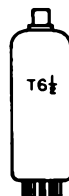
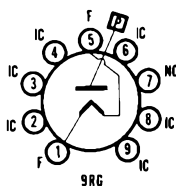
**X-RADIATION WARNING:** The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure 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<sup>(1)</sup> .....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 <sup>(1)</sup> .....	1.25 Volts
Filament Current .....	200 Ma

**DIRECT INTERELECTRODE CAPACITANCES**

Plate to Filament .....	1.0 Pf
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**RATINGS (Design Maximum Rating System)**

**Pulse Rectifier Service<sup>(2)</sup>**

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
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**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.

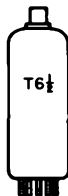
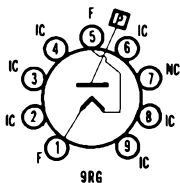
**X-RADIATION WARNING:** The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure 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 Solder 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 <sup>(1)</sup> .....	1.25 Volts
Filament Current .....	200 Ma

**DIRECT INTERELECTRODE CAPACITANCES**

Plate to Filament .....	1.0 Pf
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**RATINGS (Design Maximum Rating System)**

**Pulse Rectifier Service<sup>(2)</sup>**

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
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**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.

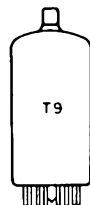
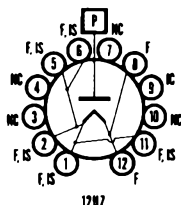
**X-RADIATION WARNING:** The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure 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 <sup>(2)</sup> .....	12HZ
Outline .....	9-98
Maximum Diameter .....	1.188 In.
Maximum Seated Height .....	2.750 In.
Maximum Overall Height .....	3.125 In.

**ELECTRICAL DATA****FILAMENT OPERATION**

Filament Voltage <sup>(1)</sup> .....	1.25 Volts
Filament Current .....	200 Ma

**DIRECT INTERELECTRODE CAPACITANCES**

Plate to Filament and Internal Shield .....	Without Shield 1.6 pf
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**RATINGS (Design Maximum Rating System)****Pulse Rectifier Service<sup>(2)</sup>**

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 $I_b = 7.0$ Ma .....	225 Volts
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**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.

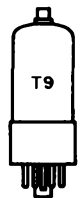
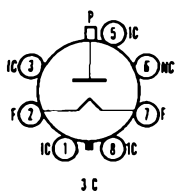


Color Television Type  
**HIGH VOLTAGE RECTIFIER**

**1G3GT/1B3GT**

**Filamentary Diode**

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



**ELECTRICAL DATA**

**FILAMENT OPERATION**

Filament Voltage<sup>(3)</sup> ..... 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<sup>(4)</sup>**

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.

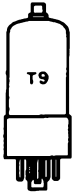
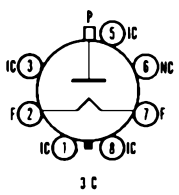
**X-RADIATION WARNING:** The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure 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<sup>(1)</sup> ..... B6-8 or B6-60  
 Top Cap ..... Small, C1-34  
 Basing<sup>(2)</sup> ..... 3C  
 Outline<sup>(3)</sup> ..... 9-53 or 9-54  
     Maximum Diameter ..... 1.188 In.  
     Maximum Seated Height ..... 3.000 In.  
     Maximum Overall Height ..... 3.562 In.



**ELECTRICAL DATA****FILAMENT OPERATION**

Filament Voltage <sup>(4)</sup> .....	1.25 Volts
Filament Current .....	200 Ma

**DIRECT INTERELECTRODE CAPACITANCES**

Plate to Filament and Internal Shield (Approx.) .....	1.6 Pf
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**RATINGS (Design Maximum Rating System)****Pulse Rectifier Service<sup>(5)</sup>**

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 $I_b = 7$ Ma (Approx.) .....	225 Volts
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**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.

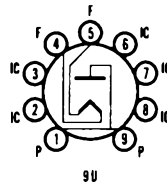
**X-RADIATION WARNING:** The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure 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 <sup>(1)</sup> .....	.9U
Outline .....	6-2
Maximum Diameter .....	0.875 In.
Maximum Seated Height .....	1.937 In.
Maximum Overall Height .....	2.187 In.

**ELECTRICAL DATA****FILAMENT OPERATION**

Filament Voltage <sup>(2)</sup> .....	0.625 Volts
Filament Current .....	300 Ma

**DIRECT INTERELECTRODE CAPACITANCES**

Plate to Filament (Approx.) .....	0.8 Pf
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**RATINGS (Design Maximum Rating System)****Pulse Rectifier Service<sup>(3)</sup>**

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 $I_b = 7$ Ma (Approx.) .....	135 Volts
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**NOTES:**

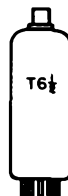
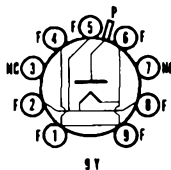
- (1) Socket terminals 2, 3, 7, and 8 shall not be used. Terminal 6 may be used as a tie point for components at or near filament potential.
- (2) Under no circumstances should the filament voltage be less than 0.525 volts or more than 0.725 volts.
- (3) For operation in a 525-line, 30-frame system as 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<sup>(1)</sup> ..... .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<sup>(2)</sup>**

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.

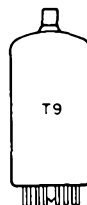
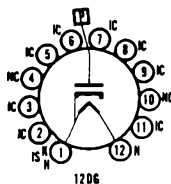
**X-RADIATION WARNING:** The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure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

**HIGH VOLTAGE RECTIFIER**

**2A42**

**Heater-Cathode Diode**

Construction ..... Compactron T-9  
 Base ..... Button 12 Pin, E12-70  
 Top Cap ..... Small, C1-34  
 Basing<sup>(1,2)</sup> ..... 12DG  
 Outline  
 Maximum Diameter ..... 1.188 In.  
 Maximum Seated Height ..... 3.000 In.  
 Maximum Overall Height ..... 3.375 In.



**ELECTRICAL DATA**

**HEATER OPERATION**

Heater Voltage<sup>(2)</sup> ..... 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<sup>(4)</sup>**

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:**

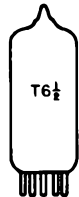
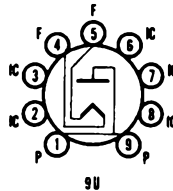
- (1) Pins designated Internal Connection (IC) may or may not have connections to internal elements depending on manufacturer. To maintain interchangeability do not use these pins for external connections.
- (2) Pins 4 and 10 may be used as tie points for components at or near filament potential.
- (3) 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.



**Filamentary Diode**

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



**ELECTRICAL DATA**

**FILAMENT OPERATION**

Filament Voltage<sup>(2)</sup> ..... 1.8 Volts  
 Filament Current ..... 225 Ma

**DIRECT INTERELECTRODE CAPACITANCES**

Plate to Filament ..... 0.8 Pf

**RATINGS (Design Maximum Rating System)**

**Pulse Rectifier Service<sup>(3)</sup>**

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

**NOTES:**

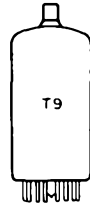
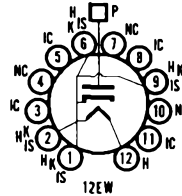
- (1) Socket terminals 2, 3, 7, and 8 shall not be used. Terminal 6 may be used as a tie point for components at or near filament potential.
- (2) Under no circumstances should the filament voltage be less than 1.53 volts or more than 2.07 volts.
- (3) For operation in a 525-line, 30-frame system as 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<sup>(1), (4)</sup> ..... 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<sup>(2)</sup>..... 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<sup>(3)</sup>**

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.

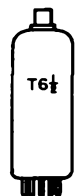
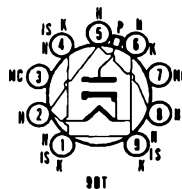
Color Television Type

**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 <sup>(1)</sup> .....	3.15 Volts
Heater Current .....	220 Ma

**DIRECT INTERELECTRODE CAPACITANCES**

Plate to Heater, Cathode, and Internal Shield .....	1.0 Pf
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**RATINGS (Design Maximum Rating System)**

**Pulse Rectifier Service<sup>(2)</sup>**

Peak Inverse Plate Voltage (Max.) .....	18,000 Volts
Peak Plate Current (Max.) .....	80 Ma
Average Plate Current (Max.).....	1.5 Ma

**NOTES:**

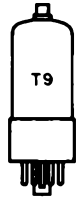
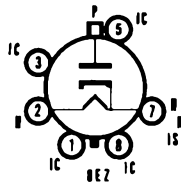
- (1) Under no circumstance should voltage fall below 2.65 volts or exceed 3.65 volts.
- (2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse 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.



**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 <sup>(1)</sup> .....	3.15 Volts
Heater Current .....	220 Ma

**DIRECT INTERELECTRODE CAPACITANCES**

Plate to Heater, Cathode, and Internal Shield.....	1.5 Pf
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**RATINGS (Design Maximum Rating System)**

**Pulse Rectifier Service<sup>(2)</sup>**

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
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**X-RADIATION CHARACTERISTIC**

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

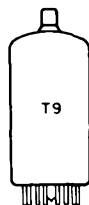
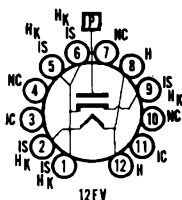
**X-RADIATION WARNING:** The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure 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<sup>(1)</sup>..... 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<sup>(2)</sup>**

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.

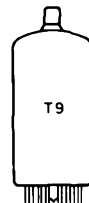
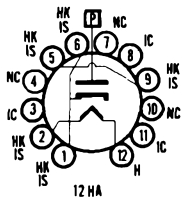
**X-RADIATION WARNING:** The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard with prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure 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<sup>(1)</sup>..... 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<sup>(2)</sup>**

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:**

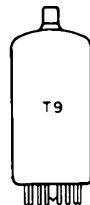
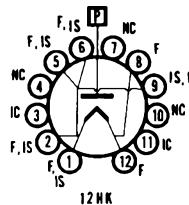
- (1) Under no circumstance should voltage fall below 2.65 volts or exceed 3.65 volts.
- (2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse 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.



**Filamentary Diode**

Construction..... Compactron T-9  
 Base ..... Button 12 Pin, E12-70  
 Top Cap ..... Small, C1-34  
 Basing<sup>(1,2,3,4)</sup> ..... 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<sup>(2)</sup>..... 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<sup>(4)</sup>**

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 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.

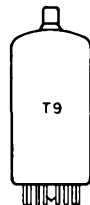
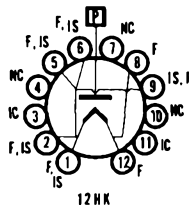
*Color Television Type*

**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<sup>(1),(2),(4)</sup> ..... 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<sup>(3)</sup>..... 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<sup>(4)</sup>**

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  $I_b = 7$  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.

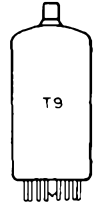
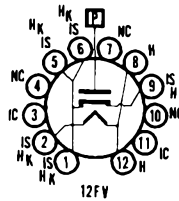
**X-RADIATION WARNING:** The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure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

**3BN2A**

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 <sup>(1)</sup> .....	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
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**RATINGS (Design Maximum Rating System)****Pulse Rectifier Service<sup>(2)</sup>**

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 $I_b = 7$ Ma .....	150 Volts
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**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.

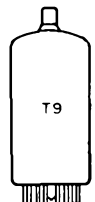
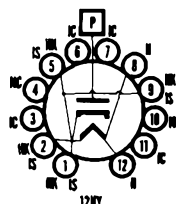
**X-RADIATION WARNING:** The high voltages associated with this tube type result in the production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Precautions must be exercised during the servicing of equipment to assure 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<sup>(2)</sup> ..... 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**

Plate to Heater, Cathode and Internal Shield .....	<b>Without Shield</b>
	1.6 pf

**RATINGS (Design Maximum Rating System)**

**Pulse Rectifier Service<sup>(1)</sup>**

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 $I_b = 7.0$ Ma .....	60 Volts
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**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**

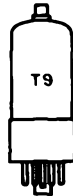
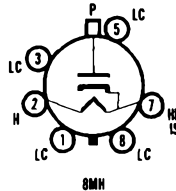
**3CA3**

**Heater-Cathode Diode**

Construction .....	Octal T-9
Base.....	Octal 6 Pin, B6-8 or B6-60
Top Cap .....	Small, C1-34
Basing <sup>(1)</sup> .....	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 <sup>(2)</sup> .....	3.6 Volts
Heater Current .....	225 Ma

**DIRECT INTERELECTRODE CAPACITANCES**

Plate Heater, Cathode, and Internal Shield .....	1.6 Pf
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**RATINGS (Design Maximum Rating System)**

**Pulse Rectifier Service<sup>(3)</sup>**

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 $I_b = 11$ Ma .....	100 Volts
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**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

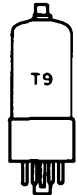
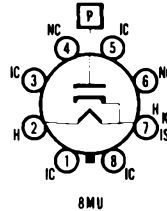
## Color Television Type HIGH VOLTAGE RECTIFIER

**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<sup>(1)</sup> ..... 8MU  
 Outline

Maximum Diameter ..... 1.281 In.  
 Maximum Seated Height ..... 3.250 In.  
 Maximum Overall Height ..... 3.812 In.



**ELECTRICAL DATA**

**HEATER OPERATION**

Heater Voltage <sup>(2)</sup> .....	2CN3B 1.8	3CN3A 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<sup>(3)</sup>**

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.

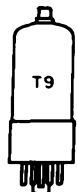
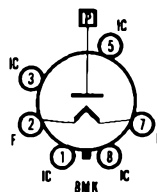
# 3CU3A

## 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<sup>(1), (2), (3)</sup> ..... 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**

Plate to Filament and Internal Shield.....	<b>Without Shield</b> 1.5 pf
--	---------------------------------

**RATINGS (Design Maximum Rating System)**

**Pulse Rectifier Service<sup>(4)</sup>**

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 $I_b = 7.0$ 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 1/4 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.

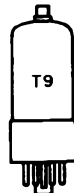
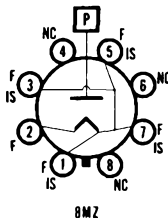
Color Television Type  
**HIGH VOLTAGE RECTIFIER**

**3DC3**

**Filamentary Diode**

Construction ..... Octal T-9  
 Base ..... B8-6, B8-58, B8-142, B8-251  
 Basing<sup>(2), (3)</sup> ..... 8MZ  
 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**

Plate to Filament and Internal Shield.....	<b>Without Shield</b> 1.5 pf
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**RATINGS (Design Maximum Rating System)**

**Pulse Rectifier Service<sup>(4)</sup>**

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 $I_b = 7.0$ Ma.	50 Volts
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**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:**

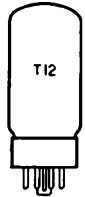
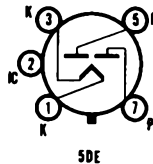
- (1) Good high voltage practice dictates that a minimum of 1/2 inch be maintained between the tube envelope and the filament and/or DC output leads.
- (2) Socket connections 4, 6 and 8 may be used as tie points.
- (3) Use Pin 7 as high voltage output connection.
- (4) For operation as a pulsed rectifier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



**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.



**ELECTRICAL DATA**

**FILAMENT OPERATION**

Filament Voltage	3.3 Volts
Filament Current	3800 Ma

**RATINGS (Design Maximum Rating System)**

**Rectifier Service<sup>(1)</sup>**

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**

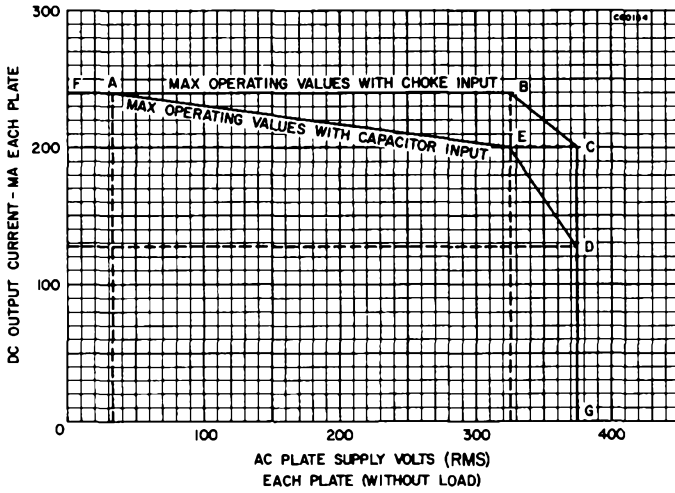
**Full Wave Rectifier—Capacitor Input Filter**

AC Plate Supply Voltage (Each Plate, RMS) <sup>(2)</sup>	275 Volts
Filter Input Capacitor	40 $\mu$ f
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 $I_b = 350$ 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)

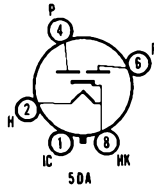


**FULL-WAVE POWER RECTIFIER**

**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<sup>(1)</sup>**

- 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) <sup>(2)</sup>	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**

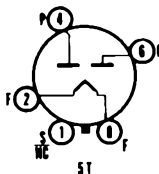
AC Plate Supply Voltage (Each Plate, RMS) <sup>(2)</sup>	300	350	400	450	500	550 Volts
DC Output Current.....	250	250	250	250	250	225 Ma
DC Output Voltage.....	250	290	330	375	420	465 Volts
Limiting Resistor (Per Plate).....	0	0	0	0	0	0 Ohm
Filter Input Choke.....	10	10	10	10	10	10 Henrys

**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<sup>(1)</sup>.....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<sup>(2)</sup>**

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)<sup>(3)</sup> ..... 300 450 Volts  
 Filter Input Capacitor ..... 40 40  $\mu$ f  
 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**

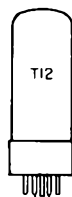
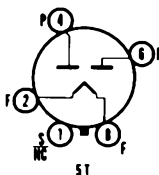
AC Plate Supply Voltage (Each Plate, RMS)<sup>(3)</sup> ..... 550 Volts  
 Filter Input Choke ..... 10 Henrys  
 DC Output Current ..... 275 Ma  
 DC Output Voltage at Filter Input ..... 420 Volts  
 Tube Voltage Drop for  $I_b = 275$  Ma (Each Plate) ..... 50 Volts  
 300 Ma (Each Plate) ..... 54 Volts

**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<sup>(1)</sup>.....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<sup>(2)</sup>**

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.) <sup>(3)</sup> .....	525 Ma

**CHARACTERISTICS AND TYPICAL OPERATION**

**Full-Wave Rectifier—Capacitor Input Filter**

AC Plate Supply Voltage (Each Plate, RMS) <sup>(4)</sup> .....	300	400 Volts
Filter Input Capacitor .....	40	40 $\mu$ f
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) <sup>(4)</sup> .....		500 Volts
Filter Input Choke .....		10 Henrys
DC Output Current .....		325 Ma
DC Output Voltage at Filter Input .....		395 Volts
Tube Voltage Drop for $I_b = 350$ 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.

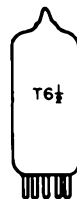
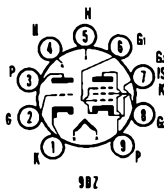
Color Television Type

**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 <sup>(1)</sup>		
Fixed Bias (Max.) .....	0.5	0.25 Megohms
Cathode Bias (Max.) .....	1.0	1.0 Megohms

**CHARACTERISTICS AND TYPICAL OPERATION**

	<b>Triode Section</b>	<b>Pentode Section</b>
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 $\mu$ mhos
Amplification Factor .....	21	—
Plate Resistance (Approx.) .....	4700	170,000 Ohms
E <sub>c1</sub> for I <sub>b</sub> = 20 $\mu$ a (Approx.).....	-17	-6 Volts
I <sub>b</sub> with E <sub>c1</sub> = -3 Volts, R <sub>K</sub> = 0 .....	—	1.6 Ma

**NOTE:**

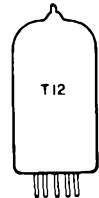
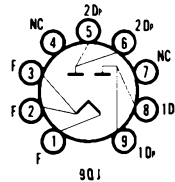
(1) If either section is operating at maximum rated conditions, the grid No. 1 circuit resistance for both sections should not exceed the stated values.



**Filamentary Twin Diode**

Construction .....Novar T-12  
 Base .....Large Button 9-Pin, E9-76  
 Basing<sup>(1,2)</sup> .....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<sup>(3)</sup>**

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) <sup>(4)</sup> .....	300	450	550 Volts
Filter Input Capacitor .....	40	40	40 $\mu$ f
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

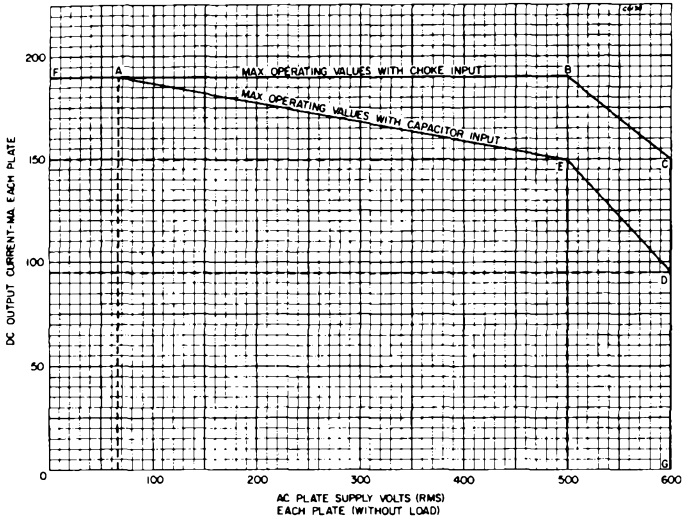
**Full-Wave Rectifier—Choke Input Filter**

AC Plate Supply Voltage			
(Each Plate, RMS) <sup>(4)</sup> .....		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 I <sub>b</sub> = 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)**

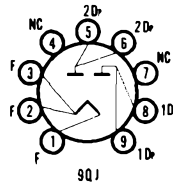


**FULL-WAVE POWER RECTIFIER**

**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.

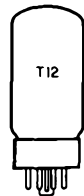
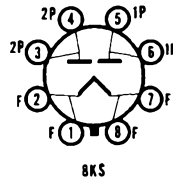


**FULL-WAVE POWER RECTIFIER**

**5DJ4**

**Filamentary Twin Diode**

Construction .....Octal T-12  
 Base .....Octal 8 Pin, B8-118  
 Basing<sup>(1)</sup> .....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.....  
 Filament Current .....

5.0 Volts  
 3000 Ma

**RATINGS (Design Maximum Rating System)**

**Rectifier Service<sup>(2)</sup>**

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) <sup>(3)</sup> .....	300	450 Volts
Filter Input Capacitor.....	40	40 $\mu$ f
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) <sup>(3)</sup> .....		550 Volts
Filter Input Choke .....		10 Henrys
DC Output Current.....		275 Ma
DC Output Voltage at Filter Input .....		420 Volts
Tube Voltage Drop for $I_b = 225$ Ma (Each Plate) .....		44 Volts
275 Ma (Each Plate) .....		50 Volts
300 Ma (Each Plate) .....		54 Volts

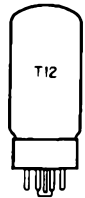
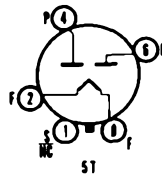
**NOTES:**

- (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.



**Filamentary Twin Diode**

Construction .....	Octal T-12
Base .....	B5-121, B5-127 or B8-118
Basing <sup>(1)</sup> .....	.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<sup>(2)</sup>**

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) <sup>(2)</sup> .....	300	450 Volts
Filter Input Capacitor.....	40	40 $\mu$ f
Effective Plate-Supply Resistance (Each Plate) .....	21	67 Ohms
DC Output Current.....	300	275 Ma
DC Output Voltage at Filter Input.....	290	460 Volts

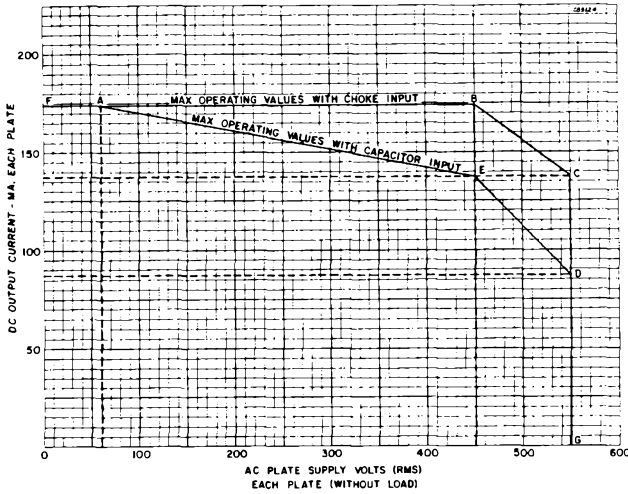
**Full-Wave Rectifier—Choke Input Filter**

AC Plate Supply Voltage (Each Plate, RMS) <sup>(2)</sup> .....		550 Volts
Filter Input Choke .....		10 Henrys
DC Output Current.....		275 Ma
DC Output Voltage at Filter Input.....		420 Volts
Tube Voltage Drop for $I_b = 225$ 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)

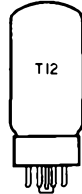
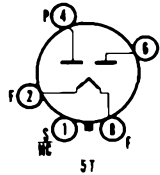


Color Television Type  
**FULL-WAVE POWER RECTIFIER**

**5V3A**

**Filamentary Twin Diode**

- Construction ..... Octal T-12
- Base ..... B8-110, B5-121 or B8-118
- Basing<sup>(1)</sup> ..... 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 Maximum Rating System)**

**Rectifier Service<sup>(2)</sup>**

- 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)<sup>(3)</sup> ..... 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

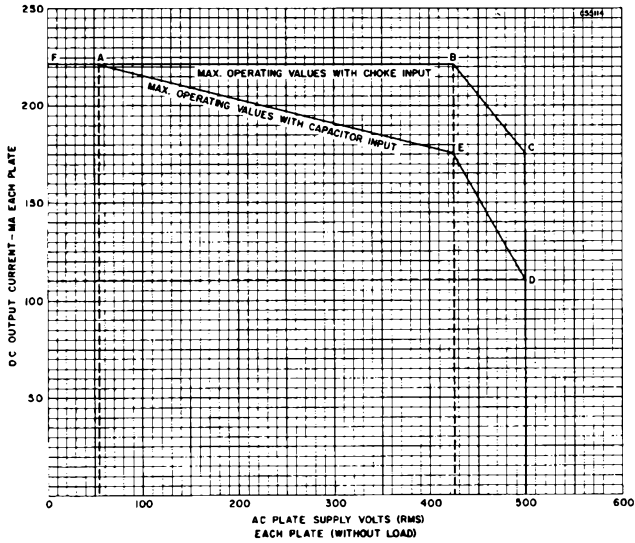
**Full-Wave Rectifier—Choke Input Filter**

- AC Plate Supply Voltage (Each Plate RMS)<sup>(3)</sup> ..... 500 Volts
- Filter Input Choke ..... 10 Henrys
- DC Output Current ..... 350 Ma
- DC Output Voltage at Filter Input ..... 390 Volts
- Tube Voltage Drop for I<sub>b</sub> = 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)**

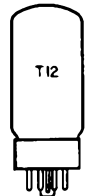
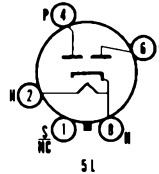


**5V4GA**

**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

- Heater Voltage.....5.0 Volts
- Heater Current .....2000 Ma

**RATINGS (Design Maximum Rating System)**

**Rectifier Service<sup>(1)</sup>**

- 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)<sup>(2)</sup> .....375 Volts
- Filter Input Capacitor.....10  $\mu$ f
- 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)<sup>(2)</sup> .....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  $I_b = 175$  Ma (Each Plate) .....25 Volts

**NOTES:**

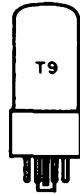
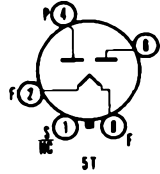
- (1) For use with sinusoidal supply voltages within the frequency range of 25 to 1000 Hertz.
- (2) AC plate voltage is measured without load.

Color Television Type  
**FULL-WAVE POWER RECTIFIER**

**5Y3GT**

**Filamentary Twin Diode**

Construction .....Octal T-9  
 Base .....5 Pin, B5-10 or B5-62  
 Basing<sup>(1)</sup> .....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<sup>(2)</sup>**

Peak Inverse Plate Voltage (Max.) ..... 1400 Volts  
 AC Plate Supply Voltage (Each Plate) (Max.)<sup>(2)</sup> ..... 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  $I_b = 125$  Ma (Each Plate) ..... 60 Volts

**CHARACTERISTICS AND TYPICAL OPERATION**

**Full-Wave Rectifier Service—Capacitor Input Filter**

AC Plate Supply Voltage (Each Plate RMS)<sup>(2)</sup> ..... 350 Volts  
 Input Capacitor ..... 10  $\mu$ f  
 Effective Plate Supply Impedance (Each Plate) ..... 50 Ohms  
 DC Output Current ..... 125 Ma  
 DC Output Voltage ..... 350 Volts

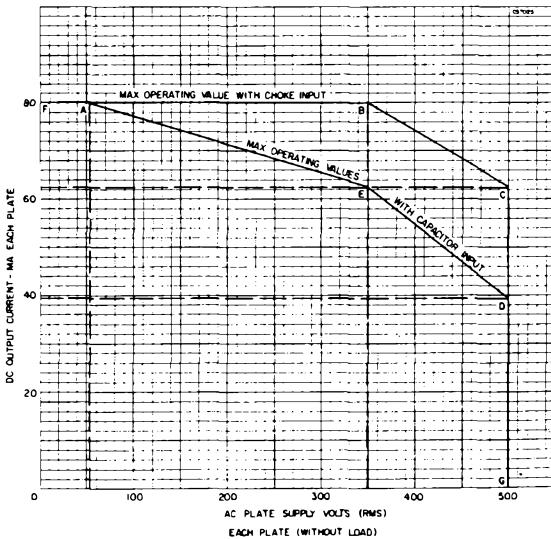
**Full-Wave Rectifier Service—Choke Input Filter**

AC Plate Supply Voltage (Each Plate RMS)<sup>(2)</sup> ..... 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
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**CHARACTERISTICS AND TYPICAL OPERATION**

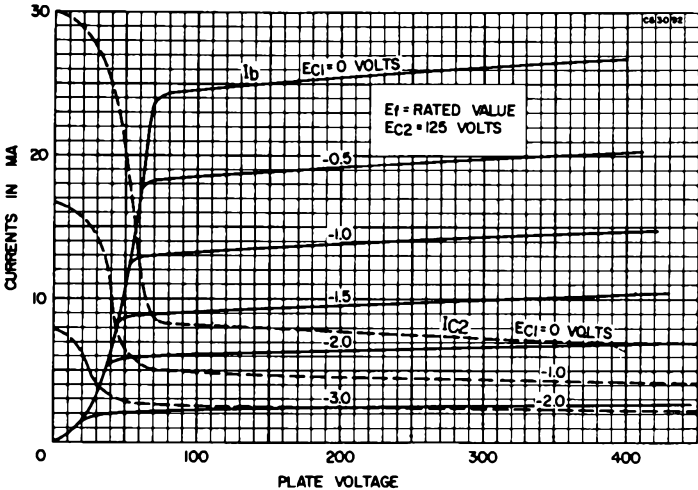
**Pentode Section**

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 $\mu$ mhos
Plate Resistance (Approx.) .....	150,000 Ohms
Grid No. 1 Voltage for $I_b = 20 \mu$ a (Approx.) .....	-7 Volts

**Diode Section (Each Diode)**

Tube Voltage Drop for $I_b = 50$ Ma .....	10 Volts
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**AVERAGE PLATE CHARACTERISTICS**



**6AC10**  
8AC10

Color Television Type  
**COLOR MATRIX AMPLIFIER**

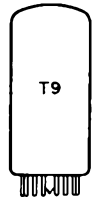
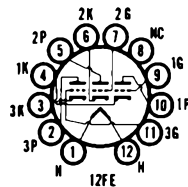
**Medium Mu Triple Triode**

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**

Heater Voltage .....	8.4
Heater Current .....	450
Heater Warm-up Time .....	11



**8AC10 Series**

**6AC10 Parallel**

**6AC10 Series**

6.3 $\pm$ 0.6	6.3 Volts
0.6	600 Ma
—	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 $\mu$ mhos
Plate Current .....	9.0 Ma
Grid Voltage for $I_b = 100 \mu$ a .....	-5 Volts

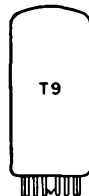
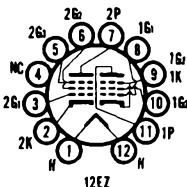
Color Television Type

**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 + 1S) .....		11.0 Pt
Output: p to (h + 1k + 1g2 + 1g3 + 1S) .....		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 + 1S) .....		8.0 Pf
Grid No. 3 to (h + 2k + 2g1 + 2g2 + 2p + 1S) .....		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
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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 $\mu$ mhos
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

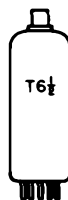
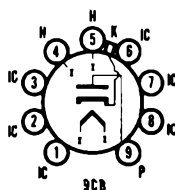
**Section No. 2 (FM Detector)**

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 $\mu$ mhos
Transconductance (G3) .....	600 $\mu$ mhos
Plate Current .....	2.8 Ma
Screen Current .....	3.4 Ma
Ec1 for Ib = 20 $\mu$ a .....	-4.5 Volts
Ec3 for Ib = 20 $\mu$ a .....	-7 Volts



**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>12AF3 Series</b>	<b>6AF3 Parallel</b>
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.) <sup>(1)</sup> .....	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
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**NOTE:**

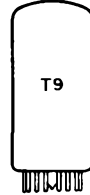
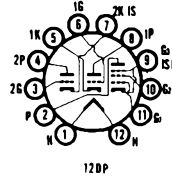
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

**AGC KEYSER, 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**

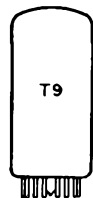
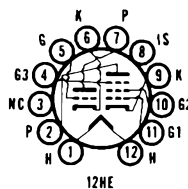
Plate Voltage (Max.) .....	330 Volts
Positive DC Grid Voltage (Max.) .....	0 Volt
Plate Dissipation (Max.) .....	2.0 Watts

Grid Circuit Resistance		
Fixed Bias (Max.)	.....	0.5 Megohm
Cathode Bias (Max.)	.....	1.0 Megohm
<b>Pentode</b>		
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
<b>CHARACTERISTICS AND TYPICAL OPERATION</b>		
<b>Triode No. 1</b>		
Plate Voltage	.....	200 Volts
Grid Voltage	.....	-2.0 Volts
Amplification Factor	.....	68
Plate Resistance (Approx.)	.....	12,400 Ohms
Transconductance	.....	5500 $\mu$ mhos
Plate Current	.....	7.0 Ma
Grid Voltage (Approx.)	.....	-5.5 Volts
I <sub>b</sub> = 10 $\mu$ a	.....	
<b>Triode No. 2</b>		
Plate Voltage	.....	200 Volts
Cathode-Bias Resistor	.....	220 Ohms
Amplification Factor	.....	41
Plate Resistance (Approx.)	.....	9400 Ohms
Transconductance	.....	4400 $\mu$ mhos
Plate Current	.....	9.2 Ma
Grid Voltage (Approx.)	.....	-6.5 Volts
I <sub>b</sub> = 10 $\mu$ a	.....	
<b>Pentode Section</b>		
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 $\mu$ mhos
Plate Current	55	24 Ma
Screen Current	18	4.8 Ma
Grid No. 1 Voltage (Approx.)	—	-10 Volts
I <sub>b</sub> = 100 $\mu$ a	.....	



**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.



**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)**

<b>Triode</b>		
Grid to Plate	.....	2.8 Pf
Input: T <sub>g</sub> to (h + T <sub>k</sub> + IS)	.....	3.6 Pf
Output: T <sub>p</sub> to (h + T <sub>k</sub> + 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)**

	<b>Pentode Section</b>	<b>Triode Section</b>
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**

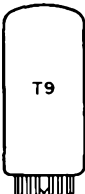
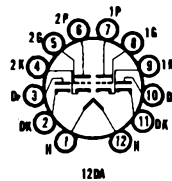
	<b>Pentode Section</b>	<b>Triode Section</b>
Plate Voltage .....	55 250	150 Volts
Screen Voltage .....	125 150	— Volts
Grid No. 1 Voltage .....	0 —	— Volt
Cathode-Bias Resistor .....	— 56	350 Ohms
Amplification Factor .....	— —	39
Plate Resistance (Approx.) .....	— 40,000	8500 Ohms
Transconductance .....	— 30,000	4600 $\mu$ mhos
Plate Current .....	56 28	6.2 Ma
Screen Current .....	21 5.6	— Ma
Grid No. 1 Voltage (Approx.)		
Ib = 20 $\mu$ a .....	— —	-7 Volts
Grid No. 1 Voltage (Approx.)		
Ib = 100 $\mu$ a .....	— -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**

	<b>30AG11 Series</b>	<b>6AG11 Parallel</b>
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)**

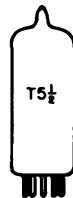
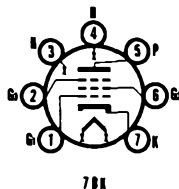
Plate to Cathode and Heater.....	2.2 Pf
Cathode to Plate and Heater.....	5.5 Pf

<b>Coupling</b>	
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
<b>RATINGS (Design Maximum Rating System)</b>	
<b>Triode (Each Section)</b>	
Plate Voltage (Max.) .....	330 Volts
Plate Dissipation (Max.) .....	2.0 Watts
<b>Diode (Each Section)</b>	
Diode Current (Continuous Operation) (Max.) .....	5.0 Ma
<b>CHARACTERISTICS AND TYPICAL OPERATION</b>	
<b>Triode (Each Section)</b>	
Plate Voltage .....	125 Volts
Grid Voltage .....	-1.0 Volt
Amplification Factor .....	66
Plate Resistance.....	8500 Ohms
Transconductance .....	7800 $\mu$ mhos
Plate Current .....	7.5 Ma
Grid Voltage for $I_b = 30 \mu a$ .....	-5 Volts
<b>Diode (Each Section)</b>	
Average Diode Current for $E_b = 5$ Volts .....	18 Ma



**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 .....	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: $g_1$ to $(h + k + g_2 + g_3)$ .....	10 Pf
Output: $p$ to $(h + k + g_2 + g_3)$ .....	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**

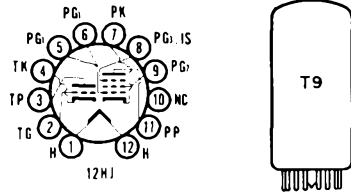
	<b>Triode Conn.</b>	<b>Pentode Conn.</b>
Plate Voltage .....	150	300 Volts
Grid No. 3 Voltage .....	Connected to Cathode at Socket	
Grid No. 2 Voltage .....	—	150 Volts
Cathode Bias Resistor .....	160	160 Ohms
Plate Current .....	12.5	10 Ma
Grid No. 2 Current .....	—	2.5 Ma
Transconductance .....	11,000	9000 $\mu$ mhos
Amplification Factor .....	40	—
Plate Resistance (Approx.) .....	3600	500K Ohms
$E_{c1}$ for $I_b = 10 \mu a$ (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**

	<b>9AH9</b>	<b>6AH9</b>
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)**

	<b>Triode Section</b>	<b>Pentode Section</b>
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**

	<b>Triode Section</b>	<b>Pentode Section</b>	
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 <sup>(1)</sup> 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:**

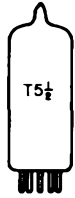
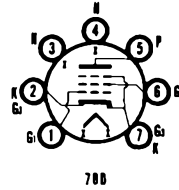
(1) Current drawn only for short intervals so as not to damage the tube.

# 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.



**ELECTRICAL DATA**

**HEATER OPERATION**

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

**DIRECT INTERELECTRODE CAPACITANCES**

	Shielded <sup>(1)</sup>	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 <sup>(2)</sup> .....	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

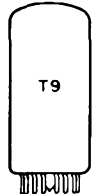
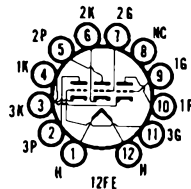
9AK10

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.



**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)**

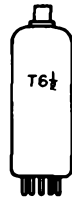
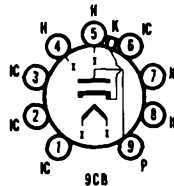
Plate Voltage .....	200 Volts
Plate Current .....	10 Ma
Amplification Factor .....	53
Plate Resistance (Approx.) .....	7500 Ohms
Transconductance .....	7000 $\mu$ mhos
E <sub>c1</sub> for I <sub>b</sub> = 100 $\mu$ a .....	-7 Volts

**DAMPER**

**6AL3/EY88**

**Heater-Cathode Diode**

Construction .....	Miniature T-6½
Base .....	E9-1
Top Cap .....	C1-2
Basing .....	9CB
Outline .....	.6-1.01
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<sup>(1)</sup>**

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

**NOTE:**

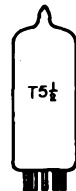
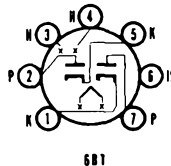
(1) For operation in a 525-line, 30-frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission." The duty cycle of the voltage pulse not to exceed 15% of a horizontal scanning cycle.

*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**

	<b>3AL5</b>	<b>6AL5</b>	<b>12AL5</b>
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**

	<b>Shielded (1)</b>	<b>Unshielded</b>
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
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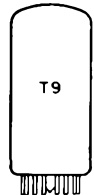
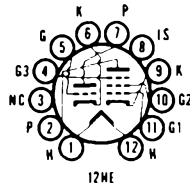
**NOTE:**

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



**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>6AL9</b>	<b>8AL9</b>
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)**

	<b>Triode Section</b>	<b>Pentode Section</b>
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**

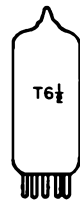
	<b>Triode Section</b>	<b>Pentode Section</b>
Plate Voltage .....	200	55 250 Volts
Grid No. 1 Voltage .....	—	0 — Volt
Grid No. 2 Voltage .....	—	125 150 Volts
Cathode Bias Resistor .....	270	— 56 Ohms
Plate Current .....	7.6	56 28 Ma
Grid No. 2 Current .....	—	21 5.6 Ma
Transconductance .....	6300	— 30,000 $\mu$ mhos
Amplification Factor .....	59	—
Plate Resistance (Approx.) .....	9200	— 40,000 Ohms
Ec1 for Ib = 100 $\mu$ a (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**

	<b>5AM8 Series</b>	<b>6AM8A Parallel</b>
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)<sup>(1)</sup>**

	<b>Pentode</b>
Grid to Plate (Max.).....	0.015 Pf
Input .....	6.0 Pf
Output .....	3.4 Pf
<b>Diode</b>	
Input: p to (h + k).....	2.3 Pf
Cathode to (h + p) .....	3.0 Pf
<b>Coupling</b>	
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)**

	<b>Pentode</b>
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
<b>Diode</b>	
Diode Current for Continuous Operation (Max.) .....	5.0 Ma

**CHARACTERISTICS AND TYPICAL OPERATION**

	<b>Pentode</b>
Plate Voltage .....	125 Volts
Grid No. 2 Voltage .....	125 Volts
Cathode Resistor .....	56 Ohms

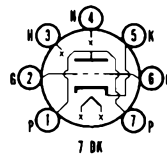
Plate Current .....	12.5 Ma
Grid No. 2 Current .....	3.2 Ma
Transconductance .....	7800 $\mu$ mhos
Plate Resistance (Approx.) .....	0.3 Megohm
Grid No. 1 Voltage for $I_b = 20 \mu$ a .....	-6 Volts
$I_b$ at $E_{c1} = -3$ Volts, $R_k = 0$ .....	2.0 Ma
<b>Diode</b>	
Diode Plate Voltage for Diode Current of 50 Ma <sup>(2)</sup> .....	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.

**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 <sup>(1)</sup>	Unshielded
Grid to Plate .....	1.7	1.7 Pf
Input .....	3.3	2.9 Pf
Output .....	1.8	0.25 Pf
Heater to Cathode <sup>(2)</sup> .....	2.9	3.0 Pf
Grid to Cathode <sup>(2)</sup> .....	2.6	2.6 Pf
Plate to Cathode <sup>(2)</sup> .....	0.18	0.20 Pf
<b>Grounded Grid Operation</b>		
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 $\mu$ mhos
Amplification Factor .....	70
Grid Voltage for $I_b = 20 \mu$ a .....	-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 $\mu$ mhos

**NOTES:**

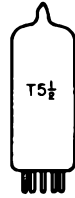
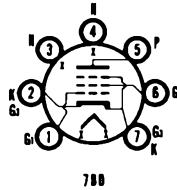
- (1) Shield No. 316.
- (2) Measured between specified elements only. When external shield is used, it shall be grounded.

# 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 .....  
 Heater Current .....  
 Maximum Heater-Cathode Voltage .....

6.3 Volts  
 450 Ma  
 90 Volts

**DIRECT INTERELECTRODE CAPACITANCES**

Grid No. 1 to Plate .....  
 Input .....  
 Output .....

0.075 Pf  
 9.0 Pf  
 4.8 Pf

**RATINGS (Design Center Rating System)**

Plate Voltage (Max.) ..... 120  
 Grid No. 2 Voltage (Max.) ..... 120  
 Cathode Current (Max.) ..... 50  
 Plate Dissipation (Max.) ..... 4.2  
 Grid No. 2 Dissipation (Max.) ..... 1.4  
 Grid No. 1 Circuit Resistance  
     Fixed Bias (Max.) ..... 0.1  
     Cathode Bias (Max.) ..... 0.1

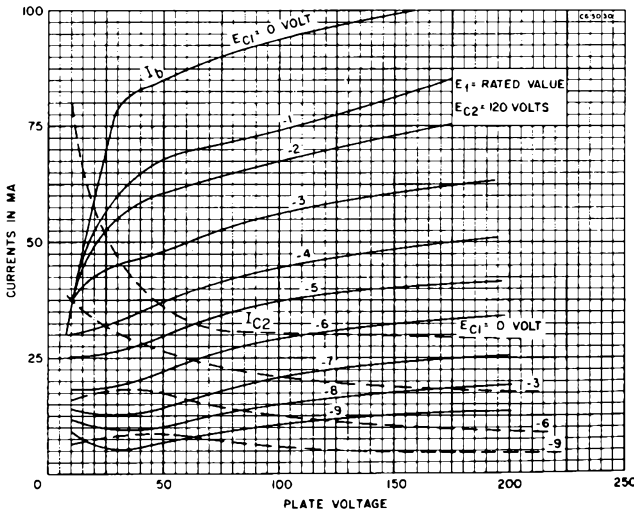
300 Volts  
 300 Volts  
 20 Ma  
 1.7 Watts  
 0.56 Watts  
 0.1 Megohm  
 0.1 Megohm

**CHARACTERISTICS AND TYPICAL OPERATION**

Plate Voltage .....  
 Grid No. 2 Voltage .....  
 Cathode Resistor .....  
 Plate Current .....  
 Grid No. 2 Current .....  
 Plate Resistance .....  
 Transconductance .....  
 Load Resistance .....  
 Power Output (Approx.) .....  
 Plate Current for  $I_b = 1$  Ma .....

120 Volts  
 120 Volts  
 120 Ohms  
 35 Ma  
 12 Ma  
 12,500 Ohms  
 8000  $\mu$ mhos  
 2500 Ohms  
 1.3 Watts  
 -20 Volts

**AVERAGE PLATE CHARACTERISTICS**



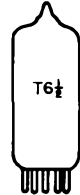
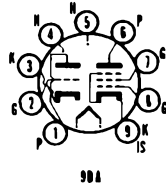
**6AN8A**

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 <sup>(1)</sup>		
Fixed Bias (Max.) .....	0.5	0.25 Megohm
Cathode Bias (Max.) .....	1.0	1.0 Megohm

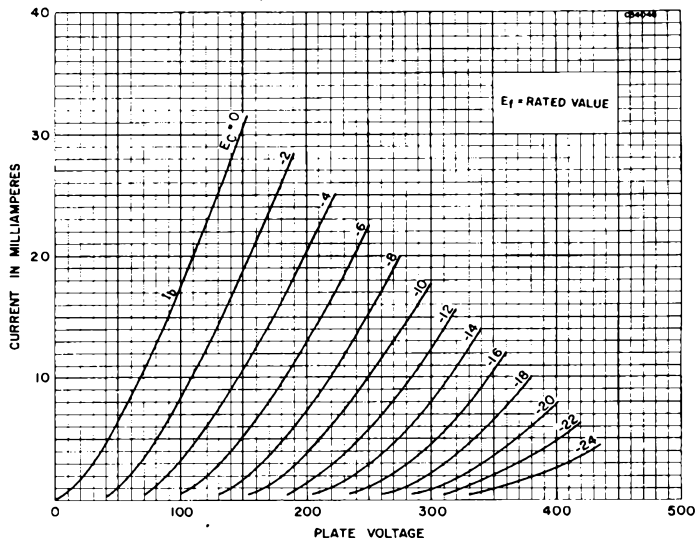
**CHARACTERISTICS AND TYPICAL OPERATION**

	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 $\mu$ mhos
Amplification Factor .....	21	—
Plate Resistance (Approx.) .....	4700	170,000 Ohms
E <sub>c1</sub> for I <sub>b</sub> = 20 $\mu$ a (Approx.) .....	-17	-6 Volts
I <sub>b</sub> with E <sub>c1</sub> = -3 Volts, R <sub>k</sub> = 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)**



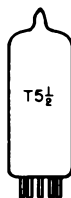
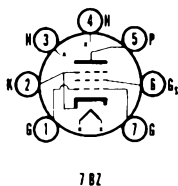
*Color Television Type*

**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.



7BZ

**ELECTRICAL DATA  
HEATER OPERATION**

	<b>19AQ5</b>	<b>12AQ5</b>	<b>5AQ5</b>	<b>6AQ5A</b>
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				200 Volts
Total DC and Peak.....				
Heater Positive with Respect to Cathode				100 Volts
DC .....				200 Volts
Total DC and Peak.....				

**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<sup>(1)</sup>—Triode Connected<sup>(2)</sup>**

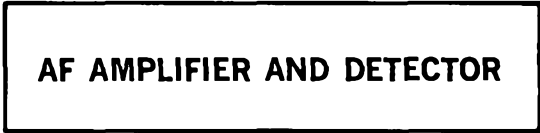
Plate Voltage (Max.) .....	275 Volts
Peak Positive Plate Voltage (Abs. Max.) .....	1100 Volts
Plate Dissipation (Max.) <sup>(3)</sup> .....	10 Watts
Peak Negative Grid No. 1 Voltage (Max.) .....	275 Volts
Average Cathode Current (Max.) .....	40 Ma
Peak Cathode Current (Max.) .....	115 Ma
Grid No. 1 Circuit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

**CHARACTERISTICS AND TYPICAL OPERATION**

	<b>Triode Conn.</b>	<b>Pentode Conn.</b>	
<b>Class A1 Amplifier</b>			
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 $\mu$ hms
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

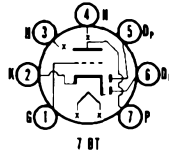
**NOTES:**

- (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.



**Double Diode and High Mu Triode**

Construction .....	Miniature T-5 $\frac{1}{2}$
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 .....	6.3 Volts
Heater Current .....	150 Ma
Maximum Heater Cathode Voltage .....	90 Volts

**DIRECT INTERELECTRODE CAPACITANCES (Shielded)<sup>(1)</sup>**

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
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**CHARACTERISTICS AND TYPICAL OPERATION**

**Class A1 Amplifier**

Plate Voltage .....	100	250 Volts
Grid No. 1 Voltage <sup>(2)</sup> .....	-1	-3 Volts
Plate Resistance (Approx.) .....	61,000	58,000 Ohms
Transconductance .....	1150	1200 $\mu$ hms
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.

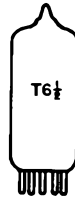
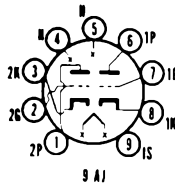


Color Television Type  
**RF AMPLIFIER AND MIXER**

**6AQ8/ECC85**  
9AQ8

**High Mu Twin Triode**

Construction ..... Miniature T-6½  
 Base ..... Button 9 Pin, E9-1  
 Basing<sup>(1,2)</sup> ..... 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**

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:**

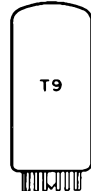
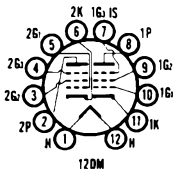
- (1) Section No. 1 connects to Pins 6, 7, and 8.
- (2) An internal shield is connected to Pin No. 9 to provide isolation between the two sections.

**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**

	<b>11AR11</b>	<b>8AR11</b>	<b>6AR11</b>
Heater Voltage.....	11.2	8.4	6.3 Volts
Heater Current .....	450	600	800 Ma
Heater Warm-up Time .....	11	11	— Seconds
<b>Maximum Heater-Cathode Voltage</b>			
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)<sup>(1)</sup>**

**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 $\mu$ mhos
Plate Current .....	11 Ma
Screen Current .....	3.5 Ma
Grid No. 1 Voltage (Approx.) .....	
Gm = 50 $\mu$ mhos .....	-15 Volts

**NOTE:**

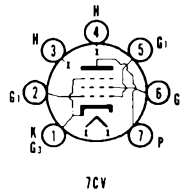
(1) With external shield (EIA 309) connected to cathode of section under test.

**6AS5**

**AUDIO POWER AMPLIFIER**

**Beam Pentode**

Construction .....	Miniature T-5 $\frac{1}{2}$
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.



**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 $\mu$ mhos
Load Resistance .....	4500 Ohms
Total Harmonic Distortion .....	10 Percent
Maximum Signal Power Output .....	2.2 Watts

*Color Television Type*

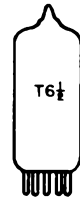
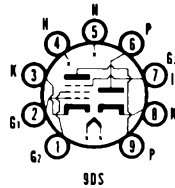
**AUDIO/VIDEO DETECTOR or DC RESTORER (D) IF/VIDEO/AGC AMPLIFIER (P)**

**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**

	<b>5AS8 Series</b>	<b>6AS8 Parallel</b>
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)**

<b>Pentode Section</b>	
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
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**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
<b>Diode Section</b>	
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**

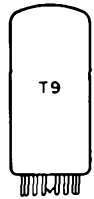
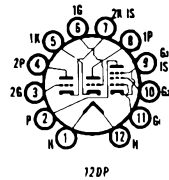
Plate Supply Voltage	200 Volts
Grid No. 2 Supply Voltage	150 Volts
Grid No. 3 Voltage	Connected to Cathode at Socket
Cathode Resistor	180 Ohms
Plate Current	9.5 Ma
Grid No. 2 Current	3.0 Ma
Transconductance	6200 $\mu$ mhos
Plate Resistance (Approx.)	0.3 Megohm
Grid No. 1 Voltage for $I_b = 10 \mu a$ (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: P <sub>g1</sub> to (T2k + Pk + Pg2 + Pg3 + IC + IS)	9.5 Pf
Output: P <sub>p</sub> 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 $\mu$ mhos
Plate Resistance (Approx.) .....	12,400 Ohms
Amplification Factor .....	68
Grid Voltage for $I_b = 10 \mu$ a .....	-5.5 Volts

**Triode (Section 2)**

Plate Voltage .....	200 Volts
Cathode Bias Resistor .....	220 Ohms
Plate Current .....	9.2 Ma
Transconductance .....	4400 $\mu$ mhos
Plate Resistance (Approx.) .....	9400 Ohms
Amplification Factor .....	41
Grid Voltage for $I_b = 100 \mu$ a .....	-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 $\mu$ mhos
Plate Resistance (Approx.) .....	70,000 Ohms
Grid 1 Voltage for $I_b = 10 \mu$ a .....	-8 Volts

Color Television Type

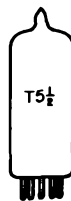
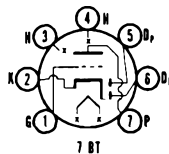
**AF AMPLIFIER AND DETECTOR**

**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

Heater Voltage .....	<b>12AT6</b> 12.6	<b>6AT6</b> 6.3 Volts
Heater Current .....	150	300 Ma
Maximum Heater-Cathode Voltage .....	90	90 Volts

**DIRECT INTERELECTRODE CAPACITANCES**

Grid to Plate .....	<b>Shielded</b> <sup>(1)</sup> 2.0	<b>Unshielded</b> 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
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**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 $\mu$ mhos
Amplification Factor .....	70	70
Plate Resistance .....	54,000	58,000 Ohms
Average Diode Current at 10 Volts DC <sup>(2)</sup> .....	2.0	2.0 Ma

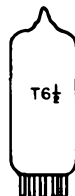
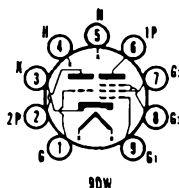
**NOTES:**

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



**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>5AT8</b>	<b>6AT8A</b>
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**

	<b>Shielded<sup>(1)</sup></b>	<b>Unshielded</b>
<b>Triode Section</b>		
Grid to Plate .....	1.5	1.5 Pf
Input .....	2.4	2.0 Pf
Output .....	1.0	0.5 Pf
<b>Pentode Section</b>		
Grid No. 1 to Plate (Max.) .....	0.016	0.025 Pf
Input .....	4.7	4.5 Pf
Output .....	1.6	0.9 Pf
<b>Pentode Section Triode Connected<sup>(2)</sup></b>		
Grid No. 1 to Plate .....	1.3	1.3 Pf
Input .....	3.3	3.0 Pf
Output .....	2.5	1.7 Pf
<b>Coupling</b>		
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 <sup>(3)</sup>	6.5 Pf

**RATINGS (Design Center Rating System)**

	Triode Section as Oscillator	Pentode Section as Mixer
<b>Converter Service</b>		
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<sup>(2)</sup>**

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 $\mu$ mhos
Amplification Factor .....	40	—
Plate Resistance (Approx.) .....	6900	750,000 Ohms
E <sub>c1</sub> for I <sub>b</sub> = 10 $\mu$ a (Approx.) .....	-10	-10 Volts

	Triode Section as 250 MHz Oscillator <sup>(4)</sup>	Pentode Section as Mixer <sup>(5)</sup>
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 $\mu$ mhos
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 $\mu$ a
Oscillator Power Output (Approx.) <sup>(4)</sup> .....	0.5	— Watt

**Pentode Section as Triode Connected Mixer<sup>(2)</sup>**

Plate Voltage .....	150 Volts
Grid No. 1 Supply Voltage .....	-3.5 Volts
Plate Current .....	7.8 Ma
Conversion Transconductance .....	2800 $\mu$ mhos
Oscillator Voltage at Grid No. 1 (RMS) .....	2.6 Volts
Grid No. 1 Current .....	2.0 $\mu$ a
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.

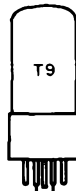
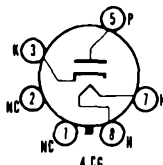
**6AU4GTA**

19AU4GTA

Color Television Type

**DAMPER****Heater-Cathode Diode**

Construction ..... Octal T-9  
 Base<sup>(1)</sup> ..... Octal 5 or 6 Pin, B5-85 or B6-60  
 Basing<sup>(1)</sup> ..... 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<sup>(2)</sup>**

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.

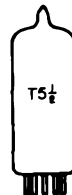
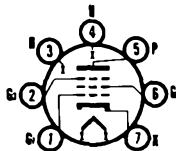
**6AU6A**

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.



7BK



**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 $\mu$ mhos
Plate Resistance (Approx.) .....	0.5	1.5	1.0 Megohm
Grid No. 1 Voltage for $I_b = 10 \mu a$ .....	-4.2	-5.5	-6.5 Volts

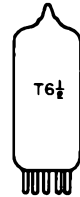
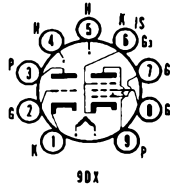
Color Television Type

**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.



**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)**

<b>Triode Section</b>	
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)**

	<b>Triode Section</b>	<b>Pentode Section</b>
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**

	<b>Triode Section</b>	<b>Pentode Section</b>
<b>Class A1 Amplifier</b>		
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 $\mu$ mhos
Amplification Factor	43	—
Plate Resistance (Approx.)	8100	100,000 Ohms
Grid No. 1 Voltage (Approx.)		
for $I_b = 100$ ma	-6.5	-7.5 Volts dc

# 6AV5GA

12AV5GA, 17AV5GA,  
25AV5GA

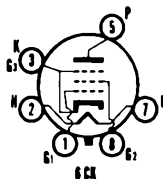
*Color Television Type*

## 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**

	<b>25AV5GA</b>	<b>17AV5GA</b>	<b>12AV5GA</b>	<b>6AV5GA</b>
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<sup>(1)</sup>**

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.) <sup>(2)</sup>	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 $\mu$ mhos
Triode Amplification Factor <sup>(2)</sup> .....	4.3
Grid No. 1 Voltage (Approx.) for $I_b = 1$ Ma .....	-43 Volts

**INSTANTANEOUS PLATE KNEE VALUES**

$E_b = 60$  V,  $E_{c2} = 150$  V, and  $E_{c1} = 0$  V;  
 $I_b = 260$  Ma; and  $I_{c2} = 26$  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  $E_b = E_{c2} = 150$  Volts and  $E_{c1} = -22.5$  Volts.

Color Television Type

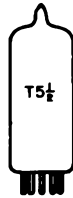
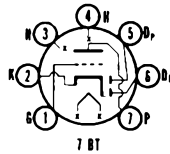
## DETECTOR and AF AMPLIFIER

# 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.



**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 <sup>(1)</sup>	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 <sup>(2)</sup> (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 $\mu$ mhos
Amplification Factor .....	100	100

**Diode (Each Section)**

Tube Voltage Drop for $I_b = 1.2$ 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.

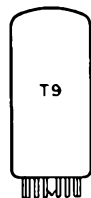
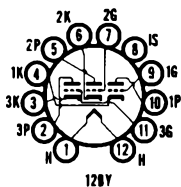
# 6AV11

Color Television Type

## AMPLIFIER, PHASE INVERTER or OSCILLATOR

### Triple Medium Mu Triode

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

#### 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 $\mu$ mhos
Plate Current .....	11.8	10.5 Ma
Grid Voltage (Approx.) .....	—	-24 Volts
$I_b = 10 \mu a$ .....	—	—

# 6AW8A

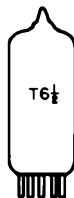
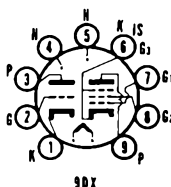
8AW8A

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 <sup>(1)</sup>	Unshielded
<b>Triode</b>		
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
<b>Pentode</b>		
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
<b>Coupling</b>		
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

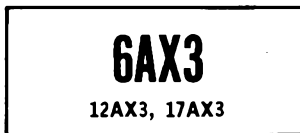
	Triode	Pentode
Plate Voltage .....	200	150 Volts
Grid No. 2 Voltage .....	—	150 Volts
Grid No. 1 Voltage .....	-2	0 Volts
Cathode Bias Resistor .....	—	150 Ohms
Plate Current .....	4.0	15 Ma
Grid No. 2 Current .....	—	3.5 Ma
Transconductance .....	4000	9500 $\mu$ mhos
Amplification Factor .....	70	—
Plate Resistance (Approx.) .....	—	0.20 Megohm
Grid No. 1 Voltage (Approx.) .....	-5	-8 Volts

INSTANTANEOUS PLATE KNEE VALUES

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

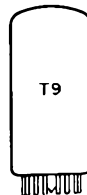
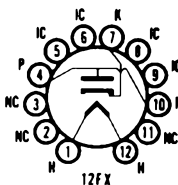
NOTE:

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



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

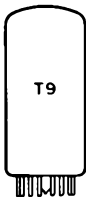
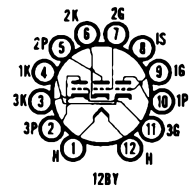
	17AX3	12AX3	6AX3
Heater Voltage.....	16.8	12.6	6.3 Volts
Heater Current .....	450	600	1200 Ma
Heater Warm-up Time .....	11	11	— Seconds

# 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 ..... 200 Volts  
 Total DC and Peak .....  
 Heater Positive with Respect to Cathode ..... 100 Volts  
 DC ..... 200 Volts  
 Total DC and Peak .....

**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 $\mu$ mhos
Plate Current	11.8	10.5 Ma
Grid Voltage (Approx.)		
I <sub>b</sub> = 10 $\mu$ a.....	—	-24 Volts

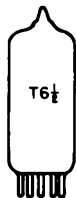
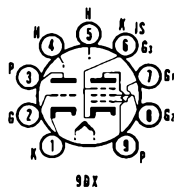
# 6AW8A

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 ..... 200 Volts Total DC and Peak .....		

Heater Positive with Respect to Cathode

DC .....	100 Volts
Total DC and Peak.....	200 Volts

DIRECT INTERELECTRODE CAPACITANCES

	Shielded <sup>(1)</sup>	Unshielded
<b>Triode</b>		
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
<b>Pentode</b>		
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
<b>Coupling</b>		
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

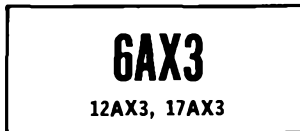
	Triode	Pentode
Plate Voltage .....	200	150 Volts
Grid No. 2 Voltage .....	—	150 Volts
Grid No. 1 Voltage .....	-2	0 Volts
Cathode Bias Resistor .....	—	150 Ohms
Plate Current .....	4.0	15 Ma
Grid No. 2 Current .....	—	3.5 Ma
Transconductance .....	4000	9500 $\mu$ mhos
Amplification Factor .....	70	—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



Heater-Cathode Diode

Construction.....Compactron T-9  
Base .....

Base .....

Basing .....

Outline

Maximum Diameter .....

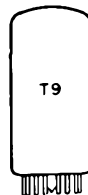
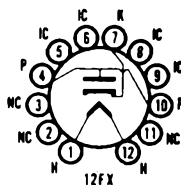
Maximum Seated Height .....

Maximum Overall Height .....

ELECTRICAL DATA

HEATER OPERATION

Heater Voltage.....	16.8
Heater Current .....	450
Heater Warm-up Time .....	11



	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

<b>Maximum Heater-Cathode Voltage</b>	
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
<b>DIRECT INTERELECTRODES CAPACITANCES (Unshielded)</b>	
Cathode to Plate and Heater .....	7.5 Pf
Plate to Cathode and Heater .....	5.5 Pf
Heater to Cathode .....	2.8 Pf
<b>RATINGS (Design Maximum Rating System)</b>	
<b>Damper Service<sup>(1)</sup></b>	
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
<b>CHARACTERISTICS AND TYPICAL OPERATION</b>	
Tube Voltage Drop for $I_b = 250$ Ma .....	32 Volts

**NOTE:**

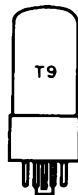
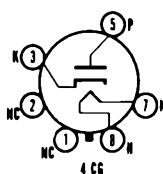
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

**6AX4GTB**  
12AX4GTB,  
17AX4GTA/17DM4A

Color Television Type  
**DAMPER**

**Heater-Cathode Diode**

Construction .....	Octal T-9
Base .....	Octal 5 Pin, B5-82
Basing <sup>(1)</sup> .....	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
<b>Maximum Heater-Cathode Voltage</b>			
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<sup>(2)</sup>**

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 $I_b = 250$ Ma .....	32 Volts
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**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.

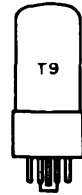
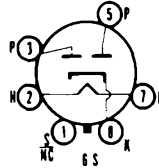


**FULL-WAVE POWER RECTIFIER**

**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<sup>(1)</sup>**

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  $\mu$ f  
 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.

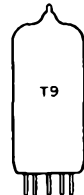
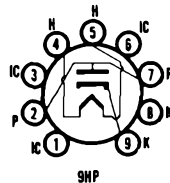
**DAMPER**

**6AY3**

12AY3, 17AY3

**Heater-Cathode Diode**

Construction .....Novar T-9  
 Base .....Novar Button 9 Pin, E9-75  
 Basing<sup>(1)</sup> .....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**

Heater Voltage.....	17AY3 16.8	12AY3 12.6	6AY3 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<sup>(2)</sup>**

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:**

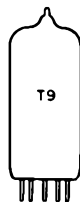
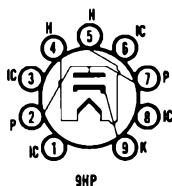
- (1) Pins 1, 3, 6, and 8 should not be used as tie points.
- (2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one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



**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.

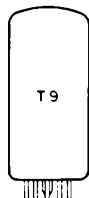
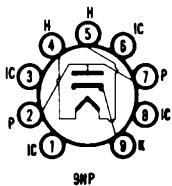
6AY3A is identical to 6AY3 except for shorter bulb.



**Heater-Cathode Diode**

Construction .....Novar T-9  
 Base .....Novar Button 9 Pin, E9-89  
 (Exhaust Tip on Base)  
 Basing .....9HP  
 Outline .....9-85  
 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.



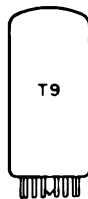
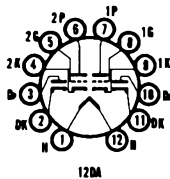
Color Television Type

## 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 $\mu$ hms
Plate Current .....	1.2 Ma

**Diode (Each Section)**

Average Diode Current with 5.0 Voltage DC Applied .....	18 Ma
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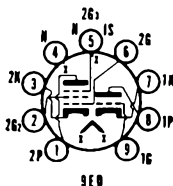
Color Television Type

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

# 6AZ8

**Medium Mu Triode and Sharp Cutoff Pentode**

Construction ..... Miniature T-6-1/2  
 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**

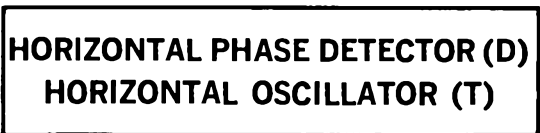
Triode Grid to Pentode Plate (Max.).....	0.027 Pf
Pentode Grid No. 1 to Triode Plate (Max.).....	0.020 Pf
Pentode Plate to Triode Plate (Max.).....	0.045 Pf

**RATINGS (Design Center Rating System)**

	<b>Triode</b>	<b>Pentode</b>
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

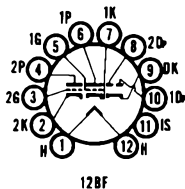
**CHARACTERISTICS AND TYPICAL OPERATION**

	<b>Triode</b>	<b>Pentode</b>
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 $\mu$ mhos
Grid No. 1 Voltage for $I_b = 10 \mu$ a.....	-19	— Volts
Grid No. 1 Voltage for $G_m = 10 \mu$ mhos.....	—	-12.5 Volts
Plate Current.....	13	9.5 Ma
Grid No. 2 Current.....	—	3 Ma



**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.



**ELECTRICAL DATA**  
**HEATER OPERATION**

	<b>8B10</b>	<b>6B10</b>
Heater Voltage.....	8.5	6.3 Volts
Heater Current.....	450	600 Ma
Heater Warm-up Time.....	11	11 Seconds

<b>Maximum Heater-Cathode Voltage</b>	
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)**

<b>Triode No. 1</b>	
Grid to Plate .....	1.5 Pf
Input: 1Tg to (h + 1Tk + IS) .....	1.7 Pf
Output: 1Tp to (h + 1Tk + IS) .....	1.6 Pf
<b>Triode No. 2</b>	
Grid to Plate .....	1.5 Pf
Input: 2Tg to (h + 2Tk + IS) .....	1.8 Pf
Output: 2Tp to (h + 2Tk + IS) .....	0.6 Pf
<b>Diode No. 1</b>	
Plate to Cathode, Heater and Internal Shield .....	1.9 Pf
<b>Diode No. 2</b>	
Plate to Cathode, Heater, and Internal Shield .....	1.8 Pf
<b>Coupling</b>	
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)**

<b>Triode (Each Section)</b>	
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
<b>Diode (Each Section)</b>	
Average Diode Current for Eb = 5 Volts .....	20 Ma

**CHARACTERISTICS AND TYPICAL OPERATION**

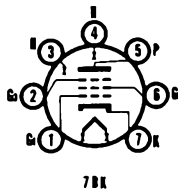
<b>Triode (Each Section)</b>	
Plate Voltage .....	250 Volts
Grid Voltage .....	-9.5 Volts
Plate Current .....	7.0 Ma
Amplification Factor .....	18
Plate Resistance .....	9750 Ohms
Transconductance .....	1850 $\mu$ mhos
Grid Voltage for Ib = 50 $\mu$ a .....	-20 Volts
<b>Diode (Each Section)</b>	
Average 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-5 $\frac{1}{2}$
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**

	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
<b>Maximum Heater-Cathode Voltage</b>				
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 <sup>(1)</sup>	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 $\mu$ mhos
Plate Current	10.8	11.0 Ma
Grid No. 2 Current	4.4	4.2 Ma
Grid No. 1 Voltage for $G_m = 40 \mu$ mhos	-20	-20 Volts

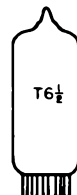
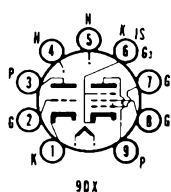
**NOTE:**

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



**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 <sup>(1)</sup>	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**

	<b>Triode</b>	<b>Pentode</b>
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 $\mu$ mhos
Amplification Factor .....	18	—
Plate Resistance (Approx.) .....	6700	400,000 Ohms
Grid No. 1 Voltage for $I_b = 10 \mu a$ (Approx.) .....	-16	-10 Volts

**INSTANTANEOUS PLATE KNEE VALUES**

$E_b = 65 V$ ,  $E_{c2} = 150 V$ , and  $E_{c1} = 0 V$ ;  
 $I_b = 42 Ma$ ; and  $I_{c2} = 12.5 Ma$

**NOTE:**

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

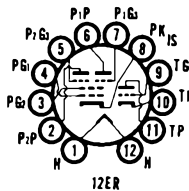
*Color Television Type*

**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>8BA11</b>	<b>6BA11</b>
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 .....		200 Volts
Total DC and Peak .....		
Heater Positive with Respect to Cathode .....		100 Volts
DC .....		200 Volts
Total DC and Peak .....		

**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: $g_1$ to $(k + h)$ .....	2.0 Pf
Output: $p$ to $(k + h + IS)$ .....	1.9 Pf

**RATINGS (Design Maximum Rating System)**

	<b>Triode Section</b>	<b>Pentode Section</b>
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

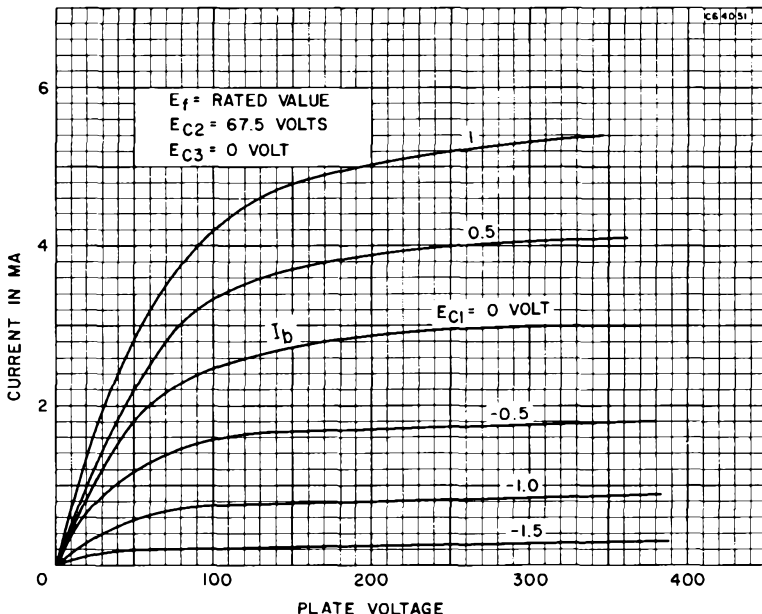
**CHARACTERISTICS AND TYPICAL OPERATION**

	Pentode				
	Triode Section	Each Section Separately <sup>(2)</sup>		Both Sections Operating <sup>(3)</sup>	
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	—	—	— $\mu$ mhos
Amplification Factor .....	18	—	—	—	—
Grid No. 3 Transconductance ...	—	—	450	—	— $\mu$ mhos
Grid No. 1 Voltage					
I <sub>b</sub> = 100 $\mu$ a .....	-18	2.3	—	—	— Volts
Grid No. 3 Voltage (Approx.)					
For I <sub>b</sub> = 100 $\mu$ a .....	—	—	-3.2	—	— Volts

**NOTES:**

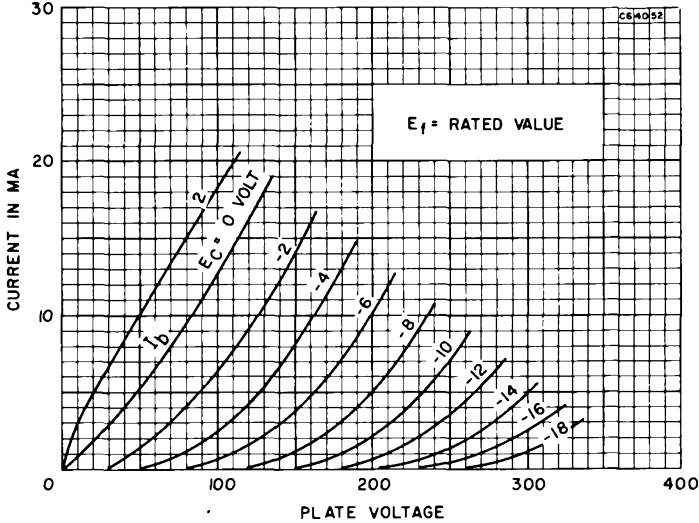
- (1) Grid current adjusted for 100  $\mu$ a DC.
- (2) Plate and Grid No. 3 of opposite section grounded.
- (3) Voltages and plate current apply to each section.

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





**AVERAGE PLATE CHARACTERISTICS  
(Triode Section)**

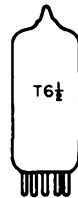
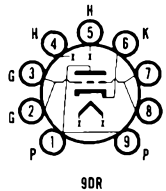


**RF AMPLIFIER**

**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.



**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**

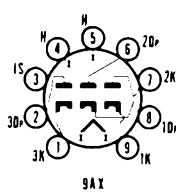
- Plate Supply Voltage..... 150 Volts
- Cathode Bias Resistor..... 100 Ohms
- Amplification Factor..... 48
- Plate Resistance..... 4800 Ohms
- Transconductance..... 10,000 μmhos
- Grid Bias for Ib = 10 μa..... -10 Volts
- Plate Current..... 14.5 Ma

# 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.



### 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

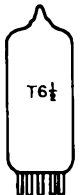
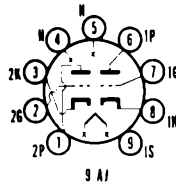
# 6BC8

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.



### ELECTRICAL DATA

#### HEATER OPERATION

Heater Voltage.....	<b>4BC8</b> 4.2	<b>6BC8</b> 6.3 Volts
Heater Current.....	600	400 Ma
Heater Warm-up Time.....	11	— Seconds

#### Maximum Heater-Cathode Voltage

Heater Negative with Respect to Cathode <sup>(1)</sup> Total DC and Peak.....	200 Volts
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Heater Positive with Respect to Cathode DC.....	100 Volts
Total DC and Peak.....	200 Volts

#### DIRECT INTERELECTRODE CAPACITANCES (Shielded)<sup>(2)</sup>

	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.) <sup>(1)</sup> .....	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
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Grid Voltage .....	0 Volt
Cathode Bias Resistor .....	220 Ohms
Plate Current .....	10 Ma
Transconductance .....	6200 $\mu$ mhos
Plate Resistance .....	5300 Ohms
Amplification Factor .....	35
Grid Voltage for $G_m = 50 \mu$ mhos (Approx.) .....	-13 Volts

**NOTES:**

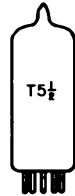
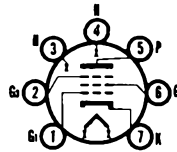
- (1) This rating may be as high as 300 volts max. under cutoff conditions when the tube is used as a cascode amplifier and the two sections are connected in series.
- (2) Shield No. 315.

**RF/IF AMPLIFIER**

**6BD6**  
12BD6

**Remote Cutoff Pentode**

Construction ..... Miniature T-5 $\frac{1}{2}$   
 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 .....	<b>12BD6</b> 12.6	<b>6BD6</b> 6.3 Volts
Heater Current .....	150	300 Ma
Maximum Heater-Cathode Voltage .....		90 Volts

**DIRECT INTERELECTRODE CAPACITANCES**

	<b>Shielded<sup>(1)</sup></b>	<b>Unshielded</b>
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 $\mu$ mhos
Plate Resistance .....	0.12	0.7 Megohm
$E_{c1}$ for $G_m = 10 \mu$ mhos (Approx.) .....	-35	-35 Volts

**NOTE:**

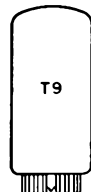
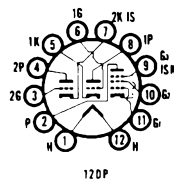
- (1) With external Shield No. 316 connected to pin 7 (cathode).

**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.



**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.) .....	1.1 Watts (15BD11A = 1.5)
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 $\mu$ mhos
Plate Current .....	7.0 Ma
Grid Voltage (Approx.)	
Ib = 100 $\mu$ a .....	-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 $\mu$ mhos
Plate Current .....	9.2 Ma
Grid Voltage (Approx.)	
Ib = 100 $\mu$ a .....	-6.5 Volts

**Pentode Section**

Plate Voltage .....	35	135 Volts
Screen Voltage .....	135	135 Volts
Grid No. 1 Voltage <sup>(1)</sup> .....	0	— Volt
Cathode Bias Resistor .....	—	100 Ohms

Plate Resistance (Approx.) .....	—	45,000 Ohms
Transconductance .....	—	10,400 $\mu$ mhos
Plate Current .....	34	17 Ma
Screen Current .....	13	4.0 Ma
Grid No. 1 Voltage (Approx.) .....	—	—
$I_b = 100 \mu$ a .....	—	-6 Volts

**NOTE:**

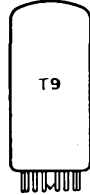
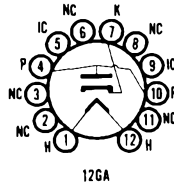
(1) Applied for short interval (two seconds maximum) so as not to damage tube.

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.



**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 <sup>(1)</sup> (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 $I_b = 350$ Ma DC.....	22.5 Volts
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**NOTE:**

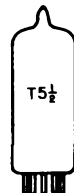
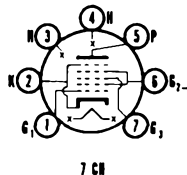
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>3BE6</b>	<b>4BE6</b>	<b>12BE6</b>	<b>6BE6</b>
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
<b>Maximum Heater-Cathode Voltage</b>				
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**

	<b>Shielded<sup>(2)</sup></b>	<b>Unshielded</b>
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<sup>(2)</sup>**

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 $\mu$ mhos
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 $\mu$ mhos.....	-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 $\mu$ mhos
Amplification Factor.....	20
Grid No. 3 Voltage (Approx.) for Ib = 10 $\mu$ a.....	-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

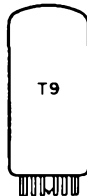
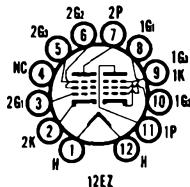
12BF11, 17BF11, 24BF11

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 + 1g <sub>2</sub> + 1g <sub>3</sub> + 1S).....	13.0 Pf
Output: p to (h + 1k + 1g <sub>2</sub> + 1g <sub>3</sub> + 1S).....	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 + 2g <sub>2</sub> + 2g <sub>3</sub> + 1S).....	6.5 Pf
Grid No. 3 to (h + 2k + 2g <sub>2</sub> + 2g <sub>3</sub> + 2p + 1S).....	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 $\mu$ mhos
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)**

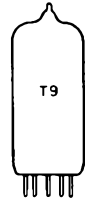
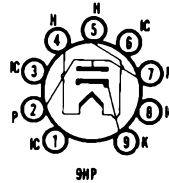
Plate Voltage.....	150 Volts
Suppressor Voltage.....	0 Volt
Screen Voltage.....	100 Volts
Cathode Resistor.....	560 Ohms
Plate Resistance (Approx.).....	150,000 Ohms
Transconductance (G1).....	1000 $\mu$ mhos
Transconductance (G3).....	400 $\mu$ mhos
Plate Current.....	1.3 Ma
Screen Current.....	2.1 Ma
E <sub>c1</sub> for I <sub>b</sub> = 30 $\mu$ a.....	-4.5 Volts
E <sub>c3</sub> for I <sub>b</sub> = 50 $\mu$ a.....	-4.5 Volts

**6BH3**  
17BH3, 22BH3

**DAMPER**

**Heater-Cathode Diode**

Construction ..... Novar T-9  
 Base ..... Button 9 Pin, E9-75  
 Basing<sup>(1)</sup> ..... 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**

	<b>22BH3</b>	<b>17BH3</b>	<b>6BH3</b>
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.) <sup>(2)</sup> .....	5500 Volts
Plate Dissipation (Max.) .....	6.5 Watts
Steady State Peak Current (Max.) .....	1100 Ma
DC Plate Current (Max.) .....	180 Ma

**NOTES:**

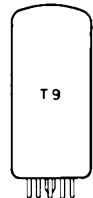
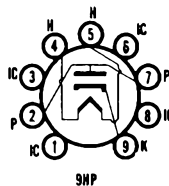
- (1) Pins 1, 3, 6, and 8 should not be used as tie points.
- (2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one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



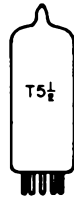
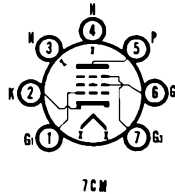


**RF AMPLIFIER**

**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.



**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**

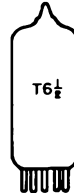
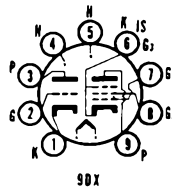
Plate Voltage .....	100	250 Volts
Grid No. 3 Voltage .....	Connected to Cathode at Socket	
Grid No. 2 Voltage .....	100	150 Volts
Grid No. 1 Voltage .....	-1.0	-1.0 Volt
Cathode Bias Resistor .....	200	95 Ohms
Plate Current .....	3.6	7.4 Ma
Grid No. 2 Current .....	1.4	2.9 Ma
Transconductance .....	3400	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.



**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)**

<b>Triode</b>		
Grid to Plate .....	.....	2.4 Pf
Input .....	.....	2.6 Pf
Output .....	.....	0.38 Pf
<b>Pentode</b>		
Grid to Plate .....	.....	0.046 Pf
Input .....	.....	7.0 Pf
Output .....	.....	2.4 Pf
<b>Coupling</b>		
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)**

	<b>Triode</b>	<b>Pentode</b>
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**

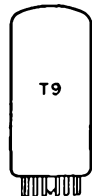
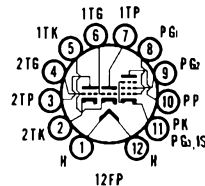
	<b>Triode</b>	<b>Pentode</b>
Plate Voltage .....	150	200 Volts
Grid No. 2 Voltage .....	—	125 Volts
Grid No. 1 Voltage .....	-5	— Volts
Cathode Bias Resistor .....	—	82 Ohms
Amplification Factor .....	17	—
Plate Resistance (Approx.) .....	5150	150,000 Ohms
Transconductance .....	3300	7000 $\mu$ mhos
Plate Current .....	9.5	15 Ma
Grid No. 2 Current .....	—	3.4 Ma
Grid No. 1 Voltage (Approx.)		
For $I_b = 100 \mu$ a .....	-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)**

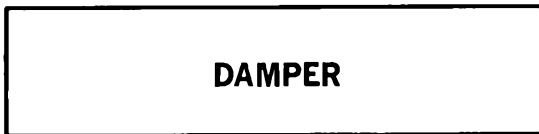
	<b>Pentode Section Horiz. Osc. Service<sup>(1)</sup></b>	<b>Each Triode Section</b>
DC Plate Voltage (Max.) .....	350	330 Volts
Screen Supply Voltage (Max.) .....	330	— Volts
Screen Voltage (Max.) .....	See Rating Chart (Gen. Info. Sec.)	
Positive DC Grid No. 1 Voltage (Max.) .....	0	0 Volt
Peak Negative 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**

	<b>Pentode Section</b>	<b>Each Triode Section</b>
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 $\mu$ mhos
Plate Current .....	12	13.5 Ma
Screen Current .....	4.0	— Ma
Grid No. 1 Voltage (Approx.) .....		
Ib = 10 $\mu$ a .....	-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.



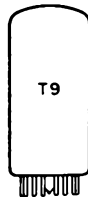
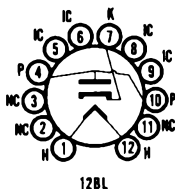
**Heater-Cathode Diode**

Construction .....	Compactron T-9
Base .....	Button 12 Pin, E12-70
Basing <sup>(1)</sup> .....	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 <sup>(1)</sup> (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
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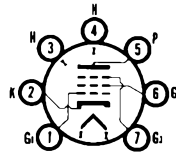
**NOTES:**

- (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.

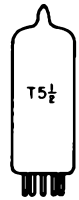


**Remote Cutoff Pentode**

- 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



- 6.3 Volts
- 150 Ma
- 90 Volts

**ELECTRICAL DATA**

**HEATER OPERATION**

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

**DIRECT INTERELECTRODE CAPACITANCES**

	Shielded <sup>(1)</sup>	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)**

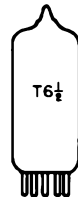
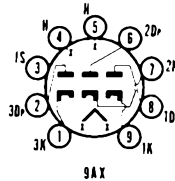
The 6BJ6A, except for controls on formation of interface impedance, is identical to Type 6BJ6. The interface impedance control consists of a life test conducted for 500 hours with the filament operating with 6.9 volts imposed. The other tube elements are unconnected simulating operation at cutoff conditions. 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.



**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**

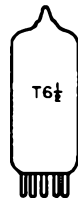
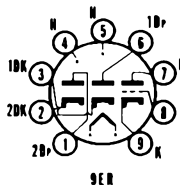
Tube Voltage Drop (Each Section) for Ib = 10 Ma DC .....	2.7 Volts
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Color Television Type  
**PHASE SPLITTER/COMPARATOR  
VERTICAL DEFLECTION AMPLIFIER**

**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.



**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
<b>Triode Section</b>	
Grid to Plate .....	2.6 Pf
Input: g to (h + Tk) .....	2.8 Pf
Output: p to (h + Tk) .....	0.31 Pf
<b>Coupling</b>	
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
<b>RATINGS (Design Maximum Rating System)</b>	

	Class A1 Amplifier	Vert. Def. Amplifier <sup>(1)</sup>
<b>Triode Section</b>		
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 <sup>(2)</sup> (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
<b>Diode Section</b>		
Peak Plate Current (Each Plate) (Max.).....	—	54 Ma
DC Current (Each Plate) (Max.) .....	—	9 Ma

**CHARACTERISTICS AND TYPICAL OPERATION**

<b>Triode Section</b>		
<b>Class A1 Amplifier</b>		
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
<b>Diode Section</b>		
Average Current Each Plate at 10 Volts DC <sup>(3)</sup> .....		50 Ma
Voltage Drop Each Section at Ib = 9 Ma DC .....		2.6 Volts

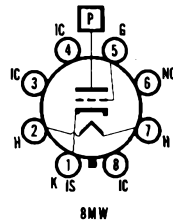
**NOTES:**

- (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.



**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.) <sup>(1)</sup> .....	-440 Volts
DC Plate Current (Abs. Max.) .....	1.6 Ma
Plate Dissipation (Max.) .....	40 Watts
Grid Circuit Resistance (Abs. Max.) <sup>(2)</sup> .....	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 $\mu$ hos
DC Plate Current	

For Load Current of 0 Ma .....	1000 $\mu$ a
For Load Current of 1 Ma .....	45 $\mu$ a

**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."

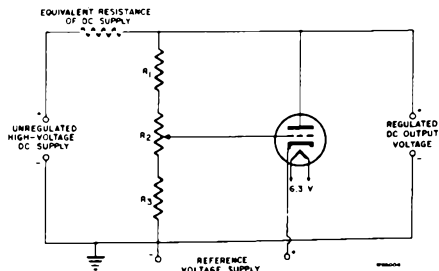
Lot acceptance sampling procedures for the manufacturer's initial and life tests for X-Radiation are based on MIL-STD-105, "Military Standard Sampling Procedures and Tables for Inspection by Attributes." Lot acceptance and life control limits are established substantially below the X-Radiation Characteristic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

**NOTES:**

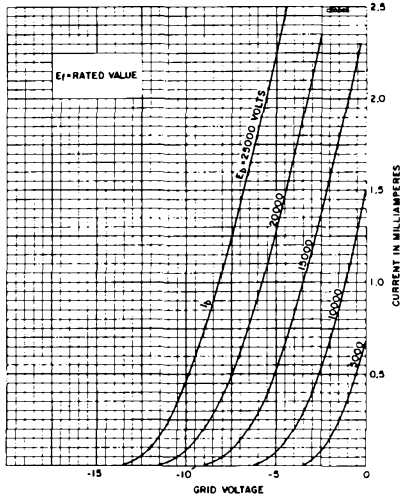
- (1) Peak value for maximum of 20 seconds during equipment warm-up.
- (2) With flyback transformer high voltage supply.

**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)**

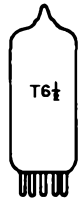
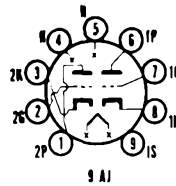


**6BK7B**  
5BK7A

*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.



**ELECTRICAL DATA**  
**HEATER OPERATION**

	<b>5BK7A</b>	<b>6BK7B</b>
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 <sup>(1)</sup> .....		200 Volts
Heater Positive with Respect to Cathode		
DC .....		100 Volts
Total DC and Peak.....		200 Volts

**DIRECT INTERELECTRODE CAPACITANCES (Unshielded)**

	<b>Section 1<sup>(2)</sup></b>	<b>Section 2<sup>(2)</sup></b>
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
<b>Grounded Grid Operation</b>		
Plate to Cathode .....	0.22	0.22 Pf
Input .....	6.0	6.0 Pf
Output .....	2.4	2.4 Pf
<b>RATINGS (Design Center Rating System)</b>		
Plate Voltage (Max.) .....		300 Volts



Negative DC Grid Voltage (Max.) .....	50 Volts
Plate Dissipation (Each Section) (Max.) .....	2.7 Watts
<b>CHARACTERISTICS AND TYPICAL OPERATION</b>	
<b>Class A1 Amplifier (Each Section)</b>	
Plate Voltage .....	150 Volts
Cathode Bias Resistor .....	56 Ohms
Plate Current .....	18 Ma
Transconductance .....	9300 $\mu$ mhos
Amplification Factor .....	43
Plate Resistance.....	4600 Ohms
Grid Voltage for $I_b = 10 \mu$ a .....	-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.

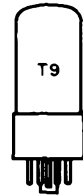
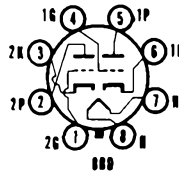
Color Television Type

**VERTICAL DEFLECTION  
OSCILLATOR AND AMPLIFIER**

**6BL7GT**

**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<sup>(1,2)</sup>**

	Oscillator	Amplifier
Plate Voltage (Max.) .....	500	500 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.).....	3	2000 Volts
Plate Dissipation (Each Plate) (Max.) <sup>(3)</sup> .....	10	10 Watts
Total Plate Dissipation (Both Plates) (Max.) .....	12	12 Watts
Peak Negative Pulse Grid Voltage (Max.).....	400	250 Volts
Average Cathode Current.....	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 $\mu$ mhos
Amplification Factor .....	15
Plate Resistance (Approx.) .....	2150 Ohms
Plate Current at $E_c = -17$ Volts .....	4.0 Ma
$E_{c1}$ for $I_b = 50 \mu$ a (Approx.).....	-23 Volts

**INSTANTANEOUS PLATE KNEE CHARACTERISTICS**

$E_b = 150$  V and  $E_{c1} = 0$  V  
 $I_b = 65$  Ma

**NOTES:**

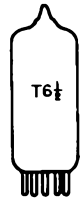
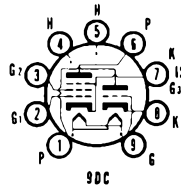
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) Section No. 1 is recommended 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
<b>Maximum Heater-Cathode Voltage</b>			
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.) <sup>(1)</sup> .....	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 (Igl = 0.3 µa) (Max.) <sup>(2)</sup> .....	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.) <sup>(2)</sup> .....	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 $\mu$ mhos
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 $\mu$ mhos
Amplification Factor .....	20

**Converter Service<sup>(3)</sup>**

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 $\mu$ a
Conversion Conductance .....	2200	2100 $\mu$ mhos
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.

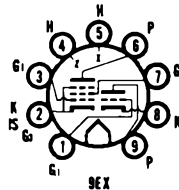
Color Television Type

**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)**

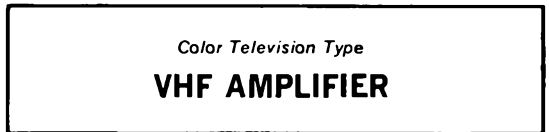
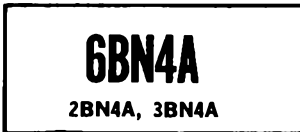
	<b>Triode</b>	<b>Pentode</b>
Plate Supply Voltage (Max.) .....	550	900 Volts
Plate Voltage (Max.) .....	300	600 Volts
Grid No. 2 Supply Voltage (Max.) .....	—	550 Volts
Grid No. 2 Voltage (Max.) .....	—	300 Volts
Cathode Current (Max.) .....	15	50 Ma
Plate Dissipation (Max.) .....	1	7 Watts
Grid No. 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**

	<b>Triode</b>	<b>Pentode</b>
Plate Voltage .....	100	200 Volts
Grid No. 2 Voltage .....	—	200 Volts
Grid No. 1 Voltage .....	0	-16 Volts
Amplification Factor .....	70	9.5 <sup>(1)</sup>
Plate Resistance .....	—	20,000 Ohms
Transconductance .....	2500	6400 $\mu$ mhos
Plate Current .....	3.5	35 Ma
Grid No. 2 Current .....	—	7 Ma

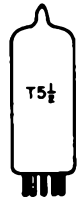
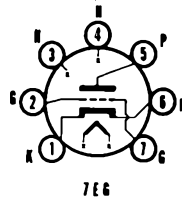
**NOTE:**

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



**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**

	<b>2BN4A</b>	<b>3BN4A</b>	<b>6BN4A</b>
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**

	<b>Unshielded</b>	<b>Shielded</b>
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**

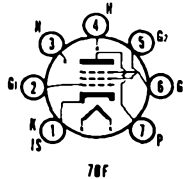
Plate Voltage .....	150 Volts
Cathode Bias Resistor .....	220 Ohms
Plate Current .....	9.0 Ma
Transconductance .....	7700 $\mu$ mhos
Amplification Factor .....	43
Plate Resistance (Approx.) .....	5400 Ohms
Ec for Ib = 100 $\mu$ a (Approx.) .....	-6 Volts

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.



**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) <sup>(1)</sup> .....	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 Milihertz
Frequency Deviation.....	± 75	± 75	± 25 Kilo hertz
Minimum Signal Voltage for Limiting Action (RMS) <sup>(2)</sup> .....	1.25	1.25	1.25 Volts
Input Signal Level for AM Rejection Adjustment <sup>(1)</sup> .....	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:**

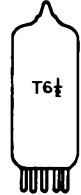
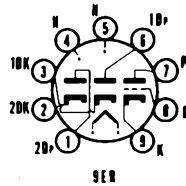
- (1) The cathode resistor should be adjusted for maximum AM rejection in the output of the limiter-discriminator stage at the specified signal level. AM rejection is measured with an applied signal containing 30% AM and 30% FM.
- (2) At signal levels above specified value, limiting is within ± 2 decibels. 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.



**ELECTRICAL DATA  
HEATER OPERATION**

	<b>8BN8</b>	<b>6BN8</b>
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 <sup>(1)</sup> .....	50 Ma
Voltage Drop Each Section at Ib = 9 Ma DC.....	2.6 Volts

**NOTE:**

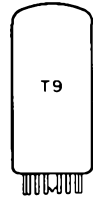
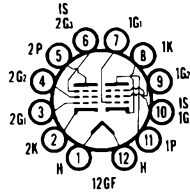
(1) Test conditions only.

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**

	<b>6BN11</b>	<b>8BN11</b>
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)<sup>(1)</sup>**

**Section 1**

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

**Section 2**

Grid No. 1 to Plate.....	0.03 Pf
Input: 2g1 to (2k + 2g2 + 2g3 + 1g3 + h + 1S).....	12 Pf
Output: 2p to (2k + 2g2 + 2g3 + 1g3 + h + 1S).....	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.) <sup>(2)</sup> .....	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 $\mu$ mhos
Plate Current.....	11 Ma
Screen Current.....	3.8 Ma
Grid No. 1 Voltage (Approx.)	
I <sub>b</sub> = 20 $\mu$ a.....	-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

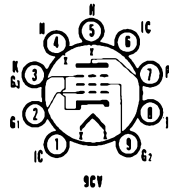
8BQ5, 10BQ5

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.



**ELECTRICAL DATA**  
**HEATER OPERATION**

	<b>10BQ5</b>	<b>8BQ5</b>	<b>6BQ5/EL84</b>
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.) <sup>(1)</sup> .....	300 Volts
Grid No. 2 Voltage (Max.) <sup>(1)</sup> .....	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 <sup>(2)</sup>			Pentode Operation		
	Class A1 Single Tube	Class AB1 Push-pull		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 <sup>(3)</sup> .....	270	270	270	135	130	130 Ohms
Grid Voltage (RMS) <sup>(4)</sup> .....	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 <sup>(1)</sup> .....	—	—	—	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 <sup>(1)</sup> ...	9	2.5	2.5	10	3.0	4.0 Percent

**CLASS AB1 ULTRA-LINEAR CONNECTION<sup>(5)</sup>**

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

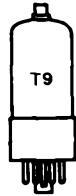
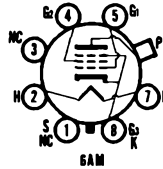
## HORIZONTAL DEFLECTION AMPLIFIER

## 6BQ6GTB / 6CU6

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

**Beam Power Pentode**

Construction ..... Octal T-9  
 Base<sup>(1)</sup>... 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.



**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 <sup>(2)</sup>	
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.) <sup>(3)</sup> .....	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

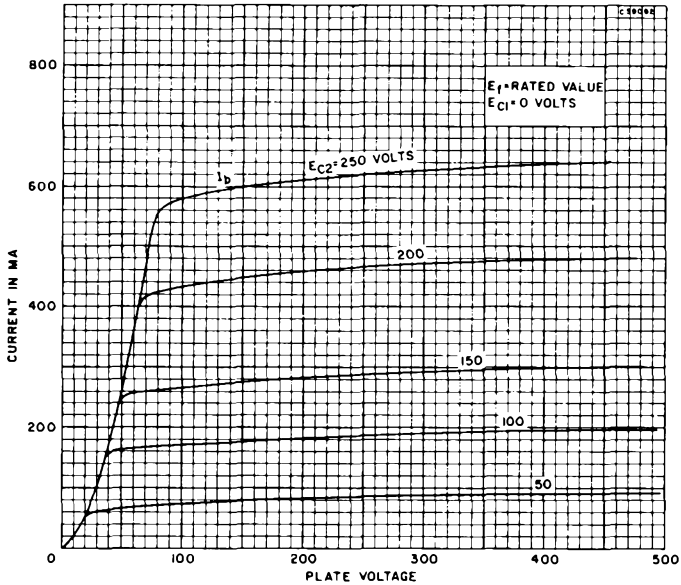
**INSTANTANEOUS PLATE KNEE VALUES**

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**

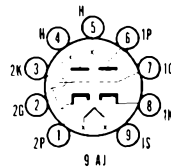


**6BQ7A/6BZ7**  
4BQ7A/4BZ7, 5BQ7A, 5BZ7

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 <sup>(1)</sup> .....			200 Volts
Heater Positive with Respect to Cathode			
DC .....			100 Volts
Total DC and Peak.....			200 Volts

**DIRECT INTERELECTRODE CAPACITANCES (Shielded)<sup>(2)</sup>**

	Section 1 <sup>(3)</sup>	Section 2 <sup>(3)</sup>
Grid to Plate .....	1.2	1.2 Pf
Input: g to (h + k + IS) .....	2.6	5.0 <sup>(4)</sup> Pf
Output: p to (h + k + IS) .....	1.2	2.2 <sup>(4)</sup> 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.) <sup>(1)</sup> .....	250 Volts
Plate Dissipation (Max.) .....	2 Watts
Cathode Current (Max.) .....	20 Ma
Grid Circuit Resistance (Max.) .....	0.5 Megohm

**CHARACTERISTICS AND TYPICAL OPERATION**

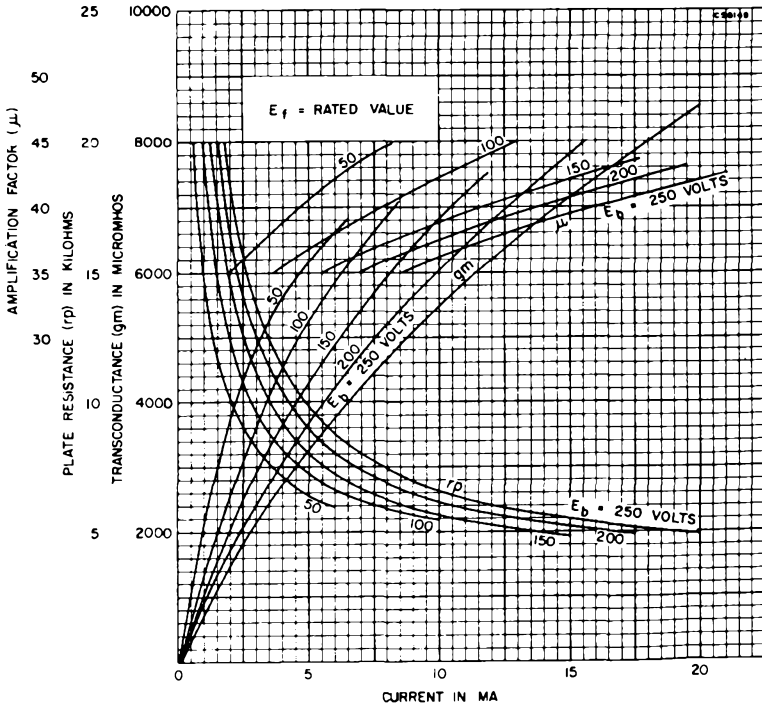
**Class A1 Amplifier (Each Section)**

Plate Voltage .....	150 Volts
Cathode Bias Resistor .....	220 Ohms
Plate Current .....	9 Ma
Transconductance .....	6400 $\mu$ mhos
Plate Resistance .....	5900 Ohms
Amplification Factor .....	38
Grid Voltage for $I_b = 100 \mu$ a (Approx.) .....	-6.5 Volts

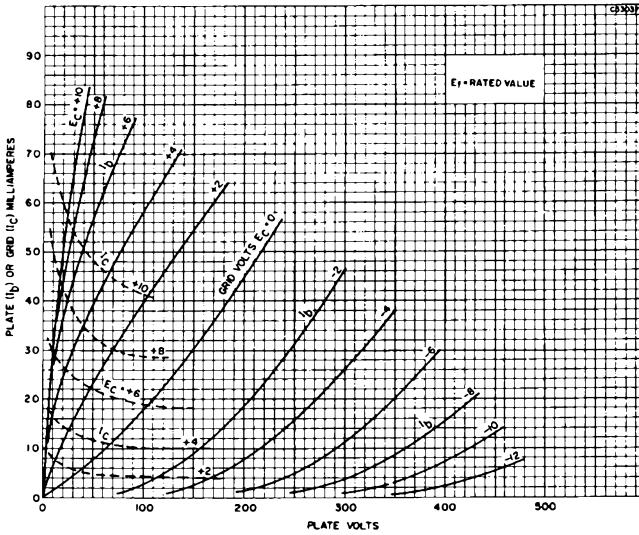
**NOTES:**

- (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**

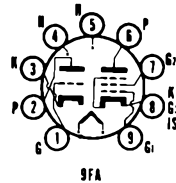


**6BR8A**  
5BR8

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.



**ELECTRICAL DATA  
HEATER OPERATION**

	<b>5BR8</b>	<b>6BR8A</b>
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**

	<b>Shielded (1)</b>	<b>Unshielded</b>
<b>Triode Section</b>		
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
<b>Pentode Section</b>		
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)**

	<b>Triode Section</b>	<b>Pentode Section</b>
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**

	<b>Triode Section</b>	<b>Pentode Section</b>
<b>Class A1 Amplifier</b>		
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 $\mu$ mhos
Amplification Factor .....	40	—
Plate Resistance (Approx.) .....	—	200,000 Ohms
Zero Bias Transconductance (with $E_b = 100$ V, $E_{c2} = 70$ V) .....	—	6000 $\mu$ mhos

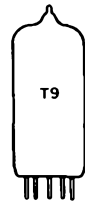
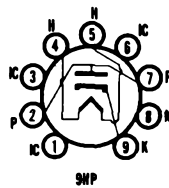
**NOTE:**

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



**Heater-Cathode Diode**

Construction ..... Novar T-9  
 Base ..... Button 9 Pin, E9-75  
 Basing<sup>(1)</sup> ..... 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**

	<b>17BS3</b>	<b>12BS3</b>	<b>6BS3</b>
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.) <sup>(2)</sup> .....	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 $I_b = 140$ Ma .....	12 Volts
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**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

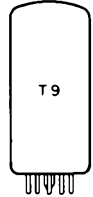
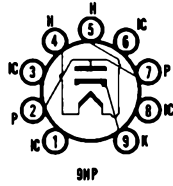
Color Television Type  
**DAMPER**

**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.



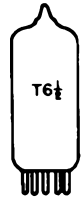
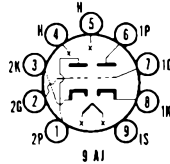
**6BS8**  
5BS8, 4BS8

Color Television Type  
**VHF CASCADE 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)<sup>(1)</sup>**

	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 $\mu$ mhos
Amplification Factor .....	36
Plate Resistance.....	5000 Ohms
Grid Voltage for $I_b = 10 \mu$ a (Section 2 only) .....	-7 Volts

**Cascode Amplifier**

Plate Supply Voltage.....	250 Volts
Plate Current .....	16 Ma
Grid Voltage .....	-1 Volt
Transconductance .....	10,000 $\mu$ mhos
Ec1 for $g_m = 50 \mu$ mhos (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

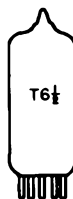
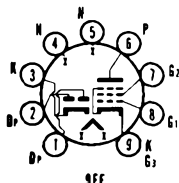
**AFC or DETECTOR (D)**  
**IF/VIDEO/AGC AMPLIFIER (P)**

**6BT8**

5BT8

**Double Diode and Sharp Cutoff Pentode**

Construction .....	Miniature T-6 $\frac{1}{2}$
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**

Heater Voltage.....	<b>5BT8</b> 4.7	<b>6BT8</b> 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)**

<b>Pentode Section</b>	
Grid No. 1 to Plate (Max.).....	0.04 Pf
Input .....	7.0 Pf
Output .....	2.3 Pf
<b>Diode (Each Section)</b>	
Plate to (h + k) .....	1.3 Pf
Cathode to (h + p) .....	3.0 Pf
<b>Coupling</b>	
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**

<b>Pentode</b>	
Plate Voltage .....	200 Volts

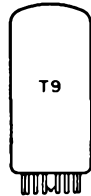
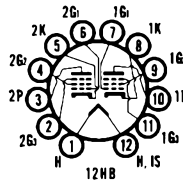
Grid No. 2 Voltage .....	150 Volts
Cathode Bias Resistor .....	180 Ohms
Plate Current .....	9.5 Ma
Grid No. 2 Current .....	2.8 Ma
Transconductance .....	6200 $\mu$ mhos
Plate Resistance (Approx.) .....	300,000 Ohms
Grid No. 1 Voltage for $I_b = 10 \mu$ a (Approx.) .....	-8 Volts
<b>Diode</b>	
Average 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**

Heater Voltage .....	<b>12BV11</b> 12.6	<b>6BV11</b> 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: $g_1$ to ( $h + k + g_2 + g_3 + IS$ ) .....	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)**

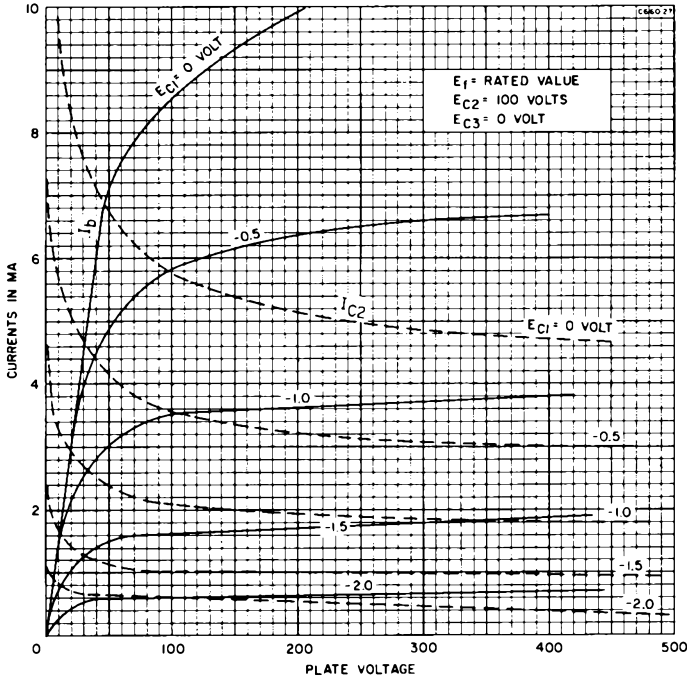
DC Plate Voltage (Max.) .....	300 Volts
Positive Grid No. 3 Voltage (DC and Peak) (Max.) .....	25 Volts
Negative Grid No. 3 Voltage (DC and Peak) (Max.) .....	100 Volts
DC Grid No. 2 Supply Voltage (Max.) .....	300 Volts
DC Grid No. 2 Voltage (Max.) .....	See Rating Chart (Gen. Info. Sec.)
Positive Grid 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 ( $E_{c2}$ up to 150 V) (Max.) .....	1.0 Watt
Grid No. 2 Input ( $E_{c2}$ 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 $\mu$ mhos
Grid No. 3 Transconductance .....	390 $\mu$ mhos
Plate Resistance (Approx.) .....	0.17 Megohm
$E_{c1}$ for $I_b = 75 \mu$ a (Approx.) .....	-3.5 Volts
$E_{c3}$ for $I_b = 85 \mu$ a (Approx.) .....	-5.5 Volts
Amplification Factor ( $g_3$ -P) .....	67



**AVERAGE PLATE CHARACTERISTICS  
(Each Section)**

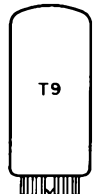
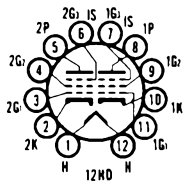


*Color Television Type*  
**GENERAL PURPOSE AMPLIFIER  
VIDEO AMPLIFIER**

**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 ..... 200 Volts
- Total DC and Peak.....
- Heater Positive with Respect to Cathode
- DC ..... 100 Volts
- Total DC and Peak..... 200 Volts

**DIRECT INTERELECTRODE CAPACITANCES<sup>(1)</sup>**

**Section No. 1**

- Grid to Plate ..... 0.03 pf
- Input: g to (h + 1K + 1g2 + 1g3 + 1S)..... 7.5 pf
- Output: p to (h + 1K + 1g2 + 1g3 + 1S)..... 2.8 pf

**Section No. 2**

- Grid to Plate (Max.)..... 0.03 pf
- Input: g to (h + 1K + 1g2 + 1g2 + 1S)..... 12.0 pf
- Output: p to (h + 1K + 1g2 + 1g3 + 1S)..... 2.8 pf

**Coupling**

Cathode Section 1, to Cathode Section 2: (1K to 2K), Maximum <sup>(1)</sup> .....	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**

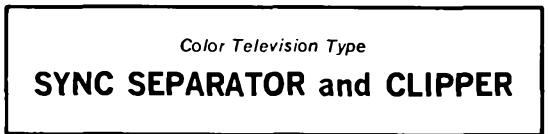
Plate Voltage .....	125 Volts
Screen Voltage .....	125 Volts
Cathode Resistor .....	56 Ohms
Plate Resistance (Approx.) .....	120,000 Ohms
Transconductance .....	8500 $\mu$ mhos
Plate Current .....	22 Ma
Screen Current .....	4.8 Ma
E <sub>c1</sub> for I <sub>b</sub> = 20 $\mu$ a .....	9.5 Volts

**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 $\mu$ mhos
Plate Current .....	11 Ma
Screen Current .....	3.8 Ma
E <sub>c1</sub> for I <sub>b</sub> = 20 $\mu$ a .....	-3 Volts

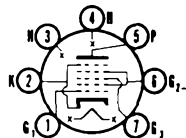
**NOTES:**

- (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.



**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>3BY6</b>	<b>6BY6</b>
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**

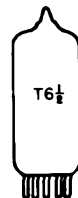
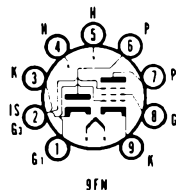
Plate Voltage .....	10 Volts
Grid No. 3 Voltage .....	0 Volt
Grid No. 2 and Grid No. 4 Voltage .....	25 Volts
Grid No. 1 Voltage .....	0 Volt
Plate Current .....	1.4 Ma
Grid No. 2 and Grid No. 4 Current.....	3.5 Ma
Eg3 for Eb = Eg2 = Eg4 = 25 V, Eg1 = 0 V and Ib = 50 $\mu$ a.....	-2.5 Volts
Eg1 for Eb = Eg2 = Eg4 = 25 V, Eg3 = 0 V and Ib = 50 $\mu$ a.....	-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)<sup>(1)</sup>**

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 $\mu$ mhos
Plate Resistance (Approx.) .....	0.5	1.5	1.0 Megohms
Ec1 for Ib = 10 $\mu$ a (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.



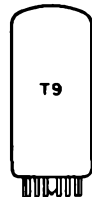
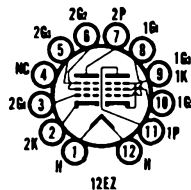
**Power Pentode and Dual-Control Pentode**

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.

**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**

**Section No. 1**

Grid to Plate .....	0.28 pf
Input: g to (h + 1k + 1g <sub>2</sub> + 1g <sub>3</sub> + 1S) .....	12.0 pf
Output: p to (h + 1k + 1g <sub>2</sub> + 1g <sub>3</sub> + 1S) .....	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 + 2g <sub>2</sub> + 2g <sub>3</sub> + 1S) .....	7.0 pf
Grid No. 3 to (h + 2k + 2g <sub>2</sub> + 2g <sub>3</sub> + 2p + 1S) .....	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 $\mu$ hos
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 (G <sub>1</sub> ) .....	2500 $\mu$ hos
Transconductance (G <sub>3</sub> ) .....	850 $\mu$ hos
Plate Current .....	1.3 Ma
Screen Current .....	2.1 Ma
E <sub>c1</sub> for I <sub>b</sub> = 20 $\mu$ a .....	-4.0 Volts
E <sub>c3</sub> for I <sub>b</sub> = 50 $\mu$ a .....	-3.0 Volts

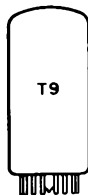
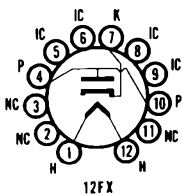
Without Shield

**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**

	<b>17BZ3</b>	<b>6BZ3</b>
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)**

<b>Damper Service<sup>(1)</sup></b>	
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
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**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

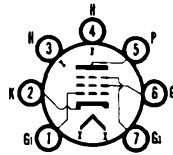
3BZ6, 4BZ6, 12BZ6

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.



**ELECTRICAL DATA  
HEATER OPERATION**

	<b>7CM</b>			
	<b>3BZ6</b>	<b>4BZ6</b>	<b>12BZ6</b>	<b>6BZ6</b>
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**

	<b>Shielded<sup>(1)</sup></b>	<b>Unshielded</b>
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 $\mu$ mhos
Plate Resistance (Approx.) .....	260,000 Ohms
E <sub>c1</sub> for G <sub>m</sub> = 50 $\mu$ mhos (Approx.) .....	-19 Volts
G <sub>m</sub> with E <sub>c1</sub> = -4.5 V, R <sub>K</sub> = 0 .....	700 $\mu$ mhos

**NOTE:**

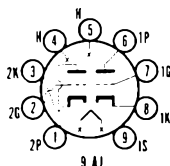
(1) External Shield No. 316 connected to Pin No. 2 (cathode) at socket.

**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**

	<b>4BZ8</b>	<b>6BZ8</b>
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)**

	<b>Section No. 1</b>	<b>Section No. 2</b>
<b>Cascode Operation</b>		
Grid to Plate .....	1.15	— Pf
Plate to Cathode .....	—	0.15 Pf
Triode No. 1 Plate to Triode No. 2 Plate .....	0.010	— Pf
<b>RATINGS (Design Maximum Rating System) (Each Section)</b>		
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 $\mu$ mhos
Amplification Factor .....	45
Plate Resistance .....	5600 Ohms
Grid Voltage (Approx.) for G <sub>m</sub> = 50 $\mu$ mhos .....	-13 Volts
Cascode Operation at E <sub>b</sub> = 250 Volts, E <sub>c1</sub> = -0.5 Volts	
Transconductance .....	10,000 $\mu$ mhos
Plate Current .....	15 Ma

**NOTE:**

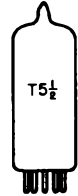
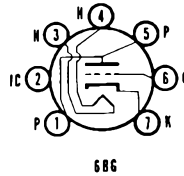
(1) Use external shield No. 315.

**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.



**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 <sup>(1)</sup>	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 <sup>(2)</sup> .....	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 I <sub>b</sub> = 10 μa .....	-10	-25 Volts

**Class C Telegraphy <sup>(3)</sup>**

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.

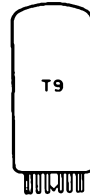
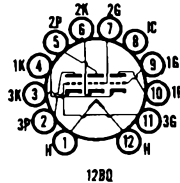


**AMPLIFIER, PHASE INVERTER**

**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.



**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**

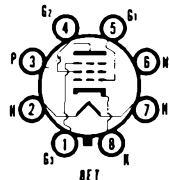
Plate Voltage.....	100	250 Volts
Grid Voltage.....	-1.0	-2.0 Volts
Amplification Factor.....	100	100
Plate Resistance (Approx.).....	80,000	62,500 Ohms
Transconductance.....	1250	1600 $\mu$ mhos
Plate Current.....	0.5	1.2 Ma

**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

Heater Voltage.....	6.3 Volts
Heater Current.....	1500 Ma

<b>Maximum Heater Cathode Voltage</b>	
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)**

	<b>Triode Conn.</b>	<b>Pentode Conn.</b>
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.) <sup>(1)</sup> .....	0.7	0.7 Megohm

**CHARACTERISTICS AND TYPICAL OPERATION**

	<b>Triode Operation Push-Pull</b>	<b>Pentode Operation Single Tube</b>	
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	— $\mu$ mhos
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:**

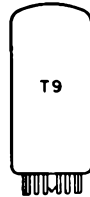
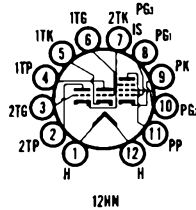
(1) The maximum permissible limit for Grid No. 1 Resistor in a Class B Circuit is 0.5 Megohm.

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.



**ELECTRICAL DATA  
HEATER OPERATION**

Heater Voltage .....	<b>11CA11</b>	<b>6CA11</b>
Heater Current .....	10.7	6.3 Volts
Heater Warm-up Time .....	600	1020 Ma
Maximum Heater-Cathode Voltage	11	— Seconds
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

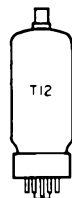
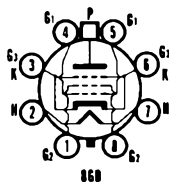
Grid Voltage .....		-2.0 Volts
Amplification Factor .....		63
Plate Resistance (Approx.) .....		10,000 Ohms
Transconductance .....		6300 $\mu$ mhos
Plate Current .....		7.1 Ma
Grid Voltage (Approx.) $I_b = 100 \mu a$ .....		-6.3 Volts
<b>Triode No. 2</b>		
Plate Voltage .....		200 Volts
Cathode-Bias Resistor .....		270 Ohms
Amplification Factor .....		69
Plate Resistance (Approx.) .....		12,400 Ohms
Transconductance .....		5500 $\mu$ mhos
Plate Current .....		7.1 Ma
Grid Voltage (Approx.) $I_b = 100 \mu a$ .....		-5.5 Volts
<b>Pentode Section</b>		
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 $\mu$ mhos
Plate Current .....	68	27.5 Ma
Screen Current .....	17.6	4.9 Ma
Grid No. 1 Voltage (Approx.) $I_b = 100 \mu a$ .....	—	-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<sup>(1)</sup>**

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 $\mu$ mhos
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:**

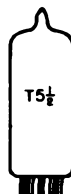
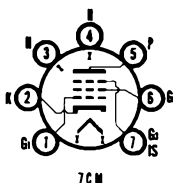
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

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.



**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 $\mu$ mhos
Plate Resistance (Approx.) .....	0.28 Megohm
Grid No. 1 Voltage for Ib = 20 $\mu$ a (Approx.) .....	-6.5 Volts

**NOTE:**

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

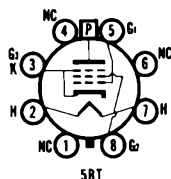
**6CD6GA**

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 <sup>(1)</sup> .....	.5BT
Outline .....	12-21
Maximum Diameter .....	1.563 In.
Maximum Seated Height .....	4.250 In.
Maximum Overall Height .....	5.000 In.

**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<sup>(2)</sup>**

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.) <sup>(3)</sup> .....	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 $\mu$ mhos
Amplification Factor <sup>(4)</sup> .....	3.9
Plate Resistance .....	7200 Ohms
E <sub>c1</sub> for I <sub>b</sub> = 1.0 Ma (Approx.) .....	-55 Volts

**INSTANTANEOUS PLATE KNEE VALUES**E<sub>b</sub> = 60 V, E<sub>c2</sub> = 100 V, and E<sub>c1</sub> = 0 VI<sub>b</sub> = 230 Ma and I<sub>c2</sub> = 21 Ma**NOTES:**

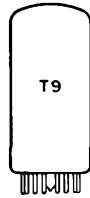
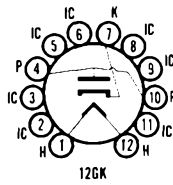
- (1) Horizontal operation permitted if plane of Pins 2 and 7 is vertical.
- (2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>34CE3, 34CD3</b>	<b>6CE3/6CD3</b>
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
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**NOTE:**

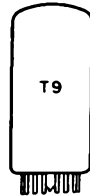
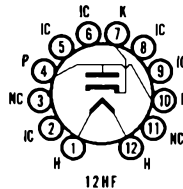
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

Color Television Type  
**DAMPER**

**6CG3**  
19CG3, 25CG3

**Heater-Cathode Diode**

Construction ..... Compactron T-9  
 Base ..... Button 12 Pin, E12-70  
 Basing<sup>(1)</sup> ..... 12HF  
 Outline ..... 9-62  
 Maximum Diameter ..... 1.188 In.  
 Maximum Seated Height ..... 3.000 In.  
 Maximum Overall Height ..... 3.375 In.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>19CG3</b>	<b>25CG3</b>	<b>6CG3</b>
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<sup>(2)</sup>**

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
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**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

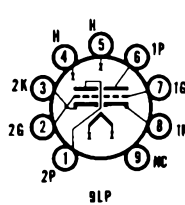
8CG7/8FQ7, 12FQ7

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.



**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 <sup>(1)</sup>	Vert. Defl. Oscillator <sup>(1)</sup>
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 <sup>(2)</sup>			
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 $\mu$ mhos
Amplification Factor .....	20	20
Plate Resistance (Approx.) .....	6700	7700 Ohms
Grid Voltage for $I_b = 10 \mu$ a (Approx.) .....	-7	-18 Volts
Plate Current at $E_c = -12.5$ Vdc. ....	—	1.3 Ma

**NOTES:**

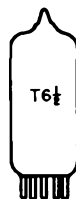
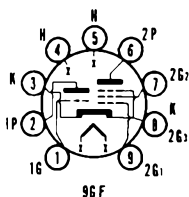
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) In stages operating with grid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



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>5CG8</b>	<b>6CG8A</b>
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**

	<b>Shielded <sup>(1)</sup></b>	<b>Unshielded</b>
<b>Triode Section</b>		
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
<b>Pentode Section</b>		
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
<b>Coupling</b>		
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 <sup>(2)</sup>	5.5 Pf

**RATINGS (Design Maximum Rating System)**

	<b>Triode Section</b>	<b>Pentode Section</b>
<b>Converter Service</b>		
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 $\mu$ mhos
Amplification Factor .....	40	—
Plate Resistance (Approx.) .....	6000	300,000 Ohms
E <sub>c1</sub> for I <sub>b</sub> = 10 $\mu$ a (Approx.) .....	-7	-6.5 Volts

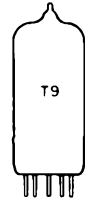
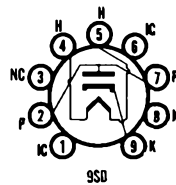
**NOTES:**

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



**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<sup>(1)</sup>**

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 I <sub>b</sub> = 680 Ma .....	20 Volts
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**NOTE:**

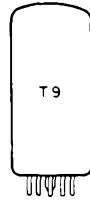
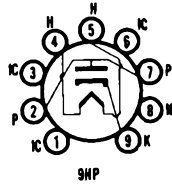
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

**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.



**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<sup>(1)</sup>**

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
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**NOTE:**

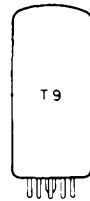
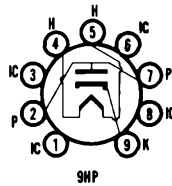
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

*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<sup>(1)</sup> .....9HP  
 Outline  
 Maximum Diameter .....1.188 In.  
 Maximum Seated Height .....2.625 In.  
 Maximum Overall Height .....3.005 In.



**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
<b>DIRECT INTERELECTRODE CAPACITANCES (Unshielded)</b>	
Heater to Cathode .....	3.0 Pf
Plate to Cathode and Heater .....	6.5 Pf
Cathode to Plate and Heater .....	9.0 Pf
<b>RATINGS (Design Maximum Rating System)</b>	
<b>Damper Service<sup>(2)</sup></b>	
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
<b>CHARACTERISTICS AND TYPICAL OPERATION</b>	
Tube Voltage Drop for Ib = 350 Ma .....	16 Volts

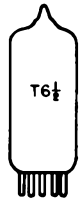
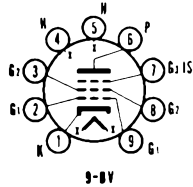
**NOTES:**

- (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.



**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.



**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

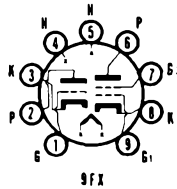
Total Harmonic Distortion .....	8 Percent
Maximum Signal Power Output.....	2.8 Watts
<b>4 MHz Bandwidth Video Amplifier</b>	
Plate Supply Voltage.....	300 Volts
Grid No. 3 Voltage.....	Connected to Cathode at Socket
Grid No. 2 Supply Voltage.....	300 Volts
Grid No. 1 Bias Voltage.....	-2 Volts
Peak-to-Peak 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.



**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 <sup>(1)</sup>	Unshielded
<b>Triode Section</b>		
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
<b>Tetrode Section</b>		
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
<b>Class A1 Amplifier</b>		
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 $\mu$ mhos
Amplification Factor .....	40	—
Plate Resistance .....	5000	100K Ohms
Grid No. 1 Voltage for $I_b = 10 \mu$ a (Approx.) .....	-9	-10 Volts

**NOTE:**

(1) Shield No. 315.

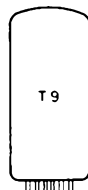
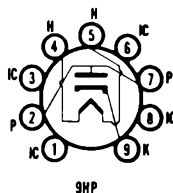
## 6CM3

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.



**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
<b>DIRECT INTERELECTRODE CAPACITANCES (Without Shield)</b>			
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<sup>(1)</sup>**

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 ( $I_b = 350$ 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

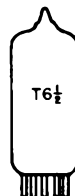
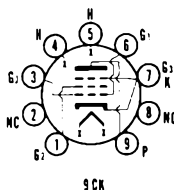
5CM6, 12CM6

*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  
 Maximum Diameter ..... 0.875 In.  
 Maximum Seated Height ..... 2.375 In.  
 Maximum Overall Height ..... 2.625 In.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>12CM6</b>	<b>5CM6</b>	<b>6CM6</b>
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 Dissipation (Max.).....	2 Watts
Grid No. 1 Circuit Resistance	
Fixed Bias (Max.).....	0.1 Megohm
Cathode Bias (Max.).....	0.5 Megohm

**Vertical Deflection Amplifier<sup>(1)</sup>**

	<b>Pent. Conn.</b>	<b>Tri. Conn.</b>
Plate Voltage (Max.).....	315	315 Volts
Peak Positive Plate Voltage (Abs. Max.).....	2000	2000 Volts
Plate Dissipation (Max.) <sup>(2)</sup> .....	8	9 Watts
Grid No. 2 Voltage.....	285	— Volts
Grid No. 2 Dissipation <sup>(2)</sup> .....	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**

	<b>Tri. Conn.</b>	<b>Single Tube</b>			<b>Push-Pull</b>	
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.

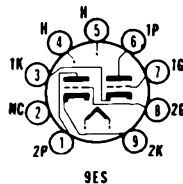
**VERTICAL DEFLECTION  
OSCILLATOR and AMPLIFIER**

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.



**ELECTRICAL DATA  
HEATER OPERATION**

	<b>8CM7</b>	<b>6CM7</b>
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)**

	<b>Section 1<sup>(1)</sup></b>	<b>Section 2</b>
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<sup>(2)</sup>**

	<b>Section 1<sup>(1)</sup> (Oscillator)</b>	<b>Section 2 (Amplifier)</b>
DC Plate Voltage (Max.) .....	500	500 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.) .....	—	2200 Volts
Plate Dissipation (Max.) <sup>(3)</sup> .....	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**

	<b>Section 1<sup>(1)</sup> (Oscillator)</b>	<b>Section 2 (Amplifier)</b>
Plate Voltage .....	200	250 Volts
Grid Voltage .....	-7	-8 Volts
Plate Current .....	5	20 Ma
Transconductance .....	2000	4400 $\mu$ mhos
Amplification Factor .....	21	18
Plate Resistance .....	10,500	4100 Ohms
Plate Current at $E_c = -10$ Volts .....	1.0	— Ma
Grid Voltage for $I_b = 10 \mu$ a .....	-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

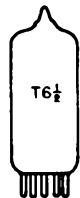
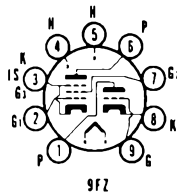
GENERAL PURPOSE AMPLIFIER (T)  
IF/VIDEO/AGC AMPLIFIER (P)

**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.

**ELECTRICAL DATA  
HEATER OPERATION**

	<b>5CM8</b>	<b>6CM8</b>
Heater Voltage.....	4.7	6.3 Volts
Heater Current .....	600	450 Ma
Heater Warm-up Time .....	11	11 Seconds





<b>Maximum Heater-Cathode Voltage</b>	
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)**

	<b>Triode</b>	<b>Pentode</b>
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**

	<b>Triode</b>	<b>Pentode</b>
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 $\mu$ mhos
Grid No. 1 Voltage for Ib = 10 $\mu$ a (Approx.) .....	—	-8 Volts

Color Television Type

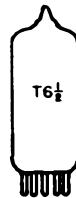
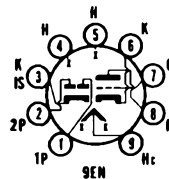
**REACTANCE TUBE or SYNC  
SEP/AMP (T); PHASE DETECTOR (D)**

**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**

	<b>8CN7</b>	<b>6CN7</b>
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
<b>Maximum Heater-Cathode Voltage</b>		
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**

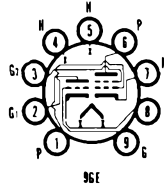
**Class A1 Amplifier**

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 $\mu$ mhos
Plate Current .....	0.8	1.0 Ma
Average Diode Current, Each Diode with 5.0 Volts DC Applied .....	—	20 Ma



**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.



**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
<b>Triode Section</b>		
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
<b>Pentode Section</b>		
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
<b>Coupling</b>		
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**

	<b>Triode Section</b>	<b>Tetrode Section</b>
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 $\mu$ mhos
Amplification Factor .....	40	—
Plate Resistance (Approx.) .....	5000	140,000 Ohms
Ec1 for Ib = 100 $\mu$ a (Approx.) .....	-7	-7 Volts

**NOTE:**

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

Color Television Type

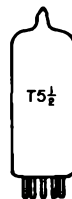
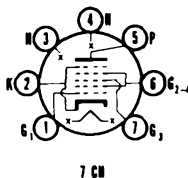
**SYNC SEPARATOR and CLIPPER**

**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>12CS6</b>	<b>4CS6</b>	<b>3CS6</b>	<b>6CS6</b>
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

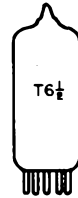
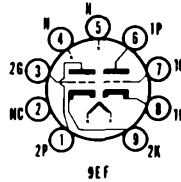
Grid No. 1 Voltage .....	0	0	-1.0 Volt
Grid No. 3 Voltage .....	0	-1.0	0 Volt
Plate Current .....	1.2	0.8	0.75 Ma
Grid No. 2 Current .....	4.1	4.0	1.1 Ma
Transconductance			
Grid No. 1.....	—	—	950 $\mu$ mhos
Grid No. 3.....	—	1250	— $\mu$ mhos
Plate Resistance (Approx.) .....	—	0.7	1.0 Megohm
Grid Voltage for $I_b = 50 \mu a$			
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 <sup>(1)</sup>	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<sup>(2)</sup>**

	Section 1 <sup>(1)</sup> (Oscillator)	Section 2 (Amplifier)
DC Plate Voltage (Max.) .....	500	500 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.).....	—	2200 Volts
Plate Dissipation (Max.) <sup>(1)</sup> .....	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 <sup>(1)</sup>	Section 2
Plate Voltage .....	250	250 Volts
Grid Voltage .....	-8.5	-10.5 Volts
Plate Current .....	10.5	19.0 Ma

Transconductance .....	2200	4500 $\mu$ mhos
Amplification Factor .....	17.0	15.5
Plate Resistance.....	7700	3450 Ohms
Plate Current at $E_c = -16$ Volts .....	—	3.0 Ma
Grid Voltage for $I_b = 10 \mu$ a.....	-24	— Volts
Grid Voltage for $I_b = 50 \mu$ a.....	—	-22 Volts

**NOTES:**

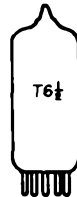
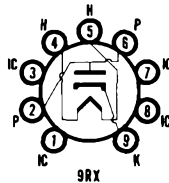
- (1) Section 1 connects to Pins 6, 7, and 8. Section 2 connects to Pins 1, 3, and 9.
- (2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must 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.



**Heater-Cathode Diode**

Construction ..... Miniature T-6½  
 Base ..... E9-1  
 Basing<sup>(1)</sup> ..... 9RX  
 Outline

Maximum Diameter ..... 0.875 In.  
 Maximum Seated Height ..... 2.875 In.  
 Maximum Overall Height ..... 3.125 In.



**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<sup>(1)</sup>**

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 ( $I_b = 350$ Ma) .....	16 Volts
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**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.

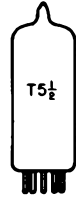
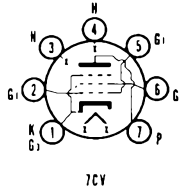
# 6CU5

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.



### ELECTRICAL DATA HEATER OPERATION

	50C5	25C5	17C5/17CU5	12C5/12CU5	6CU5
Heater Voltage.....	50	25	16.8	12.5	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

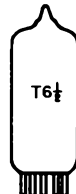
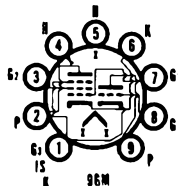
Plate Voltage .....	120 Volts
Grid No. 2 Voltage .....	110 Volts
Grid No. 1 Voltage .....	-8 Volts
Peak AF Grid No. 1 Voltage .....	8 Volts
Zero-Signal Plate Current .....	49 Ma
Maximum-Signal Plate Current .....	50 Ma
Zero-Signal Grid No. 2 Current .....	4.0 Ma
Maximum-Signal Grid No. 2 Current .....	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 + g <sub>3</sub> + IS) .....	1.9 Pf
Plate to (k + h + g <sub>3</sub> + IS) .....	1.6 Pf

**Pentode Section**

Grid No. 1 to Plate (Max.) .....	0.025 Pf
Grid No. 1 to (k and g <sub>3</sub> + g <sub>2</sub> + h + Tk + IS) .....	7.0 Pf
Plate to (k and g <sub>3</sub> + g <sub>2</sub> + 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 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 $\mu$ mhos
Amplification Factor .....	24	—
Plate Resistance .....	4100	17000 Ohms
Ec1 for Ib = 10 $\mu$ a (Approx.) .....	-12	-6 Volts
Ib at Ec1 = -3 Volts, RK = 0 .....	—	1.6 Ma

Color Television Type

**VHF AMPLIFIER**

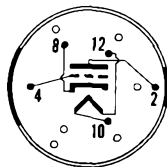
**6CW4**

2CW4, 13CW4

**High Mu Triode**

Construction ..... Nuvistor, Metal  
 Base ..... Medium Ceramic Wafer  
                     Twelvac 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
<b>DIRECT INTERELECTRODE CAPACITANCES (Shielded)</b>			
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
<b>RATINGS (Design Maximum Rating System)</b>			
Plate Supply Voltage (Max.) .....			300 Volts
Plate Voltage (Max.) .....			135 Volts
Plate Dissipation (Max.) .....			1.0 Watt
DC Cathode Current (Max.) .....			15 Ma
Negative 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 $\mu$ mhos
Amplification Factor .....	68	65
Plate Resistance (Approx.) .....	5440	6600 Ohms
Ec for Ib = 10 $\mu$ a (Approx.) .....	—	—4 Volts

**6CW5/EL86**

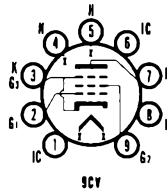
8CW5A, 10CW5/LL86  
15CW5/PL84, 30CW5

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.



**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<sup>(1)</sup>—Triode Connected<sup>(2)</sup>**

Plate Voltage (Max.) .....	275 Volts
Peak Positive Plate Voltage (Abs. Max.) .....	2200 Volts



Plate Dissipation (Max.) <sup>(a)</sup> .....	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 $\mu$ mhos
Amplification Factor (g <sub>1</sub> to g <sub>2</sub> ) .....	8
Plate Resistance .....	26,000 Ohms

**NOTES:**

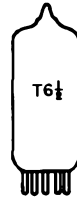
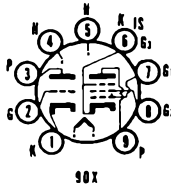
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) Grid No. 2 connected to plate.
- (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-6 $\frac{1}{2}$
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**

	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	Pentode Section
Grid to Plate .....	4.4 Pf	0.06 Pf
Input .....	2.2 Pf	9.0 Pf
Output .....	0.38 Pf	4.4 Pf
<b>Coupling</b>		
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 $\mu$ mhos
Amplification Factor .....	40	—
Plate Resistance (Approx.) .....	8700	70,000 Ohms
Grid No. 1 Voltage for $I_b = 100 \mu a$ (Approx.) .....	-5.0	-8.5 Volts

**INSTANTANEOUS PLATE KNEE CHARACTERISTICS**

$E_b = 40 V, E_{c2} = 125 V, E_{c1} = 0 V$   
 $I_b = 40 Ma, I_{c2} = 15.5 Ma$

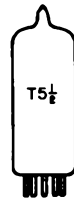
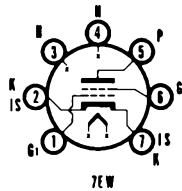
# 6CY5

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.



**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)<sup>(1)</sup>**

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 $\mu$ mhos
Plate Resistance .....	0.1 Megohm
Grid No. 1 Voltage for $I_b = 20 \mu a$ .....	-6 Volts

**NOTE:**

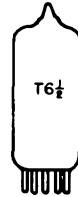
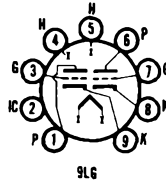
(1) Shield No. 316 connected to cathode.

**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.



**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. <sup>(1)</sup> Section No. 1	Vertical Defl. Amp. <sup>(1)</sup> 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.) <sup>(2)</sup> .....	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

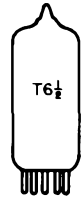
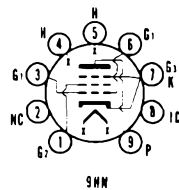
5CZ5

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.



**ELECTRICAL DATA**  
**HEATER OPERATION**

Heater Voltage.....	<b>5CZ5</b>	<b>6CZ5</b>
Heater Current .....	4.7	6.3 Volts
Heater Voltage .....	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 <sup>(2)</sup>	— Volts
DC Grid No. 2 Voltage (Max.) .....	315	285 Volts
Peak Negative Grid No. 1 Voltage (Max.) .....	275	— Volts
Plate Dissipation (Max.) <sup>(1)</sup> .....	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 <sup>(3,4)</sup> .....	—	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:**

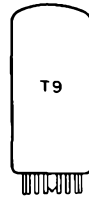
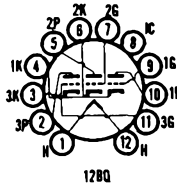
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the pulse must not exceed 15% of one horizontal scanning cycle.
- (2) Under no circumstances should this 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.



**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**

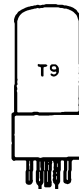
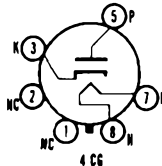
Plate Voltage.....	125 Volts
Grid Voltage.....	-1.0 Volt
Plate Current.....	4.2 Ma
Plate Resistance.....	13,600 Ohms
Transconductance.....	4200 $\mu$ mhos
Amplification Factor.....	57
$E_c$ for $I_b = 20 \mu a$ .....	-4 Volts

**DAMPER**

**6DA4A/6DM4A**  
12D4A, 17D4A

**Heater-Cathode Diode**

Construction .....Octal T-9  
 Base .....Octal 5 Pin, B5-85  
 Basing<sup>(1)</sup> .....4CG  
 Outline .....9-41  
     Maximum Diameter .....1.188 In.  
     Maximum Seated Height .....2.750 In.  
     Maximum Overall Height .....3.313 In.



**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<sup>(2)</sup>**

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
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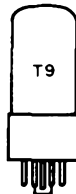
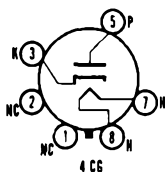
**NOTES:**

- (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.



**Heater-Cathode Diode**

Construction .....	Octal T-9
Base <sup>(1)</sup> .....	Octal 5 Pin, B5-85
Basing <sup>(2)</sup> .....	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.) <sup>(3)</sup> .....	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
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**NOTES:**

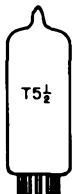
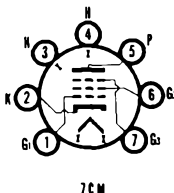
- (1) On some base arrangements Pins 1, 4, and 6 are omitted.
- (2) Pins 1, 2, 4, and 6 should not be used as tie points.
- (3) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the 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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>4DE6</b>	<b>6DE6</b>
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**

	<b>Shielded</b>	<b>Unshielded</b>
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**

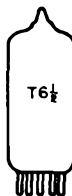
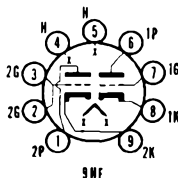
Plate Voltage.....	125 Volts
Grid No. 3 Voltage.....	Connected to Cathode at Socket
Grid No. 2 Voltage.....	125 Volts
Cathode Bias Resistor.....	56 Ohms
Plate Current.....	15.5 Ma
Grid No. 2 Current.....	4.2 Ma
Transconductance.....	8000 μmhos
Plate Resistance (Approx.).....	0.25 Megohm
Transconductance with Ecl = -5.5, Rk = 0.....	700 μmhos
Ecl 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.



**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<sup>(1)</sup>**

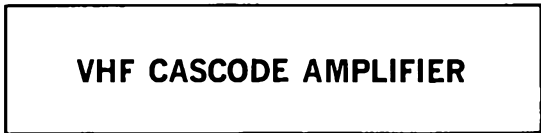
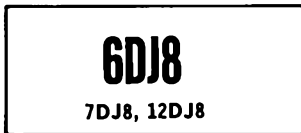
	Section No. 1 Oscillator	Section No. 2 Amplifier
DC Plate Voltage (Max.) .....	330	275 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.).....	—	1500 Volts
Peak Negative Pulse Grid Voltage (Max.) .....	400	250 Volts
Plate Dissipation (Max.) <sup>(2)</sup> .....	1.5	7.0 Watts
Average Cathode Current (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 $\mu$ mhos
Amplification Factor .....	17.5	6.0
Plate Resistance (Approx.) .....	8750	925 Ohms
Grid Voltage for $I_b = 10 \mu a$ .....	-20	— Volts
Grid Voltage for $I_b = 50 \mu a$ .....	—	-44 Volts
Plate Current at $E_c = -24 Vdc$ .....	—	10 Ma
Zero Bias Plate Current		
$E_b = 60 V$ ; $E_c = 0$ (Instantaneous Values) .....	—	80 Ma

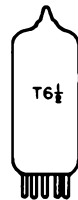
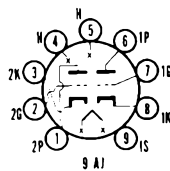
**NOTES:**

- (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.



**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
<b>Grounded-Cathode Section<sup>(1)</sup></b>		
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
<b>Grounded-Grid Section<sup>(1)</sup></b>		
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 ( $I_b = 0$ Ma) (Max.).....	550 Volts
Plate Voltage (Max.) <sup>(2)</sup> .....	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

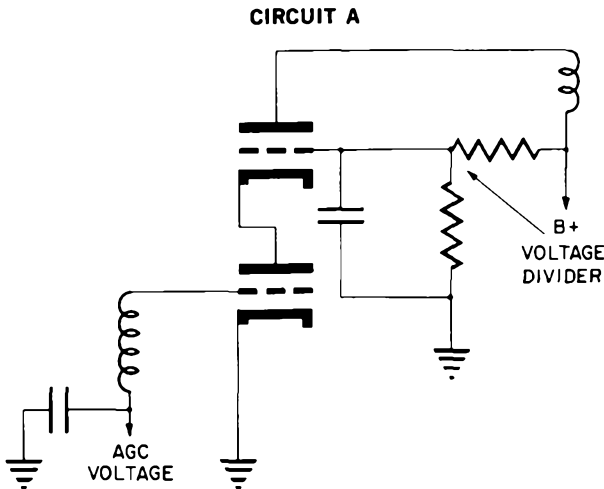
**CHARACTERISTICS AND TYPICAL OPERATION**

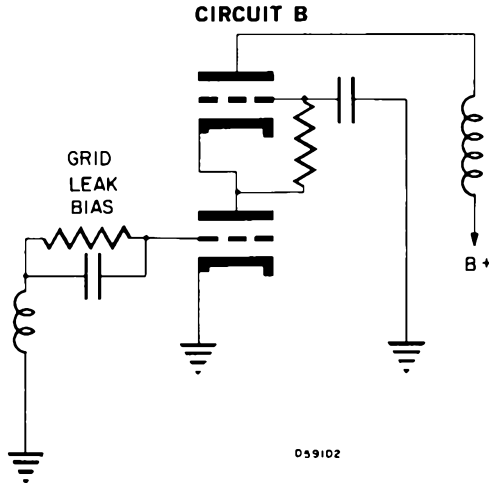
**Class A1 Amplifier (Each Section)**

Plate Voltage .....	90 Volts
Grid Voltage .....	-1.3 Volts
Plate Current .....	15 Ma
Transconductance .....	12,500 $\mu$ mhos
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 cascade 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).



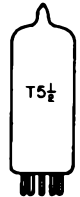
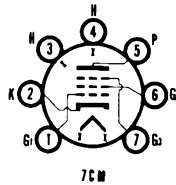


**6DK6**  
3DK6, 4DK6, 12DK6

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**

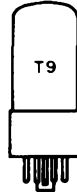
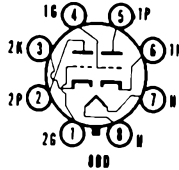
Plate Voltage .....	125 Volts
Grid No. 3 Voltage (Suppressor) .....	Connected to Cathode at Socket
Grid No. 2 Voltage .....	125 Volts
Cathode Bias Resistor .....	56 Ohms
Plate Current .....	12.0 Ma
Grid No. 2 Current .....	3.8 Ma
Transconductance .....	9800 μmhos
Plate Resistance.....	0.35 Megohm
Grid No. 1 Bias for Ib of 20 μa (Approx.).....	-6.5 Volts

**VERTICAL DEFLECTION  
OSCILLATOR and AMPLIFIER**

**GDN7**

**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) <sup>(1)</sup>	Vertical Deflection Service (Section 2) <sup>(1)</sup>
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 <sup>(2)</sup> 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 <sup>(3)</sup> -9.5 Volts
Amplification Factor.....	22.5	— 15.4
Plate Resistance (Approx.).....	9000	— 2000 Ohms
Transconductance.....	2500	— 7700 $\mu$ mhos
Plate Current.....	8.0	68 41 Ma
Grid Voltage (Approx.)		
I <sub>b</sub> = 10 $\mu$ a.....	-18	— -22 Volts
I <sub>b</sub> = 50 $\mu$ a.....	—	— -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.

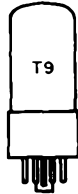
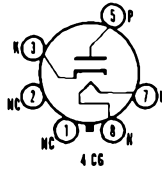
# 6DQ4

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.



**ELECTRICAL DATA  
 HEATER OPERATION**

	<b>17DQ4</b>	<b>12DQ4</b>	
Heater Voltage .....	16.8	12.6	
Heater Current .....	450	600	
Heater Warm-up Time .....	11	11	

**6DQ4**  
 6.3 Volts  
 1200 Ma  
 — 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
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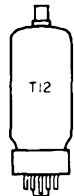
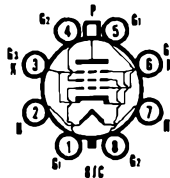
# 6DQ5

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.



**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<sup>(1)</sup>**

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.) <sup>(2)</sup>	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 $\mu$ mhos
Plate Resistance (Approx.)	5500 Ohms
Amplification Factor <sup>(3)</sup>	3.3
E <sub>c1</sub> for I <sub>b</sub> = 1.0 Ma	-75 Volts

**INSTANTANEOUS PLATE KNEE VALUES**

E<sub>b</sub> = 70 V, E<sub>c2</sub> = 125 V, and E<sub>c1</sub> = 0 V  
 I<sub>b</sub> = 550 Ma, and I<sub>c2</sub> = 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 E<sub>b</sub> and E<sub>c2</sub> = 125 V and E<sub>c1</sub> = -25 V.

Color Television Type

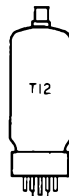
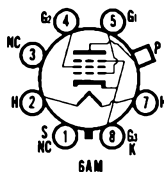
**HORIZONTAL  
DEFLECTION AMPLIFIER**

**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.



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

**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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 $\mu$ mhos
Amplification Factor <sup>(2)</sup> .....	4.4
Plate Resistance .....	18,000 Ohms
Ec1 for Ib = 1.0 Ma (Approx.) .....	-42 Volts

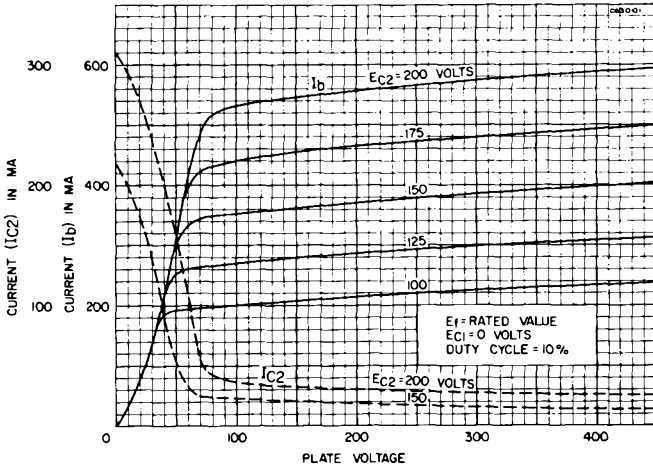
**INSTANTANEOUS PLATE KNEE VALUES**

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**

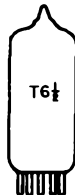
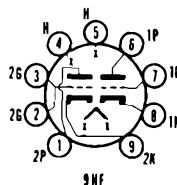


**6DR7**  
10DR7, 13DR7

**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<sup>(1)</sup>**

	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.) <sup>(2)</sup>	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 $\mu$ mhos
Amplification Factor	68	6.0
Plate Resistance (Approx.)	40,000	925 Ohms
Ec for Ib = 10 $\mu$ a (Approx.)	-5.5	— Volts
Ec for Ib = 50 $\mu$ a (Approx.)	—	-44 Volts
Ib at Ec = -24 Vdc (Approx.)	—	10 Ma

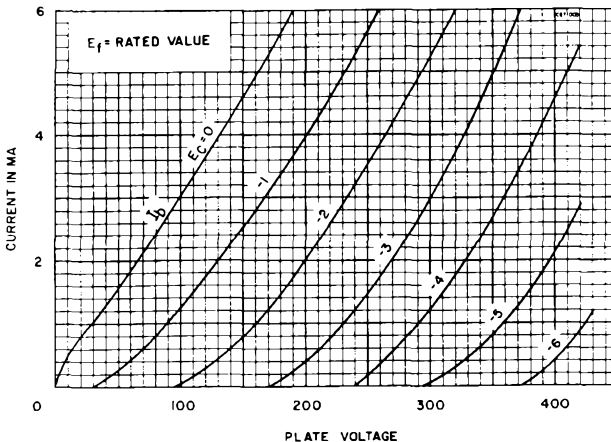
**INSTANTANEOUS PLATE KNEE VALUES (Section No. 2)**

Eb = 60 V; Ec = 0  
Ib = 80 Ma

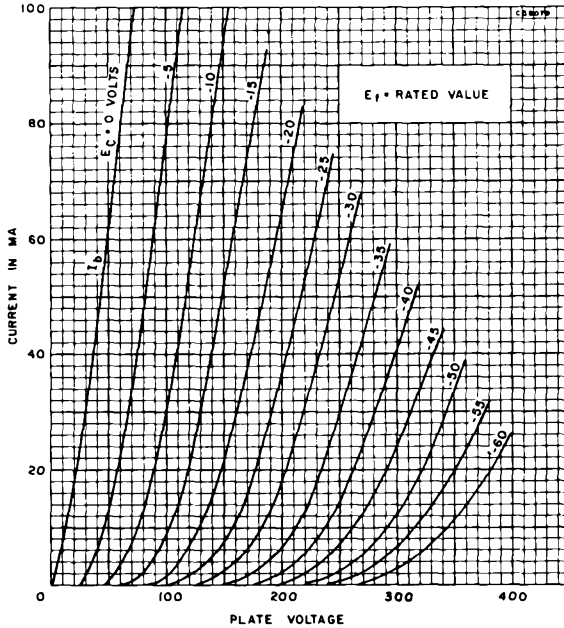
**NOTES:**

- (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.



**ELECTRICAL DATA**  
**HEATER OPERATION**

	<b>12AQ</b>	<b>2DS4</b>	<b>6DS4</b>
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

<b>DIRECT INTERELECTRODE CAPACITANCES</b>	
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

<b>RATINGS (Design Maximum Rating System)</b>	
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**

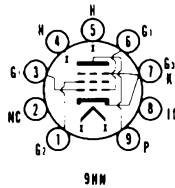
Plate Voltage .....	70	110 Volts
Grid Resistor .....	47,000	— Ohms
Cathode Resistor .....	—	130 Ohms
Plate Current .....	7	6.5 Ma
Transconductance .....	12,500	9000 $\mu$ mhos
Amplification Factor .....	68	63
Plate Resistance (Approx.) .....	5440	7000 Ohms
Ec for Ib = 100 $\mu$ a (Approx.) .....	—	-5 Volts
Ec for Ib = 10 $\mu$ a (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.



**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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	9.0 Watts
Grid No. 2 Dissipation (Max.) <sup>(2)</sup> .....	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 $\mu$ mhos
Ec1 for Ib = 100 $\mu$ a (Approx.) .....	-35 Volts

**INSTANTANEOUS PLATE KNEE VALUES**

Zero Bias: With  $E_b = 60$  V and  $E_{c2} = 150$  V

Plate Current .....	100 Ma
Grid No. 2 Current .....	15 Ma

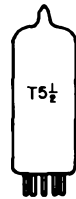
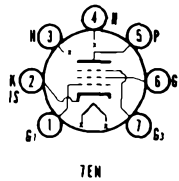
**NOTES:**

- (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.



**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.



**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)<sup>(1)</sup>**

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 $E_{b2}$ up to 165 Volts (Max.).....	1.1 Watts
For $E_{b2}$ 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 $\mu$ mhos
Grid No. 3 to Plate .....	515 $\mu$ mhos
Plate Resistance (Approx.) .....	0.15 Megohm
Grid No. 1 Voltage for $I_b = 10 \mu$ a .....	-5.2 Volts
Grid No. 3 Voltage for $I_b = 10 \mu$ a .....	-4.2 Volts

**NOTE:**

- (1) Shield No. 316 connected to cathode.

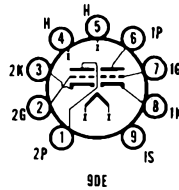
**RF AMPLIFIER or  
OSCILLATOR and MIXER**

**6DT8**

12DT8

**High Mu Twin Triode**

Construction ..... Miniature T-6½  
 Base ..... Button 9 Pin, E9-1  
 Basing<sup>(1)</sup> ..... 9DE  
 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.....	<b>12DT8</b>	<b>6DT8</b>
Heater Current.....	12.6	6.3 Volts
Maximum Heater-Cathode Voltage	150	300 Ma
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)**

	<b>Section No. 1<sup>(1)</sup></b>	<b>Section No. 2</b>
Grid to Plate.....	1.5	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

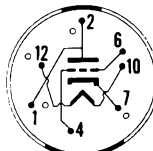
**UHF OSCILLATOR**

**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**

	<b>2DV4</b>	<b>6DV4</b>
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.) <sup>(1)</sup> .....	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 <sup>(2)</sup> .....	
Fixed Bias (Max.).....	0.1 Megohm
Cathode Bias (Max.).....	0.2 Megohm

**CHARACTERISTICS AND TYPICAL OPERATION**

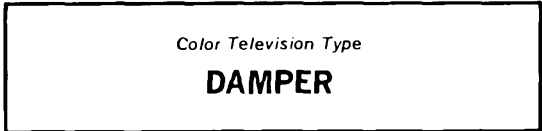
Plate Supply Voltage.....	75 Volts
Cathode Bias Resistor.....	100 Ohms
Amplification Factor.....	35
Plate Resistance (Approx.).....	3100 Ohms
Transconductance.....	11,500 $\mu$ mhos
Grid Voltage for $I_b = 10 \mu$ a.....	-7 Volts
Plate Current.....	10.5 Ma

**Oscillator at 950 MHz**

Plate Voltage.....	60 Volts
Grid Voltage.....	-2 Volts
Grid Resistor.....	5600 Ohms
Plate Current.....	8 Ma
Grid Current.....	350 $\mu$ a

**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.

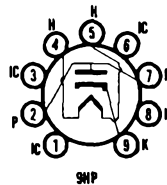


**Heater-Cathode Diode**

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

**ELECTRICAL DATA  
HEATER OPERATION**

	<b>17DW4A</b>	<b>12DW4A</b>	<b>6DW4A</b>
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.) <sup>(2)</sup> .....	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**

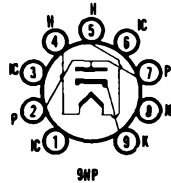
**6DW4B**

**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.



*Color Television Type*

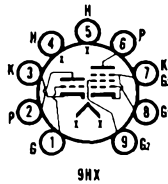
**KEYED AGC, SYNC SEP./AMP. (T)  
VIDEO AMPLIFIER (P)**

**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

Heater Voltage .....	10.2	6DX8/ECL84
Heater Current .....	450	6.3 Volts
Maximum Heater-Cathode Voltage		720 Ma
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 $\mu$ mhos
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 $\mu$ mhos
Amplification Factor .....	65

**6DZ4/6AF4A**

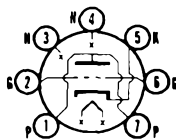
2DZ4/2AF4B  
3DZ4/3AF4B

Color Television Type

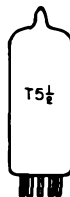
**UHF OSCILLATOR**

**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 $\mu$ mhos
Amplification Factor .....	14
Plate Resistance (Approx.) .....	2000 Ohms
Ec for Ib = 20 $\mu$ a (Approx.) .....	-11 Volts

**Oscillator at 1000 MHz<sup>(1)</sup>**

Plate Supply Voltage .....	135 Volts
Plate Resistor .....	2700 Ohms
Grid Resistor .....	10,000 Ohms
Plate Current .....	15.5 Ma
Grid Current (Approx.) .....	800 $\mu$ a

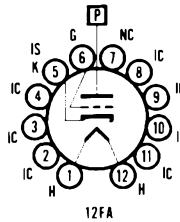
**NOTE:**

(1) Measured in JEDEC Standard Oscillator No. 400.



**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.



**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.) <sup>(1)</sup> .....	440 Volts
Plate Dissipation (Max.) .....	30 Watts
DC Plate Current (Max.) .....	1.6 Ma
Grid Circuit Resistance (Max.) <sup>(2)</sup> .....	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 $\mu$ mhos
DC Plate Current for Zero Load Current .....	1000 $\mu$ a

DC Plate Current for Load Current of 1 Ma .....	45 $\mu$ a
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.

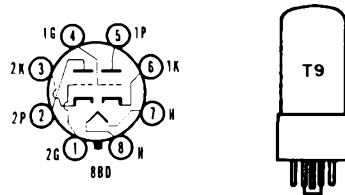
**WARNING:**

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.



**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
<b>Maximum Heater-Cathode Voltage</b>		
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 <sup>(1)</sup>	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<sup>(1)</sup>**

	Section No. 1 <sup>(1)</sup> 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.) <sup>(2)</sup> .....	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 <sup>(1)</sup>	Section No. 2
Plate Voltage .....	250	175 Volts
Grid No. 1 Voltage .....	-3	-25 Volts
Plate Current .....	2.0	40 Ma
Transconductance .....	2200	6000 $\mu$ mhos
Amplification Factor .....	66	5.5
Plate Resistance (Approx.) .....	30,000	920 Ohms
Ec for Ib = 20 $\mu$ a (Approx.).....	-5.3	— Volts
Ec for Ib = 200 $\mu$ a (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.

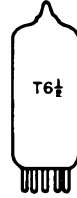
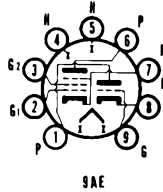
Color Television Type

**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.



**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
<b>Maximum Heater-Cathode Voltage</b>				
Heater Negative with Respect to Cathode				200 Volts
Total DC and Peak.....				
Heater Positive with Respect to Cathode				100 Volts
DC .....				200 Volts
Total DC and Peak.....				

**DIRECT INTERELECTRODE CAPACITANCES (Shielded)**

<b>Triode Section</b>		
Grid to Plate .....		1.7 Pf
Input .....		3.2 Pf
Output .....		1.9 Pf
Heater to Cathode .....		3.0 Pf
<b>Pentode Section</b>		
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
<b>Maximum Grid No. 1 Circuit Resistance</b>			
Fixed Bias .....	2.2	—	2.2 Megohms
Self Bias .....	2.2	—	2.2 Megohms

**CHARACTERISTICS AND TYPICAL OPERATION**

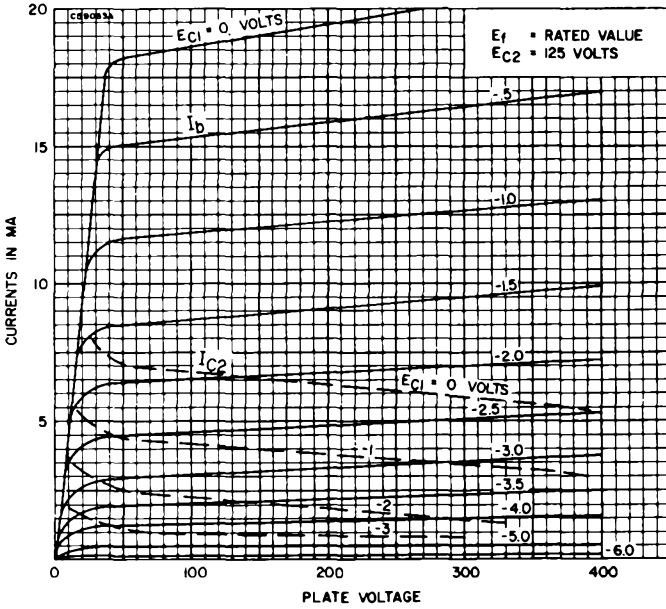
	Triode Section	Pentode Section
<b>Class A1 Amplifier</b>		
Plate Voltage .....	150	125 Volts
Grid No. 2 Voltage .....	—	125 Volts
Grid No. 1 Voltage .....	—	-1.0 Volts
Cathode Bias Resistor .....	56	— Ohms
Plate Current .....	18	12 Ma
Grid No. 2 Current .....	—	4 Ma

Transconductance .....	8500	6400 $\mu$ mhos
Amplification Factor .....	40	—
Plate Resistance (Approx.) .....	5000	200,000 Ohms
$E_{c1}$ for $I_b = 10 \mu$ a (Approx.) .....	-12	-9 Volts

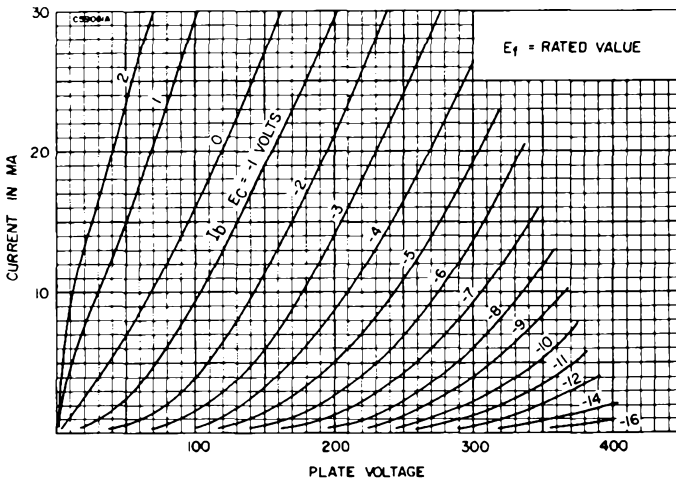
**NOTE:**

- (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)**



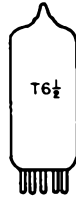
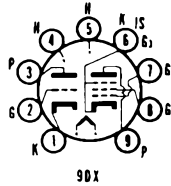
Color Television Type

**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)**

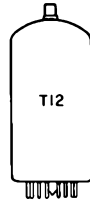
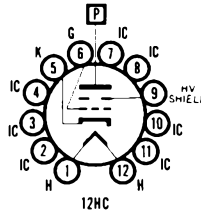
Eb = 45 Volts, Ec2 = 125 Volts and Ec1 = 0 Volt  
 Ib = 40 Ma and Ic2 = 15 Ma

# 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 <sup>(1)</sup> .....	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 <sup>(2)</sup> .....	440 Volts
Plate Dissipation.....	40 Watts
DC Plate Current.....	1.6 Ma
Grid-Circuit Resistance <sup>(3)</sup> .....	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 $\mu$ mhos
DC Plate Current for Zero Load Current.....	1000 $\mu$ a
DC Plate Current for Load Current of 1 Ma.....	45 $\mu$ a
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.

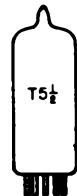
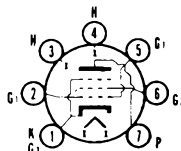
# 6EH5

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.



7CV

**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 <sup>(1)</sup>	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

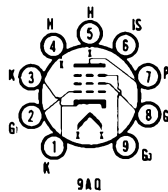
**VHF/IF AMPLIFIER**

**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.



**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 $I_b = 0$ Ma (Max.) .....	550 Volts
Plate Voltage (Max.) .....	275 Volts
Grid No. 2 Voltage with $I_{c2} = 0$ 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

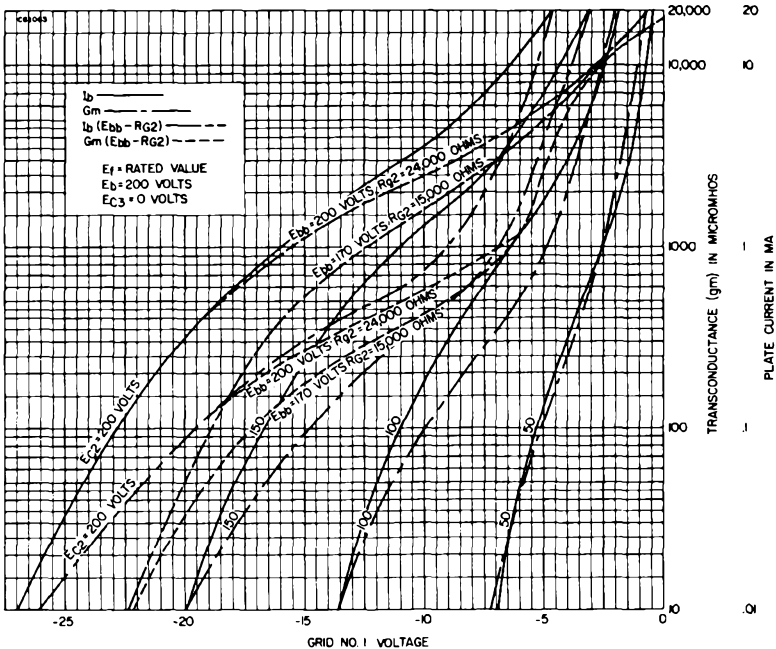
**CHARACTERISTICS AND TYPICAL OPERATION**

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 $\mu$ mhos
Plate Resistance (Approx.) .....	0.5 Megohm
Grid No. 1 Impedance at 40 MHz <sup>(1)</sup> .....	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
Transconductance .....	125      625      1250
$E_{c1}$ for a Cross Mod. Factor of 1% .....	450      160      100
	12,500 $\mu$ mhos
	— Mv rms

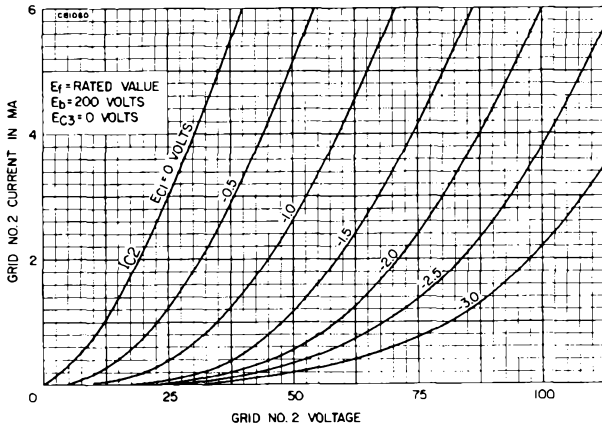
**NOTE:**

(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**

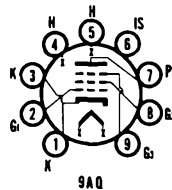


Color Television Type  
**IF AMPLIFIER**

**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

Heater Voltage .....	3EJ7/XF184	4EJ7	6EJ7/EF184
Heater Current .....	3.4	4.4	6.3 Volts
Heater Warm-up Time .....	600	450	300 Ma
Maximum Heater-Cathode Voltage	11	11	— Seconds

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**

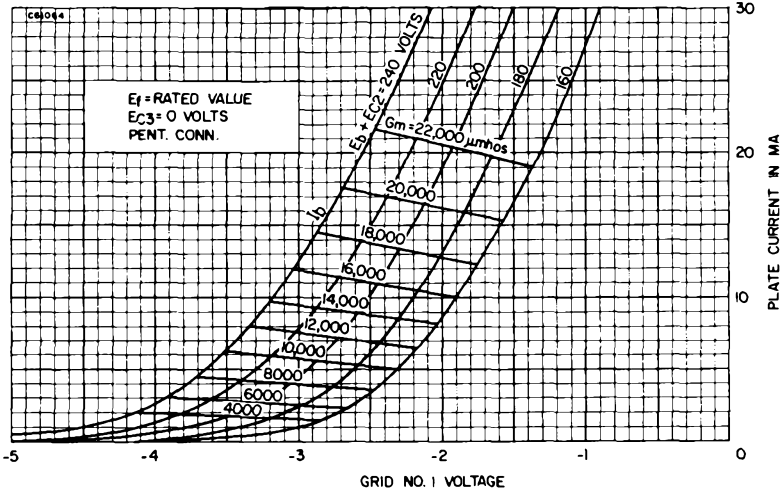
Plate Voltage .....	200 Volts
Grid No. 3 Voltage .....	0 Volt

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 $\mu$ mhos
Amplification Factor (G2 to G1) .....	60
Plate Resistance (Approx.) .....	0.35 Megohm
Grid No. 1 Impedance at 40 MHz(1) .....	30,000 Ohms

**NOTE:**

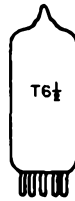
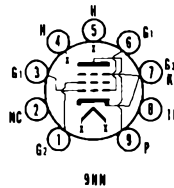
(1) Input damping of tube and typical ceramic socket with both cathode leads tied directly to ground is about 10,000 Ohms.

**AVERAGE TRANSFER CHARACTERISTICS**



**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.



**ELECTRICAL DATA  
 HEATER OPERATION**

Heater Voltage .....	8.4
Heater Current .....	600
Heater Warm-up Time .....	11
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

<b>8EM5</b>
6.3 Volts
800 Ma
— Seconds

**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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	10.0 Watts
Grid No. 2 Input (Max.) <sup>(2)</sup> .....	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 $\mu$ mhos
Amplification Factor <sup>(3)</sup> .....	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

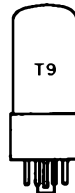
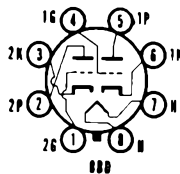
## VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

# 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<sup>(1)</sup>**

	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.) <sup>(2)</sup> .....	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 <sup>(1)</sup>	Section No. 2
Plate Voltage .....	250	150 Volts
Grid No. 1 Voltage .....	-3	-20 Volts
Plate Current .....	1.4	50 Ma
Transconductance .....	1600	7200 $\mu$ mhos
Amplification Factor .....	68	5.4
Plate Resistance (Approx.) .....	40,000	750 Ohms
Ec for Ib = 10 $\mu$ a (Approx.) .....	-5.5	- Volts
Ec for Ib = 100 $\mu$ a (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.

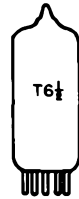
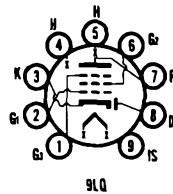
# 6EQ7

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.



**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 <sup>(1)</sup> .....	
Grid No. 1 Resistor .....	2.2 Megohms
Plate Current .....	9.0 Ma
Grid No. 2 Current .....	3.5 Ma
Transconductance .....	3800 $\mu$ mhos
Plate Resistance (Approx.) .....	250,000 Ohms
E <sub>c1</sub> for gm = 40 $\mu$ mhos (Approx.) .....	-20 Volts
Average Diode Current with 10 Volts DC Applied (Test Condition ONLY) .....	2.0 Ma

**NOTE:**

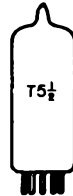
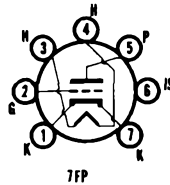
(1) Average contact potential bias developed across specified grid resistor.

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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>2ER5</b>	<b>3ER5</b>	<b>6ER5</b>
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**

	<b>Shielded</b>	<b>Unshielded</b>
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 $\mu$ mhos
Amplification Factor .....	80
Plate Resistance .....	8000 Ohms
E <sub>c1</sub> for Gm = 500 $\mu$ mhos .....	-3.8 Volts
E <sub>c1</sub> for Gm = 100 $\mu$ mhos .....	-5.6 Volts

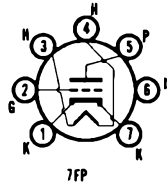
# 6ES5

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.



**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 <sup>(1)</sup>	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.

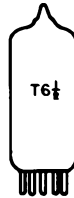
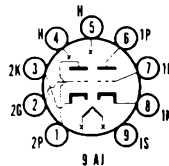
# 6ES8/ECC189

4ES8, 5ES8

# VHF CASCODE AMPLIFIER

**Semi-Remote Cutoff Twin Triode**

Construction ..... Miniature T-6½  
 Base ..... Button 9 Pin, E9-1  
 Basing <sup>(1)</sup> ..... 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**

	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 $\mu$ mhos
Amplification Factor .....	34

**Cascode Amplifier<sup>(2)</sup>**

Supply Voltage.....	180 Volts
Plate Current .....	15 Ma
Transconductance .....	12,500 $\mu$ mhos
Noise Figure <sup>(3)</sup> .....	6.5 db
Ec for gm = 125 $\mu$ a (Approx.).....	-9.0 Volts
Input Voltage for Cross Modulation Factor of 1% at gm = 125 $\mu$ mhos ...	500 Mv

**NOTES:**

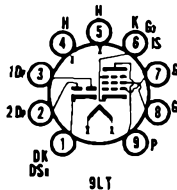
- (1) Section No. 1 (grounded cathode input section) connects to Pins 6, 7, and 8.  
Section No. 2 (grounded grid output section) connects to Pins 1, 2, and 3.
- (2) The grid of the output section, Section No. 2, is connected to a potentiometer.
- (3) Noise figure measurements taken with tube operating in a TV tuner.

**HORIZONTAL PHASE DETECTOR (D)  
VIDEO AMPLIFIER (P)**

**6E7**  
8E7

**Double Diode and Sharp Cutoff Pentode**

Construction .....	Miniature T-6 $\frac{1}{2}$
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**

	8E7	6E7
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)**

<b>Pentode Section</b>	
Grid No. 1 to Plate (Max.).....	0.1 Pf
Input: g1 to (h + Pk, g3, 1S + g2 + Dk, Dsh) .....	10 Pf

Output: p to (h + Pk, g <sub>2</sub> , IS + g <sub>2</sub> + Dk, Dsh) .....	4.2 Pf
<b>Diode Section (Each Diode)</b>	
Diode Plate to (h + Dk, Dsh + Pk, g <sub>3</sub> , IS) .....	1.5 Pf
Diode Cathode; Diode Shield to (h + Dp + Pk, g <sub>3</sub> , IS) .....	7.5 Pf
<b>Coupling</b>	
Pentode Grid No. 1 to Diode Plate (Each Diode) (Max.) .....	0.005 Pf
Pentode Plate to Diode Plate (Each Diode) (Max.) .....	0.02 Pf
<b>RATINGS (Design Maximum Rating System)</b>	
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 $\mu$ mhos
Plate Resistance (Approx.) .....	60,000 Ohms
Ec1 for Ib = 100 $\mu$ a (Approx.) .....	-10 Volts
Average Diode Current with 10 Volts DC Applied (Each Diode) .....	1.5 Ma

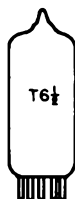
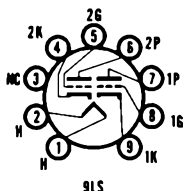
**INSTANTANEOUS PLATE KNEE VALUES**

Eb = 60 V, Ec2 = 150 V, Ec1 = 0 V;  
Ib = 55 Ma and Ic2 = 18 Ma



**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 $\mu$ mhos
Amplification Factor .....	100	100

Plate Resistance.....	80,000	62,500 Ohms
Equivalent Noise and Hum Voltage (Referenced to Grid—Each Unit) Average Value <sup>(1)</sup> (RMS) ...	—	1.8 $\mu$ Volts

**NOTE:**

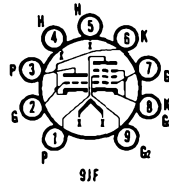
(1) Measured under the following conditions:  $E_f = 6.3$  Vac, center-tap of heater transformer grounded;  $E_{bb} = 250$  Vdc;  $R_b = 0.1$  Megohm;  $R_k = 2700$  Ohms;  $C_k = 100 \mu f$ ;  $R_g = 0$ ;  $F = 25$  to 10,000 Hz.

**OSCILLATOR (T)  
MIXER (P)**

**6EU8**  
5EU8

**Medium Mu Triode and Sharp Cutoff Pentode**

Construction ..... Miniature T-6½  
 Base ..... Button 9 Pin, E9-1  
 Base ..... 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**

	<b>5EU8</b>	<b>6EU8</b>
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**

**Pentode Section**

	<b>Shielded</b>	<b>Unshielded</b>
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)**

	<b>Triode</b>	<b>Pentode</b>
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**

	<b>Triode</b>	<b>Pentode</b>
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 $\mu$ mhos
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 $I_b = 10 \mu a$ .....	-12.0	-9.0 Volts
Cathode Warm-up Time <sup>(1)</sup> .....	35	— Seconds

**NOTE:**

(1) Cathode Warm-up Time is defined as the time required for transconductance to reach 6500  $\mu$ mhos 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.

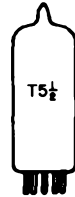
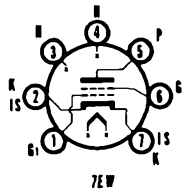
# 6EV5

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.



**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)<sup>(1)</sup>**

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.

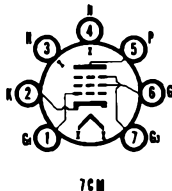
# 6EW6

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.





**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 <sup>(1)</sup>	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 $\mu$ mhos
Plate Resistance (Approx.).....	0.2 Megohm
Grid No. 1 Voltage for Ib = 20 $\mu$ a (Approx.).....	-3.5 Volts

**NOTE:**

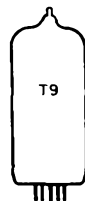
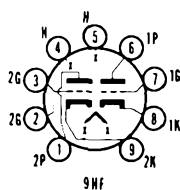
(1) Shield No. 316 tied to cathode.

**VERTICAL DEFLECTION  
OSCILLATOR and AMPLIFIER**

**6EW7**  
10EW7, 15EW7,  
19EW7, 20EW7

**Dissimilar Double Triode**

Construction.....	9T-9
Base.....	Button 9 Pin, E9-68
Basing <sup>(1)</sup> .....	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 <sup>(1)</sup> No. 1	Section <sup>(1)</sup> 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<sup>(2)</sup>**

	Section <sup>(1)</sup> No. 1 Oscillator	Section <sup>(1)</sup> No. 2 Amplifier
Plate Voltage (Max.)	330	330 Volts
Peak Positive Pulse Plate Voltage (Max.)	—	150 Volts
Peak Negative Pulse Grid Voltage (Max.)	400	250 Volts
Plate Dissipation (Max.) <sup>(3)</sup>	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 <sup>(1)</sup> No. 1	Section <sup>(1)</sup> No. 2
Plate Voltage	250	150 Volts
Grid No. 1 Voltage	-11	-17.5
Plate Current	5.5	45 Ma
Transconductance	2000	7500 $\mu$ mhos
Amplification Factor	17.5	6.0
Plate Resistance (Approx.)	8750	800 Ohms
Ec for Ib = 10 $\mu$ a (Approx.)	-20	— Volts
Ec for Ib = 100 $\mu$ a (Approx.)	—	-40 Volts
Ib at Ec = -25 Vdc	—	8 Ma
Ib with Eb = 60 V and Ec = 0 V (Instantaneous Values)	—	95 Ma

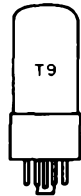
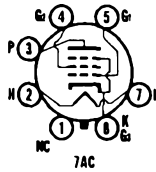
**NOTES:**

- (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.



**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.



**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<sup>(1)</sup>**

DC Plate Voltage (Max.)	350 Volts
Peak Pulse Plate Voltage (Max.)	2500 Volts
Screen Voltage (Max.)	300 Volts
Plate Dissipation (Max.) <sup>(2)</sup>	12 Watts
Screen Dissipation (Max.) <sup>(2)</sup>	2.75 Watts
DC Cathode Current (Max.)	75 Ma
Peak Cathode Current (Max.)	260 Ma

Grid No. 1 Circuit Resistance		2.2 Megohms
With Cathode Bias (Max.)	.....	1.0 Megohm
With Fixed Bias (Max.)	.....	200 °C
Bulb Temperature at Hottest Point (Max.)	.....	

**CHARACTERISTICS AND TYPICAL OPERATION**

Plate Voltage	60	250 Volts
Screen Voltage	250	250 Volts
Grid No. 1 Voltage	0 <sup>(1)</sup>	-20 Volts
Plate Resistance (Approx.)	—	50,000 Ohms
Transconductance	—	4100 $\mu$ mhos
Plate Current	180	43 Ma
Screen Current	26	3.5 Ma
Grid No. 1 Voltage (Approx.)	—	-50 Volts
I <sub>b</sub> = 100 $\mu$ a	.....	

**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

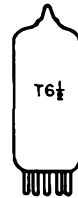
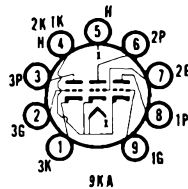
**VHF AMPLIFIER or  
OSCILLATOR and MIXER**

**6E28**

19E28

**Triple Triode**

Construction	.....	Miniature T-6½
Base	.....	Button 9 Pin, E9-1
Basing <sup>(1)</sup>	.....	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**

	19E28	6E28
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 $\mu$ mhos
Amplification Factor	.....	57
Ec for I <sub>b</sub> = 20 $\mu$ a	.....	-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.

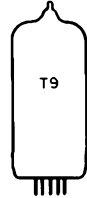
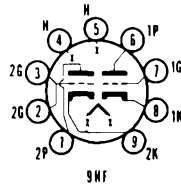
# 6FD7

10FD7, 13FD7

## VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

**Dissimilar Double Triode**

Construction .....9T-9  
 Base ..... Button 9 Pin, E9-68  
 Basing<sup>(1)</sup> .....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 <sup>(1)</sup> No. 1	Section <sup>(1)</sup> 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<sup>(2)</sup>**

	Section <sup>(1)</sup> No. 1 Oscillator	Section <sup>(1)</sup> 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.) <sup>(3)</sup> .....	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 <sup>(1)</sup> No. 1	Section <sup>(1)</sup> 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:**

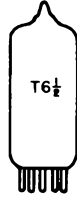
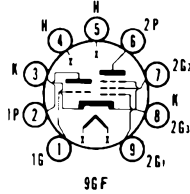
- (1) Section No. 1 connects to Pins 6, 7 and 8. Section No. 2 connects to Pins 1, 2 and 9.
- (2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse 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.



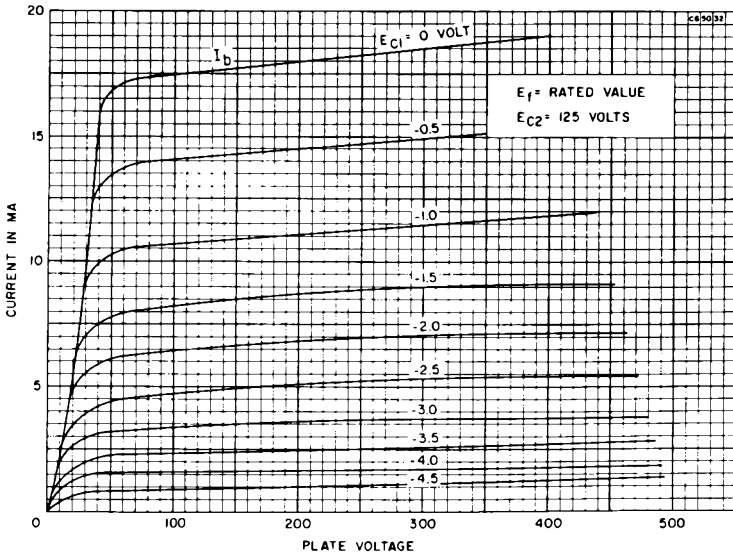
**ELECTRICAL DATA**  
**HEATER OPERATION**

	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

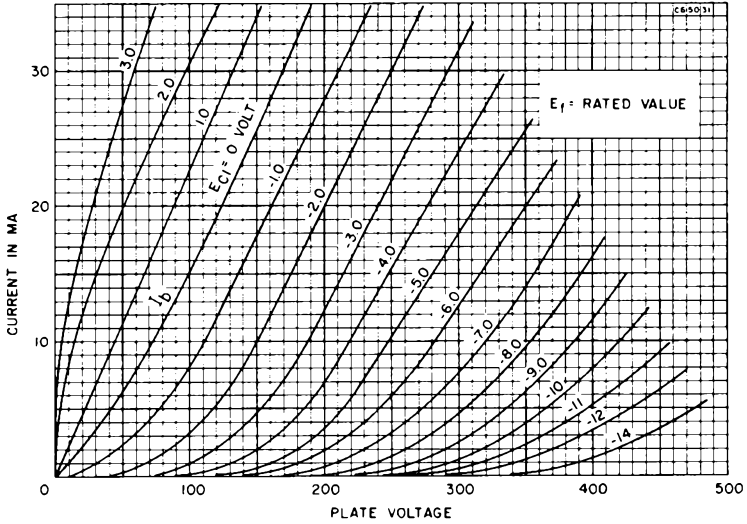
**DIRECT INTERELECTRODE CAPACITANCES**

	Shielded (1)	Unshielded
<b>Triode Section</b>		
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
<b>Pentode Section</b>		
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 $I_b = 30 \mu a$ (Approx.)	-6.5	-7.5 — Volts

**NOTE:**

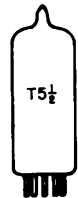
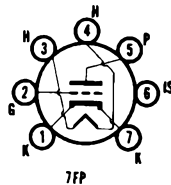
(1) Shield No. 315 connected to cathode of section under test.

**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**

	<b>2FH5</b>	<b>3FH5</b>	<b>6FH5</b>
Heater Voltage.....	2.35	3.0	6.3 Volts
Heater Current.....	600	450	200 Ma
Heater Warm-up Time.....	11	11	— Seconds
<b>Heater-Cathode Voltage</b>			
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**

	<b>Shielded</b>	<b>Unshielded</b>
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 $\mu$ mhos
Amplification Factor.....	50
Plate Resistance (Approx.).....	5600 Ohms
Ec for Ib = 100 $\mu$ a (Approx.).....	-5.5 Volts

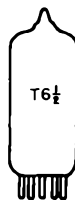
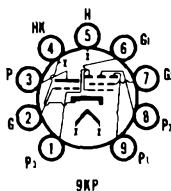
**HARMONIC GENERATOR**

**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

Heater Voltage.....	6.3 Volts
Heater Current.....	450 Ma

**DIRECT INTERELECTRODE CAPACITANCES (Shielded)<sup>(1)</sup>**

**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**

	<b>Triode Unit</b>	<b>Tetrode Unit</b>
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 $\mu$ mhos
Plate Current .....	7.9 Ma
Grid Voltage (Approx.) for Plate Current of 100 $\mu$ a .....	-7 Volts

**Tetrode Unit with Plates No. 2 and No. 3 Connected to Cathode**

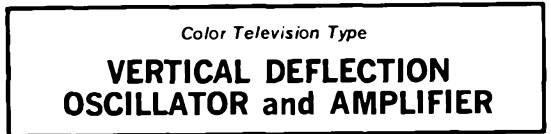
Plate No. 1 Voltage .....	250 Volts
Grid No. 2 Voltage .....	250 Volts
Grid No. 1 Voltage .....	-2 Volts
Plate No. 1 Resistance (Approx.) .....	750,000 Ohms
Transconductance, Grid No. 1 to Plate No. 1 .....	4400 $\mu$ mhos
Plate No. 1 Current .....	7.3 Ma
Grid No. 2 Current .....	1.4 Ma
Grid No. 1 Voltage (Approx.) for Plate No. 1 Current of 100 $\mu$ a .....	-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 $\mu$ mhos
Grid No. 1 to Plate No. 2 .....	70 $\mu$ mhos
Grid No. 1 to Plate No. 3 .....	70 $\mu$ mhos

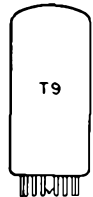
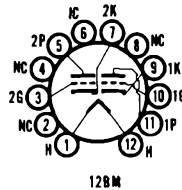
**NOTE:**

(1) Shield No. 315 connected to cathode.



**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.



**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)**

	<b>Section 1</b>	<b>Section 2</b>
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)**

	<b>Vertical Oscillator Service<sup>(1)</sup> (Section 1)</b>	<b>Vertical Deflection Amplifier<sup>(1)</sup> (Section 2)</b>
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 <sup>(2)</sup> 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**

	<b>Section 1 (Oscillator)</b>	<b>Section 2 (Amplifier)</b>
Plate Voltage .....	250	150 250 Volts
Grid Voltage .....	-8.0	0 <sup>(3)</sup> -9.5 Volts
Amplification Factor .....	22.5	— 15.4
Plate Resistance (Approx.) .....	9000	— 2000 Ohms
Transconductance .....	2500	— 7700 $\mu$ mhos
Plate Current .....	8.0	68 41 Ma
Grid Voltage (Approx.)		
I <sub>b</sub> = 10 $\mu$ a .....	-18	— Volts
Grid Voltage (Approx.)		
I <sub>b</sub> = 50 $\mu$ a .....	—	-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

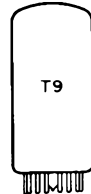
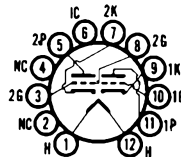
## VERTICAL DEFLECTION OSCILLATOR and AMPLIFIER

# 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.



**ELECTRICAL DATA  
HEATER OPERATION**

	<b>15FM7</b>	<b>13FM7</b>	<b>6FM7</b>
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

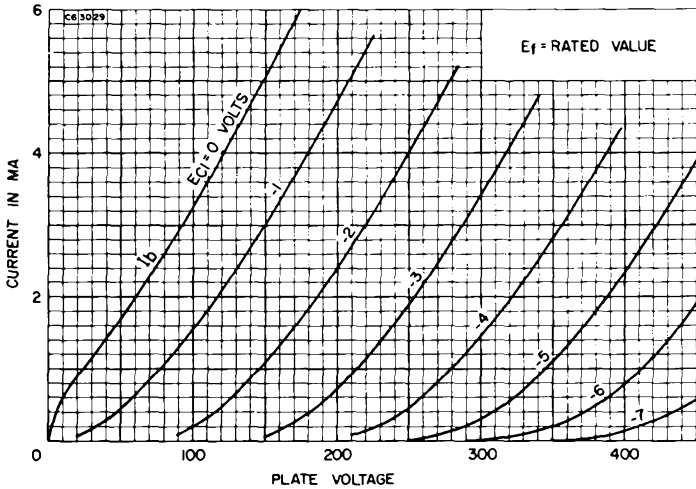
**DIRECT INTERELECTRODE CAPACITANCES (Unshielded)**

	<b>Section No. 1</b>	<b>Section No. 2</b>
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

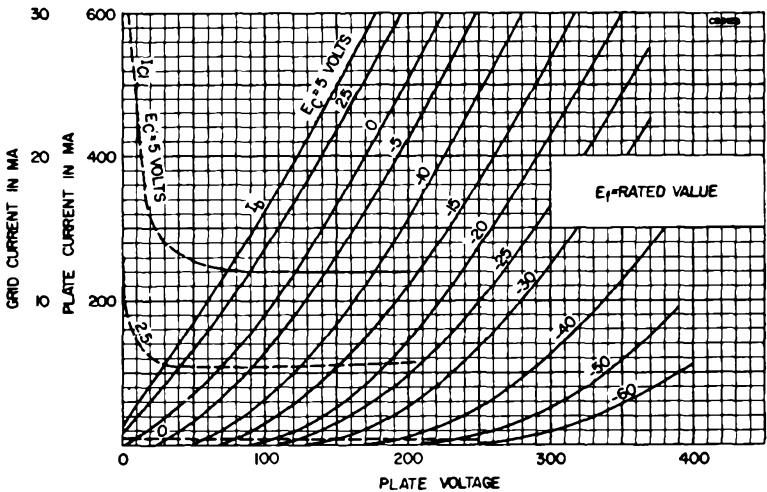
**RATINGS (Design Maximum Rating System)  
Vertical Deflection Oscillator and Amplifier<sup>(1)</sup>**

	Section <sup>(2)</sup> No. 1 Oscillator	Section <sup>(2)</sup> 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.) <sup>(3)</sup> .....	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 $\mu$ mhos
Amplification Factor .....	66	5.5
Plate Resistance (Approx.) .....	30,000	920 Ohms
Ec for Ib = 20 $\mu$ a (Approx.) .....	-5.3	- Volts
Ec for Ib = 200 $\mu$ a (Approx.) .....	—	-45 Volts

**NOTES:**

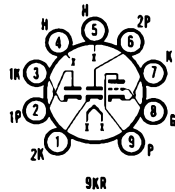
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse not to exceed 15% of one horizontal scanning cycle.
- (2) Section No. 1 connects to Pins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



**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
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**CHARACTERISTICS AND TYPICAL OPERATION**

**Triode: Class A1 Amplifier**

Plate Voltage .....	250 Volts
Grid Voltage .....	-3 Volts
Plate Current .....	1.0 Ma
Transconductance .....	1200 $\mu$ mhos
Amplification Factor .....	70
Plate Resistance (Approx.) .....	58,000 Ohms

**Diodes**

Average Current Each Plate at 5 Volts DC <sup>(1)</sup> .....	20 Ma
---	-------

**NOTE:**

- (1) Test condition only.

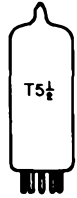
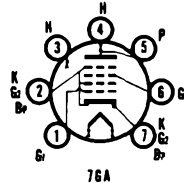
# 6FS5

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.



**ELECTRICAL DATA**

**HEATER OPERATION**

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**

Grid No. 1 to Plate: (g1 to p) .....	Shielded <sup>(1)</sup>	Unshielded
Input: g1 to (h + k + g2 + g3 + b.p.) .....	0.016	0.03 Pf
Output: p to (h + k + g2 + g3 + b.p.) .....	4.8	4.8 Pf
	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.

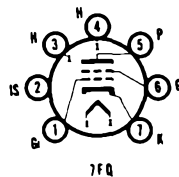
# 6FV6

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.



**ELECTRICAL DATA  
HEATER OPERATION**

	<b>2FV6</b>	<b>6FV6</b>
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)<sup>(1)</sup>**

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 $\mu$ mhos
Plate Resistance.....	0.1 Megohm
Grid No. 1 Voltage for $I_b = 20 \mu a$ .....	-6 Volts

**NOTE:**

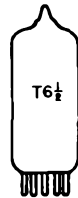
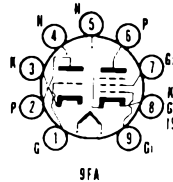
(1) Shield No. 316 connected to cathode.

**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.



**ELECTRICAL DATA  
HEATER OPERATION**

	<b>5FV8</b>	<b>6FV8A</b>
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**

	<b>Shielded<sup>(1)</sup></b>	<b>Unshielded</b>
<b>Triode Section</b>		
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
<b>Pentode Section</b>		
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. <sup>(2)</sup>	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.) <sup>(3)</sup> .....	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 <sup>(3)</sup>	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 $\mu$ mhos
Plate Current .....	12.0	12.0 Ma
Grid No. 2 Current .....	—	4.0 Ma
Plate Resistance (Approx.) .....	5600	200,000 Ohms
Amplification Factor .....	45	—
E <sub>c1</sub> for I <sub>b</sub> = 20 $\mu$ a (Approx.) .....	-7.5	-9 Volts

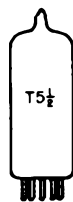
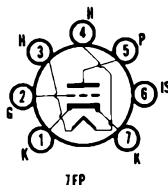
**NOTES:**

- (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.



**High Mu Triode**

- Construction ..... Miniature T-5 $\frac{1}{2}$
- 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**

	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**

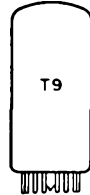
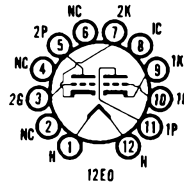
Plate Voltage .....	135	135	135	135 Volts
Negative Grid Bias.....	1	3.1	5	4.5 Volts
Plate Current .....	11	—	—	0.1 Ma
Transconductance .....	13,000	625	125	— $\mu$ mhos
Amplification Factor .....	70	—	—	—

**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 <sup>(1)</sup> (Section 1)	Vertical Deflection Amplifier <sup>(1)</sup> (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 <sup>(2)</sup> 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	150 Volts
Grid Voltage .....	-3.0	0 <sup>(3)</sup> -17.5 Volts
Amplification Factor .....	65	6.0
Plate Resistance (Approx.) .....	40,500	920 Ohms
Transconductance .....	1600	6500 $\mu$ mhos
Plate Current .....	1.4	35 Ma
Plate Current (Approx.) $E_c = -25$ Volts.....	—	6 Ma
Grid Voltage (Approx.) $I_b = 30 \mu a$ .....	-5.5	— Volts
Grid Voltage (Approx.) $I_b = 50 \mu a$ .....	—	-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.

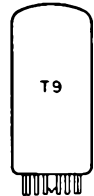
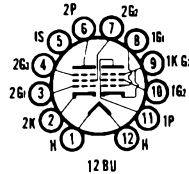
# 6G11

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**

Heater Voltage.....	<b>12G11</b>	<b>6G11</b>
Heater Current.....	12.6	6.3 Volts
Heater Warm-up Time.....	600	1200 Ma
Maximum Heater-Cathode Voltage	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)**

**Section 1**

Grid No. 1 to Plate.....	0.26 Pf
Input: 1g1 to (h + 1k + 1g2 + bp + 1S).....	12 Pf
Output: 1p to (h + 1k + 1g2 + bp + 1S).....	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 + 1S).....	6.5 Pf
Grid No. 3 to All: 2g3 to (h + 2k + 2g1 + 2g2 + 2p + 1S).....	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 $\mu$ mhos
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**

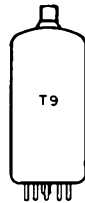
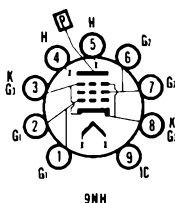
Plate Voltage .....	150 Volts
Suppressor Voltage .....	0 Volt
Screen Voltage .....	100 Volts
Cathode Bias Resistor .....	560 Ohms
Plate Resistance (Approx.) .....	0.15 Megohm
Grid No. 1 Transconductance .....	1000 $\mu$ mhos
Grid No. 3 Transconductance .....	400 $\mu$ mhos
Plate Current .....	1.3 Ma
Screen Current .....	2.0 Ma
Grid No. 1 Voltage (Approx.) $I_b = 10 \mu$ a .....	-4.5 Volts
Grid No. 3 Voltage (Approx.) $I_b = 10 \mu$ a .....	-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.



**ELECTRICAL DATA**

<b>HEATER OPERATION</b>	<b>28GB5</b>	<b>27GB5 /PL500</b>	<b>18GB5</b>	<b>13GB5 /XL500</b>	<b>6GB5 /EL500</b>
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
<b>RATINGS (Design Maximum Rating System)</b>					
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
<b>CHARACTERISTICS AND TYPICAL OPERATION</b>					
Supply Voltage .....	170	200	230 Volts		
Minimum Value of Screen-Grid Resistor <sup>(1)</sup> .....	1.2	1.5	2.2 Kilohms		
Screen-Grid Voltage .....	130	150	180 Volts		
Plate Voltage at End of Scan <sup>(2)</sup> .....	55	59	65 Volts		
Control-Grid Voltage at End of Scan <sup>(3)</sup> .....	-10	-10	-10 Volts		
Peak Plate Current .....	210	270	360 Ma		
<b>Non-Stabilized Circuits (Drive Below the Knee)</b>					
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 <sup>(3)</sup> .....	+1	+1	+1 Volt		
Peak Plate Current <sup>(4)</sup> .....	200	250	320 Ma		
<b>INSTANTANEOUS PLATE KNEE VALUES</b>					
$E_b = 75$ V, $E_{c2} = 200$ V and $E_{c1} = -10$ V					
$I_b = 440$ Ma and $I_{c2} = 37$ Ma					

**NOTES:**

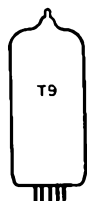
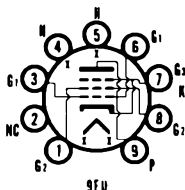
- (1) The quoted values are the minimum values of  $R_{g2}$  which are required to prevent an excessive screen-grid dissipation during the warm-up period.
- (2) These values refer to nominal line voltage. At a line voltage 10% below nominal the tube will still operate above the knee.
- (3) The minimum 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.



### 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 $\mu$ mhos
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

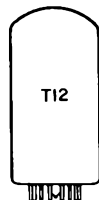
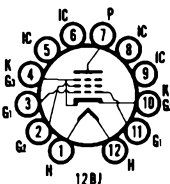
# 6GE5

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.



**ELECTRICAL DATA  
HEATER OPERATION**

	<b>17GE5</b>	<b>12GE5</b>	<b>6GE5</b>
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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 $\mu$ mhos
Plate Resistance.....	—	18,000 Ohms
Amplification Factor <sup>(3)</sup> .....	—	4.4
E <sub>c1</sub> for I <sub>b</sub> = 1.0 Ma (Approx.) .....	-100	-42 Volts

**INSTANTANEOUS PLATE KNEE VALUES**

E<sub>b</sub> = 60 V; E<sub>c2</sub> = 150 V and E<sub>c1</sub> = 0  
I<sub>b</sub> = 345 Ma, and I<sub>c2</sub> = 27 Ma

**NOTES:**

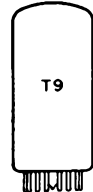
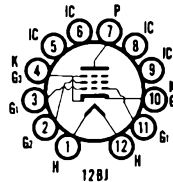
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse is not to exceed 15% of one horizontal scanning cycle.
- (2) In stages operating with grid 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 .....	Butt-on 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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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**

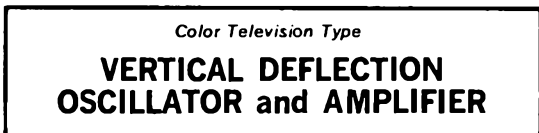
Plate Voltage .....	250 Volts
Screen Voltage .....	150 Volts
Grid No. 1 Voltage .....	-26.5 Volts
Plate Resistance (Approx.) .....	260,000 Ohms
Transconductance .....	4700 μmhos
Plate Current .....	34 Ma
Screen Current .....	1.6 Ma
Grid No. 1 Voltage (Approx.) Ib = 1.0 Ma .....	-46 Volts
Triode Amplification Factor <sup>(4)</sup> .....	4.2

**INSTANTANEOUS PLATE KNEE VALUES<sup>(3)</sup>**

Eb = 60 V, Ec2 = 150 V, and Ec1 = 0 V  
Ib = 345 Ma and Ic2 = 27 Ma

**NOTES:**

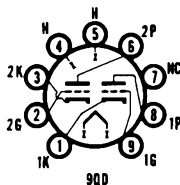
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) In stages operating with grid-leak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



**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<sup>(1)</sup>**

	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.) <sup>(2)</sup> .....	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 <sup>(3)</sup>	Section No. 2 <sup>(3)</sup>
Plate Voltage .....	250	150 Volts
Grid No. 1 Voltage .....	-3	-20 Volts
Plate Current .....	1.4	50 Ma
Transconductance .....	1600	7200 $\mu$ mhos
Amplification Factor .....	64	5.4
Plate Resistance (Approx.) .....	40,000	750 Ohms
Ec for Ib = 10 $\mu$ a (Approx.) .....	-5.5	— Volts
Ec for Ib = 100 $\mu$ a (Approx.) .....	—	-45 Volts
Ib at Ec = -28 Vdc (Approx.) .....	—	10 Ma

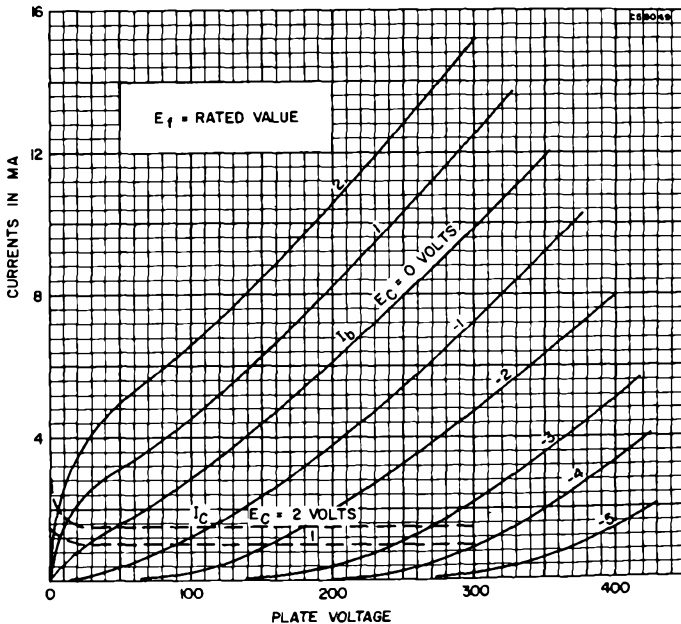
**INSTANTANEOUS PLATE KNEE VALUES (Section No. 2)**

Eb = 60 V; Ec = 0; Ib = 95 Ma

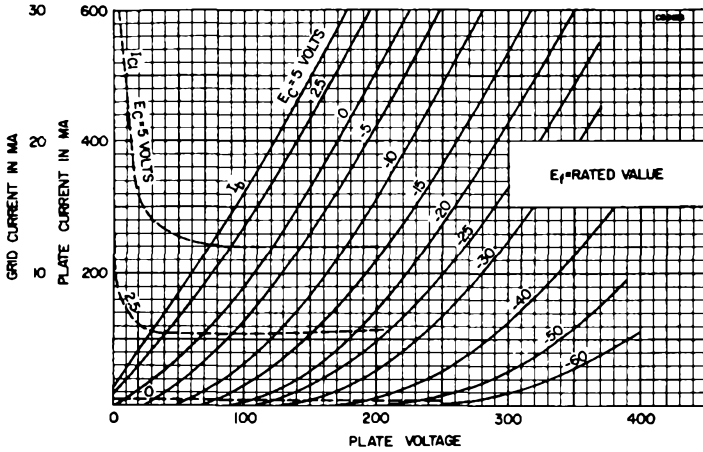
**NOTES:**

- (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)

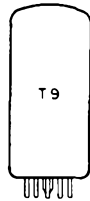
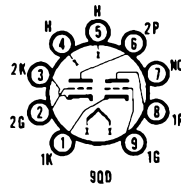


**6GF7A**  
10GF7A, 13GF7A

*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.

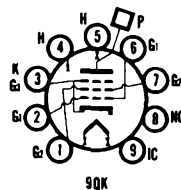


**6GJ5**  
12GJ5, 17GJ5

**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.



**ELECTRICAL DATA  
HEATER OPERATION**

Heater Voltage.....	16.8	12.6	6.3 Volts
Heater Current.....	450	600	1200 Ma
Heater Warm-up Time.....	11	11	— Seconds

<b>17GJ5</b>	<b>12GJ5</b>	<b>6GJ5</b>
16.8	12.6	6.3 Volts
450	600	1200 Ma
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: $g_1$ to $(k + g_3 + g_2 + h)$ .....	15 Pf
Output: $p$ to $(k + g_3 + g_2 + h)$ .....	6.5 Pf

**RATINGS (Design Maximum Rating System)**

**Horizontal Deflection Amplifier<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 $\mu$ mhos
Amplification Factor <sup>(3)</sup> .....	4.4
Plate Resistance .....	15,000 Ohms
$E_{c1}$ for $I_b = 1$ Ma (Approx.) .....	-42 Volts

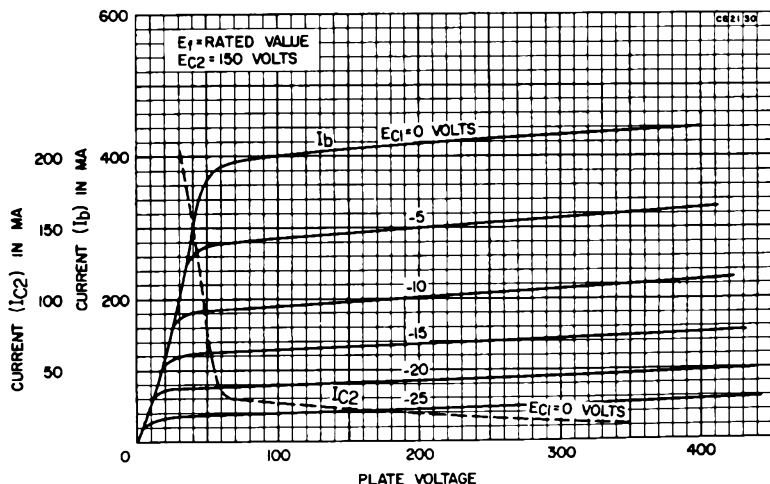
**INSTANTANEOUS PLATE KNEE VALUES**

$E_b = 60$  V,  $E_{c2} = 150$  V and  $E_{c1} = 0$  V;  
 $I_b = 390$  Ma; and  $I_{c2} = 32$  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

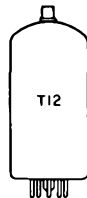
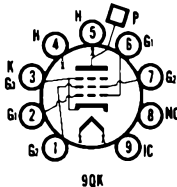
12GJ5A, 17GJ5A

## 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.



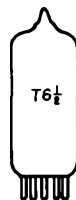
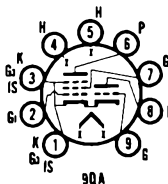
# 6GJ7/ECF801

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.



**ELECTRICAL DATA**

**HEATER OPERATION**

Heater Voltage.....  
 Heater Current .....  
 Maximum Heater-Cathode Voltage  
 Heater Positive with Respect to Cathode  
 Total DC and Peak.....  
 Heater Positive with Respect to Cathode  
 Total DC and Peak.....

	4GJ7	5GJ7	8GJ7/PCF801	6GJ7/ECF801
Heater Voltage	4.1	5.6	8.0	6.3 Volts
Heater Current	600	450	300	410 Ma

110 Volts  
 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 $\mu$ mhos

**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 $\mu$ a
DC Grid No. 1 Current	10	2.3 $\mu$ a
Conversion Transconductance	5000	4700 $\mu$ mhos
Input Resistance at 200 Hz	600	600 Ohms

**Pentode Section as an If Amplifier**

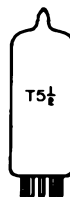
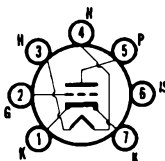
Plate Supply Voltage	200	200 Volts
Plate Load Resistance	2700	4700 Ohms
Grid No. 2 Resistance	27,000	27,000 Ohms
Grid No. 1 Resistance	0.1	1 Megohm
DC Grid No. 1 Supply Voltage	-1.2	0 Volts
Plate Current	10	12.5 Ma
DC Grid No. 2 Current	3	3.7 Ma
Transconductance	11,000	14,000 $\mu$ mhos
DC Grid No. 1 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.



**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**

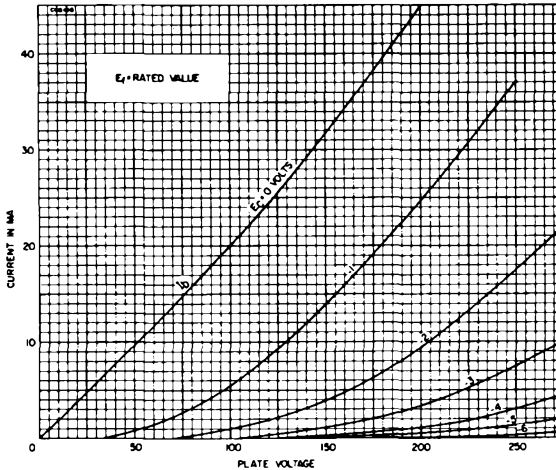
**Class A1 Amplifier**

Plate Voltage .....	135 Volts
Grid Voltage .....	-1.0 Volts
Plate Current .....	11.5 Ma
Transconductance .....	1500 $\mu$ mhos
Amplification Factor .....	78
Plate Resistance (Approx.) .....	5400 Ohms
$E_c$ for $G_m = 150 \mu$ mhos (Approx.) .....	-4.2 Volts
$E_c$ for $G_m = 1500 \mu$ mhos (Approx.) .....	-2.5 Volts
Input Resistance (200 Hz) <sup>(1)</sup> .....	275 Ohms
Input Capacitance (200 Hz) <sup>(1)</sup> .....	11.2 Pf
Noise Figure (200 Hz) <sup>(2)</sup> .....	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

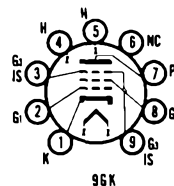
## AUDIO POWER AMPLIFIER or VIDEO AMPLIFIER

**Beam Power Pentode**

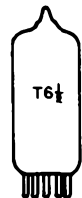
Construction .....	Miniature T-5½
Base .....	Button 9 Pin, E9-1
Basing .....	.9GK
Outline .....	6-4
Maximum Diameter .....	0.875 In.
Maximum Seated Height .....	2.812 In.
Maximum Overall Height .....	3.062 In.

**ELECTRICAL DATA  
HEATER OPERATION**

Heater Voltage .....	
Heater Current .....	
Heater Warm-up Time .....	



<b>16GK6</b>	<b>10GK6</b>
16.0	10.0
300	450
11	11



<b>6GK6</b>
6.3 Volts
760 Ma
— 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.)<sup>(1)</sup>..... 330 Volts

Grid No. 2 Voltage (Max.)<sup>(1)</sup>..... 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

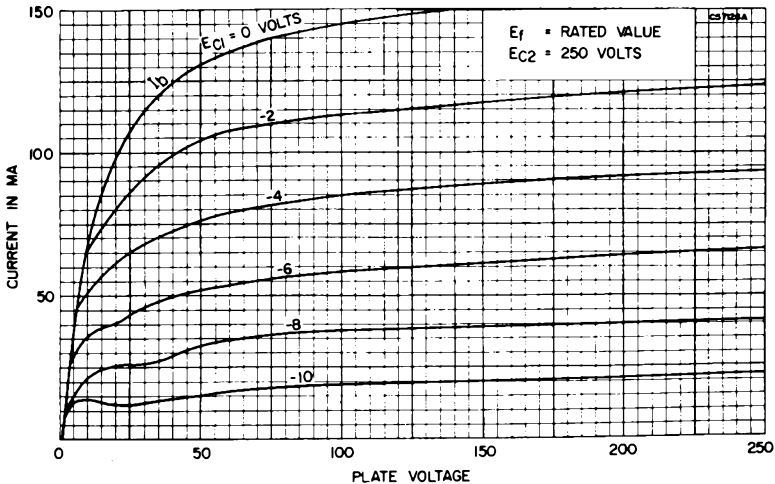
**CHARACTERISTICS AND TYPICAL OPERATION**

	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 <sup>(2)</sup> .....	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**



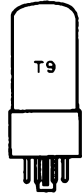
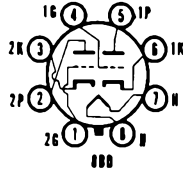
# 6GL7

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<sup>(1,2)</sup>**

	Oscillator	Amplifier
Plate Voltage (Max.) .....	350	550 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.) .....	—	1500 Volts
Plate Dissipation (Each Plate) (Max.) <sup>(3)</sup> .....	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 $\mu$ mhos
Amplification Factor .....	66	—	5
Plate Resistance (Approx.) .....	30,000	—	780 Ohms
Grid Voltage for $I_b = 20 \mu a$ .....	5.3	—	— Ma
Grid Voltage for $I_b = 200 \mu a$ .....	—	—	-60 Volts

**INSTANTANEOUS PLATE KNEE CHARACTERISTICS (Section No. 2)**

$E_b = 60 V$ , and  $E_{c1} = 0 V$   
 $I_b = 100 Ma$

**NOTES:**

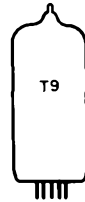
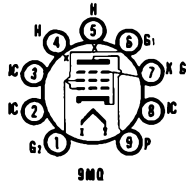
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) Section No. 1 is recommended 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.)<sup>(1)</sup> ..... 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		Ultra-Linear Operation <sup>(2)</sup>	
	S.T.—Class A1 Amp.		Class AB1—Push-Pull	
Plate Voltage	300	400	400	425 Volts
Grid No. 2 Voltage	300	Note 2	Note 2	Note 2 Volts
Grid No. 1 Voltage	-10	-20.5	-	- Volts
Cathode Resistor	-	-	-	185 Ohms
Peak A-F Grid Voltage	10	41	41	42 Volts
Zero-Signal Plate Current	60	80	80	88 Ma
Maximum-Signal Plate Current	75	138	138	104 Ma
Zero-Signal Grid No. 2 Current	8	11.5	11.5	13 Ma
Maximum Signal Grid No. 2 Current	15	26.4	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	6600 Ohms
Power Output	11	32	32	26 Watts
Total Harmonic Distortion	13	1.0	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.

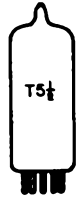
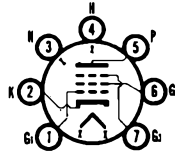
# 6GM6

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.



**ELECTRICAL DATA  
HEATER OPERATION**

	<b>7CM</b>	<b>4GM6</b>	<b>5GM6</b>	<b>6GM6</b>
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

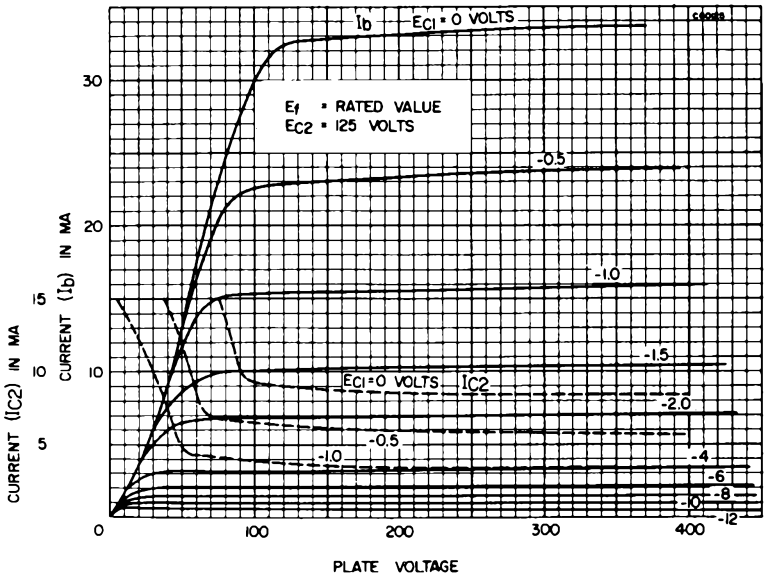
**DIRECT INTERELECTRODE CAPACITANCES (Unshielded)**

Grid No. 1 to Plate (Max.).....	0.036 Pf
Input: g1 to (h + k + g2 + g3 + 1S).....	10.0 Pf
Output: p to (h + k + g2 + g3 + 1S).....	2.4 Pf

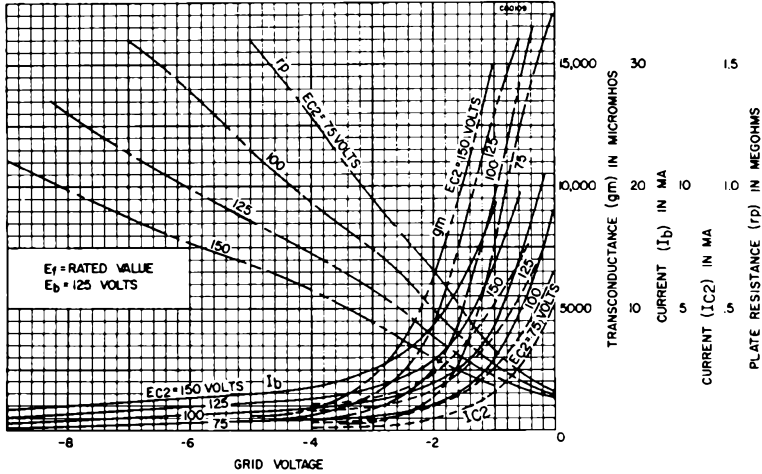
**RATINGS (Design Maximum Rating System)**

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**

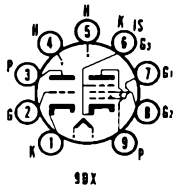
Plate Voltage .....	125 Volts
Grid No. 3 .....	Tied to Cathode
Grid No. 2 Voltage .....	125 Volts
Cathode Bias Resistor .....	56 Ohms
Plate Current .....	14 Ma
Grid No. 2 Current .....	3.4 Ma
Transconductance .....	13,000 $\mu$ mhos
Plate Resistance (Approx.) .....	0.2 Megohm
$E_{c1}$ for $G_m = 60 \mu$ mhos (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.



**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)**

<b>Triode Section</b>	
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: $g_1$ to $(h + k + g_2 + g_3 + IS)$ .....	11 Pf
Output: $p$ to $(h + k + g_2 + g_3 + IS)$ .....	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)**

	<b>Triode Section</b>	<b>Pentode Section</b>
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**

	<b>Triode Section</b>	<b>Pentode Section</b>
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 $\mu$ mhos
Amplification Factor .....	100	—
Plate Resistance .....	37,000	60,000 Ohms
$E_{c1}$ for $I_b = 100 \mu a$ (Approx.).....	—	-10 Volts
$E_{c1}$ for $I_b = 200 \mu a$ (Approx.).....	-5	— Volts

**INSTANTANEOUS PLATE KNEE CHARACTERISTICS (Pentode Section)**

$E_b = 60$  Volts,  $E_{c2} = 150$  Volts and  $E_{c1} = 0$  Volts  
 $I_b = 55$  Ma and  $I_{c2} = 18$  Ma.



**Triode 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**

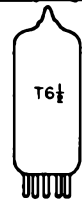
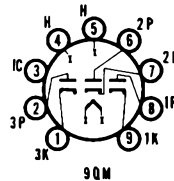
	<b>19GQ7</b>	<b>6GQ7</b>
Heater Voltage.....	18.9	6.3 Volts
Heater Current .....	150	450 Ma
Maximum Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
Total DC and Peak.....		200 Volts
Heater Positive with Respect to Cathode		
DC .....		100 Volts
Total DC and Peak.....		200 Volts

**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 .....	9 Ma
Total Effective Supply Impedance (Min.) .....	300 Ohms





**CHARACTERISTICS AND TYPICAL OPERATION (Each Section)**

**Half Wave Rectifier**

Diode Current at  $E_b = 10$  Volts DC..... 60 Ma

Color Television Type

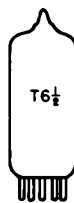
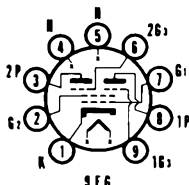
**SYNC SEPARATOR/CLIPPER  
and AGC TUBE**

**6GS8**

6BU8, 3GS8/3BU8,  
4GS8/4BU8

**Double Pentode**

Construction ..... Miniature T-6½  
Base ..... Button 9 Pin, E9-1  
Basing<sup>(1)</sup> ..... 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 $\mu$ mhos
Grid No. 1 Transconductance.....	1500	11 $\mu$ mhos
Grid No. 3 Voltage (Approx.) for $I_b = 100 \mu$ a.....	—	-4.5 Volts
Grid No. 1 Voltage (Approx.) for $I_b = 100 \mu$ a.....	—	-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  $\mu$ a DC.

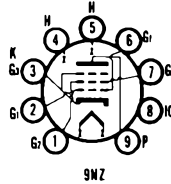
# 6GT5

12GT5, 17GT5

# HORIZONTAL DEFLECTION AMPLIFIER

**Beam Power Pentode**

Construction ..... Novar T-12  
 Base ..... Novar Button 9 Pin, E9-76  
 Basing ..... 9N2  
 Outline ..... 12-64  
 Maximum Diameter ..... 1.562 In.  
 Maximum Seated Height ..... 3.050 In.  
 Maximum Overall Height ..... 3.410 In.



**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: $g_1$ to $(h + k + g_2 + g_3)$ .....	15 Pf
Output: $p$ to $(h + k + g_2 + g_3)$ .....	6.5 Pf

**RATINGS (Design Maximum Rating System)**

**Horizontal Deflection Amplifier<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 $\mu$ mhos
Amplification Factor <sup>(3)</sup> .....	4.4
Plate Resistance.....	15,000 Ohms
$E_{c1}$ for $I_b = 1$ Ma (Approx.).....	-42 Volts

**INSTANTANEOUS PLATE KNEE VALUES**

$E_b = 60$  V,  $E_{c2} = 150$  V, and  $E_{c1} = 0$  V;  
 $I_b = 390$  Ma; and  $I_{c2} = 32$  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

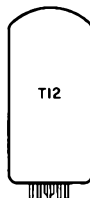
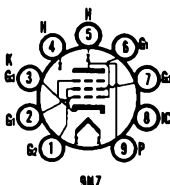
12GT5A, 17GT5A

### 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.



## VHF AMPLIFIER

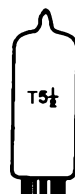
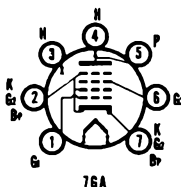
# 6GU5

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.



### ELECTRICAL DATA HEATER OPERATION

Heater Voltage .....  
 Heater Current .....  
 Heater Warm-up Time .....

	2GU5	3GU5
Heater Voltage	2.4	3.1
Heater Current	600	450
Heater Warm-up Time	11	11

**6GU5**  
 6.3 Volts  
 220 Ma  
 — Seconds

Maximum Heater-Cathode Voltage  
 Heater Negative with Respect to Cathode  
 Total DC and Peak .....  
 Heater Positive with Respect to Cathode  
 DC .....  
 Total DC and Peak .....

200 Volts  
 100 Volts  
 200 Volts

### DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

Grid No. 1 to Plate .....  
 Input: g1 to (h + k + g2 + g3 + bp) .....  
 Output: p to (h + k + g2 + g3 + bp) .....

0.018 Pf  
 7.0 Pf  
 3.2 Pf

### RATINGS (Design Maximum Rating System)

Plate Voltage (Max.) .....  
 Screen Voltage (Max.) .....  
 Positive DC Grid No. 1 Voltage (Max.) .....  
 Negative DC Grid No. 1 Voltage (Max.) .....  
 Plate Dissipation (Max.) .....  
 Screen Dissipation (Max.) .....  
 DC Cathode Current (Max.) .....  
 Grid No. 1 Circuit Resistance  
 With Fixed Bias (Max.) .....

300 Volts  
 150 Volts  
 0 Volt  
 50 Volts  
 3.0 Watts  
 0.15 Watt  
 20 Ma  
 0.5 Megohm

### CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage .....  
 Screen Voltage .....  
 Grid No. 1 Voltage .....  
 Plate Resistance (Approx.) .....  
 Transconductance .....  
 Plate Current .....  
 Screen Current .....  
 Noise Figure  
 Measured at 200 Hz .....  
 Grid No. 1 Voltage (Approx.) .....  
 Gm = 100 μmhos .....

135  
 135  
 -0.4  
 0.67  
 15,000  
 9.0  
 0.25  
 5.9  
 -6.2  
 275 Volts  
 135 Volts  
 -0.4 Volt  
 0.165 Megohm  
 15,500 μmhos  
 10 Ma  
 0.17 Ma  
 5.7 Decibels  
 -6.5 Volts

# 6GU7

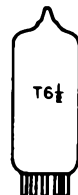
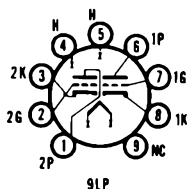
8GU7

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.



**ELECTRICAL DATA  
HEATER OPERATION**

	<b>8GU7</b>	<b>6GU7</b>
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.) <sup>(1)</sup> .....	330 Volts
Positive Grid Voltage (Max.) .....	0 Volt
Plate Dissipation (Max.) <sup>(2)</sup> .....	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.

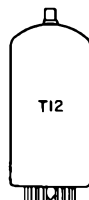
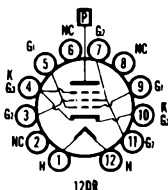
# 6GV5

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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>17GV5</b>	<b>6GV5</b>
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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 $\mu$ mhos
Plate Resistance.....	—	18,000 Ohms
Amplification Factor <sup>(3)</sup> .....	—	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**

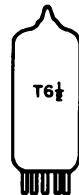
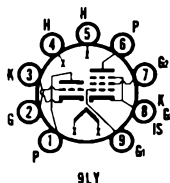
**6GV8**

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.



**ELECTRICAL DATA****HEATER OPERATION**

	<b>18GV8</b>	<b>9GV8</b>	<b>6GV8</b>
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.) <sup>(1)</sup> .....			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.) <sup>(2)</sup> .....			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 $\mu$ mhos
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 $\mu$ mhos
Amplification Factor.....			50
Internal Plate Resistance.....			7600 Ohms

**Pentode Section<sup>(3)</sup>**

Plate Voltage at End of the Scan (Min.).....	55 <sup>(4)</sup>	55 <sup>(4)</sup>	75 <sup>(5)</sup> Volts
Screen Grid Voltage.....	170	200	210 Volts
Negative Control Grid Voltage at End of the Scan <sup>(3)</sup> .....	6	9.5	11 Volts
Peak Plate Current.....	135	135	125 Ma
Nominal Screen Grid Dissipation.....	1.1	1.4	1.35 Watts

**NOTES:**

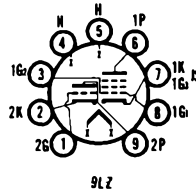
- (1) Maximum pulse duration 5% of a cycle with a maximum of 1 Msec.
- (2) Maximum pulse duration 200  $\mu$ sec. If a larger flyback is required Peak Cathode Current = 100 Ma with a maximum pulse duration of 400  $\mu$ sec.
- (3) If the vertical sweep circuit is designed so that full deflection is obtained 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.



**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 $\mu$ mhos
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)<sup>(1)</sup>****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

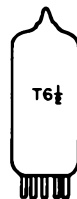
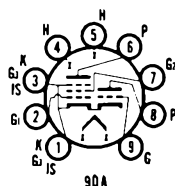
Control grid to cathode spacing of the pentode section of this type is of such low order of magnitude as to preclude the use of voltage between these elements of more than 30 volts dc or peak ac in commercial tube checkers and shorts indicating devices, particularly where mechanical excitation of the 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 $\mu$ mhos
Amplification Factor .....	—	40	—	—
Plate Resistance (Approx.) .....	—	4700	—	200,000 Ohms
Ec1 for Ib = 20 $\mu$ a (Approx.) .....	-6.0	—	-2.5	— Volts

**NOTE:**

(1) Shield connected to cathode.



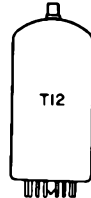
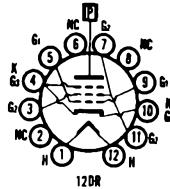


# HORIZONTAL DEFLECTION AMPLIFIER

**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
<b>Maximum Heater-Cathode Voltage</b>			
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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 <sup>(3)</sup> .....	—	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.

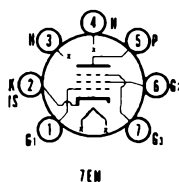
**6GY6/6GX6**  
5GX6

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.

**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.) <sup>(1)</sup> .....	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:**

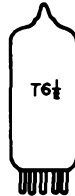
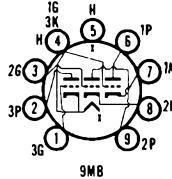
(1) The duration of the pulse must not exceed 15% of one horizontal scanning cycle. In a 525-line, 30-frame system, 15% of one horizontal scanning cycle is 10 μsec.

**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

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

**DIRECT INTERELECTRODE CAPACITANCES**

	Section 1 <sup>(1)</sup>		Section 2 <sup>(1)</sup>		Section 3 <sup>(1)</sup>	
	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 <sup>(1)</sup>	Section 2 & 3 <sup>(1)</sup>
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:**

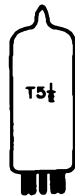
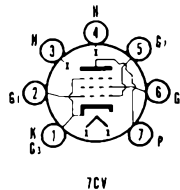
(1) Section 1 connects to pins 4, 6, and 7. Section 2 connects to pins 3, 8, and 9. Section 3 connects to pins 1, 2, and 4.

**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

Heater Voltage..... 6.3 Volts  
 Heater Current ..... 380 Ma  
 Heater Warm-up Time ..... — Seconds

4GZ5  
4.0  
600  
11

**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**

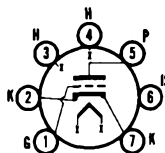
Plate Supply Voltage	250	250 Volts
Grid No. 2 Supply Voltage	250	250 Volts
Cathode Resistor	270	270 Ohms
Peak Audio Grid No. 1 Voltage	9.8	2.0 Volts
Zero Signal Plate Current	16	16 Ma
Maximum Signal Plate Current	16	16 Ma
Zero Signal Grid No. 2 Current	2.7	2.7 Ma
Maximum Signal Grid No. 2 Current	5.0	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.



**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)<sup>(1)</sup>**

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 $\mu$ mhos
Amplification Factor .....	82	78
Grid Cutoff Bias		
GM = 150 $\mu$ mhos .....	-5.1	-5.7 Volts
GM = 1500 $\mu$ mhos .....	—	-2.7 Volts
Grid Resistance .....	0.1	0 Megohm
Hot Input Resistance <sup>(1)</sup> .....	—	1000 Ohms
Hot Input Capacitance <sup>(2)</sup> .....	—	8.5 Pf
Noise Figure <sup>(2)</sup> .....	4.0	4.2 db

**NOTES:**

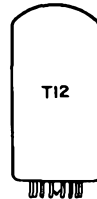
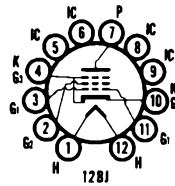
- (1) With JEDEC Shield No. 316 connected to Pin No. 2.
- (2) Measured at 200 MHz with plate at signal ground  $E_{c1} = -1.5$  volts.
- (3) In a 200 MHz noise matched, optimized, neutralized grounded cathode, triode amplifier stage.

**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**

Heater Voltage .....	<b>21HB5</b> 21	<b>6HB5</b> 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)**

<b>Horizontal-Deflection Amplifier Service<sup>(1)</sup></b>		
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.) <sup>(2)</sup> .....		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 <sup>(2)</sup>	-20 Volts
Plate Resistance (Approx.) .....	—	—	11,000 Ohms
Transconductance .....	—	—	9100 $\mu$ mhos
Plate Current .....	—	410	50 Ma

Screen Current .....	—	24	1.75 Ma
Grid No. 1 Voltage (Approx.)			
$I_b = 1.0$ Ma .....	-66	—	-33 Volts
Triode Amplification Factor <sup>(4)</sup> .....	—	—	4.7

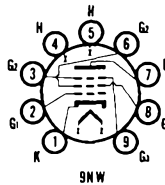
**NOTES:**

- (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  $E_b = E_{c2} = 130$  volts and  $E_{c1} = -20$  volts.



**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 $\mu$ mhos
Plate Resistance .....	28,000	24,000 Ohms
G1 Voltage for $I_b = 100$ $\mu$ a .....	-6.4	-13 Volts

**INSTANTANEOUS PLATE KNEE CHARACTERISTICS**

$E_b = 60$  Volts;  $E_{c2} = 250$  Volts;  $E_{c1} = 0$  Volt;  
 $I_b = 150$  Ma;  $I_{c2} = 37$  Ma

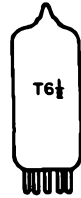
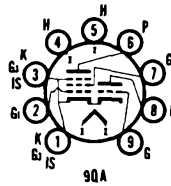
Color Television Type  
**VHF OSCILLATOR and MIXER**

**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.



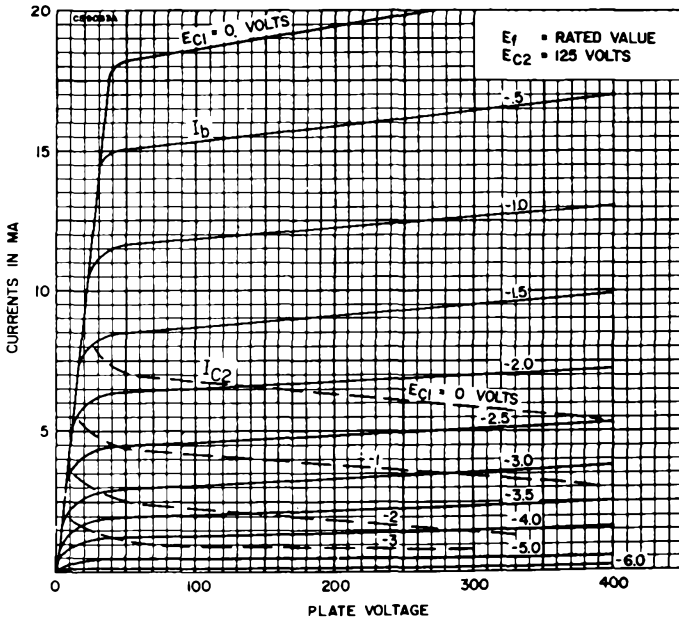
**ELECTRICAL DATA  
 HEATER OPERATION**

Heater Voltage.....	<b>5HB7</b>	<b>6HB7</b>
Heater Current.....	4.7	6.3 Volts
Heater Warm-up Time.....	600	450 Ma
Maximum Heater-Cathode Voltage	11	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

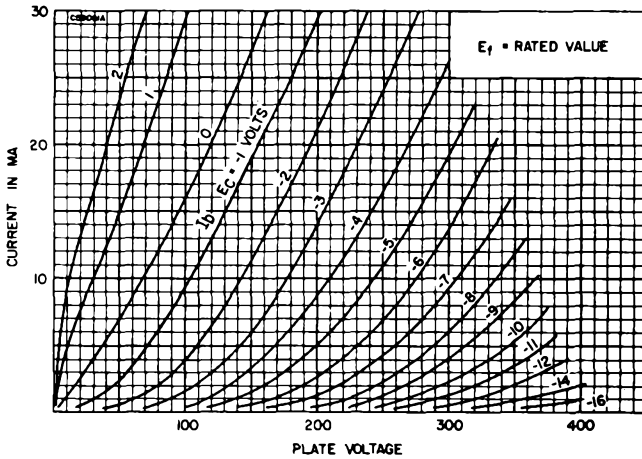
**DIRECT INTERELECTRODE CAPACITANCES (Shielded)**

<b>Triode Section</b>		
Grid to Plate.....		1.9 Pf
Input.....		3.0 Pf
Output.....		1.9 Pf
<b>Pentode Section</b>		
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)**

Plate Voltage (Max.) .....	330	<b>Triode Section</b>	<b>Pentode Section</b>
Grid No. 2 Supply Voltage (Max.) .....	—	330 Volts	330 Volts
Grid No. 2 Voltage .....	See Rating Chart (Gen. Info. Sec.)	—	—
Plate Dissipation (Max.) .....	2.5	3.1 Watts	3.1 Watts
Grid No. 2 Dissipation (Max.) .....	—	0.55 Watt	0.55 Watt
Positive Grid No. 1 Voltage (Max.) .....	0	0 Volt	0 Volt

**CHARACTERISTICS AND TYPICAL OPERATION**

**Class A1 Amplifier**

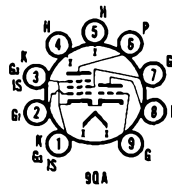
	<b>Triode Section</b>	<b>Pentode Section</b>
Plate Voltage .....	150	125 Volts
Grid No. 2 Voltage .....	—	125 Volts
Grid No. 1 Voltage .....	—	-1.0 Volts
Cathode Bias Resistor .....	56	— Ohms
Plate Current .....	18	12 Ma
Grid No. 2 Current .....	—	4 Ma
Transconductance .....	8500	6400 $\mu$ mhos
Amplification Factor .....	40	—
Plate Resistance (Approx.) .....	5000	200,000 Ohms
$E_{c1}$ for $I_b = 10 \mu$ a (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 ..... .90A
- 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)<sup>(1)</sup>**

**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 $\mu$ mhos
Plate Current .....	14	19 Ma
Grid Cutoff Voltage <sup>(2)</sup> .....	-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 $\mu$ mhos
Plate Current .....	10.5	12 Ma
Grid 2 Current .....	3.0	3.5 Ma
Grid 1 Cutoff Voltage <sup>(2)</sup> .....	-2.5	-6.5 Volts

**NOTES:**

- (1) With external shield connected to cathode.
- (2) For a plate current of 20  $\mu$ a.

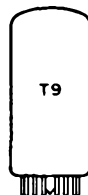
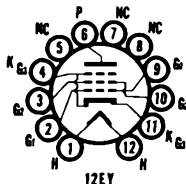
Color Television Type

## 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)**

<b>Vertical Deflection Amplifier<sup>(1)</sup></b>	
Plate Voltage (Max.).....	350 Volts
Peak Positive Pulse Plate Voltage (Abs. Max.).....	2500 Volts
Grid No. 2 Voltage (Max.).....	300 Volts
Plate Dissipation (Max.) <sup>(2)</sup> .....	12 Watts
Grid No. 2 Input (Max.) <sup>(3)</sup> .....	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 $\mu$ mhos
Plate Resistance (Approx.).....	5000 Ohms
E <sub>c1</sub> Voltage for I <sub>b</sub> = 100 $\mu$ a (Approx.).....	-50 Volts

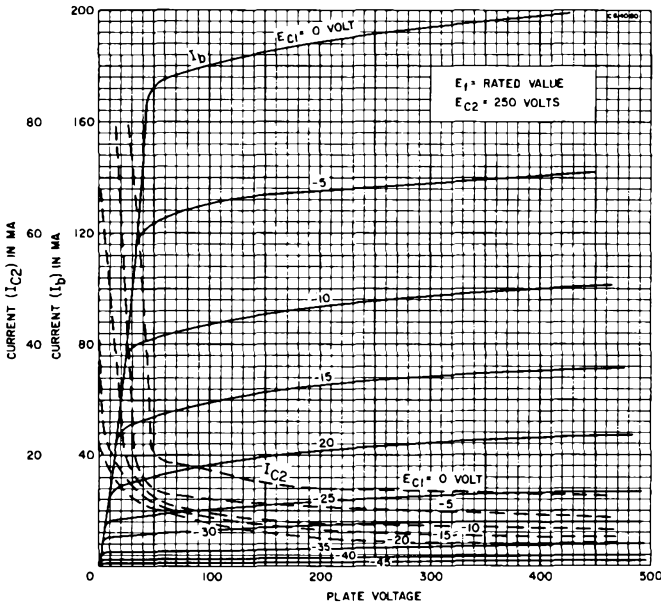
**INSTANTANEOUS PLATE KNEE VALUES**

E<sub>b</sub> = 60 V; E<sub>c2</sub> = 250 V; E<sub>c1</sub> = 0 V;  
 I<sub>b</sub> = 180 Ma and I<sub>c2</sub> = 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**



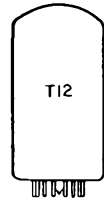
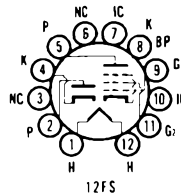
**DAMPER and HORIZONTAL DEFLECTION AMPLIFIER**

**6HE7**

12HE7, 33HE7, 38HE7, 58HE7

**High Perveance Diode and Beam Power Pentode**

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)**

Section	Capacitance
<b>Diode Section</b>	
Cathode to Plate and Heater.....	8.0 Pf
Plate to Cathode and Heater.....	7.0 Pf
Heater to Cathode.....	1.6 Pf
<b>Pentode Section</b>	
Grid No. 1 to Plate.....	0.38 Pf
Input: $g_1$ to $(h + k + g_2 + bp)$ .....	19 Pf
Output: $p$ to $(h + k + g_2 + bp)$ .....	8.0 Pf

**RATINGS (Design Maximum Rating System)**

**Horizontal Deflection Amplifier Service<sup>(1)</sup>**

<b>Pentode Section</b>	
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.) <sup>(2)</sup> .....	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<sup>(1)</sup>**

<b>Diode Section</b>	
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**

<b>Pentode Section</b>			
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 $\mu$ mhos
Plate Current.....	—	450	60 Ma
Screen Current.....	—	40	2.8 Ma
Grid No. 1 Voltage (Approx.)			
$I_b = 1.0$ Ma.....	-80	—	-39 Volts
Triode Amplification Factor <sup>(2)</sup> .....	—	—	4.2

**Diode Section**

Tube Voltage Drop	
$I_b = 250$ 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.

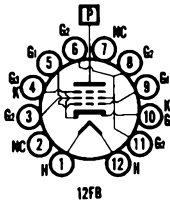
# 6HF5

Color Television Type

## HORIZONTAL DEFLECTION AMPLIFIER

**Beam Power Pentode**

Construction..... Compactron T-12  
 Base ..... Button 12 Pin, E12-74  
 Top Cap ..... C1-1  
 Basing ..... 12F B  
 Outline ..... 12-89  
 Maximum Diameter ..... 1.563 In.  
 Maximum Seated Height ..... 3.750 In.  
 Maximum Overall Height ..... 4.125 In.



**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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 <sup>(3)</sup> .....	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.

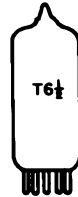
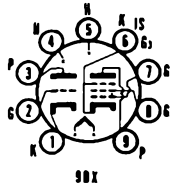
Color Television Type

**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.



**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
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**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**

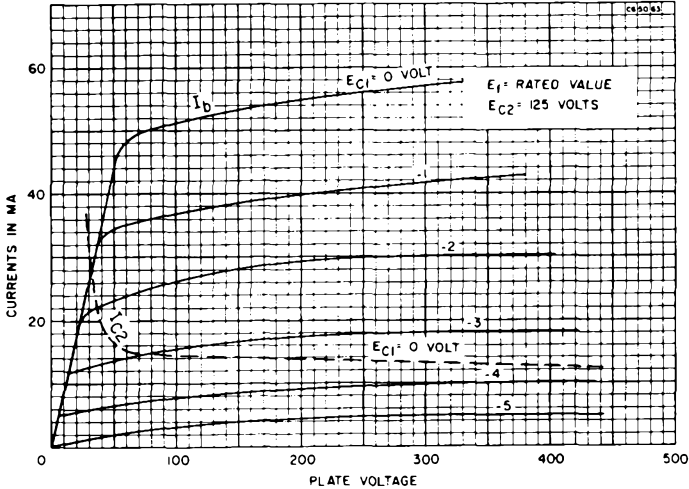
**Class A1 Amplifier**

	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)**

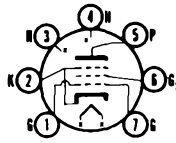


**6HG5**

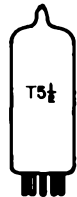
**AUDIO POWER AMPLIFIER**

**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<sup>(1)</sup> ..... 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 $\mu$ mhos
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

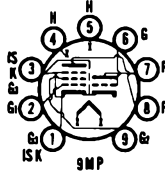
**VHF OSCILLATOR and MIXER**

**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

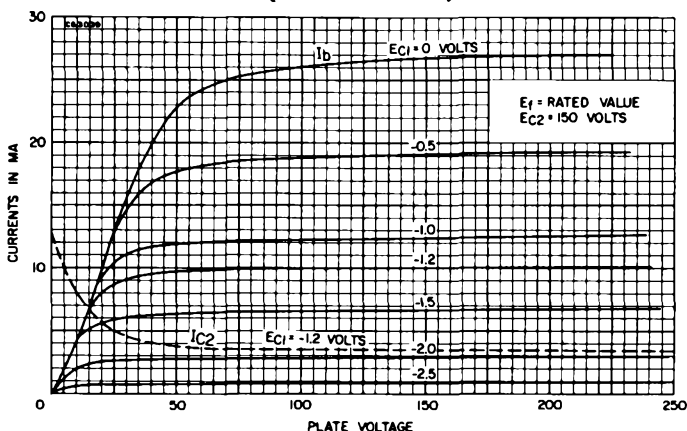
Grid No. 1 Circuit Resistance (Max.) .....	0.5	— Megohm
Fixed Bias (Max.) .....	—	0.25 Megohm
Cathode Bias (Max.) .....	—	0.5 Megohm

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 pentode or 50 volts for the triode.

**CHARACTERISTICS AND TYPICAL OPERATION**

	<b>Triode Section</b>	<b>Pentode Section</b>
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 $\mu$ mhos
Amplification Factor ( $g_1$ to $g_2$ ) .....	17	70
Plate Resistance.....	3100	350,000 Ohms

**AVERAGE PLATE CHARACTERISTICS (Pentode Section)**

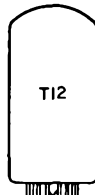
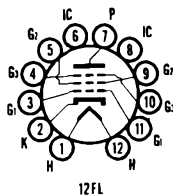


**6HJ5**  
21HJ5, 30HJ5

**HORIZONTAL DEFLECTION AMPLIFIER**

**Beam Power Pentode**

Construction.....	Compactron T-12
Base .....	Buttun 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.



**ELECTRICAL DATA HEATER OPERATION**

	<b>30HJ5</b>	<b>21HJ5</b>	<b>6HJ5</b>
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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 <sup>(3)</sup>	400 <sup>(3)</sup>	540 <sup>(3)</sup>	80 Ma
Grid No. 2 Current .....	160 <sup>(3)</sup>	42 <sup>(3)</sup>	48 <sup>(3)</sup>	5.5 Ma
Triode Amplification Factor .....	—	—	—	4.2
Transconductance .....	—	—	—	10,000 $\mu$ mhos
Plate Resistance .....	—	—	—	5000 Ohms
Grid No. 1 Voltage (Approx.) for Ib = 1 Ma (Ep = 4.5 KV) .....	—	—	—	-70 Volts

**NOTES:**

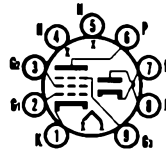
- (1) For operating in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations, Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) Surge not to exceed 15 seconds duration.
- (3) Instantaneous Values.

**DETECTOR or DC RESTORER  
and IF/AGC AMPLIFIER**

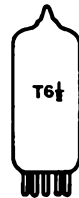
**6HJ8**

**High Perveance Diode and Sharp Cutoff Pentode**

Construction .....	Miniature T-6 $\frac{1}{2}$
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.



9CY



**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)<sup>(1)</sup>**

<b>Pentode</b>	
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
<b>Diode</b>	
Input: p to (h+k) .....	2.4 Pf
Output: k to (h+p) .....	3.0 Pf
<b>Coupling</b>	
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 $\mu$ mhos
Plate Resistance (Approx.)	0.20 Megohm
Grid No. 1 Voltage for $I_b = 20 \mu$ a (Approx.)	-6 Volts
Diode Plate Voltage for Diode Current of 50 Ma <sup>(2)</sup>	10 Volts

**NOTES:**

- (1) Shield No. 315.
- (2) Test condition only.

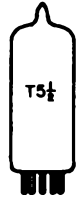
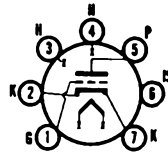
# 6HK5

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.



**ELECTRICAL DATA**  
**HEATER OPERATION**

	7GM			
	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)<sup>(1)</sup>**

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 $\mu$ mhos
Amplification Factor .....	75
Plate Resistance (Approx.) .....	5000 Ohms
$E_c$ for $G_m = 150 \mu$ mhos (Approx.) .....	-5.0 Volts
$E_c$ for $G_m = 1500 \mu$ mhos (Approx.) .....	-2.6 Volts
Input Resistance (200 MHz) <sup>(1)</sup> .....	600 Ohms
Input Capacitance (200 MHz) <sup>(2)</sup> .....	9.0 Pf
Noise Figure (200 MHz) <sup>(3)</sup> .....	4.2 db

**NOTES:**

- (1) Shield No. 316.
- (2) Measured under grounded plate conditions.
- (3) Optimized neutralized triode RF amplifier stage, noise matched.

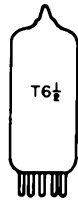
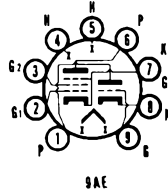
*Color Television Type*

**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.



**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**

**Triode Section**

	Shielded	Unshielded
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 $\mu$ mhos
Plate Current .....	12.5	12.0 Ma
Grid No. 2 Current .....	—	4.5 Ma
Plate Resistance (Approx.) .....	5000	150,000 Ohms
Amplification Factor .....	40	—
$E_{c1}$ for $I_b = 20 \mu$ a (Approx.) .....	—	-7 Volts

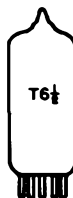
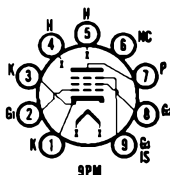
# 6HM6

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

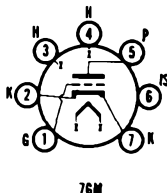
# 6HQ5

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**

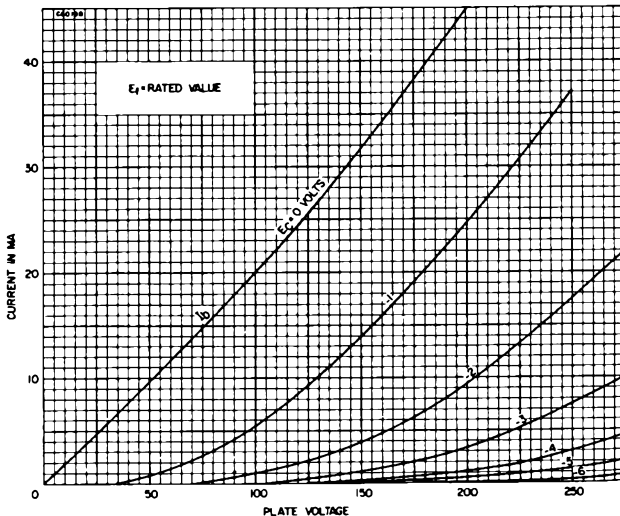
**Class A1 Amplifier**

Plate Voltage.....	135 Volts
Grid Voltage.....	-1.0 Volt
Plate Current.....	11.5 Ma
Transconductance.....	15,000 $\mu$ mhos
Amplification Factor.....	78
Plate Resistance (Approx.).....	5400 Ohms
Ec for Gm = 150 $\mu$ mhos (Approx.).....	-4.2 Volts
Ec for Gm = 1500 $\mu$ mhos (Approx.).....	-2.5 Volts
Input Resistance (200 MHz) <sup>(1)</sup> .....	275 Ohms
Input Capacitance (200 MHz) <sup>(1)</sup> .....	11.2 Pf
Noise Figure (200 MHz) <sup>(2)</sup> .....	4.7 db

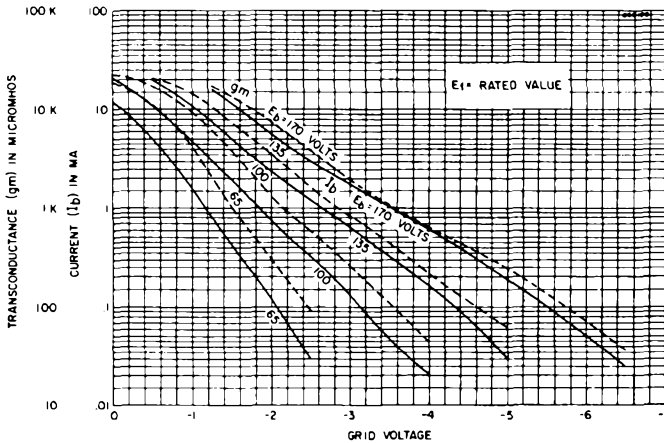
**NOTES:**

- (1) Measured under grounded plate conditions.
- (2) Optimized neutralized triode RF amplifier stage, noise matched.

**AVERAGE PLATE CHARACTERISTICS**



**AVERAGE TRANSFER CHARACTERISTICS**

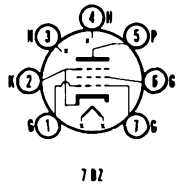


**6HR5**

**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.



**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<sup>(1)</sup>**

- 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<sup>(1)</sup> ..... -19 Volts
- Transconductance ..... — ..... 3600 μmhos
- Plate Current ..... 105 ..... 30 Ma

Grid 2 Current .....	25	2.3 Ma
Grid 1 Cutoff Voltage <sup>(2)</sup> .....	—	-43 Volts

**NOTES:**

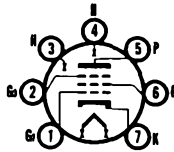
- (1) Applied for short interval (maximum of 2 seconds) so as not to damage tube.
- (2) For plate current of 100  $\mu$ a.
- (3) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," 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.



**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**

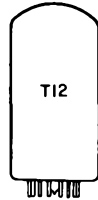
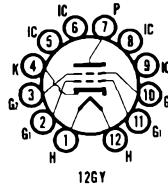
Plate Supply Voltage.....	200 Volts
Grid No. 3 .....	Connected to Cathode at Socket
Grid No. 2 Supply Voltage.....	115 Volts
Grid No. 1 Supply Voltage.....	0 Volt
Cathode Resistor .....	68 Ohms
Plate Resistance (Approx.) .....	0.5 Megohm
Transconductance .....	8500 $\mu$ hos
Plate Current .....	13.2 Ma
Grid No. 2 Current .....	4.3 Ma
Grid No. 1 Voltage (Approx.) for Transconductance = 60 $\mu$ hos .....	-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.



### 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<sup>(1)</sup>

Peak Plate Voltage.....	5500 Volts
Plate Dissipation.....	30 Watts
Peak Plate Current.....	325 Ma
Grid-Circuit Resistance <sup>(2)</sup> .....	0.1 Megohm
Bulb Temperature at Hottest Point.....	220 °C

#### CHARACTERISTICS AND TYPICAL OPERATION

Pulse Plate Voltage <sup>(1)</sup> .....	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%.

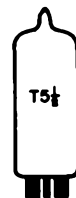
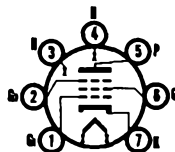
# 6HS6

19HS6

# 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**

	<b>19HS6</b>	<b>6HS6</b>
Heater Voltage.....	18.9	6.3 Volts
Heater Current .....	150	450 Ma
Heater Warm-up Time .....	17	11 Seconds
<b>Maximum Heater-Cathode Voltage</b>		
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.)
<b>Maximum Circuit Values:</b>	
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 $\mu$ mhos
Plate Current .....	—	8.8 Ma
Grid No. 2 Current .....	—	2.8 Ma
Grid No. 1 Voltage (Approx.) for Plate Current of 20 $\mu$ a .....	—	-4 Volts

Color Television Type

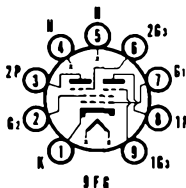
**SYNC SEPARATOR/CLIPPER  
and AGC**

**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**

	<b>3HS8</b>	<b>4HS8</b>	<b>6HS8</b>
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

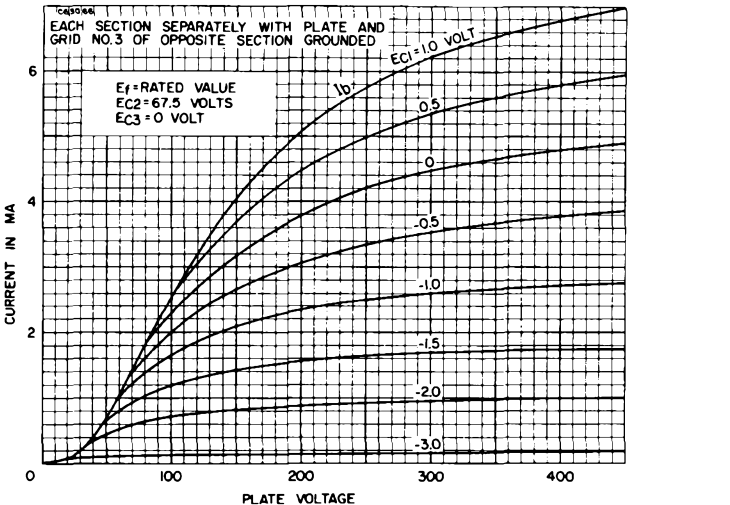
**Each Section Operating Separately with Plate and Grid No. 3 of Opposite Section Grounded**

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 $\mu$ mhos
Grid No. 1 Transconductance .....	1100	— $\mu$ mhos
Ec3 for Ib = 100 $\mu$ a (Approx.) .....	—	-3.5 Volts
Ec1 for Ib = 100 $\mu$ a (Approx.) .....	—	-2.3 Volts

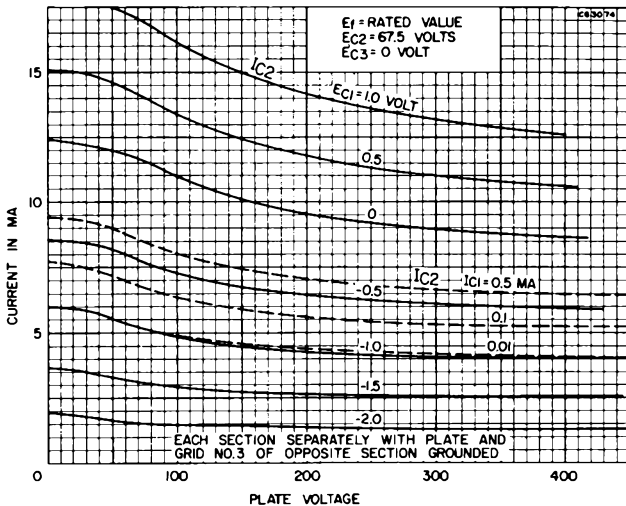
**NOTE:**

(1) Grid current adjusted for 100  $\mu$ a dc.

**AVERAGE PLATE CHARACTERISTICS**



**AVERAGE SCREEN CHARACTERISTICS**

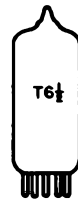
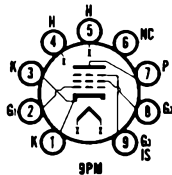


**IF AMPLIFIER**

**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 <sup>(1)</sup>	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 $\mu$ mhos
Plate Current .....	15 Ma
Grid 2 Current .....	4.0 Ma
Grid 1 Cutoff Bias <sup>(2)</sup> .....	-6.7 Volts
Cutoff Transconductance:	
For Grid 1 Volts = -1.5 .....	12,000 $\mu$ mhos
For Grid 1 Volts = -3.5 .....	300 $\mu$ mhos
For Grid 1 Volts = -4.5 .....	100 $\mu$ mhos
Hot Input Resistance <sup>(3)</sup> .....	12,700 Ohms
Hot Input Capacitance <sup>(3)</sup> .....	7.45 Pf

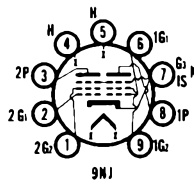
**NOTES:**

- (1) With JEDEC Shield No. 315 connected to ground.
- (2) For transconductance of 50  $\mu$ mhos.
- (3) Measured at 44 MHz with unbypassed 56 Ohm cathode resistance.

<h1 style="margin: 0;">6HU8/ELL80</h1> <p style="margin: 0;">12HU8/PLL80</p>	<h2 style="margin: 0;">AF AMPLIFIER</h2>
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**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 + g <sup>2</sup> + g <sup>3</sup> + IS) .....	7.0	7.0 pf
Output: p to (h + k + g <sup>2</sup> + g <sup>3</sup> + 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 $\mu$ mhos
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

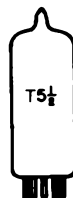
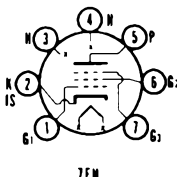
Color Television Type  
**FM DETECTOR**

**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.



**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

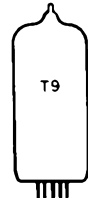
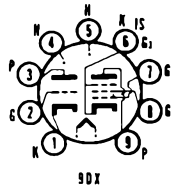
**CHARACTERISTICS AND TYPICAL OPERATION**

**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.

**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 $\mu$ mhos
Amplification Factor.....	70	—
Plate Resistance (Approx.).....	—	14,000 Ohms
Ec for Ib = 10 $\mu$ a (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

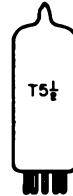
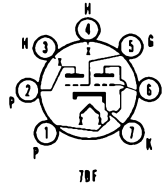
**HIGH FREQUENCY OSCILLATOR,  
AMPLIFIER or MIXER**

**6J6A**

SJ6, 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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	19J6	SJ6	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 <sup>(1,2)</sup> .....	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 <sup>(2)</sup> .....	-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 <sup>(2)</sup> .....	820 Ohms
Oscillator Peak Voltage.....	3 Volts
Plate Current.....	4.8 Ma
Plate Resistance.....	10,000 Ohms
Conversion Transconductance.....	1900 μmhos

**NOTES:**

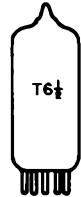
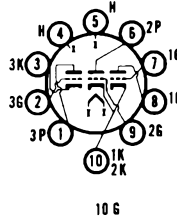
- (1) Value is for both sections operating as specified.
- (2) Under rated maximum conditions, total grid circuit resistance should not exceed 0.5 megohm. Fixed bias operation is not recommended.
- (3) Obtained by a grid resistor of 625 ohms or a cathode resistor of 220 ohms.

**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<sup>(1)</sup> ..... 10G  
 Outline ..... 6-13  
 Maximum Diameter ..... 0.875 In.  
 Maximum Seated Height ..... 1.940 In.  
 Maximum Overall Height ..... 2.190 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.....	100 Volts
Heater Positive with Respect to Cathode	
Total DC and Peak.....	100 Volts

**DIRECT INTERELECTRODE CAPACITANCES**

	Shielded <sup>(2)</sup>	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 10, 11, and 12.
- (2) Shield No. 315 ties to cathode of triode under test.

**6J10**

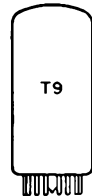
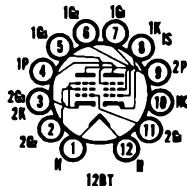
13J10/13Z10

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 <sup>(1)</sup> .....	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 <sup>(2)</sup> .....	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 <sup>(1)</sup> .....	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:**

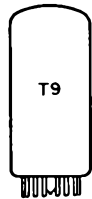
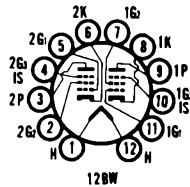
- (1) The cathode resistor should be adjusted for maximum AM rejection in the output of the limiter-discriminator stage at the specified signal level. AM rejection is measured with an applied signal containing 30% AM and 30% FM.
- (2) At signal levels above specified value, limiting is within  $\pm 3$  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)<sup>(1)</sup>**

**Section 1**

Grid No. 1 to Plate (Max.) .....	0.04 Pf
Input: 1g1 to (h + 1k + 1g2 + 1g3 + 2g3 + 1S) .....	11 Pf
Output: 1p to (h + 1k + 1g2 + 1g3 + 2g3 + 1S) .....	2.8 Pf

**Section 2**

Grid No. 1 to Plate (Max.) .....	0.04 Pf
Input: 2g1 to (h + 2k + 2g2 + 2g3 + 1g3 + 1S) .....	11 Pf
Output: 2p to (h + 2k + 2g2 + 2g3 + 1g3 + 1S) .....	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 $\mu$ mhos
Plate Current .....	11 Ma
Screen Current .....	3.8 Ma
Grid No. 1 Voltage, (Approx.) .....	
I <sub>b</sub> = 20 $\mu$ a .....	-3 Volts

**NOTE:**

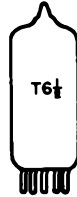
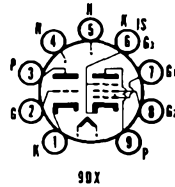
- (1) Shield No. 309 connected to cathode of section under test.

**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.



**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 Pt
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 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)**

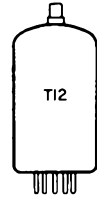
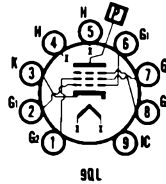
Eb = 30 V, Ec2 = 135 V and Ec1 = 0 V  
Ib = 32 Ma and Ic2 = 14 Ma

**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.

**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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 <sup>(3)</sup> .....	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.

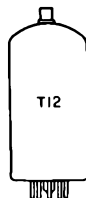
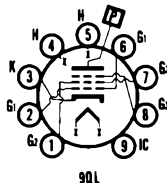
**HORIZONTAL DEFLECTION  
AMPLIFIER**

**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.

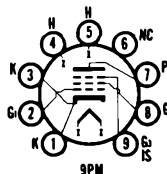


*Color Television Type*  
**IF AMPLIFIER**

**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.



**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 + 1S).....	8.2 Pf
Output: p to (h + k + g2 + g3 + 1S).....	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**

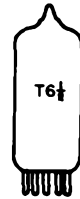
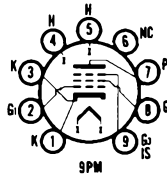
Plate Supply Voltage.....	125 Volts
Grid No. 3 Voltage .....	Connected to Cathode at Socket
Grid No. 2 Supply Voltage.....	125 Volts
Cathode Resistor .....	56 Ohms
Plate Current .....	13 Ma
Grid No. 2 Current .....	3.2 Ma
Transconductance .....	15,000 $\mu$ mhos
Plate Resistance (Approx.) .....	180,000 Ohms
Grid No. 1 Voltage for $I_b = 100 \mu$ a .....	-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.

**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 + 1S).....	8.5 Pf
Output: p to (h + k + g2 + g3 + 1S).....	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**

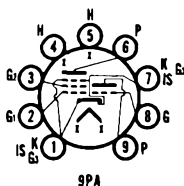
Plate Supply Voltage.....	125 Volts
Grid No. 3 Voltage .....	Connected to Cathode at Socket
Grid No. 2 Supply Voltage.....	125 Volts
Cathode Resistor .....	56 Ohms
Plate Current .....	14 Ma
Grid No. 2 Current .....	3.4 Ma
Transconductance .....	16,000 $\mu$ mhos
Plate Resistance (Approx.) .....	180,000 Ohms
Grid No. 1 Voltage for $I_b = 100 \mu$ a .....	-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.



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
<b>Triode Section</b>		
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
<b>Pentode Section</b>		
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
<b>Coupling</b>		
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 <sup>(a)</sup>	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

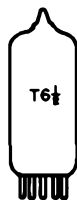
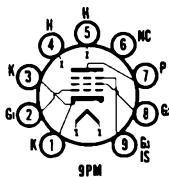
3JD6, 4JD6

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
<b>Maximum Heater-Cathode Voltage</b>			
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

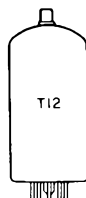
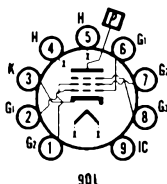
**HORIZONTAL DEFLECTION  
AMPLIFIER**

**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.



**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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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.) <sup>(2)</sup> .....	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	— $\mu$ mhos
Triode Amplification Factor (Grid No. 2 Connected to Plate)		
(Eb = Ec2 = 125 Volts; Ec1 = -25 Volts) .....	3.0 <sup>(3)</sup>	—
Plate Resistance (Approx.) .....	5500	— Ohms
Grid No. 1 Voltage for Ib = 1 Ma (Approx.) .....	-54	— Volts

**SPECIAL TESTS AND RATINGS**

**Primary Beam—Plate Emission<sup>(4)</sup>**

Initial Maximum .....	100 $\mu$ a
After 1000 Hours of Operation Within Ratings (Max.) .....	100 $\mu$ a

**NOTES:**

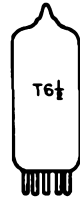
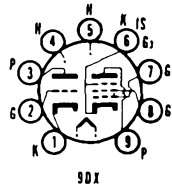
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) In stages operating with grid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

**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 <sup>(1)</sup> Watts
Grid No. 2 Dissipation (Max.) .....	—	2 <sup>(1)</sup> 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
<b>Class A1 Amplifier</b>		
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 $\mu$ mhos
Amplification Factor .....	70	—
Plate Resistance (Approx.) .....	—	140,000 Ohms
Ec1 for Ib = 10 $\mu$ a (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.

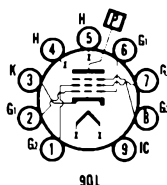
## HORIZONTAL DEFLECTION AMPLIFIER

## 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.



**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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 $\mu$ mhos
Plate Resistance .....	12,000 Ohms
Amplification Factor <sup>(3)</sup> .....	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.

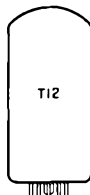
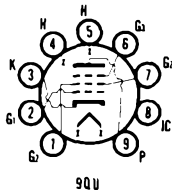
6JG6A

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.



**ELECTRICAL DATA  
HEATER OPERATION**

	22JG6A	17JG6A	
Heater Voltage .....	22	16.8	<b>6JG6A</b>
Heater Current .....	450	600	6.3 Volts
Heater Warm-up Time .....	11	11	1600 Ma
Maximum Heater-Cathode Voltage			— 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)**

Grid No. 1 to Plate .....		0.7 Pf
Input .....		22 Pf
Output .....		9.0 Pf

**RATINGS (Design Maximum Rating System)**

<b>Horizontal Deflection Amplifier<sup>(1)</sup></b>		
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 <sup>(2)</sup> .....		-20 Volts
Plate Current .....		80 Ma
Grid No. 2 Current .....		2.5 Ma
Transconductance .....		10,000 μmhos
Plate Resistance .....		12,000 Ohms
Amplification Factor <sup>(3)</sup> .....		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:**

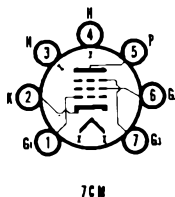
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) In stages operating with grid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



**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 <sup>(1)</sup>	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:**

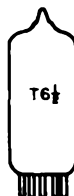
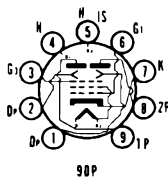
(1) External Shield No. 316 connected to Pin No. 2 (cathode) at socket.

Color Television Type  
**SYNCHRONOUS DETECTOR**

**6JH8**

**Double Plate Sheet Beam Tube**

Construction ..... Miniature T-6½  
 Base ..... Button 9 Pin, E9-1  
 Basing<sup>(1)</sup> ..... .9DP  
 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

**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<sup>(1)</sup>**

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 $\mu$ mhos
G1 Voltage for $I_b = 10 \mu$ a.....	-13 Volts

**AVERAGE DEFLECTOR CHARACTERISTICS<sup>(2)</sup>**

Plate No. 1 Voltage.....	250 Volts
Plate No. 2 Voltage.....	250 Volts
Accelerator Voltage.....	250 Volts
Cathode Resistor.....	220 Ohms
Deflector Switching Voltage (Max.) <sup>(2)</sup> .....	20 Volts
Deflector-Bias for Minimum Deflector Switching Voltage.....	-14 Volts
Voltage Difference Between Deflectors for $I_{b1} = I_{b2}$ (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

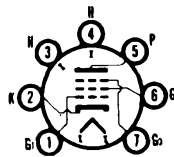
4JK6, 5JK6

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 $\mu$ mhos
Plate Resistance (Approx.) .....	0.15 Megohm
Grid No. 1 Voltage for Ib = 20 $\mu$ a (Approx.) .....	-3.5 Volts
R Input at 44 MHz .....	4000 Ohms

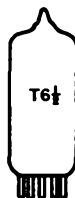
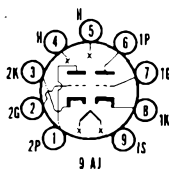
**RF AMPLIFIER  
OSCILLATOR and MIXER**

**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	17JK8	8JK8	6JK8
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**

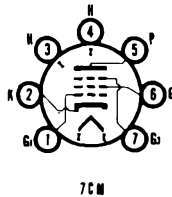
	Oscillator Section No. 1	R-F Amp. Section No. 2
<b>Class A1 Amplifier</b>		
Plate Voltage .....	100	135 Volts
Grid Voltage .....	-1.0	-1.2 Volts
Plate Current .....	5.3	10 Ma
Transconductance .....	6800	13,000 $\mu$ mhos
Amplification Factor .....	55	70
Plate Resistance (Approx.) .....	8000	5400 Ohms
Ec for Ib = 20 $\mu$ a (Approx.) .....	-4.4	— Volts
Ec for Gm = 150 $\mu$ mhos (Approx.) .....	—	-5.5 Volts
Ec for Gm = 1500 $\mu$ mhos (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.



**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 + 1S) .....	9.3 Pf
Output: p to (h + k + g2 + g3 + 1S) .....	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 <sup>(1)</sup> .....	68 Ohms



Plate Current .....	12.5 Ma
Grid No. 2 Current .....	4.0 Ma
Transconductance .....	15,500 $\mu$ mhos
Plate Resistance (Approx.) .....	120,000 Ohms
E <sub>c1</sub> for gm = 1500 $\mu$ mhos (Approx.) .....	-2.7 Volts
E <sub>c1</sub> for gm = 150 $\mu$ mhos (Approx.) .....	-5.5 Volts

**NOTE:**

(1) Optimized unbypassed cathode resistor for gain controlled IF Service is 33 Ohms.

Color Television Type

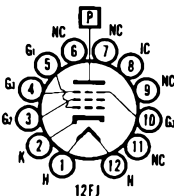
**HORIZONTAL DEFLECTION  
AMPLIFIER**

**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**

Heater Voltage.....	<b>17JM6</b>	<b>6JM6</b>
Heater Current .....	16.8	6.3 Volts
Heater Warm-up Time .....	450	1200 Ma
Maximum Heater-Cathode Voltage	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)**

Grid No. 1 to Plate .....	0.6 Pf
Input .....	16 Pf
Output .....	7 Pf

**RATINGS (Design Maximum Rating System)**

**Horizontal Deflection Amplifier<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 $\mu$ mhos
Plate Resistance.....	—	18,000 Ohms
Amplification Factor <sup>(3)</sup> .....	—	4.4
E <sub>c1</sub> for I <sub>b</sub> = 1.0 Ma (Approx.) .....	-100	-42 Volts

**INSTANTANEOUS PLATE KNEE VALUES**

E<sub>b</sub> = 60 V; E<sub>c2</sub> = 150 V and E<sub>c1</sub> = 0 V  
 I<sub>b</sub> = 345 Ma, and I<sub>c2</sub> = 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.

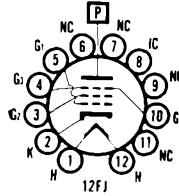
- (2) In stages operating with grid leak bias, an adequate cathode bias resistor or other suitable means is required to protect the tube in the absence of excitation.
- (3) Amplification factor with tube operating as a triode with 150 volts on the plate and Grid No. 2 and -22.5 volts on Grid No. 1.

**6JM6A**  
17JM6A

Color Television Type  
**HORIZONTAL DEFLECTION  
AMPLIFIER**

**Beam Power Pentode**

Construction.....Compactron T-12  
Base .....Bultron 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**

	<b>17JM6A</b>	<b>6JM6A</b>
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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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.....	—	15,000 Ohms
Amplification Factor <sup>(3)</sup> .....	—	4.4
Ec1 for Ib = 1.0 Ma (Approx.).....	-100	-42 Volts

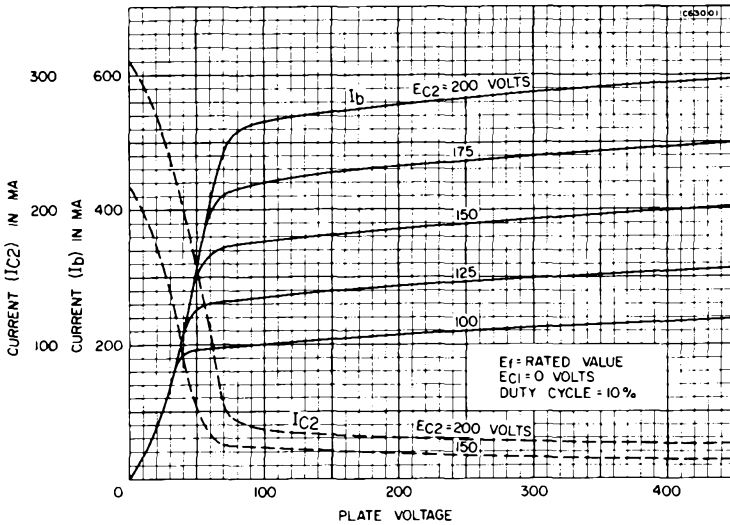
**INSTANTANEOUS PLATE KNEE VALUES**

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**

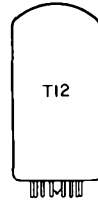
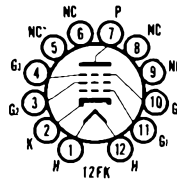


Color Television Type  
**HORIZONTAL DEFLECTION  
 AMPLIFIER**

**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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 $\mu$ mhos
Plate Resistance	—	18,000 Ohms
Amplification Factor <sup>(1)</sup>	—	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

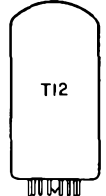
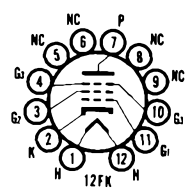
12JN6A, 17JN6A

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<sup>(1)</sup>**

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.) <sup>(2)</sup>	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 $\mu$ mhos
Plate Resistance .....	—	150,000 Ohms
Amplification Factor <sup>(1)</sup> .....	—	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.

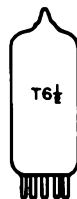
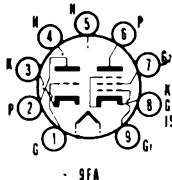
**HORIZONTAL DEFLECTION OSC.  
and GENERAL PURPOSE TRIODE**

**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.



**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)<sup>(1)</sup>**

**Pentode Section**

Grid No. 1 to Plate (Max.) (g1 to p) .....	0.01 Pf
Input: P <sub>g1</sub> to (h + P <sub>k</sub> + P <sub>g2</sub> + P <sub>g3</sub> + IS) .....	5.5 Pf
Output: P <sub>p</sub> to (h + P <sub>k</sub> + P <sub>g2</sub> + P <sub>g3</sub> + 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**

	<b>Pentode Section</b>	<b>Triode Section</b>
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 $\mu$ mhos
Plate Current .....	12	13.5 Ma
Screen Current .....	4.0	— Ma
Grid No. 1 Voltage (Approx.) .....	—	—
$I_b = 10 \mu a$ .....	-8	-8 Volts

**NOTE:**

(1) With external shield (EIA 315) connected to cathode of section under test.

6JS6C

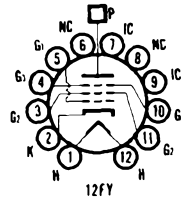
12JS6, 23JS6A, 31JS6C

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: $g_1$ to $(h + k + g_2 + bp)$ .....	24 Pf
Output: $p$ to $(h + k + g_2 + bp)$ .....	10 Pf

**RATINGS (Design Maximum Rating System)**

**Horizontal Deflection Amplifier<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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.) <sup>(2)</sup> .....	0.47 Megohms
Grid No. 1 Circuit Resistance <sup>(4)</sup> .....	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 $\mu$ mhos
Amplification Factor <sup>(3)</sup> .....	3
Plate Resistance .....	5500 Ohms
$E_{c1}$ for $I_b = 1$ Ma (Approx.) .....	-54 Volts

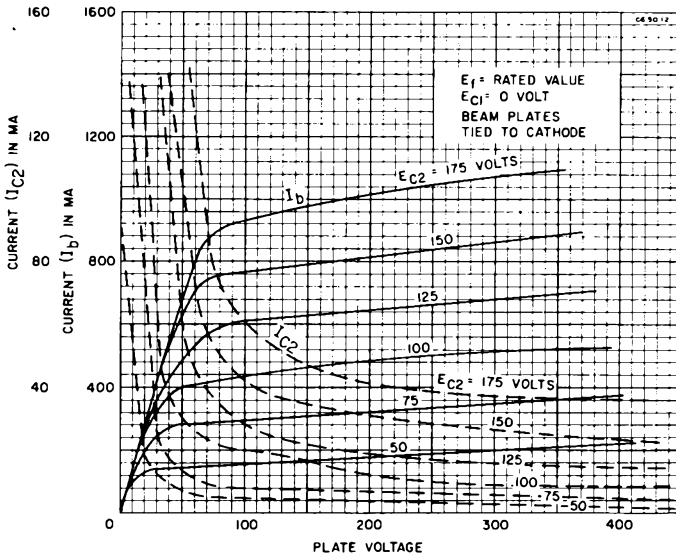
**INSTANTANEOUS PLATE KNEE VALUES**

$E_b = 62$  V,  $E_{c2} = 125$  V and  $E_{c1} = 0$  V;  $E_b = 70$  V (12JS6)  
 $I_b = 570$  Ma; and  $I_{c2} = 34$  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**

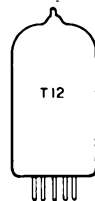
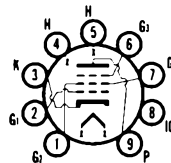


**HORIZONTAL DEFLECTION AMPLIFIER**

**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.



**ELECTRICAL DATA - HEATER OPERATION**

Heater Voltage .....	17JT6	12JT6	6JT6
Heater Current .....	16.8	12.6	6.3 Volts
Heater Warm-up Time .....	450	600	1200 Ma
	11	11	- Seconds

<b>Maximum Heater-Cathode Voltage</b>	
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<sup>(1)</sup>**

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
<b>Cathode Current</b>	
Peak (Max.).....	550 Ma
Average (Max.) .....	175 Ma
Grid No. 2 Input (Max.) .....	3.5 Watts
Plate Dissipation (Max.) <sup>(2)</sup> .....	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

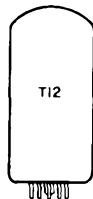
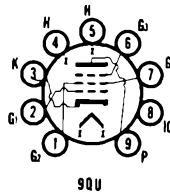
12JT6A, 17JT6A

## 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.





Color Television Type

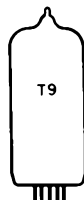
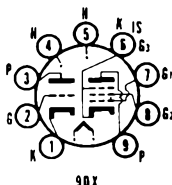
**VOLTAGE AMP. or SYNC SEP. (T)  
VIDEO AMPLIFIER (P)**

**6JT8**

8JT8, 10JT8

**High 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.



**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			200 Volts
Total DC and Peak.....			
Heater Positive with Respect to Cathode			100 Volts
DC.....			200 Volts
Total DC and Peak.....			

**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 $\mu$ mhos
Amplification Factor.....	100	—
Plate Resistance (Approx.).....	37,000	50,000 Ohms
E <sub>c1</sub> for I <sub>b</sub> = 100 $\mu$ a (Approx.).....	—	-5 Volts
E <sub>c</sub> for I <sub>b</sub> = 20 $\mu$ a (Approx.).....	-5.3	— Volts

**INSTANTANEOUS PLATE KNEE CHARACTERISTICS (Pentode Section)**

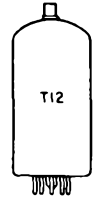
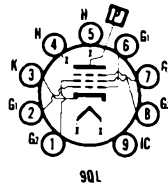
E<sub>b</sub> = 50 V, E<sub>c2</sub> = 100 V and E<sub>c1</sub> = 0 V  
I<sub>b</sub> = 55 Ma, and I<sub>c2</sub> = 18 Ma

**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.



**ELECTRICAL DATA  
HEATER OPERATION**

Heater Voltage.....	<b>22JU6</b>	<b>6JU6</b>
Heater Current .....	22.0	6.3 Volts
Heater Warm-up Time .....	450	1600 Ma
Maximum Heater-Cathode Voltage	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)**

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)**

<b>Horizontal Deflection Amplifier</b>	
DC Plate Supply Voltage (Max.).....	770 Volts
Peak Positive Pulse Plate Voltage (Max.) <sup>(4)</sup> .....	6500 Volts
Peak Negative Pulse Plate Voltage (Max.) .....	1500 Volts
DC Grid No. 3 Voltage <sup>(3)</sup> .....	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
<b>Cathode Current</b>	
Peak .....	950 Ma
Average .....	275 Ma
Grid No. 2 Input .....	3.5 Watts
Plate Dissipation <sup>(6)</sup> .....	17 Watts
Envelope Temperature (At Hottest Point).....	240 °C
<b>Grid No. 1 Circuit Resistance</b>	
Grid Bias Operation .....	0.47 Megohms
Plate Pulse Operation (Horizontal Deflection Circuit Only) .....	10 Megohms

**CHARACTERISTICS AND TYPICAL OPERATION**

Peak Positive Pulse Plate Voltage <sup>(5)</sup> .....	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) <sup>(1)</sup> .....	—	—	4.7	—
Plate Resistance (Approx.) .....	—	—	—	18 Kilohms
Transconductance .....	—	—	—	7000 μmhos
DC Plate Current .....	—	470 <sup>(2)</sup>	—	45 Ma
DC Grid No. 2 Current .....	—	32 <sup>(2)</sup>	—	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

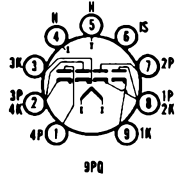
## PHASE DETECTOR COLOR KILLER

# 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.



**ELECTRICAL DATA**  
**HEATER OPERATION**

Heater Voltage .....  
 Heater Current .....  
 Heater Warm-up Time .....  
 Maximum Heater-Cathode Voltage  
   Heater Negative with Respect to Cathode .....  
   Heater Positive with Respect to Cathode .....

<b>8JU8A</b>	<b>6JU8A</b>
8.4	6.3 Volts
450	600 Ma
11	— Sec.
	300 Volts
	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
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Color Television Type

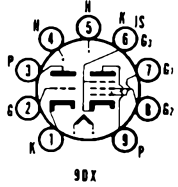
## VOLTAGE AMP. or SYNC SEP. (T) VIDEO AMPLIFIER (P)

# 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.



**ELECTRICAL DATA**  
**HEATER OPERATION**

Heater Voltage .....  
 Heater Current .....  
 Heater Warm-up Time .....  
 Maximum Heater-Cathode Voltage  
   Heater Negative with Respect to Cathode  
     Total DC and Peak.....  
   Heater Positive with Respect to Cathode  
     DC .....

<b>8JV8</b>	<b>6JV8</b>
8.5	6.3 Volts
450	600 Ma
11	11 Seconds
	200 Volts
	100 Volts
	200 Volts

**DIRECT INTERELECTRODE CAPACITANCES (Unshielded)**

<b>Triode Section</b>	
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: $g_1$ to $(h + k + g_2 + g_3 + IS)$ .....	8 Pf
Output: $p$ to $(h + k + g_2 + g_3 + IS)$ .....	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)**

	<b>Triode Section</b>	<b>Pentode Section</b>
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**

	<b>Triode Section</b>	<b>Pentode Section</b>	
<b>Class A1 Amplifier</b>			
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 $\mu$ mhos
Amplification Factor .....	70	—	—
Plate Resistance (Approx.) .....	17,500	150,000	100,000 Ohms
Ec1 for $I_b = 20 \mu a$ (Approx.) .....	-5	-9	-5.5 Volts

**INSTANTANEOUS PLATE KNEE CHARACTERISTICS**

$E_b = 60$  V;  $E_{c2} = 200$  V and  $E_{c1} = 0$  V  
 $I_b = 51$  Ma (Approx.) and  $I_{c2} = 14$  Ma (Approx.)

# 6JW8/ECF802

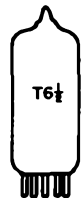
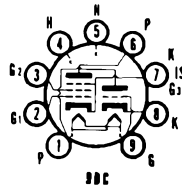
9JW8

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.



**ELECTRICAL DATA  
HEATER OPERATION**

	<b>9JW8</b>	<b>6JW8/ECF802</b>
Heater Voltage.....	9.3	6.3 Volts
Heater Current .....	450	430 Ma
Maximum Heater-Cathode Voltage .....	100	100 Volts

**DIRECT INTERELECTRODE CAPACITANCES**

<b>Pentode Section</b>	
Grid No. 1 .....	5.4 Pf
Plate to Grid No. 1 .....	0.060 Pf
Grid No. 1 to Filament .....	0.1 Pf
<b>Triode Section</b>	
Grid.....	2.4 Pf
Plate to Grid .....	1.5 Pf
Grid to Filament .....	0.1 Pf

**RATINGS (Design Center Rating System)**

<b>Pentode Section</b>	
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.) <sup>(1)</sup>	50 Ma
Input Impedance at 60 Hertz (Max.)	300 K Ohms
<b>Triode Section</b>	
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 $\mu$ ms
Input Resistance	0.4 Megohm
Amplification Factor (Grid No. 1 to Grid No. 2)	47
Plate Current ( $E_{g1} = 0$ V)	12.5 Ma
Grid No. 2 Current ( $E_{g1} = 0$ V)	3.5 Ma
Grid No. 1 Voltage ( $E_b = E_{g2} = 200$ V, $I_b = 10$ $\mu$ a)	-16 Volts
Grid No. 1 Voltage ( $I_{c1} = +0.3$ $\mu$ a)	-1.3 Volts

**Triode Section**

Plate Voltage	200 Volts
Grid Voltage	-2 Volts
Plate Current	3.5 Ma
Transconductance	3500 $\mu$ ms
Input Resistance	20 K Ohms
Amplification Factor	70
Plate Current ( $I_c = 10$ $\mu$ a)	10 Ma
Grid Voltage ( $I_c = +0.3$ $\mu$ a)	-1.3 Volts

**NOTE:**

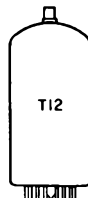
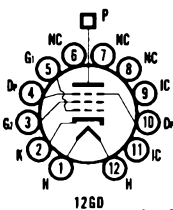
(1) Duty cycle 30% maximum; pulse time 30  $\mu$ sec. maximum.

**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

Heater Voltage	21.0	6JZ6 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: $g_1$ to ( $h + k + g_2 + b.p.$ )	24 Pf
Output: $p$ to ( $h + k + g_2 + b.p.$ )	8.5 Pf

**RATINGS (Design Maximum Rating System)**

**Horizontal Deflection Amplifier Service<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 <sup>(3)</sup>	-20 Volts
Plate Resistance (Approx.) .....	—	—	9500 Ohms
Transconductance .....	—	—	9000 $\mu$ mhos
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 <sup>(4)</sup> .....	—	—	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 Ecl = -20 V.

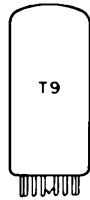
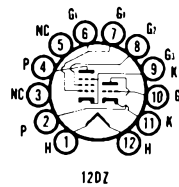
# 6JZ8

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.



**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<sup>(1)</sup>**

	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.) <sup>(2)</sup>	1.0	7 Watts
Grid No. 2 Dissipation (Max.) <sup>(2)</sup>	—	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 $\mu$ mhos
Amplification Factor	20	—
Plate Resistance (Approx.)	8500	11,700 Ohms
Ec for Ib = 10 $\mu$ a (Approx.)	-11	— Volts
Ec for Ib = 100 $\mu$ a (Approx.)	—	-25 Volts

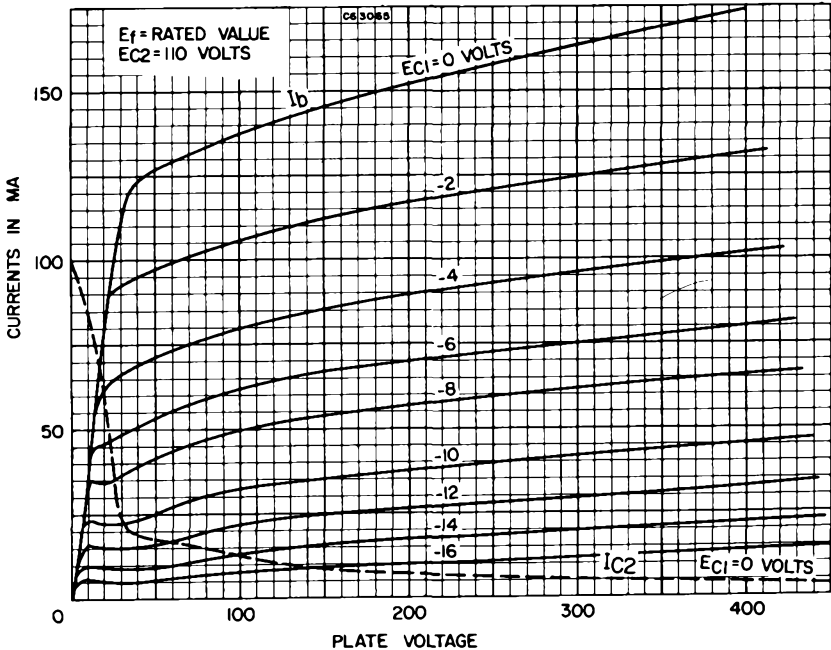
**INSTANTANEOUS PLATE KNEE VALUES**

Eb = 45 V; Ec2 = 110 V; and Ec = 0 V  
Ib = 122 Ma, and Ic2 = 16.5 Ma

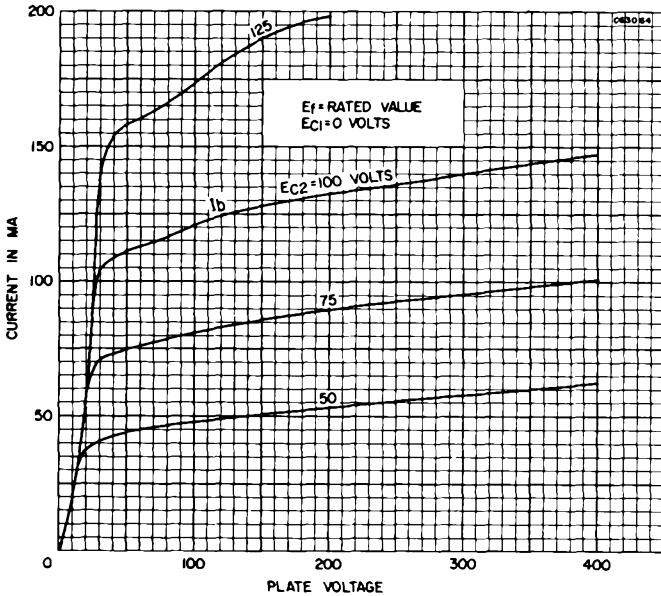
**NOTES:**

- (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)**

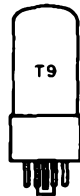
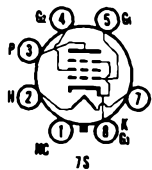


**6K6GT**

**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 <sup>(1)</sup> .....	-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 $\mu$ mhos
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 <sup>(1)</sup> .....	-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:**

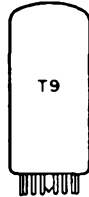
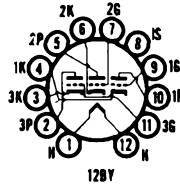
(1) The DC resistance in the grid circuit under rated maximum conditions should not exceed 0.5 megohm for self-bias operation, and 0.1 megohm for fixed-bias operation.

**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.



**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

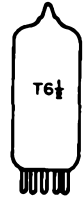
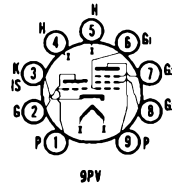
**CHARACTERISTICS AND TYPICAL OPERATION**  
**Class A1 Amplifier**

	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 $\mu$ mhos
Amplification Factor .....	17	100
Ec for Ib = 10 $\mu$ a .....	-24	- Volts



**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.



**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.) <sup>(1)</sup> .....	—	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**

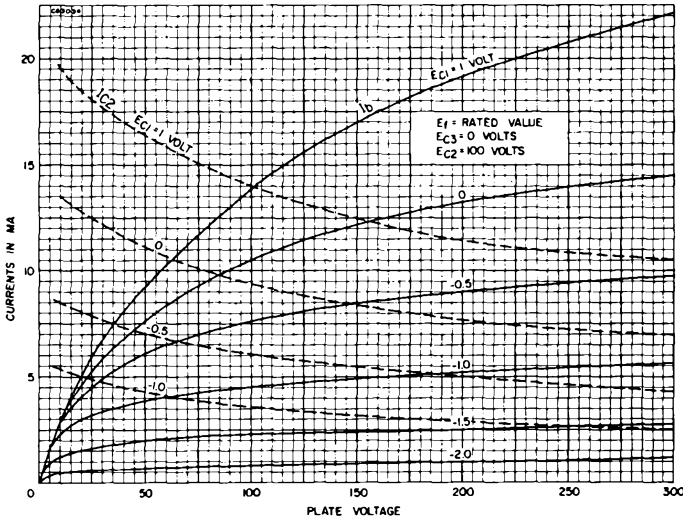
	Triode Section	Pentode Section
Plate Supply Voltage .....	200	150 Volts
Grid No. 2 Voltage .....	—	100 Volts

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 $\mu$ mhos
Transconductance (G3 to P) .....	—	600 $\mu$ mhos
Ec3 for Ib = 20 $\mu$ a (Approx.) .....	—	-7 Volts
Ec1 for Ib = 10 $\mu$ a (Approx.) .....	-5	— Volts
20 $\mu$ a (Approx.) .....	—	-4 Volts

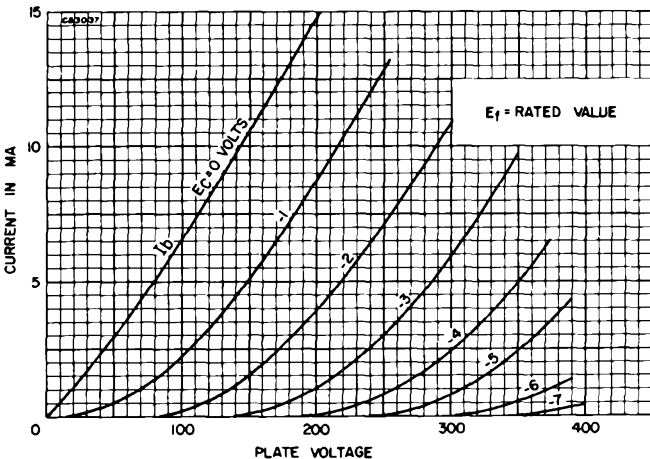
**NOTE:**

- (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  $\mu$ sec.

**AVERAGE PLATE CHARACTERISTICS  
(Pentode Section)**



**AVERAGE PLATE CHARACTERISTICS  
(Triode Section)**



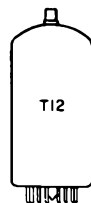
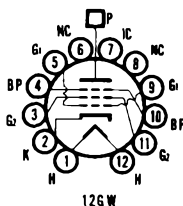
**6KD6**

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<sup>(1)</sup> ..... 12GW  
 Outline ..... 12-118  
 Maximum Diameter ..... 1.563 In.  
 Maximum Seated Height ..... 4.250 In.  
 Maximum Overall Height ..... 4.625 In.

**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<sup>(2)</sup>**

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.) <sup>(3)</sup> .....	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.) <sup>(3)</sup> .....	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 $\mu$ mhos
Amplification Factor <sup>(4)</sup> .....	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:**

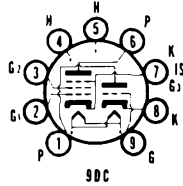
- (1) Pins designated Internal Connection (IC) may or may not be connected to an internal element, depending on manufacturer. To maintain interchangeability, these pins should not be used as tie points.
- (2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering 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-5½  
 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

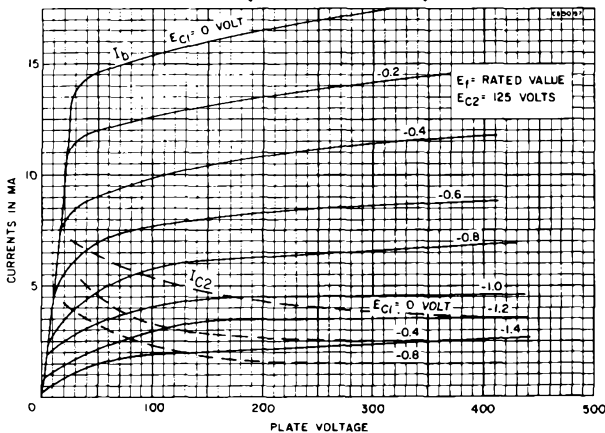
**DIRECT INTERELECTRODE CAPACITANCES (Shielded)**

Section	Capacitance
<b>Triode Section</b>	
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
<b>Pentode Section</b>	
Grid No. 1 to Plate (Max.)	0.015 Pt
Input: g1 to (k + g3 + IS + g2 + h)	5.0 Pf
Output: p to (k + g3 + IS + g2 + h)	3.4 Pf

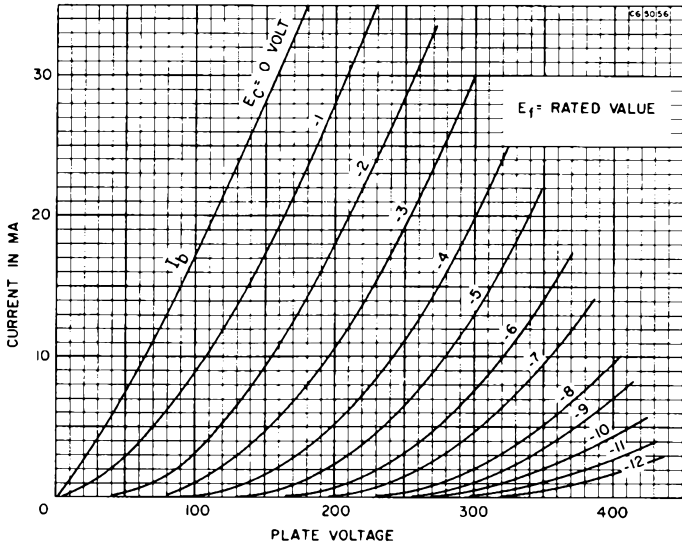
**RATINGS (Design Maximum Rating System)**

	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)**

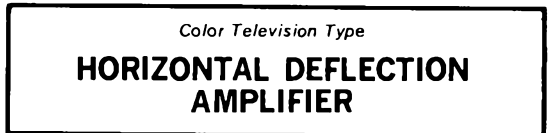


**AVERAGE PLATE CHARACTERISTICS  
(Triode Section)**



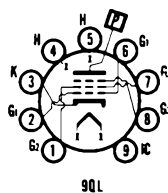
**CHARACTERISTICS AND TYPICAL OPERATION  
Class A1 Amplifier**

	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 $\mu$ mhos
Amplification Factor .....	40	—
Plate Resistance (Approx.) .....	5000	125,000 Ohms
$E_{c1}$ for $I_b = 100 \mu a$ (Approx.) .....	-5	— Volts
$E_{c1}$ for $I_b = 50 \mu a$ (Approx.) .....	—	-3 Volts



**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 <sup>(4)</sup> .....	9QL
Outline .....	12-70
Maximum Diameter .....	1.562 In.
Maximum Seated Height .....	3.170 In.
Maximum Overall Height .....	3.550 In.



**ELECTRICAL DATA  
HEATER OPERATION**

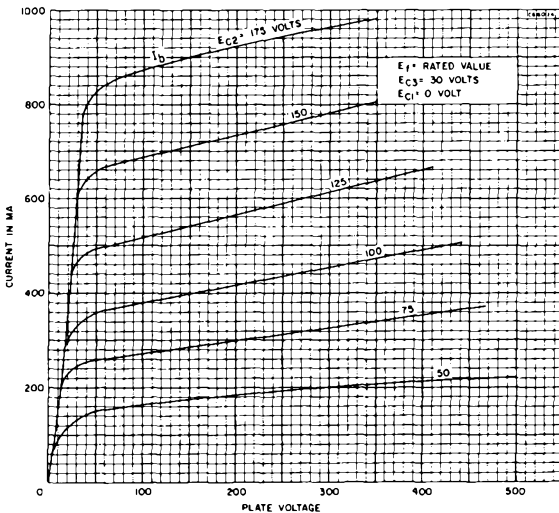
	22KM6	6KM6
Heater Voltage .....	22.0	6.3 Volts
Heater Current .....	450	1600 Ma
Heater Warm-up Time .....	11	— Seconds
Maximum Heater-Cathode Voltage Heater Negative with Respect to Cathode Total DC and Peak .....		200 Volts

Heater Positive with Respect to Cathode		
DC .....	100 Volts	
Total DC and Peak .....	200 Volts	
<b>DIRECT INTERELECTRODE CAPACITANCES (Unshielded)</b>		
Grid to Plate .....	1.2 Pf	
Input .....	22.0 Pf	
Output .....	9.0 Pf	
<b>RATINGS (Design Maximum Rating System)</b>		
<b>Horizontal Deflection Amplifier<sup>(1)</sup> (Sections in Parallel)</b>		
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.) <sup>(2)</sup> .....	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	
<b>CHARACTERISTICS AND TYPICAL OPERATION</b>		
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 $\mu$ mhos
Plate Resistance .....	—	6000 Ohms
Amplification Factor <sup>(3)</sup> .....	—	4.0
E <sub>c1</sub> for I <sub>b</sub> = 1.0 Ma (Approx.) .....	-110	-42 Volts
<b>INSTANTANEOUS PLATE KNEE VALUES (Sections in Parallel)</b>		
E <sub>b</sub> = 60 V; E <sub>c2</sub> = 140 V; E <sub>c3</sub> = 30 V; and E <sub>c1</sub> = 0 V		
I <sub>b</sub> = 560 Ma; and I <sub>c2</sub> = 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**

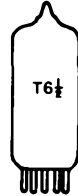
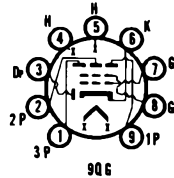


**6KM8**

**“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 $\mu$ mhos



Plate Current .....	4.2 Ma
Grid No. 2 Current .....	1.7 Ma
Grid No. 1 Voltage for Plate $\mu_a = 20$ (Approx.) .....	-4 Volts
<b>Triode Connection</b>	
<b>Grid No. 2 Connected to Plates 1A, 1B, and 2 at Socket</b>	
Plate Voltage .....	100 Volts
Grid No. 1 Supply Voltage .....	0 Volt
Grid No. 1 Resistor (Bypassed) .....	2.2 Megohms
Transconductance .....	4500 $\mu$ mhos
Amplification Factor .....	45
Plate Current .....	5.5 Ma
<b>Separate Plate Operation (Plates Not Under Test Grounded)</b>	
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 $\mu$ mhos
Grid No. 1 to Plate 1B .....	2000 $\mu$ mhos
Grid No. 1 to Plate 2 .....	1800 $\mu$ mhos
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

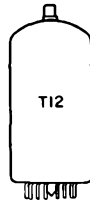
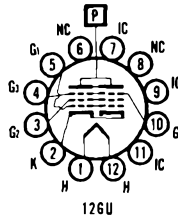
**HORIZONTAL DEFLECTION  
AMPLIFIER**

**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.



**ELECTRICAL DATA  
HEATER OPERATION**

Heater Voltage .....	<b>42KN6</b>	<b>6KN6</b>
Heater Current .....	42	6.3 Volts
Heater Warm-up Time .....	450	3000 Ma
Maximum Heater-Cathode Voltage	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)**

Grid to Plate .....	1.0 Pf
Input .....	44.0 Pf
Output .....	18.0 Pf

**RATINGS (Design Maximum Rating System)**

<b>Horizontal Deflection Amplifier (Sections in Parallel)<sup>(1)</sup></b>	
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.) <sup>(2)</sup> .....	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 $\mu$ mhos
Plate Resistance .....	—	4000 Ohms
Amplification Factor <sup>(3)</sup> .....	—	4.5
E <sub>c1</sub> for I <sub>b</sub> = 1.0 Ma (Approx.) .....	—	-33 Volts
E <sub>c1</sub> for I <sub>b</sub> = 75 $\mu$ a (Approx.) .....	100	— Volts

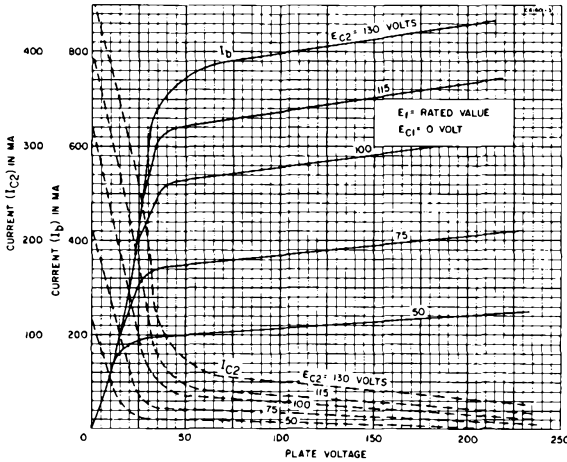
**INSTANTANEOUS PLATE KNEE VALUES (Sections in Parallel)**

E<sub>b</sub> = 60 V, E<sub>c2</sub> = 125 V, and E<sub>c1</sub> = 0 V  
 I<sub>b</sub> = 800 Ma; and I<sub>c2</sub> = 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**

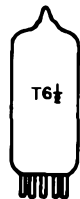
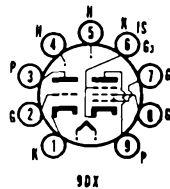


**6KR8**  
 8KR8, 10KR8

**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**

	<b>8KR8</b>	<b>10KR8</b>	<b>6KR8</b>
Heater Voltage.....	8.0	10.5	6.3 Volts
Heater Current .....	600	450	750 Ma
Heater Warm-up Time .....	11	11	— Seconds
<b>Maximum Heater-Cathode Voltage</b>			
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)**

	<b>Pentode Section</b>	<b>Triode Section</b>
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**

	<b>Pentode Section</b>		<b>Triode Section</b>
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 $\mu$ mhos
Plate Current .....	54	19.5	15 Ma
Screen Current .....	13.5	3.0	— Ma
Grid No. 1 Voltage (Approx.) Ib = 10 $\mu$ a .....	—	—	-8 Volts
Grid No. 1 Voltage (Approx.) Ib = 100 $\mu$ a .....	—	-6.3	— Volts

**GENERAL PURPOSE AMPLIFIER (T)  
VIDEO AMPLIFIER (P)**

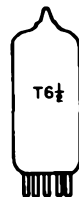
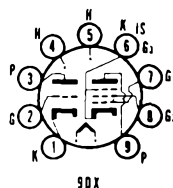
**6KR8A**

**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.



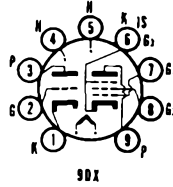
**6KS8**

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.



**ELECTRICAL DATA  
HEATER OPERATION**

	<b>6KS8</b>	<b>8KS8</b>
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**

**Triode Section**

	<b>Shielded<sup>(1)</sup></b>	<b>Unshielded</b>
Grid to Plate .....	2.2	2.2 Pf
Input: g to (h + Tk + Pk, g3, 1S) .....	3.4	3.2 Pf
Output: p to (h + Tk + Pk, g3, 1S) .....	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, 1S + g2) .....	10	10 Pf
Output: p to (h + Tk + Pk, g3, 1S + 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)**

	<b>Triode Section</b>	<b>Pentode Section</b>
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**

	<b>Triode Section</b>	<b>Pentode Section</b>
<b>Class A1 Amplifier</b>		
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**

$E_b = 65 \text{ V}$ ,  $E_{c2} = 150 \text{ V}$ ,  $E_{c1} = 0$  and  $I_b = 60 \text{ Ma}$ ,  $I_{c2} = 20 \text{ Ma}$

**NOTE:**

(1) External shield No. 315 connected to Pins 4 and 5.

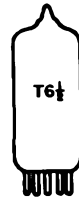
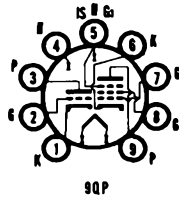
*Color Television Type*

**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<sup>(2)</sup> ..... 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 <sup>(1)</sup>	Unshielded
<b>Triode Section</b>		
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
<b>Pentode Section</b>		
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
<b>Coupling</b>		
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

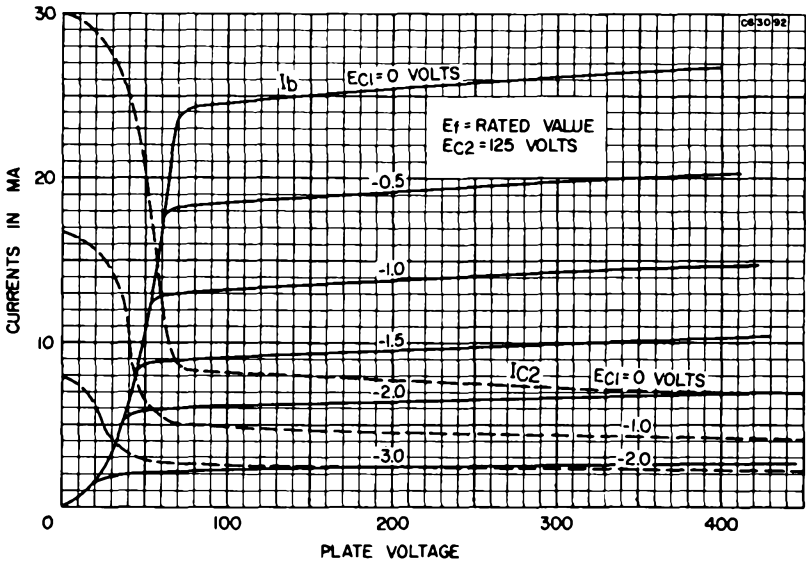
**CHARACTERISTICS AND TYPICAL OPERATION**

	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
$E_{c1}$ for $I_b = 20 \mu\text{a}$ (Approx.) .....	-3.5	-7 Volts

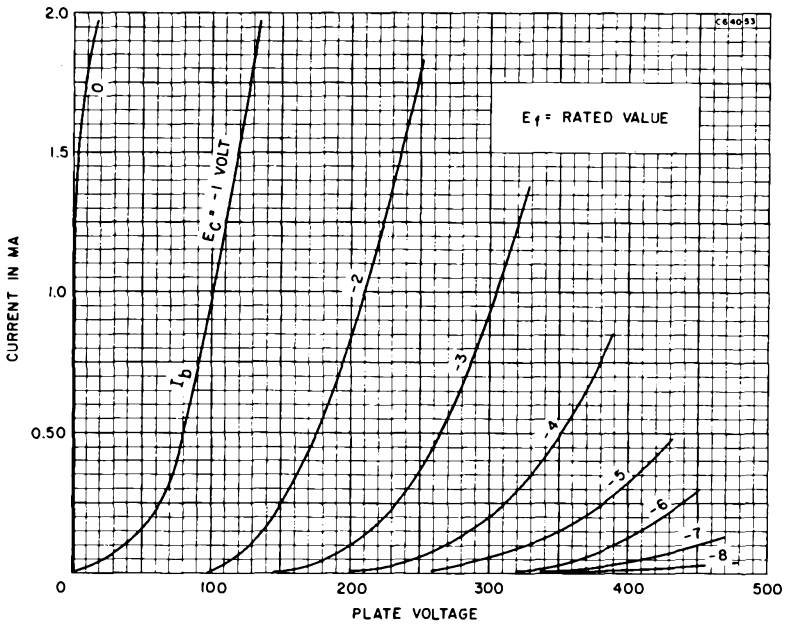
**NOTES:**

- (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)

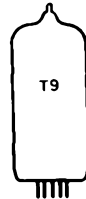
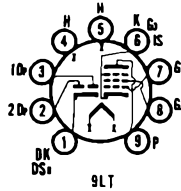


**HORIZONTAL PHASE DETECTOR (D)  
VIDEO AMPLIFIER (P)**

**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**

	<b>10KU8</b>	<b>6KU8</b>
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: P <sub>g1</sub> to P <sub>p</sub> (Max.) .....	0.10 Pf
Input: P <sub>g1</sub> to (h + P <sub>k</sub> , g <sub>3</sub> + IS + g <sub>2</sub> + D <sub>k</sub> + IS) .....	12.0 Pf
Output: P <sub>p</sub> to (h + P <sub>k</sub> , g <sub>3</sub> + IS + g <sub>2</sub> + D <sub>k</sub> + IS) .....	3.0 Pf

**Diodes**

No. 1 Plate to All: No. 1 D <sub>p</sub> to (h + D <sub>k</sub> + IS + P <sub>k</sub> + g <sub>3</sub> + IS) .....	1.1 Pf
No. 2 Plate to All: No. 2 D <sub>p</sub> to (h + D <sub>k</sub> + IS + P <sub>k</sub> + g <sub>3</sub> + IS) .....	1.1 Pf
Cathode to No. 1 Plate: D <sub>k</sub> to (h + 1 D <sub>p</sub> + P <sub>k</sub> + g <sub>3</sub> + IS) .....	0.8 Pf
Cathode to No. 2 Plate: D <sub>k</sub> to (h + 2 D <sub>p</sub> + P <sub>k</sub> + g <sub>3</sub> + 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)**

Plate Voltage (Max.) .....	330 Volts
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**

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
E <sub>c1</sub> for I <sub>b</sub> = 100 μa (Approx.) .....	-5 Volts

**INSTANTANEOUS PLATE KNEE CHARACTERISTICS (Pentode Section)**

E<sub>b</sub> = 50 V, E<sub>c2</sub> = 100 V and E<sub>c1</sub> = 0 V  
I<sub>b</sub> = 55 Ma, and I<sub>c2</sub> = 18 Ma

**DIODE CHARACTERISTICS (Each Diode)**

Average Current with 10 Vdc Applied .....	2.0 Ma
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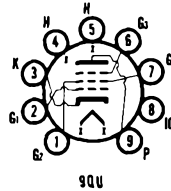
# 6KV6A

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.) <sup>(1)</sup> .....	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.) <sup>(4)</sup> .....	275 Ma
Grid No. 2 Input (Max.).....	2.0 Watts
Plate Dissipation (Max.) <sup>(2)</sup> .....	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) <sup>(1)</sup> .....	—	4
Plate Resistance (Approx.).....	—	6000 Ohms
Transconductance.....	—	10,000 μmhos
DC Plate Current.....	440 <sup>(2)</sup>	40 Ma
DC Grid No. 2 Current.....	30 <sup>(2)</sup>	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.

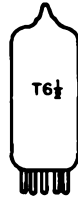
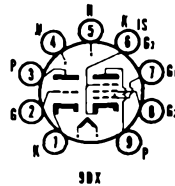


**SYNC SEPARATOR, SOUND  
IF/VOLTAGE AMP. (T)  
VIDEO AMPLIFIER (P)**

**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.



**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**

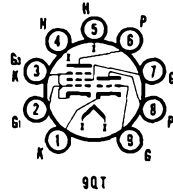
	Triode Section	Pentode Section
Plate Voltage .....	200	125 200 Volts
Grid No. 2 Voltage .....	—	125 125 Volts
Grid No. 1 Voltage .....	-2	0 0 Volts
Cathode Bias Resistor .....	—	82 68 Ohms
Plate Current .....	4	16.5 20 Ma
Grid No. 2 Current .....	—	3.1 3.5 Ma
Transconductance .....	4000	21,000 23,000 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.



**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<sup>(1)</sup>**

	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.) <sup>(2)</sup> .....	1.5	12 Watts
Grid No. 2 Dissipation (Max.) <sup>(2)</sup> .....	—	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:**

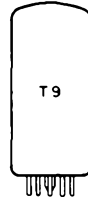
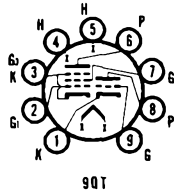
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) In stages operating with grid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

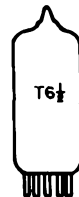
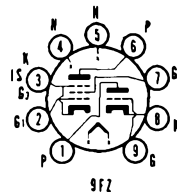


Color Television Type  
**VHF OSCILLATOR and MIXER**

**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.



**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)<sup>(1)</sup>**

**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 <sup>(2)</sup> 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 <sup>(2)</sup> Pf

**RATINGS (Design Maximum Rating System)**

	Triode Section	Pentode Section
<b>Converter Service</b>		
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

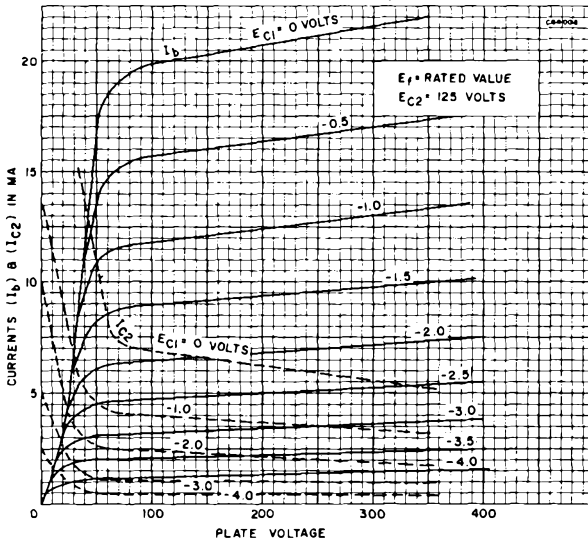
**CHARACTERISTICS AND TYPICAL OPERATION**

	<b>Triode Section</b>	<b>Pentode Section</b>
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 $\mu$ mhos
Amplification Factor .....	46	—
Plate Resistance (Approx.) .....	5400	200,000 Ohms
$E_{c1}$ for $I_b = 10 \mu$ a (Approx.) .....	-8	-8 Volts

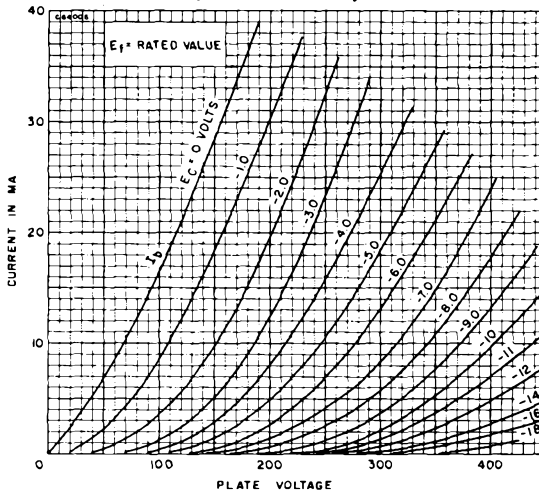
**NOTES:**

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

**AVERAGE PLATE CHARACTERISTICS  
(Pentode Section)**



**AVERAGE PLATE CHARACTERISTICS  
(Triode Section)**

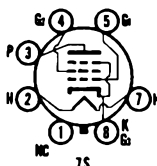


**AUDIO POWER AMPLIFIER**

**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 <sup>(1)</sup> 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

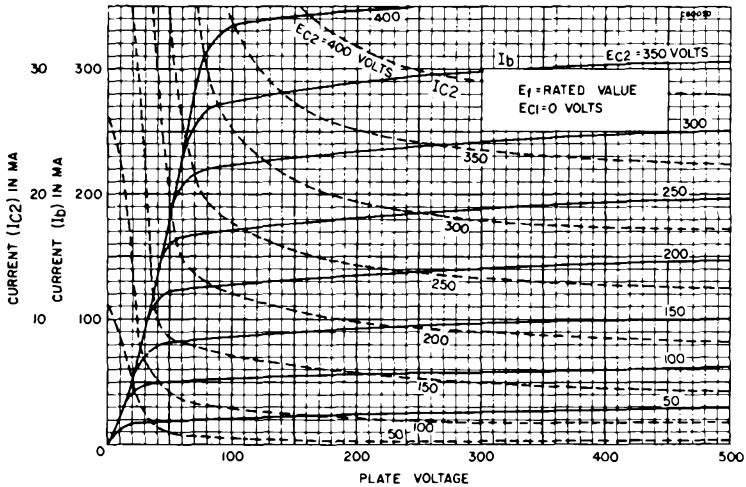
**Triode Operation**

	<b>Class A1 Amp. Single Tube</b>	<b>Class AB1 Amp. Push-Pull</b>
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	— $\mu$ mhos
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

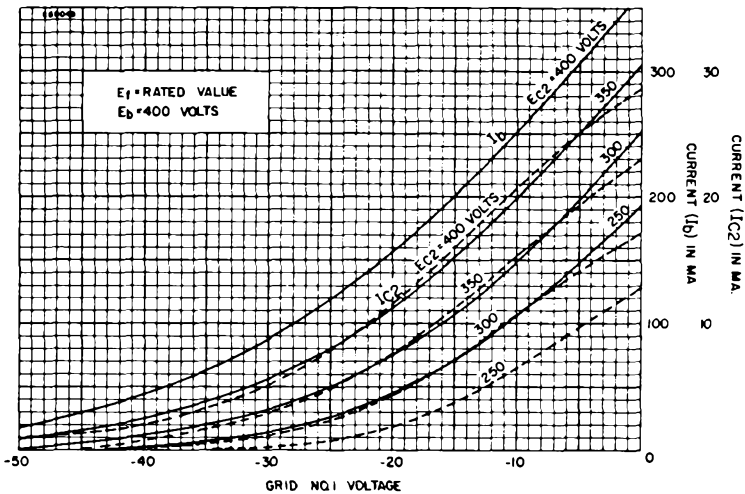
**NOTE:**

- (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.

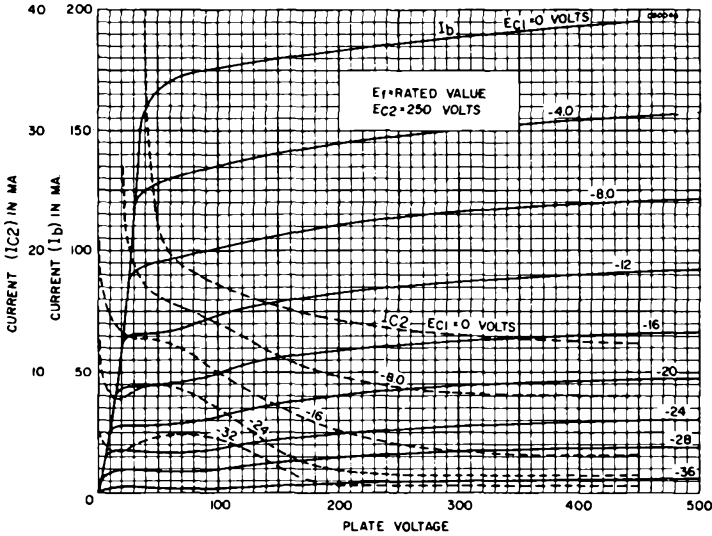
**AVERAGE PLATE CHARACTERISTICS**



**AVERAGE TRANSFER CHARACTERISTICS**



**AVERAGE PLATE CHARACTERISTICS**

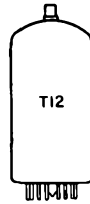
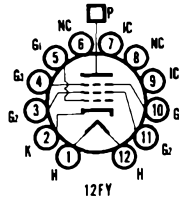


Color Television Type  
**HORIZONTAL DEFLECTION  
 AMPLIFIER**

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.



**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<sup>(1)</sup>**

- 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)<sup>(2)</sup> ..... 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.) <sup>(2)</sup> .....	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 $\mu$ mhos
Plate Current .....	—	900 <sup>(4)</sup>	560 <sup>(4)</sup>	105 Ma
Screen Current .....	—	110 <sup>(4)</sup>	46 <sup>(4)</sup>	2.0 Ma
Grid No. 1 Voltage (Approx.)				
I <sub>b</sub> = 1.0 Ma .....	-125	—	—	-40 Volts
Triode Amplification Factor <sup>(5)</sup> .....	—	—	—	4.0

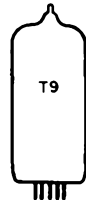
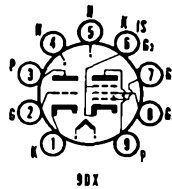
**NOTES:**

- (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 E<sub>b</sub> = E<sub>c2</sub> = 125 volts, and E<sub>c1</sub> = -25 volts.



**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.



**ELECTRICAL DATA**  
**HEATER OPERATION**

Heater Voltage .....	<b>10LB8</b>	<b>6LB8</b>
Heater Current .....	10.2	6.3 Volts
Heater Warm-up Time .....	450	725 Ma
Maximum Heater-Cathode Voltage	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)**

<b>Triode Section</b>	
Grid to Plate .....	2.8 Pf
Input: g to (h + Tk + Pk, g <sub>3</sub> , IS) .....	1.9 Pf
Output: p to (h + Tk + Pk, g <sub>3</sub> , IS) .....	1.8 Pf
<b>Pentode Section</b>	
Grid No. 1 to Plate (Max.) .....	0.10 Pf
Input: g <sub>1</sub> to (h + Pk, g <sub>3</sub> , IS + g <sub>2</sub> ) .....	12 Pf
Output: p to (h + Pk, g <sub>3</sub> , IS + g <sub>2</sub> ) .....	3.0 Pf
<b>Coupling</b>	
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.) <sup>(2)</sup> .....	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 $\mu$ mhos
Amplification Factor .....	30	—
Plate Resistance (Approx.) .....	6000	50,000 Ohms
E <sub>c1</sub> for I <sub>b</sub> = 100 $\mu$ a (Approx.) .....	—	-5 Volts
E <sub>c</sub> for I <sub>b</sub> = 20 $\mu$ a (Approx.) .....	-10	— Volts

**INSTANTANEOUS PLATE KNEE CHARACTERISTICS (Pentode Section)<sup>(1)</sup>**

E<sub>b</sub> = 50 V, E<sub>c2</sub> = 100 V and E<sub>c1</sub> = 0 V  
I<sub>b</sub> = 55 Ma and I<sub>c2</sub> = 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.



**Beam Power Triode**

Construction .....

Base.....Octal T-12

Top Cap .....

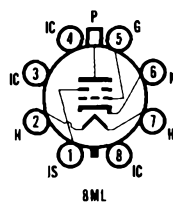
Basing<sup>(1)</sup> .....

Outline .....

    Maximum Diameter .....

    Maximum Seated Height .....

    Maximum Overall Height .....



**ELECTRICAL DATA**  
**HEATER OPERATION**

Heater Voltage .....	6.3 Volts
Heater Current .....	200 Ma
Maximum Heater-Cathode Voltage	
Heater Negative with Respect to Cathode <sup>(2)</sup> .....	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.) <sup>(2)</sup> .....	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 $\mu$ mhos
DC Plate Current for Zero Load Current .....	1000 $\mu$ a
DC Plate Current for Load Current of 1 Ma .....	45 $\mu$ a
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.

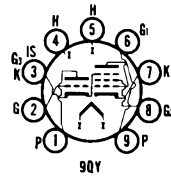
**WARNING:**

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.



**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.



**ELECTRICAL DATA HEATER OPERATION**

Heater Voltage .....	<b>8LC8</b> 8.4	<b>6LC8</b> 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)**

	<b>Triode Section</b>	<b>Pentode Section</b>
Plate Voltage (Max.) .....	300	300 Volts
Peak Positive Pulse Plate Voltage (Max.) <sup>(1)</sup> .....	—	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**

	<b>Triode Section</b>	<b>Pentode Section</b>
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 $\mu$ mhos
Transconductance (G3 to P) .....	—	600 $\mu$ mhos
Ec3 for Ib = 20 $\mu$ a (Approx.) .....	—	-7 Volts
Ec1 for Ib = 10 $\mu$ a (Approx.) .....	-5	— Volts
20 $\mu$ a (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

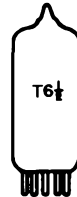
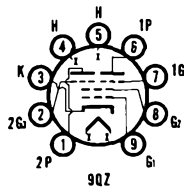
## COLOR DEMODULATOR

# 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.



**ELECTRICAL DATA**  
**HEATER OPERATION**

	<b>15LE8</b>	<b>10LE8</b>	<b>8LE8</b>	<b>6LE8</b>
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)**

<b>Grid No. 1 Control</b>	
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 $\mu$ mhos

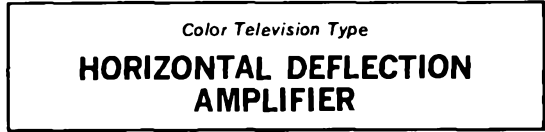
Plate Resistance (Approx.) .....	50,000 Ohms
Grid No. 1 Voltage for $I_b = 20 \mu a$ .....	-7.2 Volts
Grid No. 1 Voltage for $I_b = 100 \mu a$ .....	-6.3 Volts

**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 $\mu mhos$
Plate Resistance .....	50,000 Ohms
Grid No. 3 Voltage for $I_b = 20 \mu a^{(1)}$ .....	-17.4 Volts
Grid No. 3 Voltage for $I_b = 100 \mu a^{(1)}$ .....	-16.5 Volts

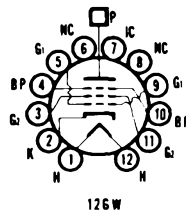
**NOTE:**

(1) Measured with -3.0 volts on Grid No. 1 to maintain Grid No. 2 within dissipation rating.



**Beam Pentode**

Construction .....	Compactron T-12
Base .....	E12-74
Top Cap .....	C1-1
Basing .....	J2GW
Outline	
Maximum Diameter .....	1.563 In.
Maximum Seated Height .....	4.570 In.
Maximum Overall Height .....	4.950 In.



**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: $g_1$ to $(h + k + g_2 + bp)$ .....	37 pf
Output: $p$ to $(h + k + g_2 + bp)$ .....	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 <sup>(1)</sup> (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  $\mu sec$ .

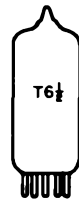
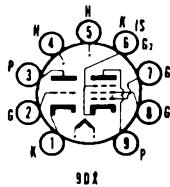
Color Television Type

## 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)**

<b>Triode Section</b>	
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
<b>Pentode Section</b>	
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
<b>Coupling</b>	
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
Grid No. 2 Voltage.....	—	—
Grid No. 1 Voltage.....	-2	3
Plate Current.....	4.0	11
Grid No. 2 Current.....	—	—
Grid No. 1 Current.....	0	2.7
Transconductance.....	4000	4000
Amplification Factor.....	70	40
Plate Resistance (Approx.).....	17,500	10,000
Ec for Ib = 20 µa (Approx.).....	-5	—

**INSTANTANEOUS PLATE KNEE CHARACTERISTICS**

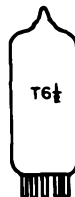
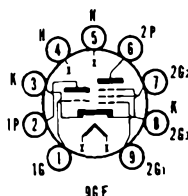
Eb = 65 V, Ec2 = 150 V, Ec1 = 0 V  
 Ib = 60 Ma, Ic2 = 20 Ma

**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**

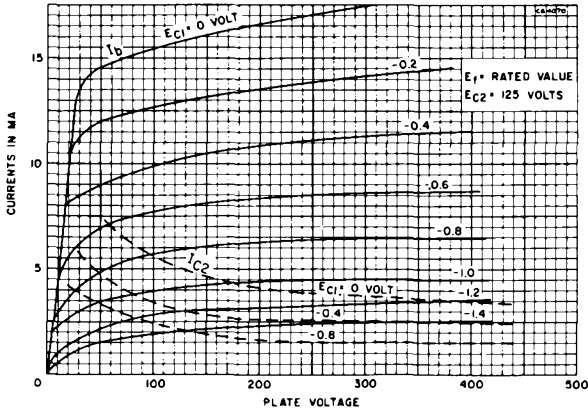
**Class A1 Amplifier**

	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 $\mu$ mhos
Amplification Factor .....	40	—
Plate Resistance (Approx.) .....	5000	125,000 Ohms
E <sub>c1</sub> for I <sub>b</sub> = 30 $\mu$ a (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)**



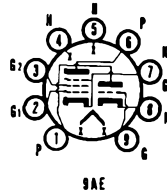
*Color Television Type*

**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.



**ELECTRICAL DATA  
HEATER OPERATION**

	Series	Parallel
Heater Voltage .....	6.3	6.3 Volts
Heater Current .....	450	450 Ma
Heater Warm-up Time .....	11	— Sec.
<b>Maximum Heater-Cathode Voltage</b>		
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)<sup>(1)</sup>**

<b>Triode Section</b>	
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
<b>Pentode Section</b>	
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.)	
<b>Grid No. 1 (Control-Grid) Voltages:</b>		
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

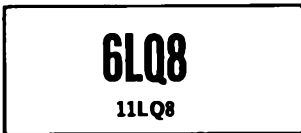
**CHARACTERISTICS AND TYPICAL OPERATION**

**Class A1 Amplifier**

	<b>Triode Section</b>	<b>Pentode Section</b>
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 $\mu$ mhos
Plate Current	13.5	12 Ma
Grid No. 2 Current	—	4 Ma
Grid No. 1 Voltage (Approx.) for Plate $\mu$ a = 10	-8	-14 Volts

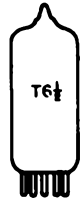
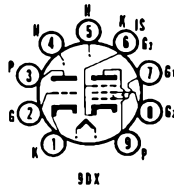
**NOTE:**

(1) Shield No. 315.



**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**

	<b>11LQ8</b>	<b>6LQ8</b>
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)**

<b>Triode Section</b>		
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
<b>Pentode Section</b>		
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**

	<b>Triode Section</b>	<b>Pentode Section</b>
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:	—	1 Watt
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**

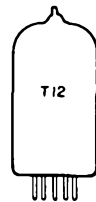
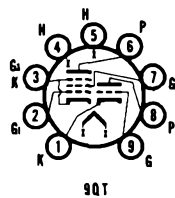
	Triode Section	Pentode Section	
DC Plate Supply Voltage .....	125	125	200 Volts
DC Grid No. 2 Supply Voltage .....	—	125	125 Volts
Grid No. 1 .....	Connected to Negative End of Rk		
Cathode Resistor .....	68	82	68 Ohms
Amplification Factor .....	46	—	—
Plate Resistance (Approx.) .....	4400	55,000	75,000 Ohms
Transconductance .....	10,400	21,000	23,000 $\mu$ mhos
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 $\mu$ a .....	-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<sup>(1)</sup>**

	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.) <sup>(2)</sup> .....	2.5	14 Watts
Grid No. 2 Dissipation (Max.) <sup>(2)</sup> .....	—	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**

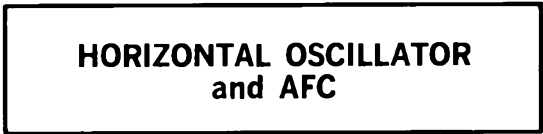
	Triode Section	Pentode Section
Plate Voltage .....	250	135 Volts
Grid No. 2 Voltage .....	—	120 Volts
Grid No. 1 Voltage .....	-4	-10 Volts
Plate Current .....	2.3	56 Ma
Grid No. 2 Current .....	—	3 Ma
Transconductance .....	3600	9300 $\mu$ mhos
Amplification Factor .....	58	6.5 <sup>(1)</sup>
Plate Resistance (Approx.) .....	16,000	12,000 Ohms
Ec for Ib = 10 $\mu$ a .....	-6.6	— Volts
Ec for Ib = 1 Ma (Approx.) .....	—	-26 Volts
Ec for Ib = 100 $\mu$ a .....	—	-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.



**Double Diode and Pentode**

Construction .....

Base .....

Basing .....

Outline .....

Maximum Diameter .....

Maximum Seated Height .....

Maximum Overall Height .....

**ELECTRICAL DATA**  
**HEATER OPERATION**

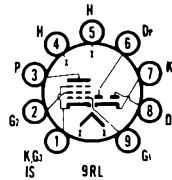
	11LT8	8LT8	6LT8
Heater Voltage .....	11.4	8.1	6.3 Volts
Heater Current .....	315	450	600 Ma
Heater Warm-up Time .....	11	11	11 Seconds
Maximum Heater-Cathode Voltage			
Heater Negative with Respect to Cathode			
Total DC and Peak .....			200 Volts
Heater Positive with Respect to Cathode			
DC .....			100 Volts
Total DC and Peak .....			200 Volts

**DIRECT INTERELECTRODE CAPACITANCES (Unshielded)**

<b>Pentode Section</b>		
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
<b>Diode Sections</b>		
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)**

<b>Pentode Section</b>		
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



<b>Diode Section</b>	
Diode Current for Continuous Operation (Each Diode).....	5.0 Ma
<b>CHARACTERISTICS AND TYPICAL OPERATION</b>	
<b>Pentode Section</b>	
Plate Voltage .....	125 Volts
Screen Voltage.....	125 Volts
Cathode-Bias Resistor .....	56 Ohms
Plate Resistance (Approx.) .....	200,000 Ohms
Transconductance .....	13,000 $\mu$ mhos
Plate Current .....	10 Ma
Screen Current .....	3.4 Ma
Grid No. 1 Voltage (Approx.) $I_b = 20 \mu$ a .....	-3.5 Volts
<b>Diode Section</b>	
Average Diode Current Each Diode with 5 Volts DC Applied .....	20 Ma

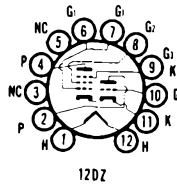
Color Television Type

**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.



**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
<b>Maximum Heater-Cathode Voltage</b>			
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<sup>(1)</sup>**

	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.) <sup>(2)</sup> .....	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
<b>Grid Circuit Resistance</b>		
Self Bias (Max.) .....	2.2	2.2 Megohms
Fixed Bias (Max.) .....	—	1.0 Megohm
Bulb Temperature (Max.) .....	—	210 °C

**CHARACTERISTICS AND TYPICAL OPERATION**

	<b>Triode Section</b>	<b>Pentode Section</b>
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 $\mu$ mhos
Amplification Factor .....	58	6.5 <sup>(1)</sup>
Plate Resistance (Approx.) .....	16,000	12,000 Ohms
Ec for Ib = 10 $\mu$ a .....	-6.6	— Volts
Ec for Ib = 1 Ma (Approx.) .....	—	-26 Volts
Ec for Ib = 100 $\mu$ a .....	—	-30 Volts

**INSTANTANEOUS PLATE KNEE VALUES**

Eb = 45 V; Ec2 = 125 V; and Ec = 0 V  
Ib = 200 Ma, and Ic2 = 20 Ma

**NOTES:**

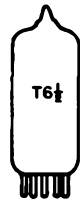
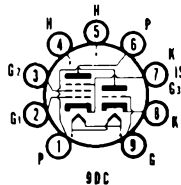
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) In stages operating with grid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



**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**

<b>Pentode Section</b>	
Grid No. 1 .....	5.4 Pf
Plate to Grid No. 1 .....	0.060 Pf
Grid No. 1 to Filament .....	0.1 Pf
<b>Triode Section</b>	
Grid .....	2.4 Pf
Plate to Grid .....	1.5 Pf
Grid to Filament .....	0.1 Pf

**RATINGS (Design Center Rating System)**

<b>Pentode Section</b>	
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.) <sup>(1)</sup> .....	50 Ma
Input Impedance at 60 Hertz (Max.) .....	300 K Ohms
<b>Triode Section</b>	
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 $\mu$ mhos
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 $\mu$ a) .....	-16 Volts
Grid No. 1 Voltage (Ic1 = +0.3 $\mu$ a) .....	-1.3 Volts

**Triode Section**

Plate Voltage .....	200 Volts
Grid Voltage .....	-2 Volts
Plate Current .....	3.5 Ma
Transconductance .....	3500 $\mu$ mhos
Input Resistance .....	20 K Ohms
Amplification Factor .....	70
Plate Current (Ic = 10 $\mu$ a) .....	10 Ma
Grid Voltage (Ic = +0.3 $\mu$ a) .....	-1.3 Volts

**NOTE:**

(1) Duty cycle 30% maximum; pulse time 30  $\mu$ sec. maximum.

*Color Television Type*

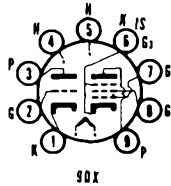
**VIDEO AMPLIFIER (P)  
GENERAL PURPOSE AMPLIFIER (T)**

**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.



**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	Triode Section
<b>Pentode Section</b>		
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
<b>Triode Section</b>		
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**

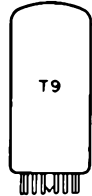
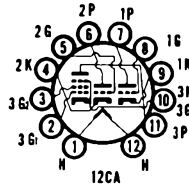
	Pentode Section	Triode Section
Plate Voltage	35	250 Volts
Screen Voltage	100	— Volts
Grid No. 1 Voltage	0	-2.0 Volts
Cathode Bias Resistor	—	— Ohms
Amplification Factor	—	100
Plate Resistance (Approx.)	—	59,000 Ohms
Transconductance	—	1700 $\mu$ hms
Plate Current	54	1.0 Ma
Screen Current	13.5	— Ma
Grid Voltage (Approx.) $I_b = 10 \mu a$	—	-5 Volts
Grid No. 1 Voltage (Approx.) $I_b = 100 \mu a$	—	-6.3 Volts



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 $\mu$ mhos
Plate Current .....	11	8.0 Ma
Screen Current .....	3.4	— Ma
Grid No. 1 Voltage (Approx.) $I_b = 20 \mu$ a .....	-3.5	— Volts
Grid No. 1 Voltage (Approx.) $I_b = 50 \mu$ a .....	—	-4.5 Volts

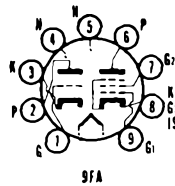
Color Television Type

**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.



**ELECTRICAL DATA  
HEATER OPERATION**

	<b>5MB8</b>	<b>6MB8</b>
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)**

<b>Triode Section</b>		
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
<b>Pentode Section</b>		
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)**

	<b>Triode Section</b>	<b>Pentode Section</b>
Plate Voltage (Max.) .....	280	280 Volts
Grid No. 2 Supply Voltage (Max.) .....	—	280 Volts
Grid No. 2 Pulse Voltage (Max.) <sup>(1)</sup> .....	—	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**

	<b>Triode Section</b>	<b>Pentode Section</b>
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 $\mu$ mhos
Amplification Factor .....	40	—
Plate Resistance (Approx.) .....	5000	125,000 Ohms
$E_{c1}$ for $I_b = 100 \mu a$ .....	-5	— Volts
$E_{c1}$ for $I_b = 50 \mu a$ .....	—	-3 Volts

**NOTE:**

(1) Rating determined at television horizontal deflection sweep frequency of 15,750 Hertz.

# 6MD8

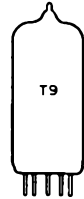
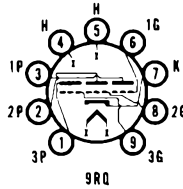
12MD8

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.



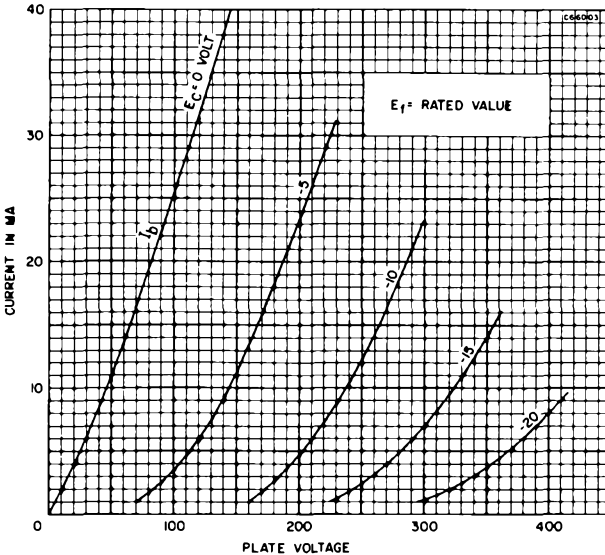
**ELECTRICAL DATA  
HEATER OPERATION**

	<b>12MD8</b>	<b>6MD8</b>
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)**

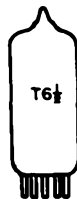
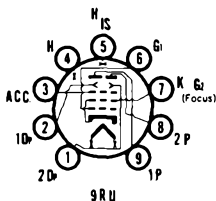
Plate Voltage .....	250 Volts
Grid Voltage .....	-10.5 Volts
Plate Current .....	11.5 Ma
Amplification Factor .....	17
Plate Resistance (Approx.) .....	5500 Ohms
Transconductance .....	3100 $\mu$ ms
Ib for Ec1 = -14 Volts .....	4 Ma
Ec1 for Ib = 50 $\mu$ a .....	-23 Volts

Color Television Type  
**SYNCHRONOUS DETECTOR**

**6ME8**

**Sheet Beam Tube (Double Plate)**

Construction .....	Miniature T-6½
Base .....	Button 9 Pin, E9-1
Basing <sup>(1)</sup> .....	9RU
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

**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
Accelerator 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

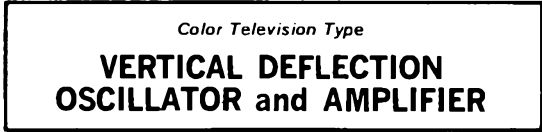
**CHARACTERISTICS AND TYPICAL OPERATION<sup>(2)</sup>**

Plate Voltage (Plates 1 and 2 Connected Together) .....	250 Volts
Accelerator 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 $\mu$ ms
Grid No. 1 Voltage (Approx.)	
Ib (total) = 10 $\mu$ a .....	-16 Volts
Deflector Switching Voltage (Max.) <sup>(2)</sup> .....	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.)  $E_{d1} = 125$  V,  $E_{d2} = 25$  V ..... 0.04 Ma  
 Deflector No. 2 Current (Max.)  $E_{d1} = 25$  V,  $E_{d2} = 125$  V ..... 0.04 Ma

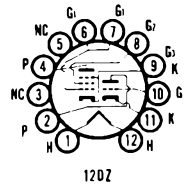
**NOTES:**

- (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.



**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.



**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<sup>(1)</sup>**

	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.) <sup>(2)</sup> .....	2.5	12 Watts
Grid No. 2 Dissipation (Max.) <sup>(2)</sup> .....	—	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 $\mu$ mhos
Amplification Factor .....	58	—
Plate Resistance (Approx.) .....	14,000	5000 Ohms
Ec for Ib = 10 $\mu$ a .....	-6.6	— Volts
Ec for Ib = 100 $\mu$ a .....	—	-65 Volts

**INSTANTANEOUS PLATE KNEE VALUES**

Eb = 60 V; Ec2 = 250 V; and Ec = 0 V  
Ib = 200 Ma, and Ic2 = 20 Ma

**NOTES:**

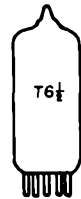
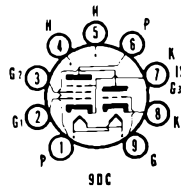
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) In stages operating with grid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

**6M68**

**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)**

	<b>Triode Section</b>	<b>Pentode Section</b>
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**

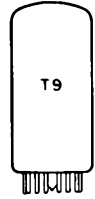
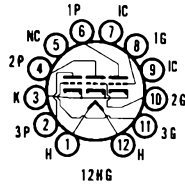
	<b>Triode Section</b>	<b>Pentode Section</b>
Plate Voltage .....	150	170 Volts
Grid No. 2 Voltage .....	—	170 Volts
Grid No. 1 Voltage .....	—	-2.0 Volts
Cathode Bias Resistor .....	56	— Ohms
Plate Current .....	18.0	10 Ma
Grid No. 2 Current .....	—	2.8 Ma
Transconductance .....	8500	6200 $\mu$ mhos
Plate Resistance (Approx.) .....	5.0	400 K Ohms
Amplification Factor .....	40	47 (G2-G1)
Grid No. 1 Voltage (Ib = 10 $\mu$ a) .....	-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.



### 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  $\mu$ mhos  
 Ib for Ecl = -14 Volts ..... 4 Ma  
 Ecl for Ib = 50  $\mu$ a ..... -23 Volts

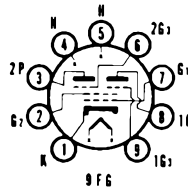
# 6MK8

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.



### ELECTRICAL DATA

#### HEATER OPERATION

Heater Voltage..... 4.2  
 Heater Current ..... 450  
 Heater Warm-up Time ..... 11  
 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)**

$E_b = 100 \text{ V}$ ,  $E_{c2} = E_{c1} = 67.5 \text{ V}$ ,  $E_{c3} = 0$ ,  $R_{g1} = 0.68 \text{ Megohms}$  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 $\mu\text{mhos}$
Grid No. 1 Transconductance .....	1100	— $\mu\text{mhos}$
$E_{c3}$ for $I_b = 100 \mu\text{a}$ (Approx.) .....	—	-3.5 Volts
$E_{c1}$ for $I_b = 100 \mu\text{a}$ (Approx.) .....	—	-2.3 Volts

**NOTE:**

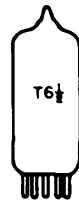
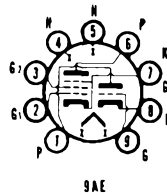
(1) Grid current adjusted for 100  $\mu\text{a}$  dc.

**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
<b>Triode Section</b>		
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
<b>Pentode Section</b>		
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 $\mu$ mhos
Amplification Factor .....	35	—
Plate Resistance (Approx.) .....	5800	165,000 Ohms
Ec1 for Ib = 10 $\mu$ a (Approx.) .....	-5.8	— Volts
Ec1 for Ib = 20 $\mu$ a (Approx.) .....	—	-9.5 Volts

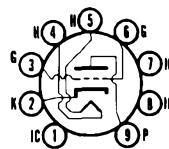
**6S4A**

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



T6½

**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

<b>DIRECT INTERELECTRODE CAPACITANCES (Unshielded)</b>	
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<sup>(1)</sup>**

Plate Voltage (Max.) .....	500 Volts
Peak Positive Plate Voltage (Abs. Max.) .....	2200 Volts
Plate Dissipation (Max.) <sup>(2)</sup> .....	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 $\mu$ mhos
Amplification Factor .....	16
Plate Resistance.....	3600 Ohms
Plate Current at $E_c = -15$ V .....	4.5 Ma
Grid Voltage for $I_b = 50 \mu a$ .....	-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:**

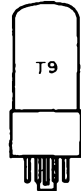
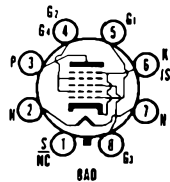
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) In stages operating with grid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

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 $\mu$ mos
Plate Resistance (Approx.)	0.5	1.0 Megohm
Cathode Current	12.3	12.5 Ma
Ec3 for Gm = 10 $\mu$ mos (Approx.)	-25	-25 Volts
Ec3 for Gm = 100 $\mu$ mos (Approx.)	-9	-9 Volts

**OSCILLATOR CHARACTERISTICS (Non-Oscillating)**

Grid No. 2 and Grid No. 4 Voltage <sup>(1)</sup>		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 <sup>(1)</sup>		4500 $\mu$ mos
Amplification Factor between Grid No. 1 and Grid No. 2 and Grid No. 4 <sup>(1)</sup>		14
Cathode Current		25 Ma
Ec1 for Ib = 10 $\mu$ a (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.

**ELECTRICAL DATA**

**HEATER OPERATION**

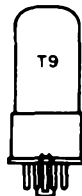
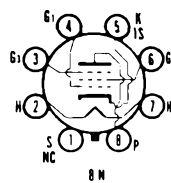
	12SJ7GT	6SJ7GT
Heater Voltage	12.6	6.3 Volts
Heater Current	150	300 Ma
Maximum Heater-Cathode Voltage	90	90 Volts

**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 $\mu$ mhos
Plate Resistance (Approx.) .....	0.7	1.0 Megohm
E <sub>c1</sub> for I <sub>b</sub> = 10 $\mu$ a (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**

Heater Voltage .....	12.6	6.3 Volts
Heater Current .....	150	300 Ma
Maximum Heater-Cathode Voltage .....	90	90 Volts

**DIRECT INTERELECTRODE CAPACITANCES (Shielded)**

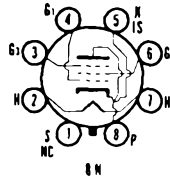
Grid No. 1 to Plate (Max.) .....	0.005 Pf
Input: g <sub>1</sub> to (H + k + g <sub>2</sub> + g <sub>3</sub> ) .....	6.5 Pf
Output: p to (H + k + g <sub>2</sub> + g <sub>3</sub> ) .....	7.5 Pf

**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 $\mu$ mhos
Plate Resistance (Approx.) .....	120,000	800,000 Ohms
E <sub>c1</sub> for G <sub>m</sub> = 10 $\mu$ mhos (Approx.) .....	-35	-35 Volts



12SK7GT

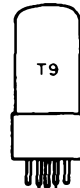
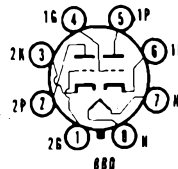
6SK7GT

**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**

Heater Voltage.....	12SL7GT 12.6	6SL7GT 6.3 Volts
Heater Current.....	150	300 Ma
Maximum Heater-Cathode Voltage.....	90	90 Volts

**DIRECT INTERELECTRODE CAPACITANCES (Shielded)<sup>(1)</sup>**

	<b>Section No. 1<sup>(2)</sup></b>	<b>Section No. 2<sup>(2)</sup></b>
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 $\mu$ mhos
Amplification Factor.....	70
Plate Resistance.....	44,000 Ohms

**NOTES:**

- (1) Standard 1 $\frac{1}{4}$ " 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.

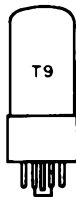
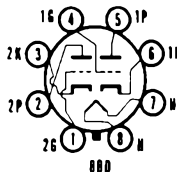
**6SN7GTB**

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**

Heater Voltage.....	12SN7GTA 12.6	8SN7GTB 8.4	6SN7GTB 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)**

	<b>Section 1<sup>(1)</sup></b>	<b>Section 2<sup>(1)</sup></b>
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)**

	<b>Class A1 Amplifier</b>	<b>Vertical<sup>(2)</sup> Deflection Amplifier</b>
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
	<b>Vertical<sup>(2)</sup> Deflection Oscillator</b>	<b>Horizontal<sup>(2)</sup> Deflection Oscillator</b>
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 $\mu$ mhos
Amplification Factor .....	20	20
Plate Resistance (Approx.) .....	6700	7700 Ohms
Plate Current at $E_c = 12.5$ Volts .....	—	1.3 Ma
Grid Voltage for $I_b = 10 \mu a$ (Approx.) .....	-7.0	-18 Volts

**NOTES:**

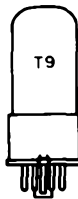
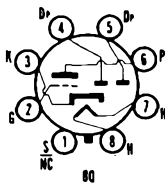
- (1) Section No. 1 connects to pins 4, 5 and 6. Section No. 2 connects to pins 1, 2 and 3.
- (2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse 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**

	<b>12SQ7GT</b>	<b>6SQ7GT</b>
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 $\mu$ mhos
Amplification Factor .....	100	100
Plate Resistance .....	110,000	85,000 Ohms
Average Diode Current with 10 Volts DC Applied (Each Diode) <sup>(1)</sup> .....	2.0	2.0 Ma

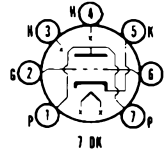
**NOTE:**

(1) Test condition only.



**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>2T4</b>	<b>6T4</b>
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**

	<b>Shielded<sup>(1)</sup></b>	<b>Unshielded</b>
Grid to Plate .....	1.7	1.7 Pf
Input .....	3.3	2.9 Pf
Output .....	1.8	0.25 Pf
Heater to Cathode <sup>(2)</sup> .....	2.9	3.0 Pf
Grid No Cathode <sup>(2)</sup> .....	2.6	2.6 Pf
Plate to Cathode <sup>(2)</sup> .....	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 $\mu$ mhos
Amplification Factor .....	13
Plate Resistance .....	1860 Ohms
Grid Voltage for $I_b = 50 \mu$ a .....	-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 $\mu$ a

**NOTES:**

(1) Shield No. 316.

(2) Measured between specified elements only. When external shield is used, it shall be grounded.

Color Television Type

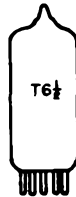
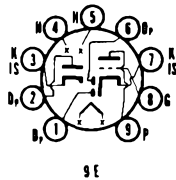
## CLAMPER or DETECTOR VOLTAGE AMPLIFIER

# 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

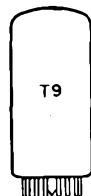
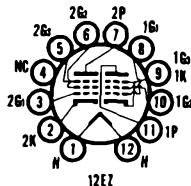
## AUDIO OUTPUT and FM DETECTOR

# 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**

	<b>12T10</b>	<b>6T10</b>
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 + 1g <sub>2</sub> + 1g <sub>3</sub> + IS).....	11.0 Pf
Output: p to (h + 1k + 1g <sub>2</sub> + 1g <sub>3</sub> + 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 + 2g <sub>2</sub> + 2g <sub>3</sub> + IS).....	6.5 Pf
Grid No. 3 to (h + 2k + 2g <sub>1</sub> + 2g <sub>2</sub> + 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 $\mu$ mhos
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 $\mu$ mhos
Transconductance (G3).....	400 $\mu$ mhos
Plate Current.....	1.3 Ma
Screen Current.....	2.1 Ma
Ec1 for Ib = 30 $\mu$ a.....	-4.5 Volts
Ec3 for Ib = 50 $\mu$ a.....	-4.5 Volts

Color Television Type

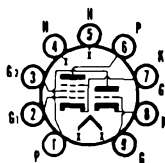
**HORIZONTAL OSC. and REACTANCE TUBE or VHF OSC. and MIXER**

**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
<b>Pentode Section</b>		
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
<b>Triode Section</b>		
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
<b>Coupling</b>		
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

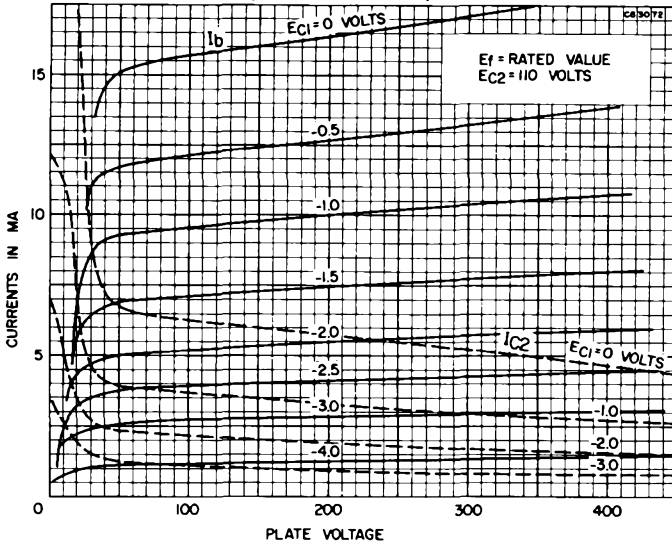
**CHARACTERISTICS AND TYPICAL OPERATION**

	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

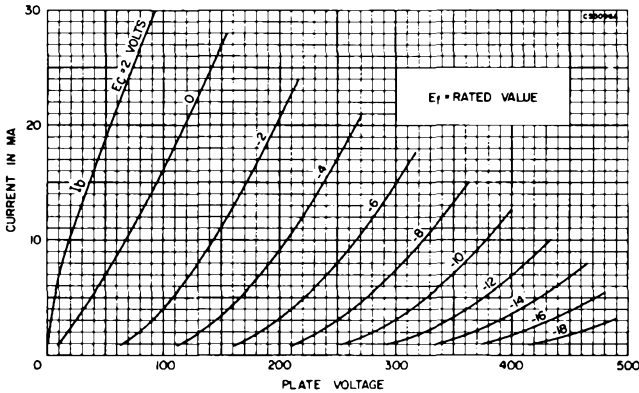
**NOTE:**

(1) External shielded No. 315 connected to cathode of section under test.

**AVERAGE PLATE CHARACTERISTICS  
(Pentode Section)**



**AVERAGE PLATE CHARACTERISTICS  
(Triode Section)**

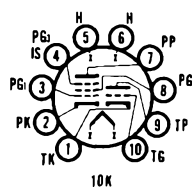


**6U9**  
5U9/LCF201, 8U9

**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 $\mu$ hos
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 $\mu$ hos
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 $\mu$ hos
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**

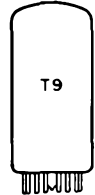
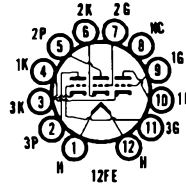
Plate Voltage .....	130-150 Volts
Plate Resistance .....	33 K Ohms
Grid Current .....	1 $\mu$ a
Plate Current .....	72 Ma

# 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

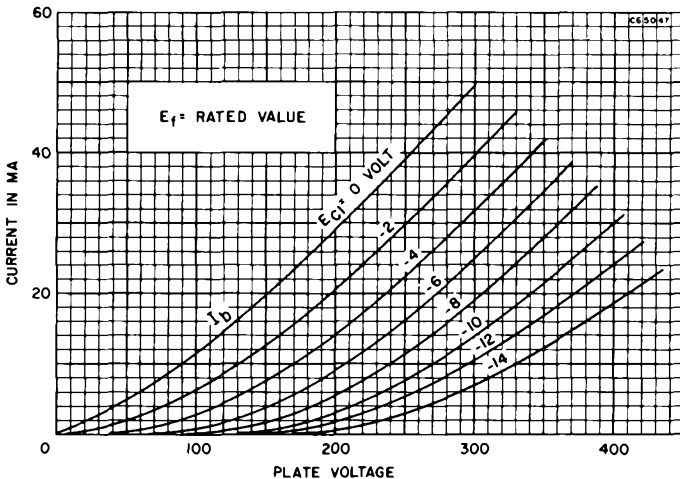
#### DIRECT INTERELECTRODE CAPACITANCES (Unshielded)

	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

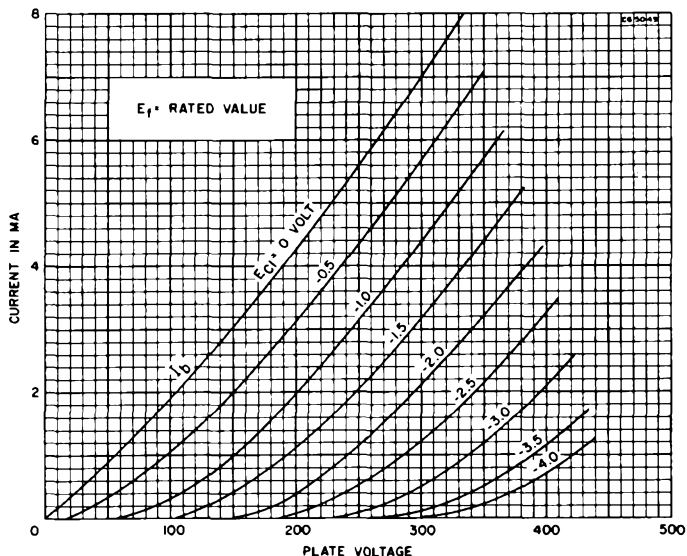
#### RATINGS (Design Maximum Rating System)

	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

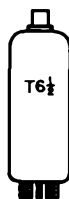
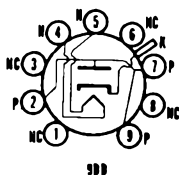
	<b>Sections No. 1 and 3</b>	<b>Section No. 2</b>
Plate Voltage .....	200	200 Volts
Grid Voltage .....	-6.0	-1.5 Volts
Plate Current .....	9.6	1.2 Ma
Plate Resistance .....	7700	61,000 Ohms
Transconductance .....	2300	1600 $\mu$ mhos
Amplification Factor .....	17.5	98
Ec for Ib = 100 $\mu$ a .....	-15	— Volts
Ec for Ib = 35 $\mu$ a .....	—	-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<sup>(2)</sup>**

Peak Inverse Plate Voltage (Abs. Max.) <sup>(1)</sup> .....	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 I <sub>b</sub> = 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

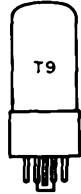
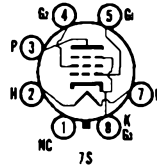
5V6GT, 12V6GT

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: g <sub>1</sub> to (h + k + g <sub>2</sub> + g <sub>3</sub> ) .....	9.0 Pf
Output: p to (h + k + g <sub>2</sub> + g <sub>3</sub> ) .....	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<sup>(1)</sup>—Triode Connected**

Plate Voltage (Max.) .....	350 Volts
Peak Positive Plate Voltage (Abs. Max.) .....	1200 Volts
Plate Dissipation <sup>(2)</sup> .....	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 $\mu$ mhos
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

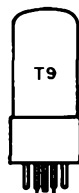
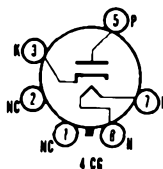
**NOTES:**

- (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.



**Heater-Cathode Diode**

Construction .....Octal T-9  
 Base .....Octal 5 or 6 Pin, B5-82  
                                   B5-85, B6-8 or B6-60  
 Basing<sup>(1)</sup> .....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<sup>(2)</sup>**

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
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**NOTES:**

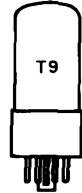
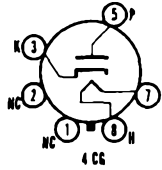
- (1) Pins 1, 2, 4, and 6 should not be used as tie points. Pin 1 omitted on bases B5-82 and B5-85.
- (2) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage 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<sup>(1)</sup>

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
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#### 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.

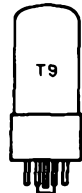
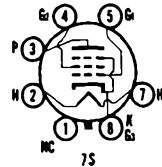
# 6W6GT

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<sup>(1)</sup>**

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 $\mu$ mhos
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 $\mu$ mhos
Amplification Factor .....	6.2
Plate Resistance .....	1600 Ohms
Grid No. 1 Voltage (Approx.) for Ib = 0.5 Ma .....	-42 Volts

**NOTES:**

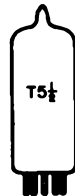
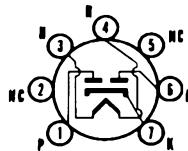
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) In stages operating with grid 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-5 $\frac{1}{2}$
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.



**ELECTRICAL DATA  
HEATER OPERATION**

Heater Voltage .....	12X4 12.6	6X4 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
<b>RATINGS (Design Center Rating System)</b>	
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 <sup>(1)</sup> .....	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	
	325	450 Volts
AC Plate Supply Voltage Per Plate (RMS).....	10	— $\mu$ f
Filter Input Capacitor <sup>(2)</sup> .....	—	10 Henrys
Filter Input Choke (Minimum) .....	525	— Ohms
Total Effective Plate Supply Impedance (Per Plate) <sup>(2)</sup> .....	70	70 Ma
DC Output Current .....		
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

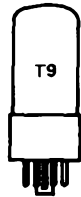
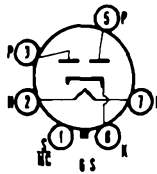
**NOTES:**

- (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  $\mu$ f is used, it may be necessary to add additional plate supply impedance to limit the hot-switching transient plate current to rated maximum.



**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) <sup>(1)</sup> .....	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  $\mu$ f is used.

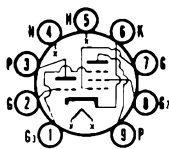


Color Television Type  
**VHF OSCILLATOR and MIXER**

**6X8A**  
 5X8, 9X8, 19X8

**Medium Mu Triode and Sharp Cutoff Pentode**

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**

**Triode Section**

	Shielded <sup>(1)</sup>	Unshielded
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
<b>Converter Service</b>		
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 <sup>(2)</sup>
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 <sup>(a)</sup>	— Watt

**NOTES:**

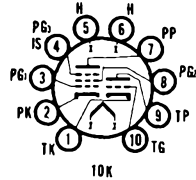
- (1) External shield No. 315 tied to cathode.
- (2) With separate excitation and triode unit grounded.
- (3) In TV or FM receivers, it is generally desirable to operate the oscillator with less power input than shown in the tabulated data in order to avoid overexcitation and excessive oscillator radiation.

**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			165 Volts
Pentode Section .....			
Triode Section .....			
Cathode Negative			165 Volts
6X9, 8X9 .....			110 Volts
5X9.....			
Cathode Positive			
6X9, 8X9 .....			220 + 165 Volts RMS
5X9.....			220 + 110 Volts RMS

**DIRECT INTERELECTRODE CAPACITANCES (Unshielded)**

<b>Pentode Section</b>	
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
<b>Triode Section</b>	
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
<b>Between Pentode and Triode Section</b>	
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)**

<b>Pentode Section</b>	
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
<b>Triode Section</b>	
Peak Plate Voltage (Ib = 0.1 Ma) <sup>(1)</sup> .....	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**

<b>Pentode Section</b>	
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 $\mu$ mhos
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 $\mu$ mhos
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 $\mu$ mhos
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 $\mu$ a
Plate Current .....	2 Ma

**NOTE:**

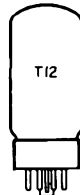
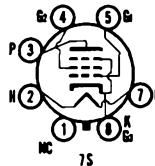
(1) 18  $\mu$ sec. Maximum, 18% of 1 cycle.

**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.) .....

Cathode Bias (Max.) .....

**CHARACTERISTICS AND TYPICAL OPERATION**

**Class A1 Amplifier**

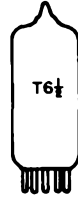
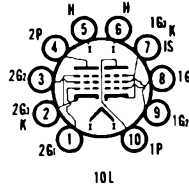
Plate Voltage .....	135	200 Volts
Grid No. 2 Voltage .....	135	135 Volts
Grid No. 1 Voltage .....	-13.5	-14 Volts
Peak AF Grid No. 1 Voltage .....	13.5	14 Volts
Zero Signal Plate Current .....	58	61 Ma
Maximum Signal Plate Current .....	60	66 Ma
Zero Signal Grid No. 2 Current .....	3.5	2.2 Ma
Maximum Signal Grid No. 2 Current .....	11.5	9 Ma
Plate Resistance (Approx.) .....	9300	18,300 Ohms
Transconductance .....	7000	7100 $\mu$ mhos
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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	<b>17Y9</b>	<b>11Y9/LFL200</b>	<b>6Y9</b>
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 <sup>(1)</sup> .....	2.9 Watts
Cathode Current <sup>(2)</sup> .....	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**

	<b>Pentode No. 1</b>	<b>Pentode No. 2</b>
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	$\mu$ mhos

**Pentode No. 2**

	<b>AGC Amplifier</b>	<b>IF Amplifier</b>	
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 $\mu$ mhos

**NOTES:**

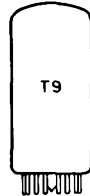
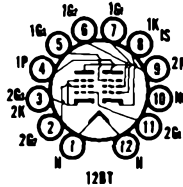
- (1) For short periods, cathode current = 85 Ma (Max.)
- (2) For short periods, cathode current = 93 Ma (Max.)

**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**

Heater Voltage .....	10Z10	6Z10
Heater Current .....	10.0	6.3 Volts
Heater Warm-up Time .....	600	950 Ma
Maximum Heater-Cathode Voltage	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**

**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 $\mu$ mhos
Grid No. 3 Transconductance .....	—	—	700 $\mu$ mhos
Grid No. 1 Voltage (Approx.) $I_b = 20 \mu a$ .....	—	—	-4 Volts
Grid No. 3 Voltage (Approx.) $I_b = 20 \mu a$ .....	—	—	-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 $\mu$ mhos
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



**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.

**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)<sup>(1)</sup>**

**Section 1**

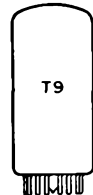
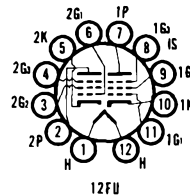
Grid No. 1 to Plate .....	0.016 Pf
Input: 1g1 to (h + 1k + 1g2 + 1g3 + 1S) .....	6.5 Pf
Output: 1p to (h + 1k + 1g2 + 1g3 + 1S) .....	2.4 Pf

**Section 2**

Grid No. 1 to Plate .....	0.015 Pf
Input: 2g1 to (h + 2k + 2g2 + 2g3 + 1g3 + 1S) .....	7.5 Pf
Output: 2p to (h + 2k + 2g2 + 2g3 + 1g3 + 1S) .....	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 $\mu$ mhos
Plate Current .....	14 Ma
Screen Current .....	3.6 Ma
Grid No. 1 Voltage (Approx.) $G_m = 50 \mu$ mhos .....	-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 $\mu$ mhos
Plate Current .....	9.0 Ma
Screen Current .....	2.5 Ma
Grid No. 1 Voltage (Approx.) $I_b = 20 \mu$ a .....	-5.5 Volts

**NOTE:**

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

Color Television Type

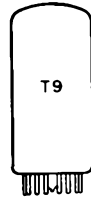
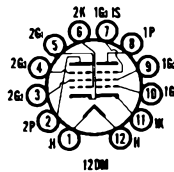
**IF AMPLIFIER**

**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**

Heater Voltage .....	11.2	<b>8BQ11</b>
Heater Current .....	450	8.4 Volts
Heater Warm-up Time .....	11	600 Ma
Maximum Heater-Cathode Voltage .....		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 (Shielded)<sup>(1)</sup>**

**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
<b>Section 2</b>	
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
<b>Coupling</b>	
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**

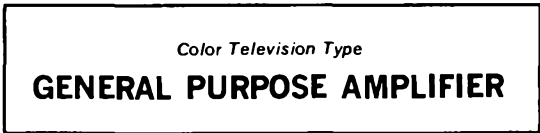
Plate Voltage .....	125 Volts
Suppressor .....	Connected to Cathode at Socket
Screen Voltage .....	125 Volts
Cathode-Bias Resistor .....	56 Ohms
Plate Resistance (Approx.) .....	0.2 Megohm
Transconductance .....	10,500 $\mu$ mhos
Plate Current .....	11 Ma
Screen Current .....	3.5 Ma
Grid No. 1 Voltage (Approx.) .....	
$G_m = 50 \mu$ mhos .....	-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 $\mu$ mhos
Plate Current .....	11 Ma
Screen Current .....	3.8 Ma
Grid No. 1 Voltage (Approx.) .....	
$I_b = 20 \mu$ a .....	-3 Volts

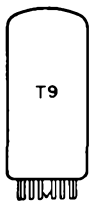
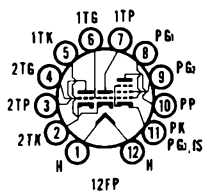
**NOTE:**

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



**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 $\mu$ mhos
Plate Current .....	12 Ma
Screen Current .....	4.0 Ma
Grid No. 1 Voltage (Approx.)	
Ib = 30 $\mu$ a .....	-8 Volts

**Each Triode Section**

Plate Voltage .....	125 Volts
Cathode Bias Resistor .....	68 Ohms
Amplification Factor .....	43
Plate Resistance (Approx.) .....	5000 Ohms
Transconductance .....	8600 $\mu$ mhos
Plate Current .....	13.5 Ma
Grid Voltage (Approx.)	
Ib = 100 $\mu$ a .....	-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.

**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**

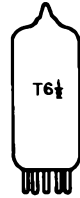
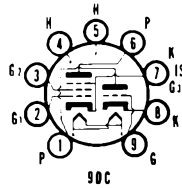
<b>Pentode Section</b>	
Input Capacitance .....	5.5 Pf
Output Capacitance.....	3.8 Pf
Plate to Grid No. 1 (Max.).....	0.025 Pf
<b>Triode Section</b>	
Input Capacitance .....	2.5 Pf
Output Capacitance.....	1.8 Pf
Plate to Grid .....	1.5 Pf
<b>Between Pentode and Triode Sections</b>	
Pentode Plate to Triode 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)**

<b>Pentode Section</b>	
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
<b>Triode Section</b>	
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**

<b>Pentode Section</b>	
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
<b>Triode Section</b>	
Plate Voltage .....	100 Volts
Grid Voltage .....	-2 Volts
Plate Current .....	14 Ma
Transconductance .....	5000 μmhos
Amplification Factor .....	20



**OPERATING CHARACTERISTICS FOR USE AS MIXER**

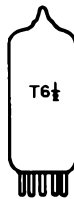
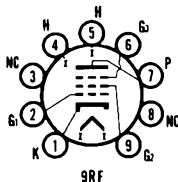
Plate Voltage .....	170	170 Volts
Grid No. 2 Voltage .....	170	170 Volts
Grid No. 1 Circuit Resistance .....	0.1	0.1 Megohm
Cathode Resistor .....	330	820 Ohms
Oscillator Voltage (RMS).....	3.5	3.5 Volts
Plate Current .....	6.5	5.2 Ma
Grid No. 2 Current .....	2.0	1.5 Ma
Grid No. 1 Current .....	25	0 $\mu$ a
Conversion Conductance .....	2200	2100 $\mu$ mhos
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.



**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	— $\mu$ mhos
Transconductance (Grid No. 3 to Plate) .....	500	— $\mu$ mhos
Plate Resistance (Approx.) .....	55,000	— Ohms
Grid No. 1 Voltage for Ib = 100 $\mu$ a (Rk = 0) .....	-4.1	— Volt

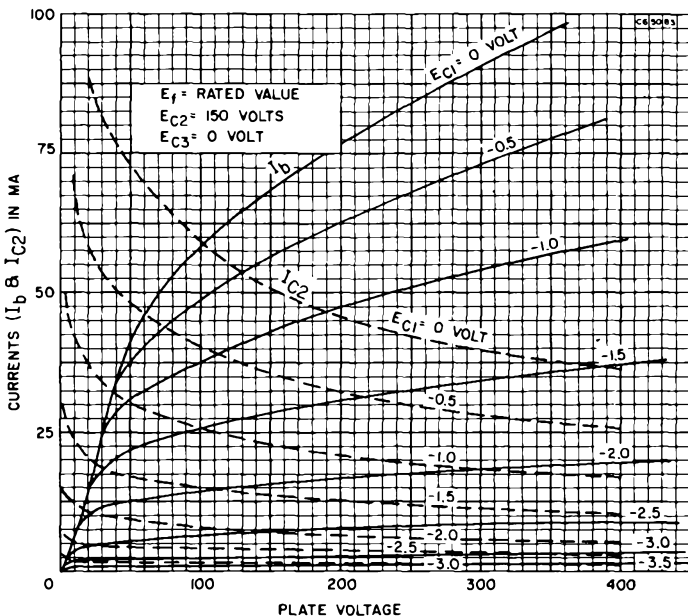
**INSTANTANEOUS PLATE KNEE CHARACTERISTICS<sup>(1)</sup>**

$E_b = 50$  V,  $E_{c2} = 100$  V, and  $E_{c1} = 0$  V  
 $I_b = 25$  Ma, and  $I_{c2} = 25$  Ma

**NOTE:**

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

**AVERAGE PLATE CHARACTERISTICS**

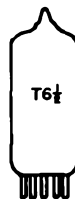
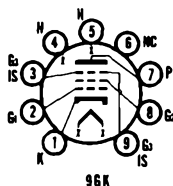


**9KX6**

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 $\mu$ mhos
Plate Resistance (Approx.) .....	50,000 Ohms
Grid No. 1 Voltage, Approx. for $I_b = 100 \mu a$ .....	-5.7 Volts

**INSTANTANEOUS PLATE KNEE CHARACTERISTICS**

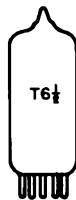
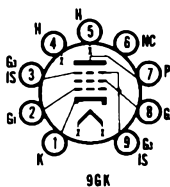
$E_b = 50 \text{ V}$ ,  $E_{c2} = 125 \text{ V}$ ,  $E_{c1} = 0 \text{ V}$ , and  $E_{c3} = 0 \text{ V}$   
 $I_b = 70 \text{ Ma}$ , and  $I_{c2} = 24 \text{ Ma}$

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.



**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 $\mu$ mhos
Plate Resistance (Approx.) .....	55,000 Ohms
Grid No. 1 Voltage (Approx.) for I <sub>b</sub> = 100 $\mu$ a (R <sub>k</sub> = 0) .....	-7.2 Volts

**INSTANTANEOUS PLATE KNEE CHARACTERISTICS**

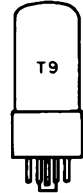
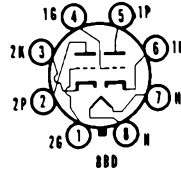
E<sub>b</sub> = 50 V, E<sub>c2</sub> = 125 V, E<sub>c1</sub> = 0 V, and E<sub>c3</sub> = 0 V  
 I<sub>b</sub> = 76 Ma, and I<sub>c2</sub> = 32 Ma

**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<sup>(1)</sup>**

	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.) <sup>(2)</sup> .....	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 <sup>(3)</sup>	Section No. 2 <sup>(3)</sup>
Plate Voltage .....	250	15u Volts
Grid No. 1 Voltage .....	-11	-17.5 Volts
Plate Current .....	5.5	45 Ma
Transconductance .....	2000	7500 $\mu$ mhos
Amplification Factor .....	17.5	6.0
Plate Resistance (Approx.) .....	8750	800 Ohms
Ec for I <sub>b</sub> = 10 $\mu$ a (Approx.) .....	-20	— Volts
Ec for I <sub>b</sub> = 100 $\mu$ a (Approx.) .....	—	-40 Volts
I <sub>b</sub> at Ec = -25 Vdc .....	—	8 Ma
I <sub>b</sub> with Eb = 60 V and Ec = 0 V .....	—	95 Ma

**NOTES:**

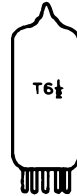
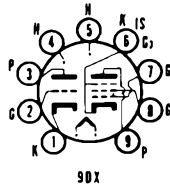
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) In stages operating with grid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



**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**

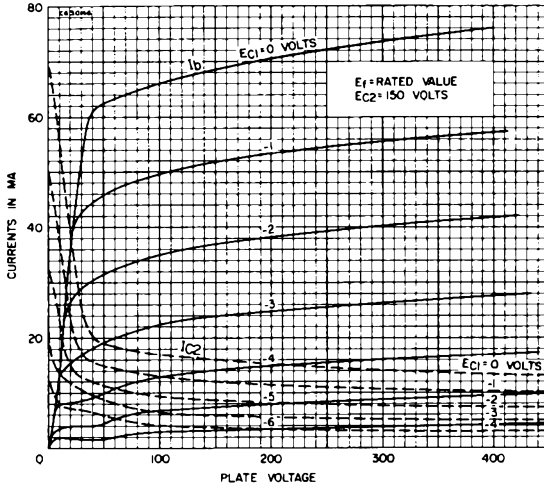
**Class A1 Amplifier**

	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

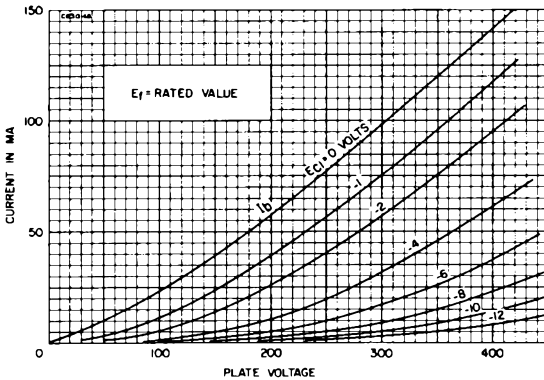
**INSTANTANEOUS PLATE KNEE CHARACTERISTICS**

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)**

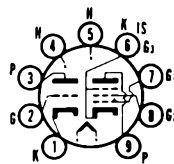


**10LW8**

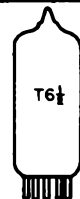
**VIDEO AMPLIFIER (P)  
GENERAL PURPOSE (T)**

**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.



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**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**

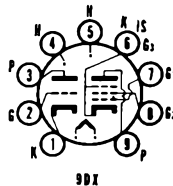
	Pentode Section	Triode Section
Plate Voltage .....	35	200 Volts
Screen Voltage .....	100	— Volts
Grid No. 1 Voltage .....	0	-2.0 Volts
Cathode-Bias Resistor .....	—	82 — Ohms
Amplification Factor .....	—	75
Plate Resistance (Approx.) .....	—	60,000
Transconductance .....	—	19,000
Plate Current .....	48	16.5
Screen Current .....	12.5	2.8
Grid Voltage (Approx.) Ib = 30 $\mu$ a .....	—	—
Grid No. 1 Voltage (Approx.) Ib = 500 $\mu$ a .....	—	-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.



**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)**

	<b>Pentode Section</b>	<b>Triode Section</b>
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**

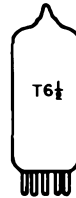
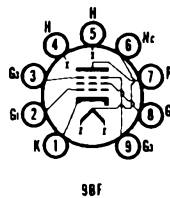
	<b>Pentode Section</b>			<b>Triode Section</b>
Plate Voltage .....	30	30	200	250 Volts
Screen Voltage .....	140	140	140	— Volts
Grid No. 1 Voltage .....	0	-1.0	-2.0	-2.0 Volts
Amplification Factor .....	—	—	—	110
Plate Resistance (Approx.) .....	—	—	150,000	52,000 Ohms
Transconductance .....	—	11,000	9500	2100 $\mu$ mhos
Plate Current .....	30	16	12	1.1 Ma
Screen Current .....	13.5	9.5	2.5	— Ma
Grid Voltage (Approx.) Ib = 10 $\mu$ a .....	—	—	—	-3.6 Volts
Grid No. 1 Voltage (Approx.) Ib = 500 $\mu$ a .....	—	-4	-4.2	— Volts

**11HM7**

Color Television Type  
**VIDEO AMPLIFIER**

**Sharp Cutoff Pentode**

Construction .....	Miniature T-6 $\frac{1}{2}$
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**

	<b>Series</b>	<b>Parallel</b>
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

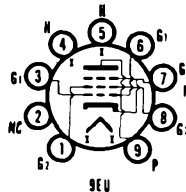
Grid No. 2 Input:	
Ec2 up to 165 V (Max.)	1 Watt
Ec2 from 165 V to 330 V	See Rating Chart (Gen. Info. Sec.)
Grid No. 1 Circuit Resistance:	
Fixed Bias (Max.)	0.1 Megohm
Cathode Bias (Max.)	0.25 Megohm
<b>CHARACTERISTICS AND TYPICAL OPERATION</b>	
Plate Supply Voltage	200 Volts
Grid No. 3 Voltage	0 Volt
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 $\mu$ mhos
DC Plate Current	30 Ma
DC Grid No. 2 Current	5.2 Ma
Cutoff DC Grid No. 1 Voltage for $i_b = 100 \mu a$	-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.



**ELECTRICAL DATA**

**HEATER OPERATION**

Heater Voltage <sup>(1)</sup>	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 $\mu$ mhos
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:**

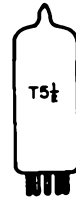
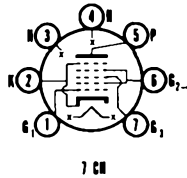
(1) This tube is intended to be used in automotive service from a nominal 12 volt battery source. The heater is therefore designed to operate over the 10.0 to 15.9 voltage range encountered in this service. The maximum ratings of the tube provide for an adequate safety factor such that the tube will 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.



**ELECTRICAL DATA**

**HEATER OPERATION**

Heater Voltage <sup>(1)</sup> .....	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 <sup>(2)</sup>	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 <sup>(2)</sup> .....	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 <sup>(4)</sup> .....	12.6 Volts
Grid No. 3 Voltage .....	0 Volt
Grid No. 1 Voltage .....	0 Volt
Transconductance .....	3600 $\mu$ mhos
Amplification Factor .....	9.4
Cathode Current .....	4.5 Ma
Grid No. 1 Voltage for $I_b = 10 \mu$ a (Approx.) .....	-3.7 Volts

**NOTES:**

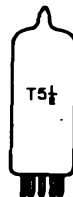
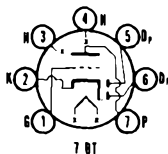
- (1) This tube is intended for use in automobile radios operated from a nominal 12 volt battery. Design of the tube is such that the heater will operate satisfactorily over the range 10.0 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered 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 <sup>(1)</sup> .....	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 $\mu$ mhos
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:**

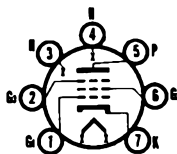
- (1) This tube is intended for use in automobile radios operated from a nominal 12 Volt battery. Design of the tube is such that the heater will operate satisfactorily over the range 10.0 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered 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

<b>HEATER OPERATION</b>	
Heater Voltage <sup>(1)</sup> .....	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 <sup>(2)</sup> (Approx.) for Gm = 10 μmhos.....	-3.5 Volts

### NOTES:

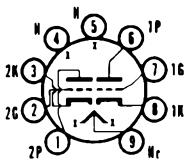
- (1) This tube is intended for use in automobile radios operated from a nominal 12 volt battery. Design of the tube is such that the heater will operate satisfactorily over the range 10.0 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered with this type of supply.
- (2) Grid No. 1 tied to Grid No. 3.

# 12AT7/ECC81

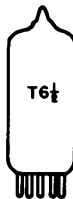
# Color Television Type GROUNDED GRID AMPLIFIER

### 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

<b>HEATER OPERATION</b>	
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
<b>Grounded Grid Section</b>		
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)**

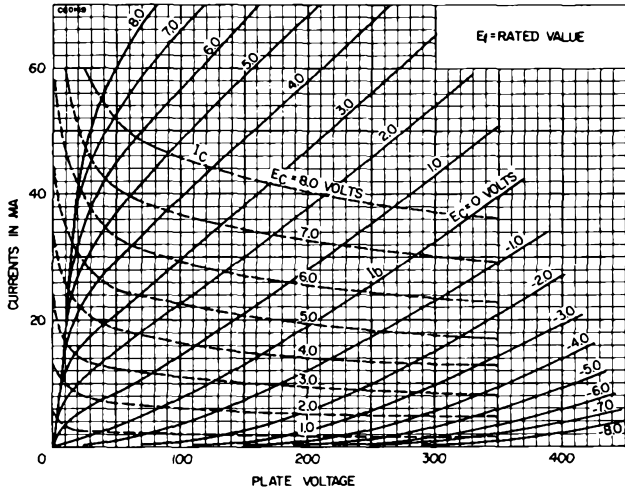
Plate Voltage (Max.) .....	300 Volts
Plate Dissipation (Max.) .....	2.5 Watts

**CHARACTERISTICS AND TYPICAL OPERATION**

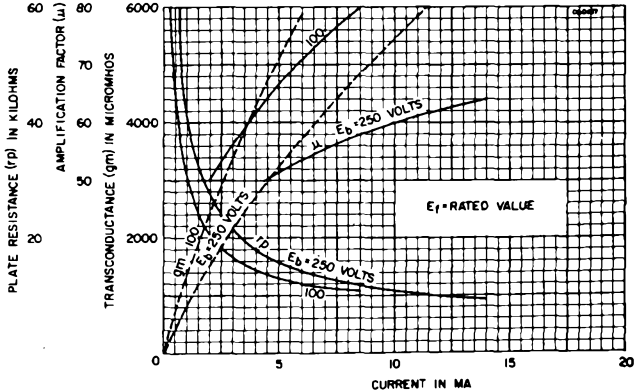
**Class A1 Amplifier (Each Section)**

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 $\mu$ mhos
Amplification Factor .....	60	62	60
$E_c$ for $I_b = 10 \mu$ a (Approx.) .....	-5	-8	-12 Volts

**AVERAGE PLATE CHARACTERISTICS**



**AVERAGE TRANSFER CHARACTERISTICS**



# 12AU7A/ECC82

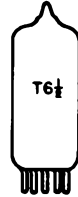
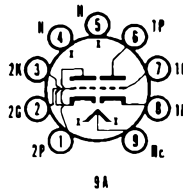
7AU7, 9AU7

## 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<sup>(1)</sup> ..... 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**

	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 <sup>(1)</sup>	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 <sup>(2)</sup> Deflection Amplifier
Plate Voltage (Max.) .....	330	330 Volts
Peak Positive Plate Voltage (Abs. Max.) .....	—	1200 Volts
Plate Dissipation <sup>(4)</sup> 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 <sup>(2)</sup> Deflection Oscillator	Horizontal <sup>(2)</sup> Deflection Oscillator
Plate Voltage (Max.) .....	330	330 Volts
Plate Dissipation <sup>(4)</sup> .....		
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)**

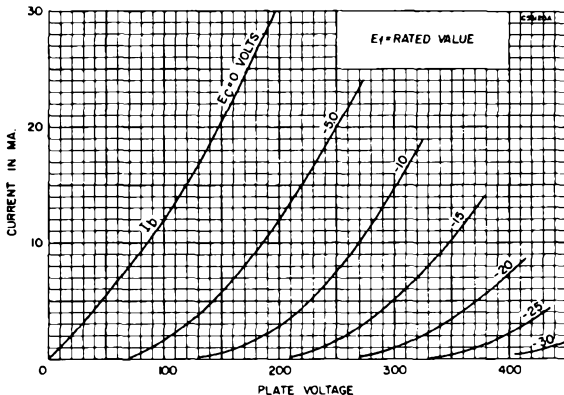
Plate Voltage .....	100	250 Volts
Grid Voltage .....	0	-8.5 Volts
Plate Current .....	11.8	10.5 Ma
Plate Resistance (Approx.) .....	6500	7700 Ohms
Transconductance .....	3100	2200 μmhos
Amplification Factor .....	20	17
Grid Voltage for Ib = 10 μa (Approx.) .....	—	-24 Volts



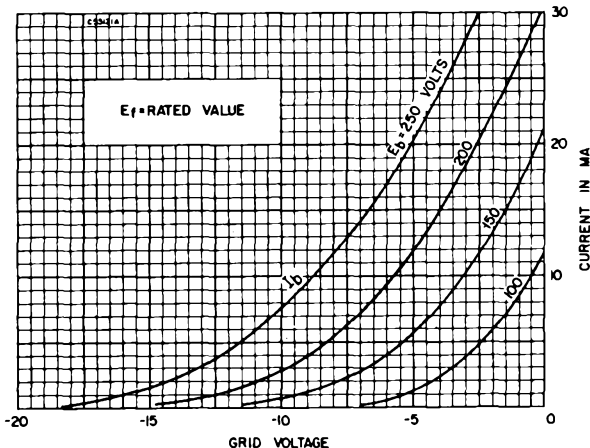
**NOTES:**

- (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**

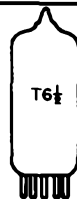
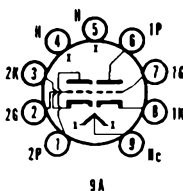


Color Television Type  
**GROUNDING GRID AMPLIFIER**

**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 <sup>(1)</sup>	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 $\mu$ mhos
Amplification Factor.....	37	41
Plate Resistance.....	6100	4800 Ohms
Grid Voltage for $I_b = 10 \mu$ a.....	-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**

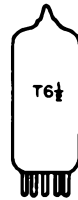
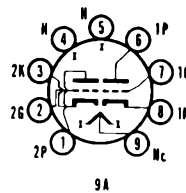
6AX7

Color Television Type

**AF AMPLIFIER or  
PHASE INVERTER**

**Double High Mu Triode**

Construction.....	Miniature T-6 $\frac{1}{2}$
Base.....	Button 9 Pin, E9-1
Basing <sup>(1)</sup> .....	.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**

	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 <sup>(2)</sup> .....	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 <sup>(1)</sup>		Section 2 <sup>(1)</sup>	
	Shielded	Unshielded	Shielded <sup>(2)</sup>	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 $\mu$ mhos
Amplification Factor .....	100	100

**NOTES:**

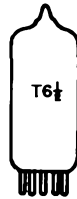
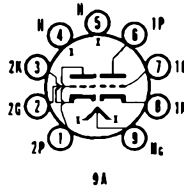
- (1) Section No. 1 connects to Pins 6, 7, and 8. Section No. 2 connects to Pins 1, 2, and 3.
- (2) External Shield No. 315 connected to cathode of section under test.
- (3) Controlled Heater Warm-up Time applies to parallel connection only.

Color Television Type  
**GROUNDING 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.



**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) <sup>(1)</sup> .....	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) <sup>(1)</sup> .....	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 $\mu$ mhos
Amplification Factor .....	60	60
Plate Resistance.....	15,000	10,900 Ohms
E <sub>c1</sub> for I <sub>b</sub> = 10 $\mu$ a (Approx.).....	-5	-12 Volts

**NOTES:**

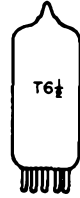
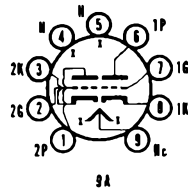
- (1) Shield No. 315.
- (2) Section 1 connects to pins 6, 7, and 8.

# 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<sup>(2)</sup> ..... 9A  
 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.....	12.6/6.3 Volts
Heater Current.....	300/600 Ma
Heater Warm-up Time <sup>(1)</sup> .....	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 <sup>(2)</sup>	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 <sup>(2)</sup> Deflection Oscillator	Horizontal <sup>(2)</sup> 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

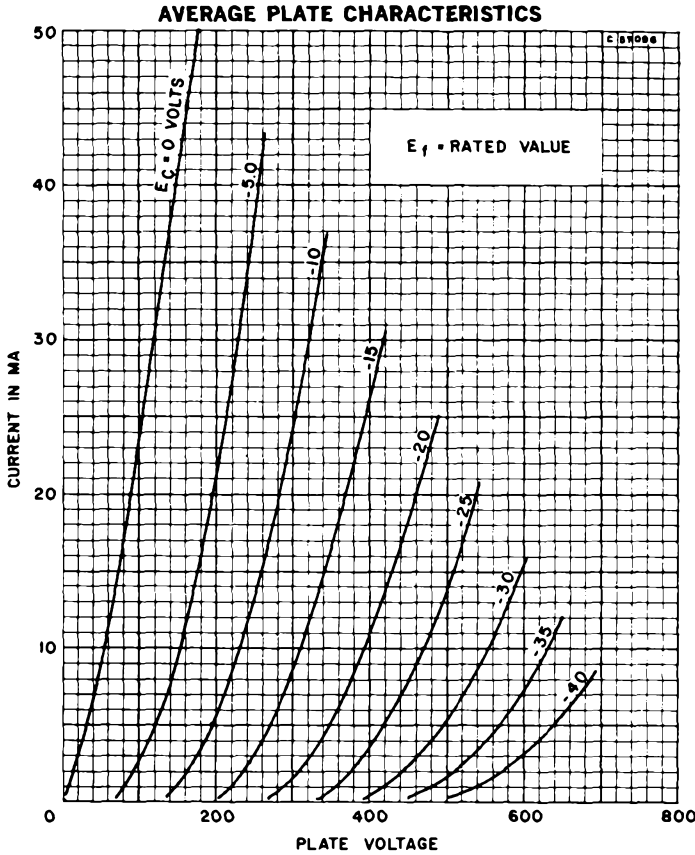
### CHARACTERISTICS AND TYPICAL OPERATION

#### 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.

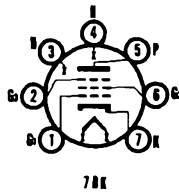


**RF/IF AMPLIFIER**

**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<sup>(1)</sup> ..... 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 <sup>(2)</sup> .....	0 Volt
Grid No. 2 Voltage .....	12.6 Volts
Grid No. 1 Voltage <sup>(2)</sup> .....	-0.65 Volts
Plate Current .....	1350 $\mu$ a
Grid No. 2 Current .....	500 $\mu$ a
Transconductance <sup>(4)</sup> .....	1350 $\mu$ mhos
Plate Resistance (Approx.) .....	0.5 Megohm
Grid No. 1 Voltage for Gm = 10 $\mu$ mhos (Approx.) .....	-6.0 Volts
Grid No. 1 and No. 3 Voltage for Gm = 10 $\mu$ mhos (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.



**Double Diode and High Mu Triode**

Construction .....	Miniature T-6 $\frac{1}{2}$
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.

**ELECTRICAL DATA  
HEATER OPERATION**

Heater Voltage .....	<b>9BR7</b> 9.4/4.7	<b>12BR7</b> 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)<sup>(1)</sup>**

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

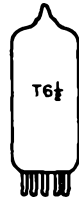
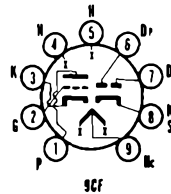
**CHARACTERISTICS AND TYPICAL OPERATION**

**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 $\mu$ mhos
Plate Current .....	3.7	10 Ma
Grid Voltage (Approx.) for Ib = 10 $\mu$ a .....	-5	-12 Volts
Average Diode Current .....	—	—
Each Diode with 5.0 volts DC applied .....	—	17 Ma

**NOTE:**

- (1) Shield No. 315.

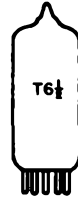
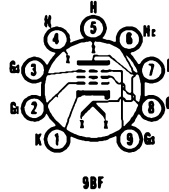


Color Television Type  
**VIDEO AMPLIFIER**

**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.



**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:**

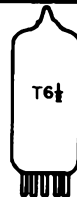
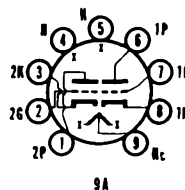
(1) Applies to parallel connection only.

**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.



**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

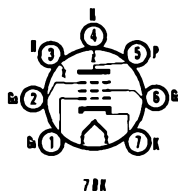
**CHARACTERISTICS AND TYPICAL OPERATION**

Plate Voltage.....	250 Volts
Grid Voltage.....	-2 Volts
Amplification Factor.....	100
Plate Resistance (Approx.).....	31,800 Ohms
Transconductance.....	3200 $\mu$ hos
Plate Current.....	2.5 Ma
Grid Circuit Resistance (Contact Bias Operation).....	5 Megohms



**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 <sup>(1)</sup> .....	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 <sup>(1)</sup> .....	— Volt
Grid No. 1 Resistor.....	2.2 Megohms
Plate Current.....	4.4 Ma
Grid No. 2 Current.....	2.0 Ma
Transconductance.....	4200 $\mu$ hos
Plate Resistance (Approx.).....	40,000 Ohms
Grid No. 1 Voltage for Ib = 10 $\mu$ a.....	-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.

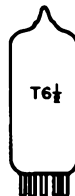
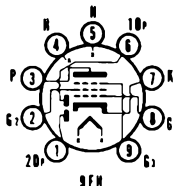
(2) Average contact potential bias developed across specified grid resistor.

**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<sup>(1)</sup> ..... 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.

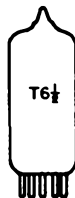
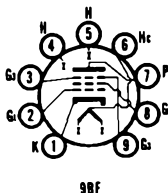
Color Television Type

**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 <sup>(1)</sup> .....	—	11 Seconds
<b>Maximum Heater-Cathode Voltage</b>		
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 $\mu$ mhos
Plate Resistance (Approx.).....	50,000 Ohms
E <sub>c1</sub> for I <sub>b</sub> = 100 $\mu$ a (Approx.).....	-5.7 Volts

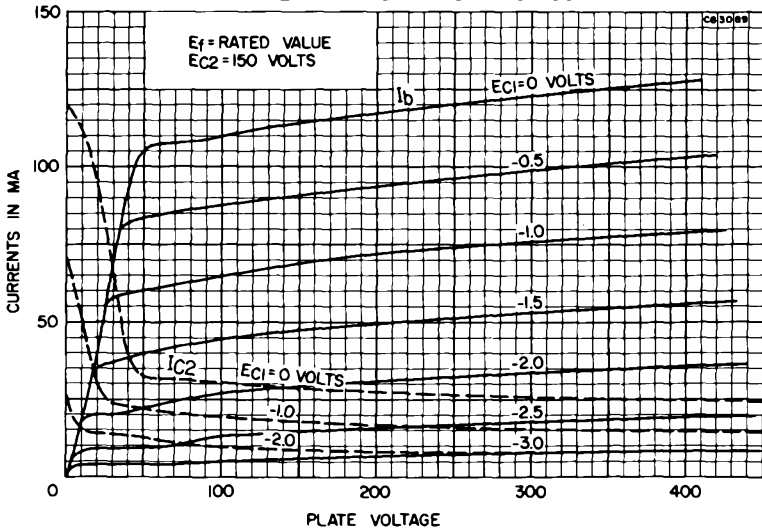
**INSTANTANEOUS PLATE KNEE CHARACTERISTICS<sup>(2)</sup>**

E<sub>b</sub> = 50 V, E<sub>c2</sub> = 125 V, and E<sub>c1</sub> = 0 V  
I<sub>b</sub> = 70 Ma, and I<sub>c2</sub> = 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**

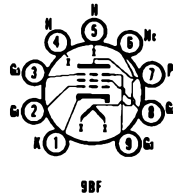


Color Television Type  
**VIDEO AMPLIFIER**

**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.



**ELECTRICAL DATA**

**HEATER OPERATION**

	Parallel	Series
Heater Voltage.....	12.6	6.3 Volts
Heater Current.....	300	600 Ma
Heater Warm-up Time <sup>(1)</sup> .....	—	11 Seconds
<b>Maximum Heater-Cathode Voltage</b>		
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<sup>(2)</sup>**

Eb = 50 V, Ec2 = 125 V, Ec1 = 0 V and Ec3 = 0 V  
 Ib = 76 Ma, and Ic2 = 32 Ma

**NOTES:**

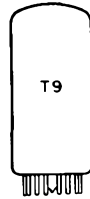
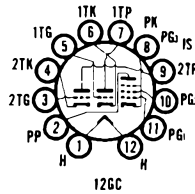
- (1) Applies to 6.3 volt connection only.
- (2) Current drawn only for short intervals so as not to damage the tube.

# 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: Pgl 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 $\mu$ mhos
Plate Current .....	40	16 Ma
Screen Current .....	13	3.0 Ma
Grid No. 1 Voltage (Approx.) $I_b = 100 \mu a$ .....	—	-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 $\mu$ mhos
Plate Current .....	7.1 Ma
Grid Voltage (Approx.) $I_b = 50 \mu a$ .....	-5.5 Volts

**Triode (Section 2)**

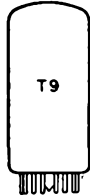
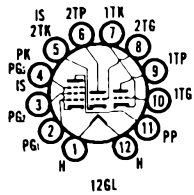
Plate Voltage .....	200 Volts
Cathode Bias Resistor .....	470 Ohms
Amplification Factor .....	40
Plate Resistance (Approx.) .....	7600 Ohms
Transconductance .....	5300 $\mu$ mhos
Plate Current .....	7.2 Ma
Grid Voltage (Approx.) $I_b = 100 \mu a$ .....	-8 Volts

**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 (1Tk + 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 $\mu$ mhos
Plate Current .....	34	17 Ma
Screen Current .....	13	4.0 Ma
Grid No. 1 Voltage (Approx.)		
I <sub>b</sub> = 100 $\mu$ a .....	—	-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 $\mu$ mhos
Plate Current .....	7.0 Ma
Grid Voltage (Approx.)	
I <sub>b</sub> = 100 $\mu$ a .....	-5.5 Volts

**Triode (Section 2)**

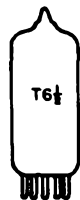
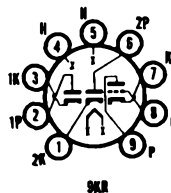
Plate Voltage .....	200 Volts
Cathode Bias Resistor .....	220 Ohms
Amplification Factor .....	41
Plate Resistance (Approx.) .....	9400 Ohms
Transconductance .....	4400 $\mu$ mhos
Plate Current .....	9.2 Ma
Grid Voltage (Approx.)	
I <sub>b</sub> = 100 $\mu$ a .....	-6.5 Volts

**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
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**CHARACTERISTICS AND TYPICAL OPERATION**

**Class A1 Amplifier**

Plate Voltage .....	250 Volts
Grid Voltage .....	-3 Volts
Plate Current .....	0.7 Ma
Transconductance .....	1000 $\mu$ mhos
Amplification Factor .....	72
Plate Resistance (Approx.) .....	72,000 Ohms

**Diodes**

Average Current Each Plate with 5 Volts DC Applied <sup>(1)</sup> .....	18 Ma
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**NOTE:**

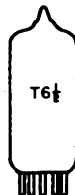
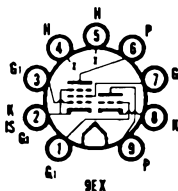
(1) Test condition only.

**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.) <sup>(1)</sup> .....	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.) <sup>(1)</sup> .....	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 $\mu$ mhos
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 $\mu$ mhos
Amplification Factor .....	70

**NOTE:**

(1) Maximum pulse duration 4% of one cycle with a maximum of 0.8 millisecond.

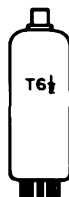
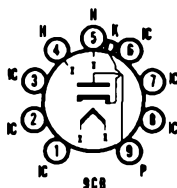


**DAMPER**

**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<sup>(1),(2)</sup> (Max.) ..... 6000 Volts

**NOTES:**

- (1) Maximum pulse duration 22% of a cycle with a maximum of 18 μsec.
- (2) Absolute maximum ratings 7500 volts.

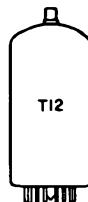
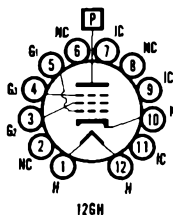
**HORIZONTAL DEFLECTION  
 AMPLIFIER**

**16KA6**

21KA6

**Beam Power Pentode**

Construction ..... Compactron T-12  
 Base ..... Button 12 Pin, E12-74  
 Top Cap ..... C1-3  
 Basing ..... 12GH  
**Outline**  
 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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 $\mu$ mhos
Plate Resistance .....	—	11,000 Ohms
Amplification Factor <sup>(3)</sup> .....	—	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.

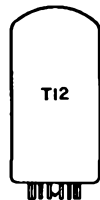
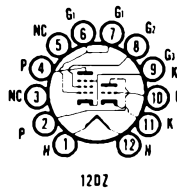
**16LU8A**

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.



**ELECTRICAL DATA**

**HEATER OPERATION**

Heater Voltage.....	16 Volts
Heater Current .....	600 Ma
Heater Warm-up Time .....	11 Seconds

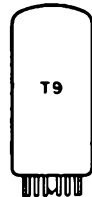
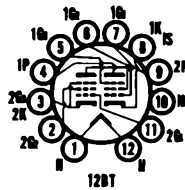
The 16LU8A is identical to the 6LU8 except for shorter bulb length and Heater Characteristic

**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 $\mu$ mhos
Grid No. 3 Transconductance.....	—	—	700 $\mu$ mhos
Grid No. 1 Voltage (Approx.) $I_b = 20 \mu a$ .....	—	—	-4 Volts
Grid No. 3 Voltage (Approx.) $I_b = 20 \mu a$ .....	—	—	-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 $\mu$ mhos
Zero-Signal Plate Current.....	36 Ma
Maximum Signal Plate Current.....	40 Ma

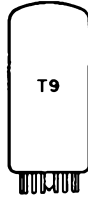
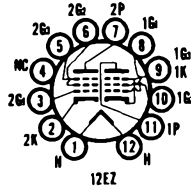
Zero-Signal Screen Current .....	3.0 Ma
Maximum Signal Screen Current .....	9.0 Ma
Load Resistance .....	3000 Ohms
Total Harmonic Distortion (Approx.) .....	10 Percent
Maximum Signal Power Output .....	2.4 Watts

# 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.

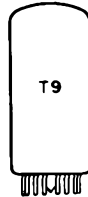
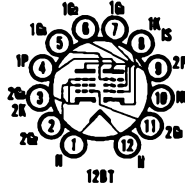


# 17X10

## 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.



### 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)

<b>Section No. 1</b>	
Grid No. 1 to (h + 1k + 1g2 + 1g3 + 1S) .....	4.4 Pf
Grid No. 3 to (h + 1k + 1g1 + 1g2 + 1p + 1S) .....	3.2 Pf
Grid No. 1 to Grid No. 3 .....	0.005 Pf
<b>Section No. 2</b>	
Grid to Plate .....	0.24 Pf
Input: g to (h + 2k + 2g2 + g3 + 1k + 1S) .....	12.0 Pf
Output: p to (h + 2k + 2g2 + g3 + 1k + 1S) .....	9.0 Pf

#### RATINGS (Design Maximum Rating System)

<b>Section No. 1</b>	
Plate Supply Voltage .....	330 Volts
Accelerator Voltage (G2) .....	110 Volts
Peak Positive G1 Voltage .....	60 Volts
DC Cathode Current .....	13 Ma
<b>Section No. 2</b>	
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 <sup>(1)</sup> .....	200-400	200-400	200-400 Ohms
Plate Load Resistor .....	0.085	6.330	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 <sup>(2)</sup> ..	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 <sup>(1)</sup> .....	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:**

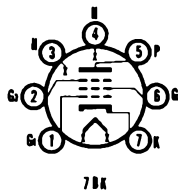
- (1) The cathode resistor should be adjusted for maximum AM rejection in the output of the limiter-discriminator stage at the specified signal level. AM rejection is measured with an applied signal containing 30% AM and 30% FM.
- (2) At signal levels above specified value, limiting is within ± 3 decibels. 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.



**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

<b>DIRECT INTERELECTRODE CAPACITANCES (Shielded)<sup>(1)</sup></b>	
Grid No. 1 to Plate (Max.) .....	0.0035 Pf
Input .....	5.5 Pf
Output .....	5.0 Pf

<b>RATINGS (Design Maximum Rating System)</b>	
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

<b>CHARACTERISTICS AND TYPICAL OPERATION</b>	
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 $\mu$ mhos
Plate Resistance (Approx.) .....	0.25 Megohm
Grid No. 1 Voltage for gm = 25 $\mu$ mhos .....	-20 Volts

**NOTE:**

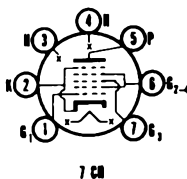
(1) External shield No. 316 connected to Pin No. 7 (cathode).

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.



**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 <sup>(1)</sup>	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<sup>(2)</sup>**

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 $\mu$ mhos
Plate Resistance (Approx.) .....	0.4 Megohm
Cathode Current .....	9 Ma
Grid No. 3 Voltage (Approx.) for $G_c = 10 \mu$ mhos .....	-21 Volts
<b>Oscillator Section Characteristics (Non-Oscillating)</b>	
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 $\mu$ mhos
Amplification Factor Between Grid No. 1 and Grid No. 2 and Grid No. 4 Connected to Plate .....	22
Grid No. 1 Voltage (Approx.) for $I_b = 20 \mu$ a .....	-9.2 Volts

**NOTES:**

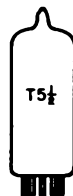
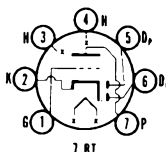
- (1) Shield No. 316 connected to cathode.
- (2) Data for self-excitation in a zero bias circuit corresponds closely to that for separate excitation.

**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.



**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 <sup>(1)</sup>	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 $\mu$ mhos
Amplification Factor .....	100
Average Diode Current, Each Diode with 10 Volts DC Applied <sup>(2)</sup> .....	2.0 Ma

**NOTES:**

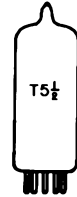
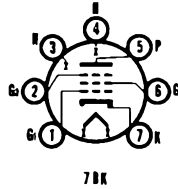
- (1) Shield No. 316 connected to Pin No. 2.
- (2) Test condition only.

# 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)<sup>(1)</sup>

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
E <sub>c1</sub> for I <sub>b</sub> = 10 μa (Approx.).....	-4.7 Volts

#### NOTE:

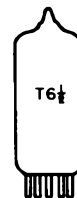
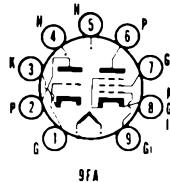
(1) External Shield No. 316 connected to Pin No. 7 (cathode).

# 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 <sup>(1)</sup>	Unshielded
<b>Pentode Section</b>		
Grid No. 1 to Plate .....	—	0.016 Pf
Input: P <sub>g1</sub> to (h + P <sub>k</sub> + P <sub>g2</sub> + P <sub>g3</sub> + IS) .....	5.5	5.5 Pf
Output: P <sub>p</sub> to (h + P <sub>k</sub> + P <sub>g2</sub> + P <sub>g3</sub> + IS) .....	3.4	2.4 Pf
Heater to Cathode .....	2.8 <sup>(2)</sup>	2.8 Pf
<b>Triode Section</b>		
Grid to Plate .....	0.9	0.9 Pf
Input: T <sub>g</sub> to (T <sub>k</sub> + h + P <sub>k</sub> + P <sub>g3</sub> + IS) .....	1.9	1.7 Pf
Output: T <sub>p</sub> to (T <sub>k</sub> + h + P <sub>k</sub> + P <sub>g3</sub> + IS) .....	2.6	1.7 Pf
Heater to Cathode .....	2.8 <sup>(2)</sup>	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 $\mu$ mhos
Plate Current .....	12	0.8 Ma
Screen Current .....	4.0	— Ma
Grid No. 1 Voltage (Approx.) I <sub>b</sub> = 50 $\mu$ a .....	—	-1.5 Volts
Grid No. 1 Voltage (Approx.) I <sub>b</sub> = 20 $\mu$ a .....	-9	— Volts

**NOTES:**

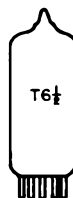
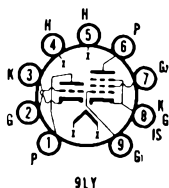
- (1) With external shield (EIA 315) connected to cathode of section under test unless otherwise indicated.
- (2) With external shield (EIA 315) connected to ground.

**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.



**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)<sup>(1)</sup>**

**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)**

	<b>Pentode Section</b>	<b>Triode Section</b>
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**

	<b>Pentode Section</b>	<b>Triode Section</b>
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 $\mu$ mhos
Plate Current .....	12	13.5 Ma
Screen Current .....	4.0	— Ma
Grid No. 1 Voltage (Approx.)		
Ib = 10 $\mu$ a.....	-8	-8 Volts

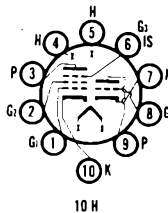
**NOTE:**

(1) With external shield (EIA 315) connected to cathode of section under test.



**Medium Mu Triode and Semi-Remote Cutoff Pentode**

Construction .....	Miniature T-6 $\frac{1}{2}$
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.



**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**

	<b>Shielded<sup>(1)</sup></b>	<b>Unshielded</b>
<b>Triode Section</b>		
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: $g_1$ to $(h + k + g_2 + Pk + IS)$ .....	5.0	5.0 Pf
Output: $p$ to $(h + k + g_2 + Pk + IS)$ .....	3.3	2.4 Pf
Heater to Cathode .....	3.0 <sup>(2)</sup>	3.0 Pf

**Coupling**

Pentode $g_1$ 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
<b>Class A1 Amplifier</b>		
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 $\mu$ mhos
Amplification Factor .....	40	—
Plate Resistance.....	5000	200 K Ohms
Grid No. 1 Voltage for $I_b = 20 \mu a$ (Approx.) .....	-9	-9
Gm with $E_c1 = 0 V, E_b = 100 V$ and $E_c2 = 70 V$ .....	—	7000 $\mu$ mhos

**NOTES:**

- (1) Shield No. 315 connected to Pin No. 4.
- (2) Shield No. 315 connected to Pin No. 3.

**AF AMPLIFIER**

**20E27**

**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.

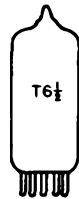
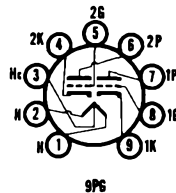
**ELECTRICAL DATA**

**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)**

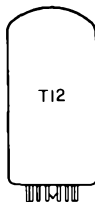
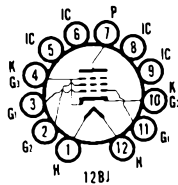
Plate Voltage .....	100	250 Volts
Grid Voltage .....	-1	-2 Volts
Amplification Factor .....	100	100
Plate Resistance .....	80,000	62,500 Ohms
Transconductance .....	1250	1600 $\mu$ mhos
Plate Current .....	0.5	1.2 Ma

# 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  $R_p = 9900$  Ohms,  $G_m = 9000$   $\mu$ mhos,  $I_b = 46$  Ma,  $I_{c2} = 1.8$  Ma,  $E_{c1}$  (for  $I_b = 1$  Ma)  $-32$  V and Triode amplification factor = 4.8.



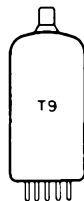
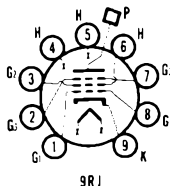
# 21KQ6

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**

Heater Voltage.....	<b>29KQ6</b>	<b>21KQ6</b>
Heater Current .....	29	21.5 Volts
Maximum Heater-Cathode Voltage .....	300	450 Ma
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: $g_1$ to ( $h + k + g_2 + g_3$ ) .....	27 Pf
Output: $p$ to ( $h + k + g_2 + g_3$ ) .....	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.) <sup>(1)</sup> .....	6500 Volts
Peak Negative Pulse Plate Voltage (Max.) <sup>(1)</sup> .....	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 <sup>(1)</sup> .....	0	0 Volt
Grid No. 2 Voltage .....	135	200 Volts
Grid No. 2 Circuit Resistance <sup>(2)</sup> .....	820	0 Ohms
Grid No. 1 Voltage .....	0	-12 Volts
Plate Current .....	450	550 <sup>(4)</sup> Ma
Grid No. 2 Current .....	35	50 <sup>(4)</sup> Ma

**NOTES:**

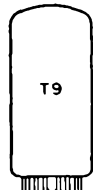
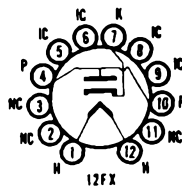
- (1) For application in horizontal deflection amplifiers circuits where the maximum pulse duration is 22% of a cycle with a maximum of 18  $\mu$ sec.
- (2) To prevent an excessive maximum grid No. 2 dissipation value, during the heating-up period the following minimum values of grid No. 2 circuit resistance 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.



**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**

Heater Voltage .....	6BW3	17BW3	22BW3
Heater Current .....	6.3	16.8	22.4 Volts
Heater Warm-up Time .....	1600	600	450 Ma
Maximum Heater-Cathode Voltage	—	11	11 Seconds

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.) <sup>(1)</sup> .....	5000 Volts
Plate Dissipation (Max.) .....	6.5 Watts
Steady State Peak Current (Max.) .....	1100 Ma
DC Plate Current (Max.) .....	175 Ma

**NOTE:**

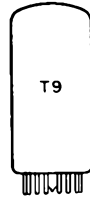
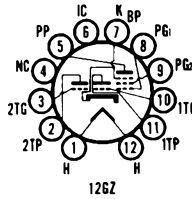
(1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.

2379

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<sup>(1)</sup>**

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<sup>(1)</sup>**

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 <sup>(2)</sup>	-8.0 Volts
Plate Resistance (Approx.) .....	—	11,700 $\mu$ mhos
Transconductance .....	—	7100 Ma
Plate Current .....	122	46 Ma
Screen Current .....	16.5	3.5 Ma
Grid No. 1 Voltage (Approx.) I <sub>b</sub> = 100 $\mu$ a .....	—	-25 Volts
<b>Triode Section 1</b>		
Plate Voltage .....		150 Volts
Grid Voltage .....		-2.0 Volts
Amplification Factor .....		43
Plate Resistance (Approx.) .....		11,000 Ohms
Transconductance .....		3900 $\mu$ mhos
Plate Current .....		5.4 Ma
Grid Voltage (Approx.) I <sub>b</sub> = 10 $\mu$ a .....		-5.7 Volts
<b>Triode Section 2</b>		
Plate Voltage .....		150 Volts
Grid Voltage .....		-5.0 Volts
Amplification Factor .....		20
Plate Resistance (Approx.) .....		8500 Ohms
Transconductance .....		2350 $\mu$ mhos
Plate Current .....		5.5 Ma
Grid Voltage (Approx.) I <sub>b</sub> = 10 $\mu$ a .....		-11 Volts

**NOTES:**

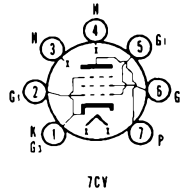
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) Applied for short interval (two seconds maximum) so as not to damage tube.

**AUDIO POWER AMPLIFIER**

**32E75A**

**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**

Heater Voltage .....	32 Volts
Heater Current .....	100 Ma
Heater Warm-up Time .....	20 Seconds
<b>Maximum Heater-Cathode Voltage</b>	
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 + g <sub>2</sub> + g <sub>3</sub> ) .....	12 Pf
Output: p to (h + k + g <sub>2</sub> + g <sub>3</sub> ) .....	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
<b>Grid No. 1 Circuit Resistance</b>	
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

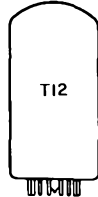
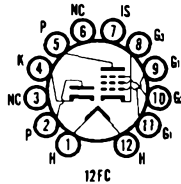
Zero-Signal Grid No. 2 Current.....	2.8 Ma
Transconductance .....	5500 $\mu$ mhos
Plate Resistance (Approx.) .....	21,000 Ohms
Load Resistance .....	2800 Ohms
Maximum Signal Power Output .....	1.2 Watts
Total Harmonic Distortion (Approx.) .....	10 Percent

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 .....	
Heater Negative with Respect to Cathode .....	<b>Pentode</b>
DC .....	—
Total DC and Peak .....	200
Heater Positive with Respect to Cathode .....	<b>Diode</b>
DC .....	100
Total DC and Peak .....	200

**DIRECT INTERELECTRODE CAPACITANCES (Unshielded)**

<b>Diode Section</b>	
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
<b>Pentode Section</b>	
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)**

<b>Pentode Section—Horizontal Deflection Amplifier Service<sup>(1)</sup></b>	
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.) <sup>(2)</sup> .....	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
<b>Diode Section—TV Damper Service</b>	
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**

<b>Pentode Section</b>			
Plate Voltage .....	3500	60	130 Volts
Screen Voltage .....	130	130	130 Volts
Grid No. 1 Voltage .....	—	0 <sup>(3)</sup>	-22.5 Volts
Plate Resistance (Approx.) .....	—	—	10,000 Ohms
Transconductance .....	—	—	6500 $\mu$ mhos
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 <sup>(4)</sup> .....	—	—	4.0



**Diode Section**

Tube Voltage Drop  
 $I_b = 250 \text{ Ma DC}$  ..... 21 Volts

**NOTES:**

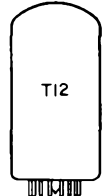
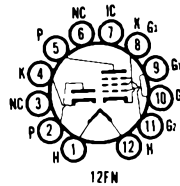
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) In stages operating with grid 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  $E_b = E_{c2} = 130 \text{ volts}$  and  $E_{c1} = -22.5 \text{ volts}$ .

**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.



**ELECTRICAL DATA  
 HEATER OPERATION**

Heater Voltage.....		33.6 Volts
Heater Current .....		450 Ma
Heater Warm-up Time .....		11 Seconds
Maximum Heater-Cathode Voltage .....	<b>Pentode</b>	<b>Diode</b>
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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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<sup>(1)</sup>**

Peak Inverse Plate Voltage .....  
 Plate Dissipation .....  
 Steady State Peak Plate Current.....  
 DC Output Current.....  
 Bulb Temperature at Hottest Point .....

**Pentode Section**

**Diode Section**

4200 Volts  
 3.8 Watts  
 810 Ma  
 135 Ma  
 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 $\mu$ mhos
Plate Current .....	—	320	48 Ma
Screen Current .....	—	22	2.9 Ma
Grid No. 1 Voltage (Approx.)			
I <sub>b</sub> = 1.0 Ma .....	-80	—	-40 Volts
Triode Amplification Factor <sup>(1)</sup> .....	—	—	4.0

**Diode Section**

Tube Voltage Drop			
I <sub>b</sub> = 250 Ma DC .....	—	—	21 Volts

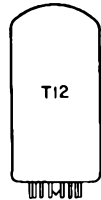
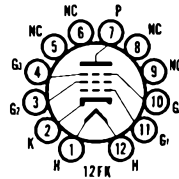
**NOTES:**

- (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.



**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<sup>(1)</sup>**

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.) <sup>(2)</sup> .....	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 $\mu$ mhos
Plate Resistance.....	11,000 Ohms
Amplification Factor <sup>(3)</sup> .....	4.7
E <sub>c1</sub> for I <sub>b</sub> = 1.0 Ma (Approx.) .....	-33 Volts

**INSTANTANEOUS PLATE KNEE VALUES**

E<sub>b</sub> = 60 V; E<sub>c2</sub> = 130 V and E<sub>c1</sub> = 0 V  
 I<sub>b</sub> = 410 Ma, and I<sub>c2</sub> = 24 Ma

**NOTES:**

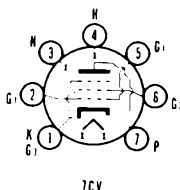
- (1) For operation in a 525 line, 30 frame system as described in "Standards of Good Engineering Practice for Television Broadcast Stations; Federal Communications Commission," the duty cycle of the voltage pulse must not exceed 15% of one horizontal scanning cycle.
- (2) In stages operating with grid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



**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: g <sub>1</sub> to (h + k + g <sub>2</sub> + g <sub>3</sub> ) .....	12 Pf
Output: p to (h + k + g <sub>2</sub> + g <sub>3</sub> ) .....	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 $\mu$ mhos
Plate Resistance (Approx.) .....	13,000 Ohms
Load Resistance .....	2500 Ohms
Maximum Signal Power Output .....	1.4 Watts
Total Harmonic Distortion (Approx.) .....	10 Percent

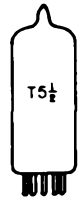
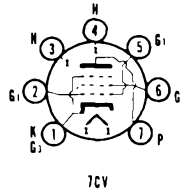
# 35C5

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.



**ELECTRICAL DATA  
 HEATER OPERATION**

Heater Voltage.....	11C5
Heater Current.....	11.6
Maximum Heater-Cathode Voltage.....	450
	200

<b>35C5</b>
35 Volts
150 Ma
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**

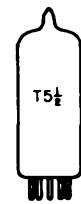
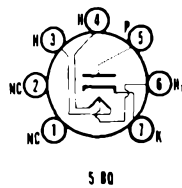
Plate Voltage.....	110 Volts
Screen Voltage.....	110 Volts
Control Grid Voltage.....	-7.5 Volts
Peak AF Control Grid Voltage.....	7.5 Volts
Zero Signal Plate Current.....	40 Ma
Maximum Signal Plate Current.....	41 Ma
Zero Signal Screen Current.....	3 Ma
Maximum Signal Screen Current.....	7 Ma
Plate Resistance (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.



**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  $\mu$ f**

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  $\mu$ f**

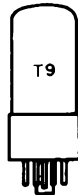
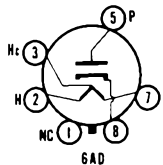
Heater Voltage.....	35 Volts
Heater Current .....	150 Ma
Plate Supply Voltage (RMS) .....	117 Volts
Minimum Effective Plate Supply Impedance .....	15 Ohms
DC Output Current.....	100 Ma
Maximum Value of Panel Lamp Shunting Resistor	
70 Ma Output .....	800 Ohms
80 Ma Output .....	400 Ohms
90 Ma Output .....	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:**

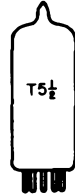
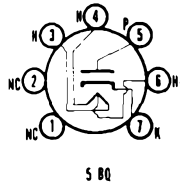
(1) Plate Current must not flow through tap section (Pins 2 and 3).

# 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.



### ELECTRICAL DATA

#### HEATER OPERATION

Heater Voltage (Pins 3 and 4) <sup>(1)</sup> .....	36 Volts
Heater Voltage (Pins 3 and 6) <sup>(1)</sup> .....	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

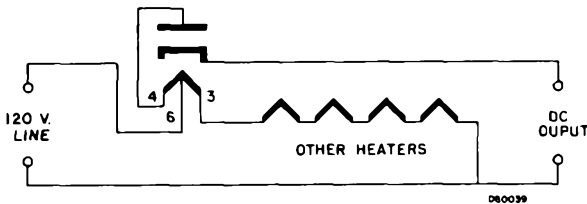
#### CHARACTERISTICS AND TYPICAL OPERATION

Tube Voltage Drop with Plate Current = 150 Ma .....	16 Volts
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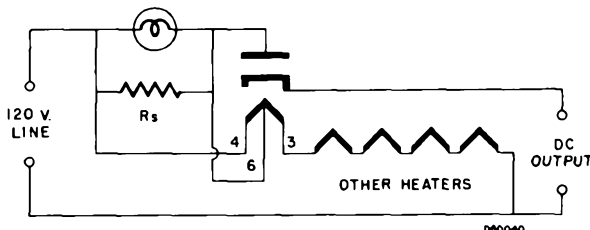
#### NOTE:

(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

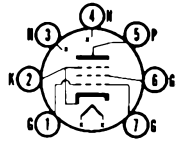


**AUDIO POWER AMPLIFIER**

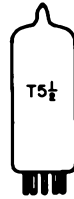
**50B5**

**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.



7BZ



**ELECTRICAL DATA**

**HEATER OPERATION**

Heater Voltage .....  
 Heater Current .....  
 Maximum Heater-Cathode Voltage .....

50 Volts  
 150 Ma  
 180 Volts

**DIRECT INTERELECTRODE CAPACITANCES (Unshielded)**

Grid to Plate .....  
 Input .....  
 Output .....

0.64 Pf  
 13 Pf  
 6.5 Pf

**RATINGS (Design Center Rating System)**

Plate Voltage (Max.) .....  
 Grid No. 2 Voltage (Max.) .....  
 Plate Dissipation (Max.) .....  
 Grid No. 2 Dissipation (Max.) .....  
 Control Grid Circuit Resistance  
 Fixed Bias (Max.) .....  
 Cathode Bias (Max.) .....

135 Volts  
 117 Volts  
 5.5 Watts  
 1.25 Watts  
 0.1 Megohm  
 0.5 Megohm

**CHARACTERISTICS AND TYPICAL OPERATION**

**Class A1 Amplifier**

Plate Voltage .....  
 Grid No. 2 Voltage .....  
 Grid No. 1 Voltage .....  
 Peak AF Grid No. 1 Voltage .....  
 Zero-Signal Plate Current .....  
 Maximum-Signal Plate Current .....  
 Zero-Signal Grid No. 2 Current .....  
 Maximum-Signal Grid No. 2 Current .....  
 Plate Resistance (Approx.) .....  
 Transconductance .....  
 Load Resistance .....  
 Maximum Signal Power Output .....  
 Total Harmonic Distortion (Approx.) .....

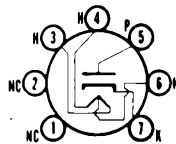
110 Volts  
 110 Volts  
 -7.5 Volts  
 7.5 Volts  
 49 Ma  
 50 Ma  
 4.0 Ma  
 8.5 Ma  
 10,000 Ohms  
 7500 μmhos  
 2500 Ohms  
 1.9 Watts  
 9.0 Percent

**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.



5BQ



**ELECTRICAL DATA**

**HEATER OPERATION (Without Panel Lamp)**

Heater Voltage (AC or DC) .....  
 Heater Tap Voltage .....  
 Heater Current .....  
 Maximum Heater-Cathode Voltage  
 Heater Negative with Respect to Cathode .....  
 Heater Positive with Respect to Cathode .....

50 Volts  
 7.5 Volts  
 150 Ma  
 330 Volts  
 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 $\mu$ f
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 $\mu$ f
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**

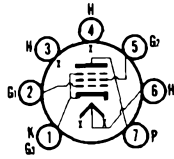
For Ib = 240 Ma DC .....	21 Volts
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**50HC6**

**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**

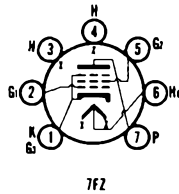
Plate Voltage .....	110 Volts
Screen Voltage .....	115 Volts
Cathode-Bias Resistor .....	62 Ohms
Peak AF Grid No. 1 Voltage .....	3.0 Volts
Plate Resistance (Approx) .....	11,000 Ohms
Transconductance .....	14,600 $\mu$ mhos
Zero-Signal Plate Current .....	42 Ma
Maximum-Signal Plate Current .....	42 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-5 $\frac{1}{2}$
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.



**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**

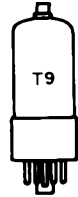
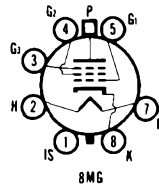
Plate Voltage .....	110 Volts
Screen Voltage .....	110 Volts
Grid No. 1 Voltage .....	-7.5 Volts
Peak AF Grid No. 1 Voltage .....	7.5 Volts
Plate Resistance (Approx.) .....	10,000 Ohms
Transconductance .....	7500 $\mu$ mhos
Zero-Signal Plate Current .....	49 Ma
Maximum-Signal Plate Current .....	50 Ma
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
<b>Maximum Heater-Cathode Voltage</b>	
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.) <sup>(1)</sup> .....	7700 Volts
Peak Negative Pulse Plate Voltage (Max.) <sup>(1)</sup> .....	1650 Volts
Grid No. 3 Voltage (Max.) <sup>(2)</sup> .....	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 $\mu$ mhos
Plate Resistance (Approx.).....	5000 Ohms
Amplification Factor <sup>(3)</sup> .....	5.6

**NOTES:**

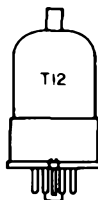
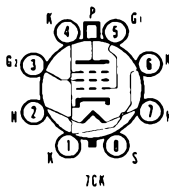
- (1) Valid for application in horizontal deflection amplifiers circuits where the maximum pulse duration is 22% of a cycle with a maximum of 18  $\mu$ sec.
- (2) In horizontal deflection amplifier service, a positive voltage may be applied to grid No. 3 to reduce interference from snivets which may 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) <sup>(1)</sup> .....	175	220	175	220 Ma
Plate Input (Max. Signal) <sup>(1)</sup> .....	90	120	90	120 Watts
Plate Dissipation <sup>(1)</sup> .....	27	35	27	35 Watts
Grid No. 2 Input (Max. Signal) <sup>(1)</sup> .....	3	3	3	3 Watts
Grid No. 1 Circuit Resistance <sup>(4)(5)</sup> .....	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 <sup>(1)</sup>		Telephony 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 <sup>(1)(3)</sup> .....	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 $\mu$ mhos
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 <sup>(2)</sup> .....	200	200 Volts
Grid No. 1 Voltage .....	-47	-48 Volts
Peak AF G1 to G1 Voltage <sup>(3)</sup> .....	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 <sup>(2)</sup> .....	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
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) <sup>(5)</sup> .....	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 <sup>(7)</sup> .....	200	200 Volts
Grid No. 1 Voltage <sup>(7)</sup> .....	-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 <sup>(6)</sup>		
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 <sup>(9)</sup> .....	165	175 Volts
Grid No. 1 Voltage <sup>(10)</sup> .....	-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 Telephony—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 <sup>(11)</sup> .....	200	200	210	220	230 Volts
Grid No. 1 Voltage <sup>(12)</sup> .....	-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.

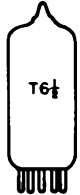
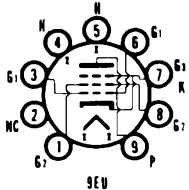
- (5) Driver stage should be capable of supplying the specified driving power at low distortion to the No. 1 grids of the AB2 stage.
- (6) To minimize distortion, the effective resistance per Grid No. 1 circuit of the AB2 stage should be held at a low value. For this purpose the use of transformer coupling 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.



**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)**

	<b>Ultra-Linear Conn.</b>	<b>Pentode Conn.</b>
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	
		250	350	400	300	310 Volts
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	—	—	—	—	— $\mu$ mhos
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
E <sub>c1</sub> for I <sub>b</sub> = 100 $\mu$ a	-40	—	—	—	—	— Volts

**Class AB Ultra-Linear Conn.**

Plate Supply Voltage	375 <sup>(1)</sup>	370 <sup>(2)</sup> 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.

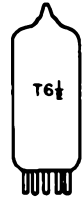
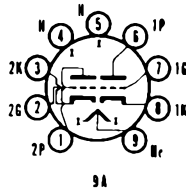
**7025**

*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.

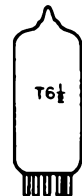
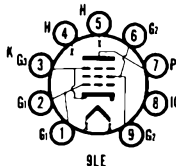


**7189A**

**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 ..... 3.062 In.



**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.) <sup>(1)</sup> .....	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.		Ultra-linear Conn.
	Single Tube Class A1	Class AB Push-Pull	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) <sup>(2)</sup> .....	—	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	—	— $\mu$ mhos
Amplification Factor <sup>(3)</sup> .....	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:**

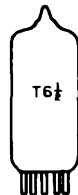
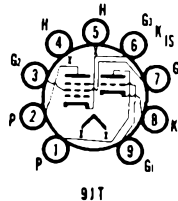
- (1) Grid No. 2 voltage is obtained from taps located at 43 percent of the output transformer windings.
- (2) Per grid
- (3) Measured from Grid No. 1 to Grid No. 2.

**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.



**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 $\mu$ mhos
Amplification Factor .....	17	—
Plate Resistance.....	0.0081	1.0 0.4 Megohm
Ec1 for Ib = 10 $\mu$ a (Approx.) .....	40	4 — Volts

**Equivalent Noise and Hum Voltage (Referenced to Grid)**

	Triode Section <sup>(1)</sup>	Pentode Section <sup>(2)</sup>
Average Value .....	10	15 $\mu$ Volts rms
Maximum Value .....	50	35 $\mu$ Volts rms

**NOTES:**

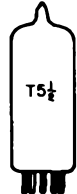
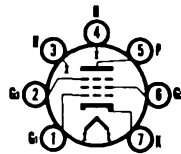
- (1) Measured under the following conditions: Ef = 6.3 Vac; center-tap of heater transformer grounded; Ebb = 250 Vdc; RL = 0.1 Megohm; Rk = 1500 ohms; Rg = 50,000 ohms; F = 25 to 10,000 Hertz.
- (2) Measured under the following conditions: Ef = 6.3 Vac; center tap of heater transformer grounded; Ebb = 250 Vdc; RL = 0.22 Megohm; Ecc2 = 250 Vdc; Rg2 = 330,000 ohms; Cg2 = 0.1  $\mu$ f; 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 <sup>(1)</sup>	Unshielded
<b>Pentode Connection</b>		
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
<b>Triode Connection<sup>(2)</sup></b>		
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. <sup>(2)</sup>	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. <sup>(2)</sup>	Pentode Connected	
		100	250
Plate Voltage.....	250	100	250 Volts
Grid No. 3 Voltage.....	—	Connected to Cathode at Socket	
Grid No. 2 Voltage.....	—	100	125 Volts
Cathode Bias Resistor.....	330	150	100
Plate Current.....	12.2	5.0	7.6
Grid No. 2 Current.....	—	2.1	3.0
Transconductance.....	4800	3900	4500
Amplification Factor.....	36	—	—
Plate Resistance (Approx.).....	—	0.5	1.5
Ec1 for Ib = 10 $\mu$ a (Approx.).....	—	-4.2	-5.5
			-6.5 Volts

**NOTES:**

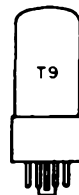
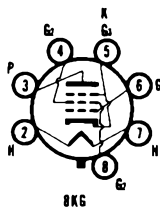
- (1) Shield No. 316 connected to Cathode Pin No. 7.
- (2) When operated as a triode Grid No. 2 and Grid No. 3 should be tied to the plate.

**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 Sealed 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.) <sup>(1)</sup> .....	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		Ultra-Linear Operation <sup>(2)</sup>	
	S. T. - Class A1 Amp.		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	—	— $\mu$ mhos	
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 <sup>2</sup>	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transcon-ductance Micros.	Amplifi-cation Factor	Ohms Load for Stated Power Output	Power Output Milli-watts
	Bulb Size or Style	Class	Biasing Diag. <sup>1</sup>	Volts	Amps.												
OA2 GB-OA2WA (3)	T-5½	Diode	5B0	.....	.....	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										
OB2 GB-OB2WA (3)	T-5½	Diode	5B0	.....	.....	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	5B0	.....	.....	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.											
1A3	T-5½	Diode	5AP	1.4	0.150	Detector											
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 <sup>A</sup>	(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. <sup>4</sup> 5 Meg. <sup>4</sup>	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.											
1AJ5	T-2X3	Diode Pent.	1AJ5	1.25†	0.040	Det. Amp.	45	0	45	1.0	0.3	300000	425	.....	.....	.....	.....

Voltage Regulator with Starting Voltage at 185, Operating Voltage 150, Operating Current 5 to 30 Ma.

Voltage Regulator with Starting Voltage at 165, Operating Voltage 75, Operating Current 5 to 40 Ma.

Relay Tube Peak Cathode Ma. = 100 D.C. Cathode Ma. = 25 Max. Starter Anode Drop = 60 V. Approx. Anode Drop = 70 V. Approx.

Switching 750 Trigger Grid Voltage = +90 Volts. Trigger Pulse Voltage = 160 Volts. Keep Alive Current = 50 µa.

Voltage Regulator with Starting Voltage at 115, Operating Voltage 105, Operating Current 5 to 30 Ma.

Voltage Regulator with Starting Voltage at 125, Operating Volts 90, Operating Current 5 Ma. Min., 30 Ma. Max.

Voltage Regulator with Starting Voltage at 105, Operating Voltage 75, Operating Current 5 Ma. Min., 30 Ma. Max.

Voltage Regulator with Starting Voltage at 135, Operating Volts 105, Operating Current 5 Ma. Min., 40 Ma. Max.

Voltage Regulator with Starting Voltage at 180, Operating 150 Volts, Operating Current 5 Ma. Min., 40 Ma. Max.

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.

Half Wave Cathode Type Rectifier for H. F. Use.

85 4.5 85 3.5 0.7 300000 800 25000 100  
90 4.5 90 4.0 0.8 300000 850 25000 11590 0.0 90 0.6 1.2 600000 250<sup>A</sup> (Ga = 90 V. Max. 1.2 Ma.)30 2.0 30 0.5 0.1 200000 450 50000 5  
45 3.0 45 1.0 0.2 170000 600 40000 15  
67.5 4.5 67.5 2.0 0.4 150000 750 25000 5030 0 30 0.45 0.16 700000 430 25000 100  
45 0 45 0.9 0.35 700000 580 25000 115  
67.5 0 67.5 1.85 0.75 700000 735 25000 115

90 0 90 3.5 1.2 500000 1550 25000 115

67.5 0 67.5 1.2 0.32 2.2 Meg. 925 25000 115  
90 0 90 1.8 0.55 1.8 Meg. 1050 25000 11567.5 0 67.5 0.7 0.25 2.8 Meg. 550 25000 115  
90 0 90 1.1 0.4 2.0 Meg. 600 25000 115

41.4 3.6 41.4 2.4 0.6 180000 1000 12000 35

45 2.0 45 0.28 0.12 2.5 Meg. 250 25000 115

45 5 Meg.<sup>4</sup> 45 0.75 0.2 1.5 Meg. 750 25000 115  
67.5 5 Meg.<sup>4</sup> 67.5 0.75 0.2 2.0 Meg. 750 25000 115Flyback H-W Rect. Maximum Peak Inverse Plate Voltage = 26,000 Volts. Maximum Peak Plate Current = 50 Ma.  
Maximum Average Plate Current = 0.5 Ma.

Det. Amp. 45 0 45 1.0 0.3 300000 425 25000 115

1AK4	T-2X3	Pentode	1AK4	1.25 $\phi$	0.020	Class A1 Amp.	....	45	0	45	0.75	0.2	1500000	750	(Screen Supply = 67.5 Volts Thru .11 Meg. Res.)
1AK5	T-2X3	Diode Pent.	1AK5	1.25 $\phi$	0.020	Det. Amp.	....	45	0	45	0.5	0.2	2000000	750	....
1AN5	T-5½	Pentode	7ES	1.4 $\phi$	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 $\phi$	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 $\phi$	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 $\phi$	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 $\phi$	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 $\phi$	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 $\phi$	0.050	Det. Amp.	....	67.5	0	67.5	2.1	0.55	.6 Meg.	630	....
1DY4A	T-5½	Triode	7DK	1.5	0.600	UHF Oac.	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 $\phi$	0.050	Det. Amp.	....	90	0.0	....	0.15	....	240000	275	65
1J3A	T-9	Diode	3C	1.25 $\phi$	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 $\phi$	0.050	R-F Amp.	....	90	0	67.5	2.9	1.2	600000	925	....
								90	0	90	4.5	2.0	350000	1025	....
1L6	T-5½	Heptode	7DC	1.4 $\phi$	0.050	Converter	....	90	0	45	0.5	0.6	650000	300 <sup>A</sup>	(Ga = 90 V., 1.2 Ma.)
1LA4	Lock-in	Power Pent.	5AD	1.4 $\phi$	0.050	Power Amp.	....	85	4.5	85	3.5	0.7	300000	800	25000 100
								90	4.5	90	4.0	0.8	300000	850	25000 115
1LA6	Lock-in	Heptode	7AK	1.4 $\phi$	0.050	Converter	....	90	0.0	45	0.55	0.6	750000	250 <sup>A</sup>	(Ga = 90 V. Max., 1.2 Ma.)
1LB4	Lock-in	Power Pent.	5AD	1.4 $\phi$	0.050	Power Amp.	....	45	4.5	45	1.6	0.3	400000	650	20000 35
								67.5	6.0	67.5	3.8	0.8	300000	875	16000 100
								90	9.0	90	5.0	1.0	250000	925	12000 200
1LC5	Lock-in	Pentode	7AO	1.4 $\phi$	0.050	R-F Amp.	....	45	0.0	45	1.1	0.35	700000	750	....
								90	0.0	45	1.15	0.30	1.5 Meg.	775	....
1LC6	Lock-in	Heptode	7AK	1.4 $\phi$	0.050	Converter	....	45	0.0	35	0.7	0.75	300000	250 <sup>A</sup>	(Ga = 45 V. Max., 1.4 Ma.)
								90	0.0	35	0.75	0.7	650000	275 <sup>A</sup>	(Ga = 45 V. Max., 1.4 Ma.)
1LD5	Lock-in	Diode Pent.	6AX	1.4 $\phi$	0.050	Amplifier	....	45	0.0	45	0.55	0.12	750000	550	....
								90	0.0	45	0.6	0.1	750000	575	....
1LE3	Lock-in	Triode	4AA	1.4 $\phi$	0.050	Amplifier	....	90	0.0	....	4.5	....	11200	1300	14.5
								90	3.0	....	1.4	....	19000	760	14.5
1LG5	Lock-in	Pentode	7AO	1.4 $\phi$	0.050	R-F Amp.	....	45	0	45	1.5	0.45	350000	800	....
								90	0	45	1.7	0.4	1000000	800	....
								90	1.5	90	3.7	0.9	500000	1050	....
1LH4	Lock-in	Diode Triode	5AQ	1.4 $\phi$	0.050	Det. Amp.	....	90	0.0	....	0.15	....	240000	275	65

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts <sup>2</sup>	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transcon-ductance Micros.	Amplifi-cation Factor	Ohms Load for Stated Power Output	Power Output Milli-watts		
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	Volts	Amps.														
1LN5	Lock-in	Pentode	7AO	1.4 $\phi$	0.050	R-F Amp.	....	90	0.0	90	1.6	0.35	1.1 Meg.	800	....	....	....		
1N2A	T-12	Diode	3C	1.25 $\phi$	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.											
1N5QT	T-9	Pentode	5Y	1.4 $\phi$	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 $\phi$	0.150	Detector	....	Half Wave Cathode Type Rectifier for High Frequency Use.											
1R5	T-5½	Heptode	7AT	1.4 $\phi$	0.050	Converter	....	45	0.0	45	0.7	2.1	500000	210 <sup>A</sup>	....	....	....		
								90	0.0	67.5	1.5	3.5	400000	280 <sup>A</sup>	....	....	....		
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 $\phi$	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 $\phi$	0.050	Det. Amp.	....	67.5	0.0	67.5	1.6	0.4	600000	625	....	....	....		
1S6	T-3	Diode Pent.	8DA	1.25 $\phi$	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 $\phi$	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 $\phi$	0.050	R-F Amp.	....	90	0	90	1.6	0.45	1.6 Meg.	900	....	....	....		
1U5	T-5½	Diode Pent.	6BW	1.4 $\phi$	0.050	Det. Amp.	....	Characteristics Same as Type 1S5.											
1U6	T-5½	Heptode	7DC	1.4 $\phi$	0.025	Converter	....	67.5	0	45	0.5	0.7	500000	260 <sup>A</sup>	....	....	....		
								90	0	45	0.6	0.6	500000	275 <sup>A</sup>	....	....	....		
								(Ga = 67.5 V., 1.0 Ma.) (Ga = 90 V., 1.1 Ma.)											
1V6	T-2x3	Tri. Pentode	1V6	1.25 $\phi$	0.040	R-F Osc. R-F Amp.	....	45	1 Meg. <sup>4</sup>	....	0.4	IG1 = 12 $\mu$ a	....	....	....	....	....		
								45	5 Meg. <sup>4</sup>	45	0.4	0.15	Conv. = 1.0 Meg.	200 <sup>A</sup>	....	....	....		
2A3	ST-16	Triode	4D	2.5 $\phi$	2.500	S.T. A1 Amp. P.P.AB1 Amp.	16.5	250	45.0	....	60.0	....	800	5250	4.2	2500	3500		
								300	62.0	....	80-147 $\uparrow$	....	Push Pull, Fixed Bias	3000 $\uparrow$	....	15000	....		
2A22	T-6½	Diode	9Y	2.1 $\phi$	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 $\phi$	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 $\phi$	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 Power Amp.	2.3	250	16.5	....	8.3	....	7600	1375	10.4	20000	....		
								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 <sup>B</sup>	....	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 <del>†</del> 2.50 <del>†</del>	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 Oac.	2.2	Characteristics Same as Type 6D X4.									
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	
2EA6	T-5½	Tetrode	7EW	2.4	0.600	VHF Amp.	3.25	Characteristics Same as Type 6EA5.									
2EG4	Nuvtior	Triode	12AQ	1.7	0.600	VHF Amp.	1.5	110	130 <sup>#</sup>	.....	6.5	.....	7000	12500	68	.....	.....
2EN6	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 <del>†</del>	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 <del>†</del> 2.8 <del>†</del>	0.200 0.100	Power Amp.	2.5	135	7.5	90	14.8	2.6	90000	1900	.....	8000	600
								150	8.4	90	13.3	2.2	100000	1900	.....	8000	700
3A5	T-5½	Duotriode	7BC	1.4 <del>†</del> 2.8 <del>†</del>	0.220 0.110	Amplifier	0.55	90	2.5	.....	3.7	.....	8300	1800	15	.....	.....
								135	20.0	.....	30.0	.....	Push-Pull Class C R.F. Amp.		.....	.....	2000
3AF4A	T-5½	Triode	7DK	3.2	0.450	UHF Oac.	2.5	Characteristics Same as Type 6AF4A.									
3AW3	T-9	Diode	8EZ	3.15 <del>†</del>	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 <del>†</del> 1.4 <del>†</del>	0.110 0.220	Power Amp. Oscillator	2.97	135	0	.....	22.0	(Class AB2)	.....	1900	20	16000	1500
								180	0	.....	25.0	(Class C) R.F. Pwr. Amp.	2800 mw at 25 mc,	1400 mw at 125 mc.			
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	1.1	57	5.5	1.6	250000	5000	.....	.....	.....
								250	2.0	100	10	2.5	600000	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 <del>†</del>	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 <del>†</del>	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 <del>†</del>	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 <del>†</del> 1.4 <del>†</del>	0.110 0.220	Power Amp.	4.95	150	4.5	90	10.2	1.8	(Class A)	2400	.....	14000	600
								150	20.0	135	23.0	6.0	(Class C)	R.F. Power Amp. at 50 mc.	.....	1400	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 <sup>2</sup>	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 Milli-watts
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	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 <sup>⚡</sup> 2.8 <sup>⚡</sup>	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 <sup>⚡</sup> 2.8 <sup>⚡</sup>	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 <sup>⚡</sup> 2.8 <sup>⚡</sup>	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 <sup>⚡</sup> 2.8 <sup>⚡</sup>	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 <sup>⚡</sup> 2.8 <sup>⚡</sup>	0.100 0.050	Power Amp.	.....	Characteristics Same as Type 3Q4.									
3Z4	T-5½	Power Pent.	7BA	1.4 <sup>⚡</sup> 2.8 <sup>⚡</sup>	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	6	.....	13	.....	5750	3300	19	.....	.....
								200	180♠	150	9.5	2.8	300000	6200	.....	.....	.....
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	390♠	.....	7.3	.....	12000	4400	53	.....	.....
								125	56♠	125	13.5	3.8	150000	8600	.....	.....	.....
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	8.5	.....	10.5	.....	7700	2200	17	.....	.....
								250	2.0	.....	1.2	.....	62500	1600	100	.....	.....
5HC7	Comp. T-9	Double Tri.	12FR	5.6	0.450	Sync. Clipper	3.0 1.2	150	1	.....	18	.....	5200	4400	23	.....	.....
								150	1	.....	1	.....	53000	1900	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 <sup>2</sup>	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 Milli-watts
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	Volts	Amps.												
5U4G	ST-16	Duodiode	5T	5.0 $\phi$	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 $\phi$	3.000	F-W Rect.	....	450 A.C. Volts Per Plate, RMS, 250 Ma. Output Current. Peak Current = 900 Ma. Per Plate.				Condenser Input to Filter.					
5U4WG(3)	T-12	Duodiode	5T	5.0 $\phi$	3.000	F-W Rect.	....	Characteristics Same as Type 5U4GB.									
5V3	T-12	Duodiode	5T	5.0 $\phi$	3.800	F-W Rect.	....	425 A.C. Volts Per Plate, RMS, 350 Ma. Output Current. 500 A.C. Volts Per Plate, RMS, 350 Ma. Output Current.				Condenser Input to Filter. Choke Input to Filter.					
5Y3GA QB-5Y3WGTA(3)	T-9 T-12	Duodiode	5T	5.0 $\phi$	2.000	F-W Rect.	....	350 A.C. Volts Per Plate, RMS, 125 Ma. Output Current. 500 A.C. Volts Per Plate, RMS, 125 Ma. Output Current.				Condenser Input to Filter. Choke Input to Filter.					
5Y4GT	T-9	Duodiode	5Q	5.0 $\phi$	2.000	F-W Rect.	....	Characteristics Same as Type 5Y3GT.									
5Z3	ST-16	Duodiode	4C	5.0 $\phi$	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 $\phi$	1.000	S.T. A1 Amp. P.P.AB1 Amp. P.P.AB1 Amp.	16.5 .... ....	250 325 325	45.0 68.0 ....	.... .... ....	60.0 80-147 $\uparrow$ (Push Pull, Fixed Bias) 80-100 $\uparrow$ (Push Pull, Self Bias Resistor 850 Ohms)	800 5250	4.2	2500 3000 $\uparrow$ 5000 $\uparrow$	3200 15000 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	100 250	1.5 3.0	50 100	1.1 3.5	1.3 2.7	600000 360000	360 <sup>*</sup> 550 <sup>*</sup>	(Ga = 100V.) (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-6 $\frac{1}{2}$	Tri. Pentode	6AB8	6.3	0.300	A-F Amp. S.T.A1 Amp.	1.0 ....	100 170	2.3 6.3	170	4 15	2.8	12500 150000	1400 3300	17 ....	11000 1000	
6AB9	T-6 $\frac{1}{2}$	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 <sup>m</sup>	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 <sup>m</sup>	....	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 Video Amp.	3.0 5.0	200 200	2 68 <sup>m</sup>	150 125	10 22	2.5 4	10000 75000	23000	....	....	
6AG5	T-5 $\frac{1}{2}$	Pentode	7BD	6.3	0.300	R-F Amp.	2.0	100 125 250	180 <sup>m</sup> 100 <sup>m</sup> 180 <sup>m</sup>	100 125 150	4.5 7.2 6.5	1.4 2.1 2.0	600000 500000 800000	4500 5100 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 <sup>m</sup>	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-6 $\frac{1}{2}$	Triode	9BX	6.3	0.225	UHF Amp.	2.2	125	68 <sup>m</sup>	....	16	....	4200	10000	42	....	
6AJ5	T-5 $\frac{1}{2}$	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 <sup>m</sup>	....	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. Defl. Amp.	.....	Maximum Peak Positive Plate Voltage = 2,500 Volts.					Maximum D.C. Cathode Current = 80 Ma.				
							10.0	150	14.0	150	49.0	3.5	16400	6200	.....	.....	.....
							1.0	150	5.0	.....	5.5	.....	8500	2350	20	.....	.....
							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 <sup>■</sup>	100	1.3	2.1	150000	G1-1000	.....	.....	.....
													G3-400	.....	.....	.....	
							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 <sup>■</sup>	.....	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 for VR Service	14.3	135	250 <sup>■</sup>	.....	125	.....	280	70000	2	.....	.....
							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 <sup>■</sup>	100	5.0	2.1	500000	3900	.....	.....	.....
								250	100 <sup>■</sup>	125	7.6	3.0	1.5 Meg.	4500	.....	.....	.....
								250	68 <sup>■</sup>	150	10.6	4.3	1.0 Meg.	5200	.....	.....	.....
6AX8	T-6½	Tri. Pentode	9AE	6.3	0.450	Sync. Sep. Video Amp.	2.97	150	56 <sup>■</sup>	.....	18	.....	5000	8500	40	.....	.....
							3.0	250	120 <sup>■</sup>	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 <sup>■</sup>	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 <sup>■</sup>	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 <sup>+</sup>	.....	.....	.....
								250	1.0	100	3.8	10.0	1 Meg.	950 <sup>+</sup>	.....	.....	.....
6BC5/6CE5	T-5½	Pentode	7BD	6.3	0.300	Tri. Amp.	2.75	250	820 <sup>■</sup>	.....	6.0	.....	9000	4400	40	.....	.....
								180	330 <sup>■</sup>	.....	8.0	.....	6000	6000	42	.....	.....
							2.2	100	180 <sup>■</sup>	100	4.7	1.4	600000	4900	.....	.....	.....
								125	100 <sup>■</sup>	125	8.0	2.4	500000	6100	.....	.....	.....
								250	180 <sup>■</sup>	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. VHF Amp.	2.75	150	56 <sup>■</sup>	.....	18.0	.....	5000	8500	40	.....	.....
							3.0	250	68 <sup>■</sup>	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 <sup>2</sup>	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 Milli-watts
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	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 <sup>#</sup>	....	8.0	...	7000	4800	35	....	....
								100	100 <sup>#</sup>	....	8.0	...	7000	4800	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	2.5	....	1.6	...	45000	1550	70	....	....
								250	2.0	....	1.2	...	62000	1600	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 <sup>#</sup>	....	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	3.4	70	0.6	....	....	....	....	....	....
								20K	2.4	70	1.0	0.5	....	....	....	....	....
6BU8A	T-6½	Duo Pentode	9FG	6.3	0.300	Sync. Sep.	1.1	100	0 Grid 1	67.5	....	....	....	180 Gr. 3	Grid No. 3 Volts = -4.5	....	....
								100	....	67.5	2.2	....	....	1500 Gr. 1	Grid No. 1 Volts = -2.3	....	....
6BV8	T-6½	Duodiode Tri.	9FJ	6.3	0.600	Det. Amp.	2.7	200	330 <sup>#</sup>	....	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. 450 A.C. Volts Per Plate, RMS, 100 Ma. Output Current. Capacitor Input to Filter. Choke Input to Filter.									
6BW8	T-6½	Duodi. Pent.	9HK	6.3	0.450	R-F or I-F Amplifier	3.0	250	68 <sup>#</sup>	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	250	390 <sup>#</sup>	....	42	....	1300	7600	10	....	....
							13.2	250	390 <sup>#</sup>	....	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	3.0	100	2.0	0.5	1 Meg.	1185	....	....	....
								250	3.0	100	2.0	0.5	1 Meg. >	1225	....	....	....
6C8G	ST-12	Duotriode	8G	6.3	0.300	Amplifier Inverter	1.1	250	4.5	....	3.2	...	22500	1600	36	(One Section)	....
								250	3.0	....	3.2	...	22500	1600	36	(One Section)	....
										Plate Load 100,000 Ohms, Self-Bias Resistor 1500 Ohms, Voltage Amplification 48. Output Volts 80, RMS for Inverter Service.							
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	4.0	110	32	3.5	16000	8100	....	3500	1100
								125	4.5	125	37	4.0	15000	9200	....	4500	1500
6CF6	T-5½	Pentode	7CM	6.3	0.300	VHF Amp.	2.3	125	56 <sup>#</sup>	125	12.5	3.7	0.3 Meg.	7800	....	....	....

6CH7	T-6½	Duotriode	9FC	6.3	0.400	Amplifier	2.2	150	220 <sup>■</sup>	10	5300	6800	36			
6CH8	T-6½	Tri. Pentode	9FT	6.3	0.450	Tri. Amp. Pent. Amp.	2.82 2.2	200 200	180 <sup>■</sup>	150	13.0 9.5	2.8	5750 300000	3300 6200	19	
6CJ3	Novar T-9	Diode	9HP	6.3	1.800	T.V. Damper	6.5	Max. Peak Inverse Pulse Plate Voltage = 5500 Volts. Max. DC Plate Current = 350 Ma.								
6CK4	T-9	Power Triode	8JB	6.3	1.250	Vert. Defl. Amp.	12	250	28	40	Max. Peak Positive Pulse Plate Voltage = 2000 Volts. Max. D.C. Cathode Current = 100 Ma.					
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 Pulse Plate Voltage = 7000 Volts. Maximum D.C. Cathode Current = 200 Ma.								
6CQ4	T-9	Diode	4CG	6.3	1.600	T.V. Damper	6.5	Max. Peak Inverse Pulse 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. Pent. Amp.	2.75 2.3	125 125	2.0 56 <sup>■</sup>	125	12.0 13.0	3.0	5500 300000	4000 7700	22	
6CS8	T-6½	Tri. Pentode	9FZ	6.3	0.450	Tri. Amp. Pent. Amp.	2.75 2.3	125 125	2.0 56 <sup>■</sup>	125	12.0 13.0	3.0	5500 300000	4000 7700	22	
6CX7	T-6½	Duotriode	9FC	6.3	0.400	Amplifier	2.2	150	220 <sup>■</sup>	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	100 250	3.0 3.0	100 100	8.0 8.2	2.2 2.0	250000 800000	1500 1600		
6DA7	T-6½	Duotriode	9EF	6.3	1.000	Sect. 2 Vert. Defl. Amp. Sect. 1 Vert. Osc.	2.2 6.6	150 250	17.5 8.0	40.0 9.0	110 7700	5700 2600	6.3 20	Max. Peak Positive Pulse Plate Voltage = 1800 Volts. Max. D.C. Cathode Current = 40 Ma.		
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.								
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 <sup>■</sup>	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	110 200	7.5 180 <sup>■</sup>	110 125	49 46	4.0 2.2	13000 28000	8000 8000	2000 4000	2100 3800
6DG7	T-6½	Pentode	9BA	6.3	0.300	R-F or I-F Amplifier	3.3	100 250	68 <sup>■</sup> 68 <sup>■</sup>	100 100	10.8 11.0	4.4 4.2	250000 1 Meg.	4300 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 <sup>■</sup>	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.								
6DR4	T-5½	Triode	6BG	6.3	0.150	A-F Amp.	1.2	100 250	1.0 2.0	0.5 1.2	80000 1250 100 62500 1600 100					

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts <sup>2</sup>	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 Milli-watts
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	Volts	Amps.												
6DS6	T-5½	Beam Pent.	7BZ	6.3	0.800	Power Amp.	9.0	200 250	180 <sup>■</sup> 270 <sup>■</sup>	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. Damp	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. C.C. Cathode Current = 65 Ma.									
6DX4	T-5½	Triode	7DK	6.3	0.200	UHF Osc.	2.2	85	150 <sup>■</sup>	.....	10.0	.....	2700	11000	30	.....	.....
6DY4A	T-5½	Triode	7DK	6.3	0.125	UHF Osc.	1.5	90	180 <sup>■</sup>	.....	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 <sup>■</sup>	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 <sup>■</sup>	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.	..... 7.15	120 145	1500 <sup>■</sup> 180 <sup>■</sup>	..... 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 <sup>■</sup>	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. 175	Peak 30	Positive 175	Pulse 67	Plate Voltage = 7000 Volts.	Max. D.C. Cathode Current = 220 Ma.	.....	.....	.....	.....
6EY6	T-9	Beam Pent.	7S	6.3	0.680	Vert. Defl. Amp.	11	Max. 250	Peak 17.5	Positive 250	Pulse 44	Plate Voltage = 2500 Volts.	Max. D.C. Cathode Current = 60 Ma.	.....	.....	.....	.....
6F5	Metal T-9	Triode	5M	6.3	0.300	A-F Amp.	.....	250	2.0	.....	0.9	.....	66000	1500	100	.....	.....
6F5GT	T-9	Power Pent.	7S	6.3	0.700	Power Amp.	12.1	250	16.5	250	34.0	6.5	80000	2500	.....	7000	3200
6F6GT	S.T.A1 Amp.					285	20.0	285	38.0	7.0	78000	2550	.....	4800	.....		
	P.P.A1 Amp.					315	24.0	285	62-80†	12-19.5†	(Current & Output, 2 Tubes)	10000†	11000	.....	.....		
	P.P.A2 Amp.	375	26.0	250	34-82†	5-19.5†	(Current & Output, 2 Tubes)	10000†	18000	.....	.....						
6FA7	T-6½	Diode Duo Plate Tet.	9MR	6.3	0.300	Frequency Divider	1.5 1.5	100	2.2 Meg <sup>4</sup>	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 <sup>4</sup>	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 <sup>■</sup> 75 <sup>■</sup>	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.									
6FR7	9-T9	Duotriode	9HF	6.3	0.925	Vert. Defl. Amplifier Vert. Osc.	10 1.5	150 250	20 3.0	.....	50 1.4	.....	40000	7200 1600	5.4 68	.....	.....	
6FW5	T-12	Beam Pent.	6CK	6.3	1.200	Horiz. Defl. Amplifier	18	250	Max. Peak Positive Plate Voltage = 6500 Volts. Max. D.C. Cathode Current = 175 Ma.									
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	250	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.									
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 <sup>■</sup>	.....	15 10	3.3	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	.....	70 150	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	.....	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 <sup>■</sup>	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 0.22	.....	.....	2.5 1.0	.....	3400 8000	4600 1300 <sup>A</sup>	.....	.....	
6GN6	T-5½	Pentode	7FW	6.3	0.300	R-F Amp.	3.3	100 250	68 <sup>■</sup> 68 <sup>■</sup>	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	.....	14 150	.....	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	.....	14 125	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 <sup>■</sup>	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	250 250	18 3	250 .....	38 1.4	3	55000 34000	5100 2000	.....	.....	.....	
6HD5	Comp. T-12	Beam Pent.	12ES	6.3	2.250	Horiz. Defl. Amp.	24	135	Max. Peak Positive Pulse Plate Voltage = 7000 Volts. Max. Cathode Current = 280 Ma.									
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 <sup>■</sup>	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 <sup>2</sup>	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 Milli-watts	
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	Volts	Amps.													
6HV5	Comp. T-12	Beam Triode	12GY	6.3	1.8	Hi-Volt. Reg.	30	Maximum Peak Plate Voltage = 5500 Volts. 3500 Pulse	4.4	300 Peak	5500	1.4	4600	65000	300	325 Ma.		
6HW8	T-6½	Duo. Plate Sheet Beam	9NQ	6.3	0.300	Duo. Plate Sheet Beam	2.0	250 Defl. Switching	270 <sup>■</sup>	250	13	1.4	4000			4000	12 Volts.	
6J4 GB-6J4WA (3)	T-5½	Triode	7BQ	6.3	0.400	Amplifier	2.5	150	100 <sup>■</sup>	15.0	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. Mixer	1.65	150	10.0	30.0	8.5	10000	1900 <sup>A</sup>			Class C Operation	38	3500
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. Power Amp.	2.0 5.0	150 300	150 <sup>■</sup> 3.5	150	10 30	7.5	7500 60000	4700 11500	35	5000	1800	
6JQ6	T-6½	Beam Pent. Diode	9RA	6.3	1.200	Vertical Defl. Amplifier	10.0	Maximum Peak Plate Voltage = 2000 Volts. 140	18.0	140	35.0	2.5	10500	4200		Maximum D.C. Cathode Current = 70 Ma.		
6JR6	Novar T-12	Beam Pent.	9QU	6.3	1.6	Horiz. Defl. Amplifier	17	Maximum Peak Plate Voltage = 6500 Volts. 130	20	125	45	1.5	18000	7000	4.7	Maximum D.C. Cathode Current = 275 Ma.		
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. Video Amp.		125 200	68 <sup>■</sup> 100 <sup>■</sup>	150	15	24	4.8	4400 55000	10400 11000	46		
6K7	Metal	Pentode	7R	6.3	0.300	R-F Amp.	3.0	100 250 250	1.0 3.0 3.0	100 100 125	9.5 7.0 10.5	2.7 1.7 2.6	150000 800000 600000	1650 1450 1650				
6K8	Metal	Tri. Hexode	8K	6.3	0.300	Mixer Osc.	.825	250 100	3.0	100	2.5	6.0	600000	350 <sup>A</sup>		(Hexode Section)		
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	(Triode Section not Oscillating)		
6KF8	T-6½	Double Pent.	9FG	6.3	0.300	Sync. Sep. AGC Amp.	1.1 1.1	100 100	G3 = -10 G3 = 0	67.5 67.5	2.8	8.4 3.8	1k = 8.5 Ma. 1k = 9.5 Ma.					
6KL8	T-6½	Diode Pent.	9LQ	6.3	0.300	Detector R-F I-F Amp.	3.0	100	Voltage Drop at Ib = 2 Ma. = 10 Volts. 2.2 Meg. <sup>A</sup>	100	5.5	2.2	550000	4300				
6KT6	T-6½	Pentode	9PM	6.3	0.300	IF Amp.	3.1	125	56 <sup>■</sup>	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 <sup>■</sup>	135	30	5.2	40000	30000				
6L7	Metal	Heptode	7T	6.3	0.300	Mixer Amp. Amplifier	1.65	250 250	6.0 3.0	150 100	3.3 5.3	9.2 6.5	1 Meg. < 600000	350 <sup>A</sup> 1100	(G3 = Neg. 15 Volts) (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 Volts.				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	200	2	150	4	17000	4000	70	
							3.75	100	2.5	20	5	200000	11000		
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	1.0		11.0		6250	7500	47
								200	4.0		4.8		10000	4000	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 <sup>†</sup> Per Pl., Ci. Sections Paralled	B Push-Pull Oper., 11300 3100 3200	Zero Sig. 35 35	8000 <sup>†</sup> (Class A Driver)	10000 (Class A Driver)
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	Metal	Heptode	8R	6.3	0.300	Converter	1.1	100 250	2.0 2.0	100 100	3.3 3.5	8.5 1.0 Meg.	500000 450 <sup>†</sup>		
6SA7GT	Metal T-9	Heptode	8AD	6.3	0.300	Converter	1.1	250	2.0	100	3.5	8.5	450 <sup>†</sup>		
								Low Loss Base.							
6SB7Y	Metal	Heptode	8R	6.3	0.300	Converter	2.2	250	1.5	100	4.0	8.5	880 <sup>†</sup>		
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	3.0 3.0	100 100	2.9 3.0	0.9 0.8	700000 1.0 Meg <	1575 1650	
								Ruggedized Version. Low Loss Base.							

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts <sup>2</sup>	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 Milli-watts		
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	Volts	Amps.														
GB-6SL7WGT(3)	T-9	Duotriode	8BD	6.3	0.300	Amplifier	1.1	250	2.0	....	2.3	...	44000	1600	70	....	....		
BB-6SN7W6TA (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.						450 A.C. Volts Per Plate, RMS, 70 Ma. Output Current. Condenser Input to Filter. 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.						450 A.C. Volts Per Plate, RMS, 60 Ma. Output Current. Condenser Input to Filter. 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 <sup>■</sup>	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.	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
								250	15.0	250	70-79†	5-13†	(Class AB1 Two Tubes)	10000†	10000	.....	10000
							285	19.0	285	70-92†	4-13.5†	(Class AB1 Two Tubes)	8000†	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 <sup>■</sup>	.....	6.0	.....	.....	3300	48	.....	
GB-7F8W (3)	Lock-in	Duotriode	8BW	6.3	0.300	Osc. Amp.	3.5	250	200 <sup>■</sup>	.....	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	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 <sup>■</sup>	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*	.....	.....	
								100	0.05 Meg.	.....	3.2	(Triode Grid Current 0.3 Ma.)	.....	.....			
							1.74	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 <sup>■</sup>	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 <sup>2</sup>	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 Milli-watts	
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	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	50000 1.0 Meg.	525 <sup>a</sup> 550 <sup>a</sup>	(Osc. Grid Resistor 20000) (Osc. Grid Current 0.5 Ma.)	.....	.....	
7R7	Lock-in	Duodi. Pent.	8AE	6.3	0.300	Det. Amp.	2.2	100 250 250	2.0 1.0 1.0	100 100 100	3.4 5.5 3.5	1.0 2.2 1.0	50000 350000 1800000	2100 3000 2200	..... ..... .....	..... ..... .....	..... ..... .....	
7S7	Lock-in	Tri. Heptode	8BL	6.3	0.300	Hep. Mixer Tri. Osc.	0.66	100 250 100 250	2.0 2.0 0.05 Meg. 0.05 Meg.	100 100	1.9 1.8 3.0 5.0	3.0 3.0 (Triode Grid Current 0.3 Ma.) (Triode Grid Current 0.4 Ma.)	50000 525 <sup>a</sup>	500 <sup>a</sup> .....	..... .....	..... .....	..... .....	
7V7	Lock-in	Pentode	8V	6.3	0.450	R-F Amp.	4.4	300	160 <sup>#</sup>	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.						450 A.C. Volts Per Plate, RMS, 70 Ma. Output Current.				
7Z4	Lock-in	Duodiode	5AB	6.3	0.900	F-W Rect.	.....	325 A.C. Volts Per Plate, RMS, 100 Ma. Output Current.						450 A.C. Volts Per Plate, RMS, 100 Ma. Output Current.				
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 <sup>#</sup>	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 <sup>#</sup>		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 <sup>#</sup> 68 <sup>#</sup>	..... 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.	..... 7.15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
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	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 <sup>■</sup> 100 <sup>■</sup>	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 <sup>■</sup> 470 <sup>■</sup> 82 <sup>■</sup>	..... ..... 100	7.1 7.2 17.4	..... ..... 3.2	12500 5300 51000	5500 3000 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	550 <sup>■</sup> <sub>μ</sub>	200 <sup>■</sup> <sub>μ</sub>	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 <sup>†</sup> 1.0 Meg <sup>†</sup>	..... .....	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 <sup>■</sup>	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 <sup>†</sup>	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	0.9 <sup>†</sup>	.....	0.5	.....	13000	1000	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	270 <sup>■</sup>	.....	3.7	.....	15000	4000	60	.....	.....
12AW6	T-5½	Pentode	7CM	12.6	0.150	R-F Amp.	2.2	250 125 100	200 <sup>■</sup> 100 <sup>■</sup> 100 <sup>■</sup>	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 Disa. Watts <sup>2</sup>	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 Milli-watts
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	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. (12B4A Designed for Series String Receivers.)			D.C. Cathode Current = 30 Ma.			
							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 <sup>■</sup>	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 <sup>4</sup>	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. Video Amp.	2.5 2.75	150 200	150 <sup>■</sup> 82 <sup>■</sup>	..... 125	9.0 15.0	..... 3.4	8200 150000	4900 7000	40	.....	.....
12CX6	T-5½	Pentode	7BK	12.6	0.150	R-F Amp.	.....	12.6	2.2 Meg <sup>4</sup>	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 <sup>4</sup>	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 <sup>4</sup>	12.6	1.3	0.5	300000	1500	.....	.....	.....
12DF5	T-6½	Duodiode	9BS	12.6 6.3	0.450 0.900	F-W Rect.	.....	325 A.V. Volts Per Plate, RMS, 100 Ma. Output Current. Condenser Input.									
								450 A.C. Volts Per Plate, RMS, 100 Ma. Output Current. Choke Input.									
12DF7	T-6½	Duotriode	9A	12.6 6.3	0.150 0.300	Audio Amp.	1.1	Characteristics Same as Type 12AX7A/ECC83. (Special Low Noise.)									
12DK5	T-6½	Pentode	9GT	12.6	0.300	R-F Amp.	.....	12.6	2.2 Meg <sup>4</sup>	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 <sup>4</sup>	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 G2 = 2 G1 = 12.6 (Space-Charge Grid Operation.)			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 <sup>■</sup>	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 <sup>†</sup>	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 <sup>†</sup>	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 <sup>†</sup>	.....	0.4	.....	19000	750	14	.....	.....
12DV8	T-6½	Duodiode Tetrode	9HR	12.6	0.375	Detector, Pwr. Amp. Dr.	.....	12.6	18 Ohm <sup>■</sup>	G1 = 12.6	6.8	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.									
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	1.0 2.0	..... .....	0.5 1.2	..... .....	80000 62500	1250 1600	100 100	..... .....	..... .....
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 <sup>†</sup> 1.0 Meg <sup>†</sup>	..... .....	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 <sup>*</sup>	..... 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 <sup>†</sup>	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 <sup>†</sup>	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 1500	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	0.8 <sup>†</sup>	12.6	.04	2.47	150000	800	.....	.....	.....
12EL6	T-5½	Duodiode Tri.	7FB	12.6	0.150	Det. Amp.	.....	12.6	1.0 Meg <sup>†</sup>	.....	.75	.....	45000	1200	55	.....	.....
12EM6	T-6½	Diode Tetrode	9HV	12.6	0.500	Det. Power Amplifier	0.55	12.6	15 Meg <sup>†</sup>	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.									
12EZ6	T-5½	Pentode	7BK	12.6	0.175	R-F or I-F Amplifier	.....	12.6	0.7 2.2 Meg <sup>†</sup>	12.6	1.9	0.7	400000	2700	.....	.....	.....

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts†	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transcon-ductance Micros.	Amplifi-cation Factor	Ohms Load for Stated Power Output	Power Output Milliwatts	
	Bulb Size or Style	Class	Basing Diag.†	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*	.....	.....	.....	
									2.2 Meg.‡	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†	.....	1.3	.....	6200	1200	74	.....	.....	
12FM6	T-5½	Duodiode Tri.	7BT	12.6	0.150	Det. Amp.	.....	12.6	2.2 Meg†	.....	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. R-F Amp.	.....	12.6	2.2 Meg†	.....	1.0	.....	.....	1200	10	.....	.....	
								12.6	2.2 Meg†	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†	.....	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#	115	35	12	17500	13500	.....	3000	1300	
12FX8A	T-6½	Tri. Heptode	9KV	12.6	0.270	R-F Amp. Converter	.....	12.6	2.2 Meg†	.....	1.3	.....	1400	300*	10	.....	.....	
								12.6	G3=2.2M†	12.6	0.29	1.25	.....	.....	EC1 = 1.6 V (RMS)	Rg1 = 33 K Ohms	.....	
12Q8	T-6½	Duotriode	9CZ	12.6	0.400	Amplifier	.....	12.6	0	Input Tri. Output Tri.	3.0	7.2	.....	8500	2600	22	2000	25
12GA6	T-5½	Heptode	7CH	12.6	0.150	Converter	.....	12.6	G†=2.2 M†	12.6	0.3	0.8	1.0 Meg.	140	.....	.....	.....	
									EC1 = 1.6 Volts (RMS),	Rg1 = 33000 Ohms,	IC1 = .06 Ma.							
12QB3	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.	9QC	12.6	0.300	Det. Amp.	.....	12.6	2.2 Meg†	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.									
12SQ7	Metal	Pentode	8BK	12.6	0.150	R-F Amp.	3.3	Characteristics Same as Type 6SQ7.									
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 <sup>■</sup> 6	100 125	1.3 36	2.0 5.5	150000 58000	1000 6400	.....	.....	.....
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 <sup>■</sup> 150 <sup>■</sup> 220 <sup>■</sup>	125 ..... .....	12.0 11.0 7.6	3.8 ..... .....	10000 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 <sup>†</sup>	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 Milli-watts
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	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 <sup>■</sup>	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	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.									
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.									
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 <sup>■</sup>	110 100	34-39 <sup>†</sup> 2.8	6.5-9.3 <sup>†</sup> 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.									
18QE6A	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 <sup>■</sup> 150 <sup>■</sup>	..... 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 <sup>1</sup> Amp.	11	110 200	7.5 180 <sup>#</sup>	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	390 <sup>#</sup> 3.5 0	28 28 28	9.0 12.5 64.0	0.7 1.0 4.0	..... 4200 .....	..... 3400 .....	4000 4000 1500 <sup>†</sup>	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 <sup>2</sup>	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transcon-ductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milli-watts	
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	Volts	Amps.													
31AL10	Comp. T-9	Double Tri. Pentode	12HR	31.5	0.315	Pent.-Vert Defl. Amp. 7.0 Sec.#2 Ver. Osc Sec.#1 Syn. Clip 1.25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
							Maximum Peak Positive Plate Voltage = 2000 Volts. Maximum D.C. Cathode Current = 70 Ma.											
							.....	120	8.0	110	46	3.5	11700	7100	.....	.....	.....	.....
							.....	150	5.0	.....	5.5	.....	8500	2350	20	.....	.....	.....
							.....	150	2.0	.....	5.4	.....	11000	3900	43	.....	.....	.....
32HQ7	Comp. T-12	Diode Pent.	12HT	32.6	0.315	Damper Diode Horiz. Defl. Amplifier	3.8	110	22.5	110	42	2.4	8000	4500	3.2	.....	.....	.....
							Maximum Peak Inverse Plate Voltage = 3300 Volts. Maximum D.C. Plate Current = 120 Ma.											
							Maximum Peak Positive Plate Voltage = 4000 Volts. Maximum D.C. Cathode Current = 125 Ma.											
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 <sup>#</sup>	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 <sup>#</sup>	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 <sup>#</sup>	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 25 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 <sup>#</sup>	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	1.5 120 <sup>#</sup> 62 <sup>#</sup>	..... 125	2.5 70-66† 125	..... 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 <sup>#</sup>	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	A-F Amp. Power Amp.	1.0 6.5	100 120	1500 <sup>#</sup> 8.0	..... 110	0.6 50.0	..... 8.5	55500 10000	1800 7500	100 .....	2500 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 <sup>#</sup>	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 <sup>#</sup>	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 <sup>2</sup>	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 Milli-watts	
	Bulb Size or Style	Class	Biasing Diag. <sup>1</sup>	Volts	Amps.													
117L7/M7GT	T-9	Diode Beam Pentode	8A0	117	0.090	H-W Rect. Power Amp.	6.6	117 A.C. Volts, RMS, 75 Ma. Output Current.	105	5.2	105	43	4.0	Condenser Input to Filter.	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 <sup>■</sup>	.....	8.2	.....	6370	5500	.....	.....	.....	
408A GB-408A (3)	T-5½	Pentode	7BD	20	0.050	Amplifier	1.7	120	200 <sup>■</sup>	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 <sup>■</sup> 0 10	..... ..... .....	4.8 4.8 Min. 0.1 Max.	7950 20K Ohms. 20K Ohms.	3400 Grid Res. = 47K Ohms. Grid Res. = 47K Ohms.	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 75	67.5 Grid No. 3 = 0 Volts Grid No. 3 = 0 Volts 5.8	2400 1700 9	..... ..... Rb = 20K, RG3 = 47K, RG1 = 47K, RG2-4 = 470 Ohms	.....	.....	.....		
1218A	T-5½	Triode	7DK	6.3	0.225	UHF Amp.	4	200	100 <sup>■</sup>	.....	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 <sup>■</sup> 200 <sup>■</sup>	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.										
QB1252/6U8A(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	7500 200000	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	0	.....	5.2	.....	1500	15	.....	.....	
								90	20	.....	13.25	.....	120 Mc. Oscillator Rg = 10000 Ohms.				
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	22.5	270	88-132†	15†	.....	.....	6600	26500	
								530	36	340	60-160†	20†	.....	.....	7200	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	5.0	0	100	For Relay Operation Limit Time to 30 Seconds. 1 Amp. Peak Current, 8 Volts Tube Drop.					
								220	4.0	0	75	.....	.....	.....	.....	.....	
5636 (3)	T-3	Pentode	8DC	6.3	0.150	Mixer	1.1	100	150 <sup>■</sup>	100	3.6	5.3	320000	1280*	.....	.....	
5639 (3)	T-3	Beam Pent.	8DL	6.3	0.450	Power Amp.	4.0	150	100 <sup>■</sup>	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	T-5½	Gas Diode	5B0	.....	.....	Volt. Ref.	.....	Starting Voltage = 115 Volts Max. Operating Voltage = 92 Volts Max. Operating Current = 3.5 Ma. Max.									
5651WA (3)																	
5654/6AK5W(3) 5654/6AK5W/6096 GB-5654(3)	T-5½	Pentode	7BD	6.3	0.175	VHF Amp.	1.65	120	200 <sup>■</sup>	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 <sup>■</sup>	.....	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	
5687 (3)	T-6½	Duotriode	9H	6.3	0.900	Amplifier	4.2	250	12.5	.....	12	.....	3000	5400	16	.....	
GB-5687 (3)				12.6	0.450			180	7.0	.....	23	.....	2000	8500	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
	Bulb Size or Style	Class	Basing Diag. <sup>†</sup>	Volts	Amps.	
5702 5702WA (3) 5702WB (3)	T-3	Pentode	5702	6.3	0.200	VHF Amp.
5703 5703WA (3) 5703WB (3)	T-3	Triode	5703	6.3	0.200	VHF Osc.
5704 (3)	T-2	Diode	5704	6.3	0.150	VHF Det.
5718 (3)	T-3	Triode	8DK	6.3	0.150	UHF Amp.
5719 (3)	T-3	Triode	8DK	6.3	0.150	UHF Amp.
5722 (3)	T-5½	Diode	5CB	4.9♠	1.600	Noise Diode
5725 (3) GB-5725 (3) 5725/6AS6W(3)	T-5½	Pentode	7CM	6.3	0.175	Mixer
5726/6AL5W(3) GB-5726 (3) 5726/6AL5W/6097(3) GB5727 (3)	T-5½	Duodiode	6BT	6.3	0.300	Rectifier
5744	T-3	Triode	5744	6.3	0.200	A-F Amp.
5749/6BA6W(3) GB-5749	T-5½	Pentode	7BK	6.3	0.300	R-F Amp.
5750 (3) 5750/6BE6W(3) GB-5750 (3)	T-5½	Heptode	7CH	6.3	0.300	Converter
5751 (3) 5751WA (3) GB-5751 (3)	T-6½	Duotriode	9A	6.3 12.6	0.350 0.175	A-F Amp.
5763	T-6½	Beam Pent.	9K	6.0	0.750	RF Amp.
5783	T-3	Gas Diode	5783	....	....	Voltage Reg.
5784	T-3	Pentode	5784	6.3	0.200	Amplifier
5785	T2x3	Diode	5785	1.25♠	0.015	H-W Rect.
5787	T-3	Gas Diode	5783	....	....	Voltage Reg.
5814 (3) GB-5814A (3) 5814WA (3)	T-6½	Duotriode	9A	6.3/ 12.6	0.350/ 0.175	Class A Amplifier
5823	T-5½	Gas Triode	4CK	....	....	Relay Tube
5824 (3)	ST-14	Beam Pent.	7S	25.0	0.300	Power Amp.
5840 (3)	T-3	Pentode	8DL	6.3	0.150	R-F Amp.
5842 (3)	T-6½	Triode	9V	6.3	0.300	UHF R-F Amplifier



Plate Diss. Watts <sup>2</sup>	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 Milli-watts
....	120	200 <sup>■</sup>	120	7.5	2.5	340000	5000	....	....	....
3.3	120	220 <sup>■</sup>	....	9.0	....	....	5000	25	....	....
3.3 150 Volts, RMS Plate, 9 Ma. D.C. Output Current.										
3.3	100	150 <sup>■</sup>	....	8.5	....	4650	5800	27	....	....
	150	180 <sup>■</sup>	....	13.0	....	4150	6500	27	....	....
.055	150	680 <sup>■</sup>	....	1.85	....	30500	2300	70	....	....
....	200	For Noise Generator Service 1b 35 Ma. Max.								
1.65	120	2	120	5.2	3.5	3200	....	....	....	....
....	117 Volts, RMS Plate, 9 Ma. D.C. Output Current Per Plate.									
....	Characteristics Same as Type 5727/2D21W.									
....	250	500 <sup>■</sup>	....	4	....	....	4000	70	....	....
3.3	100	68 <sup>■</sup>	100	10.8	4.4	250000	4300	....	....	....
	250	68 <sup>■</sup>	100	11.0	4.2	1.0 Meg.	4400	....	....	....
1.1	Characteristics Same as Type 6BE6.									
0.8	Characteristics Same as Type 12AX7/ECC83.									
13.5	350	37	250	48.5	6.2	....	....	....	....	10300
12.0	300	37.5	250	50	6.6	....	....	....	....	12000
....	Starting Voltage at 115 Volts. Operating Voltage 85. Operating Current 1.5 to 3.5 Ma.									
1.87	120	2	120	5.2	3.5	....	3200	....	....	....
....	1235 Volts, RMS Plate, 100 $\mu$ a D.C. Output Current.									
....	Starting Voltage at 135 Volts. Operating Voltage 100. Operating Current 5 to 25 Ma.									
3.0	100	0	....	11.8	....	6250	3100	19.5	....	....
	250	8.5	....	10.5	....	7700	2200	17.0	....	....
....	Peak Cathode Ma. = 100 Max. D.C. Cathode Ma. = 25 Max. Starter Anode Volt Drop = 61 Volts. Anode Drop = 62 Volts.									
13.7	135	22	135	61	2.5	15000	5000	....	1700	4300
1.1	100	150 <sup>■</sup>	100	7.5	2.4	260000	5000	....	....	....
4.0	150	62 <sup>■</sup>	....	26	....	1800	24000	43	....	....

5844 (3) GB-5844 (3)	T-5½	Duotriode	7BF	6.3	0.300	Computer	1.0	100	470 <sup>Ω</sup>	....	4.8	....	7550	3700	28	....	....
5845	T-5½	Duodiode	5CA	5.0 <sup>⊕</sup>	0.435	Control Diode	....	300max.	....	....	2.0max.	....	....	....	....	....	....
5847A (3)	T-6½	Pentode	9X	6.3	0.300	RF Amp.	3.3	150	4000 <sup>Ω</sup>	150	1.1	0.3	....	3000	....	....	....
								150	4000 <sup>Ω</sup>	150	4.4	1.2	....	8500	....	....	....
5851	T-3	Pentode	6CL	1.25 <sup>⊕</sup> 2.50 <sup>⊕</sup>	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	0.4	2000000 13700	1000 1530	....	....	....
											Triode Connected						
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 <sup>⊕</sup>	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 <sup>Ω</sup>	100	7.2	2.2	260000	4500	....	....	....
5902 (3)	T-3	Pentode	8DL	6.3	0.450	Power Amp.	4.0	110	270 <sup>Ω</sup>	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 <sup>Ω</sup>	....	3.0	....	4000	5000	20	....	....
5905 (3)	T-3	Pentode	8DL	26.5	0.045	UHF Amp.	....	26.5	2.2 Meg <sup>Ω</sup>	26.5	2.1	0.75	150000	2850	....	....	....
5906 (3)	T-3	Pentode	8DL	26.5	0.045	UHF Amp.	1.1	100	150 <sup>Ω</sup>	100	7.5	2.4	260000	5000	....	....	....
5907 (3)	T-3	Pentode	8DL	26.5	0.045	UHF Amp.	....	26.5	2.2 Meg <sup>Ω</sup>	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 <sup>Ω</sup>	26.5	3.3	2.0	31000	2200	....	....	....
5910 (3)	T-5½	Pentode	6AR	1.4 <sup>⊕</sup>	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	0	75	5.8	9.0	Grid No. 3 Voltage = 0 Rb = 20K Ohms		....	....	....
								150	10.0	75	0	0	Grid No. 3 Voltage = 0		....	....	....
								150	0	75	0	14.0	Grid No. 3 Voltage = -10		....	....	....
5916 (3)	T-3	Pentode	8DC	26.5	0.045	Dual-Control Mixer	1.1	100	150 <sup>Ω</sup>	100	5.3	3.6	110000	3200	....	....	....
5931 (3) GB-5931 (3)	T-12	Duodiode	5T	5.0 <sup>⊕</sup>	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 <sup>Ω</sup> 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 <sup>Ω</sup>	....	8.5	....	7000	6700	47	....	....
5968	T-3	Duotriode	8DQ	1.25 <sup>⊕</sup>	0.120	VHF Mixer	....	45	0	....	0.7	....	....	1300	50	....	....
5969	T-3	Duotetrode	8DR	1.25 <sup>⊕</sup>	0.200	VHF Amp. or VHF Osc.	0.96	135	3.0	45	6.0	0.6	....	1700	....	....	....
								Class A Ratings									
5970	T-3	Duo. Pentode	8DS	1.25 <sup>⊕</sup>	0.160	VHF Amp.	....	45	5 Meg. <sup>Ω</sup>	45	3.0	0.9	170000	1850	....	....	....
5977 (3)	T-3	Triode	8DK	6.3	0.150	Amplifier	3.3	100	270 <sup>Ω</sup>	....	10.0	....	3650	4500	16	....	....

TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts <sup>2</sup>	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Trans-conductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milli-watts
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	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 <sup>■</sup>	....	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 <sup>■</sup>	....	6.5	....	6480	5400	35	....	....
6028	T-5½	Pentode	7BD	20	0.050	Amplifier	1.87	120	180 <sup>■</sup>	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 <sup>■</sup>	....	200	....	280	7000	2	....	....
6082A	T-12	Duo Power Triode	8BD	26.5	0.600	Power Amp.	13	135	250 <sup>■</sup>	....	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 <sup>■</sup>	....	8.5	....	4200	4750	20	....	....
6112 (3)	T-3	Duotriode	8DG	6.3	0.300	High Mu Amplifier	0.55	100 150	1500 <sup>■</sup> 820 <sup>■</sup>	....	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 <sup>■</sup>	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 $\phi$	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	T-5 $\frac{1}{2}$	Pentode	7BD	6.3	0.300	VHF Amp.	2.5	250	200 $\blacksquare$	150	7	2	.....	5000	.....	.....	.....	
6186 (3)																		
6186/6AG5WA(3)																		
GB-6186 (3)																		
6187	T-5 $\frac{1}{2}$	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)	T-6 $\frac{1}{2}$	Duotriode	9A	6.3	0.300	Osc./Amp.	3.0	Characteristics Same as Type 12AU7.										
6189/12AU7WA(3)				12.6	0.150													
GB-6189 (3)																		
6197	T-6 $\frac{1}{2}$	Beam Pent.	9BV	6.3	0.650	Computer Applications	7.5	250	3	150	30	7	90000	11000	22	.....	.....	
6201 (3)	T-6 $\frac{1}{2}$	Duotriode	9A	6.3	0.300	VHF Amp.	2.5	Characteristics Same as Type 12AT7.										
GB-6201 (3)				12.6	0.150													
6205 (3)	T-3	Pentode	8DC	6.3	0.150	UHF Amp.	1.1	100	150 $\blacksquare$	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 $\blacksquare$	100	7.5	2.0	0.26 Meg.	4500	.....	.....	.....	
6211A	T-6 $\frac{1}{2}$	Duotriode	9A	12.6/6.3	0.150/0.300	Computer	1.3	100	2.0	.....	6.6	...	6500	4700	31	.....	.....	
6216	T-6 $\frac{1}{2}$	Beam Pent.	9CE	6.3	1.200	Voltage Reg.	10.0	100	3	100	72	3	18500	12500	.....	.....	.....	
6267	T-6 $\frac{1}{2}$	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	200 $\blacksquare$	.....	182	.....	300	13500	2.7	.....	.....	
								RK = 200 Ohm Per Section, RG = 500 Ohm Per Section.										
6350 (3)	T-6 $\frac{1}{2}$	Duotriode	9CZ	6.3	0.600	Computer	3.85	150	5.0	.....	11.0	...	3900	4600	18	.....	.....	
GB-6350 (3)				12.6	0.300													
6352 (3)	T-3	Duodiode	8EY	3.0 $\phi$ Series	0.360 Series	Regulator	.....	Temperature Limited Diode. Max. Ef. = 4.0. Max. Eb. = 275. Max. Ib. = 1.1 Ma.										
6354	T-5 $\frac{1}{2}$	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 $\phi$	0.010	Power Amp.	.....	22.5	1.2	22.5	.24	.60	420000	300	.....	100000	2200	
6463	T-6 $\frac{1}{2}$	Duotriode	9CZ	6.3	0.600	Computer	4.4	200	11.0	.....	1.0	.....	.....	.....	.....	.....	.....	
				12.6	0.300			250	620 $\blacksquare$	.....	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 $\mu$ a.									
6486A	T-6 $\frac{1}{2}$	Pentode	9DV	6.3	0.250	Dual Control Pentode	2.0	120	2	120	3.5	3.3	.....	3250	.....	.....	.....	
6516	T-5 $\frac{1}{2}$	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	23	270	170-225 $\uparrow$	9-35 $\uparrow$	15000	11000	.....	3500	60000	
								600	32.5	300	100-270 $\uparrow$	5-33 $\uparrow$	(Current, Output for 2 Tubes)		5000 $\nabla$	100000	.....	
6582A	T-6 $\frac{1}{2}$	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 Disa. Watts <sup>†</sup>	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transcon- ductance Micros.	Amplifi- cation Factor	Ohms Load for Stated Power Output	Power Output Milli- watts
	Bulb Size or Style	Class	Basing Diag. <sup>†</sup>	Volts	Amps.												
6611	T-2x3	Pentode	6611	1.25 $\frac{1}{2}$	0.020	VHF Amp.	0.1	30 45	5 Meg. <sup>4</sup> 5 Meg. <sup>4</sup>	30 45	1.0 1.0	0.35 0.35	400000 400000	1000 1000	.....	.....	.....
6612	T-2x3	Pentode	6612	1.25 $\frac{1}{2}$	0.080	VHF Amp.	0.2	30 45	2 Meg. <sup>4</sup> 2 Meg. <sup>4</sup>	30 45	3.0 3.0	1.0 1.0	180000 180000	3000 3000	.....	.....	.....
6626	T-5 $\frac{1}{2}$	Gas Diode	5B0	.....	.....	Voltage Reg.	.....	Starting Voltage = 165. Operating Voltage = 148. Operating Current = 5 to 30 Ma.									
6627	T-5 $\frac{1}{2}$	Gas Diode	5B0	.....	.....	Voltage Reg.	.....	Starting Voltage = 130. Operating Voltage = 108. Operating Current = 5 to 30 Ma.									
6660/6BA6	T-5 $\frac{1}{2}$	Pentode	7BK	6.3	0.300	R-F/I-F Amp.	3.3	100 250	68 $\square$ 68 $\square$	100 100	10.8 11	4.4 4.2	250000 1 Meg.	4300 4200	.....	.....	.....
6661/6BH6	T-5 $\frac{1}{2}$	Pentode	7CM	6.3	0.150	R-F/I-F Amp.	3.3	100 250	200 $\square$ 95 $\square$	100 100	3.6 7.4	1.4 2.9	700000 1.4 Meg.	3400 4600	.....	.....	.....
6662/6BJ6	T-5 $\frac{1}{2}$	Pentode	7CM	6.3	0.150	R-F/I-F Amp.	3.3	100 250	80 $\square$ 80 $\square$	100 100	9 9.2	3.5 3.3	250000 1.3 Meg.	3650 3600	.....	.....	.....
6663/6AL5	T-5 $\frac{1}{2}$	Duodiode	6BT	6.3	0.300	Detector	.....	A.C. Voltage Per Plate = 117 Volts. D.C. Output Current = 9.0 Ma.									
6664/6AB4	T-5 $\frac{1}{2}$	Triode	5CE	6.3	0.150	VHF Amp./ Osc.	2.9	Characteristics Same as Type 6AB4.									
6669/6AQ5	T-5 $\frac{1}{2}$	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-5 $\frac{1}{2}$	Pentode	7CM	6.3	0.300	VHF Amp.	2.3	Characteristics Same as Type 6CB6.									
6677/6CL6	T-6 $\frac{1}{2}$	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-6 $\frac{1}{2}$	Tri. Pentode	9AE	6.3	0.450	VHF Osc./ Amp.	3.0 3.0	150 250	56 $\square$ 68 $\square$	..... 110	18 10	..... 3.5	5000 400000	8500 5200	40	.....	.....
6679/12AT7	T-6 $\frac{1}{2}$	Duotriode	9A	6.3/ 12.6	0.300/ 0.150	VHF Osc./ Amp.	2.8	100 250	270 $\square$ 270 $\square$	..... .....	3.7 10	.....	15000 10900	4000 5500	60 60	.....	.....
6680/12AU7A	T-6 $\frac{1}{2}$	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-6 $\frac{1}{2}$	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 $\square$	.....	8.0	.....	.....	4800	35	.....	.....
6788 (3)	T-3	Pentode	8DL	6.3	0.175	Audio Amp.	0.5	100	1500 $\square$	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 $\square$	.....	0.8	.....	.....	1050	.....	.....	.....
6840	T-6 $\frac{1}{2}$	Duotriode	9CZ	12.6 6.3	0.400 0.800	Computer	4.0	250	620 $\square$	.....	14	.....	3400	7100	20	.....	.....
6851	T-6 $\frac{1}{2}$	Duotriode	9A	6.3	0.250	Amplifier	1.0	250	3100 $\square$	.....	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									
6854	T-6 $\frac{1}{2}$	Duotriode	9FV	6.3	0.500	Amplifier	1.65	150	240 $\square$	.....	8.2	.....	6500	5225	35	.....	.....
6870	T-6 $\frac{1}{2}$	Beam Pent.	9BF	6.3 12.6	0.600 0.300	VHF Power Amplifier	6.9	250	120 $\square$	250	25.0	3.5	230	8500	.....	.....	.....
6872	T-3	Pentode	6872	6.3	0.200	VHF Amp.	1.1	120	200 $\square$	120	7.75	2.7	340000	.....	.....	4100	.....
6877	T-6 $\frac{1}{2}$	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 <sup>■</sup>	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 <sup>■</sup>	100	8	2.3	30000	3600	.....		
6944 (3)	T-3	Pentode	8DC	6.3	0.175	R-F Amp.	1.0	100	150 <sup>■</sup>	100	7	2.1	28000	3200	.....		
6945 (3)	T-3	Beam Pent.	8DL	6.3	0.350	Power Amp.	3.0	100	270 <sup>■</sup>	100	25	1.5	20000	3500	3000	800	
6946 (3)	T-3	Triode	8DK	6.3	0.175	Amplifier	1.5	100	270 <sup>■</sup>	.....	9.0	.....	3800	16.5	.....		
6947 (3)	T-3	Duotriode	8DG	6.3	0.350	Amplifier	0.75	150	270 <sup>■</sup>	.....	6.5	.....	4000	35	.....		
6948 (3)	T-3	Duotriode	8DG	6.3	0.350	Amplifier	0.50	100	1500 <sup>■</sup>	.....	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 <sup>■</sup>	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 <sup>■</sup>	300	112-128†	7-16†	.....	.....	6600†	32000	
								380	180 <sup>■</sup>	380	138-170†	5.6-20†	.....	.....	4500†	36000	
								410	220 <sup>■</sup>	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. Class "C" Amplifier	5.0	250	120 <sup>■</sup>	150	19	3.5	100000	11500	.....	.....	
								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 <sup>■</sup>	150	9.5	2.8	600000	6200	.....	.....	
7057	T-6½	Duotriode	9AJ	13.5	0.180	VHF Amp.	2.2	150	220 <sup>■</sup>	.....	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 <sup>2</sup>	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Trans-conductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milli-watts
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	Volts	Amps.												
7059	T-6½	Tri. Pentode	9AE	13.5	0.195	VHF Osc. VHF Amp.	2.5 2.8	150 250	56 <sup>■</sup> 68 <sup>■</sup>	..... 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 <sup>■</sup> 82 <sup>■</sup>	..... 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	82 <sup>■</sup>	.....	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 <sup>■</sup>	.....	13.5	.....	.....	8500	40	.....	.....
7150	Spec. Base T-9	Tetrode	9JH	6.3	0.450	VHF Amp.	4.0	135	G1 = +8V RK = 260 Ohms	135	27.5	8.5	30000	35800	.....	.....	.....
7167	T-5½	Tetrode	7EW	13.5	0.090	VHF Amp.	2.0	250	1.0	80	10	1.4	125000	8000	.....	.....	.....
								Similar to Type 6CY5, Except Designed for Mobile Applications.									
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 <sup>■</sup>	250 300 375	48 15-105† 75-81†	5.5 1.6-25† (Cathode Current)	40000	11300	19.5	(G1 to G3)	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 <sup>■</sup>	.....	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.	4200	.....	.....	.....
								(Applied for Short Intervals—2 Sec. Max.)									
7241	TT-18	Triode	7241	6.3	7.500	Passing Tube for V.R. Serv.	100	190	200 <sup>■</sup>	.....	550	.....	67	40000	2.7	.....	.....
								RG = 500 Ohms									
7242	TT-18	Triode	7241	6.3	7.500	Passing Tube for V.R. Serv.	100	100	4	.....	555	.....	82	111000	9.0	.....	.....
								RG = 500 Ohms									
7244A	T-5½	Duotriode	7BF	6.3	0.450	Amplifier	1.1	100	50 <sup>■</sup>	.....	9.0	.....	6300	6000	38	.....	.....
7245	T-5½	Triode	7BQ	6.3	0.400	VHF Amp.	2.25	150	100 <sup>■</sup>	.....	13.5	.....	4500	11000	50	.....	.....
7246	T-2x3	Triode	7246	1.25 <sup>†</sup>	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	3 56 <sup>■</sup>	..... 125	15 12	..... 3.8	4700 170000	4500 7800	21 .....	..... .....	..... .....
								(Designed for Mobile Operation.)									

7308	T-6½	Twin Triode	9AJ	6.0	0.335	VHF Amp.	1.65	90 100	120 <sup>■</sup> 680 <sup>■</sup>	12 15	11500 12500	33			
7316	T-6½	Duotriode	9A	6.3 12.6	0.300 0.150	Computer	2.7	250 100	8.5 0	10.5 11.8	7700 6250	2200 3100	17 19.5		
7318	T-6½	Duotriode	9A	6.3 12.6	0.350 0.175	Pulse Amp.	1.35	100 250	0 8.5	13 11.5	5800 7000	3500 2350	21.3 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. Blocking Osc.	0.95	150	Pulse Applied to Grid = 40 Volts at T <sub>p</sub> = 10 μsec., P <sub>rr</sub> = 1000 Pps., Tr. = 0.2 μsec. Max., T <sub>f</sub> = 0.2 μsec. Max., PEAK Plate Current = 400 Ma. Min.						
7355	T-9	Beam Pent.	8KN	6.3	0.800	S.T.A1 Amp. P.P.AB1 Amp. P.P.AB1 Amp.	18	250 300 400	15 21 34	225 250 300	62-74† 100-185† 56-175†	3.2-16.5† 5.5-24† 3.5-24†	42000 7600 5000†	2500 28500 4000†	9000 8500 4000
7358	T-12	Pentode	8EC	6.3	1.250	Pulse Mod.	10	200 3000	200 175	200 300	100 15	4	7000	4.2 (G2 to G1) 1500 Ohm-Non Ind. Res.	
7360	T-6½	Beam Defl. Tube	9KS	6.3	0.350	Balanced Mod. Dble. Sideband Balanced Mixer Single Sideband	1.5 1.5	150 150	1200 <sup>■</sup> 1200 <sup>■</sup>	175 175	1.5 1.5	0.75 0.75	5000†	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. 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/ 40	0.260/ 0.130	Computer	4.75	120 250	2.0 12.5	36 12	1560 3000	11500 5400	18 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	120 180	2.0 2.0	120 120	7.5 7.7	2.5 2.4	300000 500000	5000 5100	
7489	T-6½	Duotriode	9A	6.3/ 12.6	0.300/ 0.150	A-F Amp.	3.0	250	8.5	10.5	7700	2200	17		
7490	T-6½	Duotriode	9A	6.3/ 12.6	0.600/ 0.300	A-F/D.C. Amp.	5.0	250	4.6	6.0	2350	32			
7492	T-6½	Duotriode	9DA	6.3/ 12.6	0.300/ 0.150	R-F Amp. and Computer	2.8	250	200 <sup>■</sup>	10	5500	60			
7494	T-6½	Duotriode	9A	12.6/ 6.3	0.150/ 0.300	A-F Amp.	1.1	250	2	1.25	59000	1600	95		
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 <sup>■</sup>	100	11	4.2	1 Meg.	4400	
7498	T-5½	Pentode	7DB	6.3	0.300	R-F Amp.	3.0	250	160 <sup>■</sup>	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 t <sub>p</sub> = 10 μsec., p <sub>rr</sub> = 1000 pps, t <sub>r</sub> = 0.8 μsec. max., t <sub>f</sub> = 1.0 μsec. max				
7551	T-6½	Pentode	9LK	12-15	0.360	RF Amp.	12	300 300	55 42	250 200	80 70	5.1 3.7	10000 8500		
7558	T-6½	Pentode	9LK	6.3	0.800	RF Amp.	.....	Characteristics Same as Type 7551.							



TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts†	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Trans-conductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milli-watts		
	Bulb Size or Style	Class	Basing Diag.†	Volts	Amps.														
7561	T-9	Beam Pent.	7561	25	0.300	S.T.A1 Amp. S.T.A1 Amp. S.T.AB1 Amp.	13	115 250 250	8.0 15 18	115 150 150	55 48-51† 50-110†	2.5 1-7† .8-14†	8000 ..... .....	10000 ..... .....	..... ..... .....	..... 5000 3000	..... 6000 17000		
7576	T-3	Triode	7576	6.3	0.450	VHF Amp.	4.1	200	0	.....	15.5	.....	.....	10700	46	.....	.....		
7581A	T-12	Beam Pent.	7S	6.3	0.900	S.T.A1 Amp. P.P.AB1 Amp. P.P.AB1 Amp.	35	250 360 450	14 22.5 37	250 270 400	72 88-132† 116-210†	5 5-15† 5.6-22†	22500 ..... .....	6000 ..... .....	..... ..... .....	2500 6600† 5600†	6500 26500 55000		
7586	M-N	Triode	12AQ	6.3	0.140	VHF Amp.	1.0	75	100 <sup>■</sup>	.....	10.5	.....	3000	11500	35	.....	.....		
7587	M-N	Tetrode	12AS	6.3	0.150	VHF Amp.	2.2	125	68 <sup>■</sup>	50	10	2.7	200000	10600	.....	.....	.....		
7591	T-9	Beam Pent.	8KG	6.3	0.800	S.T.A1 Amp. P.P.AB1 Amp. P.P.AB1 Amp. P.P.AB1 Amp. P.P.AB1 Amp. P.P.AB1 Amp. P.P.AB1 Amp. P.P.AB1 Amp. P.P.AB1 Amp.	19	300 300 350 400 450 450 450 400 425	10 12.5 15.5 16 16.5 21 200 <sup>■</sup> 20.5	300 300 350 350 350 400 400 ..... .....	55-65† 86-116† 92-130† 85-143† 77-153† 66-144† 82-94† 80-138† 88-104†	7-16† 12-26† 13-29† 11-27† 10-27† 9.4-30† 11.5-22† 11.5-26† 13-17.5†	29000 ..... ..... ..... ..... ..... ..... ..... .....	10200 ..... ..... ..... ..... ..... ..... ..... .....	..... ..... ..... ..... ..... ..... ..... ..... .....	4000 6600† 6600† 6600† 6600† 6600† 9000† 6600† 6600†	11000 23000 30000 37000 43000 45000 28000 32000 26000		
7631	T-5½	Duodiode	6BT	6.3	0.300	Detector	.....	Max. Peak Inverse Plate Voltage = 360 Volts.				Max. Peak Plate Current = 10 Ma.				.....	.....		
7643	T-6½	Tri. Pent.	9AE	6.3	0.330	VHF Amp./ Osc.	1.7 2.1	100 170	120 <sup>■</sup> 155 <sup>■</sup>	..... 170	14 10	..... 2.8	..... 400000	5000 6200	18 40	..... .....	..... .....		
7687	T-6½	Tri. Pentode	9AE	6.3	0.500	A-F Amp.	2.4 3.0	215 220	8.5 62 <sup>■</sup>	..... 130	7.5 10	..... 3.4	7200 500000	2500 5800	18 .....	..... .....	..... .....		
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 <sup>■</sup>	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 <sup>■</sup>	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. P.P.AB1 Amp.	16	130 140	11 50 <sup>■</sup>	130 140	100 210-220†	5-14† 9-20†	7000 .....	11000 .....	..... .....	1100 1500†	4500 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 High GM	1.0 5.0	125 200	1.0 68 <sup>■</sup>	..... 125	1.5 24	..... 5.2	35000 70000	2900 10000	102 .....	..... .....	..... .....		
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 <sup>■</sup>	.....	7.5	.....	.....	10500	90	.....	.....			
7721	T-6½	Pentode	9EQ	6.3	0.320	VHF Amp.	4.0	190	400 <sup>■</sup>	160	22	6.0	120000	35000	.....	.....	.....			
7722	T-6½	Pentode	9EQ	6.3	0.320	VHF Amp.	4.0	190	370 <sup>■</sup>	160	20	6.0	100000	26000	.....	.....	.....			
									G1 = +8 Volts.											
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	21	.....	35	.....	1080	5000	5.4	.....	.....			
								150	2.0	150	5.5	1.7	340000	3200	.....	.....	.....			
7737 (3)	T-6½	Pentode	9MZ	6.3	0.320	Amplifier	3.0	180	100 <sup>■</sup>	150	11.5	2.9	.....	15900	.....	.....	.....			
7738	T-5½	Triode	7DK	6.3	0.225	VHF Class C Amplifier	5.0	200	100 <sup>■</sup>	.....	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 <sup>■</sup>	.....	6.5	.....	.....	5400	35	.....	.....			
7760	T-3	Duotriode	8DG	26.5	0.090	VHF Amp./ Osc.	.....	26.5	2.2 Meg <sup>†</sup>	.....	3	.....	.....	5000	20	.....	.....			
7761	T-3	Pentode	8DL	26.5	0.110	Video Amp.	4.0	150	100 <sup>■</sup>	100	21	4	50000	9000	.....	.....	.....			
7762	T-3	Beam Pent.	8DL	26.5	0.110	S.T. A1 Amp.	4.0	110	270 <sup>■</sup>	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.			Total Plate Current = 4.2 Ma.								
									Deflection Electrode = 135 Volts.			Acc. and Screen Current = 4.0 Ma.								
7768	Ceramic and Metal	Triode	7768	6.3	0.400	VHF Amp.	5.5	200	270 <sup>■</sup>	.....	24	.....	4500	50000	225	.....	.....			
									G1 = +6 Volts											
7803	T-6½	Duotriode	9AJ	6.3	0.365	VHF Osc. Doublers	3.5	90 160	1.3 70	.....	15 26	.....	.....	12500	33	.....	.....			
									Rg1 = 33K Ohms (Class "C" Doublers to 175 Mc)			1000								
									Ig1 = 2.5 Ma.			PK R-F Grid Volts = 77								
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 <sup>■</sup>	.....	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 <sup>■</sup> 200 <sup>■</sup> 35	90 150 150	80 114-128† 58-210†	1.0 2-17† 1.4-26†	.....	12000	10000	.....	3000 6000† 5000†	7500 28000 65000		

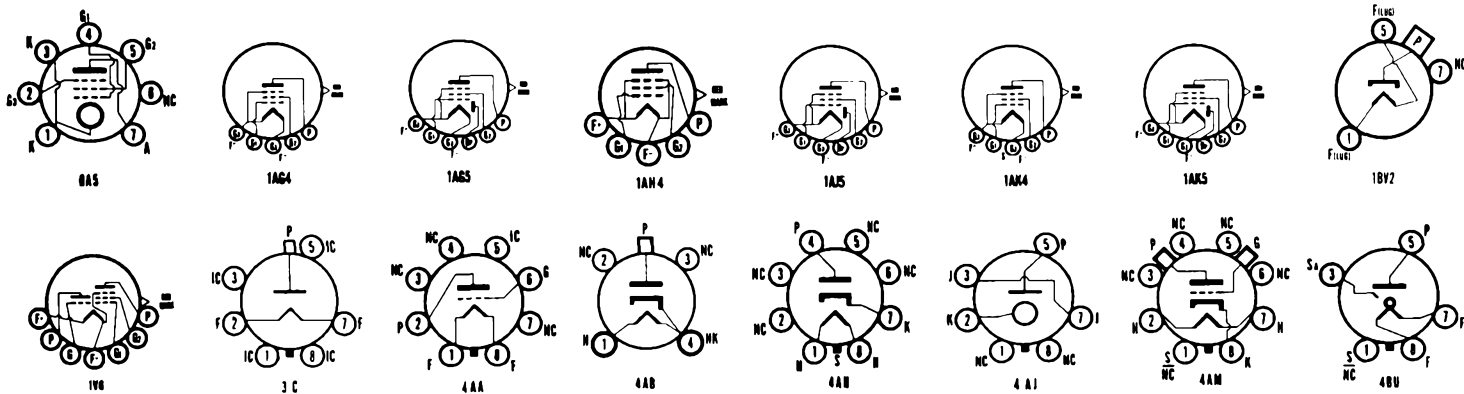
TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts <sup>2</sup>	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resis. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milli-watts
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	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 <sup>■</sup>	.....	8.5	.....	.....	5000	20	.....	.....
7888	T-3	Triode	8DK	26.5	0.045	UHF Osc.	1.0	100 150	150 <sup>■</sup> 180 <sup>■</sup>	.....	8.5 13	.....	.....	5800 6000	27 27	.....	.....
7889	T-3	Duotriode	8DG	26.5	0.090	A-F Amp.	0.55	100 150	1500 <sup>■</sup> 820 <sup>■</sup>	.....	0.8 1.75	.....	.....	1800 2500	70 70	.....	.....
7898	T-6½	Duotriode	9EP	13.5	0.150	VHF Osc./Amp.	2.75	250	200 <sup>■</sup>	.....	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	.....	6700 .....	.....	RG1 = 18 K Ohms, Driving Pwr. = 1 Watt Pk R-F Grid Volts = 43 Volts	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	.....	13500 .....	.....	Driving Pwr. = 2 Watts at 2.5 Ma.	46000
7994	T-3	Triode	8KM	6.3	0.250	VHF Amp.	2.0	100	82 <sup>■</sup>	.....	13.0	.....	2200	18000	41	.....	.....
7995	T-3	Pentode	8KZ	6.3	0.250	R-F I-F Amp.	1.6	150	160 <sup>■</sup>	150	8.0	2.0	85000	13000	.....	.....	.....
8056	M-N	Triode	12AQ	6.3	0.135	VHF Amp.	0.45	24	100 <sup>■</sup>	.....	8.7	.....	1530	7500	11.5	.....	.....
8058	M-N	Triode	12CT	6.3	0.135	UHF Amp.	1.5	110	47 <sup>■</sup>	.....	10	.....	5600	12400	70	.....	.....
8064	T-3	Beam Pent.	8DL	26.5	0.045	VHF Amp.	0.75	100	120 <sup>■</sup>	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	100 36	1.0 1.0	.....	54500	5200	.....	.....
8070	T-3	Triode	8LD	6.3	0.125	UHF Amp.	1.0	110	130 <sup>■</sup>	.....	7.5	.....	.....	11000	58	.....	.....
8071 (3)	T-3	Triode	8LE	6.3	0.125	UHF Amp.	2.0	150	100 <sup>■</sup>	.....	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. <sup>4</sup>	.....	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 <sup>■</sup>	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 <sup>■</sup>	.....	17.0	.....	.....	19000	42	.....	.....

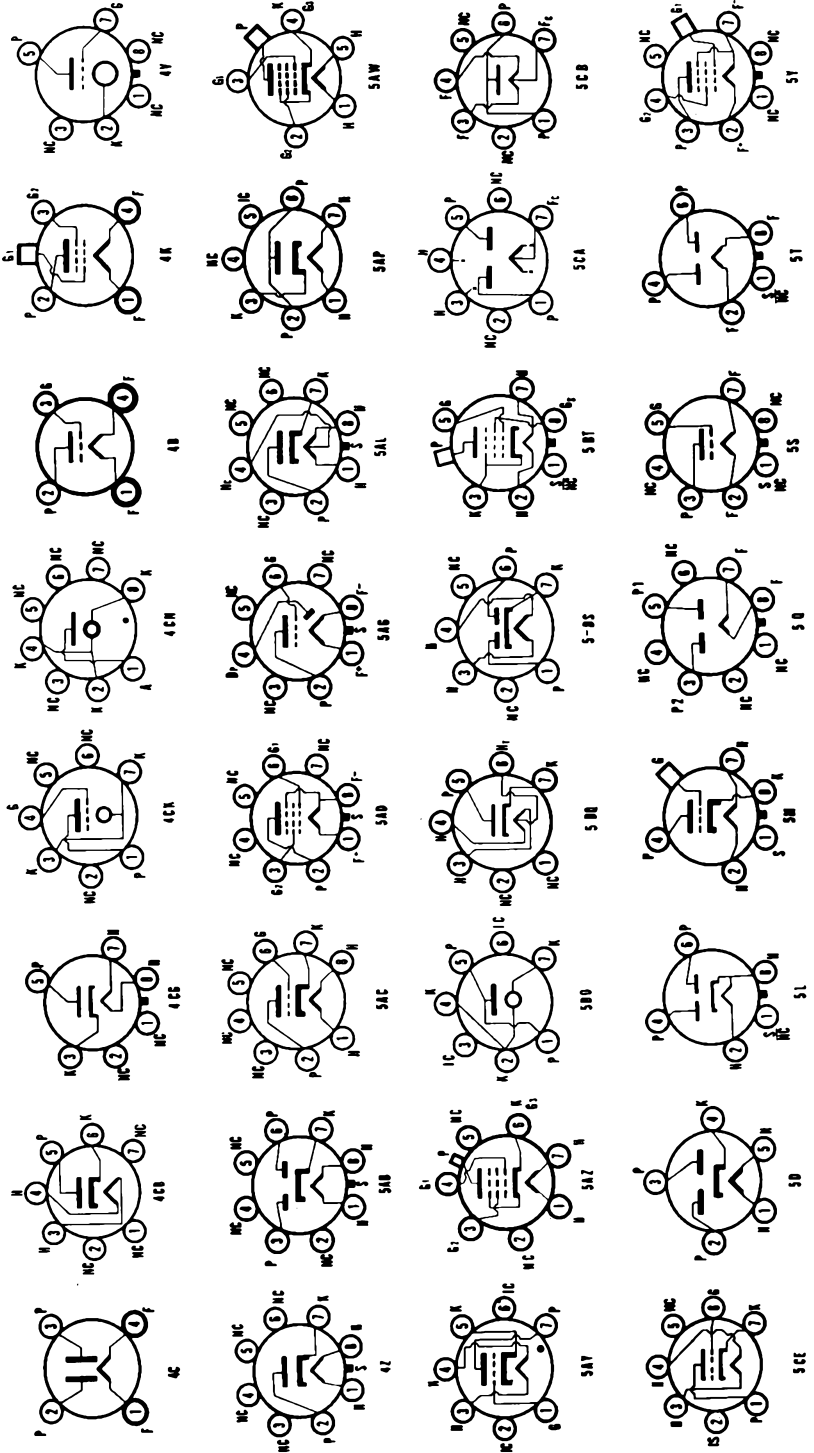
8186 (3)	T-3	Triode	8KM	26.5	0.075	R-F Pwr. Amp.	4.25	Characteristics Same as Type 8185.							
8210 (3)	T-3	Pentode	8LS	6.3	0.125	VHF Mixer VHF Amp.	1.1	100	100 <sup>■</sup>	100	7.5	2.5	260000	8500	
8211 (3)	T-3	Pentode	8DL	6.3	0.360	Video Amp.	4.0	150	62 <sup>■</sup>	100	17.0	4.2	65000	15500	
8212 (3)	T-6½	Triode	9PY	6.3 12.6	0.460 0.230	Cathode Follower	10.0	105	75 <sup>■</sup>	.....	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 <sup>■</sup>	.....	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 <sup>■</sup>	.....	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 <sup>■</sup>	.....	7.5	.....	14000	55	
8334 (3)	T-5½	Triode	7DK	6.3	0.225	UHF Amp.	4.4	200	100 <sup>■</sup>	.....	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 <sup>■</sup>	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 <sup>■</sup>	.....	15	.....	2200	12800	28
8414 (3)	T-3	Pentode	8DC	26.5	0.045	VHF Amp.	.....	26.5	2.2 Meg. <sup>4</sup>	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 <sup>■</sup>	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 <sup>■</sup>	.....	7	.....	6800	9400	64
8444 (3)	T-3	Pentode	8DC	6.3	0.125	VHF Amp.	1.1	100	100 <sup>■</sup>	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.			..... 10	.....	10900	5500	60
8448 (3)	T-6½	Pentode	9BF	6.75 13.5	0.520 0.260	Power Amp.	6.5	250	100 <sup>■</sup>	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 <sup>■</sup>	.....	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 <sup>■</sup>	.....	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	.....

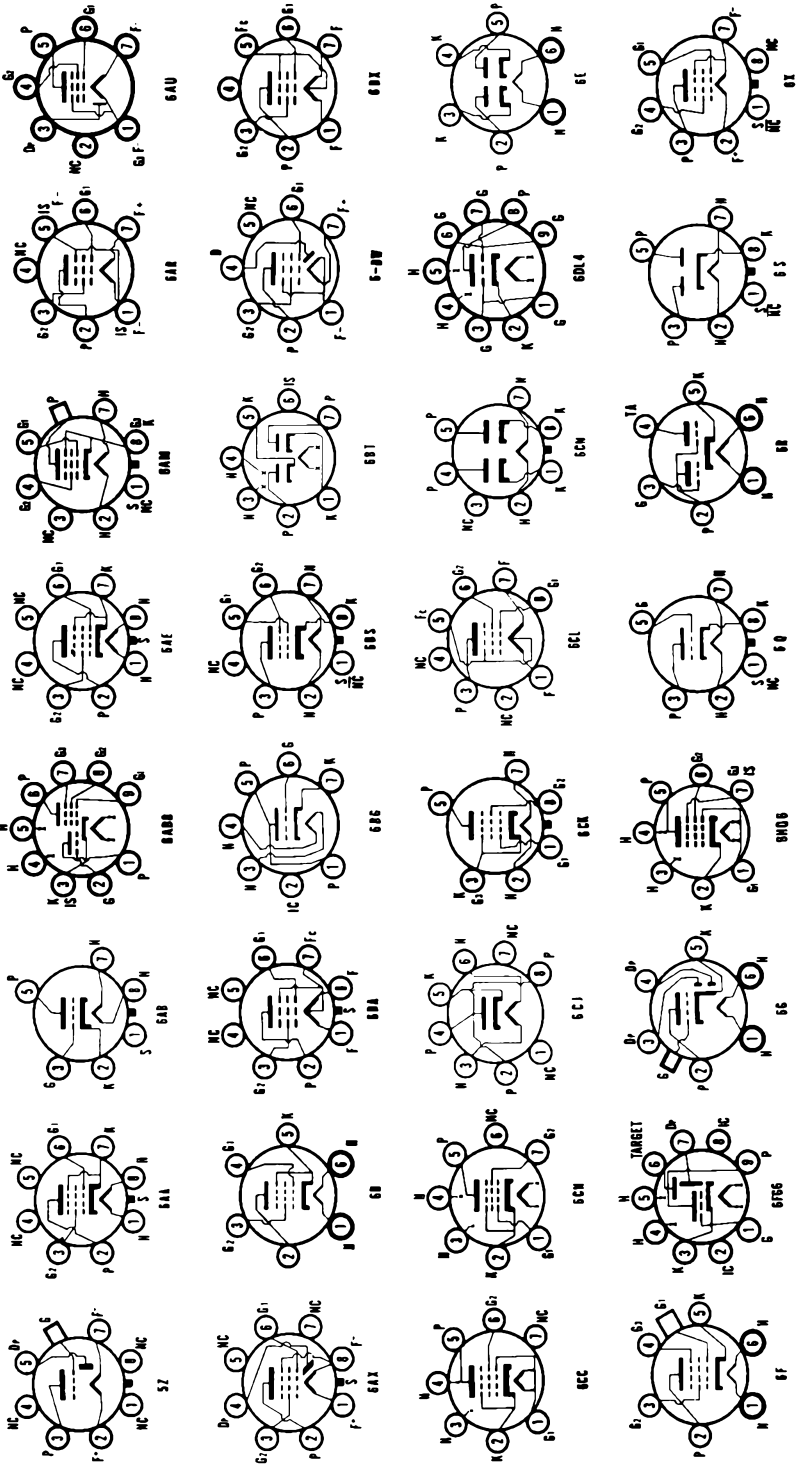
TYPE	CONSTRUCTION			EMITTER		USE	Plate Diss. Watts <sup>†</sup>	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resist. Ohms	Transconductance Micros.	Amplification Factor	Ohms Load for Stated Power Output	Power Output Milliwatts
	Bulb Size or Style	Class	Basing Diag. <sup>1</sup>	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																

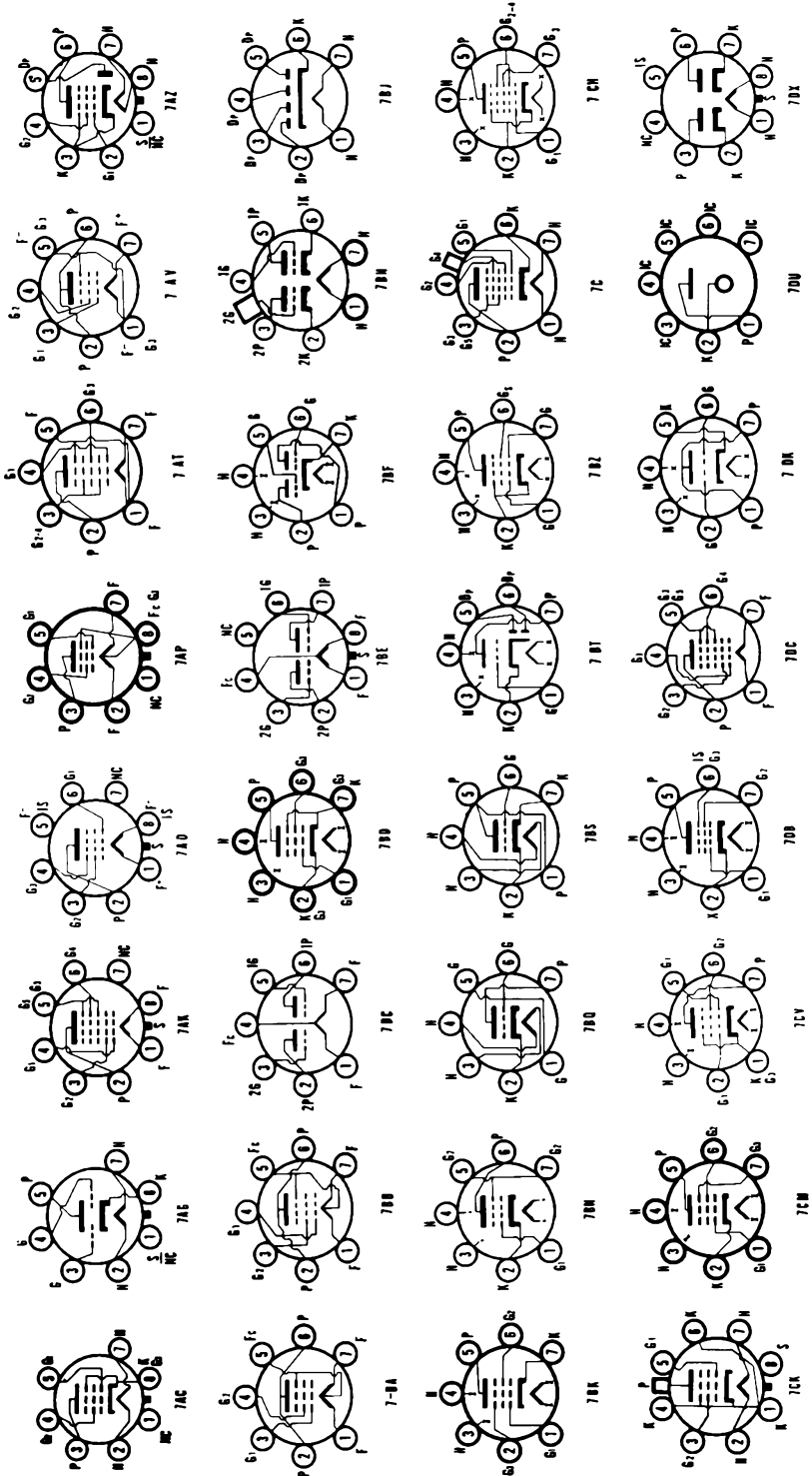
**NOTES:** (1) See Basing Diagram Section. (2) Design Maximum Values. (3) Has Special Mechanical and/or Life Characteristics. (4) Average Contact Potential Bias Developed Across Specified Grid Resistor. † Maximum Signal. ‡ Filamentary Type. ▣ Cathode Resistor (ohms). ▲ Conversion Transconductance. ¶ Plate to Plate.

## BASING DIAGRAMS FOR RECEIVING TUBE CONDENSED DATA CHART

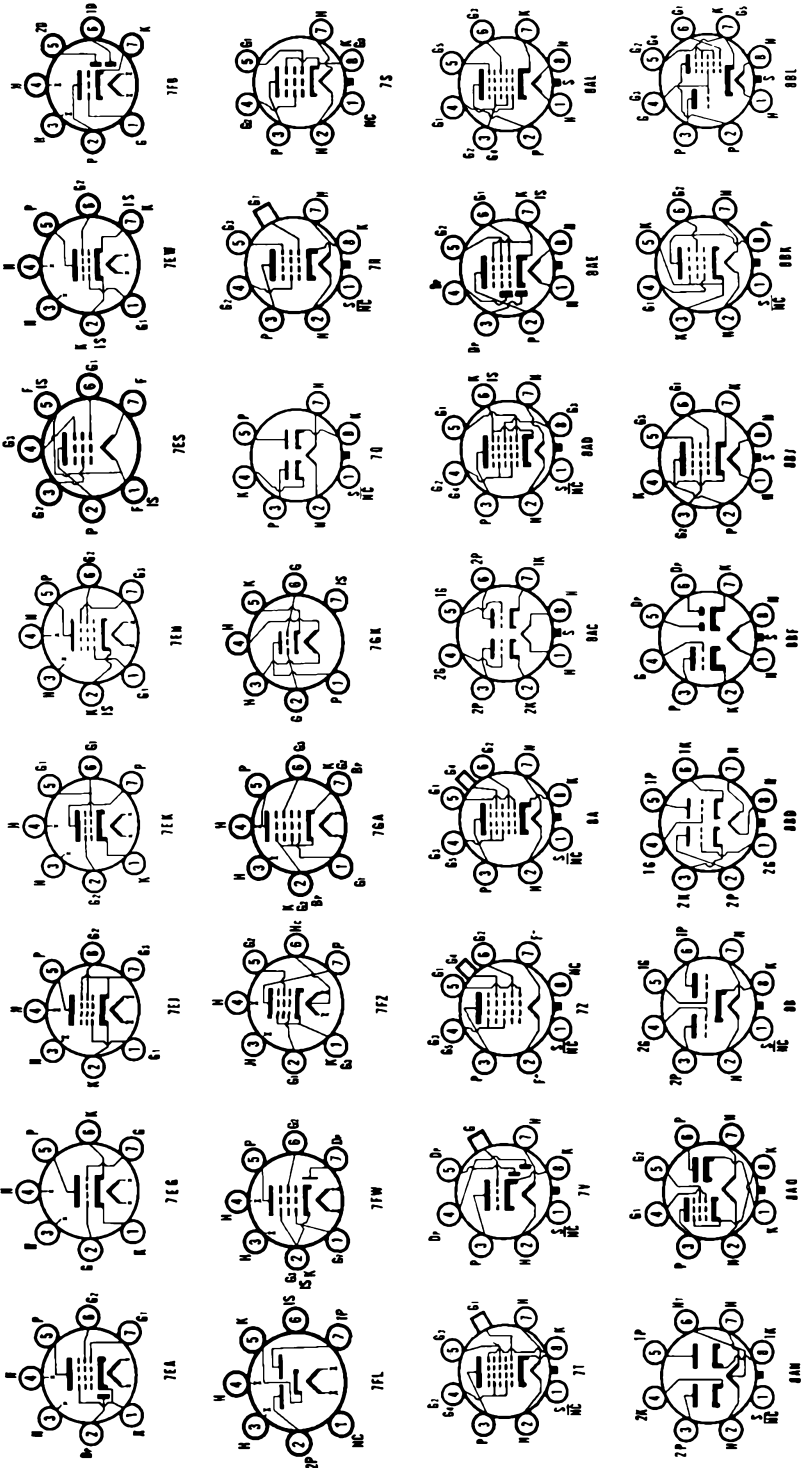


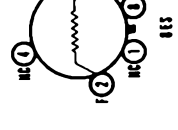
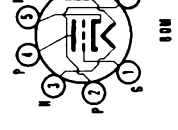
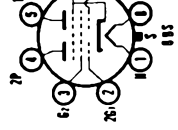
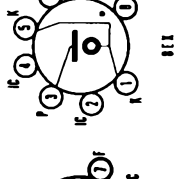
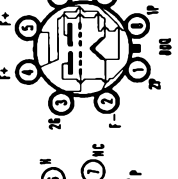
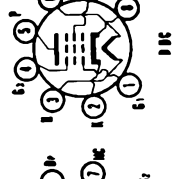
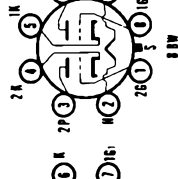
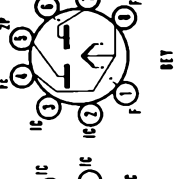
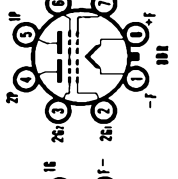
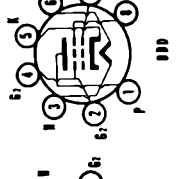
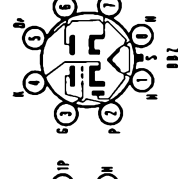
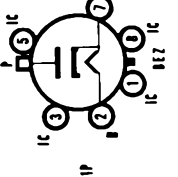
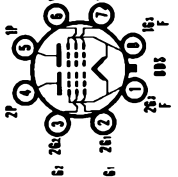
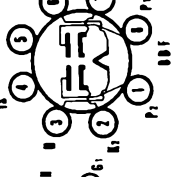
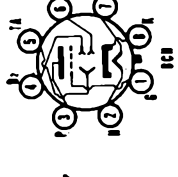
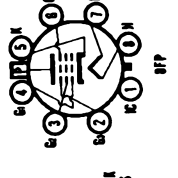
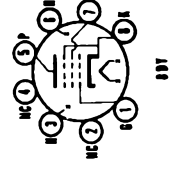
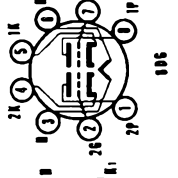
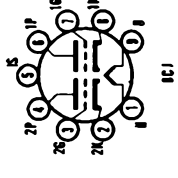
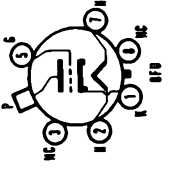
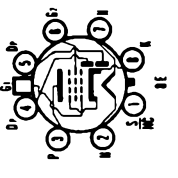
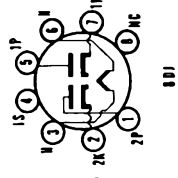
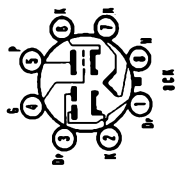
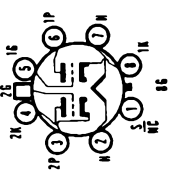
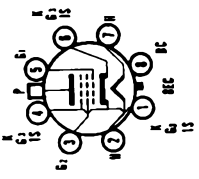
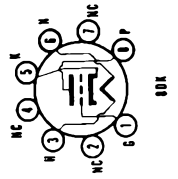
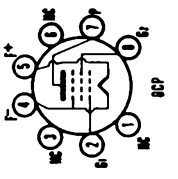
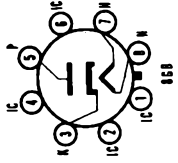
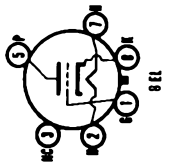
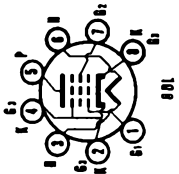
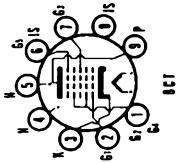


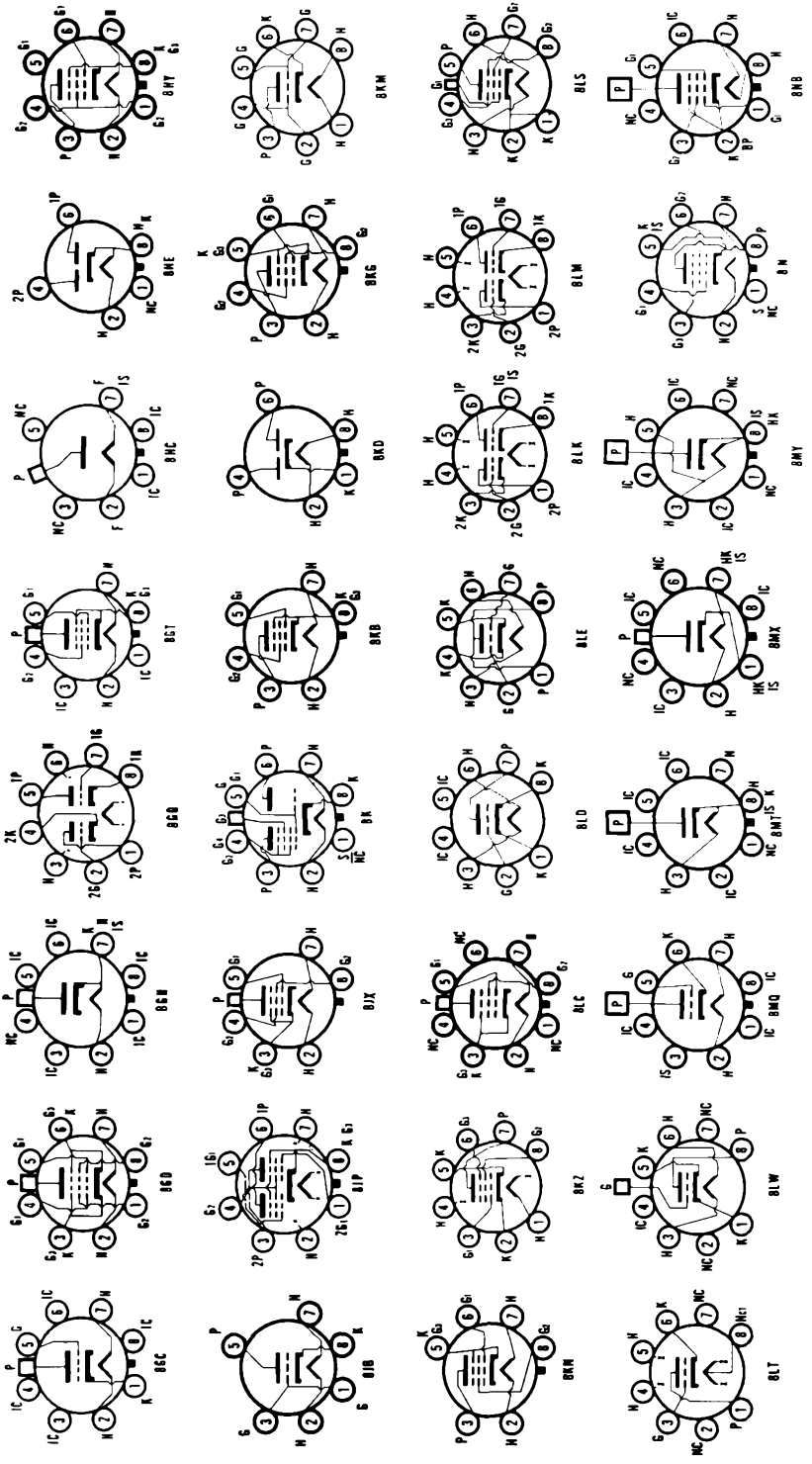




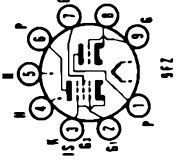
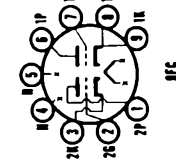
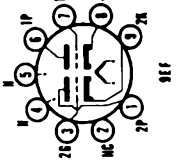
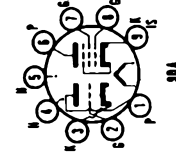
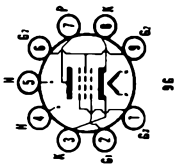
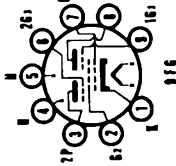
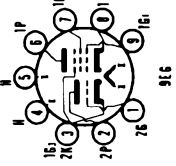
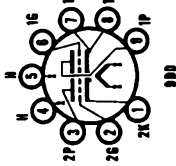
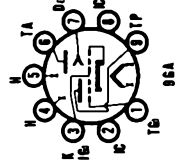
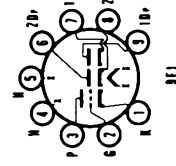
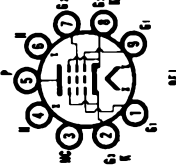
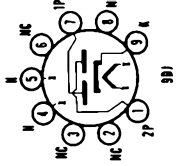
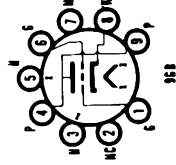
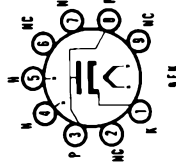
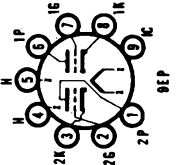
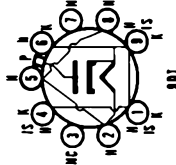
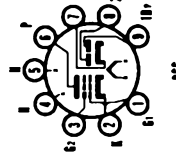
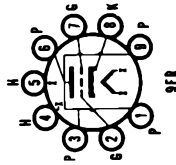
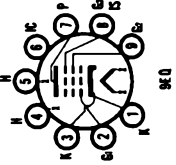
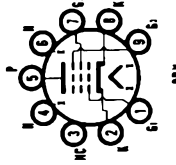
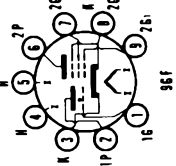
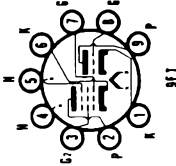
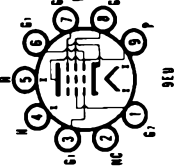
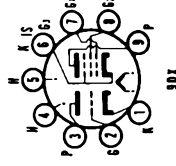
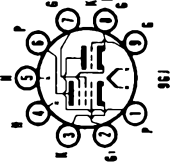
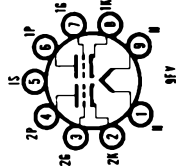
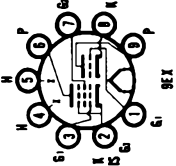
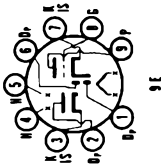
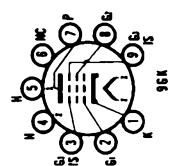
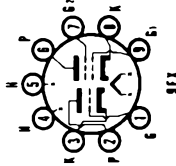
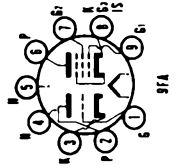
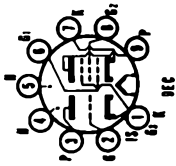




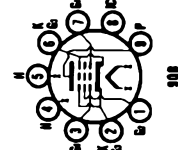
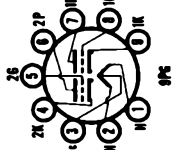
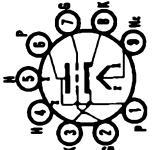
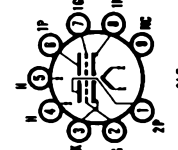
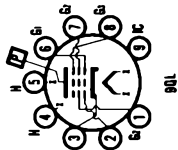
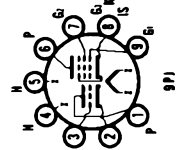
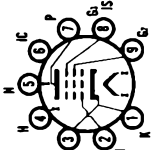
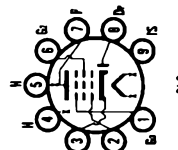
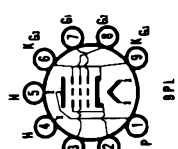
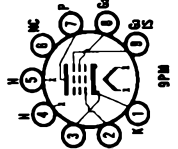
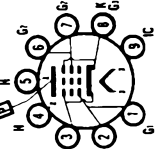
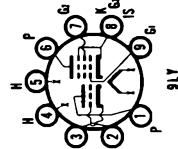
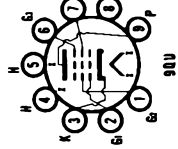
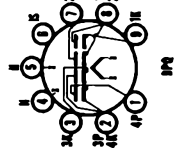
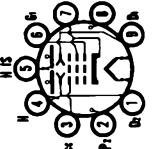
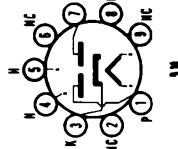
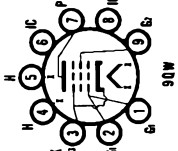
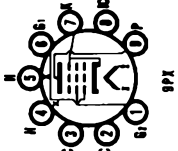
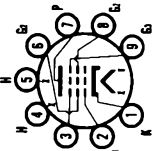
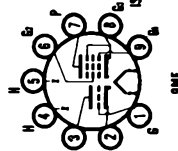
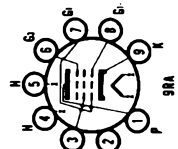
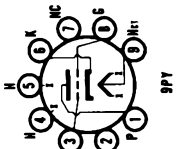
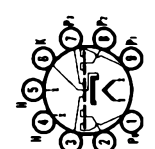
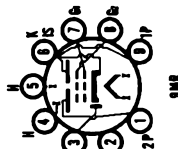
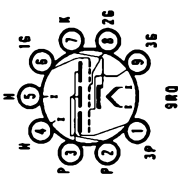
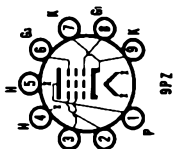
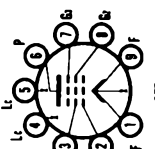
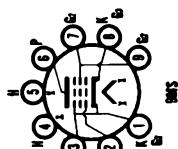








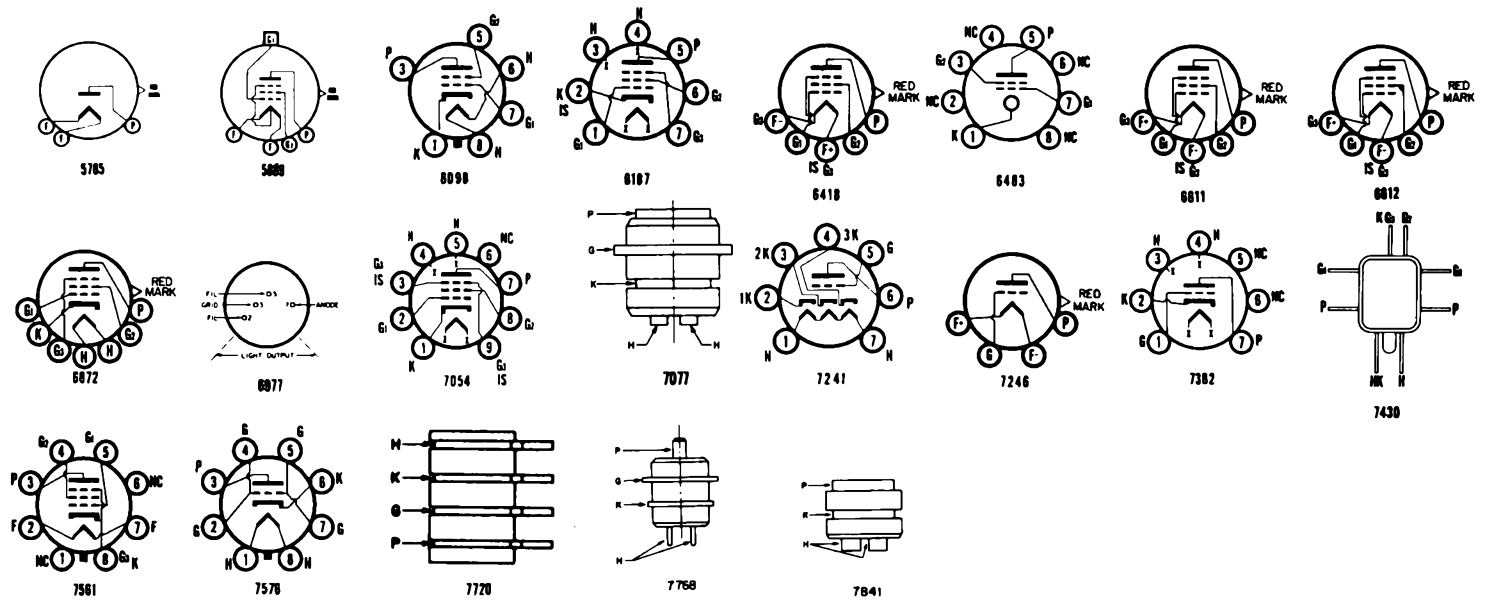












**BASING DIAGRAM SYMBOLS**

- |  |                                 |  |
|--|---------------------------------|--|
| <b>A</b> — Anode   | <b>Hc</b> — Heater Center Tap   | <b>P</b> — Plate                                   |
| <b>Dp</b> — Diode Plate  | <b>Ht</b> — Heater Tap          | <b>S</b> — Metal Shell                             |
| <b>F</b> — Filament  | <b>IC</b> — Internal Connection | <b>SA</b> — Starter Anode                          |
| <b>Fc</b> — Filament Center Tap  | <b>IS</b> — Internal Shield     | <b>T</b> — Target                                  |
| <b>G</b> — Grids numbered according to their position from the cathode | <b>J</b> — Jumper               | <b>XS</b> — External Shield                        |
| <b>H</b> — Heater  | <b>K</b> — Cathode              | <input type="checkbox"/> — Top Cap                 |
|  | <b>NC</b> — No Connection       | <input checked="" type="checkbox"/> — 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.

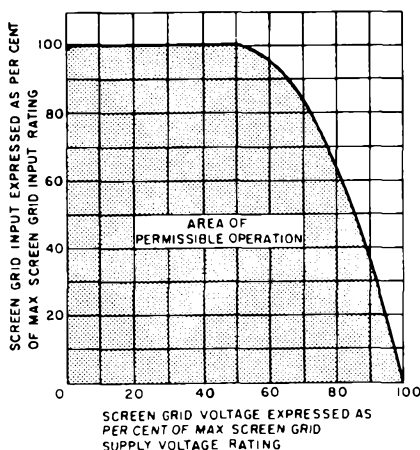
In the case where fixed screen applied voltage is desired it is necessary only to determine that the screen dissipation is within the boundary of the chart at the screen voltage to be used. In the case where a screen voltage dropping resistor is to be used it is necessary to determine the resistor value 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.

$$\frac{E_{c2}^2}{4 P_{g2}}$$

where  $E_{c2}$  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

$$R_{c2} > \frac{E_{c2}^2}{4 P_{g2}}$$

where

$R_{c2}$  is the screen dropping resistor (ohms),

$E_{c2}$  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

$$R_{c2} > \frac{250^2}{4 \times 1.0} = \frac{62500}{4} = 15625 \text{ ohms}$$

\*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 4RHH8	4BQ7A/4BZ7 4RHH8/4KN8
5AR4	5AR4/GZ34

TUBE TYPE	SYLVANIA DOUBLE/BRAND
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

TUBE TYPE	SYLVANIA DOUBLE/BRAND
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



# Foreign - American Receiving Tube Replacement Guide

Foreign Type Number	American Direct Replacement	American Similar Types	Foreign Type Number	American Direct Replacement	American Similar Types
1C1	1R5	—	6F29	6EH7/EF183	—
1C2	1AC6	—	6F30	6EJ7/EF184	—
1C3	1AB6	—	6F31	6BA6/EF93	—
1D13	1A3	—	6F33	6AS6	—
1F1	1AJ4	1T4	6F35	6AJ5	—
1F2	1L4	—	6F36	6AH6	—
1F3	1T4	—	6FD12	6DC8	—
1FDL	1AH5	1S5	6FX4	6AV4	—
1FD9	1S5	—	6G-B3A	6BQ6GTB/6CU6	—
1H35	1AB6	—	6G-B9	6DQ6B/6GW6	—
1M1	—	1M3	6G-B6	6BQ6GTB/6CU6	6DQ6B/6GW6
1N5VG	—	1N5GT	6G-K17	6AU4GTA	—
1P1	3C4	—	6H31	6BE6	—
1P10	3S4	—	6J6L	—	6J6A
1P11	3V4	—	6J6R	—	6J6A
1R5SF	1AQ5	1R5	6J8EG	—	6J8G
1RK23	1S2	—	6J8GA	—	6J8G
1S5SF	1AR5	1S5	6L10	6AG7	—
1T4SF	1AM4	1T4	6L12	6AQ8/ECC85	—
1U5SF	1AS5	1U5	6L13	12AX7A/ECC83, 7025	12AX7/ECC83
3A4T	—	3A4	6L31	6AQ5A	—
3D-HH13	3FX7/3DHH13	—	6L34	6AQ4	—
3M-R24	3DK6	3CB6	6L43	6CL6	—
3M-V7	3BZ6	—	6L43	6CL6	—
3S4SF	3W4	3S4	6LD3	6CV7	—
4R-HH2	4BQ7A/4BZ7	4BQ7/4BZ7	6LD12	6AK8/EABC80	6T8A
4R-HH8	4RHH8/4KN8	4BS8	6LD13	6BD7	—
4Y25	807	—	6LP12	6BM8/ECL82	—
5B/250A	807	—	6M1	—	6U5
5M-HH3	5J6	—	6M2	6CD7	—
5P-29	6CN6	—	6M-H1	6J4	—
5RHP1	4BL8/XCF80	—	6M-HH3	6J6A	—
5S1	807	—	6P9	6BM5	—
5Y3GB	—	5Y3GT	6P15	6BQ5/EL84	—
5Z10	5U4GB	—	6P17	6AM5	—
6AT7N	6DT8	—	6P25	6AG6	—
6B8EG	—	6B8	6Q8	6A8, G, GT	—
6B32	6AL5	—	6R-HH1	—	6DJ8, 6922
6BC32	6AV6	—	6R-HH2	6BZ8	—
6BS4	—	6DZ4/6AF4A	6R-HH8	6RHH8/6KN8	—
6C12	6AJ8	—	6R-K19	6RK19/6BR3	—
6C16	6BL8/ECF80	—	6Z31	6X4	—
6C18	6GV7	—	7D9	6AM5	—
6CC31	6J6A	—	7D10	6CH6	6BQ5/EL84
6D1	6DR4	—	7F16	6CJ5	—
6D2	6AL5	—	8D3	6AM6	6BA6/EF93
6D-HH13	6FX7/6DHH13	—	8D4	—	6W7
6E8	6A8	—	8D5	6BR7	5879
6F10	6AC7	—	8D6	6BW7	—
6F12	6AM6	6BH6	8D7	6BS7	5879
6F16	6CJ5	—	8D8	—	EF86/6267
6F18	6EC7	—	8R-HP1	8B8	—
6F19	6BY7	—	9BR8	—	9U8A
6F21	6CQ6	6BJ6, A	9D6	6CQ6	6BJ6, A
6F22	EF86/6267	5879	9M-HH3	9J6	—
6F23	6EL7	—	9P9	9BM5	—
6F24	—	6EJ7/EF184	9R-AL1	6FD7	—
6F25	—	6EH7/EF183	10C14	19D8, 19AJ8	—
6F26	6BY7	—	10F18	13EC7	—

## Foreign - American Receiving Tube Replacement Guide (cont'd)

Foreign Type Number	American Direct Replacement	American Similar Types	Foreign Type Number	American Direct Replacement	American Similar Types
10L14	26AQ8	—	66KU	6BT4	—
10LD3	14L7	—	67PT	6CK5	—
10LD12	28AK8	—	77E	—	6C6
10P18	45B5	—	77M	—	6J7, G, GT
10PL12	50BM8	—	80S	—	5Z4, GT
11L6	—	6L6, 6L6GC	85A1	OE3	—
12AU7R	—	12AU7A/ECC82	85A2	OG3	5651, A
12AX7R	—	12AX7/ECC83	85A3	5783	—
		12AX7A/ECC83	86M	—	6P5, GT
		7025	88M	—	6SK7, GT
		—	89RS	—	6B8, G
12BC32	12AV6	—	108C1	OB2	—
12F31	12BA6	—	121VP	12AC5	—
12G-B3	—	12DQ6B/12GW6	141DDT	14L7	—
12G-B6	12BQ6B/12CU6	—	141TH	14K7	—
12G-B7	12DQ6B/12GW6	—	150B2	6354	—
12G-K17	—	12D4, A	150C1	OA2	—
12H31	12BE6	—	150C2	OA2	—
12R-K19	12RK19/12BR3	12AF3	150C3	OD3, OD3A	—
12R-LL3	12AV7	—	150C4	—	OA2
13D2	6SN7GTB	—	163 Pen	16A5	—
15FM7	—	13FM7	171DDP	17C8	—
17N8	17C8	—		17N8	—
17R-HH2	—	17EW8/HCC85	213 Pen	21A6	—
17RK19	17BR3/17RK19	—	311SU	31A3	—
19AJ8	19D8	—	451PT	45A5	—
19BD	19X3	—	A676	—	76
19M-R9	18FW6A	—	A678	—	78
19M-R10	18ED6	—	A863	—	6J7, G, GT
	18GD6	—	A1834	6AS7G, GA, GYB	—
19SU	19Y3	—		6080	—
19U3	19X3	—	AA91E	5726	—
19W3	19X3	—		5726/6AL5W	—
20D3	12AH8	—	AD	6Z3	—
20D4	6AJ8	—	AG5209	OG3	5651, A
24/76	—	6P5G, GT	AG5210	—	OB2, OB2WA
24/78	—	6K7, GT	AG5211	—	OA2, OA2WA
25G-B6	25BQ6GTB/25CU6	—	ASG512	2D21	—
30C1	9A8/PCF80	9U8A	B36	12SN7GTA	—
30C15	9EN7	—	B63	6A6	—
30C18	7GV7	—	B65	6SN7GTB	—
30F5	7ED7	—	B139	7AN7	—
30FL1	9GB8	—	B152	12AT7/ECC81	—
30L1	7AN7	—	B309	12AT7/ECC81	—
30L15	7EK7	—	B319	—	7AN7
30P4	25GF6	25BQ6GTB/25CU6	B329	12AU7A/ECC82	—
30P12	12FB5	—	B339	12AX7/ECC83	—
30P16	16A5	—		7025	—
30P18	15CW5/PL84	—	B719	—	6AQ8/ECC85
30P19	25GF6	—	B739	—	12AT7/ECC81
30PL1	13GC8	—	B749	—	12AU7A/ECC82
30PL12	16A8/PCC82	—	B759	—	12AX7/ECC83,
30PL13	16GK8	—			7025
41E	—	41	BF61	6CK5	6CL6
41M	—	6K6GT	BF451	45A5	—
42E	—	42	BPMO4	6AQ5A	—
52KU	5Z4G	5V4GA	CC81E	12AT7WA	12AT7/ECC81
53KU	—	5V4GA		6201	—
62DDT	6CV7	—	CCa	6922	—
62TH	6CU7	7J7	D1C	957	—
62VP	6CJ5	—	D2C	958A	—
63ME	—	6U5	D2M9	6AL5	—
63T1	6AB8A	6AB8/ECL80	D3F	959	—
63TP	6AB8/ECL80	—	D61	—	6CT7
64ME	6CD7	—	D63	—	6H6
64SPT	6BX6/EF80	—	D77	6AL5	—
65ME	6BR5	—			



## Foreign - American Receiving Tube Replacement Guide (cont'd)

Foreign Type Number	American Direct Replacement	American Similar Types	Foreign Type Number	American Direct Replacement	American Similar Types
D152	6AL5	—	DP61	6AK5/EF95	—
D717	—	6AL5	DS77	—	6AL5
DA90	1A3	—	DY30	—	1G3GT/1B3GT
DAC32	1H5GT	—	DY70	5642	—
DAF91	1S5	—	DY80	—	1X2B
DAF92	1U5	—	DY86	1S2	1H2
DAF96	1AH5	1S5	DY87	1S2A/DY87	1H2
DAF191	—	1S5	E1F	954	—
DC70	6375	1E3	E2F	956	—
DC80	1E3	—	E55L	8233	—
DCC90	3A5	—	E80CC	6085	—
DCF60	—	1V6	E80CF	7643	—
DD6	—	6AL5	E80F	6084	—
DD7	6AM5	—	E80L	6227	—
DDR7	6AM5	—	E80T	6218	—
DF33	1N5GT	—	E81CC	12AT7WA	12AT7/ECC81
DF60	5678	—		6201	—
DF62	1AD4	—	E81L	6686	—
DF91	1T4	—	E82CC	6189/12AU7WA	12AU7A
DF92	1L4	—		6201	12AU7/ECC82
DF96	1AJ4	1T4		6686	12AX7A/ECC83
DF97	1AN5	—	E83CC	6181/12AX7A	12AX7/ECC83
DF652	1AD4	—		6689	—
OF904	1U4	—	E83F	7320	6BQ5/EL84
DH63	6Q7, GT	—	E84L	6922	—
DH63M	—	6Q7, GT	E88CC	5920	—
DH74	12Q7GT	—	E90CC	7693	6BH6
DH76	—	12Q7, GT	E90F	—	6661/6BH6
DH77	6AT6	—		6X4	—
DH81	—	7B6	E90Z	5726	6AL5
DH118	—	14L7	E91AA	5726/6AL5W	—
DH142	—	14L7		6687	5915
DH147	—	6Q7, GT	E91H	—	6BY6
DH149	7C6	—		5727	—
DH150	6CV7	—	E91N	5654	6AK5/EF95
DH718	6CV7	—	E95F	7694	6BJ6, A
DH719	6T8A	6AK8/EABC80	E99F	7534	—
DH817	6CV7	—	E130L	7062	—
DK32	1A7GT	—	E180CC	6688A	—
DK91	1R5	—	E180F	7119	7044
DK92	1AC6	—	E182CC	5847/404A	—
DK96	1AB6	—	E182F	7737	—
DK97	1AB6	—	E186F	7308	6922
DL29	3D6	—	E188CC	7722	—
DL31	1A5GT	—	E280F	6X4	—
DL33	3Q5GT	—	E902	8223	—
DL35	1C5GT	—	E288CC	6923	—
DL36	1Q5GT	—	EA52	6489	—
DL63	—	6R7	EA76	6AL5	—
DL67	6007	—	EAA91	—	6AL5
DL70	6373	—	EAA171	5726	6AL5
DL74M	—	12Q7GT	EAA901	5726/6AL5W	—
DL82	—	7B6		5726	6AL5
DL91	1S4	—	EAA901S	5726/6AL5W	—
DL92	3S4	—		6AK8/EABC80	6T8A
DL93	3A4	—	EABC80	6CT7	—
DL94	3V4	—	EAF42	—	6H6
DL95	3Q4	—	EB34	—	—
DL96	3C4	3V4	EB91	6AL5	—
DL98	3B4	3B4WA	EBC33	—	6Q7, GT
DL193	—	3A4		—	6R7
DL620	5672	—	EBC41	6CV7	—
DM70	1M3	—	EBC80	6BD7	—
DM71	1N3	—	EBC81	6BD7A	—
DM160	6977	—	EBC90	6AT6	—
			EBC91	6AV6	—

## Foreign - American Receiving Tube Replacement Guide (cont'd)

Foreign Type Number	American Direct Replacement	American Similar Types	Foreign Type Number	American Direct Replacement	American Similar Types
EBF32	—	6B8	ECH81	6AJ8	—
EBF80	6N8	—	ECH83	6DS8	—
EBF81	6AD8	—	ECH113	6CU7	7J7
EBF83	6DR8	—	ECH171	—	6AJ8
EBF89	6DC8	—	ECH200	6V9	—
EBF171	—	6N8	ECL80	6AB8/ECL80	—
EBF175	—	6DC8	ECL82	6BM8/ECL82	—
EC70	5718	—	ECL83	—	6BM8/ECL82
EC71	5718	—	ECL84	6DX8/ECL84	—
EC80	6Q4	6BC4	ECL85	6GV8	—
EC81	6R4	—	ECL86	6GW8/ECL86	—
EC84	6AJ4	—	ED2	6AL5	—
EC86	6CM4	—	EF5	6DA6	—
EC88	6DL4/EC88	—	EF9	—	6K7, GT
EC90	6C4	—	EF13	6DA6	—
EC91	6AQ4	—	EF22	7G7	7B7
EC92	6AB4	—	—	—	7A7
EC93	6BS4	6DZ4/6AF4A	EF36	6J7, GT	—
EC94	6DZ4/6AF4A	—	EF37, A	—	6J7, GT
EC95	6ER5	6ES5	EF39	—	6K7, G, G7
EC97	6FY5	6GK5/6FQ5A	EF40	—	5879
EC900	6HA5/6HM5	—	EF41	6CJ5	—
EC1000	8254	—	EF42	—	6EW6
ECC32	—	6SN7GTB	EF70	6487	—
ECC33	—	6SN7GTB	EF71	5899	—
ECC35	—	6SL7GT	EF72	5840	—
ECC40	—	6N7, GT	EF73	6488	—
ECC70	6021	—	EF74	6391	—
ECC81	12AT7/ECC81	—	EF80	6BX6/EF80	—
ECC82	12AU7/ECC82	—	EF81	6BH5	—
ECC83	12AX7A/ECC83	—	EF82	6CH6	6BQ5/EL84
—	7025	—	EF83	6BK8	—
ECC84	6CW7	6BQ7A/6BZ7	EF85	6BY7	—
ECC85	6AQ8/ECC85	—	EF86	6267	5879
ECC86	6GM8	—	—	6CF8	—
ECC88	6DJ8	6922	EF89	6DA6	—
ECC89	6FC7	6ES8/ECC189	EF89F	6DG7	—
ECC91	6J6A	—	EF91	6AM6	—
ECC180	6BQ7A/6BZ7	—	EF92	6CQ6	—
ECC186	7316	—	EF93	6BA6/EF93	—
—	12AU7A/ECC82	—	EF94	6AU6A	—
ECC189	6ES8/ECC189	—	EF95	6AK5/EF95	—
ECC230	6080	—	EF96	6AG5	6BC5/6CE5
ECC801	12AT7WA	12AT7/ECC81	EF97	6ES6	—
—	6201	—	EF98	6ET6	—
ECC801S	12AT7WA	12AT7/ECC81	EF98	—	6BX6/EF80
—	6201	—	EF174	—	6BY7
—	6189	12AU7A/ECC82	EF175	—	—
ECC802	6189	12AU7A/ECC82	EF183	6EH7/EF183	—
ECC802S	6189	12AU7A/ECC82	EF184	6EJ7/EF184	—
ECC803	12AX7A/ECC83	12AX7/ECC83	EF190	6CB6A	—
—	7025	—	EF730	5636	—
ECC803S	12AX7A/ECC83	12AX7/ECC83	EF731	5899	—
—	7025	—	EF732	5840	—
ECC804	6GA8	—	EF734	6205	—
ECC960	5920	—	EF811	—	6EH7/EF183
ECF80	6BL8/ECF80	—	EF812	6EL7	—
ECF82	6U8A/6KD8	—	EF814	—	6EJ7/EF184
ECF86	6HG8/ECF86	—	EF861	6688A	—
ECF200	6X9/ECF200	—	EF905	5654	6AK5/EF95
ECF201	6U9	—	—	5654/6AK5W	—
ECF801	6GJ7/ECF801	—	EFL200	6Y9	—
ECF802	6JW8/ECF802	—	EH90	6CS6	6BY6
ECH3G	—	6K8	EH900	—	5915
ECH35	—	6E8G, 6K8	EH900S	—	5915
ECH42	6CU7, 6C9	7J7	EK32	—	6A8, G, GT
ECH80	6AN7	—	EK90	6BE6	—

## Foreign - American Receiving Tube Replacement Guide (cont'd)

Foreign Type Number	American Direct Replacement	American Similar Types	Foreign Type Number	American Direct Replacement	American Similar Types
EL32	—	6V6GTA	GZ33	—	5V4GB
EL33	—	6V6, 6V6GTA	GZ34	5AR4/GZ34	5AR4/GZ34
EL34	6CA7/EL34	7027A	H63	6F5, GT	5U4GB
EL35	—	6Y6GA	HAA91	12AL5	—
EL36	6CM5	6Y6G	HABC80	19T8	—
EL37	—	6L6GC	HBC90	12AT6	—
EL38	6CN6	7027A	HBC91	12AV6	—
EL41	6CK5	—	HCC85	17EW8/HCC85	—
EL71	5902	6CL6	HCH81	12AJ7	—
EL80	6M5	—	HD14	1H5G, GT	—
EL81	6CJ6	6BQ5/EL84	HD30	3B4, 3B4WA	—
EL82	6DY5	—	HD51	OA2	—
EL83	6CK6	—	HD52	OB2	—
EL84	6BQ5/EL84	6CL6	HD93	1X2B	—
EL85	6BN5	—	HD94	6BQ6GTB/6CU6	—
EL86	6CW5/EL86	—	HD96	25BQ6GTB/25CU6	—
EL90	6AQ5A	—	HF61	6CJ5	—
EL91	6AM5	—	HF93	12BA6	—
EL95	6DL5	—	HF94	12AU6	—
EL180	12BY7A	—	HF121	12AC5	—
EL360	—	6CM5	HK90	12BE6	—
EL500	6GB5/EL500	—	HL90	19AQ5	—
EL803	—	6CK6	HL92	50C5	—
EL821	6CH6	6BQ5/EL84	HL94	30A5	35C5
EL822	6CH6	6BQ5/EL84	HMO4	6BE6	—
EL861	6686	—	HP6	6AM6	—
ELL80	6HU8/ELL80	—	HY90	35W4	—
EM34	6CD7	—	HZ90	12X4	—
EM80	6BR5	—	KD21	OA3, OA3A	—
EM81	6DA5	—	KD24	OC3, OC3A	—
EM84	6FG6/EM84	—	KD25	OD3, OD3A	—
EM85	6DG7	—	KL35	—	1F5G
EM87	6HU6/EM87	—	KT32	—	25L6GT
EM840	6FG6/EM84	—	KT61	6AG6G	6V6, 6V6GTA
EN32	2050	—	KT63	6F6, G, GT	6M6G
EN91	2D21	—	KT66	—	—
EN92	5696	—	KT71	—	7027A
EN93	6D4	—	KT77	6CA7/EL34	6L6GC
EQ80	6BE7	—	KT81	—	5881
EY51	6X2	—	KTW61	—	807
EY80	6U3	—	KTW63	—	50L6GT
EY81	6R3	6AF3	KTW74M	—	7027A
EY81F	6V3	—	KTZ63	—	7C5
EY82	6N3	—	L63	6C5	6S7
EY83	—	6S2	L63B	6J5, GT	6K7, G, GT
EY84	—	6AL3/EY88	L77	6C5	12K7GT
EY86	6S2	—	LC900	6J5, GT	6J7, G, GT
EY87	6S2A	—	LCF80	6C4	—
EY88	6AL3/EY88	—	LCF86	6C4	—
EY500	6EC4	—	LCF86	3HM5/3HA5	—
EZ3	6V4/EZ80	6CA4	LCF200	6LN8	—
EZ4	6CA4	—	LCF201	5HG8/LCF86	—
EZ11	6V4/EZ80	6CA4	LCF801	5X9	—
EZ35	6X5GT	—	LCF802	5U9/LCF201	—
EZ40	6BT4	—	LCH200	5GJ7	—
EZ80	6V4/EZ80	6CA4	LCL84	6LX8/LCF802	—
EZ81	6CA4	—	LCL200	5V9	—
EZ90	6X4	—	LF183	10DX8/LCL84	—
EZ91	6AV4	—	LF184	11Y9/LCL200	—
GZ30	5Z4, GT	—	LFL200	4EH7	—
GZ31	—	5U4GB		4EJ7	—
GZ32	5V4GA	—		11Y9/LFL200	—

Foreign - American Receiving Tube Replacement Guide (cont'd)

Foreign Type Number	American Direct Replacement	American Similar Types	Foreign Type Number	American Direct Replacement	American Similar Types
LL86	10CW5/LL86	—	N709	6BQ5/EL84	—
LN119	50BM8	—	N727	6AQ5A	—
LN152	6AB8/ECL80	—	OBC3	12SQ7, GT	—
LN319	13GC8	—	OF1	—	6S7
LY88	20AQ3	—	OH4	12A8GT	—
LY500	28EC4	—	OM4	—	6Q7, GT
LZ319	8A8	9A8/PCF80	OM6	—	6K7, GT
		9U8A	OM10	—	6K8
LZ329	9A8/PCF80	9U8A	OSW2190	—	6AC7
M8079	5726	6AL5	OSW2192	—	6AG7
M8080	—	6C4	OSW2600	—	6AC7
M8081	6101	6J6A	OSW2601	6AG7	—
	6101/6J6WA	—	OSW3104	—	6SA7, GT
M8082	—	6AM5	OSW3105	—	6SQ7, GT
M8083	—	6AM6	OSW3106	—	6V6, GT
M8096	5763	—	OSW3109	—	6H6
M8098	—	0G3, 5651A	OSW3110	6E5	—
M8100	5654	6AK5/EF95	OSW3111	—	6SK7, GT
	5654/6AK5W	—	OSW3112	—	6J5
M8121	5840	—	P17A	807	—
M8136	6189/12AU7WA	12AU7AECC82	PABC80	9AK8	—
M8137	12AX7A/ECC83	12AX7/ECC83	PC86	4CM4	—
	7025	—	PC95	4GK5	—
M8161	6065	—	PC97	3FY5	—
M8162	12AT7WA	12AT7/ECC81	PC900	4HA5/PC900	—
	6201	—	PCC84	7AN7	—
M8190	—	5783	PCC85	9AQ8	—
M8196	5725	6AS6	PCC88	7DJ8	—
M8204	5727	2D21	PCC89	7FC7	—
M8212	5726	6AL5	PCC189	7ES8	—
M8214	—	12AX7A/ECC83	PCC805	7EK7	—
		12AX7/ECC83	PCE800	9GB8	—
M8223	OA2WA	OA2	PCF80	9A8/PCF80	9U8A
M8224	OB2WA	OB2	PCF82	9U8A	—
M8232	6J4WA	6J4	PCF86	7HG8/PCF86	8HG8
	8532/6J4WA	—	PCF800	9EN7	—
M8245	6005	6AQ5A	PCF801	8GJ7/PCF801	—
N14	1C5GT	—	PCF805	7GV7	—
N15	3Q5GT	—	PCL82	16A8/PCL82	—
N16	3Q5GT	—	PCL84	15DQ8	—
N17	3S4	—	PCL85	18GV8	—
N18	3Q4	—	PCL800	16GK8	—
N19	3V4	—	PF9	—	6K7
N25	3C4	—	PH4	6A8, G, GT	—
N77	—	6AM5	PL21	2D21	—
		6AL5	PL36	25E5	—
N78	6BJ5	—	PL81	21A6	—
N119	45B5	—	PL82	16A5	—
N142	45A5	—	PL83	15A6	—
N144	6AM5	—	PL84	15CW5/PL84	—
N147	6AG6G	—	PL500	27GB5/PL500	—
		6V6	PL820	—	21A6
		6V6GTA	PL1267	0A4G	—
N148	—	7C5	PLL80	12HU8	—
N150	6CK5	6CL6	PM04	6BA6/EF93	—
N152	21A6	—	PM05	—	6AK5/EF95
N153	15A6	—	PM07	6AM6	—
N154	16A5	—	PY80	19X3	—
N155	6BN5	—	PY81	17Z3	—
N308	—	25E5	PY82	19Y3	—
N309	15A6	—	PY83	—	17Z3
N329	16A5	—	PY88	30AE3	—
N359	21A6	—	QA2400	6065	6CQ6
N369	16A8/PCL82	—	QA2401	—	6C4
N379	15CW5/PL84	—	QA2402	—	6AM5
N707	—	6BQ5/EL84	QA2403	—	6AM6

## Foreign - American Receiving Tube Replacement Guide (cont'd)

Foreign Type Number	American Direct Replacement	American Similar Types	Foreign Type Number	American Direct Replacement	American Similar Types
QA2404	—	6AL5	TXM100	—	2D21
QA2406	—	12AT7/ECC81			5727
QA2407	—	6X4, 6X4W	U17	—	1T4
QA2408	5692	6SN7GTB	U26	6S2	—
QB65	—	6SN7GTB	U37	1T2	—
QB309	—	12AT7/ECC81	U41	—	1G3GT/1B3GT
QE03/10	5763	—	U43	6X2	—
QE05/40	6146	—	U49	6S2	—
QE05/40H	6159	—	U50	5Y3GT	—
QE06/50	—	807	U52	5U4G	—
		5933		5U4GB	—
QL77	6C4	—	U70	—	6X5GT
QQE02/5	6939	—	U74	—	35Z4GT
QQE03/12	6360	—	U76	35Z4GT	—
QQE03/20	6252	—	U78	6X4	—
QQV02-6	6939	—	U82	—	7Y4
QQV03-10	6360	—	U119	38A3	—
QS83-3	—	0G3	U142	31A3	—
QS150/40	0D3, 0D3A	—	U145	31A3	—
QS1205	0A3, 0A3A	—	U147	6X5GT	—
QS1206	0C3, 0C3A	—	U149	7Y4	—
QS1207	0A2	—	U150	6BT4	—
QS1208	0B2	—	U151	6X2	—
QS1209	5651A	0G3	U152	19X3	—
QS1210	0A2WA	0A2	U153	17Z3	—
QS1211	0B2WA	0B2	U154	19Y3	—
QS1212	—	0G3	U191	19CS4	—
		5651A	U192	19Y3	—
		5651WA	U193	17Z3	—
QS2404	5726	6AL5	U309	—	19X3
QS2406	12AT7WA	12AT7/ECC81	U319	—	19Y3
	6201	—	U381	38A3	—
QV03-12	5763	—	U404	—	31A3
QV05/25	—	807	U707	6X4	—
QV06/20	6146	—	U709	—	6CA4
R3	1W4	—	UAVC80	28AK8	—
R12	6X2	—	UAF42	12S7	—
R12A	6X2	—	UBC41	14L7	—
R16	1T2	—	UBC80	14G6	—
R17	—	6N3	UBF80	17C8	—
R19	—	1X2B		17N8	—
R52	5Z4, GT	—	UC92	9AB4	—
R144	6AM6	—	UCC85	26AQ8	—
REL39	—	6AC7	UCH42	14K7	—
RL21	2D21	—	UCH80	14Y7	—
RL1267	0A4G	—	UCH81	19D8	—
RS1029	6360	—		19AJ8	—
S6F12	6AM6	—	UCL82	50BM8	—
S856	0A2	—	UF6A7	—	6A7
S860	0B2	—	UF41	12AC5	—
SM150-30	0A2	—	UF89	12AD6	—
SP6	6AM6	—	UL41	45A5	—
SR2	0G3	5651A	UL84	45B5	—
SR3	0B2	—	UQ80	12BE7	—
STR85/10	0G3	5651A	UU9	6BT4	—
STR108/30	0B2	—	UU12	6CA4	—
STR150/30	0A2	—	UY24B	—	24A
STV85/10	0G3	5651A	UY27	—	27
STV108/30	0B2	—	UY27A	—	27
STV150/30	0A2	—	UY35B	—	35
SU61	6X2	—	UY36	—	36
T2M05	6J6A	—	UY36A	—	36
TM12	—	6J4	UY37	—	37
TS51	—	6AK5/EF95	UY37A	—	37
		5654	UY41	31A3	—
			UY47	—	47

Foreign - American Receiving Tube Replacement Guide (cont'd)

Foreign Type Number	American Direct Replacement	American Similar Types	Foreign Type Number	American Direct Replacement	American Similar Types
UY76	—	76	X727	6BE6	—
UY82	55N3	—	XC95	2ER5	—
UY85	38A3	—	XC97	2FY5	—
UY224	—	24A	XCC82	7AU7	—
V2M70	6X4	—	XCC189	4ES8	—
V61	6BT4	—	XCF80	4BL8/XCF80	—
V177	6CQ6	—	XCH81	3AJ8	—
V311	—	31A3	XCL82	8B8	—
V741	6C4	—	XCL85	9GV8	—
V884	6CQ6	6BJ6, A	XF80	3BX6	—
V886	6AM5	—	XF85	3BY7	—
VP6	6CQ6	6BJ6, A	XF86	2HR8	—
VP12D	12C8	—	XF183	3EH7/XF183	—
W17	1T4	—	XF184	3EJ7/XF184	—
W25	1AJ4	1T4	XFR1	—	1AD4
W61	—	6K7, GT	XFR2	—	5678
W63	—	6K7, GT	XFR5	—	5678
W76	—	12K7GT	XFY14	—	5672
W77	6CQ6	6BJ6, A	XFY15	—	5672
W81	—	7H7	XL36	13CM5	—
W142	12AC5	—	XL84	8BQ5	—
W143	—	7B7	XL86	8CW5	—
W147	—	6K7, GT	—	8CW5A	—
W148	—	7H7	XL500	13GB5/XL500	—
W149	7B7	—	XY88	16AQ3/XY88	—
W150	6CJ5	—	Y25	1N3	—
W719	6BY7	—	Y61	—	6U5
W727	6BA6/EF93	—	Y63	—	6U5
W729	—	6BY7	YC95	3ER5	—
W739	6EC7	6DA6	YC97	3FY5	—
WD142	12S7	—	YCC189	5ES8	—
WD150	6CT7	—	YF183	4EH7	—
WD709	6N8	—	YF184	4EJ7	—
WT294	0D3	—	YL1370	6146B/8298A	6146
X14	1A7GT	—	YL1371	6883	—
X17	1R5	—	—	8032	—
X18	1AC6	—	—	8552	—
X20	1AC6	—	YL1372	6159B	—
X25	1AB6	—	Z14	1N5GT	—
X63 (M)	—	6A8, G, GT	Z63	6J7, G, GT	—
X64	—	6L7	Z77	6AM6	—
X77	6BE6	—	Z152	6BX6/EF80	—
X79	6AE8	—	Z300T	0A4G	—
X81	—	7S7	Z329	—	6BX6/EF80
X119	19D8	—	Z719	6BX6/EF80	—
X142	14K7	—	Z729	6267	5879
X144	—	1A7GT	—	6CF8	—
X147	6E8G	6K8	Z900T	5823	—
X148	7S7	—	ZD17	1S5	—
X150	—	6CU7	ZD25	1AH5	1S5
X155	6BZ8	—	ZD152	6N8	—
X719	6AJ8	—	—	—	—

# Industrial Receiving Tube Replacement Guides

## BROADCAST EQUIPMENT

Original Type	SYLVANIA REPLACEMENTS		Original Type	SYLVANIA REPLACEMENTS	
	Premium <sup>(1)</sup>	Standard		Premium <sup>(1)</sup>	Standard
0A2	GB-0A2WA	0A2	6BZ6	—	6BZ6
0B2	GB-0B2WA	0B2	6BZ7	—	6BQ7A/6BZ7
0B3	—	0B3	6C4; EC90	GB-6135	6C4
0C3	—	0C3	6CB6	6676/6CB6A <sup>(2)</sup>	6CB6A
0D3	—	0D3	6CD6G	—	6CD6GA
1B3/1G3GT	—	1G3GT/1B3GT	6CG7	—	6CG7/6FQ7
1X2B	—	1X2B	6CG8	—	6CG8A
2C51	GB-5670	2C51	6CL6	6677/6CL6 <sup>(2)</sup>	6CL6
2D21	GB-5727	2D21	6CS6	—	6CS6
2X2A	—	2X2A	6CU8	—	6CU8
5R4	—	5R4GYB	6CX8	—	6CX8
5U4	GB-5931	5U4GB	6CY5	GB-6CY5	6CY5
5V4	—	5V4GA	6DJ8	GB-6DJ8	6DJ8
5Y3GT	GB-5Y3WGTA	5Y3GT	6DQ6	—	6DQ6B/6GW6
6AF4	—	6DZ4/6AF4A	6EA8	—	6EA8/6GH8A
6AG5	GB-6186	6AG5	6EH7; EF183	—	6EH7/EF183
6AG7	—	6AG7	6EJ7; EF184	—	6EJ7/EF184
6AK5; EL90	GB-5654	6AK5/EF95	6ER5; EC95	—	6ER5
6AL5; EB91	GB-5726	6AL5	6EU7	—	6EU7
6AN4	—	6AN4	6EV5	—	6EV5
6AN5	—	6AN5	6GK5	—	6GK5/6FQ5A
6AN8	—	6AN8A	6HG8; ECF86	—	6HG8/ECF86
6AQ5	GB-6005	6AQ5A	6J4	GB-6J4WA	6J4
6AS5	—	6AS5	6J6; ECC91	GB-6101	6J6A
6AS6	GB-5725	6AS6	6J7	—	6J7
6AS7G	GB-6080	6AS7GA	6L6	GB-5932	6L6
6AS8	—	6AS8	6SL7GT	GB-6SL7WGT	6SL7GT
6AT6; EBC90	—	6AT6	6SN7GT	GB-6SN7WGT	6SN7GTB
6AU4	—	6AU4GTA	6T8	—	6T8A
6AU6; EF94	GB-6136; 7543 <sup>(2)</sup>	6AU6A	6U8, A	GB-1252/6U8A	6U8A/6KD8
6AU8	—	6AU8A	6V6	—	6V6
6AV6; EBC91	—	6AV6	6W6GT	—	6W6GT
6AW8	—	6AW8A	6X4	GB-6X4WA	6X4
6AX4	—	6AX4GTB	6X5GT	GB-6X5WGT	6X5GT
6AX5GT	—	6AX5GT	6X8	—	6X8
6BA6	GB-5749	6BA6/EF93	6Y6G	—	6Y6GA
6BC5	—	6BC5/6CE5	12AT7; ECC81	GB-6201	12AT7/ECC81
6BE6; EK90	GB-5750	6BE6	12AU7; ECC82	GB-5814A	12AU7A/ECC82
6BG6G	—	6BG6GA	12AV6; HBC91	—	12AV6
6BH6	6661/6BH6 <sup>(2)</sup>	6BH6	12AX7; ECC83	GB-5751	12AX7A/ECC83
6BJ6	6662/6BJ6 <sup>(2)</sup>	6BJ6	12BH7	—	12BH7A
6BJ7	—	6BJ7	12BY7A	—	12BY7A
6BK7A	—	6BK7B	407A	GB-407A	—
6BL7GT	—	6BL7GTA	408A	GB-408A	—
6BL8; ECF80	—	6BL8/ECF80	807	GB-5933	807
6BN4	—	6BN4A	1218	—	1218A
6BQ5; EL84	—	6BQ5/EL84	5651	—	5651
6BQ6	—	6BQ6GTB/6CU6	5654	GB-5654	5654
6BQ7A	GB-6BQ7A	6BQ7A/6BZ7	5670	GB-5670	5670
6BS8	—	6BS8	5687	GB-5687	—

### BROADCAST EQUIPMENT (cont'd)

Original Type	SYLVANIA REPLACEMENTS	
	Premium <sup>(1)</sup>	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 <sup>(1)</sup>	Standard
6922; ECC88	7308	6922
6939	—	6939
7025	—	7025 <sup>(2)</sup>

**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/lf amplifier
6661/6BH6	6BH6	Pentode rf/lf amplifier
6662/6BJ6	6BJ6	Pentode rf/lf 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)

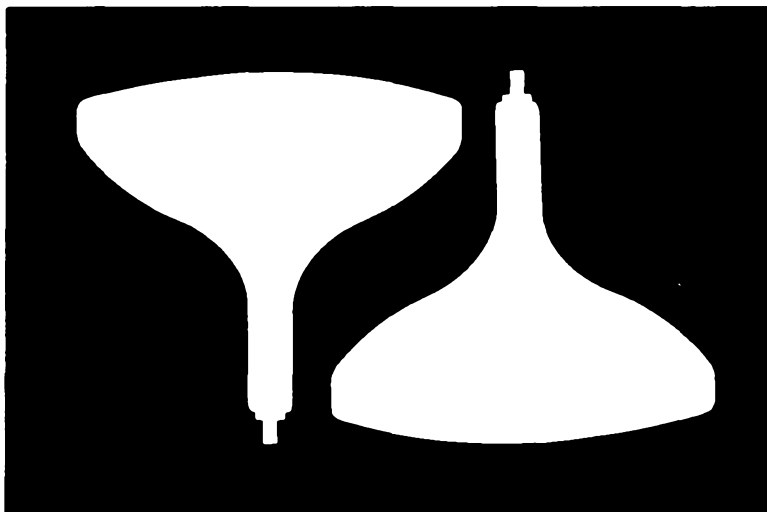
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## X-RAY WARNING:

*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. $\Delta$	FACEPLATE		OVERALL DIMENSIONS INCHES		External Coating Capacitance (pf)	Base	Basing	Heater $\Delta$ Volts/Amps	DESIGN MAXIMUM	
		Clear Tinted Alum. Shield* Anti-Ref.	Faceplate Dimensions	Length	Anode (Kv)					Convergence Electrode (Kv) $\Delta$	
11SP22	72	TA	9.88 x 8.13	14.92	600-800	B12-249	14BJ	13.8/58	18		
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	15.06	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
19GW22	90	TA-AR-BP	16.97 x 13.66	18.04	1400-1900	B12-244	14BE	6.3/90	27.5		Magnetic
19GY22	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
19HX22	90	TA-BR	17.10 x 14.01	17.87	1500-2000	B12-245	14BE	6.3/1.35	27.5		Magnetic
19HY22	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
21GW22	90	TA-AR-BP	18.81 x 15.13	19.45	1500-2000	B12-245	14BE	6.3/1.35	27.5		Magnetic
21GY22	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

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		
-.50 to +1.0	1000	15	Magnetic	-.25 to .50	200	30-50	In Line Gun	11SP22
-.50 to +1.0	700	15	Magnetic	-.25 to .50	350	40-70		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		13GP22
5.3	650	16	Magnetic	2.4 to 3.4	200	45-100	Blue Gun Down	14BCP22
5.5	550	20		8.5 to 10.2	200	45-100		15GP22
5.5	550	20		9.3	140-315	70		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	Blue Gun Down	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		16DAP22
4.8	650	20	Magnetic	3.36 to 4.00	200	50-110		16DP22
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	19HYPP22
4.4	550	20		8.5 to 10.2	200	42-78		19TP22
9.9	550	25		6.5 to 8.0	200	45-100		19VP22
6.6	660	25	Magnetic	3.8 to 5.3	150-330	75		21AXP22
6.6	660	25			200	45-100	Metal Bulb	21AXP22A
6.6	660	25	Magnetic	3.8 to 5.3	130-370	70		21CYP22A
6.6	660	25	Magnetic	4.2 to 5.0	200	45-100		21CYP22A
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	45-100		21FKP22
6.0	1000	25	Magnetic	4.12 to 5.00	130-370	70		21GFP22
6.0	1000	25			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	55-105		22EP22
6.0	1000	25			50-225	60		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	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		OVERALL DIMENSIONS INCHES		External Conductive Coating Capacitance (pf)	Base	Basing	Heater Volts/Amps	DESIGN MAXIMUM	
		Clear Tinted Alum. Shield * Anti-Refll.	Faceplate Dimensions	Length	Anode (Kv)					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	6.3/1.35	27.5	Magnetic	
25AP22A	90	TA-AR-BP	21.50 x 17.26	20.92	2000-2500	B12-244	14BE	6.3/1.35	27.5	Magnetic	
25ABP22	90	TA-BP	21.50 x 17.26	20.92	2000-2500	B12-244	14BE	6.3/1.35	27.5	Magnetic	
25AEP22	90	TA	21.50 x 17.26	20.96	2000-2500	B12-245	14BE	6.3/1.35	27.5	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	6.3/1.35	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	6.3/1.35	27.5	Magnetic	
25ANP22	90	TA-TB	21.50 x 17.26	20.73	2000-2500	B12-244	14BE	6.3/1.35	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 17.55	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	6.3/1.35	27.5	Magnetic	
25BP22A	90	TA	21.50 x 17.26	20.73	2000-2500	B12-244	14BE	6.3/1.35	27.5	Magnetic	
25CP22	90	TA-BP	21.50 x 17.26	20.92	2000-2500	B12-244	14BE	6.3/1.35	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	6.3/1.35	27.5	Magnetic	
25YP22	90	TA	21.50 x 17.26	20.73	2000-2500	B12-244	14BE	6.3/1.35	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	

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Basings—Page 506

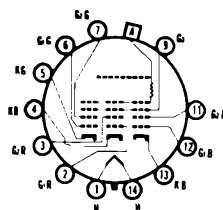
## Color Check Tubes

Type	Heater	Face	Body		Basing	Defl. Angle	Anode Volts ● KV Max.	Nominal Length (in.)
	Ef/Hf Volts Amps		Metal or Glass	External Coating Capacitance (pf)				
TT19	6.3/1.80	□	G	1500/2000	14BE	90	27.5	21.625
TT19B	6.3/1.90	□	G	1500/2100	14BE	90	27.5	18.048
TT21	6.3/1.8	○	G	2000/2500	14AU	70	27.5	25.031

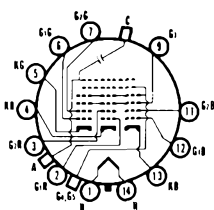
These tubes are electrically equivalent to 19", 90" rectangular and 21", 70" round color picture tubes used by all major manufacturers. They can be adapted to check all popular color picture tubes. Additional technical

information on these tubes and on their application in TV receiver servicing is available on request.

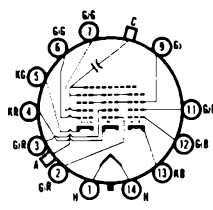
## Basing Diagrams (color tubes)



14AH

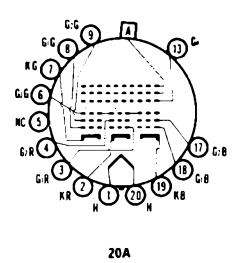
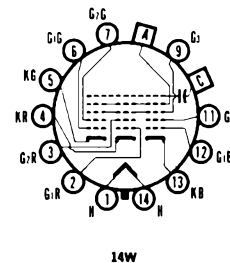
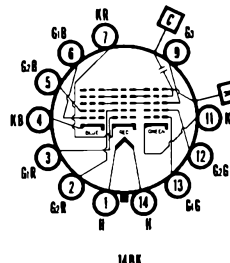
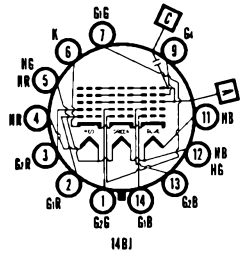
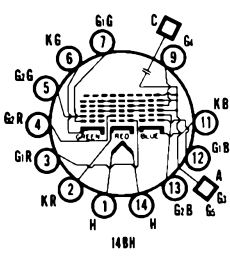
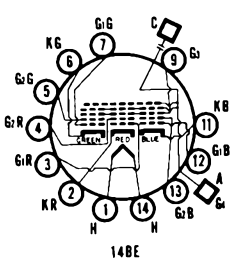


14AL



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	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	



**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		OVERALL DIMENSIONS INCHES		External Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/▲ Amps	DESIGN	
		Clear Alumin. Shield* Anti-Ref.	Faceplate Dimensions	Length	Anode (Kv)							
2EP4	30	A	2	8 1/4	300-500	N	B7-208	8JK	6.0/145	11		
5TP4	50	CA	5	11 1/4	100-500	N	B7-51	12C	6.3/60	29.7		
7DP4	50	C	7 3/4	14 1/4	400-1500	D	B7-51	12C	6.3/60	8.8		
7RP4	50	CA	7 3/4	14 1/4	.....	N	B5-57	12AD	6.3/60	13.2		
8DP4	90	T	7 3/4 x 6 1/4	10 1/2	250-350	S	B6-185	12AB	6.3/60	8.8		
8KP4	90	TA	7 3/4 x 6 1/4	11 1/2	.....	N	B6-63	12M	6.3/60	18		
9ACP4	90	TA-TB	7 3/4 x 6 1/4	8 1/4	300-750	N	E7-91	7GR	12.0/0.065	12		
9QP4	70	C	8 3/4 x 6 1/4	12 3/4	.....	S	B7-51	12AD	4.7/30	7.5		
9QP4A	70	T	8 3/4 x 6 1/4	12 3/4	.....	S	B7-51	12AD	4.7/30	7.5		
9SP4	90	A-BP	7 3/4 x 6 1/4	10 1/2	300-500	N	B7-183	8HR	6.3/60	18		
9TP4	110	A-BF	8 3/4 x 7 3/4	8 3/4	350-600	N	B7-208	8HR	6.3/45	15		
9UP4	90	TA	7 3/4 x 6 1/4	8 1/4	300-750	N	E7-91	7GR	12.6/0.075	12		
9VP4	90	TA	7 3/4 x 6 1/4	7 3/4	300-750	N	E7-91	7GR	12.6/0.075	12		
9WP4	90	TA-BR	7 3/4 x 6 1/4	8 3/4	300-750	N	E7-91	7GR	12.0/0.075	12		
9YP4	85	TA-TB	8 3/4 x 6 1/2	9 3/4	400-700	N	E7-91	7GR	12.6/0.080	15		
10ABP4	90	C	9 3/4 x 7 1/2	11 1/2	400-850	S	B6-63	12L	6.3/60	13.2		
10ABP4A	90	CA	9 3/4 x 7 1/2	11 1/2	400-850	S	B6-63	12L	6.3/60	13.2		
10ABP4B	90	T	9 3/4 x 7 1/2	11 1/2	400-850	S	B6-63	12L	6.3/60	13.2		
10ABP4C	90	TA	9 3/4 x 7 1/2	11 1/2	400-850	S	B6-63	12L	6.3/60	13.2		
10ADP4	90	T	9 3/4 x 7 1/2	11 1/2	400-850	S	B6-63	12L	8.4/45	13.2		
10AEP4	90	T	9 3/4 x 7 1/2	11 1/2	400-850	S	B6-63	12L	6.3/45	13.2		
10ARP4	90	TA-TB	8 3/4 x 6 3/4	9 3/4	300-750	N	B7-247	7GR	6.3/30	13		
10BP4	50	C	10 1/2	17 3/4	500-2500	D	B5-57	12N	6.3/60	11		
10BP4A	50	T	10 1/2	17 3/4	500-2500	D	B5-57	12N	6.3/60	11		
10BP4C	50	CA	10 1/2	17 3/4	500-2500	S	B5-57	12N	6.3/60	11		
10BP4D	50	TA	10 1/2	17 3/4	500-2500	S	B5-57	12N	6.3/60	11		
10FP4	50	CA	10 1/2	17 3/4	500-2500	N	B5-57	12N	6.3/60	13.2		
10FP4A	50	TA	10 1/2	17 3/4	500-2500	N	B5-57	12N	6.3/60	13.2		
10MP4	52	C	10 1/2	17	500-2500	D	B5-57	12G	6.3/60	11		
10MP4A	52	T	10 1/2	17	500-2500	D	B5-57	12G	6.3/60	11		
10RP4	50	CA	10 1/2	16 1/2	750-1500	N	B6-63	12L	6.3/60	17.6		
11AP4	110	TA-BL	9 3/4 x 8 1/4	8 3/4	500-750	N	B7-208	8HR	6.3/45	15		
11BP4	110	TA	9 3/4 x 8	8 3/4	400-700	N	B7-208	8HR	6.3/45	15		
11CP4	110	TA	9 3/4 x 8	8 3/4	500-750	N	B7-208	8HR	6.3/45	15		
11DP4	110	TA	9 3/4 x 8	8 3/4	500-750	N	B7-208	8HR	6.3/45	15		
11EP4	114	TA	8 3/4 x 7 1/2	8 1/2	300-500	N	B7-208	8HR	6.3/60	14		
11FP4	114	TA	8 3/4 x 7 1/2	8 1/2	300-500	N	B7-208	8HR	6.3/45	14		
11GP4	110	TA-BF	10 3/4 x 8 1/4	8 3/4	400-600	N	B7-208	8HR	6.3/45	15		
11HP4	110	TA-BR	9 3/4 x 7 3/4	8 3/4	500-750	N	B7-208	8HR	6.3/45	15		
11HP4A	110	TA-BR	9 3/4 x 8 1/4	8 1/2	500-750	N	B7-208	8HR	6.3/45	15		
11JP4	110	TA-BF	10 3/4 x 8 1/4	8 3/4	400-600	N	B7-208	8HR	6.3/30	15		
11KP4	110	TA-TB	9 3/4 x 8 1/4	8 3/4	500-750	N	B7-208	8HR	6.3/45	15		
11MP4	110	TA-BF	10 3/4 x 8 1/4	8 3/4	400-600	N	B7-208	8HR	6.3/30	15		
11QP4	90	TA	9 3/4 x 7 3/4	9 3/4	400-800	N	E7-91	7GR	12.6/0.075	14		
11RP4	90	TA-TB	9 3/4 x 7 3/4	9.0	400-750	N	E7-91	7GR	6.3/45	15		
11TP4	110	TA-TB	9 3/4 x 8 1/4	8 3/4	400-600	N	B7-208	8HR	6.3/30	15		
11UP4	104	TA-TB	9 3/4 x 7 3/4	9	400-750	N	B7-247	7GR	6.3/45	15		
12AYP4	110	A	10 3/4 x 8 3/4	9 3/4	400-900	N	B7-208	8HR	6.3/45	14		
12AZP4	110	A	10 3/4 x 8 3/4	9 3/4	400-900	N	B7-208	8HR	6.3/60	14		
12BAP4	110	A	10 3/4 x 8 3/4	9 3/4	400-900	N	B7-208	8HR	6.3/30	14		
12BEP4	110	TA-BF	11 3/8 x 8 3/4	9 3/4	500-900	N	B6-214	7FA	6.3/45	16		
12BFP4	110	TA	10 3/4 x 8 1/4	9 3/4	400-1200	N	E7-91	7GR	4.2/45	14		
12BGP4	110	TA-BF	11 3/8 x 8 3/4	9 3/4	550-850	N	B7-208	8HR	6.3/45	15		
12BJP4	110	TA	10 3/4 x 8 1/4	9 3/4	400-900	N	B7-208	8HR	4.2/45	13		
12BKP4	110	TA-TB	10 3/4 x 8 1/2	9 1/2	800-1000	N	B7-208	8HR	6.3/45	15		
12BLP4	110	TA-TB	10 3/4 x 8 1/2	9 1/2	800-1000	N	B7-208	8HR	6.3/45	16		
12BMP4	104	TA-TB	11 x 8 3/4	9 3/4	500-750	N	E7-91	7GR	6.3/45	15		
12BNP4	110	TA-BR	10 3/4 x 8 1/2	9 1/2	500-750	N	B7-208	8HR	6.3/45	16		
12BNP4A	110	TA-BR	10 3/4 x 8 1/2	9 1/2	500-750	N	B7-208	8HR	6.3/45	16		
12BQP4	110	TA-BR	10 3/4 x 8 1/2	9 1/2	600-900	N	B7-208	8HR	6.3/45	16		
12BRP4	90	TA-BR	11 3/8 x 8 3/4	10 3/4	600-1000	N	E9-94	9RS	12.6/0.08	15		
12BSP4	110	TA	10 3/4 x 8 3/4	9 3/4	400-900	N	B7-208	8HR	6.3/30	14		
12BTP4	110	TA-BF	11 3/8 x 9 3/4	9 1/2	550-850	N	B7-208	8HR	12.6/15	15		
12BUP4	110	TA-BR	10 3/4 x 8 3/4	9 3/4	450-900	N	B7-208	8HR	6.3/45	14		
12BUP4A	110	TA-BR	10 3/4 x 8 3/4	9 3/4	450-900	N	B7-208	8HR	6.3/45	14		

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 +6.6m +2.6m Magnetic -55 to +55	550 385 450 450 330	9 27 6 9 8	-50 to +350 4900 1430 120 Ma 60 to 360	300 200 250 250 200	20-30 40-100 25-65 27-63 22-51	Neck Diameter 1 1/8 Inches Projection Tube	2EP4 5TP4 7DP4 7RP4 8DP4
+8 -50 to +1.1 -11 to +55 -11 to +55 -55 to +1.1	700 250 330 330 450	16 10 5.5 5.5 14	0 400 0 to 300 0 to 400 0 to 400 0 400	300 100 200 200 300	35-72 +30 to +60* 33-77 35-57 33-77	Welded Tension Band, .788" Neck Diameter 4.7 Volt Heater 4.7 Volt Heater	8KP4 9ACP4 9QP4 9QP4A 9SP4
-55 to +1.1 -55 to +1.1 -50 to +1.0 -55 to +1.1 -50 to +50	60 250 250 250 200	12 9 9 9 12	140 60 0 to 300 0 to 300 -200 to +200	50 100 100 100 100	37-53 +35 to +55* 38-94 +32 to +50* +30 to +50*	.788" Neck Diameter .788" Neck Diameter .788" Neck Diameter .788" Neck Diameter	9TP4 9UP4 9VP4 9WP4 9YP4
-55 to +1.1 -55 to +1.1 -55 to +1.1 -55 to +1.1 -55 to +1.1	550 550 550 550 550	7.5 7.5 7.5 7.5 7.5	0 to 500 0 to 500 0 to 500 0 to 500 0 to 500	300 300 300 300 300	43-67 43-67 43-67 43-67 43-77	8.4 Volt Heater	10ABP4 10ABP4A 10ABP4B 10ABP4C 10ADP4
-55 to +1.1 -50 to +1.0 Magnetic Magnetic Magnetic	550 250 450 450 450	7.5 9 9 9 9	0 to 500 -250 to +150 100 Ma. 110 Ma. 110 Ma.	300 140 250 250 250	43-67 +31 to +49* 27-63 27-63 27-63	.840" Neck Diameter	10AEP4 10ARF4 10BP4 10BP4A 10BP4C
Magnetic Magnetic Magnetic Magnetic	450 450 450 ...	9 9 11 9	110 Ma. 110 Ma. 110 Ma. .....	250 250 250 ...	27-63 27-63 27-63 27-63		10BP4D 10FP4 10FP4A 10MP4 10MP4A
-55 to +1.1 -50 to +1.0 -50 to +1.0 -50 to +1.1 -50 to +1.0	550 250 250 550 60	14 11 11 12 11	-55 to +300 250 200 0 400 -100 to +300	300 150 150 400 50	33-77 31-49 31-49 39-94 31-49		10RP4 11AP4 11BP4 11CP4 11DP4
-55 to +1.1 -55 to +1.1 -50 to +1.0 -50 to +1.0 -50 to +1.0	550 550 200 250 250	10 10 11 11 11	0 to 400 0 to 400 -200 to +200 0 0	400 400 135 150 150	36-94 36-94 27-43 31-49 +31 to +49*	Welded Tension Band	11EP4 11FP4 11GP4 11HP4 11HP4A
-50 to +1.1 -50 to +1.0 -50 to +1.1 -50 to +1.1 -50 to +1.0	70 70 200 250 250	11 11 11 10 11	-200 to +200 -100 to +300 -200 to +200 0 to 300 0	50 50 135 100 140	27-43 +31 to +49* 27-43 32-50 31-49		11JP4 11KP4 11MP4 11QP4 11RP4
-50 to +1.0 -50 to +1.0 -55 to +1.1 -55 to +1.1 -55 to +1.1	550 250 550 550 550	10 11 10 10 10	0 to 400 0 0 to 400 0 to 400 0 to 400	400 140 400 400 400	+36 to +78* +31 to +49* 36-94 36-78 36-78	.788" Neck Diameter	11TP4 11UP4 12AYP4 12AZP4 12BAP4
-50 to +1.1 -55 to +1.1 -50 to +1.1 -55 to +1.1 -55 to +1.1	50 400 60 600 70	12 10 12 10 12	0 to 500 0 to 400 0 0 to 400 0 to 400	30 200 50 350 50	25-40 27-55 35-55 30-60 35-55	.788" Neck Diameter	12BEP4 12BFP4 12BGP4 12BJP4 12BKP4
-55 to +1.1 -50 to +1.0 -55 to +1.1 -55 to +1.1 -50 to +1.1	60 250 400 400 70	12 11 12 12 12	0 to 400 0 0 to 400 0 to 400 0 to 400	30 140 250 250 50	30-45 31-49 35-65 35-65 +30 to +50*	.788" Neck Diameter Welded Tension Band	12BLP4 12BNP4 12BNP4 12BNP4A 12BQP4
-35 to +.45 -55 to +1.1 -55 to +1.1 -55 to +1.1 -55 to +1.1 -55 to +1.1	50 600 60 70 70	10 10 12 12 12	0 to 500 0 to 400 0 0 to 400 0 to 400	30 500 50 50 50	25-35 50-93 35-55 37-49 +33 to +52*	.855" Neck Diameter	12BRP4 12BSP4 12BTP4 12BUP4 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	HeaterΔ Volts/Amps	DESH	
		Clear Tinted Alum. Shield* Anti-Refll.	Faceplate Dimensions	Length	Anode (Kv)							
12BUP4B	110	TA-TB	10 $\frac{1}{8}$ x 8 $\frac{1}{4}$	9 $\frac{1}{4}$	450-900	N	B7-208	8HR	6.3/45	14		
12BVP4	110	TA-BR	10 $\frac{1}{8}$ x 8 $\frac{1}{4}$	9 $\frac{1}{4}$	450-900	N	E7-91	7GR	12.6/075	14		
12BZP4	104	TA-BR	11 x 8 $\frac{5}{8}$	9 $\frac{1}{2}$	500-750	N	E7-91	7GR	12/157	15		
12CB4	110	TA-BR	11 x 9 $\frac{1}{8}$	9 $\frac{1}{2}$	500-900	N	B6-214	7FA	6.3/45	16		
12CDP4	104	TA-TB	11 x 8 $\frac{5}{8}$	9 $\frac{1}{2}$	500-750	N	E7-98	7GR	6.3/45	15		
12CEP4	110	TA-BF	11 $\frac{1}{2}$ x 9 $\frac{1}{4}$	9 $\frac{1}{4}$	600-900	N	E7-91	7GR	12.6/15	15		
12CFP4	110	TA-BR	10 $\frac{1}{8}$ x 8 $\frac{1}{4}$	9 $\frac{1}{4}$	450-900	N	E7-91	7GR	4.2/45	14		
12CHP4	110	TA-BR	10 $\frac{1}{8}$ x 8 $\frac{1}{4}$	9 $\frac{1}{4}$	450-900	N	E7-91	7GR	6.3/45	14		
12CNP4	110	TA-BR	10 $\frac{1}{8}$ x 8 $\frac{1}{4}$	9 $\frac{1}{2}$	600-1200	N	E7-91	7GR	4.2/45	14		
12CNP4A	110	TA-TB	10 $\frac{1}{8}$ x 8 $\frac{1}{4}$	9 $\frac{1}{2}$	600-1200	N	E7-91	7GR	4.2/45	14		
12CQP4	110	TA-BF	11 $\frac{1}{2}$ x 9 $\frac{1}{8}$	9 $\frac{1}{4}$	400-900	N	B7-208	8HR	6.3/45	15.4		
12CSP4	90	TA-BF	11 $\frac{1}{2}$ x 9 $\frac{1}{4}$	10 $\frac{1}{2}$	600-900	N	E7-91	7GR	12.6/15	15		
12CTP4	110	TA-TB	10 $\frac{1}{8}$ x 8 $\frac{1}{4}$	9 $\frac{1}{4}$	700-1000	N	E7-91	7GR	6.3/45	15		
12CVP4	100	TA-TB	11 x 8 $\frac{5}{8}$	10 $\frac{1}{2}$	500-750	N	B7-247	7GR	12.0/157	15		
12CWP4	100	TA-TB	11 x 8 $\frac{5}{8}$	10 $\frac{1}{2}$	500-750	N	B7-247	7GR	6.3/45	15		
12CZP4	110	TA-TB	10 $\frac{1}{8}$ x 8 $\frac{1}{4}$	9 $\frac{1}{4}$	400-1200	N	E7-91	7GR	12.6/075	14		
12DEP4	110	TA-TB	10 $\frac{1}{8}$ x 8 $\frac{1}{4}$	9 $\frac{1}{4}$	600-900	N	B7-247	7GR	6.3/450	15		
12DHP4	110	TA-TB	10 $\frac{1}{8}$ x 8 $\frac{1}{4}$	9 $\frac{1}{2}$	600-1200	N	B7-208	8HR	6.3/450	16		
12KPP4	54	CA	12 $\frac{1}{2}$	17 $\frac{1}{8}$	500-2500	N	B5-57	12N	6.3/60	13.2		
12KP4A	54	TA	12 $\frac{1}{2}$	17 $\frac{1}{8}$	500-2500	N	B5-57	12N	6.3/60	13.2		
12LP4	54	C	12 $\frac{1}{2}$	18 $\frac{1}{2}$	750-3000	D	B5-57	D	6.3/60	13.2		
12LPA4	54	T	12 $\frac{1}{2}$	18 $\frac{1}{2}$	750-3000	D	B5-57	12N	6.3/60	13.2		
12LPA4C	54	TA	12 $\frac{1}{2}$	18 $\frac{1}{2}$	750-3000	D	B5-57	12N	6.3/60	13.2		
12UP4	54	C	12 $\frac{1}{2}$	18 $\frac{1}{2}$	.....	S	B5-57	12D	6.3/60	13.2		
12UP4A	54	T	12 $\frac{1}{2}$	18 $\frac{1}{2}$	.....	S	B5-57	12D	6.3/60	13.2		
12UP4B	54	T, AR	12 $\frac{1}{2}$	18 $\frac{1}{2}$	.....	S	B5-57	12D	6.3/60	13.2		
12VP4	54	C	12 $\frac{1}{2}$	18	750-3000	D	B5-57	12G	6.3/60	13.2		
12VP4A	54	T	12 $\frac{1}{2}$	18	750-3000	D	B5-57	12G	6.3/60	13.2		
12WP4	55	T	12 $\frac{1}{2}$	17 $\frac{1}{4}$	750-2000	S	E9-1	9CH	6.3/60	13.2		
12YP4	54	C	12 $\frac{1}{2}$	18 $\frac{1}{2}$	750-3000	S	B5-57	12N	6.3/60	13.2		
12ZP4	54	CA	12 $\frac{1}{2}$	17 $\frac{1}{8}$	500-2500	S	B5-57	12N	6.3/60	13.2		
12ZPA4	54	TA	12 $\frac{1}{2}$	17 $\frac{1}{8}$	500-2500	S	B5-57	12N	6.3/60	13.2		
13AP4	110	TA-BF	11 $\frac{1}{2}$ x 9 $\frac{1}{8}$	9 $\frac{1}{4}$	550-850	N	B7-208	8HR	6.3/45	15		
13DP4	110	TA-BF	11 $\frac{1}{2}$ x 9 $\frac{1}{4}$	9 $\frac{1}{2}$	500-1000	N	B7-208	8HR	6.3/45	16		
14ACP4	90	TA	13 $\frac{1}{2}$ x 10 $\frac{1}{4}$	14 $\frac{1}{4}$	800-1200	S	B6-63	12L	6.3/60	15.4		
14AEP4	90	TA	13 $\frac{1}{2}$ x 10 $\frac{1}{4}$	13 $\frac{3}{4}$	800-1200	N	B6-63	12L	6.3/60	15.4		
14AJP4	110	TA	13 $\frac{1}{2}$ x 10 $\frac{1}{8}$	11 $\frac{1}{2}$	500-850	S	B7-208	8HR	6.3/60	12.1		
14ARP4	90	TA	13 x 10 $\frac{1}{4}$	13 $\frac{3}{4}$	800-1200	N	B6-63	12L	6.3/60	15.4		
14ASP4	110	TA	13 $\frac{1}{2}$ x 10 $\frac{1}{8}$	11 $\frac{1}{2}$	500-850	N	B7-208	8HR	6.3/60	15.4		
14ATP4	90	TA	13 $\frac{1}{2}$ x 10 $\frac{1}{4}$	13 $\frac{3}{4}$	500-1000	N	B6-63	12L	8.4/45	15.4		
14AUP4	90	TA	13 $\frac{1}{2}$ x 10 $\frac{1}{4}$	13 $\frac{3}{4}$	1000-1500	N	B6-63	12L	6.3/45	16.5		
14AVP4	110	TA	13 $\frac{1}{2}$ x 10 $\frac{1}{8}$	11 $\frac{1}{2}$	450-750	N	B7-183/B7-208	8HR	6.3/60	15.4		
14AWP4	90	TA	13 $\frac{1}{2}$ x 10 $\frac{1}{4}$	13 $\frac{3}{4}$	800-1200	N	B6-63	12L	6.3/45	15.4		
14BP4	70	T	12 $\frac{1}{2}$ x 9 $\frac{1}{4}$	16 $\frac{1}{2}$	500-2500	S	B5-57	12N	6.3/60	15.4		
14BP4A	70	T, AR	12 $\frac{1}{2}$ x 9 $\frac{1}{4}$	16 $\frac{1}{2}$	500-2500	S	B5-57	12N	6.3/60	13.2		
14BAP4	70	TA	12 $\frac{1}{2}$ x 9 $\frac{1}{2}$	16 $\frac{1}{2}$	750-2000	N	B6-63/B6-203	12L	6.3/60	22		
14BDP4	70	TA-BP	12 $\frac{1}{2}$ x 9 $\frac{1}{2}$	17	600-1000	N	B6-63	12L	6.3/60	22		
14CP4	70	T	12 $\frac{1}{2}$ x 9 $\frac{1}{4}$	16 $\frac{1}{4}$	750-2000	S	B5-57	12N	6.3/60	15.4		
14CP4A	70	TA	12 $\frac{1}{2}$ x 9 $\frac{1}{4}$	16 $\frac{1}{2}$	750-2000	S	B5-57	12N	6.3/60	15.4		
14CP4B	70	TA	12 $\frac{1}{2}$ x 9 $\frac{1}{4}$	16 $\frac{1}{4}$	750-2000	N	B5-57	12N	6.3/60	15.4		
14DP4	70	T	12 $\frac{1}{2}$ x 9 $\frac{1}{4}$	16 $\frac{3}{4}$	.....	D	B5-57	12D	6.3/60	15.4		
14EP4	70	T	12 $\frac{1}{2}$ x 9 $\frac{1}{2}$	16 $\frac{1}{2}$	750-2000	S	B5-57	12N	6.3/60	15.4		
14GP4	70	T	12 $\frac{1}{2}$ x 9 $\frac{1}{2}$	16 $\frac{1}{2}$	750-2000	S	B6-63	12L	6.3/60	15.4		
14HP4	70	T	12 $\frac{1}{2}$ x 9 $\frac{1}{4}$	16 $\frac{1}{2}$	750-2000	S	B6-63	12L	6.3/60	15.4		
14NP4	90	T	13 $\frac{1}{2}$ x 10 $\frac{1}{4}$	14 $\frac{1}{4}$	800-1200	S	B6-63	12L	6.3/60	15.4		
14NP4A	90	TA	13 $\frac{1}{2}$ x 10 $\frac{1}{4}$	14 $\frac{1}{4}$	800-1200	S	B6-63	12L	6.3/60	15.4		
14QP4	70	T	12 $\frac{1}{2}$ x 9 $\frac{3}{4}$	16 $\frac{1}{2}$	600-1000	S	B6-63	12L	6.3/60	12.1		
14QP4A	70	TA	12 $\frac{1}{2}$ x 9 $\frac{3}{4}$	16 $\frac{1}{2}$	600-1000	S	B6-63	12L	6.3/60	12.1		
14QP4B	70	TA	12 $\frac{1}{2}$ x 9 $\frac{3}{4}$	16 $\frac{1}{2}$	600-1000	N	B6-63	12L	6.3/60	12		
14RP4	90	T	13 $\frac{1}{2}$ x 10 $\frac{1}{4}$	14 $\frac{1}{4}$	800-1200	S	B6-63	12L	6.3/60	15.4		
14RP4A	90	TA	13 $\frac{1}{2}$ x 10 $\frac{1}{4}$	14 $\frac{1}{4}$	800-1200	S	B6-63	12L	6.3/60	15.4		
14SP4	90	TA	13 $\frac{1}{2}$ x 10 $\frac{1}{4}$	14 $\frac{1}{4}$	900-1200	S	B6-63	12L	6.3/60	15.4		
14UP4	70	TA	12 $\frac{1}{2}$ x 9 $\frac{3}{4}$	16 $\frac{1}{2}$	.....	N	B5-57	12D	6.3/60	15.4		
14WP4	90	TA	13 $\frac{1}{2}$ x 10 $\frac{1}{4}$	13 $\frac{3}{4}$	800-1200	N	B6-63	12L	6.3/60	15.4		
14XP4	90	T	13 $\frac{1}{2}$ x 10 $\frac{1}{4}$	14 $\frac{1}{4}$	1100-1500	S	B6-63	12L	6.3/45	16.5		

MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	Type
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		
			Magnet Coil Current in Ma.				
-50 to +1.1	70	12	0 to 400	50	+35 to +55*		12BU4B
-55 to +1.1	70	12	0 to 400	50	37-49	.788" Neck Diameter	12BV4
-50 to +1.0	200	11	0	100	+31 to +49*	.788" Neck Diameter	12BZ4
-50 to +1.1	50	12	0 to 500	50	+30 to +50*		12CB4
-50 to +1.0	250	11	0	140	+31 to +49*	.788" Neck Diameter	12CD4
-50 to +50	150	12	-200 to +200	100	+30 to +50*	.788" Neck Diameter	12CE4
-55 to +1.1	400	10	0 to 300	200	+27 to +57*	.788" Neck Diameter	12CF4
-55 to +1.1	550	10	0 to 400	300	30-72	.788" Neck Diameter	12CH4
-55 to +1.1	400	10	0 to 400	200	+25 to +55*	.788" Neck Diameter	12CN4
-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*		12CQ4
-50 to +50	150	12	-200 to +200	100	+30 to +50*	.788" Neck Diameter	12CS4
-50 to +50	150	12	-200 to +200	100	+30 to +50*	.788" Neck Diameter	12CT4
-50 to +1.0	200	11	0	100	+31 to +49*	.840" Neck Diameter	12CV4
-50 to +1.0	250	11	0	140	+31 to +49*	.840" Neck Diameter	12CW4
-55 to +1.1	250	12	0 to 400	100	+33 to +52*	.788" Neck Diameter	12CZ4
-50 to +50	150	12	-200 to +200	100	+30 to +50*	.840" Neck Diameter	12DE4
-55 to +1.1	80	12	0 to 400	50	+30 to +50*		12DH4
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	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		14AJ4
+1.1	77	10	-50 to +350	50	50		14AR4
-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	14AT4
-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		14AV4
-55 to +1.1	75	14	0 to 400	50	37-52		14AW4
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		14BP4B
-50 to +.80	700	18	0 to 400	300	33-77		14BP4C
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. $\downarrow$	FACEPLATE		OVERALL DIMENSIONS INCHES		External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater $\Delta$ Volts/Amps	Anode (Kv)	DESIG
		Clear Tinted Alum. Shield* Anti-Refll.		Faceplate Dimensions	Length							
14XP4A	90	TA		13 $\frac{1}{2}$ x 10 $\frac{1}{2}$	14 $\frac{1}{2}$	1100-1500	S	B6-63	12L	6.3/45	16.5	
14ZP4	90	TA		13 $\frac{1}{2}$ x 10 $\frac{1}{2}$	13 $\frac{1}{2}$	800-1200	N	B6-63	12L	6.3/60	15.4	
15ADP4	110	TA-TB		12 $\frac{1}{2}$ x 10 $\frac{1}{2}$	10 $\frac{1}{2}$	700-1100	N	B7-208	8HR	6.3/45	20	
15JP4	110	TA-BF		13 $\frac{1}{2}$ x 10 $\frac{1}{2}$	11 $\frac{1}{2}$	600-1000	N	B7-208	8HR	6.3/45	15	
16AP4	53	C		15 $\frac{1}{2}$	22 $\frac{1}{2}$	.....	D	B5-57	12D	6.3/60	15.4	
16AP4A	53	T		15 $\frac{1}{2}$	22 $\frac{1}{2}$ cm	.....	D	B5-57	12D	6.3/60	15.4	
16ABP4	70	T		14 $\frac{1}{2}$ x 11 $\frac{1}{2}$	18 $\frac{1}{2}$	750-1500	S	B5-57	12D	6.3/60	17.6	
16ACP4	60	C		15 $\frac{1}{2}$	20 $\frac{1}{2}$	200cm	S	B5-57	12D	6.3/60	15.4	
16AEP4	70	T		14 $\frac{1}{2}$ x 11 $\frac{1}{2}$	18 $\frac{1}{2}$	750-1500	S	B6-63	12L	6.3/60	17.6	
16ANP4	114	TA BP		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	800-1200	N	B7-208	8HR	6.3/60	18	
16AQP4	114	TA-AR-BP		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	800-1200	N	B7-208	8HR	6.3/60	18	
16ASP4	114	TA-BP		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/60	20	
16ATP4	114	TA-BL		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/45	18	
16AUP4	114	TA		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	800-1500	N	B7-237	B7-208	8HR	6.3/60	15.4
16AVP4	114	TA-BP		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	900-1400	N	B6-214	7FA	6.3/45	17.6	
16AWP4	114	TA-BL		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208/B7-237	8HR	6.3/30	18	
16AXP4	114	TA-BP		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/45	18	
16ATP4	114	TA		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	800-1300	N	B7-208	8HR	6.3/45	20	
16AZP4	114	TA-BL		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208/B7-237	8HR	6.3/45	18	
16BAP4	114	TA-BP		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/60	18	
16BDP4	114	TA		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	800-1300	N	B7-208	8HR	6.3/60	20	
16BEP4	114	TA-BP		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	800-1200	N	B7-208	8HR	6.3/60	18	
16BFP4	114	TA		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	800-1500	N	B7-208	8HR	6.3/45	15.4	
16BGP4	114	TA-BR		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	800-1300	N	B7-208	8HR	6.3/45	20	
16BNP4	114	TA		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/45	15.4	
16BNP4	114	TA		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/60	18	
16BRP4	114	TA-BR		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/60	18	
16BSP4	114	TA-BR		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/45	21	
16BUP4	114	TA-BL		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/45	16	
16BVP4	114	TA-TB		13 $\frac{1}{2}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1050-1450	N	B7-208	8HR	6.3/45	20	
16BWP4	114	TA-BR		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	800-1300	N	B7-208	8HR	6.3/45	20	
16BXP4	114	TA-BF		14 $\frac{1}{2}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	900-1400	N	B6-214	7FA	6.3/45	17.6	
16BYP4	114	TA-BR		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/45	16	
16CP4	52	C		15 $\frac{1}{2}$	21 $\frac{1}{2}$	.....	D	B5-57	12D	6.3/60	16.5	
16CAP4	114	TA-BR		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/45	18	
16CEP4	114	TA-BR		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/45	18	
16CFP4	104	TA-BR		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	11 $\frac{1}{2}$	1000-1500	N	E7-91	7GR	6.3/45	15	
16CHP4	114	TA-BR		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/45	20	
16CHP4A	114	TA-TB		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/45	20	
16CKP4	114	TA-BR		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/30	18	
16CMP4	114	TA BR		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/45	18	
16CMP4A	114	TA-BR		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/45	18	
16CNP4	104	TA-TB		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	11 $\frac{1}{2}$	1000-1500	N	E7-98	7GR	12/157	15	
16CQP4	104	TA-TB		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	11 $\frac{1}{2}$	1000-1500	N	E7-98	7GR	6.3/45	15	
16CTP4	114	TA-TB		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	800-1500	N	B7-208	8HR	6.3/45	15.4	
16CUP4	114	TA-TB		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	10 $\frac{1}{2}$	800-1500	N	B7-208	8HR	6.3/45	15.4	
16CWP4	100	TA-BR		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	11 $\frac{1}{2}$	1000-1500	N	B7-247	7GR	6.3/45	15	
16CXP4	100	TA-BR		13 $\frac{3}{4}$ x 11 $\frac{1}{2}$	11 $\frac{1}{2}$	1000-1500	N	B7-247	7GR	12.0/157	15	
16DP4	60	C		15 $\frac{1}{2}$	20 $\frac{1}{2}$	.....	D	B5-57	12D	6.3/60	16.5	
16DP4A	60	T		15 $\frac{1}{2}$	20 $\frac{1}{2}$	.....	D	B5-57	12D	6.3/60	16.5	
16DCP4A	100	TA-TB		13 $\frac{1}{2}$ x 11 $\frac{1}{2}$	11 $\frac{1}{2}$	1000-1500	N	B7-247	7GR	6.3/45	15	
16EP4	60	C		15 $\frac{1}{2}$	19 $\frac{1}{2}$	.....	D	B5-57	12D	6.3/60	15.4	
16EP4A	60	T		15 $\frac{1}{2}$	19 $\frac{1}{2}$	.....	D	B5-57	12D	6.3/60	15.4	
16EP4B	60	T, AR		15 $\frac{1}{2}$	19 $\frac{1}{2}$	.....	D	B5-57	12D	6.3/60	15.4	
16FP4	62	C		16 $\frac{1}{2}$	20 $\frac{1}{2}$	.....	S	B5-57	12D	6.3/60	17.6	
16GP4	70	T		15 $\frac{1}{2}$	17 $\frac{1}{2}$ cm	.....	S	B5-57	12D	6.3/60	15.4	
16GP4A	70	C		15 $\frac{1}{2}$	17 $\frac{1}{2}$ cm	.....	S	B5-57	12D	6.3/60	15.4	
16GP4B	70	T, AR		15 $\frac{1}{2}$	17 $\frac{1}{2}$ cm	.....	S	B5-57	12D	6.3/60	15.4	
16GP4C	70	C, AR		15 $\frac{1}{2}$	17 $\frac{1}{2}$ cm	.....	S	B5-57	12D	6.3/60	15.4	
16HP4	60	C		15 $\frac{1}{2}$	21 $\frac{1}{2}$	.....	D	B5-57	12N	6.3/60	15.4	
16HP4A	60	T		15 $\frac{1}{2}$	21 $\frac{1}{2}$	.....	D	B5-57	12N	6.3/60	15.4	
16JP4	60	C		16 $\frac{1}{2}$	20 $\frac{1}{2}$	750-2000	D	B5-57	12N	6.3/60	15.4	

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	440	12	-50 to +350	300	33-77	Metal Bulb	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		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	16BHP4	
-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	Welded Tension Band	16CHP4
-55 to +1.1	60	16	0 to 400	30	30-45		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	16CP4A
-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	13	105 Ma.	300	33-77	Metal Bulb	16EP4B
Magnetic	450	12	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		OVERALL DIMENSIONS INCHES		External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DES Anode (Kv)
		Clear Tinted Alum. Shield* Anti-Refll.	Faceplate Dimensions	Length							
16JP4A	60	T	16 <sup>1</sup> / <sub>2</sub>	20 <sup>3</sup> / <sub>4</sub>	750-2000	D	B5-57	12N	6.3/60	15.4	
16KP4	70	T	14 <sup>3</sup> / <sub>4</sub> x 11 <sup>1</sup> / <sub>2</sub>	18 <sup>3</sup> / <sub>4</sub>	750-1500	S	B5-57	12N	6.3/60	17.6	
16KP4A	70	TA	14 <sup>3</sup> / <sub>4</sub> x 11 <sup>1</sup> / <sub>2</sub>	18 <sup>3</sup> / <sub>4</sub>	750-1500	S	B5-57	12N	6.3/60	17.6	
16LP4	52	C	15 <sup>5</sup> / <sub>8</sub>	22 <sup>1</sup> / <sub>4</sub>	750-2000	D	B5-57	12N	6.3/60	15.4	
16LP4A	52	T	15 <sup>5</sup> / <sub>8</sub>	22 <sup>1</sup> / <sub>4</sub>	750-2000	D	B5-57	12N	6.3/60	15.4	
16MP4	60	C	16 <sup>1</sup> / <sub>2</sub>	21 <sup>3</sup> / <sub>4</sub>	1500-3500	D	B5-57	12N	6.3/60	15.4	
16MP4A	60	T	16 <sup>1</sup> / <sub>2</sub>	21 <sup>3</sup> / <sub>4</sub>	1500-3500	D	B5-57	12N	6.3/60	15.4	
16QP4	70	T	14 <sup>3</sup> / <sub>4</sub> x 11 <sup>1</sup> / <sub>2</sub>	19 <sup>3</sup> / <sub>4</sub>	.....	D	B5-57	12D	6.3/60	17.6	
16RP4	70	T	14 <sup>3</sup> / <sub>4</sub> x 11 <sup>1</sup> / <sub>2</sub>	18 <sup>3</sup> / <sub>4</sub>	750-1500	S	B5-57	12N	6.3/60	17.6	
16RP4A	70	TA	14 <sup>3</sup> / <sub>4</sub> x 11 <sup>1</sup> / <sub>2</sub>	18 <sup>3</sup> / <sub>4</sub>	750-1500	S	B5-57	12N	6.3/60	17.6	
16RP4B	70	TA	14 <sup>3</sup> / <sub>4</sub> x 11 <sup>1</sup> / <sub>2</sub>	18 <sup>3</sup> / <sub>4</sub>	750-1500	N	B5-57	12N	6.3/60	17.6	
16SP4	70	C	15 <sup>5</sup> / <sub>8</sub>	17 <sup>3</sup> / <sub>4</sub>	1500-3500	D	B5-57	12N	6.3/60	15.4	
16SP4A	70	T	15 <sup>5</sup> / <sub>8</sub>	17 <sup>3</sup> / <sub>4</sub>	1500-3500	D	B5-57	12N	6.3/60	15.4	
16TP4	70	T	14 <sup>3</sup> / <sub>4</sub> x 11 <sup>1</sup> / <sub>2</sub>	18 <sup>3</sup> / <sub>4</sub>	750-2000	S	B5-57	12N	6.3/60	15.4	
16UP4	70	T	14 <sup>3</sup> / <sub>4</sub> x 11 <sup>1</sup> / <sub>2</sub>	18 <sup>3</sup> / <sub>4</sub>	.....	S	B5-57	12D	6.3/60	16.5	
16VP4	70	T	15 <sup>5</sup> / <sub>8</sub>	17 <sup>3</sup> / <sub>4</sub>	.....	S	B5-57	12D	6.3/60	16.5	
16WP4	70	T	15 <sup>5</sup> / <sub>8</sub>	17 <sup>3</sup> / <sub>4</sub>	.....	D	B5-57	12D	6.3/60	16.5	
16WP4A	70	T	15 <sup>5</sup> / <sub>8</sub>	17 <sup>3</sup> / <sub>4</sub>	750-1500	D	B5-57	12N	6.3/60	17.6	
16WP4B	70	TA	15 <sup>5</sup> / <sub>8</sub>	17 <sup>3</sup> / <sub>4</sub>	750-1500	D	B5-57	12N	6.3/60	17.6	
16XP4	70	T	14 <sup>3</sup> / <sub>4</sub> x 11 <sup>1</sup> / <sub>2</sub>	18 <sup>3</sup> / <sub>4</sub>	.....	D	B5-57	12D	6.3/60	16.5	
16YP4	70	T	15 <sup>5</sup> / <sub>8</sub>	17 <sup>3</sup> / <sub>4</sub>	750-2000	S	B5-57	12N	6.3/60	15.4	
16ZP4	52	T	15 <sup>5</sup> / <sub>8</sub>	22 <sup>1</sup> / <sub>4</sub>	750-1500	D	B5-57	12N	6.3/60	17.6	
17AP4	70	T	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	18 <sup>3</sup> / <sub>4</sub>	750-2000	S	B5-57	12N	6.3/60	17.6	
17ATP4	90	T	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15 <sup>5</sup> / <sub>8</sub>	750-1500	S	B6-63	12L	6.3/60	17.6	
17ATP4A	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15 <sup>5</sup> / <sub>8</sub>	750-1500	S	B6-63	12L	6.3/60	17.6	
17AVP4	90	T	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15 <sup>5</sup> / <sub>8</sub>	1200-1500	S	B6-63	12L	6.3/60	17.6	
17AVP4A	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15 <sup>5</sup> / <sub>8</sub>	1200-1500	S	B6-63	12L	6.3/60	17.6	
17BP4	70	T	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	19 <sup>3</sup> / <sub>4</sub>	.....	S	B5-57	12D	6.3/60	17.6	
17BP4A	70	T	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	19 <sup>3</sup> / <sub>4</sub>	750-1500	S	B5-57	12N	6.3/60	17.6	
17BP4B	70	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	19 <sup>3</sup> / <sub>4</sub>	750-1500	S	B5-57	12N	6.3/60	17.6	
17BP4A	70	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	19 <sup>3</sup> / <sub>4</sub>	750-1500	S	B5-57	12N	6.3/60	17.6	
17BP4C	70	T, AR	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	19 <sup>3</sup> / <sub>4</sub>	750-1500	S	B5-57	12N	6.3/60	17.6	
17BP4D	70	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	19 <sup>3</sup> / <sub>4</sub>	750-1500	N	B5-57	12N	6.3/60	17.6	
17BJP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15 <sup>5</sup> / <sub>8</sub>	1000-1500	N	B6-63	12L	6.3/60	17.6	
17BKP4	90	T	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15 <sup>5</sup> / <sub>8</sub>	1200-1500	S	B6-63	12L	6.3/45	17.6	
17BKP4A	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15 <sup>5</sup> / <sub>8</sub>	1200-1500	S	B6-63	12L	6.3/45	17.6	
17BMP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15 <sup>5</sup> / <sub>8</sub>	750-1500	S	B6-63	12L	6.3/60	19.8	
17BNP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	14 <sup>3</sup> / <sub>4</sub>	750-1500	N	B6-63	12L	6.3/60	19.8	
17BRP4	110	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	12 <sup>3</sup> / <sub>4</sub>	1000-1500	S	B7-208	8HR	6.3/60	16.5	
17BSP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	14 <sup>3</sup> / <sub>4</sub>	1200-1500	N	B6-63	12L	6.3/45	17.6	
17BTP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15 <sup>5</sup> / <sub>8</sub>	900-1400	S	B7-51	12AJ	6.3/30	19.8	
17BUP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15 <sup>1</sup> / <sub>4</sub>	1200-1500	S	B6-63	12L	6.3/60	19.8	
17BVP4	110	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	13 <sup>3</sup> / <sub>4</sub>	1000-1500	S	B6-185	7FA	6.3/60	17.6	
17BWP4	110	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	12 <sup>3</sup> / <sub>4</sub>	1000-1500	N	B6-185	7FA	6.3/60	17.6	
17BYP4	110	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	12 <sup>3</sup> / <sub>4</sub>	1000-1500	N	B6-185	7FA	6.3/45	17.6	
17BZP4	110	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	12 <sup>3</sup> / <sub>4</sub>	1000-1500	N	B7-183	8HR	6.3/60	17.6	
17CP4	70	T, AR	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	18 <sup>3</sup> / <sub>4</sub>	.....	S	B5-57	12D	6.3/60	17.6	
17CP4A	70	T	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	18 <sup>3</sup> / <sub>4</sub>	.....	S	B5-57	12D	6.3/60	17.6	
17CAP4	110	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	12 <sup>3</sup> / <sub>4</sub>	1000-1500	N	B7-183/B7-208	8HR	6.3/60	17.6	
17CBP4	90	T	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15 <sup>1</sup> / <sub>4</sub>	1000-1500	S	B6-63	12L	6.3/60	19.8	
17CDP4	110	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	12 <sup>3</sup> / <sub>4</sub>	800-1500	N	B7-183/B7-208	8HR	8.4/45	17.6	
17CEP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15	1200-1500	N	B6-63	12L	6.3/45	17.6	
17CFP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15	1200-1500	N	B6-63	12L	6.3/60	17.6	
17CGP4	70	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	17 <sup>3</sup> / <sub>4</sub>	500-750	N	B6-63	12L	6.3/60	15.4	
17CKP4	110	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	12 <sup>3</sup> / <sub>4</sub>	1000-1500	N	B7-183	8HR	6.3/60	16.5	
17CLP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15 <sup>5</sup> / <sub>8</sub>	1800-2300	S	B6-63	12L	6.3/60	17.6	
17CMP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	14 <sup>3</sup> / <sub>4</sub>	1000-1500	N	B6-63	12L	6.3/60	17.6	
17CNP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15	1000-1500	N	B6-63	12L	6.3/60	17.6	
17CRP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	14 <sup>3</sup> / <sub>4</sub>	1700-2200	N	B6-63	12L	6.3/45	17.6	
17CSP4	110	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	12 <sup>3</sup> / <sub>4</sub>	900-1400	N	B6-186	7FA	6.3/60	17.6	
17CTP4	110	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	12 <sup>3</sup> / <sub>4</sub>	1000-1500	N	B7-208	8HR	6.3/45	17.6	
17CUP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	15	1200-1500	N	B6-63	12L	6.3/30	17.6	
17CVP4	110	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	12 <sup>3</sup> / <sub>4</sub>	1000-1500	N	B7-183/B7-208	8HR	6.3/30	17.6	
17CWP4	110	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	11 <sup>3</sup> / <sub>4</sub>	1000-1500	N	B7-183	8HR	6.3/60	17.6	
17CXP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	14 <sup>3</sup> / <sub>4</sub>	1000-1500	N	B6-63	12L	6.3/45	17.6	
17CYP4	90	TA	15 <sup>5</sup> / <sub>8</sub> x 12 <sup>1</sup> / <sub>4</sub>	14	1000-1500	N	B6-63	12L	6.3/60	17.6	

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*		17BMF4
-55 to +1.1	220	14	-50 to +350	110	+37 to +55*		17BNF4
-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		17CV4
-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*		17CX4
-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	OVERALL DIMENSIONS INCHES		External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Ampl	DESH	
			Faceplate Dimensions	Length						Anode (Kv)	
17CZP4	90	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	13 $\frac{3}{8}$	1000-1500	N	B6-63	12L	6.3/60	17.6	
17DAP4	110	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	10 $\frac{1}{4}$	900-1400	N	B7-208	8JK	2.68/45	17.6	
17DBP4	70	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	S	B6-63	12L	6.3/30	17.6	
17DCP4	90	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	14 $\frac{3}{8}$	1000-1500	N	B6-63	12L	6.3/30	17.6	
17DEP4	110	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	10 $\frac{3}{8}$	900-1400	N	B7-208	8JN	2.35/60	17.6	
17DHP4	110	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	11 $\frac{1}{4}$	1000-1500	N	B7-208	8HR	6.3/45	17.6	
17DJP4	90	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	15 $\frac{1}{8}$	1000-1500	S	B6-63	12L	6.3/30	17.6	
17DKP4	110	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	10 $\frac{1}{4}$	1000-1500	N	B7-208	8JR	6.3/60	23	
17DLP4	110	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	11 $\frac{3}{8}$	1000-1500	N	B6 226/B7-237	8JS	6.3/60	19.8	
17DQP4	110	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	12 $\frac{1}{8}$	1200-1700	N	B6-214	7FA	6.3/45	17.6	
17DRP4	110	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	10 $\frac{1}{4}$	900-1400	N	B7-208	8JK	2.68/45	17.6	
17DSP4	110	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	11 $\frac{1}{4}$	1000-1500	N	B7-183	8HR	6.3/60	19.8	
17DTP4	110	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	10 $\frac{3}{8}$	1000-1500	N	B7-208	8HR	6.3/60	22	
17DWP4	70	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	N	B6-63	12L	6.3/60	22	
17DXP4	110	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	10 $\frac{1}{4}$	1000-1500	N	B7-208	8JR	6.3/45	17.6	
17DZP4	110	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	10 $\frac{1}{4}$	1000-1500	N	B7-208	8HR	6.3/45	17.6	
17EAP4	70	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	1000-1500	S	B5-57	12AT	6.3/60	17.6	
17EBP4	110	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	11 $\frac{1}{4}$	1100-1700	N	B7-208	8HR	6.3/45	20	
17EFP4	110	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	11 $\frac{1}{4}$	1000-1500	N	B7-183	8HR	6.3/45	19.8	
17EHP4	110	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	11 $\frac{1}{2}$	1000-1500	N	B7-208	8HR	6.3/60	20	
17EKP4	70	TA, BP	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	600-1000	N	B6-63	12L	6.3/60	22	
17ELP4	114	TA, BF	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	11 $\frac{3}{8}$	1150-1650	N	B7-208	8HR	6.3/45	15	
17EMP4	114	TA, BR	14 $\frac{3}{8}$ x 12 $\frac{1}{4}$	11 $\frac{3}{8}$	1300-1700	N	B7-208	8HR	6.3/45	22	
17EQP4	114	TA, BF	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	11 $\frac{1}{4}$	900-1500	N	B7-208	8HR	6.3/45	19.8	
17ESP4	114	TA, BR	14 $\frac{3}{8}$ x 11 $\frac{1}{4}$	11 $\frac{1}{4}$	1000-1400	N	B7-208	8HR	6.3/45	23	
17FP4	70	T	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	500-1500	S	B6-63	12L	6.3/60	19.8	
17FPA	70	T	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-2000	S	B6-63	12L	6.3/60	19.8	
17GP4	70	T, AR	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$ (m)	.....	S	B6-63	12M	6.3/60	17.6	
17HP4	70	T	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	S	B6-63	12L	6.3/60	17.6	
17HP4A	70	T, AR	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	S	B6-63	12L	6.3/60	17.6	
17HP4B	70	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	S	B6-63	12L	6.3/60	17.6	
17HP4C	70	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	N	B6-63	12L	6.3/60	17.6	
17JP4	70	T	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	500-1500	S	B5-57	12N	6.3/60	19.8	
17KP4	70	T	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	1000-1500	S	B6-63	12P	6.3/60	17.6	
17KP4A	70	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	1000-1500	S	B6-63	12P	6.3/60	17.6	
17LP4	70	T	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	S	B6-63	12L	6.3/60	17.6	
17LP4A	70	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	S	B6-63	12L	6.3/60	17.6	
17LP4B	70	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	N	B6-63	12L	6.3/60	17.6	
17QP4	70	T	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	S	B5-57	12N	6.3/60	17.6	
17QP4A	70	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	S	B5-57	12N	6.3/60	19.8	
17QP4B	70	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	N	B5-57	12N	6.3/60	19.8	
17RP4	70	T	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	S	B6-63	12L	6.3/60	17.6	
17RP4C	70	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	S	B6-63	12L	6.3/60	17.6	
17SP4	70	T	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	500-750	S	B5-57	12N	6.3/60	15.4	
17TP4	70	T, AR	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	.....	S	B6-63	12M	6.3/60	17.6	
17UP4	70	T	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	S	B5-57	12N	6.3/60	15.4	
17VP4	70	T	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	S	B6-63	12L	6.3/60	17.6	
17VP4B	70	TA	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	750-1500	S	B6-63	12L	6.3/60	17.6	
17YP4	70	T	15 $\frac{1}{8}$ x 12 $\frac{1}{4}$	19 $\frac{1}{4}$	500-1500	S	B5-57	12N	6.3/60	19.8	
19AP4	66	C	18 $\frac{3}{8}$	21 $\frac{1}{2}$	.....	S	B5-57	12D	6.3/60	17.6	
19AP4A	66	T	18 $\frac{3}{8}$	21 $\frac{1}{2}$	.....	S	B5-57	12D	6.3/60	17.6	
19AP4B	66	T, AR	18 $\frac{3}{8}$	21 $\frac{1}{2}$	.....	S	B5-57	12D	6.3/60	17.6	
19AP4C	66	TA	18 $\frac{3}{8}$	21 $\frac{1}{2}$	.....	S	B5-57	12D	6.3/60	17.6	
19AP4D	66	C, AR	18 $\frac{3}{8}$	21 $\frac{1}{2}$	.....	S	B5-57	12D	6.3/60	17.6	
19AP4E	66	T, AR	18 $\frac{3}{8}$	21 $\frac{1}{2}$	.....	S	B5-57	12D	6.3/60	17.6	
19ABP4	114	TA	16 $\frac{1}{2}$ x 13 $\frac{1}{2}$	10 $\frac{3}{8}$	850-1400	N	B7-208	8JK	2.68/45	20	
19ACP4	114	TA	16 $\frac{1}{2}$ x 13 $\frac{1}{2}$	12 $\frac{3}{8}$	1000-1500	N	B7-208	8HR	6.3/60	20	
19AEP4	114	TA	16 $\frac{1}{2}$ x 13 $\frac{1}{2}$	11 $\frac{3}{8}$	1000-1500	N	B7-208	8HR	12.6/15	17.6	
19AFP4	114	BC, TA	17 $\frac{1}{8}$ x 14 $\frac{3}{8}$	11 $\frac{3}{8}$	1000-1500	N	B7-208	8HR	6.3/60	20	
19AHP4	114	TA	16 $\frac{1}{2}$ x 13 $\frac{1}{2}$	11 $\frac{3}{8}$	1000-1500	N	B7-208	8HR	6.3/45	17.6	
19AJP4	114	TA	16 $\frac{1}{2}$ x 13 $\frac{1}{2}$	11 $\frac{3}{8}$	1400-1900	N	B6-214	7FA	6.3/45	19.8	
19ALP4	114	TA	16 $\frac{1}{2}$ x 13 $\frac{1}{2}$	11 $\frac{3}{8}$	1000-1500	N	B7-208	8HR	6.3/30	22	
19ANP4	114	TA	16 $\frac{1}{2}$ x 13 $\frac{1}{2}$	10 $\frac{3}{8}$	1000-1500	N	B7-208	8JR	6.3/45	20	
19AQP4	114	TA	16 $\frac{1}{2}$ x 13 $\frac{1}{2}$	11 $\frac{3}{8}$	1000-1500	N	B7-208	8HR	6.3/30	20	
19ARP4	114	BC, TA	17 $\frac{1}{8}$ x 14 $\frac{3}{8}$	12 $\frac{3}{8}$	1000-1500	N	B7-208	8HR	6.3/60	20	
19ASP4	114	BC, TA	17 $\frac{1}{8}$ x 14 $\frac{3}{8}$	12 $\frac{3}{8}$	1000-1500	N	B7-208	8HR	6.3/30	20	

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	2.68 Volt Heater	17CZP4
-7 to +.95	550	14	+100 to +500	300	40-77		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		17DEP4
-55 to +1.1	770	14	0 to 400	500	48-77	Spherical Face Plate Spherical Face Plate Tri-Potential Es. Focus: Spherical Face Plate Spherical Face Plate	17DHP4
-55 to +1.1	550	14	-50 to +300	300	40-77		17DJP4
+70	600	14	0 to 400	500	48-83		17DKP4
-55 to +1.1	770	17	0 to 400	450	33-77		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
±30	700	18	0 to 400	300	33-77		17DWP4
+70	600	14	0 to 400	500	48-83		17DXP4
-5 to +1.0	550	14	0 to 400	300	33-77	Non-Potential Electrostatic Focus	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	Metal Bulb	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	Metal Bulb	17FP4
-5.5	450	16	+3100 to +4100	300	33-77		17FPA4
-5.5	550	14	+2200 to +3620	300	33-77		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	Cylindrical Faceplate	17HP4B
-55 to +1.1	550	14	-56 to +310	300	33-77		17HP4C
Magnetic	450	14	100 Ma.	300	33-77	Cylindrical Faceplate	17IP4
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		17LP4A
-55 to +1.1	550	14	-56 to +310	300	33-77	Cylindrical Faceplate	17LP4B
Magnetic	450	12	100 Ma.	300	33-77		17QP4
Magnetic	450	14	95 Ma.	300	33-77	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		17TP4
Magnetic	450	13	110 Ma.	250	33-66	Cylindrical Faceplate	17UP4
-55 to +1.1	550	14	-48 to +260	300	33-77		17VP4
-55 to +1.1	550	14	-48 to +260	300	33-77	Cylindrical Faceplate	17VP4B
Magnetic	550	16	100 Ma.	300	33-77		17YP4
Magnetic	450	12	140 Ma.	300	33-77	19AP4	
Magnetic	450	12	140 Ma.	300	33-77	Metal Bulb	19AP4A
Magnetic	450	12	140 Ma.	300	33-77		19AP4B
Magnetic	450	12	140 Ma.	300	33-77	Metal Bulb	19AP4C
Magnetic	450	12	140 Ma.	300	33-77		19AP4D
-7 to +.95	550	16	100 to 500	300	40-77	2.68 Volt Heater	19AP4E
-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	Metal Bulb	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*	Metal Bulb	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 Tri-Potential Electrostatic Focus	19ALP4
-35 to +.7	600	16	0 to 400	500	48-83		19ANP4
-50 to +1.0	550	16	0 to 400	300	38-72	Metal Bulb	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		OVERALL DIMENSIONS INCHES		External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts-Amps	Anode (Kv)	DES
		Clear Tinted Alum. Shield+ Anti-Refll.		Faceplate Dimensions	Length							
19ATP4	114	BC, TA		17 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8JR	6.3/60	20	
19AUP4	114	BC, TA, AR		17 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/60	20	
19AVP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/60	23	
19AXP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 208	8HR	6.3/45	20	
19AYP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 208	8HR	6.3/45	23	
19BAP4	114	BC, TA		17 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/30	20	
19BCP4	114	BC, TA, AR		17 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 208	8HR	6.3/30	20	
19BDP4	92	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	15 <sup>1</sup> / <sub>2</sub>	1500 2000	N	B6 63/B6 203	12L	6.3/60	20	
19BEP4	110	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/30	20	
19BFP4	92	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	15 <sup>1</sup> / <sub>2</sub>	1500-2000	N	B6-203	12L	6.3/60	20	
19BHP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 237/B7 208	8HR	6.3/60	22	
19BLP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1300-1700	N	B7 208	8HR	6.3/60	20	
19BMP4	114	BC, TA		17 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1300-1700	N	B7 208	8HR	6.3/60	20	
19BNP4	114	BC, TA		17 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	12 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/60	20	
19BQP4	114	BC, TA, AR		17 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	12 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/60	20	
19BRP4	114	TA BP		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1500 2000	N	B7 208	8HR	6.3/60	23	
19BSP4	110	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 208	8HR	6.3/60	20	
19BTP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	10 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8JR	6.3/60	23	
19BUP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1300 1700	N	B7 208	8HR	2 2/102	18.75	
19BVP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/60	23.5	
19BWP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/45	23.5	
19CAP4	110	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 208	8JR	6.3/60	20	
19CDP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1400 1900	N	B6 214	7FA	6.3/60	19.8	
19CEP4	114	BC, TA, AR		17 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 208	8HR	6.3/30	20	
19CFP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 237/ B7 208	8HR	6.3/60	17.5	
19CGP4	92	BC, TA, AR		17 <sup>1</sup> / <sub>2</sub> x 15 <sup>1</sup> / <sub>2</sub>	15 <sup>1</sup> / <sub>2</sub>	1400 1700	N	B6-203	12L	6.3/60	20	
19CHP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 208	8HR	6.3/60	20	
19CJP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1300 1700	N	B7 208	8HR	6.3/60	20	
19CKP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 237/ B7 208	8HR	6.3/60	22	
19CLP4	92	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	15 <sup>1</sup> / <sub>2</sub>	1500 2000	N	B6 203	12L	6.3/60	19.8	
19CMP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 208	8HR	6.3/45	20	
19CMP4A	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 208	8HR	6.3/45	23.5	
19CQP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1400-1900	N	B6 214	7FA	6.3/60	19.8	
19CRP4	92	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	15 <sup>1</sup> / <sub>2</sub>	1500 2000	N	B6 203	12L	6.3/60	22	
19CUP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1300 1700	N	B7 208	8HR	6.3/45	22	
19CVP4	114	TA, BC		17 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1700-2100	N	B7 208	8HR	6.3/45	23	
19CXP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1400-1900	N	B6 214	7FA	6.3/60	19.8	
19CYP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	10 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 208	8HR	6.3/60	23	
19CZP4	114	TA BP		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/45	23	
19DP4	66	C		18 <sup>1</sup> / <sub>2</sub>	21 <sup>1</sup> / <sub>2</sub>	750 2500	S	B5 57	12N	6.3/60	18.7	
19DP4A	66	T		18 <sup>1</sup> / <sub>2</sub>	21 <sup>1</sup> / <sub>2</sub>	750 2500	S	B5 57	12N	6.3/60	18.7	
19DAP4	114	TA, AR, BP		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/45	23	
19DBP4	114	TA, BP		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1400 1900	N	B6 214	7FA	6.3/45	19.8	
19DCP4	114	TA BR		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 208	8HR	6.3/60	20	
19DEP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 237/ B7 208	8HR	6.3/60	22	
19DFP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1300-1700	N	B7 208	8HR	6.3/60	22	
19DHP4	114	TA, BR		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 208	8HR	6.3/60	20	
19DJP4	110	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/30	20	
19DKP4	114	TA, BP		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/60	23	
19DLP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/60	20	
19DNP4	114	TA, BP		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/60	18	
19DQP4	114	TA, BR		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/45	23	
19DRP4	114	TA, BR		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1250 1750	N	B7 208	8HR	6.3/60	23	
19DSP4	114	TA, BR		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 208	8HR	6.3/60	20	
19DUP4	114	TA, BR		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1150-1550	N	B7 208	8HR	6.3/45	22	
19DVP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 237/ B7 208	8HR	6.3/45	20	
19DWP4	114	TA, BR		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000 1500	N	B7 208	8HR	6.3/45	23	
19DYP4	114	TA, BC		17 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1700-2100	N	B7 208	8HR	6.3/45	23	
19DZP4	114	TA		16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7 237/ B7 208	8HR	6.3/45	18	
19EP4	70	T		17 x 13 <sup>1</sup> / <sub>2</sub>	21 <sup>1</sup> / <sub>2</sub>	.....	N	B5 57	12D	6.3/60	20.9	

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		
+ 70	600	16		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	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	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	Tri-Potential Electrostatic Focus	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		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*	Tri-Potential Electrostatic Focus	19BWP4
- 35 to + 70	600	16	0 to 400	500	48-83		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		19CEP4
- 50 to +1.0	100	13	0	50	31-49		19CFP4
- 55 to +1.1	550	16	0 to 400	300	40-77	18 Second Heater Warm-up Time	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	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	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	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-Refll.	OVERALL DIMENSIONS INCHES		External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DESIG	
			Faceplate Dimensions	Length						Anode (Kv)	
19EAP4	114	TA-BR	16 <sup>3</sup> / <sub>16</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/45	20	
19EBP4	114	TA-BF	17 <sup>1</sup> / <sub>8</sub> x 14 <sup>1</sup> / <sub>4</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/60	23	
19ECP4	114	TA	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-237/ B7-208	8HR	6.3/45	20	
19EDP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/60	23	
19EFP4	114	TA-BR	16 <sup>1</sup> / <sub>16</sub> x 13 <sup>3</sup> / <sub>16</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/60	20	
19EGP4	114	TA-BF	17 <sup>1</sup> / <sub>8</sub> x 14 <sup>1</sup> / <sub>4</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/45	21	
19EHP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/60	18	
19EHP4A	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/60	18	
19EJP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/45	20	
19EKP4	114	TA-BF	17 <sup>1</sup> / <sub>8</sub> x 14 <sup>1</sup> / <sub>4</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B6-214	7FA	6.3/45	19.8	
19ELP4	114	TA	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/60	18	
19ENP4	114	TA-BR	16 <sup>1</sup> / <sub>16</sub> x 13 <sup>3</sup> / <sub>16</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/45	21	
19ENP4A	114	TA-BR	16 <sup>1</sup> / <sub>16</sub> x 13 <sup>3</sup> / <sub>16</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/45	21	
19ESP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/60	20	
19ETP4	114	TA-BR	16 <sup>1</sup> / <sub>16</sub> x 13 <sup>3</sup> / <sub>16</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/45	21	
19EUP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/60	23	
19EZP4	114	TA-BF	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B6-214	7FA	6.3/45	19.8	
19FP4	66	18"	.....	.....	.....	D	B5-57	12D	6.3/60	20.9	
19FBP4	114	TA-BF	17 <sup>1</sup> / <sub>8</sub> x 14 <sup>1</sup> / <sub>4</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/45	15	
19FCP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/45	23	
19FEP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1250-1750	N	B7-208	8HR	6.3/45	20	
19FEP4A	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1250-1750	N	B7-208	8HR	6.3/45	23.5	
19FEP4B	114	TA-TB	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/45	23.5	
19FGP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	10 <sup>3</sup> / <sub>16</sub>	1000-1500	N	B7-208	8HR	6.3/60	20	
19FHP4	114	TA-BR	16 <sup>1</sup> / <sub>16</sub> x 13 <sup>3</sup> / <sub>16</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/60	21	
19FJP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/45	18	
19FJP4A	114	TA-BR	16 <sup>1</sup> / <sub>16</sub> x 13 <sup>3</sup> / <sub>16</sub>	11 <sup>1</sup> / <sub>8</sub>	1250-1750	N	B7-208	8HR	6.3/45	18	
19FKP4	110	TA-BF	17 <sup>1</sup> / <sub>8</sub> x 14 <sup>1</sup> / <sub>4</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/30	20	
19FLP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1250-1750	N	B7-208	8HR	6.3/45	23	
19FNP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1250-1750	N	B7-208	8HR	6.3/60	23	
19FRP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1250-1750	N	B7-208	8HR	6.3/30	23	
19FTP4	114	TA-BR	16 <sup>1</sup> / <sub>16</sub> x 13 <sup>3</sup> / <sub>16</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B7-208	8HR	6.3/45	21	
19FWP4	114	TA	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	4.2/45	20	
19FZP4	110	TA-BP	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/30	20	
19GAP4	114	TA-BF	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/45	19.8	
19GBP4	114	TA-BP	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/45	23	
19GEP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1250-1750	N	B7-208	8HR	6.3/45	23	
19GEP4A	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1250-1750	N	B7-208	8HR	6.3/45	23	
19GHP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1150-1550	N	B7-208	8HR	6.3/45	22	
19GJP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/45	23	
19GJP4A	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/45	23	
19GKP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1250-1750	N	B7-208	8HR	6.3/30	23	
19GMP4	114	TA-BP	17 <sup>1</sup> / <sub>8</sub> x 14 <sup>1</sup> / <sub>4</sub>	11 <sup>1</sup> / <sub>8</sub>	700-900	N	B7-208	8HR	6.3/45	23	
19HAP4	114	TA-BF	17 <sup>1</sup> / <sub>8</sub> x 14 <sup>1</sup> / <sub>4</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/315	21	
19HGP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1700	N	B7-208	8HR	6.3/45	20	
19XP4	114	TA	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>8</sub>	1000-1500	N	B7-208	8HR	6.3/60	20	
19YP4	114	TA	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	10 <sup>3</sup> / <sub>16</sub>	1000-1500	N	B7-208	8JR	6.3/60	20	
19ZP4	114	TA	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub>	1000-1500	N	B6-226/B7-237	8JS	6.3/60	20	
20ABP4	114	TA-BR	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	12 <sup>1</sup> / <sub>16</sub>	700-900	N	B7-208	8HR	6.3/45	23	
20ADP4	114	TA-TB	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	12 <sup>1</sup> / <sub>16</sub>	1500-2000	N	B7-208	8HR	6.3/45	23	
20AEP4	114	TA-TB	16 <sup>1</sup> / <sub>2</sub> x 13 <sup>1</sup> / <sub>2</sub>	12 <sup>1</sup> / <sub>16</sub>	1500-2200	N	B7-208	8HR	6.3/45	23.5	
20CP4	70	T	18 <sup>1</sup> / <sub>16</sub> x 14 <sup>1</sup> / <sub>16</sub>	21 <sup>1</sup> / <sub>8</sub>	.....	S	B5-57	12D	6.3/60	19.8	
20CP4A	70	T	18 <sup>1</sup> / <sub>16</sub> x 14 <sup>1</sup> / <sub>16</sub>	21 <sup>1</sup> / <sub>8</sub>	500-1500	S	B5-57	12N	6.3/60	19.8	
20CP4B	70	TA	18 <sup>1</sup> / <sub>16</sub> x 14 <sup>1</sup> / <sub>16</sub>	21 <sup>1</sup> / <sub>8</sub>	.....	S	B5-57	12D	6.3/60	19.8	
20CP4C	70	T, AR	18 <sup>1</sup> / <sub>16</sub> x 14 <sup>1</sup> / <sub>16</sub>	21 <sup>1</sup> / <sub>8</sub>	.....	S	B5-57	12D	6.3/60	19.8	
20CP4D	70	TA	18 <sup>1</sup> / <sub>16</sub> x 14 <sup>1</sup> / <sub>16</sub>	21 <sup>1</sup> / <sub>8</sub>	500-1500	S	B5-57	12N	6.3/60	19.8	
20DP4	70	T	18 <sup>1</sup> / <sub>16</sub> x 14 <sup>1</sup> / <sub>16</sub>	21 <sup>1</sup> / <sub>8</sub>	.....	S	B5-57	12D	6.3/60	19.8	
20DP4A	70	T	18 <sup>1</sup> / <sub>16</sub> x 14 <sup>1</sup> / <sub>16</sub>	21 <sup>1</sup> / <sub>8</sub>	500-1500	S	B5-57	12N	6.3/60	19.8	
20DP4B	70	TA	18 <sup>1</sup> / <sub>16</sub> x 14 <sup>1</sup> / <sub>16</sub>	21 <sup>1</sup> / <sub>8</sub>	.....	S	B5-57	12D	6.3/60	19.8	
20DP4C	70	TA	18 <sup>1</sup> / <sub>16</sub> x 14 <sup>1</sup> / <sub>16</sub>	21 <sup>1</sup> / <sub>8</sub>	500-1500	S	B5-57	12N	6.3/60	19.8	
20DP4D	70	TA	18 <sup>1</sup> / <sub>16</sub> x 14 <sup>1</sup> / <sub>16</sub>	21 <sup>1</sup> / <sub>8</sub>	500-1500	S	B5-57	12N	6.3/60	19.8	
20FP4	70	T	18 <sup>1</sup> / <sub>16</sub> x 14 <sup>1</sup> / <sub>16</sub>	21 <sup>1</sup> / <sub>8</sub>	.....	S	B6-63	12M	6.3/60	19.8	
20GP4	70	T	18 <sup>1</sup> / <sub>16</sub> x 14 <sup>1</sup> / <sub>16</sub>	21 <sup>1</sup> / <sub>8</sub>	500-750	S	B6-63	12L	6.3/60	19.8	
20HP4	70	T	18 <sup>1</sup> / <sub>16</sub> x 14 <sup>1</sup> / <sub>16</sub>	21 <sup>1</sup> / <sub>8</sub>	.....	S	B6-63/B6-203	12M	6.3/60	17.6	

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	Welded Tension Band	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		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*	Welded Tension Band	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*		19GEP4A
-40 to +1.25	80	16	-200 to +200	50	+33 to +45*		19GNP4
-55 to +1.1	550	20	-200 to +200	400	50.98		Welded Tension Band
-55 to +1.1	550	20	-200 to +200	400	50.98	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*	Tri-Potential Electrostatic Focus	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		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		OVERALL DIMENSIONS INCHES		External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DESH	
		Clear Tinted Alum. Shield* Anti-Refll.	Faceplate Dimensions	Length	Anode (Kv)							
20HP4A	70	T	18 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	21 <sup>3</sup> / <sub>4</sub>	500-1500	S	B6-63/B6-203	12L	6.3/60	17.6		
20HP4B	70	T, AR	18 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	21 <sup>3</sup> / <sub>4</sub>	.....	S	B6-63/B6-203	12M	6.3/60	17.6		
20HP4C	70	TA	18 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	21 <sup>3</sup> / <sub>4</sub>	.....	S	B6-63/B6-203	12M	6.3/60	17.6		
20HP4D	70	TA	18 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	21 <sup>3</sup> / <sub>4</sub>	500-1500	S	B6-63/B6-203	12L	6.3/60	17.6		
20HP4E	70	TA	18 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	21 <sup>3</sup> / <sub>4</sub>	500-1500	N	B6-63/B6-203	12L	6.3/60	17.6		
20JP4	70	T	18 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	21 <sup>3</sup> / <sub>4</sub>	500-750	S	B5-57	12P	6.3/60	19.8		
20LP4	70	T	18 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	21 <sup>3</sup> / <sub>4</sub>	750-1500	S	B6-63	12L	6.3/60	17.6		
20MP4	70	T	18 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	21 <sup>3</sup> / <sub>4</sub>	500-1500	S	B6-63	12L	6.3/60	17.6		
20RP4	114	TA BR	17 <sup>3</sup> / <sub>8</sub> x 13 <sup>1</sup> / <sub>2</sub>	12 <sup>1</sup> / <sub>2</sub>	1600-2200	N	B7-208	8HR	6.3/45	22		
20SP4	114	TA TB	16 <sup>3</sup> / <sub>4</sub> x 13 <sup>3</sup> / <sub>8</sub>	12 <sup>1</sup> / <sub>2</sub>	1400-2000	N	B7-208	8HR	6.3/45	23		
20TP4	114	TA TB	16 <sup>3</sup> / <sub>4</sub> x 13 <sup>3</sup> / <sub>8</sub>	12 <sup>1</sup> / <sub>2</sub>	1400-2000	N	B7-208	8HR	6.3/45	23		
20UP4	114	TA BF	17 <sup>1</sup> / <sub>2</sub> x 13 <sup>3</sup> / <sub>8</sub>	12 <sup>3</sup> / <sub>8</sub>	1200-1700	N	B7-208	8HR	6.3/45	23		
20WP4	114	TA BR	16 <sup>3</sup> / <sub>4</sub> x 13 <sup>3</sup> / <sub>8</sub>	12 <sup>1</sup> / <sub>2</sub>	1600-2000	N	B7-208	8HR	6.3/45	23		
20XP4	114	TA BR	16 <sup>7</sup> / <sub>8</sub> x 13 <sup>3</sup> / <sub>8</sub>	12 <sup>1</sup> / <sub>2</sub>	1500-2000	N	B7-208	8HR	6.3/45	23		
20YP4	114	TA BR	16 <sup>7</sup> / <sub>8</sub> x 13 <sup>3</sup> / <sub>8</sub>	12 <sup>1</sup> / <sub>2</sub>	1500-2000	N	B7-208	8HR	6.3/45	23		
20ZP4	114	TA BR	16 <sup>7</sup> / <sub>8</sub> x 13 <sup>3</sup> / <sub>8</sub>	12 <sup>1</sup> / <sub>2</sub>	1500-2000	N	B7-208	8HR	6.3/45	23		
21AP4	70	T, AR	19 <sup>3</sup> / <sub>8</sub> x 15 <sup>3</sup> / <sub>8</sub>	22 <sup>3</sup> / <sub>8</sub>	.....	S	B5-57	12D	6.3/60	19.8		
21ACP4	90	T	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	2000-2500	S	B5-57	12N	6.3/60	22		
21ACP4A	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	2000-2500	S	B5-57	12N	6.3/60	22		
21AFP4	70	T	20 <sup>1</sup> / <sub>4</sub> x 15 <sup>3</sup> / <sub>8</sub>	23	.....	S	B6-63	12M	6.3/60	19.8		
21ALP4	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	500-750	S	B6-63	12L	6.3/60	19.8		
21ALP4A	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	500-750	S	B6-63	12L	6.3/60	19.8		
21ALP4B	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	500-750	S	B6-63	12L	6.3/60	22		
21AMP4	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	500-750	S	B5-57	12N	6.3/60	19.8		
21AMP4A	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	500-750	S	B5-57	12N	6.3/60	19.8		
21AMP4B	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	500-750	N	B5-57	12N	6.3/60	19.8		
21ANP4	90	T	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	.....	S	B6-63	12M	6.3/60	19.8		
21ANP4A	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	.....	S	B6-63	12M	6.3/60	19.8		
21AQP4	90	T	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	.....	S	B5-57	12D	6.3/60	19.8		
21AQP4A	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	.....	S	B5-57	12D	6.3/60	19.8		
21ARP4	70	T	20 <sup>1</sup> / <sub>4</sub> x 15 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	500-750	I	B5-57	12N	6.3/60	22		
21ARF4A	70	TA	20 <sup>1</sup> / <sub>4</sub> x 15 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	500-750	I	B5-57	12N	6.3/60	22		
21ASP4	70	T	18 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	22 <sup>1</sup> / <sub>2</sub>	.....	S	B6-63	12M	6.3/60	19.8		
21ATP4	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	1200-1500	S	B6-63	12L	6.3/60	19.8		
21ATP4A	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	1200-1500	S	B6-63	12L	6.3/60	22		
21ATP4B	90	T	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	1200-1500	S	B6-63	12L	6.3/60	19.8		
21AUP4	72	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	2000-2500	S	B6-63	12L	6.3/60	19.8		
21AUP4A	72	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	2000-2500	S	B6-63	12L	6.3/60	19.8		
21AUP4B	72	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	2000-2500	S	B6-63	12L	6.3/60	22		
21AUP4C	72	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	2000-2500	N	B6-63	12L	6.3/60	22		
21AVP4	72	T	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	2000-2500	S	B6-63/B6-203	12L	6.3/60	19.8		
21AVP4A	72	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	2000-2500	S	B6-63/B6-203	12L	6.3/60	19.8		
21AVP4B	72	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	2000-2500	S	B6-63/B6-203	12L	6.3/60	22		
21AVP4C	72	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	2000-2500	N	B6-63/B6-203	12L	6.3/60	22		
21AWP4	72	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	2000-2500	S	B5-57	12N	6.3/60	19.8		
21AWP4A	72	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	2000-2500	N	B5-57	12N	6.3/60	19.8		
21AYP4	70	T	18 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>2</sub>	22 <sup>1</sup> / <sub>2</sub>	750-2500	S	B6-63	12L	6.3/60	22		
21BAP4	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	2000-2500	N	B6-63	12L	6.3/60	22		
21BCP4	70	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	500-750	N	B6-63	12L	6.3/60	22		
21BDP4	72	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	500-750	N	B6-63	12L	6.3/60	22		
21BNP4	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	2000-2500	N	B6-63	12L	6.3/60	22		
21BSP4	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	2000-2500	S	B5-57	12N	6.3/60	22		
21BTP4	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	2000-2500	S	B6-63	12L	6.3/60	22		
21CBP4	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	18	2000-2500	N	B6-63	12L	6.3/60	19.8		
21CBP4A	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	18	2000-2500	N	B6-63	12L	6.3/60	22		
21CBP4B	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	18	2000-2500	S	B6-63	12L	6.2/60	20		
21CDP4	90	T	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	2000-2500	S	B6-63	12L	6.3/45	22		
21CDP4A	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	2000-2500	S	B6-63	12L	6.3/45	22		
21CEP4	110	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	14 <sup>3</sup> / <sub>8</sub>	2000-2500	N	B7-208	8HR	6.3/60	19.8		
21CEP4A	110	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	14 <sup>3</sup> / <sub>8</sub>	2000-2500	N	B7-208	8HR	6.3/60	22		
21CGP4	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	20	2000-2500	S	B6-63	12L	6.3/60	22		
21CHP4	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	18	2000-2500	N	B6-63	12L	6.3/60	22		
21CKP4	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	18	2000-2500	N	B6-63	12L	6.3/45	22		
21CLP4	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	19	1250-1750	S	B7-51	12AJ	6.3/30	19.8		
21CMP4	90	TA	20 <sup>1</sup> / <sub>4</sub> x 16 <sup>3</sup> / <sub>8</sub>	19	2000-2500	S	B6-63	12L	6.3/60	22		

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
Magnetic	550	16	102 Ma.	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
-55 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 +1.1	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		OVERALL DIMENSIONS INCHES		External Conductive Coating Capacitance (pf)	** Ion Trap	Base	Basing	Heater▲ Volts/Amps	DESIG	
		Clear Tinted Alum. Shield* Anti-Refll.		Faceplate Dimensions	Length						Anode (Kv)	
21CQP4	110	TA		20¼ x 16½	14¼	2000-2500	N	B6-185	7FA	6.3/60	19.8	
21CSP4	110	TA		20¼ x 16½	14¼	2000-2500	N	B6-185	7FA	6.3/45	19.8	
21CUP4	90	TA		20¼ x 16½	20	2000-2500	S	B5-57	12N	6.3/60	22	
21CVP4	90	TA		20¼ x 16½	20	2000-2500	N	B6-63	12L	6.3/60	22	
21CWP4	90	TA		22¼ x 16½	20	2000-2500	N	B6-63	12L	6.3/60	22	
21CXP4	90	TA		20¼ x 16½	18	2000-2500	S	B6-63	12L	6.3/60	22	
21CZP4	110	TA		20¼ x 16½	14¼	2000-2500	S	B7-183	8HR	6.3/60	19.8	
21DP4	70	T, AR		19¾ x 15¼	22¾m	.....	S	B6-63	12M	6.3/60	19.8	
21DAP4	110	TA		20¼ x 16½	14¼	2000-2500	N	B7-208	8HR	6.3/60	19.8	
21DEP4	110	TA		20¼ x 16½	14¼	2000-2500	N	B7-183/B7-208	8HR	6.3/60	19.8	
21DEP4A	110	TA		20¼ x 16½	14¼	2000-2500	N	B7-183/B7-208	8HR	6.3/60	22	
21DFP4	110	TA		20¼ x 16½	14¼	1500-2200	N	B7-183/B7-208	8HR	6.3/60	19.8	
21DHP4	110	TA		20¼ x 16½	14¼	1700-2500	N	B7-183/B7-208	8HR	6.3/45	19.8	
21DJP4	90	TA		20¼ x 16½	18	2000-2500	N	B6-63	12L	6.3/30	22	
21DKP4	110	TA		20¼ x 16½	14¼	1700-2500	N	B7-183/B7-208	8HR	6.3/30	19.8	
21DKP4A	110	TA		20¼ x 16½	14¼	1700-2500	N	B7-183/B7-208	8HR	6.3/30	19.8	
21DLP4	90	TA		20¼ x 16½	17	2000-2500	N	B6-63	12L	6.3/60	22	
21DMP4	110	TA		20¼ x 16½	13¾	2000-2500	N	B7-183/B7-208	8HR	6.3/60	22	
21DNP4	90	TA		20¼ x 16½	19	1200-1500	S	B6-63	12L	6.3/60	22	
21DQP4	90	TA		20¼ x 16½	17½	2000-2500	N	B6-63	12L	6.3/60	20	
21DRP4	90	TA		20¼ x 16½	18¼	2000-2500	N	B6-63/B6-203	12L	6.3/60	22	
21DSP4	90	TA		20¼ x 16½	18	2000-2500	N	B6-63	12L	6.3/60	22	
21DVP4	90	TA		20¼ x 16½	20	500-750	S	B6-63	12L	6.3/30	22	
21DWP4	110	TA		20¼ x 16½	14¼	2000-2500	N	B7-183/B7-208	8HR	6.3/60	19.8	
21EP4	70	T		20¼ x 15¾	23	.....	S	B5-57	12D	6.3/60	19.8	
21EP4A	70	T		20¼ x 15¾	23	500-750	S	B5-57	12N	6.3/60	19.8	
21EP4B	70	TA		20¼ x 15¾	23	500-750	S	B5-57	12N	6.3/60	19.8	
21EP4C	70	TA		20¼ x 15¾	23	500-750	N	B5-57	12N	6.3/60	19.8	
21EAP4	110	TA		20¼ x 16½	12¾	1500-2000	N	B7-208	8JK	2.35/60	20	
21ELP4	90	TA		20¼ x 16½	19	2000-2500	N	B6-63	12L	6.3/30	22	
21EMP4	110	TA		20¼ x 16½	13¾	2000-2500	N	B7-183	8HR	6.3/60	19.8	
21ENP4	90	TA		20¼ x 16½	19	2000-2500	S	B6-63	12L	6.3/30	22	
21EQP4	110	TA		20¼ x 16½	12¾	2000-2500	N	B7-208	8JR	6.3/60	20	
21ERP4	110	TA, AR, BP		20¼ x 16½	12¾	1500-2000	N	B7-208	8JR	6.3/60	20	
21ESP4	110	TA		20¼ x 16½	13¾	2000-2500	N	B6-226/B7-208	8JS	6.3/60	19.8	
21EVP4	110	TA		20¼ x 16½	12¾	1500-2000	N	B7-208	8JK	2.68/45	20	
21EWP4	72	TA		20¼ x 16½	23¼	.....	N	B5-57	12D	6.3/60	22	
21EXP4	110	TA		20¼ x 16½	12¾	2000-2500	N	B7-208	8JR	6.3/30	20	
21EYP4	72	TA		20¼ x 16½	23¼	1200-1500	N	B6-63/B6-203	12L	6.3/60	22	
21EZP4	110	TA		20¼ x 16½	12¾	2000-2500	N	B7-208	8JR	6.3/30	19.8	
21FP4	70	T		20¼ x 15¾	23¼	.....	S	B6-63/B6-203	12M	6.3/60	19.8	
21FPA4	70	T		20¼ x 15¾	23¾	500-750	S	B6-63/B6-203	12L	6.3/60	19.8	
21FP4C	70	TA		20¼ x 15¾	23¼	500-750	N	B6-63/B6-203	12L	6.3/60	19.8	
21FP4D	70	TA		20¼ x 15¾	23¾	500-750	N	B6-63/B6-203	12L	6.3/60	19.8	
21FAP4	110	TA		19¾ x 16½	12¾	2000-2500	N	B7-208	8JR	6.3/60	22	
21FCP4	110	TA		20¼ x 16½	13½	2000-2500	N	B7-208	8HR	6.3/30	18	
21FDP4	110	TA		20¼ x 16½	13¾	1500-2000	N	B7-208	8KW	6.3/60	20	
21FLP4	90	TA		20¼ x 16½	18	500-2500	N	B6-63	12L	6.3/60	22	
21FMP4	110	TA		20¼ x 16½	14¾	2000-2500	N	B7-237/B7-208	8HR	6.3/60	22	
21FUP4	114	TA-BF		18¾ x 14¾	12¾	1700-2500	N	B7-208	8HR	6.3/45	23	
21FVP4	114	TA-BR		18¾ x 14¾	12¾	1500-2300	N	B7-208	8HR	6.3/45	23	
21FWP4	114	TA-BR		18¾ x 14¾	12¾	1500-2300	N	B7-208	8HR	6.3/45	23	
21FXP4	114	TA-BF		18¾ x 15¾	12¾	1500-2000	N	B7-208	8HR	6.3/45	23	
21FY4	114	TA-BR		18¾ x 15¾	12¾	1900-2400	N	B7-208	8HR	6.3/45	22	
21FZP4	114	TA-BR		18¾ x 14¾	12¾	1700-2500	N	B7-208	8HR	6.3/45	23	
21GAP4	114	TA-BR		18¾ x 14¾	12¾	1300-2000	N	B7-208	8HR	6.3/45	23.5	
21GAP4A	114	TA-BR		18¾ x 14¾	12¾	1300-2000	N	B7-208	8HR	6.3/45	23.5	
21GBP4	114	TA-BR		18¾ x 14¾	12¾	1500-2300	N	B7-208	8HR	6.3/45	23	
21GCP4	114	TA-BR		18¾ x 14¾	12¾	1700-2500	N	B7-208	8HR	6.3/45	23	
21GHP4	114	TA		18¾ x 14¾	12¾	1500-2300	N	B7-208	8HR	6.3/45	23.5	
21GJP4	114	TA-BR		18¾ x 14¾	12¾	1500-2300	N	B7-183	8HR	6.3/60	20	
21GKP4	114	TA-BR		18¾ x 14¾	12¾	1700-2500	N	B7-208	8HR	6.3/45	23	
21GTP4	114	TA-BF		18¾ x 15¾	12¾	1700-2500	N	B7-208	8HR	6.3/315	23	
21JP4	70	T		20¼ x 15¾	23¼	500-750	I	B5-57	12N	6.3/60	22	
21JPA4	70	TA		20¼ x 15¾	23¾	500-750	I	B5-57	12N	6.3/60	22	

MAXIMUM RATINGS		TYPICAL OPERATION				REMARKS	Type
Focusing Electrode (Kv)	Accel. Grid (G2) Volts	Anode (Kv)	Focus Electrode Volts	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		
			Magnet Coil Current in Ma.				
-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		21CJP4
-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	21EP4
-55 to +1.1	550	17	0 to 500	300	33.77	Light Weight Bulb	21DEPA4
-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	21DKPA4
-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	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	21EXPA
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	21FPA4
-55 to +1.1	550	16	-64 to +350	300	33.77	Cylindrical Faceplate	21FPA4C
-55 to +1.1	550	16	-64 to +350	300	33.77	Cylindrical Faceplate	21FPA4D
+70m	600	16	0 to 400	500	48.83	Light Weight Bulb; Tri Potential Focus	21FPA4F
-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	21JPA4



# 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	Anode (Kv)	DESIGN
			Clear Tinted Alum. Shield* Anti-Refli.	Faceplate Dimensions							
21KP4	70	T	20 1/4 x 15 1/8	22 7/8	.....	S	B5-57	12D	6.3/60	19.8	
21KP4A	70	T	20 1/4 x 15 1/8	22 7/8	500-750	S	B5-57	12P	6.3/60	19.8	
21MP4	70	T, AR	19 3/4 x 15 1/8	22 7/8	.....	S	B6-63	12M	6.3/60	17.6	
21WP4	70	T	18 1/4 x 14 3/4	22 1/4	500-750	S	B5-57	12N	6.3/60	19.8	
21WP4A	70	TA	18 1/4 x 14 3/4	22 1/4	500-750	S	B5-57	12N	6.3/60	19.8	
21WP4B	70	TA	18 1/4 x 14 3/4	22 1/4	500-750	N	B5-57	12N	6.3/60	19.8	
21XP4	70	T	18 1/4 x 14 3/4	22 1/4	2000-2500	S	B6-63/B6-203	12L	6.3/60	19.8	
21XP4A	70	TA	18 1/4 x 14 3/4	22 1/4	2000-2500	S	B6-63/B6-203	12L	6.3/60	19.8	
21XP4B	70	TA	18 1/4 x 14 3/4	22 1/4	2000-2500	N	B6-63/B6-203	12L	6.3/60	19.8	
21YP4	70	T	20 1/4 x 15 1/8	23 1/2	500-750	S	B6-63/B6-203	12L	6.3/60	19.8	
21YP4A	70	TA	20 1/4 x 15 1/8	23 1/2	500-750	S	B6-63/B6-203	12L	6.3/60	19.8	
21YP4B	70	TA	20 1/4 x 15 1/8	23 1/2	500-750	S	B5-57	12D	6.3/60	19.8	
21ZP4	70	T	20 1/4 x 15 1/8	23 1/2	500-750	S	B5-57	12N	6.3/60	19.8	
21ZP4A	70	TA	20 1/4 x 15 1/8	23 1/2	500-750	S	B5-57	12N	6.3/60	19.8	
21ZP4B	70	TA	20 1/4 x 15 1/8	23 1/2	500-750	S	B5-57	12N	6.3/60	19.8	
21ZP4C	70	TA	20 1/4 x 15 1/8	23 1/2	500-750	N	B5-57	12N	6.3/60	19.8	
22TP4	114	TA, BF	19 1/2 x 15 1/8	13 1/8	1700-2200	N	B7-208	8HR	6.3/45	23	
22ZP4	114	TA, BR	18 1/4 x 15 1/8	13 1/8	2000-2500	N	B7-208	8HR	6.3/45	23	
23ACP4	90	TA, BC	21 1/4 x 17 1/4	19 1/2	2000-2500	N	B6-63	12L	6.3/60	18	
23AFP4	92	TA, BC	21 1/4 x 17 1/4	18 1/2	2000-2500	N	B6-203	12L	6.3/60	25	
23AMP4	92	TA	20 1/2 x 16 1/2	18	1700-2500	N	B6-203	12L	6.3/60	22	
23AKP4	114	TA	20 1/2 x 16 1/2	12 7/8	2000-2500	N	B7-208	8JR	6.3/60	22	
23ALP4	114	TA	20 1/2 x 16 1/2	14 1/2	1700-2500	N	B7-208	8HR	6.3/45	22	
23AMP4	114	TA	20 1/2 x 16 1/2	14 1/2	1700-2500	N	B7-208	8HR	6.3/30	22	
23ANP4	92	TA, BC	21 1/4 x 17 1/4	18 1/2	2000-2500	N	B6-63/B6-203	12L	6.3/60	25	
23AQP4	114	TA	20 1/2 x 16 1/2	14 3/8	1700-2500	N	B7-208	8HR	6.3/30	19.8	
23ARP4	110	TA	20 1/2 x 16 1/2	14 3/8	1700-2500	N	B7-208	8HR	6.3/60	22	
23ASP4	92	TA	20 1/2 x 16 1/2	17	1700-2500	N	B6-203	12L	6.3/60	22	
23ATP4	92	TA, AR, BC	21 1/4 x 17 1/4	18 1/4	2000-2500	N	B6-203/B6-63	12L	6.3/60	25	
23AUP4	92	TA	20 1/2 x 16 1/2	18	1700-2500	N	B6-203	12L	6.3/60	25	
23AVP4	110	TA, AR, BC	21 1/4 x 17 1/4	15 1/4	2000-2500	N	B7-208	8HR	6.3/60	22	
23AWP4	92	TA	20 1/2 x 16 1/2	18	1700-2500	N	B6-203	12L	6.3/60	22	
23AXP4	110	TA	20 1/2 x 16 1/2	14 3/4	2000-2500	N	B7-208	8HR	6.3/30	20	
23AYP4	110	TA, AR, BC	21 1/4 x 17 1/4	15 1/4	2000-2500	N	B7-208	8HR	6.3/30	22	
23AZP4	92	TA	20 1/2 x 16 1/2	18	1700-2500	N	B6-203	12L	6.3/30	22	
23BP4	110	TA, BC	21 1/4 x 17 1/4	14 1/4	2000-2500	N	B7-208	8HR	6.3/60	22	
23BAP4	110	TA, AR, BC	21 1/4 x 17 1/4	14 1/4	2000-2500	N	B7-208	8HR	6.3/60	22	
23BCP4	110	TA	20 1/2 x 16 1/2	14 7/8	1700-2500	N	B7-208	8HR	6.3/30	22	
23BDP4	92	TA, AR, BC	21 1/4 x 17 1/4	18 1/4	2000-2500	N	B6-203	12L	6.3/60	22	
23BEP4	110	TA, BC	21 1/4 x 17 1/4	15 1/4	2000-2500	N	B7-208	8HR	6.3/30	22	
23BEP4A	110	TA, BC	21 1/4 x 17 1/4	15 1/4	1700-2500	N	B7-208	8HR	6.3/60	22	
23BGP4	110	TA, AR, BC	21 1/4 x 17 1/4	15 1/4	1700-2500	N	B7-208	8HR	6.3/60	22	
23BJP4	92	TA	20 1/2 x 16 1/2	18 1/4	1700-2500	N	B6-203	12L	6.3/60	25	
23BKP4	92	TA, BC	21 1/4 x 17 1/4	18 1/4	1700-2500	N	B6-203	12L	6.3/60	25	
23BLP4	92	TA, AR, BC	21 1/4 x 17 1/4	18 1/4	1700-2500	N	B6-203	12L	6.3/60	25	
23BMP4	92	TA, BC	21 1/4 x 17 1/4	18 1/4	1700-2500	N	B6-203	12L	6.3/60	22	
23BNP4	110	TA, BC	21 1/4 x 17 1/4	15 1/4	2000-2500	N	B7-208	8HR	6.3/60	22	
23BP4	110	TA, BC	21 1/4 x 17 1/4	15 1/4	2000-2500	N	B7-208	8HR	6.3/45	23	
23BRP4	110	TA, AR, BC	21 1/4 x 17 1/4	13 1/8	2000-2500	N	B7-208	8JR	6.3/30	22	
23BSP4	110	TA, AR, BC	21 1/4 x 17 1/4	15 1/4	2000-2500	N	B7-208	8HR	6.3/30	22	
23BTP4	92	TA, BC	21 1/4 x 17 1/4	18 1/4	2000-2500	N	B6-203	12L	6.3/60	25	
23BVP4	92	TA, BC	21 1/4 x 17 1/4	18 1/4	2000-2500	N	B6-203	12L	6.3/60	25	
23BXP4	92	TA, BF	20 1/2 x 16 1/2	18 1/4	2000-2500	N	B6-203	12L	6.3/60	22	
23BYP4	110	TA, BC	21 1/4 x 17 1/4	13 1/8	2000-2500	N	B7-208	8JR	6.3/30	22	
23BZP4	92	TA	20 1/2 x 16 1/2	18	1700-2500	N	B6-203	12L	8.4/45	22	
23CP4	110	TA, BC	21 1/4 x 17 1/4	15 1/4	2000-2500	N	B7-208	8HR	6.3/60	22	
23CP4A	110	TA, BC	21 1/4 x 17 1/4	15 1/4	2000-2500	N	B7-208	8HR	6.3/60	23.5	
23CP4B	92	TA, BC	21 1/4 x 17 1/4	18 1/4	2000-2500	N	B6-203	12L	8.4/45	22	
23CBP4	110	TA, AR, BC	21 1/4 x 17 1/4	15 1/4	2000-2500	N	B7-208	8HR	6.3/45	23	
23CDP4	92	TA, BC	21 1/4 x 17 1/4	18 1/4	2000-2500	N	B6-203	12L	6.3/30	22	
23CEP4	110	TA	20 1/2 x 16 1/2	14 3/8	1700-2500	N	B7-208	8HR	6.3/45	22	
23CGP4	92	TA	20 1/2 x 16 1/2	18	1700-2500	N	B6-203	12L	6.3/45	22	
23CMP4	110	TA	20 1/2 x 16 1/2	14 3/8	1700-2500	N	B7-208	8HR	6.3/60	22	
23CQP4	114	TA	20 1/2 x 16 1/2	13 1/8	1700-2500	N	B7-208	8HR	6.3/45	23.5	

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 Cylindrical Faceplate Metal Bulb	21KP4
Auto. Es.	550	14	Auto. Es.	300	33.77		21KP4A
-55 to +1.1	550	16	-65 to +350	300	33.77		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	16	100 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*	Low Anode Voltage	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		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	Tri-Potential Electrostatic Focus	23AH4
+70m	600	16	0 to 400	500	48.83		23AK4
-55 to +1.1	550	18	0 to 400	400	41.99		23AL4
-55 to +1.1	550	18	0 to 400	400	41.99		23AM4
-50 to +1.1	70	20	0 to 500	50	+40 to +55*	23AN4	
-50 to +1.0	550	18	0 to 400	400	49.99	18 Second Heater Warm-up Time	23AQ4
-55 to +1.1	550	16	0 to 400	300	40.77		23AR4
-55 to +1.1	550	18	0 to 400	400	41.99		23AS4
-50 to +1.1	70	20	0 to 500	50	+40 to +55*		23AT4
-55 to +1.1	550	18	0 to 400	400	41.99	23AU4	
-55 to +1.1	550	16	0 to 400	300	40.77	18 Second Heater Warm-up Time	23AV4
-45 to +1.25	225	20	0 to 400	50	+41 to +59*		23AW4
-55 to +1.1	550	16	0 to 400	400	42.72		23AX4
-55 to +1.1	550	16	0 to 400	300	40.77		23AY4
-55 to +1.1	550	18	0 to 400	400	41.99	23AZ4	
-55 to +1.1	550	14	0 to 400	450	50.110	18 Second Heater Warm-up Time	23B4
-55 to +1.1	550	14	0 to 400	450	50.110		23BA4
-55 to +1.1	550	16	0 to 400	300	40.77		23BC4
-55 to +1.1	700	16	0 to 400	500	+50 to +100*		23BD4
-55 to +1.1	550	16	0 to 400	300	40.77	23BE4	
-55 to +1.1	550	16	0 to 400	300	40.77	18 Second Heater Warm-up Time	23BF4
-55 to +1.1	70	16	0 to 400	50	+37 to +52*		23BG4
-55 to +1.1	70	16	0 to 400	50	+37 to +52*		23BH4
-45 to +1.25	70	20	0 to 400	50	+41 to +59*		23BJ4
-40 to +1.25	225	20	0 to 400	50	+41 to +59*	23BK4	
-40 to +1.25	225	20	0 to 400	50	+41 to +59*	Tri-Potential Electrostatic Focus	23BL4
-55 to +1.1	550	16	0 to 400	300	40.77		23BM4
-55 to +1.1	550	18	-100 to +300	400	60.110		23BN4
-55 to +1.1	550	16	0 to 400	300	40.77		23BP4
+70m	600	16	500	500	48.83	23BR4	
-55 to +1.1	550	16	0 to 400	300	40.77	18 Second Heater Warm-up Time	23BS4
-55 to +1.1	550	16	0 to 400	300	40.77		23BT4
-55 to +1.1	550	20	0 to 400	300	40.77		23BV4
-55 to +1.1	550	16	0 to 400	300	35.72		23BX4
+70m	600	16	0 to 400	500	48.83	18 Sec. Heater Warm-up; Tri-Pot. Es. Focus	23BY4
-55 to +1.1	550	18	0 to 400	400	41.99		23BZ4
-55 to +1.1	550	16	0 to 400	300	40.77		23C4
-55 to +1.1	550	16	0 to 400	300	40.77		23CA4
-55 to +1.1	550	16	0 to 400	300	40.77	23CB4	
-55 to +1.1	550	16	0 to 400	300	40.77	23CC4	
-55 to +1.1	550	16	0 to 400	300	40.77	23CD4	
-55 to +1.1	550	16	0 to 400	300	40.77	23CE4	
-40 to +1.2	700	16	0 to 400	500	45.95	23CG4	
-55 to +1.1	550	16	0 to 400	300	40.77	23CM4	
-55 to +1.1	550	14	0 to 400	450	50.110	23CQ4	

# Monochrome TV Picture Tubes Data (cont'd)

Type	Defl. Angle and Neck Dia. $\phi$	FACEPLATE		OVERALL DIMENSIONS INCHES		External Conductive Coating Capacitance (pF)	** Ion Trap	Base	Basing	Heater $\Delta$ Volts/Amps	DESIGN	
		Clear Tinted Alum. Shield* Anti-Refll.	Faceplate Dimensions	Length	Anode (Kv)							
23CSP4	110	TA, AR, BC	21 $\frac{3}{4}$ x 17 $\frac{1}{2}$	13 $\frac{3}{8}$	2000-2500	N	B7-208	8JR	6.3/30	22		
23CTP4	92	TA, BC	21 $\frac{3}{4}$ x 17 $\frac{1}{2}$	18 $\frac{3}{8}$	2000-2500	N	B6-203	12L	6.3/45	22		
23CUP4	110	TA, AR, BC	21 $\frac{3}{4}$ x 17 $\frac{1}{2}$	13 $\frac{3}{8}$	2000-2500	N	B7-208	8JR	6.3/30	22		
23CVP4	114	TA	20 $\frac{1}{2}$ x 16 $\frac{1}{2}$	12 $\frac{3}{4}$	2000-2500	N	B7-208	8JR	6.3/30	22		
23CWP4	110	TA	20 $\frac{1}{2}$ x 16 $\frac{1}{2}$	13 $\frac{3}{8}$	2000-2500	N	B7-208	8JR	6.3/30	22		
23CXPA	110	TA	20 $\frac{1}{2}$ x 16 $\frac{1}{2}$	13 $\frac{3}{8}$	2000-2500	N	B7-208	8JR	6.3/30	22		
23CZPA	92	TA	20 $\frac{1}{2}$ x 16 $\frac{1}{2}$	18 $\frac{3}{8}$	2000-2500	N	B6-203	12L	6.3/60	25		
23DP4	110	TA, BC	21 $\frac{3}{4}$ x 17 $\frac{1}{2}$	13 $\frac{3}{8}$	2000-2500	N	B7-208	8JR	6.3/60	22		
23DAP4	94	TA	20 $\frac{1}{2}$ x 16 $\frac{1}{2}$	17 $\frac{1}{8}$	1700-2500	N	B7-208	8HR	6.3/60	23		
23DBP4	110	TA	20 $\frac{1}{2}$ x 16 $\frac{1}{2}$	14 $\frac{7}{8}$	2000-2500	N	B7-237/ B7-208	8HR	6.3/60	22		
23DCP4	94	TA	20 $\frac{1}{2}$ x 16 $\frac{1}{2}$	17 $\frac{1}{8}$	1700-2500	N	B7-208	8HR	6.3/45	23.5		
23DEP4	110	TA, BF	21 $\frac{3}{4}$ x 17 $\frac{1}{4}$	14	1500-2000	N	B7-208	8HR	6.3/30	20		
23DFP4	110	TA, BF	20 $\frac{1}{2}$ x 16 $\frac{1}{2}$	14	1500-2000	N	B7-208	8HR	6.3/30	20		
23DHP4	110	TA, BC	21 $\frac{3}{4}$ x 17 $\frac{1}{4}$	14 $\frac{3}{4}$	2000-2500	N	B7-208	8HR	6.3/30	22		
23DJP4	110	TA, BC	21 $\frac{3}{4}$ x 17 $\frac{1}{4}$	14 $\frac{3}{4}$	2000-2500	N	B7-208	8HR	6.3/30	22		
23DKP4	92	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	18	1700-2500	N	B6-203	12L	6.3/60	22		
23DLP4	92	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	18	1700-2500	N	B6-203	12L	6.3/60	22		
23DLP4A	92	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	18	1700-2500	N	B6-203	12L	6.3/60	22		
23DNP4	92	TA, BC	21 $\frac{3}{4}$ x 17 $\frac{1}{2}$	18 $\frac{3}{8}$	2000-2500	N	B6-203	12L	6.3/60	25		
23DQP4	92	TA, BC	21 $\frac{3}{4}$ x 17 $\frac{1}{2}$	18 $\frac{1}{4}$	2000-2500	N	B7-208	8HR	6.3/60	25		
23DSP4	92	TA, BR	21 $\frac{1}{4}$ x 16 $\frac{1}{8}$	18 $\frac{3}{8}$	2000-2500	N	B7-208	8HR	6.3/60	25		
23DSP4A	92	TA, BR	21 $\frac{1}{4}$ x 16 $\frac{1}{8}$	18 $\frac{3}{8}$	2000-2500	N	B7-208	8HR	6.3/60	25		
23DTP4	92	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	18 $\frac{1}{2}$	1700-2500	N	B6-203	12L	6.3/60	25		
23DVP4	114	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{3}{4}$	1700-2500	N	B7-208	8HR	6.3/60	22		
23DVP4A	114	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{3}{4}$	1700-2500	N	B7-208	8HR	6.3/60	22		
23DWP4	94	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	17 $\frac{1}{4}$	2000-2500	N	B7-208	8HR	6.3/60	22		
23DYP4	110	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{3}{4}$	2000-2500	N	B7-208	8HR	6.3/60	22		
23DZPA	114	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{3}{4}$	1700-2500	N	B7-208	8HR	6.3/45	22		
23EP4	110	TA, BC	21 $\frac{3}{4}$ x 17 $\frac{1}{2}$	15 $\frac{1}{4}$	1700-2500	N	B7-219	8KP	6.3/60	22		
23EAP4	92	TA, BC	21 $\frac{3}{4}$ x 17 $\frac{1}{2}$	18 $\frac{3}{8}$	2000-2500	N	B6-203	12L	6.3/45	22		
23ECP4	92	TA, BP	20 $\frac{1}{2}$ x 16 $\frac{1}{2}$	18 $\frac{3}{8}$	2000-2500	N	B6-203	12L	6.3/60	25		
23EDP4	92	TA, BP	20 $\frac{1}{2}$ x 16 $\frac{1}{2}$	18 $\frac{3}{8}$	2000-2500	N	B6-203	12L	6.3/60	25		
23EFP4	110	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{7}{8}$	1700-2500	N	B7-208	8HR	6.3/60	22		
23EKP4	92	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	18	1700-2500	N	B6-203	12L	6.3/45	25		
23ENP4	92	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	18 $\frac{1}{8}$	1700-2500	N	B6-203	12L	6.3/60	25		
23EQP4	114	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{1}{2}$	1700-2500	N	B7-208	8HR	6.3/45	23		
23ERP4	114	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{1}{2}$	1700-2500	N	B7-208	8HR	6.3/60	23		
23ESP4	110	TA, AR, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{3}{8}$	2000-2500	N	B7-208	8HR	6.3/45	22		
23ESP4A	110	TA, AR, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{3}{8}$	2000-2500	N	B7-208	8HR	6.3/45	22		
23ETP4	110	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{7}{8}$	1700-2500	N	B7-208	8HR	6.3/60	23		
23EWP4	114	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{3}{4}$	1700-2500	N	B7-208	8HR	6.3/45	22		
23EWP4A	114	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{3}{4}$	1700-2500	N	B7-208	8HR	6.3/45	22		
23EYP4	92	TA, BF	21 $\frac{3}{4}$ x 18 $\frac{1}{4}$	18 $\frac{1}{8}$	2000-2500	N	B6-203	12L	6.3/60	25		
23EZP4	94	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	17 $\frac{1}{4}$	1700-2500	N	B7-208	8HR	6.3/45	23.5		
23FP4	114	TA	20 $\frac{1}{2}$ x 16 $\frac{1}{2}$	13 $\frac{3}{8}$	1700-2500	N	B7-208	8HR	6.3/60	22		
23FP4A	114	TA	20 $\frac{1}{2}$ x 16 $\frac{1}{2}$	13 $\frac{3}{8}$	1700-2500	N	B7-208	8HR	6.3/60	23.5		
23FAP4	114	TA, BF	21 $\frac{3}{4}$ x 17 $\frac{1}{4}$	14 $\frac{1}{2}$	1700-2500	N	B7-208	8HR	6.3/60	22		
23FBP4	92	TA, AR, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	18 $\frac{1}{8}$	1700-2500	N	B6-203	12L	6.3/60	25		
23FCP4	110	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{3}{8}$	1700-2500	N	B7-208	8HR	6.3/45	22		
23FDP4	110	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{7}{8}$	1700-2500	N	B7-208	8HR	6.3/45	23		
23FHP4	110	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{7}{8}$	1700-2500	N	B7-208	8HR	6.3/45	23.5		
23FKP4	94	TA, BC	21 $\frac{3}{4}$ x 17 $\frac{1}{2}$	17 $\frac{1}{8}$	1700-2500	N	B7-208	8HR	6.3/60	23.5		
23FLP4	92	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	18	1700-2500	N	B6-203	12L	6.3/45	25		
23FMP4	110	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{7}{8}$	1700-2500	N	B7-208	8HR	6.3/45	23		
23FNP4	92	TA, BF	21 $\frac{3}{8}$ x 18 $\frac{1}{4}$	18	2000-2500	N	B6-206	12L	6.3/45	25		
23FRP4	110	TA, BF	21 $\frac{3}{4}$ x 17 $\frac{1}{4}$	14 $\frac{1}{4}$	1700-2500	N	B7-208	8HR	6.3/45	23		
23FSP4	110	TA, BF	21 $\frac{3}{4}$ x 17 $\frac{1}{4}$	14 $\frac{1}{8}$	1700-2500	N	B7-208	8HR	6.3/60	23		
23FVP4	110	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{7}{8}$	2000-2500	N	B7-208	8HR	6.3/45	22		
23FVP4A	110	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{7}{8}$	2000-2500	N	B7-208	8HR	6.3/45	22		
23FWP4	92	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	18	1700-2500	N	B6-63	12L	6.3/45	22		
23FWP4A	92	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	18	1700-2500	N	B6-203	12L	6.3/45	22		
23GP4	110	TA, BC	21 $\frac{3}{4}$ x 17 $\frac{1}{2}$	15 $\frac{1}{4}$	2000-2500	N	B7-208	8HR	6.3/60	22		
23GBP4	110	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{3}{8}$	1700-2500	N	B7-208	8HR	6.3/45	23		
23GDP4	114	TA, BR	20 $\frac{3}{8}$ x 16 $\frac{1}{8}$	14 $\frac{1}{2}$	2000-2500	N	B7-208	8HR	6.3/60	22		

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. 3/8" 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	3/8" 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		OVERALL DIMENSIONS INCHES		External Conductive Coating Capacitance (pF)	** Ion Trap	Base	Basing	Heater Volts/Amps	DESIGN	
		Clear Tinted Alum. Shield* Anti-Refll.		Faceplate Dimensions	Length						Anode (Kv)	
23GHP4	94	TA-BR		20 1/2 x 16 3/8	16 1/8	2000-2500	N	B7-208	8HR	6.3/45	23	
23GJP4	110	TA-BR		20 3/8 x 16 5/8	14 1/4	1700-2500	N	B7-208	8HR	6.3/45	22	
23GJP4A	110	TA-BR		20 3/8 x 16 5/8	14 1/4	1700-2500	N	B7-208	8HR	6.3/45	23	
23GK4	92	TA-BF		21 1/4 x 17	18 3/8	2000-2500	N	B6-203	12L	6.3/60	22	
23GRP4	92	TA-BF		21 1/4 x 17	18 3/8	2000-2500	N	B6-63	12L	6.3/45	22	
23GSP4	110	TA-BR		20 1/2 x 16 1/2	14 7/8	1700-2500	N	B7-208	8HR	6.3/60	23	
23GTP4	110	TA-BR		20 1/2 x 16 1/2	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 1/4	14 3/8	2000-2500	N	B7-208	8HR	6.3/45	22	
23GX4	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 3/4 x 17 3/4	15 1/2	2000-2500	N	B7-208/B7-183	8HR	6.3/60	20	
23HBP4	110	TA-BR		21 3/4 x 17 1/4	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 5/8 x 16 5/8	14 7/8	1700-2500	N	B7-208	8HR	6.3/45	23	
23HGP4	110	TA-BR		20 5/8 x 16 1/2	14 7/8	1700-2500	N	B7-208	8HR	6.3/45	23	
23HK4	110	TA-BF		21 1/4 x 17 1/4	14 7/8	1700-2500	N	B7-208	8HR	6.3/60	23	
23HMP4	110	TA-BR		20 5/8 x 16 5/8	14 3/8	1700-2500	N	B7-208	8HR	6.3/30	23	
23HQP4	110	TA-BR		20 5/8 x 16 5/8	14 3/8	1700-2500	N	B7-208	8HR	6.3/45	23	
23HR4	110	TA-BR		20 5/8 x 16 5/8	14 3/8	2000-2500	N	B7-208	8HR	6.3/45	23.5	
23HT4	110	TA-BP		20 1/2 x 16 1/2	14 3/8	2000-2500	N	B7-208	8HR	6.3/30	20	
23HUP4	110	TA-BR		20 1/2 x 16 1/2	14 3/8	1700-2500	N	B7-208	8HR	6.3/45	23.5	
23HUP4A	110	TA-BR		20 1/2 x 16 1/2	14 3/8	1700-2500	N	B7-208	8HR	6.3/45	23.5	
23HW4	110	TA-BR		20 5/8 x 16 5/8	14 7/8	2000-2500	N	B7-208	8HR	6.3/45	22	
23HW4A	110	TA-BR		20 5/8 x 16 5/8	14 7/8	2000-2500	N	B7-208	8HR	6.3/45	22	
23HX4	110	TA-AR-BR		20 1/2 x 16 1/2	14 7/8	1700-2500	N	B7-208	8HR	6.3/45	23	
23HZ4	110	TA-BR		20 5/8 x 16 5/8	14 7/8	1700-2500	N	B7-208	8HR	6.3/30	23	
23JP4	110	TA, BC		21 3/4 x 17 3/4	15 3/8	2000-2500	N	B6-214	7FA	6.3/45	22	
23JAP4	110	TA-BR		20 1/2 x 16 1/2	14 3/8	1350-2150	N	B7-208	8HR	6.3/30	23	
23JBP4	110	TA-BF		21 1/4 x 17 1/4	14 3/8	1700-2500	N	B7-208	8HR	6.3/60	23	
23JEP4	110	TA-BR		20 5/8 x 16 1/2	14 7/8	1700-2500	N	B7-208	8HR	6.3/45	23	
23JFP4	110	TA-BF		21 1/4 x 17 1/4	14 3/8	1700-2500	N	B7-208	8HR	6.3/315	23	
23JGP4	110	TA-BR		20 1/2 x 16 1/2	14 3/8	1700-2500	N	B7-208	8HR	6.3/45	23.5	
23JLP4	110	TA-BR-AR		20 5/8 x 16 5/8	14 3/8	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 1/2	1700-2500	N	B7-208	8HR	6.3/60	22	
23MP4A	114	TA		20 1/2 x 16 1/2	14 1/2	1700-2500	N	B7-208	8HR	6.3/60	22.5	
23NP4	114	TA		20 1/2 x 16 1/2	14 3/8	1700-2500	N	B7-208	8HR	6.3/60	22	
23RP4	110	TA, BC		21 3/4 x 17 3/4	13 3/8	2000-2500	N	B7-208	8JR	6.3/30	22	
23SP4	110	TA, BC		21 3/4 x 17 3/4	15 3/8	2000-2500	N	B7-208	8HR	6.3/30	22	
23TP4	90	TA, BC		21 3/4 x 17 3/4	19 1/2	1700-2500	N	B6-63/B6-203	12L	6.3/60	22	
23UP4	110	TA, BC		21 3/4 x 17 3/4	15 3/8	2000-2500	N	B7-208	8HR	6.3/45	18	
23VP4	114	TA, BC		20 1/2 x 16 1/2	13 3/8	2000-2500	N	B7-208	8HR	6.3/30	22	
23WP4	114	TA, BC		20 1/2 x 16 1/2	14 1/4	2000-2500	N	B7-208	8HR	6.3/60	20	
23XP4	92	TA, BC		21 3/4 x 17 3/4	18 3/8	2000-2500	N	B6-203	12L	6.3/60	18	
23YP4	92	TA, BC		21 3/4 x 17 3/4	18 3/8	2000-2500	N	B6-203	12L	6.3/60	22	
23ZP4	90	TA, BC		21 3/4 x 17 3/4	19 3/8	2000-2500	N	B6-63	12L	6.3/60	22	
24AP4	70	T		24	23 3/8	.....	S	B5-57	12D	6.3/60	17.6	
24AP4A	70	TA		24	23 3/8	.....	S	B5-57	12D	6.3/60	17.6	
24AP4B	70	C, AR		24	23 3/8	.....	S	B5-57	12D	6.3/60	17.6	
24ADP4	90	TA		22 1/4 x 18 3/4	21 1/8	2000-2500	S	B5-57	12N	6.3/60	24.2	
24AEP4	90	TA		22 1/4 x 18 3/4	19 1/8	2000-2500	N	B6-63	12L	6.3/60	22	
24AHP4	110	TA		22 1/4 x 18 1/2	15 1/8	2000-2500	N	B7-208	8HR	6.3/60	22	
24AJ4	90	TA		22 1/4 x 18 3/4	19 1/8	2000-2500	N	B6-63	12L	6.3/60	22	
24AL4	110	TA		22 1/4 x 18 1/2	15 1/8	2000-2500	N	B7-183	8HR	6.3/60	22	
24AMP4	110	TA		22 1/4 x 18 1/2	15 3/8	2000-2500	N	B6-185	7FA	6.3/60	22	
24ANP4	90	TA		22 1/4 x 18 3/4	20 1/8	1700-2500	S	B6-63	12L	6.3/60	22	
24AQP4	110	TA		22 1/4 x 18 1/2	15 3/8	1700-2500	N	B7-183	8HR	6.3/45	22	
24ASP4	90	TA		22 1/4 x 18 3/4	19 1/8	1700-2500	N	B6-63	12L	6.3/30	22	
24AT4	90	TA		22 1/4 x 18 3/4	19 1/8	2000-2500	N	B6-63	12L	6.3/60	22	
24AUP4	90	TA		22 1/4 x 18 3/4	18 1/2	1700-2500	N	B6-63	12L	6.3/60	22	
24AV4	110	TA		22 1/4 x 18 1/2	14 3/8	1700-2500	N	B7-208	8JK	2.35/60	20	
24AWP4	110	TA		22 1/4 x 18 1/2	14 3/8	2000-2500	N	B7-183	8HR	6.3/60	22	
24AX4	110	TA		22 1/4 x 18 1/2	15 1/8	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	

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		
-50 to +1.0	400	18	0 to 400	200	+31 to +49*	Welded Tension Band	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*		23GJPA4
-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		23GWPA4
-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		23HJPA4
-55 to +1.1	550	18	0 to 400	300	28-62		23HGPA4
-50 to +1.0	250	16	0 to 400	150	36-54	Mounting Lugs	23HKPA4
-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		23HOPA4
-55 to +1.1	60	18	0 to 400	30	+30 to +45*		23HRPA4
-55 to +1.1	550	16	0 to 400	400	42-72		23HTPA4
-40 to +1.25	60	18	0 to 400	30	+22 to +45*	Welded Tension Band	23HUP4
-40 to +1.25	60	18	0 to 400	30	+22 to +45*		23HUPA4
-55 to +1.1	70	16	0 to 400	50	+35 to +55*		23HVP4
-55 to +1.1	70	16	0 to 400	50	+35 to +55*		23HWPA4
-55 to +1.1	550	18	0 to 400	300	28-62		23HXPA4
-55 to +1.1	550	18	0 to 400	300	28-62		23HZPA4
-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		23JBPA4
-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	Welded Tension Band	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*		23JLP4
-50 to +1.0	700	16.5	250	450	33-77		23KP4
-50 to +1.0	700	18	250	450	33-77		23KPA4
-55 to +1.1	550	18	0 to 400	400	41-99	Tri-Potential Electrostatic Focus	23MP4
-55 to +1.1	550	18	0 to 400	400	41-99		23MPA4
-55 to +1.1	70	18	0 to 400	50	+39 to +54*		23NP4
+70m	600	16	0 to 400	500	48-83		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	Low Anode Voltage 18 Second Heater Warm-up Time	23TP4
-55 to +1.1	550	16	0 to 400	300	40-77		23UP4
-55 to +1.1	550	14	0 to 400	450	50-110		23VP4
-50 to +2.0	550	16	0 to 400	300	40-77		23WPA4
-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*		23ZPA4
Magnetic	450	15	114 Ma.	300	33-77		24AP4
Magnetic	450	15	114 Ma.	300	33-77		24AP4A
Magnetic	450	15	114 Ma.	300	33-77		24AP4B
Magnetic	660	18	125 Ma.	300	33-77	24ADPA4	
-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	24AJPA4	
-55 to +1.1	550	17	0 to 500	300	33-77	24ALPA4	
-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		24ANPA4
-55 to +1.1	550	16	0 to 400	300	40-77		24AOPA4
-55 to +1.1	550	18	0 to 400	300	40-77		24ASPA4
-55 to +1.1	75	18	0 to 400	50	+39 to +57*		24ATPA4
-55 to +1.1	550	18	-75 to +400	300	40-77	2.35 Volt Heater	24AUP4
-55 to +1.1	550	16	-100 to +300	300	40-77		24AVPA4
-55 to +1.1	550	16	0 to 400	300	33-77		24AWPA4
-55 to +1.1	550	16	0 to 400	300	40-77		24AXPA4
-55 to +1.1	550	14	-56 to +310	300	33-77		24BPA4

# 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	DESIGN	
		Clear Tinted Alum. Shield* Anti-Refll.	Faceplate Dimensions	Length	Anode (Kv)							
24BAP4	110	TA	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>1</sup> / <sub>2</sub>	15 <sup>3</sup> / <sub>8</sub>	1700-2500	N	N	B7-183/B7-208	8HR	6.3/60	22	
24BCP4	90	TA-BP	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	19 <sup>3</sup> / <sub>8</sub>	2000-2500	N	N	B6-203	12L	6.3/60	22	
24BEF4	110	TA	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>1</sup> / <sub>2</sub>	14 <sup>3</sup> / <sub>8</sub>	1700-2500	N	N	B7-208	8KW	6.3/60	20	
24CP4	90	T	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	2000-2500	N	S	B5-57	12N	6.3/60	22	
24CP4A	90	TA	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	2000-2500	N	S	B5-57	12N	6.3/60	22	
24CP4B	90	TA	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	2000-2500	N	N	B5-57	12N	6.3/60	22	
24DP4	90	T	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	2000-2500	N	S	B6-63	12L	6.3/60	22	
24DP4A	90	TA	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	2000-2500	N	S	B6-63	12L	6.3/60	22	
24QP4	90	T	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	500-750	N	S	B5-57	12N	6.3/60	19.8	
24TP4	90	TA	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	250-2500	N	S	B5-57	12N	6.3/60	22	
24VP4	90	T	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	2000-2500	N	S	B5-57	12N	6.3/60	24.2	
24VP4A	90	TA	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	2000-2500	N	S	B5-57	12N	6.3/60	24.2	
24XP4	90	T	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	.....	N	S	B5-57	12D	6.3/60	22	
24YP4	90	TA	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	2000-2500	N	S	B6-63	12L	6.3/60	22	
24ZP4	90	TA	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	2000-2500	N	S	B6-63	12L	6.3/60	22	
25DP4	110	TA-BF	23 <sup>1</sup> / <sub>4</sub> x 18 <sup>1</sup> / <sub>2</sub>	15 <sup>1</sup> / <sub>8</sub>	2000-2500	N	N	B7-208	8HR	6.3/30	22	
25EP4	110	TA-BF	23 <sup>1</sup> / <sub>4</sub> x 18 <sup>1</sup> / <sub>2</sub>	15 <sup>1</sup> / <sub>8</sub>	2000-2500	N	N	B7-208	8HR	6.3/30	22	
25HP4	110	TA-BF	23 <sup>1</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	15 <sup>1</sup> / <sub>8</sub>	2000-2500	N	N	B7-208	8HR	6.3/45	23	
25JP4	110	TA	22 <sup>3</sup> / <sub>8</sub> x 18 <sup>3</sup> / <sub>8</sub>	15 <sup>3</sup> / <sub>8</sub>	2000-2500	N	N	B7-208	8HR	6.3/30	22	
25KP4	110	TA-AR-BP	22 <sup>3</sup> / <sub>8</sub> x 18 <sup>1</sup> / <sub>4</sub>	16	2000-2500	N	N	B7-208	8HR	6.3/30	22	
25LP4	110	TA-BP	22 <sup>3</sup> / <sub>4</sub> x 18 <sup>3</sup> / <sub>8</sub>	16 <sup>3</sup> / <sub>8</sub>	2000-2500	N	N	B7-183	8HR	6.3/60	22	
25TP4	110	TA-BR	22 <sup>1</sup> / <sub>2</sub> x 18 <sup>1</sup> / <sub>4</sub>	15 <sup>1</sup> / <sub>8</sub>	2000-2500	N	N	B7-208	8HR	6.3/60	22	
27AP4	90	T, AR	25 <sup>1</sup> / <sub>4</sub> x 19 <sup>1</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	.....	N	S	B6-63	12M	6.3/60	19.8	
27ABP4	110	TA-BP	25 <sup>1</sup> / <sub>4</sub> x 20 <sup>3</sup> / <sub>8</sub>	17 <sup>1</sup> / <sub>8</sub>	2000-2500	N	N	B7-208	8HR	6.3/60	22	
27ACP4	90	TA-BP	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	21 <sup>3</sup> / <sub>8</sub>	2000-2500	N	N	B6-203	12L	6.3/60	25	
27ADP4	110	TA-BP	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	17 <sup>3</sup> / <sub>8</sub>	2000-2500	N	N	B7-208	8HR	6.3/60	22	
27AEP4	110	TA	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	17 <sup>1</sup> / <sub>8</sub>	2000-2500	N	N	B7-208	8HR	6.3/30	22	
27AFP4	110	TA-BP	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	17 <sup>3</sup> / <sub>8</sub>	2000-2500	N	N	B7-208	8HR	6.3/30	22	
27AGP4	110	TA-AR-BP	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	17 <sup>1</sup> / <sub>8</sub>	2000-2500	N	N	B7-208	8HR	6.3/60	22	
27EP4	90	TA	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	23 <sup>1</sup> / <sub>8</sub>	.....	N	S	B5-57	12D	6.3/60	22	
27GP4	90	T	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	23 <sup>1</sup> / <sub>8</sub>	.....	N	S	B5-57	12D	6.3/60	24.8	
27LP4	90	TA	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	24 <sup>3</sup> / <sub>8</sub>	200-400	N	S	B5-57	12N	6.3/60	24.2	
27MP4	90	TA, AR	25 <sup>1</sup> / <sub>4</sub> x 19 <sup>1</sup> / <sub>8</sub>	22 <sup>3</sup> / <sub>8</sub> m	.....	N	S	B5-57	12D	6.3/60	19.8	
27NP4	90	T	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	23	500-2500	N	S	B5-57	12N	6.3/60	19.8	
27RP4	90	TA	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	23 <sup>1</sup> / <sub>8</sub>	500-2500	N	S	B5-57	12N	6.3/60	22	
27RP4A	90	TA	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	23 <sup>1</sup> / <sub>8</sub>	500-2500	N	N	B5-57	12N	6.3/60	20	
27SP4	90	TA	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	23 <sup>1</sup> / <sub>8</sub>	500-750	N	S	B6-63	12L	6.3/60	22	
27UP4	90	T	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	23 <sup>1</sup> / <sub>8</sub>	500-750	N	S	B6-63	12L	6.3/60	22	
27VP4	90	TA	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	2000-2500	N	N	B6-63	12L	6.3/60	19.8	
27XP4	90	TA	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	20 <sup>1</sup> / <sub>8</sub>	1700-2500	N	N	B6-203	12L	6.3/60	23	
27YP4	90	TA-BP	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>8</sub>	2000-2500	N	N	B6-63	12L	6.3/60	25	
27ZP4	110	TA	25 <sup>1</sup> / <sub>2</sub> x 20 <sup>3</sup> / <sub>8</sub>	17 <sup>1</sup> / <sub>8</sub>	2000-2500	N	N	B7-208	8HR	6.3/60	22	
30BP4	90	T	30 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	.....	N	S	B5-57	12D	6.3/60	33	

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Basing Diagrams—Page 535

## Monochrome Check Tubes

Type	Heater	Face		External Coating Capacitance (pf)	Focus	Defl. Angle and Neck Diam. ⬇	Anode Volts (Kv) Max.	Basing	Ion Trap Mag.	Nominal Length (in.)
		Clear Anti-Refll. Alum. Tinted	Round or Rect.							
5AXP4	6.3/60	C	○	No	Auto	53	19.8	12S	N	10%
8XP4	6.3/60	T	□	No	Auto	90	22	12S	N	11%
8YP4	6.3/60	T	□	No	Auto	110	22	7FG	N	8 <sup>1</sup> / <sub>2</sub> %
12DMFP4	6.3/60	TA, TB	□	No	Auto	110	22	8HR	N	9 <sup>1</sup> / <sub>2</sub> %

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	Accel. Grid (G2) Volts	Negative Grid No. 1 or Positive Cathode Voltage for Raster Cutoff		
			Magnet Coil Current in Ma.				
-55 to +1.1	70	20	0 to 400	64	+47 to +63*	24BAP4 24BCP4 24BEP4 24CP4 24CP4A	
-50 to +1.1	550	18	0 to 400	400	36-94		
-55 to +1.1	550	16	-100 to +300	300	40-77	24CP4 24CP4A	
Magnetic	550	18	100 Ma.	300	33-77		
Magnetic	550	18	100 Ma.	300	33-77	24CP4B 24DP4 24DP4A 24QP4 24TP4	
-55 to +1.1	550	18	-72 to +396	300	33-77		
-55 to +1.1	550	18	-72 to +396	300	33-77	24VP4 24VP4A 24XP4 24YP4 24ZP4	
Magnetic	550	16	100 Ma.	300	33-77		
Magnetic	550	18	100 Ma.	300	33-77	24VP4 24VP4A 24XP4 24YP4 24ZP4	
-55 to +1.1	550	18	-72 to +396	300	33-77		
-55 to +1.1	550	16	0 to 500	300	33-77	Short Neck 25DP4 25EP4 25HP4 25JP4 25KP4	
-55 to +1.1	700	16	-200 to +200	300	35-72		
-55 to +1.1	700	16	-200 to +200	300	35-72		
-50 to +1.0	60	16	0 to 400	50	35-55		
-55 to +1.1	700	16	-200 to +200	300	35-72		
-55 to +1.1	700	16	-200 to +200	300	35-72		
-55 to +1.1	550	18	0 to 400	400	36-94	Metal Bulb 25LP4 25TP4 27AP4 27ABP4 27ACP4	
-55 to +1.1	550	18	0 to 400	400	36-94		
-55 to +1.1	550	15	-60 to +300	300	33-77		
-55 to +1.1	550	18	0 to 400	300	35-72		
-55 to +1.1	550	18	0 to 400	400	48-96		
-55 to +1.1	550	18	0 to 400	300	37-74		27ADP4 27AEP4 27AFP4 27AGP4 27EP4
-55 to +1.1	550	18	0 to 400	300	40-77		
-55 to +1.1	550	18	0 to 400	300	37-74		
-55 to +1.1	550	18	0 to 400	300	35-74		
Magnetic	550	16	118 Ma.	300	33-77		
Magnetic	550	20	125 Ma.	300	33-77	Metal Bulb 27GP4 27LP4 27MP4 27NP4 27RP4	
Magnetic	660	20	148 Ma.	300	33-77		
Magnetic	550	16	110 Ma.	300	42-78		
Magnetic	550	16	95 Ma.	300	33-77		
Magnetic	550	20	125 Ma.	300	33-77		
Magnetic	550	20	125 Ma.	300	33-77		27RP4A 27SP4 27UP4 27VP4 27XP4
-55 to +1.1	550	18	-72 to +396	300	33-77		
-55 to +1.1	550	16	0 to 396	300	33-77		
-55 to +1.1	550	16	-72 to +396	300	33-77		
-55 to +1.1	550	18	0 to 400	400	41-99		
-55 to +1.1	550	18	0 to 450	300	28-72	27YP4 27ZP4 30BP4	
-55 to +1.1	550	18	0 to 400	300	40-77		
Magnetic	450	22	95 Ma.	300	33-77		

## Notes:

- ◆ 94°, 110° and 114° types have a nominal neck diameter of 1 1/4". All other magnetic deflection tube types have nominal neck diameter of 1 1/4". Color tubes listed have nominal neck diameter of 2" for the round types and 1 1/4" for the rectangular types. Unless otherwise indicated in "Remarks" Column.
- ▲ All Sylvania television picture tubes (except as noted in the Remarks Column) feature controlled heater warm-up time of 11 seconds for operation in receivers employing series heater strings.

● 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.

■ Cathode drive service.

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 available 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 available 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.

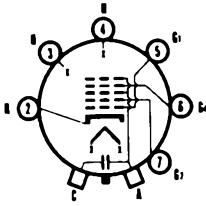
#### BL—Bonded laminated plastic shield

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.

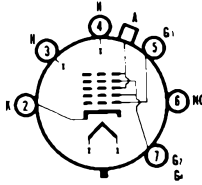
#### Nonbonded

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)



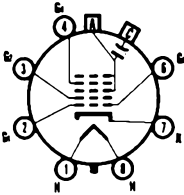
7FA



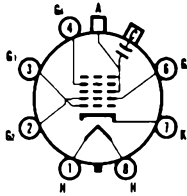
7FG



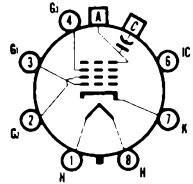
7GR



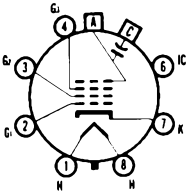
8HR



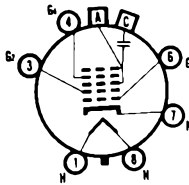
8JK



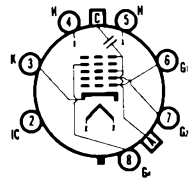
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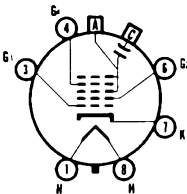
8JR



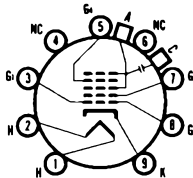
8JS



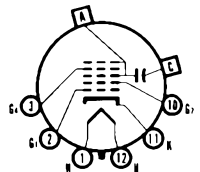
8KP



8KW

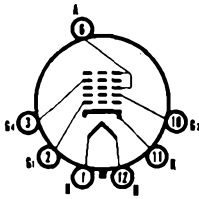


9RS

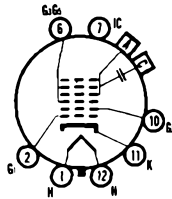


12AB

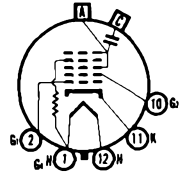
# Basing Diagrams (continued)



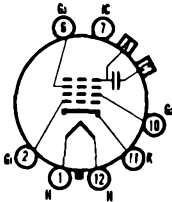
12AD



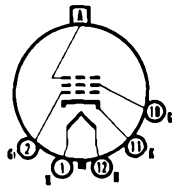
12AJ



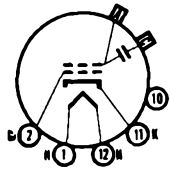
12AT



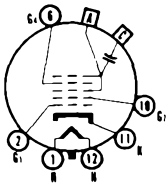
12C



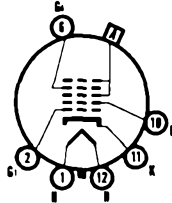
12D



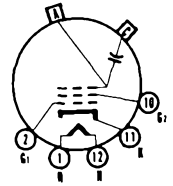
12G



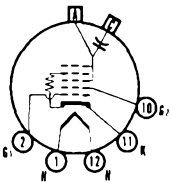
12L



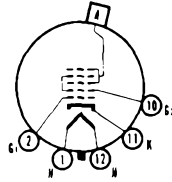
12M



12N



12P



12S

## basing diagram symbols

- |                       |                     |                         |            |
|-----------------------|---------------------|-------------------------|------------|
| A Anode               | C Conductive        | H Heater                | ■ Locating |
| A1 First Anode        | j Coating           | IC Internal             | ⌒ Lug      |
| A2 Second Anode, etc. | G1 Grid No. 1       | Connection (Do Not Use) | □ Bulb     |
|                       | G2 Grid No. 2, etc. | K Cathode               | Terminal   |

## TV PICTURE TUBE REPLACEMENT GUIDES

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<b>Monochrome Picture Tubes</b> .....	<b>539</b>
<b>Replacement Notes</b> .....	<b>544</b>
<b>Installation and Handling of TV Picture Tubes and Large Cathode Ray Tubes.</b>	<b>545</b>

# TV Picture Tube Replacement Guides

## COLOR PICTURE TUBES

Type	SYLVANIA* Replacement	Replacement Classification	Type	SYLVANIA* Replacement	Replacement Classification	
<b>11" Types</b>			490HB22	} <b>19EXP22</b>	G, H	
11SP22	} <b>11WP22</b>	Direct	490JB22			
11WP22			490LB22			
<b>15" Types</b>				<b>21" Types</b>		
15ACP22	<b>15ACP22</b>	Direct	21AXP22A	} <b>21FBP22A</b>	B	
RE15LP22	} <b>15LP22</b>	Direct	C21AXP22A			
H15LP22			21CYP22			
C15LP22			C21CYP22A			
15LP22			RE21FBP22A	} <b>21FBP22A</b>	Direct	
RE15NP22	} <b>15NP22</b>	Direct	C21FBP22A			
H15NP22			H21FBP22A			
C15NP22			AN21FBP22A			
15K P22			OC21FBP22A			
15NP22			21FBP22A			
15XP22			H21GUP22	<b>21FBP22A</b>	G	
<b>19" Types</b>			H21GVP22	<b>21FJP22A</b>	G	
RE19EXP22	} <b>19EXP22</b>	Direct	RE21FJP22A	} <b>21FJP22A</b>	Direct	
C19EXP22			C21FJP22A			
H19EXP22			H21FJP22A			
AN19EXP22			AN21FJP22A			
OC19EXP22			OC21FJP22A			
19EXP22			21FJP22A			
			RE21FKP22			
RE19EYP22	} <b>19EYP22</b>	Direct	21FKP22	} <b>22" Types</b>	Direct	
RE19EYP22			RE22JP22			
C19EYP22			C22JP22			
H19EYP22			22JP22			
AN19EYP22			REA22JP22			
OC19EYP22			CA22JP22			
19EYP22			H22JP22			
19GSP22			RE22LP22	} <b>22LP22</b>	Direct	
RE19FMP22	<b>19FMP22</b>	Direct	C22LP22			
19FXP22	<b>19EYP22</b>	Direct	22LP22			
H19GVP22	<b>19EXP22</b>	G	22QP22	<b>22JP22</b>	Direct	
H19GWP22	<b>19EYP22</b>	G	22RP22	<b>22KP22</b>	Direct	
19GXP22	<b>19EXP22</b>	G, H	22SP22	<b>22JP22</b>	Direct	
19GYP22	<b>19EXP22</b>	H				
19GZP22	<b>19EYP22</b>	Direct	RE22KP22	} <b>22KP22</b>	Direct	
19HBP22	<b>19FMP22</b>	Direct	C22KP22			
19HFP22	<b>19EYP22</b>	G	22KP22			
19HCP22	} <b>19HCP22</b>	Direct	22UP22	} <b>22UP22</b>	Direct	
19HJP22						22XP22
19HKP22						22ADP22
490AJB22	<b>19EYP22</b>	G	22AGP22			
490EB22	} <b>19EXP22</b>	G, H	22AHP22			
490FB22						
490GB22						
19JB22	<b>19EXP22</b>	Direct	22YP22	<b>22JP22</b>	Direct	

Type	SYLVANIA* Replacement	Replacement Classification	Type	SYLVANIA* Replacement	Replacement Classification
<b>23" Types</b>			RE25CP22	} <b>25CP22</b>	Direct
23EGP22	} <b>23EGP22A</b>	Direct	C25CP22		
23EGP22A			25CP22		
23EGP22	} <b>25AP22A</b>		REA25CP22		
23EGP22A			CA25CP22		
<b>25" Types</b>			25FP22	} <b>25BP22A</b>	Direct
25ABP22	<b>25CP22</b>	Direct	25FP22A		
25ADP22	} <b>25AJP22</b>	Direct	25GP22-1	} <b>25AP22A</b>	Direct
25AGP22			25GP22		
25BCP22			25GP22A		
25AEP22	<b>25BP22A</b>	Direct	25RP22	<b>25BP22A</b>	Direct
25AFP22	} <b>25AP22A</b>	Direct	25SP22	<b>25AP22A</b>	Direct
25AQP22					
25AJP22	} <b>25AJP22</b>	Direct	25ACP22	} <b>25UP22</b>	Direct
25ASP22			25ALP22		
RE25AP22A	} <b>25AP22A</b>	Direct	25AYP22		
C25AP22A			25UP22/ A63-16X		
H25AP22A			25AKP22		
AN25AP22A			25AMP22		
OC25AP22A					
25AP22A					
RE25BP22A	} <b>25BP22A</b>	Direct	25VP22	} <b>25AP22A</b>	Direct
C25BP22A			25WP22		
H25BP22A			H25XP22	<b>25AP22A</b>	G
AN25BP22A			H25YP22	<b>25BP22A</b>	G
OC25BP22A			25ZP22	<b>25AP22A</b>	Direct
25BP22A					

**MONOCHROME PICTURE TUBES**

Type	SYLVANIA* Replacement	Replacement Classification	Type	SYLVANIA* Replacement	Replacement Classification
9TP4	<b>9TP4</b>	Direct	12CBP4	<b>12CBP4</b>	Direct
9YP4	<b>9YP4</b>	Direct	12CDP4	<b>12CDP4</b>	Direct
11CP4	<b>11CP4</b>	Direct	12CEP4	<b>12CEP4</b>	Direct
11GP4	<b>11GP4</b>	Direct	12CGP4	<b>12CGP4</b>	Direct
11JP4	<b>11JP4</b>	Direct	12CSP4	<b>12CSP4</b>	Direct
12BEP4	<b>12BEP4</b>	Direct	12CTP4	<b>12CTP4</b>	Direct
12BGP4	<b>12BGP4</b>	Direct	12DKP4	<b>12DKP4</b>	Direct
12BKP4	<b>12BKP4</b>	Direct	12DQP4	<b>12DQP4</b>	Direct
12BLP4	<b>12BKP4</b>	Direct	13AP4	<b>13AP4</b>	Direct
12BMP4	<b>12CDP4</b>	Direct	13DP4	<b>13DP4</b>	Direct
12BNP4	<b>12CGP4</b>	Direct	14NP4	<b>14WP4</b>	A
12BQP4	<b>12BQP4</b>	Direct	14NP4A	<b>14WP4</b>	A
12BTP4	<b>12BTP4</b>	Direct	14RP4	<b>14WP4</b>	A
12BUP4	<b>12BUP4</b>	Direct	14RP4A	<b>14WP4</b>	A
12BZP4	<b>12BZP4</b>	Direct	14SP4	<b>14WP4</b>	A

## TV PICTURE TUBE REPLACEMENT GUIDES (cont'd)

Type	SYLVANIA* Replacement	Replacement Classification†	Type	SYLVANIA* Replacement	Replacement Classification†
14WP4	14WP4	Direct	17CDP4	17CDP4	Direct
SG14WP4	14WP4	Direct	17CFP4	17CFP4	Direct
14XP4	14XP4A	Direct	17CKP4	17DSP4	Direct
14XP4A	14XP4A	Direct	17CLP4	17BJP4	A
14ZP4	14WP4	Direct	17CNP4	17CNP4	Direct
15ADP4	15ADP4	Direct	17CRP4	17CRP4	Direct
15JP4	15JP4	Direct	17CSP4	17BWP4	D
16ANP4	16ANP4	Direct	17CTP4	17CTP4	Direct
16AQP4	16ANP4	Direct	17CWP4	17DSP4	Direct
16ASP4	16ASP4	Direct	17CXP4	17CRP4	Direct
16ATP4	16BSP4	Direct	17CZP4	17BJP4	Direct
16AUP4	16AUP4	Direct	17DAF4	17DRP4	Direct
16AVP4	16BCP4	Direct	17DHP4	17DXP4	Direct
16AXP4	16ASP4	Direct	17DKP4	17DKP4	Direct
16AYP4	16AYP4	Direct	17DLP4	17DKP4	Direct
16BAP4	16BAP4	Direct	17DQP4	17DQP4	Direct
16BCP4	16BCP4	Direct	17DRP4	17DRP4	Direct
16BGP4	16CEP4	Direct	17DSP4	17DSP4	Direct
16BRP4	16BRP4	Direct	17DTP4	17DKP4	Direct
16BSP4	16BSP4	Direct	17DXP4	17DXP4	Direct
16BVP4	16BVP4	Direct	17DZP4	17DXP4	Direct
16BP4	16BXP4	Direct	17EAP4	17HP4C	F
16CAP4	16CEP4	Direct	17EBP4	17DXP4	D
16CEP4	16CEP4	Direct	17EFP4	17DXP4	Direct
16CHP4	16BSP4	Direct	17EHP4	17EHP4	Direct
16CHP4A	16BSP4	Direct	17ELP4	17ELP4	Direct
16CJP4	16CJP4	Direct	17EMP4	17EMP4	Direct
16CMP4	16CMP4	Direct	17EQP4	17EQP4	Direct
16KP4	16RP4B	A	17FP4	17HP4C	A
16KP4A	16RP4B	A	17FP4A	17HP4C	A
16QP4	16RP4B	A, D	17HP4	17HP4C	A
16RP4	16RP4B	A	17HP4A	17HP4C	A
16RP4A	16RP4B	A	17HP4B	17HP4C	A
16RP4B	16RP4B	Direct	SG17HP4B	17HP4C	Direct
16TP4	16RP4B	A	17HP4C	17HP4C	Direct
16UP4	16RP4B	A, D	17JP4	17BP4B	Direct
16XP4	16RP4B	A, D	17KP4	17HP4C	A, F
17AF4	17BP4B	Direct	17KPA4	17HP4C	A, F
17ATP4	17BJP4	A	17LP4	17LP4B	Direct
17ATP4A	17BJP4	A	17LP4A	17LP4B	A
17AVP4	17BJP4	A	SG17LP4A	17LP4B	A
17AVP4A	17BJP4	A	17LP4B	17LP4B	Direct
17BP4	17BP4B	D	17QP4	17QP4B	A
17BP4A	17BP4B	Direct	17QP4A	17QP4B	A
17BP4B	17BP4B	Direct	SG17QP4A	17QP4B	A
17BP4C	17BP4B	Direct	17QP4B	17QP4B	Direct
17BJP4	17BJP4	Direct	17RP4	17HP4C	Direct
SG17BJP4	17BJP4	Direct	17RP4C	17HP4C	Direct
17BRP4	17DSP4	A	17SP4	17LP4B	A, F
17BWP4	17BWP4	Direct	17UP4	17QP4B	Direct
17BUP4	17BJP4	A	17VP4	17LP4B	Direct
17BVP4	17BWP4	A	17VP4B	17LP4B	Direct
17BZP4	17DSP4	Direct	17YP4	17QP4B	Direct
17CAP4	17DSP4	Direct	470ACB4	19AYP4	Direct
17CBP4	17BJP4	A	19ABP4	19ABP4	Direct

Type	SYLVANIA* Replacement	Replacement Classification	Type	SYLVANIA* Replacement	Replacement Classification
19ACP4	19CHP4	Direct	19EBP4	19EBP4	Direct
19AFP4	19AFP4	Direct	19ECP4	19FTP4	Direct
AR19AFP4	19AFP4	Direct	19EDP4	19EDP4	Direct
19AGP4	19AVP4	Direct	19EFP4	19EFP4	Direct
19AHP4	19AHP4	Direct	19EGP4	19EGP4	Direct
19AJP4	19AJP4	Direct	19EHP4	19EDP4	Direct
19ANP4	19AYP4	Direct	19EHP4A	19EDP4	Direct
19ARP4	19AFP4	Direct	19EJP4	19FEP4A	Direct
19AUP4	19AFP4	Direct	19EKP4	19EKP4	Direct
19AVP4	19AVP4	Direct	19ELP4	19AVP4	Direct
19AXP4	19AYP4	Direct	19EMP4	19FGP4	Direct
19AYP4	19AYP4	Direct	19ENP4	19ENP4	Direct
19BAP4	19BAP4	Direct	19ENP4A	19ENP4	Direct
19BDP4	19BDP4	Direct	19ERP4	19EDP4	Direct
19BFP4	19BFP4	Direct	19ESP4	19EFP4	Direct
19BHP4	19BTP4	Direct	19EUP4	19EDP4	Direct
19BLP4	19AVP4	Direct	19EVP4	19FDP4	Direct
19BMP4	19AFP4	Direct	19EWP4	19FDP4	Direct
19BRP4	19DKP4	Direct	19EZP4	19EFP4	Direct
19BQP4	19BQP4	Direct	19FBP4	19EGP4	Direct
19BTP4	19BTP4	Direct	19FCP4	19DWP4	Direct
19BVP4	19AVP4	Direct	19FDP4	19FDP4	Direct
19BWP4	19AYP4	Direct	19FEP4A	19FEP4A	Direct
19CDP4	19CDP4	Direct	19FEP4B	19FEP4A	Direct
19CFP4	19CHP4	Direct	19FGP4	19FGP4	Direct
19CHP4	19CHP4	Direct	19FHP4	19FHP4	Direct
19CJP4	19AVP4	Direct	19FJP4	19FJP4	Direct
19CKP4	19CHP4	Direct	19FLP4	19FTP4	Direct
19CLP4	19CRP4	Direct	19FSP4	19ENP4	Direct
19CMP4	19CMP4	Direct	19FTP4	19FTP4	Direct
19CQP4	19CDP4	Direct	19GAP4	19GAP4	Direct
19CRP4	19CRP4	Direct	19GFP4	19GFP4	Direct
19CUP4	19CUP4	Direct	19GJP4	19GJP4	Direct
19CVP4	19CVP4	Direct	19GMP4	19GMP4	Direct
19CWP4	19BAP4	Direct	19GTP4	19GTP4	Direct
19CXP4	19CXP4	Direct	19XP4	19AVP4	Direct
19CYP4	19BTP4	Direct	19YP4	19BTP4	Direct
19CZP4	19CZP4	Direct	19ZP4	19AVP4	Direct
19DAP4	19DAP4	Direct	20ADP4	20ADP4	Direct
19DBP4	19DBP4	Direct	20CP4	20DP4D	A, D
19DCP4	19EDP4	Direct	20CP4A	20DP4D	A
19DEP4	19AVP4	Direct	20CP4B	20DP4D	A, D
19DFP4	19DFP4	Direct	20CP4C	20DP4D	A, D
19DHP4	19EFP4	Direct	20CP4D	20DP4D	A
19DKP4	19DKP4	Direct	20DP4	20DP4D	A, D
19DLP4	19CHP4	Direct	20DP4A	20DP4D	A
19DNP4	19DKP4	Direct	20DP4B	20DP4D	A, D
19DQP4	19DWP4	Direct	20DP4C	20DP4D	A
19DRP4	19EDP4	Direct	20DP4D	20DP4D	Direct
19DSP4	19EFP4	Direct	SG20DP4D	20DP4D	Direct
19DUP4	19DUP4	Direct	20HP4	20HP4D	D
19DWP4	19DWP4	Direct	20HP4A	20HP4D	Direct
19DYP4	19CVP4	Direct	20HP4B	20HP4D	D
19DZP4	19DVP4	Direct	20HP4C	20HP4D	D
19EAP4	19ENP4	Direct	20HP4D	20HP4D	Direct



## TV PICTURE TUBE REPLACEMENT GUIDES (cont'd)

Type	SYLVANIA* Replacement	Replacement Classification	Type	SYLVANIA* Replacement	Replacement Classification
20LP4	20HP4D	Direct	21CUP4	21AMP4B	Direct
20MP4	20HP4D	Direct	21CVP4	21CBP4A	Direct
20RP4	20RP4	Direct	21CWP4	21CBP4A	A
20SP4	20YP4	Direct	21CXP4	21DSP4	Direct
20TP4	20XP4	Direct	21CZP4	21DMP4	A
20UP4	20UP4	Direct	21DAP4	21DMP4	Direct
20WP4	20WP4	Direct	21DEP4	21DMP4	Direct
20XP4	20XP4	Direct	21DEP4A	21DMP4	Direct
500KB4	20XP4	Direct	SG21DEP4A	21DMP4	Direct
20YP4	20YP4	Direct	21DFP4	21EMP4	Direct
20ZP4	20ZP4	Direct	21DHP4	21DHP4	Direct
21ACP4	21AMP4B	A	21DLP4	21DLP4	Direct
21ACP4A	21AMP4B	A	21DMP4	21DMP4	Direct
SG21ACP4A	21AMP4B	A	21DNP4	21CBP4A	A
21AFP4	21YP4A	D	21DQP4	21DLP4	Direct
21ALP4	21CBP4A	A	21DSP4	21DSP4	Direct
21ALP4A	21CBP4A	A	21EAP4	21FDP4	C
21ALP4B	21CBP4A	A	21EP4	21EP4C	A, D
21AMP4	21AMP4B	A	21EP4A	21EP4C	A
21AMP4A	21AMP4B	A	21EP4B	21EP4C	A
21AMP4B	21AMP4B	Direct	SG21EP4B	21EP4C	Direct
21ANP4	21CBP4A	A, D	21EP4C	21EP4C	Direct
21ANP4A	21CBP4A	A, D	21EMP4	21EMP4	Direct
21AQP4	21AMP4B	A, D	21EQP4	21EQP4	Direct
21AQP4A	21AMP4B	A, D	21ESP4	21EMP4	Direct
21ASP4	21XP4B	A	21EVP4	21FDP4	C
21ATP4	21CBP4A	A	21FP4	21FP4D	A, D
21ATP4A	21CBP4A	A	21FP4A	21FP4D	A
21ATP4B	21CBP4A	A	21FP4C	21FP4D	A
21AUP4	21AUP4C	A	SG21FP4C	21FP4D	Direct
21AUP4A	21AUP4C	A	21FP4D	21FP4D	Direct
21AUP4B	21AUP4C	A	21FAP4	21FAP4	Direct
SG21AUP4B	21AUP4C	Direct	21FDP4	21FDP4	Direct
21AUP4C	21AUP4C	Direct	21FLP4	21CBP4A	Direct
21AVP4	21AUP4C	A	21FUP4	21FUP4	Direct
21AVP4A	21AUP4C	A	21FVP4	21FWP4	Direct
21AVP4B	21AUP4C	A	21FWP4	21FWP4	Direct
21AVP4C	21AUP4C	Direct	21FXP4	21FXP4	Direct
21AWP4	21AWP4A	A	21FYP4	21FYP4	Direct
21AWP4A	21AWP4A	Direct	21FZP4	21FZP4	Direct
SG21AWP4A	21AWP4A	Direct	21GCP4	21GCP4	Direct
21AYP4	21XP4B	A	21GTP4	21GTP4	Direct
21BAP4	21CBP4A	Direct	21WP4	21WP4B	A
21BCP4	21YP4B	Direct	21WP4A	21WP4B	A
21BDP4	21AUP4C	Direct	SG21WP4A	21WP4B	Direct
21BNP4	21CBP4A	Direct	21WP4B	21WP4B	Direct
21BSP4	21AMP4B	A	21XP4	21XP4B	A
21BTP4	21CBP4A	A	21XP4A	21XP4B	A
21CBP4	21CBP4A	Direct	SG21XP4A	21XP4B	Direct
21CBP4A	21CBP4A	Direct	21XP4B	21XP4B	Direct
21CBP4B	21CBP4A	Direct	21YP4	21YP4B	Direct
21CEP4	21EMP4	Direct	21YP4A	21YP4B	Direct
21CEP4A	21EMP4	Direct	21YP4B	21YP4B	Direct
21CMP4	21CBP4A	A	21ZP4	21ZP4C	A, D
21CQP4	21CQP4	Direct	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
23BT4	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

Type	SYLVANIA* Replacement	Replacement Classification†
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	23FPA4	Direct
23FP4A	23FPA4	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
23HQP4	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	23FPA4	Direct
23KP4A	23FPA4	Direct
23MP4	23FPA4	Direct
23MP4A	23FPA4	Direct

## TV PICTURE TUBE REPLACEMENT GUIDES (cont'd)

Type	SYLVANIA* Replacement	Replacement Classification	Type	SYLVANIA* Replacement	Replacement Classification
23NP4	23NP4	Direct	24VP4	24CP4B	A
23TP4	23BTP4	Direct	24VP4A	24CP4B	A
23UP4	23BQP4	Direct	24XP4	24CP4B	A, D
23WP4	23FP4A	Direct	24YP4	24AEP4	A
23XP4	23BTP4	Direct	24ZP4	24AEP4	Direct
23YP4	23BTP4	Direct	27ABP4	27ADP4	Direct
23ZP4	23ZP4	Direct	27ACP4	27YP4	Direct
24ADP4	24CP4B	A	27ADP4	27ADP4	Direct
24AEP4	24AEP4	Direct	27AGP4	27ADP4	Direct
24AHP4	24AHP4	Direct	27EP4	27RP4	D
24AJP4	24AJP4	Direct	27GP4	27RP4	D
24ALP4	24AHP4	Direct	27LP4	27LP4	Direct
24ANP4	24AEP4	A	27NP4	27RP4	Direct
24ATP4	24AJP4	Direct	27RP4	27RP4	Direct
24AUP4	24AUP4	Direct	27XP4	27XP4	Direct
24AVP4	24BEP4	E	27YP4	27YP4	Direct
24BEP4	24BEP4	Direct	27ZP4	27ZP4	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			

## 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.

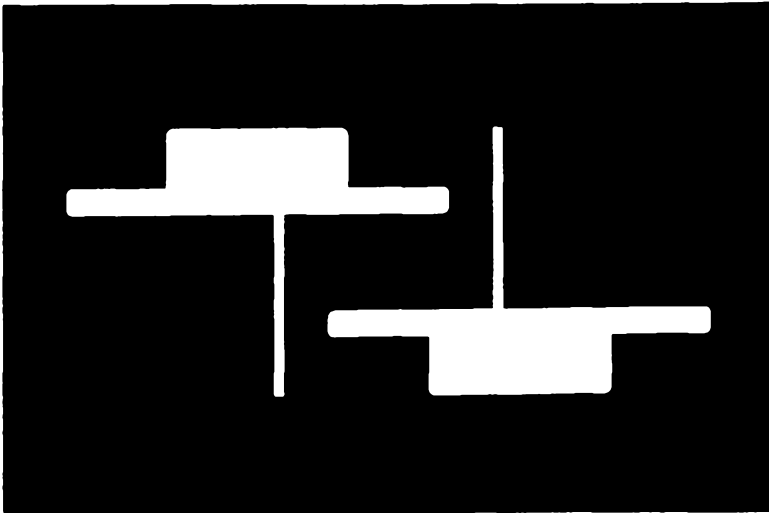
5. Some picture tubes have a conductive coating on both the inside and outside surfaces to form a condenser. This condenser should be discharged before the tube is handled. Even a slight unexpected shock might cause a tube to be dropped.

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.

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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 oper-

ation 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 (BV <sub>CB0</sub> )	Collector-Emitter Voltage (BV <sub>CEO</sub> )	Base-Emitter Voltage (BV <sub>EB0</sub> )	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 <sup>(1)</sup>	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 <sup>(1)</sup>	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 <sup>(1)</sup>	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 <sup>(1)</sup>	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 <sup>(1)</sup>	90	TO-3 Fig. 3
ECG105	PNP-Germanium	Audio Power Output	50V	35V (CER) Min.	20V	15 A	100 W	10 KHz <sup>(1)</sup>	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 <sup>(2)</sup>	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 <sup>(2)</sup>	20 Min	TO-92 Fig. 6



# TRANSISTORS (cont'd)

MAXIMUM RATINGS AT 25° C AMBIENT UNLESS OTHERWISE NOTED

Type	Description	Applications	Collector-Base Voltage (BV <sub>CB0</sub> )	Collector-Emitter Voltage (BV <sub>CE0</sub> )	Base-Emitter Voltage (BEV <sub>EB0</sub> )	Max. Collector Current	Max. Collector Dissipation	Frequency	Typical Current Gain (H <sub>FE</sub> )	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 <sup>(2)</sup>	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 <sup>(1)</sup>	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 <sup>(2)</sup>	180	TO-5 <sup>(3)</sup> Fig. 8
ECG123A	NPN-Silicon	Audio Amp, RF Amp	55V	40V	6V	600 mA	500 mW	200 MHz	200	TO-18 <sup>(3)</sup> 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 <sup>(2)</sup>	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 <sup>(2)</sup>	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 <sup>(2)</sup>	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 <sup>(2)</sup>	90	TO-5 Fig. 1
ECG129	PNP-Silicon	Audio Pre-Amp, Driver, Output, Video Amp.	100V	80V (CER)	7V	1A	1 W	120 MHz <sup>(2)</sup>	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 <sup>(1)</sup>	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 <sup>(2)</sup>	60	“P-66” (Plastic) Fig. 12

ECG153	PNP-Silicon	Audio Power Output	60V	60V	5V	3 A	40 W	3 MHz <sup>(2)</sup>	60	"P-66" (Plastic) Fig. 12
ECG154	NPN-Silicon	Color/BW TV Video Output Amp.	300V	300V	7V	50 mA	1 W	40 MHz <sup>(2)</sup>	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 ( $\mu$ Mhos)	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

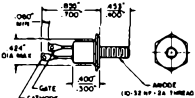
Type	Outline Drawing	Description
ECG109	Fig. 15	Germanium general purpose 75 volt P.R.V.
ECG110	Fig. 15	Germanium matched pair
ECG111	Fig. 16	Silicon UHF TV mixer diode

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	<p><b>Silicon Controlled Rectifier</b> (Shipped Complete With All Mounting Hardware)</p> 	<p>Continuous and Peak Forward and Reverse Blocking Voltage ..... 200 Volts</p> <p>Continuous Anode Forward Current at or Below 70°C Case Temp. .... 7.0 Ampere</p> <p>Average Anode Forward Current (180 Conduction Angle) at or Below 70°C Case Temp. .... 5.0 Ampere</p> <p>Peak Anode Surge Current (60 Hz—½ Sinewave) ..... 100 Ampere</p> <p>Gate Trigger Current (Max.) ..... 25 mA</p> <p>Gate Trigger Voltage (Max.) ..... 4.0 Volt</p> <p>Holding Current ..... 25 mA-Max</p>

# 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

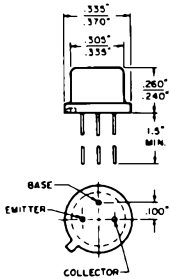


FIGURE 2

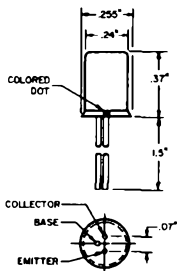


FIGURE 3

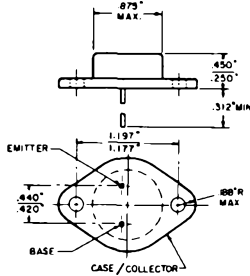


FIGURE 4

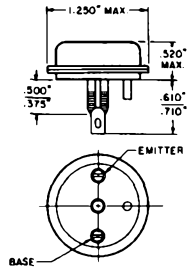


FIGURE 5

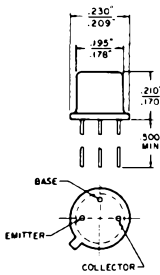


FIGURE 6

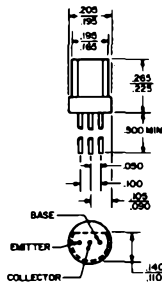


FIGURE 7

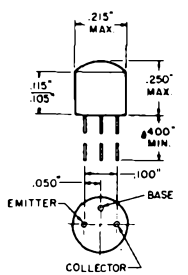


FIGURE 8

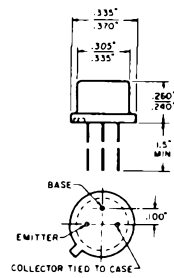


FIGURE 9

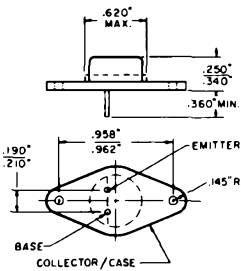


FIGURE 10

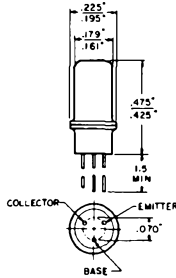


FIGURE 11

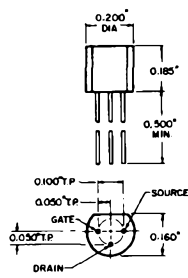


FIGURE 12

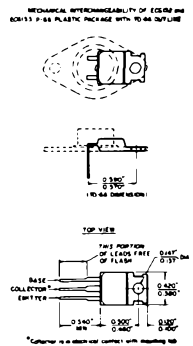


FIGURE 13

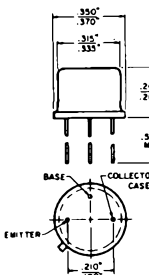
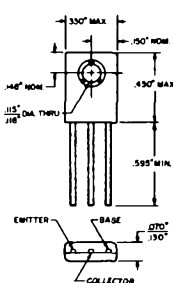


FIGURE 14



DIODES and RECTIFIERS

FIGURE 15

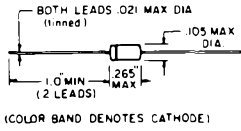


FIGURE 16

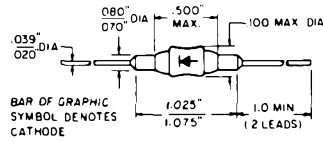


FIGURE 17

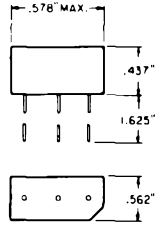


FIGURE 18

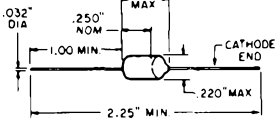


FIGURE 19

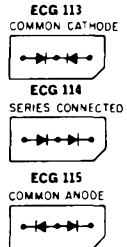
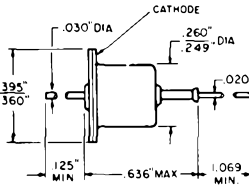


FIGURE 20

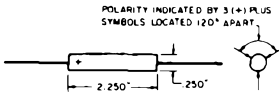


FIGURE 22

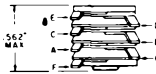


FIGURE 21

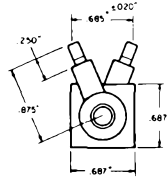
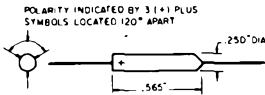
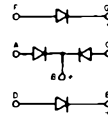
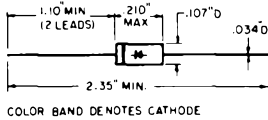


FIGURE 23



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
<b>ECG370</b> <b>AGC/Squelch</b> <b>Amplifier</b>	<p>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.</p>
<b>ECG371</b> <b>RF/IF Amplifier</b>	<p>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).</p>
<b>ECG372</b> <b>AM IF Strip</b>	<p>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.</p>

## LINEAR INTEGRATED CIRCUITS (cont'd)

Type	Description
<b>ECG703</b> <b>RF/IF Amplifier,</b> <b>Oscillator, Mixer</b>	<p>Direct replacement for <math>\mu</math>A 703, <math>\mu</math>A 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 <math>\mu</math>mhos; operates on 6-12 VDC supply.</p>
<b>ECG704</b> <b>TV Sound—IF</b> <b>Amplifier and</b> <b>Detector</b>	<p>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.</p>
<b>ECG705</b> <b>Color TV Chroma</b> <b>Demodulator</b>	<p>Direct plug-in replacement for the <math>\mu</math>A 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.</p>
<b>ECG716</b> <b>Audio Amplifier</b>	<p>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.</p>

# ECG SEMICONDUCTOR REPLACEMENT GUIDES

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<b>Diodes and Rectifiers Replacement Guide</b> .....	<b>599</b>
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<b>For Canadian Receivers Replacement Guide</b> .....	<b>623</b>



# TRANSISTOR

## replacement guide

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	Type To Be Replaced	Sylvania ECG Replacement
0000101	126	022-5511-790	126	080236	126	2G339A	103	2N34A	102	2N97A	101
0000102	126	022-3516-380	126	080244	126	2G344	126	2N35	103	2N98	102
0000103	102	022-3640-050	121	080245	126	2G345	100	2N36	102	2N98A	101
0000104	102	022-3640-080	108	080253	126	2G371	100	2N37	102	2N99	101
002-005100	102	025B	123	080266	126	2G371A	100	2N38	102	2N100	101
002-006300	126	025-100003	108	080267	126	2G374	100	2N38A	102	2N103	101
002-006500	123	025-100004	108	080269	126	2G374A	100	2N39	102	2N104	102
002-006600	102	025-100009	108	080274	100	2G376	126	2N40	102	2N105	102
002-006800	102	025-1000012	108	080275	100	2G377	126	2N41	102	2N106	102
002-006900	102	025-1000013	108	080276	100	2G381	102	2N42	102	2N107	102
002-007000	104	025-1000014	128	080277	126	2G381A	102	2N43	102	2N108	102
002-007100	126	025-100015	128	081001	102	2G382	162	2N43A	102	2N109	102
002-007200	126	026-100003	121	081018	102	2G383	102	2N44	102	2N109/5	126
002-007300	102	026-100005	102	081019	102	2G384	102	2N44A	102	2N109YEL	102
002-007400	126	026-100012	102	081038	102	2G385	102	2N45	102	2N109GRN	102
002-008100	104	026-100013	128	081046	102	2G386	102	2N45A	100	2N109BLU	102
002-008400	100	026-100017	123	081047	102	2G387	102	2N46	102	2N109WHT	102
002-008800	121	026-100018	102	081048	102	2G394	100	2N47	102	2N109M1	102
002-009100	124	026-100020	121 M P	081049	102	2G395	100	2N48	102	2N109M2	102
002-009500	123	03-0020-0	102	081050	102	2G396	100	2N48A	102	2N111	100
002-009501	123	03-0022	102	081056	102	2G397	100	2N49	102	2N111A	100
002-009600	123	03-0023-0	102	084001	129	2G401	102	2N50	102	2N111B	126
002-009701	121	03-57-001	126	087003	102	2G402	102	2N51	102	2N111M1	126
002-009800	129	03-57-002	126	1G100	105	2G403	102	2N52	102	2N111M2	126
002-009900	123	03-57-101	126	2A	126	2G404	102	2N53	102	2N112	126
002-010100	129	03-57-201	126	2AC128	100	2G413	102	2N54	102	2N112A	100
002-010300	121	03-57-301	102	2AD140	121	2G414	102	2N55	102	2N112M1	126
002-010400	123	03-57-304	102	2B	100	2G415	102	2N56	102	2N113	100
002-010500	129	03-57-501	121	2C	100	2G416	102	2N59	102	2N114	100
002-010600	129	04-57-303	102	2D	100	2G417	102	2N59A	102	2N117	123
002-010700	128	0573036	102	2E	126	2G508	102	2N59B	102	2N118	123
002-010800	102	0573037	102	2F	126	2G509	102	2N59C	102	2N118A	123
002-010900	129	0573142	102	2G	126	2G524	100	2N59D	102	2N119	123
002-011400	108	0573166	104	2G101	100	2G525	100	2N60	102	2N120	100
002-011500	108	0573199	127	2G102	100	2G526	100	2N60A	102	2N123	123
002-011600	100	0573200	102	2G103	126	2G527	100	2N60B	102	2N123A	126
002-011700	103	0573212	127	2G104	126	2G577	100	2N60C	102	2N124	101
002-011800	102	0573366	126	2G106	126	2G601	126	2N60R	102	2N125	101
002-011900	102	0573398	126	2G108	100	2G602	126	2N61	102	2N126	101
002-012000	123	0573422	102	2G109	100	2G603	126	2N61A	102	2N127	101
002-012100	129	0573428	126	2G110	100	2G604	126	2N61B	102	2N128	126
002-012200	128	0573469	123	2G111	100	2G605	102	2N61C	102	2N129	126
002-012500	128	0573474	108	2G139	100	2G1024	100	2N62	102	2N130	102
002-012600	129	0573475	108	2G140	100	2G1025	100	2N63	102	2N130A	102
003-1+03	102	0573480	102	2G201	100	2G1026	100	2N64	102	2N131	102
004-8000	121	0573481	123	2G202	100	2G1027	102	2N65	102	2N131A	102
007-0074	152	0573515	124	2G210	121	2H1254	106	2N71	102	2N132	102
011-H01	100	0573518	126	2G220	121	2H1255	106	2N72	126	2N132A	102
012-H02	100	0573532	128	2G221	121	2H1256	106	2N73	102	2N133	102
0130	128	080001	126	2G222	121	2H1257	106	2N74	102	2N133A	102
02P1B	128	080003	102	2G223	104	2H1258	106	2N75	126	2N135	100
019-003315	126	080004	102	2G224	121	2H1259	106	2N76	102	2N136	100
019-003317	103	080006	108	2G225	121	2J72	126	2N77	102	2N137	100
019-003318	103	080021	108	2G240	121	2J73	126	2N78	101	2N138	102
019-003319	103	080022	108	2G270	102	2K48	126	2N78A	101	2N138A	102
019-003324	100	080023	108	2G271	102	2MC	126	2N79	102	2N138B	100
019-003342	100	080026	126	2G301	102	2N2J324	128	2N80	102	2N139	102
019-003343	100	080027	126	2G302	102	2N23	102	2N81	102	2N140	100
019-003349	108	080028	126	2G303	102	2N24	102	2N82	102	2N140M1	100
019-003415	102	080041	108	2G304	102	2N25	102	2N83	100	2N140M2	100
019-003416	102	080042	108	2G306	102	2N26	102	2N85	126	2N145	101
019-003777	126	080043	108	2G308	102	2N27	100	2N86	126	2N146	101
019-003778	126	080059	108	2G309	126	2N28	101	2N87	126	2N147	101
0019-003485	152	080060	108	2G319	100	2N29	101	2N88	126	2N148	123
022-006500	123	080061	126	2G320	100	2N30	126	2N89	126	2N148A	123
022-3504-040	102	080071	126	2G321	102	2N31	126	2N90	126	2N149	123
022-3504-060	102	080072	126	2G322	102	2N32	102	2N94	101	2N149A	123
022-3505-910	102	080073	102	2G323	102	2N32A	102	2N94A	101	2N150	101
022-5311-770	126	080114	126	2G324	102	2N33	126	2N96	102	2N150A	101
022-5311-780	126	080206	126	2G339	103	2N34	102	2N97	101	2N151	102

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement
2N155	121	2N206	102	2N267	100	2N329A	129	2N396	100
2N156	104	2N207	102	2N268	121	2N329B	129	2N396A	100
2N157	121	2N207A	102	2N268A	121	2N330	129	2N397	100
2N157A	121	2N207B	102	2N269	100	2N330A	129	2N398	102
2N158	121	2N207BLU	102	2N270	102	2N331	126	2N398B	102
2N158A	121	2N211	101	2N270A	102	2N332	123	2N399	104
2N159	102	2N212	101	2N270-5M	102	2N332A	123	2N400	104
2N160	123	2N213	103	2N271	100	2N333	123	2N401	104
2N160A	123	2N213A	103	2N271A	100	2N333A	123	2N402	104
2N161	123	2N214	103	2N272	102	2N334	123	2N403	102
2N161A	123	2N214A	103	2N273	100	2N334A	123	2N404	102
2N162	123	2N215	102	2N274	126	2N335	123	2N404A	102
2N162A	123	2N216	101	2N274BLU	126	2N335A	123	2N405	102
2N163	123	2N217	102	2N274WHT	126	2N335B	123	2N406	102
2N163A	123	2N217A	100	2N275	126	2N336	123	2N406BRN	100
2N164	101	2N217RED	100	2N276	126	2N336A	101	2N406RED	100
2N164A	101	2N217YEL	100	2N277	105	2N337	107	2N406GRN	100
2N165	101	2N217WHT	100	2N278	105	2N337A	108	2N406GRN	100
2N166	101	2N218	100	2N279	102	2N338	123	2N406BLU	100
2N167	101	2N219	100	2N280	102	2N338A	123	2N406GRN-YEL	100
2N167A	101	2N220	102	2N281	102	2N344	126	2N407	102
2N168	101	2N222	102	2N282	102	2N345	126	2N407BLK	102
2N168A	101	2N223	102	2N283	102	2N346	126	2N407RED	102
2N169	101	2N224	102	2N284	102	2N350	121	2N407YEL	102
2N169A	101	2N225	102	2N284A	102	2N350A	121	2N407GRN	102
2N170	101	2N226	102	2N2P5	104	2N351	121	2N407WHT	102
2N172	101	2N227	102	2N285A	104	2N351A	121	2N408	102
2N173	105	2N228	103	2N285B	104	2N352	121	2N408WHT	102
2N174	105	2N229	103	2N286	100	2N353	121	2N409	100
2N174A	105	2N230	104	2N290	104	2N356	101	2N410	100
2N175	102	2N231	126	2N291	102	2N356A	101	2N411	100
2N176	104	2N231YEL	100	2N292	101	2N357	101	2N412	100
2N176A	104	2N231YEL-RED	100	2N292A	101	2N357A	101	2N413	100
2N176G	104	2N231BLU	100	2N293	101	2N358	101	2N413A	100
2N176W	104	2N232	126	2N296	104	2N358A	101	2N414	100
2N176BLK	121	2N233	101	2N297	121	2N359	102	2N414A	100
2N176RED	121	2N233A	101	2N297A	121	2N360	102	2N414B	100
2N176GRN	121	2N234	121	2N299	126	2N361	102	2N414C	100
2N176BLU	121	2N234A	121	2N300	126	2N362	102	2N415	100
2N176 PUR	121	2N235	121	2N301	121	2N362B	102	2N415A	100
2N176WHT	121	2N235A	121	2N301A	121	2N363	102	2N416	100
2N176YEL	104	2N235B	121	2N301B	102	2N364	103	2N417	100
2N176-1	104	2N236	121	2N301G	102	2N365	103	2N418	121
2N176-1YEL	121	2N236A	121	2N301W	102	2N366	103	2N419	104
2N176-1BLU	121	2N236B	121	2N302	102	2N367	102	2N420	121
2N176-1WHT	121	2N237	102	2N303	102	2N368	102	2N420A	121
2N176-3PUR	121	2N238	102	2N306	103	2N369	102	2N422	102
2N176-4PUR	121	2N238D	102	2N306A	103	2N370	126	2N422A	102
2N176-5WHT	121	2N238E	102	2N307	121	2N370A	126	2N425	100
2N176-6WHT	121	2N238F	102	2N307A	121	2N370/33	126	2N426	100
2N178	104	2N238ORN	102	2N307B	121	2N371	126	2N427	100
2N179	104	2N240	126	2N308	100	2N371/33	103	2N428	100
2N180	102	2N241	102	2N309	100	2N372	126	2N428A	100
2N181	102	2N241A	102	2N310	102	2N372/33	126	2N431	123
2N182	101	2N242	104	2N311	100	2N373	126	2N432	123
2N183	101	2N247	126	2N312	101	2N374	126	2N433	123
2N184	101	2N247/33	126	2N313	101	2N375	104	2N438	101
2N185	102	2N248	126	2N314	101	2N376	104	2N438A	101
2N185-BLU	102	2N249	100	2N315	100	2N376A	104	2N439	101
2N186	102	2N250	104	2N315A	102	2N377	101	2N439A	101
2N186A	102	2N250A	104	2N315B	102	2N377A	101	2N440	101
2N187	102	2N251	104	2N316	100	2N378	104	2N440A	101
2N187A	102	2N251A	121	2N316A	102	2N379	121	2N441	105
2N188	102	2N252	100	2N317	100	2N380	104	2N441BLU	105
2N188A	102	2N253	101	2N317A	100	2N381	102	2N442	105
2N189	102	2N254	101	2N318	126	2N382	102	2N443	105
2N190	102	2N255	104	2N319	102	2N383	102	2N444	101
2N191	102	2N255A	104	2N320	102	2N384	126	2N444A	103
2N192	102	2N256	104	2N321	102	2N384/33	126	2N445	101
2N193	101	2N256A	104	2N322	102	2N385	101	2N445A	123
2N194	101	2N257	104	2N323	102	2N385A	101	2N446	101
2N194A	101	2N257A	104	2N324	102	2N386	104	2N446A	103
2N195	102	2N257B	104	2N325	104	2N387	104	2N447	101
2N196	102	2N257G	104	2N327	100	2N388	101	2N447A	103
2N197	102	2N257W	104	2N327A	100	2N388A	101	2N447B	103
2N198	102	2N262	100	2N327B	129	2N392	104	2N448	101
2N199	102	2N263	108	2N328	129	2N393	126	2N449	101
2N200	102	2N264	108	2N328A	129	2N394	100	2N450	100
2N204	102	2N265	102	2N328B	129	2N394A	100	2N456	104
2N205	102	2N266	102	2N329	129	2N395	100	2N456A	104

## 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
2N456B	104	2N514	121	2N574A	105	2N639B	104	2N717A	108
2N457	104	2N514A	121	2N575	105	2N640	126	2N718	108
2N457A	104	2N514B	121	2N575A	105	2N641	126	2N718A	108
2N457B	104	2N515	101	2N576	101	2N641REDM/F	126	2N721	106
2N458	104	2N516	101	2N576A	101	2N642	126	2N721A	106
2N458A	104	2N517	101	2N578	100	2N643	126	2N722	106
2N458B	121	2N518	126	2N579	100	2N644	126	2N722A	106
2N459	121	2N519	100	2N580	100	2N645	126	2N723	106
2N459A	121	2N519A	100	2N581	100	2N646	103	2N725	126
2N460	102	2N520	100	2N582	102	2N647	103	2N726	106
2N461	102	2N520A	100	2N583	100	2N647/22	103	2N727	106
2N462	102	2N521	100	2N584	102	2N648	103	2N728	123
2N464	102	2N521A	100	2N585	101	2N649	103	2N729	123
2N465	102	2N522	102	2N586	100	2N649/5	102	2N741	126
2N466	102	2N522A	100	2N587	101	2N650	102	2N741A	126
2N467	102	2N523	102	2N588	126	2N650A	102	2N742	123
2N468	102	2N523A	100	2N588A	126	2N651	102	2N742A	123
2N470	123	2N524	102	2N589	121	2N651A	102	2N743	108
2N471	123	2N524A	102	2N591	102	2N652	102	2N743A	108
2N471A	123	2N525	102	2N591A	102	2N652A	102	2N744	108
2N472	123	2N525A	102	2N591/5	102	2N653	102	2N745	123
2N472A	123	2N526	102	2N591-6M	126	2N654	102	2N746	123
2N473	123	2N526A	102	2N592	100	2N655	102	2N747	123
2N474	123	2N527	102	2N593	100	2N655RED	102	2N748	123
2N474A	123	2N527A	102	2N594	101	2N655GRN	102	2N749	123
2N475	108	2N529	126	2N595	101	2N656	128	2N750	123
2N475A	108	2N530	100	2N596	101	2N656A	128	2N751	123
2N476	123	2N531	100	2N597	100	2N657	100	2N752	108
2N477	123	2N532	100	2N598	100	2N658	100	2N753	108
2N478	123	2N533	100	2N599	100	2N659	100	2N754	123
2N479	123	2N534	126	2N600	100	2N660	100	2N756	108
2N479A	123	2N535	102	2N602	126	2N661	100	2N756A	108
2N480	123	2N535A	102	2N602A	126	2N662	100	2N757	123
2N480A	108	2N535B	102	2N603	126	2N663	121	2N757A	123
2N480B	123	2N536	102	2N603A	126	2N665	121	2N758	108
2N481	100	2N537	126	2N604	126	2N669	121	2N758A	123
2N482	100	2N538	121	2N604A	126	2N672	100	2N758B	123
2N483	100	2N538A	121	2N605	126	2N674	100	2N759	108
2N483B	102	2N539	104	2N606	126	2N677	121	2N759A	123
2N483-6M	102	2N539A	104	2N607	126	2N677A	121	2N759B	123
2N484	100	2N540	104	2N608	126	2N677B	121	2N760	108
2N485	100	2N540A	104	2N609	102	2N677C	121	2N760A	123
2N486	100	2N541	107	2N610	102	2N678	121	2N760B	123
2N486B	100	2N542	107	2N611	102	2N678A	121	2N761	108
2N487	102	2N542A	123	2N612	102	2N678B	121	2N762	108
2N495	106	2N543	108	2N613	102	2N678C	121	2N768	126
2N495/18	106	2N543A	108	2N614	100	2N679	101	2N769	126
2N496	106	2N544	126	2N615	100	2N680	126	2N770	123
2N497	128	2N544/33	126	2N616	100	2N694	126	2N771	123
2N497A	128	2N546	123	2N617	100	2N695	126	2N772	123
2N498	128	2N547	123	2N618	121	2N696	123	2N773	123
2N499	126	2N548	123	2N619	108	2N697	123	2N774	123
2N499A	126	2N549	123	2N620	108	2N697A	123	2N775	123
2N500	126	2N550	123	2N621	108	2N700	126	2N776	123
2N500RED	126	2N551	123	2N622	108	2N700A	126	2N777	123
2N500BLU	126	2N552	123	2N623	126	2N700/18	126	2N778	123
2N500WHT	126	2N553	121	2N624	126	2N700A/18	126	2N779	126
2N501	126	2N554	121	2N625	103	2N701	123	2N779A	126
2N501A	126	2N555	121	2N627	121	2N702	108	2N779B	126
2N501/18	126	2N556	101	2N628	121	2N703	108	2N780	108
2N502	126	2N557	101	2N629	121	2N705	126	2N781	102
2N502A	126	2N558	101	2N630	121	2N705A	126	2N782	102
2N502B	126	2N559	126	2N631	102	2N706	108	2N783	108
2N503	126	2N560	123	2N632	102	2N706A	108	2N784	108
2N504	126	2N561	121	2N633	102	2N706B	108	2N784A	108
2N505	126	2N563	102	2N633B	102	2N706C	123	2N789	123
2N506	102	2N564	102	2N634	101	2N707	108	2N790	108
2N507	103	2N565	102	2N634A	101	2N707A	123	2N791	123
2N508	102	2N566	102	2N635	101	2N708	108	2N792	123
2N508A	102	2N567	102	2N635A	101	2N708A	108	2N793	123
2N509	100	2N568	102	2N636	101	2N709	108	2N794	108
2N511	104	2N569	102	2N636A	101	2N709A	108	2N795	126
2N511A	104	2N570	102	2N637	104	2N709/52	108	2N796	126
2N511B	104	2N571	102	2N637A	104	2N710	126	2N797	103
2N512	104	2N572	102	2N637B	104	2N710A	126	2N799	102
2N512A	104	2N573	102	2N638	104	2N711	126	2N800	102
2N512B	104	2N573BRN	102	2N638A	104	2N711A	126	2N801	100
2N513	104	2N573RED	102	2N638B	104	2N711B	126	2N802	100
2N513A	104	2N573ORN	102	2N639	104	2N715	123	2N803	100
2N513B	104	2N574	105	2N639A	104	2N717	108	2N804	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
2N805	100	2N930	123	2N1021A	121	2N1110	100	2N1167A	121
2N806	100	2N930A	108	2N1022	121	2N1111	102	2N1168	121
2N807	100	2N933	126	2N1022A	121	2N1111A	102	2N1169	103
2N808	100	2N934	126	2N1023	126	2N1111B	102	2N1170	103
2N809	100	2N935	123	2N1024	106	2N1111RED	126	2N1171	100
2N810	100	2N936	123	2N1025	106	2N1112	101	2N1172	104
2N811	100	2N937	123	2N1026	106	2N1114	101	2N1173	103
2N812	100	2N938	123	2N1026A	106	2N1115	100	2N1173W	103
2N813	100	2N939	123	2N1027	106	2N1115A	100	2N1174	103
2N814	100	2N940	123	2N1028	106	2N1116	123	2N1175	102
2N815	101	2N941	123	2N1029	121	2N1117	123	2N1175A	102
2N816	101	2N942	123	2N1029A	121	2N1118	126	2N1176	100
2N817	101	2N943	123	2N1029B	121	2N1118A	106	2N1176A	126
2N818	101	2N944	123	2N1029C	121	2N1119	126	2N1176B	126
2N819	101	2N945	123	2N1030	121	2N1120	121	2N1177	126
2N820	101	2N946	123	2N1030A	121	2N1121	101	2N1178	126
2N821	101	2N947	123	2N1030B	121	2N1122	100	2N1179	126
2N822	101	2N955	101	2N1030C	121	2N1122A	100	2N1180	126
2N823	101	2N955A	101	2N1031	121	2N1123	104	2N1182	121
2N824	101	2N957	108	2N1031A	121	2N1124	102	2N1183	121
2N825	102	2N960	126	2N1031B	121	2N1125	102	2N1183A	121
2N826	102	2N960/46	126	2N1031C	121	2N1126	102	2N1183B	121
2N827	126	2N961	126	2N1032	121	2N1127	102	2N1184	121
2N828	126	2N961/46	126	2N1032A	121	2N1128	102	2N1184A	121
2N828A	126	2N962	126	2N1032B	121	2N1129	102	2N1184B	121
2N829	126	2N963	126	2N1032C	121	2N1130	102	2N1185	100
2N834	108	2N964	126	2N1033	121	2N1131	106	2N1186	100
2N834A	123	2N964A	126	2N1034	106	2N1131A	106	2N1187	100
2N835	108	2N964/46	126	2N1035	106	2N1132	106	2N1188	100
2N837	100	2N965	126	2N1036	106	2N1132A	106	2N1189	102
2N838	126	2N966	126	2N1037	106	2N1132B	129	2N1190	102
2N839	108	2N967	126	2N1038	104	2N1132/46	129	2N1191	102
2N840	108	2N968	126	2N1040	104	2N1135	129	2N1192	102
2N841	108	2N969	126	2N1042	126	2N1135A	129	2N1193	102
2N842	108	2N970	126	2N1043	126	2N1136	104	2N1194	102
2N843	108	2N971	126	2N1044	102	2N1136A	104	2N1195	126
2N844	123	2N972	126	2N1045	102	2N1136B	104	2N1198	103
2N846	126	2N973	126	2N1046	127	2N1137	104	2N1199A	128
2N846A	126	2N974	126	2N1046A	127	2N1137A	121	2N1200	123
2N846B	126	2N975	126	2N1046B	127	2N1137B	121	2N1201	123
2N849	108	2N976	126	2N1051	123	2N1138	104	2N1202	105
2N850	108	2N977	126	2N1054	123	2N1138A	121	2N1203	105
2N851	108	2N978	126	2N1056	102	2N1138B	121	2N1204	100
2N852	108	2N979	126	2N1057	102	2N1141	100	2N1204A	126
2N858	106	2N980	126	2N1058	101	2N1141A	100	2N1205	123
2N859	106	2N981	126	2N1059	103	2N1142	100	2N1213	126
2N860	106	2N982	126	2N1060	108	2N1142A	100	2N1214	126
2N861	106	2N983	126	2N1065	126	2N1143	100	2N1215	126
2N862	106	2N984	126	2N1066	126	2N1143A	100	2N1216	126
2N863	106	2N985	126	2N1069	130	2N1144	102	2N1217	103
2N864	106	2N986	126	2N1070	130	2N1145	104	2N1218	121
2N864A	106	2N987	126	2N1073	127	2N1146	102	2N1219	106
2N865	106	2N988	108	2N1073A	127	2N1146A	104	2N1220	106
2N865A	106	2N989	108	2N1073B	127	2N1146B	104	2N1221	106
2N866	123	2N990	126	2N1078	121	2N1146C	104	2N1222	106
2N867	123	2N991	126	2N1081	123	2N1147	104	2N1223	106
2N869	106	2N992	126	2N1082	123	2N1147A	104	2N1224	126
2N869A	106	2N993	100	2N1086	101	2N1147B	104	2N1225	126
2N909	123	2N994	126	2N1086A	101	2N1147C	104	2N1226	126
2N913	108	2N995	106	2N1087	101	2N1149	123	2N1227	104
2N914	108	2N995A	106	2N1090	101	2N1150	123	2N1227A	104
2N914A	108	2N996	106	2N1091	101	2N1151	123	2N1227-3	104
2N914/51	108	2N1000	101	2N1092	123	2N1152	123	2N1227-4	104
2N916	108	2N1003	126	2N1093	126	2N1153	123	2N1227-4R	104
2N916A	108	2N1004	126	2N1094	126	2N1157	105	2N1228	106
2N917	108	2N1005	108	2N1095	103	2N1157A	105	2N1229	106
2N917A	108	2N1006	128	2N1096	103	2N1158	100	2N1230	106
2N918	108	2N1007	104	2N1097	102	2N1159	121	2N1231	106
2N919	108	2N1008	102	2N1098	102	2N1160	121	2N1232	106
2N920	108	2N1008A	102	2N1099	105	2N1162	104	2N1233	106
2N921	108	2N1008B	102	2N1100	105	2N1162A	104	2N1238	106
2N922	108	2N1009	102	2N1101	103	2N1163	121	2N1239	106
2N923	106	2N1010	102	2N1102	103	2N1163A	131	2N1240	106
2N924	106	2N1011	121	2N1102/5	101	2N1164	104	2N1241	106
2N925	106	2N1012	101	2N1103	123	2N1164A	104	2N1245	104
2N926	106	2N1014	121	2N1104	123	2N1165	104	2N1246	104
2N927	106	2N1017	101	2N1107	100	2N1165A	121	2N1247	123
2N928	106	2N1018	101	2N1108	100	2N1166	104	2N1248	123
2N929	123	2N1020	121	2N1108RED	126	2N1166A	121	2N1249	123
2N929A	123	2N1021	121	2N1109	126	2N1167	104	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	101	2N1544A	121	2N1665	100
2N1273ORN	102	2N1366	101	2N1473	100	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	123	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	126
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	100
2N1299	101	2N1401	126	2N1517	126	2N1560A	121	2N1731	101
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	126	2N2337	106
2N1808	101	2N1999	100	2N2138A	104	2N2204	124	2N2349	123
2N1838	123	2N2000	100	2N2139	104	2N2205	123	2N2353	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	108	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
2N1922	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	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
2N2490	105	2N2672GRN	100	2N2894A	106	2N3117	123	2N3322	126
2N2491	105	2N2673	108	2N2904	106	2N3121	129	2N3323	100
2N2492	105	2N2674	108	2N2904A	106	2N3122	129	2N3324	100
2N2493	105	2N2675	128	2N2905	106	2N3125	121	2N3325	100
2N2494	126	2N2676	128	2N2905A	106	2N3132	121	2N3338	108
2N2495	126	2N2677	128	2N2906	106	2N3133	106	2N3339	108
2N2496	126	2N2678	128	2N2906A	129	2N3134	106	2N3340	108
2N2501	108	2N2692	128	2N2907	106	2N3135	106	2N3341	106
2N2512	102	2N2693	128	2N2907A	106	2N3136	106	2N3342	106
2N2520	123	2N2695	129	2N2921	128	2N3137	107	2N3343	106
2N2521	123	2N2696	129	2N2922	128	2N3148	126	2N3344	106
2N2522	123	2N2699	101	2N2923	128	2N3153	126	2N3345	106
2N2523	123	2N2706	102	2N2924	123	2N3202	129	2N3346	106
2N2524	123	2N2707	103	2N2925	123	2N3203	129	2N3371	100
2N2526	127	2N2708	108	2N2926	123	2N3208	109	2N3390	123
2N2527	127	2N2709	129	2N2926ORN	128	2N3209	129	2N3391	123
2N2528	127	2N2710	108	2N2926GRN	128	2N3210	123	2N3391A	123
2N2529	123	2N2711	108	2N2926-6	128	2N3211	123	2N3392	123
2N2530	123	2N2712	123	2N2927	129	2N3212	121	2N3393	123
2N2531	123	2N2713	123	2N2928	126	2N3213	121	2N3394	123
2N2532	123	2N2714	108	2N2929	100	2N3214	121	2N3395	123
2N2533	123	2N2715	108	2N2930	121	2N3215	121	2N3396	123
2N2534	123	2N2716	123	2N2931	123	2N3216	102	2N3397	123
2N2539	128	2N2717	126	2N2932	123	2N3217	106	2N3398	123
2N2540	128	2N2719	128	2N2933	123	2N3218	106	2N3399	108
2N2541	102	2N2728	105	2N2934	123	2N3219	106	2N3400	100
2N2553	102	2N2729	105	2N2935	123	2N3226	130	2N3401	106
2N2555	102	2N2730	105	2N2938	128	2N3227	108	2N3402	123
2N2564	102	2N2731	105	2N2942	102	2N3228	122	2N3403	123
2N2565	102	2N2732	105	2N2943	102	2N3232	130	2N3404	123
2N2569	128	2N2783	126	2N2944	106	2N3241	123	2N3405	123
2N2570	128	2N2784	108	2N2945	129	2N3241A	123	2N3407	108
2N2571	128	2N2784/52	108	2N2945A	129	2N3242	123	2N3412	100
2N2572	128	2N2786	100	2N2946	129	2N3242A	123	2N3414	123
2N2586	128	2N2786A	100	2N2946A	129	2N3245	106	2N3415	108
2N2587	126	2N2793	105	2N2949	128	2N3246	128	2N3416	128
2N2588	126	2N2795	126	2N2951	123	2N3247	123	2N3417	100
2N2595	129	2N2796	126	2N2952	128	2N3248	129	2N3427	102
2N2596	129	2N2797	102	2N2953	102	2N3249	129	2N3428	102
2N2597	129	2N2798	102	2N2955	126	2N3250	129	2N3440	124
2N2601	129	2N2799	100	2N2956	126	2N3250A	129	2N3443	100
2N2602	129	2N2800	106	2N2957	126	2N3251	106	2N3445	130
2N2603	129	2N2800/46	129	2N2958	123	2N3251A	129	2N3446	130
2N2604	129	2N2801	106	2N2959	123	2N3261	123	2N3447	130
2N2605	129	2N2802	106	2N2960	123	2N3267	100	2N3448	130
2N2605A	129	2N2803	106	2N2961	123	2N3268	123	2N3449	126
2N2610	128	2N2804	106	2N2966	100	2N3279	126	2N3451	129
2N2612	104	2N2805	106	2N2968	106	2N3280	126	2N3462	128
2N2613	102	2N2806	106	2N2969	106	2N3281	126	2N3463	128
2N2614	102	2N2807	106	2N2970	106	2N3282	126	2N3464	129
2N2616	108	2N2831	128	2N2971	106	2N3283	126	2N3469	128
2N2617	123	2N2832	121	2N2996	126	2N3284	126	2N3478	108
2N2618	123	2N2835	131	2N2997	126	2N3285	126	2N3485	106
2N2621	100	2N2836	121	2N2998	126	2N3286	126	2N3485A	129
2N2622	100	2N2837	106	2N2999	126	2N3287	108	2N3486	106
2N2623	100	2N2838	106	2N3009	123	2N3288	108	2N3486A	129
2N2624	100	2N2845	129	2N3010	108	2N3289	108	2N3493	108
2N2625	100	2N2846	128	2N3011	108	2N3290	108	2N3496	129
2N2626	100	2N2847	129	2N3012	106	2N3291	108	2N3498	123
2N2627	100	2N2848	128	2N3013	123	2N3292	108	2N3502	129
2N2628	100	2N2849	128	2N3014	123	2N3293	108	2N3503	129
2N2629	100	2N2850	128	2N3015	123	2N3294	108	2N3504	129
2N2630	100	2N2851	128	2N3035	108	2N3301	128	2N3505	129
2N2635	126	2N2852	128	2N3053	128	2N3302	128	2N3506	128
2N2636	121	2N2853	128	2N3054	152	2N3304	106	2N3507	128
2N2637	121	2N2854	128	2N3055	130	2N3305	106	2N3508	108
2N2639	108	2N2855	128	2N3058	106	2N3309	106	2N3509	106
2N2640	108	2N2856	128	2N3059	129	2N3307	106	2N3510	128
2N2641	108	2N2857	108	2N3060	129	2N3308	106	2N3511	108
2N2642	108	2N2860	100	2N3072	129	2N3310	123	2N3527	108
2N2643	108	2N2861	106	2N3073	129	2N3311	105	2N3544	108
2N2644	108	2N2862	106	2N3074	126	2N3312	105	2N3545	129
2N2648	102	2N2865	108	2N3075	126	2N3313	105	2N3546	106
2N2651	108	2N2869	121	2N3077	123	2N3314	105	2N3547	129
2N2654	126	2N2869/ZN301	121	2N3078	123	2N3315	105	2N3548	129
2N2656	128	2N2870	121	2N3081	106	2N3317	106	2N3549	129
2N2671	126	2N2873	126	2N3082	107	2N3318	106	2N3550	129
2N2672	126	2N2883	108	2N3083	107	2N3319	106	2N3563	108
2N2672A	100	2N2884	108	2N3115	108	2N3320	126	2N3563-1	108
2N2672BLK	100	2N2894	106	2N3116	108	2N3321	126	2N3564	108

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
2N3565	123	2N3770	126	2N4059	106	2N5110	129	2S49	100
2N3566	128	2N3771	130	2N4060	106	2N5111	129	2S51	100
2N3567	128	2N3772	130	2N4061	106	2N5126	123	2S52	100
2N3568	128	2N3774	129	2N4062	106	2N5127	123	2S53	100
2N3569	128	2N3775	129	2N4072	108	2N5128	123	2S54	102
2N3570	108	2N3776	129	2N4073	108	2N5129	123	2S56	102
2N3571	108	2N3778	129	2N4074	108	2N5130	123	2S58	126
2N3572	108	2N3779	129	2N4078	131	2N5131	123	2S60	100
2N3576	106	2N3780	129	2N4080	106	2N5132	123	2S91	100
2N3579	129	2N3782	129	2N4086	108	2N5135	123	2S92	100
2N3580	129	2N3793	108	2N4087	108	2N5136	123	2S92A	100
2N3581	106	2N3794	108	2N4087A	108	2N5137	123	2S93	100
2N3582	106	2N3798	106	2N4105	103	2N5163	132	2S93A	100
2N3583	124	2N3799	106	2N4106	121	2N5172	123	2S95A	128
2N3588	126	2N3819	132	2N4121	106	2N5180	108	2S96	126
2N3600	108	2N3820	132	2N4122	106	2N5183	123	2S98	126
2N3605	108	2N3825	128	2N4123	108	2N5190	152	2S101	128
2N3606	108	2N3826	107	2N4124	128	2N5191	152	2S102	128
2N3607	108	2N3827	107	2N4125	106	2N5193	153	2S103	128
2N3611	121	2N3828	107	2N4134	108	2N5194	153	2S104	128
2N3612	121	2N3829	106	2N4140	128	2N5200	123	2S109	126
2N3613	121	2N3832	108	2N4141	108	2N5201	100	2S110	126
2N3614	121	2N3840	129	2N4142	129	2N5248	132	2S111	100
2N3615	121	2N3843	128	2N4143	106	2N5354	129	2S112	126
2N3616	121	2N3843A	128	2N4234	129	2NJ5A	100	2S131	128
2N3617	121	2N3844	128	2N4235	128	2NJ6	100	2S141	126
2N3618	121	2N3844A	128	2N4237	128	2NJB8A	100	2S142	126
2N3633	108	2N3845	128	2N4241	121	2NJB9A	102	2S143	126
2N3638	129	2N3845A	128	2N4248	128	2NJD9	102	2S145	126
2N3638A	129	2N3846	107	2N4249	128	2NJS0	126	2S146	126
2N3639	106	2N3854	128	2N4250	129	2NJS1	126	2S155	100
2N3640	106	2N3854A	128	2N4251	108	2NJS2	126	2S159	100
2N3641	108	2N3855	128	2N4254	107	2NJS3	126	2S160	100
2N3642	108	2N3855A	128	2N4255	107	2NJS31	102	2S163	102
2N3643	108	2N3856	128	2N4256	108	2NJS32	102	2S167	100
2N3644	129	2N3856A	128	2N4257	108	2NS121	102	2S174	100
2N3645	108	2N3857	129	2N4259	126	2S001	128	2S176	126
2N3646	106	2N3858	128	2N4274	128	2S002	128	2S178	100
2N3647	123	2N3858A	128	2N4275	128	2S003	128	2S179	102
2N3648	123	2N3859	128	2N4286	123	2S004	128	2S189	102
2N3662	108	2N3859A	128	2N4287	123	2S005	128	2S301	129
2N3663	108	2N3860	128	2N4288	106	2S006	108	2S302	129
2N3667	130	2N3862	123	2N4290	106	2S014	128	2S302A	129
2N3671	128	2N3863	130	2N4291	106	2S017	128	2S303	129
2N3672	106	2N3864	130	2N4296	124	2S019	128	2S304	129
2N3673	106	2N3866	123	2N4297	124	2S022	129	2S306	129
2N3677	129	2N3867	129	2N4298	124	2S023	129	2S307	129
2N3682	108	2N3869	123	2N4299	124	2S033	130	2S321	129
2N3688	108	2N3877	128	2N4346	127	2S034	130	2S322	129
2N3689	108	2N3880	128	2N4395	130	2S035	130	2S322A	129
2N3690	128	2N3883	100	2N4400	128	2S036	130	2S323	129
2N3691	108	2N3900	128	2N4401	128	2S12	100	2S324	129
2N3692	123	2N3900A	128	2N4402	129	2S13	100	2S326	128
2N3693	123	2N3901	128	2N4403	129	2S14	102	2S327	129
2N3694	123	2N3905	106	2N4410	128	2S15	102	2S501	128
2N3702	129	2N3906	106	2N4424	123	2S15A	102	2S502	128
2N3703	129	2N3911	106	2N4425	123	2S22	102	2S503	102
2N3704	128	2N3912	106	2N4425	124	2S24	102	2S512	108
2N3705	128	2N3914	106	2N4911	124	2S25	124	2S701	123
2N3706	128	2N3915	106	2N4912	124	2S26	121	2S702	123
2N3707	123	2N3924	123	2N4913	130	2S26A	121	2S703	123
2N3708	123	2N3932	108	2N4914	130	2S30	100	2S711	123
2N3709	123	2N3933	108	2N4916	129	2S31	100	2S712	123
2N3710	123	2N3973	123	2N4918	153	2S32	102	2S731	128
2N3711	123	2N3974	123	2N4919	153	2S33	102	2S732	128
2N3712	123	2N3975	123	2N4921	152	2S34	102	2S733	128
2N3713	130	2N3976	123	2N4922	152	2S35	126	2S741	128
2N3714	130	2N3977	106	2N4951	123	2S36	126	2S742	128
2N3715	130	2N3978	106	2N4952	123	2S37	102	2S743	128
2N3716	130	2N3979	106	2N4953	123	2S38	102	2S744	128
2N3719	129	2N3983	108	2N4954	123	2S39	102	2S745	128
2N3720	129	2N3984	108	2N4956	123	2S40	102	2S746	128
2N3721	107	2N3985	108	2N4967	123	2S41	104	2S3010	129
2N3730	127	2N3995	100	2N4968	123	2S41A	104	2S3020	106
2N3731	127	2N4013	123	2N4996	108	2S42	104	2S3021	106
2N3732	127	2N4014	123	2N4997	108	2S43	102	2S3030	106
2N3738	124	2N4032	106	2N5053	108	2S44	102	2S3040	129
2N3739	124	2N4034	106	2N5054	108	2S45	100	2S3210	129
2N3766	124	2N4035	106	2N5067	130	2S46	102	2S3220	129
2N3767	124	2N4058	106	2N5068	130	2S47	102	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	1000
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	126	2SA234A	126	2SA306	126
2SA21	126	2SA94	126	2SA150	100	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	2SA330	100
2SA51	100	2SA102AA	126	2SA170	100	2SA246	126	2SA331	126
2SA52	100	2SA102BA	126	2SA171	100	2SA246V	126	2SA332	100
2SA53	100	2SA103	126	2SA172	100	2SA247	126	2SA335	126
2SA54	100	2SA103A	126	2SA172A	100	2SA248	100	2SA337	126
2SA55	100	2SA103B	126	2SA173	100	2SA250	126	2SA338	126
2SA56	100	2SA103C	126	2SA174	102	2SA251	126	2SA339	126
2SA57	126	2SA103CA	126	2SA175	126	2SA252	126	2SA340	126
2SA58	126	2SA103CG	126	2SA176	126	2SA253	126	2SA341	126
2SA59	126	2SA103DA	126	2SA180	100	2SA254	126	2SA341-OA	126
2SA60	126	2SA104	126	2SA181	100	2SA255	100	2SA341-OB	126
2SA61	100	2SA104D	126	2SA182	100	2SA256	126	2SA342	126
2SA64	126	2SA104P	126	2SA183	100	2SA257	126	2SA342A	126
2SA65	100	2SA105	126	2SA188	100	2SA258	126	2SA343	126
2SA66	100	2SA106	126	2SA189	100	2SA259	126	2SA344	126
2SA67	126	2SA107	126	2SA197	102	2SA260	126	2SA345	126
2SA69	126	2SA108	126	2SA198	100	2SA261	126	2SA346	126
2SA70	126	2SA109	126	2SA201	100	2SA262	126	2SA347	126
2SA70F	126	2SA110	126	2SA201A	100	2SA263	126	2SA348	126
2SA70L	126	2SA111	126	2SA201B	126	2SA264	126	2SA349	126
2SA70MA	126	2SA112	126	2SA202	100	2SA265	126	2SA350	126
2SA70OB	126	2SA113	126	2SA202A	100	2SA266	126	2SA350A	126
2SA70OY	126	2SA114	126	2SA202B	100	2SA267	100	2SA350R	126
2SA71	126	2SA115	126	2SA202C	100	2SA268	126	2SA350T	126
2SA71A	126	2SA116	126	2SA202D	100	2SA269	100	2SA350Y	126
2SA71AB	126	2SA117	126	2SA203	100	2SA270	126	2SA351	126
2SA71AC	126	2SA118	126	2SA203A	126	2SA271	126	2SA351A	126
2SA71B	126	2SA121	126	2SA203B	100	2SA272	126	2SA351B	126
2SA71D	126	2SA122	126	2SA204	100	2SA273	126	2SA352	126
2SA71BS	126	2SA123	126	2SA205	100	2SA274	126	2SA352B	126
2SA71Y	126	2SA124	126	2SA206	100	2SA275	126	2SA353	126
2SA72	126	2SA125	126	2SA207	100	2SA276	126	2SA353A	126
2SA72BRN	126	2SA126	126	2SA208	100	2SA277	100	2SA353B	126
2SA72ORN	126	2SA127	126	2SA209	100	2SA278	100	2SA354	126
2SA72BLU	126	2SA128	126	2SA210	100	2SA279	100	2SA354B	126
2SA72WHY	126	2SA129	126	2SA211	100	2SA280	100	2SA355	126
2SA72BLU-BLU	126	2SA130	100	2SA212	100	2SA281	100	2SA356	126
2SA73	126	2SA131	100	2SA213	126	2SA282	100	2SA357	126
2SA74	100	2SA132	100	2SA214	126	2SA283	100	2SA358	126
2SA75	100	2SA133	126	2SA215	126	2SA284	100	2SA359	126
2SA76	126	2SA134	126	2SA216	126	2SA285	126	2SA360	126
2SA77	126	2SA135	100	2SA217	100	2SA286	126		
2SA77A	126	2SA136	126	2SA218	100	2SA287	126		
2SA77B	126	2SA137	100	2SA219	126	2SA288	126		

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
2SA361	126	2SA463	126	2SB42	104	2SB121	102	2SB175A	102
2SA362	100	2SA464	126	2SB43	102	2SB122	121	2SB175B	102
2SA364	126	2SA466	126	2SB43A	102	2SB123	104	2SB176	102
2SA365	126	2SA466BLK	126	2SB44	102	2SB123A	104	2SB176PR	102
2SA367	126	2SA466YEL	126	2SB46	102	2SB124	121	2SB176PRC	102
2SA368	126	2SA466BLU	126	2SB47	102	2SB126	127	2SB177	102
2SA369	126	2SA466-2	126	2SB48	102	2SB126F	107	2SB178	102
2SA372	126	2SA466-3	126	2SB49	102	2SB126V	107	2SB178A	102
2SA373	126	2SA468	126	2SB50	102	2SB127	124	2SB178M	102
2SA375	100	2SA469	126	2SB51	102	2SB128	127	2SB178T	102
2SA376	126	2SA470	126	2SB52	102	2SB128V	127	2SB180	104
2SA377	126	2SA471	126	2SB53	102	2SB129	121	2SB181	104
2SA378	126	2SA471-1	126	2SB54	102	2SB130	131	2SB181A	104
2SA379	126	2SA471-2	126	2SB54B	126	2SB130A	131	2SB183	102
2SA380	126	2SA471-3	126	2SB55	102	2SB131	104	2SB184	102
2SA381	126	2SA472	126	2SB56	102	2SB132	104	2SB185	102
2SA382	126	2SA472A	126	2SB56A	102	2SB134	100	2SB186	102
2SA383	126	2SA472B	126	2SB57	102	2SB135	102	2SB186A	102
2SA384	126	2SA472C	126	2SB59	102	2SB135A	102	2SB186AG	102
2SA385	126	2SA472D	126	2SB60	102	2SB135B	102	2SB186B	102
2SA385A	126	2SA472E	126	2SB60A	102	2SB135C	102	2SB186BY	102
2SA385L	126	2SA474	102	2SB61	102	2SB136	102	2SB186G	102
2SA391	126	2SA476	126	2SB62	104	2SB136B	102	2SB186Y	102
2SA392	126	2SA477	126	2SB63	131	2SB136C	102	2SB187	102
2SA393	126	2SA478	126	2SB64	104	2SB137	121	2SB187AA	102
2SA393A	126	2SA479	126	2SB65	102	2SB138	121	2SB187B	102
2SA394	126	2SA499	129	2SB66	100	2SB140	104	2SB187C	102
2SA395	126	2SA500	129	2SB67	102	2SB141	104	2SB187G	102
2SA396	102	2SA517	126	2SB67A	102	2SB142	104	2SB187R	102
2SA397	102	2SA518	126	2SB68	102	2SB142B	100	2SB188	102
2SA398	126	2SA522	129	2SB69	127	2SB142C	100	2SB189	102
2SA399	126	2SA522A	129	2SB71	102	2SB143	104	2SB189	102
2SA400	126	2SA525	126	2SB72	102	2SB143P	104	2SB200	102
2SA401	100	2SA525A	126	2SB73	102	2SB144	104	2SB200A	102
2SA403	126	2SA525B	126	2SB74	102	2SB144P	104	2SB201	126
2SA404	126	2SA530H	129	2SB75	102	2SB145	104	2SB202	102
2SA405	126	2SA539	129	2SB75A	102	2SB146	104	2SB203AA	102
2SA406	100	2SA564	128	2SB75B	102	2SB147	104	2SB215	127
2SA407	100	2SA564A	128	2SB75C	102	2SB149	104	2SB216	127
2SA408	126	2SB16A	105	2SB76	102	2SB150	102	2SB216A	127
2SA409	126	2SB17A	105	2SB77	102	2SB151	104	2SB217	121
2SA410	126	2SB18A	105	2SB77A	102	2SB152	104	2SB217A	121
2SA411	126	2SB19	104	2SB77A/P	102	2SB153	102	2SB217G	121
2SA412	126	2SB20	104	2SB77B	102	2SB154	102	2SB217U	121
2SA413	126	2SB21	104	2SB77C	102	2SB155	102	2SB218	121
2SA414	100	2SB22	102	2SB78	102	2SB155A	102	2SB219	102
2SA415	100	2SB22A	102	2SB80	121	2SB156	100	2SB220	102
2SA416	127	2SB22B	100	2SB81	121	2SB156A	102	2SB220A	102
2SA417	126	2SB23	102	2SB82	121	2SB156B	102	2SB221	102
2SA419	126	2SB24	102	2SB83	104	2SB156C	100	2SB221A	102
2SA420	126	2SB25	104	2SB84	121	2SB157	102	2SB222	102
2SA421	126	2SB25B	126	2SB85	102	2SB158	102	2SB223	102
2SA422	126	2SB26	104	2SB87	102	2SB159	102	2SB224	102
2SA425	100	2SB26A	104	2SB89	102	2SB160	102	2SB225	102
2SA426	100	2SB27	104	2SB89A	102	2SB161	102	2SB226	102
2SA427	126	2SB28	104	2SB90	102	2SB162	102	2SB227	102
2SA428	126	2SB29	104	2SB91	102	2SB163	102	2SB228	104
2SA431	126	2SB30	104	2SB92	102	2SB164	102	2SB229	121
2SA432	126	2SB31	104	2SB94	102	2SB165	102	2SB230	104
2SA433	126	2SB32	102	2SB95	102	2SB166	102	2SB231	127
2SA434	126	2SB32-0	102	2SB97	102	2SB167	102	2SB232	127
2SA435	126	2SB32-1	102	2SB98	102	2SB168	102	2SB233	104
2SA435A	126	2SB32-2	102	2SB99	102	2SB169	102	2SB235	105
2SA435B	104	2SB32-4	102	2SB100	102	2SB170	102	2SB236	105
2SA436	126	2SB33	102	2SB101	102	2SB171	102	2SB237	105
2SA437	126	2SB33C	102	2SB102	102	2SB171B	102	2SB237-12A	105
2SA438	126	2SB33D	102	2SB103	100	2SB172	102	2SB237-12B	105
2SA440	126	2SB33E	102	2SB104	100	2SB172A	102	2SB238-12A	105
2SA440A	126	2SB33F	102	2SB107	102	2SB172AF	102	2SB238-12B	105
2SA446	126	2SB33-4	102	2SB107A	121	2SB172B	102	2SB238-12C	105
2SA447	126	2SB34	102	2SB108	100	2SB172D	102	2SB239	121
2SA448	126	2SB37	102	2SB110	102	2SB172E	102	2SB239A	121
2SA453	126	2SB37A	102	2SB111	102	2SB172F	102	2SB240	102
2SA454	126	2SB37B	102	2SB112	102	2SB172P	102	2SB240A	102
2SA455	126	2SB37C	102	2SB113	102	2SB172R	102	2SB241	102
2SA456	126	2SB37F	102	2SB114	102	2SB173	102	2SB246	104
2SA457	126	2SB38	102	2SB115	102	2SB173A	102	2SB247	121
2SA460	126	2SB39	102	2SB116	102	2SB173B	102	2SB248	121
2SA461	126	2SB40	102	2SB117	102	2SB174	102	2SB248A	121
2SA462	126	2SB41	104	2SB120	102	2SB175	102	2SB249	104

## 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
2SB249A	104	2SB329	102	2SB416	100	2SC41	130	2SC156	108
2SB250	104	2SB331	105	2SB417	100	2SC45	108	2SC157	123
2SB250A	104	2SB332	105	2SB422	102	2SC46	128	2SC158	123
2SB251	127	2SB333	105	2SB423	102	2SC47	123	2SC159	108
2SB251A	127	2SB334	105	2SB424	121	2SC48	123	2SC160	108
2SB252	127	2SB335	102	2SB425	121	2SC49	123	2SC163	128
2SB252A	127	2SB336	102	2SB426	121	2SC50	101	2SC166	108
2SB253	127	2SB337	121	2SB426Y	121	2SC50A	101	2SC170	128
2SB253A	127	2SB337B	121	2SB427	100	2SC52	123	2SC171	128
2SB254	131	2SB338	121	2SB428	100	2SC53	123	2SC172	108
2SB255	131	2SB339	121	2SB431	102	2SC54	108	2SC172A	108
2SB256	131	2SB340	121	2SB432	127	2SC55	108	2SC173	101
2SB257	102	2SB341	127	2SB439	102	2SC56	123	2SC174	123
2SB258	105	2SB341V	127	2SB439A	102	2SC58A	128	2SC174A	123
2SB259	105	2SB342	127	2SB440	102	2SC60	101	2SC175	101
2SB260	105	2SB343	127	2SB443	102	2SC61	123	2SC176	101
2SB261	102	2SB345	100	2SB443B	102	2SC62	108	2SC177	101
2SB262	102	2SB346	100	2SB445	131	2SC64	123	2SC178	101
2SB263	102	2SB347	102	2SB446	131	2SC67	124	2SC179	101
2SB264	102	2SB348	100	2SB447	127	2SC68	124	2SC180	101
2SB265	102	2SB349	126	2SB448	127	2SC71	101	2SC181	101
2SB266	102	2SB350	102	2SB449	104	2SC72	101	2SC182	123
2SB266P	102	2SB351	105	2SB450	102	2SC73	101	2SC183	108
2SB266Q	102	2SB352	105	2SB450A	102	2SC74	108	2SC183E	108
2SB267	102	2SB353	105	2SB452	102	2SC75	101	2SC183J	108
2SB268	102	2SB354	105	2SB457	102	2SC76	101	2SC183K	108
2SB269	102	2SB355	104	2SB457A	102	2SC77	101	2SC183L	108
2SB270	102	2SB356	104	2SB458A	104	2SC77C	102	2SC183M	108
2SB270B	102	2SB358	127	2SB459	102	2SC78	101	2SC183P	108
2SB270C	102	2SB359	127	2SB463	131	2SC79	108	2SC183Q	108
2SB270D	102	2SB360	127	2SB463Y	131	2SC80	108	2SC184	108
2SB270E	102	2SB361	127	2SB464	127	2SC81	123	2SC184H	108
2SB271	100	2SB362	127	2SB465	127	2SC87	123	2SC184J	108
2SB272	100	2SB364	102	2SB466	131	2SC88A	108	2SC184L	108
2SB273	100	2SB365	102	2SB467	131	2SC89	101	2SC185	108
2SB274	127	2SB367	131	2SB468	127	2SC90	101	2SC185J	108
2SB275	127	2SB367H	131	2SB468A	127	2SC91	101	2SC185M	108
2SB276	127	2SB368	131	2SB468B	127	2SC97	123	2SC185R	108
2SB282	102	2SB368A	131	2SB468C	127	2SC98	108	2SC185V	108
2SB283	121	2SB370	102	2SB470	102	2SC99	108	2SC186	128
2SB284	121	2SB370A	102	2SB471	121	2SC100	123	2SC187	108
2SB285	121	2SB371	100	2SB471-2	121	2SC101	124	2SC188	123
2SB290	126	2SB373	102	2SB471B	121	2SC101A	124	2SC188A	108
2SB291	100	2SB375	127	2SB472	121	2SC102	105	2SC188AB	108
2SB292	100	2SB376	126	2SB473	131	2SC103	128	2SC189	123
2SB292A	100	2SB377	126	2SB474	131	2SC103A	128	2SC190	123
2SB293	102	2SB378	126	2SB475	102	2SC104	128	2SC191	123
2SB294	100	2SB379	102	2SB475B	102	2SC104A	128	2SC192	123
2SB295	121	2SB379-2	102	2SB475F	102	2SC105	128	2SC193	123
2SB296	127	2SB380	102	2SB481	131	2SC108	123	2SC194	123
2SB299	100	2SB380A	102	2SB486	102	2SC109	123	2SC195	123
2SB300	127	2SB381	102	2SB492	102	2SC115	128	2SC196	123
2SB301	127	2SB382	102	2SB496	102	2SC116	128	2SC197	123
2SB302	102	2SB383	102	2SB497	102	2SC116T	128	2SC199	108
2SB303	102	2SB383-1	102	2SC11	101	2SC117	128	2SC200	123
2SB303A	102	2SB383-2	102	2SC12	128	2SC118	128	2SC201	123
2SB303B	102	2SB384	126	2SC13	101	2SC119	128	2SC202	123
2SB304	100	2SB385	126	2SC14	101	2SC120	128	2SC203	128
2SB304A	100	2SB387	100	2SC15	106	2SC121	128	2SC204	128
2SB309	127	2SB389	126	2SC16	128	2SC122	128	2SC205	128
2SB310	127	2SB390	127	2SC16A	128	2SC123	128	2SC206	128
2SB311	127	2SB391	127	2SC17	108	2SC124	128	2SC208	128
2SB312	127	2SB392	100	2SC17A	108	2SC125	100	2SC210	123
2SB314	100	2SB393	100	2SC18	128	2SC127	108	2SC211	123
2SB315	100	2SB394	100	2SC19	128	2SC128	101	2SC214	123
2SB316	100	2SB395	100	2SC27	128	2SC129	101	2SC216	123
2SB317	102	2SB396	100	2SC28	123	2SC131	128	2SC217	123
2SB318	127	2SB400	126	2SC29	123	2SC132	128	2SC218	123
2SB319	127	2SB401	100	2SC30	123	2SC133	128	2SC220	123
2SB320	127	2SB402	100	2SC31	123	2SC134	128	2SC221	123
2SB321	102	2SB403	100	2SC32	108	2SC135	128	2SC222	123
2SB322	102	2SB405	102	2SC33	108	2SC136	128	2SC225	108
2SB323	100	2SB405A	102	2SC34	101	2SC137	128	2SC226	123
2SB324	102	2SB405B	102	2SC35	101	2SC138	123	2SC227	123
2SB324A	102	2SB405C	102	2SC36	101	2SC138A	123	2SC228	123
2SB324B	102	2SB407	104	2SC37	108	2SC139	123	2SC229	123
2SB324N	102	2SB408	100	2SC38	108	2SC150	108	2SC230	108
2SB326	102	2SB413	104	2SC39	108	2SC150T	128	2SC231	123
2SB327	102	2SB414	104	2SC39A	108	2SC151	108	2SC232	123
2SB328	102	2SB415	102	2SC40	108	2SC155	108	2SC233	123

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC 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	2SC5183E	123	2SD136	124
2SC272	108	2SC442	123	2SC601	108	2SC5184E	123	2SD137	124
2SC281	123	2SC443	128	2SC602	108	2SC5184J	108	2SD141	130
2SC281B	123	2SC454	128	2SC605	108	2SC5429J	108	2SD142	152
2SC281C	123	2SC454A	128	2SC606	108	2SC5430H	108	2SD143	152
2SC282	108	2SC454B	128	2SC608	128	2SC5461F	108	2SD146	130
2SC283	108	2SC454C	128	2SC608T	128	2SC5469F	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	103	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
2SC361	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	101
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	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
2T66	103	2TN95	102	4JD3B1	101	6-70	126	11B555	108
2T66R	103	2TN95A	102	4JX1A520	102	6-71	126	11B1052	108
2T67	101	2V362	102	4JX1A520B	102	6-72	126	11B1055	108
2T69	103	2V363	102	4JX1A520C	102	6-88	102	11C3B1	124
2T71	101	2V464	100	4JX1A520D	100	6-89	126	11C551	108
2T72	101	2V465	100	4JX1A520E	100	6-89X	126	11C553	108
2T73	101	2V466	100	4JX1A813	101	6-90	123	11C557	108
2T73R	101	2V467	100	4JX1C850	100	6-93	123	11C1061	108
2T74	101	2V482	100	4JX1C850A	100	6D122	100	11C1053	108
2T75	101	2V483	100	4JX1E821	100	6D122R	100	11C1057	108
2T75R	101	2V484	100	4JX1E850	103	6D122V	100	11C1536	124
2T76	101	2V485	100	4JX2A60	100	6MC	126	11C1B1	128
2T76R	101	2V486	100	4JX2A601	103	7-4	108	11C3B3	124
2T77	101	2V559	126	4JX2A801	101	7-6	108	11C5B1	124
2T77R	101	2V560	126	4JX2A816	103	7-7	108	11C7B1	124
2T78	101	2V561	100	4JX2A822	103	7-8	108	11C10B1	124
2T78R	101	2V562	100	4JX8040A	121	7A30	107	11C11B1	124
2T82	101	2V563	100	4JX8P404	121	7A31	107	12A6240	100
2T83	101	2V631	100	4JX8P409	121	7A32	107	12A9275	102
2T84	103	2V632	100	4JX16A567	108	7B1	124	12A9275-1	102
2T85	103	2V633	100	4JX16A667/G	107	7B2	124	12M2	121
2T85A	103	2-36	103	4JX16A667/O	107	7B13	124	12MC	126
2T86	103	3B15	102	4JX16A667/R	107	7C1	124	12M2	126
2T89	103	3B15-1	102	4JX16A667/Y	107	7C2	124	12X047	108
2T201	126	3L4-6001-01	130	4JX16A668/G	107	7C3	124	13-0020	108
2T202	123	3MC	126	4JX16A668/O	107	7D1	124	13-1032-5	108
2T203	126	3N22	101	4JX16A668/Y	107	7D2	124	13-10321-5	108
2T204	126	3N23	101	4JX16A669/G	123	7D3	124	13-10321-6	108
2T204A	126	3N23A	101	4JX16A669/Y	107	7E1	124	13-10321-7	108
2T205	126	3N23B	101	4JX16A670/G	123	7E2	124	13-10321-8	108
2T205A	126	3N23C	101	4JX16B670/B	107	7E3	124	13-10321-10	108
2T230	102	3N29	101	4JX16B670/G	123	7G1	124	13-10321-11	108
2T231	102	3N30	101	4JX16B670/R	128	7G2	124	13-10321-12	108
2T311	102	3N31	101	4JX16B670/Y	128	7G3	124	13-10321-14	108
2T312	102	3N34	126	4JX2816	103	7G4	124	13-10321-15	108
2T313	102	3N35	128	4JX2825	103	8-0024-1	108	13-10321-16	108
2T314	102	3N35A	128	5-8	128	8-0024-2	108	13-10321-17	108
2T315	102	3N36	101	5RC10	122	8-0024-3	123	13-105698-1	128
2T321	102	3N37	101	5RC10G	122	8-0062	102	13-14604-1	121MP
2T322	102	3N49	105	5RC15	122	8-723-650	103	13-14735-1	121
2T323	102	3N50	105	5RC15A	122	8D	126	13-14735A	121
2T324	102	3N51	105	5RC20	122	8E	126	13-14735-1	121
2T383	102	3N52	105	5RC20A	122	8F	126	13-14778-1	121MP
2T402	123	3N71	107	5RCL10	122	8H303	121	13-14886-1	126
2T403	108	3N72	107	5RCL15	122	8L	126	13-14887-1	126
2T404	108	3N73	107	5RCL20	122	8L201	121	13-14888-3	102
2T513	101	3N90	129	6-4	128	8L201B	121	13-14889-1	126
2T520	101	3N91	129	6-04	123	8L201R	121	13-15805-1	102
2T521	101	3N92	129	6-04ORN	128	8L201V	121	13-15808-1	123
2T522	103	3N93	129	6-04GRN	128	8L404	121	13-15808-2	123
2T523	103	3N94	129	6-04S1	128	8P	126	13-15809-1	128
2T524	101	3N95	129	6-04S2	128	8P40	104	13-15810-1	108
2T551	101	3N112	106	6-05	123	8P40A	104	13-15833-1	128
2T552	103	3N113	106	6-05VEL	128	8P404F	104	13-15835-1	108
2T650	101	3RC10	122	6-05F	128	8P404R	121	13-15836-1	102
2T681	103	3RC10A	122	6-11	128	8P404ORN	104	13-15840-1	128
2T682	103	3RC15	122	6-13	128	8P404T	121	13-15840-2	128
2T918	108	3RC20	122	6-19	128	8P404V	121	13-15841-1	108
2T919	107	3RC20A	122	6-30	128	8P416C	121	13-15842-1	103
2T2001	102	3S004	123	6-31	102	10A	126	13-16570-1	106
2T2708	108	3T201	101	6-53	102	10B	126	13-16592-1	127
2T2857	108	3T202	101	6-53/63	102	10B551	108	13-16607-1	127
2T3011	104	3T203	101	6-53A	102	10B553	108	13-16608-1	127
2T3021	104	3TE120	130	6-60	126	10B555	108	13-17607B	127
2T3022	104	3TE230	130	6-60B	126	10B556	108	13-17607-1	127
2T3030	104	3TE240	130	6-60D	126	10H1051	108	13-17608B	127
2T3031	104	3TX003	130	6-60P	126	10H1055	108	13-17608C	127
2T3032	104	3TX004	130	6-61	126	10C	126	13-17608-1	127
2T3033	104	4C28	123	6-61B	126	10CS73	108	13-17608-2	127
2T3041	104	4C29	123	6-61D	126	10CS74	108	13-17609-1	127
2T3042	104	4C30	123	6-61P	126	10G1051	108	13-18034	121
2T3043	104	4C31	123	6-62	126	10G1052	108	13-18034A	121
2TN15	100	4D20	123	6-62A	126	10H551	108	13-18034-1	121
2TN32	100	4D21	123	6-62B	126	10H553	108	13-18087-1	123
2TN45A	102	4D22	123	6-62D	126	10H1051	108	13-18087-2	123
2TN48	100	4D24	123	6-62P	126	10H1053	108	13-18158-1	123
2TN49	100	4D25	123	6-63	102	10P1	129	13-18198-1	121MP
2TN52	100	4D26	123	6-63A	126	11B551	108	13-18282	124
2TN53	100	4JD1A1.7	100	6-69	126	11B552	108	13-18282-1	124
2TN56	102	4JD1A7.3	102	6-69X	126	11B554	108	13-18304-1	102

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement
13-1836-1	124	14-602-32	129	21-37	102	27T410	103	34-6000-77	126
13-18359	124	14-602-34	108	21A005-000	102	27T411	123	34-6000-78	126
13-18359A	124	14-602-35	123	21A015-001	102	27T412	126	34-6000-79	126
13-18359-1	124	14-603-02	108	21A015-004	108	29A4	129	34-6000-80	126
13-18363	123	14-603-03	108	21A015-005	103	29V008M01	100	34-6000-81	126
13-18363-1	123	14-604-02	121	21A015-006	102	29V011H01	100	34-6000-82	126
13-18363-1A	123	14-2002-1	121MP	21A015-013	123	29V012H01	100	34-6000-83	100
13-18364-1	123	15-2	128	21A038-000	102	29V0038H03	102	34-6000-84	126
13-18363-1	123	15-4	106	21A048-000	126	30-004-001	121	34-6000-85	126
13-18642	121	15-5	129	21A049-000	126	30-090	152	34-6001-16	102
13-18642-1	121MP	15Z3	129	21A050-000	126	30V-H6	102	34-6001-28	102
13-18654-1	103	16-736	108	21A050-001	126	31-0015	126	34-6001-33	102
13-18927-1	128	16-21426	108	21A053-000	102	31-0016	126	34-6001-43	100
13-18927-1A	128	16A1	103	21A054-000	102	31-0017	102	34-6001-44	100
13-18944-1	102	16A2	103	21A055-000	102	31-0018	102	34-6001-50	123
13-18946-1	126	16G2	108	21A062-000	126	31-0035	102	34-6001-52	128
13-18947-1	126	16J1	108	21A064-000	121	31-0041	126	34-6001-53	123
13-18948-1	126	16J2	108	21A074-000	102	31-0042	126	34-6001-54	123
13-18948-2	126	16K1	108	21A097-000	121	31-0107	102	34-6001-55	123
13-18950-1	108	16K2	108	23	128	31-0108	126	34-6001-56	123
13-18951-1	126	16K3	108	23-1	129	31-0123	126	34-6001-57	123
13-18951-2	126	16L2	108	23-2	129	31-0124	126	34-6001-58	128
13-21606-1	127	16L3	108	23-3	129	31-0132	126	34-6001-60	123
13-22581	123	16L5	108	23B-210-025	121	31-0134	126	34-6001-61	128
13-22581-1	128	16L22	108	23B-210-230-2	127	31-0135	126	34-6001-62	128
13-22582-1	129	16L23	108	24A	129	31-0139	126	34-6001-63	123
13-22692-1	132	16L42	101	24-002	108	31-0141	126	34-6001-64	123
13-22739-1	121MP	16L43	108	24B	108	31-0150	126	34-6001-65	123
13-22741	121	16L44	108	24M W15	102	31-0153	102	34-6001-66	102
13-22741-1	121MP	16L62	108	24M W27	126	31-0161	102	34-6001-69	123
13-23543-1	124	16L63	108	24M W28	102	31-0168	102	34-6001-70	123
13-23594-1	128	16L64	108	24M W29	102	31-0170	126	34-6001-71	102
13-23785-1	102	16P3367	128	24M W34	126	31-0171	126	34-6001-72	123
13-23822-1	108	16X1	108	24M W43	102	31-0172	102	34-6001-73	123
13-23824-1	108	16X2	108	24M W44	126	31-0175	127	34-6001-74	128
13-23825-1	123	17A4422-1	121	24M W55	126	31-0177	123	34-6001-76	102
13-23826-1	106	19-020-031	126	24M W59	126	31-0178	126	34-6001-77	123
13-23826-2	106	19-020-032	126	24M W60	102	31-0180	126	34-6002-17	104
13-23840-1	128	19-020-033	100	24M W61	126	31-0184	126	34-6002-18	104
13-23916-1	128	19-020-034	102	24M W69	102	31-0187	123	34-6002-18A	104
13-25343-1	124	19-020-035	102	24M W70	102	31-0188	102	34-6002-19	104
13-26099-1	108	19-020-036	102	24M W74	126	31-0190	126	34-6002-20	104
13-26386-1	106	19-020-037	108	24M W77	100	31-0191	126	34-6002-21	124
13-26576-1	108	19-020-048	108	24M W78	102	31-0192	121	34-6002-22	104
13-26576-2	108	19-020-04	108	24M W83	102	31-0196	127	34-6002-22A	104
13-26577-1	108	19-1	129	24M W84	102	31-0205	102	34-6002-26	124
13-26577-3	108	19A115129-2	103	24M W107	102	31-0217	126	34-6008	102
13-26666-1	128	19A115180-2	129	24M W111	126	31-0225	102	34-6009	102
13-27404-1	123	19A115249-1	108	24M W115	108	31-0228	126	34-6015-1	108
13-27443-1	128	19A115300-1	128	24M W116	102	31-0229	102	34-6015-2	123
13-86416-1	103	19A115300-2	128	24M W130	103	31-0239	123	34-6015-3	108
13-94096-2	102	19A115304-2	128	24M W132	102	31-0240	131MP	34-6015-4	108
14-3	128	19A115342-1	108	24M W205	126	31-0241	121	34-6015-5	108
14-573-10	105	19A115440-1	108	24M W263	102	31-0241-1	121	34-6015-6	108
14-574-10	121	19A115441-1	108	24M W271	126	32-16599	121MP	34-6015-7	108
14-575-10	103	19A115527	152	24M W303	126	32-20738	123	34-6015-8	108
14-577-10	102	19A115561	121	24M W352	126	32-20739	129	34-6015-9	108
14-578-10	104	19A115666-1	108	24M W353	126	33-071	123	34-6015-10	108
14-581-01	126	19A115720-1	123	24M W458	123	33-090	152	34-6015-11	108
14-583-01	103	19A115728-1	123	24T-002	108	33-096	153	34-6015-13	123
14-600-01	126	19A115786	123	24T-016	108	34-6	126	34-6015-14	123
14-600-02	126	19A115786A	123	24T-016-001	108	34-119	126	34-6016-11	102
14-600-04	126	19A123160-1	108	24T-016-005	108	34-220	126	34-6016-14	123
14-600-10	126	19A126813	130	24T-016-013	108	34-221	126	34-6016-17	123
14-600-16	126	19-3415	102	25-100015	108	34-298	126	34-8001-43	126
14-600-19	126	19-3416	102	25A	108	34-1000	130	35P1	102
14-601-01	105	20A0007	102	25AM624	108	34-1002	152	35P2	102
14-601-03	104	20A0009	102	25B	108	34-1003	153	35P2C	102
14-601-05	121	20A0015	102	25B378	100	34-6000-3	100	35T1	102
14-601-06	104	20A0017	121	25T1	102	34-6000-10	126	36P1	102
14-601-08	121	20C71	102	26T1	102	34-6000-16	126	36P1C	102
14-602-01	123	20C72	102	27T401	100	34-6000-18	100	36P1F	102
14-602-02	128	20M C	126	27T402	100	34-6000-19	100	36P2F	102
14-602-03	123	20V-HG	102	27T403	102	34-6000-62	126	36P3	102
14-602-05	102	21-28	121	27T404	102	34-6000-64	108	36P3A	102
14-602-05A	102	21-32	126	27T405	102	34-6000-69	108	36P3C	102
14-602-13	123	21-33	126	27T406	121	34-6000-70	108	36P4	102
14-602-29	123	21-34	102	27T407	105	34-6000-71	108	36P4C	102
14-602-30	123	21-35	124	27T408	101	34-6000-72	108	36P5	102
14-602-31	108	21-36	102	27T409	123	34-6000-76	126	36P5C	102

## 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
36P7	102	43P4C	102	48R869475	102	48S134941	123	57A21-5	108
36P7C	102	43P6	102	48R869475A	102	48S134942	128	57B2-3	102
36P8	102	43P6A	102	48S134943	103	48S134943	129	57B2-7	102
36T1	102	43P6C	100	48R869476A	103	48S134945	108	57B2-8	103
37T1	126	43P7	102	48S10079A02	126	48S134946	108	57B2-11	126
38T1	102	43P7A	102	48S134405	123	48S134947	121	57B2-13	126
38P1	102	43P7C	102	48S134407	102	48S134948	108	57B2-14	126
39A9	102	43X16A567	123	48S134408	102	48S134949	108	57B2-15	102
39P1	121	44-13	126	48S134666	123	48S134950	108	57B2-19	126
39P1C	121	44A354637-001	152	48S134695	126	48S134956	126	57B2-22	126
39T1	102	44P1	126	48S134718	123	48S134960	108	57B2-23	100
40D1547	126	45N1	103	48S134719	123	48S134970	108	57B2-25	102
40P1	102	45M2	103	48S134720	123	48S134972	124	57B4-2	121
40P2	102	45N2M	123	48S134732	123	48S134979	108	57B4-4	121
41B581014	128	45N3	128	48S134733	123	48S134981	108	57B6	102
41N1	108	45N4	123	48S134733A	123	48S134992	128	57B21	108
41N2	108	45NP	108	48S134734	123	48S137007	123	57B21-2	108
41N2B	108	45X1A502C	102	48S134734A	123	48S65123A67	108	57B21-4	108
41N3	108	45X2	100	48S134737	123	48S134804	123	57B21-5	108
42-16599	121	46-8682-3	123	48S134739	124	48SP134826	108	57B21-6	108
42-17143	102	46-86143-3	123	48S134739A	124	48SP134837	108	57B21-7	108
42-17444	102	47P1	121	48S134747	121	48SP134855	123	57B101-4	108
42-18109	102	47-2	108	48S134759	108	48SP134857	108	57B102-4	108
42-18111	123	48-21598B01	128	48S134761	121	48S134894	123	57B103-4	108
42-18310	124	48A124315	102	48S134765	123	48SP134897	123	57B104-8	128
42-19642	128	48A134434	126	48S134766	121	48SP134903	123	57B105-12	128
42-19643	129	48C124246	121	48S134767	121	48SP134904	108	57B106-12	129
42-19644	123	48C125237	102	48S134768	123	48SP134905	123	57B107-8	128
42-19670	123	48K135P1	102	48S134773	108	48SP134906	123	57B108-6	129
42-19671	102	48K36P1	102	48S134774	108	48SP134933	123	57B109-9	128
42-19682	100	48K36P3	102	48S134775	108	48S134937	108	57B110-9	129
42-19683	108	48K39P1	121	48S134776	108	48X134970	108	57B122-9	129
42-19792	126	48K39P3	102	48S134783	108	49P1C	121	57B129-9	128
42-19840	123	48K43P3	102	48S134784	108	50P2	126	57B130-9	129
42-19862	103	48K43P4	102	48S134785	108	50P3	126	57B131-10	128
42-19862A	102	48K56P1	100	48S134797	108	51	128	57B132-10	129
42-19863	102	48K57B2	121	48S134804	108	51D170	102	57B136-12	128
42-19863A	102	48K57B42	121	48S134805	108	51D188	100	57B137-12	129
42-19864	102	48K125230	104	48S134807	108	51D189	100	57B141-4	108
42-19864A	102	48K134458	102	48S134809	123	51P2	126	57B142-4	108
42-20738	123	48K134494	126	48S134810	123	51P4	126	57B143-12	128
42-20739	129	48K134495	126	48S134811	123	53P151	123	57B144-12	128
42-20960	152	48K134496	126	48S134820	108	53P153	121	57B145-12	129
42-20961	130	48K134601	126	48S134825	108	53P157	102	57B146-12	123
42-21401	108	48K134796	126	48S134826	108	53P158	123	57B147-12	129
42-21402	108	48K134798	126	48S134827	108	53P159	123	57B148-12	129
42-21403	100	48K869001	100	48S134832	108	53P161	123	57B149-12	132
42-21404	102	48K86904GF	126	48S134837	108	53P162	123	57B151-6	108
42-21405	103	48K869228	128	48S134838	128	53P163	123	57B152-12	108
42-21406	102	48P1	102	48S134840	108	53P165	123	57B153-9	123
42-21407	123	48P63005A72	123	48S134841	108	53P166	129	57B155-10	124
42-21443	121MP	48P65112A65	108	48S134842	123	53P169	128	57B156-9	123
42-22008	129	48P65113A88	108	48S134843	123	53P170	129	57B157-9	129
42-22158	128	48P65118A64	108	48S134844	123	54	128	57B159-12	129
42-22778	126	48P65123A67	108	48S134845	108	54A	123	57C5	103
42-22779	126	48P65123A95	108	48S134853	123	54B	123	57C5-1	126
42-22780	126	48P65144A72	108	48S134854	123	54C	123	57C5-2	126
42-22781	126	48P65146A61	108	48S134855	123	54D	123	57C5-3	126
42-22784	126	48P65146A62	108	48S134857	108	54E	123	57C5-4	126
42-22785	123	48P65146A63	108	48S134860	100	54BLK	128	57C5-5	126
42-22786	123	48R134407	102	48S134861	100	54BRN	128	57C5-6	108
42-22787	123	48R134573	102	48S134862	100	54RED	128	57C5-7	108
42-22809	123	48R134621	102	48S134872	130	54GRN	128	57C5-8	108
42-22810	129	48R134632	102	48S134879	108	54VEL	128	57C5-9	126
42-22811	123	48R134665	103	48S134894	108	54GRN	128	57C5-10	126
42-22812	123	48R134666	123	48S134898	123	54BLU	128	57C6-1	102
42-22834	121MP	48R134695	121	48S134899	123	54WHT	128	57C6-2	102
42X210	103	48R134722	121	48S134903	123	55P2	126	57C6-3	121
42X230	102	48R859428	128	48S134904	108	55P3	126	57C6-4	123
42X233	102	48R869138	128	48S134905	123	55-1016	102	57C6-5	103
42X308	102	48R869148	102	48S134906	123	55-1026	123	57C6-6	102
42X309	102	48R869170	128	48S134909	102	55-1027	123	57C6-6A	100
42X310	103	48R869248	123	48S134910	129	55-1029	102	57C6-6B	100
42X311	102	48R869249	102	48S134918	123	55-1031	102	57C6-6C	100
43N3	123	48R869253	102	48S134919	128	55-1032	123	57C6-7	123
43N6	123	48R869254	103	48S134920	124	55-1034	123	57C6-8	121
43P1	100	48R869282	102	48S134932	108	56P1	126	57C6-9	123
43P2	102	48R869283	103	48S134933	128	56P2	126	57C6-10	124
43P3	100	48R869426	129	48S134935	123	56P3	126	57C6-11	123
43P4	102	48R869464	128	48S134937	108	56P4	126	57C6-12	121

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
57C6-14	124	57D184	100	80P1	102	86-100-2	126	86-277-2	123
57C6-15	102	57D186	126	81T2	128	86-101-2	126	86-278-2	126
57C6-16	126	57D187	126	83P1B	129	86-102-2	126	86-279-2	126
57C6-17	123	57D188	102	83P2	123	86-108-2	126	86-280-2	126
57C6-19	123	57D189	102	83P2B	129	86-109-2	126	86-281-2	126
57C6-21	103	57D1127	102	83P3	129	86-110-2	123	86-282-2	126
57C6-22	102	57D1130	126	83P3B	129	86-111-2	126	86-283-2	126
57C6-23	121	57D1131	126	83P3M	129	86-112-2	126	86-284-2	123
57C6-24	124	57D1132	126	83-1056	121	86-114-2	126	86-291-2	123
57C6-27	123	57D1143	102	84	121	86-115-2	102	86-292-2	127
57C6-29	123	57D1186	126	84B	121	86-116-2	100	86-295-2	126
57C6-30	123	57P1	102	86A318	102	86-117-2	126	86-296-2	100
57C6-31	129	58B2-14	126	86-4-2	101	86-119-2	126	86-301-2	102
57C6-32	123	61C001-1	123	86-6-2	101	86-120-2	121	86-303-2	102
57C6-33	129	61C002-1	102	86-8-2	121	86-123-2	123	86-304-2	102
57C9-2	121	61C003-1	102	86-10-2	102	86-126-2	102	86-305-2	102
57C10-1	108	61C004-1	128	86-11-2	103	86-127-2	121	86-308-2	123
57C10-2	108	61C005-1	121	86-12-2	103	86-128-2	102	86-310-2	123
57C12-4	128	61P1	126	86-13-2	103	86-129-2	102	86-311-2	126
57C15-3	126	61P10	126	86-14-2	103	86-130-2	102	86-312-2	126
57C16	126	63P3	102	86-16-2	102	86-131-2	126	86-313-2	121MP
57C20-1	108	63-29459	121	86-18-2	126	86-132-2	100	86-317-2	121
57C23-1	129	64T1	100	86-19-2	121	86-133-2	100	86-319-2	121
57C23-2	129	65A	106	86-20-2	126	86-135-2	126	86-327-2	123
57C27-2	108	65B	106	86-21-2	100	86-136-2	126	86-328-2	123
57D1-11	102	65C	106	86-22-2	100	86-138-2	108	86-334-2	129
57D1-26	102	65D	106	86-23-2	102	86-139-2	123	86-336-2	128
57D1-27	102	65E	106	86-24-2	103	86-141-2	121	86-339-2	123
57D1-30	100	65F	106	86-25-2	103	86-142-2	128	86-340-2	129
57D1-31	100	65T1	100	86-26-2	101	86-143-2	123	86-342-2	123
57D1-32	100	66-6023-00	102	86-27-2	100	86-146-2	121	86-344-2	152
57D1-42	102	66-6024-00	102	86-28-2	100	86-147-2	121	86-345-2	153
57D1-43	102	66-6025-00	102	86-29-2	102	86-149-2	126	86-348-2	100
57D1-44	102	66-6026-00	102	86-30-2	102	86-150-2	126	86-367-2	126
57D1-56	102	66-6027-00	102	86-31-2	101	86-151-2	126	86-368-2	126
57D1-68	100	66-6028-00	102	86-32-2	100	86-155-2	123	86-370-2	121MP
57D1-69	100	67P1	121	86-33-2	100	86-156-2	102	86-373-2	126
57D1-70	102	67P2	121	86-35-2	103	86-156-2A	102	86-374-2	126
57D1-80	100	68P1	121	86-36-2	126	86-157-2	123	86-389-2	123
57D1-81	126	68P1B	121	86-37-2	126	86-158-2	123	86-390-2	123
57D1-84	100	69N1	108	86-38-2	126	86-159-2	102	86-391-2	123
57D1-86	100	70N1	123	86-39-2	102	86-161-2	128	86-396-2	153
57D1-87	100	70N2	123	86-42-1	123	86-162-2	126	86-399-2	123
57D1-88	126	71N1	124	86-44-2	101	86-163-2	126	86-403-2	123
57D1-89	100	71N2	124	86-45-2	102	86-164-2	126	86-512-2	105
57D1-96	126	72N1	108	86-46-2	100	86-169-2	102	86-1392	123
57D1-97	126	72N1B	108	86-47-2	100	86-170-2	128	86-5042-2	102
57D1-105	126	72N2	128	86-48-2	100	86-171-2	123	86-5043-2	102
57D1-107	126	72N2B	128	86-49-2	102	86-173-2	121	86-5067-2	121
57D1-111	102	73N1	108	86-50-2	102	86-175-2	123	86-5084-2	130
57D1-114	126	73N1B	128	86-58-2	103	86-177-2	124	86-5943-2	121
57D1-119	104	74	108	86-59-2	100	86-178-2	129	86X0006-001	128
57D1-120	102	74P1	100	86-60-2	100	86-179-2	126	86X0007-004	123
57D1-121	102	74N1	100	86-61-2	102	86-180-2	126	86X0008-001	123
57D1-123	123	75N1	123	86-62-2	121	86-181-2	126	86X0009-001	121
57D1-124	123	76	100	86-63-2	101	86-185-2	108	86X0011-001	126
57D3-6	102	76-13570-39	108	86-72-2	102	86-188-2	123	86X0012-001	123
57D4-1	121	76-13570-59	108	86-73-2	100	86-191-2	123	86X0013-001	126
57D5-1	126	76-13866-17	108	86-74-2	102	86-194-2	123	86X0014-001	100
57D5-2	126	76-13866-18	108	86-75-2	100	86-199-2	123	86X0015-001	121
57D5-4	126	76-13866-19	108	86-76-2	103	86-201-2	123	86X0017-001	102
57D6-10	124	76-13866-62	108	86-77-2	102	86-204-2	108	86X0018-001	102
57D6-12	121	76N1	123	86-78-2	100	86-208-2	108	86X0022-001	123
57D6-19	123	76N1B	128	86-79-2	100	86-228-2	124	86X0025-001	123
57D9-1	121	76N2	123	86-80-2	102	86-234-2	128	86X0028-001	124
57D24-1	108	76N2B	128	86-81-2	102	86-235-2	121	86X0029-001	123
57D24-2	108	76N3B	128	86-82-2	102	86-237-2	123	86X0030-001	121MP
57D24-3	108	77	100	86-83-2	102	86-238-2	123	86X0031-001	123
57D68	102	77N1	123	86-84-2	102	86-243-2	108	86X0031-002	123
57D126	102	77N2	123	86-86-2	126	86-244-2	108	86X0031-003	123
57D127	102	77N2B	128	86-87-2	126	86-245-2	108	86X0033-001	131
57D130	126	77N3	123	86-88-2	126	86-246-2	129	86X0034-001	128
57D131	126	77N4	128	86-89-2	126	86-247-2	128	86X0035-001	123
57D132	126	78N1	123	86-90-2	126	86-249-2	102	86X0036-001	106
57D143	102	78BLK	100	86-91-2	126	86-250-2	123	86X0037-001	103
57D156	102	78RED	100	86-92-2	102	86-251-2	129	86X0038-001	128
57D168	126	78YEL	100	86-93-2	126	86-253-2	102	86X6-1	123
57D169	102	78GRN	100	86-95-2	102	86-254-2	126	86X6-4-518	123
57D170	102	78-5009	121	86-98-2	102	86-255-2	123	86X7-2	128
57D180	100	79P1	100	86-99-2	126	86-257-2	124	86X7-3	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
86XB-1	123	100X6	130	121-19	102	121-150	126	121-296	126
86XB-3	123	101-12	100	121-21	101	121-151	100	121-297	126
86X34-1	128	101A	126	121-22	101	121-152	126	121-298	126
90T2	107	101B	126	121-24	101	121-153	100	121-299	126
91A	128	101M	126	121-25	101	121-154	100	121-300	100
91B	128	101P1	106	121-26	101	121-157	126	121-301	100
91BGRM	128	104	128	121-27	101	121-160	100	121-302	123
91C	128	104-17	126	121-33	103	121-161	100	121-303	100
91D	128	104-19	126	121-34	126	121-162	100	121-304	108
91E	128	104-21	126	121-135	126	121-163	100	121-305	102
91F	128	104H01	128	121-136	126	121-164	102	121-306	102
91N1	108	104T2	130	121-137	126	121-179	100	121-307	102
92N1	108	106KB0	129	121-138	100	121-180	100	121-308	121
92N1B	108	106P1	104	121-139	126	121-181	100	121-309	100
93A9	102	107A	102	121-44	100	121-184	102	121-310	102
93A9-3	100	107B	102	121-45	100	121-185	126	121-311	102
93A9-4	100	107BRM	128	121-46	100	121-186	100	121-312	126
93C39-11	123	107M	102	121-47	102	121-187	100	121-313	126
94N1	123	108-1	126	121-48	100	121-189	100	121-314	102
94N1B	128	108-2	126	121-49	100	121-190	102	121-315	124
94N1R	123	108-3	126	121-50	100	121-191	102	121-319	102
96N1	124	108-4	126	121-51	100	121-192	102	121-320	102
96XZ6051-28N	126	108GRN	129	121-52	102	121-193	102	121-321	100
96XZ6051-35N	126	110P1	129	121-53	100	121-205	100	121-327	102
96XZ6051-36N	126	112-001	100	121-54	100	121-206	100	121-328	126
96XZ6053-09N	102	112-002	126	121-59	101	121-207	100	121-329	126
96XZ6053-10N	126	112-003	102	121-60	101	121-208	100	121-330	126
96XZ6053-24N	126	112-004	102	121-61	102	121-219	100	121-331	126
96XZ6053-27N	102	112-000172	126	121-62	100	121-220	100	121-332	126
96-138-2	108	112-000185	126	121-63	100	121-221	100	121-333	126
96-5143-01	121	112-000187	121	121-64	102	121-222	100	121-334	126
96-5143-02	121	112-000267	126	121-65	100	121-225	100	121-335	102
96-5165-01	128	112-003	102	121-66	100	121-226	102	121-336	126
96-5190-01	123	112-2	129	121-67	100	121-227	102	121-347	102
97N2	101	113-118	123	121-68	102	121-228	126	121-348	102
97P1	102	114-118	108	121-69	102	121-229	126	121-349	126
98P1	129	115-1	123	121-70	101	121-230	126	121-350	126
99A76	102	115-4	123	121-71	101	121-231	126	121-351	126
99B5	102	116-1	124	121-72	100	121-232	102	121-352	126
99BA6	100	117-1	124	121-73	100	121-233	126	121-353	100
99B6E	100	118-1	108	121-74	100	121-234	100	121-354	126
99K7	101	118-2	108	121-75	100	121-235	100	121-356	126
99L6	103	118-3	108	121-76	100	121-236	100	121-357	126
99P1	129	118-4	108	121-78	100	121-237	100	121-358	126
99P1M	129	119	128	121-79	100	121-238	100	121-359	126
99P2	129	119-0077	128	121-80	100	121-239	100	121-363	121
99SA7	101	120BLU	128	121-81	100	121-240	100	121-364	123
99SK7	101	120-1	128	121-82	100	121-241	100	121-365	123
99S07	103	120-2	128	121-83	100	121-242	126	121-366	123
99S001	121	120-3	128	121-84	100	121-243	126	121-367	123
99S002	102	120-001192	100	121-85	100	121-244	126	121-369	123
99S003	100	120-001195	102	121-86	100	121-245	126	121-371	121
99S004	102	120-002013	102	121-87	100	121-246	102	121-372	102
99S005	102	120-00213	126	121-88	100	121-247	100	121-373	102
99S011	102	120-002213	126	121-89	100	121-248	100	121-374	102
99S011A	102	120-002214	126	121-90	100	121-254	100	121-375	102
99S012	123	120-002216	126	121-91	100	121-256	102	121-377	108
99S012A	123	120-002513	126	121-92	100	121-257	126	121-378	108
99S012E	123	120-002515	126	121-93	100	121-258	126	121-379	108
99S014	121	120-002518	126	121-94	100	121-259	126	121-380	108
99S015	121	120-002520	126	121-95	102	121-260	126	121-381	126
99S016	108	120-002521	102	121-96	102	121-261	126	121-382	121
99S017	108	120-002748	102	121-100	100	121-262	126	121-383	126
99S018	108	120-004492	126	121-101	126	121-263	126	121-384	126
99S019	108	120-004493	102	121-102	100	121-266	102	121-385	102
99S019A	108	120-004494	102	121-103	100	121-267	102	121-388	126
99S019B	108	120-004495	102	121-104	100	121-268	102	121-389	121
99S020	123	120-004496	108	121-105	100	121-269	126	121-395	102
99S022	703	120-004497	108	121-106	102	121-270	104	121-396	102
99S025	123	120-190	102	121-107	102	121-271	104	121-397	100
99S031	108	121-1	129	121-113	100	121-272	102	121-398	121
99S032	108	121-1RED	129	121-120	102	121-273	100	121-399	102
99S033	128	121-6	101	121-128	100	121-274	102	121-400	102
99S034	128	121-7	101	121-134	104	121-275	100	121-401	102
99S035	128	121-9	100	121-135	104	121-276	123	121-403	102
99S036	128	121-10	100	121-136	104	121-277	123	121-404	128
99S037	108	121-11	100	121-137	104	121-278	123	121-408	102
100B63	102	121-12	100	121-145	100	121-279	123	121-409	102
100N1	108	121-14	100	121-146	100	121-294	126	121-411	126
100T2	130	121-18	124	121-147	100	121-295	126	121-412	126

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
121-413	102	121-616	108	130	128	207A10	108	297V042C04	102
121-414	126	121-630	108	130-138	108	207B	100	297V042H01	102
121-415	126	121-632	102	135ORN	128	207M	100	297V042H02	102
121-417	129	121-633	102	136RED	128	217-1	128	297V042H03	126
121-418	121	121-634	102	145-T1B	126	223	128	297V042H04	126
121-419	129	121-635	102	146-T1	121	229-0180-32	108	297V043H01	102
121-422	123	121-636	102	147-T1	121	229-0180-33	108	297V045H01	126
121-425	102	121-637	123	154A3675-105	102	229-0180-34	108	297V045H02	126
121-426	126	121-638	123	154A3676	126	229-0204-6	108	297V049H01	123
121-427	126	121-639	123	154A3676-205	102	229-0204-23	108	297V049H03	123
121-428	126	121-640	102	154A3677	126	235	100	297V049H04	123
121-430	123	121-641	103	154A3679	102	248-38104-1	128	297V050C02	100
121-431	123	121-662	123	154A3679-5110	126	251M1	103	297V050H01	102
121-432	126	121-671	123	154A3680	121	297V002M04	101	297V050H02	102
121-433	123	121-678	128	154A5943	124	297V002M05	101	297V050H03	102
121-434	123	121-679	129	154A5943-1	124	297V003H03	102	297V051C03	102
121-435	123	121-695	123	154A8681	102	297V003H06	102	297V051C04	102
121-436	124	121-697	126	154-T1	126	297V003H09	102	297V051H01	102
121-437	102	121-698	126	154-T1A	126	297V003M01	102	297V051H02	102
121-441	129	121-699	129	154-T1B	126	297V003M07	102	297V051H03	102
121-442	129	121-706	128	155-T1	126	297V004H03	102	297V051H04	100
121-446	129	121-707	153	156-T1	126	297V004H06	102	297V052C01	102
121-447	123	121-708	152	156WHT	128	297V004H10	102	297V052H01	102
121-448	123	121-709	153	156-043	130	297V004H14	102	297V052H02	102
121-450	123	121-710	152	157-T1	126	297V004H15	102	297V053C01	102
121-451	124	121-711	123	157YEL	129	297V004H16	102	297V053H01	102
121-453	108	121-713	124	159-T1	126	297V004M01	102	297V053H02	102
121-460	108	121-714	126	160-T1	126	297V011H01	126	297V054C01	100
121-461	108	121-722	128	161-T1	126	297V012H01	126	297V054C02	100
121-462	108	121-726	130	161-T2	108	297V012H06	100	297V054H01	100
121-470	108	121-730	128	162-T1	126	297V012H08	100	297V054H02	100
121-471	108	121G3019	128	162-T2	108	297V012H09	100	297V055C01	100
121-472	108	121G3020	128	169-257	124	297V012H10	126	297V055H01	100
121-480	108	121-830	100	169-284	124	297V012H11	126	297V057H01	102
121-481	108	121-1032	102	171-001-9-001	121	297V012H14	102	297V057H02	102
121-482	108	121-1033	102	171-003-9-001	124	297V012H15	126	297V059H01	123
121-483	108	121-1034	102	172-003-9-001	124	297V025H02	102	297V059H02	123
121-488	126	121-1035	102	173A4419-2	121	297V025H04	102	297V059H03	123
121-490	102	121-1036	102	173A3936	121	297V025H05	102	297V060H01	124
121-491	100	121-1124	121	173A3963	121	297V025H15	102	297V060H02	124
121-492	100	121-1134	121	173A4419	121	297V026H01	125	297V060H03	124
121-493	100	121-1330	100	173A4419-1	121	297V026H03	100	297V061C01	130
121-494	100	121-1350	100	173A4419-2	121	297V027H01	102	297V061C02	130
121-495	106	121-1360	100	173A4419-3	121	297V032H01	102	297V061C03	123
121-496	106	121-1390	100	173A4420	121	297V033H01	102	297V061C04	123
121-497	129	121-1400	100	173A4420-1	121	297V034H01	126	297V061C05	128
121-497WHT	129	121-1410	101	173A4420-5	101	297V035H01	126	297V061C06	123
121-498	108	122-229	100	173A4421-1	121	297V036H01	126	297V061C07	123
121-499	128	122-1028	105	173A4424	102	297V036H02	126	297V062C01	121
121-500	108	122-1625	121	173A4436	121	297V037H01	102	297V062C05	121
121-510	108	122-1648	126	173A4469	121	297V037H02	102	297V062C06	128
121-520	108	122-1962	103	173A4490-5	128	297V038H01	100	297V063C01	126
121-538	126	122GRN	129	173A4491-2	130	297V038H02	100	297V064B01	126
121-539	126	122YEL	129	174-25566-01	129	297V038H03	100	297V065C01	126
121-540	126	122-1	123	176-003-9-001	108	297V038H04	102	297V065C02	126
121-540B	126	122-2	123	176-004-9-001	108	297V038H05	108	297V065C03	126
121-541	126	124-1	121	176-005-9-001	108	297V038H06	126	297V070C01	126
121-541B	126	127	128	176-006-9-001	108	297V038H07	102	297V070H49	108
121-542	126	127-7	101	176-007-9-001	108	297V038H09	100	297V071C03	124
121-542B	126	128	108	176-008-9-001	123	297V038H10	100	297V072C01	108
121-543	102	128WHT	128	177-001-9-001	129	297V038H11	100	297V072C03	108
121-544	102	129	108	180T2	130	297V038H12	100	297V072C04	123
121-546	108	129WHT	128	180T2A	130	297V040H01	102	297V072C05	128
121-547	108	129-4	102	180T2C	130	297V040H08	102	297V072C06	123
121-551	108	129-5	121	181T2A	130	297V040H10	102	297V073C01	129
121-552	126	129-6	104	181T2C	130	297V040H11	102	297V073C02	129
121-553	126	129-7	104	183P1	129	297V040H12	102	297V073C03	129
121-580	108	129-8	102	199-Power	121	297V040H13	102	297V074C03	123
121-581	123	129-8-1	102	200A	103	297V040H15	121	297V074C03	123
121-582	124	129-8-1A	102	200-010	108	297V040H16	102	297V074C04	123
121-585	126	129-8-2	102	200-015	108	297V041H01	102	297V074C06	123
121-587	128	129-9	121	200-016	123	297V041H02	121	297V074C07	123
121-600	128	129-10	121	201A	126	297V041H03	121	297V074C08	123
121-602	129	129-11	100	201B	126	297V041H04	121	297V074C09	108
121-603	129	129-13	121	201M	126	297V041H05	104	297V074C10	128
121-610	123	129-14	123	201-254343-12	108	297V041H06	121	297V074C11	129
121-612	108	129-15	123	202A	103	297V041H07	104	297V074C12	128
121-613	108	129-16	108	207A	100	297V042C01	102	297V076B01	102
121-614	108	129-17	102	207A1	126	297V042C02	102	297V076C01	102
121-615	106	129-18	102	207A9	108	297V042C03	102	297V077C01	126

## 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
29V078C01	128	325-1446-26	123	511-519	123	690V040H57	126	775BRN	128
29V078C02	128	325-1446-27	123	512RED	128	690V040H58	126	776GRN	128
29V080C01	129	325-1446-28	123	515	123	690V040H59	126	779BLU	128
29V081C01	102	325-1513-29	123	515-521	123	690V040H60	126	783RED	128
29V082B01	128	325-1513-30	123	515ORN	128	690V040H61	102	784ORN	128
29V082B02	129	325-1513-46	128	516	123	690V040H62	102	785YEL	128
29V082B03	129	325-1771-15	123	517 518	123	690V043H62	102	786	128
299 Power	105	325-1771-16	123	520T1	100	690V043H63	102	787BLU	128
300	102	326T1	100	521T1	100	690V047H54	126	791	128
301	102	350	100	524WHT	128	690V047H55	126	792-286	102
302	102	352	102	576-003-009	126	690V047H56	100	792-287	102
310	102	353	102	576-0001-002	102	690V047H57	100	792-288	102
310-068	126	353-9001-001	126	576-0001-003	102	690V047H58	102	792-289	102
310-68	126	353-9001-002	126	576-0001-004	123	690V047H60	102	792-290	102
310-123	126	353-9001-003	126	576-0001-005	123	690V049H81	108	800-196	104MP
310-124	126	353-9002-002	126	576-0001-009	102	690V052H23	102	800-250-102	123
310-139	126	353-9301-001	128	576-0002-002	104	690V052H24	102	800-501-00	123
310-187	123	353-9304-004	129	576-0003-008	126	690V054H21	102	800-502-00	102
310-188	102	353-9306-001	123	576-0003-009	126	690V056H89	126	800-503-00	103
310-189	100	353-9306-002	123	576-0003-010	126	690V056H90	102	800-504-00	126
310-190	100	365T1	100	576-0003-013	126	690V057H25	126	800-505-00	100
310-191	126	386-7118P1	108	576-0003-014	126	690V057H27	102	800-506-00	102
310-192	121	386-7118P1	123	576-0003-015	126	690V057H28	102	800-507-00	121
322T1	100	386-7183P1	130	576-0004-004	128	690V057H59	126	800-509-00	123
323T1	100	386-7184P1	129	576-0004-005	128	690V057H62	126	800-510-01	130
324	102	386-7188P1	108	576-0036-847	123	690V060H58	108	800-516-000	129
324T1	100	394-3074-2	102	576-0036-918	108	690V060H59	108	800-521-01	123
324-019	128	394-3074-5	102	576-0036-919	108	690V061H98	102	800-521-02	123
324-0029	102	394-3097-1	102	576-0036-920	102	690V061H99	102	800-522-01	123
324-0038	126	394-3097-2	102	576-0036-921	108	690V063H14	126	800-522-02	128
324-0041	102	394-3127-1	128	576-0040-051	121	690V063H15	126	800-523-01	123
324-0055	102	394-3127-2	128	576-2000-990	126	690V063H16	102	800-523-02	123
324-0056	102	394-3127-3	128	576-2000-993	128	690V063H17	102	800-524-02	130
324-0086	126	394-3135	130	605	123	690V063H51	102	800-526-00	123
324-0088	102	396-7178P1	108	614X1	102	690V066H44	126	800-527-00	129
324-0089	126	412	100	614X2	126	690V066H45	126	800-528-00	103
324-0090	126	421-6	126	614X3	126	690V066H46	102	800-529-00	123
324-0091	102	417-124	108	614X4	126	690V066H47	102	800-53001	123
324-0092	102	417-125	108	614X5	102	690V066H89	126	801B	108
324-0093	102	417-126	123	614X6	102	690V068H29	126	815-181D	102
324-0098	126	417-127	123	614X7	102	690V068H30	102	818WHT	128
324-0099	126	417-129	108	614X8	103	690V068H31	102	822A	123
324-0106	126	417-132	129	614X9	102	690V070H49	108	822ABLU	128
324-0116	127	417-144	152	614X10	102	690V070H98	108	822B	123
324-0121	126	417-145	153	630-076	123	690V073H59	126	823WHT	128
324-0128	127	420T1	100	642-152	104	690V073H85	126	823B	128
324-0129	126	421T1	100	642-206	104	690V077H34	126	827BRN	128
324-0130	126	421-7	126	650-105	102	690V077H35	126	828GRN	128
324-0131	126	421-8	126	650-106	102	690V077H36	126	829A	106
324-0132	126	421-11	102	650-107	102	690V077H37	102	829B	106
324-0133	102	421-12	102	650-108	102	690V080H36	102	829C	106
324-0134	103	421-13	102	650-109	103	690V080H37	126	829D	106
324-0136	126	421-14	102	660B	102	690V080H38	128	829E	106
324-0137	126	421-15	102	660-125	128	690V080H39	102	829F	106
324-0138	126	421-16	126	660-126	128	690V080H40	126	830	100
324-0139	102	421-17	126	660-127	108	690V080H41	123	833	129
324-0140	102	421-18	124	660-128	128	690V080H42	127	847BLK	128
324-0142	102	421-19	102	660-131	123	690V080H43	127	881-250-102	123
324-0143	102	421-26	126	660-134	123	690V080H44	102	884-250-001	121
324-0144	102	429-0093-69	126	660-145	123	690V080H45	130	914F298-1	128
324-0145	126	429-0094-39	126	669	106	690V081H07	108	921-7	123
324-0146	102	448A662	128	686-0012	128	690V084H94	108	921-8	103
324-0149	108	454A104	128	686-0112	128	690V084H95	108	921-29B	126
324-0150	108	455-1	126	686-0130	128	690V084H96	108	94T1	100
324-0151	123	473A31	121	686-0210	152	690V086H39	102	955-1	126
324-0152	123	473B6-2	102	686-0243	130	690V086H86	129	955-2	126
324-0154	123	473B6-2A	102	686-143	130	690V086H87	108	955-3	126
324-144	102	473B6-4	102	690V02H69	108	690V086H88	128	964-19862	103
324-6011	128	473B6-5	102	690V010H40	108	690V086H89	129	964-19863	102
325T1	100	473B6-7	102	690V010H41	108	690V086H90	128	964-19864	102
325-0031-303	123	491A948	128	690V010H42	100	694D	123	965T1	102
325-0031-304	123	501E5001M	108	690V02H28	108	703B	128	987T1	102
325-0031-305	123	501T1	100	690V028H48	108	720-35019	102	988T1	102
325-0031-306	102	503T1	100	690V028H69	108	750-137	102	989T1	102
325-0042-351	123	504T1	126	690V028H89	108	750-138	102	990T1	102
325-0076-306	123	505T1	126	690V034H29	126	750-139	102	991T1	102
325-0076-307	123	506T1	126	690V034H30	102	750-140	102	992T1	102
325-0076-308	108	507T1	126	690V034H31	102	770-045	152	992-00271	130
325-1442-8	102	508T1	126	690V034H39	102	773RED	128	992-008-890	121
325-1442-9	124	511-515	123	690V040H56	126	774ORN	128	1004	123

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement
1004-17	108	2057B2-61	102	3202 5H01	128	4315	102	4584GRN	121
1005	123	2057B2-62	123	3227 E	108	4348	102	4586	126
1005-17	102	2057B2-63	123	3425	100	4349	102	4587	108
1020-17	108	2057B2-64	108	3434	100	4363	126	4589	126
1023-17	102	2057B2-65	126	3435	100	4363ORN	126	4590	106
1024-17	104	2057B2-66	126	3458	100	4363GRN	126	4594	123
1030	129	2057B2-67	126	3500	100	4363BLU	126	4595	126
1032	102	2057B2-68	126	3504	100	4363WHT	126	4596	102
1033	102	2057B2-70	126	3505	128	4364	102	4597	105
1033-1	126	2057B2-71	126	3506	128	4365	126	4597 RED	105
1033-2	126	2057B2-72	102	3507	100	4366	126	4597 GRN	105
1033-3	126	2057B2-73	123	3508	128	4367	126	4603	126
1033-4	126	2057B2-77	126	3509	128	4398	102	4604	126
1033-5	102	2057B2-78	102	3510	108	4450	102	4605	126
1033-6	103	2057B2-79	126	3511	108	4451	100	4605RED	126
1033-7	102	2057B2-80	126	3512	121	4454	126	4607	102
1034	102	2057B2-83	102	3513	108	4456	126	4608	121
1034-17	123	2057B2-84	124	3514	121	4457	126	4619RED	121
1035	102	2057B2-85	108	3515	121	4459	127	4620GRN	121
1036	102	2057B2-86	102	3516	121	4462	102	4621	126
1124	121	2057B2-87	108	3517	100	4463	121	4622	126
1124A	121	2057B2-88	126	3518	128	4464	123	4623	127
1124B	121	2057B2-89	126	3519	123	4465	123	4624	123
1124C	104	2057B2-90	126	3520	124	4466ORN	102	4627	102
1145	100	2057B2-93	126	3523	100	4468BRN	102	4630	123
1146	100	2057B2-97	123	3524	108	4469RED	102	4632	126
1192	102	2057B2-101	108	3532-1	128	4470	123	4648	128
1241A	102	2057B2-102	108	3533-1	129	4470-31	123	4649	121
1248	102	2057B2-104	126	3535	108	4470-32	123	4652	127
1320	102	2057B2-105	126	3537	108	4470M-32	123	4677	126
1329	102	2057B100-7	102	3538	128	4470-33	123	4689	128
1330	102	2058	126	3540	129	4471ORN	102	4700	101
1340	100	2295	124	3541	128	4471YEL	102	4701	130
1349-17	103	2417	124	3543	128	4472GRN	102	4705	123
1350	100	2427	128	3544	100	4473	102	4714	123
1360	102	2443	123	3545	128	4473-1	128	4715	130
1390	100	2445	108	3546	128	4473-2	128	4722RED	121
1400	100	2446	123	3547	128	4473-3	128	4722ORN	121
1410	100	2447	108	3548	128	4473-M3	128	4722YEL	121
1414-179	130	2448	123	3551	126	4473-4	128	4722GRN	121
1414-180	152	2450	108	3551A	126	4473-5	128	4722BLU	121
1459	102	2473	108	3551AGR N	126	4473-5X	128	4722PUR	121
1524	123	2474	128	3551ABL U	126	4473-6	123	4727	121
1526	126	2475	123	3552	126	4473-7	128	4730	121
1567	123	2476	108	3553	126	4473-8	128	4732	128
1567-0	123	2477	108	3554	123	4473-9	128	4733	128
1567-2	123	2482	100	3555	123	4473-11	128	4734	128
1858	101	2487B	101	3556	100	4473-12	128	4737	127
2007-01	121	2488A	121	3558	128	4473-M-12	128	4745	106
2011	152	2489A	100	3559	129	4473-N	128	4756	108
2015-00	126	2490A	102	3560	123	4474YEL	102	4765	123
2015-1	130	2491B	124	3561	128	4475GRN	102	4768	128
2015-2	130	2494	127	3562	129	4476BLU	102	4789	128
2015-3	130	2495	128	3563	129	4477PUR	102	4801-1100-011	121
2020-00	126	2496	127	3564	130	4478	129	4815	129
2021-00	126	2500	127	3565	128	4483	128	4819	128
2028-00	108	2502	129	3566	128	4484	100	4820	108
2039-2	101	2546	128	3577	121	4485	100	4821	128
2057B2-4	102	2584	123	3600	102	4486	100	4825	128
2057B2-28	102	2634	108	3607	101	4501	126	4826	128
2057B2-29	102	2700	126	3609	101	4509	126	4837	108
2057B2-32	102	2780	121	3714H1	100	4510	102	4838	123
2057B2-34	102	2780-4	121	3746	100	4545	126	4839	126
2057B2-35	126	2780-5	121	3851	126	4545BLU	126	4840	128
2057B2-38	123	2781	102	3852	100	4545WHT	126	4841	128
2057B2-41	126	2781	123	3907	102	4553BRN	102	4842	128
2057B2-42	126	2797	126	3907 2N404A	126	4553RED	102	4843	128
2057B2-43	102	2797	126	3961	126	4553ORN	102	4844	106
2057B2-44	102	2798	126	3970	100	4553YEL	102	4845	108
2057B2-45	102	2799	126	3999	128	4553GRN	102	4851	127
2057B2-46	103	2900-007	108	4013	129	4553BLU	102	4852	128
2057B2-47	124	2901-010	121	4021	123	4562	102	4853	128
2057B2-48	126	2904-008	121	4022	123	4563	102	4854	123
2057B2-49	102	2904-016	126	4057	128	4564	102	4855	128
2057B2-50	126	2904-029	126	4066	128	4565	102	4857	108
2057B2-51	126	2904-033	108	4085	128	4567	102	4872	124
2057B2-57	102	2904-034	123	4086	128	4570	121	4882	130
2057B2-58	124	2904-035	123	4087	129	4573	105	4888A	121
2057B2-59	123	3002	108	4247	104	4582BRN	121	4888B	121
2057B2-60	100	3011	128	4313	102	4583RED	121	5093	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
5226-1	106	17142	102	34219	100	38920	108	40426	124
5226-2	128	17143	102	34220	100	38921	108	40427	124
5253	104	17144	123	34221	100	40004	126	40439	127
5766-25	102	17444	123	34298	121	40005	126	40440	127
6100	102	17887	121	34315	121	40006	126	40461	133
6100-35	102	17945	121	35004	108	40022	104	40461-2	128
6154	126	18109	102	35044	121	40050	104	40462	104
6155	126	18310	124	35045	102	40051	104	40464	130
6158	108	18493	126	35084	104	40051-2	121	40465	130
6162	126	18509	123	35168	126	40053	128	40466	130
6181-1	128	18529	100	35169	126	40080	123	40469	108
6440	102	18530	102	35170	126	40081	123	40470	108
6445	100	18540	100	35201	104	40217	123	40471	130
6452	102	18541	126	35231	121	40218	123	40472	108
6651-486	128	18555	123	35260	104	40219	123	40475	108
7122	128	18601	102	35349	121	40220	123	40476	123
7123	128	18611	102	35449	108	40221	123	40478	108
7124	128	18731	102	35454	102	40222	123	40479	104
7125	128	19278	124	35454-1	102	40231	123	40482	123
7126	128	19420	108	35454-2	102	40232	108	40487	102
7127	128	19645	123	35454-3	102	40233	108	40488	100
7128	128	20738	123	35628	102	40234	108	40491	124
7129	128	20739	129	35677	126	40235	108	40517	123
7131	128	22008	129	35678	126	40236	108	40518	123
7132	128	22158	128	35728	121	40237	108	40519	123
7133	128	30201	102	35815	126	40238	108	40546	124
7134	128	30202	102	35816	126	40239	108	40547	124
7214	108	30203	121	35817	126	40240	108	40578	128
7215	108	30204	102	35818	126	40242	108	40534-1	130
7216	108	30206	102	35819	102	40243	108	42396	133
7217	108	30207	102	35820	102	40244	108	43992-2	101
7218	108	30208	100	35820-1	102	40245	108	44616-1	102
7219	108	30208-2	102	35820-2	102	40246	108	44967-2	102
7220	108	30210	123	35820-3	102	40250	124	45495-2	101
7221	108	30211	121	35824	126	40251	104	46490-2	101
7425	128	30213	126	35885A	121	40253	102	46590-2	103
7426	128	30214	126	35885B	121	40254	104	46591-2	103
7427	128	30215	126	35950	102	40261	126	46592-2	103
7428	128	30216	102	35951	121	40262	126	46593-2	103
7429	128	30218	102	35952	102	40263	102	46631-2	101
7430	128	30219	123	35953	102	40264	124	46774-1	101
7431	128	30221	126	35954	102	40264-V1	124	46775-2	101
7432	128	30222	126	35965	102	40268	100	46776-2	102
7516	123	30223	126	36212V1	108	40269	100	47394-2	102
7810	128	30224	123	36303	121	40280	123	47645-2	103
7811	128	30226	123	36304	121	40283	123	47737-2	102
7812	128	30227	123	36477	121	40290	123	48385-2	103
7813	128	30228	123	36534	102	40294	108	48937-2	126
7814	128	30229	123	36557	102	40295	108	48939-2	126
7815	128	30230	126	36558	102	40309	123	49058-2	103
7816	128	30231	100	36559	126	40311	123	49138-2	101
7817	128	30234	124	36560	126	40314	128	49139-2	102
7818	128	30235	123	36563	126	40315	128	50137-2	128
8405	129	30238	126	36577	129	40316	130	50447-4	121
8540	129	30239	126	36578	108	40317	128	51650	121
9367-1	128	30240	126	36579	128	40320	128	57000-5452	123
9390	102	30241	123	36580	123	40321	123	57000-5503	123
9391	102	30242	123	36581	108	40322	124	61003-4	102
9600	128	30243	123	36582	132	40323	123	64071-1	102
10003	130	30244	102	36634	124	40326	123	65804-62	126
10032	102	30245	124	36816	100	40327	123	65804-63	102
10036	102	30246	121	36847	108	40328	124	67193-85	102
10037	102	30246A	121	36917	128	40329	102	67802	128
10038	100	30247	126	36918	108	40347	128	68504-62	126
10039	100	30248	123	36919	108	40348	128	68504-63	102
12163	104	30254	152	37383	108	40350	128	68895-13	102
12178	104	30256	152	37384	108	40351	108	69107-42	126
12180	126	30257	124	37464	128	40352	108	69107-44	126
15024	121	30259	123	37584	124	40359	102	69107-45	102
15027	121	30268	128	37585	123	40395	102	70231	108
15809-1	123	30269	128	37694	128	40396N	103	70434	121
15810-1	123	30270	106	37730	124	40396P	102	75960CH	102
15835-1	123	30271	153	37800	128	40397	108	77068-3170756	124
15840-1	123	30272	152	38175	103	40398	108	78331	106
15841-1	123	30273	100	38176	102	40400	108	79855	128
16598	102	30274	126	38177	102	40411	130	79856	128
16599	121	30291	128 & 129 (CP)	38178	123	40422	124	80050	121
16958	102	30302	102	38207	108	40423	124	80416C	121
16959	121	34022	121	38208	108	40424	124	86452	102
17047-1	102	34119	100	38209	100	40425	124	86812	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
86822	123	99103	100	116086	127	121663	123	162002-041	126
86832	102	99104	100	116087	127	121664	123	162002-042	126
86842	102	99105	126	116088	127	122244	102	162002-062	121
90050	121	99106	126	116089	127	122517	108	162002-A-062	121
94008	102	99107	126	116091	102	122518	102	162002-090	123
94009	102	99108	126	116092	123	122664	123	162002-095	121
94017	102	99109-1	123	116093	121	122665	123	162002-40	126
94032	121	99109-2	123	116148	121	122901	102	162002-41	126
94050	128	99120	126	116198	108	122902	108	170376	121
94051	128	99121	126	116199	108	122904	108	170376-1	121
94052	128	99201	102	116200	108	123274	123	170407-1	121
95101	126	99202	102	116201	102	123275	124	170479-1	121
95102	126	99203	102	116202	102	123791	102	170666-1	121
95103	126	99204	102	116203	102	123792	121M P	170668-1	121M P
95107	126	99205	102	116206	102	123877	131M P	170783-3	103
95108	126	99206-1	123	116207	126	123940	129	170850-1	121M P
95110	126	99206-2	123	116208	126	123941	128	171003	127
95111	126	99207-2	123	116209	126	124412	108	171004	127
95112	101	99217	102	116279	124	124623	129	171005	126
95113	101	99218	102	116284	129	124624	129	171016	126
95114	101	99250	121	116588	123	124625	126	171017	102
95115	101	99252	124	116683	126	124626	102	171018	102
95116	126	99252-1	124	116684	126	124753	123	171026	123
95117	126	99252-2	124	116685	102	124754	108	171027	123
95118	126	99252-3	124	116686	102	124755	129	171028	108
95119	126	99252-4	152	116687	103	124756	123	171029	108
95120	126	100678	126	116756	126	124757	108	171030	108
95120A	100	100693	102	116757	102	125135	123	171038	108
95121	126	101078	126	116875	123	125137	108	171039	126
95122	126	101434	108	116997	102	125138	108	171040	123
95123	126	101678	101	116998	102	125139	123	171044	108
95124	126	101974	102	117208	102	125140	123	171045	108
95125	108	104009	126	117209	102	125141	123	171046	123
95126	108	104059	126	117210	102	125142	128	171048	108
95127	108	110263	101	117616	100	125143	123	171049	102
95128	108	110494	102	117617	100	125144	128	171052	108
95129	108	110495	103	117618	126	125263	108	171054	108
95130	108	110515	121	117658	126	125389	123	175006-181	126
95131	108	110669	128	117724	126	125390	108	175006-182	126
95201	102	110697	108	117725	126	125475	123	175006-183	126
95202	103	110699	128	117726	126	125972	126	175006-184	126
95203	102	111117	126	117727	102	125994	108	175006-185	126
95204	102	111118	126	117728	102	125995	102	175006-186	102
95208	102	111954	126	117823	108	126093	108	175006-187	108
95209	102	111955	126	118279	124	126093-1	102	186342A	128
95211	101	111956	126	118686	124	126093-2	102	190425	121
95212	102	111957	102	118713	123	126093-4	102	190425A	121
95213	102	111958	103	118822	108	126138	124	198039-0507	130
95214	102	111959	102	119013	126	126150	123	214396	121
95216	123	112296	126	119414	108	126188	124	216986	121
95216YEL	123	113398	108	119526	126	126334	123	217119	105
95216RED	123	113938	108	119554	108	126398	108	217230	105
95217	102	114267	108	119555	108	126699	128	217892	121
95218	102	114525	108	119556	108	126700	129	218502	102
95219	102	115063	104	119557	108	126701	128	218503	102
95220	128	115225	123	119635	123	126702	128	219016	101
95221	123	115227	126	119636	123	126703	128	219301	121
95222-1	102	115228	126	119650	124	126704	128	219940	121
95222-2	103	115229	126	119722	127	126705	128	221600	123
95223	108	115268	121	119723	127	126706	128	221601	101
95224-1	102	115269	121	119982	123	126707	129	221602	121
95224-2	103	115275	126	119983	129	126708	128	221605	121
95225	123	115281	121	120073	123	126711	123	221856	100
95226-1	128	115282	121	120074	123	126712	123	221857	123
95226-2	123	115283	121	120075	102	126713	123	221918	123
95226-3	129	115284	121	120481	123	126714	128	221924	101
95226-4	128	115875	123	120482	123	126715	128	221940	121
95227	129	115910	128	120483	123	126716	123	221941	121
95228	133	116068	127	121151	102	126717	128	222915	121
95233	128	116072	126	121152	102	126718	129	223124	102
95250	121	116073	108	121153	100	126719	129	223365	121
95250-1	121	116074	123	121154	100	126720	128	223366	102
95251	121	116075	124	121243	129	126721	128	223367	101
95252	124	116078	129	121467	129	126724	129	223368	101
95252-1	124	116079	108	121655	123	126725	128	223369	126
95252-2	124	116080	108	121658	129	126726	124	223370	101
95252-3	124	116081	128	121659	128	127214	102	223371	102
95252-4	124	116082	108	121660	123	127962	132	223372	100
99101	100	116083	108	121661	128-129(CP)	162002-033	121	223473	100
99102	100	116085	123	121662	123	162002-040	126	223474	126

## 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
223475	100	234630	102	573402	126	610056-1	126	815023B	102
223482	103	234631	126	573405	126	610056-2	126	815024	102
223483	102	235194	102	573406	126	610056-3	126	815024A	102
223484	102	235200	126	573422	102	610056-4	126	815024B	102
223485	102	235205	123	573432	102	610061-1	126	815025	100
223486	102	235206	123	573469	128	610064-1	121	815025A	100
223487	126	235312	121	573472	108	610067-3	121M P	815025B	100
223490	121	236251	108	573475	108	610068-1	104	815025	101
223576	121	236265	101	573479	123	610069-1	108	815026A	100
223684	101	236285	123	573480	123	610070-1	123	815026B	101
223810	102	236286	123	573494	108	610070-2	123	815026C	101
224503	121	236706	108	573495	108	610071-1	124	815026D	100
224584	100	236907	108	573501	128	610072-1	108	815027	100
224586	126	236935	121	573518	126	610072-2	108	815027A	100
224587	126	237450	124	573529	102	610073-1	108	815027B	100
224696	102	237452	121	576001	102	610074-1	129	815027C	100
224820	103	238417	102	576005	102	610074-2	100	815028	102
224857	102	238418	102	601040	126	610075-1	123	815028A	100
224873	121	297074C11	129	601054	126	610076-1	123	815028B	100
225311	126	297240-1	102	601065	103	610076-2	123	815028C	100
225593	102	300486	101	601113	108	610077-1	123	815029	102
225594	126	300536	101	602032	121	610077-2	123	815029A	102
225594A	126	300538	102	602040	102	610077-3	123	815029B	102
225595	121	300540	102	602075	126	610078-1	123	815029C	102
225596	121	300541	102	602113	108	610079-1	102	815030	102
225600	126	300542	101	603020	126	610080-1	102	815030A	102
225925	121	300774	101	603030	126	610083	129	815030B	102
225927	121	309421	102	603031	121	610083-1	129	815031	102
226181	100	310017	102	603040	126	610083-2	129	815031A	102
226338	100	310030	126	603113	108	610083-3	129	815031B	102
226441	101	310035	102	603312	126	610088-2	102	815034	102
226634	121	310132	126	604030	126	610091-1	108	815034A	102
226789	105	310157	126	604040	126	610092-1	108	815034B	102
226791	103	310158	126	604080	126	610094-1	123	815034C	102
226924	102	310159	102	604112	126	610096-1	108	815036	100
226999	121	310160	102	604113	108	610099	129	815036A	100
227752	100	310162	126	605030	102	610099-1	129	815036B	100
227804	121	310201	102	605112	803	610099-2	129	815036C	100
228229	121	310204	126	605113	108	610099-3	102	815037	100
228230	121	310221	126	606020	102	610100-1	108	815037A	100
228287	102	310223	100	607030	123	610102-1	106	815037B	100
228558	121	310224	126	608112	121	610106-1	104	815037C	100
228559	121	310225	102	609020	126	610107-1	108	815038	102
229045	105	373003	102	609112	123	610107-2	128	815038A	102
229133	126	373117	102	610035	102	610110-1	129	815038B	102
230208	121	373119	102	610035-1	102	611020	100	815038C	102
230209	101	551051	102	610035-2	102	612022	127	815041	100
230214	128	560004	121M P	610036-1	102	613112	108	815041A	100
230253	102	5700005452	123	610036-2	102	660059	102	815041B	100
230256	101	5700005503	123	610036-3	102	660060	102	815041C	100
230259	102	570004-503	123	610336-4	102	660070	128	815043	100
230523	121	570005-452	123	610036-5	102	660072	102	815043A	100
230524	102	570005-503	123	610036-7	102	660074	128	815043B	100
230525	102	570009-01-504	123	610036-8	102	660082	102	815043C	100
231374	123	573001	102	610039-1	121	660095	121	815055	100
231588	102	573005	102	610040-1	102	660103	121	815056	100
231672	121	573011	102	610040-2	102	670850-1	121M P	815057	100
231797	121	573012	102	610041-2	108	700080	130	815058	102
232194	121	573018	102	610041-3	108	700083	130	815058A	102
232359	130	573022	102	610042-1	108	700230-00	123	815058B	102
232674	121	573029	102	610043-3	102	700231-00	123	815058C	102
232675	121	573101	108	610043-4	100	701584-00	129	815058X	100
232676	126	573103	102	610043-6	100	701678-00	128	815064	126
232680	126	573117	102	610043-7	102	702407-00	128	815064A	126
232681	126	573119	102	610045-2	108	702415-00	123	815064B	126
232840	108	573125	102	610045-3	123	731009	102	815064C	126
232841	128	573142	102	610045-4	123	815003	102	815065	100
232949	101	573152	102	610050-1	126	814044A	102	815065A	100
233305	105	573153	102	610050-2	126	815015	102	815065B	100
233307	105	573166	121	610050-3	126	815020	100	815065C	100
233507	100	573199	102	610051-1	126	815020A	100	815066	100
233508	105	573200	127	610051-2	126	815020B	100	815066A	100
233509	121	573212	127	610051-4	126	815021	100	815066B	100
233945	100	573303	126	610052-1	100	815021A	100	815066C	100
234015	126	573329	126	610053-1	126	815021B	100	815067	126
234076	102	573330	126	610053-2	126	815022	102	815067A	126
234077	121	573335	126	610055	126	815022A	102	815067B	126
234078	105	573336	126	610055-1	126	815022B	102	815067C	126
234566	121	573371	126	610055-2	126	815023	102	815068	126
234612	123	573398	126	610055-3	126	815023A	102	815068A	126

## TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement
815068B	126	815184E	123	981144	126	2001653-20	126	2091859-0712	121
815068C	126	815185	129	981145	126	2001653-21	126	2091859-0713	104
815069	102	815185E	129	981146	126	2001653-23	102	2091859-0714	121
815069A	102	815186	123	981148	102	2001653-24	102	2091859-0715	104
815069B	102	815186C	123	981203	126	2001812-65	100	2091859-0716	104
815069C	102	815186L	123	981204	126	2002153-58	126	2091859-0717	104
815070	102	815189	102	981206	102	2002153-59	126	2091859-0718	104
815070A	102	815190	123	981672	102	2002153-60	126	2091859-0720	104
815070B	102	815191	123	981673	102	2002153-71	102	2091859-0723	121
815070C	102	815193	126	981674	102	2002153-76	126	2091859-2	121
815070D	102	815195	102	981675	102	2002153-77	123	2091859-4	121
815074	102	815196	102	981969	105	2002153-78	102	2091859-6	121
815075	103	815197	126	982150	126	2002153-83	103	20918-9-8	104
815076	103	815198	128	982151	102	2002210-110	102	2091859-0008	121
815083	102	815199-6	129	982152	102	2002211-24	102	2091859-9	121
815101	100	815201	123	983874	121	2002211-25	102	2091859-10	121
815103	100	815202	128	983945	105	2002332-95	108	2091859-0011	121
815104	102	815203-3	121A4F	983975	121	2002336-19	102	2091859-11	121
815105	100	815206	108	985036	121	2002403-19	102	2092417-0707	126
815107	100	815308A	100	985431	101	2002620-18	108	2092417-0708	126
815108	100	816135	124	985432	125	2002620-19	108	2092417-0709	126
815109	100	825065	100	985443	121	2002621-2	123	2092417-0710	126
815114	102	910799	128	985447	121	2003073-8	102	2092417-0711	108
815115	100	965632	108	985449	121	2003073-9	123	2092417-0712	108
815116	100	965633	108	985453	121	2003073-10	123	2092417-0713	108
815117	100	965634	108	985455	121	2003073-11	126	2092417-0715	108
815118	102	980052	105	985686	121	2003073-12	126	2092417-0716	108
815120	102	980132	121	988080	121	2003073-13	126	2092417-0717	126
815120A	102	980134	105	988336	121	2003073-14	102	2092417-1	126
815120B	102	980135	105	988413	121	2003073-15	102	2092417-2	126
815120C	102	980136	100	988414	105	2003073-16	103	2092417-3	126
815120D	102	980138	108	988468	121	2003073-91	130	2092417-6	126
815120E	102	980139	10P	988977	105	2003168-135	123	2092418-071	126
815133	123	980140	126	989171	105	2003168-136	123	2092418-0710	126
815134	123	980142	126	989387	121	2003779-22	108	2092418-0711	101
815136	102	980144	102	989615	105	2003779-23	108	2092418-0712	126
815137	121M4F	980146	126	989692	105	2003779-24	108	2092418-0715	108
815138	121	980147	123	989693	105	2003779-25	108	2092418-0716	108
815139	102	980148	102	994634	108	2004746-97	124	2092418-0717	108
815158	102	980149	102	995001	121	2004746-114	108	2092418-0719	108
815160	102	980150	127	995002	102	2004746-115	108	2092418-0720	108
815160A	102	980153	102	995003	102	2057013-0701	129	2092418-0721	108
815160B	102	980155	121	995014	121	2057013-0702	129	2092418-0724	108
815160C	102	980372	126	995030	124	2057013-0703	129	2092418-1	126
815160D	102	980373	126	1473514-1	127	2076393	126	2092428-2	126
815160E	102	980374	126	1810037	108	2076403	126	2092418-5	126
815160F	102	980375	102	1810038	108	2076403-0703	126	2092418-6	126
815160H	102	980376	102	1810039	108	2076945-0701	102	2092418-7	126
815164	108	980426	100	1944748	102	2090056-1	104	2092609-001	123
815165	108	980432	100	1956016	121	2090056-5	104	2092609-0001	123
815166	124	980434	100	1960584	102	2090056-27	104	2092609-0002	123
815166-4	124	980435	126	1960643	121	2090924-6	102	2092609-0022	123
815167-3	124	980437	121	1961480	121	2090924-008	102	2092609-0705	123
815170	108	980438	100	1961835	121	2090924-0008	102	2092609-0706	123
815171	123	980439	100	1961837	102	2090924-8	102	2092609-0707	123
815171D	123	980440	123	1965017	121	2090924-8A	102	2092609-0713	123
815172	108	980441	126	1965079	121	2091211-0014	102	2092609-0715	121
815172A	108	980462	105	1967799	128	2091211-0005	102	2092609-0718	123
815173	108	980463	105	1967799-1	128	2091241-0719	126	2092609-0720	128
815173A	108	980505	126	1967801	128	2091241-1	100	2092609-0721	123
815173C	108	980506	126	2000287-28	102	2091241-2	100	2092609-1	101
815173F	108	980507	126	2000625-31	102	2091241-3	100	2092609-2	101
815174	123	980508	102	2000625-32	102	2091241-5A	126	2092609-3	123
815174L	123	980509	126	2000625-33	102	2091241-7	100	2092609-5	101
815175	124	980510	102	2000625-34	102	2091241-0013	100	2092693-0724	108
815175H	124	980511	102	2000646-103	123	2091241-13	100	2092693-0725	108
815177	102	980514A	126	2000646-104	126	2091241-13A	100	2092693-1	102
815178	102	980545A	126	2000646-105	108	2091241-0014	100	2092693-2	126
815179	102	980626	126	2000646-106	126	2091241-14	100	2092693-3	126
815180-3	124	980636A	126	2000646-107	123	2091241-15	100	2092693-4	126
815180-4	124	980833	126	2000646-108	102	2091241-15A	100	2092693-8	102
815180-7	124	980834	126	2000646-109	127	2091241-0015	102	2092693-9	126
815181	102	980835	126	2000646-110	127	2091241-0018	102	2093308-070	108
815181A	102	980836	102	2000646-111	102	2091260-1	103	2093308-0701	101
815181B	102	980837	102	2000646-113	121	2091260-2	103	2093308-0702	101
815181C	102	980958	126	2000752-80	128	2091260-3	101	2093308-0703	101
815181D	102	980959	126	2000757-80	108	2091578-0702	102	2093308-0704	123
815182	123	980960	102	2000804-7	123	2091578-1	102	2093308-0705	108
815183	123	980961	102	2000804-8	123	2091858-11	121	2093308-0706	108
815184	123	981143	126	2000804-9	102	2091859-0711	108	2093308-0708	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
2093308-1	108	8020540	102	A1M-1	128	A158C	123	AC116	102
2093308-2	108	8020560	102	A1N	124	A159B	123	AC117	102
2093308-3	108	8021897	102	A1P	128	A163	126	AC117P	102
2097013-0702	128	8021898	102	A1P-1	128	A168	123	AC120	102
2243255-1	102	8022630	102	A1P/4922	108	A170	129	AC121	102
2320031	108	8023892	102	A1P/4923	108	A301	108	AC122	102
2495012	100	8024250	127	A1R	128	A306	108	AC122GRN	100
2495013	100	8024390	102	A1R-1	128	A307	108	AC122RED	100
2495014	102	8538640	126	A1R-2	128	A310	128	AC122YEL	100
2495166-1	108	9100502	102	A1R/4924	108	A311	128	AC123	102
2495166-2	123	9100621	102	A1R-1/4925	108	A321	108	AC124	100
2495166-4	123	9100706	102	A1R-2/4926	108	A344	108	AC125	100
2495166-8	123	9100944	102	A1S	128	A345	108	AC126	100
2495166-9	123	1302000	102	A1T	123	A346	108	AC127	103
2495200	100	13020002	102	A1T-1	123	A376	126	AC127-132	103
2712080	102	23114001	108	A1U	108	A415	108	AC128	100
3004856	123	23114004	127	A1V	128	A417	128	AC129	126
3005861	123	23114009	127	A1W	123	A418	128	AC130	101
3146977	130	23114015	123	A1Z	108	A419	128	AC131	102
3152170	130	23114026	127	A2A	128	A420	128	AC132	102
3170757	128	23114031	108	A2B	128	A435	126	AC134	126
3539307-001	108	23114033	121	A2C	108	A466	128	AC135	100
3539307-002	108	23114034	108	A2D	108	A467	108	AC136	100
4080187-0502	152	23114043	108	A2E	130	A473	108	AC137	102
4813466	123	25114116	108	A2EBLK	130	A480	128	AC138	102
6100724-2	100	25114121	108	A2EBRN	130	A482	128	AC141	101
7026011	108	25114130	123	A2F	128	A483	128	AC141B	101
7026012	108	25114143	152	A2FGRN	123	A484	128	AC141K	101
7026013	108	25114161	108	A2G	108	A485	128	AC150	102
7026014	123	27125080	123	A2H	108	A490	128	AC150GRN	100
7026015	123	27125090	123	A2J	128	A492	128	AC150YEL	100
7026016	123	27125140	123	A2K	128	A494	123	AC151	100
7026019	129	27125150	102	A2L	123	A514-027662	102	AC151R	100
7026020	123	27125160	123	A2M	128	A522	130	AC152	102
7274653	121	27125210	108	A2N	128	A567	123	AC153	102
7276211	100	27125230	126	A2N-1	128	A567A	123	AC153K	102
7276605	105	27125240	100	A2N-2	128	A572	130	AC154	102
7278421	100	27125250	123	A2P	128	A667RED	108	AC155	102
7278422	102	27125260	102	A2S	130	A748	123	AC156	102
7278423	102	27126220	108	A2SB240A	108	A749	123	AC157	103
7279293	105	48134666	123	A2SB242A	104	A937-1	123	AC160	126
7279379	100	61260039	126	A2SB248A	104	A937-3	123	AC160A	126
7279779	126	61260039A	126	A2T	128	A1016	129	AC160B	126
7279780	126	570004503	123	A2U	124	A1109	108	AC160GRN	100
7279781	126	5700045452	123	A2V	108	A1170	108	AC160RED	100
7279788	100	570005503	123	A2W	128	A1220	126	AC160YEL	100
7279789	100	152221011	102	A2Y	108	A1243	100	AC161	102
7279940	100	1522210131	126	A2Z	128	A1314	128	AC162	102
7279941	100	1522210300	126	A3E	128	A1341	128	AC163	102
7281307	100	1522210921	126	A3F	128	A1377	100	AC164	126
7281308	100	1522211021	126	A3G	128	A1378	100	AC165	102
7281309	100	1522211200	102	A3K	128	A1379	128	AC166	102
7281310	102	1522211328	102	A3M	128	A1380	123	AC167	102
7281891	100	1522214400	126	A3N	128	A1383	126	AC168	102
7282315	105	1522214411	126	A3T	123	A1384	126	AC169	126
7284751	102	1522214435	126	A3U	130	A1462	108	AC170	100
7285663	121	1522214821	126	A3W	128	A1518	108	AC171	100
7292308	126	1522216500	102	A3Y	128	A1519	108	AC172	101
7294133	102	1522216600	126	A3Z	128	A1520	108	AC175	103
7295195	108	1522217400	126	A4A	128	A1521	108	AC175P	103
7295196	108	152223720	123	A4B	128	A1567	123	AC179	101
7296314	123	3121004900	126	A4F	128	A1567-1	123	AC180	102
7570003-01	121	3121007744	126	A4G	108	A3011112	128	AC181	101
7570004	123	3121024033	126	A4H	128	A403764-2	129	AC182	100
7570004-01	123	3121024044	126	A18	130	AA1	128	AC183	101
7570005	123	3121047111	126	A24	108	AA2	101	AC184	100
7570005-01	123	3122005400	102	A102	126	AA3	126	AC185	101
7570005-02	123	5700045452	123	A104	123	AA4	121	AC186	101
7570005-03	123	57000901504	123	A106	108	AA5	105	AC187	103
7570008	123	A1A	123	A107	128	AC105	102	AC187/01	103
7570008-02	123	A1B	123	A108	123	AC106	102	AC188	102
7570009-01	123	A1E	108	A111	123	AC107	126	AC188/01	102
7570009-21	128	A1F	123	A115	128	AC107M	126	AC197	102
7570013-01	129	A1G	108	A122	126	AC108	102	AC198	102
7570022-01	130	A1G-1	128	A128	123	AC109	102	AC199	102
8000736	128	A1H	123	A128A	123	AC110	102	AC199	102
8000737	128	A1J	128	A132	128	AC113	102	AC201	102
8020322	102	A1K	108	A156	123	AC113A	102	AC202	102
8020324	102	A1L	123	A158	123	AC114	102	AC203	100
8020333	102	A1M	128	A158B	123	AC115	102	AC207	102

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement
ACY28	102	AF142	100	AR8	104	AT11	126	B1274B	121
ACY29	102	AF143	100	AR8P404R	121	AT12	126	B1368	121
ACY30	102	AF144	126	AR9	104	AT13	126	B1368A	121
ACY31	102	AF146	100	AR10	104	AT14	126	B1368B	121
ACY32	102	AF147	126	AR11	104	AT15	100	B1368C	121
ACY34	102	AF148	126	AR12	104	AT16	100	B1368D	121
ACY35	102	AF149	126	AR13	104	AT17	100	B1368E	121
ACY36	102	AF150	126	AR14	121	AT20H	102	B1368F	121
ACY38	100	AF164	102	AR15	124	AT20M	102	B3746	128
ACY40	100	AF165	102	AR18	124	AT20N	102	B5000	152
ACY41	102	AF166	126	AR102	102	AT30H	102	B10064	104
ACY44	102	AF168	102	AR103	126	AT30M	102	B10069	104
AD003	121	AF169	126	AR104	126	AT30N	102	B10142	127
AD104	121	AF170	126	AR105	126	AT50	102	B10142A	127
AD105	121	AF171	126	AR107	123	AT52	101	B10142B	127
AD130	121	AF172	126	AR108	123	AT53	101	B10143	127
AD131	121	AF178	126	AR200	108	AT71	101	B10143A	127
AD132	121	AF179	126	AR201	108	AT72	101	B10162	121
AD138	104	AF180	126	AR202	108	AT73R	101	B10163	121
AD138/50	121	AF181	126	AS33867	102	AT74	101	B10474	121
AD139	104	AF182	126	AS33868	102	AT75R	101	B10475	121
AD140	121	AF185	126	AS34280	103	AT76R	101	B10912	121
2-AD140	121	AF186	102	ASY12-1	126	AT77	101	B10913	121
AD143	121	AF186G	106	ASY12-2	126	AT100H	102	B170000	130
AD148	131	AF186W	126	ASY13-1	126	AT100M	100	B170000BLK	130
AD149	127	AF188	102	ASY13-2	126	AT100N	102	B170000BRN	130
AD150	121	AF192	101	ASY14	126	AT312	128	B170001	130
AD152	131	AF193	100	ASY14-1	126	AT316	128	B170001BLK	130
AD155	131	AF200	126	ASY14-2	126	AT521	101	B170001BRN	130
AD156	131	AF201	126	ASY14-3	126	AT551	101	B170002	130
AD157	131	AF202	126	ASY24	126	AT1856	130	B170003	130
AD159	121	AF202S	102	ASY26	100	AT5156	129	B170004	130
AD162	131	AFY10	126	ASY27	100	ATGP	102	B170005	130
AD164	131	AFY11	126	ASY28	101	AU101	127	B170006	130
AD166	127	AFY12	126	ASY29	101	AU102	127	B170007	130
AD167	127	AFY14	126	ASY30	126	AU105	127	B170009	130
AD169	131	AFY15	100	ASY31	100	AU109	104	B170010	130
ADY22	121	AFY16	126	ASY32	100	AU119	121	B170011	130
ADY23	121	AFY18	100	ASY48	100	AU20	121	B170012	130
ADY24	121	AFY34	102	ASY49	126	AU221	104	B170013	130
ADY26	105	AFY37	102	ASY50	100	AU222	104	B170014	130
ADY27	121	AFY39	102	ASY51	100	AU228	127	B170015	130
ADZ11	105	AFY40	126	ASY52	126	AV105	121	B170016	130
ADZ12	105	AFY40K	126	ASY53	101	AX91770	108	B170018	130
AE50	102	AFZ10	100	ASY54	102	B2S241	104	B170019	130
AEX79846	130	AFZ11	100	ASY55	126	B2SB244	104	B170020	130
AF101	100	AFZ12	102	ASY56	126	B5	102	B170021	130
AF102	126	AFZ23	100	ASY57	126	B5A	102	B170022	130
AF105	126	AG134	126	ASY58	126	B22-3	102	B170024	130
AF105A	126	AL100	127	ASY59	126	B22-4	102	B170025	130
AF106	126	AL102	127	ASY61	126	B23	102	B5493957-4	129
AF107	100	AL103	127	ASY62	101	B23-1	102	B5493957-5	129
AF108	100	AL210	100	ASY63	126	B23-2	102	B5493957-6	129
AF109	126	ALZ10	100	ASY67	126	B24-1	102	BA6	100
AF111	100	AM3235	130	ASY70	102	B26	102	BA6A	100
AF112	100	AMF104	130	ASY71	126	B49	102	BA67	128
AF113	100	AMF105	130	ASY72	101	B51	126	BA71	128
AF114	126	AMF115	130	ASY73	101	B131	152	BB71	128
AF115	126	AMF116	130	ASY74	101	B132	153	BC71	128
AF116	126	AMF117	130	ASY75	101	B134	121	BC107	123
AF117	126	AMF117A	130	ASY76	100	B134A	121	BC107A	108
AF118	126	AMF118	130	ASY77	100	B134C	121	BC107B	108
AF120	126	AMF118A	130	ASY80	100	B169	123	BC108	123
AF121	126	AMF119	130	ASY86	101	B177	121	BC108A	108
AF124	126	AMF119A	130	ASY87	101	B178	121	BC108B	108
AF125	126	AMF120	130	ASY88	101	B179	121	BC108C	108
AF126	126	AMF120A	130	ASY89	101	B224	101	BC109	108
AF127	126	AMF210	130	ASZ10	126	B1017	104	BC109B	108
AF128	100	AMF210A	130	ASZ11	126	B1022	102	BC109C	108
AF129	126	AO1	126	ASZ15	121	B1058	102	BC111	108
AF130	126	AO7	101	ASZ17	121	B1151	104	BC112	108
AF131	126	AO2	128	ASZ18	121	B1151A	104	BC113	123
AF132	126	AQ3	128	ASZ20	102	B1151B	104	BC114	123
AF133	126	AQ4	123	ASZ21	102	B1152	104	BC115	128
AF134	126	AQ5	128	ASZ30	126	B1152A	104	BC116	129
AF135	126	AQ6	123	AT6	102	B1152B	104	BC117	128
AF136	126	AR4	104	AT6A	102	B1154	102	BC118	128
AF137	126	AR5	104	AT10H	102	B1215	121	BC119	128
AF138	126	AR6	104	AT10M	102	B1274	121	BC120	128
AF139	126	AR7	104	AT10N	102	B1274A	121	BC121	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
BC122	123	BD111	130	BFY45	128	BSY34	123	C424	108
BC123	123	BD112	130	BFY46	128	BSY38	128	C425	128
BC125	123	BD113	130	BFY47	128	BSY39	128	C426	128
BC126	129	BD115	130	BFY48	123	BSY44	124	C444	108
BC127	108	BD116	130	BFY49	128	BSY45	124	C450	108
BC128	108	BD118	130	BFY50	128	BSY46	124	C536E	123
BC129	123	BD119	124	BFY51	128	BSY51	123	C537F	123
BC130	123	BD120	124	BFY52	128	BSY52	123	C673	133
BC131	123	BD121	130	BFY55	128	BSY53	123	C674	133
BC134	108	BD132	153	BFY56	128	BSY54	123	C684	133
BC135	128	BD153	123	BFY56A	128	BSY55	123	C684A	133
BC136	128	BD100	130	BFY63	128	BSY56	128	C685	133
BC138	128	BDY11	130	BFY64	128	BSY58	123	C693E	123
BC139	129	BDY12	130	BFY65	128	BSY62	128	C693G	123
BC140	128	BDY13	130	BFY66	128	BSY63	128	C960	103
BC140A	128	BE6	100	BFY67	128	BSY70	108	C1437	100
BC140B	128	BEEA	100	BFY67A	128	BSY71	128	C1438	100
BC140C	128	BE71	128	BFY67C	128	BSY72	128	C9080	106
BC140D	128	BF15	108	BFY68	128	BSY73	108	C9081	106
BC141	128	BF153	108	BFY68A	128	BSY74	108	C9082	106
BC142	128	BF154	128	BFY69	128	BSY75	128	C9083	106
BC143	129	BF155	108	BFY69A	128	BSY76	128	C9084	106
BC148	108	BF158	108	BFY69B	128	BSY77	128	C9085	106
BC148C	123	BF159	108	BFY70	128	BSY78	128	C10215-2	126
BC149	123	BF160	108	BFY72	128	BSY79	128	C10227	102
BC153	129	BF162	108	BFY74	128	BSY80	108	C10230-3	102
BC154	106	BF163	108	BFY75	108	BSY81	128	C10258	126
BC155	128	BF164	108	BFY76	123	BSY82	128	C10260	126
BC180	108	BF165	128	BFY77	123	BSY83	128	C10261	126
BC442	108	BF166	128	BFY78	108	BSY84	128	C10262	126
BC1073	104	BF167	128	BFY79	108	BSY85	128	C10279-1	123
BC1073A	104	BF169	128	BFY90	108	BSY86	128	C10279-3	123
BC1274	104	BF173	108	BFY99	128	BSY87	128	C11021	102
BC1274A	104	BF175	128	BG71	128	BSY88	128	C36577	129
BC1274B	104	BF184	128	BH71	128	BSY90	123	C36578	128
BC6500	108	BF185	128	BI71	128	BSY91	128	C36579	128
BCY10	106	BF187	108	BI7201	123	BSY92	128	C36580	128
BCY11	106	BF188	108	BLY10	130	BSY93	108	CB1F4	105
BCY12	106	BF189	108	BLY11	130	BSY95	108	CD0000	123
BCY13	108	BF216	128	BLY12	130	BSY95A	108	CD0014	123
BCY15	123	BF217	128	BLY15	130	BSY168	108	CD0021	123
BCY16	123	BF218	128	BLY47	130	BT67	128	CD8000	123
BCY17	106	BFX12	106	BLY48	106	BT71	128	CD12000	123
BCY18	106	BFX13	106	BLY49	130	BU67	128	CD8021	128
BCY19	106	BFX17	128	BLY50	130	BU71	128	CDCl2077F	123
BCY21	106	BFX18	108	BLY61	128	BUY10	130	CDCl3000-18	123
BCY22	106	BFX19	108	BP67	128	BUY11	130	CDCl3016A	123
BCY23	106	BFX20	108	BQ67	128	BV67	128	CDQ10001	123
BCY24	106	BFX21	108	BR67	128	BV71	128	CDQ10002	108
BCY25	106	BFX61	108	BS67	128	BW67	128	CDQ10003	123
BCY26	106	BFY10	128	BS475	123	BW71	128	CDQ10004	108
BCY27	106	BFY11	128	BSX12	108	BX67	128	CDQ10005	123
BCY28	106	BFY12	128	BSX21	108	BX71	128	CDQ10006	108
BCY30	106	BFY13	128	BSX22	128	BY67	128	CDQ10008	108
BCY31	106	BFY14	128	BSX24	108	BY71	128	CDQ10009	123
BCY32	106	BFY15	128	BSX25	108	BZ67	128	CDQ10010	108
BCY33	106	BFY16	128	BSX26	108	BZ71	128	CDQ10011	128
BCY34	106	BFY17	128	BSX27	108	CS08A042	121	CDQ10012	128
BCY38	106	BFY18	128	BSX28	108	C63	128	CDQ10014	128
BCY39	106	BFY19	128	BSX29	106	C64	108	CDQ10016	108
BCY40	106	BFY22	128	BSX30	108	C73	100	CDQ10017	108
BCY42	128	BFY23	128	BSX35	106	C75	100	CDQ10018	123
BCY43	108	BFY23A	128	BSX38	108	C76	100	CDQ10019	108
BCY49	106	BFY24	128	BSX53	128	C82S	108	CDQ10020	108
BCY50	123	BPY25	128	BSX54	128	C101	106	CDQ10021	123
BCY51	128	BFY26	128	BSY10	128	C102	106	CDQ10022	108
BCY54	106	BFY27	128	BSY11	108	C103	108	CDQ10023	108
BCY56	108	BFY28	128	BSY17	108	C106	106	CDQ10024	123
BCY58	123	BFY29	128	BSY18	108	C111B	108	CDQ10026	108
BCY59	123	BFY30	128	BSY19	108	C118	106	CDQ10027	108
BCY69	108	BFY33	128	BSY20	108	C119	106	CDQ10032	108
BCY70	129	BFY34	128	BSY21	128	C201	106	CDQ10033	128
BCY72	129	BFY37	128	BSY22	108	C202	106	CDQ10035	108
BCY443	128	BFY39	128	BSY23	128	C302	106	CDQ10036	108
BCZ10	106	BFY39/1	128	BSY24	108	C313	108	CDQ10037	128
BCZ11	106	BFY39/2	128	BSY25	123	C400	108	CDQ10044	128
BCZ12	129	BFY39/3	128	BSY26	108	C401	106	CDQ10045	128
BCZ13	106	BFY40	128	BSY27	108	C402	129	CDQ10046	128
BCZ14	106	BFY43	128	BSY28	108	C407	106	CDQ10047	128
BD71	129	BFY44	128	BSY29	108	C420	128	CDQ10049	124

TRANSISTORS (cont'd)

Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement
CDT1309	121	CK762	126	CS1255HF	128	CTP1729	104	D28D3	152
CDT1310	121	CK766	100	CS1256HG	129	CTP1730	104	D28D4	152
CDT1311	121	CK766A	126	CS1258	123	CTP1731	104	D28D5	152
CDT1312	121	CK768	100	CS1259	123	CTP1732	104	D28D7	152
CDT1319	121	CK776	100	CS1286	123	CTP1733	104	D28D10	152
CDT1320	121	CK776A	100	CS1288	123	CTP1735	104	D29A4	128
CDT1321	121	CK790	102	CS1289	123	CTP1736	104	D29A5	128
CDT1322	127	CK791	102	CS1293	108	CTP1739	121	D30A1	129
CDT1349	121	CK793	102	CS1303	129	CTP3500	104	D63	123
CDT1349A	121	CK794	102	CS1340E	108	CTP3503	104	D64	103
CDT1350	121	CK870	102	CS1340G	108	CTP3504	104	D65	126
CDT1350A	121	CK871	126	CS1368C	123	CTP3508	104	D66	126
CIL511	108	CK872	102	CS1368D	123	CTP3544	104	D101B	102
CIL512	108	CK875	102	CS1369	129	CTP3545	104	D105B	102
CIL513	108	CK878	102	CS2711	128	CTP3552	104	D101	133
CIL521	108	CK879	102	CS2712	128	CTP3553	104	D1102	133
CIL522	108	CK882	102	CS2713	128	D019	100	D1301	133
CIL523	108	CK888	102	CS2714	128	D031	100	D1302	133
CIL531	108	CK891	102	CS2715	128	D038	100	D1303	133
CIL532	108	CK892	102	CS2716	128	D043	100	D1666	108
CIL533	108	CK942	129	CS2923	128	D063	126	DAT1A	126
CK4	126	CM0770	128	CS2924	128	D078	100	DAT2	102
CK4A	126	CM2550	121	CS3393	128	D079	126	DS1	101
CK13	100	CM2484	128	CS3394	128	D080	127	DS2	101
CK13A	100	CP400	130	CS3396	128	D081	121	DS3	102
CK14	100	CP401	130	CS3397	128	D083	103	DS4	101
CK14A	100	CP404	130	CS3398	128	D085	103	DS5	101
CK16	100	CP405	130	CS3605	128	D086	126	DS6	101
CK16A	100	CP406	130	CS3606	128	D087	108	DS7	101
CK17	100	CP407	130	CS3607	128	D088	108	DS8	101
CK17A	100	CP408	130	CS3707	128	D1A	123	DS9	101
CK22	102	CQT940A	104	CS3708	128	D1F	101	DS11	101
CK22A	102	CQT940B	104	CS3709	128	D-1R38	123	DS12	101
CK22B	102	CQT940BA	104	CS3710	128	D-2R38	123	DS14	102
CK22C	102	CQT1075	104	CS3711	128	D4D24	123	DS16	102
CK25	100	CQT1076	104	CS3843	128	D4D25	123	DS17	100
CK25A	100	CQT1077	104	CS3844	128	D4D26	123	DS19	100
CK26	100	CQT1110	121	CS3845	128	D7A30	128	DS21	100
CK26A	100	CQT1110A	121	CS3859	128	D7A31	128	DS22	100
CK27	100	CQT1111	121	CS3860	128	D7A32	128	DS23	100
CK27A	100	CQT1111A	121	CST1739	104	D10G1051	123	DS24	126
CK28	126	CQT1112	121	CST1740	104	D10G1052	123	DS25	102
CK28A	126	CR11544	104	CST1741	104	D11C1B1	104	DS26	100
CK64	102	CR11545	104	CST1742	104	D11C3B1	128	DS29	100
CK64A	102	CR11552	104	CST1743	121	D11C5B1	108	DS34	126
CK64B	102	CR11553	104	CST1744	121	D11C10B1	124	DS35	126
CK64C	102	CS360	123	CST1745	121	D11C11B1	124	DS36	126
CK65	102	CS1014	108	CST1746	121	D11C1F1	108	DS37	126
CK65A	102	CS1018	108	CT1122	104	D11C3F1	128	DS38	126
CK65B	102	CS1129E	128	CT1124	104	D11C5F1	108	DS41	126
CK65C	102	CS1168E	123	CT1124A	104	D11C10F1	124	DS42	126
CK65	102	CS1168F	108	CT1124B	104	D11C11F1	124	DS44	123
CK65A	102	CS1168G	123	CT1300	108	D11C201B20	123	DS45	123
CK65B	102	CS1168H	123	CT1500	108	D11C203B20	128	DS46	123
CK66C	102	CS1170F	129	CTP1104	104	D11C205B20	108	DS47	123
CK67	102	CS1225E	128	CTP1108	104	D11C210B20	124	DS51	126
CK67A	102	CS1225F	128	CTP1109	104	D11C211B20	124	DS52	126
CK67B	102	CS1226	104	CTP1111	104	P16E7	108	DS53	126
CK67C	102	CS1226E	108	CTP1117	104	D16E9	108	DS56	126
CK261	101	CS1226F	108	CTP1124	104	D16K1	108	DS62	126
CK262	101	CS1226G	108	CTP1133	121	D16K2	108	DS63	126
CK419	128	CS1227E	108	CTP1135	121	D16K3	108	DS64	126
CK422	128	CS1227F	123	CTP1136	104	D24A3394	108	DS65	126
CK474	128	CS1227G	123	CTP1137	104	D26B1	128	DS66	123
CK475	128	CS1229D	123	CTP1500	104	D26B2	128	DS67	123
CK476	108	CS1229E	128	CTP1503	104	D26C1	128	DS67W	123
CK477	108	CS1229F	128	CTP1504	104	D26E2	128	DS71	123
CK661	100	CS1229H	123	CTP1508	104	D26G1	128	DS72	123
CK662	100	CS1236D	123	CTP1509	105	D27C1	152	DS73	108
CK721	102	CS1237	129	CTP1511	121	D27C2	152	DS74	108
CK722	102	CS1238	108	CTP1512	121	D27C3	152	DS75	123
CK725	102	CS1243H	108	CTP1513	121	D27C4	152	DS76	123
CK727	102	CS1244J	108	CTP1514	121	D28A5	152	DS77	123
CK751	102	CS1245F	123	CTP1544	104	D28A6	152	DS78	108
CK754	102	CS1245G	123	CTP1545	104	D28A9	152	DS81	108
CK759	100	CS1245H	128	CTP1550	121	D28A10	152	DS83	129
CK759A	102	CS1245I	123	CTP1551	121	D28A12	152	DS85	108
CK760	100	CS1250E	128	CTP1552	104	D28A13	152	DS501	105
CK760A	102	CS1251E	129	CTP1553	104	D28D1	152	DS502	105
CK761	100	CS1255H	128	CTP1728	104	D28D2	152	DS503	104

## 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
DSS504	105	E-2445	102	EA15X50	108	EN697	108	ES15X19	108
DSS505	105	E-2447	103	EA15X51	108	EN706	128	ES15X20	123
DSS506	105	E2448	102	EA15X52	108	EN708	108	ES15X23	123
DSS509	130	E2449	128	EA15X53	105	EN914	108	ES15X24	123
DSS520	104	E2450	123	EA15X54	108	EN918	108	ES15X30	108
DSS525	105	E2451	100	EA15X55	108	EN2894A	129	ES15X31	102
DSS570	105	E2452	123	EA15X56	123	EN3009	123	ES15X32	102
DT41	104	E2453	102	EA15X57	128	EN3013	123	ES15X37	123
DT80	105	E2454	123	EA15X59	123	EN3014	123	ES15X42	123
DT100	105	E2455	123	EA15X63	123	E044A	102	ES15X43	121
DT161	123	E2459	123	EA15X68	123	E065	100	ES15X45	104
DT401	104	E-2460	124	EA15X72	123	E066	100	ESA213	126
DT1040	121	E-2461	123	EA15X73	123	E067	100	ESA223	126
DT1110	128	E2462	126	EA15X75	123	E068	100	ET1	100
DT1111	128	E2464	103	EA15X76	123	E070	126	ET2	100
DT1112	128	E2465	102	EA15X77	123	E0105	100	ET3	102
DT1120	128	E2466	101	EA15X83	123	ER15X4	126	ET4	102
DT1121	128	E2467	102	EA15X84	123	ER15X5	102	ET5	102
DT1122	128	E2474	126	EA15X85	123	ER15X6	126	ET6	104
DT1311	128	E2475	126	EA15X86	123	ER15X7	102	ET7	105
DT1321	128	E2476	102	EA15X88	121	ER15X9	102	ET8	101
DT1510	128	E2477	126	EA15X94	123	ER15X10	121	ET9	101
DT1511	128	E2478	126	EA15X96	123	ER15X11	126	ET10	102
DT1512	123	E2479	126	EA15X100	130	ER15X12	126	ET11	103
DT1520	128	E2480	102	EA1080	123	ER15X13	126	ET12	126
DT1521	128	E2481	102	EA1081	102	ER15X14	126	ET15X1	100
DT1522	123	E2482	100	EA1082	121	ER15X15	126	ET15X3	108
DT1602	123	EAD081	128	EA1129	129	ER15X16	126	ET15X4	121
DT1610	123	EAD086	129	EA1129	123	ER15X17	102	ET15X5	121
DT1612	123	EAD087	129	EA1135	123	ER15X18	102	ET15X7	108
DT4110	130	EAD090	128	EA1145	123	ER15X19	126	ET15X9	108
DT4111	130	EAD091	108	EA1337	126	ER15X20	126	ET15X10	123
OT4120	130	EAD092	123	EA1338	126	ER15X21	126	ET15X11	123
DT4121	130	EAD093	108	EA1339	126	ER15X22	102	ET15X12	123
DT6110	121	EAD094	108	EA1340	126	ER15X23	102	ET15X13	123
DTG110	104	EAD095	108	EA1341	104	ER15X24	126	ET15X14	123
DTG110B	104	EAD002	126	EA1342	126	ER15X25	126	ET15X15	123
DTG1011	104	EAD007	126	EA1343	123	ER15X26	126	ET15X17	121
DTG1040	104	EAD009	126	EA1344	123	ES3	126	ET15X18	108
DT1110	104	EAD013	108	EA1345	123	ES5	101	ET15X19	108
DTG1200	121	EAD053	126	EA1346	126	ES7	104	ET15X20	123
DTG2000	121	EA15Y11	126	EA1406	123	ES9	104	ET15X21	108
DTG2100	121	EA15X1	123	EA1407	123	ES10	105	ET15X23	108
DTG2200	121	EA15X2	102	EA1408	123	ES13	104	ET15X24	123
DTG2300	121	EA15X3	102	EA1451	123	ES14	126	ET15X27	123
DTG2400	121	EA15X4	102	EA1452	123	ES18	121	ET15X29	126
DU1	126	EA15X5	123	EA1499	123	ES19	102	ET15X30	108
DU2	126	EA15X6	105	EA1549	128	ES21	105	ET15X31	102
DU3	100	EA15X7	102	EA1562	108	ES23	102	ET15X32	102
DU4	102	EA15X8	102	EA1563	108	ES25	100	ET15X33	129
DU5	100	EA15X9	123	EA1564	123	ES26	100	ET15X36	128
DU6	121	EA15X10	104	EA1578	123	ES41	126	ET15X37	123
DU47	105	EA15X11	126	EA1581	128	ES46	103	ET15X38	129
E-044A	102	EA15X12	104	EA1628	123	ES501	105	ET15X39	129
E-065	126	EA15X13	126	EA1629	123	ES503	121	ET15X40	121
E-066	126	EA15X15	121	EA1630	123	ES3110	126	ET15X41	123
E-067	126	EA15X18	123	EA1684	128	ES3111	126	ET15X42	123
E-068	126	EA15X19	102	EA1696	128	ES3112	126	ET15X43	104
E-070	102	EA15X20	123	EA1697	128	ES3113	126	ET15X45	123
E-102	126	EA15X22	123	EA1698	128	ES3114	126	ET1511	102
E-105	126	EA15X23	102	EA1700	121	ES3115	126	ETS-003	130
E-132	126	EA15X24	123	EA1703	128	ES3116	126	ETT-GDC-12000	123
E-158	102	EA15X25	102	EA1716	128	ES3120	126	ETX18	123
E-241	100	EA15X26	121	EA1718	128	ES3121	126	EU15X1	108
E-214A	102	EA15X27	126	EA1733	123	ES3122	126	EU15X2	108
E-241B	102	EA15X28	102	EA1735	128	ES3123	126	EU15X27	128
E-2412	100	EA15X30	126	EA1740	130	ES3124	126	EU15X34	128
E-2427	103	EA15X31	123	EA1778	128	ES3125	126	EX15X25	102
E-2428	103	EA15X33	121	EA1-380	152	ES3126	126	F20-1001	108
E-2429	103	EA15X35	121	E80001	102	ES15X1	102	F20-1002	108
E-2430	103	EA15X36	102	E80003	102	ES15X4	102	F20-1003	108
E-2431	123	EA15X37	123	ED51	126	ES15X7	123	F20-1004	108
E-2434	108	EA15X38	121	ED52	100	ES15X8	100	F20-1005	108
E-2435	108	EA15X40	126	ED53	100	ES15X10	123	F20-1006	102
E-2436	123	EA15X41	126	ED54B	100	ES15X11	123	F20-1007	102
E-2438	126	EA15X43	126	ED55	102	ES15X12	123	F20-1008	102
E-2439	126	EA15X44	123	ED56	102	ES15X14	123	F20-1009	102
E-2440	126	EA15X45	108	ED57	102	ES15X16	123	F67E	121
E-2441	128	EA15X48	108	EK136	102	ES15X17	121	F215-1001	108
E-2444	123	EA15X49	108	EK159	100	ES15X18	108	F215-1002	108

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
F215-1003	108	FS1974	123	GC463	103	GER-A-D	126	GME4001	108
F215-1004	108	FS2299	126	GC464	102	GET103	102	GME4002	108
F215-1005	108	FS2109	108	GC465	103	GET113	102	GME4003	108
F215-1006	102	FS2301	108	GC466	102	GET113A	102	GME6001	108
F215-1007	102	FS25002	108	GC467	103	GET114	102	GME6002	108
F215-1008	102	FSP-1	108	GC520	102	GET572	121	GME6003	108
F215-1009	102	FSP-42	108	GC521	102	GET671	126	GME9001	108
F302-1	123	FSP-42-1	108	GC532	102	GET672	126	GME9002	108
F302-2	123	FSP-164	108	GC551	100	GET672A	126	GME9021	108
F302-1532	123	FSP-165	108	GC552	102	GET673	126	GME9022	108
F302-2532	123	FSP-166	108	GC578	102	GET691	126	GMO375	126
F306-001	123	FSP-166-1	108	GC579	102	GET692	126	GMO376	126
F306-022	123	FSP-215	108	GC580	102	GET693	126	GMO377	126
F247	108	FSP-242-1	123	GC581	102	GET871	100	GP1432	121
F2443	123	FSP-270-1	108	GC588	102	GET872	100	GPT16	121
F2448	123	FSP-289-1	108	GC608	103	GET873	126	GT11	100
F2450	108	FT025	128	GC609	103	GET873A	126	GT12	100
F2584	123	FT34C	108	GC630A	103	GET874	100	GT13	100
F2633	108	FT34D	108	GC639	102	GET875	100	GT14	100
F2634	108	FT40	108	GC640	102	GET880	126	GT14H	102
F2636	108	FT45	108	GC641	121	GET881	126	GT18	102
F4706	108	FT001	123	GC680	102	GET882	100	GT20	102
F4709	128	FT002	123	GC682	102	GET883	126	GT20H	102
F15810	108	FT003	108	GC685	102	GET885	100	GT20R	102
F15835	108	FT004	108	GC864	102	GET887	126	GT1202	101
F15840	123	FT004A	108	GC1034	101	GET888	126	GT31	102
F15840-1	123	FT005	123	GC1035	101	GET889	126	GT32	102
F15841	108	FT006	123	GC1036	101	GET890	126	GT33	102
FB401	126	FT008	123	GC1092	126	GET891	126	GT34	102
FB402	126	FT008A	123	GC1093X3	126	GET892	100	GT34HV	102
FB403	126	FT015	108	GC1134	102	GET895	100	GT34S	100
FB420	102	FT026	108	GC1142	126	GET896	100	GT35	103
FB421	102	FT027	108	GC1143	102	GET897	100	GT40	126
FB440	126	FT052	123	GC1144	123	GET898	102	GT41	126
FCS1168E641	108	FT053	108	GC1146	126	GET5117	126	GT42	126
FCS1168F813	128	FT300	124	GC1148	126	GET5116	126	GT43	126
FCS1168G704	123	FT709	124	GC1149	126	GEX8	101	GT44	126
FCS1227E814	108	FT1315	108	GC1150	102	GF20	102	GT45	126
FCS1227F743	108	FT1341	108	GC1159	100	GF21	102	GT46	126
FCS1227G810	108	FT1702	106	GC1182	126	GF32	102	GT47	126
FCS1229G	123	FT1746	106	GC1183	102	GFT44	100	GT66	126
FCS9014B	108	FW914	108	GC1186	102	GFT45	102	GT74	102
FCS9016F	108	FW918	108	GC1187	102	GFT3008/40	102	GT75	102
FCS9066	108	FW2369A	108	GC1302	100	G11	100	GT81	102
FE100	133	FW2484	108	GC4022	100	G12	102	GT81H	102
FE100A	133	FW2747C	100	GC4045	121	G13	126	GT81HS	102
FE102	133	FW2894	106	GC4062	121	G14	102	GT81R	102
FE102A	133	FW3014	108	GC4097	121	G15	101	GT82	102
FE104A	133	FW3299	108	GC4144	102	G16	101	GT83	100
FE400	133	FW3300	108	GC4267-2	121	G17	101	GT87	100
FE402	133	G11	100	GC5000	102	G18	103	GT88	100
FE402A	133	G12	102	GE-1	100	G19	121	GT109	102
FE404A	133	G13	126	GE-2	102	G10	105	GT109R	102
FF400	133	G14	102	GE-3	104	GI2711	123	GT122	102
FK914	108	G19	121	GE-4	105	GI2921	123	GT123	102
FK918	108	G110	105	GE-5	101	GI2922	123	GT132	102
FK2369A	108	G101079	101	GE-6	101	GI3708	123	GT153	102
FK2484	108	GA52829	100	GE-7	101	GI3709	123	GT167	102
FK2894	106	GA53149	100	GE-8	103	GI3710	123	GT210H	103
FK3014	108	GA53242	100	GE-9	126	GM0290	100	GT222	102
FK3299	108	GA53270	101	GE-10	123	GM0378	100	GT229	101
FK3300	108	GC60	100	GE-11	108	GM0380	108	GT269	100
FM708	108	GC61	100	GE-12	124	GM290	100	GT336	103
FM709	108	GC148	103	GE-13	121MP	GM290A	100	GT364	103
FM720A	108	GC181	100	GE-14	130	GM308	108	GT365	103
FM780	108	GC182	100	GE-15	130MP	GM378	100	GT366	103
FM871	108	GC282	126	GE-16	121	GM378A	102	GT751	102
FM910	108	GC283	126	GE-17	128	GM380	108	GT758	102
FM911	108	GC284	126	GE-18	128	GM428	121	GT759	100
FM914	108	GC285	103	GE-19	130	GM656A	100	GT759R	100
FM1613	108	GC286	103	GE-20	128	GM770	108	GT760	100
FM1711	108	GC343	102	GE-21	129	GME0404	106	GT760R	100
FM1893	108	GC360	100	GE-22	129	GME0404-1	106	GT761	100
FM2368	108	GC408	102	GE-23	152	GME0404-2	106	GT761R	100
FM2369	108	GC452	101	GE-24	152(2)	GME1001	128	GT762	100
FM2846	108	GC453	101	GE-25	127	GME1002	108	GT762R	100
FM2894	106	GC454	101	GE-26	153	GME2001	128	GT763	102
FM3014	108	GC460	126	GE-208	126	GME2002	108	GT764	100
FS1221	123	GC461	126	GE-FET-1	133	GME3001	108	GT766	100
FS1331	128	GC462	126	GER-A	102	GME3002	108	GT766A	102

## 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
GT792	101	HA5002	101	HEP233	105	HF6	108	HR-18	123
GT832	101	HA5003	101	HEP234	127	HF6H	100	HR-18A	123
GT903	103	HA5005	101	HEP235	127	HF6M	126	HR-19	123
GT904	101	HA5009	101	HEP240	124	HF7	108	HR-19A	123
GT905	101	HA5011	101	HEP242	129	HF8	108	HR-20	126
GT905R	103	HA5012	101	HEP243	128	HF9	128	HR-20A	126
GT947	101	HA5014	101	HEP245	152	HF10	129	HR-21	126
GT948	101	HA5016	101	HEP246	153	HF12H	126	HR-21A	126
GT948R	101	HA5020	101	HEP247	130	HF12M	126	HR-22	126
GT949	103	HA5021	101	HEP250	102	HF12N	126	HR-22A	126
GT949R	103	HA5022	101	HEP251	102	HF20H	126	HR-22B	126
GT1200	101	HA5023	101	HEP252	100	HF20M	126	HR-24	126
GT1223	102	HA5024	101	HEP253	100	HF50H	126	HR-24A	126
GT1604	100	HA5025	101	HEP254	102	HF50M	126	HR-25	126
GT1605	100	HA5026	101	HEP280	102	HJ-15	102	HR-25A	126
GT1606	100	HA7520	106	HEP281	100	HJ-15D	126	HR-26	126
GT1607	100	HA7522	106	HEP300	122	HJ-17	102	HR-26A	126
CT1608	101	HA7523	106	HEP302	122	HJ-17D	102	HR-27	126
GT1609	101	HA7526	106	HEP323	121	HJ-22	100	HR-27A	126
GT1644	106	HA7527	106	HEP624	121	HJ-22D	100	HR28	128
GT1658	103	HA7530	129	HEP625	127	HJ-23	100	HR-30	102
GT1665	102	HA7531	129	HEP626	127	HJ-23D	100	HR-36	123
GT2693	100	HA7532	106	HEP627	127	HJ-32	126	HR-38	123
GT2694	100	HA7533	106	HEP628	127	HJ-34	126	HR-39	102
GT2695	100	HA7536	106	HEP629	102	HJ-34A	126	HR40	126
GT2696	102	HA7537	106	HEP630	102	HJ-35	104	HR42	126
GT2765	101	HA7597	106	HEP631	102	HJ-37	100	HR43	126
GT2766	101	HA7598	106	HEP632	102	HJ-41	100	HR44	126
GT2767	101	HA7599	106	HEP633	102	HJ-43	102	HR45	126
GT2768	103	HA7630	129	HEP634	102	HJ-50	126	HR46	126
GT2883	102	HA7631	129	HEP635	100	HJ-51	126	HR-47	123
GT2884	101	HA7632	129	HEP636	100	HJ-54	100	HR-48	123
GT2885	102	HA7730	106	HEP637	100	HJ-55	126	HR50	126
GT2886	101	HA7732	106	HEP638	100	HJ-56	126	HR51	126
GT2887	102	HA7806	106	HEP639	126	HJ-57	126	HR52	126
GT2888	101	HA7807	106	HEP640	126	HJ-60	100	HR53	102
GT2906	101	HA7808	129	HEP641	101	HJ-60A	100	HR-101	104
GT5116	126	HA9048	106	HEP704	130	HJ-60C	100	HR-101A	121
GT5117	126	HA9049	106	HEP706	128	HJ-62	100	HR103	121
GT5148	102	HB-00054	102	HEP708	106	HJ-70	126	HR103A	121
GT5149	102	HB-00056	102	HEP709	108	HJ-71	100	HR105	121
GT5151	126	HB32	102	HEP710	129	HJ-72	100	HR105A	102
GT5153	126	HB33	102	HEP711	128	HJ-73	100	HR105B	121
GTE1	100	HB54	102	HEP712	128	HJ-74	100	HS5	102
GTE2	100	HB55	102	HEP713	128	HJ-226	100	HS-15	102
GTV	100	HB75	102	HEP714	128	HJ-228	100	HS-17D	102
GTX2001	121	HB77	102	HEP715	129	HJ-230	100	HS-22D	102
H10	102	HB171	102	HEP716	106	HJ-315	102	HS-23D	102
H12	105	HB172	102	HEP717	129	HJ-606	100	HS-29D	102
H12A	105	HB175	102	HEP718	108	HJX2	100	HS-102	102
H1567	123	HB176	102	HEP719	108	HM-00049	100	HS-170	102
HA00052	100	HB178	102	HEP720	108	HM-08014	102	HT-100	106
HA00053	100	HB186	102	HEP721	128	HO300	127	HT-101	106
HA12	126	HB187	102	HEP722	128	HR-1	102	HT400	128
HA15	100	HB263	102	HEP723	128	HR-2	102	HT401	128
HA49	100	HC 00730	101	HEP724	128	HR-2A	102	HT102341B	126
HA52	100	HC 01820	123	HEP725	128	HR-3	102	HT102341C	126
HA53	100	HC 01830	108	HEP726	128	HR-4	100	HT102351A	126
HA54	102	HC206	108	HEP727	128	HR-4A	100	HT103501A	126
HA56	102	HC454	108	HEP728	128	HR-5	100	HT200771B	126
HA70	126	HC460	108	HEP729	128	HR-6	100	HT304581B	123
HA102	100	HC461	108	HEP730	128	HR-7	100	HT304581C	123
HA103	126	HC515	124	HEP731	128	HR-7A	102	HV12	102
HA104	126	HC645	108	HEP732	128	HR-8	100	HV15	102
HA201	126	HC829	108	HEP733	128	HR-8A	100	HV16	102
HA235	126	HEP1	126	HEP734	128	HR-9	100	HV17	100
HA330	100	HEP3	126	HEP735	128	HR-9A	100	HV17B	102
HA342	126	HEP50	128	HEP736	128	HR-11	123	HV19	102
HA350	126	HEP51	129	HEP737	128	HR-11A	123	HV23	123
HA1040	126	HEP52	129	HEP738	128	HR-11B	123	HV23F	123
HA1350	102	HEP53	123	HEP739	129	HR-13	123	HV25	123
HA1360	102	HEP54	123	HEP801	133	HR-13A	123	IE-850	123
HA2001	133	HEP55	108	HEP802	132	HR-14	123	IF-65	102
HA2010	133	HEP56	108	HF1	108	HR-14A	123	IG-100	105
HA2190	126	HEP57	106	HF2	108	HR-15	123	IR1601	122
HA3210	126	HEP200	104	HF3	108	HR-15A	123	IR1602	122
HA3480	126	HEP201	105	HF3H	126	HR-16	123	IR172	122
HA3670	126	HEP230	121	HF3M	100	HR-16A	123	IR1774	122
HA4400	126	HEP231	105	HF4	108	HR-17	123	IRF E-100	133
HA5001	101	HEP232	121	HF5	108	HR-17A	123	ISO-162	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
J5062	126	M65B	106	M4463	121	M4730	127	MA882	102
J5063	102	M65C	106	M4464	123	M4732	128	MA883	102
J5064	102	M65D	106	M4465	123	M4733	128	MA884	102
J24561	108	M65E	106	M4466ORN	102	M4734	128	MA885	100
J24562	108	M65F	106	M4468BRN	102	M4737	123	MA886	100
J24563	108	M76	126	M4469RED	102	M4739	123	MA887	102
J24564	123	M77	126	M4470ORN	102	M4745	106	MA888	102
J24565	123	M78	126	M4471YEL	102	M4756	108	MA889	102
J24566	124	M78BLK	100	M4472GRN	102	M4757	108	MA890	100
JC100	105	M78RED	100	M4473	102	M4765	123	MA891	100
JEM-1	105	M78YEL	100	M4474YEL	102	M4767	121	MA892	100
JEM-2	105	M78GRN	100	M4475GRN	102	M4768	123	MA893	100
JEM-3	105	M84	121	M4476BLU	102	M4789	108	MA894	100
JEM-4	105	M84B	127	M4477PUR	102	M4815	129	MA895	100
JEM-5	105	M91A	128	M4478	129	M4819	128	MA896	100
JP40	104	M91B	128	M4484	100	M4820	108	MA897	100
JR5	106	M91B GRN	128	M4485	100	M4821	108	MA898	100
JR10	126	M91C	108	M4486	100	M4825	108	MA899	100
JR15	100	M91CM624	123	M4501	126	M4826	108	MA900	100
JR30	126	M91D	128	M4509	126	M4834	123	MA901	100
JR30X	126	M91E	128	M4510	102	M4837	108	MA902	100
JR40	104	M91F	128	M4545	126	M4838	123	MA903	100
JR100	126	M91FM624	123	M4545BLU	126	M4840	108	MA904	100
JR200	126	M100	133	M4545WHT	126	M4840A	108	MA909	102
K04774	104	M101	133	M4553BRN	102	M4841	123	MA910	102
K2001	108	M108	102	M4553RED	102	M4842	128	MA1318	102
K2501	107	M351	126	M4553ORN	102	M4842A	123	MA1702	100
K2502	107	M501	121	M4553YEL	102	M4843	108	MA1703	102
K2503	107	M652/PIC	129	M4553GRN	102	M4844	108	MA1704	100
K2509	107	M73RED	128	M4553BLU	102	M4845	108	MA1705	100
K4002	107	M77AORN	128	M4553PUR	105	M4852	128	MA1706	102
KD2101	102	M775BRN	128	M4562	102	M4853	128	MA1707	100
KD2102	123	M776GRN	128	M4563	102	M4854	128	MA1708	102
KGS100	100	M779BLU	128	M4564	102	M4855	108	MA4670	121
KT1017	121	M780WHT	128	M4565	102	M4857	108	MA520	126
KV1	102	M783RED	128	M4567	102	M4872	124	MA521	126
KV2	102	M784ORN	128	M4570	121	M4882	130	MA522	126
KV4	102	M785YEL	128	M4573	105	M4885	124	MA523	126
L5021	102	M786	128	M4582BRN	127	M4888A	121	MC101	126
L5022	102	M787BLU	128	M4583RED	121	M4888B	121	MC103	126
L5022A	102	M791	128	M4584GRN	121	M4898	123	MD420	102
L5025	102	M818WHT	128	M4586	126	M8014	100	MD501	102
L5025A	102	M822	123	M4589	126	M8062A	102	MD501B	102
L5108	126	M822A	123	M4590	106	M8062B	126	MDS31	102
L5121	126	M822A BLU	128	M4594	123	M8062C	102	MDS32	102
L5122	126	M822B	123	M4595	126	M8105	126	MDS33	102
L5181	126	M823WHT	128	M4596	102	M8116	123	MDS33A	102
L2091241-2	126	M823B	128	M4597	105	M8120	101	MDS33C	102
L2091241-3	126	M827BRN	128	M4597RED	105	M8124	126	MDS33D	102
LDA404	128	M828GRN	128	M4597GRN	105	M8640	102	MDS34	102
LDA405	128	M829A	106	M4603	126	M8640A	108	MDS35	126
LDA406	128	M829B	106	M4604	126	M9010	108	MDS36	100
LDA408	128	M829C	106	M4605	126	M9138	128	MDS37	126
LDA450	129	M829D	106	M4607	102	M9148	128	MDS38	102
LDS200	128	M829E	106	M4608	102	M9228	108	MDS39	102
LDS201	128	M829F	106	M4619RED	121	MA1	126	MDS40	102
LS52	104	M833	106	M4620GRN	121	MA23	102	ME040	106
LU2N544	126	M847BLK	128	M4621	126	MA23B	102	ME040A-2	106
M1X	128	M3519	128	M4622	105	MA25	102	ME213	123
M2N168A	101	M4313	102	M4623	127	MA100	100	ME213A	123
M24A	108	M4315	102	M4624	123	MA112	100	ME216	107
M24B	108	M4331	127	M4627	102	MA113	100	ME217	107
M25	108	M4363	126	M4630	123	MA114	100	ME900	123
M25A	108	M4363ORN	126	M4632	126	MA115	100	ME900A	123
M25B	108	M4363GRN	126	M4648	128	MA116	102	ME901	123
M54	123	M4363BLU	126	M4649	104	MA117	102	ME901A	123
M54A	123	M4363WHT	126	M4652	127	MA206	102	ME1001	123
M54B	123	M4364	126	M4689	128	MA240	102	ME1002	108
M54C	123	M4365	126	M4697	126	MA286	100	ME1075	128
M54BLK	128	M4366	126	M4706	108	MA287	100	ME1120	128
M54BRN	128	M4367	126	M4714	123	MA288	100	ME2001	128
M54RED	128	M4368	126	M4715	130	MA393	102	ME2002	108
M54ORN	128	M4398	102	M4722	121	MA393A	102	ME3001	108
M54YEL	128	M4442	106	M4722RED	121	MA393B	102	ME3002	108
M54GRN	128	M4450	102	M4722ORN	121	MA393C	102	ME4001	123
M54BLU	128	M4454	126	M4722YEL	121	MA393E	102	ME4002	123
M54WHT	128	M4456	126	M4722GRN	121	MA393G	102	ME4003	123
M54D	128	M4457	126	M4722BLU	121	MA393R	102	ME5001	108
M54E	128	M4459	127	M4722PUR	121	MA815	102	ME6001	128
M65A	106	M4462	102	M4727	104	MA881	100	ME6002	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
ME6003	123	MM1152	102	MP3614	121	MPS6542	108	NKT202	100
ME8201	106	MM1153	102	MP3615	121	MP56543	108	NKT203	100
ME9001	108	MM1154	102	MP3617	121	MP56546	108	NKT204	100
ME9002	108	MM11367/ZSC684	108	MP3730	127	MP56547	108	NKT205	100
ME9021	128	MM11382	108	MP3731	127	MP56548	108	NKT206	100
ME9022	108	MM11387	108	MPF102	132	MP56552	123	NKT207	100
MF1161	107	MM1157	107	MPF103	133	MP56553	123	NKT208	102
MF1162	107	MM11756	108	MPF104	133	MP56554	123	NKT211	126
MF1163	107	MM11757	107	MPF105	133	MP56555	123	NKT212	100
MF1164	107	MM11758	108	MPS25	121	MP56573	123	NKT213	100
MF3304	106	MM1803	108	MPS404	129	MP56574	123	NKT214	100
MHM1001	108	MM1941	123	MPS706	108	MP56575	123	NKT215	100
MHM1101	108	MM1943	128	MPS834	123	MP56576	123	NKT216	100
MHT180	105	MM1945	108	MPS918	107	MQ1	123	NKT217	100
MHT181	105	MM2483	128	MPS1097	126	MQ2	123	NKT218	100
MHT230	105	MM2484	128	MPS2711	128	MR3932	128	NKT221	126
MHT1802	105	MM2503	126	MPS2712	128	MR3933	128	NKT222	102
MHT1803	105	MM2550	100	MPS2713	128	MR3934	129	NKT222S1	100
MHT1804	105	MM2552	100	MPS2714	123	MST-10	128	NKT222S2	100
MHT1807	105	MM2554	100	MPS2715	128	MT100	108	NKT223	102
MHT1808	105	MM2894	106	MPS2716	128	MT101	108	NKT224	102
MHT1809	105	MM3000	128	MPS2894	107	MT102	108	NKT225	102
MHT2002	101	MM3726	129	MPS2923	128	MT106	108	NKT226	102
MHT2003	101	MM5000	100	MPS2924	128	MT107	108	NKT227	102
MHT2004	101	MM5001	100	MPS2925	128	MT3202	124	NKT228	102
MHT2008	101	MM5002	100	MPS2926	128	M2N168A	101	NKT231	102
MHT2009	101	MM22	121	MPS2926BRN	128	N1X	123	NKT232	102
MHT2010	101	MM23	121	MPS2926RED	128	N2XA	123	NKT242	106
MHT2305	105	MM24	104	MPS2926ORN	128	NA20	101	NKT243	126
MHT2414	128	MM25	104	MPS3392	128	NA30	103	NKT244	102
MHT2418	128	MM26	104	MPS3393	128	NKT4	100	NKT246	102
MHT4401	128	MM29	104	MPS3394	128	NKT5	100	NKT247	102
MHT4411	128	MM29GRN	121	MPS3395	128	NKT24	126	NKT249	126
MHT4412	128	MM29BLK	121	MPS3396	128	NKT25	126	NKT251	102
MHT4413	128	MM29PUR	121	MPS3397	128	NKT32	126	NKT252	126
MHT4451	128	MM29WHT	121	MPS3398	128	NKT33	126	NKT253	100
MHT4483	128	MM32	104	MPS3563	107	NKT42	126	NKT254	126
MHT4511	128	MM46	104	MPS3638	129	NKT43	126	NKT255	126
MHT4512	128	MM48	121	MPS3638A	129	NKT52	126	NKT261	100
MHT4513	128	MM49	121	MPS3639	106	NKT53	126	NKT262	126
MHT5906	152	MM52	102	MPS3640	106	NKT54	126	NKT263	100
MHT7401	128	MM53	102	MPS3646	108	NKT62	126	NKT264	126
MHT7411	128	MM53RED	102	MPS3693	128	NKT63	126	NKT265	126
MHT7412	128	MM53GRN	102	MPS3694	128	NKT64	126	NKT270	126
MHT7601	130	MM53BLU	102	MPS3702	106	NKT72	126	NKT271	126
MHT7602	130	MM60	102	MPS3703	106	NKT73	126	NKT272	126
MHT7603	130	MM61	127	MPS3704	108	NKT74	126	NKT274	126
MHT7607	130	MM63	127	MPS3705	128	NKT102	100	NKT275A	126
MHT7608	130	MM64	127	MPS3706	128	NKT103	100	NKT275B	126
MHT7609	130	MM73	104	MPS3707	128	NKT104	100	NKT275E	126
MHT9001	128	MM73BLK	104	MPS3708	128	NKT105	100	NKT275J	126
MHT9002	128	MM73WHT	104	MPS3709	128	NKT106	100	NKT278	126
MHT9004	128	MM194	127	MPS3710	128	NKT107	100	NKT303	102
MHT9005	128	MM500	105	MPS3711	128	NKT108	102	NKT308	102
MHT18010	105	MM500A	105	MPS3721	128	NKT109	100	NKT401	121
MJ480	130	MM501	105	MPS3826	128	NKT121	126	NKT402	121
MJ481	130	MM501A	105	MPS3827	128	NKT122	126	NKT403	121
MJ2251	124	MM502	105	MP56507	108	NKT123	126	NKT404	121
MJ2252	124	MM502A	105	MP56511	108	NKT124	126	NKT405	121
MJ2800	130	MM504	105	MP56512	128	NKT125	126	NKT415	121
MJ2801	130	MM504A	105	MP56513	128	NKT126	126	NKT416	121
MJ3201	124	MM505	105	MP56514	108	NKT127	126	NKT450	121
MJ3202	124	MM505A	105	MP56515	128	NKT128	126	NKT451	121
MJ4101	130	MM506	105	MP56516	129	NKT129	126	NKT452	121
MJ5202	124	MM506A	105	MP56517	129	NKT131	126	NKT452S1	121
MJ5203	124	MM507	105	MP56518	106	NKT132	126	NKT453	121
MJ5204	124	MM507A	105	MP56519	106	NKT133	126	NKT454	121
MJE370	153	MM525	121	MP56520	108	NKT141	126	NKT501	121
MJE371	153	MP2060	121	MP56521	108	NKT142	126	NKT503	121
MJE520	152	MP2061	121	MP56522	106	NKT143	126	NKT504	121
MM5E21	152	MP2062	121	MP56523	106	NKT144	126	NKT618	126
MM486	128	MP2137A	121	MP56528	128	NKT151	126	NKT675	126
MM487	128	MP2138A	121	MP56530	128	NKT152	126	NKT676	126
MM488	128	MP2139A	121	MP56531	128	NKT153/25	126	NKT677	126
MM511	128	MP2142A	121	MP56532	128	NKT154/25	126	NKT701	103
MM512	128	MP2143A	121	MP56533	106	NKT162	126	NKT703	103
MM513	128	MP2144A	121	MP56534	106	NKT163	126	NKT713	103
MM709	108	MP3611	121	MP56535	106	NKT164	102	NKT717	101
MM1139	100	MP3612	121	MP56539	108	NKT163/25	126	NKT734	101
MM1151	102	MP3613	121	MP56541	108	NKT164/25	126	NKT736	101

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
NKT751	103	OC26	104	OC306-3	126	P1C	129	PQ30	126
NKT752	103	OC27	104	OC307	126	P1D	129	PQ31	122
NKT753	101	OC28	104	OC307-1	126	P1G	121	PRC10A	121
NKT773	103	OC29	104	OC307-2	126	P1H	129	PRC15A	122
NKT781	101	OC30	131	OC307-3	126	P1J	129	PRC20A	122
NPC115	128	OC30A	131	OC308	126	P1K BLK	121	Power 12	121
NPC187	128	OC30B	131	OC309	100	P1K BRN	121	Power 25	121
NPC189	128	OC34	102	OC309-1	100	P1K RED	121	Power 40	105
NR5	101	OC35	104	OC309-2	100	P1K ORN	121	Power 60	105
NR10	101	OC36	104	OC309-3	100	P1K YEL	121	Power 80	105
NR20	103	OC38	102	OC318	102	P1K GRN	121	Power 99	121
NR30	101	OC41	100	OC330	102	P1K BLU	121	Power 299	121
NS381	108	OC42	126	OC331	126	P1L	126	PS-1	121
NS382	108	OC43	126	OC340	102	P1L/4956	126	PT2A	126
NS404	129	OC44	100	OC341	126	P1N	106	PT2S	126
NS475	108	OC45	100	OC342	126	P1N-1	106	PT3	121
NS476	108	OC46	126	OC343	126	P1N-2	106	PT3A	121
NS477	108	OC47	126	OC350	102	P1N-3	106	PT6	121
NS478	128	OC53	102	P1P	126	P1P	129	PT12	121
NS479	128	OC54	102	OC360	102	P1P-1	129	PT25	121
NS480	108	OC55	102	OC361	126	P1R	121	PT30	121
NS661	106	OC56	102	OC362	126	P1V	153	PT40	121
NS662	106	OC57	126	OC363	126	P1W	106	PT50	104
NS663	106	OC58	126	OC364	102	P1Y	127	PT150	121
NS664	106	OC59	126	OC390	126	P2A	106	PT155	121
NS665	106	OC60	126	OC410	100	P2D BRN	121	PT176	121
NS666	106	OC65	126	OC430	106	P2D RED	121	PT234	121
NS667	106	OC66	126	OC430K	106	P2D ORN	121	PT235	121
NS668	106	OC70	126	OC440	106	P2D GRN	121	PT235A	104
NS731	108	OC71	126	OC440K	106	P2K	153	PT236	104
NS731A	108	OC71A	102	OC443	106	P3139	130	PT236A	104
NS732	108	OC71N	102	OC443K	106	P5152	123	PT236B	121
NS732A	108	OC72	102	OC445	106	P5153	123	PT236C	121
NS733	108	OC73	102	OC449	106	P8890	121	PT242	121
NS733A	108	OC74	102	OC450	106	P8890A	121	PT250	105
NS734	108	OC75	102	OC460	106	P31898	121	PT255	121
NS734A	108	OC75N	102	OC460K	106	P75534	121	PT256	121
NS949	128	OC76	102	OC463	106	PA1000	106	PT285	106
NS1000	106	OC77	102	OC463K	106	PA1001	106	PT285A	121
NS1001	106	OC77M	102	OC465	106	PA10889-1	102	PT301	121
NS1356	108	OC79	102	OC465K	106	PA10889-2	102	PT301A	121
NS1500	107	OC80	102	OC466	106	PA10890	104	PT307	121
NS1510	107	OC81	102	OC466K	106	PA10890-1	121	PT307A	121
NS1672	129	OC81D	102	OC467	106	PADT20	126	PT501	105
NS1673	129	OC81DD	102	OC467K	106	PADT71	126	PT515	105
NS1674	129	OC83	126	OC468	106	PADT72	126	PT530	100
NS1861	129	OC84	126	OC468K	106	PADT73	126	PT530A	100
NS1862	129	OC122	102	OC469	106	PADT74	126	PT554	104
NS1863	129	OC123	126	OC469K	106	PADT25	126	PT555	121
NS1864	129	OC130	100	OC470	106	PADT26	126	PT612	128
NS1972	108	OC139	101	OC470K	106	PADT77	126	PT627	123
NS1973	108	OC140	101	OC502	102	PADT28	126	PT703	123
NS1974	108	OC141	101	OC502SQ	102	PADT30	126	PT720	123
NS1975	108	OC169	126	OC503	102	PADT31	126	PT850	128
NS2100	128	OC169R	126	OC604	102	PADT35	126	PT850A	128
NS2101	128	OC170	126	OC604SP	102	PADT40	126	PT851	123
NS3039	107	OC170R	126	OC612	126	PADT50	104	PT855	126
NS3040	107	OC170V	126	OC613	126	PADT51	126	PT856	126
NS3041	107	OC171	126	OC614	126	PAR12	121	PT886	123
NS3300	108	OC171R	126	OC615	126	PB110	121	PT887	128
NS6062	106	OC171V	126	OC700	106	PBE3014-1	102	PT888	128
NS6063	106	OC200	102	OC700A	106	PBE3014-2	102	PT896	128
NS6064	106	OC201	106	OC700B	106	PBE3020-1	102	PT897	128
NS6065	106	OC202	106	OC702	106	PBE3020-2	103	PT898	128
NS9400	128	OC203	106	OC702A	106	PBE3162	102	PT1558	128
NS9420	128	OC204	106	OC702B	106	PEP2	128	PT1559	128
NS9500	128	OC205	129	OC704	106	PEP-5	108	PT1610	128
NS9540	128	OC206	106	OC711	102	PEP-6	108	PT1835	128
NS9710	108	OC207	129	OC740	106	PEP-7	108	PT1836	128
NS9728	128	OC303	126	OC740G	129	PEP-8	108	PT1837	128
NS9729	128	OC304	102	OC740M	106	PEP9	128	PT1941	130
NS9730	128	OC304-1	126	OC740Q	106	PEP1001	128	PT2040A	123
NS9731	128	OC304-2	126	OC742	106	PEP2001	128	PT2760	123
OC16	104	OC304-3	126	OC742G	129	PET4001	128	PT3141	123
OC19	121	OC305	126	OC742M	106	PET9021	128	PT3141A	123
OC20	121	OC305-1	126	OC742O	106	PET9022	128	PT3501	123
OC22	104	OC305-2	126	OF129	102	PMT1767	108	PT3151A	108
OC23	104	OC306	126	ON174	126	PQ27	126	PT3151B	128
OC24	104	OC306-1	102	PJA	121	PQ28	102	PT3151C	128
OC25	104	OC306-2	126	P1B	102	PQ29	102	PT3500	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
PT3502	128	R227	100	RS1547	101	RS3867	100	RS5552	102
PT4800	123	R242	102	RS1548	102	RS3868	126	RS5553	102
PT4816	107	R244	100	RS1549	103	RS3880	102	RS5554	102
PT4830	107	R255	102	RS1550	100	RS3892	100	RS5556	102
PTO-6	121	R258	100	RS1553	101	RS3897	102	RS5557	102
PQO139	102	R289	102	RS1554	100	RS3898	126	RS5558	102
PQ27	126	R290	102	RS1555	102	RS3900	126	RS5563	102
PQ28	102	R291	102	RS2350	102	RS3901	126	RS5564	102
PQ29	102	R324	102	RS2351	102	RS3902	126	RS5565	102
PQ30	126	R338	102	RS2352	102	RS3903	126	RS5566	102
PQ31	104	R339	102	RS2353	102	RS3904	102	RS5567	102
PXB103	102	R340	123	RS2354	102	RS3905	126	RS5568	102
PXB113	102	R341	102	RS2355	102	RS3906	126	RS5602	102
PXC101	102	R424	100	RS2356	101	RS3907	126	RS5603	102
PXC101A	102	R424-1	102	RS2359	101	RS3911	126	RS5605	102
PXC101AB	102	R425	100	RS2360	101	RS3912	126	RS5607	102
O1-7C	102	R428	102	RS2364	101	RS3913	126	RS5608	102
O2N4006	102	R488	100	RS2365	101	RS3914	100	RS5610	102
O2N1526	126	R497	126	RS2366	101	RS3915	100	RS5612	121
O2N2613	102	R506	100	RS2367	102	RS3925	102	RS5613	121
Q34450	124	R515	126	RS2373	102	RS3926	102	RS5614	121
Q40359	126	R516	121	RS2374	102	RS3929	126	RS5616	121
QA-8	128	R530	102	RS2375	101	RS3931	103	RS5704	102
QA-11	129	R539	126	RS2675	102	RS3959-1	104	RS5704-2	102
QA-16	128	R558	100	RS2677	102	RS3986	126	RS5708	102
QG0074	104	R579	100	RS2679	126	RS3995	126	RS5708-2	102
QG0076	102	R592	101	RS2680	126	RS5008	102	RS5709	102
QG0254	123	R593	102	RS2683	102	RS5101	126	RS5711	102
OP-1	121	R608	102	RS2684	100	RS5102	102	RS5717	102
OP-1A	121	R608A	102	RS2685	100	RS5103	102	RS5717-1	102
OP-2	121	R684	126	RS2686	100	RS5104	100	RS5717-3	102
OP-6	121	R714	126	RS2687	100	RS5105	126	RS5717-6	102
OP-7	121	R715	126	RS2688	100	RS5106	100	RS5720	102
OP-8	130	R1273	102	RS2689	102	RS5107	126	RS5731	102
QR2378	102	R1274	102	RS2690	100	RS5108	126	RS5732	102
QSE1001	108	R1533	101	RS2691	100	RS5109	126	RS5733	102
QSE3001	108	R2444	124	RS2692	100	RS5201	126	RS5734	102
QSE5020	108	R2473	108	RS2694	100	RS5202	102	RS5735	102
QOV60526	102	R2476	108	RS2695	100	RS5203	102	RS5736	102
QOV60527	103	R2477	108	RS2696	100	RS5204	102	RS5737	102
QOV60528	102	R2749	102	RS2697	102	RS5205	126	RS5738	102
QOV60529	123	R2749M	102	RS3211	102	RS5206	126	RS5740-1	102
QOV60630	123	R2964	127	RS3275	102	RS5207	126	RS5742	102
QOV60537	103	R2982	130	RS3276	102	RS5208	126	RS5743	102
QOV60538	102	R3293	103	RS3277	100	RS5209	126	RS5743-1	102
R16	102	R4369	130	RS3278	100	RS5243-2	102	RS5743-2	102
R24-1001	102	RC1700	130	RS3279	100	RS5301	126	RS5743-3	102
R24-1002	102	RC2270	130	RS3280	102	RS5302	100	RS5744	102
R24-1003	102	RCA35953	102	RS3281	102	RS5303	100	RS5744-3	102
R24-1004	102	RCA35954	102	RS3282	102	RS5305	126	RS5745	102
R33	101	RCA40231	103	RS3283	126	RS5306	126	RS5746	102
R34	101	RM120	123	RS3284	102	RS5311	126	RS5747	102
R35	102	RR7504	123	RS3285	102	RS5312	126	RS5748	102
R52	102	RS406	102	RS3286	102	RS5313	126	RS5749	102
R56	102	RS593	126	RS3287	100	RS5314	126	RS5750	102
R61	101	RS684	126	RS3288	100	RS5401	126	RS5751	102
R62	101	RS685	126	RS3289	102	RS5402	100	RS5753	126
R63	101	RS686	102	RS3293	102	RS5403	100	RS5753-2	126
R64	102	RS687	102	RS3299	102	RS5406	102	RS5754	126
R65	102	RS1049	123	RS3301	102	RS5502	102	RS5755	126
R66	102	RS1059	123	RS3306	101	RS5503	102	RS5756	126
R67	102	RS1192	102	RS3308	102	RS5504	100	RS5757	126
R79	101	RS1513	101	RS3309	100	RS5505	102	RS5758	126
R80	101	RS1524	103	RS3310	102	RS5506	102	RS5759	126
R83	102	RS1530	101	RS3316	102	RS5507	102	RS5760	126
R87	102	RS1531	101	RS3316-1	102	RS5511	100	RS5761	126
R98	102	RS1532	101	RS3316-2	102	RS5530	102	RS5762	102
R177	101	RS1533	103	RS3318	102	RS5531	102	RS5765	126
R119	100	RS1534	101	RS3322	126	RS5532	102	RS5766	102
R120	102	RS1536	101	RS3323	126	RS5533	102	RS5767	102
R125	101	RS1537	101	RS3324	126	RS5534	102	RS5768	102
R135	101	RS1538	101	RS3359-1	121	RS5535	102	RS5802	126
R136	101	RS1539	100	RS3717	102	RS5536	102	RS5818	126
R137	101	RS1540	102	RS3726	102	RS5540	100	RS5835	121
R152	102	RS1541	102	RS3857	102	RS5541	102	RS5851	123
R163	100	RS1542	102	RS3858-1	121	RS5542	102	RS5852	102
R164	102	RS1543	102	RS3862	126	RS5543	102	RS5853	123
R186	100	RS1544	102	RS3863	126	RS5544	102	RS5854	123
R202	101	RS1545	102	RS3864	126	RS5545	102	RS5855	121MP
R203	101	RS1546	102	RS3866	126	RS5551	102	RS5856	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
RS5857	123	RS7522	108	RT7515	123	S1674	108	SA411	106
RS5821	126	RS7523	108	RT7517	123	S1674A	108	SA412	106
RS5822	126	RS7525	123	RT7518	123	S1682	108	SA413	106
RS5824	100	RS7526	123	RT7528	123	S1835	123	SA414	106
RS5840	102	RS7527	123	RT7638	123	S1891	123	SA415	106
RS6846	123	RS7528	123	RT6101A	100	S1891A	123	SA416	106
RS7101	108	RS7529	123	RT61015	102	S1891B	123	SA495	106
RS7102	108	RS7530	123	RT61016	102	S2020	108	SA495A	106
RS7103	123	RS7532	108	S-39T	121	S2059	124	SA496	106
RS7104	108	RS7533	108	S-40T	121	S2172	108	SA496A	106
RS7105	123	RS7542	123	S-40TB	121	S2590	123	SA496B	106
RS7106	108	RS7568	102	S-41T	121	S2617	108	SA537	106
RS7107	108	RS7569	123	S-42T	121	S3019	108	SA538	106
RS7108	108	RS7607	123	S-43T	121	S5327E	108	SA539	106
RS7109	108	RS7609	123	S-46T	121	S5328E	108	SA540	106
RS7110	108	RS7610	123	S-48T	121	S5670E	108	SAC40	106
RS7112	108	RS7611	123	S-49T	121	S15649	108	SAC40A	106
RS7113	108	RS7612	123	S-55TB	126	S15650	108	SAC40B	106
RS7114	108	RS7613	123	S-58TB	121	S15657	108	SAC42	106
RS7115	108	RS7614	123	S-70T	126	S15658	108	SAC42A	106
RS7116	123	RS7620	128	S-80T	126	S15659	108	SAC42B	106
RS7117	128	RS7622	123	S-87TB	126	S95101	126	SAC44	106
RS7118	108	RS7623	123	S-88TB	126	S95102	126	SB100	126
RS7119	108	RS7624	123	S133-1	123	S95103	126	SB168	102
RS7120	108	RS7625	123	S905	130	S95104	126	SB169	102
RS7122	108	RS7626	123	S305A	130	S95106	126	SB200	126
RS7123	108	RS7627	123	S-873TB	126	S95125	108	SB5122	126
RS7124	108	RS7628	123	S-874TB	126	S95125A	108	SC12	102
RS7125	108	RS7638	123	S1009	108	S95126	108	SC43	100
RS7126	108	RS7639	123	S1019	108	S95126A	108	SC44	100
RS7127	108	RS7665	129	S1037	108	S95201	102	SC45	102
RS7128	108	RS8406	102	S1041	108	S95202	123	SC46	100
RS7129	128	RS8407	103	S1044	108	S95203	102	SC56	103
RS7132	128	RS57433	102	S1058	108	S95204	102	SC63	102
RS7133	128	RS57042	102	S1059	108	S95206	102	SC65	123
RS7135	128	RS57062	102	S1060	108	S95207	102	SC66	102
RS7136	123	RT141	128	S1061	123	S95214	102	SC68	102
RS7138	108	RT154	128	S1062	108	S95253	121	SC69	102
RS7142	108	RT185	102	S1065	123	S95253-1	121	SC70	121
RS7144	123	RT188	128	S1066	123	S99101	126	SC71	126
RS7201	108	RT482	128	S1068	123	S99102	126	SC72	126
RS7202	108	RT483	128	S1069	123	S99103	126	SC73	102
RS7209	108	RT484	128	S1076	123	S99104	126	SC74	126
RS7210	108	RT929H	123	S1078	123	S99201	102	SC78	126
RS7212	108	RT930H	123	S1079	123	S99203	102	SC79	126
RS7215	108	RT2016	123	S1080	123	SA7	101	SC80	126
RS7217	108	RT2329	102	S1128	123	SA29	102	SC727	124
RS7218	108	RT2330	102	S1142	108	SA50	106	SC777	124
RS7219	108	RT2331	102	S1143	123	SA51	106	SC832	124
RS7220	108	RT2332	123	S1153	108	SA52	106	SC4004	124
RS7311	124	RT2709	102	S1221	123	SA52A	106	SC4044	123
RS7312	124	RT2914	123	S1221A	123	SA52B	106	SC4131	124
RS7315	124	RT2915	108	S1227	108	SA53	106	SC4131-1	124
RS7316	124	RT3063	128	S1245	123	SA54	106	SC4167	124
RS7317	124	RT3064	123	S1276	108	SA55	106	SC4244	124
RS7318	124	RT3065	128	S1286	108	SA56	106	SCR02C	122
RS7320	124	RT3069	128	S1296	108	SA70	106	SDD420	123
RS7321	124	RT3070	108	S1313	108	SA128	102	SDD421	128
RS7327	124	RT3071	129	S1316	108	SA197	102	SDD820	108
RS7328	124	RT3095	108	S1317	108	SA197-1	102	SDD821	108
RS7329	124	RT3096	103	S1318	108	SA197-2	102	SDD1220	128
RS7330	124	RT3097	102	S1331	123	SA197-3	102	SDD3000	108
RS7407	123	RT3098	102	S1331N	123	SA204	102	SDT9201	130
RS7408	123	RT3361	126	S1331W	123	SA205BRN	102	SE504	108
RS7410	123	RT3362	126	S1348	102	SA205RED	102	SE1001	108
RS7411	123	RT3363	102	S1349	102	SA205ORN	102	SE1002	123
RS7412	123	RT3364	102	S1360	108	SA205YEL	102	SE1010	123
RS7413	123	RT3365	102	S1361	108	SA205GRN	102	SE1019	108
RS7504	123	RT3565	123	S1362	108	SA205BLU	102	SE1044	108
RS7510	128	RT3566	102	S1363	123	SA205PUR	102	SE1331	123
RS7511	123	RT3567	123	S1364	123	SA205WHT	102	SE1419	108
RS7512	108	RT5151	128	S1369	123	SA240	102	SE2001	123
RS7513	123	RT5152	128	S1403	108	SA310	106	SE2002	128
RS7514	108	RT5230	129	S1408	108	SA311	106	SE3001	108
RS7515	108	RT5401	128	S1409	108	SA312	106	SE3002	108
RS7516	123	RT5402	128	S1559	123	SA313	106	SE3019	108
RS7517	108	RT5403	128	S1570	123	SA314	106	SE3030	130
RS7518	123	RT5404	128	S1629	123	SA315	106	SE3031	130
RS7519	128	RT7511	123	S1639	102	SA316	106	SE3032	130
RS7520	108	RT7514	123	S1640	126	SA410	106	SE3033	130

## 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
SE3035	130	SFT268	126	SJE277	153	SP62	127	SPS43-1	128
SE3036	123	SFT288	126	SJE278	152	SP148-3	121	SPS1097	129
SE4001	123	SFT298	101	SJE279	153	SP334	121	SPS1523	106
SE4002	123	SFT306	126	SJE280	152	SP404T	121	SPS3003	108
SE4010	123	SFT307	126	SJE305	152	SP441	121	SPS3015	128
SE5001	108	SFT308	126	SJE340	152	SP441D	104	SPS3724	106
SE5002	108	SFT315	126	SJE408	153	SP441G	121	SPS3735	128
SE5003	108	SFT316	126	SJE721	152	SP441S	104	SPS3900	128
SE5004	108	SFT317	126	SJE736	153	SP485	121	SPS3907	128
SE5006	108	SFT318	126	SJE737	152	SP485B	121	SPS3908	128
SE5020	108	SFT319	126	SJE769	152	SP485W	104	SPS3909	128
SE5021	108	SFT320	126	SJE787	153	SP485BLK	121	SPS3923	128
SE5022	108	SFT321	100	SJE799	153	SP485BRM	121	SPS3924	129
SE5023	108	SFT322	102	SJE1518	153	SP485BLU	121	SPS3925	128
SE5024	108	SFT323	100	SJE1519	152	SP485WHT	121	SPS3926	128
SE5025	108	SFT327	102	SJE1520	152	SP486WHT	121	SPS3927	129
SE5050	108	SFT337	126	SK7	101	SP486	106	SPS3929	108
SE5051	128	SFT351	100	SK1856	106	SP486W	121	SPS3930	128
SE6001	123	SFT352	102	SK2604	106	SP634	121	SPS3931	106
SE6002	123	SFT353	102	SK3003	102	SP649	121	SPS3936	128
SE6006	128	SFT354	126	SK3004	102	SP649-1	121	SPS3937	128
SE7001	123	SFT357	126	SK3005	100	SP834	121	SPS3938	128
SE7002	128	SFT357P	100	SK3006	126	SP875	121	SPS3940	128
SE7005	128	SFT358	126	SK3007	126	SP880	104	SPS3948	128
SE7006	124	SFT377	101	SK3008	126	SP880-1	121	SPS3951	128
SE7020	124	SFT400	128	SK3009	121	SP880-3	121	SPS3952	128
SE7030	124	SFT443	128	SK3010	103	SP891	104	SPS3957C	128
SE8001	128	SFT443A	128	SK3011	101	SP891B	121	SPS3967	128
SE8002	128	SFT445	128	SK3012	105	SP891W	104	SPS3968	128
SE8010	128	SFT526	100	SK3013	104MP	SP891BLU	121	SPS3971	128
SE40022	121	SFT713	128	SK3014	121	SP891G	121	SPS3972	128
SE50399	127	SFT714	123	SK3015	121MP	SP891GRN	121	SPS3973	128
SEC1078	128	SJ130	124	SK3015	104	SP891WHT	121	SPS3987	129
SEC1079	128	SJ670	123	SK3018	108	SP1108	104	SPS3988	129
SEC1477	128	SJ619	130	SK3019	108	SP1137	104	SPS3990	129
SEC1479	128	SJ619-1	130	SK3020	123	SP1403	121	SPS3999	128
SF1713	103	SJ806	124	SK3021	124	SP1481-1	121	SPS4002	108
SF1714	103	SJ1165	124	SK3024	128	SP1481-2	121	SPS4003	128
SF1726	123	SJ1201	124	SK3025	129	SP1481-3	104	SPS4004	128
SFT124	100	SJ1286	124	SK3026	152	SP1481-4	121	SPS4005	128
SFT125	102	SJ1470	130	SK3027	130	SP1482-2	121	SPS4006	128
SFT125P	102	SJ3604	130	SK3028	152(2)	SP1482-3	121	SPS4007	129
SFT143	100	SJ8701	130	SK3029	130MP	SP1482-4	121	SPS4008	128
SFT144	100	SJ910	130	SK3034	127	SP1482-5	104	SPS4009	128
SFT162	102	SJE100	152	SK3035	127	SP1482-6	121	SPS4013	106
SFT163	100	SJE106	152	SK3036	130	SP1482-7	121	SPS4014	129
SFT171	100	SJE108	153	SK3037	130MP	SP1483	121	SPS4016	128
SFT172	100	SJE111	153	SK3041	152	SP1483-1	121	SPS4017	128
SFT173	100	SJE112	153	SK3960	123	SP1483-2	121	SPS4018	129
SFT174	100	SJE113	152	SK5184A	124	SP1483-3	121	SPS4019	129
SFT184	103	SJE114	153	SK5915	123	SP1484	121	SPS4020	128
SFT186	128	SJE202	153	SK7181	123	SP1550-3	121	SPS4025	106
SFT191	121	SJE203	152	SKA4129	129	SP1556	121	SPS4026	129
SFT212	121	SJE210	153	SL100	108	SP1556-1	121	SPS4027	129
SFT213	121	SJE211	152	SL200	106	SP1556-2	121	SPS4028	129
SFT214	121	SJE221	153	SL201	106	SP1556-3	121	SPS4029	128
SFT221	126	SJE222	152	SL300	123	SP1556-4	121	SPS4030	108
SFT222	100	SJE227	153	SM217	100	SP1563-2	121	SPS4031	106
SFT223	126	SJE228	152	SM2700	123	SP1603	121	SPS4032	128
SFT226	126	SJE229	152	SM2701	123	SP1603-1	121	SPS4034	128
SFT227	126	SJE237	152	SM4508-B	123	SP1603-2	121	SPS4039	128
SFT228	126	SJE241	153	SM5564	123	SP1603-3	121	SPS4040	128
SFT229	126	SJE242	152	SM5643	123	SP1651	104	SPS4041	128
SFT237	126	SJE243	153	SM6251	128	SP1742	127	SPS4042	128
SFT238	121	SJE244	152	SM7815	123	SP1950	121	SPS4043	108
SFT239	121	SJE245	153	SM7836	123	SP2072	121	SPS4044	128
SFT240	121	SJE246	152	SM9135	123	SP2076	121	SPS4045	128
SFT241	100	SJE248	152	SN60	123	SP2158	124	SPS4049	128
SFT243	100	SJE253	152	SN80	108	SP2361	127	SPS4050	108
SFT250	121	SJE257	153	SN166	128	SP8400	128	SPS4051	108
SFT251	102	SJE261	152	SN167	128	SP8401	128	SPS4052	128
SFT252	100	SJE262	152	SNT204	106	SPC40	128	SPS4053	128
SFT253	102	SJE265	153	SO1	126	SPC42	128	SPS4054	106
SFT259	101	SJE267	153	SO2	126	SPC50	128	SPS4055	128
SFT260	101	SJE271	152	SO3	126	SPC51	128	SPS4056	129
SFT261	101	SJE272	152	SO25	102	SPC52	128	SPS4059	128
SFT264	105	SJE273	153	SO65	100	SPF024	133	SPS4060	128
SFT265	105	SJE274	152	SO65A	126	SPS4	128	SPS4061	128
SFT266	105	SJE275	153	SO88	102	SPS20	128	SPS4062	128
SFT267	105	SJE276	152	SP39	127	SPS38	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	129	ST30	108	ST910	108	SYL160	100	T77	102
SPS4067	128	ST31	108	ST926	108	SYL165	100	T78	103
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	128	ST123	102	STX0015	130	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	100
SPS7652	128	ST157	123	STX0087	100	SYL3613	100	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	STX0106	102	T0012	100	T1006	102
SSA43	129	ST176	123	STX0110	102	T0014	102	T1007	102
SSA43A	129	ST177	123	STX0114	102	T0015	102	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-3321	126	T1034	126
ST10	108	ST304	102	SV31	102	T-3323	126	T1038	126
ST11	108	ST302	102	SV3711	123	T39	100	T1040	104
ST12	108	ST370	100	SK3826	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	TO-014	100	TC2484	108	T1482	128
T1225	126	T1961	100	TO-015	100	TCR13	122	T1483	128
T1232	100	T2015	126	TO-033	102	TCR18	122	T1484	123
T1233	100	T2016	126	TO-038	102	TCR23	122	T1485	108
T1250	126	T2017	126	TO-039	102	TCR28	122	T1492	123
T1251	100	T2019	126	TO-040	102	TCR1005	122	T1493	123
T1275	129	T2020	126	TO-041	102	TCR1505	122	T1494	123
T1276	129	T2021	126	TO-101	100	TCR2005	122	T1495	123
T1289	100	T2022	126	TO-102	100	TF30	102	T1496	123
T1291	100	T2024	126	TO-103	102	TF49	102	T13010	126
T1298	100	T2025	126	TO-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	128
T1306	100	T2030	126	TA-4	102	TF66/30	100	T13027	101
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	TA101	102
T1326	100	T2122	100	TA1575B	100	TF75	102	TA103	100
T1327	100	T2159	100	TA1614	121	TF77	102	TA104	102
T1328	100	T2172	100	TA1620A	103	TF78	123	TA105	100
T1334	100	T2173	100	TA1620B	103	TF78/30	100	TA107	104
T1342	100	T2256	100	TA1628	126	TF78/30Z	121	TA103	104
T1346	100	T2257	100	TA1650A	126	TF78/60	100	TA104	105
T1352	102	T2258	100	TA1655B	100	TF80/30	121	TA104	133
T1363	126	T2259	100	TA1658	126	TF80/302	121	TA108	108
T1364	126	T2260	100	TA1659	126	TG48	102	TA108	128
T1366	104	T2261	100	TA1660	126	T-H2SC313	108	TA108	128
T1366A	704	T2322	126	TA1662	126	T-H2SC387	108	TA124	108
T1367	104	T2323	126	TA1682	121	T-H2SC536	123	TA134	132
T1367A	104	T2324	126	TA1682A	121	T-H2SC693	123	TA137	129
T1368	104	T2357	106	TA1697	102	T-H2SC715	123	TA138	129
T1368A	104	T2364	126	TA1704	100	T1338	126	TA144	128
T1369	104	T2379	126	TA1705	121	T1363	100	TA145	128
T1369A	104	T2384	126	TA1706	100	T1364	100	TA146	128
T1370	104	T2439	100	TA1730	102	T1365	100	TA147	128
T1370A	104	T2440	100	TA1731	126	T1366	104	TA148	128
T1387	126	T2441	100	TA1755	126	T1366A	104	TA149	128
T1388	126	T2446	123	TA1756	126	T1367	104	TA151	128
T1389	126	T2788	100	TA1757	126	T1367A	104	TA152	128
T1390	126	T2878	100	TA1759	101	T1368	104	TA153	129
T1391	126	T2896	126	TA1763	100	T1368A	104	TA154	129
T1400	126	T2945	126	TA1763A	100	T1369	104	TA155	128
T1401	126	T2946	102	TA1765	121	T1369A	104	TA156	128
T1403	126	T3005	100	TA1766	101	T1370	104	TA157	128
T1415	123	T3321	102	TA1767	121	T1370A	104	TA158	132
T1416	123	T3322	102	TA1771	101	T1387	126	TA159	132
T1417	123	T50818	126	TA1772	101	T1388	126	TA160	123
T1454	100	T6028	126	TA1773	121	T1389	126	TA161	123
T1459	100	T6029	126	TA1778	100	T1390	126	TA162	108
T1460	126	T6030	126	TA1782	100	T1391	126	TA163	108
T1474	100	T6031	126	TA1783	100	T1393	100	TA164	108
T1495	123	T6032	126	TA1794	121	T1395	100	TA167	128
T1510	100	T10010	102	TA1796	126	T1396	100	TA168	128
T1524BRN	126	T11618	100	TA1797	126	T1397	100	TA183	128
T1524BRN/RED	126	T13000	102	TA1798	126	T1398	100	TA184	108
T1546	102	T152148	100	TA1828	126	T1399	126	TA185	108
T1548	126	T50339A	102	TA1829	126	T1400	100	TA190	102
T1573	102	T50631	102	TA1830	126	T1401	126	TA191	126
T1574	102	T50944	100	TA1846	126	T1402	126	TA192	126
T1577	102	T52147	100	TA1847	126	T1403	126	TA19316	126
T1583	102	T52147Z	100	TA1860	126	T1407	108	TA1895	126
T1618	126	T52148Z	100	TA1861	126	T1408	108	TA13016	108
T1642B	123	T52149	100	TA1881	121	T1409	108	TA13016A	108
T1654	126	T52149Z	100	TA1890	121	TA110	108	TA13024	100
T1654BLU	126	T52150	102	TA1891	121	TA111	108	TA13032	100
T1657	126	T52150Z	102	TA1928A	102	TA115	123	TA13031	100
T1690	126	T52151	102	TA2083	127	TA116	123	TA13040	100
T1691	126	T52151Z	102	TA2188	127	TA117	108	TA13027	100
T1692	126	T52159	102	TA2301	121	TA118	108	TA13040	100
T1737	126	T59235A	123	TA2322	126	TA119	108	TA13045	100
T1738	126	T59247	102	TA2503	108	TA120	128	TA13041	126
T1740	102	T59249	102	TA2577A	130	TA122	108	TA13042	126
T1788	126	T59276	123	TA6200	128	TA124	128	TA13043	126
T1814	126	T59277	123	TAC047	123	TA130	128	TA13044	126
T1831	126	TO-003	100	TC0914	108	TA431	108	TA13045	126
T1877	100	TO-004	100	TC0918	108	TA432	128	TA13046	126
T1902	100	TO-005	100	TC2369A	108	TA480	108	TA13047	126
T1903	102	TO-012	100	TC2483	108	TA481	123	TA13048	126

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
T1XM10	100	TN J60283	102	TR06	126	TR722	102	TRC71	102
T1XM11	126	TN J60362	126	TR-6R26	102	TR760	126	TRC72	102
T1XM13	100	TN J60363	126	TR-6R35	123	TR761	126	TR-RR38	123
T1XM14	100	TN J60364	126	TR07	126	TR762	126	TRS1005	124
T1XM15	100	TN J60365	102	TR-7R35	123	TR763	102	TRS1005LP	124
T1XM16	100	TN J60604	108	TR08	101	TR1009	130	TRS1205	124
T1XM17	100	TN J60605	108	TR-8R35	123	TR1490	130	TRS1405	124
T1XM18	100	TN J60606	108	TR09	103	TR1491	130	TRS1405LP	124
T1XM19	100	TN J60607	108	TR10	101	TR1492	130	TRS1605	124
T1XM101	100	TN J60608	100	TR11	126	TR1493	130	TRS1805	124
T1XM103	100	TN J60610	102	TR12	100	TR1512-80	108	TRS1805LP	124
T1XM104	100	TN J60611	102	TR13	100	TR1605LP	124	TRS2005	124
T1XM105	100	TN J60612	102	TR14	126	TR8001	126	TRS2005LP	124
T1XM106	100	TN J60728	102	TR15	100	TR8002	126	TRS2255	124
T1XM107	100	TNT839	108	TR16	104	TR8003	126	TRS2255LP	124
T1XM108	100	TNT840	108	TR17	126	TR8004	108	TRS2505	124
T1XM201	126	TNT841	108	TR18	126	TR8005	124	TRS2505LP	124
T1XM202	126	TNT843	108	TR19	129	TR8006	121	TR82755	124
T1XM203	126	TO-003	126	TR20	126	TR8007	102	TRS2755LP	124
T1XM204	126	TO-004	126	TR21	128	TR310011	102	TRS3015LP	124
T1XM205	126	TO-005	102	TR22	128	TR310012	102	TRS3016LC	124
T1XM206	126	TO-012	121	TR23	124	TR310015	100	TRS4016LC	124
T1XM207	126	TO-014	102	TR25	128	TR310017	102	TRS5016LC	124
T1XS09	108	TO-015	121	TR26	130	TR310018	102	TR6016LC	124
T1XS10	108	TO-033	108	TR27	127	TR310019	126	TR-TR38	123
T1XS12	123	TO-038	108	TR28	129	TR310026	102	TS-1	102
T1XS13	123	TO-039	108	TR30	106	TR310065	126	TS-2	102
T1XS28	108	TO-040	108	TR34	102	TR310068	126	TS-3	102
T1XS29	108	TO-041	102	TR36	108	TR310069	126	TS-13	102
T1XS30	108	TO-101	102	TR38	108	TR310075	102	TS-14	102
T1SX31	108	TO-102	102	TR43	102	TR310107	102	TS-15	102
TK23C	126	TO-103	102	TR44	102	TR310123	126	TS-162	102
TK33C	101	TO-104	102	TR45	102	TR310124	126	TS-163	102
TK40	102	TQ1	128	TR51	126	TR310125	102	TS-164	102
TK40C	102	TQ2	108	TR52	126	TR310136	102	TS-165	102
TK41	102	TQ3	108	TR53	100	TR310139	126	TS-166	102
TK41C	126	TQ4	123	TR54	102	TR310147	126	TS-173	121
TK42	102	TQ5	108	TR55	100	TR310150	126	TS-176	104
TK42C	126	TQ6	108	TR56	104	TR310153	102	TS-601	100
TK45C	126	TQ7	108	TR57	105	TR310155	126	TS-602	100
TK49C	103	TQ8	108	TR62	126	TR310156	126	TS-603	102
TMT696	108	TQ9	108	TR71	102	TR310157	126	TS-604	102
TMT697	108	TQ63	129	TR72	102	TR310158	126	TS-609	105
TMT839	108	TQ63A	129	TR81	102	TR310159	102	TS-610	104
TMT840	108	TQ64	129	TR167	101	TR310160	103	TS-612	104
TMT841	108	TQ64A	129	TR182	101	TR310161	100	TS-613	104
TMT842	108	TQ5020	100	TR183	101	TR310164	102	TS-614	104
TMT843	108	TQ5021	126	TR193	101	TR310230	108	TS-615	126
TMT1543	123	TQ5022	126	TR194	101	TR310231	108	TS-616	100
TMT2427	108	TQ5023	102	TR211	101	TR310232	126	TS-617	100
TN53	128	TQ5025	102	TR212	101	TR310235	102	TS-618	100
TN55	128	TQ5026	102	TR213	101	TR310236	103	TS-619	102
TN56	128	TQ5027	102	TR214	101	TRA-4	123	TS-620	126
TN59	128	TQ5028	121	TR216	101	TRA-4A	123	TS-621	126
TN60	128	TQ5031	101	TR262-2	124	TRA-4B	123	TS-622	102
TN61	128	TQ5032	101	TR266-2	124	TRA-7R	121	TS-627A	100
TN62	128	TQ5034	126	TR271R26	130	TRA-7RM	121	TS-627B	100
TN63	128	TQ5035	126	TR320	102	TRA-8R	121	TS-629	102
TN64	128	TQ5036	121	TR320A	102	TRA-9R	123	TS-630	100
TN237	128	TQ5038	125	TR321	102	TRA-10R	126	TS-672A	100
TN J60063	126	TQ5039	101	TR321 (HF6H1)	100	TRA-11R	126	TS-672B	100
TN J60064	126	TQ5049	108	TR321A	102	TRA-12R	126	TS-673A	100
TN J60065	126	TR01	121	TR323	126	TRA-22	126	TS-673B	100
TN J60066	108	TR-1R26	126	TR323A	102	TRA-22A	126	TS-739	102
TN J60067	126	TR-1R35	108	TR331	126	TRA-22B	126	TS-739B	102
TN J60068	126	TR02	104	TR332	102	TRA-23	126	TS-740	102
TN J60069	126	TR-2R26	126	TR333	121	TRA-23A	126	TS-765	102
TN J60070	102	TR-2R35	108	TR334	105	TRA-23B	126	TS-1007	102
TN J60071	126	TR03	105	TR335	101	TRA-24	126	TS-1266	102
TN J60073	126	TR-3R26	126	TR336	101	TRA-24A	126	TS-1657	121
TN J60074	102	TR-3R35	108	TR337	101	TRA-24B	126	TS1727	102
TN J60075	127	TR-3R38	123	TR338	103	TRA-24C	102	TS1728	102
TN J60076	123	TR04	102	TR383 (H6FH-2)	102	TRA33	102	TT204	108
TN J60077	126	TR-4R26	126	TR482	100	TRA34	123	TT204A	108
TN J60079	102	TR-4R35	108	TR482A	100	TRA36	123	TT204AB	108
TN J60080	102	TR-4R38	129	TR508	102	TRC44	100	TT204B	108
TN J60279	126	TR05	102	TR508A	102	TRC44A	102	TT204C	108
TN J60280	126	TR-5R26	102	TR650	102	TRC45	102	TT1083	121
TN J60281	126	TR-5R35	123	TR653	100	TRC45A	100	TT1097	123
TN J60282	102	TR-5R38	123	TR721	102	TRC70	102	TV25B126	127



## 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	Type To Be Replaced	Sylvania ECG Replacement
TV2S8448	127	U2S93	126	VM30234	124	X137	105	ZT81	108	ZT3512	128
TV15	108	U2S8267	102	VM30241	123	X1005	121	ZT82	108	ZT3600	128
TV15A	108	U2T85	103	VM30242	123	XA101	126	ZT83	108	ZT3866	128
TV15B	108	U1177	133	VM30244	102	XA102	126	ZT84	108		
TV16	108	U1178	133	VM30245	124	XA103	100	ZT86	108		
TV17	108	U1180	133	VS-CS1255H	128	XA104	100	ZT87	108		
TV18	108	U1181	133	VS-CS1256HG	129	XA111	126	ZT88	108		
TV19	128	U1285	133	VS2SA71	126	XA112	126	ZT89	108		
TV20	108	U1322	133	VS2SA71B	126	XA121	126	ZT90	128		
TV44	100	U1323	133	VS2SA103	126	XA122	126	ZT93	128		
TV115	108	U1324	133	VS2SA378	126	XA123	126	ZT94	128		
TV116	108	U2848-1	123	VS2SA379	126	XA124	126	ZT110	108		
TV1000	108	U2091858-11	121	VS2SA385	126	XA126	126	ZT111	108		
TV2403	108	UBFY11	108	VS2SB126	127	XA131	126	ZT112	108		
TV2404	108	UC20	133	VS2SB126F	127	XA141	100	ZT113	108		
TV2455	126	UC100	133	VS2SB126V	127	XA142	100	ZT114	108		
TV24102	108	UC105	133	VS2SB128V	127	XA143	100	ZT116	108		
TV24137	126	UC110	133	VS2SB171	102	XB1	102	ZT117	108		
TV24142	127	UC115	133	VS2SB172	102	XB2	102	ZT118	108		
TV24143	103	UC120	133	VS2SB176	102	XB3	102	ZT119	108		
TV24148	108	UC125	133	VS2SB178	102	XB3B	102	ZT152	106		
TV24152	100	UC1100	106	VS2SB178A	102	XB3C	102	ZT153	106		
TV24154	102	UMT3202	124	VS2SB324	123	XB4	103	ZT154	106		
TV24156	102	UTRA-7RM	121	VS2SB448	127	X85	104	ZT180	106		
TV24158	126	V6/2R	126	VS2SC206	108	XB7	104	ZT181	106		
TV24160	108	V6/2RC	100	VS2SC208	108	XB8	126	ZT182	106		
TV24161	108	V6/2RJ	126	VS2SC288A	108	XB9	100	ZT183	106		
TV24162	127	V6/4R	126	VS2SC324H	123	XB10	100	ZT184	106		
TV24163	127	V6/4RC	100	VS2SC385L	126	XB102	102	ZT187	106		
TV24166	126	V6/4RJ	126	VS2SC538	123	XB103	102	ZT190	128		
TV24172	126	V6/8R	126	VS2SC563	108	XB104	126	ZT191	128		
TV24189	102	V6/8RJ	102	VS2SC645	108	XB112	102	ZT192	128		
TV24194	102	V6/RC	100	VS2SC645A	108	XB113	102	ZT193	128		
TV24229	126	V10/1S	100	VS2SC684	108	XB114	102	ZT202	108		
TV24230	126	V10/1SJ	102	VS2SC762	108	XC101	102	ZT203	108		
TV24239	126	V10/2S	100	VSF2745	100	XC121	102	ZT204	108		
TV24363	129	V10/2SJ	100	WC19862	103	XC141	121	ZT210	128		
TV24372	108	V10/15A	102	WC19862A	102	XC142	121	ZT211	128		
TV24387	108	V10/30A	102	WC19863	102	XC155	104	ZT280	106		
TV24453	128	V10/50A	102	WC19864	102	XC156	104	ZT281	106		
TVS2SA71B	102	V13/11	100	WTV6-PWR	121	XJ13	102	ZT282	106		
TVS2SA103	126	V15/10DP	121	WTV12-PWR	121	XJ71	126	ZT286	129		
TVS2SA171	100	V15/20DP	121	WTV15MG	100	XJ72	126	ZT287	106		
TVS2SA385	126	V15/20R	126	WTV20VHG	102	XJ73	126	ZT402	108		
TVS2SA385A	126	V15/30DP	121	WTV20MG	102	XN12A	104	ZT403	108		
TVS2SB126	121	V30/10DP	121	WTV25-PWR	121	XN12B	104	ZT404	108		
TVS2SB171	102	V30/20DP	121	WTV30VHG	102	XN12C	104	ZT406	128		
TVS2SC208	108	V60/10P	121	WTV30VMG	102	XN12E	104	ZT696	128		
TV135	106	V60/20P	121	WTV40-PWR	121	XT15X3	108	ZT697	128		
TV100-1	123	V60/30P	121	WTV99-PWR	121	YV1	102	ZT706	108		
TX100-2	123	V120	126	WTV129-PWR	105	YV1A	102	ZT706A	108		
TX100-3	124	V120PH	108	WTV199-PWR	121	YV2	102	ZT708	108		
TX100-4	128	V120RH	128	WTV299-PWR	105	ZDT10	108	ZT709	108		
TX100-5	124	V205	106	WTVAT6	102	ZDT11	108	ZT917	108		
TX101-8	124	Z220	123	WTVAT6A	100	ZDT20	108	ZT918	108		
TX101-9	128	V221	108	WTVB5	100	ZDT21	108	ZT1479	128		
TX101-11	124	Z222	123	WTVB5A	102	ZDT30	108	ZT1481	128		
TX101-12	123	Z297	128	WTVBA6	100	ZDT31	108	ZT1487	130		
TX102-1	123	V405	108	WTVBA6A	102	ZJ40	108	ZT1488	130		
TX102-2	123	V410	106	WTVBE6	100	ZJ72	126	ZT1489	130		
TX102-4	124	V435	108	WTVBE6A	102	ZJ73	126	ZT1490	130		
TX103-1	104	VB-11	102	WTV-BMC	100	ZT20	108	ZT1613	128		
TX104-3	102	VD-13	102	WTV-L6	101	ZT21	108	ZT1700	128		
TX106-1	102	VFG2745B	104	WTVSA7	101	ZT22	108	ZT1702	130		
TX107-1	123	VFG-274513	104	WTVSK7	101	ZT23	108	ZT1708	128		
TX107-3	123	VFL-2744K	126	WTVSQ7	101	ZT24	108	ZT1711	128		
TX107-4	123	VFP-2746C	104	WTV3MC	100	ZT40	108	ZT2205	108		
TX107-5	123	VFP-6537C	121	WTV6MC	100	ZT41	108	ZT2206	128		
TX107-6	123	VFQ-2745F	100	WTV12MC	100	ZT42	108	ZT2270	128		
TX107-10	123	VFS5K	126	WTV15VMG	102	ZT43	108	ZT2368	128		
TX107-12	123	VFS-2745	100	WTV20MC	100	ZT44	108	ZT2369	128		
TX107-13	124	VFS-2745J	102	WTV20VH6	102	ZT50	108	ZT2369A	128		
TX108-1	123	VFT-2745H	102	WTV20VMG	102	ZT60	108	ZT2475	128		
TX111-1	124	VFU-2746B	121	WTV30VHG	102	ZT61	108	ZT2476	128		
TX112-1	123	VFW-27450	126	WTV30VLG	102	ZT62	108	ZT2477	128		
TZ8	121	VFY-2745E	100	WTV30VMG	102	ZT63	108	ZT2708	108		
TZ10	102	VL/8RJ	126	X1C1644	102	ZT64	108	ZT2857	108		
U2N34	102	VM30203	121	X16N1485	123	ZT66	108	ZT2938	128		
U2N96	102	VM30209	123	X42	100	ZT68	128	ZT3053	128		
U2N474A	123	VM30233	124	X78	100	ZT80	108	ZT3269A	108		

# DIODES and RECTIFIERS

## replacement guide

Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement
0004-003500	116, 117	0402	116, 117	¼M5.6AZ	136	.25T7.5B	138	.75N62	149	1E4	116, 117
003-005400	109	04049B	116, 117	¼M5.6AZ5	136	.25T9.1	139	.75N82	150	1E5	116, 117
003-006700	109	0410	116, 117	¼M5.6AZ10	136	.25T9.1B	139	.75N110	151	1E6	116, 117
003-007500	109	0411	116, 117	¼M6.2AZ5	137	.25T10	140	1-016	109, 110	1E7	125
003-009000	109	0412	116, 117	¼M10Z	140	.25T10B	140	1-017	109	1E8	125
003-009100	145	0450	116, 117	¼M10Z10	140	.25T11.5	141	1-20-001-890	116, 117	1E10	125
003-009200	109	0460	116, 117	¼M14	144	.25T11.5B	141	1-530-012-11	116, 117	1E12Z	142
003-009600	109, 110	051-0003	116, 117	¼M14Z5	144	.25T12	142	1-531-105-11	116, 117	1E122Z	142
003-009700	141	051-0006	116, 117	¼M14Z10	144	.25T12B	142	1-531-105-13	116, 117	1E12Z10	142
003-009900	116	051-0020	116, 117	¼M15Z	145	.25T12.8	143	1-531-106-17	116, 117	1E14Z	144
003-010000	142	051-0024	139	¼M15Z5	145	.25T12.8B	143	1-534-105-13	116, 117	1E14Z5	144
004-002000	116, 117	0525005	116, 117	¼M15Z10	145	.25T14	144	1AC12	142	1E14Z10	144
004-002700	116, 117	0575001	109	¼M27Z	146	.25T14B	144	1AC12A	142	1E15Z	145
004-002800	116, 117	0575005	109	¼M27Z5	146	.25T15	145	1AC12B	142	1E15Z5	145
004-002900	113	0575019	110	¼M27Z10	146	.25T15B	145	1AC15	145	1E15Z10	145
004-003000	116, 117	0575047	116, 117	¼M33Z	147	.25T27	146	1AC15A	145	1E27Z	146
004-003100	119	0727-50	116, 117	¼M33Z5	147	.25T27B	146	1AC15B	145	1E27Z5	146
004-003200	118	08-0040	116, 117	¼M33Z10	147	.25T33	147	1AC27	146	1E27Z10	146
004-003300	116, 117	08-0821	116, 117	¼M6Z2	149	.25T33B	147	1AC27A	146	1E33Z	147
004-003400	116, 117	080500	116, 117	¼M6Z25	149	.25T55	148	1AC27B	146	1E33Z5	147
004-003500	116, 117	085002	109	¼M6Z210	149	.25T55B	148	1AC33	147	1E33Z10	147
004-003600	116, 117	085003	109	¼M8Z2	150	.25T62	149	1AC33A	147	1E6Z2	149
004-003700	120	085004	109	¼M8Z25	150	.25T62B	149	1AC33B	147	1E6Z25	149
004-003900	116, 117	085005	110	¼M8Z210	150	.25T82	150	1AC62	149	1E6Z210	149
004-004000	116, 117	085006	109	¼M110Z	151	.25T82B	150	1AC62A	149	1E8Z2	150
004-004100	116, 117	085016	109	¼M110Z5	151	.25T110	151	1AC62B	149	1E8Z25	150
004-004300	119	085026	110	¼M110Z10	151	.25T110B	151	1AC82	150	1E8Z210	150
004-03200	118	¼A10	140	¼Z14D	144	.4T5.6	136	1AC82A	150	1E110Z	151
004-03300	116, 117	¼A10A	140	¼Z14D5	144	.4T5.6A	136	1AC82B	150	1E110Z5	151
004-03500	116, 117	¼A10B	140	¼Z14D10	144	.4T5.6B	136	1AC110	151	1E110Z10	151
004-03600	116, 117	¼A14	144	¼Z15D5	145	.4T6.2	137	1AC110A	151	1E70Z	116, 117
004-03700	116, 117	¼A14A	144	¼Z15D10	145	.4T6.2A	137	1AC110B	151	1E705	116, 117
013-339	116, 117	¼A14B	144	¼Z27D	146	.4T6.8A	137	1B05J20	116, 117	1E71	116, 117
015-002	116, 117	¼A15	145	¼Z27D5	146	.4T7.5	138	1B05J40	116, 117	1E72	116, 117
015-006	116, 117	¼A15A	145	¼Z27D10	146	.4T7.5A	138	1B2	116, 117	1E73	116, 117
0100	116, 117	¼A15B	145	¼Z33D	147	.4T7.5B	138	1B8	125	1E74	116, 117
0102	116, 117	¼A27	146	¼Z33D5	147	.4T9.1	139	1B10J20	116, 117	1E75	116, 117
0110	116, 117	¼A27A	146	¼Z33D10	147	.4T9.1A	139	1C2	116, 117	1E76	116, 117
0111	116, 117	¼A27B	146	¼Z62D	149	.4T10	140	1C8	125	1E77	125
0112	116, 117	¼A33	147	¼Z62D5	149	.4T10A	140	1C12Z	142	1E78	125
019-001918	109	¼A33A	147	¼Z62D10	149	.4T11.5	141	1C12ZA	142	1E710	125
002-002718	109	¼A33B	147	¼Z82D	150	.4T11.5A	141	1C15Z	145	1E23.6	134
019-002935	116, 117	¼A62	149	¼Z82D5	150	.4T12	142	1C15ZA	145	1E25.1	135
019-00370-013	116, 117	¼A62A	149	¼Z82D10	150	.4T12A	142	1C27Z	146	1E25.6	136
019-00370-020	116, 117	¼A62B	149	¼Z110D	151	.4T12.8	143	1C27ZA	146	1E29.1	139
019-005043	109	¼A82	150	¼Z110D5	151	.4T12.8A	143	1C33Z	147	1E21Z	142
019-005045	116, 117	¼A82A	150	¼Z110D10	151	.4T14	144	1C33ZA	147	1E21Z5	145
022-3901-001	109	¼A82B	150	¼Z25.1T5	135	.4T14A	144	1C62Z	149	1E227	146
022-3905-001	116, 117	¼A110	151	¼Z25.6T5	136	.4T15	145	1C62ZA	149	1F2	116, 117
027-000296	116, 117	¼A110A	151	¼Z26.2T5	137	.4T15A	145	1C8Z2	150	1F8	125
027-000306	116, 117	¼A110B	151	¼Z21T5	142	.4T27	146	1C8Z2A	150	1G02	109
027-000312	116, 117	¼A33.605	134	¼Z15T5	145	.4T27A	146	1C110Z	151	1G8	125
027-300226	113	¼AZ3.6 D10	134	¼Z27T5	146	.4T33	147	1C110ZA	151	1GA	116, 117
03-0018-0	116, 117	¼AZ5.1D	135	¼Z33T5	147	.4T33A	147	1D2	116, 117	1G02	109
03-0021-0	109	¼AZ5.1D5	135	¼Z62T5	149	.4T55	148	1D5.1A	135	1H40	116, 117
0300	116, 117	¼AZ5.1D10	135	¼Z82T5	150	.4T55A	148	1D5.1B	135	1H450	116, 117
0302	116, 117	¼AZ5.6D	136	¼Z12D5	142	.4T62	149	1D5.6	136	1H480	125
0307	125	¼AZ5.6D5	136	¼Z12D10	142	.4T62A	149	1D5.6A	136	1H4Y100	125
0310	116, 117	¼AZ5.6D10	136	.25N14	144	.4T82	150	1D5.6B	136	1JL50	116, 117
0311	116, 117	¼AZ6.2D5	137	.25N15	145	.4T82A	150	1D6.2	137	1JL51	116, 117
0312	116, 117	¼LZ3.6D	102	.25N27	146	.4T110	151	1D6.2A	137	1JL52	116, 117
0314	116, 117	¼LZ3.6D5	102	.25N33	147	.4T110A	151	1D6.2B	137	1JL53	116, 117
0317	125	¼LZ5.6D	136	.25N62	149	.75N5	145	1D6.2SA	137	1JL56	116, 117
0320	116, 117	¼LZ5.6D5	136	.25N82	150	.75N5.1	135	1D6.2SB	137	1JL57	116, 117
0321	116, 117	¼LZ5.6D10	136	.25N110	151	.75N5.6	136	1D8	125	1JL58	125
0322	116, 117	¼LZ6.2D	137	.25T5.6	136	.75N6.2	137	1D10	125	1JL59	125
0324	116, 117	¼LZ6.2D5	137	.25T5.6B	136	.75N7.5	138	1E05	116, 117	1JL63	125
0327	125	¼M3.6AZ5	134	.25T6.2	137	.75N12	142	1E1	116, 117	1JL64	125
0400	116, 117	¼M3.6AZ10	134	.25T6.2B	137	.75N27	146	1E2	116, 117	1M12Z	142
0401	116, 117	¼M5.1AZ5	135	.25T7.5	138	.75N33	147	1E3	116, 117	1M12Z5	142

NOTE — Numbers in ( ) indicates the number of replacement devices required to replace original type.

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1M12Z10	142	1N86	109	1N292	109	1N368	116, 117	1N493B	141
1M14Z	144	1N87	109	1N294	109	1N376	117, 135	1N497	109
1M14Z5	144	1N87A	109	1N295A	109	1N400	117, 116	1N498	109
1M14Z10	144	1N87G	109	1N295X	109	1N400B	117, 116	1N500	109
1M15Z	145	1N87GA	109	1N295	109	1N417	109	1N503	116, 117
1M15Z5	145	1N87S	109	1N296	109	1N418	109	1N504	116, 117
1M15Z10	145	1N87T	109	1N298	111, 112	1N419	109	1N505	116, 117
1M27Z	146	1N90	109	1N298A	109	1N429	137	1N506	116, 117
1M27Z5	146	1N90G	109	1N304	109	1N435	109	1N507	116, 117
1M27Z10	146	1N90GA	109	1N305	109	1N440	117, 116	1N508	116, 117
1M33Z	147	1N91	116, 117	1N306	109	1N440B	117, 116	1N509	125
1M33Z5	147	1N92	116, 117	1N308	109	1N441	117, 116	1N510	125
1M33Z10	147	1N93	116, 117	1N309	109	1N441B	117, 116	1N511	116, 117
1M62Z	149	1N93A	116, 117	1N312	109	1N442	117, 116	1N512	116, 117
1M62Z5	149	1N95	109	1N315	116, 117	1N442B	116, 117	1N513	116, 117
1M62Z10	149	1N96A	109	1N315A	116, 117	1N443	117, 116	1N514	116, 117
1M82Z	150	1N103	109	1N316	117, 116	1N443B	117, 116	1N515	116, 117
1M82Z5	150	1N104	109	1N316A	117, 116	1N444	117, 116	1N516	116, 117
1M82Z10	150	1N105	109	1N317	117, 116	1N444B	117, 116	1N517	125
1M110Z	151	1N107	109	1N317A	117, 116	1N445	116, 117	1N518	125
1M110Z5	151	1N108	109	1N318	117, 116	1N445B	116, 117	1N519	116, 117
1M110Z10	151	1N109	109	1N318A	117, 116	1N447	109	1N520	116, 117
1MJJ3.6	134	1N110	111, 112	1N319	117, 116	1N448	117, 116	1N521	116, 117
1MJJ3.6A	134	1N111	109	1N319A	117, 116	1N449	117, 116	1N522	116, 117
1MJJ6.2	137	1N112	109	1N320	117, 116	1N451	117, 116	1N523	116, 117
1MJJ6.2A	137	1N113	109	1N320A	116, 117	1N452	117, 116	1N524	116, 117
1MJJ9.1	139	1N114	109	1N321	116, 117	1N453	117, 116	1N525	125
1MJJ9.1A	139	1N115	109	1N321A	125	1N454	117, 116	1N526	125
1MJJ12	142	1N116	109	1N322	125	1N455	117, 116	1N527	109
1MJJ12A	142	1N116A	109	1N322A	125	1N456	117, 116	1N530	117, 116
1N4A	109	1N117	109	1N323	117, 116	1N456A	117, 116	1N531	117, 116
1N4A4G	109	1N117A	109	1N323A	117, 116	1N457	117, 116	1N532	117, 116
1N34	109	1N118	109	1N324	117, 116	1N457A	117, 116	1N533	117, 116
1N34A	109	1N118A	109	1N324A	117, 116	1N458	117, 116	1N534	117, 116
1N34AS	109	1N119	109	1N325	117, 116	1N458A	117, 116	1N535	117, 116
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1N34GA	109	1N120	109	1N326	117, 116	1N459A	117, 116	1N537	117, 116
1N35	109	1N120A	109	1N326A	117, 116	1N460	117, 116	1N538	117, 116
1N36	109	1N124	111, 112	1N327	117, 116	1N460A	117, 116	1N539	117, 116
1N40	109	1N124A	111, 112	1N327A	117, 116	1N461	116, 117	1N540	117, 116
1N41	109	1N125	109	1N328	125	1N461A	116, 117	1N541	110
1N43	109	1N126	109	1N328A	125	1N462	117, 116	1N542	109, 110
1N45	109	1N126A	109	1N329	125	1N462A	117, 116	1N547	116, 117
1N46	109	1N128	109	1N329A	125	1N463	117, 116	1N548	125
1N49	109	1N132	109	1N332	116, 117	1N463A	117, 116	1N550	116, 117
1N51	109	1N133	111, 112	1N333	117, 116	1N464	117, 116	1N551	116, 117
1N50	109	1N134	109	1N335	117, 116	1N464A	117, 116	1N552	116, 117
1N54	109	1N135	109	1N337	117, 116	1N468	135	1N553	116, 117
1N54A	109	1N139	109	1N338	116, 117	1N468A	135	1N554	116, 117
1N54G	109	1N144	109	1N339	116, 117	1N468B	135	1N555	116, 117
1N54GA	109	1N145	109	1N340	117, 116	1N471	134	1N560	125
1N56	109	1N147	111, 112	1N341	116, 117	1N473	135	1N561	125
1N56A	109	1N147A	111, 112	1N342	116, 117	1N473A	135	1N562	125
1N60	109	1N148	109	1N343	116, 117	1N473B	135	1N563	125
1N60A	109	1N151	116, 117	1N344	116, 117	1N476	116, 117	1N568	109
1N60F	109	1N152	116, 117	1N345	116, 117	1N480	109	1N569	109
1N60G	109	1N153	116, 117	1N346	116, 117	1N486B	116, 117	1N571	109
1N60GA	109	1N158	116, 117	1N347	116, 117	1N487	117, 116	1N596	116, 117
1N60P	109	1N172	111, 112	1N348	116, 117	1N482A	117, 116	1N597	125
1N60S	109	1N192	109	1N349	116, 117	1N482B	117, 116	1N598	125
1N64	109	1N195	109	1N350	117, 116	1N483	117, 116	1N599	117, 116
1N64A	109	1N227	143	1N351	117, 116	1N483A	117, 116	1N599A	117, 116
1N64B	109	1N227A	143	1N352	117, 116	1N483B	117, 116	1N600	116, 117
1N64G	109	1N253	116, 117	1N353	117, 116	1N484	117, 116	1N600A	116, 117
1N64GA	109	1N254	116, 117	1N354	117, 116	1N484A	117, 116	1N601	116, 117
1N65	109	1N255	117, 116	1N359	117, 116	1N484B	117, 116	1N601A	116, 117
1N66	109	1N256	117, 116	1N359A	117, 116	1N485	117, 116	1N602	116, 117
1N69	109	1N266	116, 117	1N360	117, 116	1N485A	117, 116	1N602A	116, 117
1N69A	109	1N267	109	1N360A	117, 116	1N485B	117, 116	1N603	116, 117
1N71	109	1N268	109	1N361	117, 116	1N486	117, 116	1N603A	116, 117
1N72	111, 112	1N270	109	1N361A	117, 116	1N486A	117, 116	1N604	116, 117
1N73	109	1N273	109	1N362	117, 116	1N487	116, 117	1N604A	116, 117
1N74	109	1N276	109	1N362A	117, 116	1N487A	116, 117	1N605	116, 117
1N81	109	1N278	109	1N363	117, 116	1N488	117, 116	1N605A	116, 117
1N81A	109	1N279	109	1N363A	117, 116	1N488A	117, 116	1N606	117, 116
1N76G	109	1N281	109	1N364	125	1N492	141	1N606A	117, 116
1N82	111, 112	1N283	109	1N364A	125	1N492A	141	1N607	116, 117
1N82A	111, 112	1N287	109	1N365	125	1N492B	141	1N607A	116, 117
1N82AG	111, 112	1N288	109	1N365A	125	1N493	141	1N608	116, 117
1N84	109	1N289	109	1N367	109	1N493A	141	1N608A	116, 117

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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
1N609	116, 117	1N760	109	1N911	109	1N1217B	116, 117	1N1528	146
1N609A	116, 117	1N761	135	1N941	141	1N1218	116, 117	1N1528A	146
1N610	116, 117	1N761A	135	1N941A	141	1N1218A	116, 117	1N1539	116, 117
1N610A	116, 117	1N761-2	135	1N941B	141	1N1218B	116, 117	1N1540	116, 117
1N611	116, 117	1N765	142	1N942	141	1N1219	116, 117	1N1541	116, 117
1N611A	116, 117	1N765-1	100	1N945	141	1N1219A	116, 117	1N1542	116, 117
1N612	116, 117	1N766	143	1N945A	141	1N1219B	116, 117	1N1543	116, 117
1N612A	116, 117	1N766A	143	1N945B	141	1N1220	116, 117	1N1544	116, 117
1N613	116, 117	1N766-3	144	1N946	141	1N1220A	116, 117	1N1556	116, 117
1N613A	116, 117	1N767-1	145	1N946A	141	1N1220B	116, 117	1N1557	116, 117
1N614	116, 117	1N770	109	1N946B	141	1N1221	117, 116	1N1558	116, 117
1N614A	116, 117	1N772A	109	1N947	117, 116	1N1221A	117, 116	1N1559	116, 117
1N616	109	1N773	109	1N949	109	1N1221B	117, 116	1N1560	116, 117
1N631	109	1N773A	109	1N960	139	1N1222	117, 116	1N1561	109
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1N636	109	1N774A	109	1N960B	139	1N1222B	117, 116	1N1563	116, 117
1N643A	116, 117	1N775	109	1N961	140	1N1223	116, 117	1N1563A	116, 117
1N645	116, 117	1N776	109	1N961A	140	1N1223A	116, 117	1N1564	116, 117
1N645A	116, 117	1N777	109	1N961B	140	1N1223B	116, 117	1N1564A	116, 117
1N645B	116, 117	1N781	109	1N963	142	1N1224	116, 117	1N1565	116, 117
1N646	116, 117	1N788	109	1N963A	142	1N1224A	125	1N1565A	116, 117
1N647	116, 117	1N806	109	1N963B	142	1N1224B	125	1N1566	116, 117
1N648	116, 117	1N819	116, 117	1N965	145	1N1225	125	1N1566A	116, 117
1N649	116, 117	1N821	137	1N965A	145	1N1225A	125	1N1567	116, 117
1N658	116, 117	1N821A	137	1N965B	145	1N1225B	125	1N1567A	116, 117
1N662	116, 117	1N822	137	1N971	146	1N1226	125	1N1568	117, 116
1N663	116, 117	1N823	137	1N971A	146	1N1226A	125	1N1568A	117, 116
1N665	142	1N823A	137	1N971B	146	1N1226B	125	1N1617	116, 117
1N666	145	1N824	137	1N973	147	1N1251	116, 117	1N1618	116, 117
1N669	146	1N825	137	1N973A	147	1N1252	116, 117	1N1619	116, 117
1N673	116, 117	1N827	137	1N973B	147	1N1253	116, 117	1N1620	116, 117
1N675	137	1N827A	137	1N980	149	1N1254	116, 117	1N1644	116, 117
1N676	116, 117	1N829	137	1N980A	149	1N1255	116, 117	1N1645	116, 117
1N677	116, 117	1N829A	137	1N980B	149	1N1255A	116, 117	1N1646	116, 117
1N678	116, 117	1N846	116, 117	1N983	150	1N1256	116, 117	1N1647	116, 117
1N679	116, 117	1N847	116, 117	1N983A	150	1N1257	117, 116	1N1648	116, 117
1N681	116, 117	1N848	116, 117	1N983B	150	1N1258	125	1N1649	116, 117
1N682	116, 117	1N849	116, 117	1N986	151	1N1259	125	1N1650	116, 117
1N683	116, 117	1N850	116, 117	1N986A	151	1N1260	125	1N1651	116, 117
1N684	116, 117	1N851	116, 117	1N986B	151	1N1261	125	1N1652	116, 117
1N685	116, 117	1N852	117, 116	1N994	109	1N1313A	139	1N1653	117, 116
1N686	116, 117	1N853	125	1N995	109	1N1314	140	1N1692	116, 117
1N687	116, 117	1N854	125	1N996	109	1N1314A	140	1N1693	116, 117
1N689	116, 117	1N855	125	1N1008	116, 117	1N1315	142	1N1694	116, 117
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1N709A	137	1N862	116, 117	1N1035	116, 117	1N1426	142	1N1704	116, 117
1N713	139	1N863	117, 116	1N1036	116, 117	1N1427	145	1N1705	116, 117
1N714	140	1N864	125	1N1037	116, 117	1N1430	146	1N1706	116, 117
1N714A	140	1N865	125	1N1038	116, 117	1N1439	116, 117	1N1707	116, 117
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1N733A	149	1N875	125	1N1083	116, 117	1N1489	116, 117	1N1763A	116, 117
1N736	150	1N876	125	1N1084	116, 117	1N1490	116, 117	1N1764	116, 117
1N736A	150	1N877	125	1N1093	109	1N1491	116, 117	1N1764A	116, 117
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1N747A	134	1N881	116, 117	1N1101	116, 117	1N1513	142	1N1766A	137
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1N753	137	1N884	116, 117	1N1104	116, 117	1N1514A	145	1N1773	142
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1N757A	139	1N887	125	1N1122A	116, 117	1N1520A	136	1N1775A	145
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1N1793	150	1N2038-1	145	1N2861A	116, 117	1N3238	116, 117	1N3639	116, 117
1N1793A	150	1N2041	135	1N2862	116, 117	1N3239	116, 117	1N3640	116, 117
1N1796	151	1N2041-2	135	1N2862A	116, 117	1N3240	116, 117	1N3641	116, 117
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3MS10	116, 117	5MA5	116, 117	10AT8	125	13-16247-3	116, 117	20A90	109
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3T510	125	6G4	116, 113	10C8	125	14-501-01	113	21A006-000	120
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4JA10DX32	116, 117	6RS18PH110BB1	118	10DB1	116, 117(4)	15-00002	116, 117	21B-17	116, 117
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24MW244	110	34-8055-3	116, 117	46AR15	125	48-134659	144	48P60022A97	109, 110
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27Z6	144	34-8057-16	116, 117	46AR50	125	48-134851	141	48R10062A04	116, 117
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32-18537	109	42-21866	116, 117	46BD32	125	48D63590A01	109	50E8	125
32-18539	110	42A11	116, 117	46BD33	125	48D66037A03	116, 117	50E10	125
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53A002-1	116, 117	66X21	113	86-1-3	116, 117	93B27-1	109	103-105	146
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53B003-1	116, 117	66X25	113	86-4-1	116, 117	93B27-3	109	103-131	110
53B004-1	109	66X26	116, 117	86-7-1	116, 117	93B30-1	116, 117	102-142	109
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212-71	116, 117	325-1376-60	109	474-025	116, 117	702-810	113	2102-074	116, 117
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295V034C01	119	384M	125	618	116, 117	1020	116, 117	5130	146
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296V006H02	109	384Z	125	624-0005	113	1033-8	116, 117	5145	151
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320A	116, 117	386AW	116, 117	652C1	136	1133	147	7711-1	125
320B	116, 117	386AX	116, 117	652C7	137	1138	116, 117	7712-1	125
320C	116, 117	386AY	116, 117	655C9	140	1263A	116, 117	7713-1	125
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12850	109	72129	109	118823	116, 117	530065-2	109	575051	116, 117
13782	116, 117	72130	117, 116	119594	140	530065-3	109	575996	120
14027	116, 117	72130-1	117, 116	119596	109, 110	530071-1	116, 117	576063	109
17002	116, 117	72135	138	119597	116	530071-2	116, 117	580029	116, 117
17443	116, 117	72137	116, 117	119662	112	530071-3	116, 117	606113	116, 117
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36508	109	93022	116, 117	124098	116, 117	530073-17	145	612112	116, 117
36535	116, 117	93022A	116, 117	124812	116, 117	530073-18	146	613020	116, 117
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36539	142	93030	140	125261	112	530082-2	116, 117	614010	116, 117
36549	116, 117	95002	109	125528	116	530082-3	116, 117	614020	109, 110
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36555	116, 117	95015	116, 117	125529	116	530086-1	116, 117	633977	114
36564	116, 117	98613-43	109	125787	116, 117(2)	530087-2	120	661010	116, 117
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37680	116, 117	100520	116, 117	126131	116, 117	530088-2	125	700021-00	118
37987	116, 117	100624	116, 117	126177	109	530092-1	109	700043-00	116, 117
38174	116, 117	101403	116, 117	126320	116, 117	530092-1001	109	700055-00	113
40024	116, 117	103318	116, 117	126321	116, 117	530092-2	109	700063-00	116, 117
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981207	109	9246055	116, 117	A2D4	116, 117	A4E9	116, 117	A86-3-1	115
981522	109	9248015	116, 117	A2D5	116, 117	A4F1	116, 117	A86-4-1	114
981676	109	9248055	116, 117	A2D9	116, 117	A4F5	116, 117	A86-9-1	113
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2000757-79	113	A1B1	116, 117	A3D1	116, 117	A5G5	116, 117	AA113	109
20001786-134	109	A1B5	116, 117	A3D3	116, 117	A5G9	116, 117	AA116	109
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2495083	110	A1H1	116, 117	A3K1	125	A10B	116, 117	AA1Y139	109
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AH814	125	AS6	116, 117	B2K9	125	B5G1	116, 117	BY100S	125
AH815	125	AS11	116, 117	B2M1	125	B5G5	116, 117	BY101	116, 117
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AM53	116, 117	B1E1	116, 117	B4A9	116, 117	B250C125N2	116, 117	BY1201	125
AM62	116, 117	B1E5	116, 117	B4B1	116, 117	B250C125X4	116, 117	BY1202	125
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AM420	116, 117	B2B1	116, 117	B4K5	125	B4Y44	116, 117	BZ17	142
AM425	116, 117	B2B5	116, 117	B4K9	125	B4Y64	116, 117	BZ19	145
AM430	116, 117	B2B9	116, 117	B4M1	125	B4Y86	116, 117	BZ25	146
AM435	116, 117	B2C1	116, 117	B4M5	125	B4Y87	116, 117	BZ27	147
AM440	116, 117	B2C5	116, 117	B4M9	125	B4Y90	125	BZX29C5V1	135
AM445	116, 117	B2C9	116, 117	B5A1	116, 117	B5B1A	116, 117	BZX29C5V6	136
AM450	116, 117	B2D1	116, 117	B5A5	116, 117	BB107	116, 117	BZX29C27	146
AM460	116, 117	B2D5	116, 117	B5A9	116, 117	BB117	116, 117	BZX29C62	149
AR7C	116, 117	B2D9	116, 117	B5B1	116, 117	BB127	116, 117	BZX29C82	150
AR16	116, 117	B2E1	116, 117	B5B5	116, 117	BC207	116, 117	BZY18	142
AR17	116, 117	B2E5	116, 117	B5C1	116, 117	BC307	116, 117	BZY19	145
AR18	116, 117	B2E9	116, 117	B5C5	116, 117	BD107	116, 117	BZY29C33	147

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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
BZ Y57	135	CD31-00007	136	CER72D	125	CL7	125	C11A	122
BZ Y58	136	CD31-00008	137	CER72F	125	C11-B	125	C11A-U	122
BZ Y65	135	CD31-00012	139	CER73	125	CM	113	C11B	122
BZ Y69	142	CD31-00015	142	CER73A	125	COD1531	116, 117	C15A-U	122
BZ Y83/C5V1	135	CD31-00017	145	CER73B	125	COD1532	116, 117	C20A-U	122
BZ Y83/C5V6	136	CD31-00023	146	CER73C	125	COD1533	116, 117	C1083B	113
BZ Y83/C10	140	CD31-00025	147	CER73D	125	COD1534	116, 117	C10159	116, 117
BZ Y83/C15	145	CD31-10361	146	CER73F	125	COD1535	116, 117	C21383	140
BZ Y83/DSV6	136	CD31-10365	145	CER500	116, 117	COD1536	116, 117	C23680	116, 117
BZ Y83/D10	140	CD31-12019	139	CER500A	116, 117	COD1537	125	D01-100	116, 117
BZ Y83/D15	145	CD31-12022	142	CER500B	116, 117	COD1538	125	D1-52S	116, 117
BZ Y85/C3V6	134	CD31-12024	145	CER500C	116, 117	COD1551	116, 117	D1F	149
BZ Y85/C5V1	135	CD31-12030	146	CER670	116, 117	COD1552	116, 117	D1G	139
BZ Y85/C5V6	136	CD31-12032	147	CER670A	116, 117	COD1553	116, 117	D1H	116, 117
BZ Y85/C10	140	CD1111	116, 117	CER670B	116, 117	COD1554	116, 117	D1R35	109, 110
BZ Y85/C15	145	CD1112	116, 117	CER670C	116, 117	COD1555	116, 117	D1R39	109, 110
BZ Y85/C27	146	CD1113	116, 117	CER680	116, 117	COD1556	116, 117	D1T	144
BZ Y85/C33	147	CD1114	116, 117	CER680A	116, 117	COD1611	116, 117	D1W	146
BZ Y85/DSV6	136	CD1115	116, 117	CER680B	116, 117	COD1612	116, 117	D1Z RED	144
BZ Y85/D10	140	CD1116	116, 117	CER680C	116, 117	COD1613	116, 117	D1Z YEL	145
BZ Y85/D15	145	CD1122	116, 117	CER690	116, 117	COD1614	116, 117	D1Z BLU	145
BZ Y88/CSV1	135	CD1123	116, 117	CER690A	116, 117	COD1615	116, 117	D1Z PUR	143
BZ Y88/CSV6	136	CD1124	116, 117	CER690B	116, 117	COD1616	116, 117	D2G	141
BZ Y88/CEV2	137	CD1125	116, 117	CER700	116, 117	COD1617	125	D2H	116, 117
BZ Y92/CSV1	135	CD1126	116, 117	CER700A	116, 117	COD1618	125	D3R38	116, 117
BZ Y92/CSV6	136	CD1127	116, 117	CER700B	116, 117	COD1-537	125	D3R39	116, 117
BZ Y92/C15	145	CD1141	116, 117	CER700C	116, 117	COD1-538	125	D4R26	116, 117
BZ Y92/C27	146	CD1142	116, 117	CER710	116, 117	COD1-617	125	D4R39	116, 117
BZ Y92/C33	147	CD1143	116, 117	CER710A	116, 117	COD1-618	125	D4	113
BZ Y94/C12	142	CD1147	116, 117	CER710B	116, 117	COD1-6045	116, 117	D5R35	116, 117
BZ Y94/C15	145	CD1148	116, 117	CER710C	116, 117	COD1-6046	116, 117	D5R39	116, 117
BZ Y94/C27	146	CD1149	116, 117	CER720	125	COD1-6047	116, 117	D6H2	116, 117
BZ Y94/C33	147	CD1151	116, 117	CER720A	125	COD1-6048	116, 117	D5	114
BZ Y94/CE2	149	CD3122	135	CER720B	125	COD11556	116, 117	D6	115
CI B	116, 117	CD3171	149	CER720C	125	COD15524	116, 117	D7	115
CI H	122	CD03174	150	CER730	125	COD15534	116, 117	D8H2	125
CI 11A	122	CD04116	142	CER730A	125	COD15544	116, 117	D15A	116, 117
CI 11B	122	CD04117	142	CER730B	125	COD15564	116, 117	D15C	116, 117
CI 1F	122	CD04118	142	CER730C	125	CP102	125	D16U3	113
CO	109	CD04121	142	CF102DA	116, 117	CP102BA	116, 117	D16U4	113
CI0110	116, 117	CD04122	142	CF102PA	125	CP102DA	116, 117	D18	116, 117
CI15C1E1C	116, 117	CD13332	116, 117	CG12RA	125	CP102FA	116, 117	D25	116, 117
CA10	116, 117	CD13333	116, 117	CG12E	109	CP102HA	116, 117	D25A	116, 117
CA20	116, 117	CD13334	116, 117	CG64H	109	CP102KA	116, 117	D25B	116, 117
CA50	116, 117	CD13335	116, 117	CG65H	109	CP102MA	116, 117	D25C	116, 117
CA100	116, 117	CD13336	116, 117	CG66H	109	CP102PA	125	D28	116, 117
CA102BA	116, 117	CD13337	116, 117	CG74H	109	CP102RA	125	D30	116, 117
CA102DA	116, 117	CD13338	116, 117	CG86H	109	CP102VA	125	D45C	116, 117
CA102FA	116, 117	CD13339	116, 117	CGD462	109	CP103	125	D45CZ	116, 117
CA102HA	116, 117	CE502	116, 117	CGD591	109	CP152VA	125	D48	116, 117
CA102KA	116, 117	CE504	116, 117	CGD685	109	CR1034	116, 117	D50	116, 117
CA102MA	116, 117	CE506	116, 117	CGD1029	109	CS131D	116, 117	D51	113
CA102PA	125	CE508	125	CHA423.6	134	CT16XT	113	D65C	116, 117
CA102RA	125	CE510	125	CHA425.1	135	CT100	116, 117	D68	116, 117
CA102VA	125	CE6050	116, 117	CHA425.6	136	CT200	116, 117	D85C	125
CA150	116, 117	CER6B	116, 117	CHA26.2	137	CT300	116, 117	D88	116, 117
CA152VA	125	CER6F	116, 117	CHA26.2A	137	CT461	109	D100	116, 117
CA200	116, 117	CER67A	116, 117	CHZ10	140	CT600	116, 117	D105C	125
CA250	116, 117	CER67B	116, 117	CHZ10A	140	CTN200	116, 117	D108	125
CA1020A	116, 117	CER67C	116, 117	CHM23.6	134	CTP461	109	D124	116, 117(4)
CB10	116, 117	CER68	116, 117	CHM25.1	135	CTP573	109	D144S	116, 117
CB20	116, 117	CER68A	116, 117	CHM25.6	136	CV425	109	D144S	116, 117
CB50	116, 117	CER68B	116, 117	CK119D	116, 117	CV442	109	D200	116, 117
CB100	116, 117	CER68C	116, 117	CK705	109	CX-0036	109	D300	116, 117
CB150	116, 117	CER69	116, 117	CK706	109	CX-0037	116, 117	D400	116, 117
CB163	109	CER69A	116, 117	CK706A	109	CX-0039	116, 117	D500	116, 117
CB200	116, 117	CER69B	116, 117	CK706P	109	CX-0040	116, 117	D600	116, 117
CB250	116, 117	CER69C	116, 117	CK710	111, 112	CX-9001	116, 117	D800	126
CC102DA	116, 117	CER70	116, 117	CK715	109	CV40	116, 117	D1000	125
CC102FA	116, 117	CER70A	116, 117	CK731	111, 112	CY50	116, 117	D1172S	116, 117
CC102HA	116, 117	CER70B	116, 117	CL010	116, 117	CY80	125	D3530	112
CC102KA	116, 117	CER70C	116, 117	CL025	116, 117	CY100	125	D6462	109
CC102MA	116, 117	CER71	116, 117	CL25	116, 117	CZD010	140	D6623	116, 117
CC102PA	125	CER71A	116, 117	CL1	116, 117	CZD012.5	142	D6623A	116, 117
CC102RA	125	CER71B	116, 117	CL1.5	116, 117	CZD014	144	D6624	116, 117
CC102VA	125	CER71C	116, 117	CL2	116, 117	CZD014.5	144	D6624A	116, 117
CC152VA	125	CER72	125	CL3	116, 117	CZD015	145	D6625	116, 117
CD0014	109	CER72A	125	CL4	116, 117	CZD015.5	145	D6625A	116, 117
CD31-00002	134	CER72B	125	CL5	116, 117	CZD0105	140	D6726	109
CD31-00006	135	CER72C	125	CL6	116, 117	C1.0E2	125	D10167	116, 117

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Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement
O10168	116, 117	DR351	109	E1018N	116, 117	ED3000A	116, 117	ER101	116, 117
DA000	116, 117	OR352	109	E1410	116, 117	ED3000B	116, 117	ER102	116, 117
DA001	116, 117	DR365	109	E1411	116, 117	ED3001	116, 117	ER102D	116, 117
DA002	116, 117	DR385	109	E1412	116, 117	ED3001A	116, 117	ER103D	116, 117
DA058	125	DR400	116, 117	E1413	116, 117	ED3001B	116, 117	ER103E	116, 117
DA90	109	OR426	109	E1415	116, 117	ED3002	116, 117	ER104D	116, 117
DA2068	125	DR427	116, 117	E1440	116, 117	ED3002A	116, 117	ER105D	116, 117
DC6V	127	DR434	109	E2484	110	ED3002B	116, 117	ER106D	116, 117
DD-000	116, 117	DR435	116, 117	E2486	137	ED3003	116, 117	ER107D	125
DD-003	116, 117	DR449	109	E3006	116, 117	ED3003A	116, 117	ER108D	125
DD-006	116, 117	DR464	109	E10116	116, 117	ED3003B	116, 117	ER181	116, 117
DD-007	116, 117	DR500	116, 117	E10157	116, 117	ED3003S	116, 117	ER182	116, 117
DD-04	113	DR600	116, 117	EA005	116, 117	ED3004	116, 117	ER183	116, 117
DD-05	114	DR668	116, 117	EA-0015	116, 117	ED3004A	116, 117	ER184	116, 117
DD-06	115	DR669	116, 117	EA-0016	116, 117	ED3004B	116, 117	ER185	116, 117
DD-056	116, 117	DR670	116, 117	EA-0031	116, 117	ED3005	116, 117	ER186	125
DD175C	116, 117	DR671	116, 117	EA-010	116, 117	ED3005A	116, 117	ER187	125
DD176C	116, 117	DR695	116, 117	EA-020	116, 117	ED3005B	116, 117	ER201	116, 117
DD177C	116, 117	DR698	116, 117	EA-030	116, 117	ED3006	116, 117	ER301	116, 117
DD236	116, 117	DR699	116, 117	EA040	116, 117	ED3006A	116, 117	ER401	116, 117
DD266	116, 117	DR700	125	EA050	116, 117	ED3006B	116, 117	ER501	116, 117
DD268	125	DR800	125	EA060	116, 117	ED3007	125	ERD300	116, 117
DD2066	116, 117	DR826	116, 117	EA080	116, 117	ED3007A	125	ER308	125
DD2068	125	DR848	116, 117	EA16X1	109	ED3007B	125	ER310	116, 117
DDMV-1	109	DR863	116, 117	EA16X4	141	ED3008	125	ER381	125
DDMV-2	109	DR900	125	EA16X5	109	ED3008A	125	ERD400	116, 117
DE14	116, 117	DR1000	125	EA16X8	116, 117	ED3008B	125	ER601	116, 117
DE14A	116, 117	DR5101	116, 117	EA16X9	109	ED3009	125	ER801	125
DE16	116, 117	DR5102	116, 117	EA16X21	116, 117	ED3009A	125	ER1001	125
DE16A	116, 117	DR5102	116, 117	EA57X1	116, 117	ED3009B	125	ERD700	125
DER1	125	DRS104	116, 117	EA57X3	116, 117	ED3010	125	ERD800	125
DG1NR	116, 117	DRS106	116, 117	EA57X8	116, 117	ED3010A	125	ERD900	125
DH4R2	116, 117	DRS107	125	EA57X10	116, 117	ED3010B	125	ERD1000	125
DH14	116, 117	DS1K-7D	116, 117	EA57X11	116, 117	EER600-2	117, 116	ES16X2	109
DH14A	116, 117	DS1P	116, 117	EA75X1	116, 117	EF100	125	ES16X21	116
DH16	116, 117	DS2N	116, 117	EA100	125	EG100	125	ES57X1	116, 117
DH16A	116, 117	DS13	116, 117	EA1072	116, 117	EHZC11	116, 139	ES57X2	116, 117
DHD805	116, 117	DS14	116, 117	EA1123	109	EM1J2	116, 117	ESKE40C500	116, 117
DHD806	109	DS16E	116, 117	EA1318	142	EM401	116, 117	ESKE125C500	125
DI-7	116, 117	DS17	116, 117(2)	EA1448	116, 117	EM402	116, 117	ET16X1	109
DI-42S	116, 117	DS31	110	EA5711	116, 117	EM403	116, 117	ET16X7	113
DI-46	116, 117	DS39	110	EC100	125	EM404	116, 117	ET16X10	113
DI-52S	116, 117	DS49	139	EC401	116, 117	EM405	116, 117	ET16X11	113
DI55	116, 117	DS-0065	116, 117	EC402	116, 117	EM406	116, 117	ET16X14	112
DI-56	116, 117	DS-1K	116, 117	ECR-600-2	116, 117	EM407	116, 117	ET55-25	116, 117
DI71	116, 117	DS-1M	116, 117	ED-4	116, 117	EM408	116, 117	ET55X25	116, 117
DI-72S	116, 117	DS-13	116, 117	ED-5	116, 117	EM410	116, 117	ET57X25	116, 117
DI-645	116, 117	DS-27	109	ED-6	116, 117	EM501	116, 117	ET57X29	116, 117
DI-646	116, 117	DU400	116, 117	ED-7	116, 117	EM502	116, 117	ET57X30	116, 117
DI647	116, 117	DU600	116, 117	ED1804	116, 117	EM503	116, 117	ET57X31	119
DI648	116, 117	DU800	125	ED1892	116, 117	EM504	116, 117	ET57X32	118
DI649	116, 117	DU1000	125	ED2106	116, 117	EM507	125	ET57X33	116, 117
DI650	125	DZ12A	142	ED2107	116, 117	EM508	125	ET57X35	116, 117
DI705	116, 117	DZ15A	145	ED2108	116, 117	EM510	125	ET57X39	116, 117
DI-1649	116, 117	DZ27A	146	ED2109	116, 117	EO-704	116, 117	ET57X40	116, 117
DIB	113	DZ33A	147	ED2110	116, 117	EP16X20	109	ET200	116, 117
DIC	113	DZ82A	150	ED2842	116, 117	EP16X21	110	ET400	116, 117
DICR1	125	DW520	116, 117	ED2843	116, 117	EP57X1	116, 117	ET600	116, 117
DIE	125	E-075L	116, 117	ED2844	116, 117	EP200	116, 117	ETD-1N60	109
DIE	116, 117	E1	116, 117	ED2845	116, 117	EP400	116, 117	ETD-10D1	116, 117
DIJ	116, 117	E1M3	125	ED2846	116, 117	EP600	116, 117	ETD-10D2	116, 117
DIK	125	E1N3	125	ED2847	125	EP800	125	ETD-SD46	109
DIL	116, 117	E14C350	116, 117	ED2848	125	EP1000	125	EU16X1	109, 110
DI M	136	E2	116, 117	ED2849	125	EP-1259	116, 117	EU16X4	112
DIS	143	E25C5	116, 117	ED2910	125	ER1	116, 117	EU16X19	110
DIS-1S	116, 117	E125C200	116, 117	ED2911	125	ER2	116, 117	EU57X31	119
DIT	144	E3	116, 117	ED2912	125	ER-11	116, 117	EU57X32	118
DK19	109	E5	116, 117	ED2913	125	ER12	116, 117	EU57X38	120
DK20	109	E6	116, 117	ED2914	116, 117	ER21	116, 117	EU57X40	116, 117
DK21	109	E8	125	ED2915	116, 117	ER22	116, 117	EVR4	136
DP100	125	E9	125	ED2916	116, 117	ER-31	116, 117	EVR4A	136
DR1	116, 117	E10	125	ED2917	116, 117	ER-41	116, 117	EVR4B	136
DR2	116, 117	E84	140	ED2918	116, 117	ER42	116, 117	EVR5	137
DR3	116, 117	E135	116, 117	ED2919	116, 117	ER51	116, 117	EVR5A	137
DR4	116, 117	E143	116, 117	ED2920	116, 117	ER57X2	116, 117	EVR5B	137
DR5	116, 117	E146	116, 117	ED2921	116, 117	ER57X3	116, 117	EVR9	139
DR100	116, 117	E150L	116, 117	ED2922	125	ER57X4	116, 117	EVR9A	139
DR200	116, 117	E252	142	ED2923	125	ER61	116, 117	EVR9B	139
DR291	109	E300L	116, 117	ED2924	125	ER62	116, 117	ER12	142
DR300	116, 117	E650L	116, 117	ED3000	116, 117	ER81	125	EVR12A	142



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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
EVR12B	142	FW200	116, 117	G222	116, 117	GSM54	116, 117	HG5006	109
EVR15	145	FW400	116, 117	G296	116, 117	GSM482	116, 117	HG5007	109
EVR15A	145	FW500	116, 117	G409	109	GSM483	116, 117	HG5008	109
EVR15B	145	FW600	116, 117	G498	109	GSR1	125	HG5009	109
EVR27	146	FW600A	116, 117	G580	109	GZ5.1	135	HG5078	109
EVR27A	146	FWL100	116, 117	G657	116, 117	GZ6.2	137	HG5079	109
EVR27B	146	FWL200	116, 117	G659	116, 117	GZ9.1	139	HG5085	109
EVR82	150	FWL300	116, 117	G700	116, 117	GZ27	146	HG5808	109
EVR82A	150	FZ3.6T5	134	G701	116, 117	H50	116, 117	HGR1	116, 117
EVR82B	150	FZ3.6T10	134	G702	116, 117	H100	116, 117	HGR2	116, 117
EVR110	151	FZ5.1T5	135	G766	109	H200	116, 117	HGR3	116, 117
EVR110A	151	FZ5.1T10	135	G788	109	H300	116, 117	HGR4	116, 117
EVR110B	151	FZ5.6T5	136	G789	109	H400	116, 117	HR5A8E	116, 117
F-05	116, 117	FZ5.6T10	136	G790	109	H500	116, 117	HR10	116, 117
F1	116, 117	FZ6.2T10	137	G814	109	H600	116, 117	HR11	116, 117
F2	116, 117	FZ12A	142	G815	109	H800	125	HR13	116, 117
F3	116, 117	FZ12T5	142	G816	109	H-881	125	HS-7/1	118
F4	116, 117	FZ12T10	142	G820	109	H1000	125	HS-7/17M	118
F5	116, 117	FZ14T5	144	G821	109	H8287	109, 110	HS-8/1	118
F6	116, 117	FZ14T10	144	G822	109	H8287-4	109, 110	HS133	111, 112
F8	125	FZ15A	145	G823	109	HA50	116, 117	HS1001	116, 117
F10	125	FZ15T5	145	G824	109	HA100	116, 117	HS1002	116, 117
F16	137	FZ15T10	145	G825	109	HA200	116, 117	HS1003	116, 117
F20-1010	109	FZ21A	146	G844	109	HA300	116, 117	HS1007	116, 117
F20-1012	109	FZ27T5	146	G845	109	HA400	116, 117	HS1008	116, 117
F20-1013	109	FZ27T10	146	G846	109	HA500	116, 117	HS1009	116, 117
F20-1014	109	FZ33A	147	G847	109	HA600	116, 117	HS1010	116, 117
F20-1015	116, 117	FZ82A	150	G868	109	HA800	125	HS1011	116, 117
F20-1016	116, 117	G01	116, 117	G869	109	HA1000	125	HS1012	116, 117
F136	109	G01A	111, 112	G10119	116, 117	HAR10	116, 117	HS1020	116, 117
F215-1010	109	G02	116, 117	GD1E	109	HAR15	116, 117	HS2036	134
F215-1012	109	G1	116, 117	GD1P	109	HAR20	116, 117	HS2051	135
F215-1013	109	G1HA	109	GD1Q	109	HB2	116, 117	HS2056	136
F215-1014	109	G2	116, 117	GD4E	109	HB3	116, 117	HS2062	137
F215-1016	116, 117	G3	116, 117	GD5E	109	HC30	116, 117	HS2100	140
F215-1017	116, 117	G4	116, 117	GD6E	109	HC67	116, 117	HS2120	142
F10124	116, 117	G5	116, 117	GD8E	109	HC68	116, 117	HS2150	145
F10148	116, 117	G5C	109	GD11E	116, 117	HC69	116, 117	HS2270	146
F20303	109	G5F	109	GD12	116, 117	HC71	116, 117	HS2330	147
FA4	116, 117	G5K	109	GD12E	116, 117	HC72	125	HS3103	116, 117
FA6	116, 117	G5.1T5	135	GD13E	109	HC73	125	HS3104	116, 117
FA8	125	G5.1T10	135	GD72E/3	116, 117	HC80	116, 117	HS3108	125
FA8005	141	G5.1T20	135	GD72E/4	116, 117	HC500	116, 117	HS3110	125
FA8006	141	G5.6T5	136	GD72E/5	116, 117	HC670	116, 117	HS7036	134
FA8007	141	G5.6T10	136	GD73E/3	109	HC680	116, 117	HS7051	135
FA8008	141	G5.6T20	136	GD73E/4	109	HC700	116, 117	HS7056	136
FA8009	145	G6	116, 117	GD73E/5	109	HC710	116, 117	HS7062	137
FA8010	145	G7	111, 112	GD74E/4	109	HC720	125	HS7100	140
FA8011	145	G7A	111, 112	GD74E/5	109	HC730	125	HS7120	142
FA8012	145	G7D	109	GD400	109	HCV	116, 117	HS7150	145
FD3	116, 117	G7E	109	GD401	109	HD6865	116, 117	HS7270	146
FD6	116, 117	G7F	109	GD402	109	HD1000303	109, 110	HS7330	147
FD222	116, 117	G7G	109	GD403	109	HD1000309	138	HW15	109
FD333	116, 117	G8	125	GD404	109	HD2000110	116, 117	HW8.2A	139
FD1599	116, 117	G9.1T5	139	GD405	109	HE-1N34A	109	HW9.1	139
FD1708	114	G9.1T10	139	GD406	109	HE-1N60	109	HW9.1A	139
FD3389	116, 117	G9.1T20	139	GD409	109	HE-1S188	109	HW9.1B	139
FD6451	109	G10	125	GD663	109	HE-1S426	109	HW12	142
FDM600	116, 117	G12T5	142	GE42-7	116, 117	HE-1S446	109	HW12A	142
FM1J2	125	G12T10	142	GE-CR1	118	HE-SD1	116, 117	HW12B	142
FR-1	116, 117	G12T20	142	GE-CR2	119	HEP154	116, 117	HW15	145
FR-1M	116, 117	G15T10	145	GE-CR3	120	HEP156	116, 117	HW15A	145
FR-1P	116, 117	G15T20	145	GE-504	116, 117	HEP157	116, 117	HW15B	145
FR-10	125	G27T5	146	GE-504A	116, 117	HEP158	116, 117	HW27	146
FR-1033	118	G27T10	146	GE505	116, 117	HEP159	125	HW27A	146
FSA1169	115	G27T20	146	GE509A	125	HEP160	125	HW27B	146
FSA1177	113	G100B	116, 117	GE-X1	122	HEP165	113	HW33	147
FSA1178	113	G100D	116, 117	GEX-11	140	HEP166	115	HW33A	147
FSA1202	115	G100G	116, 117	GE-X36	116, 117	HEP300	122	HW33B	147
FSP288-1	116, 117	G100J	116, 117	GE-X66	116, 117	HEP302	122	HW62	149
FST2	116, 117	G100K	125	GJ4M	116, 117	HF-0S005	116, 117	HW62A	149
FST3	116, 117	G100M	125	GM1J2	125	HFSD1	116, 117	HW62B	149
FT-1	116, 117	G130	116, 117	GP230	116, 117	HF-SD-1A	116, 117	HW82	150
FT1N	116, 117	G156	109	GP250	116, 117	HFSD1B	116, 117	HW82A	150
FT10	125	G157	109	GPMINA	109	HFSD1Z	116, 117	HW82B	150
FUIK	116, 117	G158	109	GPM1NB	109	HF-SG005	116, 117	IR1601	122
FUI0	116, 117	G159	109	GPM2NA	109	HFOW05	116, 117	IR1602	122
FV21	138	G198	109	GSM51	116, 117	HG1090	109	IR1772	122
FV22	137	G199	109	GSM52	116, 117	HG5002	109	IR1774	122
FW100	116, 117	G200	109	GSM53	116, 117	HG5004	109	IRFE100	133

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IT23	109	K5E5	116, 117	LPM33A	147	M500	116, 117	MC030A	116, 117
IT23G	109	K5F5	116, 117	LPM62	149	M500A	116, 117	MC030B	116, 117
J24567	110	K5G5	116, 117	LPM62A	149	M500B	116, 117	MC035	116, 117
J24570	116, 117	K5H5	125	LPM82	150	M500C	116, 117	MC040	116, 117
JAM702C	116, 117	K5K5	125	LPM82A	150	M604	116, 117	MC040A	116, 117
JB-BB1A	116, 117(4)	K5M5	125	LPM110	151	M670	116, 117	MC070	125
JB18C4	116, 117(4)	K6	109, 112	LPM110A	151	M670A	116, 117	MC070A	125
JCK505	116, 117	K34S747	111, 116	LPZT12	142	M670B	116, 117	MC080	125
JCN1	116, 117	K80	109	LPZT15	145	M670C	116, 117	MC080A	125
JCN2	116, 117	K112C	113	LPZT27	146	M680	116, 117	MC090	125
JCN-3	116, 117	K115J510-1	113	LPZT33	147	M680A	116, 117	MC090A	125
JCN-4	116, 117	K115J510-2(WT16X7)	113	LR51CH	135	M680B	116, 117	MC19	116, 117
JCN5	116, 117	K115J511-2	109	LR56CH	135	M680C	116, 117	MC100	125
JCN7	125	K117J460-1	113	LR150CH	145	M690	116, 117	MC100A	125
JCV-2	116, 117	K117J460-2	113	LZ5.6	136	M690A	116, 117	MC170	116, 117
JCV-3	116, 117	K118J966-1(WT16X9)	114	LZ10	140	M690B	116, 117	MC456	116, 117
JCV7	125	K118J966-2	115	LRR-50	116, 117	M690C	116, 117	MC1520	116, 117
JD-BB1A	116, 117	K118J966-3(WT16X8)	115	LRR-100	116, 117	M700	116, 117	MC1521	116, 117
JDS01D	116, 117	K118J966-4	115	LRR-200	116, 117	M700A	116, 117	MC1522	116, 117
JP575005	110	K122	113	LRR-300	116, 117	M700B	116, 117	MC1523	116, 117
JP575995	110	K122J176-1	118	LRR-400	116, 117	M700C	116, 117	MC1524	116, 117
J241	109	K122J176-2	118	LRR-500	116, 117	M701B	116, 117	MC1527	125
J242	109	K122J177-P1	119	M-0027	116, 117	M702C	116, 117	MC1528	125
J243	109	K882	109	M1H	116, 117	M710	116, 117	MC1529	125
J2441	109	K1615	113	M4HZ	116, 117	M710A	116, 117	MC6007	136
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KC08C11/10	116, 117	KC08C22/1	116, 117(4)	M4Z15	145	M720	125	MC500A	137
KC08C21/5	116, 117	KC08E911/8	116, 117	M4Z27	146	M720A	125	MC501A	140
KC0911/8	116, 117	KC0202/1	116, 117	M4Z33	147	M720B	125	MC5014A	140
KC1322/1	116, 117	KC24P11/1412/1	116(3)	M4Z62	149	M720C	125	MC6016	142
KD2100	122	KC24P12/1	116, 117(2)	M4Z62A	149	M730	125	MC6016A	142
KD2103	116, 117	KC13C22/1	116, 117	M4Z82	150	M730A	125	MC6018	145
KSK4E40C200	116, 117	KD27	109	M4Z110	151	M730B	125	MC6018A	145
KSK4E40C500	116, 117	KD2104	116, 117	M6HZ	116, 117	M730C	125	MC6024	146
K1A5	116, 117	KD2501	140	M8HZ	125	M4552	144	MC6024A	146
K1B5	116, 117	KD2503	137	M12	116, 117	M4659	144	MC6026	147
K1C5	116, 117	KD2504	139	M14	116, 117	M4663	147	MC6026A	147
K1D5	116, 117	KD2506	142	M22	116, 117	M4728	151	MC6107	136
K1E5	116, 117	KS31A	134	M34A	109	M4736	116, 117	MC6107A	136
K1F5	116, 117	KS35A	135	M4A2	116, 117	M4850	141	MC6108	137
K1G5	116, 117	KS35AF	135	M51	109	M4851	141	MC6108A	137
K1.3G22-1A	116, 117	KS37A	137	M67A	109	M4858	147	MC6116	142
K1H5	125	KS42A	140	M62	116, 117	M8222	116, 117	MC6116A	142
K1K5	125	KS42B	140	M67	116, 117	M8482	112	MC6118	145
K1M5	125	KS44A	142	M67A	116, 117	M8513	109	MC6118A	145
K2A5	116, 117	KS44B	142	M67B	116, 117	M9206	116, 117	MC6124	146
K2B5	116, 117	KS46	145	M67C	116, 117	M9312	116, 117	MC6124A	146
K2C5	116, 117	KS100A	140	M68	116, 117	M9314	116, 117	MC6126	147
K2D5	116, 117	KS120A	142	M68A	116, 117	M9317	116, 117	MC6126A	147
K2E5	116, 117	KS120B	142	M68B	116, 117	M9319	116, 117	MCR2305-4	122
K2F5	116, 117	KS150A	145	M68C	116, 117	M105064	120	MCV	116, 117
K2G5	116, 117	KS150B	145	M69	116, 117	M109474	113	MD04	116, 117
K2H5	125	KSO51A	135	M69A	116, 117	M41232-2	116, 117	MD46	109
K2K5	125	KSO56A	136	M69B	116, 117	MA2	116, 117	MD60	109
K2M5	125	KSO56B	136	M69C	116, 117	MA-8	109	MD60A	109
K3	111, 112	KSO62A	137	M70	116, 117	MA-23B	109	MD134	116, 117
K3B5	116, 117	KSKE12C500	125	M70A	116, 117	MA26	116, 117	MD135	116, 117
K3C5	116, 117	KSKE40C200	116, 117	M70B	116, 117	MA51A	109	MD136	116, 117
K3D5	116, 117	KSKE40C500	116, 117	M70C	116, 117	MA101	116, 117	MD137	116, 117
K3E	111, 112	KSKE125C200	125	M71	116, 117	MA102	116, 117	MD138	116, 117
K3F5	116, 117	KVR10	140	M71A	116, 117	MA110	116, 117	MD752	136
K3G5	116, 117	L3/2H	116, 117	M71B	116, 117	MA203	116, 117	MD752A	136
K3H5	125	L6/2H	116, 117	M71C	116, 117	MA211	116, 117	MD753	137
K3K5	116, 117	L8/2H	116, 117	M72	125	MA215	116, 117	MD753A	137
K3M5	125	LCO.09M11/3	116, 117	M72A	125	MA350	116, 117	MD757	139
K4E5	116, 117	LP1H	116, 117	M72B	125	MA351	116, 117	MD757A	139
K4B5	116, 117	LP1H	116, 117	M72C	125	MA900	109	MD759	142
K4C5	116, 117	LP2H	116, 117	M72D	125	M801	116, 117	MD759A	142
K4D5	116, 117	LP3H	116, 117	M73	125	MC010	116, 117	MEZ5.6T5	136
K4E5	116, 117	LP4H	116, 117	M73A	125	MCD15	116, 117	MEZ5.6T10	136
K4F5	116, 117	LPM9.1	139	M73B	125	MCD20	116, 117	MEZ12T5	142
K4G5	116, 117	LPM9.1A	139	M73C	125	MC021	116, 117	MEZ12T10	142
K4H5	125	LPM12	142	M82	125	MC021A	116, 117	MEZ15T5	145
K4K5	125	LPM12A	142	M95	109	MC022	116, 117	MEZ15T10	145
K4M5	125	LPM15	145	M102	125	MC022A	116, 117	MEZ27T5	146
K5A5	116, 117	LPM15A	145	M124J779-1	116, 117	MC023	116, 117	MEZ27T10	146
K5B5	116, 117	LPM27	146	M135	138	MC023A	116, 117	MH67	116, 117
K5C5	116, 117	LPM27A	146	M150	116, 117	MC025	116, 117	MH68	116, 117
K5D5	116, 117	LPM33	147	M204B	116, 117(4)	MC030	116, 117	MH70	116, 117

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MH71	116, 117	MZ12	142	OA73C	109	PA305	116, 117	PE405	116, 117
MH72	125	MZ12A	142	OA79	109	PA305A	116, 117	PE406	116, 117
MH500	116, 117	MZ12B	142	OA81	109	PA310	116, 117	PE408	125
MH670	116, 117	MZ15A	145	OA90	109	PA310A	116, 117	PE410	125
MH680	116, 117	MZ15T20	145	OA91	109	PA315	116, 117	PE502	116, 117
MH70	116, 117	MZ27A	146	OA126/5	135	PA315A	116, 117	PE504	116, 117
MH710	116, 117	MZ23A	147	OA126/10	140	PA320	116, 117	PE506	116, 117
MH720	125	MZ28A	150	OA126/12	142	PA320A	116, 117	PE508	125
MH730	125	MZ500-5	134	OA126/14	144	PA320B	116, 117	PE510	125
MM0	116, 117	MZ500-9	135	OA127	116, 117	PA325	116, 117	PH9d522/1	116, 117(4)
MM2	116, 117	MZ500-10	136	OA128	116, 117	PA325A	116, 117	PH25C22/1	116, 117
MM3	116, 117	MZ500-15	139	OA129	116, 117	PA325B	116, 117	PH108	116, 117
MM4	116, 117	MZ500-16	140	OA130	116, 117	PA330	116, 117	PH109	125
MM5	116, 117	MZ500-18	142	OA131	116, 117	PA330A	116, 117	PH1021	116, 117
MM6	116, 117	MZ500-20	145	OA132	116, 117	PA330B	116, 117	PR515	135
MM7	125	MZ500-26	146	OA134Q	109	PA340	116, 117	PR605	135
MM8	125	MZ500-28	147	OA150	116, 117	PA340A	116, 117	PR617	142
MM9	125	MZ500-35	149	OA150	116, 117	PA340B	116, 117	PR620	145
MM10	125	MZ500-38	150	OA172	109	PA350	116, 117	PR804	135
MN34A	109	MZ605	137	OA174	109	PA350A	116, 117	PRC10A	122
MN51	109	MZ610	137	OA180	109	PA360	117, 116	PRC15A	122
MN60	109	MZ620	137	OA200	116, 117	PA360A	116, 117	PRC20A	122
MP-01	116, 117	MZ640	137	OA202	116, 117	PA380	125	PRS3017	135
MP100	116, 117	MZ1005	135	OA210	116, 117	PA400	116, 117	PS005	116, 117
MP225	116, 117	MZ1010	140	OA211	116, 117	PA600	116, 117	PS010	116, 117
MP300	116, 117	MZ1014	144	OA214	116, 117	PA10556	116, 117	PS015	116, 117
MP400	116, 117	NZ A	109	OAZ201	135	PBE3322	109	PS020	116, 117
MP500	116, 117	N48	109	OAZ202	136	PC0211/2	116, 117	PS025	116, 117
MP600	116, 117	NA13	116, 117	OAZ209	135	PD101	116, 117	PS030	116, 117
MPX-25	116, 117	NA21	116, 117	OAZ213	142	PD102	216, 117	PS035	116, 117
MPX215	116, 117	NA22	116, 117	OAZ242	136	PD103	116, 117	PS040	116, 117
MQ3/2	116, 117	NA25	116, 117	OAZ269	135	PD104	116, 117	PS050	116, 117
MQ6/2	116, 117	NA32	116, 117	OSS16308	116, 117	PD105	116, 117	PS060	117, 116
MQ8/2	116, 117	NA33	116, 117	OSS16685	109	PD106	116, 117	PS105	116, 117
MR36H	134	NA35	116, 117	OSS36503	116, 117	PD107	116, 117	PS110	116, 117
MR150C-H	145	NA36	116, 117	OSS36885	116, 117	PD107A	116, 117	PS120	116, 117
MR990	125	NA42	116, 117	OY101	116, 117	PD108	116, 117	PS125	116, 117
MR1032B	116, 117	NA45	116, 117	OY5061	116, 117	PD110	116, 117	PS130	116, 117
MR1237FB	116, 117	NA46	116, 117	OY5062	116, 117	PD111	116, 117	PS135	116, 117
MR1237FL	116, 117	NA62	117, 116	OY5063	116, 117	PD114	125	PS140	116, 117
MR1237SB	116, 117	NA63	117, 116	OY5064	116, 117	PD115	125	PS150	116, 117
MR1237SL	116, 117	NA65	117, 116	OY5065	116, 117	PD116	125	PS160	116, 117
MR1247FB	116, 117	NA66	117, 116	OY5066	117, 116	PD122	116, 117	PS405	116, 117
MR1247FL	116, 117	NA74	125	OY5067	125	PD125	116, 117	PS410	116, 117
MR1247SB	116, 117	NA75	125	PIA5	116, 117	PD129	116, 117	PS415	116, 117
MR1247SL	116, 117	NA76	125	PIB5	116, 117	PD130	116, 117	PS420	116, 117
MR1267	116, 117	NA84	125	P2A5	116, 117	PD131	116, 117	PS425	116, 117
MR1337-1	116, 117	NA85	125	P2B5	116, 117	PD132	116, 117	PS430	116, 117
MR1337-2	116, 117	NA86	125	P3A5	116, 117	PD133	116, 117	PS435	116, 117
MR1337-3	116, 117	NA104	125	P3A/2H	116, 117	PD134	116, 117	PS440	116, 117
MR1337-4	116, 117	NA105	125	P4A5	116, 117	PD135	116, 117	PS450	116, 117
MR1337-5	116, 117	NGP3002	109	P5A5	116, 117	PD910	116, 117	PS460	117, 116
MR2261	116, 117	NGP3003	116, 117	P6A5	116, 117	PD913	125	PS603	116, 117
MR2266	125	NGP5002	137	P6/2H	116, 117	PD914	125	PS604	116, 117
MR2272	116	NGP5007	139	P6RP8	125	PD915	125	PS605	116, 117
MR2273	116, 117	NGP5010	142	PERP10	125	PD916	125	PS609	116, 117
MS1H	116, 117	NL5	116, 117	P7A5	116, 117	PD6003	134	PS610	116, 117
MS2H	116, 117	NL10	116, 117	P8/2H	116, 117	PD6003A	134	PS611	116, 117
MS3H	116, 117	NL15	116, 117	P15	113	PD6007	135	PS615	116, 117
MS4H	116, 117	NL20	116, 117	P16	114	PD6007A	135	PS616	116, 117
MS5H	116, 117	NL25	116, 117	P17	115	PD6008	136	PS617	116, 117
MS11H	116, 117	NL30	116, 117	P100	116, 117	PD6008A	136	PS621	116, 117
MS12H	116, 117	NL40	116, 117	P200	116, 117	PD6009	137	PS622	116, 117
MS13H	116, 117	NL50	116, 117	P400	116, 117	PD6009A	137	PS623	116, 117
MS14H	116, 117	NL60	117, 116	P500	116, 117	PD6014	140	PS627	116, 117
MS35H	116, 117	NPP50A	116, 117	P600	116, 117	PD6014A	140	PS628	116, 117
MS36H	116, 117	NPP60A	117, 116	P800	116, 125	PD6016	142	PS629	116, 117
MS50	116, 117	NPC0010	116, 117	P1000	125	PD6016A	142	PS632	116, 117
MT14	116, 117	NSS1021	125	PI0115	116, 117	PD6018	145	PS633	116, 117
MT24	116, 117	NU34	109	PI0155	109	PD6018A	145	PS636	116, 117
MT44	116, 117	NU398B	116, 117	PI0156	116, 117	PD6044	134	PS637	116, 117
MT64	116, 117	O101	116, 117	P21316	116, 117	PD6048	135	PS1140	125
MT84	125	OA6	109	P21317	116, 117	PD6049	136	PS1511	140
MZ5A	136	OA7	109	P21344	139	PD6055	140	PS1512	140
MZ5-1T5	135	OA9	109	PA069	116, 117	PD6059	145	PS1513	140
MZ6-2	137	OA70	109	PA070	116, 117	PE401	116, 117	PS1514	140
MZ6-2A	137	OA71	109	PA071	116, 117	PE401N	116, 117	PS1515	140
MZ6-2B	137	OA71C	109	PA3	116, 117	PE402	116, 117	PS1516	140
MZ6-2T5	137	OA72	109	PA200	116, 117	PE403	116, 117	PS1517	140
MZ10A	140	OA73	109	PA300	125	PE404	116, 117	PS2207	116, 117

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PS2208	116, 117	QZ27T10	146	RFV60500	116, 117	S1D	125	S79	116, 117
PS2209	116, 117	R080	125	RL31	109	S1S-M-150-02	116, 117	S81	116, 117
PS2247	116, 117	R1	116, 117	RL32	109	S1S-W-05-02	116, 117	S82	116, 117
PS2449	116, 117	R1A	116, 117	RL32G	109	S1S20	109	S83	116, 117
PS2412	116, 117	R1B	116, 117	RL34	109	S2A06	116, 117	S84	116, 117
PS2413	116, 117	R3/H2	116, 117	RL34G	109	S2A10	116, 117	S85	116, 117
PS2415	116, 117	R4A	116, 117	RL41	109	S2A11	116, 117	S86	116, 117
PS2416	125	R5	125	RL41G	109	S2A22	116, 117	S91	116, 117
PS2417	125	R5B	125	RL42	109	S2C30	116, 117	S91-A	116, 117
PS4559	116, 117	R5C	125	RL52	109	S2C40	116, 117	S91-H	116, 117
PS4560	116, 117	R6	125	RL232G	109	S2C40A	116, 117	S92	116, 117
PS4725	116, 117	R67/2H	116, 117	RL246	109	S2E20	116, 117	S92-A	116, 117
PS5300	116, 117	R8	125	RL252	109	S2E60	116, 117	S92-H	116, 117
PS5301	116, 117	R8/2H	125	RLF1G	116, 117	S2E60-1	116, 117	S93	116, 117
PS5302	116, 117	R60-1007	109	RS220AF	116, 117	S2E100	125	S93A	116, 117
PS6325	150	R66-8504	116, 117	RS230AF	116, 117	S2PB	116, 117(4)	S93H	116, 117
PS6468	135	R122C	116, 117	RS1264	116, 117	S3A06	116, 117	S94	116, 117
PS8906	135	RS154B	116, 117(4)	RS1290	137	S3A11	116, 117	S95	116, 117
PS8907	136	R855-2	116, 117	RS1296	116, 117(4)	S3M X	116, 117	S100	125
PS8908	137	R105064	118	RS1805	116, 117	S4A06	116, 117	S101	116, 117
PS8915	142	R106379	116, 117	RS1811	109	S4A11	116, 117	S102	116, 117
PS8917	145	R109328	113	RS1832	116, 117	S4A12	116, 117	S103	116, 117
PS10019B	139	R109474	113	RS2801	109	S4A30	116, 117	S104	116, 117
PS10022B	142	R113321	116, 117	RS3570	116, 117	S4FN300	116, 117	S105	116, 117
PS10024B	145	R113392	116, 117	RS3727	116, 117	S5A11	116, 117	S106	116, 117
PS10063	139	RC080	125	RS6344	116, 117	S5A12	116, 117	S107	116, 117
PS10066	142	RD05A	135	RS6461	116, 117	S6A11	116, 117	S108	116, 117
PS10068	145	RD05B	135	RS6471	116, 117	S6A12	116, 117	S115	116, 117
PT-3	116, 117	RD11A	141	RS6705	116, 117	S7A11	125	S129	116, 117
PT-5	116, 117	RD13A	143	RT1008	109	S8A11	125	S201	116, 117
PT-5B	116, 117	RD13B	143	RT1106	109	S8A12	125	S202	116, 117
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PT9C22/1	116, 117(4)	RD13D	143	RT1184	109	S10	116, 117	S204	116, 117
PT-505	116, 117	RD250	116, 117	RT1567	109	S10A	116, 117	S205	116, 117
PT-510	116, 117	RD3472	116, 117	RT1689	109	S10A11	125	S206	117, 116
PT-515	116, 117	RD26235-1	116, 117	RT1840	116, 117	S10A12	125	S208	125
PT-520	116, 117	RD29799P	116, 117	RT2016	109	S13	116, 117	S210	125
PT-525	116, 117	RD131903P	116, 117	RT2334	109	S14	116, 117	S217	116, 117
PT-530	116, 117	RE2	116, 117	RT2451	109	S15	116, 117	S218	117, 116
PT-540	116, 117	RE3	116, 117	RT2452	109	S16	116, 117	S219	116, 117
PT-550	116, 117	RE504	117, 116	RT2669	116, 117(2)	S16A	116, 117	S220	116, 117
PT-560	116, 117	RE1023	113	RT2694	109	S16B	116, 117	S221	116, 117
PT580	125	RF1811	109	RT3072	109	S17	116, 117	S222	116, 117
PT72130	116, 117	RF3160	116, 117	RT3099	109	S17A	116, 117	S223	116, 117
PV-8	116, 117	RF3472	116, 117	RT3443	116, 117	S18	116, 117	S224	116, 117
Q1B	116, 117	RF5464-1P	113	RT3469	109	S18A	116, 117	S230	116, 117
Q1H	116, 117	RF5465	113	RT3574	138	S18B	116, 117	S232	117, 116
Q2	116, 117	RF5465-1P	113	RT3671	145	S19	116, 117	S233	116, 117
Q4B	116, 117	RF5794	114	RT3858	116, 117	S19A	116, 117	S234	117, 116
Q6/2	116, 117	RF6235-1	116, 117	RT3981	116, 117	S20	125	S235	116, 117
Q8/2	116, 117	RF26234-1	116, 117	RT4050	116, 117	S20ND400	116, 117	S238	116, 117
Q49	109	RF26235-1	116, 117	RT4232	116, 117	S20NH400	116, 117	S239	116, 117
Q50	109	RF26235-5	116, 117	RT61012	109	S21	116, 117	S240	116, 117
Q51	109	RF29799P	116, 117	RV6.2	137	S22	116, 117	S241	116, 117
Q52	116, 117	RF31903P	116, 117	RZ3.6	134	S22A	116, 117	S243	116, 117
Q53	116, 117	RF32101R	116, 117	RZ5.1	135	S23	117, 116	S250	116, 117
Q54	116, 117	RF32101-8	116, 117	RZ5.6	136	S23A	116, 117	S251	116, 117
Q55	116, 117	RF32101-9	116, 117	RZ6.2	137	S24	125	S252	116, 117
Q56	116, 117	RF32102R	119	RZ10	140	S26	116, 117	S253	116, 117
Q57	116, 117	RF32103-1	118	RZ15	145	S28	125	S254	116, 117
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Q60	116, 117	RF32645	116, 117	RZ27A	146	S32	116, 117	S257	125
QZ3.6T5	134	RF33426-7	113	RZ33A	147	S33	116, 117	S258	125
QZ3.6T10	134	RF33976	116, 117	RZ82A	150	S34	116, 117	S260	125
QZ5.1T5	135	RF34383	116, 117	RZ23.6	134	S35	116, 117	S262	116, 117
QZ5.1T10	135	RF35117	116, 117	RZ25.1	135	S36	116, 117	S428	116, 117
QZ5.6T5	136	RFJ30704	116, 117	RZ25.6	136	S40	116, 117	S431	116, 117
QZ5.6T10	136	RFJ31218	116, 117	RZ26.2	137	S40A	116, 117	S500	125
QZ6.2T5	137	RFJ31362	116, 117	RZ210	140	S44	116, 117	S500B	116, 117
QZ6.2T10	137	RFJ31363	116, 117	RZ215	145	S46	116, 117	S500C	116, 117
QZ10T5	140	RFJ33292	116, 117	S010G	125	S47	116, 117	S750	125
QZ10T10	140	RFJ60286	116, 117	S046	137	S48	116, 117	S750C	125
QZ12T5	142	RFJ60313	113	S1A-3	137	S49	116, 117	S855	120
QZ12T10	142	RFJ60366	116, 117	S1AR1	116, 117	S61	125	S913	118
QZ14T5	144	RFJ60614	109	S1AR2	116, 117	S62	125	S926	118
QZ14T10	144	RFJ60869	116, 117	S1A06	116, 117	S63	125	S1384	110
QZ15T5	145	RF130596	116, 117	S1A060	116, 117	S73	116, 117	S6005	116, 117
QZ15T10	145	RFLM33160	116, 117	S1B	116, 117	S75	116, 117	S10149	116, 117(4)
QZ27T5	146	RFP33118	116, 117	S1C	125	S77	116, 117	S17074	113

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SB01	116, 117	SD-94	116, 117	SI600	116, 117	SLA536	116, 117	SM130	116, 117
SB-2	116, 117	SD-94A	116, 117	SID2A-1	113	SLA537	116, 117	SM140	116, 117
SB302	116, 117	SD-94AB	116, 117	SID2A-3	113	SLA538	116, 117	SM150-005	109
SB315	116, 117	SD945	116, 117	SID3B-3	115	SLA539	116, 117	SM150-02	116, 117
SB332	116, 117	SD94S	116, 117	SID01E	116, 117	SLA540	116, 117	SM150-6	116, 117
SB333	116, 117	SD-95A	116, 117	SID01K	125	SLA547	116, 117	SM150	116, 117
SB393	116, 117	SD96	116, 117	SID01L	116, 117	SLA560	125	SM150A	116, 117
SC1	116, 117	SD96A	116, 117	SID02E	116, 117	SLA561	125	SM150B	116, 117
SC2	116, 117	SD98A	125	SID02K	125	SLA599	116, 117	SM150C	125
SC4	116, 117	SD98S	125	SID02L	116, 117	SLA599A	116, 117	SM150D	125
SC-6	109	SD-101	116, 117	SIGL/100	116, 117	SLA600	116, 117	SM150S	116, 117
SC8	125	SD102	116, 117	SIGL/200	116, 117	SLA600A	116, 117	SM150SS	116, 117
SC8A	125	SD104	116, 117	SIGL/400	116, 117	SLA601	116, 117	SM160	116, 117
SC10	125	SD105	116, 117	SIGL/600	116, 117	SLA601A	116, 117	SM170	125
SC10A	125	SD165	116, 117	SIGL/800	125	SLA602	116, 117	SM180	125
SC20	109	SD-201	116, 117	SIL200	116, 117	SLA602A	116, 117	SM200	125
SC54	109	SD-404	111, 112	SISM-150-01	116, 117	SLA603	116, 117	SM205	116, 117
SC110	117, 116	SD500	116, 117	SISW-05-02	116, 117	SLA603A	116, 117	SM210	116, 117
SC305	116, 117	SD300C	116, 117	SJ051F	116, 117	SLA604	116, 117	SM220	116, 117
SC4116	116, 117	SD600	116, 117	SJ052F	116, 117	SLA604A	116, 117	SM230	116, 117
SCA05	116, 117	SD060C	116, 117	SJ60F	116, 117	SLA605	116, 117	SM240	116, 117
SCA1	116, 117	SD080	125	SJ101F	116, 117	SLA605A	116, 117	SM250	116, 117
SCA2	116, 117	SD910	125	SJ102F	116, 117	SLA606	116, 117	SM260	116, 117
SCA3	116, 117	SD910A	125	SJ201F	116, 117	SLA606A	116, 117	SM270	125
SCA4	116, 117	SD910S	125	SJ202F	116, 117	SLA1095	116, 117	SM280	125
SCA5	116, 117	SDD4	113	SJ301F	116, 117	SLA1100	116, 117	SM300	125
SCA6	116, 117	SDD5	114	SJ302F	116, 117	SLA1100	116, 117	SM483	116, 117
SCA8	125	SDD6	115	SJ401F	116, 117	SLA1101	116, 117	SM486	116, 117
SCA10	125	SE05	116, 117	SJ402F	116, 117	SLA1102	116, 117	SM487	116, 117
SCE1	116, 117	SE05A	116, 117	SJ501F	116, 117	SLA1103	116, 117	SM488	116, 117
SCE2	116, 117	SE05B	116, 117	SJ601F	116, 117	SLA1104	116, 117	SM505	116, 117
SCE4	116, 117	SE05D	116, 117	SK3016	116, 117	SLA1105	117, 116	SM510	116, 117
SCE6	116, 117	SE05S	116, 117	SK3017	116, 117	SLA1487	116, 117	SM512	116, 117
SCE8	125	SE05SS	116, 117	SK3017A	116, 117	SLA1488	116, 117	SM513	116, 117
SCE10	125	SE46	116, 117	SK3030	116, 117	SLA1489	116, 117	SM514	116, 117
SC05	116, 117	SE1730	125	SK3031	116, 117	SLA1490	116, 117	SM515	116, 117
SC05E	116, 117	SE30B26A	116, 117	SK3032	125	SLA1491	116, 117	SM516	116, 117
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SD05	116, 117	SFD112	109	SL-2	116, 117	SLA1692	116, 117	SM518	125
SD07	116, 117	SFR135	116, 117	SL-3	116, 117	SLA1693	116, 117	SM520	125
SD1	116, 117	SFR151	116, 117	SL5	116, 117	SLA1694	116, 117	SM645	116, 117
SD-1A	116, 117	SFR152	116, 117	SL91	116, 117	SLA1695	116, 117	SM646	116, 117
SD-1B	125	SFR153	116, 117	SL92	116, 117	SLA1696	116, 117	SM705	116, 117
SD1C	125	SFR154	116, 117	SL93	116, 117	SLA1697	116, 117	SM710	116, 117
SD-1HF	116, 117	SFR155	116, 117	SL608	125	SLA2610	116, 117	SM720	116, 117
SD1L	116, 117	SFR156	116, 117	SL610	125	SLA2611	116, 117	SM730	116, 117
SD-1LA	116, 117	SFR164	116, 117	SL708	125	SLA2612	116, 117	SM740	116, 117
SD-1X	116, 117	SFR251	116, 117	SL710	125	SLA2613	116, 117	SM750	116, 117
SD-1Y	116, 117	SFR252	116, 117	SL-833	116, 117	SLA2614	116, 117	SM760	116, 117
SD-1Z	125	SFR253	116, 117	SL-833A	116, 117	SLA2615	116, 117	SM770	125
SD2	116, 117	SFR254	116, 117	SLA11AB	116, 117	SLA2616	125	SM780	125
SD2A	116, 117	SFR255	116, 117	SLA11C	116, 117	SLA2617	125	SM800	125
SD2B	125	SFR256	116, 117	SLA12AB	116, 117	SLA3193	116, 117	SO10G	125
SD2C	125	SFR258	125	SLA12C	116, 117	SLA3194	116, 117	SP-1	116, 117
SD4	116, 117	SFR264	116, 117	SLA13AB	116, 117	SLA3195	116, 117	SPN-01	116, 117
SD6	116, 117	SFR266	116, 117	SLA13C	116, 117	SLA3196	125	SQ46	109
SD7	125	SFR268	125	SLA14AB	116, 117	SLA01	125	SR-0004	113
SD8	125	SFZ708	136	SLA14C	116, 117	SM4	116, 117	SR-1	116, 117
SD12	116, 117	SFZ716	142	SLA15AB	116, 117	SM5	116, 117	SR1DMX	116, 117
SD12B	109	SFR-005	116, 117	SLA15C	116, 117	SM10	116, 117	SR1EMZ	116, 117
SD12E	109	SG105	116, 117	SLA16AB	116, 117	SM11	116, 117	SR1T	116, 117
SD12M	109	SG-205	116, 117	SLA16C	116, 117	SM20	116, 117	SR1Z	116, 117
SD14	109	SG-305	116, 117	SLA17AB	116, 117	SM30	116, 117	SR2A-1	116, 117
SD15	109	SG323	116, 117	SLA17C	116, 117	SM31	116, 117	SR2A-2	116, 117
SD21A	109	SG505	116, 117	SLA18AB	125	SM40	116, 117	SR2A-4	116, 117
SD-46	109	SG-805	116, 117	SLA18C	125	SM50	116, 117	SR2A-8	116, 117
SD-51	109	SG-119B	116, 117	SLA19AB	125	SM51	116, 117	SR2A-12	117, 116
SD56	109	SG-3400	116, 117	SLA19C	125	SM60	116, 117	SR3	116, 117
SD-80	116, 117	SH1	116, 117	SLA440	116, 117	SM70	125	SR5	116, 117
SD-82	111, 112	SH1A	116, 117	SLA440B	116, 117	SM71	125	SR6	113
SD82A	112	SH1B	125	SLA441	116, 117	SM73	125	SR10	114
SD82AG	112	SH1C	125	SLA441B	116, 117	SM80	125	SR13	113
SD-91	116, 117	SH4D05	116, 117	SLA442	116, 117	SM81	125	SR14	114
SD-91A	116, 117	SH4D1	116, 117	SLA442B	116, 117	SM83	125	SR15	114
SD91S	116, 117	SH4D2	116, 117	SLA443	116, 117	SM100	125	SR17	116, 117
SD-92	116, 117	SH4D3	116, 117	SLA444	116, 117	SM101	125	SR20	116, 117
SD-92A	117, 116	SH4D4	116, 117	SLA444A	116, 117	SM103	125	SR21	113
SD92S	116, 117	SH4D6	116, 117	SLA444B	116, 117	SM105	125	SR22	116, 117
SD-93	116, 117	SH4D8	125	SLA445	116, 117	SM110	116, 117	SR23	116, 117
SD-93A	116, 117	SI91G	116, 117	SLA445B	116, 117	SM120	116, 117	SR24	116, 117

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SR28	116, 117	ST47	111, 112	T2G	109	TE1078A	116, 117	TK800	125
SR29	113	ST2040P	116, 117	T3/2	116, 117	TE1080	116, 117	TK1000	125
SR30	116, 117	SV122	135	T3G	109	TE1086	113	TKF5	116, 117
SR31	119	SV133	140	T7	109	TE1095	118	TKF10	116, 117
SR32	118	SV135	142	T8/2	116, 117	TF20	116, 117	TKF20	116, 117
SR37	120	SV137	144	T8G	109	TF21	116, 117	TKF40	116, 117
SR40	116, 117	SV138	145	T9	109	TF22	116, 117	TKF60	116, 117
SR50	116, 117	SV1017	142	T9G	109	TF23	116, 117	TKF80	125
SR60	116, 117	SV1019	144	T11	109	TFR120	116, 117	TKF100	125
SR76	116, 117	SV1020	145	T12	109	TG11	116, 117	TL1	116, 117
SR100	116, 117	SV1238E	116, 117	T12G	109	TG12	116, 117	TL2	116, 117
SR101-1	116, 117	SV4012	142	T13	109	TG21	116, 117	TL11	116, 117
SR101-2	116, 117	SV4012A	142	T13G	109	TG22	116, 117	TL12	116, 117
SR105	116, 117	SV4014	144	T14	109	TG31	116, 117	TL21	116, 117
SR112	116, 117	SV4014A	144	T14G	109	TG32	116, 117	TL22	116, 117
SR114	116, 117	SV4015	145	T17	109	TG41	116, 117	TL31	116, 117
SR120	116, 117	SV4015A	145	T18	109	TG42	116, 117	TL32	116, 117
SR131-1	116, 117	SV4027	146	T20	109	TG51	116, 117	TL41	116, 117
SR144	116, 117	SV4027A	146	T20G	109	TG52	116, 117	TL42	116, 117
SR145	116, 117	SV4033	147	T21	109	TG61	116, 117	TL51	116, 117
SR150	125	SV4033A	147	T21G	109	TG62	116, 117	TL61	116, 117
SR151	116, 117	SV4055	148	T22	109	TH1S557	116, 117	TM33	116, 117
SR152	116, 117	SV4055A	148	T22G	109	TH400	116, 117	TM43	116, 117
SR200	116, 117	SV4062	149	T23G	109	TH600	116, 117	TM62	116, 117
SR200B	116, 117	SV4062A	149	T24G	109	TH800	125	TM63	116, 117
SR205	116, 117	SV4082	150	T26G	109	TH801	116, 117	TM65	116, 117
SR401	116, 117	SV4082A	150	T27G	109	TH802	116, 117	TM66	116, 117
SR405	116, 117	SV12388E	116, 117	T50	116, 117	TH803	116, 117	TM86	125
SR499	116, 117	SV12388E	116, 117	T100	116, 117	TH804	116, 117	TMD01	135
SR500	116, 117	SVC625	137	T140A0	122	TH805	116, 117	TMD01A	135
SR500B	116, 117	SVC1125	141	T140A1	122	TH806	116, 117	TMD02	136
SR605	116, 117	SV1150	141	T140A2	122	TH808	125	TMD02A	136
SR846-2	116, 117	SVM61	137	T200	116, 117	TH810	125	TMD03	137
SR889	116, 117	SVM111	141	T300	116, 117	TH1000	125	TMD03A	137
SR1493	116, 117	SVM601	137	T400	116, 117	THSG105	116, 117	TMD08	140
SR1668	116, 117	SVM602	137	T450	116, 117	TI52	116, 117	TMD08A	140
SR1692	116, 117	SVM605	137	T500	116, 117	TI53	116, 117	TMD41	116, 117
SR1693	116, 117	SVM1105	141	T550	116, 117	TI54	116, 117	TMD42	116, 117
SR1694	116, 117	SVM11020	141	T600	116, 117	TI-55	116, 117	TMD45	116, 117
SR1695	116, 117	SVM11021	141	T650	116, 117	TI56	116, 117	TP34	109
SR1731-1	116, 117	SW05-01	116, 117	T800	125	TI57	116, 117	TP34A	109
SR1731-2	116, 117	SW-05-02	116, 117	T800X	125	TI58	116, 117	TP101	116, 117
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SR1984	116, 117	SW05S	116, 117	T21238	109	TI004	116, 117	TR320008	109
SR2121	116, 117	SW05SS	116, 117	T21312	116, 117	TI005	116, 117	TR320020	116, 117
SR2301A	116, 117	SW05V	116, 117	T21313	109	TI006	116, 117	TR320022	116, 117
SR3010	116, 117	SW1	116, 117	T21333	116, 117	TI007	116, 117	TR320039	109
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SR3943	116, 117	SWD	125	T4590	116, 117	TI009	116, 117	TR320048	109
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SR6325	116, 117	SX633	116, 117	TA200	116, 117	TI XD747	134	TRC-P4	137
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SR6560	116, 117	SX642	116, 117	TA400	116, 117	TI XD758	140	TS05	116, 117
SR6567	116, 117	SX643	116, 117	TA500	116, 117	TJ5A	116, 117	TS1	116, 117
SR6617	116, 117	SX644	116, 117	TA600	116, 117	TJ10A	116, 117	TS2	116, 117
SRIA-1	116, 117	SX645	116, 117	TA800	125	TJ15A	116, 117	TS2A	116, 117
SRIA-2	116, 117	SYL128	110	TA1000	125	TJ20A	116, 117	TS4	116, 117
SRIA-4	116, 117	SZ5	135	TA1062	116, 117	TJ25A	116, 117	TS6	116, 117
SRIA-8	116, 117	SZ5.1	135	TA1063	116, 117	TJ30A	116, 117	TS8	125
SRIA-12	117, 116	SZ5.6	136	TA1064	116, 117	TJ35A	116, 117	TSB245	116, 117
SR9000	118	SZ6.2	137	TC02P12	116, 117	TJ40A	116, 117	TY66X26	116, 117
SR9001	119	SZ7.2A	139	TC0.09M21/3	114	TJ60A	116, 117	TV4	116, 117
SR9002	113	SZ9	139	TC0.2P11/2	116, 117	TK5	116, 117	TV6.5	116, 117
SR9003	116(33)	SZ10	140	TC27A5A	146	TK10	116, 117	TV8	125
SS321	116, 117	SZ12	142	TC33A5A	147	TK11	116, 117	TV2496	116, 117
SS322	116, 117	SZ12.0	142	TC62A5B	149	TK20	116, 117	TV24103	112
SS324	116, 117	SZ14	144	TC82A5B	150	TK21	116, 117	TV24104	116, 117
SS334	116, 117	SZ15	145	TC110A5B	151	TK30	116, 117	TV24125	116, 117
SS337	116, 117	SZ15.0	145	TC136	116, 117	TK40	116, 117	TV24136	116, 117
SS455	116, 117	SZ200	135	TE1011	116, 117	TK41	116, 117	TV24155	116, 117
ST2B	116, 117(4)	SZ1200	148	TE1024C	116, 117	TK50	116, 117	TV24159	112
ST12	116, 117	T-065	116, 117	TE1029	116, 117	TK60	116, 117	TV24169	116, 117
ST14	116, 117	T-075	116, 117	TE1042	116, 117	TK61	116, 117	TV24182	111, 112
ST16	116, 117	T-0150	116, 117	TE1050	116, 117	TK400	116, 117	TV24190	113

## DIODES and RECTIFIERS (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
TV24191	116, 117	TZ110	151	V8H600	116, 117	XS-17	116, 117	ZA33	147
TV24193	116, 117	TZ10A	151	VD11	109	XS17A	116, 117	ZA33A	147
TV24200	116, 117	TZ110B	151	VD12	109	XS18	116, 117	ZA33B	147
TV24224	116, 117	TZ110C	151	VD13	109	XS22	116, 117	ZA62	149
TV24226	113	UJ1S102	116, 117	VFA2745C	116, 117	XS23	116, 117	ZA62A	149
TV24232	116, 117	U212	116, 117	VM009M	113	XS23A	116, 117	ZA62B	149
TV24234	116, 117	U212-25	116, 117	VM-PH9D522/1	116, 117	XS-31	116, 117	ZA82	150
TV24237	120	U213	116, 117	VMFH11D522/1	116, 117	XO604	116, 117	ZA82A	150
TV2C-6	120	U214	116, 117	VM-TC02P11/2	116, 117	Y100	114	ZA82B	150
TVM-EH2C11	116(3)	U633	116, 117	VR10	140	YCO2P11/2	116, 117	ZA110	151
TVM-K112C	113	U2400-03	116, 117	VR12	142	YSG-V47-1.3	116, 117	ZA110A	151
TVM-M204B	116, 117	U13033801	116, 117	VR12A	142	Z1B5.1	135	ZA110B	151
TVM-PS622/11	116, 117(4)	UR105	116, 117	VR12B	142	Z1B5.6	136	ZB1-11	141
TVM-PT6D22/1	116, 117	UR110	116, 117	VR33	147	Z1B5.2	137	ZB5.1	135
TVM-TP711/2	116, 117	UR115	116, 117	VR33A	147	Z1B7.5	138	ZB5.6	136
TVM-TK705M	113	UR120	116, 117	VR33B	147	Z1B10	140	ZB5.6A	136
TVS-0A70	109	UR125	116, 117	VR110	151	Z1B12	142	ZB5.6B	136
TVS-0A90	109	UT11	116, 117	VR110A	151	Z1B15	145	ZB6.2	137
TVS-0A91	109	UT12	116, 117	VR110B	151	Z1D06.2	137	ZB6.2A	137
TVS-10D8	125	UT13	116, 117	V50A70	109	Z1D07.5	138	ZB6.2B	137
TVS-182G	112	UT14	116, 117	VS-1	116, 117	Z1D15	145	ZB10	140
TVS-DC1NR	116, 117	UT15	116, 117	VS120	116, 117	Z2A51F	135	ZB10X	140
TVS-DS-1K	116, 117	UT16	116, 117	VS292	116, 117	Z2A56F	136	ZB12	142
TVS-DS1M	116, 117	UT17	116, 117	VSD1G1NR	116, 117	Z2A62F	137	ZB12A	142
TVS-FR-1P	116, 117	UT18	116, 117	VSG-20024	116, 117	Z2A91F	139	ZB12B	142
TVS-FR2P	116, 117	UT21	116, 117	VS-FR1	116, 117	Z2A120F	142	ZB15	145
TVS-FR10	125	UT22	116, 117	VS-FR1P	116, 117	Z2A150F	145	ZB15A	145
TVS-FT1N	116, 117	UT23	116, 117	VS-FT-1N	116, 117	Z3.6	134	ZB15B	145
TVS-K112C	113	UT24	116, 117	VSPH9D522/1	116, 117	Z4B5.1	135	ZB27	146
TVS-PC02P11/2	116, 117	UT25	116, 117	VS-SD-1B	125	Z4B5.6	136	ZB27A	146
TVS-PC02P11/2	116, 117	UT26	116, 117	VS-SD-1Z	116, 117	Z4B9.1	139	ZB27B	146
TVS-RD7A	138	UT27	116, 117	VS-SD-82A	111, 112	Z4B12	142	ZB33	147
TVS-S82	112	UT111	116, 117	VS-TCO-2P11/2	116, 117	Z4B15	145	ZB33A	147
TVS-SD1A	116, 117	UT112	116, 117	WCI4020	116, 117	Z4B27	146	ZB33B	147
TVS-SD-1B	125	UT113	116, 117	WC14027	116, 117	Z4B33	147	ZB62	149
TVS-TC0.09M21/3	114	UT114	116, 117	WC19865	116, 117	Z4X5.1A	135	ZB62A	149
TVS-ZB1-11	141	UT115	116, 117	WD001	116, 117	Z4X5.1B	135	ZB62B	149
TW3	116, 117	UT116	116, 117	WD002	116, 117	Z4X6.2	137	ZB82	150
TW5	116, 117	UT117	116, 117	WD003	116, 117	Z4X6.2B	137	ZB82A	150
TW10	116, 117	UT118	116, 117	WD004	116, 117	Z4X7.5	138	ZB82B	150
TW20	116, 117	UT119	125	WD005	116, 117	Z4X9.1	139	ZC012	142
TW30	116, 117	UT120	125	WD006	116, 117	Z4X9.1B	139	ZC015	145
TW40	116, 117	UT211	116, 117	WD007	116, 117	Z4X12	142	ZC027	146
TW50	116, 117	UT212	116, 117	WD008	116, 117	Z4X12B	142	ZC033	147
TW60	116, 117	UT213	116, 117	WD009	116, 117	Z5B3.6	134	ZD012	142
TW80	125	UT214	116, 117	WD010	116, 117	Z5B5.1	135	ZD015	145
TW100	125	UT215	116, 117	WD011	116, 117	Z5B5.6	136	ZD027	146
TWV	116, 117	UT226	116, 117	WD012	116, 117	Z5B9.1	139	ZD033	147
TX1N645	116, 117	UT227	116, 117	WD013	116, 117	Z5B10	140	ZD5.1A	135
TX1N647	116, 117	UT228	116, 117	WD014	116, 117	Z5B12	142	ZD5.1B	135
TX1N3190	116, 117	UT229	116, 117	WD015	116, 117	Z5B15	145	ZD5.6A	136
TX1N3191	116, 117	UT231	116, 117	WR006	116, 117	Z5.6	136	ZD5.6B	136
TZ9.1	139	UT232	116, 117	WR011	116, 117	Z6.2	137	ZD6.2A	137
TZ9.1A	139	UT233	116, 117	WR030	116, 117(4)	Z10	140	ZD6.2B	137
TZ9.1B	139	UT234	116, 117	WR040	116, 117(4)	Z10K	140	ZD9.1	139
TZ9.1C	139	UT235	116, 117	WR100	116, 117	Z12K	142	ZD9.1A	139
TZ12	142	UT236	116, 117	WR200	116, 117	Z15	145	ZD9.1B	139
TZ12A	142	UT237	116, 117	WR300	116, 117	Z15K	145	ZD12	142
TZ12B	142	UT238	116, 117	WR400	116, 117	Z33	147	ZD12A	142
TZ12C	142	UT347	125	WR5981	116, 117	Z1010	139	ZD12B	142
TZ15	145	UT361	125	WT16X7	113	Z1012	140	ZD15	145
TZ15A	145	U23.6	134	WT16X8	115	Z1014	142	ZD15A	145
TZ15B	145	U25.1	135	WT16X9	114	Z1022	146	ZD15B	145
TZ15C	145	U26.2	137	WX6	109	Z1108	139	ZD27	146
TZ27	146	U27.5	138	WZ535	142	Z1112	142	ZD27A	146
TZ27A	146	U29.1	139	WZ537	144	Z1112C	142	ZD27B	146
TZ27B	146	U215	145	WZ538	145	Z1120	146	ZD33	147
TZ27C	146	V01G	125	WZ905	135	ZA9.1	139	ZD33A	147
TZ33	147	V210C	116, 117	WZ916	141	ZA9.1A	139	ZD33B	147
TZ33A	147	V270-D1	116, 117	WZ917	142	ZA9.1B	139	ZD62	149
TZ33B	147	V442	116, 117	WZ919	144	Z42	142	ZD62A	149
TZ33C	147	V8634-3	112	WZ920	145	ZA12A	142	ZD62B	149
TZ62	149	V10158	116, 117	XA121	116, 117	ZA12B	145	ZD82	150
TZ62A	149	V10916-3	109	XD2A	110	ZA13	144	ZD82A	150
TZ62B	149	VB100	116, 117	X5M6	116, 117	ZA15	145	ZD110	151
TZ62C	149	VB300	116, 117	X16	109	ZA15A	145	ZD110A	151
TZ82	150	VB400	116, 117	X18	109	ZA15B	145	ZD110B	151
TZ82A	150	VB500	116, 117	XS-10	116, 117	ZA27	146	ZE5.6	136
TZ82B	150	VB600	116, 117	XS16	116, 117	ZA27A	146	ZE10	140
TZ82C	150	VB600A	116, 117	XS16A	116, 117	ZA27B	146	ZE12	142

DIODES and RECTIFIERS (cont'd)

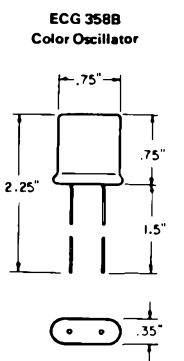
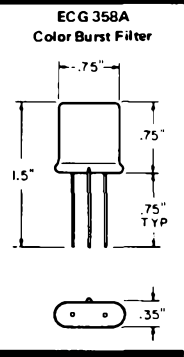
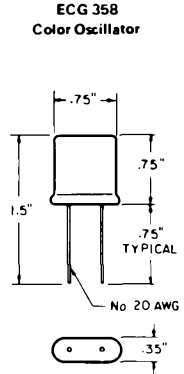
Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement	Type To Be Replaced	Sylvania ECC Replacement
ZE12A	142	ZH62A	149	ZP33A	147	ZS32	116, 117	ZU27A	146
ZE12B	142	ZH62B	149	ZP33B	147	ZS32A	116, 117	ZU27B	146
ZE15	145	ZH82	150	ZP62	149	ZS32B	116, 117	ZU33	147
ZE15A	145	ZH82A	150	ZP62A	149	ZS33	147	ZU33A	147
ZE15B	145	ZH82B	150	ZP62B	149	ZS33A	147	ZU33B	147
ZE27	146	ZH110	151	ZP82	150	ZS33B	147	ZU62	149
ZE27A	146	ZH110A	151	ZP82A	150	ZS34	116, 117	ZU62A	149
ZE27B	146	ZH110B	151	ZP82B	150	ZS34A	116, 117	ZU62B	149
ZE33	147	ZJ12	142	ZP110	151	ZS34B	116, 117	ZU82	150
ZE33A	147	ZJ12A	142	ZP110A	151	ZS50	116, 117	ZU82A	150
ZE33B	147	ZJ12B	142	ZP110B	151	ZS51	116, 117	ZU82B	150
ZE62	149	ZJ15	145	ZQ9.1	139	ZS52	116, 117	ZU110	151
ZE62A	149	ZJ15A	145	ZQ9.1A	139	ZS53	116, 117	ZU110A	151
ZE62B	149	ZJ15B	145	ZQ9.1B	139	ZS62	149	ZU110B	151
ZE82	150	ZJ27	146	ZQ12	142	ZS62A	149	ZV9.1	139
ZE82A	150	ZJ27A	146	ZQ12A	142	ZS62B	149	ZV9.1A	139
ZE82B	150	ZJ27B	146	ZQ12B	142	ZS70	116, 117	ZV9.1B	139
ZE110	151	ZJ33	147	ZQ15	145	ZS71	116, 117	ZV12	142
ZE110A	151	ZJ33A	147	ZQ15A	145	ZS72	116, 117	ZV12A	142
ZE110B	151	ZJ33B	147	ZQ15B	145	ZS73	116, 117	ZV12B	142
ZECS.6	136	ZJ62	149	ZQ27	146	ZS74	116, 117	ZV15	145
ZEC12	142	ZJ62A	149	ZQ27A	146	ZS74B	116, 117	ZV15A	145
ZEC27	146	ZJ62B	149	ZQ27B	146	ZS76	116, 117	ZV15B	145
ZF3.6	134	ZJ82	150	ZQ33	147	ZS78	125	ZV27	146
ZF5.1	135	ZJ82A	150	ZQ33A	147	ZS78A	125	ZV27A	146
ZF5.6	136	ZJ82B	150	ZQ33B	147	ZS78B	125	ZV27B	146
ZF6.2	137	ZJ110	151	ZQ62	149	ZS82	150	ZV33	147
ZF10	140	ZJ110A	151	ZQ62A	149	ZS82A	150	ZV33A	147
ZF12	142	ZJ110B	151	ZQ62B	149	ZS82B	150	ZV33B	147
ZF12A	142	ZJ252B	116, 117	ZQ82	150	ZS90	116, 117	ZV62	149
ZF12B	142	ZM33	147	ZQ82A	150	ZS91	116, 117	ZV62A	149
ZF15	145	ZO-12	142	ZQ82B	150	ZS92	116, 117	ZV62B	149
ZF15A	145	ZO-12A	142	ZQ110	151	ZS94	116, 117	ZV82	150
ZF15B	145	ZO-12B	142	ZQ110A	151	ZS100	116, 117	ZV82A	150
ZF27	146	ZO-15	145	ZQ110B	151	ZS101	116, 117	ZV82B	150
ZF27A	146	ZO-15A	145	ZR15	116, 117	ZS102	116, 117	ZV110	151
ZF27B	146	ZO-15B	145	ZR60	116, 117	ZS103	116, 117	ZV110A	151
ZF33	147	ZO-27	146	ZR61	116, 117	ZS104	116, 117	ZV110B	151
ZF33A	147	ZO-27A	146	ZR62	116, 117	ZS108	116, 117	ZW2	116, 117
ZF33B	147	ZO-27B	146	ZR63	116, 117	ZS110	151	ZY12	142
ZF62	149	ZO-33	147	ZR64	116, 117	ZS110A	151	ZY12A	142
ZF62A	149	ZO-33A	147	ZR66	116, 117	ZS110B	151	ZY12B	142
ZF62B	149	ZO-33B	147	ZR500	116, 117	ZS120	116, 117	ZY15	145
ZF82	150	ZO-62	149	ZR590A	116, 117	ZT5.6	136	ZY15A	145
ZF82A	150	ZO-62A	149	ZR1025	116, 117	ZT5.6A	136	ZY15B	145
ZF82B	150	ZO-62B	149	ZR1031	116, 117	ZT5.6B	136	ZY27	146
ZGS.6	136	ZO-82	150	ZR1035	116, 117	ZT6.2	137	ZY27A	146
ZG10	140	ZO-82A	150	ZR1076	116, 117	ZT6.2A	137	ZY27B	146
ZG12	142	ZO-82B	150	ZS5.6	136	ZT6.2B	137	ZY33	147
ZG15	145	ZO-110	151	ZS5.6A	136	ZT9.1	139	ZY33A	147
ZG15A	145	ZO-110A	151	ZS5.6B	136	ZT9.1A	139	ZY33B	147
ZG15B	145	ZO-110B	151	ZS7	116, 117	ZT9.1B	139	ZY62	149
ZG27	146	ZOB3.6	134	ZS8	116, 117	ZT12	142	ZY62A	149
ZG27A	146	ZOB5.1	135	ZS9.1	139	ZT12A	142	ZY62B	149
ZG27B	146	ZOB5.6	136	ZS9.1A	139	ZT12B	142	ZY82	150
ZG33	147	ZOB6.2	137	ZS9.1B	139	ZT15	145	ZY82A	150
ZG33A	147	ZOB12	142	ZS10A	116, 117	ZT15A	145	ZY82B	150
ZG33B	147	ZOB15	145	ZS10B	116, 117	ZT15B	145	ZY110	151
ZG62	149	ZOB27	146	ZS12	142	ZT27	146	ZY110A	151
ZG62A	149	ZOB33	147	ZS12A	142	ZT27A	146	ZY110B	151
ZG62B	149	ZOB62	149	ZS12B	142	ZT27B	146	ZZ3.6	134
ZG82	150	ZOB82	150	ZS15	145	ZT33	147	ZZ5.6	136
ZG82A	150	ZOB110	151	ZS15A	145	ZT33A	147	ZZ6.2	137
ZG82B	150	ZOB6.2	137	ZS15B	145	ZT33B	147	ZZ10	140
ZH9.1	139	ZOD15	145	ZS20A	116, 117	ZT62	149	ZZ12	142
ZH9.1A	139	ZOD27	146	ZS20B	116, 117	ZT62A	149	ZZ15	145
ZH9.1B	139	ZOD33	147	ZS21	116, 117	ZT62B	149	ZZ17	146
ZH12	142	ZOD62	149	ZS22	116, 117	ZT82	150	ZZ33	147
ZH12A	142	ZOD82	150	ZS23	116, 117	ZT82A	150	ZZ62	149
ZH12B	142	ZOD110	151	ZS24	116, 117	ZT82B	150	ZZ82	150
ZH15	145	ZP12	142	ZS25	116, 117	ZT110	151	ZZ110	151
ZH15A	145	ZP12A	142	ZS27	146	ZT110A	151		
ZH15B	145	ZP12B	142	ZS27A	146	ZT110B	151		
ZH27	146	ZP15	145	ZS27B	146	ZU12	142		
ZH27A	146	ZP15A	145	ZS30	116, 117	ZU12A	142		
ZH27B	146	ZP15B	145	ZS30A	116, 117	ZU12B	142		
ZH33	147	ZP27	146	ZS30B	116, 117	ZU15	145		
ZH33A	147	ZP27A	146	ZS31	116, 117	ZU15A	145		
ZH33B	147	ZP27B	146	ZS31A	116, 117	ZU15B	145		
ZH62	149	ZP33	147	ZS31B	116, 117	ZU27	146		



# QUARTZ COLOR OSCILLATOR CRYSTALS

replacement guide by set manufacturer

Type to Be Replaced	ECG Replacement	Type to be Replaced	ECG Replacement	Type to be Replaced	ECG Replacement
<b>ADMIRAL</b>		<b>DU MONT</b>		<b>PILOT</b>	
9383-3	358	105330	358	817147	358
9383-4	358	R105330	358	<b>RCA</b>	
93822-3	358	817129	358	78896	358
93C22-1	358	817147	358	100449	358
93C22-3	358	<b>ELECTRHOME</b>		102249	358
<b>AIRLINE</b>		37-8-01	358	105330	358
TV24176	358	105330	358	1107863-1	358
QC-1	358	<b>EMERSON</b>		1107863-2	358
136-000100	358	R105330	358	1107863-3	358
105330	358	817036	358	<b>RAYTHEON</b>	
530089-2	358	817129	358	8M-26102	358
<b>AMBASSADOR</b>		817147	358	<b>SETCHELL-CARLSON</b>	
R105330	358	817175	358	3.58MC	358
817129	358	<b>GENERAL ELECTRIC</b>		X-1018	358
817147	358	GE 41	358A	<b>SENTINEL</b>	
817157	358	GE 42	358	3.5MC Crystal	358
<b>AMC</b>		E T41X27	358A	20E1114	358
66X0003-001	358	E T41X47	358A	<b>SHARP</b>	
68X0003-001	358	23B-210067-001	358A	6I5I30	358
105330	358	23B-210067-002	358A	<b>(SEARS) SILVERTONE</b>	
817147	358	<b>HOFFMAN</b>		T-E0317	358
<b>ANDREA</b>		3.58MC Crystal	358	33-4-3	358
3.5MC Crystal	358	136-000100	358	33-4-3A	358
A95-5286	358	136-000200	358	33-7-3	358
<b>ARISTOCRAT</b>		136-000300	358	48-77	358
3.5MC Crystal	358	<b>MAGNAVOX</b>		3374-3	358
2001786-169	358	M100449	358	105330	358
<b>BRADFORD</b>		M105330	358	599995	358
66X0003-001	358	530089-2	358	<b>STROMBERG CARLSON</b>	
68X0003	358	530128-1	358	162201	358
68X0003-001	358	<b>MOTOROLA</b>		<b>SYLVANIA</b>	
105330	358	48B7322230	358	72059	358
T-E0137	358	48T66544A88	358	105330	358
<b>CAPEHART</b>		48C66865A01	358	26-16162-1	358
750746A	358	48C66865A02	358B	<b>SYMPHONIC</b>	
<b>CATALINA</b>		48C66865A03	358B	T-E0317	358
66X0003-001	358	48C66865A04	358B	<b>TOSHIBA</b>	
105330	358	<b>MUNTZ</b>		599995	358
817147	358	CX9000	358	<b>TRUE-TONE</b>	
<b>CLAIRTONE</b>		<b>OLYMPIC</b>		8M-26102	358
80000900	358	CR32077R	358	66X0003-001	358
<b>CBS COLUMBIA</b>		CR32077-1	358	68X0003-001	358
63000061	358	105330	358	105330	358
<b>CORONADO</b>		<b>PACKARD BELL</b>		<b>TV MFRS OF AMERICA</b>	
CX-9000	358	72020	358	CX-9000	358
66X0003-001	358	72059	358	<b>WESTINGHOUSE</b>	
68X0003-001	358	<b>PANASONIC</b>		296V001H01	358
105330	358	TSS-616-1	358	296V001M01	358
<b>CURTISMATHES</b>		<b>PENNCREST</b>		296V023C	358B
3.58MC	358	66X0003-001	358	690V38H25	358
9A1	358	68X0003-001	358	<b>ZENITH</b>	
09A001-00	358	105330	358	103-28	358
<b>DEL MONICO</b>		<b>PHILCO</b>		103-71	358
A04021	358	34-0012	358	103-89	358
QC-1	358	34-8028	358		
<b>DOMINION</b>		34-8034-4	358		
37-8-1	358				



# CANADIAN RECEIVERS

replacement guide by Set Manufacturer

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
<b>FLEETWOOD</b>							
		XB102	100	800-527-00	100	14-585-01	126
		XB103	102	800-529-00	103	14-586-01	104
16A1	123	XB104	102			14-587-01	102
16A2	123	XB112	102			14-588-01	126
79F015	109	XB113	102	<b>ELECTROHOME</b>		14-589-01	104
C83-829	116, 117			14-501-01	113	14-590-01	104
C83-880	116, 117	XB114	102	14-501-02	113	14-591-01	126
		XC101	102	14-503-01	114	14-600-01	126
86-1-3	116, 117	XC121	102	14-503-02	114	14-600-02	126
86-3-1	114	XC131	102	14-503-03	114	14-600-04	126
86-3-3	116, 117	XC141	104				
86-9-3	116, 117			14-503-04	114	14-600-07	126
86-47-3	116, 117(3)	XC142	104	14-504-01	109	14-600-10	126
		XC155	104	14-504-04	114	14-600-11	126
86-55-3	120	XC156	104	14-509-01	142	14-600-13	126
86-56-3	120	XC171	102	14-509-02	135	14-600-16	126
DTG110	104	77-270993-1	116, 117	14-510-01	110	14-600-19	126
E4676B	116, 117	78-254566-1	116, 117	14-511-01	109	14-600-20	126
SR14	116, 117	78-254566-4	116, 117	14-512-01	109	14-600-22	126
		78-271030-1	116, 117	14-513-01	109	14-601-01	104
SR15	114	78-271143-1	116, 117	14-513-10	104	14-601-02	104
TF65	102	78-271199-1	109				
		78-271228-1	109	14-514-01	109	14-601-03	104
<b>CLAIRTONE</b>		93K2-1	113	14-514-02	116, 117	14-601-04	104
AF102	126	800-002-00	110	14-514-04	110	14-601-05	104
AF114	126	800-003-00	109	14-514-05	109	14-601-06	121
AF115	126	800-004-00	142	14-514-06	109	14-601-07	121
AF116	126						
AF117	126	800-005-00	109	14-514-08	109	14-601-08	104
		800-007-00	113	14-514-09	109	14-601-09	104
AF118	126	800-010-00	116, 117	14-514-10	109	14-601-10	130
IN87A	106	800-011-00	119	14-514-11	110	14-601-11	104
IN541	109	800-013-00	116, 117	14-514-12	109	14-601-12	130
IN542	110						
		800-017-00	118	14-514-13	110	14-601-13	130
OC45	100	800-020-00	109	14-514-14	109	14-601-15	130
OC71	126	800-021-00	109	14-514-15	109	14-601-16	130
OC72	126	800-022-00	109	14-514-16	109	14-602-01	128
OC74	102	800-023-00	142	14-514-17	109	14-602-02	123
OC75	102						
		800-501-00	123	14-514-18	116	14-602-03	123
OC169	126	800-502-00	102	14-514-19	116, 117	14-602-04	102
OC170	126	800-503-00	103	14-515-01	142	14-602-05	102
OC304	102	800-504-00	126	14-515-02	135	14-602-10	102
OC602	102	800-505-00	100	14-515-03	142	14-602-11	102
OC604	102						
		800-506-00	102	14-515-04	138	14-602-12	123
PT510	116, 117	800-507-00	121	14-515-07	145	14-602-13	123
XB1	102	800-509-00	123	14-515-11	145	14-602-14	108
XB2	102	800-510-01	130	14-515-13	138	14-602-15	102, 103
XB3	102	800-515-00	108	14-515-15	135	14-602-16	128
XB3B	102						
		800-516-00	126	14-574-10	104	14-602-17	128
XB3C	102	800-517-00	109	14-575-10	123	14-602-18	128
XB4	103	800-521-01	108	14-577-10	102	14-602-19	128
XB5	104	800-521-02	108	14-578-10	104	14-602-20	126
XB7	104	800-522-01	108	14-579-10	104	14-602-21	103
XB8	126						
		800-522-02	108	14-580-01	126	14-602-22	108
XB9	126	800-523-01	126	14-581-01	126	14-602-23	108
XB10	100	800-523-02	126	14-582-01	126	14-602-24	128
XB12	128	800-524-002	130	14-583-01	123	14-602-25	123
XB13	100	800-526-00	108	14-584-01	102	14-602-26	108
XB14	104						

## CANADIAN RECEIVERS (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
<b>ELECTROHOME (cont'd)</b>							
14-602-27	102, 103	14-602-55	128	28-22-01	116, 117	28-26-01	116, 117
14-602-28	126	14-602-56	128	28-22-02	116, 117	1P542	109
14-602-29	128	14-602-58	106	28-22-03	116, 117	S1907	130
14-602-30	108	14-602-59	128	28-22-04	116, 117	T1503	100
14-602-31	108	14-602-60	106	28-22-05	116, 117	11252	109
14-602-32	108	14-602-61	108	28-22-06	116, 117	15027	104
14-602-34	108	14-602-62	108	28-22-08	116, 117	49022	104
14-602-35	108	14-602-63	128	28-22-09	116, 117	40050	104
14-602-36	154	14-603-01	128	28-22-10	116, 117	106379	116, 117
14-602-37	154	14-603-02	128	28-22-11	116, 117	109474	113
14-602-41	108	14-603-03	108	28-22-12	116, 117	113391	119
14-602-43	128	14-603-04	108	28-22-13	116, 117	113392	116, 117
14-602-44	108	14-603-05	108	28-22-14	116, 117	113397	118
14-602-45	108	14-603-06	123	28-22-15	116, 117		
14-602-46	123	14-603-07	128	28-22-16	116, 117		
14-602-47	106	14-604-08	121	28-22-17	116, 117		
14-602-48	108	28-6-01	116, 117	28-22-19	125, 156		
14-602-49	108	28-18-01	116, 117(4)	28-22-21	116, 117		
14-602-50	123	28-19-01	116, 117	28-23-01	118		
14-602-54	106	28-21-01	116, 117	28-24-01	119		



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