

Refer to chart at end of section.

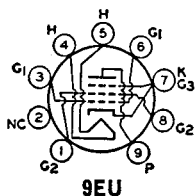
12A6Y

Refer to chart at end of section.

12A7

Refer to chart at end of section.

12A8GT



9EU

**BEAM POWER TUBE**

12AB5

Miniature type used in the output stage of automobile radio receivers operating from a 12-volt storage battery. Outlines section, 6E; requires miniature 9-contact socket.

Heater-Voltage Range (ac/dc)*	10 to 15.9	volts
Heater Current (Approx.) at 12.6 volts	0.2	ampere
Peak Heater-Cathode Voltage	±90 max	volts
Direct Interelectrode Capacitances:		
Grid No.1 to Plate	0.7 max	pF
Grid No.1 to Cathode, Heater, Grid No.2, and Grid No.3	8	pF
Plate to Cathode, Heater, Grid No.2, and Grid No.3	8.5	pF

\* For longest life, it is recommended that the heater be operated within the voltage range of 11 to 14 volts.

**Class A<sub>1</sub> Amplifier**

**MAXIMUM RATINGS (Design-Center Values)**

Plate Voltage	315	volts
Grid-No.2 (Screen-Grid) Voltage	285	volts
Plate Dissipation	12	watts
Grid-No.2 Input	2	watts
Bulb Temperature (At hottest point)	250	°C

**TYPICAL OPERATION WITH 12.6 VOLTS ON HEATER**

Plate Supply Voltage	250	250	volts
Grid-No.2 Supply Voltage	200	250	volts
Grid-No.1 (Control-Grid) Voltage	—	—12.5	volts
Cathode-Bias Resistor	270	—	ohms
Peak AF Grid-No.1 Voltage	10.5	12.5	volts
Zero-Signal Plate Current	33.5	45	mA
Maximum-Signal Plate Current	36	47	mA
Zero-Signal Grid-No.2 Current	1.6	4.5	mA
Maximum-Signal Grid-No.2 Current	3.2	7	mA
Plate Resistance (Approx.)	75000	50000	ohms
Transconductance	4000	4100	μmhos
Load Resistance	6000	5000	ohms
Total Harmonic Distortion	8	8	per cent
Maximum-Signal Power Output	3.3	4.5	watts

**MAXIMUM CIRCUIT VALUES**

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

**Push-Pull Class AB<sub>1</sub> Amplifier**

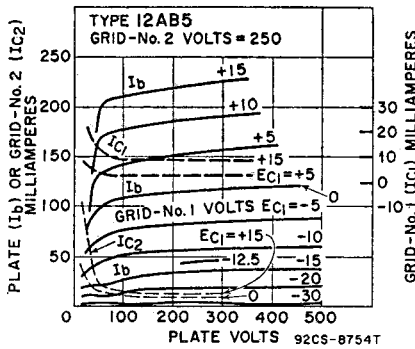
**MAXIMUM RATINGS (Same as for Single-Tube Class A<sub>1</sub> Amplifier)**

**TYPICAL OPERATION WITH 12.6 VOLTS ON HEATER (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-to-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
Effective Load Resistance (Plate-to-Plate)	10000	ohms
Total Harmonic Distortion	5	per cent
Maximum-Signal Power Output	10	watts

**MAXIMUM CIRCUIT VALUES**

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



**12AC6**

Refer to chart at end of section.

**12AC10A**

Refer to type 6AC10

**12AD6**

Refer to chart at end of section.

**12AE6**

Refer to chart at end of section.

**12AE6A**

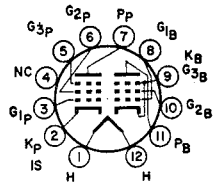
**12AE7**

Refer to chart at end of section.

**12AE10**

**BEAM POWER TUBE—  
SHARP-CUTOFF PENTODE**

Duodecar type used as combined FM detector and audio-frequency output amplifier in television receivers. The beam power unit is used in af output stages and the pentode unit as an FM detector. Outlines section, 8C; requires duodecar 12-contact socket. Heater: volts (ac/dc), 12.6; amperes, 0.45; warm-up time (average), 11 seconds; maximum heater-cathode volts, ±200 peak, 100 average.



**12EZ**

**Beam Power Unit as Class A<sub>1</sub> Amplifier**

**MAXIMUM RATINGS** (Design-Maximum Values)

Plate Voltage .....	165	volts
Grid-No.2 (Screen-Grid) Voltage .....	150	volts
Cathode Current .....	60	mA
Plate Dissipation .....	6	watts
Grid-No.2 Input .....	1.25	watts

**TYPICAL OPERATION**

Plate Voltage .....	145	volts
Grid-No.2 Voltage .....	110	volts
Grid-No.1 (Control-Grid) Voltage .....	-7	volts
Peak AF Grid-No.1 Voltage .....	7	volts
Zero-Signal Plate Current .....	34	mA
Maximum-Signal Plate Current .....	39	mA
Zero-Signal Grid-No.2 Current .....	6.5	mA
Maximum-Signal Grid-No.2 Current .....	9.3	mA
Plate Resistance (Approx.) .....	33000	ohms
Transconductance .....	5600	μmhos
Load Resistance .....	2500	ohms
Total Harmonic Distortion (Approx.) .....	12	per cent
Maximum-Signal Power Output .....	1.45	watts

**MAXIMUM CIRCUIT VALUE**

Grid-No.1-Circuit Resistance: For cathode-bias operation .....	1	megohm
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**Pentode Unit as Class A<sub>1</sub> Amplifier**

**CHARACTERISTICS**

Plate Voltage .....	150	volts
Grid-No.3 (Suppressor-Grid) Voltage .....	0	volts
Grid-No.2 Voltage .....	100	volts
Cathode-Bias Resistor .....	560	ohms
Plate Resistance (Approx.) .....	0.15	megohm
Transconductance, Grid No.1 .....	1000	μmhos
Transconductance, Grid No.3 .....	400	μmhos
Plate Current .....	1.3	mA
Grid-No.2 Current .....	2	mA
Grid-No.1 Voltage (Approx.) for plate current of 10 μA .....	-4.5	volts
Grid-No.3 Voltage (Approx.) for plate current of 10 μA .....	-4.5	volts

**Pentode Unit as FM Detector**

**MAXIMUM RATINGS (Design-Maximum Values)**

Plate Voltage .....	330	volts
Grid-No.3 Voltage .....	28	volts
Grid-No.2 Supply Voltage .....	330	volts
Grid-No.2 Voltage .....	See curve page 300	
Grid-No.1 Voltage, Positive-bias value .....	0	volts
Plate Dissipation .....	1.7	watts
Grid-No.2 Input .....	1.1	watts

Refer to type 6AF3.

**12AF3  
12AF3/12BR3/  
12RK19**

Refer to chart at end of section.

**12AF6**

Refer to chart at end of section.

**12AH7GT**

Refer to chart at end of section.

**12AJ6**

Refer to type 6AL5.

**12AL5**

Refer to chart at end of section.

**12AL8**

Refer to type 6AL11.

**12AL11**

Refer to type 6AQ5A.

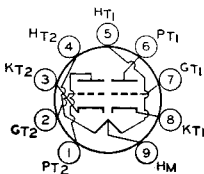
**12AQ5**

Refer to type 6AT6.

**12AT6**

For replacement use type 12AT7/ECC81.

**12AT7**



**9A**

**HIGH-MU TWIN TRIODE**

**12AT7/  
ECC81**

Miniature types used as push-pull cathode-drive amplifiers or frequency converters in the FM and television broadcast bands. **Outlines section, 6B**; require miniature 9-contact socket. Each triode unit is independent of the other except for the common heater. For typical operation as a resistance-coupled amplifier, refer to **Resistance-Coupled Amplifier section**.

Heater Arrangement:	<b>Series</b>	<b>Parallel</b>	
Heater Voltage (ac/dc) .....	12.6	6.3	volts
Heater Current .....	0.15	0.3	ampere
Peak Heater-Cathode Voltage .....		±90 max	volts

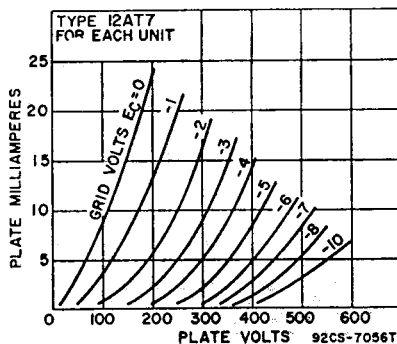
## Direct Interelectrode Capacitances:

Grid-Drive Operation:		
Grid to Plate (Each unit) .....	1.5	pF
Grid to Cathode and Heater (Each unit) .....	2.2	pF
Plate to Cathode and Heater:		
Unit No.1 .....	0.5	pF
Unit No.2 .....	0.4	pF
Cathode-Drive Operation:		
Cathode to Plate (Each unit) .....	0.2	pF
Cathode to Grid and Heater (Each unit) .....	4.6	pF
Plate to Grid and Heater (Each unit) .....	1.8	pF
Heater to Cathode (Each Unit) .....	2.4	pF

Class A<sub>1</sub> Amplifier (Each Unit)

## MAXIMUM AND MINIMUM RATINGS (Design-Center Values)

Plate Voltage .....	300	volts
Grid Voltage, Negative-bias value .....	50	volts
Plate Dissipation .....	2.5	watts



## CHARACTERISTICS

Plate Supply Voltage .....	100	250	volts
Cathode-Bias Resistor .....	270	200	ohms
Amplification Factor .....	60	60	
Plate Resistance (Approx.) .....	15000	10900	ohms
Transconductance .....	4000	5500	$\mu$ mhos
Grid Voltage (Approx.) for plate current of 10 $\mu$ A .....	-5	-12	volts
Plate Current .....	3.7	10	mA

12AT7WA

Refer to chart at end of section.

12AT7WB

Refer to chart at end of section.

12AU6

Refer to type 6AU6A.

12AU7

Refer to chart at end of section.

For replacement use type 12AU7A/ECC82.

12AU7A

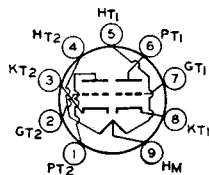
For replacement use type 12AU7A/ECC82.

# 12AU7A/ ECC82

7AU7, 9AU7

## MEDIUM-MU TWIN TRIODE

Miniature types used as phase inverters or push-pull amplifiers in ac/dc radio equipment and as multivibrators or oscillators in industrial control devices. Also used as combined vertical oscillators and vertical-deflection amplifiers, and as horizontal-deflection oscillators, in color and black-and-white television receivers. Outlines section, 6B; require miniature 9-contact socket. Each triode unit is independent of the other except for the common heater. For typical opera-



tion as a resistance-coupled amplifier, refer to **Resistance-Coupled Amplifier** section. Types 7AU7 and 9AU7 are identical with type 12AU7 and 12AU7A/ECC82 except for heater ratings.

	7AU7	9AU7	12AU7A 12AU7A/ ECC82	
Heater Voltage(ac/dc):				
Series .....	7	9.4	12.6	volts
Parallel .....	3.5	4.7	6.3	volts
Heater Current:				
Series .....	0.3	0.225	0.15	ampere
Parallel .....	0.6	0.45	0.3	ampere
Heater Warm-up Time (Parallel, Average) ..	11	11	—	seconds
Heater-Cathode Voltage:				
Peak value .....	±200 max	±200 max	±200 max	volts
Average value .....	100 max	100 max	100 max	volts
Direct Interelectrode Capacitances (Approx.):	Unit No.1		Unit 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 .....	0.5		0.35	pF

**Class A<sub>1</sub> Amplifier** (Each Unit Unless Otherwise Specified)

**MAXIMUM RATINGS** (Design-Maximum Values)

Plate Voltage .....	330	volts
Cathode Current .....	22	mA
Plate Dissipation:		
Each Plate .....	2.75	watts
Both Plates (Both units operating) .....	5.5	watts

**CHARACTERISTICS**

Plate Voltage .....	100	250	volts
Grid Voltage .....	0	-8.5	volts
Amplification Factor .....	19.5	17	
Plate Resistance (Approx.) .....	6250	7700	ohms
Transconductance .....	3100	2200	μmhos
Plate Current .....	11.8	10.5	mA
Grid Voltage (Approx.) for plate current of 10 μA .....	—	-24	volts

**MAXIMUM CIRCUIT VALUES**

Grid-Circuit Resistance:		
For fixed-bias operation .....	0.25	megohm
For cathode-bias operation .....	1	megohm

**Oscillator** (Each Unit Unless Otherwise Specified)

For operation in a 525-line, 30-frame system

	Vertical-Deflection Oscillator	Horizontal-Deflection Oscillator	
<b>MAXIMUM RATINGS</b> (Design-Maximum Values)			
DC Plate Voltage .....	330	330	volts
Peak Negative-Pulse Grid Voltage .....	440	660	volts
Peak Cathode Current .....	66	330	mA
Average Cathode Current .....	22	22	mA
Plate Dissipation:			
Each Plate .....	2.75	2.75	watts
Both Plates (Both units operating) .....	5.5	5.5	watts

**MAXIMUM CIRCUIT VALUES**

Grid-Circuit Resistance .....	2.2	2.2	megohms
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**Vertical-Deflection Amplifier** (Each Unit Unless Otherwise Specified)

For operation in a 525-line, 30-frame system

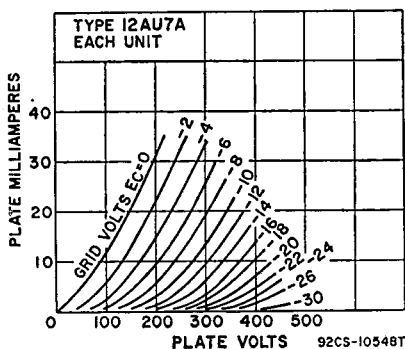
**MAXIMUM RATINGS** (Design-Maximum Values)

DC Plate Voltage .....	330	volts
Peak Positive-Pulse Plate Voltage# .....	1200	volts
Peak Negative-Pulse Grid Voltage .....	275	volts
Peak Cathode Current .....	66	mA
Average Cathode Current .....	22	mA
Plate Dissipation:		
Each Plate .....	275	volts
Both Plates (Both units operating) .....	5.5	watts

**MAXIMUM CIRCUIT VALUE**

Grid-Circuit Resistance, for cathode-bias operation .....	2.2	megohms
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# Pulse duration must not exceed 15% of a vertical scanning cycle (2.5 milliseconds).

**12AV5GA**

Refer to type 6AV5GA.

**12AV6**

Refer to type 6AV6.

**12AV7**

Refer to chart at end of section.

**12AW6**

Refer to chart at end of section.

**12AX3**

Refer to type 6AX3.

**12AX4GT  
12AX4GTA**

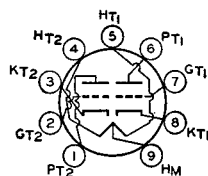
Refer to chart at end of section.

**12AX4GTB**

Refer to type 6AX4GTB.

**12AX7**Refer to chart at end of section.  
For replacement use type 12AX7A/ECC83.**12AX7A**

For replacement use type 12AX7A/ECC83.

**12AX7A/  
ECC83****HIGH-MU TWIN TRIODE****9A**

Miniature types used as phase inverters or twin resistance-coupled amplifiers in radio equipment. Outlines section, 6B; require miniature 9-contact socket. Each triode unit is independent of the other except for common heater. For characteristics and curves, refer to type 6AV6. For typical operation as a resistance-coupled amplifier, refer to Resistance-Coupled Amplifier section.

Heater Arrangement:	Series	Parallel	
Heater Voltage (ac/dc) .....	12.6	6.3	volts
Heater Current .....	0.15	0.3	ampere
Heater-Cathode-Voltage:			
Peak value .....		±200 max	volts
Average value .....		100 max	volts
Direct Interelectrode Capacitances (Approx.):	Unit No.1	Unit No.2	
Grid to Plate .....	1.7	1.7	pF
Grid to Cathode and Heater .....	1.6	1.6	pF
Plate to Cathode and Heater .....	0.46	0.34	pF

**Class A<sub>1</sub> Amplifier (Each Unit)**

**MAXIMUM RATINGS (Design-Maximum Values)**

Plate Voltage .....	330	volts
Grid Voltage:		
Negative-bias value .....	55	volts
Positive-bias value .....	0	volts
Plate Dissipation .....	1.2	watts

**EQUIVALENT-NOISE AND HUM VOLTAGE (References To Grid, Each Unit)\***

Average Value .....	1.8	$\mu$ V rms
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\* Measured in "true rms" units under the following conditions: Heater voltage (parallel connection), 6.3 volts ac; center tap of heater-transformer grounded; plate supply voltage, 250 volts dc; plate load resistor, 100000 ohms; cathode resistor, 2700 ohms bypassed by 100- $\mu$ F capacitor; grid resistor, 0 ohms; and amplifier covering frequency range between 25 and 10000 Hz.

Refer to chart at end of section.

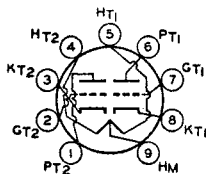
**12AY3**

Refer to type 6AY3B.

**12AY3A<sub>6</sub>**

**MEDIUM-MU TWIN TRIODE**

**12AY7**



**9A**

Miniature type used in the first stages of high-gain audio-frequency amplifiers. Outlines section, 6B; requires miniature 9-contact socket. Each triode unit is independent of the other except for the common heater. Use of the 12.6-volt connection with an ac heater supply is not recommended for applications involving low hum. For typical operation as a resistance-coupled amplifier, refer to Resistance-Coupled Amplifier section.

Heater Arrangement:	Series	Parallel	
Heater Voltage (ac/dc) .....	12.6	6.3	volts
Heater Current .....	0.15	0.3	ampere
Peak Heater-Cathode Voltage .....		$\pm$ 90 max	volts
Direct Interelectrode Capacitances (Approx., Each Unit)			
Grid to Plate .....		1.3	pF
Grid to Cathode and Heater .....		1.3	pF
Plate to Cathode and Heater .....		0.6	pF

**Class A<sub>1</sub> Amplifier (Each Unit)**

**MAXIMUM RATINGS (Design-Center Values)**

Plate Voltage .....	300	volts
Grid Voltage:		
Negative-bias value .....	50	volts
Positive-bias value .....	0	volts
Cathode Current .....	10	mA
Plate Dissipation .....	1.5	watts

**CHARACTERISTICS**

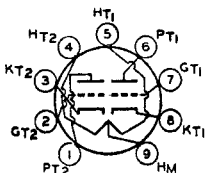
Plate Voltage .....	250	volts
Grid Voltage .....	-4	volts
Amplification Factor .....	40	
Plate Resistance .....	22800	ohms
Transconductance .....	1750	$\mu$ mhos
Plate Current .....	3	mA
Grid Voltage (Approx.) for plate current of 10 mA .....	-11	volts

Refer to chart at end of section.

**12AZ7**

**HIGH-MU TWIN TRIODE**

**12AZ7A**



**9A**

Miniature type used in direct-coupled cathode-drive rf amplifier circuits of vhf color and black-and-white television tuners. Outlines section, 6B; requires miniature 9-contact socket. For characteristics as class A<sub>1</sub> amplifier, refer to miniature type 12AT7.

Heater Voltage (ac/dc):		
Series .....	12.6	volts
Parallel .....	6.3	volts
Heater Current:		
Series .....	0.225	ampere
Parallel .....	0.45	ampere
Heater Warm-up Time (Average) .....		
	11	seconds
Heater-Cathode Voltage:		
Peak value .....	±200 max	volts
Average value .....	100 max	volts
Direct Interelectrode Capacitance (Approx.):		
	Unshielded	Shielded <sup>A</sup>
Grid to Plate (Each unit) .....	2	1.9
Grid to Cathode and Heater (Each unit) .....	2.6	2.8
Plate to Cathode and Heater:		
Unit No.1 .....	0.44	pF
Unit No.2 .....	0.36	pF

<sup>A</sup> With external shield connected to cathode of unit under test.

### Class A<sub>1</sub> Amplifier (Each Unit)

#### MAXIMUM RATINGS (Design-Maximum Values)

Plate Voltage .....	330	volts
Grid Voltage, Negative-bias value .....	55	volts
Plate Dissipation .....	2.5	watts

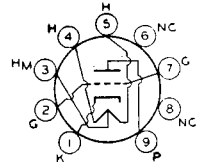
#### MAXIMUM CIRCUIT VALUES (Each Unit)

Grid-Circuit Resistance:		
For fixed-bias operation .....	0.25	megohm
For cathode-bias operation .....	1	megohm

# 12B4A

## LOW-MU TRIODE

Miniature type used as vertical-deflection amplifier in television receivers. Outlines section, 6E; requires miniature 9-contact socket.



9AG

Heater Voltage .....		
	Series	Parallel
	12.6	6.3
Heater Current .....		
	0.3	0.6
Heater Warm-up Time .....		
	—	11
Heater-Cathode Voltage:		
Peak value .....	±200 max	volts
Average value .....	100 max	volts
Direct Interelectrode Capacitances:		
Grid to Plate .....	4.8	pF
Grid to Cathode and Heater .....	5	pF
Plate to Cathode and Heater .....	1.5	pF

### Class A<sub>1</sub> Amplifier

#### MAXIMUM RATINGS (Design-Center Values)

Plate Voltage .....	550	volts
Grid Voltage, Negative-bias value .....	50	volts
Plate Dissipation .....	5.5	watts

#### CHARACTERISTICS

Plate Voltage .....	150	volts
Grid Voltage .....	-17.5	volts
Amplification Factor .....	6.5	
Plate Resistance (Approx.) .....	1030	ohms
Transconductance .....	6300	μmhos
Plate Current .....	34	mA
Plate Current for grid voltage of -23 volts .....	9.6	mA
Grid Voltage (Approx.) for plate current of 200 μA .....	-32	volts

#### MAXIMUM CIRCUIT VALUES

Grid-Circuit Resistance:		
For fixed-bias operation .....	0.47	megohm
For cathode-bias operation .....	2.2	megohms

### Vertical-Deflection Amplifier

For operation in a 525-line, 30-frame system

#### MAXIMUM RATINGS (Design-Center Values)

DC Plate Voltage .....	550	volts
Peak Positive-Pulse Plate Voltage# (Absolute Maximum) .....	1000†	volts



Peak Negative-Pulse Grid Voltage .....	250	volts
Peak Cathode Current .....	105	mA
Average Cathode Current .....	30	mA
Plate Dissipation .....	5.5	watts

**MAXIMUM CIRCUIT VALUE**

Grid-Circuit Resistance, for cathode-bias operation .....	2.2	megohms
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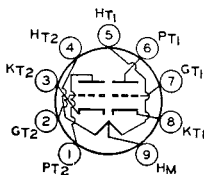
# Pulse duration must not exceed 15% of a vertical scanning cycle (2.5 milliseconds).

† Under no circumstances should this absolute value be exceeded.

Refer to chart at end of section.	<b>12B8GT</b>
Refer to type 6BA6.	<b>12BA6</b>
Refer to chart at end of section.	<b>12BA7</b>
Refer to chart at end of section.	<b>12BD6</b>
Refer to type 6BE3.	<b>12BE3</b>
Refer to type 6BE6.	<b>12BE6</b>
Refer to chart at end of section.	<b>12BF6</b>
Refer to type 6BF11.	<b>12BF11</b>
Refer to chart at end of section.	<b>12BH7</b>

**MEDIUM-MU TWIN TRIODE**

**12BH7A**



**9A**

Miniature type used as combined vertical-deflection amplifier and vertical oscillator, and as horizontal-deflection oscillator, in television receivers, and in phase-inverter and multivibrator circuits. Outlines section, 6E; requires miniature 9-contact socket. Each triode unit is independent of the other except for the common heater.

Heater Arrangement:	<b>Series</b>	<b>Parallel</b>	
Heater Voltage (ac/dc) .....	12.6	6.3	volts
Heater Current .....	0.3	0.6	ampere
Heater Warm-up Time (Average) .....	—	11	seconds
Heater-Cathode Voltage:			
Peak value .....		±200 max	volts
Average value .....		100 max	volts
Direct Interelectrode Capacitances (Approx.):	<b>Unit No.1</b>	<b>Unit No.2</b>	
Grid to Plate .....	2.6	2.6	pF
Grid to Cathode and Heater .....	3.2	3.2	pF
Plate to Cathode and Heater .....	0.5	0.4	pF
Plate of Unit No.1 to Plate of Unit No.2 .....		0.8	pF

**Class A<sub>1</sub> Amplifier (Each Unit)**

**MAXIMUM RATINGS (Design-Center Values)**

Plate Voltage .....	300	volts
Grid Voltage:		
Negative-bias value .....	50	volts
Positive-bias value .....	0	volts
Cathode Current .....	20	mA
Plate Dissipation:		
Each Plate .....	3.5	watts
Both plates (Both units operating) .....	7	watts

**CHARACTERISTICS**

Plate Voltage .....	250	volts
Grid Voltage .....	-10.5	volts
Amplification Factor .....	16.5	
Plate Resistance (Approx.) .....	5300	ohms
Transconductance .....	3100	μmhos
Plate Current .....	11.5	mA
Plate Current for grid voltage of -14 volts .....	4	mA
Grid Voltage (Approx.) for plate current of 50 μA .....	-23	volts

**MAXIMUM CIRCUIT VALUES**

Grid-Circuit Resistance:

For fixed-bias operation .....	0.25	megohm
For cathode-bias operation .....	1	megohm

**Oscillator (Each Unit)**

For operation in a 525-line, 30-frame system

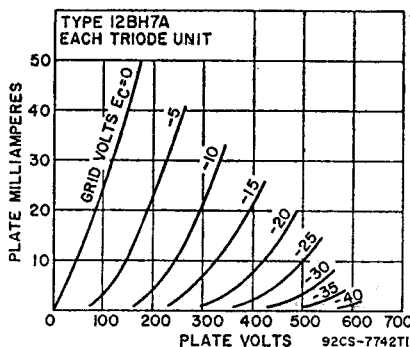
MAXIMUM RATINGS (Design-Center Values)	Vertical-Deflection Oscillator	Horizontal-Deflection Oscillator	
DC Plate Voltage .....	450	450	volts
Peak Negative-Pulse Grid Voltage .....	400	600	volts
Peak Cathode Current .....	70	300	mA
Average Cathode Current .....	20	20	mA
Plate Dissipation:			
Each Plate .....	3.5	3.5	watts
Both Plates (Both units operating) .....	7	7	watts
<b>MAXIMUM CIRCUIT VALUES</b>			
Grid-Circuit Resistance .....	2.2	2.2	megohms

**Vertical-Deflection Amplifier (Each Unit)**

For operation in a 525-line, 30-frame system

**MAXIMUM RATINGS (Design-Center Values)**

DC Plate Voltage .....	450	volts
Peak Positive-Pulse Plate Voltage# (Absolute maximum) .....	1500*	volts
Peak Negative-Pulse Grid Voltage .....	250	volts
Peak Cathode Current .....	70	mA
Average Cathode Current .....	20	mA
Plate Dissipation:		
Each Plate .....	3.5	watts
Both Plates (Both units operating) .....	7	watts

**MAXIMUM CIRCUIT VALUE**

Grid-Circuit Resistance for cathode-bias operation ..... 2.2 megohms

# Pulse duration must not exceed 15% of a vertical scanning cycle (2.5 milliseconds).

\* Under no circumstances should this absolute value be exceeded.

**12BK5**

Refer to chart at end of section.

**12BL6**

Refer to chart at end of section.

**12BN6**

Refer to chart at end of section.

**12BQ6GTB/12CU6**

Refer to type 6BQ6GTB/6CU6.

**12BR3**

For replacement use type 12AF3/12BR3/12RK19.

**12BR7**

Refer to chart at end of section.

**12BS3**Refer to chart at end of section.  
For replacement use type 12BS3A/12DW4A.