TECHNICAL DATA
ELECTRON TUBES

PUBLISHED BY
TUNG-SOL
ELECTRIC INC.

TUNG–SOL Technical Data Electron Tubes

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1st March, 1963	21st June, 1963
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1st May, 1963	19th July, 1963
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1st September, 1963	1st October, 1963
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1st November, 1963	24th February, 1964
1st December, 1963	1st April, 1964
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1st September, 1965	
1st October, 1965	
1st November, 1965	
1st December, 1965	

for Contents (yellow sheets)
" (blue sheets) Military + Industrial }

TUNG-SOL

See File 2 on my desk
for Contents C.R.T. (green sheets) See Vol. 4

TECHNICAL DATA

TUNG-SOL

ELECTRON TUBES

TUNG-SOL ELECTRIC INC.
ELECTRON TUBE DIVISION
NEWARK, N. J.
U. S. A.

PRINTED IN U. S. A.

PLATE
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OCT. 1
1951

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INTRODUCTION

These Technical Data Books have been compiled for the use of the Electronics industry. Inclusion of data for a specific tube type does not necessarily mean that the tube will be available and for sale by Tung-Sol.

The technical data sheets in these books are arranged in numerical alphabetical order, with respect to tube type designation. The Table of Contents on the following pages will, in all cases, list the sheets which have been issued to the current date. If any sheets, listed in the Table of Contents, are missing from your book, additional copies may be obtained from the address given below.

Additional sheets covering new tube types or changes on existing types will be issued on the first of each month. The Main Contents pages will be revised approximately every six months, the Supplemental Contents page will be revised with each monthly issue of sheets.

TUNG-SOL ELECTRIC INC.
ELECTRON TUBE DIVISION
200 BLOOMFIELD AVENUE
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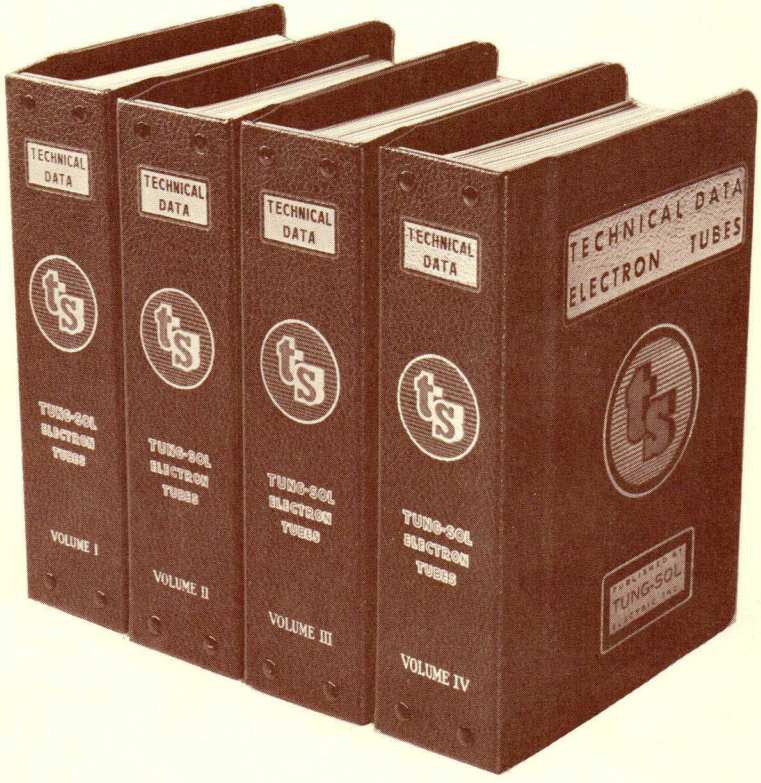

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TUNG-SOL

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A separate Contents Page listing Military and Industrial Tubes will be located at the beginning of the Blue Section.

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TUNG-SOL

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6CU8	6705	6E5	3376	6FV6	5450	6J6-6J6A	4800
6CU8	5094	6EA5	5554	6FV6	5451	6J10	6889
6CU8	5095	6EA7	6091	6FV8	6335	6JA8	6870
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6CW5	5863	6EA8	5186	6FV8A	6512	6JA8	6872
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DEFINITIONS

CLASS A AMPLIFIER:

The Class A Amplifier is an amplifier in which the grid bias and the exciting grid voltage are such that plate current flows approximately 360 electrical degrees of the cycle. The ideal Class A Amplifier operates on the linear portion of the plate current vs grid voltage characteristic in such a manner that the wave form of the plate current is an exact reproduction of the exciting grid voltage. The Class A Amplifier is characterized by low efficiency, low output and low percentage of harmonic distortion.

CLASS AB AMPLIFIER:

The Class AB Amplifier is an amplifier in which the grid bias and the exciting grid voltage are such that plate current flows for appreciably more than 180 electrical degrees but less than 360 electrical degrees of the cycle. This class of amplifier, sometimes designated as "Class A' (prime) Amplifier" is characterized by efficiency, output and percentage of harmonic distortion intermediate to those of Class A and Class B Amplifiers.

CLASS B AMPLIFIER:

The Class B Amplifier is an amplifier in which the grid bias and the exciting grid voltage are such that plate current flows approximately 180 electrical degrees of the cycle. The grid bias is approximately equal to the plate current cut-off value, and the power output is proportional to the square of the excitation grid voltage. The Class B Amplifier is characterized by medium efficiency, medium output and medium percentage of harmonic distortion.

CLASS BC AMPLIFIER:

The Class BC Amplifier is an amplifier in which the grid bias and the exciting grid voltage are such that the plate current flows slightly less than 180 electrical degrees of the cycle. The Class BC Amplifier is characterized by an efficiency, an output and a percentage of harmonic distortion intermediate to those of Class B and Class C Amplifiers.

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CLASS C AMPLIFIER:

The Class C Amplifier is an amplifier in which the grid-bias voltage and the exciting grid voltage are such that the plate current flows for considerably less than 180 electrical degrees of the cycle. The Class C Amplifier is characterized by high plate-circuit efficiency, high power output and a high percentage of harmonic distortion.

NOTE: The suffix 1 added to the letter or letters of the class identification denotes that grid current does not flow during any part of the input cycle. The suffix 2 denotes that grid current flows during some part of the cycle.

AMPLIFICATION FACTOR:

The amplification factor μ is the ratio of a small change in plate voltage to a small change in control-grid voltage under the conditions that the plate current remains unchanged and that all other electrode voltages are maintained constant. It is a measure of the effectiveness of the control-grid voltage relative to that of the plate voltage upon the plate current.

PLATE RESISTANCE

The plate resistance r_p is the ratio of a small change in the alternating plate voltage to a small change of the in-phase component of the alternating current produced thereby, all other electrode voltages being maintained constant.

TRANSCONDUCTANCE:

Transconductance g_m from one electrode to another is the ratio of a small change in the magnitude of the alternating currents' in-phase component that flows in the second electrode to a small change in the alternating voltage of the first electrode, all other electrode voltages being maintained constant.

CONVERSION TRANSCONDUCTANCE:

Conversion transconductance s_c is the ratio of a small magnitude of single beat-frequency component $(F_1 + F_2)$ or $(F_1 - F_2)$ of the output electrode current to the magnitude of a small control-electrode voltage of frequency F_1. This is under the conditions that all direct electrode voltages and the magnitude of the electrode alternating voltage F_2 remains constant and that no impedances at the frequencies F_1 or F_2 are present in the output circuit.

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CONVERSION PLATE IMPEDANCE:

Conversion plate impedance is the ratio of a small change in the plate voltage of a frequency converter to a small change in its plate current under the conditions that all direct voltages remain constant and that no impedances to the oscillator frequency or to the measurement frequency are present in its plate circuit.

CONVERSION GAIN:

Conversion gain is the ratio of the magnitude of the intermediate frequency voltage developed at the output circuit of the frequency converter, to the magnitude of the exciting voltage applied to the signal grid.

VOLTAGE GAIN:

The voltage gain of an amplifier stage is the ratio of voltage developed across the plate impedance to the exciting grid voltage.

VOLTAGE AMPLIFIER:

A voltage amplifier is an amplifier whose primary purpose is to obtain a voltage gain without regard to the power delivered into its output circuit.

PHASE INVERTER:

Phase inverter is an amplifier whose purpose is shifting the phase of an incoming signal voltage by 180 degrees to provide a driving voltage in combination with the original signal for a push-pull amplifier.

POWER AMPLIFIER:

Power amplifier is an amplifier whose primary purpose is to deliver power into a load circuit.

PUSH-PULL AMPLIFIER:

A push-pull amplifier consists of two similar amplifiers so arranged, that the output voltage of one is 180° out of phase with the other. Push-pull amplifiers are characterized by increased power output for a given total harmonic distortion as this type of connection cancels the even harmonics.

UNDISTORTED POWER OUTPUT:

The undistorted power output is defined as the power output delivered by a vacuum tube into a resistance load, under the conditions that the total generated harmonic distortion with a sinusoidal excitation voltage shall not exceed an arbitrary criterion of permissable total harmonic distortion of five per cent.

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POWER OUTPUT:

The power output is the AC power developed in an external non-inductive resistor of rated value connected in the plate circuit of the amplifier. The maximum power output is limited by an arbitrary criterion of permissible total harmonic distortion.

POWER SENSITIVITY:

Power sensitivity of an output tube is the ratio of the undistorted power output to the square of the exciting grid voltage. The unit of power sensitivity is the mho or μmho.

MODULATION:

Modulation is the process by which some characteristic of a periodic wave is varied with time in accordance with a signal.

DEMODULATION:

The process of recovering a modulating signal (in a detector) from a modulated wave.

INTERMODULATION:

Intermodulation is the production in a non-linear circuit element of frequencies corresponding to the sums and differences of the fundamentals and harmonics of two or more frequencies which are transmitted through that element.

CROSS MODULATION:

Cross modulation is the modulation of the carrier of the desired signal by a modulating voltage of an undesired signal.

AMPLITUDE DISTORTION:

Amplitude distortion results from non-linear amplification in such a manner that the output wave form is not exactly proportional to the amplitude of the input signal, and harmonics of the signal are generated in the amplifier.

FREQUENCY DISTORTION:

Frequency distortion results when the frequency components of the input signal are not amplified with equal magnitude.

PHASE DISTORTION:

Phase distortion results when the phase relation of the frequency components in the output differ from the phase relation of the frequency components in the input.

PLATE 620-1

PEAK FORWARD ANODE VOLTAGE:

Peak forward anode voltage is the maximum instantaneous voltage appearing across the anode and cathode in the direction in which the tube is designed to conduct current.

PEAK INVERSE ANODE VOLTAGE:

Peak inverse anode voltage is the maximum instantaneous voltage appearing across the anode and cathode in the direction opposite to that in which the tube is designed to conduct current.

TUBE VOLTAGE DROP:

In a vacuum tube, the tube voltage drop varies with the current and is the anode voltage produced by a specified plate current. Tube voltage drop in a gas or vapor-filled tube is the anode to cathode voltage during the conducting period.

MAXIMUM PEAK PLATE CURRENT:

Maximum peak plate current is the highest peak current that the plate of a vacuum tube can safely pass in the direction in which the tube is designed to conduct the current.

CATHODE CURRENT:

Cathode current is the total electronic current passing to or from the cathode through the vacuous space.

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PLATE
621-1

NOV. 20
1939

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SYMBOLS OF TUBE CHARACTERISTICS

C_{gk}	Grid to cathode capacitance (input)
C_{pk}	Plate to cathode capacitance (output)
C_{gp}	Grid to plate capacitance
E_b	Average or quiescent value of plate voltage
E_{bb}	Plate supply voltage
E_c	Average or quiescent value of grid voltage
E_{c1}	Average or quiescent value of #1 grid voltage
E_{c2}	Average or quiescent value of #2 grid voltage
E_{cc1}	#1 Grid supply voltage
E_{cc2}	#2 Grid supply voltage
E_f	Filament or heater terminal voltage
E_{ff}	Heater or filament supply voltage
E_{inv}	Peak (or crest) inverse voltage
E_{sig}	Signal voltage (input to control grid)
g_m	Grid-plate transconductance (mutual conductance)
I_b	Average or quiescent value of plate current
I_c	Average or quiescent value of grid current
I_{c1}	Average or quiescent value of #1 grid current
I_{c2}	Average or quiescent value of #2 grid current
I_f	Filament or heater current
I_L	Load current
I_s	Total electron emission (total cathode current)
ma.	Current in milliamperes
megohm	Resistance in millions of ohms
mw.	Milliwatts is power expressed in thousandths of watts
P_i	Power input
P_o	Power output
P_p	Anode dissipation
RMS	Root-Mean-Square
R_L	Load resistance
r_p	Plate resistance
s_c	Conversion tranconductance
t_k	Cathode heating time
μ	Amplification factor
μfd	Capacitance in microfarads
$\mu\mu$fd	Capacitance in micro-microfarads
μmhos	Conductance in micromhos

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PLATE
1452
AUG. 31
1944

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SYMBOLS OF TUBE ELEMENTS

(AS EMPLOYED IN CONNECTION WITH BASE DIAGRAMS)

USE THIS COLUMN FOR ALL DATA SHEETS DATED PRIOR TO JUNE 15, 1944		USE THIS COLUMN FOR ALL DATA SHEETS DATED JUNE 15, 1944 AND LATER	
G_a	Anode Grid	A (A_1, A_2, etc.)	Anode
R	Ray Control Electrode	D (D_1, D_2, etc.)	Deflectors, Ray Control Electrode
F	Filament	F	Filament
F_t	Filament Tap	F_t	Filament Tap
G	Control Grid	G (G_1, G_2, etc.)	Grid
H	Heater	H	Heater
H_t	Heater Tap	H_t	Heater Tap
I_c	Internal Connection	I_c	Internal Connection (Not For External Use)
		J	Jumper
K	Cathode	K	Cathode
N_c	No Connection	N_c	No Connection
P	Plate	P (P_1, P_2, etc.)	Plate, Diode Plate
D_p	Diode Plate		
S	Metal Shell	S	Shell
S_i	Internal Shield	S_i	Internal Shield
X_s	External Shield	S_x	External Shield
T	Target	T	Target
▮	Beam Plate	▮	Beam Plate
F_c	Filament Center (Electrical)		
G_m	Modulator Grid		
G_o	Oscillator Grid		
G_s	Screen Grid		
H_c	Heater Center (Electrical)		
P_i	Input Plate		
P_o	Oscillator Plate		
P_r	Remote Cut-Off Plate		
P_s	Sharp Cut-Off Plate		
S_u	Suppressor Grid		

[A] GRID SUBSCRIPT NUMBERS ARE USED ONLY WHEN THERE IS MORE THAN ONE GRID IN THE TUBE. THEY SIGNIFY THE SEQUENCE FROM THE CATHODE. FOR EXAMPLE, G_3 INDICATES THE 3RD. GRID FROM THE CATHODE. WHEN THERE ARE TWIN ELEMENTS IN A TUBE, SUBSCRIPTS ARE USED ONLY IF THERE IS MORE THAN ONE GRID IN ANY GIVEN UNIT. FOR EXAMPLE, A TRIODE-PENTODE IS LABELLED G_2, G_3 FOR A PENTODE SECTION, WHEREAS THE TRIODE SECTION IS LABELLED G. IF THERE ARE 2 PENTODE SECTIONS, THERE ARE THEN TWO SETS OF SUBSCRIPTS.

ALL BASING DIAGRAMS ARE BOTTOM VIEWS. THEY ARE SYMBOLIC AND DO NOT NECESSARILY REPRESENT INTERNAL TUBE CONSTRUCTION.

PLATE 1453
AUG. 31 1944

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TUBE TYPES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

The following listed electron tube types should not generally be considered for new equipment design without prior assurance of availability. Some of these types use bulb or base styles or manufacturing techniques and processes which no longer are available to the tube industry. Others, because of a continued low demand, have disappeared from manufacturers' and jobbers' stocks and most likely will never be manufactured again.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., APRIL 1, 1962 PLATE #6429

TUBE TYPES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	FILAMENT TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE MMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
00A	TRIODE	5	0.25	FIL.	DETECTOR	45		0	1.5		666	30	20						ST-14	78	MED. 4 PIN	4D	00A
01A	TRIODE	5	0.25	FIL.	CLASS A AMPLIFIER	135		9	3		800	10	8						ST-14	78	MED. 4 PIN	4D	01A
0Y4	GAS FILLED DIODE			COLD	HALF-WAVE RECTIFIER	Pins 7-8 Must be Connected. Max. DC Starting Voltage: 95 V. Peak Current: 500 Ma. Max. Tube Drop: Approx. 12 V.										300	40 to 75		MT-8	17	5 PIN OCTAL	4BU	0Y4
0Y4G	GAS FILLED DIODE			COLD	HALF-WAVE RECTIFIER	SAME CHARACTERISTICS AS 0Y4													T-7	12	5 PIN OCTAL	4BU	0Y4G
0Z4G	GAS FILLED DOUBLE DIODE			COLD	FULL-WAVE RECTIFIER	Peak starting-supply voltage per plate: 300 min. Peak plate-to-plate voltage: 1000 DC output voltage: 300; peak plate current: 200 ma.											30 to 75		T-7	12	5 PIN OCTAL	4R•	0Z4G
1A3	DIODE	1.4	0.15	HEATER	HF DETECTOR RECTIFIER											117	330	0.5	T-5½	4	MIN. 7 PIN	5AP	1A3
1A4P	PENTODE	2	0.06	FIL.	CLASS A AMPLIFIER	180	67.5	3	2.3	0.8	750	1000	750	Cutoff: 15 μmhos @ −15 V.					ST-12	72	SMALL 4 PIN	4M	1A4P
1A4T	TETRODE	2	0.06	FIL.	CLASS A AMPLIFIER	180	67.5	3	2.3	0.7	750	960	720						ST-12	72	MED. 4 PIN	4K	1A4T
1A5GT	PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90 85	90 85	4.5 4.5	4 2.5	0.8 0.7	850 800	300 300		25,000 25,000	0.115 0.100	Signal: 3.2 V. RMS			T-9	35	7 PIN OCTAL	6X	1A5GT
1A6	HEPTODE	2	0.06	FIL.	CONVERTER	180 135	67.5 67.5	3 3	1.3 1.2	2.4 2.5	300 275	500 400		Eg_2 = 180 V. Eg_2 = 135 V.					ST-12	72	SMALL 6 PIN	6L	1A6
1A7G	HEPTODE	1.4	0.05	FIL.	CONVERTER	90	45	0	0.55	0.6	250	600		Eg_2 = 90 V. Ig_2 = 1.2 Ma. Osc. Grid Resistor = 0.2 Meg. Ig_1 = 35 μa					T-9	52	8 PIN OCTAL	7Z	1A7G
1A7GT	HEPTODE	1.4	0.05	FIL.	CONVERTER	90	90	0	0.6	1.2	250	600		Eg_2: 90 volts: Ig_2: 1.2 ma. Osc. grid resistor: 0.2 megohm; Ig_1: 35 μa.					T-9	34	8 PIN OCTAL	7Z	1A7GT
1AB5	PENTODE	1.2	0.13	FIL.	CLASS A AMPLIFIER	150 90	150 90	1.5 0	6.8 3.5	2 0.8	1350 1100	1250 275		Cutoff: 10 μmhos @ −23 V. Cutoff: 10 μmhos @ −14 V.					T-9	25	8 PIN LOC.	5BF	1AB5
1AF4	PENTODE	1.4	0.025	FIL.	CLASS A AMPLIFIER	67.5 90	67.5 90	0 0	1.2 1.8	0.32 0.56	925 1050	2200 1800		Cut-off: 10 μmhos at −2.8 V. Cut-off: 10 μmhos at −3.8 V.					T-5½	4	MIN. 7 PIN	6AR	1AF4

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1AF5-1D8GT

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANSCONDUCTANCE MICROMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB: STYLE	BULB: OUTLINE NO.	BASE: STYLE	BASE: BASING	TYPE
1AF5	DIODE PENTODE	1.4	0.025	FIL.	CLASS A AMPLIFIER	90	90	0	1.1	0.4	600	2000	Cutoff: 10 μmhos @ −3.5 V.						T-5½	4	MIN. 7 PIN	6AU	1AF5
1AJ5	DIODE PENTODE	1.25	0.04	FIL.	CLASS A AMPLIFIER	45	45	0	1.0	0.3	425	300	Minimum Diode Current @ 10 VDC = 0.5 Ma.						T-2X3	2	SUB. MIN. 6 PIN	1AJ5	1AJ5
1AX2	DIODE	1.4	0.65	FIL.	HALF-WAVE RECTIFIER	Positive Pulse Plate Voltage = 20,000 V. Negative Pulse Plate Voltage = 5000 V.										DC Output Voltage = 20,000 V. DC Load Current = 300 μa.			T-6½	10	MIN. 9 PIN	9Y	1AX2
1B4P	PENTODE	2	0.06	FIL.	CLASS A AMPLIFIER	180	67.5	3	1.7	0.6	650	1500	1000						ST-12	72	SMALL 4 PIN	4M	1B4P
1B5	DOUBLE DIODE TRIODE	2	0.06	FIL.	CLASS A AMPLIFIER	135		3	0.8		575	35	20						ST-12	70	SMALL 6 PIN	6M	1B5
1B7G	HEPTODE	1.4	0.1	FIL.	CONVERTER	90	45	0	1.5	1.3	350	350	Eg_2 = 90 V. Ig_2 = 1.6 Ma. Ig_1 = 35 μa Osc. Grid Resistor = 0.2 Megohm						T-9	44	8 PIN OCTAL	7Z	1B7G
1B8GT	DIODE TRIODE HEPTODE	1.4	0.1	FIL.	CLASS A AMPLIFIER	90 90	90	6 0	6.3[F] 0.15	1.4[F]	1150 275	240		14,000	0.21				T-9	33	8 PIN OCTAL	8AJ	1B8GT
1C5GT	PENTODE	1.4	0.1	FIL.	CLASS A AMPLIFIER	90	90	7.5	7.5	1.6	1550	115		8000	0.24	Signal: 5.3 V. RMS			T-9	35	7 PIN OCTAL	6X	1C5GT
1C6	HEPTODE	2	0.12	FIL.	CONVERTER	180 135	67.5 67.5	3 3	1.5 1.3	2 2.5	325 300	700 600	Eg_2 = 180 V. thru 20,000 Ohms Eg_2 = 135 V.						ST-12	72	SMALL 6 PIN	6L	1C6
1C7G	HEPTODE	2	0.12	FIL.	CONVERTER	180 135	67.5 67.5	3 3	1.5 1.3	2 2.5	325 300	700 600	Eg_2 = 180 V. thru 20,000 Ohms Eg_2 = 135 V.						ST-12	71	8 PIN OCTAL	7Z	1C7G
1C8	HEPTODE	1.25	0.04	FIL.	CONVERTER	30	30	0	0.32	0.75	100	300	Osc. Grid Resistance: 0.1 Meg. Osc. Grid Current: 30 μamp						T-3	1	SUB. MIN. 8 PIN	8CN	1C8
1D5GP	PENTODE	2	0.06	FIL.	CLASS A AMPLIFIER	180	67.5	3	2.3	0.75	750	960	750						ST-12	71	8 PIN OCTAL	5Y	1D5GP
1D5GT	TETRODE	2	0.06	FIL.	CLASS A AMPLIFIER	180	67.5	3	2.3	0.7	750	960	720						ST-12	71	8 PIN OCTAL	5R	1D5GT
1D7G	HEPTODE	2	0.06	FIL.	CONVERTER	180 135	67.5 67.5	3[Z] 3[Z]	1.3 1.2	2.4 2.5	300 275	500 400	Eg_2 = 180 V. thru 20,000 ohms Eg_2 = 135 V.						ST-12	71	8 PIN OCTAL	7Z	1D7G
1D8GT	DIODE TRIODE PENTODE	1.4	0.1	FIL.	TRIODE UNIT AS CLASS A AMPLIFIER	90		0	0.3		325	77	25						T-9	33	8 PIN OCTAL	8AJ	1D8GT
					PENTODE UNIT AS CLASS A AMPLIFIER	90	90	9	5	1	925	200		1200	0.2								

[F] Zero signal. [Z] Minimum value.

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. APRIL 1, 1962 PLATE #6430

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANSCONDUCTANCE μMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
1E4G	TRIODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90 90		3 0	1.5 4.5		825 1325	17 11	14 14.5						T-9	48	7 PIN OCTAL	5S	1E4G
1E5GP	PENTODE	2	0.06	FIL.	CLASS A AMPLIFIER	180	67.5	3	1.7	0.6	650	1500	1000						ST-12	71	7 PIN OCTAL	5Y	1E5GP
1E5GT	TETRODE	2	0.06	FIL.	CLASS A AMPLIFIER	180	67.5	3	1.7	0.6	650	1500	1000						ST-12	71	8 PIN OCTAL	5R	1E5GT
1E7G	DOUBLE PENTODE	2	0.24	FIL.	CLASS A AMPLIFIER	135	135	4.5	7.5	2.2	1425	260		16,000	0.29	Each Section			ST-12	50	8 PIN OCTAL	8C	1E7G
1F4	PENTODE	2	0.12	FIL.	CLASS A AMPLIFIER	135 90	135 90	4.5 3	8 4	2.4 1.1	1700 1400	200 240	340 340	16,000 20,000	0.31 0.11	Signal: 3.2 V. RMS Signal: 2.1 V. RMS			ST-14	78	MED. 5 PIN	5K	1F4
1F5G	PENTODE	2	0.12	FIL.	CLASS A AMPLIFIER	135 90	135 90	4.5 3	8 4	2.4 1.1	1700 1400	200 240	340 340	16,000 20,000	0.31 0.11	Signal: 3.2 V. RMS Signal: 3.2 V. RMS			ST-14	77	7 PIN OCTAL	6X	1F5G
1F6	DOUBLE DIODE PENTODE	2	0.06	FIL.	CLASS A AMPLIFIER	180	67.5	1.5	2.2	0.7	650	1000	650	Cutoff: 20 μmhos @ −12 V.					ST-12	71	SMALL 6 PIN	6W	1F6
1F7G	DOUBLE DIODE PENTODE	2	0.06	FIL.	CLASS A AMPLIFIER	180	67.5	1.5	2.2	0.7	650	1000	650	Cutoff: 20 μmhos @ −12 V.					ST-12	71	8 PIN OCTAL	7AD	1F7G
1F7GH	DOUBLE DIODE PENTODE	2	0.06	FIL.	CLASS A AMPLIFIER	180	67.5	1.5	2.2	0.7	650	1000	650	Cutoff: 20 μmhos @ −12 V.					ST-12	71	8 PIN OCTAL	7AF	1F7GH
1G4GT	TRIODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90		6	2.3		825	10.7	8.8						T-9	32	8 PIN OCTAL	5S	1G4GT
1G5G	PENTODE	2	0.12	FIL.	CLASS A AMPLIFIER	135 90	135 90	13.5 6	8.7 8.5	2.5 2.5	1550 1550			9000 8500	0.55 0.25	Signal: 6.5 V. RMS Signal: 4.2 V. RMS			ST-14	77	7 PIN OCTAL	7AB	1G5G
1G6GT	DOUBLE TRIODE	1.4	0.1	FIL.	CLASS B AMPLIFIER	90		0	2[F]	Current for Both Sections				12,000	0.35	Load is Plate-to-Plate			T-9	35	8 PIN OCTAL	7AB	1G6GT
1H4G	TRIODE	2	0.06	FIL.	CLASS A AMPLIFIER	180		13.5	3.1		900	10.3	9.3						ST-12	69	7 PIN OCTAL	5S	1H4G
1H5GT	DIODE TRIODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90 67.5		0 0	0.15 0.06		275 210	240 300	65 60						T-9	34	7 PIN OCTAL	5Z	1H5GT
1H6G	DOUBLE DIODE TRIODE	2.0	0.06	FIL.	CLASS A AMPLIFIER	135		3	0.8		575	35	20						T-9	35	8 PIN OCTAL	7AA	1H6G

[F] Zero signal.

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

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1J5G-1N6G

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE μMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	BASE TYPE
1J5G	PENTODE	2.0	0.12	FIL.	CLASS A AMPLIFIER	135	135	16.5	7	2	950		100	13,500	0.45				ST-14	77	7 PIN OCTAL	6X	1J5G
1J6G	DOUBLE TRIODE	2.0	0.24	FIL.	CLASS B AMPLIFIER	135		0	10	Current for Both Sections				10,000	2.1	Load is Plate-to Plate			ST-12	69	8 PIN OCTAL	7AB	1J6G
1L6	HEPTODE	1.4	0.05	FIL.	CONVERTER	90	90	0	0.5	1.2	300	650	Ig_2: 1.2 ma. Ig_1: 35 μa thru 200 000 ohms Ia: 2.35 ma.						T-5½	4	MIN. 7 PIN	7DC	1L6
1LA4	PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90	90	4.5	4	0.8	850	300		2500	0.115				T-9	26	8 PIN LOC.	5AD	1LA4
1LA6	HEPTODE	1.4	0.05	FIL.	CONVERTER	90	45	0 Min.	0.55	0.6	250	750	Eg_2 = 90 V.; Ig_2 = 1.2 Ma.; Ig_1 = 35 μa Osc. Grid Resistor = 0.2 Megohm						T-9	26	8 PIN LOC.	7AK	1LA6
1LB4	PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90 45	90 45	9 4.5	5[F] 1.6[F]	1[F] 0.3[F]	925 650	250 400		12,000 20,000	0.2 .035				T-9	26	8 PIN LOC.	5AD	1LB4
1LC5	PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90 45	45 45	0 0	1.15	0.30 0.35	775 750	1000 700	Cutoff: 10 μa @ −3.4 V. Cutoff: 10 μa @ −3.4 V.						T-9	26	8 PIN LOC.	7AO	1LC5
1LC6	HEPTODE	1.4	0.05	FIL.	CONVERTER	90 45	35 35	0 0	0.7 0.7	0.7 0.75	275 250	650 300	Eg_2 = 45 V.; Ig_2 = 1.4 Ma.; Ig_1 = 35 μa Osc. Grid Resistor = 0.2 Megohm						T-9	26	8 PIN LOC.	7AK	1LC6
1LD5	DIODE PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90	45	0	0.6	0.1	575	750							T-9	26	8 PIN LOC.	6AX	1LD5
1LE3	TRIODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90 90		3 0	1.4 4.5		760 1300	19 11.2	14.5 14.5						T-9	26	8 PIN LOC.	4AA	1LE3
1LG5	PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90 90	90 45	1.5 0	3.7 1.7	0.9 0.4	1150 800	500 1000	Cutoff: 10 μmhos @ −19 V. Cutoff: 10 μmhos @ −10 V.						T-9	26	8 PIN LOC.	7AO	1LG5
1LH4	DIODE TRIODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90 67.5		0 0	0.15 0.06		275 210	240 300	65 60						T-9	26	8 PIN LOC.	5AG	1LH4
1LN5	PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90	90	0	1.6	0.35	800	1100	Cut-off: 10 μmhos at −4.5 V.						T-9	26	8 PIN LOC.	7AO	1LN5
1N6G	DIODE PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90	90	4.5	3.1		800	300		25,000	0.1	Signal: 3.5 V. RMS			T-9	48	8 PIN OCTAL	7AM	1N6G

[F] Zero signal.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. APRIL 1, 1962 PLATE #6431

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

1N6GT-1V5

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT M.A.	SCREEN CURRENT M.A.	TRANSCONDUCTANCE μMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB: STYLE	BULB: OUTLINE NO.	BASE: STYLE	BASE: BASING	TYPE
1N6GT	DIODE PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90	90	4.5	3.1		800	300		25,000	0.1	Signal: 3.5 V. RMS			T-9	36	8 PIN OCTAL	7AM	1N6GT
1P5G	PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90	90	0	2.3	0.7	750	800	Cutoff: 10 μmhos @ −12 V.						T-9	52	7 PIN OCTAL	5Y	1P5G
1P5GT	PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90	90	0	2.3	0.7	750	800	Cut-off: 10 μmhos at −12 V.						T-9	34	7 PIN OCTAL	5Y	1P5GT
1Q5GT	BEAM PENTODE	1.4	0.1	FIL.	CLASS A AMPLIFIER	90 85	90 85	4.5 5	9.5[F] 7.0[F]	1.3[F] 0.8[F]	2200 1950	90 70		8000 9000	0.27 0.25	Signal: 3.2 V. RMS			T-9	35	7 PIN OCTAL	6AF	1Q5GT
1Q6	DIODE PENTODE	1.25	0.04	FIL.	CLASS A AMPLIFIER	67.5 30	67.5 30	0 0	1.6 0.33	0.4 0.09	600 330	400 500							T-3	1	SUB. MIN. 8 PIN	8CO	1Q6
1R4	DIODE	1.4	0.15	FIL.	RF RECTIFIER	Resonant Frequency: 1500 Mc. Voltage Drop @ 2 Ma.; 8 Vdc.										117		1	T-9	26	8 PIN LOC.	4AH	1R4
1S4	PENTODE	1.4	0.1	FIL.	CLASS A AMPLIFIER	90 45	67.5 45	7 4.5	7.4[F] 3.8[F]	1.4[F] 0.8[F]	1575 1250	100 100		8000 8000	0.27 0.065	Signal: 5 V. RMS Signal: 3.2 V. RMS			T-5½	4	MIN. 7 PIN	7AV	1S4
1SA6GT	PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90 45	67.5 45	0 0	2.4 1.1	0.68 0.3	970 750	800 700	Cutoff: 5 μmhos @ −5.5 V. Cutoff: 5 μmhos @ −3.5 V.						T-9	36	8 PIN OCTAL	6BD	1SA6GT
1SB6GT	DIODE PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90 45	67.5 45	0 0	1.45 0.6	0.38 0.16	665 500	700 900							T-9	35	8 PIN OCTAL	6AF	1SB6GT
1T5GT	BEAM PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	90	90	6	6.5	0.8	1150	250		14,000	0.17	Signal: 4.3 V. RMS			T-9	35	7 PIN OCTAL	6X	1T5GT
1U6	HEPTODE	1.4	0.025	FIL.	CONVERTER	90	90	0	0.6	1.1	300	500							T-5½	4	MIN. 7 PIN	7DC	1U6
1-V	DIODE	6.3	0.3	HEATER	HALF-WAVE RECTIFIER											325	1000	45	ST-12	70	SMALL 4 PIN	4G	1-V
1V5	PENTODE	1.25	0.04	FIL.	CLASS A AMPLIFIER	67.5	67.5	4.5	2	0.4	750	150		25,000	0.05				T-3	1	SUB. MIN. 8 PIN	8CP	1V5

[F] Zero signal.

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

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1W4-2B7

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS. CONDUCTANCE MMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
1W4	PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	67.5 90	67.5 90	6 9	3.8[F] 5[F]	0.8[F] 1[F]	875 925	300 250		16,000 12,000	0.1 0.2				T-5½	4	MIN. 7 PIN	5BZ	**1W4**
1W5	PENTODE	1.25	0.04	FIL.	RF AMPLIFIER	67.5	67.5	0	1.85	0.75	735	700	Cutoff: 10 μamp @ −2 V.						T-3	1	SUB. MIN. 8 PIN	8CP	**1W5**
1X2A	DIODE	1.25	0.2	FIL.	HALF-WAVE RECTIFIER IN TV RECEIVERS	Peak Plate Current: 11 Ma. Max. Max. DC Load Current: 1.1 Ma. Positive Pulse Plate Volts: 14 KV.							Tube Voltage Drop at 7 Ma.: 100 V. DC Output Voltage (Approx.): 14 KV. Negative Pulse Plate Voltage: 3.5 KV.						T-6½	10	MIN. 9 PIN	9Y	**1X2A**
2A3	TRIODE	2.5	2.5	FIL.	CLASS A AMPLIFIER CLASS AB AMPLIFIER	250 300		45 62	60 80	Current and output for 2 tubes.	5250	0.8	4.2	2500 3000	3.5 15	Grid bias measured from filament center Load is plate-to-plate			ST-16	84	MED. 4 PIN	4D	**2A3**
2A4G	THYRATRON	2.5	2.5	FIL.	CONTROL TUBE	Instantaneous forward or inverse anode voltage 200 V. Anode current: peak 1.25 amps., average 0.10 amp. Maximum averaging time: 45 sec. Cold starting time: 2 sec.													ST-12	69	7 PIN OCTAL	5S	**2A4G**
2A5	PENTODE	2.5	1.75	HEATER	CLASS A AMPLIFIER	250	250	16.5	34[F]	6.5[F]	2500	80		7000	3.2				ST-14	78	MED. 6 PIN	6B	**2A5**
2A6	DOUBLE DIODE TRIODE	2.5	0.8	HEATER	CLASS A AMPLIFIER	250		2	0.9		1100	91	100						ST-12	72	SMALL 6 PIN	6G	**2A6**
2A7	HEPTODE	2.5	0.8	HEATER	CONVERTER	250	100	3	3.5	2.7	550	360	Eg_2 = 180 V. thru 20,000 Ohms						ST-12	72	SMALL 7 PIN	7C	**2A7**
2AF4	TRIODE	2.35	0.6	HEATER	CLASS A AMPLIFIER	80		[A]	17.5		6500	2.1	13.5						T-5½	4	MIN. 7 PIN	7DK	**2AF4**
2B3	DIODE	1.75	0.25	FIL.	HIGH VOLTAGE RECTIFIER	Steady State Peak Plate Current = 50 Ma.										27000	0.5		T-9	49	INT. 8 PIN OCTAL	8HC	**2B3**
2B5	DOUBLE TRIODE	2.4 1.2	0.13 0.26	FIL.	AMPLIFIER	90	1.0		2.6		1150	18.7	21.5						T-3	1	SUB. MIN. 8 PIN	8DP	**2B5**
2B6	DOUBLE TRIODE	2.5	0.225	HEATER	AMPLIFIER	250 250		+2.5 24	40 4		3500 600		18 7.2	5000 5000	0.035 0.600								**2B6**
2B7	DOUBLE DIODE PENTODE	2.5	0.8	HEATER	CLASS A AMPLIFIER	250	125	3	9	2.3	1125	600							ST-12	72	SMALL 7 PIN	7D	**2B7**

[F] Zero signal.

[A] Bias obtained thru 150 ohm cathode resistor.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A.-APRIL 1, 1962 PLATE #6432

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

2C4-3BN4

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE MMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB: STYLE	BULB: OUTLINE NO.	BASE: STYLE	BASE: BASING	TYPE
2C4	THYRATRON	2.5	0.65	FIL.	CONTROL TUBE	Max. Voltage Between Elements: 450 V. Avg. Anode Current: 5 Ma.											Peak Anode Current: 20 Ma. Voltage Drop at 5 Ma.: 16 V.			T-5½	4	MIN. 7 PIN	5AS	2C4
2E5	TRIODE INDICATOR	2.5	0.8	HEATER	TUNING INDICATOR	Plate: 250 V. thru 1 Meg. 0.24 Ma. Shadow Angle: 90° @ Zero Bias; 0° @ −8 V. Bias Target: 250 V., 4 Ma.														ST-12	70	SMALL 6 PIN	6R	2E5
2G5	TRIODE INDICATOR	2.5	0.8	HEATER	TUNING INDICATOR	Plate: 250 V. thru 1 Meg. 0.24 Ma. Shadow Angle: 90° at zero bias, 0° at −22 V. bias Target: 250 V., 4 Ma. Subject to wide variation														ST-12	70	SMALL 6 PIN	6R	2G5
2S/4S	DOUBLE DIODE	2.5	1.35	HEATER	DETECTOR	Plate Voltage: 50 Volts per Plate Cathode Current: 80 Ma.														ST-12	70	SMALL 5 PIN	5D	2S/4S
2V2	DIODE	2.5 1.25	0.2 0.4	FIL.	HIGH VOLTAGE RECTIFIER	Steady State Peak Plate Current: 80 Ma. Tube Voltage Drop @ 7.0 Ma.: 150 V.											15,000	2.0		T-11	57	MED. OCTAL 8 PIN	8FV	2V2
2V3G	DIODE	2.5	5.0	FIL.	HIGH VOLTAGE RECTIFIER												16,500	2.0		ST-12	72	SMALL 6 PIN	4Y	2V3G
2W3	DIODE	2.5	1.5	FIL.	HALF-WAVE RECTIFIER											350		55		MT-8	20	5 PIN OCTAL	4X	2W3
2W3GT	DIODE	2.5	1.5	FIL.	HALF-WAVE RECTIFIER											350		55		T-9	32	5 PIN OCTAL	4X	2W3GT
2X2/879	DIODE	2.5	1.75	HEATER	HIGH VOLTAGE RECTIFIER											4500	12,500	7.5		ST-12	71	SMALL 4 PIN	4AB	2X2/879
3A8GT	DIODE TRIODE PENTODE	1.4 2.8	0.1 0.05	FIL.	CLASS A AMP. TRIODE UNIT	90		0	0.15		275	240	65							T-9	38	8 PIN OCTAL	8AS	3A8GT
3B2	DIODE	3.15	0.22	HEATER	HALF WAVE RECTIFIER	Max. Peak Plate Current = 80 Ma. Max. Average Plate Current = 1.1 Ma.											25,000			T-12	68A	SHORT JUMBO 8 PIN	8GH	3B2
3B5GT	BEAM PENTODE	1.4 2.8	0.1 0.05	FIL.	CLASS A AMPLIFIER	67.5 67.5	67.5 67.5	7 7	8[F] 6.7[F]	0.6[F] 0.5[F]	1650 1500	100 100		5000 5000	0.2 0.18	Signal: 5 V. RMS Signal: 5 V. RMS				T-9	36	7 PIN OCTAL	7AP	3B5GT
3B7	DOUBLE TRIODE	1.4 2.8	0.22 0.11	FIL.	CLASS AB AMPLIFIER	135		0	18.2[F]		1900		20	16,000	1.5					T-9	26	8 PIN LOC.	7BE	3B7
3BN4	TRIODE	3.0	0.45*	HEATER	CLASS A AMPLIFIER	150		[B]	9.0		6800	6.3	43	Cut-off: 100 μamp. @ −6 V.						T-5½	4	MIN. 7 PIN	7EG	3BN4

* Heater warm-up time: 11 seconds.

[B] Bias obtained thru 220 ohm cathode resistor.

[F] Zero signal.

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3C2-5AS8

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE μMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
3C2	DIODE	3.15 0.42	0.21 1.58	FIL.	HIGH VOLTAGE RECTIFIER	Steady State Peak Plate Current = 80 Ma.										33,000	1.1		T-12	26	SHORT OCTAL 8 PIN	8FV	3C2
3C5GT	PENTODE	1.4 2.8	0.1 0.05	FIL.	CLASS A AMPLIFIER	90 90	90 90	9 9	6 6	1.4 1.4	1550 1450			8000 10,000	0.24 0.26				T-9	32	7 PIN OCTAL	7AP	3C5GT
3CF6	PENTODE	3.15	0.6*	HEATER	CLASS A AMPLIFIER	200	150	A	9.5	2.8	6200	600	Cut-off: 35 μa @ −6.5 V.						T-5½	4	MIN. 7 PIN	7CM	3CF6
3D6	BEAM PENTODE	1.4 2.8	0.22 0.11	FIL.	CLASS A AMPLIFIER	150	90	4.5	9.9	1	2400			14,000	0.6				T-9	26	8 PIN LOC.	6BA	3D6
3E5	BEAM PENTODE	1.4 2.8	0.05 0.025	FIL.	CLASS A AMPLIFIER	110 110	90 90	7 7	8.1 7.0	1.5 1.3	1550 1450	110 120		11,000 11,000	0.33 0.30	Signal: 7 V. RMS Signal: 7 V. RMS			T-5½	4	MIN. 7 PIN	6BX	3E5
3E6	PENTODE	1.4 2.8	0.1 0.05	FIL.	SHARP CUT OFF AMPLIFIER P G	110 90	90 90	0 0	4.2 2.9	1.7 1.2	2000 1700	250 325	Cut-off: 10 μa at −5.5 V. Cut-off: 10 μa at −4.0 V.						T-9	26	8 PIN LOC.	7CJ	3E6
3LF4	BEAM PENTODE	1.4 2.8	0.1 0.05	FIL.	CLASS A AMPLIFIER P G	110 110	110 110	6.6 6.6	10 8.5	1.4 1.1	2200 2200	100 110		8000 8000	0.4 0.33				T-9	26	7 PIN OCTAL	6BB	3LF4
3Q5GT	BEAM PENTODE	1.4 2.8	0.1 0.05	FIL.	CLASS A AMPLIFIER P G	110 110	110 110	6.6 6.6	10 8.5	1.4 1.1	2200 2000	100 110		8000 8000	0.4 .33	Signal: 3.2 V. RMS			T-9	35	7 PIN OCTAL	7AQ	3Q5GT
4BA6	PENTODE	4.2	0.45*	HEATER	CLASS A AMPLIFIER	100 250	100 100	C C	10.8 11	4.4 4.2	4300 4400	250 1000	Cut-off: 40 μmhos at −20 V. Cut-off: 40 μmhos at −20 V.						T-5½	4	MIN. 7 PIN	7BK	4BA6
4BE6	HEPTODE	4.2	0.45*	HEATER	CONVERTER	100 250	100 100	1.5 1.5	2.6 2.9	7.0 6.8	455 475	400 1000							T-5½	4	MIN. 7 PIN	7CH	4BE6
4BX8	TWIN TRIODE	4.5	0.6*	HEATER	CASCODE AMPLIFIER	65		1.0	9		6700		25	Cut-off: 10 μamp. @ −7 V.					T-6½	8	MIN. 9 PIN	9AJ	4BX8
4BZ8	TWIN TRIODE	4.2	0.6*	HEATER	CLASS A AMPLIFIER	125		D	10		8000	5.6	45	Cut-off: 50 μmhos @ −13 V.					T-6½	8	MIN. 9 PIN	9AJ	4BZ8
4CE5	PENTODE	4.2	0.45*	HEATER	CLASS A AMPLIFIER	200	150	A	9.5	2.8	6200	600	Cut-off: 35 μamp. @ −6.5 V.						T-5½	4	MIN. 7 PIN	7BD	4CE5
4DK6	PENTODE	4.2	0.45*	HEATER	CLASS A AMPLIFIER	125	125	H	12	3.8	9800		Cut-off: 20 μa @ −6.5 V.						T-5½	4	MIN. 7 PIN	7CM	4DK6
5AS8	DIODE PENTODE	4.7	0.6*	HEATER	CLASS A AMPLIFIER	200	150	A	9.5	3	6200	300	Cut-off: 10 μa @ −8 V.						T-6½	8	MIN. 9 PIN	9DS	5AS8

* Heater warm-up time: 11 seconds.

A Bias obtained thru 180 ohm cathode resistor.

D Bias obtained thru 100 ohm cathode resistor.

G Values for series filament.

C Bias obtained thru 68 ohm cathode resistor.

H Bias obtained thru 56 ohm cathode resistor.

P Values for parallel filament.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., APRIL 1, 1962 PLATE #6433

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

5AV8-5Y4G

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANSCONDUCTANCE MMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
5AV8	TRIODE PENTODE	4.7	0.6*	HEATER	CLASS A B AMPLIFIER A	200 200	150	6 G	13 9.5	2.8	3300 6200	5.75 300	19	Cut-off: 10 μamp. @ −19 V. Cut-off: 10 μamp. @ −8 V.					T-6½	8	MIN. 9 PIN	9DZ	5AV8
5AW4	DIODE	5.0	4.0	FIL.	FULL WAVE RECTIFIER	Tube Voltage Drop: Ib = 250 Ma. DC per Plate: 46 V.										450 550		250 250	T-12	68	OCTAL 5 PIN	5T	5AW4
5AX4GT	DOUBLE DIODE	5	2.5	FIL.	FULL-WAVE RECTIFIER	Max. Steady State Peak Plate Current per Plate: 525 Ma. Max. Transient Peak Plate Current per Plate: 3.5 Amp. Tube Voltage Drop at 175 Ma.: 65 V.										350	1400	175	T-9	37	5 PIN OCTAL	5T	5AX4GT
5BE8	TRIODE PENTODE	4.7	0.6*	HEATER	CLASS A B AMPLIFIER A	150 250	110	0 H 0 J	18 10	3.5	8500 5200	5 400	40	Cut-off: 10 μa @ −12 V. Cut-off: 10 μa @ −12 V.					T-6½	8	MIN. 9 PIN	9EG	5BE8
5BS8	TWIN DIODE	5.6	0.45*	HEATER	CLASS A AMPLIFIER	150		E	10		7200	5	36	Cut-off: 10 μa @ −7 V. (Section 2 Only)					T-5½	8	MIN. 9 PIN	9AJ	5BS8
5BT8	TWIN DIODE PENTODE	4.7	0.6*	HEATER	GENERAL PURPOSE	200	150	G	9.5	2.8	6200	300		Cut-off: 10 μamp. @ −8 V.					T-6½	8	MIN. 9 PIN	9FE	5BT8
5BZ7	TWIN TRIODE	5.6	0.45*	HEATER	CLASS A AMPLIFIER	150			10		6800	5.6	38						T-6½	8	MIN. 9 PIN	9AJ	5BZ7
5CM6	PENTODE	4.7	0.6*	HEATER	VERTICAL DEFLECTION AMPLIFIER	250 250	250	12.5 12.5	45 49.5	4.5	4100 5000	50 19.6	9.8	Cutoff: 0.5 Ma. @ −37 V. Cutoff: 0.5 Ma. @ −37 V.					T-6½	9	MIN. 9 PIN	9CK	5CM6
5CM8	TRIODE PENTODE	4.7	0.6*	HEATER	CLASS A B AMPLIFIER D	250 200	150	2 G	1.8 9.5	2.8	2000 6200	50 300	100	Cut-off: 10 μamp. @ −8 V.					T-6½	8	MIN. 9 PIN	9FZ	5CM8
5T4	DOUBLE DIODE	5	2	FIL.	FULL-WAVE RECTIFIER											450	1550	225	MT-10	21	5 PIN OCTAL	5T•	5T4
5U4GA	DOUBLE DIODE	5.0	3.0	FIL.	FULL WAVE RECTIFIER	Tube Voltage Drop: Ib = 250 Ma. DC per Plate: 44 V.										450 550	1550 1550	250 250	T-11	58	OCTAL 8 PIN	5T	5U4GA
5W4	DOUBLE DIODE	5	1.5	FIL.	FULL-WAVE RECTIFIER											350	1400	100	MT-88	20	5 PIN OCTAL	5T	5W4
5W4GT	DOUBLE DIODE	5	1.5	FIL.	FULL-WAVE RECTIFIER											350	1400	100	T-9	37	5 PIN OCTAL	5T	5W4GT
5X3	DOUBLE DIODE	5	2	FIL.	FULL-WAVE RECTIFIER											1275		30	ST-14	78	MED. 4 PIN	4C	5X3
5X4G	DOUBLE DIODE	5	3	FIL.	FULL-WAVE RECTIFIER											450	1550	225	ST-16	82	8 PIN OCTAL	5Q	5X4G
5Y4G	DOUBLE DIODE	5	2	FIL.	FULL-WAVE RECTIFIER											350	1400	125	ST-14	77	8 PIN OCTAL	5Q	5Y4G

* Heater warm-up time: 11 seconds.

A Pentode section. B Triode section. D Tetrode section. E Bias obtained thru 220 ohm cathode resistor. G Bias obtained thru 180 ohm cathode resistor. H Bias obtained thru 56 ohm cathode resistor. J Bias obtained thru 68 ohm cathode resistor.

• Pin #1 has no connection.

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL

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5Y4GA-6AD6G

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT M.A.	SCREEN CURRENT M.A.	TRANS-CONDUCTANCE μMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT M.A.	BULB STYLE	BASE OUTLINE NO.	BASE STYLE	BASING	TYPE
5Y4GA	DOUBLE DIODE	5.0	2.0	FIL.	FULL WAVE RECTIFIER											350 350	1400 1400	125 125	T-12	64	OCTAL 8 PIN	5Q	5Y4GA
5Z4	DOUBLE DIODE	5	2	HEATER	FULL-WAVE RECTIFIER											350	1400	125	MT-8B	20	5 PIN OCTAL	5L	5Z4
6A3	TRIODE	6.3	1	FIL.	CLASS A AMPLIFIER	250		45	60		5250	0.8	4.2	2500	3.2				ST-16	84	MED. 4 PIN	4D	6A3
6A4/LA	PENTODE	6.3	0.3	FIL.	CLASS A AMPLIFIER	180	180	12	22	3.9	2200	45.5		8000	1.4				ST-14	78	MED. 5 PIN	5B	6A4/LA
6A6	DOUBLE TRIODE	6.3	0.8	HEATER	CLASS B AMPLIFIER	300		0	35[F]	Current for both sections				8000	8	Load is plate-to-plate			ST-14	78	MED. 7 PIN	7B	6A6
					CLASS A AMPLIFIER	294		6	7		3200	11	35	Both sections in parallel									
6A7	HEPTODE	6.3	0.3	HEATER	CONVERTER	250 100	250 100	3 1.5	3.5 1.1	4.0 2.0	550 360	360 600							ST-12	72	SMALL 7 PIN	7C	6A7
6A8	HEPTODE	6.3	0.3	HEATER	CONVERTER	SAME CHARACTERISTICS AS TYPE 6A8GT													MT-8A	18	8 PIN OCTAL	8A	6A8
6A8G	HEPTODE	6.3	0.3	HEATER	CONVERTER	SAME CHARACTERISTICS AS TYPE 6A8GT													ST-12	71	8 PIN OCTAL	8A•	6A8G
6A8GT	HEPTODE	6.3	0.3	HEATER	CONVERTER	250 100	250 100	3 1.5	3.5 1.1	4.0 2.0	550 360	360 600							T-9	34	8 PIN OCTAL	8A	6A8GT
6AB5	TRIODE INDICATOR	6.3	0.15	HEATER	TUNING INDICATOR	Plate: 135 V. thru 0.25 Meg. 0.5 Ma. Target: 135 V. 2 Ma.							Shadow Angle: 90° @ Zero Bias. 0° @ −10 V.						T-9	51	SMALL 6 PIN	6R	6AB5
6AB6G	TRIODE PENTODE	6.3	0.5	HEATER	DIRECT-COUPLED AMPLIFIER	250 250		0 0	34 5		1800	40	72	8000	3.5	Signal: 18 V. RMS			ST-12	73	8 PIN OCTAL	7AU	6AB6G
6AB7	PENTODE	6.3	0.45	HEATER	CLASS A AMPLIFIER [V]	300	200	3	12.5	3.2	5000	700	3500						MT-8	17	8 PIN OCTAL	8N	6AB7
					[W]	300	300	3	12.5	3.2	5000	700	3500										
6AC5GT	TRIODE	6.3	0.4	HEATER	CLASS B AMPLIFIER	250		0	5[F]	Current and Output for 2 Tubes				10,000	8	Load is Plate-To-Plate			T-9	35	6 PIN OCTAL	6Q	6AC5GT
6AC6GT	DOUBLE TRIODE	6.3	1.1	HEATER	DIRECT-COUPLED AMPLIFIER	180 180		0 0	7 45		3000	18	54	4000	3.8				T-9	35	7 PIN OCTAL	7AU	6AC6GT
6AD5G	TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		2	0.9		1500	66	100						ST-12	69	6 PIN OCTAL	6Q	6AD5G
6AD6G	TRIODE INDICATOR	6.3	0.15	HEATER	TUNING INDICATOR	Each Target: 100 V. 1.5 Ma. Each Target: 100 V. 1 Ma.							Shadow Angle: 0° @ +45 V. Shadow Angle: 90° @ 0 V.						T-9	27	7 PIN OCTAL	7AG	6AD6G

[F] Zero signal. [V] With fixed screen supply. [W] With series screen resistor.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A.-APRIL 1, 1962 PLATE #6434

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

6AE5GT-6AU4GT

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE μMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. VOLTS RMS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB: STYLE	BULB: OUTLINE NO.	BASE: STYLE	BASE: BASING	TYPE
6AE5GT	TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	95		15	7		1200	3.5	4.2						T-9	35	6 PIN OCTAL	6Q	6AE5GT
6AE6G	DOUBLE TRIODE	6.3	0.15	HEATER	CONTROL TUBE	250 250		1.5 1.5	6.5 4.5		1000 950	25 35	25 33	Remote Cutoff Sharp Cutoff					ST-12	69	7 PIN OCTAL	7AH	6AE6G
6AE7GT	DOUBLE TRIODE	6.3	0.5	HEATER	CLASS A AMPLIFIER	250		13.5	5		1500	9.3	14						T-9	35	8 PIN OCTAL	7AX	6AE7GT
6AF5G	TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	180		18	7		1500	4.9	7.4						ST-12	69	6 PIN OCTAL	6Q	6AF5G
6AH5G	BEAM PENTODE	6.3	0.9	HEATER	CLASS A AMPLIFIER	350	250	18	54	2.5	5200	33		4200	10.8				ST-16	86	6 PIN OCTAL	6AP	6AH5G
6AJ4	TRIODE	6.3	0.225	HEATER	GROUNDED GRID AMPLIFIER	125			16		10,000	4.2	42	Cut-off: I_b of 10μa = −9 V.					T-6½	7	MIN. 9 PIN	9BX	6AJ4
6AJ7	PENTODE	6.3	0.45	HEATER	CLASS A AMPLIFIER	300	300		10	2.5	9000	1000							MT-8G	17	8 PIN OCTAL	8N	6AJ7
6AK7	PENTODE	6.3	0.65	HEATER	CLASS A AMPLIFIER	300	150	3	30	7	11,000	130		10,000	3				MT-8B	20	8 PIN OCTAL	8Y	6AK7
6AL6G	BEAM PENTODE	6.3	0.9	HEATER	CLASS A AMPLIFIER	350 250	250 250	18 14	54[F] 72[F]	2.5[F] 5[F]	5200 6000	33 22.5		4200 2500	10.8 6.5	Signal: 12.7 V. RMS Signal: 10 V. RMS			ST-16	86	7 PIN OCTAL	6AM	6AL6G
6AL7GT	TRIODE INDICATOR	6.3	0.15	HEATER	TUNING INDICATOR	365 Max.													T-9	29	8 PIN OCTAL	8CH	6AL7GT
6AM8	DIODE PENTODE	6.3	0.45*	HEATER	VIDEO DETECTOR	125	125	[BD]	12.5	3.2	7800	300							T-6½	8	MIN. 9 PIN	9CY	6AM8
6AN6	QUADRUPLE DIODE	6.3	0.2	HEATER	HALF-WAVE RECTIFIER	Peak Plate Current per Plate: 45 Ma. Tube Voltage Drop per Plate @ 6.6 Ma.: 9 V.											75	210	8	T-5½	4	MIN. 7 PIN	7BJ	6AN6
6AQ7GT	DOUBLE-DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		2	2.3		1600	44	70						T-9	35	8 PIN OCTAL	8CK	6AQ7GT
6AU4GT	DIODE	6.3	1.8	HEATER	DAMPER SERVICE	Tube Voltage Drop at 350 Ma. Each Plate: 25 V. Maximum Steady State Peak Plate Current: 1050 Ma.											4500	175	T-9	46	6 PIN OCTAL	4CG	6AU4GT

* Heater warm-up time: 11 seconds.

[F] Zero signal.

[BD] Bias obtained thru 56 ohm cathode resistor.

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL

PRINTED IN U. S. A.

6AV5GT-6BA5

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE μMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BASE OUTLINE NO.	BASE STYLE	BASING	TYPE
6AV5GT	BEAM PENTODE	6.3	1.2	HEATER	CLASS A AMP.	250	150	22.5	45	2.1	5500		4.5[BH]	Peak Plate Current: 155 ma.					T-9	31	6 PIN OCTAL	6CK	**6AV5GT**
					HORIZONTAL DEFLECTION AMPLIFIER FOR 8AP4	200	125	[BI]	66	12				Peak Neg. Surge Grid 1 Voltage: −100 V. Grid 1 Current: 58 μa. High Voltage Developed: 7 kv. Sweep Angle: 54 Degrees									
						Peak Pos. Surge Plate Voltage: 2000 V. Cathode Bias Resistor: 0 ohms																	
6AW7GT	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	100		0	1.4		1200		80						T-9	53	8 PIN OCTAL	8CQ	**6AW7GT**
6AW8	TRIODE PENTODE	6.3	0.6*	HEATER	CLASS A AMPLIFIER D	200		2	4.0		4000	17.5	70	Cut-off: 10 μa @ −5 V.					T-6½	9	MIN. 9 PIN	9DX	**6AW8**
					E	200	150	[A]	13	3.5	9000	400		Cut-off: 10 μa @ −10 V.									
6AX6G	DOUBLE DIODE	6.3	2.5	HEATER	FULL-WAVE RECTIFIER	Tube Voltage Drop at 250 Ma. Each Plate: 21 V. Max. Steady State Peak Plate Current Each Plate: 600 Ma. Max. Steady State DC Output Current Each Plate: 125 Ma.										350 350	1250 2000		ST-14	77	7 PIN OCTAL	7Q	**6AX6G**
6AX8	TRIODE PENTODE	6.3	0.45	HEATER	VIDEO AMPLIFIER D	150			18		8500	.5	40	Cut-off: 10 μa @ −12 V.					T-6½	8	MIN. 9 PIN	9AE	**6AX8**
					E	250	110	[K]	10	3.5	4800	400											
6B4G	TRIODE	6.3	1	FIL.	CLASS A AMPLIFIER	250		45	60		5250	0.8	4.2	2500	3.2	Grid bias measured from filament center			ST-16	82	8 PIN OCTAL	5S	**6B4G**
					CLASS AB AMPLIFIER	325		68	80[F]	Current and output for 2 tubes				3000	15	Load is plate-to-plate							
6B5	DIRECT COUPLED TRIODES	6.3	0.8	HEATER	CLASS A AMPLIFIER	300	300[AB]	0	45	8[AB]	2400	24		7000	4	Signal: 15 V. RMS			ST-14	78	MED. 6 PIN	6AS	**6B5**
6B6G	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		2	0.9		1100	91	100						ST-12	71	7 PIN OCTAL	7V	**6B6G**
6B8	DOUBLE-DIODE PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	SAME CHARACTERISTICS AS TYPE 6B8GT													MT-8A	18	8 PIN OCTAL	8E	**6B8**
6B8G	DOUBLE-DIODE PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	125	3	9	2.3	1125	600	Cut-off: 1000 μmhos @ −17 V.						ST-12	71	8 PIN OCTAL	8E	**6B8G**
6B8GT	DOUBLE-DIODE PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	125	3	10	2.3	1325	600	Cut-off: 1325 μmhos @ −21 V.						T-9	39	8 PIN OCTAL	8E	**6B8GT**
6BA5	PENTODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	100	100		4.8	1.25	3300	150	Cutoff: 10 μa @ −90 V.						T-3	1	SUB. MIN. 5 PIN		**6BA5**

* Heater warm-up time: 11 seconds.
[D] Triode unit.
[E] Pentode unit.
[BI] Grid #1 resistor = 0.22 meg.
[AB] Input section.
[A] Bias obtained thru 180 ohm cathode resistor.
[K] Bias obtained thru 120 ohm cathode resistor.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. APRIL 1, 1962 PLATE #6435

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

6BD5GT-6C5GT

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANSCONDUCTANCE MMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
6BD5GT	BEAM PENTODE	6.3	0.9	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	200	200	12		5000	Peak Neg. Surge Grid 1 Voltage: −200 V. Plate and Grid 2 Supply Voltage DC: 310 V. DC Cathode Current: 90 ma. Peak Pos. Surg. Plate Voltage (approx.): 2500 V.								T-9	45	6 PIN OCTAL	6CK	**6BD5GT**
6BE8	TRIODE PENTODE	6.3	0.45	HEATER	CLASS A AMPLIFIER M CLASS A AMPLIFIER N	150 250	110	L AU	18 10	3.5	8500 5200	5.0 400	40		Cut-off: 10 μamp. @ −12 V. Cut-off: 10 μamp. @ −10 V.				T-6½	8	MIN. 9 PIN	9EG	**6BE8**
6BE8A	TRIODE PENTODE	6.3	0.45*	HEATER	CLASS A AMPLIFIER M CLASS A AMPLIFIER N	150 250	110	L AU	18 10	3.5	8500 5200	5 400	40		Cut-off: 10 μa @ −12 V. Cut-off: 10 μa @ −10 V.				T-6½	8	MIN. 9 PIN	9EG	**6BE8A**
6BK7	TWIN TRIODE	6.3	0.45	HEATER	CLASS A AMPLIFIER	150			18		8500	4.7	40						T-6½	8	MIN. 9 PIN	9AJ	**6BK7**
6BL4	DIODE	6.3	3.0	HEATER	HALF WAVE RECTIFIER	Max. DC Plate Current: 200 Ma. Max. Peak Plate Current: 1200 Ma. Max. Plate Dissipation: 8.0 watts										4500			T-12	63	OCTAL 8 PIN	8GB	**6BL4**
6BL7GT	DOUBLE TRIODE	6.3	1.5	HEATER	CLASS A AMPLIFIER	250		9	40		7000	2.15	15		Cut-off: 50 μa @ −25 V.				T-9	35	8 PIN OCTAL	8BD	**6BL7GT**
6BN7	DOUBLE TRIODE	6.3	0.75	HEATER	CLASS A AMPLIFIER	120 250		1 15	5 24		2000 5500	14 2.2	28 12		Cutoff: 100 μamp @ −7 V. Cutoff: 100 μamp @ −35 V.				T-6½	9	MIN. 9 PIN	9AJ	**6BN7**
6BQ6GA	PENTODE	6.3	1.2	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	250	150	22.5	55	2.1	5500	20			Cut-off: 1.0 Ma. @ −46 V.				T-11	56	OCTAL 7 PIN	6AM	**6BQ6GA**
6BT8	TWIN DIODE PENTODE	6.3	0.45	HEATER	CLASS A AMPLIFIER	200	150	A	9.5	2.8	6200	300			Cut-off: 10 μamp. @ −8 V.				T-6½	8	MIN. 9 PIN	9FE	**6BT8**
6BY5G	DOUBLE DIODE	6.3	1.6	HEATER	FULL WAVE RECTIFIER	Tube Voltage Drop @ 175 Ma. Each Plate: 32 V.										380	1400	175	ST-14	77	7 PIN OCTAL	6CN	**6BY5G**
6BY5GA	DOUBLE DIODE	6.3	1.6	HEATER	FULL WAVE RECTIFIER	Tube Voltage Drop @ 175 Ma. each plate: 32 V.										380	1400	175	T-12	60	OCTAL 7 PIN	6CN	**6BY5GA**
6C5	TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		8	8		2000	10	20						MT-8A	16	6 PIN OCTAL	6Q	**6C5**
6C5G	TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	SAME CHARACTERISTICS AS TYPE 6C5													ST-12		6 PIN OCTAL	6Q	**6C5G**
6C5GT	TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	SAME CHARACTERISTICS AS TYPE 6C5													T-9	32	6 PIN OCTAL	6Q	**6C5GT**

* Heater warm-up time: 11 seconds.
M Triode section.
N Pentode section.
L Bias obtained thru 56 ohm cathode resistor.
A −8 volts @ I_b = 10 μA.
AU Bias obtained thru 68 ohm cathode resistor.

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL

PRINTED IN U. S. A.

6C6-6D8G

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	FILAMENT TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
6C6	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER BIAS DETECTOR	Plate V. 250 / 100; Screen Grid V. 100 / 100; Control Grid (NEG.) V. 3 / 3; Plate Current mA. 2 / 2; Screen Current mA. 0.5 / 0.5; Trans-Conductance µmhos 1225 / 1185; Plate Resistance Ohms 1000 / 1000 MIN.; Amplification Factor —; Load Resistance Ohms —; Power Output Watts —; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate —; Max. Peak Inverse Volts —; Max. D.C. Output mA. — Cut-off: at −7 V. Plate: 250 V. thru 0.5 Meg. Screen: 100 V. Cathode res. 10,000 ohms Plate: 100 V. thru 1 Meg. Screen: 100 V. thru 2 Megs. Cathode res. 25,000 ohms.	ST-12C	76	SMALL 6 PIN	6F	**6C6**
6C7	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	Plate V. 250; Screen Grid V. —; Control Grid (NEG.) V. 9; Plate Current mA. 4.5; Screen Current mA. —; Trans-Conductance µmhos 1250; Plate Resistance Ohms 16; Amplification Factor 20; Load Resistance Ohms —; Power Output Watts —; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate —; Max. Peak Inverse Volts —; Max. D.C. Output mA. —	ST-12C	75	SMALL 7 PIN	7G	**6C7**
6C8G	DOUBLE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	Plate V. 250; Screen Grid V. —; Control Grid (NEG.) V. 4.5; Plate Current mA. 3.2; Screen Current mA. —; Trans-Conductance µmhos 1600; Plate Resistance Ohms 22.5; Amplification Factor 36; Load Resistance Ohms —; Power Output Watts —; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate —; Max. Peak Inverse Volts —; Max. D.C. Output mA. — Single section	ST-12	71	8 PIN OCTAL	8G	**6C8G**
6CA5	PENTODE	6.3	1.2	HEATER	CLASS A AMPLIFIER	Plate V. 125 / 110; Screen Grid V. 125 / 110; Control Grid (NEG.) V. 4.5 / 4.0; Plate Current mA. 37[F] / 32[F]; Screen Current mA. 4.0[F] / 3.5[F]; Trans-Conductance µmhos 9200 / 8100; Plate Resistance Ohms 15 / 16; Amplification Factor —; Load Resistance Ohms 4500 / 3500; Power Output Watts 1.5 / 1.1; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate —; Max. Peak Inverse Volts —; Max. D.C. Output mA. —	T-5½	9	MIN. 7 PIN	7CV	**6CA5**
6CD6G	BEAM PENTODE	6.3	2.5	HEATER	HORIZONTAL DEFLECTION AMPLIFIER FOR TV RECEIVERS	DC Plate Supply Voltage: From DC Power Supply: 350 V. From DC Boost Supplied by 6W4GT: 150 V. Total Supply Voltage: 500 V. Grid 2 Voltage: 170 V. Cathode Bias Resistor: 300 ohms. Grid 1 Input Voltage: Peak-to-Peak Sawtooth Component: 75 V. Neg. Peaking Component: 55 V. Max. Grid 1 Circuit Resistance: 1 Meg. DC Plate Current: 92 ma. DC Grid 2 Current: 15 ma. Peak Positive-Pulse Plate Output Voltage approx. for Kinescope Anode Current of 0 µa: 5500 V.	ST-16	83	6 PIN OCTAL	5BT	**6CD6G**
6CG8	TRIODE PENTODE	6.3	0.45	HEATER	CONVERTER D E	Plate V. 100 / 250; Screen Grid V. 150; Control Grid (NEG.) V. P; Plate Current mA. 8.5 / 7.7; Screen Current mA. 1.6; Trans-Conductance µmhos 5800 / 4600; Plate Resistance Ohms 6.9 / 750; Amplification Factor 40; Load Resistance Ohms —; Power Output Watts —; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate —; Max. Peak Inverse Volts —; Max. D.C. Output mA. — Cut-off: 10 µamp. @ −10 V. Cut-off: 10 µamp. @ −10 V.	T-6½	8	MIN. 9 PIN	9FA	**6CG8**
6CL5	PENTODE	6.3	2.5	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	Pentode Operation With E_b = 175 V., E_c2 = 175 V., E_c1 = −40 V. Plate Current mA. 90; Screen Current mA. 7.0; Trans-Conductance µmhos 6500; Plate Resistance Ohms 6.0; Amplification Factor —; Load Resistance Ohms —; Power Output Watts —; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate —; Max. Peak Inverse Volts —; Max. D.C. Output mA. —	T-12	62	SHORT MED. 8 PIN	8GD	**6CL5**
6CR8	TRIODE PENTODE	6.3	0.45*	HEATER	CLASS A AMPLIFIER D E	Plate V. 125 / 125; Screen Grid V. 125; Control Grid (NEG.) V. 2 / 0; Plate Current mA. 12 / 13; Screen Current mA. 3; Trans-Conductance µmhos 4000 / 7700; Plate Resistance Ohms 5.5 / 300; Amplification Factor 22; Load Resistance Ohms —; Power Output Watts —; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate —; Max. Peak Inverse Volts —; Max. D.C. Output mA. — Cut-off: 10 µamp. @ −13 V. Cut-off: 20 µamp. @ −6 V.	T-6½	8	MIN. 9 PIN	9GJ	**6CR8**
6D6	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	Plate V. 250 / 100; Screen Grid V. 100 / 100; Control Grid (NEG.) V. 3 / 3; Plate Current mA. 8.2 / 8; Screen Current mA. 2 / 2.2; Trans-Conductance µmhos 1600 / 1500; Plate Resistance Ohms 800 / 250; Amplification Factor —; Load Resistance Ohms —; Power Output Watts —; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate —; Max. Peak Inverse Volts —; Max. D.C. Output mA. — Cut-off: 2 µmhos at −50 V. Cut-off: 2 µmhos at −50 V.	ST-12C	76	SMALL 6 PIN	6F	**6D6**
6D7	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	Plate V. 250; Screen Grid V. 100; Control Grid (NEG.) V. 3; Plate Current mA. 2; Screen Current mA. 0.5; Trans-Conductance µmhos 1225; Plate Resistance Ohms —; Amplification Factor —; Load Resistance Ohms —; Power Output Watts —; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate —; Max. Peak Inverse Volts —; Max. D.C. Output mA. —	ST-12C	75	SMALL 7 PIN	7H	**6D7**
6D8G	HEPTODE	6.3	0.15	HEATER	CONVERTER	Plate V. 250; Screen Grid V. 100; Control Grid (NEG.) V. 3; Plate Current mA. 3.5; Screen Current mA. 2.6; Trans-Conductance µmhos 550; Plate Resistance Ohms 400; Amplification Factor —; Load Resistance Ohms —; Power Output Watts —; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate —; Max. Peak Inverse Volts —; Max. D.C. Output mA. —	ST-12	71	8 PIN OCTAL	8A	**6D8G**

* Heater warm-up time: 11 seconds.

[F] Zero signal.

[D] Triode unit.

[E] Pentode unit.

[P] Bias obtained thru 100 ohm cathode resistor.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. APRIL 1, 1962 PLATE #6436

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANSCONDUCTANCE MMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB: STYLE	BULB: OUTLINE NO.	BASE: STYLE	BASE: BASING	TYPE
6DB5	BEAM PENTODE	6.3	1.2	HEATER	CLASS A AMPLIFIER	110 200	110 125	7.5 A	49[F] 46[F]	4[F] 2.2[F]	8000 8000	13 28							T-6½	10B	MIN. 9 PIN	9GR	**6DB5**
6DB6	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	150	150	1	5.8	6.6	2050	50		Cut-off: 10 μa @ −6.5 V.					T-5½	4	MIN. 7 PIN	7CM	**6DB6**
6DN6	BEAM PENTODE	6.3	2.5	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	Pentode Operation With E_b = 125 V., E_{c2} = 125 V., E_{c1} = −18 V.			70	6.3	9000	4.0							T-12	62	SHORT MED. 8 PIN	5BT	**6DN6**
6DQ6	BEAM PENTODE	6.3	1.2	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	DC Grid #1 Voltage: −28 V. DC Grid #2 Voltage: 140 V. Peak Positive Plate Voltage: 3440 V. Grid #1 Input Voltage: Peak To Peak Sawtooth: 74 V. Negative Peaking: 18 V.							DC Plate Current: 83 Ma. DC Grid #2 Current: 12.3 Ma. Plate Dissipation: 5.1 Watts					T-12	56	SHORT MED. 7 PIN	6AM	**6DQ6**
6E6	DOUBLE TRIODE	6.3	0.6	HEATER	CLASS A AMPLIFIER	250		27.5	18		1700	35	6	14,000	1.6				ST-14	77	MED. 7 PIN	7B	**6E6**
6E7	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	100	3	8.2	2	1600	800	1280	Cutoff: 2 μmhos @ −42.5 V.					ST-12C	75	SMALL 7 PIN	7H	**6E7**
6EF6	PENTODE	6.3	0.9	HEATER	VERTICAL DEFLECTION AMPLIFIER	250	250	18	50	2	5000			Cutoff: 1 Ma. at −40 V.					T-9	37	INT. OCTAL 7 PIN	7S	**6EF6**
6F5G	TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 100		2 1	0.9 0.4		1500 1150	66 85	100 100						ST-12	71	5 PIN OCTAL	5M	**6F5G**
6F5GT	TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 100		2 1	0.9 0.4		1500 1150	66 85	100 100						T-9	33	5 PIN OCTAL	5M	**6F5GT**
6F7	TRIODE PENTODE	6.3	0.3	HEATER	TRIODE UNIT AS CLASS A AMPLIFIER PENTODE UNIT AS CLASS A AMPLIFIER	100 250	 100	3[F] 3	3.5 6.5	 1.5	500 1100	16 850	8 900	 Cutoff: 10 μmhos at −35 V.					ST-12	72	SMALL 7 PIN	7E	**6F7**
6F8G	DOUBLE TRIODE	6.3	0.6	HEATER	CLASS A AMPLIFIER	250		8	9		2600	7.7	20	Each section					ST-12	71	8 PIN OCTAL	8G	**6F8G**
6G6G	PENTODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	180	180	9	15[F]	2.5[F]	2300	175	400	10 000	1.1	Signal: 6.4 V. RMS			ST-12	69	7 PIN OCTAL	7S	**6G6G**

[F] Zero signal.

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6G6GT-6N4

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
6G6GT	PENTODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	Plate V: 180; Screen Grid V: 180; Control Grid V (NEG.): 9; Plate Current mA: 15[F]; Screen Current mA: 2.5[F]; Transconductance μmhos: 2300; Plate Resistance Megohms: 175; Amplification Factor: 400; Load Resistance Ohms: 10,000; Power Output Watts: 1.1; Rectifier: Signal: 6.4 V. RMS	T-9	35	7 PIN OCTAL	7S	**6G6GT**
6J7	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER BIAS DETECTOR	SAME CHARACTERISTICS AS TYPE 6J7GT	MT-8A	18	7 PIN OCTAL	7R	**6J7**
6J7G	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER BIAS DETECTOR	SAME CHARACTERISTICS AS TYPE 6J7GT	ST-12	71	7 PIN OCTAL	7R	**6J7G**
6J7GT	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	Plate V: 250; Screen Grid V: 100; Control Grid V (NEG.): 3; Plate Current mA: 2; Screen Current mA: 0.5; Transconductance μmhos: 1225; Plate Resistance Megohms: 1000[Z]; Rectifier: Cutoff: at −7 V.	T-9	34	7 PIN OCTAL	7R	**6J7GT**
					BIAS DETECTOR	Plate: 250 V. thru 0.5 Meg. Screen: 100 V. Cathode res. 10 000 ohms Plate: 100 V. thru 1 Meg. Screen: 100 V. thru 2 Megs. Cathode res. 25 000 ohms					
6J8G	TRIODE HEPTODE	6.3	0.3	HEATER	CONVERTER	250; 100; 3; 1.3; 3.5; 290; 2500	ST-12	71	8 PIN OCTAL	8H	**6J8G**
6K5G	TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 / 100; ; 3 / 1.5; 1.1 / 0.35; ; 1400 / 900; 50 / 78; 70 / 70	T-9	33	7 PIN OCTAL	5U	**6K5G**
6K7	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 / 100; 125 / 100; 3 / 1; 10.5 / 9.5; 2.6 / 2.7; 1650 / 1650; 600 / 150; Cutoff: 2 μmhos @ −52 V. / Cutoff: 2 μmhos @ −38 V.	MT-8A	18	7 PIN OCTAL	7R	**6K7**
6K7G	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 / 100; 125 / 100; 3 / 1; 10.5 / 9.5; 2.6 / 2.7; 1650 / 1650; 600 / 150; Cutoff: 2 μmhos @ −52 V. / Cutoff: 2 μmhos @ −38 V.	ST-12	71	7 PIN OCTAL	7R	**6K7G**
6K8	TRIODE HEXODE	6.3	0.3	HEATER	CONVERTER	SAME CHARACTERISTICS AS TYPE 6K8GT	MT-8G	19	8 PIN OCTAL	8K	**6K8**
6K8G	TRIODE HEXODE	6.3	0.3	HEATER	CONVERTER	SAME CHARACTERISTICS AS TYPE 6K8GT	ST-12	71	8 PIN OCTAL	8K	**6K8G**
6K8GT	TRIODE HEXODE	6.3	0.3	HEATER	CONVERTER	250 / 100; 100 / 100; 3 / 3; 2.5 / 2.3; 6 / 6.2; 350 / 325; 600 / 400; Triode plate: 100 V., 3.8 ma. / Triode grid: 50 000 ohms, 0.15 ma.	T-9	42	8 PIN OCTAL	8K	**6K8GT**
6L5G	TRIODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	250; ; 9; 8; ; 1900; 9; 17	ST-12	69	6 PIN OCTAL	6Q	**6L5G**
6L7G	HEPTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250; 100; 3; 5.3; 6.5; 1100; 600; 670	ST-12	71	7 PIN OCTAL	7T	**6L7G**
6N4	TRIODE	6.3	0.2	HEATER	UHF AMPLIFIER	180; ; 3.5; 12; ; 6000; 5.4; 32	T-5½	3	MIN. 7 PIN	7CA	**6N4**

[F] Zero signal. [Z] Minimum value.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., APRIL 1, 1962 PLATE #6437

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE μMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB: STYLE	BULB: OUTLINE NO.	BASE: STYLE	BASE: BASING	BASE: TYPE
6P5GT	TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		13.5	5		1450	9.5	13.8						T-9	35	6 PIN OCTAL	6Q	**6P5GT**
6P7G	TRIODE PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 100	100	3 3	6.5 3.5	1.5	1100 450		900 8						ST-12	71	8 PIN OCTAL	7U	**6P7G**
6Q6G	DIODE TRIODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	250 135		3 1.5	1.2 0.9		1050 1000		65 65						ST-12	71	8 PIN OCTAL	6Y	**6Q6G**
6Q7	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	SAME CHARACTERISTICS AS TYPE 6Q7GT													MT-8A	18	7 PIN OCTAL	7V	**6Q7**
6Q7G	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	SAME CHARACTERISTICS AS TYPE 6Q7GT													ST-12	71	7 PIN OCTAL	7V	**6Q7G**
6Q7GT	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 100		3 1.5	1.0 0.8		1200 1200	58 58	70 70						T-9	34	7 PIN OCTAL	7V	**6Q7GT**
6R6G	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	100	3	7	1.7	1450		1160						ST-12	71	7 PIN OCTAL	6AW	**6R6G**
6R7	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	SAME CHARACTERISTICS AS TYPE 6R7GT													MT-8A	18	7 PIN OCTAL	7V	**6R7**
6R7G	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		9	9.5		1900	8.5	16						ST-12	71	7 PIN OCTAL	7V	**6R7G**
6R7GT	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		9	9.5		1900	8.5	16						T-9	33	7 PIN OCTAL	7V	**6R7GT**
6R8	TRIPLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		9	9.5		1900	8.5	16	10 000	0.3				T-6½	8	MIN. 9 PIN	9E	**6R8**
6S4	TRIODE	6.3	0.6	HEATER	VERTICAL DEFLECTION AMPLIFIER IN TV RECEIVERS	DC Plate Voltage: 500 Max. Cathode-Bias Resistor: 820 ohms Grid Input Voltage (approx.): Peak-to-Peak Sawtooth Component: 60 V. Negative Peaking Component: 48 V. DC Plate Current: 18 ma. Plate Output (approx.): Peak-to-Peak Sawtooth Component: 350 V. Peak Positive-Pulse Component: 800 V. Min. Cathode-Bias Resistance: 220 ohms Max. Grid Circuit Resistance: 2.2 meg.												T-6½	9	MIN. 9 PIN	9AC	**6S4**
6S7	PENTODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	250	100	3	8.5	2	1750	1000	Cutoff: 10 μmhos @ −38.5 V.						MT-8G	19	7 PIN OCTAL	7R	**6S7**

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL

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6S7G-6SN7GTA

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE μMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	OUTLINE NO.	BASE STYLE	BASING	TYPE
6S7G	PENTODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	250	100	3	8.5	2	1750	1000	Cutoff: 10 μmhos @ −38.5 V.						ST-12	71	7 PIN OCTAL	7R	6S7G
6S8GT	TRIPLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 100		2 1	0.9 0.4		1100 900	91 110	100 100						T-9	43	8 PIN OCTAL	8CB	6S8GT
6SA7GT	HEPTODE	6.3	0.3	HEATER	CONVERTER AD	250 100	100 100	2 2	3.5 3.5	8.5 8.5	450 425	1000 500	Eg_1: 0.5 ma. thru 20 000 ohms Eg_1: 0.5 ma. thru 20 000 ohms						T-9	35	8 PIN OCTAL	8AD	6SA7GT
6SB7Y	HEPTODE	6.3	0.3	HEATER	CONVERTER AD	250	100	1	3.8	10	950	Eg_1: 0.35 Ma. thru 20 000 ohms							MT-8	17	8 PIN OCTAL	8R	6SB7Y
6SC7GT	DOUBLE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		2	2		1325	53	70						T-9	35	8 PIN OCTAL	8S	6SC7GT
6SD7GT	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 100	125 100	2 2	9.5 5.7	3 2	4250 3350	700 250	Cutoff: 20 μmhos at −27 V.						T-9	32	8 PIN OCTAL	8N	6SD7GT
6SE7GT	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	100	4.5	0.9		1500		100						T-9	32	8 PIN OCTAL	8N	6SE7GT
6SF7	DIODE PENTODE	6.3	0.3	HEATER	AMPLIFIER	250	100	1	12.4	3.3	2050	0.7	Cutoff: 10 μmhos at −35 V.						MT-8	17	8 PIN OCTAL	7AZ	6SF7
6SG7GT	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	150	2.5	9.2	3.4	4000	1000	Cutoff: 40 μmhos @ −17.5 V.						T-9	32	8 PIN OCTAL	8BK	6SG7GT
6SH7GT	PENTODE	6.3	0.3	HEATER	RF AMPLIFIER	250 100	150 100	1 1	10.8 5.3	4.1 2.1	4900 4000	900 350							T-9	32	8 PIN OCTAL	8BK	6SH7GT
6SH7L	PENTODE	6.3	0.3	HEATER	RF AMPLIFIER	250 100	150 100	1 1	10.8 5.3	4.1 2.1	4900 4000	900 350							T-9	40	8 PIN OCTAL	8BK	6SH7L
6SJ7	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	SAME CHARACTERISTICS AS TYPE 6SJ7GT													MT-8	17	8 PIN OCTAL	8N	6SJ7
6SJ7GT	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 100	100 100	3 3	3 2.9	0.8 0.9	1650 1575	1000[z] 700	Cutoff: at −9 V.						T-9	32	8 PIN OCTAL	8N	6SJ7GT
6SN7GT	DOUBLE TRIODE	6.3	0.6	HEATER	CLASS A AMPLIFIER	250 90		8 0	9 10		2600 3000	7.7 6.7	20 20	Each Section					T-9	35	8 PIN OCTAL	8BD	6SN7GT
6SN7GTA	DOUBLE TRIODE	6.3	0.6	HEATER	CLASS A AMPLIFIER	250 90		8 0	9 10		2600 3000	7.7 6.7	20 20	Each Section					T-9	35	8 PIN OCTAL	8BD	6SN7GTA

[AD] Separate excitation. [z] Minimum value.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., APRIL 1, 1962 PLATE #6438

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT M.A.	SCREEN CURRENT M.A.	TRANSCONDUCTANCE μMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS V. VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB: STYLE	BULB: OUTLINE NO.	BASE: STYLE	BASE: BASING	BASE: TYPE
6SR7	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		9	9.5		1900	8.5	16						MT-8	17	8 PIN OCTAL	8Q	**6SR7**
6SR7GT	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	SAME CHARACTERISTICS AS TYPE 6SR7													T-9	35	8 PIN OCTAL	8Q	**6SR7GT**
6T4	TRIODE	6.3	0.225	HEATER	UHF TV OSCILLATOR	80			18	7000		13							T-5½	3	MIN. 7 PIN	7DK	**6T4**
6T8	TRIPLE DIODE TRIODE	6.3	0.45	HEATER	CLASS A AMPLIFIER	250 100		3 1	1 0.8		1200 1300	58 54	70 70	Average Diode Current with 5 V. DC Applied = 20 Ma.					T-6½	8	MIN. 9 PIN	9E	**6T8**
6U6GT	BEAM PENTODE	6.3	0.75	HEATER	CLASS A AMPLIFIER	200	135	14	55	3	6200	20		3000	5.5				T-9	35	7 PIN OCTAL	7AC	**6U6GT**
6SV7	DIODE PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	150	1	7.5	2.8	3600	1500							MT-8	17	8 PIN OCTAL	7AZ	**6SV7**
6SZ7	DOUBLE DIODE TRIODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	250		3	1		1200	58	70						MT-8G	17	8 PIN OCTAL	8Q	**6SZ7**
6T5	TRIODE INDICATOR	6.3	0.3	HEATER	TUNING INDICATOR	Plate: 250 V. thru 1 Meg. 3 Ma. Eg: 0 for Min. Illumination								Target: 250 V. Max. Eg: 22 for Max. Illumination					T-9	51	SMALL 6 PIN	6R	**6T5**
6T7G	DOUBLE DIODE TRIODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	250 135		3 1.5	1.2 0.9		1050 1000	62 65	65 65						ST-12	71	7 PIN OCTAL	7V	**6T7G**
6U4GT	DIODE	6.3	1.2	HEATER	HALF WAVE RECTIFIER	Tube Voltage Drop @ 250 Ma.: 21 V. DC Output Potential: 335 V.										350	1375	125	T-9	37	5 PIN OCTAL	4CG	**6U4GT**
6U7G	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	100	3	8.2	2	1600	800	Cutoff: 2 μmhos @ −50 V.						ST-12C	75	7 PIN OCTAL	7R	**6U7G**
6V7G	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 180 135		20 13.5 10.5	8 6 3.7		1100 975 750	7.5 8.5 11	8.3 8.3 8.3	20,000 20,000 25,000	0.35 0.16 0.075				ST-12	71	7 PIN OCTAL	7V	**6V7G**
6V8	TRIPLE DIODE TRIODE	6.3	0.45	HEATER	CLASS A AMPLIFIER	250 100		3 1	1.0 0.8		1200 1300	58 54	70 70						T-6½	8	MIN. 9 PIN	9AH	**6V8**
6W5G	DIODE	6.3	0.9	HEATER	FULL WAVE RECTIFIER											325	1250	90	ST-12	69	6 PIN OCTAL	6S	**6W5G**

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

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6W7G-7AJ7

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE MICROMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	BASE TYPE
6W7G	PENTODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	250	100	3	2	0.5	1225	1500							ST-12	71	7 PIN OCTAL	7R	6W7G
6Y3G	DIODE	6.3	0.7	HEATER	HALF-WAVE RECTIFIER											5000		7.5	ST-12	71	8 PIN OCTAL	4AC	6Y3G
6Y5	DOUBLE DIODE	6.3	0.8	HEATER	FULL WAVE RECTIFIER											350	1250	50	ST-12	70	SMALL 6 PIN	6J	6Y5
6Y7G	DOUBLE TRIODE	6.3	0.6	HEATER	CLASS B AMPLIFIER	250 180		0 0	10.6[F] 7.6[F]	Current and Output for Both Sections				14,000 7000	8.0 5.5				ST-12	69	8 PIN OCTAL	8B	6Y7G
6Z7G	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS B AMPLIFIER	180 135		0 0	8.4[F] 6[F]	Current and Output for Both Sections				12,000 9000	4.2 2.5				ST-12	69	8 PIN OCTAL	8B	6Z7G
6ZY5G	DOUBLE DIODE	6.3	0.3	HEATER	FULL-WAVE RECTIFIER	Peak Plate Current per Plate: 120 Ma.										450	1250	40	ST-12	69	6 PIN OCTAL	6S	6ZY5G
7A4	TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 90		8 0	9 10		2600 3000	7.7 6.7	20 20						T-9	26	8 PIN LOC.	5AC	7A4
7A5	BEAM PENTODE	6.3	0.75	HEATER	CLASS A AMPLIFIER	110	110	7.5	41[F]	3.0[F]	5800	16		2500	1.5				T-9	30	8 PIN LOC.	6AA	7A5
7A6	DOUBLE DIODE	6.3	0.15	HEATER	RECTIFIER	Single section										150		8	T-9	26	8 PIN LOC.	7AJ	7A6
7A7	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 100	100 100	3 1	9.2 13	2.6 4	2000 2350	800 120	Cutoff: 10 μmhos @ −35 V.						T-9	26	8 PIN LOC.	8V	7A7
7AB7	PENTODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	250	100	2	4	1.3	1800	500							T-9	26	7 PIN LOC.	8BO	7AB7
7AD7	PENTODE	6.3	0.6	HEATER	CLASS A AMPLIFIER	300	150	0	28	7	9500	300							T-9	37	8 PIN LOC.	8V	7AD7
7AF7	DOUBLE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		10	9		2100	7.6	16						T-9	26	8 PIN LOC.	8AC	7AF7
7AG7	PENTODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	250 100	250 100	[U]	6 1.6	2 0.5	4200 2600	750	Cut-off: 10 μamp. at −10 V.						T-9	26	8 PIN LOC.	8V	7AG7
7AH7	PENTODE	6.3	0.15	HEATER	REMOTE CUTOFF AMPLIFIER	250	250		6.8	1.9	3300	1000							T-9	32	8 PIN LOC.	8V	7AH7
7AJ7	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	100 250	100 100	1 3	5.7 2.2	1.8 0.7	2275 1575	400 1000							T-9	26	8 PIN LOC.	8V	7AJ7

[F] Zero signal.

[U] Fixed bias not recommended, cathode bias: 250 ohms.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., APRIL 1, 1962 PLATE #6439

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

		FILAMENT				TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS												BULB		BASE	
TYPE	DESCRIPTION	VOLTS	AMPERES	TYPE OF CATHODE	APPLICATION	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE μMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. VOLTS RMS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	STYLE	OUTLINE NO.	STYLE	BASING	TYPE
7B4	TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		2	0.9		1500	66	100						T-9	26	8 PIN LOC.	5AC	7B4
7B5	PENTODE	6.3	0.4	HEATER	CLASS A AMPLIFIER	250 100	250 100	21 7	25.5 9	4.0 1.6	2100 1500	110 104		9000 12,000	4.5 0.35				T-9	30	8 PIN LOC.	6AE	7B5
7B6	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 100		2 1	0.9 0.4		1100 900	91 110	100 100						T-9	26	8 PIN LOC.	8W	7B6
7B7	PENTODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	250 100	100 100	3 3	8.5 8.2	1.7 1.8	1750 1675	750 300	Cut-off: 10 μmhos at −40 V.						T-9	26	8 PIN LOC.	8V	7B7
7B8	HEPTODE	6.3	0.3	HEATER	CONVERTER	250 100	100 50	3 1.5	3.5 1.1	2.7 1.3	550 360	360 600	Eg_2: 250 V. thru 20,000 ohms Eg_2: 100 V.						T-9	26	8 PIN LOC.	8X	7B8
7C6	DOUBLE DIODE TRIODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	250 100		1 0	1.3 1.0		1000 850	100 100	100 85						T-9	26	8 PIN LOC.	8W	7C6
7E5	TRIODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	180		3	5.5		3000	12	36						T-9	30	8 PIN LOC.	8BN	7E5
7E6	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		9	9.5		1900	8.5	16						T-9	26	8 PIN LOC.	8W	7E6
7E7	DOUBLE DIODE PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	100	3	7.5	1.6	1300	700	Cut-off: 2 μmhos at −42.5 V.						T-9	26	8 PIN LOC.	8AE	7E7
7G7	PENTODE	6.3	0.45	HEATER	CLASS A AMPLIFIER	250	100	2	6	2	4500	800							T-9	26	8 PIN LOC.	8V	7G7
7G8	DOUBLE TETRODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	100	2.5	4.5	0.8	2100	225	Cutoff: 10 μa @ −10 V. Each Section						T-9	24	8 PIN LOC.	8BV	7G8
7H7	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 100	150 100	[A] 0	10 7	3.2 2.6	4000 4000	800 350	Cut-off: 35 μmhos at −19 V. Cut-off: 35 μmhos at −12 V.						T-9	26	8 PIN LOC.	8V	7H7
7J7	TRIODE HEXODE	6.3	0.3	HEATER	CONVERTER	250	100	3	1.4	2.8	290	1500							T-9	26	8 PIN LOC.	8BL	7J7
7K7	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		2	2.3		1600	44	70						T-9	26	8 PIN LOC.	8BF	7K7
7L7	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	100	1.5	4.5	1.5	3100	1000							T-9	26	8 PIN LOC.	8V	7L7
7Q7	HEPTODE	6.3	0.3	HEATER	CONVERTER	250 100	100 100	2 2	3.5 3.3	8.5 8.5	550 525	1000 500							T-9	26	8 PIN LOC.	8AL	7Q7

[A] Bias obtained thru 180 ohm cathode resistor.

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL

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7R7-10C8

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS CONDUCTANCE MMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BASE OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
7R7	DOUBLE DIODE PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	100	1	5.7	2.1	3200	1000							T-9	26	8 PIN LOC.	8AE	7R7
7S7	TRIODE-HEXODE	6.3	0.3	HEATER	CONVERTER	250	100	2	1.8	3	525	1250	Triode Plate: 250 V. thru 20,000 ohms 5 Ma. Triode Grid: 50,000 ohms 0.5 Ma.						T-9	26	8 PIN LOC.	8BL	7S7
					TRIODE UNIT	100		0	7		1650	10.5	18										
7T7	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	150	1	10.8	4.1	4900	900							T-9	26	8 PIN LOC.	8V	7T7
7W7	PENTODE	6.3	0.45	HEATER	CLASS A AMPLIFIER	300	150	AV	10	3.9	5800	300							T-9	26	8 PIN LOC.	8BJ	7W7
7X6	DOUBLE DIODE	6.3	1.2	HEATER	HALF-WAVE RECTIFIER	Max. Steady State Peak Plate Current: 450 Ma.										700	75		T-9	30	8 PIN LOC.	7AJ	7X6
7Y4	DOUBLE DIODE	6.3	0.5	HEATER	FULL-WAVE RECTIFIER	Peak Plate Current per plate: 210 Ma.										450	1250	70	T-9	26	8 PIN LOC.	5AB	7Y4
7Z4	DOUBLE DIODE	6.3	0.5	HEATER	FULL-WAVE RECTIFIER	Max. Peak Plate Current: 300 Ma.										450	1250	100	T-9	30	8 PIN LOC.	5AB	7Z4
8BH8	TRIODE PENTODE	8.4	0.45*	HEATER	CLASS A AMPLIFIER H	200	125	R	15	3.4	7000	150	17	Cut-off: 100 μamp. @ −8 V.					T-6½	9	MIN. 9 PIN	9DX	8BH8
					AMPLIFIER G	200		5	9.5		3300	5.15		Cut-off: 100 μamp. @ −14 V.									
8BN8	DOUBLE DIODE TRIODE	8.4	0.45*	HEATER	CLASS A AMPLIFIER	100		1	1.5		3500	21		Cut-off: 10 μamp. @ −2.5 V.					T-6½	9	MIN. 9 PIN	9ER	8BN8
						250		3	1.6		2500	70		Cut-off: 10 μamp. @ −5.5 V.									
8SN7GTB	DOUBLE TRIODE	8.4	0.45*	HEATER	CLASS A AMPLIFIER	250		8	9		2600	7.7	20	Each Section					T-9	35	8 PIN OCTAL	8BD	8SN7GTB
						90		0	10		3000	6.7	20										
9CL8	TRIODE TETRODE	9.5	0.3	HEATER	CLASS A AMPLIFIER G	125		K	15		8000	5	40	Cut-off: 10 μamp. @ −9 V.					T-6½	8	MIN. 9 PIN	9FX	9CL8
					D	125	125	1.0	12	4.0	5800	100		Cut-off: 10 μamp. @ −10 V.									
9U8A	TRIODE PENTODE	9.45	0.3	HEATER	CLASS A AMPLIFIER H	250	110	B	10	3.5	5200	400		Cut-off: 10 μamp. @ −10 V.					T-6½	8	MIN. 9 PIN	9AE	9U8A
					G	150		K	18		8500	5	40	Cut-off: 10 μamp. @ −12 V.									
9X8	TRIODE PENTODE	9.5	0.3*	HEATER	OSCILLATOR G	100		C	8.5		5800	6.9	40	Cut-off: 10 μamp. @ −10 V.					T-6½	8	MIN. 9 PIN	9AK	9X8
					MIXER H	250	150	D	7.7	1.6	4600	750		Cut-off: 10 μamp. @ −10 V.									
10	TRIODE	7.5	1.25	FIL.	CLASS A AMPLIFIER	425		40	18		1600	5	8	10,200	1.6				ST-16	85	MED. 4 PIN	4D	10
10C8	TRIODE PENTODE	10.5	0.3*	HEATER	CLASS A AMPLIFIER H	135	135	C	11.5	3.2	8000	190	53	Cut-off: 50 μamp. @ −6 V.					T-6½	8	MIN. 9 PIN	9DA	10C8
					G	250		E	7.3		4400	12		Cut-off: 10 μamp. @ −10 V.									

* Heater warm-up time: 11 seconds.

H Pentode unit. D Tetrode unit.
G Triode unit. C Bias obtained thru 100 ohm cathode resistor.
E Bias obtained thru 390 ohm cathode resistor.
AV Bias obtained thru 160 ohm cathode resistor.
R Bias obtained thru 82 ohm cathode resistor.
K Bias obtained thru 56 ohm cathode resistor.
B Bias obtained thru 68 ohm cathode resistor.
D Bias obtained thru 200 ohm cathode resistor.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A.-APRIL 1, 1952 PLATE #6440

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

11C5-12B8GT

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANSCONDUCTANCE μMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB: STYLE	BULB: OUTLINE NO.	BASE: STYLE	BASE: BASING	TYPE
11C5	BEAM PENTODE	11.6	0.45	HEATER	CLASS A AMPLIFIER	110	110	7.5	40[F]	3[F]	5800	2.5			1.5				T-5½	5	MIN. 7 PIN	7CV	**11C5**
12A	TRIODE	5	0.25	DC FIL.	CLASS A AMPLIFIER	180		13.5	7.7		1800	4.7	8.5	10,650	0.285				ST-14	78	MED. 4 PIN	4D	**12A**
12A4	TRIODE	12.6	0.3	HEATER	CLASS A AMPLIFIER	250		9	23		8000		20	Cutoff: 50 μa at Eb = 500 V.: −33 V.					T-6½	9	MIN. 9 PIN	9AG	**12A4**
					VERTICAL DEFLECTION AMPLIFIER	DC Plate Voltage: 250 V. Grid Input Voltage (approx.): Peak-to-Peak Sawtooth Component: 25 V. Negative Peaking Component: 30 V. DC Plate Current: 15 mA.								Plate Output Voltage: Peak Positive Pulse Component: 450 V. Peak-to-Peak Sawtooth Component: 220 V. Peak-to-Peak Sawtooth Current in Yoke (50 mh. inductance): 360 mA.								
12A5	PENTODE	6.3	0.6	HEATER	CLASS A AMPLIFIER	180	180	25	45	8	2400	35		3300	3.4				ST-12	70	SMALL 7 PIN	7F	**12A5**
12A6GT	BEAM PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250	250	12.5	30	3.5	3000			7500	3				T-9	35	7 PIN OCTAL	7S	**12A6GT**
12A7	DIODE PENTODE	12.6	0.3	HEATER	HALF-WAVE RECTIFIER											125		30	ST-12	72	SMALL 7 PIN	7K	**12A7**
12A8GT	HEPTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	100	50	1.5	1.1	1.3	360	600							T-9	34	8 PIN OCTAL	8A	**12A8GT**
12AD7	TWIN TRIODE	6.3 12.6	.45 .225	HEATER	CLASS A AMPLIFIER	250		2	1.25		1600	62.5	100						T-6½	8	MIN. 9 PIN	9A	**12AD7**
12AH7GT	DOUBLE TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	180		6.5	7.6		1900	8.4	16	Each Section					T-9	29	8 PIN OCTAL	8BE	**12AH7GT**
12AX4GT	DIODE	12.6	0.6	HEATER	TV DAMPER SERVICE	Max. Steady State Peak Plate Current: 600 mA. Max. Transient Peak Plate Current: 3 Amp. Tube Voltage Drop at 250 mA.: 32 V.											4000	125	T-9	36	6 PIN OCTAL	4CG	**12AX4GT**
12B4	TRIODE	12.6 6.3	0.3 0.6	HEATER	CLASS A AMPLIFIER	150		17.5	35		6500		6.5						T-6½	9	MIN. 9 PIN	9AG	**12B4**
12B7	PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250	100	3	9.2	2.4	2000	800							T-9	26	8 PIN LOC.	8V	**12B7**
12B8GT	TRIODE PENTODE	12.6	0.3	HEATER	TRIODE UNIT AS CLASS A AMPLIFIER	90		0	2.8		2400	37	90						T-9	42	8 PIN OCTAL	8A	**12B8GT**

[F] Zero signal.

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12BH7-12CT8

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE μMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB: STYLE	BULB: OUTLINE NO.	BASE: STYLE	BASE: BASING	TYPE
12BH7	DOUBLE TRIODE	12.6 6.3	0.3 0.6	HEATER	CLASS A AMPLIFIER VERTICAL DEFLECTION AMPLIFIER	250 85		10.5 0		11.5 20		3100 6200	17 21	Cut-off: 50 μamp. @ Eb = 500 V. and −45 V. DC Plate Voltage: 350 Grid Input Voltage (approx.): Peak-to-Peak Sawtooth Component: 25 V. Negative Peak Component: 32 V. DC Plate Current: 16 mA. Plate Output (approx.): Peak-to-Peak Sawtooth Component: 230 V. Peak Positive Pulse Component: 670 V. Cathode Bias Resistor: 560 Ohms.			T-6½	9	MIN. 9 PIN	9A	**12BH7**
12BK5	PENTODE	12.6	0.6*	HEATER	CLASS A AMPLIFIER	250	250	5	35[F]	3.5[F]	8500	100		6500	3.5				T-6½	9	MIN. 9 PIN	9BQ	**12BK5**
12BQ6GA	PENTODE	12.6	0.6*	HEATER	CLASS A AMPLIFIER	250	150	22.5	55	2.1	5500	20		Cutoff: 1 μa @ −46 V.					T-9	52	7 PIN OCTAL	6AM	**12BQ6GA**
12BT6	DOUBLE DIODE TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250		3	1		1200	58	70						T-5½	5	MIN. 7 PIN	7BT	**12BT6**
12BU6	DOUBLE DIODE TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250		9	9.5		1900	8.5	16	10,000	0.3				T-5½	5	MIN. 7 PIN	7BT	**12BU6**
12BV7	PENTODE	12.6 6.3	0.3 0.6	HEATER	VIDEO AMPLIFIER	250	150	[A]	25	6.0	12000	90	11000	Similar to 12BY7					T-6½	9	MIN. 9 PIN	9BF	**12BV7**
12BY7	PENTODE	12.6 6.3	0.30 0.60	HEATER	CLASS A AMPLIFIER	250	150	[A]	25	6	12000	90	1035						T-6½	9	MIN. 9 PIN	9BF	**12BY7**
12BZ7	TWIN TRIODE	12.6 6.3	0.3 0.6	HEATER	CLASS A AMPLIFIER	250		2	2.5		3200	31.8	100						T-6½	9	MIN. 9 PIN	9A	**12BZ7**
12C8	DOUBLE DIODE PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250	125	3	10	2.3	1325	600		Identical to type 6B8 except for heater ratings.					MT-8	19	SMALL WAFER 8 PIN	8E	**12C8**
12CM6	BEAM PENTODE	12.6	0.225	HEATER	CLASS A AMPLIFIER	315	225	13.0	34[F]	2.2[F]	3750	80		8500	5.5				T-6½	9	MIN. 9 PIN	9CK	**12CM6**
12CN5	PENTODE	12.6	0.45	HEATER	IF AMPLIFIER	12.6	12.6		4.5	3.5	3800	40							T-5½	5	MIN. 7 PIN	7CV	**12CN5**
12CS5	BEAM PENTODE	12.6	0.6	HEATER	CLASS A AMPLIFIER	110 200	110 125	7.5 [A]	49[F] 46[F]	4[F] 2.2[F]	8000 8000	13 28		2000 4000	2.1 3.8				T-6½	10A	MIN. 9 PIN	9CK	**12CS5**
12CS6	HEPTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	100	30	1	0.75	1.1	950	1000		Cut-off: 50 μa @ −2.5 V.					T-5½	4	MIN. 7 PIN	7CH	**12CS6**
12CT8	TRIODE PENTODE	12.6	0.3*	HEATER	CLASS A AMPLIFIER B C	200 150	125	[D] [E]	15 9.0	3.4	7000 4900	150 8.2	40	Cut-off: 100 μamp. @ −8 V. Cut-off: 100 μamp. @ −6.5 V.					T-6½	8	MIN. 9 PIN	9DA	**12CT8**

[F] Zero signal. * Heater warm-up time: 11 seconds.
[B] Pentode section. [C] Triode section.
[A] Bias obtained thru 68 ohm cathode resistor.
[D] Bias obtained thru 82 ohm cathode resistor.
[E] Bias obtained thru 150 ohm cathode resistor.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. APRIL 1, 1962 PLATE #6441

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

12CU6-12J5GT

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANSCONDUCTANCE μMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
12CU6	PENTODE	12.6	0.6	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	310	140		79	11.2	Average Plate Voltage: 540 V. Peak Positive Plate Voltage: 4.6 Kv. Peak Plate Current: 270 mA.								T-12	59	INT. OCTAL 7 PIN	6AM	**12CU6**
12CX6	PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	12.6	12.6		3.0	1.4	3100	40	Cut-off: 10 μamp. @ −4.5 V.						T-5½	4	MIN. 7 PIN	7BK	**12CX6**
12D4	DIODE	12.6	0.6	HEATER	DAMPING TUBE	Tube Voltage Drop With I_b = 250 mA. = 22 V. Max. DC Plate Current = 155 mA. Max. Peak Plate Current = 900 mA. Max. Plate Dissipation = 5.5 Watts													T-9	32	6 PIN OCTAL	4CG	**12D4**
12DB5	PENTODE	12.6	0.6	HEATER	CLASS A AMPLIFIER	110 200	110 125	7.5 G	49 F 46 F	4 F 2.2 F	8000 8000	13 28							T-6½	10B	MIN. 9 PIN	9GR	**12DB5**
12DQ6	PENTODE	12.6	0.6	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	DC Grid #1 Voltage: −28 V. DC Grid #2 Voltage: 140 V. Peak Positive Plate Voltage: 3440 V. Grid #1 Input Voltage: Peak To Peak Sawtooth: 74 V. Negative Peaking: 18 V.								DC Plate Current: 83 mA. DC Grid #2 Current: 12.3 mA. Plate Dissipation: 5.1 Watts					T-12	56	SHORT 8 PIN	6AM	**12DQ6**
12E5GT	TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250 100		13.5 5	5 2.5		1450 1150	9.5 12	13.8 13.8						T-9	35	6 PIN OCTAL	6Q	**12E5GT**
12EF6	BEAM PENTODE	12.6	0.45*	HEATER	VERTICAL DEFLECTION AMPLIFIER	250	250	18	50	2	5000		Cut-off: 1 mA. at −40 V.						T-9	37	INT. OCTAL 8 PIN	7S	**12EF6**
12F5GT	TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250		2	0.9		1500	66	100						T-9	33	5 PIN OCTAL	5M	**12F5GT**
12G8	DOUBLE TRIODE	12.6	0.4	HEATER	DIRECT COUPLED G AMPLIFIER	12.6		0 A	3.0 FD 7.2 FN		2600	8.5	2.2	2000	25				T-6½	9	MIN. 9 PIN	9CZ	**12G8**
12J5	TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250 90		8 0	9 10		2600 3000	7.7 6.7	20 20						MT-8	17	6 PIN OCTAL	6Q	**12J5**
12J5GT	TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250 90		8 0	9 10		2600 3000	7.7 6.7	20 20	Cut-off: 10 μamp. @ −18 V. Cut-off: 10 μamp. @ −7.0 V.					T-9	35	6 PIN OCTAL	6Q	**12J5GT**

* Heater warm-up time: 11 seconds.
A Input section.
F Zero signal.
FD Zero signal (input section).
G With cathode of input section connected to grid of output section.
FN Zero signal (output section).

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

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12J7GT-12SJ7

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANSCONDUCTANCE μMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB: STYLE	BASE: OUTLINE NO.	BASE: STYLE	BASE: BASING	TYPE
12J7GT	PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250 100	100 100	3 3	2 2	0.5 0.5	1225 1185	1000 1000	Cut-off: at −7 V.						T-9	34	7 PIN OCTAL	7R	**12J7GT**
					BIAS DETECTOR	Plate: 250 V. thru 0.5 Meg. Grid #2: 100 V. Cathode resistor: 10,000 ohms Plate: 100 V. thru 1 Meg. Grid #2: 100 V. Cathode resistor: 25,000 ohms																	
12K7GT	PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250 100	125 100	3 1	10.5 9.5	2.6 2.7	1650 1650	600 150	Cutoff: 2 μmhos @ −52 V. Cutoff: 2 μmhos @ −38 V.						T-9	34	7 PIN OCTAL	7R	**12K7GT**
12K8GT	TRIODE HEXODE	12.6	0.15	HEATER	CONVERTER	250	100	3	2.5	6	350	600							T-9	42	8 PIN OCTAL	8K	**12K8GT**
12L8GT	DOUBLE PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	180	180	9	13.5	4.6	2150	160		10,000	1 Each Section				T-9	35	8 PIN OCTAL	8BU	**12L8GT**
12Q7GT	DOUBLE DIODE TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250 100		3 0	1.1 2.3		1200 1400	58 43	70 70						T-9	34	7 PIN OCTAL	7V	**12Q7GT**
12R5	PENTODE	12.6	0.6*	HEATER	VERTICAL DEFLECTION AMPLIFIER	110	110	8.5	40	3.3	7000	13		Cut-off: 0.5 mA. @ −22 V.					T-5½	5	MIN. 7 PIN	7CV	**12R5**
12S8GT	TRIPLE DIODE TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250		2	0.9		1100	91	100						T-9	43	8 PIN OCTAL	8CB	**12S8GT**
12SA7GT	HEPTODE	12.6	0.15	HEATER	CONVERTER	250 100	100 100	2 2	3.5 3.5	8.5 8.5	450 425	1000 500	Ig_1: 0.5 mA. through 20,000 ohms Ig_1: 0.5 mA. through 20,000 ohms						T-9	32	8 PIN OCTAL	8AD	**12SA7GT**
12SC7	DOUBLE TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250		2	2		1325	53	70						MT-8	17	8 PIN OCTAL	8S	**12SC7**
12SF5GT	TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250		2	0.9		1500	66	100						T-9	35	6 PIN OCTAL	6AB	**12SF5GT**
12SF7	DIODE PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250 100	100 100	1 1	12.4 12	3.3 3.4	2050 1975	700 200							MT-8	17	8 PIN OCTAL	7AZ	**12SF7**
12SJ7	PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	SAME CHARACTERISTICS AS TYPE 12SJ7GT													MT-8	17	8 PIN OCTAL	8N	**12SJ7**

* Heater warm-up time: 11 seconds.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. APRIL 1, 1962 PLATE #6942

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	FILAMENT TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE μMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASING	TYPE
12SJ7GT	PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250 100	100 100	3 3	3 2.9	0.8 0.9	1650 1575	1000 700	Cutoff: at −8 V.						T-9	32	8 PIN OCTAL	8N	12SJ7GT
12SK7GT	PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250 100	100 100	3 1	9.2 13	2.6 4	2000 2350	800 120	Cutoff: 10 μmhos at −35 V.						T-9	32	8 PIN OCTAL	8N	12SK7GT
12SQ7GT	DOUBLE DIODE TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250 100		2 1	1.1 0.5		1175 925	85 110	100 100						T-9	40	8 PIN OCTAL	8Q	12SQ7GT
12SR7GT	DOUBLE DIODE TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250		9	9.5		1900	8.5	16						T-9	35	8 PIN OCTAL	8Q	12SR7GT
12SW7	DOUBLE DIODE TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250		9	9.5		1900	8.5	16						MT-8G	17	8 PIN OCTAL	8Q	12SW7
12SX7GT	TRIODE	12.6	0.3	HEATER	CLASS A AMPLIFIER	90 250		0 8	10 9		3000 2600	6.7 7.7	20 20						T-9	33	8 PIN OCTAL	8BD	12SX7GT
12SY7	HEPTODE	12.6	0.15	HEATER	CONVERTER	250	100	2	3.5	8.5	450	1000							MT-8G	17	8 PIN OCTAL	8R	12SY7
12SY7GT	HEPTODE	12.6	0.15	HEATER	CONVERTER	250	100	2	3.5	8.5	450	1000							T-9	33	8 PIN OCTAL	8R	12SY7GT
12Z3	DIODE	12.6	0.3	HEATER	HALF-WAVE RECTIFIER											235	700	55	ST-12	70	SMALL 4 PIN	4G	12Z3
14A4	TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	90 250		0 8	10 9		3000 2600	6.7 7.7	20 20						T-9	19	8 PIN LOC.	5AC	14A4
14A5	BEAM PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	125	125	9	44	3.3	6000	17		2700	2.2				T-9	26	8 PIN LOC.	6AA	14A5
14B6	DOUBLE DIODE TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250 100		2 1	0.9 0.4		1100 900	91 110	100 100						T-9	19	8 PIN LOC.	8W	14B6
14C5	BEAM PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	315	225	13	34	2.2	3750	58		8500	5.5				T-9	26	8 PIN LOC.	6AA	14C5
14C7	PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250	100	3	2.2	0.7	1575	1000	Cutoff: at −7 V.						T-9	26	8 PIN LOC.	8V	14C7

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

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14E6-17H3

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE μMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
14E6	DOUBLE DIODE-TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250		9	9.5		1900	8.5	16						T-9	19	8 PIN LOC.	8W		14E6
14E7	DOUBLE DIODE PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250	100	3	7.5	1.6	1300	700	Cutoff: 2 μmhos @ −42.5 V.						T-9	19	8 PIN LOC.	8AE		14E7
14F7	DOUBLE TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250		2	2.3		1600	44	70	Each Section					T-9	19	8 PIN LOC.	8AC		14F7
14F8	DOUBLE TRIODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250		[B]	6		3300		48	Cutoff: 10 μa. at −11 V. Each Section					T-9	24	8 PIN LOC.	8BW		14F8
14H7	PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250	150	0	10	3.2	4000	800	Cutoff: 35 μmhos @ −19 V.						T-9	26	8 PIN LOC.	8V		14H7
14J7	TRIODE HEXODE	12.6	0.15	HEATER	CONVERTER	250	100	3	1.4	2.8	290	1500							T-9	26	8 PIN LOC.	8BL		14J7
14N7	DOUBLE TRIODE	12.6	0.3	HEATER	CLASS A AMPLIFIER	250		8	9		2600	7.7	20	Each Section					T-9	26	8 PIN LOC.	8AC		14N7
14Q7	HEPTODE	12.6	0.15	HEATER	CONVERTER	250 100	100 100	2 2	3.5 3.3	8.5 8.5	550 525	1000 500							T-9	26	8 PIN LOC.	8AL		14Q7
14R7	DOUBLE DIODE PENTODE	12.6	0.15	HEATER	CLASS A AMPLIFIER	250	100	1	5.7	2.1	3200	1000	Cutoff: 2 μmhos at −20 V.						T-9	26	8 PIN LOC.	8AE		14R7
15	PENTODE	2	0.22	HEATER	CLASS A AMPLIFIER	135	67.5	1.5	1.85	0.3	750	800	600						ST-12	72	SMALL 5 PIN	5F		15
17AV5GA	PENTODE	16.8	0.45*	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	250 60	150 150	22.5 0	55 225	2.1 25	5500	20	Cutoff: 1.0 mA. @ −46 V.						T-11	55	6 PIN OCTAL	6CK		17AV5GA
17CA5	PENTODE	16.8	0.45*	HEATER	CLASS A AMPLIFIER	110 125	110 125	4.0 4.5	32[F] 37[F]	3.5[F] 4.0[F]	8100 9200	16 15		3500 4500	1.1 1.5				T-5½	5	MIN. 7 PIN	7CV		17CA5
17DQ6	PENTODE	16.8	0.45*	HEATER	HORIZONTAL DEFLECTION AMPLIFIER		140	28	83	12.3	Grid #1 Input Voltage: Peak To Peak Sawtooth: 74 V. Negative Peaking: 18 V. Peak Positive Plate Voltage: 3440 V. Plate Dissipation: 5.1 Watts								T-12	56	7 PIN OCTAL	6AM		17DQ6
17H3	DIODE	17.5	0.3*	HEATER	DAMPING TUBE	Tube voltage drop at I_b-140 mA DC: 22 V.											2000	75	T-6½	9	MIN. 9 PIN	9FK		17H3

* Heater warm-up time: 11 seconds.

[F] Zero signal.

[B] Bias obtained thru 500 ohm cathode resistor.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. APRIL 1, 1962 PLATE #6443

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

17L6GT-24S

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE MMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
17L6GT	BEAM PENTODE	16.8	0.45*	HEATER	CLASS A AMPLIFIER	110 200	110 125	7.5 0	49[F] 46[F]	4[F] 2.2[F]	8000 8000	13 28		2000 4000	2.1 3.8				T-9	36	INT. OCTAL 7 PIN	7S	**17L6GT**
17R5	PENTODE	16.8	0.45*	HEATER	VERTICAL DEFLECTION AMPLIFIER	110	110	8.5	40	3.3	7000	13	Cut-off: 0.5 mA. @ −22 V.						T-5½	5	MIN. 7 PIN	7CV	**17R5**
18A5	BEAM PENTODE	18.5	0.3*	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	60 200	125 125	0 17	165 40	15 1.1	4800	27							T-9	41	6 PIN OCTAL	6CK	**18A5**
19	DOUBLE TRIODE	2	0.26	DC FIL.	CLASS B AMPLIFIER	135		0	10					10,000	2.1				ST-12	70	SMALL 6 PIN	6C	**19**
19BG6G	BEAM PENTODE	18.9	0.3	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	250	250	15	75	4	6000	25	Cut-off: 1 ma. @ −45 V.						ST-16	83	6 PIN OCTAL	5BT	**19BG6G**
19BG6GA	BEAM PENTODE	18.9	0.3	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	60 250	250 250	0 15	180 75	18 4.0	6000	25	Cut-off: 1 mA. @ − 45 V.						T-12	62	5 PIN OCTAL	5BT	**19BG6GA**
19C8	TRIPLE DIODE TRIODE	18.9	0.15	HEATER	CLASS A AMPLIFIER	100		1	0.5		1250	80	100						T-6½	8	MIN. 9 PIN	9AE	**19C8**
19J6	DOUBLE TRIODE	18.9	0.15	HEATER	CLASS A AMP. [L]	100		[C]	8.5		5300	7.1	38						T-5½	4	MIN. 7 PIN	7BF	**19J6**
					MIXER SERVICE [L]	150		[D]	4.8		1900	10.2	Oscillator Peak Voltage: 3 V. Short Circuit Input conductance at 100 mc.: 96 μmhos.										
19X8	TRIODE PENTODE	19.8	0.15	HEATER	OSCILLATOR MIXER E G H	100 250 150	150		8.5 7.7 7.8	1.6	5800 4600 4000	6.9 750 7.9	40 42						T-6½	8	MIN. 9 PIN	9AK	**19X8**
20	TRIODE	3.3	0.13	DC FIL.	CLASS A AMPLIFIER	135		22.5	6.5		525	6.3	3.3	6500	0.11				T-8	14	SMALL 4 PIN	4D	**20**
24A	TETRODE	2.5	1.75	HEATER	CLASS A AMPLIFIER	250	90	3	4	1.7	1050	600	630						ST-14	79	MED. 5 PIN	5E	**24A**
24S	TETRODE	2.5	1.75	HEATER	CLASS A AMPLIFIER	250	90	3	4	1.7	1050	600	630						ST-14	79	MED. 5 PIN	5E	**24S**

* Heater warm-up time: 11 seconds.
[F] Zero signal.
[A] For each section.
[C] Fixed bias not recommended, cathode bias: 50 ohms for both units.
[D] Fixed bias not recommended, cathode bias: 810 ohms for both units.

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

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25A6-25D8GT

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	FILAMENT TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANSCONDUCTANCE MICROMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
25A6	PENTODE	25	0.3	HEATER	CLASS A AMPLIFIER	160	120	18	33	6.5	2375	42		5000	2.2	Signal: 12.7 V. RMS			MT-8B	20	7 PIN OCTAL	7S	25A6
25A6GT	PENTODE	2.5	0.3	HEATER	CLASS A AMPLIFIER	160	120	18	33	6.5	2375	42		5000	2.2				T-9	35	7 PIN OCTAL	7S	25A6GT
25A7GT	DIODE PENTODE	25	0.3	HEATER	PENTODE UNIT AS CLASS A AMPLIFIER	100	100	15	20.5	4	1800	50		4500	0.77				T-9	35	8 PIN OCTAL	8F	25A7GT
25AC5GT	TRIODE	25	0.3	HEATER	POSITIVE BIAS AMPLIFIER	110		+15	45		3800	15.2	58	Grid Current: 7 Ma.					T-9	35	6 PIN OCTAL	6Q	25AC5GT
25B5	DOUBLE TRIODE	25	0.3	HEATER	CLASS A AMPLIFIER	110	110	0	45	7	2200	11.5		2000	2	Signal: 21 V. RMS			ST-12C	74	SMALL 6 PIN	6D	25B5
25B6G	PENTODE	25	0.3	HEATER	CLASS A AMPLIFIER	200 105	135 105	23 16	62 48	1.8 2	5000 4800	18 15.5		2500 1700	7.1 2.4				ST-14	77	7 PIN OCTAL	7S	25B6G
25B8GT	TRIODE PENTODE	25	0.15	HEATER	CLASS A AMPLIFIER	100 100	100	1 3	0.6 7.6	2	1500 2000	75 185	112 370						T-9	33	8 PIN OCTAL	8T	25B8GT
25BK5	PENTODE	25	0.3	HEATER	CLASS A AMPLIFIER	250	250	5	37	10	8500	100		6500	3.5				T-6½	9	MIN. 9 PIN	9BQ	25BK5
25BQ6GA	PENTODE	25	0.3	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	250	150	22.5	55	2.1	5500	20							T-11	56	MED. OCTAL 7 PIN	6AM	25BQ6GA
25C6G	BEAM PENTODE	25	0.3	HEATER	CLASS A AMPLIFIER	135	135	13.5	58	3.5	7000	9.3		2000	3.6	Signal: 9.9 V. RMS			ST-14	77	7 PIN OCTAL	7S	25C6G
25CD6GA	BEAM PENTODE	25	0.6*	HEATER	HORIZONTAL DEFLECTION AMPLIFIER		170	[A]	92	15.5	7500		3.8	DC Power Supply Volt.: 350 V. Total Power Supply Volt.: 500 V.					ST-16	83	INT. OCTAL 6 PIN	5BT	25CD6GA
25CU6	PENTODE	25	0.3	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	310	140		79	11.2				Plate Dissipation: 7 W. Grid #2 Dissipation: 1.57 W. Peak Plate Current: 270 mA.					T-12	59	INT. OCTAL 7 PIN	6AM	25CU6
25D8GT	DIODE TRIODE PENTODE	25	0.15	HEATER	CLASS A AMPLIFIER	100 100	100	1 3	0.5 8.5	2.7	1100 1900	91 200	100	Cutoff: 2 μmhos @ −35 V.					T-9	43	8 PIN OCTAL	8AF	25D8GT

* Heater warm-up time: 11 seconds.

[A] Bias obtained thru 300 ohm cathode resistor.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. APRIL 1, 1962 PLATE #6444

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
25DQ6	BEAM PENTODE	25.0	0.3	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	Grid #1 Voltage: −28 V.; DC Grid #2 Voltage: 140 V.; Peak Positive Plate Voltage: 3440 V.; Grid #1 Input Voltage: Peak To Peak Sawtooth: 74 V., Negative Peaking: 18 V.; DC Plate Current: 83 mA.; DC Grid #2 Current: 12.3 mA.; Plate Dissipation: 5.1 Watts	T-12	59	SHORT 7 PIN OCTAL	6AM	**25DQ6**
25F5	BEAM PENTODE	25.0	0.15	HEATER	CLASS A AMPLIFIER [B] [C]	Plate Volts: 110 / 110; Screen Grid Volts: 110 / 110; Control Grid Volts (Neg.): 7.5 / 8.0; Plate Current MA.: 37 / 78; Screen Current MA.: 7.0 / 13.6; Trans-Conductance μmhos: 5800; Plate Resistance Megohms: 16.0; Amplification Factor: —; Load Resistance Ohms: 2500 / 4500; Power Output Watts: 1.2 / 2.9	T-5½	5	MIN. 7 PIN	7CV	**25F5**
25N6G	DOUBLE TRIODE	25	0.3	HEATER	CLASS A AMPLIFIER	Plate Volts: 110; Screen Grid Volts: 110; Control Grid Volts (Neg.): 0; Plate Current MA.: 45; Screen Current MA.: 7; Trans-Conductance μmhos: 2200; Plate Resistance Megohms: 11.5; Amplification Factor: 25; Load Resistance Ohms: 2000; Power Output Watts: 2	ST-12C	73	7 PIN OCTAL	7W	**25N6G**
25W4GT	DIODE	25	0.3	HEATER	HALF-WAVE RECTIFIER	Peak I_b-600 mA. max.; Hot-Switching Transient I_b for 0.2 sec. max.- 3.5 amp. max.; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate: 350; Max. Peak Inverse Volts: 1250; Max. D.C. Output MA.: 125	T-9	35	6 PIN OCTAL	4CG	**25W4GT**
25X6GT	DOUBLE DIODE	25	0.15	HEATER	HALF-WAVE RECTIFIER	Rectifier Condenser Input: Max. A.C. RMS Volts per Plate: 125; Max. Peak Inverse Volts: —; Max. D.C. Output MA.: 60	T-9	35	7 PIN OCTAL	7Q	**25X6GT**
25Y4GT	DIODE	25	0.15	HEATER	HALF-WAVE RECTIFIER	Tube Voltage Drop at 125 Ma.: 18 V.; Max. Peak Plate Current: 250 Ma.; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate: 125; Max. Peak Inverse Volts: —; Max. D.C. Output MA.: 75	T-9	32	6 PIN OCTAL	5AA	**25Y4GT**
25Z4	DIODE	25	0.3	HEATER	HALF-WAVE RECTIFIER	Max. Peak Plate Current: 750 Ma.; Tube Voltage Drop at 125 mA.: 12 V.; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate: 125; Max. Peak Inverse Volts: —; Max. D.C. Output MA.: 125	T-9	32	6 PIN OCTAL	5AA	**25Z4**
25Z5	DOUBLE DIODE	25	0.3	HEATER	HALF-WAVE RECTIFIER VOLTAGE DOUBLER	DC Current for Each Section; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate: 235; Max. Peak Inverse Volts: 700; Max. D.C. Output MA.: 75	ST-12	70	SMALL 6 PIN	6E	**25Z5**
25Z6	DOUBLE DIODE	25	0.3	HEATER	HALF-WAVE RECTIFIER VOLTAGE DOUBLER	DC Current for Each Section; Rectifier Condenser Input: Max. A.C. RMS Volts per Plate: 235; Max. Peak Inverse Volts: 700; Max. D.C. Output MA.: 75	MT-8B	20	7 PIN OCTAL	7Q	**25Z6**
26	TRIODE	1.5	1.05	FIL.	CLASS A AMPLIFIER	Plate Volts: 180; Screen Grid Volts: —; Control Grid Volts (Neg.): 14.5; Plate Current MA.: 6.2; Screen Current MA.: —; Trans-Conductance μmhos: 1150; Plate Resistance Megohms: 7.3; Amplification Factor: 8.3; Load Resistance Ohms: —; Power Output Watts: —	ST-14	78	MED. 4 PIN	4D	**26**
26A7GT	DOUBLE PENTODE	26.5	0.6	HEATER	CLASS A AMPLIFIER	Plate Volts: 26.5; Screen Grid Volts: 26.5; Control Grid Volts (Neg.): 4.5; Plate Current MA.: 20; Screen Current MA.: 1.9; Trans-Conductance μmhos: 5700; Plate Resistance Megohms: —; Amplification Factor: —; Load Resistance Ohms: 1500; Power Output Watts: 0.18	T-9	46	8 PIN OCTAL	8BU	**26A7GT**
26BK6	DOUBLE DIODE TRIODE	26.5	0.07	HEATER	CLASS A AMPLIFIER	Plate Volts: 250; Screen Grid Volts: —; Control Grid Volts (Neg.): 2; Plate Current MA.: 1.2; Screen Current MA.: —; Trans-Conductance μmhos: 1600; Plate Resistance Megohms: 62.5; Amplification Factor: 100; Load Resistance Ohms: —; Power Output Watts: —	T-5½	5	MIN. 7 PIN	7BT	**26BK6**
26CG6	PENTODE	26.5	0.07	HEATER	CLASS A AMPLIFIER	Plate Volts: 250; Screen Grid Volts: 150; Control Grid Volts (Neg.): 8; Plate Current MA.: 9; Screen Current MA.: 2.3; Trans-Conductance μmhos: 2000; Plate Resistance Megohms: 720; Amplification Factor: Cutoff: 40 μmhos @ −24 V.; Load Resistance Ohms: —; Power Output Watts: —	T-5½	4	MIN. 7 PIN	7BK	**26CG6**
27	TRIODE	2.5	1.75	HEATER	CLASS A AMPLIFIER	Plate Volts: 250 / 90; Screen Grid Volts: —; Control Grid Volts (Neg.): 21 / 6; Plate Current MA.: 5.2 / 2.7; Screen Current MA.: —; Trans-Conductance μmhos: 975 / 820; Plate Resistance Megohms: 9.25 / 11.0; Amplification Factor: 9 / 9; Load Resistance Ohms: —; Power Output Watts: —	ST-12	70	SMALL 5 PIN	5A	**27**

[B] Single tube. [C] Two tubes in push-pull.

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

PRINTED IN U. S. A.

28Z5-36

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
28Z5	DOUBLE DIODE	28	0.24	HEATER	FULL-WAVE RECTIFIER	Peak Plate Current per Plate: 300 Ma. — Rectifier Condenser Input: Max. A.C. RMS Volts per Plate 450; Max. Peak Inverse Volts 1250; Max. D.C. Output Ma. 100	T-9	30	8 PIN LOC.	6BJ	**28Z5**
30	TRIODE	2	0.06	DC FIL.	CLASS A AMPLIFIER	Plate Volts 180; Control Grid Volts (Neg.) 13.5; Plate Current Ma. 3.1; Trans-Conductance Micromhos 900; Plate Resistance Kilohms 10.3; Amplification Factor 9.3	ST-12	70	SMALL 4 PIN	4D	**30**
31	TRIODE	2	0.13	DC FIL.	CLASS A AMPLIFIER	Plate Volts 180 / 135; Control Grid Volts (Neg.) 30 / 22.5; Plate Current Ma. 12.3 / 8; Trans-Conductance Micromhos 1050 / 925; Plate Resistance Kilohms 3.6 / 4.1; Amplification Factor 3.8 / 3.8; Load Resistance Ohms 5700 / 7000; Power Output Watts 0.375 / 0.185	ST-12	70	SMALL 4 PIN	4D	**31**
32	TETRODE	2	0.06	FIL.	CLASS A AMPLIFIER	Plate Volts 180; Screen Grid Volts 67.5; Control Grid Volts (Neg.) 3; Plate Current Ma. 1.7; Screen Current Ma. 0.4; Trans-Conductance Micromhos 650; Plate Resistance Kilohms 1200; Amplification Factor 780	ST-14	79	MED. 4 PIN	4K	**32**
32L7GT	DIODE BEAM PENTODE	32.5	0.3	HEATER	CLASS A AMPLIFIER	Plate Volts 90; Screen Grid Volts 90; Control Grid Volts (Neg.) 5; Plate Current Ma. 38; Screen Current Ma. 3; Trans-Conductance Micromhos 6000; Plate Resistance Kilohms 15; Amplification Factor 90; Load Resistance Ohms 2600; Power Output Watts 0.8	ST-9	35	8 PIN OCTAL	8Z	**32L7GT**
33	PENTODE	2	0.26	DC FIL.	CLASS A AMPLIFIER	Plate Volts 180 / 135; Screen Grid Volts 180 / 135; Control Grid Volts (Neg.) 18 / 13.5; Plate Current Ma. 22 / 14.5; Screen Current Ma. 5 / 3; Trans-Conductance Micromhos 1700 / 1450; Plate Resistance Kilohms 55 / 50; Amplification Factor 90 / 70; Load Resistance Ohms 6000 / 7000; Power Output Watts 1.4 / 0.7	ST-14	78	MED. 5 PIN	5K	**33**
34	PENTODE	2	0.06	DC FIL.	CLASS A AMPLIFIER	Plate Volts 180 / 135; Screen Grid Volts 67.5 / 67.5; Control Grid Volts (Neg.) 3 / 3; Plate Current Ma. 2.8 / 2.8; Screen Current Ma. 1 / 1; Trans-Conductance Micromhos 620 / 600; Plate Resistance Kilohms 1000 / 600; Amplification Factor 620 / 360; Cutoff: 15 μmhos @ −22.5 V.	ST-14	79	MED. 4 PIN	4M	**34**
35	TETRODE	2.5	1.75	HEATER	CLASS A AMPLIFIER	Plate Volts 250; Screen Grid Volts 90; Control Grid Volts (Neg.) 3 min.; Plate Current Ma. 6.5; Screen Current Ma. 2.5; Trans-Conductance Micromhos 1050; Plate Resistance Kilohms 400; Amplification Factor 420; Cutoff: 15 μmhos @ −40 V.	ST-14	79	MED. 5 PIN	5E	**35**
35A5	BEAM PENTODE	35	0.15	HEATER	CLASS A AMPLIFIER	Plate Volts 200 / 110; Screen Grid Volts 125 / 110; Control Grid Volts (Neg.) 0 / 7.5; Plate Current Ma. 43[F] / 40[F]; Screen Current Ma. 2.0[F] / 3.0[F]; Trans-Conductance Micromhos 6100 / 5800; Plate Resistance Kilohms 34 / 14; Load Resistance Ohms 5000 / 2500; Power Output Watts 3.0 / 1.5; Signal: 5.3 V. RMS	T-9	30	8 PIN LOC.	6AA	**35A5**
35Y4	DIODE	35	0.15	HEATER	HALF-WAVE RECTIFIER	Peak Plate Current per Plate: 600 mA. — Rectifier Condenser Input: Max. A.C. RMS Volts per Plate 235; Max. Peak Inverse Volts 700; Max. D.C. Output Ma. 100	T-9	25	8 PIN LOC.	5AL	**35Y4**
35Z3	DIODE	35	0.15	HEATER	HALF-WAVE RECTIFIER	Rectifier Condenser Input: Max. A.C. RMS Volts per Plate 235; Max. Peak Inverse Volts 700; Max. D.C. Output Ma. 100	T-9	30	8 PIN LOC.	4Z	**35Z3**
35Z4GT	DIODE	35	0.15	HEATER	HALF-WAVE RECTIFIER	Rectifier Condenser Input: Max. A.C. RMS Volts per Plate 235; Max. Peak Inverse Volts 700; Max. D.C. Output Ma. 100	T-9	35	6 PIN OCTAL	5AA	**35Z4GT**
35Z6G	DOUBLE DIODE	35	0.3	HEATER	HALF-WAVE RECTIFIER	DC Current for Each Section — Rectifier Condenser Input: Max. A.C. RMS Volts per Plate 235; Max. Peak Inverse Volts 700; Max. D.C. Output Ma. 110	ST-14	77	7 PIN OCTAL	7Q	**35Z6G**
36	TETRODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	Plate Volts 250; Screen Grid Volts 90; Control Grid Volts (Neg.) 3; Plate Current Ma. 3.2; Screen Current Ma. 1.7; Trans-Conductance Micromhos 1080; Plate Resistance Kilohms 550; Amplification Factor 595	ST-12	72	SMALL 5 PIN	5E	**36**

[F] Zero signal.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., PLATE 1, 1962 PLATE 86445

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE μMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB: STYLE	BULB: OUTLINE NO.	BASE: STYLE	BASE: BASING	TYPE
37	TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		18	7.5		1100	8.4	9.2						ST-12	70	SMALL 5 PIN	5A	**37**
38	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	250	25	22	3.8	1200	100	120	10,000	2.5				ST-12	72	SMALL 5 PIN	5F	**38**
39/44	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	90	3	5.8	1.4	1050		Cutoff: 2 μmhos @ −42.5 V.						ST-12	72	SMALL 5 PIN	5F	**39/44**
40	TRIODE	5	0.25	DC FIL.	CLASS A AMPLIFIER	180		3	0.2		200	150	30	Load Resistance: 0.25 Megohm					ST-14	78	MED. 4 PIN	4D	**40**
41	PENTODE	6.3	0.4	HEATER	CLASS A AMPLIFIER	315	250	21	25.5[F]	4.0[F]	2100	110		9000	4.5	Signal: 12.7 V. RMS			ST-12	70	SMALL 6 PIN	6B	**41**
42	PENTODE	6.3	0.7	HEATER	CLASS A AMPLIFIER	285 250	285 250	20 16.5	38 34	7 6.5	2550 2500	78 80		7000 7000	4.8 3.2	Signal: 11.6 V. RMS			ST-14	78	MED. 6 PIN	6B	**42**
43	PENTODE	25	0.3	HEATER	CLASS A AMPLIFIER	160 95	120 95	18 15	33 20	6.5 4	2375 2000	42 45		5000 4500	2.2 0.9	Signal: 12.7 V. RMS Signal: 10.6 V. RMS			ST-14	78	MED. 6 PIN	6B	**43**
45	TRIODE	2.5	1.5	FIL.	CLASS A AMPLIFIER	275 180		56 31.5	36 31		2050 2125	1.70 1.65	3.5 3.5	4600 2700	2.0 .825				ST-14	78	MED. 4 PIN	4D	**45**
45Z3	DIODE	45	0.075	HEATER	HALF-WAVE RECTIFIER											117	350	65	T-5½	4	MIN. 7 PIN	5AM	**45Z3**
45Z5GT	DIODE	45	0.15	HEATER	HALF-WAVE RECTIFIER											235	700	60	T-9	35	6 PIN OCTAL	6AD	**45Z5GT**
46	TETRODE	2.5	1.75	FIL.	CLASS A AMPLIFIER [D]	250		33	22		2350	2.38	5.6	6400	1.25	Grid bias measured from filament center			ST-16	84	MED. 5 PIN	5C	**46**
					CLASS B AMPLIFIER [E]	400		0	12[F]	Current and output for 2 tubes				5800	20	Load is plate-to-plate							
47	PENTODE	2.5	1.75	FIL.	CLASS A AMPLIFIER	250	250	16.5	31	6	2500	60	150	7000	2.7				ST-16	84	MED. 5 PIN	5B	**47**
48	TETRODE	30	0.4	DC HEATER	CLASS A AMPLIFIER	125	100	20	56	9.5	3900			1500	2.5				ST-16	84	MED. 6 PIN	6A	**48**

[D] Grid tied to plate. [F] Zero signal. [E] Two grids tied together.

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TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

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TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE MMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB: STYLE	BULB: OUTLINE NO.	BASE: STYLE	BASE: BASING	TYPE
49	TETRODE	2	0.12	FIL.	CLASS A AMPLIFIER	135		20	6		1125	4.175	4.7	11,000	0.17				ST-14	78	MED. 5 PIN	5C	**49**
50	TRIODE	7.5	1.25	FIL.	CLASS A AMPLIFIER	450		84	55		2100	1.8	3.8	4350	4.6				ST-16	89	MED. 4 PIN	4D	**50**
50A5	BEAM PENTODE	50	0.15	HEATER	CLASS A AMPLIFIER	200 110	125 110	0 7.5	47 50	8.5 10	8000 8000	28 13		4000 2000	3.8 2.1				T-9	30	8 PIN LOC.	6AA	**50A5**
50AX6G	DOUBLE DIODE	50	0.3	HEATER	FULL-WAVE RECTIFIER											350	1250		ST-14	77	7 PIN OCTAL	7Q	**50AX6G**
50BK5	BEAM PENTODE	50	0.15	HEATER	CLASS A AMPLIFIER	110	110	7.5	49[F]	3.5[F]	8500	100		6500	3.5				T-6½	9	MIN. 9 PIN	9BQ	**50BK5**
50C6G	BEAM PENTODE	50	0.15	HEATER	CLASS A AMPLIFIER	200	135	14	61	2.2	7100	18.3		2600	6	Signal: 10 V. RMS			ST-14	77	7 PIN OCTAL	7S	**50C6G**
50X6	DOUBLE DIODE	50	0.15	HEATER	HALF-WAVE RECTIFIER											235		75	T-9	30	8 PIN LOC.	7AJ	**50X6**
50Y7GT	DOUBLE DIODE	50	0.15	HEATER	VOLTAGE DOUBLER H-W RECTIFIER SINGLE SECTION	With plate current passing through pilot lamp and tapped heater section										117 235		65 65	T-9	35	8 PIN OCTAL	8AN	**50Y7GT**
50Z7G	DOUBLE DIODE	50	0.15	HEATER	HALF-WAVE RECTIFIER											235		65	ST-12	69	8 PIN OCTAL	8AN	**50Z7G**
53	DOUBLE TRIODE	2.5	2	HEATER	CLASS B AMPLIFIER	300		0	35[F]	Current and output for both sections				8000	10	Load is plate-to-plate			ST-14	78	MED. 7 PIN	7B	**53**
					CLASS A AMPLIFIER	300		6	7		3200	11	35	Both sections in parallel									
55	DOUBLE DIODE TRIODE	2.5	1.0	HEATER	CLASS A AMPLIFIER	250		20	8		1100	7.5	8.3	20,000	0.35				ST-12	72	SMALL 6 PIN	6G	**55**
55S	DOUBLE DIODE TRIODE	2.5	1.0	HEATER	CLASS A AMPLIFIER	250		20	8		1100	7.5	8.3	20,000	0.35				ST-12	72	SMALL 6 PIN	6G	**55S**
56	TRIODE	2.5	1.0	HEATER	CLASS A AMPLIFIER	250		13.5	5		1450	9.5	13.8						ST-12	70	SMALL 5 PIN	5A	**56**
56S	TRIODE	2.5	1.0	HEATER	CLASS A AMPLIFIER	250		13.5	5		1450	9.5	13.8						ST-12	70	SMALL 5 PIN	5A	**56S**

[F] Zero signal.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A.-APRIL 1, 1962 PLATE #6446

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

		FILAMENT				TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS											RECTIFIER CONDENSER INPUT			BULB		BASE		
TYPE	DESCRIPTION	VOLTS	AMPERES	TYPE OF CATHODE	APPLICATION	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE μMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	MAX. A.C. RMS VOLTS PER PLATE	MAX. PEAK INVERSE VOLTS	MAX. D.C. OUTPUT MA.	STYLE	OUTLINE NO.	STYLE	BASING	TYPE
57	PENTODE	2.5	1.0	HEATER	CLASS A AMPLIFIER	250	100	3	2	0.5	1225	1000							ST-12C	76	SMALL 6 PIN	6F	57
58	PENTODE	2.5	1.0	HEATER	CLASS A AMPLIFIER	250	100	3	8.2	2	1600	800	1280	Cutoff: 2 μmhos @ −50 V.					ST-12C	76	SMALL 6 PIN	6F	58
59	PENTODE	2.5	2.0	HEATER	CLASS A AMPLIFIER	250	250	18	35	9	2500	40	100	6000	3				ST-16	84	MED. 7 PIN	7A	59
70A7GT	DIODE PENTODE	70	0.15	HEATER	PENTODE CLASS A AMPLIFIER	110	110	7.5	40	3	5800		80	2500	1.5				T-9	35	8 PIN OCTAL	8AB	70A7GT
71A	TRIODE	5	0.25	FIL.	CLASS A AMPLIFIER	180		40.5	20		1700	1.75	3	4800	0.79				ST-14	78	MED. 4 PIN	4D	71A
75	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		2	0.9		1100	91	100						ST-12	72	SMALL 6 PIN	6G	75
75S	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		2	0.9		1100	91	100						ST-12	72	SMALL 6 PIN	6G	75S
76	TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 100		13.5 2	5 2.5		1450 1150	9.5 12	13.8						ST-12	70	SMALL 5 PIN	5A	76
77	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	100	3	2.3	0.5	1250	1000							ST-12	72	SMALL 6 PIN	6F	77
78	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 90	125 90	3 3	10.5 5.4	2.6 1.3	1650 1275	600 300	Cutoff: 2 μmhos @ −42.5 V. Cutoff: 2 μmhos @ −38.5 V.						ST-12	72	SMALL 6 PIN	6F	78
79	DOUBLE TRIODE	6.3	0.6	HEATER	CLASS B AMPLIFIER	250		0	10.6					14,000	8				ST-12	72	SMALL 6 PIN	6H	79
80	DOUBLE DIODE	5	2	FIL.	FULL-WAVE RECTIFIER											350	1400	125	ST-14	78	MED. 4 PIN	4C	80
81	DIODE	7.5	1.25	FIL.	HALF-WAVE RECTIFIER											700	2000	85	ST-16	89	MED. 4 PIN	4B	81
82	MERCURY FILLED DOUBLE DIODE	2.5	3	FIL.	FULL-WAVE RECTIFIER											450	1550	115	ST-14	78	MED. 4 PIN	4C	82
83V	DOUBLE DIODE	5	2	HEATER	FULL-WAVE RECTIFIER											375	1400	175	ST-14	78	MED. 4 PIN	4AD	83V
84/6Z4	DOUBLE DIODE	6.3	0.5	HEATER	FULL-WAVE RECTIFIER											325	1250	60	ST-12	70	SMALL 5 PIN	5D	84/6Z4

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL

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85-713A

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	TYPE OF CATHODE	APPLICATION	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE MICROMHOS	PLATE RESISTANCE MEGOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB: STYLE	BULB: OUTLINE NO.	BASE: STYLE	BASE: BASING	TYPE
85	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		20	8		1100	7.5	8.3	20,000	0.35				ST-12	72	SMALL 6 PIN	6G	85
89	PENTODE	6.3	0.4	HEATER	CLASS A AMPLIFIER	250	250	25	32	5.5	1800	70	125	6750	3.4				ST-12	72	SMALL 6 PIN	6F	89
117L7/ M7GT	DIODE BEAM PENTODE	117	0.09	HEATER	BEAM POWER UNIT AS CLASS A AMPLIFIER	105	105	5.2	43	4	5300	17		4000	0.85				T-9	41	8 PIN OCTAL	8AO	117L7/ M7GT
					HALF-WAVE RECTIFIER											117	350	75					
117N7GT	DIODE BEAM PENTODE	117	0.09	HEATER	BEAM POWER UNIT AS CLASS A AMPLIFIER	100	100	6	51	5	7000	16		3000	1.2				T-9	41	8 PIN OCTAL	8AV	117N7GT
					HALF-WAVE RECTIFIER											117	350	75					
117P7GT	DIODE BEAM PENTODE	117	0.09	HEATER	PENTODE CLASS A AMPLIFIER	105	105	5.2	43	4	5300	17		4000	0.85				T-9	41	8 PIN OCTAL	8AV	117P7GT
117Z4GT	DIODE	117	0.04	HEATER	HALF-WAVE RECTIFIER											117	350	90	T-9	28	6 PIN OCTAL	5AA	117Z4GT
117Z6GT	DOUBLE DIODE	117	0.075	HEATER	HALF-WAVE RECTIFIER	DC current for each section										235	700	60	T-9	35	7 PIN OCTAL	7Q	117Z6GT
183	TRIODE	5	1.25	FIL.	CLASS A AMPLIFIER	250		60	25		1800	1.8	3.2	4500	2				ST-14	78	MED. 4 PIN	4D	183
316A	TRIODE	2.0	3.65	FIL.	CLASS C AMPLIFIER	450		250	80						7.5				T-4½		ACORN		316A
485	TRIODE	3	1.3	HEATER	CLASS A AMPLIFIER	180		9	6		1350	9.3	12.5						ST-12	70	SMALL 5 PIN	5A	485
703A	TRIODE	1.15	4.5	FIL.	OSCILLATOR AMPLIFIER MIXER	350					2075								T-4½		ACORN		703A
705A	DIODE	5.0	5	FIL.	HALF-WAVE RECTIFIER	Max. Peak Inverse Plate Voltage: 35 Kv. Max. Avg. Rectified Plate Current: 100 Ma.									Max. Peak Plate Current: 500 Ma. Voltage Drop (I_B = 365 Ma.): 300 V.				T-4½		ACORN		705A
713A	PENTODE	6.3	.175	HEATER	CLASS A AMPLIFIER	120	120	2	7.5	2.5	4000	250							T-4½		ACORN		713A

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. APRIL 1, 1962 PLATE #6447

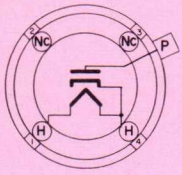
717A-XXL

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPERES	FILAMENT TYPE OF CATHODE	APPLICATION	TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS: PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA.	SCREEN CURRENT MA.	TRANS-CONDUCTANCE MICROMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. A.C. RMS VOLTS PER PLATE	RECTIFIER CONDENSER INPUT: MAX. PEAK INVERSE VOLTS	RECTIFIER CONDENSER INPUT: MAX. D.C. OUTPUT MA.	BULB: STYLE	BULB: OUTLINE NO.	BASE: STYLE	BASE: BASING	TYPE
717A	PENTODE	6.3	.175	HEATER	CLASS A AMPLIFIER	120	120	2	7.5	2.5	4000	250							T-4½		ACORN			717A
950	PENTODE	2	0.12	DC FIL.	CLASS A AMPLIFIER	135	135	16.5	7	2	950	105	100	13,500	0.45				ST-14	78	MED. 5 PIN	5K		950
954	PENTODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	90 250	90 100	3 3	1.2 2	0.5 0.7	1100 1400	1000 1500							T-4½		ACORN			954
955	TRIODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	180 250		5 7	4.5 6.3		2000 2200	12.5 11.4	25 25						T-4½		ACORN			955
956	PENTODE	6.3	0.15	HEATER	CLASS A AMPLIFIER	250	100	3	6.7	2.7	1800	700							T-4½		ACORN			956
1625	BEAM PENTODE	12.6	0.45	HEATER	CLASS C AMPLIFIER	750	250	45	100	6					50				ST-16	89	MED. 7 PIN BAY.	5AZ		1625
1626	TRIODE	12.6	0.25	HEATER	CLASS C AMPLIFIER	250		32	25		2500	2.5							ST-12	70	8 PIN OCTAL	6Q		1626
1629	TRIODE INDICATOR	12.6	0.15	HEATER	TUNING INDICATOR	Plate: 250 V. thru 1 Meg. 0.24 Ma. Target: 250 V. 4 Ma.												Shadow Angle: 90° at Zero Bias 0° at −8 V. Bias	T-9	50	7 PIN OCTAL	7AL		1629
1654	DIODE	1.4	0.05	FIL.	HALF-WAVE RECTIFIER											2500	6	1	T-5½		MIN. 7 PIN			1654
9004	DIODE	6.3	0.15	HEATER	UHF DETECTOR	Max. AC Plate Voltage: 117 V. RMS Max. DC Output Current: 5 mA.													T-4½		ACORN	4BJ		9004
9005	DIODE	3.6	0.165	HEATER	UHF DETECTOR	Max. AC Plate Voltage: 117 V. RMS Max. DC Output Current: 1.0 mA.													T-4½		ACORN	5BG		9005
9006	DIODE	6.3	0.15	HEATER	DETECTOR RECTIFIER											270	750	5	T-5½	3	MIN. 7 PIN	6BH		9006
XXD	TWIN TRIODE	14.0	0.16	HEATER	CLASS A AMPLIFIER	250		10	9.0		2100	7.6	16						T-9	26	8 PIN LOC.	8AC		XXD
XXL	TRIODE	7.0	0.32	HEATER	CLASS A AMPLIFIER	100 250		0 8	10.0 8.0		3600 2300	7.0 8.7	25 20						T-9	26	8 PIN LOC.			XXL

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL



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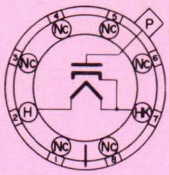

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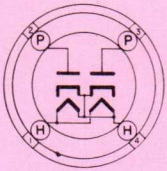

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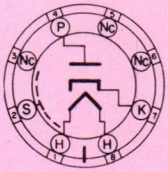

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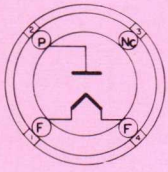

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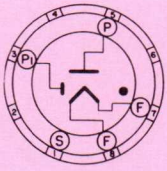

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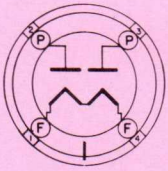

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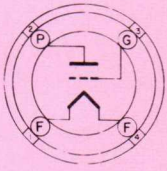

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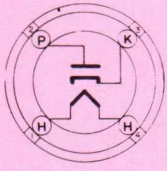

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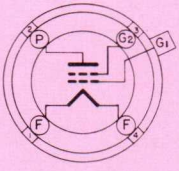

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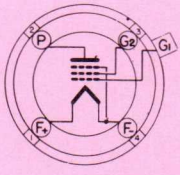

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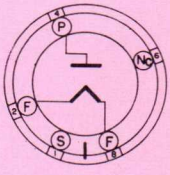

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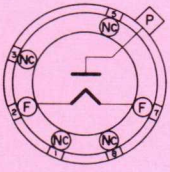

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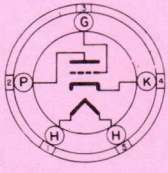

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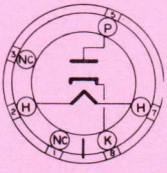

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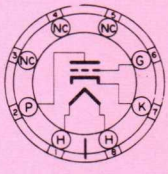

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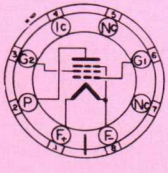

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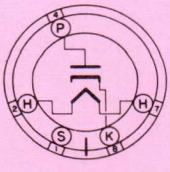

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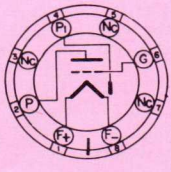

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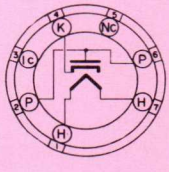

5AM

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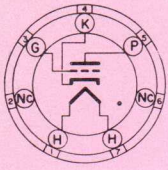
BASE DIAGRAMS FOR TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL



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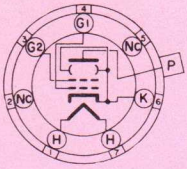

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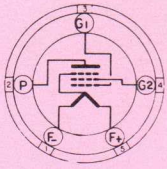

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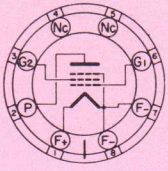

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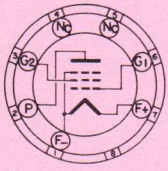

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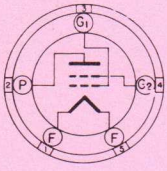

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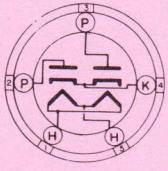

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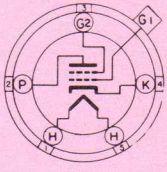

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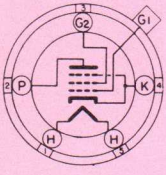

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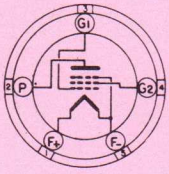

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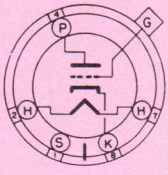

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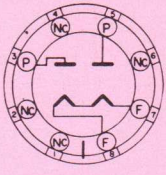

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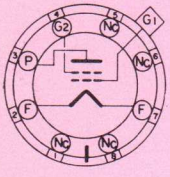

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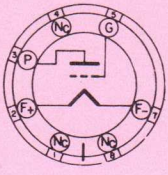

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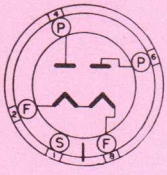

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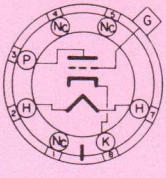

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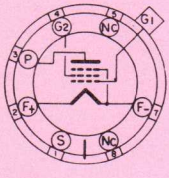

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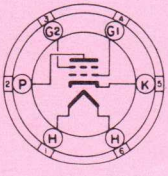

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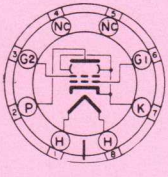

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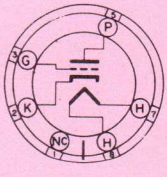
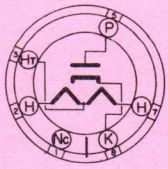


6AB

BASE DIAGRAMS FOR TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL



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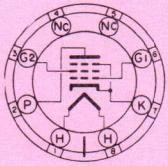

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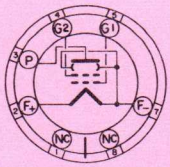

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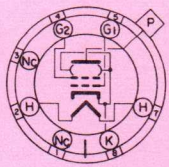

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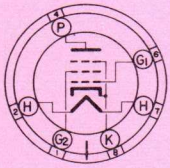

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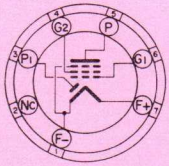

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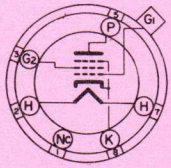

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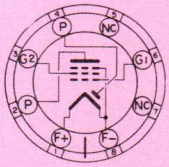

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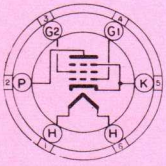

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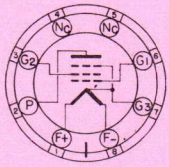

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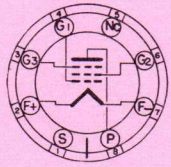

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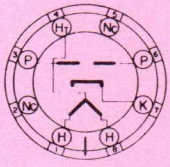

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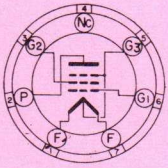

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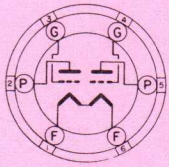

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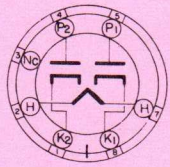

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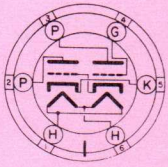

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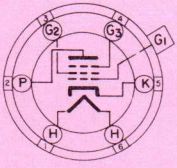

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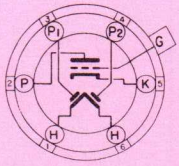

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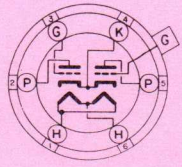

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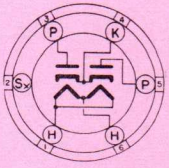

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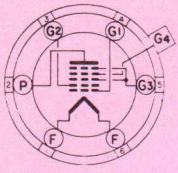

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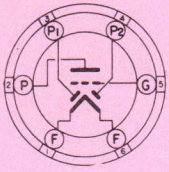

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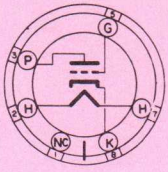

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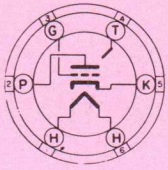

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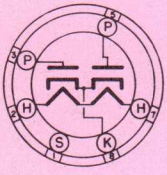

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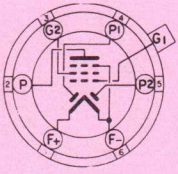

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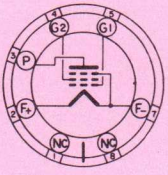

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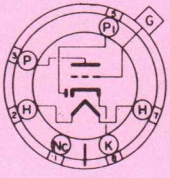

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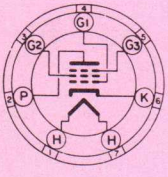

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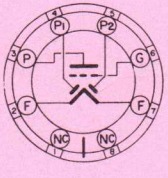

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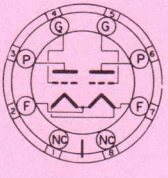

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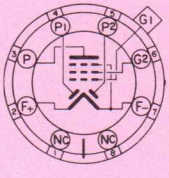

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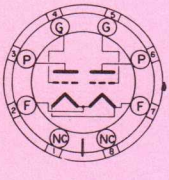

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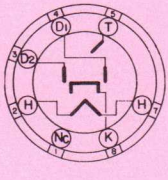

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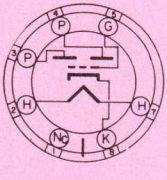

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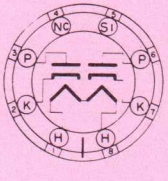

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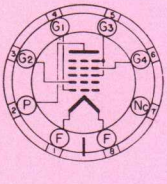

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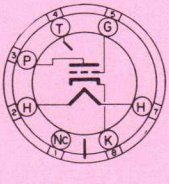

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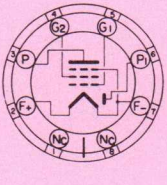

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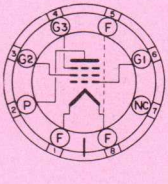

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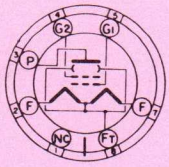

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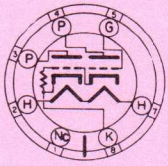

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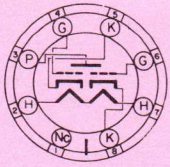

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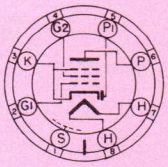

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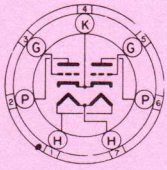

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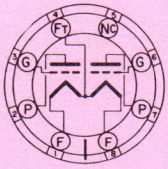

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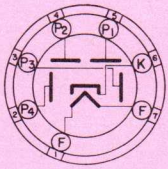

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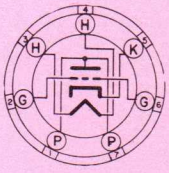

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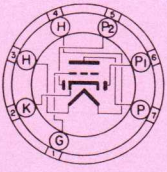

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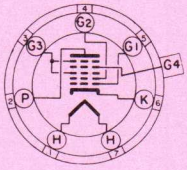

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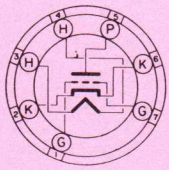

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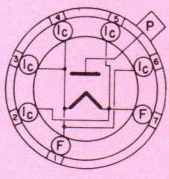

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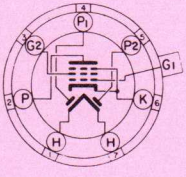

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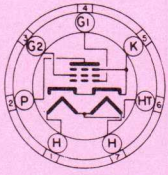

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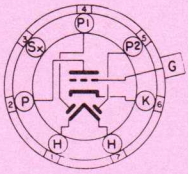

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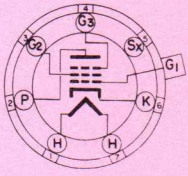

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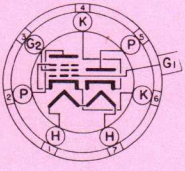

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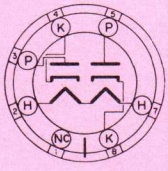

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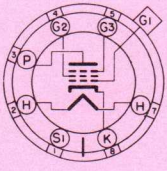

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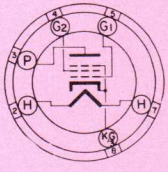

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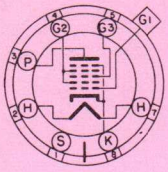

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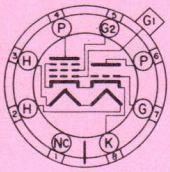

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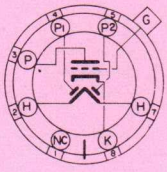

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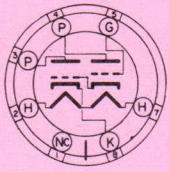

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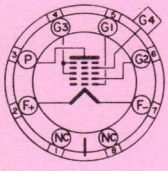

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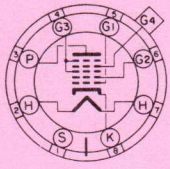

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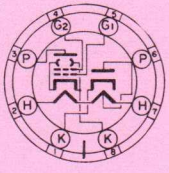

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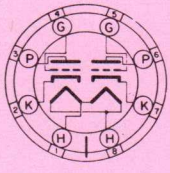

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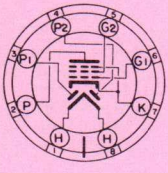

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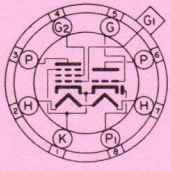

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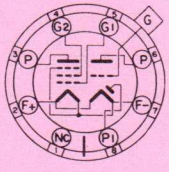

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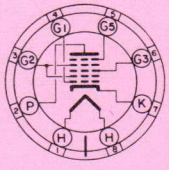

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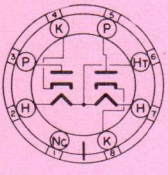

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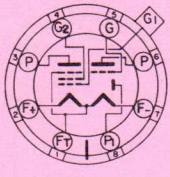

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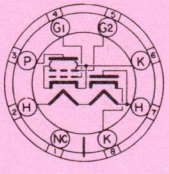

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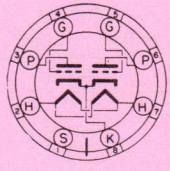

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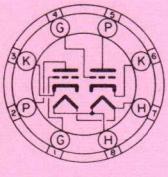

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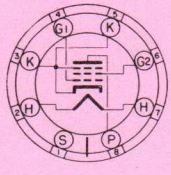

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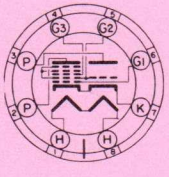

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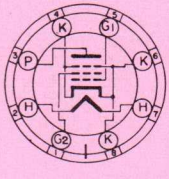

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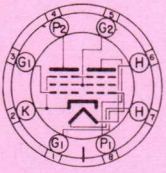

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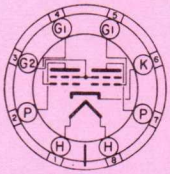

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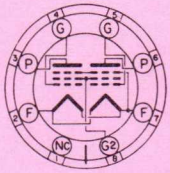

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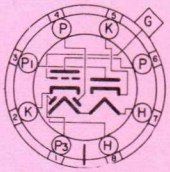

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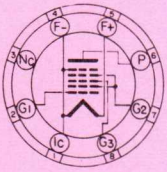

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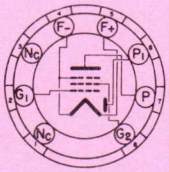

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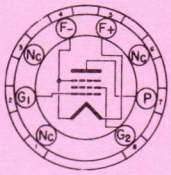

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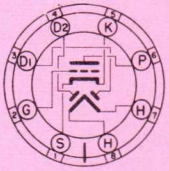

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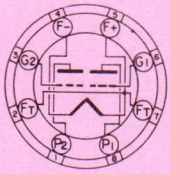

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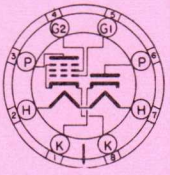

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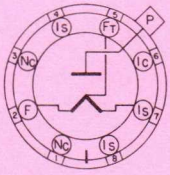

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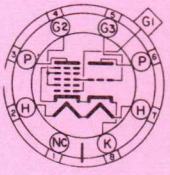

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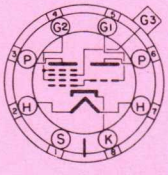

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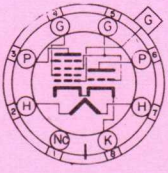

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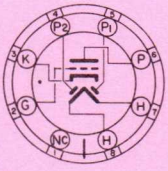

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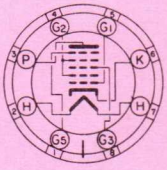

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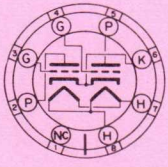

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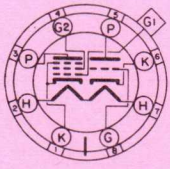

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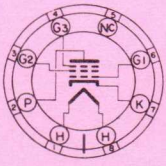

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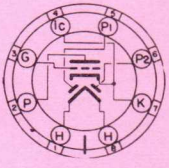

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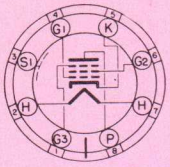

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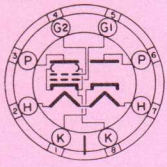

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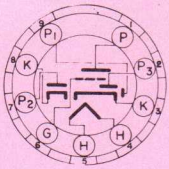

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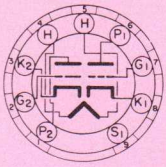

9AJ

RATING SYSTEMS FOR ELECTRON DEVICES

A THE CONDITIONS UNDER WHICH AN ELECTRON TUBE MAY BE OPERATED ARE LIMITED BY THE FUNDAMENTAL CAPABILITIES OF THE TUBE ITSELF. PHYSICAL LIMITATIONS EXIST, FOR EXAMPLE, IN THE PERMISSIBLE TEMPERATURES AT WHICH THE VARIOUS ELECTRODES MAY BE OPERATED, IN THE AMOUNT OF CURRENT WHICH CAN BE EMITTED BY THE CATHODE, AND IN THE VOLTAGE GRADIENTS WHICH MAY BE PERMITTED BETWEEN THE VARIOUS TUBE ELEMENTS.

MAXIMUM TUBE RATINGS HAVE BEEN ESTABLISHED TO DEFINE THESE VARIOUS PHYSICAL LIMITATIONS OF THE TUBE IN TERMS OF READILY MEASURABLE QUANTITIES. THE NUMERICAL QUANTITIES PRESENTED AS MAXIMUM RATINGS INDICATE THE LIMITING OPERATING VALUES REQUIRED TO ASSURE SATISFACTORY TUBE LIFE AND PERFORMANCE.

BEFORE THE VALUE OF ANY RATING CAN BECOME MEANINGFUL, THE RATING SYSTEM ON WHICH THE RATING IS BASED MUST BE SPECIFIED. THE SYSTEM MUST DEFINE THE INTERPRETATION REQUIRED OF THE NUMERICAL VALUES AND INDICATE THE PROCEDURE NECESSARY TO DETERMINE WHETHER OR NOT A TUBE IS OPERATING WITHIN ITS RATING.

DEFINITION OF RATING SYSTEMS

DESIGN-CENTER RATING SYSTEM

B DESIGN-CENTER RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER NORMAL CONDITIONS.

THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE IN AVERAGE APPLICATIONS, TAKING RESPONSIBILITY FOR NORMAL CHANGES IN OPERATING CONDITIONS DUE TO RATED SUPPLY VOLTAGE VARIATION; EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, ENVIRONMENTAL CONDITIONS, AND VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY NO DESIGN-CENTER VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE IN EQUIPMENT OPERATING AT THE STATED NORMAL SUPPLY VOLTAGE.*

*FOR AN AC POWER SOURCE, 117 VOLT PLUS OR MINUS 10% IS ACCEPTED USA PRACTICE.

ABSOLUTE-MAXIMUM RATING SYSTEM

C ABSOLUTE-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO ANY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS.

THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING NO RESPONSIBILITY FOR EQUIPMENT VARIATIONS, ENVIRONMENT VARIATIONS, AND THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS.

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THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO ABSOLUTE-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH ANY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, ENVIRONMENTAL CONDITIONS, AND VARIATIONS IN DEVICE CHARACTERISTICS.

DESIGN-MAXIMUM RATING SYSTEM

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS.

THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS.

THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

DISCUSSION

THE DESIGN-CENTER SYSTEM ASSIGNS THE ENTIRE RESPONSIBILITY FOR DEVICE USAGE TO THE DEVICE MANUFACTURER; HE MUST ACCEPT FULL RESPONSIBILITY FOR THE EFFECTS OF VARIATIONS IN DEVICE CHARACTERISTICS, AND VARIATIONS IN ANY POSSIBLE CIRCUIT OPERATING CONDITIONS. THE ABSOLUTE-MAXIMUM SYSTEM ASSIGNS THIS ENTIRE RESPONSIBILITY TO THE CIRCUIT DESIGNER. THE DESIGN-MAXIMUM SYSTEM EFFECTS A MORE LOGICAL DIVISION OF THESE BASIC RESPONSIBILITIES. IT ASSIGNS THE EFFECT OF VARIATIONS IN DEVICE CHARACTERISTICS TO THE DEVICE MANUFACTURER AND THE EFFECTS OF VARIATIONS IN THE CIRCUIT OPERATING CONDITIONS TO THE EQUIPMENT MANUFACTURER.

FOR AN EQUIPMENT DESIGNER TO DETERMINE WHETHER HE IS OPERATING WITHIN RATING UNDER ANY OF THE ABOVE SYSTEMS HE MUST ACCOMPLISH THE FOLLOWING:

DESIGN-CENTER SYSTEM

1. SELECT OR OTHERWISE OBTAIN A BOGEY DEVICE.
2. OPERATE EQUIPMENT USING BOGEY DEVICE AT STATED NORMAL SUPPLY VOLTAGE.
3. SELECT ALL COMPONENTS ASSOCIATED WITH DEVICE FOR AVERAGE VALUES, AND SET ALL CONTROLS FOR NORMAL SETTINGS.
4. MEASURE ALL DEVICE CURRENTS, VOLTAGE, DISSIPATIONS, ETC., AND COMPARE WITH RATINGS. IF NO RATING IS EXCEEDED THE DEVICE IS BEING OPERATED WITHIN RATING WHERE THE EQUIPMENT IS NOT SUBJECTED TO SUPPLY VOLTAGE VARIATIONS IN EXCESS OF STANDARD ACCEPTED PRACTICE.

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ABSOLUTE-MAXIMUM SYSTEM

1. ESTABLISH THE WORST PROBABLE OPERATING CONDITIONS FOR THE ITEM (VOLTAGE, CURRENT, DISSIPATION, ETC.,) TO BE RATED. THIS MEANS COMBINING EXTREMES OF SUPPLY VOLTAGE, LIMIT COMPONENTS, EXTREMES OF CONTROL SETTINGS, SIGNAL, AND ENVIRONMENT, AND LIMIT DEVICES IN SUCH A WAY AS TO PRODUCE THE WORST PROBABLE VALUE.
2. UNDER THE ABOVE CONDITIONS MEASURE THE ITEM CONSIDERED AND IF THIS IS WITHIN RATING, THE RATING IS BEING MET.
3. REPEAT THE ABOVE FOR EACH ITEM BEING CONSIDERED.

DESIGN-MAXIMUM SYSTEM

1. ESTABLISH THE WORST PROBABLE OPERATING CONDITIONS FOR THE ITEM TO BE RATED. THIS MEANS COMBINING EXTREMES OF SUPPLY VOLTAGE, LIMIT COMPONENTS, EXTREMES OF CONTROL SETTINGS, SIGNAL, AND ENVIRONMENT SO AS TO PRODUCE THE WORST PROBABLE CONDITIONS.
2. UNDER THE ABOVE CONDITIONS, USING A BOGEY DEVICE MEASURE THE ITEM CONSIDERED AND IF THIS IS WITHIN RATING, THE RATING IS BEING MET.
3. REPEAT THE ABOVE FOR EACH ITEM BEING CONSIDERED.

TO UNDERSTAND THE ABOVE ONE NEED TO UNDERSTAND THE FOLLOWING DEFINITION:

A. BOGEY TUBE:

A BOGEY TUBE IN THE EXACT SENSE WOULD BE A TUBE OF A SPECIFIED TYPE WHICH HAS EACH AND ALL OF ITS CHARACTERISTICS EQUAL TO THE PUBLISHED VALUES. SUCH A TUBE IS EXTREMELY DIFFICULT TO FIND BECAUSE OF THE LARGE NUMBER OF CHARACTERISTICS INVOLVED. FOR PRACTICAL PURPOSES OF APPLICATION, A BOGEY TUBE CAN BE OBTAINED BY CONSIDERING ONLY THOSE CHARACTERISTICS WHICH ARE DIRECTLY RELATED TO THE CLASS OF SERVICE BEING EVALUATED.

B. WORST PROBABLE CONDITIONS:

THE WORST PROBABLE CONDITION IS DIFFERENTIATED FROM THE WORST POSSIBLE CONDITIONS IN THAT SOME EQUIPMENT CAN BE ADJUSTED TO OPERATE SO AS TO BE UNUSABLE. THE PROBABILITY OF OPERATING EQUIPMENT UNDER SUCH CONDITIONS FOR ANY LENGTHY PERIOD OF TIME IS SMALL AND HENCE SHOULD NOT BE CONSIDERED AS WITHIN THE WORST PROBABLE CONDITION, BUT THE WORST POSSIBLE CONDITION.

FOR EXAMPLE A TELEVISION SET, CAN BE MISADJUSTED SO AS TO PRODUCE NO PICTURE AND AT THIS TIME EXTREMES OF VOLTAGE OR DISSIPATION MAY BE REACHED, WHICH COULD BE CALLED A WORST POSSIBLE CONDITION. THIS CAN BE CONTRASTED TO A CONDITION WHEREIN THE SET IS MISADJUSTED BUT A USABLE PICTURE IS STILL OBTAINED. SUCH A CONDITION WOULD BE CALLED THE WORST PROBABLE CONDITION.

THE ABOVE DEFINITIONS WERE TAKEN FROM A PUBLICATION (J5-C3) OF THE JOINT ELECTRON TUBE ENGINEERING COUNCIL. THIS PUBLICATION, INCLUDES A MORE EXTENSIVE WRITE UP FOR THOSE WISHING TO FURTHER STUDY THE SUBJECT OF MEANING AND APPLICATION OF THE RATING SYSTEM.

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NOTES ON THE USE OF LIMIT TUBES

TUNG-SOL

At least two occasions arise which make it desirable to obtain limit tubes for one or more characteristics. One is where one is trying to determine the ability of a circuit to operate with limit tubes; the other is when one wants to determine whether tubes are being operated within absolute-maximum ratings in a circuit.

However limit tubes are difficult to obtain even for one characteristic. And very often such tubes are unstable or have other characteristics out of limits. Therefore we believe an alternate procedure is much to be preferred. This consists of obtaining a number of tubes having known values for the characteristics of importance: preferably the range on these values should be fairly wide. Then a graph can be plotted which will show the correlation between the performance in the circuit in question and the known characteristics. Extrapolation of this graph will then lead to information on the performance of the circuit when limit tubes are installed in it.

An alternate method has three advantages over the limit tube method. First, it is easier to obtain tubes with the required known characteristics. Second, these tubes are generally more stable and may well be used many times for the purpose. Third, since it is not necessary that the tubes have limit characteristics, all characteristics on the tubes can be measured and used to determine the effect of any characteristic on circuit performance.

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TYPES BY CLASSIFICATION

RF - IF AMPLIFIERS

GENERAL PURPOSE

APPLICATION	HEATER VOLTAGES						150 MILLIAMPERE HEATER CURRENT		300 MILLIAMPERE HEATER CURRENT		600 MILLIAMPERE HEATER CURRENT	
	1.4	6.3				12.6						
TRIODES	4BQ7A●●● 4BZ7●●● 5BK7A● 5J6● 26 957* 958*	6AD4 6BC4 6C4 6J4 6K4 6N4	7A4 12H4 37 76 955 5718	5719 5744 9002 XXL		12H4 10DA7	6AD4 6C4 12H4 955 5718 9002		7A4 12H4 37 76			
DOUBLE TRIODES	3A5 3B7/1291 4BX8●●● 5BQ7A⊙	2C51 5BZ7⊙ 6AH7GT 6BK7 6BK7A	6BK7B 6BF7 6BQ7A 6BZ7 6BX8	6DA7 6J6 6J6A 7AF7 7F7	7F8 7N7 5670	12AH7GT 14F8 12AT7 19J6✱✱ 14AF7/XXD 14F7	12AH7GT 14F8 12AT7 19J6 14AF7/XXD 14F7		2B5 7AF7 2C51 7F7 6AH7GT 7F8 6BF7 12AT7		4BQ7A 4BX8 4BZ7 5BK7A 5J6	
TETRODES	24A✱	7G8 36							7G8 36			
PENTODES	1AD4 1AD5 1AE4 1AF4 1AH4* 1L4 1LC5 1LN5 1N5GT 1P5GT 1T4 1U4 1W5* 3AU6 ◆ 3BA6 ◆ 3BC5 ◆ 3CB6 ◆ 3CE5 ◆ 3CF6 ◆ 3DT6 ◆ 3E6 4CE5●●● 959*	4AU6●●● 4DT6●●● 6AG5 6AH6 6AJ5 6AK5 6AS6 6AU6 6AU6A 6BA6 6BC5 6BD6 6BH6 6BJ6 6C6 6CB6 6CB6A 6CE5 6CF6 6CG6 6D6 6DT6 6J7	6J7G 6J7GT 6K7 6K7G 6K7GT 6S7 6S7G 6SD7GT 6SG7 6SH7 6SH7GT 6SJ7 6SJ7GT 6SK7 6SK7GT 6SS7 6SS7GT	6U7G 7A7 7AD7 7AG7 7B7 7C7 7G7 7H7 7L7 7V7 39/44 77 78	954 956 5654 5686 5693 5749 5784 5840 5899 9001 9003	12AU6 12H7 12AW6 26CG6** 12BA6 12BD6 12B7 12CN5 12J7GT 12K7GT 12SG7 12SH7 12SH7GT 12SJ7 12SJ7GT 12SK7 12SK7GT 14A7/12B7 14C7	6BH6 12SG7 6BJ6 12SH7 6S7 12SH7GT 6S7G 12SJ7 6SS7 12SJ7GT 6SS7GT 12SK7 7AG7 12SK7GT 7B7 14A7/12B7 7C7 14C7 12AU6 14H7 12AW6 954 12B7 956 12BA6 5840 12BD6 9001 12J7GT 9003 12K7GT		6AU6 6SH7GT 6AU6A 6SJ7 6BA6 6SJ7GT 6BD6 6SK7 6C6 6SK7GT 6CB6 6U7G 6CB6A 7A7 6CG6 7H7 6CE5 7L7 6CF6 39/44 6D6 77 6J7 78 6J7G 5693 6J7GT 6K7 6K7G 6K7GT 6SD7GT 6SG7 6SH7		3AU6 3BA6 3BC5 3CB6 3CE5 3CF6 3DT6	

TELEVISION

TRIODES	2AF4●● 2AF4A●● 2BN4△ 2T4●● 3AF4A‡ 3BN4■	6AB4 6AF4 6AF4A 6AJ4	6AM4 6AN4 6BN4	6T4 12A4		12A4	6AB4		12A4		2AF4 2AF4A 2T4	12A4
DOUBLE TRIODES	4BC8●●● 4BS8●●● 4CX7●●● 5BK7A● 5J6●	6BC8 6BK7 6BK7A 6BS8 6CH7	6CX7 6J6 6J6A 6SN7GTA 6SN7GTB	12AT7		12AT7 19J6✱✱ 12SN7GTA	12AT7 19J6		12AT7 12SN7GTA		4BS8 4CX7 5BK7A 5J6	6SN7GTA 6SN7GTB
PENTODES	3AU6 ◆ 3BC5 ◆ 3BZ6 ◆ 3CB6 ◆ 4BC5●●●	6AB7 6AC7 6AG5 6AK5	6AS6 6AU6 6AU6A 6BC5	6BH6 6BZ6 6CB6 6CL6 6DB6 6DC6 6DE6 12BV7		12AU6 12BV7	6BH6 12AU6		6AG5 6DB6 6AU6 6DC6 6AU6A 6DE6 6BC5 12BV7 6BZ6 6CB6		12BV7	
HEPTODE	3BY6 ◆ 3CS6 ◆	6BY6 6CS6				12CS6	12CS6		6BY6 6CS6		3BY6 3CS6	

△ 2.3 V. ‡ 3.2 V. * 1.25 V. ✱✱ 18.9 V. ** 26.5 V. ●● 2.35 V. ● 4,7 V. ●●● 4.2 V. ✱ 2.5 V. ◆ 3.15 V. ■ 2.8 V. ⊙ 5,6 V.

TUNG-SOL

TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. NOVEMBER 1, 1956 PLATE #809

TYPES BY CLASSIFICATION

APPLICATION		HEATER VOLTAGES						150 MILLIAMPERE HEATER CURRENT		300 MILLIAMPERE HEATER CURRENT			600 MILLIAMPERE HEATER CURRENT
		1.4	5.0	6.3			12.6						
AF AMPLIFIERS	TRIODES	1C3 1G4GT 1LE3 26 5676*		6C5 6C5GT 6F5 6F5GT 6J5 6J5GT	6K5GT 6L5G 6P5GT 6SF5 6SF5GT 7A4	7B4 7E5 12H4 37 56 76	12G4 12H4 12J5 12J5GT 12SF5 12SF5GT	6L5G 12G4 12H4 12J5 12J5GT 12SF5 12SF5GT		6C5 6C5GT 6F5 6F5GT 6J5	6J5GT 6K5G 6K5GT 6P5GT 6SF5 6SF5GT	7A4 7B4 12H4 37 56 76	
	DOUBLE TRIODES	3A5 6AX7●● 7AU7*		4BZ8‡ 6A6 6AX7 6AS6 6BZ8 6C8G 6F8G 6N7 6N7G 6SC7 6SL7GT 6SN7GT	6SN7GTA 6SN7GTB 6Y7G 7AF7 7AU7# 7F7 8CG7■ 8CM7■ 8CS7■ 8SN7GTB■ 9AU7** 12AU7	12AU7A 12AV7 12AX7 12AY7 12AZ7 12B7 79 5687 5751 5814	12AD7 12AU7 12AU7A 12AV7 12AX7 12AY7 12AZ7 12BZ7 12SC7 12SL7GT 12SN7GT 12SN7GTA	14AF7 14F7 14N7 19C8▲ 5687 5751 5814	12AU7 12AU7A 12AV7 12AX7 12AY7 12BZ7 12SC7 12SL7GT 14AF7 14F7 19C8	6AX7 6C8G 6SC7 6SL7GT 7AU7 7F7 12AU7 12AU7A 12AV7 12AX7	12AY7 12BZ7 12SN7GT 12SN7GTA 14N7	4BZ8 6AX7 6SN7GTB 7AU7
	TETRODES	24A◆		36						36			
	PENTODES	1AD4* 1AF4 1L4 1LG5 1U4 3AU6●● 4AU6‡ 959*		6AS6 6AU6 6AU6A 6BH6 6C6 6J7 6J7G 6J7GT 6SG7 6SH7	6SH7GT 6SJ7 6SJ7GT 6W6GT 7AG7 7AH7 7AK7 7C7 7G7	7L7 7V7 7W7 12BY7 12BY7A 77 717A 954 956 6550 9001 9003	12AU6 12BY7 12BY7A 12J7GT 12SH7 12SH7GT 12SJ7 12SJ7GT 12W6GT 14C7 14V7		6BH6 6W7G 7AG7 7AH7 7E5 12AU6 12J7GT 12SH7 12SH7GT 12SJ7	12SJ7GT 14C7 954 956 9001 9003	6AU6 6AU6A 6C6 6J7 6J7G 6J7GT 6SG7 6SH7 6SH7GT 6SJ7 6SJ7GT	7C7 7L7 7W7 12BY7 12BY7A 77	12BY7 12BY7A 12W6GT
INDICATORS	TUNING INDICATORS			6AB5/6N5 6AD6G 6AF6G 6AL7GT 6E5 6G5 6T5 6U5/6G5				6AL7GT		6E5 6G5 6T5 6U5/6G5			
	INDICATOR CONTROL			6AE6G				6AE6G					

* 1.25 V. ▲ 18.9 V. • 3.5 V. # 7.0 V. ●● 3.15 V. ◆ 2.5 V. ‡ 4.2 V. ■ 8.4 V. ** 9.4 V.

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TYPES BY CLASSIFICATION

TUNG-SOL

APPLICATION			HEATER VOLTAGES 1.4	2.5	6.3	12.6	18.9	25	35	50	150 MILLI-AMPERE HEATER CURRENT	300 MILLI-AMPERE HEATER CURRENT	600 MILLI-AMPERE HEATER CURRENT
POWER AMPLIFIERS	GENERAL PURPOSE	TRIODES		2A3 45	6A3 6C4 6A5G 50† 6AC5GT 6AJ4 6B4G			25AC5GT				25AC5GT	
		DOUBLE TRIODES	1G6GT 3C6/XXB	53 3C6/XXB#	6A6 6N7GT 6AS7G 79 6AS7GA 6N7								
		TETRODES			6005	12K5		28D7▲					
		PENTODES	1A5GT 3D6 1AC5 3LE4 1C5GT 3LF4 1LA4 3V4 1LB4 3Q4 1S4 3S4 1V5* 5672• 3A4	2A5 3A4# 3LE4# 3Q4 3S4# 3V4# 47	2E22 6G6G 6AG7 6F6GT 6AK6 6K6GT 6AN5 7B5 6AR5 38 6CL6 41 6F6 42 6F6G 89 6F6GT 5686			25BK5 43			6AK6 6G6G	25A6 25A6GT 25BK5 25B6G 38 43	
		BEAM PENTODES	1Q5G 1Q5GT 1T5GT 3B5GT 3E5 3LF4 3Q5GT	3E5# 3LF4# 3Q5GT# 5A6 5AQ5•• 5V6GT••	6AQ5 6U6GT 6AQ5A 6V5GT 6AR6 6V6 6AS5 6V6GT 6BK5 6V6GTA 6CA5 6W6GT 6CB5 6Y6G 6CS5 6Y6GA 6CU5 7A5 6DG6GT 7C5 6L6 5881 6L6G 5902 6L6GA 5932 6L6GB	12A6 12AB5 12AQ5 12C5 12CA5 12CS5 12CU5 12BK5 12L6GT 12V6GT 12W6GT 14C5 1625	17C5 ◆ 17CU5 ◆	25C5 25C6G 25C6GA 25CA5 25F5 25L6 25L6GT 25W6GT 26A7GT▲	35L6GT 35A5 35B5 35C5	50A5 50B5 50BK5 50C5 50C6G 50C6GA 50L6GT	12A6 50L6GT 35A5 50BK5 35C5 35C6GT 50B5 50C5 50C6G	25C6G 25C6GA 25L6 25L6GT 25W6GT	5AQ5 5V6GT 12BK5 12C5 12CA5 12CS5 12CU5 12L6GT 12W6GT
		DIRECT COUPLED			6B5 6N6G			25N6GT				25N6G	
	TELEVISION HORIZONTAL DEFLECTION	BEAM PENTODES			6AU5GT 6CD6G 6AV5GA 6CB5 6AV5GT 6CB5A 6BD5GT 6CL5 6BG6G 6CU6 6BQ6G 6DB5 6BQ6GA 6DN6 6BQ6GT 6DQ6 6BQ6GTA 6DQ6A 6BQ6GTB 807 6BU5	12AV5GA 12BQ6GA 12BQ6GT 12BQ6GTB 12CR5 12CU6 12DQ6 12DQ6A	17AV/5GA ◆ 17DQ6 ◆ 19BG6G 19BG/6GA	18A5■ 25AV5GT 25AV5GA 25BQ6GA 25BQ6GT 25BQ6GTB 25CD6G 25CD6GA 25CD6GB 25CU6 25DN6 25DQ6	35CD6GA		6BU5	19BG6G 19BG6GA 25AV5GA 25AV5GT 25BQ6GA 25BQ6GT 25BQ6GTB 25DQ6	12AV5GA 12BQ6GA 12BQ6GT 12BQ6GTB 12CU6 12DQ6 25CD6GA 25CD6GB 25CU6 25DN6
	TELEVISION VERTICAL DEFLECTION	TRIODES OR TRIODE CONNECTED PENTODES			6AR5 6SN7GT 6BD4A 6SN7GTA 6BF5 6W6GT 6BL7GT 7AU7• 6CM6 12A4 6CM7 12AU7 6CS7 12B4A 6K6GT 12BH7 6S4A 12BH7A	12AU7 12A4 12B4A 12BH7 12BH7A 12CM6 12R5 12SN7GT 12W6GT	17R5 ◆				12AU7	7AU7 12A4 12AU7 12B4A 12BH7 12BH7A 12SN7GT	6BD4A 12W6GT 6CS7 6S4A 7AU7 12B4A 12BH7A 12R5

◆ 16.8 V. * 1.25 V. # 2.8 V. † 7.5 V. ▲ 26.5 V. • 3.5 & 7.0 V. •• 4.7 V. ■ 18.5 V.

TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. NOVEMBER 1, 1956 PLATE #4810

MULTI-FUNCTION TUBES

APPLICATION	HEATER VOLTAGES									150 MILLI-AMPERE HEATER CURRENT	300 MILLI-AMPERE HEATER CURRENT	600 MILLI-AMPERE HEATER CURRENT
	1.4	6.3			12.6	25	35	70	117			
GATED BEAM DEFLECTION	3BN6•	6BN6			12BN6					12BN6	6BN6	3BN6
DIODE TRIODES	1H5G 1H5GT 1LH4											
DOUBLE-DIODE TRIODES	3AV6•	6AQ6 6AQ7GT 6AT6 6AV6 6B6G 6B6GA 6BF6 6BJ8 6BK6 6BN8 6BT6	6BU6 6BV8 6CN7• 6Q7 6Q7G 6Q7GT 6R7 6R7G 6R7GT 6SQ7 6SQ7GT	6SR7 6SR7GT 6ST7 7B6 75 7C6 85 7E6 7K7 7X7 8CN7•• 12BR7	8BN8•• 12SR7 12AT6 12SR7GT 12AV6 14B6 12BF6 14E6 12BK6 14X7 12BR7 12BT6 12BU6 12Q7GT 12SQ7 12SQ7GT	26BK6▲				6AQ6 12BU6 6ST7 12Q7GT 7C6 12SQ7 12AT6 12SQ7GT 12AV6 12SR7 12BF6 12SR7GT 12BK6 12SW7 12BT6 14B6 14E6 14X7	6AQ7GT 6Q7G 7B6 6AT6 6Q7GT 7E6 6AV6 6R7 7K7 6BF6 6R7GT 7X7 6BK6 6SQ7 75 6BT6 6SQ7GT 85 6BU6 6SR7 6CN7 6SR7G 6Q7	3AV6 6BJ8 6CN7
TRIPLE-DIODE TRIODES	5T8 ◆	6R8 6S8GT	6T8 6T8A 6V8		12S8GT.	19C8## 19T8## 19V8##				12S8GT 19T8 19C8 19V8	6S8GT	5T8
DIODE PENTODES	1AJ5• 1LD5 1S5 1T6• 1U5 5AM8 ◆ 5AS8 ◆	6AM8 6AM8A 6AS8 6BY8 6CR6 6SF7 6SF7GT	6SV7		12CR6 12SF7GT					12SF7GT	6CR6 6SF7 6SV7	5AM8 5AS8 6BY8
DIODE POWER PENTODES	1N6GT											
DOUBLE-DIODE PENTODES	5BT8 ◆	6B7 6B8 6B8G	6B8GT 6BT8 7E7	7R7	12C8 14R7					12C8 14R7	6B7 6B8GT 6B8 7E7 6B8G 7R7	5BT8
TRIODE PENTODES	1V6• 5AN8 ◆ 5AT8 ◆ 5AV8 ◆ 5B8 ◆ 5CM8 ◆ 5U8 ◆ 5X8 ◆	5BR8 ◆ 5CG8 ◆ 5BE8 ◆ 6AD7G 6AN8 6AN8A 6AT8 6AU8 6AW8 6AW8A	6AX8 6AZ8 6BA8 6BA8A 6BE8 6BH8 6BR8 6CG8 6CG8A 6CH8	6CM8 6CR8 6CS8 6F7 6F7G 6U8 6U8A 6X8 6X8A	19X8##	8AU8•• 8AW8A•• 8BA8A•• 8BH8••• 9U8A••• 15A8				19X8	6F7 6F7G 9U8A	5AN8 5X8 5AT8 6AU8 5B8 6AW8 5BE8 6AW8A 5BR8 6BA8 5CG8 6BH8 5CM8 15A8 5U8
DIODE TRIODE PENTODES	1D8GT											
HALF-WAVE RECTIFIERS BEAM PENTODES							32L7GT†	70A7GT 70L7GT	117L7/ M7GT 117N7GT 117P7GT	70A7GT 70L7GT	32L7GT	
TRIPLE DIODES			6BC7	6BJ7								

• 1.25 V. ## 18.9 V. ▲ 26.5 V. † 32.5 V. ◆ 4.7 V. • 3.15 V. •• 8.4 V. ••• 9.45 V.

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TYPES BY CLASSIFICATION

APPLICATION			HEATER VOLTAGES							150 MILLI-AMPERE HEATER CURRENT	300 MILLI-AMPERE HEATER CURRENT	600 MILLI-AMPERE HEATER CURRENT
			1.4	5.0	6.3	12.6	25	35	50	117			
CONVERTERS	GENERAL PURPOSE	PENTAGRID HEPTODE OCTODE	1A7GT 1LA6 1B7GT 1LC6 1E8 1R5 1L6 1U6	3BE6●	6A7 6SA7 6A8 6SA7GT 6A8G 6SB7Y 6A8GT 7A8 6BA7 7B8 6BE6 7Q7 6CS6 5750 6D8G	12A8GT 12SA7GT 12BA7 14B8 12BE6 14Q7 12SA7					6D8G 14B8 7A8 14Q7 12A8GT 12BA7 12BE6 12SA7GT	6A7 6SA7 6A8 6SA7GT 6A8G 6SB7Y 6A8GT 7B8 6BA7 7Q7 6BE6 6CS6	3BE6
		TRIODE HEXODES TRIODE HEPTODES			6J8G 7D7 6K8 7J7 6K8G 7S7 6K8GT	12K8 12K8GT 14J7 14S7					7D7 14J7 12K8 14S7 12K8GT	6J8G 7J7 6K8 7S7 6K8G 6K8GT	
		MIXERS			6AS6 5725 6L7 6L7G							6L7 6L7G	
	TELEVISION	DOUBLE TRIODE MIXERS	5J6●●		6BF7 12AT7 6CG7 12AV7 6J6 12AZ7	12AT7 12AZ7 12AV7 14F8					12AT7 14F8	12AT7 6BF7	5J6 6CG7
		PENTODE MIXERS		3BC5●	6AG5 6BC5 6AK5 6CB6							6AG5 6CB6 6BC5	3BC5
		TRIODE PENTODE MIXERS AND OSCILLATORS		5AT8●● 5B8●● 5U8●● 5X8●●	6AT8 6U8 6V8 6X8								5AT8 5X8 5B8 5U8
RECTIFIERS	GENERAL PURPOSE — HIGH VACUUM — HALF-WAVE	DIODES	1AX2 3A2● 3A3●		1-V 6BC7 81† 5641	12Z3	25W4GT 26Z5W	35W4 35Y4 35Z3 35Z4GT 35Z5GT	45Z3* 45Z5GT*	117Z3 117Z4GT	35Y4 35Z3 35Z4GT 35Z5GT 45Z5GT	1-V 1Z2 12Z3 25W4GT	
		DOUBLE DIODES — FULL-WAVE		5AS4 5W4GT 5AU4 5X3 5AW4 5X4G 5AZ4 5X4GA 5R4GY 5Y3G 5R4GYA 5Y3GA 5T4 5Y3GT 5U4G 5Y4G 5U4GA 5Y4GA 5U4GB 5Y4GT 5V3 5Z3 5V4G 5Z4 5V4GA 80 5W4G 83V	6AX5GT 6ZY5G 6BW4 7X6 6BY5G 7Y4 6BY5GA 7Z4 6X4 84/6Z4 6X5 5852 6X5GT 5896 6Z5/12Z5	6Z5/12Z5 12BW4 12X4	25Z5 25Z6 25Z6GT 5839▲ 5903▲		50X6GT 50Y6GT 50Y7GT	117Z6GT	50Y6GT 50Y7GT	5AS4 6ZY5G 12X4 25Z5 25Z6 25Z6GT 5896	
		DIODES — DETECTORS	1A3 1R4/ 1294		6V3A 7C4/1203A 9004 9006						1A3 9004 1R4 9006 7C4/1203A		
		DOUBLE DIODES	3AL5●		6AL5 7A6 6H6 6H6GT	12AL5 12H6					7A6 12AL5 12H6	6AL5 6H6 6H6GT	3AL5
		TRIPLE DIODES			6BC7 6BJ7								
	VOLTAGE DOUBLER	DOUBLE DIODE					25Z5 25Z6 25Z6GT		50X6 50Y6GT 50Y7GT	117Z6GT	50X6 50Y6GT 50Y7GT	25Z5 25Z6 25Z6GT	

† 7.5 V. ▲ 26.5 V. * 45 V. ● 3.15 V. ●● 4.7 V.

TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. NOVEMBER 1, 1956 PLATE #1811

APPLICATION				COLD CATHODE	HEATER VOLTAGES 1.4	2.5	6.3	12.6	25	150 MILLIAMPERE HEATER CURRENT	300 MILLIAMPERE HEATER CURRENT	600 MILLIAMPERE HEATER CURRENT
RECTIFIERS	TELEVISION — HIGH VACUUM	HIGH VOLTAGE	DIODES		4B3GT 1X2 1X2A 1X2B 1V2 1Y2 2B3 3C2	2X2 3B2• 879						
		VIDEO DETECTOR	DOUBLE DIODES				6AL5 5726	12AL5		12AL5	6AL5 5726	
		DAMPER SERVICE	DIODES			5V4G••	6AU4GT 6AU4GTA 6AX4GT 6AX6G 6BL4 6BY5G 6M3 6U4GT 6V3A 6W4GT	12AX4GT 12AX4GTA 12D4 17AX4GT ◆ 17H3■	19AU4• 25AX4GT 25W4GT		6BL4 25AX4GT 25W4GT	12AX4GTA 12D4 19AU4
			DIODE CONNECTED				6AS7G			6AS7G		
		DC RESTORER	DOUBLE DIODE				6AL5	12AL5		12AL5	6AL5	
	GENERAL PURPOSE—GAS	HALF WAVE	DIODES	0Y4								
		FULL WAVE	DOUBLE DIODE	0Z4 0Z4G		82 83						
	VOLTAGE REGULATOR		GLOW DISCHARGE DIODE	0A2 0A3/VR-75 0B2 0B3/VR-90 0C3/VR-105 0D3/VR-150								
	CONTROL SERVICE		GAS TRIODE	1C21		2A4G 2B4 885	6D4 6Q5G 884					
			GAS TETRODES				2D21 2050 2051					
			RELAY TUBE	0A5								

• 18.9 V. •• 5.0 V. * 3.15 V. ◆ 16.8 V. ■ 17.5 V.

FOREWORD

The circuit diagrams in the following section have been selected to represent satisfactory commercial practice in the application of receiving tube types. None of the circuits represent an actual commercial piece of equipment but rather a composite of several designs of a particular class. This has been necessary in order to illustrate in one diagram many different circuit possibilities which may not necessarily be economical in one commercial model. It is therefore quite feasible to utilize portions of several circuits to arrive at a design for a particular service.

Wherever possible, actual circuit values are shown with the exception of parallel coil and condenser combinations which should be chosen from commercial components for the frequencies desired. While values of resistances, capacitances, and voltages are furnished, it is most important that reference be made to the individual tube rating sheets to ascertain that maximum and minimum ratings are not exceeded when attempting to combine several of these circuits.

The scope of the diagrams included represents the most popular circuit applications. As a result, a strict adherence to the current "preferred tube types" list has been made wherever possible. In several instances two tube type designations are shown since comparable performance can be expected when interchanging the indicated types.

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4 TUBE PORTABLE SUPERHETERODYNE RECEIVER

TYPICAL CIRCUIT

TUNG-SOL

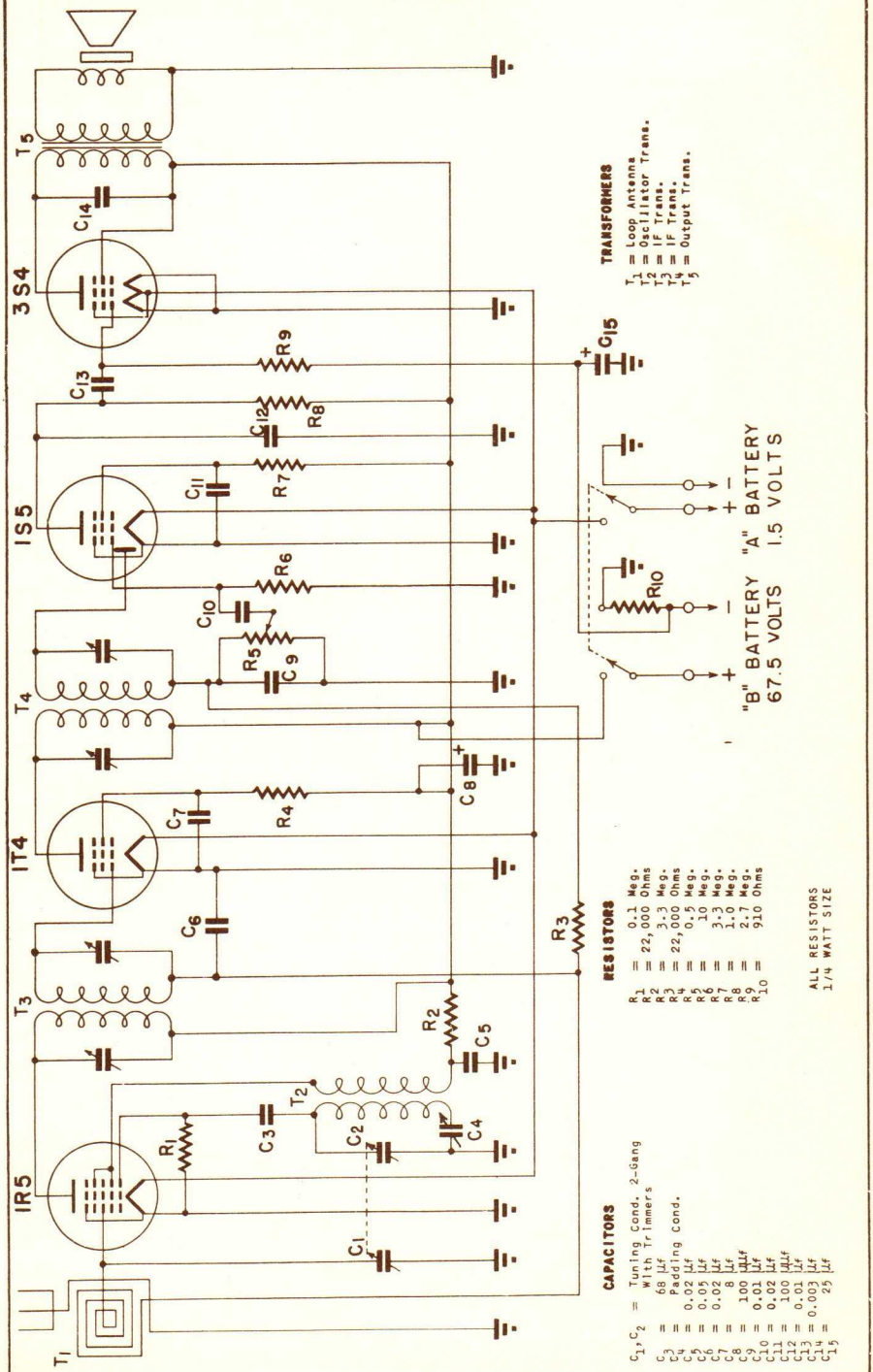

PLATE 1731
SEPT. 2 1946

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5 TUBE AC/DC SUPERHETERODYNE RECEIVER

TYPICAL CIRCUIT

TUNG-SOL

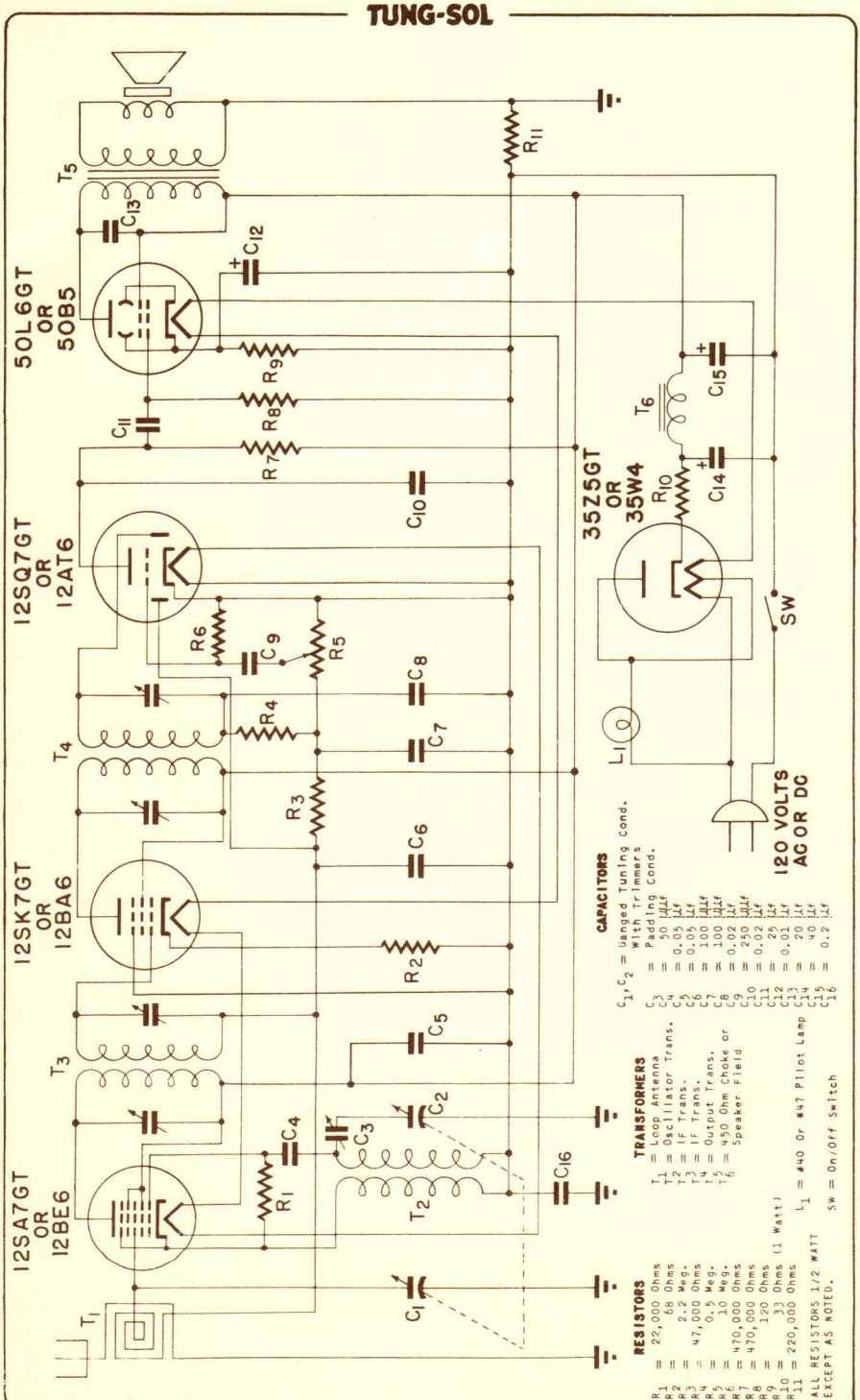

PLATE 1732
SEPT. 2 1946

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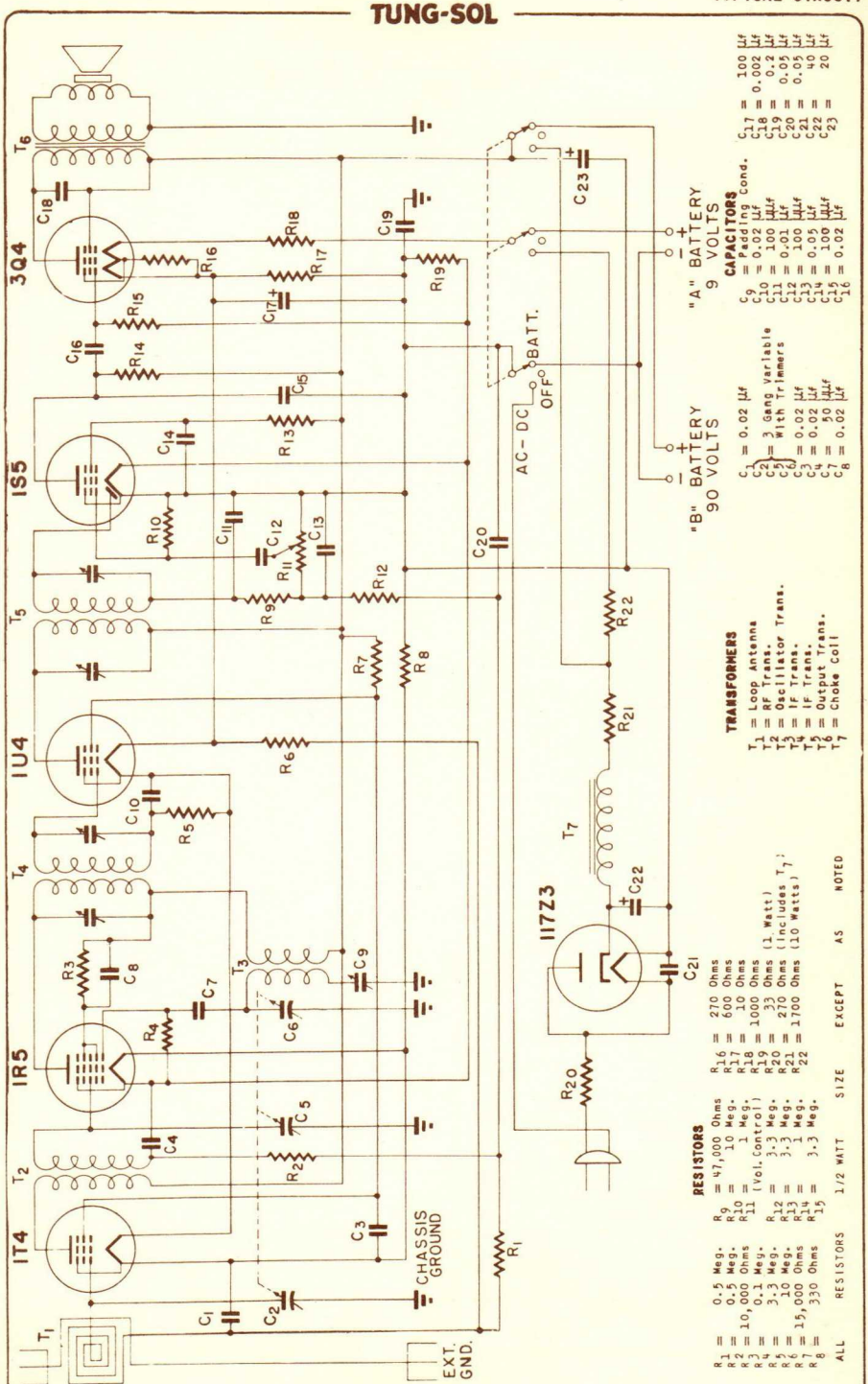
6 TUBE AC/DC BATTERY PORTABLE RECEIVER

TYPICAL CIRCUIT

TUNG-SOL


1T4
1R5
1S5
1U4
3Q4
1T4
1R5
1S5
1U4
3Q4
1T2
1T4
1R5
1S5
1U4
3Q4
1T6
1T5
1T4
1T3
1T2
1T1

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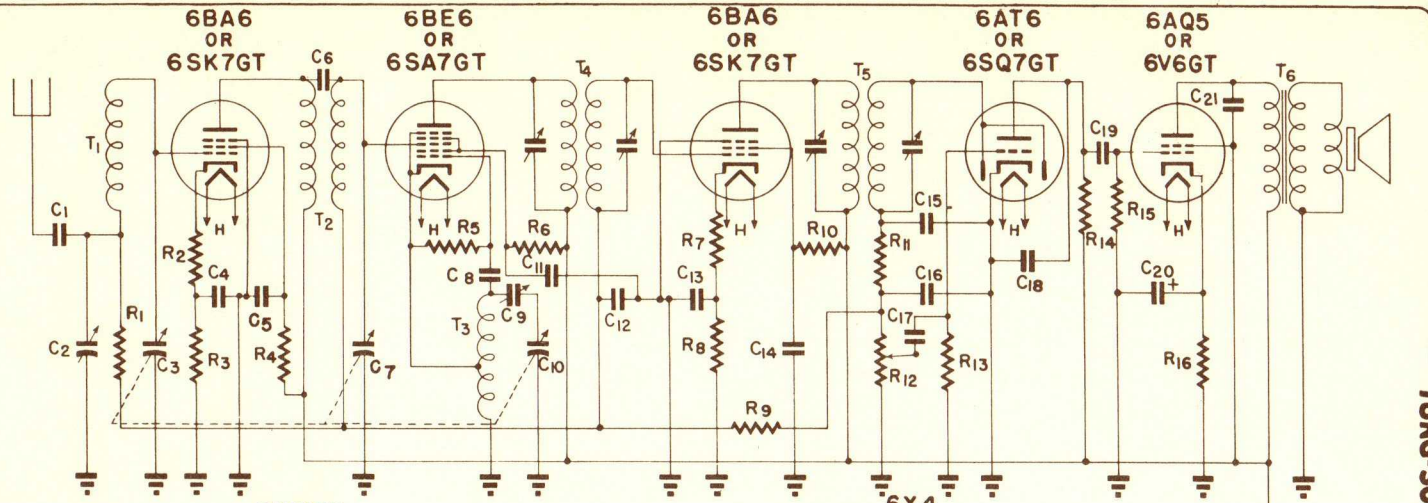
6 TUBE AUTOMOBILE RECEIVER

TYPICAL CIRCUIT — TUNG-SOL



CAPACITORS

C_1	= 0.005 µf	C_9	= Oscillator Padding Cond.	C_{20}	= 25 µf
C_2	= 100 - 500 µµf Antenna Trimmer	C_{11}	= 0.05 µf	C_{21}	= 0.01 µf
C_3, C_7, C_{10}	= 3-Gang Tuning Condenser with Trimmers	C_{12}	= 0.05 µf	C_{22}	= 250 µµf Parallel
		C_{13}	= 0.05 µf		0.5 µf
		C_{14}	= 0.05 µf	C_{23}	= 250 µµf
C_4	= 0.05 µf	C_{15}	= 100 µµf	C_{24}	= 0.5 µf
C_5	= 0.05 µf	C_{16}	= 100 µµf	C_{25}	= 0.004 µf (1600 V.)
C_6	= Capacity Coupling in Transformer T_2	C_{17}	= 0.02 µf	C_{26}	= 0.001 µf
C_8	= 50 µµf	C_{18}	= 100 µµf	C_{27}	= 20 µf
		C_{19}	= 0.05 µf	C_{28}	= 20 µf

RESISTORS

R_1	= 0.22 Meg.	R_{12}	= 0.5 Meg. (Vol. Control)	R_{15}	= 0.47 Meg.
R_2	= 68 Ohms	R_{13}	= 10.0 Meg.	R_{16}	= 220 Ohms (1 Watt)
R_3	= 220 Ohms	R_{14}	= 0.47 Meg.	R_{17}	= 100 Ohms
R_4	= 68,000 Ohms			R_{18}	= 100 Ohms
R_5	= 22,000 Ohms				
R_6	= 22,000 Ohms				
R_7	= 68 Ohms				
R_8	= 220 Ohms				
R_9	= 1.0 Meg.				
R_{10}	= 68,000 Ohms				
R_{11}	= 47,000 Ohms				

ALL RESISTORS 1/2 WATT SIZE EXCEPT AS NOTED

TRANSFORMERS

T_1 = Antenna Coil
T_2 = RF Amp. Trans.
T_3 = Oscillator Coil
T_4 = IF Trans.
T_5 = IF Trans.
T_6 = Output Trans.
T_7 = Power Trans.

CHOKES - COIL

L_1 = RF Choke
L_2 = Speaker Field Coil
L_3 = Filter Choke

V = Vibrator

PLATE 1734
SEPT. 2 1946

ELECTRON TUBE DIVISION — NEWARK, NEW JERSEY, U. S. A.

10 TUBE AC SUPERHETERODYNE RECEIVER

TUNG-SOL

TYPICAL CIRCUIT

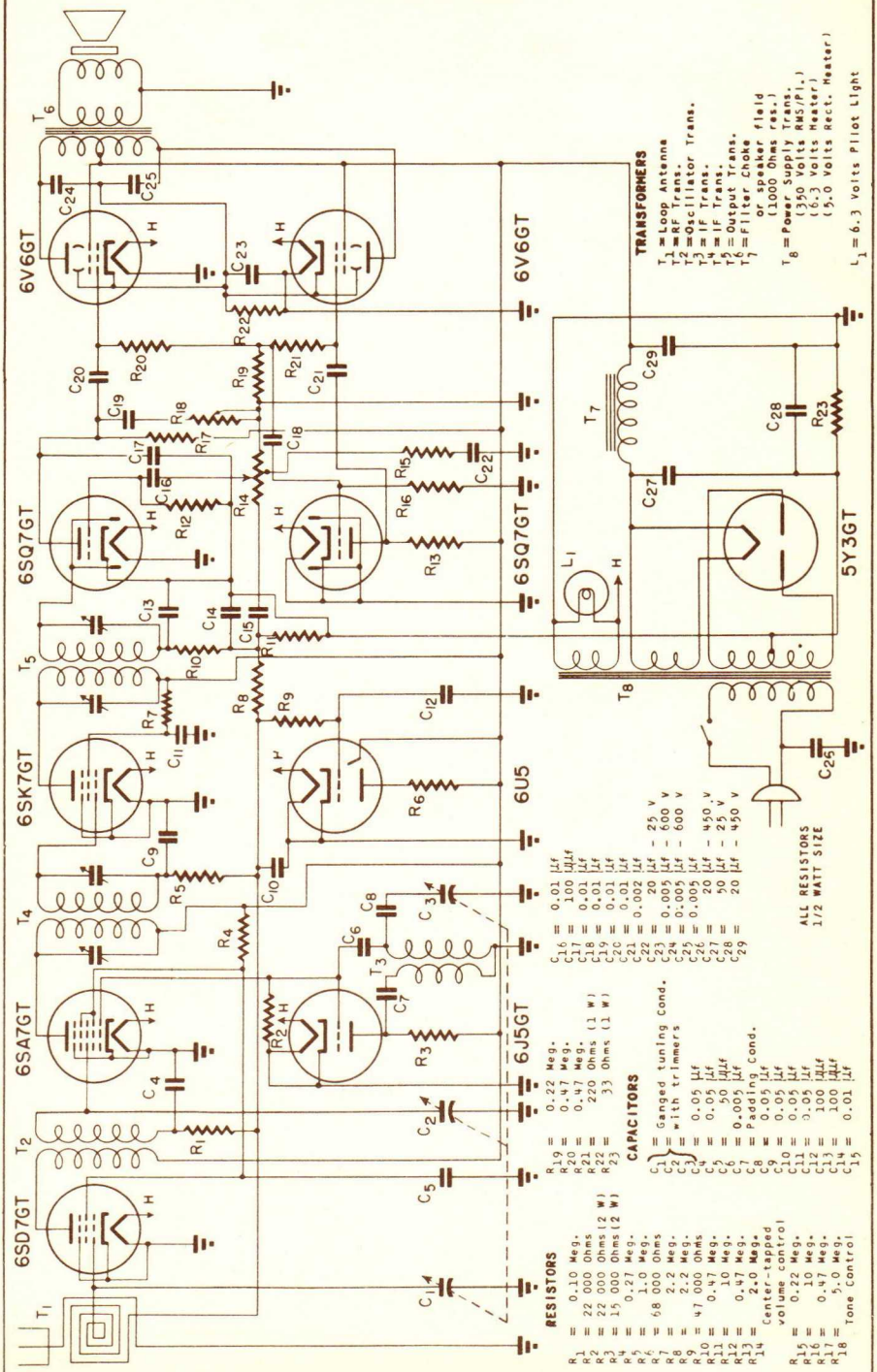


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PLATE 1839
JULY 1, 1947

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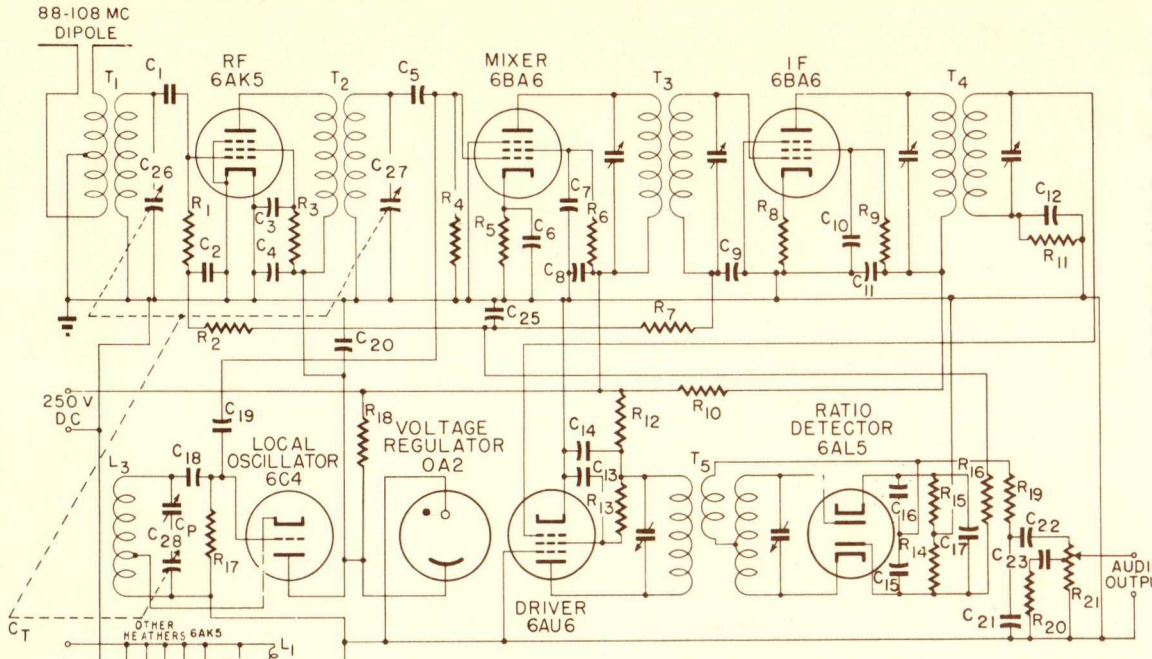

CAPACITORS

C_1, C_5, C_{18},	=	50 µµF
C_2, C_3, C_4, C_{20}, C_{24}	=	500 µµF
C_6 to C_{14} inclusive, C_{21}	=	0.003 µF
C_{15}, C_{16}	=	250 µµF
C_{17}	=	5 µF 50 V.
C_{19}	=	1 µF
C_{22}, C_{23}	=	0.02 µF
C_{25}	=	0.006 µF
C_P	=	OSCILLATOR PADDER
C_{26}, C_{27}, C_{28}	=	3 GANG TUNING CONDENSER

RESISTORS

R_1, R_4, R_{16},	= 1 Meg.
R_2, R_6, R_7	= 0.12 Meg.
R_3	= 15 000 Ohms (1 Watt)
R_5	= 220 Ohms
R_8	= 68 Ohms
R_9, R_{13}	= 33 000 Ohms (1 Watt)
R_{10}, R_{12}	= 1 000 Ohms (1 Watt)
R_{11}	= 0.47 Meg.

RESISTORS

R_{14}, R_{15}	= 15 000 Ohms
R_{17}	= 22 000 Ohms
R_{18}	= 2 500 Ohms (10 Watt)
R_{19}	= 22 000 Ohms
R_{20}	= 10 000 Ohms
R_{21}	= 0.5 Meg. Volume Control Tapped at 0.2 Meg.

ALL RESISTORS ½ WATT SIZE EXCEPT AS NOTED

TRANSFORMERS

T_1	= Antenna Transformer
T_2	= RF Transformer
T_3, T_4	= 10.7 MC IF Transformer
T_5	= 10.7 MC Ratio Detector Transformer
L_1, L_2	= 100 MC RF Chokes
L_3	= Oscillator Coil

TYPICAL CIRCUIT

FREQUENCY MODULATION TUNER

TUNG-SOL

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ELECTRON TUBE DIVISION NEWARK, NEW JERSEY, U.S.A.

PLATE 2096 OCT. 1, 1948

TUNG-SOL

TRANSISTOR ELECTRICAL SYMBOLS

SMALL SIGNAL AND HIGH FREQUENCY PARAMETERS
AT SPECIFIED BIAS

h_{ob}	Common base – output admittance, input AC open-circuited
h_{ib}	Common base – input impedance, output AC short-circuited
h_{rb}	Common base – reverse voltage transfer ratio, input AC open-circuited
h_{fb}	Common base
h_{fe}	Common emitter
h_{fc}	Common collector
	} forward current transfer ratio, output AC short-circuited
h_{oe}, h_i	Examples of other corresponding common emitter symbols
$f_{\alpha b}$	Common base
$f_{\alpha e}$	Common emitter
	} the frequency at which the magnitude of the small-signal short-circuit forward current transfer ratio is 0.707 of its low frequency value.
C_{ob}	Collector to base
C_{oe}	Collector to emitter
	} Capacitance measured across the output terminals with the input AC open-circuited.
r_b	Base spreading resistance
G_e	Common emitter Power Gain (use G_b for common base)
NF	Noise Figure

SWITCHING CHARACTERISTICS
AT SPECIFIED BIAS

t_d	Ohmic delay time
t_r	Rise time
t_s	Storage time
t_f	Fall time
	} These depend on both transistor and circuit parameters
V_{CE} (SAT.)	Saturation voltage at specified I_C and I_B. This is defined only within the collector saturation region.
h_{FE}	Common emitter – static value of short-circuit forward current transfer ratio. $h_{FE} = \frac{I_C}{I_B}$

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TRANSISTOR ELECTRICAL SYMBOLS – CONT'D

SWITCHING CHARACTERISTICS – cont'd
AT SPECIFIED BIAS

h_{FE} (INV)	Inverse h_{FE} (emitter and collector leads switched)
$\overline{h_{fe}}$	Large-signal value of h_{fe}. Large-signal values of parameters are indicated by proper symbol and subscripts, with addition of a bar over the symbol.

DC MEASUREMENTS

I_C, I_E, I_B	DC currents into collector, emitter, or base terminal
V_{CB}, V_{EB}	Voltage collector to base, or emitter to base
V_{CE}	Voltage collector to emitter
V_{BE}	Voltage base to emitter
BV_{CBO}	Breakdown voltage, collector to base junction reverse biased, emitter open-circuited (value of I_C should be specified)
V_{CEO}	Voltage collector to emitter, at zero base current, with the collector junction reverse biased. Specify I_C.
BV_{CEO}	Breakdown voltage, collector to emitter, with base open-circuited. This may be a function of both "m" (the charge carrier multiplication factor) and the h_{fb} of the transistor. Specify I_C.
V_{CER}	Similar to V_{CEO} except a resistor of value "R" between base and emitter
V_{CES}	Similar to V_{CEO} but base shorted to emitter
V_{PT}	Punch-through voltage, collector to base voltage at which the collector space charge layer has widened until it contacts the emitter junction. At voltages above punch-through, $V_{PT} = V_{CB} - V_{EB}$
V_{CCB}	Supply Voltage collector to base
V_{CCE}	Supply voltage collector to emitter
V_{BBE}	Supply voltage base to emitter

NOTE – third subscript may be omitted if no confusion results.

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TRANSISTOR ELECTRICAL SYMBOLS - CONT'D

DC MEASUREMENTS - cont'd

I_{CO}, I_{CBO}	Collector current when collector junction is reverse biased and emitter is DC open-circuited.
I_{EO}, I_{EBO}	Emitter current when emitter junction is reverse biased and collector is DC open-circuited.
I_{CEO}	Collector current with collector junction reverse biased and base open-circuited
I_{CES}	Collector current with collector junction reverse biased and base shorted to emitter.
I_{ECS}	Emitter current with emitter junction reverse biased and base shorted to collector.

NOTE:

SUBSCRIPTS FOR MULTI-ELECTRODE DEVICES ARE DEVELOPED BY NUMERIC ADDITIONS TO THE SUBSCRIPTS. SIMILAR ELECTRODES MAY BE NUMBERED IN SEQUENCE FROM THE INTENDED INPUT TO THE INTENDED OUTPUT ELECTRODES. EXAMPLES: V_{EB2}, V_{1B2}, V_{CB2}, I_{c2}, I_{c2}

NOTE:

REVERSE BIASED JUNCTION MEANS BIASED FOR CURRENT FLOW IN THE HIGH RESISTANCE DIRECTION.

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BULB TEMPERATURE CURVES

One of the most important factors affecting the useful life of electron tubes is the temperature at which certain parts are required to operate. In the past this has been controlled largely by electrode dissipation ratings. Recently a few, but now increasing number of tube types have been rated for the maximum allowable bulb temperature in addition to these dissipation ratings. The following curves relate the approximate "hot-spot" bulb temperature to the total dissipation (including heater power) for various sizes of bulbs under arbitrary reference conditions. Therefore, if the dissipation is known, these curves may be used to estimate whether or not the bulb temperature rating would be exceeded under such conditions. However, sufficient departure from these conditions would require actual temperature measurement.

The curves may also be used to find the approximate dissipation indirectly from bulb temperature when complex non-linear voltages and currents, such as are frequently encountered in radar, pulse and television service, make measurement by conventional direct methods very difficult if not impossible.

Data for the curves were taken by applying D.C. voltages to the indicated representative types in a 5" X 5" X 7" enclosure, and measuring the hottest bulb temperature with an iron-constantan thermocouple made of .003" wire. This "hot-spot" is usually found two-thirds to three-quarters of the way up the plate structure near the place where the plate is closest to the glass.

Any bulb temperature measurement should be made with a thermocouple that is made of very fine wire. In addition, great care must also be taken to minimize convection cooling, and to allow sufficient time to obtain a stable reading.

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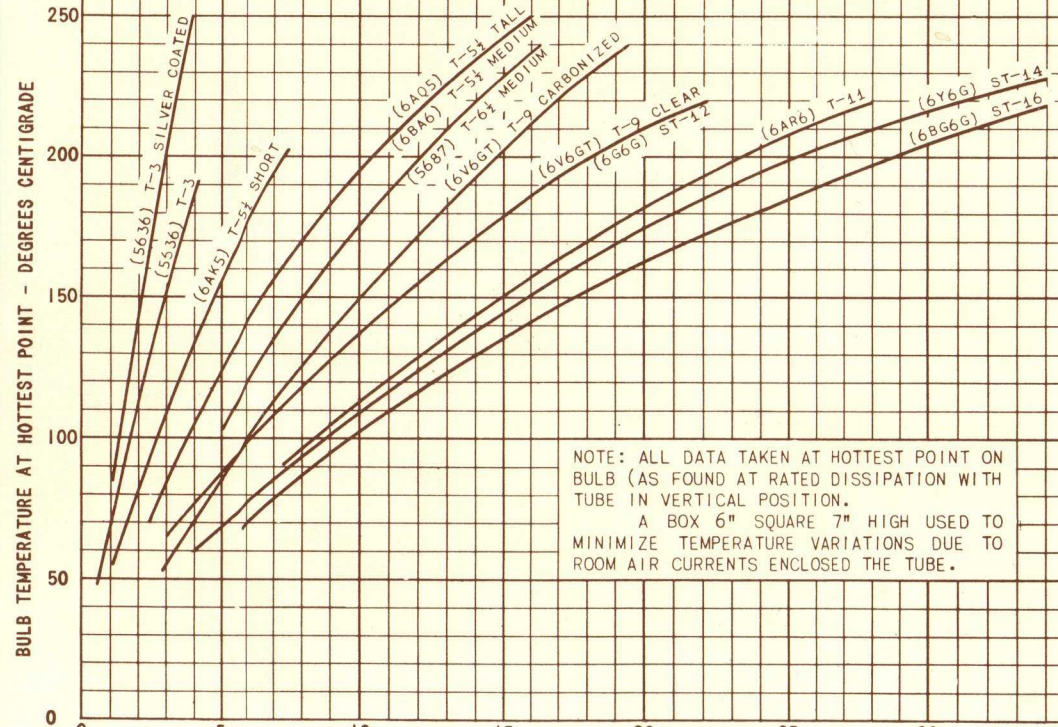
PLATE #3297 AUGUST 1, 1953 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION NEWARK, NEW JERSEY, U.S.A.

BULB TEMPERATURE vs DISSIPATION



NOTE: ALL DATA TAKEN AT HOTTEST POINT ON BULB (AS FOUND AT RATED DISSIPATION WITH TUBE IN VERTICAL POSITION.

A BOX 6" SQUARE 7" HIGH USED TO MINIMIZE TEMPERATURE VARIATIONS DUE TO ROOM AIR CURRENTS ENCLOSED THE TUBE.

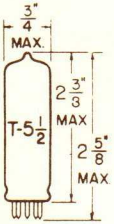
TUNG-SOL

VOLTAGE REGULATOR

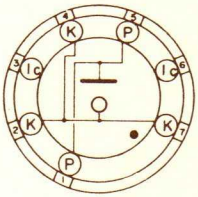
MINIATURE TYPE

COLD-CATHODE GLOW DISCHARGE

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE OA2 IS A COLD CATHODE GLOW-DISCHARGE TUBE USING THE MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS A VOLTAGE REGULATOR TO MAINTAIN CONSTANT VOLTAGE ACROSS A LOAD WITH MODERATE CHANGES IN LOAD CURRENT AND SUPPLY VOLTAGE.

RATINGS

MAXIMUM AND MINIMUM RATINGS ARE ABSOLUTE VALUES

MAXIMUM AVERAGE STARTING CURRENT[A]	75	MA.
MAXIMUM DC OPERATING CURRENT (CONTINUOUS)	30	MA.
MINIMUM DC OPERATING CURRENT (CONTINUOUS)	5	MA.
MAXIMUM AMBIENT TEMPERATURE	+90	°C
MINIMUM AMBIENT TEMPERATURE	-55	°C

[A] AVERAGED OVER STARTING PERIOD NOT EXCEEDING 10 SECONDS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

MINIMUM DC ANODE SUPPLY VOLTAGE[B]	185	VOLTS
DC STARTING VOLTAGE (APPROX.)	155	VOLTS
DC OPERATING VOLTAGE (APPROX.)	150	VOLTS
SERIES RESISTOR	C	
MAXIMUM SHUNT CAPACITOR	0.1	µf
REGULATION (5 TO 30 MA.)	2	VOLTS

[B] NOT LESS THAN INDICATED SUPPLY VOLTAGE SHOULD BE PROVIDED TO INSURE "STARTING" THROUGHOUT TUBE LIFE.

[C] SHOULD BE SUFFICIENT TO LIMIT OPERATING CURRENT THROUGH TUBE TO 30 MA. AT ALL TIMES AFTER THE STARTING PERIOD.

SIMILIAR TYPE REFERENCE: Ratings and characteristics somewhat similiar to type OD3/VR150.

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PLATE 2018
JUNE 1, 1948

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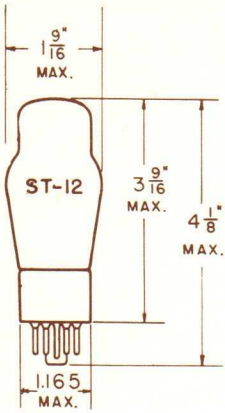
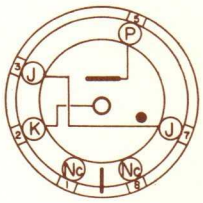


VOLTAGE REGULATOR

COLD CATHODE - GLOW DISCHARGE

GLASS BULB

SMALL SHELL OCTAL 6-PIN BASE



BOTTOM VIEW

THE 0A3/VR75, 0B3/VR90, 0C3/VR105, AND 0D3/VR150 ARE COLD-CATHODE, GLOW-DISCHARGE TUBES. THEY ARE INTENDED FOR USE AS VOLTAGE REGULATORS IN APPLICATIONS WHERE IT IS NECESSARY TO MAINTAIN A CONSTANT DC OUTPUT VOLTAGE ACROSS A LOAD, INDEPENDENT OF LOAD CURRENT AND MODERATE LINE-VOLTAGE VARIATIONS. LIKE OTHER GLOW-DISCHARGE TUBES, THEY MAY ALSO BE USED AS RELAXATION OSCILLATORS, AND FOR SPARK-OVER PROTECTION.

RATINGS AND TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

MAXIMUM AND MINIMUM RATINGS ARE ABSOLUTE VALUES

	0A3/VR75	0B3/VR90	
DC ANODE SUPPLY VOLTAGE [A]	105 MIN.	125 MIN.	VOLTS
DC OPERATING CURRENT (CONTINUOUS)	40 MAX.	30 MAX.	MA.
DC OPERATING CURRENT (CONTINUOUS)	5.0 MIN.	10 MIN.	MA.
AMBIENT TEMPERATURE RANGE	-55 TO + 90		°C
DC STARTING VOLTAGE (APPROX.)	100		VOLTS
DC OPERATING VOLTAGE (APPROX.)	75	90	VOLTS
REGULATION (5 TO 30 MA.)	3.0		VOLTS
REGULATION (5 TO 40 MA.)	5.0		VOLTS
REGULATION (10 TO 30 MA.)		8.0	VOLTS

	0C3/VR105	0D3/VR150	
DC ANODE SUPPLY VOLTAGE [A]	133 MIN.	185 MIN.	VOLTS
DC OPERATING CURRENT (CONTINUOUS)	40 MAX.	40 MAX.	MA.
DC OPERATING CURRENT (CONTINUOUS)	5.0 MIN.	5.0 MIN.	MA.
AMBIENT TEMPERATURE RANGE	-55 TO + 90	-55 TO + 90	°C
DC STARTING VOLTAGE (APPROX.)	115	160	VOLTS
DC OPERATING VOLTAGE (APPROX.)	105	150	VOLTS
REGULATION (5 TO 30 MA.)	1.0	2.0	VOLTS
REGULATION (5 TO 40 MA.)	2.0	4.0	VOLTS

[A] NOT LESS THAN INDICATED SUPPLY VOLTAGES SHOULD BE PROVIDED TO INSURE "STARTING" THROUGHOUT TUBE LIFE.

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PLATE 1454
AUG. 31 1944

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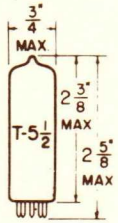
TUNG-SOL

VOLTAGE-REGULATOR

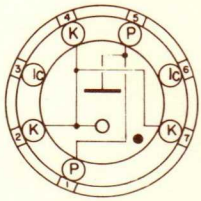
MINIATURE TYPE

COLD CATHODE

ANY OPERATING POSITION



GLASS BULB



BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE

5B0

THE OC2 IS A COLD-CATHODE, GLOW-DISCHARGE VOLTAGE REGULATOR IN THE 7-PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN VOLTAGE REGULATOR APPLICATIONS IN WHICH A RELATIVELY CONSTANT DC OUTPUT VOLTAGE IS REQUIRED ACROSS A LOAD, INDEPENDENT OF MODERATE LINE-VOLTAGE VARIATIONS.

RATINGS
MAXIMUM AND MINIMUM [A]

VOLTAGE-REGULATOR SERVICE

MAXIMUM AVERAGE STARTING CURRENT[B]	75	MA.
MAXIMUM DC CATHODE CURRENT	30	MA.
MINIMUM DC CATHODE CURRENT	5	MA.
MAXIMUM FREQUENCY	0	CPS.
AMBIENT TEMPERATURE RANGE	-55 TO + 90	°C
MAXIMUM CIRCUIT VALUES:		
SHUNT CAPACITANCE	0.1	μf

[A] ABSOLUTE VALUES.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	MIN.	AVG.	MAX.	
DC ANODE-SUPPLY VOLTAGE	C	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE:				
UNDER TOTAL DARKNESS	---	---	145[D]	VOLTS
UNDER NORMAL AMBIENT LIGHT CONDITIONS	---	105	115[D]	VOLTS
ANODE VOLTAGE DROP	68[E]	75	83	VOLTS
REGULATION (5 TO 30 MA.)	---	3	4.5	VOLTS

[B] AVERAGED OVER STARTING PERIOD NOT EXCEEDING 10 SECONDS. THIS STARTING PERIOD MUST BE FOLLOWED BY A STEADY-STATE OPERATING CONDITION OF AT LEAST 20 MINUTES, OR TUBE PERFORMANCE WILL BE IMPAIRED.

[C] THE MINIMUM VALUE TO INSURE "STARTING" THROUGHOUT TUBE LIFE MUST BE EQUAL TO THE ANODE BREAKDOWN VOLTAGE PLUS THE VOLTAGE DROP ACROSS THE SERIES RESISTOR AT THE MAXIMUM VALUE OF THE LOAD CURRENT.

[D] MAXIMUM INDIVIDUAL TUBE VALUE DURING USEFUL LIFE. [E] MIN. INDIVIDUAL TUBE VALUE DURING USEFUL LIFE.

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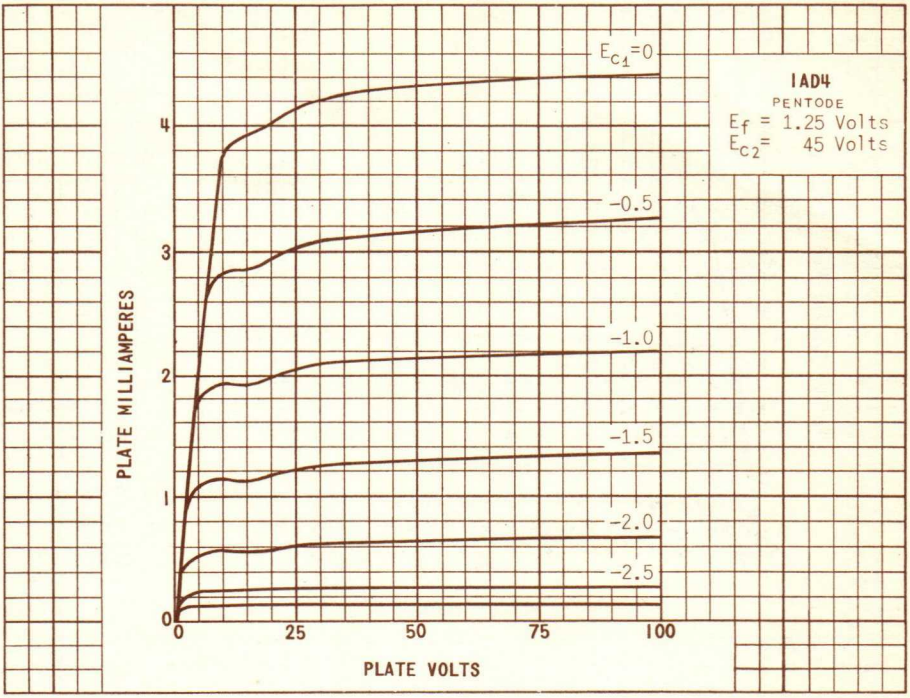

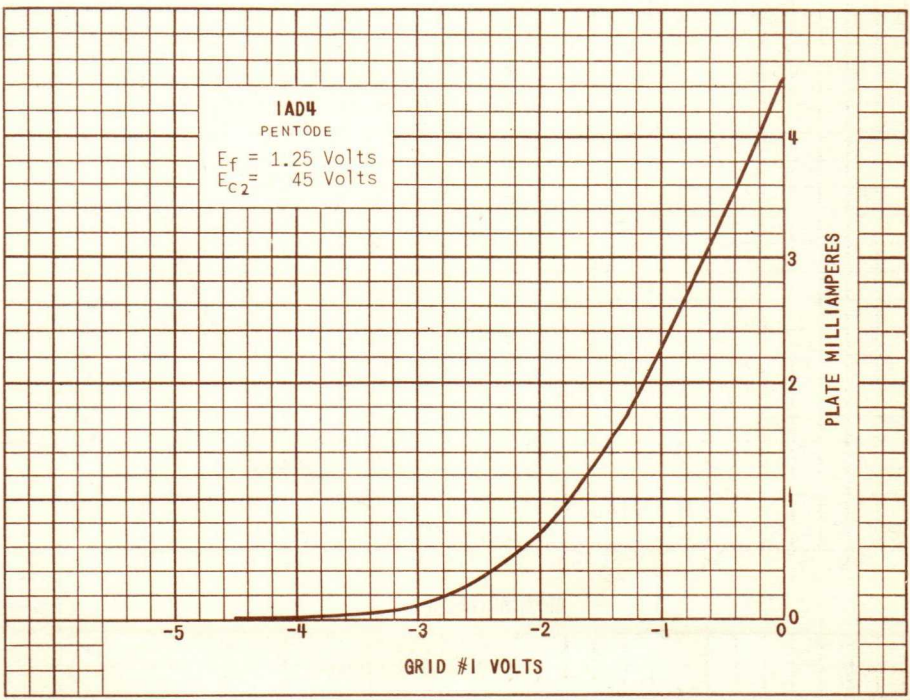

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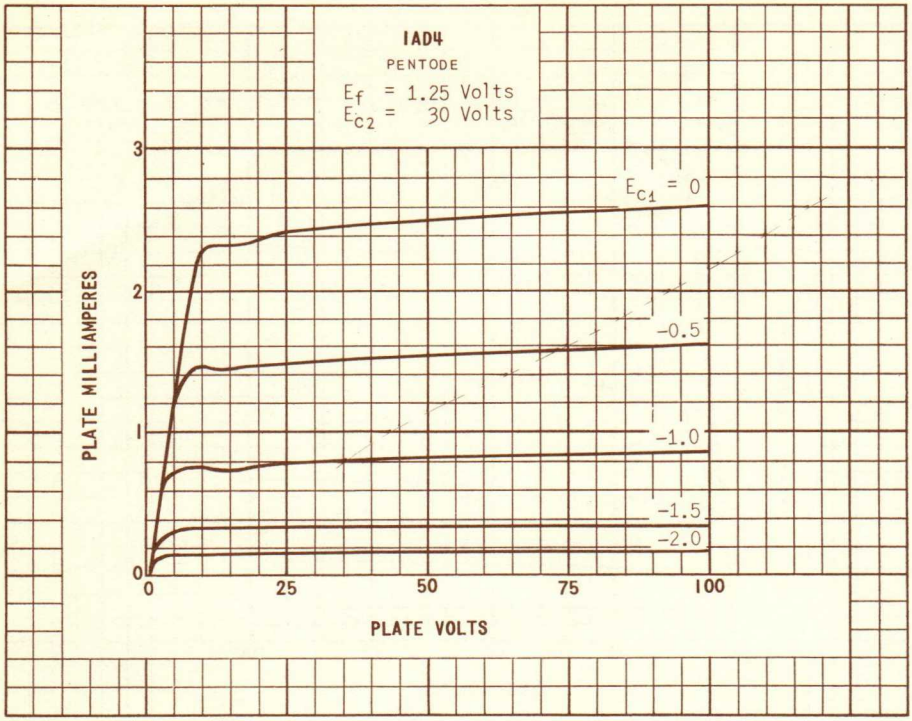
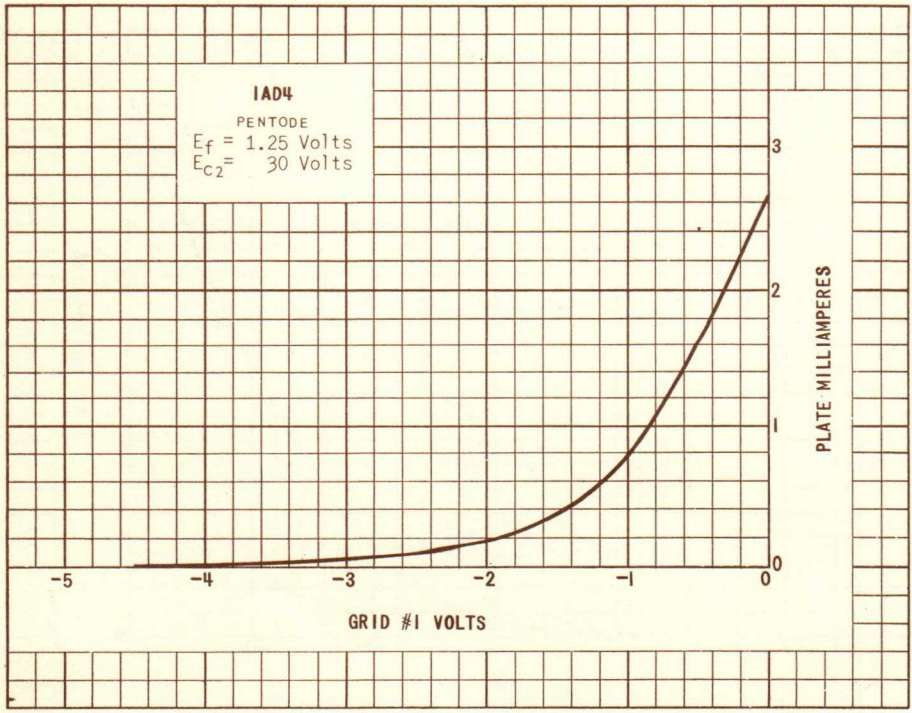
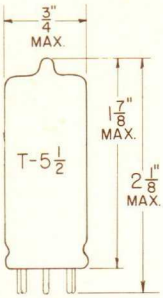

1AD4
PENTODE
E_f = 1.25 Volts
E_{c2} = 30 Volts
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
PLATE MILLIAMPERES
PLATE VOLTS
0
1
2
3
0
25
50
75
100


1AD4
PENTODE
E_f = 1.25 Volts
E_{c2} = 30 Volts
PLATE MILLIAMPERES
GRID #1 VOLTS
0
1
2
3
-5
-4
-3
-2
-1
0

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

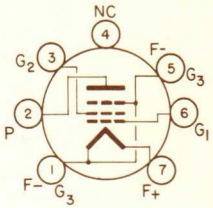
MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-2

FILAMENT

1.25±0.19 VOLTS 0.1 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 6AR

THE 1AE4 IS A FILAMENT TYPE SHARP CUT-OFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR RF APPLICATIONS IN PORTABLE EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #313

GRID #1 TO PLATE (MAX.)	0.008	pf
INPUT	3.6	pf
OUTPUT	4.4	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

FILAMENT VOLTAGE (DC)	1.25±0.19	VOLTS
MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM GRID #1 VOLTAGE		
NEGATIVE-BIAS VALUE	50	VOLTS
POSITIVE-BIAS VALUE	0	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	11	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	90	VOLTS
GRID #2 VOLTAGE	90	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE RESISTANCE	0.5	MEGOHM
TRANSCONDUCTANCE	1550	μMHOS
PLATE CURRENT	3.5	MA.
GRID #2 CURRENT	1.2	MA.
GRID #1 VOLTAGE (APPROX. FOR Ib = 50 μA)	-5	VOLTS

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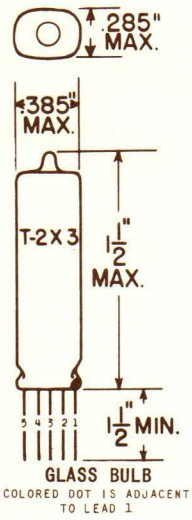


GLASS BULB

COLORED DOT IS ADJACENT TO LEAD 1

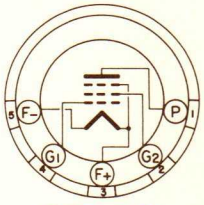
PENTODE

SUBMINIATURE TYPE

COATED FILAMENT

1.25 VOLTS 0.04 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS
LENGTH: 1.5" MIN.
SPACING: 0.048" CENTER-TO-CENTER

GRID #3 IS COMPOSED OF TWO SEPARATE DEFLECTOR PLATES, ONE OF WHICH IS CONNECTED TO LEAD 3 & THE OTHER TO LEAD 5.

THE 1AG4 IS A FILAMENT TYPE POWER PENTODE OF SUBMINIATURE CONSTRUCTION DESIGNED FOR USE IN THE OUTPUT STAGE IN BATTERY OPERATED RECEIVERS. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.20" LENGTH.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

FILAMENT VOLTAGE (DC)	1.25	VOLTS
MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM CATHODE CURRENT (ZERO SIGNAL)	4	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE (DC)	1.25	VOLTS
FILAMENT CURRENT	0.04	AMP.
PLATE VOLTAGE	41.4	VOLTS
GRID #2 VOLTAGE	41.4	VOLTS
GRID #1 VOLTAGE	-3.6	VOLTS
PEAK AF GRID #1 VOLTAGE	3.6	VOLTS
PLATE RESISTANCE	.18	MEGOHM
TRANSCONDUCTANCE	1 000	μMHOS
ZERO-SIGNAL PLATE CURRENT	2.4	MA.
ZERO-SIGNAL GRID #2 CURRENT	0.6	MA.
LOAD RESISTANCE	12 000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	12	PERCENT
POWER OUTPUT	35	MW.

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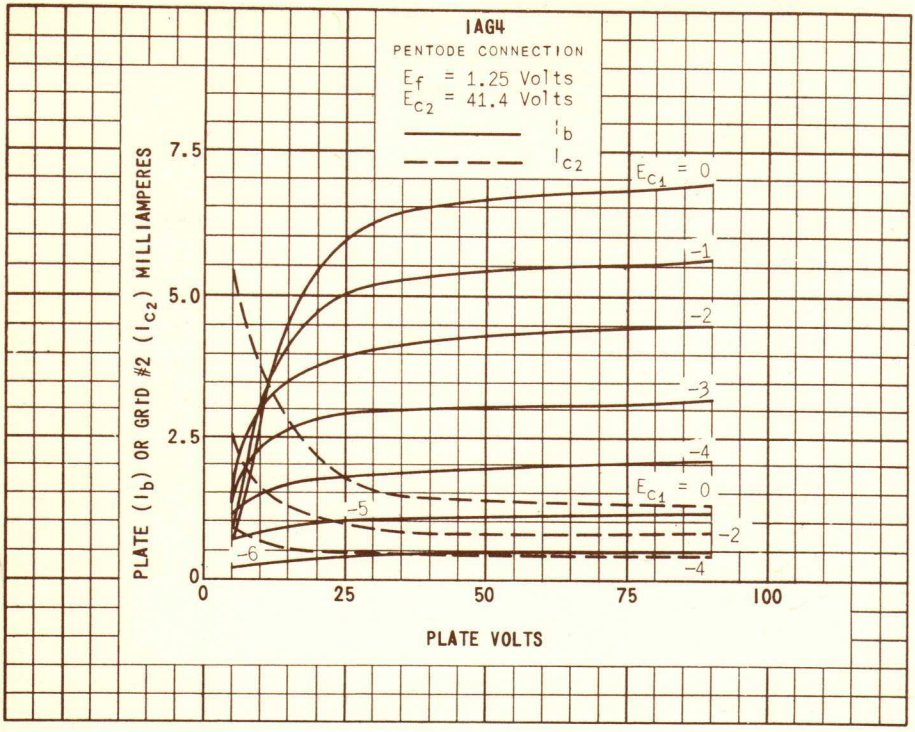
1AG4



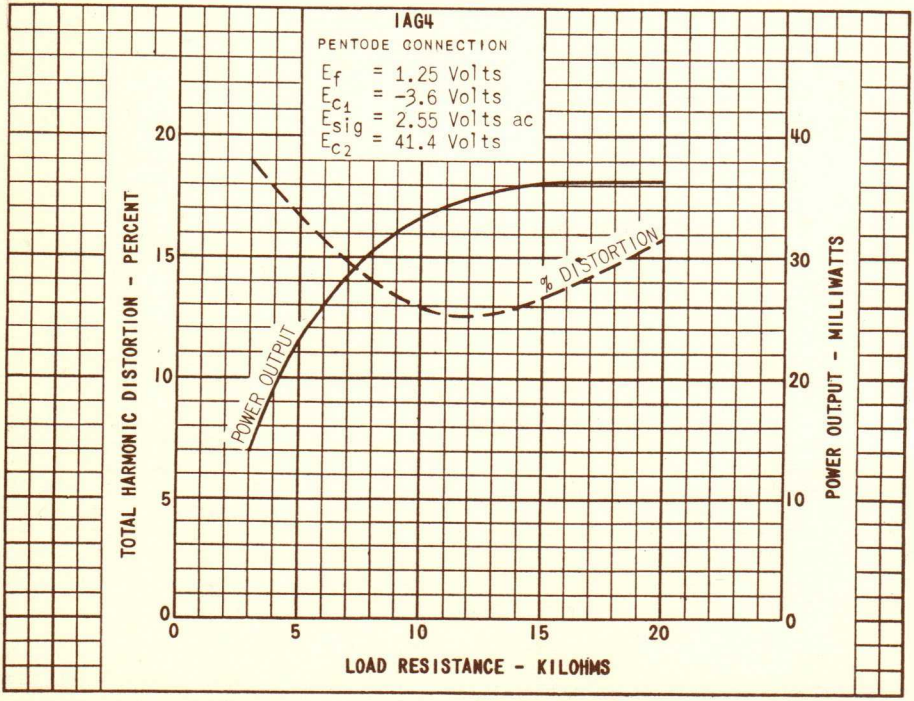


PLATE #4263 MARCH 1, 1955 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

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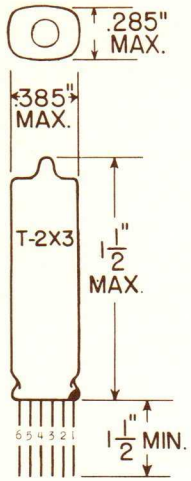
DIODE PENTODE

SUBMINIATURE TYPE

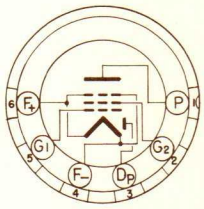


GLASS BULB

COLORED DOT IS ADJACENT TO LEAD 1

COATED FILAMENT
1.25 VOLTS .03 AMP.
DC

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS
LENGTH: 1.5" MIN.
SPACING: 0.048" CENTER-TO-CENTER

GRID #3 IS COMPRISED OF TWO SEPARATE DEFLECTOR PLATES, ONE OF WHICH IS CONNECTED TO LEAD 4 AND THE OTHER TO LEAD 6.

THE 1AG5 IS A FILAMENT TYPE DIODE-PENTODE DESIGNED FOR USE IN APPLICATIONS REQUIRING EXTREME ECONOMY OF SPACE, WEIGHT, AND BATTERY DRAIN. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.020" LENGTH.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH CLOSE FITTING SHIELD CONNECTED TO LEAD 4

GRID TO PLATE: (G_1 TO P)	0.10	μμf
INPUT: G_1 TO (F+G_2+G_3)	1.7	μμf
OUTPUT: P TO (F+G_2+G_3)	2.4	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

MAXIMUM FILAMENT VOLTAGE (DC)	1.25±20%	VOLTS
MAXIMUM PLATE VOLTAGE	50	VOLTS
MAXIMUM GRID #2 VOLTAGE	50	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	0.5	MA.
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION[A]	0.25	MA.

[A] THE DIODE IS LOCATED AT THE NEGATIVE END OF THE FILAMENT.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

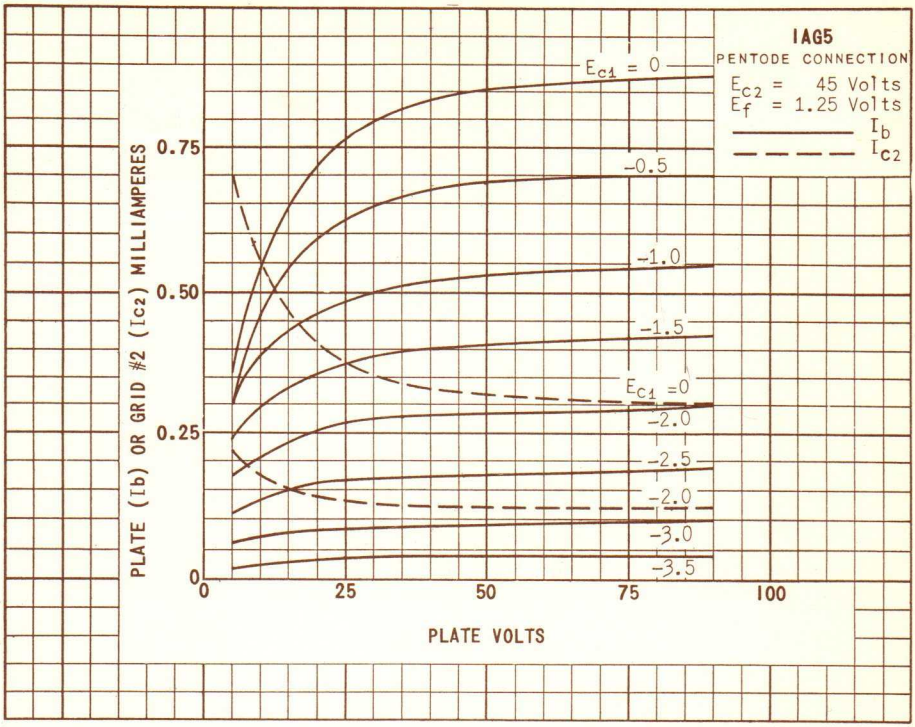
FILAMENT VOLTAGE (DC)	1.25	1.25	VOLTS
FILAMENT CURRENT	.03	.03	AMP.
PLATE VOLTAGE	22.5	45	VOLTS
GRID #2 VOLTAGE	22.5	45	VOLTS
GRID #1 VOLTAGE	0	-2.0	VOLTS
PLATE RESISTANCE	0.7	2.5	MEGOHM
TRANSCONDUCTANCE	235	250	μMHOS
PLATE CURRENT	0.17	0.28	MA.
GRID #2 CURRENT	0.043	0.12	MA.
GRID #1 RESISTOR	5	0	MEGOHM
MINIMUM DIODE CURRENT AT 10 VOLTS DC[A]	0.5		MA.

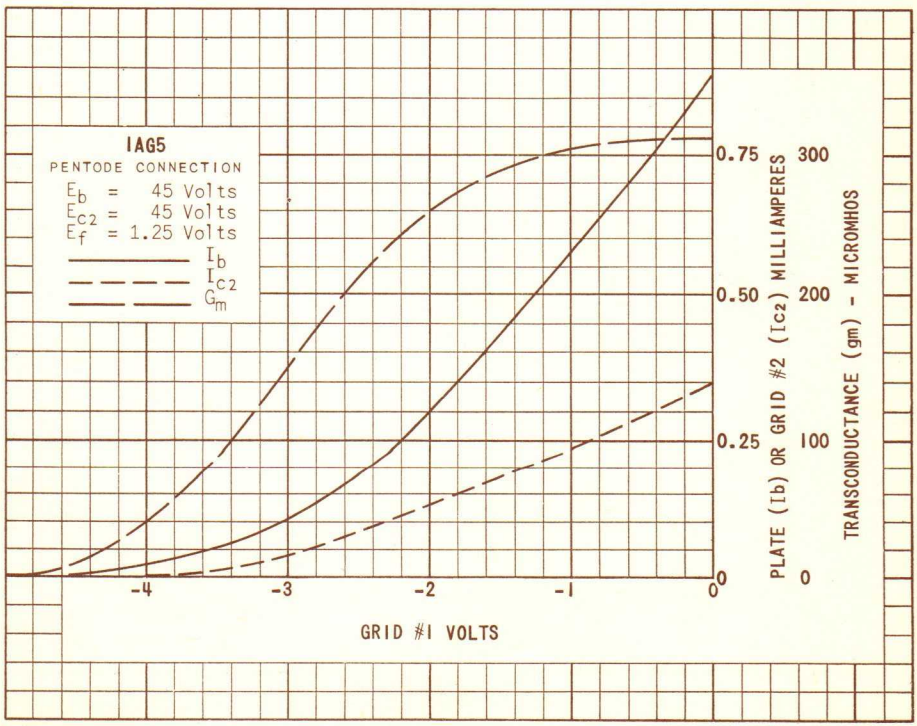
RESISTANCE – COUPLED AMPLIFIER

FILAMENT VOLTAGE (DC)	1.25	1.25	VOLTS
FILAMENT CURRENT	.03	.03	AMP.
PLATE SUPPLY VOLTAGE	45	67.5	VOLTS
GRID #2 SUPPLY VOLTAGE	45	67.5	VOLTS
GRID #1 VOLTAGE[B]	0	0	VOLTS
LOAD RESISTANCE	1	1	MEGOHM
SERIES GRID #2 RESISTOR	5	5	MEGOHMS
GRID #2 BY-PASS CONDENSER	0.1	0.1	μf
GRID #1 RESISTOR (FOLLOWING TUBE)	10	10	MEGOHMS
VOLTAGE GAIN (APPROX.)	50	70	

[A] THE DIODE IS LOCATED AT THE NEGATIVE END OF THE FILAMENT.

[B] GRID #1 RESISTOR = 5 MEGOHMS.





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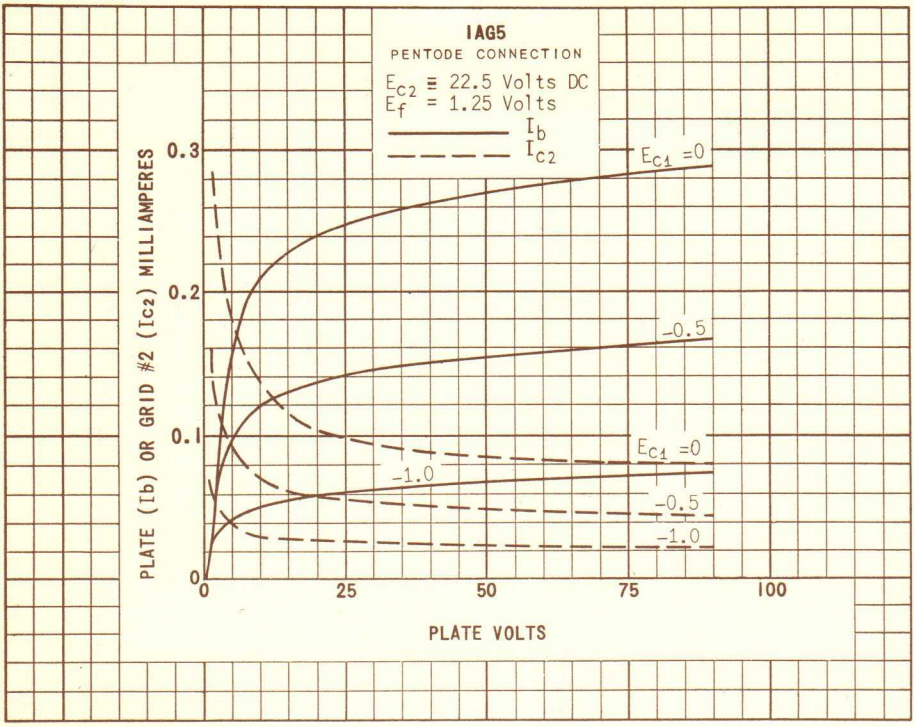
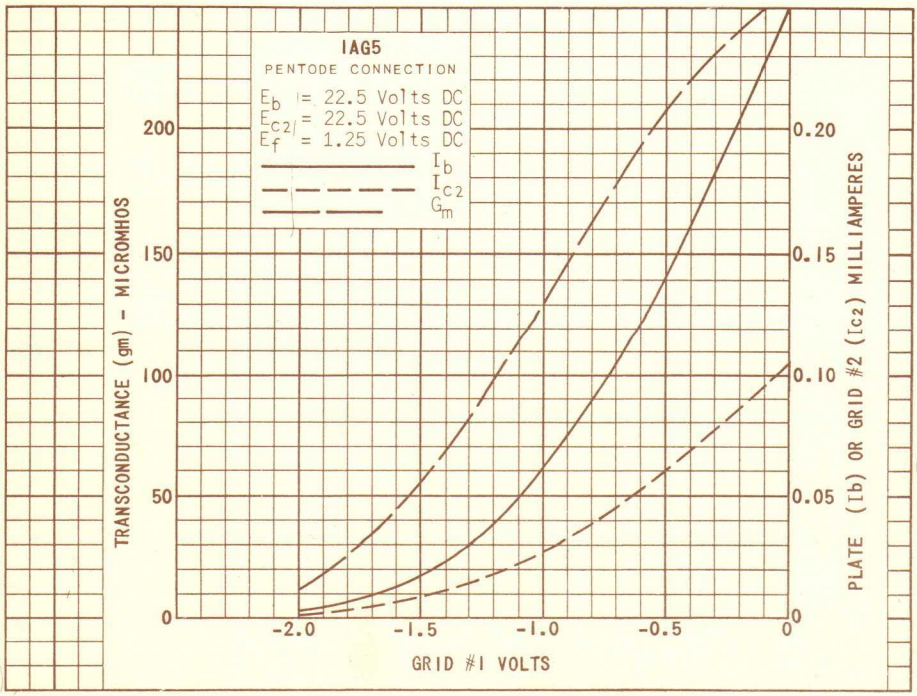
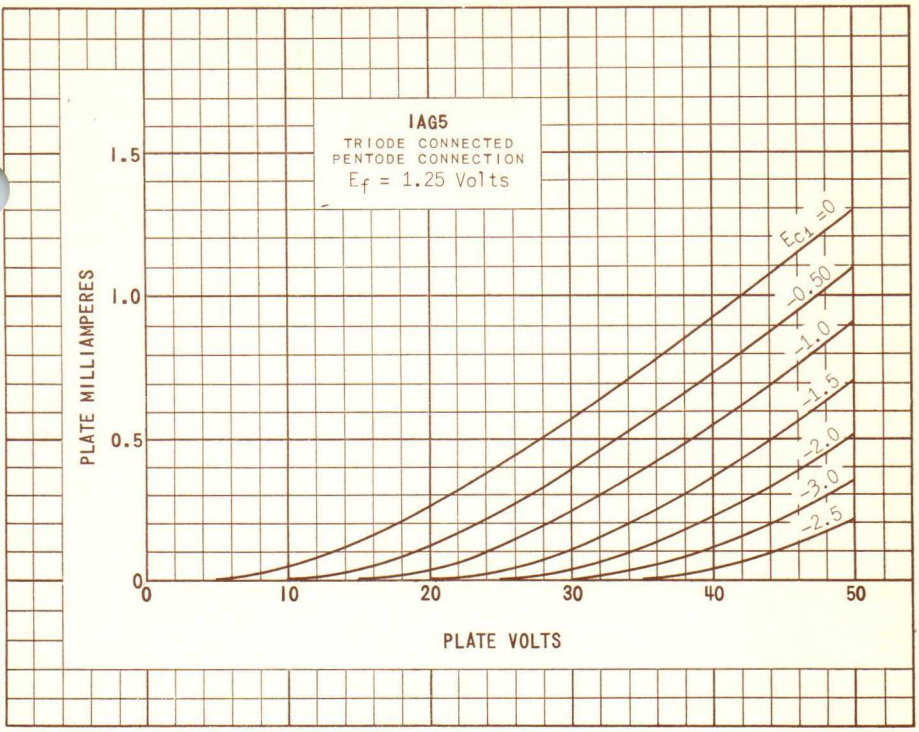

1AG5
PENTODE CONNECTION
Ec2 = 22.5 Volts DC
Ef = 1.25 Volts
Ib
Ic2
Ec1 =0
-0.5
-1.0
Ec1 =0
-1.0
-0.5
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0.3
0.2
0.1
0
0
25
50
75
100
PLATE VOLTS


1AG5
PENTODE CONNECTION
Eb = 22.5 Volts DC
Ec2 = 22.5 Volts DC
Ef = 1.25 Volts DC
Ib
Ic2
Gm
TRANSCONDUCTANCE (gm) - MICROMHOS
200
150
100
50
0
0.20
0.15
0.10
0.05
0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
-2.0
-1.5
-1.0
-0.5
0
GRID #1 VOLTS



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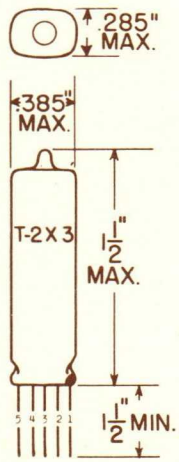
PENTODE

SUBMINIATURE TYPE



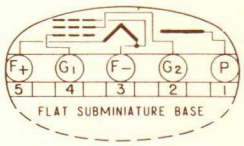
GLASS BULB
RED DOT IS ADJACENT TO LEAD 1

BULB IS ENTIRELY COATED WITH A METALLIC SHIELD CONNECTED TO LEAD 3.

COATED FILAMENT

1.25 VOLTS 0.04 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS

0.05" SPACING CENTER-TO-CENTER

GRID #3 IS COMPRISED OF TWO SEPARATE DEFLECTOR PLATES, ONE OF WHICH IS CONNECTED TO LEAD 3 AND THE OTHER TO LEAD 5.

THE 1AH4 IS A FILAMENT TYPE, FULLY SHIELDED, SUBMINIATURE PENTODE DESIGNED FOR SERVICE IN RF APPLICATIONS REQUIRING ECONOMY OF SPACE, WEIGHT, AND BATTERY DRAIN. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED TO CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.20" LENGTH.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE (MAX.)	0.01	μμf
INPUT	3.5	μμf
OUTPUT	4.5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

DESIGN CENTER VALUES

FILAMENT VOLTAGE	1.25	VOLTS
PLATE VOLTAGE	90	VOLTS
GRID #2 VOLTAGE	90	VOLTS
TOTAL CATHODE CURRENT	2.0	MA.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.25	1.25	VOLTS
FILAMENT CURRENT	0.04	0.04	AMP.
PLATE VOLTAGE	45	67.5	VOLTS
GRID #2 VOLTAGE	45	---	VOLTS
GRID #2 SUPPLY VOLTAGE	---	67.5	VOLTS
GRID #2 RESISTOR	---	0.1	MEGOHM
GRID #1 RESISTOR[A]	0	0	VOLTS
PLATE RESISTANCE	1.5	2.0	MEGOHMS
TRANSCONDUCTANCE	750	750	µMHOS
PLATE CURRENT	0.75	0.75	MA.
GRID #2 CURRENT	0.2	0.2	MA.
GRID #1 VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE = 10 µMHOS	-3	-3.5	VOLTS

[A] GRID RESISTOR = 5 MEGOHMS.

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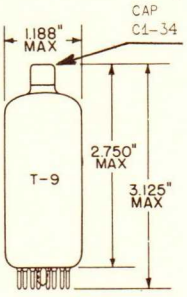
DIODE



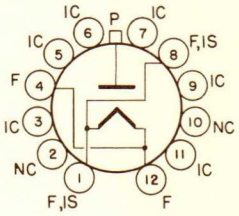
GLASS BULB
BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-98

COATED FILAMENTARY CATHODE

FOR TV HIGH VOLTAGE
RECTIFIER

ANY MOUNTING POSITION

SOCKET CLIPS 2 & 10 MAY BE USED AS
TIE POSTS AT A POTENTIAL NEAR
THAT OF THE FILAMENT



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12EL

THE 1AJ2 IS A FILAMENTARY HIGH-VOLTAGE DIODE IN A DOUBLE-ENDED T-9 COMPACTRON CONSTRUCTION. IT IS DESIGNED FOR USE AS THE RECTIFIER IN THE FLY-BACK CIRCUIT TO SUPPLY THE ANODE OF THE TELEVISION PICTURE TUBE.

DIRECT INTERELECTRODE CAPACITANCE

WITHOUT EXTERNAL SHIELD

PLATE TO ALL: P TO (P + I.S.) - APPROX.	1.8	pf

FILAMENT CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.25 VOLTS	200	MA.
LIMITS OF APPLIED FILAMENT VOLTAGE			
AC OR DC		1.25±0.20	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

FLYBACK VOLTAGE RECTIFIER SERVICE

INVERSE PLATE VOLTAGE		
TOTAL DC AND PEAK	26	KV.
DC	22	KV.
PEAK PLATE CURRENT	50	MA.
DC OUTPUT CURRENT	0.5	MA.

AVERAGE CHARACTERISTICS

TUBE DROP WITH 7 MA PLATE CURRENT - APPROX.	140	VOLTS

CONTINUED ON FOLLOWING PAGE

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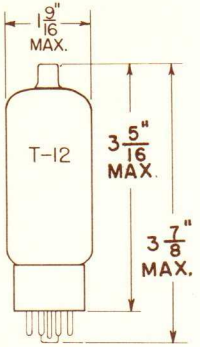
THE FLYBACK PULSE SHOULD BE TAKEN FROM THE HORIZONTAL DEFLECTION CIRCUIT OF A 525-LINE, 30-FRAME TELEVISION SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS" FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

PRECAUTIONARY NOTE:

THIS TUBE MAY PRODUCE SOFT X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS ADEQUATELY SHIELDED.

TUNG-SOL

DIODE



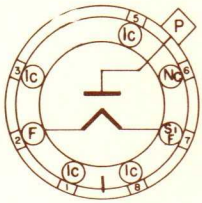
GLASS BULB

COATED FILAMENT CATHODE

FILAMENT

1.25±0.2 VOLTS 0.20 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM SHELL
OCTAL
7 PIN BASE[A]
3C

THE 1AU3 IS A FILAMENTARY HALF-WAVE DIODE INCORPORATING AN ELECTROSTATIC SHIELD, WHICH IS LOCATED ADJACENT TO THE FILAMENT. IT IS INTENDED FOR SERVICE AS THE HIGH VOLTAGE RECTIFIER IN TELEVISION RECEIVERS AND OTHER HIGH VOLTAGE RECTIFIER APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

PLATE TO FILAMENT AND INTERNAL SHIELD	2.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[D]

FLYBACK VOLTAGE RECTIFIER[E]

FILAMENT VOLTAGE[B]	1.25±0.2	VOLTS
MAXIMUM INVERSE PLATE VOLTAGE		
TOTAL DC AND PEAK	30 000	VOLTS
DC	26 000	VOLTS
MAXIMUM PEAK PLATE CURRENT	50	MA.
MAXIMUM AVERAGE PLATE CURRENT	0.5	MA.

CHARACTERISTICS

FILAMENT VOLTAGE[B]	1.25±0.2	VOLTS
FILAMENT CURRENT[C]	0.20	AMP.
TUBE DROP FOR Ib = 7 MA. (APPROX.)	225	VOLTS

[A] SOCKET TERMINALS 1, 3, 4, 5, 6 AND 8 MAY BE CONNECTED TO TERMINAL 7 OR TO A CORONA SHIELD WHICH CONNECTES TO TERMINAL 7. TERMINALS 4 AND 6 MAY BE USED AS TIE POINTS FOR COMPONENTS AT OR NEAR FILAMENT POTENTIAL.

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[B] THE EQUIPMENT DESIGNER SHALL DESIGN THE EQUIPMENT THAT THE FILAMENT VOLTAGE IS CENTERED AT THE SPECIFIED BOGEY VALUE. FILAMENT SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN FILAMENT VOLTAGE WITHIN THE SPECIFIED TOLERANCE.

[C] THE BOGEY VALUE OF CURRENT IS OBTAINED WHEN OPERATING THE FILAMENT AT THE SPECIFIED 1.25 VOLTS.

[D] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[E] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

WARNING:

X-RAY RADIATION SHIELD MAY BE NECESSARY TO PROTECT AGAINST POSSIBLE DANGER OF PERSONAL INJURY FROM PROLONGED EXPOSURE AT CLOSE RANGE IF THIS TUBE IS OPERATED AT HIGHER THAN THE MANUFACTURER'S MAXIMUM RATED PLATE VOLTAGE OF 16,000 VOLTS, WHICHEVER IS LESS.

TUNG-SOL

DIODE

OUTLINE DRAWING

OUTLINE NOTES

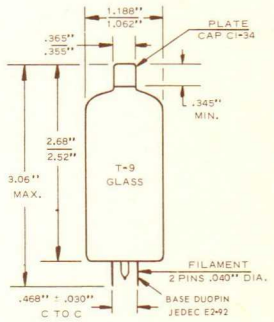
CONNECTORS SHOULD NOT EXERT MORE THAN 7 POUNDS RADIAL COMPRESSION AT ANY POINT AROUND THE CIRCUMFERENCE OF THE CAP.

MAXIMUM ECCENTRICITY OF PIN CENTER LINE AND BULB CENTER LINE .040".

EITHER FILAMENT PIN MAY BE USED FOR THE OUTPUT CONNECTION.

FOR HIGH VOLTAGE SUPPLY

IN TV SERVICE



COATED FILAMENT

ANY MOUNTING POSITION

THE 1AY2 IS A FILAMENTARY HIGH-VOLTAGE DIODE IN DOUBLE-ENDED CONSTRUCTION WITH A NEW TWO-PIN "DUOPIN" BASE. IT IS DESIGNED FOR USE AS THE HIGH-VOLTAGE RECTIFIER IN THE FLY-BACK CIRCUIT TO SUPPLY THE ANODE OF THE TELEVISION PICTURE TUBE. ITS ELECTRICAL CHARACTERISTICS ARE SIMILAR TO THE 1B3GT.

DIRECT INTERELECTRODE CAPACITANCE

PLATE TO FILAMENT	1.4	pf

MAXIMUM RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

FLYBACK VOLTAGE RECTIFIER ▲

INVERSE PLATE VOLTAGE: TOTAL DC AND PEAK	26	KV
DC	22	KV
PEAK PLATE CURRENT	50	mA
AVERAGE PLATE CURRENT	0.5	mA

FILAMENT CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM SYSTEM-SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.25	VOLTS	200	mA
LIMITS OF APPLIED VOLTAGE - AC OR DC			1.25 ± 0.20	VOLTS

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP FOR I_b = 7 mA	75	VOLTS

▲ FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

WARNING

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

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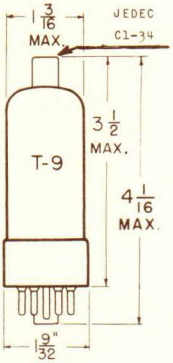
TUNG-SOL

DIODE



GLASS BULB

SEE NOTE "A"

OUTLINE DRAWING
JEDEC 9-51 OR 9-52

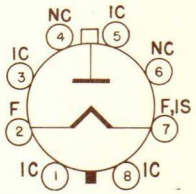
COATED FILAMENT

FOR HIGH VOLTAGE SUPPLY

IN T.V. SERVICE

ANY MOUNTING POSITION

CONNECTORS SHOULD NOT EXERT MORE THAN 7 POUNDS RADIAL COMPRESSION AT ANY POINT AROUND THE CIRCUMFERENCE OF THE CAP.



BOTTOM VIEW

BASING DIAGRAM
JEDEC 3C

SOCKET TERMINALS 1, 3, 4, 5, 6 & 8 MAY BE CONNECTED TO TERMINAL 7 OR TO A CORONA SHIELD WHICH CONNECTS TO TERMINAL 7. TERMINALS 4&6 MAY BE USED AS TIE POINTS FOR COMPONENTS AT OR NEAR FILAMENT POTENTIAL.

THE 1B3GT IS A FILAMENTARY DIODE DESIGNED TO OPERATE AT RELATIVELY HIGH INVERSE PEAK VOLTAGES OVER A CONSIDERABLE RANGE OF SUPPLY VOLTAGE FREQUENCIES. IT IS INTENDED TO SUPPLY THE REQUIRED HIGH VOLTAGES FOR THE CATHODE RAY PICTURE TUBE IN TELEVISION SERVICE.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

PLATE TO FILAMENT: (P TO F+I.S.)	1.3	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES -SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	125 VOLTS	200	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION[B]		1.25±0.2	VOLTS
CURRENT OPERATION (AT Ef = 1.25 V.)		200	MA.
TUBE DROP (APPROX) WITH 7 MA. PLATE CURRENT		100	VOLTS

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

FLYBACK VOLTAGE RECTIFIER[C]

INVERSE PLATE VOLTAGE:		
TOTAL DC AND PEAK	26	KV
DC	22	KV
PEAK PLATE CURRENT	50	MA.
AVERAGE PLATE CURRENT	0.5	MA.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

MAXIMUM RATINGS - CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

RF VOLTAGE RECTIFIER

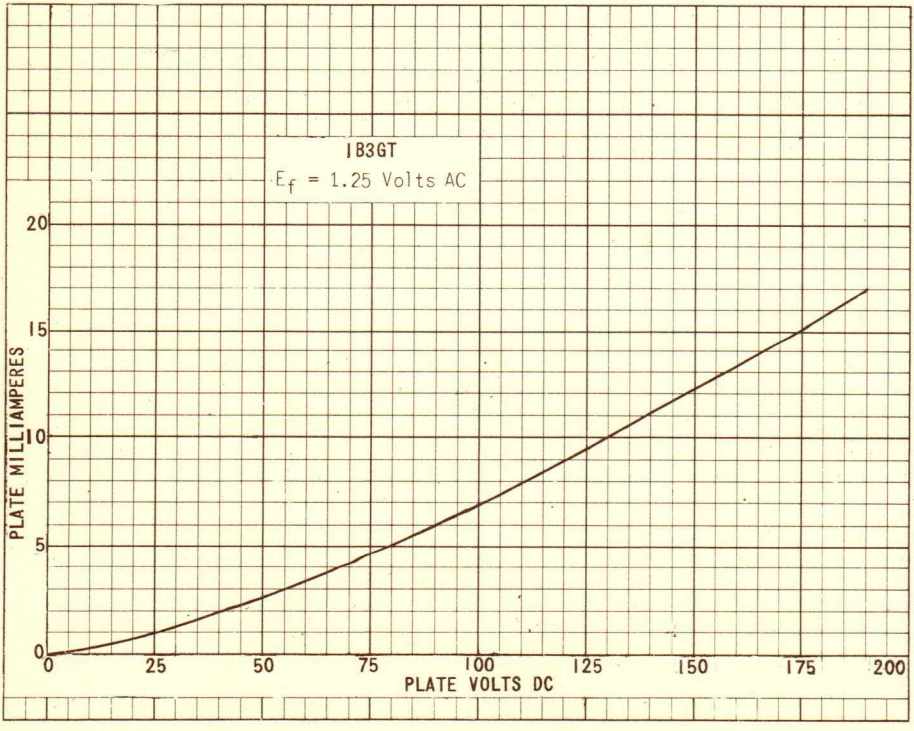
PEAK INVERSE PLATE VOLTAGE	33	KV
PEAK PLATE CURRENT	.35	MA.
AVERAGE PLATE CURRENT	1.1	MA.
FREQUENCY OF SUPPLY VOLTAGE (MAX.)	100	KCS
FREQUENCY OF SUPPLY VOLTAGE (MIN.)	1.5	KCS

[A] B5-82,B6-8, B6-60, B6-144, B7-166, B7-211, B8-6, B8-50, OCTAL 5, 6, 7, OR 8- PIN

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

THIS TUBE MAY PRODUCE SOFT X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS ADEQUATELY SHIELDED



TUNG-SOL

DIODE PENTODE

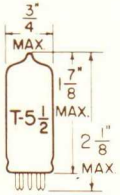
MINIATURE TYPE

COATED FILAMENT

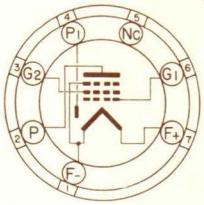
1.4 VOLTS 0.05 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
6BW

THE DIODE PLATE IS LOCATED AT THE NEGATIVE END OF THE FILAMENT

THE 1DN5 IS A COMBINED SINGLE DETECTOR DIODE AND REMOTE CUT-OFF PENTODE WITH A COMMON FILAMENTARY CATHODE IN THE 7 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS INTENDED FOR USE AS AN AUDIO AMPLIFIER IN LIGHT-WEIGHT, PORTABLE EQUIPMENT AT LOW PLATE SUPPLY VOLTAGE. THE DESIGN OF THIS TYPE PERMITS THE APPLICATION OF AVC VOLTAGE TO THE CONTROL GRID, THEREBY IMPROVING OVERALL RECEIVER AVC.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

DIODE PLATE TO GRID #1 (MAX.)	0.04	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

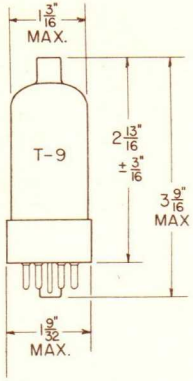
FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	-50	VOLTS
MAXIMUM CATHODE CURRENT	3	MA.
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION	0.25	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FILAMENT VOLTAGE	1.4	VOLTS
FILAMENT CURRENT	0.05	AMP.
PLATE VOLTAGE	67.5	VOLTS
GRID #2 VOLTAGE	67.5	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE CURRENT	2.1	MA.
GRID #2 CURRENT	0.55	MA.
TRANSCONDUCTANCE	630	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR G_m = 10 μMHOS	-11.5	VOLTS
PLATE RESISTANCE (APPROX.)	0.6	MEGOHMS
AVERAGE DIODE CURRENT AT 10 VOLTS DC	1.0	MA.

TUNG-SOL

HALF-WAVE RECTIFIER



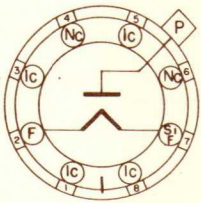
GLASS BULB

COATED FILAMENT

1.25 VOLTS 0.2 AMP.

AC
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
5 PIN OCTAL
OR
SHORT INTERMEDIATE SHELL
5 PIN OCTAL
WITH EXTERNAL BARRIERS
OR
INTERMEDIATE SHELL
6 PIN OCTAL
OR
SHORT INTERMEDIATE SHELL
6 PIN OCTAL
WITH EXTERNAL BARRIERS
OR
SHORT INTERMEDIATE SHELL
7 PIN OCTAL
OR
INTERMEDIATE SHELL
7 PIN OCTAL

THE 1G3GT IS A HALF-WAVE RECTIFIER UTILIZING A COATED FILAMENT. IT IS INTENDED FOR USE AS A RECTIFIER OF HIGH-VOLTAGE PULSES PRODUCED IN THE SCANNING SYSTEMS OF MONOCHROME TELEVISION RECEIVERS AND AS A RECTIFIER IN HIGH VOLTAGE RF-OPERATED POWER SUPPLIES OF ELECTRONIC EQUIPMENT. IT IS SIMILAR TO THE 1B3GT, BUT IS CONSTRUCTED IN A SMALLER BULB FOR COMPACT EQUIPMENT DESIGN.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

PLATE TO FILAMENT AND INTERNAL SHIELD	1.3	μμf

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

PULSE-RECTIFIER SERVICE[A]

FILAMENT VOLTAGE[B]	1.25	VOLTS
MAXIMUM INVERSE PLATE VOLTAGE:		
TOTAL DC AND PEAK (ABS. MAX.)[C]	26 000[C]	VOLTS
DC	21 000	VOLTS
MAXIMUM PLATE CURRENT:		
PEAK	50	MA.
AVERAGE	0.5	MA.

RF RECTIFIER SERVICE

FILAMENT VOLTAGE[B]	1.25	VOLTS
FILAMENT CURRENT	0.2	AMP.
MAXIMUM PEAK INVERSE PLATE VOLTAGE (ABS. MAX.)	33 000[C]	VOLTS
MAXIMUM PLATE CURRENT:		
PEAK	30	MA.
AVERAGE	1	MA.
FREQUENCY RANGE OF SUPPLY VOLTAGE	1.5 TO 100	KC.

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] FILAMENT VOLTAGE: 1.05 MIN., 1.25 AVG., 1.45 MAX. VOLTS.

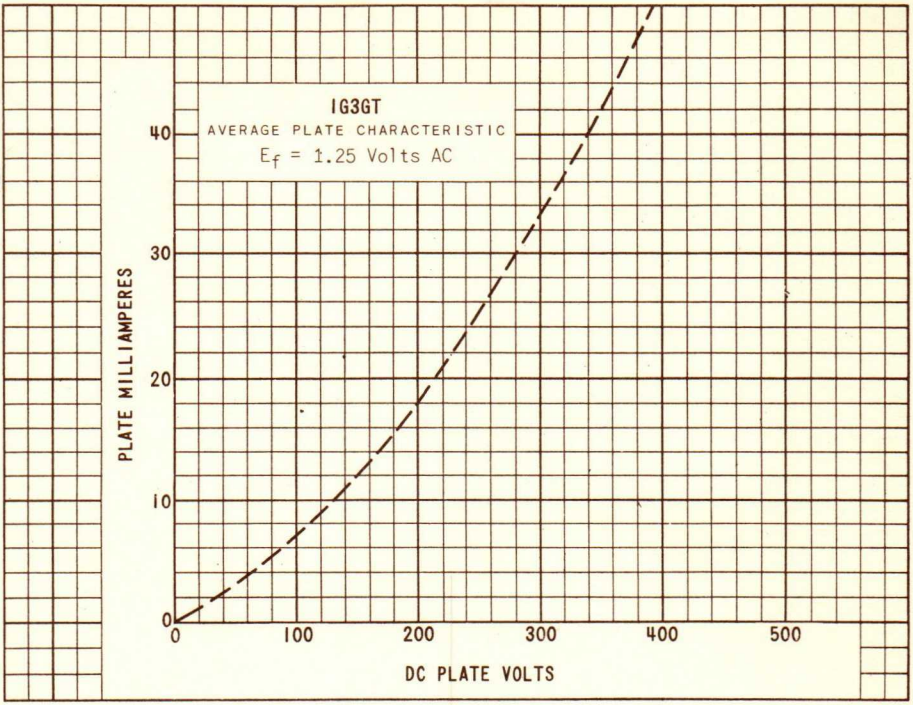
[C] UNDER NO CIRCUMSTANCES SHOULD THIS ABSOLUTE VALUE BE EXCEEDED.

NOTES:

ON THE 5-PIN BASES, PIN #1 IS OMITTED.

ON THE 5-PIN BASES, THE 6-PIN BASES, AND THE 7-PIN BASE JEDEC #B7-166, PIN 4 IS OMITTED.

ON THE 5-PIN BASES, THE 6-PIN BASES, AND THE 7-PIN BASE JEDEC #B7-47, PIN 6 IS OMITTED.



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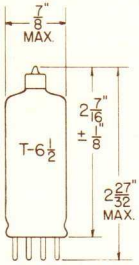
TUNG-SOL

DIODE

MINIATURE TYPE



GLASS BULB
TOP CAP—MINIATURE

COATED UNIPOTENTIAL CATHODE

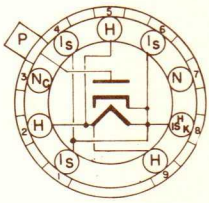
HEATER

1.4 VOLTS 0.55 AMP.

AC OR DC

ANY MOUNTING POSITION

*SOCKET TERMINALS 3 & 7 MAY BE USED AS TIE POINTS FOR COMPONENTS AT OR NEAR FILAMENT POTENTIAL.



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9LX

THE 1H2 IS A MINIATURE HEATER-CATHODE TYPE DIODE DESIGNED FOR USE IN TELEVISION RECEIVERS AS THE HIGH-VOLTAGE RECTIFIER TO SUPPLY POWER TO THE ANODE OF THE TELEVISION PICTURE TUBE. THE 1H2 IS PRIMARILY INTENDED FOR USE IN FLY-BACK TYPES OF POWER SUPPLIES.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

PLATE TO HEATER, CATHODE & INTERNAL SHIELD	1.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FLYBACK RECTIFIER SERVICE[A]

HEATER VOLTAGE	1.4	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE		
DC COMPONENT	24 000	VOLTS
TOTAL DC AND PEAK	30 000	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	50	MA.
MAXIMUM DC OUTPUT CURRENT	0.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP (APPROX.)		
I_b = 7.0 MA.	100	VOLTS

CONTINUED ON FOLLOWING PAGE

*INDICATES AN ADDITION.

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TUNG-SOL

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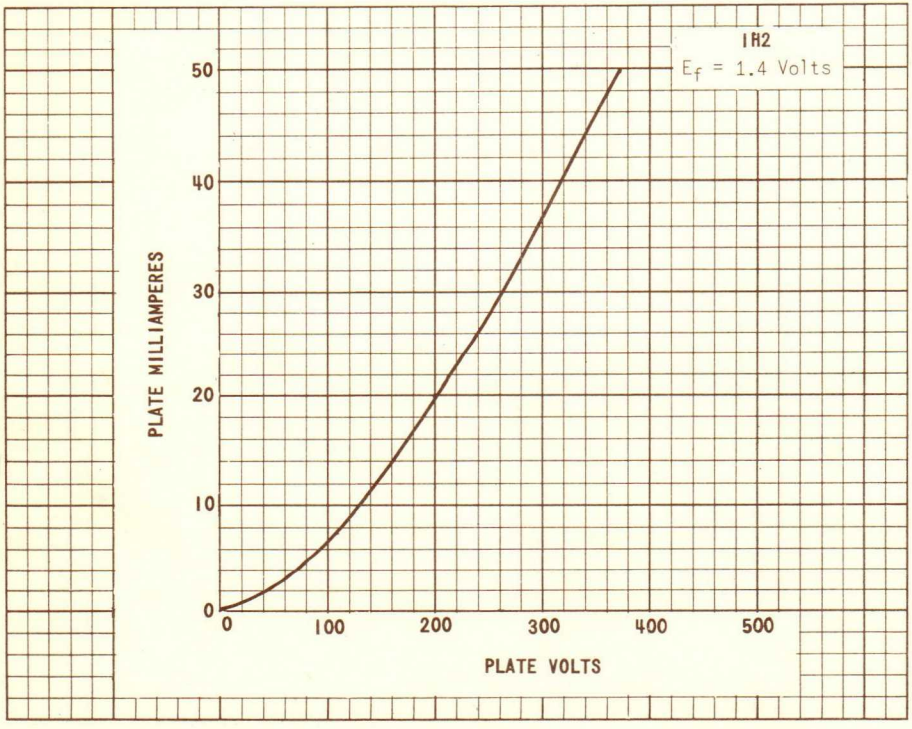
NOTES

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

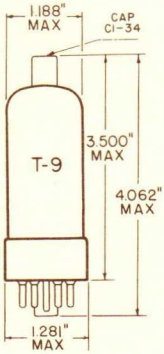
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

THE VOLTAGES EMPLOYED IN SOME TELEVISION RECEIVERS AND OTHER HIGH-VOLTAGE EQUIPMENT ARE SUFFICIENTLY HIGH THAT HIGH-VOLTAGE RECTIFIER TUBES MAY PRODUCE SOFT X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS SUCH TUBES ARE ADEQUATELY SHIELDED. THE NEED FOR THIS PRECAUTION SHOULD BE CONSIDERED IN EQUIPMENT DESIGN. RELATIVELY SIMPLE SHIELDING SHOULD PROVE ADEQUATE.



TUNG-SOL

DIODE



GLASS BULB

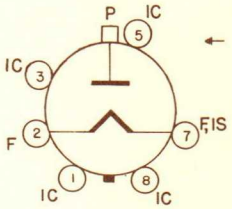
B6-8 INTERMEDIATE SHELL
OR
B6-60 SHORT
INTERMEDIATE SHELL
6 PIN OCTAL

COATED FILAMENT

1.25 VOLTS 0.2 AMP.
AC OR DC

ANY MOUNTING POSITION

CONNECTORS SHOULD NOT EXERT MORE THAN 7 POUNDS RADIAL COMPRESSION AT ANY POINT AROUND THE CIRCUMFERENCE OF THE CAP.



BOTTOM VIEW

BASING DIAGRAM
JEDEC 3C

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.

THE 1J3 IS A FILAMENTARY DIODE DESIGNED FOR USE IN TELEVISION RECEIVERS AS THE HIGH-VOLTAGE RECTIFIER TO SUPPLY POWER TO THE ANODE OF THE TELEVISION PICTURE TUBE. IT IS INTENDED PRIMARILY FOR USE IN FLYBACK TYPES OF POWER SUPPLIES.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.
WITHOUT EXTERNAL SHIELD

PLATE TO FILAMENT	1.6	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM
FLYBACK RECTIFIER SERVICE[A]

FILAMENT VOLTAGE	1.25[B]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE		
DC COMPONENT	22 000	VOLTS
TOTAL DC AND PEAK	26 000	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	50	MA.
MAXIMUM DC OUTPUT CURRENT	0.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FILAMENT VOLTAGE	1.25	VOLTS
FILAMENT CURRENT	0.2	AMP.
TUBE VOLTAGE DROP (APPROX.) I_b=7.0 MA. DC	225	VOLTS

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→INDICATES A CHANGE.

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NOTES

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

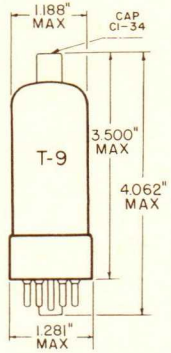
[B] UNDER NO CIRCUMSTANCES SHOULD THE FILAMENT VOLTAGE BE LESS THAN 1.05 VOLTS OR MORE THAN 1.45 VOLTS.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

THE VOLTAGES EMPLOYED IN SOME TELEVISION RECEIVERS AND OTHER HIGH-VOLTAGE EQUIPMENT ARE SUFFICIENTLY HIGH THAT HIGH-VOLTAGE RECTIFIER TUBES MAY PRODUCE SOFT X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS SUCH TUBES ARE ADEQUATELY SHIELDED. THE NEED FOR THIS PRECAUTION SHOULD BE CONSIDERED IN EQUIPMENT DESIGN. RELATIVELY SIMPLE SHIELDING SHOULD PROVE ADEQUATE.

TUNG-SOL

DIODE



GLASS BULB
B6-8 INTERMEDIATE SHELL
OR
B6-60 SHORT
INTERMEDIATE SHELL
6 PIN OCTAL

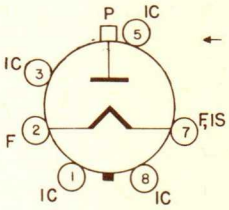
OUTLINE DRAWING
9-53 WITH B6-60 OR
9-54 WITH B6-8

COATED FILAMENT

1.25 VOLTS 200 MA.
AC OR DC

ANY MOUNTING POSITION

* CONNECTORS SHOULD NOT EXERT MORE THAN 7 POUNDS RADIAL COMPRESSION AT ANY POINT AROUND THE CIRCUMFERENCE OF THE CAP.



BOTTOM VIEW

BASING DIAGRAM
JEDEC 3C

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.

THE 1K3 IS A FILAMENTARY DIODE DESIGNED FOR USE IN TELEVISION RECEIVERS AS THE HIGH-VOLTAGE RECTIFIER TO SUPPLY POWER TO THE ANODE OF THE TELEVISION PICTURE TUBE. IT IS INTENDED PRIMARILY FOR USE IN FLYBACK TYPES OF POWER SUPPLIES AND IS A DIRECT REPLACEMENT FOR THE 1J3.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

PLATE TO FILAMENT	1.6	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FLYBACK RECTIFIER SERVICE[A]

FILAMENT VOLTAGE	1.25[B]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE		
DC COMPONENT	22 000	VOLTS
TOTAL DC AND PEAK	26 000	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	50	MA.
MAXIMUM DC OUTPUT CURRENT	0.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FILAMENT VOLTAGE	1.25	VOLTS
FILAMENT CURRENT	0.2	AMP.
TUBE VOLTAGE DROP (APPROX.) I_b =7.0 MA. DC	225	VOLTS

CONTINUED ON FOLLOWING PAGE

*INDICATES AN ADDITION.

→INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

NOTES

A FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

B UNDER NO CIRCUMSTANCES SHOULD THE FILAMENT VOLTAGE BE LESS THAN 1.05 VOLTS OR MORE THAN 1.45 VOLTS.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

THE VOLTAGES EMPLOYED IN SOME TELEVISION RECEIVERS AND OTHER HIGH-VOLTAGE EQUIPMENT ARE SUFFICIENTLY HIGH THAT HIGH-VOLTAGE RECTIFIER TUBES MAY PRODUCE SOFT X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS SUCH TUBES ARE ADEQUATELY SHIELDED. THE NEED FOR THIS PRECAUTION SHOULD BE CONSIDERED IN EQUIPMENT DESIGN. RELATIVELY SIMPLE SHIELDING SHOULD PROVE ADEQUATE.

TUNG-SOL

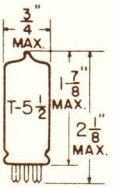
RF AMPLIFIER PENTODE

MINIATURE TYPE

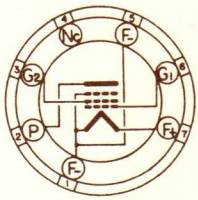
COATED FILAMENT

FILAMENT
1.4 VOLTS 0.05 AMPERE
DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 1L4 IS A RF PENTODE OF THE MINIATURE TYPE WITH A SHARP CUT-OFF CHARACTERISTIC. IT IS RECOMMENDED FOR USE WHEREVER A SHARP CUT-OFF PENTODE IS REQUIRED IN COMPACT, LIGHT-WEIGHT, PORTABLE RECEIVERS. THE TUBE IS, THEREFORE, OF INTEREST IN FM RECEIVERS AND IN OTHER CIRCUITS NOT REQUIRING AVC. THE 1L4 FEATURES INTERNAL SHIELDING WHICH ELIMINATES THE NEED FOR AN EXTERNAL BULB SHIELD, BUT A SOCKET WITH SHIELDING IS ESSENTIAL IF MINIMUM GRID-PLATE CAPACITANCE IS TO BE OBTAINED.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID TO PLATE: (G_1 TO P) MAX.	0.008	µµf
INPUT: G_1 TO (F + G_2 + G_3 + I.S.)	3.6	µµf
OUTPUT: P TO (F + G_2 + G_3 + I.S.)	7.5	µµf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	110	VOLTS
MINIMUM GRID #1 VOLTAGE	0	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	6.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	CLASS A_1 AMPLIFIER		
FILAMENT VOLTAGE	1.4	1.4	VOLTS
FILAMENT CURRENT	0.05	0.05	AMP.
PLATE VOLTAGE	90	90	VOLTS
GRID #2 VOLTAGE	67.5	90	VOLTS
GRID #1 VOLTAGE	0	0	VOLTS
PLATE CURRENT	2.9	4.5	MA.
GRID #2 CURRENT	1.2	2.0	MA.
PLATE RESISTANCE (APPROX.)	0.6	0.35	MEGOHM
TRANSCONDUCTANCE	925	1 025	µMHOS
GRID #1 VOLTAGE FOR PLATE CURRENT = 10 µAMPS	-6	-8	VOLTS

SIMILIAR TYPE REFERENCE: Characteristics somewhat similar to 1LN5 and 1N5GT.

→ INDICATES A CHANGE OR ADDITION.

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PLATE 1825
JUNE 2, 1947

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1L4

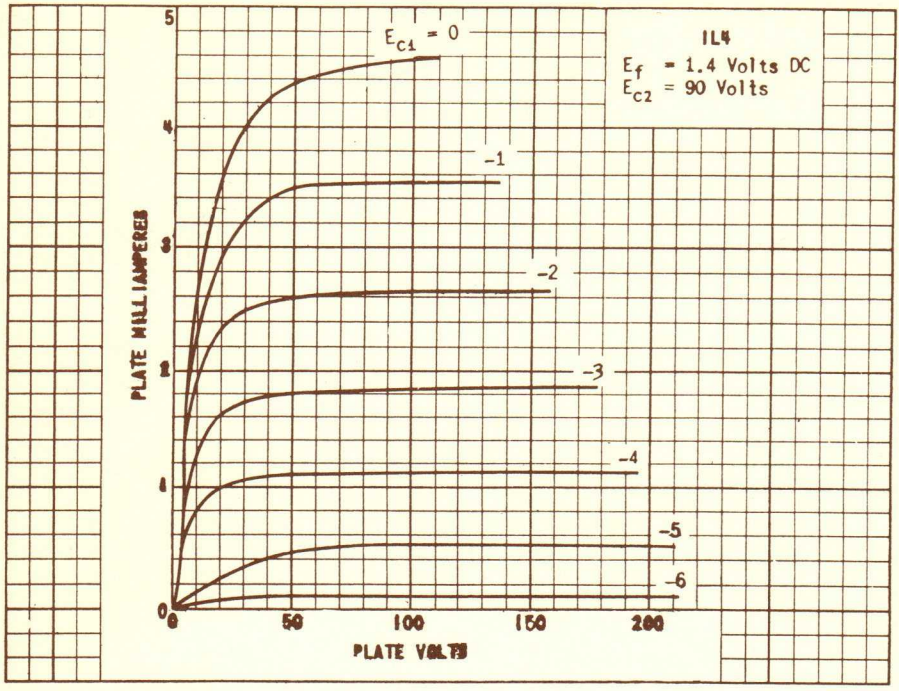

PLATE
1826
JUNE 2,
1947

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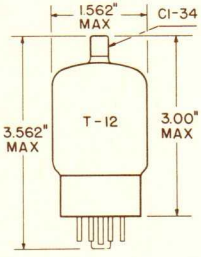
TUNG-SOL

DIODE

COATED FILAMENT

FOR HIGH VOLTAGE
RECTIFIER APPLICATIONS

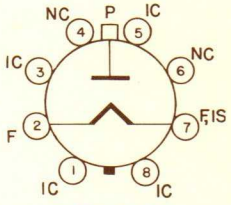
ANY MOUNTING POSITION



GLASS BULB

SHORT MEDIUM SHELL
7 PIN OCTAL B7-227

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 & 6 MAY BE USED AS TIE POINTS AT OR NEAR FILAMENT POTENTIAL.



BOTTOM VIEW

BASING DIAGRAM
JEDEC 3C

THE 1N2A IS A FILAMENTARY HALF-WAVE DIODE INTENDED FOR SERVICE AS THE HIGH VOLTAGE RECTIFIER IN TELEVISION RECEIVERS AND OTHER HIGH VOLTAGE RECTIFIER APPLICATIONS.

IT IS IDENTICAL TO TYPE 1N2 EXCEPT TYPE 1N2A IS CONTAINED IN A SHORTER BULB THAN TYPE 1N2.

DIRECT INTERELECTRODE CAPACITANCES

PLATE TO FILAMENT AND INTERNAL SHIELD	1.4	pf

FILAMENT CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.25 VOLTS	200	MA.
FILAMENT SUPPLY LIMITS:			
VOLTAGE OPERATION [C]		1.25±0.20	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

FLYBACK VOLTAGE RECTIFIER[D]

INVERSE PLATE VOLTAGE:		
TOTAL DC AND PEAK	28,000	VOLTS
DC	24,000	MA.
PEAK PLATE CURRENT	50	MA.
AVERAGE PLATE CURRENT	0.5	MA.

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CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS

TUBE DROP FOR Ib = 7 MA. (APPROX.)	100	VOLTS

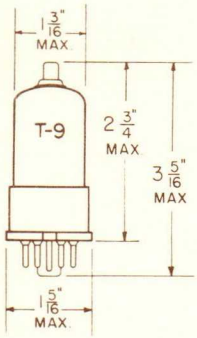
[C] FILAMENT SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN FILAMENT VOLTAGE WITHIN THE SPECIFIED VALUES.

[D] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

X-RAY RADIATION SHIELDING MAY BE NECESSARY TO PROTECT AGAINST POSSIBLE DANGER OF PERSONAL INJURY FROM PROLONGED EXPOSURE AT CLOSE RANGE IF THIS TUBE IS OPERATED AT HIGHER THAN THE MANUFACTURER'S MAXIMUM RATED PLATE VOLTAGE OR 16,000 VOLTS WHICHEVER IS LESS.

TUNG-SOL

PENTODE

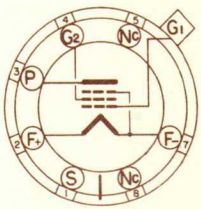


GLASS BULB

COATED FILAMENT

FILAMENT
1.4 VOLTS 50 MA.
DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL WAFER
7 PIN OCTAL
5Y

THE 1N5GT IS A FILAMENTARY TYPE SHARP CUT-OFF PENTODE VOLTAGE AMPLIFIER. IT IS DESIGNED FOR SERVICE IN LOW DRAIN BATTERY OPERATED RECEIVERS AS AN RF, IF OR AF AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

EXTERNAL SHIELD #308 CONNECTED TO PIN 7

GRID TO PLATE: (G_1 TO P) MAX.	0.007	μμf
INPUT: G_1 TO (F&G_3&IS+G_2+BS)	2.8	μμf
OUTPUT: P TO (F&G_3&IS+G_2+BS)	9.0 ←	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	110	VOLTS
MAXIMUM CATHODE CURRENT	5.0 ←	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.4	VOLTS
FILAMENT CURRENT	50	MA.
PLATE VOLTAGE	90	VOLTS
GRID #2 VOLTAGE	90	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE RESISTANCE (APPROX.)	1.5	MEGOHMS
TRANSCONDUCTANCE	750	μMHOS
PLATE CURRENT	1.2	MA.
GRID #2 CURRENT	0.3	MA.
GRID #1 VOLTAGE (APPROX.) FOR g_m = 50 μMHOS	-3.2	VOLTS
GRID #1 VOLTAGE (APPROX.) FOR g_m = 5 μMHOS	-4.0 ←	VOLTS

→ INDICATES A CHANGE.

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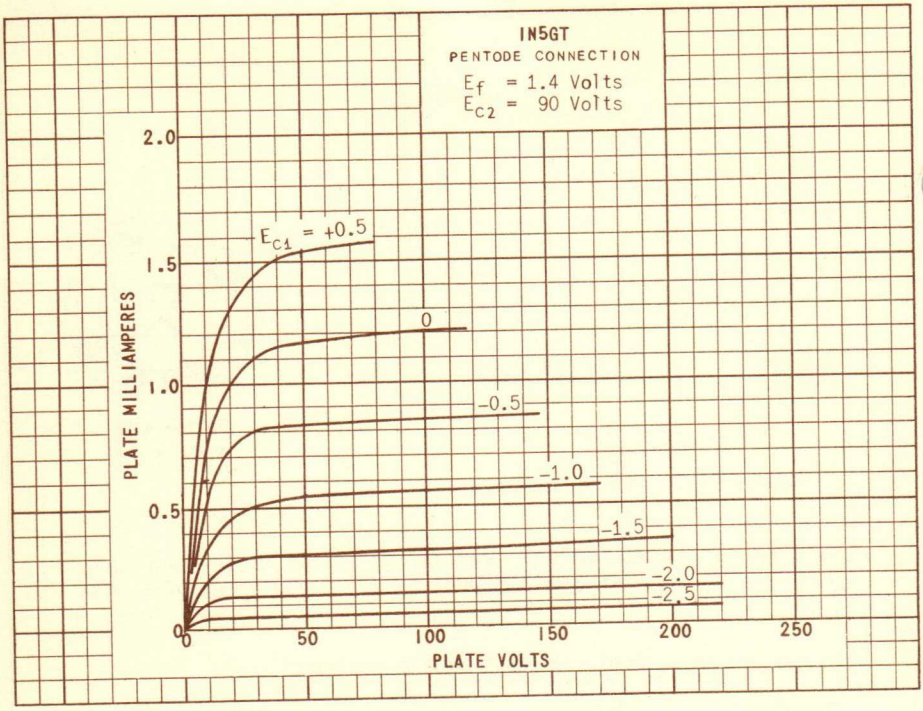
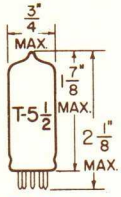
IN5GT


IN5GT
PENTODE CONNECTION
E_f = 1.4 Volts
E_{c2} = 90 Volts
PLATE MILLIAMPERES
2.0
1.5
1.0
0.5
0
E_{c1} = +0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
0
50
100
150
200
250
PLATE VOLTS

TUNG-SOL

HEPTODE

MINIATURE TYPE

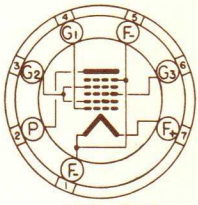


GLASS BULB

COATED FILAMENT

1.4 VOLTS 0.05 AMP.
DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7AT

THE 1R5 IS A HEPTODE CONVERTER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR SERVICE AS A COMBINED OSCILLATOR AND MIXER IN COMPACT, LIGHT-WEIGHT, PORTABLE BATTERY OPERATED EQUIPMENT. IT FEATURES A HIGH EFFICIENCY FILAMENT, ADAPTABILITY TO AVC AND PROVIDES REASONABLE CONVERSION GAIN WITH LOW BATTERY VOLTAGE AND LOW ELECTRODE CURRENTS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
MIXER GRID TO PLATE: (G_3 TO P) MAX.	0.3	0.4	μμf
RF INPUT: G_3 TO ($F+G_1+G_{2\&4}+G_5+P$)	7.0	7.0	μμf
MIXER OUTPUT: P TO ($F+G_1+G_{2\&4}+G_3+G_5$)	12.0	7.5	μμf
OSCILLATOR INPUT: G_1 TO ($F+G_{2\&4}+G_3+G_5+P$)	3.8	3.8	μμf
COUPLING: (G_1 TO G_3) MAX.	0.2	0.2	μμf
OSCILLATOR GRID TO PLATE: (G_1 TO P) MAX.	0.10	0.10	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #1.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRIDS #2 AND #4 VOLTAGE	67.5	VOLTS
MAXIMUM GRIDS #2 AND #4 SUPPLY VOLTAGE	90	VOLTS
MAXIMUM CATHODE CURRENT (ZERO-SIGNAL)	5.5	MA.
MINIMUM POSITIVE DC GRID #3 VOLTAGE	0	VOLTS

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PLATE 3015
1952

→INDICATES A CHANGE OR ADDITION

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE – SEPARATE EXCITATION[B]

FILAMENT VOLTAGE	1.4	1.4	1.4	VOLTS
FILAMENT CURRENT	0.05	0.05	0.05	AMP.
PLATE VOLTAGE	45	67.5	90	VOLTS
GRIDS #2 AND #4 VOLTAGE	45	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	0	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID) RMS	15	25	25	VOLTS
GRID #1 CURRENT (OSCILLATOR GRID)	150	250	250	μA.
GRID #1 RESISTANCE (OSCILLATOR GRID)	0.1	0.1	0.1	MEGOHM
PLATE RESISTANCE (APPROX.)	0.5	0.4	0.4	MEGOHM
PLATE CURRENT	0.7	1.4	1.5	MA.
GRIDS #2 AND #4 CURRENT	2.1	3.5	3.5	MA.
CATHODE CURRENT	3.0	5.2	5.3	MA.
CONVERSION TRANSCONDUCTANCE	210	280	280	μMHOS
GRID #3 VOLTAGE FOR G_c = 10 μMHOS	-7.0	-13	-13	VOLTS
GRID #3 VOLTAGE FOR G_c = 100 μMHOS	-2.2	-4.9	-5.0	VOLTS

[B]CHARACTERISTICS SHOWN ARE OBTAINED IN THE STANDARD RMA CONVERSION CONDUCTANCE TEST SET WHICH USES SEPARATE EXCITATION. THE CHARACTERISTICS UNDER THESE CONDITIONS CORRESPOND VERY CLOSELY WITH THOSE OBTAINED IN A SELF-EXCITED OSCILLATORY CIRCUIT OPERATING WITH ZERO BIAS.

OSCILLATOR TRANSCONDUCTANCE
NOT OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE (OSCILLATOR)	0	VOLTS
GRIDS #2 AND #4 CONNECTED TO PLATE	67.5	VOLTS
TRANSCONDUCTANCE BETWEEN GRID #1 AND GRIDS #2 AND #4 CONNECTED TO PLATE	1400	μMHOS
CATHODE CURRENT	9.0	MA.
AMPLIFICATION FACTOR BETWEEN GRID #1 AND GRIDS #2 AND #4 CONNECTED TO PLATE	6.5	
GRID #1 VOLTAGE FOR I_b = 10 μA. (APPROX.)	17	VOLTS

PLATE 3016
SEPT. 1 1952

→INDICATES A CHANGE OR ADDITION.

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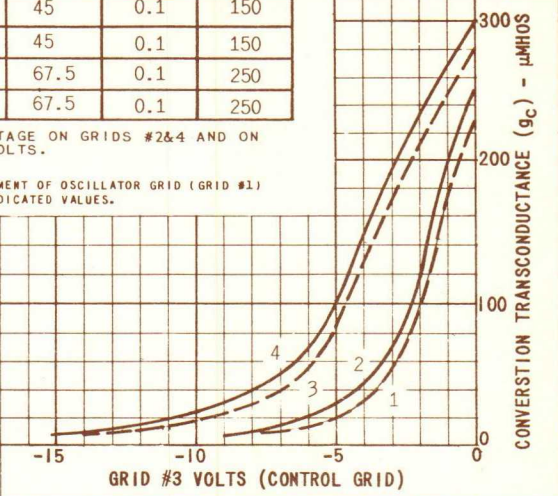
IR5
E_f = 1.4 Volts DC

CURVE	PLATE VOLTS	GRIDS 2 & 4 volts	GRID #1 RESISTOR MEGOHM	GRID #1 CURRENT[A] µAMP
1	45	45	0.1	150
2	90	45	0.1	150
3	67.5	67.5	0.1	250
4	90	67.5	0.1	250

OSCILLATOR VOLTAGE ON GRIDS #2&4 AND ON FILAMENT = O VOLTS.

[A] OBTAINED BY ADJUSTMENT OF OSCILLATOR GRID (GRID #1) VOLTAGE TO GIVE INDICATED VALUES.



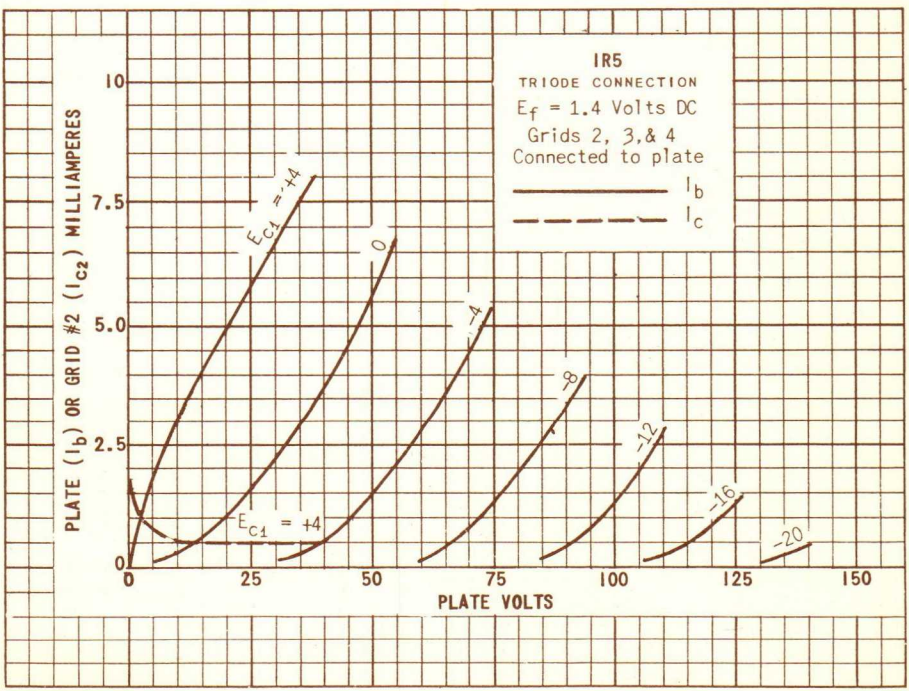


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PLATE
3017
SEPT. 1
1952

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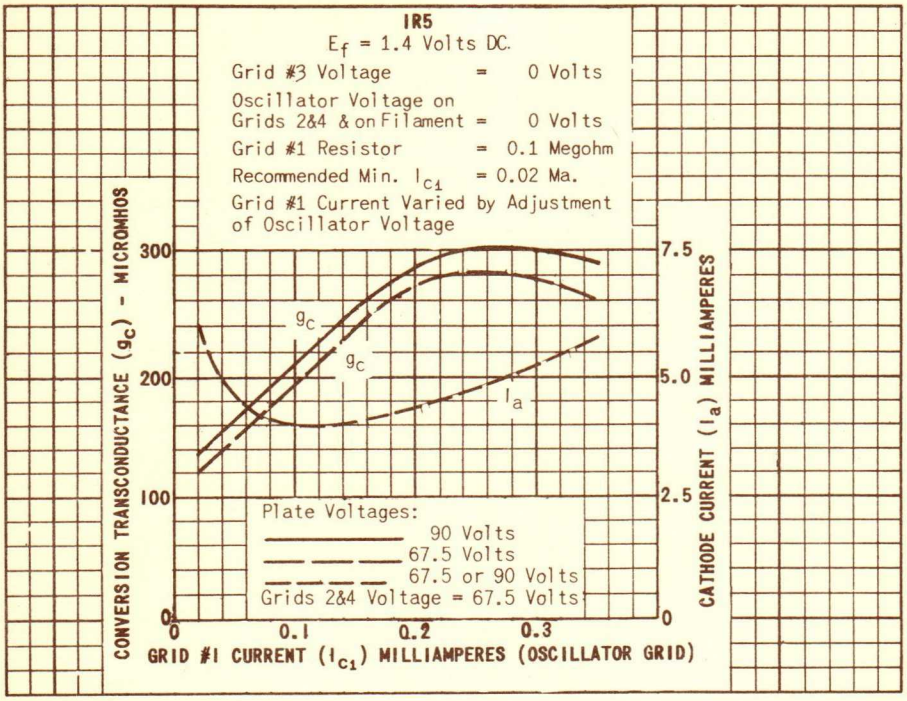

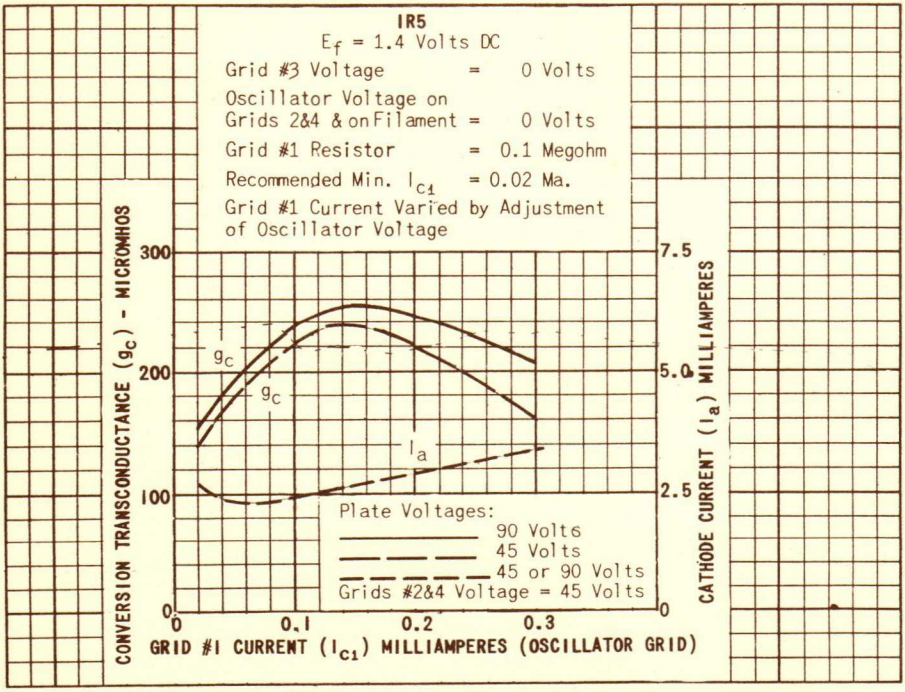

PLATE 3018
SEPT. 1 1952

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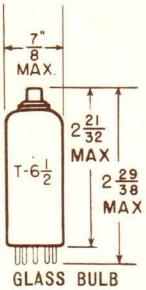
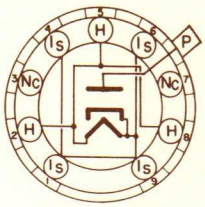
RECTIFIER



COATED UNIPOTENTIAL CATHODE

HEATER
1.4 VOLTS[A] 0.55 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW[B]
SMALL BUTTON
9 PIN NOVAL
9DT

THE 1S2A IS A HIGH VACUUM-SINGLE ANODE RECTIFIER DESIGNED FOR E.H.T. SUPPLY FROM THE LINE TIME BASE IN TELEVISION RECEIVERS. EXCEPT FOR A CHEMICALLY TREATED ENVELOPE, WHICH AVOIDS FLASH-OVER UNDER CONDITIONS OF HIGH HUMIDITY AND LOW ATMOSPHERIC PRESSURE, IT IS IDENTICAL TO THE 1S2.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

PLATE TO CATHODE AND HEATER	1.8	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	1.4	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	22 000[CD]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE AT ZERO PLATE CURRENT	24 000[CD]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE (ABS. LIMIT)	27 000[CD]	VOLTS
MAXIMUM DC OUTPUT CURRENT	0.8	MA.
MAXIMUM PEAK PLATE CURRENT	40[E]	MA.
MAXIMUM FILTER INPUT CAPACITOR	2 000	μμf
HEATER VOLTAGE AT A D.C. OUTPUT CURRENT LESS THAN 200 μAMPS (ABSOLUTE LIMITS)	1.4±15%	VOLTS
HEATER VOLTAGE AT D.C. OUTPUT CURRENT HIGHER THAN 200 μAMPS. (ABS. LIMITS)	1.4±7%	VOLTS

OPERATING CONDITIONS

HEATER VOLTAGE	1.4	VOLTS
HEATER CURRENT	0.55	AMP.
DC OUTPUT CURRENT	0.15	MA.
DC OUTPUT VOLTAGE	18 000	VOLTS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES

A WHEN THE HEATER IS TO BE OPERATED ON R.F. VOLTAGE OR FLY BACK PULSES, THE HEATER VOLTAGE CAN BE ADJUSTED TO 1.4 VOLTS BY COMPARISON OF THE COLOR OF THE CATHODE WITH THAT OF A CATHODE HEATED BY 1.4 VOLTS DC OR LOW-FREQUENCY AC.

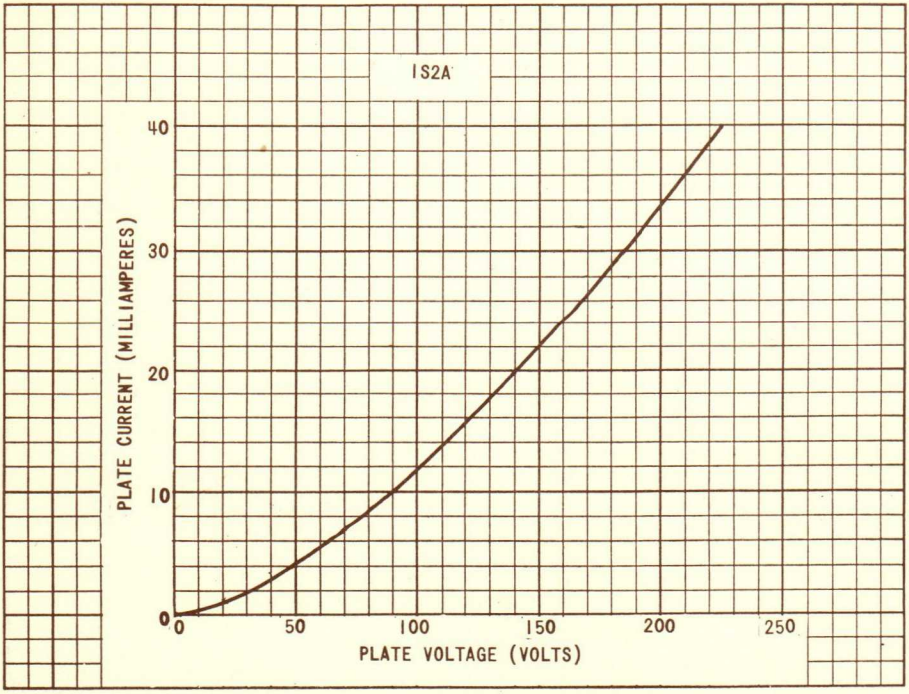
B TO PREVENT CORONA IT IS RECOMMENDED TO USE AN ANTI-CORONA RING AROUND THE TUBEHOLDER, WHICH SHOULD BE CONNECTED TO THE CATHODE (PINS 1,4,6 AND 9).

CIRCUIT ELEMENTS HAVING THE SAME POTENTIAL AS THE HEATER (E.G. A SERIES RESISTOR) MAY BE SUPPORTED BY THE TUBEHOLDER CONTACTS 3 OR 7. THESE CONTACTS SHOULD, HOWEVER, NEVER BE EARTHED.

C DUE TO RINGING CAUSED BY THE LINE OUTPUT TRANSFORMER, AN ADDITIONAL NEGATIVE PLATE VOLTAGE MAY OCCUR, THE PEAK VALUE OF WHICH MUST BE TAKEN INTO ACCOUNT. THE INCREASE OF THE PEAK INVERSE PLATE VOLTAGE DUE TO THIS EFFECT MAY AMOUNT UP TO 23% OF THE D.C. OUTPUT VOLTAGE OF THE TUBE.

D MAXIMUM PULSE DURATION 18% OF A CYCLE, WITH A MAXIMUM OF 18 μSEC,

E MAXIMUM PULSE DURATION 10% OF A CYCLE, WITH A MAXIMUM OF 10 μSEC.



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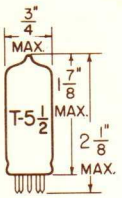
DIODE PENTODE

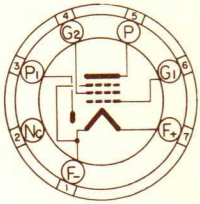


GLASS BULB

COATED FILAMENT

FILAMENT
1.4 VOLTS 50 MA.
DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6AU

THE 1S5 IS A DIODE PENTODE AMPLIFIER ESPECIALLY DESIGNED FOR DETECTOR-AUDIO SERVICE IN COMPACT, LIGHT-WEIGHT, PORTABLE EQUIPMENT. THE HIGH OPERATING EFFICIENCY ALLOWS IT TO BE USED WITH EXTREMELY LOW PLATE-SUPPLY VOLTAGE.

DIRECT INTERELECTRODE CAPACITANCES ←

DIODE PLATE TO GRID #1 [A]	0.1	μμf
DIODE PLATE TO FILAMENT & PIN #2 [B]	1.1	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM CATHODE CURRENT	3	MA.
MAXIMUM DIODE CURRENT FOR CONTINOUS OPERATION	0.25	MA.
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	-50	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - PENTODE UNIT

FILAMENT VOLTAGE	1.4	VOLTS
FILAMENT CURRENT	50	MA.
PLATE VOLTAGE	67.5	VOLTS
GRID #2 VOLTAGE	67.5	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE RESISTANCE (APPROX.)	0.6	MEGOHM
TRANSCONDUCTANCE	625	μMHOS
PLATE CURRENT	1.6	MA.
GRID #2 CURRENT	0.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA DC	-5	VOLTS
AVERAGE DIODE CURRENT AT 10 VOLTS DC	1.5	MA.

CONTINUED ON FOLLOWING PAGE

[A] WITHOUT EXTERNAL SHIELD OR WITH EXTERNAL SHIELD #316 CONNECTED TO PIN #1.

[B] WITHOUT EXTERNAL SHIELD.

→ INDICATES A CHANGE.

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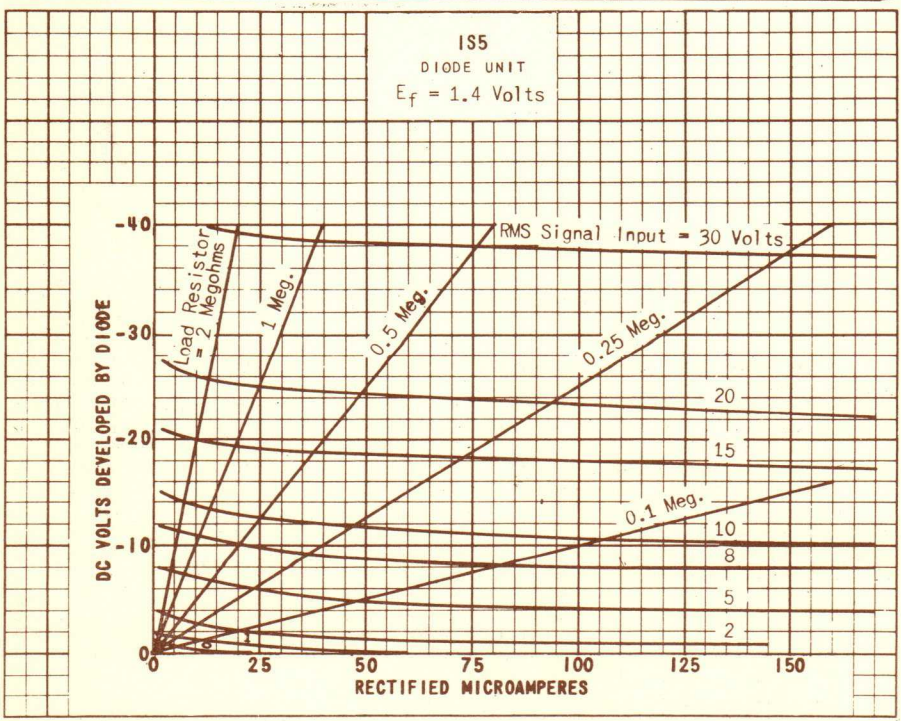
CONTINUED FROM PRECEDING PAGE

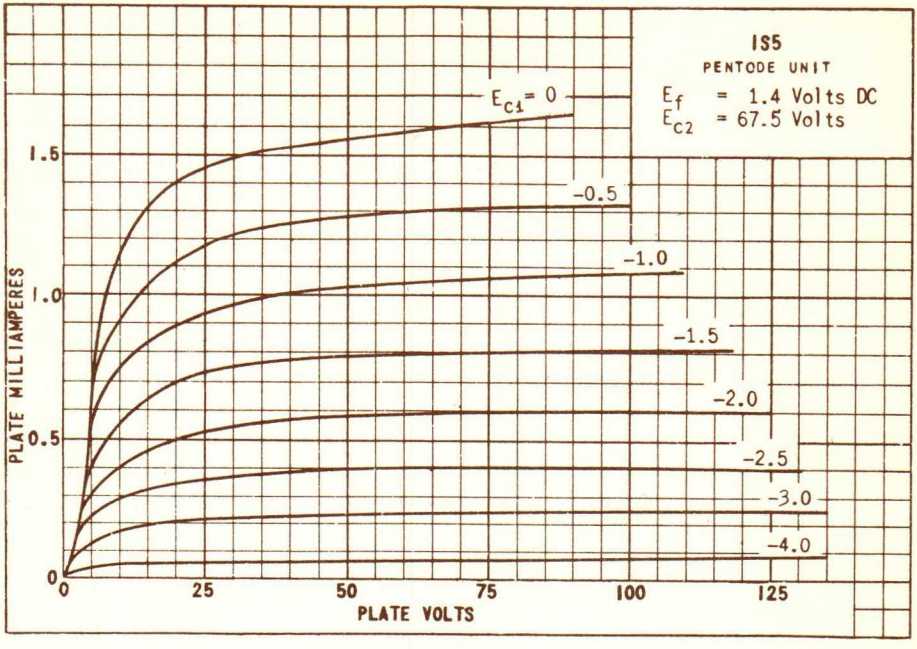
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

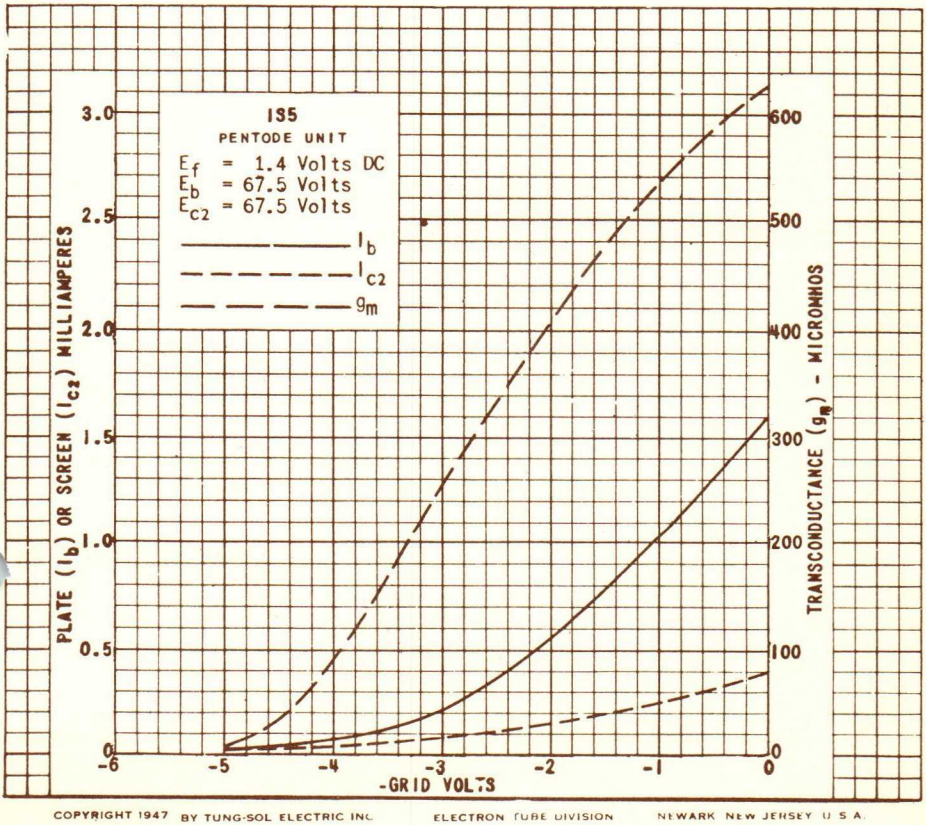
RESISTANCE COUPLED AMPLIFIER

PENTODE UNIT

FILAMENT VOLTAGE	1.4	1.4	VOLTS
PLATE SUPPLY VOLTAGE	45	90	VOLTS
SCREEN SUPPLY VOLTAGE	45	90	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	470 000	470 000	OHMS
CONTROL GRID RESISTOR	10	10	MEGOHMS
SERIES SCREEN RESISTOR	2.2	2.2	MEGOHMS
SCREEN BY-PASS CONDENSER	0.1	0.1	μf
INPUT CONDENSER	0.01	0.01	μf
OUTPUT CONDENSER	0.01	0.01	μf
GRID RESISTOR OF FOLLOWING STAGE	1.0	1.0	MEGOHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1000	1000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	5.5	17.0	VOLTS
VOLTAGE GAIN AT 400 CPS	33	50	







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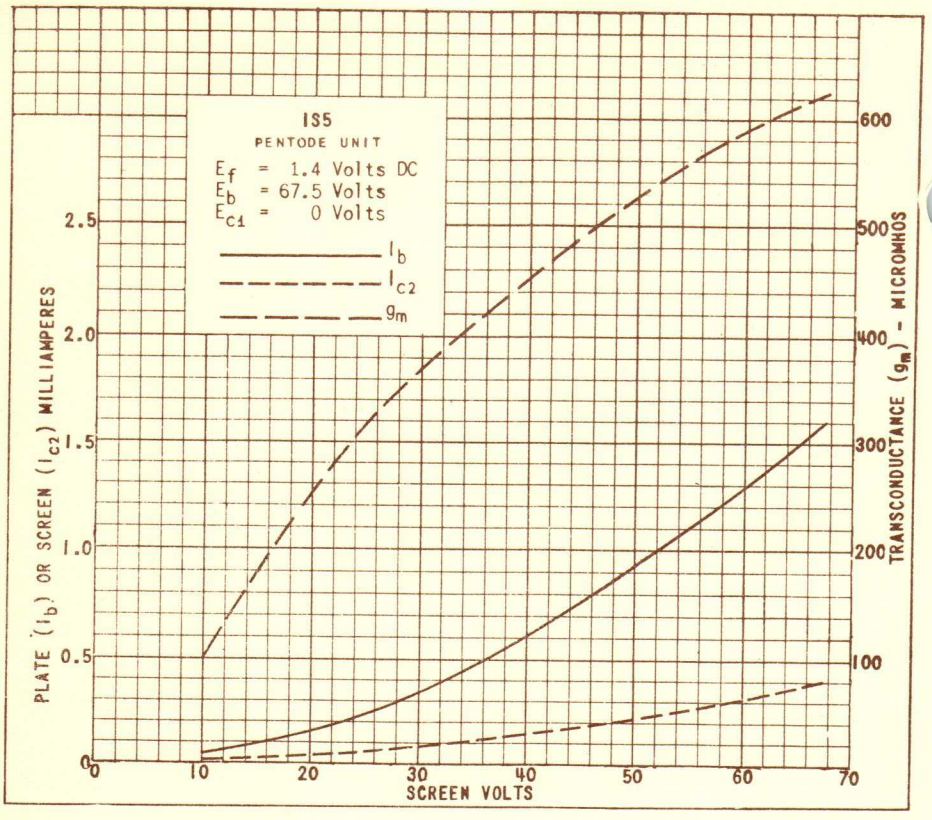
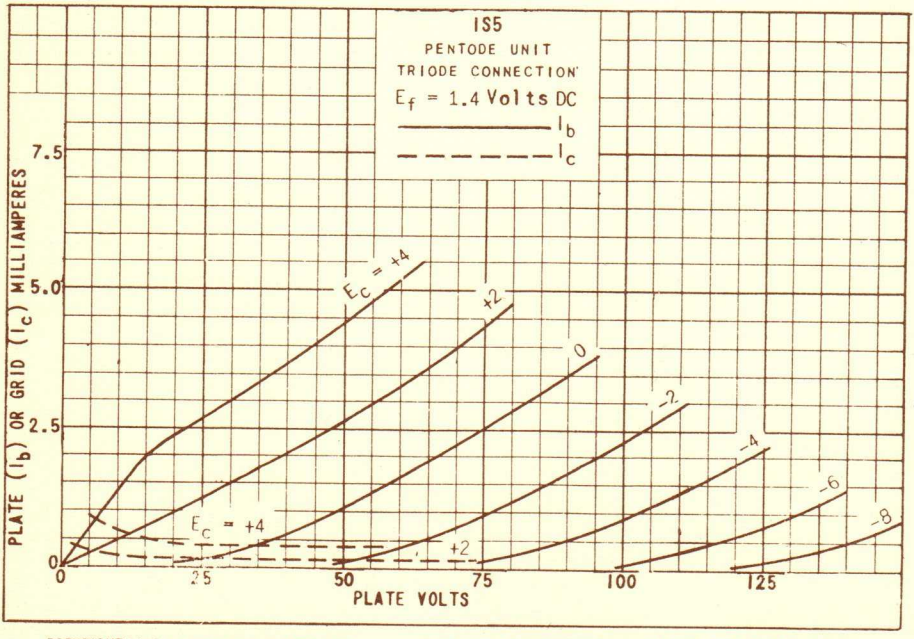
1S5





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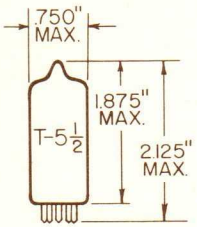
PENTODE

MINIATURE TYPE

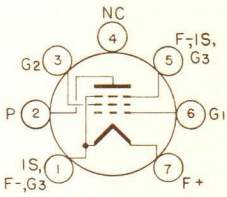


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED FILAMENT

FILAMENT
1.4 VOLTS 50 MA.
DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6AR

THE 1T4 IS A MINIATURE SUPER-CONTROL RF PENTODE. IT IS RECOMMENDED FOR USE IN COMPACT, LIGHT-WEIGHT, PORTABLE RECEIVERS WHERE AVC IS REQUIRED. THE 1T4 FEATURES ADEQUATE INTERNAL SHIELDING FOR MOST PURPOSES, BUT EXTERNAL SHIELDING IS RECOMMENDED WHERE MINIMUM GRID-PLATE CAPACITANCE IS TO BE OBTAINED.

DIRECT INTERELECTRODE CAPACITANCES

WITH OR WITHOUT EXTERNAL SHIELD #316 CONNECTED TO PIN #1

GRID TO PLATE: (G_1 TO P) MAX.	0.01	pf
INPUT: G_1 TO ($F\&G_3+G_2$)	3.6	pf
OUTPUT: P TO ($F\&G_3+G_2$)	7.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	→ 90	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM CATHODE CURRENT	5.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	45	67.5	90	90	VOLTS
GRID #2 VOLTAGE	45	67.5	45	67.5	VOLTS
GRID #1 VOLTAGE	0	0	0	0	VOLTS
PLATE RESISTANCE (APPROX.)	0.35	0.25	0.8	0.5	MEGOHM
TRANSCONDUCTANCE	700	875	750	900	µMHOS
PLATE CURRENT	1.7	3.4	1.8	3.5	MA.
GRID #2 CURRENT	0.7	1.5	0.65	1.4	MA.
GRID #1 VOLTAGE FOR g_m = 10 µMHOS	-10	-16	-10	-16	VOLTS

→ INDICATES A CHANGE.

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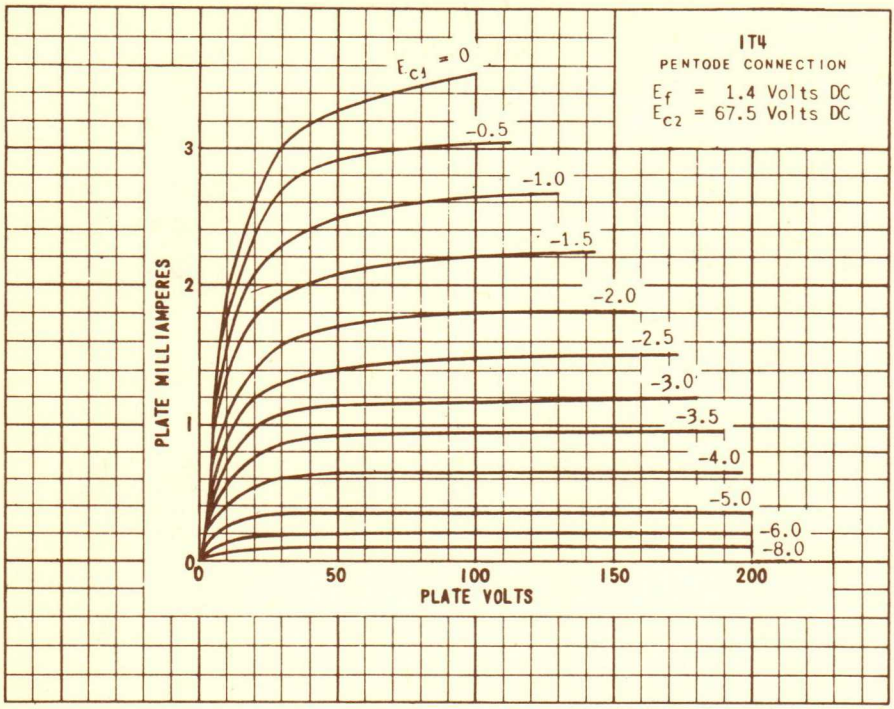
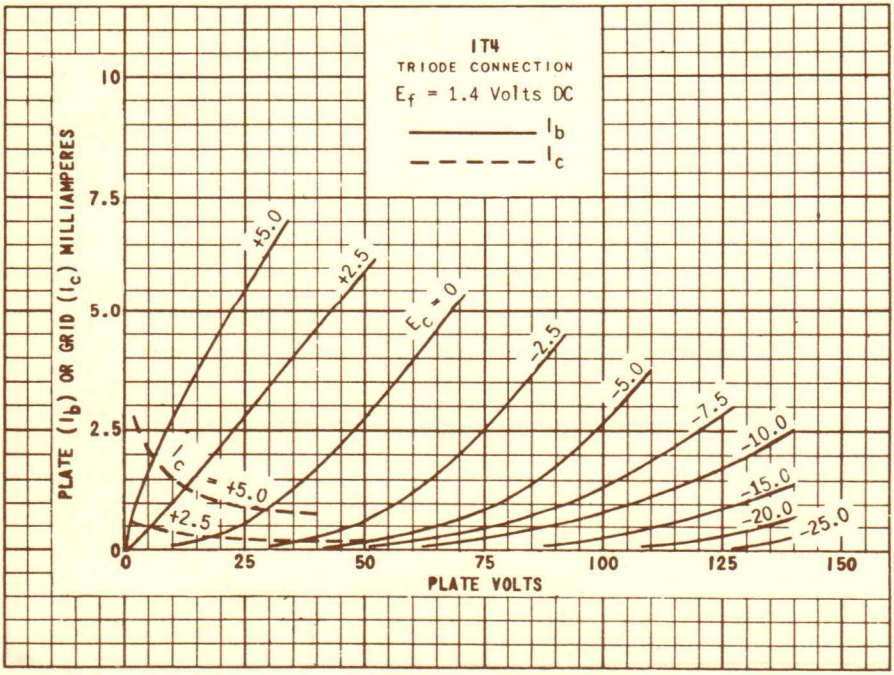
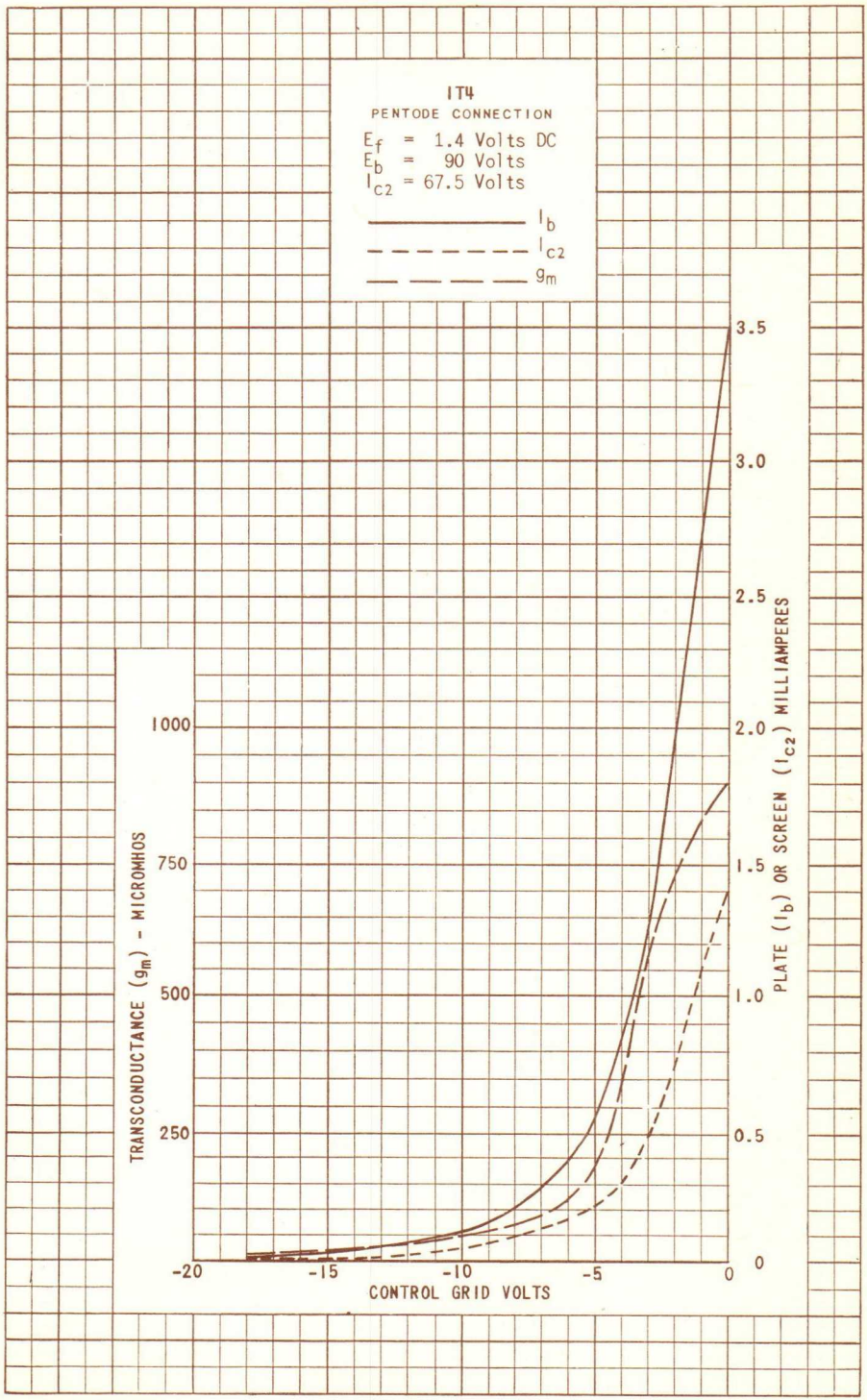
1T4


1T4
PENTODE CONNECTION
E_f = 1.4 Volts DC
E_{c2} = 67.5 Volts DC
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-5.0
-6.0
-8.0
PLATE MILLIAMPERES
PLATE VOLTS
0
1
2
3
50
100
150
200


1T4
TRIODE CONNECTION
E_f = 1.4 Volts DC
I_b
I_c
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
+5.0
+2.5
E_c = 0
-2.5
-5.0
-7.5
-10.0
-15.0
-20.0
-25.0
0
2.5
5.0
7.5
10
25
50
75
100
125
150



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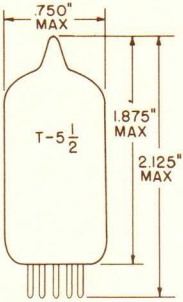
PENTODE



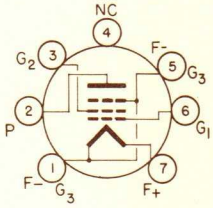
GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED FILAMENT

FOR

AF AND RF APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6AR

THE 1U4 IS A MINIATURE FILAMENTARY TYPE SHARP CUT-OFF PENTODE AMPLIFIER. IT IS INTENDED FOR RFOR AF APPLICATION WHERE CONSERVATION OF BATTERY POWER IS IMPORTANT.

DIRECT INTERELECTRODE CAPACITANCES

WITH OR WITHOUT SHIELD 316 CONNECTED TO PIN 1 OR 5

GRID TO PLATE: G1 TO P (MAX.)	0.01	pf
INPUT: G1 TO (F+G2+G3+I.S.)	3.6	pf
OUTPUT: P TO (F+G2+G3+I.S.)	7.5	pf

FILAMENT CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.4 VOLTS	50	MA.
FILAMENT SUPPLY LIMITS:			
VOLTAGE OPERATION: 1.5 VOLT DRY CELL SUPPLY	1.1 TO 1.6		VOLTS
OTHER BATTERY SUPPLIES OR POWER LINE	1.1 TO 1.5		VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	→ 120	VOLTS
GRID 2 VOLTAGE	→ 120	VOLTS
POSITIVE DC GRID 1 VOLTAGE	→ 0	VOLTS
CATHODE CURRENT	→ 6.6	MA.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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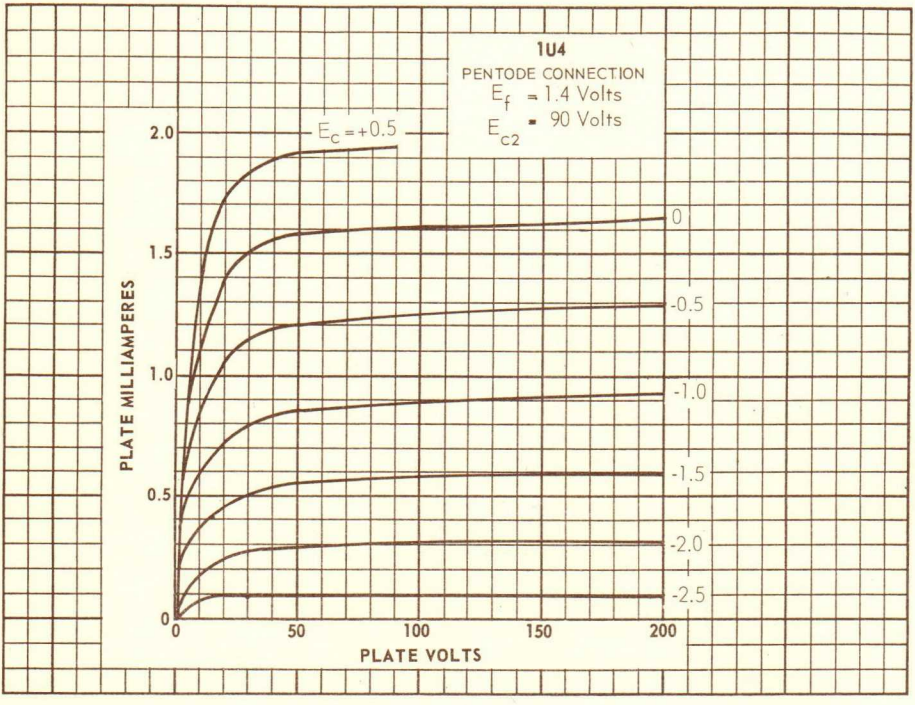
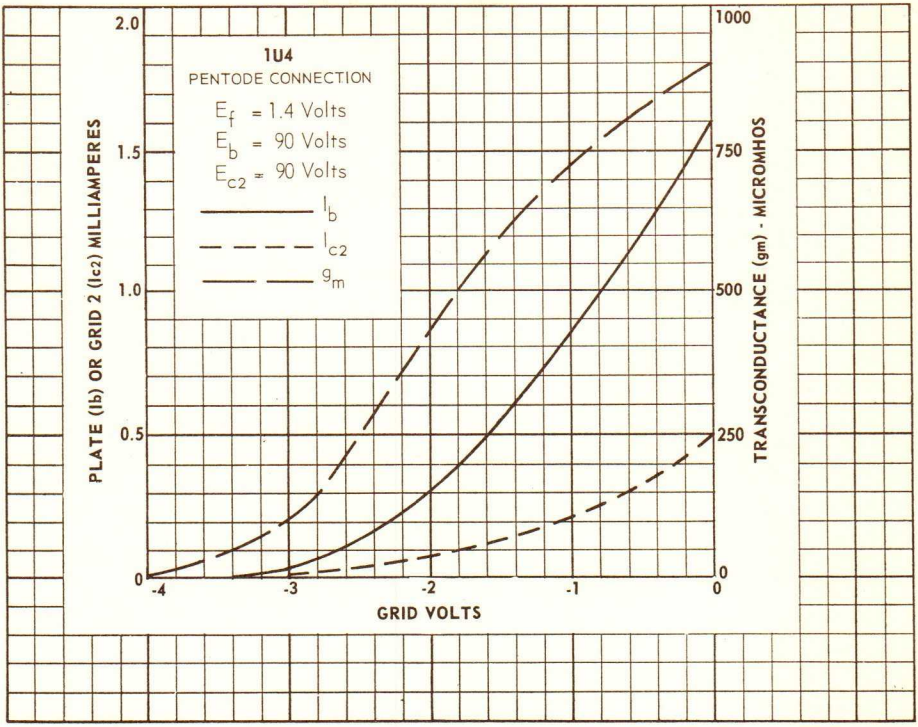
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CHARACTERISTICS

PLATE VOLTAGE	90	VOLTS
GRID 2 VOLTAGE	90	VOLTS
GRID 1 VOLTAGE	0	VOLTS
PLATE RESISTANCE (APPROX.)	1.0	MEGOHM
TRANSCONDUCTANCE	900	μMHOS
PLATE CURRENT	1.6	MA.
GRID 2 CURRENT	0.50	MA.
GRID 1 VOLTAGE FOR Ib= 10 μA. (APPROX)	-4	VOLTS





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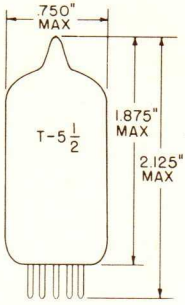
DIODE PENTODE

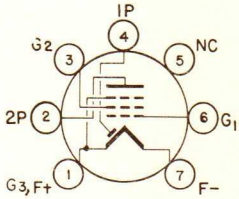


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED FILAMENT

FILAMENT
1.4 VOLTS 50 MA.
DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6BW

THE 1U5 IS A DIODE PENTODE AMPLIFIER ESPECIALLY DESIGNED FOR DETECTOR-AUDIO SERVICE IN COMPACT, LIGHT-WEIGHT, PORTABLE EQUIPMENT. THE HIGH OPERATING EFFICIENCY ALLOWS IT TO BE USED WITH EXTREMELY LOW PLATE-SUPPLY VOLTAGE.

DIRECT INTERELECTRODE CAPACITANCES ←

PENTODE GRID #1 TO DIODE PLATE (PG1 TO DP) MAX.	0.04	pf

FILAMENT CHARACTERISTICS AND RATINGS*

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.4 VOLTS	50	MA.
FILAMENT SUPPLY LIMITS:			
VOLTAGE OPERATION: 1.5 VOLT DRY CELL SUPPLY		1.1 TO 1.6	VOLTS
OTHER BATTERY SUPPLIES OR POWER LINE		1.1 TO 1.5	VOLTS

MAXIMUM RATINGS ←

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

		MA.
		MA.
PENTODE PLATE VOLTAGE	100	VOLTS
PENTODE GRID #2 VOLTAGE	100	VOLTS
CATHODE CURRENT	3.3	MA.
DIODE PLATE CURRENT	0.28	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - PENTODE UNIT

PLATE VOLTAGE	67.5	VOLTS
GRID #2 VOLTAGE	67.5	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE RESISTANCE (APPROX.)	0.6	MEGOHM
TRANSCONDUCTANCE	625	µMHOS
PLATE CURRENT	1.6	MA.
GRID #2 CURRENT	0.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µA DC	-5	VOLTS
AVERAGE DIODE CURRENT AT 10 VOLTS DC	1.5	MA.

CONTINUED ON FOLLOWING PAGE

[A] WITH SHIELD #316 CONNECTED TO PIN #1 OR WITHOUT EXTERNAL SHIELD.

— INDICATES A CHANGE. *INDICATES AN ADDITION.

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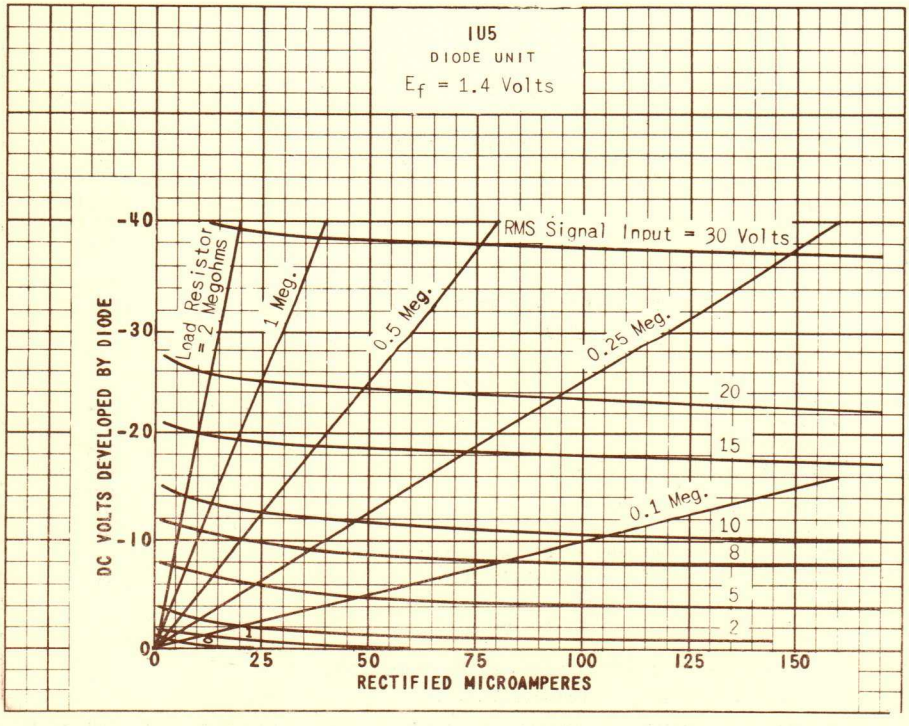
CONTINUED FROM PRECEDING PAGE

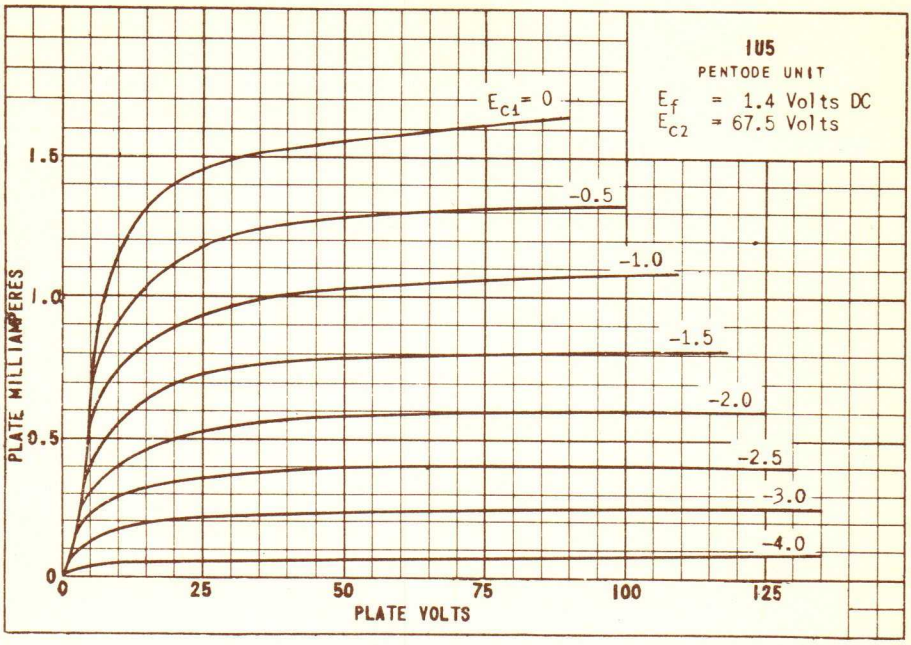
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

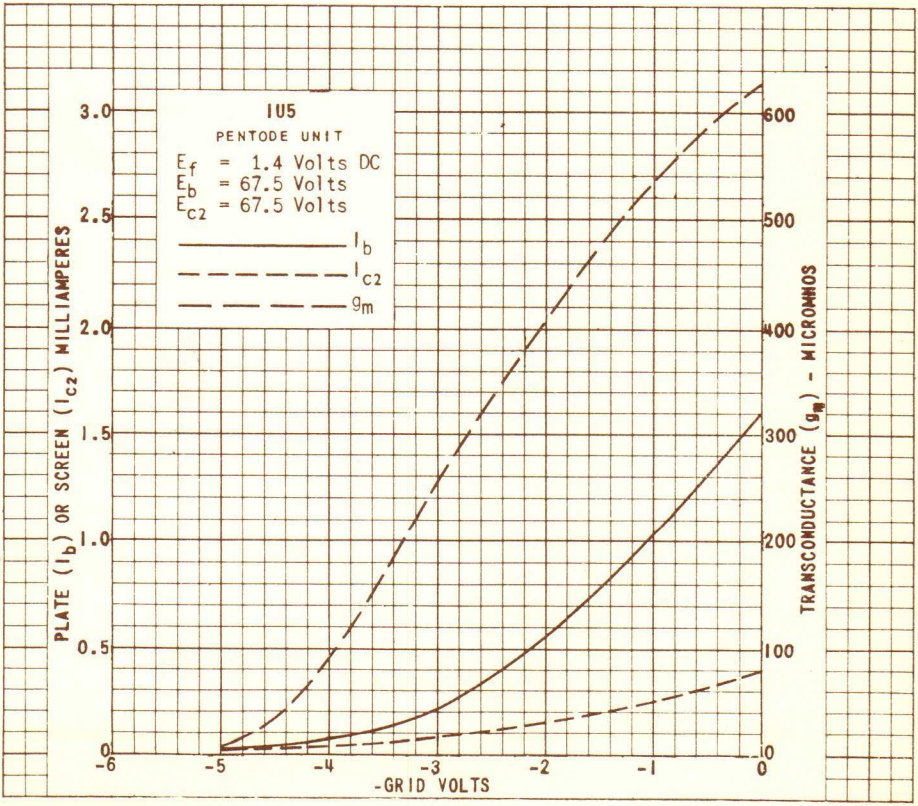
RESISTANCE COUPLED AMPLIFIER

PENTODE UNIT

PLATE SUPPLY VOLTAGE	45	90	VOLTS
SCREEN SUPPLY VOLTAGE	45	90	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	470 000	470 000	OHMS
CONTROL GRID RESISTOR	10	10	MEGOHMS
SERIES SCREEN RESISTOR	2.2	2.2	MEGOHMS
SCREEN BY-PASS CONDENSER	0.1	0.1	μf
INPUT CONDENSER	0.01	0.01	μf
OUTPUT CONDENSER	0.01	0.01	μf
GRID RESISTOR OF FOLLOWING STAGE	1.0	1.0	MEGOHM
SIGNAL SOURCE IMPEDANCE (MAX.)	1000	1000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	5.5	17.0	VOLTS
VOLTAGE GAIN AT 400 CPS	33	50	







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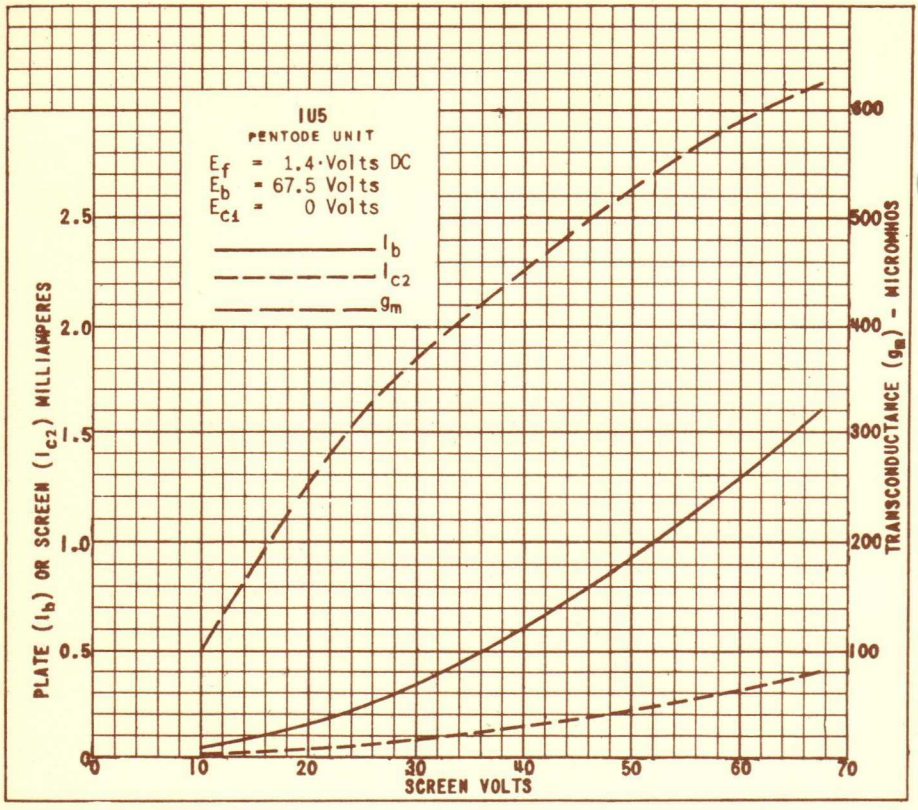
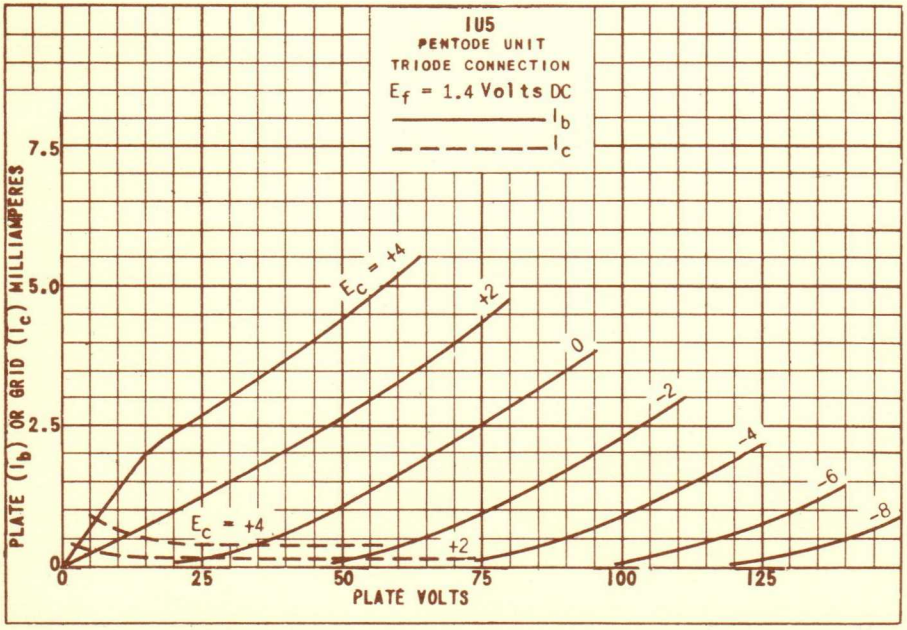
1U5





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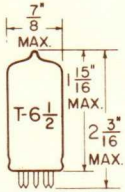
DIODE

MINIATURE TYPE

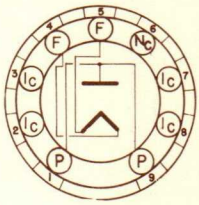


GLASS BULB

COATED FILAMENT
0.625 VOLTS 300 MA.
AC

ANY MOUNTING POSITION

SOCKET TERMINALS 2,3,7 AND 8 SHALL NOT BE USED. TERMINAL 6 MAY BE USED AS A TIE POINT FOR COMPONENTS AT NEAR FILAMENT POTENTIAL.



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9U

THE 1V2 IS A FILAMENTARY DIODE USING THE SMALL BUTTON 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN HIGH-VOLTAGE, PULSE-OPERATED RECTIFYING SYSTEMS. IN VIEW OF ITS SINGLE-ENDED CONSTRUCTION AND RESULTANT LOWER VOLTAGE RATINGS, THIS TUBE IS INTENDED FOR USE IN VOLTAGE DOUBLER CIRCUITS TO PROVIDE ADEQUATE HIGH VOLTAGE IN TELEVISION RECEIVING SYSTEMS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

PLATE TO FILAMENT: (P TO F)	0.8	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FLYBACK VOLTAGE RECTIFIER[B]

FILAMENT VOLTAGE[C]	0.625	VOLTS
FILAMENT CURRENT	300	MA.
MAXIMUM INVERSE PLATE VOLTAGE		
TOTAL DC AND PEAK (ABSOLUTE MAXIMUM)	8250 ←	VOLTS
DC	7000 ←	VOLTS
MAXIMUM PEAK PLATE CURRENT	11 ←	MA.
MAXIMUM AVERAGE PLATE CURRENT	0.6 ←	MA.
TUBE DROP (APPROX.) WITH 7 MA. PLATE CURRENT)	135	VOLTS

[A] ALL VALUES ARE EVALUATED ON DESIGN CENTER SYSTEM EXCEPT WHERE ABSOLUTE MAXIMUM IS STATED.

[B] 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 NOT TO EXCEED 15% OF A SCANNING CYCLE.

[C] UNDER NO CIRCUMSTANCES SHOULD THE FILAMENT VOLTAGE BE LESS THAN 0.525 VOLTS OR MORE THAN 0.725 VOLTS.

→ INDICATES A CHANGE

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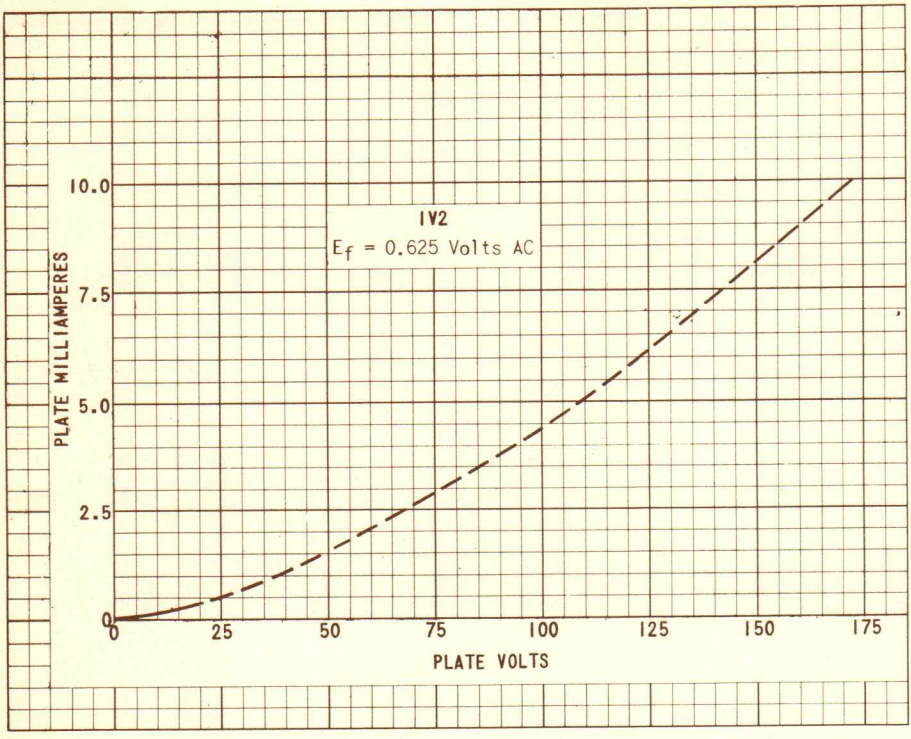
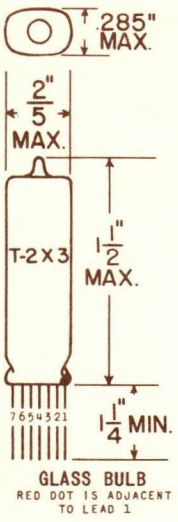

1V2
E_f = 0.625 Volts AC
PLATE MILLIAMPERES
10.0
7.5
5.0
2.5
0
0
25
50
75
100
125
150
175
PLATE VOLTS

TUNG-SOL

TRIODE PENTODE

SUBMINIATURE TYPE

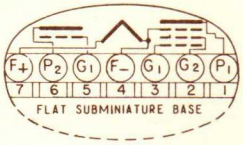


GLASS BULB
RED DOT IS ADJACENT TO LEAD 1

COATED FILAMENT

1.25 VOLTS 0.04 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
0.016" TINNED FLEXIBLE LEADS
0.05" SPACING CENTER-TO-CENTER

THE 1V6 IS A FILAMENT TYPE COMBINED TRIODE-PENTODE DESIGNED FOR SERVICE AS A CONVERTER IN RADIO RECEIVERS AND OTHER PORTABLE EQUIPMENT WHERE SMALL SIZE, LIGHT WEIGHT, AND LOW BATTERY DRAIN ARE IMPORTANT. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.20" LENGTH.

DIRECT INTERELECTRODE CAPACITANCES

WITH CLOSE FITTING SHIELD CONNECTED TO FILAMENT, NEGATIVE

TRIODE GRID #1 TO PENTODE GRID #1	0.75	μμf
PENTODE GRID #1 PENTODE PLATE	0.05	μμf
PENTODE GRID #1 TO TRIODE PLATE	0.12	μμf
TRIODE GRID #1 TO TRIODE PLATE	1.2	μμf
PENTODE GRID #1 TO ALL	3.2	μμf
TRIODE GRID #1 TO ALL	4.0	μμf
TRIODE PLATE TO ALL	1.9	μμf
PENTODE PLATE TO ALL	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

DESIGN CENTER VALUES

FILAMENT VOLTAGE	1.25	VOLTS
PLATE VOLTAGE (PENTODE)	90	VOLTS
GRID #2 VOLTAGE	90	VOLTS
PLATE VOLTAGE (TRIODE)	90	VOLTS
GRID #1 VOLTAGE (PENTODE)	NEVER POSITIVE	
TOTAL CATHODE CURRENT	1.5	MA.

CONTINUED ON FOLLOWING PAGE

→INDICATES A CHANGE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FREQUENCY CONVERTER

FILAMENT VOLTAGE	1.25	VOLTS
FILAMENT CURRENT	0.04	AMP.
PLATE VOLTAGE (PENTODE)	45	VOLTS
GRID #2 VOLTAGE	45	VOLTS
PLATE VOLTAGE (TRIODE)	45	VOLTS
GRID #1 VOLTAGE (PENTODE) [B]	0	VOLTS
GRID #1 RESISTOR (OSCILLATOR) [C]	1	MEGOHM
PLATE CURRENT (PENTODE)	400	µAMP.
GRID #2 CURRENT (PENTODE)	150	µAMP.
CONVERSION PLATE RESISTANCE (APPROX.)	1.0	MEGOHM
PLATE CURRENT (TRIODE) APPROX.	400	µAMP.
GRID #1 CURRENT (OSCILLATOR)	12	µAMP.
CONVERSION TRANSCONDUCTANCE	200	µMHOS
GRID #1 VOLTAGE (PENTODE) (APPROX.) FOR CONVERSION TRANSCONDUCTANCE = 5 µMHOS.	3.5	VOLTS

[B] GRID #1 RESISTOR = 5 MEGOHMS.

[C] GRID COUPLING CONDENSER = 10 µµFD.

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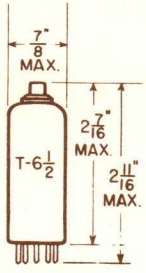


GLASS BULB

DIODE

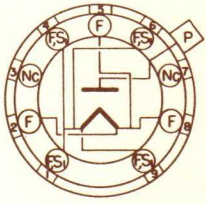
MINIATURE TYPE

COATED FILAMENT

1.25 VOLTS 200 MA.
AC

ANY MOUNTING POSITION

PINS 3 AND 7 MAY BE USED AS TIE POINTS FOR FILAMENT DROPPING RESISTOR AND HIGH VOLTAGE FILTER RESISTOR OR CONNECTED TO FILAMENT. DO NOT CONNECT TO LOW POTENTIAL CIRCUITS.



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE

THE 1X2 IS A FILAMENTARY DIODE USING THE MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN TELEVISION SET AS A HIGH VOLTAGE RECTIFIER TO SUPPLY POWER TO THE ANODE OF THE PICTURE TUBE. IT CAN BE USED IN BOTH RF AND FLYBACK TYPES OF POWER SUPPLIES AS WELL AS FOR USE AT POWER LINE FREQUENCY.

DIRECT INTERELECTRODE CAPACITANCES

PLATE TO FILAMENT: (P TO F)	1	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.25	VOLTS
FILAMENT CURRENT	200	MA.
MAXIMUM PEAK INVERSE PLATE POTENTIAL	15 000	VOLTS
MAXIMUM PEAK PLATE CURRENT	10	MA.
MAXIMUM DC LOAD CURRENT	1	MA.
MAXIMUM FREQUENCY OF SUPPLY VOLTAGE	300	KC
TUBE VOLTAGE DROP WITH TUBE CONDUCTING 7 MA.	100	VOLTS

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PLATE 2238
SEPT. 1 1949

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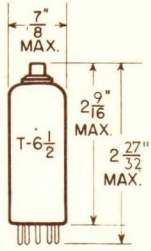
TUNG-SOL

DIODE

MINIATURE TYPE



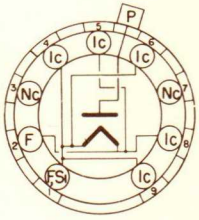
GLASS BULB
SKIRTED
MINIATURE CAP

COATED FILAMENT

1.25 VOLTS[A] 0.2 AMP.
AC OR DC

ANY MOUNTING POSITION

THIS TUBE MAY PRODUCE SOFT X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS ADEQUATELY SHIELDED.



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9Y

PINS #3&7 MAY BE CONNECTED TO FILAMENT; OTHERWISE DO NOT USE

THE 1X2B IS A MINIATURE FILAMENTARY TYPE DIODE PARTICULARLY SUITED FOR USE IN FLYBACK VOLTAGE TYPE POWER SUPPLIES.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

PLATE TO FILAMENT: P TO (F+IS)	1.0	μμf

RATINGS[B]

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FLY-BACK VOLTAGE RECTIFIER[C]

FILAMENT VOLTAGE[A]	1.25	VOLTS
FILAMENT CURRENT	0.2	AMP.
MAXIMUM INVERSE PLATE VOLTAGE:		
TOTAL DC AND PEAK (ABSOLUTE MAXIMUM)	22 ←	KV.
DC	18 ←	KV.
MAXIMUM PEAK PLATE CURRENT	45 ←	MA.
MAXIMUM AVERAGE PLATE CURRENT	0.5 ←	MA.
TUBE VOLTAGE DROP (APPROX.) WITH 7 MA. PLATE CURRENT	100	VOLTS

[A] UNDER NO CIRCUMSTANCES SHOULD THE FILAMENT VOLTAGE BE LESS THAN 1.05 VOLTS OR MORE THAN 1.45 VOLTS.

[B] ALL VALUES ARE EVALUATED ON DESIGN CENTER SYSTEM EXCEPT WHERE ABSOLUTE MAXIMUM IS STATED.

[C] 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 NOT TO EXCEED 15% OF A SCANNING CYCLE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

→ INDICATES A CHANGE.

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TUNG-SOL

TRIODE

MINIATURE TYPES

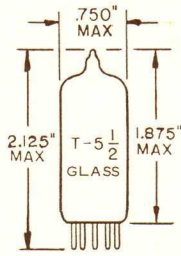
FOR

UHF TELEVISION SERVICE

COATED UNIPOTENTIAL CATHODE

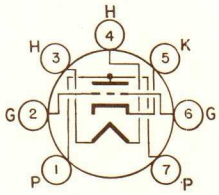
ANY MOUNTING POSITION

2AF4
OUTLINE
JEDEC 5-2



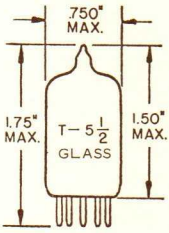
BASE 7 PIN BUTTON
JEDEC E7-1

BASING DIAGRAM
JEDEC 7DK



BOTTOM VIEW

2AF4A
OUTLINE
JEDEC 5-1



BASE 7 PIN BUTTON
JEDEC E7-1

THE 2AF4 AND 2AF4A ARE MEDIUM MU TRIODES IN THE 7 PIN MINIATURE CONSTRUCTION. THEY ARE DESIGNED FOR LOCAL OSCILLATOR SERVICE IN TELEVISION RECEIVERS WHICH OPERATE IN THE UHF REGION. INTERNAL LEAD INDUCTANCE IS REDUCED BY EMPLOYING DOUBLE CONNECTIONS TO THE PLATE AND GRID. ELECTRICALLY, THE 2AF4 IS IDENTICAL TO THE 2AF4A AND DIFFERS IN ENVELOPE SIZE.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #316 CONNECTED TO CATHODE EXCEPT AS NOTED

GRID TO PLATE	1.9	pf
GRID TO CATHODE AND HEATER	2.2	pf
PLATE TO CATHODE AND HEATER	1.4	pf
HEATER TO CATHODE - SEE NOTE BELOW	2.2	pf

NOTE: WITH EXTERNAL SHIELD #316 CONNECTED TO PLATE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	2.35 VOLTS	600	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	mA
PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		50	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		50	VOLTS
DC COMPONENT		25	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

UHF OSCILLATOR

PLATE VOLTAGE	150	VOLTS
NEGATIVE GRID VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID CURRENT	2	mA
CATHODE CURRENT	24	mA

CHARACTERISTICS

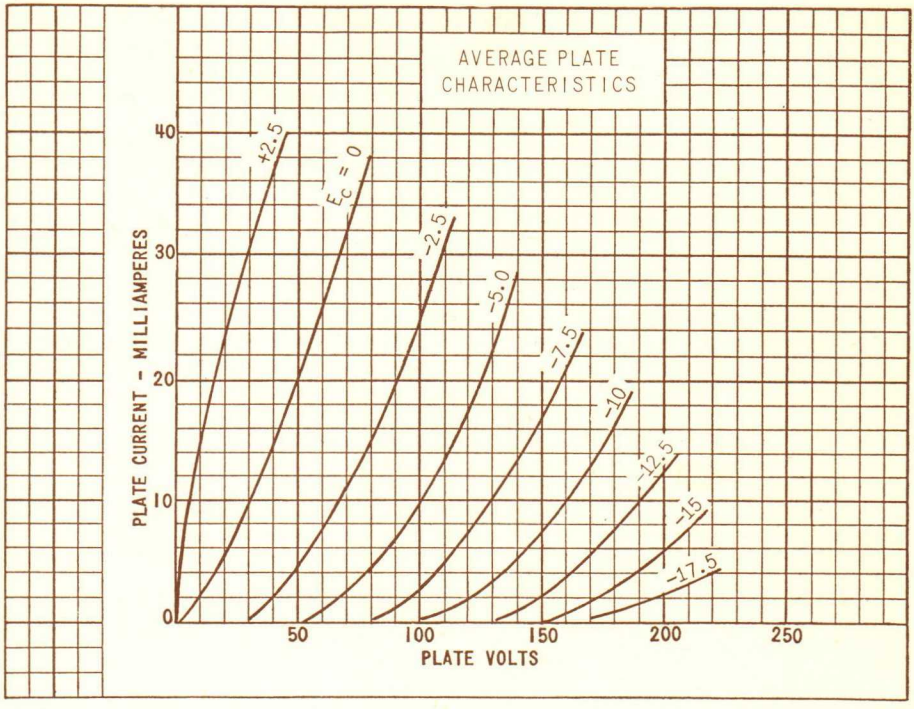
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	80	VOLTS
CATHODE RESISTOR	150	OHMS
PLATE CURRENT	17.5	mA
TRANSCONDUCTANCE	6,500	μMHOS
AMPLIFICATION FACTOR	13.5	
PLATE RESISTANCE	APPROX. 2,100	OHMS

TYPICAL OPERATION

AT FREQUENCY OF 1.000 MC/S

PLATE VOLTAGE	100	VOLTS
PLATE RESISTOR	220	OHMS
GRID RESISTOR	10,000	OHMS
PLATE CURRENT	17	mA
GRID CURRENT	APPROX. 750	μA



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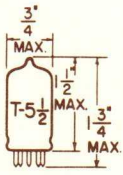
TUNG-SOL

TRIODE

MINIATURE TYPE

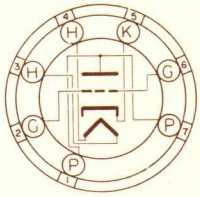


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER.
2.35 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7DK

THE 2AF4B IS A MEDIUM MU TRIODE DESIGNED FOR LOCAL OSCILLATOR SERVICE IN TELEVISION RECEIVERS WHICH OPERATE IN THE ULTRA-HIGH-FREQUENCY REGION. INTERNAL LEAD INDUCTANCE IS REDUCED BY EMPLOYING DOUBLE CONNECTIONS TO THE PLATE AND GRID. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID TO PLATE	1.9	μμf
GRID TO CATHODE AND HEATER	2.2	μμf
PLATE TO CATHODE AND HEATER	0.45	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

OSCILLATOR SERVICE

HEATER VOLTAGE	2.35	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE[A]	180	VOLTS
MAXIMUM DC PLATE VOLTAGE	150	VOLTS
MAXIMUM DC GRID VOLTAGE	-50	VOLTS
MAXIMUM DC GRID CURRENT	8	MA.
MAXIMUM PLATE INPUT	2.5	WATTS
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM DC CATHODE CURRENT	28	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:		
FIXED BIAS	NOT RECOMMENDED	
CATHODE BIAS	0.5	MEGOHM
HEATER WARM-UP TIME*	11.0	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

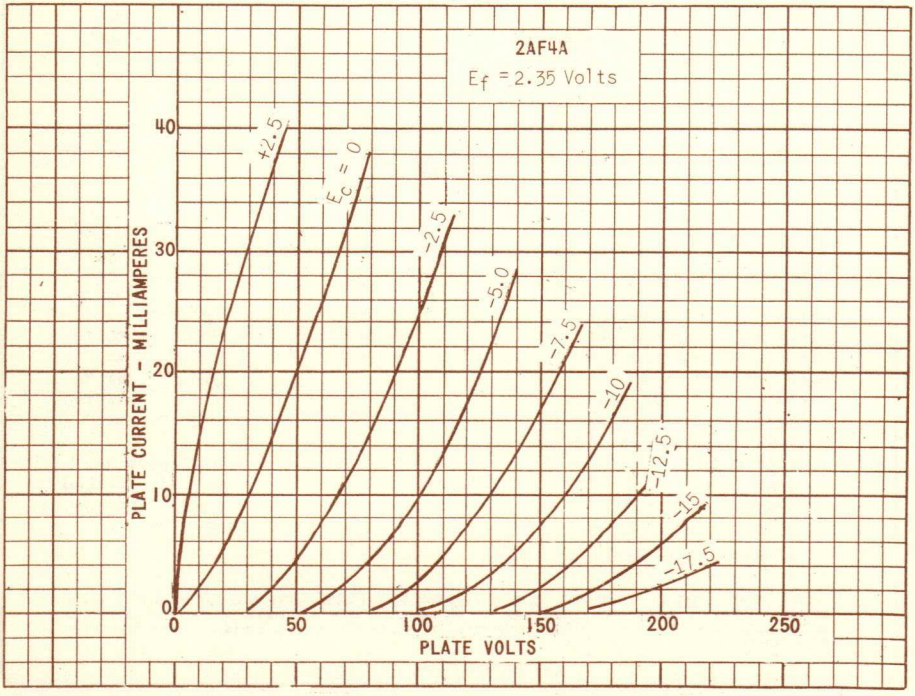
HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	80	VOLTS
CATHODE BIAS RESISTOR	150.	OHMS
AMPLIFICATION FACTOR	15	
PLATE RESISTANCE	2 270	OHMS
TRANSCONDUCTANCE	6 600	μMHOS
PLATE CURRENT	16	MA.

OPERATION AT 950 MC.

DC PLATE VOLTAGE	100	VOLTS
DC GRID VOLTAGE	−4	VOLTS
FROM A GRID RESISTOR OF	10 000	OHMS
DC PLATE CURRENT	22	MA.
DC GRID CURRENT (APPROX.)	400	μAMP.

SIMILAR TYPE REFERENCE: Except for the higher heater-cathode voltage rating, the 2AF4B is identical to the 2AF4A.

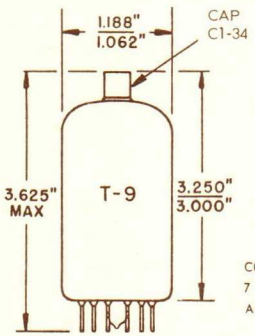
The 2AF4 curves also apply to 2AF4B.



TUNG-SOL

DIODE

COMPACTRON TYPE



GLASS BULB

BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-100

FOR

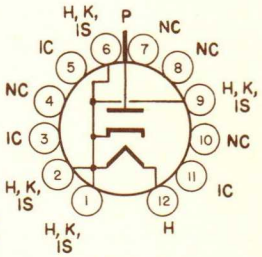
TV HIGH VOLTAGE

RECTIFIER APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

CONNECTORS SHOULD NOT EXERT MORE THAN 7 POUNDS RADIAL COMPRESSION AT ANY POINT AROUND THE CIRCUMFERENCE OF THE CAP.



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12EW
TERMINALS 4, 7 & 10 MAY BE USED AS TIE POINTS FOR COMPONENTS AT OR NEAR HEATER POTENTIAL

THE 2AS2 IS A HEATER-CATHODE TYPE DIODE IN A T-9 COMPACTRON ENVELOPE. IT IS DESIGNED FOR USE AS A HIGH-VOLTAGE RECTIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER, CATHODE AND INTERNAL SHIELD	(APPROX.)	1.4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	2.5	VOLTS	330	MA.
LIMITS OF APPLIED VOLTAGE			2.5±0.4	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

FLYBACK RECTIFIER SERVICE[A]

PEAK INVERSE PLATE VOLTAGE		
DC COMPONENT	24	KVOLTS
TOTAL DC AND PEAK	30	KVOLTS
STEADY-STATE PEAK CURRENT	80	MA.
DC OUTPUT CURRENT	1.5	MA.

A
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 MUST NOT EXCEED 15 PERCENT OF ONE SCANNING CYCLE.

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TUNG-SOL

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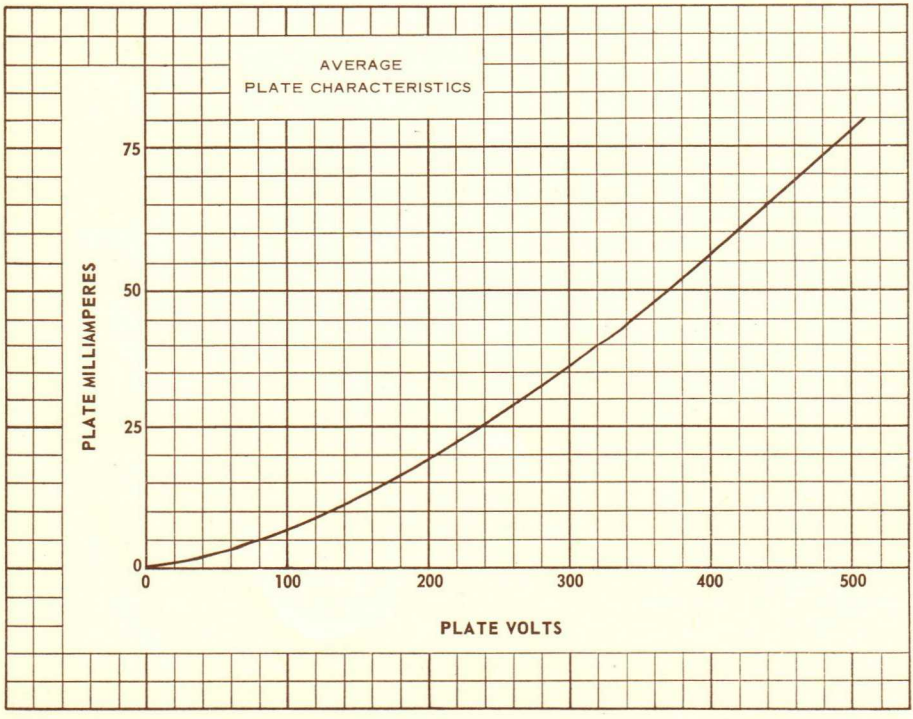
AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP, APPROX. Ib = 7.0 MA.	100	VOLTS



TUNG-SOL

TRIODE

MINIATURE TYPE

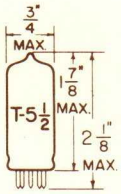
COATED UNIPOTENTIAL CATHODE

HEATER

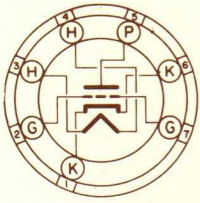
2.35 VOLTS 0.6±6% AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7EG

THE 2BN4 AND 2BN4A ARE MINIATURE MEDIUM-MU TRIODES DESIGNED FOR USE AS RADIO-FREQUENCY AMPLIFIERS IN VHF TELEVISION TUNERS. THERMAL CHARACTERISTICS OF THE HEATERS ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED THEY ARE USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE HIGHER TRANSCONDUCTANCE AND LOWER PLATE RESISTANCE OF THE 2BN4A, THE TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #316

GRID TO PLATE	1.2	μμf
INPUT	3.2	μμf
OUTPUT	1.4	μμf
HEATER TO CATHODE	2.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	2.35	VOLTS
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHMS
HEATER WARM-UP TIME*	11	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

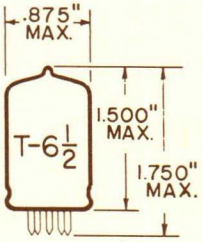
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.6±6%	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE-BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	43	
PLATE RESISTANCE (APPROX.) FOR 2BN4	6 300	OHMS
PLATE RESISTANCE (APPROX.) FOR 2BN4A	5 400	OHMS
TRANSCONDUCTANCE (FOR 2BN4)	6 800	μMHOS
TRANSCONDUCTANCE (FOR 2BN4A)	8 000	μMHOS
PLATE CURRENT	9.0	MA.
GRID VOLTAGE (APPROX.)		
I_b = 100 μAMPS.	-6	VOLTS

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



GLASS BULB

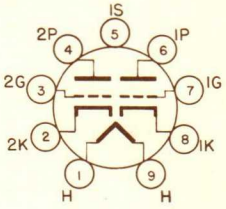
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-1

COATED UNIPOTENTIAL CATHODE

FOR

APPLICATIONS IN THE LOW
TO VHF FREQUENCY RANGE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8CJ

THE 2C51 COMBINES TWO INDEPENDENT AND SHIELDED, MEDIUM-MU, INDIRECTLY HEATED CATHODE TYPE TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN AMPLIFIER, MIXER, OSCILLATOR, MULTIVIBRATOR AND CLAMP CIRCUITS. THE USEFUL RANGE EXTENDS FROM LOW FREQUENCIES THROUGH THE VHF RANGE.

→ DIRECT INTERELECTRODE CAPACITANCES

EACH SECTION

	WITH SHIELD	WITHOUT SHIELD	
GRID TO PLATE: (G TO P)	1.3[A]	1.3	pf
INPUT: G TO (H+K+I.S.)	2.3[A]	2.2	pf
OUTPUT: P TO (H+K+I.S.)	1.3[A]	1.0	pf
PLATE TO PLATE	0.03[B]	0.04	pf

A
PIN #5 & EXTERNAL SHIELD #315 CONNECTED TO CATHODE PIN OF SECTION UNDER TEST. ELEMENTS OF OTHER SECTION GROUNDED.

B
PIN #5 & EXTERNAL SHIELD #315 CONNECTED TO GROUND WITH OTHER ELEMENTS.

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		90	VOLTS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TUNG-SOL

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MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

EACH SECTION

PLATE VOLTAGE	300	VOLTS
PLATE POSITIVE DC GRID VOLTAGE*	0	VOLTS
PLATE DISSIPATION	1.5	WATTS
CATHODE CURRENT	18	MA.
GRID CIRCUIT RESISTANCE*	1	MEGOHM

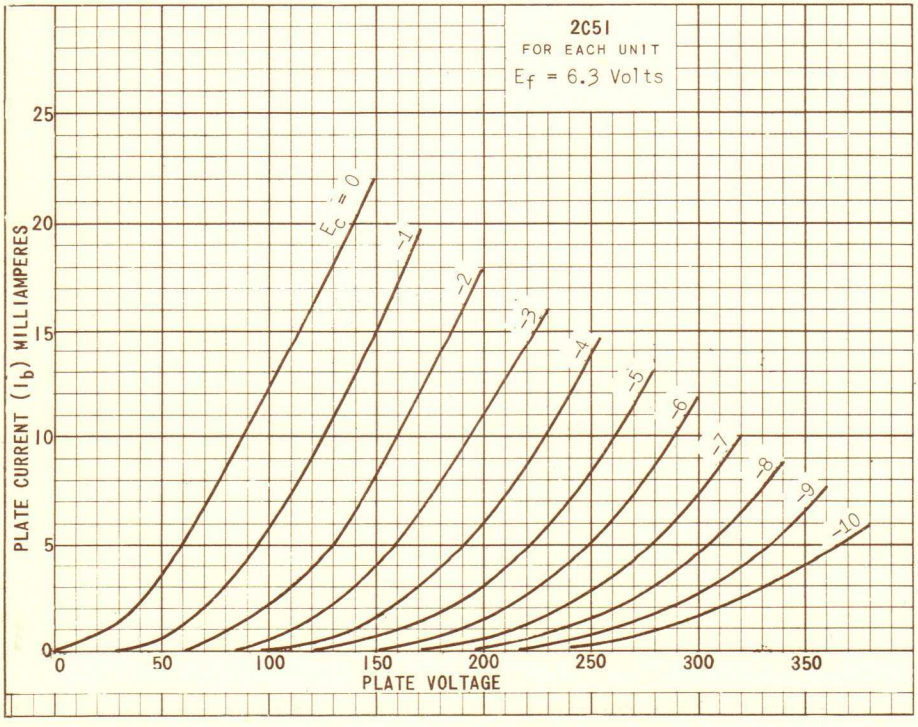
→ TYPICAL OPERATING CHARACTERISTICS

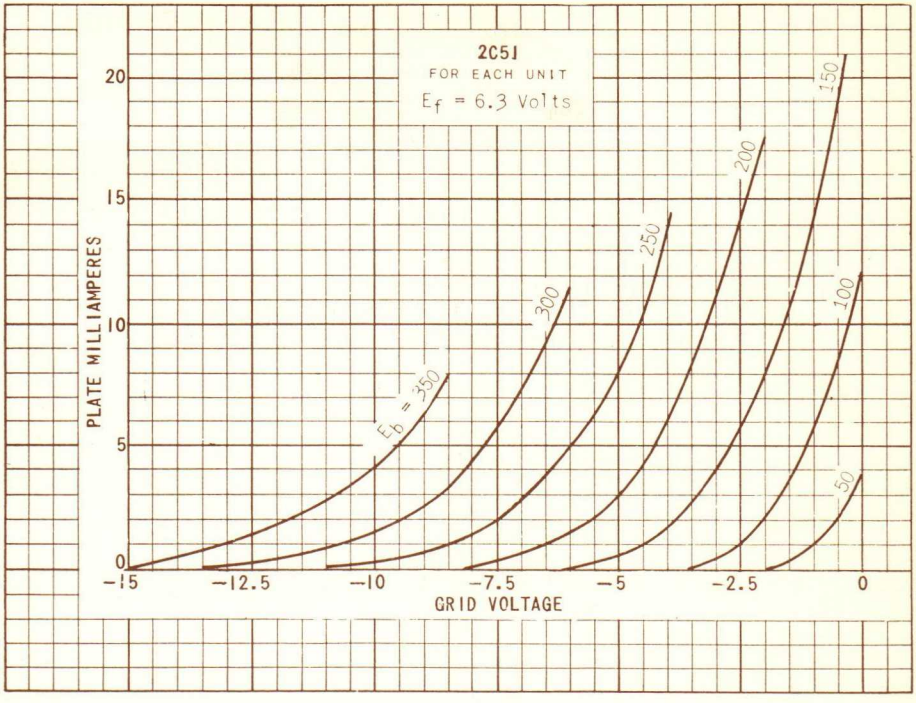
CLASS A_1 AMPLIFIER

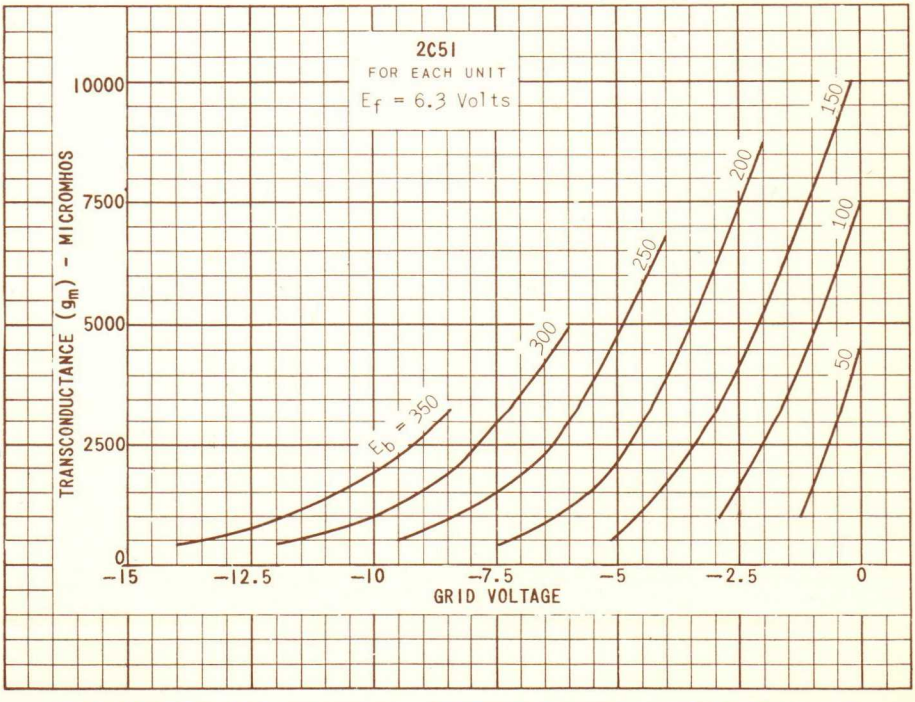
EACH SECTION

PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	240	OHMS
PLATE CURRENT	8.2	MA.
PLATE RESISTANCE (APPROX.)	6500	OHMS
TRANSCONDUCTANCE	5500	μMHOS
AMPLIFICATION FACTOR	35	
GRID #1 VOLTAGE FOR Ib = 10 μA	-8	VOLTS

*INDICATES AN ADDITION.
→ INDICATES A CHANGE.







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MAY 1
1951

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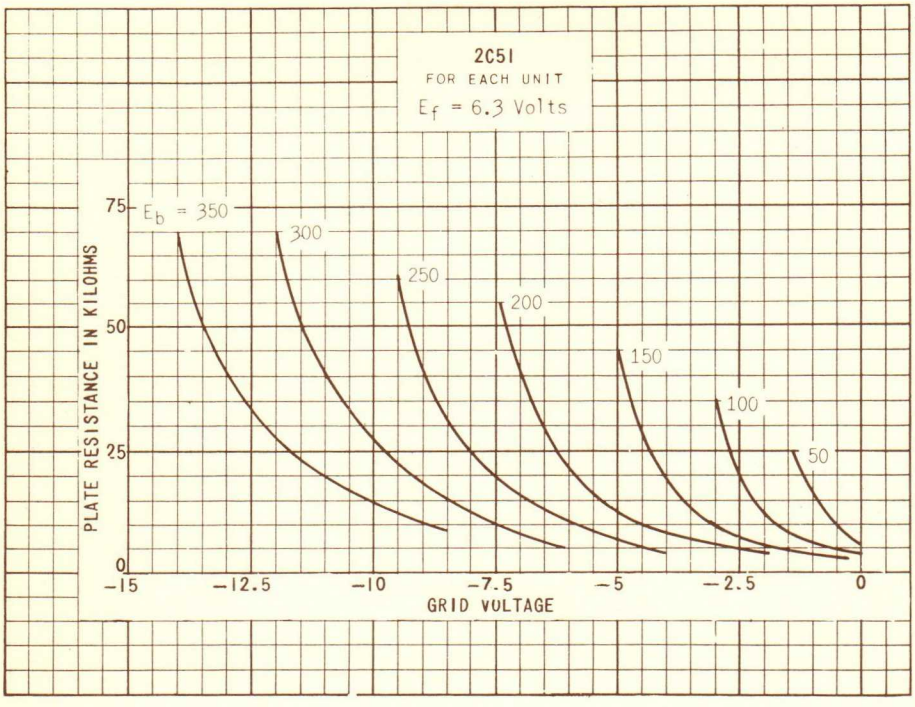
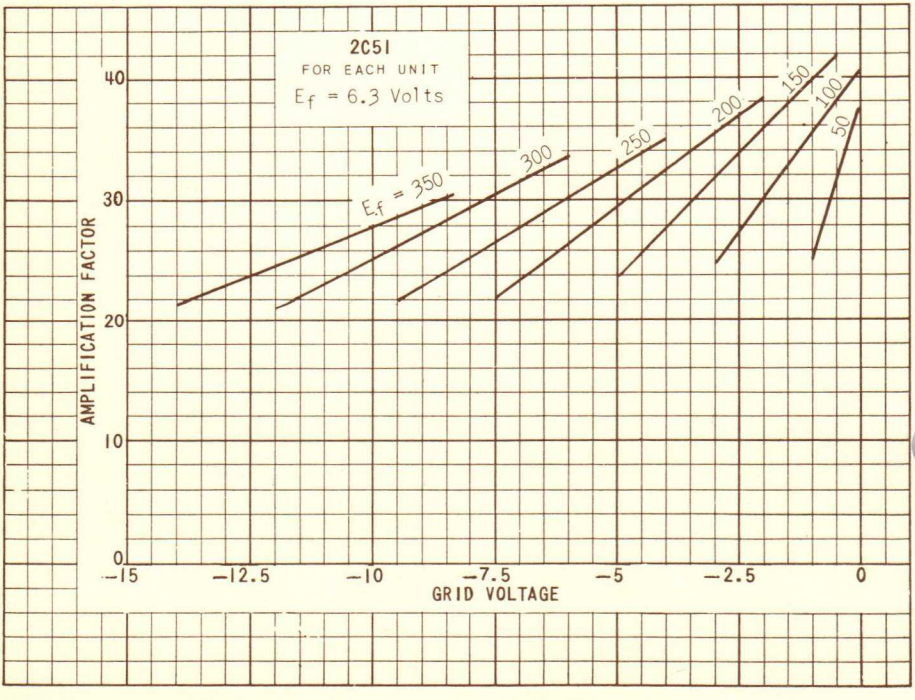
2C51





PLATE
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MAY 1
1951

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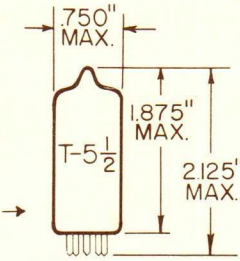


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

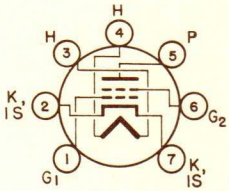
TETRODE

MINIATURE TYPE

COATED UNIPOTENTICAL CATHODE

HEATER
2.4 VOLTS 600±36 MAMPS. ←
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7EW

THE 2CY5 IS A SHARP-CUTOFF TETRODE IN THE 7-PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR SERVICE IN VHF TUNERS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 2CY5 IS IDENTICAL TO THE 3CY5, 4CY5, AND THE 6CY5.

DIRECT INTERELECTRODE CAPACITANCES[A]

GRID #1 TO PLATE	0.03	μμf
INPUT	4.5	μμf
OUTPUT	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 (SCREEN) SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CHART	
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATTS
MAXIMUM GRID #1 (CONTROL GRID) VOLTAGE		
POSITIVE VALUE	0	MA.
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.)[B]	11.0	SECONDS

[A] WITH SHIELD #316 CONNECTED TO CATHODE.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

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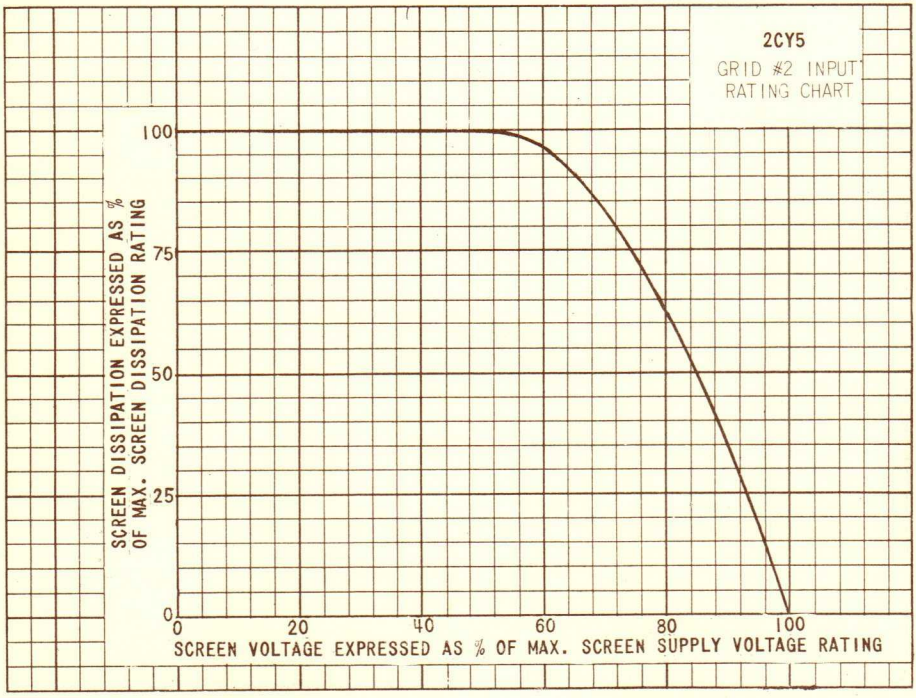
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	−1	VOLTS
PLATE RESISTANCE	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
GRID #1 CUTOFF BIAS[C]	−6	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	1.5	MA.

[C] PLATE CURRENT 20 μA.



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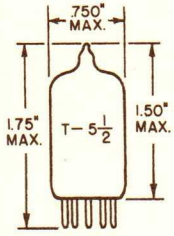
TRIODE

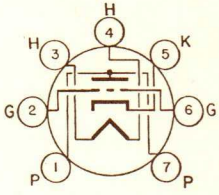
MINIATURE TYPE

MEDIUM MU TRIODE
FOR
UHF OSCILLATOR SERVICE



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-1

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
7 DK

THE 2DZ4 IS A MEDIUM MU TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR UHF OSCILLATOR SERVICE. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 2DZ4 IS IDENTICAL TO THE 3DZ4 AND THE 6DZ4.

DIRECT INTERELECTRODE CAPACITANCES
WITH SHIELD

GRID TO PLATE	1.8	pf
INPUT: G TO (H + K + E.S.)	2.2	pf
OUTPUT: P TO (H + K + E.S.)	1.3	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	2.35 VOLTS	600	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	MA.
HEATER - CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		180	VOLTS
HEATER POSITIVE WITH-RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		180	VOLTS

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MAXIMUM RATINGS
DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

UHF OSCILLATOR SERVICE

PLATE VOLTAGE	135	VOLTS
NEGATIVE GRID VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.3	WATTS
CATHODE CURRENT	20	MA.
GRID CURRENT	2	MA.

CHARACTERISTICS AND TYPICAL OPERATION
CLASS A1 AMPLIFIER

PLATE SUPPLY VOLTAGE	80	VOLTS
PLATE DROPPING RESISTOR	2,700	OHMS
PLATE CURRENT	15	MA.
TRANSCONDUCTANCE	6,700	μMHOS
AMPLIFICATION FACTOR	14	
PLATE RESISTANCE	APPROX. 2,000	OHMS
GRID VOLTAGE FOR I_b = 20 μA	APPROX. -11	VOLTS

OSCILLATOR AT 1000 Mc/s
MEASURED IN JEDEC STANDARD OSCILLATOR NO. 400

PLATE SUPPLY VOLTAGE	80	VOLTS
PLATE DROPPING RESISTOR	2,700	OHMS
GRID RESISTOR	10,000	OHMS
PLATE CURRENT	15.5	MA.
GRID CURRENT	APPROX. 800	μA

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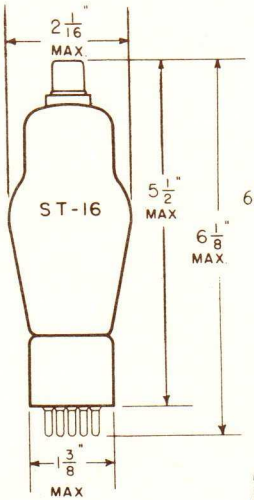
PENTODE POWER AMPLIFIER OSCILLATOR



COATED FILAMENT

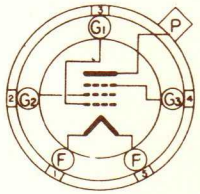
6.3 VOLTS[A] 1.5 AMPS.
AC OR DC

GLASS BULB

MOUNTING POSITION

HORIZONTAL OPERATION PERMITTED IF PINS 2 AND 4 ARE IN A VERTICAL PLANE.

MEDIUM METAL CAP



BOTTOM VIEW

MEDIUM 5 PIN
MICANOL BASE

TYPE 2E22 IS DESIGNED PRIMARILY FOR CLASS C AMPLIFIER OR OSCILLATOR SERVICE IN PORTABLE EQUIPMENT.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	750	VOLTS
MAXIMUM SCREEN GRID VOLTAGE	250	VOLTS
MAXIMUM CONTROL GRID VOLTAGE	-200	VOLTS
MAXIMUM PLATE DISSIPATION	30	WATTS
MAXIMUM SCREEN DISSIPATION	10	WATTS
MAXIMUM PLATE CURRENT	110	MA.
MAXIMUM CONTROL GRID CURRENT	9.0	MA.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE (WITH SHIELD)	0.20 MAX.	μμf
INPUT	13	μμf
OUTPUT	8.0	μμf

[A] THE FILAMENT VOLTAGE SHOULD BE HELD AS CLOSE TO 6.3 VOLTS AS POSSIBLE. INTERMITTENT OPERATION TO AS HIGH AS 7.0 OR AS LOW AS 5.5 VOLTS IS PERMISSIBLE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS C, R-F AMPLIFIER OR OSCILLATOR

PLATE VOLTAGE	500	500	750	750	VOLTS
SCREEN VOLTAGE	250	250	250	250	VOLTS
SCREEN RESISTOR[B]	15 000	15 000	30 000	30 000	OHMS
SUPPRESSOR VOLTAGE	0	22.5	0	22.5	VOLTS
PLATE CURRENT	100	100	100	100	MA.
SCREEN CURRENT	16	16	16	16	MA.
CONTROL GRID CURRENT (APPROX.)	6.0	6.0	6.0	6.0	MA.
CONTROL GRID RESISTOR[C]	10 000	10 000	10 000	10 000	OHMS
PEAK R-F GRID VOLTAGE (APPROX.)	100	100	100	100	VOLTS
GRID DRIVING POWER (APPROX.)	0.55	0.55	0.55	0.55	WATT
POWER OUTPUT (APPROX.)	30	34	48	53	WATTS

SUPPRESSOR MODULATED CLASS C AMPLIFIER

PLATE VOLTAGE	500	750	VOLTS
SCREEN VOLTAGE	250	250	VOLTS
SCREEN RESISTOR	8 500	17 000	OHMS
SUPPRESSOR VOLTAGE	-65	-90	VOLTS
PEAK A-F INPUT	65	90	VOLTS
PEAK R-F GRID VOLTAGE	100	100	VOLTS
PLATE CURRENT	50	55	MA.
SCREEN CURRENT (APPROX.)	29	29	MA.
CONTROL GRID CURRENT (APPROX.)	6.5	6.5	MA.
CONTROL GRID RESISTOR[C]	10 000	10 000	OHMS
GRID DRIVING POWER (APPROX.)	0.6	0.6	WATT
POWER OUTPUT (APPROX.)	10.5	16.5	WATTS
MODULATION	95	95	PER CENT

[B] SERIES SCREEN DROPPING RESISTOR SHOULD NOT BE USED IF UNDER KEY-UP CONDITIONS THE SCREEN VOLTAGE EXCEEDS 500 VOLTS.

[C] THE TOTAL EFFECTIVE GRID CIRCUIT RESISTANCE SHALL NOT EXCEED 25,000 OHMS.

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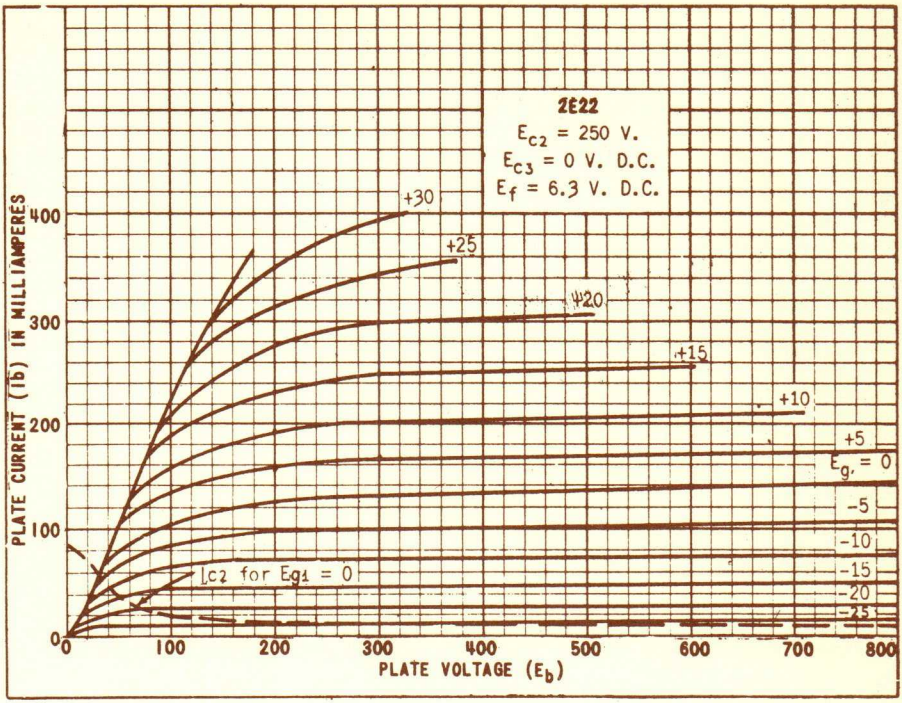

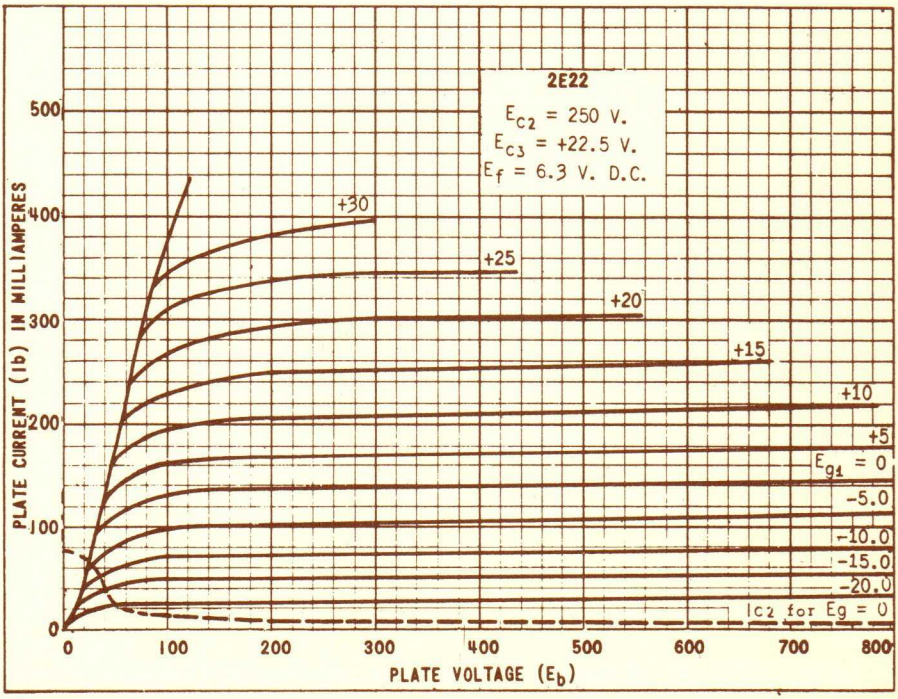

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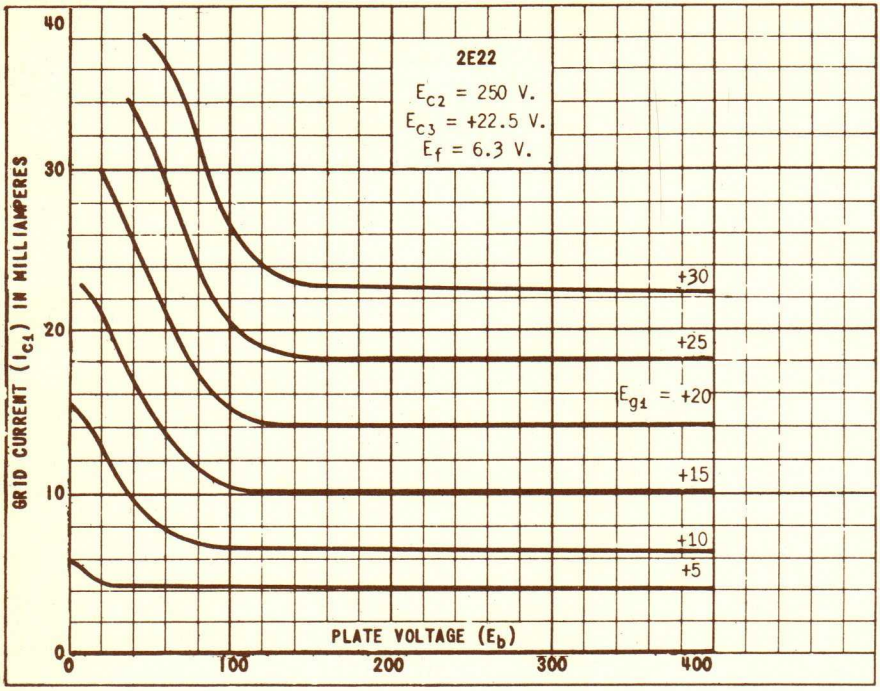
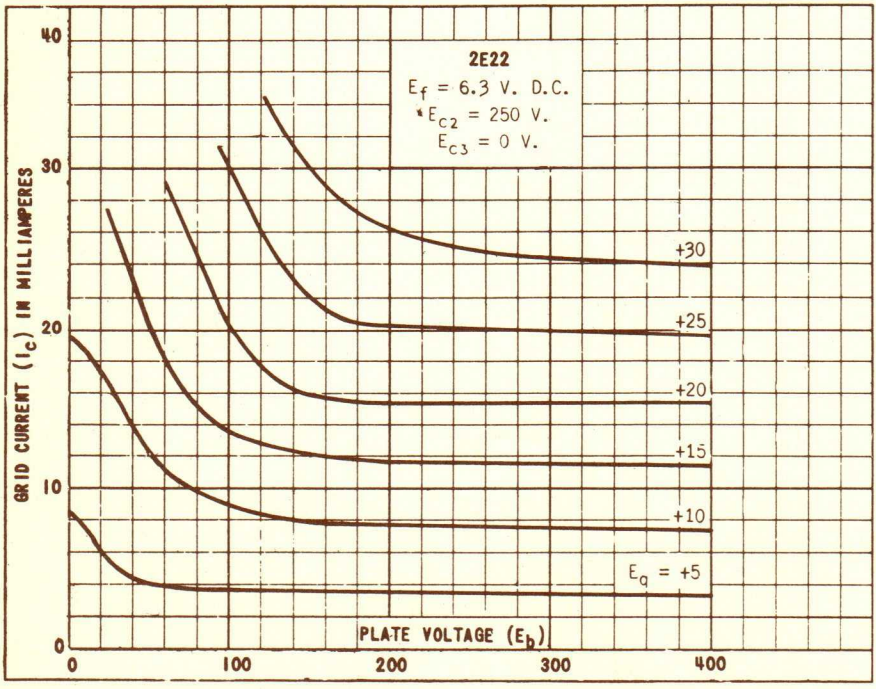
2E22





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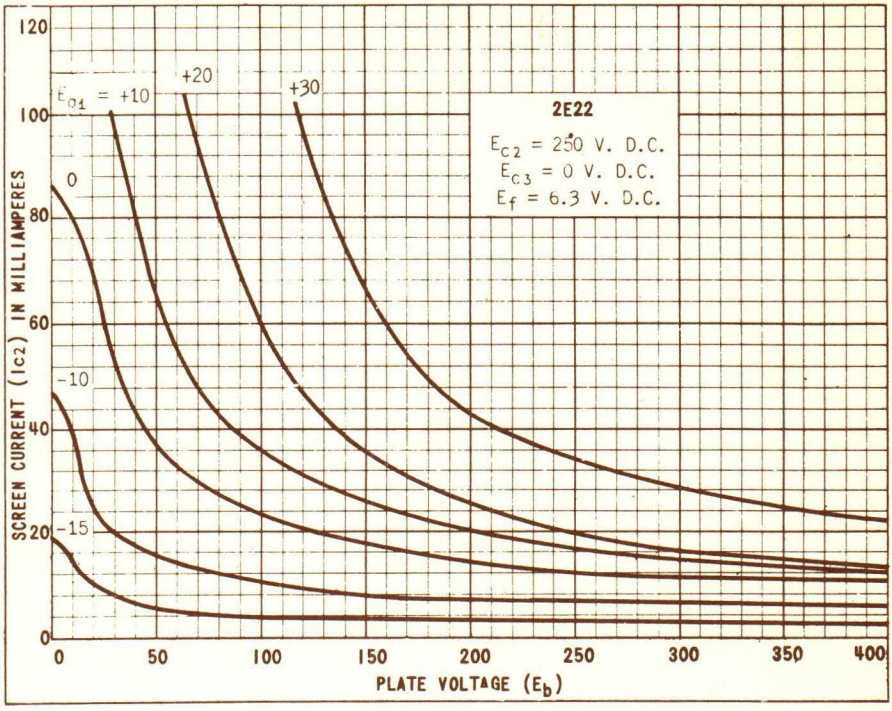

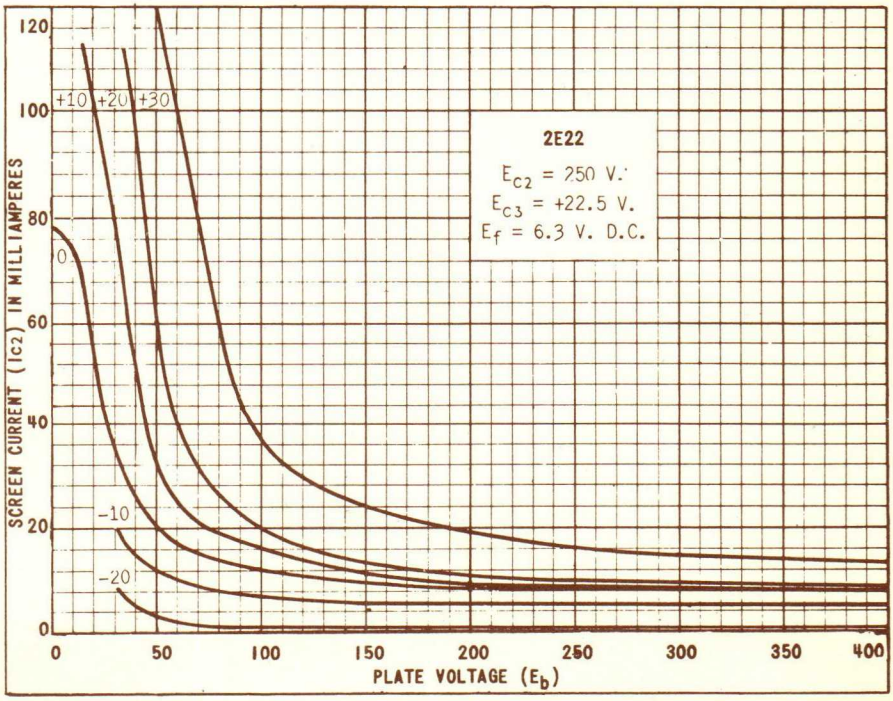

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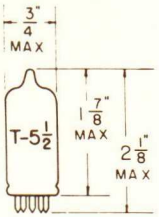
TETRODE

MINIATURE TYPE



GLASS BULB

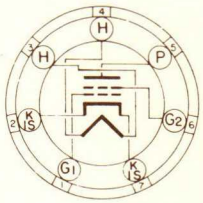
COATED UNIPOTENTIAL CATHODE

HEATER

2.4 VOLTS 0.60±6% AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON MINIATURE
7 PIN BASE

7EW

THE 2EA5 IS A SHARP CUTOFF TETRODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR HIGH PLATE VOLTAGE OPERATION AS AN RF AMPLIFIER IN VHF TUNERS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND WARM-UP TIME, THE 2EA5 IS IDENTICAL TO THE 3EA5 AND 6EA5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE (G1 TO P) (MAX.)	0.05	0.06	μμf
INPUT: G1 TO (H+K+G2+I.S.)	4.5	3.8	μμf
OUTPUT: P TO (H+K+G2+I.S.)	3.0	2.3	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	2.4	2.4	2.4	VOLTS
MAXIMUM PLATE VOLTAGE	250	250	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	150	150	VOLTS
MAXIMUM PLATE DISSIPATION	3.25	3.25	3.25	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	0.5	0.5	WATTS
MAXIMUM CATHODE CURRENT (DC)	20	20	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK	200	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC	100	100	100	VOLTS
TOTAL DC AND PEAK	200	200	200	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	11.0	11.0	SECONDS

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN 2.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	2.4	2.4	2.4	VOLTS
HEATER CURRENT	0.60±6%	0.60±6%	0.6 ±6%	AMPS.
PLATE VOLTAGE	250	250	250	VOLTS
GRID #2 VOLTAGE	140	140	140	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	-1.0	VOLTS
PLATE RESISTANCE (APPROX.)	0.15	0.15	0.15	MEGOHM
TRANSCONDUCTANCE	8000	8000	8000	μMHO
PLATE CURRENT	10	10	10	MA.
GRID #2 CURRENT	0.95	0.95	0.95	MA.
GRID #1 VOLTAGE FOR GM LESS THAN 100 μMHO	-6	-6	-6	VOLTS

B

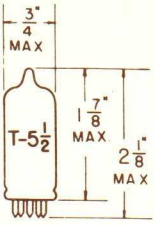
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

DOUBLE DIODE

MINIATURE TYPE



GLASS BULB

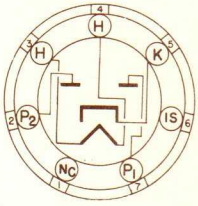
COATED UNIOPTENTIAL CATHODE

HEATER

2.1 VOLTS 0.45±6% AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON MINIATURE
7 PIN BASE
7FL

THE 2EN5 IS A DOUBLE DIODE IN THE 7 PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR USE AS A PHASE COMPARATOR IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH[A] SHIELD	
DIODE INPUT: P TO (H+K+I.S.) (EACH UNIT)	3.7	3.8	μμf
COUPLING: PLATE TO PLATE 1P TO 2P (MAX.)	1.3	3.8	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #6.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	2.1	VOLTS
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
DC	100	VOLTS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EA.PLATE)	5.0	MA.
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	2.1	VOLTS
HEATER CURRENT	0.45±6%	AMP.
DIODE VOLTAGE DROP (APPROX.) FOR I_b=20 MA.(EA.PLATE)	5.0	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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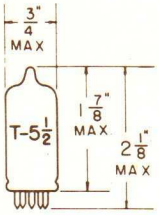
TUNG-SOL

TETRODE

MINIATURE TYPE



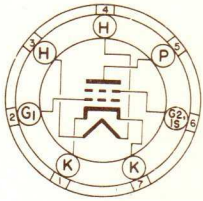
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

2.3 VOLTS 0.60 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

THE 2ER5 IS A REMOTE CUT-OFF FRAME GRID TETRODE DESIGNED ESPECIALLY FOR V.H.F. TELEVISION TUNERS. SEPARATE CATHODE LEADS PROVIDE LOW LEAD INDUCTANCE; THE SCREEN GRID IS DESIGNED PRIMARILY AS A SHIELD TO REDUCE DIRECT GRID TO PLATE CAPACITANCE. EXCEPT FOR HEATER RATINGS THE 2ER5 IS IDENTICAL TO THE 3ER5 AND 6ER5.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD	
PLATE TO GRID	0.38	0.36	μμf
GRID TO ALL OTHER ELECTRODES EXCEPT PLATE	4.4	4.4	μμf
PLATE TO ALL OTHER ELECTRODES EXCEPT GRID	3.0	4.0	μμf
GRID TO HEATER (MAX.)	0.28	0.28	μμf
PLATE TO CATHODE	0.24	0.20	μμf
GRID TO CATHODE	3.1	3.1	μμf
CATHODE TO HEATER	2.8	2.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	2.3	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM CATHODE CURRENT	20	MAMPS
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM VOLTAGE BETWEEN CATHODE AND HEATER	100	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM CIRCUIT RESISTANCE BETWEEN CATHODE AND HEATER	20 000	OHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	2.3	2.3		VOLTS
HEATER CURRENT	0.60	0.60		AMP.
PLATE VOLTAGE	200			VOLTS
GRID VOLTAGE	-1.2	-3.8	-5.6	VOLTS
PLATE CURRENT	10			MAMPS
TRANSCONDUCTANCE	10 500	500	100	μMHOS
AMPLIFICATION FACTOR	80			
GRID VOLTAGE FOR A CROSS-MODULATION FACTOR OF 1% (RMS)	100	100	100	MV.

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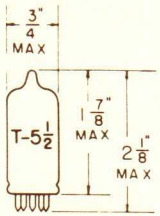
TUNG-SOL

HI-MU TRIODE ←

MINIATURE TYPE



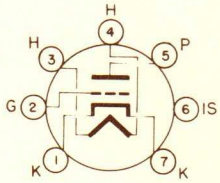
GLASS BULB
BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER

2.3 VOLTS 0.60 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7FP

THE 2ER5 IS A HIGH TRANSCONDUCTANCE SHIELDED TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED ESPECIALLY FOR USE IN V.H.F. TELEVISION TUNERS. SEPARATE CATHODE LEADS PROVIDE LOW LEAD INDUCTANCE AND THE INTERNAL SHIELD REDUCES DIRECT GRID TO PLATE CAPACITANCE. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 2ER5 IS IDENTICAL TO THE 3ER5 AND THE 6ER5.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD	
PLATE TO GRID	0.38	0.36	μμf
GRID TO ALL OTHER ELECTRODES EXCEPT PLATE	4.4	4.4	μμf
PLATE TO ALL OTHER ELECTRODES EXCEPT GRID	3.0	4.0	μμf
GRID TO HEATER (MAX.)	0.28	0.28	μμf
PLATE TO CATHODE	0.24	0.20	μμf
GRID TO CATHODE	3.1	3.1	μμf
CATHODE TO HEATER	2.8	2.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	2.3	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM CATHODE CURRENT	20	MAMPS
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM VOLTAGE BETWEEN CATHODE AND HEATER	100	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM CIRCUIT RESISTANCE BETWEEN CATHODE AND HEATER	20 000	OHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	2.3	2.3		VOLTS
HEATER CURRENT	0.60	0.60		AMP.
PLATE VOLTAGE	200			VOLTS
GRID VOLTAGE	-1.2	-3.8	-5.6	VOLTS
PLATE CURRENT	10			MAMPS
TRANSCONDUCTANCE	10 500	500	100	μMHOS
AMPLIFICATION FACTOR	80			
GRID VOLTAGE FOR A CROSS-MODULATION FACTOR OF 1% (RMS)	100	100	100	MV.

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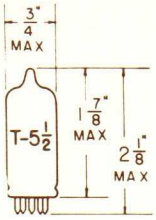
TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

2.35 VOLTS 0.60±6% AMP.

ANY MOUNTING POSITION

BOTTOM VIEW

SMALL BUTTON MINIATURE

7 PIN BASE

7FP

THE 2ES5 IS A TRIODE TUNER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN GROUNDED CATHODE RF AMPLIFIERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 2ES5 IS IDENTICAL TO THE 3ES5 AND THE 6ES5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G TO P (MAX.)	0.5	0.5	μμf
INPUT: G TO (H+K+I.S.)	3.2	3.2	μμf
OUTPUT: P TO(H+K+I.S.)	4.0	3.2	μμf

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN 1.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	2.35	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM POSITIVE GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE: (TOTAL DC AND PEAK)		
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.60±6%	AMP.
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

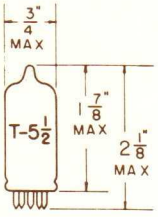
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

TETRODE

MINIATURE TYPE



GLASS BULB

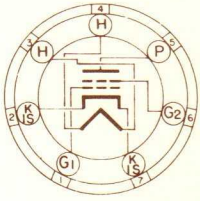
COATED UNIPOTENTIAL CATHODE

HEATER

2.4 VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
7 PIN BASE
7EW

THE 2EV5 IS A HIGH GAIN, SHARP-CUTOFF SEVEN PIN TETRODE DESIGNED PARTICULARLY FOR SERVICE IN V.H.F. TELEVISION TUNERS. IT HAS HIGH TRANSCONDUCTANCE, EXTREMELY LOW SCREEN CURRENT AND HIGH INPUT IMPEDANCE AT 200 MC. RESULTING IN IMPROVED NOISE FIGURE. EXCEPT FOR HEATER RATINGS, THE 2EV5 IS IDENTICAL TO THE 3EV5 AND IS SIMILAR TO THE 6EV5.

DIRECT INTERELECTRODE CAPACITANCES[A]

WITH EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.035	μμf
INPUT	4.50	μμf
OUTPUT	2.90	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	2.4	VOLTS
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CHART	
MAXIMUM PLATE DISSIPATION	3.25	WATTS
MAXIMUM GRID #2 DISSIPATION	0.2	WATTS
MAXIMUM GRID #1 VOLTAGE:		
POSITIVE VALUE	0	VOLTS
MAXIMUM CATHODE CURRENT	20	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
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHM
HEATER WARM-UP TIME*	11.0	SECONDS

[A] WITH SHIELD #316 CONNECTED TO PIN #2.

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABEE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TUNG-SOL

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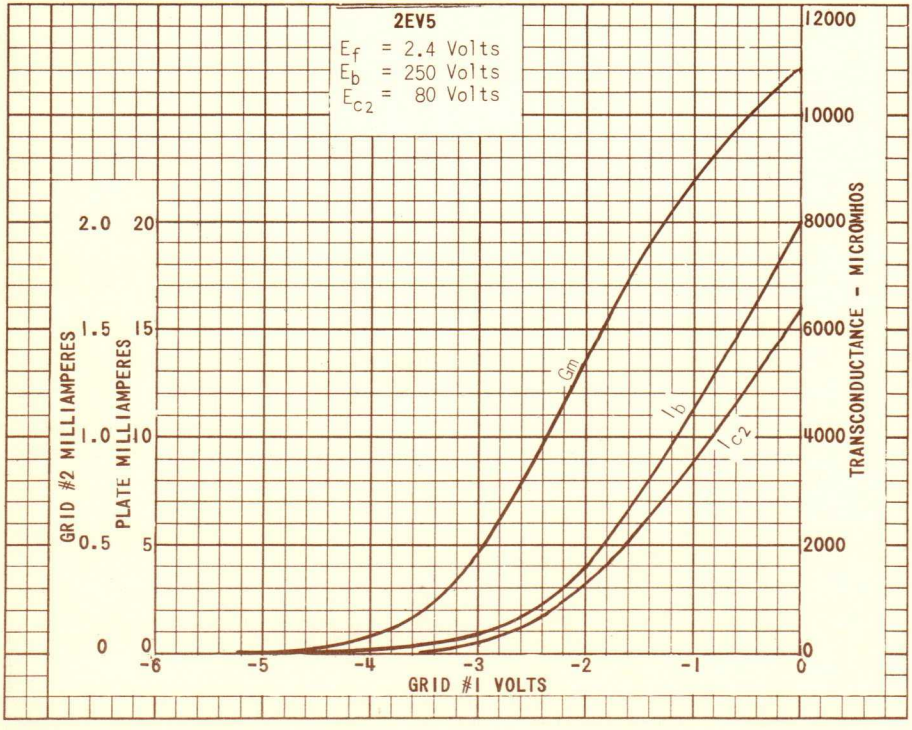
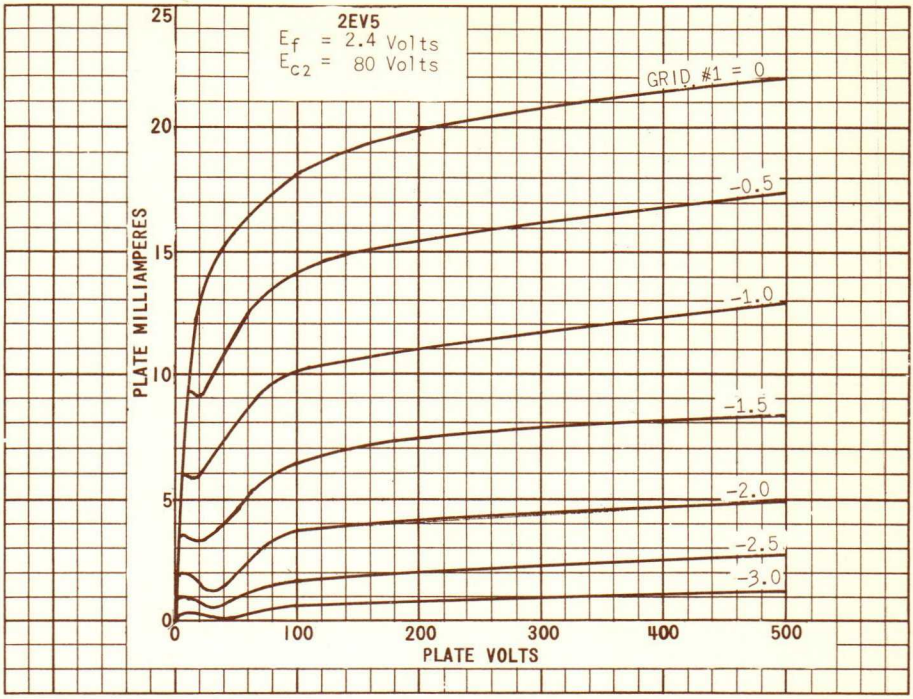
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

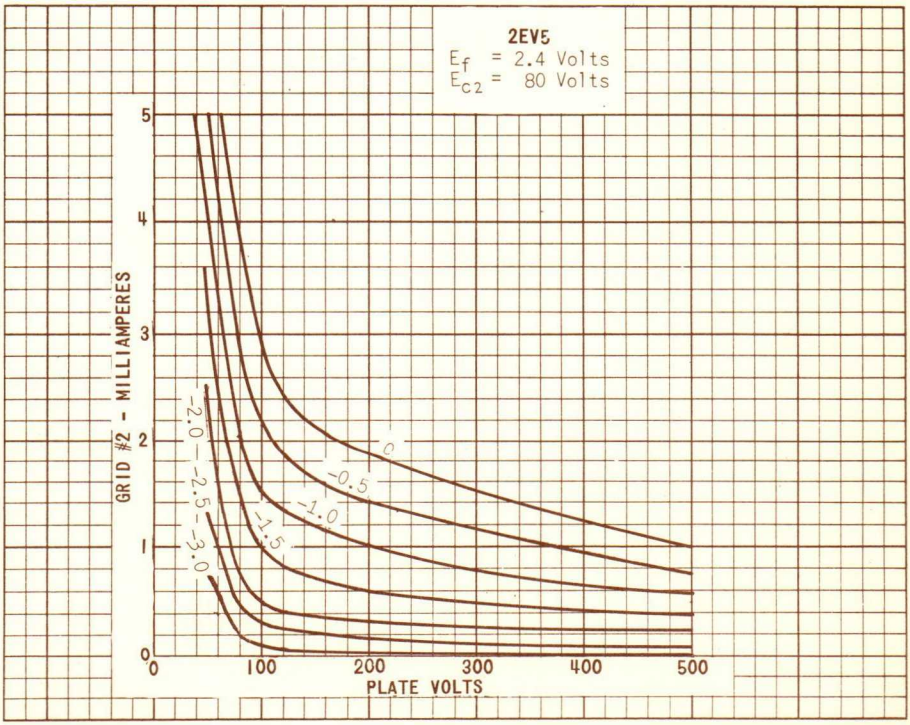
HEATER VOLTAGE	2.4	VOLTS
HEATER CURRENT	0.60	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	-1	VOLTS
PLATE RESISTANCE	0.150	MEGOHM
TRANSCONDUCTANCE	8800	μMHOS
GRID #1 CUTOFF BIAS[C]	4.5	VOLTS
PLATE CURRENT	11.5	MA.
GRID #2 CURRENT	0.90	MA.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[C] FOR TRANSCONDUCTANCE OF 100 μMHOS.







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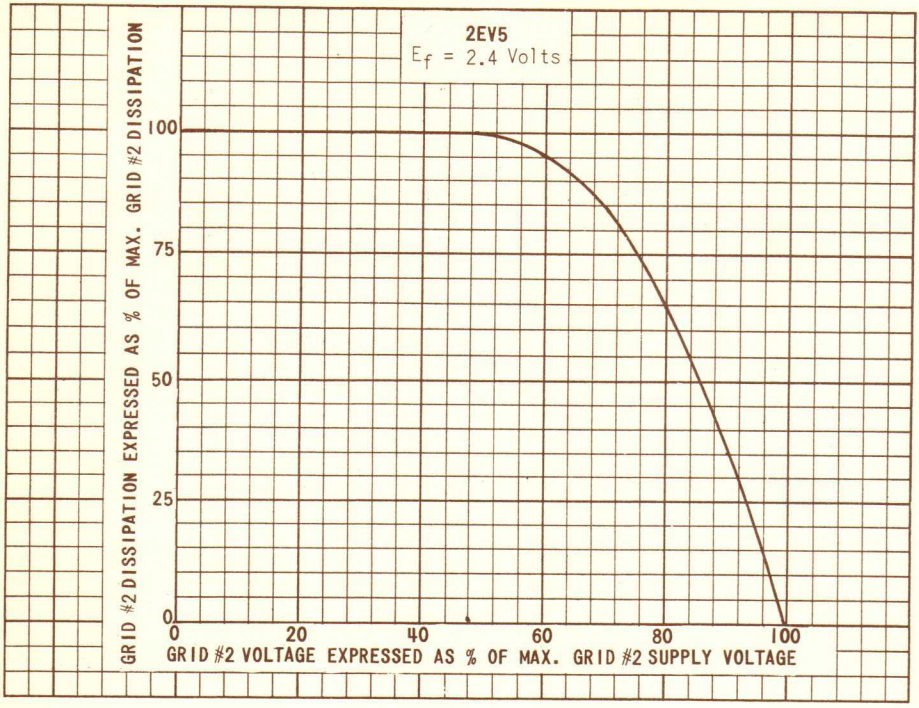
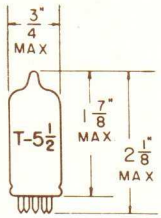


TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

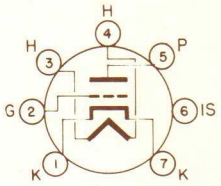
SMALL BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER

2.35 VOLTS 0.6±6% AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7FP

THE 2FH5 IS A NEUTRODE TRIODE TUNER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN GROUNDED CATHODE RF AMPLIFIERS WITH THE NEUTRODE CONSTRUCTION PROVIDING A LOWER GRID TO PLATE CAPACITANCE WITH CONSEQUENT EASE OF NEUTRALIZATION. THE CONVENTIONAL GRID RESULTS IN LOW INPUT CAPACITANCE. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 2FH5 IS IDENTICAL TO THE 3FH5 AND 6FH5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
GRID TO PLATE: G TO P (MAX.) (BOGEY)	→ 0.52	→ 0.52	pf
INPUT: G TO (H+K+I.S.)	3.2	3.2	pf
OUTPUT: P TO (H+K+I.S.)	4.0	3.2	pf

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN #1.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	2.35	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID VOLTAGE (POSITIVE)	0	VOLT
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	MEGOHM
→ MAXIMUM DC HEATER-CATHODE VOLTAGE (TOTAL DC AND PEAK):		
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.6±6%	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	−1.0	VOLT
PLATE RESISTANCE (APPROX.)	5600	OHMS
TRANSCONDUCTANCE	9000	μMHOS
AMPLIFICATION FACTOR	50	
PLATE CURRENT	11	MA.
GRID VOLTAGE (APPROX.) FOR 100 μA PLATE CURRENT	−5.5	VOLTS

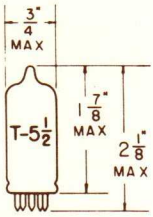
* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VALUE AFTER APPLYING FOUR TIMES THE RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE EQUAL TO THREE TIMES THE RATED HEATER VOLTAGE DIVIDED BY THE RATED HEATER CURRENT.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

TRIODE

MINIATURE TYPE



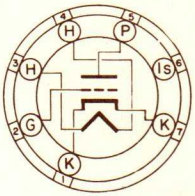
GLASS BULB
5-2

COATED UNIPOTENTIAL CATHODE

HEATER

2.3 VOLTS 0.60 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7FP

THE 2FQ5 IS A SEMI-REMOTE CUTOFF TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF AND RF AMPLIFIER AT A B+ OF 135 VOLTS. EXCEPT FOR HEATER RATINGS, AND HEATER WARM-UP TIME, THE 2FQ5 IS IDENTICAL TO THE 3FQ5 AND THE 6FQ5.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD

GRID TO PLATE	0.4	μμf
INPUT: G TO (H+K+I.S.+E.S.)	4.8	μμf
OUTPUT: P TO (H+K+I.S.+E.S.)	4.0	μμf
HEATER TO CATHODE	2.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE[D]	2.3[A]	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	1.0	MEGOHMS
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
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE[D]	2.3[A]	VOLTS
HEATER CURRENT[D]	0.60±.04	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	-1.2	VOLTS
PLATE CURRENT	11.5	MA.
TRANSCONDUCTANCE	11 000	μMHOS
AMPLIFICATION FACTOR	60	
PLATE RESISTANCE (APPROX.)	5 500	OHMS
Ec FOR Ib = 100 μA (APPROX.)	-5	VOLTS

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NOTES

A THE BOGEY VALUE OF VOLTAGE/CURRENT PRECEDING THIS NOTE IS OBTAINED WHEN OPERATING THE HEATER WITH THE SPECIFIED VALUE OF CURRENT/VOLTAGE.

B FOR SERIES/PARALLEL OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER/CURRENT VOLTAGE.

C DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

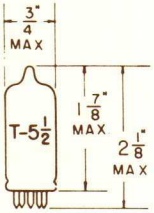
D HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE/CURRENT WITHIN THE SPECIFIED TOLERANCE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

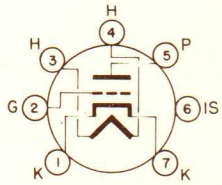
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER

2.3 VOLTS 0.60[B] AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7FP

THE 2FQ5A IS A SEMI-REMOTE CUTOFF TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF AND RF AMPLIFIER AT A B+ OF 135 VOLTS. EXCEPT FOR HEATER RATINGS, AND HEATER WARM-UP TIME, THE 2FQ5A IS IDENTICAL TO THE 3FQ5A AND THE 6FQ5A.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD

GRID TO PLATE	0.52	pf
INPUT: G TO (H+K+I.S.+E.S.)	5.0	pf
OUTPUT: P TO (H+K+I.S.+E.S.)	3.5	pf
HEATER TO CATHODE	2.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[C]

HEATER VOLTAGE[D]	2.3	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	1.0	MEGOHMS
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
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE[D]	2.3	VOLTS
HEATER CURRENT[D]	0.60±.04	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	-1.2	VOLTS
PLATE CURRENT	8.9	MA.
TRANSCONDUCTANCE	12000	μMHOS
AMPLIFICATION FACTOR	74	
PLATE RESISTANCE (APPROX.)	6300	OHMS
Ec FOR Ib = 100 μA (APPROX.)	-4.5	VOLTS

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NOTES

[B] FOR SERIES/PARALLEL OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER/CURRENT VOLTAGE.

[C] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

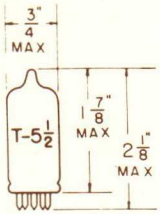
[D] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE/CURRENT WITHIN THE SPECIFIED TOLERANCE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

TETRODE

MINIATURE TYPE



GLASS BULB

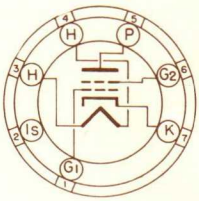
UNIPOTENTIAL CATHODE

HEATER

2.4 VOLTS 0.6±6% AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON MINIATURE

7 PIN BASE

7FQ

THE 2FV6 IS A SHARP-CUTOFF TETRODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS AN RF AMPLIFIER IN VHF TUNERS OF TELEVISION RECEIVERS. THIS TUBE FEATURES HIGH TRANSCONDUCTANCE AND A HIGH RATIO OF PLATE CURRENT TO GRID #2 CURRENT.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITH EXTERNAL SHIELD #316 CONNECTED TO CATHODE

GRID #1 TO PLATE (MAX.)	0.03	μμf
GRID #1 TO CATHODE, I.S., G2, & H.	4.5	μμf
PLATE TO CATHODE, I.S., G2, & H.	3	μμf
CATHODE TO HEATER	2.7	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	2.4	VOLTS
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE FIG.#3	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE-BIAS VALUE	0	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 90 VOLTS	0.5	WATT
FOR GRID #2 VOLTAGES BETWEEN 90 & 180 VOLTS	SEE FIG.#3	
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
MAXIMUM CIRCUIT VALUES:		
GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHM
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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TUNG-SOL

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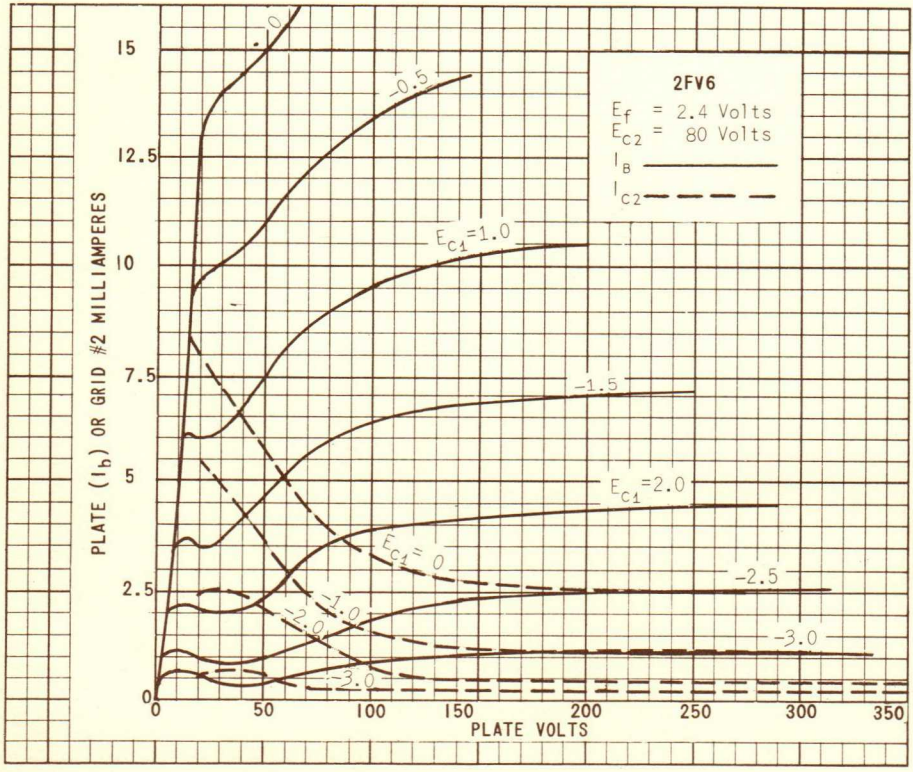
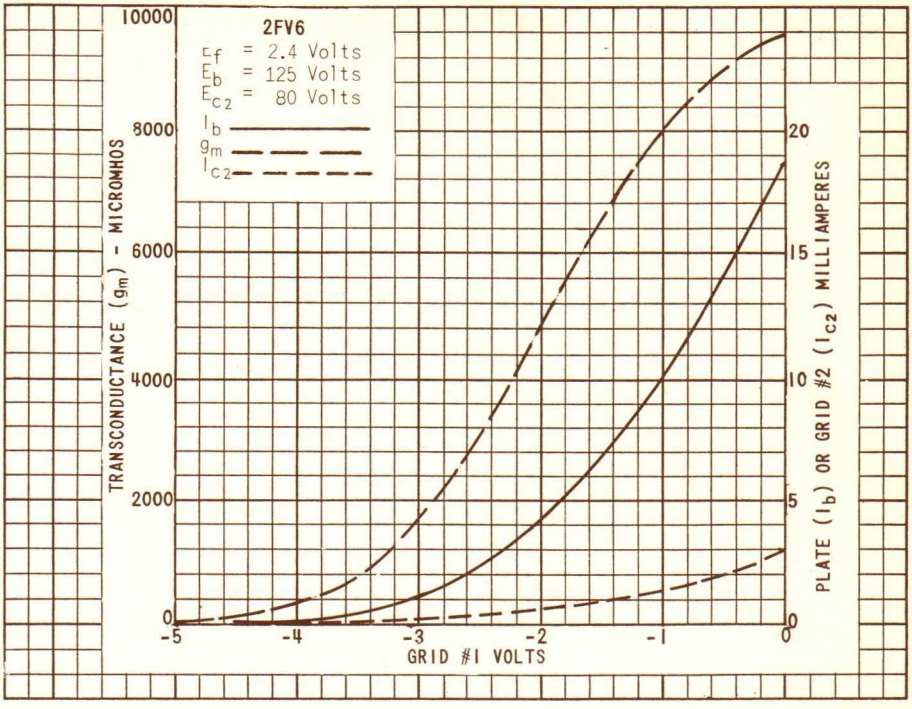
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

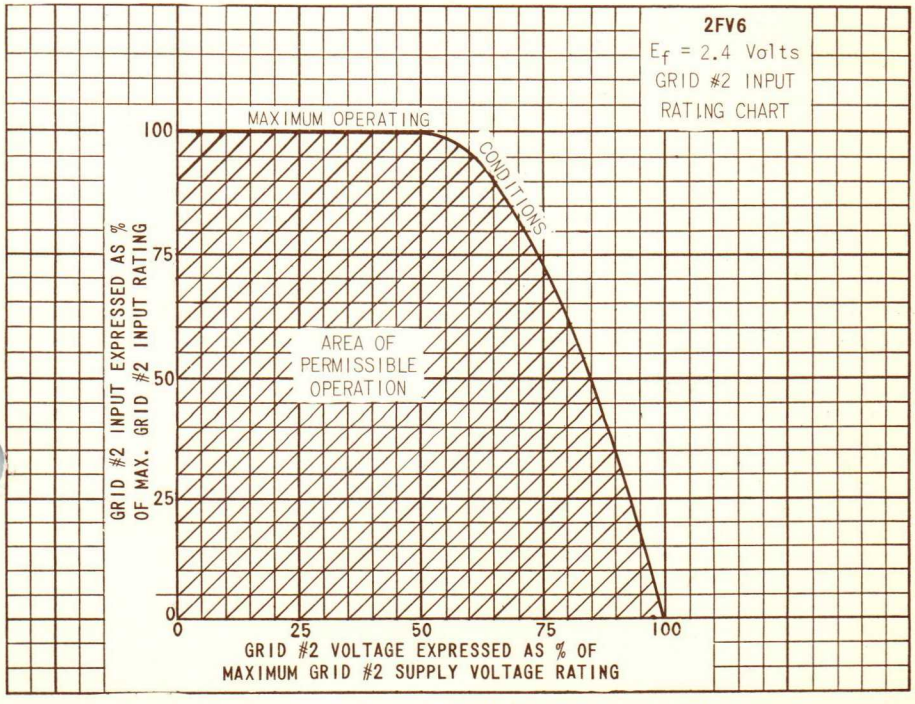
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	2.4	VOLTS
HEATER CURRENT	0.6±6%	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #2 (SCREEN-GRID) VOLTAGE	80	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	-1	VOLTS
PLATE RESISTANCE (APPROX.)	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	1.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 20 μA.	-6	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.







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TUNG-SOL

TRIODE

MINIATURE TYPE

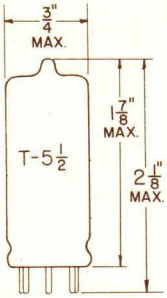
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES SUPPLY

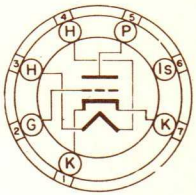
2.4 VOLTS 0.60 AMP.

ANY MOUNTING POSITION



GLASS BULB

5-2



BOTTOM VIEW

7FP

THE 2FY5 IS A REMOTE CUT-OFF, FRAME GRID SHIELDED TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR SERVICE IN VHF TUNERS OF TELEVISION RECEIVERS, AND IS CONTROLLED FOR LOW NOISE FIGURE AT 220 MC/S AND OPERATION AT LOW SUPPLY VOLTAGES. EXCEPT FOR HEATER RATINGS, THE 2FY5 IS IDENTICAL TO THE 3FY5 AND THE 6FY5.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT EXT. SHIELD	WITH EXT. SHIELD	
INPUT	4.75	4.75	μμf
OUTPUT	3.3	4.3	μμf
GRID TO HEATER (MAX.)	0.28	0.28	μμf
PLATE TO CATHODE	0.25	0.21	μμf
GRID TO CATHODE	3.2	3.2	μμf
CATHODE TO HEATER	2.5	2.5	μμf
PLATE TO GRID	0.50	0.48	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	2.4	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE VOLTAGE (ZERO PLATE CURRENT)	550	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM CATHODE-HEATER VOLTAGE	100	VOLTS
MAXIMUM CATHODE-HEATER CIRCUIT RESISTANCE	20 000	OHMS

TYPICAL OPERATION

HEATER VOLTAGE			2.4		VOLTS
HEATER CURRENT			0.60		AMP.
PLATE VOLTAGE	135	135	135	135	VOLTS
NEGATIVE GRID BIAS	1	3.1	5	4.5	VOLTS
PLATE CURRENT	11			0.1	MA.
TRANSCONDUCTANCE	13 000	625	125	---	μMHOS
AMPLIFICATION FACTOR	70				

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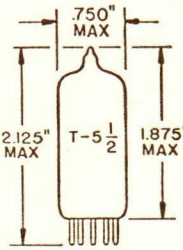
TUNG-SOL

TRIODE

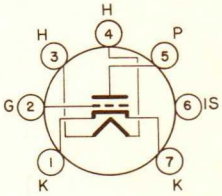
MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

SHIELDED TRIODE
FOR
NEUTRODE CIRCUIT
APPLICATIONS



BOTTOM VIEW
JEDEC 7 FP

THE 2GK5 IS A FRAME GRID GAIN CONTROLLED SHIELDED TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF RF AMPLIFIER AT A B+ OF 135 VOLTS.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD

GRID TO PLATE	0.52	pf
INPUT: G TO (H + K + I.S. + E.S.)	5.0	pf
OUTPUT: P TO (H + K + I.S. + E.S.)	3.5	pf
HEATER TO CATHODE	2.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	2.3 VOLTS	600	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT	600 ± 40		MA.
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

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MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

PLATE VOLTAGE	200	VOLTS
GRID VOLTAGE	-50	VOLTS
PLATE DISSIPATION	2.5	WATTS
DC CATHODE CURRENT	22	MA.
GRID CIRCUIT RESISTANCE - SELF BIAS	1.0	MEGOHMS

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A1 AMPLIFIER

PLATE VOLTAGE		135	VOLTS
GRID VOLTAGE		-1.0	VOLTS
PLATE CURRENT		11.5	MA.
TRANSCONDUCTANCE		15,000	μMHOS
AMPLIFICATION FACTOR		78	
PLATE RESISTANCE	Approx.	5,400	OHMS
E_c FOR G_m = 150 μMHOS	Approx.	-4.2	VOLTS
E_c FOR G_m = 1,500 μMHOS	Approx.	-2.5	VOLTS
HOT INPUT RESISTANCE - 200 Mc/s - GROUNDED PLATE		275	OHMS
HOT INPUT CAPACITANCE - 200 Mc/s - GROUNDED PLATE		11.2	pf
NOISE FIGURE - 200 Mc/s - OPTIMIZED NEUTRALIZED TRIODE RF AMPLIFIER STAGE, NOISE MATCHED		4.7	DB

TUNG-SOL

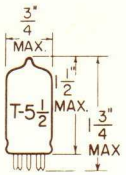
TRIODE

MINIATURE TYPE

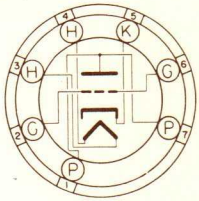
COATED UNIPOTENTIAL CATHODE

HEATER
2.35 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7DK

THE 2T4 IS A LOW-MU TRIODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS AN OSCILLATOR IN UHF, 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6T4.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE	1.7	1.7	μμf
INPUT	3.3	2.9	μμf
OUTPUT	1.8	0.25	μμf
HEATER TO CATHODE[B]	2.9	3.0	μμf
GRID TO CATHODE[B]	2.6	2.6	μμf
PLATE TO CATHODE[B]	0.18	0.20	μμf
GROUNDED GRID OPERATION			
INPUT	5.7	5.5	μμf
OUTPUT	3.4	1.8	μμf

[A] SHIELD #316.

[B] MEASURED BETWEEN SPECIFIED ELEMENTS ONLY. WHEN EXTERNAL SHIELD IS USED, IT SHALL BE GROUNDED.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	2.35	VOLTS
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
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION	3.5	WATTS
MAXIMUM GRID CURRENT	8	MA.
MAXIMUM CATHODE CURRENT	30	MA.
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

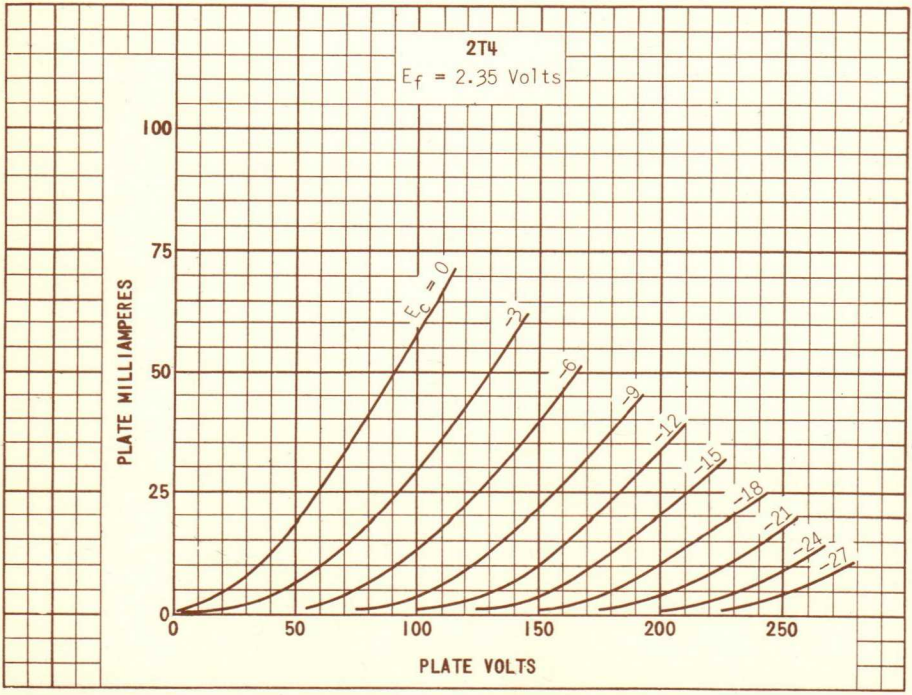
CONTINUED FROM PRECEDING PAGE

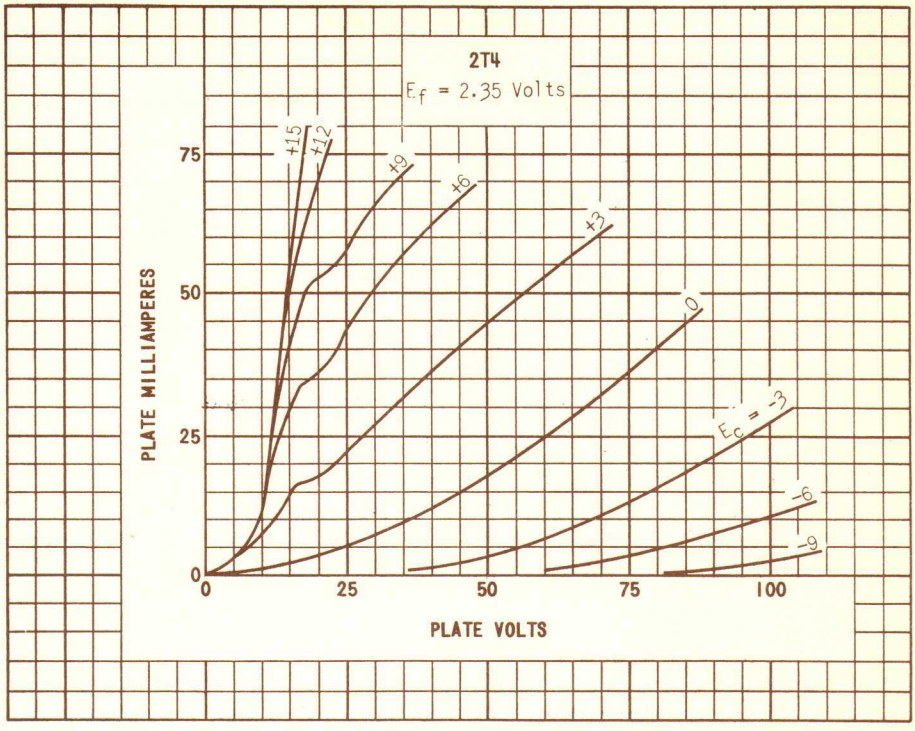
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

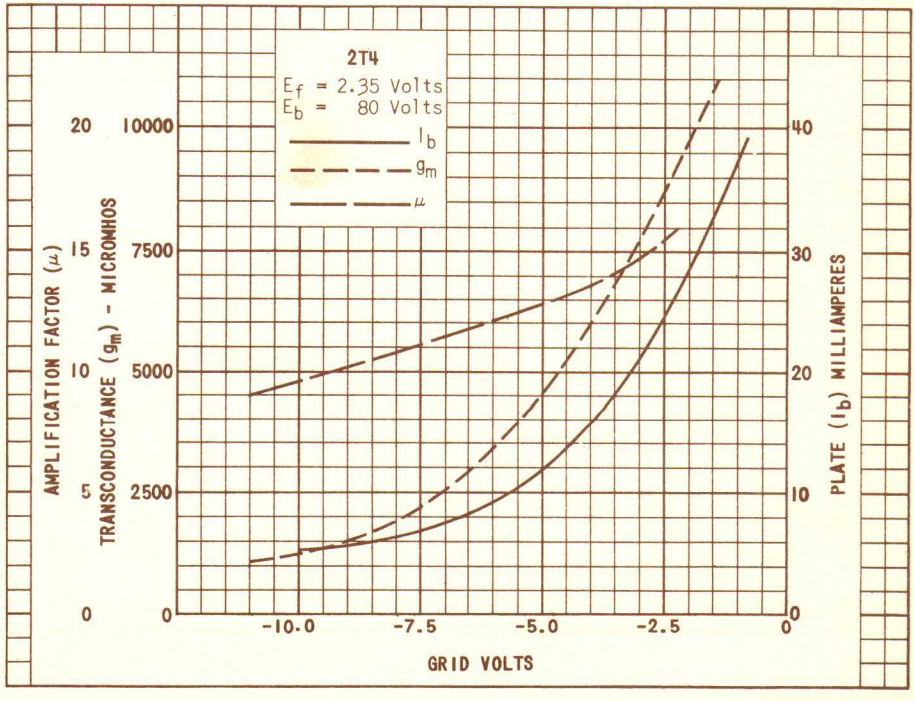
HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	80	VOLTS
CATHODE BIAS RESISTOR	150	OHMS
PLATE CURRENT	18	MA.
TRANSCONDUCTANCE	7 000	μMHOS
AMPLIFICATION FACTOR	13	
PLATE RESISTANCE	1 860	OHMS
GRID VOLTAGE FOR 50 μA. PLATE CURRENT	−15	VOLTS

OSCILLATOR AT 950 MC.

HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	80	VOLTS
GRID VOLTAGE (SELF BIAS)	−4	VOLTS
GRID RESISTOR	10 000	OHMS
PLATE CURRENT	18	MA.
GRID CURRENT (APPROX.)	400	μA.







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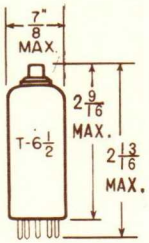
TUNG-SOL

DIODE

MINIATURE TYPE

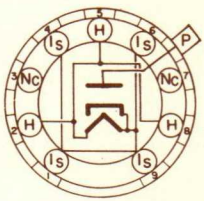


GLASS BULB
SKIRTED
MINIATURE CAP

UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.22 AMP.
AC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON NOVAL
9 PIN BASE
9DT

THE 3A2 IS A DOUBLE-ENDED, 9 PIN MINIATURE TYPE OF HALF-WAVE VACUUM RECTIFIER UTILIZING AN INDIRECTLY HEATED CATHODE. IT IS DESIGNED FOR USE AS A RECTIFIER OF HIGH VOLTAGE PULSES PRODUCED IN THE SCANNING SYSTEMS OF COLOR TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER, CATHODE, & INTERNAL SHIELD	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
PULSED RECTIFIER SERVICE *

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	18 000	VOLTS
MAXIMUM PEAK PLATE CURRENT	80	MA.
MAXIMUM AVERAGE PLATE CURRENT	1.5	MA.

* FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

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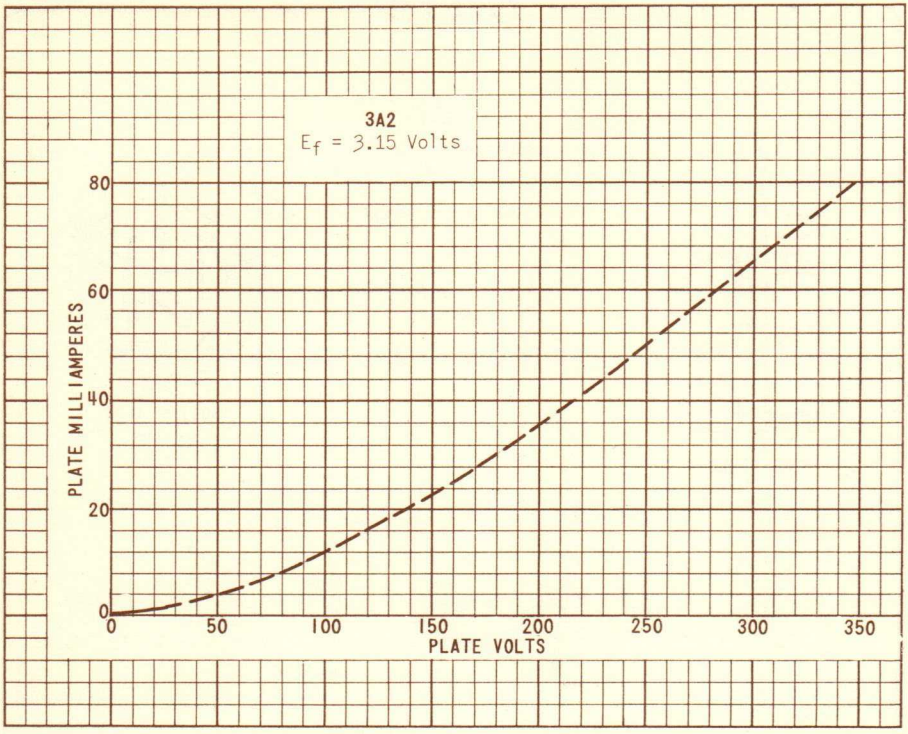
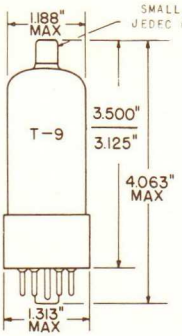

3A2
E_f = 3.15 Volts
PLATE MILLIAMPERES
0
20
40
60
80
0
50
100
150
200
250
300
350
PLATE VOLTS

TUNG-SOL

DIODE



GLASS BULB

INTERMEDIATE SHELL

7 PIN OCTAL B6-8 & B6-60

COATED UNIPOTENTIAL CATHODE

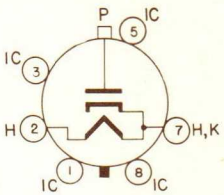
HEATER

3.15 VOLTS 0.22 AMP.

AC

ANY MOUNTING POSITION

CONNECTORS SHOULD NOT EXERT MORE THAN 7 POUNDS RADIAL COMPRESSION AT ANY POINT AROUND THE CIRCUMFERENCE OF THE CAP.



BOTTOM VIEW

BASING DIAGRAM JEDEC 8E2

THE 3A3 IS A HALF-WAVE VACUUM RECTIFIER TUBE OF THE GLASS OCTAL TYPE UTILIZING AN INDIRECTLY HEATED CATHODE. IT IS DESIGNED FOR USE AS A RECTIFIER OF HIGH VOLTAGE PULSES PRODUCED IN THE SCANNING SYSTEMS OF TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITH NO EXTERNAL SHIELD

PLATE TO HEATER, CATHODE & INTERNAL SHIELD	1.5	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

PULSED RECTIFIER SERVICE

HEATER VOLTAGE	3.15[B]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE[C]	30 000	VOLTS
MAXIMUM PEAK PLATE CURRENT	88	MA.
MAXIMUM AVERAGE PLATE CURRENT	1.7	MA.

[A] AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS." FEDERAL COMMUNICATIONS COMMISSION.

[B] UNDER NO CIRCUMSTANCES SHOULD THIS VOLTAGE FALL BELOW 2.65 VOLTS, OR EXCEED 3.65 VOLTS.

[C] 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 MICROSECONDS.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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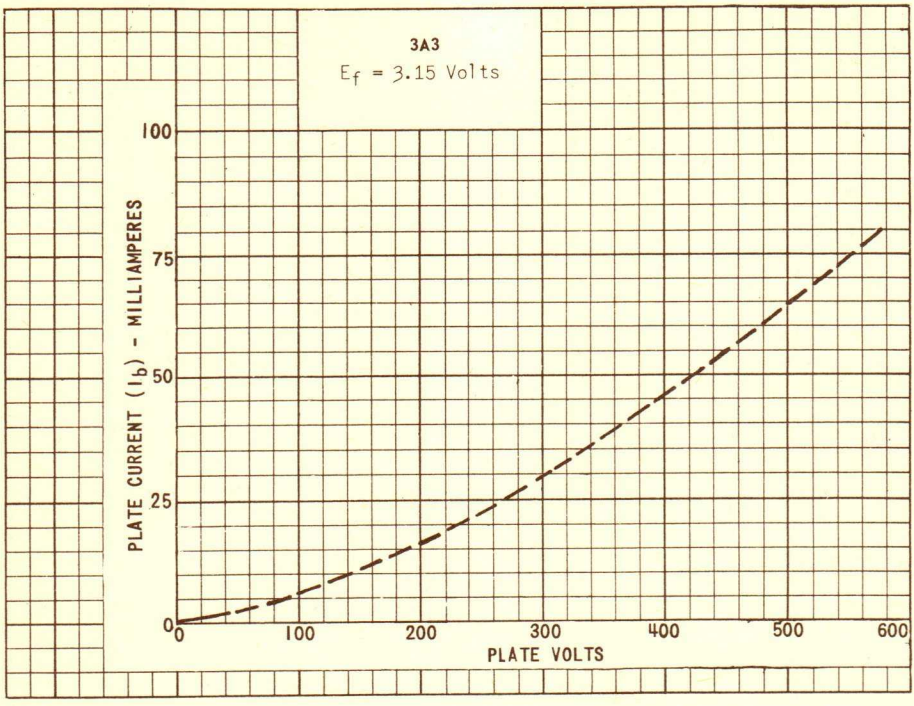
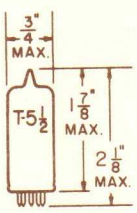

3A3
E_f = 3.15 Volts
PLATE CURRENT (I_b) - MILLIAMPERES
0
25
50
75
100
0
100
200
300
400
500
600
PLATE VOLTS

TUNG-SOL

POWER AMPLIFIER PENTODE

MINIATURE TYPE

COATED FILAMENT



GLASS BULB

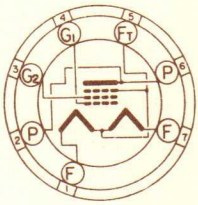
SERIES FILAMENT
E_f APPLIED BETWEEN PINS 1 & 7
E_{g1} REFERRED TO PIN 1

PARALLEL FILAMENT
E_f APPLIED BETWEEN PIN 5 AND PINS 1 & 7 TIED TOGETHER.
E_{g1} REFERRED TO PIN 5

2.8 VOLTS	1.4 VOLTS
0.1 AMP.	0.2 AMP.

DC

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 1 AND 5 FOR SERIES-FILAMENT OPERATION. ITS VALUE SHOULD BE SUCH THAT THE VOLTAGE ACROSS THE SHUNTED SECTION IS EQUAL TO THE VOLTAGE BETWEEN PINS 5 AND 7. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 1 AND 7 IF OTHER TUBES USED IN SERIES-FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3A4.



BOTTOM VIEW
MINIATURE BUTTON 7 PIN BASE

ANY MOUNTING POSITION

THE 3A4 IS DESIGNED FOR USE IN COMPACT, LIGHTWEIGHT, PORTABLE EQUIPMENT. THE RELATIVELY LARGE FILAMENT EMPLOYED IN THE 3A4 ENABLES IT TO SUPPLY THE HIGH PEAK CURRENTS REQUIRED IN RF POWER APPLICATIONS. IN RF AMPLIFIER SERVICE THE 3A4 WILL DELIVER A POWER OUTPUT OF ABOUT 1.2 WATTS AT 10 MEGACYCLES. IT IS RECOMMENDED THAT NO MATERIAL BE PERMITTED TO OBSTRUCT THE HOLE IN THE BASE SOCKET AS THIS TYPE MAY BE MANUFACTURED WITH THE EXHAUST-TUBE TIP AT THE BASE END.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	AF POWER AMPLIFIER	RF POWER AMPLIFIER	
MAXIMUM PLATE VOLTAGE	150	150	VOLTS
MAXIMUM SCREEN VOLTAGE	90	135	VOLTS
MAXIMUM GRID VOLTAGE	---	-30	VOLTS
MAXIMUM PLATE CURRENT	---	20	MA.
MAXIMUM GRID CURRENT	---	0.25	MA.
MAXIMUM TOTAL CATHODE CURRENT	18	25	MA.
MAXIMUM PLATE INPUT	---	3.0	WATTS
MAXIMUM PLATE DISSIPATION	2.0	2.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.4	0.9	WATT

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID TO PLATE (MAX.)	0.34	μμf
INPUT	4.8	μμf
OUTPUT	4.2	μμf

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→ INDICATES A CHANGE OR ADDITION

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

VALUES FOR SERIES-FILAMENT OPERATION WILL BE APPROXIMATELY THE SAME AS FOR PARALLEL-FILAMENT OPERATION.

	PARALLEL FILAMENT ARRANGEMENT			
	AF POWER AMPLIFIER		RF POWER AMPLIFIER AT 10 MC.	
PLATE VOLTAGE	135	150	150	VOLTS
SCREEN VOLTAGE	90	90	135	VOLTS
GRID VOLTAGE	-7.5	-8.4	---	VOLTS
PEAK AF GRID VOLTAGE	7.5	8.4	---	VOLTS
ZERO-SIGNAL PLATE CURRENT	14.8	13.3	---	MA.
ZERO-SIGNAL SCREEN CURRENT	2.6	2.2	---	MA.
MAXIMUM-SIGNAL PLATE CURRENT	14.9	14.1	18.3	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	3.5	3.5	6.5	MA.
GRID CURRENT	---	---	0.13	MA.
GRID RESISTOR	---	---	0.2	MEGOHM
LOAD RESISTANCE	8 000	8 000	---	OHMS
PLATE RESISTANCE	90 000	100 000	---	OHMS
TRANSCONDUCTANCE	1 900	1 900	---	μMHOS
MAXIMUM-SIGNAL POWER OUTPUT	0.6	0.7	1.2 (APPROX.)	WATTS
TOTAL HARMONIC DISTORTION	5.0	6.0	---	PER CENT

→ INDICATES A CHANGE OR ADDITION

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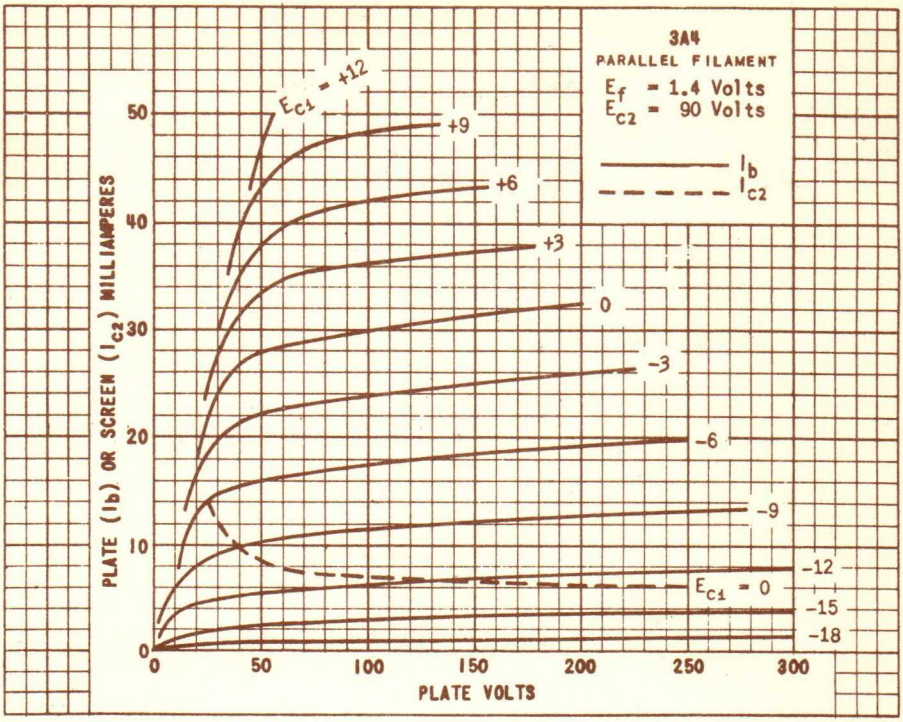

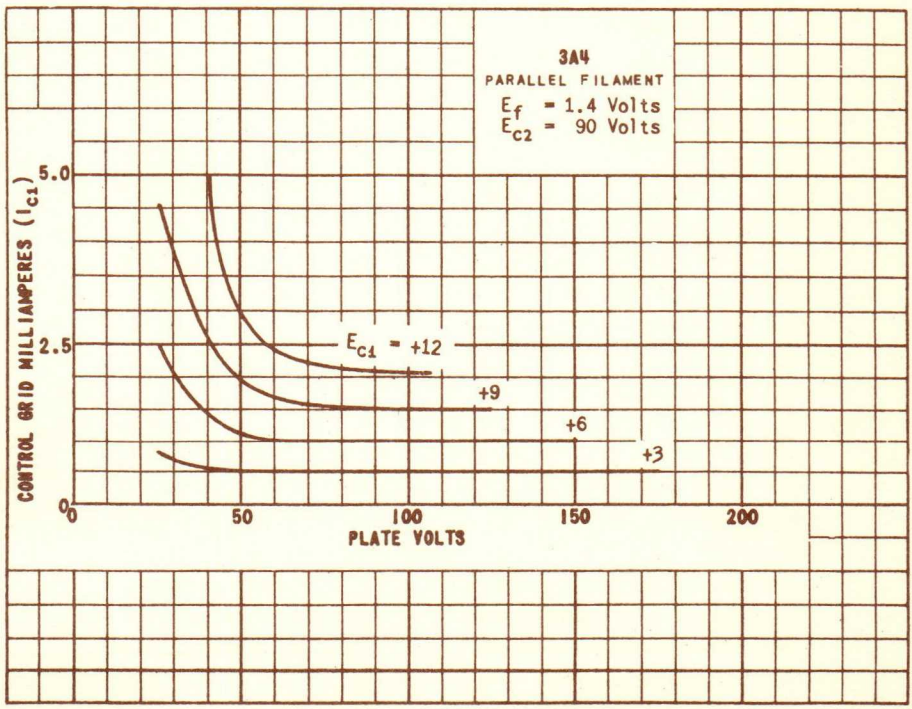

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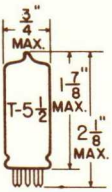
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

COATED FILAMENT



GLASS BULB

SERIES FILAMENT
E_f APPLIED BETWEEN PINS 1 & 7
E_g REFERRED TO PIN 1

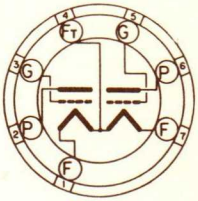
2.8 VOLTS
110 MA.

PARALLEL FILAMENT
E_f APPLIED BETWEEN PIN 4 AND PINS 1 & 7 TIED TOGETHER.
E_g REFERRED TO PIN 4

1.4 VOLTS
220 MA.

DC

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 1 AND 4 FOR SERIES-FILAMENT OPERATION. ITS VALUE SHOULD BE SUCH THAT THE VOLTAGE ACROSS THE SHUNTED SECTION IS EQUAL TO THE VOLTAGE BETWEEN PINS 4 AND 7. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 1 AND 7 IF OTHER TUBES USED IN SERIES-FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3A5.



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

ANY MOUNTING POSITION

THE 3A5 IS INTENDED FOR USE IN HIGH FREQUENCY APPLICATIONS. THE RELATIVELY LARGE FILAMENT EMPLOYED IN THE 3A5 ENABLES IT TO SUPPLY THE HIGH PEAK CURRENTS REQUIRED IN RF POWER APPLICATIONS. IN CLASS C SERVICE, A 3A5 WITH ITS UNITS IN PUSH-PULL WILL DELIVER A POWER OUTPUT OF APPROXIMATELY 2 WATTS AT 40 MEGACYCLES. IT MAY BE USED AT STILL HIGHER FREQUENCIES WITH REDUCED EFFICIENCY. EACH TRIODE MAY BE USED INDEPENDENTLY OF THE OTHER.

DIRECT INTERELECTRODE CAPACITANCES

	TRIODE UNIT 1	TRIODE UNIT 2	
GRID TO PLATE: (G TO P)	3.2	3.2	μμf
INPUT: (G TO H)	0.9	0.9	μμf
OUTPUT: (P TO H)	1.0	1.0	μμf
PLATE TO PLATE: (P TO P)	0.32		μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	AF AMPLIFIER	RF AMPLIFIER	
FILAMENT VOLTAGE	1.4 2.8	1.4 2.8	VOLTS
MAXIMUM PLATE VOLTAGE	135	135	VOLTS
MAXIMUM DC GRID VOLTAGE	---	-30	VOLTS
MAXIMUM PLATE CURRENT	5	---	MA.
MAXIMUM DC PLATE CURRENT (PER UNIT)	---	15	MA.
MAXIMUM DC GRID CURRENT (PER UNIT)	---	2.5	MA.
MAXIMUM PLATE DISSIPATION	0.5	---	WATT
MAXIMUM PLATE DISSIPATION (PER UNIT)	---	1.0	WATT
MAXIMUM PLATE INPUT (PER UNIT)	---	2.0	WATT

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AF AMPLIFIER

HEATER VOLTAGE	1.4	2.8	VOLTS
HEATER CURRENT	220	110	MA.
PLATE VOLTAGE	90		VOLTS
GRID VOLTAGE	-2.5		VOLTS
PLATE CURRENT	3.7		MA.
PLATE RESISTANCE	8 300		OHMS
TRANSCONDUCTANCE	1 800		µMHOS
AMPLIFICATION FACTOR	15		

RF POWER AMPLIFIER AND OSCILLATOR-CLASS "C' TELEGRAPHY

AT 40 MC WITH BOTH UNITS IN PUSH-PULL
(KEY-DOWN CONDITIONS PER TUBE WITHOUT MODULATION)

FILAMENT VOLTAGE	1.4	2.8	VOLTS
FILAMENT CURRENT	220	110	MA.
DC PLATE VOLTAGE	135		VOLTS
DC GRID VOLTAGE:			
FROM A FIXED SUPPLY OF	-20		VOLTS
FROM A GRID RESISTOR OF	4 000		OHMS
FROM A CATHODE RESISTOR OF	570		OHMS
PEAK RF GRID-TO-GRID VOLTAGE	90		VOLTS
DC PLATE CURRENT	30		MA.
DC GRID CURRENT (APPROX.)	5		MA.
DRIVING POWER (APPROX.)	0.2		WATT
POWER OUTPUT (APPROX.)	2		WATTS

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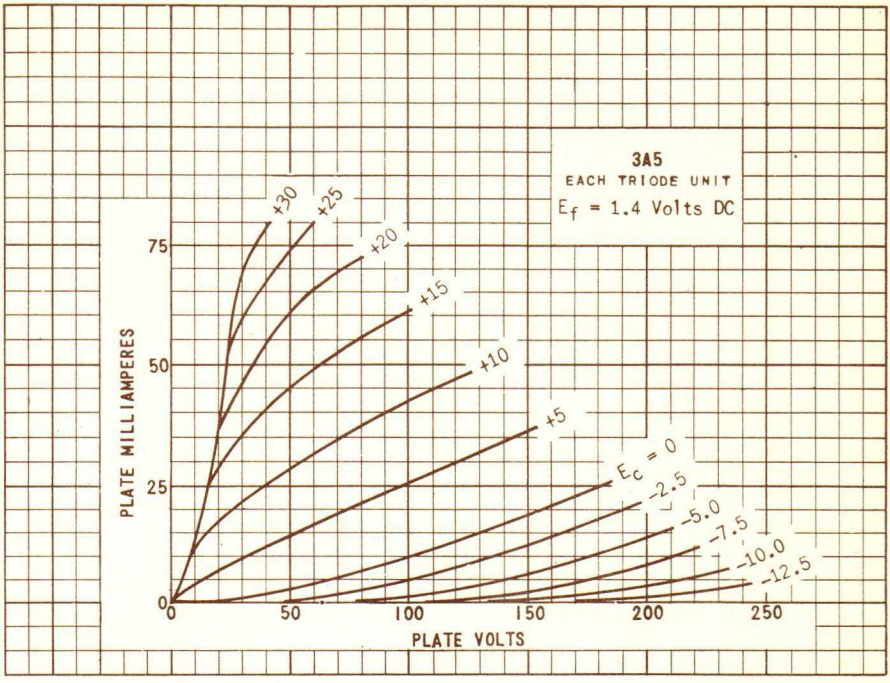

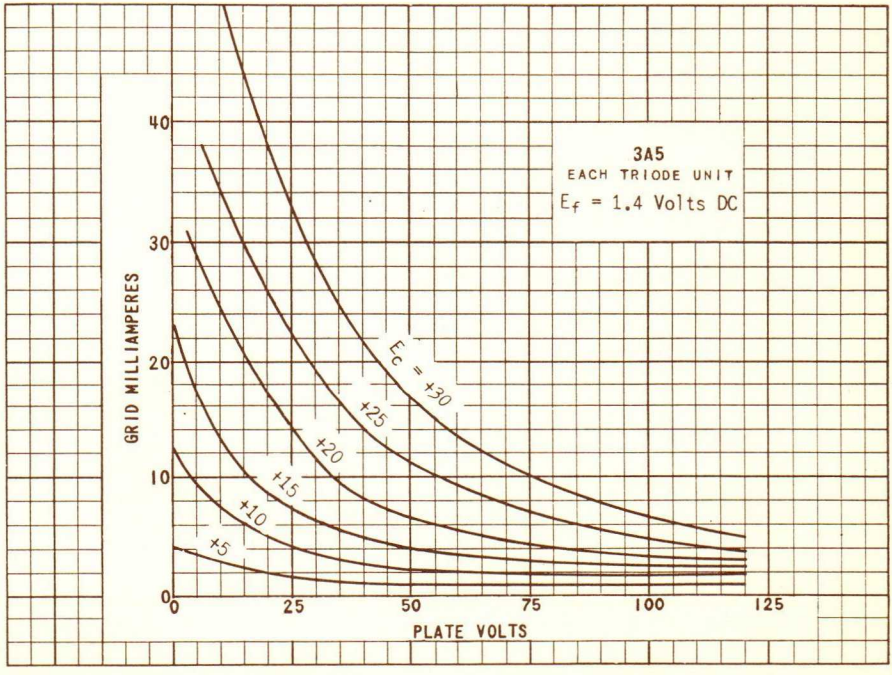

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PLATE
1911
NOV. 1,
1947

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TUNG-SOL

TRIODE

MINIATURE TYPES

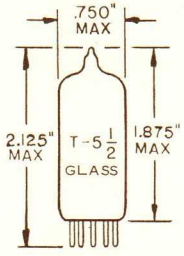
FOR

UHF TELEVISION SERVICE

COATED UNIPOTENTIAL CATHODE

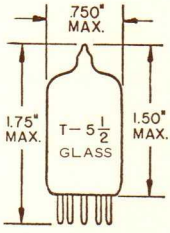
ANY MOUNTING POSITION

3AF4
OUTLINE
JEDEC 5-2



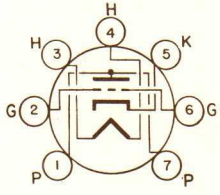
BASE 7 PIN BUTTON
JEDEC E7-1

3AF4A
OUTLINE
JEDEC 5-1



BASE 7 PIN BUTTON
JEDEC E7-1

BASING DIAGRAM
JEDEC 7DK



BOTTOM VIEW

THE 3AF4 AND 3AF4A ARE MEDIUM MU TRIODES IN THE 7 PIN MINIATURE CONSTRUCTION. THEY ARE DESIGNED FOR LOCAL OSCILLATOR SERVICE IN TELEVISION RECEIVERS WHICH OPERATE IN THE UHF REGION. INTERNAL LEAD INDUCTANCE IS REDUCED BY EMPLOYING DOUBLE CONNECTIONS TO THE PLATE AND GRID. ELECTRICALLY THE 3AF4 IS IDENTICAL TO THE 3AF4A AND DIFFERS IN ENVELOPE SIZE.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #316 CONNECTED TO CATHODE EXCEPT AS NOTED

GRID TO PLATE	1.9	pf
GRID TO CATHODE AND HEATER	2.2	pf
PLATE TO CATHODE AND HEATER	1.4	pf
HEATER TO CATHODE - SEE NOTE BELOW	2.2	pf

NOTE: WITH EXTERNAL SHIELD #316 CONNECTED TO PLATE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15 VOLTS	450	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	mA
PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		50	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		50	VOLTS
DC COMPONENT		25	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

UHF OSCILLATOR

PLATE VOLTAGE	150	VOLTS
NEGATIVE GRID VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID CURRENT	2	mA
CATHODE CURRENT	24	mA

CHARACTERISTICS

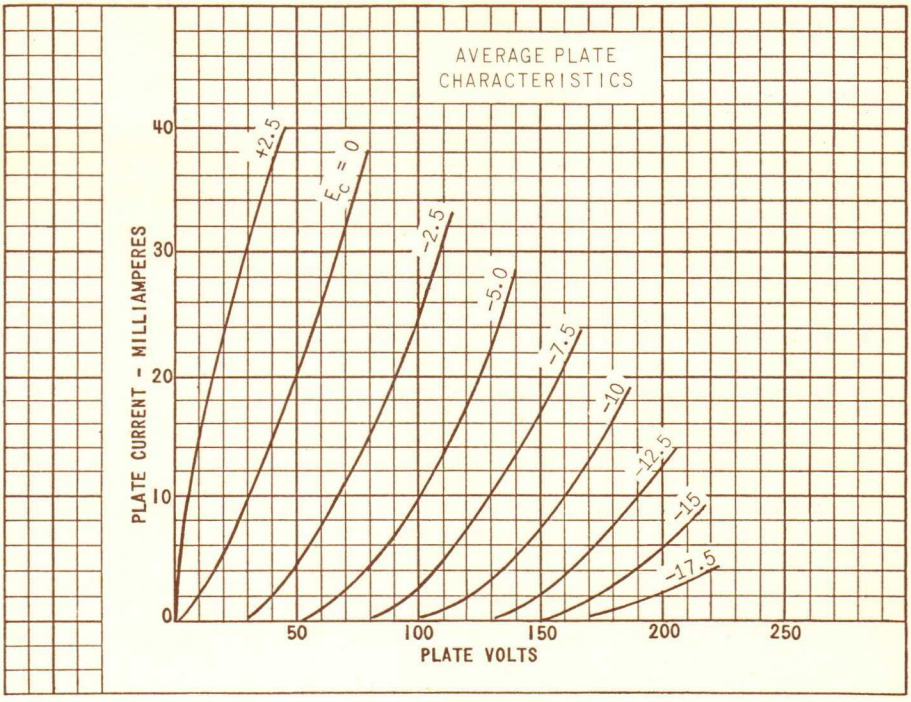
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	80	VOLTS
CATHODE RESISTOR	150	OHMS
PLATE CURRENT	17.5	mA
TRANSCONDUCTANCE	6,500	μMHOS
AMPLIFICATION FACTOR	13.5	
PLATE RESISTANCE	APPROX. 2,100	OHMS

TYPICAL OPERATION

AT FREQUENCY OF 1.000 MC/S

PLATE VOLTAGE	100	VOLTS
PLATE RESISTOR	220	OHMS
GRID RESISTOR	10,000	OHMS
PLATE CURRENT	17	mA
GRID CURRENT	APPROX. 750	μA



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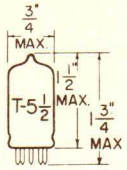
DOUBLE DIODE

MINIATURE TYPE

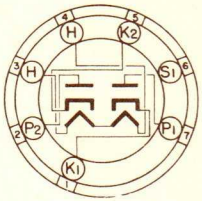


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6BT

THE 3AL5 COMBINES TWO INDEPENDENT DIODE UNITS IN THE 7 PIN MINIATURE CONSTRUCTION. DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS, ITS HIGH PERVEANCE PERMITS HIGH EFFICIENCY IN EITHER FM OR AM DETECTOR SERVICE. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO TYPE 6AL5.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
PLATE INPUT: P TO (H+K+IS) EACH UNIT	2.5	3.2	μμf
COUPLING: 1P TO 2P (MAX.)	0.068	0.026	μμf
CATHODE INPUT: K TO (P+H+IS) EACH UNIT	3.4	3.6	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #6.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM HEATER-CATHOLDE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	330	VOLTS
MAXIMUM AC PLATE VOLTAGE (EACH PLATE) RMS	117	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT (EACH PLATE)	54	MA.
MAXIMUM DC OUTPUT CURRENT (EACH PLATE)	9	MA.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE (EACH PLATE)	300	OHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER

HEATER VOLTAGE	3.15	VOLTS
HEATER CURRENT	0.6	AMP.
AVERAGE DIODE CURRENT (EACH UNIT) AT 10 VOLTS DC	60	MA.

THE RESONANT FREQUENCY OF EACH UNIT OF THE 3AL5 IS 700 MC. (APPROX.)

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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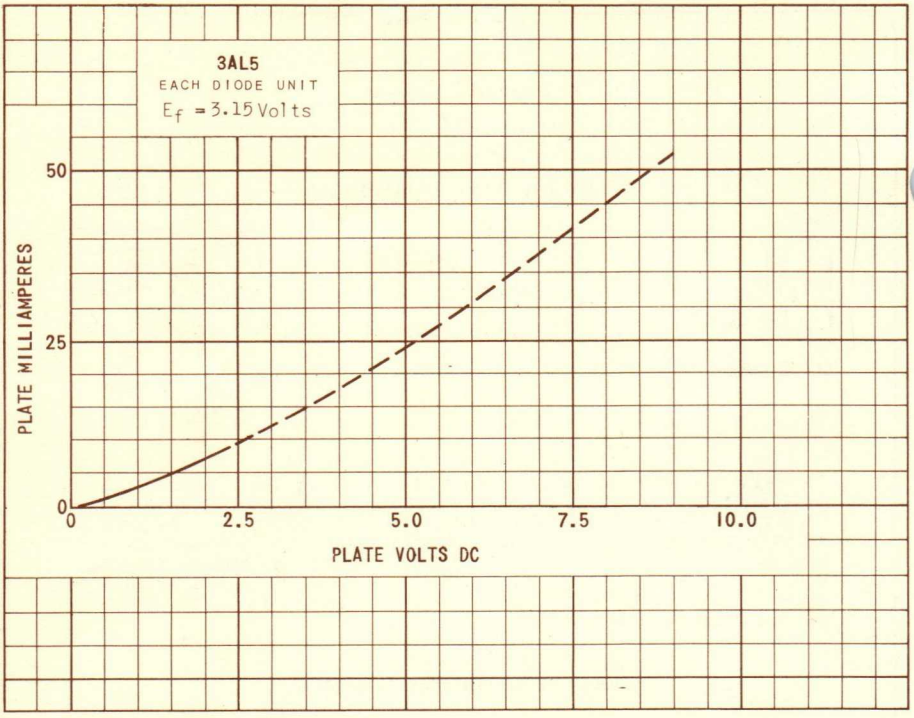
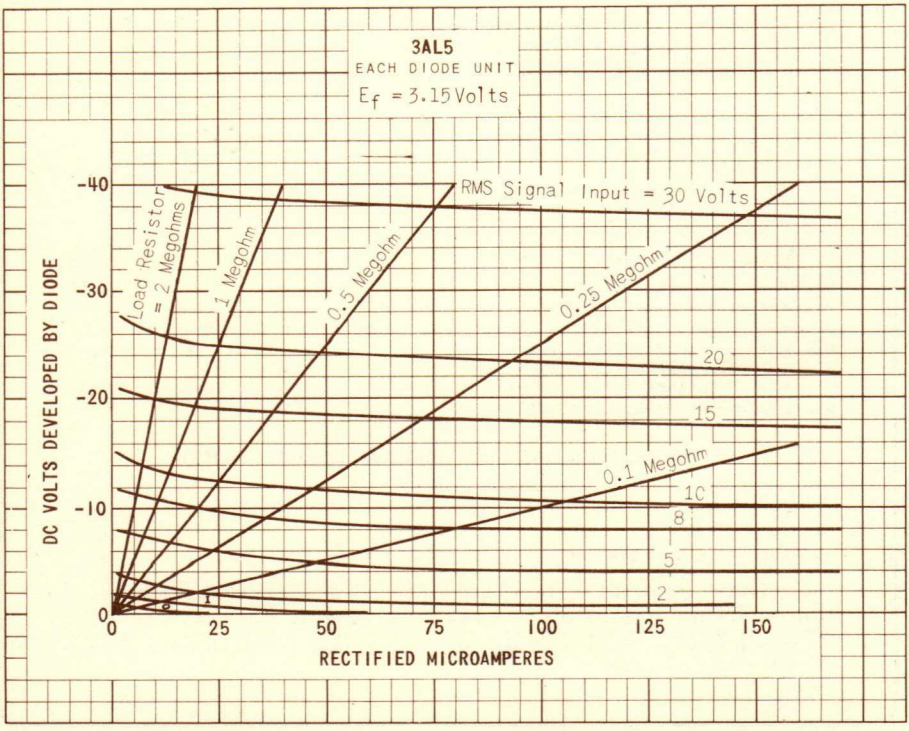
3AL5


3AL5
EACH DIODE UNIT
E_f = 3.15 Volts
PLATE MILLIAMPERES
50
25
0
0
2.5
5.0
7.5
10.0
PLATE VOLTS DC


3AL5
EACH DIODE UNIT
E_f = 3.15 Volts
DC VOLTS DEVELOPED BY DIODE
-40
-30
-20
-10
0
Load Resistor = 2 Megohms
1 Megohm
0.5 Megohm
0.25 Megohm
0.1 Megohm
RMS Signal Input = 30 Volts
20
15
10
8
5
2
0
25
50
75
100
125
150
RECTIFIED MICROAMPERES

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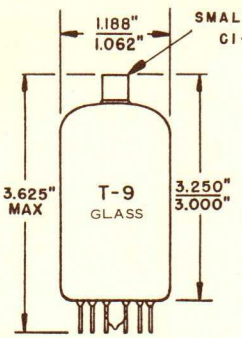
OUTLINE DRAWING
JEDEC 9-100

DIODE

COMPACTRON

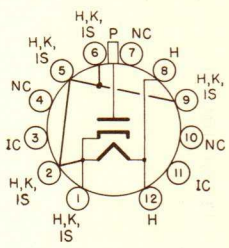


BASE 12 PIN BUTTON
JEDEC E12-70

CATHODE TYPE DIODE
FOR
USE AS A HIGH VOLTAGE
HALF-WAVE RECTIFIER
IN T.V. RECEIVERS

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 12FV ←



BOTTOM VIEW

THE 3AT2 IS A CATHODE TYPE DIODE IN THE T-9, 12 PIN, DOUBLE ENDED COMPACTRON CONSTRUCTION. IT IS DESIGNED FOR USE AS A HIGH VOLTAGE RECTIFIER IN THE FLY-BACK CIRCUITS OF TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER, CATHODE AND INTERNAL SHIELD	Approx. 1.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15 VOLTS	220	MA
LIMITS OF APPLIED VOLTAGE		3.15 ± 0.3	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

FLY-BACK VOLTAGE RECTIFIER

PEAK INVERSE PLATE VOLTAGE	30,000	VOLTS
PEAK PLATE CURRENT	88	MA
DC PLATE CURRENT	1.7	MA

→ INDICATES A CHANGE

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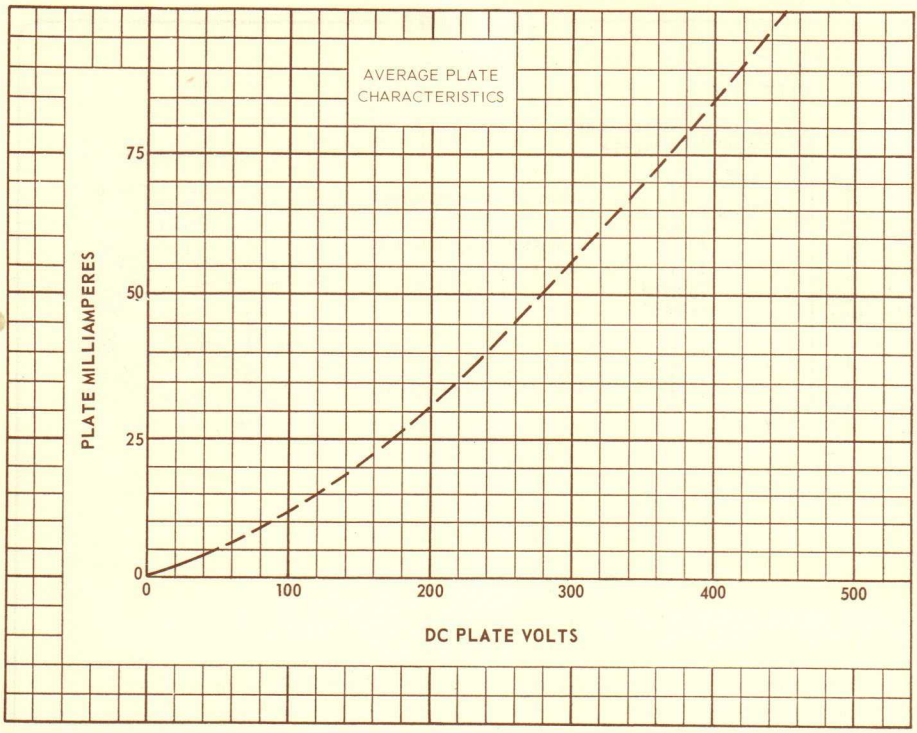
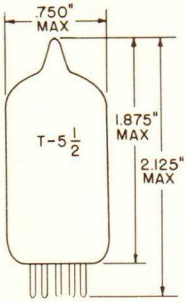

AVERAGE PLATE
CHARACTERISTICS
PLATE MILLIAMPERES
75
50
25
0
0
100
200
300
400
500
DC PLATE VOLTS

TUNG-SOL



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

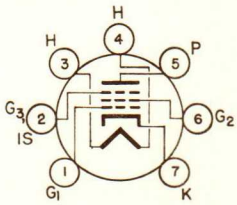
PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 600±40 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BK

THE 3AU6 IS A PENTODE AMPLIFIER WITH SHARP CUT-OFF CONTROL CHARACTERISTICS. USING THE 7 PIN MINIATURE CONSTRUCTION, IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. WITH HIGH TRANSCONDUCTANCE AND LOW GRID PLATE CAPACITANCE, IT IS INTENDED FOR SERVICE AS EITHER AN RF OR AF AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO TYPE 6AU6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE CONNECTION:			
GRID TO PLATE: (G_1 TO P) MAX.	0.003	0.003	pf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.5	5.5	pf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5	5	pf
TRIODE CONNECTION:			
GRID TO PLATE: G_1 TO (P+G_2+G_3&IS)	2.6	2.6	pf
INPUT: G_1 TO (H+K)	3.2	3.2	pf
OUTPUT: (P+G_2+G_3&IS) TO (H+K)	8.5	1.2	pf

[A] SHIELD #316 CONNECTED TO PIN #7.

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE CONNECTION[C]	PENTODE CONNECTION	
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200•	200•	VOLTS
MAXIMUM PLATE VOLTAGE	275	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	SEE J5-C4-2	
MAXIMUM GRID #3 VOLTAGE PIN #2 CONNECTED TO:	PLATE	CATHODE	
MAXIMUM PLATE DISSIPATION	3.5	3.5	WATTS
MAXIMUM GRID #2 DISSIPATION	---	---	WATTS
MAXIMUM GRID #2 INPUT: *			VOLTS
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	---	0.75	WATT
FOR GRID #2 VOLTAGES BETWEEN 165 VOLTS AND 330 VOLTS *	---	SEE J5-C4-2	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
HEATER WARM-UP TIME (APPROX.) *		11.0	SECONDS

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – PENTODE CONNECTION

PLATE VOLTAGE	100	250	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE BIAS RESISTOR	150	100	68	OHMS
GRID #3 VOLTAGE	PIN #2 CONNECTED TO PIN #7 AT SOCKET			
TRANSCONDUCTANCE	3 900	4 500	5 200	μMHOS
PLATE CURRENT	5	7.6	10.6	MA.
GRID #2 CURRENT	2.1	3	4.3	MA.
PLATE RESISTANCE (APPROX.)	0.5	1.5	1	MEGOHMS
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA.	-4.2	-5.5	-6.5	VOLTS

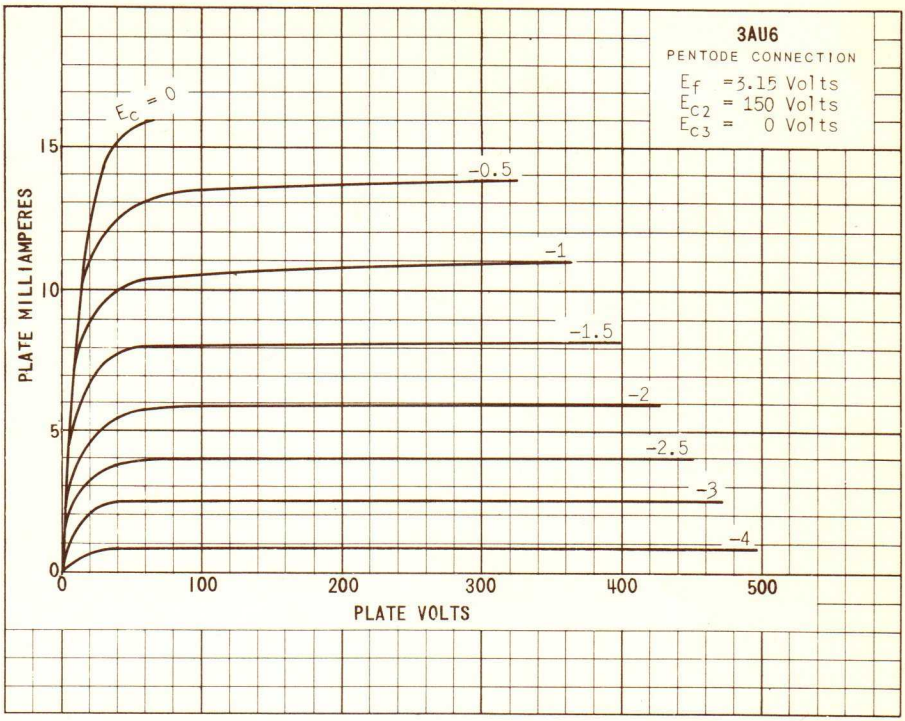
CLASS A_1 AMPLIFIER – TRIODE CONNECTION[C]

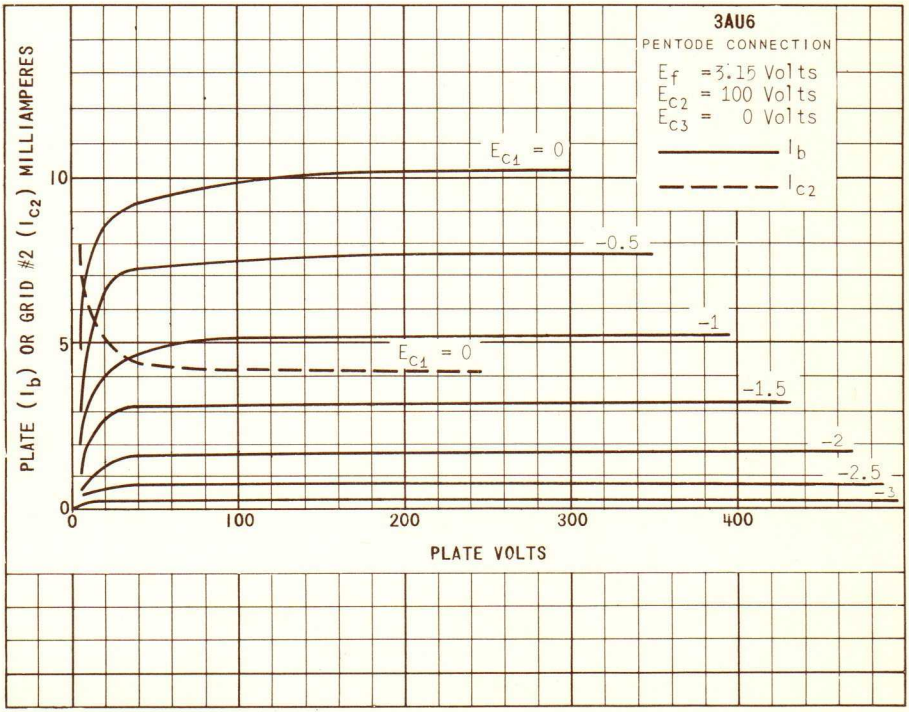
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	PLATE	
CATHODE RESISTOR	330	OHMS
GRID #3 VOLTAGE	PLATE	
TRANSCONDUCTANCE	4 800	μMHOS
PLATE CURRENT	12.2	MA.
AMPLIFICATION FACTOR	36	

[C] TRIODE CONNECTION: GRID #2 AND GRID #3 CONNECTED TO PLATE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

• THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.





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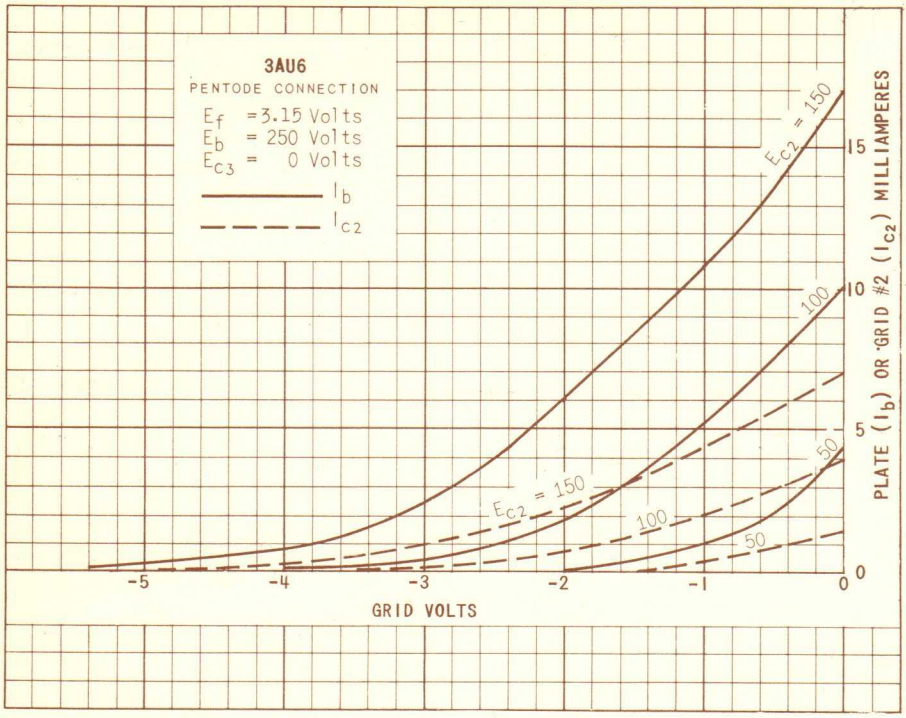
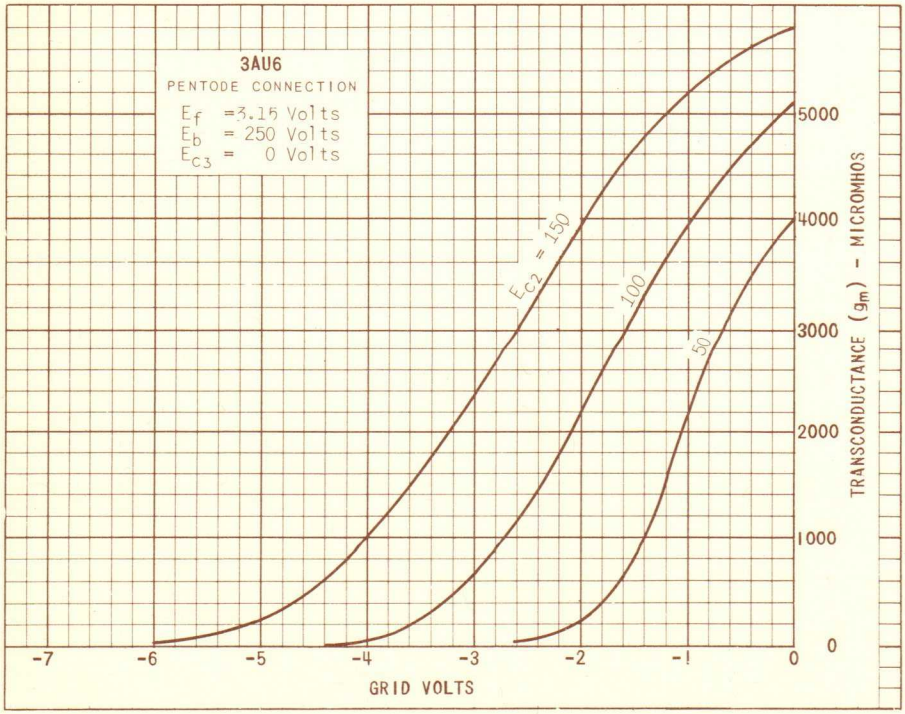

3AU6
PENTODE CONNECTION
Ef =3.15 Volts
Eb = 250 Volts
Ec3 = 0 Volts
Ib
Ic2
Ec2 = 150
100
50
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
GRID VOLTS
-5
-4
-3
-2
-1
0
15
10
5
0


3AU6
PENTODE CONNECTION
Ef =3.15 Volts
Eb = 250 Volts
Ec3 = 0 Volts
Ec2 = 150
100
50
TRANSCONDUCTANCE (gm) - MICROMHOS
GRID VOLTS
-7
-6
-5
-4
-3
-2
-1
0
5000
4000
3000
2000
1000
0

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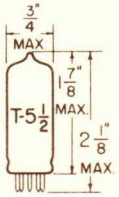
DOUBLE-DIODE TRIODE

MINIATURE TYPE

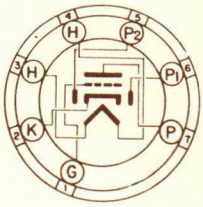


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

THE 3AV6, WHICH COMBINES A HIGH-MU TRIODE AND TWO INDEPENDENT DIODE UNITS IN THE 7 PIN MINIATURE CONSTRUCTION, IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT PERMITS A SINGLE TUBE TO FUNCTION AS A DETECTOR, AVC RECTIFIER, AND AUDIO AMPLIFIER. COUPLING BETWEEN THE DIODE AND TRIODE SECTIONS IS MINIMIZED BY THE USE OF INTERNAL SHIELDING. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO TYPE 6AV6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G TO P)	2	2	μμf
INPUT: G TO (H+K)	2.2	2.2	μμf
OUTPUT: P TO (H+K)	1.2	0.8	μμf
COUPLING: #2 DIODE PLATE TO GRID (MAX.)	0.04	0.04	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	3.15	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
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EACH UNIT)	1	MA.
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

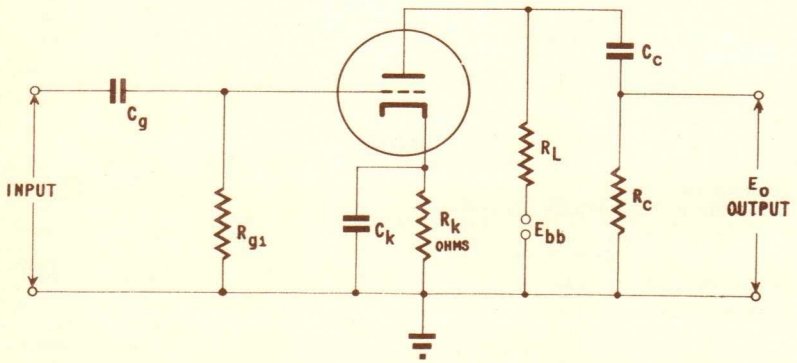
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #1 VOLTAGE	−1	−2	VOLTS
PLATE RESISTANCE	80 000	62 500	OHMS
AMPLIFICATION FACTOR	100	100	
TRANSCONDUCTANCE	1 250	1 600	µMHOS
PLATE CURRENT	0.5	1.2	MA.
AVERAGE DIODE CURRENT AT 10 VOLTS DC (EACH UNIT)	2.0	2.0	MA.

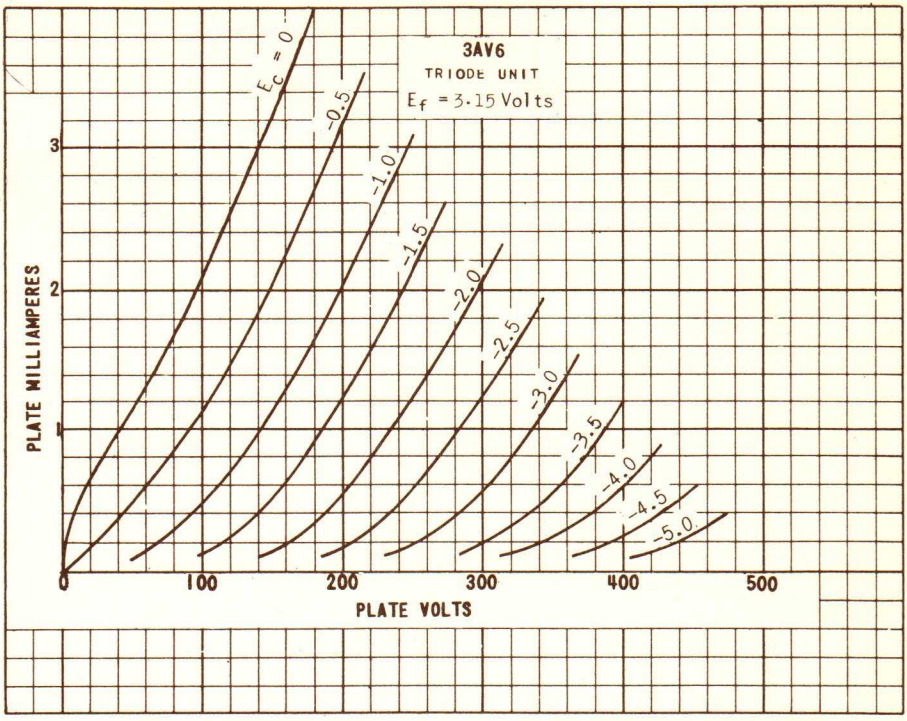
RESISTANCE COUPLED AMPLIFIER

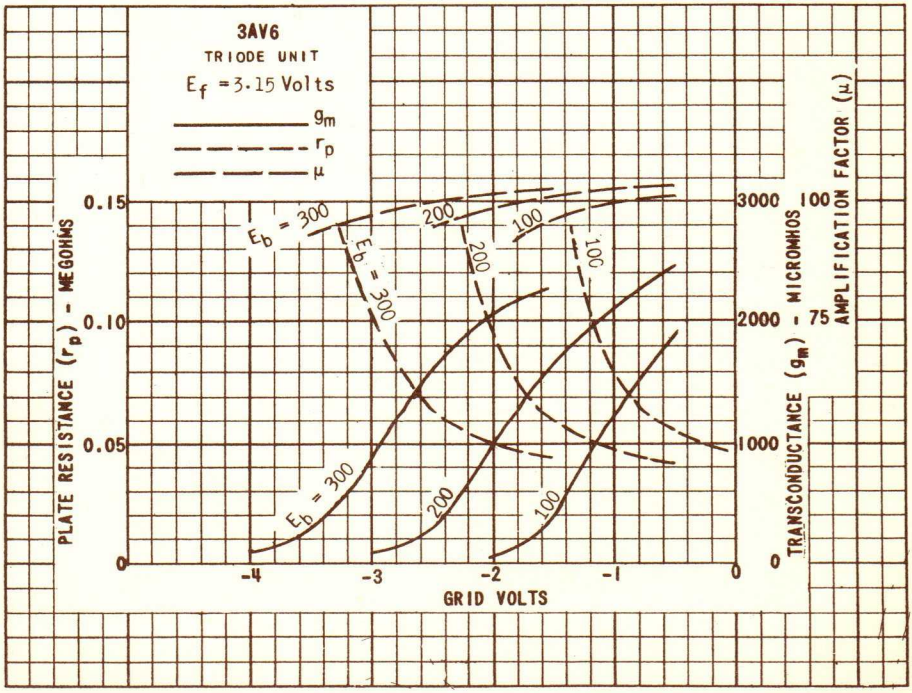
TRIODE UNIT

HEATER VOLTAGE	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE SUPPLY VOLTAGE	90	250	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	220 000	470 000	OHMS
CONTROL GRID RESISTOR	10.0	10.0	MEGOHMS
INPUT CONDENSER	0.01	0.01	µf
OUTPUT CONDENSER	0.01	0.01	µf
GRID RESISTOR OF FOLLOWING STAGE	470 000	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	1 000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	5.5	30	VOLTS
VOLTAGE GAIN AT 400 CPS	42	63	



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.





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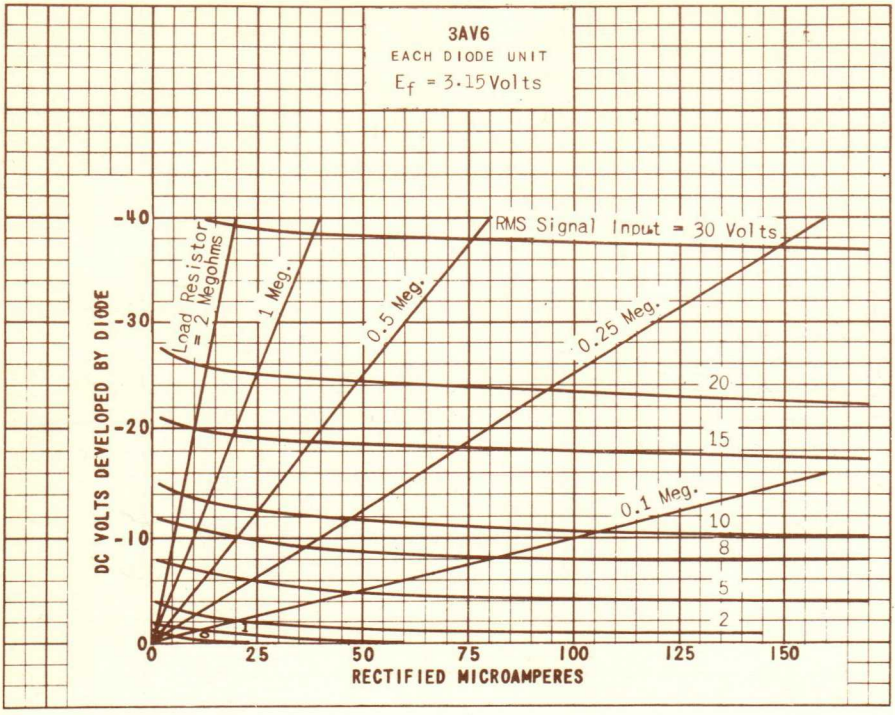
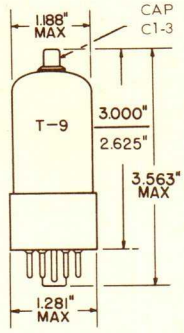

3AV6
EACH DIODE UNIT
E_f = 3.15 Volts
DC VOLTS DEVELOPED BY DIODE
-40
-30
-20
-10
0
Load Resistor = 2 Megohms
1 Meg.
0.5 Meg.
0.25 Meg.
0.1 Meg.
RMS Signal Input = 30 Volts
20
15
10
8
5
2
1
0
25
50
75
100
125
150
RECTIFIED MICROAMPERES

TUNG-SOL

DIODE

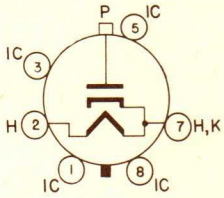


GLASS BULB
INTERMEDIATE SHELL
6 PIN OCTAL B6-8
OR
SHORT INTERMEDIATE SHELL
6 PIN OCTAL
WITH BARRIERS B6-50

HEATER

3.15 VOLTS 0.22 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8EZ

THE 3AW3 IS A CATHODE TYPE DIODE DESIGNED FOR USE AS A HIGH VOLTAGE, HALF-WAVE RECTIFIER OF THE HIGH-VOLTAGE PULSES PRODUCED IN THE SCANNING SECTIONS OF TELEVISION RECEIVERS. ELECTRICALLY IT IS SIMILAR TO THE 3A3, BUT IT IS SHORTER IN LENGTH.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD.

PLATE TO HEATER CATHODE & INTERNAL SHIELD (APPROX.)	1.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FLY BACK VOLTAGE RECTIFIER[B]

HEATER VOLTAGE[A]	3.15	VOLTS
MAXIMUM INVERSE PLATE VOLTAGE	30,000	VOLTS
MAXIMUM PEAK PLATE CURRENT	88	MA.
MAXIMUM AVERAGE PLATE CURRENT	1.7	MA.
MAXIMUM VOLTAGE PULSE DURATION	10	μSEC.

[A] THE HEATER VOLTAGE SHOULD NEVER FALL BELOW 2.65 VOLTS NOR RISE ABOVE 3.65 VOLTS.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

→ INDICATES A CHANGE.

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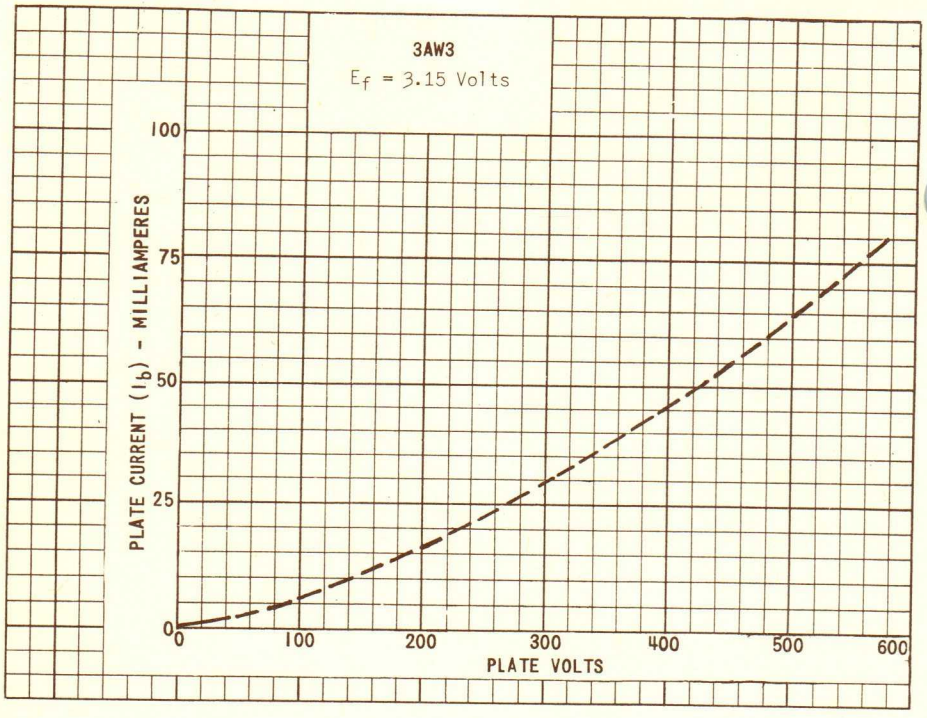
3AW3


3AW3
E_f = 3.15 Volts
PLATE CURRENT (I_b) - MILLIAMPERES
0
25
50
75
100
0
100
200
300
400
500
600
PLATE VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

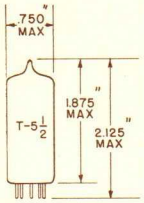
COATED UNIPOTENTIAL CATHODE

HEATER

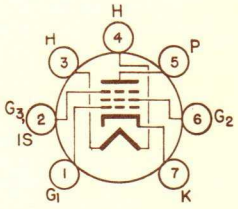
3.15 VOLTS 600±40 MA.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BK ←

THE 3BA6 IS A REMOTE CUT-OFF PENTODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A HIGH-GAIN FREQUENCY OR INTERMEDIATE-FREQUENCY AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BA6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G_1 TO P (MAX.)	0.0035	0.0035	pf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.5	5.5	pf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5.5	5	pf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

→RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[C]	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4	
MAXIMUM GRID #3 VOLTAGE	PIN #2 CONNECTED TO PIN #7 AT SOCKET	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	3.4	WATTS
MAXIMUM GRID #2 DISSIPATION:		
FOR VOLTAGES UP TO 165 VOLTS	0.7	WATT
FOR VOLTAGES BETWEEN 165 & 330 VOLTS	SEE J5-C4	

[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE	100	100	VOLTS
CATHODE BIAS RESISTOR	68	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	1.0	MEGOHM
TRANSCONDUCTANCE	4 300	4 400	μMHOS
PLATE CURRENT	10.8	11	MA.
GRID #2 CURRENT	4.4	4.2	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 40 μMHOS	-20	-20	VOLTS

→INDICATES A CHANGE.

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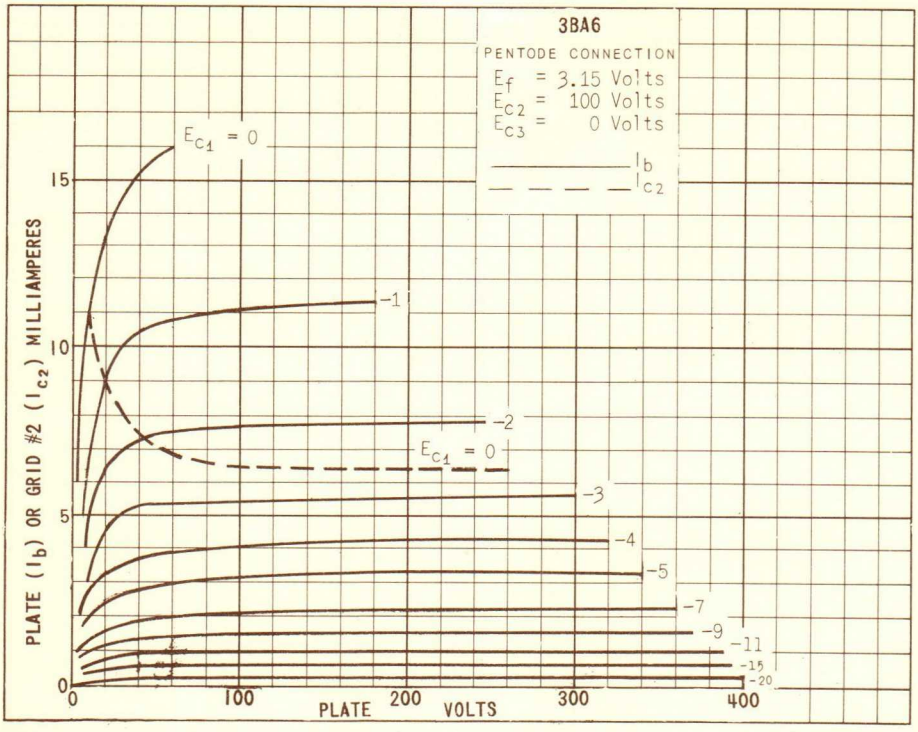
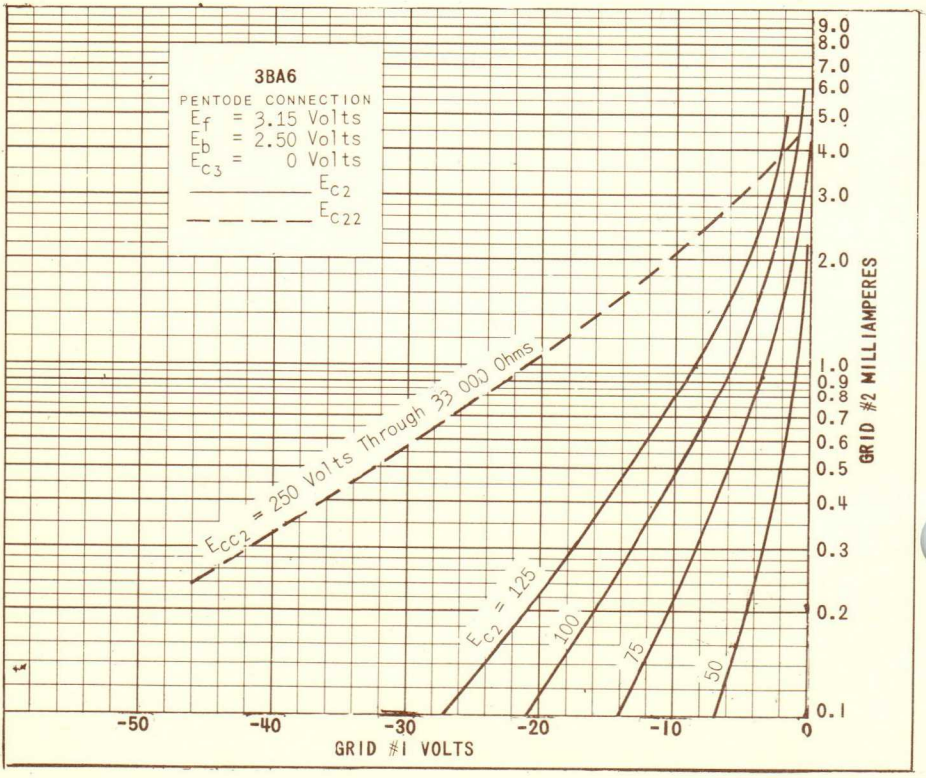
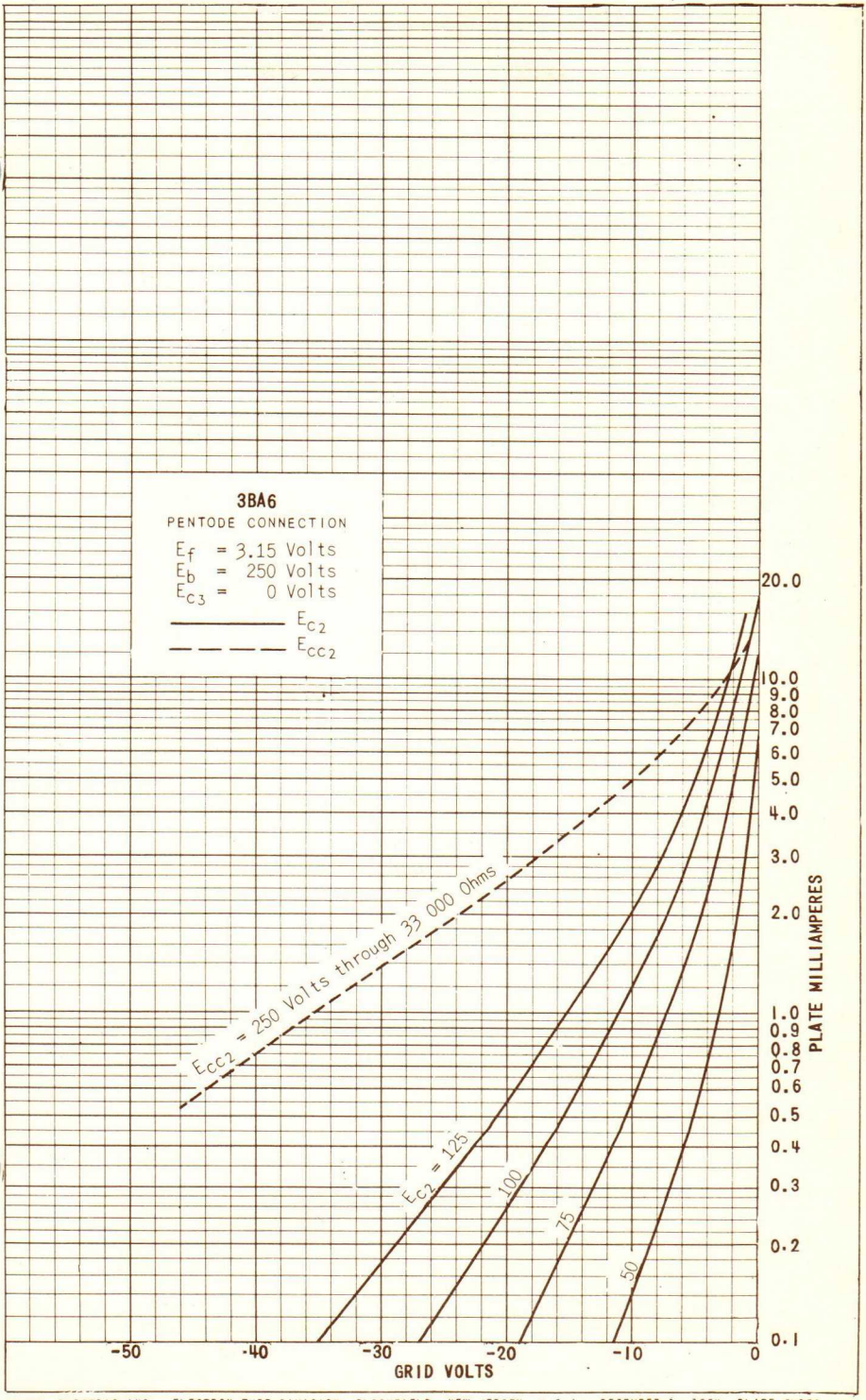

3BA6
PENTODE CONNECTION
Ef = 3.15 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
Ib
Ic2
Ec1 = 0
-1
-2
Ec1 = 0
-3
-4
-5
-7
-9
-11
-15
-20
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0
5
10
15
0
100
200
300
400
PLATE VOLTS


3BA6
PENTODE CONNECTION
Ef = 3.15 Volts
Eb = 2.50 Volts
Ec3 = 0 Volts
Ec2
Ec22
Ecc2 = 250 Volts Through 33 000 Ohms
Ec2 = 125
100
75
50
GRID #2 MILLIAMPERES
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
-50
-40
-30
-20
-10
0
GRID #1 VOLTS



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3BA6

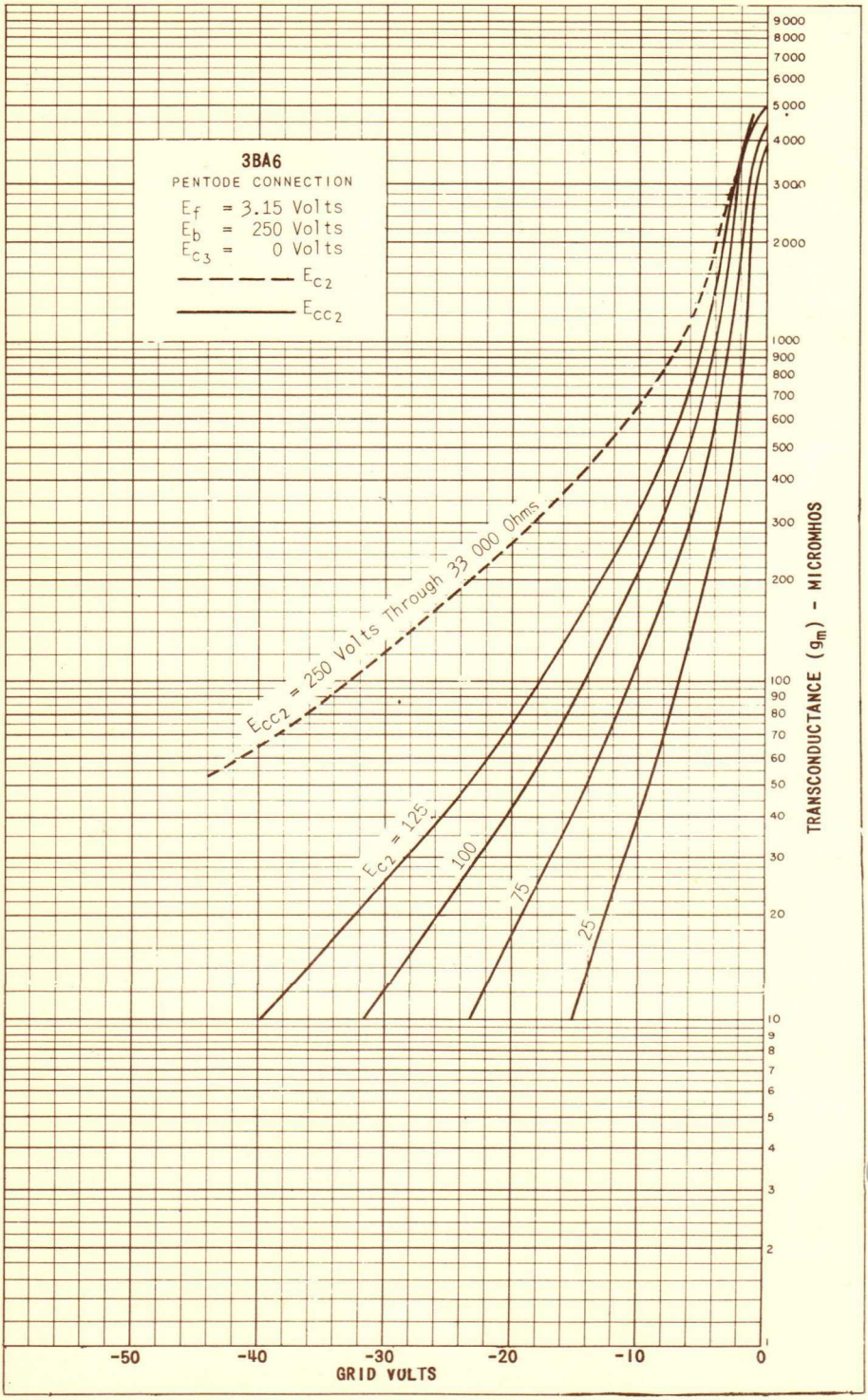


PLATE #4174 DECEMBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

PENTODE

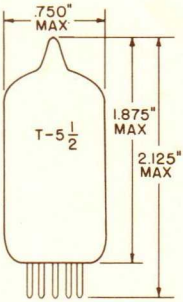
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HIGH FREQUENCY INTERMEDIATE

AND RF AMPLIFIER

ANY MOUNTING POSITION

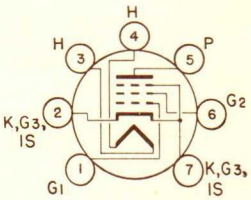


GLASS BULB

MINIATURE BUTTON 7 PIN BASE E7-1

OUTLINE DRAWING

JEDEC 5-2



BOTTOM VIEW

BASING DIAGRAM

BASING DIAGRAM

JEDEC 7BD

THE 3BC5 IS A HIGH TRANSCONDUCTANCE PENTODE VOLTAGE AMPLIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT IS USEFUL AS AN RF AMPLIFIER UP TO ABOUT 400 MC. AND AS A HIGH-FREQUENCY INTERMEDIATE AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
PENTODE CONNECTION:			
GRID TO PLATE: (G1 TO P) MAX.	0.020	0.030	pf
INPUT: G1 TO (H+K+G2+G3 & I.S.)	6.6	6.5	pf
OUTPUT: P TO (H+K+G2+G3& I.S.)	3.1	1.8	pf
TRIODE CONNECTION: (G2 TIED TO PLATE)			
GRID TO PLATE: G1 TO (P+G2)	2.5	2.5	pf
INPUT: G1 TO (H+K+G3 & I.S.)	4.0	3.9	pf
OUTPUT: (P+G2) TO (H+K+G3 & I.S.)	4.3	3.0	pf

A EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15 VOLTS	600	MA.
HEATER WARM-UP TIME*		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600 ± 40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE;			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[B]	VOLTS

B DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE [C]	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID #2 VOLTAGE	PLATE	SEE RATING CHART	
GRID #2 SUPPLY VOLTAGE	PLATE	330	VOLTS
PLATE DISSIPATION	2.9 [C]	2.3	WATTS
GRID #1 VOLTAGE (POSITIVE BIAS VALUE)	0	0	VOLT
GRID #2 DISSIPATION			
FOR VOLTAGES UP TO 165 V.	---	0.55	WATTS
FOR VOLTAGES BETWEEN 165 & 330 V.	---	SEE RATING CHART	

→ TYPICAL OPERATING CHARACTERISTICS

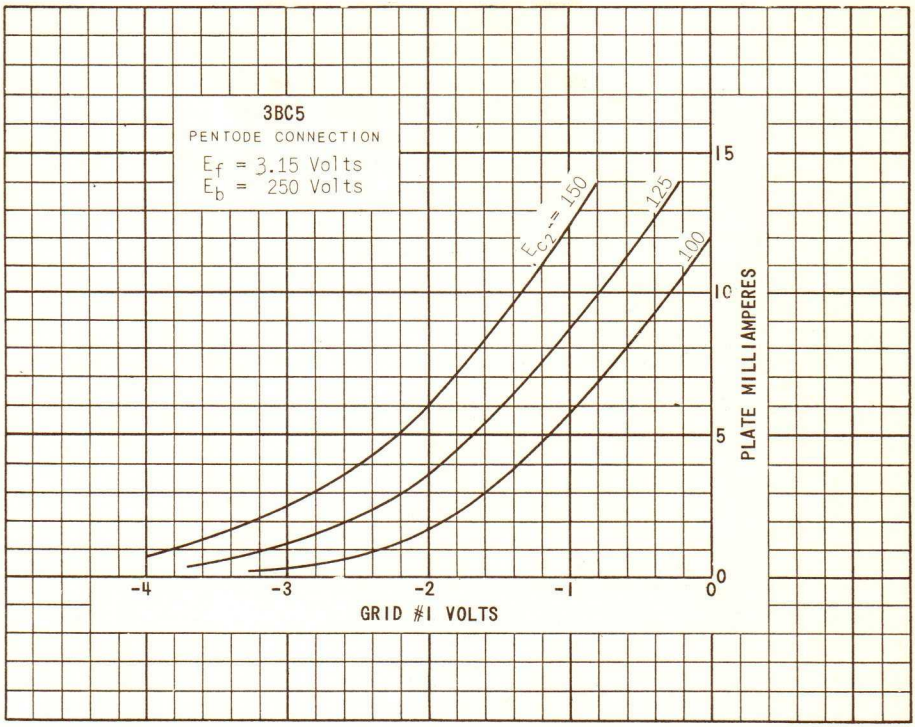
CLASS A_1 AMPLIFIER

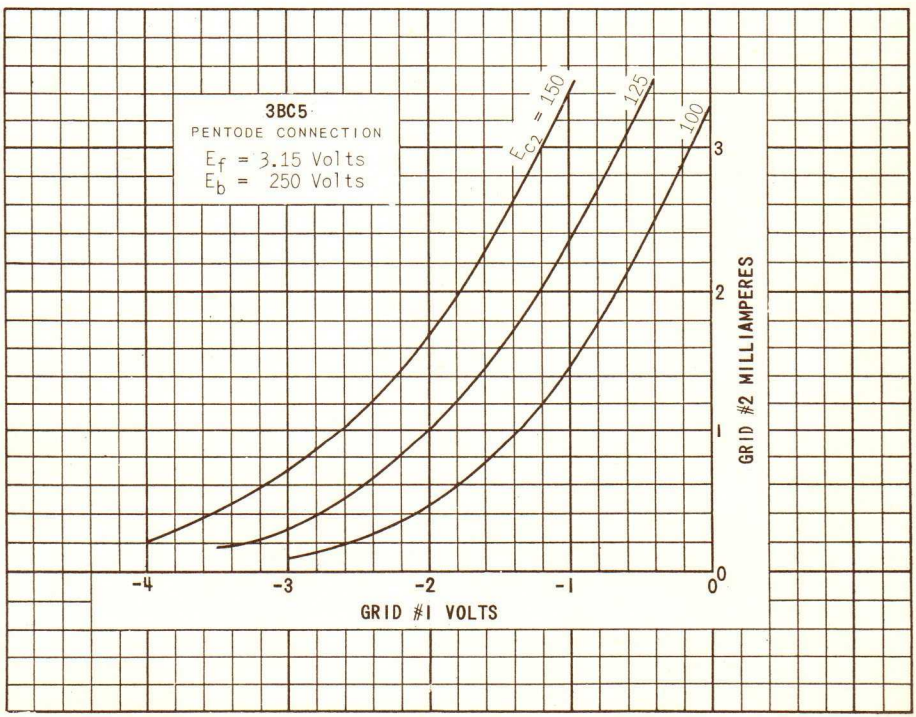
	TRIODE [C]		PENTODE			
PLATE VOLTAGE	250	180	100	125	250	VOLTS
GRID #2 VOLTAGE			100	125	150	VOLTS
CATHODE RESISTOR	820	330	180	100	180	OHMS
TRANSCONDUCTANCE	4400	6000	4900	6100	5700	μMHOS
PLATE RESISTANCE (APPROXIMATELY)	0.009	0.006	0.6	0.5	0.8	MEGOHM
AMPLIFICATION FACTOR	40	42	---	---	---	
PLATE CURRENT	6.0	8.0	4.7	8.0	7.5	MA.
GRID #2 CURRENT	---	---	1.4	2.4	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR Ib = 10 μA.	---	---	-5	-6	-8	VOLTS

[C] G2 TIED TO PLATE.

→ INDICATES A CHANGE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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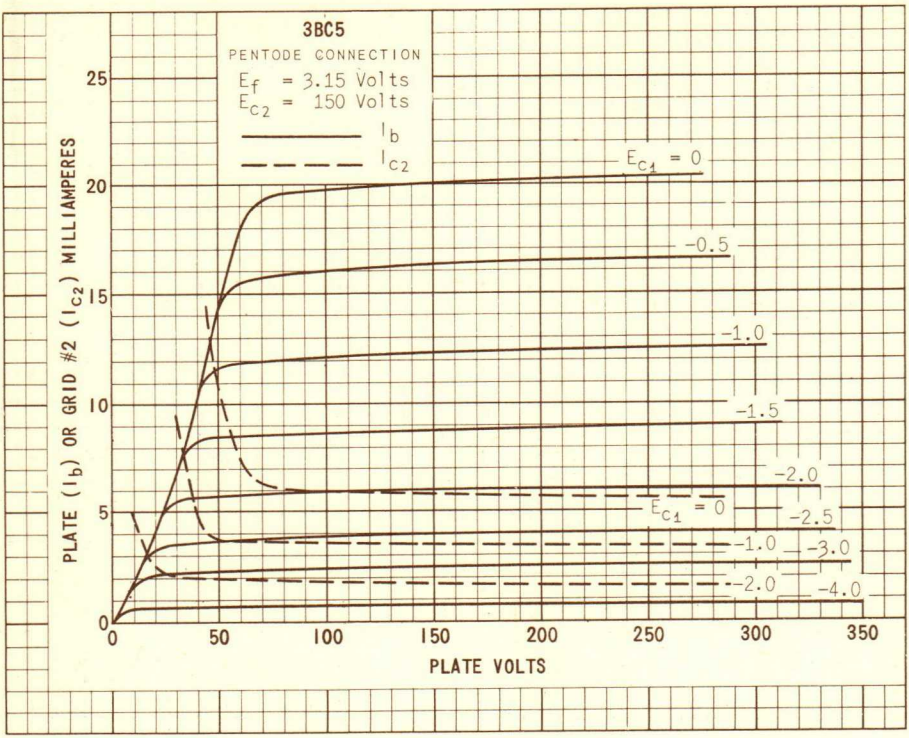
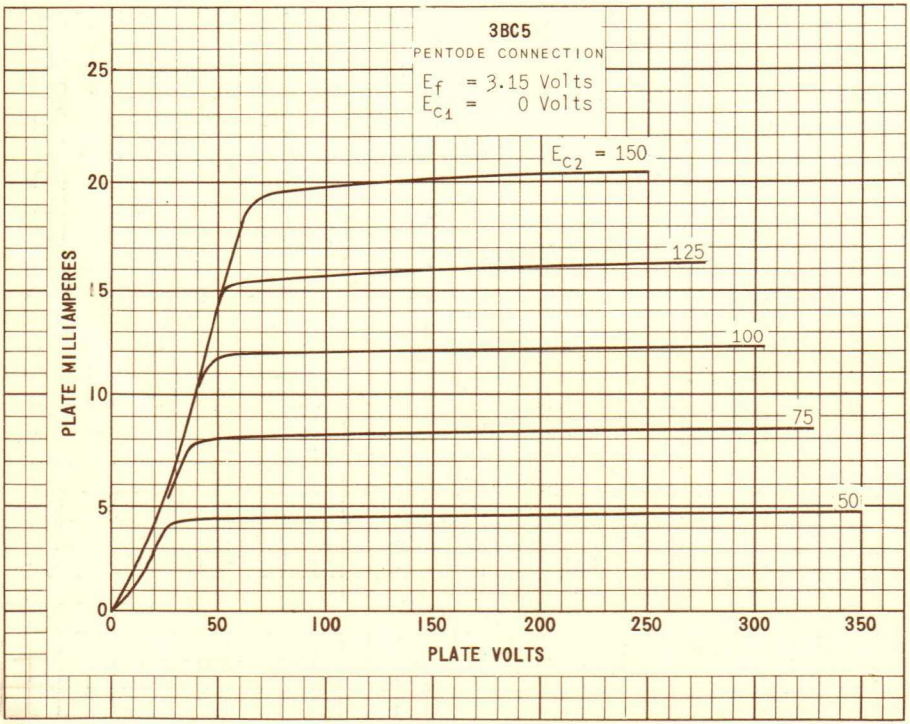
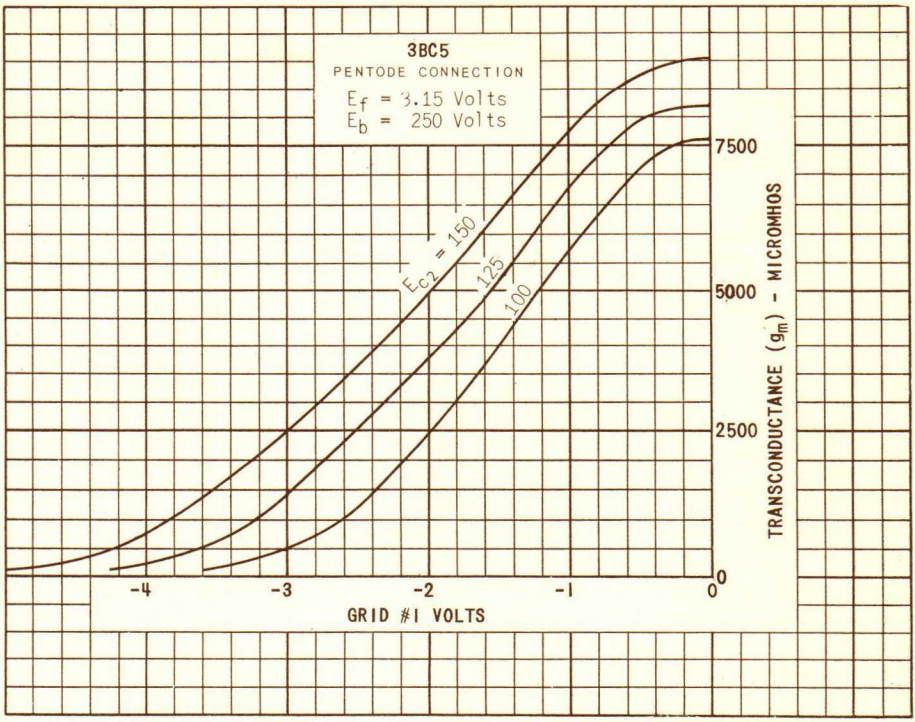
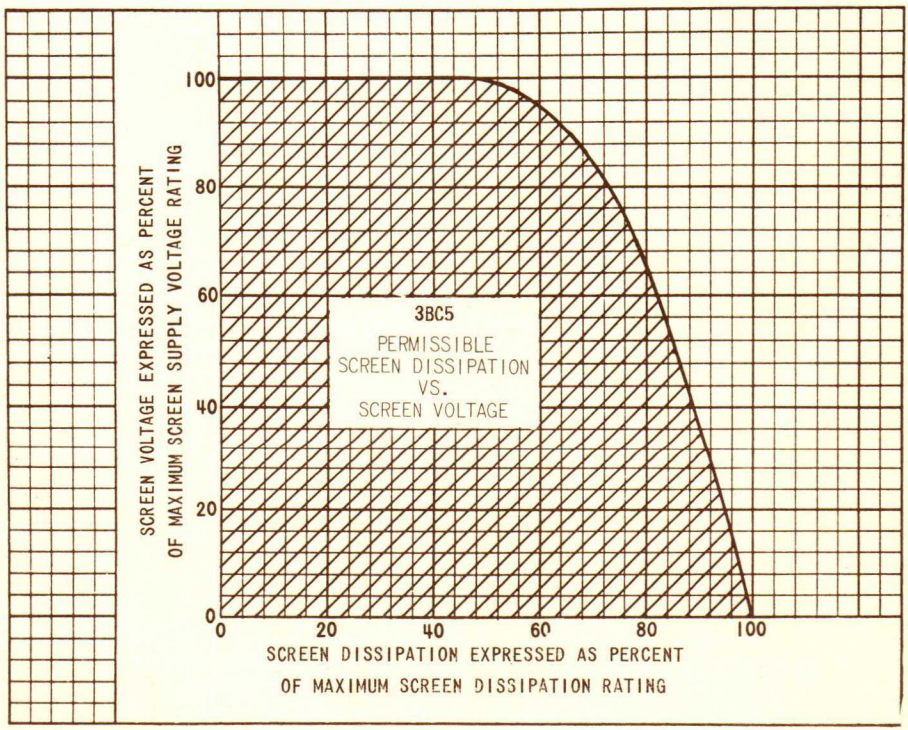

3BC5
PENTODE CONNECTION
E_f = 3.15 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
E_{c1} = 0
-2.5
-1.0
-3.0
-2.0
-4.0
0
5
10
15
20
25
0
50
100
150
200
250
300
350


3BC5
PENTODE CONNECTION
E_f = 3.15 Volts
E_{c1} = 0 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_{c2} = 150
125
100
75
50
0
5
10
15
20
25
0
50
100
150
200
250
300
350





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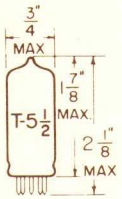
TUNG-SOL

HEPTODE

MINIATURE TYPE

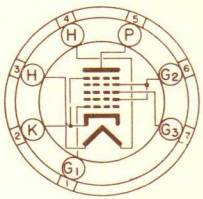


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CH

THE 3BE6, A PENTAGRID CONVERTER USING THE 7 PIN MINIATURE CONSTRUCTION, IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED SUPERHETERODYNE RECEIVERS. IT IS INTENDED FOR SERVICE AS A COMBINED OSCILLATOR AND MIXER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO TYPE 6BE6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
MIXER GRID TO PLATE: (G_3 TO P) MAX.	0.25	0.30	μμf
MIXER GRID TO OSCILLATOR GRID: (G_3 TO G_1) MAX.	0.15	0.15	μμf
RF INPUT: G_3 TO (H+K+G_1+$G_{2\&4}$+G_5+P)	7.0	7.0	μμf
OSCILLATOR INPUT: G_1 TO (H+K+$G_{2\&4}$+G_3+G_5+P)	5.5	5.5	μμf
MIXER OUTPUT: P TO (H+K+G_1+$G_{2\&4}$+G_3+G_5)	13	8.0	μμf
OSCILLATOR GRID TO CATHODE: (G_1 TO K+G_5)	3.0	3.0	μμf
OSCILLATOR OUTPUT: K TO (H+$G_{2\&4}$+G_3+P)	20	15	μμf
OSCILLATOR GRID TO PLATE: (G_1 TO P) MAX.	0.05	0.1	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	3.15	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
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRIDS #2 AND #4 VOLTAGE	100	VOLTS
MAXIMUM GRIDS #2 AND #4 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE	-50	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM GRIDS #2 AND #4 DISSIPATION	1.0	WATT
MAXIMUM CATHODE CURRENT	14	MA.
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

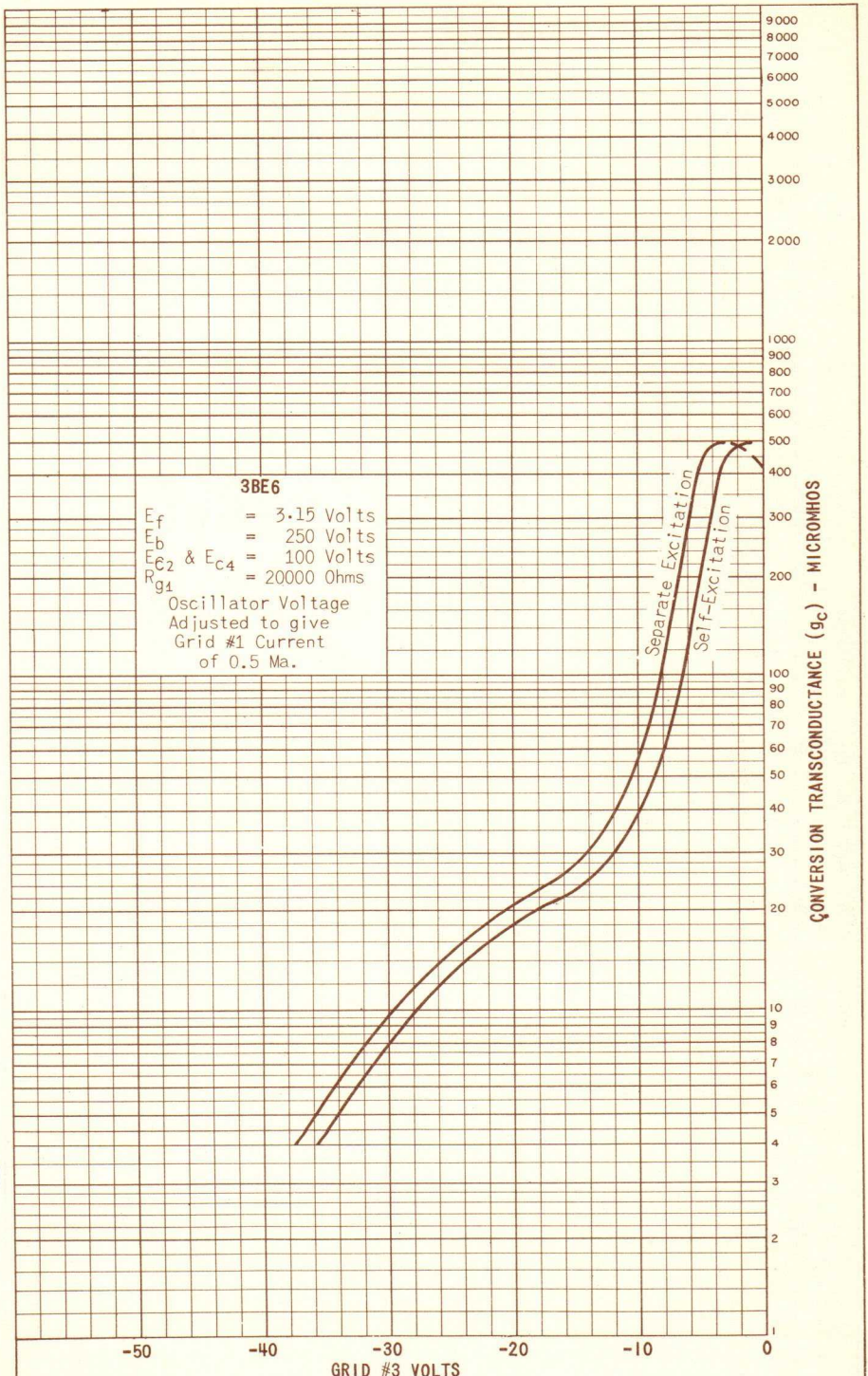
CONVERTER SERVICE – SEPARATE EXCITATION[B]

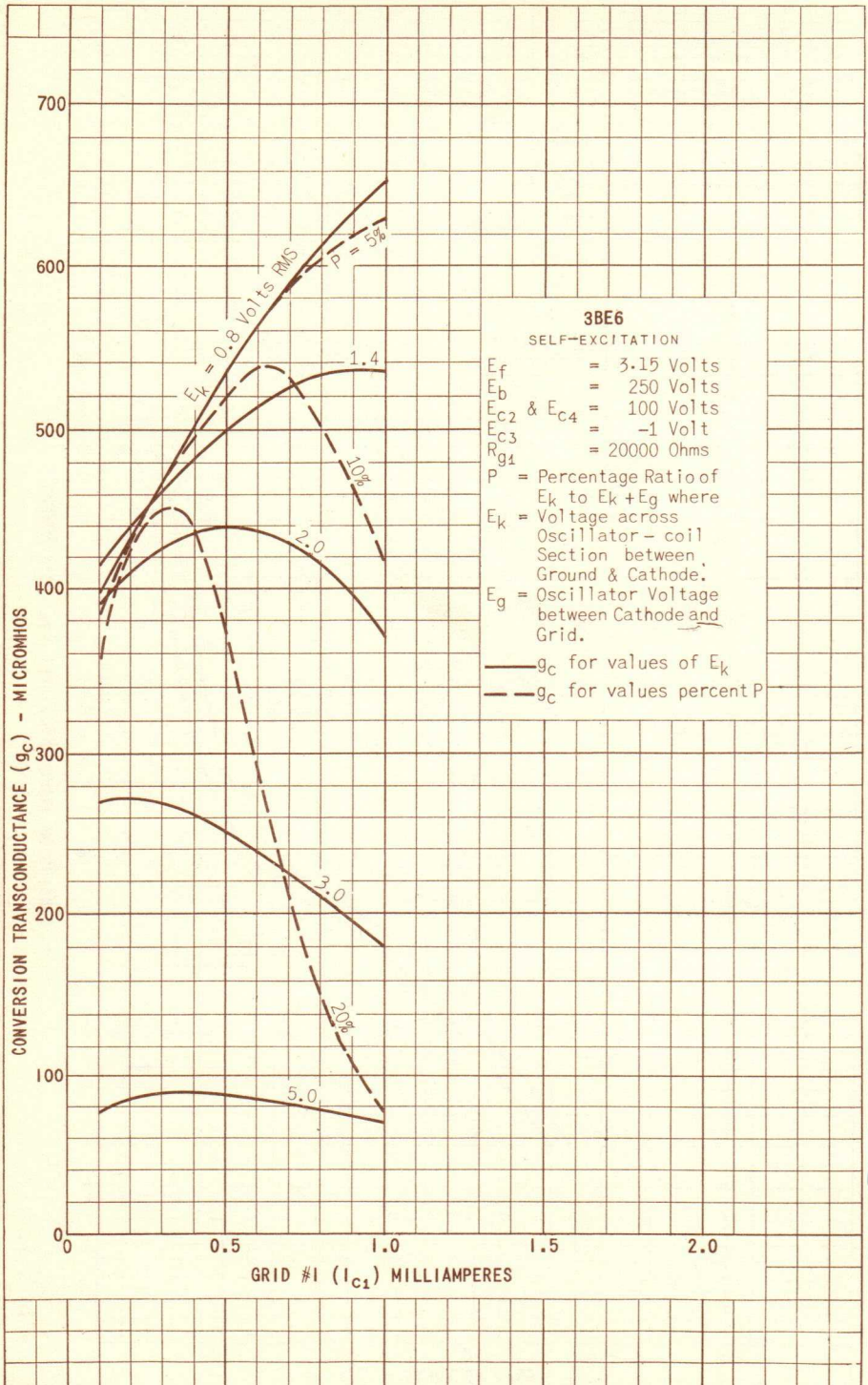
HEATER VOLTAGE	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	-1.5	-1.5	VOLTS
GRIDS #2 AND #4 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID) RMS	10	10	VOLTS
GRID #1 RESISTANCE (OSCILLATOR GRID)	20 000	20 000	OHMS
PLATE RESISTANCE (APPROX.)	0.4	1.0	MEGOHMS
GRID #1 CURRENT (OSCILLATOR GRID)	0.5	0.5	MA.
CONVERSION TRANSCONDUCTANCE	455	475	µMHOS
PLATE CURRENT	2.6	2.9	MA.
GRIDS #2 AND #4 CURRENT	7.0	6.8	MA.
CATHODE CURRENT	10.1	10.2	MA.
GRID #3 VOLTAGE FOR G_c = 10 µMHOS (APPROX.)	-30	-30	VOLTS
GRID #3 VOLTAGE FOR G_c = 100 µMHOS (APPROX.)	-6	-6	VOLTS

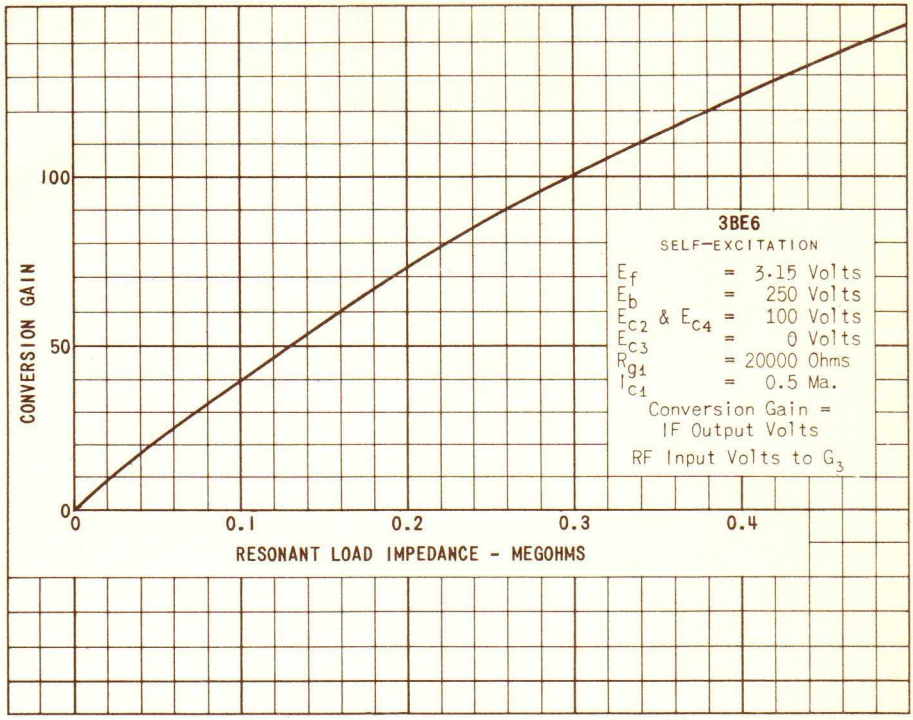
[B] CHARACTERISTICS SHOWN ARE OBTAINED IN THE STANDARD RMA CONVERSION CONDUCTANCE TEST SET WHICH USES SEPARATE EXCITATION. THE CHARACTERISTICS UNDER THESE CONDITIONS CORRESPOND VERY CLOSELY WITH THOSE OBTAINED IN A SELF-EXCITED OSCILLATORY CIRCUIT OPERATING WITH ZERO BIAS.

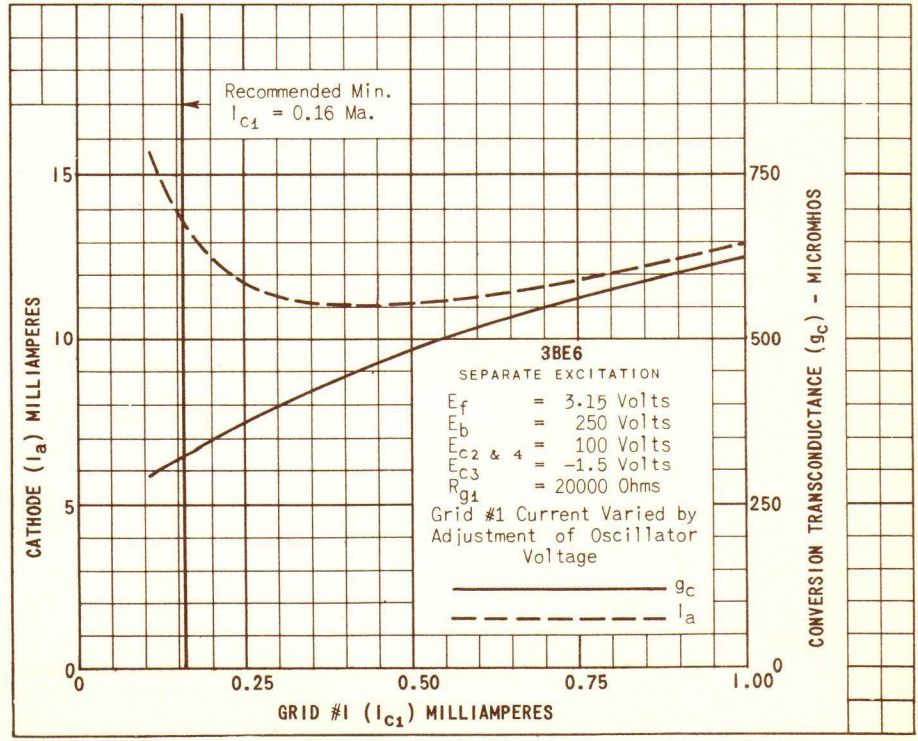
OSCILLATOR CHARACTERISTICS
NOT OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID)	0	VOLTS
GRIDS #2 AND #4 CONNECTED TO PLATE	100	VOLTS
TRANSCONDUCTANCE BETWEEN GRID #1 AND GRIDS #2 AND #4 CONNECTED TO PLATE	7 250	µMHOS
AMPLIFICATION FACTOR BETWEEN GRID #1 AND GRIDS #2 AND #4 CONNECTED TO PLATE	20	
CATHODE CURRENT	25	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µA	-11	VOLTS


3BE6
E_f = 3.15 Volts
E_b = 250 Volts
E_{c2} & E_{c4} = 100 Volts
R_{g1} = 20000 Ohms
Oscillator Voltage Adjusted to give Grid #1 Current of 0.5 Ma.
Separate Excitation
Self-Excitation
CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
9000
8000
7000
6000
5000
4000
3000
2000
1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1
-50
-40
-30
-20
-10
0
GRID #3 VOLTS


3BE6
SELF-EXCITATION
E_f = 3.15 Volts
E_b = 250 Volts
E_{c2} & E_{c4} = 100 Volts
E_{c3} = -1 Volt
R_{g1} = 20000 Ohms
P = Percentage Ratio of E_k to $E_k + E_g$ where
E_k = Voltage across Oscillator – coil Section between Ground & Cathode.
E_g = Oscillator Voltage between Cathode and Grid.
——g_c for values of E_k
– – –g_c for values percent P
E_k = 0.8 Volts RMS
P = 5%
1.4
10%
2.0
3.0
20%
5.0
CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
GRID #1 (I_{c1}) MILLIAMPERES
0
100
200
300
400
500
600
700
0
0.5
1.0
1.5
2.0





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TUNG-SOL

TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

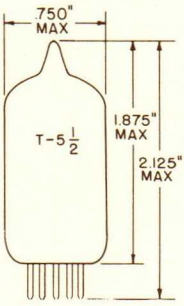
HEATER

3.0 VOLTS 450±30 MA.[A]

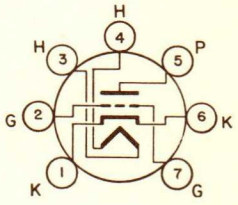
AC OR DC

ANY MOUNTING POSITION

[A] DESING MAXIMUM RATING SYSTEM.



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7EG

THE 3BN4A IS A MINIATURE MEDIUM-MU TRIODE DESIGNED FOR USE AS A RADIO-FREQUENCY AMPLIFIER IN VHF TELEVISION TUNERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #316

GRID TO PLATE	1.2	pf
INPUT	3.2	pf
OUTPUT	1.4	pf
HEATER TO CATHODE	2.8	pf

RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHMS
HEATER WARM-UP TIME*	11	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

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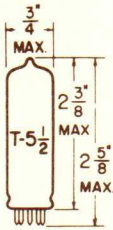
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	150	VOLTS
CATHODE-BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	43	
PLATE RESISTANCE (APPROX.)	5 400	OHMS
TRANSCONDUCTANCE	8 000	µMHOS
PLATE CURRENT	9.0	MA.
GRID VOLTAGE (APPROX.)		
I_b = 100 µAMPS.	-6	VOLTS

TUNG-SOL

PENTODE
MINIATURE TYPE

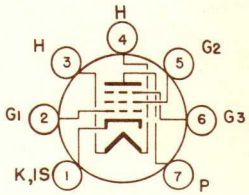


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

GATED-BEAM DISCRIMINATOR
FOR FM AND INTERCARRIER
TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7DF

THE 3BN6 IS A GATED-BEAM DISCRIMINATOR TUBE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED TO PERFORM THE COMBINED OPERATION OF DETECTOR AND AUDIO-VOLTAGE AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. A UNIQUE DESIGN, MAKING USE OF THE ELECTROSTATIC BEAM DEFLECTION PRINCIPLE, RESULTS IN VERY EFFICIENT LIMITING AS WELL AS PROVIDING FOR FM DETECTION AND AMPLIFICATION. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BN6.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #1 TO ALL	4.2	pf
GRID #3 TO ALL	3.3	pf
GRID #1 TO GRID #3 (MAX.)	0.004	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15 VOLTS	600	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±60	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
HEATER WARM-UP TIME (APPROX.)*		11	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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MAXIMUM RATINGS ←

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE SUPPLY VOLTAGE	330	VOLTS
GRID VOLTAGE	110	VOLTS
PEAK POSITIVE LIMITER-GRID VOLTAGE	60	VOLTS
DC CATHODE CURRENT	13	MA.

TYPICAL OPERATING CHARACTERISTICS ←

LIMITER-DISCRIMINATOR SERVICE

INPUT-SIGNAL CENTER FREQUENCY	10.7	10.7	4.5	MEGACYCLES
FREQUENCY DEVIATION	±75	±75	±25	KCYCLES
PLATE-SUPPLY VOLTAGE	85	285	270	VOLTS
PLATE VOLTAGE	63	122	121	VOLTS
ACCELERATOR VOLTAGE	55	100	100	VOLTS
CATHODE-BIAS RESISTOR (VARIABLE) [A]	200-400	200-400	200-400	OHMS
PLATE LOAD RESISTOR	85000	330000	330000	OHMS
PLATE LINEARITY RESISTOR	470	1500	1000	OHMS
INTEGRATING CAPACITOR	0.002	0.001	0.001	μf
COUPLING CAPACITOR	0.25	0.01	0.25	μf
MINIMUM SIGNAL VOLTAGE FOR LIMITING ACTION, RMS [B]	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 [A]	1.25	2.0	2.0	VOLTS
AM REJECTION AT Esig=2.0V., RMS	31	20	25	DECIBELS
AM REJECTION AT Esig=3.0V., 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

[A] THE CATHODE RESISTOR SHOULD BE ADJUSTED FOR MAXIMUM AM REJECTION IN THE OUTPUT OF LIMITER-DISCRIMINATOR STAGE AT THE SPECIFIED SIGNAL LEVEL. AM REJECTION IS MEASURED WITH AN APPLIED SIGNAL CONTAINING 30-PERCENT AMPLITUDE MODULATION AND 30-PERCENT FREQUENCY MODULATION.

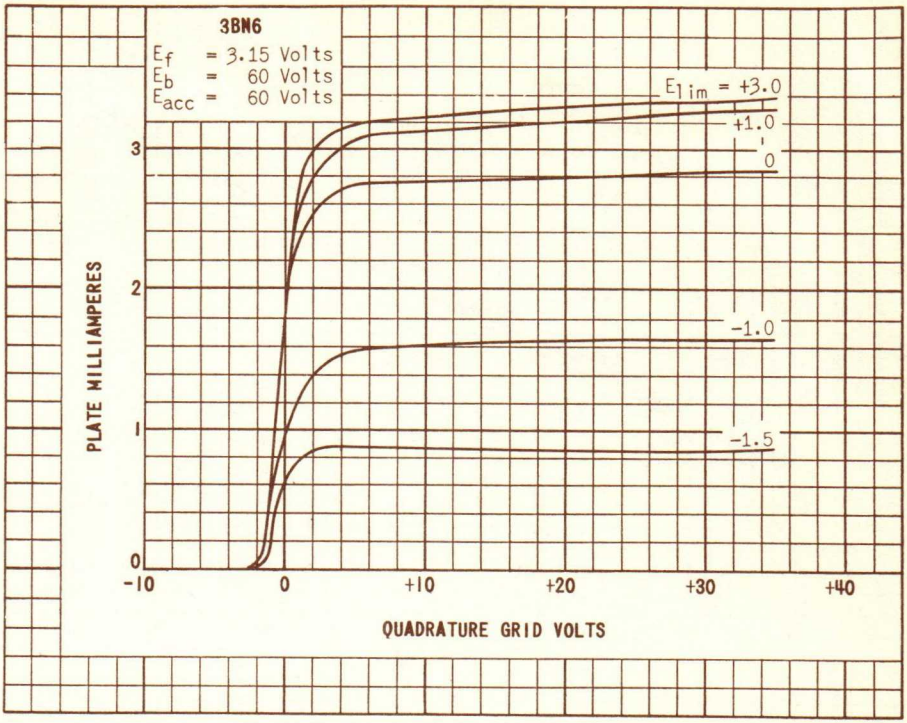
[B] AT SIGNAL LEVELS ABOVE SPECIFIED VALUE, LIMITING IS WITHIN ±2 DECIBELS.

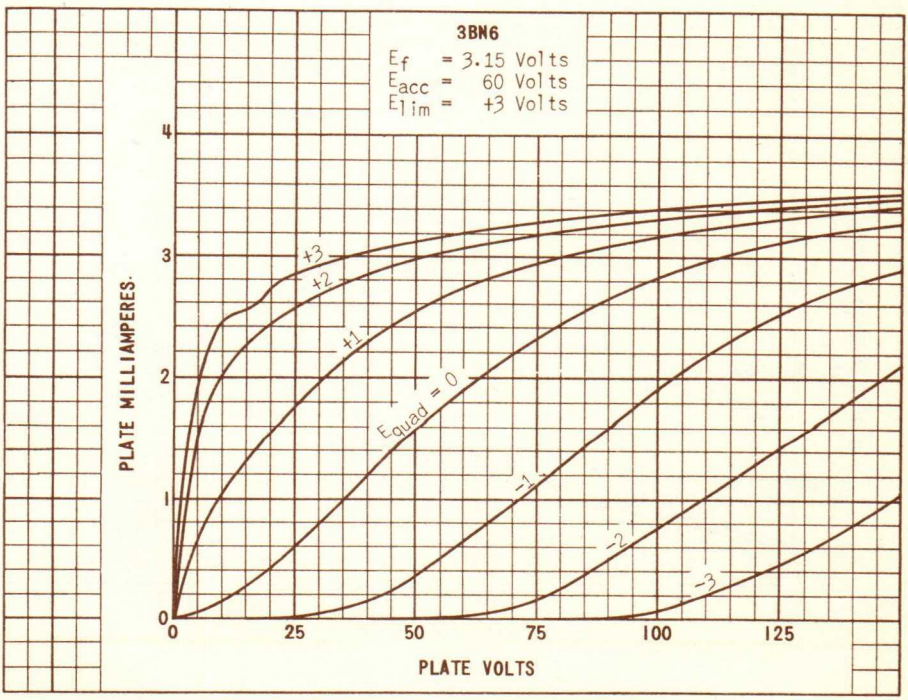
ADEQUATE SHIELDING BETWEEN COMPONENTS OF THE LIMITER GRID AND THE QUADRATURE GRID MUST BE USED TO INSURE PROPER PHASING OF THE VOLTAGE DEVELOPED ON THE QUADRATURE GRID.

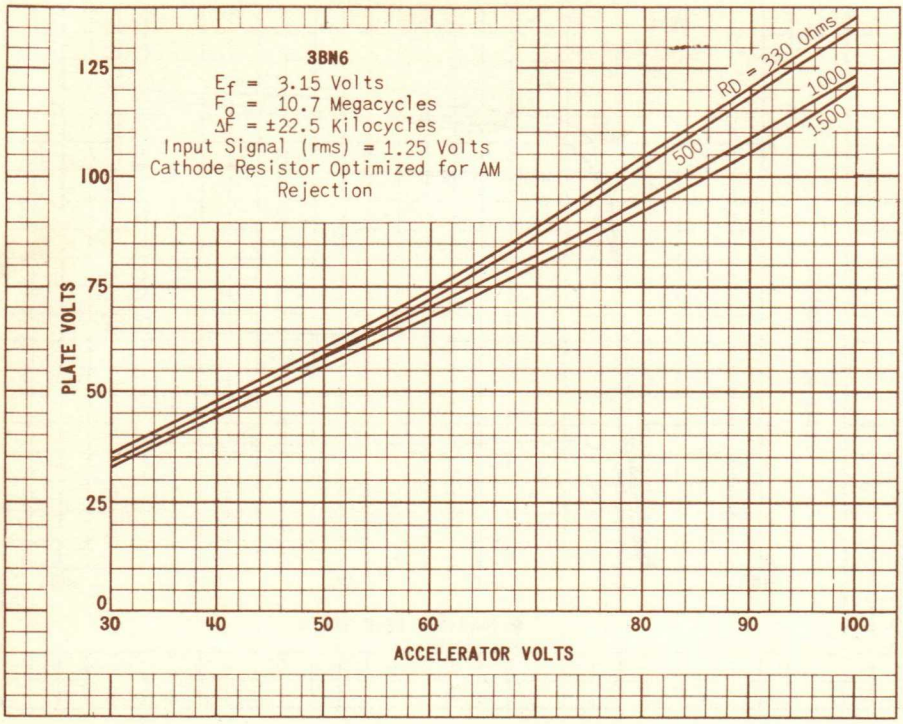
STANDARD DE-EMPHASEIS REQUIREMENTS FOR FM ARE INCLUDED.

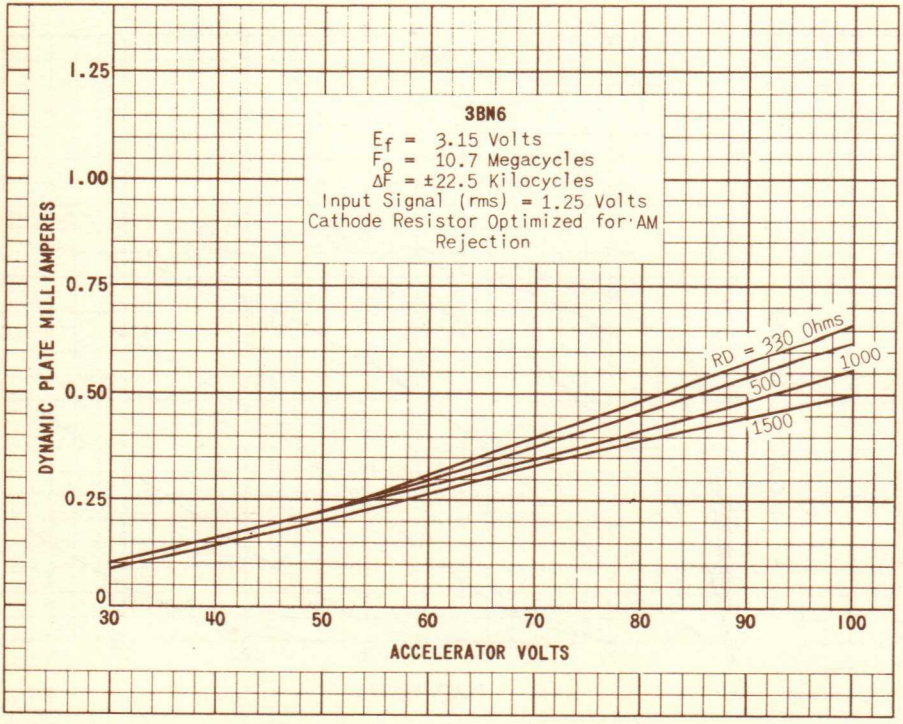
THE Q OF THE QUADRATURE GRID CIRCUIT SHOULD BE HIGH ENOUGH TO DEVELOP A MINIMUM OF 4 VOLTS (RMS) SIGNAL WITH 2 VOLTS (RMS) OF THE CENTER-FREQUENCY SIGNAL APPLIED TO THE LIMITER GRID. IT IS RECOMMENDED THAT THE COIL BE SHUNTED BY A MINIMUM OF 10 μμf. THE CAPACITANCE MAY BE COMPOSED OF TUBE INPUT CAPACITANCE, STRAY CAPACITANCE, AND DISTRIBUTED CAPACITANCE, AS WELL AS PHYSICAL CAPACITANCE.

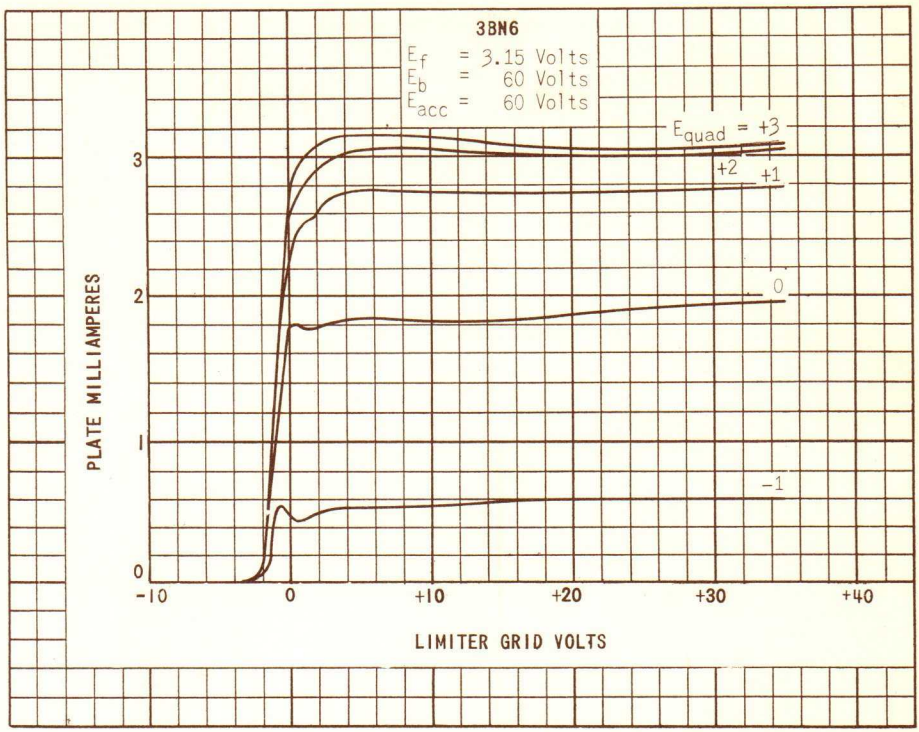
→ INDICATES A CHANGE.


3BN6
Ef = 3.15 Volts
Eb = 60 Volts
Eacc = 60 Volts
Elim = +3.0
+1.0
0
-1.0
-1.5
PLATE MILLIAMPERES
0
1
2
3
-10
0
+10
+20
+30
+40
QUADRATURE GRID VOLTS


3BN6
Ef = 3.15 Volts
Eacc = 60 Volts
Elim = +3 Volts
PLATE MILLIAMPERES
0
1
2
3
4
+3
+2
+1
Equad = 0
-1
-2
-3
0
25
50
75
100
125
PLATE VOLTS


3BN6
E_f = 3.15 Volts
F_o = 10.7 Megacycles
ΔF = ±22.5 Kilocycles
Input Signal (rms) = 1.25 Volts
Cathode Resistor Optimized for AM Rejection
RD = 330 Ohms
500
1000
1500
PLATE VOLTS
0
25
50
75
100
125
30
40
50
60
80
90
100
ACCELERATOR VOLTS


3BN6
E_f = 3.15 Volts
F_o = 10.7 Megacycles
ΔF = ±22.5 Kilocycles
Input Signal (rms) = 1.25 Volts
Cathode Resistor Optimized for AM Rejection
RD = 330 Ohms
500
1000
1500
DYNAMIC PLATE MILLIAMPERES
0
0.25
0.50
0.75
1.00
1.25
30
40
50
60
70
80
90
100
ACCELERATOR VOLTS



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TUNG-SOL

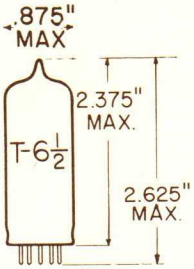
TWIN PENTODE

MINIATURE TYPE

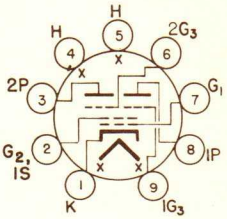
COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 600 ± 40 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9FG

THE 3BU8 IS A MINIATURE MULTISECTION TUBE WHICH INCORPORATES SEPARATE PLATES AND NUMBER 3 GRIDS FOR THE TWO SECTIONS TOGETHER WITH A COMMON SCREEN, NUMBER 1 GRID, AND CATHODE. THE TUBE IS INTENDED FOR USE AS A COMBINED SYNC-AGC TUBE IN TELEVISION RECEIVERS. IN THIS SERVICE, WHEN USED IN CONJUNCTION WITH SUITABLE CIRCUITRY, ONE SECTION OF THE 3BU8 FUNCTIONS AS SYNC SEPARATOR AND SYNC CLIPPER, WHILE THE OTHER SECTION IS USED TO GENERATE THE AUTOMATIC-GAIN-CONTROL VOLTAGE. IN ADDITION, BY UTILIZING THE COMMON, #1 GRID, NOISE PULSES CAN BE SUPPRESSED FROM BOTH SYNCHRONIZING AND AUTOMATIC-GAIN-CONTROL CIRCUITS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS THE 3BU8 IS IDENTICAL TO THE 6BU8.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE, (EACH SECTION)	1.9	pf
GRID #1 TO ALL	6.0	pf
GRID #3 TO ALL (EACH SECTION)	3.6	pf
PLATE TO ALL (EACH SECTION)	3.0	pf
GRID #3 (SECTION 1) TO GRID #3 (SECTION 2) MAX.	0.015	pf

RATINGS

→ DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

MAXIMUM PLATE VOLTAGE (EACH SECTION)	300	VOLTS
MAXIMUM SCREEN VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE (EACH SECTION)	3.0	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM PEAK POSITIVE GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.1	WATTS
MAXIMUM SCREEN DISSIPATION	0.75	WATTS
MAXIMUM DC CATHODE CURRENT	12	MA.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

RATINGS — CONT'D

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

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
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHMS
MAXIMUM GRID #3 CIRCUIT RESISTANCE (EACH SECTION)	0.5	MEGOHMS
HEATER WARM–UP TIME*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

BOTH SECTIONS OPERATING

PLATE VOLTAGE (EACH SECTION)	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE (EACH SECTION)	-10	0	VOLTS
GRID #1 VOLTAGE	**	**	
PLATE CURRENT (EACH SECTION)		2.2	MA.
SCREEN CURRENT	6.5	3.3	MA.
CATHODE CURRENT	6.6	7.8	MA.

EACH SECTION SEPARATELY [A]

PLATE VOLTAGE	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	**	VOLTS
GRID #3 TRANSCONDUCTANCE	---	180	μMHOS
GRID #1 TRANSCONDUCTANCE	1 500	---	μMHOS
PLATE CURRENT	---	2.2	MA.
GRID #3 VOLTAGE (APPROX.) I_b=100μAMPS	---	-4.5	VOLTS
GRID #1 VOLTAGE (APPROX.) I_b=100μAMPS	---	2.3	VOLTS

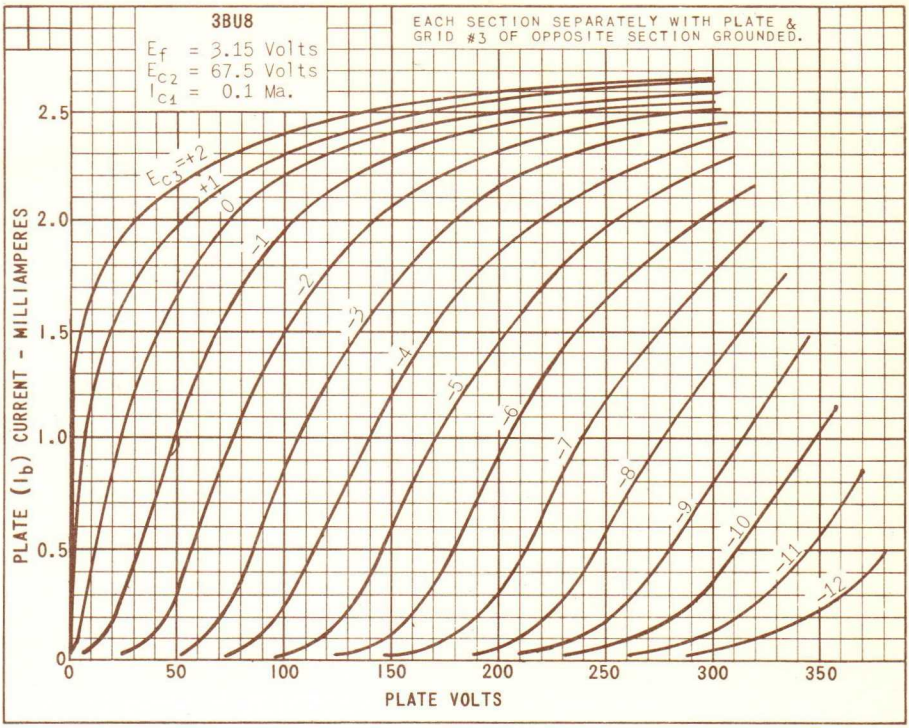
* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

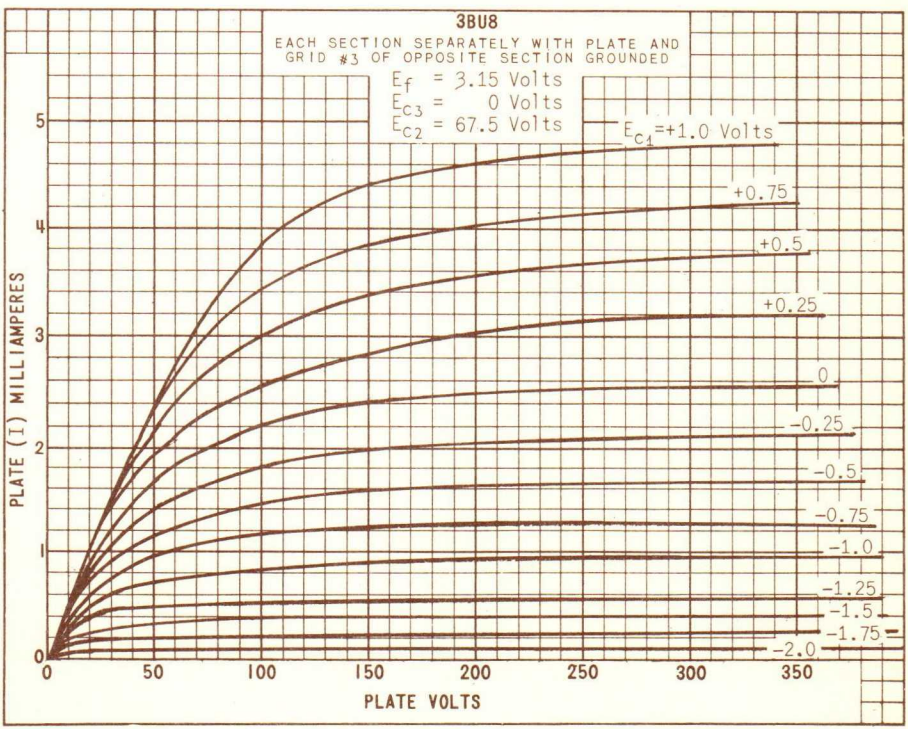
** WITH GRID CURRENT ADJUSTED FOR 100 μAMPS D-C.

A WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time the 3BU8 is identical to the 6BU8.*





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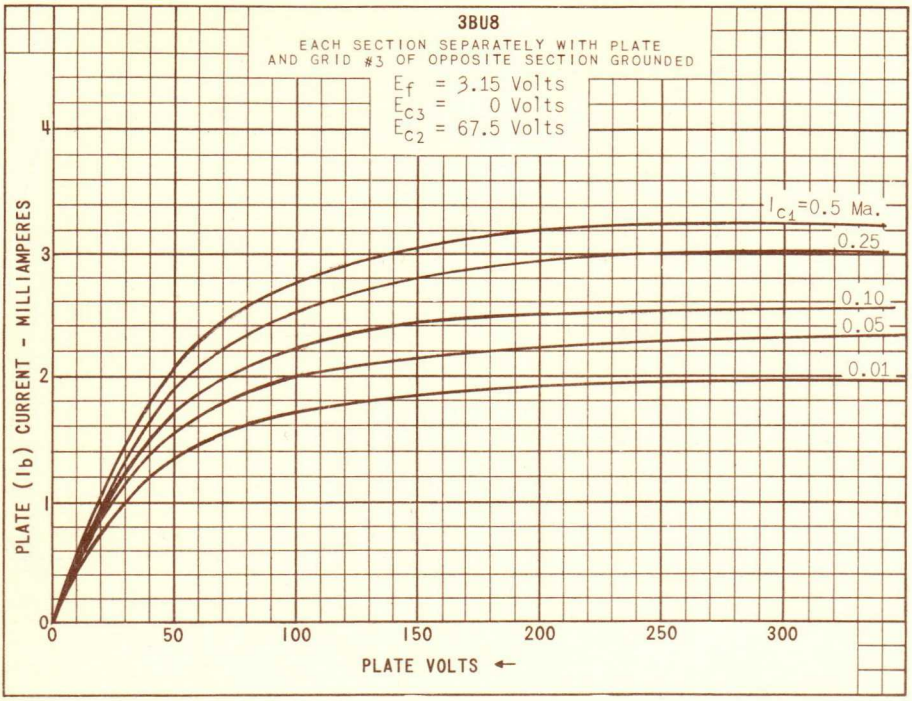
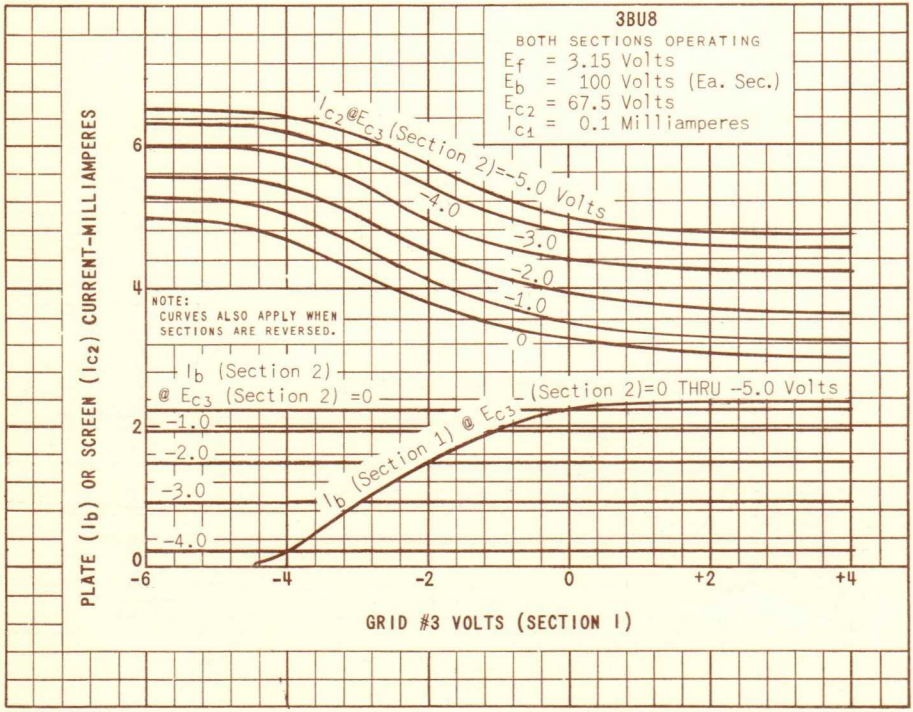
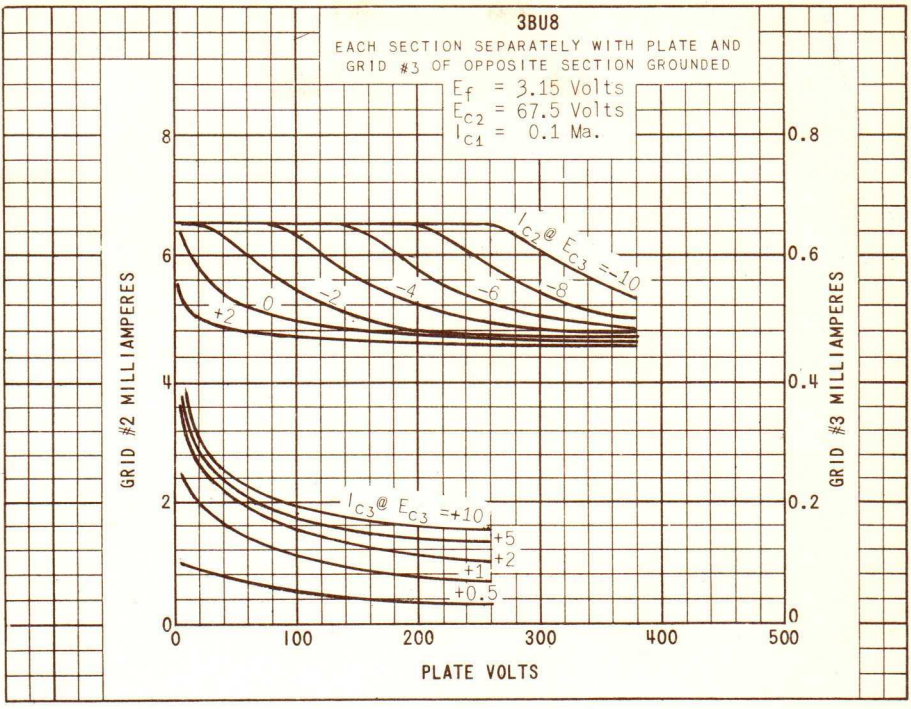
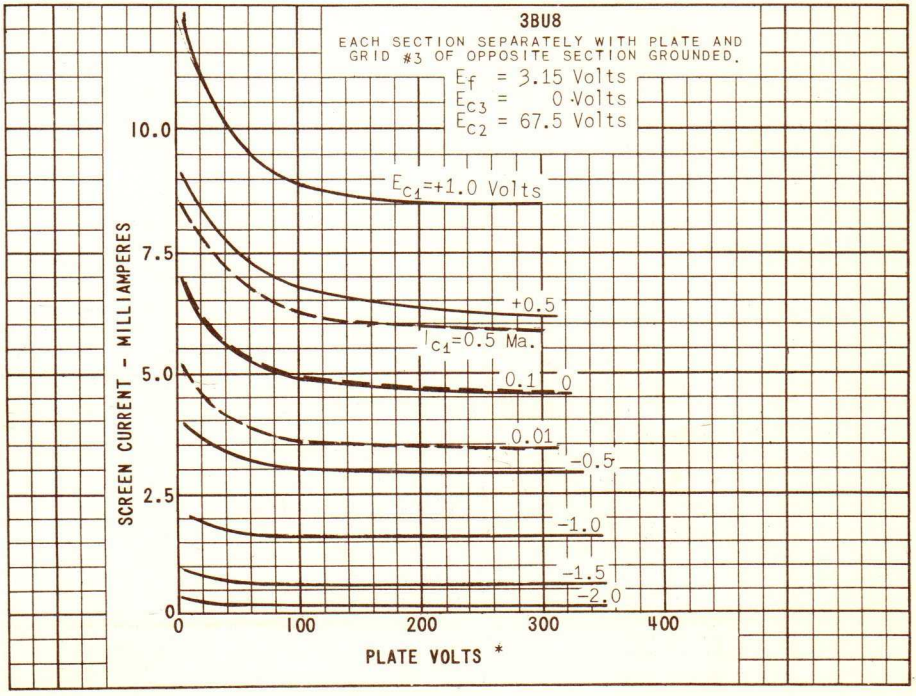

3BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 3.15 Volts
E_{c3} = 0 Volts
E_{c2} = 67.5 Volts
I_{c_1}=0.5 Ma.
0.25
0.10
0.05
0.01
PLATE (I_b) CURRENT - MILLIAMPERES
PLATE VOLTS ←
0
1
2
3
4
50
100
150
200
250
300


3BU8
BOTH SECTIONS OPERATING
E_f = 3.15 Volts
E_b = 100 Volts (Ea. Sec.)
E_{c2} = 67.5 Volts
I_{c_1} = 0.1 Milliamperes
I_{c_2}@E_{c_3} (Section 2)=-5.0 Volts
-4.0
-3.0
-2.0
-1.0
0
NOTE:
CURVES ALSO APPLY WHEN SECTIONS ARE REVERSED.
I_b (Section 2) @ E_{c_3} (Section 2) =0
-1.0
-2.0
-3.0
-4.0
I_b (Section 1) @ E_{c_3} (Section 2)=0 THRU -5.0 Volts
PLATE (I_b) OR SCREEN (I_{c_2}) CURRENT-MILLIAMPERES
GRID #3 VOLTS (SECTION 1)
0
2
4
6
-6
-4
-2
0
+2
+4





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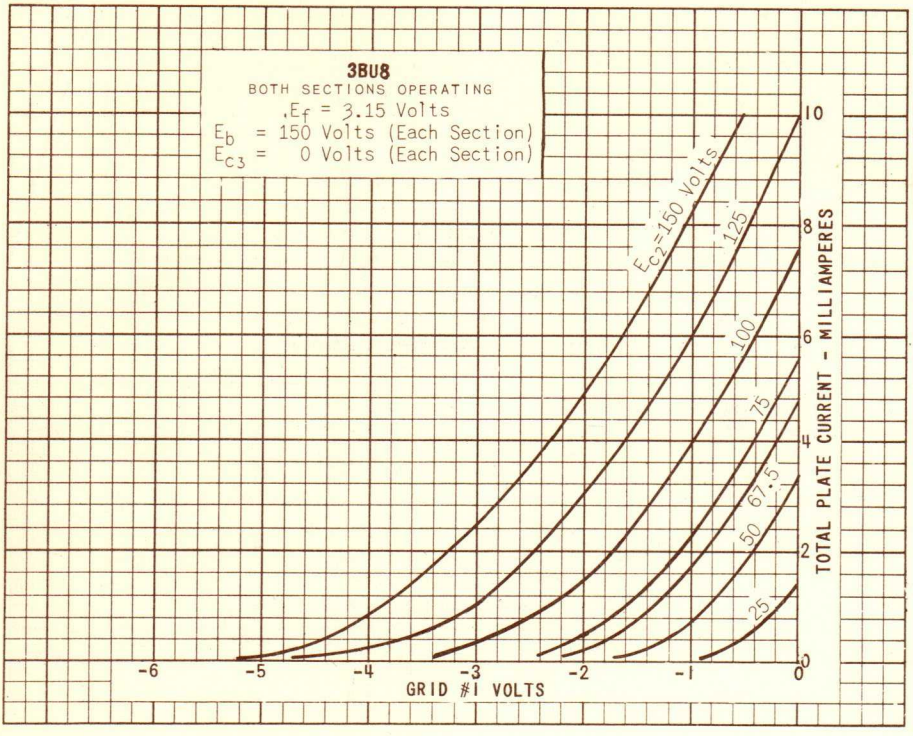
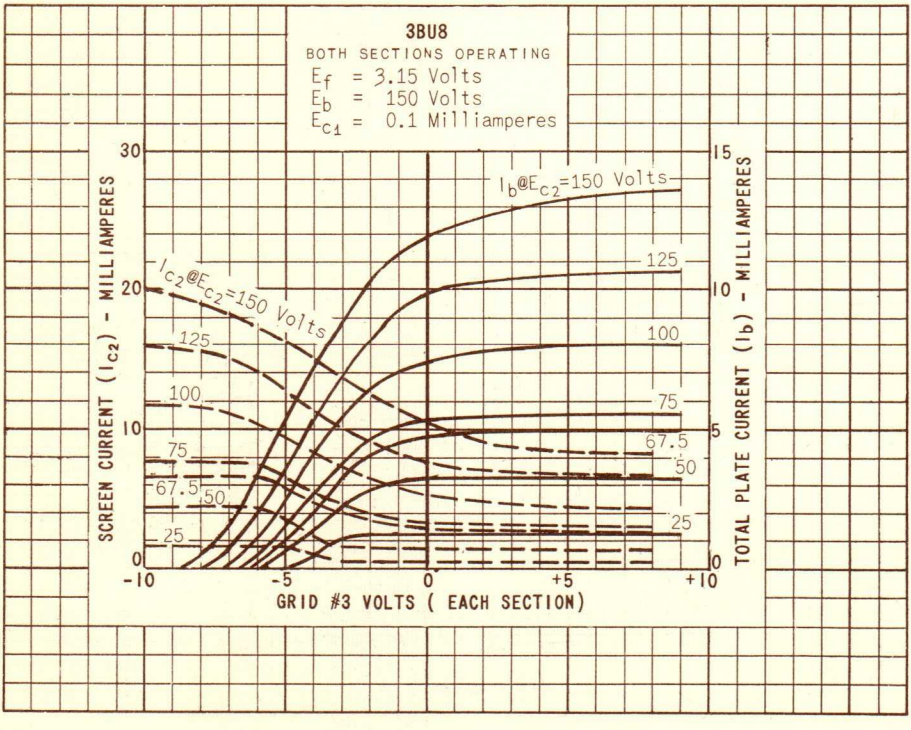
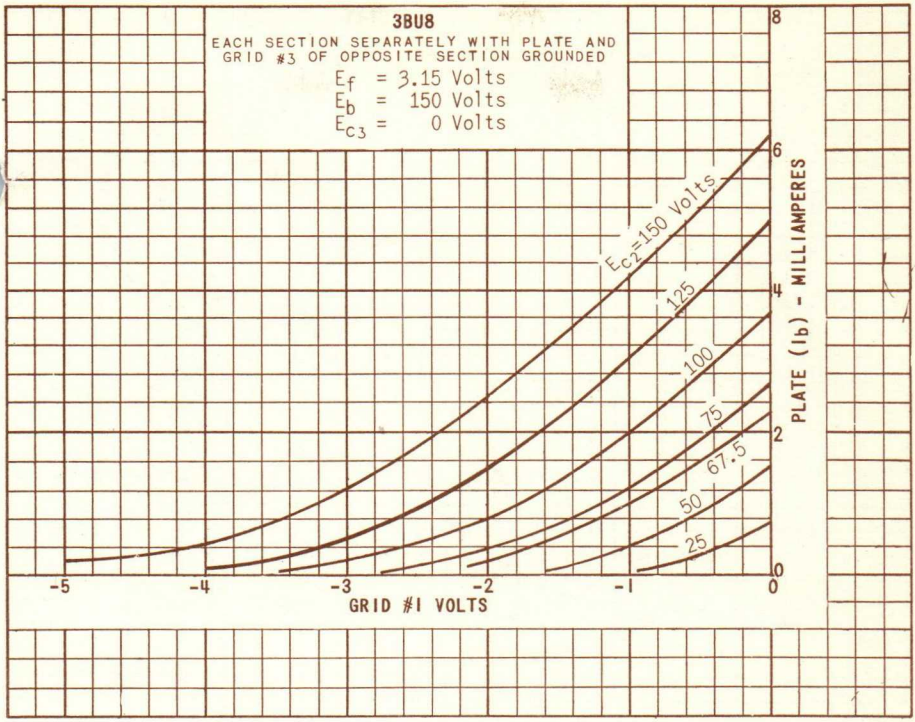
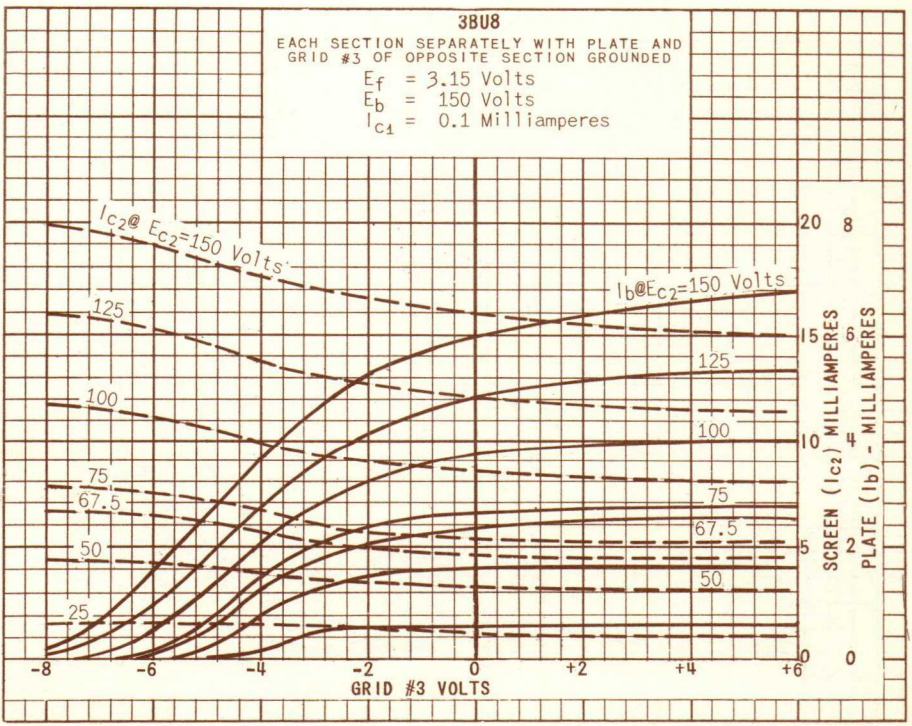

3BU8
BOTH SECTIONS OPERATING
E_f = 3.15 Volts
E_b = 150 Volts (Each Section)
E_{c3} = 0 Volts (Each Section)
E_{c2}=150 Volts
125
100
75
67.5
50
25
TOTAL PLATE CURRENT - MILLIAMPERES
GRID #1 VOLTS
-6
-5
-4
-3
-2
-1
0
2
4
6
8
10


3BU8
BOTH SECTIONS OPERATING
E_f = 3.15 Volts
E_b = 150 Volts
E_{c1} = 0.1 Milliamperes
I_b@E_{c2}=150 Volts
125
100
75
67.5
50
25
I_{c2}@E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT (I_{c2}) - MILLIAMPERES
TOTAL PLATE CURRENT (I_b) - MILLIAMPERES
GRID #3 VOLTS (EACH SECTION)
-10
-5
0
+5
+10
0
10
20
30
0
5
10
15





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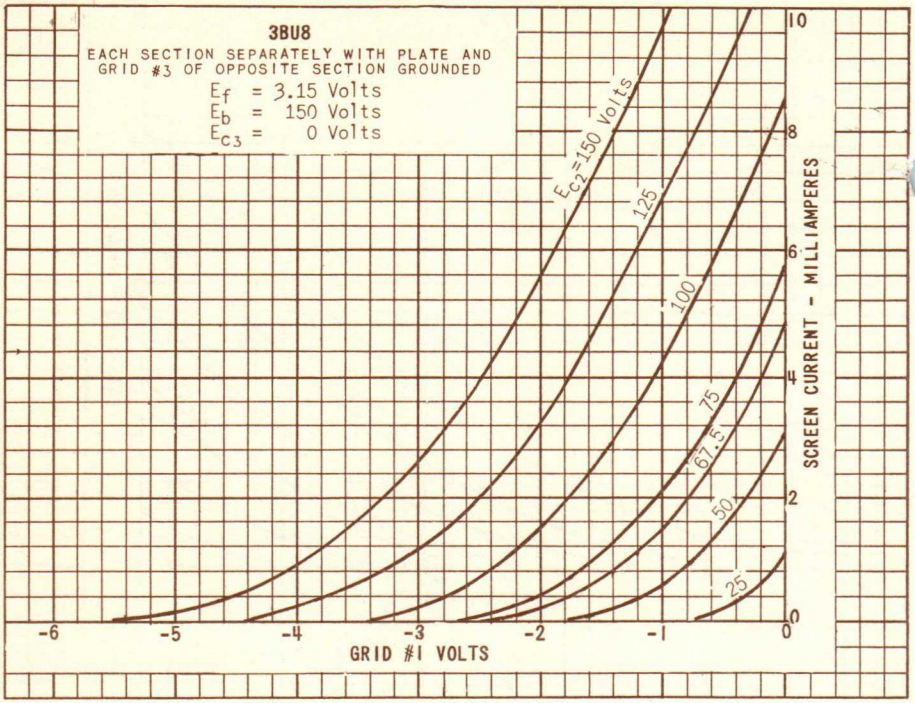
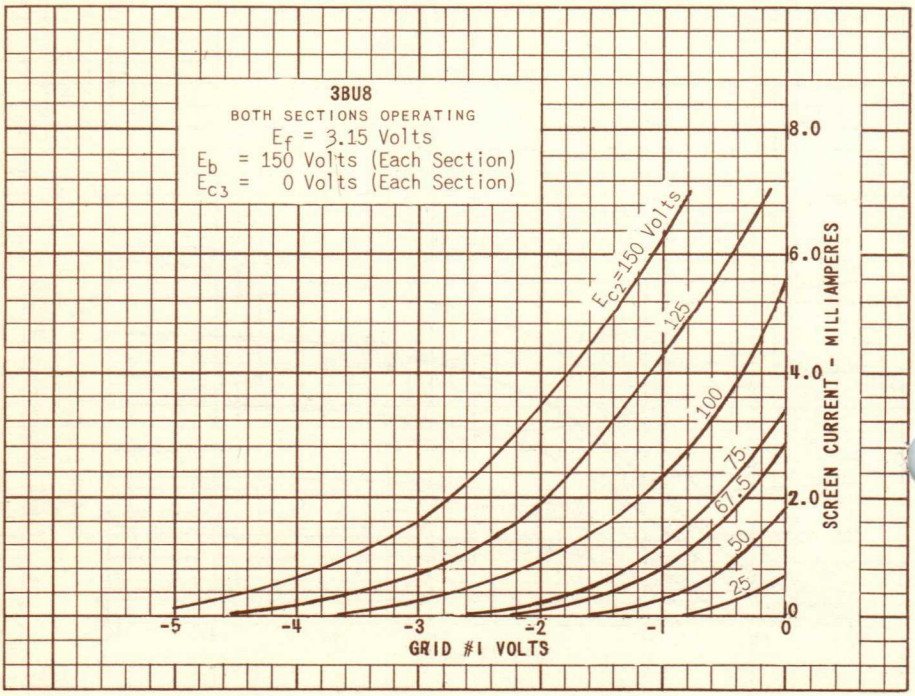
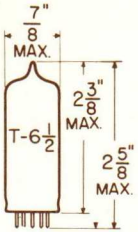

3BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 3.15 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT - MILLIAMPERES
GRID #1 VOLTS
-6
-5
-4
-3
-2
-1
0
10
8
6
4
2
0


3BU8
BOTH SECTIONS OPERATING
E_f = 3.15 Volts
E_b = 150 Volts (Each Section)
E_{c3} = 0 Volts (Each Section)
E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT - MILLIAMPERES
GRID #1 VOLTS
-5
-4
-3
-2
-1
0
8.0
6.0
4.0
2.0
0

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

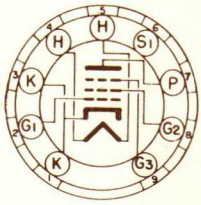
COATED UNIPOTENTIAL CATHODE

HEATER

3.4 VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

9AQ

THE 3BX6 IS A PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS AN R.F., I.F. OR A VIDEO AMPLIFIER OR MIXER IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS, THE 3BX6 IS IDENTICAL TO THE 12BX6.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELEMENTS EXCEPT ANODE	7.5	μμf
PLATE TO ALL OTHER ELEMENTS EXCEPT GRID #1	3.3	μμf
PLATE TO GRID #1 (MAX.)	0.007	μμf
PLATE TO CATHODE (MAX.)	0.012	μμf
GRID #2 TO ALL OTHER ELEMENTS	5.4	μμf
GRID #2 TO GRID #1	2.6	μμf
GRID #1 TO HEATER (MAX.)	0.15	μμf
CATHODE TO HEATER	5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	3.4	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 VOLTAGE WITH COLD CATHODE	550	VOLTS
MAXIMUM GRID #2 VOLTAGE	250	VOLTS
MAXIMUM GRID #2 DISSIPATION	0.7	WATTS
MAXIMUM GRID #2 DISSIPATION AT PLATE DISSIPATION < 1.8 WATTS	0.9	WATTS
MAXIMUM CATHODE CURRENT	15	MAMPS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM VOLTAGE BETWEEN CATHODE AND HEATER	150	VOLTS
MAXIMUM CIRCUIT RESISTANCE BETWEEN CATHODE AND HEATER	20 000	OHMS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

R.F. AMPLIFIER

HEATER VOLTAGE	3.4	3.4	3.4	VOLTS
HEATER CURRENT	0.60	0.60	0.60	AMP.
PLATE VOLTAGE	170	200	250	VOLTS
GRID #3 VOLTAGE	0	0	0	VOLT
GRID #2 VOLTAGE	170	200	250	VOLTS
GRID #1 VOLTAGE	-2.0	-2.55	-3.5	VOLTS
PLATE CURRENT	10	10	10	MAMPS
GRID #2 CURRENT	2.5	2.6	2.8	MAMPS
TRANSCONDUCTANCE	7400	7100	6800	μMHOS
PLATE RESISTANCE	0.5	0.55	0.65	MEGOHM
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	50	50	50	
EQUIVALENT NOISE RESISTANCE	1000	1100	1200	OHMS
INPUT RESISTANCE AT FREQUENCY = 50 MC (PIN 1 CONNECTED TO PIN 3)	10 000	12 000	15 000	OHMS

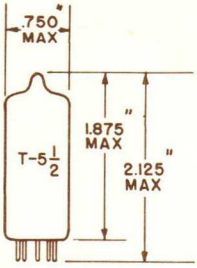
OBSERVATION

WHEN USING THE 3BX6 AS VIDEO AMPLIFIER THE AMPLIFICATION BETWEEN THE INPUT GRID OF THE 3BX6 AND THE INPUT OF THE CATHODE RAY TUBE SHOULD NOT EXCEED A VALUE OF 25, IN ORDER TO PREVENT MICROPHONIC EFFECT.

TUNG-SOL

HEPTODE

MINIATURE TYPE



GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

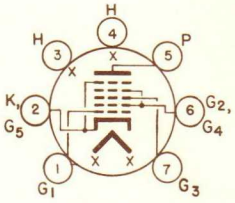
COATED UNIPOTENTIAL CATHODE

FOR USE

AS A GATED AMPLIFIER IN

TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CH

THE 3BY6 IS A PENTAGRID AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED EXPECIALLY FOR USE AS A GATED AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TV RECEIVERS. IN SUCH SERVICE, IT MAY BE USED AS A COMBINED SYNC SEPARATOR AND SYNC CLIPPER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BY6.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.08	pf
GRID #3 TO PLATE (MAX.)	0.35	pf
GRID #1 TO GRID #3 (MAX.)	0.22	pf
GRID #1 TO ALL OTHER ELECTRODES AND HEATER	5.4	pf
GRID #3 TO ALL OTHER ELECTRODES AND HEATER	6.9	pf
PLATE TO ALL OTHER ELECTRODES AND HEATER	7.6	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15 VOLTS	600	MA.
HEATER SUPPLY LIMITS: CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[B]	VOLTS
HEATER WARM-UP TIME[A]		11	SECONDS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

GATED AMPLIFIER SERVICE

PLATE VOLTAGE	→ 330	VOLTS
GRID #2 & #4 VOLTAGE	SEE RATING CHART	
GRID #2 & #4 SUPPLY VOLTAGE	→ 330	VOLTS
GRID #3 VOLTAGE:		
NEGATIVE BIAS VALUE	→ 55	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
POSITIVE PEAK VALUE	→ 27	VOLTS

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MAXIMUM RATINGS - CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

GATED AMPLIFIER SERVICE

GRID #1 VOLTAGE:		
NEGATIVE BIAS VALUE	→ 110	VOLTS
PLATE DISSIPATION	→ 2.3	WATTS
GRID #3 INPUT	0.1	WATT
GRIDS #2 & #4 INPUT:*		
FOR GRIDS #2 & #4 VOLTAGES UP TO 165 VOLTS	1.1	WATTS
FOR GRIDS #2 & #4 VOLTAGES BETWEEN 165 VOLTS AND 330 VOLTS	SEE RATING CHART	
GRID #1 INPUT	0.1	WATT
GRID #1 OR GRID #3 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.5	MEGOHM
CATHODE BIAS OPERATION	1.0	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRIDS #2 & #4 VOLTAGE	100	VOLTS
GRID #3 VOLTAGE	-2.5	VOLTS
GRID #1 VOLTAGE	-2.5	VOLTS
GRID #3 TO PLATE TRANSCONDUCTANCE	500	µMHOS
GRID #1 TO PLATE TRANSCONDUCTANCE	1 900	µMHOS
PLATE CURRENT	6.5	MA.
GRID #2 & #4 CURRENT	9	MA.
GRID #3 VOLTS (APPROX.) FOR I_b = 35 µAMP. AND GRID #1 VOLTS = -4	-15	VOLTS
GRID #1 VOLTS (APPROX.) FOR I_b = 35 µAMP. AND GRID #3 VOLTS = 0	-12	VOLTS

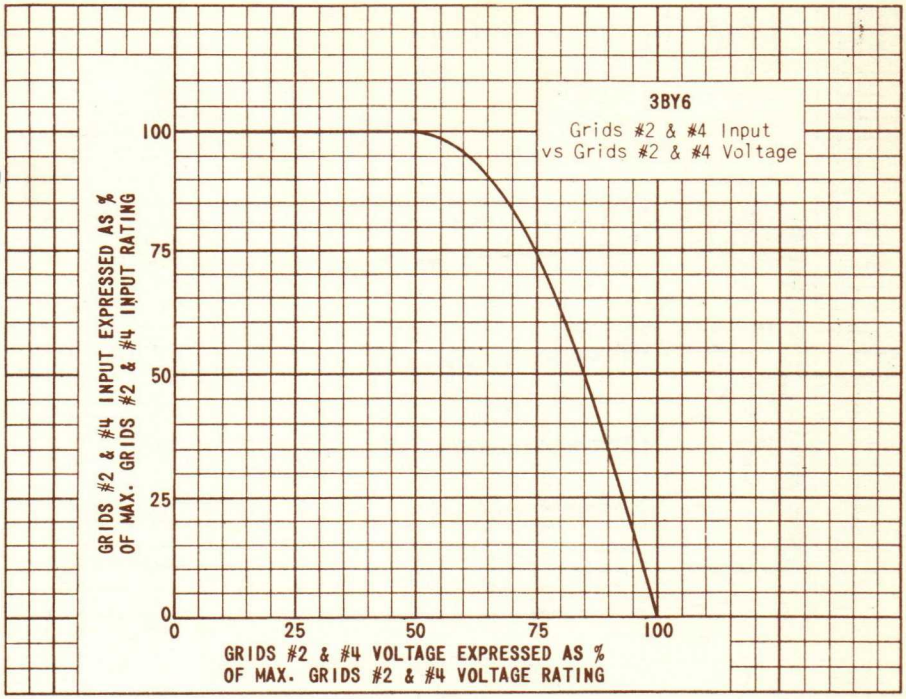
SYNC SEPARATOR AND SYNC CLIPPER

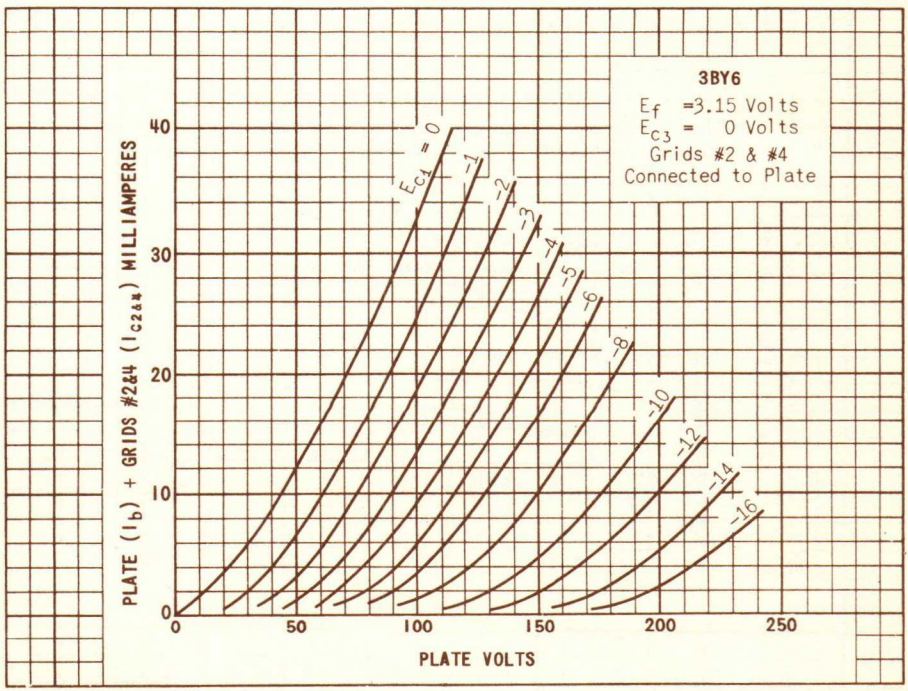
PLATE VOLTAGE	10	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 & #4 VOLTAGE	25	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE CURRENT	1.4	MA.
GRIDS #2 & #4 CURRENT	3.5	MA.
GRID #3 BIAS VOLTS (APPROX.) FOR PLATE VOLTAGE OF 25 VOLTS, GRIDS #2 & #4 VOLTAGE OF 25 VOLTS, GRID #1 VOLTAGE OF 0 VOLTS AND PLATE CURRENT OF 50 µAMP.	-2.5	VOLTS
GRID #1 BIAS VOLTAGE (APPROX.) FOR PLATE VOLTAGE OF 25 VOLTS, GRIDS #2 & #4 VOLTAGE OF 25 VOLTS, GRID #3 VOLTAGE OF 0 VOLTS AND PLATE CURRENT OF 50 µAMP.	-2.3	VOLTS

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE. * INDICATES AN ADDITION.





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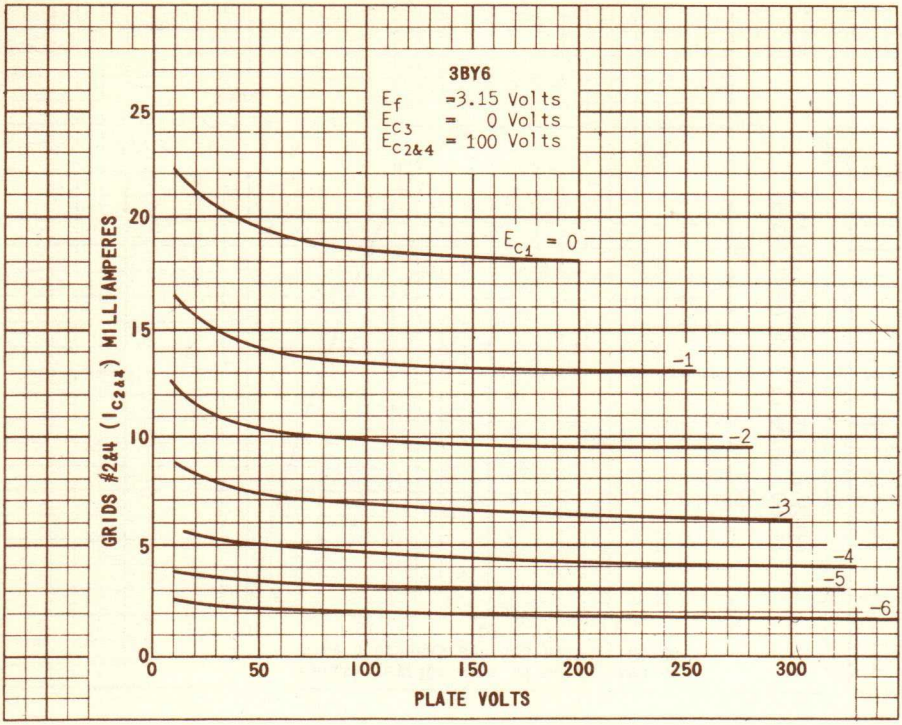
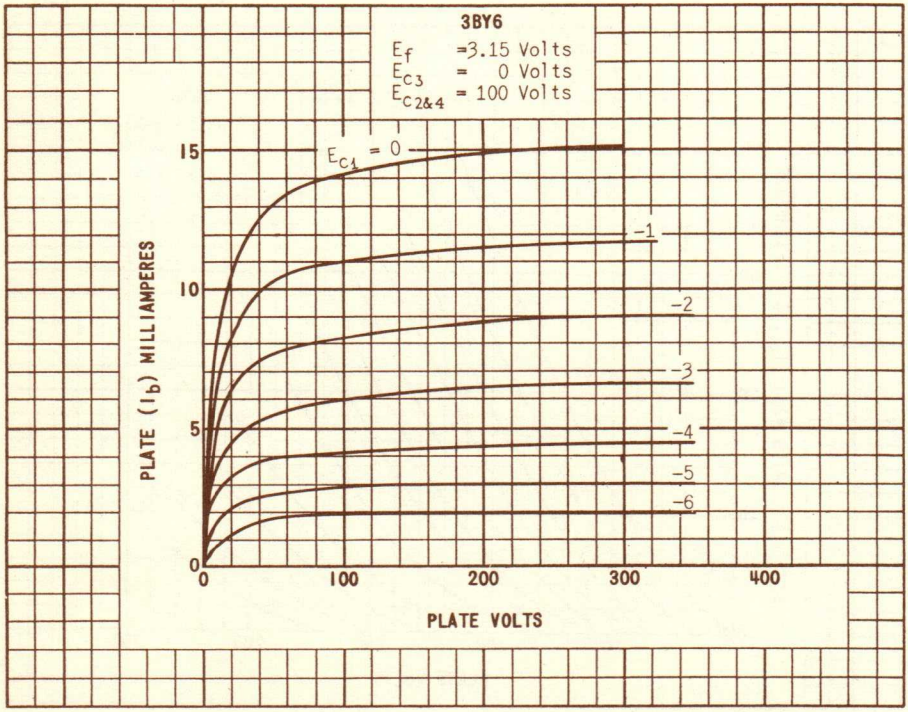
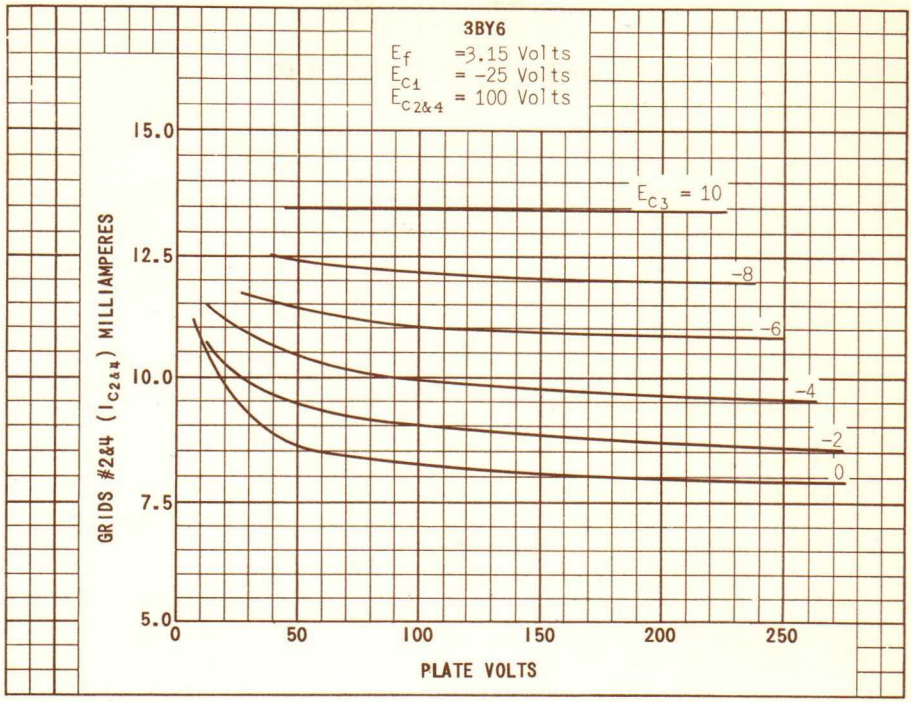
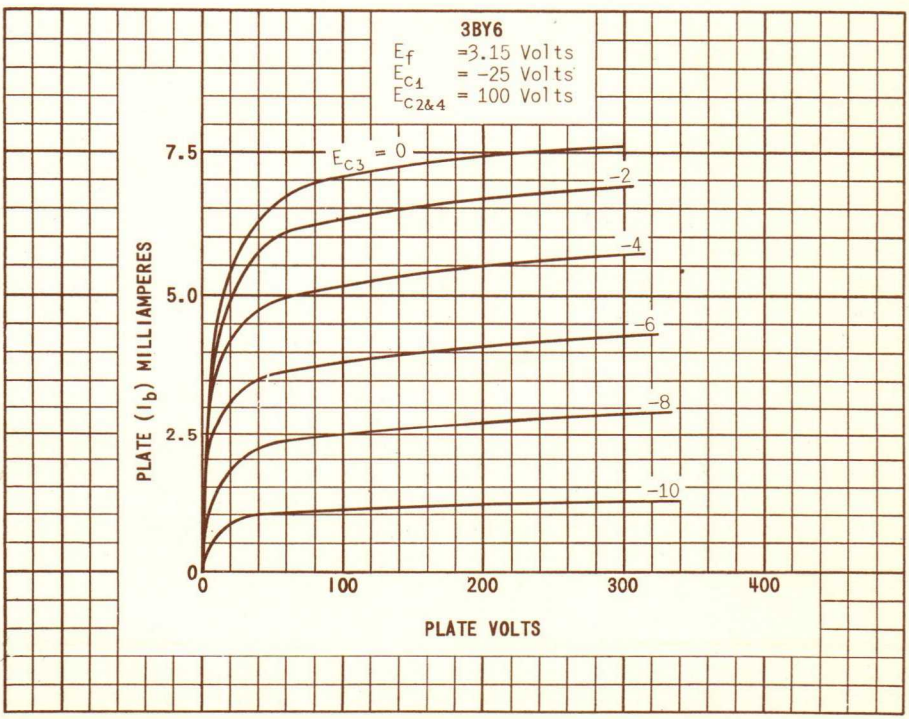

3BY6
E_f =3.15 Volts
E_{c3} = 0 Volts
$E_{c2\&4}$ = 100 Volts
E_{c1} = 0
-1
-2
-3
-4
-5
-6
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
0
5
10
15
20
25
0
50
100
150
200
250
300
PLATE VOLTS


3BY6
E_f =3.15 Volts
E_{c3} = 0 Volts
$E_{c2\&4}$ = 100 Volts
E_{c1} = 0
-1
-2
-3
-4
-5
-6
PLATE (I_b) MILLIAMPERES
0
5
10
15
0
100
200
300
400
PLATE VOLTS





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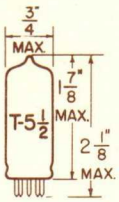
TUNG-SOL

PENTODE

MINIATURE TYPE

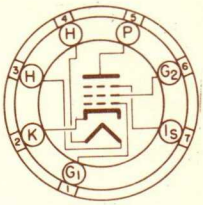


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 3BZ6 IS A HIGH TRANSCONDUCTANCE, SEMI-REMOTE CUT-OFF, PENTODE AMPLIFIER. IT IS DESIGNED FOR SERVICE AS AN AUTOMATIC GAIN CONTROLLED IF AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BZ6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G_1 TO P (MAX.)	0.015	0.02	μμf
INPUT: G_1 TO $(H+K+G_2+G_3+IS)$	7.5	7.5	μμf
OUTPUT: P TO $(H+K+G_2+G_3+IS)$	2.8	1.8	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO CATHODE AT SOCKET.

RATINGS[B]

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE[C] ←		
TOTAL DC AND PEAK	300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CURVE	
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATT
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.25	MEGOHM
SELF BIAS OPERATION	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)*	11.0	SECOND

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

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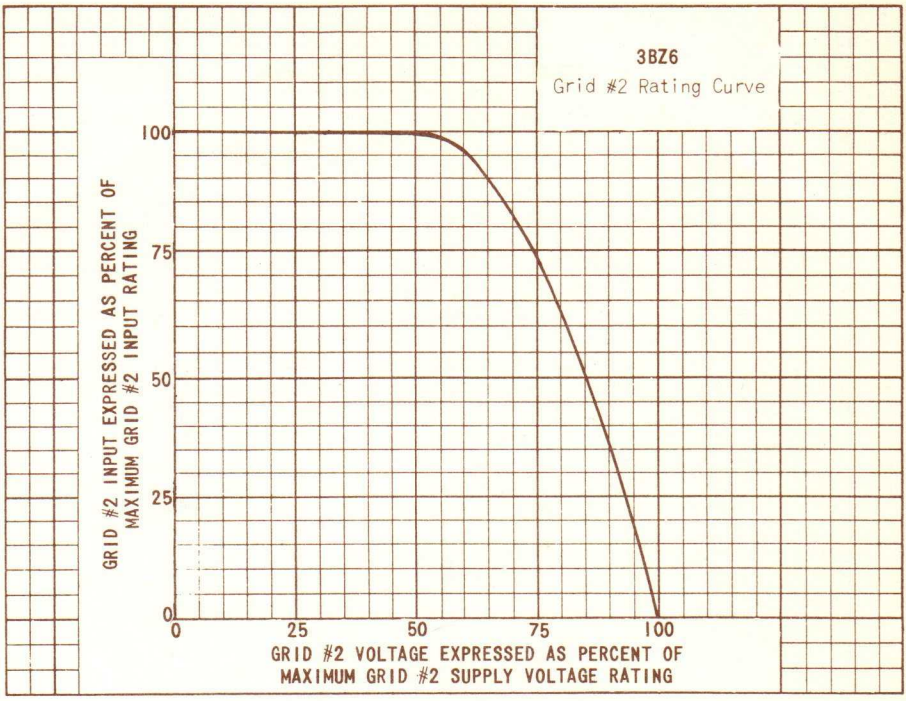
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

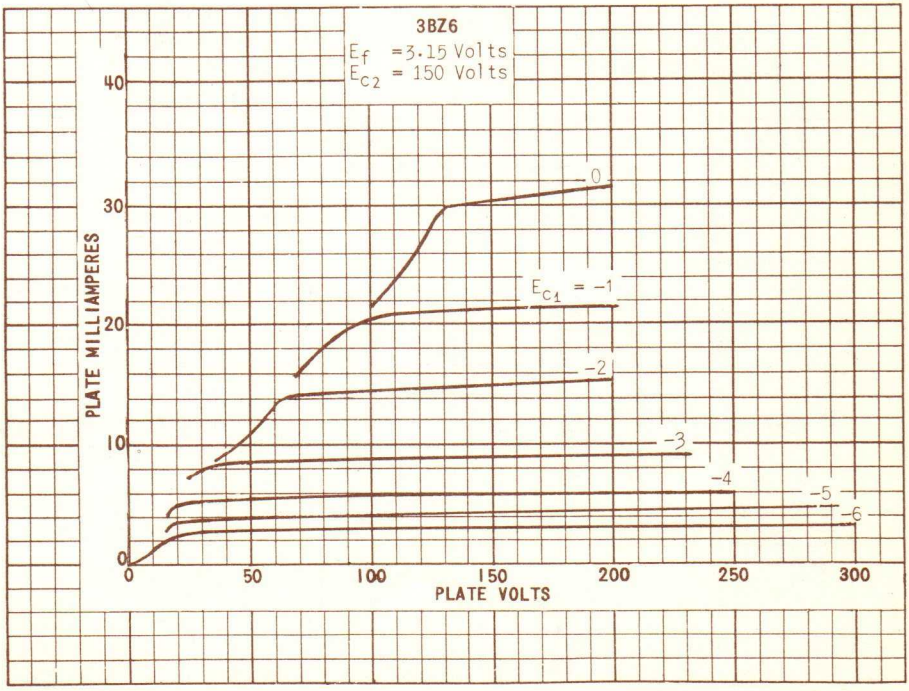
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	3.15	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	200	VOLTS
GRID #2 VOLTAGE	150	VOLTS
GRID #3 VOLTAGE	PIN #7 CONNECTED TO PIN #2 AT SOCKET	
CATHODE BIAS RESISTOR	180	OHMS
PLATE RESISTANCE (APPROX.)	0.6	MEGOHM
TRANSCONDUCTANCE	6100	μMHOS
PLATE CURRENT	11	MA.
GRID #2 CURRENT	2.6	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 50 μMHOS	-23	VOLTS

[B] DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] THE DC COMPONENT MUST NOT EXCEED 200 VOLTS.





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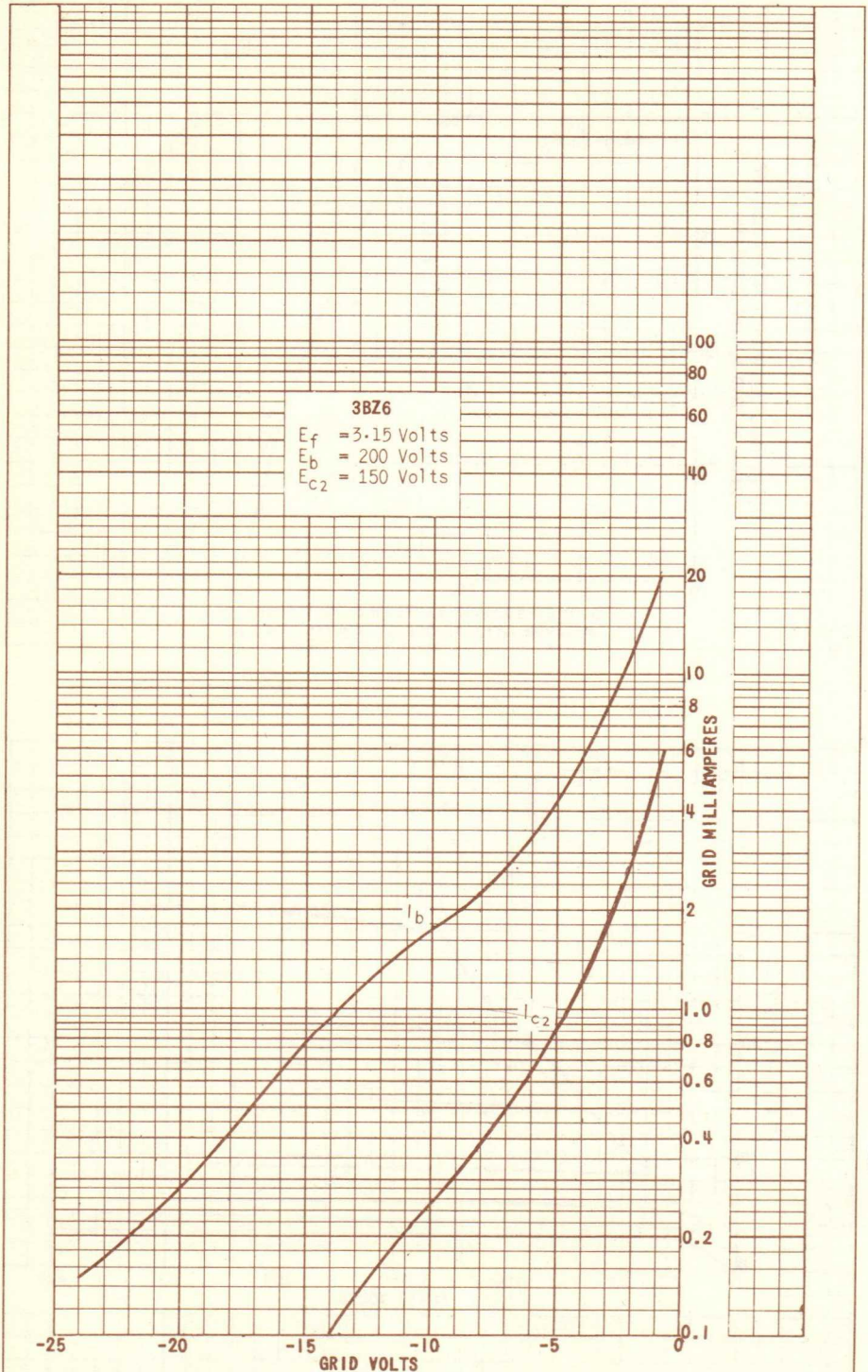
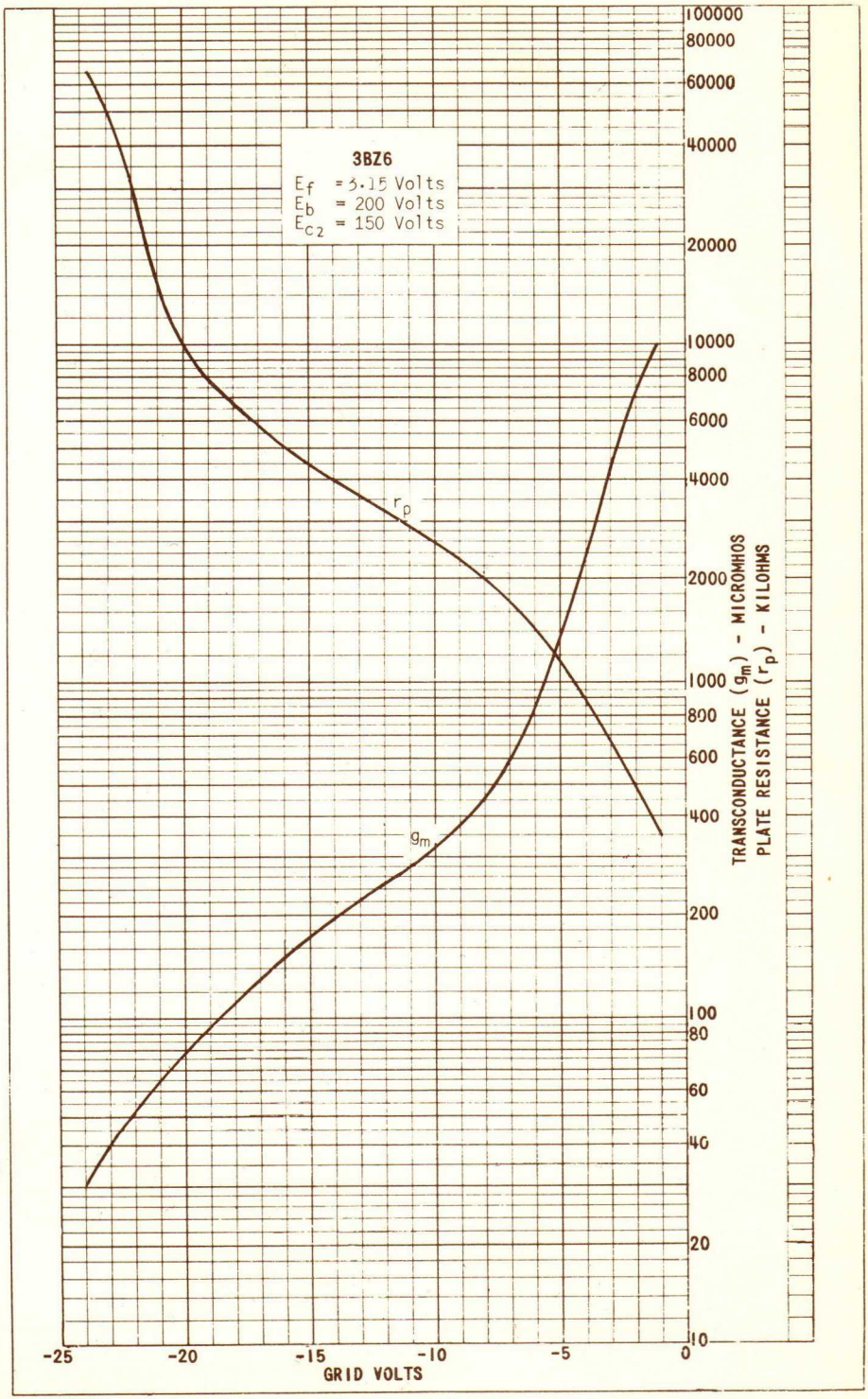

3BZ6
E_f = 3.15 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
GRID MILLIAMPERES
100
80
60
40
20
10
8
6
4
2
1.0
0.8
0.6
0.4
0.2
0.1
-25
-20
-15
-10
-5
0
GRID VOLTS


3BZ6
E_f = 3.15 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
r_p
g_m
100000
80000
60000
40000
20000
10000
8000
6000
4000
2000
1000
800
600
400
200
100
80
60
40
20
10
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - KILOHMS
-25
-20
-15
-10
-5
0
GRID VOLTS

TUNG-SOL

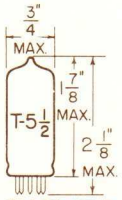
PENTODE

MINIATURE TYPE

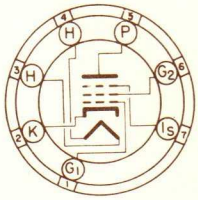
COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 3CB6 IS A SHARP CUT-OFF PENTODE USING THE SMALL BUTTON SEVEN PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS AS AN IF AMPLIFIER OPERATING AT FREQUENCIES ABOVE 20 MC. IT IS ALSO WELL SUITED FOR USE AS AN RF AMPLIFIER IN VHF TELEVISION RECEIVERS. IT IS CHARACTERIZED BY HIGH TRANSCONDUCTANCE AND LOW CAPACITANCE VALUES. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH EXCEPTION OF HEATER RATINGS ITS CHARACTERISTICS ARE IDENTICAL TO THE 6CB6.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH[A] SHIELD	
GRID TO PLATE: (G_1 TO P) MAX.	→ 0.025	→ .015	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	6.5	6.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	→ 2.0	3.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS ←

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4-2	
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM PLATE DISSIPATION	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	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
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

→ INDICATES A CHANGE.

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TUNG-SOL

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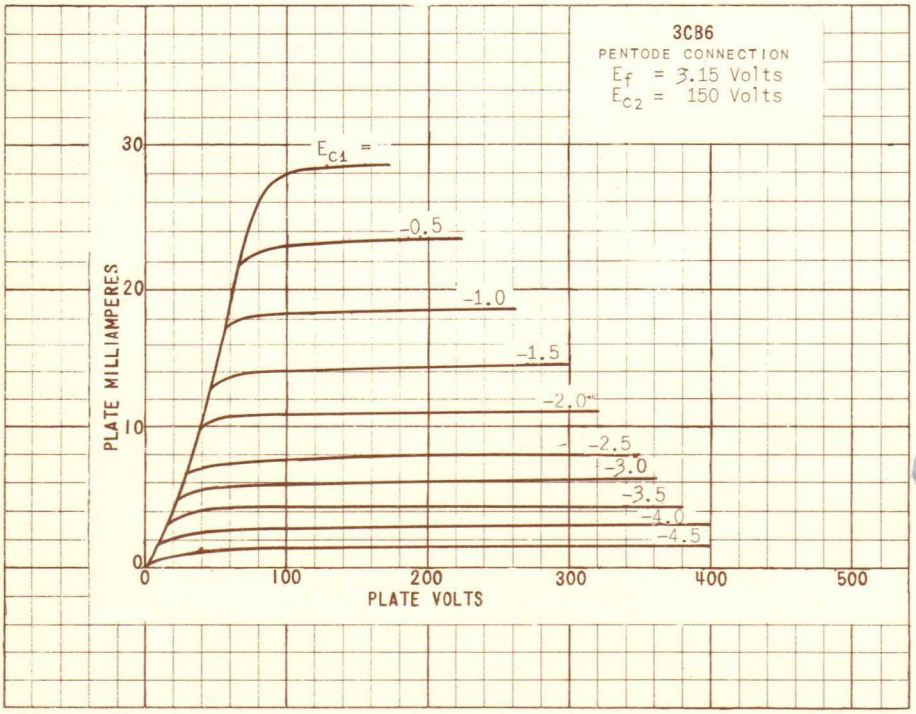
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS ←

HEATER VOLTAGE	3.15	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	125	VOLTS
GRID #3 VOLTAGE		
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.28	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
PLATE CURRENT	13.0	MA.
GRID #2 CURRENT	3.7	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b=20 μA.	-6.5	VOLTS
PLATE CURRENT AT E_{c1}=-3V., R_k=0	2.8	MA.

B DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.



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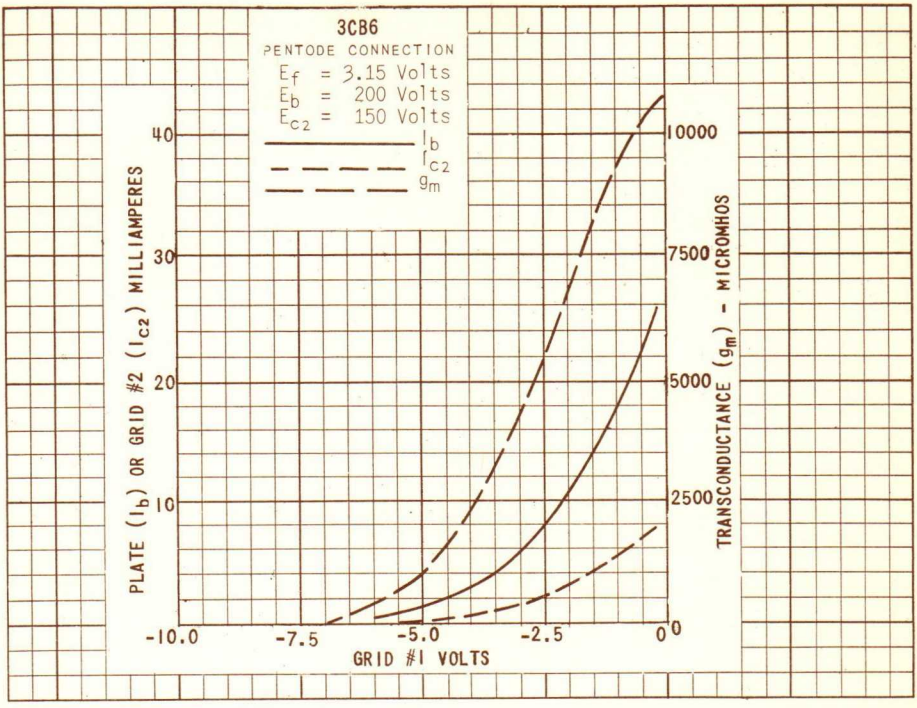

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TUNG-SOL

PENTODE

MINIATURE TYPE

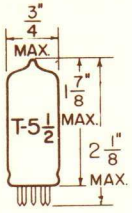
COATED UNIPOTENTIAL CATHODE

HEATER

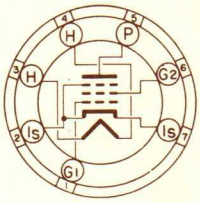
3.15 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7B0

THE 3CE5 IS AN RF PENTODE HAVING HIGH TRANSCONDUCTANCE COUPLED WITH CLOSELY CONTROLLED GRID CUTOFF CHARACTERISTICS IN THE MINIATURE SEVEN PIN CONSTRUCTION. DESIGNED TO OBTAIN BETTER PERFORMANCE OF LOW COST VHF TELEVISION TUNERS AND TELEVISION IF STAGES, THE 3CE5 IMPROVES AUTOMATIC GAIN CONTROL WITH RESULT THAT SIGNAL CAPACITY IS INCREASED. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (MAX.)	0.030	μμf
INPUT	6.5	μμf
OUTPUT	1.9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
* MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
* MAXIMUM GRID #2 VOLTAGE	SEE SCREEN RATING CHART	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.0	WATTS
* MAXIMUM GRID #2 DISSIPATION	0.5	WATTS
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
HEATER WARM-UP TIME (APPROX.)[A]	11.0	SECONDS

A
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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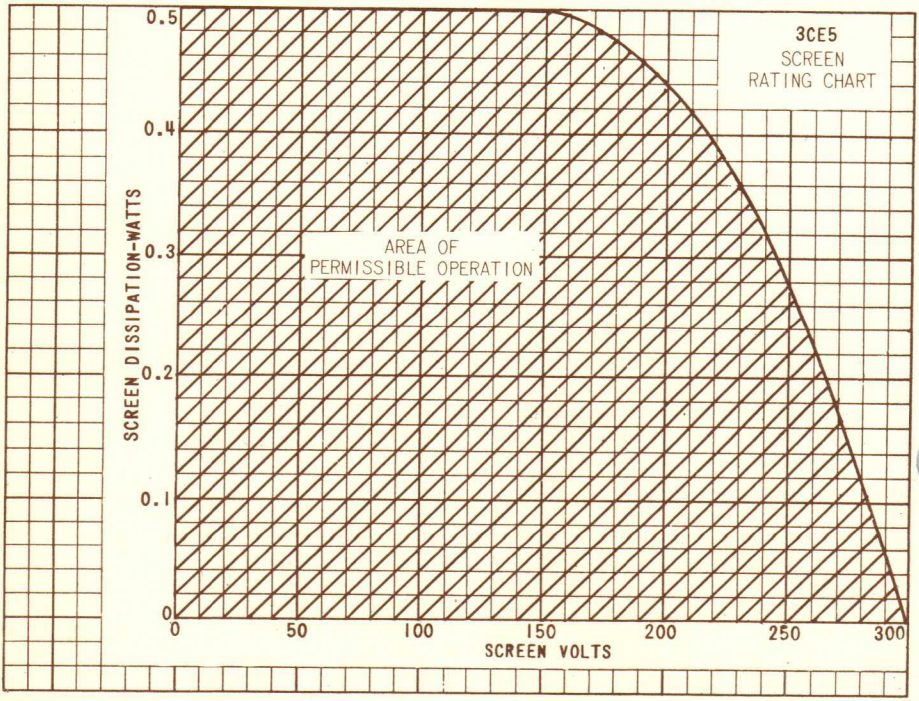
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

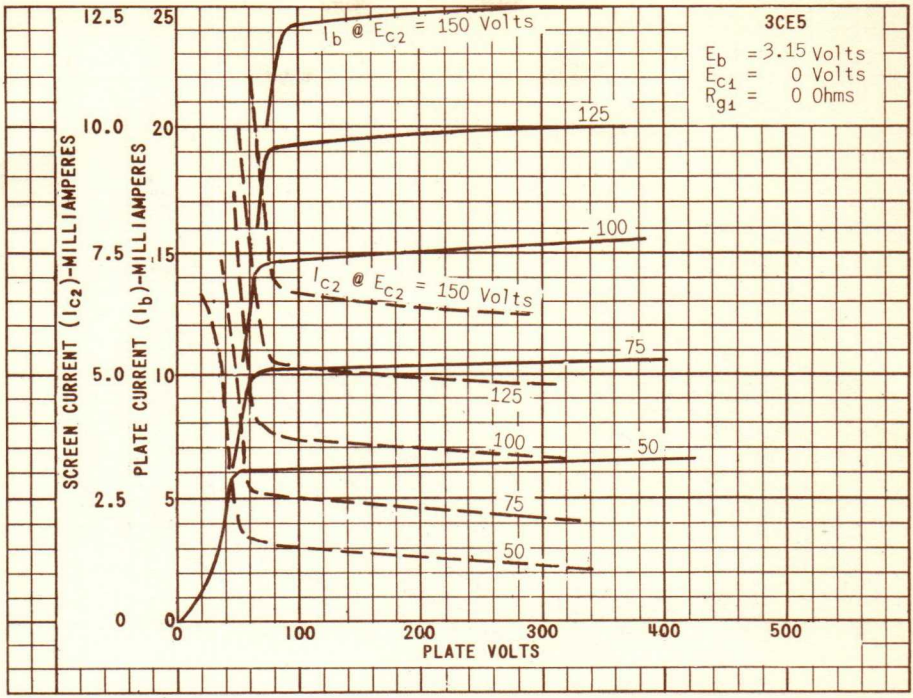
CLASS A_1 AMPLIFIER

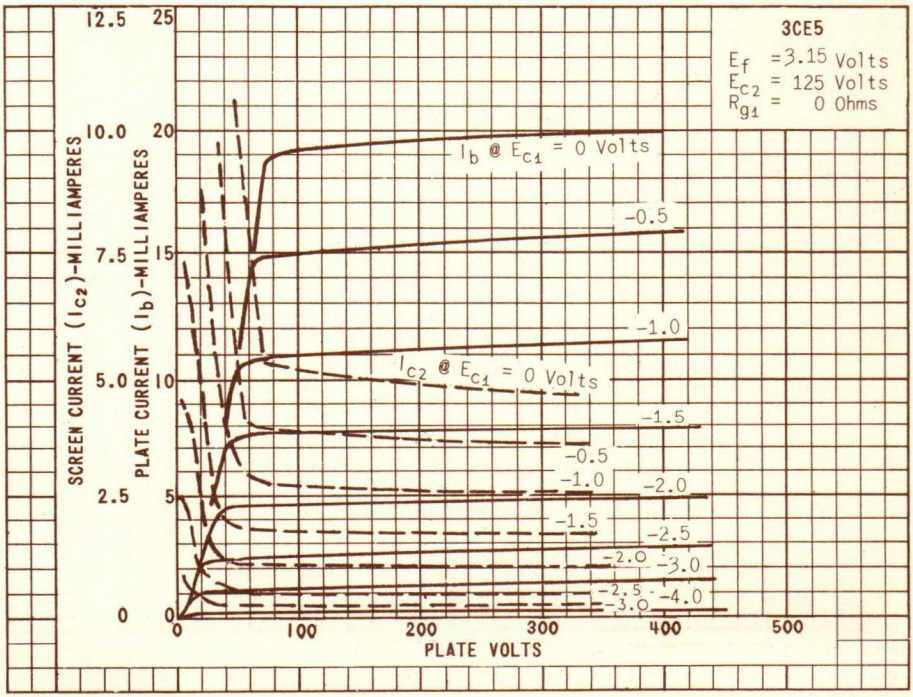
HEATER VOLTAGE	3.15	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	125	VOLTS
SCREEN VOLTAGE	125	VOLTS
* GRID #1 SUPPLY VOLTAGE	-1.0	VOLTS
GRID #1 RESISTOR (BYPASSED)	1.0	MEGOHMS
PLATE RESISTANCE (APPROX.)	0.3	MEGOHMS
TRANSCONDUCTANCE	7 600	μMHOS
PLATE CURRENT	11	MA.
SCREEN CURRENT	2.8 ←	MA.
GRID #1 VOLTAGE (APPROX.) Ib = 35 μAMPS.	-5.0	VOLTS

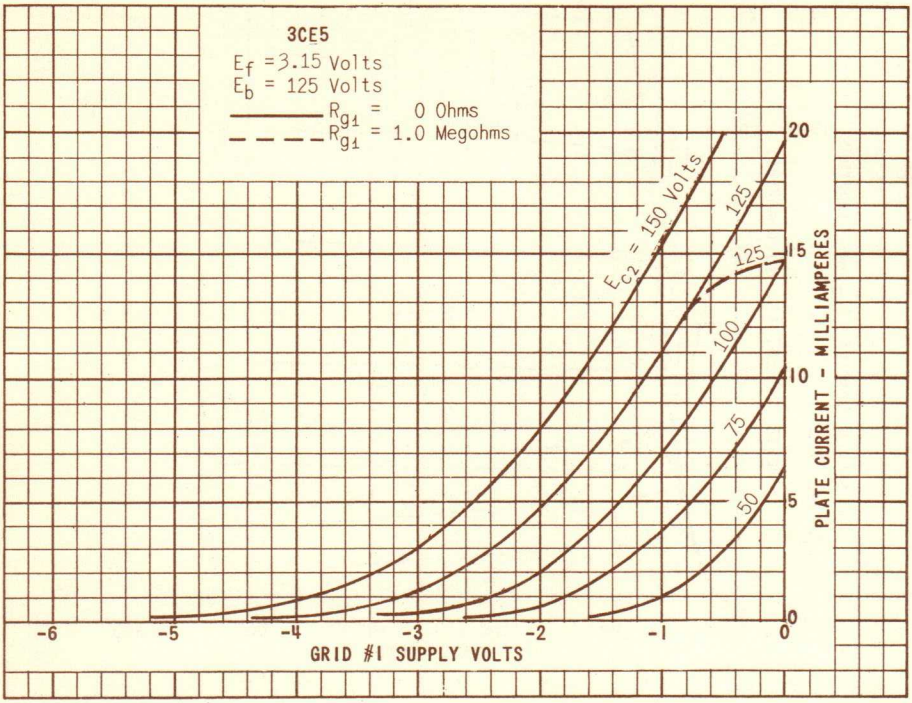
SIMILAR TYPE REFERENCE. *Except for heater ratings, the 3CE5 is identical to the 4CE5 and the 6CE5.*

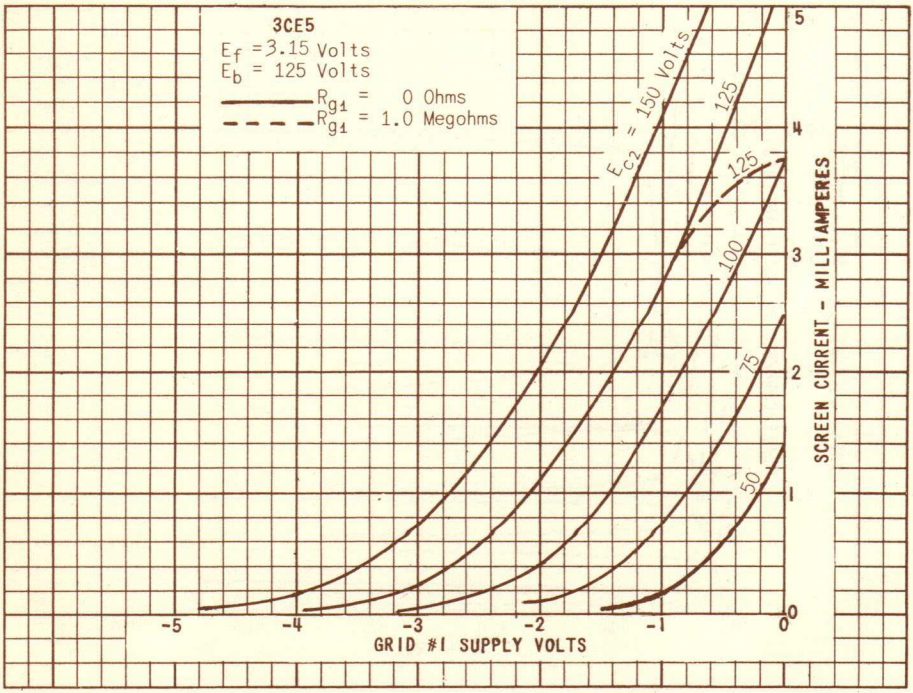
→ INDICATES A CHANGE.
* INDICATES AN ADDITION.




3CE5
E_b = 3.15 Volts
E_{c1} = 0 Volts
R_{g1} = 0 Ohms
I_b @ E_{c2} = 150 Volts
I_{c2} @ E_{c2} = 150 Volts
125
100
75
50
SCREEN CURRENT (I_{c2})-MILLIAMPERES
PLATE CURRENT (I_b)-MILLIAMPERES
PLATE VOLTS
0
2.5
5.0
7.5
10.0
12.5
0
5
10
15
20
25
0
100
200
300
400
500


3CE5
E_f = 3.15 Volts
E_{c2} = 125 Volts
R_{g1} = 0 Ohms
I_b @ E_{c1} = 0 Volts
I_{c2} @ E_{c1} = 0 Volts
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
SCREEN CURRENT (I_{c2})-MILLIAMPERES
PLATE CURRENT (I_b)-MILLIAMPERES
PLATE VOLTS
0
2.5
5.0
7.5
10.0
12.5
0
5
10
15
20
25
0
100
200
300
400
500


3CE5
E_f = 3.15 Volts
E_b = 125 Volts
R_{g1} = 0 Ohms
R_{g1} = 1.0 Megohms
E_{c2} = 150 Volts
125
125
100
75
50
20
15
10
5
0
PLATE CURRENT - MILLIAMPERES
-6
-5
-4
-3
-2
-1
0
GRID #1 SUPPLY VOLTS


3CE5
E_f = 3.15 Volts
E_b = 125 Volts
R_{g1} = 0 Ohms
R_{g1} = 1.0 Megohms
E_{c2} = 150 Volts
125
125
100
75
50
5
4
3
2
1
0
SCREEN CURRENT - MILLIAMPERES
-5
-4
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-2
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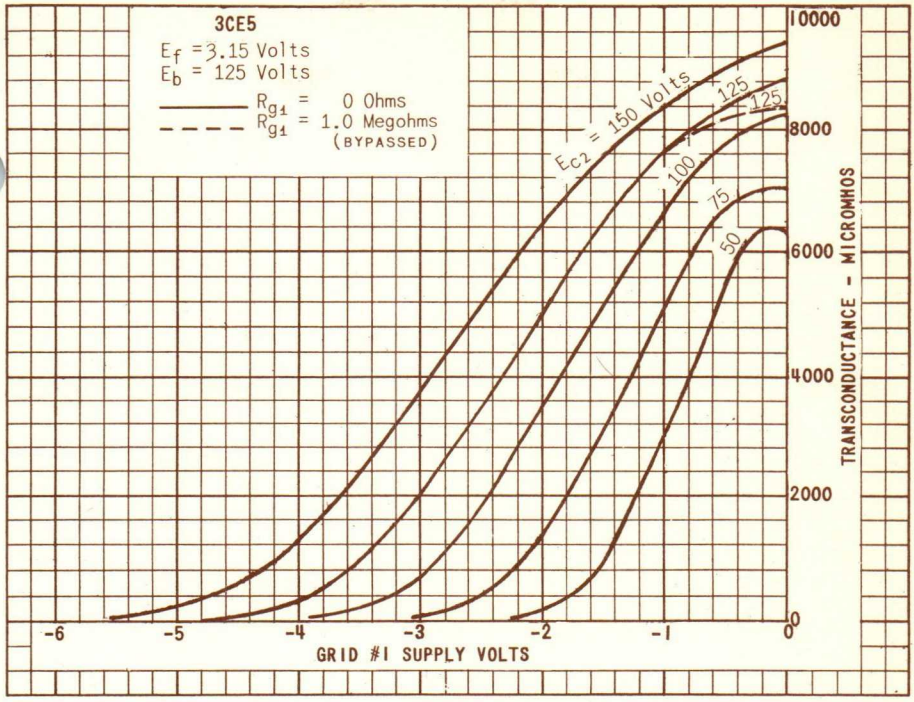
0
GRID #1 SUPPLY VOLTS



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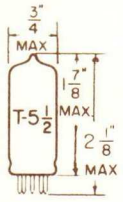
TUNG-SOL

HEPTODE

MINIATURE TYPE

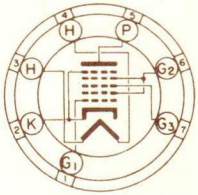


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6 AMP
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CH

THE 3CS6 IS A MINIATURE DUAL CONTROL PENTAGRID DESIGNED FOR USE IN SYNC SEPARATOR CIRCUITS IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. EACH OF THE CONTROL GRIDS HAVE A SHARP CUT-OFF CHARACTERISTIC. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6CS6.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID #1 TO PLATE: G_1 TO P (MAX.)	0.05	μμf
GRID #3 TO PLATE: G_3 TO P (MAX)	0.36	μμf
#1 INPUT: G_1 TO (H+K+G_2+$G_{3\&5}$)	5.5	μμf
#3 INPUT: G_3 TO (H+K+G_1+$G_{2\&5}$)	7.0	μμf
OUTPUT: P TO (H+K+G_1+G_2+$G_{3\&5}$)	7.5	μμf
COUPLING: G_1 TO G_3 (MAX.)	0.22	μμf

RATINGS ←

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DESIGN CENTER VALUES

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 & #4 VOLTAGE[A]		
MAXIMUM GRID #2 & #4 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION		
MAXIMUM SCREEN DISSIPATION:		
FOR GRIDS #2 & #4 VOLTAGE UP TO 150 VOLTS	1.0	VOLTS
FOR GRIDS #2 & #4 VOLTAGE BETWEEN 150 & 300 VOLTS [A]		
MAXIMUM CATHODE CURRENT	14	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM GRID #3 CIRCUIT RESISTANCE	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] SEE SCREEN DISSIPATION RATING CHART JEDEC #J5-C4-2.

→ INDICATES A CHANGE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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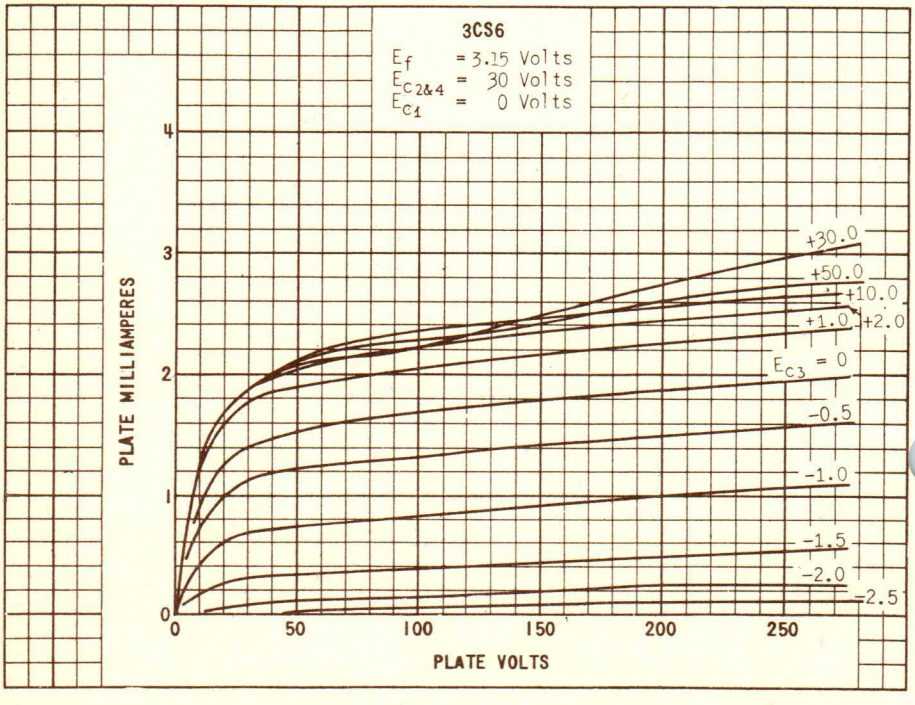
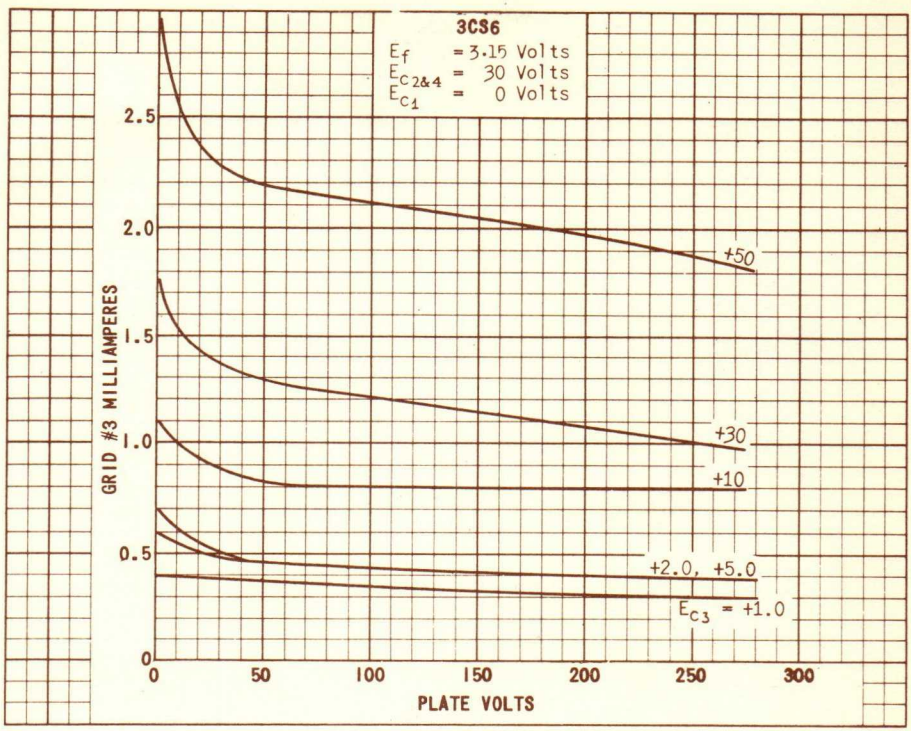
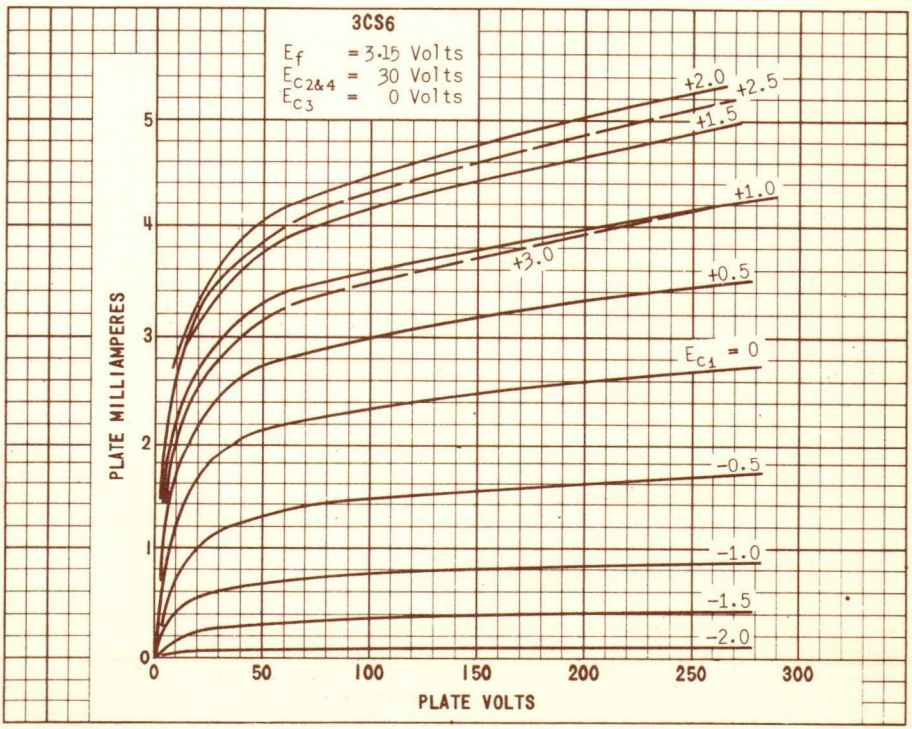
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

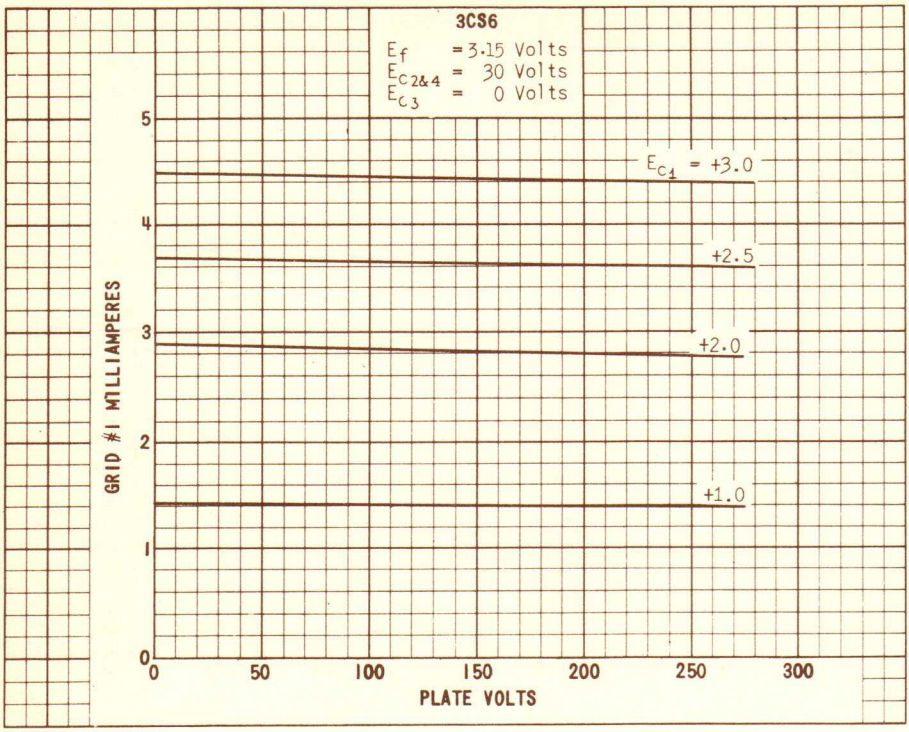
HEATER VOLTAGE	3.15	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	10	100	100	VOLTS
GRID #2 & #4 VOLTAGE	30	30	30	VOLTS
GRID #1 VOLTAGE	0	0	-0	VOLTS
GRID #3 VOLTAGE	0	-1	0	VOLTS
PLATE CURRENT	2.0	0.8	1.0	MA.
GRID #2 & #4 CURRENT	4.5	5.5	1.3	MA.
TRANSCONDUCTANCE (MEASURED BETWEEN GRID #1 AND PLATE)	---	---	1 100	μMHOS
TRANSCONDUCTANCE (MEASURED BETWEEN GRID #3 AND PLATE)	---	1 500	---	μMHOS
PLATE RESISTANCE (APPROX.)	---	0.7	1.0	MEGOHM
GRID #1 VOLTAGE (APPROX.) FOR I_b=50 μA	---	---	-2.5	VOLTS
GRID #3 VOLTAGE (APPROX.) FOR I_b=50 μA	---	-2.2	---	VOLTS




3CS6
E_f = 3.15 Volts
$E_{c2\&4}$ = 30 Volts
E_{c1} = 0 Volts
GRID #3 MILLIAMPERES
PLATE VOLTS
0
0.5
1.0
1.5
2.0
2.5
50
100
150
200
250
300
+50
+30
+10
+2.0, +5.0
E_{c3} = +1.0


3CS6
E_f = 3.15 Volts
$E_{c2\&4}$ = 30 Volts
E_{c3} = 0 Volts
PLATE MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
50
100
150
200
250
300
+2.0
+2.5
+1.5
+1.0
+3.0
+0.5
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0

3CS6



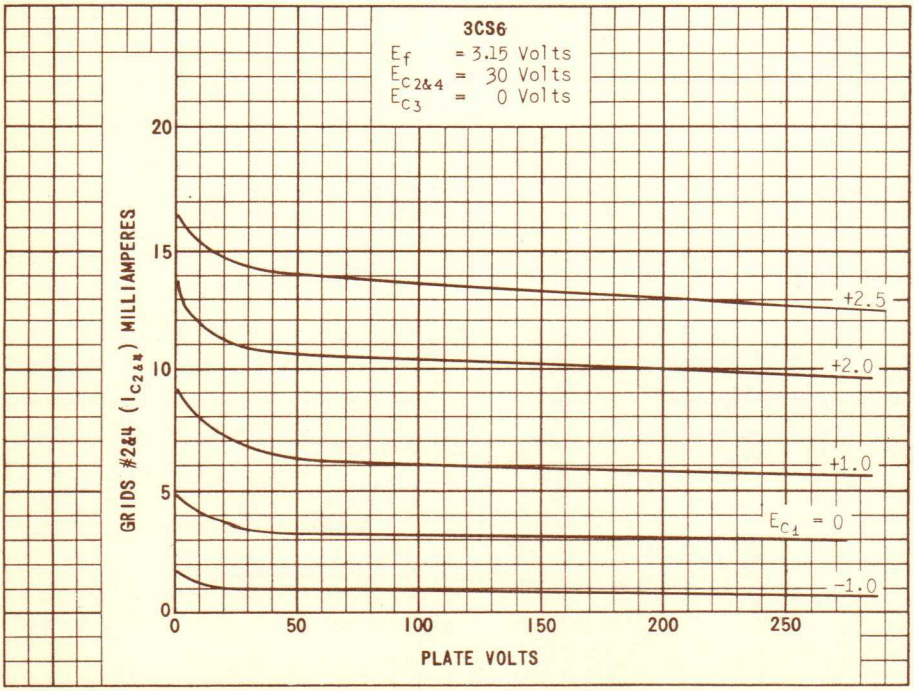
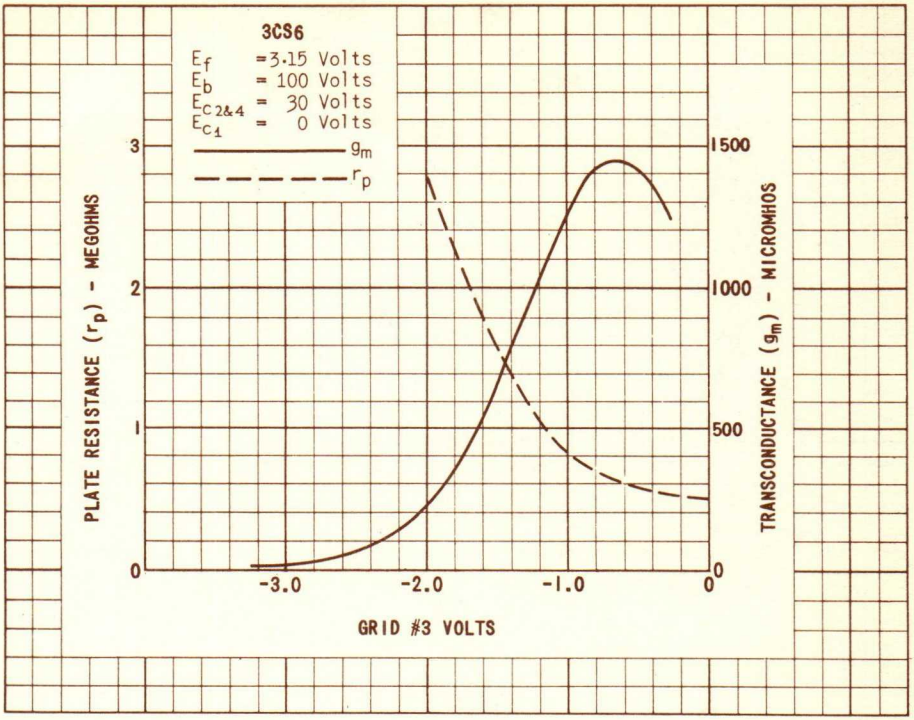
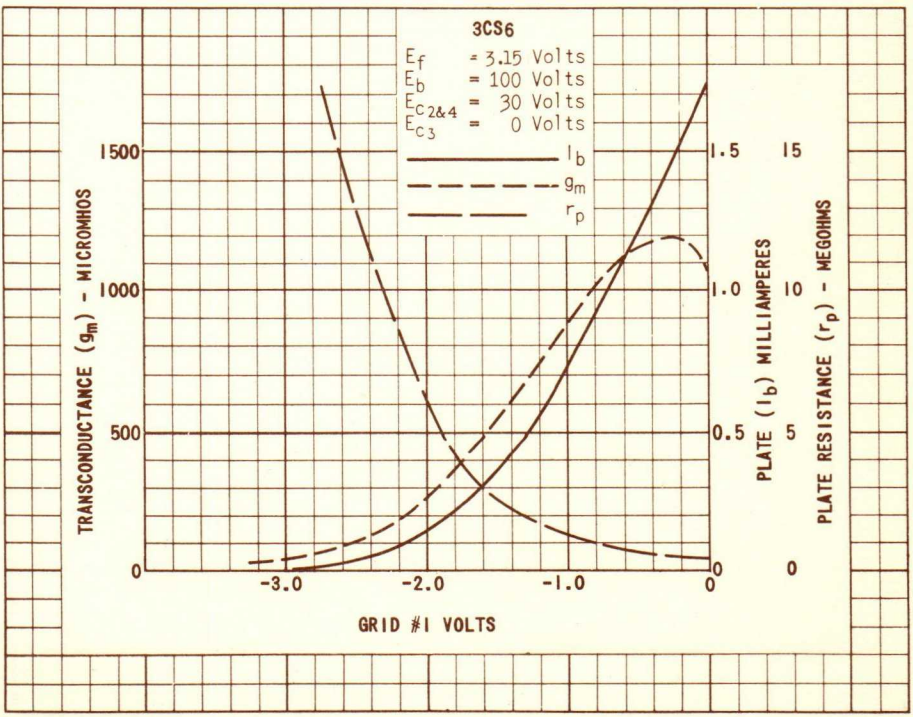


PLATE #4178 DECEMBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.





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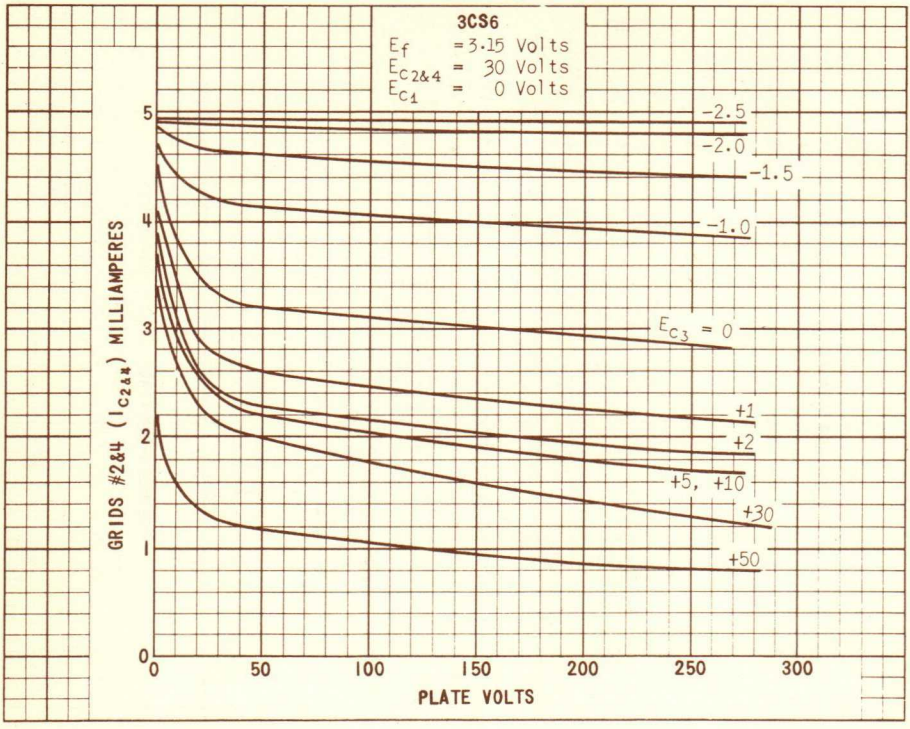
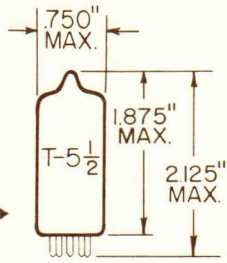
3CS6


3CS6
E_f = 3.15 Volts
$E_{c2\&4}$ = 30 Volts
E_{c1} = 0 Volts
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
0
50
100
150
200
250
300
-2.5
-2.0
-1.5
-1.0
E_{c3} = 0
+1
+2
+5, +10
+30
+50

TUNG-SOL



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

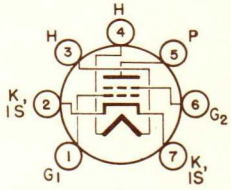
TETRODE

MINIATURE TYPE

COATED UNIPOTENTICAL CATHODE

HEATER
2.9 VOLTS 450±27 MAMPS. ←
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7EW

THE 3CY5 IS A SHARP-CUTOFF TETRODE IN THE 7-PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR SERVICE IN VHF TUNERS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 3CY5 IS IDENTICAL TO THE 2CY5, 4CY5, AND THE 6CY5.

DIRECT INTERELECTRODE CAPACITANCES[A]

GRID #1 TO PLATE	0.03	μμf
INPUT	4.5	μμf
OUTPUT	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 (SCREEN) SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CHART	
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATTS
MAXIMUM GRID #1 (CONTROL GRID) VOLTAGE		
POSITIVE VALUE	0	MA.
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.)[B]	11.0	SECONDS

[A] WITH SHIELD #316 CONNECTED TO CATHODE.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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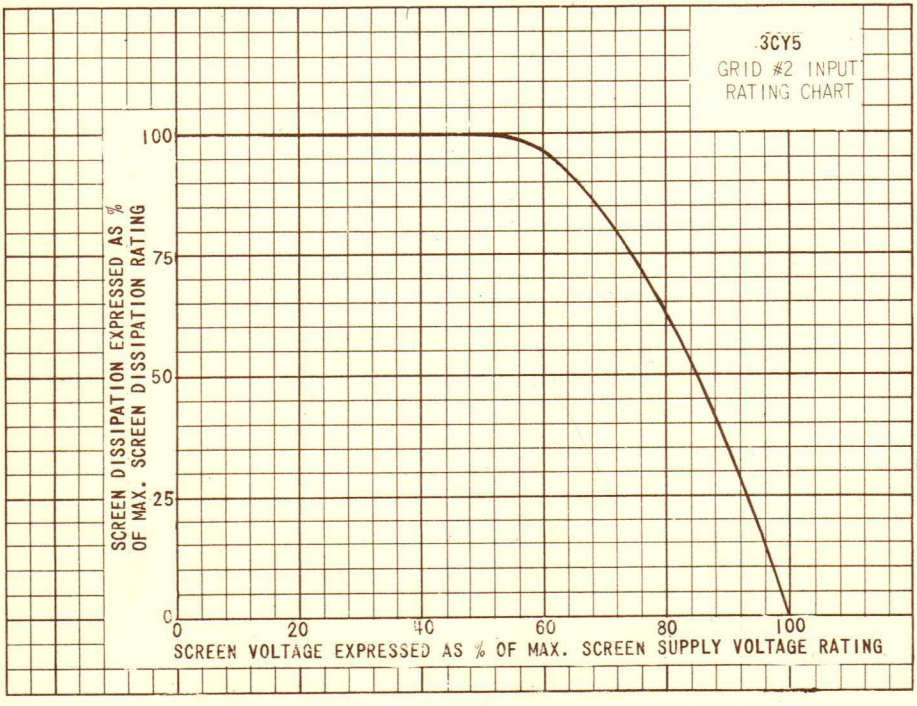
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	-1	VOLTS
PLATE RESISTANCE	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
GRID #1 CUTOFF BIAS[C]	-6	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	1.5	MA.

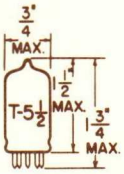
[C] PLATE CURRENT 20 μA.



TUNG-SOL

TETRODE

MINIATURE TYPE



GLASS BULB

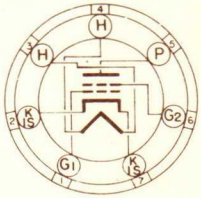
COATED UNIPOTENTICAL CATHODE

HEATER

2.9 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7EW

THE 3CY5 IS A SHARP-CUTOFF TETRODE IN THE 7-PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR SERVICE IN VHF TUNERS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 3CY5 IS IDENTICAL TO THE 2CY5, 4CY5, AND THE 6CY5.

DIRECT INTERELECTRODE CAPACITANCES[A]

GRID #1 TO PLATE	0.03	μμf
INPUT	4.5	μμf
OUTPUT	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	2.9	VOLTS
MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 (SCREEN) SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CHART	
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATTS
MAXIMUM GRID #1 (CONTROL GRID) VOLTAGE		
POSITIVE VALUE	0	MA.
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.)[B]	11.0	SECONDS

[A] WITH SHIELD #316 CONNECTED TO CATHODE.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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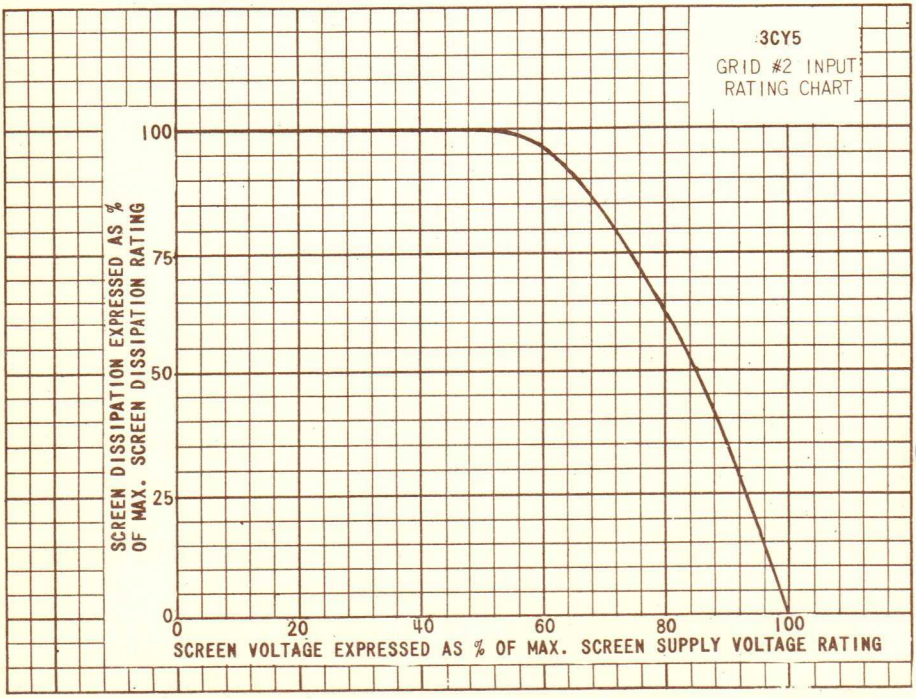
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

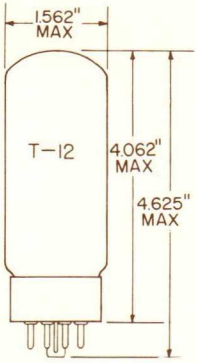
HEATER VOLTAGE	2.9	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	−1	VOLTS
PLATE RESISTANCE	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
GRID #1 CUTOFF BIAS[C]	−6	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	1.5	MA.

[C] PLATE CURRENT 20 μA.



TUNG-SOL

TWIN DIODE



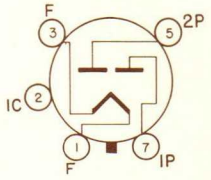
GLASS BULB
SHORT MEDIUM-SHELL
5 PIN OCTAL
B8-110 OR B8-118
OUTLINE DRAWING
JEDEC 12-16

COATED FILAMENT

3.3±0.3 VOLTS 3.8 AMP.
AC OR DC

ANY MOUNTING POSITION

*OPPOSITE ENDS OF THE DIRECTLY HEATED CATHODE ARE CONNECTED TO PINS 1 AND 3. CATHODE-HEATING VOLTAGE SHOULD BE CONNECTED BETWEEN THESE PINS. OUTPUT CURRENT MAY BE TAKEN FROM EITHER PIN 1 OR PIN 3.



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5DE

THE 3DG4 IS A TWIN DIODE WITH A DIRECTLY HEATED FILAMENT DESIGNED FOR USE AS A FULL-WAVE RECTIFIER IN THE POWER SUPPLY OF TELEVISION RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

RECTIFIER SERVICE

MAXIMUM PEAK INVERSE PLATE VOLTAGE	1050	VOLTS
MAXIMUM AC PLATE-SUPPLY VOLTAGE PER PLATE	SEE RATING CHART	
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	1200	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT PER PLATE, MAXIMUM DURATION 0.2 SECOND	SEE RATING CHART	
	6.5	AMP.
MAXIMUM DC OUTPUT CURRENT		
BULB TEMPERATURE AT HOTTEST POINT	200	°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER

	CAPACITOR-INPUT FILTER	
AC PLATE-SUPPLY VOLTAGE PER PLATE, RMS	275	VOLTS
FILTER INPUT CAPACITOR	40	μF
TOTAL PLATE-SUPPLY RESISTANCE PER PLATE	32	OHMS
DC OUTPUT CURRENT	350	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	300	VOLTS
TUBE VOLTAGE DROP		
I_b = 350 MA. DC PER PLATE	25	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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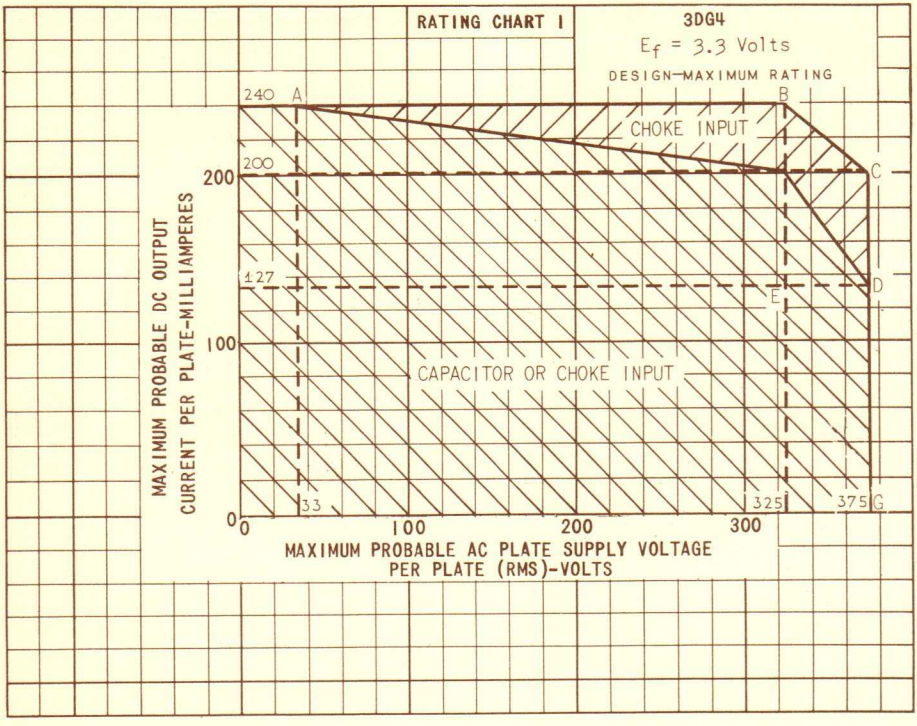
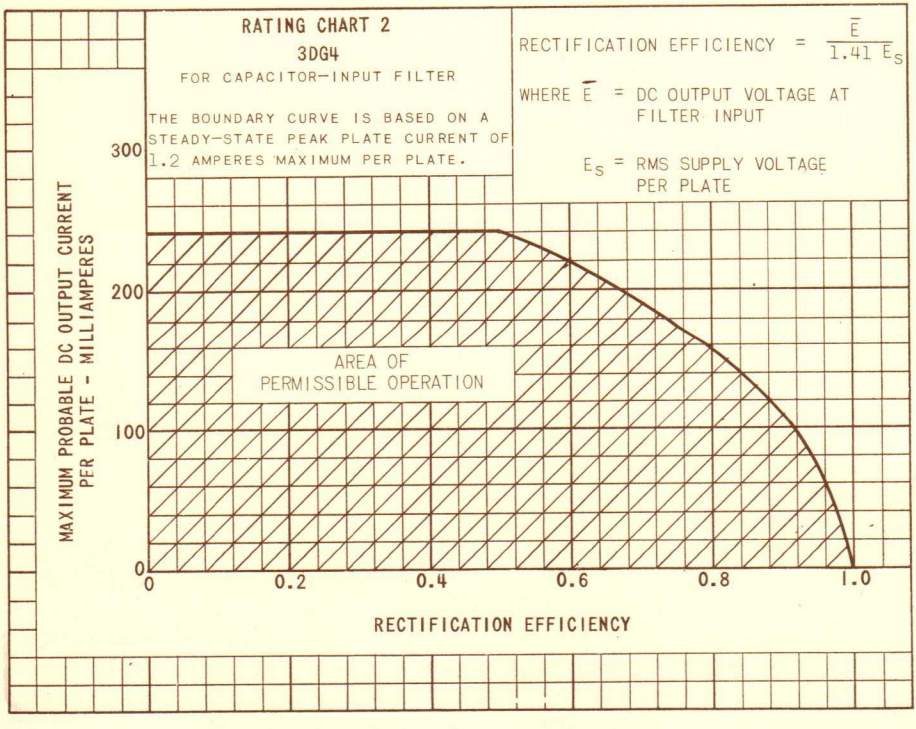

RATING CHART 1
3DG4
E_f = 3.3 Volts
DESIGN-MAXIMUM RATING
240
A
B
CHOKE INPUT
200
C
D
E
127
CAPACITOR OR CHOKE INPUT
33
325
375
G
0
100
200
300
MAXIMUM PROBABLE DC OUTPUT CURRENT PER PLATE-MILLIAMPERES
MAXIMUM PROBABLE AC PLATE SUPPLY VOLTAGE PER PLATE (RMS)-VOLTS


RATING CHART 2
3DG4
FOR CAPACITOR-INPUT FILTER
THE BOUNDARY CURVE IS BASED ON A STEADY-STATE PEAK PLATE CURRENT OF 1.2 AMPERES MAXIMUM PER PLATE.
RECTIFICATION EFFICIENCY = $\frac{\bar{E}}{1.41\ E_s}$
WHERE $\bar{E}$ = DC OUTPUT VOLTAGE AT FILTER INPUT
E_s = RMS SUPPLY VOLTAGE PER PLATE
AREA OF PERMISSIBLE OPERATION
300
200
100
0
0
0.2
0.4
0.6
0.8
1.0
MAXIMUM PROBABLE DC OUTPUT CURRENT PER PLATE - MILLIAMPERES
RECTIFICATION EFFICIENCY

$R_S = R_{sec} + N^2R_{pri} + R_A$

WHERE

R_S = PLATE SUPPLY RESISTANCE PER PLATE

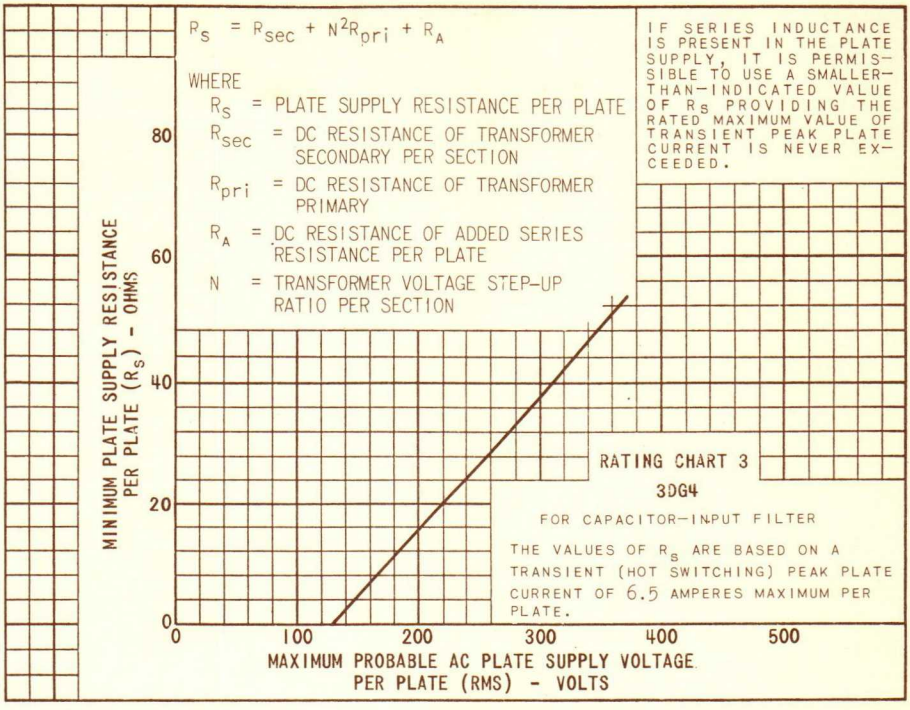
R_{sec} = DC RESISTANCE OF TRANSFORMER SECONDARY PER SECTION

R_{pri} = DC RESISTANCE OF TRANSFORMER PRIMARY

R_A = DC RESISTANCE OF ADDED SERIES RESISTANCE PER PLATE

N = TRANSFORMER VOLTAGE STEP-UP RATIO PER SECTION

IF SERIES INDUCTANCE IS PRESENT IN THE PLATE SUPPLY, IT IS PERMISSIBLE TO USE A SMALLER THAN-INDICATED VALUE OF R_S PROVIDING THE RATED MAXIMUM VALUE OF TRANSIENT PEAK PLATE CURRENT IS NEVER EXCEEDED.

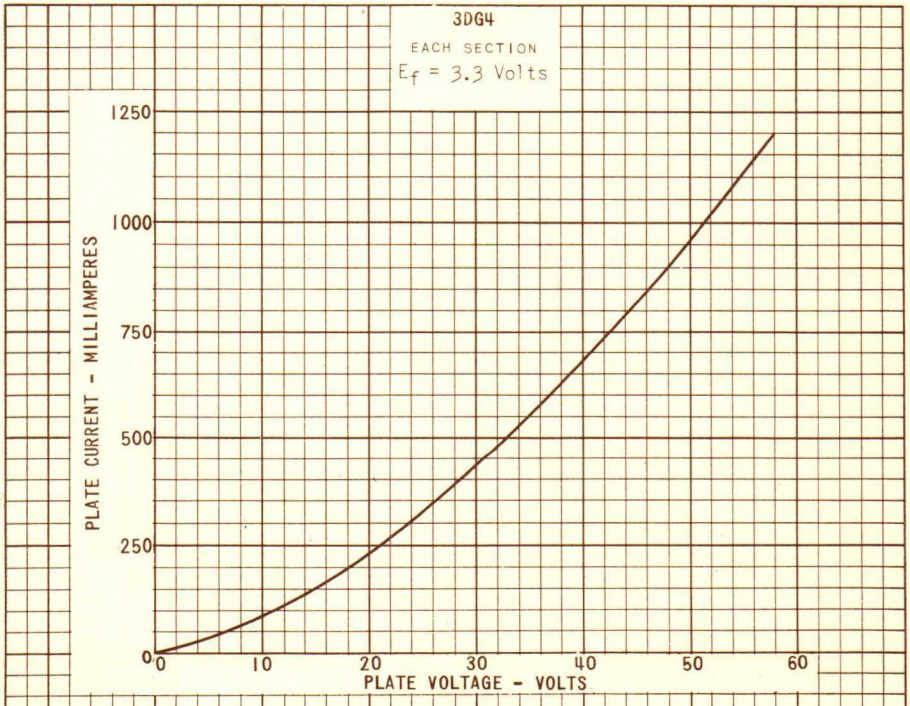


RATING CHART 3

3DG4

FOR CAPACITOR-INPUT FILTER

THE VALUES OF R_S ARE BASED ON A TRANSIENT (HOT SWITCHING) PEAK PLATE CURRENT OF 6.5 AMPERES MAXIMUM PER PLATE.



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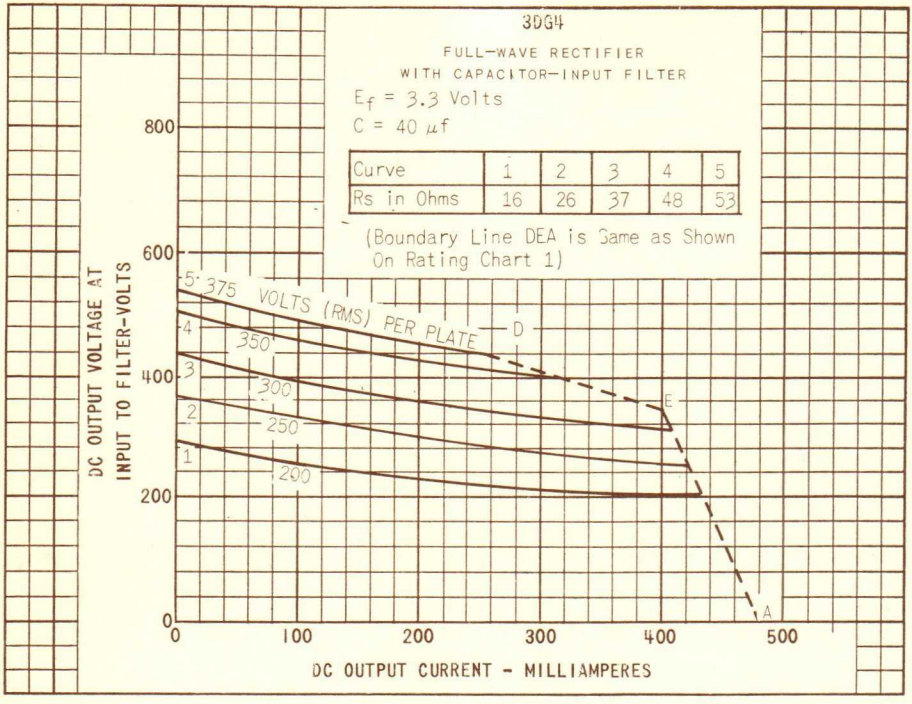
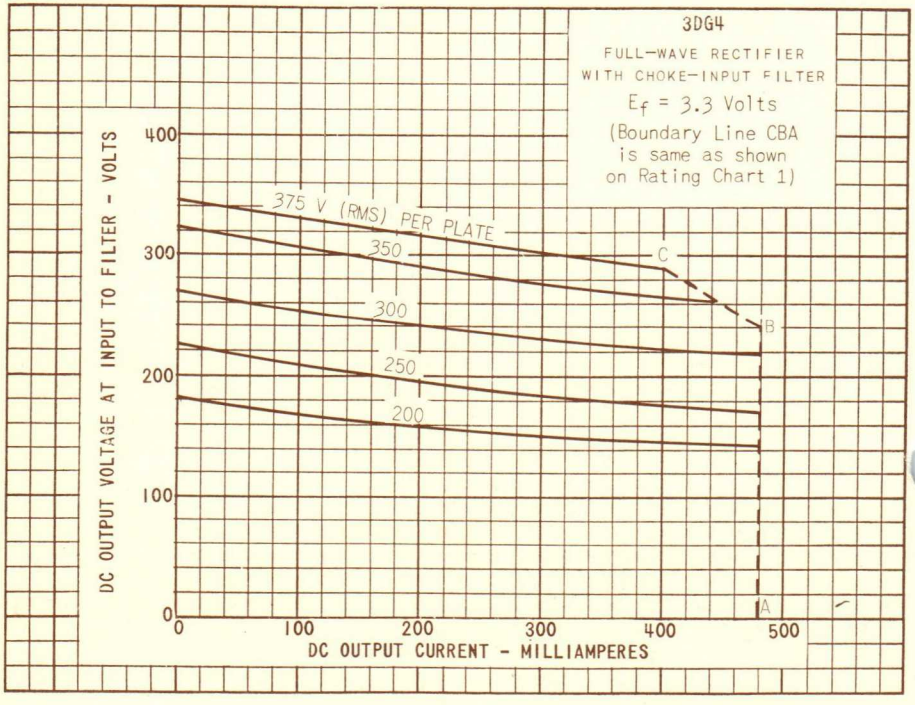
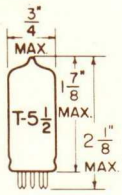

3DG4
FULL-WAVE RECTIFIER
WITH CAPACITOR-INPUT FILTER
E_f = 3.3 Volts
C = 40 μf
Curve 1 2 3 4 5
Rs in Ohms 16 26 37 48 53
(Boundary Line DEA is Same as Shown On Rating Chart 1)
DC OUTPUT VOLTAGE AT INPUT TO FILTER-VOLTS
800
600
400
200
0
375 VOLTS (RMS) PER PLATE
350
300
250
200
5
4
3
2
1
D
E
A
0
100
200
300
400
500
DC OUTPUT CURRENT - MILLIAMPERES


3DG4
FULL-WAVE RECTIFIER
WITH CHOKE-INPUT FILTER
E_f = 3.3 Volts
(Boundary Line CBA is same as shown on Rating Chart 1)
DC OUTPUT VOLTAGE AT INPUT TO FILTER - VOLTS
400
300
200
100
0
375 V (RMS) PER PLATE
350
300
250
200
C
B
A
0
100
200
300
400
500
DC OUTPUT CURRENT - MILLIAMPERES

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

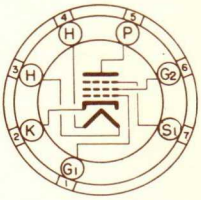
COATED UNIPOTENTIAL CATHODE

HEATER

3.15 VOLTS 0.6±10% AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7CM

THE 3DK6 IS A SHARP CUTOFF PENTODE IN THE 7-PIN MINIATURE CONSTRUCTION DESIGNED FOR SERVICE AS A WIDE-BAND HIGH-FREQUENCY AMPLIFIER. THE VERY HIGH TRANSCONDUCTANCE AT LOW PLATE AND SCREEN POTENTIALS COMBINED WITH THE LOW INTERELECTRODE CAPACITANCES MAKES IT PARTICULARLY SUITABLE FOR USE AS AN IF AMPLIFIER IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, THE 3DK6 IS IDENTICAL TO THE 4DK6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)*	0.025	μμf
INPUT	6.3	μμf
OUTPUT	1.9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE*	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CURVE	
MAXIMUM PLATE DISSIPATION	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATTS
MAXIMUM GRID #1 VOLTAGE:*		
POSITIVE VALUE	0	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.)[A]		

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

*INDICATES AN ADDITION

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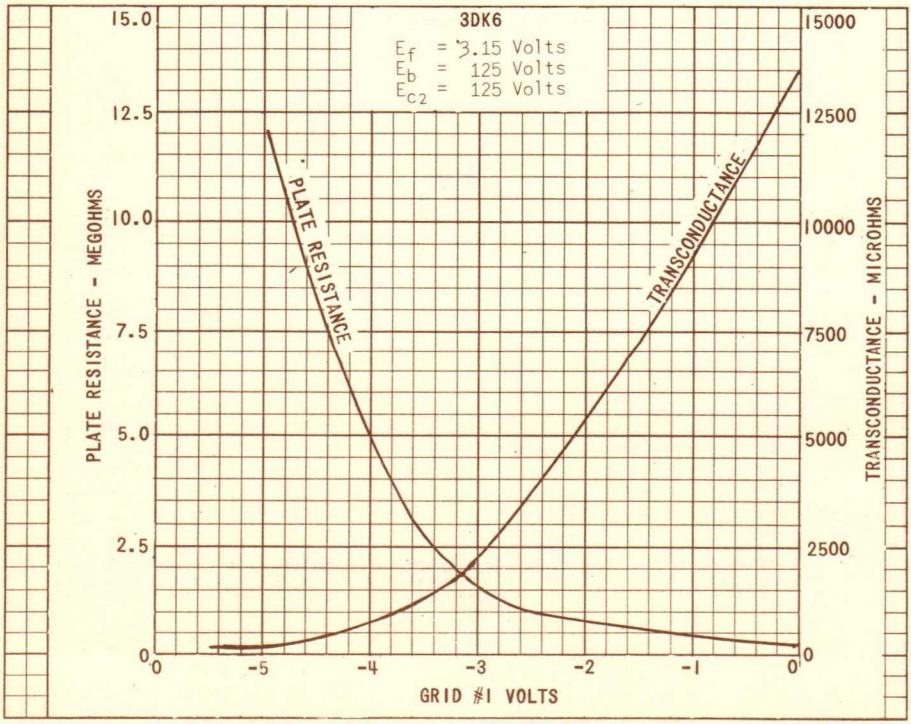
TUNG-SOL

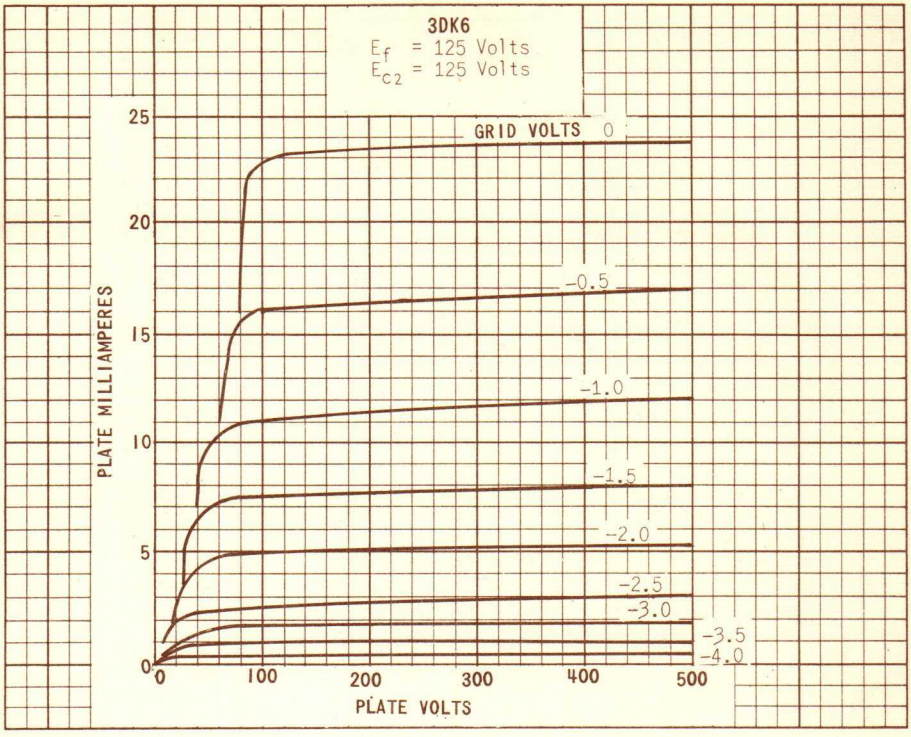
CONTINUED FROM PRECEDING PAGE

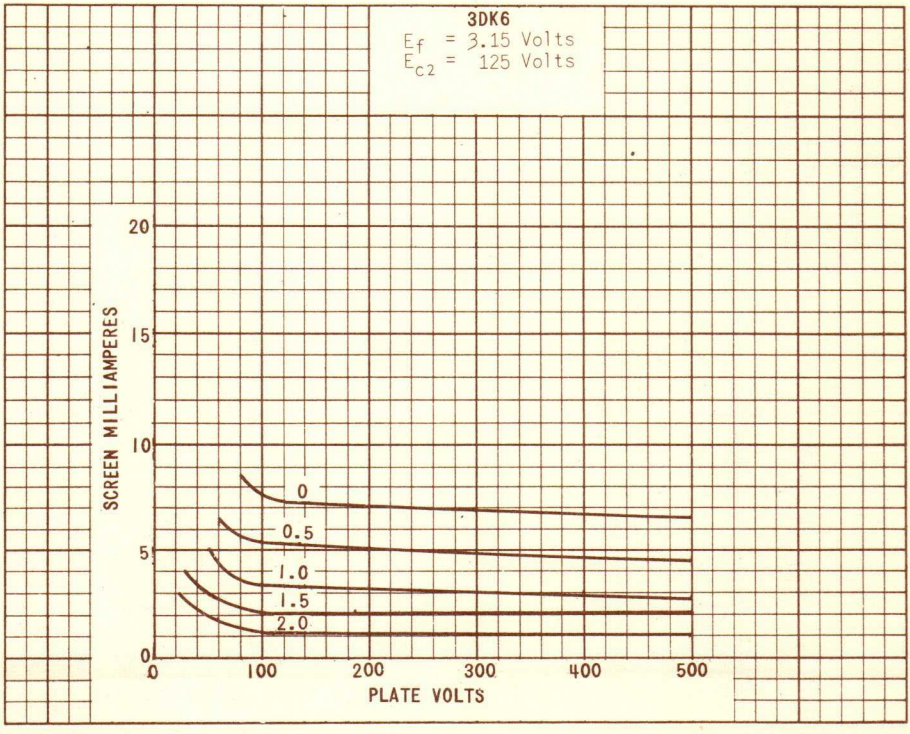
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	3.15	VOLTS
HEATER CURRENT	0.6±10%	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #3 (SUPPRESSOR)	CONNECTED TO CATHODE AT SOCKET	
GRID #2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)*	0.35	MEGOHM
TRANSCONDUCTANCE	9800	μMHOS
PLATE CURRENT	12.0	MA.
GRID #2 CURRENT	3.8	MA.
GRID #1 CUTOFF BIAS[B]	-6.5	VOLTS

[B] FOR PLATE CURRENT OF 20 μA.







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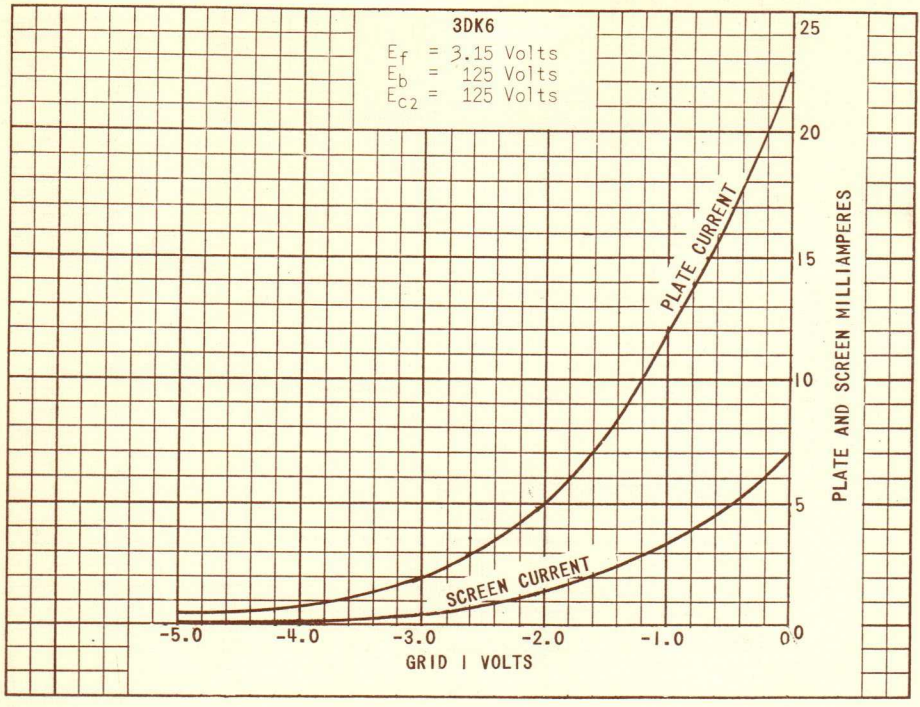
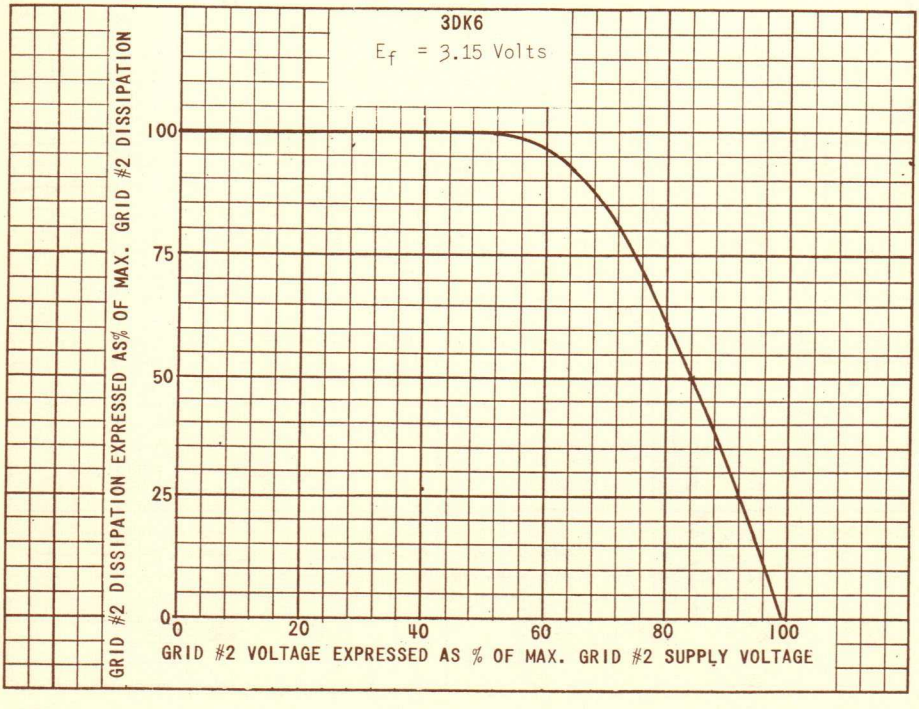

3DK6
E_f = 3.15 Volts
E_b = 125 Volts
E_{c2} = 125 Volts
PLATE CURRENT
SCREEN CURRENT
25
20
15
10
5
0
PLATE AND SCREEN MILLIAMPERES
-5.0
-4.0
-3.0
-2.0
-1.0
0
GRID 1 VOLTS


3DK6
E_f = 3.15 Volts
100
75
50
25
0
GRID #2 DISSIPATION EXPRESSED AS% OF MAX. GRID #2 DISSIPATION
0
20
40
60
80
100
GRID #2 VOLTAGE EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE

TUNG-SOL

PENTODE

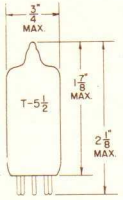
MINIATURE TYPE

UNIPOTENTIAL CATHODE

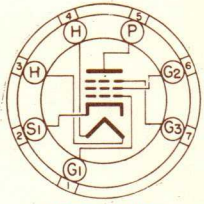
HEATER
3.15 VOLTS 0.6±10% AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE
7EN

THE 3DT6 IS A SHARP CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN FM DETECTOR IN 600 MA SERIES HEATER OPERATED TELEVISION RECEIVERS. DESIGNED SO THAT GRID #1 AND GRID #3 CAN EACH BE USED AS INDEPENDENT SHARP CUTOFF CONTROL ELECTRODES, THE TUBE MAY ALSO BE USED IN DELAY CIRCUITS, GAIN-CONTROLLED AMPLIFIER CIRCUITS, AND MIXER CIRCUITS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER WARM-UP TIME AND HEATER CHARACTERISTICS, THE 3DT6 IS IDENTICAL TO THE 6DT6.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH EXTERNAL SHIELD, #316, CONNECTED TO CATHODE

GRID #1 TO PLATE	0.02	μμf
GRID #1 TO GRID #3	0.1	μμf
GRID #3 TO ALL OTHER ELECTRODES	6.1	μμf
GRID #1 TO GRID #2, GRID #3, HEATER, AND INTERNAL SHIELD AND CATHODE	5.8	μμf
GRID #3 TO PLATE	1.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FM DETECTOR SERVICE

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM GRID #3 (SUPPRESSOR) VOLTAGE	28 ←	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330 ←	VOLTS
MAXIMUM GRID #2 (SCREEN) VOLTAGE	SEE RATING CHART	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.7 ←	WATTS
MAXIMUM GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	1.1 ←	WATTS
FOR GRID #2 VOLTAGES BETWEEN 165 AND 330 VOLTS	SEE RATING CHART	
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
HEATER WARM-UP TIME (APPROX.) *	11	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	3.15	VOLTS
HEATER CURRENT	0.6±10%	AMP.
PLATE SUPPLY VOLTAGE	150	VOLTS
GRID #3 SUPPLY VOLTAGE	0	VOLTS
GRID #2 SUPPLY VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	560	OHMS
PLATE RESISTANCE (APPROX.)	0.15	MEGOHM
TRANSCONDUCTANCE:		
GRID #1 TO PLATE	800	μMNOS
GRID #3 TO PLATE	515	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-4.5	VOLTS
GRID #3 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-3.5	VOLTS
PLATE CURRENT	1.1	MA.
GRID #2 CURRENT	2.1	MA.

TYPICAL OPERATION IN THE ACCOMPANYING LOCKED-OSCILLATOR, QUADRATURE-GRID FM DETECTOR CIRCUIT AT A CARRIER FREQUENCY OF 4.5 MC:

INPUT SIGNAL TO GRID OF DRIVER TUBE	15	200	500	MV RMS
PLATE SUPPLY VOLTAGE	250	250	250	VOLTS
GRID #3 VOLTAGE (OBTAINED FROM A 560000-OHM RESISTOR)	-5	-6	-6.4	VOLTS
GRID #2 SUPPLY VOLTAGE	100	100	100	VOLTS
CATHODE-BIAS RESISTOR	560	560	560	OHMS
PLATE LOAD RESISTOR	0.27	0.27	0.27	MEGOHM
PLATE CURRENT	0.23	0.22	0.21	MA.
GRID #2 CURRENT	3.4	5.5	6	MA.
GRID #1 CURRENT	0.013	0.6	0.8	MA.
BANDWIDTH:				
FOR A TOTAL HARMONIC DISTORTION OF 10 PERCENT	65	120	118	KC
AM REJECTION (APPROX.)[B]	33	29	28	DB
AUDIO OUTPUT VOLTAGE (RMS, APPROX.):				
WITH ± 7.5-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	5.5	6.5	7.5	VOLTS
WITH ± 25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	17	21	23	VOLTS
TOTAL HARMONIC DISTORTION:				
WITH ± 25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	2	3	4	PERCENT
SENSITIVITY:				
WITH ±7.5-KC DEVIATION FROM MEAN VALUE OF 4.5 MC			5[C]	MILLIVOLTS
WITH ±25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC			15[C]	MILLIVOLTS
MAXIMUM CIRCUIT VALUES:				
GRID #1 CIRCUIT RESISTANCE; FOR FIXED-BIAS OPERATION			0.25	MEGOHM
FOR CATHODE-BIAS OPERATION			0.5	MEGOHM

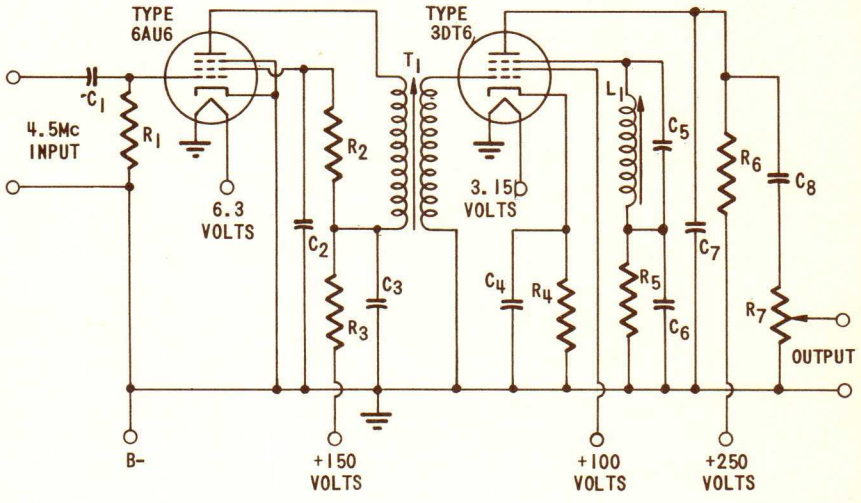
[B] RATIO OF THE AUDIO OUTPUT VOLTAGE PRODUCED BY 30-PERCENT AMPLITUDE MODULATION OF THE 4.5-MC CARRIER FREQUENCY TO THE AUDIO OUTPUT PRODUCED BY ± 25-KC DEVIATION FROM THE 4.5-MC CARRIER FREQUENCY, WITH A MODULATING FREQUENCY OF 400 CPS IN BOTH CASES.

[C] SIGNAL LEVEL AT WHICH DETECTOR CIRCUIT WILL HANDLE THE INDICATED DEVIATION IN FREQUENCY FROM THE MEAN VALUE OF 4.5 MC, BEFORE DISTORTION OCCURS.

→ INDICATES A CHANGE.

TUNG-SOL

LOCKED-OSCILLATOR, QUADRATURE-GRID DETECTOR CIRCUIT UTILIZING TYPE 3DT6



C_1: 47μμf, 400 VOLTS
C_2 C_3: 0.01μf, 400 VOLTS
C_4: 0.01μf, 200 VOLTS
C_5: 18μμf, 200 VOLTS
C_6: 0.05μf, 200 VOLTS
C_7: 100 TO 1000μμf, 400 VOLTS
C_8: 0.01μf, 400 VOLTS

L_1: SLUG-TUNED INDUCTOR WITH Q OF 50 AND TUNEABLE TO 4.5-MC.

R_1: 100000 OHMS, 0.5 WATT
R_2: 12000 OHMS, 0.5 WATT
R_3: 1000 OHMS, 0.5 WATT
R_4: 560 OHMS, 0.5 WATT
R_5: 560000 OHMS, 0.5 WATT

R_6: 270000 OHMS, 0.5 WATT
R_7: 0.5 MEGOHM POTENTIOMETER

T_1: SLUG-TUNED, BIFILAR WOUND IF TRANSFORMER WITH RATIO OF 1:1.5, Q > 60, AND TUNEABLE TO 4.5-MC WITH TUBE AND WIRING CAPACITANCE.

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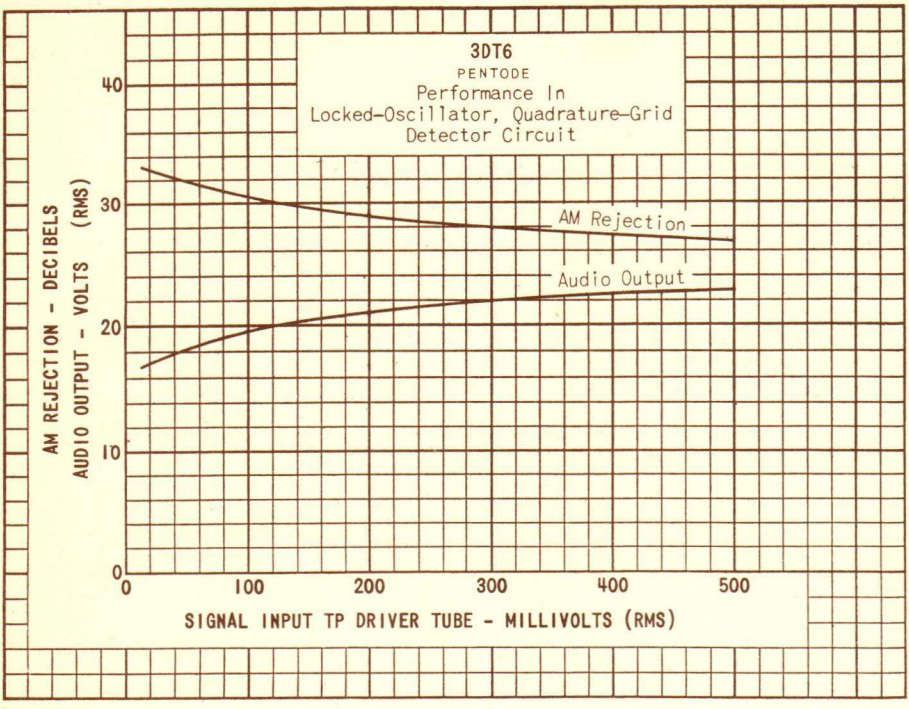
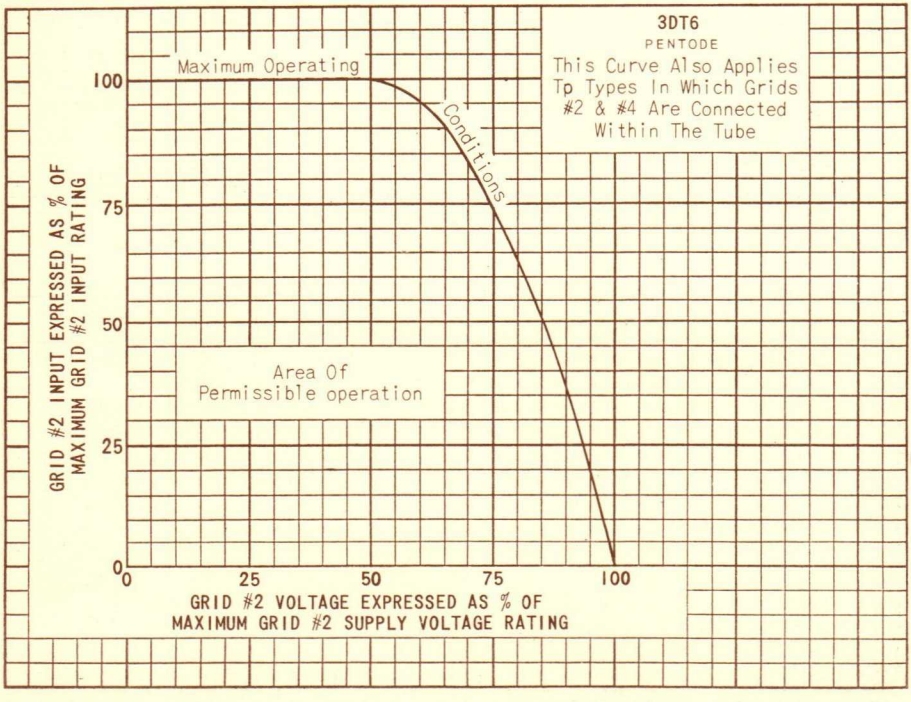
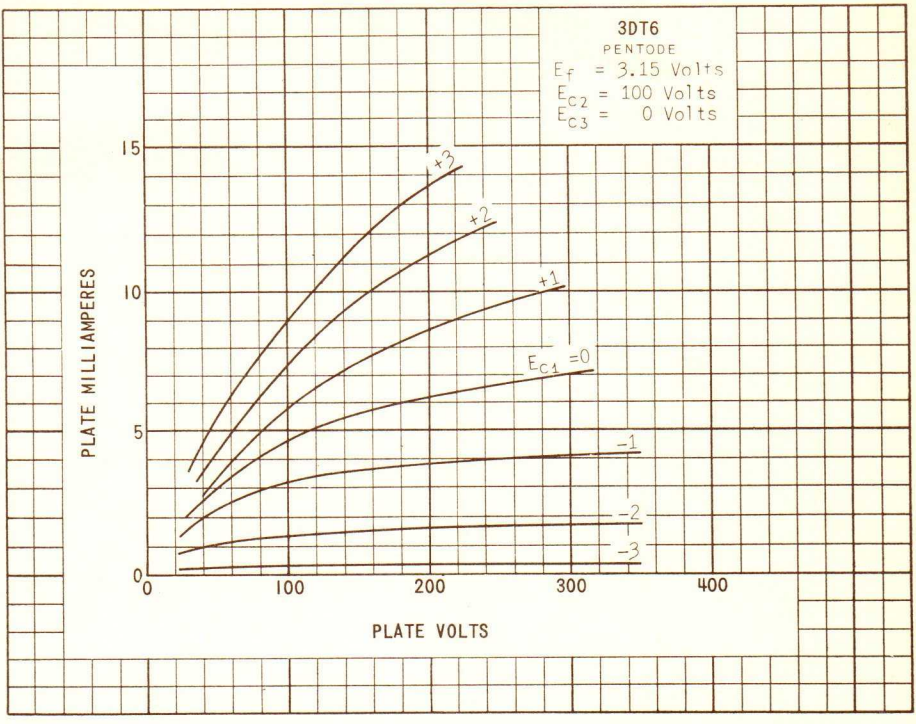
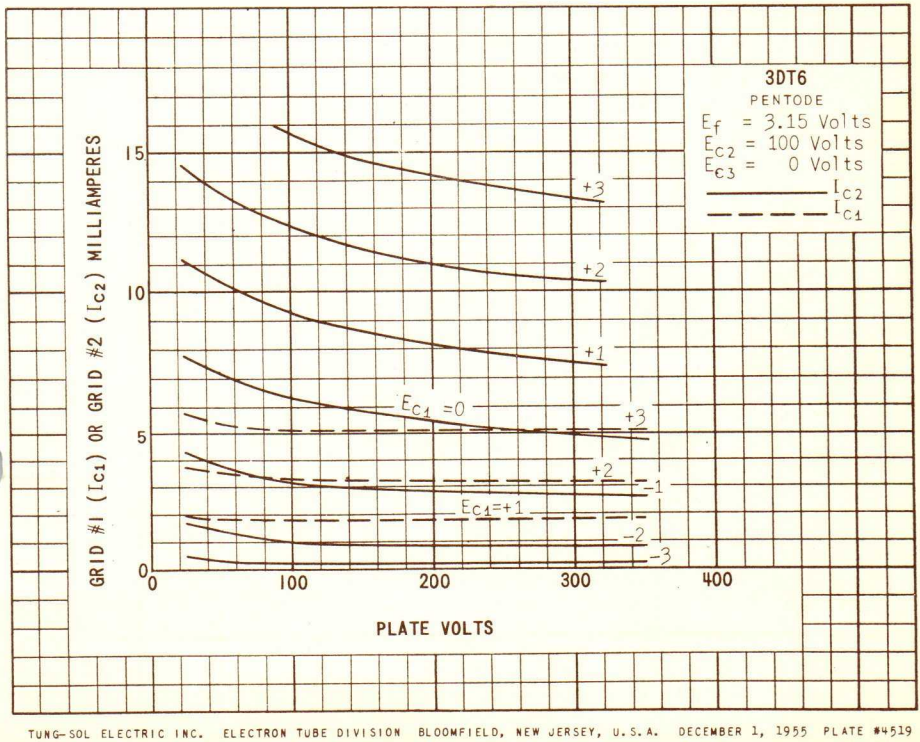

3DT6
PENTODE
Performance In
Locked-Oscillator, Quadrature-Grid
Detector Circuit
AM Rejection
Audio Output
AM REJECTION - DECIBELS
AUDIO OUTPUT - VOLTS (RMS)
0
10
20
30
40
0
100
200
300
400
500
SIGNAL INPUT TP DRIVER TUBE - MILLIVOLTS (RMS)


3DT6
PENTODE
This Curve Also Applies
Tp Types In Which Grids
#2 & #4 Are Connected
Within The Tube
Maximum Operating
Conditions
Area Of
Permissible operation
GRID #2 INPUT EXPRESSED AS % OF
MAXIMUM GRID #2 INPUT RATING
0
25
50
75
100
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS % OF
MAXIMUM GRID #2 SUPPLY VOLTAGE RATING





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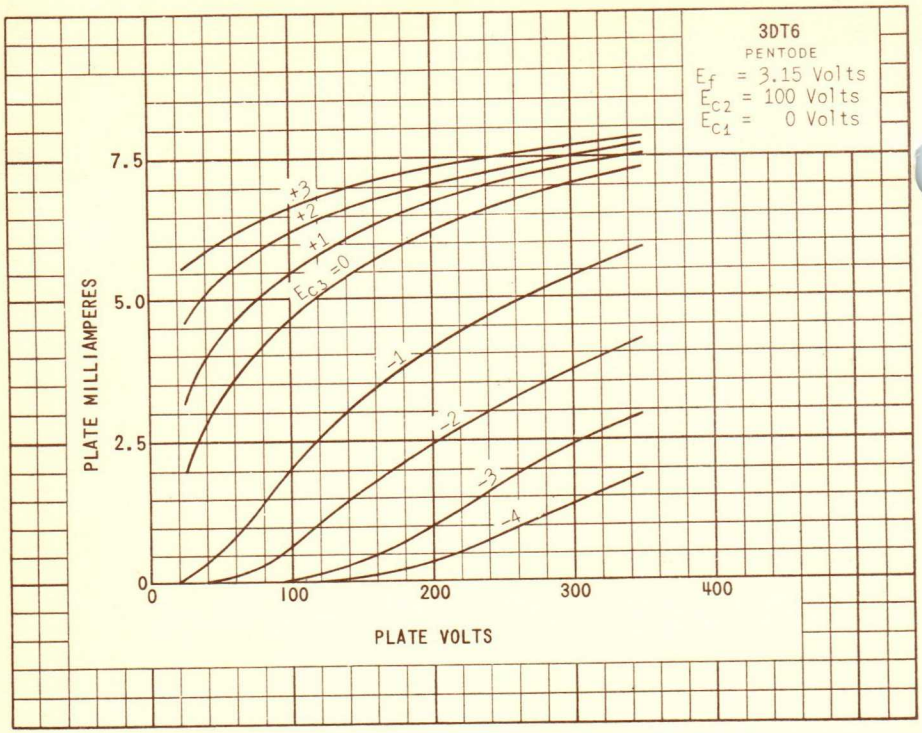
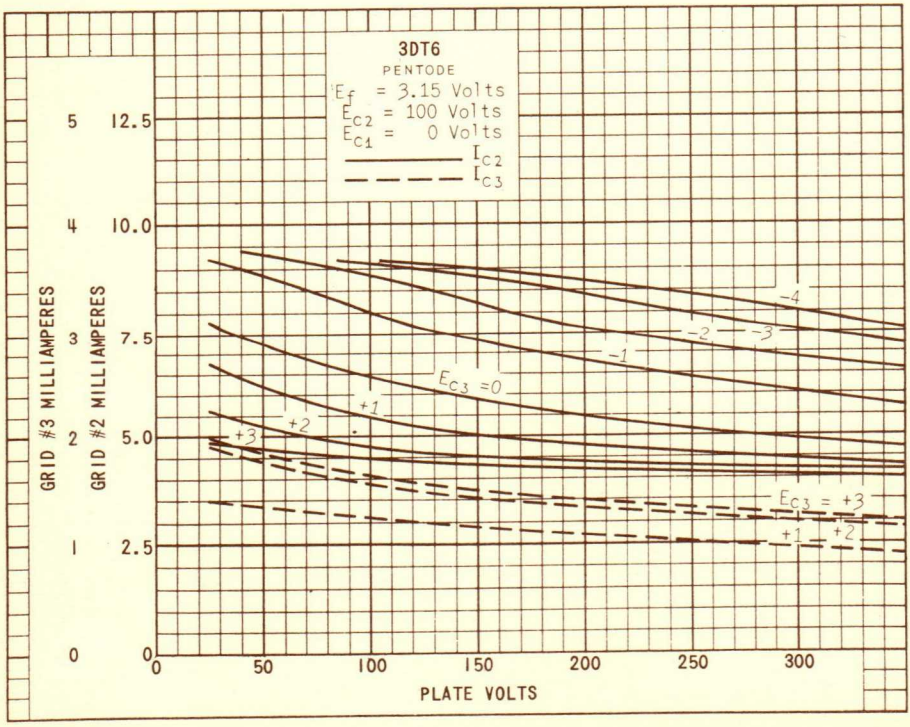
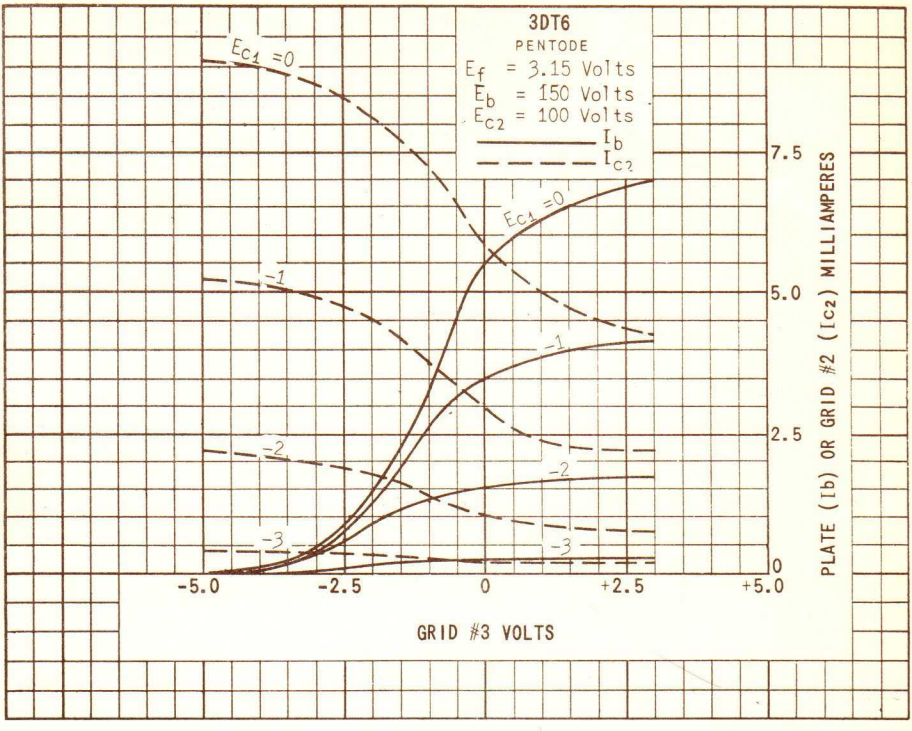
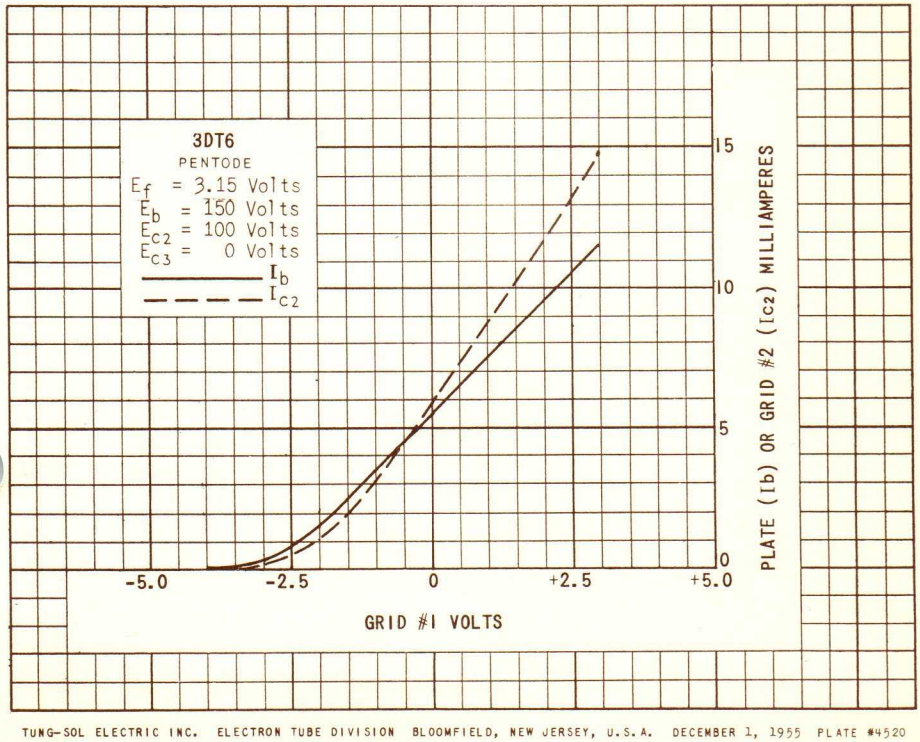

3DT6
PENTODE
E_f = 3.15 Volts
E_{c2} = 100 Volts
E_{c1} = 0 Volts
PLATE MILLIAMPERES
7.5
5.0
2.5
0
+3
+2
+1
E_{c3} =0
-1
-2
-3
-4
0
100
200
300
400
PLATE VOLTS


3DT6
PENTODE
E_f = 3.15 Volts
E_{c2} = 100 Volts
E_{c1} = 0 Volts
I_{c2}
I_{c3}
GRID #3 MILLIAMPERES
GRID #2 MILLIAMPERES
5
4
3
2
1
0
12.5
10.0
7.5
5.0
2.5
0
-4
-2
-3
-1
E_{c3} =0
+1
+2
+3
E_{c3} = +3
+1
+2
0
50
100
150
200
250
300
PLATE VOLTS


3DT6
PENTODE
Ef = 3.15 Volts
Eb = 150 Volts
Ec2 = 100 Volts
Ib
Ic2
Ec1 =0
-1
-2
-3
7.5
5.0
2.5
0
-5.0
-2.5
0
+2.5
+5.0
GRID #3 VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES

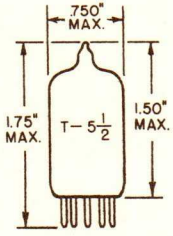

3DT6
PENTODE
Ef = 3.15 Volts
Eb = 150 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
Ib
Ic2
15
10
5
0
-5.0
-2.5
0
+2.5
+5.0
GRID #1 VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES

TUNG-SOL

TRIODE

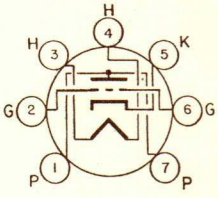
MINIATURE TYPE

MEDIUM MU TRIODE
FOR
UHF OSCILLATOR SERVICE



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-1

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
7 DK

THE 3DZ4 IS A MEDIUM MU TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR UHF OSCILLATOR SERVICE. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 3DZ4 IS IDENTICAL TO THE 2DZ4 AND THE 6DZ4.

DIRECT INTERELECTRODE CAPACITANCES
WITH SHIELD

GRID TO PLATE	1.8	pf
INPUT: G TO (H + K + E.S.)	2.2	pf
OUTPUT: P TO (H + K + E.S.)	1.3	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.2 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.
HEATER - CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		180	VOLTS
HEATER POSITIVE WITH-RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		180	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

UHF OSCILLATOR SERVICE

PLATE VOLTAGE	135	VOLTS
NEGATIVE GRID VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.3	WATTS
CATHODE CURRENT	20	MA.
GRID CURRENT	2	MA.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A1 AMPLIFIER

PLATE SUPPLY VOLTAGE		80	VOLTS
PLATE DROPPING RESISTOR		2,700	OHMS
PLATE CURRENT		15	MA.
TRANSCONDUCTANCE		6,700	μMHOS
AMPLIFICATION FACTOR		14	
PLATE RESISTANCE	APPROX.	2,000	OHMS
GRID VOLTAGE FOR I_b = 20 μA	APPROX.	-11	VOLTS

OSCILLATOR AT 1000 Mc/s

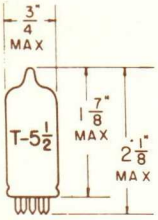
MEASURED IN JEDEC STANDARD OSCILLATOR NO. 400

PLATE SUPPLY VOLTAGE		80	VOLTS
PLATE DROPPING RESISTOR		2,700	OHMS
GRID RESISTOR		10,000	OHMS
PLATE CURRENT		15.5	MA.
GRID CURRENT	APPROX.	800	μA

TUNG-SOL

TETRODE

MINIATURE TYPE



GLASS BULB

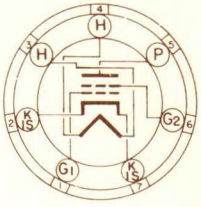
COATED UNIPOTENTIAL CATHODE

HEATER

2.9 VOLTS 0.45±6% AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON MINIATURE
7 PIN BASE

7EW

THE 3EA5 IS A SHARP CUTOFF TETRODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR HIGH PLATE VOLTAGE OPERATION AS AN RF AMPLIFIER IN VHF TUNERS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND WARM-UP TIME, THE 2EA5 IS IDENTICAL TO THE 2EA5 AND 6EA5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE (G1 TO P) (MAX.)	0.05	0.06	μμf
INPUT: G1 TO (H+K+G2+I.S.)	4.5	3.8	μμf
OUTPUT: P TO (H+K+G2+I.S.)	3.0	2.3	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	2.9	2.9	2.9	VOLTS
MAXIMUM PLATE VOLTAGE	250	250	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	150	150	VOLTS
MAXIMUM PLATE DISSIPATION	3.25	3.25	3.25	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	0.5	0.5	WATTS
MAXIMUM CATHODE CURRENT (DC)	20	20	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK	200	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC	100	100	100	VOLTS
TOTAL DC AND PEAK	200	200	200	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	11.0	11.0	SECONDS

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN 2.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	2.9	2.9	2.9	VOLTS
HEATER CURRENT	0.45±6%	0.45±6%	0.45±6%	AMPS.
PLATE VOLTAGE	250	250	250	VOLTS
GRID #2 VOLTAGE	140	140	140	VOLTS
GRID #1 VOLTAGE	−1.0	−1.0	−1.0	VOLTS
PLATE RESISTANCE (APPROX.)	0.15	0.15	0.15	MEGOHM
TRANSCONDUCTANCE	8000	8000	8000	μMHO
PLATE CURRENT	10	10	10	MA.
GRID #2 CURRENT	0.95	0.95	0.95	MA.
GRID #1 VOLTAGE FOR GM LESS THAN 100 μMHO	−6	−6	−6	VOLTS

B

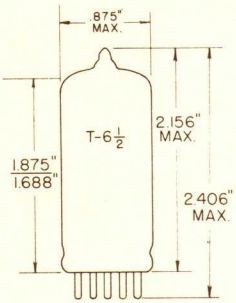
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

REMOTE-CUTOFF PENTODE

MINIATURE TYPE

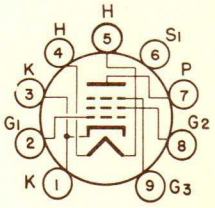


GLASS BULB
MINIATURE
9 PIN BASE E9-1

UNIPOTENTIAL CATHODE

HIGH Gm, SMALL SIGNAL
RF & IF AMPLIFIER
WITH GAIN CONTROL

SERIES STRING OPERATION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9AQ

THE 3EH7 IS A REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT FEATURES VERY HIGH Gm WITH A REMOTE CUTOFF AND IS DESIGNED FOR FREQUENCIES INTO THE VHF RANGE. ITS CHIEF APPLICATION IS IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: (G1 TO P) MAX.	0.0055	pf
INPUT: G1 TO (H+G2+G3+K+IS)	9.5	pf
OUTPUT: P TO (H+G2+G3+K+IS)	2.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.4 VOLTS	600	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER CATHODE VOLTAGE		165	VOLTS
HEATER WARM-UP TIME*		11	SECONDS

MAXIMUM RATINGS

DESING CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID #2 VOLTAGE	250	VOLTS
GRID #2 DISSIPATION	0.65	WATTS
CATHODE CURRENT	20	MA
GRID #1 CIRCUIT RESISTANCE	1	MEGOHM

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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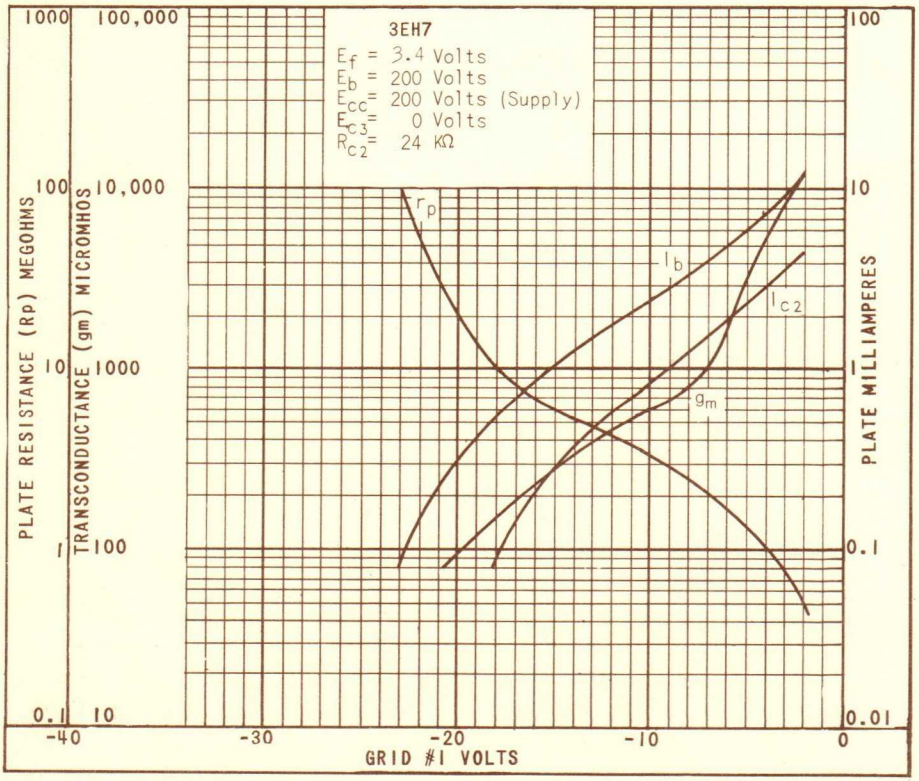
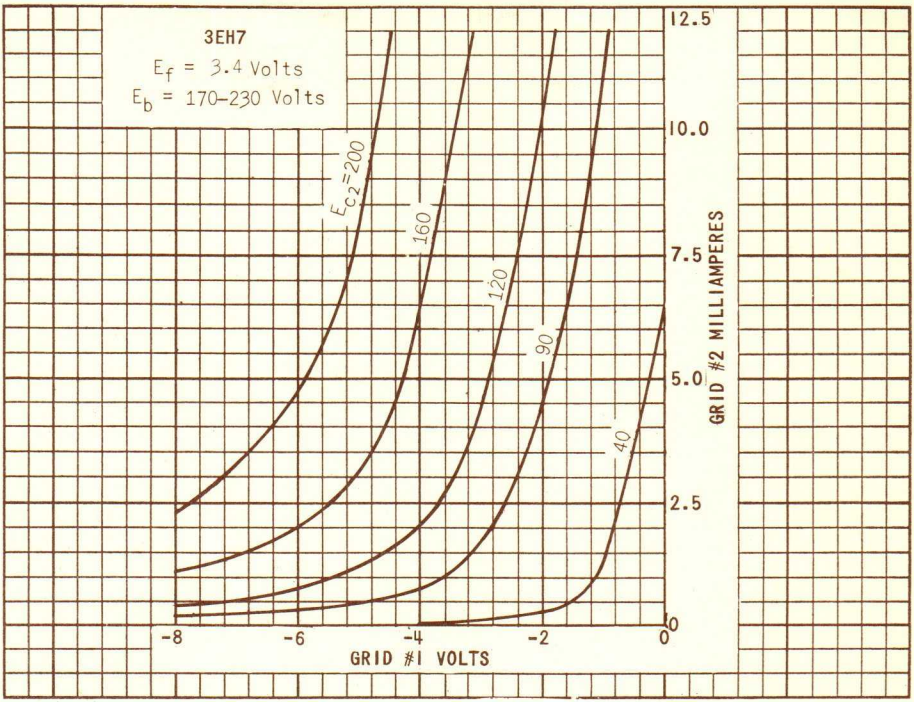
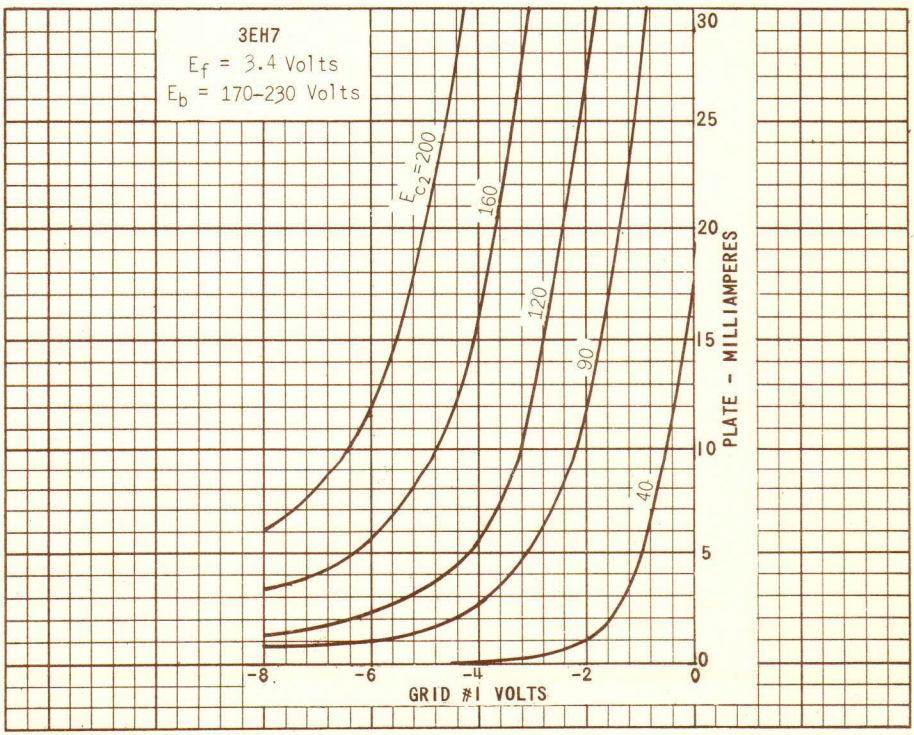
TYPICAL OPERATING CHARACTERISTICS

PLATE VOLTAGE	200	200	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE (SUPPLY)	90	200	VOLTS
GRID #2 SERIES RESISTOR	0	24	KILOHMS
GRID #1 VOLTAGE	-2	-2	VOLTS
PLATE CURRENT	12	---	MA.
GRID #2 CURRENT	4.5	---	MA.
TRANSCONDUCTANCE	12500	12500	μMHOS
PLATE RESISTANCE	0.5	---	MEGOHMS
GRID #1 IMPEDANCE AT 40 MC	13	---	KILOHMS
GRID #1 CUTOFF: E_{c1} =-6.5		1250	μMHOS
E_{c1} =-9.5		625	μMHOS
E_{c1}=-19.5		125	μMHOS
GRID #1 VOLTAGE FOR A CROSS-MODULATION FACTOR OF 1%:			
E_{c1} =-6.5		100	MV.
E_{c1} =-9.5		160	MV.
E_{c1}=-19.5		450	MV.







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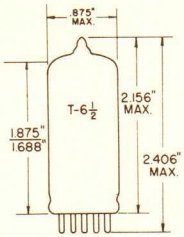
TUNG-SOL

SHARP CUTOFF PENTODE

MINIATURE TYPE



MINIATURE BUTTON 9 PIN BASE E9-1

OUTLINE DRAWING SPECIAL

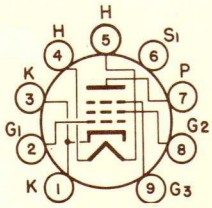
GLASS BULB

COATED UNIPOTENTIAL CATHODE

FOR IF CIRCUITS IN TV RECEIVERS

SERIES STRING OPERATION

ANY MOUNTING POSITION



BASING DIAGRAM
JEDEC 9AQ

BOTTOM VIEW

THE 3EJ7 IS A HIGH TRANSCONDUCTANCE SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS AN IF AMPLIFIER IN TELEVISION RECEIVERS. CONTROLLED HEATER WARM-UP TIME MAKES THE TUBE SUITABLE FOR SERIES STRING OPERATION.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	.005	pf
INPUT: G1 TO (H+K+G2+G3+I.S.)	10	pf
OUTPUT: P TO (H+K+G2+G3+I.S.)	3	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.4 VOLTS	600	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		150	VOLTS
HEATER WARM-UP TIME [A]		11	SECONDS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239 [B]

PLATE VOLTAGE WITH Ib = 0 MA.	550	VOLTS
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE WITH Ic2 = 0 MA	550	VOLTS
GRID #2 VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID #2 DISSIPATION	0.9	WATTS
CATHODE CURRENT	25	MA.
GRID #1 CIRCUIT RESISTANCE	1.0	MEGOHM

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CHARACTERISTICS

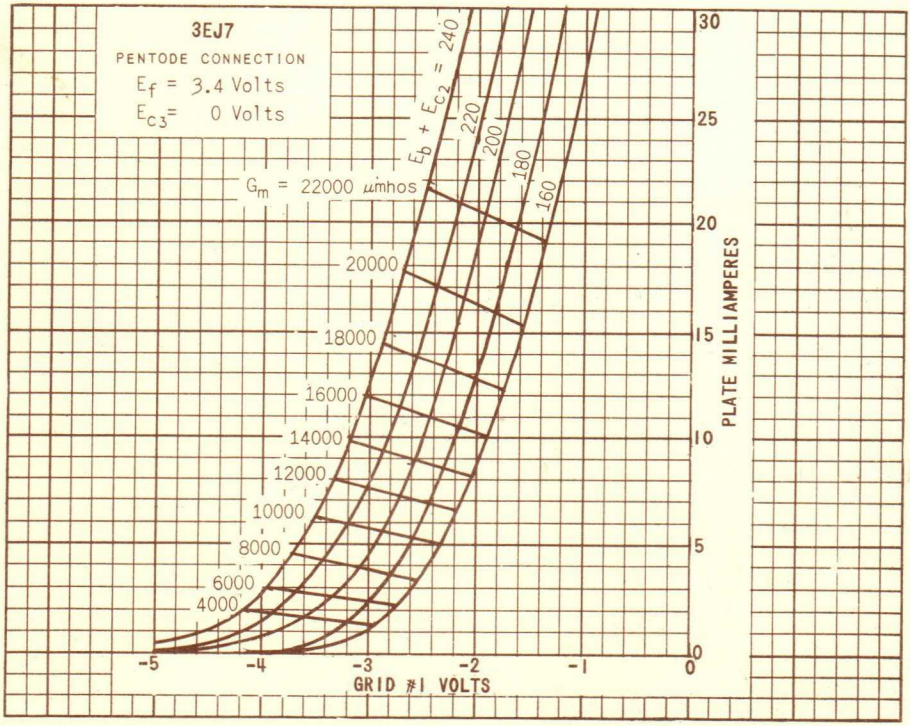
CLASS A_1 AMPLIFIER

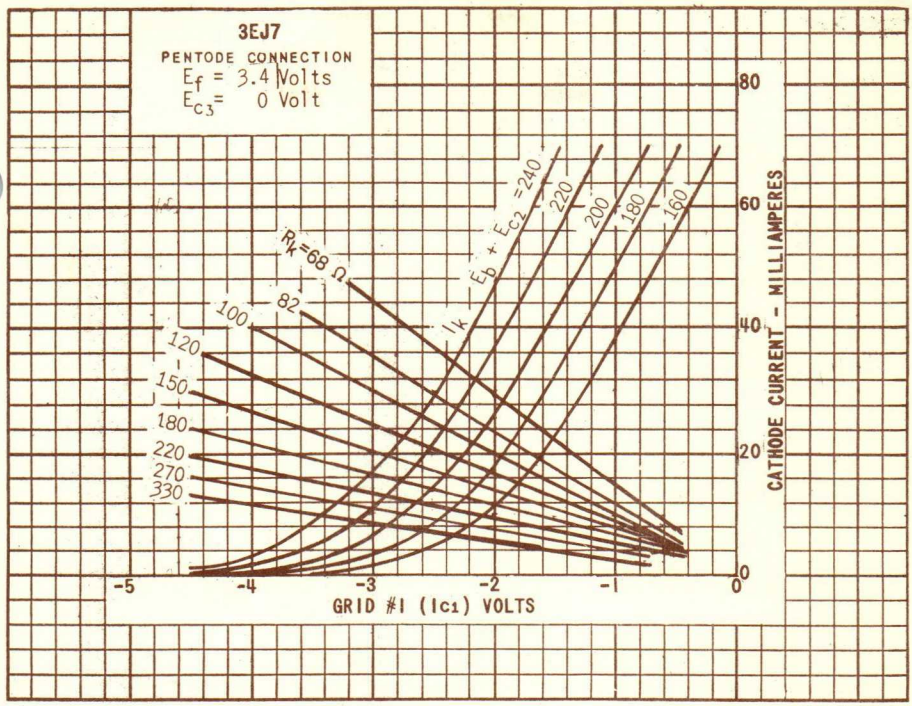
PLATE VOLTAGE	200	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 VOLTAGE	200	VOLTS
GRID #1 VOLTAGE	−2.5	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	4.1	MA.
TRANSCONDUCTANCE	15000	μMHOS
AMPLIFICATION FACTOR (G2 TO G1)	60	
PLATE RESISTANCE (APRROX)	0.35	MEGOHM
GRID #1 IMPEDANCE AT 40MC	30000	OHMS[C]

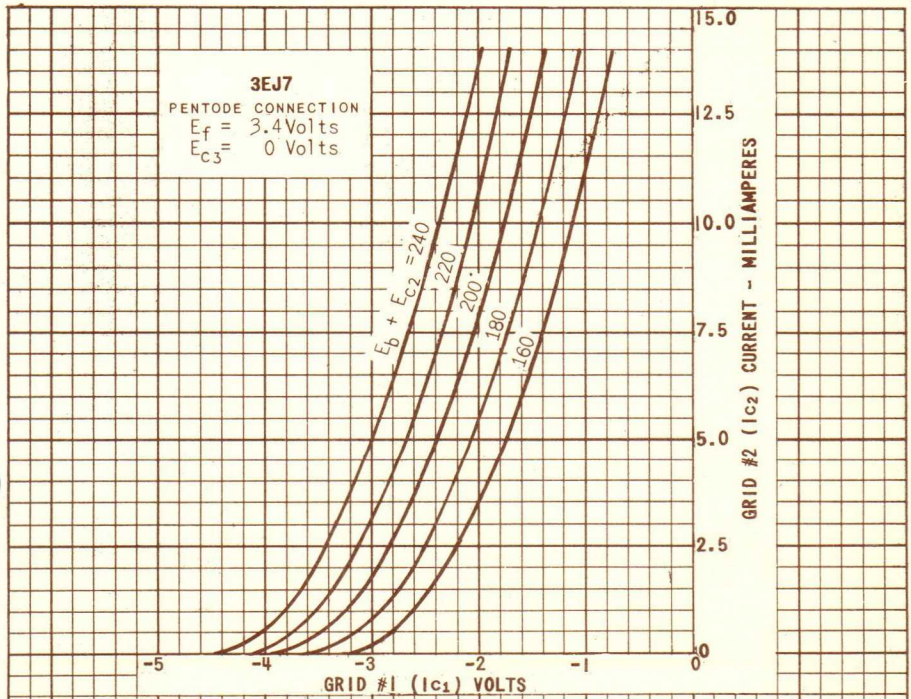
[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[B] FOR SERIES OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

[C] INPUT DAMPING OF TUBE AND TYPICAL CERAMIC SOCKET WITH BOTH CATHODE LEADS TIED DIRECTLY TO GROUND IS ABOUT 10,000 OHMS.







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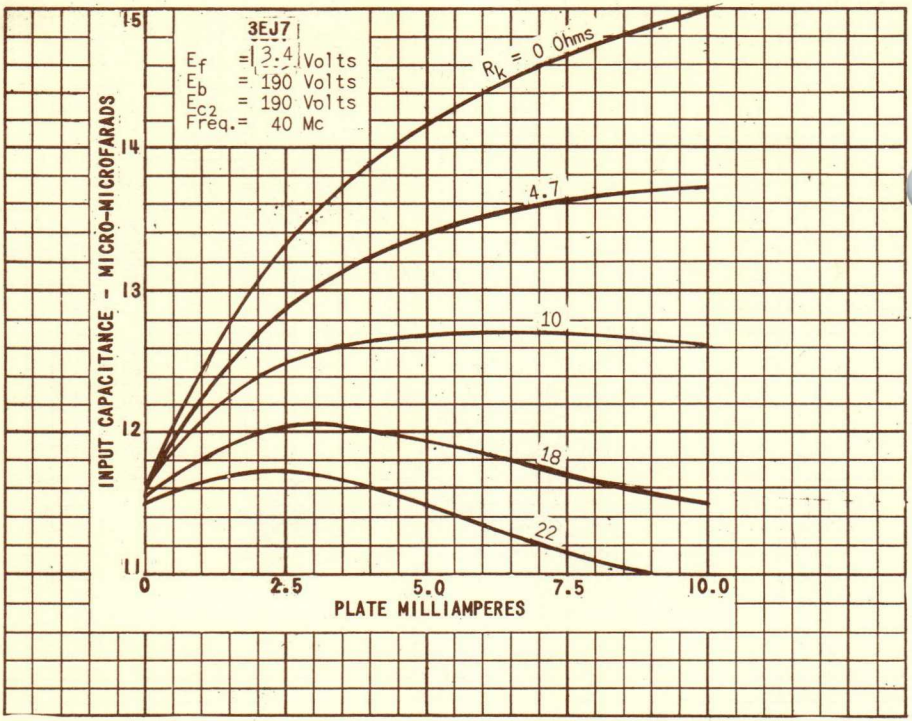
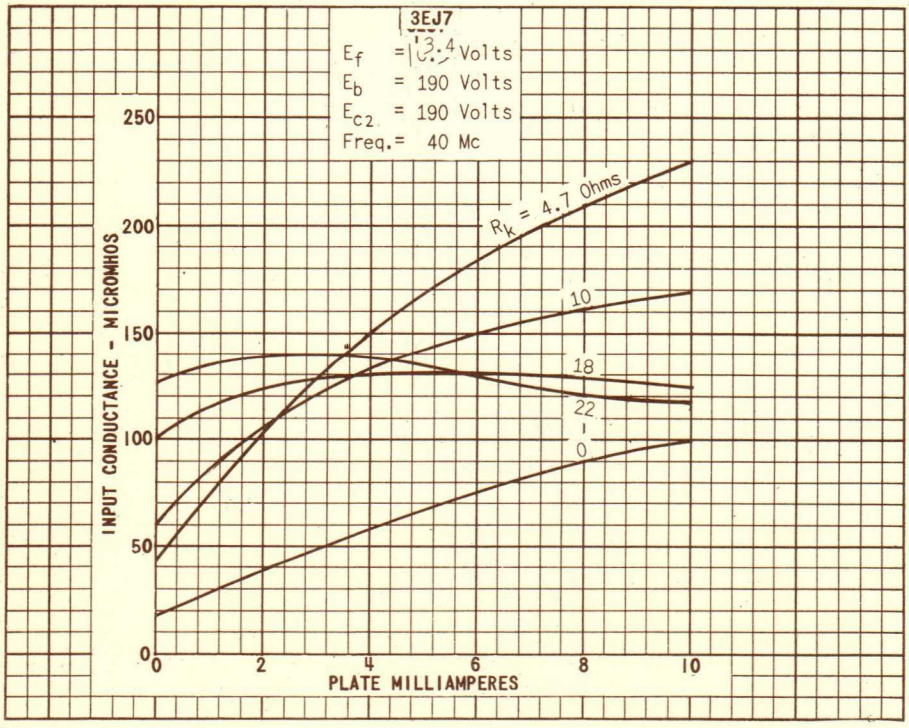
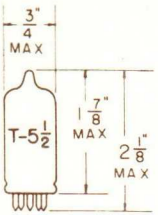

3EJ7
E_f = 13.4 Volts
E_b = 190 Volts
E_{c2} = 190 Volts
Freq.= 40 Mc
R_k = 0 Ohms
4.7
10
18
22
INPUT CAPACITANCE - MICRO-MICROFARADS
15
14
13
12
11
0
2.5
5.0
7.5
10.0
PLATE MILLIAMPERES


3EJ7
E_f = 13.4 Volts
E_b = 190 Volts
E_{c2} = 190 Volts
Freq.= 40 Mc
R_k = 4.7 Ohms
10
18
22
0
INPUT CONDUCTANCE - MICROMHOS
250
200
150
100
50
0
0
2
4
6
8
10
PLATE MILLIAMPERES

TUNG-SOL

TETRODE

MINIATURE TYPE



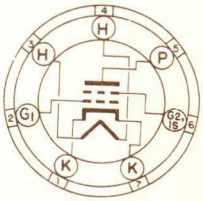
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

2.8 VOLTS 0.45 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

THE 3ER5 IS A REMOTE CUT-OFF FRAME GRID TETRODE DESIGNED ESPECIALLY FOR V.H.F. TELEVISION TUNERS. SEPARATE CATHODE LEADS PROVIDE LOW LEAD INDUCTANCE; THE SCREEN GRID IS DESIGNED PRIMARILY AS A SHIELD TO REDUCE DIRECT GRID TO PLATE CAPACITANCE. EXCEPT FOR HEATER RATINGS THE 3ER5 IS IDENTICAL TO THE 2ER5 AND 6ER5.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD	
PLATE TO GRID	0.38	0.36	μμf
GRID TO ALL OTHER ELECTRODES EXCEPT PLATE	4.4	4.4	μμf
PLATE TO ALL OTHER ELECTRODES EXCEPT GRID	3.0	4.0	μμf
GRID TO HEATER (MAX.)	0.28	0.28	μμf
PLATE TO CATHODE	0.24	0.20	μμf
GRID TO CATHODE	3.1	3.1	μμf
CATHODE TO HEATER	2.8	2.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	2.8	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM CATHODE CURRENT	20	MAMPS
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM VOLTAGE BETWEEN CATHODE AND HEATER	100	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM CIRCUIT RESISTANCE BETWEEN CATHODE AND HEATER	20 000	OHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	2.8	2.8		VOLTS
HEATER CURRENT	0.45	0.45		AMP.
PLATE VOLTAGE	200			VOLTS
GRID VOLTAGE	-1.2	-3.8	-5.6	VOLTS
PLATE CURRENT	10			MAMPS
TRANSCONDUCTANCE	10 500	500	100	μMHOS
AMPLIFICATION FACTOR	80			
GRID VOLTAGE FOR A CROSS-MODULATION FACTOR OF 1% (RMS)	100	100	100	MV.

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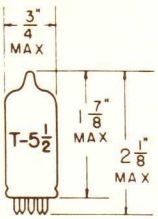
TUNG-SOL

HI-MU TRIODE ←

MINIATURE TYPE



GLASS BULB

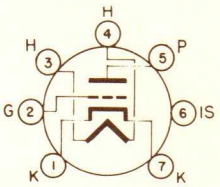
BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER

2.8 VOLTS 0.45 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7FP

THE 3ER5 IS A HIGH TRANSCONDUCTANCE SHIELDED TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED ESPECIALLY FOR USE IN V.H.F. TELEVISION TUNERS. SEPARATE CATHODE LEADS PROVIDE LOW LEAD INDUCTANCE AND THE INTERNAL SHIELD REDUCES DIRECT GRID TO PLATE CAPACITANCE. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 3ER5 IS IDENTICAL TO THE 2ER5 AND THE 6ER5.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD	
PLATE TO GRID	0.38	0.36	μμf
GRID TO ALL OTHER ELECTRODES EXCEPT PLATE	4.4	4.4	μμf
PLATE TO ALL OTHER ELECTRODES EXCEPT GRID	3.0	4.0	μμf
GRID TO HEATER (MAX.)	0.28	0.28	μμf
PLATE TO CATHODE	0.24	0.20	μμf
GRID TO CATHODE	3.1	3.1	μμf
CATHODE TO HEATER	2.8	2.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	2.8	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM CATHODE CURRENT	20	MAMPS
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM VOLTAGE BETWEEN CATHODE AND HEATER	100	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM CIRCUIT RESISTANCE BETWEEN CATHODE AND HEATER	20 000	OHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	2.8	2.8		VOLTS
HEATER CURRENT	0.45	0.45		AMP.
PLATE VOLTAGE	200			VOLTS
GRID VOLTAGE	-1.2	-3.8	-5.6	VOLTS
PLATE CURRENT	10			MAMPS
TRANSCONDUCTANCE	10 500	500	100	μMHOS
AMPLIFICATION FACTOR	80			
GRID VOLTAGE FOR A CROSS-MODULATION FACTOR OF 1% (RMS)	100	100	100	MV.

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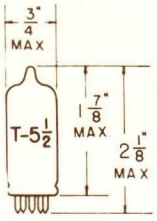
TRIODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

3.0 VOLTS 0.45±6% AMP.

ANY MOUNTING POSITION

BOTTOM VIEW

SMALL BUTTON MINIATURE

7 PIN BASE

7FP

THE 3ES5 IS A TRIODE TUNER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN GROUNDED CATHODE RF AMPLIFIERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 3ES5 IS IDENTICAL TO THE 2ES5 AND THE 6ES5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G TO P (MAX.)	0.5	0.5	μμf
INPUT: G TO (H+K+I.S.)	3.2	3.2	μμf
OUTPUT: P TO(H+K+I.S.)	4.0	3.2	μμf

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN 1.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	3.0	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM POSITIVE GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE: (TOTAL DC AND PEAK)		
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.) *	11.0	SECONDS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	3.0	VOLTS
HEATER CURRENT	0.45±6%	AMP.
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

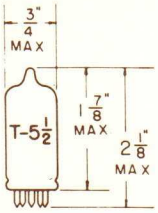
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

B DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

TETRODE

MINIATURE TYPE



GLASS BULB

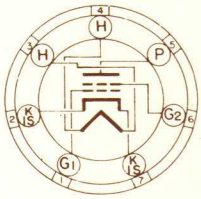
COATED UNIPOTENTIAL CATHODE

HEATER

2.9 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
7 PIN BASE
7EW

THE 3EV5 IS A HIGH GAIN, SHARP-CUTOFF SEVEN PIN TETRODE DESIGNED PARTICULARLY FOR SERVICE IN V.H.F. TELEVISION TUNERS. IT HAS HIGH TRANSCONDUCTANCE, EXTREMELY LOW SCREEN CURRENT AND HIGH INPUT IMPEDANCE AT 200 MC. RESULTING IN IMPROVED NOISE FIGURE. EXCEPT FOR HEATER RATINGS, THE 3EV5 IS IDENTICAL TO THE 2EV5 AND IS SIMILAR TO THE 6EV5.

DIRECT INTERELECTRODE CAPACITANCES[A]

WITH EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.035	μμf
INPUT	4.50	μμf
OUTPUT	2.90	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	2.9	VOLTS
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CHART	
MAXIMUM PLATE DISSIPATION	3.25	WATTS
MAXIMUM GRID #2 DISSIPATION	0.2	WATTS
MAXIMUM GRID #1 VOLTAGE:		
POSITIVE VALUE	0	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
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
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHM

[A] WITH SHIELD #316 CONNECTED TO PIN #2.

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABEE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TUNG-SOL

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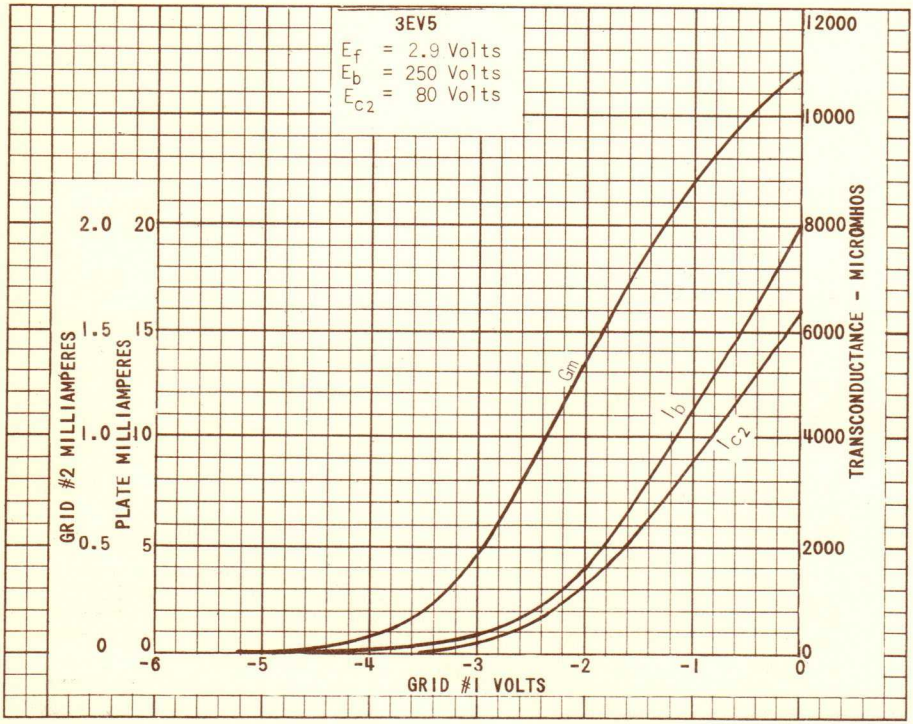
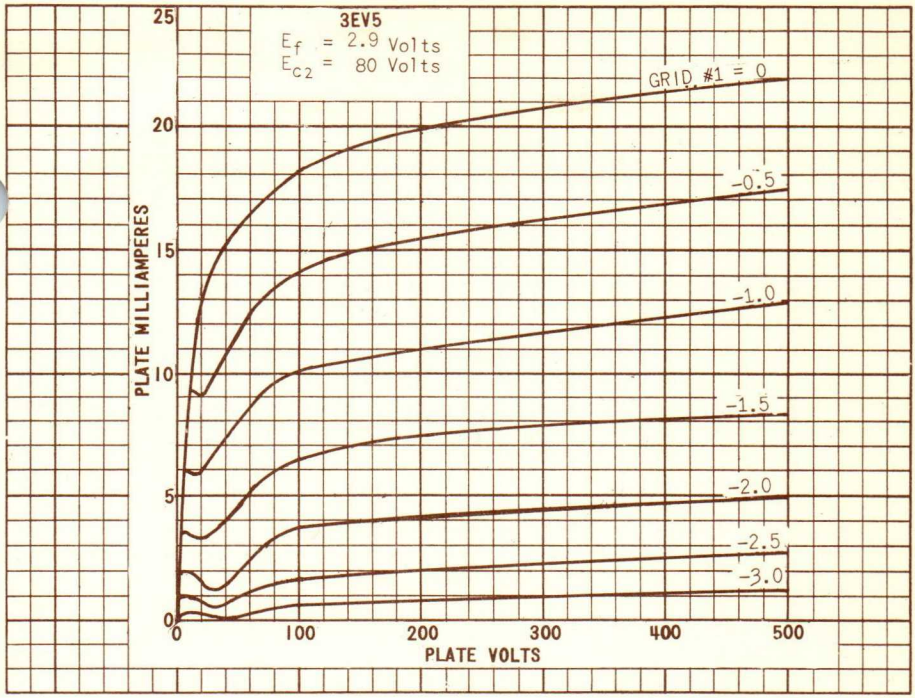
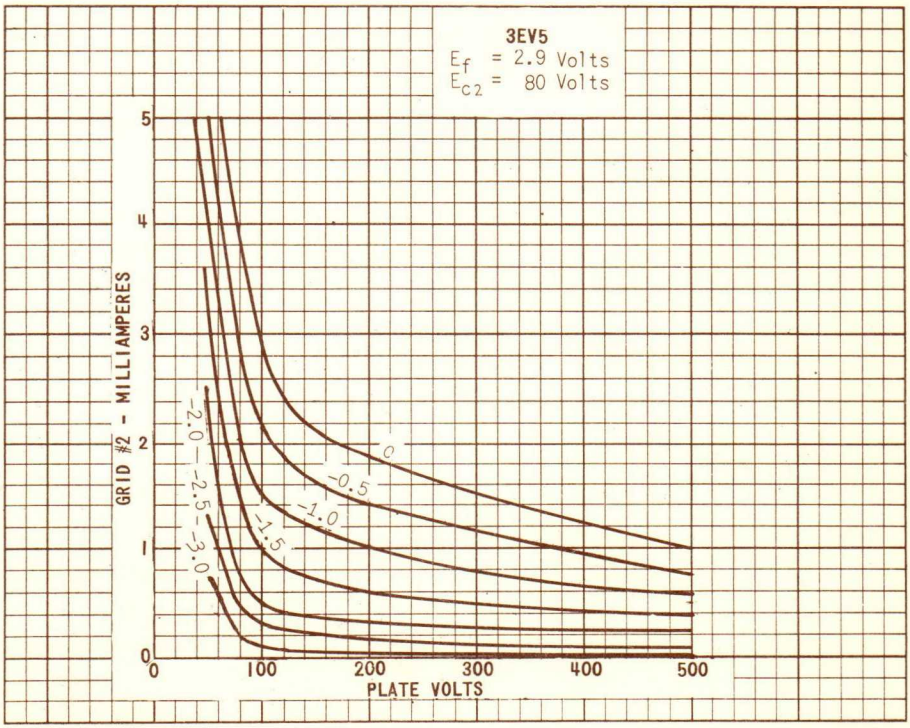
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	2.9	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	-1	VOLTS
PLATE RESISTANCE	0.150	MEGOHM
TRANSCONDUCTANCE	8800	μMHOS
GRID #1 CUTOFF BIAS[C]	4.5	VOLTS
PLATE CURRENT	11.5	MA.
GRID #2 CURRENT	0.90	MA.

[C] FOR TRANSCONDUCTANCE OF 100 μMHOS.







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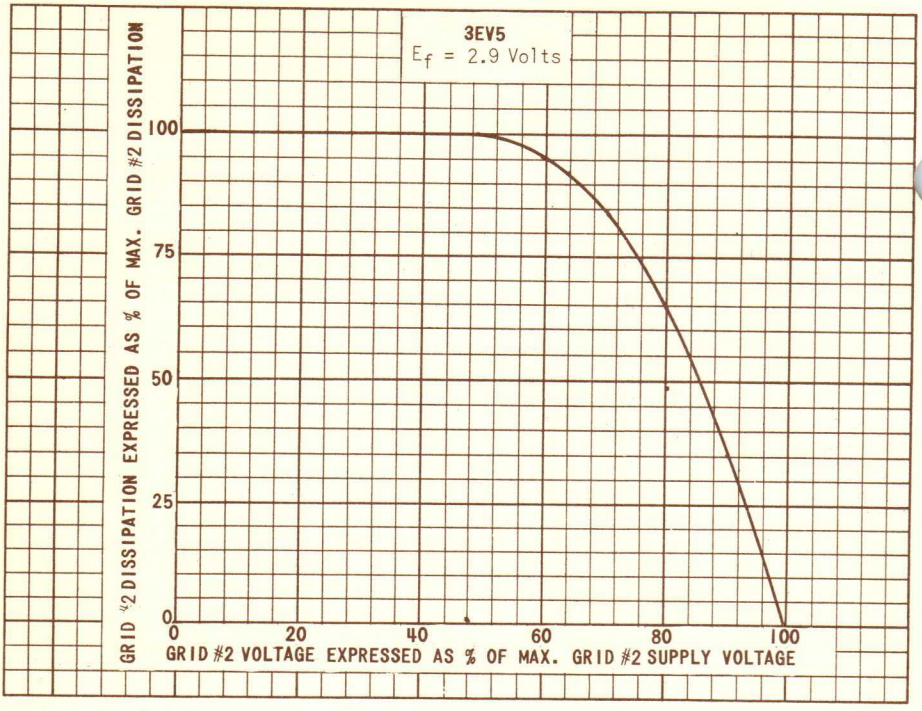

3EV5
E_f = 2.9 Volts
GRID #2 DISSIPATION EXPRESSED AS % OF MAX. GRID #2 DISSIPATION
100
75
50
25
0
0
20
40
60
80
100
GRID #2 VOLTAGE EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE

TUNG-SOL

TRIODE

MINIATURE TYPE

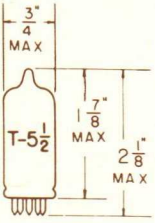
COATED UNIPOTENTIAL CATHODE

HEATER

3.0 VOLTS 0.45±6% AMP.

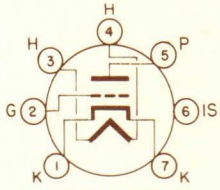
AC OR DC

ANY MOUNTING POSITION



GLASS BULB

SMALL BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7FP

THE 3FH5 IS A NEUTRODE TRIODE TUNER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN GROUNDED CATHODE RF AMPLIFIERS, WITH THE NEUTRODE CONSTRUCTION PROVIDING A LOWER GRID TO PLATE CAPACITANCE WITH CONSEQUENT EASE OF NEUTRALIZATION. THE CONVENTIONAL GRID RESULTS IN LOW INPUT CAPACITANCE. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 3FH5 IS IDENTICAL TO THE 2FH5 AND 6FH5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
GRID TO PLATE: G TO P (MAX.) (BOGEY)	→ 0.52	→ 0.52	pf
INPUT: G TO (H+K+I.S.)	3.2	3.2	pf
OUTPUT: P TO (H+K+I.S.)	4.0	3.2	pf

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN #1.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	3.0	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID VOLTAGE (POSITIVE)	0	VOLT
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	MEGOHM
→ MAXIMUM DC HEATER-CATHODE VOLTAGE (TOTAL DC AND PEAK)		
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLI FIER

HEATER VOLTAGE	3.0	VOLTS
HEATER CURRENT	0.45±6%	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	−1.0	VOLT
PLATE RESISTANCE (APPROX.)	5600	OHMS
TRANSCONDUCTANCE	9000	μMHOS
AMPLIFICATION FACTOR	50	
PLATE CURRENT	11	MA.
GRID VOLTAGE (APPROX.) FOR 100 μA PLATE CURRENT	−5.5	VOLTS

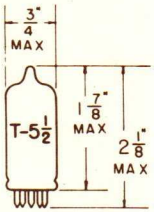
* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VALUE AFTER APPLYING FOUR TIMES THE RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE EQUAL TO THREE TIMES THE RATED HEATER VOLTAGE DIVIDED BY THE RATED HEATER CURRENT.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

TRIODE

MINIATURE TYPE



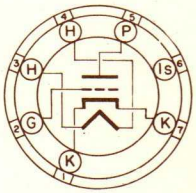
GLASS BULB
5-2

COATED UNIPOTENTIAL CATHODE

HEATER

2.8[A] VOLTS 0.45[B] AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7FP

THE 3FQ5 IS A SEMI-REMOTE CUTOFF TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF AND RF AMPLIFIER AT A B+ OF 135 VOLTS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 3FQ5 IS IDENTICAL TO THE 2FQ5 AND THE 6FQ5.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD

GRID TO PLATE	0.4	μμf
INPUT: G TO (H+K+I.S.+E.S.)	4.8	μμf
OUTPUT: P TO (H+K+I.S.+E.S.)	4.0	μμf
HEATER TO CATHODE	2.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE[D]	2.8[A]	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	1.0	MEGOHMS
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
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE[D]	2.8[A]	VOLTS
HEATER CURRENT[D]	0.45±.03	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	-1.2	VOLTS
PLATE CURRENT	11.5	MA.
TRANSCONDUCTANCE	11 000	μMHOS
AMPLIFICATION FACTOR	60	
PLATE RESISTANCE (APPROX.)	5 500	OHMS
Ec FOR Ib = 100 μA (APPROX.)	-5	VOLTS

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TUNG-SOL

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NOTES

A THE BOGEY VALUE OF VOLTAGE/CURRENT PRECEDING THIS NOTE IS OBTAINED WHEN OPERATING THE HEATER WITH THE SPECIFIED VALUE OF CURRENT/VOLTAGE.

B FOR SERIES/PARALLEL OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER/CURRENT VOLTAGE.

C DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

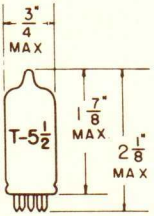
D HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE/CURRENT WITHIN THE SPECIFIED TOLERANCE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

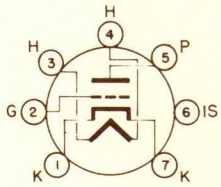
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER

2.8 VOLTS 0.45[B] AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7FP

THE 3FQ5A IS A SEMI-REMOTE CUTOFF TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF AND RF AMPLIFIER AT A B+ OF 135 VOLTS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 3FQ5A IS IDENTICAL TO THE 2FQ5A AND THE 6FQ5A.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD

GRID TO PLATE	0.52	pf
INPUT: G TO (H+K+I.S.+E.S.)	5.0	pf
OUTPUT: P TO (H+K+I.S.+E.S.)	3.5	pf
HEATER TO CATHODE	2.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[C]

HEATER VOLTAGE[D]	2.8	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	1.0	MEGOHMS
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
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE[D]	2.8	VOLTS
HEATER CURRENT[D]	0.45±.03	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	-1.2	VOLTS
PLATE CURRENT	8.9	MA.
TRANSCONDUCTANCE	12000	μMHOS
AMPLIFICATION FACTOR	74	
PLATE RESISTANCE (APPROX.)	6300	OHMS
Ec FOR Ib = 100 μA (APPROX.)	-4.5	VOLTS

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NOTES

[B] FOR SERIES/PARALLEL OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER/CURRENT VOLTAGE.

[C] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[D] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE/CURRENT WITHIN THE SPECIFIED TOLERANCE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

TRIODE

MINIATURE TYPE

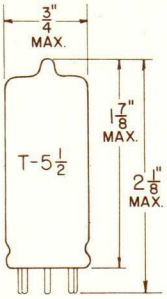
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES SUPPLY

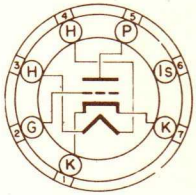
3.1 VOLTS 0.45 AMP.

ANY MOUNTING POSITION



GLASS BULB

5-2



BOTTOM VIEW

7FP

THE 3FY5 IS A REMOTE CUT-OFF, FRAME GRID SHIELDED TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR SERVICE IN VHF TUNERS OF TELEVISION RECEIVERS, AND IS CONTROLLED FOR LOW NOISE FIGURE AT 220 MC/S AND OPERATION AT LOW SUPPLY VOLTAGES. EXCEPT FOR HEATER RATINGS, THE 3FY5 IS IDENTICAL TO THE 2FY5 AND THE 6FY5.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT EXT. SHIELD	WITH EXT. SHIELD	
INPUT	4.75	4.75	μμf
OUTPUT	3.3	4.3	μμf
GRID TO HEATER (MAX.)	0.28	0.28	μμf
PLATE TO CATHODE	0.25	0.21	μμf
GRID TO CATHODE	3.2	3.2	μμf
CATHODE TO HEATER	2.5	2.5	μμf
PLATE TO GRID	0.50	0.48	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	3.1	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE VOLTAGE (ZERO PLATE CURRENT)	550	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM CATHODE-HEATER VOLTAGE	100	VOLTS
MAXIMUM CATHODE-HEATER CIRCUIT RESISTANCE	20 000	OHMS

TYPICAL OPERATION

HEATER VOLTAGE		3.3			VOLTS
HEATER CURRENT		0.45			AMP.
PLATE VOLTAGE	135	135	135	135	VOLTS
NEGATIVE GRID BIAS	1	3.1	5	4.5	VOLTS
PLATE CURRENT	11			0.1	MA.
TRANSCONDUCTANCE	13 000	625	125	---	μMHOS
AMPLIFICATION FACTOR	70				

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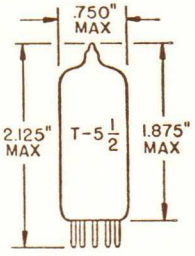
TUNG-SOL

TRIODE

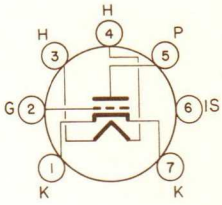
MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

SHIELDED TRIODE
FOR
NEUTRODE CIRCUIT
APPLICATIONS



BOTTOM VIEW
JEDEC 7 FP

THE 3GK5 IS A FRAME GRID GAIN CONTROLLED SHIELDED TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF RF AMPLIFIER AT A B+ OF 135 VOLTS.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD

GRID TO PLATE	0.52	pf
INPUT: G TO (H + K + I.S. + E.S.)	5.0	pf
OUTPUT: P TO (H + K + I.S. + E.S.)	3.5	pf
HEATER TO CATHODE	2.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	2.8 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED	600 ± 40		MA.
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

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MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

PLATE VOLTAGE	200	VOLTS
GRID VOLTAGE	-50	VOLTS
PLATE DISSIPATION	2.5	WATTS
DC CATHODE CURRENT	22	MA.
GRID CIRCUIT RESISTANCE - SELF BIAS	1.0	MEGOHMS

CHARACTERISTICS AND TYPICAL OPERATION

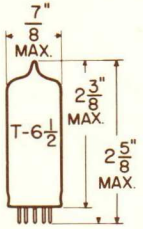
CLASS A1 AMPLIFIER

PLATE VOLTAGE		135	VOLTS
GRID VOLTAGE		-1.0	VOLTS
PLATE CURRENT		11.5	MA.
TRANSCONDUCTANCE		15,000	μMHOS
AMPLIFICATION FACTOR		78	
PLATE RESISTANCE	Approx.	5,400	OHMS
E_c FOR G_m = 150 μMHOS	Approx.	-4.2	VOLTS
E_c FOR G_m = 1,500 μ MHOS	Approx.	-2.5	VOLTS
HOT INPUT RESISTANCE - 200 Mc/s - GROUNDED PLATE		275	OHMS
HOT INPUT CAPACITANCE - 200 Mc/s - GROUNDED PLATE		11.2	pf
NOISE FIGURE - 200 Mc/s - OPTIMIZED NEUTRALIZED TRIODE RF AMPLIFIER STAGE, NOISE MATCHED		4.7	DB

TUNG-SOL

DUAL PENTODE

MINIATURE TYPE



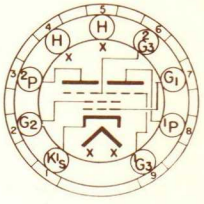
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

3.15 VOLTS 0.60 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON

9 PIN BASE

9LW

THE 3GS8 IS A DUAL PENTODE WITH A SEPARATE PLATE AND A SEPARATE #3 GRID IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS PRIMARILY INTENDED FOR SERVICE AS A COMBINED SYNC SEPARATOR-CLIPPER AND AGC TUBE IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 3GS8 IS IDENTICAL TO THE 4GS8 AND THE 6GS8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE (EACH SECTION)	2.0	μμf
GRID #1 TO ALL	6.0	μμf
GRID #3 (EACH SECTION) TO ALL	3.8	μμf
PLATE (EACH SECTION) TO ALL	3.2	μμf
GRID #3 (SECTION #1) TO GRID #3 (SECTION 2) (MAX.)	0.015	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM A

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM PLATE VOLTAGE (EACH SECTION)	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE (EACH SECTION)	3.0	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM PEAK POSITIVE GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.1	WATTS
MAXIMUM GRID #2 DISSIPATION	0.75	WATTS
MAXIMUM DC CATHODE CURRENT	12	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHM
MAXIMUM GRID #3 CIRCUIT RESISTANCE (EACH SECTION)	0.5	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.) *	11.0	SECONDS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

BOTH SECTIONS OPERATING

HEATER VOLTAGE	3.15		VOLTS
HEATER CURRENT	0.60		AMP.
* PLATE VOLTAGE (EACH SECTION)	100	100	VOLTS
GRID #2 VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE (EACH SECTION)	-10	0	VOLTS
GRID #1 VOLTAGE	NOTE B	NOTE B	
PLATE CURRENT (EACH SECTION)		2.0	MA.
GRID #2 CURRENT	6.0	3.6	MA.
CATHODE CURRENT	6.1	7.7	MA.

EACH SECTION OPERATING SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED.

PLATE VOLTAGE	100	100	VOLTS
GRID #2 VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	NOTE B	
PLATE CURRENT		2.0	MA.
GRID #3 TRANSCONDUCTANCE		270	μMHOS
GRID #1 TRANSCONDUCTANCE	1200		μMHOS
E_{c3} FOR I_b = 100 μA (APPROX.)		-3.7	VOLTS
E_{c1} FOR I_b = 100 μA (APPROX.)		-2.0	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

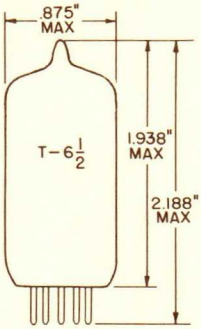
[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST-PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[B] GRID CURRENT ADJUSTED FOR 100 μA DC.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

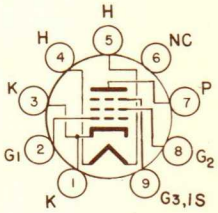
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

SHARP-CUTOFF PENTODE

FOR

IF AMPLIFIER STAGES

IN TV RECEIVERS



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9PM

THE 3HM6 IS A FRAME-GRID, SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 3HM6 IS IDENTICAL TO THE 4HM6 AND THE 6HM6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315 CONNECTED TO CATHODE	WITHOUT SHIELD	
GRID TO PLATE	0.024	0.031	pf
INPUT	8.70	8.70	pf
OUTPUT	3.00	2.15	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15	VOLTS	600	MA.
HEATER WARM-UP TIME			11	SECONDS
LIMITS OF SUPPLIED CURRENT			600 ± 40	MA.
HEATER CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK		MAX.	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK		MAX.	200	VOLTS

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MAXIMUM RATINGS

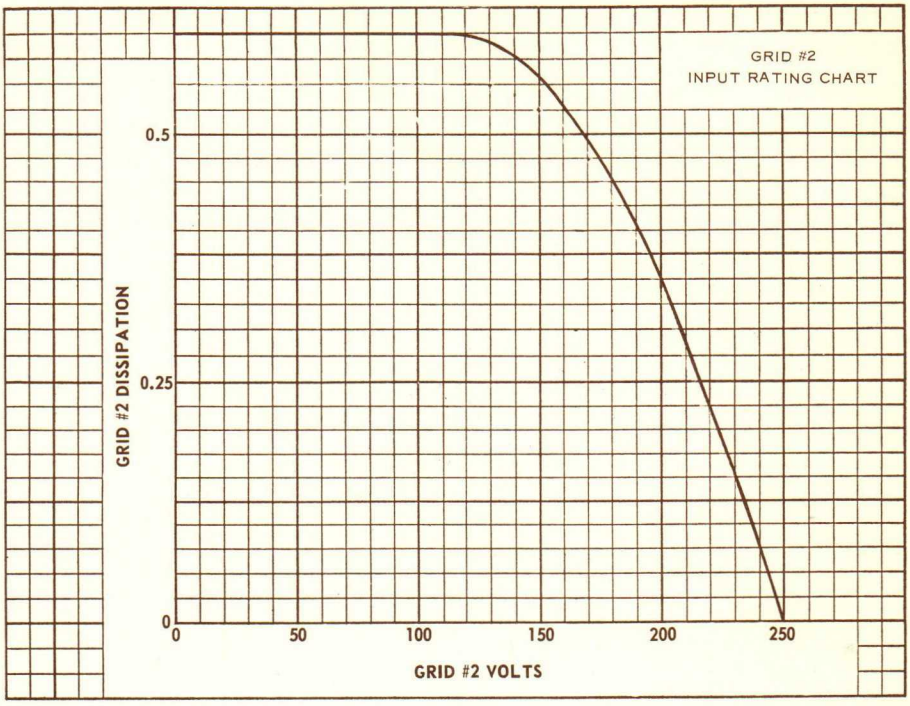
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

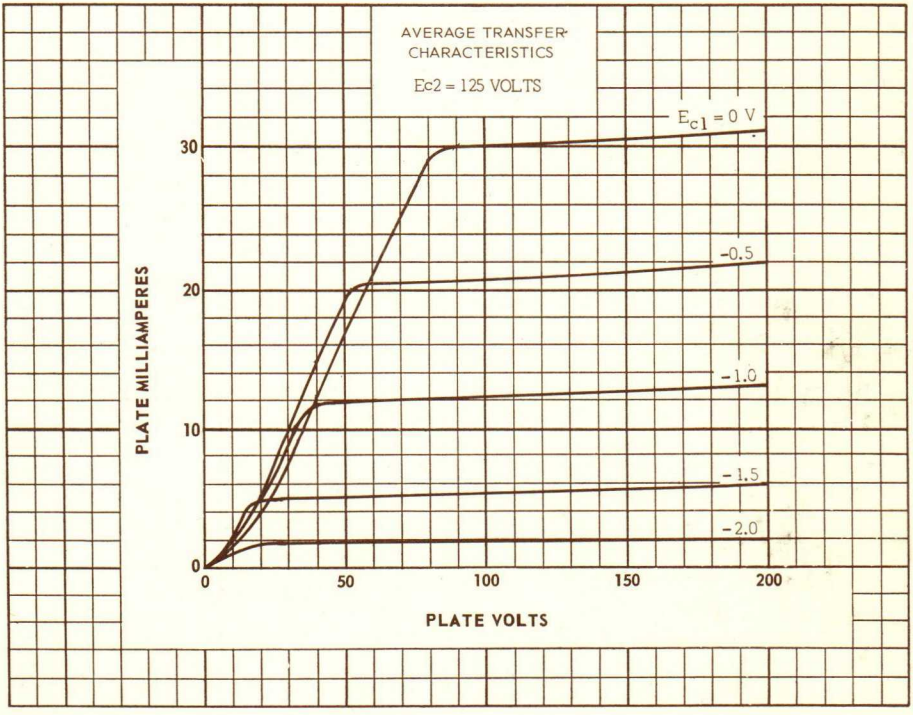
PLATE VOLTAGE	250	VOLTS
GRID 2 SUPPLY VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
NEGATIVE GRID 1 VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 125 VOLTS	0.6	WATT
GRID 1 CIRCUIT RESISTANCE:		
CATHODE-BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	Connected To Cathode At Socket	
GRID 2 VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE CURRENT	13	MA.
GRID 2 CURRENT	3.2	MA.
TRANSCONDUCTANCE	15,000	μMHOS
PLATE RESISTANCE	0.156	MEGOHM
HOT INPUT RESISTANCE [A]	13,000	OHMS
HOT INPUT CAPACITANCE [A]	7.4	pf
GRID 1 VOLTAGE AT Gm = 100 μMHOS	-3.0	VOLTS

[A] MEASURED AT 44 MC/S WITH UNBYPASSED 56 OHM CATHODE RESISTOR.





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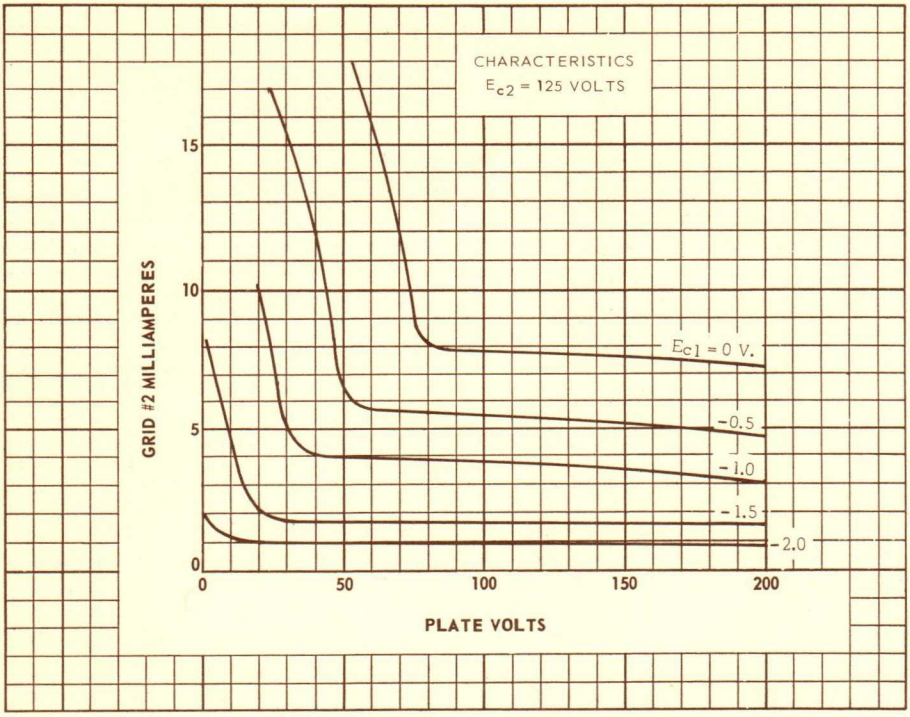
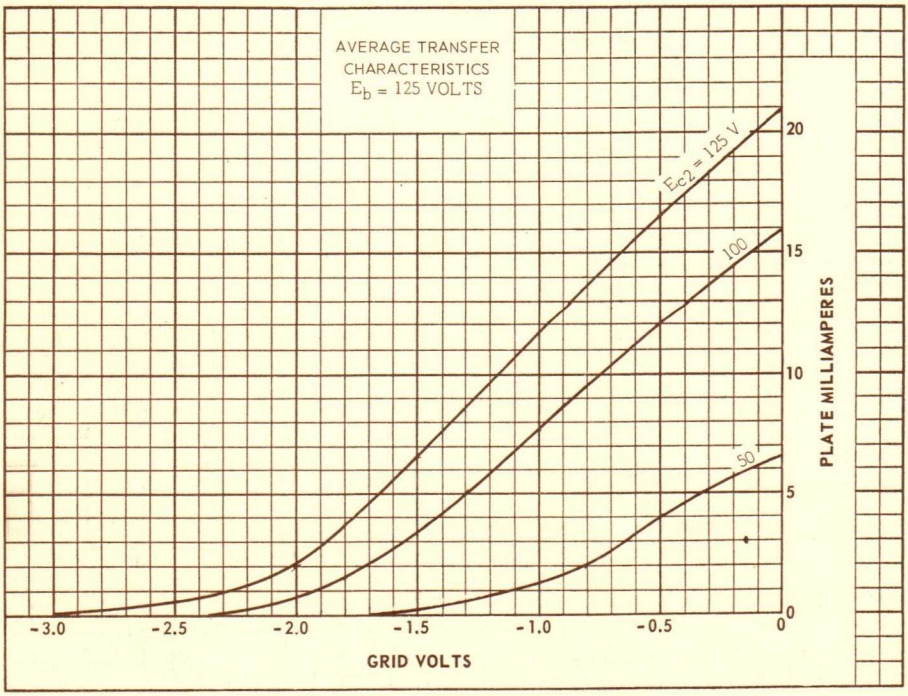
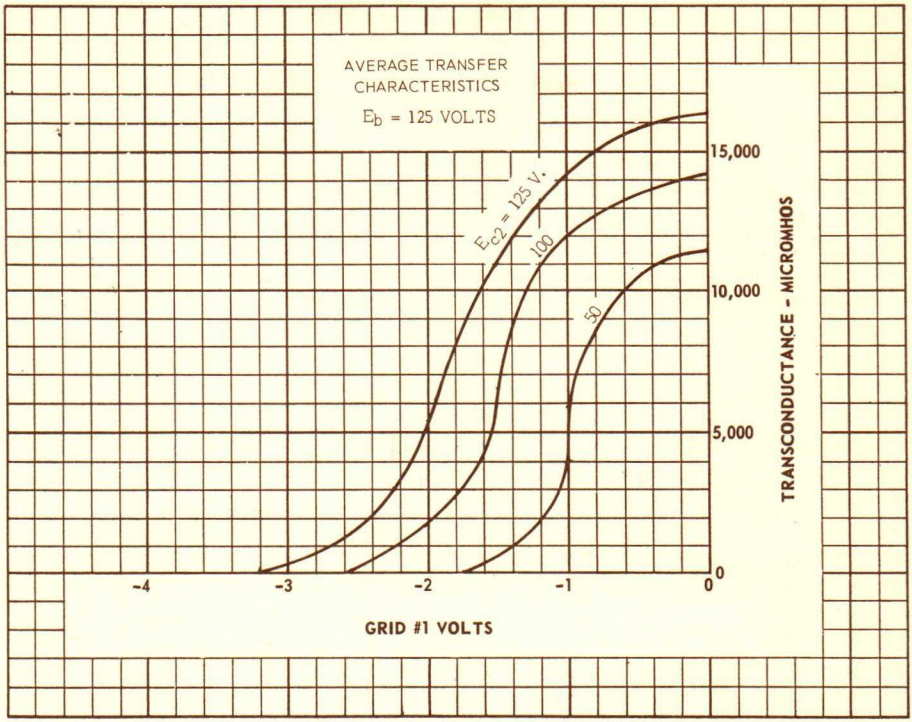
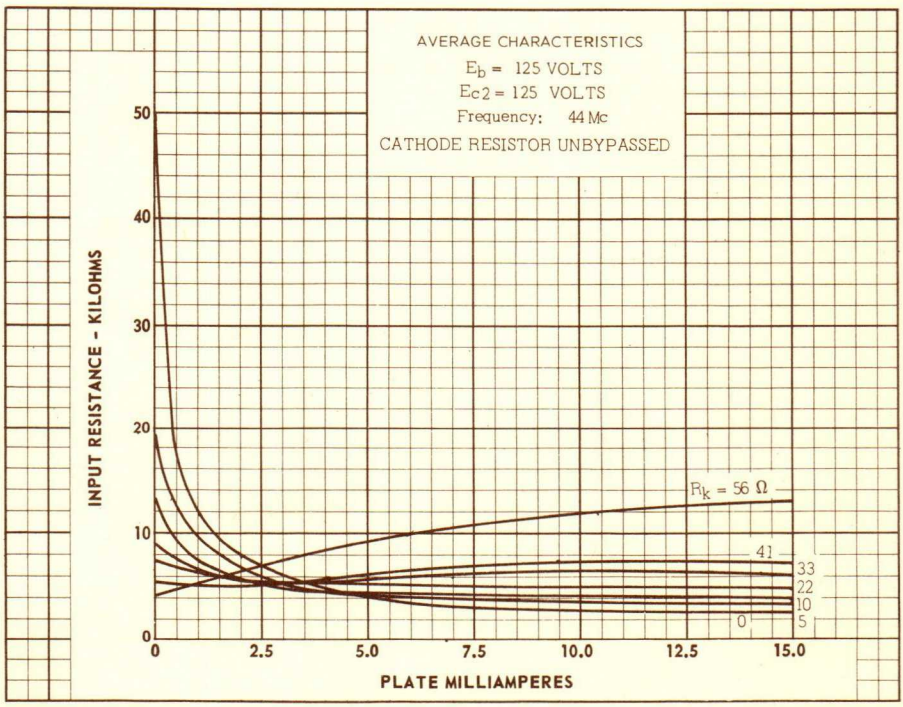
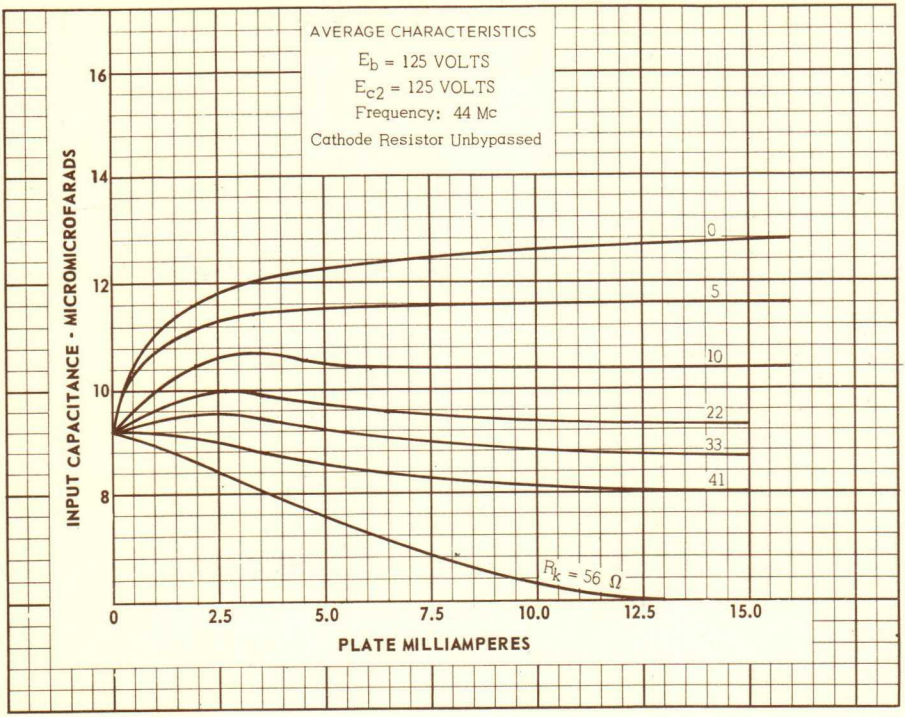

CHARACTERISTICS
E_{c2} = 125 VOLTS
GRID #2 MILLIAMPERES
15
10
5
0
E_{c1} = 0 V.
-0.5
-1.0
-1.5
-2.0
0
50
100
150
200
PLATE VOLTS


AVERAGE TRANSFER
CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 V
100
50
20
15
10
5
0
PLATE MILLIAMPERES
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0
GRID VOLTS


AVERAGE TRANSFER CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 V.
100
50
15,000
10,000
5,000
0
TRANSCONDUCTANCE - MICROMHOS
-4
-3
-2
-1
0
GRID #1 VOLTS


AVERAGE CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 VOLTS
Frequency: 44 Mc
CATHODE RESISTOR UNBYPASSED
INPUT RESISTANCE - KILOHMS
50
40
30
20
10
0
R_k = 56 Ω
41
33
22
10
5
0
0
2.5
5.0
7.5
10.0
12.5
15.0
PLATE MILLIAMPERES

3HM6


AVERAGE CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 VOLTS
Frequency: 44 Mc
Cathode Resistor Unbypassed
INPUT CAPACITANCE - MICROMICROFARADS
16
14
12
10
8
0
2.5
5.0
7.5
10.0
12.5
15.0
PLATE MILLIAMPERES
0
5
10
22
33
41
R_k = 56 Ω

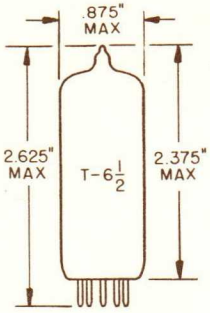
TUNG-SOL

TWIN PENTODE
MINIATURE TYPE

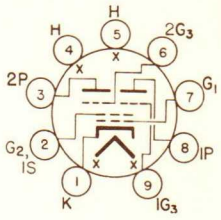
COATED UNIPOTENTIAL CATHODE

FOR T.V. APPLICATIONS

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9FG

THE 3HS8 IS A MINIATURE TWIN PENTODE THAT INCORPORATES SEPARATE PLATES AND #3 GRIDS FOR THE TWO SECTIONS TOGETHER WITH A COMMON SCREEN, #1 GRID, AND CATHODE. IT IS INTENDED FOR USE AS A COMBINED SYNC-AGC TUBE IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 3HS8 IS IDENTICAL TO THE 4HS8 AND THE 6HS8.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE, EACH SECTION	2.0	pf
GRID #1 TO ALL	6.0	pf
GRID #3 (EACH SECTION) TO ALL	3.6	pf
PLATE (EACH SECTION) TO ALL	3.0	pf
GRID #3 (SECTION 1) TO GRID #3 (SECTION 2), MAX.	0.015	pf

HEATER RATINGS AND CHARACTERISTICS

DESIGN-MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15	VOLTS	600	MA.
HEATER WARM-UP TIME[A]			11	SECONDS
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			600 ± 40	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
HEATER WARM-UP TIME[A]			11	SECONDS

A
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE, EACH SECTION	300	VOLTS
SCREEN VOLTAGE	150	VOLTS
POSITIVE DC GRID #3 VOLTAGE, EACH SECTION	3.0	VOLTS
NEGATIVE DC GRID #3 VOLTAGE, EACH SECTION	50	VOLTS
PEAK POSITIVE GRID #3 VOLTAGE, EACH SECTION	50	VOLTS
NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
PLATE DISSIPATION, EACH SECTION	1.1	WATTS
SCREEN DISSIPATION	0.75	WATT
DC CATHODE CURRENT	12	MA.
GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHM
GRID #3 CIRCUIT RESISTANCE, EACH SECTION	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS - BOTH SECTIONS OPERATING

PLATE VOLTAGE, EACH SECTION	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE, EACH SECTION	-10	0	VOLTS
GRID #1 VOLTAGE [B]			
PLATE CURRENT, EACH SECTION	---	2.0	MA.
SCREEN CURRENT	7.0	4.4	MA.
CATHODE CURRENT	7.1	8.5	MA.

AVERAGE CHARACTERISTICS - EACH SECTION SEPARATELY

WITH PLATE & GRID #3 OF OPPOSITE SECTION GROUNDED

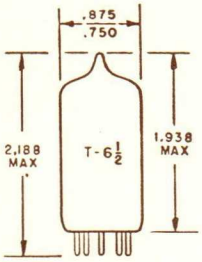
PLATE VOLTAGE	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	B	VOLTS
GRID #3 TRANSCONDUCTANCE	---	450	μMHOS
GRID #1 TRANSCONDUCTANCE	1100	---	μMHOS
PLATE CURRENT	---	2.0	MA.
GRID #3 VOLTAGE, (APPROX.) AT Ib = 100 μA	---	-3.5	VOLTS
GRID #1 VOLTAGE, (APPROX.) Ib = 100 μAMPS.	---	-2.3	VOLTS

[B] WITH GRID CURRENT ADJUSTED FOR 100 MICROAMPERES DC.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

SEMI-REMOTE-CUTOFF PENTODE

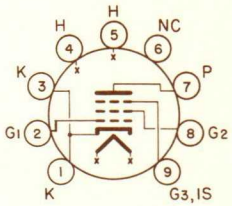
FOR

I.F. AMPLIFIER STAGES

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9 PM

THE 3HT6 IS A SEMI-REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN TELEVISION RECEIVER I.F. AMPLIFIER STAGES. THE SEMI-REMOTE CUTOFF CHARACTERISTICS IS DESIRABLE FOR USE IN AGC CONTROLLED STAGES.
EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 3HT6 IS IDENTICAL TO THE 6HT6 AND THE 4HT6.

DIRECT INTERELECTRODE CAPACITANCES

	SHIELD 315 CONNECTED TO GROUND	UNSHIELDED	
GRID 1 TO PLATE	0.024	0.031	pf
INPUT	8.70	8.70	pf
OUTPUT	3.00	2.15	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15 VOLTS	600	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	MA.
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

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

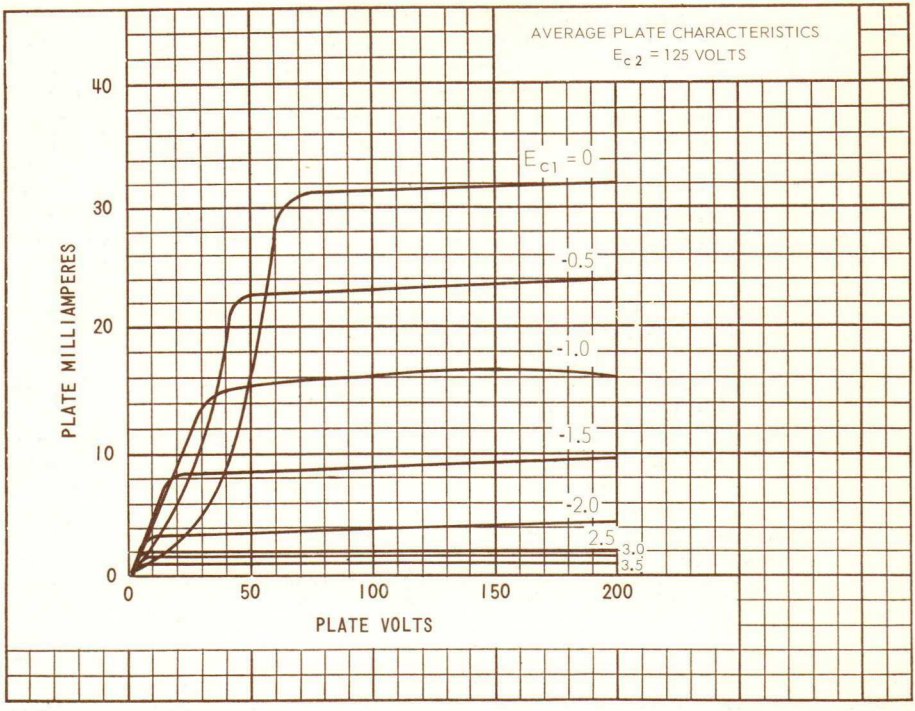
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

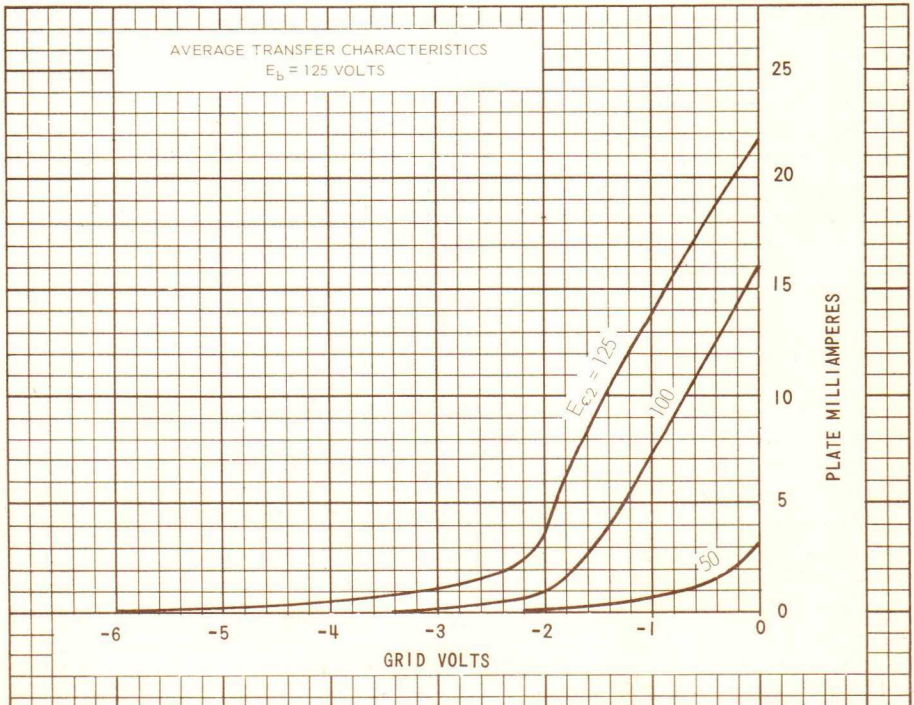
PLATE VOLTAGE	250	VOLTS
GRID 2 SUPPLY VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
GRID 1 VOLTAGE	-50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION	0.6	WATTS
CATHODE CURRENT	25	MA.
GRID 1 CIRCUIT RESISTANCE:		
CATHODE BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID 2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE CURRENT	15	MA.
GRID 2 CURRENT	4.0	MA.
TRANSCONDUCTANCE	14,000	μMHOS
PLATE RESISTANCE	0.143	MEGOHM
GRID 1 CUTOFF BIAS FOR G_m = 50 μMHOS	-6.7	VOLTS
CUTOFF TRANSCONDUCTANCE:		
FOR E_{c1} = -1.5	12,000	μMHOS
FOR E = -3.5	300	μMHOS
HOT INPUT RESISTANCE [A]	12,700	OHMS
HOT INPUT CAPACITANCE [A]	7.45	pf

A - MEASURED 44 Mc/s WITH UNBYPASSED 56 OHM CATHODE RESISTANCE





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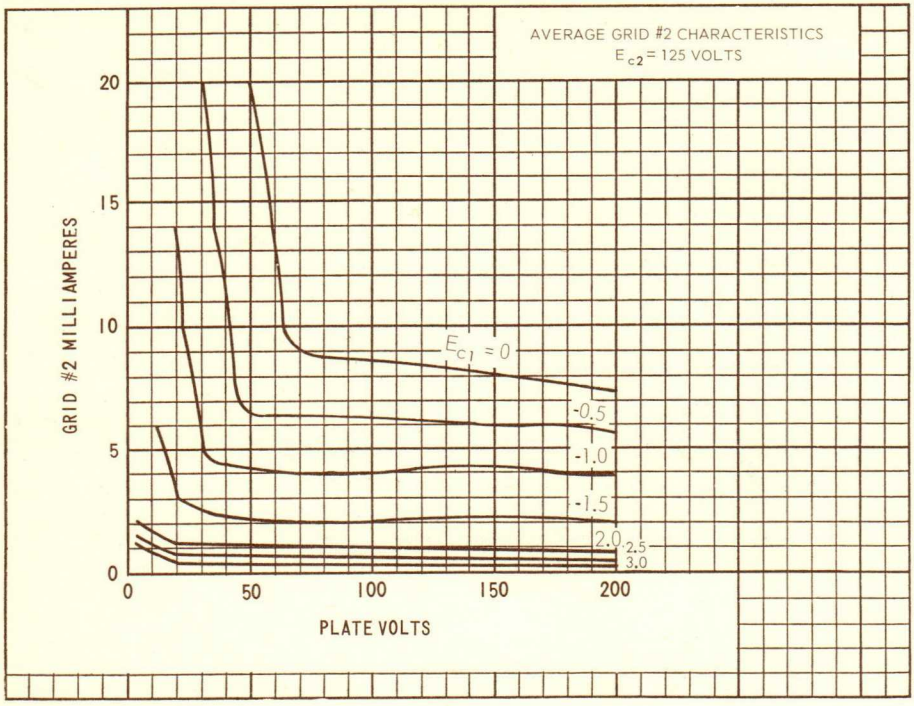
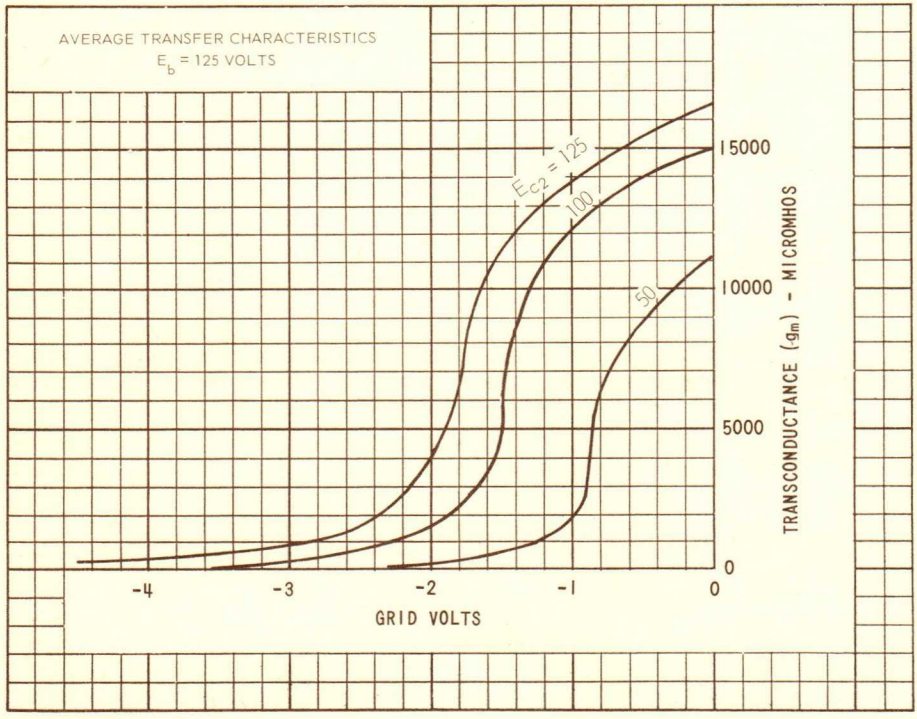
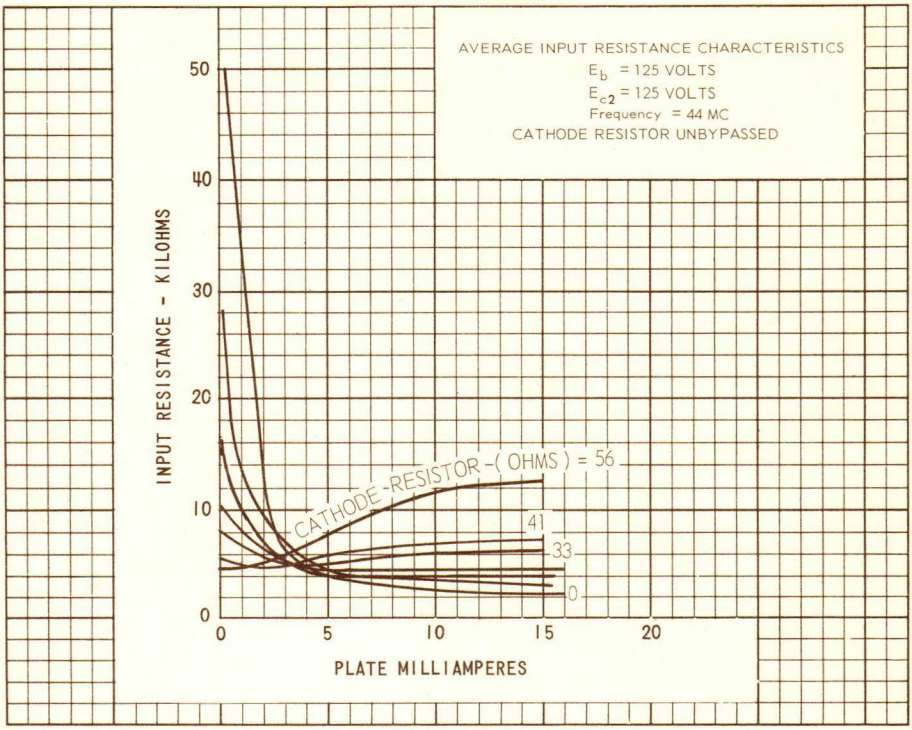
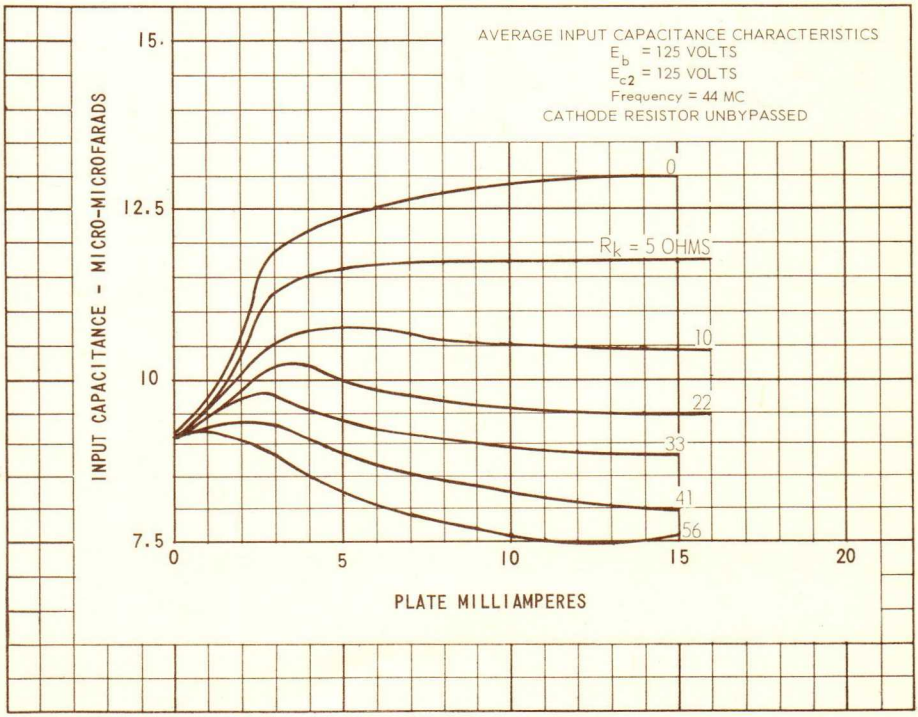
3HT6


AVERAGE GRID #2 CHARACTERISTICS
E_{c2} = 125 VOLTS
GRID #2 MILLIAMPERES
20
15
10
5
0
E_{c1} = 0
-0.5
-1.0
-1.5
2.0
2.5
3.0
0
50
100
150
200
PLATE VOLTS


AVERAGE TRANSFER CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125
100
50
15000
10000
5000
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
-4
-3
-2
-1
0
GRID VOLTS





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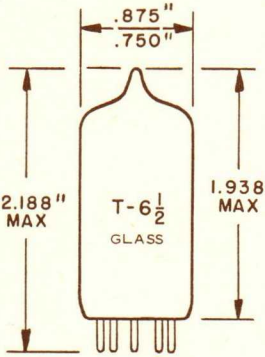
TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE
JEDEC 6-2

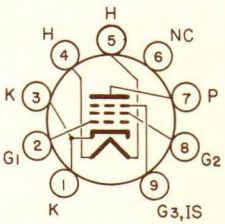


BASE 9 PIN BUTTON
JEDEC E9-1

SEMI-REMOTE-CUTOFF PENTODE
FOR
I.F. AMPLIFIER STAGES
IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9PM



BOTTOM VIEW

THE 3JC6 IS A FRAME-GRID, SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 3JC6 IS IDENTICAL TO THE 4JC6 AND THE 6JC6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE - MAX.	.019	pf
INPUT (G1 TO H + K + G3 + I.S. + G2)	8.2	pf
OUTPUT (P TO H + K + G3 + I.S. + G2)	3.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.5 VOLTS	600	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	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

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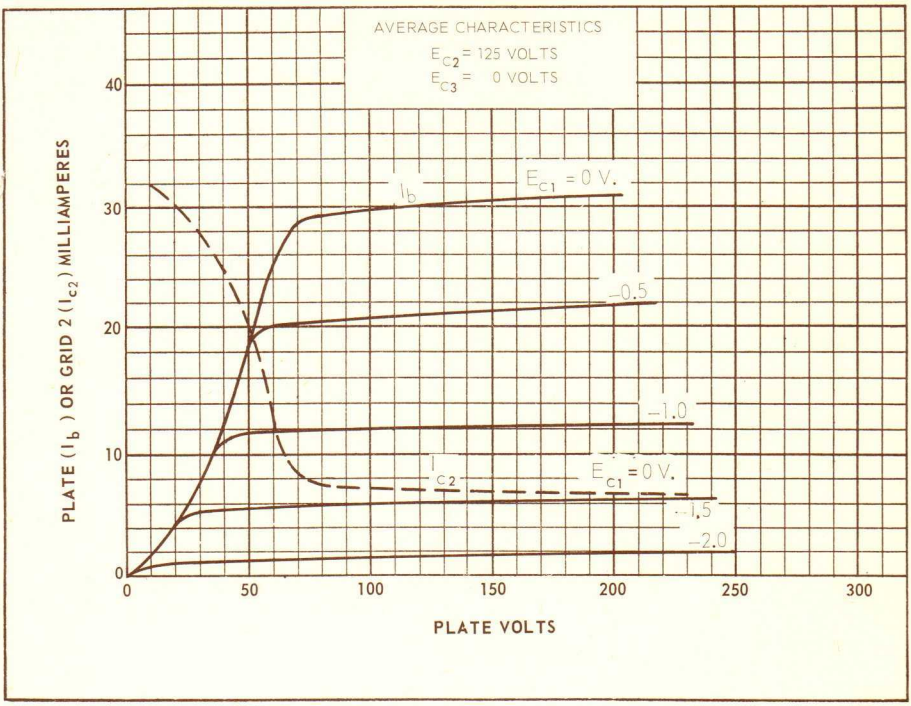
MAXIMUM RATINGS

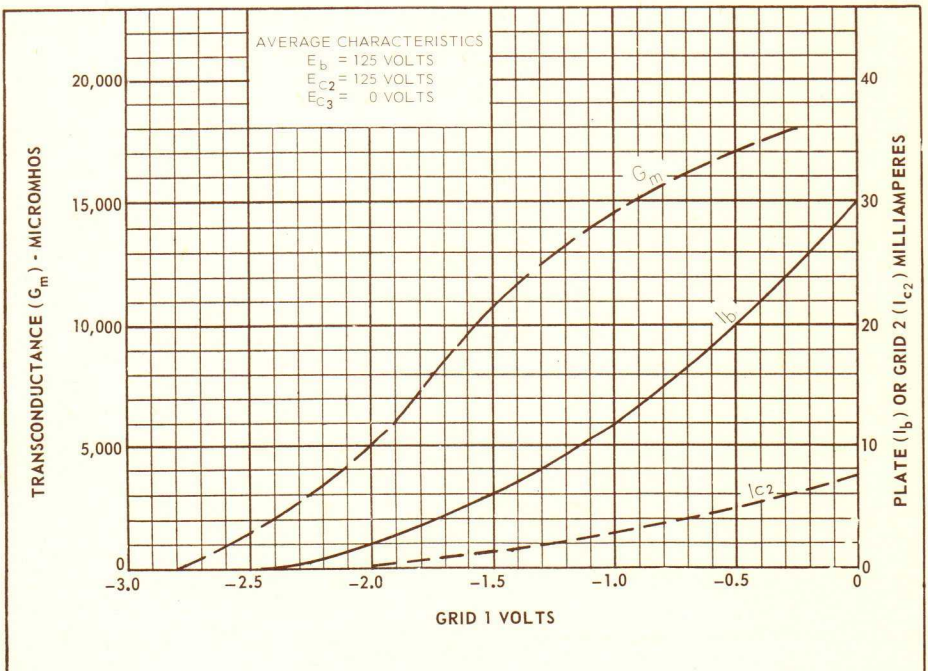
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
POSITIVE GRID 1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 165 VOLTS	0.6	WATT
GRID 1 CIRCUIT RESISTANCES:		
CATHODE-BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	Connected To Cathode At Socket	
GRID 2 VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE CURRENT	13	mA
GRID 2 CURRENT	3.2	mA
TRANSCONDUCTANCE	15,000	μMHOS
PLATE RESISTANCE	0.18	MEGOHM
GRID 1 VOLTAGE FOR I_b = 100 mA	-3.0	VOLTS





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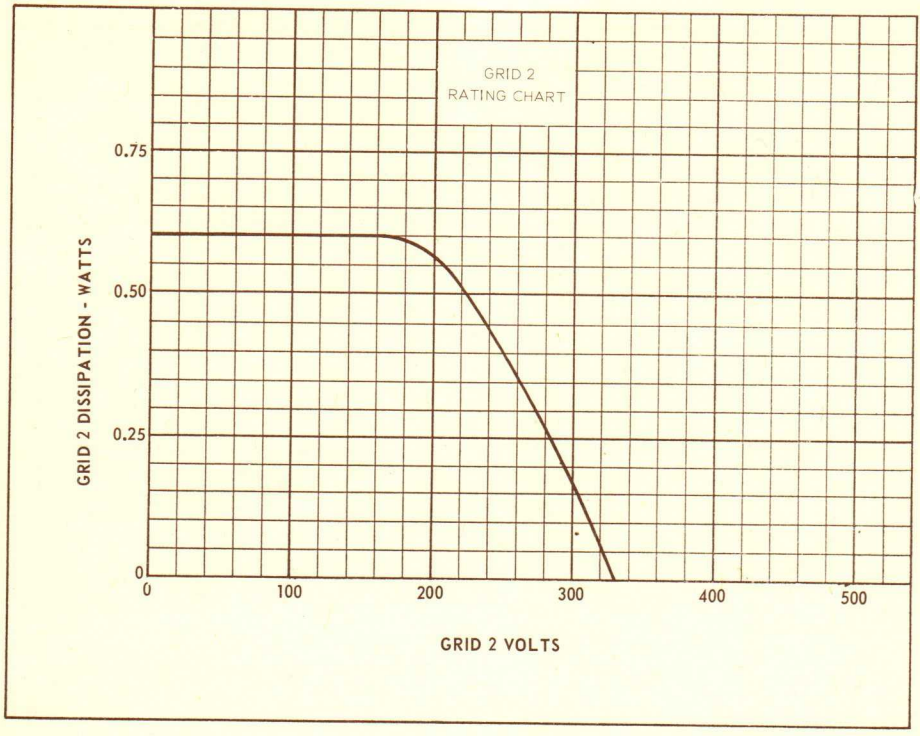
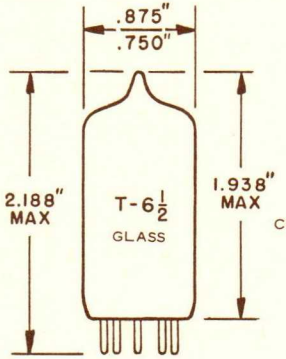

GRID 2
RATING CHART
GRID 2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
500
GRID 2 VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE
JEDEC 6-2



BASE 9 PIN BUTTON
JEDEC E9-1

SHARP-CUTOFF PENTODE

FOR

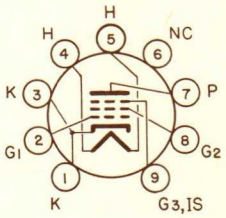
IF AMPLIFIER STAGES

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9PM



BOTTOM VIEW

THE 3JD6 IS A SEMI-REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN TELEVISION RECEIVER I.F. AMPLIFIER STAGES. THE SEMI-REMOTE CUTOFF CHARACTERISTICS IS DESIRABLE FOR USE IN AGC CONTROLLED STAGES. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 3JD6 IS IDENTICAL TO THE 4JD6 AND THE 6JD6.

DIRECT INTERELECTROCE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE - MAX.	0.019	pf
INPUT (G TO H + K + G3 + I.S. + G2)	8.2	pf
OUTPUT (P TO H + K + G3 + I.S. + G2)	3.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES • SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.5 VOLTS	600	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	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

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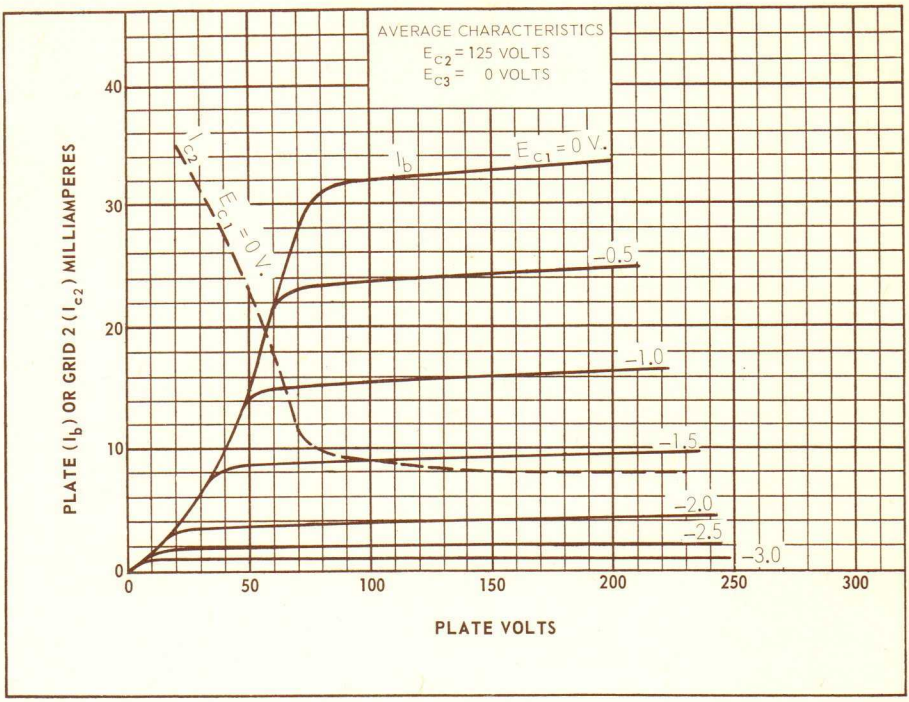
MAXIMUM RATINGS

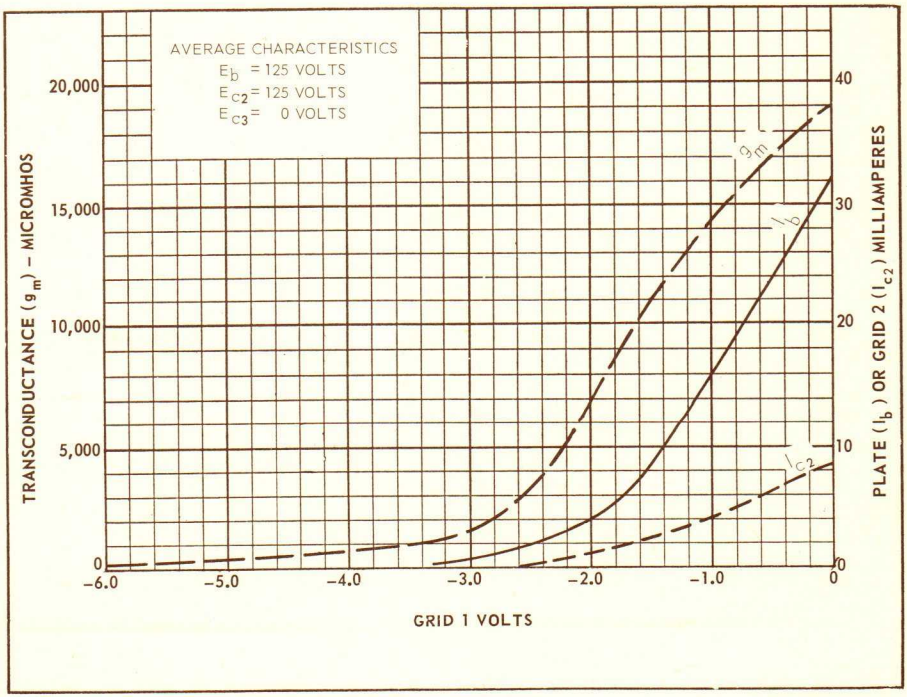
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 165 VOLTS	0.6	WATTS
GRID 1 CIRCUIT RESISTANCE:		
CATHODE BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID 2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE CURRENT	15	mA
GRID 2 CURRENT	4	mA
TRANSCONDUCTANCE	14,000	μMHOS
PLATE RESISTANCE	0.16	MEGOHM
GRID 1 VOLTAGE FOR G_m = 600 μMHOS	−4.5	VOLTS





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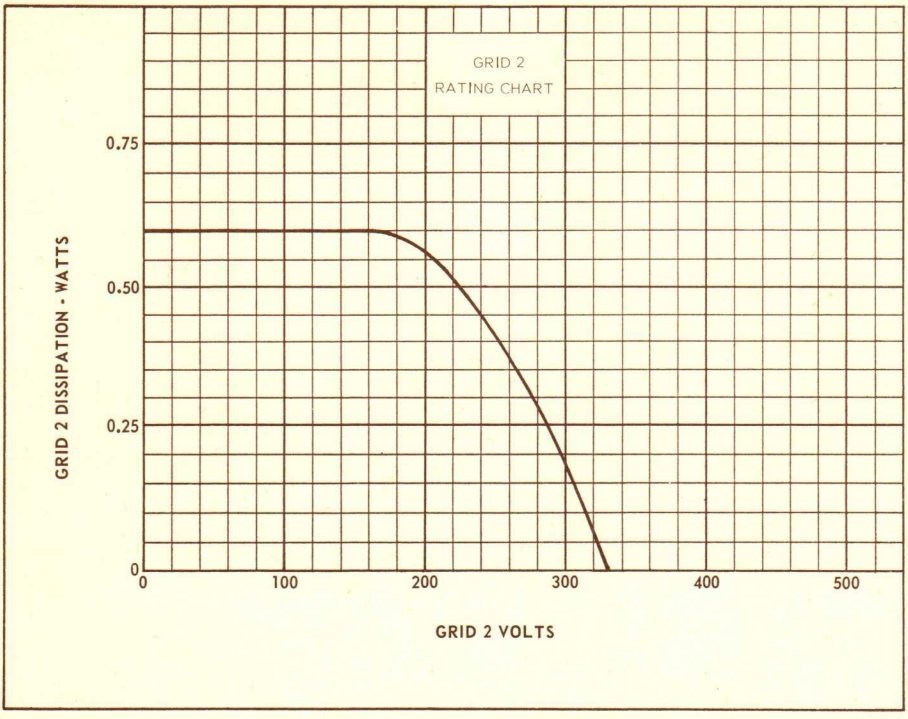
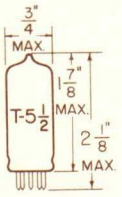
3JD6


GRID 2
RATING CHART
GRID 2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
500
GRID 2 VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE



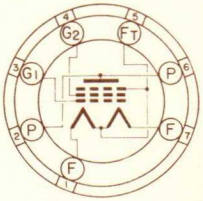
GLASS BULB

COATED FILAMENT

SERIES FILAMENT	PARALLEL FILAMENT
E_f APPLIED BETWEEN PINS 1 & 7	E_f APPLIED BETWEEN PIN 5 AND PINS 1 & 7 TIED TOGETHER
E_{g1} REFERRED TO PIN 1	E_{g1} REFERRED TO -F
2.8 VOLTS 50 MA.	1.4 VOLTS 100 MA.

DC

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 1 AND 5 FOR SERIES-FILAMENT OPERATION TO BY-PASS ANY CATHODE CURRENT IN EXCESS OF THE 6 MA. RATED MAXIMUM PER SECTION. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 1 AND 7 IF OTHER TUBES USED IN SERIES-FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3Q4.



BOTTOM VIEW

MINIATURE BUTTON 7 PIN BASE

ANY MOUNTING POSITION

THE 3Q4 IS A FILAMENTARY TYPE POWER OUTPUT PENTODE IN THE MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY ECONOMY OF FILAMENT POWER AND HIGH POWER SENSITIVITY ADAPTING IT TO USE IN THE "3-WAY" OPERATED PORTABLE RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

	SERIES FILAMENT	PARALLEL FILAMENT	
FILAMENT VOLTAGE	2.8	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	90	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	90	VOLTS
MAXIMUM CATHODE CURRENT	6[A]	6[A] ←	MA.

[A] FOR EACH 1.4 VOLT FILAMENT SECTION.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	CLASS A_1 AMPLIFIER			
FILAMENT VOLTAGE	2.8	1.4	1.4	VOLTS
FILAMENT CURRENT	50	100	100	MA.
PLATE VOLTAGE	90	85	90	VOLTS
GRID #2 VOLTAGE	90	85	90	VOLTS
GRID #1 VOLTAGE	-4.5	-5	-4.5	VOLTS
PEAK AF SIGNAL VOLTAGE	4.5	5	4.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	7.7	6.9	9.5	MA.
ZERO-SIGNAL GRID #2 CURRENT (NOMINAL)	1.7	1.5	2.1	MA.
PLATE RESISTANCE (APPROX.)	0.12	0.12	0.1	MEGOHM
TRANSCONDUCTANCE	2 000	1 975	2 150	μMHOS
LOAD RESISTANCE	10 000	10 000	10 000	OHMS
TOTAL HARMONIC DISTORTION	7	10	7	PERCENT
POWER OUTPUT	240	250	270	MW

→ INDICATES A CHANGE.

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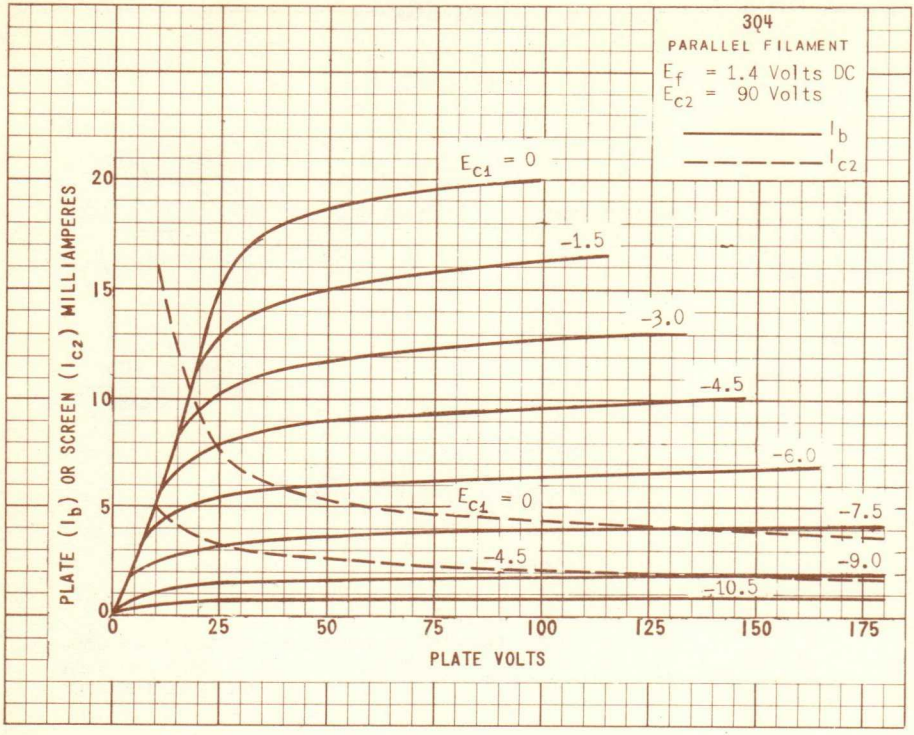
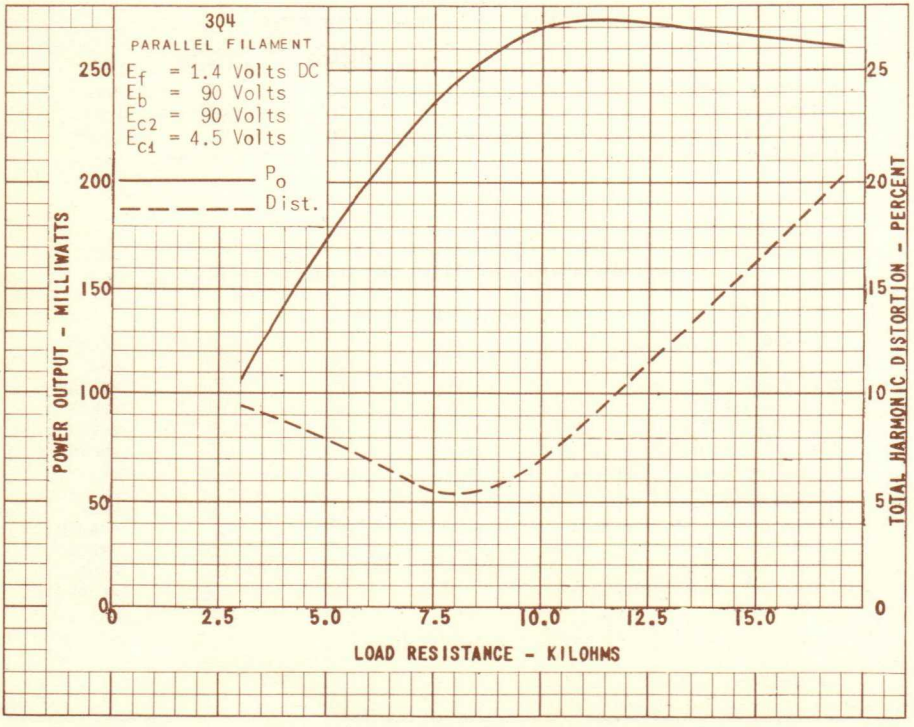

3Q4
PARALLEL FILAMENT
E_f = 1.4 Volts DC
E_{c2} = 90 Volts
I_b
I_{c2}
E_{c1} = 0
-1.5
-3.0
-4.5
-6.0
E_{c1} = 0
-7.5
-4.5
-9.0
-10.5
PLATE (I_b) OR SCREEN (I_{c2}) MILLIAMPERES
0
5
10
15
20
0
25
50
75
100
125
150
175
PLATE VOLTS

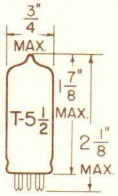

3Q4
PARALLEL FILAMENT
E_f = 1.4 Volts DC
E_b = 90 Volts
E_{c2} = 90 Volts
E_{c1} = 4.5 Volts
P_o
Dist.
POWER OUTPUT - MILLIWATTS
0
50
100
150
200
250
TOTAL HARMONIC DISTORTION - PERCENT
0
5
10
15
20
25
0
2.5
5.0
7.5
10.0
12.5
15.0
LOAD RESISTANCE - KILOHMS

TUNG-SOL

PENTODE

MINIATURE TYPE

COATED FILAMENT



GLASS BULB

SERIES FILAMENT

E_f APPLIED BETWEEN PINS 1 & 7

E_{g1} REFERRED TO PIN 1

2.8 VOLTS
50 MA.

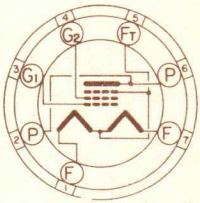
PARALLEL FILAMENT

E_f APPLIED BETWEEN PIN 5 AND PINS 1 & 7 TIED TOGETHER

E_{g1} REFERRED TO PIN -F

1.4 VOLTS
100 MA.

DC



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 1 AND 5 FOR SERIES-FILAMENT OPERATION TO BY-PASS ANY CATHODE CURRENT IN EXCESS OF THE 5.5 MA. RATED MAXIMUM PER SECTION. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 1 & 7 IF OTHER TUBES USED IN SERIES FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3S4.

ANY MOUNTING POSITION

THE 3S4 IS A FILAMENTARY TYPE POWER OUTPUT PENTODE IN THE MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY ECONOMY OF FILAMENT POWER AND ABILITY TO PERFORM WELL AT LOW PLATE SUPPLY VOLTAGES SUCH AS ENCOUNTERED IN PORTABLE EQUIPMENT.

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

	SERIES FILAMENT	PARALLEL FILAMENT	
FILAMENT VOLTAGE	2.8	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	90	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	67.5	67.5	VOLTS
MAXIMUM CATHODE CURRENT	6[A] ←	6[A] ←	MA.
			MA.

[A] FOR EACH 1.4 FILAMENT SECTION.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	SERIES FILAMENT		PARALLEL FILAMENT		
FILAMENT VOLTAGE	2.8	2.8	1.4	1.4	VOLTS
FILAMENT CURRENT	50	50	100	100	MA.
PLATE VOLTAGE	67.5	90	67.5	90	VOLTS
GRID #2 VOLTAGE	67.5	67.5	67.5	67.5	VOLTS
GRID #1 VOLTAGE	-7	-7	-7	-7	VOLTS
PEAK AF SIGNAL VOLTAGE	7	7	7	7	VOLTS
PLATE RESISTANCE (APPROX.)	0.1	0.1	0.1	0.1	MEGOHM
TRANSCONDUCTANCE	1 400	1 425	1 550	1 575	μMHOS
ZERO-SIGNAL PLATE CURRENT	6	6.1	7.2	7.4	MA.
ZERO-SIGNAL GRID #2 CURRENT	1.2	1.1	1.5	1.4	MA.
LOAD RESISTANCE	5 000	8 000	5 000	8 000	OHMS
TOTAL HARMONIC DISTORTION	12	13	10	12	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	160	235	180	270	MW

→ INDICATES A CHANGE.

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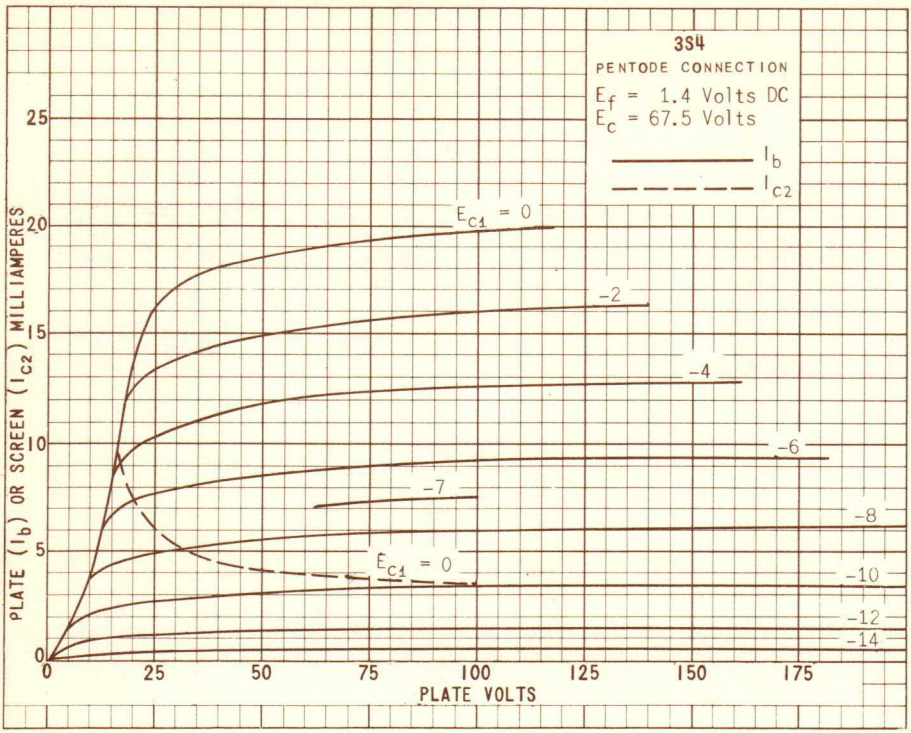
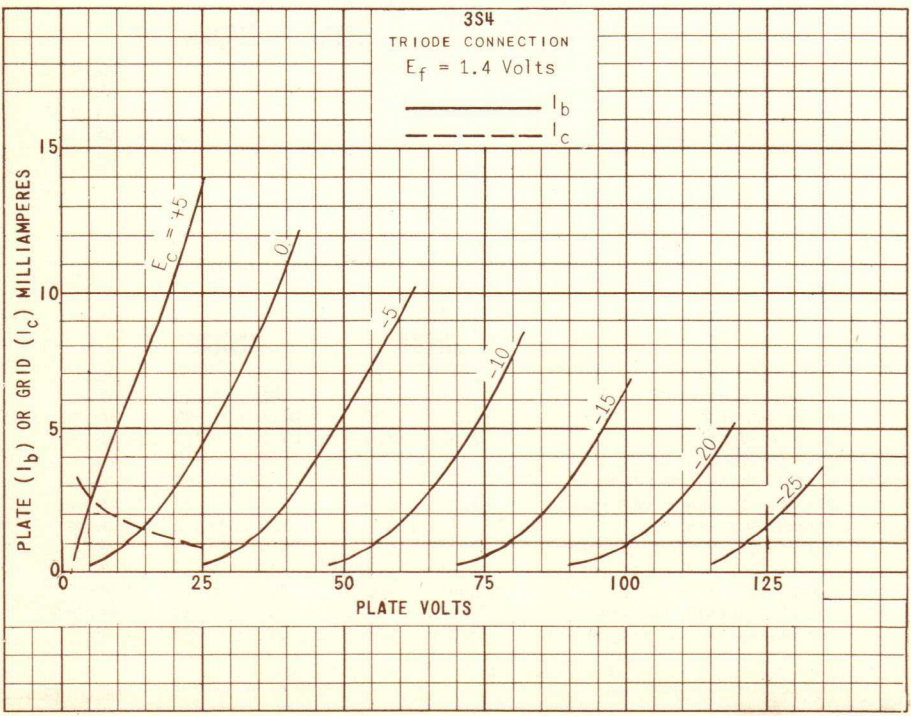
3S4


3S4
PENTODE CONNECTION
E_f = 1.4 Volts DC
E_c = 67.5 Volts
I_b
I_{c2}
E_{c1} = 0
-2
-4
-6
-7
-8
E_{c1} = 0
-10
-12
-14
PLATE (I_b) OR SCREEN (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
0
25
50
75
100
125
150
175


3S4
TRIODE CONNECTION
E_f = 1.4 Volts
I_b
I_c
E_c = +5
0
-5
-10
-15
-20
-25
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
0
5
10
15
0
25
50
75
100
125

3S4

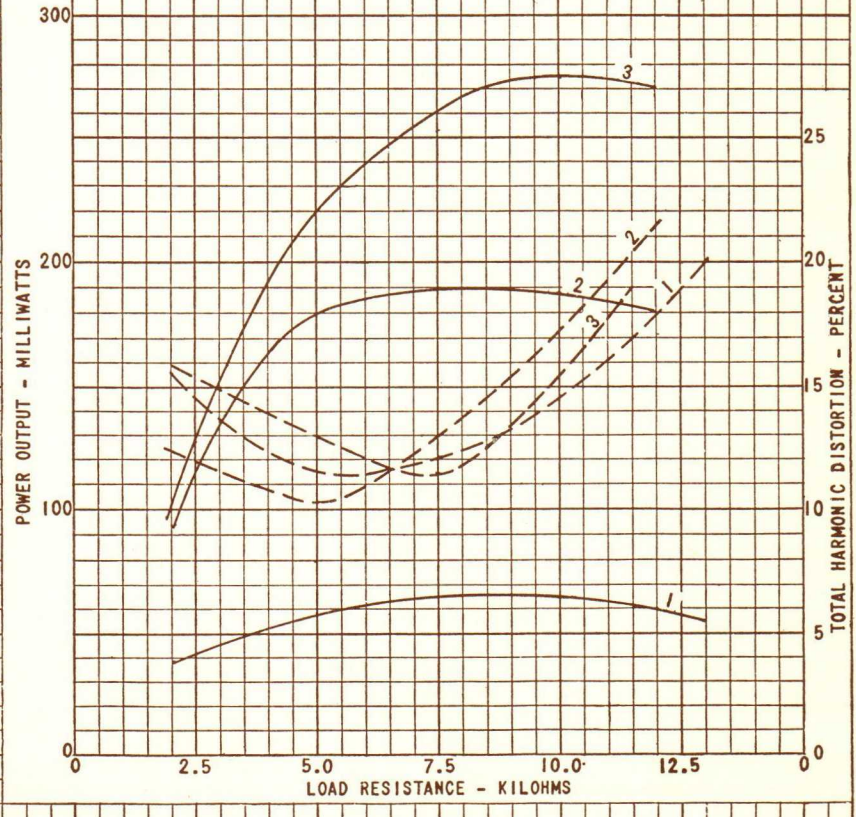
PENTODE CONNECTION

E_f = 1.4 Volts DC

——— P_o

– – – – – Dist.

CURVE	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	SIGNAL VOLTS
1	45	45	-4.5	3.2
2	67.5	67.5	-7	4.95
3	90	67.5	-7	4.95



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1948

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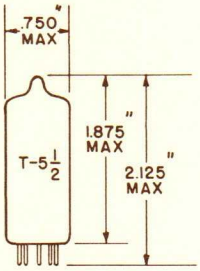
POWER AMPLIFIER PENTODE

MINIATURE TYPE

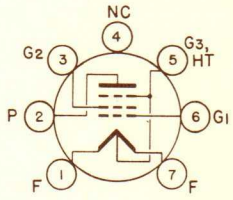


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED FILAMENT

FOR USE IN THE OUTPUT STAGE OF
AC/DC PORTABLE RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6BX

THE 3V4 IS A POWER AMPLIFIER PENTODE UTILIZING THE MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN THE OUTPUT STAGE OF AC/DC BATTERY PORTABLE RECEIVERS. IT IS IDENTICAL TO THE 3Q4 EXCEPT FOR THE DIFFERENT BASING ARRANGEMENT.

FILAMENT CHARACTERISTICS AND RATINGS *

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS			
SERIES [A]	2.8 VOLTS	50	MA.
PARALLEL [B]	1.4 VOLTS	100	MA.
FILAMENT SUPPLY LIMITS:			
VOLTAGE OPERATION:	SERIES [A]	PARALLEL [B]	
1.5 VOLT DRY CELL SUPPLY	2.2 TO 3.2	1.1 TO 1.6	VOLTS
OTHER BATTERY SUPPLIES OR POWER LINE	2.2 TO 3.0	1.1 TO 1.5	VOLTS

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	SERIES [A]	PARALLEL [B]	
PLATE VOLTAGE	100	100	VOLTS
GRID #2 VOLTAGE	100	100	VOLTS
CATHODE CURRENT	12.0 [C]	12.0	MA.

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

	SERIES	PARALLEL		
FILAMENT VOLTAGE	2.8	1.4	1.4	VOLTS
PLATE VOLTAGE	90	85	90	VOLTS
GRID #2 VOLTAGE	90	85	90	VOLTS
GRID #1 VOLTAGE	-4.5	-5	-4.5	VOLTS
PEAK GRID #1 SIGNAL VOLTAGE	4.5	5	4.5	VOLTS
PLATE CURRENT (AT ZERO SIGNAL)	7.7	6.9	9.5	MA.
GRID #2 CURRENT (AT ZERO SIGNAL)	1.7	1.5	2.1	MA.
PLATE RESISTANCE (APPROX.)	0.12	0.12	0.1	MEGOHMS
TRANSCONDUCTANCE	2,000	1,975	2,150	μMHOS
LOAD RESISTANCE	10,000	10,000	10,000	OHMS
TOTAL HARMONIC DISTORTION	7	10	7	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	240	250	270	MW

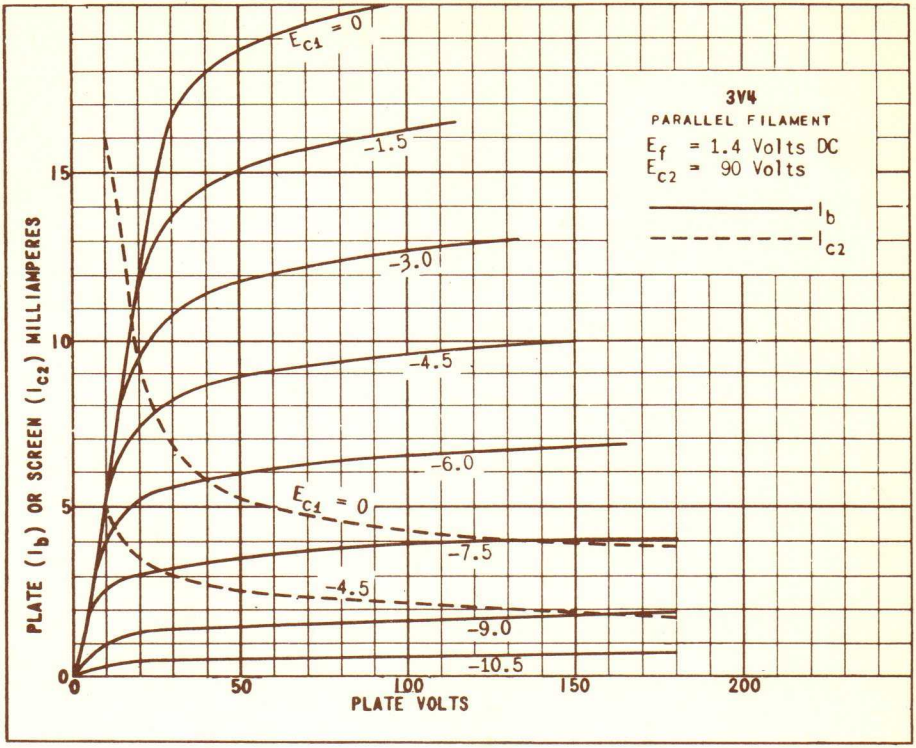
[A] FILAMENT VOLTAGE APPLIED ACROSS THE TWO SECTIONS IN SERIES BETWEEN PIN #1 & #7. GRID #1 VOLTAGE IS REFERRED TO PIN #1.

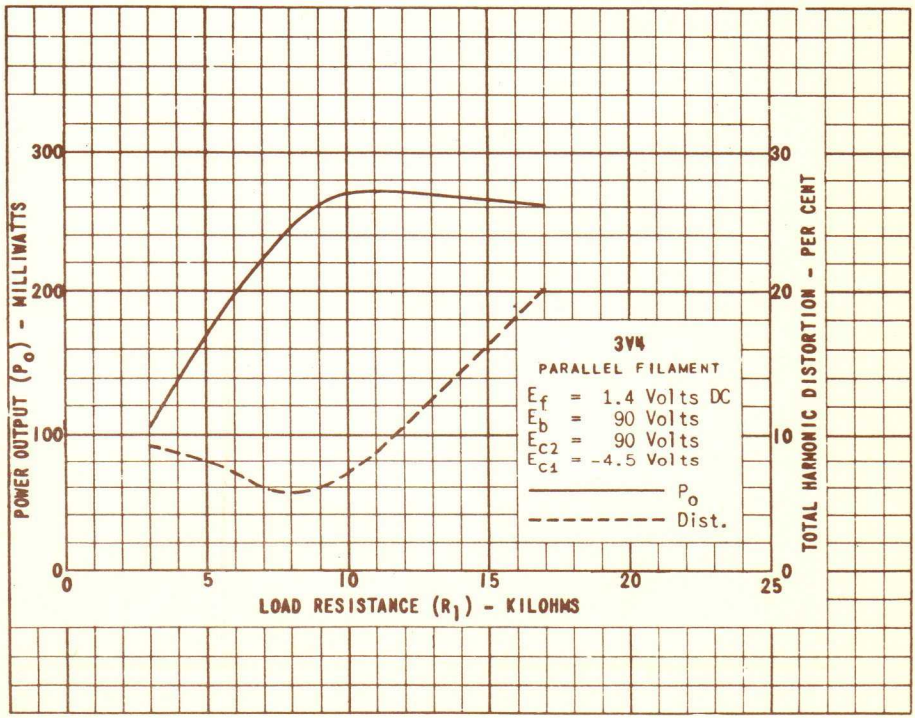
[B] FILAMENT VOLTAGE APPLIED ACROSS THE TWO SECTIONS IN PARALLEL, BETWEEN PIN #5 & PINS #1 & #7 TIED TOGETHER. GRID #1 VOLTAGE REFERRED TO PIN #5.

[C] THE MAXIMUM ALLOWABLE CATHODE CURRENT FOR EACH 1.4 VOLT FILAMENT SECTION IS 6 MA. FOR SERIES OPERATION OF THE SECTIONS, A SHUNTING RESISTOR MUST BE CONNECTED ACROSS THE SECTION BETWEEN PINS #1 & #5 TO BYPASS CATHODE CURRENT IN EXCESS OF 6 MA. WHEN OTHER TUBES IN A SERIES FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3V4, AN ADDITIONAL SHUNTING RESISTOR MAY BE REQUIRED BETWEEN PINS #1 & #7.

* INDICATES AN ADDITION.

→ INDICATES A CHANGE.





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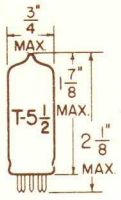
PENTODE

MINIATURE TYPE



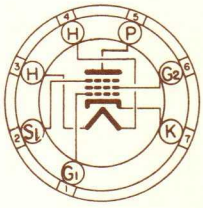
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

4.2 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BK

THE 4AU6 IS A PENTODE AMPLIFIER HAVING A SHARP CUT-OFF CONTROL CHARACTERISTIC USING THE MINIATURE CONSTRUCTION. WITH HIGH TRANSCONDUCTANCE, LOW GRID-PLATE CAPACITANCE, IT IS INTENDED FOR SERVICE AS EITHER AN RF OR AF AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME AND HEATER RATINGS THE 4AU6 IS IDENTICAL TO THE 6AU6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE CONNECTION:			
GRID TO PLATE: (G_1 TO P) MAX.	0.003	0.003	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.5	5.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5	5	μμf
TRIODE CONNECTION:			
GRID TO PLATE: G_1 TO (P+G_2+G_3&IS)	2.6	2.6	μμf
INPUT: G_1 TO (H+K)	3.2	3.2	μμf
OUTPUT: (P+G_2+G_3&IS) TO (H+K)	8.5	1.2	μμf

[A] SHIELD #316 CONNECTED TO PIN #7.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE CONNECTION[B]	PENTODE CONNECTION	
HEATER VOLTAGE	4.2	4.2	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	100	VOLTS
MAXIMUM PLATE VOLTAGE	250	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	PLATE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	PLATE	SEE J5-C4	
MAXIMUM GRID #3 VOLTAGE PIN #2 CONNECTED TO:	PLATE	CATHODE	
MAXIMUM PLATE DISSIPATION	3.2	3	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.65	WATTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

[B] TRIODE CONNECTION: G_2 AND G_3 CONNECTED TO PLATE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

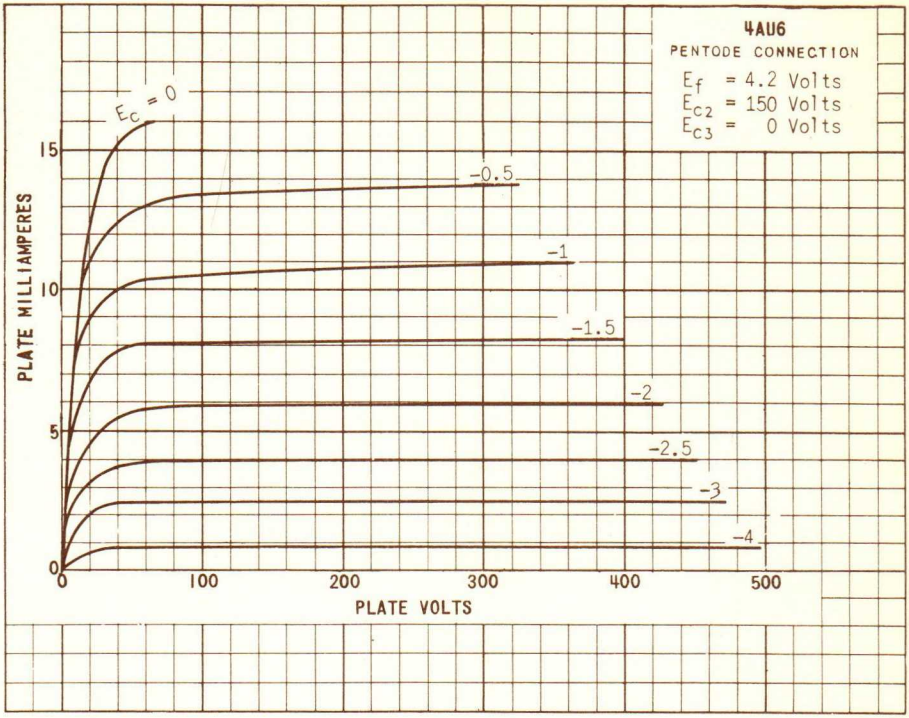
CLASS A_1 AMPLIFIER – PENTODE CONNECTION

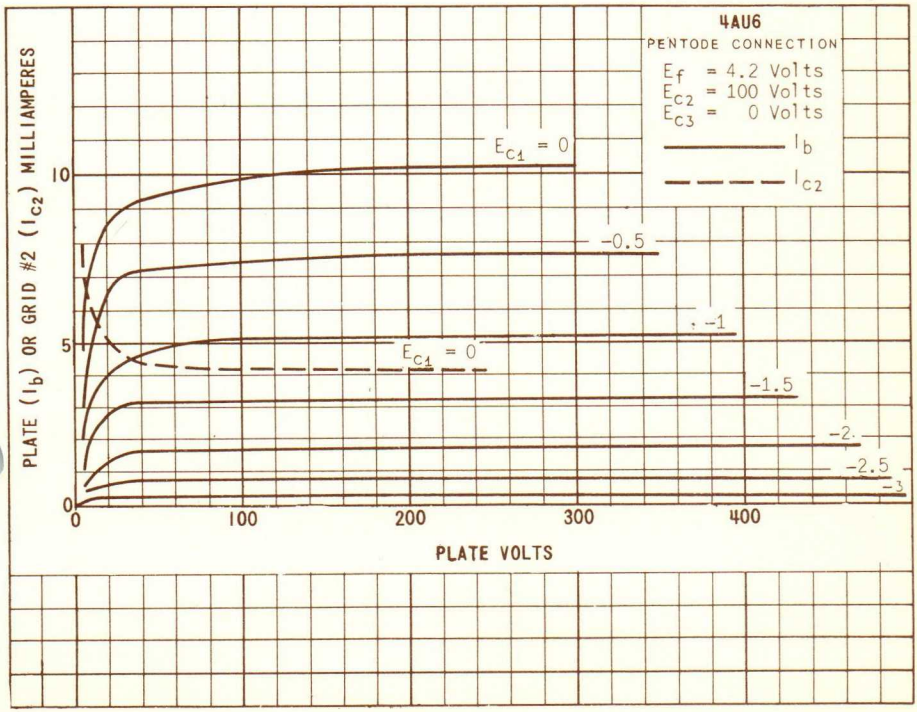
HEATER VOLTAGE	4.2	4.2	4.2	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	100	250	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE BIAS RESISTOR	150	100	68	OHMS
GRID #3 VOLTAGE	PIN #2 CONNECTED TO PIN #7 AT SOCKET			
TRANSCONDUCTANCE	3 900	4 500	5 200	μMHOS
PLATE CURRENT	5	7.6	10.6	MA.
GRID #2 CURRENT	2.1	3	4.3	MA.
PLATE RESISTANCE (APPROX.)	0.5	1.5	1	MEGOHMS
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA.	-4.2	-5.5	-6.5	VOLTS

CLASS A_1 AMPLIFIER – TRIODE CONNECTION[C]

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	PLATE	
CATHODE RESISTOR	330	OHMS
GRID #3 VOLTAGE	PLATE	
TRANSCONDUCTANCE	4 800	μMHOS
PLATE CURRENT	12.2	MA.
AMPLIFICATION FACTOR	36	

[C] TRIODE CONNECTION: GRID #2 AND GRID #3 CONNECTED TO PLATE.





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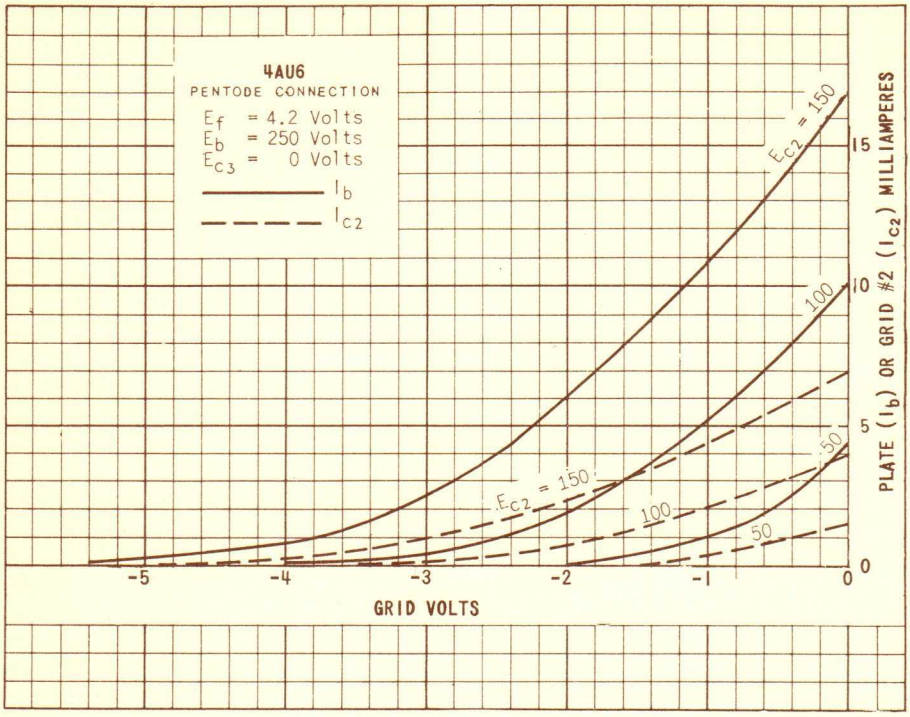
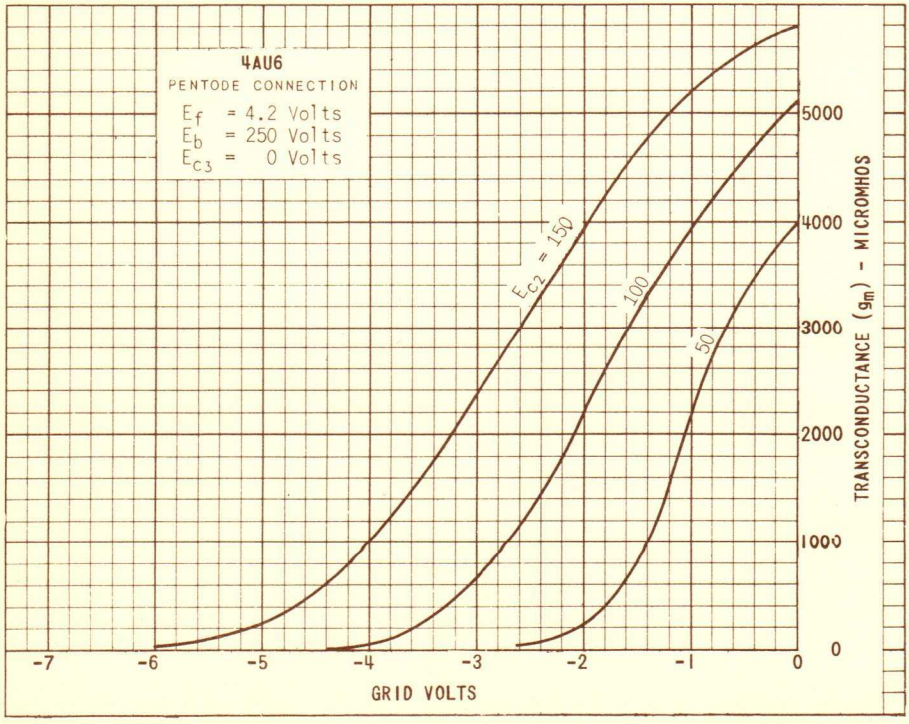

4AU6
PENTODE CONNECTION
E_f = 4.2 Volts
E_b = 250 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c2} = 150
100
50
E_{c2} = 150
100
50
-5
-4
-3
-2
-1
0
GRID VOLTS
0
5
10
15
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES


4AU6
PENTODE CONNECTION
E_f = 4.2 Volts
E_b = 250 Volts
E_{c3} = 0 Volts
E_{c2} = 150
100
50
-7
-6
-5
-4
-3
-2
-1
0
GRID VOLTS
0
1000
2000
3000
4000
5000
TRANSCONDUCTANCE (g_m) - MICROMHOS

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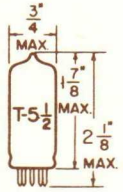
DOUBLE-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-2

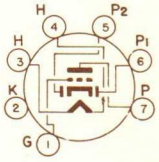
COATED UNIPOTENTIAL CATHODE

HEATER

4.2 VOLTS 0.45±.03 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7BT

THE 4AV6 COMBINES A HIGH-MU TRIODE AND TWO INDEPENDENT DIODE UNITS IN THE 7 PIN MINIATURE CONSTRUCTION. IT PERMITS A SINGLE TUBE TO FUNCTION AS DETECTOR, AVC RECTIFIER, AND AUDIO AMPLIFIER. COUPLING BETWEEN THE DIODE AND TRIODE SECTIONS IS MINIMIZED BY THE USE OF INTERNAL SHIELDING. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 4AV6 IS IDENTICAL TO THE 6AV6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G TO P)	2	2	μμf
INPUT: G TO (H+K)	2.2	2.2	μμf
OUTPUT: P TO (H+K)	1.2	0.8	μμf
COUPLING: #2 DIODE PLATE TO GRID (MAX.)	0.04	0.04	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
DC COMPONENT	100	VOLTS
MAXIMUM PLATE DISSIPATION	0.55	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM DIODE CURRENT EACH UNIT FOR CONTINUOUS OPERATION	1	MA.
HEATER WARM-UP TIME (AVG.)	11	SECONDS

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

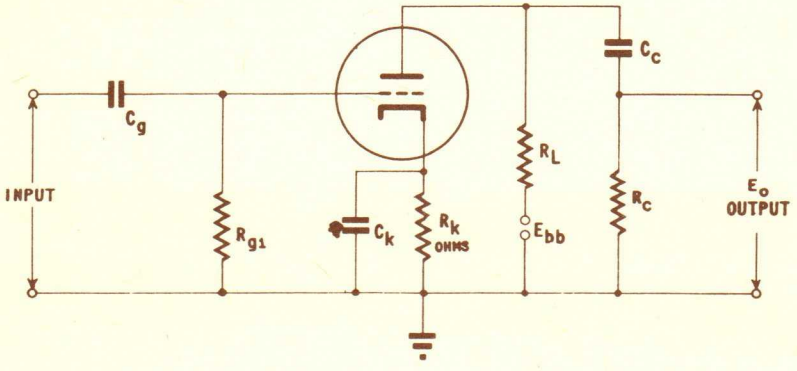
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID #1 VOLTAGE	−1	−2	VOLTS
PLATE RESISTANCE	80 000	62 500	OHMS
AMPLIFICATION FACTOR	100	100	
TRANSCONDUCTANCE	1 250	1 600	µMHOS
PLATE CURRENT	0.5	1.2	MA.
AVERAGE DIODE CURRENT AT 10 VOLTS DC (EACH UNIT)	2.0	2.0	MA.

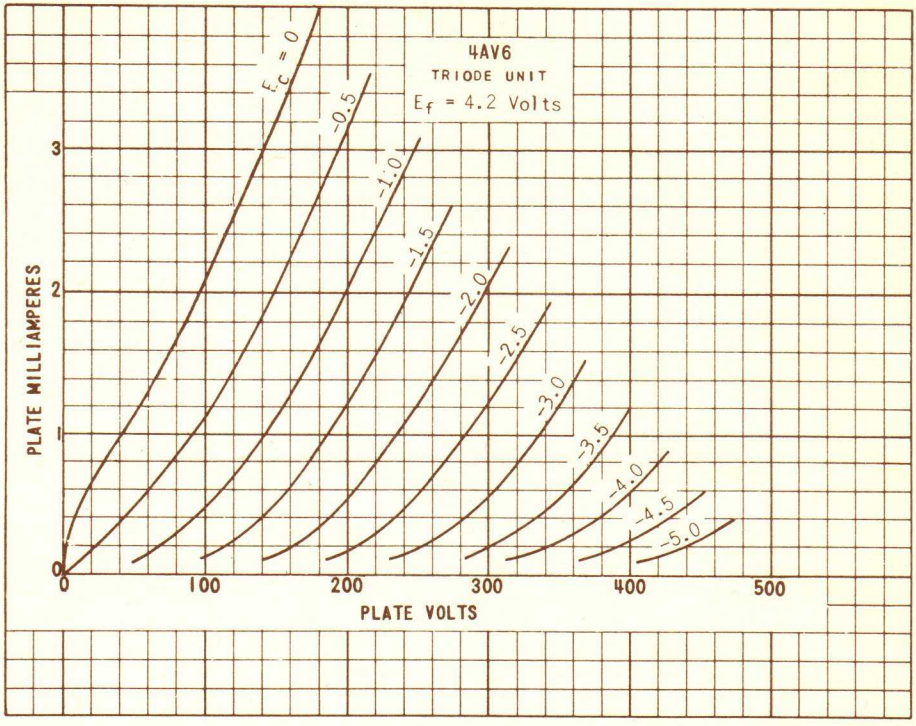
RESISTANCE COUPLED AMPLIFIER

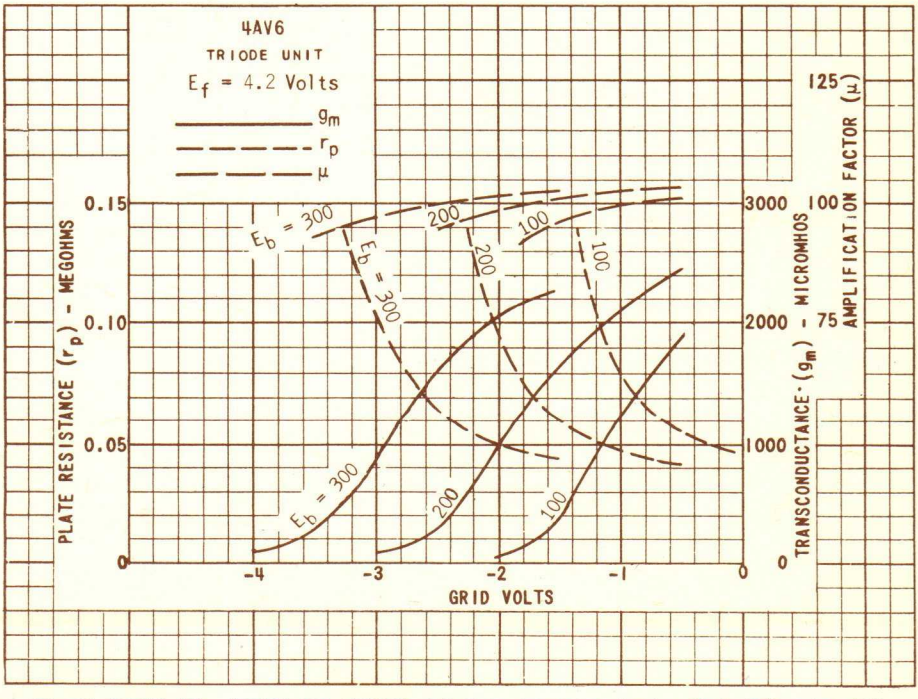
TRIODE UNIT

PLATE SUPPLY VOLTAGE	90	250	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	220 000	470 000	OHMS
CONTROL GRID RESISTOR	10.0	10.0	MEGOHMS
INPUT CONDENSER	0.01	0.01	µf
OUTPUT CONDENSER	0.01	0.01	µf
GRID RESISTOR OF FOLLOWING STAGE	470 000	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	1 000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	5.5	30	VOLTS
VOLTAGE GAIN AT 400 CPS	42	63	



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.





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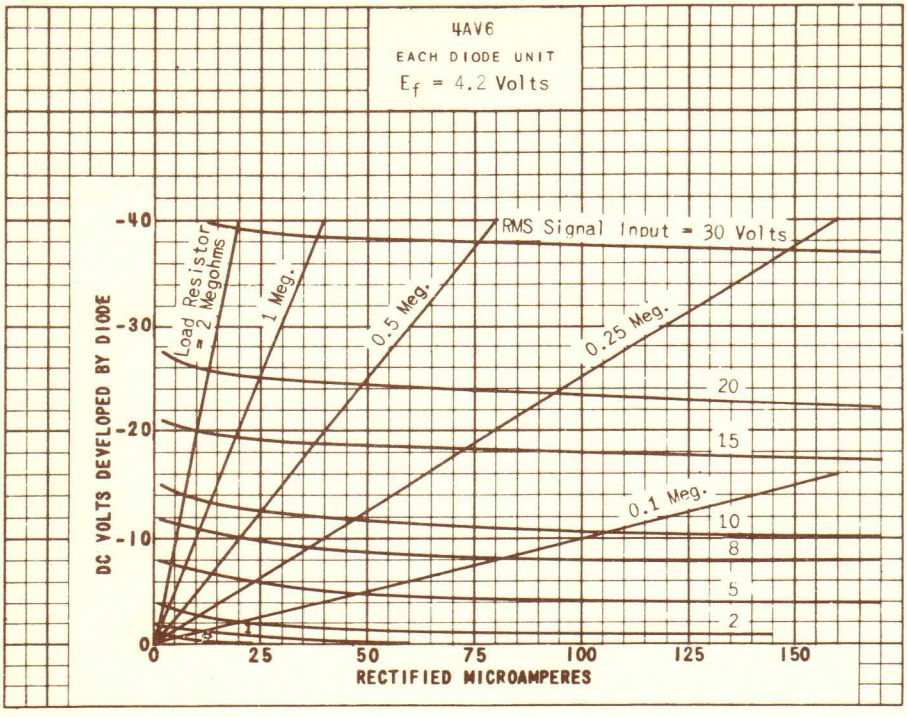
4AV6
EACH DIODE UNIT
E_f = 4.2 Volts
RMS Signal Input = 30 Volts
Load Resistor = 2 Megohms
1 Meg.
0.5 Meg.
0.25 Meg.
0.1 Meg.
20
15
10
8
5
2
-40
-30
-20
-10
0
DC VOLTS DEVELOPED BY DIODE
0
25
50
75
100
125
150
RECTIFIED MICROAMPERES

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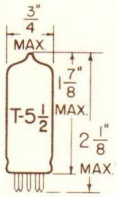
PENTODE

MINIATURE TYPE

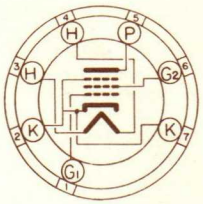


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BD

THE 4BC5, A HIGH TRANSCONDUCTANCE PENTODE VOLTAGE AMPLIFIER IN THE 7 PIN MINIATURE CONSTRUCTION, IS DESIGNED FOR USE IN 450 MA. SERIES HEATER OPERATED RECEIVERS. IT IS USEFUL AS AN RF AMPLIFIER UP TO ABOUT 400 MC. AND AS A HIGH-FREQUENCY INTERMEDIATE AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO TYPE 6BC5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE CONNECTION:			
GRID TO PLATE: (G_1 TO P)	0.02	0.03	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	6.6	6.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	3.1	1.8	μμf
TRIODE CONNECTION: (G_2 TIED TO PLATE)			
GRID TO PLATE: (G_1 TO P+G_2)	2.5	2.5	μμf
INPUT: G_1 TO (H+K+G_3&IS)	4	3.9	μμf
OUTPUT: P+G_2 TO (H+K+G_3&IS)	4.3	3	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE[B]	PENTODE	
HEATER VOLTAGE	4.2	4.2	VOLTS
MAXIMUM PEAK 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
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	300	VOLTS
MAXIMUM PLATE DISSIPATION	2.5[C]	2	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

[A] TRIODE CONNECTION: G_2 CONNECTED TO PLATE.

[B] TOTAL DISSIPATION FOR PLATE PLUS SCREEN.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

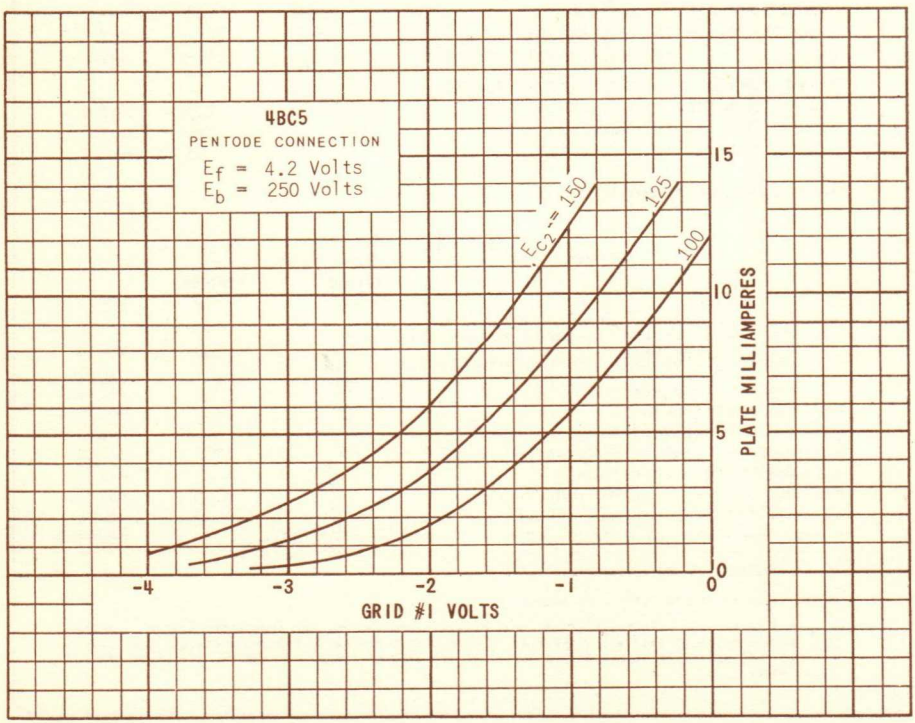
CLASS A_1 AMPLIFIER - PENTODE CONNECTION

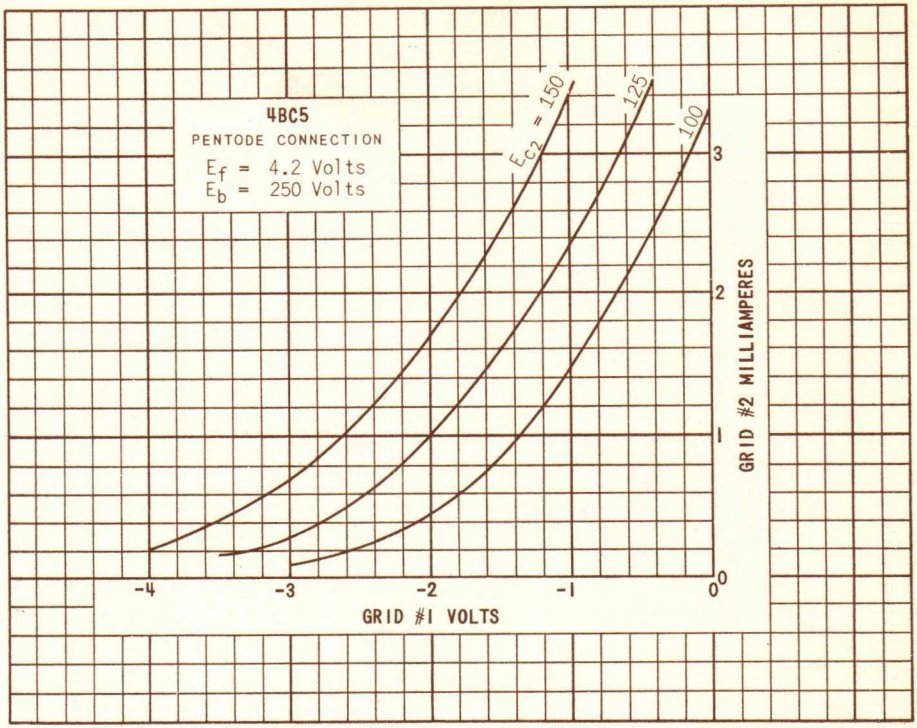
HEATER VOLTAGE	4.2	4.2	4.2	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	100	125	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE RESISTOR	180	100	180	OHMS
PLATE RESISTANCE (APPROX.)	0.6	0.5	0.8	MEGOHM
TRANSCONDUCTANCE	4900	6100	5700	µMHOS
PLATE CURRENT	4.7	8	7.5	MA.
GRID #2 CURRENT	1.4	2.4	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_{b2} = 10 µA.	-5	-6	-8	VOLTS

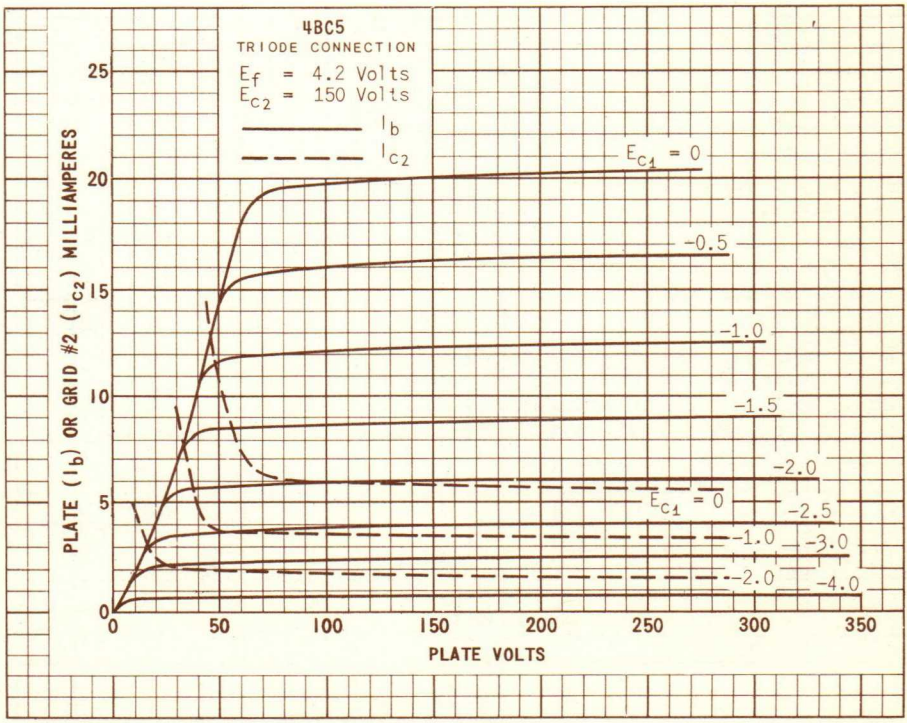
CLASS A_1 AMPLIFIER - TRIODE CONNECTION[B]

HEATER VOLTAGE	4.2	4.2	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	250	180	VOLTS
CATHODE RESISTOR	820	330	OHMS
PLATE RESISTANCE (APPROX.)	0.009	0.006	MEGOHM
TRANSCONDUCTANCE	4400	6000	µMHOS
PLATE CURRENT	6	8	MA.
AMPLIFICATION FACTOR	40	42	

[B] TRIODE CONNECTION G_2 CONNECTED TO PLATE.







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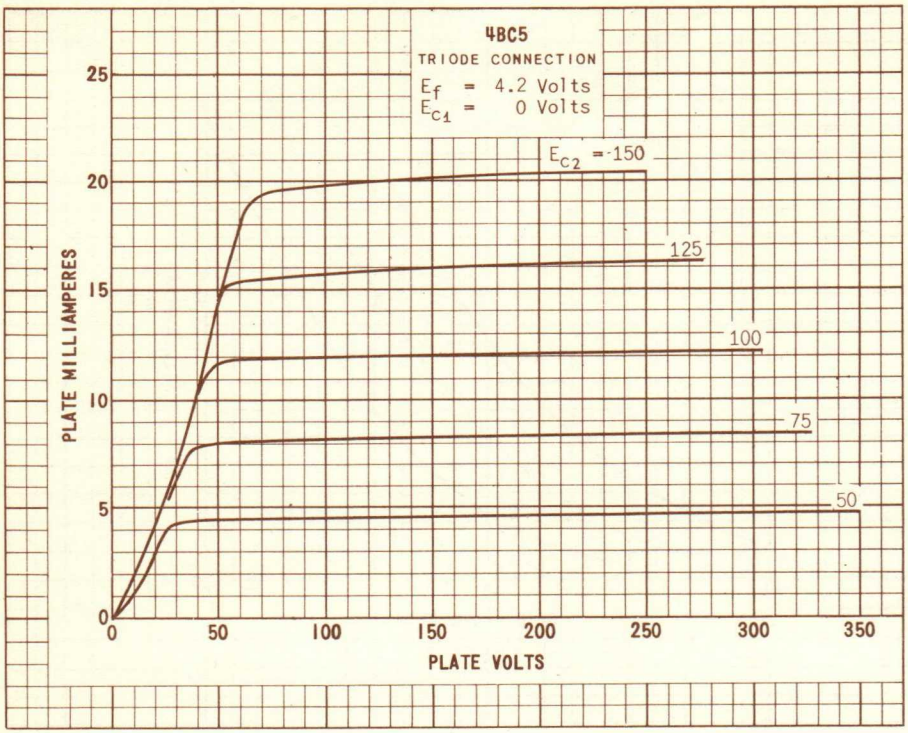
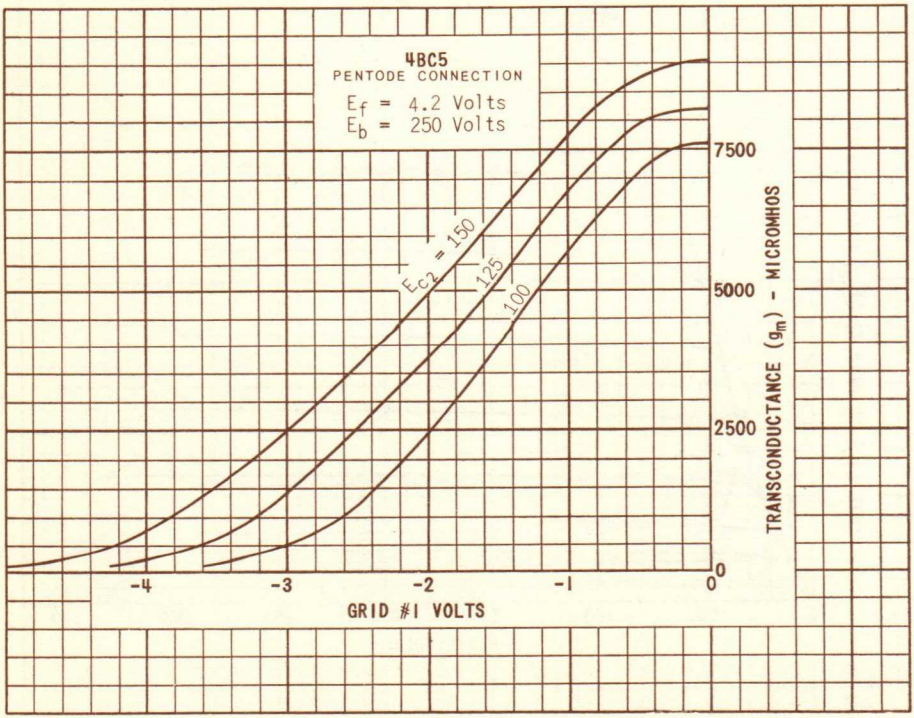
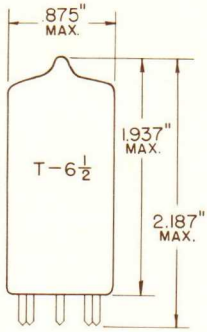

4BC5
TRIODE CONNECTION
E_f = 4.2 Volts
E_{c_1} = 0 Volts
E_{c_2} = 150
125
100
75
50
PLATE MILLIAMPERES
25
20
15
10
5
0
0
50
100
150
200
250
300
350
PLATE VOLTS


4BC5
PENTODE CONNECTION
E_f = 4.2 Volts
E_b = 250 Volts
E_{c_2} = 150
125
100
TRANSCONDUCTANCE (g_m) - MICROMHOS
7500
5000
2500
0
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

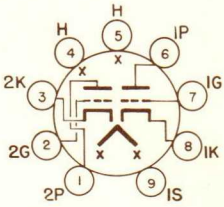


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

CASCODE AMPLIFIER
FOR SERIES STRING VHF
TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9AJ

THE 4BC8 IS A MEDIUM-MU, SEMI-REMOTE CUT-OFF TWIN TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A CASCODE AMPLIFIER IN 600 MA. SERIES HEATER OPERATED VHF TELEVISION RECEIVER TUNERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

EXTERNAL SHIELD #315 CONNECTED TO PIN 9

	#1 TRIODE	#2 TRIODE	
GRID TO PLATE (G TO P)	→1.2	→1.2	pf
PLATE TO CATHODE (P TO K)		→0.12	pf
HEATER TO CATHODE (H TO K)	→2.8	→2.8	pf
#1 INPUT: G1 TO (H+K+I.S.)	→2.6		pf
#2 INPUT: K TO (H+G+I.S.)[A]		→5.5	pf
#1 OUTPUT: P TO (H+K+I.S.)	1.3		pf
#2 OUTPUT: P TO (H+G+I.S.)[A]		→2.4	pf
#1 PLATE TO #2 PLATE (1P TO 2P)(MAX.)	→.02		pf
#2 PLATE TO #1 PLATE AND GRID:(2P TO 1P+1G) MAXIMUM	→.04		pf

[A] READ AS GROUNDED GRID AMPLIFIER.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.2 VOLTS	600	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE[B]			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME (AVG.)[C]		11	SECONDS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.2	WATTS
CATHODE CURRENT	→ 22	MA.
GRID CIRCUIT RESISTANCE	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

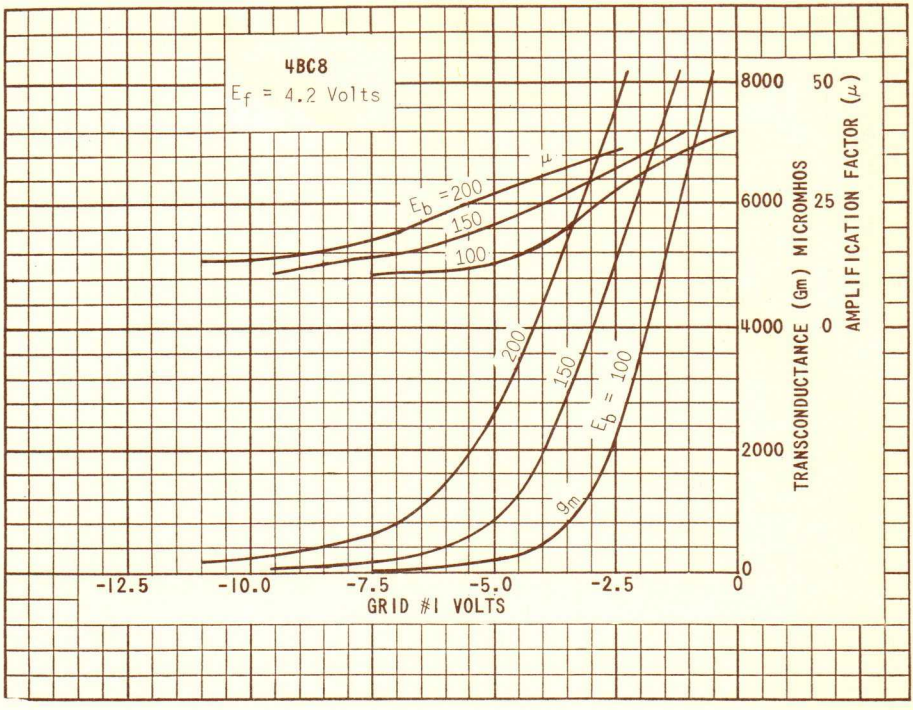
EACH UNIT

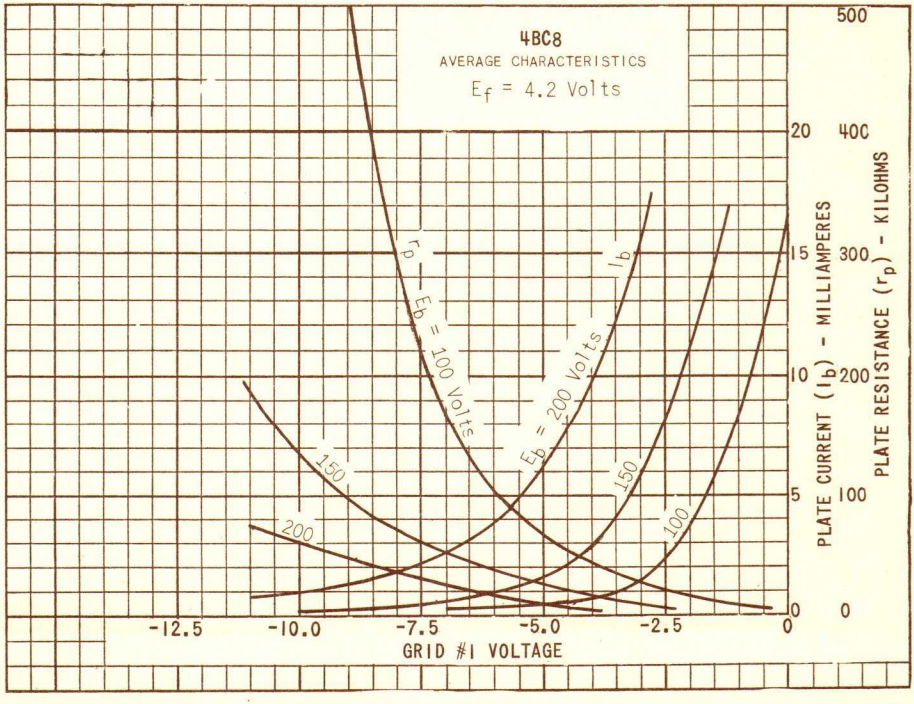
PLATE VOLTAGE	150	VOLTS
CATHODE RESISTOR	220	OHMS
PLATE RESISTANCE*	5300	OHMS
TRANSCONDUCTANCE	6200	μMHOS
AMPLIFICATION FACTOR	35	
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR GM =50 μMHOS	-13	VOLTS

[B] THIS RATING MAY BE AS HIGH AS 300 VOLTS UNDER CUTOFF CONDITIONS WHEN THE TUBE IS USED AS A CASCODE AMPLIFIER AND THE TWO SECTIONS ARE CONNECTED IN SERIES.

[C] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.





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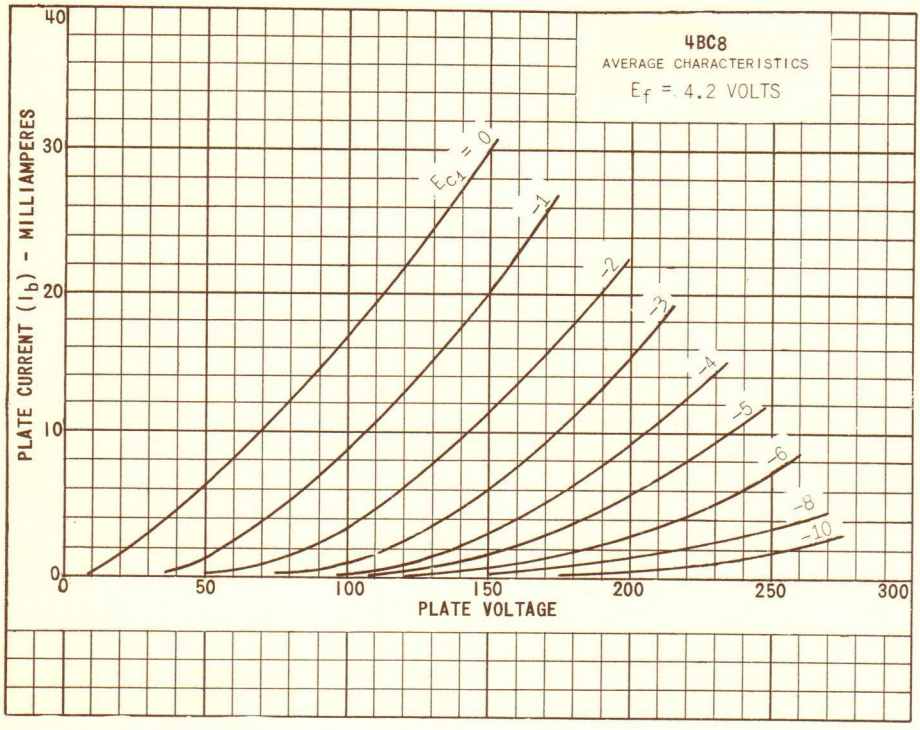
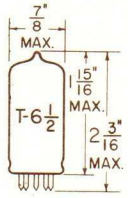

4BC8
AVERAGE CHARACTERISTICS
E_f = 4.2 VOLTS
PLATE CURRENT (I_b) - MILLIAMPERES
PLATE VOLTAGE
E_{c1} = 0
-1
-2
-3
-4
-5
-6
-8
-10
0
10
20
30
40
50
100
150
200
250
300

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

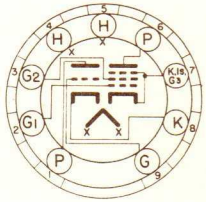
COATED UNIPOTENTIAL CATHODE

HEATER

4.6 VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

9DC

THE 4BL8 IS A TRIODE PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A FREQUENCY CHANGER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

PENTODE SECTION:		
INPUT CAPACITANCE	5.2	μμf
OUTPUT CAPACITANCE	3.4	μμf
PLATE TO GRID #1 (MAX.)	0.025	μμf
TRIODE SECTION		
INPUT CAPACITANCE	2.5	μμf
OUTPUT CAPACITANCE	1.8	μμf
PLATE TO GRID	1.5	μμf
BETWEEN PENTODE AND TRIODE SECTIONS		
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.07	μμf
PENTODE PLATE TO TRIODE GRID (MAX.)	0.02	μμf
PENTODE GRID TO TRIODE PLATE (MAX.)	0.16	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

PENTODE SECTION		
HEATER VOLTAGE	4.6	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM GRID #2 VOLTAGE AT A CATHODE CURRENT OF 14 MAMPS	175	VOLTS
MAXIMUM GRID #2 VOLTAGE AT A CATHODE CURRENT LESS THAN 10 MAMPS	200	VOLTS
MAXIMUM GRID #2 DISSIPATION AT A PLATE DISSIPATION MORE THAN 1.2 WATTS	0.75	WATT

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RATINGS - cont'd.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

PENTODE SECTION (CONT'D.)

MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH AUTOMATIC BIAS	1	MEG.
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH FIXED BIAS	0.5	MEG.
MAXIMUM CATHODE CURRENT	14	MAMPS
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE (CATHODE NEGATIVE WITH RESPECT TO HEATER)	100	VOLTS
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE (CATHODE POSITIVE WITH RESPECT TO HEATER)	200[A]	VOLTS

TRIODE SECTION

HEATER VOLTAGE	4.6	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM PLATE DISSIPATION	1.5	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEG.
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE (CATHODE NEGATIVE WITH RESPECT TO HEATER)	100	VOLTS
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE (CATHODE POSITIVE WITH RESPECT TO HEATER)	200[A]	VOLTS
MAXIMUM CATHODE CURRENT	14	MAMPS.

[A] DC COMPONENT 120 VOLTS MAX.

TYPICAL CHARACTERISTICS

PENTODE SECTION

HEATER VOLTAGE	4.6	VOLTS
HEATER CURRENT	0.60	AMP.
PLATE VOLTAGE	170	VOLTS
GRID #2 VOLTAGE	170	VOLTS
GRID #1 BIAS	−2	VOLTS
PLATE CURRENT	10	MAMPS.
GRID #2 CURRENT	2.8	MAMPS.
TRANSCONDUCTANCE	6200	μMHOS
PLATE RESISTANCE	0.4	MEG.
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	47	
INPUT RESISTANCE AT 50MC	10 000	OHMS
EQUIVALENT NOISE RESISTANCE	1500	OHMS

TRIODE SECTION

HEATER VOLTAGE	4.6	VOLTS
HEATER CURRENT	0.60	AMP.
PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	−2	VOLTS
PLATE CURRENT	14	MAMPS.
TRANSCONDUCTANCE	5000	μMHOS
AMPLIFICATION FACTOR	20	

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TUNG-SOL

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OPERATING CHARACTERISTICS

FOR USE AS MIXER

HEATER VOLTAGE	4.6		VOLTS
HEATER CURRENT	0.60		AMP.
PLATE VOLTAGE	170	170	VOLTS
GRID #2 VOLTAGE	170	170	VOLTS
GRID #1 CIRCUIT RESISTANCE	0.1	0.1	MEG.
CATHODE RESISTOR	330	820	OHMS
OSCILLATOR VOLTAGE (RMS)	3.5	3.5	VOLTS
PLATE CURRENT	6.5	5.2	MAMPS
GRID #2 CURRENT	2.0	1.5	MAMPS.
GRID #1 CURRENT	20	0	μAMPS
CONVERSION CONDUCTANCE	2200	2100	μMHOS
PLATE RESISTANCE	0.8	0.87	MEG.

OPTIMUM PEAK CATHODE CURRENT OF THE TRIODE SECTION IN FRAME OUTPUT APPLICATION. TO ALLOW FOR TUBE SPREAD, FOR DETERIORATION DURING LIFE AND FOR EMISSION DROP AT UNDERHEATING THE SET SHOULD BE DESIGNED SO THAT WITH A PEAK CATHODE CURRENT OF 100 MA (MAX. PULSE DURATION 4% OF A CYCLE, WITH A MAXIMUM OF 0.8 MSEC.) IT STILL OPERATES SATISFACTORILY. IT IS RECOMMENDED THAT THE AMPLITUDE OF THE PEAK CURRENTS OCCURRING WITH FRESH TUBES BE LIMITED AUTOMATICALLY TO THIS MAX. VALUE OF 100 MA. (e.g. BY NON-BYPASSED RESISTANCES IN THE GRID LEAD).

NOTE: IT IS RECOMMENDED TO EMPLOY THE TRIODE IN A COLPITTS TYPE OF CIRCUIT AND NOT IN A HARTLEY TYPE.

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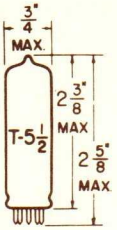
PENTODE

MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

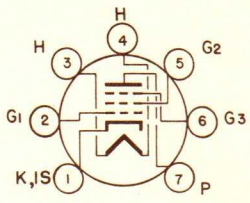
COATED UNIPOTENTIAL CATHODE

GATED-BEAM DISCRIMINATOR

FOR FM AND INTERCARRIER

TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7DF

THE 4BN6 IS A GATED-BEAM DISCRIMINATOR TUBE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED TO PERFORM THE COMBINED OPERATION OF DETECTOR AND AUDIO-VOLTAGE AMPLIFIER IN 450 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. A UNIQUE DESIGN, MAKING USE OF THE ELECTROSTATIC BEAM DEFLECTION PRINCIPLE, RESULTS IN VERY EFFICIENT LIMITING AS WELL AS PROVIDING FOR FM DETECTION AND AMPLIFICATION. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BN6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO ALL	4.2	pf
GRID #3 TO ALL	3.3	pf
GRID #1 TO GRID #3 (MAX.)	0.004	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.2 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±45	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
HEATER WARM-UP TIME (APPROX.)*		11	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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MAXIMUM RATINGS ←

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE SUPPLY VOLTAGE	330	VOLTS
GRID VOLTAGE	110	VOLTS
PEAK POSITIVE LIMITER-GRID VOLTAGE	60	VOLTS
DC CATHODE CURRENT	13	MA.

TYPICAL OPERATING CHARACTERISTICS ←

LIMITER-DISCRIMINATOR SERVICE

INPUT-SIGNAL CENTER FREQUENCY	10.7	10.7	4.5	MEGACYCLES
FREQUENCY DEVIATION	±75	±75	±25	KCYCLES
PLATE-SUPPLY VOLTAGE	85	285	270	VOLTS
PLATE VOLTAGE	63	122	121	VOLTS
ACCELERATOR VOLTAGE	55	100	100	VOLTS
CATHODE-BIAS RESISTOR (VARIABLE) [A]	200-400	200-400	200-400	OHMS
PLATE LOAD RESISTOR	85000	330000	330000	OHMS
PLATE LINEARITY RESISTOR	470	1500	1000	OHMS
INTEGRATING CAPACITOR	0.002	0.001	0.001	μf
COUPLING CAPACITOR	0.25	0.01	0.25	μf
MINIMUM SIGNAL VOLTAGE FOR LIMITING ACTION, RMS [B]	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 [A]	1.25	2.0	2.0	VOLTS
AM REJECTION AT Esig=2.0V., RMS	31	20	25	DECIBELS
AM REJECTION AT Esig=3.0V., 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

[A] THE CATHODE RESISTOR SHOULD BE ADJUSTED FOR MAXIMUM AM REJECTION IN THE OUTPUT OF LIMITER-DISCRIMINATOR STAGE AT THE SPECIFIED SIGNAL LEVEL. AM REJECTION IS MEASURED WITH AN APPLIED SIGNAL CONTAINING 30-PERCENT AMPLITUDE MODULATION AND 30-PERCENT FREQUENCY MODULATION.

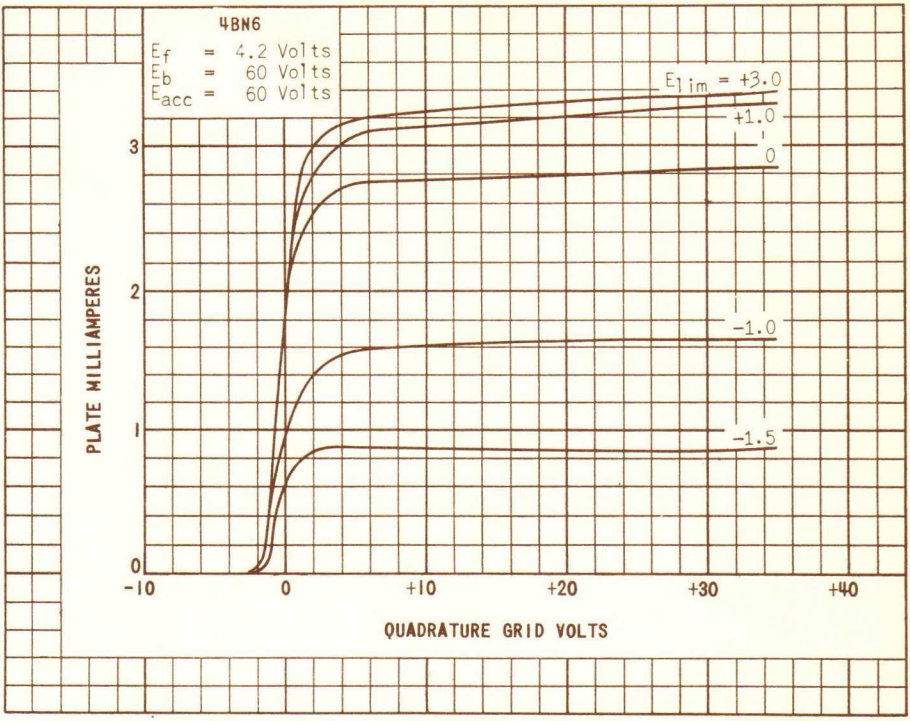
[B] AT SIGNAL LEVELS ABOVE SPECIFIED VALUE, LIMITING IS WITHIN ±2 DECIBELS.

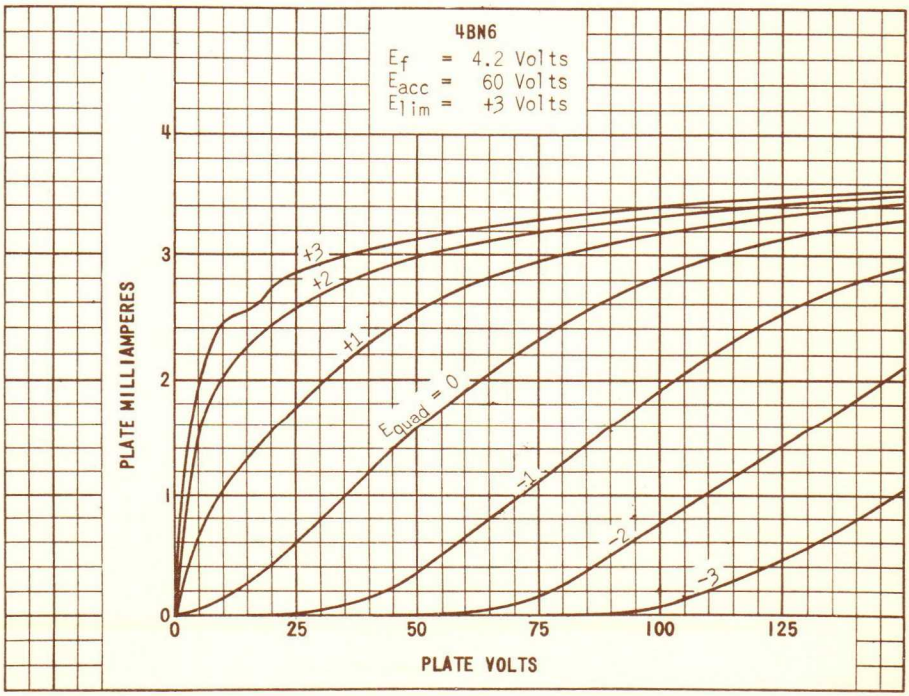
ADEQUATE SHIELDING BETWEEN COMPONENTS OF THE LIMITER GRID AND THE QUADRATURE GRID MUST BE USED TO INSURE PROPER PHASING OF THE VOLTAGE DEVELOPED ON THE QUADRATURE GRID.

STANDARD DE-EMPHASEIS REQUIREMENTS FOR FM ARE INCLUDED.

THE Q OF THE QUADRATURE GRID CIRCUIT SHOULD BE HIGH ENOUGH TO DEVELOP A MINIMUM OF 4 VOLTS (RMS) SIGNAL WITH 2 VOLTS (RMS) OF THE CENTER-FREQUENCY SIGNAL APPLIED TO THE LIMITER GRID. IT IS RECOMMENDED THAT THE COIL BE SHUNTED BY A MINIMUM OF 10 μμf. THE CAPACITANCE MAY BE COMPOSED OF TUBE INPUT CAPACITANCE, STRAY CAPACITANCE, AND DISTRIBUTED CAPACITANCE, AS WELL AS PHYSICAL CAPACITANCE.

→ INDICATES A CHANGE.





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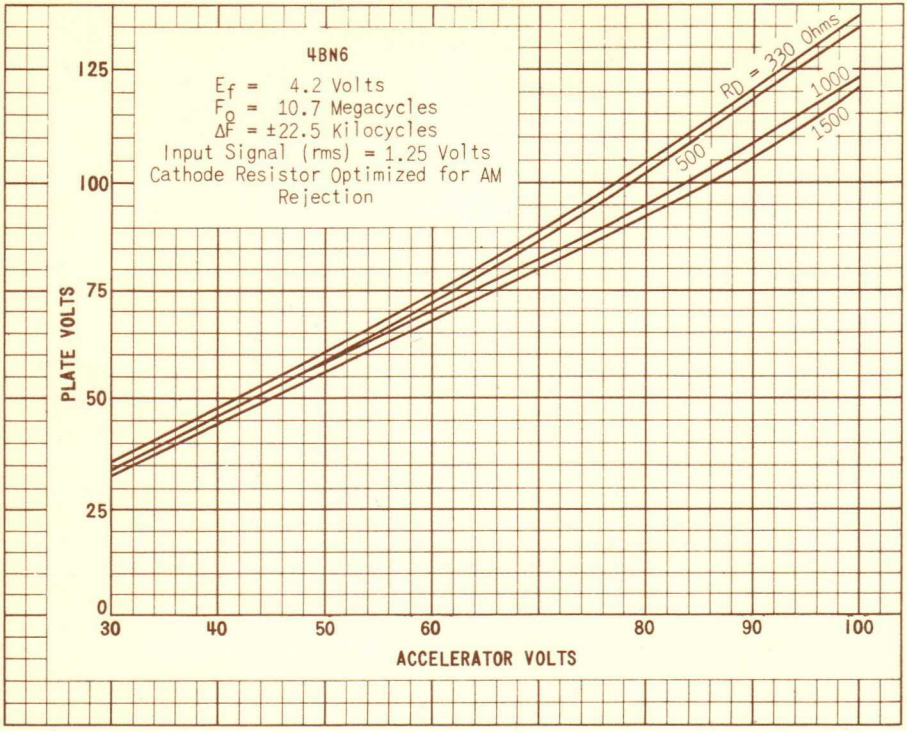
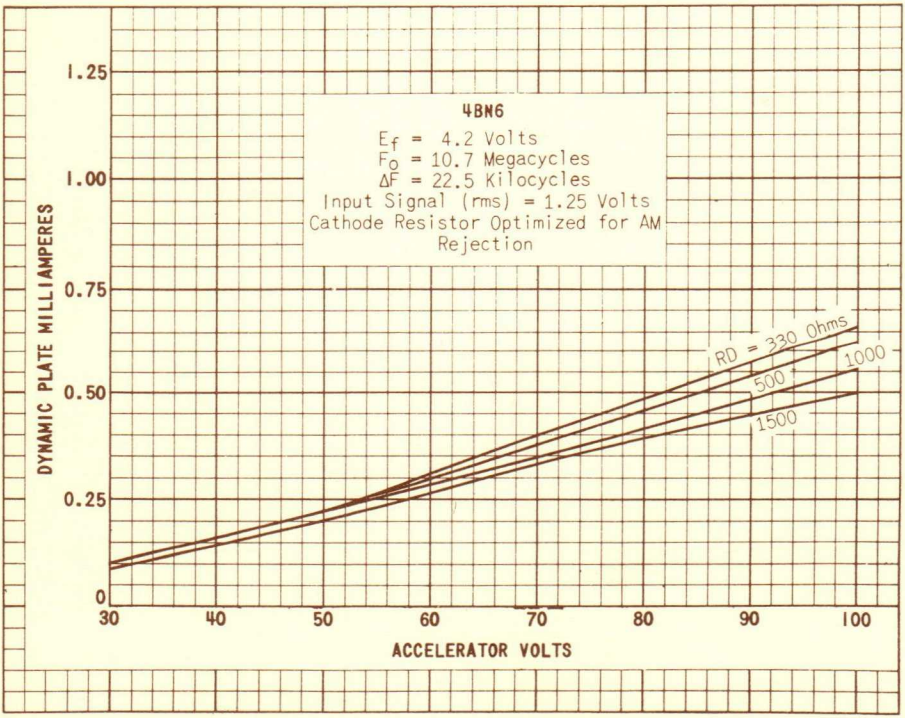
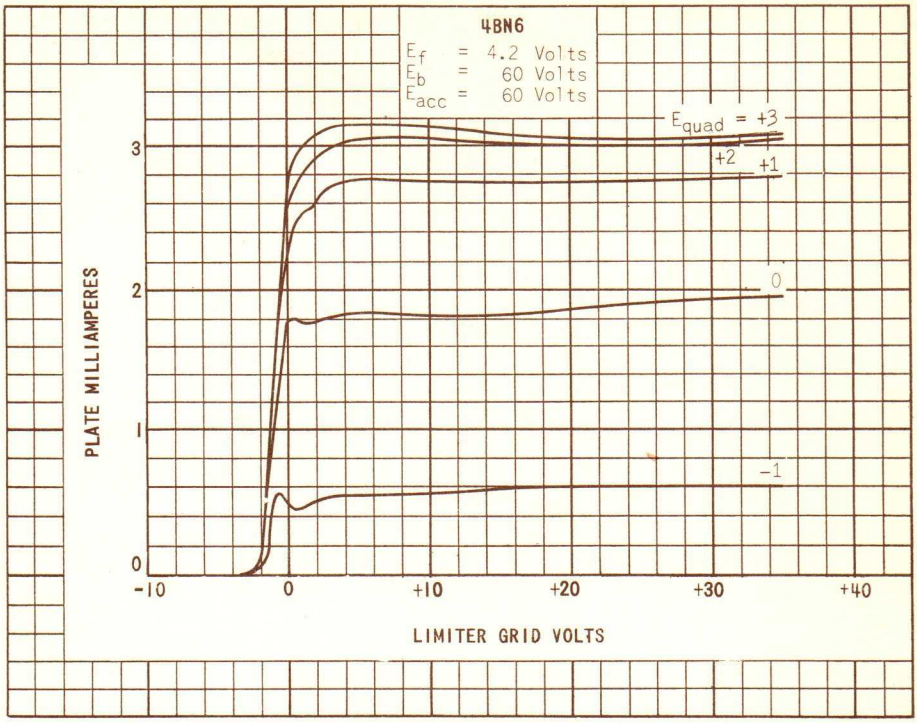

4BN6
E_f = 4.2 Volts
F_o = 10.7 Megacycles
ΔF = ±22.5 Kilocycles
Input Signal (rms) = 1.25 Volts
Cathode Resistor Optimized for AM Rejection
RD = 330 Ohms
500
1000
1500
PLATE VOLTS
0
25
50
75
100
125
30
40
50
60
80
90
100
ACCELERATOR VOLTS


4BN6
E_f = 4.2 Volts
F_o = 10.7 Megacycles
ΔF = 22.5 Kilocycles
Input Signal (rms) = 1.25 Volts
Cathode Resistor Optimized for AM Rejection
RD = 330 Ohms
500
1000
1500
DYNAMIC PLATE MILLIAMPERES
0
0.25
0.50
0.75
1.00
1.25
30
40
50
60
70
80
90
100
ACCELERATOR VOLTS



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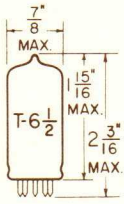
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

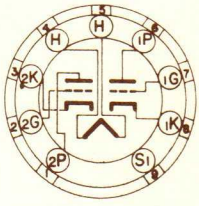


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN NOVAL
9AJ

THE 4BQ7A, A MEDIUM-MU DOUBLE TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION, IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT IS INTENDED FOR SERVICE AS THE FIRST RF AMPLIFIER TUBE IN TUNERS OF VHF TELEVISION RECEIVERS OR AS A LOW NOISE IF PRE-AMPLIFIER TUBE IN UHF TELEVISION RECEIVERS EMPLOYING A CRYSTAL MIXER. HIGH TRANSCONDUCTANCE, LOW INPUT CAPACITANCE, LOW INPUT LOADING, AND LOW PLATE TO CATHODE CAPACITANCE MAKE IT SPECIALLY USEFUL IN THE DIRECT-COUPLED RF STAGE OF TELEVISION RECEIVERS UTILIZING A DRIVEN RF-GROUNDED-GRID AMPLIFIER FOR THE CASCODE TYPE OF CIRCUIT. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES THAT ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BQ7A.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315

	UNIT #1	UNIT #2	
GRID TO PLATE	1.15	1.15	μμf
INPUT	2.85	----	μμf
INPUT (GROUNDED GRID)	----	4.95	μμf
OUTPUT	1.35	----	μμf
OUTPUT (GROUNDED GRID)	----	2.27	μμf
PLATE TO CATHODE (MAX.)	0.15	0.15	μμf
HEATER TO CATHODE	2.65	2.70	μμf
PLATE OF UNIT #1 TO PLATE OF UNIT #2 (MAX.)	0.010		μμf
PLATE OF UNIT #2 TO PLATE AND GRID OF UNIT #1 (MAX.)	0.024		μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

CLASS A_1 AMPLIFIER - EACH TRIODE UNIT

HEATER VOLTAGE	4.2	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
MAXIMUM PLATE VOLTAGE	250[A]	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHM
HEATER WARM-UP TIME (APPROX.)*	11.0	SEC.

[A] UNDER CUT-OFF CONDITIONS, IN RF-GROUNDED-GRID CIRCUITS WITH DIRECT-COUPLED DRIVE, IT IS PERMISSIBLE FOR THIS VOLTAGE TO BE AS HIGH AS 300 VOLTS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH UNIT

	DESIGN CENTER VALUES	
HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	39	
PLATE RESISTANCE	6 100	OHMS
TRANSCONDUCTANCE	6 400	µMHOS
PLATE CURRENT	9	MA.
GRID VOLTS (APPROX.) FOR I_b = 10 µAMP.	−10	VOLTS

PUSH–PULL RF GROUNDED GRID CIRCUIT – EACH UNIT

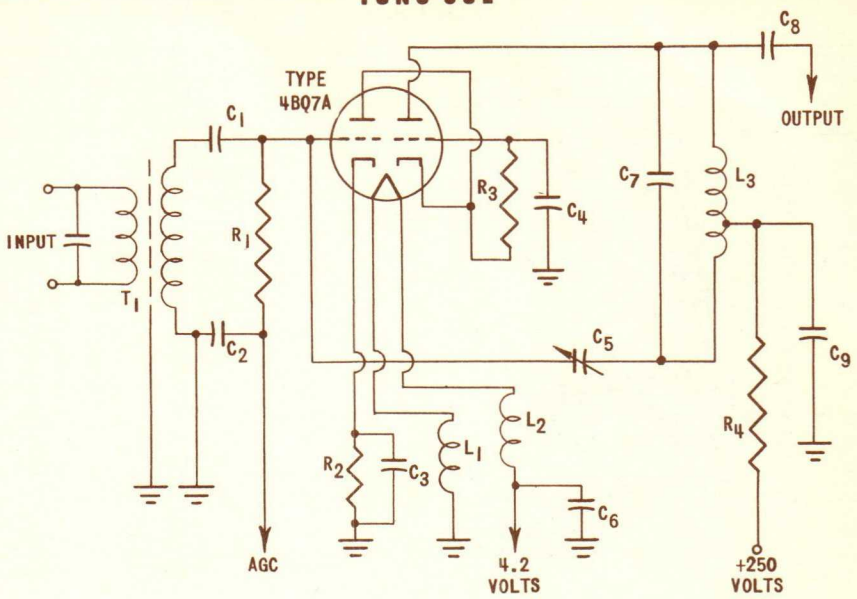
HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	150	VOLTS
GRID VOLTAGE (OBTAINED FROM CATHODE RESISTOR)	−2	VOLTS
CATHODE RESISTOR (COMMON TO BOTH UNITS)	100	OHMS
PLATE CURRENT	10	MA.

RF GROUNDED GRID CIRCUIT WITH DIRECT–COUPLED DRIVE

UNIT #1 (DRIVER TUBE) IS DIRECTLY COUPLED TO UNIT #2 (DRIVEN RF-GROUNDED-GRID AMPLIFIER TUBE) AS SHOWN IN ACCOMPANYING CIRCUIT.

	UNIT #1	UNIT #2	
HEATER VOLTAGE	4.2	4.2	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PEAK HEATER CATHODE VOLTAGE: HEATER NEGATIVE WITH RESPECT TO CATHODE	1	250	VOLTS
PLATE SUPPLY VOLTAGE	250	250	VOLTS
PLATE VOLTAGE	135	115	VOLTS
GRID VOLTAGE	−1	---	VOLTS
GRID RESISTOR	---	0.5	MEGOHM
PLATE CURRENT	10	10	MA.
GRID CURRENT	0	0	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 µAMP.	−14	---	VOLTS

TUNG-SOL

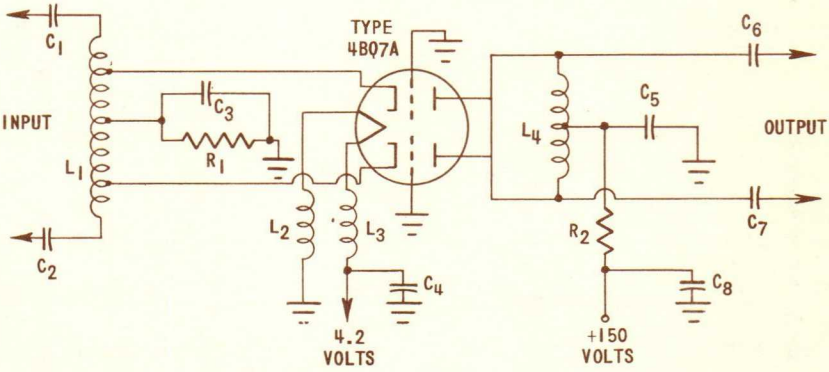


C1: 33 uuf, 400 VOLTS
C2: 1000 uuf, 400 VOLTS
C3: 1000 uuf, 400 VOLTS
C4: 1000 uuf, 400 VOLTS
C5: 0.5 to 1.5 uuf, 400 VOLTS
C6: 1000 uuf, 400 VOLTS
C7: 2 uuf, 400 VOLTS
C8: 33 uuf, 400 VOLTS
C9: 1000 uuf, 400 VOLTS

L1, L2: BIFILAR CHOKES, EACH 10 TURNS NO. 18 ENAMEL WIRE 1/4" COIL FORM
L3: TUNED CIRCUIT ELEMENT OF TUNER. VALUE DEPENDS ON DISTRIBUTED CIRCUIT CAPACITANCES. TO DETERMINE TAP POINT, TAP DOWN TO 80 TO 90% OF TOTAL NUMBER OF TURNS

R1: 10000 OHMS, 0.5 WATT
R2: 100 OHMS, 0.5 WATT
R3: 500000 OHMS, 0.5 WATT
R4: 100 OHMS, 0.5 WATT
T1: TUNED CIRCUIT ELEMENT OF TUNER. VALUE DEPENDS ON DISTRIBUTED CIRCUIT CAPACITANCES.

DRIVEN RF-GROUNDED GRID AMPLIFIER CIRCUIT WITH DIRECT COUPLED DRIVE



C1 C2 C3 C4 C5: 1000 uuf, 400 VOLTS
C6 C7: 100 uuf, 400 VOLTS
C8: 1000 uuf, 400 VOLTS

L1 L4: TUNED CIRCUIT ELEMENTS OF TUNER. VALUES DEPEND ON DISTRIBUTED CIRCUIT CAPACITANCES.

L2 L3: BIFILAR CHOKES, EACH 10 TURNS OF NO. 18 ENAMEL WIRE, 1/4" COIL FORM.
R1 R2: 100 OHMS, 0.5 WATT

PUSH-PULL RF GROUNDED-GRID CIRCUIT

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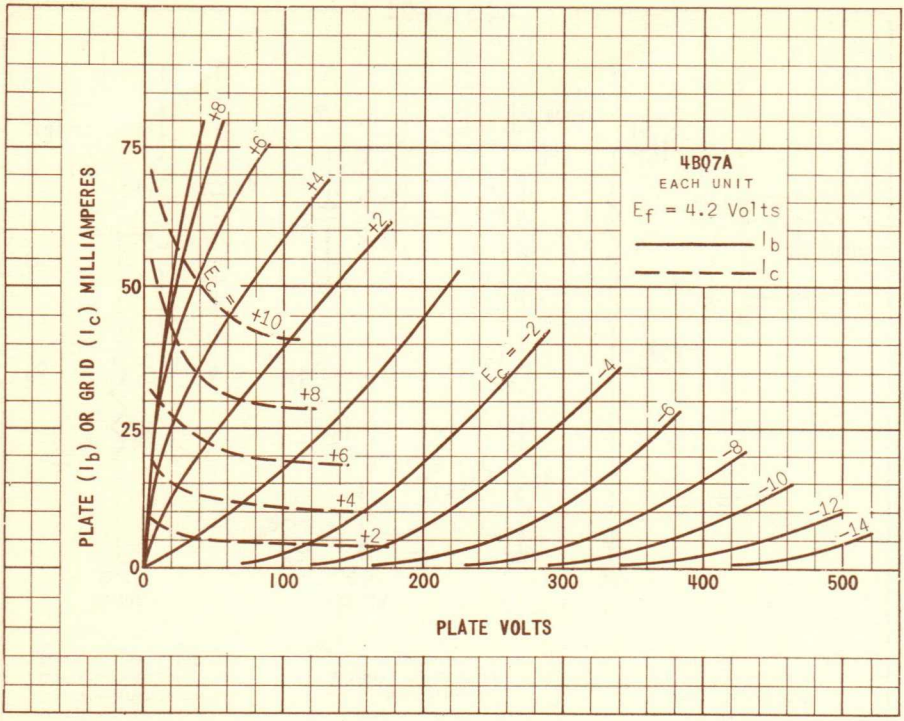
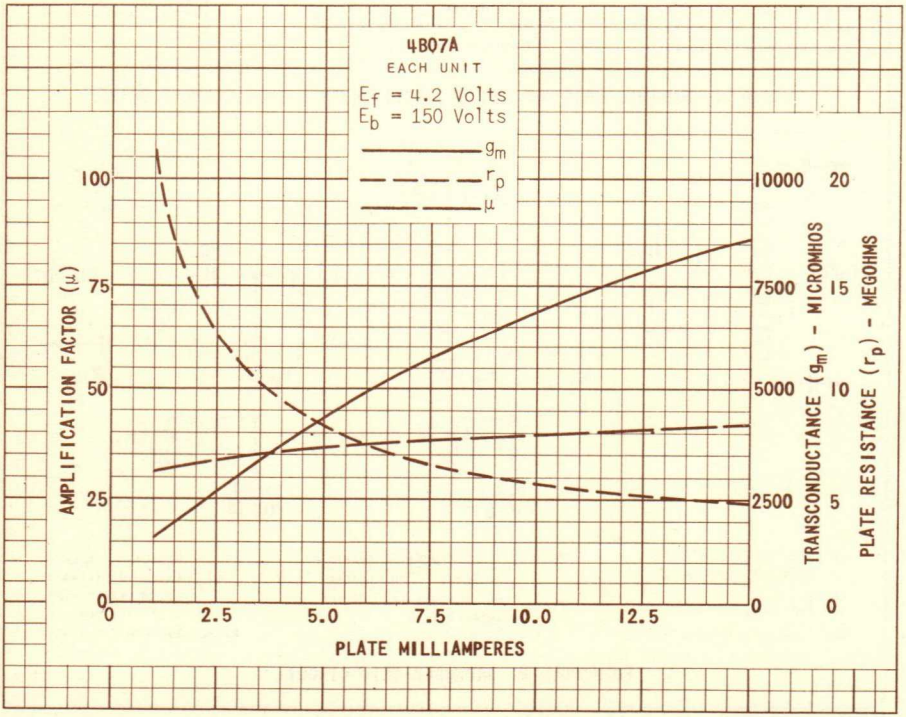
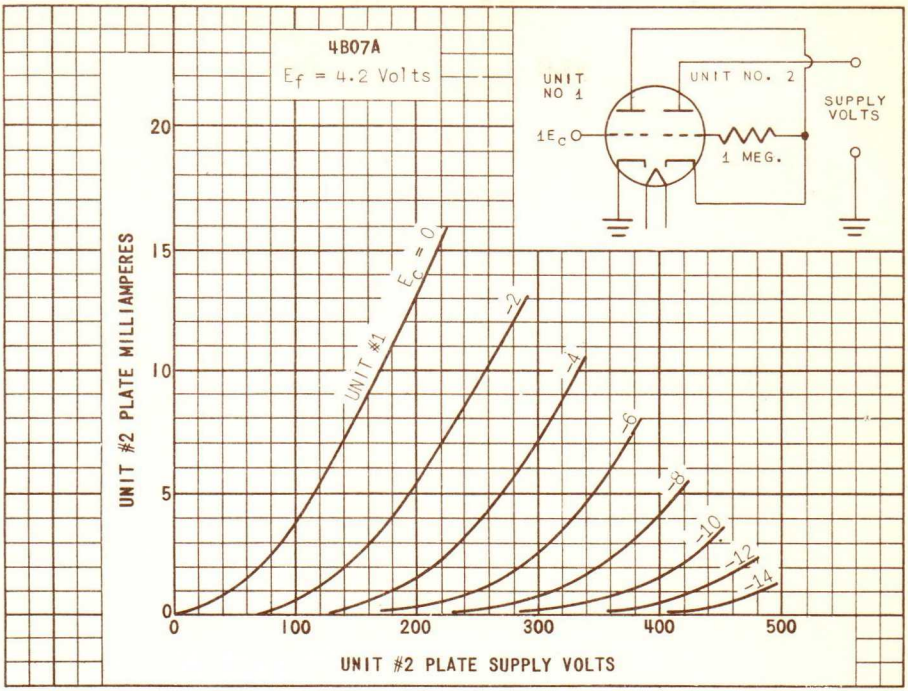
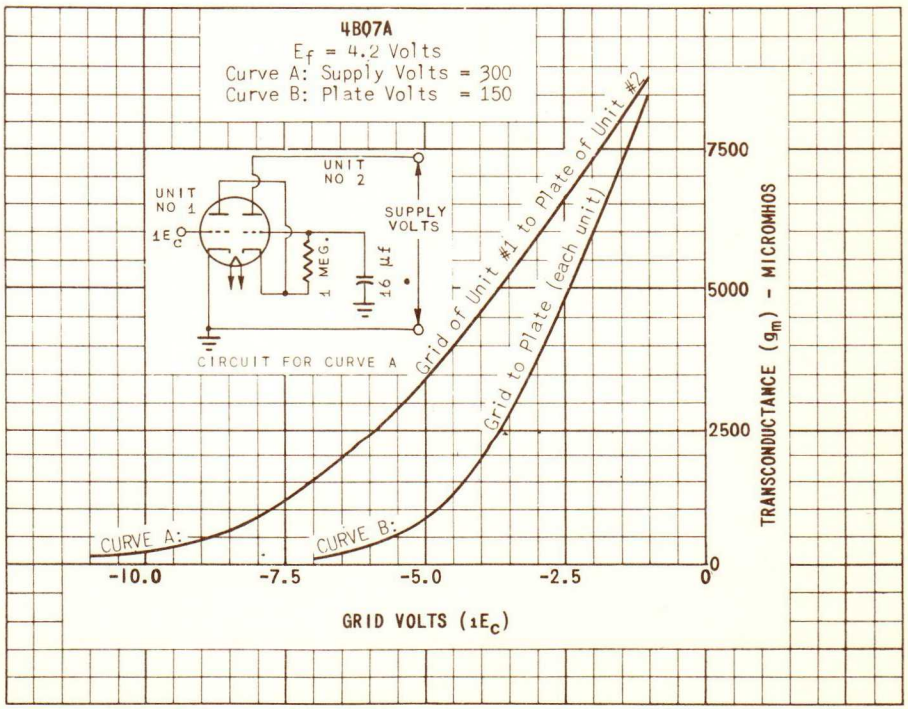

4BQ7A
EACH UNIT
E_f = 4.2 Volts
I_b
I_c
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
200
300
400
500
+8
+6
+4
+2
E_c = +2
+10
+8
+6
+4
+2
E_c = -2
-4
-6
-8
-10
-12
-14


4BQ7A
EACH UNIT
E_f = 4.2 Volts
E_b = 150 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - MEGOHMS
PLATE MILLIAMPERES
0
25
50
75
100
2500
5000
7500
10000
0
5
10
15
20
2.5
5.0
7.5
10.0
12.5





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TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

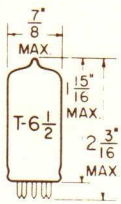
COATED UNIPOTENTIAL CATHODE

HEATER

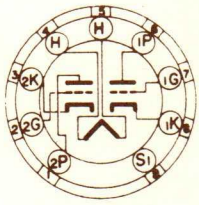
4.5 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

SMALL-BUTTON NOVAL
9 PIN BASE

9AJ

THE 4BS8 IS A 9-PIN MINIATURE TWIN TRIODE DESIGNED FOR USE AS A LOW-NOISE VHF AMPLIFIER IN CASCODE OPERATION. THIS TYPE HAS HIGH GAIN AND HIGH CASCODE TRANSCONDUCTANCE. IT IS DESIGNED FOR OPERATION WITH SECTION 2 (PINS 1, 2, AND 3) AS INPUT SECTION OF THE CASCODE CIRCUIT. THERMAL CHARACTERISTICS OF THE HEATER HAVE BEEN CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER WARM-UP TIME AND HEATER RATINGS, IT IS IDENTICAL TO THE 6BS8.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315

	UNIT 1	UNIT 2	
GRID TO PLATE	1.15	1.15	μμf
PLATE TO CATHODE (MAX.)	0.15	0.15	μμf
HEATER TO CATHODE	2.60	2.6	μμf
INPUT	2.60		μμf
OUTPUT	1.2		μμf
PLATE OF UNIT 1 TO PLATE OF UNIT 2 (MAX.)		0.010	μμf
PLATE OF UNIT 2 TO PLATE AND GRID OF UNIT 1 (MAX.)		0.024	μμf
GROUNDED GRID OPERATION:			
INPUT		5.0	μμf
OUTPUT		2.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER - EACH UNIT

HEATER VOLTAGE	4.5	VOLTS
MAXIMUM DC PLATE VOLTAGE	150	VOLTS
MAXIMUM DC CATHODE CURRENT	20	MA.
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM CIRCUIT VALUE: (EACH UNIT)		
GRID CIRCUIT RESISTANCE	0.5	MEGOHM
HEATER WARM-UP TIME (APPROX.)	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	4.5	VOLTS
HEATER CURRENT	0.6	AMPERE
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	36	
PLATE RESISTANCE	5000	OHMS
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA	-7 (SEC. 2 ONLY)	VOLTS
TRANSCONDUCTANCE	7200	μMHOS

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TYPICAL CASCODE CONDITIONS AND CHARACTERISTICS

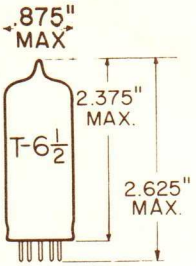
HEATER VOLTAGE	4.5	VOLTS
HEATER CURRENT	0.6	AMPERE
PLATE SUPPLY VOLTAGE	250	VOLTS
GRID VOLTAGE	-1	VOLTS
PLATE CURRENT	16	MA.
GRID VOLTAGE (APPROX.) FOR G_m = 50 μMHOS	-6	VOLTS
TRANSCONDUCTANCE	10 000	μMHOS

→ INDICATES A CHANGE.

TUNG-SOL

TWIN PENTODE

MINIATURE TYPE

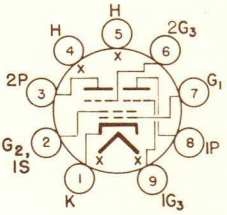


GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 450 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9FG

THE 4BU8 IS A MINIATURE MULTISECTION TUBE WHICH INCORPORATES SEPARATE PLATES AND NUMBER 3 GRIDS FOR THE TWO SECTIONS TOGETHER WITH A COMMON SCREEN, NUMBER 1 GRID, AND CATHODE. THE TUBE IS INTENDED FOR USE AS A COMBINED SYNC-AGC TUBE IN TELEVISION RECEIVERS. IN THIS SERVICE, WHEN USED IN CONJUNCTION WITH SUITABLE CIRCUITRY, ONE SECTION OF THE 4BU8 FUNCTIONS AS SYNC SEPARATOR AND SYNC CLIPPER, WHILE THE OTHER SECTION IS USED TO GENERATE THE AUTOMATIC-GAIN-CONTROL VOLTAGE. IN ADDITION, BY UTILIZING THE COMMON, #1 GRID, NOISE PULSES CAN BE SUPPRESSED FROM BOTH SYNCHRONIZING AND AUTOMATIC-GAIN-CONTROL CIRCUITS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS THE 4BU8 IS IDENTICAL TO THE 6BU8.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE, (EACH SECTION)	1.9	pf
GRID #1 TO ALL	6.0	pf
GRID #3 TO ALL (EACH SECTION)	3.6	pf
PLATE TO ALL (EACH SECTION)	3.0	pf
GRID #3 (SECTION 1) TO GRID #3 (SECTION 2) MAX.	0.015	pf

RATINGS

→ DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

MAXIMUM PLATE VOLTAGE (EACH SECTION)	300	VOLTS
MAXIMUM SCREEN VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE (EACH SECTION)	3.0	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM PEAK POSITIVE GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.1	WATTS
MAXIMUM SCREEN DISSIPATION	0.75	WATTS
MAXIMUM DC CATHODE CURRENT	12	MA.

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→ INDICATES A CHANGE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS — CONT'D

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

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
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHMS
MAXIMUM GRID #3 CIRCUIT RESISTANCE (EACH SECTION)	0.5	MEGOHMS
HEATER WARM-UP TIME*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

BOTH SECTIONS OPERATING

PLATE VOLTAGE (EACH SECTION)	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE (EACH SECTION)	-10	0	VOLTS
GRID #1 VOLTAGE	**	**	
PLATE CURRENT (EACH SECTION)		2.2	MA.
SCREEN CURRENT	6.5	3.3	MA.
CATHODE CURRENT	6.6	7.8	MA.

EACH SECTION SEPARATELY [A]

PLATE VOLTAGE	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	**	VOLTS
GRID #3 TRANSCONDUCTANCE	---	180	μMHOS
GRID #1 TRANSCONDUCTANCE	1 500	---	μMHOS
PLATE CURRENT	---	2.2	MA.
GRID #3 VOLTAGE (APPROX.) I_b=100μAMPS	---	-4.5	VOLTS
GRID #1 VOLTAGE (APPROX.) I_b=100μAMPS	---	2.3	VOLTS

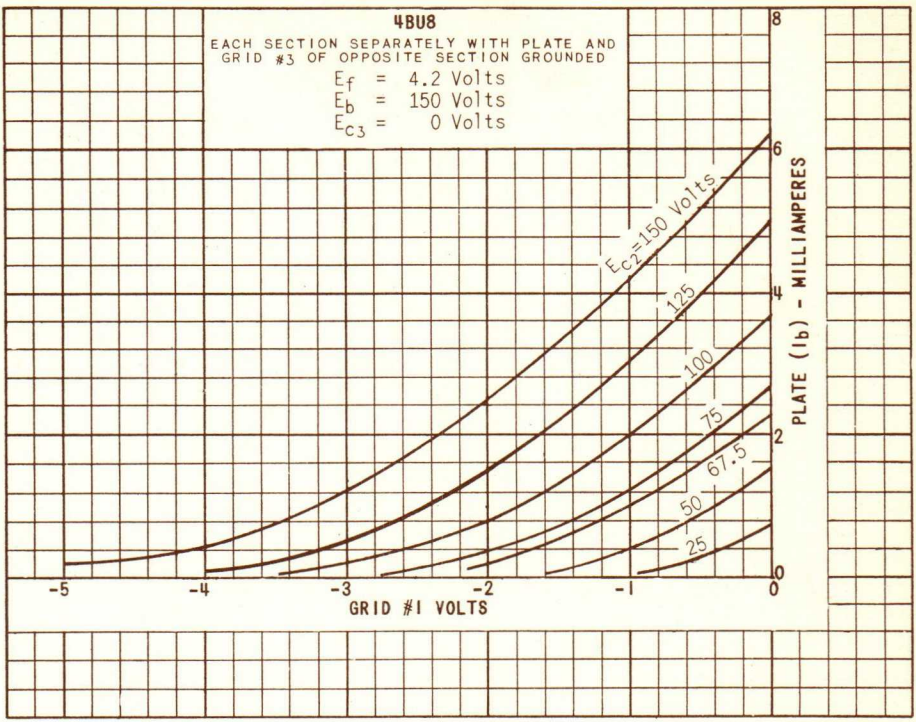
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

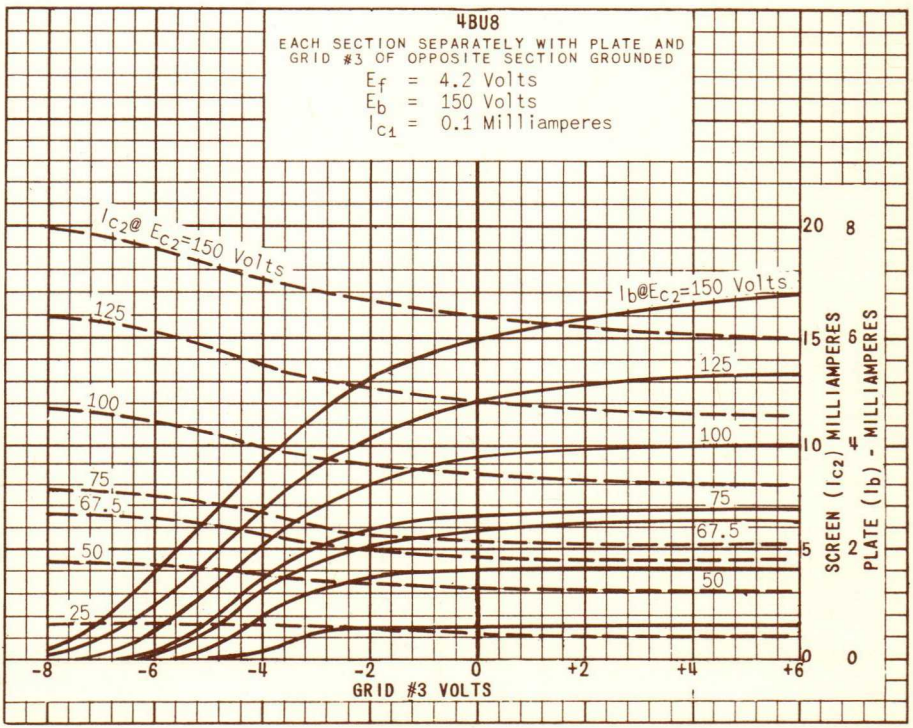
** WITH GRID CURRENT ADJUSTED FOR 100 μAMPS D-C.

A WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

SIMILAR TYPE REFERENCE: Except for heater ratings the 4BU8 is identical to the 6BU8.





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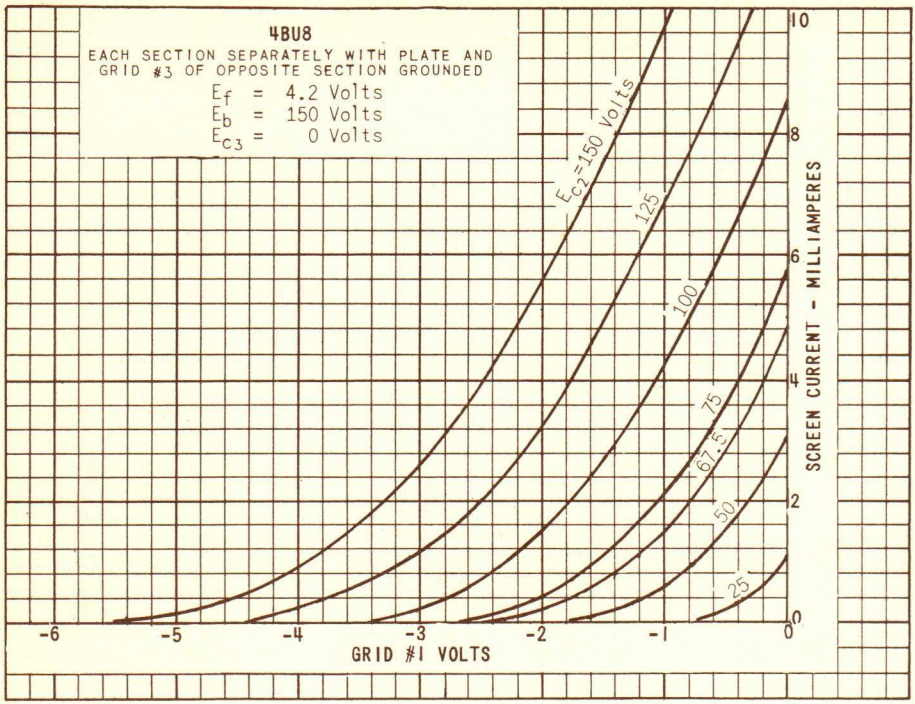
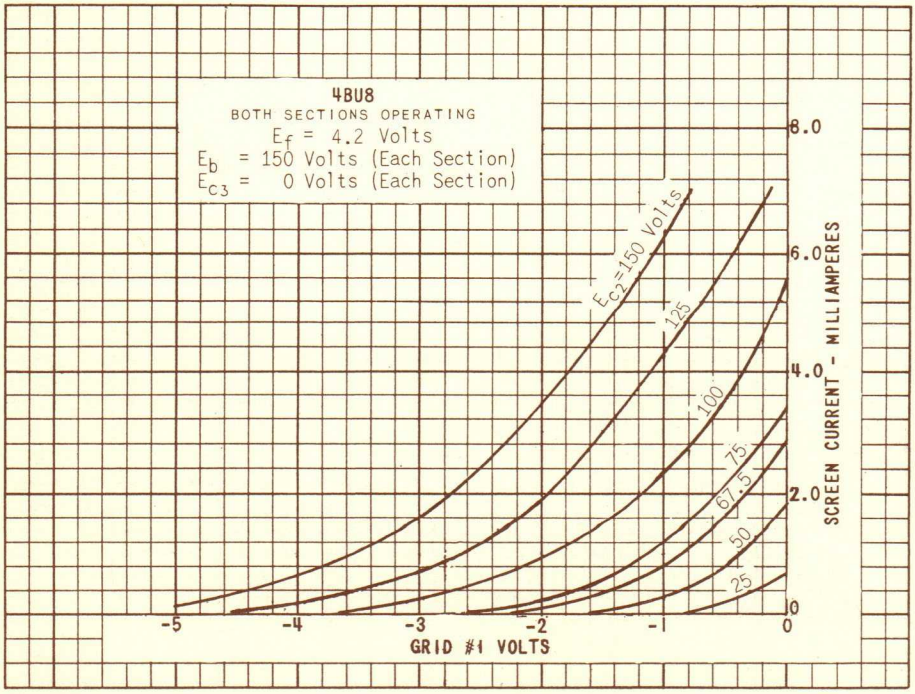
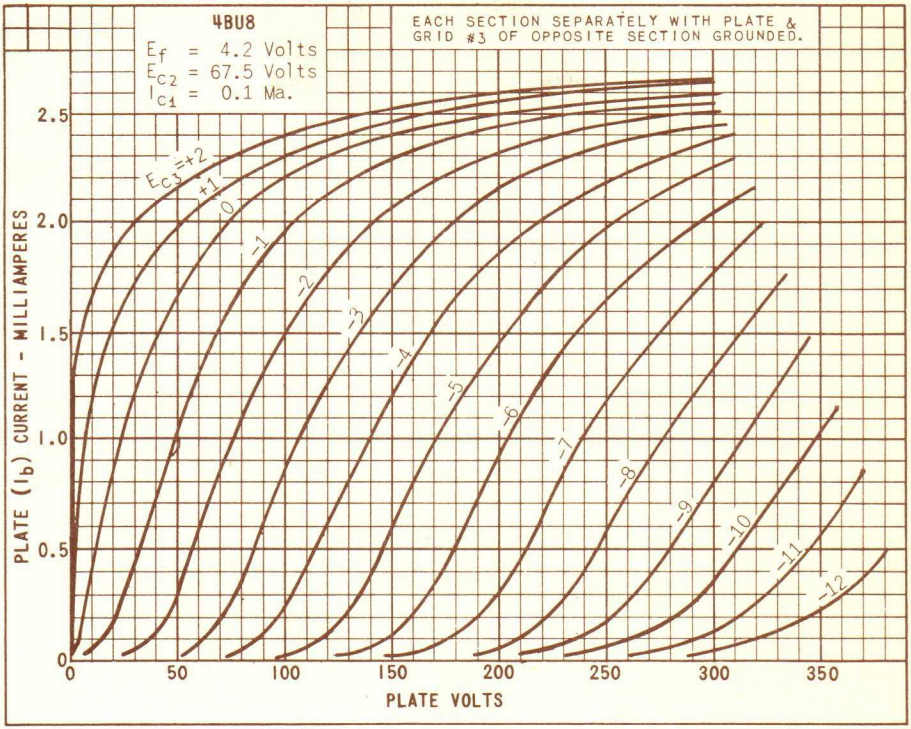
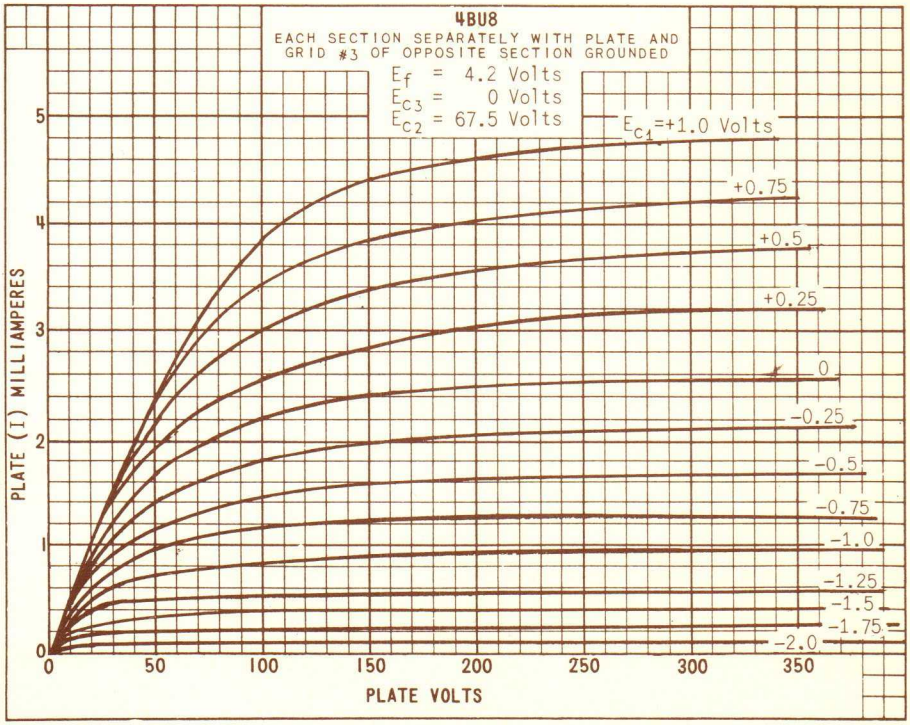

4BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 4.2 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT - MILLIAMPERES
10
8
6
4
2
0
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


4BU8
BOTH SECTIONS OPERATING
E_f = 4.2 Volts
E_b = 150 Volts (Each Section)
E_{c3} = 0 Volts (Each Section)
E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT - MILLIAMPERES
8.0
6.0
4.0
2.0
0
-5
-4
-3
-2
-1
0
GRID #1 VOLTS





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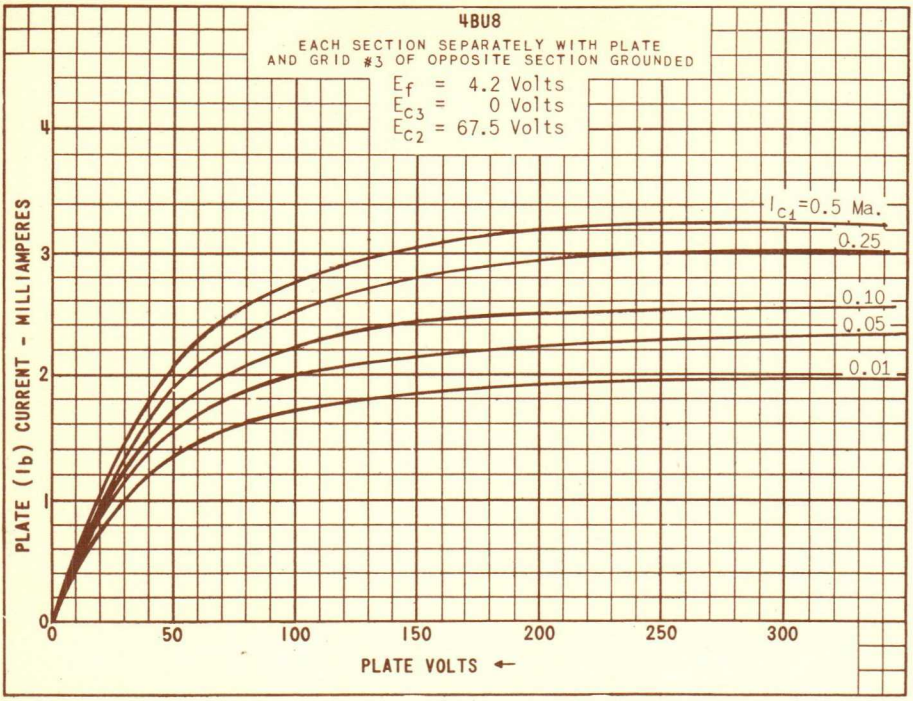
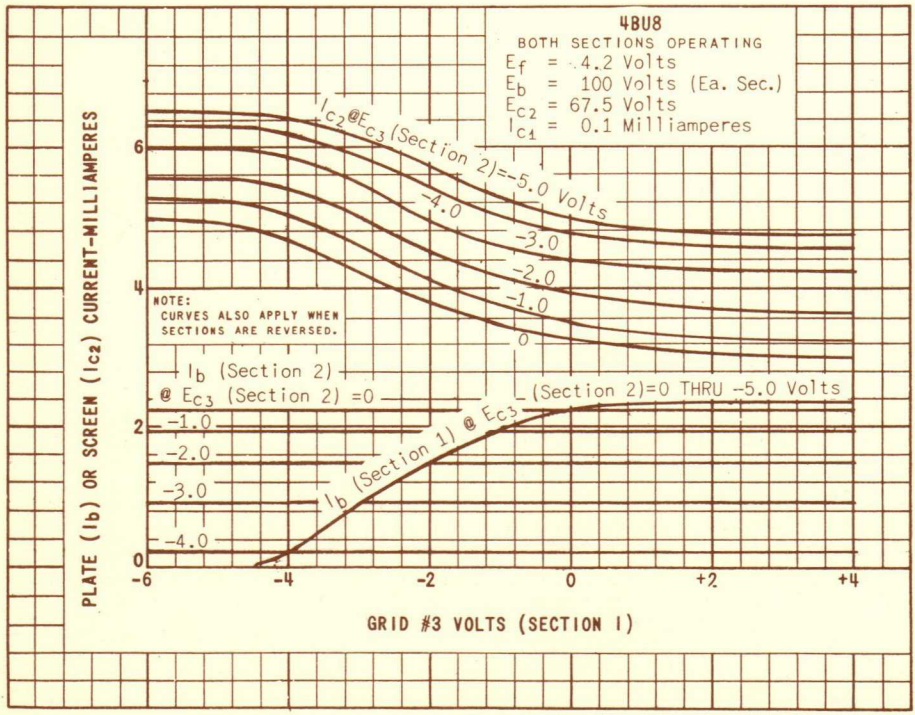
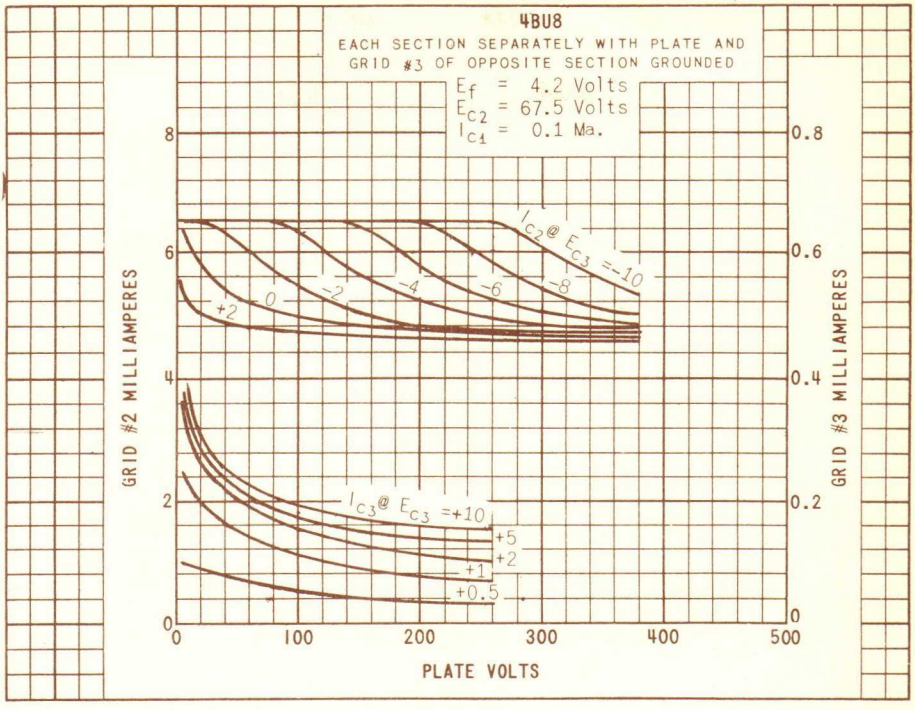
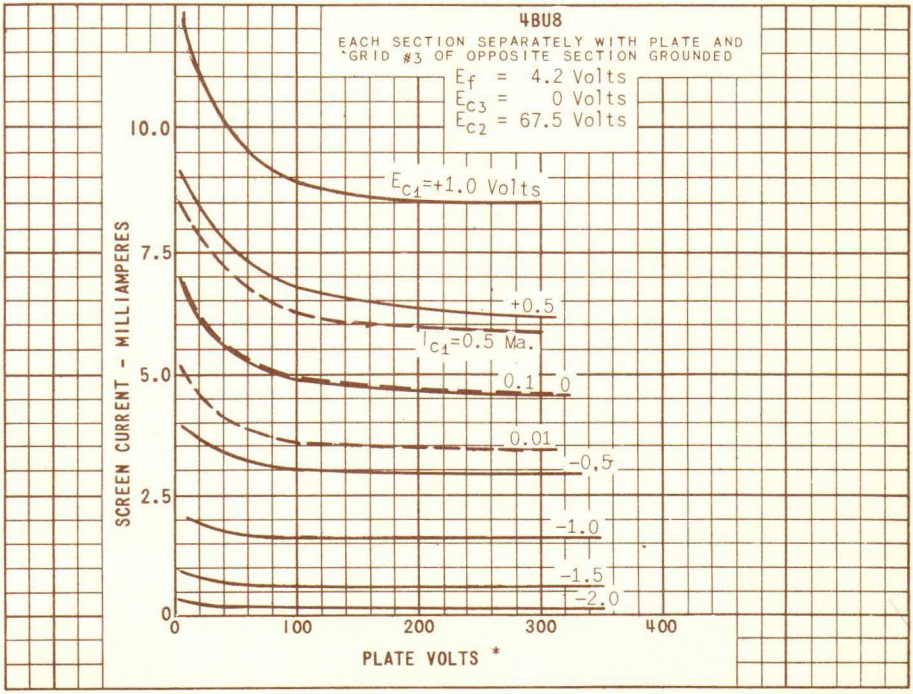
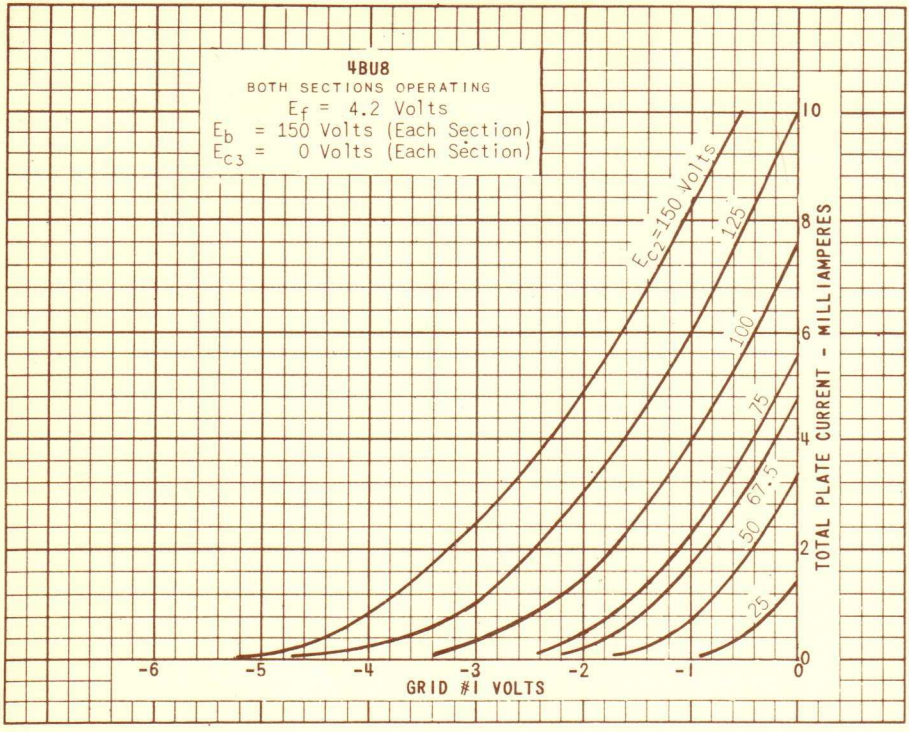
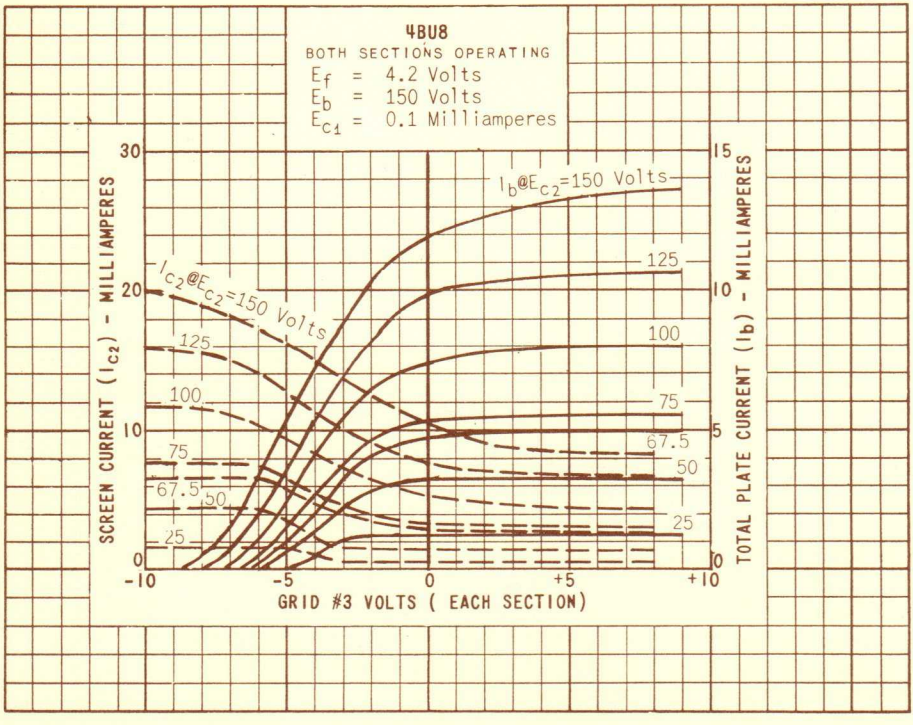

4BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 4.2 Volts
E_{c3} = 0 Volts
E_{c2} = 67.5 Volts
I_{c_1}=0.5 Ma.
0.25
0.10
0.05
0.01
PLATE (I_b) CURRENT - MILLIAMPERES
PLATE VOLTS ←
0
50
100
150
200
250
300
1
2
3
4


4BU8
BOTH SECTIONS OPERATING
E_f = 4.2 Volts
E_b = 100 Volts (Ea. Sec.)
E_{c2} = 67.5 Volts
I_{c_1} = 0.1 Milliamperes
I_{c_2}@E_{c_3} (Section 2)=-5.0 Volts
-4.0
-3.0
-2.0
-1.0
0
NOTE:
CURVES ALSO APPLY WHEN SECTIONS ARE REVERSED.
I_b (Section 2) @ E_{c_3} (Section 2) =0
-1.0
-2.0
-3.0
-4.0
I_b (Section 1) @ E_{c_3} (Section 2)=0 THRU -5.0 Volts
PLATE (I_b) OR SCREEN (I_{c_2}) CURRENT-MILLIAMPERES
GRID #3 VOLTS (SECTION 1)
-6
-4
-2
0
+2
+4
2
4
6


4BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 4.2 Volts
E_{c2} = 67.5 Volts
I_{c1} = 0.1 Ma.
I_{c2} @ E_{c3} =-10
-8
-6
-4
-2
0
+2
I_{c3} @ E_{c3} =+10
+5
+2
+1
+0.5
GRID #2 MILLIAMPERES
GRID #3 MILLIAMPERES
PLATE VOLTS
0
2
4
6
8
0.2
0.4
0.6
0.8
100
200
300
400
500


4BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 4.2 Volts
E_{c3} = 0 Volts
E_{c2} = 67.5 Volts
E_{c1}=+1.0 Volts
+0.5
I_{c1}=0.5 Ma.
0.1
0
0.01
-0.5
-1.0
-1.5
-2.0
SCREEN CURRENT - MILLIAMPERES
PLATE VOLTS *
0
2.5
5.0
7.5
10.0
100
200
300
400

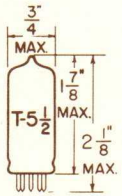

4BU8
BOTH SECTIONS OPERATING
E_f = 4.2 Volts
E_b = 150 Volts (Each Section)
E_{c3} = 0 Volts (Each Section)
E_{c2}=150 Volts
125
100
75
67.5
50
25
TOTAL PLATE CURRENT - MILLIAMPERES
GRID #1 VOLTS
-6
-5
-4
-3
-2
-1
0
2
4
6
8
10


4BU8
BOTH SECTIONS OPERATING
E_f = 4.2 Volts
E_b = 150 Volts
E_{c1} = 0.1 Milliamperes
I_b@E_{c2}=150 Volts
125
100
75
67.5
50
25
I_{c2}@E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT (I_{c2}) - MILLIAMPERES
TOTAL PLATE CURRENT (I_b) - MILLIAMPERES
GRID #3 VOLTS (EACH SECTION)
-10
-5
0
+5
+10
0
5
10
15
20
30

TUNG-SOL

PENTODE

MINIATURE TYPE

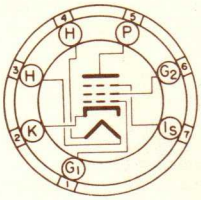


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 0.45±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 4BZ6 IS A HIGH TRANSCONDUCTANCE, SEMI-REMOTE CUT-OFF, PENTODE AMPLIFIER. IT IS DESIGNED FOR SERVICE AS AN AUTOMATIC GAIN CONTROLLED IF AMPLIFIER IN 450 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BZ6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G_1 TO P (MAX.)	.015	.025	μμf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	7.0	7.0	μμf
OUTPUT: P TO (H+K+G_2+G_3+IS)	3.0	2.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO CATHODE AT SOCKET.

RATINGS[B]

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

HEATER VOLTAGE	4.2	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
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CURVE	
MAXIMUM PLATE DISSIPATION	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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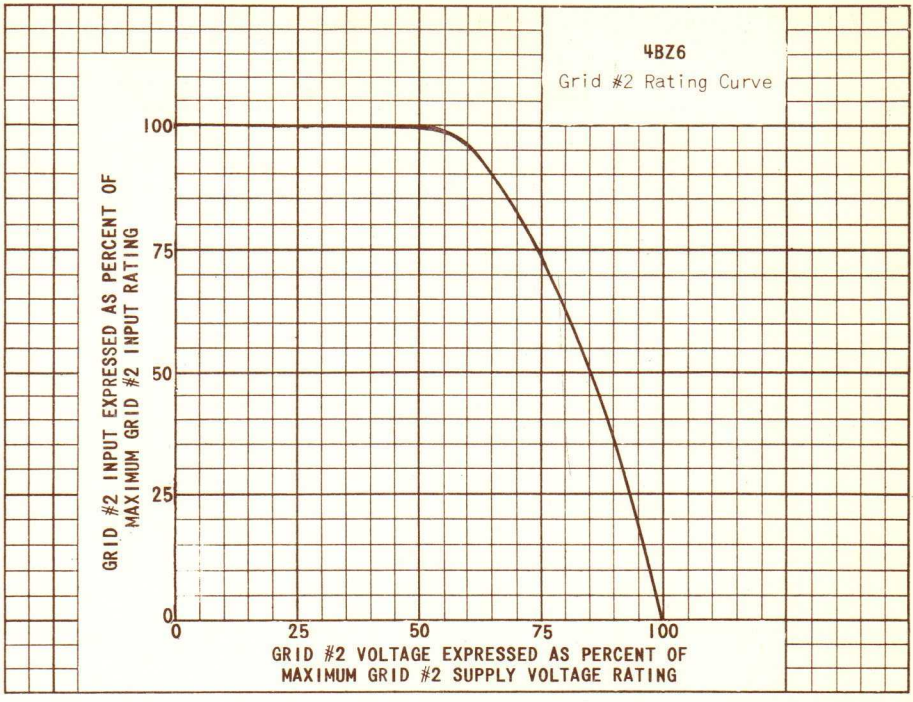
CONTINUED FROM PRECEDING PAGE

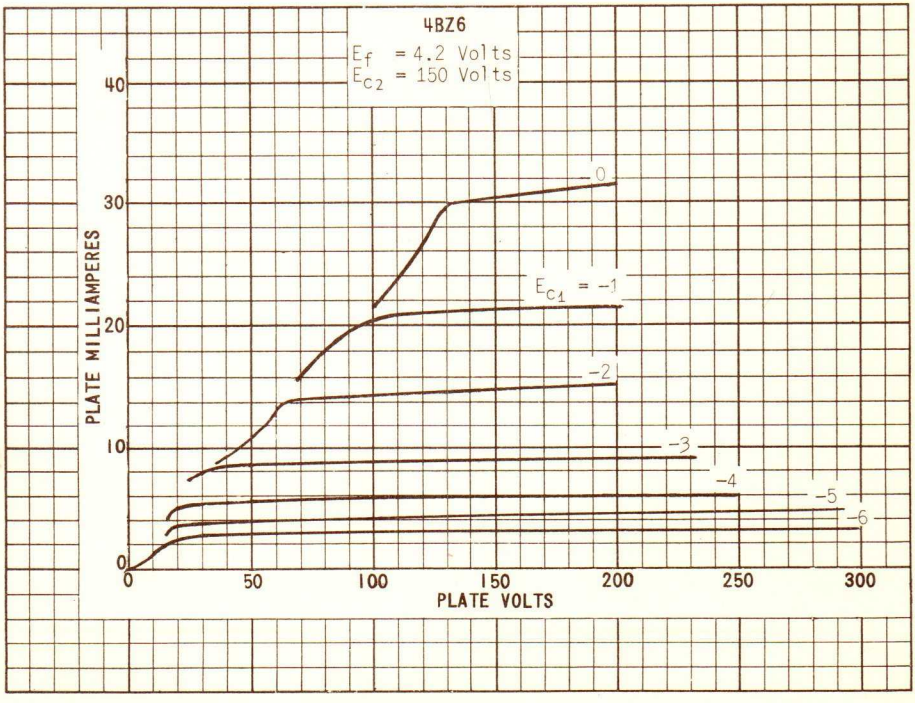
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.45±6%	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	125	VOLTS
GRID #3 VOLTAGE	PIN #7 CONNECTED TO PIN #2 AT SOCKET	
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.26	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
PLATE CURRENT	14	MA.
GRID #2 CURRENT	3.6	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 50 μMHOS	−19	VOLTS
TRANSCONDUCTANCE (E_{c1}=−4.5 V., R_k=0)	700	μMHOS

[B] DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.





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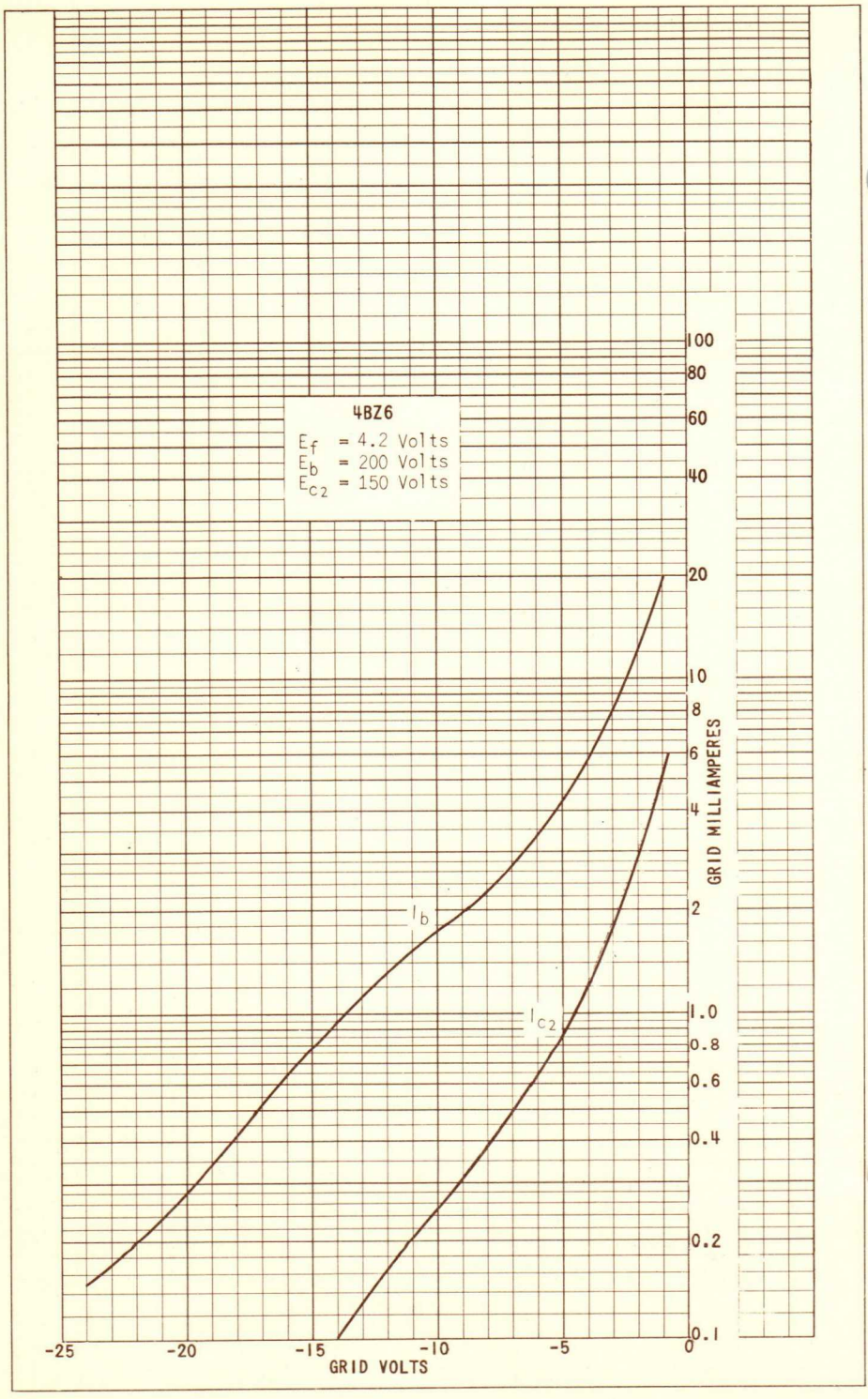
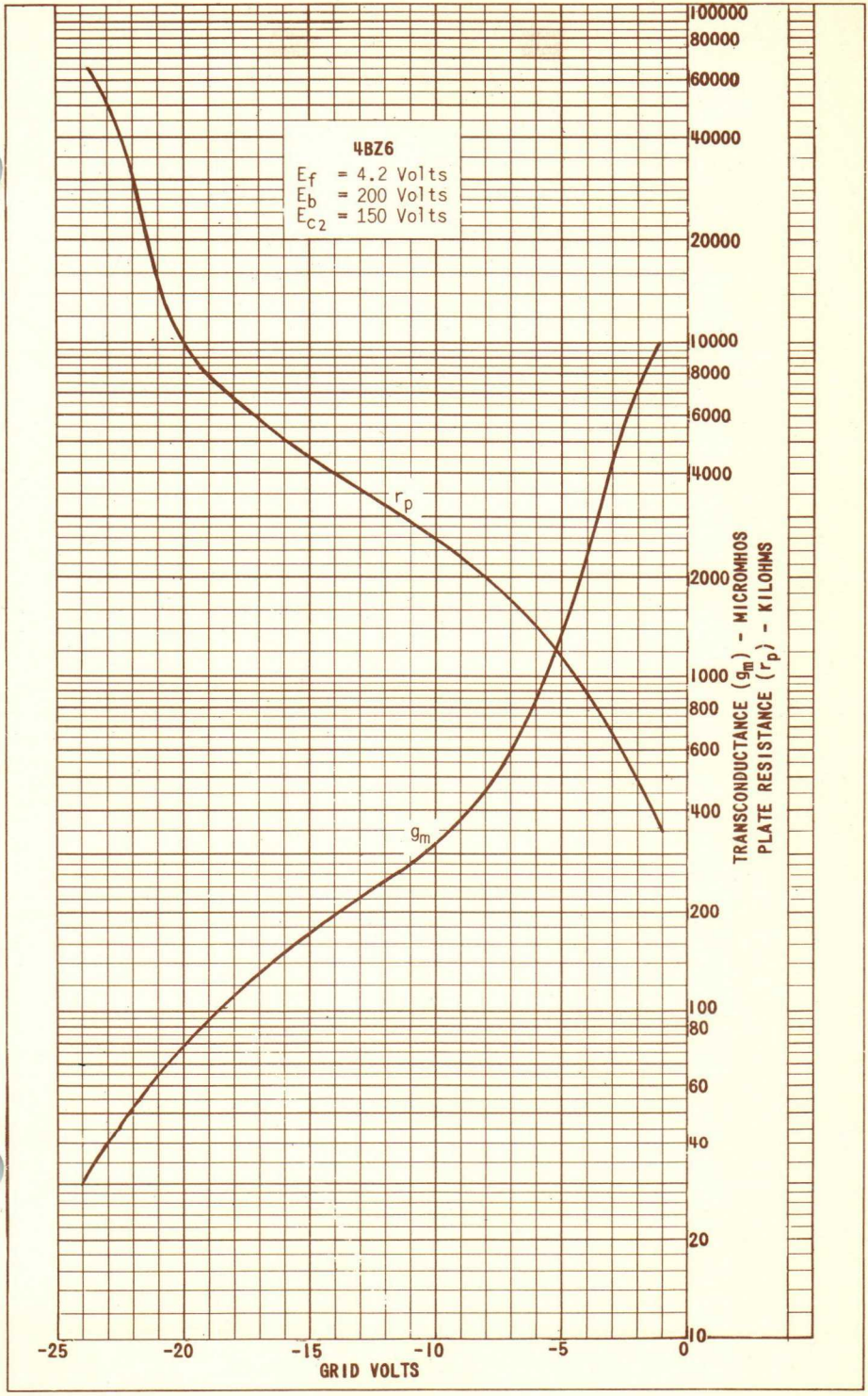
4BZ6


4BZ6
E_f = 4.2 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
GRID MILLIAMPERES
100
80
60
40
20
10
8
6
4
2
1.0
0.8
0.6
0.4
0.2
0.1
-25
-20
-15
-10
-5
0
GRID VOLTS



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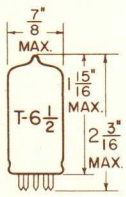
DOUBLE TRIODE

MINIATURE TYPE

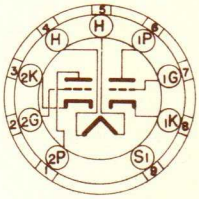


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AJ

THE 4BZ7 IS A MEDIUM-MU DOUBLE TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS AND IS INTENDED FOR SERVICE IN LOW NOISE VHF CASCODE AMPLIFIER APPLICATIONS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED, WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BZ7.

DIRECT INTERELECTRODE CAPACITANCES

WITH RETMA SHIELD #315

	TRIODE UNIT #1		TRIODE UNIT #2	
GRID TO PLATE	1.15		1.15	μμf
INPUT	2.85		---	μμf
INPUT (GROUNDED GRID)	---		4.95	μμf
OUTPUT	1.35		---	μμf
OUTPUT (GROUNDED GRID)	---		2.27	μμf
PLATE TO CATHODE (MAX.)	0.15		0.15	μμf
HEATER TO CATHODE	2.20		2.30	μμf
PLATE UNIT #1 TO PLATE UNIT #2 (MAX.)		0.01		μμf
PLATE UNIT #2 TO PLATE & GRID UNIT #1 (MAX.)		0.024		μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH TRIODE UNIT

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

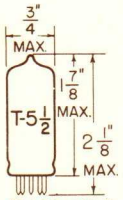
CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	38	
PLATE RESISTANCE	5 600	OHMS
TRANSCONDUCTANCE	6 800	µMHOS
PLATE CURRENT	10	MA.
GRID VOLTAGE FOR PLATE CURRENT OF 10 MA. (APPROX.)	11	VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE



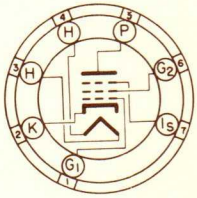
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

4.2 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 4CB6 IS A SHARP CUT-OFF PENTODE USING THE SMALL BUTTON SEVEN PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN 450 MA. SERIES HEATER OPERATED RECEIVERS AS AN IF AMPLIFIER OPERATING AT FREQUENCIES ABOVE 20 MC. IT IS ALSO WELL SUITED FOR USE AS AN RF AMPLIFIER IN VHF TELEVISION RECEIVERS. IT IS CHARACTERIZED BY HIGH TRANSCONDUCTANCE AND LOW CAPACITANCE VALUES. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH EXCEPTION OF HEATER RATINGS ITS CHARACTERISTICS ARE IDENTICAL TO THE 6CB6.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH[A] SHIELD	
GRID TO PLATE: (G_1 TO P) MAX.	0.025	.015	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	6.5	6.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	2.0	3.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4-2	
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM PLATE DISSIPATION	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	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
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

• DC COMPONENT MUST NOT EXCEED 200 VOLTS.

→ INDICATES A CHANGE.

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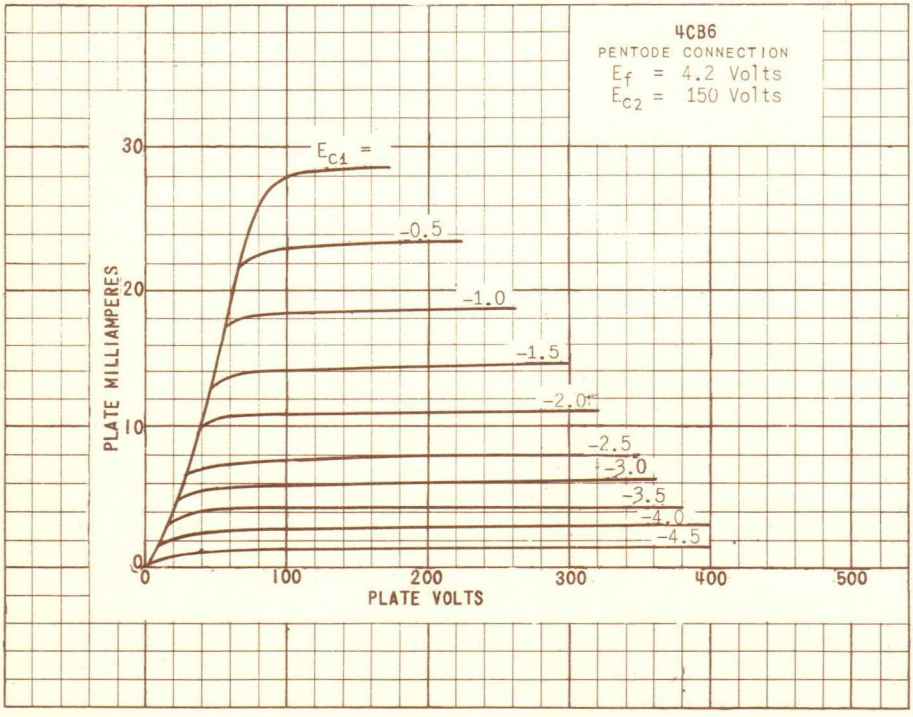
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	125	VOLTS
GRID #3 VOLTAGE		
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.28	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
PLATE CURRENT	13.0	MA.
GRID #2 CURRENT	3.7	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b=20 μA.	-6.5	VOLTS
PLATE CURRENT AT E_{c1}=-3V., R_k=0	2.8	MA.

B DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.



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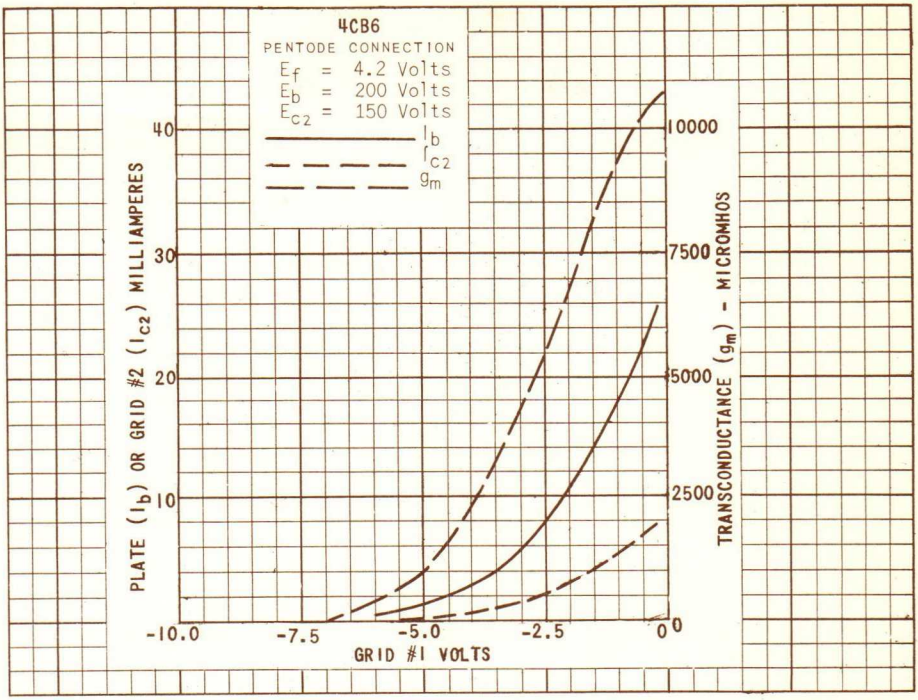

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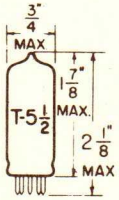
TUNG-SOL

HEPTODE

MINIATURE TYPE



GLASS BULB

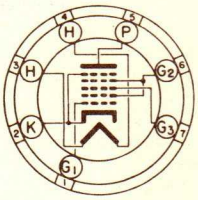
COATED UNIPOTENTIAL CATHODE

HEATER

4.2 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7CH

THE 4CS6 IS A MINIATURE DUAL CONTROL PENTAGRID TUBE INTENDED FOR USE IN SYNC SEPARATOR CIRCUITS. IN THESE CIRCUITS IT PROVIDES IMPROVED NOISE IMMUNITY. BOTH CONTROL GRIDS HAVE SHARP CUT-OFF CHARACTERISTICS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID #1 TO PLATE: G_1 TO P (MAX.)	0.05	μμf
GRID #3 TO PLATE: G_3 TO P (MAX)	0.36	μμf
#1 INPUT: G_1 TO (H+K+G_2+$G_{3\&5}$)	5.5	μμf
#3 INPUT: G_3 TO (H+K+G_1+$G_{2\&5}$)	7.0	μμf
OUTPUT: P TO (H+K+G_1+G_2+$G_{3\&5}$)	7.5	μμf
COUPLING: G_1 TO G_3 (MAX.)	0.22	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DESIGN CENTER VALUES

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 & #4 VOLTAGE	100	VOLTS
MAXIMUM GRID #2 & #4 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM GRID #2 & #4 DISSIPATION	1.0	WATT
MAXIMUM CATHODE CURRENT	14	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM GRID #3 CIRCUIT RESISTANCE	2.2	MEGOHMS
HEATER WARM-UP TIME*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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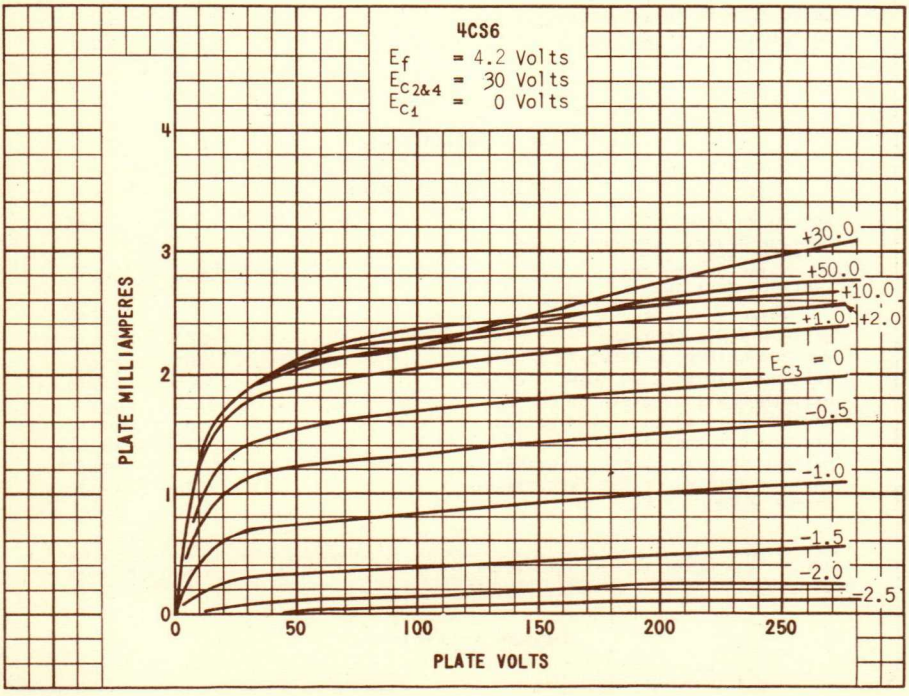
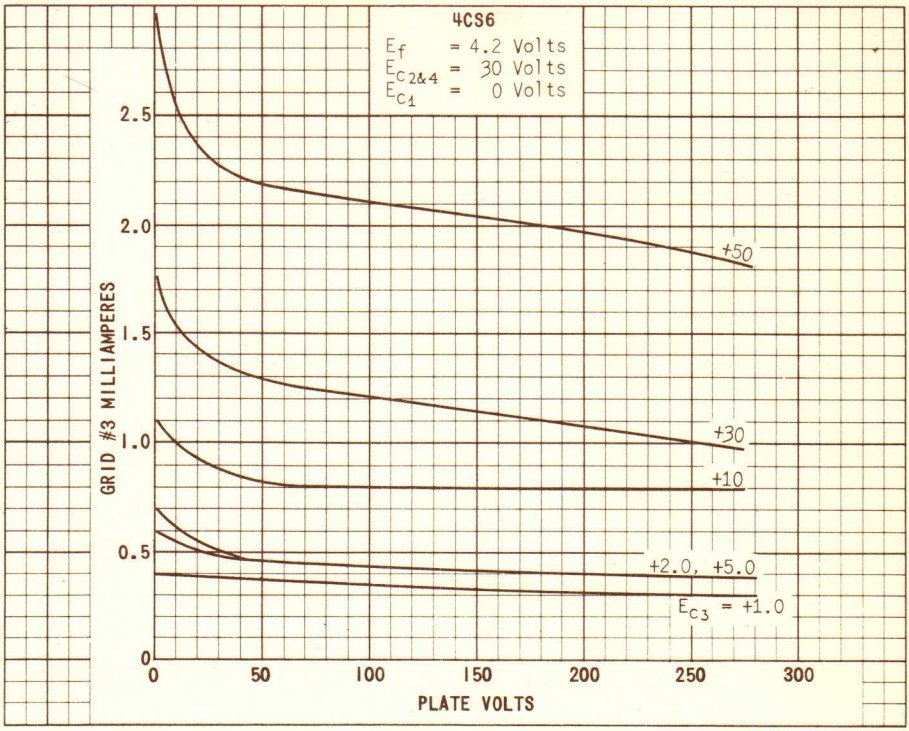
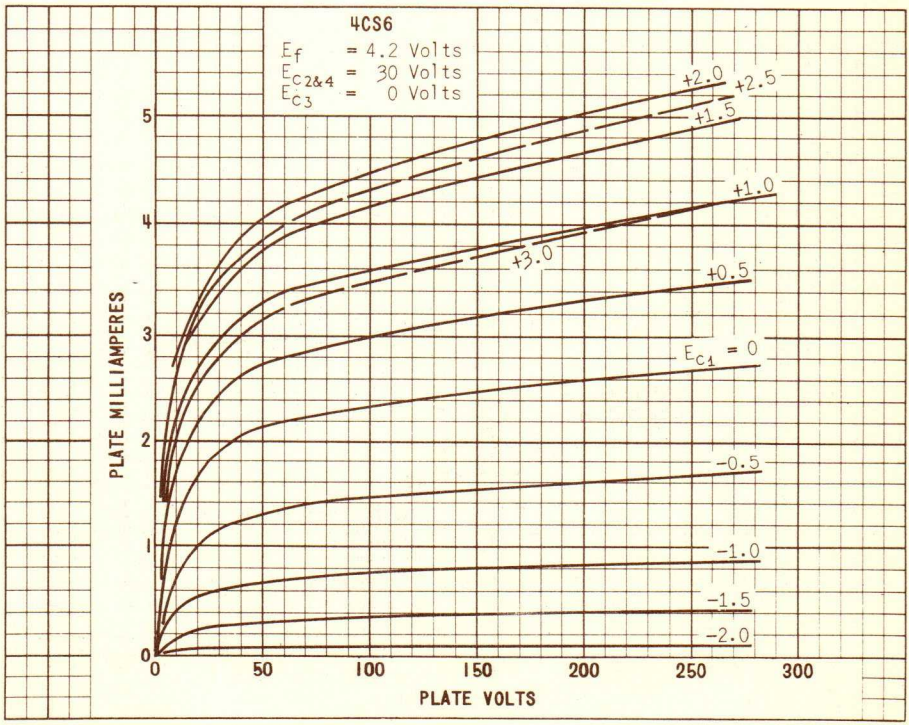
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.2	4.2	4.2	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	10	100	100	VOLTS
GRID #2 & #4 VOLTAGE	30	30	30	VOLTS
GRID #1 VOLTAGE	0	0	−1	VOLTS
GRID #3 VOLTAGE	0	−1	0	VOLTS
PLATE CURRENT	2.0	0.8	1.0	MA.
GRID #2 & #4 CURRENT	4.5	5.5	1.3	MA.
TRANSCONDUCTANCE (MEASURED BETWEEN GRID #1 AND PLATE)	---	---	1 100	μMHOS
TRANSCONDUCTANCE (MEASURED BETWEEN GRID #3 AND PLATE)	---	500	---	μMHOS
PLATE RESISTANCE (APPROX.)	---	0.7	1.0	MEGOHM
GRID #1 VOLTAGE (APPROX.) FOR I_b=50 μA	---	---	−2.5	VOLTS
GRID #3 VOLTAGE (APPROX.) FOR I_b=50 μA	---	−2.2	---	VOLTS







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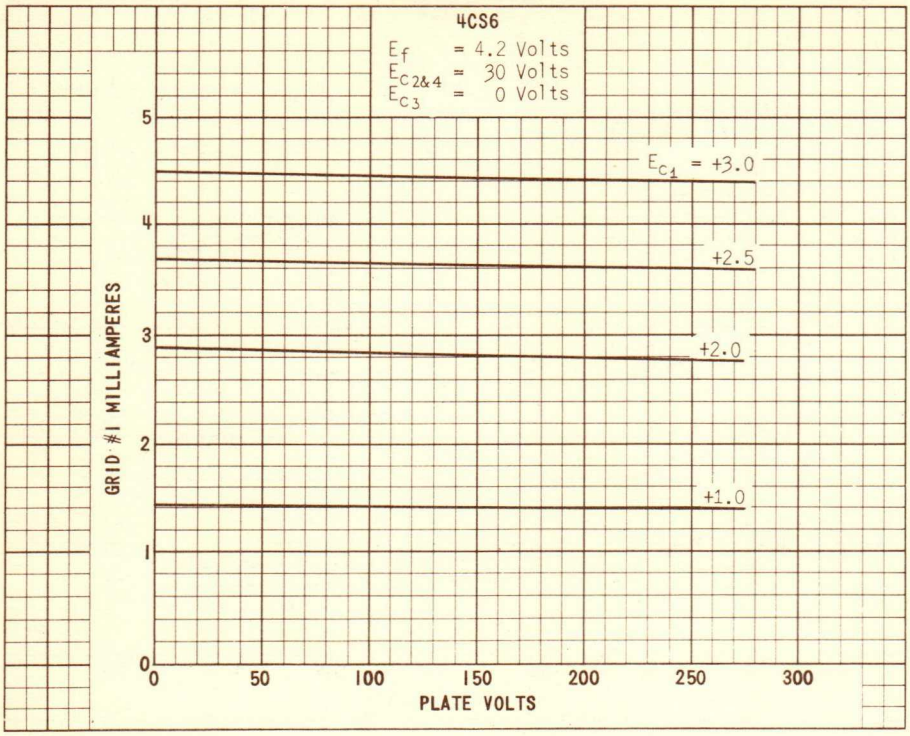
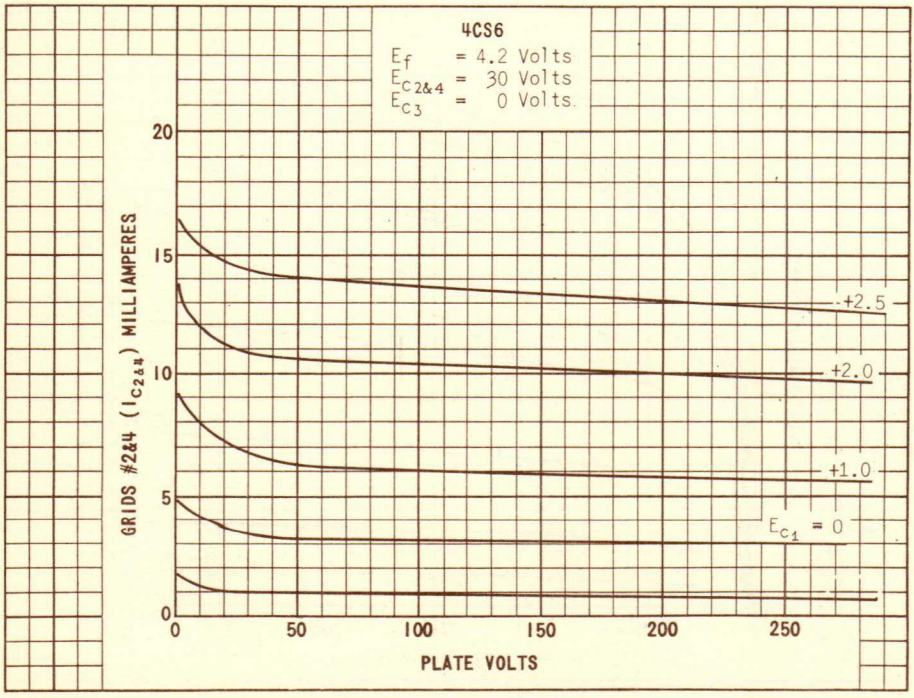
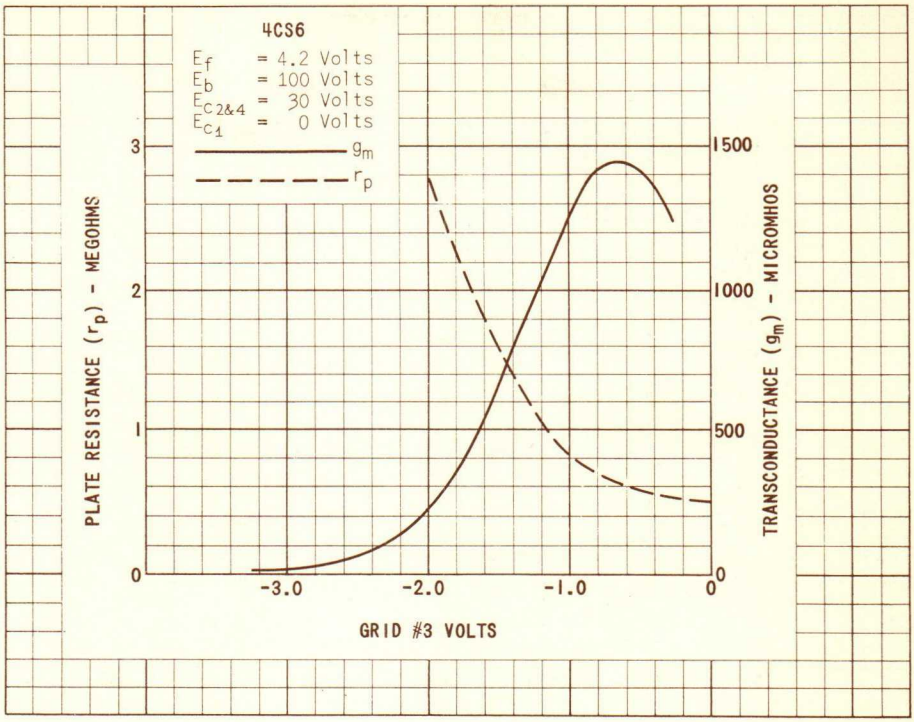
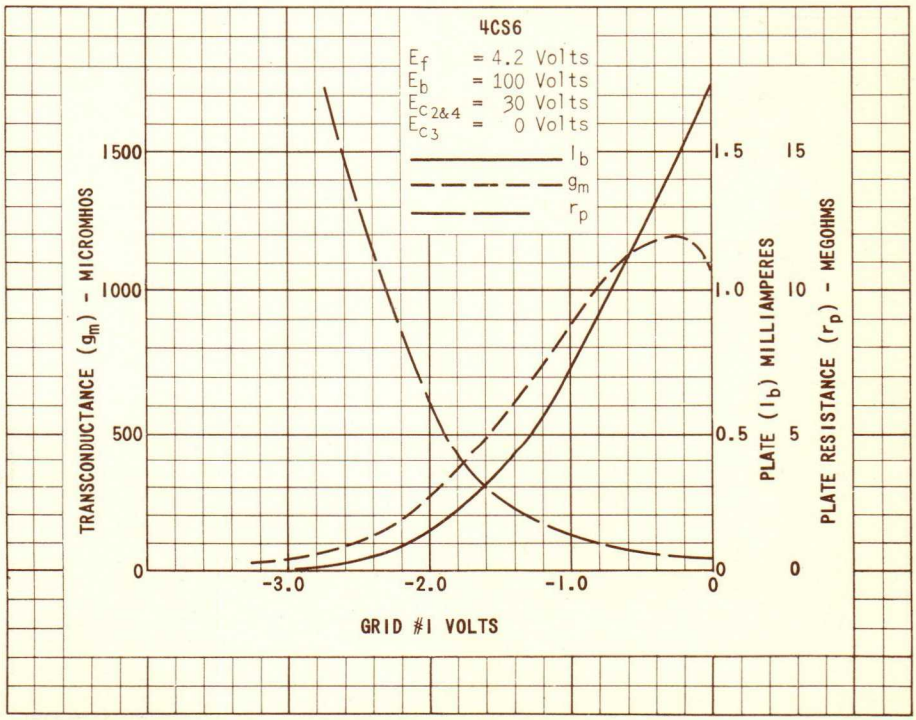

4CS6
E_f = 4.2 Volts
$E_{c2\&4}$ = 30 Volts
E_{c3} = 0 Volts
E_{c1} = +3.0
+2.5
+2.0
+1.0
GRID #1 MILLIAMPERES
0
1
2
3
4
5
0
50
100
150
200
250
300
PLATE VOLTS


4CS6
E_f = 4.2 Volts
$E_{c2\&4}$ = 30 Volts
E_{c3} = 0 Volts
+2.5
+2.0
+1.0
E_{c1} = 0
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
0
5
10
15
20
0
50
100
150
200
250
PLATE VOLTS





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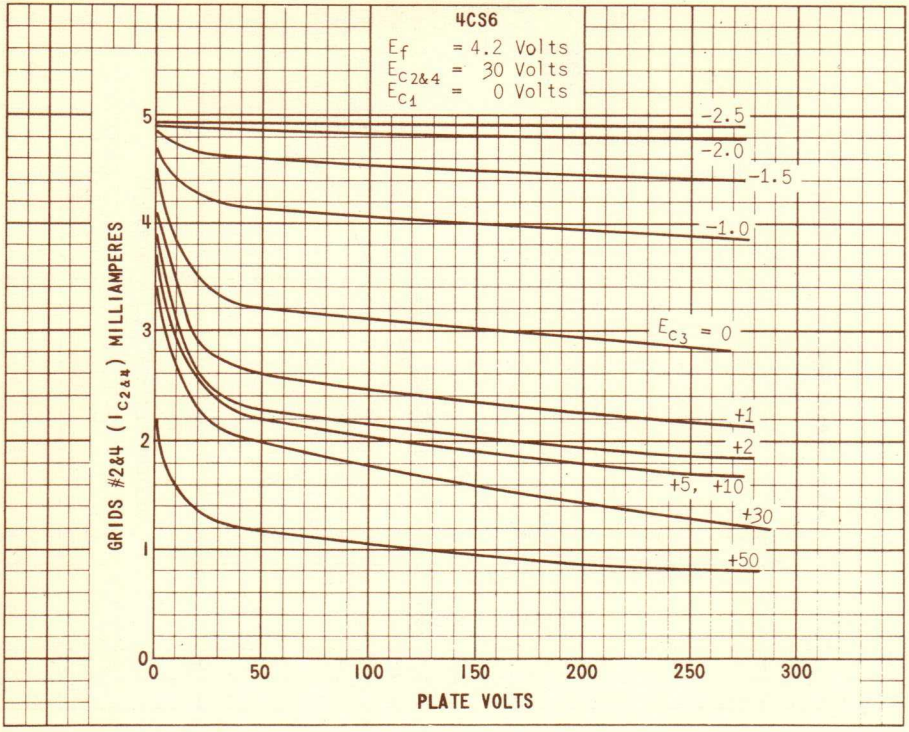

4CS6
E_f = 4.2 Volts
$E_{c2\&4}$ = 30 Volts
E_{c1} = 0 Volts
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
0
50
100
150
200
250
300
-2.5
-2.0
-1.5
-1.0
E_{c3} = 0
+1
+2
+5, +10
+30
+50

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

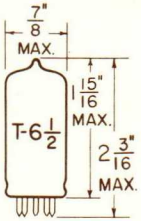
COATED UNIPOTENTIAL CATHODE

HEATER

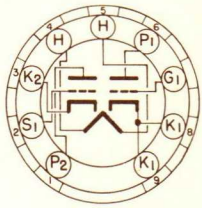
4.2 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE

9FC

THE 4CX7 IS A MEDIUM MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR OPERATION AS A CASCODE (VHF) AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, IT IS IDENTICAL TO THE 6CX7.

DIRECT INTERELECTRODE CAPACITANCES

SHIELD #315 CONNECTED TO HEATER UNLESS SPECIFIED DIFFERENTLY

	SECTION #1		SECTION #2	
GRID TO PLATE: (G TO P)	1.2		---	μμf
INPUT: G TO (H+K+E.S.)	2.4		---	μμf
OUTPUT: P TO (H+K+E.S.)	1.3		---	μμf
HEATER TO CATHODE: (H TO K) [A]	2.4		2.2	μμf
PLATE TO CATHODE: (P TO K) (MAX)	0.17		0.17	μμf
#2 PLATE TO #1 PLATE AND #1 GRID:				
#2 P TO (#1P+#1G) (MAX.)		.027		μμf
PLATE TO PLATE: (#1 P TO #2 P) (MAX.)		.017		μμf
GROUNDED GRID OPERATION:				
INPUT: K TO (G+I.S.+H+E.S.)	---		4.2	μμf
OUTPUT: P TO (G+I.S.+H+E.S.)	---		1.7	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK [C]	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE [C]	250	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
HEATER WARM-UP TIME [B]	11	SECONDS

[A] SHIELD #315 CONNECTED TO GROUND.

[B] HEATER-WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[C] UNDER CUTOFF CONDITIONS WHEN THE TUBE IS USED AS A CASCODE AMPLIFIER, THIS RATING MAY BE AS HIGH AS 300 VOLTS MAXIMUM.

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TUNG-SOL

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RATINGS – CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

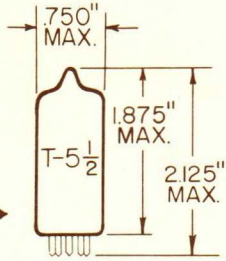
CATHODE CURRENT (MAX.)	20	MA.
GRID CIRCUIT RESISTANCE (MAX.)	0.5	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH SECTION

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	150	VOLTS
GRID VOLTAGE	0	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
PLATE CURRENT	9.0	MA.
TRANSCONDUCTANCE	6 400	μMHOS
AMPLIFICATION FACTOR	39	
GRID VOLTAGE FOR I_b =10 μA (APPROX.)	−10	VOLTS

TUNG-SOL



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

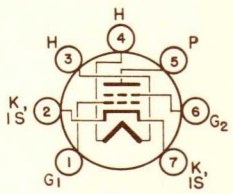
TETRODE

MINIATURE TYPE

COATED UNIPOTENTICAL CATHODE

HEATER
4.5 VOLTS 300±18 MAMPS. ←
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7EW

THE 4CY5 IS A SHARP-CUTOFF TETRODE IN THE 7-PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR SERVICE IN VHF TUNERS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 4CY5 IS IDENTICAL TO THE 2CY5, 3CY5, AND THE 6CY5.

DIRECT INTERELECTRODE CAPACITANCES[A]

GRID #1 TO PLATE	0.03	μμf
INPUT	4.5	μμf
OUTPUT	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 (SCREEN) SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CHART	
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATTS
MAXIMUM GRID #1 (CONTROL GRID) VOLTAGE		
POSITIVE VALUE	0	MA.
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.)[B]	11.0	SECONDS

[A] WITH SHIELD #316 CONNECTED TO CATHODE.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

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TUNG-SOL

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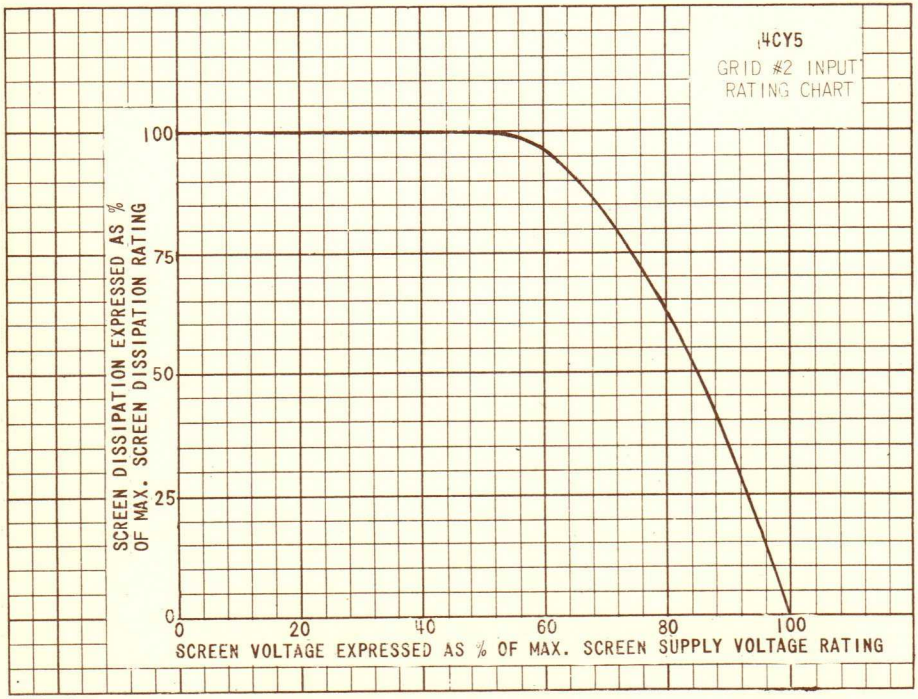
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	−1	VOLTS
PLATE RESISTANCE	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
GRID #1 CUTOFF BIAS[C]	−6	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	1.5	MA.

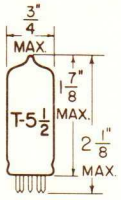
[C] PLATE CURRENT 20 μA.



TUNG-SOL

PENTODE

MINIATURE TYPE

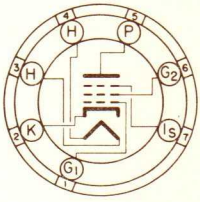


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 4DE6 IS A SHARP-CUTOFF PENTODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN 40 MEGACYCLE GAIN-CONTROLLED VIDEO IF STAGES. EXCEPT FOR HEATER CHARACTERISTICS, THE 4DE6 IS IDENTICAL TO THE 6DE6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G_1 TO P) (MAX.)	.015	.025	μμf
INPUT: G_1 TO (H+K+G_2+G_3+i.s.)	6.5	6.5	μμf
OUTPUT: P TO (H+K+G_2+G_3+i.s.)	3.0	2.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS[B]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.2	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
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE		SEE CURVE
MAXIMUM PLATE DISSIPATION	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[B] DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

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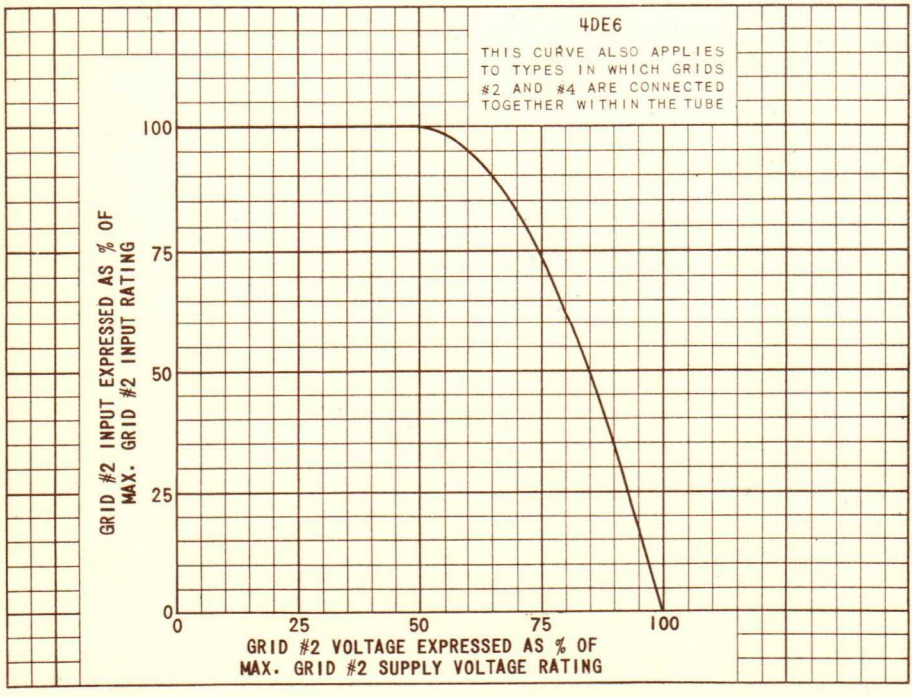
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #3 VOLTAGE	PIN 7 CONNECTED TO PIN 2 AT SOCKET	
GRID #2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR Ib = 20 μA	−9	VOLTS
TRANSCONDUCTANCE (E_{c1} = − 5.5V., Rk = 0)	700	μMHOS
PLATE CURRENT	15.5	MA.
GRID #2 CURRENT	4.2	MA.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.



TUNG-SOL

PENTODE

MINIATURE TYPE

SHARP-CUTOFF PENTODE

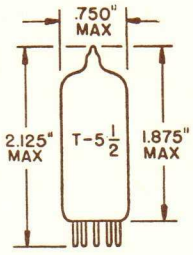
FOR

USE AS AN IF AMPLIFIER

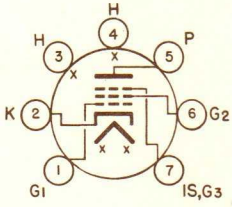
IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CM

THE 4DK6 IS A SHARP-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A WIDE-BAND HIGH-FREQUENCY AMPLIFIER AND IS PARTICULARLY SUITABLE FOR USE AS AN IF AMPLIFIER IN TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 4DK6 IS IDENTICAL TO THE 3DK6 AND THE 6DK6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	MAX.	0.025	pf
INPUT		6.3	pf
OUTPUT		1.9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.2	VOLTS	450	MA.
HEATER WARM-UP TIME			11	SECONDS
LIMITS OF SUPPLIED CURRENT			450 ± 30	MA.

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

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

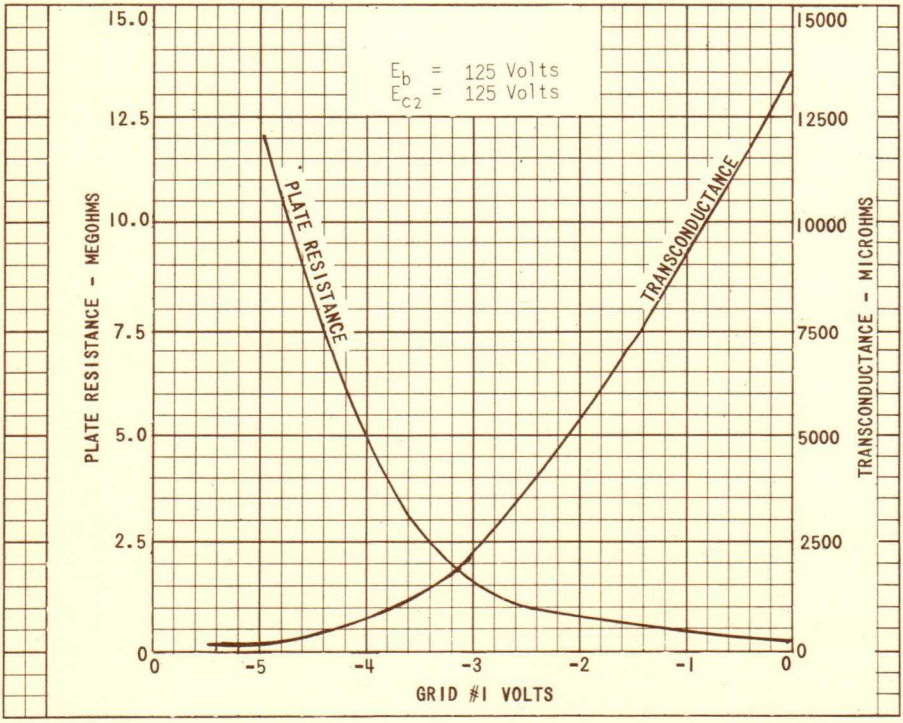
MAXIMUM RATINGS

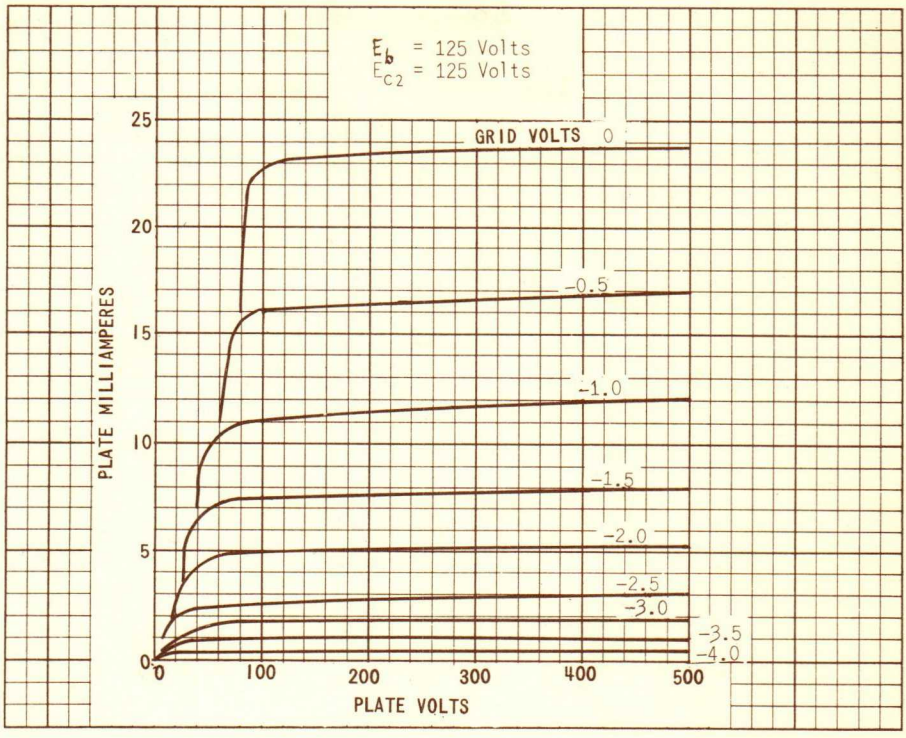
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

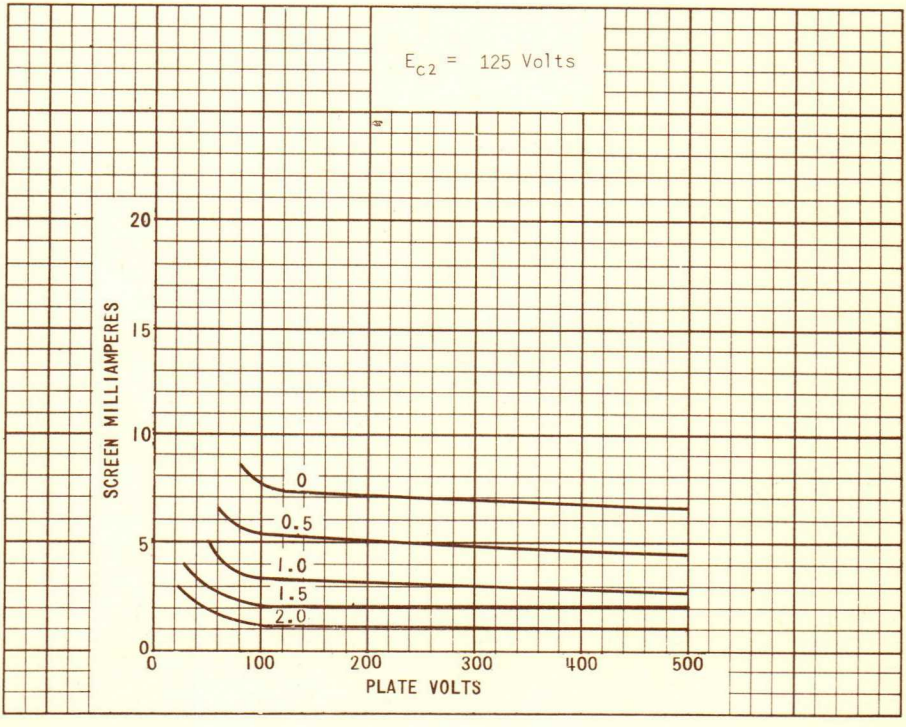
PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
PLATE DISSIPATION	2.3	WATTS
GRID 2 DISSIPATION	0.55	WATTS
GRID 1 VOLTAGE - POSITIVE VALUE	0	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE		125	VOLTS
GRID 3 (SUPPRESSOR)	Connected To Cathode At Socket		
GRID 2 VOLTAGE		125	VOLTS
CATHODE BIAS RESISTOR		56	OHMS
PLATE CURRENT		12.0	MA.
GRID 2 CURRENT		3.8	MA.
TRANSCONDUCTANCE		9 800	μMHOS
PLATE RESISTANCE	APPROX.	0.35	MEGOHMS
GRID 1 VOLTAGE FOR Ib = 20 μA		-6.5	VOLTS







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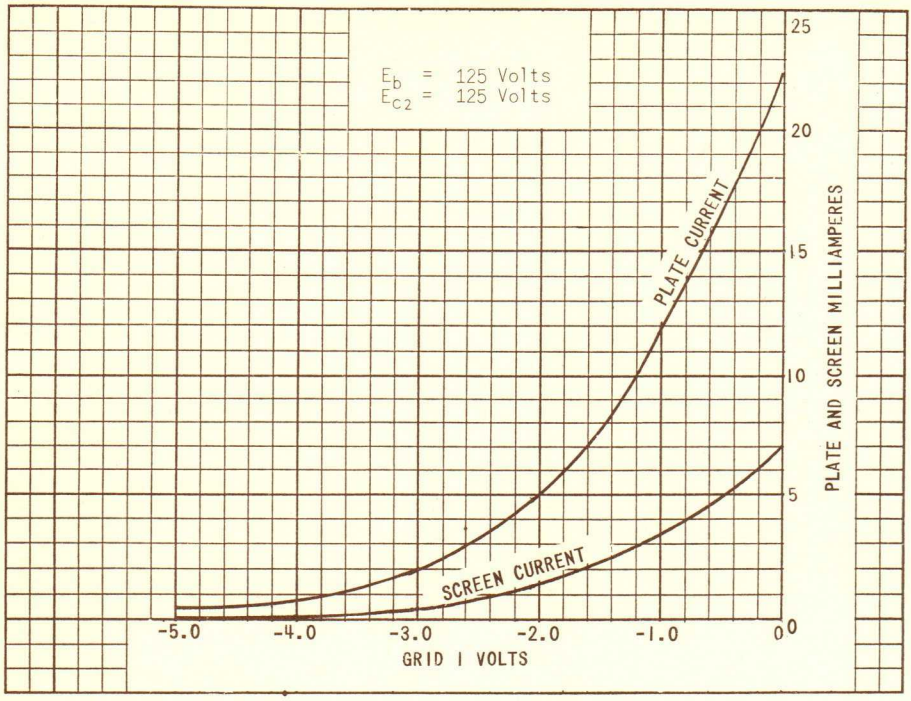
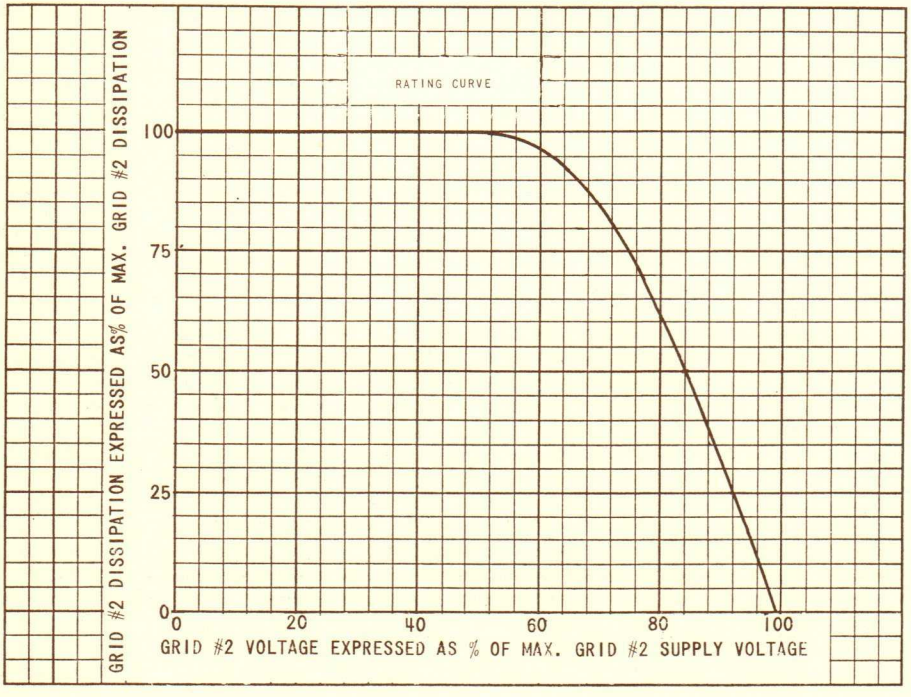

E_b = 125 Volts
E_{c2} = 125 Volts
PLATE CURRENT
SCREEN CURRENT
25
20
15
10
5
0
PLATE AND SCREEN MILLIAMPERES
-5.0
-4.0
-3.0
-2.0
-1.0
0
GRID 1 VOLTS


RATING CURVE
GRID #2 DISSIPATION EXPRESSED AS% OF MAX. GRID #2 DISSIPATION
100
75
50
25
0
0
20
40
60
80
100
GRID #2 VOLTAGE EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE

TUNG-SOL

PENTODE

MINIATURE TYPE

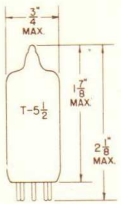
UNIPOTENTIAL CATHODE

HEATER

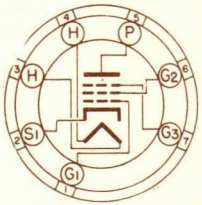
4.2 VOLTS 0.45±6% AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

SMALL-BUTTON MINIATURE
7 PIN BASE

7EN

THE 4DT6 IS A SHARP CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN FM DETECTOR IN TELEVISION RECEIVERS. DESIGNED SO THAT GRID #1 AND GRID #3 CAN EACH BE USED AS INDEPENDENT SHARP CUTOFF CONTROL ELECTRODES, THE TUBE MAY ALSO BE USED IN DELAY CIRCUITS, GAIN-CONTROLLED AMPLIFIER CIRCUITS, AND MIXER CIRCUITS. WITH THE EXCEPTION OF HEATER WARM-UP TIME AND HEATER CHARACTERISTICS, IT IS IDENTICAL TO THE 3DT6.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITH EXTERNAL SHIELD, #316, CONNECTED TO CATHODE

GRID #1 TO PLATE	0.02	μμf
GRID #1 TO GRID #3	0.1	μμf
GRID #3 TO ALL OTHER ELECTRODES	6.1	μμf
GRID #1 TO GRID #2, GRID #3, HEATER, AND INTERNAL SHIELD AND CATHODE	5.8	μμf
GRID #3 TO PLATE	1.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FM DETECTOR SERVICE

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM GRID #3 (SUPPRESSOR) VOLTAGE	28 ←	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330 ←	VOLTS
MAXIMUM GRID #2 (SCREEN) VOLTAGE	SEE J5-C4-2 ←	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.7 ←	WATTS
MAXIMUM GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	1.1 ←	WATTS
FOR GRID #2 VOLTAGES BETWEEN 165 AND 330 VOLTS	SEE J5-C4-2 ←	
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
HEATER WARM-UP TIME (APPROX.) *	11	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.45±6%	AMP.
PLATE SUPPLY VOLTAGE	150	VOLTS
GRID #3 SUPPLY VOLTAGE	0	VOLTS
GRID #2 SUPPLY VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	560	OHMS
PLATE RESISTANCE (APPROX.)	0.15	MEGOHM
TRANSCONDUCTANCE:		
GRID #1 TO PLATE	800	μMHOS
GRID #3 TO PLATE	515	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-4.5	VOLTS
GRID #3 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-3.5	VOLTS
PLATE CURRENT	1.1	MA.
GRID #2 CURRENT	2.1	MA.

TYPICAL OPERATION IN THE ACCOMPANYING LOCKED-OSCILLATOR, QUADRATURE-GRID FM DETECTOR CIRCUIT AT A CARRIER FREQUENCY OF 4.5 MC:

INPUT SIGNAL TO GRID OF DRIVER TUBE	**15**	**200**	**500**	**MV RMS**
PLATE SUPPLY VOLTAGE	250	250	250	VOLTS
GRID #3 VOLTAGE (OBTAINED FROM A 560000-OHM RESISTOR)	-5	-6	-6.4	VOLTS
GRID #2 SUPPLY VOLTAGE	100	100	100	VOLTS
CATHODE-BIAS RESISTOR	560	560	560	OHMS
PLATE LOAD RESISTOR	0.27	0.27	0.27	MEGOHM
PLATE CURRENT	0.23	0.22	0.21	MA.
GRID #2 CURRENT	3.4	5.5	6	MA.
GRID #1 CURRENT	0.013	0.6	0.8	MA.
BANDWIDTH:				
FOR A TOTAL HARMONIC DISTORTION OF 10 PERCENT	65	120	118	KC
AM REJECTION (APPROX.)[B]	33	29	28	DB
AUDIO OUTPUT VOLTAGE (RMS, APPROX.):				
WITH ± 7.5-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	5.5	6.5	7.5	VOLTS
WITH ± 25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	17	21	23	VOLTS
TOTAL HARMONIC DISTORTION:				
WITH ± 25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	2	3	4	PERCENT
SENSITIVITY:				
WITH ±7.5-KC DEVIATION FROM MEAN VALUE OF 4.5 MC			59	MILLIVOLTS
WITH ±25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC			15[C]	MILLIVOLTS
MAXIMUM CIRCUIT VALUES:				
GRID #1 CIRCUIT RESISTANCE:				
FOR FIXED-BIAS OPERATION			0.25	MEGOHM
FOR CATHODE-BIAS OPERATION			0.5	MEGOHM

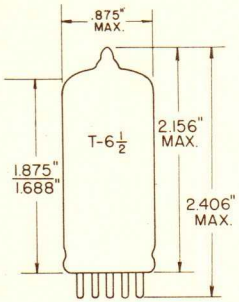
[B] RATIO OF THE AUDIO OUTPUT VOLTAGE PRODUCED BY 30-PERCENT AMPLITUDE MODULATION OF THE 4.5-MC CARRIER FREQUENCY TO THE AUDIO OUTPUT PRODUCED BY ± 25-KC DEVIATION FROM THE 4.5-MC CARRIER FREQUENCY, WITH A MODULATING FREQUENCY OF 400 CPS IN BOTH CASES.

[C] SIGNAL LEVEL AT WHICH DETECTOR CIRCUIT WILL HANDLE THE INDICATED DEVIATION IN FREQUENCY FROM THE MEAN VALUE OF 4.5 MC, BEFORE DISTORTION OCCURS.

TUNG-SOL

REMOTE-CUTOFF PENTODE

MINIATURE TYPE

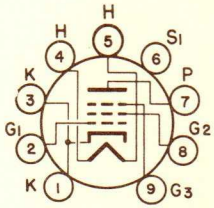


GLASS BULB
MINIATURE
9 PIN BASE E9-1

UNIPOTENTIAL CATHODE

HIGH GM, SMALL SIGNAL
RF & IF AMPLIFIER
WITH GAIN CONTROL

SERIES STRING OPERATION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9AQ

THE 4EH7 IS A REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT FEATURES VERY HIGH GM WITH A REMOTE CUTOFF AND IS DESIGNED FOR FREQUENCIES INTO THE VHF RANGE. ITS CHIEF APPLICATION IS IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: (G1 TO P) MAX.	0.0055	pf
INPUT: G1 TO (H+G2+G3+K+IS)	9.5	pf
OUTPUT: P TO (H+G2+G3+K+IS)	2.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.4 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±30	MA.
MAXIMUM HEATER CATHODE VOLTAGE		165	VOLTS
HEATER WARM-UP TIME *		11	SECONDS

MAXIMUM RATINGS

DESING CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID #2 VOLTAGE	250	VOLTS
GRID #2 DISSIPATION	0.65	WATTS
CATHODE CURRENT	20	MA
GRID #1 CIRCUIT RESISTANCE	1	MEGOHM

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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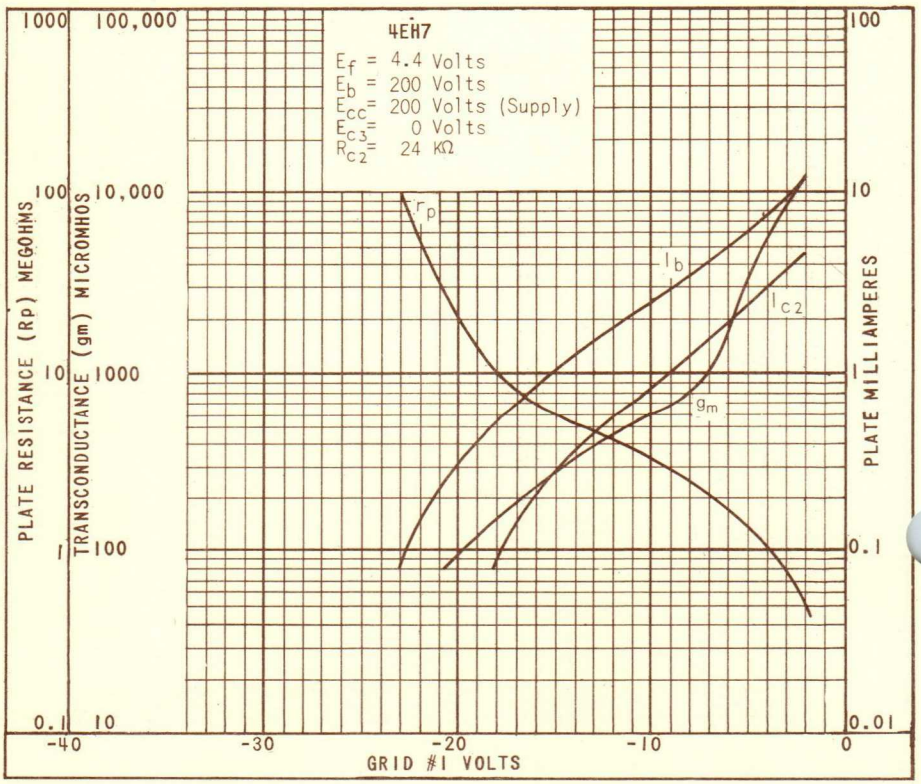
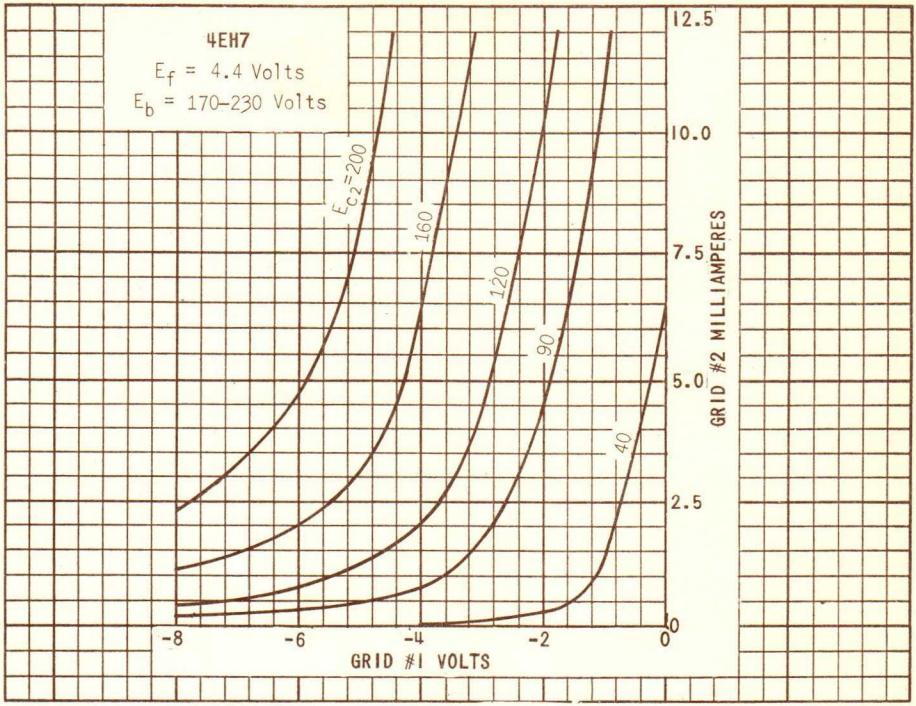
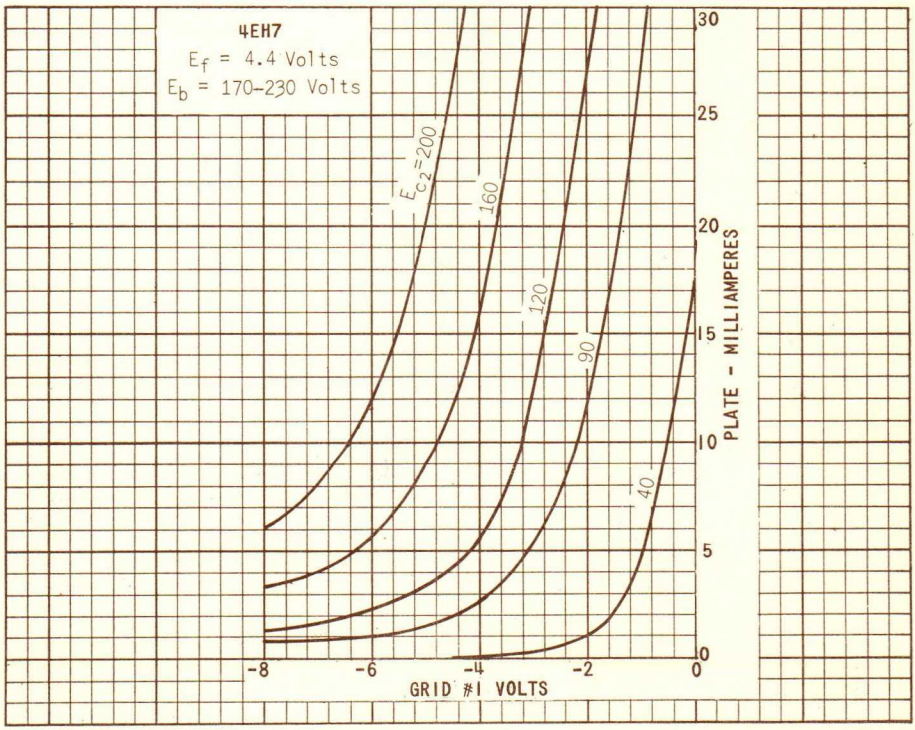
TYPICAL OPERATING CHARACTERISTICS

PLATE VOLTAGE	200	200	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE (SUPPLY)	90	200	VOLTS
GRID #2 SERIES RESISTOR	0	24	KILOHMS
GRID #1 VOLTAGE	−2	−2	VOLTS
PLATE CURRENT	12	---	MA.
GRID #2 CURRENT	4.5	---	MA.
TRANSCONDUCTANCE	12500	12500	μMHOS
PLATE RESISTANCE	0.5	---	MEGOHMS
GRID #1 IMPEDANCE AT 40 MC	13	---	KILOHMS
GRID #1 CUTOFF: E_{c1} =−6.5		1250	μMHOS
E_{c1} =−9.5		625	μMHOS
E_{c1}=−19.5		125	μMHOS
GRID #1 VOLTAGE FOR A CROSS-MODULATION FACTOR OF 1%:			
E_{c1} =−6.5		100	MV.
E_{c1} =−9.5		160	MV.
E_{c1}=−19.5		450	MV.







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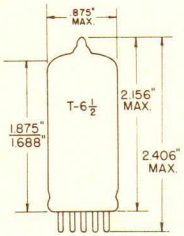
TUNG-SOL

SHARP CUTOFF PENTODE

MINIATURE TYPE



MINIATURE BUTTON
9 PIN BASE E9-1

OUTLINE DRAWING
SPECIAL

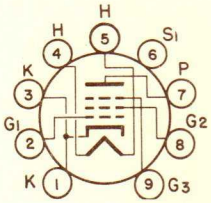
GLASS BULB

COATED UNIPOTENTIAL CATHODE

FOR IF CIRCUITS IN TV RECEIVERS

SERIES STRING OPERATION

ANY MOUNTING POSITION



BASING DIAGRAM
JEDEC 9AQ

BOTTOM VIEW

THE 4EJ7 IS A HIGH TRANSCONDUCTANCE SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS AN IF AMPLIFIER IN TELEVISION RECEIVERS. CONTROLLED HEATER WARM-UP TIME MAKES THE TUBE SUITABLE FOR SERIES STRING OPERATION.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	.005	pf
INPUT: G1 TO (H+K+G2+G3+I.S.)	10	pf
OUTPUT: P TO (H+K+G2+G3+I.S.)	3	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.4 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±30	MA
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		150	VOLTS
HEATER WARM-UP TIME [A]		11	SECONDS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239 [B]

PLATE VOLTAGE WITH Ib = 0 MA.	550	VOLTS
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE WITH Ic2 = 0 MA	550	VOLTS
GRID #2 VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID #2 DISSIPATION	0.9	WATTS
CATHODE CURRENT	25	MA.
GRID #1 CIRCUIT RESISTANCE	1.0	MEGOHM

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TUNG-SOL

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TYPICAL OPERATING CHARACTERISTICS

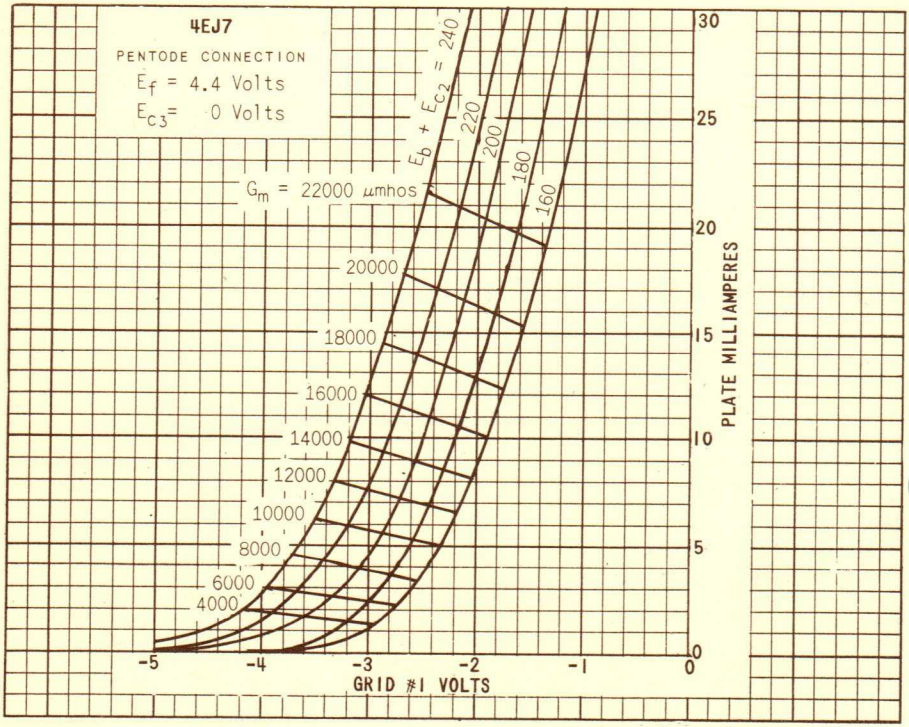
CLASS A_1 AMPLIFIER

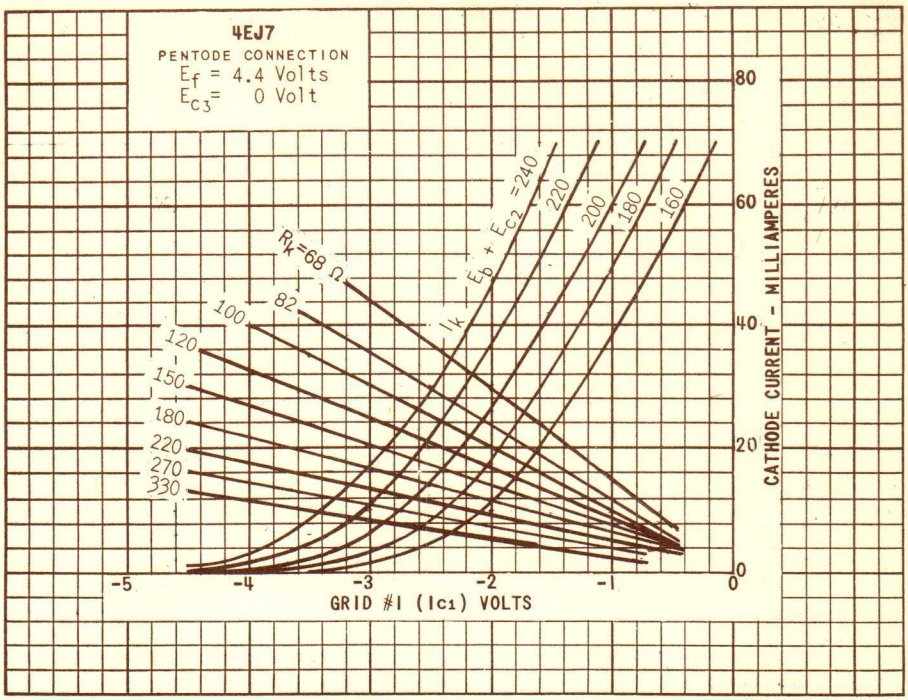
PLATE VOLTAGE	200	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 VOLTAGE	200	VOLTS
GRID #1 VOLTAGE	-2.5	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	4.1	MA.
TRANSCONDUCTANCE	15000	μMHOS
AMPLIFICATION FACTOR (G2 TO G1)	60	
PLATE RESISTANCE (APRROX)	0.35	MEGOHM
GRID #1 IMPEDANCE AT 40MC	30000	OHMS[C]

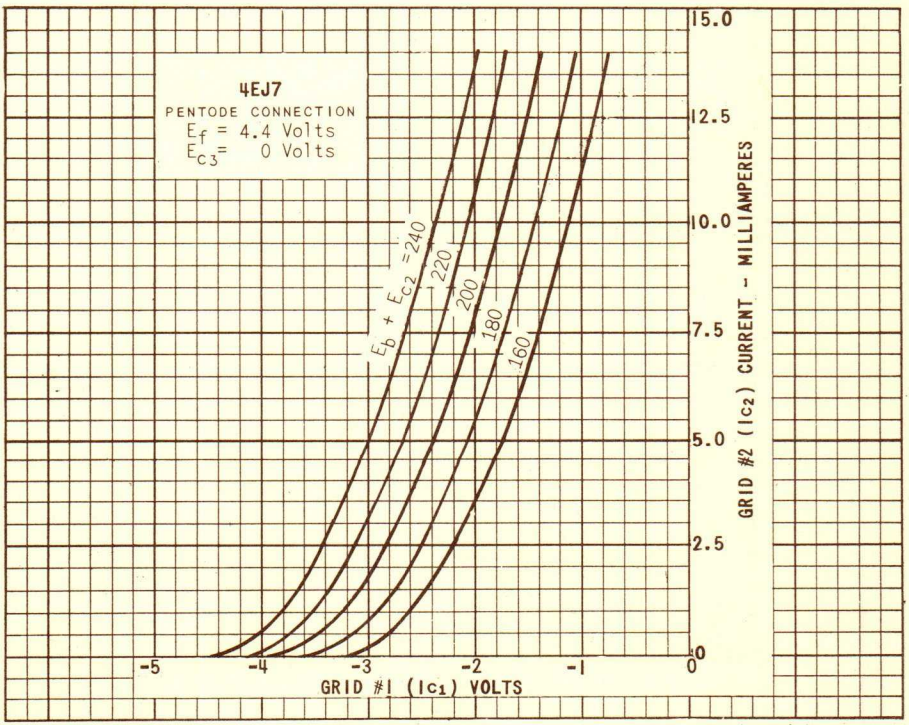
[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[B] FOR SERIES OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

[C] INPUT DAMPING OF TUBE AND TYPICAL CERAMIC SOCKET WITH BOTH CATHODE LEADS TIED DIRECTLY TO GROUND IS ABOUT 10,000 OHMS.







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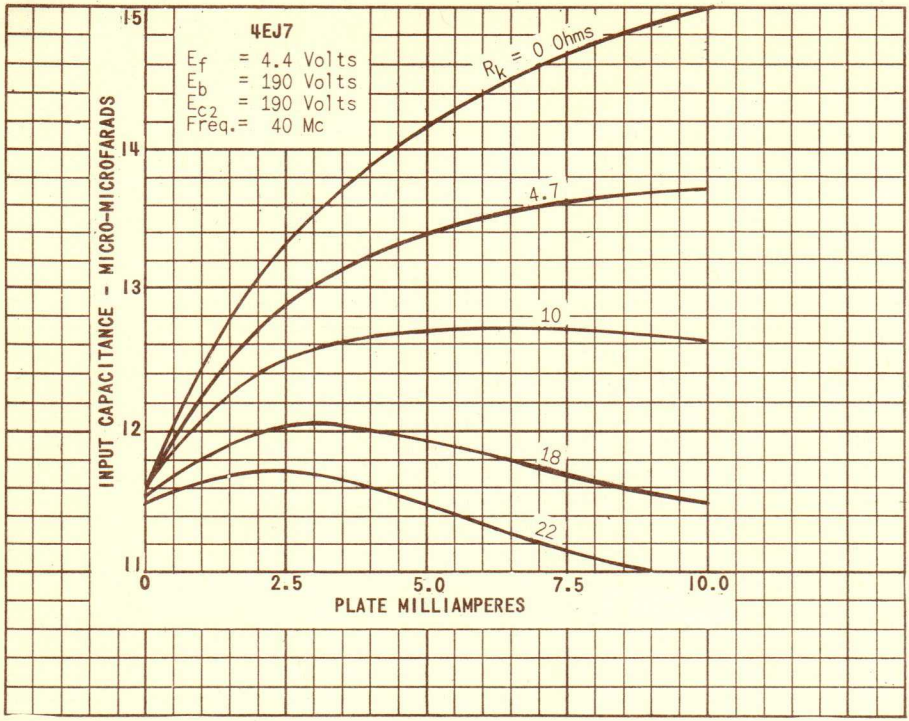
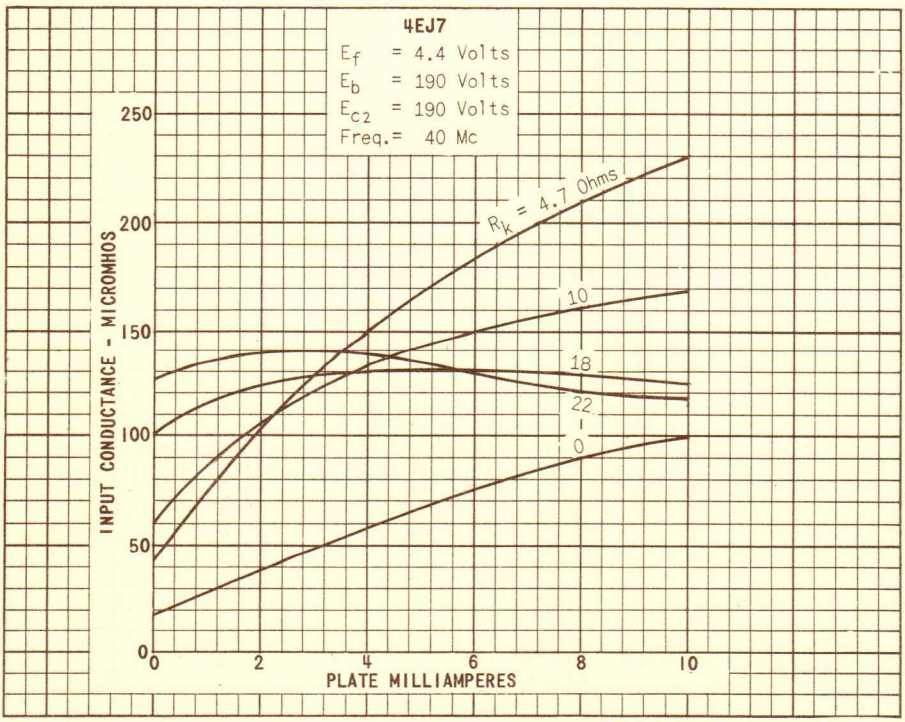
4EJ7

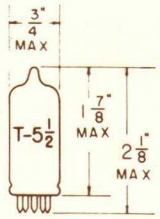

4EJ7
Ef = 4.4 Volts
Eb = 190 Volts
Ec2 = 190 Volts
Freq.= 40 Mc
Rk = 0 Ohms
4.7
10
18
22
INPUT CAPACITANCE - MICRO-MICROFARADS
15
14
13
12
11
0
2.5
5.0
7.5
10.0
PLATE MILLIAMPERES


4EJ7
Ef = 4.4 Volts
Eb = 190 Volts
Ec2 = 190 Volts
Freq.= 40 Mc
Rk = 4.7 Ohms
10
18
22
0
INPUT CONDUCTANCE - MICROMHOS
250
200
150
100
50
0
0
2
4
6
8
10
PLATE MILLIAMPERES

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

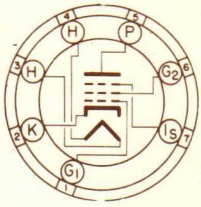
COATED UNIPOTENTIAL CATHODE

HEATER

4.2 VOLTS 0.6±6% AMPS.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7CM

THE 4EW6 IS A SHARP CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION AND HAS BEEN DESIGNED FOR INTERMEDIATE AMPLIFIER SERVICE IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME AND HEATER RATINGS THE 4EW6 IS IDENTICAL TO THE 6EW6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID #1 TO PLATE (MAX.)	0.03	0.04	μμf
INPUT	10.0	10.0	μμf
OUTPUT	3.4	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM VALUES

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	330	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	WATTS
MAXIMUM SCREEN DISSIPATION	0.65	WATTS
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
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A] WITH EXTERNAL SHIELD (EIA 316) CONNECTED TO CATHODE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TUNG-SOL

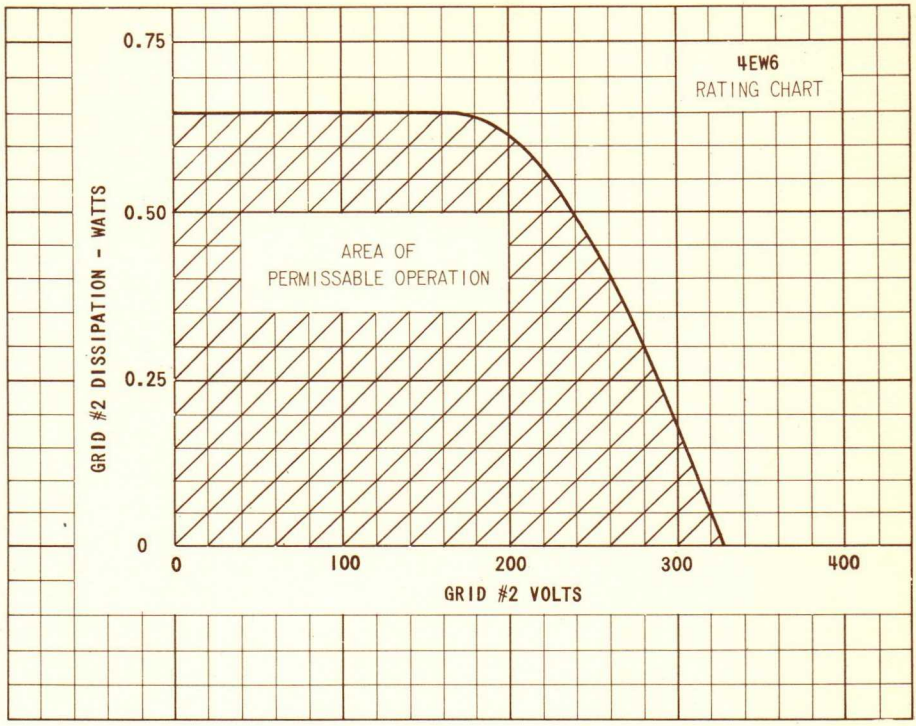
CONTINUED FROM PRECEDING PAGE

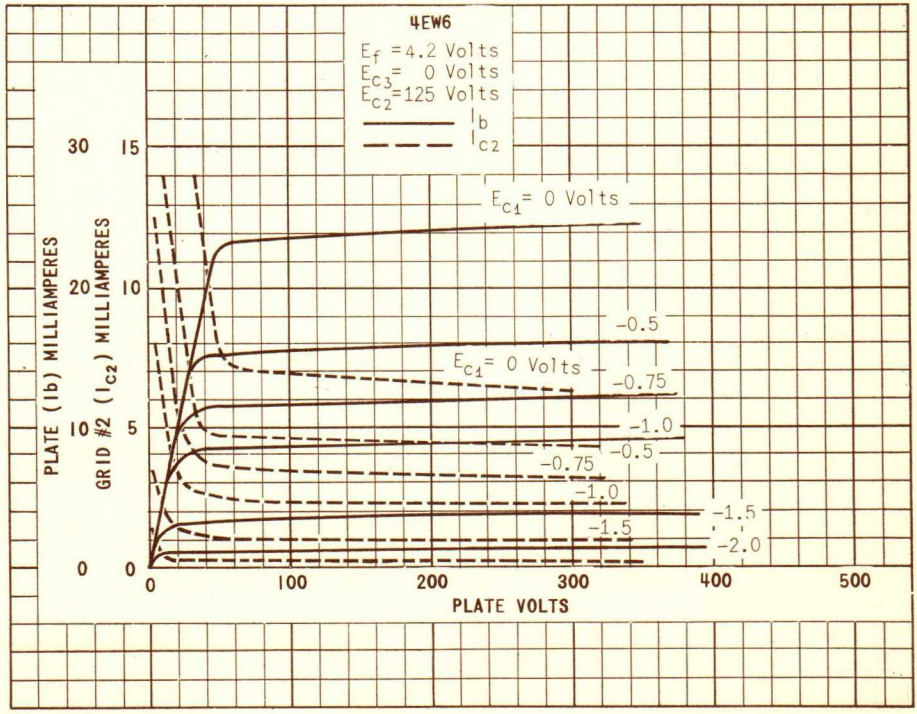
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.6±6%	AMP.
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	14 000	μMHOS
PLATE CURRENT	11	MA.
SCREEN CURRENT	3.2	MA.
GRID #1 VOLTAGE (APPROX.) I_b= 20 μAMPS.	-3.5	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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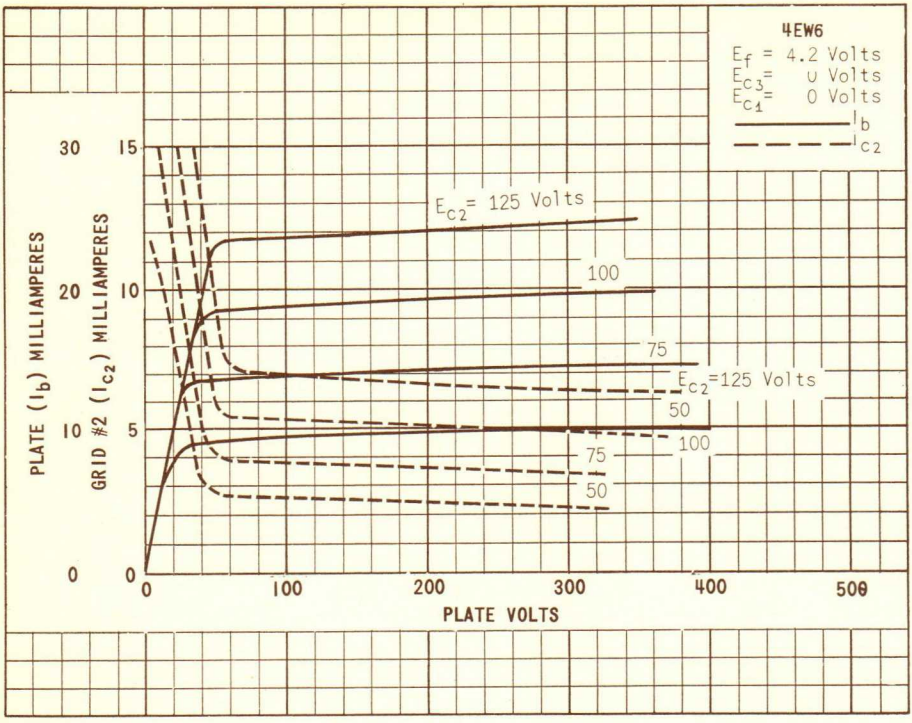
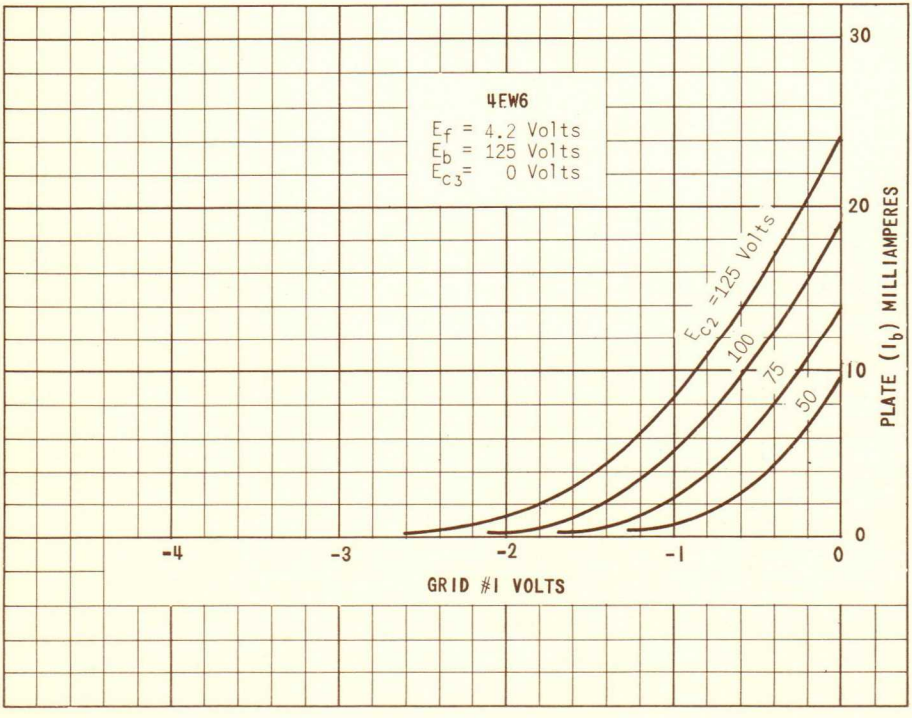
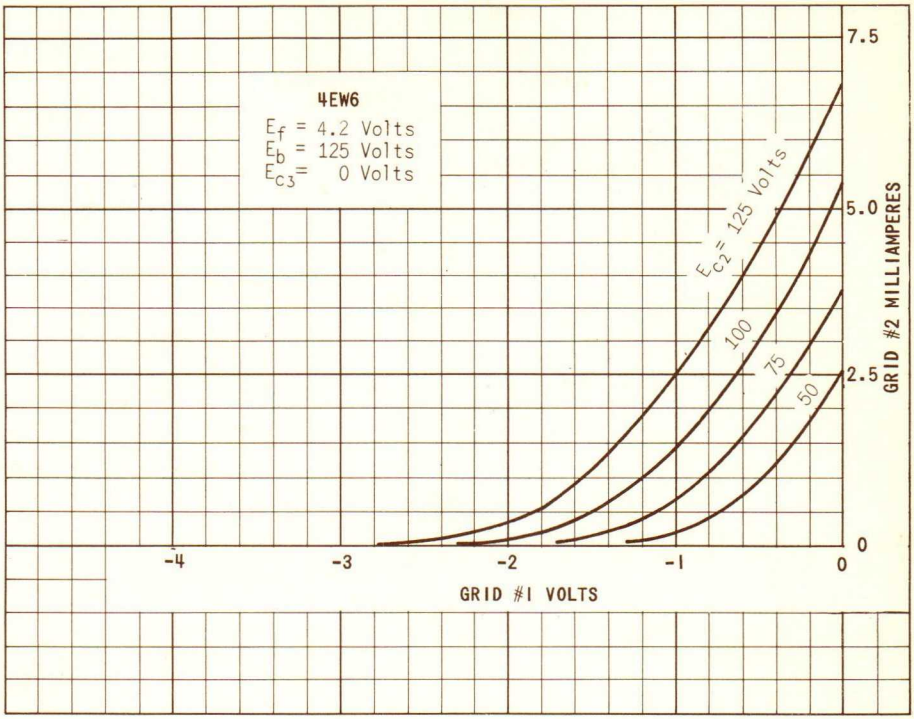
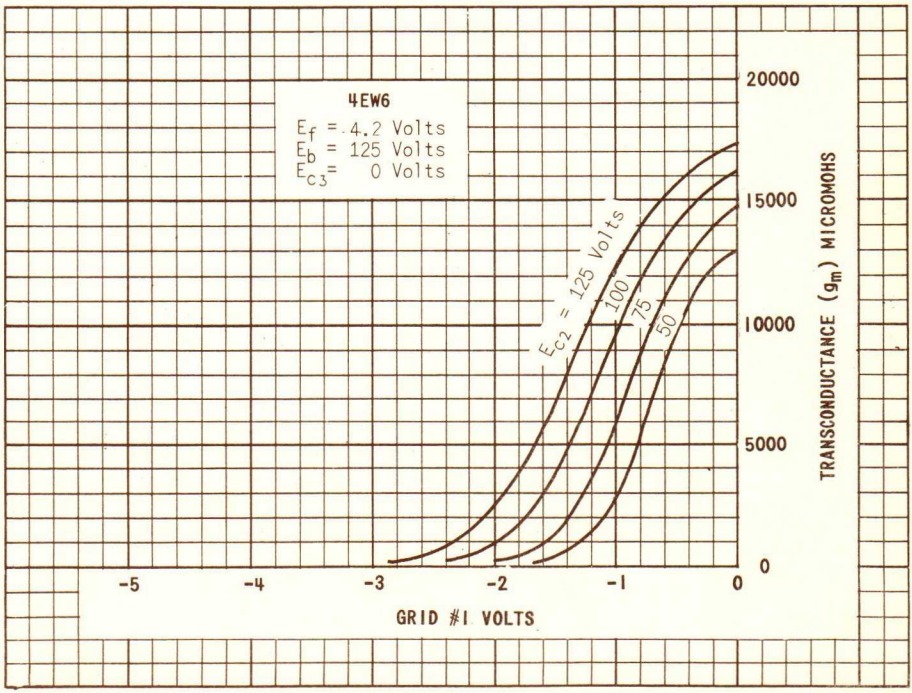

4EW6
E_f = 4.2 Volts
E_{c_3} = 0 Volts
E_{c_1} = 0 Volts
I_b
I_{c_2}
E_{c_2}= 125 Volts
100
75
50
E_{c_2}=125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #2 (I_{c_2}) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
5
10
15
20
30


4EW6
E_f = 4.2 Volts
E_b = 125 Volts
E_{c_3} = 0 Volts
E_{c_2} =125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #1 VOLTS
-4
-3
-2
-1
0
10
20
30





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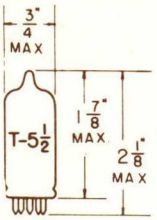
TUNG-SOL

PENTODE

MINIATURE TYPE



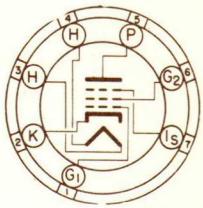
GLASS BULB

UNIPOTENTIAL CATHODE

HEATER

4.2 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE
7CM

THE 4GM6 IS A SEMIREMOTE-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR USE IN GAIN-CONTROLLED PICTURE-IF STAGES OF TELEVISION RECEIVERS OPERATING AT INTERMEDIATE FREQUENCIES OF THE ORDER OF MEGACYCLES.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.036	μμf
GRID #1 TO CATHODE, INTERNAL SHIELD & G3,G2 & H.	10	μμf
PLATE TO CATHODE, INTERNAL SHIELD & G3, G2 & H.	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #3 (SUPPRESSOR) VOLTAGE	0	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) VOLTAGE (SEE JEDEC INPUT RATING CHART J5-C4-2)		
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	WATTS
MAXIMUM GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	0.65	WATT
FOR GRID #2 VOLTAGES BETWEEN 165 AND 330 VOLTS (SEE JEDEC INPUT RATING CHART J5-C4-2)		
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.6±6%	AMP.
PLATE SUPPLY VOLTAGE	125	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET	
GRID #2 SUPPLY VOLTAGE	125	VOLTS
CATHODE RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.2	MEGOHMS
TRANSCONDUCTANCE	13 000	μMHOS
PLATE CURRENT	14	MA.
GRID #2 CURRENT	3.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR TRANCONDUCTANCE = 60 μMHOS	-15	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SER ICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WROST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

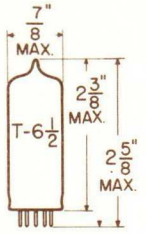
SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time, the 4GM6 is identical to the 5GM6 and the 6GM6.*

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

DUAL PENTODE

MINIATURE TYPE



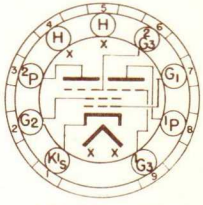
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

4.2 VOLTS 0.45 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9LW

THE 4GS8 IS A DUAL PENTODE WITH A SEPARATE PLATE AND A SEPARATE #3 GRID IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS PRIMARILY INTENDED FOR SERVICE AS A COMBINED SYNC SEPARATOR-CLIPPER AND AGC TUBE IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 4GS8 IS IDENTICAL TO THE 3GS8 AND THE 6GS8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE (EACH SECTION)	2.0	μμf
GRID #1 TO ALL	6.0	μμf
GRID #3 (EACH SECTION) TO ALL	3.8	μμf
PLATE (EACH SECTION) TO ALL	3.2	μμf
GRID #3 (SECTION #1) TO GRID #3 (SECTION 2) (MAX.)	0.015	μμf

RATINGS

- INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM [A]

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM PLATE VOLTAGE (EACH SECTION)	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE (EACH SECTION)	3.0	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM PEAK POSITIVE GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.1	WATTS
MAXIMUM GRID #2 DISSIPATION	0.75	WATTS
MAXIMUM DC CATHODE CURRENT	12	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHM
MAXIMUM GRID #3 CIRCUIT RESISTANCE (EACH SECTION)	0.5	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.) *	11.0	SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

BOTH SECTIONS OPERATING

HEATER VOLTAGE	4.2		VOLTS
HEATER CURRENT	0.45		AMP.
PLATE VOLTAGE (EACH SECTION)	100	100	VOLTS
GRID #2 VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE (EACH SECTION)	-10	0	VOLTS
GRID #1 VOLTAGE	NOTE B	NOTE B	
PLATE CURRENT (EACH SECTION)		2.0	MA.
GRID #2 CURRENT	6.0	3.6	MA.
CATHODE CURRENT	6.1	7.7	MA.

EACH SECTION OPERATING SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED.

PLATE VOLTAGE	100	100	VOLTS
GRID #2 VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	NOTE B	
PLATE CURRENT		2.0	MA.
GRID #3 TRANSCONDUCTANCE		270	μMHOS
GRID #1 TRANSCONDUCTANCE	1200		μMHOS
E_{c3} FOR I_b = 100 μA (APPROX.)		-3.7	VOLTS
E_{c1} FOR I_b = 100 μA (APPROX.)		-2.0	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

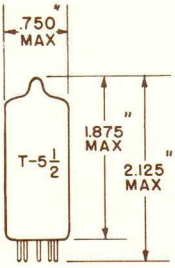
A DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

B GRID CURRENT ADJUSTED FOR 100 μA DC.

TUNG-SOL

PENTODE

MINIATURE TYPE

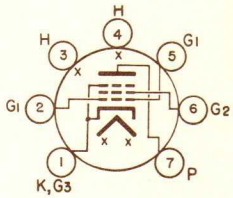


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

FOR AUDIO OUTPUT
APPLICATIONS
IN RADIO AND T.V.
RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CV

THE 4GZ5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN THE AUDIO OUTPUT STAGE OF RADIO AND TELEVISION RECEIVERS. ITS HEATER IS DESIGNED FOR OPERATION IN A 600 MILLIAMPERE SERIES STRING CIRCUIT.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: G1 TO P	0.24	pf
INPUT: G1 TO (H+K+G2)	8.5	pf
OUTPUT: P TO (H+K+G2)	3.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.0 VOLTS	600	MA.
HEATER WARM-UP TIME[A]		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	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

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	300	VOLTS
GRID #2 VOLTAGE	300	VOLTS
POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	4.8	WATTS
GRID #2 DISSIPATION — CONTINUOUS	1.1	WATTS
CATHODE CURRENT— AVERAGE	30	MA.
GRID #1 CIRCUIT RESISTANCE		
FIXED BIAS	.5	MEGOHM
SELF BIAS	1.0	MEGOHM
BULB TEMPERATURE	200	°C

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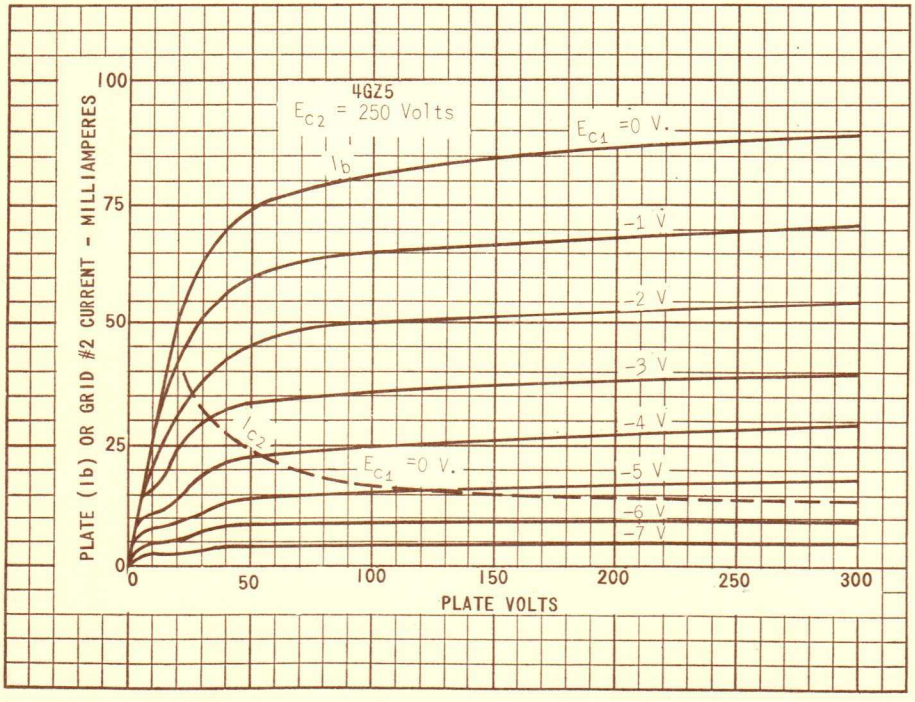
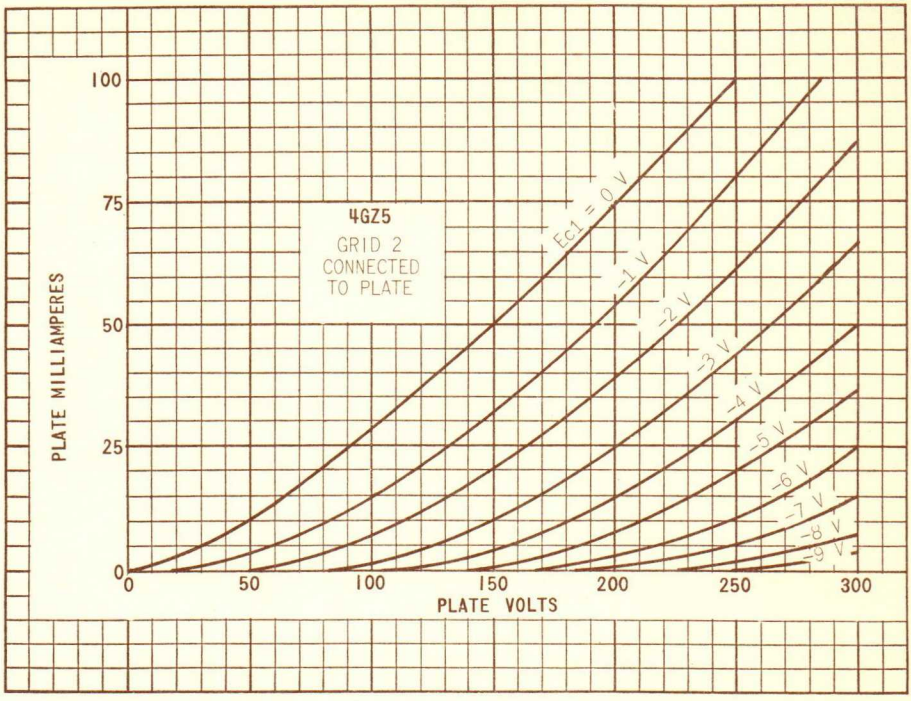
TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AUDIO AMPLIFIER

PLATE SUPPLY VOLTAGE	250	250	VOLTS
GRID #2 SUPPLY VOLTAGE	250	250	VOLTS
CATHODE RESISTOR	270	270	OHMS
BYPASSING	NONE	CONDENSER	
PEAK AUDIO GRID #1 VOLTAGE	9.8	2.0	VOLTS
ZERO SIGNAL PLATE CURRENT	16	16	MA.
MAXIMUM SIGNAL PLATE CURRENT	16	16	MA.
ZERO SIGNAL GRID #2 CURRENT	2.7	2.7	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	5.0	5.0	MA.
TRANSCONDUCTANCE	---	8400	μMHOS
PLATE RESISTANCE (APPROX.)	---	.15	MEGOHMS
LOAD RESISTANCE	15 000	15 000	OHMS
TOTAL HARMONIC DISTORTION	10	10	PERCENT
POWER OUTPUT	1.8	1.1	WATTS

A
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES THE RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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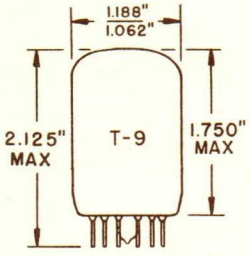
DUAL TRIODE

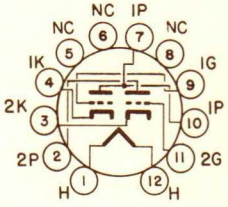
MINIATURE TYPE



GLASS BULB
BUTTON 12 PIN
BASE E12-70
OUTLINE DRAWING

TWO DISSIMILAR TRIODES
FOR
SYNC CLIPPER AND
AGC AMPLIFIER
SERVICE IN
TV RECEIVERS

COATED UNIPOTENTIAL CATHODES
ANY MOUNTING POSITION



BASING DIAGRAM
JEDEC 12 FR

THE 4HC7 CONTAINS TWO DISSIMILAR TRIODES IN A T-9 COMPACTRON CONSTRUCTION. EACH ELEMENT IS BROUGHT OUT TO A SEPARATE BASE PIN. TRIODE #1 HAS A LOW MU AND TRIODE #2 HAS A HIGH MU. THE 4HC7 IS DESIGNED FOR SYNC CLIPPER AND GATED AGC AMPLIFIER SERVICE IN TV RECEIVERS. THE HEATER IS INTENDED TO BE OPERATED IN A SERIES STRING. EXCEPT FOR HEATER RATINGS, THE 4HC7 IS IDENTICAL TO THE 5HC7

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	TRIODE 1	TRIODE 2	
GRID TO PLATE (g to p)	1.9	2.2	pf
INPUT: g to (h + k)	2.0	1.9	pf
OUTPUT: p to (h + k)	0.7	0.56	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES-SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.2 VOLTS	600	MA.
HEATER WARM-UP TIME		11	SECS.
LIMITS OF SUPPLIED CURRENT		600 ± 40	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

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TUNG-SOL

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE 1	TRIODE 2	
PLATE VOLTAGE	330	330	VOLTS
NEGATIVE DC GRID VOLTAGE	100	100	VOLTS
POSITIVE DC GRID VOLTAGE	0	0	VOLTS
POSITIVE TRANSIENT GRID VOLTAGE	60	-	VOLTS
PLATE DISSIPATION	3	1.2	WATTS
GRID CIRCUIT RESISTANCE	5.0	5.0	MEGOHMS

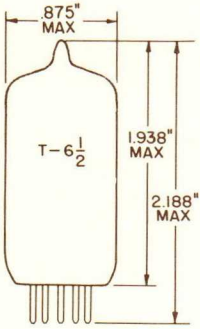
CHARACTERISTICS

PLATE VOLTAGE	150	150	VOLTS
GRID VOLTAGE	-1	-1	VOLTS
PLATE CURRENT	18	1.0	MA
TRANSCONDUCTANCE	4400	1900	μMHOS
AMPLIFICATION FACTOR	23	100	
PLATE RESISTANCE (APPROX.)	5,200	53,000	OHMS
GRID VOLTAGE FOR I_b = 10 μA (APPROX.)	-13	-2.2	VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

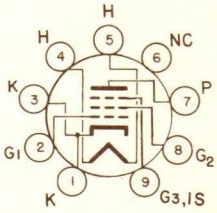
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

SHARP-CUTOFF PENTODE

FOR

IF AMPLIFIER STAGES

IN TV RECEIVERS



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9PM

THE 4HM6 IS A FRAME-GRID, SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 4HM6 IS IDENTICAL TO THE 3HM6 AND THE 6HM6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315 CONNECTED TO CATHODE	WITHOUT SHIELD	
GRID TO PLATE	0.024	0.031	pf
INPUT	8.70	8.70	pf
OUTPUT	3.00	2.15	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.2	VOLTS	450	MA.
HEATER WARM-UP TIME			11	SECONDS
LIMITS OF SUPPLIED CURRENT			450 ± 30	MA.
HEATER CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK		MAX.	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK		MAX.	200	VOLTS

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MAXIMUM RATINGS

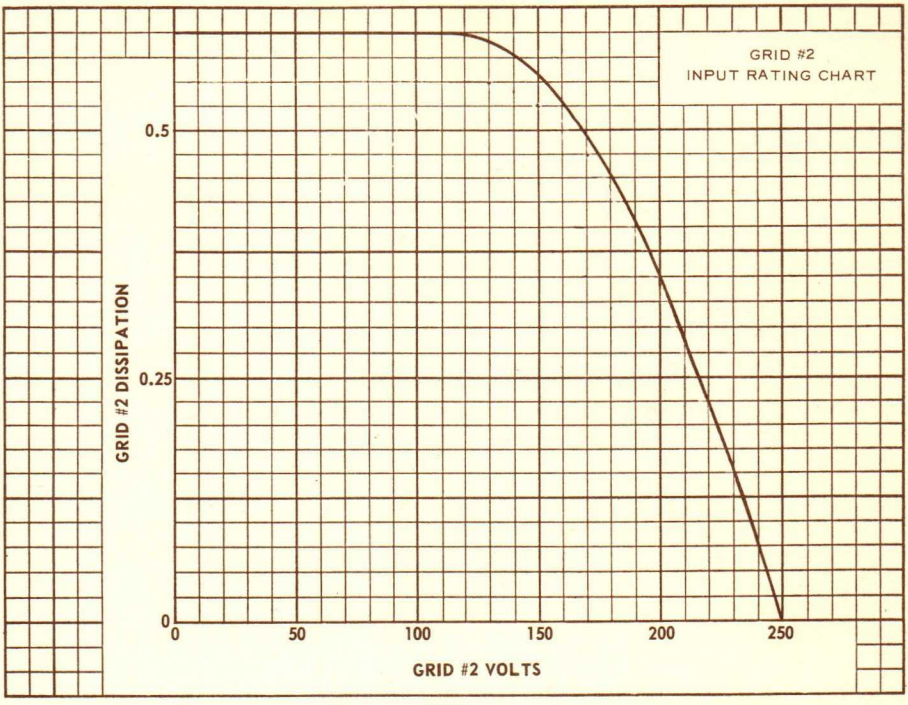
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

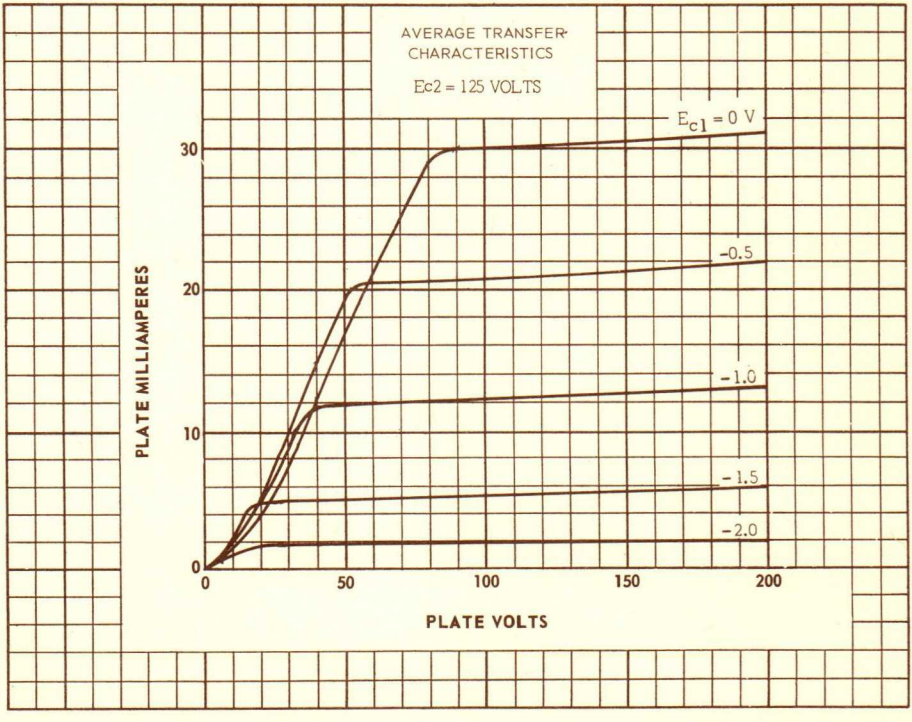
PLATE VOLTAGE	250	VOLTS
GRID 2 SUPPLY VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
NEGATIVE GRID 1 VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 125 VOLTS	0.6	WATT
GRID 1 CIRCUIT RESISTANCE:		
CATHODE-BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	Connected To Cathode At Socket	
GRID 2 VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE CURRENT	13	MA.
GRID 2 CURRENT	3.2	MA.
TRANSCONDUCTANCE	15,000	μMHOS
PLATE RESISTANCE	0.156	MEGOHM
HOT INPUT RESISTANCE [A]	13,000	OHMS
HOT INPUT CAPACITANCE [A]	7.4	pf
GRID 1 VOLTAGE AT Gm = 100 μMHOS	-3.0	VOLTS

[A] MEASURED AT 44 MC/S WITH UNBYPASSED 56 OHM CATHODE RESISTOR.





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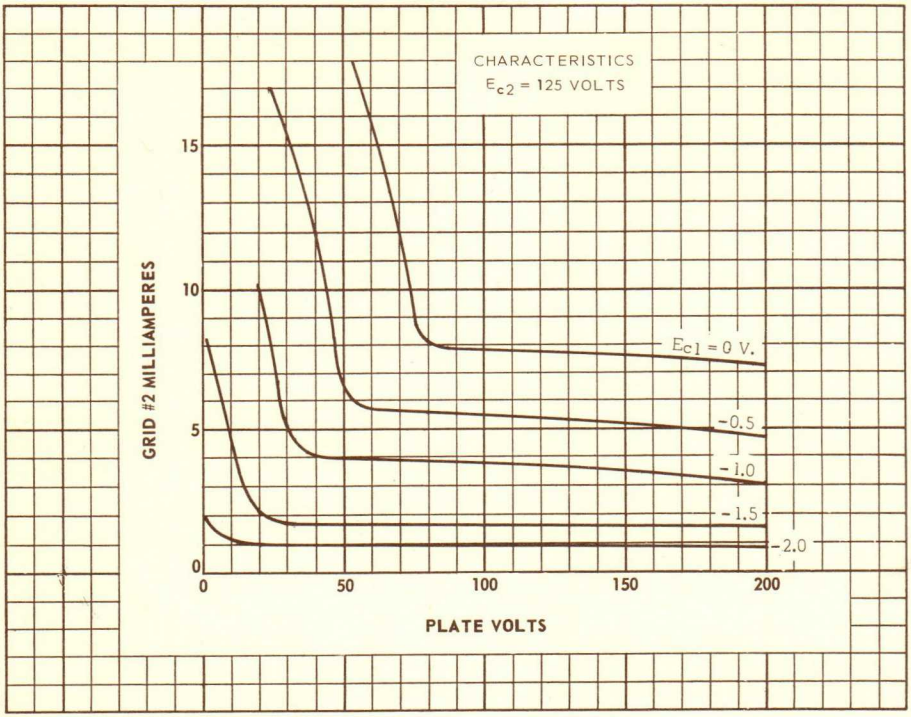
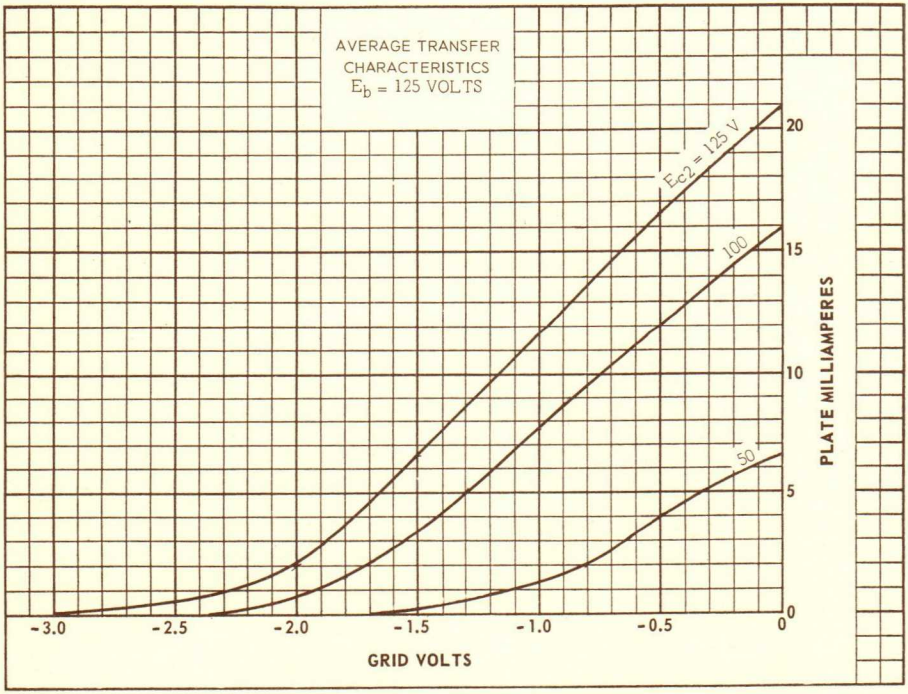
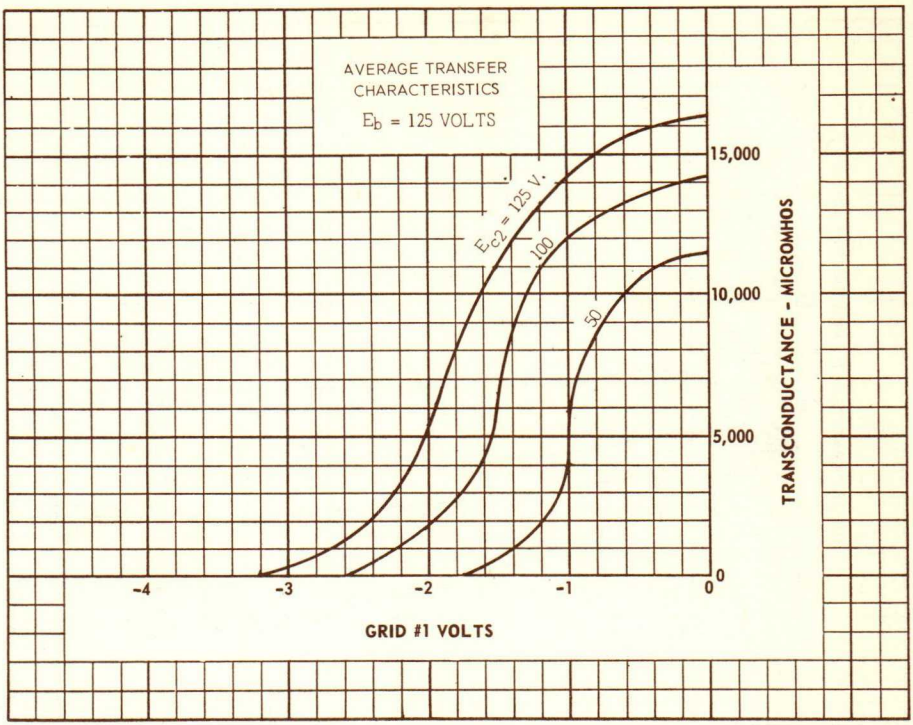
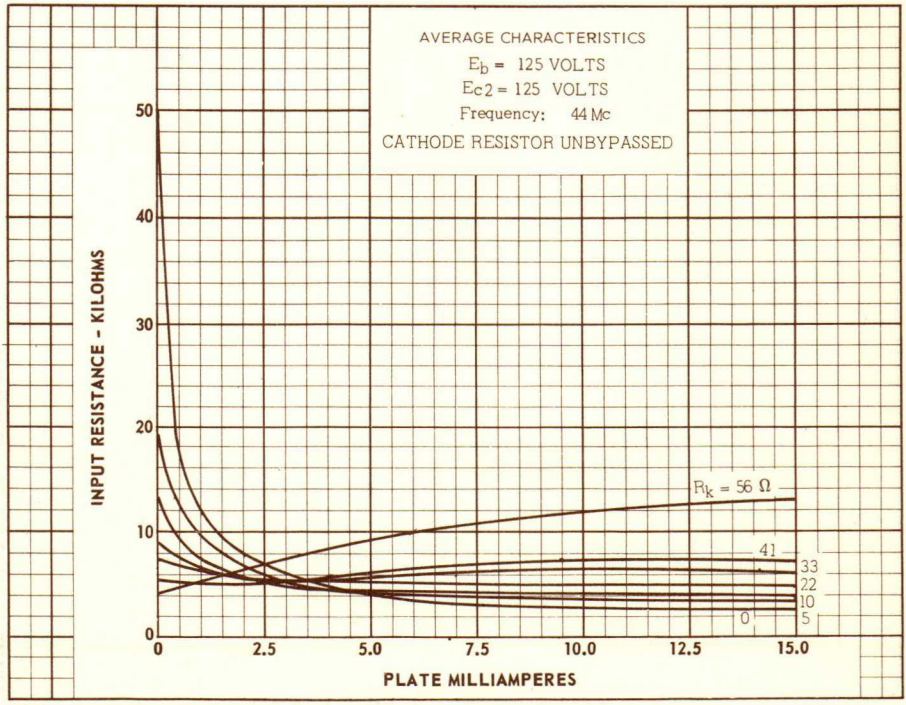

CHARACTERISTICS
E_{c2} = 125 VOLTS
GRID #2 MILLIAMPERES
15
10
5
0
E_{c1} = 0 V.
-0.5
-1.0
-1.5
-2.0
0
50
100
150
200
PLATE VOLTS


AVERAGE TRANSFER
CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 V
100
50
20
15
10
5
0
PLATE MILLIAMPERES
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0
GRID VOLTS





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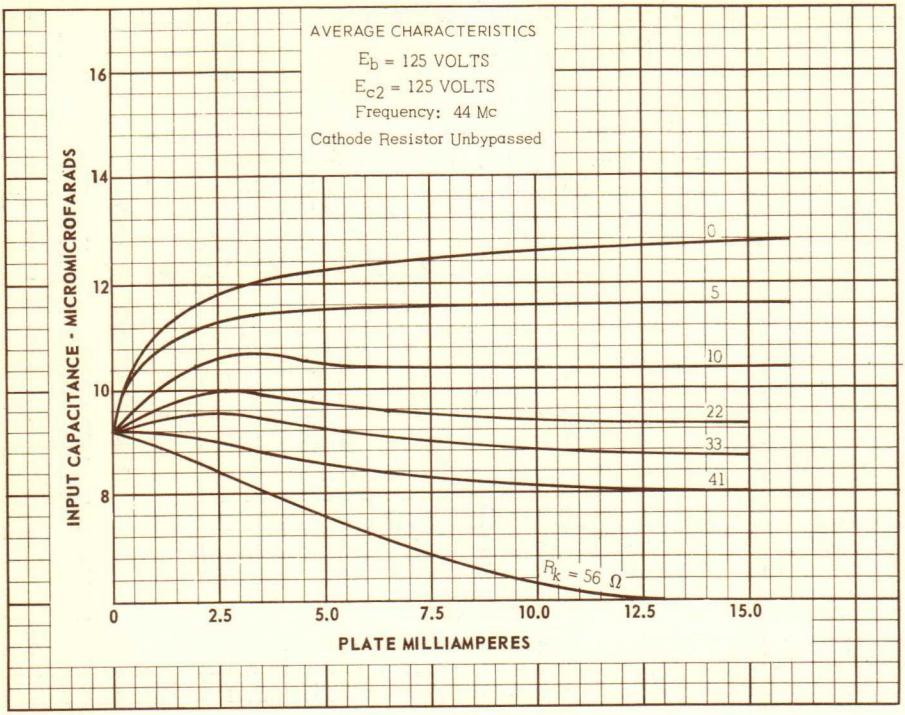

AVERAGE CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 VOLTS
Frequency: 44 Mc
Cathode Resistor Unbypassed
INPUT CAPACITANCE - MICROMICROFARADS
16
14
12
10
8
0
2.5
5.0
7.5
10.0
12.5
15.0
PLATE MILLIAMPERES
0
5
10
22
33
41
R_k = 56 Ω

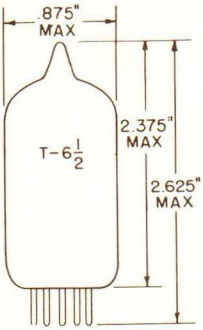
TUNG-SOL

TWIN PENTODE
MINIATURE TYPE

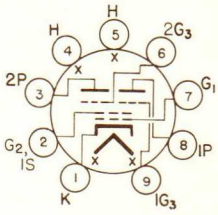
COATED UNIPOTENTIAL CATHODE

FOR T.V. APPLICATIONS

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9FG

THE 4HS8 IS A MINIATURE TWIN PENTODE THAT INCORPORATES SEPARATE PLATES AND #3 GRIDS FOR THE TWO SECTIONS TOGETHER WITH A COMMON SCREEN, #1 GRID, AND CATHODE. IT IS INTENDED FOR USE AS A COMBINED SYNC-AGC TUBE IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE, EACH SECTION	2.0	pf
GRID #1 TO ALL	6.0	pf
GRID #3 (EACH SECTION) TO ALL	3.6	pf
PLATE (EACH SECTION) TO ALL	3.0	pf
GRID #3 (SECTION 1) TO GRID #3 (SECTION 2), MAX.	0.015	pf

HEATER RATINGS AND CHARACTERISTICS
DESIGN-MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.2 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±25	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
HEATER WARM-UP TIME[A]		11	SECONDS

A
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE, EACH SECTION	300	VOLTS
SCREEN VOLTAGE	150	VOLTS
POSITIVE DC GRID #3 VOLTAGE, EACH SECTION	3.0	VOLTS
NEGATIVE DC GRID #3 VOLTAGE, EACH SECTION	50	VOLTS
PEAK POSITIVE GRID #3 VOLTAGE, EACH SECTION	50	VOLTS
NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
PLATE DISSIPATION, EACH SECTION	1.1	WATTS
SCREEN DISSIPATION	0.75	WATT
DC CATHODE CURRENT	12	MA.
GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHM
GRID #3 CIRCUIT RESISTANCE, EACH SECTION	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS - BOTH SECTIONS OPERATING

PLATE VOLTAGE, EACH SECTION	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE, EACH SECTION	-10	0	VOLTS
GRID #1 VOLTAGE [B]			
PLATE CURRENT, EACH SECTION	---	2.0	MA.
SCREEN CURRENT	7.0	4.4	MA.
CATHODE CURRENT	7.1	8.5	MA.

AVERAGE CHARACTERISTICS - EACH SECTION SEPARATELY

WITH PLATE & GRID #3 OF OPPOSITE SECTION GROUNDED

PLATE VOLTAGE	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	B	VOLTS
GRID #3 TRANSCONDUCTANCE	---	450	μMHOS
GRID #1 TRANSCONDUCTANCE	1100	---	μMHOS
PLATE CURRENT	---	2.0	MA.
GRID #3 VOLTAGE, (APPROX.) AT Ib = 100 μA	---	-3.5	VOLTS
GRID #1 VOLTAGE, (APPROX.) Ib = 100 μAMPS.	---	-2.3	VOLTS

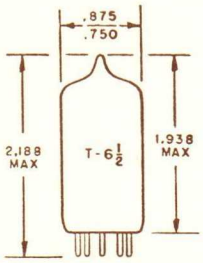
[B] WITH GRID CURRENT ADJUSTED FOR 100 MICROAMPERES DC.

SIMILAR TYPE REFERENCE: Except for heater ratings, and heater warm-up time, the 4HS8 is identical to the 6HS8.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

SEMI-REMOTE-CUTOFF PENTODE

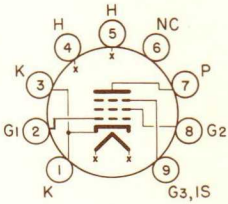
FOR

I.F. AMPLIFIER STAGES

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9 PM

THE 4HT6 IS A SEMI-REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN TELEVISION RECEIVER I.F. AMPLIFIER STAGES. THE SEMI-REMOTE CUTOFF CHARACTERISTICS IS DESIRABLE FOR USE IN AGC CONTROLLED STAGES.
EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 4HT6 IS IDENTICAL TO THE 3HT6 AND THE 6HT6.

DIRECT INTERELECTRODE CAPACITANCES

	SHIELD 315 CONNECTED TO GROUND	UNSHIELDED	
GRID 1 TO PLATE	0.024	0.031	pf
INPUT	8.70	8.70	pf
OUTPUT	3.00	2.15	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.2 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.
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

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MAXIMUM RATINGS

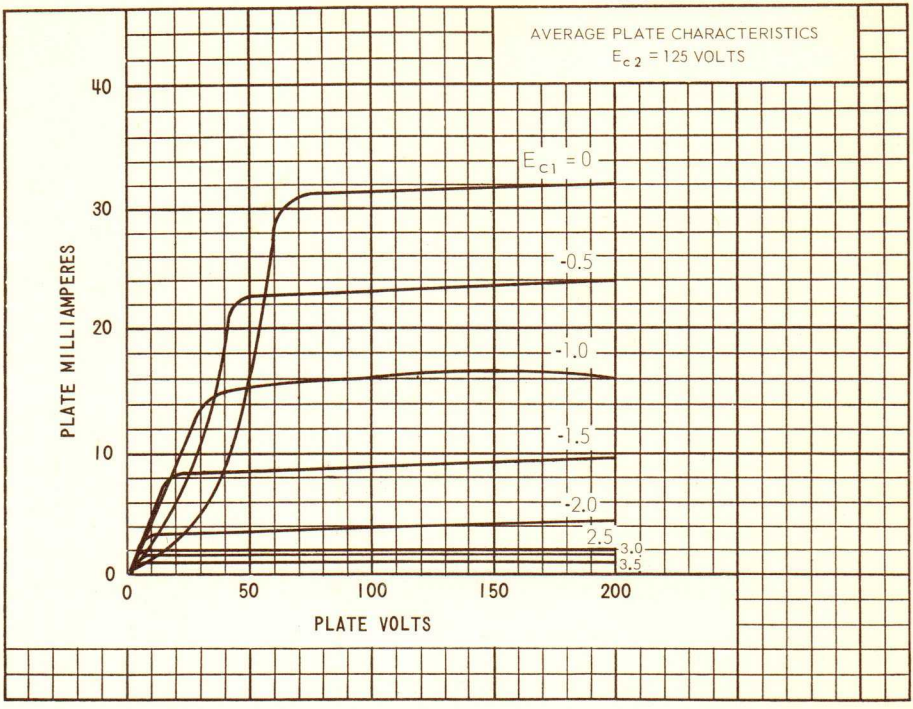
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

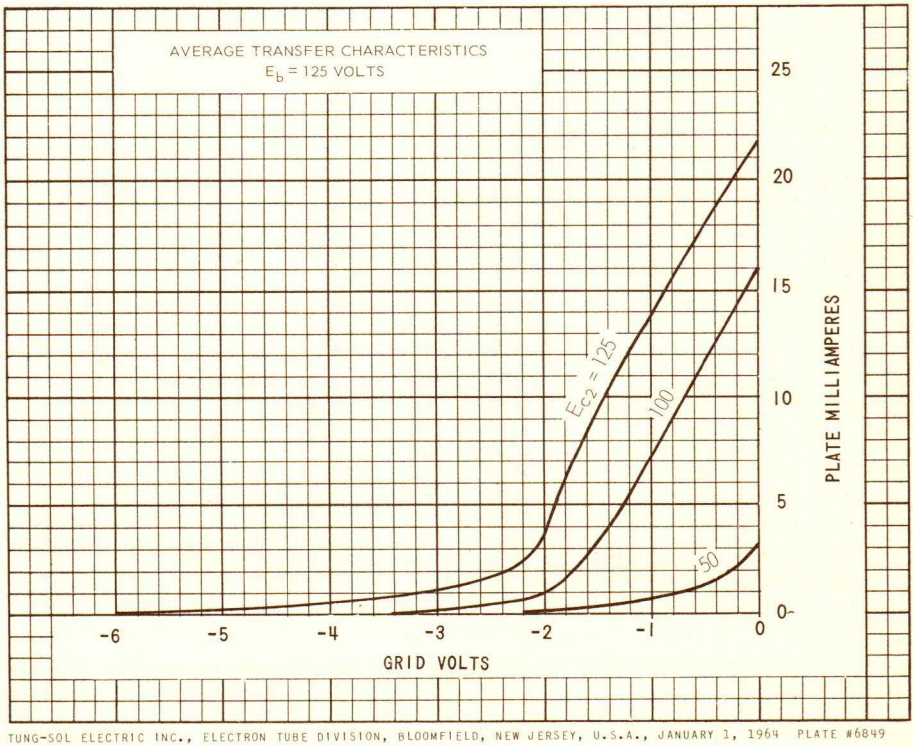
PLATE VOLTAGE	250	VOLTS
GRID 2 SUPPLY VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
GRID 1 VOLTAGE	-50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION	0.6	WATTS
CATHODE CURRENT	25	MA.
GRID 1 CIRCUIT RESISTANCE:		
CATHODE BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID 2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE CURRENT	15	MA.
GRID 2 CURRENT	4.0	MA.
TRANSCONDUCTANCE	14,000	μMHOS
PLATE RESISTANCE	0.143	MEGOHM
GRID 1 CUTOFF BIAS FOR G_m = 50 μMHOS	-6.7	VOLTS
CUTOFF TRANSCONDUCTANCE:		
FOR E_{c1} = -1.5	12,000	μMHOS
FOR E = -3.5	300	μMHOS
HOT INPUT RESISTANCE [A]	12,700	OHMS
HOT INPUT CAPACITANCE [A]	7.45	pf

A - MEASURED 44 Mc/s WITH UNBYPASSED 56 OHM CATHODE RESISTANCE





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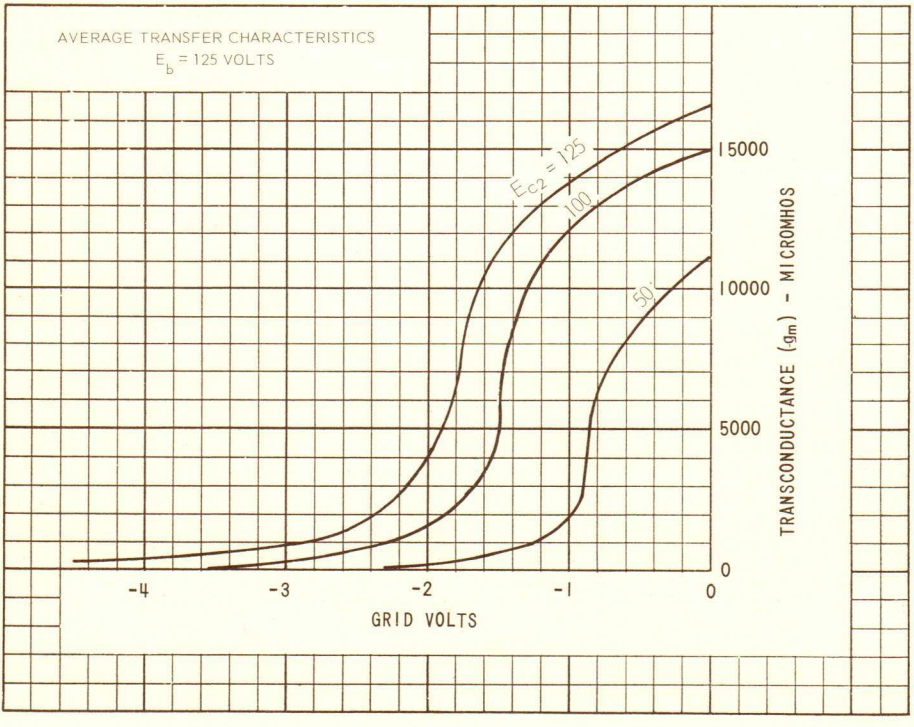
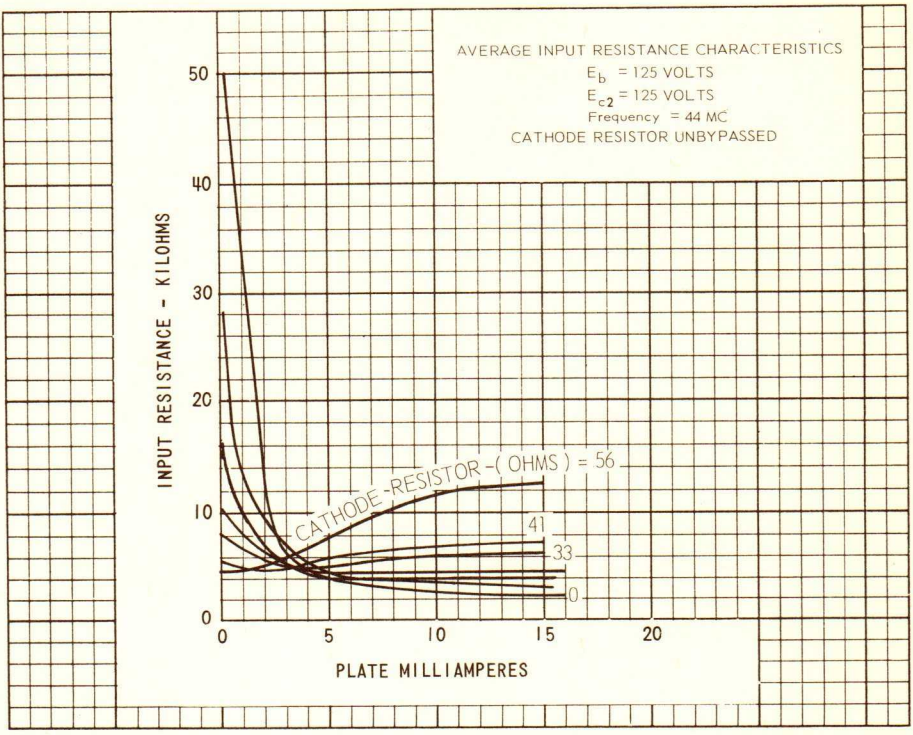
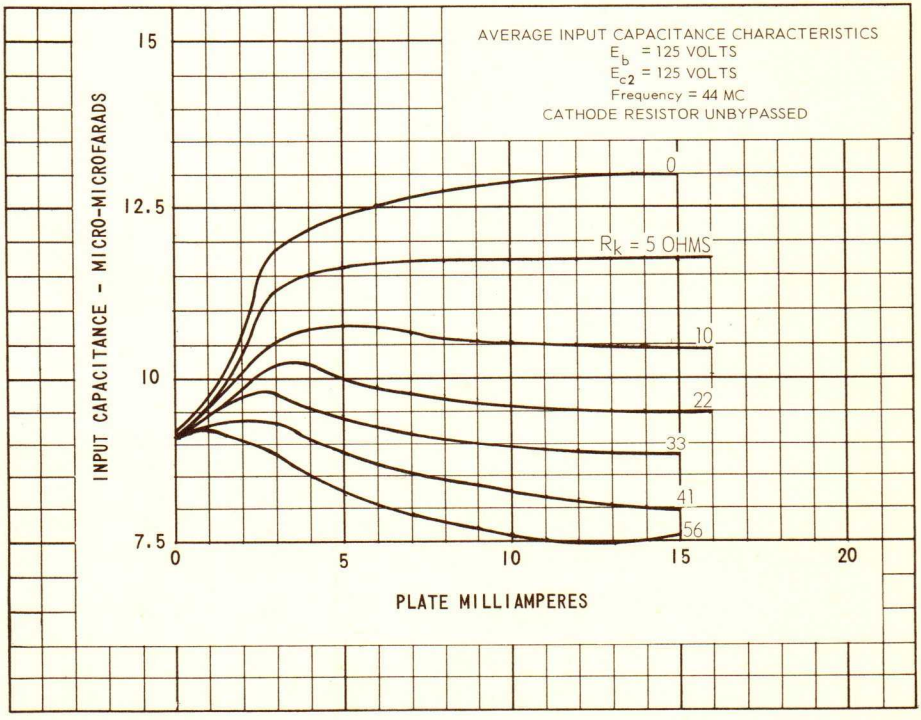
AVERAGE GRID #2 CHARACTERISTICS
E_{c2} = 125 VOLTS
GRID #2 MILLIAMPERES
20
15
10
5
0
E_{c1} = 0
-0.5
-1.0
-1.5
2.0
2.5
3.0
0
50
100
150
200
PLATE VOLTS


AVERAGE TRANSFER CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125
100
50
15000
10000
5000
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
-4
-3
-2
-1
0
GRID VOLTS





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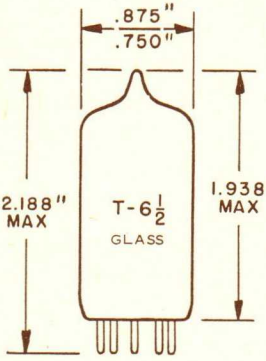
TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE
JEDEC 6-2

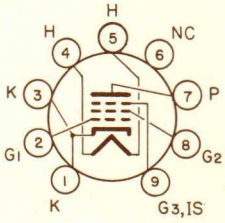


BASE 9 PIN BUTTON
JEDEC E9-1

SEMI-REMOTE-CUTOFF PENTODE
FOR
I.F. AMPLIFIER STAGES
IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9PM



BOTTOM VIEW

THE 4JC6 IS A FRAME-GRID, SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 4JC6 IS IDENTICAL TO THE 3JC6 AND THE 6JC6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE - MAX.	.019	pf
INPUT (G1 TO H + K + G3 + I.S. + G2)	8.2	pf
OUTPUT (P TO H + K + G3 + I.S. + G2)	3.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.5 VOLTS	450	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	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

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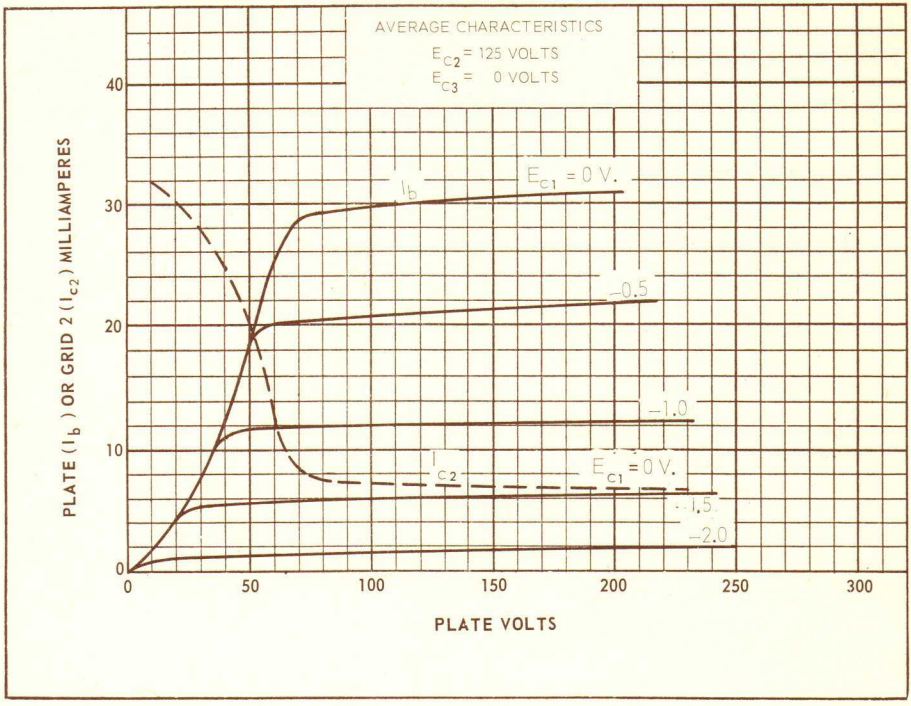
MAXIMUM RATINGS

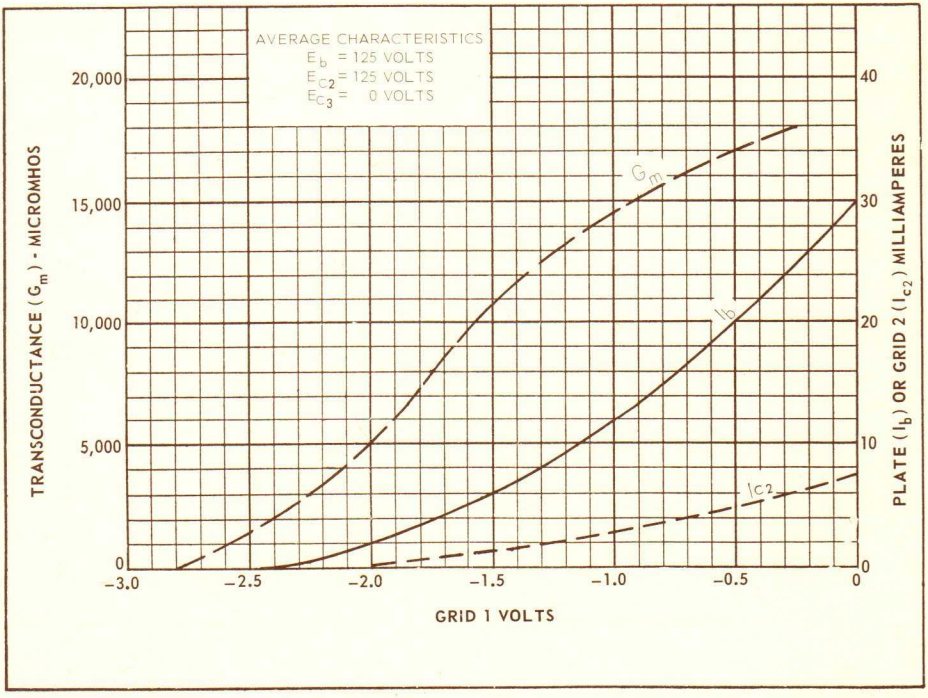
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
POSITIVE GRID 1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 165 VOLTS	0.6	WATT
GRID 1 CIRCUIT RESISTANCES:		
CATHODE-BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	Connected To Cathode At Socket	
GRID 2 VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE CURRENT	13	mA
GRID 2 CURRENT	3.2	mA
TRANSCONDUCTANCE	15,000	μMHOS
PLATE RESISTANCE	0.18	MEGOHM
GRID 1 VOLTAGE FOR I_b = 100 mA	-3.0	VOLTS





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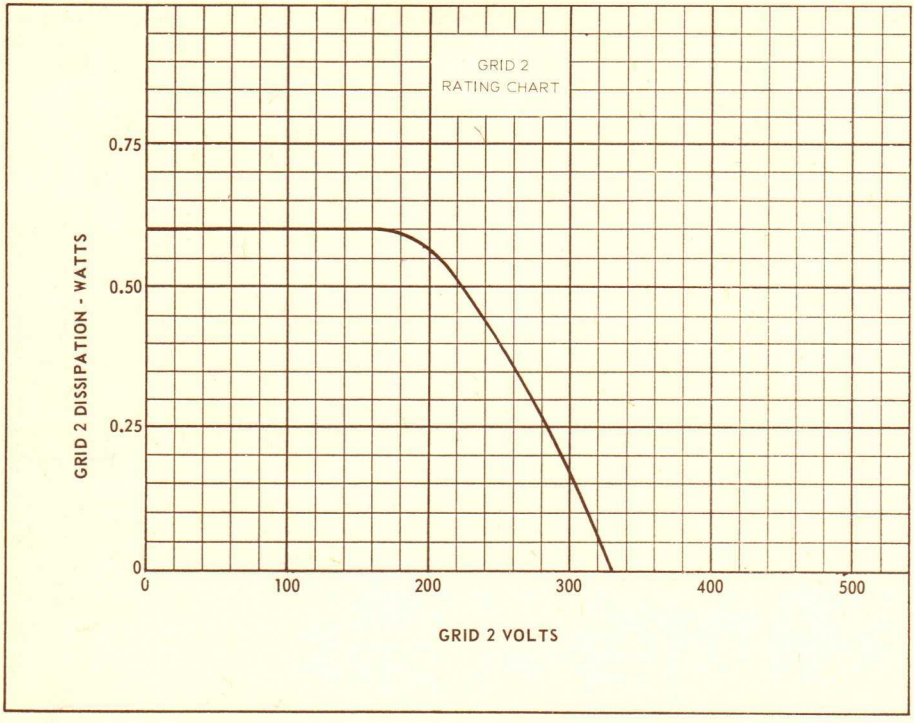
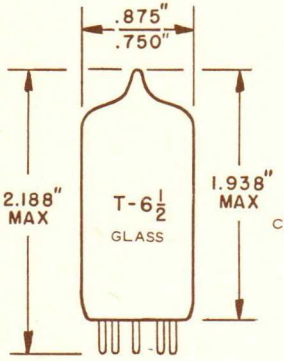

GRID 2
RATING CHART
GRID 2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
500
GRID 2 VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE
JEDEC 6-2



BASE 9 PIN BUTTON
JEDEC E9-1

SHARP-CUTOFF PENTODE

FOR

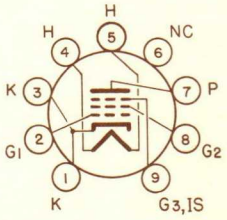
IF AMPLIFIER STAGES

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9PM



BOTTOM VIEW

THE 4JD6 IS A SEMI-REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN TELEVISION RECEIVER I.F. AMPLIFIER STAGES. THE SEMI-REMOTE CUTOFF CHARACTERISTICS IS DESIRABLE FOR USE IN AGC CONTROLLED STAGES. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 4JD6 IS IDENTICAL TO THE 3JD6 AND THE 6JD6.

DIRECT INTERELECTROCE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE - MAX.	0.019	pf
INPUT (G TO H + K + G3 + I.S. + G2)	8.2	pf
OUTPUT (P TO H + K + G3 + I.S. + G2)	3.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.5 VOLTS	450	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	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

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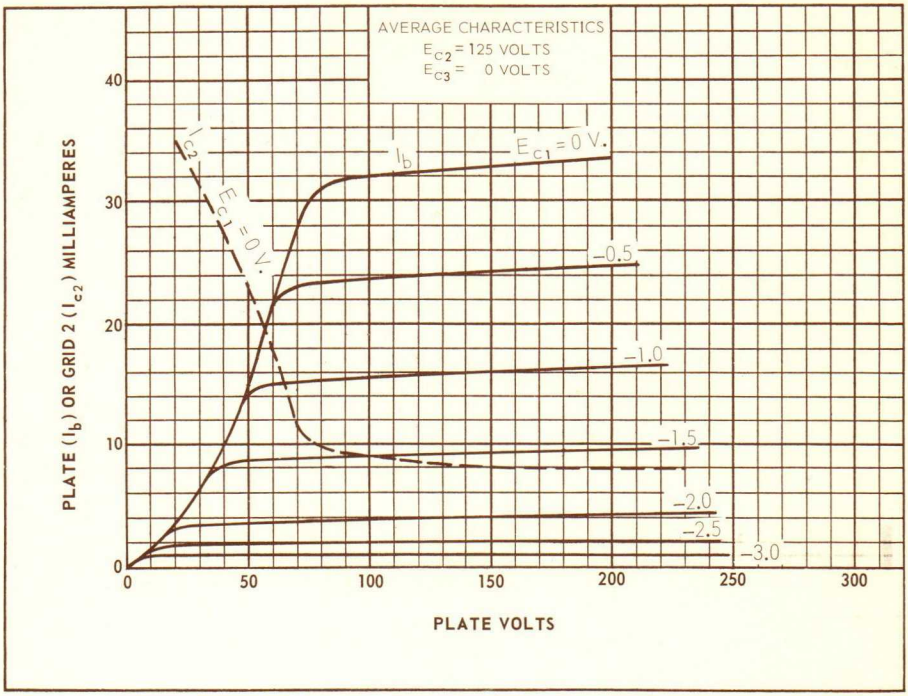
MAXIMUM RATINGS

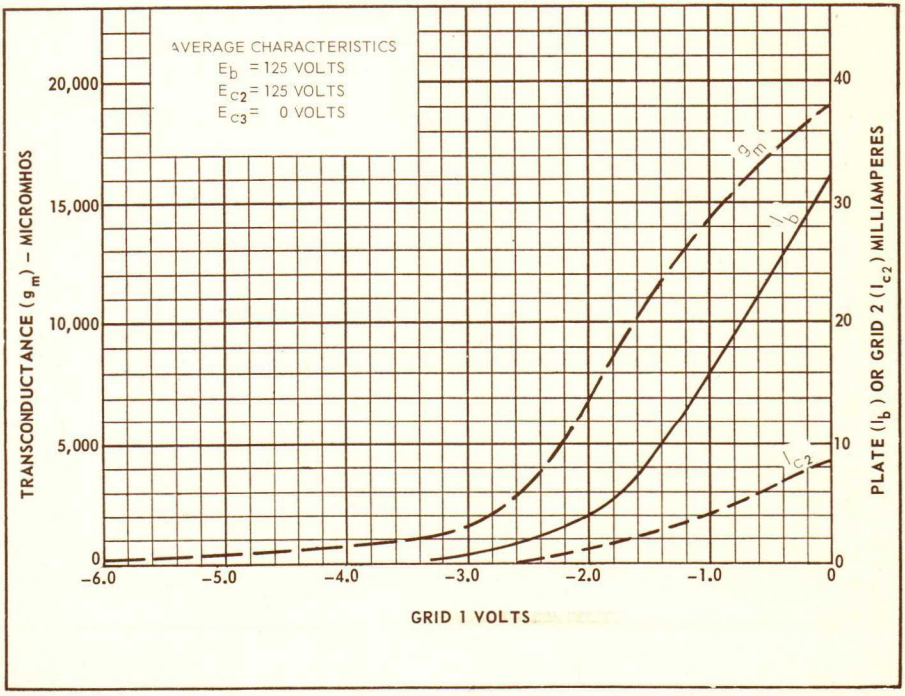
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 165 VOLTS	0.6	WATTS
GRID 1 CIRCUIT RESISTANCE:		
CATHODE BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID 2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE CURRENT	15	mA
GRID 2 CURRENT	4	mA
TRANSCONDUCTANCE	14,000	μMHOS
PLATE RESISTANCE	0.16	MEGOHM
GRID 1 VOLTAGE FOR G_m = 600 μMHOS	−4.5	VOLTS





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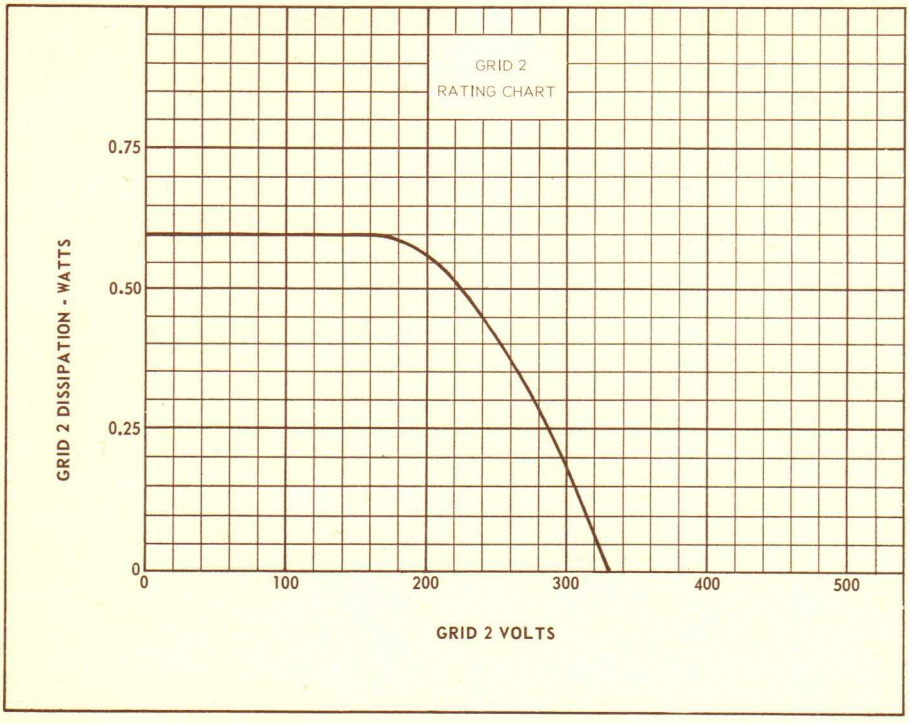
4JD6


GRID 2
RATING CHART
GRID 2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
500
GRID 2 VOLTS

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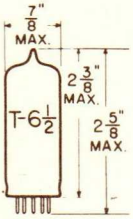
BEAM PENTODE

MINIATURE TYPE



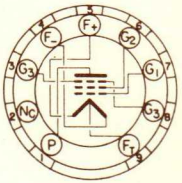
GLASS BULB

COATED FILAMENT

SERIES FILAMENT	PARALLEL FILAMENT
E_f APPLIED BETWEEN PINS #4 AND #5	E_f APPLIED BETWEEN PIN #9 AND PINS #4 & #5 TIED TOGETHER.
E_{g1} REFERRED TO PIN #4	E_{g1} REFERRED TO PIN #9
5.0 VOLTS	2.5 VOLTS
230 MA.	460 MA.

DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON 9 PIN BASE 9L

THE 5A6 IS A MINIATURE FILAMENTARY TYPE PENTODE RF POWER AMPLIFIER, INTENDED FOR SERVICE WHERE MODERATE AMOUNTS OF RF POWER ARE DESIRED IN PORTABLE EQUIPMENT. ITWILL DELIVER 3 WATTS OF RF POWER WITH LOW DRIVING POWER AT 70 MEGACYCLES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD	WITHOUT SHIELD	
GRID TO PLATE: (G_1 TO P) MAX.	0.10	0.15	μμf
INPUT: G_1 TO ($F+G_2+G_3$)	8.5	8.5	μμf
OUTPUT: P TO ($F+G_2+G_3$)	9.5	6	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

CLASS B OR CLASS C AMPLIFIER

FILAMENT VOLTAGE (±15%)	2.5	5.0	VOLTS
MAXIMUM PLATE VOLTAGE	150		VOLTS
MAXIMUM GRID #3 VOLTAGE	0		VOLTS
MAXIMUM GRID #2 VOLTAGE	150		VOLTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	-75		VOLTS
MAXIMUM PLATE DISSIPATION	5		WATTS
MAXIMUM GRID #2 POWER INPUT	2		WATTS
MAXIMUM PLATE CURRENT	40		MA.
MAXIMUM GRID #1 CURRENT	3		MA.
MAXIMUM FREQUENCY FOR MAXIMUM PLATE INPUT POWER	100		MC

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NOV. 1, 1949

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

RF AMPLIFIER AT 70 MC

	CLASS B		CLASS C		
FILAMENT VOLTAGE	2.5	5.0	2.5	5.0	VOLTS
FILAMENT CURRENT	460	230	460	230	MA.
DC PLATE VOLTAGE	150		150		VOLTS
GRID #3 VOLTAGE	0		0		VOLTS
DC GRID #2 VOLTAGE	150		150		VOLTS
DC GRID #1 VOLTAGE	-15		-24		VOLTS
PEAK RF GRID #1 VOLTAGE	23		35		VOLTS
GRID #2 RESISTOR	1 500		0		OHMS
GRID #1 RESISTOR	15 000		20 000		OHMS
DC PLATE CURRENT	40		40		MA.
DC GRID #2 CURRENT	7		11		MA.
DC GRID #1 CURRENT	1		1.2		MA.
GRID #1 DRIVING POWER (APPROX.)	60		100		MW.
USEFUL POWER OUTPUT	2.8		3.1		WATTS
TRIODE AMPLIFICATION FACTOR (APPROX. AT I_b = 30 MA.)	6.8				

PLATE 2271

NOV. 1, 1949

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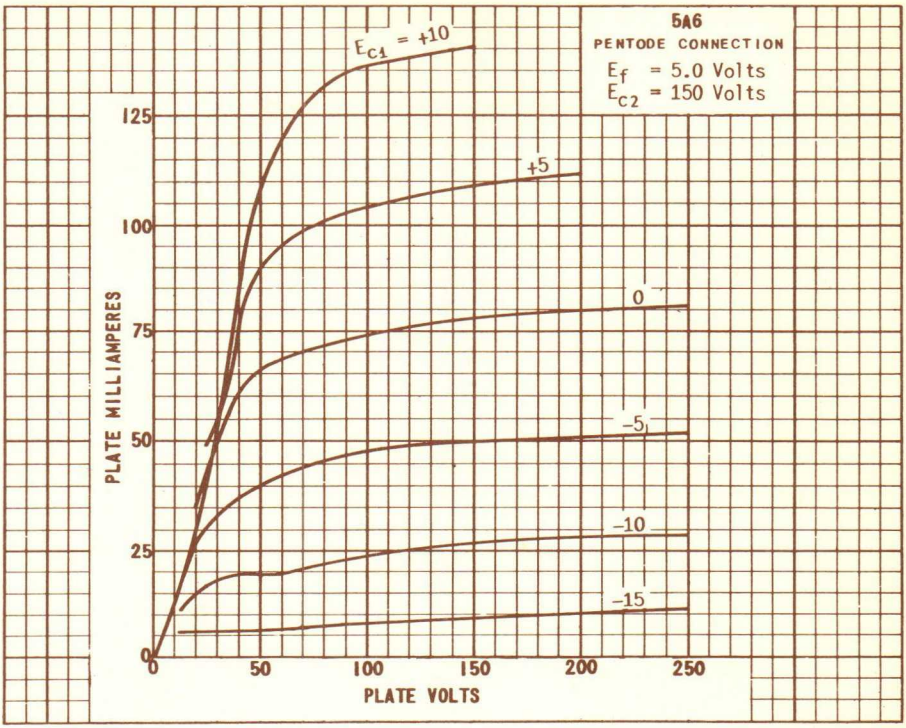

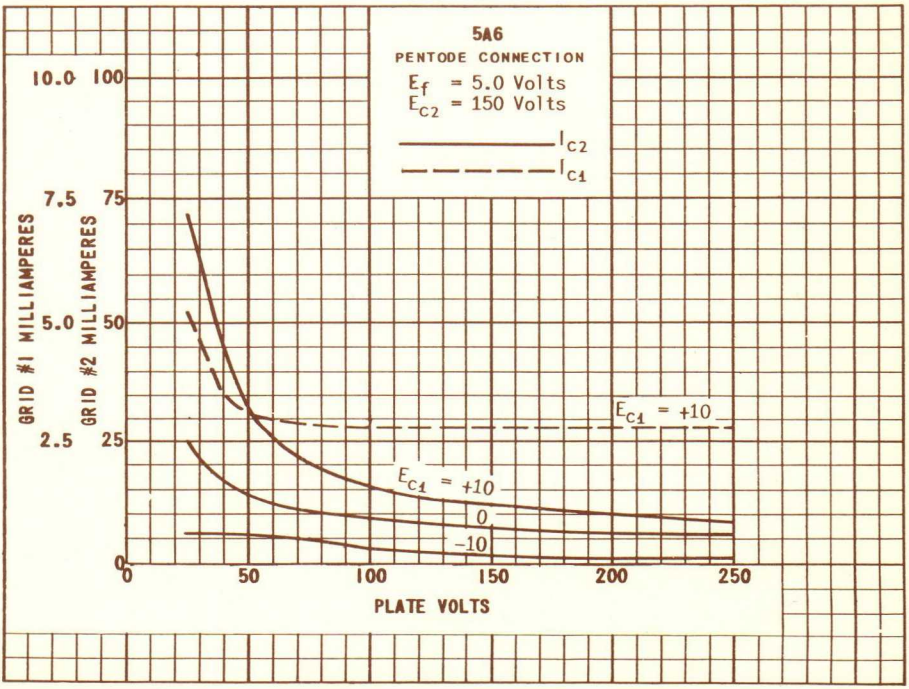

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PLATE
2210
JUNE 1,
1949

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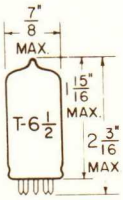
DIODE PENTODE

MINIATURE TYPE

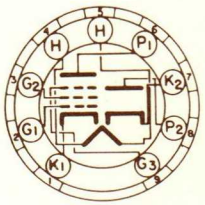


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9CY

THE 5AM8 IS A DIODE PENTODE ESPECIALLY DESIGNED FOR USE AS A VIDEO DETECTOR AND IF AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE			
GRID #1 TO PLATE (MAX.)	0.015	0.015	μμf
INPUT	6.0	6.0	μμf
OUTPUT	3.4	2.6	μμf
DIODE			
INPUT: P TO (H+K)	2.3	1.7	μμf
CATHODE TO (H+P)	3.0	3.0	μμf
COUPLING (DIODE PLATE TO PENTODE PLATE)	0.035	0.10	μμf
COUPLING (DIODE PLATE TO GRID #1)	0.005	0.006	μμf
COUPLING (DIODE CATHODE TO PENTODE PLATE)	0.15	0.15	μμf

[A] SHIELD #315.

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RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	4.7	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
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	2.8	WATTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATT
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM GRID #3 VOLTAGE	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
CATHODE BIAS	1.0	MEGOHM
FIXED BIAS	0.25	MEGOHM
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION	5.0	MA.
HEATER WARM-UP TIME (APPROX.)[B]	11.0	SECONDS

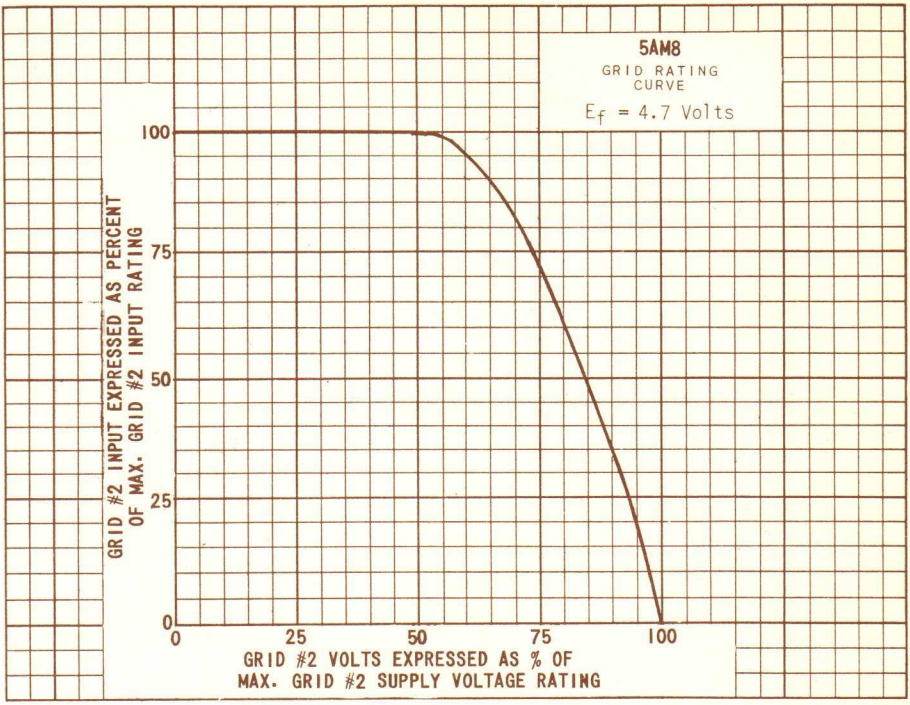
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

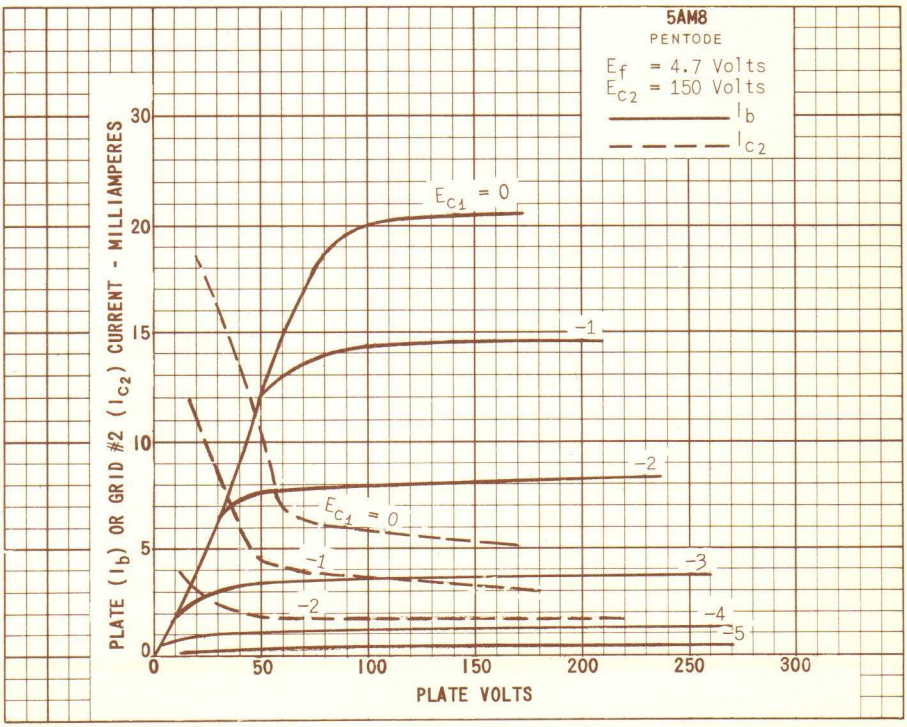
HEATER VOLTAGE	4.7	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	200	VOLTS
GRID #2 VOLTAGE	150	VOLTS
GRID #3 VOLTAGE	0	VOLTS
CATHODE RESISTOR	120	OHMS
PLATE CURRENT	11.5	MA.
GRID #2 CURRENT	2.7	MA.
TRANSCONDUCTANCE	7 000	μMHOS
PLATE RESISTANCE (APPROX.)	0.6	MEGOHM
GRID #1 VOLTAGE FOR I_b = 10 μAMP.	−8	VOLTS
DIODE PLATE VOLTAGE FOR DIODE CURRENT = 50 MA.[C]	10	VOLTS

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[C] TEST CONDITION ONLY. OPERATING CONDITIONS MUST NOT EXCEED THE DESIGN CENTER RATING.

SIMILAR TYPE REFERENCE: Its characteristics are identical to the 6AM8 except for heater ratings and heater warm-up time.





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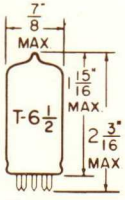
TRIODE-PENTODE

MINIATURE TYPE

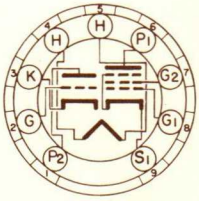


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE

THE 5AN8 IS A GENERAL PURPOSE, MULTI-UNIT TUBE USING THE 9 PIN MINIATURE CONSTRUCTION. CONTAINING A MEDIUM-MU TRIODE AND A SHARP-CUTOFF PENTODE IN ONE ENVELOPE, IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT IS INTENDED FOR A WIDE VARIETY OF APPLICATIONS IN COLOR TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6AN8.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

TRIODE UNIT		
GRID TO PLATE	1.5	μμf
INPUT	2.0	μμf
OUTPUT	0.27	μμf
PENTODE UNIT		
GRID #1 TO PLATE (MAX.)	0.04	μμf
INPUT	7.0	μμf
OUTPUT	2.3	μμf
TRIODE GRID TO PENTODE PLATE	0.005	μμf
PENTODE GRID #1 TO TRIODE PLATE	0.006	μμf
PENTODE PLATE TO TRIODE PLATE	0.045	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER – DESIGN CENTER VALUES

	TRIODE UNIT		PENTODE UNIT	
HEATER VOLTAGE	4.7			VOLTS
MAXIMUM PEAK 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[A]		200[A]	VOLTS
MAXIMUM PLATE VOLTAGE	300		300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---		300	VOLTS
MAXIMUM GRID #2 VOLTAGE	---		SEE CURVE #1	
MAXIMUM GRID #1 VOLTAGE				
POSITIVE BIAS VALUE	0		0	VOLTS
MAXIMUM PLATE DISSIPATION	2.6 ←		2.0	WATTS
MAXIMUM GRID #2 INPUT	---		0.5	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE:[B]				
FOR CATHODE-BIAS OPERATION	1.0		1.0	MEGOHM
FOR FIXED-BIAS OPERATION	0.5		0.25	MEGOHM
HEATER WARM-UP TIME (APPROX.)*	11.0			SEC.

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[B] IF EITHER UNIT IS OPERATING AT MAXIMUM RATED CONDITIONS, GRID #1 CIRCUIT RESISTANCES FOR BOTH UNITS SHOULD NOT EXCEED THE STATED VALUES.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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→ INDICATES A CHANGE.

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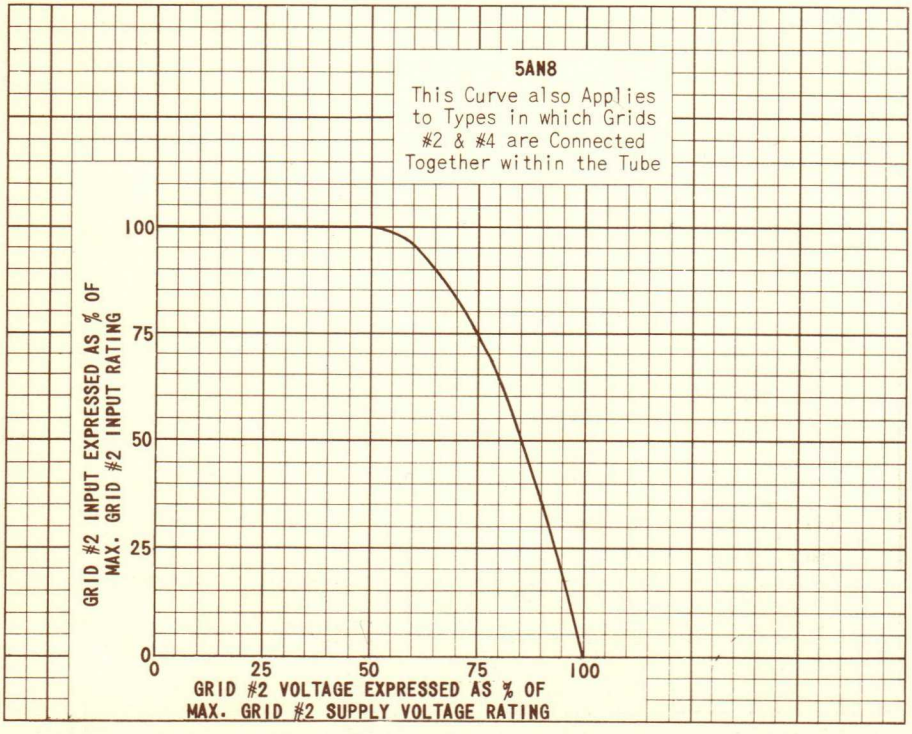
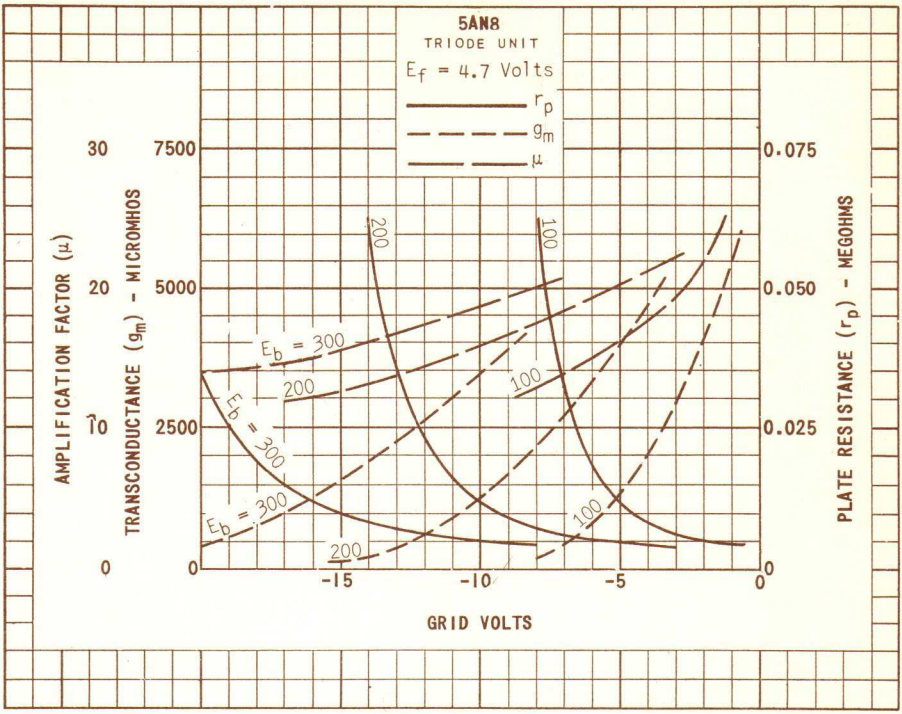
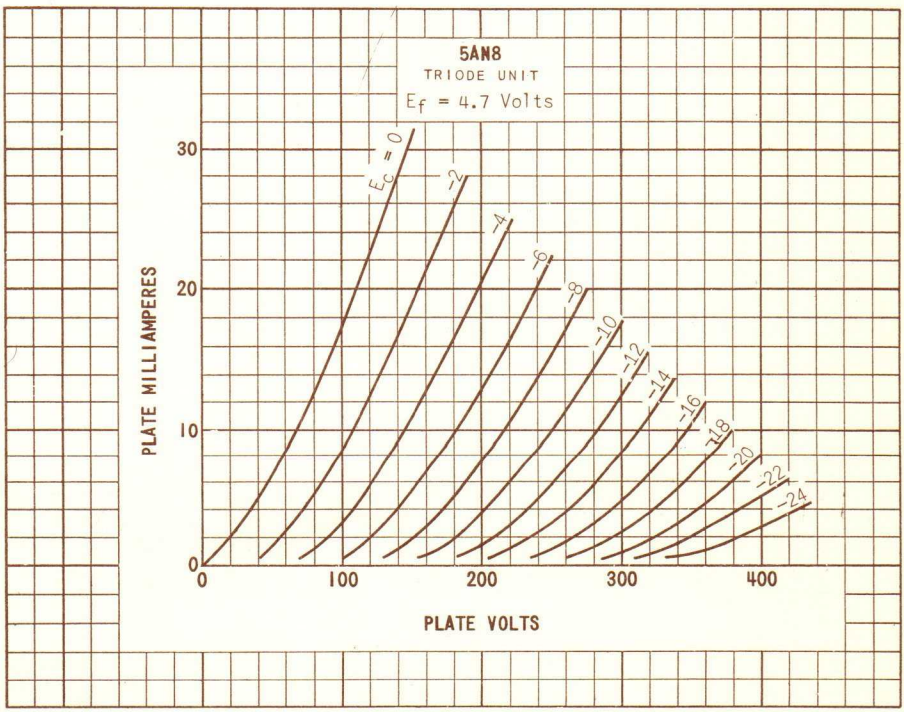
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE UNIT		PENTODE UNIT	
HEATER VOLTAGE		4.7		VOLTS
HEATER CURRENT		0.6		AMP.
PLATE SUPPLY VOLTAGE	200		200	VOLTS
GRID #2 SUPPLY VOLTAGE	---		150	VOLTS
GRID #1 VOLTAGE	-6		---	VOLTS
CATHODE BIAS RESISTOR	---		180	OHMS
AMPLIFICATION FACTOR	19		---	
PLATE RESISTANCE (APPROX.)	5 750		300 000	OHMS
TRANSCONDUCTANCE	3 300		6 200	µMHOS
GRID #1 BIAS (APPROX.) FOR I_b = 10 µA.	-19		-8	VOLTS
PLATE CURRENT	13		9.5	MA.
GRID #2 CURRENT	---		2.8	MA.







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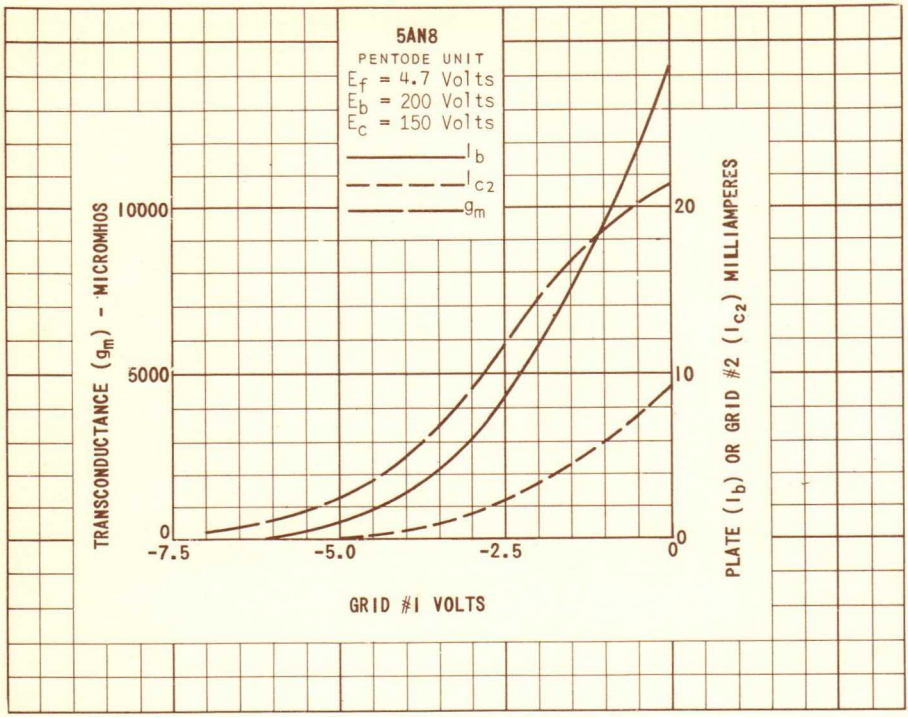
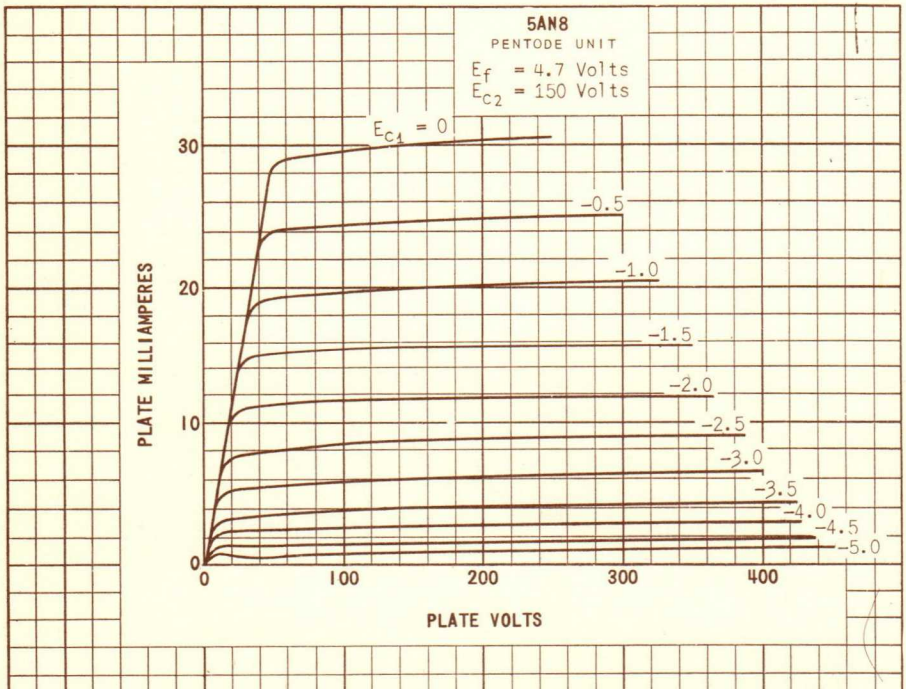

5AN8
PENTODE UNIT
E_f = 4.7 Volts
E_b = 200 Volts
E_c = 150 Volts
I_b
I_{c2}
g_m
TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
5000
0
20
10
0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
-7.5
-5.0
-2.5
0
GRID #1 VOLTS


5AN8
PENTODE UNIT
E_f = 4.7 Volts
E_{c2} = 150 Volts
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
PLATE MILLIAMPERES
30
20
10
0
0
100
200
300
400
PLATE VOLTS

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

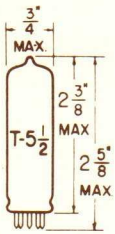
COATED UNIPOTENTIAL CATHODE

HEATER

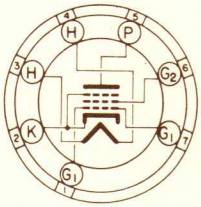
4.7 VOLTS 0.6±6% AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7BZ

THE 5AQ5 IS A BEAM POWER AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN 600MA. SERIES HEATER OPERATED TV RECEIVERS WHERE HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT IS DESIRED. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6AQ5.

DIRECT INTERELECTRODE CAPACITANCES — APPROX. ←

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.4	μμf
INPUT	8.0	μμf
OUTPUT	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	0.6±6%	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	275 ←	VOLTS
MAXIMUM GRID #2 VOLTAGE	275 ←	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 INPUT	2	WATTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)[A]	250	°C
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.1	MEGOHMS
CATHODE BIAS OPERATION	0.5	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] HIGH AMBIENT TEMPERATURE AND SHIELDING MAY NECESSITATE A REDUCTION IN OPERATING DISSIPATION. WHEN TUBE SHIELDS ARE USED, IT IS ADVISABLE TO PAINT THE INSIDE AND OUTSIDE SURFACES OF THE TUBE SHIELD A DULL BLACK AND TO PROVIDE VENTILATION SLOTS TO REDUCE OPERATING TEMPERATURE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VERTICAL DEFLECTION AMPLIFIER[B C] *

GRID #2 CONNECTED TO PLATE

HEATER VOLTAGE	0.6±6%	VOLTS
MAXIMUM DC PLATE VOLTAGE	275	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABS. MAX.)	1100	VOLTS
MAXIMUM PLATE DISSIPATION[D]	10	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	275	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	40	MA.
MAXIMUM PEAK CATHODE CURRENT	115	MA.
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	250	°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER[E]

HEATER VOLTAGE	0.6±6%	0.6±6%	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	180	250	VOLTS
GRID #2 VOLTAGE	180	250	VOLTS
GRID #1 VOLTAGE	-8.5	-12.5	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	12.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	29	45	MA.
MAXIMUM SIGNAL PLATE CURRENT	30	47	MA.
ZERO-SIGNAL GRID #2 CURRENT (APPROX.)	3	4.5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (APPROX.)	4	7	MA.
PLATE RESISTANCE (APPROX.)	58 000	52 000	OHMS
TRANSCONDUCTANCE	3 700	4 100	μMHOS
LOAD RESISTANCE	5 500	5 000	OHMS
TOTAL HARMONIC DISTORTION	8	8	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	2.0	4.5	WATTS

[E] SINGLE TUBE.

AVERAGE CHARACTERISTICS - TRIODE CONNECTED*

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-12.5	VOLTS
PLATE CURRENT	49.5	MA.
TRANSCONDUCTANCE	4800	μMHOS
AMPLIFICATION FACTOR	9.5	
PLATE RESISTANCE (APPROX.)	1970	OHMS
GRID VOLTAGE (APPROX.) FOR I_b=0.5 MA.	-37	VOLTS

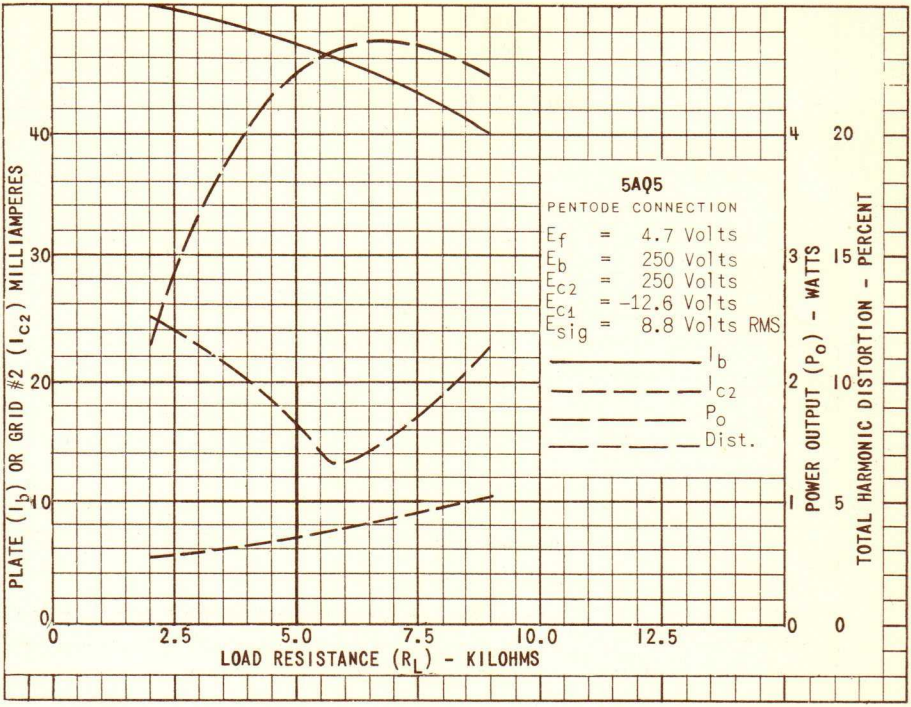
[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

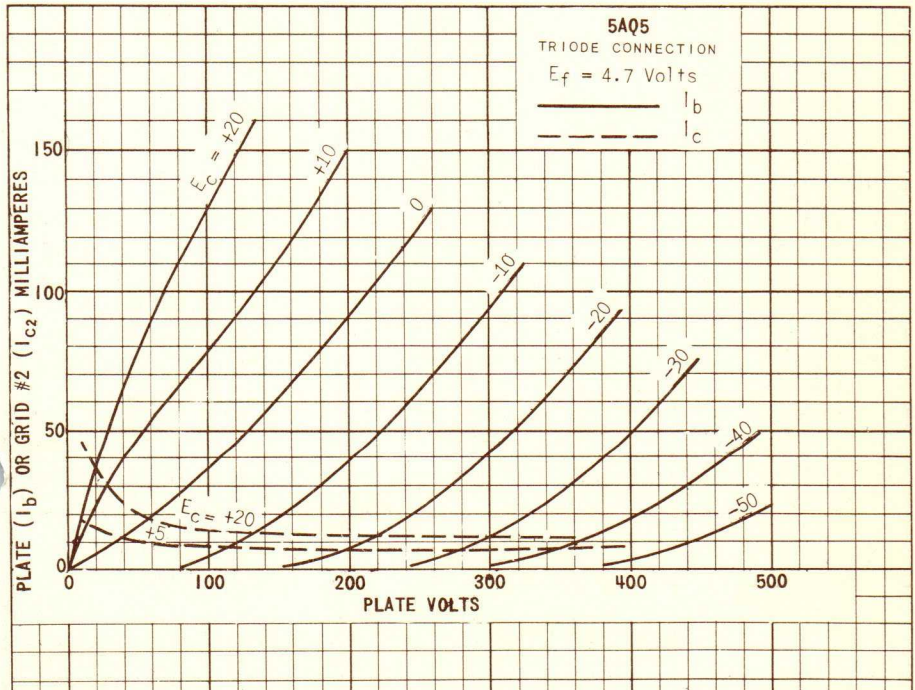
[C] TRIODE CONNECTED.

[D] 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.

*INDICATES AN ADDITION.

→ INDICATES A CHANGE.





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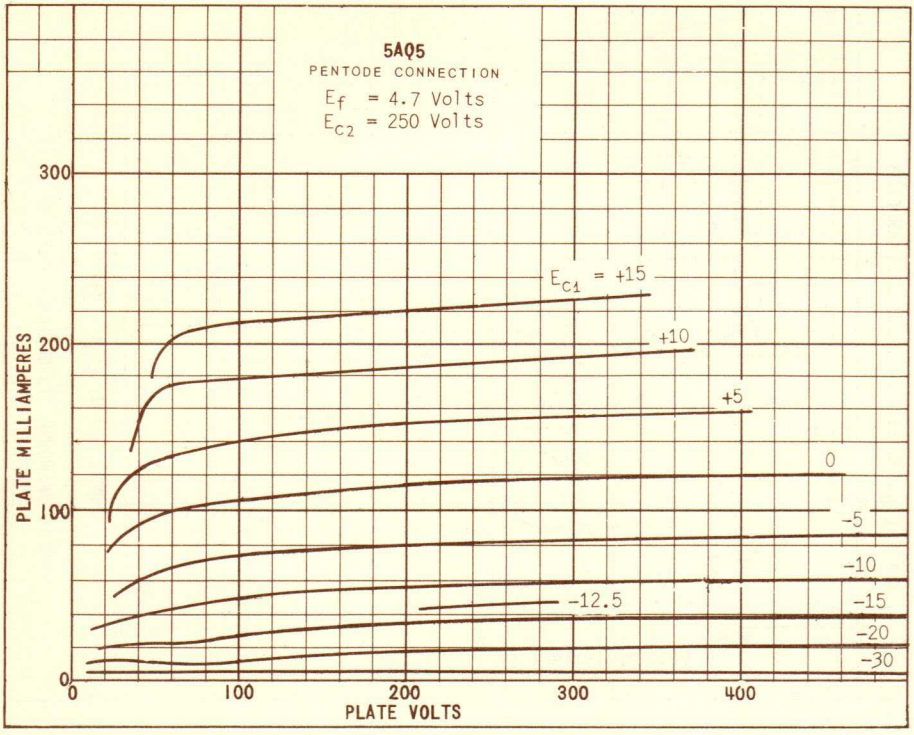
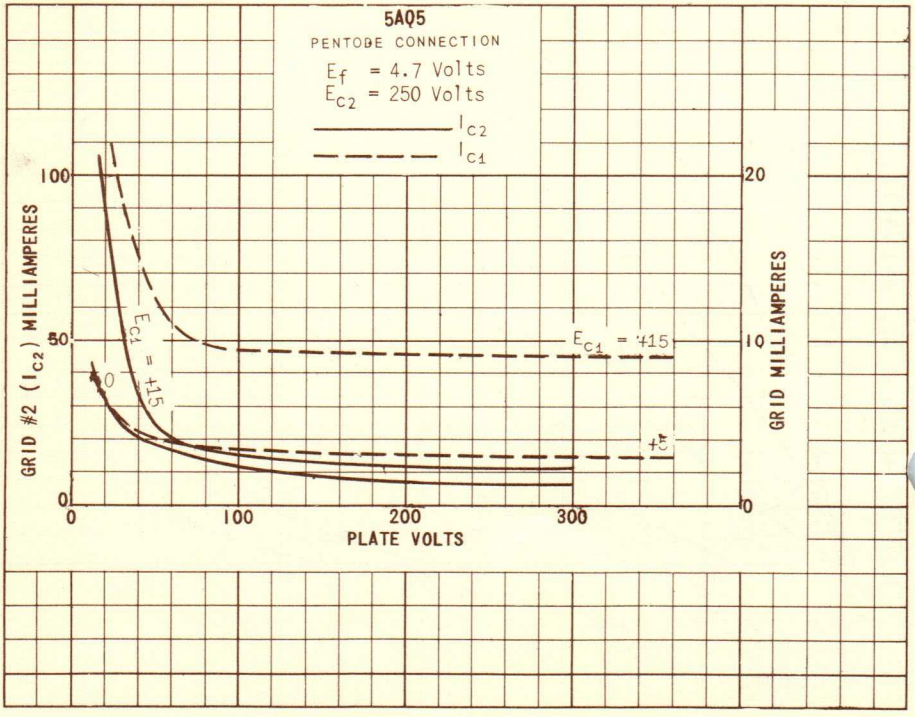
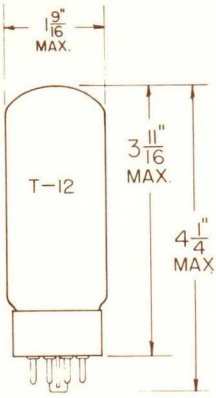

5AQ5
PENTODE CONNECTION
E_f = 4.7 Volts
E_{c2} = 250 Volts
E_{c1} = +15
+10
+5
0
-5
-10
-15
-20
-30
-12.5
PLATE MILLIAMPERES
PLATE VOLTS
0
100
200
300
400


5AQ5
PENTODE CONNECTION
E_f = 4.7 Volts
E_{c2} = 250 Volts
I_{c2}
I_{c1}
E_{c1} = +15
+10
GRID #2 (I_{c2}) MILLIAMPERES
GRID MILLIAMPERES
PLATE VOLTS
0
50
100
10
20
200
300

TUNG-SOL

TWIN-DIODE



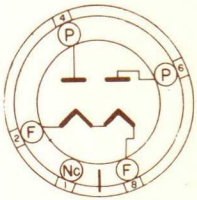
GLASS BULB

COATED FILAMENT

FILAMENT
5 VOLTS 3 AMP.
AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION PERMITTED IF PINS 1 & 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW

SHORT MEDIUM SHELL
5 PIN OCTAL

OR

SHORT MEDIUM SHELL
8 PIN OCTAL

WITH
EXTERNAL BARRIERS
5T

PINS 3, 5, & 7
NO CONNECTION.

THE 5AS4A IS A FULL-WAVE VACUUM RECTIFIER INTENDED FOR USE IN POWER SUPPLIES OF TELEVISION RECEIVERS AND RADIO EQUIPMENT HAVING HIGH DC REQUIREMENTS. IT IS ESPECIALLY DESIGNED TO PERMIT OPERATION AT HIGHER PEAK AND AVERAGE CURRENT RATINGS. EXCEPT FOR THE USE OF A T-12 BULB, IT IS IDENTICAL TO THE 5AS4.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

FULL-WAVE RECTIFIER

FILAMENT VOLTAGE	5	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1 550	VOLTS
MAXIMUM STEADY STATE PEAK CURRENT PER PLATE	1.0	AMP.
MAXIMUM AC PLATE SUPPLY VOLTAGE (RMS) PER PLATE	550	VOLTS
MAXIMUM DC OUTPUT CURRENT PER PLATE (SEE RATING CHART 1)		
MAXIMUM TRANSIENT PEAK PLATE CURRENT PER PLATE	4.6	AMP.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER
CAPACITOR-INPUT FILTER

FILAMENT VOLTAGE	5	5	VOLTS
FILAMENT CURRENT	3	3	AMP.
AC PLATE TO PLATE SUPPLY VOLTAGE (RMS)[A]	600	900	VOLTS
FILTER INPUT CAPACITOR	40	40	μf
TOTAL EFFECT. PLATE SUPPLY IMPEDANCE(PER PLATE)	21	67	OHMS
DC OUTPUT CURRENT	300	275	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	290	460	VOLTS
TUBE VOLTAGE DROP	54	50	VOLTS

[A] MEASURED WITHOUT LOAD.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

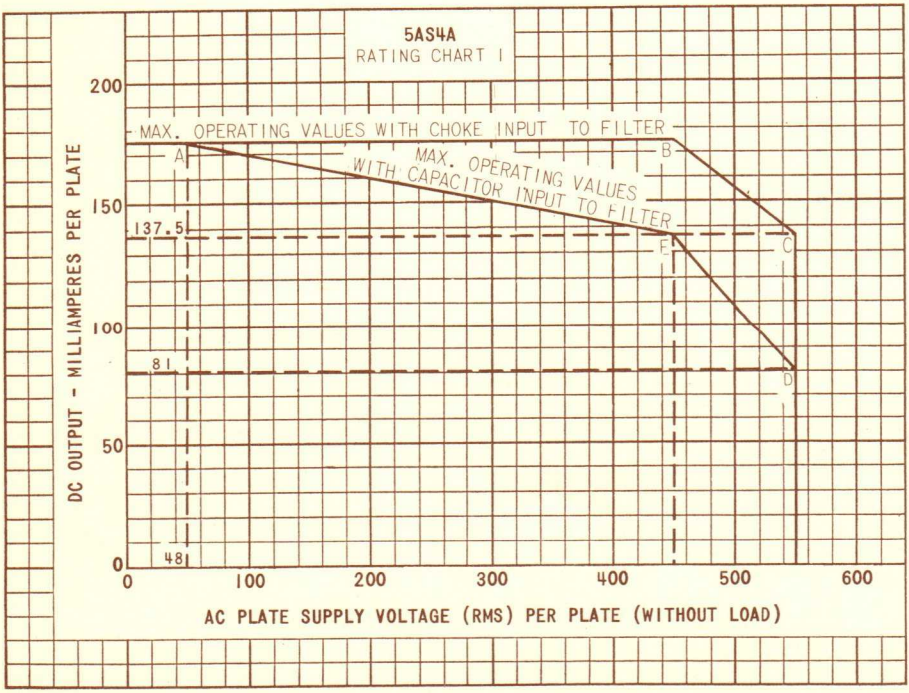
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

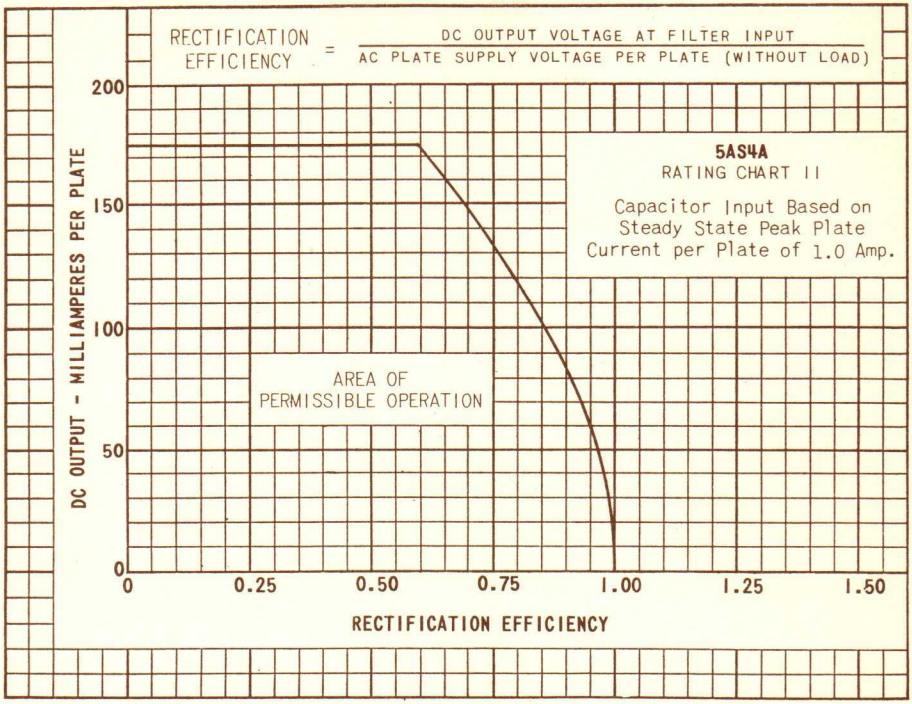
FULL-WAVE RECTIFIER

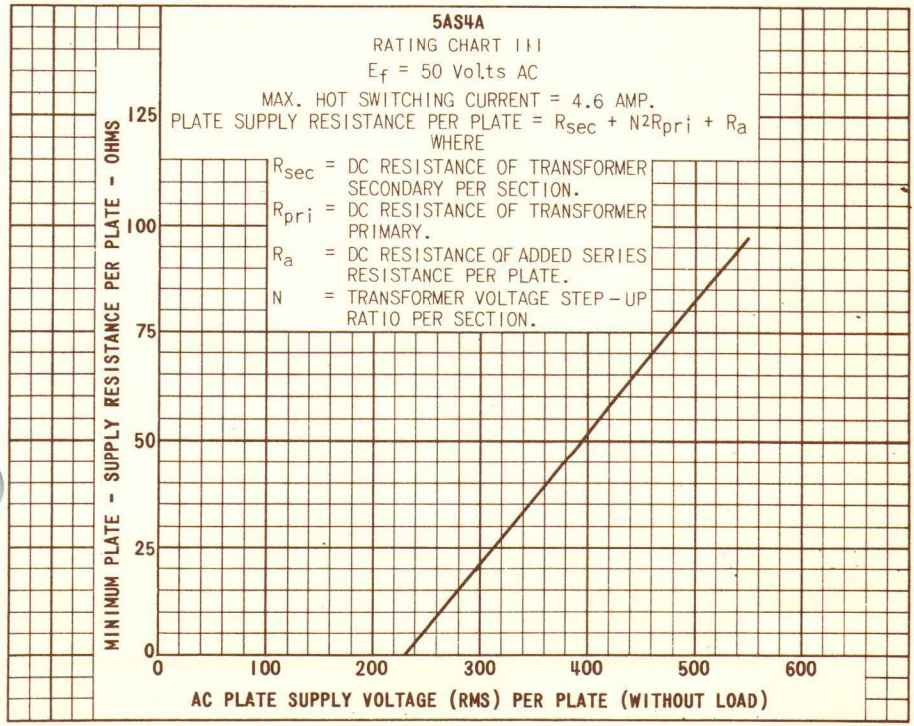
CHOKE-INPUT FILTER

FILAMENT VOLTAGE	5	VOLTS
FILAMENT CURRENT	3	AMP.
AC PLATE TO PLATE SUPPLY VOLTAGE (RMS)[A]	1 100	VOLTS
FILTER INPUT CHOKE	10	HENRIES
DC OUTPUT CURRENT	275	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	420	VOLTS

[A] MEASURED WITHOUT LOAD







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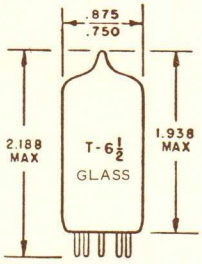
TUNG-SOL

DIODE PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 6-2



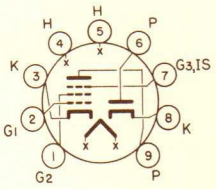
BASE 9 PIN BUTTON
JEDEC E9-1

FOR
GENERAL PURPOSE
APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9DS



BOTTOM VIEW

THE 5AS8 IS A GENERAL-PURPOSE, MULTIUNIT TUBE USING THE 9 PIN MINIATURE CONSTRUCTION. IT CONTAINS A HIGH PERVEANCE DIODE AND A SHARP-CUTOFF PENTODE IN ONE ENVELOPE. IT IS INTENDED FOR DIVERSIFIED APPLICATIONS IN TELEVISION AND RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITH NO EXTERNAL SHEILD

DIODE UNIT		
PLATE TO HEATER & CATHODE & INTERNAL SHIELD	3.0	pf
PENTODE UNIT		
GRID #1 TO PLATE (MAX.)	0.03	pf
INPUT	7.0	pf
OUTPUT	2.4	pf
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

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7 VOLTS	600	MA
HEATER WARM-UP TIME		APPROX. 11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	MA
HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS

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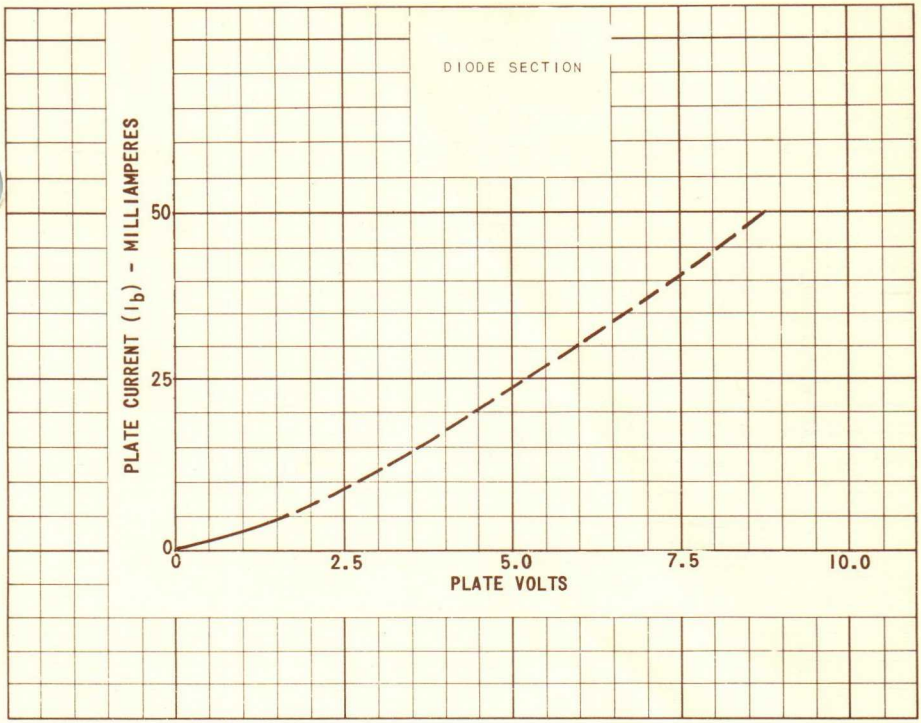
MAXIMUM RATINGS

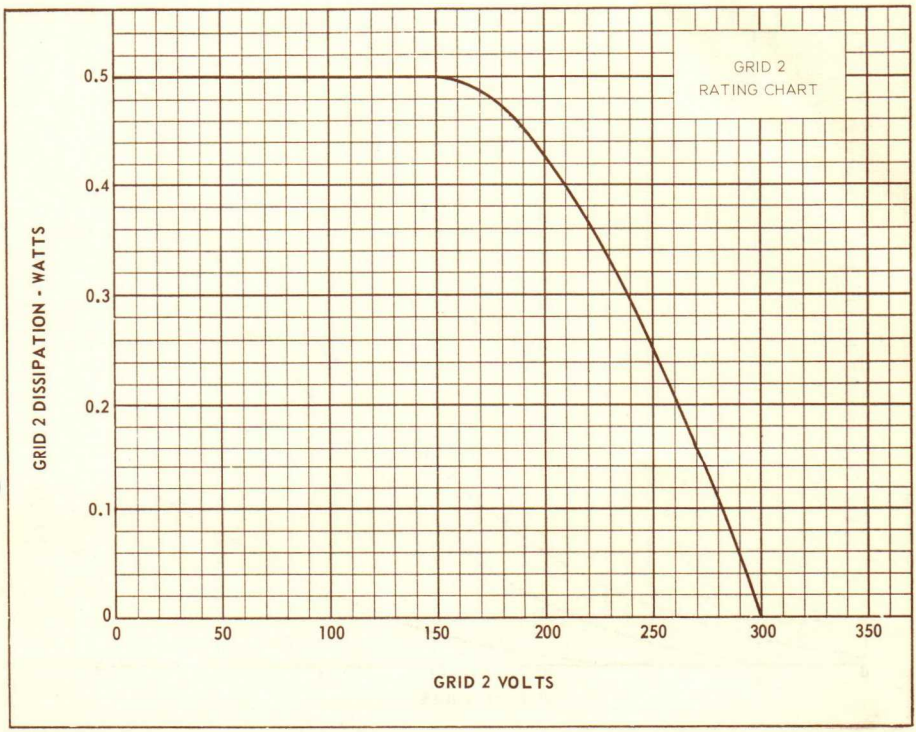
DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

	DIODE UNIT	PENTODE UNIT	
MAXIMUM PLATE VOLTAGE		300	VOLTS
MAXIMUM GRID #3 VOLTAGE		0	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		300	VOLTS
MAXIMUM GRID #2 VOLTAGE		SEE RATING CHART	
MAXIMUM GRID #1 VOLTAGE:			
POSITIVE BIAS VALUE		0	VOLTS
MAXIMUM PLATE DISSIPATION		2.5	WATTS
MAXIMUM GRID #2 INPUT		0.5	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
CATHODE BIAS OPERATION		1.0	MEGOHM
FIXED BIAS OPERATION		0.25	MEGOHM
MAXIMUM PEAK INVERSE PLATE VOLTAGE	330		VOLTS
MAXIMUM PEAK PLATE CURRENT	50		MA
MAXIMUM DC PLATE CURRENT	5		MA

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE SUPPLY VOLTAGE	200	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET	
GRID #2 SUPPLY VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	180	OHMS
PLATE CURRENT	9.5	MA
GRID #2 CURRENT	3	MA
TRANSCONDUCTANCE	6,200	μMHOS
PLATE RESISTANCE (APPROX.)	300,000	OHMS
GRID #1 BIAS (APPROX.) FOR I_b = 10 μA	−8	VOLTS





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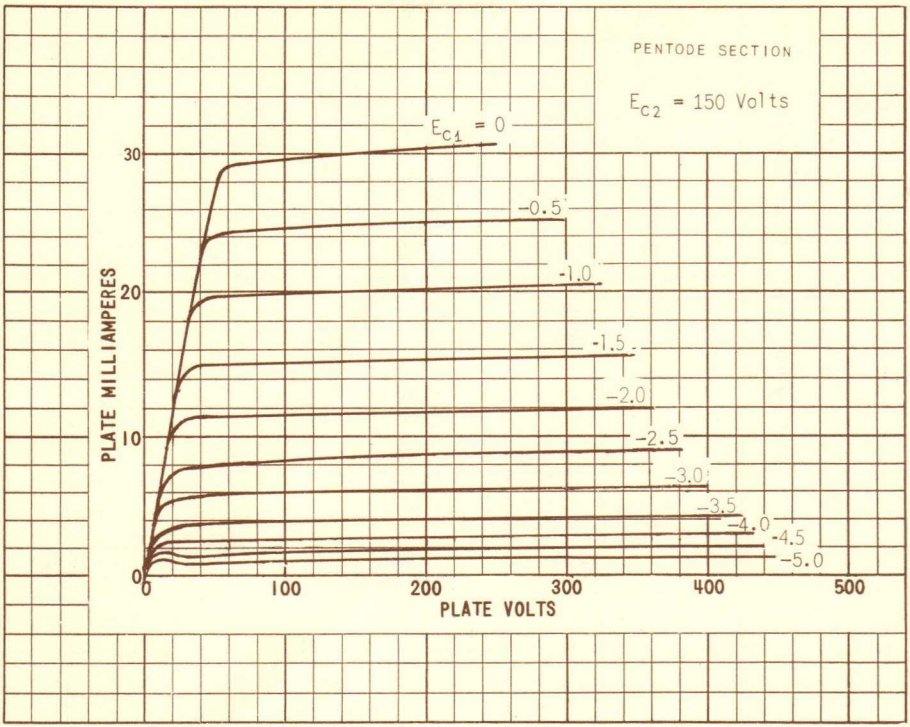
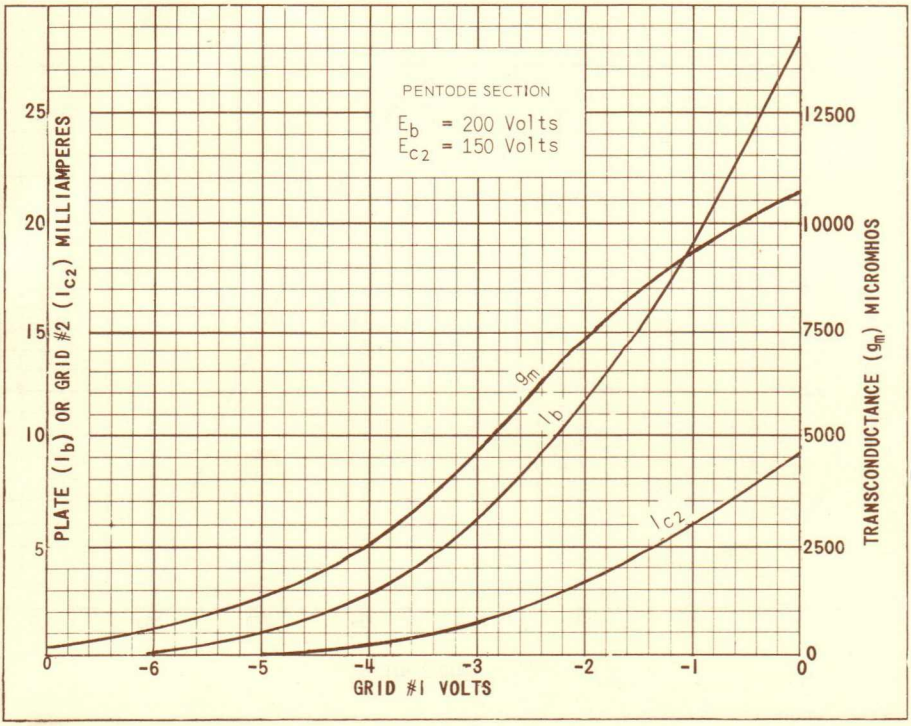
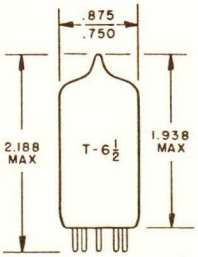

PENTODE SECTION
E_{c2} = 150 Volts
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
PLATE MILLIAMPERES
PLATE VOLTS
0
10
20
30
100
200
300
400
500


PENTODE SECTION
E_b = 200 Volts
E_{c2} = 150 Volts
g_m
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (g_m) MICROMHOS
GRID #1 VOLTS
0
5
10
15
20
25
2500
5000
7500
10000
12500
-6
-5
-4
-3
-2
-1
0

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

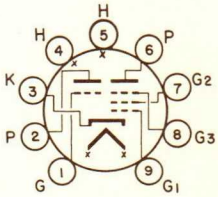
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

FOR

CONVERTER SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9DW

THE 5AT8 IS A MULTI-UNIT TUBE USING THE 9 PIN MINIATURE CONSTRUCTION. IT CONTAINS A MEDIUM-MU TRIODE AND A SHARP CUT-OFF PENTODE WITH A COMMON CATHODE IN ONE ENVELOPE. IT IS DESIGNED PRIMARILY FOR USE IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS UTILIZING AN INTERMEDIATE FREQUENCY IN THE ORDER OF 40 MC. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

		WITH SHIELD #315	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE:(PG1 TO PP)	MAX.	→ 0.03	→ 0.06	pf
PENTODE INPUT: PG1 TO (H+K+PG2+PG3)		→ 4.8	→ 4.6	pf
PENTODE OUTPUT: PP TO (H+K+PG3+PG2)		1.6	0.9	pf
CATHODE TO HEATER (K TO H)		→ 6.0	→ 6.0	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)		1.5	1.5	pf
TRIODE INPUT: TG TO (H + K)		2.4	2.0	pf
TRIODE OUTPUT: TP TO (H + K)		1.0	0.5	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP)	MAX.	0.04	0.05	pf
PENTODE PLATE TO TRIODE PLATE: (PP TO TP)	MAX.	0.008	0.05	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7	VOLTS	600	MA.
HEATER WARM-UP TIME [A]			11	SECONDS
LIMITS OF SUPPLIED CURRENT			600 ± 40	MA.

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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HEATER CHARACTERISTICS AND RATINGS - CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	→ 200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	→ 200	VOLTS

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

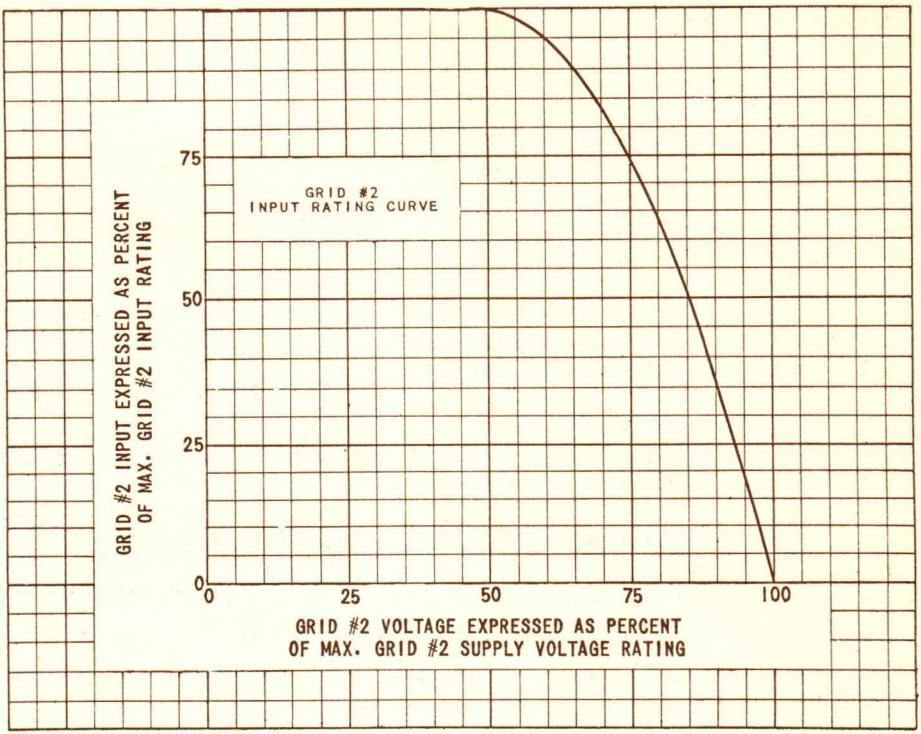
PENTODE PLATE VOLTAGE	275	VOLTS
TRIODE PLATE VOLTAGE	275	VOLTS
GRID 2 SUPPLY VOLTAGE	275	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
PENTODE PLATE DISSIPATION	2.3	WATTS
GRID 2 DISSIPATION	0.45	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	1.7	VOLTS

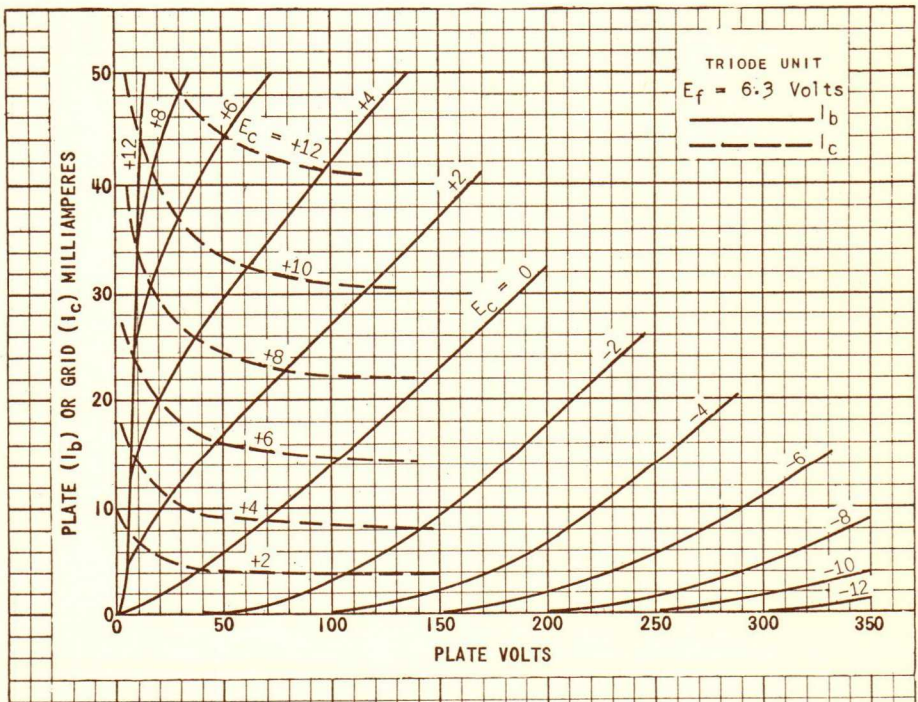
TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

		PENTODE	TRIODE	
PLATE VOLTAGE		125	125	VOLTS
GRID 3 VOLTAGE		Connected to pin 3 at socket		
GRID 2 VOLTAGE		125	-----	
GRID 1 VOLTAGE		-1.0	-1.0	VOLTS
PLATE CURRENT		9.0	12.0	MA.
GRID 2 CURRENT		2.2	-----	MA.
TRANSCONDUCTANCE		5,500	6,500	μMHOS
PLATE RESISTANCE	(APPROX.)	300,000	6,000	OHMS
AMPLIFICATION FACTOR		-----	40	
GRID 1 VOLTAGE (APPROX.) FOR Ib = 20 μA		-6.5	-7	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb = 100 V; Ec2 = 70 V)		5,700	-----	μMHOS

→ INDICATES A CHANGE.





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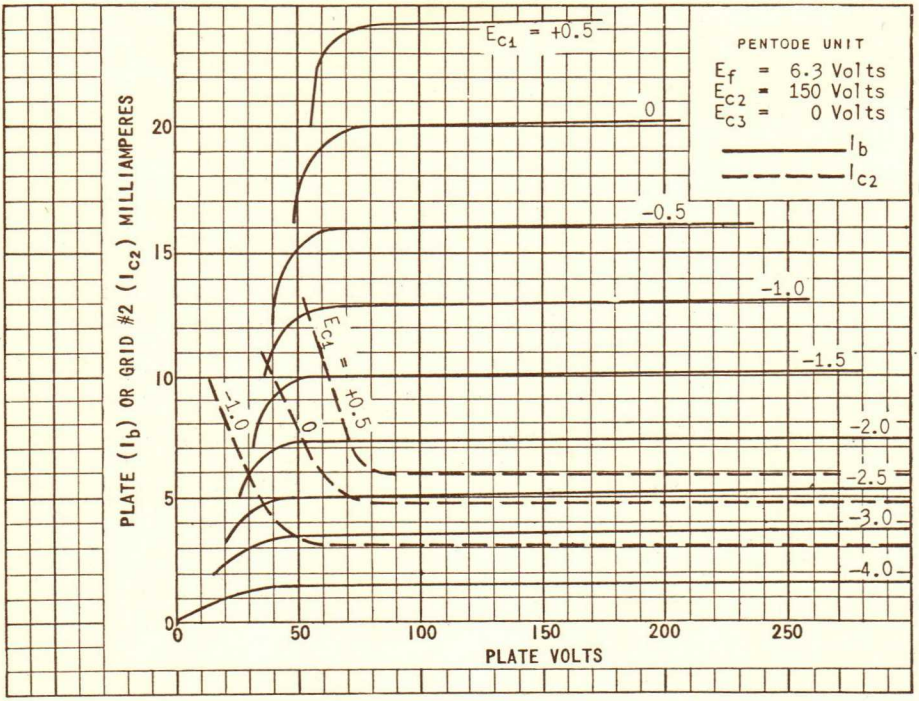
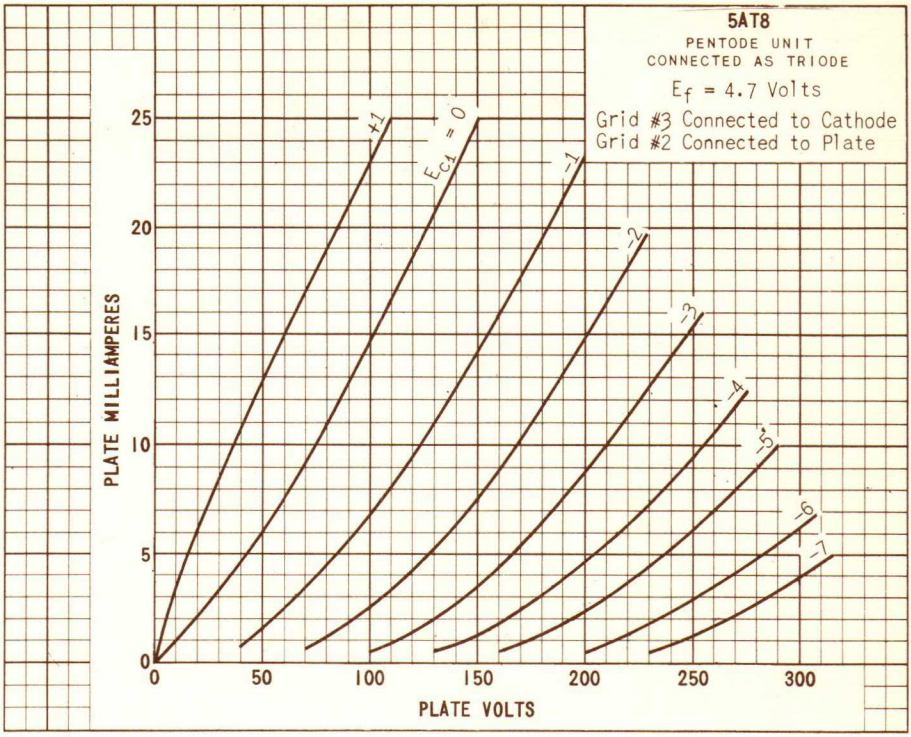
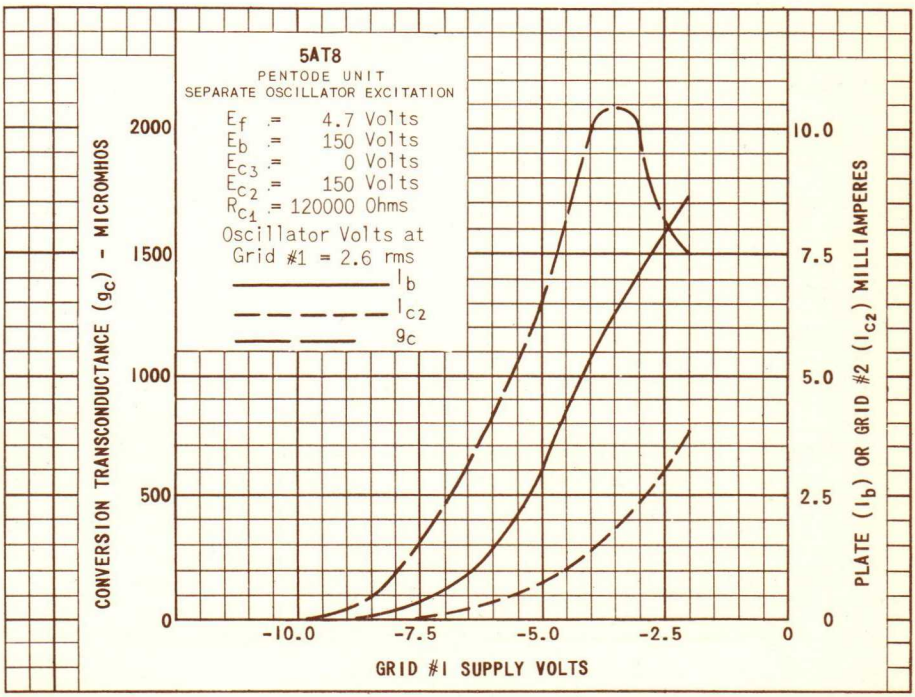

PENTODE UNIT
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c1} = +0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
50
100
150
200
250





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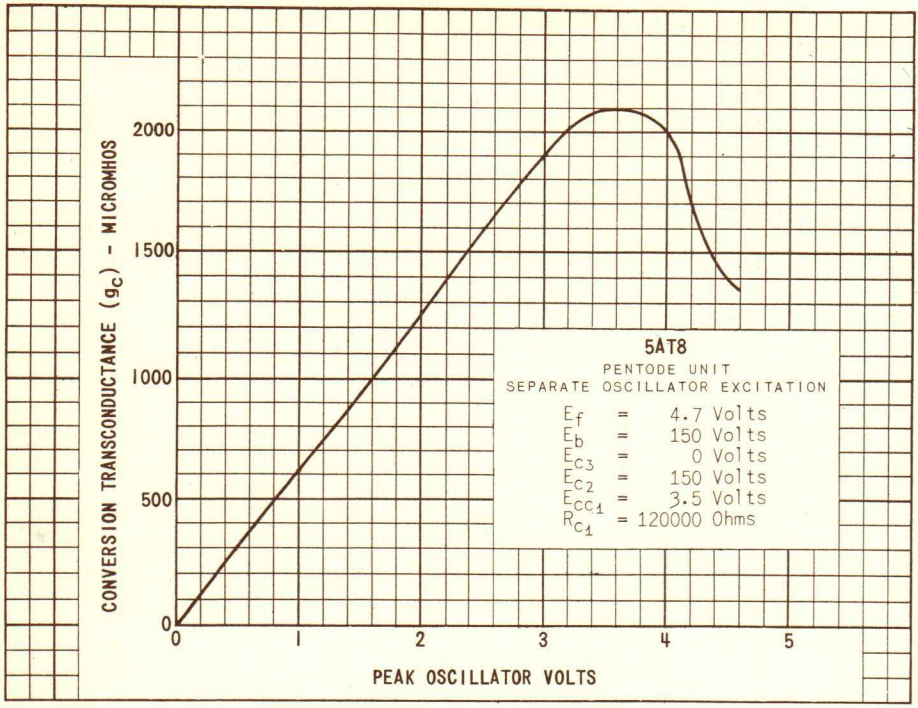


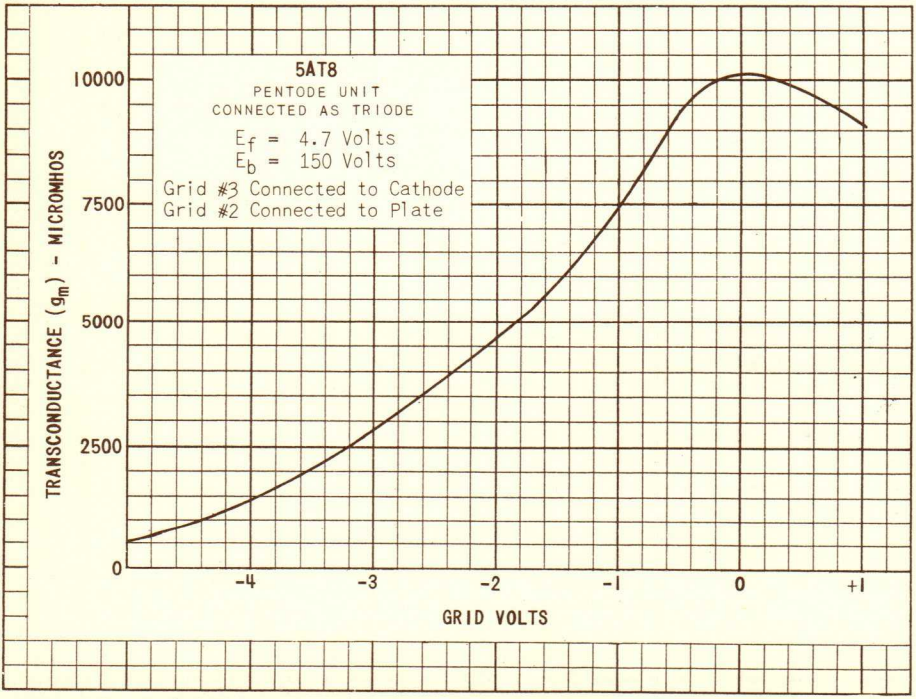
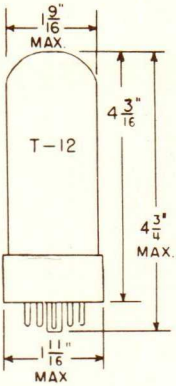


PLATE #4272 MARCH 1, 1955 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

TWIN DIODE



GLASS BULB

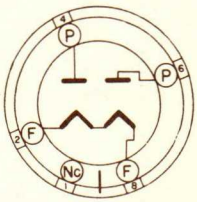
COATED FILAMENT

5.0 VOLTS 3.75 AMP.

AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
8 PIN OCTAL
5T

THE 5AU4 IS A FILAMENTARY FULL-WAVE HIGH-VACUUM RECTIFIER DESIGNED FOR USE IN THE POWER SUPPLY OF TELEVISION RECEIVERS AND OTHER EQUIPMENTS WHICH HAVE HIGH OUTPUT CURRENT REQUIREMENTS. IN FULL-WAVE OPERATION WITH A SUPPLY VOLTAGE OF 300 VOLTS RMS, THE 5AU4 IS CAPABLE OF DELIVERING A DC OUTPUT CURRENT OF 350 MILLIAMPERES.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

RECTIFIER SERVICE[A]

FILAMENT VOLTAGE	5.0	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1 400	VOLTS
MAXIMUM AC PLATE SUPPLY VOLTAGE (PER PLATE)	SEE RATING CHART #1	
MAXIMUM STEADY-STATE PEAK PLATE CURRENT (PER PLATE)	1 075	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT (PER PLATE) MAXIMUM DURATION 0.2 SECOND	5.25	AMP.
MAXIMUM DC OUTPUT CURRENT	SEE RATING CHART #1	

[A] FOR USE WITH SINUSOIDAL SUPPLY VOLTAGES WITHIN THE FREQUENCY RANGE OF 25 TO 1000 CYCLES PER SECOND.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

FILAMENT VOLTAGE	5.0		VOLTS
FILAMENT CURRENT	3.75 ←		AMP.
AC PLATE-SUPPLY VOLTAGE (PER PLATE) RMS	300	400	VOLTS
FILTER INPUT CAPACITOR	40	40	μf
TOTAL PLATE-SUPPLY RESISTANCE (PER PLATE)	30	50	OHMS
DC OUTPUT CURRENT	350	325	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	275	395	VOLTS

FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER

FILAMENT VOLTAGE	5.0	VOLTS
FILAMENT CURRENT	4.5	AMP.
AC PLATE-SUPPLY VOLTAGE (PER PLATE) RMS	500	VOLTS
FILTER INPUT CHOKE	10	HENRYS
DC OUTPUT CURRENT	325	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	395	VOLTS
TUBE VOLTAGE DROP I_b = 350 MA. DC (PER PLATE)	50	VOLTS

→ INDICATES A CHANGE.

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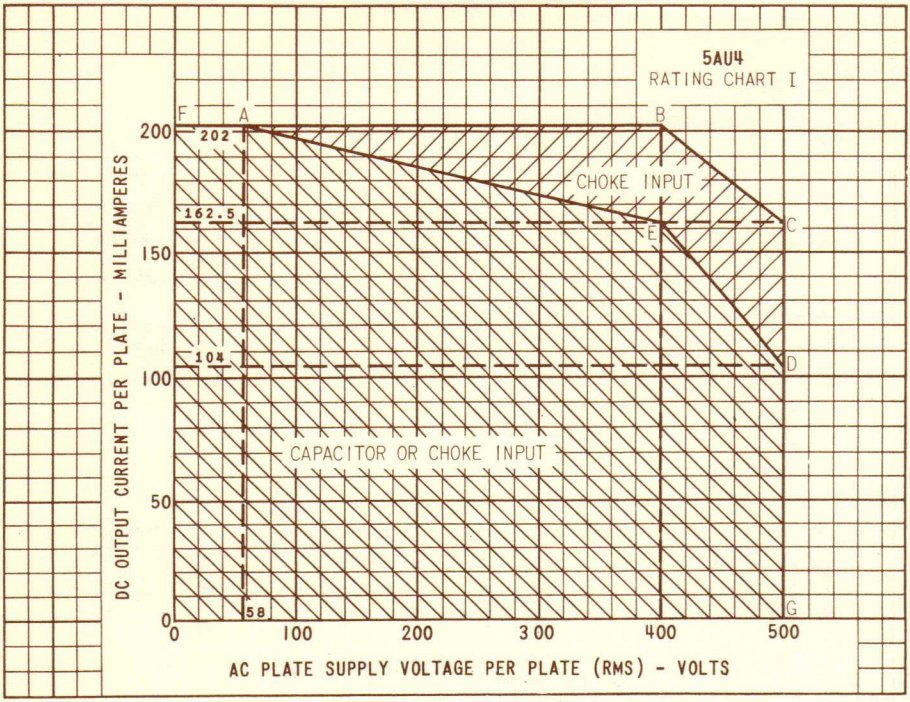
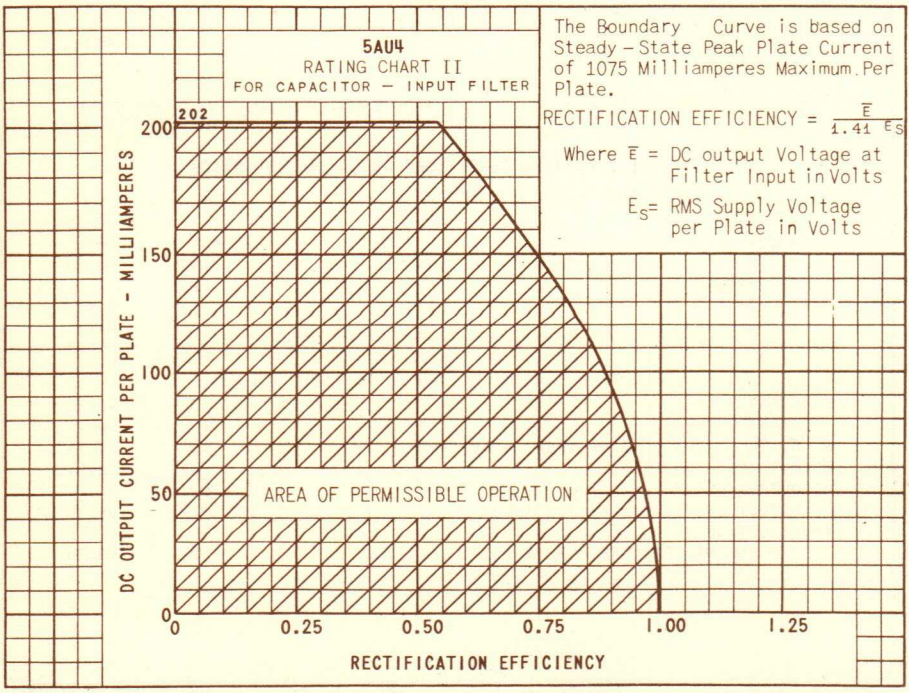
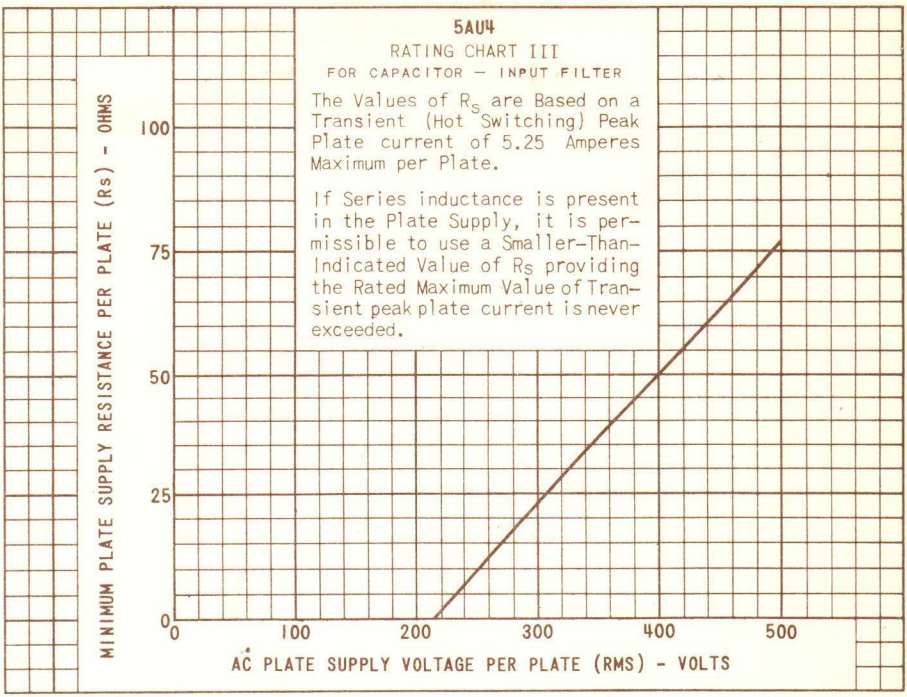
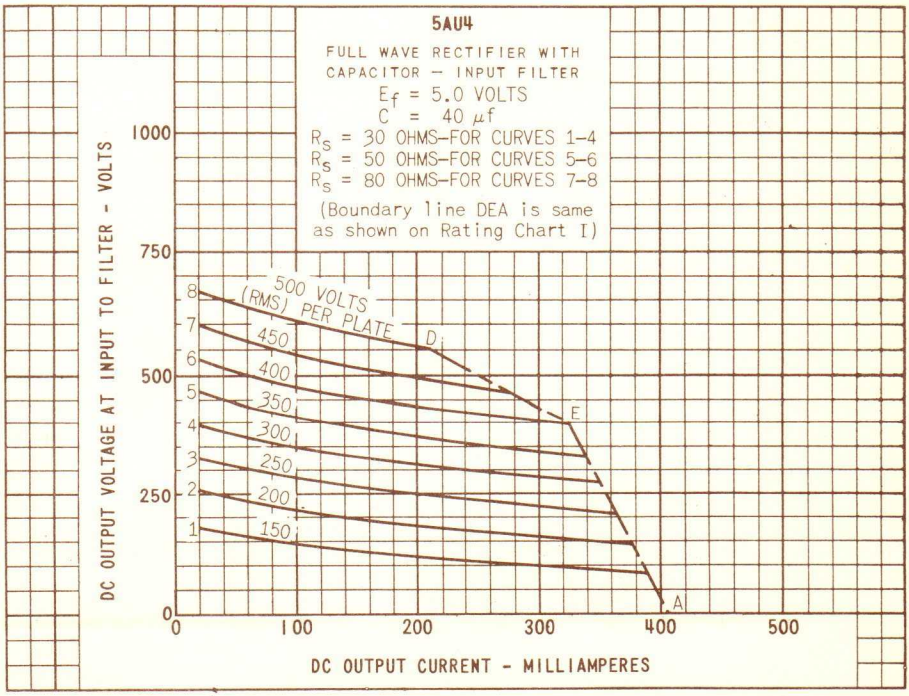
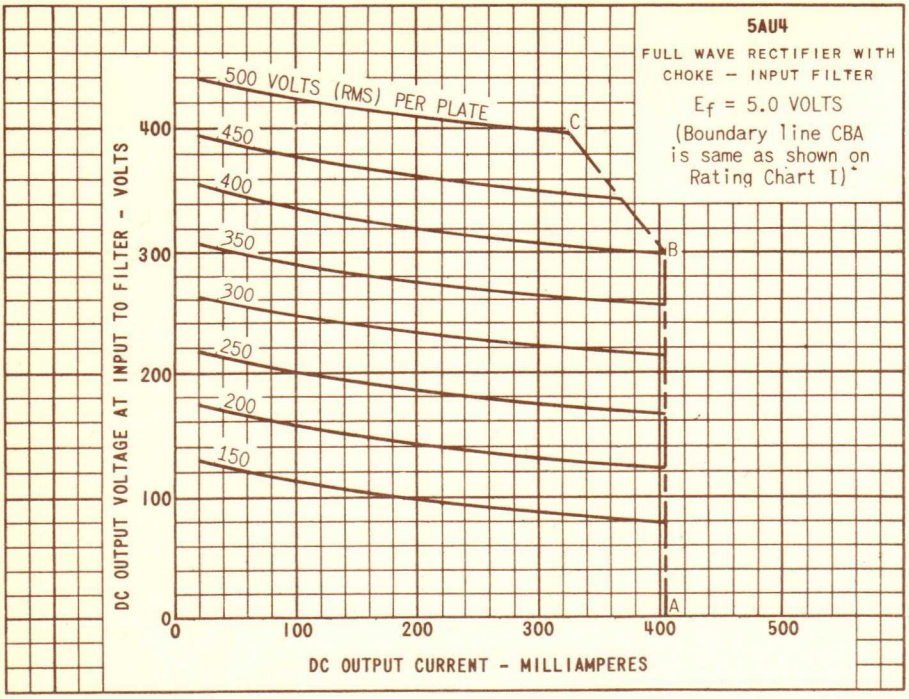
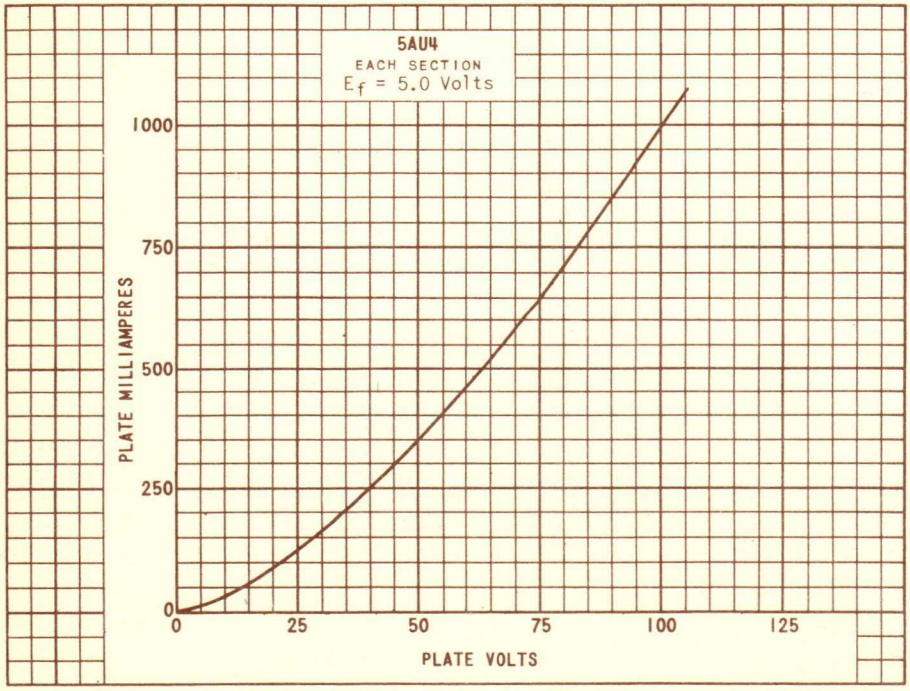

5AU4
RATING CHART I
F
A
B
202
CHOKE INPUT
162.5
E
C
104
D
CAPACITOR OR CHOKE INPUT
58
G
200
150
100
50
0
0
100
200
300
400
500
DC OUTPUT CURRENT PER PLATE - MILLIAMPERES
AC PLATE SUPPLY VOLTAGE PER PLATE (RMS) - VOLTS


5AU4
RATING CHART II
FOR CAPACITOR - INPUT FILTER
The Boundary Curve is based on Steady-State Peak Plate Current of 1075 Milliamperes Maximum Per Plate.
RECTIFICATION EFFICIENCY = Ē / 1.41 Es
Where Ē = DC output Voltage at Filter Input in Volts
Es = RMS Supply Voltage per Plate in Volts
202
AREA OF PERMISSIBLE OPERATION
200
150
100
50
0
0
0.25
0.50
0.75
1.00
1.25
DC OUTPUT CURRENT PER PLATE - MILLIAMPERES
RECTIFICATION EFFICIENCY


5AU4
RATING CHART III
FOR CAPACITOR – INPUT FILTER
The Values of R_s are Based on a Transient (Hot Switching) Peak Plate current of 5.25 Amperes Maximum per Plate.
If Series inductance is present in the Plate Supply, it is permissible to use a Smaller-Than-Indicated Value of R_s providing the Rated Maximum Value of Transient peak plate current is never exceeded.
MINIMUM PLATE SUPPLY RESISTANCE PER PLATE (Rs) - OHMS
100
75
50
25
0
0
100
200
300
400
500
AC PLATE SUPPLY VOLTAGE PER PLATE (RMS) - VOLTS


5AU4
FULL WAVE RECTIFIER WITH CAPACITOR – INPUT FILTER
E_f = 5.0 VOLTS
C = 40 μf
R_s = 30 OHMS–FOR CURVES 1–4
R_s = 50 OHMS–FOR CURVES 5–6
R_s = 80 OHMS–FOR CURVES 7–8
(Boundary line DEA is same as shown on Rating Chart I)
DC OUTPUT VOLTAGE AT INPUT TO FILTER - VOLTS
1000
750
500
250
0
500 VOLTS (RMS) PER PLATE
450
400
350
300
250
200
150
8
7
6
5
4
3
2
1
D
E
A
0
100
200
300
400
500
DC OUTPUT CURRENT - MILLIAMPERES


5AU4
FULL WAVE RECTIFIER WITH
CHOKE – INPUT FILTER
E_f = 5.0 VOLTS
(Boundary line CBA
is same as shown on
Rating Chart I)*
500 VOLTS (RMS) PER PLATE
450
400
350
300
250
200
150
C
B
A
DC OUTPUT VOLTAGE AT INPUT TO FILTER - VOLTS
0
100
200
300
400
DC OUTPUT CURRENT - MILLIAMPERES
500


5AU4
EACH SECTION
E_f = 5.0 Volts
PLATE MILLIAMPERES
0
250
500
750
1000
0
25
50
75
100
125
PLATE VOLTS

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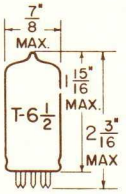
TRIODE PENTODE

MINIATURE TYPE

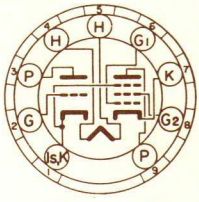


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9EC

THE 5B8 IS A MEDIUM-MU TRIODE AND A SHARP CUTOFF PENTODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF OSCILLATOR AND MIXER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

TRIODE GRID TO TRIODE PLATE	1.7	μμf
PENTODE GRID #1 TO PENTODE PLATE (MAX.)	0.032 ←	μμf
TRIODE GRID TO (TRIODE CATHODE, PENTODE GRID #3, I.S., HEATER)	1.9	μμf
TRIODE PLATE TO (TRIODE CATHODE, PENTODE GRID #3, I.S., HEATER)	1.4	μμf
PENTODE GRID #1 TO (PENTODE CATHODE, GRID #2, HEATER)	6.0	μμf
PENTODE PLATE TO (PENTODE CATHODE, GRID #2, GRID #3, TRIODE CATHODE, I.S., HEATER)	2.6	μμf
PENTODE PLATE TO (PENTODE CATHODE, GRID #2, HEATER)	0.15	μμf
TRIODE GRID TO PENTODE PLATE	0.0078	μμf
PENTODE GRID #1 TO TRIODE PLATE	0.0033	μμf
TRIODE PLATE TO PENTODE PLATE	0.060	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	4.7		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
DC	100		VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	300	VOLTS
MAXIMUM GRID #2 VOLTAGE		SEE RATING CHART	
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	2.0	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.5	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE[A]:			
FIXED BIAS	0.5	0.25	MEGOHM
SELF BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

[A] IF EITHER UNIT IS OPERATING AT MAXIMUM RATED CONDITIONS, GRID #1 CIRCUIT RESISTANCES FOR BOTH UNITS SHALL NOT EXCEED THE STATED VALUES.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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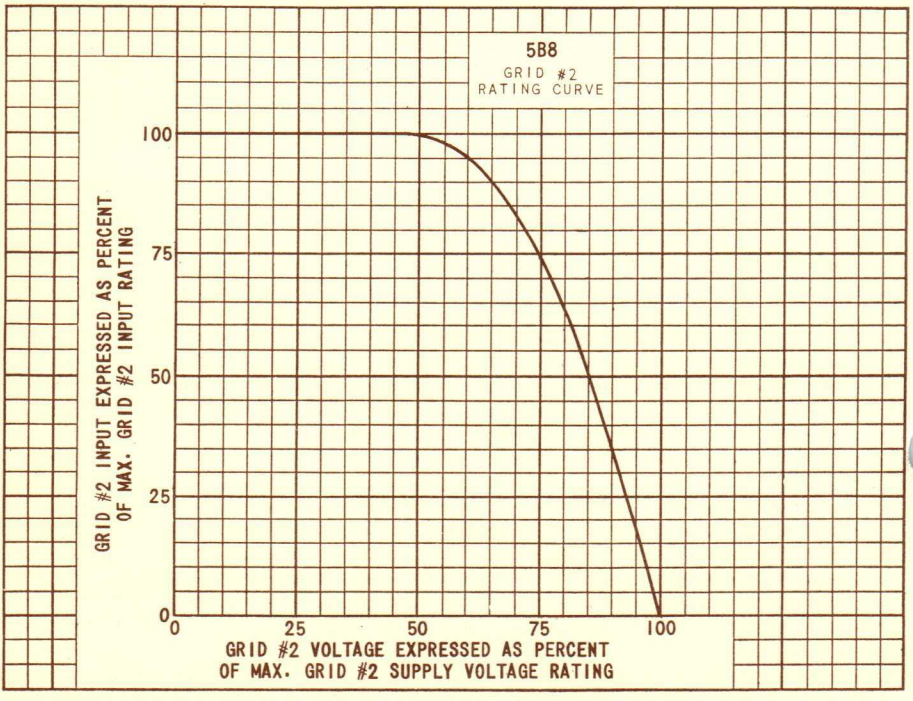
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE[B]	
HEATER VOLTAGE	4.7		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	200	200	VOLTS
GRID #2 VOLTAGE	---	150	VOLTS
GRID #1 VOLTAGE	-6	0	VOLTS
CATHODE BIAS RESISTOR	---	180	OHMS
PLATE CURRENT	13	9.5	MA.
GRID #2 CURRENT	---	2.8	MA.
AMPLIFICATION FACTOR	19	---	
TRANSCONDUCTANCE	3 300	6 200	μMHOS
PLATE RESISTANCE (APPROX.)	5 750	300 000	OHMS
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μAMP.	-19	-8	VOLTS

[B] WHEN READING CHARACTERISTICS OF THE PENTODE SECTION, ALL TRIODE ELEMENTS SHALL BE AT GROUND POTENTIAL. THUS, BECAUSE OF INTERNAL CONNECTIONS TO PIN #1, THE PENTODE SUPPRESSOR WILL ALSO BE AT GROUND.



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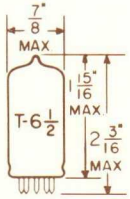
DOUBLE TRIODE

MINIATURE TYPE

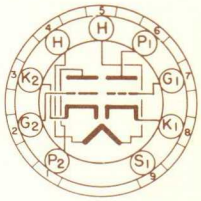


GLASS BULB

COATED UNIPOTENTIAL CATHODES

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE

9AJ

IT IS RECOMMENDED THAT PIN #9 BE GROUNDED

THE 5BK7A IS A MINIATURE DOUBLE TRIODE DESIGNED PRIMARILY FOR USE AS A CASCODE AMPLIFIER AT FREQUENCIES BELOW APPROXIMATELY 300 MEGACYCLES IN 600 MA. SERIES HEATER OPERATED RECEIVERS. THE PERFORMANCE OF THE TUBE AS A CASCODE AMPLIFIER IN CHARACTERIZED BY HIGH GAIN AND A LOW NOISE FIGURE. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BK7A.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	SECTION 1	SECTION 2	
GRID TO PLATE	1.8	1.8	μμf
INPUT	3.0	3.0	μμf
OUTPUT	1.0	0.9	μμf
HEATER TO CATHODE	2.8	3.0	μμf
GRID TO GRID (MAX.)	0.004		μμf
PLATE TO PLATE (MAX.)	0.075		μμf
GROUNDED GRID OPERATION			
PLATE TO CATHODE	0.22	0.22	μμf
INPUT	6.0	6.0	μμf
OUTPUT	2.4	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

HEATER VOLTAGE	4.7	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION	2.7	WATTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] WHEN THE 5BK7A IS USED AS A CASCODE AMPLIFIER AND THE TWO SECTIONS ARE CONNECTED IN SERIES, THE HEATER CATHODE VOLTAGE OF THE GROUNDED GRID STAGE MAY BE AS HIGH AS 250 VOLTS MAXIMUM WITH RESPECT TO THE CATHODE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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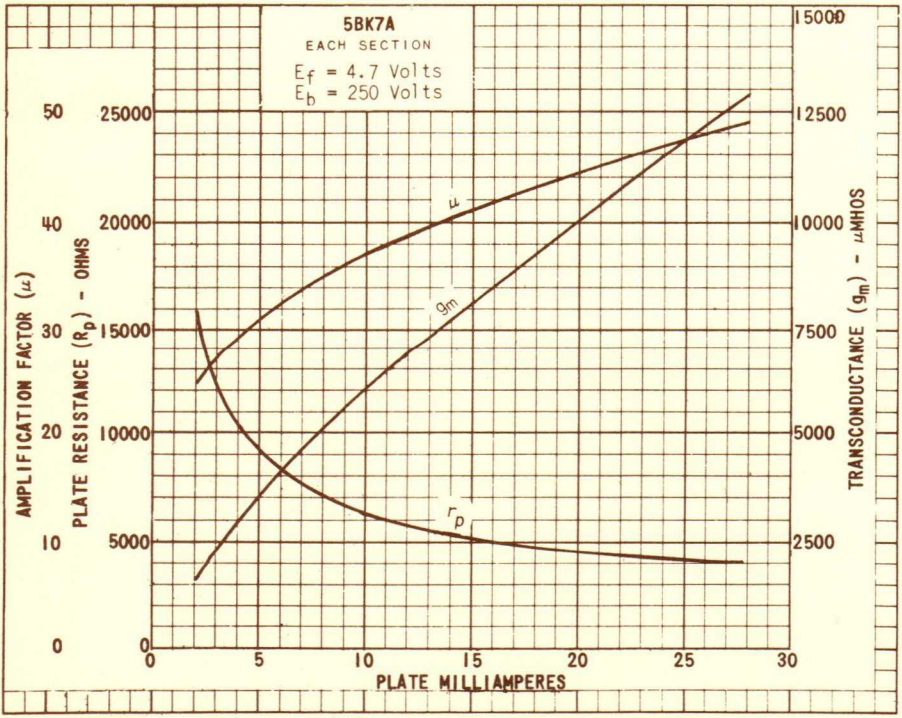
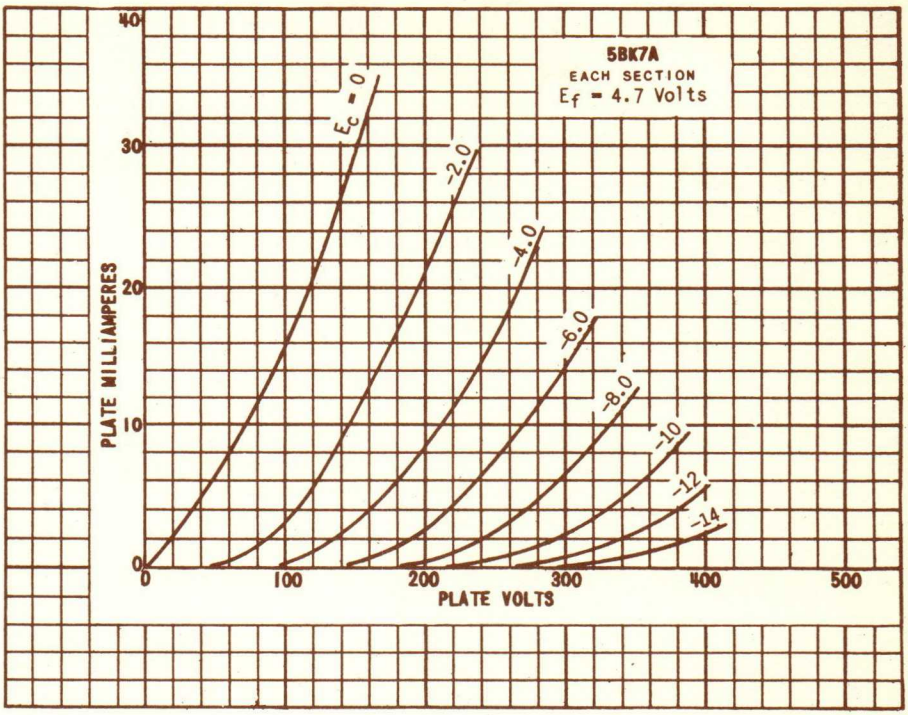
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

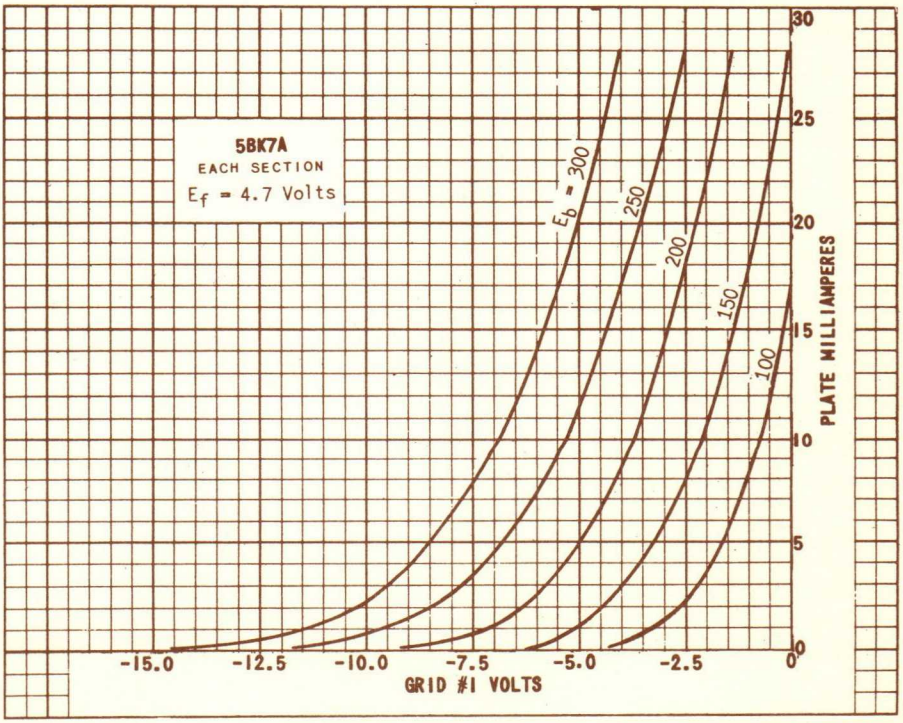
CLASS A_1 AMPLIFIER – EACH SECTION

HEATER VOLTAGE	4.7	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
AMPLIFICATION FACTOR	43	
PLATE RESISTANCE (APPROX.)	4 600	OHMS
TRANSCONDUCTANCE	9 300	µMHOS
PLATE CURRENT	18	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 µA.	-11	VOLTS
NOISE FIGURE[B]	7	DECIBELS

[B] AS MEASURED IN A CASCODE AMPLIFIER WHICH OPERATES AT A PLATE SUPPLY VOLTAGE OF 250 VOLTS, A PLATE CURRENT OF 18 MA., A FREQUENCY OF 200 MEGACYCLES, A STAGE BANDWIDTH OF 7 MEGACYCLES, AND AN EFFECTIVE NOISE BANDWIDTH OF 3.5 MEGACYCLES.





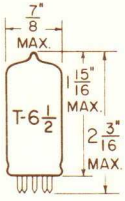


TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. OCTOBER 1, 1954 PLATE #4026

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

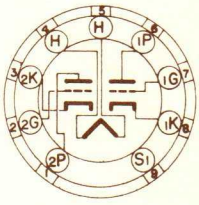


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
5.6 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN NOVAL
9AJ

THE 5BQ7A IS A MEDIUM-MU DOUBLE TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS THE FIRST RF AMPLIFIER TUBE IN TUNERS OF VHF TELEVISION RECEIVERS OR AS A LOW NOISE IF PRE-AMPLIFIER TUBE IN UHF TELEVISION RECEIVERS EMPLOYING A CRYSTAL MIXER. HIGH TRANSCONDUCTANCE, LOW INPUT CAPACITANCE, LOW INPUT LOADING AND LOW PLATE TO CATHODE CAPACITANCE MAKES IT ESPECIALLY USEFUL IN THE DIRECT-COUPLED RF STAGE OF TELEVISION RECEIVERS UTILIZING A DRIVEN RF-GROUNDED-GRID AMPLIFIER OR THE CASCODE TYPE OF CIRCUIT. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315

	UNIT #1	UNIT #2	
GRID TO PLATE	1.15	1.15	μμf
INPUT	2.85	----	μμf
INPUT (GROUNDED GRID)	----	4.95	μμf
OUTPUT	1.35	----	μμf
OUTPUT (GROUNDED GRID)	----	2.27	μμf
PLATE TO CATHODE (MAX.)	0.15	0.15	μμf
HEATER TO CATHODE	2.65	2.70	μμf
PLATE OF UNIT #1 TO PLATE OF UNIT #2 (MAX.)	0.010		μμf
PLATE OF UNIT #2 TO PLATE AND GRID OF UNIT #1 (MAX.)	0.024		μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

HEATER VOLTAGE	5.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200[A]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200[A]	VOLTS
MAXIMUM PLATE VOLTAGE	250[A]	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHM
HEATER WARM-UP TIME (APPROX.)*	11.0	SEC.

[A] UNDER CUT-OFF CONDITIONS, IN RF-GROUNDED-GRID CIRCUITS WITH DIRECT-COUPLED DRIVE, IT IS PERMISSIBLE FOR THIS VOLTAGE TO BE AS HIGH AS 300 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH UNIT

	DESIGN CENTER VALUES	
HEATER VOLTAGE	5.6	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	39	
PLATE RESISTANCE	6 100	OHMS
TRANSCONDUCTANCE	6 400	µMHOS
PLATE CURRENT	9	MA.
GRID VOLTS (APPROX.) FOR I_b = 10 µAMP.	−10	VOLTS

PUSH–PULL RF GROUNDED GRID CIRCUIT – EACH UNIT

HEATER VOLTAGE	5.6	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	150	VOLTS
GRID VOLTAGE (OBTAINED FROM CATHODE RESISTOR)	−2	VOLTS
CATHODE RESISTOR (COMMON TO BOTH UNITS)	100	OHMS
PLATE CURRENT	10	MA.

RF GROUNDED GRID CIRCUIT WITH DIRECT–COUPLED DRIVE

UNIT #1 (DRIVER TUBE) IS DIRECTLY COUPLED TO UNIT #2 (DRIVEN RF-GROUNDED-GRID AMPLIFIER TUBE) AS SHOWN IN ACCOMPANYING CIRCUIT.

	UNIT #1	UNIT #2	
HEATER VOLTAGE	5.6	5.6	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PEAK HEATER CATHODE VOLTAGE: HEATER NEGATIVE WITH RESPECT TO CATHODE	1	250	VOLTS
PLATE SUPPLY VOLTAGE	250	250	VOLTS
PLATE VOLTAGE	135	115	VOLTS
GRID VOLTAGE	−1	---	VOLTS
GRID RESISTOR	---	0.5	MEGOHM
PLATE CURRENT	10	10	MA.
GRID CURRENT	0	0	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 µAMP.	−14	---	VOLTS

SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time the 5BQ7A is identical to the 6BQ7A.*

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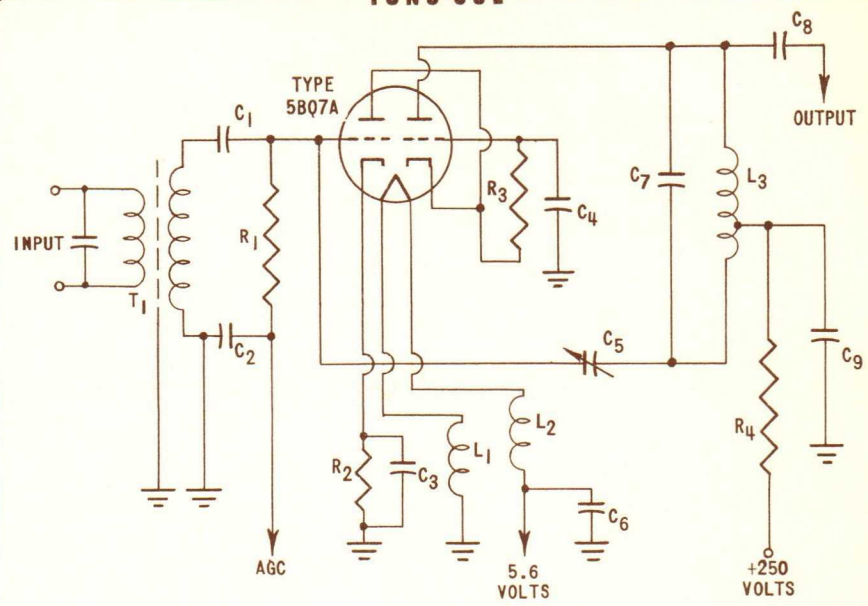
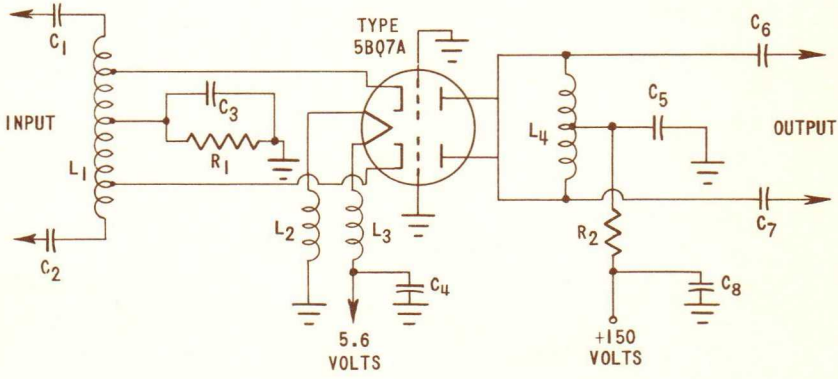


C1: 33 uuf, 400 VOLTS
C2: 1000 uuf, 400 VOLTS
C3: 1000 uuf, 400 VOLTS
C4: 1000 uuf, 400 VOLTS
C5: 0.5 to 1.5 uuf, 400 VOLTS
C6: 1000 uuf, 400 VOLTS
C7: 2 uuf, 400 VOLTS
C8: 33 uuf, 400 VOLTS
C9: 1000 uuf, 400 VOLTS

L1, L2: BIFILAR CHOKES, EACH 10 TURNS NO. 18 ENAMEL WIRE 1/4" COIL FORM
L3: TUNED CIRCUIT ELEMENT OF TUNER. VALUE DEPENDS ON DISTRIBUTED CIRCUIT CAPACITANCES. TO DETERMINE TAP POINT, TAP DOWN TO 80 TO 90% OF TOTAL NUMBER OF TURNS

R1: 10000 OHMS, 0.5 WATT
R2: 100 OHMS, 0.5 WATT
R3: 500000 OHMS, 0.5 WATT
R4: 100 OHMS, 0.5 WATT
T1: TUNED CIRCUIT ELEMENT OF TUNER. VALUE DEPENDS ON DISTRIBUTED CIRCUIT CAPACITANCES.

DRIVEN RF-GROUNDED GRID AMPLIFIER CIRCUIT WITH DIRECT COUPLED DRIVE



C1 C2 C3 C4 C5: 1000 uuf, 400 VOLTS
C6 C7: 100 uuf, 400 VOLTS
C8: 1000 uuf, 400 VOLTS

L1 L4: TUNED CIRCUIT ELEMENTS OF TUNER. VALUES DEPEND ON DISTRIBUTED CIRCUIT CAPACITANCES.

L2 L3: BIFILAR CHOKES, EACH 10 TURNS OF NO. 18 ENAMEL WIRE, 1/4" COIL FORM.
R1 R2: 100 OHMS, 0.5 WATT

PUSH-PULL RF GROUNDED-GRID CIRCUIT

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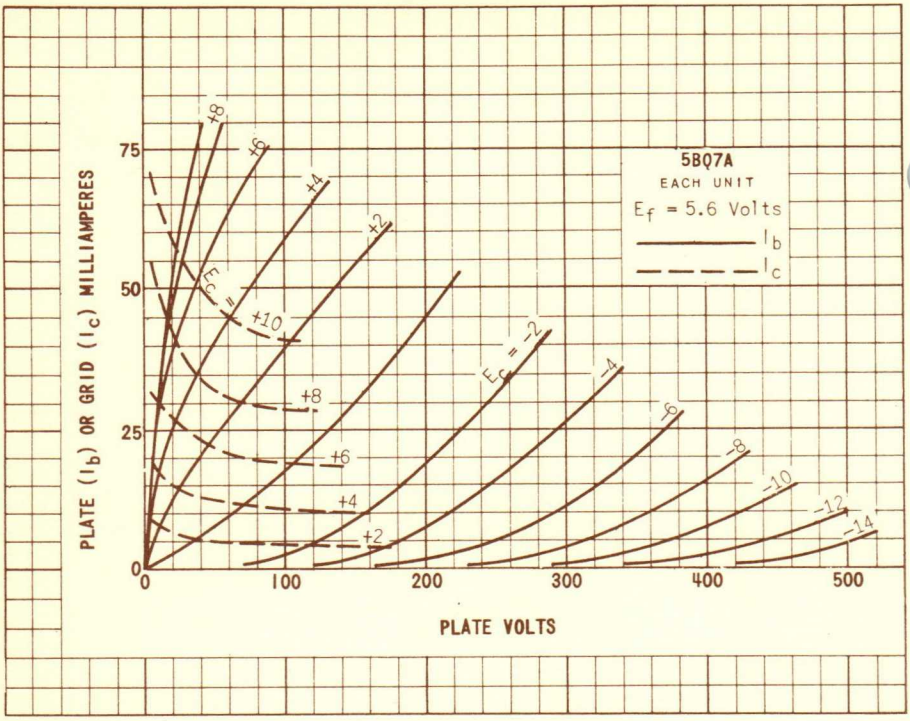
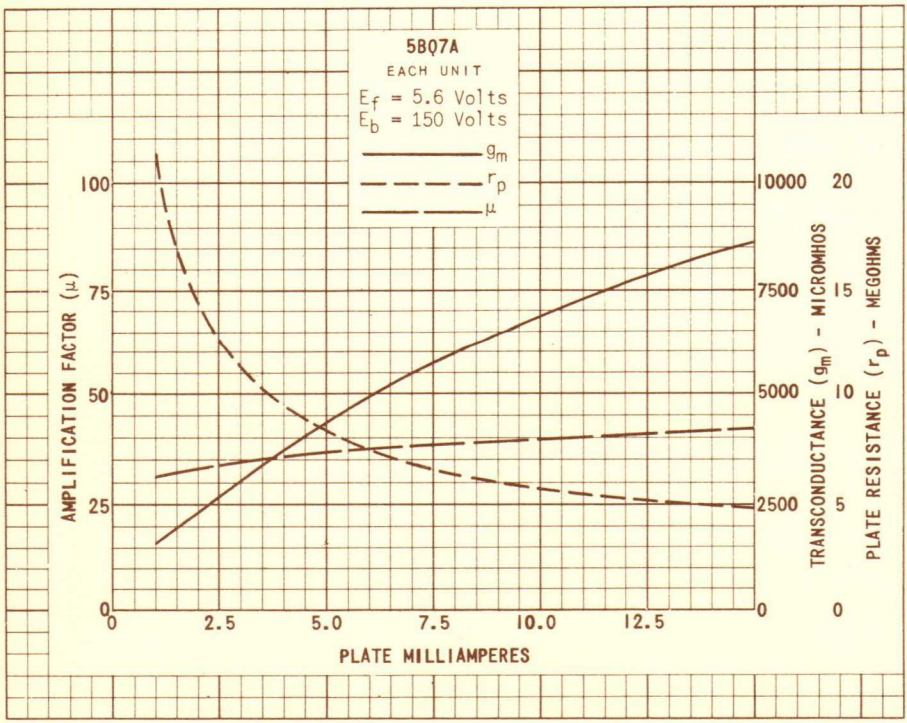
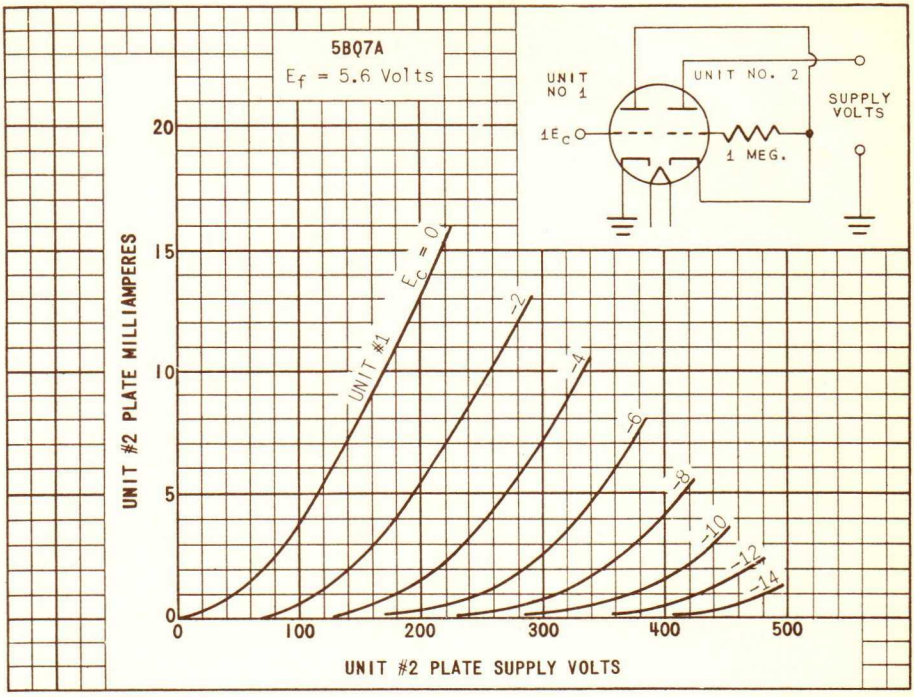
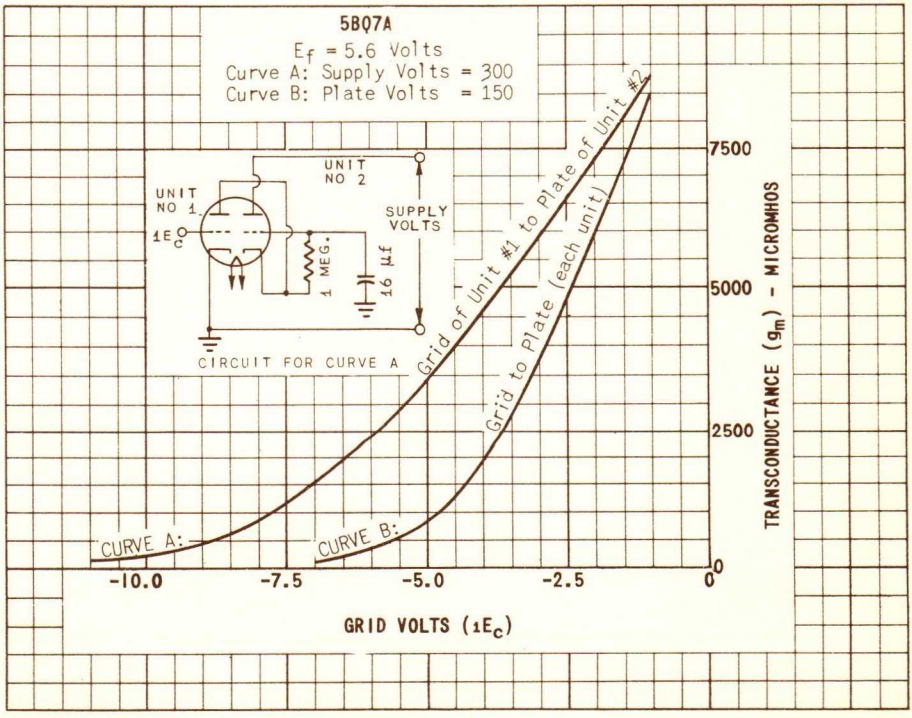

5BQ7A
EACH UNIT
E_f = 5.6 Volts
I_b
I_c
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
200
300
400
500
+8
+6
+4
+2
E_c = +10
+8
+6
+4
+2
E_c = -2
-4
-6
-8
-10
-12
-14


5BQ7A
EACH UNIT
E_f = 5.6 Volts
E_b = 150 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - MEGOHMS
PLATE MILLIAMPERES
0
25
50
75
100
2.5
5.0
7.5
10.0
12.5
2500
5000
7500
10000
5
10
15
20





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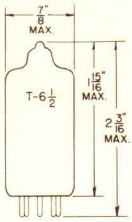
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

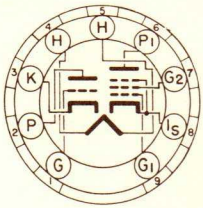


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9FA

THE 5BR8 COMPRISES TWO ELECTRICALLY INDEPENDENT SECTIONS -- A TRIODE AND A PENTODE -- IN THE 9 PIN MINIATURE CONSTRUCTION. BOTH UNITS ARE CAPABLE OF GOOD PERFORMANCE AT THE HIGHER FREQUENCIES. THE TUBE MAY BE USED AS A LOCAL OSCILLATOR PENTODE MIXER FOR FM OR TELEVISION RECEIVERS OR IN THE MANY COMBINED FUNCTIONS IN SUCH RECEIVERS. THE 5BR8 IS INTENDED FOR USE IN 600 MA. SERIES HEATER RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF THE HEATER VOLTAGE ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BR8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315	WITHOUT SHIELD	
PENTODE UNIT:			
GRID #1 TO PLATE	0.008	0.015MAX.	μμf
INPUT	5.0	5.0	μμf
OUTPUT	3.5	2.6	μμf
TRIODE UNIT:			
GRID TO PLATE	1.8	1.8	μμf
GRID TO CATHODE	2.5	2.5	μμf
PLATE TO CATHODE	1.0	0.4	μμf
CATHODE TO HEATER (EITHER SECTION) APPROX.	3.0	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	4.7		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE; HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	250	250	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 VOLTAGE		300	VOLTS
MAXIMUM PLATE DISSIPATION	2.7	2.8	WATTS
MAXIMUM GRID #2 DISSIPATION		0.5	WATTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	---	0	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	---	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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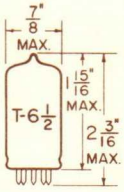
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE	PENTODE	
HEATER VOLTAGE	4.7		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	150	250	VOLTS
GRID #2 VOLTAGE	---	110	VOLTS
CATHODE RESISTOR	56	68	OHMS
TRANSCONDUCTANCE	8 500	5 200	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR I_b=10 μA.	−12	−10	VOLTS
PLATE CURRENT	18	10	MA.
GRID #2 CURRENT	---	3.5	MA.
PLATE RESISTANCE (APPROX.)	.005	0.40	MEGOHM
AMPLIFICATION FACTOR	40	---	

TUNG-SOL

DOUBLE-DIODE PENTODE

MINIATURE TYPE

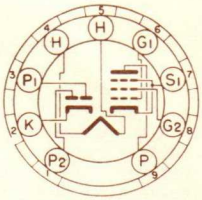


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9HK

THE 5BW8 IS A DOUBLE-DIODE PENTODE IN WHICH SEPARATE CATHODES ARE PROVIDED FOR THE TWO SECTIONS. THE DIODE SECTIONS ARE INTENDED FOR USE PRIMARILY AS A HORIZONTAL PHASE DETECTOR IN TELEVISION RECEIVERS. THE PENTODE SECTION IS SUITABLE FOR USE AS A SOUND IF AMPLIFIER, SOUND LIMITER, AND AUTOMATIC-GAIN-CONTROL KEYER.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE GRID #1 TO PLATE (MAX.)	0.020	μμf
PENTODE INPUT	4.8	μμf
PENTODE OUTPUT	2.6	μμf
GRID #1 TO EACH DIODE PLATE (MAX.)	0.006	μμf
DIODE #1 PLATE TO DIODE CATHODE & HEATER	1.3	μμf
DIODE #2 PLATE TO DIODE CATHODE & HEATER	1.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	4.7	VOLTS
MAXIMUM PLATE VOLTAGE	0.6±6%	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	330	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.55	WATTS
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
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
WITH FIXED BIAS	0.1	MEGOHMS
WITH CATHODE BIAS	0.5	MEGOHMS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EA. SEC.)	5.0	MA.
HEATER WARM-UP TIME (APPROX.) *	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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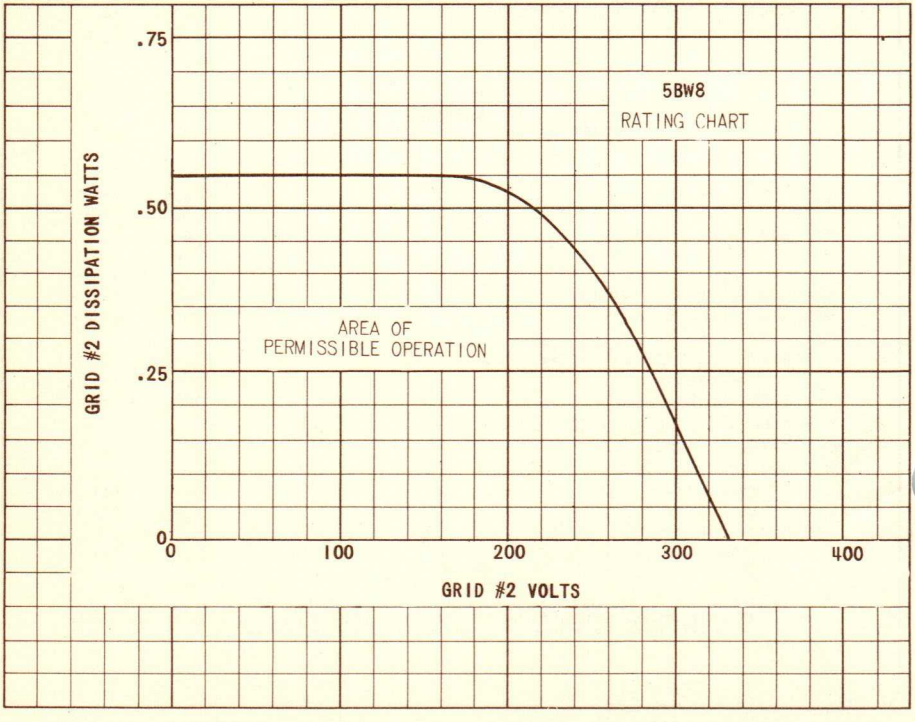
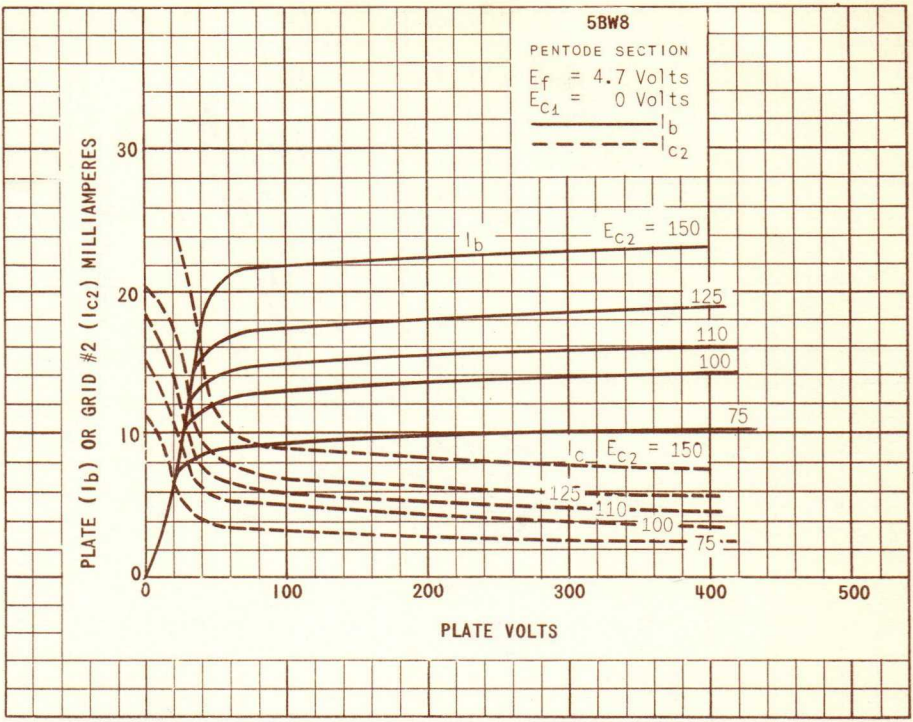
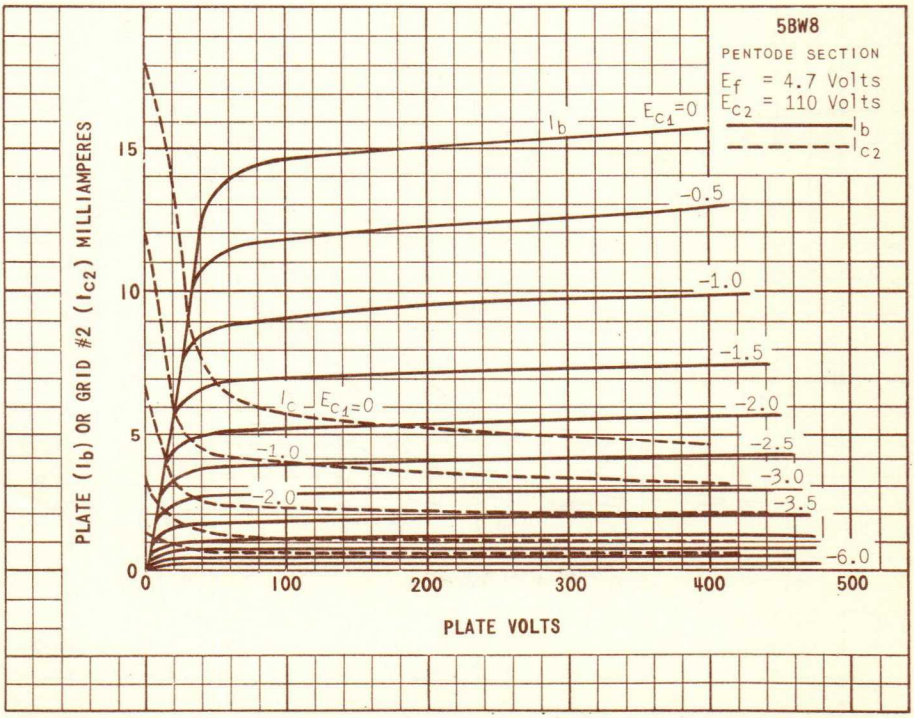
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	4.7	VOLTS
HEATER CURRENT	0.6±6%	AMP.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	110	VOLTS
CATHODE-BIAS RESISTOR	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHMS
TRANSCONDUCTANCE	5200	μMHOS
PLATE CURRENT	10	MA.
SCREEN CURRENT	3.5	MA.
GRID #1 VOLTAGE (APPROX.) I_b=10 μAMPS	-10	VOLTS
AVERAGE DIODE CURRENT (EACH DIODE) WITH 5 VOLTS DC APPLIED	20	MA.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.







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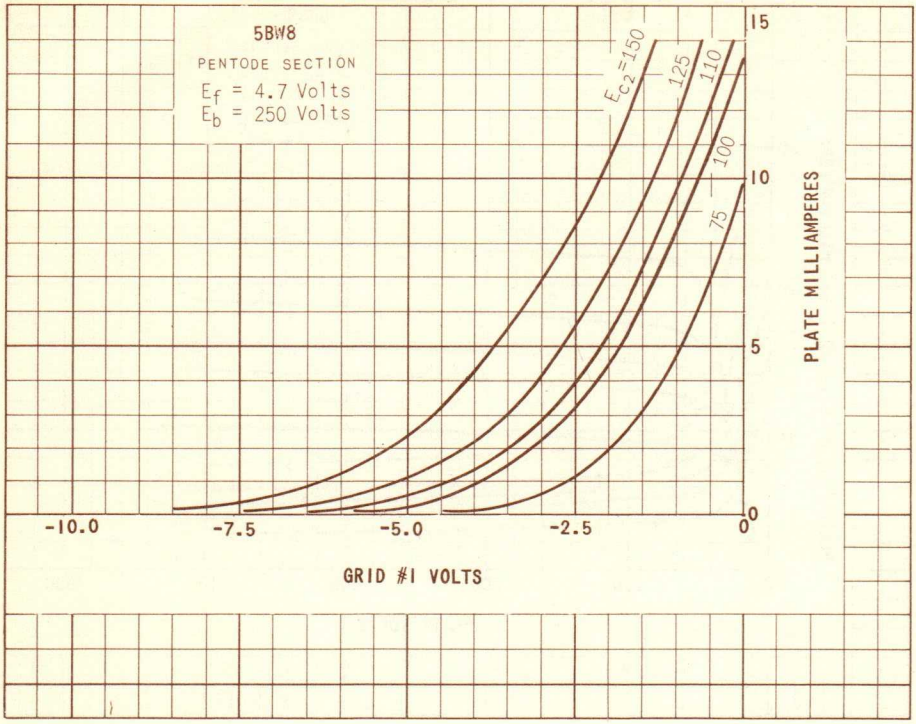
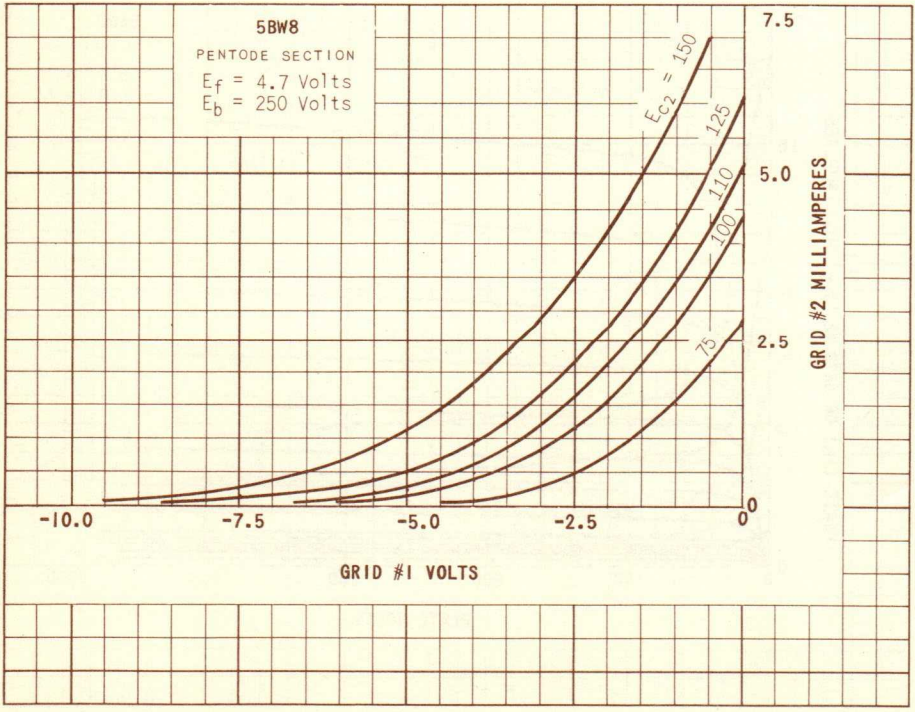
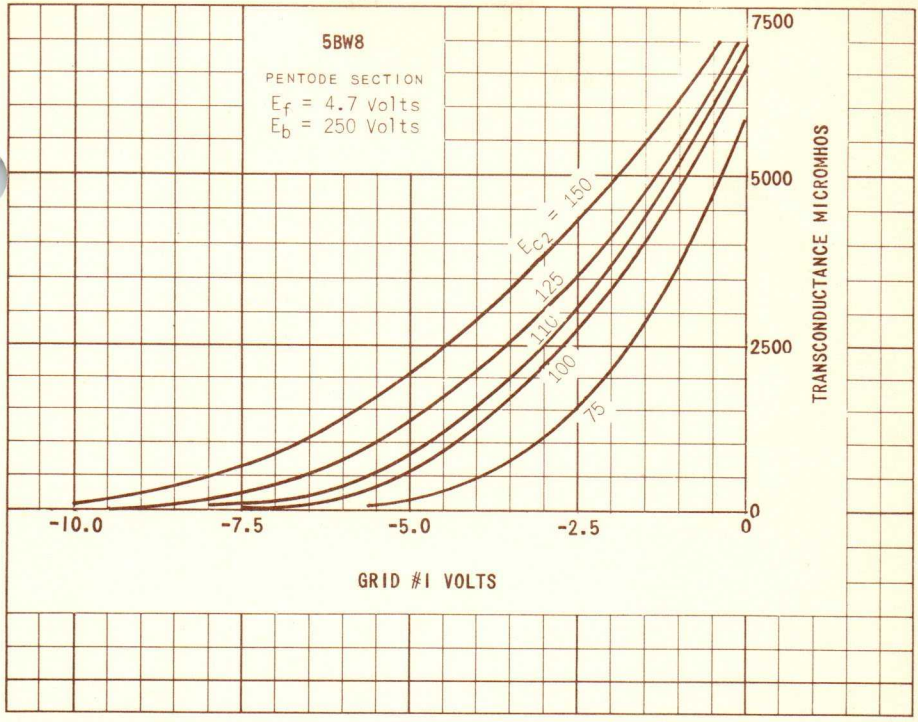
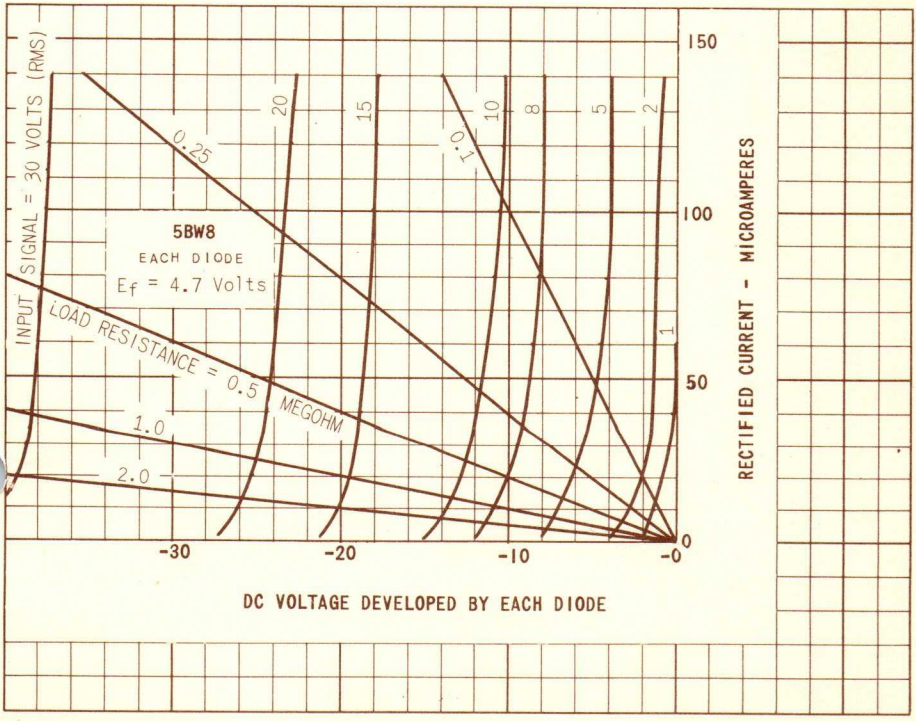

5BW8
PENTODE SECTION
E_f = 4.7 Volts
E_b = 250 Volts
E_{c2}=150
125
110
100
75
15
10
5
0
PLATE MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS


5BW8
PENTODE SECTION
E_f = 4.7 Volts
E_b = 250 Volts
E_{c2} = 150
125
110
100
75
7.5
5.0
2.5
0
GRID #2 MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS





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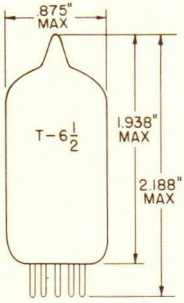
TRIODE PENTODE

MINIATURE TYPE

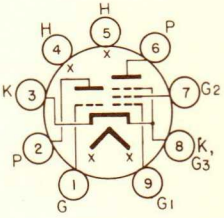


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

FOR USE AS A COMBINED
OSCILLATOR AND MIXER
IN TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9GF

THE 5CG8 IS A MULTIUNIT TUBE OF THE 9 PIN MINIATURE CONSTRUCTION CONTAINING A MEDIUM-MU TRIODE AND SHARP CUTOFF PENTODE IN ONE ENVELOPE. IT IS DESIGNED PRIMARILY FOR USE AS A COMBINED OSCILLATOR AND MIXER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS UTILIZING AN INTERMEDIATE FREQUENCY IN THE ORDER OF 40 MC. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE: (PG1 TO PP) MAX.	0.02	0.04	pf
PENTODE INPUT: PG1 TO (H+K+PG2+PG3)	4.8	4.6	pf
PENTODE OUTPUT: PP TO (H+K+PG2+PG3)	1.6	0.9	pf
CATHODE TO HEATER: (K TO H)	6.0[B]	6.0	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)	1.5	1.5	pf
TRIODE INPUT: TG TO (H+K)	2.4	2.0	pf
TRIODE OUTPUT: TP TO (H+K)	1.0	0.5	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP) MAX.	0.04	0.05	pf
PENTODE PLATE TO TRIODE PLATE: (PP TO TP) MAX.	0.008	0.05	pf

[A] EXTERNAL SHIELD 315 CONNECTED TO PIN 3.

[B] EXTERNAL SHIELD 315 CONNECTED TO PIN 6.

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7 VOLTS	600	MA.
HEATER WARM-UP TIME [C]		11	SECONDS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		4.7	VOLTS
CURRENT OPERATION		600±40	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

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE PLATE VOLTAGE	275	VOLTS
TRIODE PLATE VOLTAGE	275	VOLTS
GRID 2 SUPPLY VOLTAGE	275	VOLTS
GRID 2 VOLTAGE	SEE J5-C4-2	
PENTODE PLATE DISSIPATION	2.3	WATTS
GRID 2 DISSIPATION	0.45	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	1.7	WATTS

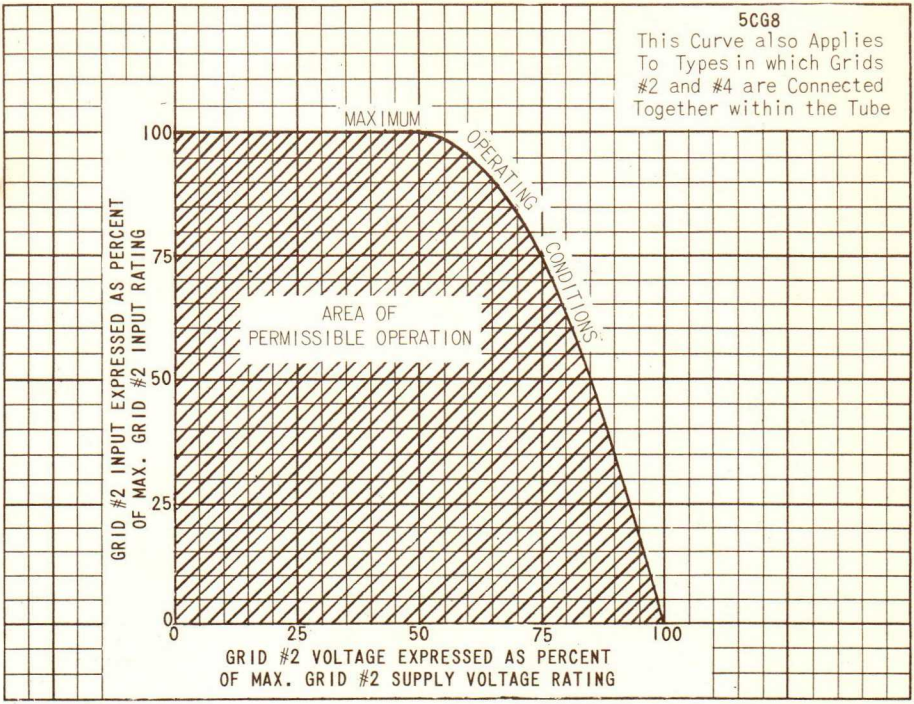
TYPICAL OPERATING CHARACTERISTICS

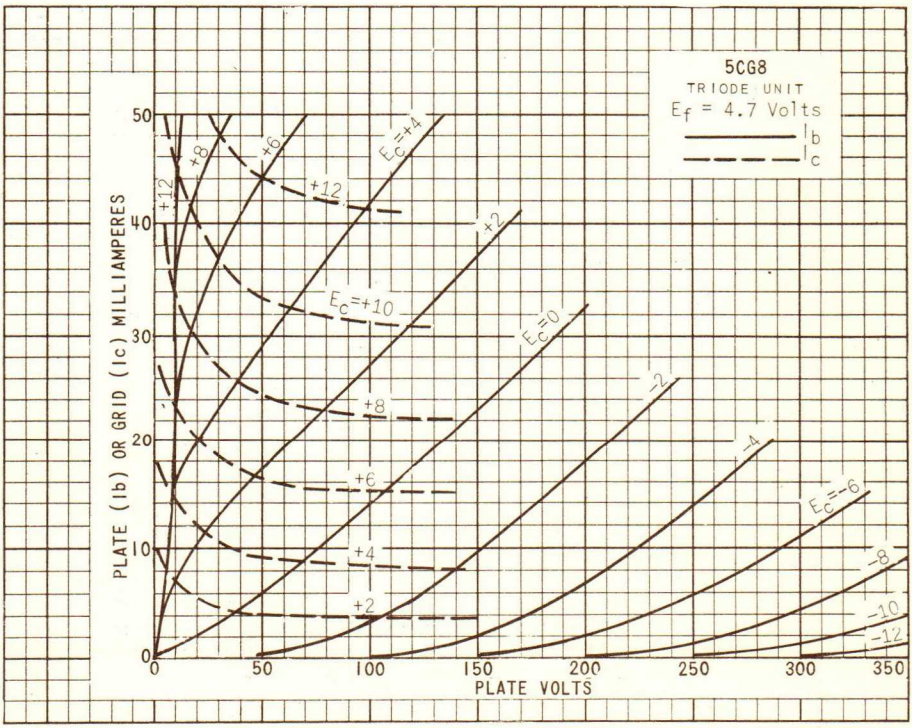
CLASS A1 AMPLIFIER

	TRIODE	PENTODE	
PLATE VOLTAGE	125	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO PIN 3 AT SOCKET		
GRID 2 VOLTAGE	----	125	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	6,500	5,500	μMHOS
PLATE CURRENT	12.0	9.0	MA.
GRID 2 CURRENT	----	2.2	MA.
PLATE RESISTANCE (APPROX.)	6,000	300,000	OHMS
AMPLIFICATION FACTOR	40	----	
GRID 1 VOLTAGE (APPROX.) FOR Ib=20μA	-7	-6.5	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb = 100 V; Ec2 = 70 V)	----	5,700	μMHOS

C

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SEREIS WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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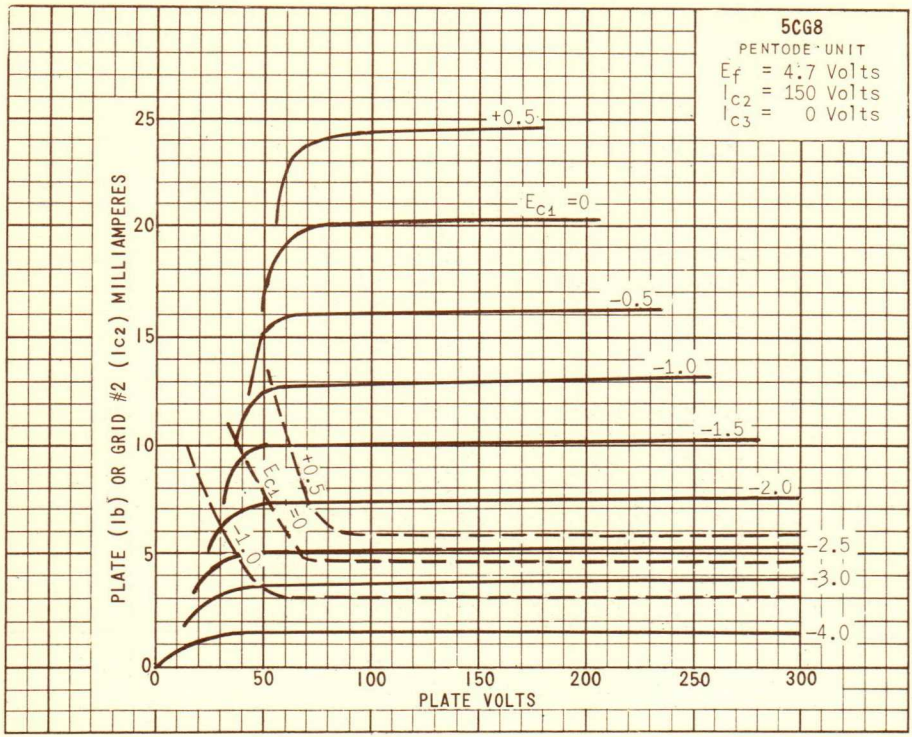
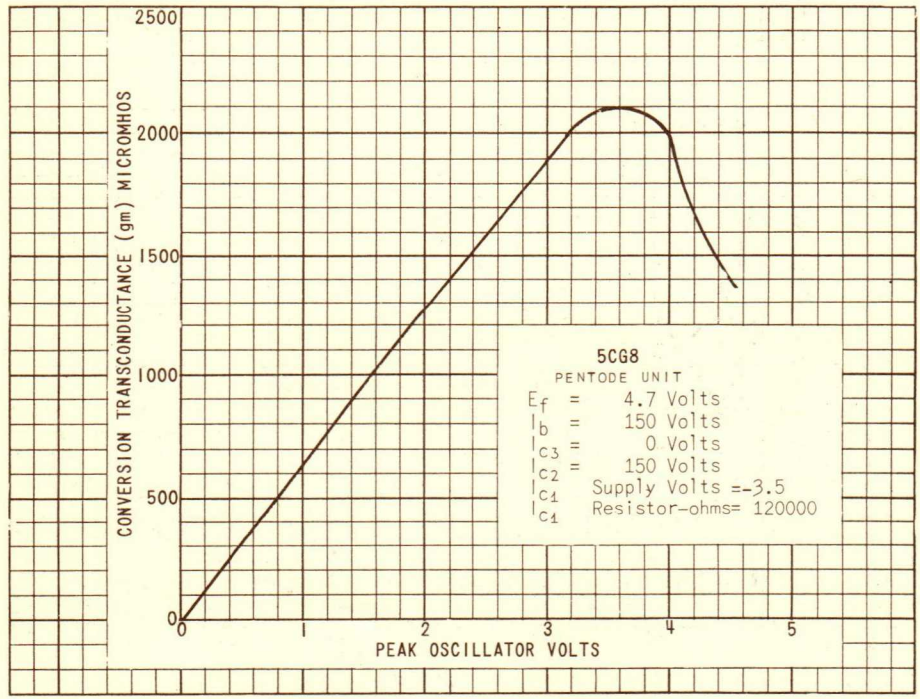
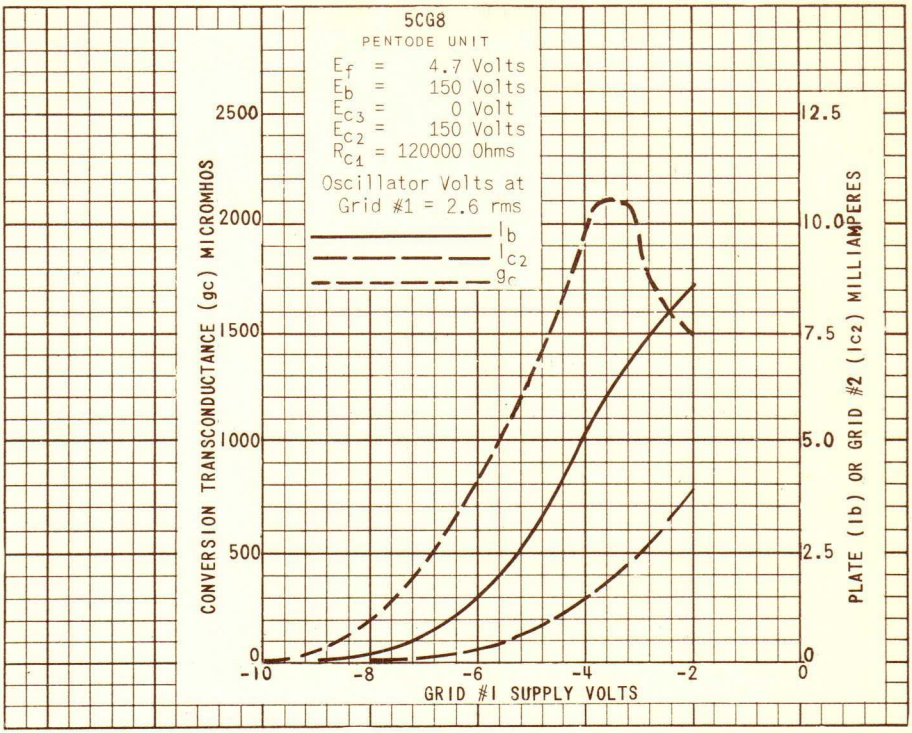

5CG8
PENTODE UNIT
Ef = 4.7 Volts
Ic2 = 150 Volts
Ic3 = 0 Volts
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
+0.5
Ec1 =0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
0
5
10
15
20
25
50
100
150
200
250
300


CONVERSION TRANSCONDUCTANCE (gm) MICROMHOS
PEAK OSCILLATOR VOLTS
5CG8
PENTODE UNIT
Ef = 4.7 Volts
Ib = 150 Volts
Ic3 = 0 Volts
Ic2 = 150 Volts
Ic1 Supply Volts =-3.5
Ic1 Resistor-ohms= 120000
0
500
1000
1500
2000
2500
1
2
3
4
5



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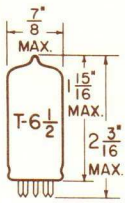
TRIODE TETRODE

MINIATURE TYPE



GLASS BULB

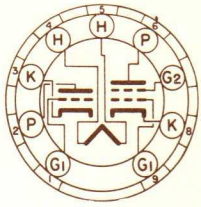
COATED UNIPOTENTIAL CATHODE

HEATER

4.7 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9FX

THE 5CL8 IS A MINIATURE TRIODE TETRODE DESIGNED FOR USE AS A VHF OSCILLATOR–MIXER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM–UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, THE 5CL8 IS IDENTICAL TO THE 6CL8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315	WITHOUT SHIELD	
TRIODE:			
GRID TO PLATE (G TO P)	1.8	1.8	μμf
INPUT: G TO (H + K)	2.7	2.7	μμf
OUTPUT: P TO (H + K)	1.2	0.4	μμf
TETRODE:			
GRID TO PLATE (G_1 TO P) (MAX.)	.016	.028	μμf
INPUT: G_1 TO (H+K+G_2)	5.0	5.0	μμf
OUTPUT: P TO (H+K+G_2)	3.0	2.0	μμf
CATHODE TO HEATER (EITHER SECTION APPROX.)	2.5	2.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	TETRODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
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
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM PLATE DISSIPATION	2.7	2.8	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.5	WATT
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS

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RATINGS—CONT'D.

	TRIODE	TETRODE	
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.5	0.25	MEGOHM
SELF BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME*	11.0		SECONDS

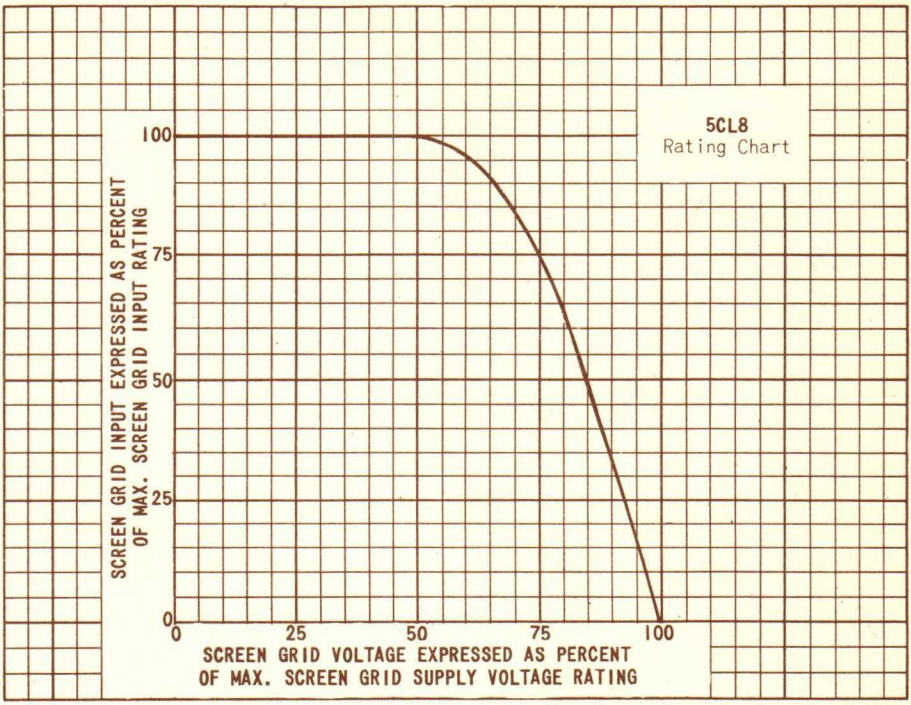
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE	---	125	VOLTS
GRID #1 VOLTAGE	0	-1.0	VOLTS
CATHODE BIAS RESISTOR	56	---	OHMS
AMPLIFICATION FACTOR	40	---	
PLATE RESISTANCE (APPROX.)	.005	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	5 800	μMHOS
PLATE CURRENT	15	12	MA.
GRID #2 CURRENT	---	4.0	MA.
GRID #1 VOLTAGE (APPROX.)			
FOR I_b =10 μA. DC	-9	-10	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time the 5CL8 is identical to the 6CL8.*



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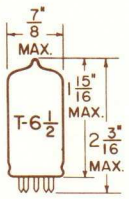
TRIODE TETRODE

MINIATURE TYPE



GLASS BULB

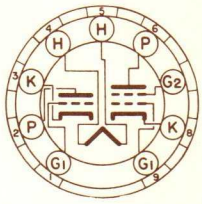
COATED UNIPOTENTIAL CATHODE

HEATER

4.7 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9FX

THE 5CL8A IS A MINIATURE TRIODE TETRODE DESIGNED FOR USE AS A VHF OSCILLATOR–MIXER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM–UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS THE 5CL8A IS IDENTICAL TO THE 6CL8A.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[B] SHIELD #315	WITHOUT SHIELD	
TRIODE:			
GRID TO PLATE (G TO P)	1.8	1.8	μμf
INPUT: G TO (H+K)	2.7	2.7	μμf
OUTPUT: P TO (H+K)	1.2	0.4	μμf
TETRODE:			
GRID TO PLATE (G_1 TO P) (MAX.)	0.010	0.028	μμf
INPUT: G_1 TO (H+K+G_2)	5.0	5.0	μμf
OUTPUT: P TO (H+K+G_2)	3.4	2.4	μμf
CATHODE TO HEATER (EITHER SECTION APPROX.)	2.5[C]	2.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	TETRODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
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
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM PLATE DISSIPATION	2.7	2.8	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS

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RATINGS—CONT'D.

	TRIODE	TETRODE	
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.5	0.25	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME[A]	11.0		SECONDS

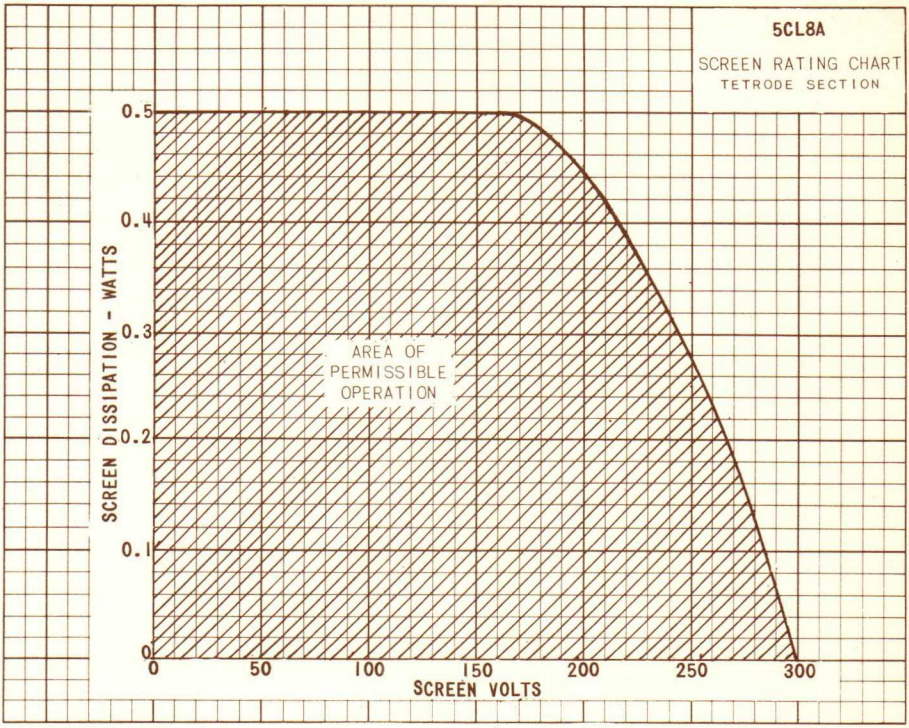
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TETRODE SECTION		TRIODE SECTION	
HEATER VOLTAGE	4.7	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	100	125	125	VOLTS
SCREEN VOLTAGE	100	125	---	VOLTS
GRID #1 VOLTAGE	0	-1.0	---	VOLTS
CATHODE-BIAS RESISTOR	---	---	56	OHMS
AMPLIFICATION FACTOR	---	---	40	
PLATE RESISTANCE (APPROX.)	---	100000	5000	OHMS
TRANSCONDUCTANCE	8200	6400	8000	μMHOS
PLATE CURRENT	---	12	15	MA.
SCREEN CURRENT	---	4.0	---	MA.
GRID #1 VOLTAGE (APPROX.) I_b = 10 μAMPERES	---	-10	-9	VOLTS

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

SIMILAR TYPE REFERENCE: Except for heater ratings, the 5CL8A is identical to the 6CL8A.



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HIGH VACUUM CATHODE-RAY TUBE

ELECTROSTATIC DEFLECTION AND FOCUSING

5CP1	5CP4
NO. 1 PHOSPHOR GREEN FLUORESCENT SCREEN MEDIUM PERSISTENCE	NO. 4 PHOSPHOR WHITE FLUORESCENT SCREEN MEDIUM PERSISTENCE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMPERE
AC OR DC

GLASS BULB

MEDIUM SHELL DIHEPTAL 12 PIN BASE

RATINGS*

MAXIMUM ANODE NO. 3 VOLTAGE (SUPPLEMENTARY HIGH VOLTAGE ELECTRODE)	4400	VOLTS
MAXIMUM ANODE NO. 2 VOLTAGE (HIGH VOLTAGE ELECTRODE)	2200	VOLTS
MAXIMUM ANODE NO. 1 VOLTAGE (FOCUSING ELECTRODE)	1100	VOLTS
GRID VOLTAGE (CONTROL ELECTRODE)	NEVER POSITIVE	
MAXIMUM PEAK VOLTAGE BETWEEN ANODE NO. 2 AND ANY DEFLECTOR	550	VOLTS
MAXIMUM DC HEATER CATHODE POTENTIAL[A]	125	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1.5	MEGOHMS
MAXIMUM IMPEDANCE OF ANY DEFLECTOR CIRCUIT AT HEATER SUPPLY FREQUENCY	1.0	MEGOHM

*MAXIMUM RATINGS ARE ABSOLUTE VALUES

DIRECT INTERELECTRODE CAPACITANCES (APPROX.)

GRID TO ALL OTHER ELECTRODES	8.0	μμf
CATHODE TO ALL OTHER ELECTRODES	8.0	μμf
D1 TO D2	2.0	μμf
D3 TO D4	2.0	μμf
D1 TO ALL OTHER ELECTRODES	9.0	μμf
D3 TO ALL OTHER ELECTRODES	7.0	μμf
D1 TO ALL OTHER ELECTRODES EXCEPT D2	7.0	μμf
D2 TO ALL OTHER ELECTRODES EXCEPT D1	7.0	μμf
D3 TO ALL OTHER ELECTRODES EXCEPT D4	5.0	μμf
D4 TO ALL OTHER ELECTRODES EXCEPT D3	6.0	μμf

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PLATE
1411
MARCH 15
1944

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE NO. 3 VOLTAGE	2000	3000	4000	VOLTS
ANODE NO. 2 VOLTAGE[B]	2000	1500	2000	VOLTS
ANODE NO. 1 VOLTAGE FOR FOCUS AT 75% OF GRID VOLTAGE CUT-OFF[C]	575	430	575	VOLTS
GRID VOLTAGE FOR CUT-OFF[D]	-60[E]	-45[E]	-60[E]	VOLTS
DEFLECTION SENSITIVITY:[F]				
D1 AND D2	0.350	0.370	0.280	MM/VOLT DC
D3 AND D4	0.390	0.450	0.340	MM/VOLT DC
DEFLECTION FACTOR[F]				
D1 AND D2	73	69	92	VOLTS DC/IN
D3 AND D4	64	56	74	VOLTS DC/IN

SPOT POSITION AND TEST CONDITIONS

THE UNDEFLECTED FOCUSED SPOT FALLS WITHIN A 25 MM. SQUARE CENTERED ON THE TUBE FACE.

TEST CONDITIONS ARE:

ANODE NO. 3 VOLTAGE	4000 VOLTS
ANODE NO. 2 VOLTAGE	2000 VOLTS
ANODE NO. 1 VOLTAGE	ADJUSTED FOR FOCUS
GRID VOLTAGE	NEAR CUT-OFF
DEFLECTOR RESISTORS (CONNECTED TO ANODE NO. 2)	1 MEGOHM EACH

NOTE: SHIELD TUBE FROM ALL STRAY FIELDS.

[A] WHEN THE HEATER IS OPERATED AT A NEGATIVE POTENTIAL WITH RESPECT TO THE CATHODE THEN THE CATHODE RETURN SHOULD BE MADE AT THE CENTER TAP OF THE FILAMENT TRANSFORMER.

[B] USE OF LESS THAN 1500 VOLTS RESULTS IN DECREASED BRILLIANCE.

[C] CERTAIN TUBES MAY REQUIRE ADJUSTMENT OF +25% TO -30% WITH GRID VOLTAGE BETWEEN ZERO AND CUT-OFF.

[D] THE VISUAL EXTINCTION OF A FOCUSED SPOT.

[E] THE GRID SUPPLY SHOULD BE VARIABLE TO ± 50%.

[F] VALUES SUBJECT TO VARIATION OF ± 20%.

DEFLECTOR LOCATIONS:

D1 AND D2	NEAREST TO SCREEN
D3 AND D4	NEAREST TO BASE
D1	SAME SIDE OF TUBE AS PIN NO. 5
D3	SAME SIDE AS PIN NO. 2

PLATE 1412
MARCH 15 1944

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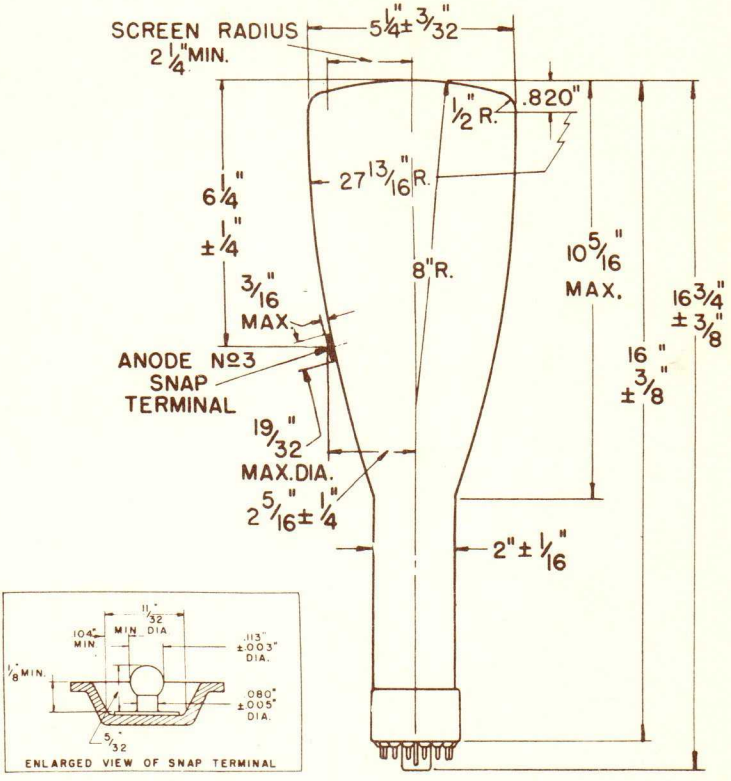

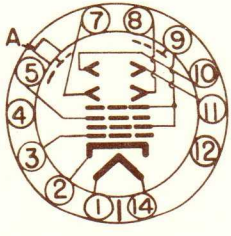

BOTTOM VIEW

1. HEATER
2. CATHODE
3. GRID NO. 1
4. INTERNAL CONNECTION (DO NOT USE)
5. ANODE NO. 1
7. DEFLECTOR NO. 3 (D3)
8. DEFLECTOR NO. 4 (D4)
9. GRID NO. 2
   ANODE NO. 2
10. DEFLECTOR NO. 2 (D2)
11. DEFLECTOR NO. 1 (D1)
12. NO CONNECTION
14. HEATER

A. ANODE NO. 3 (SNAP TERMINAL)

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PLATE 1413
MARCH 15 1944

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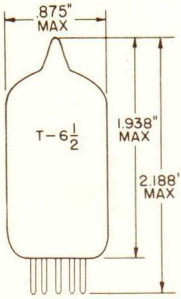
TUNG-SOL

TRIODE-TETRODE

MINIATURE TYPE

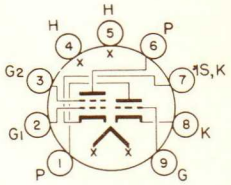


GLASS BULB
SMALL-BUTTON NOVAL
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 600±40 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9GE

THE 5CQ8 IS A MEDIUM-MU TRIODE AND SHARP CUTOFF TETRODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT MAY BE USED IN A WIDE VARIETY OF APPLICATIONS IN BLACK AND WHITE AND COLOR TELEVISION RECEIVERS, PARTICULARLY AS A COMBINED VHF OSCILLATOR AND MIXER IN TUNERS OF SUCH RECEIVERS UTILIZING AN INTERMEDIATE FREQUENCY IN THE ORDER OF 40 MC. THE TETRODE UNIT IS INTENDED FOR USE AS A MIXER TUBE, BUT IT IS ALSO USEFUL AS A VIDEO INTERMEDIATE-FREQUENCY AMPLIFIER TUBE AND AS A SOUND INTERMEDIATE FREQUENCY AMPLIFIER TUBE. THE TRIODE UNIT IS SUITABLE FOR USE NOT ONLY AS A VHF OSCILLATOR, BUT ALSO AS A PHASE SPLITTER, SYNC-CLIPPER, SYNC-SEPARATOR, AND RF AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT EXTERNAL SHIELD	WITH[A] EXTERNAL SHIELD	
TRIODE UNIT:			
GRID TO PLATE	1.8	1.8	pf
GRID TO CATHODE & HEATER	2.7	2.7	pf
PLATE TO CATHODE AND HEATER	0.4	1.2	pf
TETRODE UNIT:			
GRID #1 TO PLATE (MAX.)	0.019	0.015	pf
GRID #1 TO CATHODE & I.S., GRID #2 & HEATER	5.0	5.0	pf
PLATE TO CATHODE & I.S., GRID #2 & HEATER	2.5	3.3	pf
TETRODE PLATE TO TRIODE PLATE (MAX.)	0.07	0.01	pf
HEATER TO CATHODE	3.0	3.0[B]	pf

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM ←

CONVERTER SERVICE

	TRIODE UNIT AS OSC.	TETRODE UNIT AS MIXER	
MAXIMUM PLATE VOLTAGE	330 ←	330 ←	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	330 ←	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) VOLTAGE	---	SEE FIGURE #2	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:			
POSITIVE BIAS VALUE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1 ←	3.2 ←	WATTS
MAXIMUM GRID #2 INPUT:			
→ FOR GRID #2 VOLTAGES UP TO 165 VOLTS	---	0.7 ←	WATT
→ FOR GRID #2 VOLTAGES BETWEEN 165 & 300V.	---	SEE FIGURE #2	
MAXIMUM GRID #1 INPUT	0.55 ←	---	WATT
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE[C]	200	200[C]	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

MAXIMUM CIRCUIT VALUES

	TRIODE UNIT	TETRODE UNIT	
GRID #1 CIRCUIT RESISTANCE:			
FOR CATHODE-BIAS OPERATION (MAX.)	1.0	1.0	MEGOHM
FOR FIXED-BIAS OPERATION (MAX.)	0.5	0.25	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE UNIT	TETRODE UNIT	
PLATE SUPPLY VOLTAGE	125	125	VOLTS
GRID #2 SUPPLY VOLTAGE	---	125	VOLTS
GRID #1 VOLTAGE	---	-1	VOLT
CATHODE-BIAS RESISTOR	56	---	OHMS
AMPLIFICATION FACTOR	40	---	
PLATE RESISTANCE (APPROX.)	5 000	140 000	OHMS
TRANSCONDUCTANCE	8 000	5 800	μMHOS
GRID #1 VOLTAGE (APPROX.)			
FOR PLATE CURRENT OF 100 μAMP	-7	-7	VOLTS
PLATE CURRENT	15	12	MA.
GRID #2 CURRENT	---	4.2	MA.

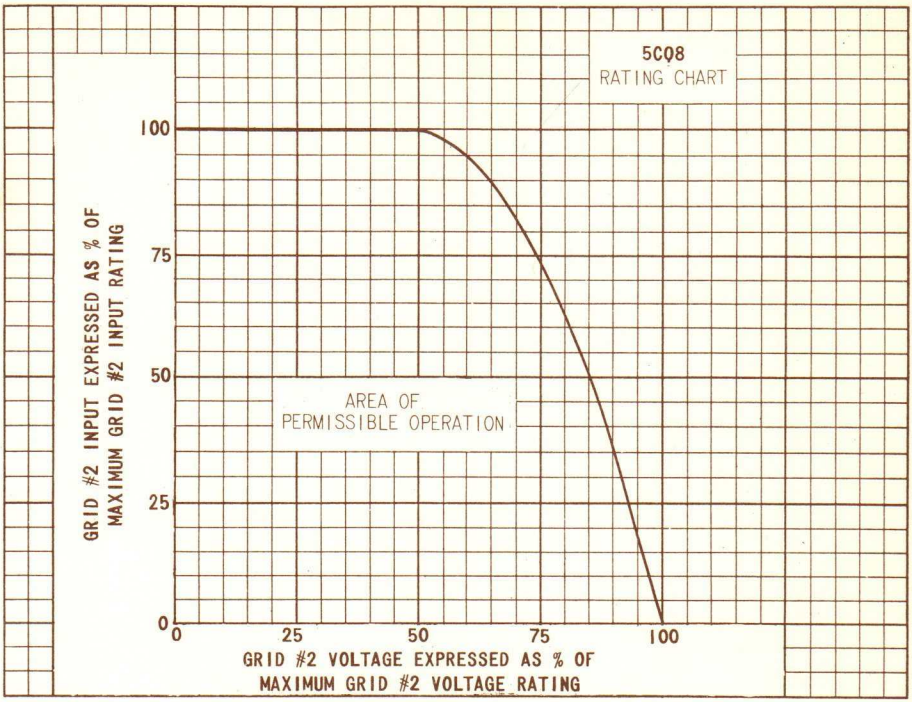
[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF UNIT UNDER TEST.

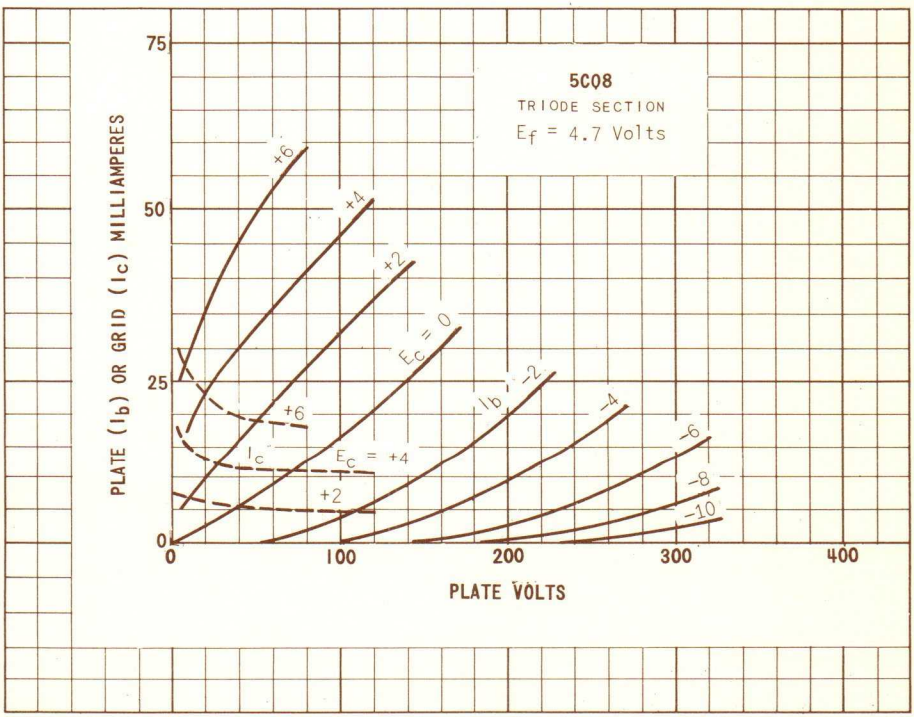
[B] WITH EXTERNAL SHIELD #315 CONNECTED TO GROUND.

[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.





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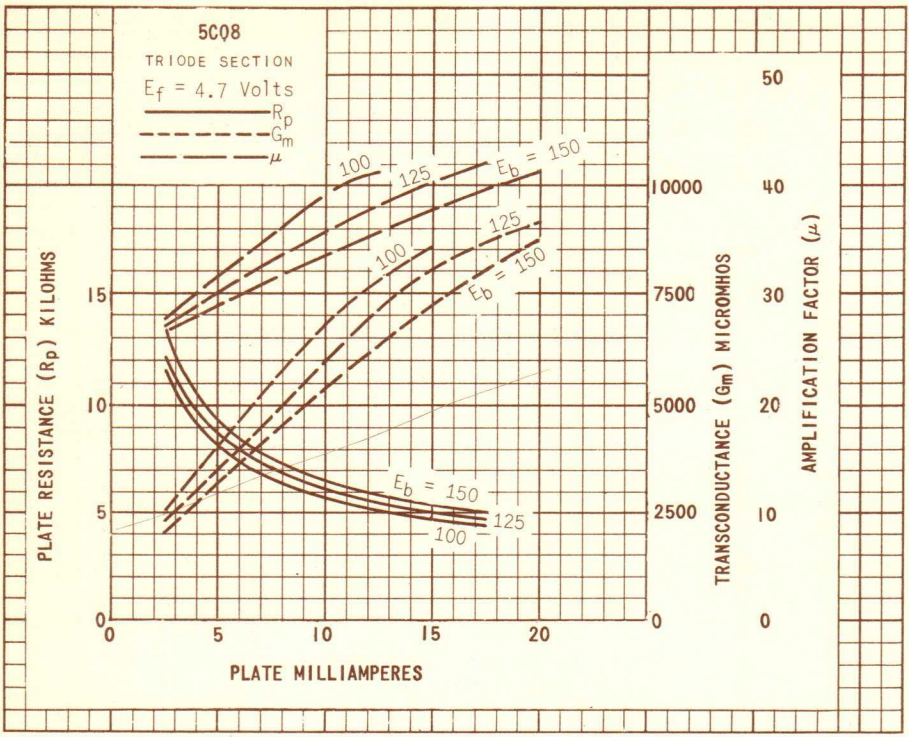
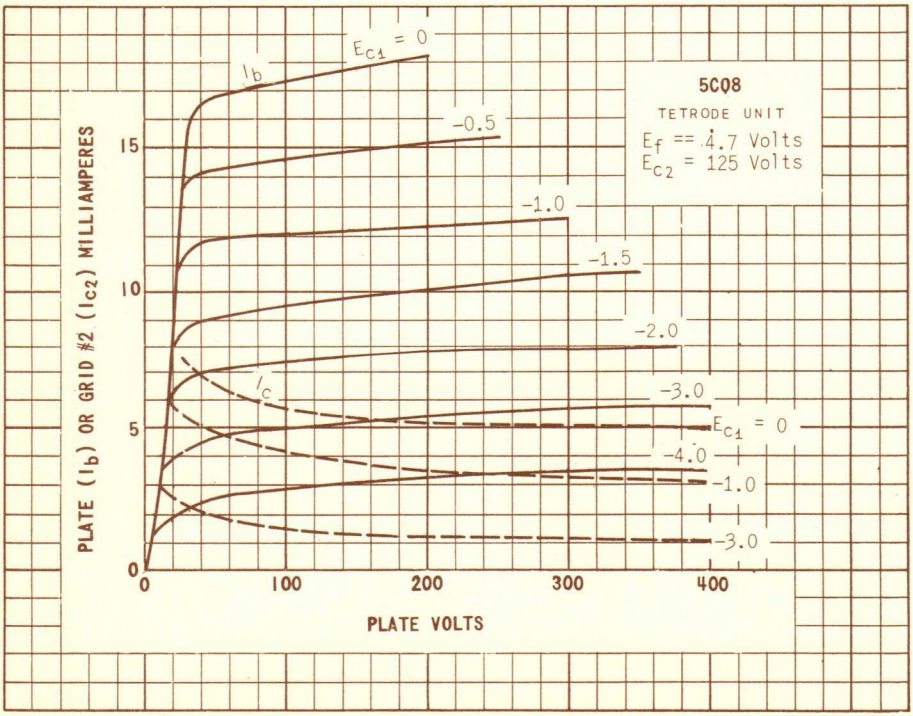
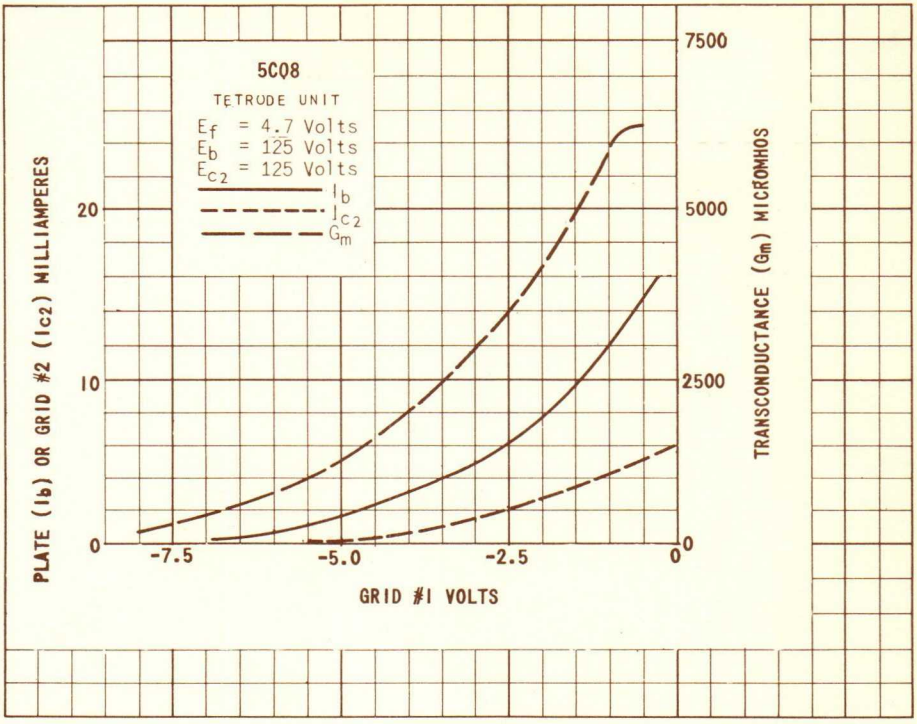

5CQ8
TRIODE SECTION
E_f = 4.7 Volts
R_p
G_m
μ
PLATE RESISTANCE (R_p) KILOHMS
TRANSCONDUCTANCE (G_m) MICROMHOS
AMPLIFICATION FACTOR (μ)
PLATE MILLIAMPERES
E_b = 150
125
100
0
5
10
15
20
2500
5000
7500
10000
30
40
50


5CQ8
TETRODE UNIT
E_f = 4.7 Volts
E_{c2} = 125 Volts
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
I_b
I_c
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-3.0
-4.0
0
100
200
300
400
5
10
15



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TRIODE-PENTODE

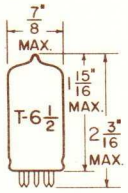
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

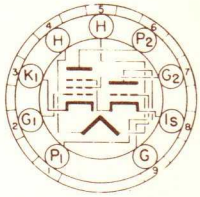
HEATER

4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BUB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9GJ

THE 5CR8 IS A MINIATURE TRIODE PENTODE USING THE 9-PIN MINIATURE CONSTRUCTION. THE PENTODE IS DESIGNED FOR TELEVISION IF AND CONTAINS A SUPPRESSOR INTERNALLY CONNECTED TO THE TRIODE CATHODE PERMITTING DEGENERATION IN THE PENTODE CATHODE. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER VOLTAGE AND CURRENT, THE 5CR8 IS IDENTICAL TO THE 6CR8.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

TRIODE:		
GRID TO PLATE: G TO P	1.6	μμf
INPUT: G TO (H + K)	2.6	μμf
OUTPUT: P TO (H + K)	1.4	μμf
PENTODE:		
GRID #1 TO PLATE: G_1 TO P (MAX.)	0.018	μμf
INPUT: G_1 TO (H+K+G_2+G_3+I.S.)	6.0	μμf
OUTPUT: P TO (H+K+G_2+G_3+I.S.)	2.8	μμf
COUPLING:		
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.10	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	0.14	μμf
PENTODE PLATE TO TRIODE GRID (MAX.)	0.011	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.75	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION		0.55	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
FIXED BIAS	0.5		MEGOHM
SELF BIAS	1.0		MEGOHM
HEATER WARM-UP TIME*	11.0		SECONDS

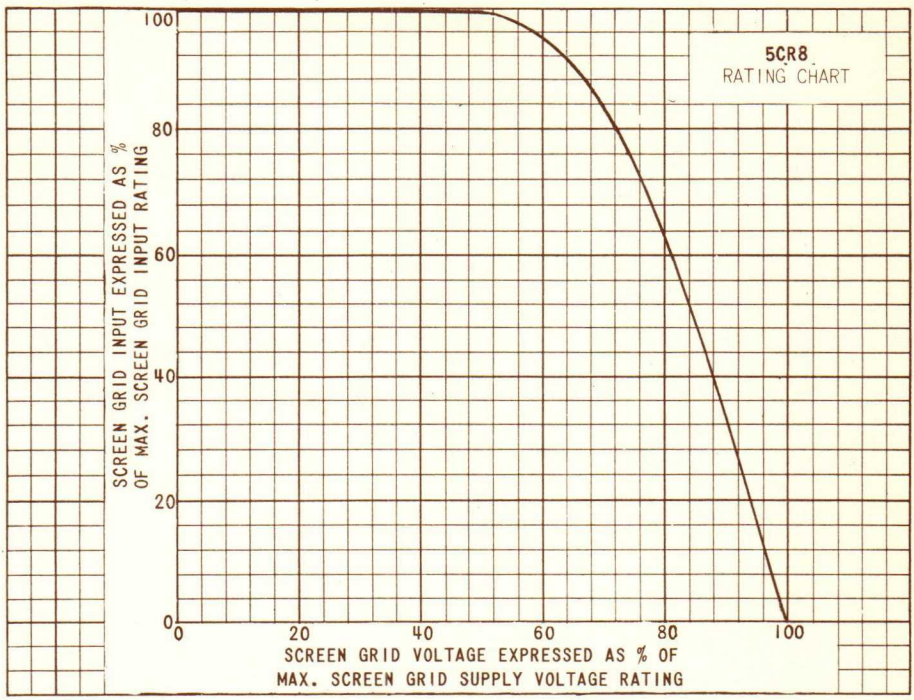
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE		125	VOLTS
GRID #1 VOLTAGE	-2	0	VOLTS
CATHODE BIAS RESISTOR		56	OHMS
PLATE CURRENT	12	13	MA.
GRID #2 CURRENT		3	MA.
AMPLIFICATION FACTOR	22		
TRANSCONDUCTANCE	4 000	7 700	μMHOS
PLATE RESISTANCE (APPROX.)	5 500	300 000	OHMS
GRID #1 VOLTAGE (APPROX.) FOR Ib = 10 μA	-13		VOLTS
GRID #1 VOLTAGE (APPROX.) FOR Ib = 20 μA		-6.5	VOLTS
PLATE CURRENT WITH E_{c1} =-3 Vdc, RK=0		2.8	MA.

[A] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.



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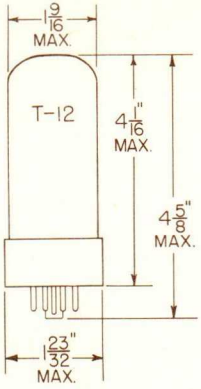
TUNG-SOL

RECTIFIER



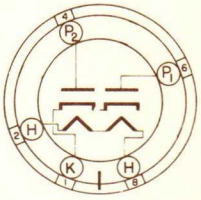
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

5.0 VOLTS 3.5 AMP.

ANY MOUNTING POSITION •



BOTTOM VIEW
SHORT MEDIUM SHELL
5 PIN OCTAL
8KD

THE 5CU4 IS AN INDIRECTLY-HEATED CATHODE TYPE RECTIFIER DESIGNED FOR USE IN TELEVISION RECIEVERS. THE HIGH PERVEANCE OF THE DESIGN PERMITS MAXIMUM DC VOLTAGE OUTPUT..

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	5.0	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	800	VOLTS
MAXIMUM AC PLATE VOLTAGE PER PLATE	285	VOLTS
MAXIMUM DC OUTPUT CURRENT	425	MA.
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	1.3	AMP.
MAXIMUM TRANSIENT PEAK PLATE CURRENT EACH PLATE	6.0	AMP.
TUBE VOLTAGE DROP	SEE CURVE	

TYPICAL OPERATION

FULL WAVE RECTIFIER WITH CAPACITANCE INPUT

HEATER VOLTAGE	5.0	VOLTS
HEATER CURRENT	3.5	AMP.
AC PLATE SUPPLY VOLTAGE EACH PLATE (R.M.S.)	260	VOLTS
INPUT CAPACITANCE	40	μfd
EFFECTIVE PLATE SUPPLY RESISTANCE (EACH PLATE)	30	OHMS
DC OUTPUT CURRENT	385	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	300	VOLTS

• IN SERVICE, CATHODE SHOULD BE CONNECTED TO HEATER.

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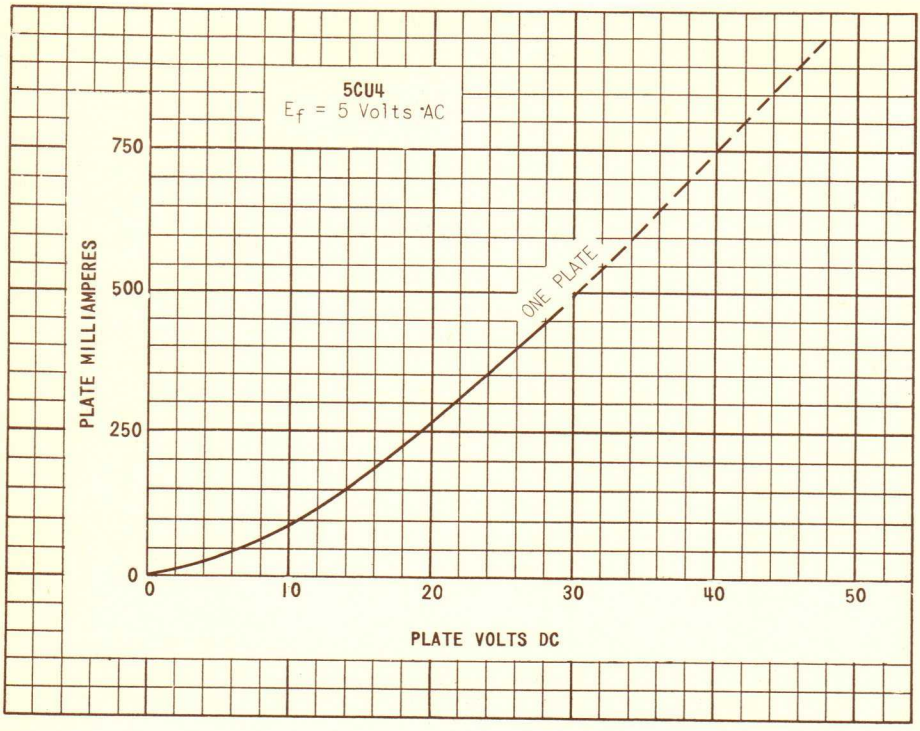
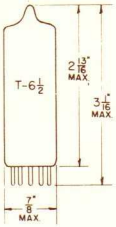
TENTATIVE DATA



TUNG-SOL

BEAM POWER PENTODE

MINIATURE TYPE

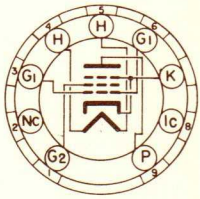


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6±10% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN NOVAL

9HN

THE 5CZ5 IS A HIGH PERVEANCE BEAM POWER PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS INTENDED PRIMARILY FOR USE AS A VERTICAL-DEFLECTION AMPLIFIER TUBE IN HIGH-EFFICIENCY DEFLECTION CIRCUITS OF TELEVISION RECEIVERS UTILIZING PICTURE TUBES HAVING DIAGONAL DEFLECTION ANGLES OF 110 DEGREES AND OPERATING AT VOLTAGES UP TO 18,000 VOLTS. IT IS ALSO USEFUL IN THE AUDIO OUTPUT STAGES OF TELEVISION AND RADIO RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.4	μμf
GRID #1 TO: (K+G_3+G_2+H)	9.0 ←	μμf
PLATE TO: (K+G_3+G_2+H)	6.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VERTICAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	4.7	**VOLTS**
MAXIMUM PLATE VOLTAGE:		
DC	315	VOLTS
PEAK POSITIVE PULSE (ABS. MAX.)[B]	2 200[C]	VOLTS
MAXIMUM GRID #2 VOLTAGE	315 ←	VOLTS
MAXIMUM PEAK NEGATIVE-PULSE GRID #1 VOLTAGE	-275 ←	VOLTS
MAXIMUM CATHODE CURRENT:		
PEAK	155 ←	MA.
AVERAGE	45 ←	MA.
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 INPUT	2.2 ←	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[D]	VOLTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	250	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D.
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VERTICAL DEFLECTION AMPLIFIER[A]

MAXIMUM CIRCUIT VALUES

GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.5	MEGOHM
FOR CATHODE-BIAS OPERATION	1	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	75	250	VOLTS
GRID #2 (SCREEN-GRID) VOLTAGE	250	250	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	0	-14	VOLTS
PLATE RESISTANCE (APPROX.)	---	73 000	OHMS
TRANSCONDUCTANCE	---	4 800	μMHOS
PLATE CURRENT	130[G]	46	MA.
GRID #2 CURRENT	16[G]	4.6	MA.
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 100 μAMP.	---	-40 ←	VOLTS

NOTES

[A] AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS", FEDERAL COMMUNICATIONS COMMISSION.

[B] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15 PER CENT OF ONE VERTICAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15 PER CENT OF ONE SCANNING CYCLE IS 2.5 MILLISECONDS.

[C] UNDER NO CIRCUMSTANCES SHOULD THIS ABSOLUTE VALUE BE EXCEEDED.

[D] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[E] SUBSCRIPT 1 INDICATES THAT GRID #1 CURRENT DOES NOT FLOW DURING ANY PART OF THE INPUT CYCLE.

[F] THE TYPE OF INPUT COUPLING NETWORK USED SHOULD NOT INTRODUCE TOO MUCH RESISTANCE IN THE GRID #1 CIRCUIT. TRANSFORMER OR IMPEDANCE-COUPLING DEVICES ARE RECOMMENDED

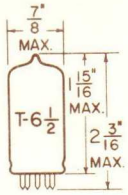
[G] THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RE-CURRENT WAVEFORM SUCH THAT THE PLATE DISSIPATION AND GRID #2 INPUT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

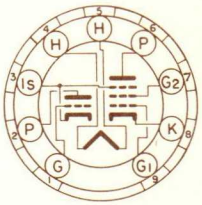


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
5.2 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9EG

THE 5DH8 IS A MINIATURE TUBE CONTAINING A SHARP-CUTOFF PENTODE AND A HIGH-MU TRIODE IN ONE ENVELOPE. THE PENTODE SECTION IS INTENDED FOR USE AS A VIDEO IF AMPLIFIER OR AS AN AUDIO IF AMPLIFIER. PROVIDED THE CATHODE IS GROUNDED, THE TRIODE SECTION MAY BE USED AS A VERTICAL OSCILLATOR, SYNC AMPLIFIER, SYNC SEPARATOR, OR SYNC CLIPPER. AN INTERNAL CONNECTION BETWEEN THE PENTODE SUPPRESSOR AND TRIODE CATHODE ALLOWS THE SUPPRESSOR TO BE GROUNDED WHEN A CATHODE BIAS RESISTOR IS EMPLOYED FOR THE PENTODE SECTION. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE SECTION:		
GRID #1 TO PLATE (MAX.)	0.03	μμf
INPUT: G_1 TO (K+H+S)	6.5	μμf
OUTPUT: PLATE TO (K+S+TK+I.S.+H&SUPPRESSOR)	2.2	μμf
PLATE TO (K+S & H)	4.2	μμf
TRIODE SECTION:		
GRID TO PLATE	1.6	μμf
INPUT: G TO (K+I.S.+H & P_S)	2.4	μμf
OUTPUT: P TO (K+I.S.+H & P_S)	1.4	μμf
PENTODE GRID #1 TO TRIODE PLATE	0.008	μμf
TRIODE GRID TO PENTODE PLATE	0.005	μμf
PENTODE PLATE TO TRIODE PLATE	0.04	μμf

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TUNG-SOL

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RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER SERVICE

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	5.2	5.2	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	300	---	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	2.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.55	---	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS	0.25	0.5	MEGOHMS
WITH CATHODE BIAS	1.0	1.0	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

VERTICAL OSCILLATOR SERVICE[A]

	TRIODE SECTION	
HEATER VOLTAGE	5.2	VOLTS
MAXIMUM DC PLATE VOLTAGE	300	VOLTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATTS
MAXIMUM DC CATHODE CURRENT	12	MA.
MAXIMUM PEAK CATHODE CURRENT	35	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
MAXIMUM GRID CIRCUIT RESISTANCE:		
WITH FIXED BIAS	2.2	MEGOHMS
WITH CATHODE BIAS	2.2	MEGOHMS
WITH GRID-LEAK BIAS	2.2	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	5.2	5.2	VOLTS
HEATER CURRENT	0.6±6%	0.6±6%	AMP.
PLATE VOLTAGE	125	250	VOLTS
SCREEN VOLTAGE	125	---	VOLTS
GRID #1 VOLTAGE	---	---	VOLTS
CATHODE-BIAS RESISTOR	56	390	OHMS
AMPLIFICATION FACTOR	---	53	

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

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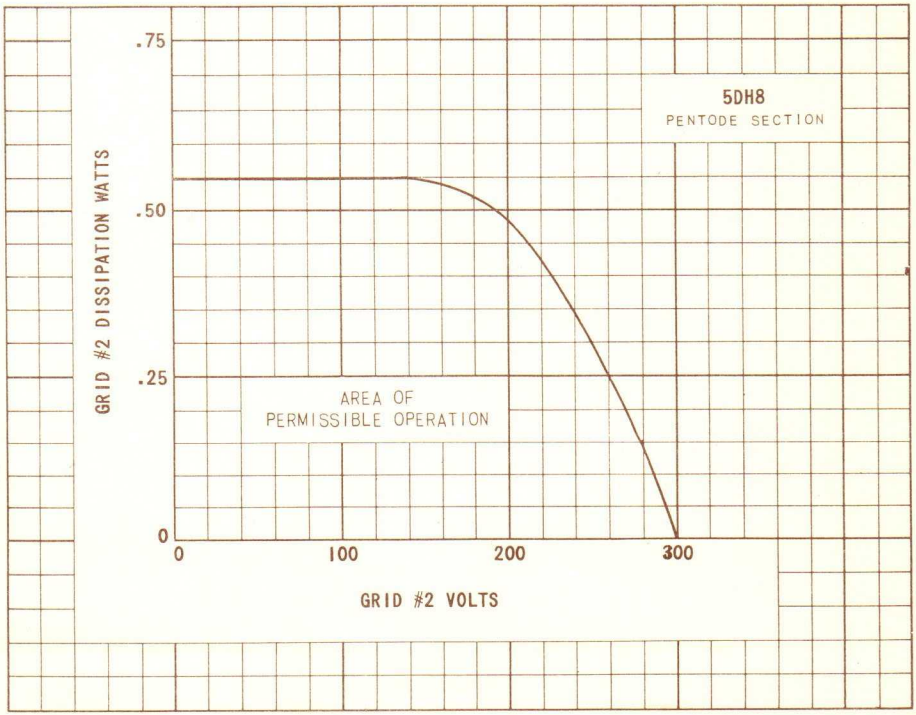
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

	PENTODE SECTION	TRIODE SECTION	
PLATE RESISTANCE (APPROX.)	150 000	12 000	VOLTS
TRANSCONDUCTANCE	8 600	4 400	μMHOS
PLATE CURRENT	13.5	7.3	MA.
SCREEN CURRENT	3.8	---	MA.
GRID #1 VOLTAGE (APPROX.)			
Tb = 10 μAMPS	---	-10	VOLTS
Ib = 20 μAMPS	-6	---	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

AFOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.



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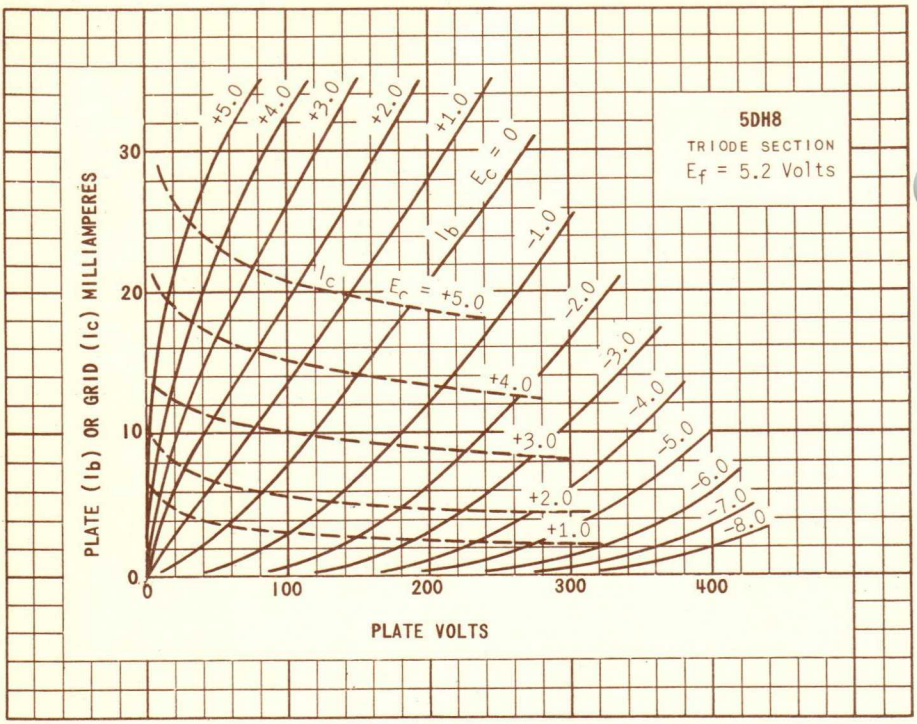
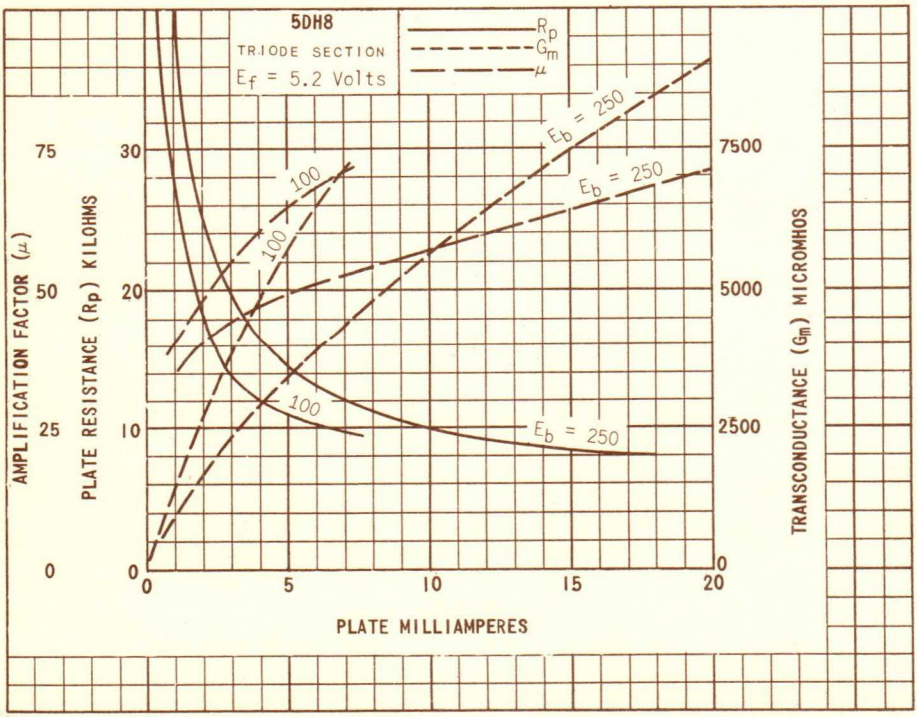
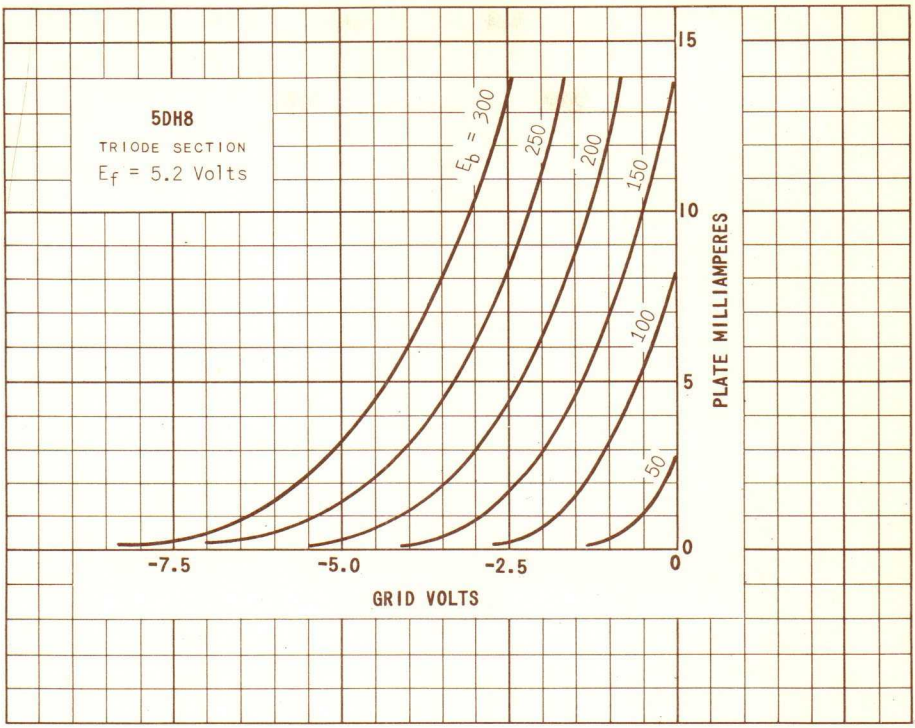
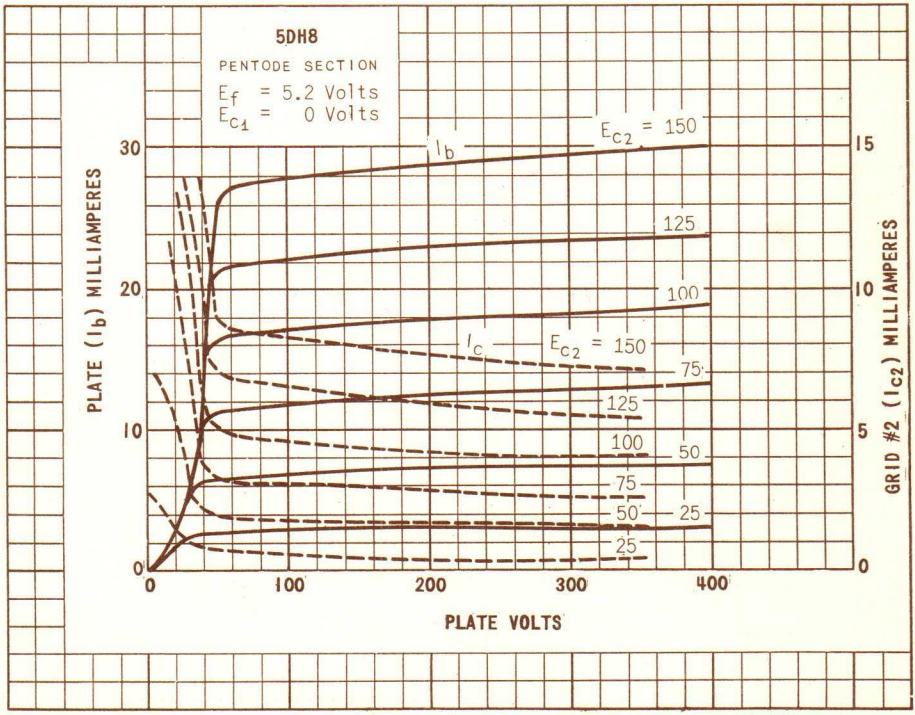

5DH8
TRIODE SECTION
E_f = 5.2 Volts
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
Ib
Ic
Ec = 0
+5.0
+4.0
+3.0
+2.0
+1.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
Ec = +5.0
0
10
20
30
100
200
300
400


5DH8
TRIODE SECTION
E_f = 5.2 Volts
R_p
G_m
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (R_p) KILOHMS
TRANSCONDUCTANCE (G_m) MICROMHOS
PLATE MILLIAMPERES
E_b = 250
100
0
25
50
75
10
20
30
2500
5000
7500
5
15





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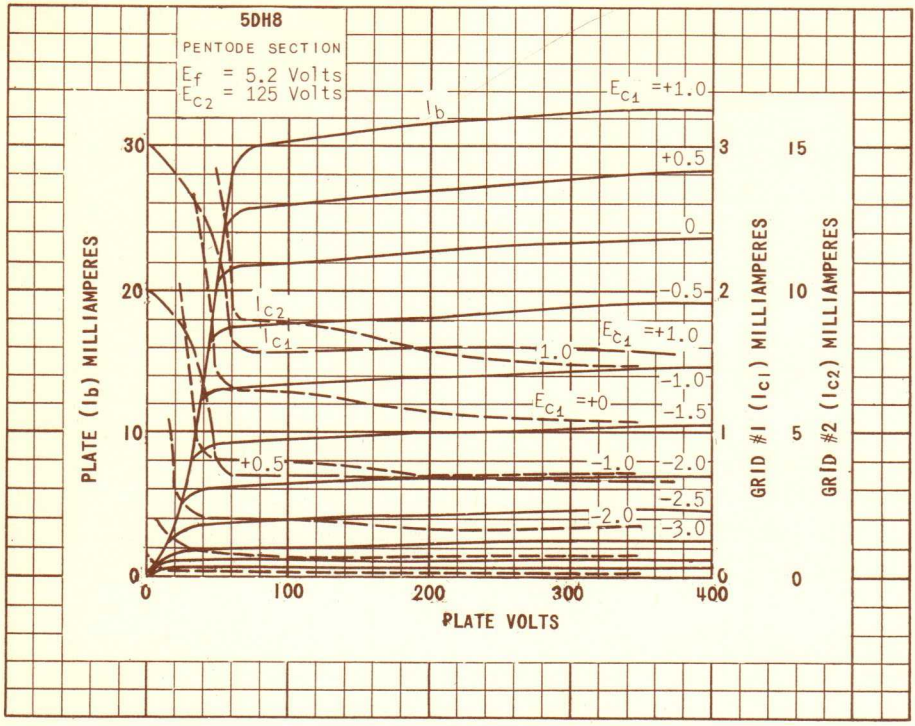
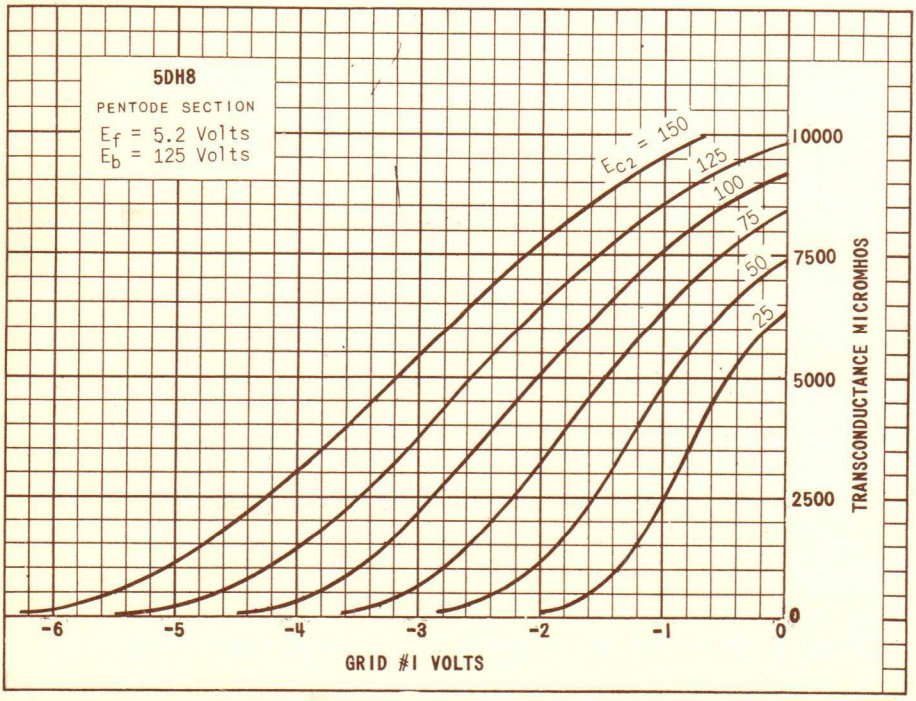
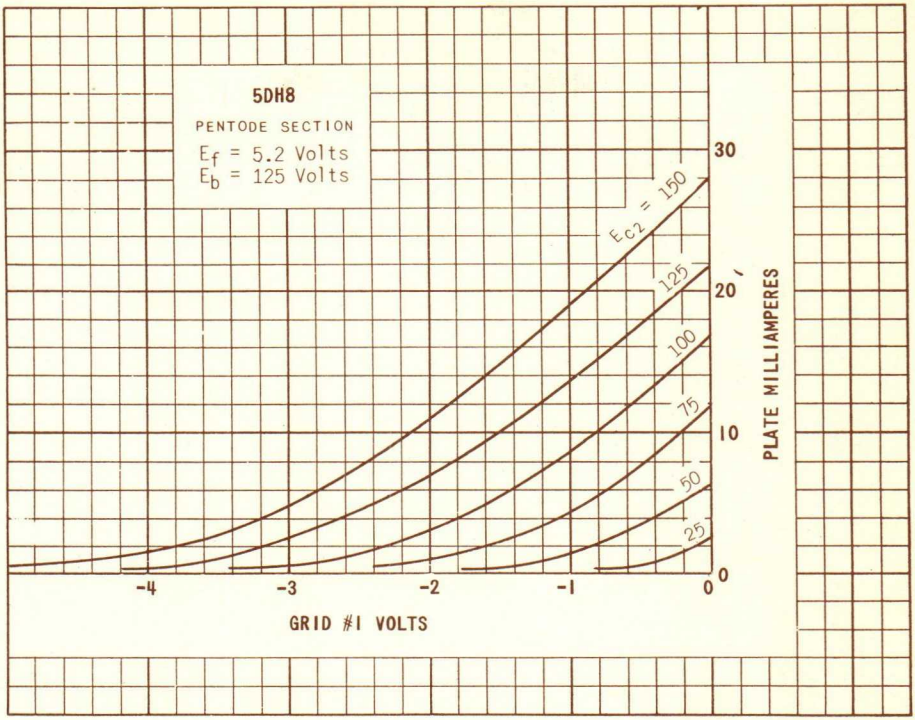
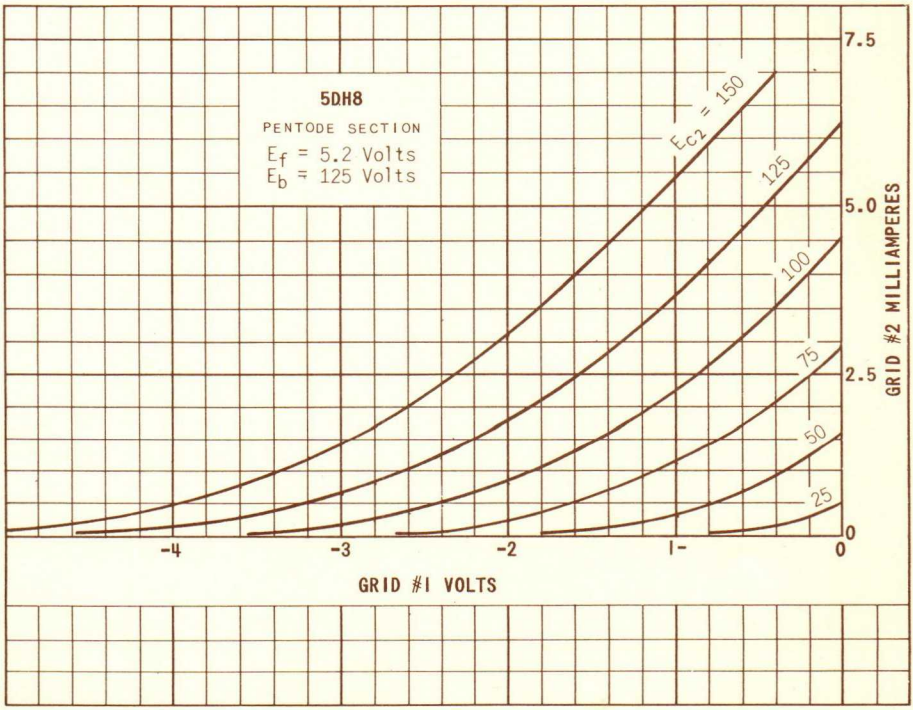

5DH8
PENTODE SECTION
Ef = 5.2 Volts
Ec2 = 125 Volts
Ib
Ec1 =+1.0
+0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
Ic2
Ic1
PLATE (Ib) MILLIAMPERES
GRID #1 (Ic1) MILLIAMPERES
GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
10
20
30
1
2
3
5
10
15


5DH8
PENTODE SECTION
Ef = 5.2 Volts
Eb = 125 Volts
Ec2 = 150
125
100
75
50
25
TRANSCONDUCTANCE MICROMHOS
GRID #1 VOLTS
-6
-5
-4
-3
-2
-1
0
10000
7500
5000
2500
0





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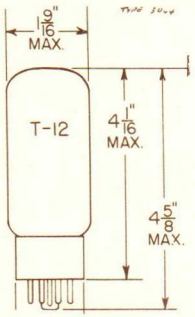
TUNG-SOL

POWER RECTIFIER



GLASS BULB
12-16

COATED FILAMENT CATHODE

FILAMENT

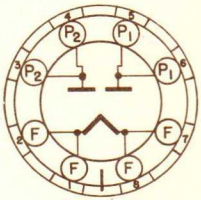
5.0 VOLTS 3.0 AMP.[A]

AC OR DC

[A] 1.5 AMP PER BASE LEAD

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION PERMITTED IF PIN 2 & 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
SHORT MEDIUM SHELL
8 PIN OCTAL
8KS

THE 5DJ4 IS A HIGH-VACUUM POWER RECTIFIER WITH DOUBLE FILAMENT LEADS AND DOUBLE PLATE LEADS WHICH REDUCE THE CURRENT THROUGH EACH LEAD TO ONE-HALF THE CURRENT OF SINGLE LEAD TUBES.

ELECTRICALLY, THE 5DJ4 IS IDENTICAL TO THE 5U4GB AND MAY BE USED FOR THE SAME APPLICATIONS.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

RECTIFIER SERVICE[B]

MAXIMUM VOLTAGE, PEAK INVERSE	1700	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE, RMS (RATING CHART 1)	600	VOLTS
MAXIMUM DC OUTPUT CURRENT (RATING CHART 1)		
MAXIMUM STEADY-STATE PEAK PLATE CURRENT, EACH PLATE (RATING CHART 2)	1.0	AMP.
MAXIMUM TRANSIENT PEAK PLATE CURRENT, EACH PLATE (RATING CHART 3)	5.0	AMP.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

TUBE CONDUCTING:		
225 MA (EACH PLATE)	44	VOLTS
275 MA (EACH PLATE)	50	VOLTS
300 MA (EACH PLATE)	54	VOLTS

FULL-WAVE RECTIFIER - CAPACITOR INPUT FILTER

PLATE SUPPLY VOLTAGE, RMS (EACH PLATE)[C]	300	450	VOLTS
PLATE SUPPLY RESISTANCE (EACH PLATE)	21	67	OHMS
FILTER INPUT CAPACITOR	40	40	μf
OUTPUT CURRENT, DC	300	275	MA
OUTPUT VOLTAGE AT FILTER INPUT, DC	290	460	VOLTS

[B] FOR USE WITH SINUSOIDAL SUPPLY VOLTAGES WITHIN THE FREQUENCY RANGE OF 25 TO 1000 C.P.S.

[C] THE INDICATED AC SUPPLY VOLTAGE IS MEASURED WITHOUT LOAD.

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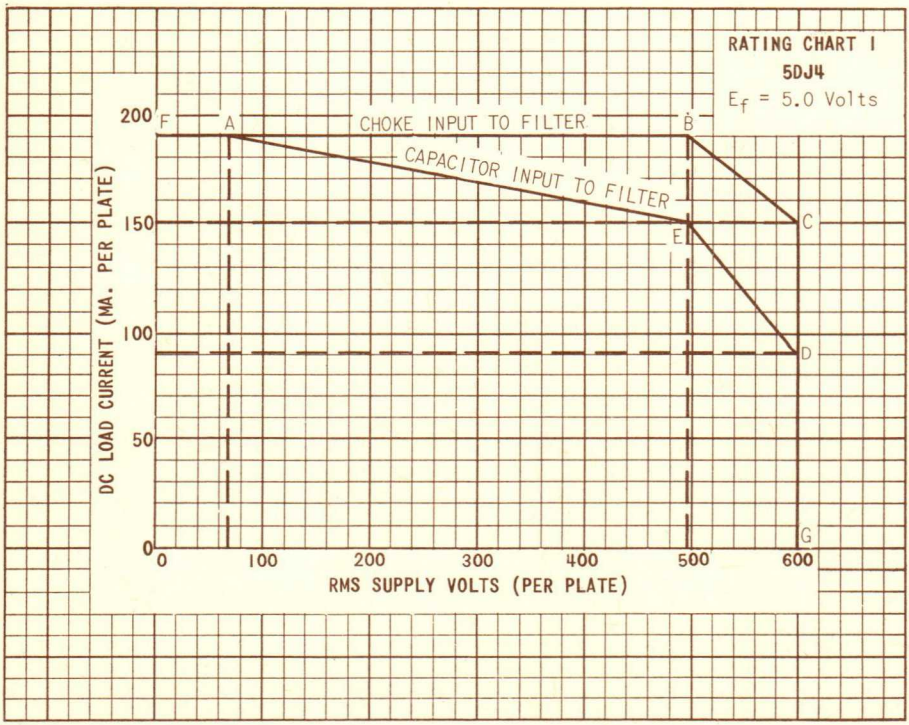
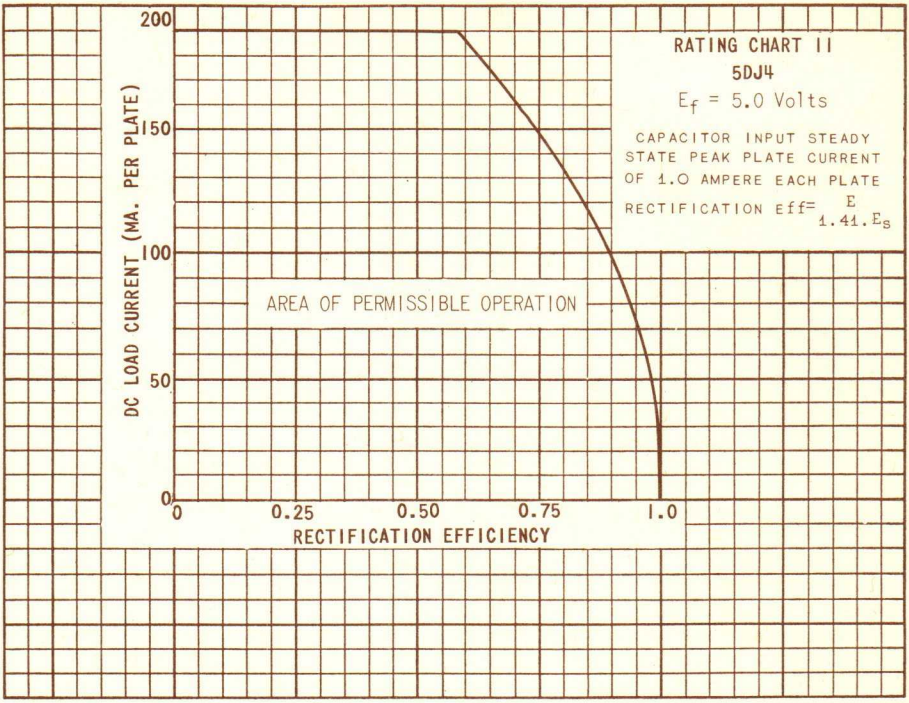
TYPICAL OPERATING CONDITIONS AND CHARAGTERISTICS - cont'd.

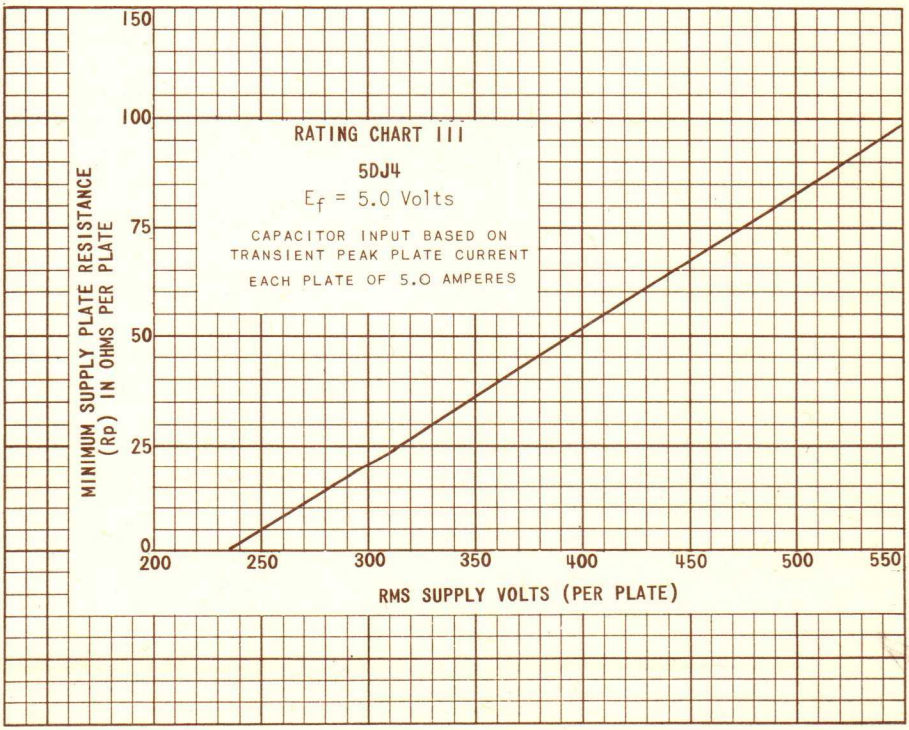
FULL-WAVE RECTIFIER - CHOKE INPUT FILTER

PLATE SUPPLY VOLTAGE, RMS (EACH PLATE)[C]	550	VOLTS
FILTER INPUT CHOKE	10	HENRYS
OUTPUT CURRENT, DC	275	MA
OUTPUT VOLTAGE AT FILTER INPUT, DC	420	VOLTS

[C] THE INDICATED AC SUPPLY VOLTAGE IS MEASURED WITHOUT LOAD.







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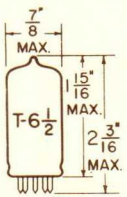
TRIODE PENTODE
MINIATURE TYPE

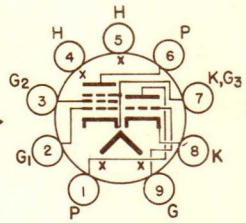


GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9AE

THE 5EA8 IS A SHARP CUTOFF PENTODE AND A TRIODE IN THE 9-PIN MINIATURE CONSTRUCTION. EACH SECTION HAS ITS OWN CATHODE AND IS ELECTRICALLY INDEPENDENT. THE TUBE IS INTENDED PRIMARILY FOR USE AS A COMBINED TRIODE OSCILLATOR AND PENTODE MIXER IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, THE 5EA8 IS IDENTICAL TO THE 6EA8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
PENTODE SECTION:			
GRID #1 TO PLATE: (Pg1 TO Pp) (MAX.)	0.01	0.02	pf
INPUT: Pg1 TO (H+Pk+Pg2+Pg3+I.S.)	5.0	5.0	pf
OUTPUT: Pp TO (H+Pk+Pg2+Pg3+I.S.)	3.4	2.6	pf
HEATER TO CATHODE:(Pk TO h)	3.0[B]	3.0	pf
TRIODE SECTION:			
GRID TO PLATE: (Tg TO Tp)	1.7	1.7	pf
INPUT: Tg TO (Tk+H+Pk+Pg3+I.S.)	3.2	3.0	pf
OUTPUT: Tp TO (Tk+H+Pk+Pg3+I.S.)	1.1	0.3	pf
HEATER TO CATHODE: (Tk TO H)	3.0	3.0	pf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	4.7	4.7	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	330	---	VOLTS
MAXIMUM SCREEN VOLTAGE			
MAXIMUM POSITIVE-DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	3.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.55	---	WATTS

→ INDICATES A CHANGE.

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RATINGS – CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION	TRIODE SECTION	
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER WARM-UP TIME*	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

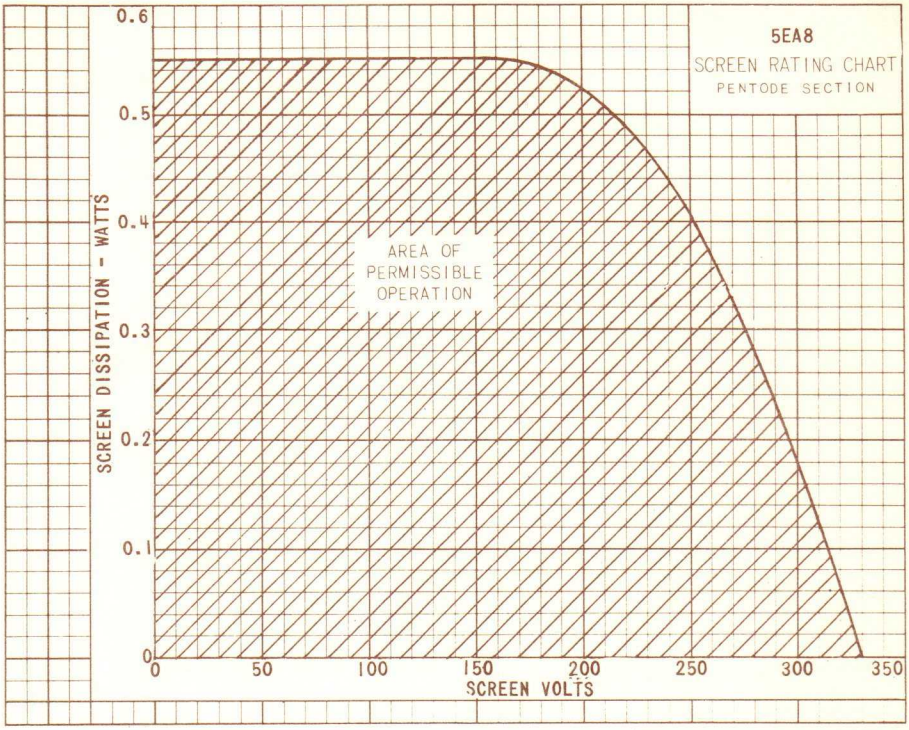
	PENTODE SECTION	TRIODE SECTION	
PLATE VOLTAGE	125	150	VOLTS
SCREEN VOLTAGE	125	---	VOLTS
GRID #1 VOLTAGE	-1.0	---	
CATHODE-BIAS RESISTOR	---	56	OHMS
AMPLIFICATION FACTOR	---	40	
PLATE RESISTANCE (APPROX.)	200 000	5 000	OHMS
TRANSCONDUCTANCE	6 400	8 500	μAMPS
PLATE CURRENT	12	18	MA.
SCREEN CURRENT	4.0	---	MA.
GRID #1 VOLTAGE (APPROX.)			
I_b = 10 μAMPS.	-9	-12	VOLTS

[A] WITH EXTERNAL SHIELD 315 CONNECTED TO CATHODE OF SECTION UNDER TEST UNLESS OTHERWISE INDICATED.

[B] WITH EXTERNAL SHIELD 315 CONNECTED TO GROUND.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.



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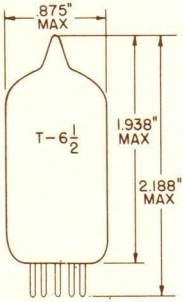
TUNG-SOL



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

TRIODE PENTODE

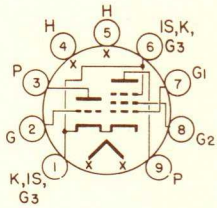
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER

4.7 VOLTS 600 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9JG

THE 5EH8 IS A MEDIUM MU-TRIODE AND A SHARP CUTOFF PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS INTENDED PRIMARILY FOR USE AS A COMBINED VHF OSCILLATOR AND MIXER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT THE HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315	WITHOUT SHIELD	
TRIODE:*			
GRID TO PLATE	1.8	1.8	pf
INPUT: G TO (H+K+P_K+P_{G3}+I.S.)	2.8	2.8	pf
OUTPUT: P TO (H+K+P_K+P_{G3}+I.S.)	2.2	1.7	pf
PENTODE:*			
GRID #1 TO PLATE (MAX.)	.012	.020	pf
INPUT: G_1 TO (H+K+G_2+G_3+TK+I.S.)	4.8	4.8	pf
OUTPUT: P TO (H+K+G_2+G_3+TK+I.S.)	3.2	2.4	pf
CATHODE TO HEATER: H TO (TK+PK+P_{G3}+I.S.)	7.5	7.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE SECTION	PENTODE SECTION	
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		300	VOLTS
MAXIMUM GRID #2 VOLTAGE			
MAXIMUM PLATE DISSIPATION	2.5	2.8	WATTS
MAXIMUM GRID #2 DISSIPATION		0.5	WATT

*INDICATES AN ADDITION.

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM [A]

	TRIODE SECTION	PENTODE SECTION	
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS	0.5	0.25	MEGOHM
WITH SELF BIAS	1.0	1.0	MEGOHM
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
HEATER WARM-UP TIME*	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE SECTION	PENTODE SECTION		
PLATE VOLTAGE	125	100	125	VOLTS
GRID #2 VOLTAGE		70	125	VOLTS
GRID #1 VOLTAGE	-1.0	0	-1.0	VOLTS
PLATE CURRENT	13.5		12	MA.
GRID #2 CURRENT			4.0	MA.
TRANSCONDUCTANCE	7500	6500	6000	μMHOS
AMPLIFICATION FACTOR	40			
PLATE RESISTANCE (APPROX.)			0.17	MEGOHM
GRID #1 VOLTAGE FOR I_b=20 μA (APPROX.)	-9		-10	VOLTS

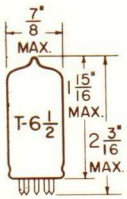
[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



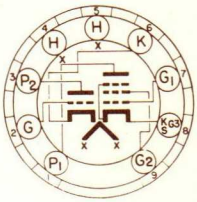
GLASS BULB

HEATER

4.7 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON

9 PIN BASE

9JF

THE 5EU8 IS A HEATER-CATHODE TYPE TRIODE-PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR THE USE AS A COMBINED TRIODE OSCILLATOR AND PENTODE MIXER IN TELEVISION RECEIVERS. THE TRIODE HAS A CONTROLLED CATHODE WARM-UP CHARACTERISTIC. EXCEPT FOR HEATER CHARACTERISTICS, THE 5EU8 IS IDENTICAL TO THE 6EU8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD	WITHOUT SHIELD	
PENTODE SECTION:			
GRID #1 TO PLATE: (G1 TO P) (MAX.)	0.10	0.02	μμf
INPUT: G1 TO (H+K)	5.0	5.0	μμf
OUTPUT: P TO (H+K)	3.4	2.6	μμf
TRIODE SECTION:			
GRID TO PLATE: (G TO P)	1.7	1.7	μμf
INPUT: G TO (H+K)	3.2	3.0	μμf
OUTPUT: P TO (H+K+S)	1.1	1.6	μμf
CATHODE TO HEATER (EACH SECTION): (K TO H)	3.60	3.60	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER MAXIMUM SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	330	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	3.1	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.55	WATTS
MAXIMUM GRID #1 RESISTANCE	100	100	KILOHMS

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TUNG-SOL

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RATINGS - cont'd.

INTERPRETED ACCORDING TO DESIGN CENTER MAXIMUM SYSTEM

HEATER VOLTAGE	4.7	VOLTS
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
HEATER WARM-UP TIME*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

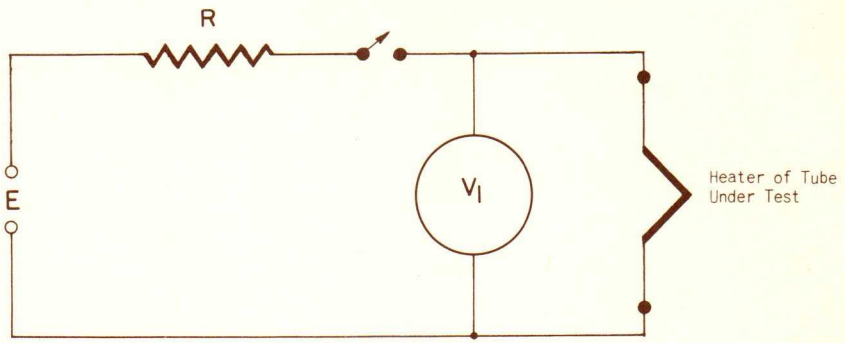
	TRIODE	PENTODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	150	125	VOLTS
GRID #2 VOLTAGE	---	125	VOLTS
CATHODE RESISTOR	56	---	OHMS
GRID #1 VOLTAGE	---	-1.0	VOLT
AMPLIFICATION FACTOR	40.0	---	
TRANSCONDUCTANCE	8500	6400	μMHOS
PLATE RESISTANCE (APPROX.)	5000	80000	OHMS
PLATE CURRENT	18.0	12.0	MA.
GRID #2 CURRENT	---	4.0	MA.
GRID #1 VOLTAGE (APPROX.) FOR Ib = 10μA	-12.0	-9.0	VOLTS
CATHODE WARM-UP TIME[A]	35	---	SECONDS

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TERMINALS TO INCREASE FROM ZERO TO THE HEATER TEST VOLTAGE (V_1).

FOR TYPE	5EU8
E=	18.8
V_1=	3.76
R=	23.5

A. CATHODE WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR TRANSCONDUCTANCE TO REACH 6500 μMHOS WHEN A TUBE IS OPERATED FROM A COLD START AT A PLATE POTENTIAL OF 100 VOLTS DC, ZERO GRID BIAS, AND AT A CONSTANT HEATER CURRENT OF 560 MILLIAMPERES FOR 5EU8 OR A HEATER POTENTIAL OF 5.5 VOLTS FOR THE 6EU8.

TUNG-SOL



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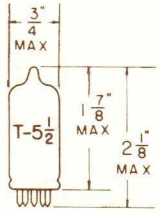
TUNG-SOL

PENTODE

MINIATURE TYPE



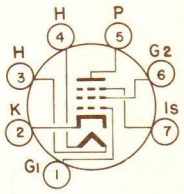
COATED UNIPOTENTIAL CATHODE

HEATER

5.6 VOLTS 0.45±.03 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-2

BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CM

THE 5EW6 IS A SHARP CUTOFF PENTODE IN THE 7-PIN MINIATURE CONSTRUCTION AND HAS BEEN DESIGNED FOR INTERMEDIATE AMPLIFIER SERVICE IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 5EW6 IS IDENTICAL TO THE 6EW6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID #1 TO PLATE (MAX.)	0.03	0.04	μμf
INPUT	10.0	10.0	μμf
OUTPUT	3.4	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM VALUES

HEATER VOLTAGE	5.6	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	330	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	WATTS
MAXIMUM SCREEN DISSIPATION	0.65	WATTS
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
HEATER WARM-UP TIME (AVG.) *	11	SECONDS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A] WITH EXTERNAL SHIELD (EIA 316) CONNECTED TO CATHODE.

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TUNG-SOL

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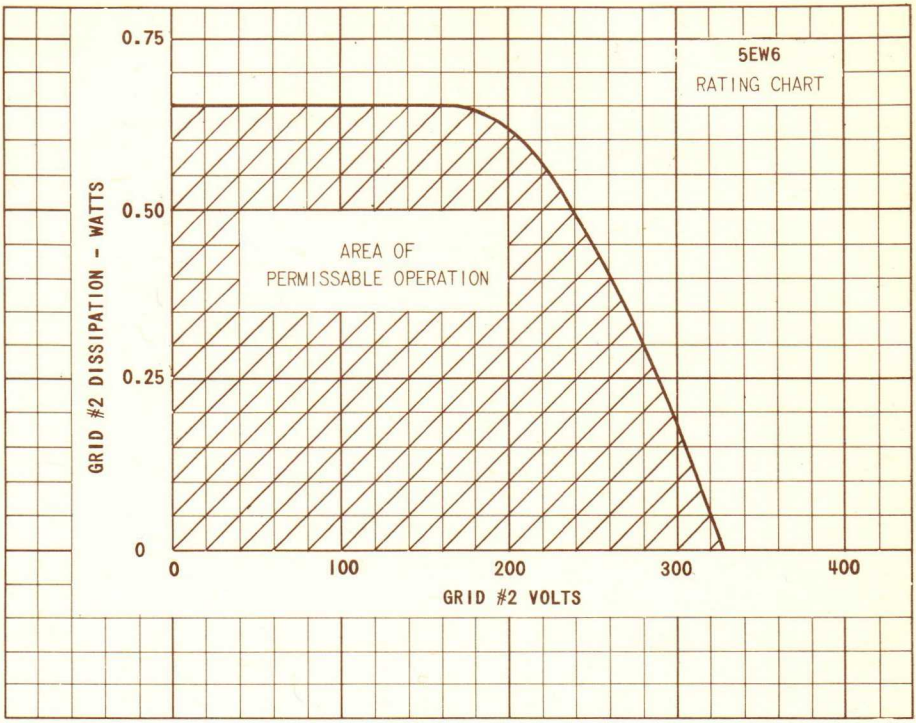
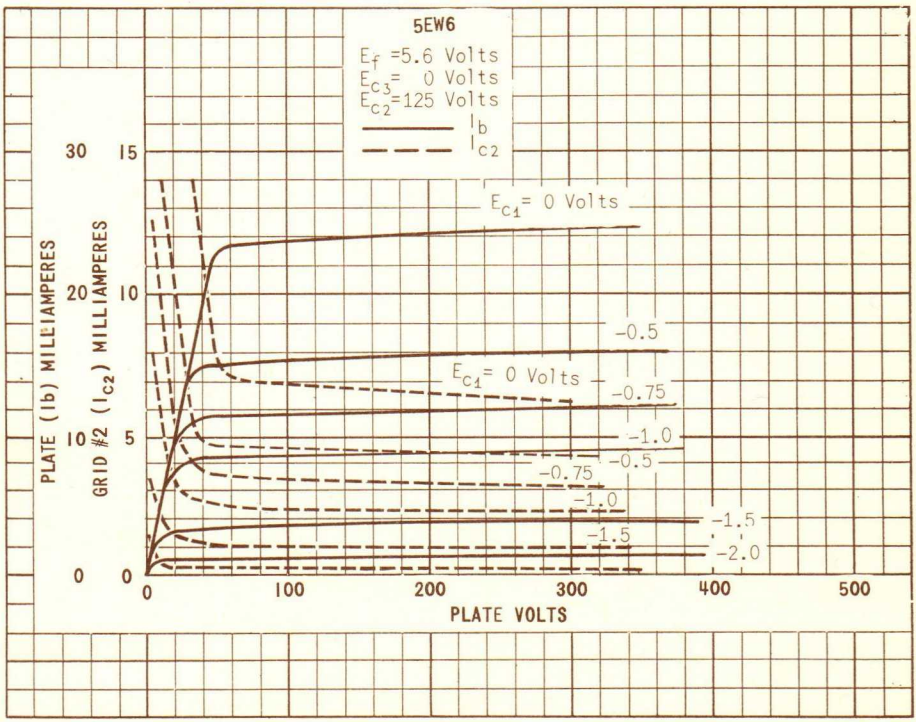
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	125	VOLTS
SUPPRESSOR, CONNECTED TO CATHODE AT SOCKET		
SCREEN VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.2	MEGOHMS
TRANSCONDUCTANCE	14 000	μMHOS
PLATE CURRENT	11	MA.
SCREEN CURRENT	3.2	MA.
GRID #1 VOLTAGE (APPROX.) I_b= 20 μAMPS.	-3.5	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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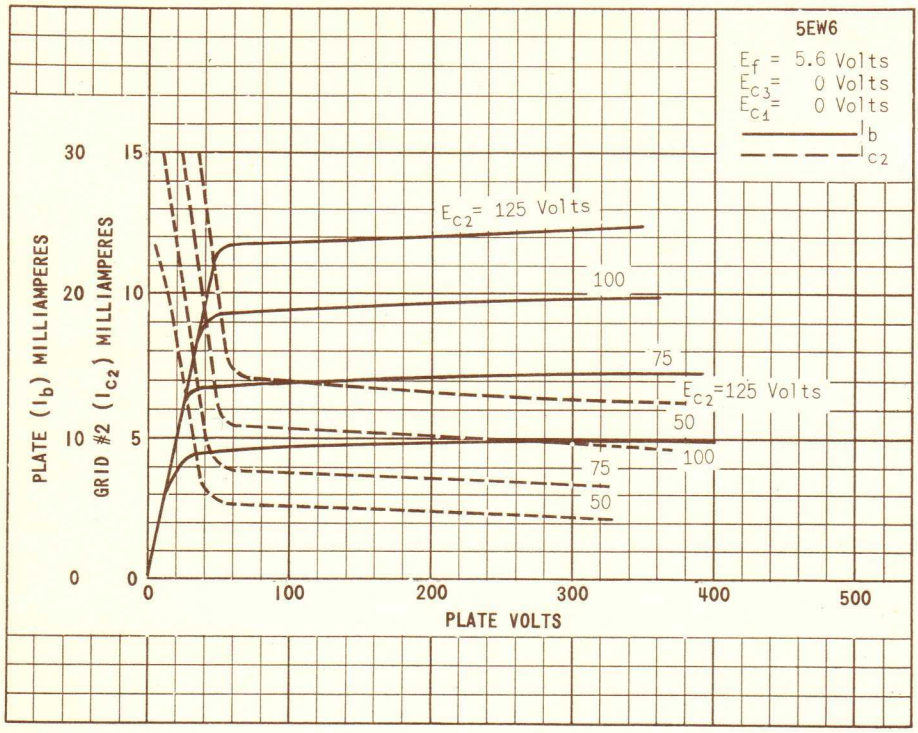
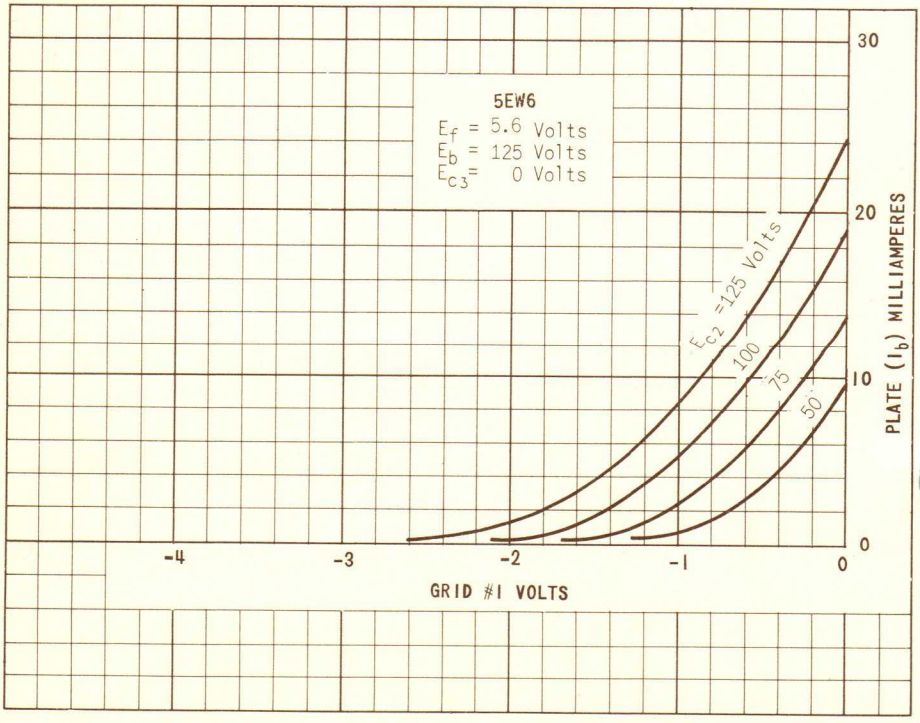
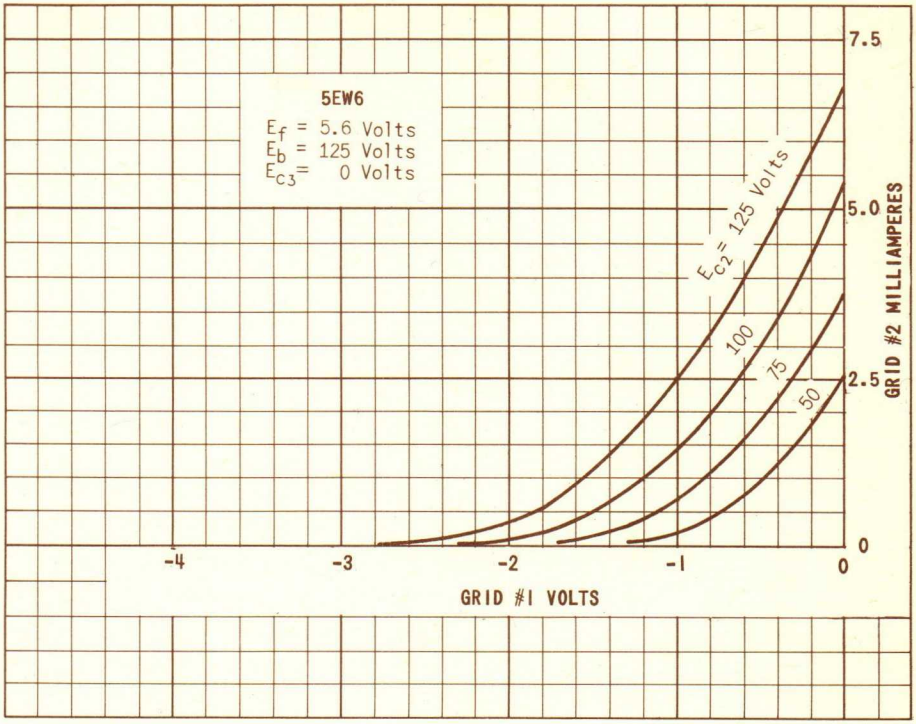
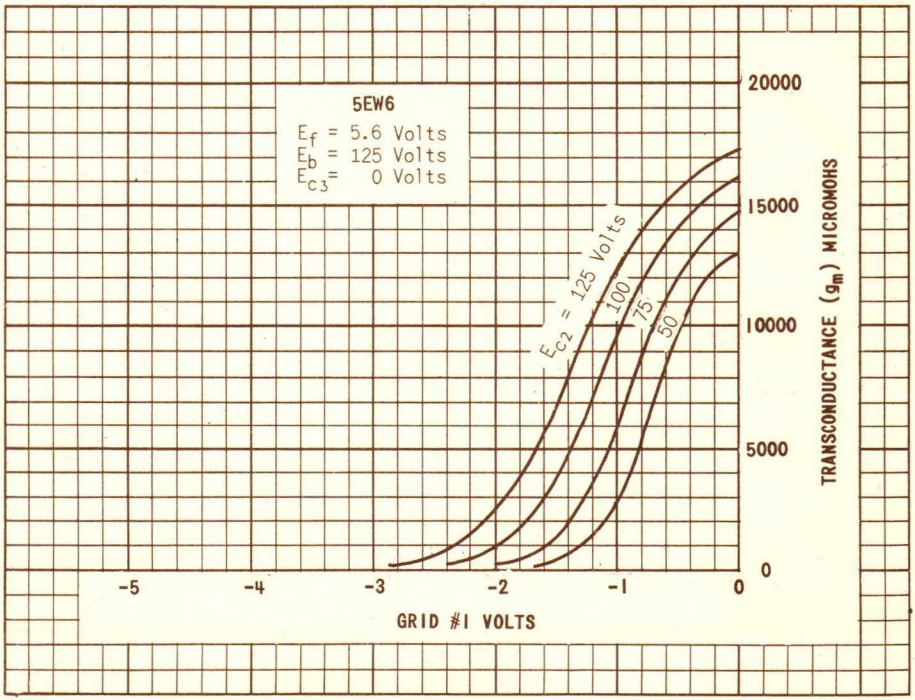
5EW6


5EW6
E_f = 5.6 Volts
E_{c3} = 0 Volts
E_{c1} = 0 Volts
I_b
I_{c2}
PLATE (I_b) MILLIAMPERES
GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
E_{c2} = 125 Volts
100
75
50
E_{c2}=125 Volts
100
75
50
0
100
200
300
400
500
5
10
15
20
30


5EW6
E_f = 5.6 Volts
E_b = 125 Volts
E_{c3} = 0 Volts
E_{c2} =125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #1 VOLTS
-4
-3
-2
-1
0
10
20
30





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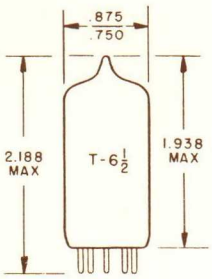
TUNG-SOL

TRIODE - PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 6-2



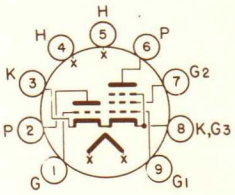
BASE 9 PIN BUTTON
JEDEC E9-1

FOR
USE IN VHF
TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9GF



BOTTOM VIEW

THE 5FG7 IS A MEDIUM-MU TRIODE AND SHARP-CUTOFF PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A COMBINED TRIODE OSCILLATOR AND PENTODE MIXER IN VHF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 5FG7 IS IDENTICAL TO THE 6FG7.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	SHIELD #315 CONNECTED TO CATHODE	
TRIODE UNIT:			
GRID TO PLATE	1.8	1.8	pf
GRID TO CATHODE AND PENTODE GRID 3 & HEATER 3	3	3	pf
PLATE TO CATHODE & PENTODE GRID 3 & HEATER	1.3	1.9	pf
PENTODE UNIT:			
GRID 1 TO PLATE - MAX.	0.02	0.01	pf
GRID 1 TO CATHODE & GRID 2, GRID 2, AND HEATER	5	5	pf
PLATE TO CATHODE & GRID, GRID 2, AND HEATER	2.4	3.4	pf
HEATER TO CATHODE & PENTODE GRID 3	6	6 A	pf

A = SHIELD #315 CONNECTED TO GROUND

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7 VOLTS	600	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	mA
PEAK HEATER - CATHODE VOLTAGE - EACH UNIT:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS

MAXIMUM RATINGS

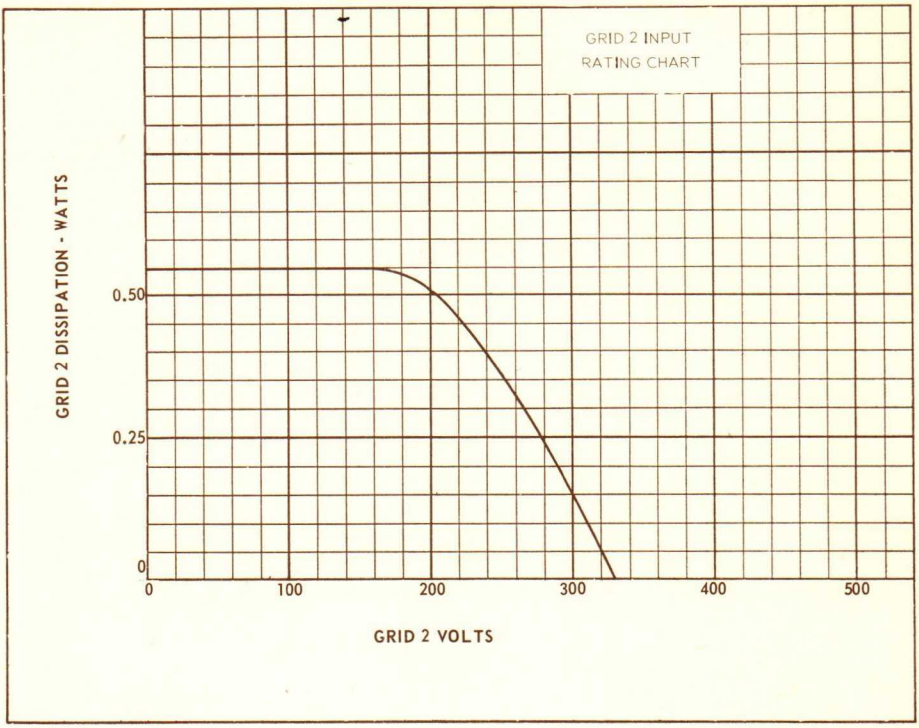
DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

	TRIODE UNIT	PENTODE UNIT	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 SUPPLY VOLTAGE		330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART		
GRID 1 VOLTAGE:			
POSITIVE + BIAS VALUE	0	0	VOLTS
GRID 2 INPUT:			
FOR GRID 2 VOLTAGES UP TO 165 VOLTS		0.55	WATT
FOR GRID 2 VOLTAGES BETWEEN 165 AND 330 VOLTS	SEE RATING CHART		
PLATE DISSIPATION	2.5	3	WATTS

CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT		
PLATE VOLTAGE	125	100	125	VOLTS
GRID 2 VOLTAGE	–	100	125	VOLTS
GRID 1 VOLTAGE	–1	0	–1	VOLTS
PLATE CURRENT	13		11	mA
GRID 2 CURRENT	–	–	4	mA
TRANSCONDUCTANCE	7,500	7,400	6,000	μMHOS
AMPLIFICATION FACTOR	43			
PLATE RESISTANCE - APPROX.	5.7	–	180	KOHMS
GRID 1 VOLTAGE FOR I_b = 30 μA - APPROX.	–6.5	–	–7.5	VOLTS



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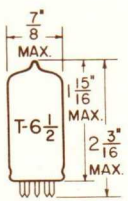
TRIODE-PENTODE

MINIATURE TYPE



GLASS BULB

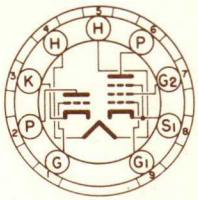
COATED UNIPOTENTIAL CATHODE

HEATER

4.7 VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE
9FA

THE 5FV8 IS A TRIODE-PENTODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR SERVICE IN TELEVISION RECEIVERS WITH THE TRIODE SERVING AS A VERTICAL DEFLECTION OSCILLATOR, AND THE PENTODE SERVING AS A GENERAL PURPOSE OR *IF* AMPLIFIER. DESIGN OF THE TUBE IS SUCH THAT HIGH VALUES OF INTERELEMENT LEAKAGE RESISTANCE ARE MAINTAINED THROUGHOUT LIFE. EXCEPT FOR HEATER RATINGS, THE 5FV8 IS IDENTICAL TO THE 6FV8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
TRIODE SECTION:			
GRID TO PLATE	1.8	1.8	μμf
INPUT: G TO (H+TK+I.S.)	2.8	2.8	μμf
OUTPUT: P TO (H+TK+I.S.)	2.0	1.5	μμf
PENTODE SECTION:			
GRID #1 TO PLATE (MAX.)	.010	.020	μμf
INPUT: G1 TO (H+PK+G2+G3+I.S.)	5.0	5.0	μμf
OUTPUT: P TO (H+PK+G2+G3+I.S.)	3.0	2.0	μμf
PENTODE PLATE TO TRIODE PLATE((MAX.)	0.03	0.15	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE[B] SECTION VER-DEF OSC.	PENTODE SECTION CLASS A AMPLIFIER	
HEATER VOLTAGE	4.7	4.7	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE GRID #1 VOLTAGE		0	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	250		VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20		MA.
MAXIMUM PEAK CATHODE CURRENT	70		MA.
MAXIMUM PLATE DISSIPATION	2.0	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION		0.55	WATT
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
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
FIXED BIAS		0.25	MEGOHM
SELF BIAS	3.0[C]	1.0	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.60	0.60	AMP.
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE		125	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	8 000	6 500	μMHOS
PLATE CURRENT	14.0	12.0	MA.
GRID #2 CURRENT		4.0	MA.
PLATE RESISTANCE (APPROX.)	5 000	200,000	OHMS
AMPLIFICATION FACTOR	40		
GRID #1 VOLTAGE (APPROX.) FOR I_b = 20 μA.	-9	-9	VOLTS

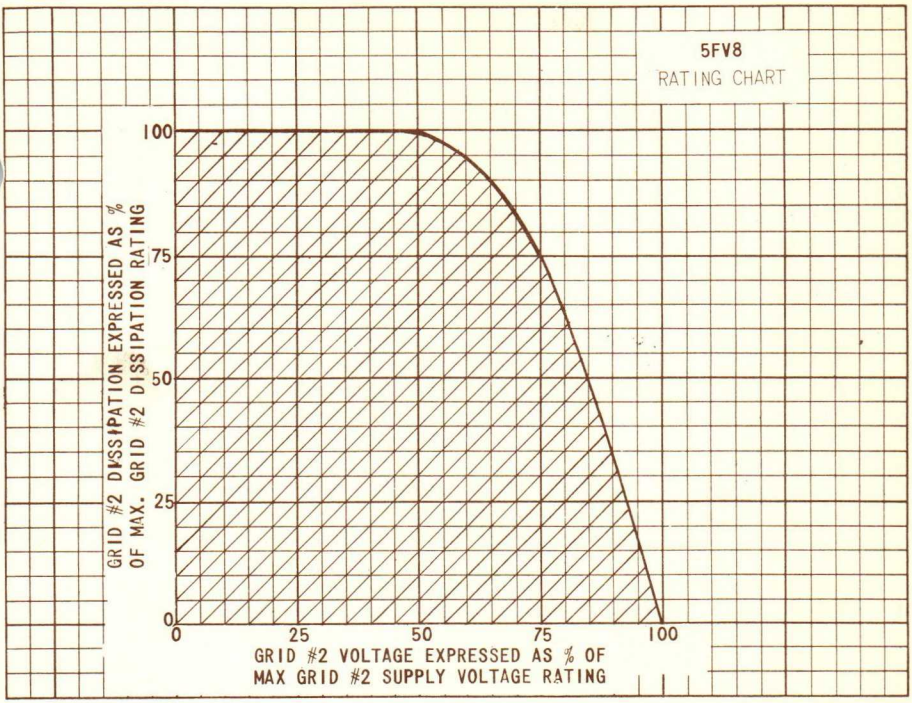
[A] SHIELD #315 TIED TO PIN #4.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C] 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 WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THD DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.



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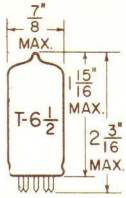
TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE



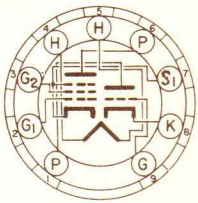
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9AE

THE 5GH8 IS A SHARP-CUTOFF PENTODE AND A MEDIUM-MU TRIODE CONTAINED IN A 9 PIN MINIATURE ENVELOPE. EACH SECTION HAS A SEPARATE CATHODE AND IS ELECTRICALLY INDEPENDENT. THE PENTODE SECTION IS INTENDED PRIMARILY FOR SERVICE AS AN OSCILLATOR IN THE HORIZONTAL DEFLECTION SYSTEM OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS, THE 5GH8 IS IDENTICAL TO THE 6GH8.

DIRECT INTERELECTRODE CAPACITANCES ←

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE SECTION:			
GRID #1 TO PLATE: (Pg1 TO Pp) (MAX.)	0.015	0.02	μμf
INPUT: Pg1 TO (H+Pk+Pg2+Pg3+I.S.)	5.5	5.5	μμf
OUTPUT: Pp TO (H+Pk+Pg2+Pg3+I.S.)	3.4	2.6	μμf
HEATER TO CATHODE (Pk TO H)	3.0[B]	3.0	μμf
TRIODE SECTION:			
GRID TO PLATE:(Tg TO Tp)	1.6	1.6	μμf
INPUT: Tg TO (Tk+H+Pk+Pg3+I.S.)	3.6	3.4	μμf
OUTPUT: Tp TO (Tk+H+Pk+Pg3+I.S.)	2.2	1.7	μμf
HEATER TO CATHODE: (Tk TO H)	3.0[B]	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION (HORIZONTAL OSCILLATOR SERVICE)[C]	TRIODE SECTION	
HEATER VOLTAGE	4.7	4.7	VOLTS
MAXIMUM ALLOWABLE HEATER CURRENT	0.56 to 0.64		AMP.
MAXIMUM DC PLATE VOLTAGE	350	330	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	330	---	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0.	VOLTS
MAXIMUM PEAK NEGATIVE DC GRID #1 VOLTAGE	175	---	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	2.5	WATTS
MAXIMUM SCREEN DISSIPATION	0.55	---	WATTS
MAXIMUM DC CATHODE CURRENT	20	---	MA.
MAXIMUM PEAK CATHODE CURRENT	300	---	MA.

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→ INDICATES A CHANGE.

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RATINGS — CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION (HORIZONTAL OSCILLATOR SERVICE)[C]		TRIODE SECTION	
HEATER VOLTAGE	4.7		4.7	VOLTS
MAXIMUM HEATER—CATHODE VOLTAGE:				
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT	100		100	VOLTS
TOTAL DC AND PEAK	200		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK	200		200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE				
WITH FIXED BIAS	2.2		2.2	MEGOHMS
WITH CATHODE BIAS	2.2		2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*		11.0		SECONDS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	125	125	VOLTS
SCREEN VOLTAGE	125	---	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	VOLTS
AMPLIFICATION FACTOR	---	46	
PLATE RESISTANCE (APPROX.)	200 000	5400	OHMS
TRANSCONDUCTANCE	7500	8500	μMHOS
PLATE CURRENT	12	13.5	MA.
SCREEN CURRENT	4.0	----	MA.
GRID #1 VOLTAGE (APPROX.)			
I_b = 10 μAMPS.	-8	-8	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[A] WITH EXTERNAL SHIELD 315 CONNECTED TO CATHODE OF SECTION UNDER TEST UNLESS OTHERWISE INDICATED.

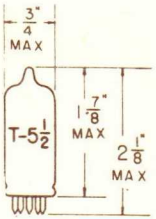
[B] WITH EXTERNAL SHIELD 315 CONNECTED TO GROUND.

[C] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB.

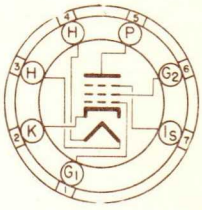
UNIPOTENTIAL CATHODE

HEATER

5.6 VOLTS 0.45±6% AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON MINIATURE
7 PIN BASE
7CM

THE 5GM6 IS A SEMIREMOTE-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR USE IN GAIN-CONTROLLED PICTURE-IF STAGES OF TELEVISION RECEIVERS OPERATING AT INTERMEDIATE FREQUENCIES OF THE ORDER OF 40 MEGACYCLES.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.036	μμf
GRID #1 TO CATHODE, INTERNAL SHIELD & G3,G2 & H.	10	μμf
PLATE TO CATHODE, INTERNAL SHIELD & G3, G2 & H.	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	5.6	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #3 (SUPPRESSOR) VOLTAGE	0	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) VOLTAGE (SEE JEDEC INPUT RATING CHART J5-C4-2)		
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	WATTS
MAXIMUM GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	0.65	WATT
FOR GRID #2 VOLTAGES BETWEEN 165 AND 330 VOLTS (SEE JEDEC INPUT RATING CHART J5-C4-2)		
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	5.6	VOLTS
HEATER CURRENT	0.45±6%	AMP.
PLATE SUPPLY VOLTAGE	125	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET	
GRID #2 SUPPLY VOLTAGE	125	VOLTS
CATHODE RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.2	MEGOHMS
TRANSCONDUCTANCE	13 000	μMHOS
PLATE CURRENT	14	MA.
GRID #2 CURRENT	3.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR TRANCONDUCTANCE = 60 μMHOS	-15	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SER ICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WROST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time, the 5GM6 is identical to the 4GM6 and the 6GM6.*

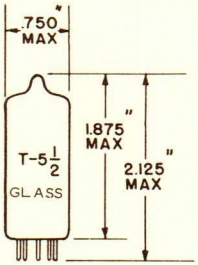
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 5-2

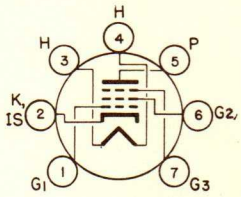


BASE 7 PIN BUTTON
JEDEC E7-1

FOR
FM SOUND DETECTOR
SERVICE

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 7EN



BOTTOM VIEW

THE 5GX6 IS A SHARP-CUTOFF PENTODE WITH DUAL CONTROL GRIDS IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR FM SOUND DETECTOR - SERVICE. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 5GX6 IS IDENTICAL TO THE 6GX6.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	0.26	pf
GRID 1 TO (K & I.S., G3, G2, H)	8	pf
GRID 1 TO GRID 3	0.12	pf
GRID 3 TO PLATE	1.6	pf
GRID 3 TO (K & I.S., P, G2 G1, H)	6.5	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7 VOLTS	600	mA
HEATER WARM UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ±40	mA
PEAK HEATER - CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

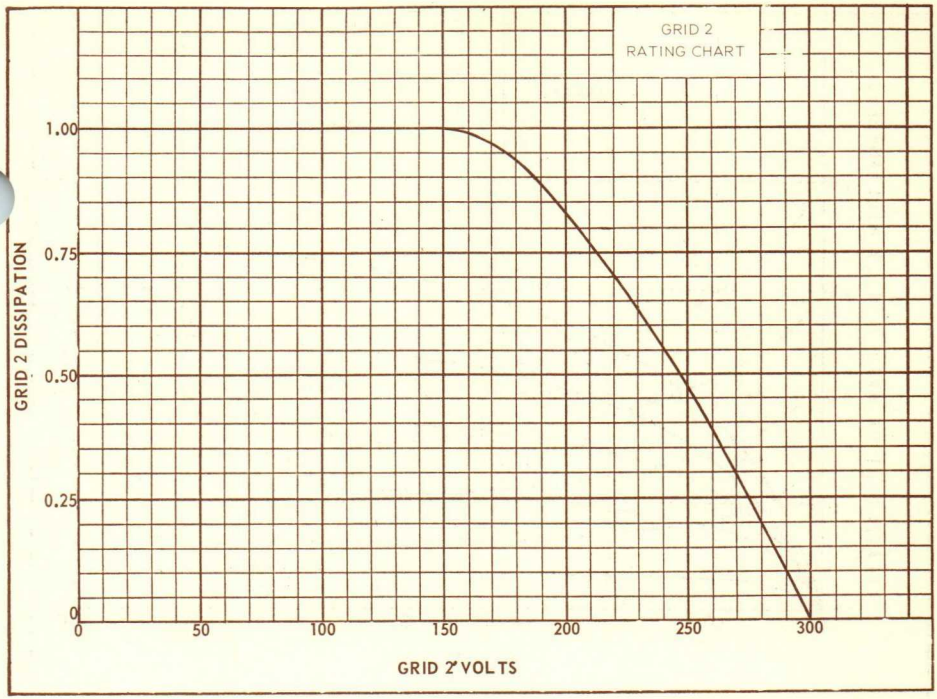
FM SOUND DETECTOR SERVICE

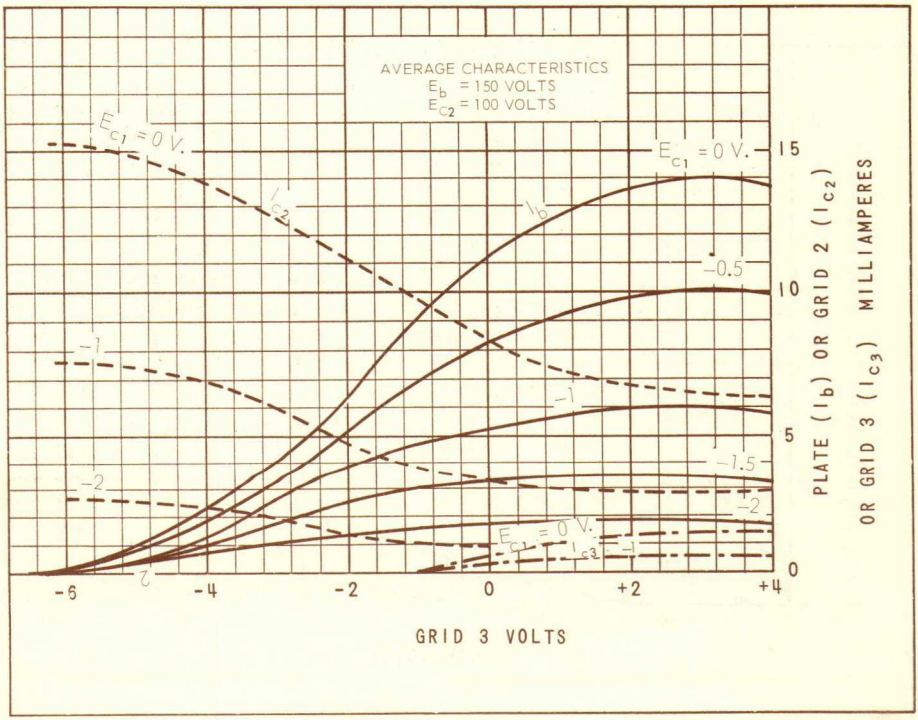
PLATE VOLTAGE		300	VOLTS
GRID 3 VOLTAGE:			
NEGATIVE VALUE - DC AND PEAK		100	VOLTS
POSITIVE VALUE - DC AND PEAK		25	VOLTS
GRID 2 SUPPLY VOLTAGE		300	VOLTS
GRID 2 VOLTAGE		SEE RATING CHART	
GRID 1 VOLTAGE:			
NEGATIVE - BIAS VALUE		56	VOLTS
POSITIVE - BIAS VALUE		0	VOLTS
GRID 3 INPUT		0.1	WATT
GRID 2 INPUT - UP TO 150 VOLTS		1	WATT
- BETWEEN 150 VOLTS AND 300 VOLTS		SEE RATING CHART	
PLATE DISSIPATION		1.7	WATTS
GRID 3 CIRCUIT RESISTANCE		0.68	MEGOHM
GRID 1 CIRCUIT RESISTANCE:			
FOR FIXED - BIAS OPERATION		0.22	MEGOHM
FOR CATHODE - BIAS OPERATION		0.47	MEGOHM

CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE SUPPLY VOLTAGE		150	VOLTS
GRID 3 SUPPLY VOLTAGE		0	VOLTS
GRID 2 SUPPLY VOLTAGE		100	VOLTS
GRID 1 SUPPLY VOLTAGE		0	VOLTS
CATHODE RESISTOR		180	OHMS
PLATE CURRENT		3.7	mA
GRID 2 CURRENT		3.0	mA
TRANSCONDUCTANCE - GRID 1 TO PLATE		3,700	μMHOS
TRANSCONDUCTANCE - GRID 3 TO PLATE		750	μMHOS
PLATE RESISTANCE	APPROX.	0.14	MEGOHM
GRID 1 VOLTAGE FOR I_b = 20 μA	APPROX.	−4.5	VOLTS
GRID 3 VOLTAGE FOR I_b = 20 μA	APPROX.	−7	VOLTS





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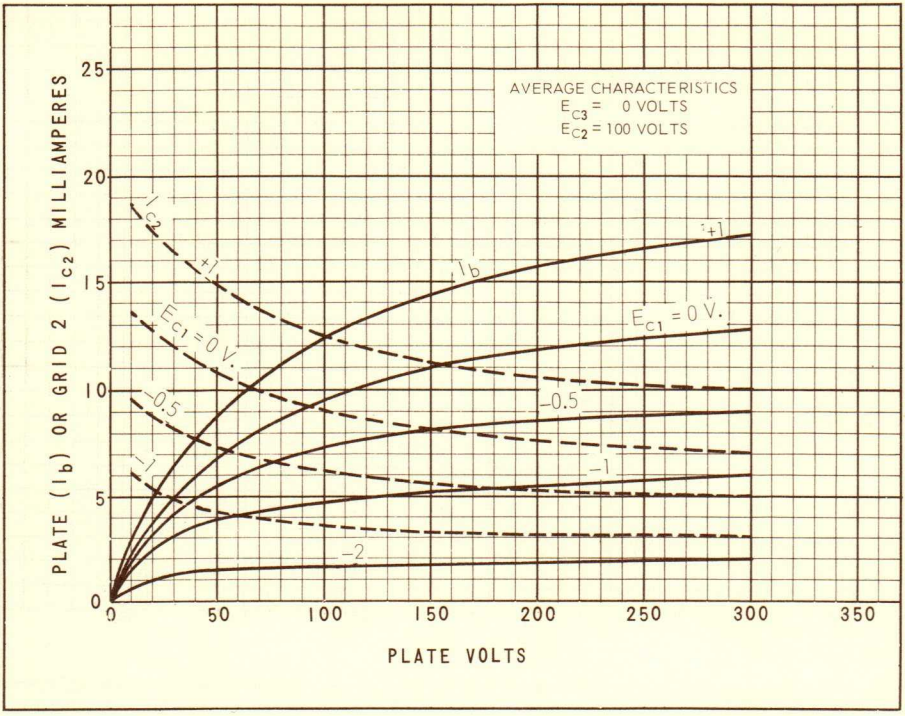
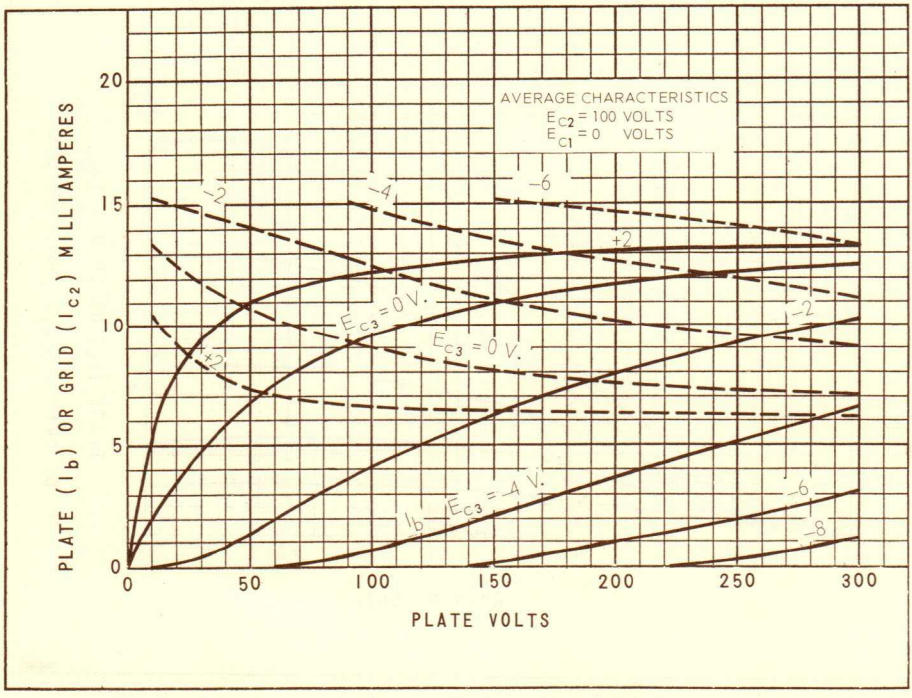
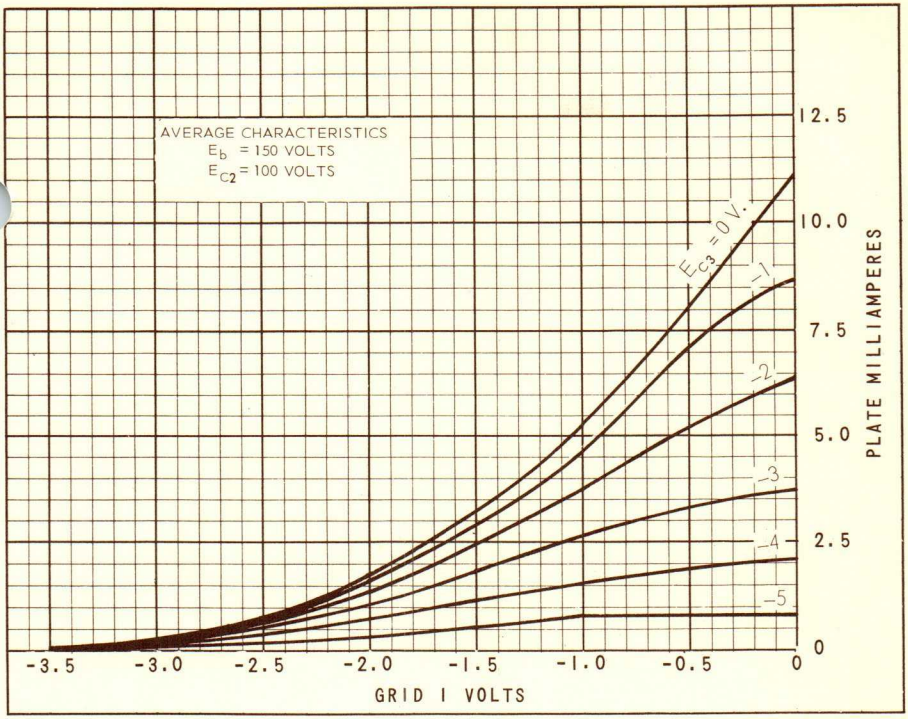
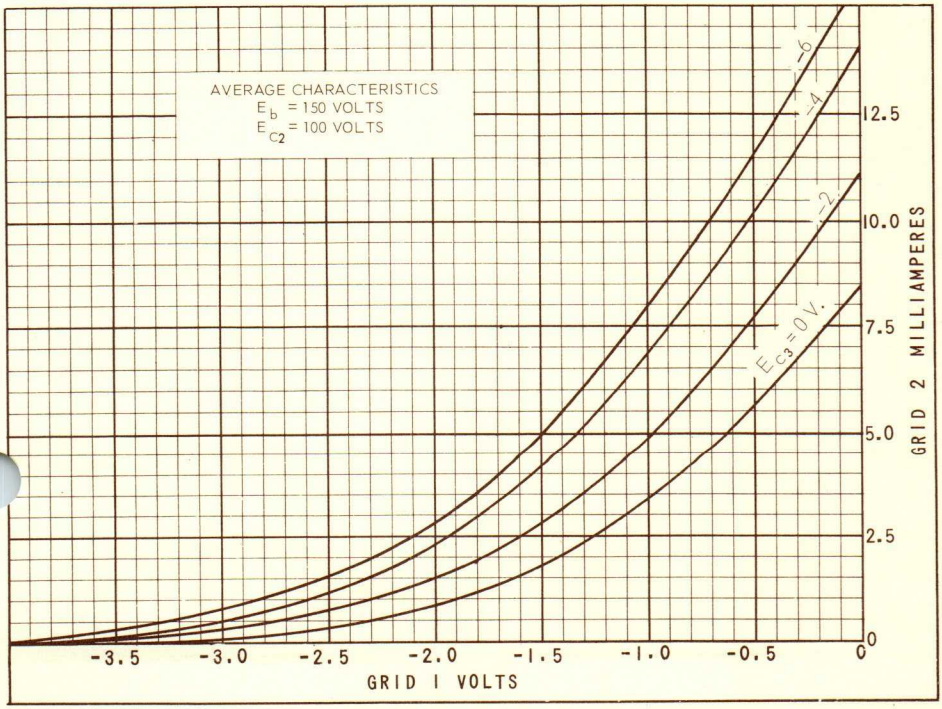

AVERAGE CHARACTERISTICS
E_{c3} = 0 VOLTS
E_{c2} = 100 VOLTS
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
I_{c2}
I_b
E_{c1} = 0 V.
+1
-0.5
-1
-2
0
5
10
15
20
25
50
100
150
200
250
300
350


AVERAGE CHARACTERISTICS
E_{c2} = 100 VOLTS
E_{c1} = 0 VOLTS
PLATE (I_b) OR GRID (I_{c2}) MILLIAMPERES
PLATE VOLTS
I_b
E_{c3} = 0 V.
E_{c3} = -4 V.
-2
-4
-6
+2
-8
0
5
10
15
20
50
100
150
200
250
300





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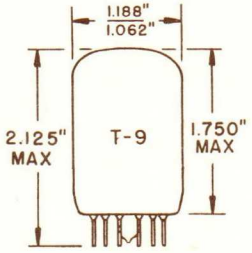
DUAL TRIODE

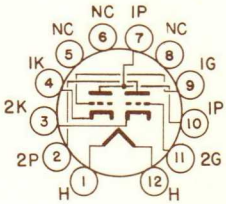
MINIATURE TYPE



GLASS BULB
BUTTON 12 PIN
BASE E12-70
OUTLINE DRAWING

TWO DISSIMILAR TRIODES
FOR
SYNC CLIPPER AND
AGC AMPLIFIER
SERVICE IN
TV RECEIVERS

COATED UNIPOTENTIAL CATHODES
ANY MOUNTING POSITION



BASING DIAGRAM
JEDEC 12 FR

THE 5HC7 CONTAINS TWO DISSIMILAR TRIODES IN A T-9 COMPACTRON CONSTRUCTION. EACH ELEMENT IS BROUGHT OUT TO A SEPARATE BASE PIN. TRIODE #1 HAS A LOW MU AND TRIODE #2 HAS A HIGH MU. THE 5HC7 IS DESIGNED FOR SYNC CLIPPER AND GATED AGC AMPLIFIER SERVICE IN TV RECEIVERS. THE HEATER IS INTENDED TO BE OPERATED IN A SERIES STRING. EXCEPT FOR HEATER RATINGS, THE 5HC7 IS IDENTICAL TO THE 4HC7

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	TRIODE 1	TRIODE 2	
GRID TO PLATE (g to p)	1.9	2.2	pf
INPUT: g to (h + k)	2.0	1.9	pf
OUTPUT: p to (h + k)	0.7	0.56	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES-SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	5.6 VOLTS	450	MA
HEATER WARM-UP TIME		11	SEC.
LIMITS OF SUPPLIED CURRENT		450 ± 30	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

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TUNG-SOL

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE 1	TRIODE 2	
PLATE VOLTAGE	330	330	VOLTS
NEGATIVE DC GRID VOLTAGE	100	100	VOLTS
POSITIVE DC GRID VOLTAGE	0	0	VOLTS
POSITIVE TRANSIENT GRID VOLTAGE	60	-	VOLTS
PLATE DISSIPATION	3	1.2	WATTS
GRID CIRCUIT RESISTANCE	5.0	5.0	MEGOHMS

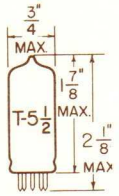
CHARACTERISTICS

PLATE VOLTAGE	150	150	VOLTS
GRID VOLTAGE	-1	-1	VOLTS
PLATE CURRENT	18	1.0	MA
TRANSCONDUCTANCE	4400	1900	μMHOS
AMPLIFICATION FACTOR	23	100	
PLATE RESISTANCE (APPROX.)	5,200	53,000	OHMS
GRID VOLTAGE FOR I_b = 10 μA (APPROX.)	-13	-2.2	VOLTS

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

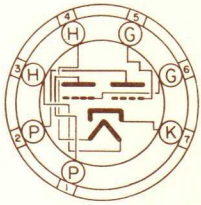


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
78F

THE 5J6 IS A TWIN TRIODE HAVING TWO PLATES AND TWO GRIDS WITH A COMMON CATHODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN THE RF AMPLIFIER, OSCILLATOR AND MIXER STAGES OF 450 MA. SERIES HEATER OPERATED TV RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER HEATER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS ITS CHARACTERISTICS ARE IDENTICAL TO THE 6J6.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
GRID TO PLATE (EACH SECTION)	1.6	1.5	μμf
INPUT (EACH SECTION)	2.2	2.6	μμf
OUTPUT (SECTION 1)	0.4	1.6	μμf
OUTPUT (SECTION 2)	0.4	1.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

	AF AMPLIFIER	RF AMPLIFIER	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE ←	±100	±100	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	0	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	---	-40	VOLTS
MAXIMUM PLATE INPUT	---	4.5	WATTS
MAXIMUM PLATE DISSIPATION	1.5	1.5	WATTS
MAXIMUM PLATE CURRENT	---	15	MA.
MAXIMUM GRID CURRENT	---	8	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (CATHODE BIAS)	0.5	---	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

*HEATER-WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH SECTION

HEATER VOLTAGE	4.7	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR (BOTH SECTIONS)[B]	50	OHMS
AMPLIFICATION FACTOR	38	
PLATE RESISTANCE	7 100	OHMS
TRANSCONDUCTANCE	5 300	μMHOS
PLATE CURRENT	8.5	MA.

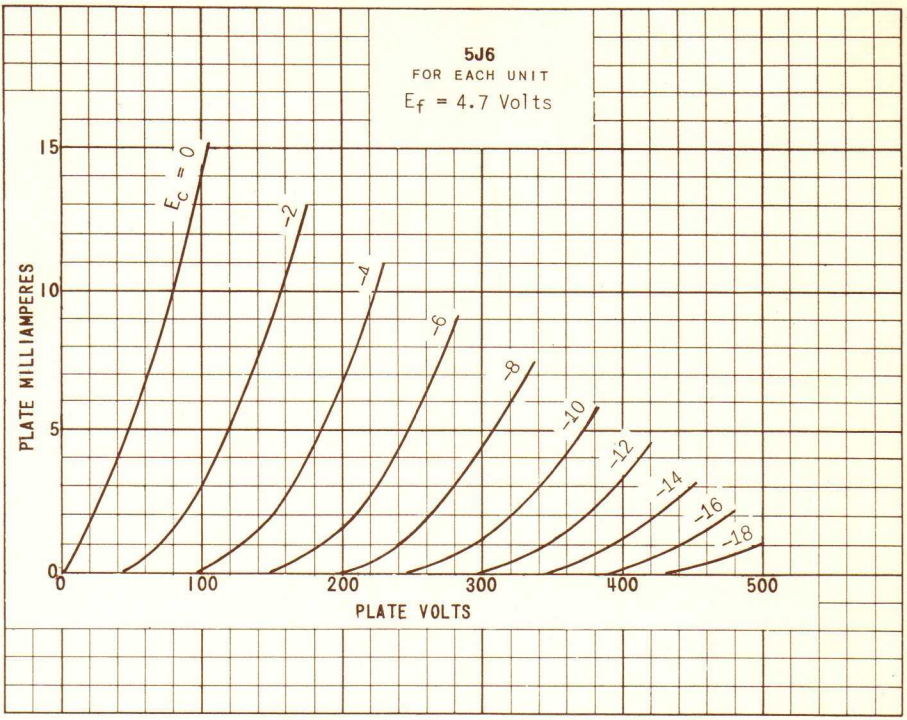
[B] OPERATION WITH FIXED BIAS IS NOT RECOMMENDED.

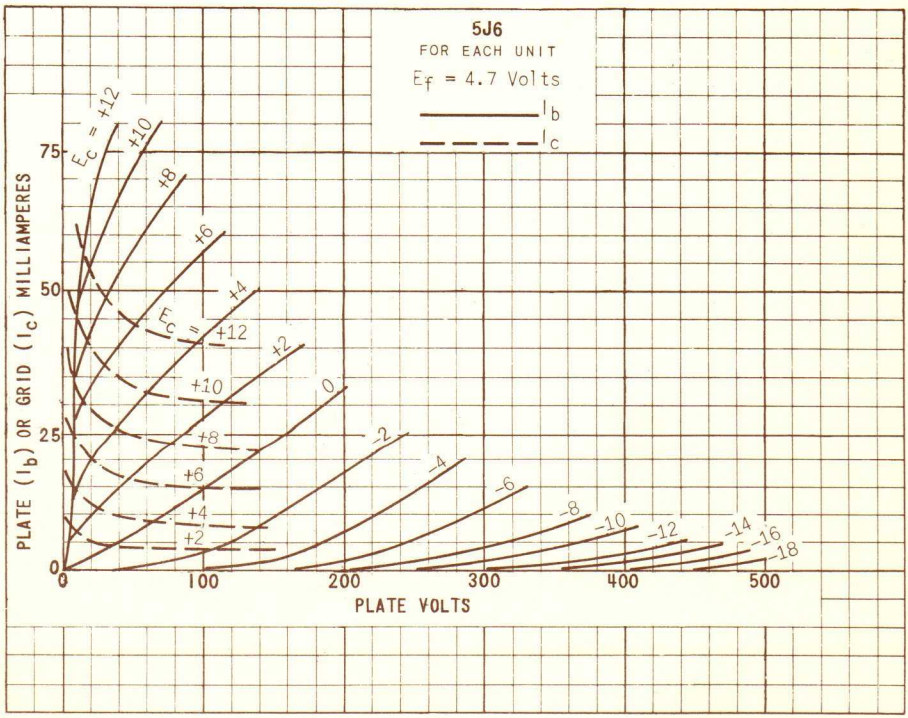
CLASS C TELEGRAPHY – RF POWER AMPLIFIER AND OSCILLATOR

BOTH SECTIONS IN PUSH PULL

HEATER VOLTAGE	4.7	VOLTS
HEATER CURRENT	0.6	AMP.
DC PLATE VOLTAGE	150	VOLTS
DC GRID VOLTAGE[C]	-10	VOLTS
DC PLATE CURRENT	30	MA.
DC GRID CURRENT (APPROX.)	16	MA.
DRIVING POWER (APPROX.)	0.35	WATT
POWER OUTPUT (APPROX.)	3.5	WATTS

[C] OBTAINED BY A 525-OHMS GRID RESISTOR, A 220-OHMS CATHODE RESISTOR, OR A FIXED VOLTAGE SUPPLY.





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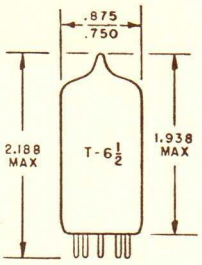
TRIODE-PENTODE

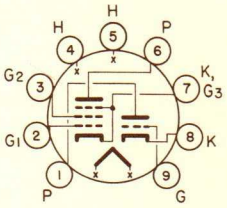
MINIATURE TYPE



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

FOR
USE AS A COMBINED
VHF OSCILLATOR AND MIXER

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9 AE

THE 5KD8 IS A MEDIUM MU TRIODE AND SHARP CUTOFF PENTODE IN THE 9 PIN MINATURE CONSTRUCTION. IT IS INTENDED FOR USE AS A COMBINED VHF OSCILLATOR AND MIXER IN TELEVISION RECEIVERS.

GRID 1 (CONTROL GRID) TO CATHODE SPACING ON THE 6KD8 IS OF SUCH LOW ORDER OF MAGNITUDE AS TO PRECLUDE THE USE OF VOLTAGE BETWEEN THESE ELEMENTS OF MORE THAN 100 VOLTS DC OR PEAK AC IN COMMERCIAL TUBE CHECKERS AND SHORTS INDICATING DEVICES, PARTICULARY WHERE MECHANICAL EXCITATION OF THE TUBE IS EMPLOYED. THE 5KD8 IS SIMI- TO THE 6KD8.

DIRECT INTERELECTRODE CAPACITANCES

	SHIELD 315 CONNECTED TO PIN 4	UNSHIELDED	
PENTODE SECTION			
GRID 1 TO PLATE	Max. .007	Max. .015	pf
INPUT: G1 TO (H+ K + G2 + G3 + I.S.)	5.0	5.0	pf
OUTPUT: P TO (H + K + G2 + G3 + I.S.)	3.5	2.6	pf
CATHODE TO HEATER	3.0 A	3.0	pf
TRIODE SECTION			
GRID TO PLATE	1.8	1.8	pf
INPUT: G TO (H + PK + TK + G3 + I.S.)	2.8	2.8	pf
OUTPUT: P TO (H + PK + TK + G3 + I.S.)	2.0	1.5	pf
CATHODE TO HEATER	3.0 A	3.0	pf
COUPLING			
PENTODE GRID 1 TO TRIODE PLATE	Max. 0.2	Max. 0.2	pf
PENTODE PLATE TO TRIODE PLATE	Max. .02	Max. 0.1	pf

A- SHIELD 315 CONNECTED TO PIN 6.

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	5.6	VOLTS	450	MA.
LIMITS OF SUPPLIED CURRENT			450 ± 30	MA.
HEATER WARM - UP			11	SEC.
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC			100	VOLTS
TOTAL DC AND PEAK			200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 SUPPLY VOLTAGE		330	VOLTS
GRID 2 VOLTAGE		SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
PLATE DISSIPATION	2.5	3.0	WATTS
GRID 2 DISSIPATION		0.55	WATTS
GRID 1 CIRCUIT RESISTANCE			
FIXED BIAS		0.5	MEGOHM
SELF BIAS		1.0	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	125	125	VOLTS
GRID 2 VOLTAGE		110	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
PLATE CURRENT	13.5	9.5	MA.
GRID 2 CURRENT		3.5	MA.
TRANSCONDUCTANCE	7,500	5,000	μMHOS
AMPLIFICATION FACTOR	40		
PLATE RESISTANCE		Approx. 0.2	MEGOHM
E_{c1} FOR I_b = 20 μA	Approx. -9	Approx. -8	VOLTS
G_m AT E_{c1} = 0 V., E_b = 100 V., E_{c2} = 70 V.		5,500	μMHOS

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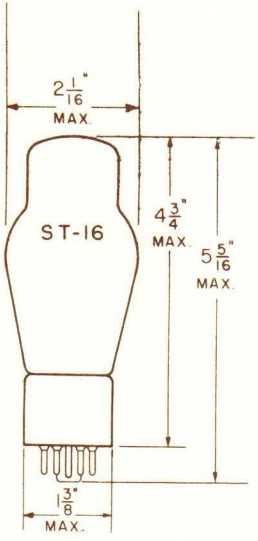
FULL-WAVE HIGH-VACUUM RECTIFIER



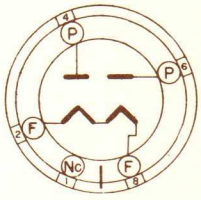
GLASS BULB

COATED FILAMENT

HEATER
5.0 VOLTS 2.0 AMPERES
AC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMISSIBLE IF PINS 1 AND 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW

MEDIUM SHELL 5-PIN
OCTAL MICANOL BASE

THE 5R4GY IS DESIGNED FOR RECTIFIER USE IN EQUIPMENT REQUIRING A HIGH PEAK INVERSE VOLTAGE RATING. SATISFACTORY OPERATION OF THIS TUBE TYPE UNDER CONDITIONS FALLING WITHIN AREA 1 ON CURVE NO. 1 MAY BE OBTAINED WITHOUT FILAMENT PREHEATING. FILAMENT PREHEATING FOR 10 SECONDS BEFORE PLATE VOLTAGE IS APPLIED IS RECOMMENDED FOR SATISFACTORY OPERATION UNDER CONDITIONS FALLING WITHIN AREA 2 ON THE SAME CURVE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FULL-WAVE RECTIFIER

FILAMENT VOLTAGE (AC)	5.0	5.0	5.0	VOLTS
FILAMENT CURRENT	2.0	2.0	2.0	AMPS.
MAX. PEAK INVERSE PLATE VOLTAGE (NO LOAD)	2100	2400	2800	VOLTS
MAX. PEAK PLATE CURRENT PER PLATE	650	650	650	MA.
DC OUTPUT CURRENT:				
WITH CONDENSER INPUT TO FILTER	250	175	150	MA.
WITH CHOKE INPUT TO FILTER	250	250[A]	175[B]	MA.

[A] FOR INPUT CHOKE FILTER=5 HENRIES MINIMUM.
[B] FOR INPUT CHOKE FILTER=10 HENRIES MINIMUM.

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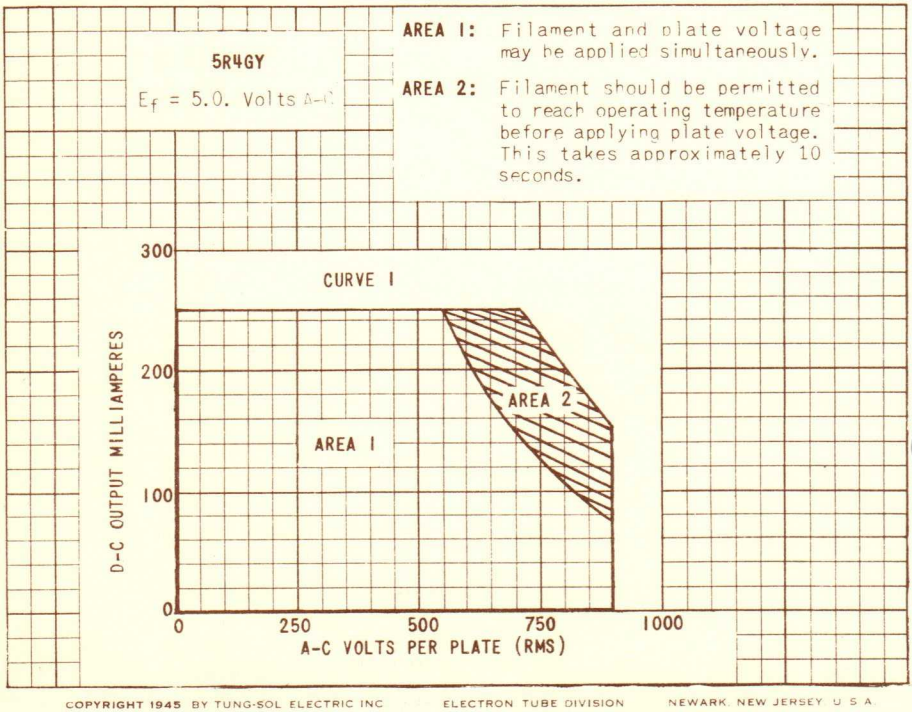
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER

	CONDENSER-INPUT FILTER		CHOKE-INPUT FILTER		
AC PLATE-TO-PLATE SUPPLY VOLTAGE (RMS)					
FULL LOAD	1400	1800	1500	1900	VOLTS
NO LOAD	1500	2000	1700	2000	VOLTS
FILTER INPUT CONDENSER	4	4	-	-	µf
TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE PER PLATE[C]	125	575	-	-	OHMS
FILTER INPUT CHOKE	-	-	5	10	H.
DC OUTPUT CURRENT	250	250	250	175	MA.
DC OUTPUT VOLTAGE (APPROX.) (AT INPUT TO FILTER)	700	700	550	750	VOLTS
VOLTAGE REGULATION (APPROX.) (HALF-LOAD TO FULL-LOAD CURRENT)	90	110	40	60	VOLTS

[C] PEAK PLATE CURRENT WILL BE LIMITED TO MAXIMUM RATED VALUE FOR THE GIVEN CONDITIONS AND VALUES. FOR A FILTER-INPUT CONDENSER GREATER THAN 4 µf, MORE PLATE-SUPPLY IMPEDANCE MAY BE REQUIRED TO LIMIT THE PEAK PLATE CURRENT TO THE RATED VALUE.



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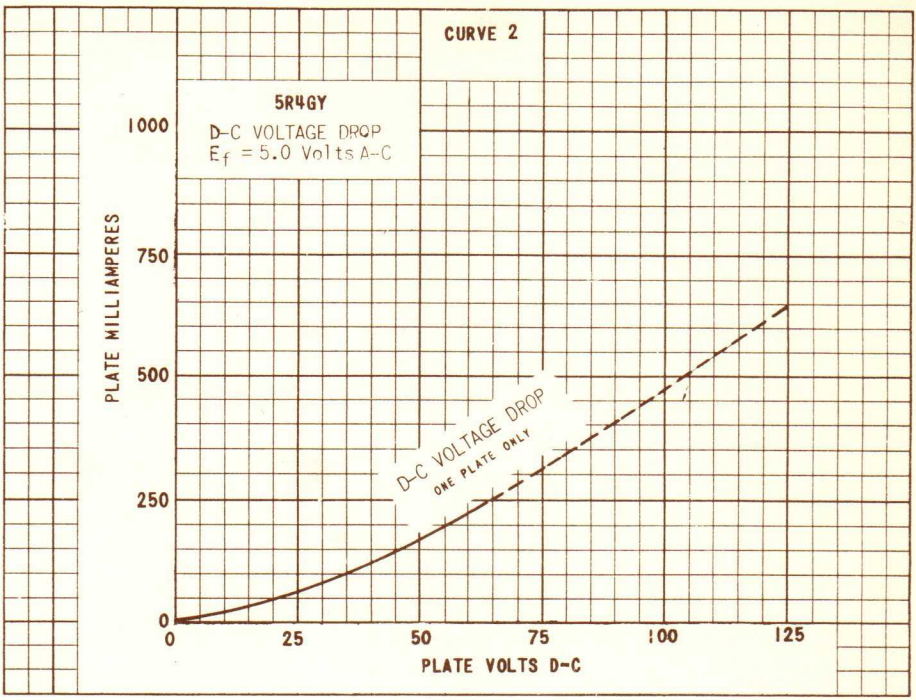

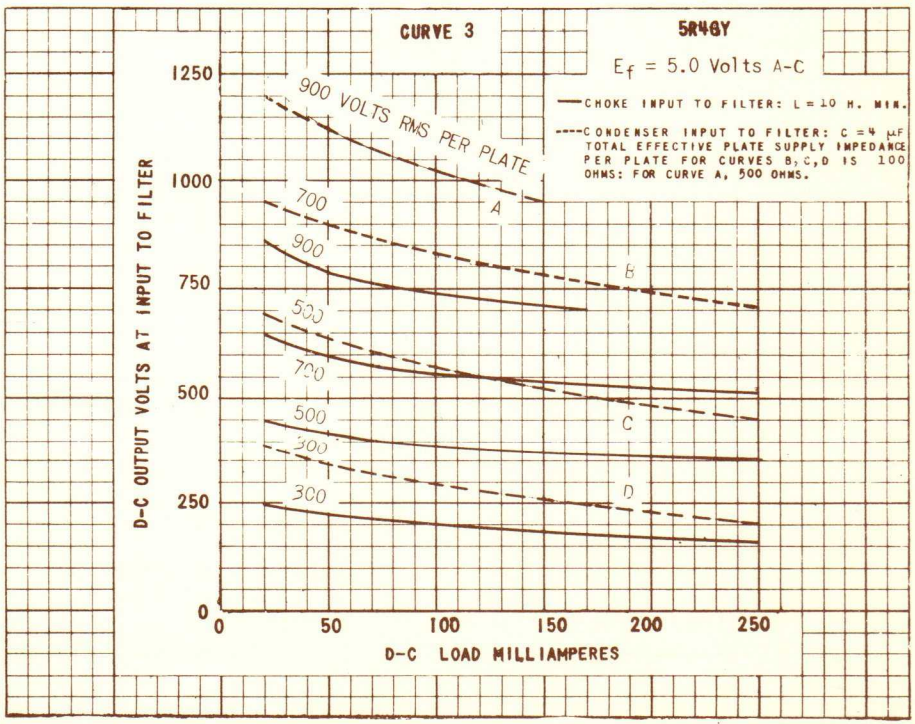

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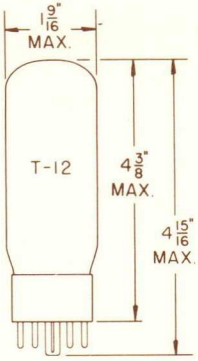
TWIN DIODE



GLASS BULB

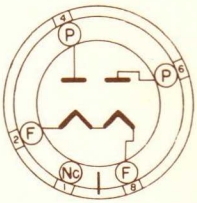
COATED FILAMENT

5.0 VOLTS 2.0 AMP.

AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION PERMITTED IF PINS 1 & 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW

MEDIUM SHELL
5 PIN OCTAL
WITH
EXTERNAL BARRIERS

5T

THE 5R4GYA IS A FULL-WAVE HIGH-VACUUM RECTIFIER DESIGNED FOR USE IN POWER SUPPLIES OF HIGH CURRENT REQUIREMENTS. THE TUBE INCORPORATES A LOW-LOSS BASE AND IS CAPABLE OF WITHSTANDING HIGH PEAK INVERSE PLATE VOLTAGES. ELECTRICALLY, THE 5R4GYA IS A REPLACEMENT FOR THE 5R4GY; IT DIFFERS PRIMARILY FROM THE 5R4GYA BY EMPLOYING A STRAIGHT-SIDED T-12 CONSTRUCTION.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

RECTIFIER SERVICE

FILAMENT VOLTAGE*	5.0	5.0	5.0	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE				
NO-LOAD CONDITION[A]	2100	2400	2800	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE				
CURRENT PER PLATE	650	650	650	MA.
MAXIMUM DC OUTPUT CURRENT				
WITH CAPACITOR-INPUT FILTER	250	175	150	MA.
WITH CHOKE-INPUT FILTER	250	250[B]	175[C]	MA.
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210	210	210	°C

* SEE RATING CHART 1 FOR RESTRICTIONS ON APPLYING THE PLATE AND FILAMENT VOLTAGES SIMULTANEOUSLY.

[A] OPERATION WITH PEAK INVERSE PLATE VOLTAGES UP TO 2400 VOLTS MAXIMUM IS PERMITTED AT ALTITUDES UP TO 40000 FEET. OPERATION WITH PEAK INVERSE PLATE VOLTAGES GREATER THAN 2400 AND UP TO 2800 VOLTS IS PERMITTED ONLY WHEN THE ALTITUDE DOES NOT EXCEED 20000 FEET AND THE DC OUTPUT CURRENT IS REDUCED TO THE VALUE INDICATED IN THE MAXIMUM RATINGS.

[B] INPUT CHOKE OF 5 HENRYS MINIMUM REQUIRED FOR 60-CYCLE POWER SUPPLY.

[C] INPUT CHOKE OF 10 HENRYS MINIMUM REQUIRED FOR 60-CYCLE POWER SUPPLY.

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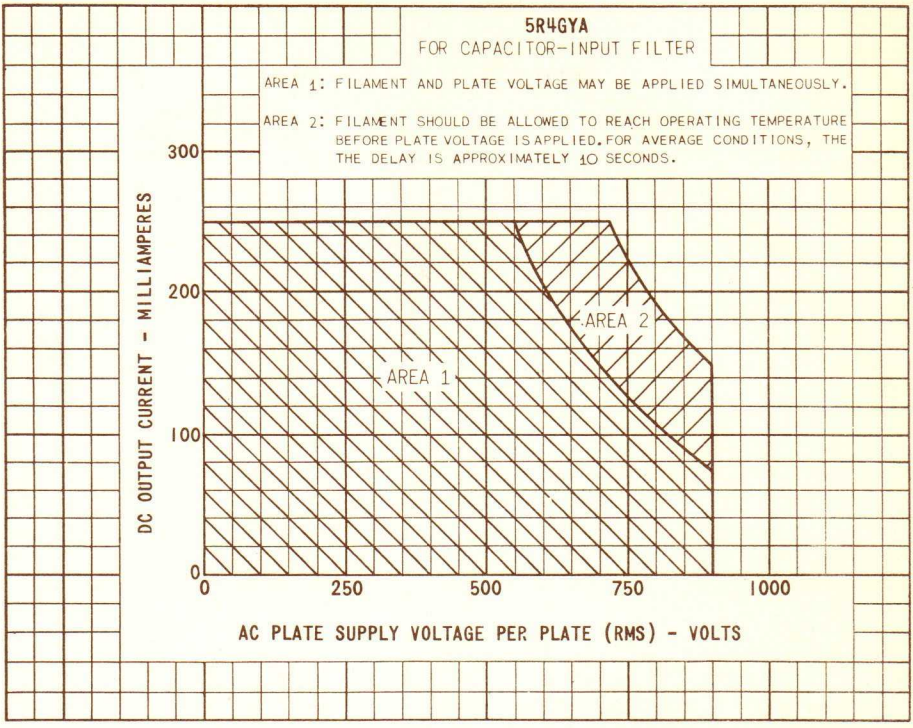
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

FILAMENT VOLTAGE	5.0	5.0	5.0	VOLTS
FILAMENT CURRENT	2.0	2.0	2.0	AMP.
AC PLATE-SUPPLY VOLTAGE PER PLATE, RMS				
FULL LOAD	700	750	900	VOLTS
NO LOAD	750	850	1000	VOLTS
FILTER INPUT CAPACITOR	4	4	4	μFD.
TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE PER PLATE	125	500	575	OHMS
DC OUTPUT CURRENT	250	150	150	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT				
FOR DC OUTPUT CURRENT OF 75 MA.	---	900	1060	VOLTS
FOR DC OUTPUT CURRENT OF 125 MA.	790	---	---	VOLTS
FOR DC OUTPUT CURRENT OF 150 MA.	---	810	950	VOLTS
FOR DC OUTPUT CURRENT OF 250 MA.	700	---	---	VOLTS

FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER

FILMENT VOLTAGE	5.0	5.0	VOLTS
FILAMENT CURRENT	2.0	2.0	AMP.
AC PLATE-SUPPLY VOLTAGE PER PLATE, RMS			
FULL LOAD	750	950	VOLTS
NO LOAD	850	1000	VOLTS
FILTER INPUT CHOKE	5	10	HENRYS
DC OUTPUT CURRENT	250	175	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT			
FOR DC OUTPUT CURRENT OF 87.5 MA.	---	810	VOLTS
FOR DC OUTPUT CURRENT OF 125 MA.	590	---	VOLTS
FOR DC OUTPUT CURRENT OF 175 MA.	---	750	VOLTS
FOR DC OUTPUT CURRENT OF 250 MA.	550	---	VOLTS
TUBE VOLTAGE DROP			
Ib=250 MA. DC PER PLATE		67	VOLTS



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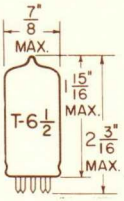
TRIPLE-DIODE TRIODE

MINIATURE TYPE

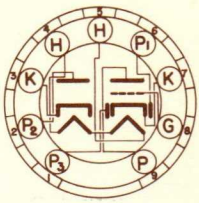
COATED UNIPOTENTIAL CATHODES

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE GLASS BUTTON
9 PIN BASE
9E

THE 5T8 COMBINES THREE HIGH PERVEANCE DIODES AND A HIGH-MU TRIODE IN ONE ENVELOPE WITH THE 9 PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. ONE OF THE THREE DIODE PLATES HAS AN INDEPENDENT CATHODE PROVIDING SATISFACTORY OPERATION IN BALANCED LOW IMPEDANCE DETECTOR CIRCUITS. THIS TUBE STRUCTURE PERMITS THE CONSTRUCTION OF AM/FM RECEIVERS WITH A MINIMUM OF SWITCHING. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6T8.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH[A] SHIELD	
TRIODE GRID TO PLATE	1.7	1.7	μμf
TRIODE INPUT	1.6	1.7	μμf
TRIODE OUTPUT	1.2	2.4	μμf
GRID TO ANY DIODE PLATE (MAX.)	.034	.034	μμf
INPUT DIODE 1	3.8	3.8	μμf
INPUT DIODE 2	3.8	3.8[B]	μμf
INPUT DIODE 3	3.4	3.6	μμf
DIODE 2 CATHODE TO ALL	7.5	8.5[C]	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	4.7	VOLTS
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.1 ←	WATTS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EA. PLATE)	5.5 ←	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
HEATER WARM-UP TIME (APPROX.)**	11.0	SECONDS

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6±6%	0.6±6%	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-3	VOLTS
AMPLIFICATION FACTOR	70	70	
PLATE RESISTANCE (APPROX.)	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	μMHOS
PLATE CURRENT	0.8	1.0	MA.
AVERAGE DIODE CURRENT: (EACH SECTION) MEASURED WITH 5 VOLTS DC APPLIED		20	MA.

TRIODE UNIT AS RESISTANCE COUPLED AMPLIFIER

PLATE SUPPLY VOLTAGE	90	VOLTS
CONTROL GRID VOLTAGE	0	VOLTS
PLATE LOAD RESISTOR	220 000	OHMS
CONTROL GRID RESISTOR	10.0	MEGOHMS
INPUT CONDENSER	0.01	μf
OUTPUT CONDENSER	0.01	μf
GRID RESISTOR OF FOLLOWING STAGE	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	OHMS
DISTORTION	5	PERCENT
OUTPUT VOLTAGE	8.5	VOLTS
VOLTAGE GAIN AT 400 CPS	35	

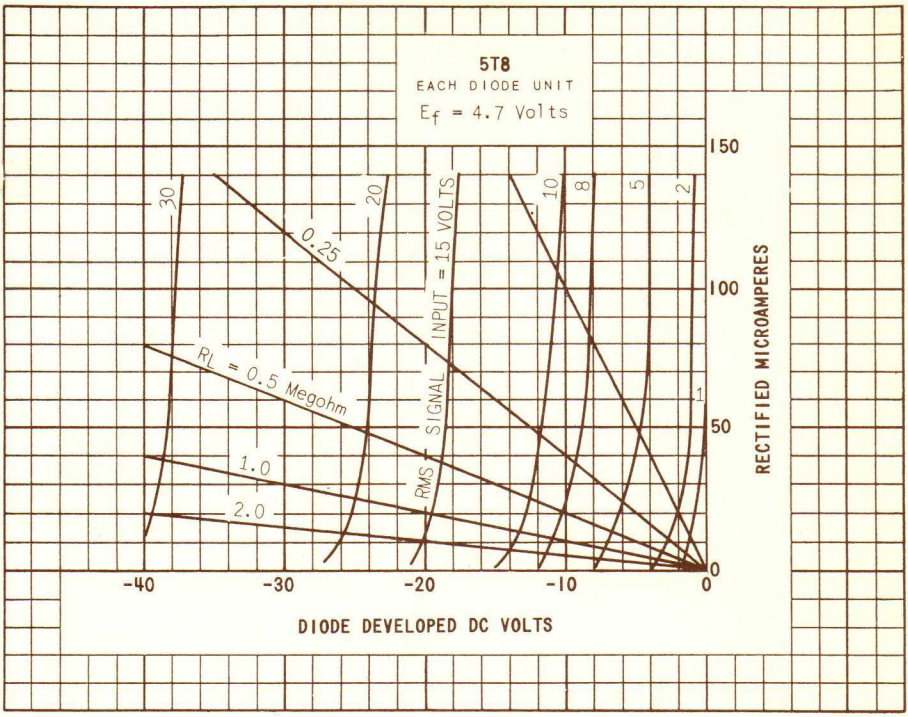
[A] WITH EXTERNAL SHIELD #315 CONNECTED TO PIN #7.

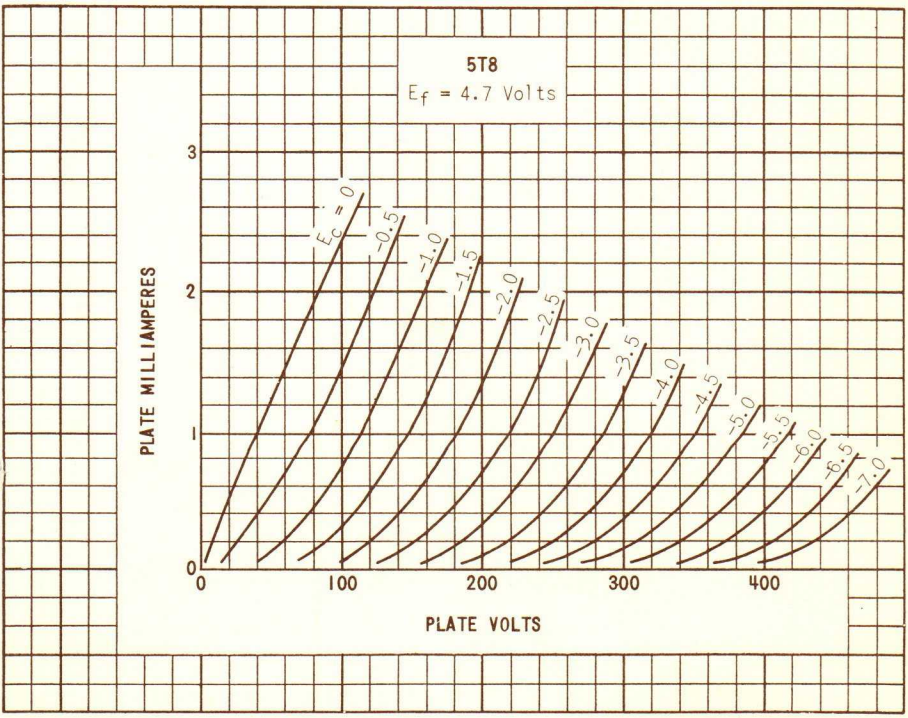
[B] WITH EXTERNAL SHIELD #315 CONNECTED TO PIN #3.

[C] WITH EXTERNAL SHIELD #315 CONNECTED TO PINS #4 AND #5.

** HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.





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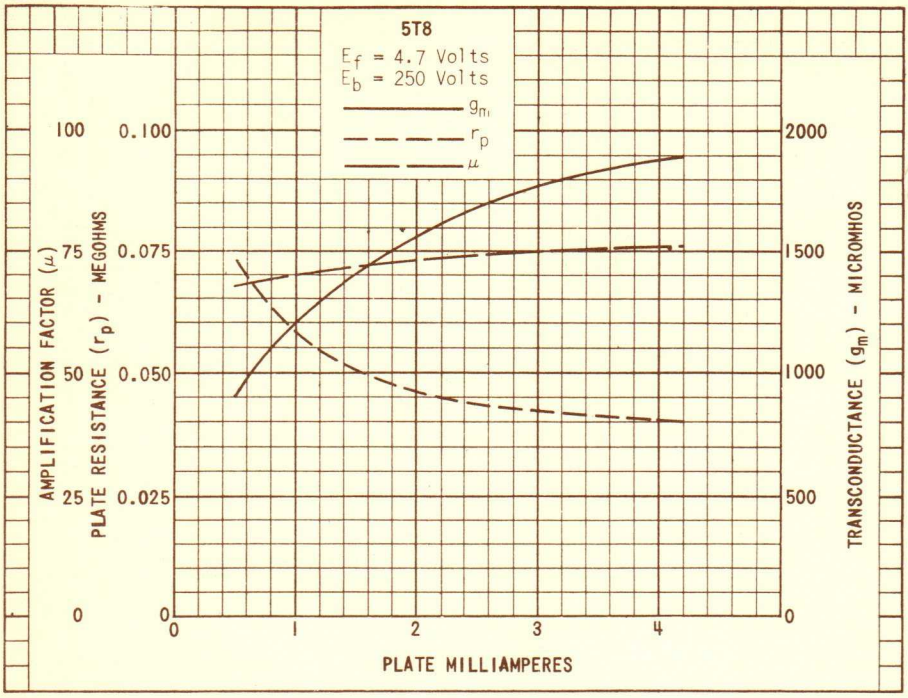
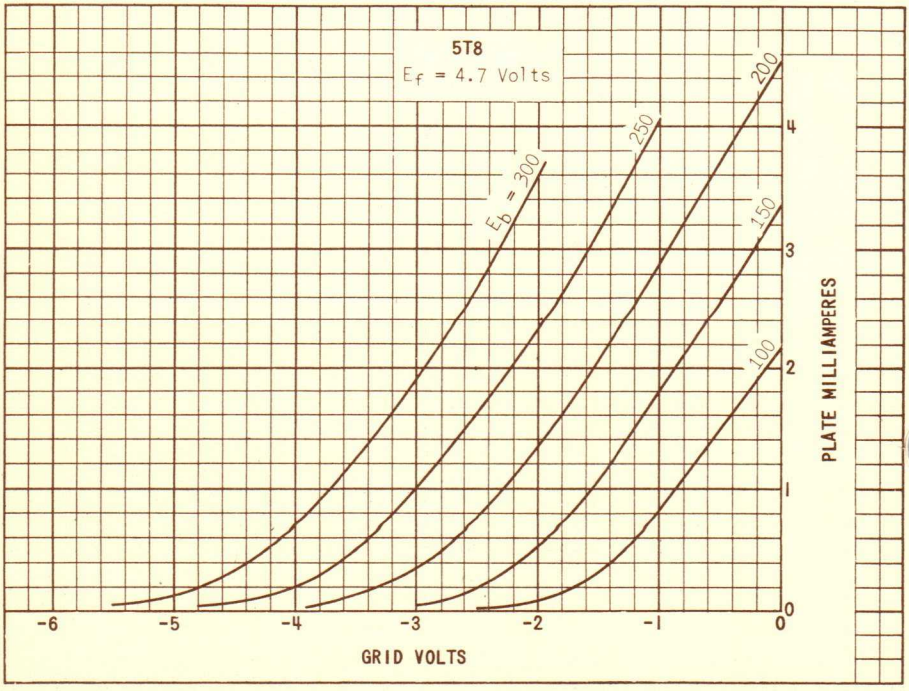

5T8
E_f = 4.7 Volts
E_b = 250 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE MILLIAMPERES
100
75
50
25
0
0.100
0.075
0.050
0.025
0
2000
1500
1000
500
0
0
1
2
3
4


5T8
E_f = 4.7 Volts
E_b = 300
250
200
150
100
PLATE MILLIAMPERES
GRID VOLTS
-6
-5
-4
-3
-2
-1
0
0
1
2
3
4

RESISTANCE COUPLED AMPLIFIER

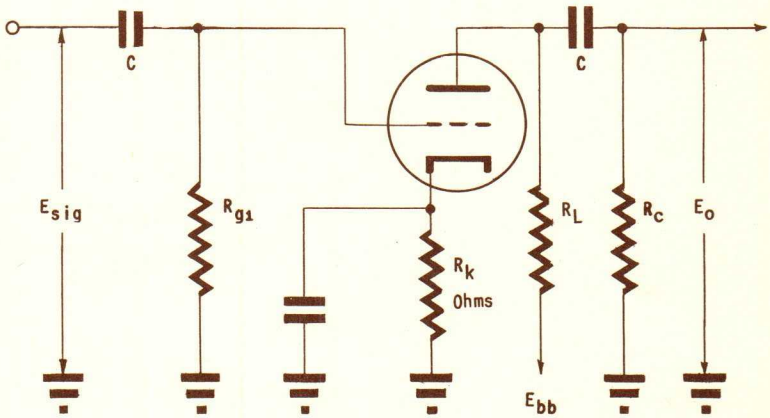
R1	Rg1	Rc	Ebb = 90 VOLTS			Ebb = 180 VOLTS			Ebb = 300 VOLTS		
MEG.	MEG.	MEG.	Rk	GAIN	Eo	Rk	GAIN	Eo	Rk	GAIN	Eo
0.10	A	0.10	5700	21	7	2400	29	18	1800	33	35
0.10	A	0.24	6100	26	9	2700	34	23	2000	38	42
0.24	A	0.24	9100	30	10	4300	40	24	3000	44	43
0.24	A	0.51	10000	34	13	4700	45	31	3300	49	52
0.51	A	0.51	15000	37	14	7500	47	28	5600	51	50
0.51	A	1	16000	40	16	8200	50	35	6200	55	60
0.24	10	0.24	---	31	5.0	---	44	19	---	48	40
0.24	10	0.51	---	37	7.0	---	49	25	---	52	52
0.51	10	0.51	---	39	7.5	---	51	22	---	54	44
0.51	10	1	---	42	10	---	54	28	---	58	56

[A] VALUE OF Rg1 IS NOT CRITICAL.

Rk TAKEN TO NEAREST RMA VALUE FOR EACH CASE INSTEAD OF ABSOLUTE OPTIMUM VALUE.

Eo IS RMS OUTPUT AT 5% TOTAL HARMONIC DISTORTION.

GAIN MEASURED AT Eo = 2.0 VOLTS RMS OUTPUT.



NOTE: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. Rk SHOULD BE ADEQUATELY BY-PASSED.

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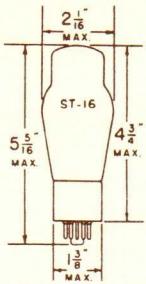


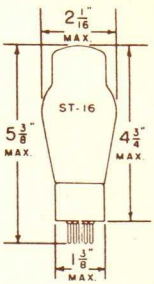
5U4G – MEDIUM 5 PIN OCTAL BASE
5X4G – MEDIUM 8 PIN OCTAL BASE

FULL WAVE
HIGH VACUUM RECTIFIER

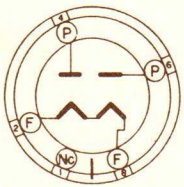
COATED FILAMENT

5.0 VOLTS 3.0 AMPERES
AC

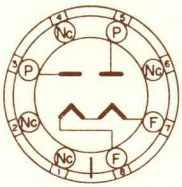
GLASS BULB



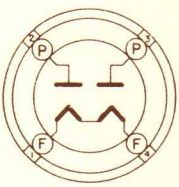
5Z3 – MEDIUM 4 PIN BASE



G-5Ta
BOTTOM VIEW
5U4G



G-5Q
BOTTOM VIEW
5X4G



4C
BOTTOM VIEW
5Z3

THE TUNG-SOL 5U4G, 5X4G AND 5Z3 ARE DESIGNED FOR SERVICE AS POWER RECTIFIERS IN AC OPERATED RECEIVERS WHICH REQUIRE HIGH CURRENTS. THEIR RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	1550	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	675	MA.

OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	450	VOLTS
DC OUTPUT CURRENT MAX.	225	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN. A	75	OHMS

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	550	VOLTS
DC OUTPUT CURRENT MAX.	225	MA.
VALUE OF INPUT CHOKE MIN.	3	HENRYS
TUBE VOLTAGE DROP AT 225 MA. PER PLATE	58	VOLTS

A WHEN FILTER CONDENSERS LARGER THAN 40 μfds ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

CONTINUED NEXT PAGE

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PLATE
687-2

JAN. 29
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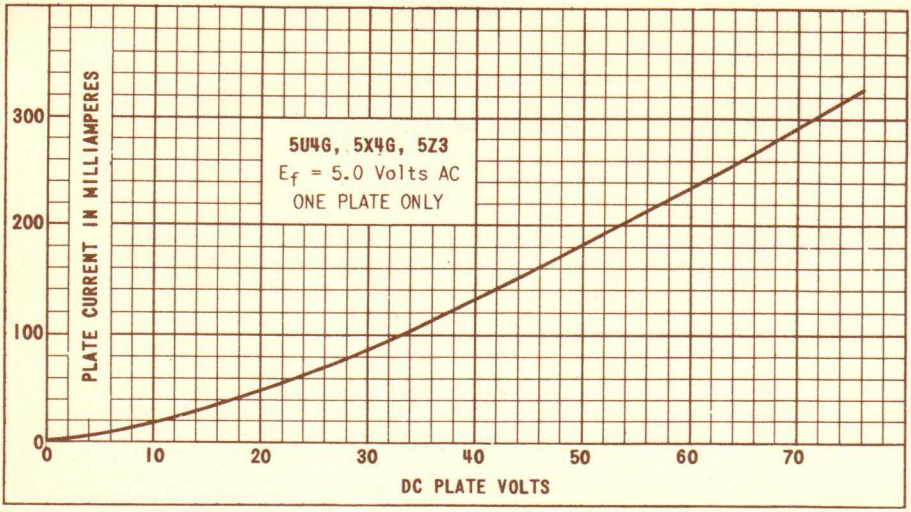
5U4G (5X4G, 5Z3)



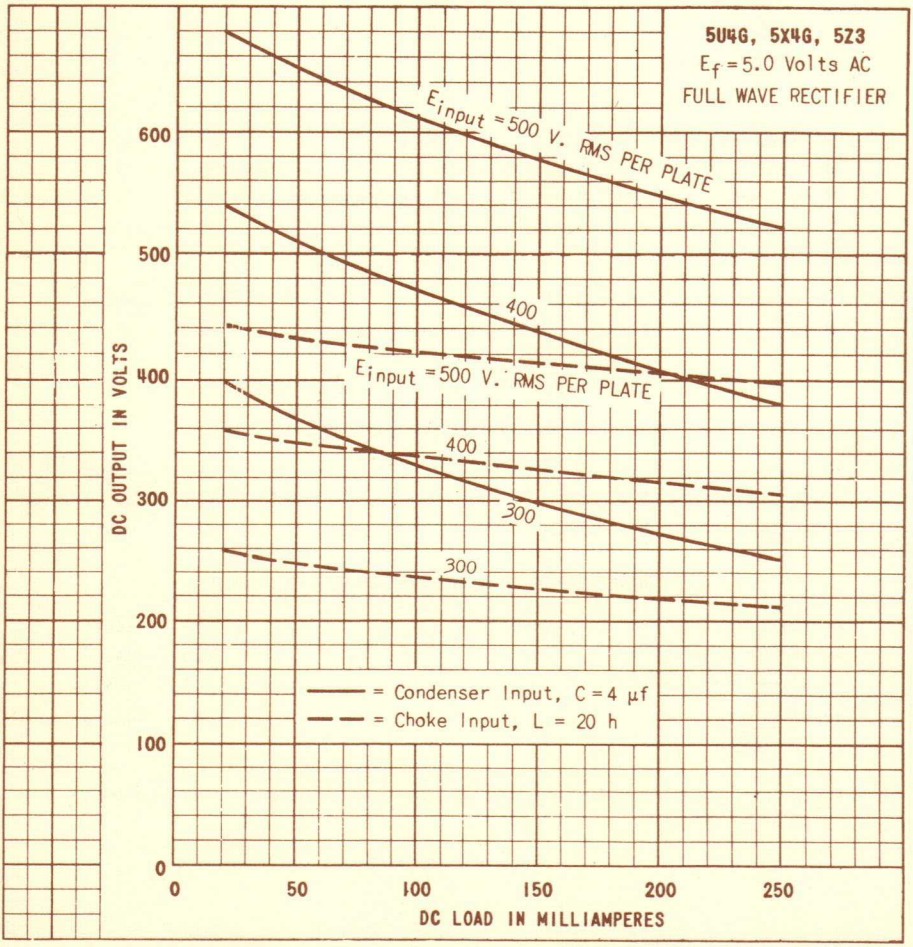


PLATE
688-1

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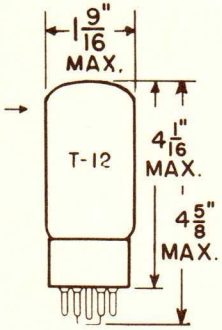
TUNG-SOL

DOUBLE DIODE



GLASS BULB

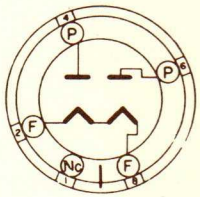
COATED FILAMENT

5.0 VOLTS 3.0 AMP.

AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMITTED IF PINS 1 AND 4 ARE IN A VERTICAL PLANE. ←



BOTTOM VIEW

MEDIUM SHELL
5 PIN OCTAL
5T

THE 5U4GB IS A FILAMENTARY FULL-WAVE HIGH VACUUM RECTIFIER DESIGNED FOR USE IN THE POWER SUPPLY OF TELEVISION RECEIVERS AND OTHER EQUIPMENT WHICH HAS HIGH OUTPUT CURRENT REQUIREMENTS. IT IS A REPLACEMENT FOR THE 5U4G; HOWEVER, THE 5U4GB HAS A STRAIGHT SIDED T-12 ENVELOPE AND HAS HIGHER CURRENT RATINGS THAN THE 5U4G.

RATINGS

INTEPRETED ACCORDING TO DESIGN CENTER SYSTEM

RECTIFIER SERVICE[A]

FILAMENT VOLTAGE	5.0	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1550	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE (EACH PLATE) RMS (SEE RATING CHART #1)	550	VOLTS
MAXIMUM DC OUTPUT CURRENT (SEE RATING CHART #1)	---	
MAXIMUM STEADY STATE PEAK PLATE CURRENT (EACH PLATE))SEE RATING CHART #2	1.0	AMP.
MAXIMUM TRANSIENT PEAK PLATE CURRENT (EACH PLATE) SEE RATING CHART #3	4.6	AMP
TUBE VOLTAGE DROP		
TUBE CONDUCTING: 225 MA. EACH PLATE	44	VOLTS
275 MA. EACH PLATE	50	VOLTS
300 MA. EACH PLATE	54	VOLTS

[A] FOR USE WITH SINUSOIDAL SUPPLY VOLTAGES WITHIN THE FREQUENCY RANGE OF 25 TO 1000 CYCLES PER SECOND.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

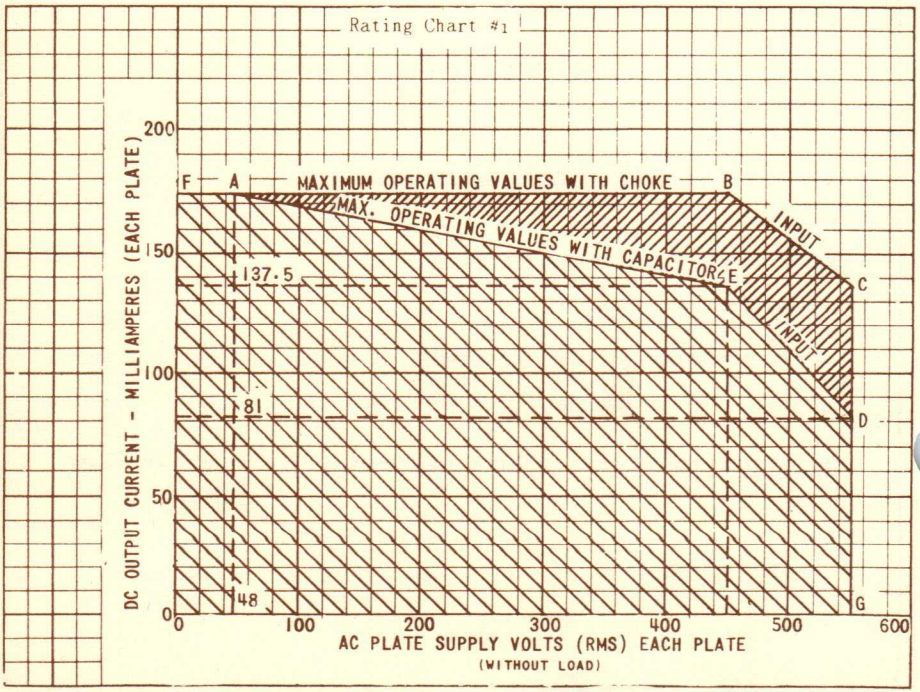
FULL-WAVE RECTIFIER - CAPACITOR INPUT FILTER

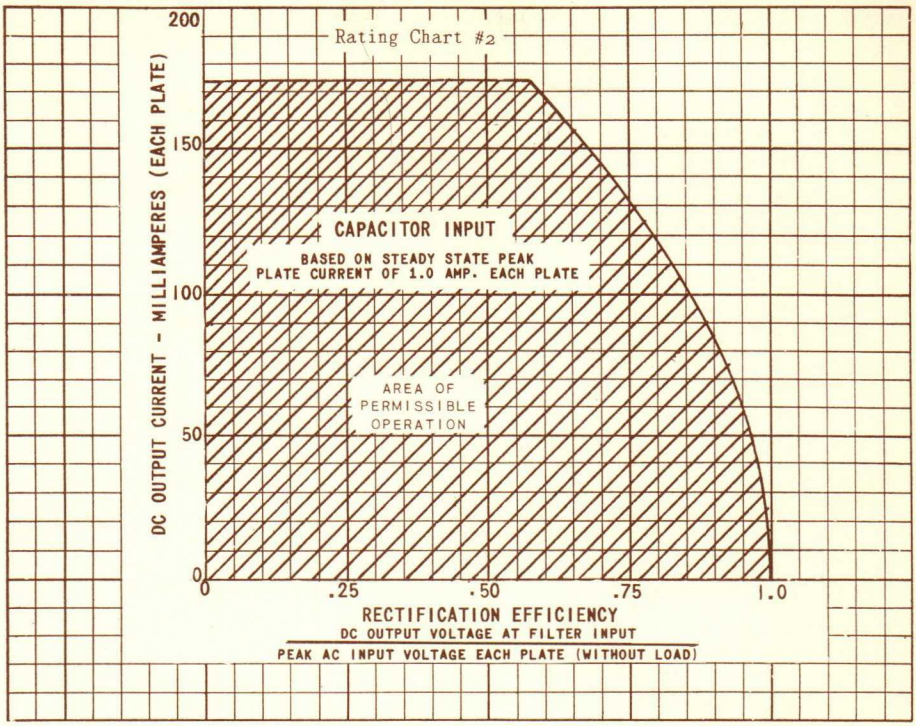
FILAMENT VOLTAGE	5.0		VOLTS
FILAMENT CURRENT	3.0		AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS[B]	300	450	VOLTS
FILTER INPUT CAPACITOR	40	40	μf
EFFECTIVE PLATE-SUPPLY RESISTANCE (EACH PLATE)	21	67	OHMS
DC OUTPUT CURRENT	300	275	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	290	460	VOLTS

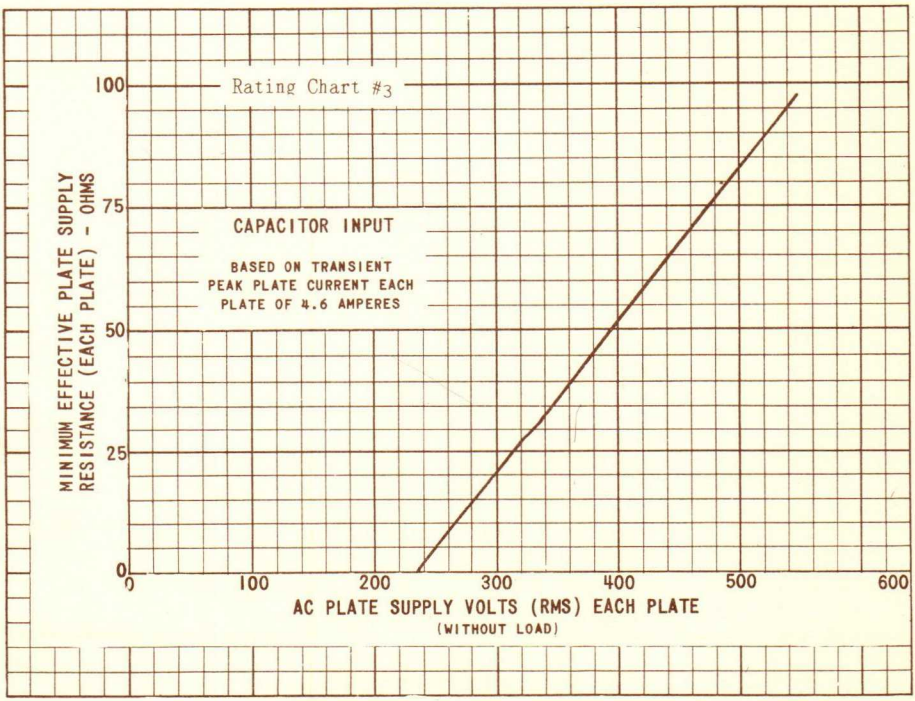
FULL-WAVE RECTIFIER - CHOKE INPUT FILTER

FILAMENT VOLTAGE	5.0	VOLTS
FILAMENT CURRENT	3.0	AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS[B]	550	VOLTS
FILTER INPUT CHOKE	10	HENRYS
DC OUTPUT CURRENT	275	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	420	VOLTS

[B] AC PLATE VOLTAGE IS MEASURED WITHOUT LOAD.







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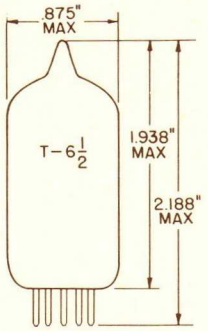
TRIODE PENTODE
MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

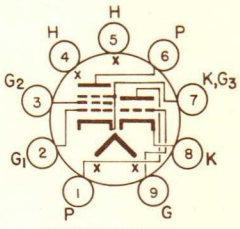
COATED UNIPOTENTIAL CATHODE

FOR

APPLICATION IN FM

OR TV RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9AE

THE 5U8 COMBINES TWO ELECTRICALLY INDEPENDENT SECTIONS-A TRIODE AND A PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. BOTH UNITS ARE CAPABLE OF GOOD PERFORMANCE AT THE HIGH FREQUENCIES. THE TUBE MAY BE USED AS A LOCAL OSCILLATOR-PENTODE MIXER IN FM OR TELEVISION RECEIVERS OR IN THE MANY COMBINED FUNCTIONS OF SUCH RECEIVERS. IN

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE: (PG1 TO PP) MAX.	→ 0.007	→ 0.015	pf
PENTODE INPUT: PG1 TO (H+PK+PG2+PG3+I.S.)	5.0	5.0	pf
PENTODE OUTPUT: PP TO (H+PK+PG2+PG3+I.S.)	3.5	2.6	pf
PENTODE CATHODE TO HEATER: H TO (PK+PG3+I.S.)	3.0[B]	3.0	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)	1.8	1.8	pf
TRIODE INPUT: TG TO (TK+H+PK+PG3+I.S.)	2.8	2.8	pf
TRIODE OUTPUT: TP TO (TK+h+PK+PG3+I.S.)	2.0	1.5	pf
TRIODE CATHODE TO HEATER (TK TO H)	3.0[B]	3.0	pf
PENTODE GRID TO TRIODE PLATE (PG TO TP) (MAX.)	0.20	0.2	pf
PENTODE PLATE TO TRIODE PLATE (PP TO TP) (MAX.)	0.02	0.1	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7 VOLTS	600	MA.
HEATER WARM-UP TIME [C]		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER CATHODE VOLTAGE: (EACH UNIT)			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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CONTINUED FROM PRECEDING PAGE

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE PLATE VOLTAGE	330	VOLTS
TRIODE PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
PENTODE PLATE DISSIPATION	3.0	WATTS
GRID 2 DISSIPATION: *		
FOR VOLTAGES UP TO 165 VOLTS	0.55	WATTS
FOR VOLTAGES BETWEEN 165 & 330 VOLTS	SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	2.5	WATTS
PENTODE GRID 1 CIRCUIT RESISTANCE:*		
WITH CATHODE BIAS	1.0	MEGOHM
WITH FIXED BIAS	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

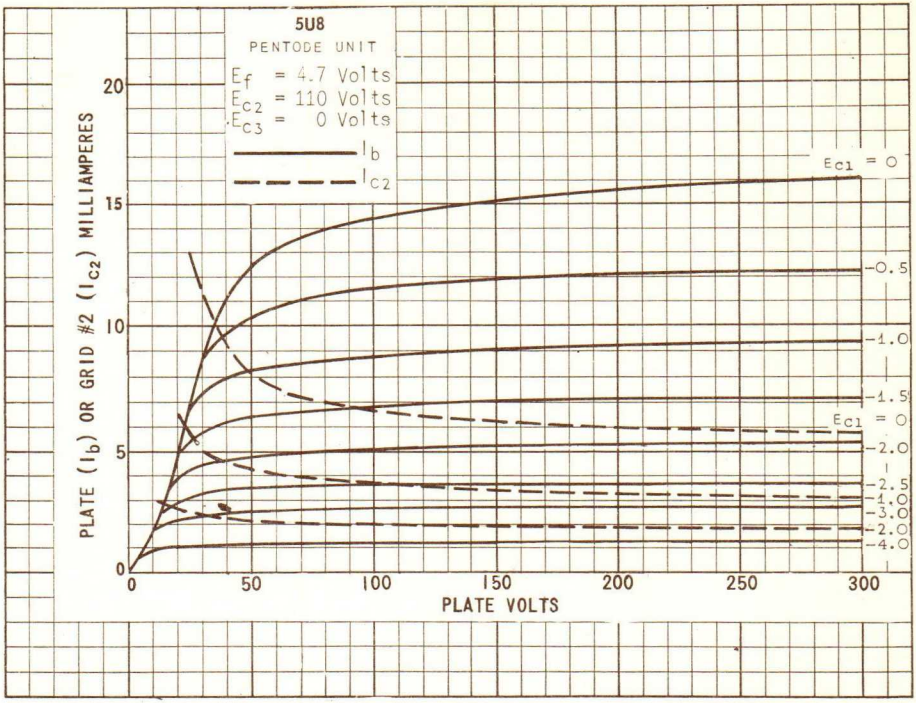
	TRIODE	PENTODE	
PLATE VOLTAGE	125	125	VOLTS
GRID 2 VOLTAGE	----	110	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	7500	5000	μMHOS
PLATE CURRENT	13.5	9.5	MA.
GRID 2 CURRENT	----	3.5	MA.
PLATE RESISTANCE (APPROX.)	----	0.2	MEGOHM
AMPLIFICATION FACTOR	40	----	
GRID 1 VOLTAGE (APPROX.) FOR Ib=20 μA	-9	-8	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb=100 V; Ec2=70 V)*	----	5500	μMHOS

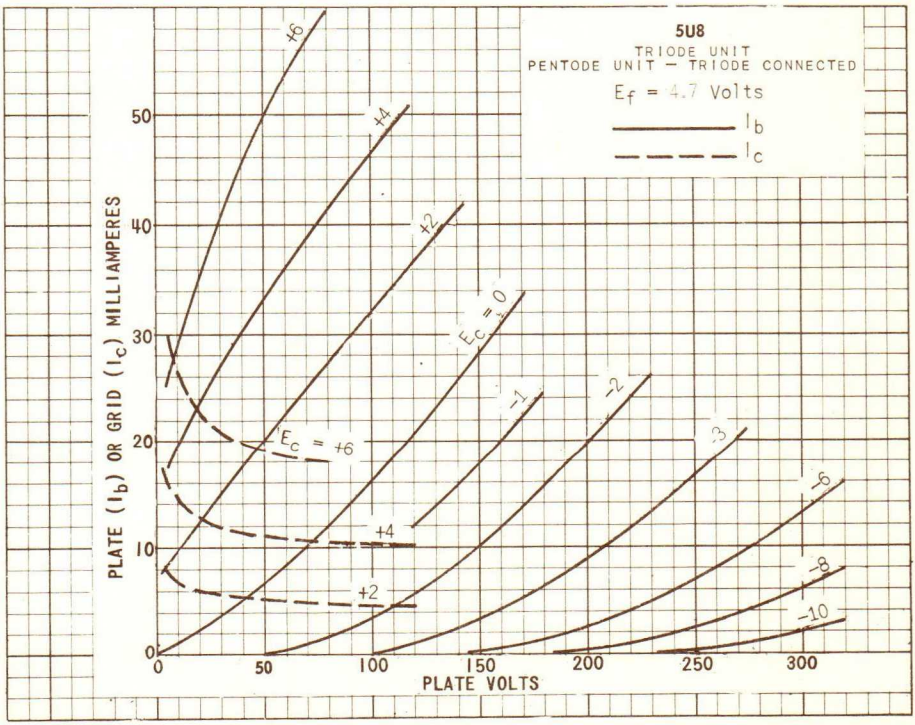
A
EXTERNAL SHIELD 315 CONNECTED TO PIN 4.

B
EXTERNAL SHIELD 315 CONNECTED TO PIN 6.

C
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.
* INDICATES AN ADDITION.





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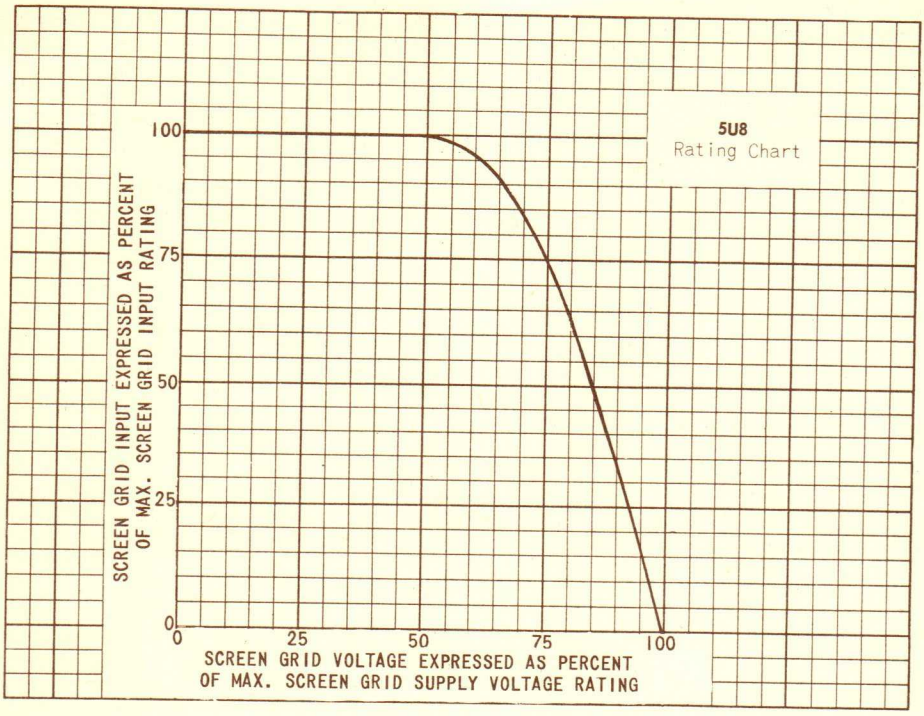
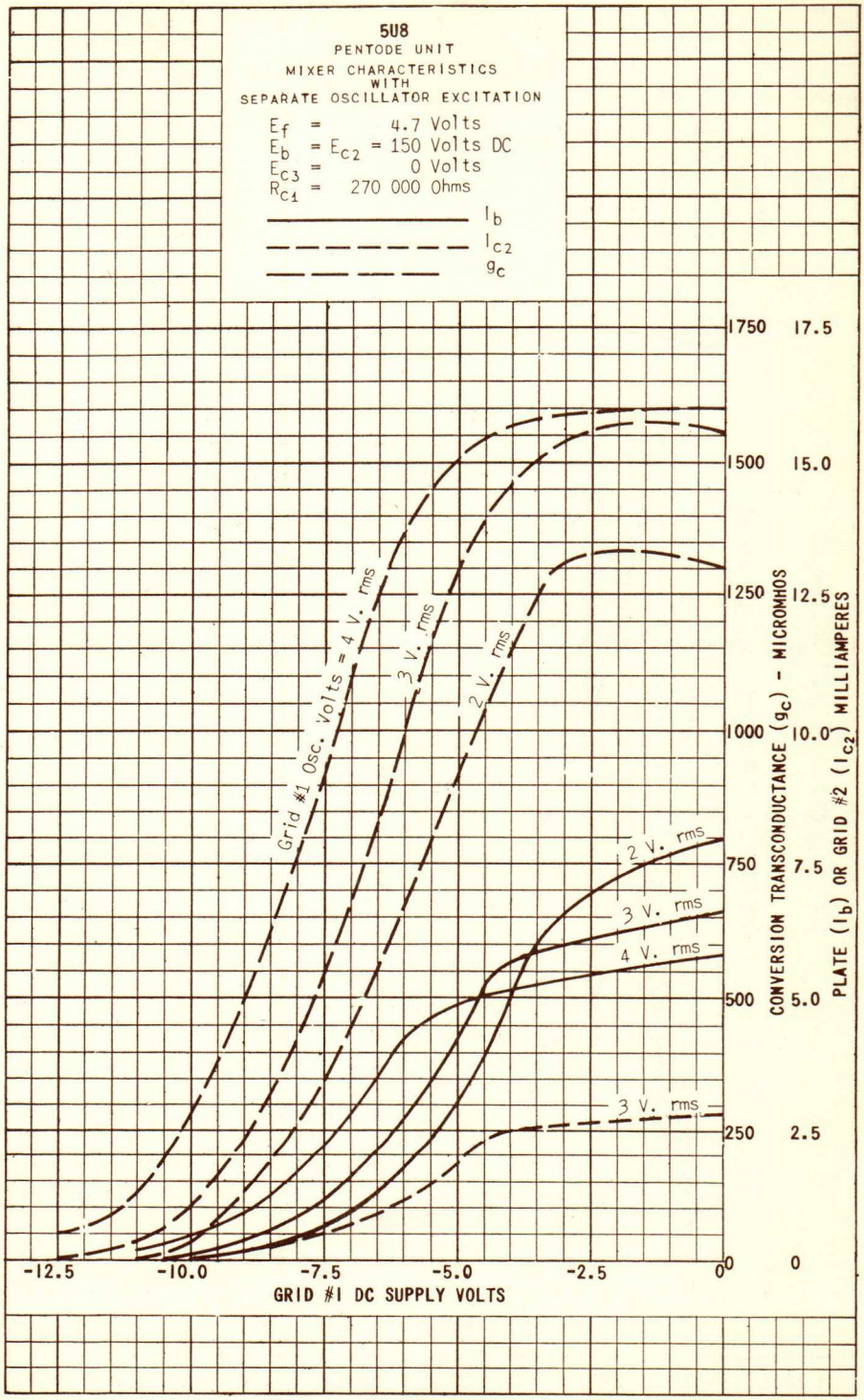

5U8
Rating Chart
SCREEN GRID INPUT EXPRESSED AS PERCENT OF MAX. SCREEN GRID INPUT RATING
100
75
50
25
0
0
25
50
75
100
SCREEN GRID VOLTAGE EXPRESSED AS PERCENT OF MAX. SCREEN GRID SUPPLY VOLTAGE RATING



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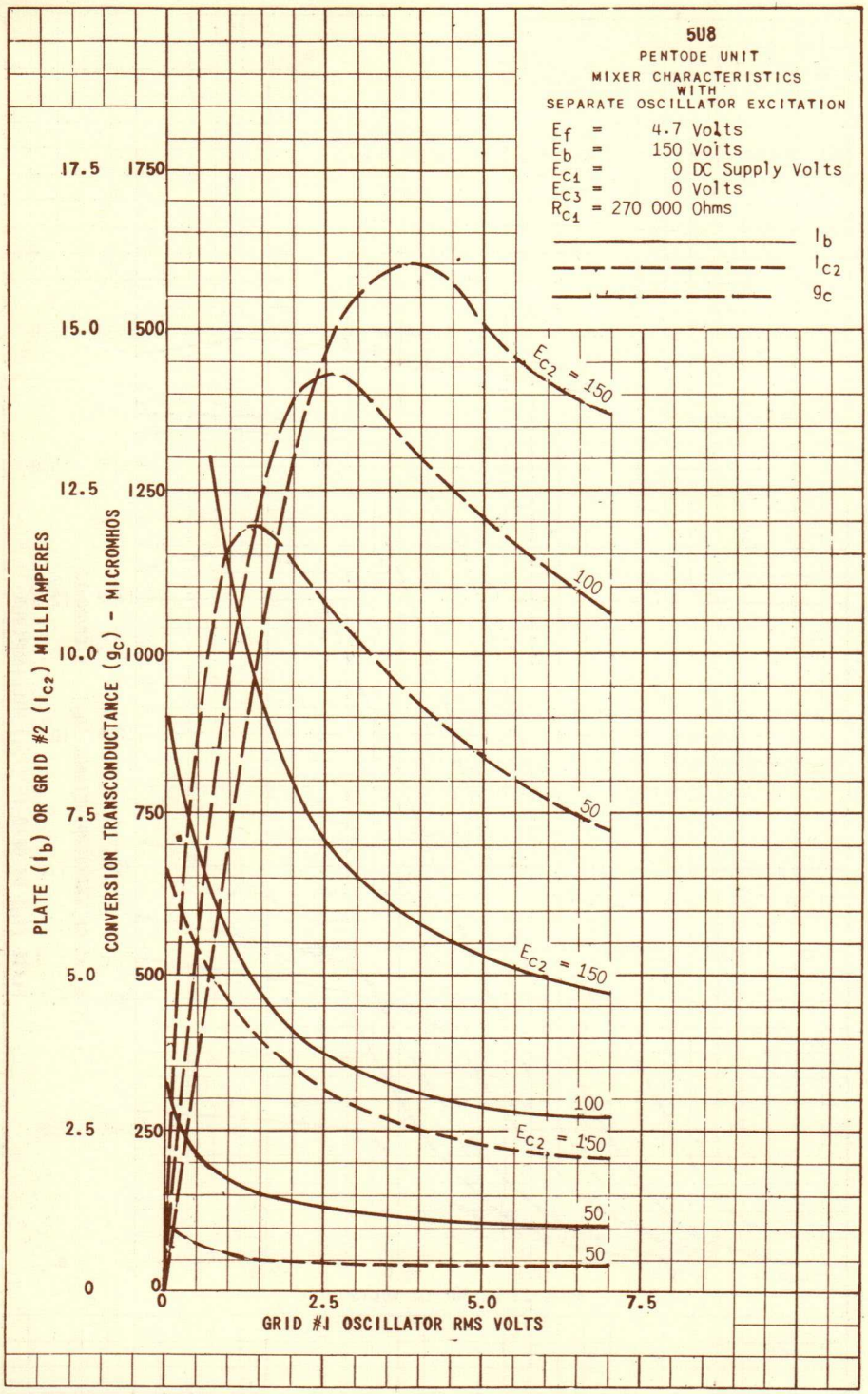
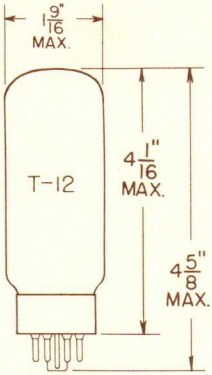

5U8
PENTODE UNIT
MIXER CHARACTERISTICS
WITH
SEPARATE OSCILLATOR EXCITATION
Ef = 4.7 Volts
Eb = 150 Volts
Ec1 = 0 DC Supply Volts
Ec3 = 0 Volts
Rc1 = 270 000 Ohms
Ib
Ic2
gc
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
CONVERSION TRANSCONDUCTANCE (gc) - MICROMHOS
GRID #1 OSCILLATOR RMS VOLTS
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0
1750
1500
1250
1000
750
500
250
0
2.5
5.0
7.5
Ec2 = 150
100
50
Ec2 = 150
100
Ec2 = 150
50
50

TUNG-SOL

TWIN DIODE



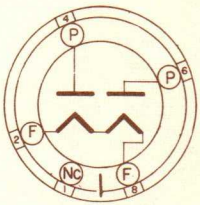
GLASS BULB

COATED FILAMENT

5.0 VOLTS 3.8 AMP.
AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
SHORT-MEDIUM SHELL
8 PIN OCTAL
5T

THE 5V3 IS A FILAMENTARY, FULL-WAVE, HIGH VACUUM RECTIFIER DESIGNED FOR SERVICE IN THE POWER SUPPLY OF COLOR TELEVISION RECEIVERS OR OTHER EQUIPMENT REQUIRING HIGH CURRENT.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

RECTIFIER SERVICE [B]

FILAMENT VOLTAGE	5.0	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1 400	VOLTS
MAXIMUM AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS (SEE RATING CHART #1)	500	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT (EACH PLATE) (SEE RATING CHART #2)	1.2	AMP.
MAXIMUM TRANSIENT PEAK PLATE CURRENT (EACH PLATE) (SEE RATING CHART #3)	5.5	AMP.
MAXIMUM DC OUTPUT CURRENT	SEE RATING CHART #1	

[B] FOR USE WITH SINUSOIDAL SUPPLY VOLTAGES WITHIN THE FREQUENCY RANGE OF 25 TO 1000 CPS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER – CAPACITOR INPUT FILTER

FILAMENT VOLTAGE	5.0		VOLTS
FILAMENT CURRENT	3.8		AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS [C]	300	425	VOLTS
FILTER INPUT CAPACITOR	40	40	μf
EFFECTIVE PLATE SUPPLY RESISTANCE (EACH PLATE)	24	56	OHMS
DC OUTPUT CURRENT	380	350	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	285	430	VOLTS

[C] AC PLATE VOLTAGE IS MEASURED WITHOUT LOAD.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

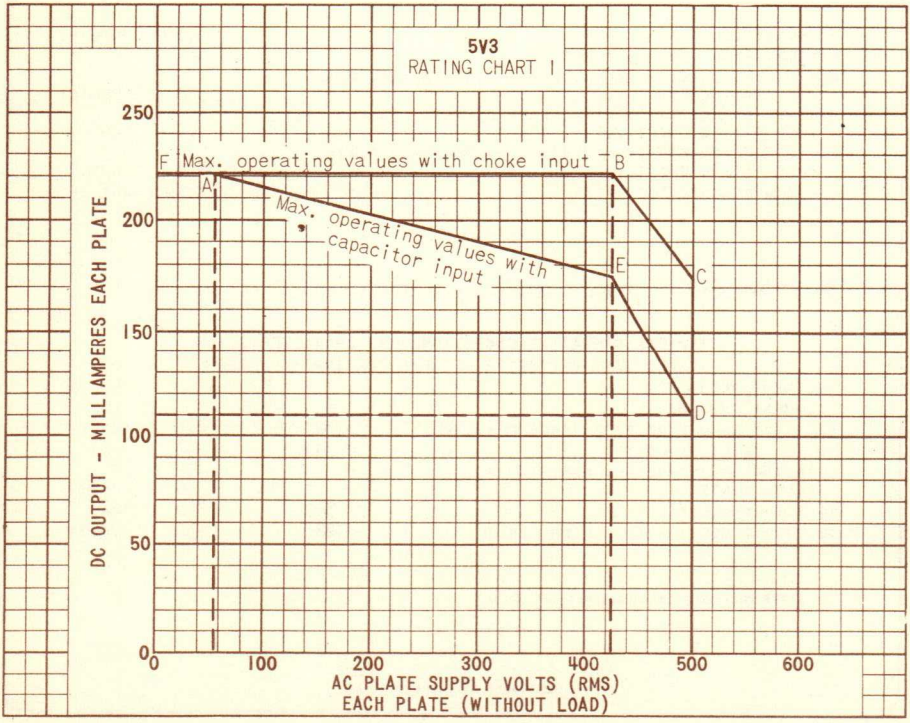
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D.

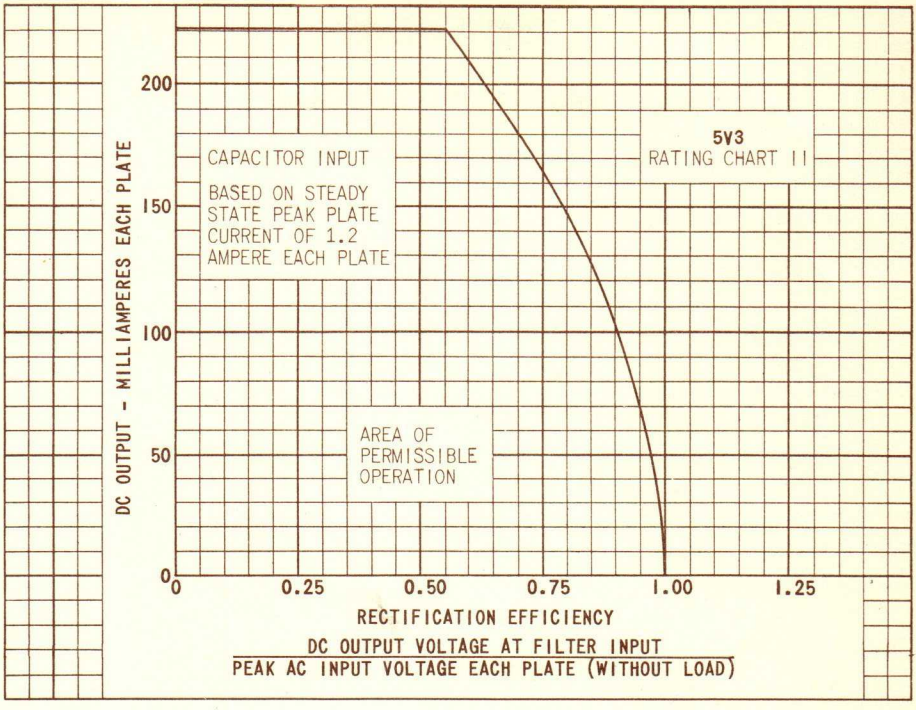
FULL WAVE RECTIFIER – CHOKE INPUT FILTER

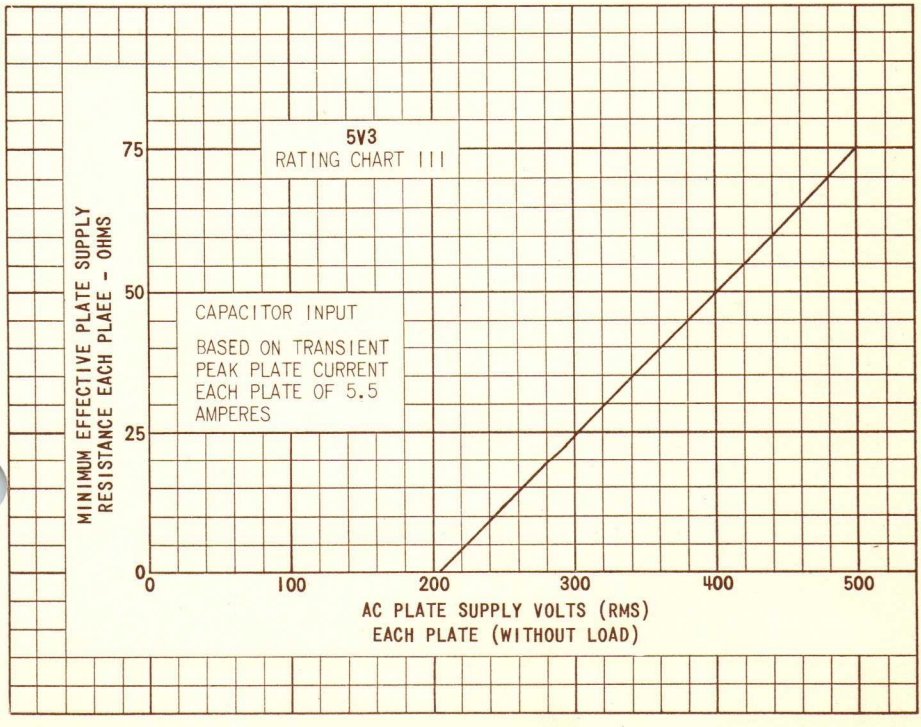
FILAMENT VOLTAGE	5.0	VOLTS
FILAMENT CURRENT	3.8	AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS[C]	500	VOLTS
FILTER INPUT CHOKE	10	HENRYS
DC OUTPUT CURRENT	350	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	385	VOLTS
TUBE VOLTAGE DROP		
TUBE CONDUCTING 350 MA. (EACH PLATE)*	47	VOLTS

[C] AC PLATE VOLTAGE IS MEASURED WITHOUT LOAD.

*INDICATES AN ADDITION.

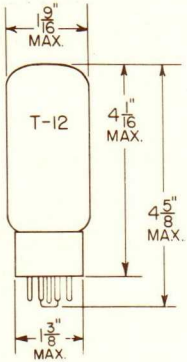



DC OUTPUT - MILLIAMPERES EACH PLATE
200
150
100
50
0
0
0.25
0.50
0.75
1.00
1.25
CAPACITOR INPUT
BASED ON STEADY STATE PEAK PLATE CURRENT OF 1.2 AMPERE EACH PLATE
5V3
RATING CHART II
AREA OF PERMISSIBLE OPERATION
RECTIFICATION EFFICIENCY
DC OUTPUT VOLTAGE AT FILTER INPUT
PEAK AC INPUT VOLTAGE EACH PLATE (WITHOUT LOAD)


MINIMUM EFFECTIVE PLATE SUPPLY RESISTANCE EACH PLAEE - OHMS
75
50
25
0
0
100
200
300
400
500
5V3
RATING CHART III
CAPACITOR INPUT
BASED ON TRANSIENT PEAK PLATE CURRENT EACH PLATE OF 5.5 AMPERES
AC PLATE SUPPLY VOLTS (RMS)
EACH PLATE (WITHOUT LOAD)

TUNG-SOL

TWIN DIODE



GLASS BUBL

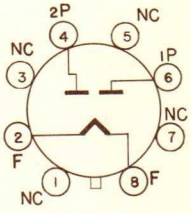
TUBE OUTLINE
JEDEC 12-16

COATED FILAMENT

5.0 VOLTS 3.0 AMP.

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW

SHORT MEDIUM SHELL
8 PIN OCTAL
WITH BARRIER

BASING DIAGRAM

JEDEC 5T

THE 5V3A IS A FILAMENTARY FULL WAVE, HIGH VACUUM RECTIFIER DESIGNED FOR SERVICE IN THE POWER SUPPLY OF TELEVISION RECEIVERS OR OTHER EQUIPMENT REQUIRING HIGH CURRENTS.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

RECTIFIER SERVICE[C]

FILAMENT VOLTAGE	5.0±0.5	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1550	VOLTS
MAXIMUM RMS AC PLATE SUPPLY VOLTAGE (EACH PLATE)	550	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT(EA. PLATE)	1.4	AMP.
MAXIMUM TRANSIENT PEAK PLATE CURRENT (EACH PLATE)	6.6	AMP.
MAXIMUM DC OUTPUT CURRENT (CONDENSER INPUT) WITH AC PLATE SUPPLY VOLTAGE OF 470 VOLTS (RMS)	415	MA.
MAXIMUM BULB TEMPERATURE	240	°C
TUBE VOLTAGE DROP, TUBE CONDUCTING 350 MA (EA. PLATE)	42	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER–CAPACITOR INPUT FILTER

AC PLATE SUPPLY VOLTAGE (EA. PLATE)RMS[D]	300	425	VOLTS
FILTER INPUT CAPACITOR	40	40	μf
EFFECTIVE PLATE SUPPLY RESISTANCE (EA. 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[D]	500	VOLTS
FILTER INPUT CHOKE	10	HENRY
DC OUTPUT CURRENT	350	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	390	VOLTS

CONTINUED ON FOLLOWING PAGE

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NOTES

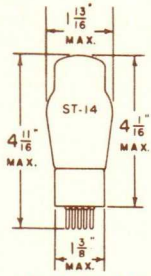
[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] FOR USE WITH SINUSOIDAL SUPPLY VOLTAGES WITHIN THE FREQUENCY RANGE OF 25 TO 1000 CYCLES.

[D] AC PLATE VOLTAGE IS MEASURED WITHOUT LOAD.

[E] FILAMENT CURRENT AT 5.0 VOLTS.

TUNG-SOL



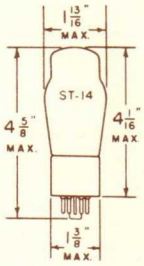
MEDIUM 4 PIN BASE
83V

FULL WAVE
HIGH VACUUM RECTIFIER

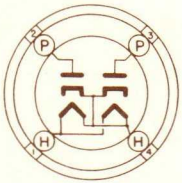
UNIPOTENTIAL CATHODE

HEATER
5.0 VOLTS 2.0 AMPERES
AC

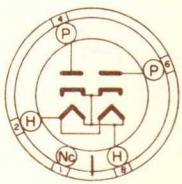
GLASS BULB



MEDIUM 5 PIN OCTAL BASE
5V4G



4L
BOTTOM VIEW



G-5L
BOTTOM VIEW

THE TUNG-SOL 5V4G AND 83V ARE POWER RECTIFIERS WITH LOW INTERNAL VOLTAGE DROPS. THEY ARE DESIGNED FOR SERVICE IN AC OPERATED RECEIVERS THAT REQUIRE HIGH CURRENTS. THEIR RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	1400	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	525	MA.

OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	375	VOLTS
DC OUTPUT CURRENT MAX.	175	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN. A	65	OHMS

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	500	VOLTS
DC OUTPUT CURRENT MAX.	175	MA.
VALUE OF INPUT CHOKE MIN. A	4.0	HENRYS
TUBE VOLTAGE DROP AT 175 MA. PER PLATE	23	VOLTS

A WHEN FILTER CONDENSERS LARGER THAN 40 μFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

FOR "INTERPRETATION OF RATINGS", REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE 699-2

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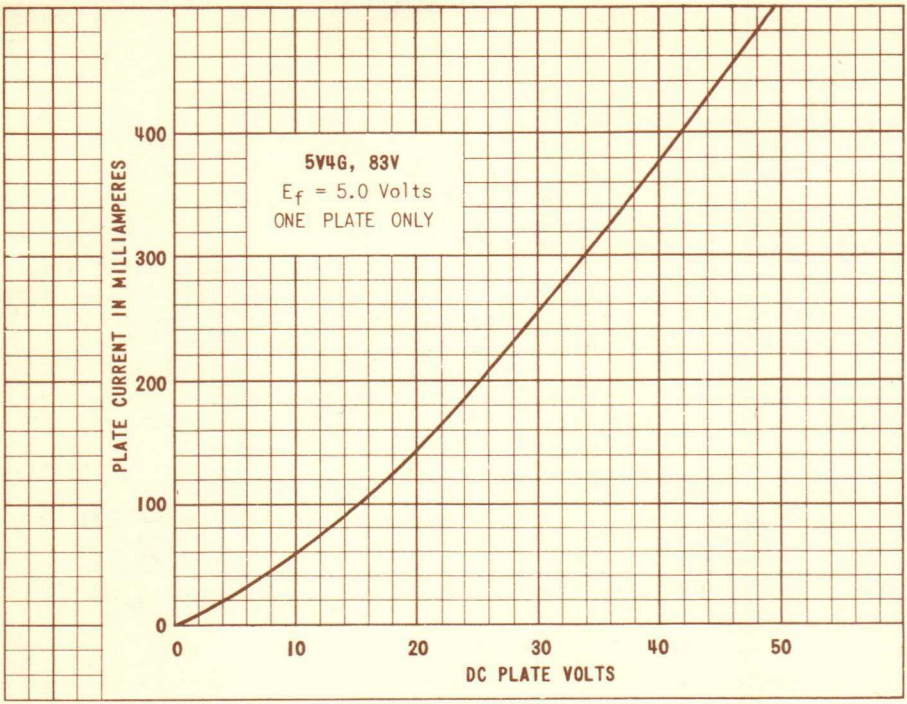
5V4G (83V)



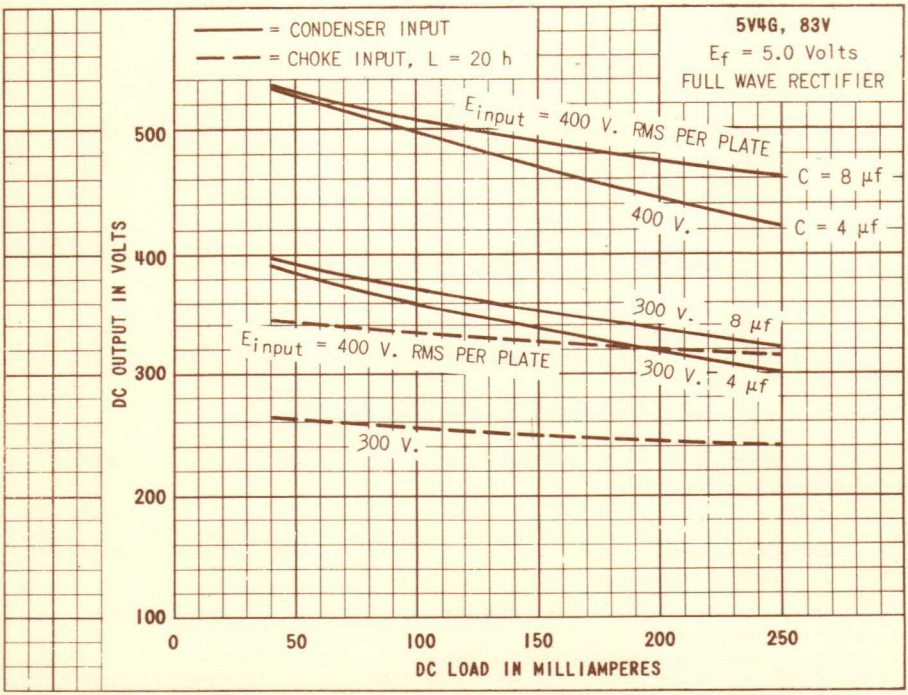


PLATE 700-1

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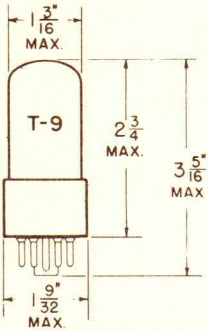
TUNG-SOL

BEAM PENTODE



GLASS BULB

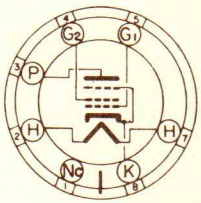
COATED UNIPOTENTIAL CATHODE

HEATER

4.7 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE SHELL
7 PIN OCTAL
7S

THE 5V6GT IS A BEAM POWER AMPLIFIER DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF 600 MA. SERIES HEATER OPERATED TV RECEIVERS. IT HAS HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT WITH COMPARATIVELY LOW SUPPLY VOLTAGE. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6V6GT.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: (G_1 TO P)	0.7	μμf
INPUT: G_1 TO (H+K+G_2+G_3)	9.0	μμf
OUTPUT: P TO (H+K+G_2+G_3)	7.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

HEATER VOLTAGE	4.7	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 DISSIPATION	2	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.1	MEGOHM
CATHODE BIAS OPERATION	0.5	MEGOHM

VERTICAL DEFLECTION AMPLIFIER - TRIODE CONNECTION[AB]

HEATER VOLTAGE	4.7	VOLTS
MAXIMUM DC PLATE VOLTAGE	315	VOLTS
MAXIMUM PEAK POSITIVE VOLTAGE (ABSOLUTE MAXIMUM)	1200	VOLTS
MAXIMUM PLATE DISSIPATION[C]	9	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	250	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	35	MA.
MAXIMUM PEAK CATHODE CURRENT	105	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (CATHODE BIAS)	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] ALL VALUES ARE EVALUATED ON DESIGN CENTER SYSTEM EXCEPT WHERE ABSOLUTE MAXIMUM IS STATED.

[B] 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 NOT TO EXCEED 15% OF A SCANNING CYCLE.

[C] 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 WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – SINGLE TUBE

HEATER VOLTAGE	4.7	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	180	250	315	VOLTS
GRID #2 VOLTAGE	180	250	225	VOLTS
GRID #1 VOLTAGE	-8.5	-12.5	-13.0	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	12.5	13.0	VOLTS
ZERO-SIGNAL PLATE CURRENT	29	45	34	MA.
MAXIMUM-SIGNAL PLATE CURRENT	30	47	35	MA.
ZERO-SIGNAL GRID #2 CURRENT	3	4.5	2.2	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	4	7	6	MA.
PLATE RESISTANCE (APPROX.)	50 000	50 000	80 000	OHMS
TRANSCONDUCTANCE	3 700	4 100	3 750	µMHOS
LOAD RESISTANCE	5 500	5 000	8 500	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	2	4.5	5.5	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	8	8	12	PERCENT

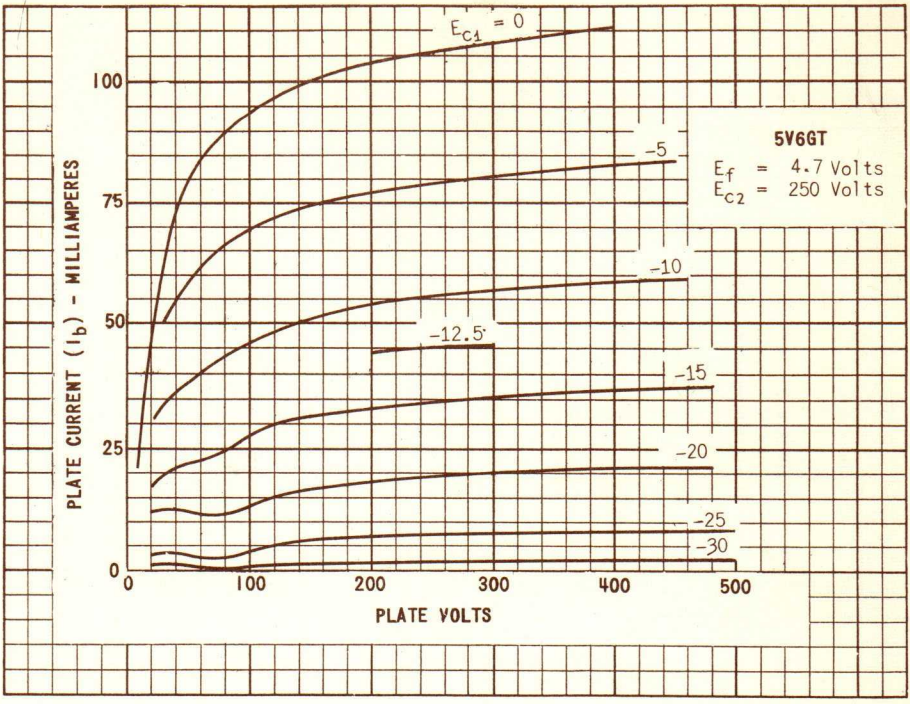
CLASS A_1 AMPLIFIER – PUSH-PULL

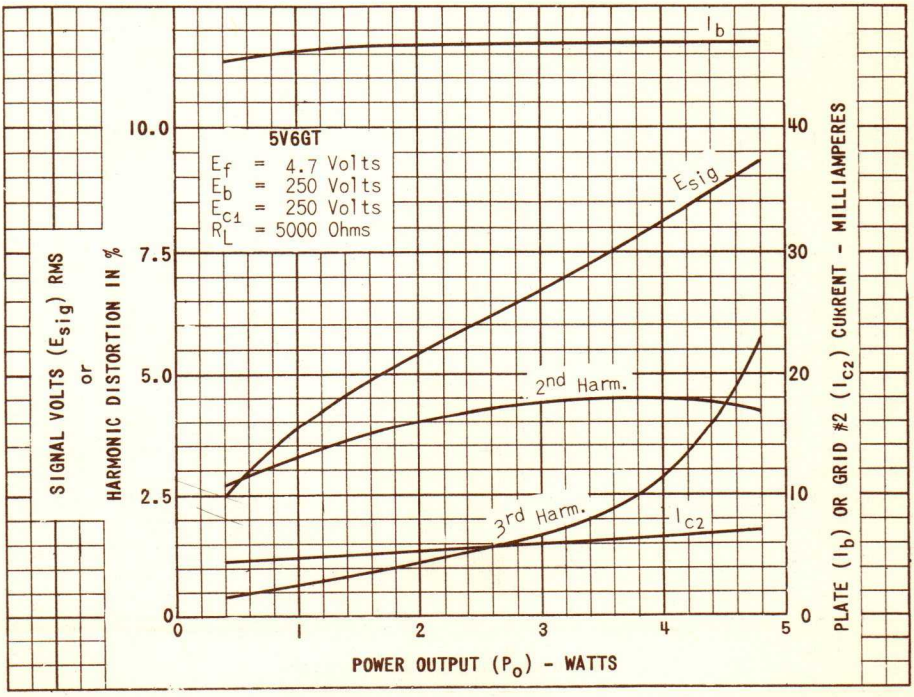
UNLESS OTHERWISE SPECIFIED, VALUES ARE FOR TWO TUBES.

HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	250	285	VOLTS
GRID #2 VOLTAGE	250	285	VOLTS
GRID #1 VOLTAGE	-15	-19	VOLTS
PEAK AF GRID #1 TO GRID #1 VOLTAGE	30	38	VOLTS
ZERO-SIGNAL PLATE CURRENT	70	70	MA.
MAXIMUM-SIGNAL PLATE CURRENT	79	92	MA.
ZERO-SIGNAL GRID #2 CURRENT	5	4	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	13	13.5	MA.
PLATE-TO-PLATE LOAD RESISTANCE	10 000	8 000	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	10	14	WATTS
TOTAL HARMONIC DISTORTION	5	3.5	PERCENT

CLASS A_1 AMPLIFIER – TRIODE CONNECTION

HEATER VOLTAGE	4.7	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-12.5	VOLTS
PLATE CURRENT	49.5	MA.
TRANSCONDUCTANCE	5 000	µMHOS
AMPLIFICATION FACTOR	9.8	
PLATE RESISTANCE (APPROX.)	1 960	OHMS
GRID VOLTAGE FOR I_b = 0.5 MA. (APPROX.)	-36	VOLTS





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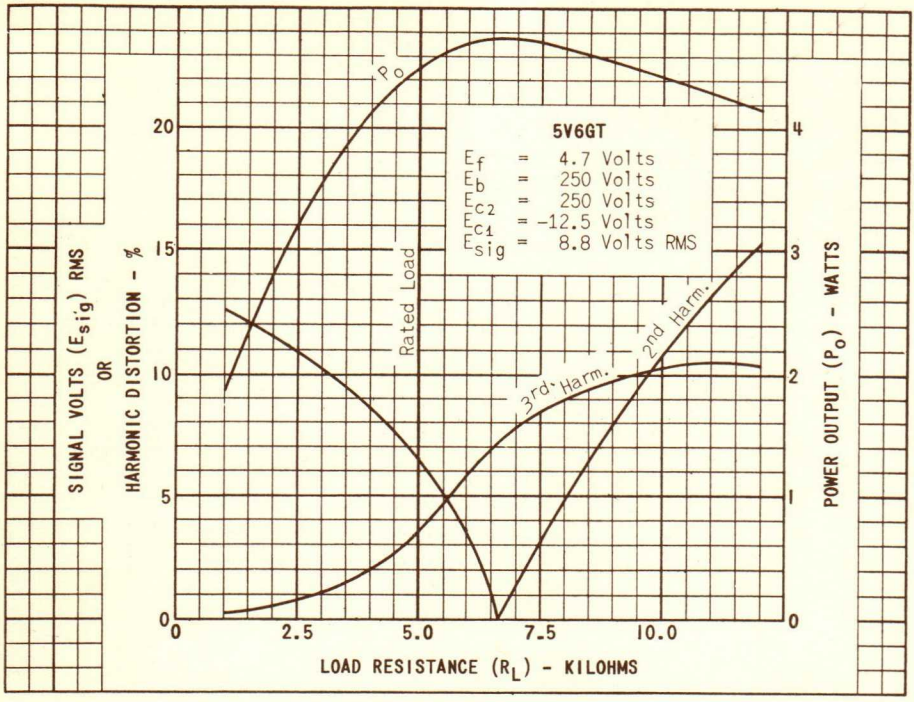
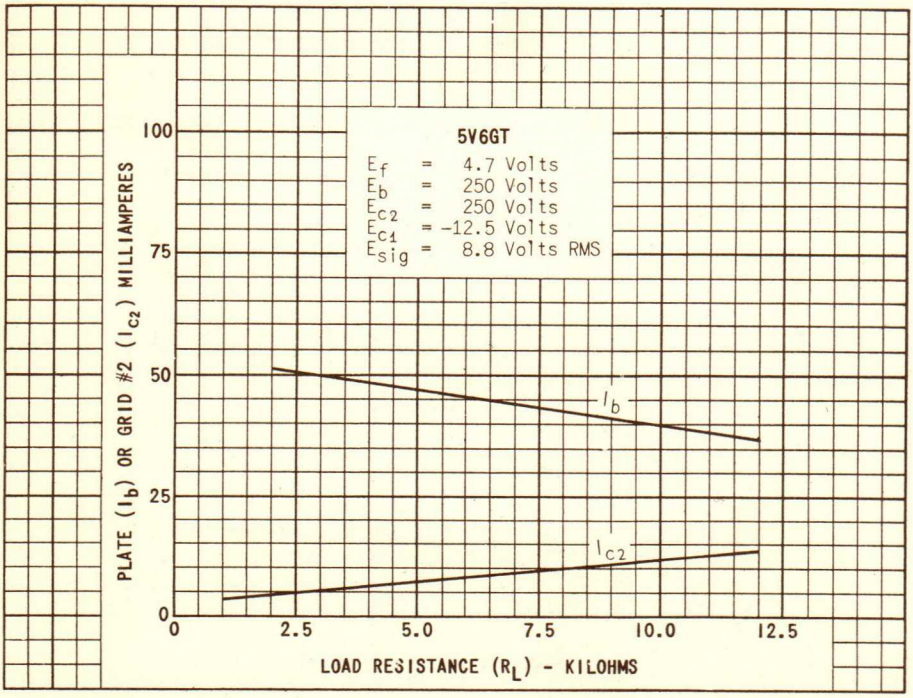
5V6GT





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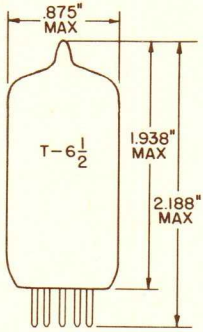
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

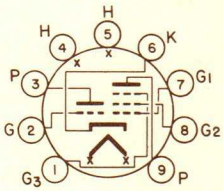
COATED UNIPOTENTIAL CATHODE

FOR USE AS A COMBINED

OSCILLATOR AND MIXER

IN AM-FM RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9AK

THE 5X8 IS A MULTI-UNIT TUBE USING THE 9 PIN MINIATURE CONSTRUCTION. IT CONTAINS A MEDIUM-MU TRIODE AND A SHARP CUTOFF PENTODE IN ONE ENVELOPE. IT IS DESIGNED PRIMARILY FOR USE AS A COMBINED OSCILLATOR AND MIXER TUBE IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS UTILIZING AN INTERMEDIATE FREQUENCY IN THE ORDER OF 40 MC/S. IT IS ESPECIALLY USEFUL IN AM/FM RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE:			
PG1 TO PP MAX.	0.06	0.09	pf
PENTODE INPUT: PG1 TO (H+K+PG2+PG3)	4.8	4.6	pf
PENTODE OUTPUT: PP TO (H+K+PG2+PG3)	1.6	0.9	pf
CATHODE TO HEATER: K TO H	6.0[B]	6.0	pf
TRIODE GRID TO TRIODE PLATE: TG TO TP	1.5	1.5	pf
TRIODE INPUT: TG TO (H+K)	2.4	2.0	pf
TRIODE OUTPUT: TP TO (H+K)	1.0	0.5	pf
PENTODE GRID 1 TO TRIODE PLATE:			
PG1 TO TP MAX.	0.04	0.05	pf
PENTODE PLATE TO TRIODE PLATE: PP TO TP MAX.	0.008	0.05	pf

[A] EXTERNAL SHIELD 315 CONNECTED TO PIN 6.

[B] EXTERNAL SHIELD 315 CONNECTED TO PIN 9.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7 VOLTS	600	MA.
HEATER WARM-UP TIME[C]		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	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

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE PLATE VOLTAGE	275	VOLTS
TRIODE PLATE VOLTAGE	275	VOLTS
GRID 2 SUPPLY VOLTAGE	275	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
PENTODE PLATE DISSIPATION	2.3	WATTS
GRID 2 DISSIPATION - SEE RATING CHART	0.45	WATT
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	1.7	WATTS

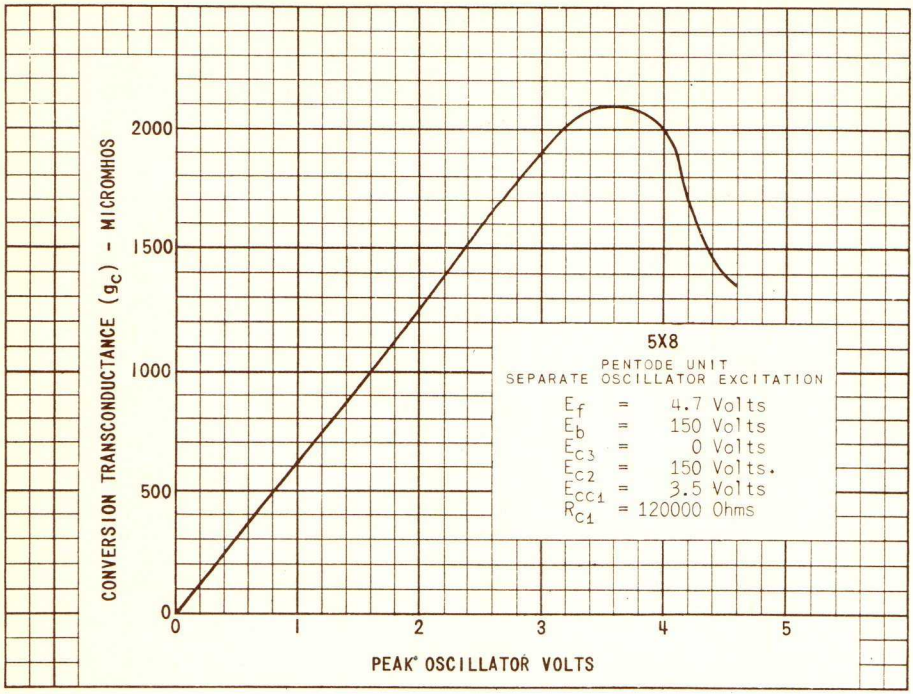
TYPICAL OPERATING CHARACTERISTICS

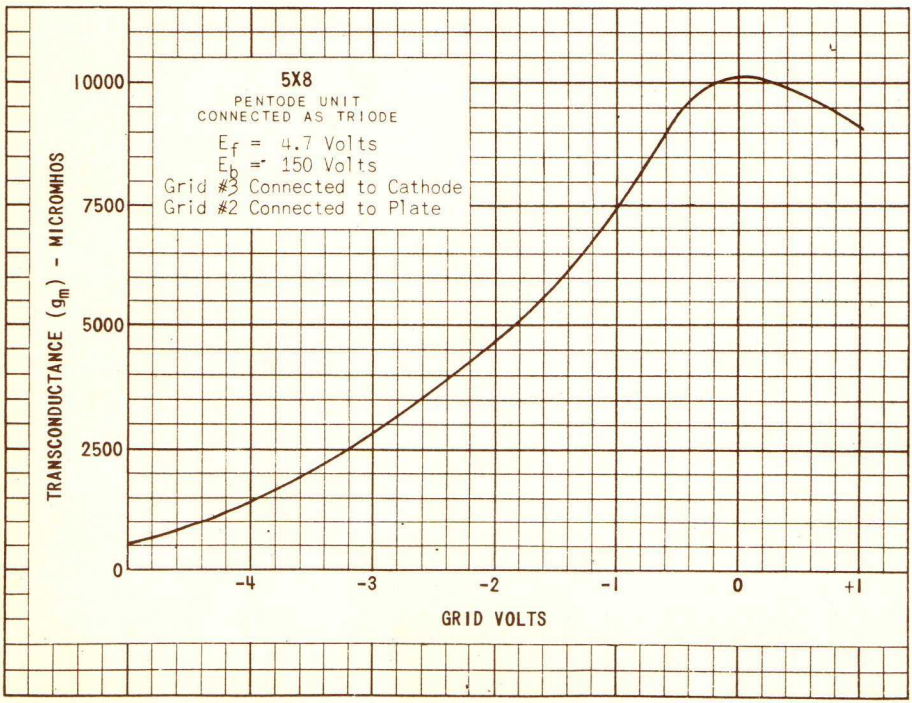
CLASS A1 AMPLIFIER

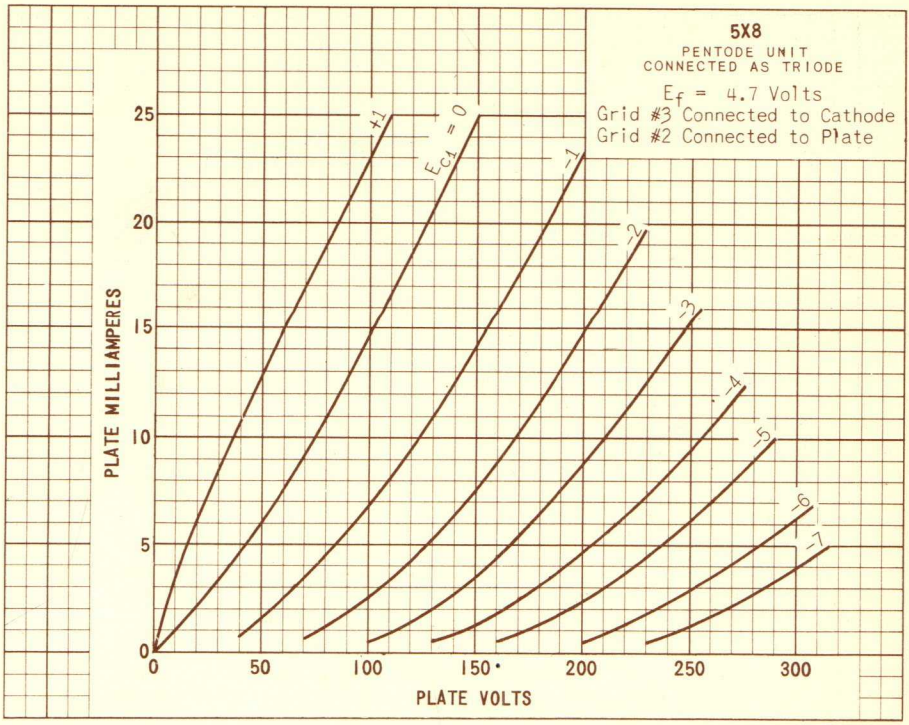
	TRIODE	PENTODE	
PLATE VOLTAGE	125	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO PIN 6 AT SOCKET		
GRID 2 VOLTAGE	-----	125	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
GRID 2 CURRENT	-----	2.2	MA.
PLATE CURRENT	12.0	9.0	MA.
TRANSCONDUCTANCE	6500	5500	μMHOS
AMPLIFICATION FACTOR	40	-----	
PLATE RESISTANCE (APPROX.)	6000	300,000	OHMS
GRID 1 VOLTAGE (APPROX.) FOR Ib=20 μA.	-7	-6.5	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb=100 V., Ec2=70 V)	-----	5700	μMHOS

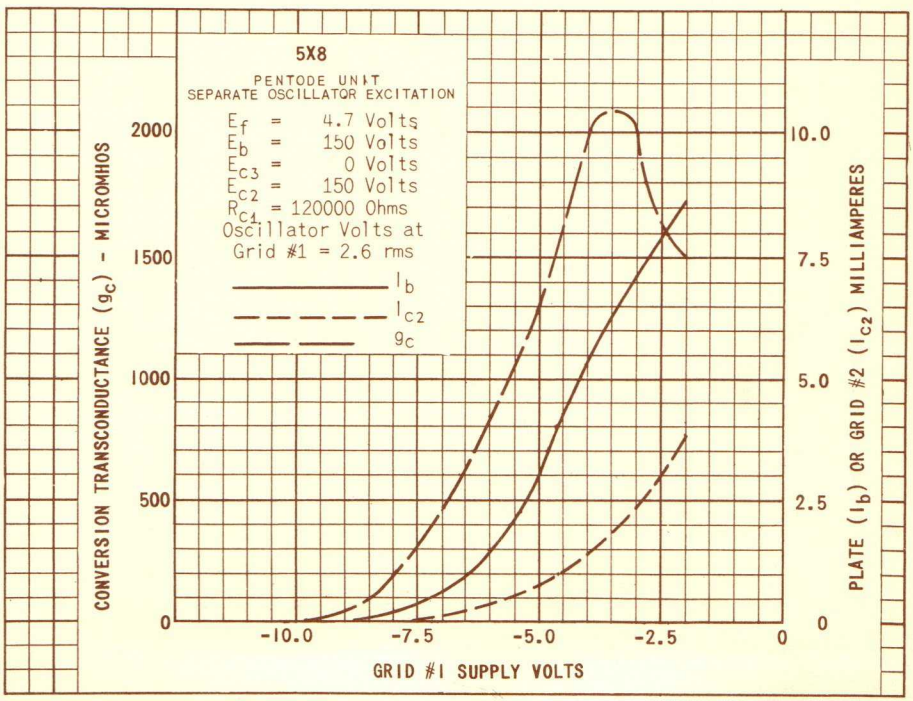
C

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SEREIS WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.


CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
2000
1500
1000
500
0
0
1
2
3
4
5
PEAK OSCILLATOR VOLTS
5X8
PENTODE UNIT
SEPARATE OSCILLATOR EXCITATION
E_f = 4.7 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2} = 150 Volts.
E_{cc_1} = 3.5 Volts
R_{c1} = 120000 Ohms


TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
7500
5000
2500
0
-4
-3
-2
-1
0
+1
GRID VOLTS
5X8
PENTODE UNIT
CONNECTED AS TRIODE
E_f = 4.7 Volts
E_b = 150 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate





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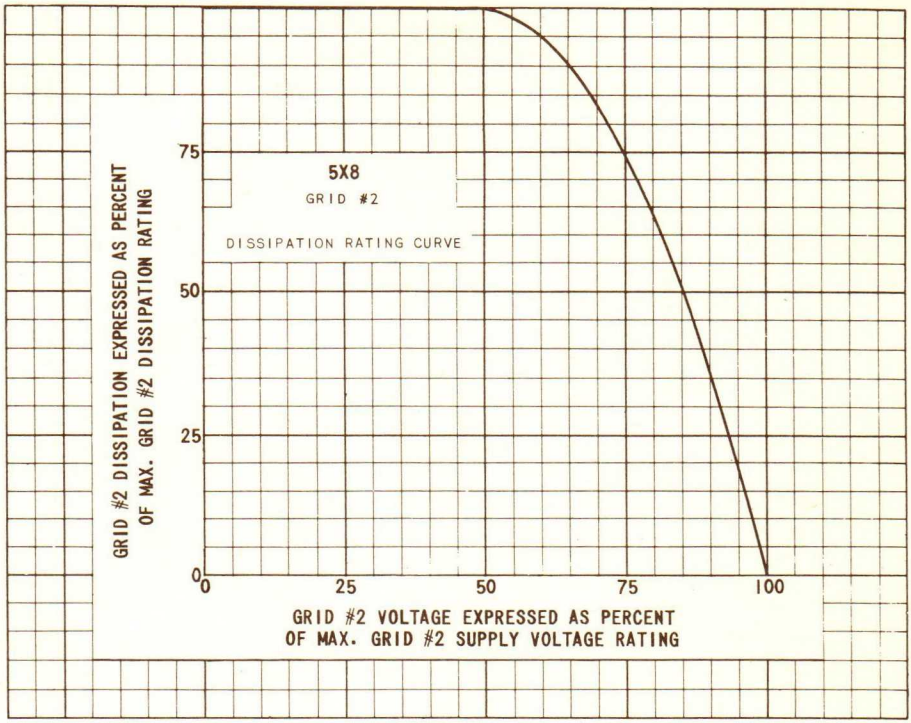

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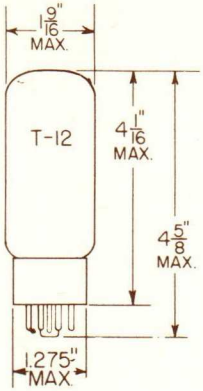
TUNG-SOL

TWIN DIODE

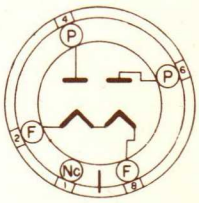


GLASS BULB

COATED FILAMENT
5.0 VOLTS 2.0 AMP.
AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION PERMITTED IF PINS 1 AND 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
SHORT MEDIUM SHELL
5 PIN OCTAL
5T

THE 5Y3GA IS A FILAMENTARY, FULL WAVE, GENERAL PURPOSE RECTIFIER EMPLOYING A T-12 ENVELOPE. ELECTRICALLY, IT IS IDENTICAL TO THE TYPE 5Y3G. EXCEPT FOR BASING, IT IS IDENTICAL TO THE TYPE 5Y4GA.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

FILAMENT VOLTAGE	5.0	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1400	VOLTS
MAXIMUM AC PLATE SUPPLY VOLTAGE EACH PLATE	SEE RATING CHART	
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE	400	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT EACH PLATE	2.2	AMPERES
MAXIMUM STEADY STATE DC OUTPUT CURRENT EACH PLATE	SEE RATING CHART	
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 125 MA. EACH PLATE)	60	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER SERVICE

	CAPACITOR INPUT	CHOKE INPUT	
FILAMENT VOLTAGE	5.0	5.0	VOLTS
FILAMENT CURRENT	2.0	2.0	AMPERES
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)	350	500	VOLTS
INPUT CAPACITOR	10		μf
INPUT CHOKE		10	HENRYS
EFFECTIVE PLATE SUPPLY IMPEDANCE EACH PLATE	50		OHMS
DC OUTPUT CURRENT	125	125	MA.
DC OUTPUT VOLTAGE	350	390	VOLTS

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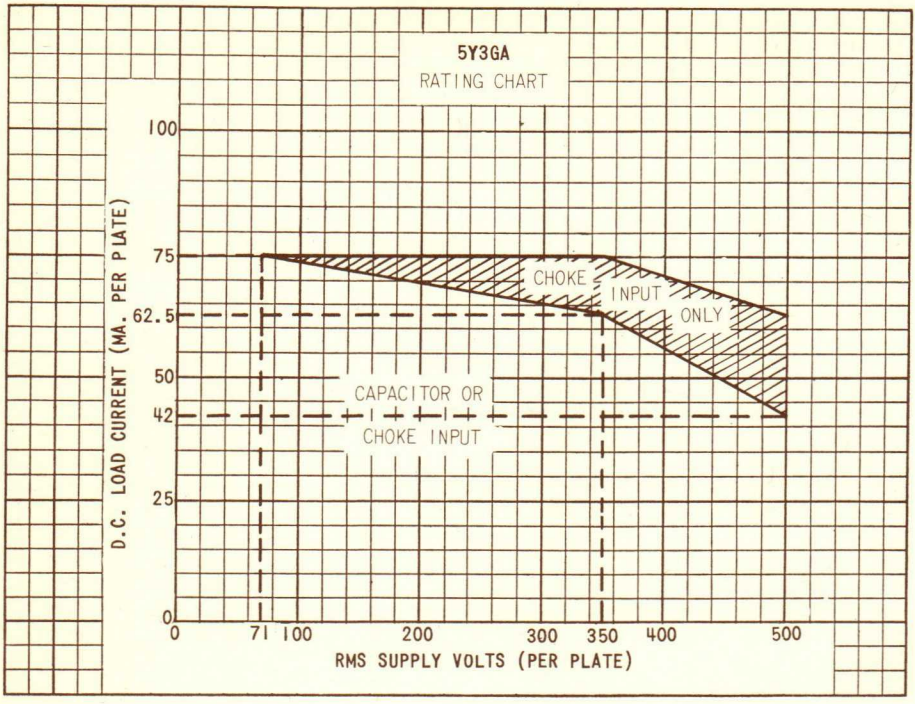
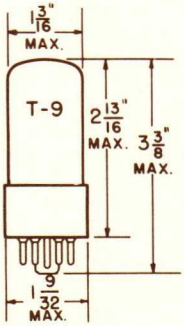

5Y3GA
RATING CHART
D.C. LOAD CURRENT (MA. PER PLATE)
100
75
62.5
50
42
25
0
CHOKE INPUT ONLY
CAPACITOR OR CHOKE INPUT
0
71
100
200
300
350
400
500
RMS SUPPLY VOLTS (PER PLATE)

TUNG-SOL

DOUBLE DIODE



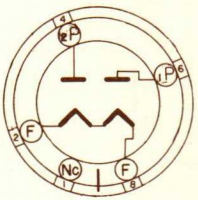
GLASS BULB

COATED FILAMENT

5.0 VOLTS 2.0 AMP.
AC OR DC

VERTICAL MOUNTING POSITION

5Y3GT – HORIZONTAL OPERATION PERMITTED ← IF PINS #2 AND #4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
INTERMEDIATE SHELL
5 PIN OCTAL
5T

THE 5Y3GT IS DESIGNED FOR USE AS A POWER RECTIFIER IN AC OPERATED RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

FILAMENT VOLTAGE		5.0	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE		1 400	VOLTS
MAXIMUM AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)		SEE CHART #1	
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE	A	440	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT EACH PLATE	B	2.5	AMP.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 125 MA. EACH PLATE)		50	VOLTS
MAXIMUM STEADY STATE DC OUTPUT CURRENT EACH PLATE		SEE CHART #1	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER

	INPUT TO CAPACITOR	INPUT TO FILTER CHOKE	
FILAMENT VOLTAGE	5.0	5.0	VOLTS
FILAMENT CURRENT	2.0	2.0	AMP.
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)	350	500	VOLTS
INPUT CAPACITOR	20	—	μf
INPUT CHOKE	—	10	HENRIES
EFFECTIVE PLATE SUPPLY IMPEDANCE EACH PLATE	50	—	OHMS
DC OUTPUT CURRENT	125	125	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	360	380	VOLTS

AC PLATE SUPPLY VOLTAGE IS MEASURED WITHOUT LOAD.

A SEE CHART #2

B SEE CHART #3

SIMILAR TYPE REFERENCE: *Electrically similar to 5Y4G and 80.*

→ INDICATES A CHANGE.

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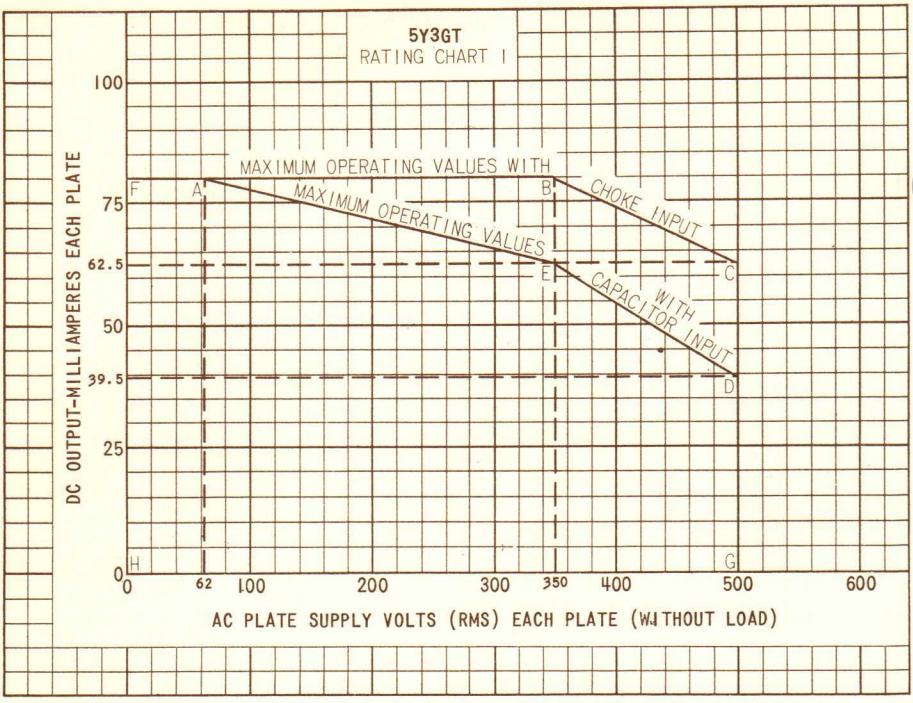
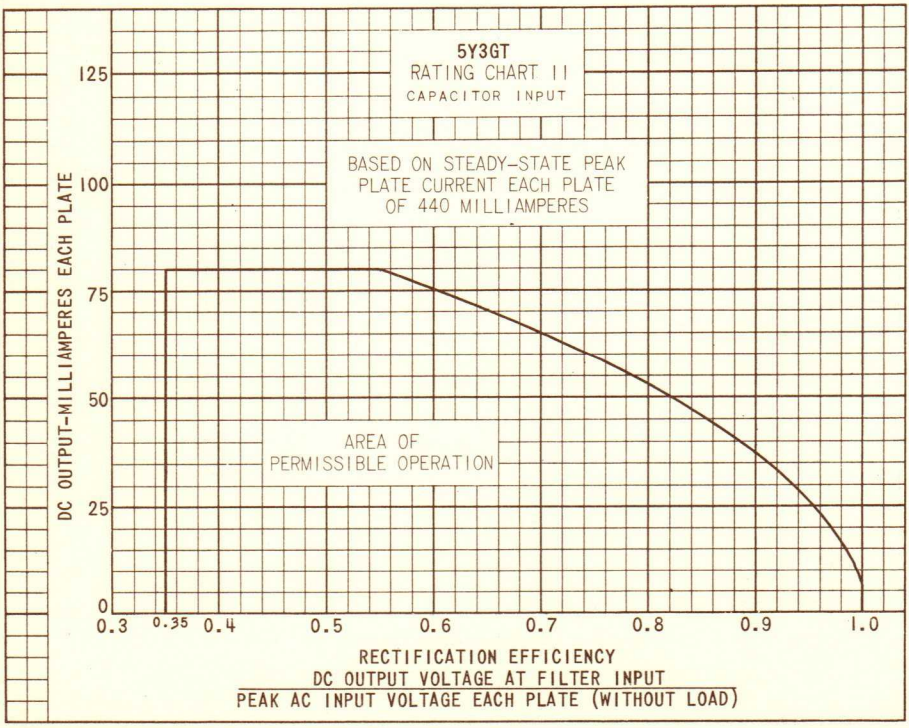
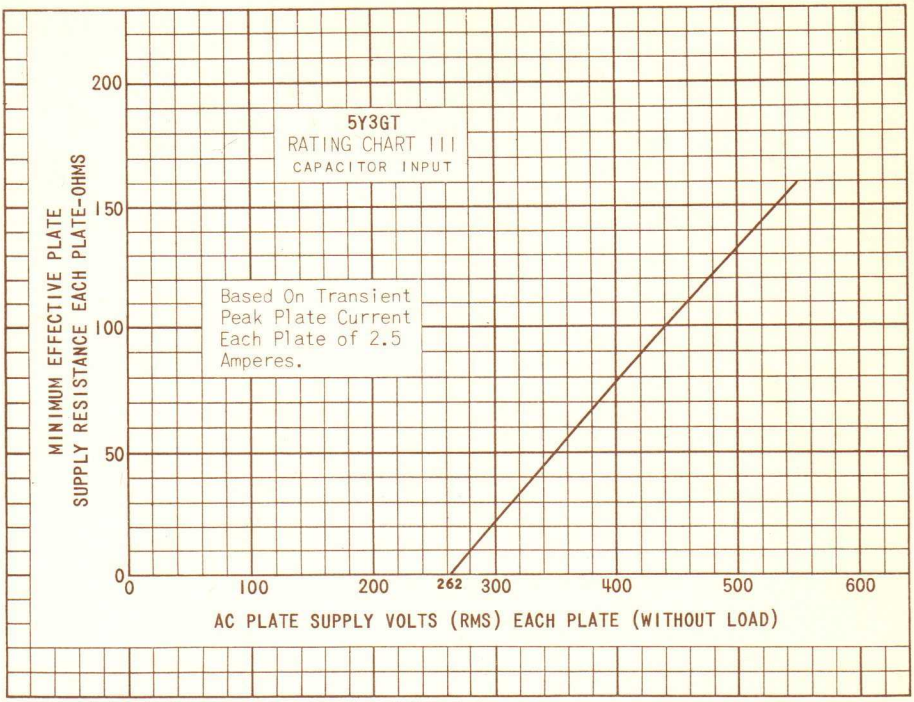
5Y3GT (5Y4G, 80)







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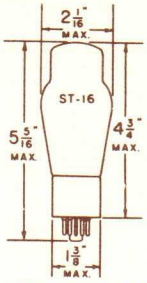


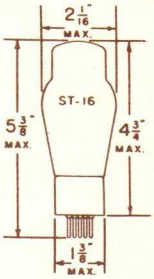
5U4G – MEDIUM 5 PIN OCTAL BASE
5X4G – MEDIUM 8 PIN OCTAL BASE

FULL WAVE
HIGH VACUUM RECTIFIER

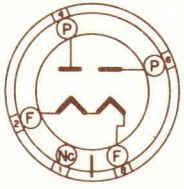
COATED FILAMENT

5.0 VOLTS 3.0 AMPERES
AC

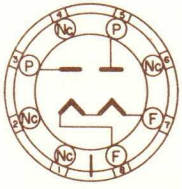
GLASS BULB



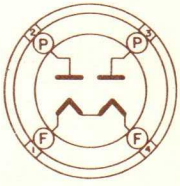
5Z3 – MEDIUM 4 PIN BASE



G-5Ta
BOTTOM VIEW
5U4G



G-5Q
BOTTOM VIEW
5X4G



4C
BOTTOM VIEW
5Z3

THE TUNG-SOL 5U4G, 5X4G AND 5Z3 ARE DESIGNED FOR SERVICE AS POWER RECTIFIERS IN AC OPERATED RECEIVERS WHICH REQUIRE HIGH CURRENTS. THEIR RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	1550	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	675	MA.

OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS)$^{MAX.}$	450	VOLTS
DC OUTPUT CURRENT$^{MAX.}$	225	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE$^{MIN.A}$	75	OHMS

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS)$^{MAX.}$	550	VOLTS
DC OUTPUT CURRENT$^{MAX.}$	225	MA.
VALUE OF INPUT CHOKE$^{MIN.}$	3	HENRYS
TUBE VOLTAGE DROP AT 225 MA. PER PLATE	58	VOLTS

A WHEN FILTER CONDENSERS LARGER THAN 40 μfds ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

CONTINUED NEXT PAGE

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PLATE 691-2

JAN. 29 1940

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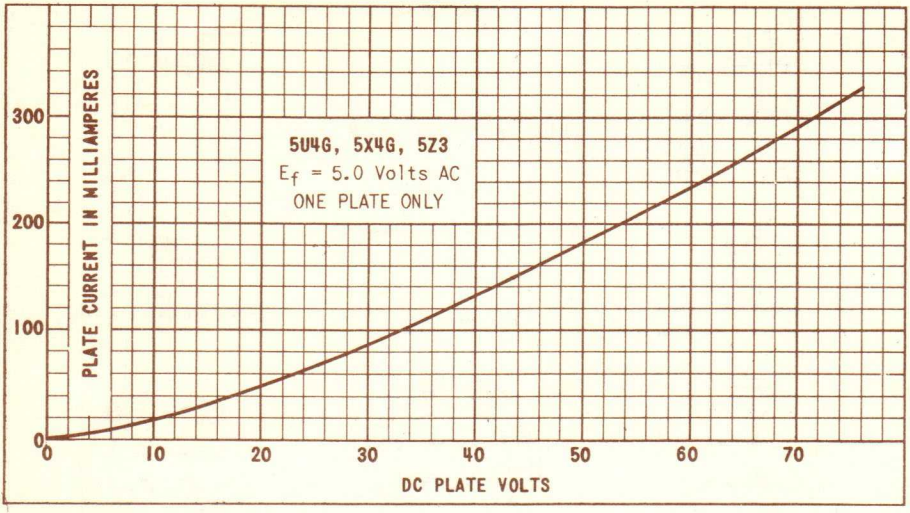
5Z3 (5U4G, 5X4G)



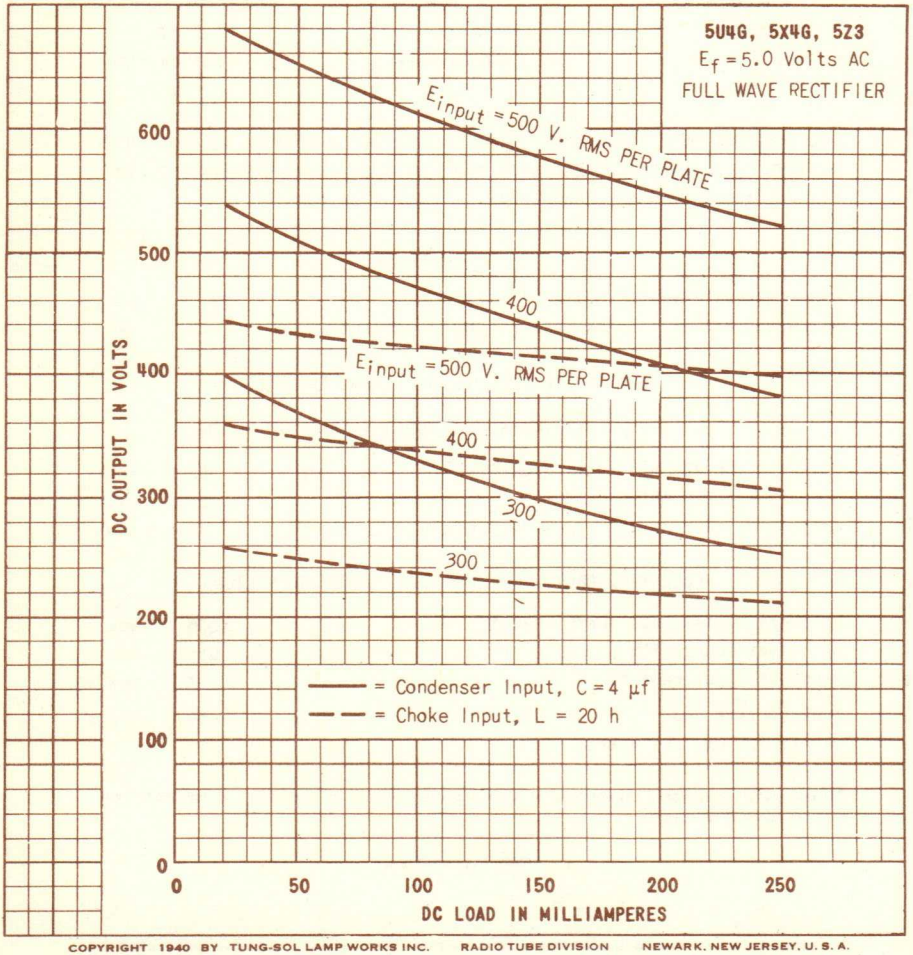


PLATE
692-1

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TUNG-SOL

TRIODE

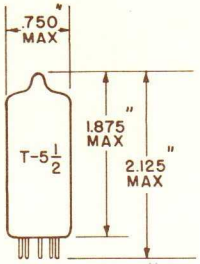
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

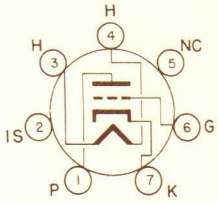
HEATER
6.3 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION

IT IS RECOMMENDED THAT PIN #2 BE GROUNDED.



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5CE

THE 6AB4 IS A TRIODE USING THE MINIATURE CONSTRUCTION. ITS LOW CAPACITANCE AND HIGH RATIO OF PLATE CURRENT TO TRANSCONDUCTANCE ADAPT IT TO USE AS A HIGH FREQUENCY OSCILLATOR AND MIXER AT FREQUENCIES BELOW APPROXIMATELY 300 MC OR AS A GROUNDED GRID RADIO FREQUENCY AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #316	WITHOUT SHIELD	
GRID TO PLATE: (G TO P)	1.5	1.5	pf
INPUT: G TO (H+K)	2.2	2.2	pf
OUTPUT: P TO (H+K)	1.4	0.5	pf
HEATER TO CATHODE: (H+K)	2.9	2.9	pf
GROUNDED GRID			
PLATE TO CATHODE: (P TO K)	0.2	0.24	pf
INPUT: K TO (H+G)	5.2	5	pf
OUTPUT: P TO (H+G)	2.6	1.7	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	-50	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
CATHODE RESISTOR	270	200	OHMS
PLATE CURRENT	3.7	10	MA.
PLATE RESISTANCE	15 000	10 900	OHMS
TRANSCONDUCTANCE	4 000	5 500	µMHOS
AMPLIFICATION FACTOR	60	60	
GRID VOLTAGE (APPROX.) FOR I_b = 10 µA.	-5	-12	VOLTS

SIMILAR TYPE REFERENCE: Somewhat similar to each unit of type 12AT7.

→ INDICATES A CHANGE.

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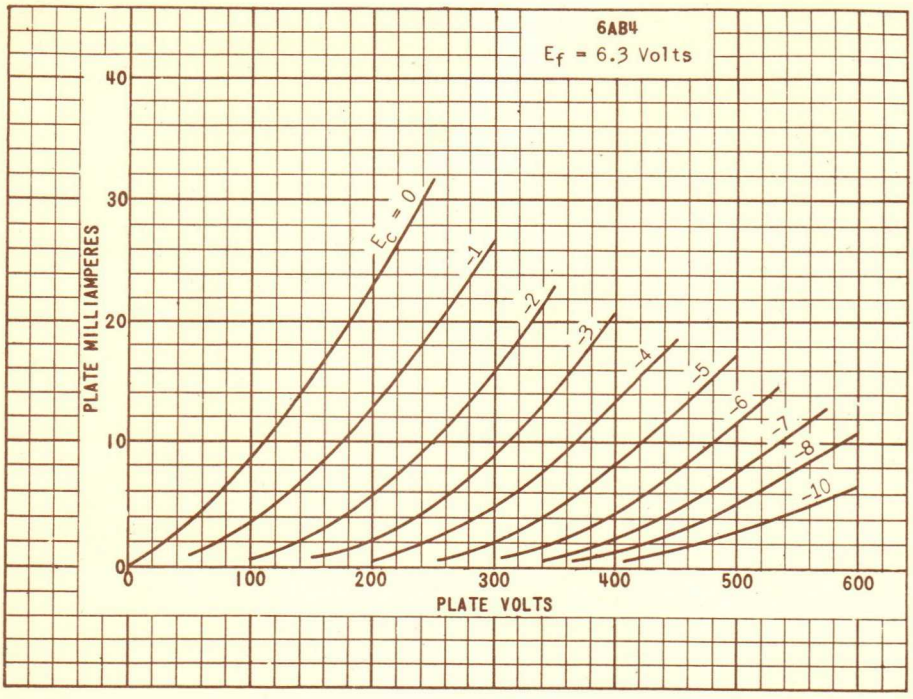
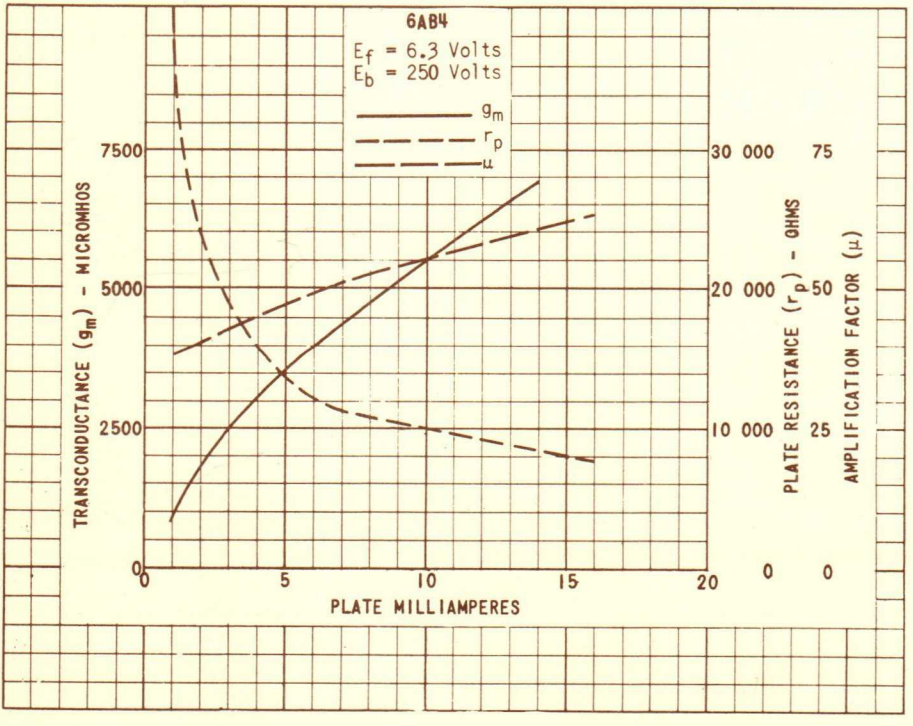
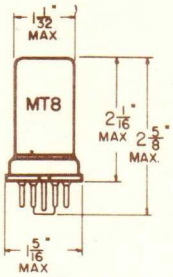
6AB4


6AB4
E_f = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_c = 0
-1
-2
-3
-4
-5
-6
-7
-8
-10
0
10
20
30
40
100
200
300
400
500
600


6AB4
E_f = 6.3 Volts
E_b = 250 Volts
g_m
r_p
μ
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - OHMS
AMPLIFICATION FACTOR (μ)
PLATE MILLIAMPERES
0
2500
5000
7500
10 000
20 000
30 000
0
25
50
75
5
10
15
20

TUNG-SOL

PENTODE



METAL SHELL

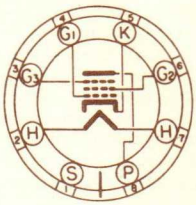
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 450 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL WAFER
8-PIN OCTAL

THE 6AC7/1852 INCORPORATES FEATURES MAKING IT SUITABLE FOR HIGH GAIN AMPLIFIER CIRCUITS. IT HAS A HIGH RATIO OF TRANSCONDUCTANCE TO PLATE CURRENT, MAINTAINING REASONABLE LOW CAPACITANCE AND CLOSE ELECTRODE SPACING.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHELL CONNECTED TO CATHODE

GRID TO PLATE: (G_1 TO P) MAX.	0.015	μμf
INPUT: G_1 TO (H + K + G_2 + G_3 + S)	11	μμf
OUTPUT: P TO (H + K + G_2 + G_3 + S)	5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	3.02	WATTS
MAXIMUM SCREEN DISSIPATION	0.38	WATT

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION

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PLATE
1867
SEPT. 2
1947

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	CONDITION 1[A]	CONDITION 2[B]	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	450	450	MA.
PLATE VOLTAGE	300	300	VOLTS
GRID #3 VOLTAGE[C]	0	0	VOLTS
GRID #2 SUPPLY VOLTAGE[D]	150	300	VOLTS
GRID #2 SERIES RESISTOR	---	60 000	OHMS
CATHODE-BIAS RESISTOR (MIN.)[E]	160	160	OHMS
PLATE RESISTANCE (APPROX.)	1.0	1.0	MEGOHM
TRANSCONDUCTANCE	9 000	9 000	µMHOS
PLATE CURRENT	10	10	MA.
GRID #2 CURRENT	2.5	2.5	MA.

[A] CONDITION 1 WITH FIXED SCREEN SUPPLY GIVES A SHARP CUT-OFF CHARACTERISTIC.

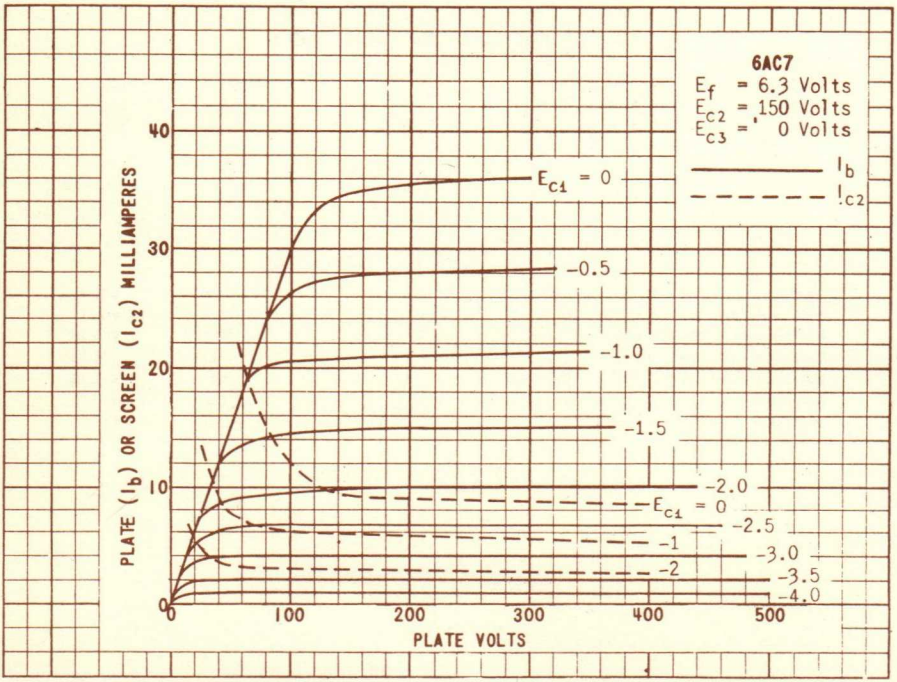
[B] CONDITION 2 WITH SERIES SCREEN RESISTOR GIVES AN EXTENDED CUT-OFF CHARACTERISTIC FOR APPLICATIONS WHERE GAIN IS CONTROLLED BY VARIATION OF GRID BIAS.

[C] TO MINIMIZE FEEDBACK THE SUPPRESSOR SHOULD BE CONNECTED DIRECTLY TO GROUND IF USED IN RF AND IF STAGES.

[D] SCREEN SUPPLY VOLTAGES IN EXCESS OF 150 VOLTS REQUIRE THE USE OF A SERIES-DROPPING RESISTOR TO LIMIT THE VOLTAGE AT THE SCREEN TO 150 VOLTS WHEN THE PLATE CURRENT IS AT ITS NORMAL VALUE OF 10 MILLIAMPERES.

[E] CATHODE BIAS RESISTOR SHOULD BE ADJUSTED TO GIVE A PLATE CURRENT OF 10 MILLIAMPERES. THE DC RESISTANCE IN THE GRID CIRCUIT SHOULD NOT EXCEED 0.25 MEGOHM WHEN THE SCREEN VOLTAGE IS OBTAINED FROM A FIXED SOURCE. WHEN A SERIES SCREEN RESISTOR IS USED WITH FULL CATHODE BIAS, THE DC RESISTANCE IN THE GRID CIRCUIT MAY BE AS HIGH AS 0.5 MEGOHM.

→ INDICATES A CHANGE OR ADDITION.



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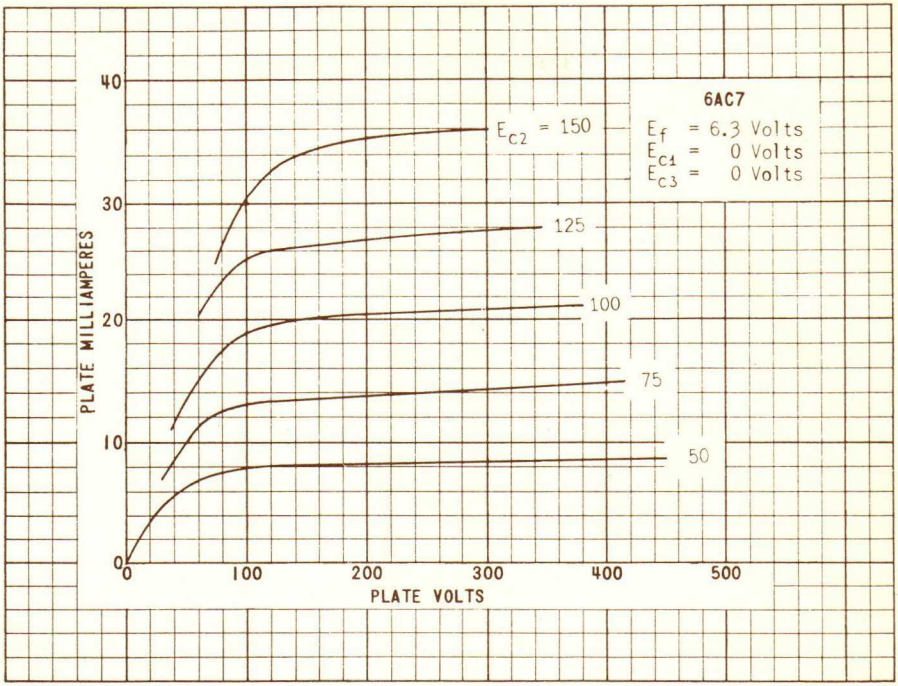

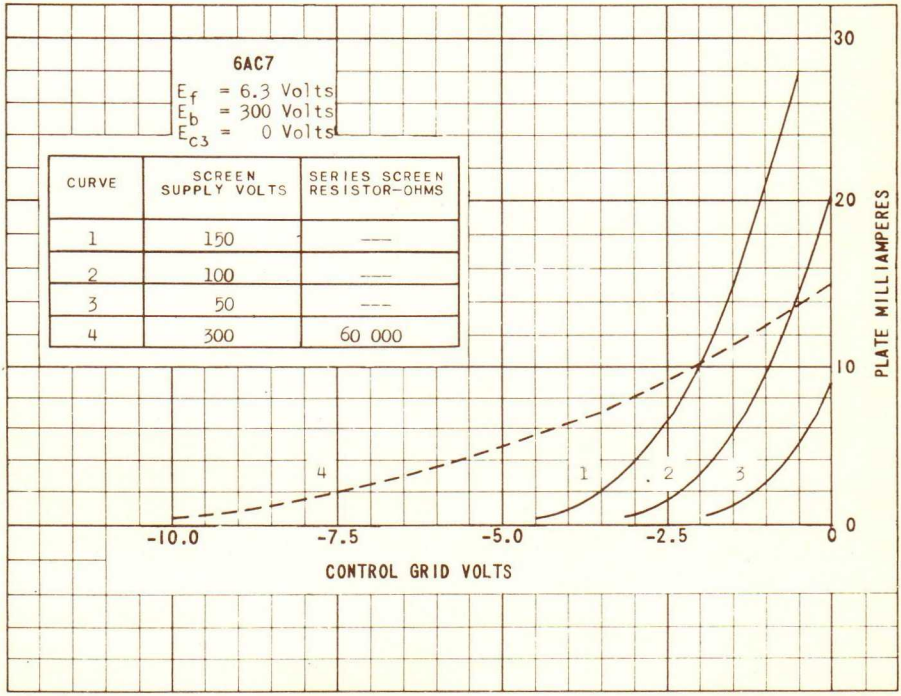

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1869
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1947

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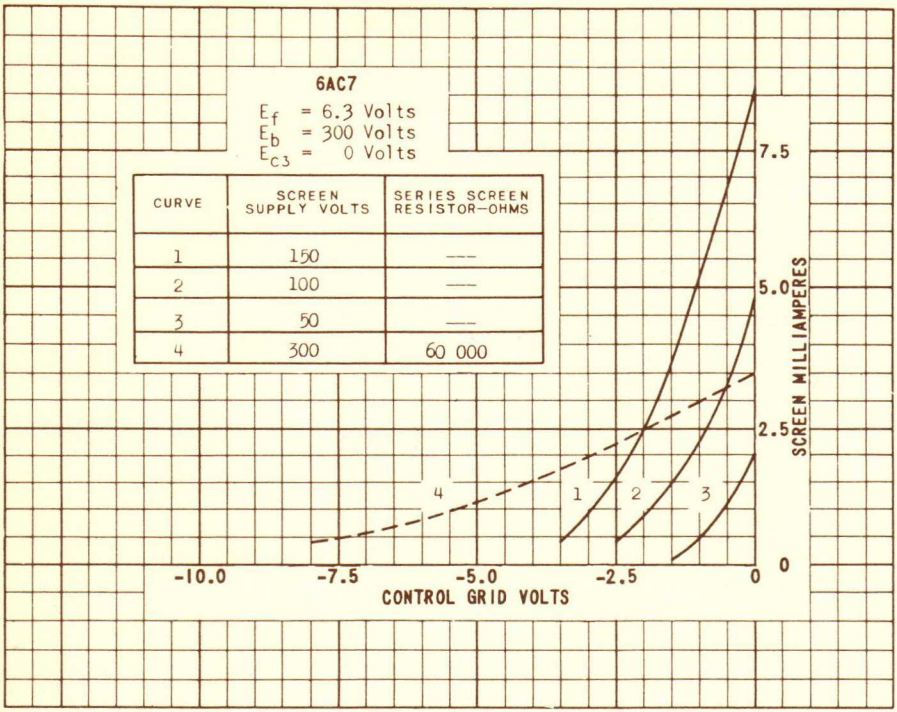
6AC7/1852



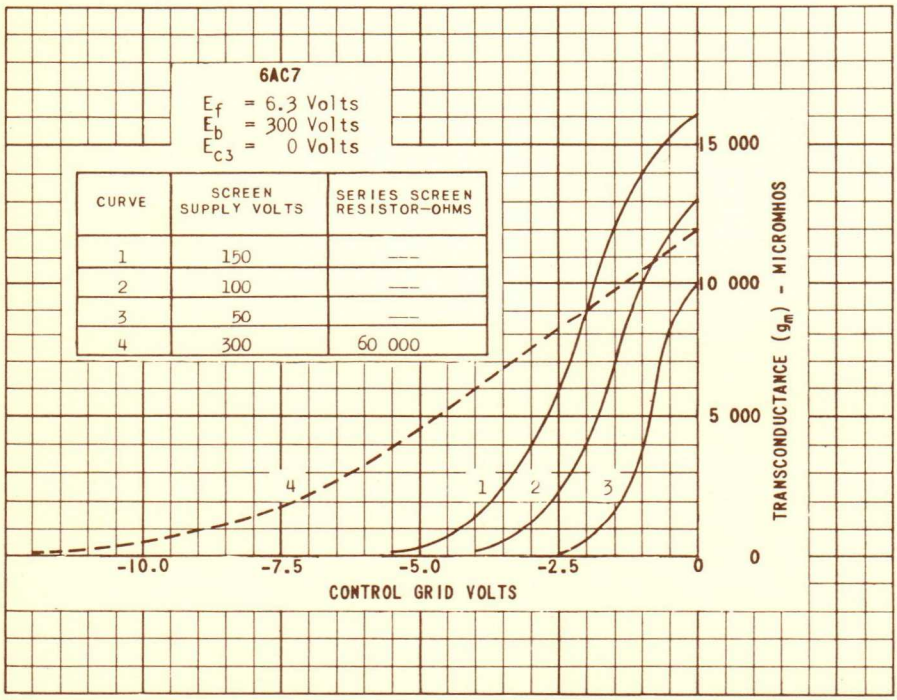


PLATE
1870
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1947

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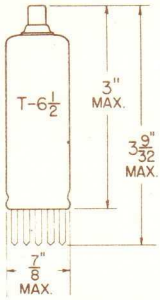


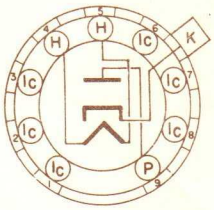
GLASS BULB
SKIRTED MINIATURE

DIODE
MINIATURE TYPE

UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON
9 PIN NOVAL
9CB

THE 6AF3 IS A SINGLE INDIRECTLY-HEATED DIODE INTENDED FOR USE IN HORIZONTAL FREQUENCY DAMPER SERVICE TELEVISION RECEIVERS. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES OF LINE FREQUENCY BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS NORMALLY ENCOUNTERED IN "DIRECT DRIVE" CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

HEATER TO CATHODE H TO K	2.8	μμf
CATHODE TO PLATE AND HEATER K TO (P + H)	9.0	μμf
PLATE TO CATHODE AND HEATER P TO (K + H)	6.0	μμf

RATINGS [A]
INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM [BC]

HEATER VOLTAGE	6.3±10%	VOLTS
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
MAXIMUM PEAK INVERSE PLATE VOLTAGE	4500	VOLTS
MAXIMUM DC PLATE CURRENT	185	MA.
MAXIMUM STEADY STATE PAEK PLATE CURRENT	750	MA.
MAXIMUM PLATE DISSIPATION	6.0	WATTS
MAXIMUM BULB TEMPERATURE	210	°C

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TUNG-SOL

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AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP (WITH TUBE CONDUCTING PLATE CURRENT =340 MA.)	30	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[A]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 CUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B]UNLESS OTHERWISE STATED.

[C]DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST EXTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

TRIODE

MINIATURE TYPES

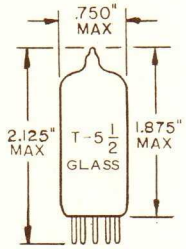
FOR

UHF TELEVISION SERVICE

COATED UNIPOTENTIAL CATHODE

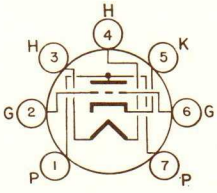
ANY MOUNTING POSITION

6AF4
OUTLINE
JEDEC 5-2



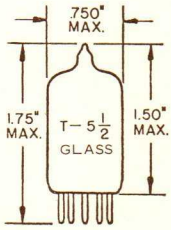
BASE 7 PIN BUTTON
JEDEC E7-1

BASING DIAGRAM
JEDEC 7DK



BOTTOM VIEW

6AF4A
OUTLINE
JEDEC 5-1



BASE 7 PIN BUTTON
JEDEC E7-1

THE 6AF4 AND 6AF4A ARE MEDIUM MU TRIODES IN THE 7 PIN MINIATURE CONSTRUCTION. THEY ARE DESIGNED FOR LOCAL OSCILLATOR SERVICE IN TELEVISION RECEIVERS WHICH OPERATE IN THE UHF REGION. INTERNAL LEAD INDUCTANCE IS REDUCED BY EMPLOYING DOUBLE CONNECTIONS TO THE PLATE AND GRID. ELECTRICALLY, THE 6AF4 IS IDENTICAL TO THE 6AF4A AND DIFFERS IN ENVELOPE SIZE.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #316 CONNECTED TO CATHODE EXCEPT AS NOTED

GRID TO PLATE	1.9	pf
GRID TO CATHODE AND HEATER	2.2	pf
PLATE TO CATHODE AND HEATER	1.4	pf
HEATER TO CATHODE - SEE NOTE BELOW	2.2	pf

NOTE: WITH EXTERNAL SHIELD #316 CONNECTED TO PLATE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	225	mA
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		50	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		50	VOLTS
DC COMPONENT		25	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

UHF OSCILLATOR

PLATE VOLTAGE	150	VOLTS
NEGATIVE GRID VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID CURRENT	2	mA
CATHODE CURRENT	24	mA

CHARACTERISTICS

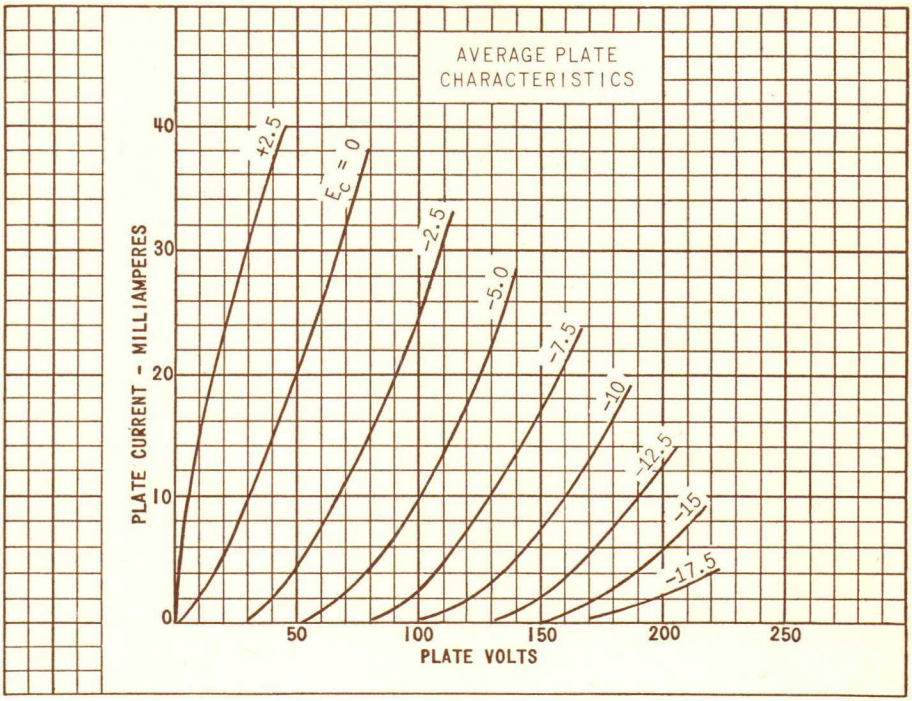
CLASS A_1 AMPLIFIER

PLATE VOLTAGE		80	VOLTS
CATHODE RESISTOR		150	OHMS
PLATE CURRENT		17.5	mA
TRANSCONDUCTANCE		6,500	μMHOS
AMPLIFICATION FACTOR		13.5	
PLATE RESISTANCE	APPROX.	2,100	OHMS

TYPICAL OPERATION

AT FREQUENCY OF 1.000 MC/S

PLATE VOLTAGE		100	VOLTS
PLATE RESISTOR		220	OHMS
GRID RESISTOR		10,000	OHMS
PLATE CURRENT		17	mA
GRID CURRENT	APPROX.	750	μA



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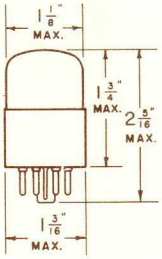
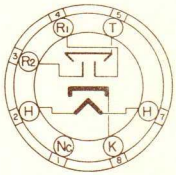


CATHODE RAY TUNING INDICATOR

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC



G-7A

GLASS BULB

SMALL 7 PIN OCTAL BASE

THE TUNG-SOL 6AF6G CONSISTS OF A CIRCULAR FLUORESCENT SCREEN WITH TWO INDEPENDENT INDICATING SHADOW ANGLES, EACH CONTROLLED BY A RAY-CONTROL ELECTRODE. WHEN THE 6AF6G IS USED AS A TUNING INDICATOR THE SHADOW ANGLE IS CONTROLLED BY POSITIVE VOLTAGES APPLIED TO THE RAY CONTROL ELECTRODES.

OPERATING CONDITIONS AND CHARACTERISTICS

TARGET VOLTAGE MAX.	135	VOLTS
TARGET VOLTAGE MIN.	90	VOLTS
RAY-CONTROL ELECTRODE SUPPLY VOLTAGE MAX.	135	VOLTS

TUNING INDICATOR

TARGET VOLTAGE	100	135	VOLTS
TARGET CURRENT T	0.9	1.5	MA.
RAY-CONTROL ELECTRODE VOLTAGE P	60	81 APPROX.	VOLTS
RAY-CONTROL ELECTRODE VOLTAGE PP	0	0 APPROX.	VOLTS

T WITH 0 VOLTS ON RAY-CONTROL ELECTRODES. SUBJECT TO WIDE VARIATION.
P FOR 0° SHADOW ANGLE PRODUCED BY EITHER RAY-CONTROL ELECTRODE.
PP FOR 100° SHADOW ANGLE PRODUCED BY EITHER RAY-CONTROL ELECTRODE.
THE PLANE OF THE CONTROL ELECTRODES PASSES THROUGH PINS #3 AND #7.

NOTE: A DOUBLE TRIODE, SUCH AS THE 6C8G OR THE 6F8G, CAN BE USED TO OBTAIN TWO SENSITIVITIES FOR A TUNING INDICATOR BY APPLYING FULL A.V.C. VOLTAGE TO ONE TRIODE AND 1/10 OF THE A.V.C. VOLTAGE TO THE OTHER.

IN AC-DC SUPERHETERODYNE RECEIVERS A SHADOW ANGLE VARIATION OF 0 TO 90° WITH A.V.C. ACTION MAY BE OBTAINED WITHOUT AN AMPLIFIER TUBE BY RAISING THE CATHODE OF THE 6AF6G TO +30 VOLTS, SUPPLYING I F TUBE SCREEN THROUGH A 50 000 OHM RESISTOR AND CONNECTING THE CONTROL ELECTRODES TO THE SCREEN.

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PLATE
238-1

DEC.12
1938

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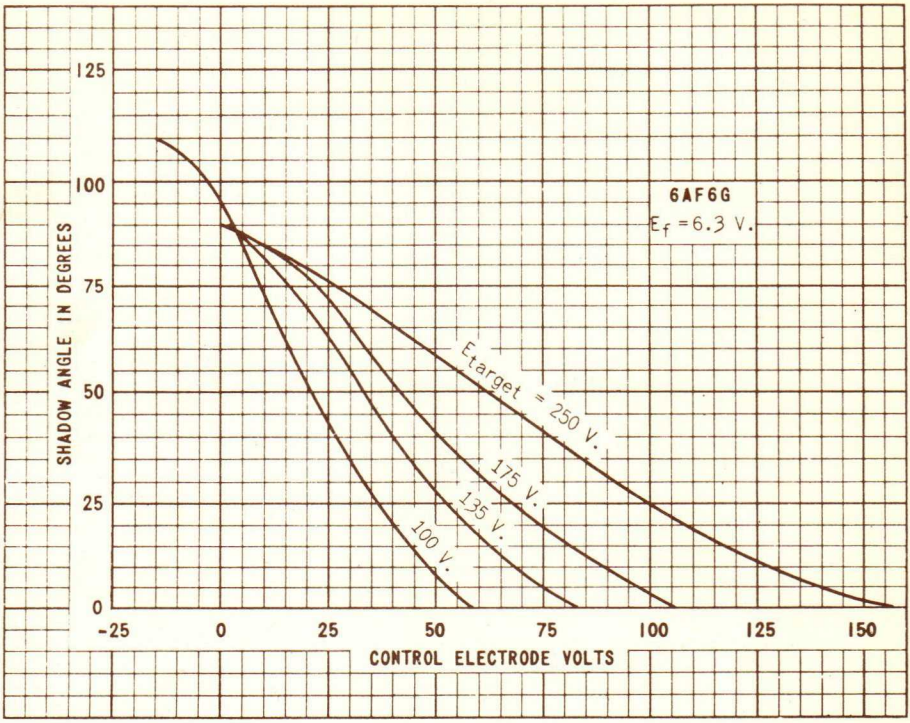

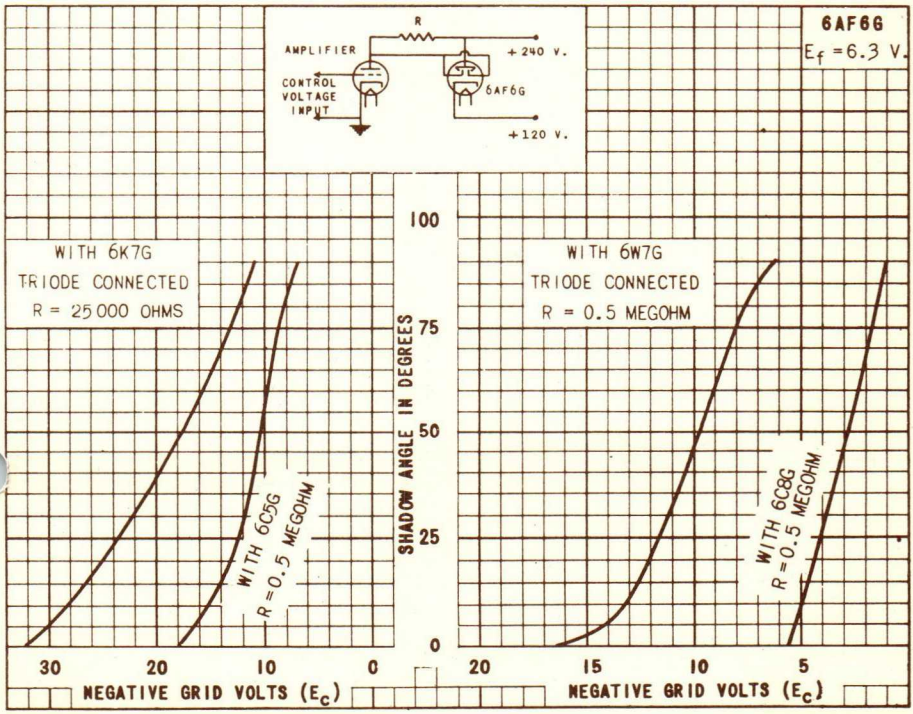

PLATE
283-1

JAN. 3
1939

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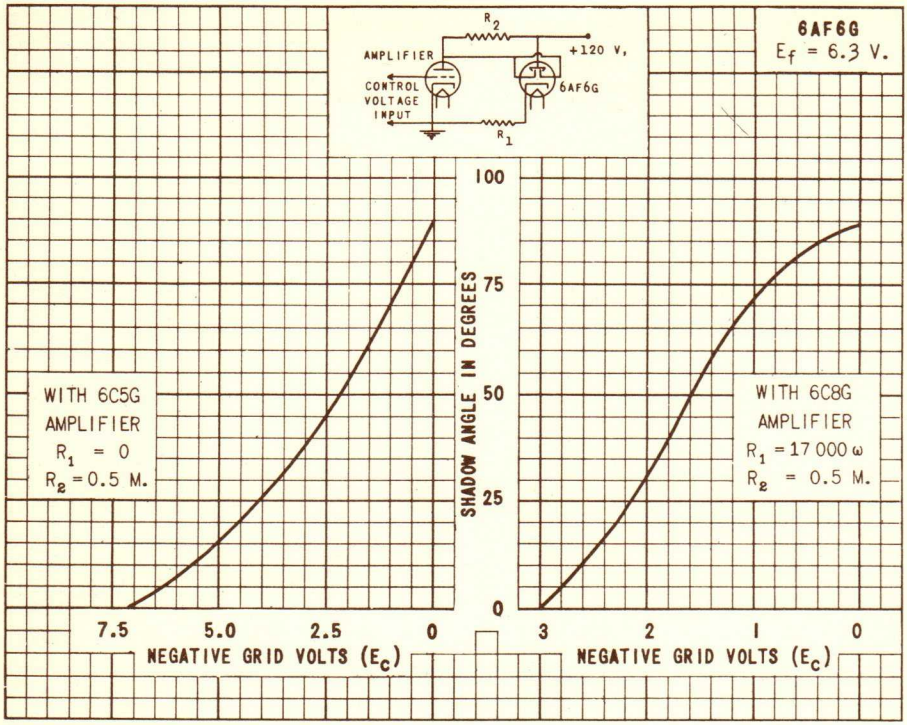
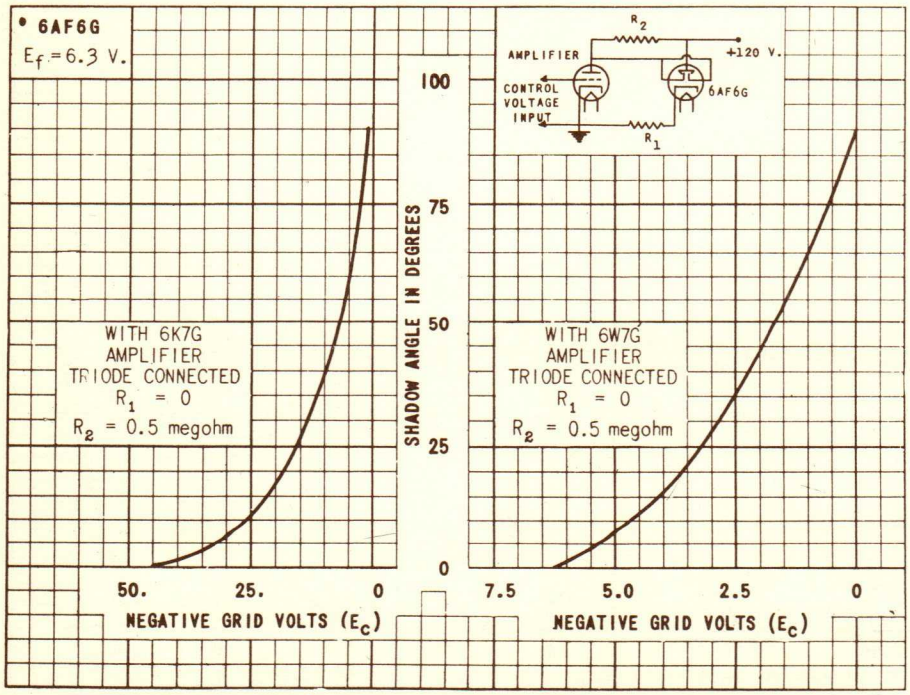
6AF6 G





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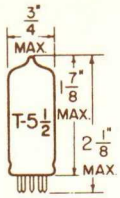
PENTODE

MINIATURE TYPE



GLASS BULB

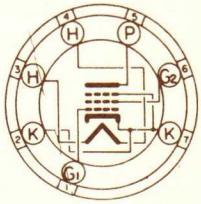
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 300 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7B0

THE 6AG5 IS A MINIATURE TYPE RF PENTODE HAVING A SHARP CUT-OFF CHARACTERISTIC AND A HIGH VALUE OF TRANSCONDUCTANCE. IN COMPACT, LIGHT-WEIGHT EQUIPMENT IT IS USEFUL AS AN RF AMPLIFIER UP TO ABOUT 400 MEGACYCLES, AND AS A HIGH-FREQUENCY, INTERMEDIATE AMPLIFIER. IT HAS LOW INPUT CAPACITANCE AND LOW OUTPUT CAPACITANCE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE CONNECTION			
GRID #1 TO PLATE: (G_1 TO P) MAX.	0.02	0.03	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	6.6	6.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	3.1	1.8	μμf
TRIODE CONNECTION (G_2 TIED TO PLATE)			
GRID TO PLATE: G TO (P+G_2)	2.5	2.5	μμf
INPUT: G TO (H+K+G_3&IS)	3.6	3.6	μμf
OUTPUT: P+G_2 (H+K+G_3&IS)	4.3	3	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	TRIODE CONNECTION[B]	PENTODE CONNECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	PLATE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	PLATE		SEE J5-C4
MAXIMUM PLATE DISSIPATION	2.5	2	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS

[B] TRIODE CONNECTION - GRID #2 CONNECTED TO PLATE.

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→ INDICATES A CHANGE OR ADDITION.

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PLATE 2950
JUNE 1 1952

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – PENTODE CONNECTION

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS	
HEATER CURRENT	300	300	300	MA.	
PLATE VOLTAGE	100	125	250	VOLTS	
GRID #2 VOLTAGE	100	125	150	VOLTS	
CATHODE RESISTOR	180	100	180	OHMS	←
TRANSCONDUCTANCE	4 500	5 100	5 000	µMHOS	←
PLATE CURRENT	4.5	7.2	6.5	MA.	←
GRID #2 CURRENT	1.4	2.1	2	MA.	←
PLATE RESISTANCE (APPROX.)	0.6	0.5	0.8	MEGOHM	←
GRID #1 VOLTAGE FOR I_b = 10 µA. (APPROX.)	−5	−6	−8	VOLTS	

CLASS A_1 AMPLIFIER – TRIODE CONNECTION[C]

HEATER VOLTAGE	6.3	6.3	VOLTS	
HEATER CURRENT	300	300	MA.	
PLATE VOLTAGE	250	180	VOLTS	
GRID #2 VOLTAGE	PLATE	PLATE		←
CATHODE RESISTOR	820	330	OHMS	←
TRANSCONDUCTANCE	3 800	5 700	µMHOS	
PLATE CURRENT	5.5	7	MA.	
PLATE RESISTANCE (APPROX.)	0.01	0.008	MEGOHM	←
AMPLIFICATION FACTOR	42	45		

[C] GRID #2 TIED TO PLATE.

PLATE 2951
JUNE 1 1952

→ INDICATES A CHANGE OR ADDITION.

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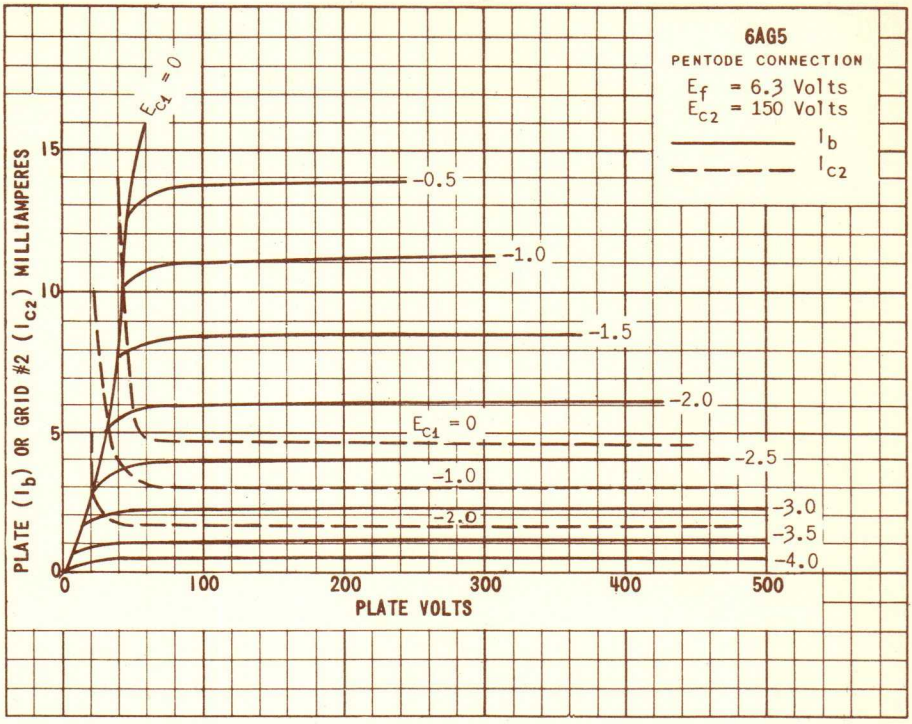

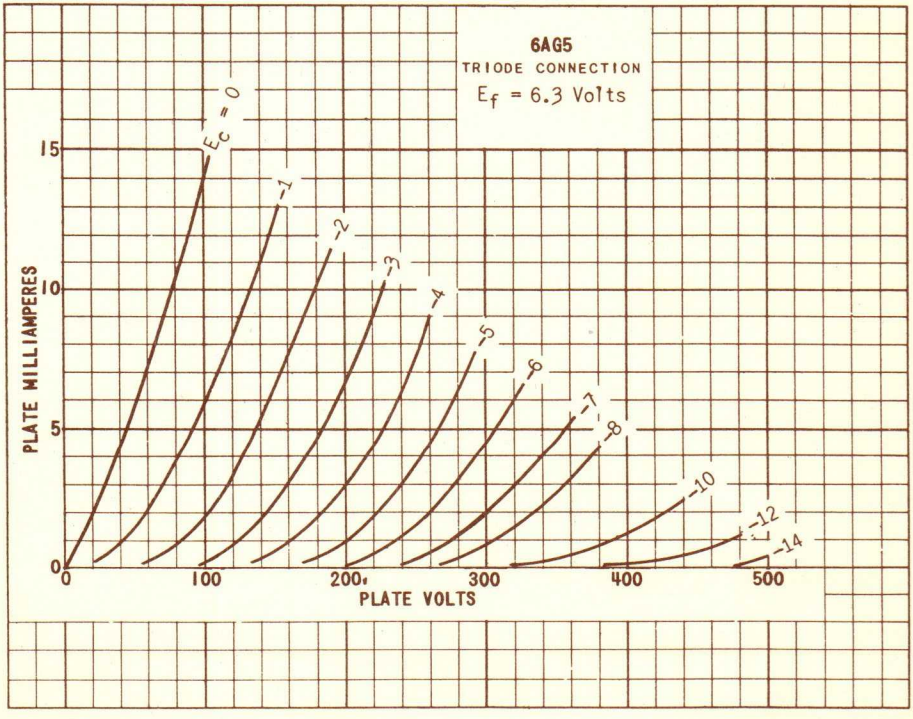

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PLATE
2952
JUNE 1
1952

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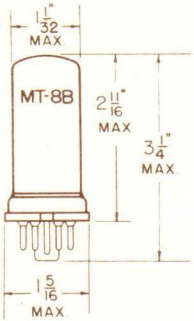
TUNG-SOL

PENTODE



METAL SHELL

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.65 AMPERE
AC OR DC

ANY MOUNTING POSITION ←
HORIZONTAL OPERATION PERMITTED IF PINS 2 & 7 ARE IN A VERTICAL PLANE.

BOTTOM VIEW
SMALL WAFER
8 PIN OCTAL

THE 6AG7 IS A POWER OUTPUT PENTODE USING THE OCTAL BASE AND METAL SHELL CONSTRUCTION. IT HAS HIGH PERVEANCE, LOW CAPACITANCES, AND THE POWER REQUIREMENTS NECESSARY FOR EITHER STRAIGHT VIDEO OUTPUT AMPLIFIER OR CATHODE FOLLOWER SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: (G TO P) MAX.	0.06	μμf
INPUT: G TO ($H+K+G_2+G_3$&S) ←	13	μμf
OUTPUT: P TO ($H+K+G_2+G_3$&S) ←	7.5	μμf
GRID #1 TO GRID #2: (G_1 TO G_2) APPROX.	5.8	μμf
GRID #1 TO CATHODE: (G_1 TO K) APPROX.	5.2	μμf
HEATER TO CATHODE: (H TO K) APPROX.	10.7	μμf

•PINS #1 AND #3 CONNECTED TO PIN #5.

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE (SHOULD NOT DEVIATE MORE THAN 10%)	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	300	VOLTS
MINIMUM NEGATIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	9	WATTS
MAXIMUM SCREEN DISSIPATION	1.5	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.25	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	1	MEGOHM

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE (SHOULD NOT DEVIATE MORE THAN 10%)	6.3	VOLTS
HEATER CURRENT	0.65	AMP.
PLATE VOLTAGE	300	VOLTS
GRID #2 VOLTAGE	150	VOLTS
GRID #1 VOLTAGE	-3	VOLTS
PEAK AF GRID #1 VOLTAGE	3	VOLTS
ZERO-SIGNAL PLATE CURRENT	30	MA.
ZERO-SIGNAL GRID #2 CURRENT (NOMINAL)	7	MA.
MAXIMUM-SIGNAL PLATE CURRENT	30.5	MA.
MAXIMUM-SIGNAL SCREEN CURRENT (NOMINAL)	9	MA.
PLATE RESISTANCE (APPROX.)	0.13	MEGOHM
TRANSCONDUCTANCE	11 000	µMHOS
LOAD RESISTANCE	10 000	OHMS
TOTAL HARMONIC DISTORTION	7	PERCENT
POWER OUTPUT	3	WATTS

VIDEO VOLTAGE AMPLIFIER - CLASS A_1

4 MC BANDWIDTH

	GRID LEAK BIAS[A]	CATHODE BIAS	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.65	0.65	AMP.
PLATE SUPPLY VOLTAGE	300	300	VOLTS
GRID #2 VOLTAGE	115[B]	125[C]	VOLTS
GRID #1 VOLTAGE	0[D]	-2	VOLTS
GRID #1 RESISTOR (MINIMUM)	0.25	---	MEGOHM
GRID #1 RESISTOR (MAXIMUM)	0.5	---	MEGOHM
CATHODE RESISTOR (BY-PASSED BY 250 µF APPROX.)	---	57	OHMS
ZERO-SIGNAL PLATE CURRENT	45	28	MA.
ZERO-SIGNAL GRID #2 CURRENT (NOMINAL)	13	7	MA.
LOAD RESISTANCE	3 500	3 500	OHMS
PEAK TO PEAK GRID SIGNAL SWING	4	4	VOLTS
PEAK TO PEAK VOLTAGE OUTPUT	135	140	VOLTS
INTERLEAD SHIELD		CONNECTED TO GROUND	

[A] TO BE USED WHERE RESISTORATION IS ACCOMPLISHED IN THE GRID CIRCUIT.

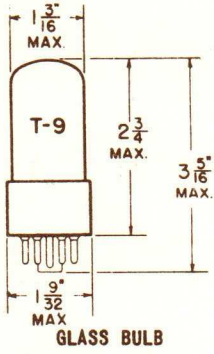
[B] OBTAINED FROM SUPPLY HAVING GOOD REGULATION.

[C] OBTAINED PREFERABLY FROM THE 300 VOLT PLATE SUPPLY THROUGH A 25000 OHM SERIES SCREEN RESISTOR.

[D] ZERO-SIGNAL VALUE.

TUNG-SOL

TRIODE

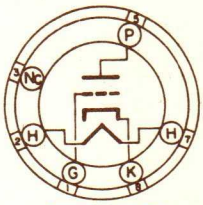


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 750 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL 6 PIN OCTAL
8EL

THE 6AH4GT IS A HIGH PERVEANCE TRIODE DESIGNED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
GRID TO PLATE: (G TO P)	4.4	4.2	μμf
INPUT: G TO (H+K)	7	7.5	μμf
OUTPUT: P TO (H+K)	1.7	3.2	μμf

[A] EXTERNAL SHIELD #308 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

VERTICAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	500	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE	2 000	VOLTS
MAXIMUM PLATE DISSIPATION[C]	7.5	WATTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	-200	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	60	MA.
MAXIMUM PEAK CATHODE CURRENT	180	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2	MEGOHMS

[B] FOR OPERATION ON A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE IN TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DURATION OF THE VOLTAGE PULSE IS NOT TO EXCEED 15% OF ONE SCANNING CYCLE.

[C] AN ADEQUATE BIAS RESISTOR OR OTHER MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CONTINUED ON FOLLOWING PAGE

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PLATE 2953
JUNE 1 1952

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	750	750	MA.
PLATE VOLTAGE	250	250	VOLTS
GRID VOLTAGE	−33	−23	VOLTS
PLATE CURRENT	5	30	MA.
TRANSCONDUCTANCE	4 500		µMHOS
AMPLIFICATION FACTOR	8		
PLATE RESISTANCE	1 780		OHMS
GRID VOLTAGE FOR 0.5 MA. PLATE CURRENT (APPROX.)	−40		VOLTS

PLATE 2954
JUNE 1 1952

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TUNG-SOL

PENTODE

MINIATURE TYPE

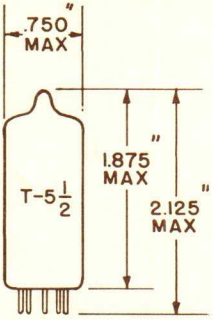
COATED UNIPOTENTIAL CATHODE

FOR

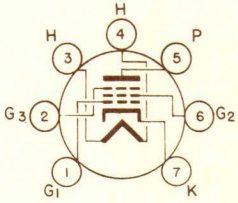
VOLTAGE AMPLIFIER

SERVICE IN T.V. APPLICATIONS

ANY MOUNTING POSITION



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW

BASING DIAGRAM

JEDEC 7CC

THE 6AH6 IS A SHARP CUT-OFF VOLTAGE AMPLIFIER IN THE MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY A VERY HIGH TRANSCONDUCTANCE AND MODERATELY LOW INTERELECTRODE CAPACITANCES WHICH ADAPT IT TO WIDE BAND VIDEO AND INTERMEDIATE FREQUENCY AMPLIFIER SERVICE.

→ DIRECT INTERELECTRODE CAPACITANCES

EXTERNAL SHIELD #316 CONNECTED TO PIN 7

GRID TO PLATE: (G1 TO P)	0.020	pf
INPUT: G1 TO (H+K+G2+G3)	10	pf
OUTPUT: P TO (H+K+G2+G3)	3.6	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	MA.

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	300	VOLTS
GRID #2 VOLTAGE	SEE RATING CHART	
PLATE DISSIPATION	3.2	WATTS
GRID #2 DISSIPATION	0.4	WATTS
CATHODE CURRENT	13	MA.
GRID #2 SUPPLY VOLTAGE	→ 300	VOLTS

→ INDICATES A CHANGE.

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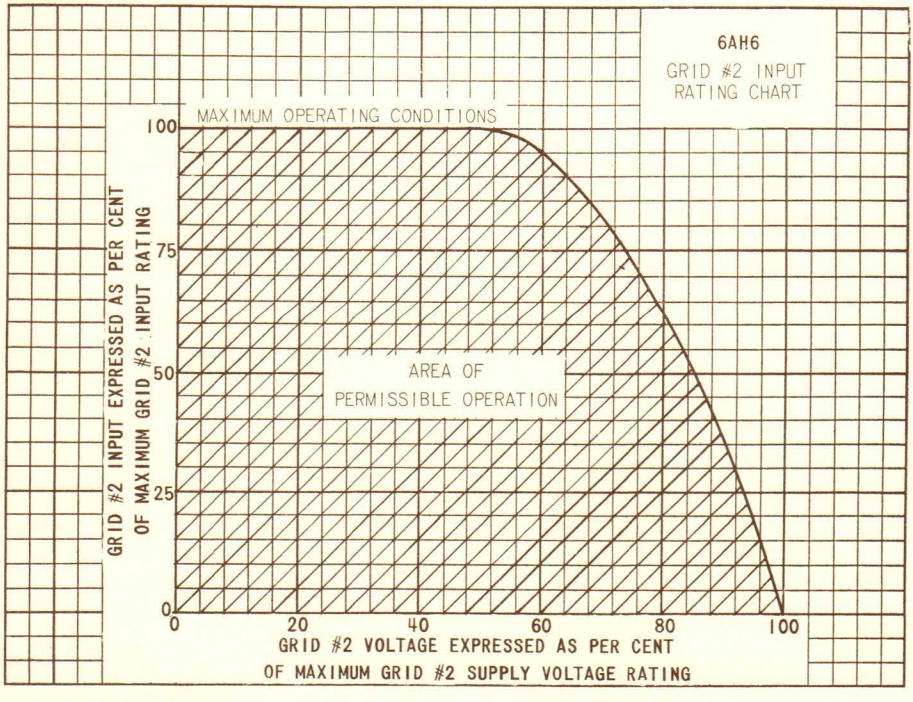
TYPICAL OPERATING CHARACTERISTICS

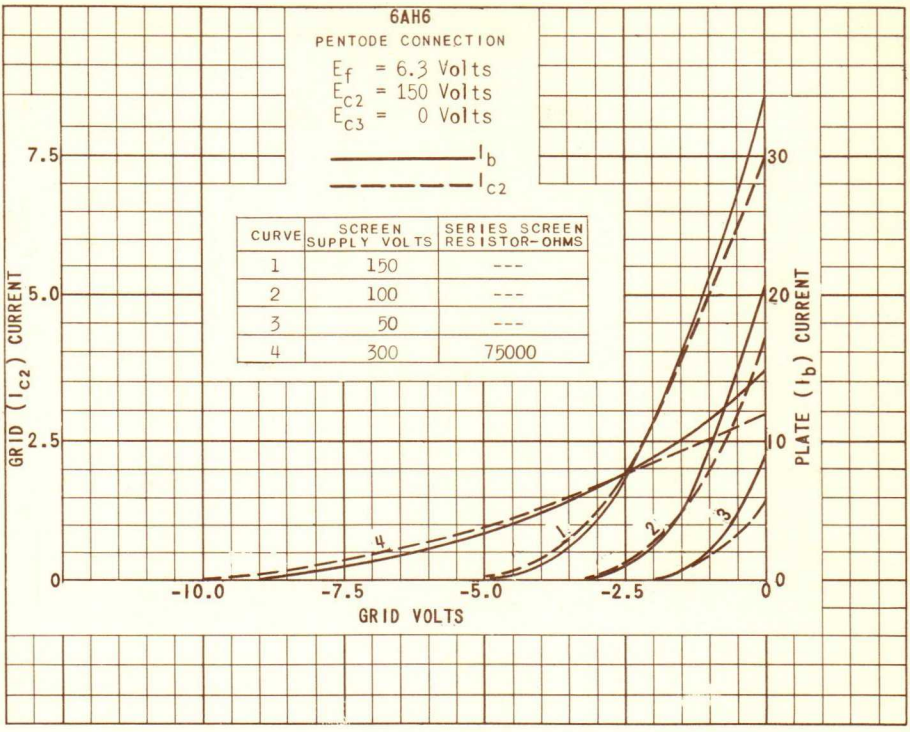
	PENTODE CONNECTED	TRIODE CONNECTED	
PLATE VOLTAGE	300	150	VOLTS
GRID #2 VOLTAGE	150	→ 150	VOLTS
GRID #3 VOLTAGE*	A	150	VOLTS
CATHODE RESISTOR	160	160	OHMS
PLATE RESISTANCE (APPROX.)	0.5	0.0036	MEGOHMS
TRANSCONDUCTANCE	9000	11000	μMHOS
TRANSCONDUCTANCE (GRID #3 TO PLATE)	B	---	
AMPLIFICATION FACTOR	---	40	
PLATE CURRENT	10	12.5	MA.
GRID #2 CURRENT	2.5	---	MA.
GRID #1 VOLTAGE (APPROX.) FOR Ib =10 μA.	-7	-7	VOLTS

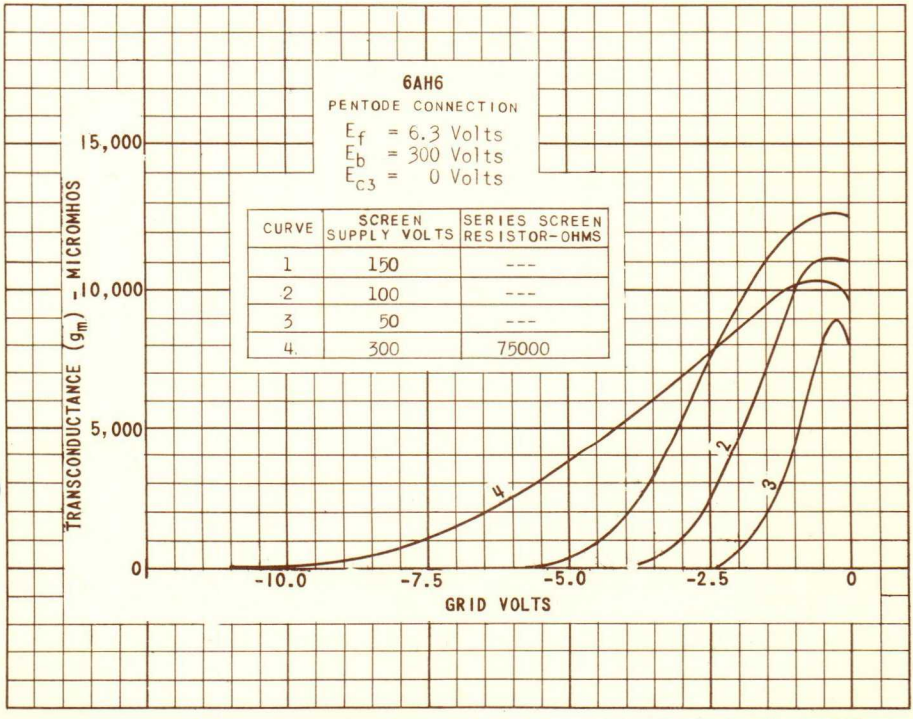
A
PIN #2 CONNECTED TO #7 AT SOCKET.

B
GRID #3 HAS PRACTICALLY NO CONTROL CHARACTERISTIC AND IT IS NOT INTENDED TO BE USED AS A CONTROL ELECTRODE. ITS TRANSCONDUCTANCE TO THE PLATE IS APPROXIMATELY 2 μMHOS AND THE MU IS 0.7 TO 1.0.

* INDICATES AN ADDITION.
→ INDICATES A CHANGE.







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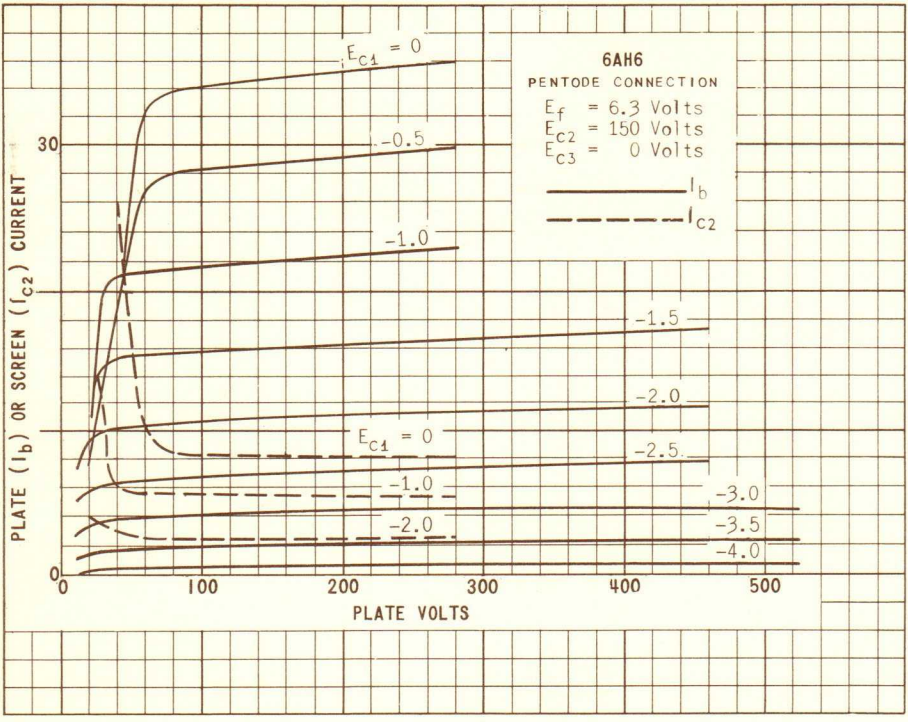
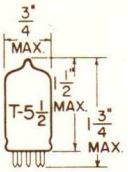

6AH6
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
E_{c1} = 0
-1.0
-2.0
30
0
0
100
200
300
400
500
PLATE (I_b) OR SCREEN (I_{c2}) CURRENT
PLATE VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

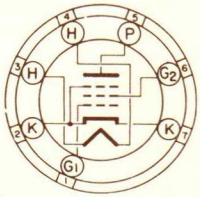


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 175 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BD

THE 6AJ5 IS A SHARP CUT-OFF PENTODE VOLTAGE AMPLIFIER IN THE MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY LOW HEATER POWER REQUIREMENTS, HIGH TRANSCONDUCTANCE, LOW CAPACITANCES, AND HIGH INPUT IMPEDANCE. ITS LOW TRIODE-MU ADAPTS IT TO SERVICE WHERE THE PLATE AND SCREEN SUPPLY POTENTIALS ARE LOW OR TO APPLICATIONS AS A SMALL POWER AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G_1 TO P) MAX.	0.02	0.03	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	4	4	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	2.8	2.1	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PINS #2 AND #7.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	140	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM CATHODE CURRENT	18	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	175	MA.
PLATE VOLTAGE	28	VOLTS
GRID #2 VOLTAGE	28	VOLTS
GRID #1 VOLTAGE	-1	VOLT
PLATE RESISTANCE (APPROX.)	0.1	MEGOHM
TRANSCONDUCTANCE	2 500	μMHOS
PLATE CURRENT	2.7	MA.
GRID #2 CURRENT	1	MA.
GRID #1 VOLTAGE FOR I_b = 10 μA.	-4.5	VOLTS

→INDICATES A CHANGE OR ADDITION.

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PLATE
2694
JULY 1
1952

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6AJ5

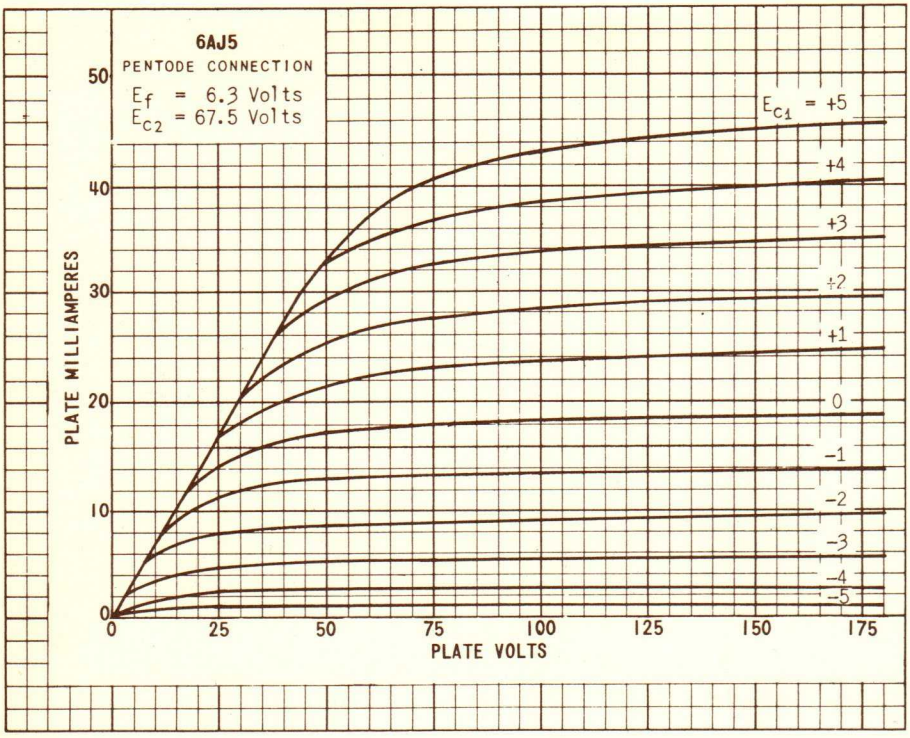

PLATE
2695
JULY 1
1951

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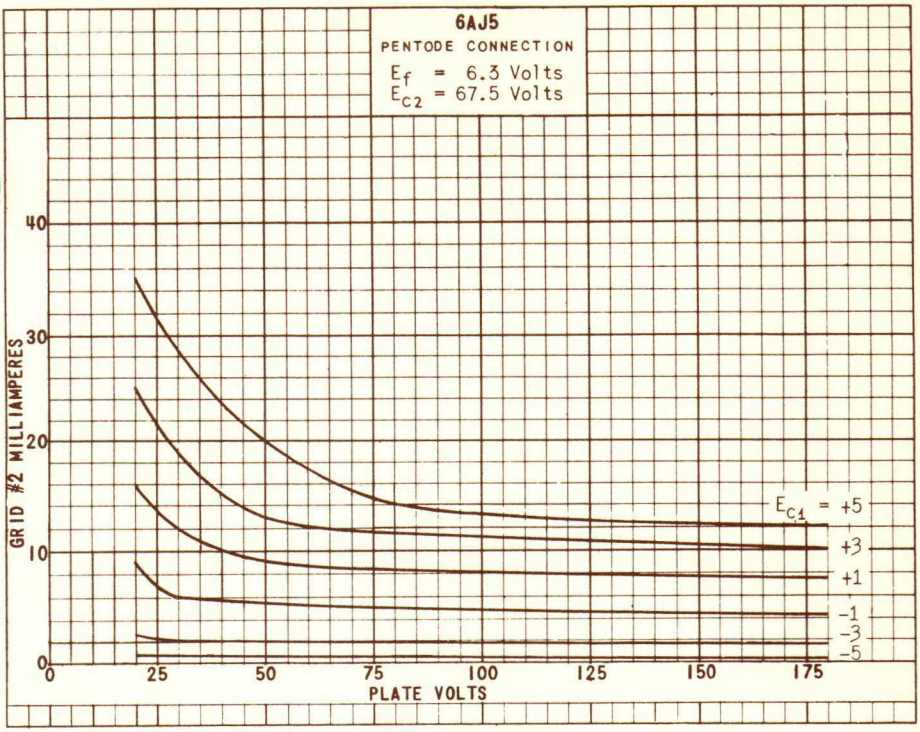

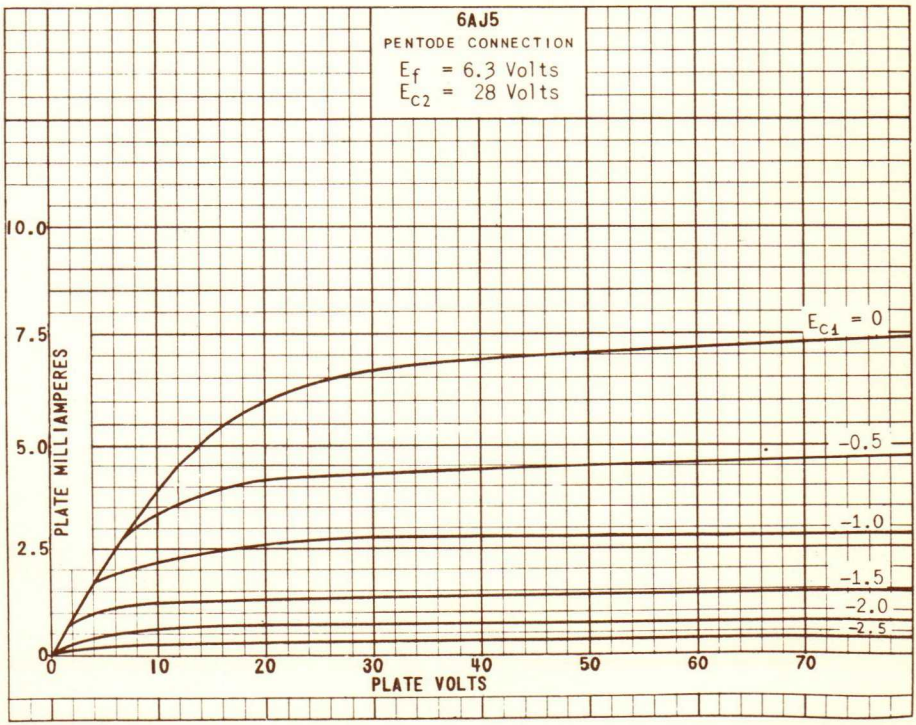

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PLATE
2035
JULY 1,
1948

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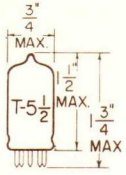
PENTODE

MINIATURE TYPE



GLASS BULB

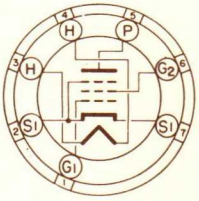
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 175 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7BD

THE 6AK5 IS A SHARP CUT-OFF VOLTAGE AMPLIFIER USING THE MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY LOW HEATER POWER REQUIREMENTS, HIGH TRANSCONDUCTANCE AND INPUT IMPEDANCE, AND LOW INTERELECTRODE CAPACITANCES AND LEAD INDUCTANCES. THESE RESULT IN A HIGHLY FAVORABLE MERIT FACTOR FOR HIGH FREQUENCY WIDE-BAND APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G_1 TO P) MAX.	0.02	0.03	μμf
INPUT: G_1 TO ($H+K+G_2+G_3$&IS)	4	4	μμf
OUTPUT: P TO ($H+K+G_2+G_3$&IS)	2.8	2.1	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PINS #2 AND #7.

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	120 ←	VOLTS
MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4 ←	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM CATHODE CURRENT	18	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	175	175	MA.
PLATE VOLTAGE	120	180	VOLTS
GRID #2 VOLTAGE	120	120	VOLTS
CATHODE RESISTOR	180	180	OHMS
PLATE RESISTANCE (APPROX.)	0.3	0.5	MEGOHM
TRANSCONDUCTANCE	5000	5100	μMHOS
PLATE CURRENT	7.5	7.7	MA.
GRID #2 CURRENT	2.5	2.4	MA.
GRID #2 VOLTAGE (APPROX.) FOR I_b = 10 μA.	-8.5	-8.5	VOLTS

→ INDICATES A CHANGE.

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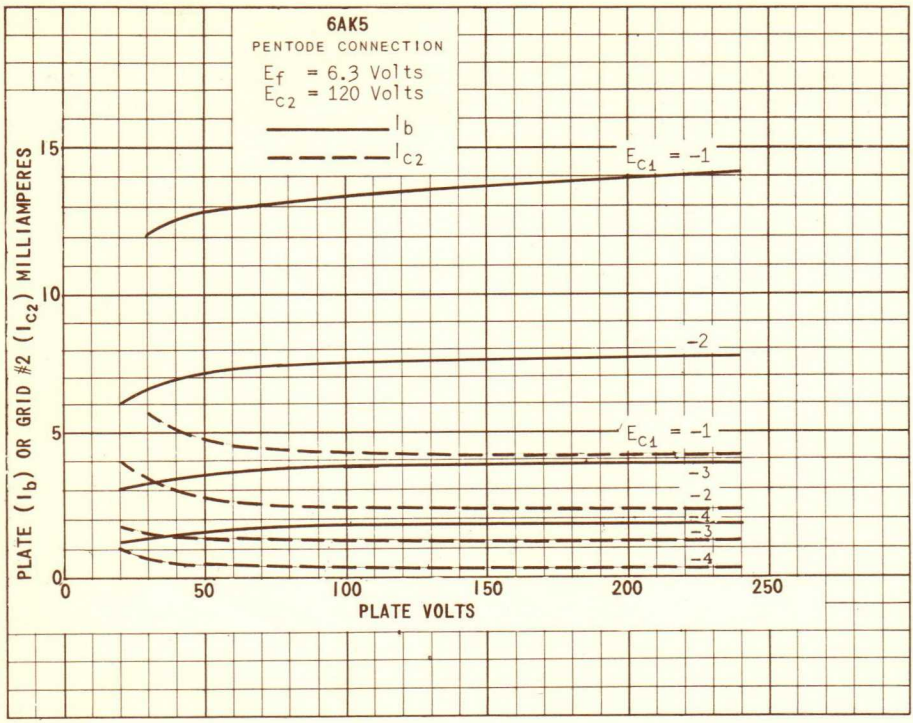
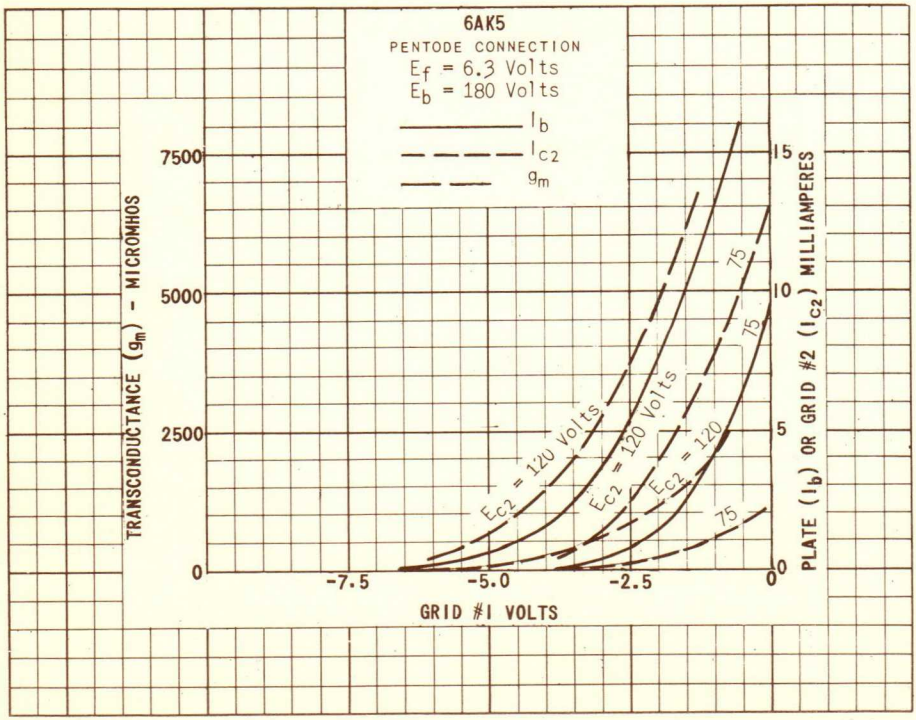
6AK5


6AK5
PENTODE CONNECTION
Ef = 6.3 Volts
Ec2 = 120 Volts
Ib
Ic2
Ec1 = -1
-2
Ec1 = -1
-3
-2
-4
-3
-4
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
5
10
15
0
50
100
150
200
250


6AK5
PENTODE CONNECTION
Ef = 6.3 Volts
Eb = 180 Volts
Ib
Ic2
gm
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
GRID #1 VOLTS
Ec2 = 120 Volts
Ec2 = 120 Volts
Ec2 = 120
75
75
75
0
2500
5000
7500
0
5
10
15
-7.5
-5.0
-2.5
0

TUNG-SOL

POWER AMPLIFIER PENTODE

MINIATURE TYPE

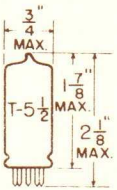
COATED UNIPOTENTIAL CATHODE

HEATER

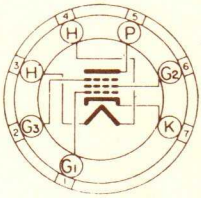
6.3 VOLTS 0.15 AMPERE

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

THE 6AK6 IS A HEATER-CATHODE TYPE OF TUBE INTENDED FOR USE IN COMPACT, LIGHT-WEIGHT EQUIPMENT. BECAUSE OF ITS SMALL SIZE, THE 6AK6 CAN BE USED SINGLY OR IN PUSH-PULL TO EFFECT A MORE COMPACT DESIGN OF POWER-LINE RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.15	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.75	WATTS
MAXIMUM SCREEN DISSIPATION	0.75	WATTS
MAXIMUM DC HEATER-CATHODE VOLTAGE	100	VOLTS

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITH NO EXTERNAL SHIELD

GRID TO PLATE	0.12	μμf
INPUT	3.6	μμf
OUTPUT	4.2	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	180	VOLTS
SCREEN VOLTAGE	180	VOLTS
SUPPRESSOR VOLTAGE	0	VOLTS
GRID VOLTAGE	-9	VOLTS
PEAK AF GRID VOLTAGE	9	VOLTS
ZERO-SIGNAL PLATE CURRENT	15	MA.
ZERO-SIGNAL SCREEN CURRENT	2.5	MA.
GRID RESISTOR (MAX.):		
FOR FIXED BIAS	0.1	MEGOHM
FOR CATHODE BIAS	0.5	MEGOHM
LOAD RESISTANCE	10 000	OHMS
PLATE RESISTANCE	0.2	MEGOHM
TRANSCONDUCTANCE	2 300	μMHOS
MAXIMUM-SIGNAL POWER OUTPUT	1.1	WATTS
TOTAL HARMONIC DISTORTION	10	PERCENT

SIMILIAR TYPE REFERENCE: Rating and characteristics identical to 6G8G.

→ INDICATES A CHANGE OR ADDITION

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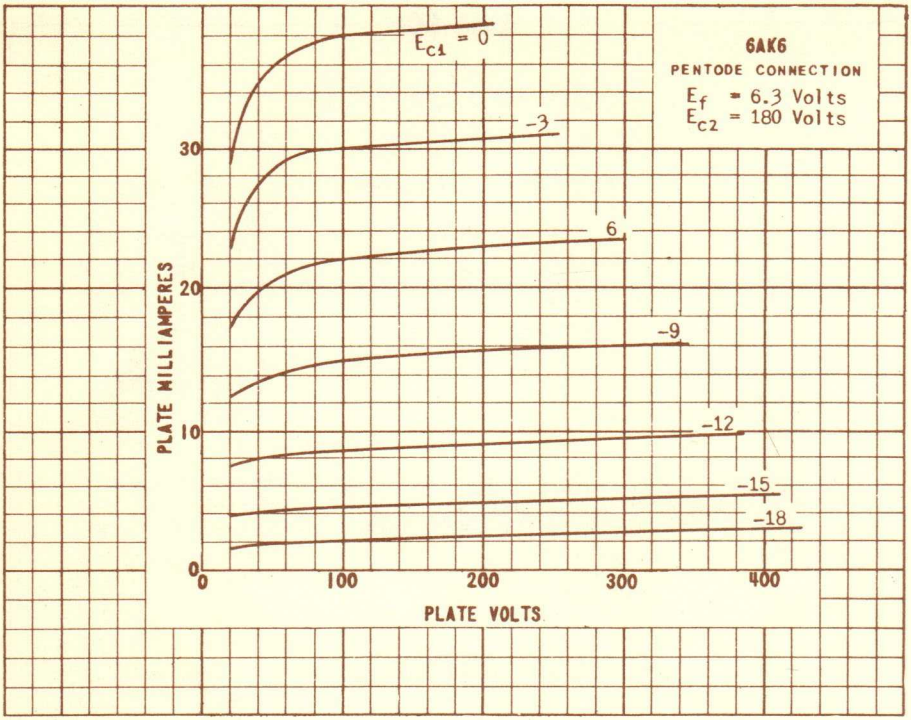
6AK6



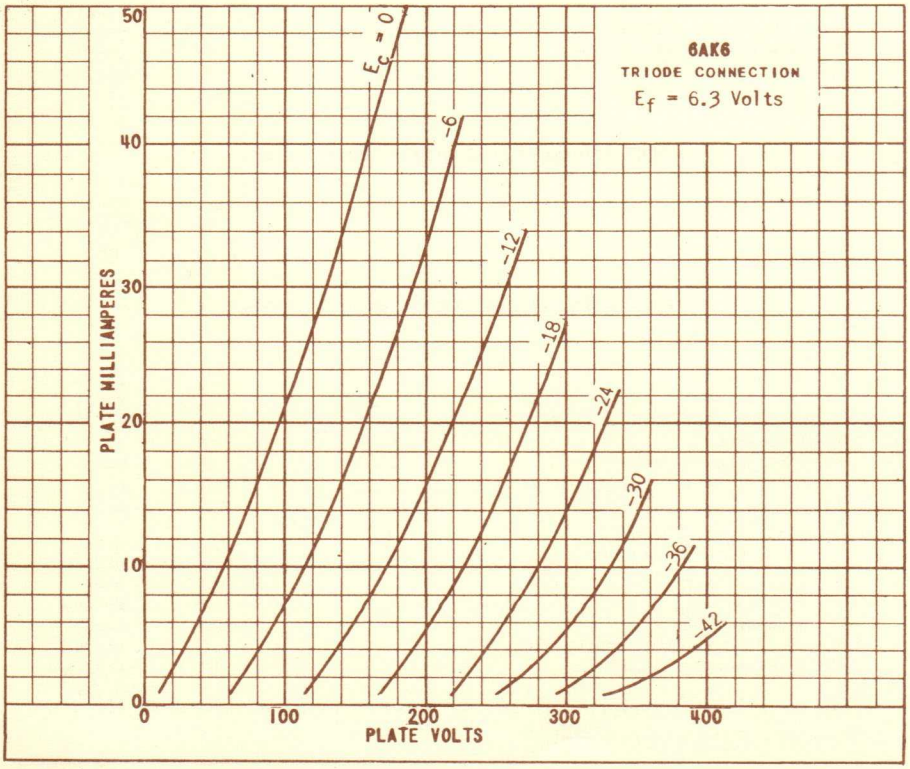


PLATE
1780
FEB. 3,
1947

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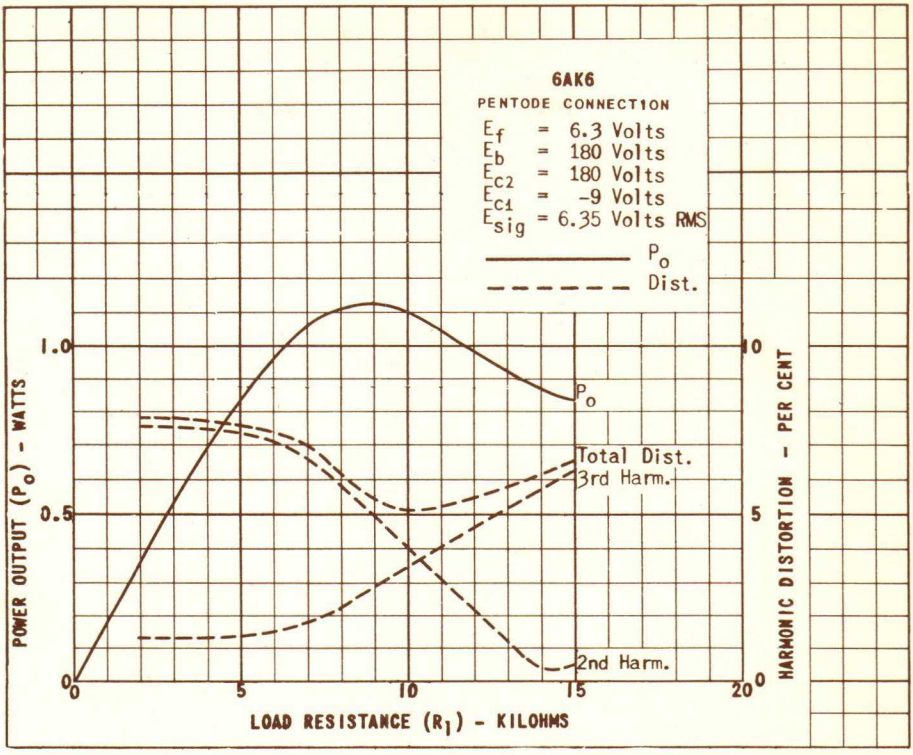

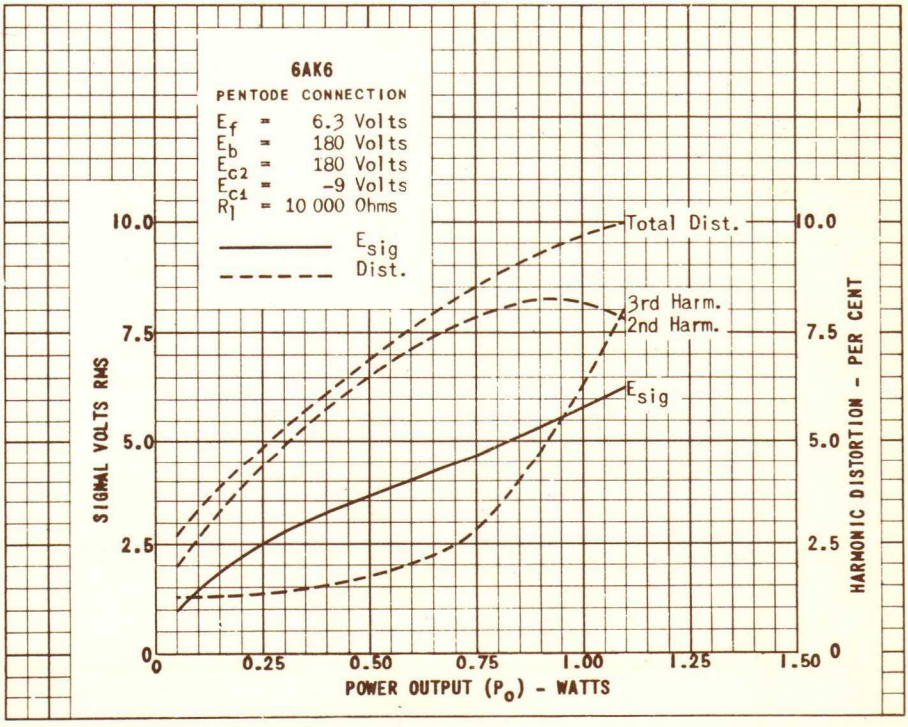

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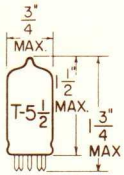
DOUBLE DIODE

MINIATURE TYPE

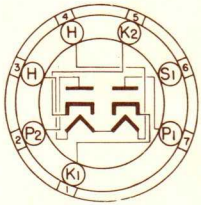


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6BT

THE 6AL5 COMBINES TWO INDEPENDENT DIODE UNITS IN THE 7 PIN MINIATURE CONSTRUCTION. ITS HIGH PERVEANCE PERMITS HIGH EFFICIENCY IN EITHER FM OR AM DETECTOR SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
PLATE INPUT: P TO (H+K+IS) EACH UNIT	2.5	3.2	μμf
COUPLING: 1P TO 2P (MAX.)	0.068	0.026	μμf
CATHODE INPUT: K TO (P+H+IS) EACH UNIT	3.4	3.6	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #6.

→ RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PEAK HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	330[A]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[B]	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	330	VOLTS
MAXIMUM AC PLATE VOLTAGE (EACH PLATE) RMS	117	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT (EACH PLATE)	54	MA.
MAXIMUM DC OUTPUT CURRENT (EACH PLATE)	9	MA.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE (EACH PLATE)	300	OHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.3	AMP.
AVERAGE DIODE CURRENT (EACH UNIT) AT 10 VOLTS DC	60	MA.

THE RESONANT FREQUENCY OF EACH UNIT OF THE 6AL5 IS 700 MC. (APPROX.)

[A] DC COMPONENT MUST NOT EXCEED 330 VOLTS

[B] DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.

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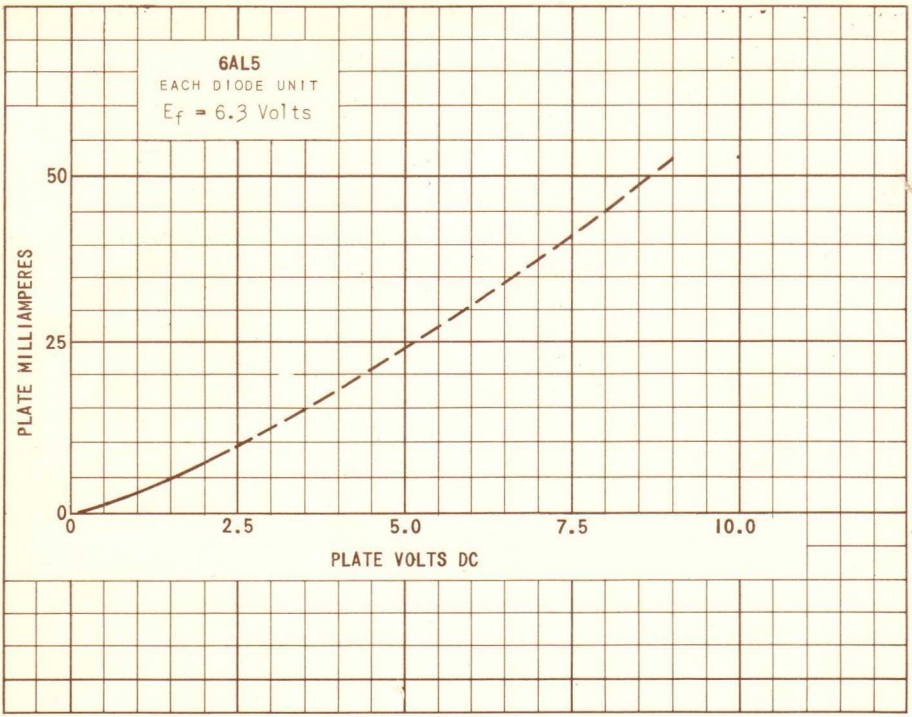
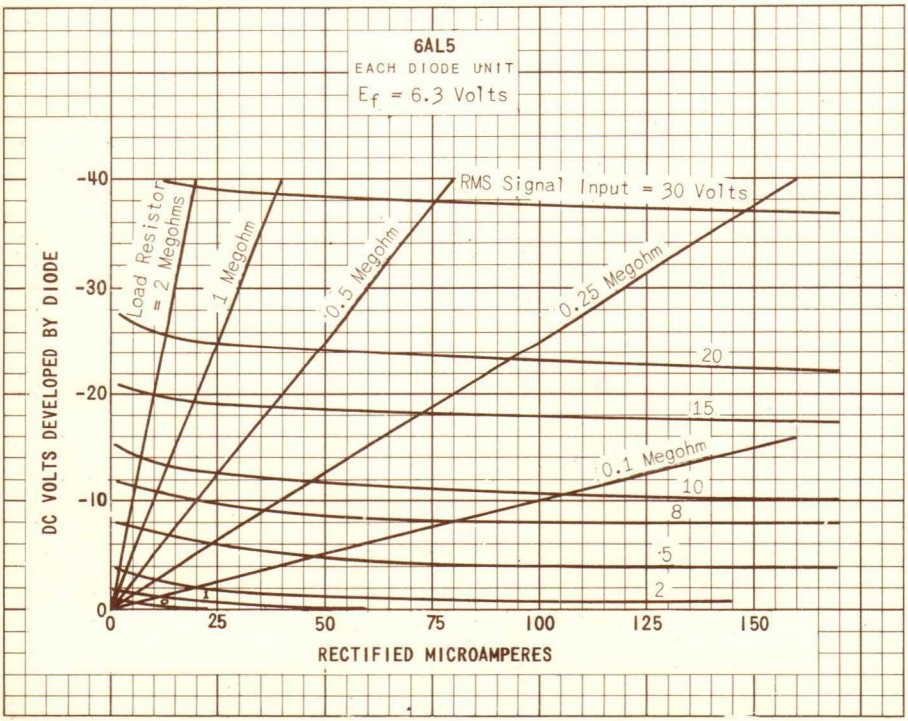
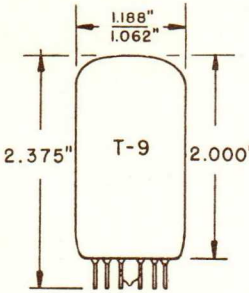

6AL5
EACH DIODE UNIT
E_f = 6.3 Volts
PLATE MILLIAMPERES
50
25
0
0
2.5
5.0
7.5
10.0
PLATE VOLTS DC


6AL5
EACH DIODE UNIT
E_f = 6.3 Volts
DC VOLTS DEVELOPED BY DIODE
-40
-30
-20
-10
0
Load Resistor = 2 Megohms
1 Megohm
0.5 Megohm
0.25 Megohm
0.1 Megohm
RMS Signal Input = 30 Volts
20
15
10
8
5
2
0
25
50
75
100
125
150
RECTIFIED MICROAMPERES

TUNG-SOL

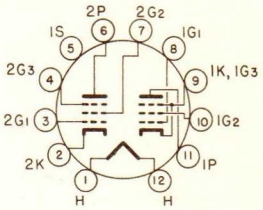
DOUBLE PENTODE

COMPACTRON



DISSIMILAR DOUBLE PENTODE
FOR
USE AS AN FM DETECTOR
AND AUDIO-FREQUENCY OUTPUT
AMPLIFIER IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



GLASS BULB
BUTTON 12 PIN
BASE E12-70
OUTLINE DRAWING
JEDEC 9-58

BOTTOM VIEW
BASING DIAGRAM
JEDEC 12BU

THE 6AL11 IS A SHARP-CUTOFF, DUAL-CONTROL PENTODE (SECTION 2) AND A POWER PENTODE (SECTION 1) IN THE T-9 COMPACTRON CONSTRUCTION. THE DUAL-CONTROL PENTODE IS INTENDED FOR USE AS AN FM DETECTOR AND THE POWER PENTODE AS AN AUDIO-FREQUENCY OUTPUT AMPLIFIER IN T.V. RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

SECTION 1		
GRID 1 TO PLATE: (1_{G1} TO IP)	0.26	pf
INPUT: IG1 TO (H+ IK + IG2 + IG3 + I.S.)	11	pf
OUTPUT: IP TO (H + IK + IG2 + IG3 + I.S.)	12	pf
SECTION 2		
GRID 1 TO PLATE: (2G1 TO 2P)	0.034	pf
GRID 3 TO PLATE: (2_{G3} TO 2P)	3.2	pf
GRID 1 TO ALL EXCEPT PLATE: 2_{G1} TO (H + 2K + 2G2 + 2G3 + I.S.)	6.5	pf
GRID 3 TO ALL: 2_{G3} TO (H + 2K + 2G1 + 2G2 + 2P + I.S.)	7.5	pf
GRID 1 TO GRID 3: (2 G1 TO 2G3)	0.24	pf
PLATE TO PLATE: (1P TO 2P)	0.12	pf

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TUNG-SOL

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	900	MA.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
HEATER-CATHODE VOLTAGE	SECTION 1	SECTION 2	
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	SECTION 1	SECTION 2	
PLATE VOLTAGE	275	330	VOLTS
GRID 2 VOLTAGE	275	SEE RATING CHART	VOLTS
GRID 2 SUPPLY VOLTAGE		330	VOLTS
GRID 3 (SUPPESSOR) VOLTAGE		28	VOLTS
POSITIVE DC GRID 1 VOLTAGE		0	VOLTS
PLATE DISSIPATION	10	1.7	WATTS
GRID 2 DISSIPATION	2.0	1.1	WATTS
GRID 1 CIRCUIT RESISTANCE			
WITH FIXED BIAS	0.25		MEGOHMS
WITH CATHODE BIAS	0.5		MEGOHMS

CHARACTERISTICS AND TYPICAL OPERATION

SECTION 1

PLATE VOLTAGE		250	VOLTS
GRID 2 VOLTAGE		250	VOLTS
GRID 1 VOLTAGE		-8.0	VOLTS
PEAK AF GRID 1 VOLTAGE		8.0	VOLTS
ZERO-SIGNAL PLATE CURRENT		35	MA.
MAXIMUM-SIGNAL PLATE CURRENT		39	MA.
ZERO-SIGNAL GRID 2 CURRENT		2.5	MA.
MAXIMUM SIGNAL GRID 2 CURRENT		7.0	MA.
MAXIMUM-SIGNAL POWER OUTPUT		4.2	WATTS
TRANSCONDUCTANCE		6,500	MICROMHOS
PLATE RESISTANCE	Approx.	100,000	OHMS
LOAD RESISTANCE		5,000	OHMS
TOTAL HARMONIC DISTORTION	Approx.	10	PERCENT

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

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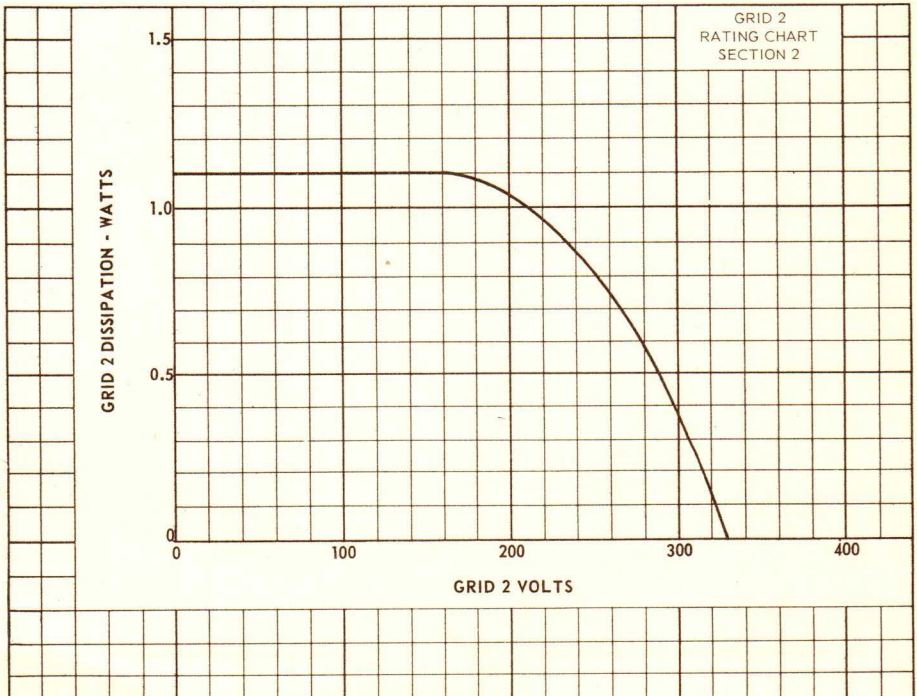
AVERAGE CHARACTERISTICS - SECTION 2

PLATE VOLTAGE		150	VOLTS
GRID 2 VOLTAGE		100	VOLTS
GRID 3 VOLTAGE		0	VOLTS
CATHODE-BIAS RESISTOR		560	OHMS
PLATE CURRENT		1.3	MA.
GRID 2 CURRENT		2.1	MA.
GRID 1 TRANSCONDUCTANCE		1,000	MICROMHOS
GRID 3 TRANSCONDUCTANCE		400	MICROMHOS
PLATE RESISTANCE	Approx.	0.15	MEGOHMS
GRID 1 VOLTAGE FOR I_b = 30 μA	Approx.	-4.5	VOLTS
GRID 3 VOLTAGE FOR I_b = 50 μA	Approx.	-4.5	VOLTS



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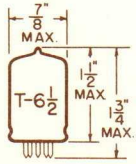
TRIODE

MINIATURE TYPE

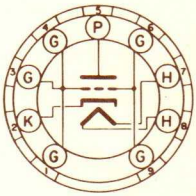


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.225 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
98X

THE 6AM4 IS A HIGH-MU TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. ITS SHARP CUT-OFF AND HIGH TRANSCONDUCTANCE, COUPLED WITH ITS EXCELLENT ISOLATION BETWEEN INPUT AND OUTPUT MAKE IT WELL SUITED FOR GROUNDED-GRID MIXER SERVICE OVER THE ENTIRE RANGE OF VHF/UHF TELEVISION FREQUENCIES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PLATE TO CATHODE: P TO K	0.16	0.16	μμf
CATHODE TO GRID AND HEATER: K TO (G&H)	4.6	4.4	μμf
PLATE TO GRID AND HEATER: P TO (G&H)	2.8	2.4	μμf
HEATER TO CATHODE: H TO K	1.8	1.8	μμf

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO GRID.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE[B]	80	VOLTS
MAXIMUM PLATE VOLTAGE	200 ←	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS

[B] WHEN THE 6AM4 IS OPERATED IN SERIES DC WITH A SECOND TUBE, AS FOR EXAMPLE IN CASCODE OR DIRECT-COUPLED CIRCUITS, THE HEATER-CATHODE VOLTAGE OF THE 6AM4 MAY BE AS HIGH AS 250 VOLTS MAXIMUM UNDER CUT-OFF CONDITIONS WITH THE HEATER NEGATIVE WITH RESPECT TO THE CATHODE.

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.225		AMP.
PLATE VOLTAGE	200	←	VOLTS
CATHODE BIAS RESISTOR[C]	100		OHMS
AMPLIFICATION FACTOR	85	←	
PLATE RESISTANCE (APPROX.)	8 700	←	OHMS
TRANSCONDUCTANCE	9 800	←	µMHOS
PLATE CURRENT	10	←	MA.
GRID VOLTAGE FOR I_b = 10 µA. (APPROX.)	-6.5	←	VOLTS

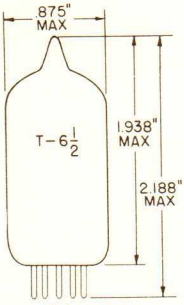
[C] OPERATION WITH FIXED BIAS IS NOT RECOMMENDED.

→ INDICATES A CHANGE.

TUNG-SOL

DIODE PENTODE

MINIATURE TYPE

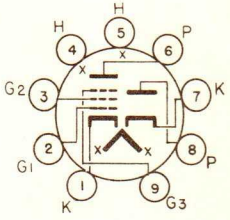


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 450 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9CY

THE 6AM8A IS A DIODE PENTODE EXPECIALLY DESIGNED FOR USE AS A VIDEO DETECTOR AND IF AMPLIFIER IN TELEVISION RECEIVERS. IN ADDITION, THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE			
GRID #1 TO PLATE (MAX.)	0.015	0.015	pf
INPUT	6.0	6.5	pf
OUTPUT	3.4	2.6	pf
DIODE			
INPUT: P TO (H+K)	2.3	1.8	pf
CATHODE TO (H+P)	3.0	3.0	pf
COUPLING (DIODE PLATE TO PENTODE PLATE)	0.035	0.10	pf
COUPLING (DIODE PLATE TO GRID #1)	0.005	0.006	pf
COUPLING (DIODE CATHODE TO PENTODE PLATE)	0.15	0.15	pf

[A] SHIELD #315 CONNECTED TO GROUND.

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RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

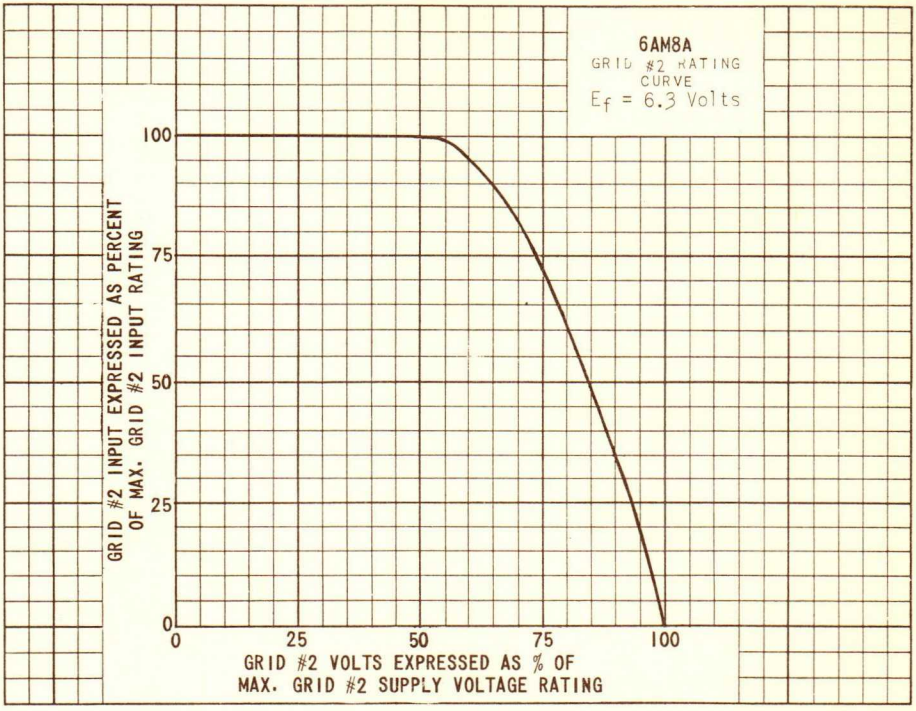
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM PLATE DISSIPATION	3.2	WATTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM GRID #3 VOLTAGE	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
CATHODE BIAS	1.0	MEGOHM
FIXED BIAS	0.25	MEGOHM
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION	5.0	MA.
HEATER WARM–UP TIME (APPROX.)*	11.0	SECONDS

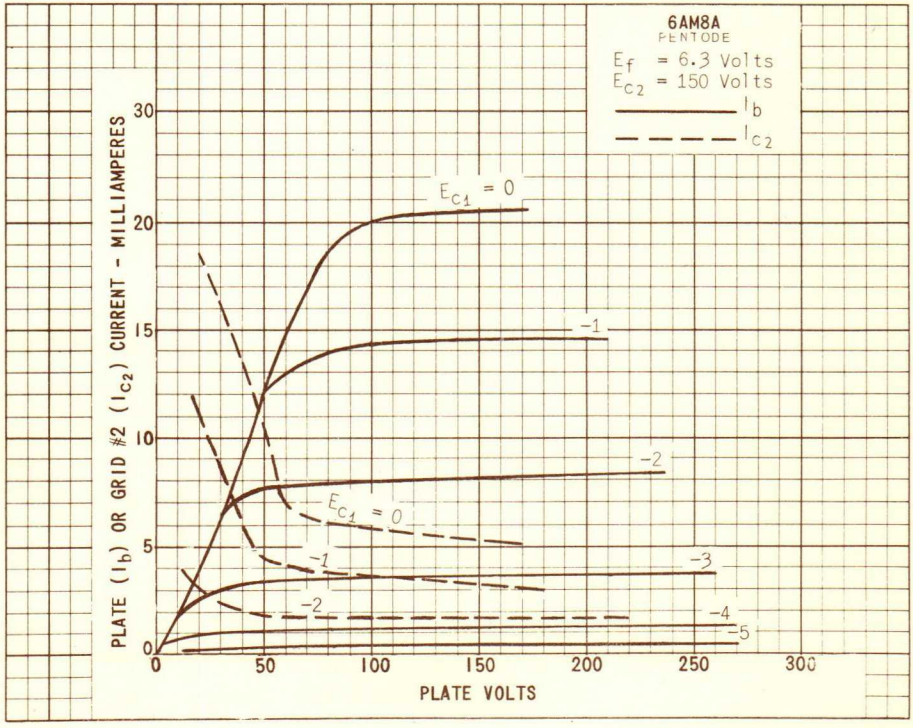
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	125	VOLTS
GRID #3 VOLTAGE	0	VOLTS
CATHODE RESISTOR	56	OHMS
PLATE CURRENT	12.5	MA.
GRID #2 CURRENT	3.2	MA.
TRANSCONDUCTANCE	7 800	μMHOS
PLATE RESISTANCE (APPROX.)	0.3	MEGOHM
GRID #1 VOLTAGE FOR I_b = 20 μA. (APPROX.)	−6	VOLTS
PLATE CURRENT AT E_{c1}=−3V., R_k =0	2.6	MA.
DIODE PLATE VOLTAGE FOR DIODE CURRENT = 50 MA.	10	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.





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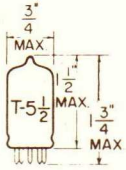
TUNG-SOL

TRIODE

MINIATURE TYPE

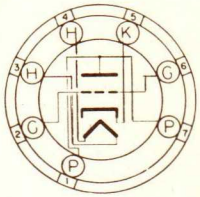


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.225 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7DK

THE 6AN4 IS A HIGH-MU TRIODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A GROUNDED-GRID AMPLIFIER OR MIXER IN UHF TELEVISION APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: (G TO P)	1.7	μμf
INPUT: G TO (H+K)	2.8	μμf
OUTPUT: P TO (H+K)	0.28	μμf
HEATER TO CATHODE: (H TO K)	3.4	μμf
GROUNDED GRID		
INPUT	6.0	μμf
OUTPUT	1.8	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	4	WATTS
MAXIMUM CATHODE CURRENT	30	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.1	MEGOHM
CATHODE BIAS OPERATION	0.5	MEGOHM

CONTINUED ON FOLLOWING PAGE

→INDICATES A CHANGE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

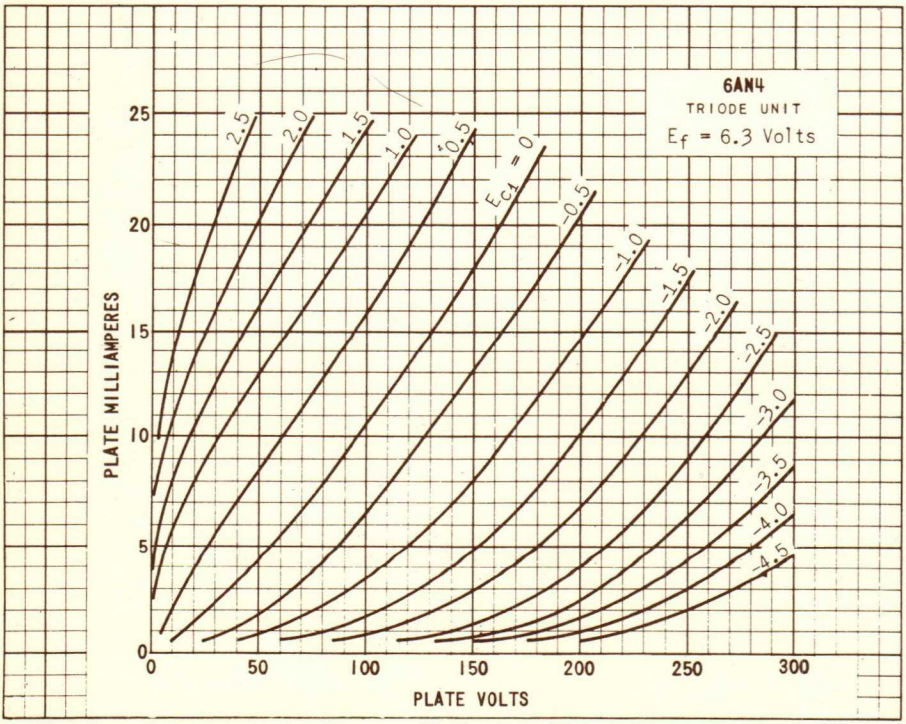
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

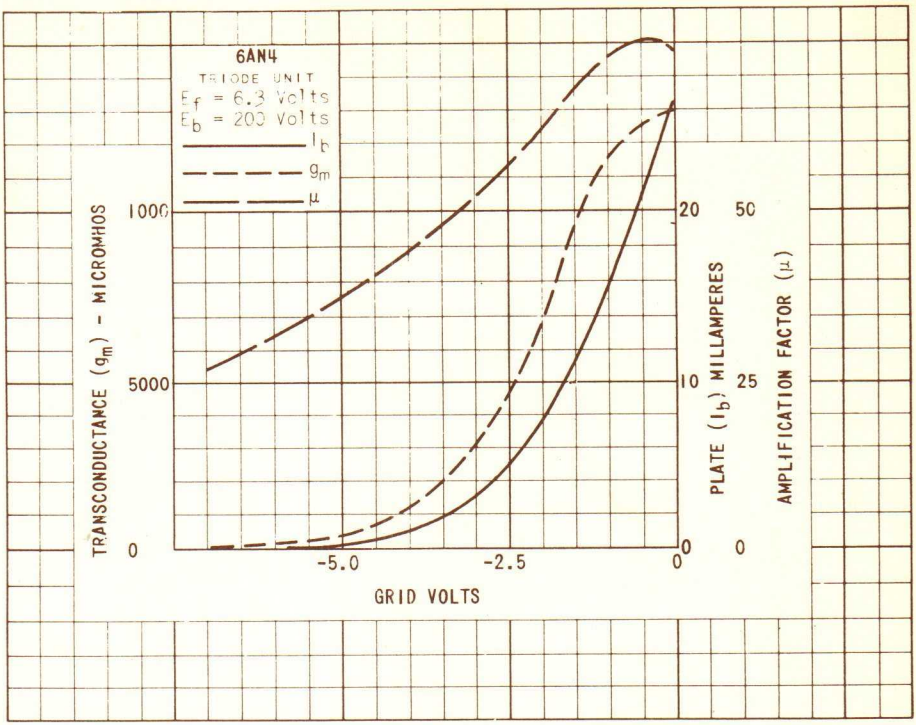
CLASS A_1 AMPLIFIER

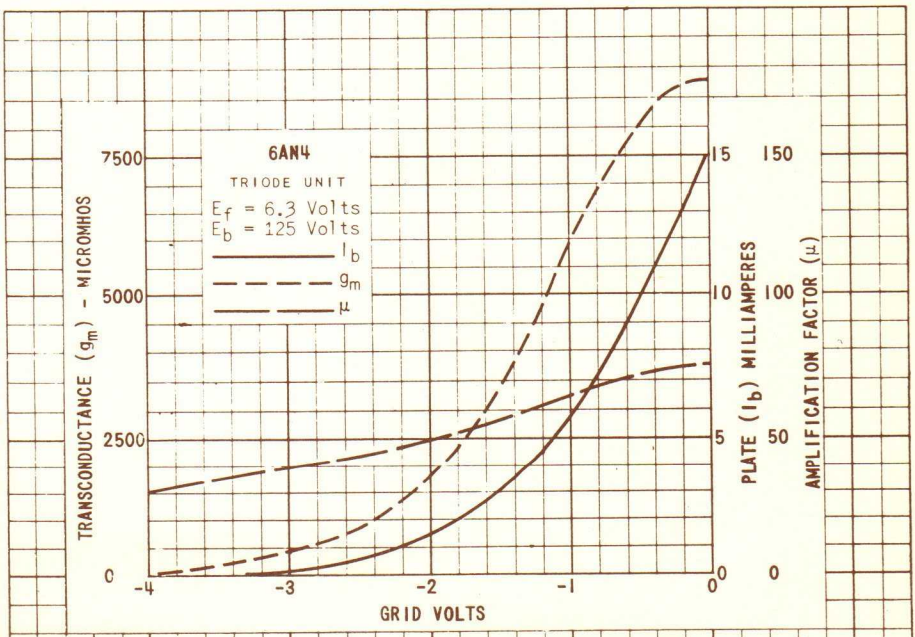
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.225	AMP.
PLATE VOLTAGE	200	VOLTS
CATHODE BIAS RESISTOR	100	OHMS
PLATE CURRENT	13	MA.
TRANSCONDUCTANCE	10 000	µMHOS
AMPLIFICATION FACTOR	70	
GRID VOLTAGE FOR 20 µA. PLATE CURRENT	−7	VOLTS

MIXER SERVICE

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.225	AMP.
PLATE VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	270	OHMS
PLATE CURRENT	7	MA.
OSCILLATOR INJECTOR VOLTAGE (RMS)	1.4	VOLTS
CONVERSION CONDUCTANCE	2 900	µMHOS







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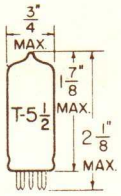
PENTODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

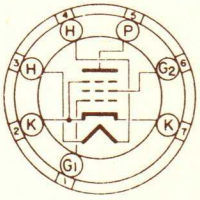
* HEATER

6.3 VOLTS 450 MA.

AC OR DC

HEATER VOLTAGE SHOULD NOT DEVIATE MORE THAN ±10 PERCENT OF THE RATED VALUE.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7B0

THE 6AN5 IS A HIGH EFFICIENCY POWER PENTODE IN THE MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY LOW INTERELECTRODE CAPACITANCES AND HIGH PERVEANCE WHICH ADAPT IT WELL TO HIGH FREQUENCY OR WIDE-BAND SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #316 CONNECTED TO CATHODE

GRID TO PLATE: (G_1 TO P) MAX.	0.075	μμf
INPUT: G_1 TO (H+K&G_3+G_2)	.9	μμf
OUTPUT: P TO (H+K&G_3+G_2)	4.8	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	90	VOLTS
MAXIMUM PLATE VOLTAGE	120	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	120	300	VOLTS
MAXIMUM PLATE DISSIPATION	4.2	1.7	WATTS
MAXIMUM GRID #2 DISSIPATION	1.4	0.56	WATTS
MAXIMUM CATHODE CURRENT	50	20	MA.
MAXIMUM BULB TEMPERATURE	140	140	°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	450	MA.
PLATE VOLTAGE	120	VOLTS
GRID #2 VOLTAGE	120	VOLTS
CATHODE RESISTOR[A]	120	OHMS
PLATE RESISTANCE (APPROX.)	12 500	OHMS
TRANSCONDUCTANCE	8 000	μMHOS
PLATE CURRENT	35	MA.
GRID #2 CURRENT	12	MA.
LOAD RESISTANCE	2 500	OHMS
POWER OUTPUT	1.3	WATTS
GRID #1 VOLTAGE FOR I_b = 1 MA. MAX.	-20	VOLTS

[A] FIXED BIAS OPERATION IS RECOMMENDED ONLY WHEN THE PLATE AND SCREEN DISSIPATION IS LESS THAN 70 PERCENT OF THE DESIGN CENTER MAXIMUM RATING. THE DC GRID CIRCUIT RESISTANCE SHOULD NOT EXCEED 100,000 OHMS FOR SELF BIAS OPERATION OR FOR THE LIMITED FIXED BIAS OPERATION DEFINED ABOVE. THE GRID CIRCUIT RESISTANCE SHOULD NOT EXCEED 250,000 FOR SELF BIAS OPERATION IN APPLICATIONS WHERE THE ABSOLUTE MAXIMUM HEATER VOLTAGE IS 6.6 VOLTS.

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PLATE 2153
MAR. 1, 1949

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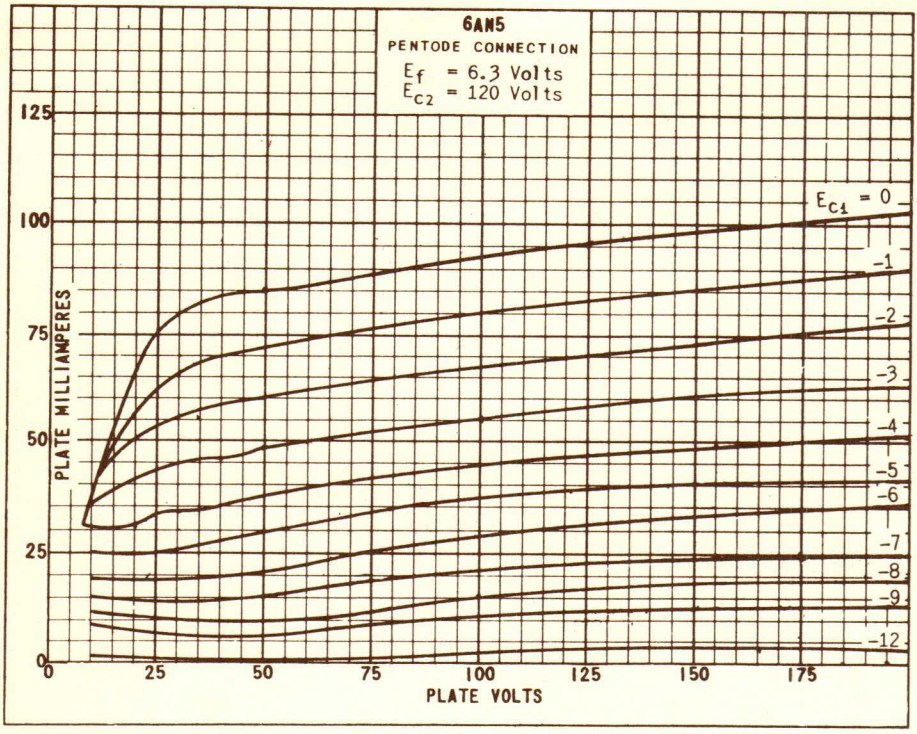
6AN5



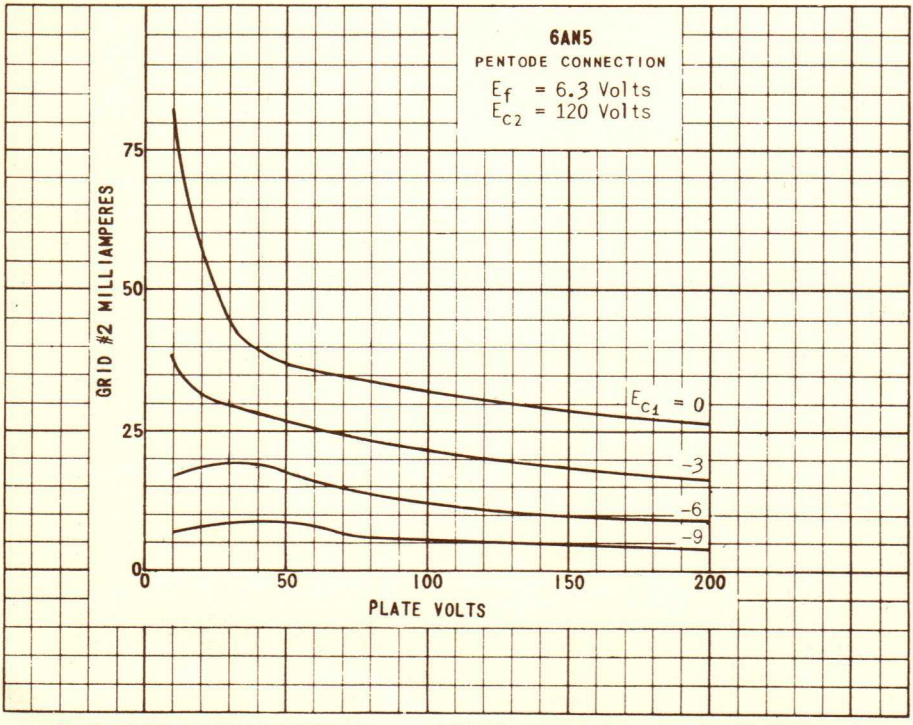


PLATE 2154
MAR. 1, 1949

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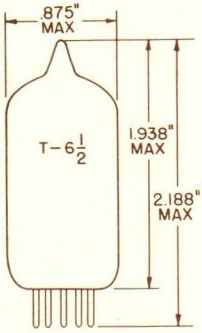
TRIODE PENTODE

MINIATURE TYPE



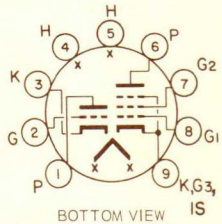
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

FOR GENERAL PURPOSE

APPLICATIONS IN TV RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM

JEDEC 9DA

THE 6AN8 IS A MEDIUM MU TRIODE AND A SHARP CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION MAY BE USED AS AN IF AMPLIFIER OR A REACTANCE TUBE WHILE THE TRIODE SECTION IS WELL SUITED FOR USE IN LOW-FREQUENCY OSCILLATOR, SYNC CLIPPER, SYNC SEPARATOR AND PHASE SPLITTER CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES

TRIODE UNIT:		
GRID TO PLATE: (TG TO TP)	1.5	pf
INPUT: TG TO (H+TK)	2.0	pf
OUTPUT: TP TO (H+TK)	→ 0.26	pf
PENTODE UNIT:		
GRID 1 TO PLATE: (PG1 TO PP) MAX.	0.04	pf
INPUT: PG1 TO (H+PK+PG2+PG3+I.S.)	7.0	pf
OUTPUT: PP TO (H+PK+PG2+PG3+I.S.)	→ 2.4	pf
COUPLING:		
TRIODE GRID TO PENTODE PLATE: (TG TO PP) MAX.	→ 0.02	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP) MAX.	→ 0.02	pf
PENTODE PLATE TO TRIODE PLATE: (Pp TO TP) MAX.	→ 0.15	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	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

CONTINUED ON FOLLOWING PAGE

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→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 VOLTAGE	----	SEE RATING CHART	
GRID 2 SUPPLY VOLTAGE	----	330	VOLTS
PLATE DISSIPATION	2.8	2.3	WATTS
GRID 2 DISSIPATION	----	0.55	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
GRID 1 CIRCUIT RESISTANCE: [B]			
FOR CATHODE-BIAS OPERATION	1.0	1.0	MEGOHM
FOR FIXED-BIAS OPERATION	0.5	0.25	MEGOHM

→ TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
PLATE SUPPLY VOLTAGE	150	125	VOLTS
GRID 2 SUPPLY VOLTAGE	----	125	VOLTS
GRID 1 VOLTAGE	-3	0	VOLTS
CATHODE BIAS RESISTOR	0	56	OHMS
AMPLIFICATION FACTOR	21	----	
TRANSCONDUCTANCE	4500	7800	μMHOS
PLATE CURRENT	15	12	MA.
PLATE RESISTANCE (APPROX)	4700	170,000	OHMS
GRID 2 CURRENT	----	3.8	MA.
GRID 1 VOLTAGE (APPROX.) FOR Ib=20 μA	-17	----	VOLTS
PLATE CURRENT AT Ec1=-3 V., Rk=0	----	1.6	MA.
GRID 1 VOLTAGE (APPROX.) FOR Ib=20 μA.	----	-6	VOLTS

[B] IF EITHER UNIT IS OPERATING AT MAXIMUM RATED CONDITIONS, GRID #1 CIRCUIT RESISTANCES FOR BOTH UNITS SHOULD NOT EXCEED THE STATED VALUES.

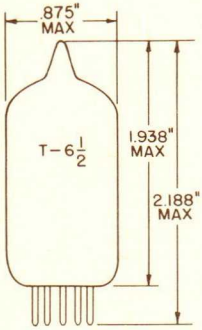
THE 6AN8A CURVES ALSO APPLY FOR THE 6AN8.

→ INDICATES A CHANGE.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



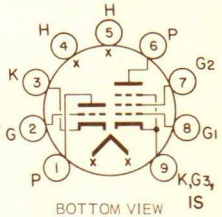
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

FOR GENERAL PURPOSE

APPLICATIONS IN TV RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM

JEDEC 9DA

THE 6AN8A IS A MEDIUM MU TRIODE AND A SHARP CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION MAY BE USED AS AN IF AMPLIFIER OR A REACTANCE TUBE WHILE THE TRIODE SECTION IS WELL SUITED FOR USE IN LOW-FREQUENCY OSCILLATOR, SYNC CLIPPER, SYNC SEPARATOR AND PHASE SPLITTER CIRCUITS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

TRIODE UNIT:		
GRID TO PLATE: (TG TO TP)	1.5	pf
INPUT: TG TO (H+TK)	2.0	pf
OUTPUT: TP TO (H+TK)	→ 0.26	pf
PENTODE UNIT:		
GRID 1 TO PLATE: (PG1 TO PP) MAX.	0.04	pf
INPUT: PG1 TO (H+PK+PG2+PG3+I.S.)	7.0	pf
OUTPUT: PP TO (H+PK+PG2+PG3+I.S.)	→ 2.4	pf
COUPLING:		
TRIODE GRID TO PENTODE PLATE: (TG TO PP) MAX.	→ 0.02	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP) MAX.	→ 0.02	pf
PENTODE PLATE TO TRIODE PLATE: (P_P TO TP) MAX.	→ 0.15	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	MA.
HEATER WARM-UP TIME[A]		11	SECONDS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	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

CONTINUED ON FOLLOWING PAGE

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→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 VOLTAGE	----	SEE RATING CHART	
GRID 2 SUPPLY VOLTAGE	----	330	VOLTS
PLATE DISSIPATION	2.8	2.3	WATTS
GRID 2 DISSIPATION	----	0.55	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
GRID 1 CIRCUIT RESISTANCE: [B]			
FOR CATHODE-BIAS OPERATION	1.0	1.0	MEGOHM
FOR FIXED-BIAS OPERATION	0.5	0.25	MEGOHM

→ TYPICAL OPERATING CHARACTERISTICS

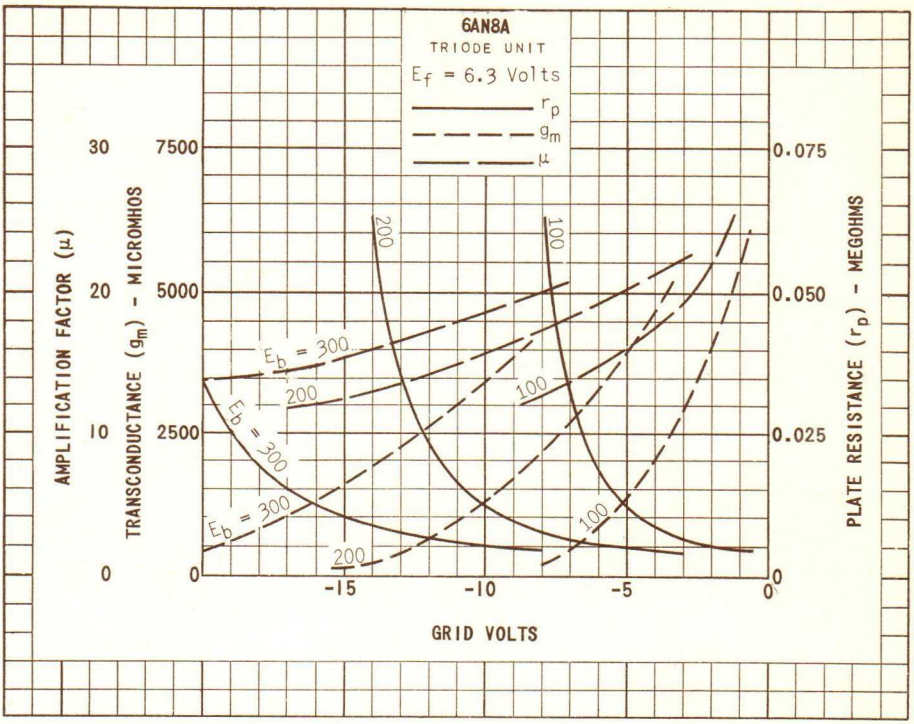
CLASS A_1 AMPLIFIER

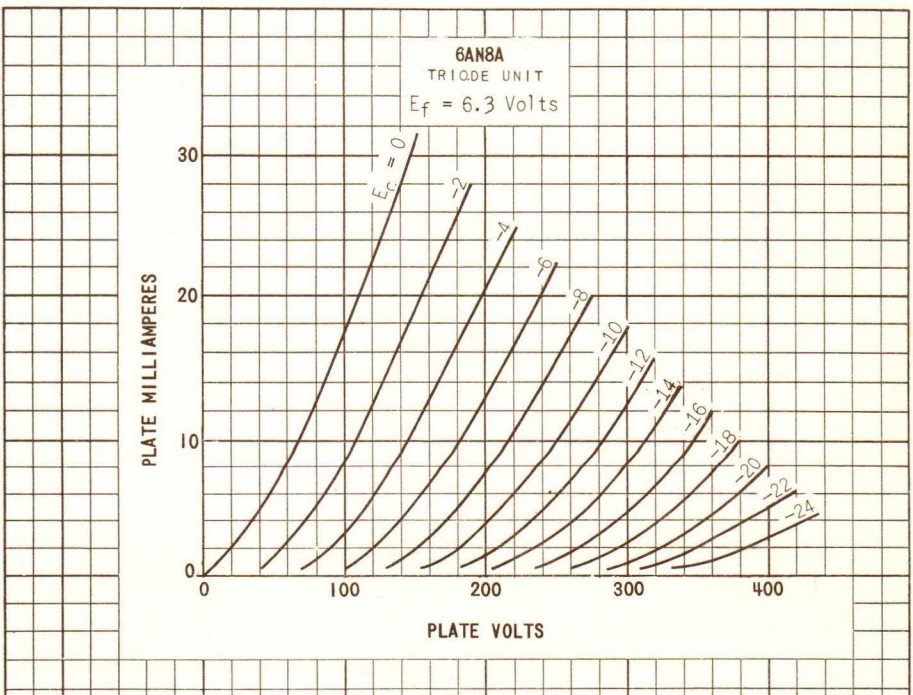
	TRIODE	PENTODE	
PLATE SUPPLY VOLTAGE	150	125	VOLTS
GRID 2 SUPPLY VOLTAGE	----	125	VOLTS
GRID 1 VOLTAGE	-3	0	VOLTS
CATHODE BIAS RESISTOR	0	56	OHMS
AMPLIFICATION FACTOR	21	----	
TRANSCONDUCTANCE	4500	7800	μMHOS
PLATE CURRENT	15	12	MA.
PLATE RESISTANCE (APPROX)	4700	170,000	OHMS
GRID 2 CURRENT	----	3.8	MA.
GRID 1 VOLTAGE (APPROX.) FOR I_b=20 μA	-17	----	VOLTS
PLATE CURRENT AT Ec1=-3 V., Rk=0	----	1.6	MA.
GRID 1 VOLTAGE (APPROX.) FOR Ib=20 μA.	----	-6	VOLTS

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SEREIS WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[B] IF EITHER UNIT IS OPERATING AT MAXIMUM RATED CONDITIONS, GRID #1 CIRCUIT RESISTANCES FOR BOTH UNITS SHOULD NOT EXCEED THE STATED VALUES.

→ INDICATES A CHANGE.





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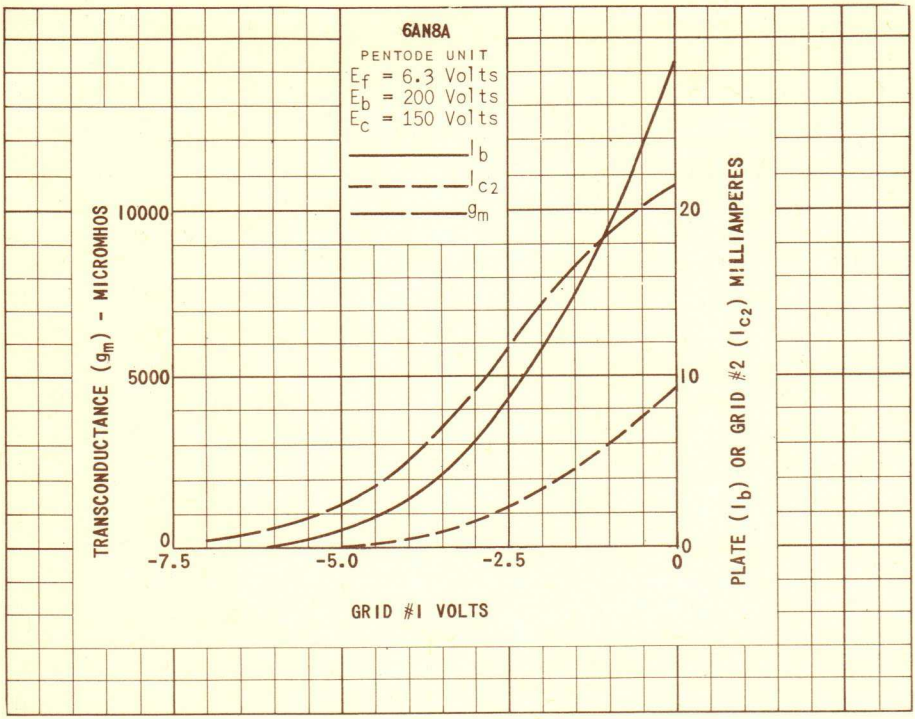
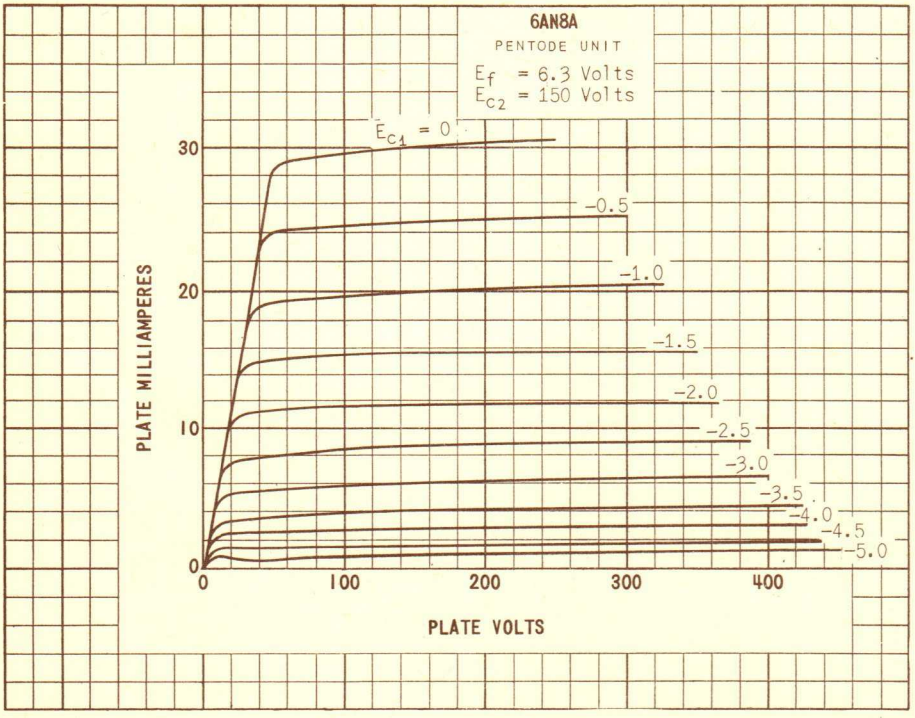
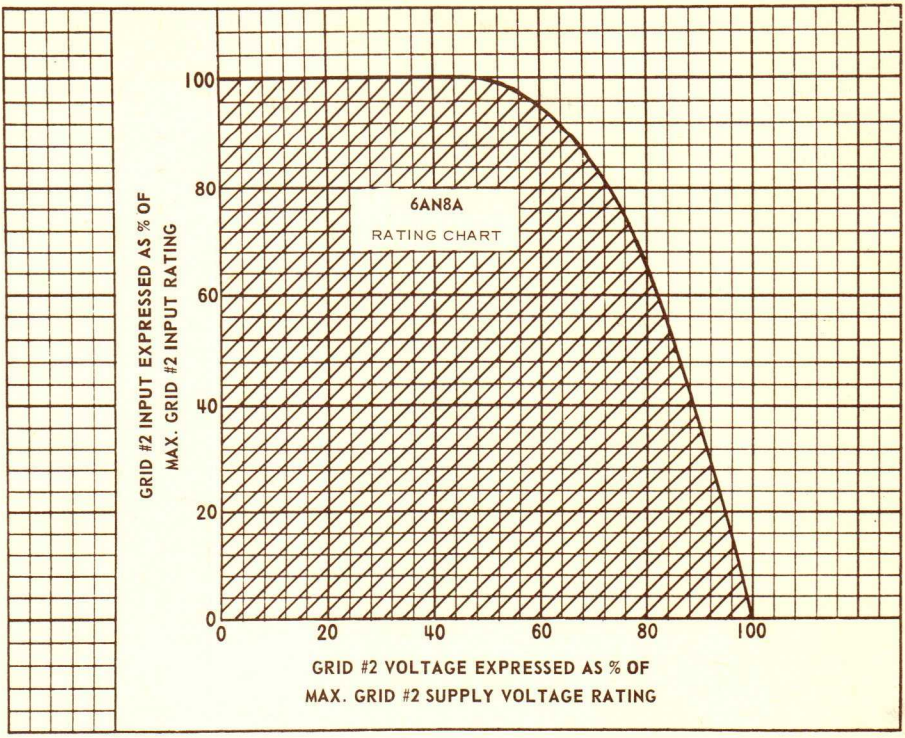

6AN8A
PENTODE UNIT
E_f = 6.3 Volts
E_b = 200 Volts
E_c = 150 Volts
I_b
I_{c2}
g_m
TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
5000
0
20
10
0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
-7.5
-5.0
-2.5
0
GRID #1 VOLTS


6AN8A
PENTODE UNIT
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
PLATE MILLIAMPERES
30
20
10
0
0
100
200
300
400
PLATE VOLTS



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BEAM PENTODE

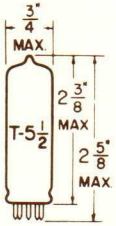
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

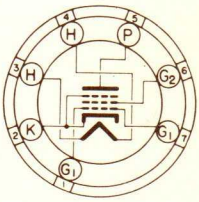
HEATER

6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BZ

THE 6AQ5 AND 6AQ5A ARE BEAM POWER AMPLIFIERS USING THE 7 PIN MINIATURE CONSTRUCTION. THEY ARE DESIGNED FOR SERVICE IN TELEVISION RECEIVERS WHERE HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT IS DESIRED. THERMAL CHARACTERISTICS OF THE HEATER OF THE 6AQ5A ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME OF THE 6AQ5A, THE TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES — APPROX. ←

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.4	μμf
INPUT	8.0	μμf
OUTPUT	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	275 ←	VOLTS
MAXIMUM GRID #2 VOLTAGE	275 ←	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 INPUT	2	WATTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)[A]	250	°C
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.1	MEGOHMS
CATHODE BIAS OPERATION	0.5	MEGOHMS
HEATER WARM-UP TIME (APPROX.)* (6AQ5A ONLY)	11.0	SECONDS

[A] HIGH AMBIENT TEMPERATURE AND SHIELDING MAY NECESSITATE A REDUCTION IN OPERATING DISSIPATION. WHEN TUBE SHIELDS ARE USED, IT IS ADVISABLE TO PAINT THE INSIDE AND OUTSIDE SURFACES OF THE TUBE SHIELD A DULL BLACK AND TO PROVIDE VENTILATION SLOTS TO REDUCE OPERATING TEMPERATURE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VERTICAL DEFLECTION AMPLIFIER[B C] *

GRID #2 CONNECTED TO PLATE

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	275	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABS. MAX.)	1100	VOLTS
MAXIMUM PLATE DISSIPATION[D]	10	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	275	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	40	MA.
MAXIMUM PEAK CATHODE CURRENT	115	MA.
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	250	°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER[E]

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	180	250	VOLTS
GRID #2 VOLTAGE	180	250	VOLTS
GRID #1 VOLTAGE	-8.5	-12.5	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	12.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	29	45	MA.
MAXIMUM SIGNAL PLATE CURRENT	30	47	MA.
ZERO-SIGNAL GRID #2 CURRENT (APPROX.)	3	4.5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (APPROX.)	4	7	MA.
PLATE RESISTANCE (APPROX.)	58 000	52 000	OHMS
TRANSCONDUCTANCE	3 700	4 100	μMHOS
LOAD RESISTANCE	5 500	5 000	OHMS
TOTAL HARMONIC DISTORTION	8	8	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	2.0	4.5	WATTS

[E] SINGLE TUBE.

AVERAGE CHARACTERISTICS - TRIODE CONNECTED*

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-12.5	VOLTS
PLATE CURRENT	49.5	MA.
TRANSCONDUCTANCE	4800	μMHOS
AMPLIFICATION FACTOR	9.5	
PLATE RESISTANCE (APPROX.)	1970	OHMS
GRID VOLTAGE (APPROX.) FOR I_b=0.5 MA.	-37	VOLTS

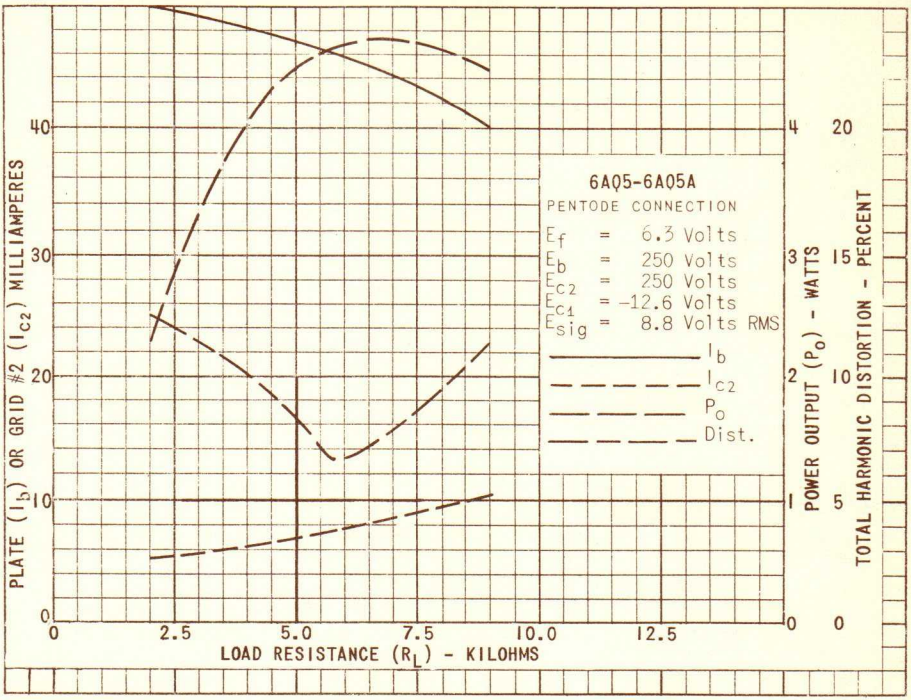
[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

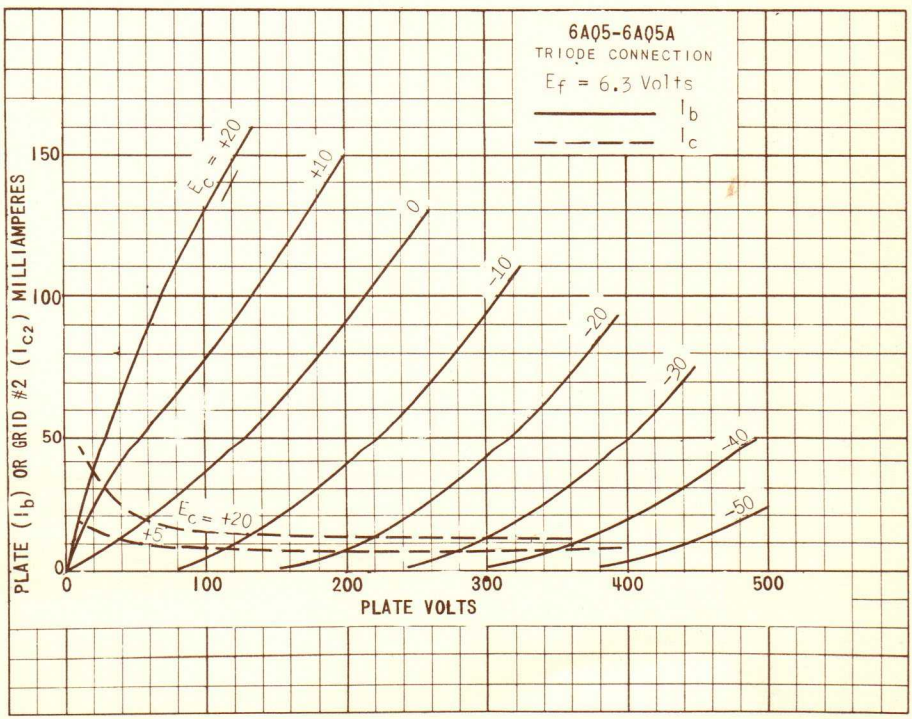
[C] TRIODE CONNECTED.

[D] 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.

*INDICATES AN ADDITION.

→ INDICATES A CHANGE.





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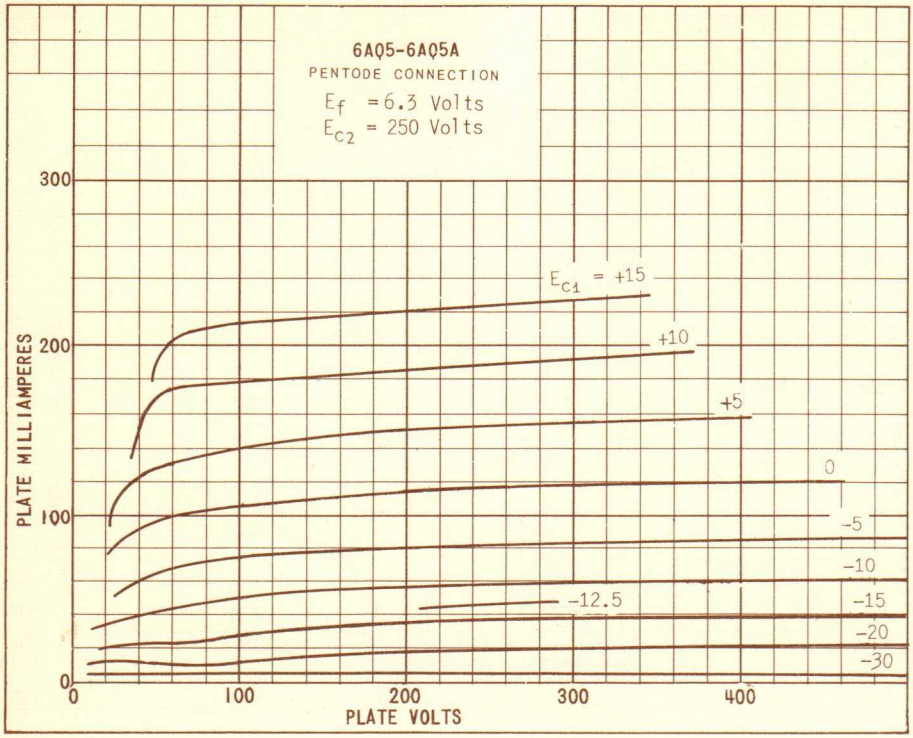
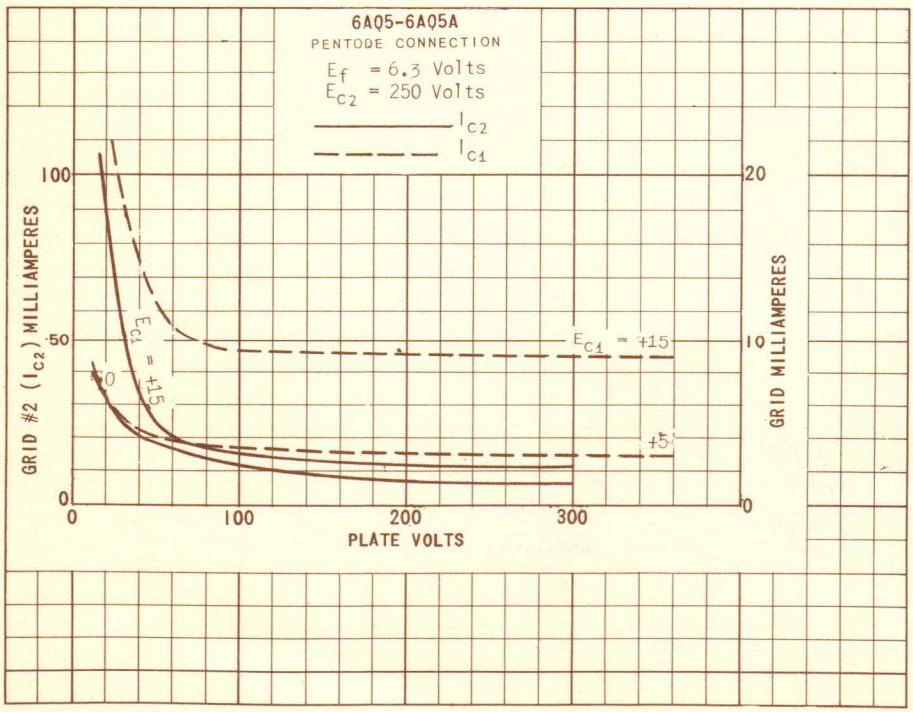
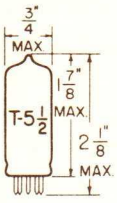

6AQ5-6AQ5A
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 250 Volts
E_{c1} = +15
+10
+5
0
-5
-10
-12.5
-15
-20
-30
PLATE MILLIAMPERES
PLATE VOLTS
0
100
200
300
400


6AQ5-6AQ5A
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 250 Volts
I_{c2}
I_{c1}
E_{c1} = +15
+10
+5
GRID #2 (I_{c2}) MILLIAMPERES
GRID MILLIAMPERES
PLATE VOLTS
0
50
100
10
20
100
200
300

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

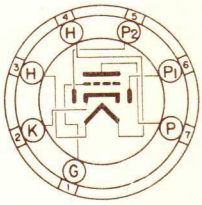
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 150 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

THE 6AQ6 COMBINES TWO DIODES AND A HIGH-MU TRIODE VOLTAGE AMPLIFIER IN THE MINIATURE CONSTRUCTION. THE THREE SECTIONS USE A COMMON CATHODE BUT ARE ADEQUATELY SHIELDED TO PROVIDE FOR SIMULTANEOUS SERVICE AS DETECTORS, AVC RECTIFIER, AND AUDIO VOLTAGE AMPLIFIER. THIS TUBE IS PARTICULARLY USEFUL IN DESIGNS REQUIRING ECONOMY OF HEATER POWER.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

TRIODE UNIT - CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-3	VOLTS
PLATE CURRENT	0.8	1.0	MA.
PLATE RESISTANCE	61 000	58 000	OHMS
TRANSCONDUCTANCE	1 150	1 200	µMHOS
AMPLIFICATION FACTOR	70	70	

DIODE UNITS - TWO

THE DIODE UNITS ARE INDEPENDENT OF THE TRIODE UNIT EXCEPT FOR THE COMMON CATHODE SLEEVE. DIODE BIASING OF THE TRIODE IS NOT SUITABLE.

SIMILAR TYPE REFERENCE: Ratings and Characteristics somewhat similar to 6AT6, 6Q7, 6Q7GT, 6SQ7, 6SQ7GT, 7B6, 7C6.

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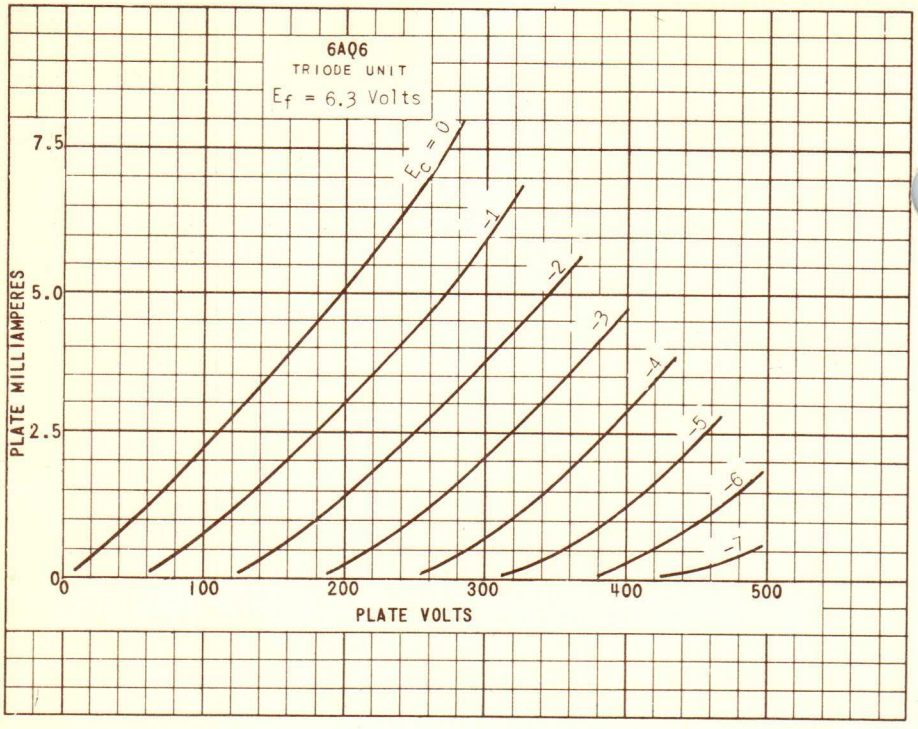
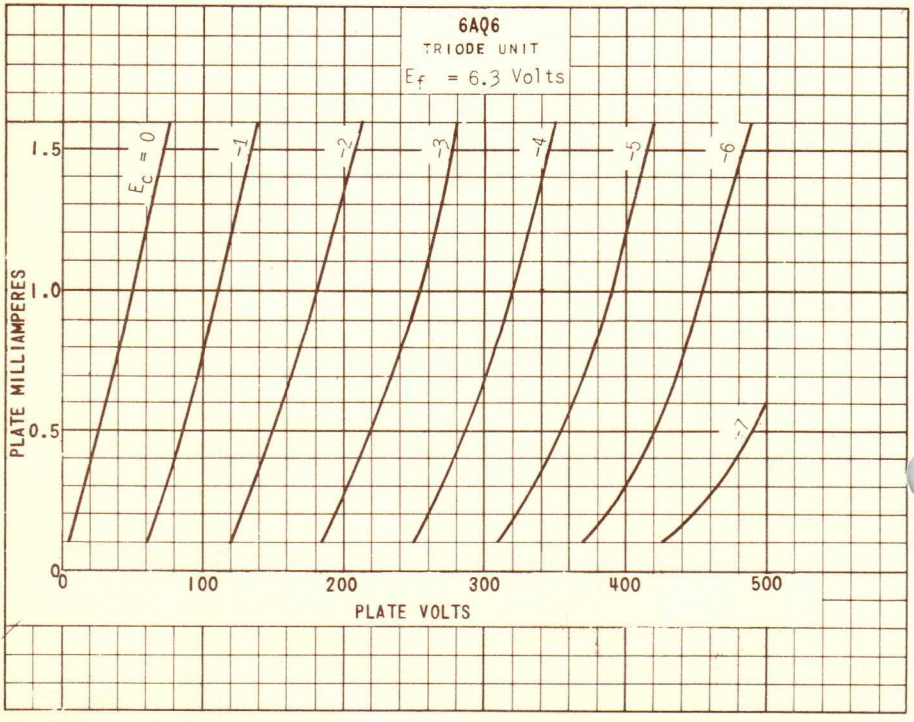
6AQ6





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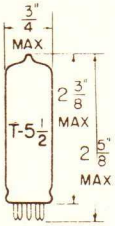
PENTODE

MINIATURE TYPE

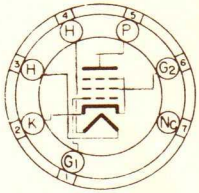


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 400 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 6AR5 IS A PENTODE POWER AMPLIFIER USING THE MINIATURE CONSTRUCTION. IT IS INTENDED FOR SERVICE IN AC AND STORAGE BATTERY OPERATED RECEIVERS WHERE MODERATE POWER SENSITIVITY AND POWER OUTPUT IS DESIRED.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	8.5	WATTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	400	400	MA.
PLATE VOLTAGE	250	250	VOLTS
GRID #2 VOLTAGE	250	250	VOLTS
GRID #1 VOLTAGE	-16.5	-18	VOLTS
PEAK AF GRID #1 VOLTAGE	16.5	18	VOLTS
PLATE RESISTANCE (APPROX.)	65 000	68 000	OHMS
TRANSCONDUCTANCE	2 400	2 300	µMHOS
ZERO-SIGNAL PLATE CURRENT	34	32	MA.
ZERO-SIGNAL GRID #2 CURRENT (NOMINAL)	5.7	5.5	MA.
MAXIMUM SIGNAL PLATE CURRENT	35	33	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (NOMINAL)	10	10	MA.
LOAD RESISTANCE	7 000	7 600	OHMS
TOTAL HARMONIC DISTORTION	7	11	PERCENT
POWER OUTPUT	3.2	3.4	WATTS

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1948

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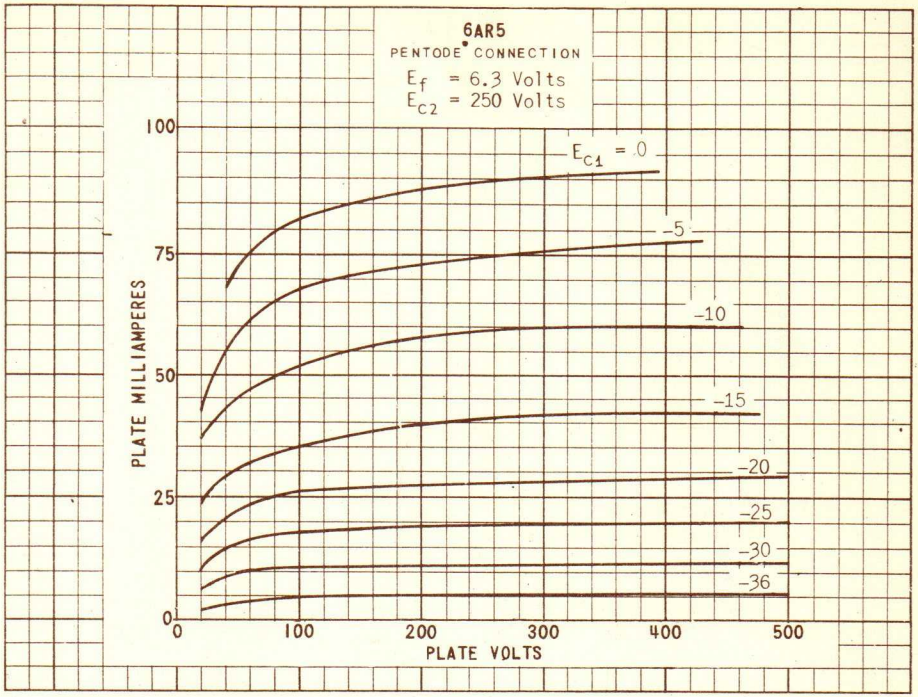

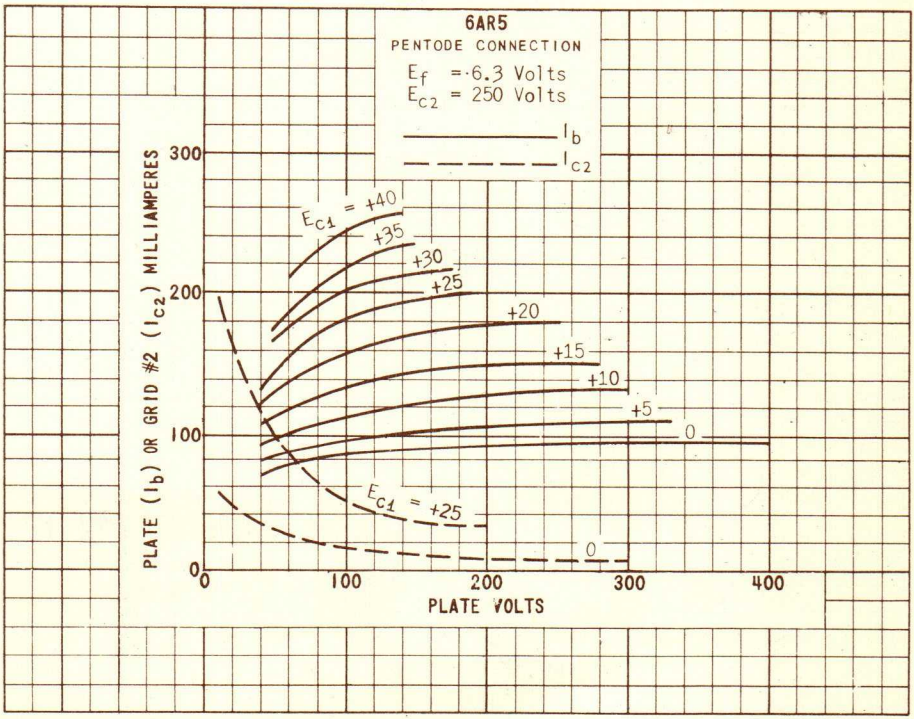

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PLATE
2242
SEPT. 1
1949

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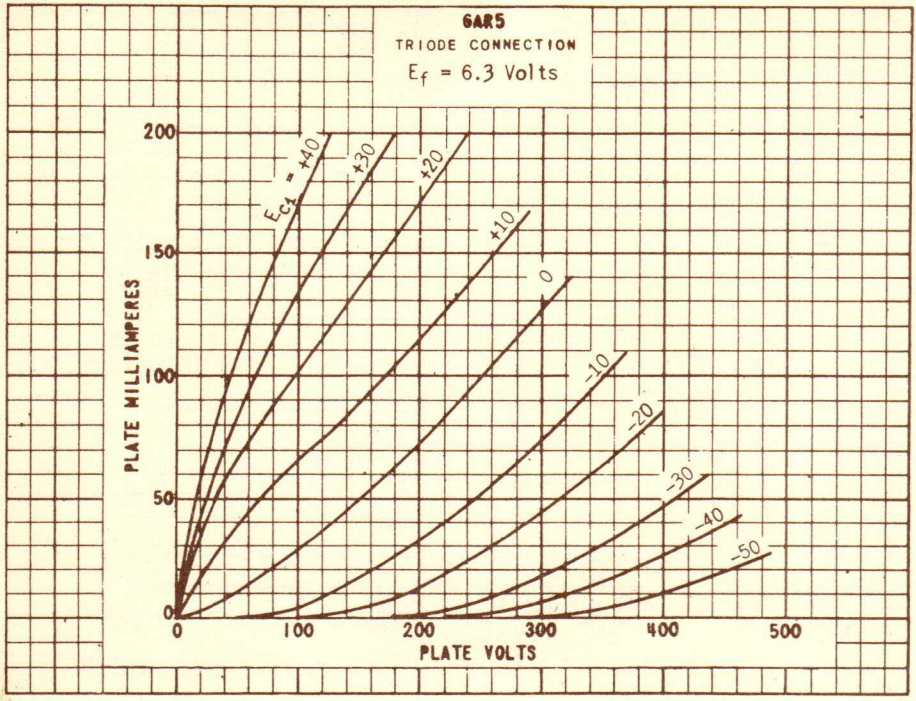
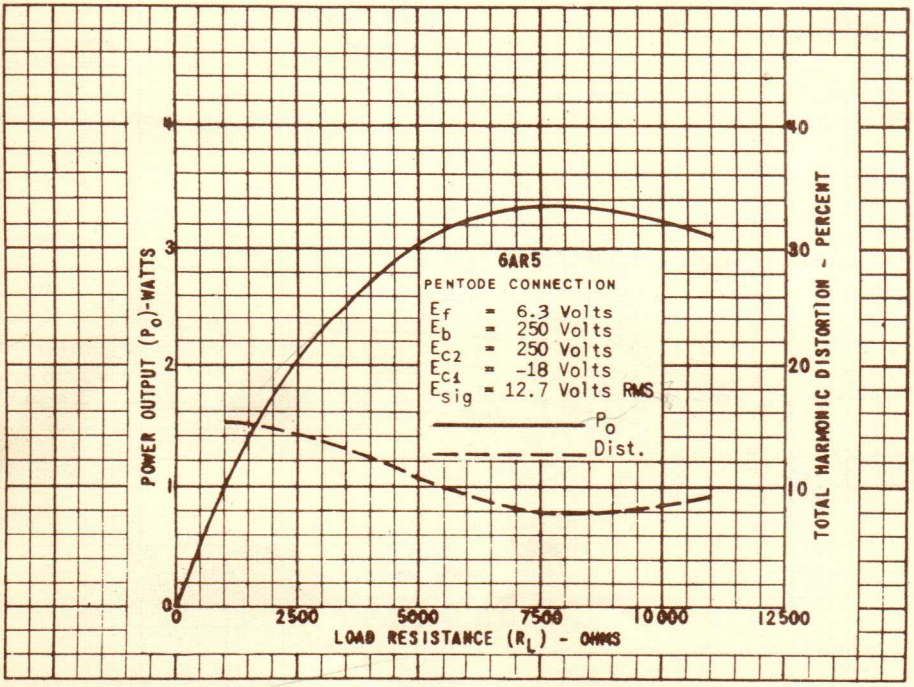
6AR5





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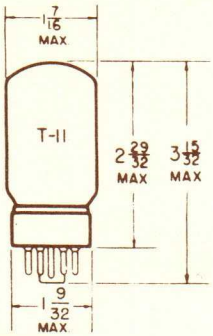
TUNG-SOL

BEAM PENTODE



GLASS BULB

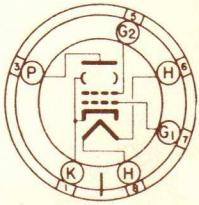
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 1.2 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE (SHORT) SHELL 6 PIN OCTAL LOW LOSS PHENOLIC BASE

6BQ

THE 6AR6 IS A BEAM POWER AMPLIFIER DESIGNED SPECIFICALLY FOR APPLICATIONS REQUIRING RELATIVELY HIGH PEAK PLATE CURRENTS AT NEGATIVE GRID POTENTIALS. IT IS CONSTRUCTED TO WITHSTAND RELATIVELY HIGH PLATE POTENTIALS.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE: (G_1 TO P)	0.55	μμf
INPUT: G_1 TO (H+K+G_2)	11	μμf
OUTPUT: P TO (H+K+G_2)	7	μμf
HEATER TO CATHODE: (H TO K)	10	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	200	VOLTS
MAXIMUM DC PLATE VOLTAGE	565	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #1 VOLTAGE	-300 TO 0	VOLTS
MAXIMUM PLATE DISSIPATION	19	WATTS
MAXIMUM GRID #2 DISSIPATION	3.2	WATTS
MAXIMUM DC PLATE CURRENT	115	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE CONNECTION	PENTODE CONNECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	AMP.
DC PLATE VOLTAGE	200	250	VOLTS
DC GRID #2 VOLTAGE	TIED TO PLATE	250	VOLTS
DC GRID #1 VOLTAGE	-12.5	-22.5	VOLTS
GRID #1 CIRCUIT RESISTANCE (MAX.)	100 000	100 000	OHMS
DC PLATE CURRENT	90	77	MA.
GRID #2 CURRENT	TIED TO PLATE	5	MA.
PLATE RESISTANCE (APPROX.)	1 000	21 000	OHMS
TRANSCONDUCTANCE	6 000	5 400	μMHOS
DC GRID #1 VOLTAGE FOR PLATE CURRENT CUTOFF	---	-65	VOLTS

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PLATE 2881

MAR. 1 1952

→ INDICATES A CHANGE OR ADDITION.

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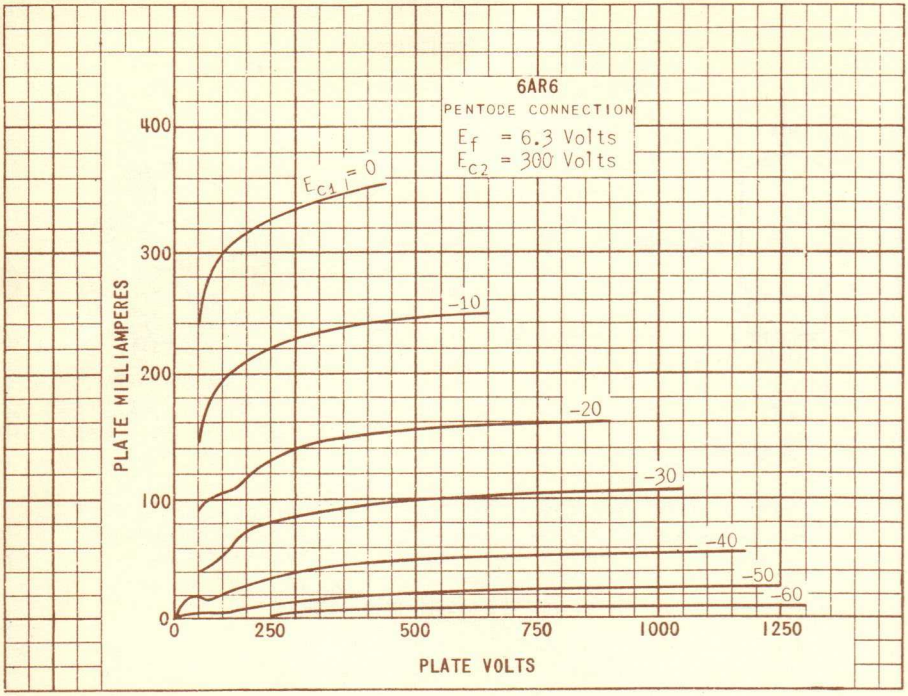
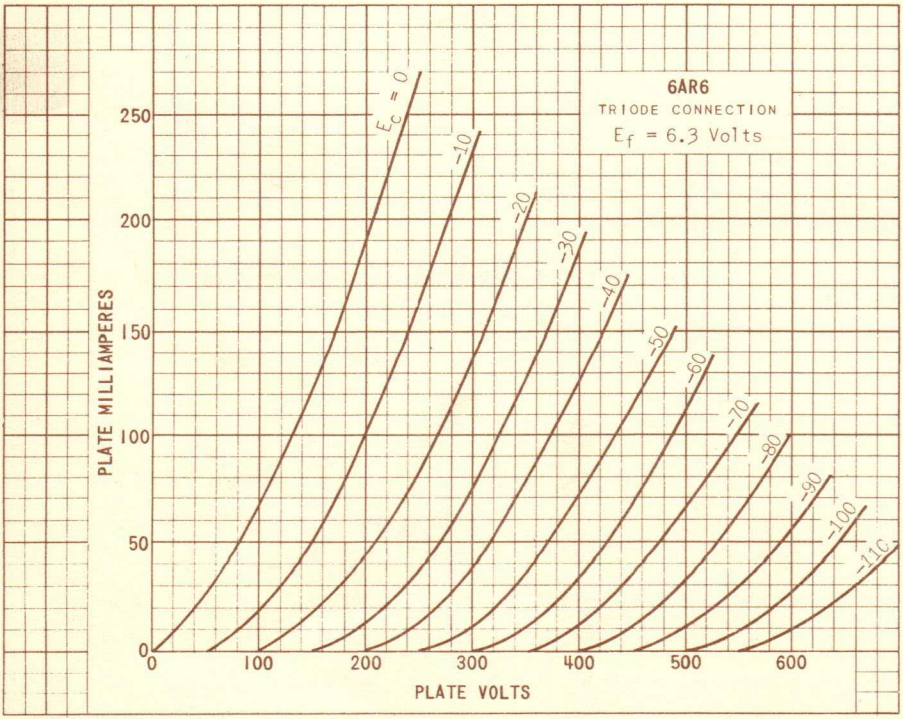
6AR6





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2882
MAR. 1
1952

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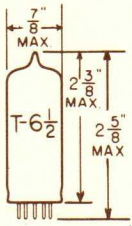
SHEET-BEAM TUBE

MINIATURE TYPE

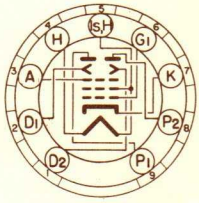


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9DP

PIN #5 SHOULD BE CONNECTED DIRECTLY TO GROUND.

THE 6AR8 IS A DOUBLE-PLATE SHEET-BEAM TUBE CONTAINING A PAIR OF BALANCED DEFLECTORS TO DIRECT THE ELECTRON BEAM TO EITHER OF THE TWO PLATES AND A CONTROL GRID TO VARY THE INTENSITY OF THE BEAM. IT IS DESIGNED FOR USE AS A SYNCHRONOUS DETECTOR IN COLOR TELEVISION RECEIVERS. IT IS ALSO SUITABLE IN THE BURST GATE CIRCUIT OF COLOR TELEVISION AND A VARIETY OF OTHER SWITCHING AND GATING APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITH NO EXTERNAL SHIELD

DEFLECTOR #1 TO ALL	4.8	μμf
DEFLECTOR #2 TO ALL	4.8	μμf
GRID #1 TO ALL EXCEPT PLATES	7.5	μμf
PLATE #1 TO ALL	5.0	μμf
PLATE #2 TO ALL	5.0	μμf
GRID #1 TO DEFLECTOR #1	0.040	μμf
GRID #1 TO DEFLECTOR #2	0.060	μμf
PLATE #1 TO PLATE #2	0.4	μμf
DEFLECTOR #1 TO DEFLECTOR #2	0.38	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE #1 VOLTAGE	300	VOLTS
MAXIMUM PLATE #2 VOLTAGE	300	VOLTS
MAXIMUM ACCELERATOR VOLTAGE	300	VOLTS
MAXIMUM PEAK POSITIVE DEFLECTOR #1 VOLTAGE	150	VOLTS
MAXIMUM PEAK NEGATIVE DEFLECTOR #1 VOLTAGE	150	VOLTS
MAXIMUM PEAK POSITIVE DEFLECTOR #2 VOLTAGE	150	VOLTS
MAXIMUM PEAK NEGATIVE DEFLECTOR #2 VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE #1 DISSIPATION	2.0	WATTS
MAXIMUM PLATE #2 DISSIPATION	2.0	WATTS
MAXIMUM DC CATHODE CURRENT	30	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.25	MEGOHM

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DEFLECTORS GROUNDED

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE #1 VOLTAGE	250	VOLTS
PLATE #2 CONNECTED TO PLATE #1 ACCELERATOR VOLTAGE	250	VOLTS
DEFLECTOR #1 VOLTAGE	0	VOLTS
DEFLECTOR #2 VOLTAGE	0	VOLTS
CATHODE-BIAS RESISTOR	300	OHMS
TOTAL PLATE CURRENT	10	MA.
ACCELERATOR CURRENT	0.4	MA.
GRID #1 TRANSCONDUCTANCE	4 000	μMHOS
GRID #1 VOLTAGE (APPROX.) I_b = 10 μAMP.	-14	VOLTS

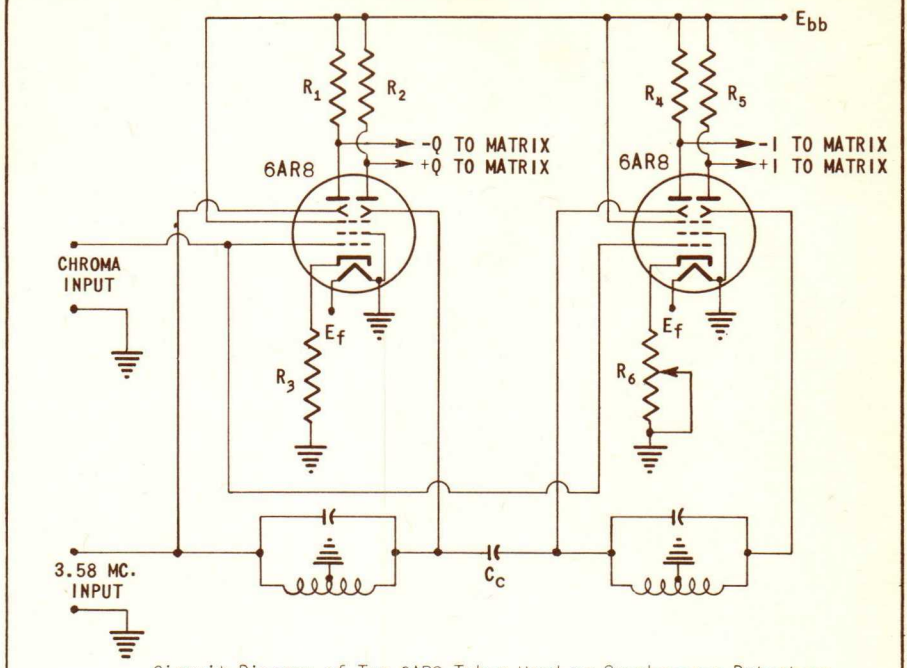
DEFLECTOR CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE #1 VOLTAGE	250	VOLTS
PLATE #2 VOLTAGE	250	VOLTS
ACCELERATOR VOLTAGE	250	VOLTS
CATHODE-BIAS RESISTOR	300	OHMS
DEFLECTING SWITCHING VOLTAGE (MAX.)	20	VOLTS
DEFLECTOR-BIAS VOLTAGE FOR MINIMUM DEFLECTOR SWITCHING VOLTAGE[A]	-8	VOLTS
VOLTAGE DIFFERENCE BETWEEN DEFLECTORS FOR $I_{b1} = I_{b2}$ (APPROX.)	0	VOLTS
PLATE #1 CURRENT (MAX.) E_{d1} = -15 VOLTS, E_{d2} = +15 VOLTS	1.0	MA.
PLATE #2 CURRENT (MAX.) E_{d1} = +15 VOLTS, E_{d2} = -15 VOLTS	1.0	MA.
DEFLECTOR #1 CURRENT (MAX.) E_{d1} = +25 VOLTS, E_{d2} = -25 VOLTS	0.5	MA.
DEFLECTOR #2 CURRENT (MAX.) E_{d1} = -25 VOLTS, E_{d2} = +25 VOLTS	0.5	MA.

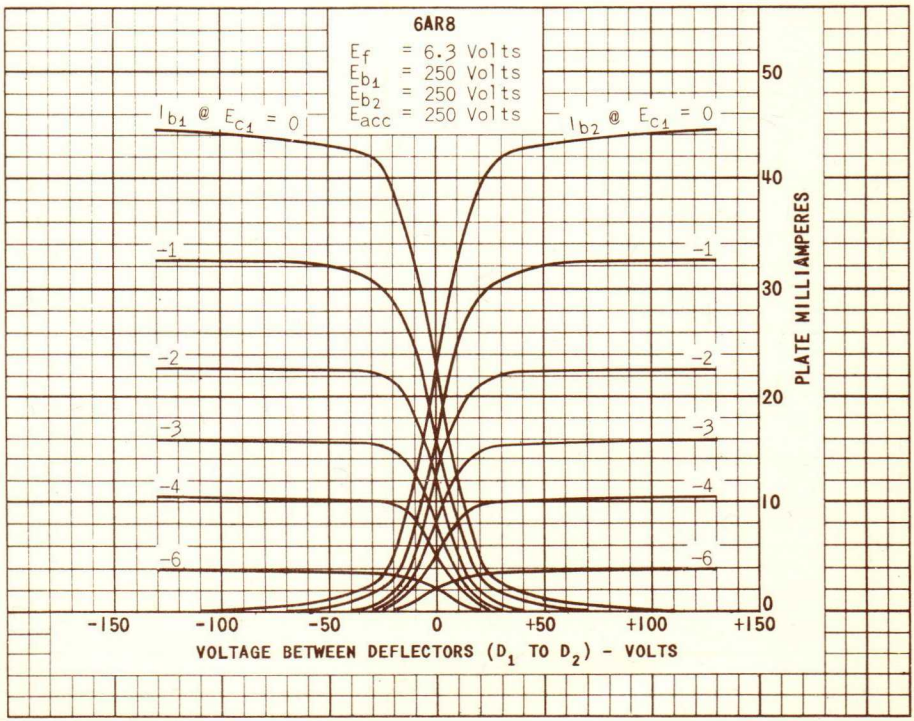
[A] DEFLECTOR SWITCHING VOLTAGE IS DEFINED AS THE TOTAL VOLTAGE CHANGE ON EITHER DEFLECTOR WITH AN EQUAL AND OPPOSITE CHANGE ON THE OTHER DEFLECTOR REQUIRED TO SWITCH THE PLATE CURRENT FROM ONE PLATE TO THE OTHER.

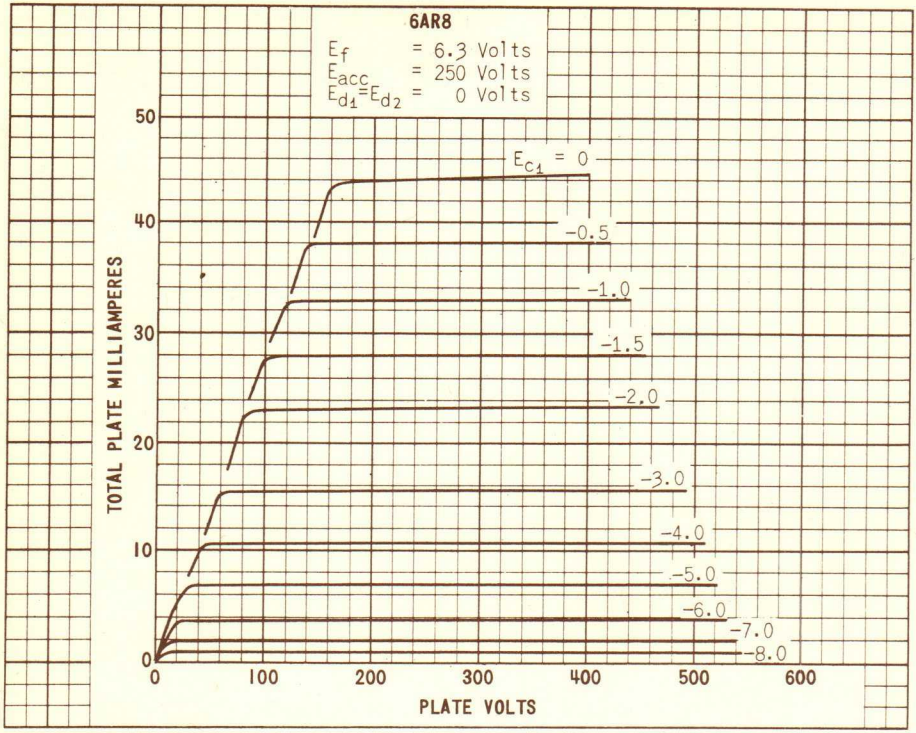
NOTE: THE 6AR8 SHOULD BE SO LOCATED IN THE RECEIVER THAT IT IS NOT SUBJECTED TO STRAY MAGNETIC FIELDS.

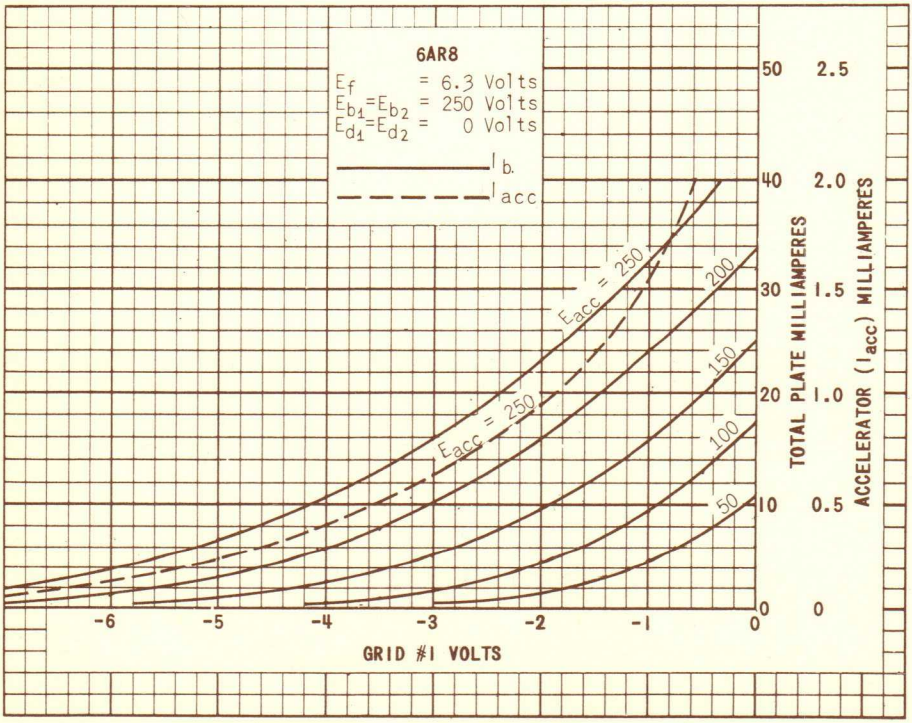
TUNG-SOL



Circuit Diagram of Two 6AR8 Tubes Used as Synchronous Detectors



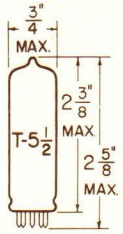

6AR8
E_f = 6.3 Volts
E_{acc} = 250 Volts
$E_{d_1}=E_{d_2}$ = 0 Volts
E_{c_1} = 0
-0.5
-1.0
-1.5
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
TOTAL PLATE MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
50
100
200
300
400
500
600


6AR8
E_f = 6.3 Volts
$E_{b_1}=E_{b_2}$ = 250 Volts
$E_{d_1}=E_{d_2}$ = 0 Volts
I_b
I_{acc}
E_{acc} = 250
E_{acc} = 250
200
150
100
50
TOTAL PLATE MILLIAMPERES
ACCELERATOR (I_{acc}) MILLIAMPERES
GRID #1 VOLTS
-6
-5
-4
-3
-2
-1
0
10
20
30
40
50
0.5
1.0
1.5
2.0
2.5

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

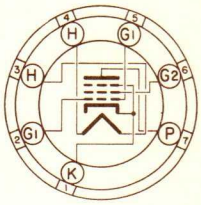
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.8 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7CV

THE 6AS5 IS A HEATER-CATHODE, BEAM PENTODE POWER AMPLIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS AN OUTPUT TUBE IN AUTOMOBILE AND AC OPERATED RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS, THE 6AS5 IS IDENTICAL TO THE 12AS5.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: (G1 TO P)	0.6	μμf
INPUT: G1 TO (H+K+G2+G3)	12	μμf
OUTPUT: P TO (H+K+G2+G3)	9.0 ←	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER MAXIMUM SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 RATING CURVE	
MAXIMUM PLATE DISSIPATION	5.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.0	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
SELF BIAS	0.5	MEGOHM
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

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TUNG-SOL

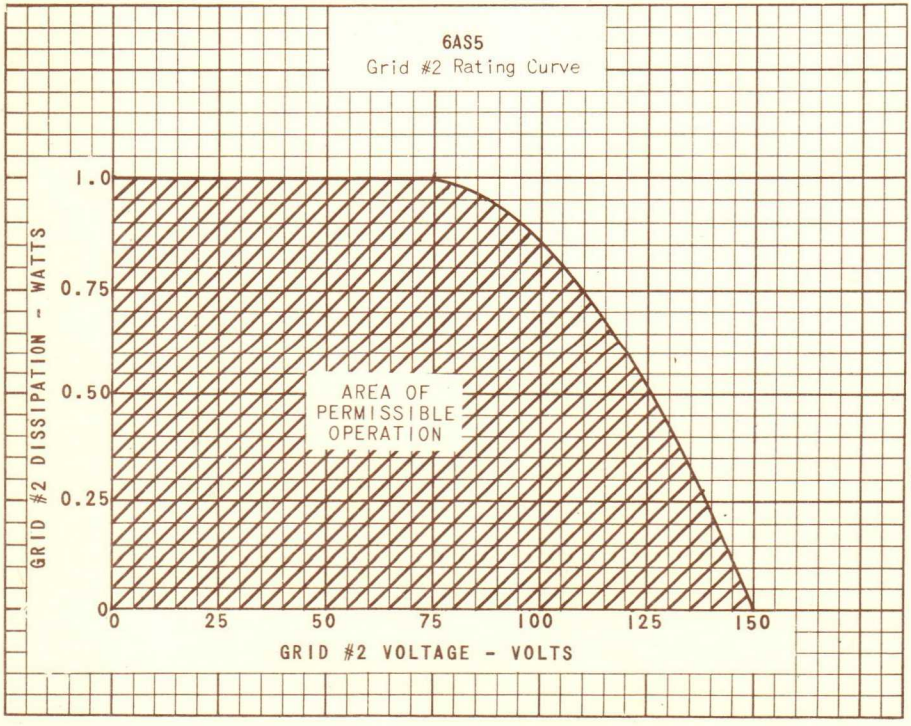
CONTINUED FROM PRECEDING PAGE

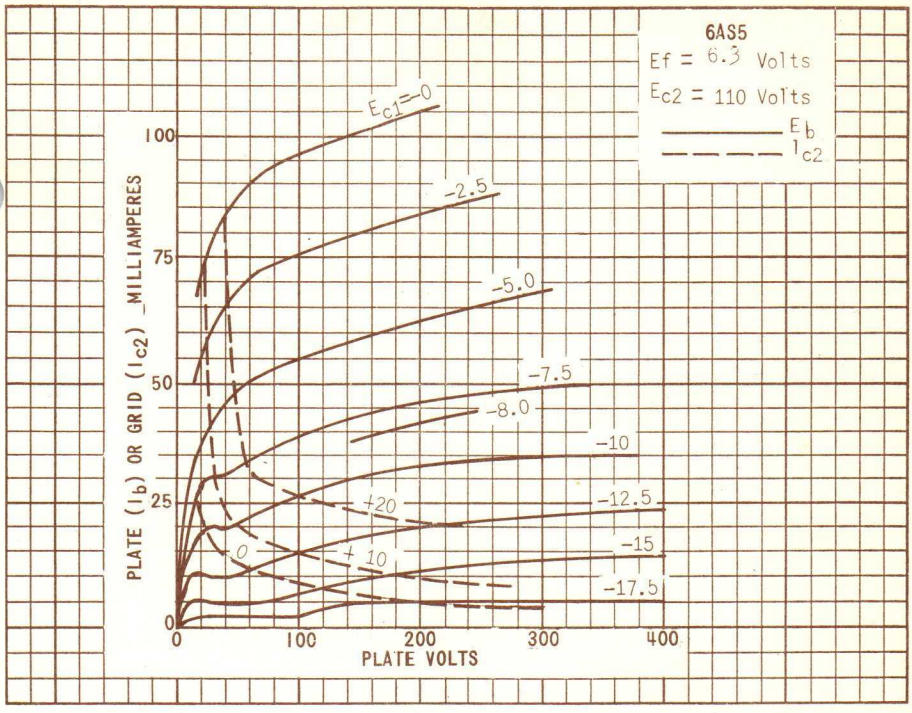
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

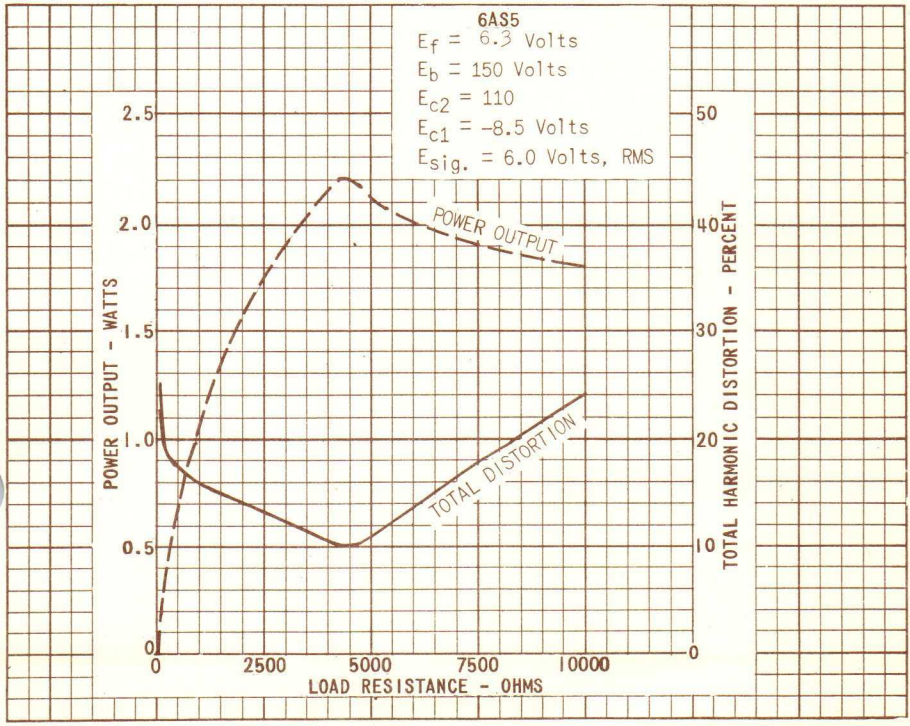
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.8	VOLTS
PLATE VOLTAGE	150	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE[A]	-8.5	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	35	MA.
MAX. SIGNAL PLATE CURRENT	36	MA.
ZERO-SIGNAL GRID #2 CURRENT (APPROX.)	2	MA.
MAX.-SIGNAL GRID #2 CURRENT (APPROX.)	6.5	MA.
TRANSCONDUCTANCE	5600	µMHOS
LOAD RESISTANCE	4500	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAX.-SIGNAL POWER OUTPUT	2.2	WATTS

[A] UNDER MAX. RATED CONDITIONS THE DC RESISTANCE OF THE GRID #1 CIRCUIT SHOULD NOT EXCEED 0.1 MEG. FOR FIXED BIAS OPERATION OR 0.5 MEG. FOR CATHODE BIAS OPERATION.







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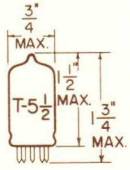
PENTODE (DUAL CONTROL)

MINIATURE TYPE

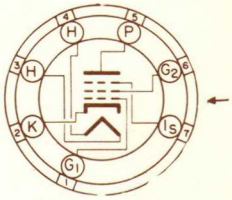


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 175 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 6AS6 IS A SHARP CUT-OFF VOLTAGE AMPLIFIER PENTODE USING THE MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY AN EFFICIENT HEATER, LOW CAPACITANCES AND HIGH TRANSCONDUCTANCE. THE SUPPRESSOR GRID IS TERMINATED IN A SEPARATE BASE CONNECTION AND IS INTENDED TO BE USED AS AN ADDITIONAL CONTROL GRID IN GATING, SWITCHING, OR MIXER SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE (1): G_1 TO P (MAX.)	0.02	0.025	μμf
GRID TO PLATE (2): G_3 TO P	0.7	0.7	μμf
INPUT (1): G_1 TO (H+K+G_2+G_3+P+IS)	4	3.9	μμf
INPUT (2): G_3 TO (H+K+G_1+G_2+P+IS)	3.4	3.3	μμf
OUTPUT: P TO (H+K+G_1+G_2+G_3+IS)	3	2.2	μμf
COUPLING: G_1 TO G_3 (MAX.)	0.15	0.15	μμf

[A] EXTERNAL SHIELD CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	140	VOLTS
MAXIMUM POSITIVE GRID #3 VOLTAGE	27	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM GRID #2 DISSIPATION	0.75	WATT

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TUNG-SOL

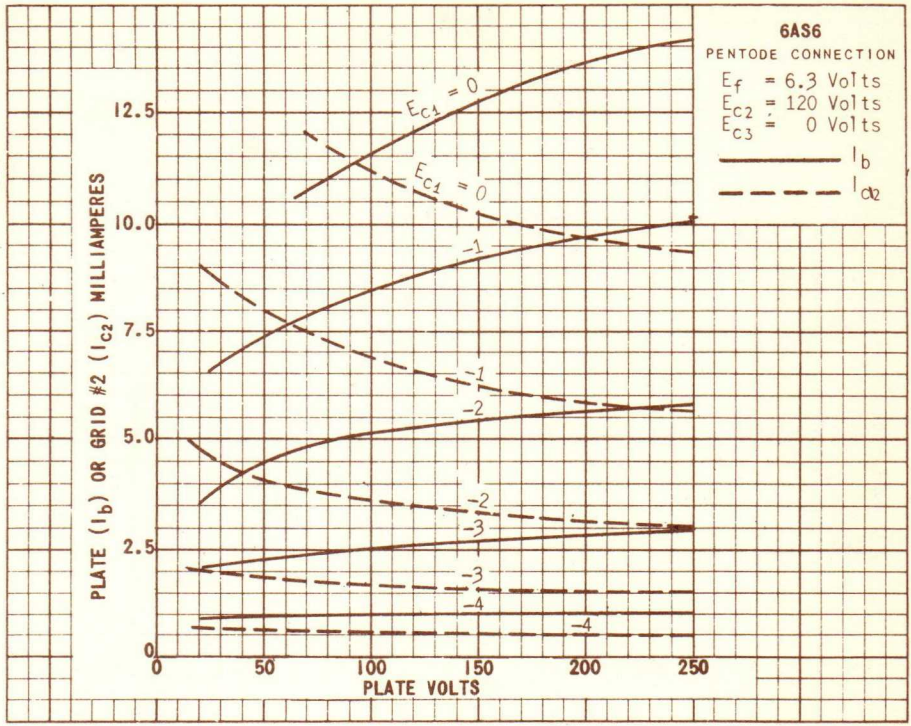
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	175	175	MA.
PLATE VOLTAGE	120	120	VOLTS
GRID #3 VOLTAGE	-3	0[B]	VOLTS
GRID #2 VOLTAGE	120	120	VOLTS
GRID #1 VOLTAGE	-2	-2	VOLTS
PLATE RESISTANCE (APPROX.)	---	0.11	MEGOHM
GRID #1 TRANSCONDUCTANCE	1 850	3 200	µMHOS
GRID #3 TRANSCONDUCTANCE	810	470	µMHOS
PLATE CURRENT	3.6	5.2	MA.
GRID #2 CURRENT	4.8	3.5	MA.
GRID #1 VOLTAGE FOR I_b = 10 µA. (APPROX.)	---	-7.5	VOLTS
GRID #3 VOLTAGE FOR I_b = 10 µA. (APPROX.)	-10	---	VOLTS

[B] GRID #3 CONNECTED TO CATHODE.



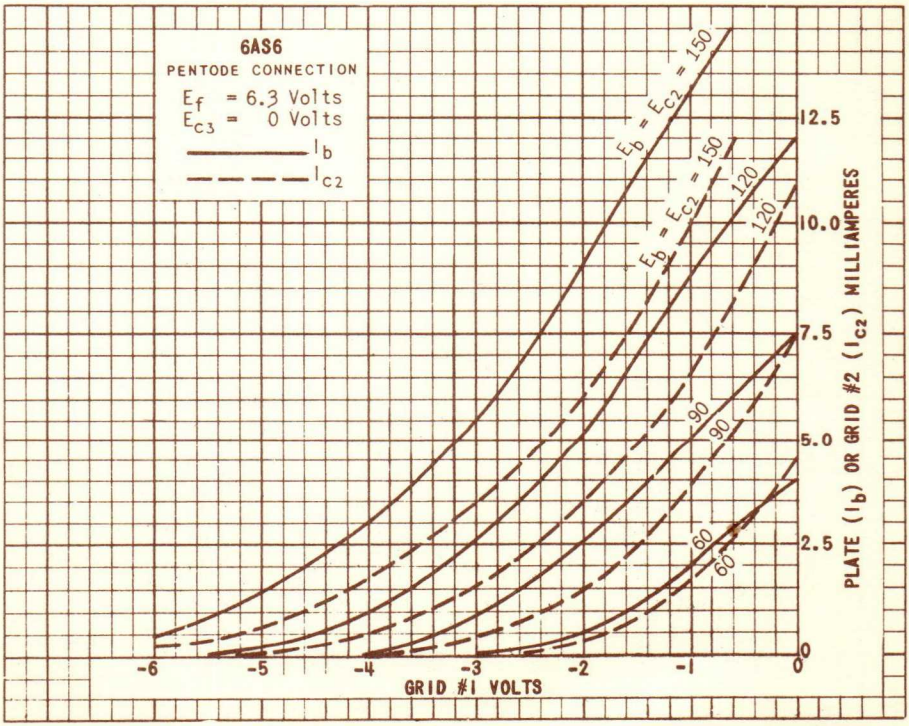


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PLATE
2957
JUNE 1
1952

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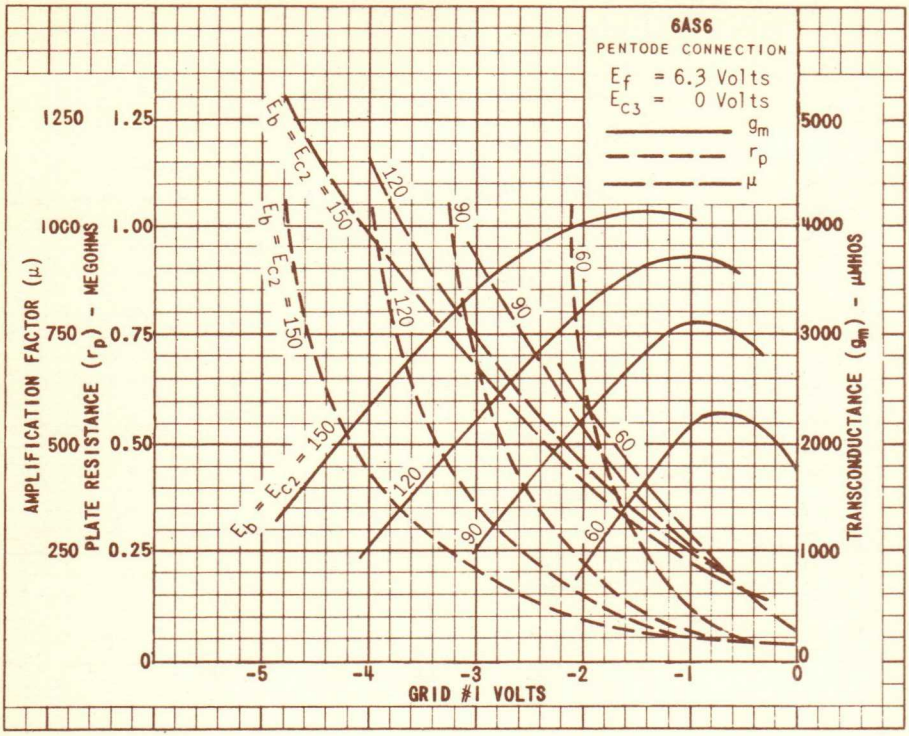
6AS6



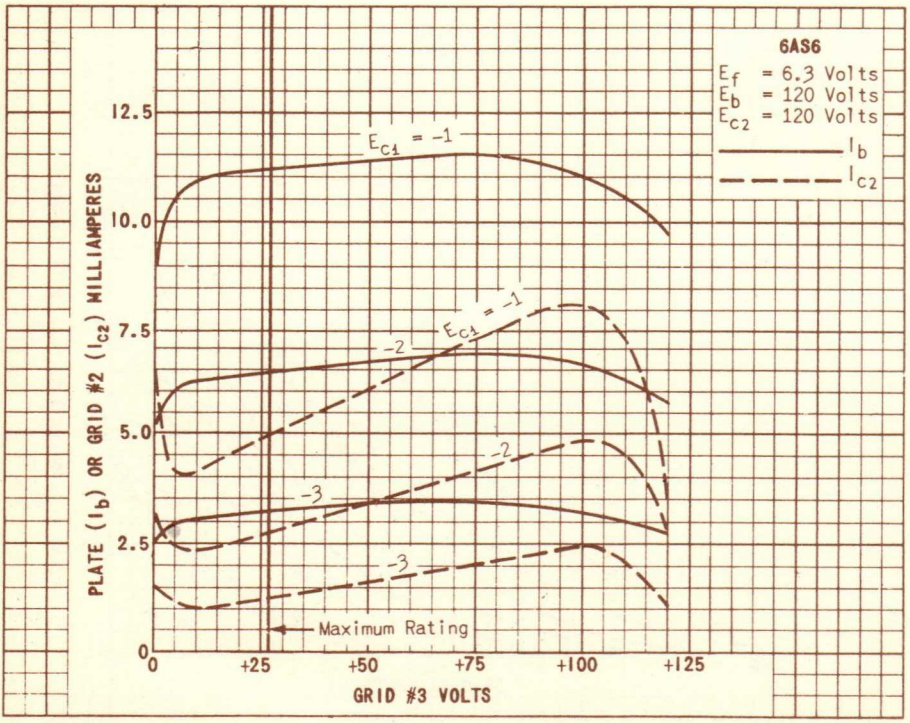


PLATE 2958
JUNE 1 1952

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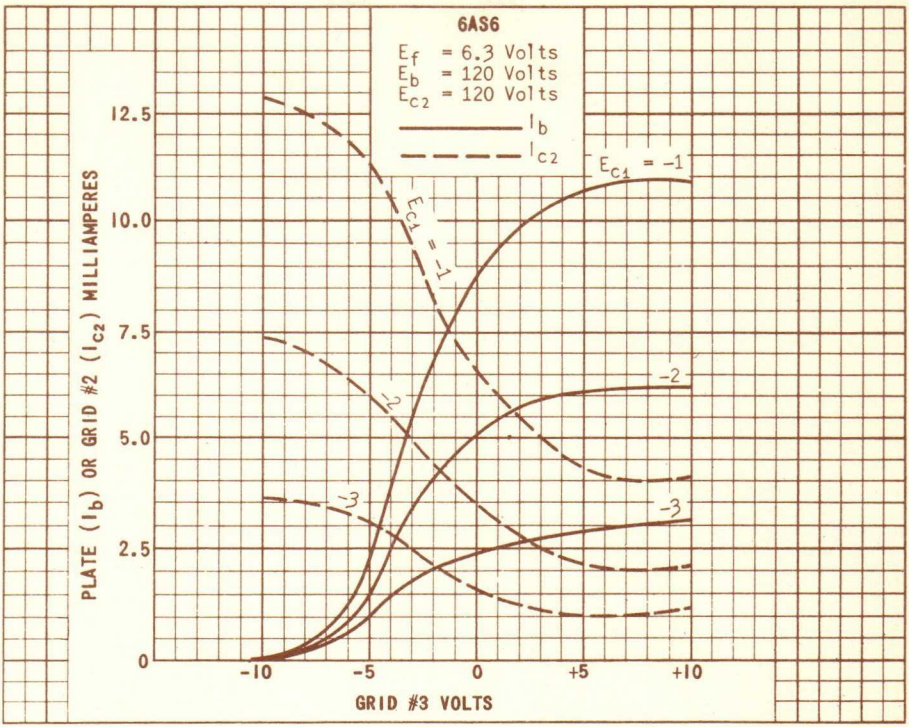

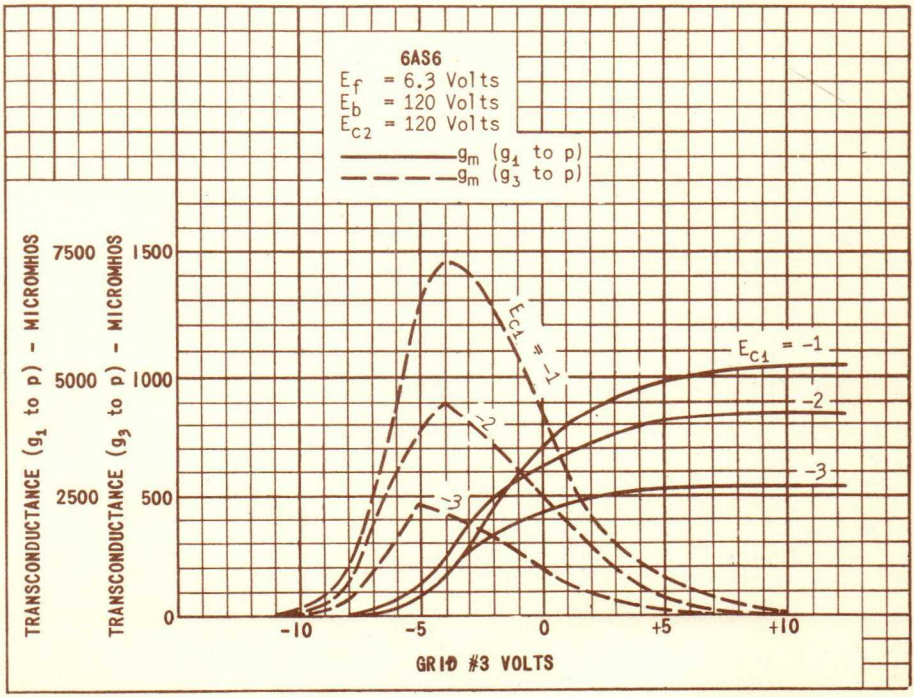

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2959
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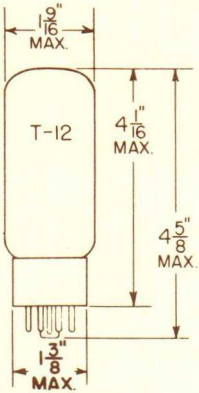
TWIN TRIODE

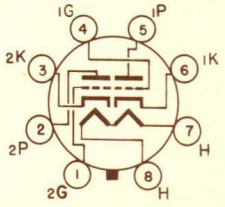


SHORT MEDIUM-SHELL
8 PIN OCTAL 88-110
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 2.5 AMP.
AC OR DC

ANY MOUNTING POSITION



BASING DIAGRAM
JEDEC 8BD
BOTTOM VIEW

THE 6AS7GA IS A LOW-MU TWIN TRIODE DESIGNED PRIMARILY FOR SERVICE AS A SERIES REGULATOR TUBE IN D-C POWER SUPPLIES. EXCEPT FOR THE USE OF A T-12 ENVELOPE, THE 6AS7GA IS IDENTICAL TO THE 6AS7G.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITH NO EXTERNAL SHIELD

GRID TO PLATE (EACH SECTION)	7.5	μμf
INPUT (EACH SECTION)	6.5	μμf
OUTPUT (EACH SECTION)	2.2	μμf
HEATER TO CATHODE (EACH SECTION)	7.0	μμf
GRID TO GRID	0.5	μμf
PLATE TO PLATE	1.9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DC AMPLIFIER SERVICE-EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	13	WATTS
MAXIMUM PLATE CURRENT	125	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	300	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	300	VOLTS
MAXIMUM GRID-CIRCUIT RESISTANCE:		
WITH CATHODE-BIAS[A]	1.0	MEGOHM

BOOSTER SCANNING SERVICE-EACH SECTION

MAXIMUM PEAK INVERSE PLATE VOLTAGE	1700	VOLTS
MAXIMUM PLATE DISSIPATION	13	WATTS
MAXIMUM PLATE CURRENT	125	MA.

[A] OPERATION WITH FIXED BIAS IS NOT RECOMMENDED.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

BOOSTER SCANNING SERVICE—EACH SECTION[B]

MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	300	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	300	VOLTS
MAXIMUM GRID–CIRCUIT RESISTANCE: WITH CATHODE–BIAS[C]	1.0	MEGOHM

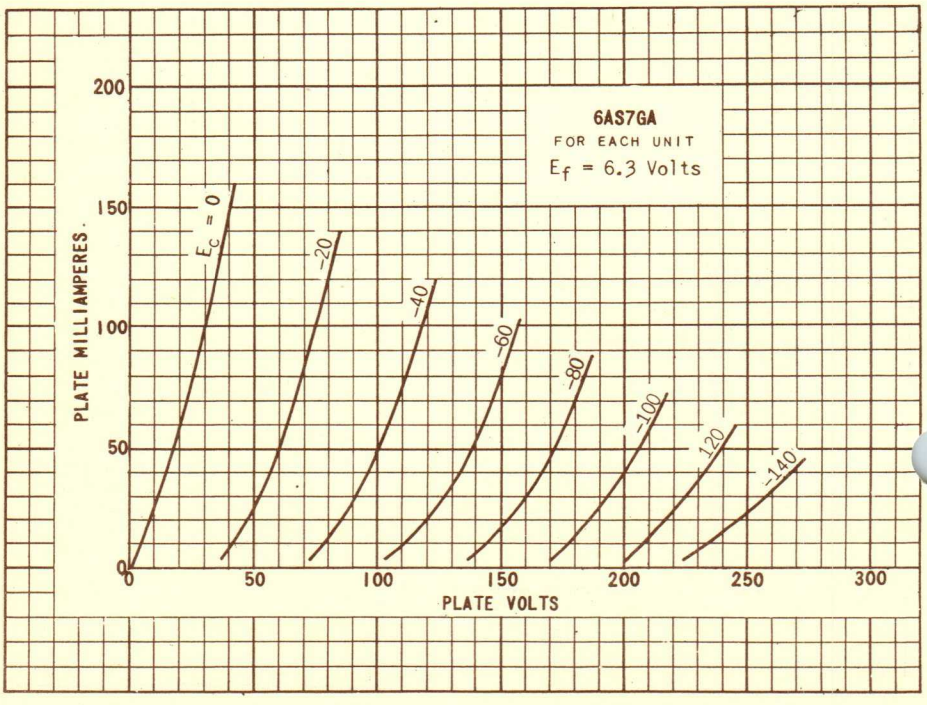
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	2.5	AMP.
PLATE VOLTAGE	135	VOLTS
CATHODE–BIAS RESISTOR	250	OHMS
AMPLIFICATION FACTOR	2.0	
PLATE RESISTANCE (APPROX.)	280	OHMS
TRANSCONDUCTANCE	7000	μMHOS
PLATE CURRENT	125	MA.

[B]FOR OPERATION IN A 525-LINE, 30-FRAME TELEVISION SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCASTING STATIONS: FEDERAL COMMUNICATIONS COMMISSION." THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C]OPERATION WITH FIXED BIAS IS NOT RECOMMENDED.



TUNG-SOL

DIODE PENTODE

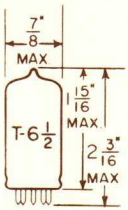
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

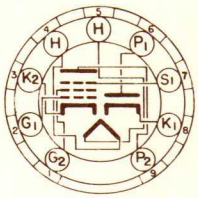
HEATER

6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9DS

THE 6AS8 IS A GENERAL-PURPOSE, MULTIUNIT TUBE USING THE 9 PIN MINIATURE CONSTRUCTION. IT CONTAINS A HIGH PERVEANCE DIODE AND A SHARP-CUTOFF PENTODE IN ONE ENVELOPE. IT IS INTENDED FOR DIVERSIFIED APPLICATIONS IN TELEVISION AND RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITH NO EXTERNAL SHIELD

DIODE UNIT		
PLATE TO HEATER & CATHODE & INTERNAL SHIELD	3.0	pf
PENTODE UNIT		
GRID #1 TO PLATE (MAX.)	→ 0.03	pf
INPUT	7.0	pf
OUTPUT	2.4	pf
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

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

	PENTODE UNIT	
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #3 VOLTAGE	0	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE SECOND CURVE	
MAXIMUM GRID #1 VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 INPUT	0.5	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
CATHODE BIAS OPERATION	1.0	MEGOHM
FIXED BIAS OPERATION	0.25	MEGOHM

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RATINGS – CONT'D

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

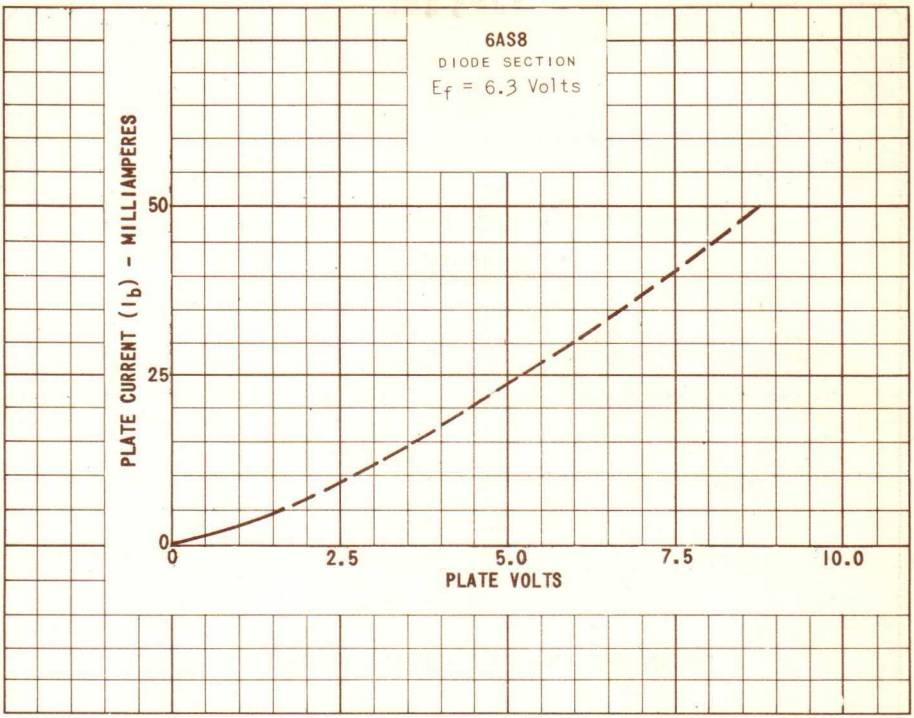
	DIODE UNIT	
MAXIMUM PEAK HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	330	VOLTS
MAXIMUM PEAK PLATE CURRENT	50	MA.
MAXIMUM DC PLATE CURRENT	5	MA.

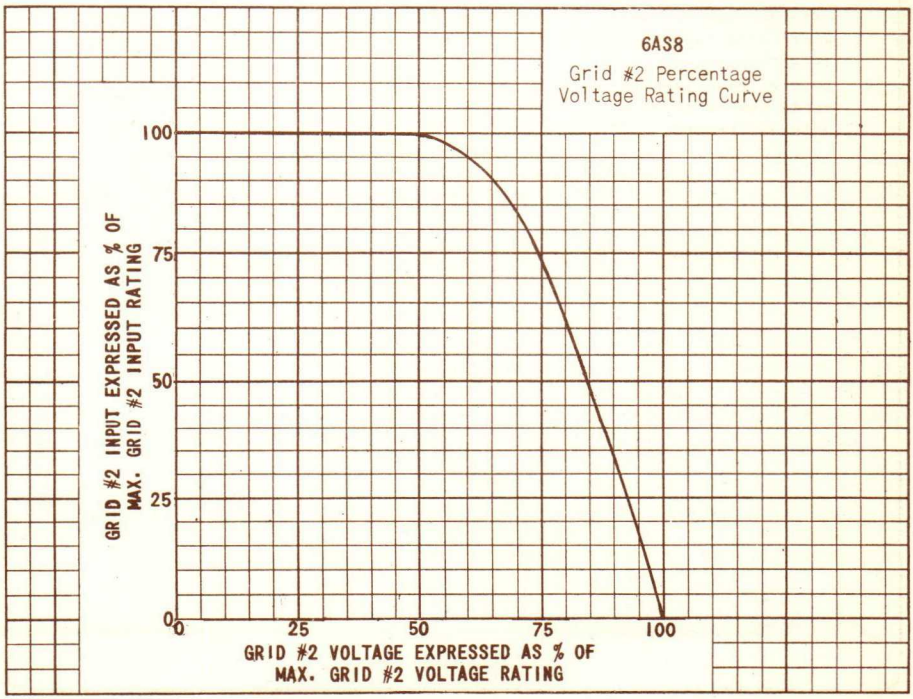
[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE SUPPLY VOLTAGE	200	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET	
GRID #2 SUPPLY VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	180	OHMS
PLATE RESISTANCE (APPROX.)	300 000	OHMS
TRANSCONDUCTANCE	6 200	µMHOS
GRID #1 BIAS (APPROX.) FOR I_b = 10 µAMP.	−8	VOLTS
PLATE CURRENT	9.5	MA.
GRID #2 CURRENT	3	MA.

→ INDICATES A CHANGE





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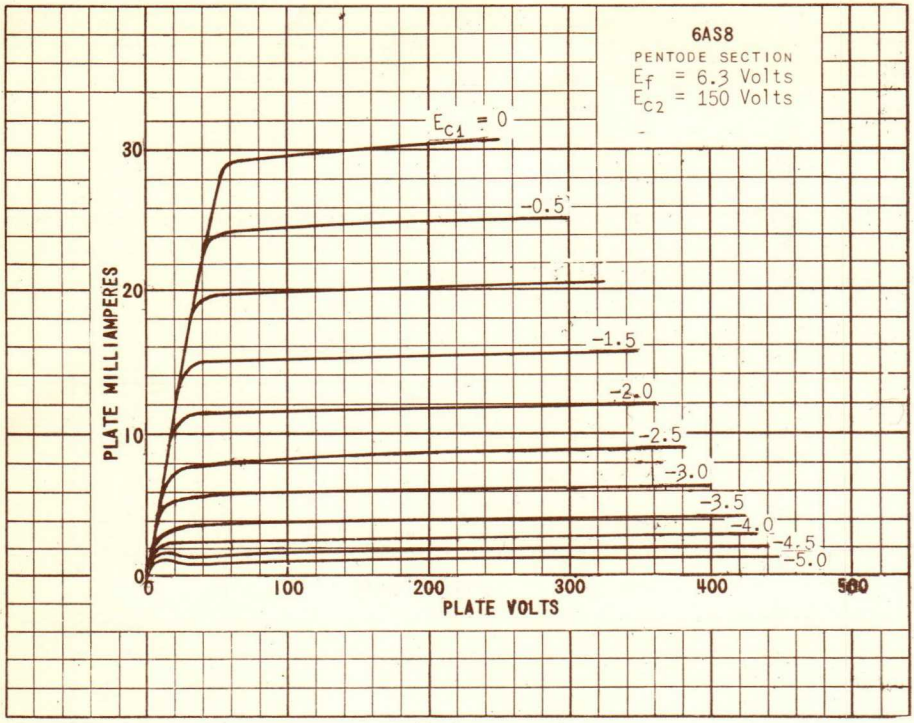
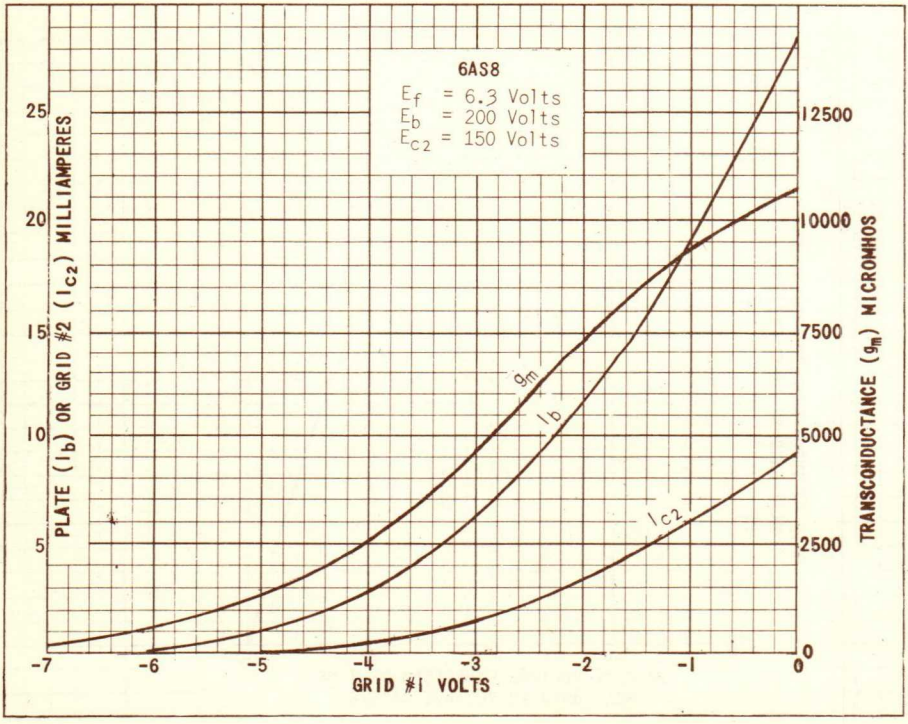
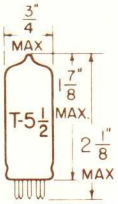

6AS8
PENTODE SECTION
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c1} = 0
-0.5
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
PLATE MILLIAMPERES
PLATE VOLTS
0
10
20
30
100
200
300
400
500


6AS8
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
g_m
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (g_m) MICROMHOS
GRID #1 VOLTS
5
10
15
20
25
2500
5000
7500
10000
12500
-7
-6
-5
-4
-3
-2
-1
0

TUNG-SOL

DOUBLE DIODE TRIODE

MINIATURE TYPE

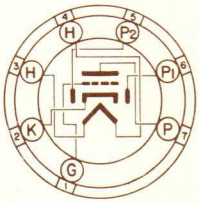


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
78T

THE 6AT6 IS A COMBINED HIGH-MU VOLTAGE AMPLIFIER AND DOUBLE-DIODE DETECTOR USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED TO PROVIDE OUTPUT VOLTAGE ADEQUATE FOR FULL POWER OUTPUT OF MOST BEAM POWER TUBES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G TO TRIODE PLATE)	2.0	2.0	μμf
INPUT: G TO (H+K)	2.2	2.2	μμf
OUTPUT: P TO (H+K)	1.2	0.8	μμf
COUPLING: #2 DIODE PLATE TO GRID (MAX.)	0.04	0.04	μμf
COUPLING: #1 DIODE PLATE TO GRID (MAX.)*		0.07	μμf
#2 DIODE PLATE TO HEATER AND CATHODE *		0.95	μμf
#1 DIODE PLATE TO HEATER AND CATHODE *		0.66	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM DIODE CURRENT (EACH UNIT) FOR CONTINOUS OPERATION	1.0	MA.

*INDICATES AN ADDITION.

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #1 VOLTAGE	-1	-3	VOLTS
PLATE RESISTANCE	54 000	58 000	OHMS
AMPLIFICATION FACTOR	70	70	
TRANSCONDUCTANCE	1 300	1 200	µMHOS
PLATE CURRENT	0.8	1.0	MA.
AVERAGE DIODE CURRENT (EACH UNIT) AT 10 VOLTS DC	2.0	2.0	MA.

RESISTANCE COUPLED AMPLIFIER

TRIODE UNIT

HEATER VOLTAGE	6.3	6.3	VOLTS
PLATE SUPPLY VOLTAGE	90	250	VOLTS
CONTROL VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	220 000	470 000	OHMS
CONTROL GRID RESISTOR	10.0	10.0	MEGOHMS
INPUT CONDENSER	0.01	0.01	µf
OUTPUT CONDENSER	0.01	0.01	µf
GRID RESISTOR OF FOLLOWING STAGE	470 000	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	1 000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	8	34	VOLTS
VOLTAGE GAIN AT 400 CPS.	35	46	

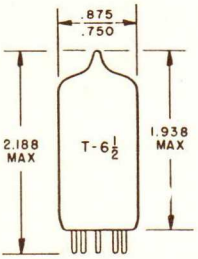
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

FOR

CONVERTER SERVICE

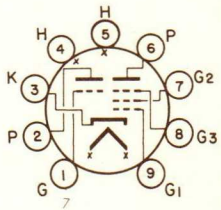


GLASS BULB

MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9DW

THE 6AT8A IS A MULTI-UNIT TUBE USING THE 9 PIN MINIATURE CONSTRUCTION. IT CONTAINS A MEDIUM-MU TRIODE AND A SHARP CUT-OFF PENTODE WITH A COMMON CATHODE IN ONE ENVELOPE. IT IS DESIGNED PRIMARILY FOR USE IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS UTILIZING AN INTERMEDIATE FREQUENCY IN THE ORDER OF 40 MC. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

		WITH SHIELD #315	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE:(PG1 TO PP)	MAX.	→ 0.03	→ 0.06	pf
PENTODE INPUT: PG1 TO (H+K+PG2+PG3)		→ 4.8	→ 4.6	pf
PENTODE OUTPUT: PP TO (H+K+PG3+PG2)		1.6	0.9	pf
CATHODE TO HEATER (K TO H)		→ 6.0	→ 6.0	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)		1.5	1.5	pf
TRIODE INPUT: TG TO (H + K)		2.4	2.0	pf
TRIODE OUTPUT: TP TO (H + K)		1.0	0.5	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP)	MAX.	0.04	0.05	pf
PENTODE PLATE TO TRIODE PLATE: (PP TO TP)	MAX.	0.008	0.05	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	450	MA.
HEATER WARM-UP TIME [A]			11	SECONDS
LIMITS OF SUPPLIED CURRENT			450±30	MA.

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS - CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	→ 200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	→ 200	VOLTS

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

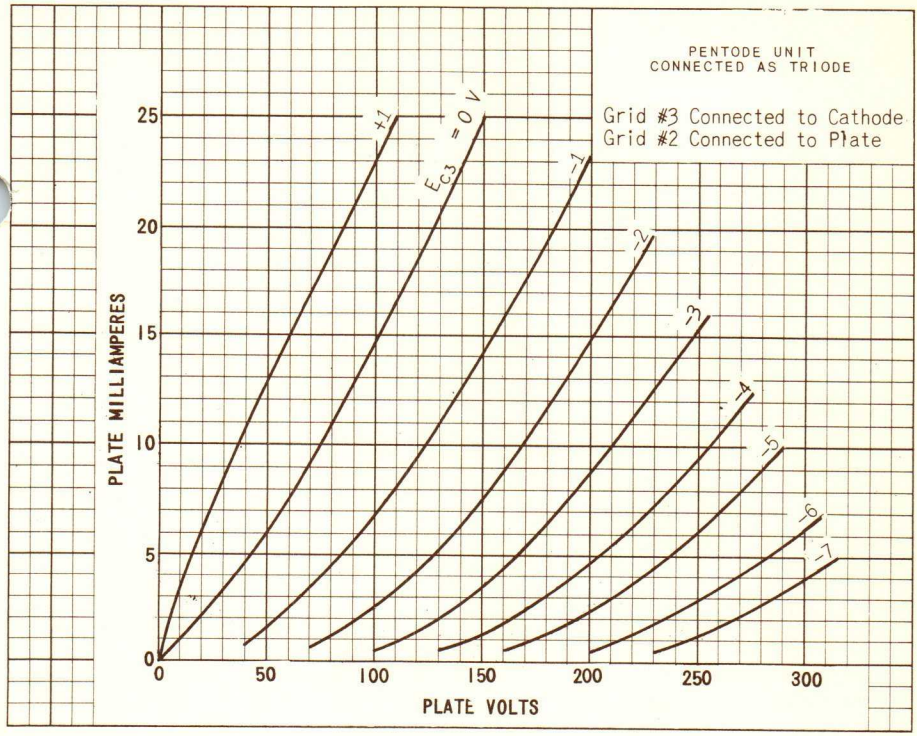
PENTODE PLATE VOLTAGE	275	VOLTS
TRIODE PLATE VOLTAGE	275	VOLTS
GRID 2 SUPPLY VOLTAGE	275	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
PENTODE PLATE DISSIPATION	2.3	WATTS
GRID 2 DISSIPATION	0.45	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	1.7	VOLTS

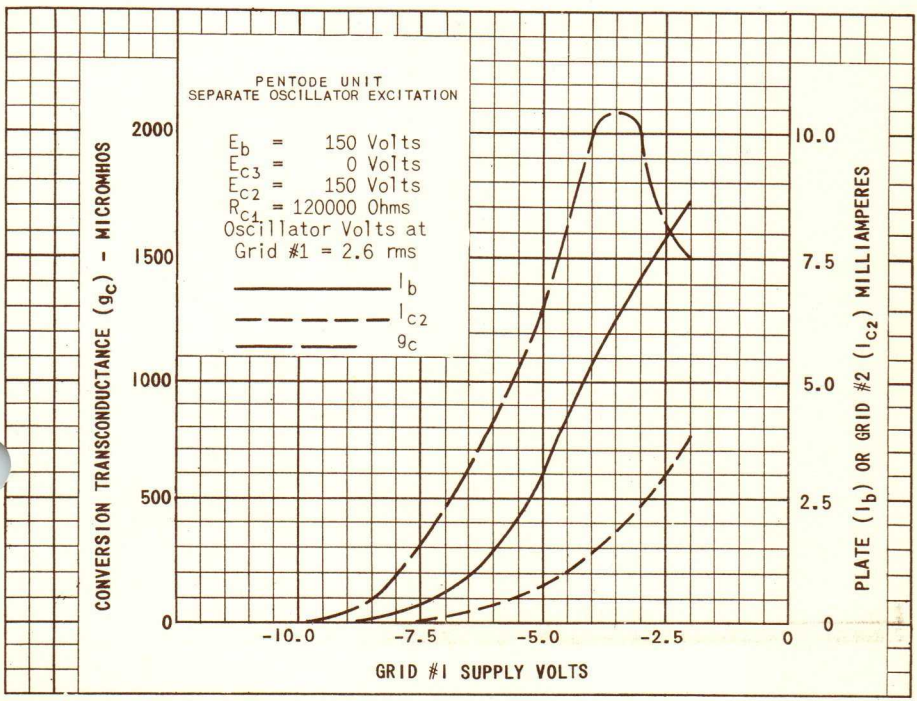
TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

		PENTODE	TRIODE	
PLATE VOLTAGE		125	125	VOLTS
GRID 3 VOLTAGE		Connected to pin 3 at socket		
GRID 2 VOLTAGE		125	-----	
GRID 1 VOLTAGE		-1.0	-1.0	VOLTS
PLATE CURRENT		9.0	12.0	MA.
GRID 2 CURRENT		2.2	-----	MA.
TRANSCONDUCTANCE		5,500	6,500	μMHOS
PLATE RESISTANCE	(APPROX.)	300,000	6,000	OHMS
AMPLIFICATION FACTOR		-----	40	
GRID 1 VOLTAGE (APPROX.) FOR Ib = 20 μA		-6.5	-7	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb = 100 V; Ec2 = 70 V)		5,700	-----	μMHOS

→ INDICATES A CHANGE





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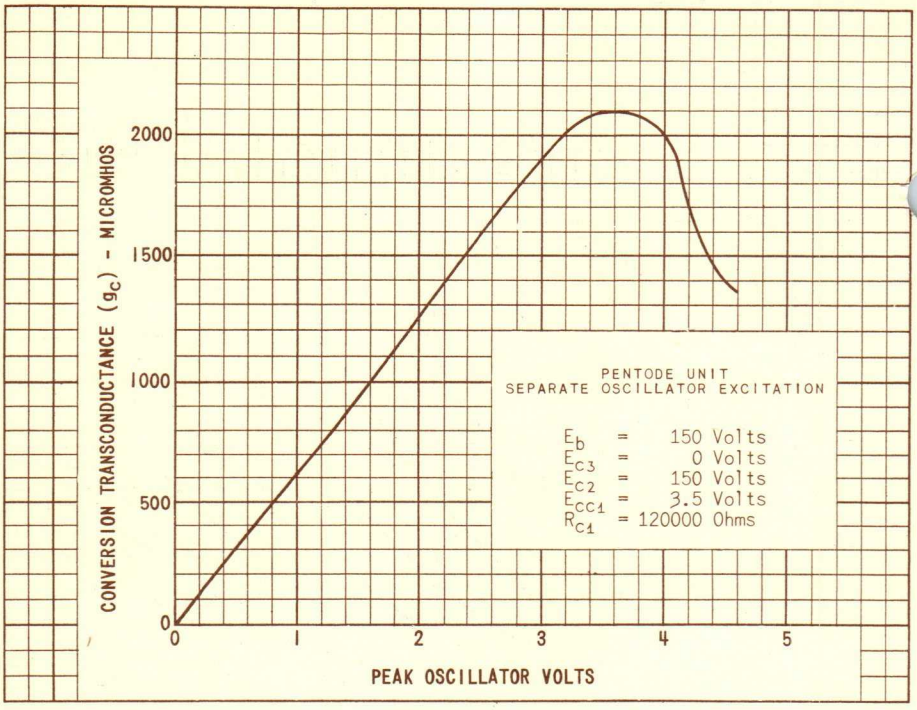
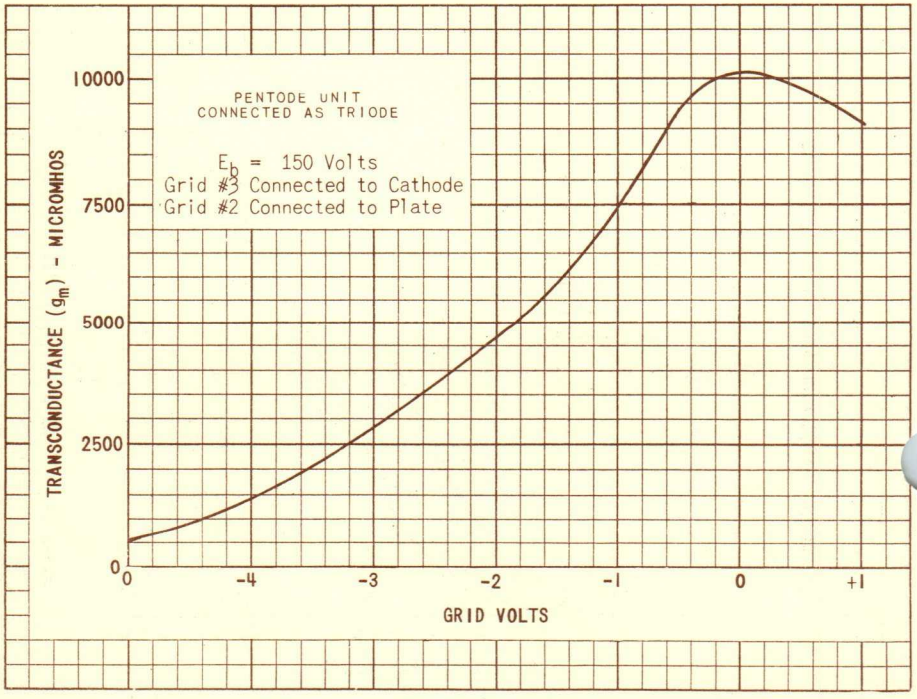
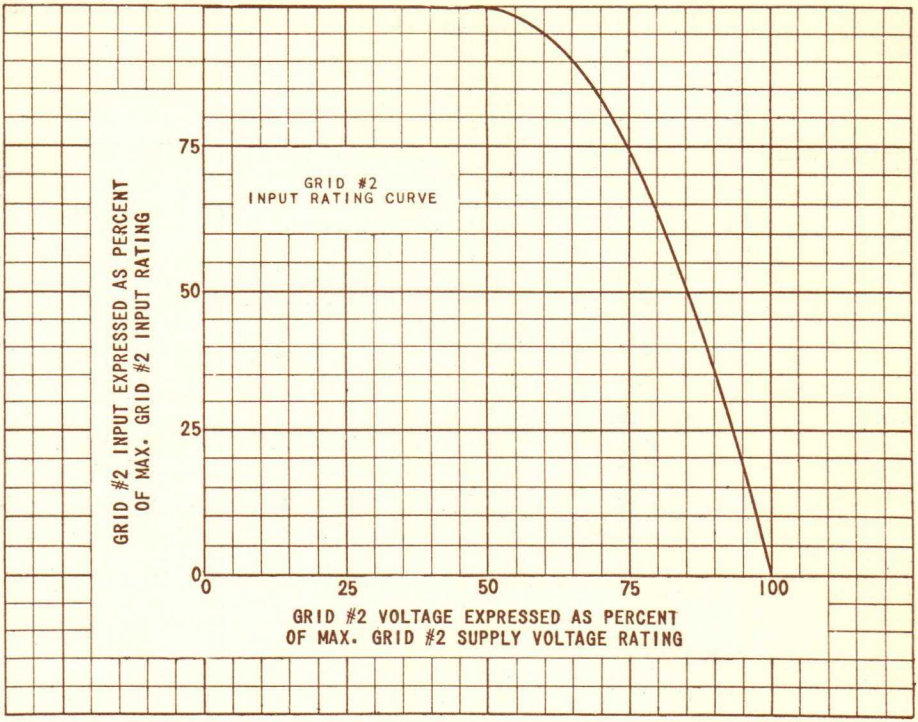
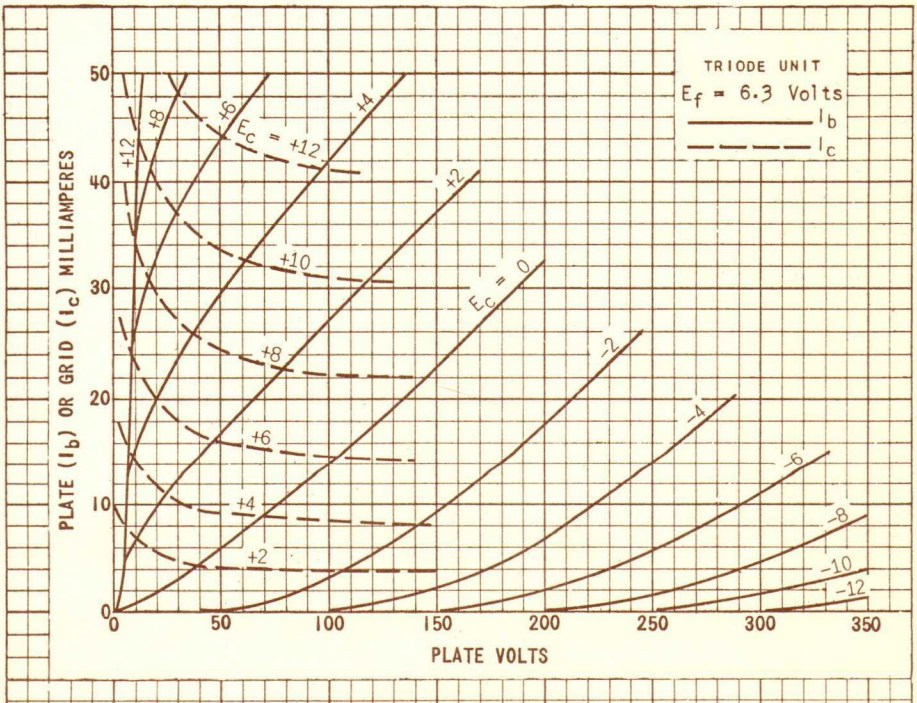

CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
2000
1500
1000
500
0
0
1
2
3
4
5
PEAK OSCILLATOR VOLTS
PENTODE UNIT
SEPARATE OSCILLATOR EXCITATION
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2} = 150 Volts
E_{cc1} = 3.5 Volts
R_{c1} = 120000 Ohms


TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
7500
5000
2500
0
0
-4
-3
-2
-1
0
+1
GRID VOLTS
PENTODE UNIT
CONNECTED AS TRIODE
E_b = 150 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate





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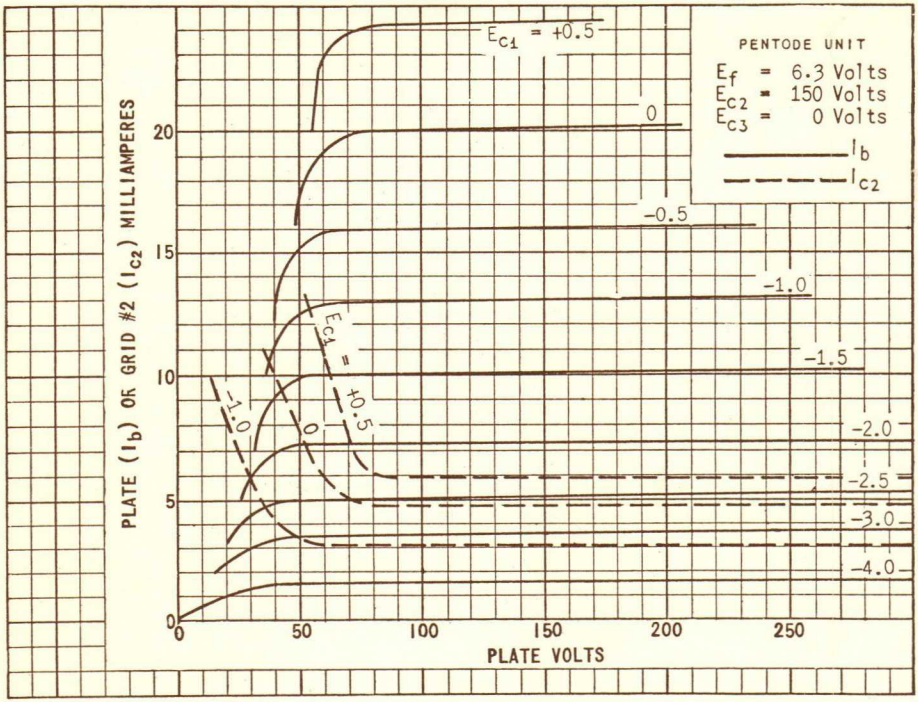
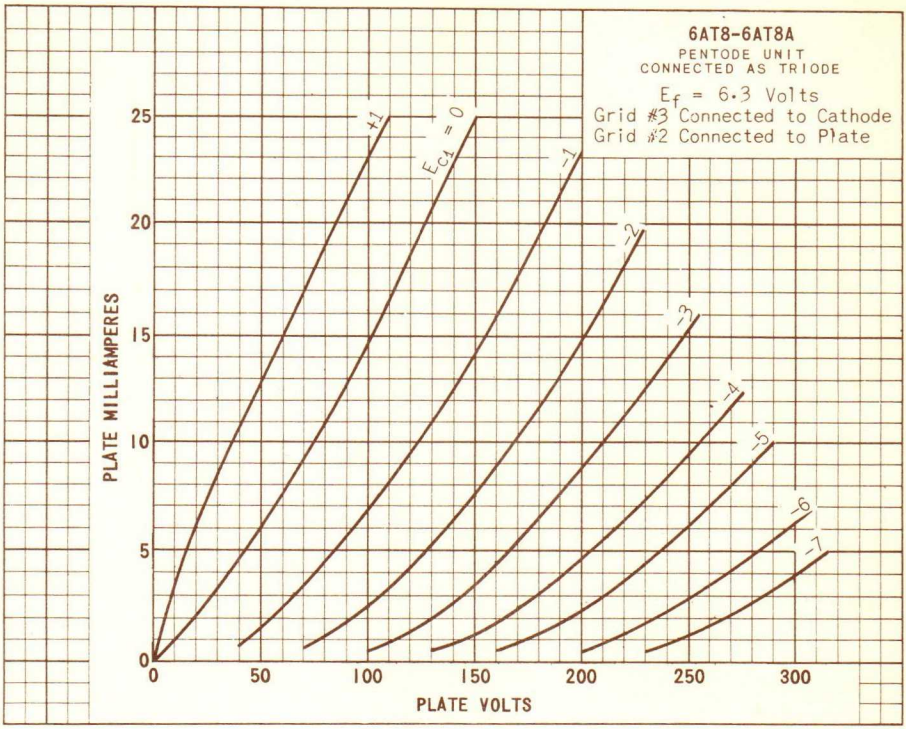
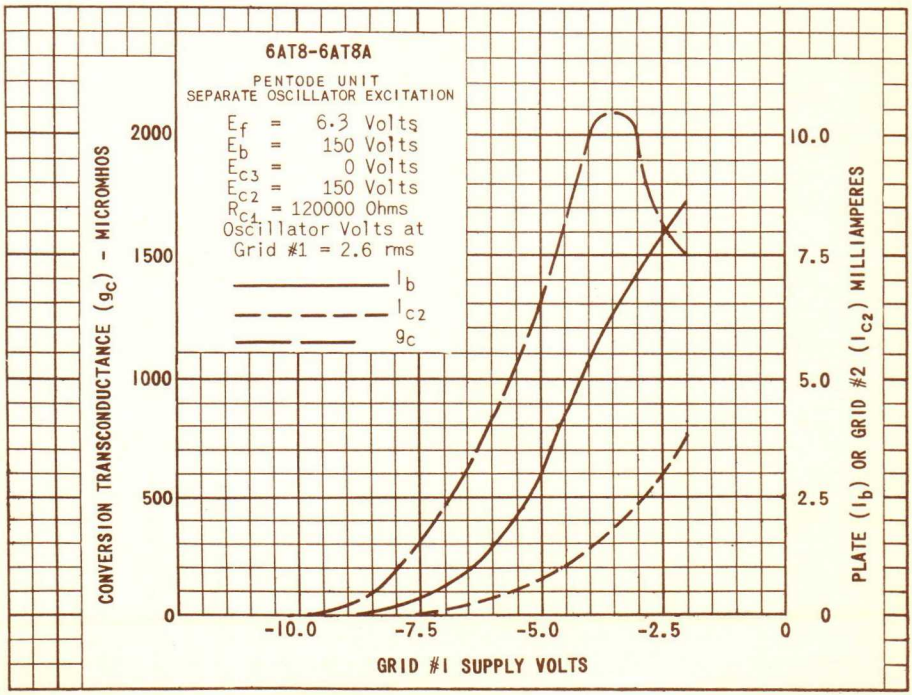
6AT8A


PENTODE UNIT
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c1} = +0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
50
100
150
200
250





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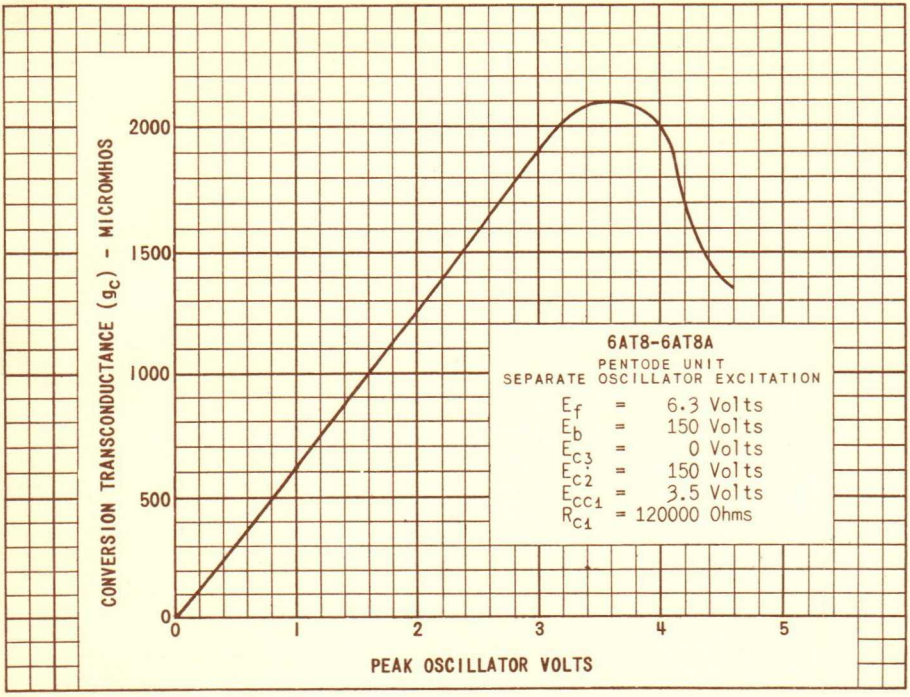
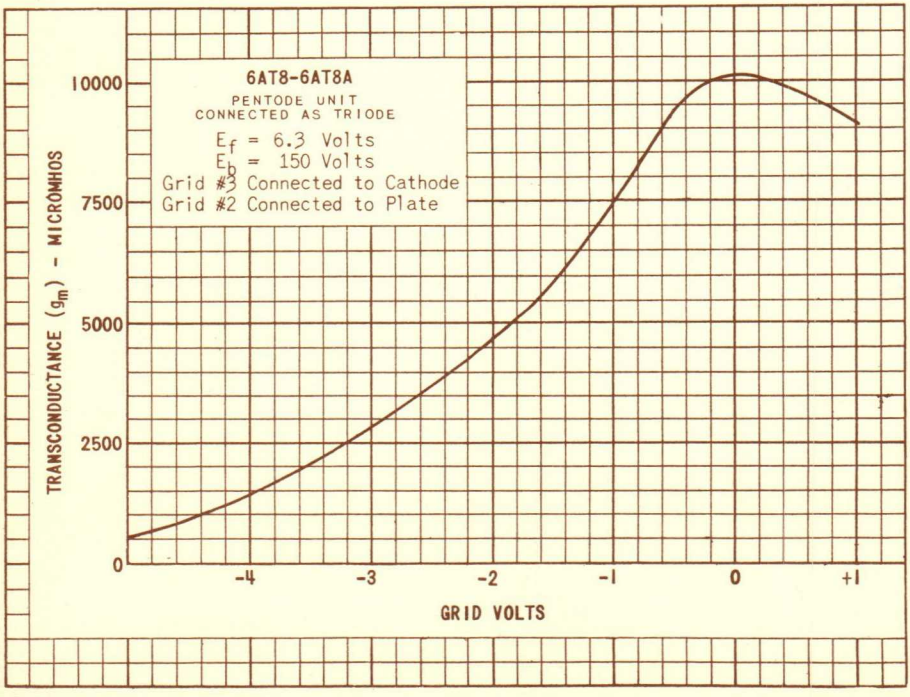
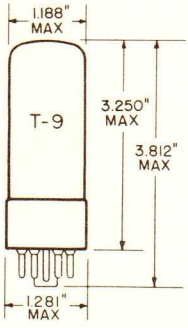

CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
2000
1500
1000
500
0
0
1
2
3
4
5
PEAK OSCILLATOR VOLTS
6AT8-6AT8A
PENTODE UNIT
SEPARATE OSCILLATOR EXCITATION
E_f = 6.3 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2} = 150 Volts
E_{cc1} = 3.5 Volts
R_{c1} = 120000 Ohms


TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
7500
5000
2500
0
-4
-3
-2
-1
0
+1
GRID VOLTS
6AT8-6AT8A
PENTODE UNIT
CONNECTED AS TRIODE
E_f = 6.3 Volts
E_b = 150 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate

TUNG-SOL

DIODE

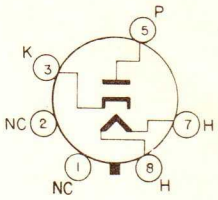


GLASS BULB
SHORT INTERMEDIATE
SHELL 5 OR 6 PIN OCTAL
WITH
EXTERNAL BARRIERS
BASE B5-85 OR B6-60

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±.6 VOLTS 1800 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 4CG

SOCKET TERMINALS #1, #2, #4 AND #6 SHOULD NOT BE USED AS TIE POINTS. PIN #1 OMITTED ON 5-PIN BASE.

4CG

THE 6AU4GTA IS A SINGLE INDIRECTLY-HEATED DIODE INTENDED FOR USE IN TELEVISION HORIZONTAL FREQUENCY DAMPER SERVICE. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES OF LINE FREQUENCY BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS NORMALLY ENCOUNTERED IN "DIRECT-DRIVE" CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES

HEATER TO CATHODE: (H TO K)	4.0	pf
PLATE TO CATHODE AND HEATER: P TO (H+K)	8.5	pf
CATHODE TO PLATE AND HEATER: K TO (P+H)	11.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

DAMPER DIODE[B]

MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	900	VOLTS
TOTAL DC AND PEAK (ABSOLUTE MAXIMUM)	4 500	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	4 500	VOLTS
MAXIMUM DC PLATE CURRENT	→ 210	MA.
MAXIMUM STEADY STATE PEAK PLATE CURRENT	→ 1300	MA.
MAXIMUM PLATE DISSIPATION	→ 6.5	WATTS
AVERAGE TUBE VOLTAGE DROP (WITH TUBE CONDUCTING 350 MA.)	25	VOLTS

[B] 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 HORIZONTAL VOLTAGE PULSE, NOT TO EXCEED 15% OF SCANNING CYCLE.

→ INDICATES A CHANGE.

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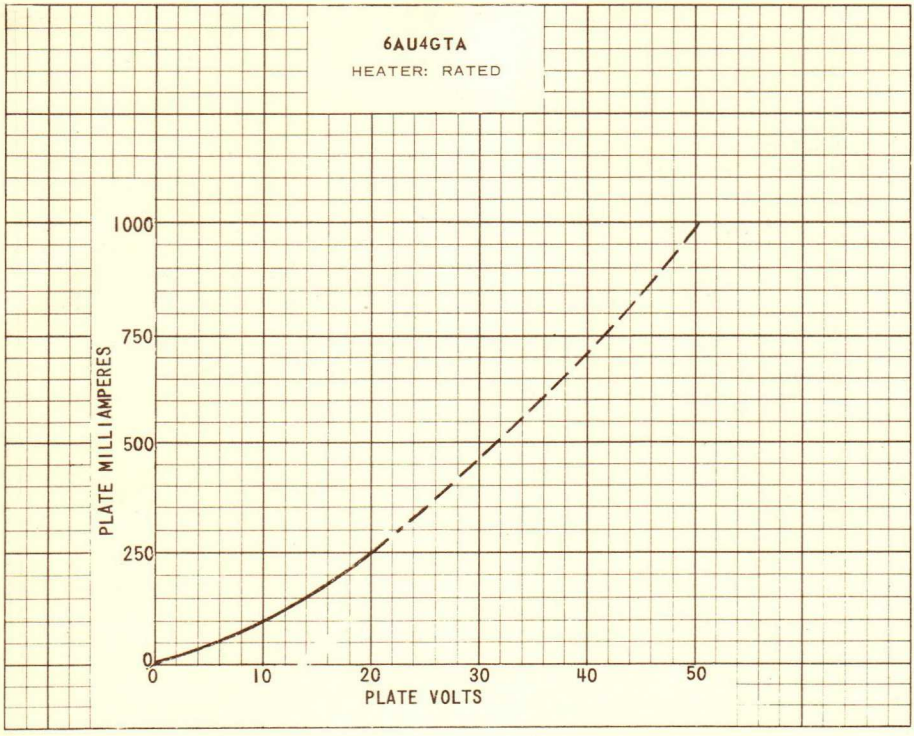
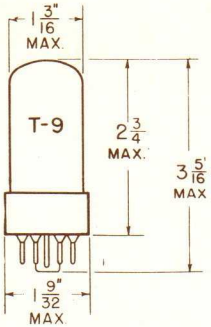
6AU4GTA


6AU4GTA
HEATER: RATED
PLATE MILLIAMPERES
1000
750
500
250
0
0
10
20
30
40
50
PLATE VOLTS

TUNG-SOL

BEAM PENTODE

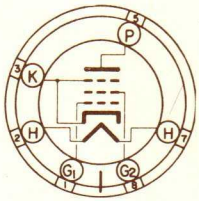


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.25 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL 6 PIN OCTAL
6CK

THE 6AU5GT IS A HIGH PERVEANCE SINGLE-ENDED, BEAM POWER AMPLIFIER DESIGNED FOR USE AS A HORIZONTAL-DEFLECTION AMPLIFIER IN LOW-COST, HIGH EFFICIENCY DEFLECTION CIRCUITS OF TELEVISION RECEIVERS. IT IS PARTICULARLY EFFECTIVE WHEN THE PLATE SUPPLY POTENTIAL IS LIMITED.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE: (G_1 TO P)	0.5	μμf
INPUT: G_1 TO ($H+K+G_2+G_3$)	11.3	μμf
OUTPUT: P TO ($H+K+G_2+G_3$)	7.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	6.3	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
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST + POWER SUPPLY)	550	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	5 500	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM PLATE DISSIPATION[B]	10	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210°	CENTIGRADE

[A] 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 NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.25	AMP.
PENTODE OPERATION:[C]		
PLATE CURRENT	60	MA.
GRID #2 CURRENT	6.8	MA.
TRANSCONDUCTANCE	5 600	µMHOS
PLATE RESISTANCE	6 000	OHMS
ZERO-BIAS:[D]		
PLATE CURRENT	210	MA.
GRID #2 CURRENT	25	MA.
CUT-OFF:[E]		
GRID #1 VOLTAGE (APPROX.)	-45	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	5.9	

[C] WITH E_b = 115 VOLTS, E_{C2} = 175 VOLTS AND E_{C1} = -20 VOLTS

[D] WITH E_b = 60 VOLTS AND E_{C2} = 175 VOLTS.

[E] FOR I_b = 1 MA. WITH E_b = 115 VOLTS AND E_{C2} = 150 VOLTS.

[F] WITH $E_b = E_{C2}$ = 100 VOLTS AND E_{C1} = -4.5 VOLTS

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

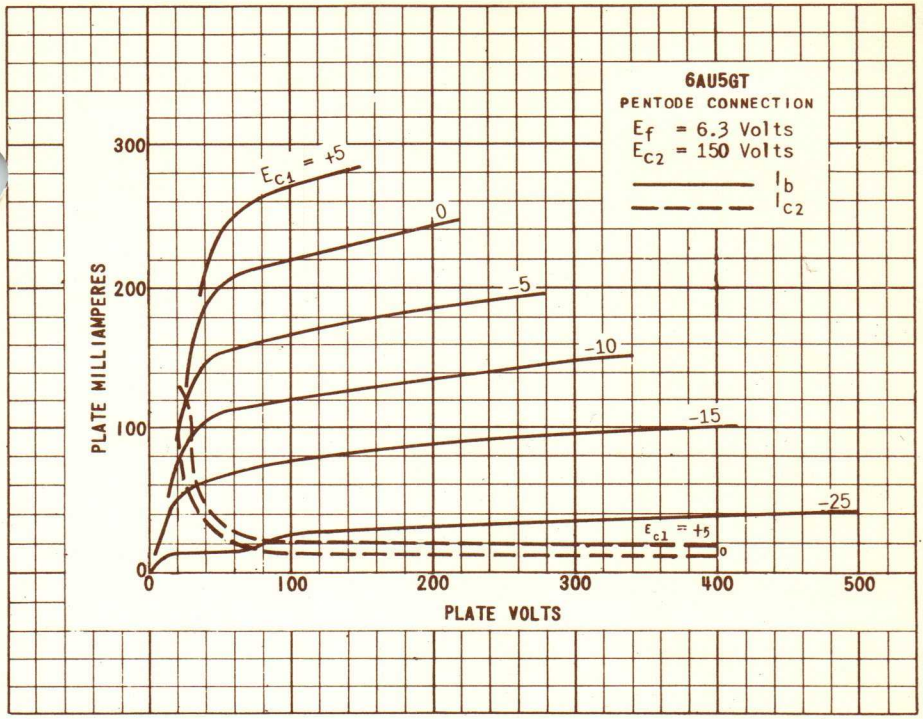
VOLTAGE REGULATOR SERVICE

TRIODE CONNECTION--GRID NO. 2 CONNECTED TO PLATE

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VALUE	125	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM CATHODE CURRENT	110	MA.
MAXIMUM TOTAL PLATE & GRID #2 DISSIPATION	10	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* INDICATES AN ADDITION.



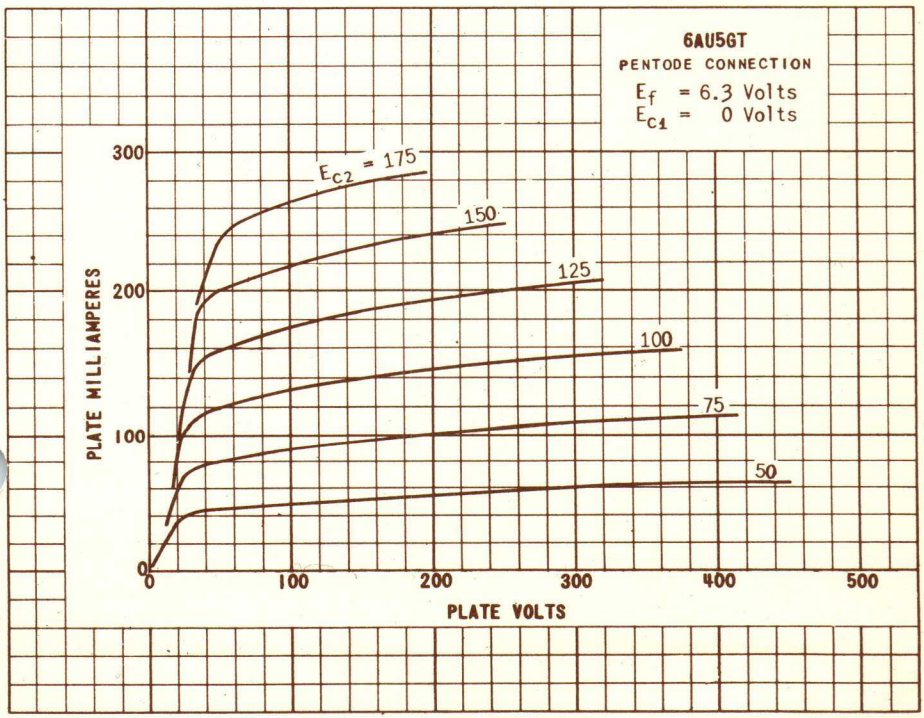


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PLATE
2376
APR. 1
1950

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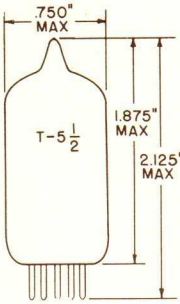


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

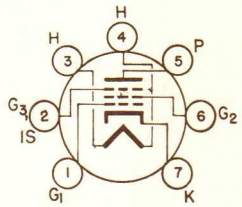
PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3± 0.6 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BK

THE 6AU6 AND 6AU6A ARE PENTODE AMPLIFIERS HAVING A SHARP CUTOFF CONTROL CHARACTERISTIC. WITH HIGH TRANSCONDUCTANCE AND LOW GRID TO PLATE CAPACITANCE THEY ARE INTENDED FOR SERVICE AS EITHER RF OR AF AMPLIFIERS. IN ADDITION, THERMAL CHARACTERISTICS OF THE HEATER OF THE 6AU6A ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME AND HIGHER HEATER-CATHODE VOLTAGE RATINGS OF THE 6AU6A, THE TWO TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE CONNECTION:			
GRID TO PLATE: (G_1 TO P) MAX.	0.003	0.003	pf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.5	5.5	pf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5	5	pf
TRIODE CONNECTION:			
GRID TO PLATE: G_1 TO (P+G_2+G_3&IS)	2.6	2.6	pf
INPUT: G_1 TO (H+K)	3.2	3.2	pf
OUTPUT: (P+G_2+G_3&IS) TO (H+K)	8.5	1.2	pf

[A] SHIELD #316 CONNECTED TO PIN #7.

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE CONNECTION[C]	PENTODE CONNECTION	
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200●	200●	VOLTS
MAXIMUM PLATE VOLTAGE	275	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	SEE J5-C4-2	
MAXIMUM GRID #3 VOLTAGE PIN #2 CONNECTED TO:	PLATE	CATHODE	
MAXIMUM PLATE DISSIPATION	3.5	3.5	WATTS
MAXIMUM GRID #2 DISSIPATION	---	---	WATTS
MAXIMUM GRID #2 INPUT:*			VOLTS
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	---	0.75	WATT
FOR GRID #2 VOLTAGES BETWEEN 165 VOLTS AND 330 VOLTS *	---	SEE J5-C4-2	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
HEATER WARM-UP TIME (APPROX.) * (6AU6A ONLY)		11.0	SECONDS

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – PENTODE CONNECTION

PLATE VOLTAGE	100	250	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE BIAS RESISTOR	150	100	68	OHMS
GRID #3 VOLTAGE	PIN #2 CONNECTED TO PIN #7 AT SOCKET			
TRANSCONDUCTANCE	3 900	4 500	5 200	µMHOS
PLATE CURRENT	5	7.6	10.6	MA.
GRID #2 CURRENT	2.1	3	4.3	MA.
PLATE RESISTANCE (APPROX.)	0.5	1.5	1	MEGOHMS
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µA.	-4.2	-5.5	-6.5	VOLTS

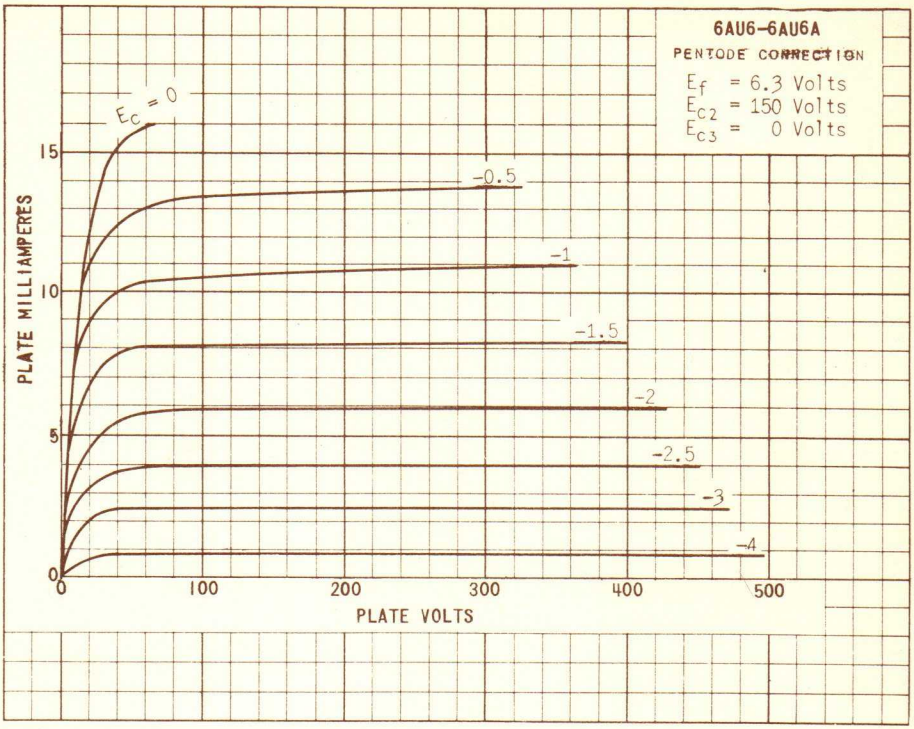
CLASS A_1 AMPLIFIER – TRIODE CONNECTION[C]

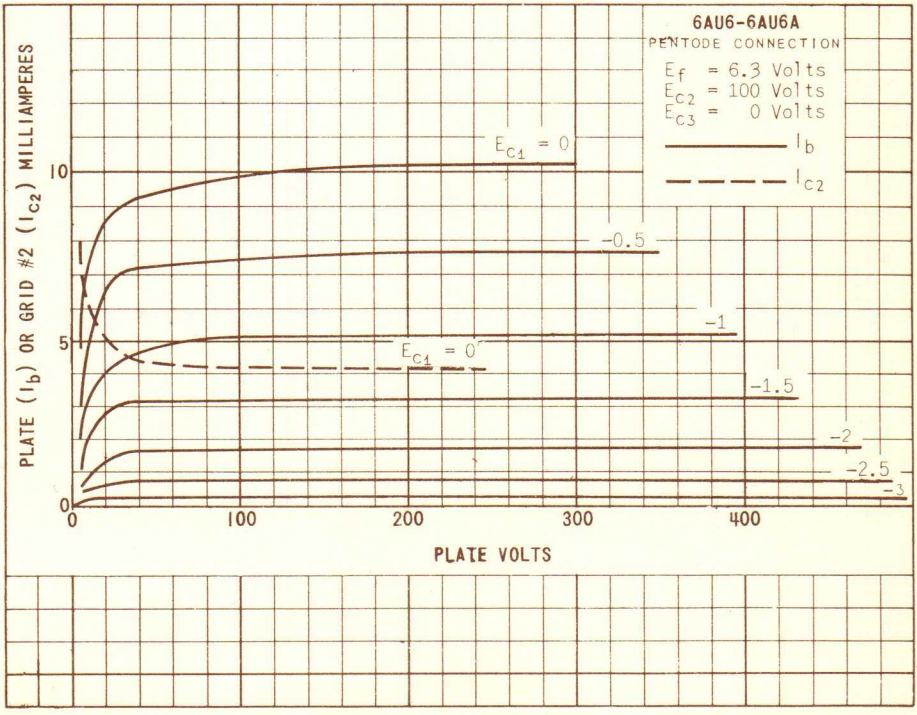
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	PLATE	
CATHODE RESISTOR	330	OHMS
GRID #3 VOLTAGE	PLATE	
TRANSCONDUCTANCE	4 800	µMHOS
PLATE CURRENT	12.2	MA.
AMPLIFICATION FACTOR	36	

[C] TRIODE CONNECTION: GRID #2 AND GRID #3 CONNECTED TO PLATE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.





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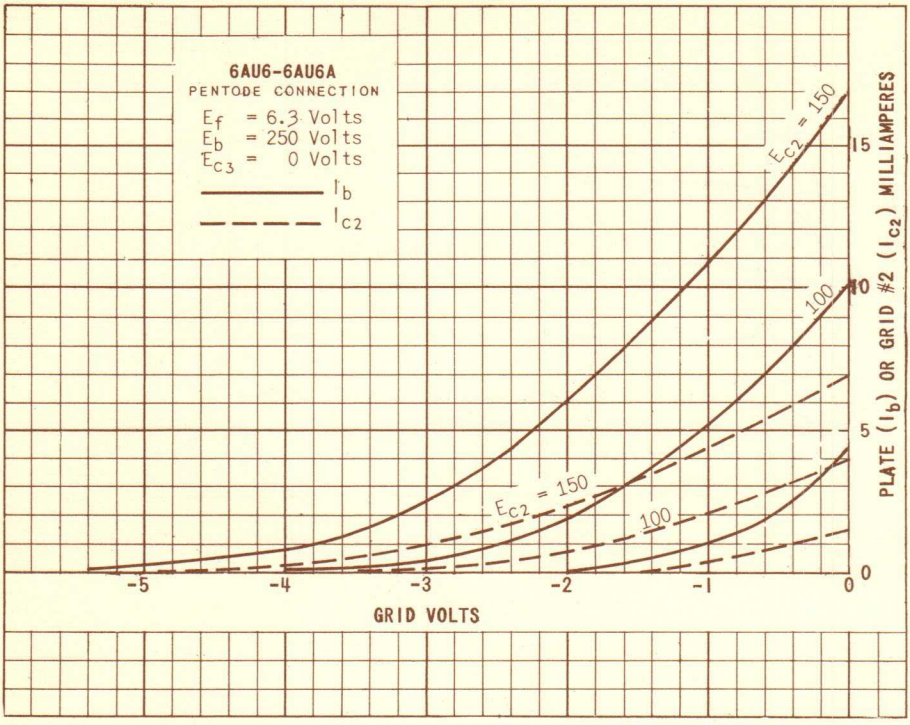
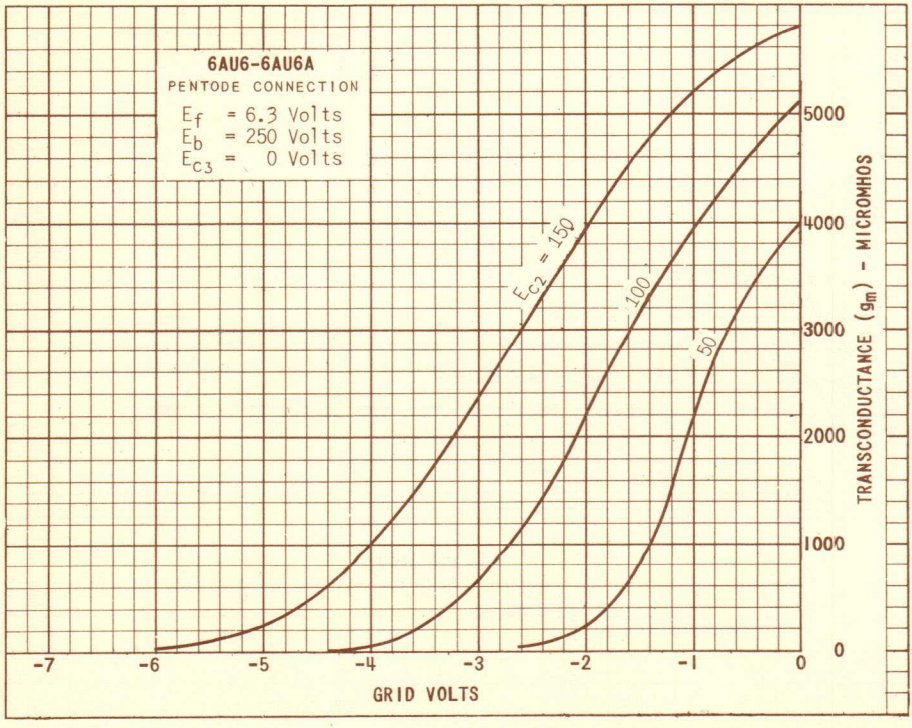

6AU6-6AU6A
PENTODE CONNECTION
Ef = 6.3 Volts
Eb = 250 Volts
Ec3 = 0 Volts
Ib
Ic2
Ec2 = 150
100
Ec2 = 150
100
-5
-4
-3
-2
-1
0
15
10
5
0
GRID VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES


6AU6-6AU6A
PENTODE CONNECTION
Ef = 6.3 Volts
Eb = 250 Volts
Ec3 = 0 Volts
Ec2 = 150
100
50
-7
-6
-5
-4
-3
-2
-1
0
5000
4000
3000
2000
1000
0
GRID VOLTS
TRANSCONDUCTANCE (gm) - MICROMHOS

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TWIN TRIODE

MINIATURE TYPE

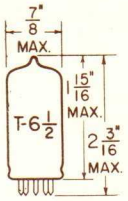
COATED UNIPOTENTIAL CATHODE

HEATER

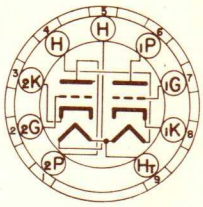
SERIES	PARALLEL
6.3 VOLTS	3.15 VOLTS
0.3 AMP.	0.6 AMP.

AC OR DC

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #9 AND PINS #4 AND #5 CONNECTED TOGETHER.



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9A

THE 6AU7 IS A MEDIUM-MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN 600 MILLIAMPERE SERIES STRING TV APPLICATIONS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6AU7 IS IDENTICAL TO THE 12AU7.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
TRIODE UNIT 1			
GRID TO PLATE: (G TO P)	1.5	1.5	μμf
INPUT: G TO (H+K)	1.8	1.6	μμf
OUTPUT: P TO (H+K)	2.0	0.40	μμf
TRIODE UNIT 2			
GRID TO PLATE: (G TO P)	1.5	1.5	μμf
INPUT: G TO (H+K)	1.8	1.6	μμf
OUTPUT: P TO (H+K)	2.0	0.32	μμf

[A] EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF UNIT UNDER TEST.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH TRIODE UNIT

	CLASS A_1[B] AMPLIFIER	VERTICAL[B] DEFLECTION AMPLIFIER	
HEATER VOLTAGE	6.3	3.15	VOLTS
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
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---	1200	VOLTS
MAXIMUM PLATE DISSIPATION:[C]			
EACH PLATE	2.75	2.75	WATTS
BOTH PLATES	5.5	5.5	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	---	250	VOLTS
MAXIMUM CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	---	60	MA.
MAXIMUM GRID CIRCUIT RESISTANCE			
FIXED BIAS OPERATION	0.25	---	MEGOHM
CATHODE BIAS OPERATION	1.0	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

[B] 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 NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

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CONTINUED FROM PRECEDING PAGE

RATINGS (CONT'D)

EACH TRIODE UNIT

	VERTICAL[D] DEFLECTION OSCILLATOR	HORIZONTAL[D] DEFLECTION OSCILLATOR	
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
MAXIMUM DC PLATE VOLTAGE	300	300	VOLTS
MAXIMUM PLATE DISSIPATION:			
EACH PLATE	2.75	2.75	WATTS
BOTH PLATES	5.5	5.5	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	600	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	60	300	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2	2.2	MEGOHMS

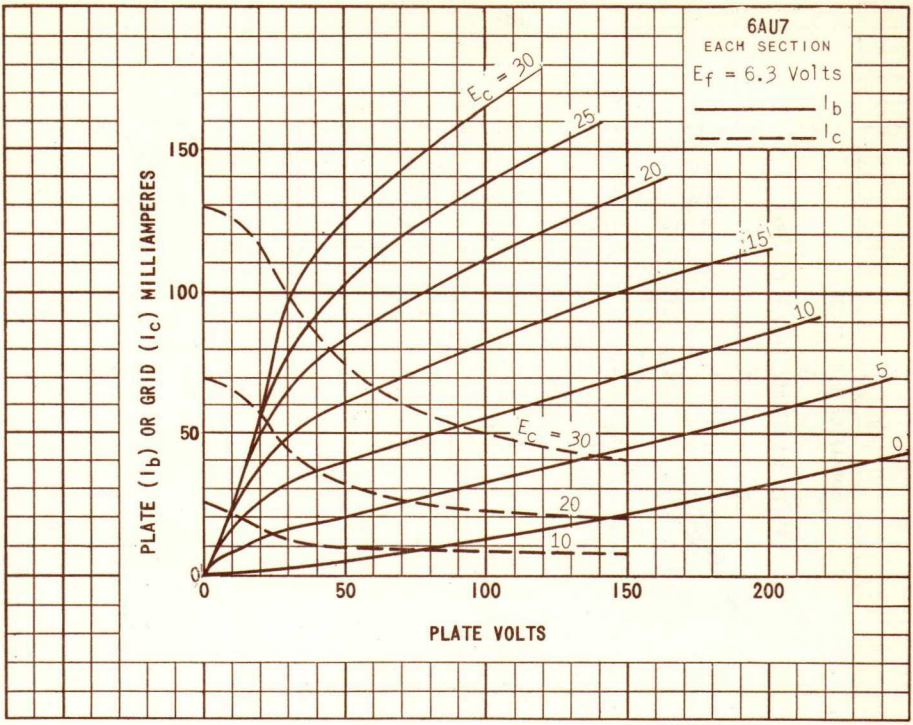
[D] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

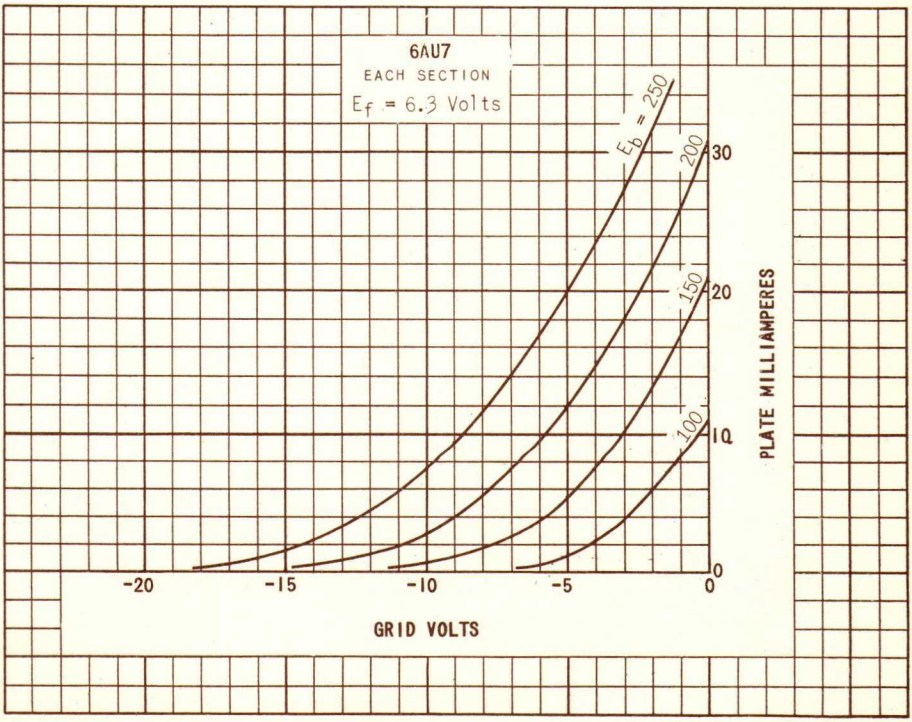
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	0	-8.5	VOLTS
PLATE CURRENT	11.8	10.5	MA.
PLATE RESISTANCE (APPROX.)	6 500	7 700	OHMS
TRANSCONDUCTANCE	3 100	2 200	µMHOS
AMPLIFICATION FACTOR	20	17	
GRID VOLTAGE FOR I_b = 10 µA. (APPROX.)	---	– 24	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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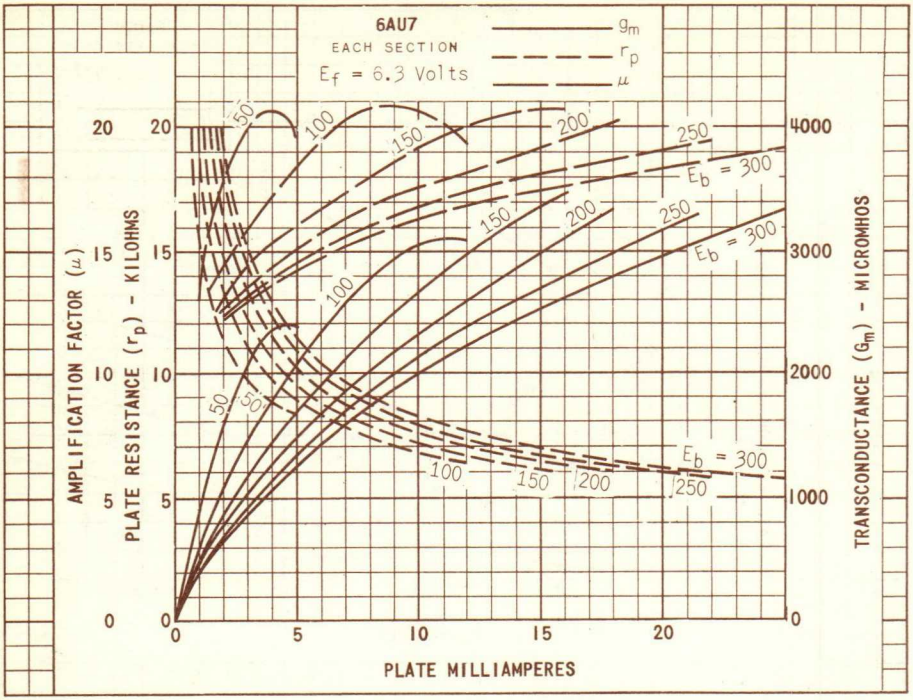
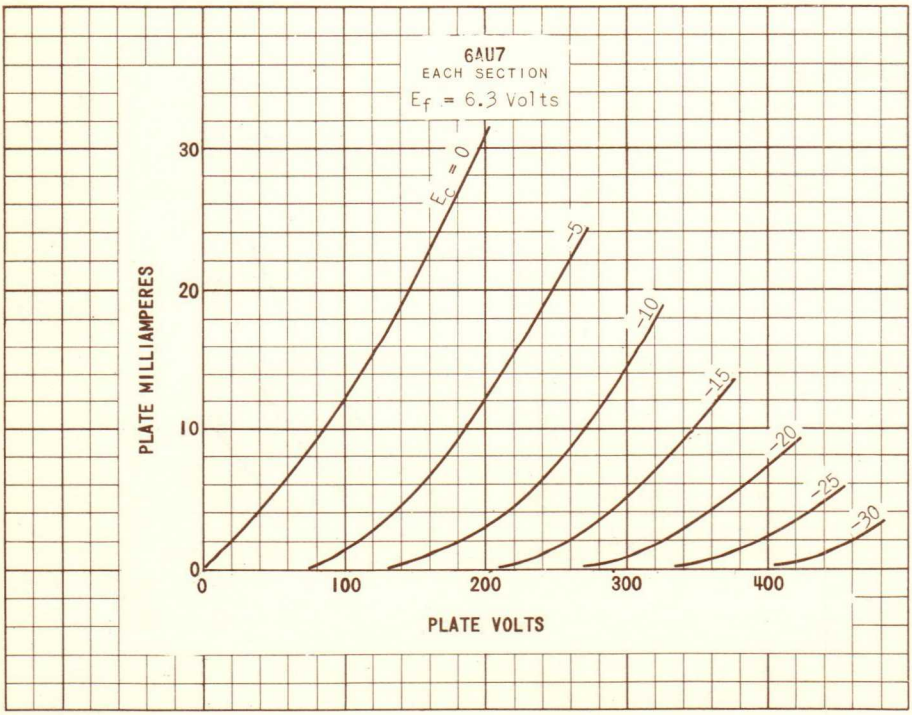

6AU7
EACH SECTION
Ef = 6.3 Volts
gm
rp
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (rp) - KILOHMS
TRANSCONDUCTANCE (Gm) - MICROMHOS
PLATE MILLIAMPERES
Eb = 300
50
100
150
200
250


6AU7
EACH SECTION
Ef = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
Ec = 0
-5
-10
-15
-20
-25
-30

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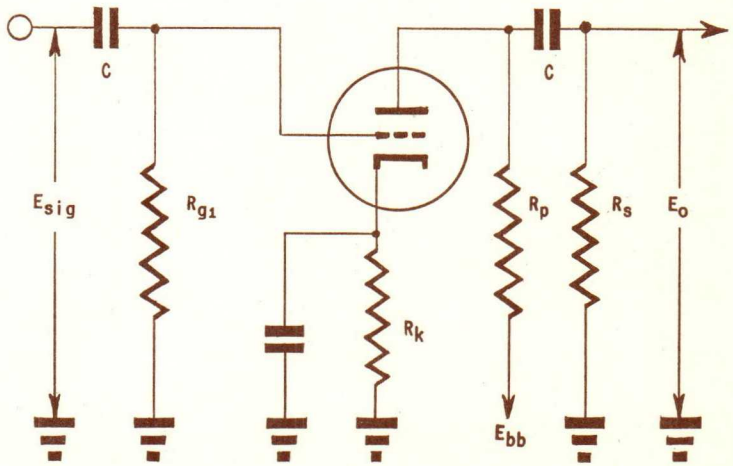
RESISTANCE COUPLED AMPLIFIER
EACH SECTION

R_p MEG.	R_s MEG.	R_{g1} MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	0.10	0.10	3300	14	13	2200	14	26	1800	14	40
0.10	0.24	0.10	3600	14	16	2700	15	33	2200	15	51
0.24	0.24	0.10	7500	14	16	5100	15	30	4300	15	44
0.24	0.51	0.10	9100	14	19	6800	15	39	5100	15	54
0.51	0.51	0.10	13000	14	16	9100	15	30	6800	16	40
0.51	1.0	0.10	15000	14	19	10000	16	32	7500	16	45
0.24	0.24	10	0	15	13	0	16	33	0	17	46
0.24	0.51	10	0	16	17	0	17	38	0	18	62
0.51	0.51	10	0	16	14	0	18	32	0	18	53
0.51	1.0	10	0	17	18	0	18	41	0	19	68

NOTES: 1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT (5%) TOTAL HARMONIC DISTORTION.
2. GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.
3. FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.



NOTES: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE.
R_k SHOULD BE ADEQUATELY BY-PASSED

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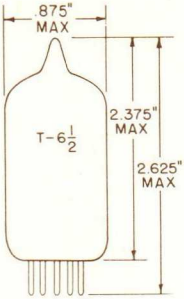
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



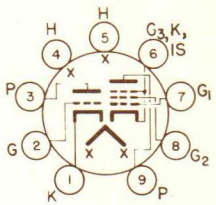
GLASS BULB

MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 600 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9DX

THE 6AU8 IS A GENERAL-PURPOSE MINIATURE TUBE CONTAINING A SHARP CUT-OFF PENTODE AND A MEDIUM-MU TRIODE IN ONE ENVELOPE. EACH SECTION HAS ITS OWN CATHODE AND IS ELECTRICALLY INDEPENDENT. IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED MONOCHROME AND COLOR TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES THAT ARE SIMILARLY CONTROLLED. THE PENTODE SECTION IS PARTICULARLY SUITED FOR USE AS A VIDEO AMPLIFIER, VIDEO IF AMPLIFIER AND SOUND IF AMPLIFIER. THE TRIODE SECTION IS INTENDED FOR USE AS A SYNC AMPLIFIER, SEPARATOR OR CLIPPER OR AS A SWEEP OSCILLATOR.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	PENTODE SECTION	TRIODE SECTION	
GRID TO PLATE	0.044	2.2	pf
INPUT	7.5	2.6	pf
OUTPUT	2.4	0.34	pf
PENTODE GRID #1 TO TRIODE PLATE	0.005		pf
TRIODE GRID TO PENTODE PLATE	0.002		pf
PENTODE PLATE TO TRIODE PLATE	0.12		pf

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

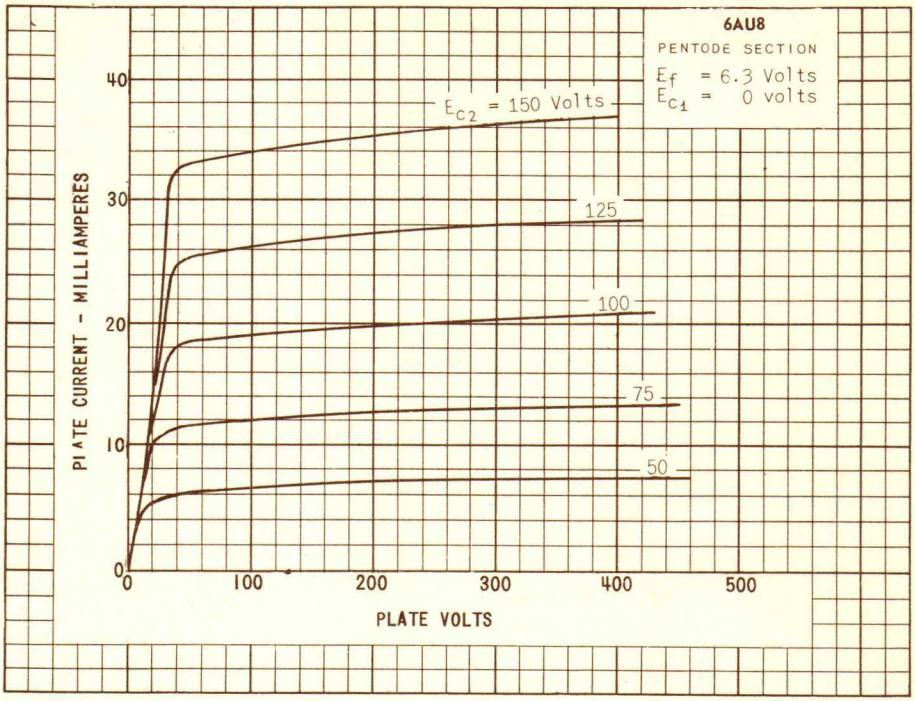
	PENTODE SECTION	TRIODE SECTION	
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	---	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.0	---	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.25	0.5	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)[A]	11.0		SECONDS

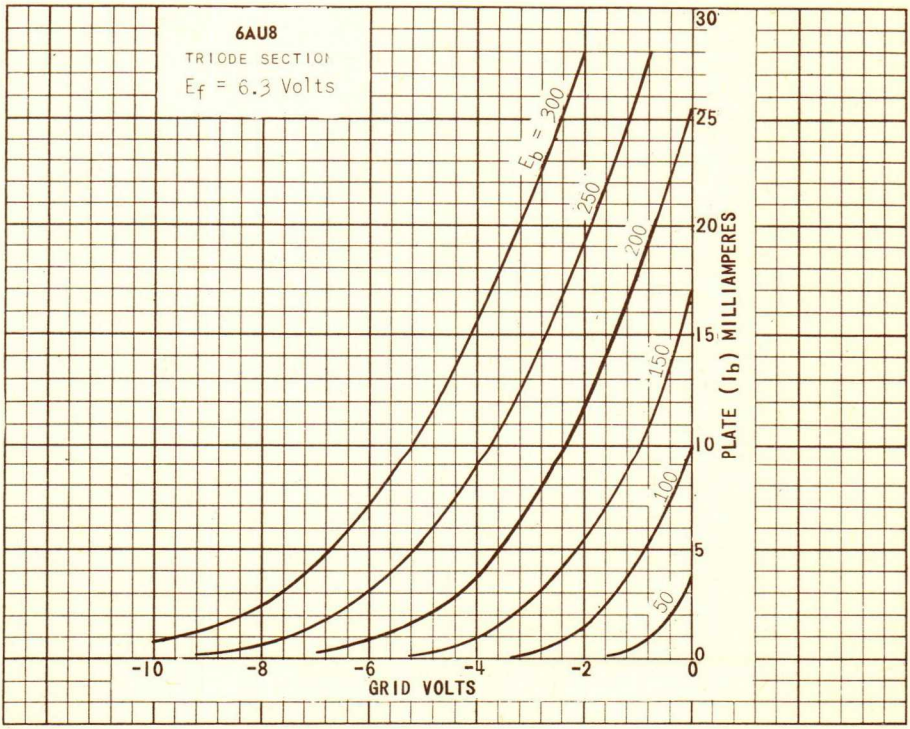
[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	PENTODE SECTION	TRIODE SECTION	
PLATE VOLTAGE	200	150	VOLTS
GRID #2 VOLTAGE	125	---	VOLTS
CATHODE BIAS RESISTOR	82	150	OHMS
AMPLIFICATION FACTOR	---	40	
PLATE RESISTANCE (APPROX.)	150 000	8 200	OHMS
TRANSCONDUCTANCE	7 000	4 900	μMHOS
PLATE CURRENT	15	9.0	MA.
GRID #2 CURRENT	3.4	---	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 100 μAMP.	-8	-6.5	VOLTS





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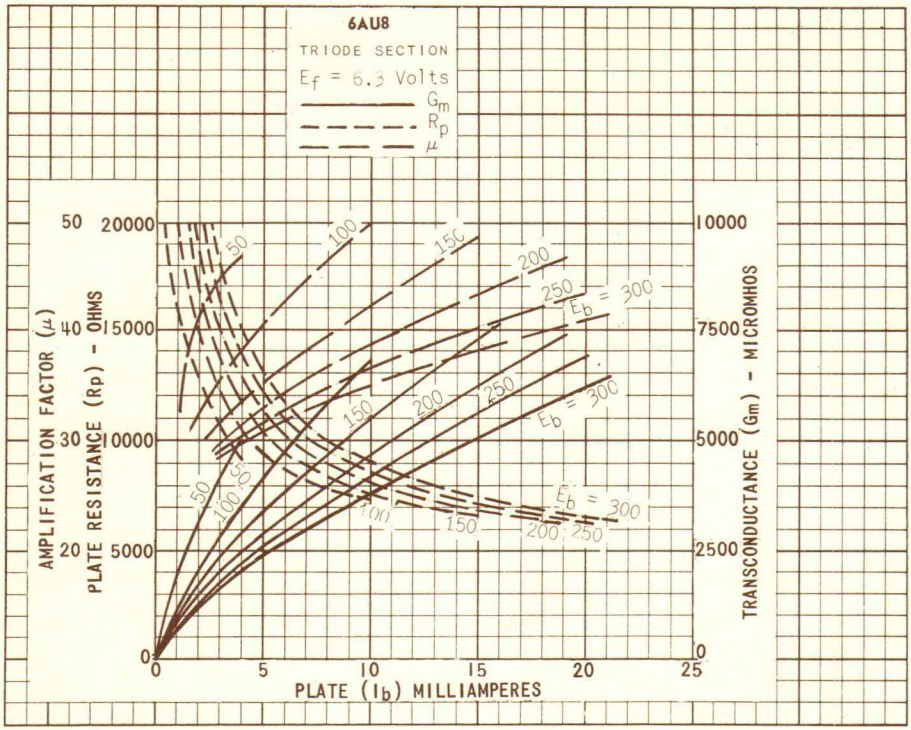
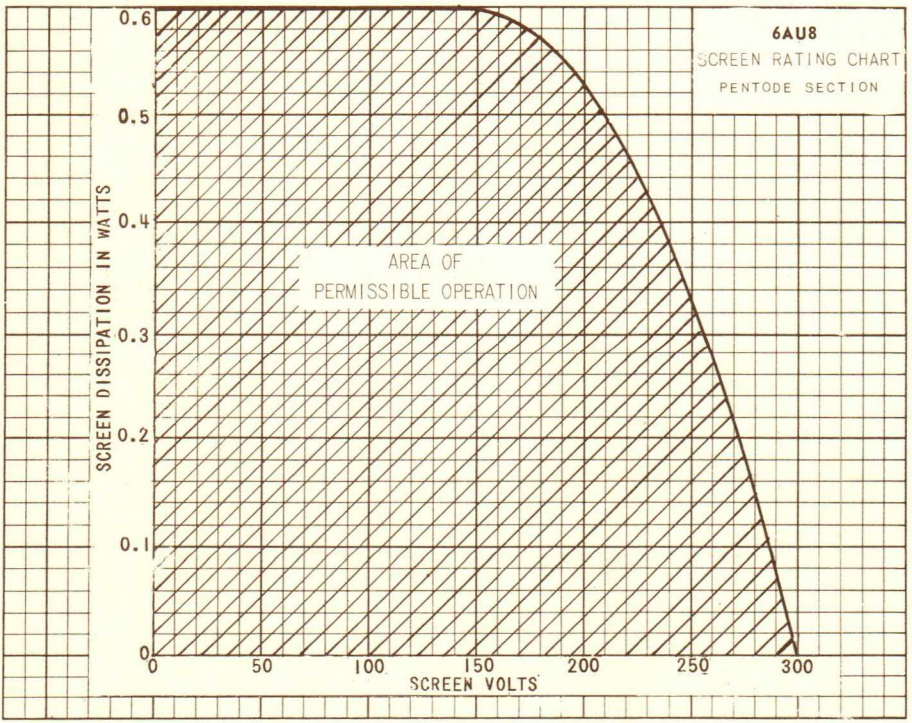
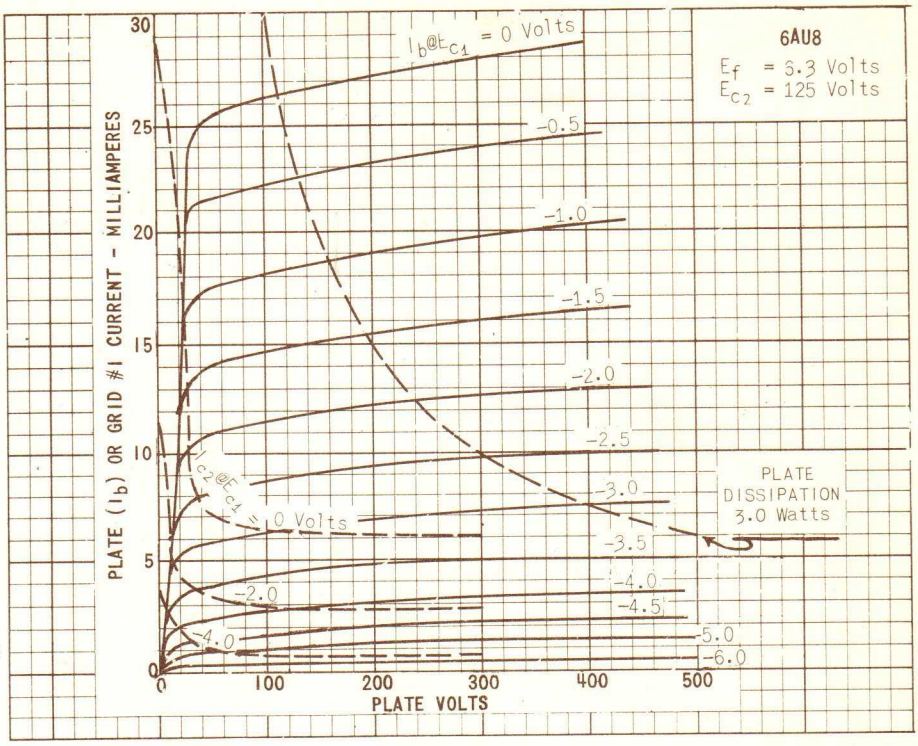
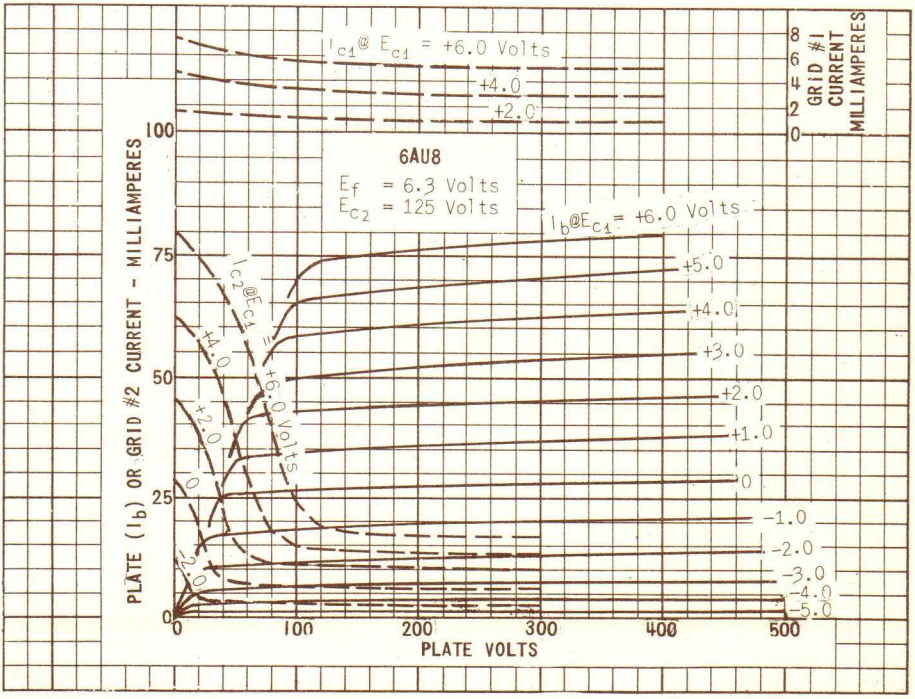

6AU8
TRIODE SECTION
E_f = 6.3 Volts
G_m
R_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (R_p) - OHMS
TRANSCONDUCTANCE (G_m) - MICROMHOS
PLATE (I_b) MILLIAMPERES
E_b = 300
50
100
150
200
250
0
5
10
15
20
25
5000
10000
20000
2500
7500


6AU8
SCREEN RATING CHART
PENTODE SECTION
AREA OF
PERMISSIBLE OPERATION
SCREEN DISSIPATION IN WATTS
SCREEN VOLTS
0
0.1
0.2
0.3
0.4
0.5
0.6
50
100
150
200
250
300





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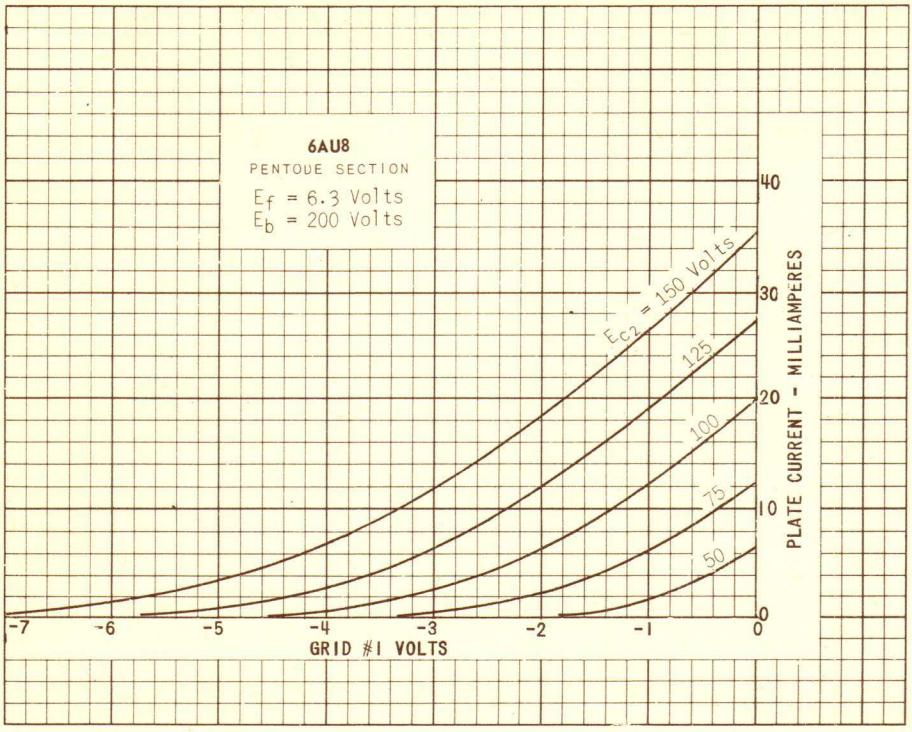
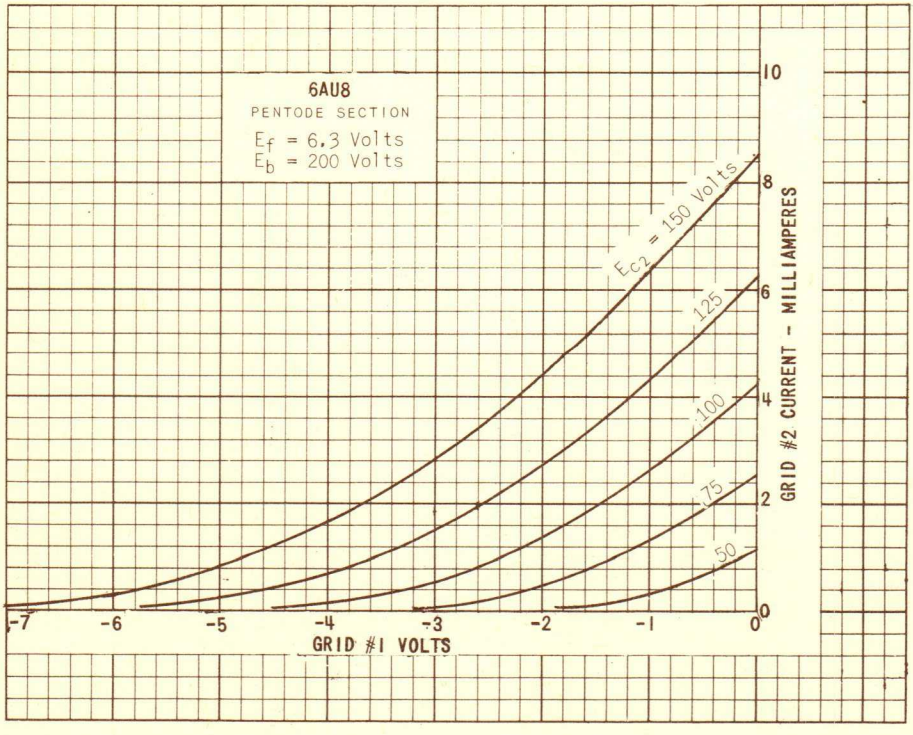
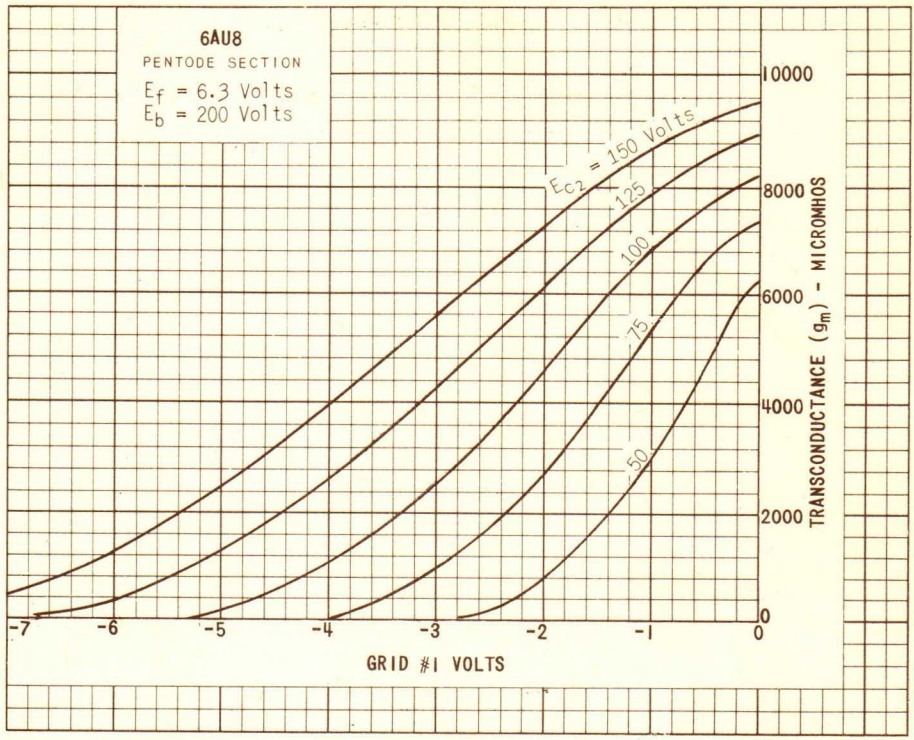
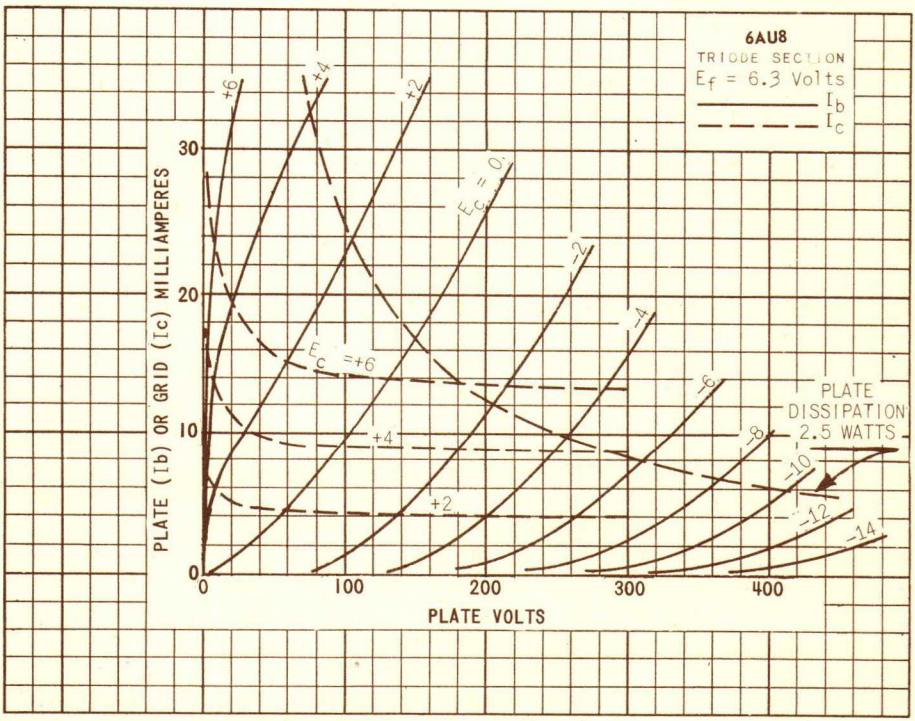

6AU8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
40
30
20
10
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
PLATE CURRENT - MILLIAMPERES


6AU8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
10
8
6
4
2
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
GRID #2 CURRENT - MILLIAMPERES





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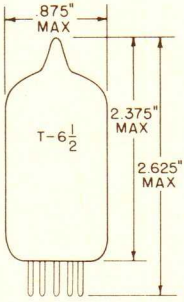
TRIODE PENTODE

MINIATURE TYPE

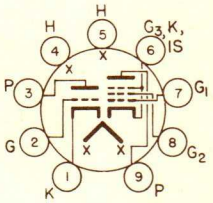


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

FOR
600 MA. SERIES HEATER OPERATED
MONOCHROME AND COLOR
TV RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9DX

THE 6AU8A IS A GENERAL-PURPOSE MINIATURE TUBE CONTAINING A SHARP CUT-OFF PENTODE AND A MEDIUM-MU TRIODE IN ONE ENVELOPE. EACH SECTION HAS ITS OWN CATHODE AND IS ELECTRICALLY INDEPENDENT. IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED MONOCHROME AND COLOR TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES THAT ARE SIMILARLY CONTROLLED. THE PENTODE SECTION IS PARTICULARLY SUITED FOR USE AS A VIDEO AMPLIFIER, VIDEO IF AMPLIFIER AND SOUND IF AMPLIFIER. THE TRIODE SECTION IS INTENDED FOR USE AS A SYNC AMPLIFIER, SEPARATOR OR CLIPPER OR AS A SWEEP OSCILLATOR.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	PENTODE SECTION	TRIODE SECTION	
GRID TO PLATE	0.06	2.2	pf
INPUT	7.5	2.6	pf
OUTPUT	3.4	0.34	pf

PENTODE GRID 2 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

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	MA.
HEATER WARM-UP TIME[A]		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	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

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→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 VOLTAGE	----	SEE RATING CHART	
GRID 2 SUPPLY VOLTAGE	----	330	VOLTS
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
PLATE DISSIPATION	2.8	3.3	WATTS
GRID 2 INPUT:			
FOR GRID 2 VOLTAGES UP TO 165 VOLTS	----	1.0	WATT
FOR GRID 2 VOLTAGES BETWEEN 165 & 330 V.	----	SEE RATING CHART	
GRID 1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS	0.5	0.25	MEGOHMS
WITH CATHODE BIAS	1.0	1.0	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

CLASS A 1 AMPLIFIER

	PENTODE SECTION	TRIODE SECTION	
PLATE VOLTAGE	200	150	VOLTS
GRID 2 VOLTAGE	125	----	VOLTS
CATHODE BIAS RESISTOR	82	150	OHMS
AMPLIFICATION FACTOR	----	40	
TRANSCONDUCTANCE	7000	4900	μMHOS
PLATE CURRENT	15	9.0	MA.
PLATE RESISTANCE (APPROX.)	150,000	8200	OHMS
GRID 2 CURRENT	3.4	----	MA.
GRID 1 VOLTAGE (APPROX.) FOR Ib =100 μAMP.	-8	-6.5	VOLTS
ZERO BIAS: *			
(WITH Eb=40 V., Ec2=125, instantaneous value)			
PLATE CURRENT	28	----	MA.
GRID 2 CURRENT	10	----	MA.

A

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

NOTE:

THE TRIODE SECTION OF THE 6AU8A MAY BE DIODE-CONNECTED AND EMPLOYED AS A HIGH-PERVEANCE DIODE IN VIDEO-DETECTOR APPLICATIONS. THE DIODE OPERATION CAN BE OBTAINED EITHER WITH THE TRIODE GRID CONNECTED TO THE TRIODE PLATE AND THE COMBINATION OPERATED AS THE PLATE OF THE DIODE, OR WITH THE TRIODE PLATE GROUNDED AND THE TRIODE GRID OPERATED AS THE PLATE OF THE DIODE.

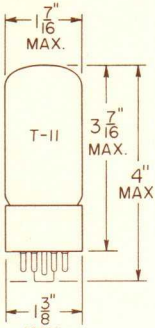
THE 6AU8 CURVES, ALSO, APPLY FOR THE 6AU8A.

→ INDICATES A CHANGE.

*INDICATES AN ADDITION.

TUNG-SOL

PENTODE



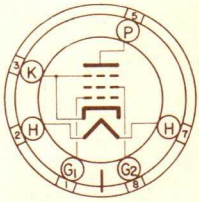
GLASS BULB

THE MAX. DIAMETER OF THE T-12 BULB IS 1 9/16"

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM SHELL
6 PIN OCTAL
6CK

THE 6AV5GA IS A BEAM PENTODE DESIGNED FOR USE AS A HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. IT USES EITHER A T-11 OR T-12 BULB.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	μμf
INPUT	14	μμf
OUTPUT	7.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HORIZONTAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
DC	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE-SUPPLY VOLTAGE (BOOST + POWER SUPPLY)	550	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAX.)	5 500[C]	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM GRID #2 VOLTAGE	175	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION[D]	11	WATTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM DC CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] UNLESS OTHERWISE SPECIFIED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME TELEVISION SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS," FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15 PERCENT OF ONE SCANNING CYCLE.

[C] THIS VALUE MUST NOT BE EXCEEDED.

[D] 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 WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATION RESISTANCE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

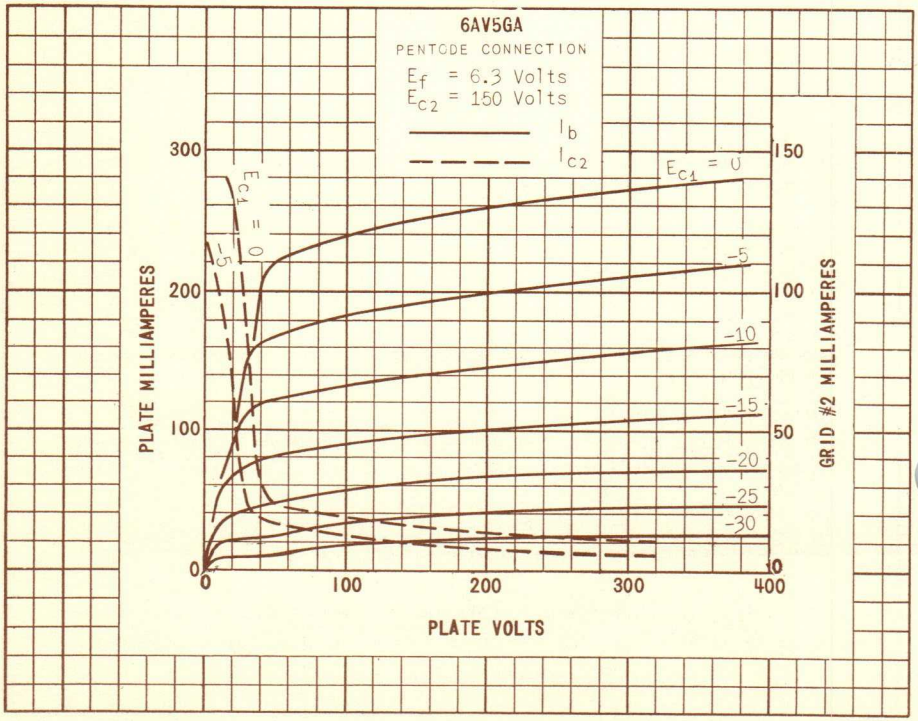
HEATER VOLTAGE		6.3		VOLTS
HEATER CURRENT		1.2		AMP.
PLATE VOLTAGE	60		250	VOLTS
GRID #2 VOLTAGE	150		150	VOLTS
GRID #1 VOLTAGE	0[E]		-22.5	VOLTS
PLATE RESISTANCE (APPROX.)	---		14 500 ←	OHMS
TRANSCONDUCTANCE	---		5 900 ←	μMHOS
PLATE CURRENT	260 ←		57 ←	MA.
GRID #2 CURRENT	26 ←		2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 1.0 MA.	---		-43 ←	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	---		4.3	

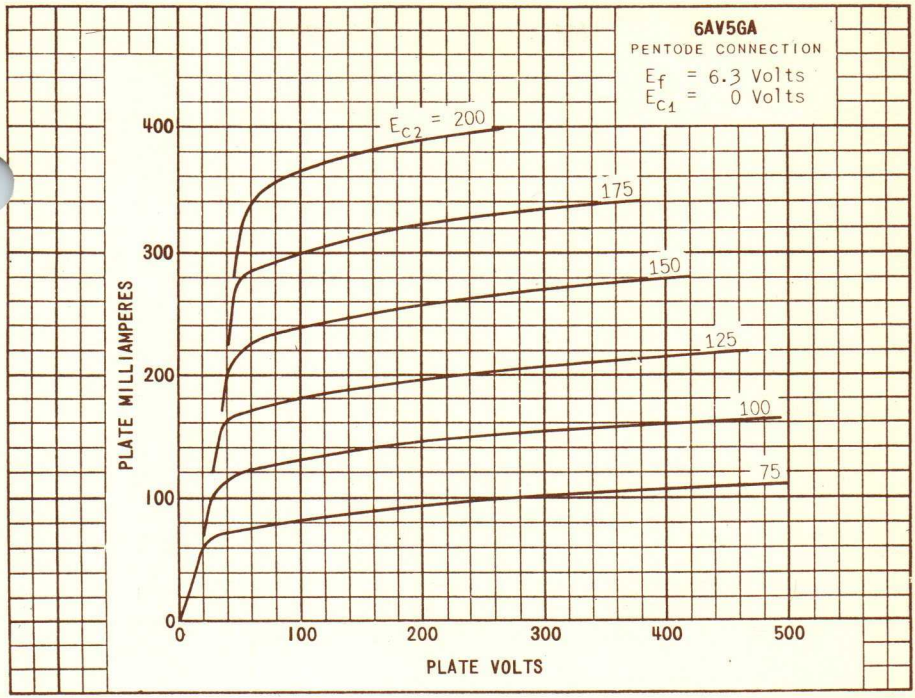
[E] APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

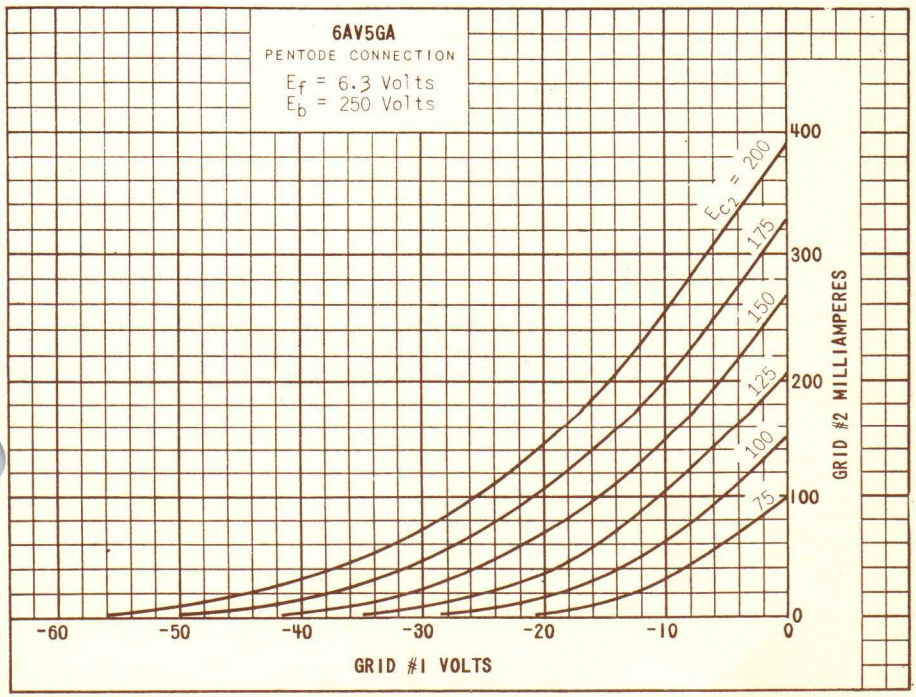
[F] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH $E_b = E_{c2} = 150$ VOLTS AND $E_{c1} = -22.5$ VOLTS

SIMILAR TYPE REFERENCE: Except for heater characteristics, the 6AV5GA is identical to the 12AV5GA, 17AV5GA & the 25AV5GA.

→ INDICATES A CHANGE.







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6AV5GA (25AV5GA)

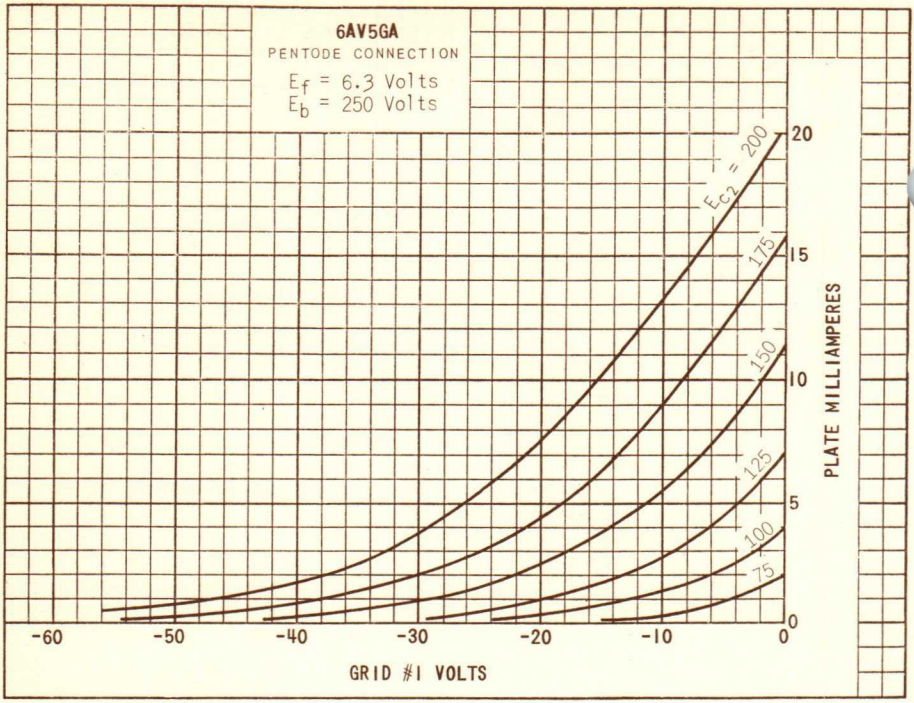
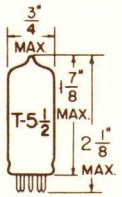


PLATE #4288 MARCH 1, 1955 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

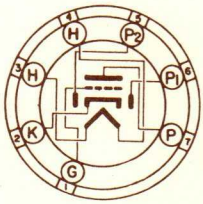
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10 VOLTS 0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7BT

THE 6AV6 COMBINES A HIGH-MU TRIODE AND TWO INDEPENDENT DIODE UNITS IN THE 7 PIN MINIATURE CONSTRUCTION. IT PERMITS A SINGLE TUBE TO FUNCTION AS DETECTOR, AVC RECTIFIER, AND AUDIO AMPLIFIER. COUPLING BETWEEN THE DIODE AND TRIODE SECTIONS IS MINIMIZED BY THE USE OF INTERNAL SHIELDING.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G TO P)	2	2	μμf
INPUT: G TO (H+K)	2.2	2.2	μμf
OUTPUT: P TO (H+K)	1.2	0.8	μμf
COUPLING: #2 DIODE PLATE TO GRID (MAX.)	0.04	0.04	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS←

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
DC COMPONENT	100	VOLTS
MAXIMUM PLATE DISSIPATION	0.55	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM DIODE CURRENT EACH UNIT FOR CONTINUOUS OPERATION	1	MA.

→INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

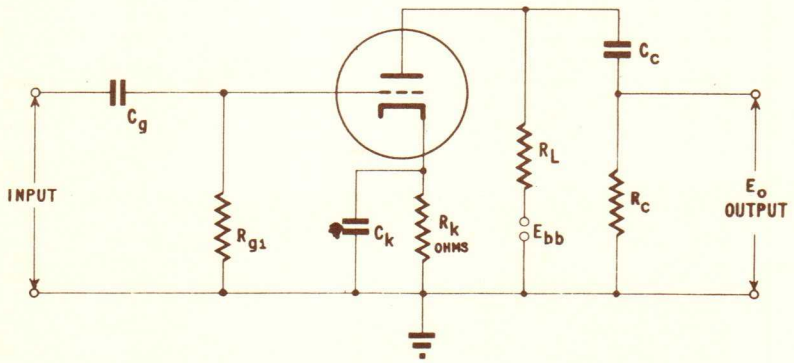
PLATE VOLTAGE	100	250	VOLTS
GRID #1 VOLTAGE	−1	−2	VOLTS
PLATE RESISTANCE	80 000	62 500	OHMS
AMPLIFICATION FACTOR	100	100	
TRANSCONDUCTANCE	1 250	1 600	µMHOS
PLATE CURRENT	0.5	1.2	MA.
AVERAGE DIODE CURRENT AT 10 VOLTS DC (EACH UNIT)	2.0	2.0	MA.

RESISTANCE COUPLED AMPLIFIER

TRIODE UNIT

PLATE SUPPLY VOLTAGE	90	250	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	220 000	470 000	OHMS
CONTROL GRID RESISTOR	10.0	10.0	MEGOHMS
INPUT CONDENSER	0.01	0.01	µf
OUTPUT CONDENSER	0.01	0.01	µf
GRID RESISTOR OF FOLLOWING STAGE	470 000	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	1 000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	5.5	30	VOLTS
VOLTAGE GAIN AT 400 CPS	42	63	

→INDICATES A CHANGE OR ADDITION.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

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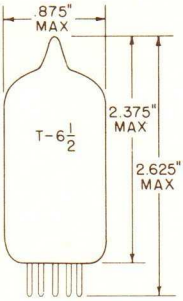
TRIODE PENTODE

MINIATURE TYPE



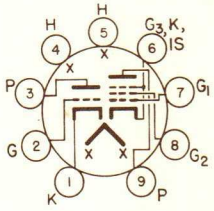
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

FOR USE AS A SYNC SEPARATOR

AND VIDEO AMPLIFIER

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9DX

THE 6AW8A IS A SHARP CUT-OFF PENTODE AND A HIGH MU TRIODE FEATURING A CONTROLLED PLATE KNEE CHARACTERISTIC FOR THE PENTODE SECTION. THE TRIODE SECTION MAY BE USED AS A SYNC SEPARATOR WHILE THE PENTODE SECTION IS DESIGNED TO SERVE AS A VIDEO AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE (PG1 TO PP) MAX.	→ 0.05	→ 0.06	pf
PENTODE INPUT: PG TO (H+PG2+PK,G3,I.S.)	10	10	pf
PENTODE OUTPUT: PP TO (H+ PG2+PK,G3,I.S.)	4.5	3.6	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)	2.2	2.2	pf
TRIODE INPUT: TG TO (H+TK=PK, PG3, I.S.)	3.4	3.2	pf
TRIODE OUTPUT: TP TO (H+TK-PK, PG3, I.S,)	3.0	1.8	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP) MAX.	.005	.008	pf
PENTODE PLATE TO TRIODE PLATE: (PP TO TP) MAX.	.025	.150	pf

[A] EXTERNAL SHIELD 315 CONNECTED TO PIN 4 AND PIN 5.

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→ INDICATES A CHANGE.

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	MA.
HEATER WARM-UP TIME [B]		11	SECONDS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION (PARALLEL HEATER OPERATION)		6.3±0.6	VOLTS
CURRENT OPERATION (SERIES HEATER OPERATION)		600±40	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

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 VOLTAGE	----	SEE J5-C4-2	
GRID 2 SUPPLY VOLTAGE	----	330	VOLTS
PLATE DISSIPATION	1.1	3.75	WATTS
GRID 2 DISSIPATION		1.1	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
GRID 1 CIRCUIT RESISTANCE			
FOR CATHODE-BIAS OPERATION	1.0	1.0	MEGOHM
FOR FIXED BIAS OPERATION	0.5	0.25	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

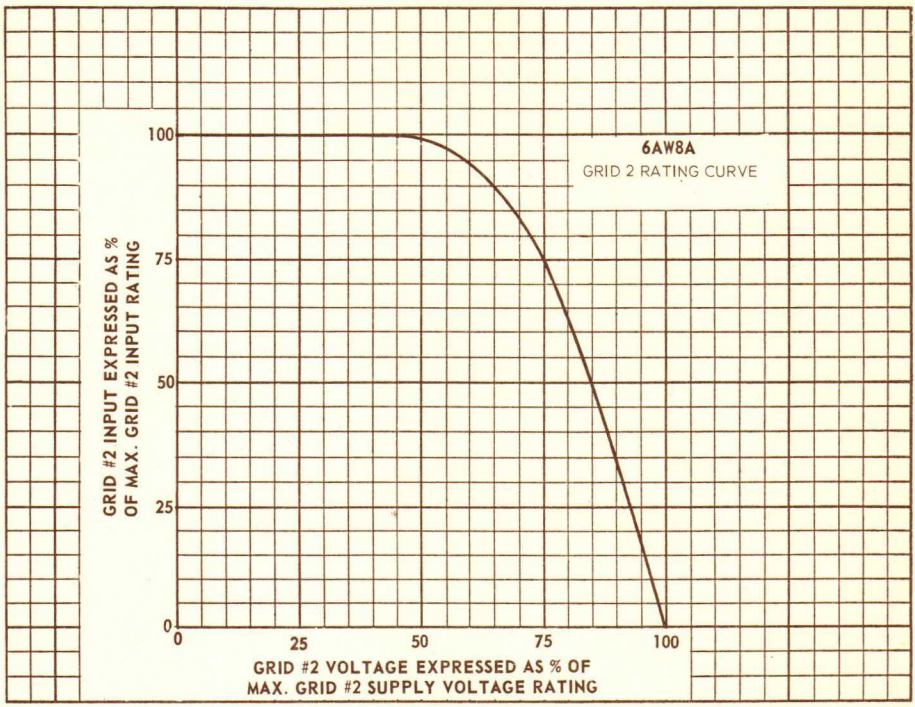
CLASS A1 AMPLIFIER

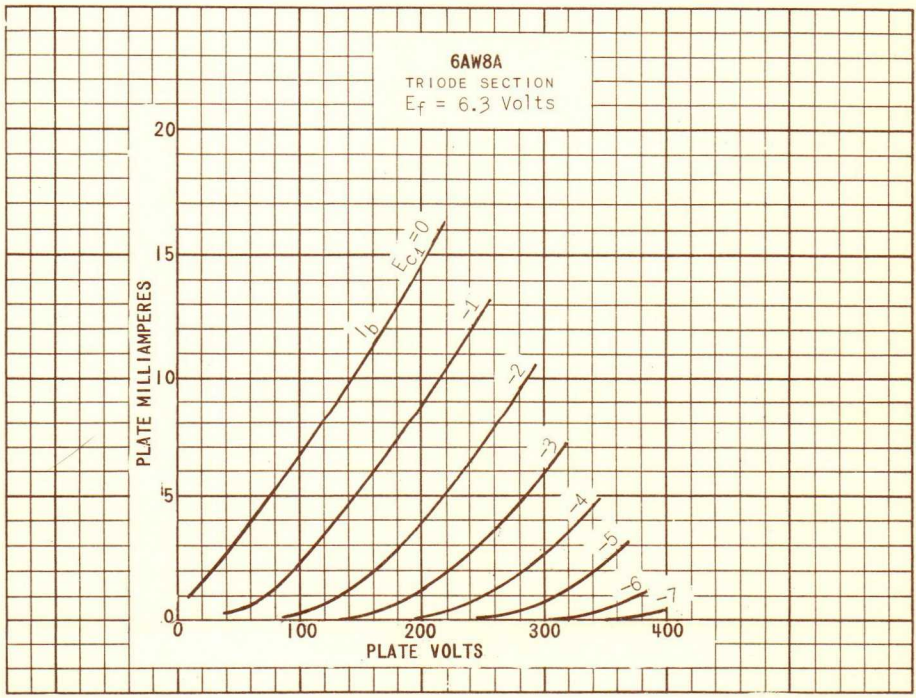
	TRIODE	PENTODE		
PLATE SUPPLY VOLTAGE	200	65	150	VOLTS
GRID 2 SUPPLY VOLTAGE		150	150	VOLTS
GRID 1 VOLTAGE	-2	0		VOLTS
CATHODE BIAS RESISTOR	----	----	150	OHMS
AMPLIFICATION FACTOR	70	----	----	
PLATE RESISTANCE (APPROX.)		----	200	KOHMS
TRANSCONDUCTANCE	4000	----	9500	μMHOS
PLATE CURRENT	4.0	46	15.0	MA.
GRID 2 CURRENT		15	3.5	MA.
GRID 1 VOLTAGE (APPROX.)				
FOR Ib = 20 μA	-5		-8	VOLTS

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SEREIS WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[C] FOR PARALLEL HEATER OPERATION, THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE HEATER VOLTAGE IS AT THE SPECIFIED BOGEY VALUE, WITH HEATER SUPPLY VARIATIONS RESTRICTED TO MAINTAIN HEATER VOLTAGE WITHIN THE SPECIFIED TOLERANCE.

FOR SERIES HEATER OPERATION, THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT HEATER CURRENT IS AT THE SPECIFIED BOGEY VALUE, WITH HEATER SUPPLY VARIATIONS RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED TOLERANCE.





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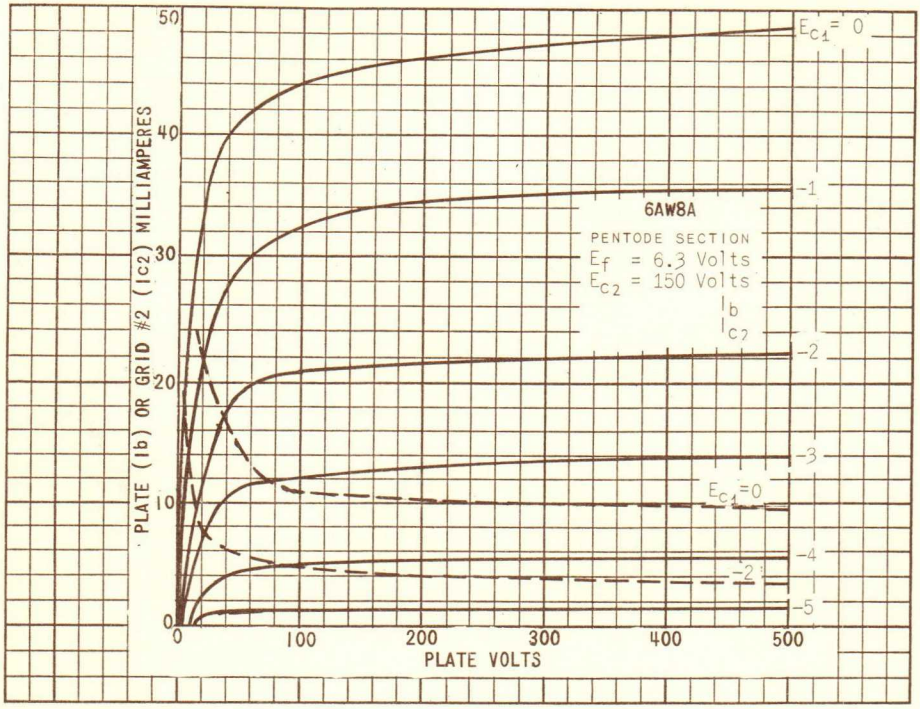
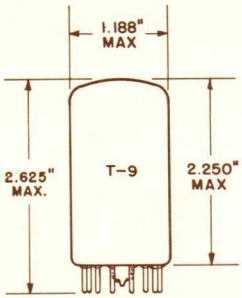

6AW8A
PENTODE SECTION
E_f = 6.3 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
E_{c1} = 0
-1
-2
-3
E_{c1}=0
-4
-2
-5
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
50
0
100
200
300
400
500

TUNG-SOL

DIODE



GLASS BULB
BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-59

COATED UNIPOTENTIAL CATHODE

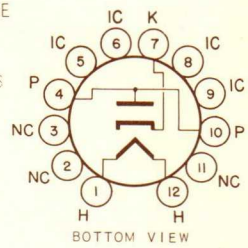
FOR

DAMPING DIODE APPLICATIONS

IN TV RECEIVERS

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12BL

THE 6AX3 IS A HEATER-CATHODE SINGLE DIODE IN THE COMPACT 12 PIN T-9 CONSTRUCTION. ITS HIGH HEATER AND CATHODE INSULATION IS DESIGNED FOR USE AS A DAMPING DIODE IN T.V. RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P+H)	7.5	pf
PLATE TO CATHODE AND HEATER: P TO (K+H	5.5	pf
HEATER TO CATHODE: (H TO K)	2.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1200	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION[A]		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC COMPONENT		900	VOLTS
TOTAL DC AND PEAK		5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		300	VOLTS

[A] THE EQUIPMENT DESIGNER SHALL DESIGN THE EQUIPMENT SO THAT THE HEATER VOLTAGE IS CENTERED AT THE SPECIFIED BOGEY VALUE, WITH HEATER SUPPLY VARIATIONS RESTRICTED TO MAINTAIN HEATER VOLTAGE WITHIN THE SPECIFIED TOLERANCE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS[B]

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

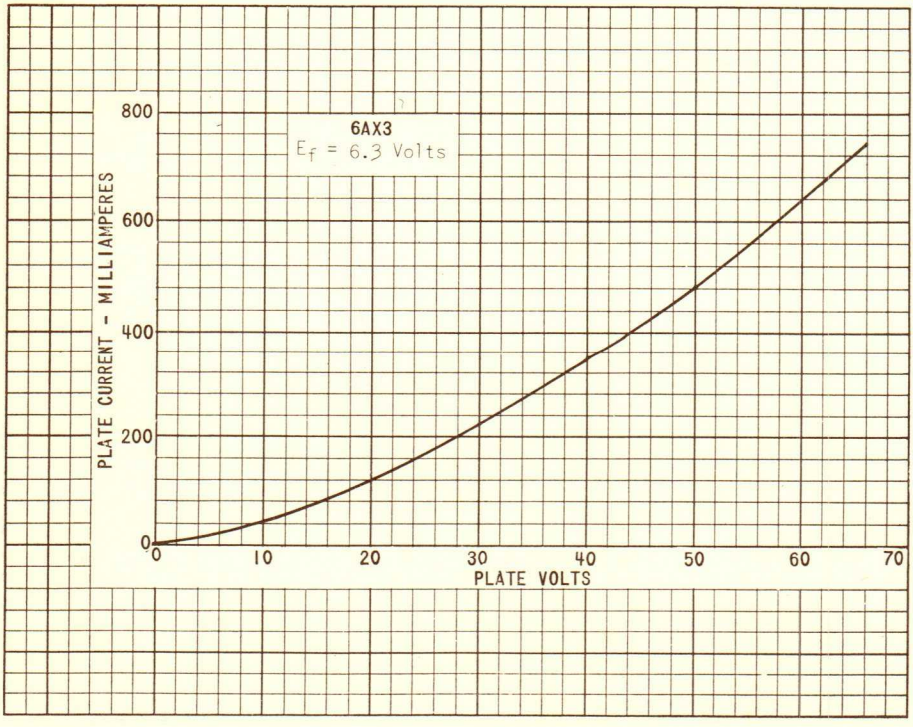
TV DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	5.3	WATTS
STEADY-STATE PEAK PLATE CURRENT	1000	MA.
DC OUTPUT	165	MA.

AVERAGE CHARACTERISTICS

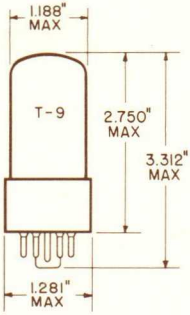
TUBE VOLTAGE DROP		
I_b = 250 MILLIAMPERES DC	32	VOLTS

[B]FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.



TUNG-SOL

DIODE



GLASS BULB

INTERMEDIATE SHELL
5 PIN OCTAL
B5-82, B5-85 OR B5-147

SHORT INTERMEDIATE SHELL
6 PIN OCTAL B6-60

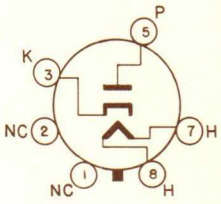
OUTLINE DRAWING
JEDEC 9-11 OR 9-41

FOR DAMPER SERVICE

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 4CG

PINS 1,2,4, & 6 SHALL NOT BE USED AS TIE POINTS.
PIN 1 IS OMITTED ON BASE B5-82, B5-85 & B5-147

THE 6AX4GT IS A SINGLE INDIRECTLY-HEATED DIODE INTENDED FOR USE IN TELEVISION HORIZONTAL FREQUENCY DAMPER SERVICE. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES OF LINE FREQUENCY BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS NORMALLY ENCOUNTERED IN 'DIRECT-DRIVE' CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.[A]

WITHOUT EXTERNAL SHIELD

HEATER TO CATHODE: H TO K	4.0	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	5.0	pf
CATHODE TO PLATE AND HEATER: K TO (P + H)	8.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	1200	MA.
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
DC			900	VOLTS
TOTAL DC AND PEAK			4400	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC			100	VOLTS
TOTAL DC AND PEAK			300	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	DAMPER SERVICE[B]	
PEAK INVERSE PLATE VOLTAGE	4400	VOLTS
DC PLATE CURRENT	→ 137	MA.
PEAK PLATE CURRENT	→ 825	MA.
PLATE DISSIPATION	→ 5.0	WATTS

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP WITH TUBE CONDUCTING 250 MA	32	VOLTS

A

FOR THE MEASUREMENT OF PLATE TO CATHODE PLUS HEATER AND CATHODE TO PLATE PLUS HEATER CAPACITIES, UNUSED PINS, METAL PARTS, ETC. SHALL BE CONNECTED TO THE HEATER.

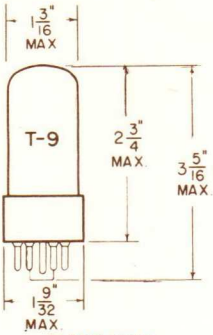
B

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 HORIZONTAL VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE. POWER RECTIFIER OPERATION IS NOT RECOMMENDED.

→ INDICATES A CHANGE.

TUNG-SOL

DIODE



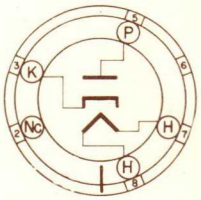
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE-SHELL
5 PIN OCTAL
4CG

THE 6AX4GTA IS A HEATER-CATHODE-TYPE SINGLE DIODE INTENDED FOR USE AS THE DAMPING DIODE IN THE HORIZONTAL-DEFLECTION CIRCUIT OF TELEVISION RECEIVERS. IT IS PARTICULARLY USEFUL IN AUTOTRANSFORMER DEFLECTION SYSTEMS IN WHICH HIGH PULSE VOLTAGES ARE APPLIED TO THE CATHODE OF THE DAMPER TUBE.

EXCEPT FOR HEATER RATINGS, THE 6AX4GTA IS IDENTICAL TO THE 12AX4GTB AND IS UNILATERALLY INTERCHANGEABLE WITH THE 6AX4GT.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER	8.5	μμf
PLATE TO CATHODE AND HEATER	5.0	μμf
HEATER TO CATHODE	4.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

TV DAMPER SERVICE

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	4400	VOLTS
MAXIMUM PLATE DISSIPATION	5.3	WATTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	1000	MA.
MAXIMUM DC OUTPUT CURRENT	165	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC COMPONENT	900	VOLTS
TOTAL DC AND PEAK	4400	VOLTS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

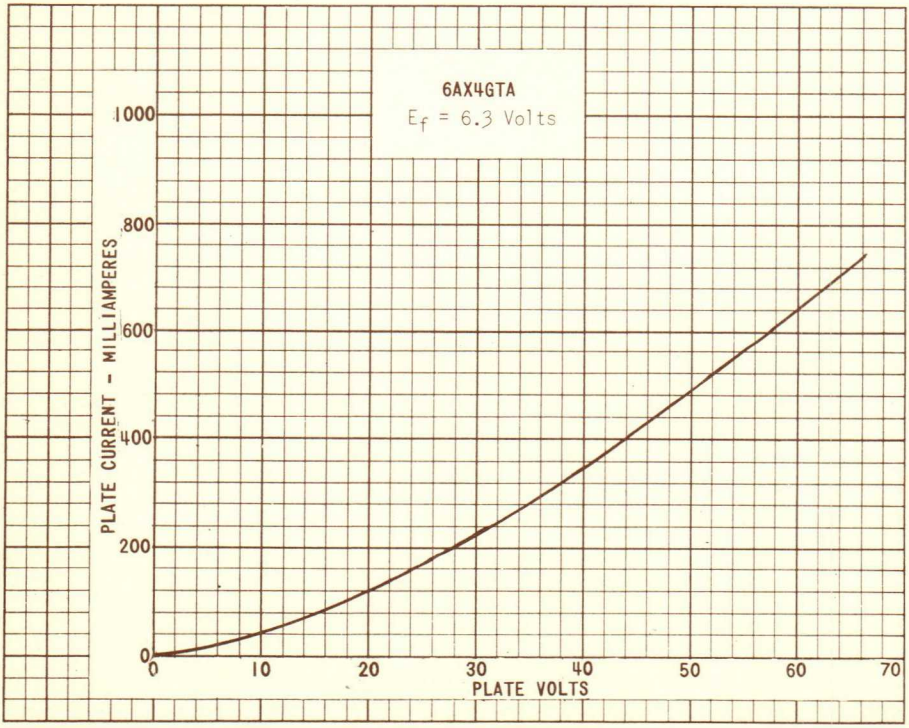
HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	1.2	AMP.
TUBE VOLTAGE DROP I_b=250 MA. DC	32	VOLTS

NOTE:

OPERATION OF THIS TUBE AS A POWER RECTIFIER IS NOT RECOMMENDED.

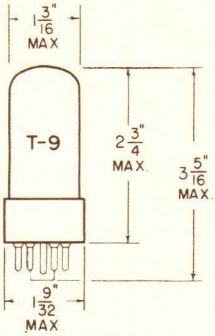
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.



TUNG-SOL

DIODE



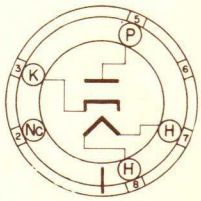
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

1 6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE-SHELL
5 PIN OCTAL

4CG

THE 6AX4GTB IS A SINGLE HEATER-CATHODE TYPE DIODE INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL-DEFLECTION CIRCUIT OF TELEVISION RECEIVERS. IT WAS DESIGNED TO WITHSTAND HIGH PULSE VOLTAGES BETWEEN THE PLATE AND CATHODE WHICH MAKES THE TUBE PARTICULARLY USEFUL IN AUTOTRANSFORMER DEFLECTION SYSTEMS IN WHICH HIGH PULSE VOLTAGES ARE APPLIED TO THE CATHODE OF THE DAMPER TUBE.

THE 6AX4GTB IS UNILATERALLY INTERCHANGEABLE WITH THE 6AX4GT AND 6AX4GTA; HOWEVER, IT DIFFERS FROM THE 6AX4GTA IN HAVING A HIGHER PEAK INVERSE PLATE VOLTAGE RATING.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER	8.5	μμf
PLATE TO CATHODE AND HEATER	5.0	μμf
HEATER TO CATHODE	4.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

TV DAMPER SERVICE

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
MAXIMUM PLATE DISSIPATION	5.3	WATTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	1000	MA.
MAXIMUM DC OUTPUT CURRENT	165	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC COMPONENT	900	VOLTS
TOTAL DC AND PEAK	5000	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
TUBE VOLTAGE DROP I_b=250 MA. DC	32	VOLTS

NOTE:

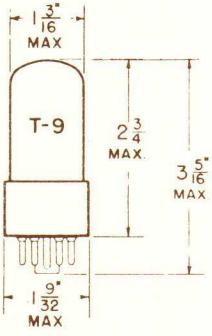
OPERATION OF THIS TUBE AS A POWER RECTIFIER IS NOT RECOMMENDED.

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

DOUBLE DIODE



GLASS BULB

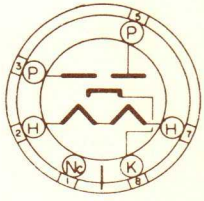
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 1.2 AMP.

AC

ANY MOUNTING POSITION



BOTTOM VIEW

SHORT INTERMEDIATE SHELL 6 PIN OCTAL

6S

THE 6AX5GT IS A FULL-WAVE RECTIFIER OF THE HEATER-CATHODE TYPE INTENDED FOR USE IN AC OPERATED AND AUTOMOBILE RECEIVERS. BECAUSE OF ITS HEATER-CATHODE CONSTRUCTION IT HAS THE SAME HEATING TIME AS THAT OF OTHER HEATER-CATHODE TYPES IN THE RECEIVER. USE OF THIS TUBE PREVENTS EXCESSIVE VOLTAGES FROM APPEARING ACROSS FILTER CONDENSERS DURING WARM-UP PERIOD.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	450	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1250	VOLTS
MAXIMUM PEAK PLATE CURRENT EACH PLATE	375	MA.
MAXIMUM HOT-SWITCHING TRANSIENT PLATE CURRENT[A]	2.6	AMP.
MAXIMUM AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)		SEE RATING CHART
MAXIMUM DC OUTPUT CURRENT EACH PLATE (RMS)		SEE RATING CHART

[A] FOR DURATION OF 0.2 SECOND MAX.

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PLATE 2721

SEPT. 1 1951

→ INDICATES A CHANGE OR ADDITION.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	AMP.
AC PLATE VOLTAGE EACH PLATE (RMS)	350	450	VOLTS
FILTER INPUT CONDENSER[B]	10	10	µf
EFFECTIVE PLATE SUPPLY IMPEDANCE EACH PLATE	50	105	OHMS
DC OUTPUT VOLTAGE AT INPUT TO FILTER (APPROX.):			
AT 62.5 MA. (HALF LOAD)	395	---	VOLTS
AT 40 MA. (HALF LOAD)	---	540	VOLTS
AT 125 MA. (FULL LOAD)	350	---	VOLTS
AT 80 MA. (FULL LOAD)	---	490	VOLTS
VOLTAGE REGULATION (APPROX.):			
HALF-LOAD TO FULL-LOAD CURRENT	45	50	VOLTS

[B] HIGHER VALUES OF CAPACITANCE THAN INDICATED MAY BE USED BUT THE EFFECTIVE PLATE SUPPLY IMPEDANCE MAY HAVE TO BE INCREASED TO PREVENT EXCEEDING THE MAXIMUM RATING FOR HOT-SWITCHING TRANSIENT PLATE CURRENT.

FULL-WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	AMP.
AC PLATE VOLTAGE EACH PLATE (RMS)	350	450	VOLTS
FILTER INPUT CHOKE	10	10	HENRIES
DC OUTPUT VOLTAGE AT INPUT TO FILTER (APPROX.):			
AT 75 MA. (HALF LOAD)	270	---	VOLTS
AT 62.5 MA. (HALF LOAD)	---	365	VOLTS
AT 150 MA. (FULL LOAD)	250	---	VOLTS
AT 125 MA. (FULL LOAD)	---	350	VOLTS
VOLTAGE REGULATION (APPROX.):			
HALF-LOAD TO FULL-LOAD CURRENT	20	15	VOLTS

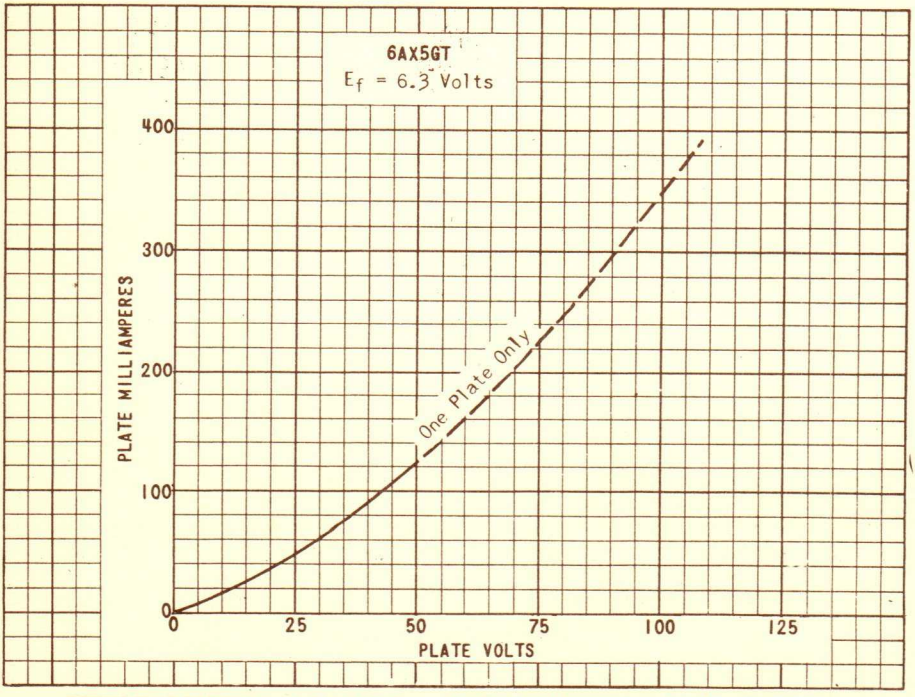

PLATE 2722
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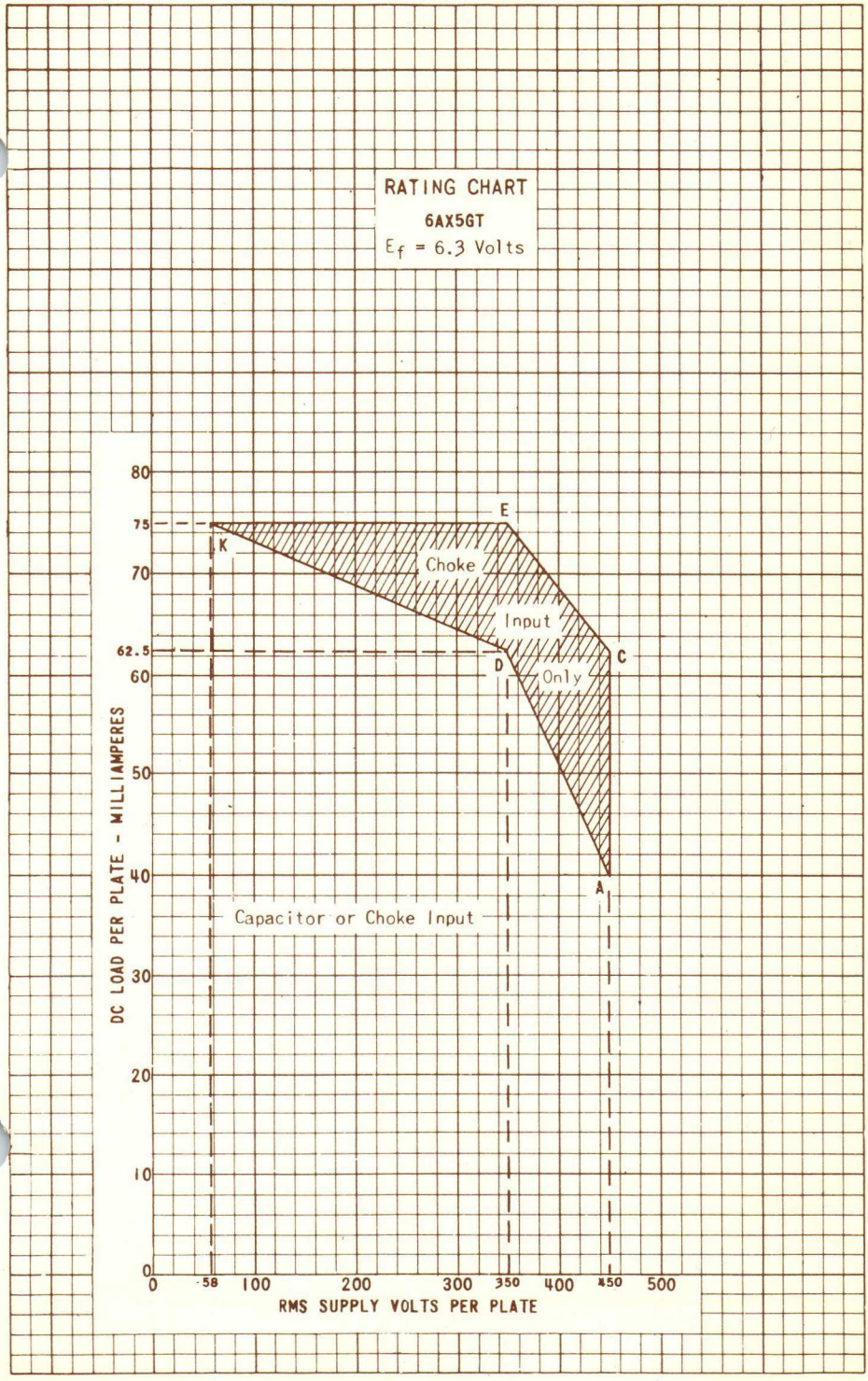

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PLATE
2379
APR. 1
1950

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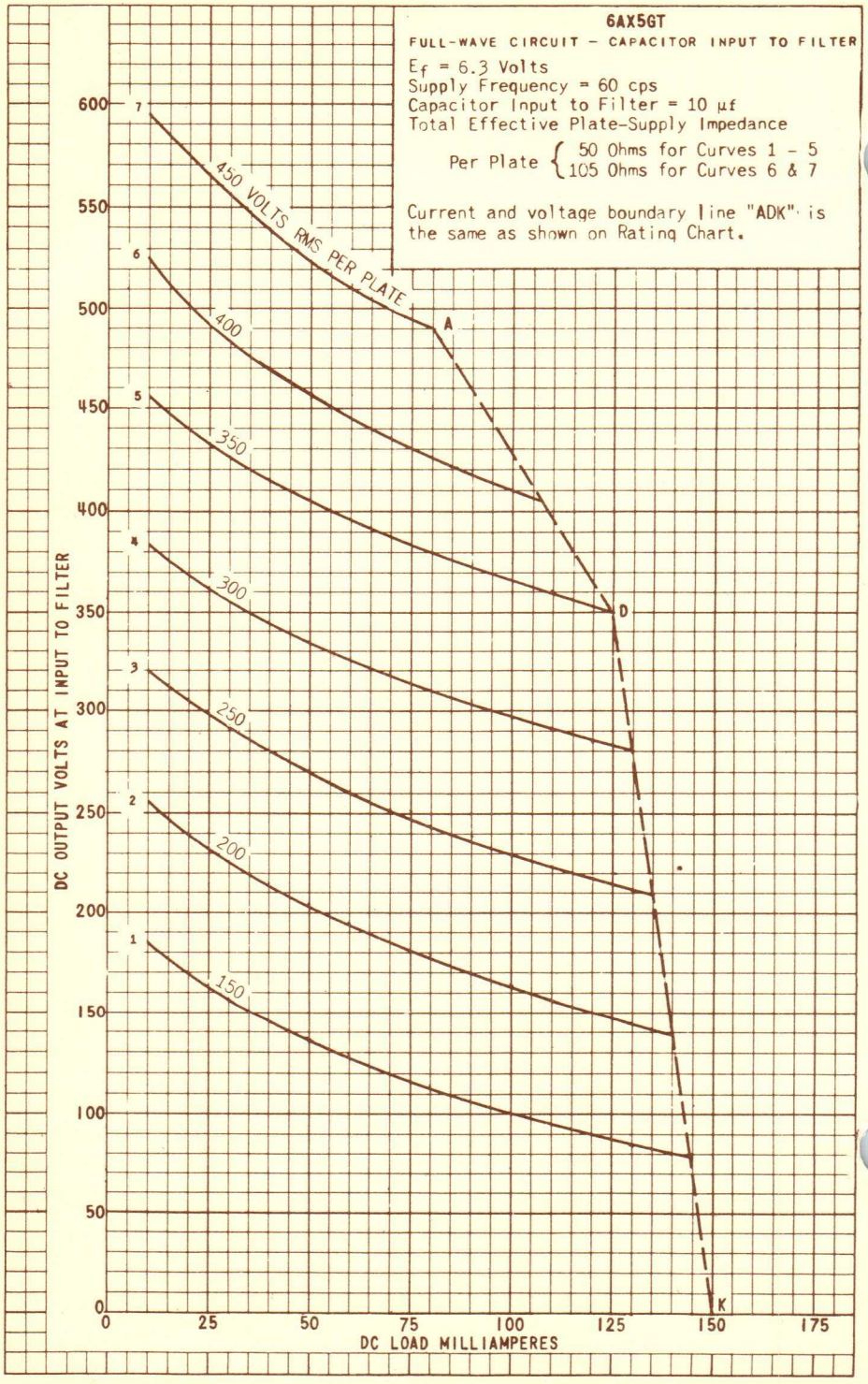
6AX5GT



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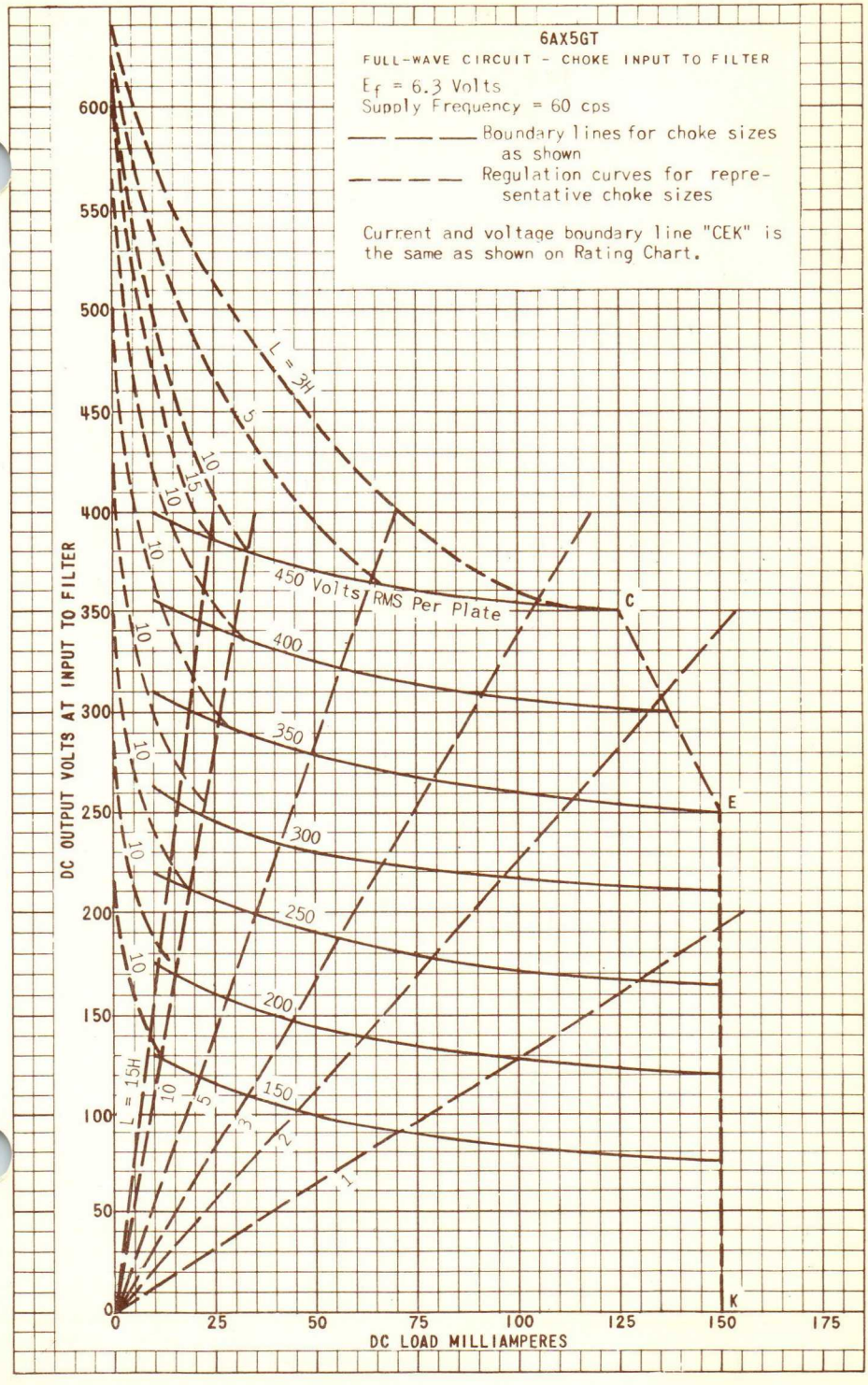

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PLATE 2381
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TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

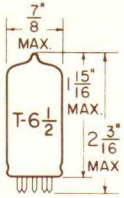
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES	PARALLEL
6.3 VOLTS	3.15 VOLTS
0.3 AMP.	0.6 AMP.

AC OR DC

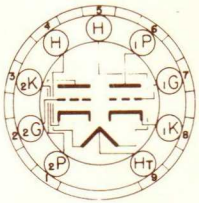
ANY MOUNTING POSITION



GLASS BULB

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #9 AND PINS #4 AND #5 CONNECTED TOGETHER.

CONTROL OF HEATER CHARACTERISTICS APPLIES ONLY TO 600 MA. HEATER CONNECTION.



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE

9A

THE 6AX7 COMBINES TWO COMPLETELY INDEPENDENT HIGH-MU TRIODES IN THE SMALL 9 PIN BUTTON CONSTRUCTION AND IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT IS ADAPTABLE TO APPLICATIONS WHERE HIGH VOLTAGE GAIN AND LOW HEATER POWER ARE THE IMPORTANT CONSIDERATION, SUCH AS VOLTAGE AMPLIFIERS; PHASE INVERTERS AND MULTIVIBRATORS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 12AX7.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE	1.7	1.7	μμf
INPUT	1.8	1.6	μμf
OUTPUT (SECTION 1)	1.9	0.46	μμf
OUTPUT (SECTION 2)	1.9	0.34	μμf

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF SECTION UNDER TEST.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH TRIODE UNIT

	3.15	6.3	
HEATER VOLTAGE			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
MAXIMUM PLATE VOLTAGE		300	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE		50	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE		0	VOLTS
MAXIMUM PLATE DISSIPATION		1	WATT
HEATER WARM-UP TIME (APPROX.)*		11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

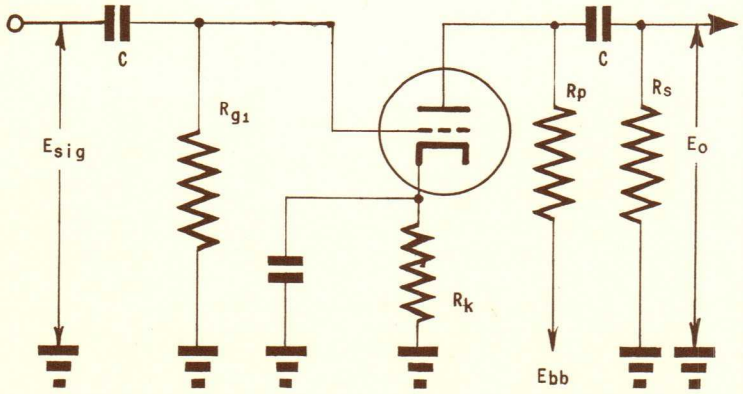
CLASS A_1 AMPLIFIER – EACH SECTION

HEATER VOLTAGE (PARALLEL CONNECTION)	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	−1	−2	VOLTS
AMPLIFICATION FACTOR	100	100	
PLATE RESISTANCE	80 000	62 500	OHMS
TRANSCONDUCTANCE	1 250	1 600	μMHOS
PLATE CURRENT	0.5	1.2	MA.

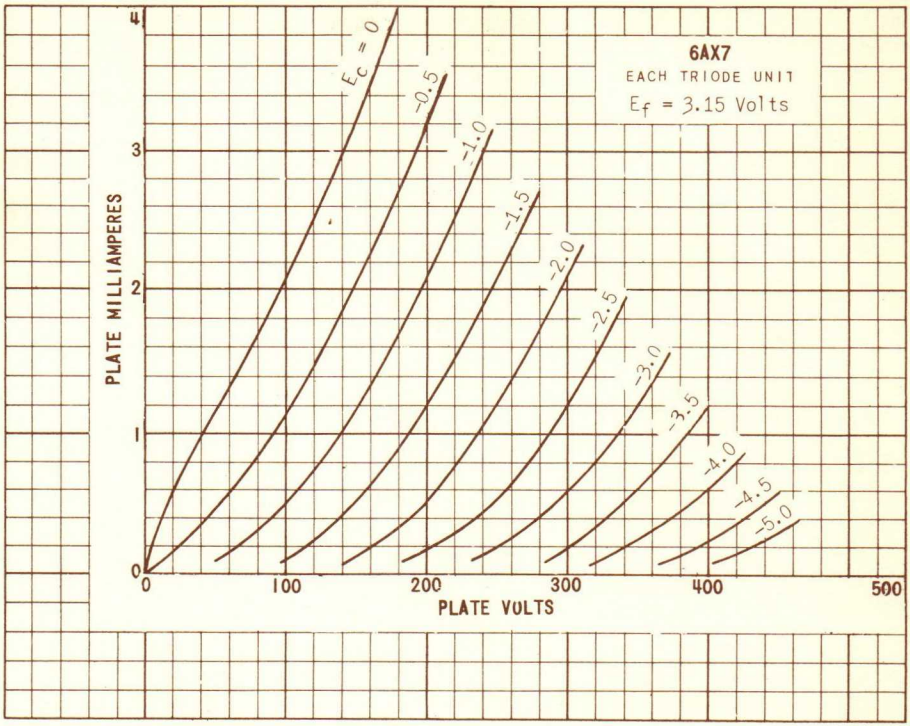
RESISTANCE COUPLED AMPLIFIER

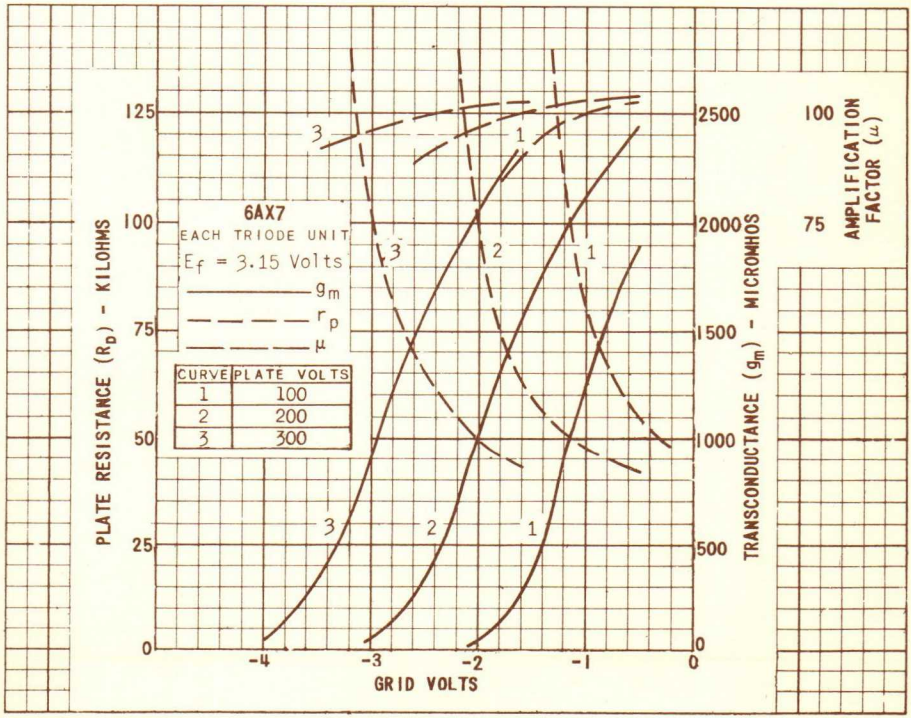
R_p MEG.	R_S MEG.	R_{g1} MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	0.10	0.1	1700	31	5.0	1000	40	15	760	43	30
0.10	0.24	0.1	2000	38	6.9	1100	46	20	900	50	40
0.24	0.24	0.1	3500	43	6.5	2000	54	18	1600	58	37
0.24	0.51	0.1	3900	49	8.6	2300	59	24	1800	64	47
0.51	0.51	0.1	7100	50	7.4	4300	62	19	3100	66	39
0.51	1.0	0.1	7800	53	9.1	4800	64	24	3600	69	46
0.24	0.24	10	0	37	3.9	0	53	15	0	62	32
0.24	0.51	10	0	44	5.4	0	60	19	0	67	41
0.51	.0.51	10	0	44	5.0	0	61	17	0	69	35
0.51	1.0	10	0	49	6.4	0	66	21	0	71	41

E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT TOTAL HARMONIC DISTORTION.
GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.
FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.



NOTE: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. Rk SHOULD BE ADEQUATELY BY-PASSED.





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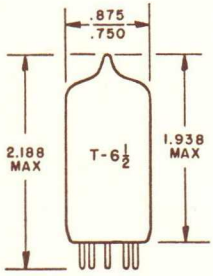
TRIODE – PENTODE

MINIATURE – TYPE

OUTLINE DRAWING
JEDEC 6-2



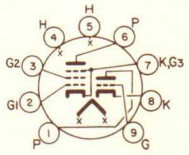
BUTTON BASE
9 PIN JEDEC E9-1

FOR
VIDEO AMPLIFIER
AND
SYNC SEPARATOR USE
IN TV APPLICATIONS

COATED UNIPOTENTIAL CATHODES

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9AE



BOTTOM VIEW

THE 6AX8 IS A TRIODE AND PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS SPECIFICALLY DESIGNED FOR VIDEO AMPLIFIER AND SYNC SEPARATOR SERVICE IN T.V. RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF UNIT UNDER TEST

TRIODE UNIT:			
GRID TO PLATE		1.8	pf
GRID TO CATHODE AND HEATER		2.5	pf
PLATE TO CATHODE AND HEATER		1	pf
PENTODE UNIT:			
GRID 1 TO PLATE	MAX.	0.006	pf
GRID 1 TO CATHODE & GRID 3 & INTERNAL SHIELD, GRID 2, AND HEATER		5	pf
PLATE TO CATHODE & GRID 3 & INTERNAL SHIELD, GRID 2, AND HEATER		3.5	pf
HEATER TO CATHODE – EACH UNIT		3.5 ×	pf

X - EXTERNAL SHIELD #315 CONNECTED TO GROUND

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	mA
PEAK HEATER – CATHODE VOLTAGE: EACH UNIT			
HEATER NEGATIVE WITH RESPECT TO CATHODE		90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		90	VOLTS

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MAXIMUM RATINGS

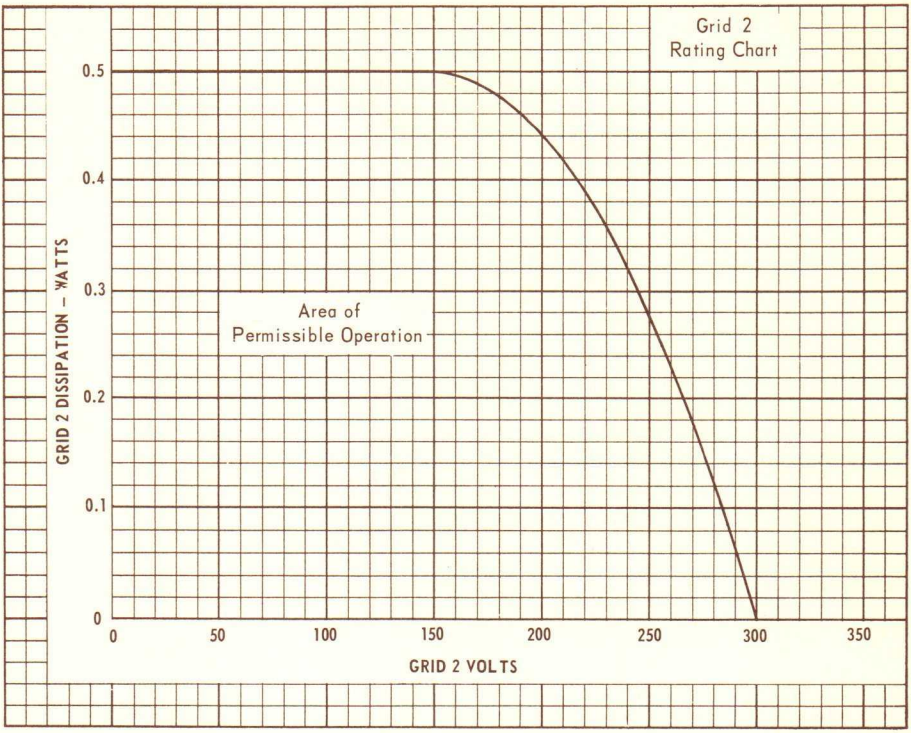
DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

	TRIODE UNIT	PENTODE UNIT	
PLATE VOLTAGE	300	300	VOLTS
GRID 2 SUPPLY VOLTAGE	–	300	VOLTS
GRID 2 VOLTAGE	–	SEE RATING CHART	
GRID 1 VOLTAGE – POSITIVE – BIAS VALUE	0	0	VOLTS
GRID 2 DISSIPATION:			
FOR GRID 2 VOLTAGES UP TO 150 VOLTS	–	0.5	WATT
FOR GRID 2 VOLTAGES BETWEEN 150 AND 300 VOLTS	–	SEE RATING CHART	
PLATE DISSIPATION	2.7	2.8	WATTS
GRID 1 CIRCUIT RESISTANCE:			
FOR FIXED – BIAS OPERATION	0.1	0.1	MEGOHM
FOR CATHODE – BIAS OPERATION	0.5	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
PLATE SUPPLY VOLTAGE	150	250	VOLTS
GRID 2 SUPPLY VOLTAGE	–	110	VOLTS
CATHODE RESISTOR	56	120	OHMS
PLATE CURRENT	18	10	mA
GRID 2 CURRENT	–	3.5	mA
TRANSCONDUCTANCE	8,500	4,800	μMHOS
AMPLIFICATION FACTOR	40	–	
PLATE RESISTANCE – APPROX.	0.005	0.4	MEGOHM
GRID 1 VOLTAGE (APPROX.) FOR $I_b = 10\mu A$	–12	–12	VOLTS



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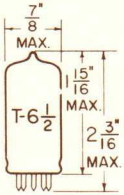
TRIODE PENTODE



GLASS BULB

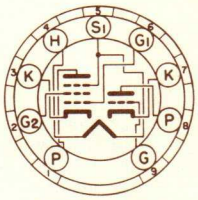
UNIPOTENTIAL CATHODES

HEATER

6.3 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON NOVAL
9 PIN BASE

9ED

THE 6AZ8 IS A MEDIUM MU TRIODE AND A SEMI-REMOTE CUTOFF PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR GENERAL PURPOSE APPLICATIONS IN BOTH MONOCHROME AND COLOR TELEVISION RECEIVERS. THE PENTODE UNIT HAS HIGH TRANSCONDUCTANCE AND A SEMI REMOTE CUTOFF CHARACTERISTIC WHICH MINIMIZES CROSS-MODULATION EFFECTS AND OVERLOAD DISTORTION IN PICTURE IF STAGES. IT MAY BE USED AS AN INTERMEDIATE FREQUENCY AMPLIFIER, VIDEO AMPLIFIER, AGC AMPLIFIER, AND AS A REACTANCE TUBE. THE TRIODE UNIT, WHICH HAS A RELATIVELY HIGH ZERO-BIAS PLATE CURRENT, IS WELL SUITED FOR USE IN LOW-FREQUENCY OSCILLATOR SYNC-SEPARATOR, SYNC-CLIPPER, AND PHASE SPLITTER CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE UNIT:		
GRID TO PLATE	1.7	μμf
GRID TO HEATER & INTERNAL SHIELD, & CATHODE	2	μμf
PLATE TO HEATER & INTERNAL SHIELD, & CATHODE	1.7	μμf
PENTODE UNIT:		
GRID #1 TO PLATE (MAX.)	0.02	μμf
GRID #1 TO HEATER & INTERNAL SHIELD & GRID #3, GRID #2, AND CATHODE	6.5	μμf
PLATE TO HEATER & INTERNAL SHIELD & GRID #3, GRID #2, AND CATHODE	2.2	μμf
TRIODE GRID TO PENTODE PLATE (MAX.)	0.027	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	0.020	μμf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.045	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	300	VOLTS
MAXIMUM GRID #2 (SCREEN) VOLTAGE	---	SEE RATING CHART	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE: POSITIVE BIAS VALUE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.6 ←	2	WATTS

→ INDICATES A CHANGE.

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
MAXIMUM GRID #2 INPUT:			
FOR GRID #2 VOLTAGES UP TO 150 VOLTS	---	0.5	WATT
FOR GRID #2 VOLTAGES BETWEEN 150 & 300 VOLTS	---	SEE RATING CHART	
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	A	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[B]	A	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

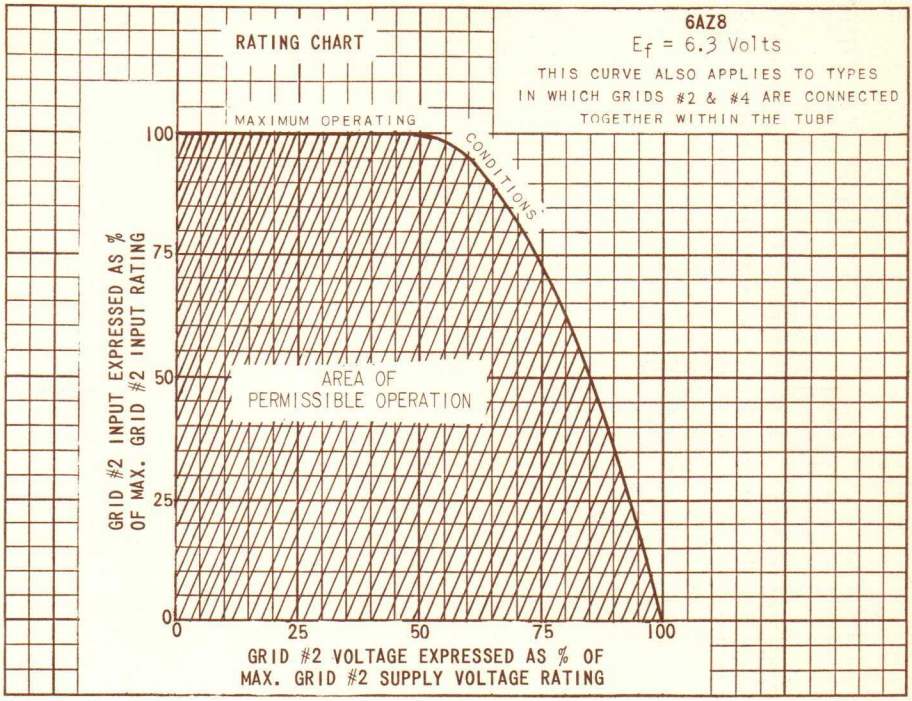
CLASS A_1 AMPLIFIER

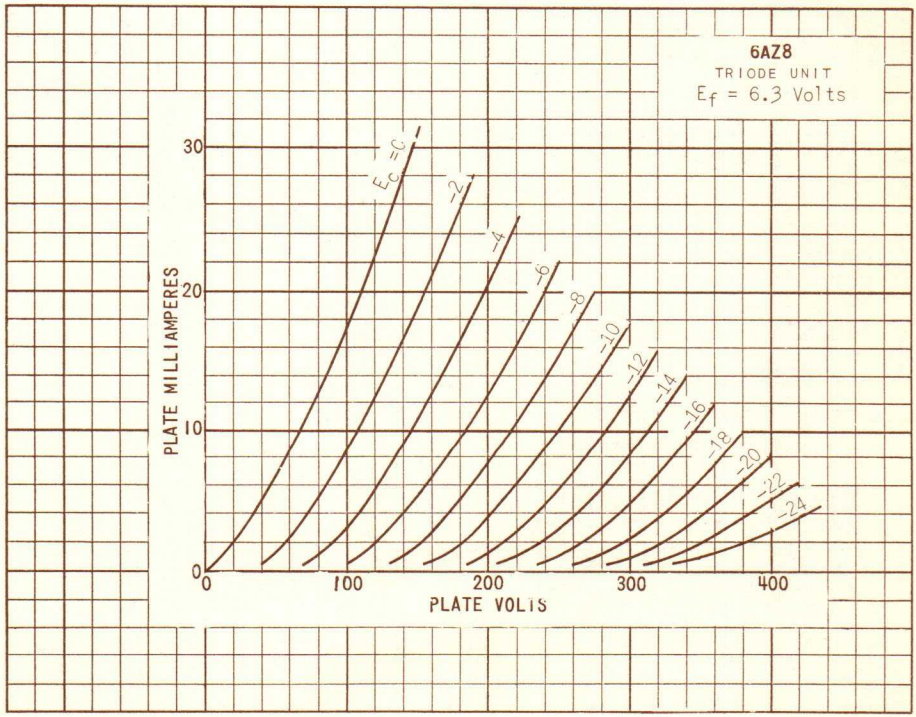
	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.45		AMP..
PLATE SUPPLY VOLTAGE	200	200	VOLTS
GRID #2 SUPPLY VOLTAGE	---	150	VOLTS
GRID #1 VOLTAGE	-6	---	VOLTS
CATHODE-BIAS RESISTOR	---	180	OHMS
AMPLIFICATION FACTOR	19	---	
PLATE RESISTANCE (APPROX.)	5 750	300 000	OHMS
TRANSCONDUCTANCE	3 300	6 000	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-19	---	VOLTS
GRID #1 VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE OF 100 μMHOS	---	-12.5	VOLTS
PLATE CURRENT	13	9.5	MA.
GRID #2 CURRENT	---	3	MA.
GRID #1 CIRCUIT RESISTANCE (MAX.)[C]			
FOR CATHODE-BIAS OPERATION	1.0	1.0	MEGOHM
FOR FIXED-BIAS OPERATION	0.5	0.25	MEGOHM

[A] THE HEATER-CATHODE VOLTAGE SHOULD NOT EXCEED THE VALUE OF THE OPERATING CATHODE BIAS BECAUSE THE VOLTAGE BETWEEN THE HEATER AND CATHODE IS ALSO APPLIED BETWEEN THE CATHODE AND GRID #3. THE NET RESULT IS TO MAKE GRID #3 NEGATIVE WITH RESPECT TO CATHODE WITH POSSIBLE CHANGE IN TUBE CHARACTERISTICS.

[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[C] IF EITHER UNIT IS OPERATED AT MAXIMUM RATED CONDITIONS, GRID #1 CIRCUIT RESISTANCES FOR BOTH UNITS SHOULD NOT EXCEED THE STATED VALUES.





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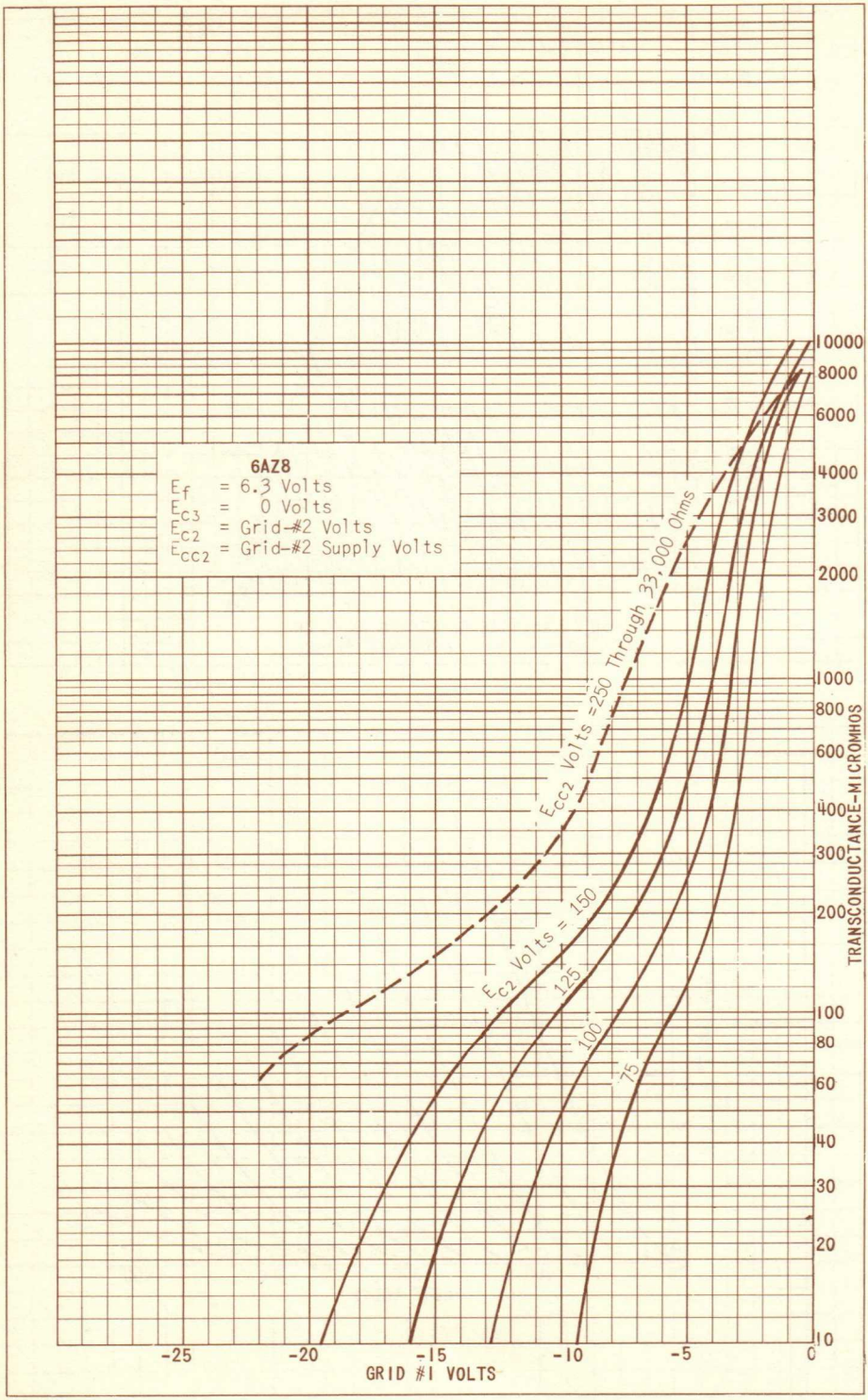
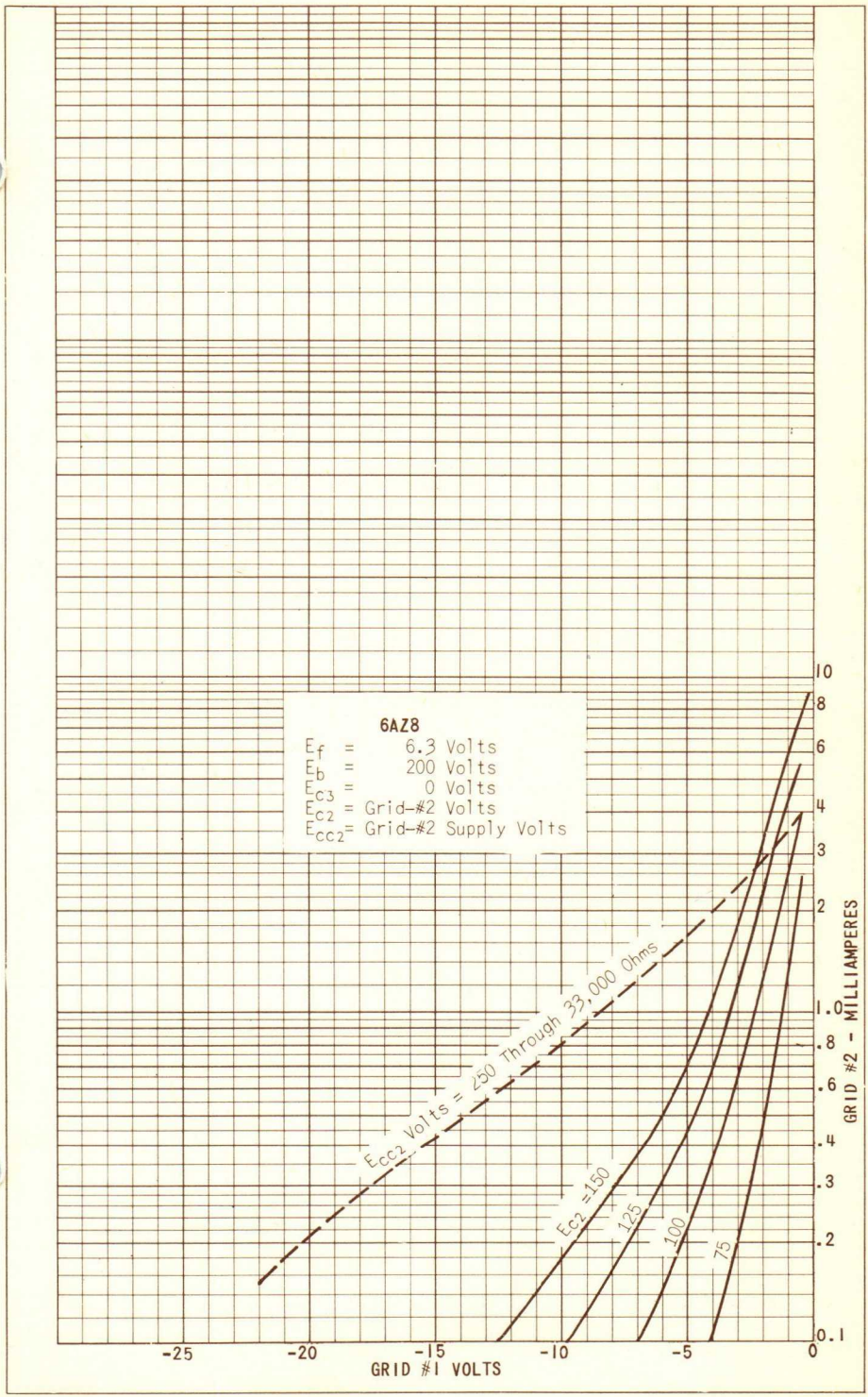

6AZ8
Ef = 6.3 Volts
Ec3 = 0 Volts
Ec2 = Grid-#2 Volts
Ecc2 = Grid-#2 Supply Volts
Ecc2 Volts = 250 Through 33,000 Ohms
Ec2 Volts = 150
125
100
75
10000
8000
6000
4000
3000
2000
1000
800
600
400
300
200
100
80
60
40
30
20
10
TRANSCONDUCTANCE-MICROMHOS
-25
-20
-15
-10
-5
0
GRID #1 VOLTS



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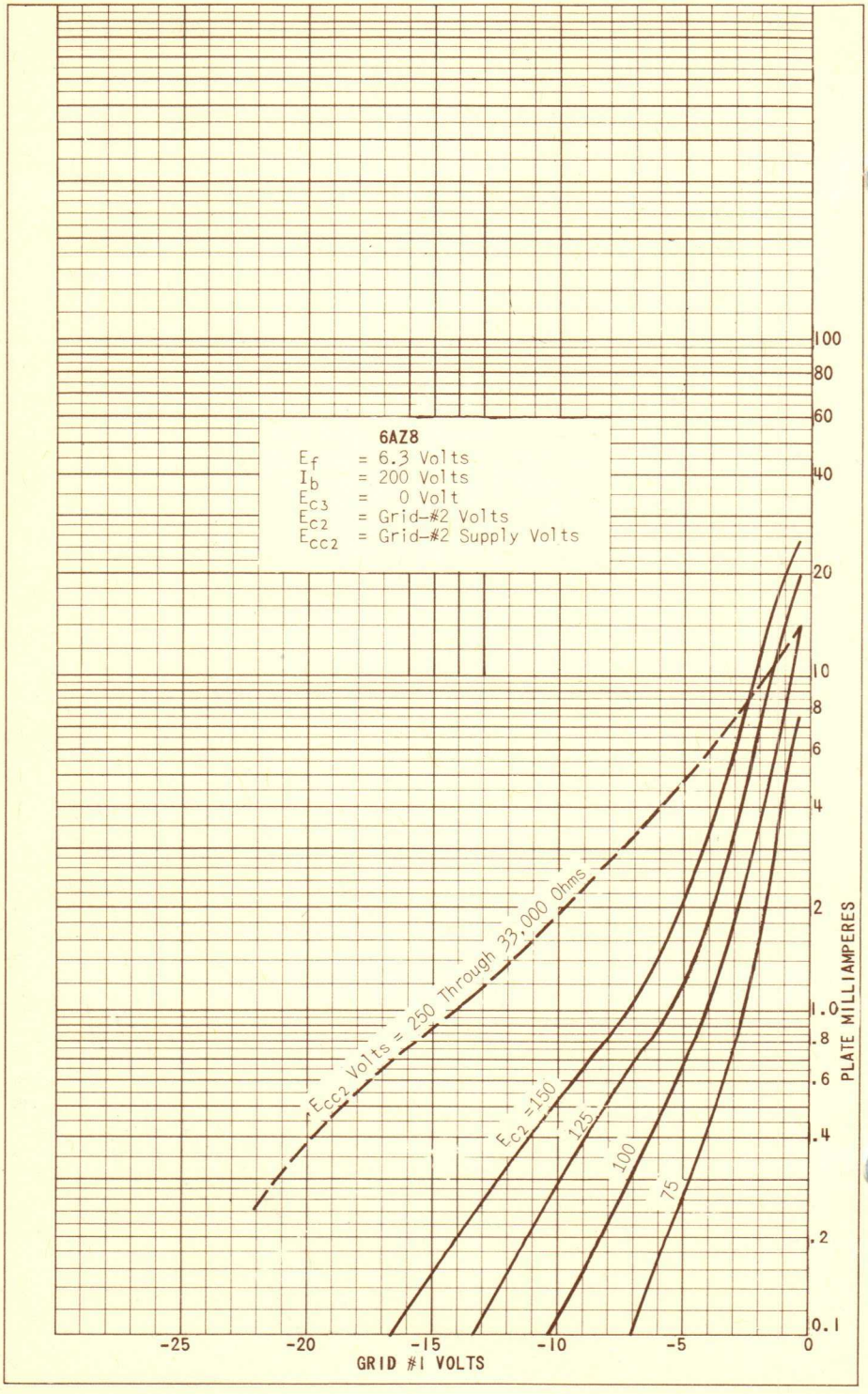
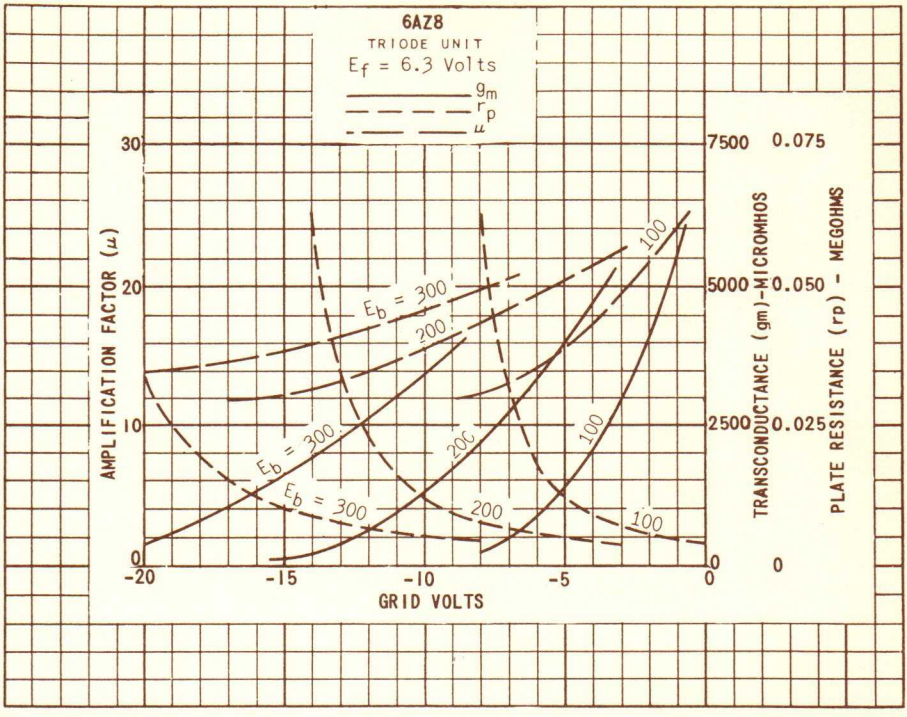
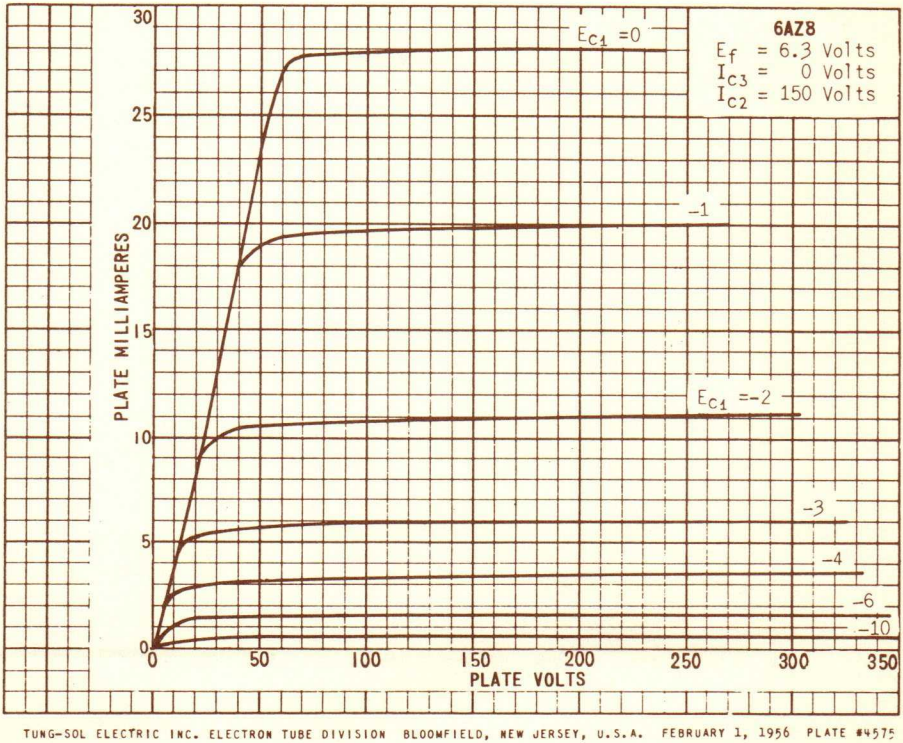
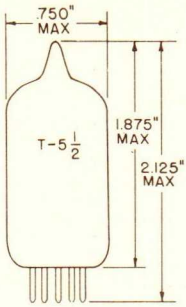

6AZ8
E_f = 6.3 Volts
I_b = 200 Volts
E_{c3} = 0 Volt
E_{c2} = Grid-#2 Volts
E_{cc2} = Grid-#2 Supply Volts
E_{cc2} Volts = 250 Through 33,000 Ohms
E_{c2} =150
125
100
75
100
80
60
40
20
10
8
6
4
2
1.0
.8
.6
.4
.2
0.1
PLATE MILLIAMPERES
-25
-20
-15
-10
-5
0
GRID #1 VOLTS


6AZ8
TRIODE UNIT
E_f = 6.3 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (gm)-MICROMHOS
PLATE RESISTANCE (rp) - MEGOHMS
GRID VOLTS
E_b = 300
200
100
30
20
10
0
7500
5000
2500
0.075
0.050
0.025
-20
-15
-10
-5


6AZ8
E_f = 6.3 Volts
I_{c3} = 0 Volts
I_{c2} = 150 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_{c1} =0
-1
E_{c1} =-2
-3
-4
-6
-10
30
25
20
15
10
5
0
50
100
150
200
250
300
350

TUNG-SOL



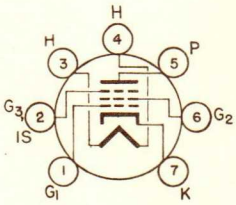
GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

PENTODE
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±0.6 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BK ←

THE 6BA6 IS A PENTODE AMPLIFIER HAVING REMOTE CONTROL GRID CHARACTERISTIC AND UTILIZING THE MINIATURE CONSTRUCTION. AS AN RF AMPLIFIER IT IS CHARACTERIZED BY HIGH TRANSCONDUCTANCE AND LOW GRID-PLATE CAPACITANCE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G_1 TO P (MAX.)	0.0035	0.0035	pf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.5	5.5	pf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5.5	5	pf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[C]	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4	
MAXIMUM GRID #3 VOLTAGE	PIN #2 CONNECTED TO PIN #7 AT SOCKET	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	3.4	WATTS
MAXIMUM GRID #2 DISSIPATION:		
FOR VOLTAGES UP TO 165 VOLTS	0.7	WATT
FOR VOLTAGES BETWEEN 165 & 330 VOLTS	SEE J5-C4	

[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE	100	100	VOLTS
CATHODE BIAS RESISTOR	68	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	1.0	MEGOHM
TRANSCONDUCTANCE	4 300	4 400	μMHOS
PLATE CURRENT	10.8	11	MA.
GRID #2 CURRENT	4.4	4.2	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 40 μMHOS	−20	−20	VOLTS

→ INDICATES A CHANGE.

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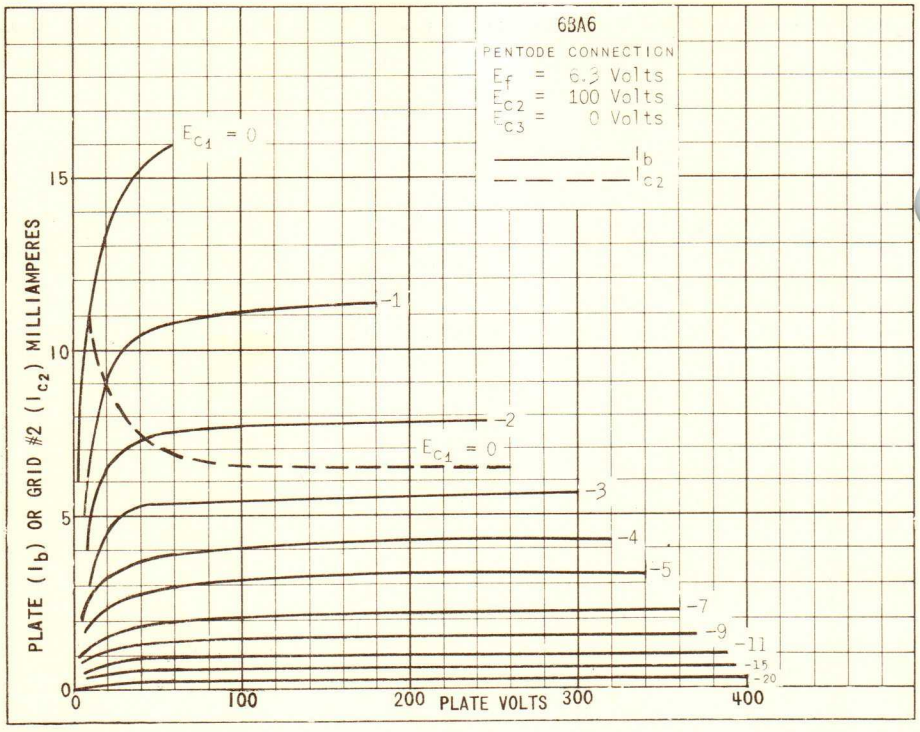
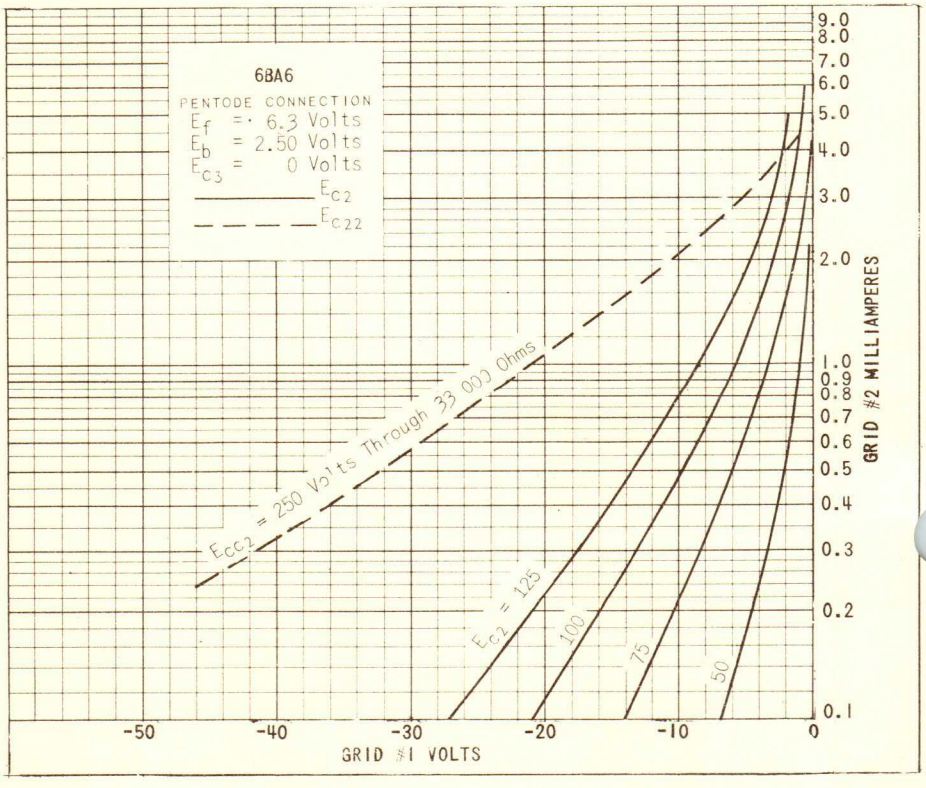

6BA6
PENTODE CONNECTION
Ef = 6.3 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
Ib
Ic2
Ec1 = 0
-1
-2
-3
-4
-5
-7
-9
-11
-15
-20
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
5
10
15


6BA6
PENTODE CONNECTION
Ef = 6.3 Volts
Eb = 2.50 Volts
Ec3 = 0 Volts
Ec2
Ec22
Ecc2 = 250 Volts Through 33 000 Ohms
Ec2 = 125
100
75
50
GRID #2 MILLIAMPERES
GRID #1 VOLTS
-50
-40
-30
-20
-10
0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1

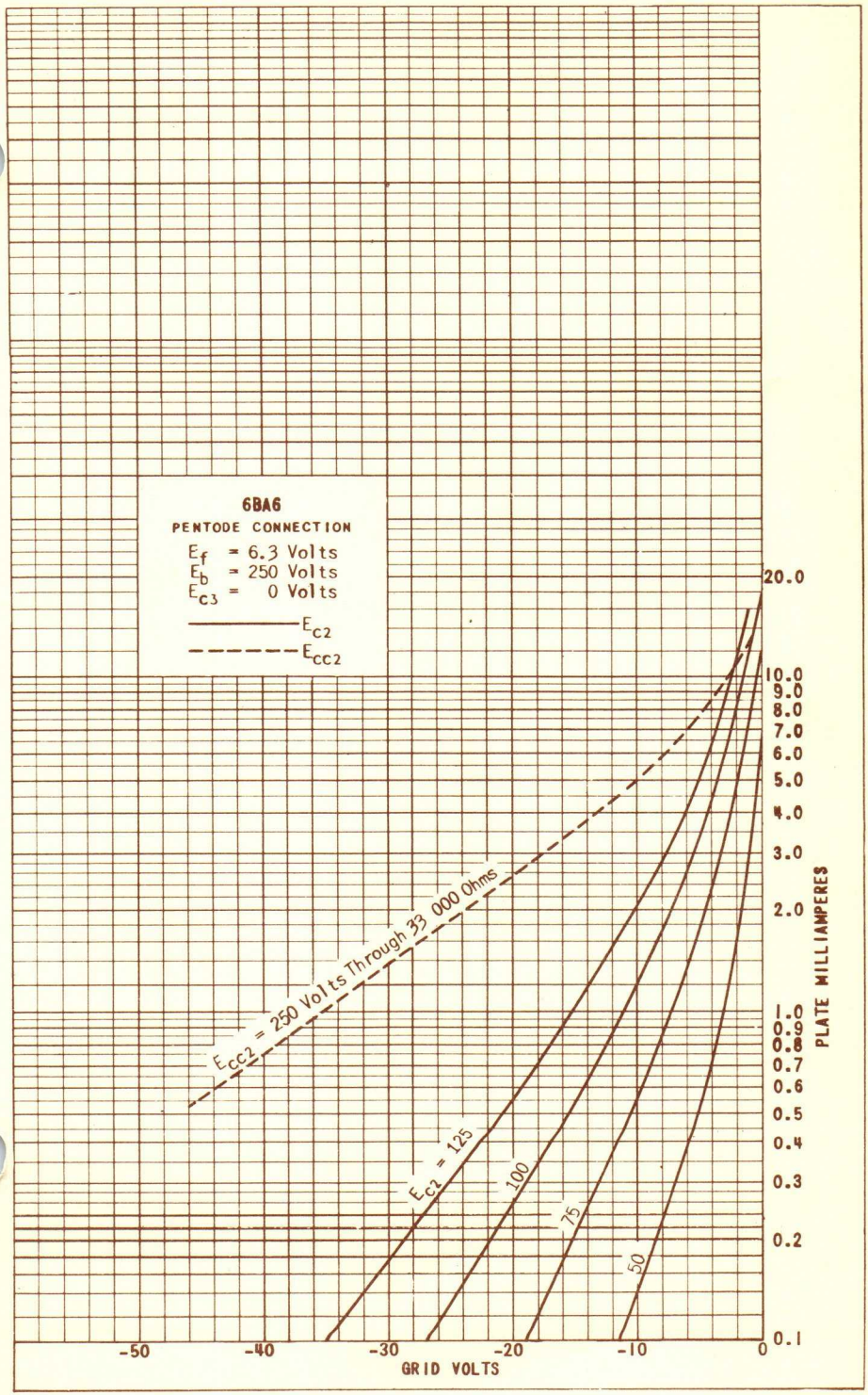


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PLATE
1791
MAY 1
1947

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6BA6

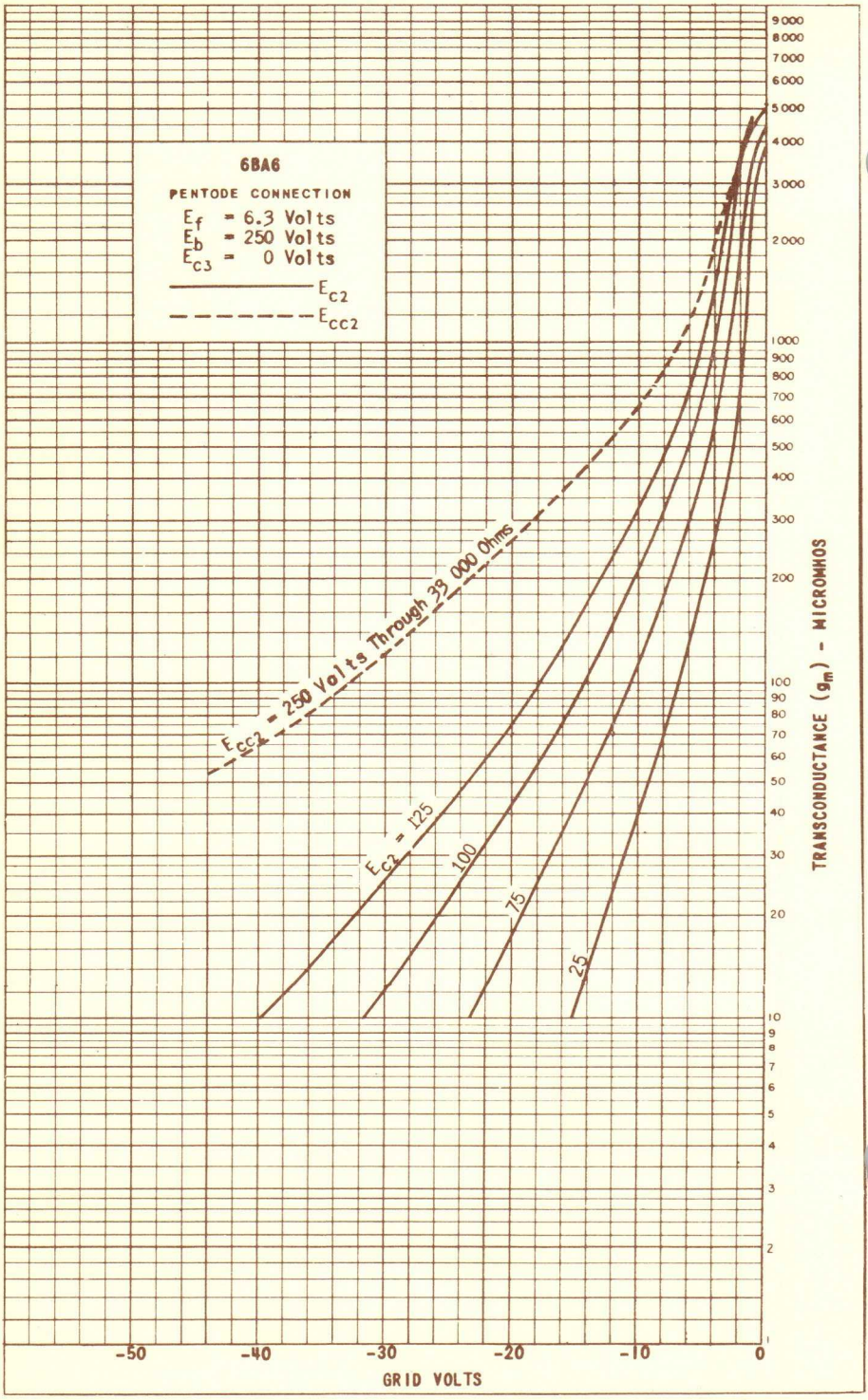

PLATE
1792
MAY 1
1947

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TUNG-SOL

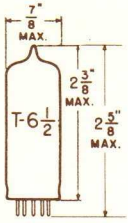
HEPTODE

MINIATURE TYPE

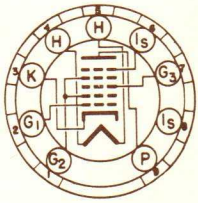
UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE

THE 6BA7 IS A CATHODE TYPE HIGH GAIN PENTAGRID CONVERTER IN THE SMALL 9-PIN BUTTON CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A COMBINED LOCAL OSCILLATOR AND MIXER AT HIGH FREQUENCIES, ESPECIALLY IN THE FM BROADCAST BAND.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID #3 TO PLATE: (G_3 TO P) MAX.	0.19	μμf
GRID #1 TO GRID #3: (G_1 TO G_3) MAX.	0.1	μμf
GRID #1 TO PLATE: (G_1 TO P) MAX.	0.05	μμf
GRID #1 TO CATHODE: (G_1 TO K)	3.3	μμf
GRID #1 TO ALL EXCEPT CATHODE: G_1 TO (H+G_2&G_4+G_3+G_5+P+IS)	3.4	μμf
CATHODE TO ALL EXCEPT GRID #1: K TO (H+G_2&G_4+G_3+G_5+P+IS)	4	μμf
RF INPUT: G_3 TO (H+K+G_1+G_2&G_4+G_5+P+IS)	9.5	μμf
OSCILLATOR INPUT: G_1 TO (H+K+G_2&G_4+G_3+G_5+P+IS)	6.7	μμf
MIXER OUTPUT: P TO (H+K+G_1+G_2&G_4+G_3+G_5+IS)	8.3	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRIDS #2 & #4 VOLTAGE	100	VOLTS
MAXIMUM GRIDS #2 & #4 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM NEGATIVE GRID #3 VOLTAGE	100	VOLTS
MAXIMUM POSITIVE GRID #3 VOLTAGE	0	VOLTS
MAXIMUM GRID #5 & INTERNAL SHIELD VOLTAGE[A]	0	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM GRIDS #2 & #4 DISSIPATION	1.5	WATTS
MAXIMUM CATHODE CURRENT	22	MA.

[A] INTERNAL SHIELD (PINS #6 AND #8) CONNECTED DIRECTLY TO GROUND.

CONTINUED ON FOLLOWING PAGE

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OCT. 1, 1948

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE - SEPARATE EXCITATION

THE CHARACTERISTICS SHOWN WITH SEPARATE EXCITATION CORRESPOND VERY CLOSELY WITH THOSE OBTAINED IN A SELF-EXCITED OSCILLATOR CIRCUIT OPERATING WITH ZERO BIAS.

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	100	250	VOLTS
GRIDS #2 & #4 VOLTAGE	100	100	VOLTS
GRID #3 VOLTAGE	-1	-1	VOLTS
GRID #5 AND INTERNAL SHIELD[A]	CONNECTED DIRECTLY TO GROUND		
GRID #1 RESISTOR	20 000	20 000	OHMS
PLATE RESISTANCE (APPROX.)	0.5	1	MEGOHM
CONVERSION TRANSCONDUCTANCE	900	950	µMHOS
PLATE CURRENT	3.6	3.8	MA.
GRIDS #2 & #4 CURRENT	10.2	10	MA.
GRID #1 CURRENT	0.35	0.35	MA.
TOTAL CATHODE CURRENT	14.2	14.2	MA.
CONVERSION TRANSCONDUCTANCE WITH E_{C3} = -20 VOLTS	3.5	3.5	µMHOS

[A] INTERNAL SHIELD (PINS #6 AND #8) CONNECTED DIRECTLY TO GROUND.

OSCILLATOR TRANSCONDUCTANCE

NOT OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE	0	VOLTS
GRIDS #2 & #4 CONNECTED TO PLATE	100	VOLTS
PLATE CURRENT	32	MA.
TRANSCONDUCTANCE BETWEEN GRID #1 & GRIDS #2 & #4 CONNECTED TO PLATE	8 000	µMHOS
AMPLIFICATION FACTOR	16.5	

SIMILAR TYPE REFERENCE: Ratings and Characteristics similar to 6SB7Y.

PLATE 2080
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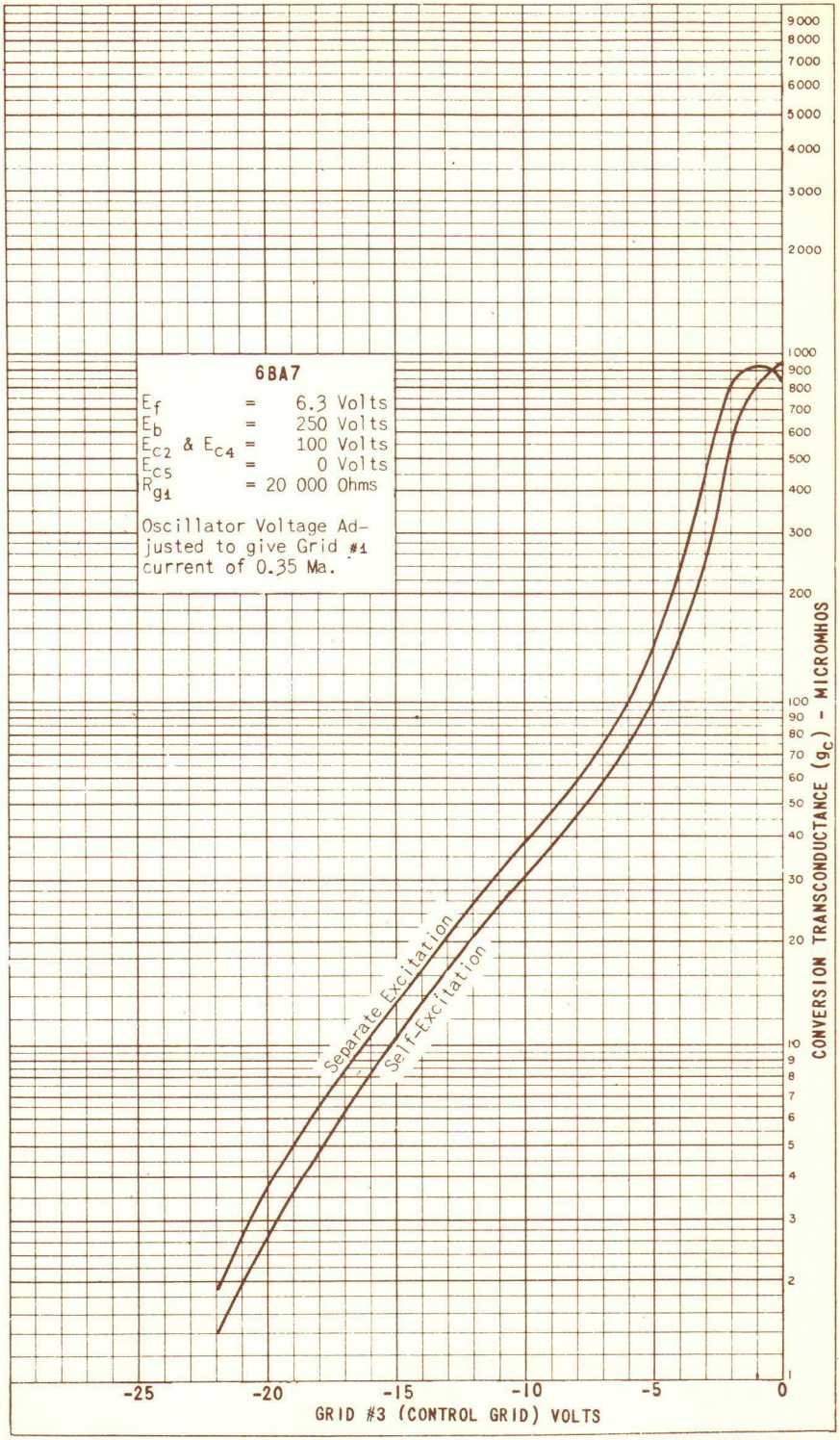

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OCT. 1, 1948

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6BA7

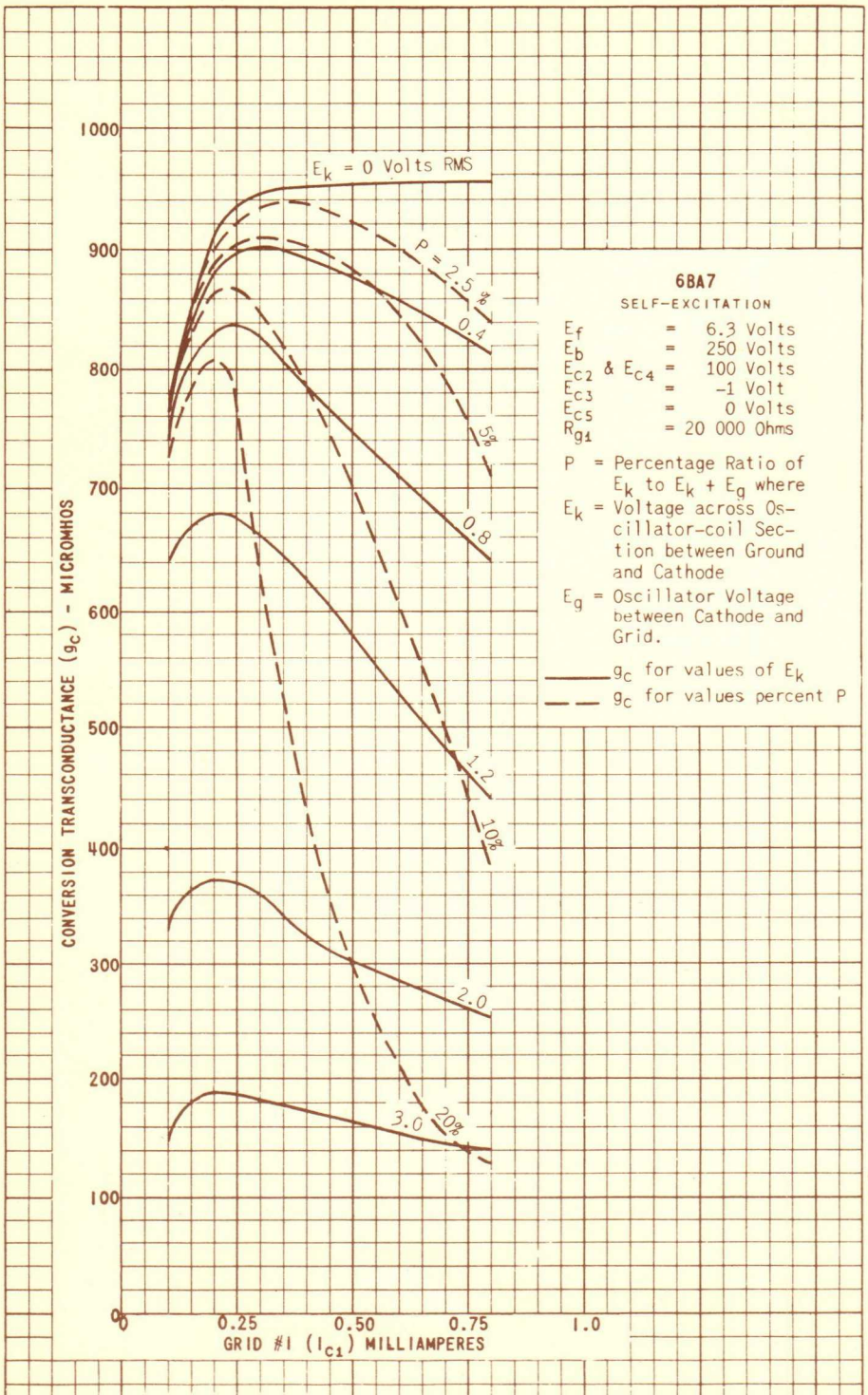

PLATE 2082
OCT. 1, 1948

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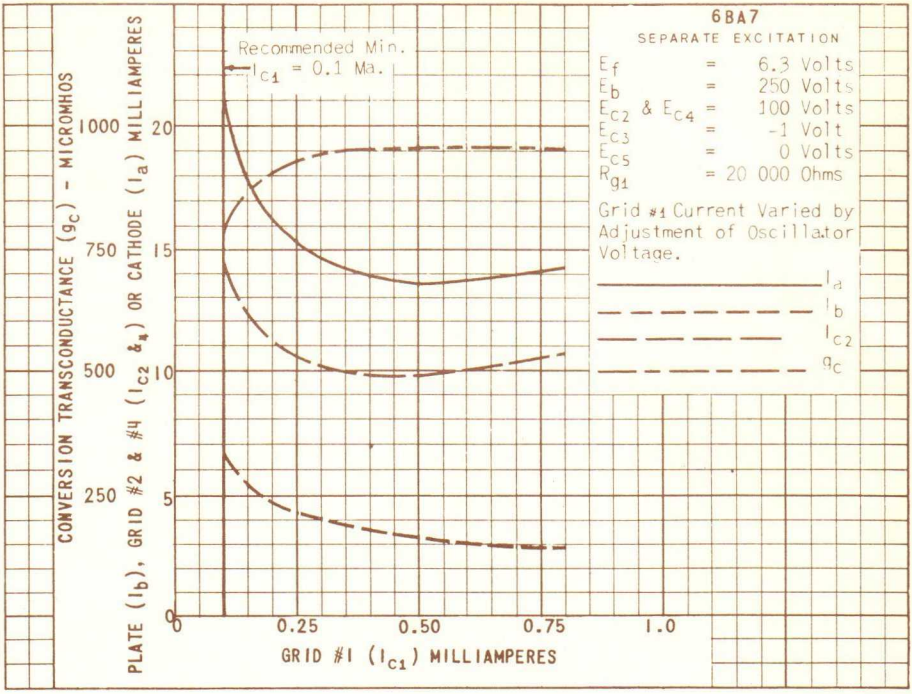

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2083
OCT. 1,
1948

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TUNG-SOL

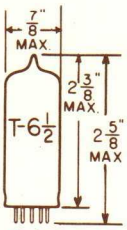
TRIODE PENTODE

MINIATURE TYPE

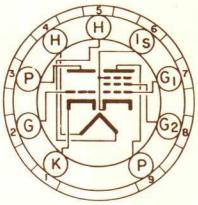
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9DX

THE 6BA8 IS A MEDIUM-MU TRIODE AND SHARP CUT-OFF PENTODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
TRIODE			
GRID TO PLATE	2.2	2.2	μμf
INPUT	2.7	2.5	μμf
OUTPUT	→ 1.9	→ 0.4	μμf
PENTODE			
GRID TO PLATE (MAX.)	.030	0.036	μμf
INPUT	→ 9.5	→ 9.5	μμf
OUTPUT	3.6	2.8	μμf
COUPLING			
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	.005	→ .010	μμf
PENTODE PLATE TO TRIODE GRID (MAX.)	.012	.022	μμf
PENTODE PLATE TO TRIODE PLATE (MAX.)	.050	0.20	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC AND PEAK	200		VOLTS
DC	100		VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM PLATE DISSIPATION	2.0	3.25	WATTS
MAXIMUM GRID #2 DISSIPATION	---	1.0	WATT
MAXIMUM NEGATIVE GRID #1 VOLTAGE	---	50	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	---	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.5	0.25	MEGOHM
SELF BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)[B]	11.0		SECONDS

[A] SHIELD #315 TIED TO CATHODE BASE PIN OF SECTION UNDER TEST.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE

CONTINUED ON FOLLOWING PAGE

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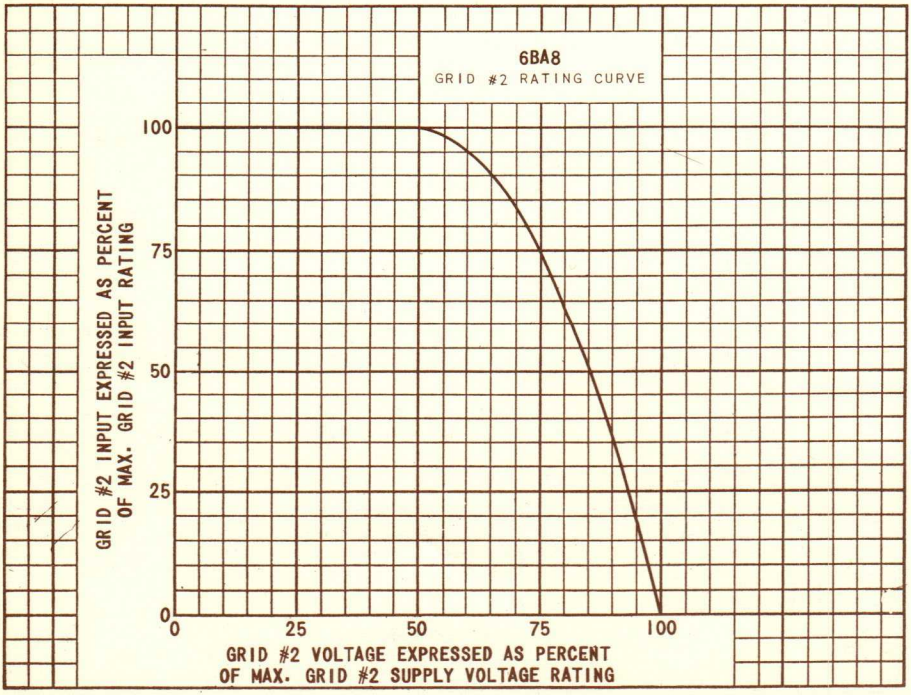
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
HEATER VOLTAGE		6.3	VOLTS
HEATER CURRENT		0.6	AMP.
PLATE VOLTAGE	200	200	VOLTS
GRID #2 VOLTAGE	---	150	VOLTS
GRID #1 VOLTAGE	-8	0	VOLTS
CATHODE BIAS RESISTOR	---	180	OHMS
AMPLIFICATION FACTOR	18	---	
PLATE RESISTANCE (APPROX.)	6 700	400 000	OHMS
TRANSCONDUCTANCE	2 700	9 000	μMHOS
PLATE CURRENT	8.0	13	MA.
GRID #2 CURRENT	---	3.5	MA.
GRID #1 VOLTAGE FOR I_b = 10 μA. (APPROX.)	-16	-10	VOLTS



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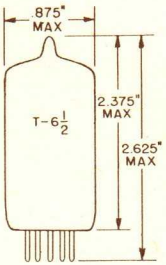


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

TRIODE PENTODE

MINIATURE TYPE

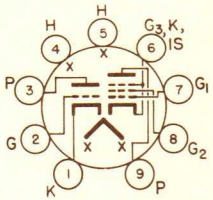
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 600 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9DX

THE 6BA8A IS A MINIATURE MEDIUM-MU TRIODE AND SHARP CUTOFF PENTODE WHICH HAS A CONTROLLED PLATE KNEE CHARACTERISTIC. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
TRIODE			
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: (G_1 TO P)	→ 0.05	→ 0.06	pf
INPUT: G TO (H+K+G_2+G_3+I.S.)	10.0	10.0	pf
OUTPUT: P TO (H+K+G_2+G_3+I.S.)	4.5	3.6	pf
COUPLING			
PENTODE GRID #1 TO TRIODE PLATE	0.003	0.006	pf
PENTODE PLATE TO TRIODE GRID	0.006	0.016	pf
PENTODE PLATE TO TRIODE PLATE	0.050	0.200	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC AND PEAK	200		VOLTS
DC	100		VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM PLATE DISSIPATION	2.0	3.25	WATTS
MAXIMUM GRID #2 DISSIPATION	---	1.0	WATT
MAXIMUM NEGATIVE GRID #1 VOLTAGE	---	50	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	---	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.5	0.25	MEGOHM
SELF BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)[B]	11.0		SECONDS

[A] SHIELD #315 TIED TO CATHODE BASE PIN OF SECTION UNDER TEST.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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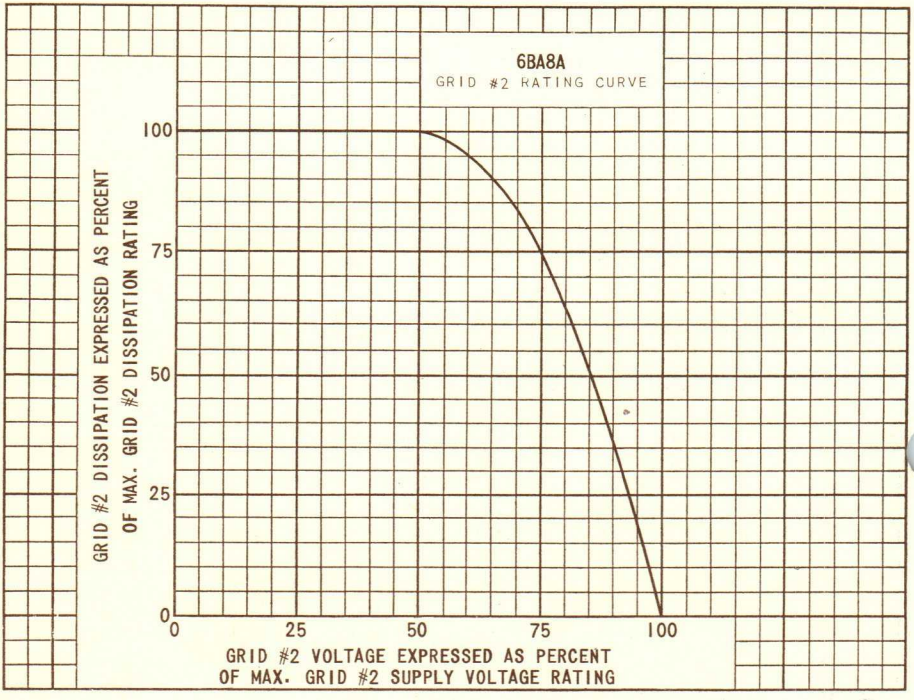
TUNG-SOL

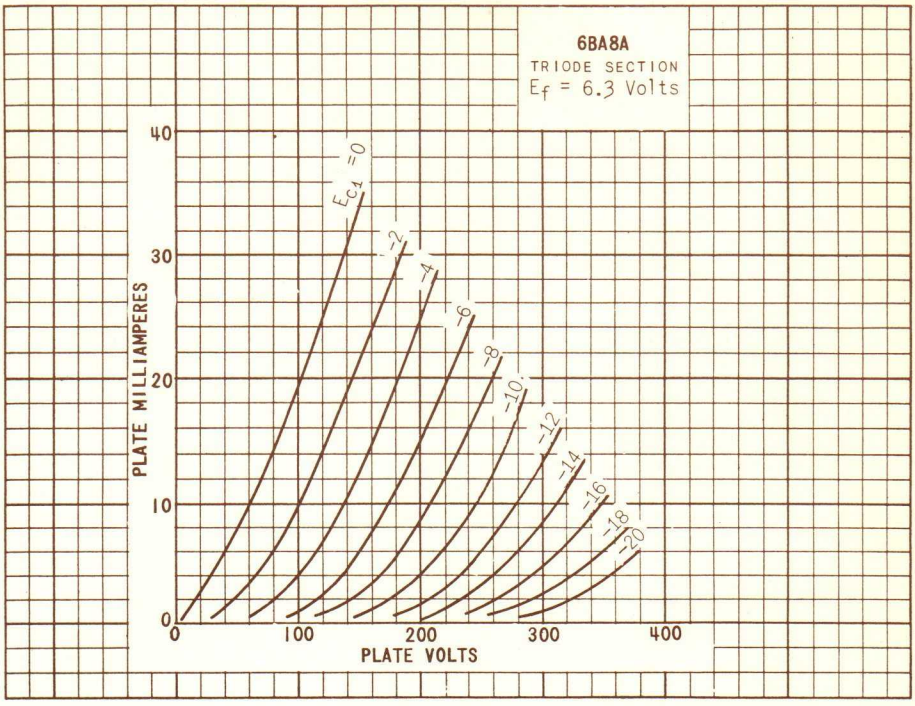
CONTINUED FROM PRECEDING PAGE

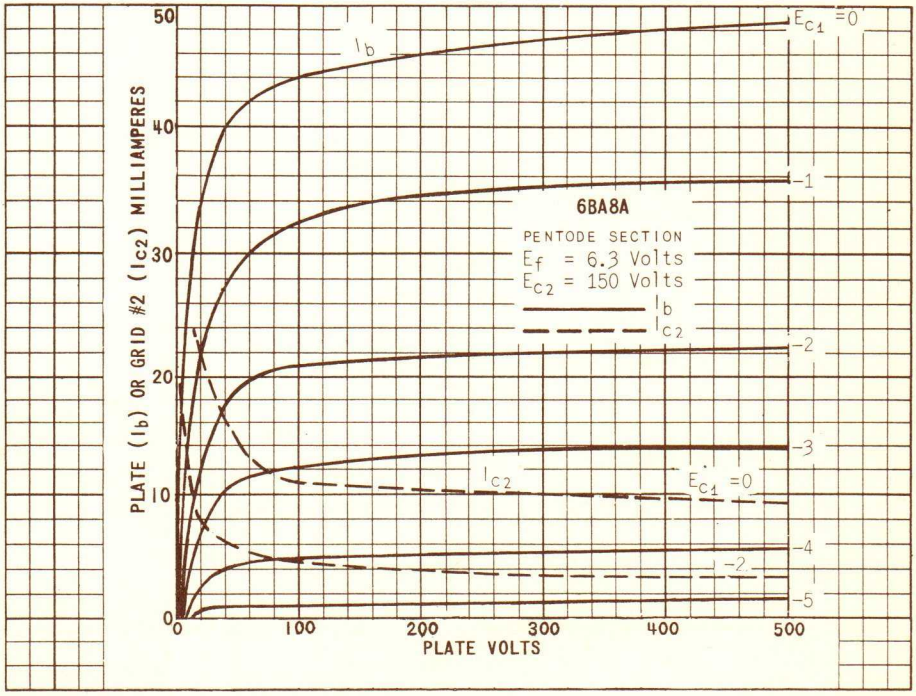
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
PLATE VOLTAGE	200	200	VOLTS
GRID #2 VOLTAGE	---	150	VOLTS
GRID #1 VOLTAGE	-8	0	VOLTS
CATHODE BIAS RESISTOR	---	180	OHMS
AMPLIFICATION FACTOR	18	---	
PLATE RESISTANCE (APPROX.)	6 700	400 000	OHMS
TRANSCONDUCTANCE	2 700	9 000	μMHOS
PLATE CURRENT	8.0	13	MA.
GRID #2 CURRENT	---	3.5	MA.
GRID #1 VOLTAGE FOR I_b = 10 μA. (APPROX.)	-16	-10	VOLTS
ZERO BIAS: WITH E_b =65V., AND E_{c2} =150 V., (INSTANTANEOUS VALUES)			
PLATE CURRENT		42	MA.
GRID #2 CURRENT		12.5	MA.







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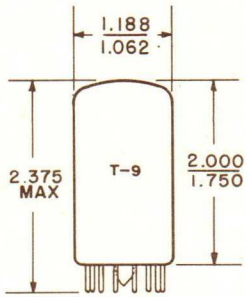
TRIODE - TWIN PENTODE

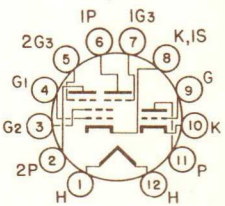


GLASS BULB
BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-58

COATED UNIPOTENTIAL CATHODE

FOR
VERTICAL DEFLECTION OSCILLATOR
AND COMBINED SYNC-AGC
APPLICATIONS IN TV CIRCUITS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12ER

THE 6BA11 IS A TRIODE-TWIN PENTODE IN A COMPACTRON STRUCTURE. THE MEDIUM MU TRIODE MAY BE USED AS A VERTICAL DEFLECTION OSCILLATOR. THE TWIN PENTODE CONSISTS OF A COMMON CATHODE, FIRST CONTROL GRID AND SCREEN GRID, WITH SEPARATE SECOND CONTROL GRIDS AND PLATES AND IS INTENDED FOR COMBINED SYNC-AGC APPLICATIONS IN TV CIRCUITS. AN INTERNAL GRID SHIELD IS CONNECTED TO THE GRID 2 OF THE PENTODES. AN INTERSECTION SHIELD BETWEEN PENTODES AND TRIODE IS CONNECTED TO PIN 8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE:		
GRID 3 TO PLATE, EACH SECTION	2.0	pf
GRID 1 TO ALL	6.0	pf
GRID 3 (EACH PENTODE) TO ALL	3.6	pf
PLATE (EACH PENTODE) TO ALL	3.0	pf
GRID 3 (PENTODE 1) TO GRID 3 (PENTODE 2) MAX.	0.026	pf
TRIODE:		
GRID TO PLATE, G TO P	2.0	pf
INPUT: G TO (K+H)	2.0	pf
OUTPUT: P TO (K+H+I.S.)	1.9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF APPLIED VOLTAGE		6.3±0.6	VOLTS
LIMITS OF SUPPLIED CURRENT		600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE (BOTH SECTIONS)			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

SECTION:	TRIODE	PENTODE	
PLATE VOLTAGE	300	300	VOLTS
GRID 2 VOLTAGE	-----	150	VOLTS
POSITIVE DC GRID 3 VOLTAGE	-----	3.0	VOLTS
NEGATIVE DC GRID 3 VOLTAGE	-----	50	VOLTS
PEAK POSITIVE GRID 3 VOLTAGE	-----	50	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	-----	50	VOLTS
PLATE DISSIPATION (EACH PLATE)	1.5	1.1	WATTS
GRID 2 DISSIPATION	-----	0.75	WATTS
DC CATHODE CURRENT	20	12	MA.
GRID 3 CIRCUIT RESISTANCE (EACH GRID)	-----	0.5	MEGOHMS
GRID 1 CIRCUIT RESISTANCE			
FIXED BIAS	0.25	0.5	MEGOHMS
CATHODE BIAS	1.0	0.5	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS

	TRIODE	PENTODE				
		EACH SECTION[A] SEPARATELY		BOTH SECTIONS[C] OPERATING		
PLATE VOLTAGE	250	100	100	100	100	VOLTS
GRID 2 VOLTAGE	-----	67.5	67.5	67.5	67.5	VOLTS
GRID 3 VOLTAGE	0	0	0	-10	0	VOLTS
GRID 1 VOLTAGE	-11	0	B	B	B	VOLTS
PLATE CURRENT	5.0	-----	2.5	0	2.5	MA.
GRID 2 CURRENT	-----	-----	-----	7.0	4.4	MA.
GRID 1 TRANSCONDUCTANCE	1800	1700	-----	-----	-----	μMHOS
AMPLIFICATION FACTOR	18	-----	-----	-----	-----	
GRID 3 TRANSCONDUCTANCE	-----	-----	450	-----	-----	μMHOS
GRID 1 VOLTAGE (APPROX.) FOR Ib = 100 μA.	-18	2.3	-----	-----	-----	VOLTS
GRID 3 VOLTAGE (APPROX.) FOR Ib = 100 μA.	-----	-----	-3.2	-----	-----	VOLTS

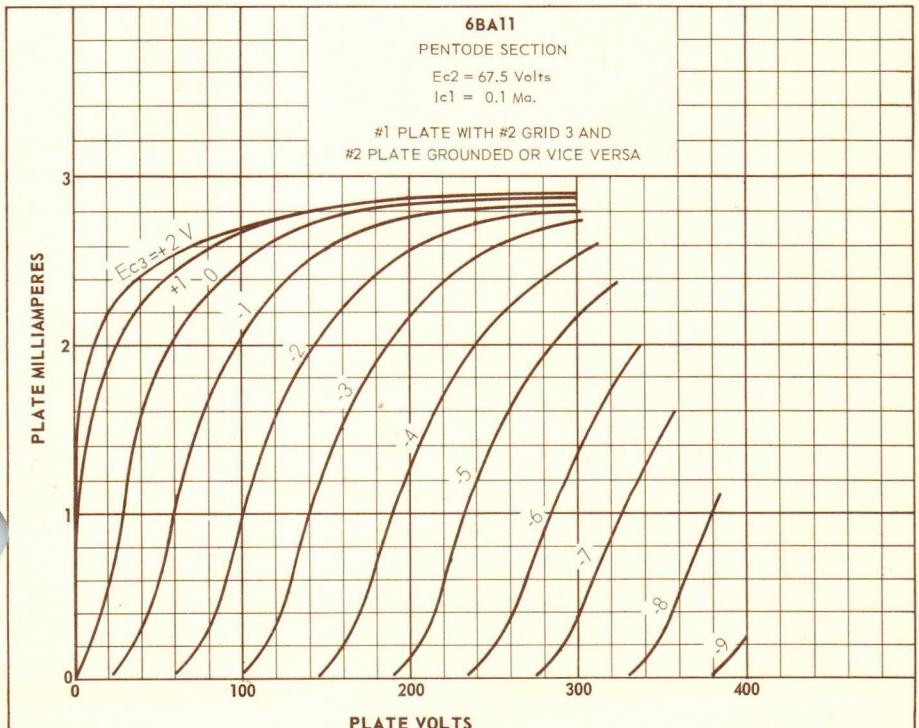
●

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

A. PLATE AND GRID 3 OF OPPOSITE SECTION GROUNDED.

B. GRID 1 VOLTAGE ADJUSTED SO THAT Ic1 = 100 μA DC.

C. VOLTAGES AND PLATE CURRENT APPLY TO EACH SECTION.



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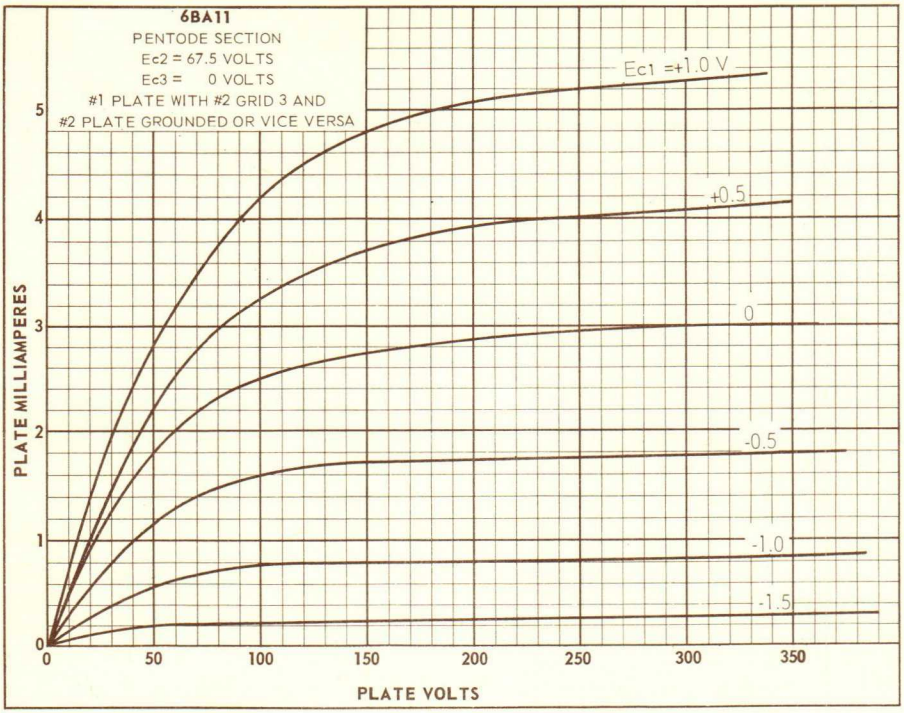
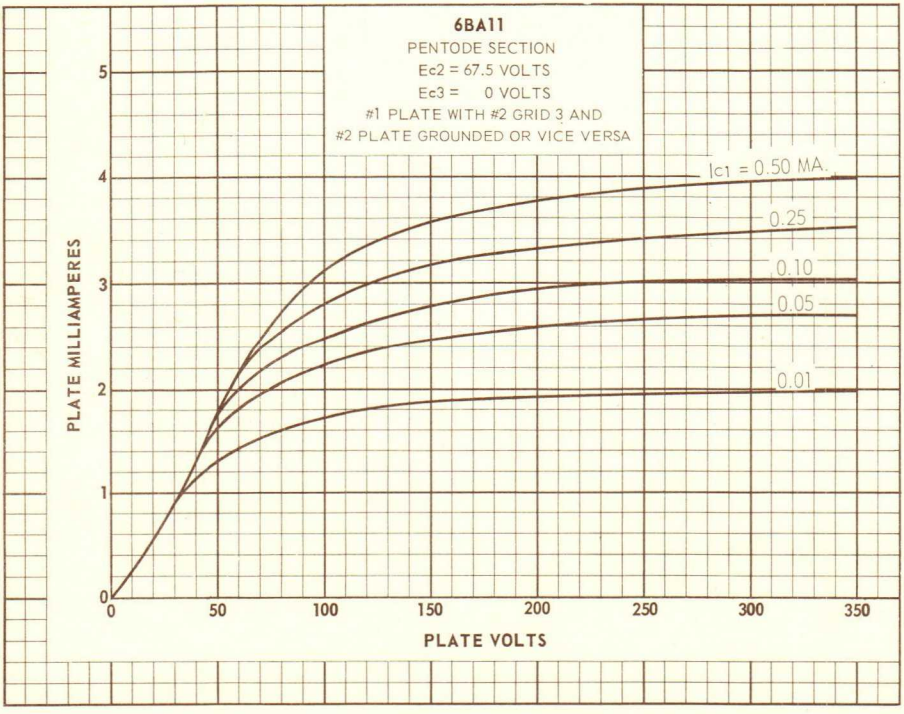
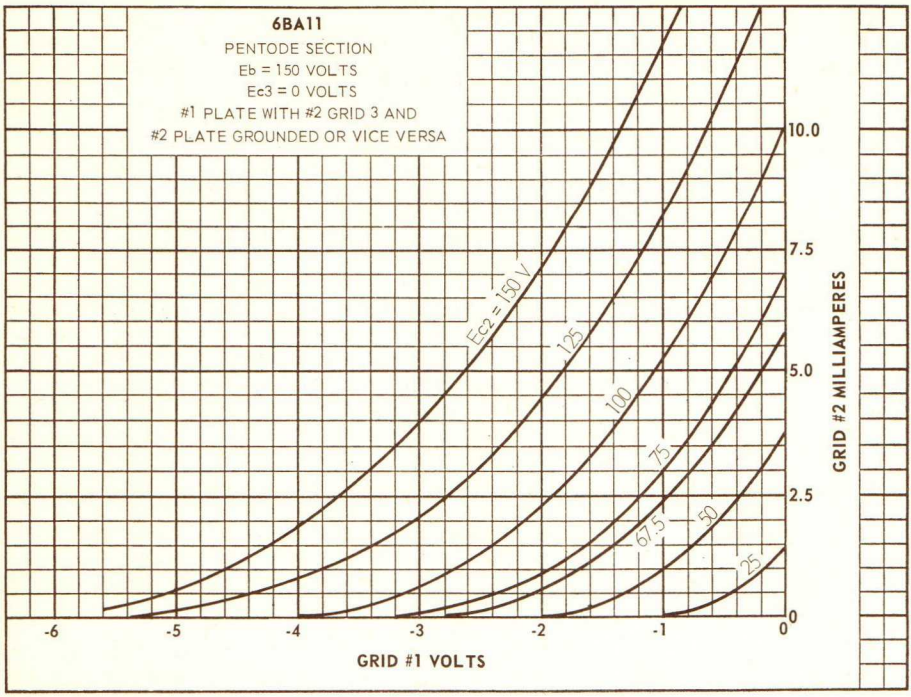
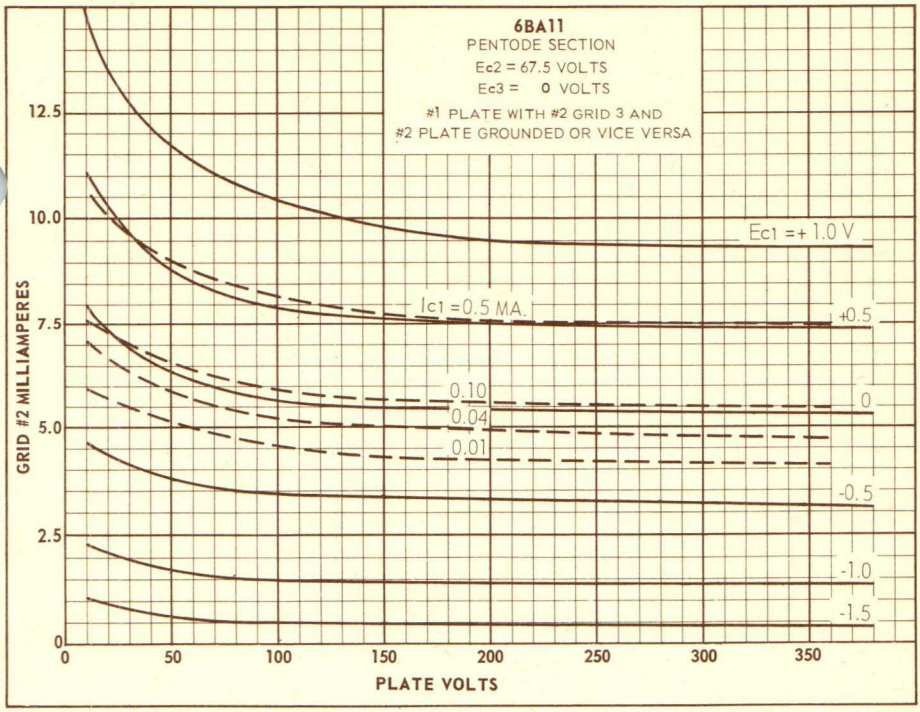
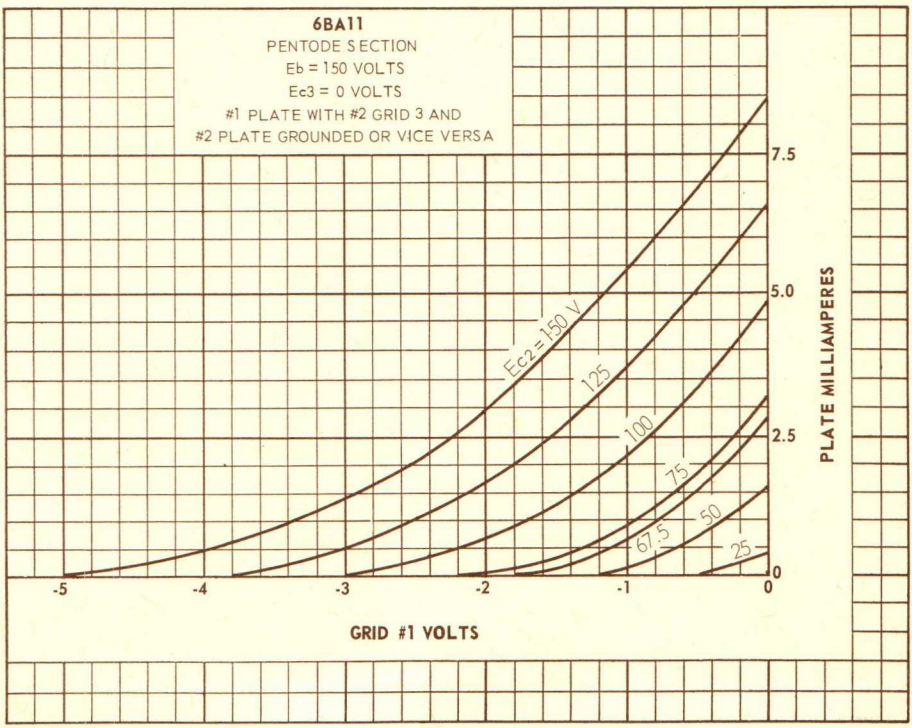

6BA11
PENTODE SECTION
Ec2 = 67.5 VOLTS
Ec3 = 0 VOLTS
#1 PLATE WITH #2 GRID 3 AND
#2 PLATE GROUNDED OR VICE VERSA
Ec1 =+1.0 V
+0.5
0
-0.5
-1.0
-1.5
PLATE MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
0
50
100
150
200
250
300
350


6BA11
PENTODE SECTION
Ec2 = 67.5 VOLTS
Ec3 = 0 VOLTS
#1 PLATE WITH #2 GRID 3 AND
#2 PLATE GROUNDED OR VICE VERSA
Ic1 = 0.50 MA.
0.25
0.10
0.05
0.01
PLATE MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
0
50
100
150
200
250
300
350


6BA11
PENTODE SECTION
Eb = 150 VOLTS
Ec3 = 0 VOLTS
#1 PLATE WITH #2 GRID 3 AND
#2 PLATE GROUNDED OR VICE VERSA
Ec2 = 150 V
125
100
75
67.5
50
25
10.0
7.5
5.0
2.5
0
GRID #2 MILLIAMPERES
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS





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TUNG-SOL

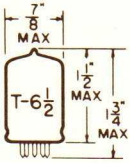
TRIODE

MINIATURE TYPE

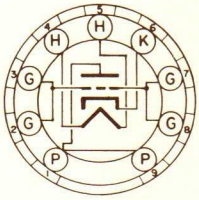
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.225 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9DR

THE 6BC4 IS A UHF MEDIUM-MU TRIODE OF THE 9-PIN MINIATURE TYPE UTILIZING A VERY SHORT BULB. IT IS DESIGNED FOR USE AS AN RF AMPLIFIER IN THE CATHODE-DRIVE CIRCUITS OF UHF TELEVISION TUNERS COVERING THE FREQUENCY RANGE OF 470 TO 890 MEGACYCLES PER SECOND.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITH NO EXTERNAL SHIELD

GRID TO PLATE	1.6	μμf
GRID TO HEATER AND CATHODE	2.9	μμf
PLATE TO HEATER AND CATHODE	0.26	μμf
HEATER TO CATHODE	2.7	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	75	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	75	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM CATHODE CURRENT	25	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM
FOR FIXED-BIAS OPERATION	NOT RECOMMENDED	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.225	AMP.
PLATE SUPPLY VOLTAGE	150	VOLTS
CATHODE-BIAS RESISTOR	100	OHMS
AMPLIFICATION FACTOR	48	
PLATE RESISTANCE	4800	OHMS
TRANSCONDUCTANCE	10000	μMHOS
GRID BIAS (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-10	VOLTS
PLATE CURRENT	14.5	MA

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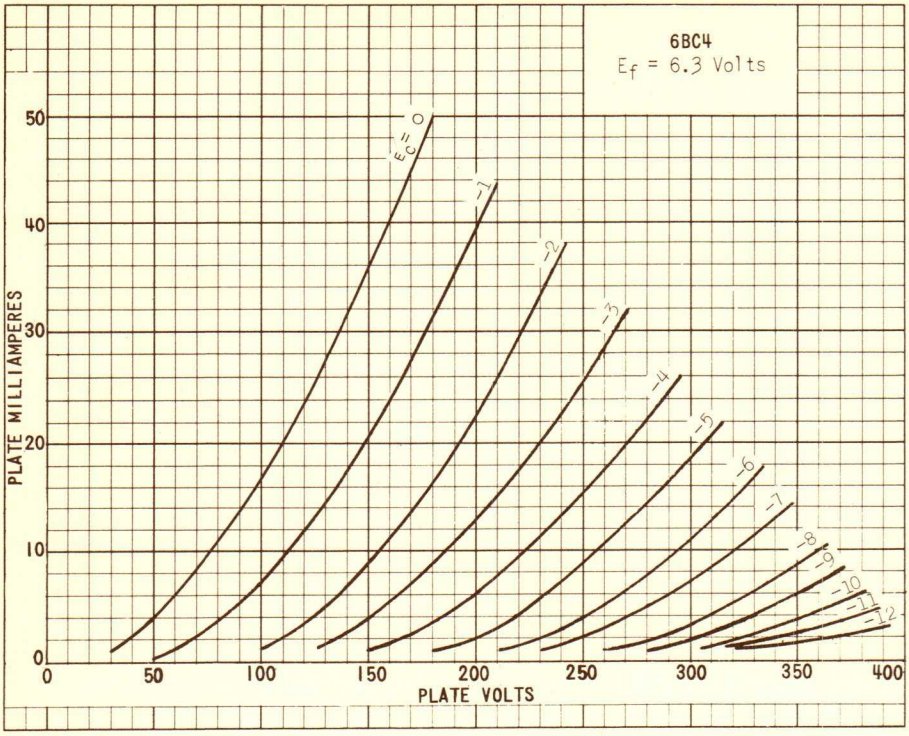
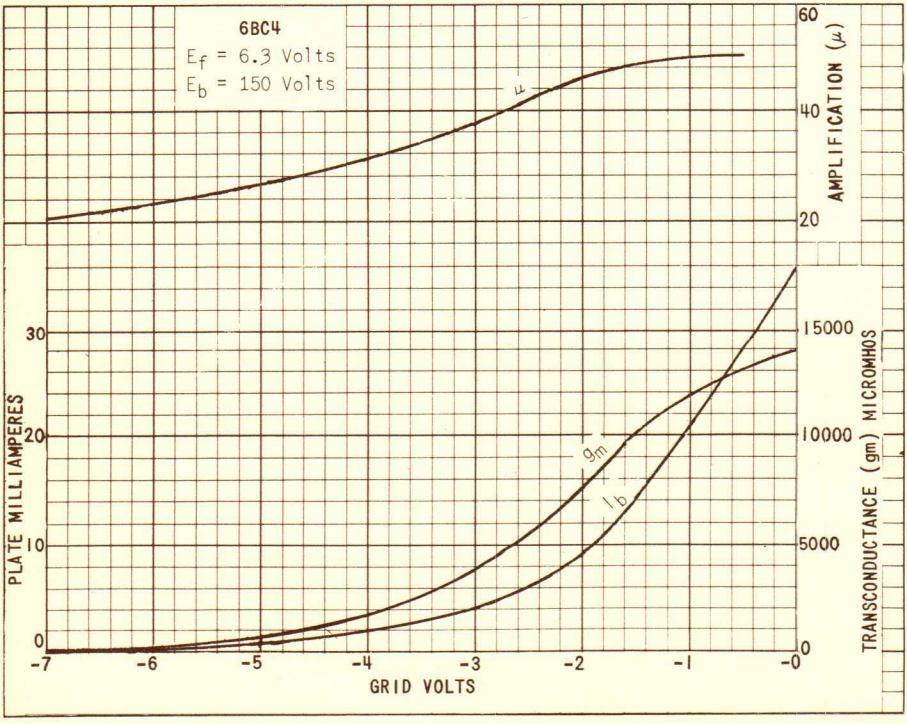
6BC4

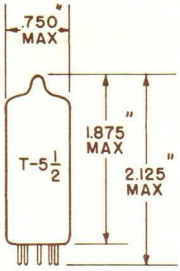

6BC4
Ef = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
Ec = 0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
0
10
20
30
40
50
0
50
100
150
200
250
300
350
400


6BC4
Ef = 6.3 Volts
Eb = 150 Volts
μ
gm
Ib
PLATE MILLIAMPERES
GRID VOLTS
AMPLIFICATION (μ)
TRANSCONDUCTANCE (gm) MICROMHOS
0
10
20
30
-7
-6
-5
-4
-3
-2
-1
-0
20
40
60
0
5000
10000
15000

TUNG-SOL

PENTODE

MINIATURE TYPE

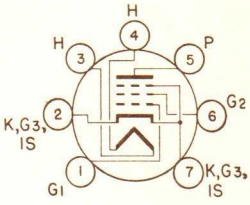


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HIGH FREQUENCY INTERMEDIATE AND RF AMPLIFIER

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
BASING DIAGRAM
JEDEC 7BD

THE 6BC5 IS A HIGH TRANSCONDUCTANCE PENTODE VOLTAGE AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS USEFUL AS AN RF AMPLIFIER UP TO ABOUT 400 MC. AND AS A HIGH-FREQUENCY INTERMEDIATE AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

		WITH SHIELD		WITHOUT SHIELD	
PENTODE CONNECTION:					
GRID TO PLATE: (G1 TO P) MAX.	→	0.020	→	0.030	pf
INPUT: G1 TO (H+K+G2+G3 & I.S.)		6.6		6.5	pf
OUTPUT: P TO (H+K+G2+G3& I.S.)	→	2.6		1.8	pf
TRIODE CONNECTION: (G2 TIED TO PLATE)					
GRID TO PLATE: G1 TO (P+G2)		2.5		2.5	pf
INPUT: G1 TO (H+K+G3 & I.S.)	→	4.0		3.9	pf
OUTPUT: (P+G2) TO (H+K+G3 & I.S.)		4.3	→	3.0	pf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		→ 200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[B]	VOLTS

[B] DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE [C]	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID #2 VOLTAGE	PLATE	SEE RATING CHART	
GRID #2 SUPPLY VOLTAGE	PLATE	330	VOLTS
PLATE DISSIPATION	2.9[C]	2.3	WATTS
GRID #2 DISSIPATION	---		WATT
GRID #1 VOLTAGE (POSITIVE BIAS VALUE)	0	0	VOLT
GRID #2 DISSIPATION			
FOR VOLTAGES UP TO 165 V.	---	.55	WATTS
FOR VOLTAGES BETWEEN 165 & 330 V.	---	SEE RATING CHART	

→ TYPICAL OPERATING CHARACTERISTICS

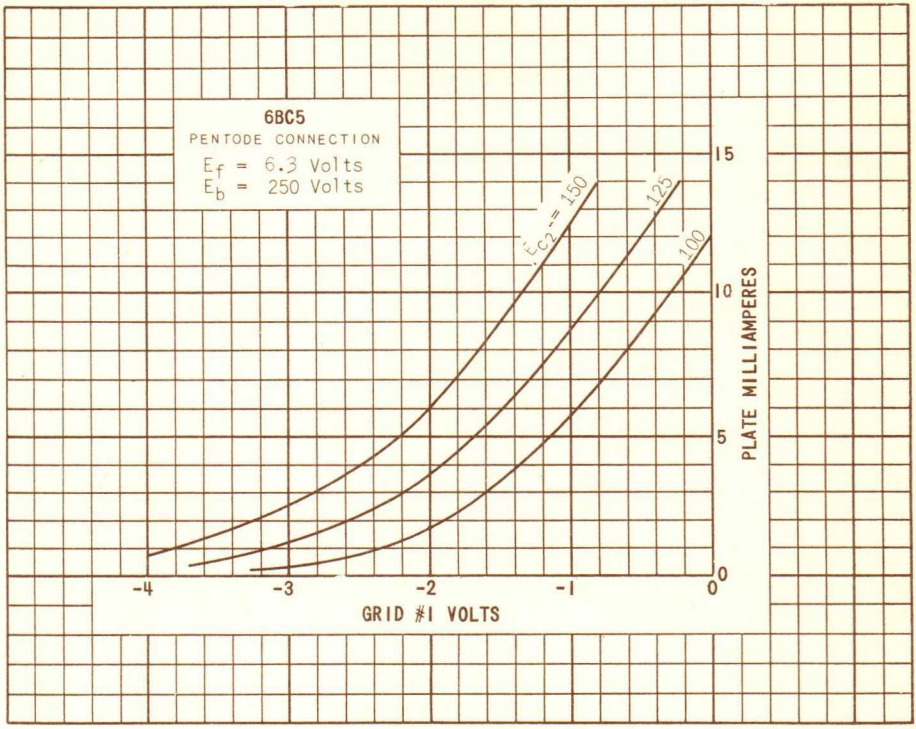
CLASS A_1 AMPLIFIER

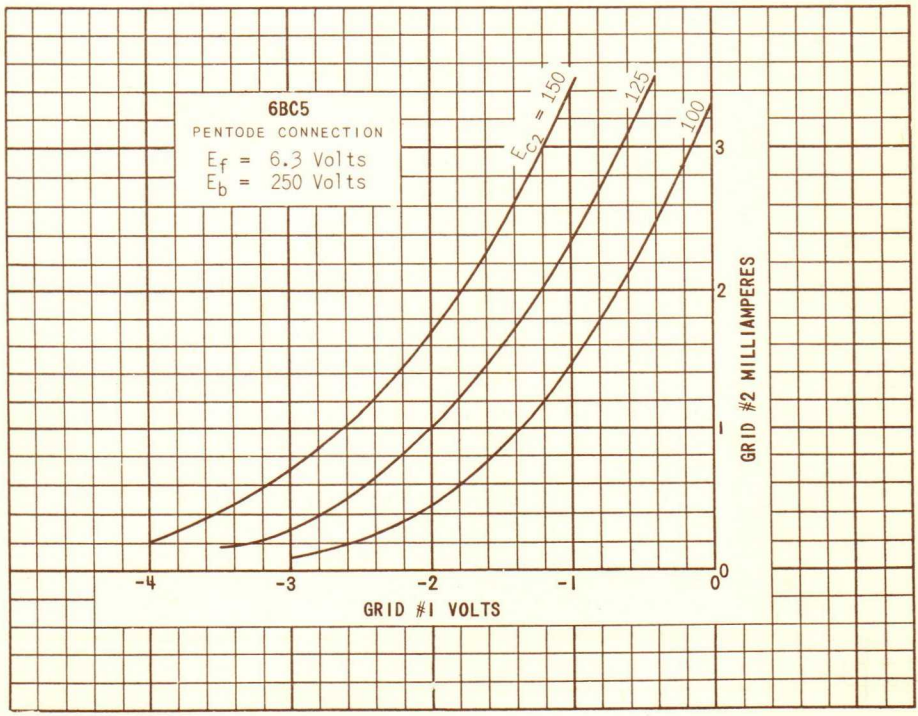
	TRIODE [C]		PENTODE			
PLATE VOLTAGE	250	180	100	125	250	VOLTS
GRID #2 VOLTAGE	PLATE	PLATE	100	125	150	VOLTS
CATHODE RESISTOR	820	330	180	100	180	OHMS
TRANSCONDUCTANCE	4400	6000	4900	6100	5700	μMHOS
PLATE RESISTANCE (APPROXIMATELY)	.009	.006	0.6	0.5	0.8	MEGOHM
AMPLIFICATION FACTOR	40	42	---	---	---	
PLATE CURRENT	6.0[D]	8.0[D]	4.7	8.0	7.5	MA.
GRID #2 CURRENT	---	---	1.4	2.4	2.1	MA.
GRID #1 VOLTAGE (APPROX.)						
FOR Ib = 10 μA.	---	---	-5	-6	-8	VOLTS

[C] G2 TIED TO PLATE.

[D] TOTAL CURRENT FLOWING TO PLATE + G2.

→ INDICATES A CHANGE.





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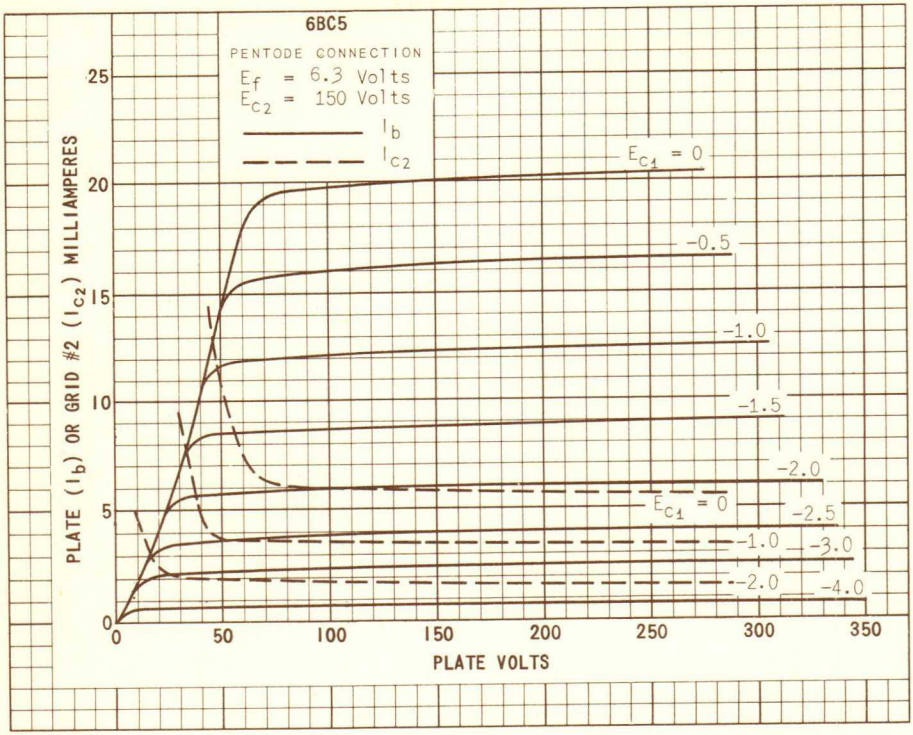
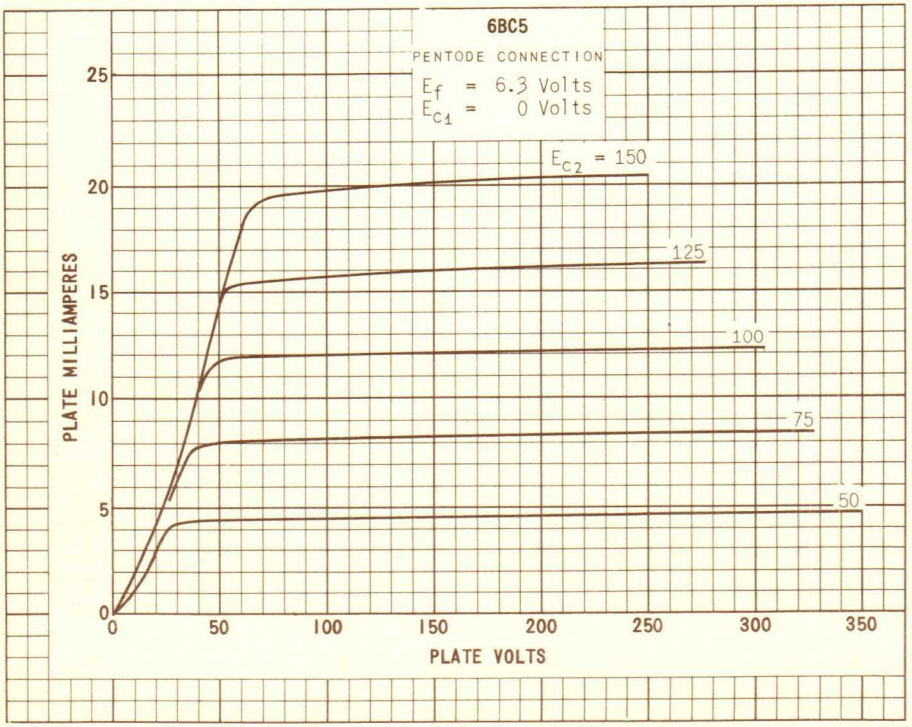
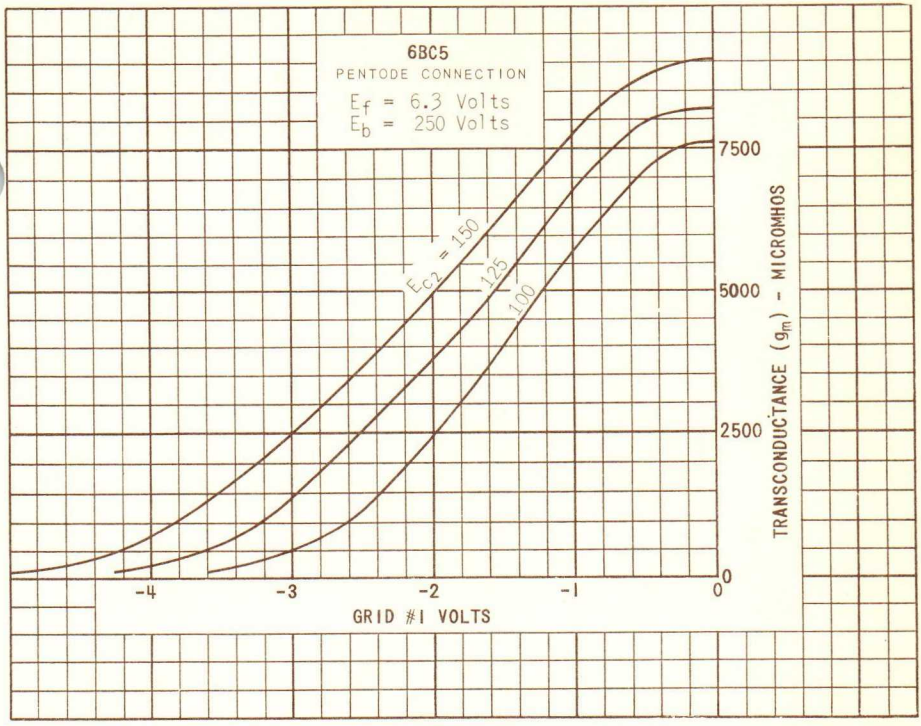
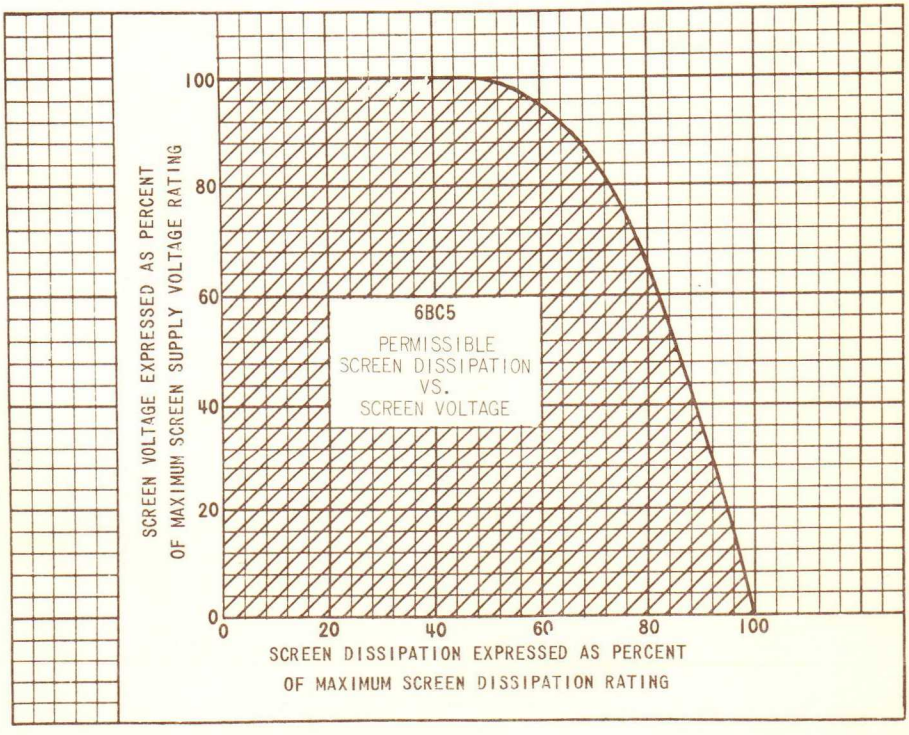

6BC5
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c_2} = 150 Volts
I_b
I_{c_2}
PLATE (I_b) OR GRID #2 (I_{c_2}) MILLIAMPERES
PLATE VOLTS
E_{c_1} = 0
-0.5
-1.0
-1.5
-2.0
E_{c_1} = 0
-2.5
-1.0
-3.0
-2.0
-4.0
0
5
10
15
20
25
0
50
100
150
200
250
300
350


6BC5
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c_1} = 0 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_{c_2} = 150
125
100
75
50
0
5
10
15
20
25
0
50
100
150
200
250
300
350





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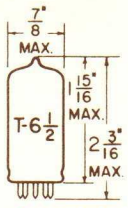
TRIPLE DIODE

MINIATURE TYPE



GLASS BULB

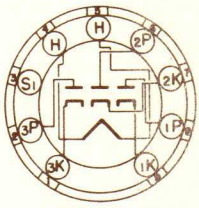
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 450 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE
9AX

THE 6BC7 COMPRISES THREE SEPARATE HIGH PERVEANCE DIODES IN THE 9 PIN MINIATURE CONSTRUCTION. THE ELEMENTS OF EACH DIODE ARE BROUGHT OUT SEPARATELY. IT CAN BE USED AS A COMBINED FM/AM DETECTOR WITHOUT THE NEED FOR ADDITIONAL SWITCHING. TWO OF THE DIODES ARE BALANCED FOR USE IN BALANCED DETECTOR APPLICATIONS. THE THREE SEPARATE AND INDEPENDENT DIODES ALLOW FOR A MULTIPLICITY OF CIRCUIT ARRANGEMENTS IN TELEVISION APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

PLATE OF DIODE #1 TO ALL OTHER ELEMENTS	3.5	μμf
PLATE OF DIODE #2 TO ALL OTHER ELEMENTS	5.5	μμf
PLATE OF DIODE #3 TO ALL OTHER ELEMENTS	3.5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
DIODE OPERATION CURRENT PER PLATE	12	MA.
PEAK HEATER–CATHODE VOLTAGE	200	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

EACH DIODE UNIT

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	450	MA.
AVERAGE CURRENT DIODES #1 AND #3 WITH 5 VOLTS DC APPLIED	35	MA.
ZERO VOLTAGE CURRENT OF EACH DIODE SECTION THRU 40,000 OHMS	21	μA.

NOTE: RATIO OF $\frac{103}{101}$ AND/OR $\frac{101}{103}$ SHALL NOT BE GREATER THAN 1.3 AT E.D. = 5 VOLTS.

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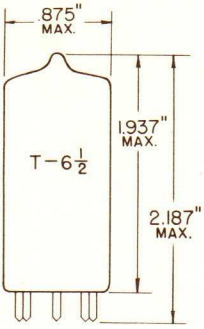
TWIN TRIODE

MINIATURE TYPE

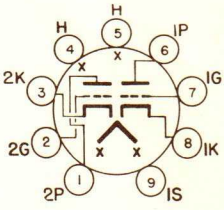


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

CASCODE AMPLIFIER
FOR SERIES STRING VHF
TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9AJ

THE 6BC8 IS A MEDIUM-MU, SEMI-REMOTE CUT-OFF TWIN TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A CASCODE AMPLIFIER IN VHF TELEVISION RECEIVER TUNERS.

DIRECT INTERELECTRODE CAPACITANCES

EXTERNAL SHIELD #315 CONNECTED TO PIN 9

	#1 TRIODE	#2 TRIODE	
GRID TO PLATE (G TO P)	→1.2	→ 1.2	pf
PLATE TO CATHODE (P TO K)		→0.12	pf
HEATER TO CATHODE (H TO K)	→2.8	→ 2.8	pf
#1 INPUT: G1 TO (H+K+I.S.)	→2.6		pf
#2 INPUT: K TO (H+G+I.S.)[A]		→ 5.5	pf
#1 OUTPUT: P TO (H+K+I.S.)	1.3		pf
#2 OUTPUT: P TO (H+G+I.S.)[A]		→ 2.4	pf
#1 PLATE TO #2 PLATE (1P TO 2P)(MAX.)	→.02		pf
#2 PLATE TO #1 PLATE AND GRID:(2P TO 1P+1G) MAXIMUM	→.04		pf

[A] READ AS GROUNDED GRID AMPLIFIER.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	400	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE[B]			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

PLATE VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.2	WATTS
CATHODE CURRENT	→ 22	MA.
GRID CIRCUIT RESISTANCE	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

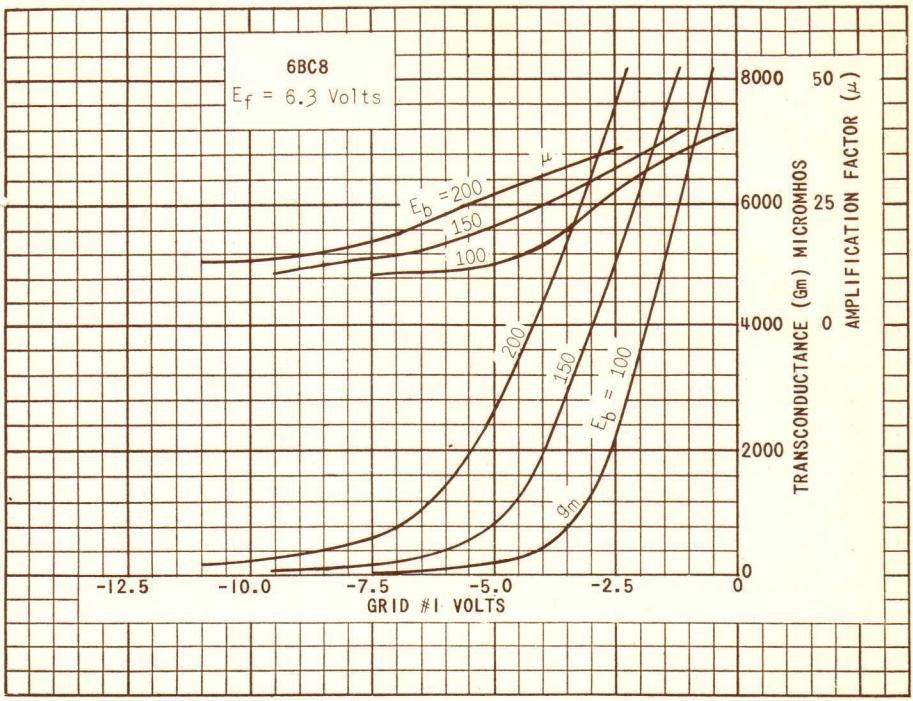
CLASS A_1 AMPLIFIER

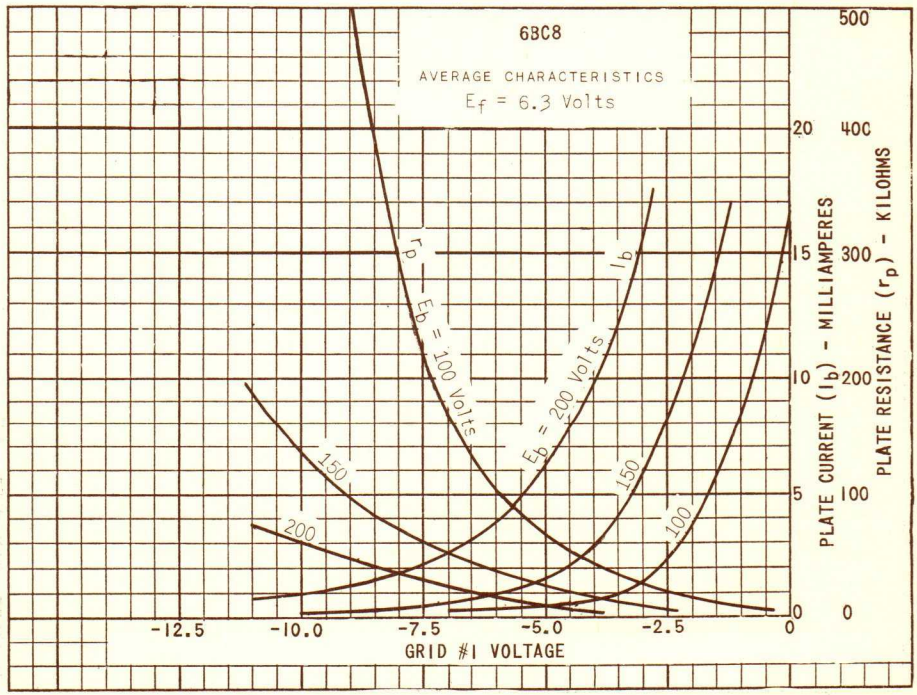
EACH UNIT

PLATE VOLTAGE	150	VOLTS
CATHODE RESISTOR	220	OHMS
PLATE RESISTANCE*	5300	OHMS
TRANSCONDUCTANCE	6200	μMHOS
AMPLIFICATION FACTOR	35	
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR GM =50 μMHOS	−13	VOLTS

[B]THIS RATING MAY BE AS HIGH AS 300 VOLTS UNDER CUTOFF CONDITIONS WHEN THE TUBE IS USED AS A CASCODE AMPLIFIER AND THE TWO SECTIONS ARE CONNECTED IN SERIES.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.





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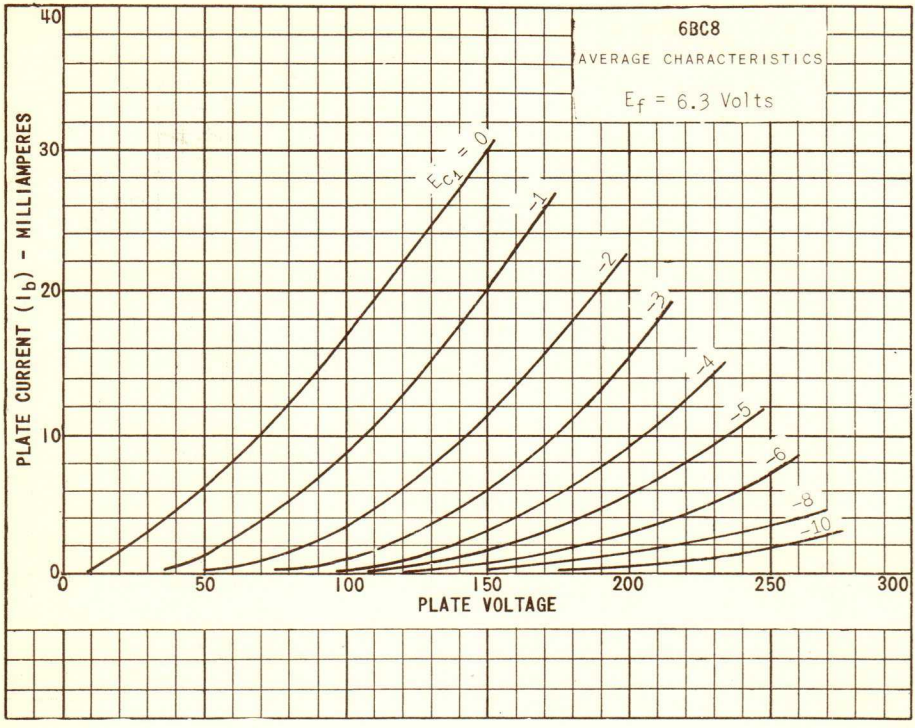
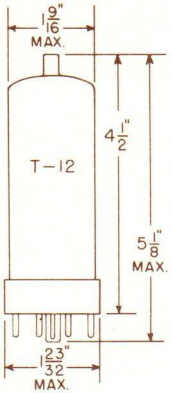
6BC8


6BC8
AVERAGE CHARACTERISTICS
E_f = 6.3 Volts
PLATE CURRENT (I_b) - MILLIAMPERES
PLATE VOLTAGE
0
10
20
30
40
0
50
100
150
200
250
300
E_{c1} = 0
-1
-2
-3
-4
-5
-6
-8
-10

TUNG-SOL

BEAM TRIODE

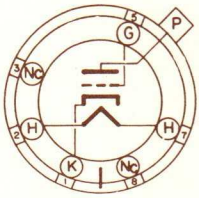


GLASS BULB
SMALL CAP

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT JUMBO-SHELL
6 PIN OCTAL

THE 6BD4 IS A LOW CURRENT, SHARP-CUTOFF BEAM TRIODE. IT IS DESIGNED SPECIFICALLY FOR THE VOLTAGE REGULATION OF HIGH VOLTAGE, LOW CURRENT DC POWER SUPPLIES.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE	1.0	μμf
INPUT	3.8	μμf
OUTPUT (MAX.)	0.04	μμf

RATINGS

INTERPRETED ACCORDING TO RETMA STANDARD M8-210

VOLTAGE CONTROL SERVICE – DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM DC PLATE VOLTAGE	20 000	VOLTS
MAXIMUM UNREGULATED DC SUPPLY VOLTAGE	40 000	VOLTS
MAXIMUM GRID VOLTAGE:		
DC VALUE	-125	VOLTS
PEAK VALUE	-550	VOLTS
MAXIMUM DC PLATE CURRENT	1.5	MA.
MAXIMUM PLATE DISSIPATION	20	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE:		
WITH UNREGULATED SUPPLY HAVING AN EQUIVALENT RESISTANCE OF AT LEAST 8 MEGOHMS	3	MEGOHMS
WITH UNREGULATED SUPPLY HAVING AN EQUIVALENT RESISTANCE LESS THAN 8 MEGOHMS	SEE CURVE #1	

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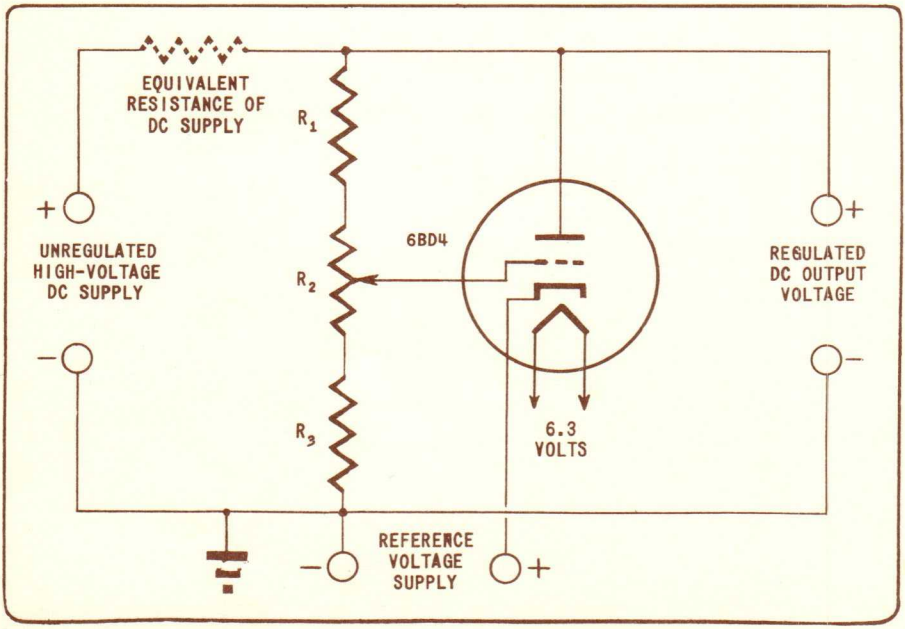
TUNG-SOL

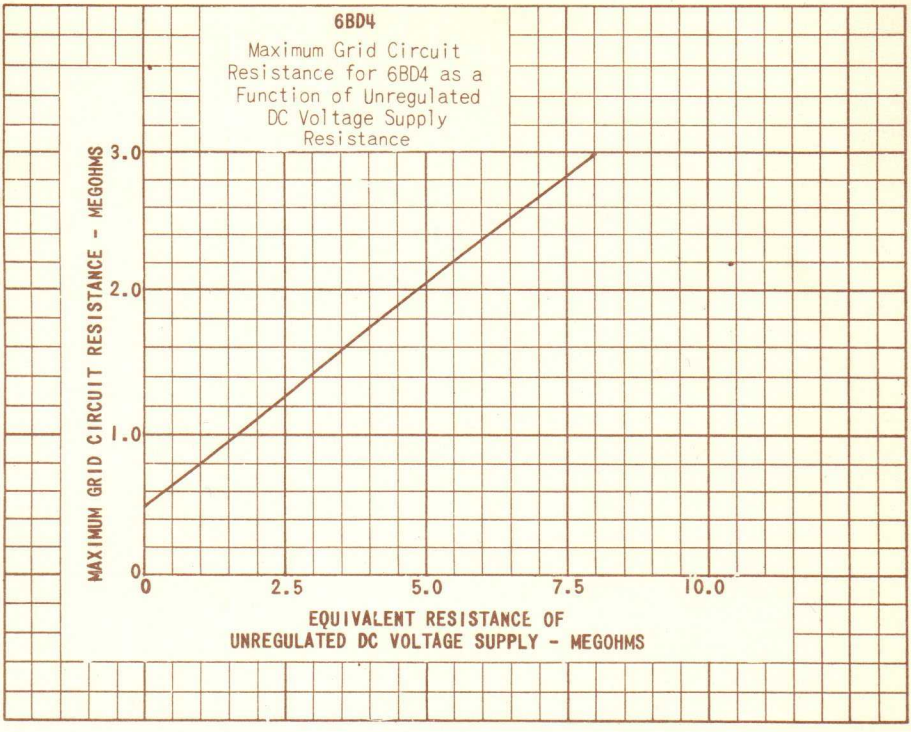
CONTINUED FROM PRECEDING PAGE

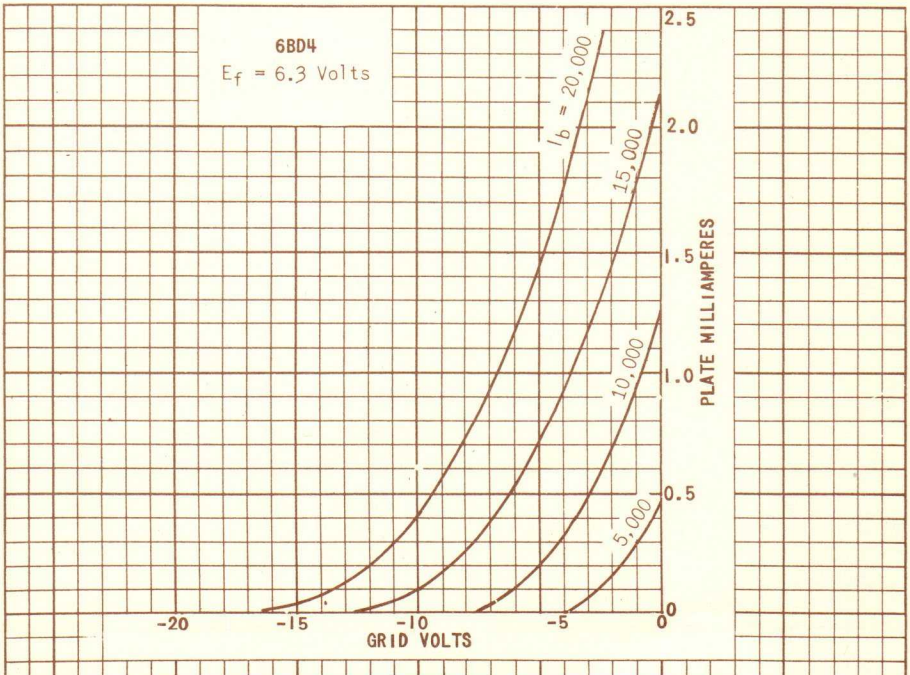
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AS A SHUNT VOLTAGE-REGULATOR TUBE IN ACCOMPANYING CIRCUIT

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
UNREGULATED SUPPLY:		
DC VOLTAGE	29 800	VOLTS
EQUIVALENT RESISTANCE	8	MEGOHMS
VOLTAGE DIVIDER VALUES:		
R_1 (5 WATTS)	120	MEGOHMS
R_2 (2 WATTS)	1	MEGOHM
R_3 (1/2 WATT)	2	MEGOHMS
REFERENCE VOLTAGE SUPPLY:		
DC VALUE	500	VOLTS
EQUIVALENT RESISTANCE	1 000	OHMS
EFFECTIVE GRID-PLATE TRANSCONDUCTANCE	138	µMHOS
DC PLATE CURRENT:		
FOR LOAD CURRENT OF 0 MA.	1 055	µAMP.
FOR LOAD CURRENT OF 1 MA.	100	µAMP.
AMPLIFICATION FACTOR	1 650	
REGULATED DC OUTPUT VOLTAGE:		
FOR LOAD CURRENT OF 0 MA.	20 000	VOLTS
FOR LOAD CURRENT OF 1 MA.	19 700	VOLTS







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TUNG-SOL

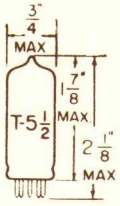
PENTODE

MINIATURE TYPE

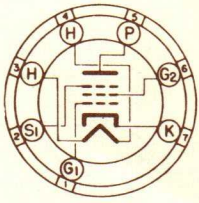
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BK

THE 6BD6 IS A MINIATURE REMOTE-CUTOFF PENTODE DESIGNED FOR USE AS A RADIO-FREQUENCY OR INTERMEDIATE-FREQUENCY AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD	WITHOUT SHIELD	
GRID TO PLATE (MAX.)	0.005	0.004	μμf
INPUT	4.3	4.3	μμf
OUTPUT	5.0	5.0	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD MB-210

DESIGN CENTER VALUES

HEATER VOLTAGE		6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		90	VOLTS *
HEATER POSITIVE WITH RESPECT TO CATHODE		90	VOLTS *
MAXIMUM PLATE VOLTAGE		300	VOLTS
MAXIMUM GRID #2 VOLTAGE		125	VOLTS
MAXIMUM PLATE DISSIPATION		3.0	WATTS →
MAXIMUM GRID #2 DISSIPATION		0.4	WATT
MAXIMUM CATHODE CURRENT		14	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS *

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	0.3	AMP.
PLATE VOLTAGE	100	125	250	VOLTS
GRID #3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET			
GRID #2 VOLTAGE	100	125	100	VOLTS
GRID #1 VOLTAGE	-1	-3	-3	VOLTS
PLATE CURRENT	13	13	9	MA.
GRID #2 CURRENT	5	5	3.0	MA.
PLATE RESISTANCE	0.15	0.18	0.8	MEGOHM
TRANSCONDUCTANCE	2 550	2 350	2 000	μMHOS
GRID VOLTAGE (APPROX.) FOR G_m = 10 μMHOS	-35	-45	-35	VOLTS

→INDICATES A CHANGE.
*INDICATES AN ADDITION.

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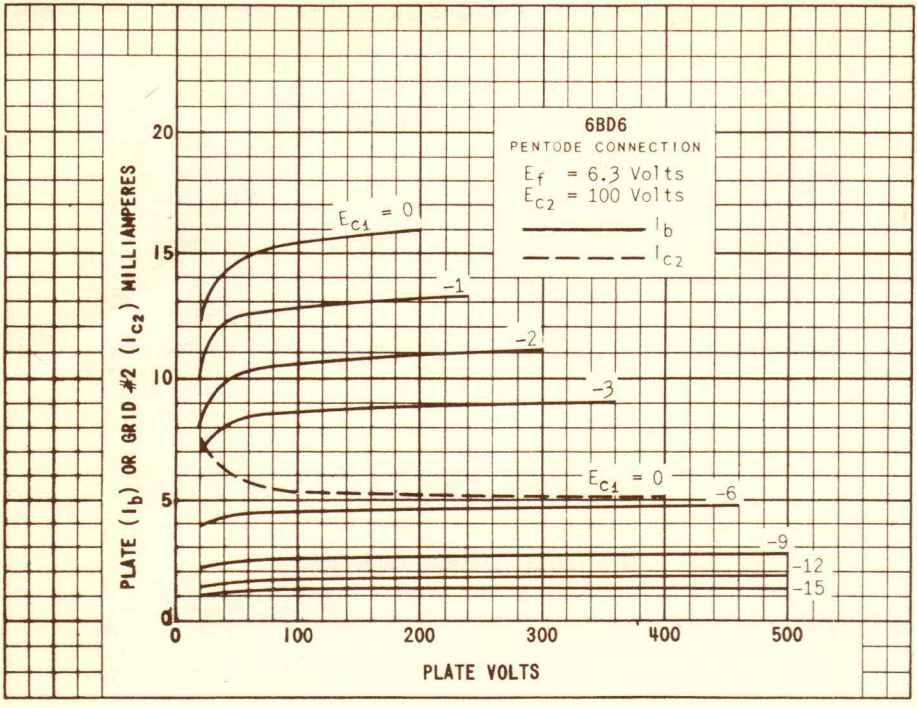
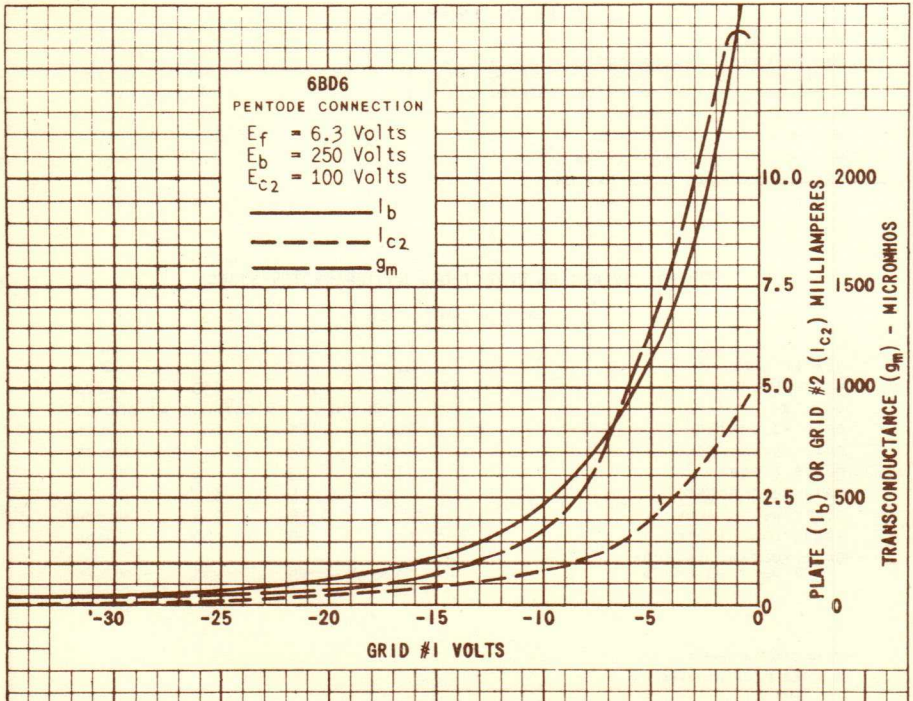
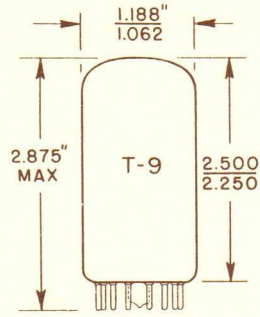

6BD6
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 100 Volts
I_b
I_{c2}
E_{c1} = 0
-1
-2
-3
E_{c1} = 0
-6
-9
-12
-15
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
0
100
200
300
400
500


6BD6
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 100 Volts
I_b
I_{c2}
g_m
GRID #1 VOLTS
-30
-25
-20
-15
-10
-5
0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (g_m) - MICROMHOS
0
2.5
5.0
7.5
10.0
0
500
1000
1500
2000

TUNG-SOL

DIODE

COMPACTRON



GLASS BULB

BUTTON

12 PIN BASE E12-70

OUTLINE DRAWING

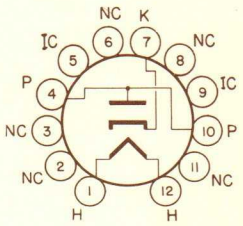
JEDEC 9-60

FOR TV DAMPING

DIODE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12GA ←
SOCKET TERMINALS 5,6,8 AND 9 SHOULD NOT BE USED AS TIE POINTS. IT IS FURTHER RECOMMENDED THAT THE SOCKET CLIPS FOR THESE PINS BE REMOVED.

THE 6BE3 IS A COMPACTRON, SINGLE HEATER-CATHODE TYPE DIODE INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL DEFLECTION CIRCUIT OF TELEVISION RECEIVERS.

EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6BE3 IS IDENTICAL TO THE 12BE3 AND THE 17BE3.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P + H)	10	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	8.0	pf
HEATER TO CATHODE: (H TO K)	3.4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	1200	MA
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
DC COMPONENT			900	VOLTS
TOTAL DC AND PEAK			5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT			100	VOLTS
TOTAL DC AND PEAK			300	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES [B] - SEE EIA STANDARD RS-239

TV DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	6.5	WATTS
STEADY STATE PEAK PLATE CURRENT	1200	MA
DC OUTPUT CURRENT	200	MA

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP, Ib = 350 MA. DC	25	VOLTS

* INDICATES AN ADDITION.

→ INDICATES A CHANGE.

B

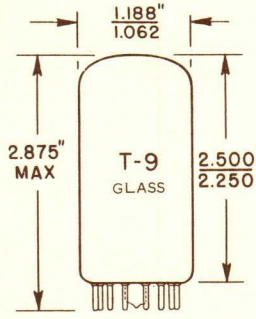
FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

TUNG-SOL

DIODE

COMPACTRON

OUTLINE DRAWING
JEDEC 9-60



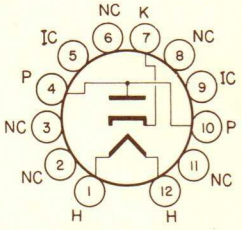
BASE 12 PIN BUTTON
JEDEC E12-70

FOR TV DAMPING
DIODE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 12GA



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12GA
SOCKET TERMINALS 5,6,8 AND 9 SHOULD NOT BE USED AS TIE POINTS. IT IS FURTHER RECOMMENDED THAT THE SOCKET CLIPS FOR THESE PINS BE REMOVED.

THE 6BE3A IS A COMPACTRON, SINGLE HEATER-CATHODE TYPE DIODE INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL DEFLECTION CIRCUIT OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6BE3A IS IDENTICAL TO THE 12BE3A AND THE 17BE3A. THE VOLTAGE DROP OF THIS TYPE IS LOWER THAN THAT OF THE 6BE3.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P + H)	10	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	8.0	pf
HEATER TO CATHODE: (H TO K)	3.4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	1200	MA
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION - AC OR DC			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
DC COMPONENT			900	VOLTS
TOTAL DC AND PEAK			5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT			100	VOLTS
TOTAL DC AND PEAK			300	VOLTS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

TV DAMPER SERVICE SEE BELOW

PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	6.5	WATTS
STEADY STATE PEAK PLATE CURRENT	1200	MA
DC OUTPUT CURRENT	200	MA

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 MUST NOT EXCEED 15 PERCENT OF ONE SCANNING CYCLE.

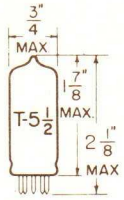
AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP, Ib = 350 MA. DC	22.5	VOLTS

TUNG-SOL

HEPTODE

MINIATURE TYPE



GLASS BULB

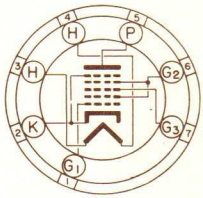
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7CH

THE 6BE6 IS A PENTAGRID CONVERTER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR SERVICE AS A COMBINED OSCILLATOR AND MIXER IN SUPERHETERODYNE RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
MIXER GRID TO PLATE: (G_3 TO P) MAX.	0.25	0.30	μμf
MIXER GRID TO OSCILLATOR GRID; (G_3 TO G_1) MAX.	0.15	0.15	μμf
RF INPUT: G_3 TO (H+K+G_1+$G_{2\&4}$+G_5+P)	7.0	7.0	μμf
OSCILLATOR INPUT: G_1 TO (H+K+$G_{2\&4}$+G_3+G_5+P)	5.5	5.5	μμf
MIXER OUTPUT: P TO (H+K+G_1+$G_{2\&4}$+G_3+G_5)	13	8.0	μμf
OSCILLATOR GRID TO CATHODE: (G_1 TO K+G_5)	3.0	3.0	μμf
OSCILLATOR OUTPUT: K TO (H+$G_{2\&4}$+G_3+P)	20	15	μμf
OSCILLATOR GRID TO PLATE: (G_1 TO P) MAX.	0.05	0.1	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS ←

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PEAK HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[C]	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRIDS #2 AND #4 VOLTAGE	110	VOLTS
MAXIMUM GRIDS #2 AND #4 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE	−55	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.1	WATT
MAXIMUM GRIDS #2 AND #4 DISSIPATION	1.1	WATT
MAXIMUM CATHODE CURRENT	15.5	MA.

[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE – SEPARATE EXCITATION[B]

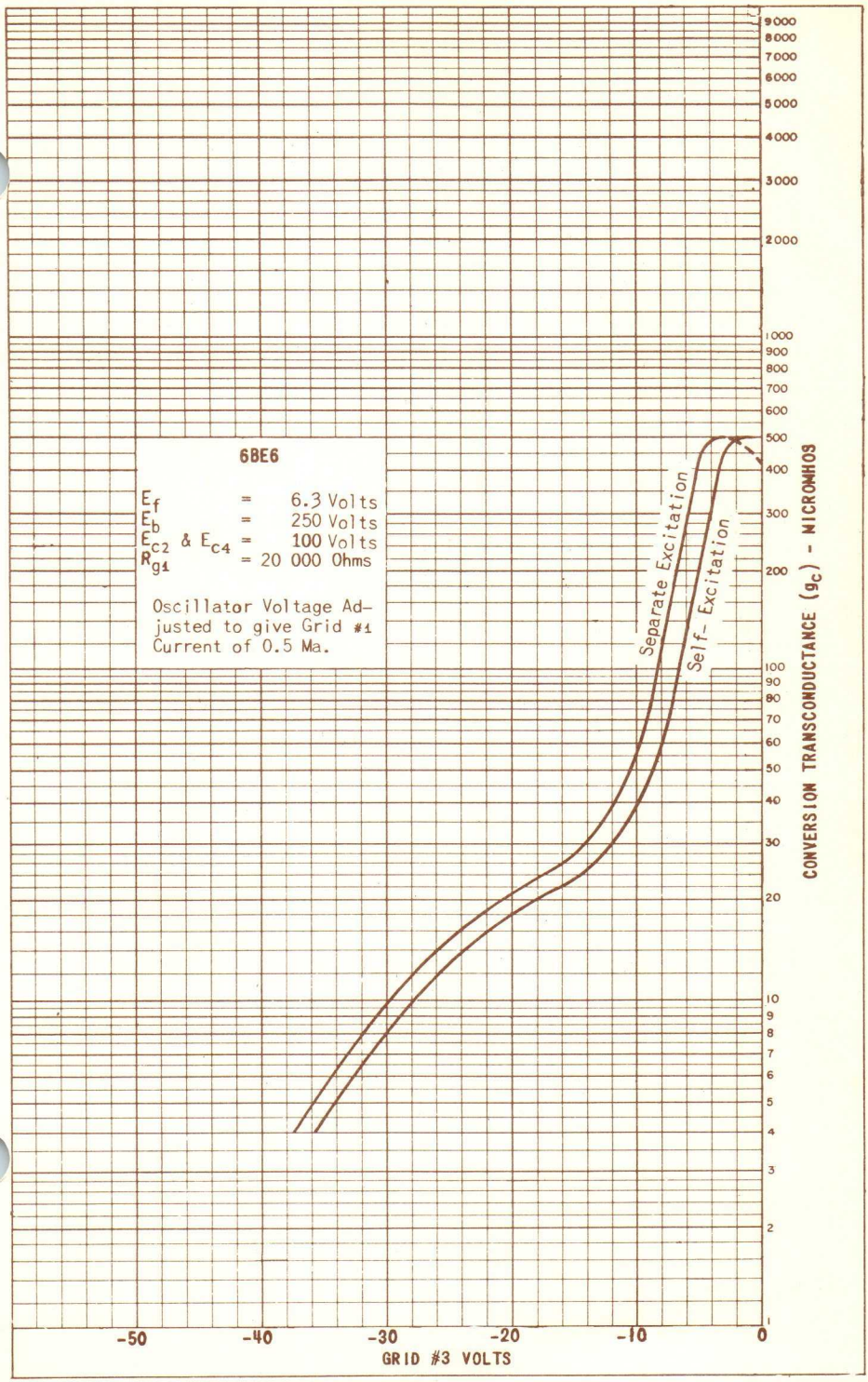
HEATER VOLTAGE	6.3±10%		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	-1.5	-1.5	VOLTS
GRIDS #2 AND #4 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID) RMS	10	10	VOLTS
GRID #1 RESISTANCE (OSCILLATOR GRID)	20 000	20 000	OHMS
PLATE RESISTANCE (APPROX.)	0.4	1.0	MEGOHMS
GRID #1 CURRENT (OSCILLATOR GRID)	0.5	0.5	MA.
CONVERSION TRANSCONDUCTANCE	455	475	μMHOS
PLATE CURRENT	2.6	2.9	MA.
GRIDS #2 AND #4 CURRENT	7.0	6.8	MA.
CATHODE CURRENT	10.1	10.2	MA.
GRID #3 VOLTAGE FOR G_C = 10 μMHOS (APPROX.)	-30	-30	VOLTS
GRID #3 VOLTAGE FOR G_C = 100 μMHOS (APPROX.)	-6	-6	VOLTS

[B]CHARACTERISTICS SHOWN ARE OBTAINED IN THE STANDARD RMA CONVERSION CONDUCTANCE TEST SET WHICH USES SEPARATE EXCITATION. THE CHARACTERISTICS UNDER THESE CONDITIONS CORRESPOND VERY CLOSELY WITH THOSE OBTAINED IN A SELF-EXCITED OSCILLATORY CIRCUIT OPERATING WITH ZERO BIAS.

OSCILLATOR CHARACTERISTICS
NOT OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID)	0	VOLTS
GRIDS #2 AND #4 CONNECTED TO PLATE	100	VOLTS
TRANSCONDUCTANCE BETWEEN GRID #1 AND GRIDS #2 AND #4 CONNECTED TO PLATE	7 250	μMHOS
AMPLIFICATION FACTOR BETWEEN GRID #1 AND GRIDS #2 AND #4 CONNECTED TO PLATE	20	
CATHODE CURRENT	25	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA	-11	VOLTS

SIMILAR TYPE REFERENCE: *Except for heater ratings, the 6BE6 is identical to the 12BE6.*



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AUG. 2, 1948

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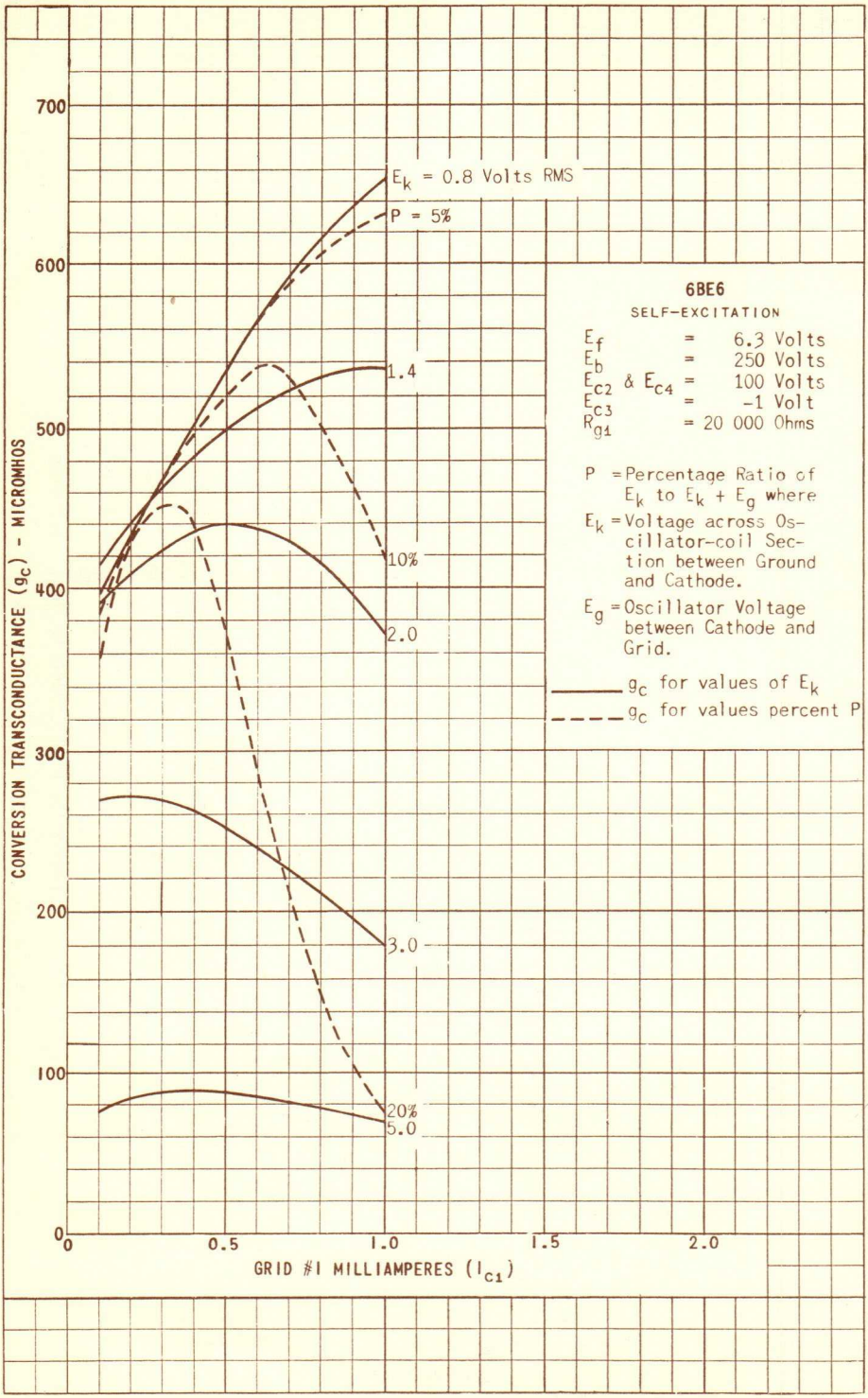
6BE6 (12BE6)



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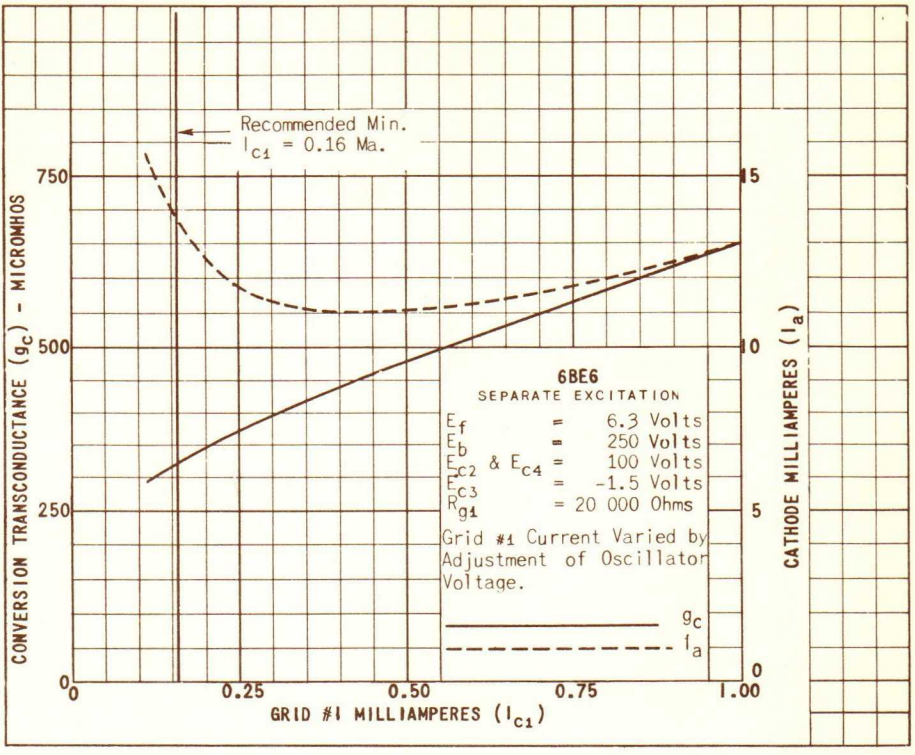

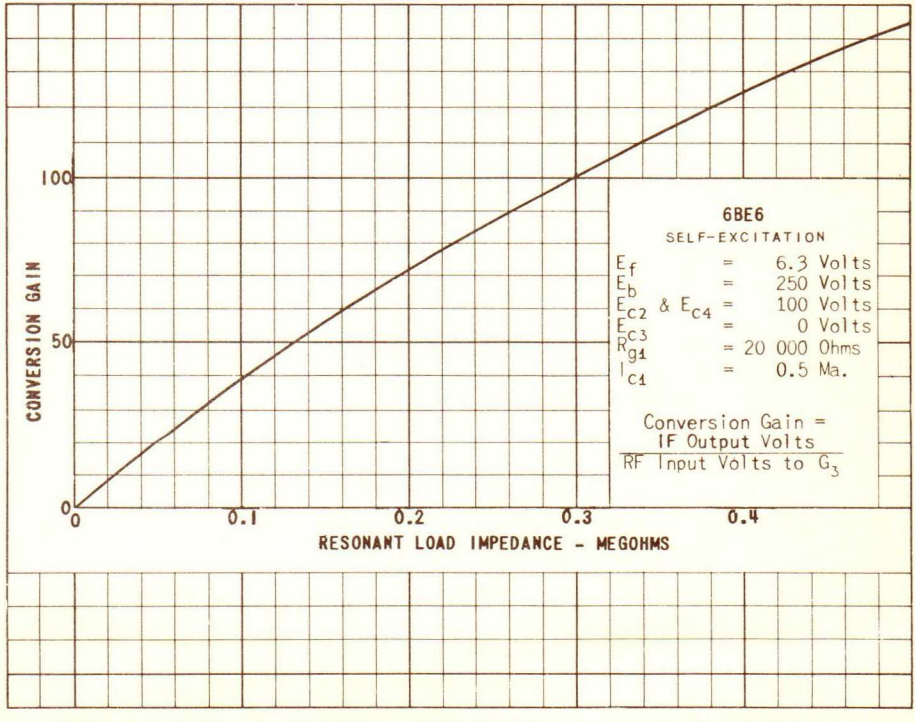

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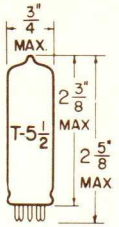
PENTODE

MINIATURE TYPE

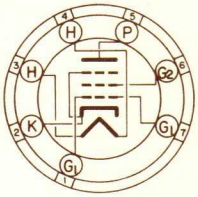


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BZ

THE 6BF5 IS A BEAM PENTODE POWER AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR USE AS A VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE: (G_1 TO P)	0.65	μμf
INPUT: G_1 TO (H+K+G_2)	14	μμf
OUTPUT: P TO (H+K+G_2)	6	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	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
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	117	VOLTS
MAXIMUM PLATE DISSIPATION	5.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS

VERTICAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	250	VOLTS
MAXIMUM PEAK POSITIVE VOLTAGE (ABSOLUTE MAXIMUM)	900	VOLTS
MAXIMUM PLATE DISSIPATION[B]	5.0	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	250	VOLTS ←
MAXIMUM CATHODE CURRENT (AVERAGE)	40	MA.
MAXIMUM PEAK CATHODE CURRENT	120	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2	MEGOHMS

[A] 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 NOT TO EXCEED 15% OF A SCANNING CYCLE.

[B] 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.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – SINGLE TUBE

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	−7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	36	MA.
MAXIMUM SIGNAL PLATE CURRENT	39	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	10.5	MA.
PLATE RESISTANCE (APPROX.)	12 000	OHMS
TRANSCONDUCTANCE	7 500	µMHOS
LOAD RESISTANCE	2 500	OHMS
MAXIMUM SIGNAL POWER OUTPUT	1.9	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT

TRIODE CONNECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PLATE VOLTAGE	225	VOLTS
GRID VOLTAGE	−30	VOLTS
PLATE CURRENT	10	MA.
TRANSCONDUCTANCE	2 700	µMHOS
AMPLIFICATION FACTOR	6.7	
PLATE RESISTANCE	2 500	OHMS
GRID VOLTAGE FOR I_b = 0.5 MA. (APPROX.)	−40	VOLTS

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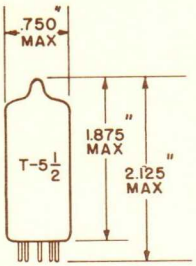
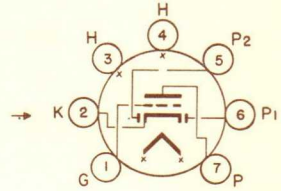


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

DOUBLE-DIODE TRIODE
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE
VOLTAGE AMPLIFIER
AND
DETECTOR

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BT

THE 6BF6 IS A COMBINED LOW-MU VOLTAGE AMPLIFIER AND DOUBLE DIODE DETECTOR USING THE 7 PIN MINIATURE CONSTRUCTION. THE LOW AMPLIFICATION FACTOR OF THE TRIODE PERMITS LARGE VALUES OF OUTPUT SIGNAL WITH LOW DISTORTION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH[A] SHIELD	
TRIODE SECTION:			
GRID TO PLATE: (G TO TP)	1.9	1.9	pf
INPUT: G TO (H+K)	1.8	1.9	pf
OUTPUT: TP TO (H+K)	0.7	1.2	pf
DIODE SECTION:			
#1 DIODE PLATE TO GRID: (1DP TO G) MAX.	0.07	0.06	pf
#2 DIODE PLATE TO GRID: (2DP TO G) MAX.	0.06	0.05	pf
#2 DIODE PLATE TO HEATER AND CATHODE	0.95		pf
#1 DIODE PLATE TO HEATER AND CATHODE	0.66		pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
CURRENT OPERATION		300±20	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		90	VOLTS

[A] EXTERNAL SHIELD 316 CONNECTED TO PIN #2.

→ INDICATES A CHANGE.

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MAXIMUM RATINGS

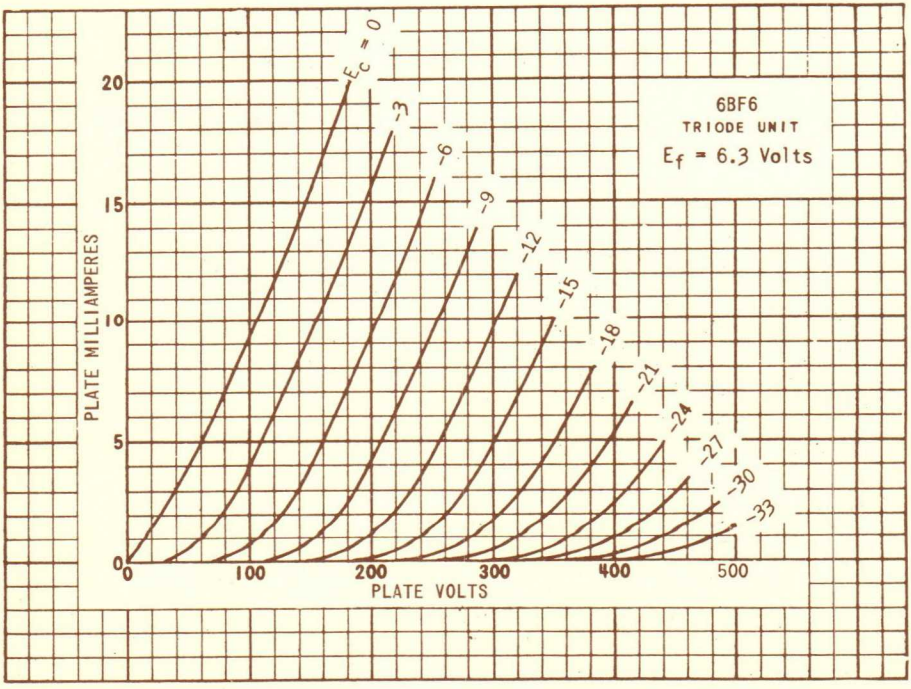
DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

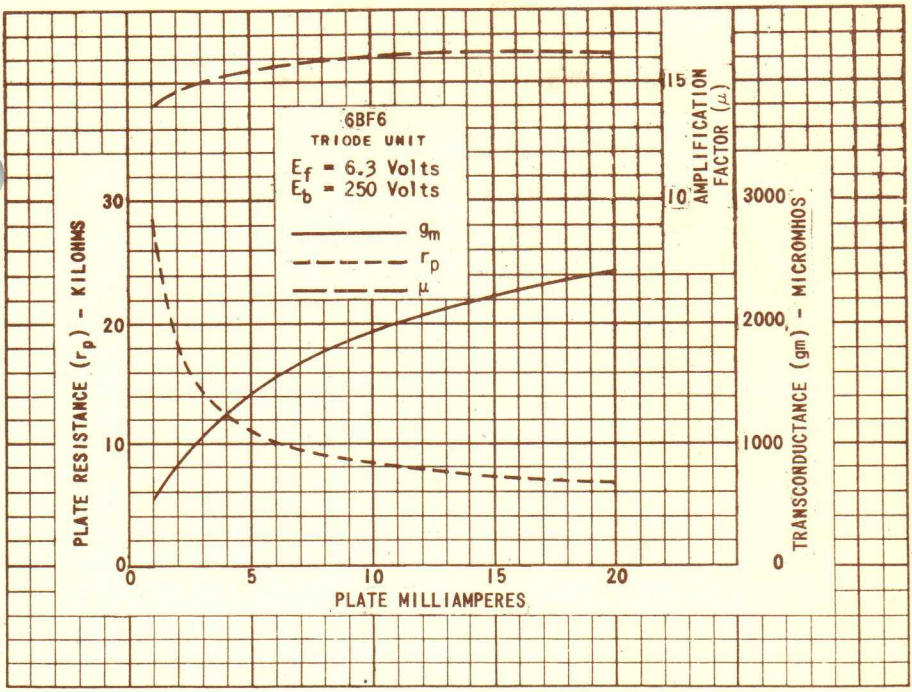
PLATE VOLTAGE	300	VOLTS
PLATE DISSIPATION	2.5	WATTS
AVERAGE DIODE CURRENT EACH UNIT FOR CONTINUOUS OPERATION	1.0	MA.

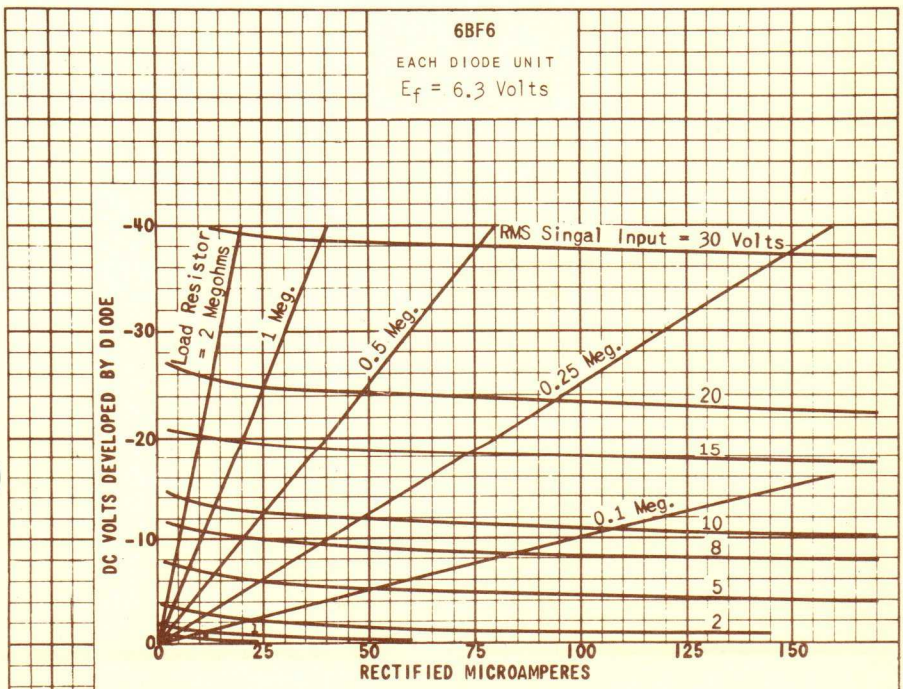
TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-9	VOLTS
PLATE RESISTANCE	8500	OHMS
TRANSCONDUCTANCE	1900	μMHOS
AMPLIFICATION FACTOR	16	
PLATE CURRENT	9.5	MA.
LOAD RESISTANCE	10000	OHMS
TOTAL HARMONIC DISTORTION	6.5	PERCENT
POWER OUTPUT	300	MW.
DIODE CURRENT EACH PLATE WITH 10 VOLTS DC APPLIED (MIN.)	0.8	MA.







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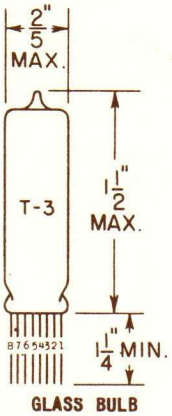
DOUBLE TRIODE

SUBMINIATURE TYPE

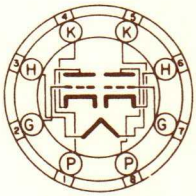


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE BUTTON
8 FLEXIBLE LEADS
8DG

THE 6BF7 IS A GENERAL PURPOSE TRIODE IN THE SUBMINIATURE CONSTRUCTION. IT IS SIMILAR IN FUNCTION TO TYPE 6J6, BUT PROVIDES ADDED FLEXIBILITY FROM THE USE OF SEPARATE CATHODE LEADS AND THE COMPACTNESS OF THE SUBMINIATURE CONSTRUCTION.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE (EACH SECTION)	1.5	1.5	μμf
INPUT (EACH SECTION)	2.0	2.0	μμf
OUTPUT:			
SECTION 1	1.6	0.28	μμf
SECTION 2	2.0	0.3	μμf
GRID TO GRID	0.008	0.009	μμf
PLATE TO PLATE	0.55	0.75	μμf

[A] EXTERNAL SHIELD OF 0.405 INCH DIAMETER CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.0	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
CATHODE BIAS RESISTOR	100	OHMS
PLATE CURRENT	8.0	MA.
AMPLIFICATION FACTOR	35	
TRANSCONDUCTANCE	4 800	μMHOS
PLATE RESISTANCE	7 000	OHMS
GRID VOLTAGE FOR 10 μAMP. PLATE CURRENT	-7.5	VOLTS

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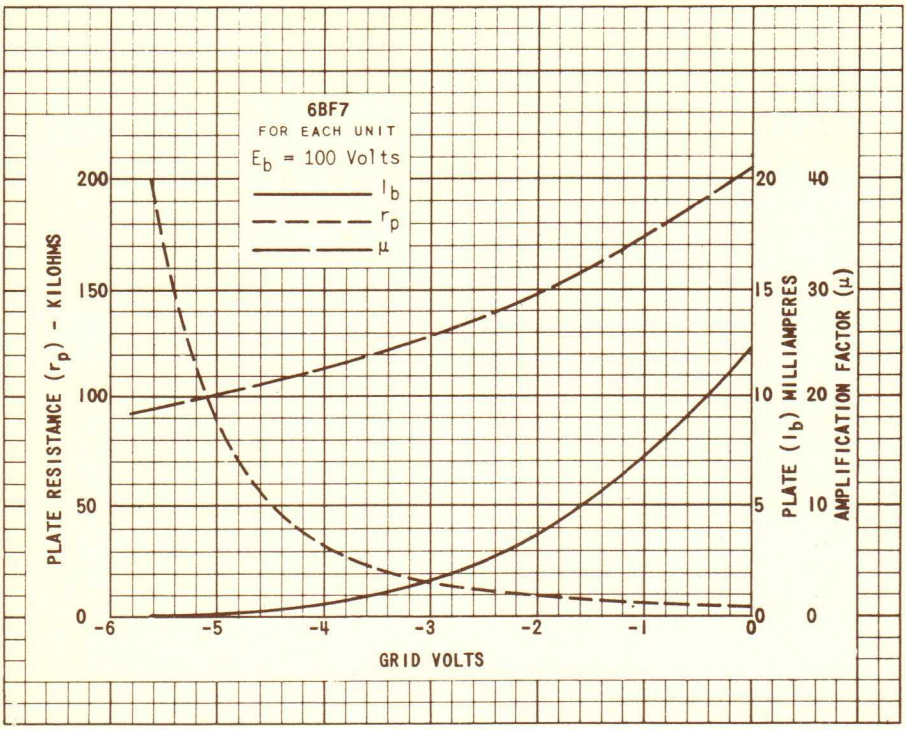
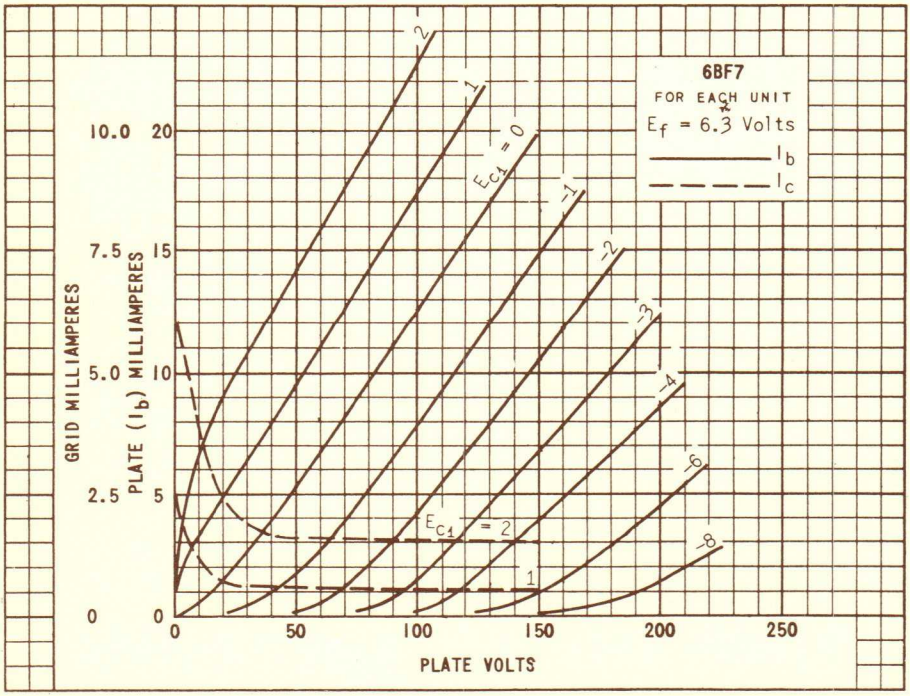

6BF7
FOR EACH UNIT
E_b = 100 Volts
I_b
r_p
μ
PLATE RESISTANCE (r_p) - KILOHMS
PLATE (I_b) MILLIAMPERES
AMPLIFICATION FACTOR (μ)
GRID VOLTS
200
150
100
50
0
20
15
10
5
0
40
30
20
10
0
-6
-5
-4
-3
-2
-1
0

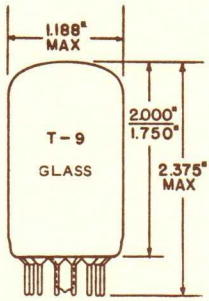

6BF7
FOR EACH UNIT
E_f = 6.3 Volts
I_b
I_c
GRID MILLIAMPERES
PLATE (I_b) MILLIAMPERES
PLATE VOLTS
E_{c1} = 0
E_{c1} = 2
2
1
-1
-2
-3
-4
-6
-8
10.0
7.5
5.0
2.5
0
20
15
10
5
0
0
50
100
150
200
250

TUNG-SOL

DUAL PENTODE

COMPACTRON

OUTLINE
JEDEC 9-58



BASE 12 PIN BUTTON
JEDEC E12-70

FOR

FM DETECTOR

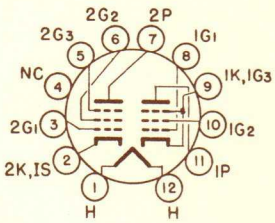
AND AUDIO OUTPUT

IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 12EZ



BOTTOM VIEW

THE TUNG-SOL 6BF11 IS A 12-PIN T-9 COMPACTRON CONTAINING TWO DISSIMILAR PENTODES. SECTION 1 IS A POWER PENTODE FOR AUDIO APPLICATION. SECTION 2 IS A DUAL CONTROL PENTODE INTENDED FOR USE AS FM DETECTOR IN TV CIRCUITS. ELECTRICALLY, SECTION 2 IS SIMILAR TO TYPE 6DT6. EXCEPT FOR HEATER CHARACTERISTICS, THE 6BF11 IS IDENTICAL TO THE 17BF11.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE 1 - GRID 1 TO PLATE	0.24	pf
INPUT: (G1 TO H + K + I.S. + G_2)	13	pf
OUTPUT: (P TO H + K + I.S. + G_2)	10	pf
PENTODE 2 - GRID 1 TO PLATE	0.036	pf
GRID 1 TO ALL (G1 TO H + K + I.S. + G_2 + G_3 + P)	6.5	pf
GRID 3 TO PLATE	3.2	pf
GRID 3 TO ALL (G_3 TO H + K + I.S. + G_1 + G_2 + P)	8.0	pf
GRID 1 TO GRID 3	0.11	pf
COUPLING - PLATE TO PLATE	0.13	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1.2	AMPS.
LIMITS OF APPLIED VOLTAGE - AC OR DC		6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE-BOTH SECTIONS			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

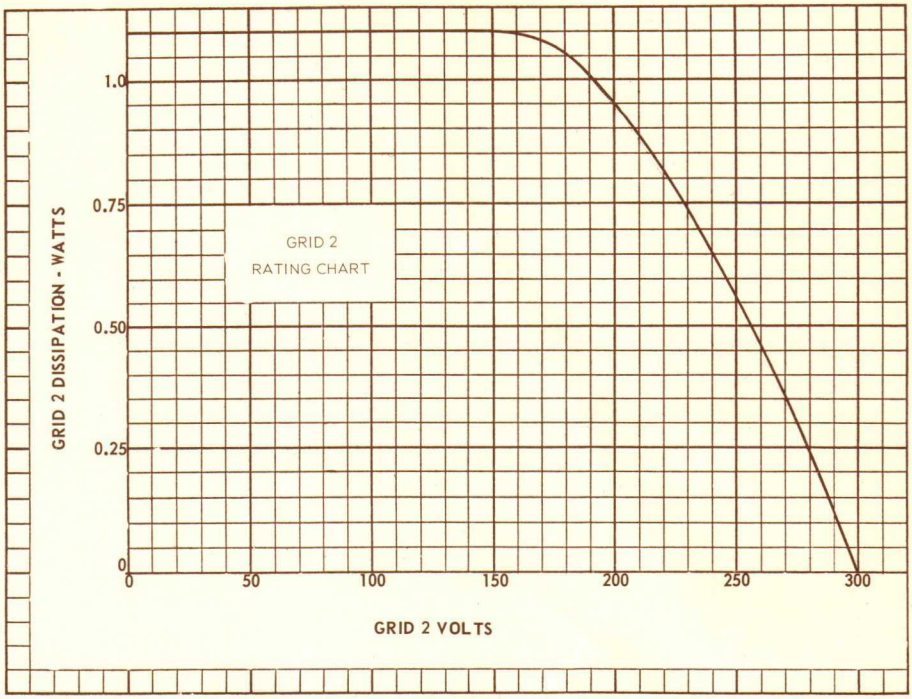
	SECTION 1	SECTION 2	
PLATE VOLTAGE	165	330	VOLTS
GRID 2 VOLTAGE	150	-	VOLTS
GRID 2 SUPPLY VOLTAGE	-	330	VOLTS
POSITIVE DC GRID 3 VOLTAGE	-	28	VOLTS
PLATE DISSIPATION	6.5	1.7	WATTS
GRID 2 DISSIPATION	1.8	SEE CHART	WATTS
UP TO 150 VOLTS	-	1.1	WATTS
CATHODE CURRENT	65	-	MA
GRID 1 CIRCUIT RESISTANCE			
FIXED BIAS	0.25	-	MEGOHMS
SELF BIAS	0.5	-	MEGOHMS

AVERAGE CHARACTERISTICS

	SECTION 1	SECTION 2	
PLATE VOLTAGE	145	150	VOLTS
GRID 2 VOLTAGE	110	100	VOLTS
GRID 3 VOLTAGE	-	0	VOLTS
GRID 1 VOLTAGE	-6.0	0	VOLTS
CATHODE RESISTOR	-	560	OHMS
PLATE CURRENT	36	1.3	MA
GRID 2 CURRENT	3.0	2.0	MA
TRANSCONDUCTANCE GRID 1 TO PLATE	8,600	1,000	μMHOS
GRID 3 TO PLATE	-	400	μMHOS
PLATE RESISTANCE - APPROX.	0.03	0.15	MEGOHMS
GRID 1 VOLTAGE FOR I_b = 10 μA	-	-4.5	VOLTS
GRID 3 VOLTAGE FOR I_b = 10 μA	-	-4.5	VOLTS

TYPICAL OPERATION - CLASS A1 POWER AMPLIFIER

	SECTION 1	
PLATE VOLTAGE	145	VOLTS
GRID 2 VOLTAGE	110	VOLTS
GRID 1 VOLTAGE	-6.0	VOLTS
PEAK AUDIO GRID 1 VOLTAGE	6.0	VOLTS
LOAD RESISTANCE	3,000	OHMS
MAXIMUM SIGNAL PLATE CURRENT	40	MA
MAXIMUM SIGNAL GRID 2 CURRENT	9.0	MA
TOTAL HARMONIC DISTORTION	10	%
POWER OUTPUT	2.4	WATTS



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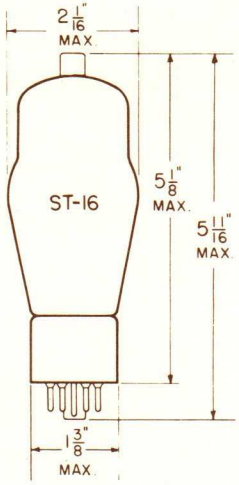
BEAM PENTODE

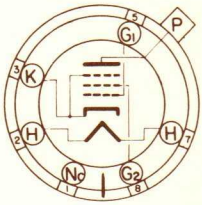


GLASS BULB
SMALL CAP

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.9 AMP.
AC OR DC

MOUNTING POSITION
VERTICAL - BASE UP OR DOWN.
HORIZONTAL - PLANE OF PINS 2 & 7 VERTICAL



BOTTOM VIEW
MEDIUM SHELL
6 PIN OCTAL
5BT

THE 6BG6G IS ESSENTIALLY A MECHANICAL REDESIGN OF TYPE 6L6G TO PERMIT OPERATION AS A HORIZONTAL DEFLECTION AMPLIFIER FOR TELEVISION SERVICE. IT USES A TOP CAP CONNECTION AND ADDITIONAL INSULATION FOR THE PLATE STRUCTURE TO WITHSTAND THE HIGH PEAK PLATE VOLTAGE ENCOUNTERED IN SUCH CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE: (G_1 TO P) MAX.	0.34 ←	μμf
INPUT: G_1 TO (H+K+G_2+IS)	12 ←	μμf
OUTPUT: P TO (H+K+G_2+IS)	6.5	μμf

RATINGS ←
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	6.3	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
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST +DC POWER SUPPLY)	700	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABS. MAX.)	6600	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1500	VOLTS
MAXIMUM PLATE DISSIPATION[B]	20	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	350	VOLTS
MAXIMUM GRID #2 DISSIPATION	3.2	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210	°C

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS ←

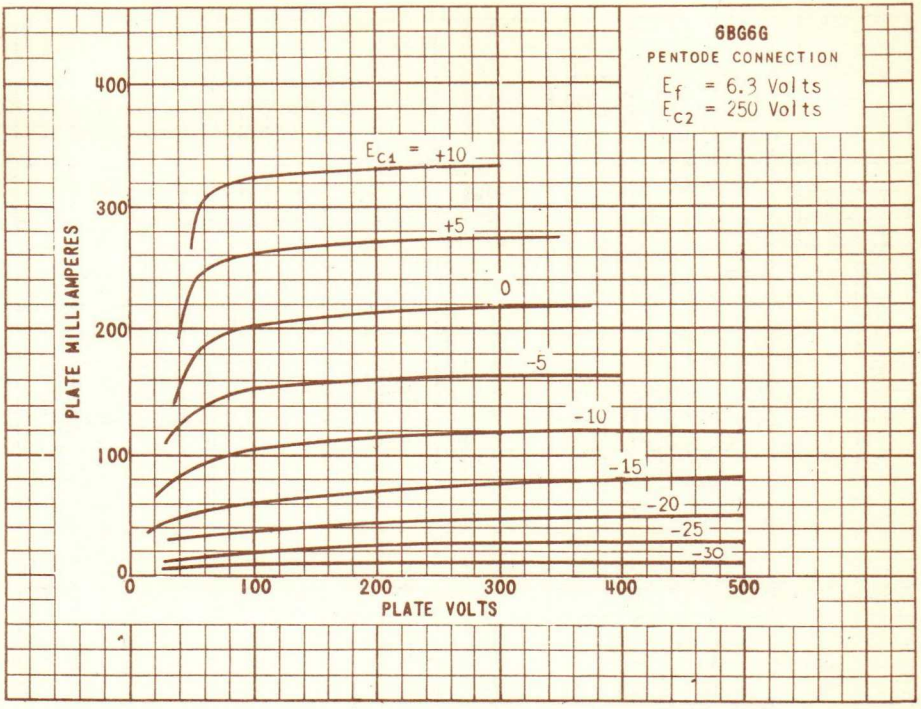
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.9	AMP.
PENTODE OPERATION: WITH E_b=250 ., E_{c2}=250V., & E_{c1}=-15V.		
PLATE CURRENT	75	MA.
GRID #2 CURRENT	4	MA.
TRANSCONDUCTANCE	6 000	μMHOS
PLATE RESISTANCE	25 000	OHMS
ZERO BIAS: WITH E_b =60V. & E_{c2}=250V.(INSTANTANEOUS VALUES)		
PLATE CURRENT	180	MA.
GRID #2 CURRENT	18	MA.
CUTOFF: FOR I_b=1 MA. WITH E_b=250 V. & E_{c2}=250 V.		
GRID #1 VOLTAGE (APPROX.)	-45	VOLTS
TRIODE μ: WITH E_b = E_{c2}=250V. & E_{c1} =-15V.	8.0	

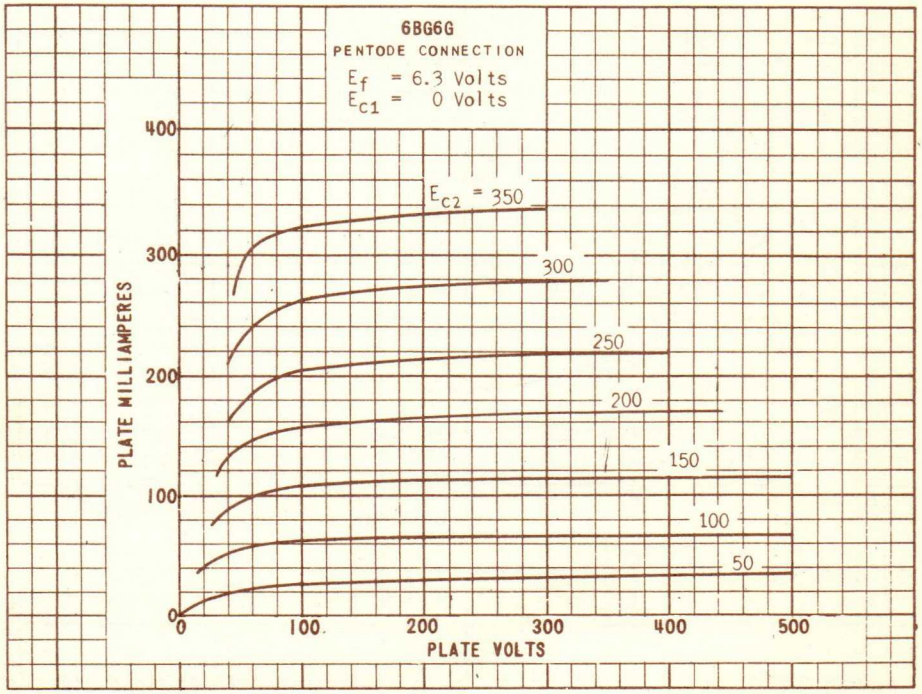
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] 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.

SIMILAR TYPE REFERENCE: *Except for heater ratings the 6BG6G is identical to the 19BG6G.*

→INDICATES A CHANGE.





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1949

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6BG6G

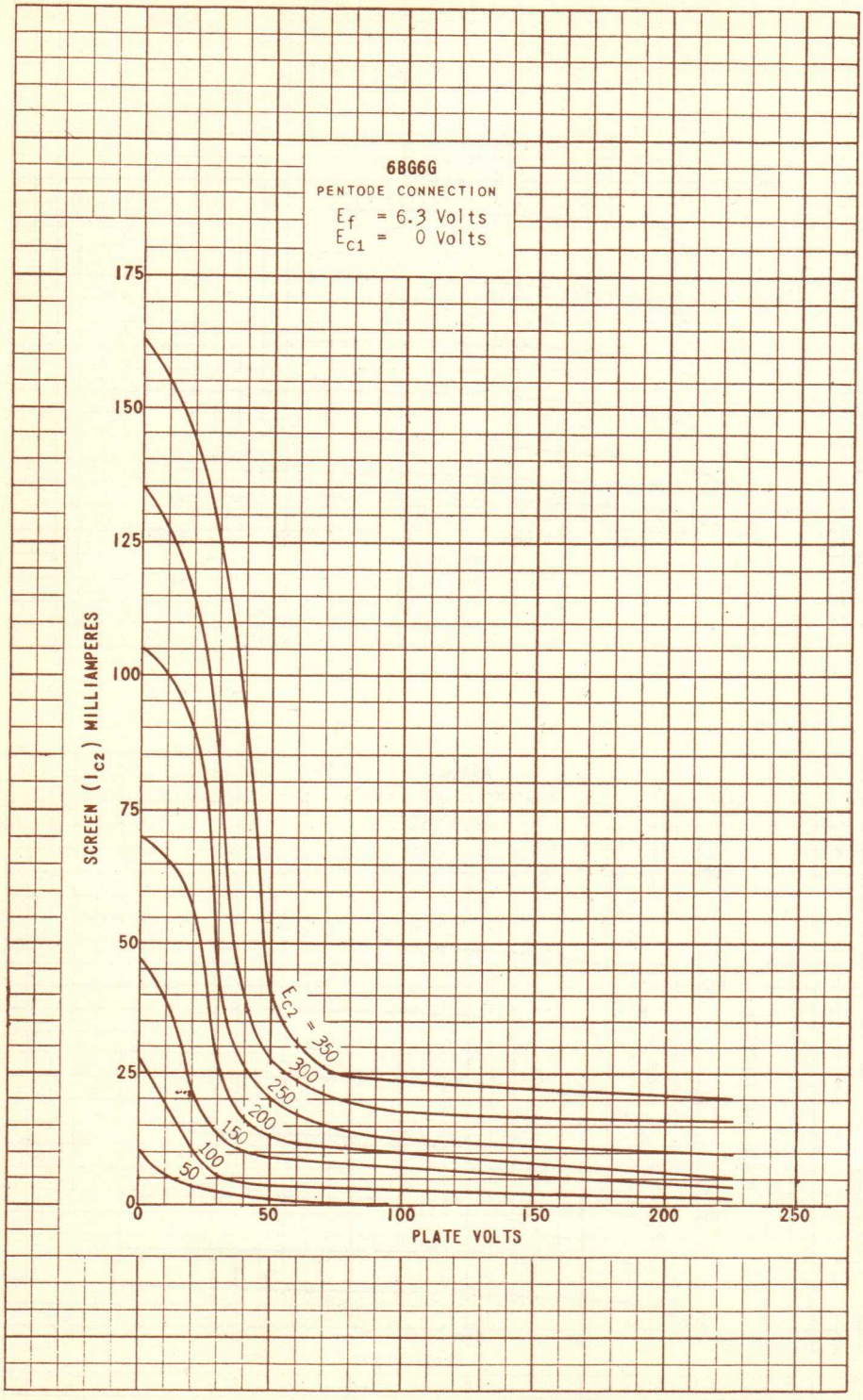

PLATE 2167
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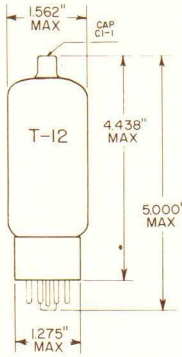
BEAM POWER PENTODE



GLASS BULB

B8-110 OR B6-120 OR B5-123 ←
SHORT MEDIUM SHELL
5 PIN OCTAL WITH
EXTERNAL BARRIERS

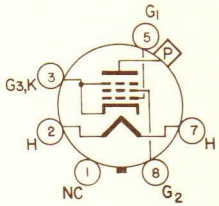
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.9 AMP.
AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION PERMITTED IF PINS #2 AND #7 ARE IN A VERTICAL PLANE.



BOTTOM VIEW

BASING DIAGRAM
JEDEC 5BT

THE 6BG6GA IS A BEAM-POWER PENTODE DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. ELECTRICALLY AND PHYSICALLY, THE 6BG6GA IS A REPLACEMENT FOR THE 6BG6G; IT DIFFERS PRIMARILY FROM THE 6BG6G BY EMPLOYING A STRAIGHT-SIDED T-12 ENVELOPE.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.8	pf
INPUT	11.0	pf
OUTPUT	6.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER[A]

MAXIMUM DC PLATE SUPPLY VOLTAGE	700	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	6600	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE	1500	VOLTS
MAXIMUM PLATE DISSIPATION[B]	20	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	350	VOLTS
MAXIMUM GRID #2 DISSIPATION	3.2	WATTS
MAXIMUM DC CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210	°C

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] 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.

→ INDICATES A CHANGE.

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RATINGS — CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER[A]

MAXIMUM HEATER—CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	60	250	VOLTS
GRID #2 VOLTAGE	250	250	VOLTS
PLATE CURRENT	180	75	MA.
GRID #2 CURRENT	18	4.0	MA.
GRID #1 VOLTAGE	0	−15	VOLTS
PLATE RESISTANCE (APPROX.)		25 000	OHMS
TRANSCONDUCTANCE		6 000	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR I_b=1.0 MA.		−45	VOLTS
TRIODE AMPLIFICATION FACTOR[C]		8.0	

[C] TRIODE CONNECTED (GRID #2 TIED TO PLATE): Eb = Ec2 = 250 VOLTS AND Ec1 = −15 VOLTS.

TUNG-SOL

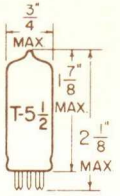
PENTODE

MINIATURE TYPE

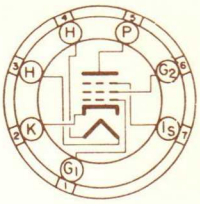
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 6BH6 IS A SHARP CUT-OFF PENTODE VOLTAGE AMPLIFIER IN THE MINIATURE CONSTRUCTION. IT FEATURES HIGH TRANSCONDUCTANCE, LOW CAPACITANCES, AND ECONOMY OF HEATER POWER AND IS USEFUL AS A GENERAL PURPOSE AMPLIFIER AT BOTH LOW AND HIGH FREQUENCIES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G TO P) MAX.	0.0035	0.0035	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.4	5.4	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	4.4	4.4	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PINS #2 AND #7.

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	PIN #7 CONNECTED TO PIN #2 AT SOCKET		
GRID #2 VOLTAGE	100	150	VOLTS
GRID #1 VOLTAGE	-1	-1	VOLT
PLATE RESISTANCE (APPROX.)	0.7	1.4	MEGOHMS
TRANSCONDUCTANCE	3 400	4 600	μMHOS
PLATE CURRENT	3.6	7.4	MA.
GRID #2 CURRENT	1.4	2.9	MA.
GRID #1 VOLTAGE FOR I_b = 10 μA.	-5	-7.7	VOLTS

→ INDICATES A CHANGE OR ADDITION.

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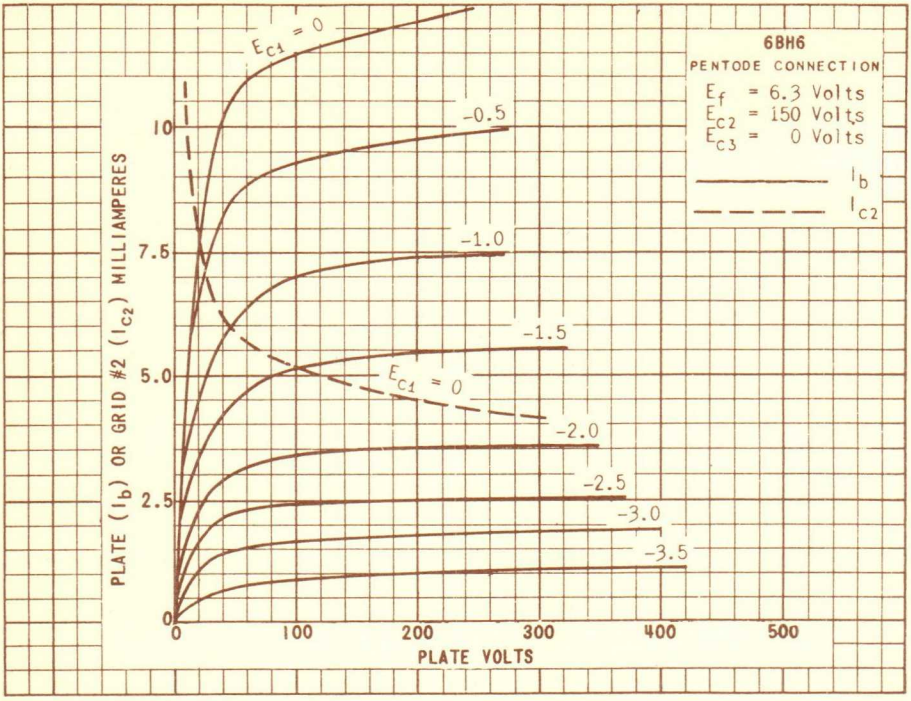
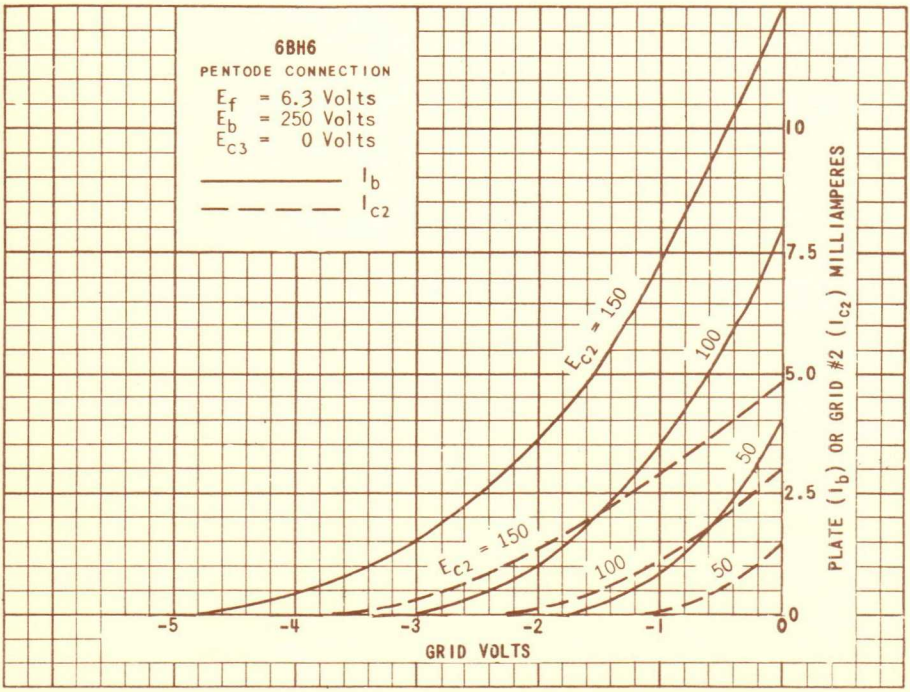
6BH6





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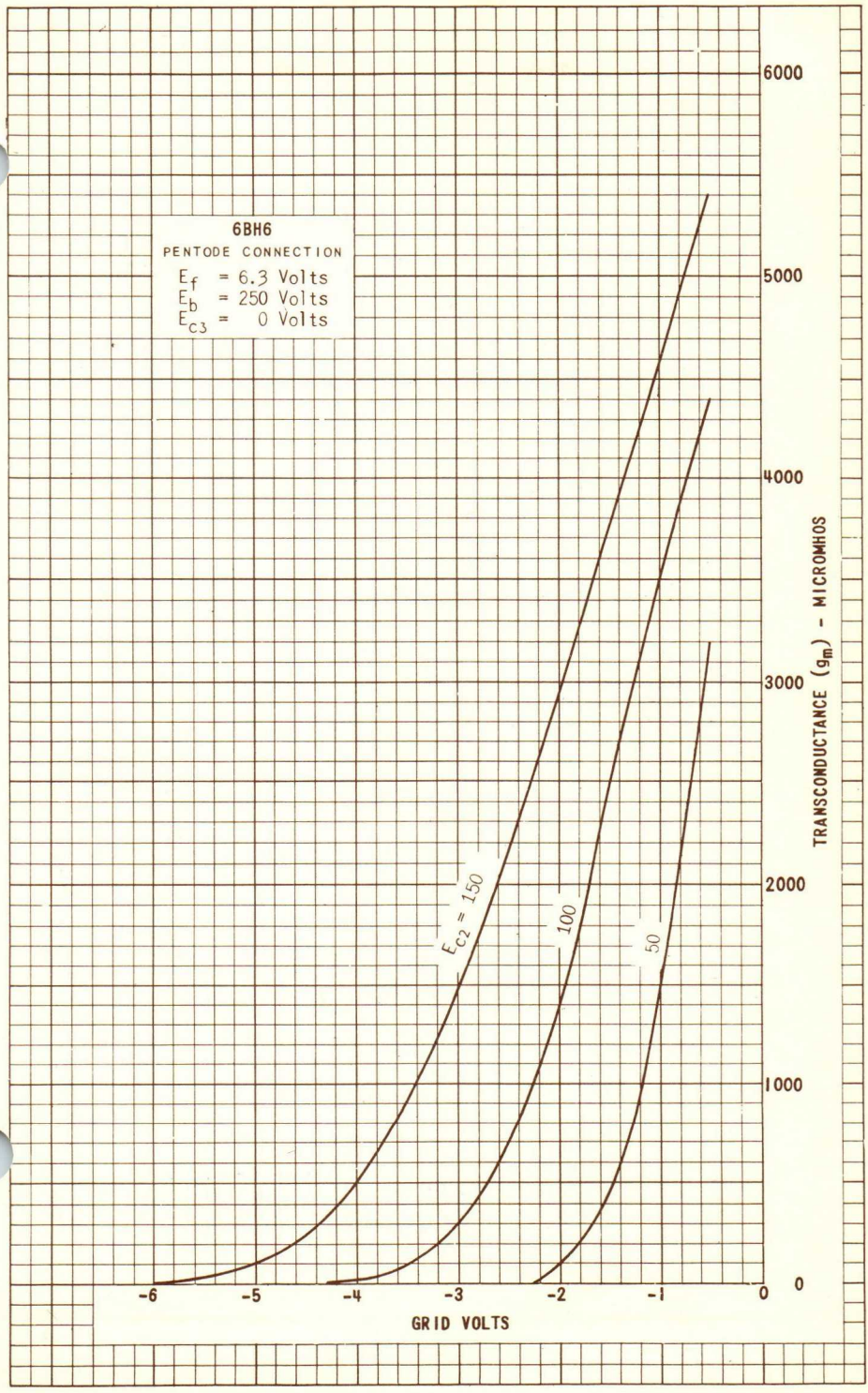

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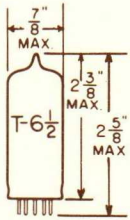
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

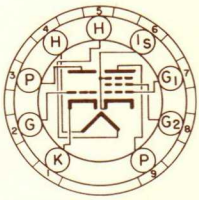


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9DX

THE 6BH8 IS A SHARP CUTOFF PENTODE AND A MEDIUM MU TRIODE IN THE 9-PIN MINIATURE CONSTRUCTION. THE TUBE IS SUITABLE FOR GENERAL PURPOSE APPLICATIONS IN BOTH MONOCHROME AND COLOR TELEVISION RECEIVERS. THE HIGH FIGURE OF MERIT OF THE PENTODE SECTION MAKES IT PARTICULARLY SUITED FOR SERVICE AS A VIDEO AMPLIFIER, VIDEO INTERMEDIATE FREQUENCY AMPLIFIER AND SOUND INTERMEDIATE FREQUENCY AMPLIFIER. THE TRIODE SECTION IS INTENDED FOR USE AS A SYNC AMPLIFIER, SEPARATOR, OR CLIPPER OR AS A SWEEP OSCILLATOR. THE TRIODE SECTION MAY ALSO BE CONNECTED AS A DIODE FOR VIDEO-DETECTOR APPLICATIONS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

	PENTODE SECTION	TRIODE SECTION	
GRID #1 TO PLATE	0.046	2.4	μμf
INPUT	7	2.6	μμf
OUTPUT	2.4	0.38	μμf
PENTODE GRID #1 TO TRIODE PLATE	0.004		μμf
TRIODE GRID TO PENTODE PLATE	0.016		μμf
PENTODE PLATE TO TRIODE PLATE	0.095		μμf

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RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	6.3		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
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	---	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.0	---	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.25	0.5	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)[A]	11.0		SECONDS

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

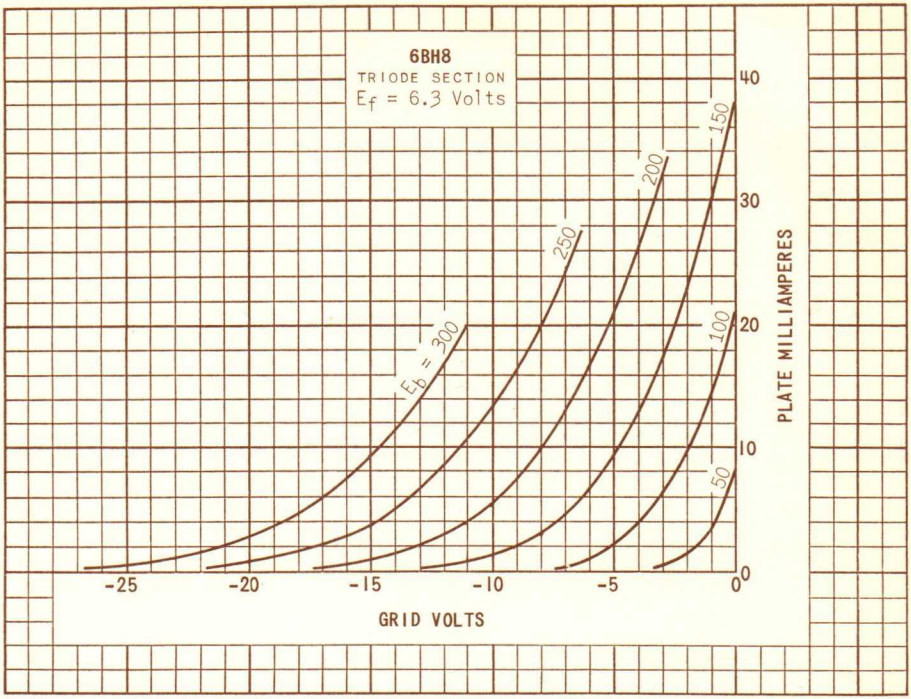
CLASS A_1 AMPLIFIER

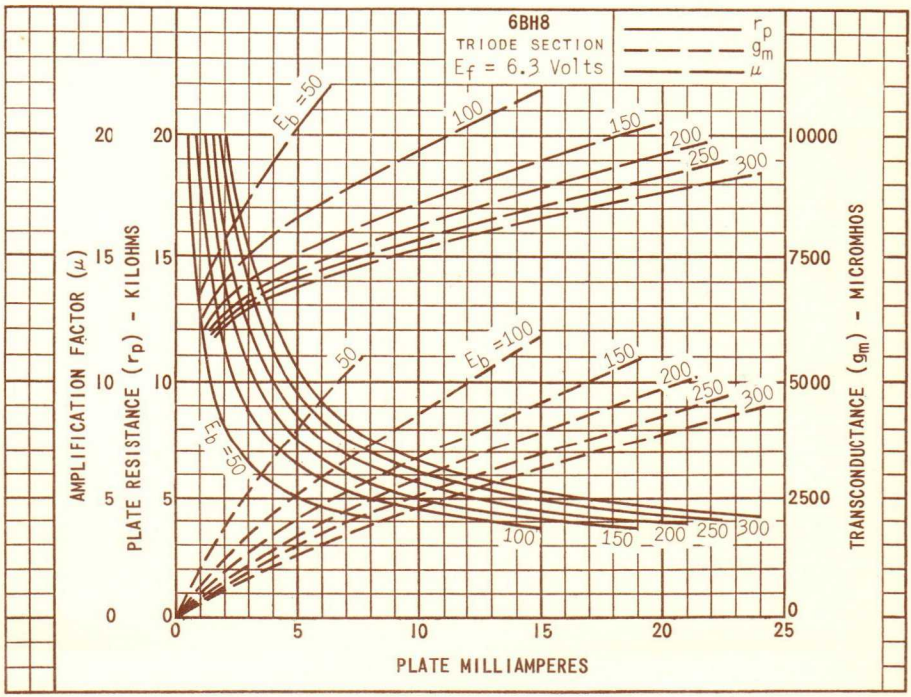
	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	200	150	VOLTS
GRID #2 VOLTAGE	125	---	VOLTS
CATHODE BIAS RESISTOR	82	---	OHMS
AMPLIFICATION FACTOR	---	17	
PLATE RESISTANCE (APPROX.)	150 000	5 150	OHMS
TRANSCONDUCTANCE	7 000	3 300	μMHOS
PLATE CURRENT	15	9.5	MA.
GRID #2 CURRENT	3.4	---	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 100 μAMP.	-8	-14	VOLTS
GRID #1 VOLTAGE	---	-5	VOLTS

NOTE:

THE TRIODE SECTION OF THE 6BH8 MAY BE DIODE-CONNECTED AND EMPLOYED AS A HIGH-PERVEANCE DIODE IN VIDEO-DETECTOR APPLICATIONS. THE DIODE OPERATION CAN BE OBTAINED EITHER WITH THE TRIODE GRID CONNECTED TO THE TRIODE PLATE AND THE COMBINATION OPERATED AS THE PLATE OF THE DIODE, OR WITH THE TRIODE PLATE GROUNDED AND THE TRIODE GRID OPERATED AS THE PLATE OF THE DIODE.

SIMILAR TYPE REFERENCE: EXCEPT FOR THE ELECTRICAL CHARACTERISTICS OF THE TRIODE SECTION, THE 6BH8 IS IDENTICAL TO THE 6AU8.





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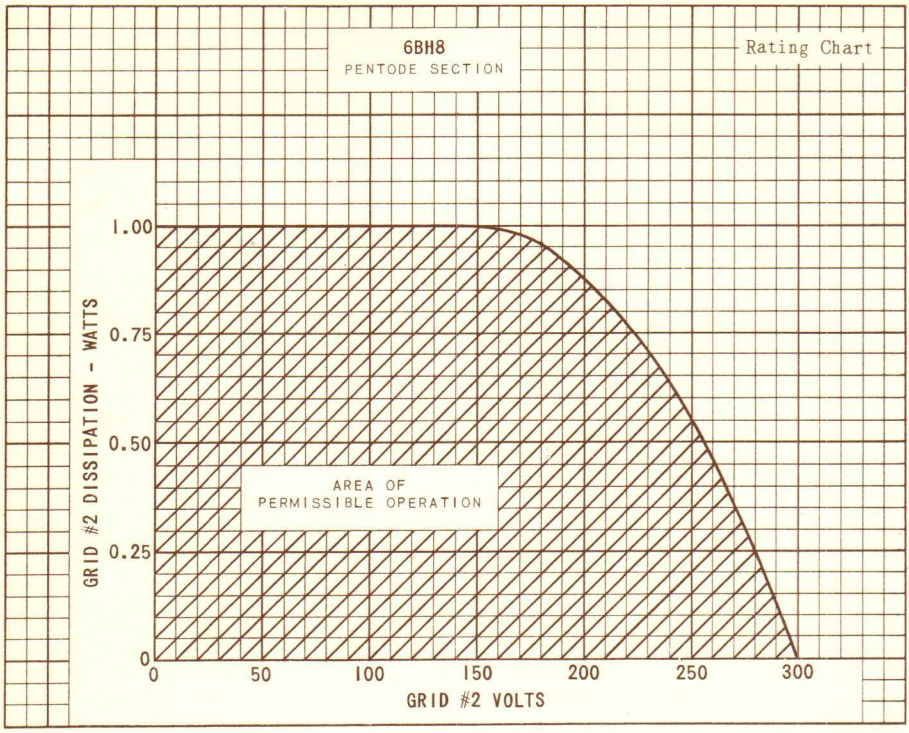
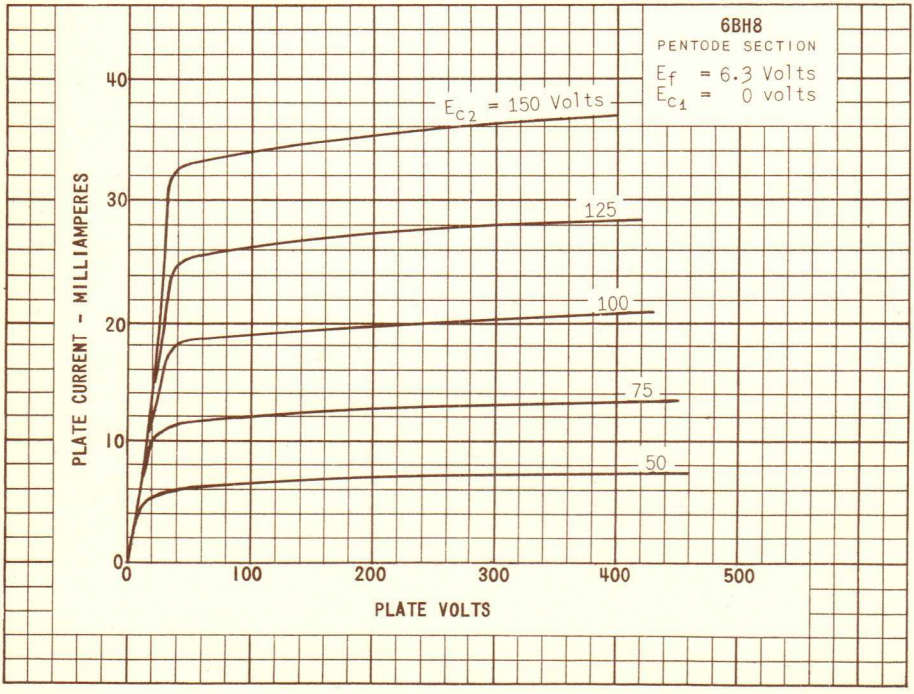
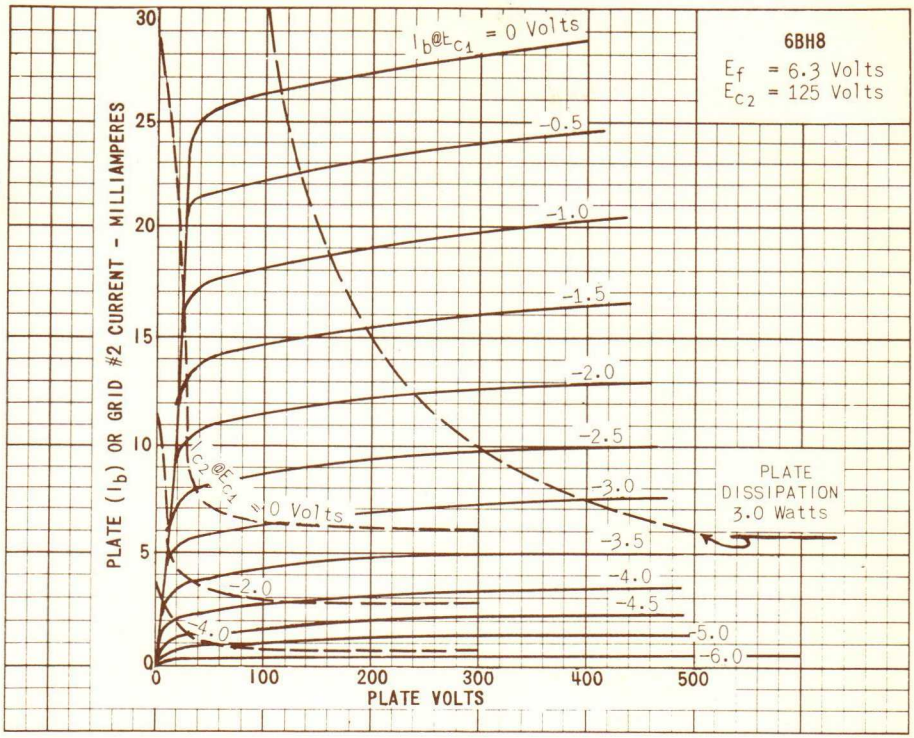
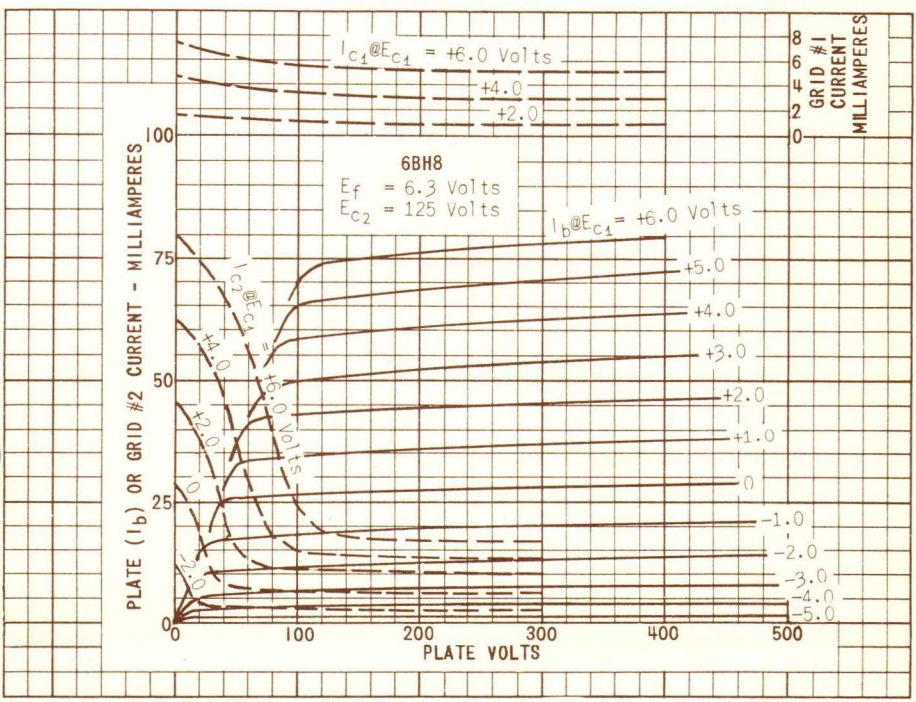
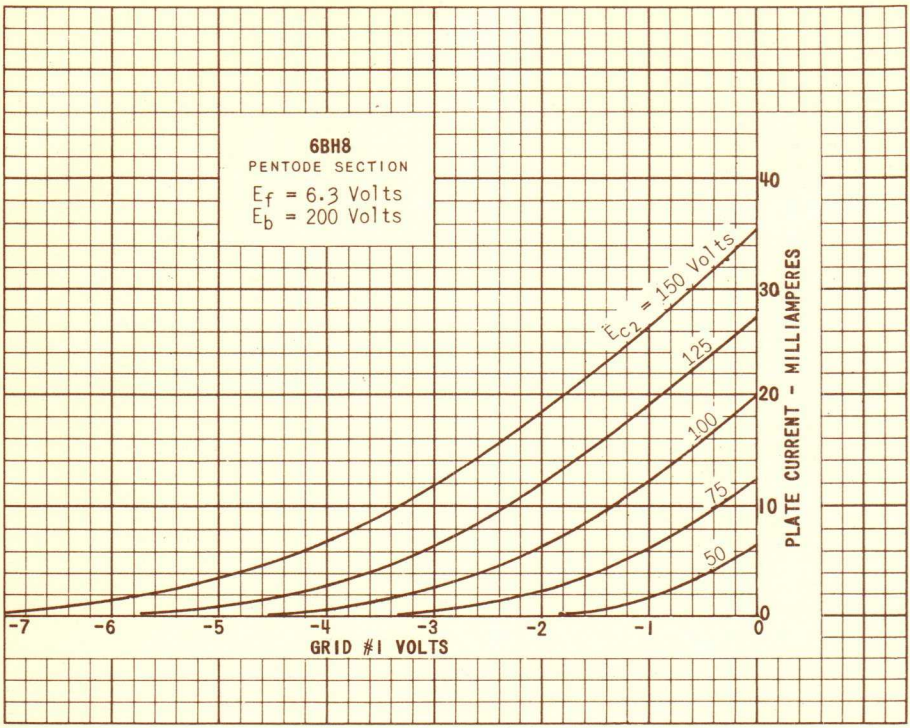
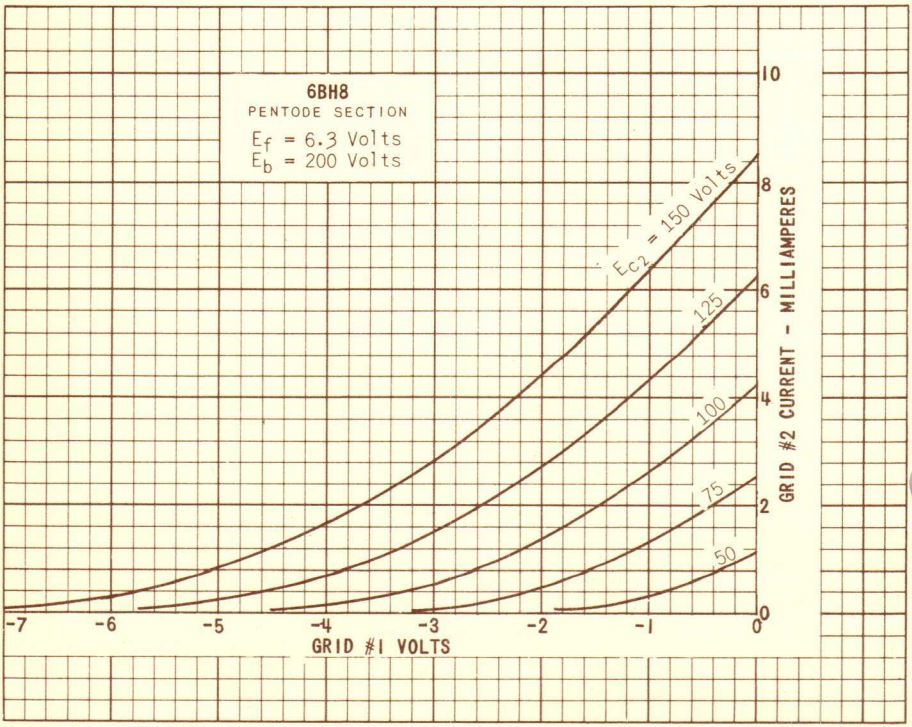

6BH8
PENTODE SECTION
Rating Chart
GRID #2 DISSIPATION - WATTS
1.00
0.75
0.50
0.25
0
AREA OF
PERMISSIBLE OPERATION
0
50
100
150
200
250
300
GRID #2 VOLTS

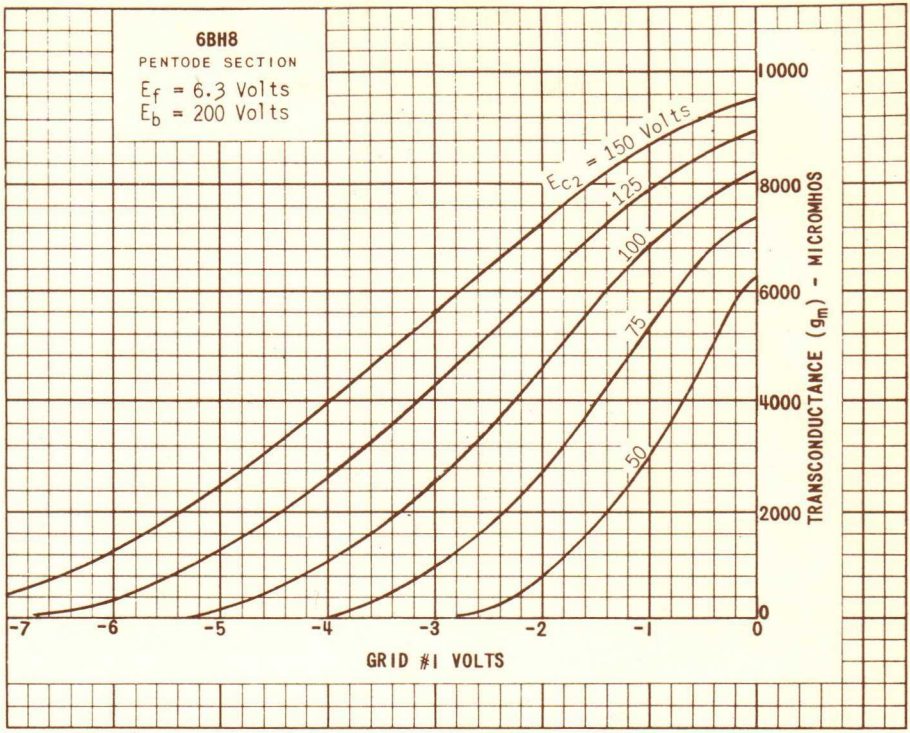

6BH8
PENTODE SECTION
E_f = 6.3 Volts
E_{c_1} = 0 volts
E_{c_2} = 150 Volts
125
100
75
50
PLATE CURRENT - MILLIAMPERES
40
30
20
10
0
0
100
200
300
400
500
PLATE VOLTS

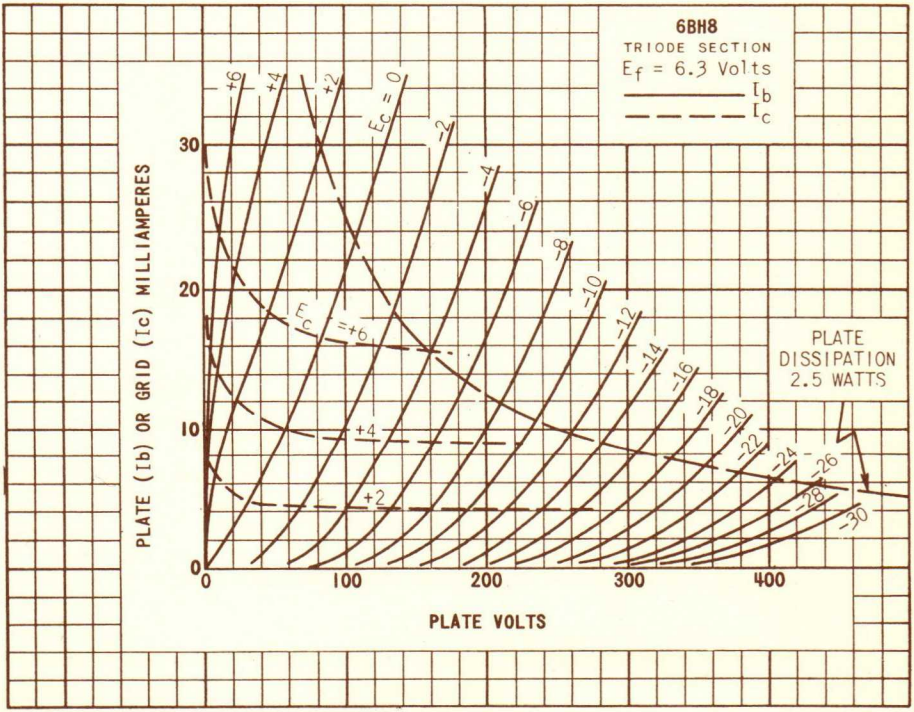

6BH8
E_f = 6.3 Volts
E_{c_2} = 125 Volts
I_b@E_{c_1} = 0 Volts
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-6.0
I_{c_2}@E_{c_1} = 0 Volts
-2.0
-4.0
PLATE DISSIPATION 3.0 Watts
PLATE (I_b) OR GRID #2 CURRENT - MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
30
100
200
300
400
500


I_{c_1}@E_{c_1} = +6.0 Volts
+4.0
+2.0
6BH8
E_f = 6.3 Volts
E_{c_2} = 125 Volts
I_b@E_{c_1} = +6.0 Volts
+5.0
+4.0
+3.0
+2.0
+1.0
0
-1.0
-2.0
-3.0
-4.0
-5.0
I_{c_2}@E_{c_1} = +6.0 Volts
+4.0
+2.0
0
-1.0
-2.0
GRID #1 CURRENT MILLIAMPERES
PLATE (I_b) OR GRID #2 CURRENT - MILLIAMPERES
PLATE VOLTS
0
2
4
6
8
25
50
75
100
200
300
400
500


6BH8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
PLATE CURRENT - MILLIAMPERES
0
10
20
30
40
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


6BH8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
GRID #2 CURRENT - MILLIAMPERES
0
2
4
6
8
10
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS





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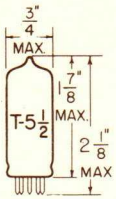
TUNG-SOL

PENTODE

MINIATURE TYPE

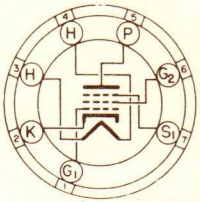


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 6BJ6, 6BJ6A ARE PENTODE VOLTAGE AMPLIFIERS WITH REMOTE CONTROL CHARACTERISTICS UTILIZING THE MINIATURE CONSTRUCTION. THEY ARE CHARACTERIZED BY HIGH TRANSCONDUCTANCE, LOW GRID-PLATE CAPACITANCE, AND AN EXTREMELY HIGH EFFICIENCY CATHODE ADAPTING THEM TO APPLICATION WHERE CONSERVATION OF HEATER POWER IS IMPORTANT.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G TO P) MAX.	0.0035	0.0035	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	4.5	4.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5.5	5.5	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PINS #2 AND #7.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	PIN #7 CONNECTED TO PIN #2 AT SOCKET		
GRID #2 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	VOLTS
PLATE RESISTANCE (APPROX.)	0.25	1.5	MEGOHMS
TRANSCONDUCTANCE	3 650	3 600	μMHOS
PLATE CURRENT	9	9.2	MA.
GRID #2 CURRENT	3.5	3.3	MA.
GRID #1 VOLTAGE FOR G_m = 10 μMHOS	-20	-20	VOLTS

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=5.7V; Eb= Ec2= Ec3= 70Vdc; AND Ec1 ADJUSTED FOR Ib=4.0 mAdc. THE MAXIMUM ALLOWABLE VALUE FOR INTERFACE IMPEDANCE IS 70 OHMS. **(NOTE IS FOR 6BJ6A ONLY)**

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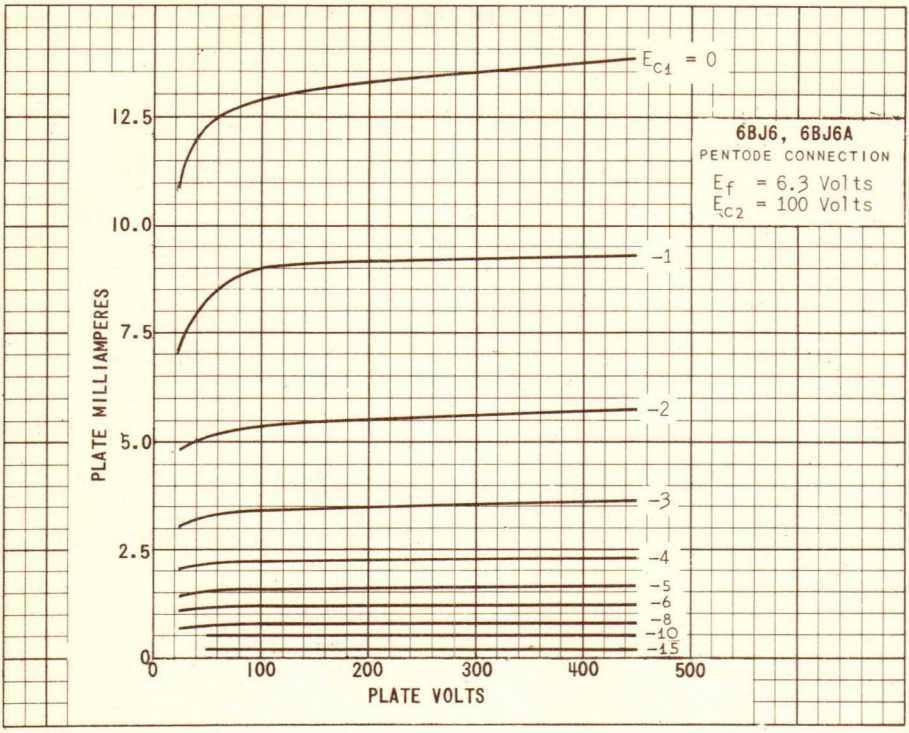

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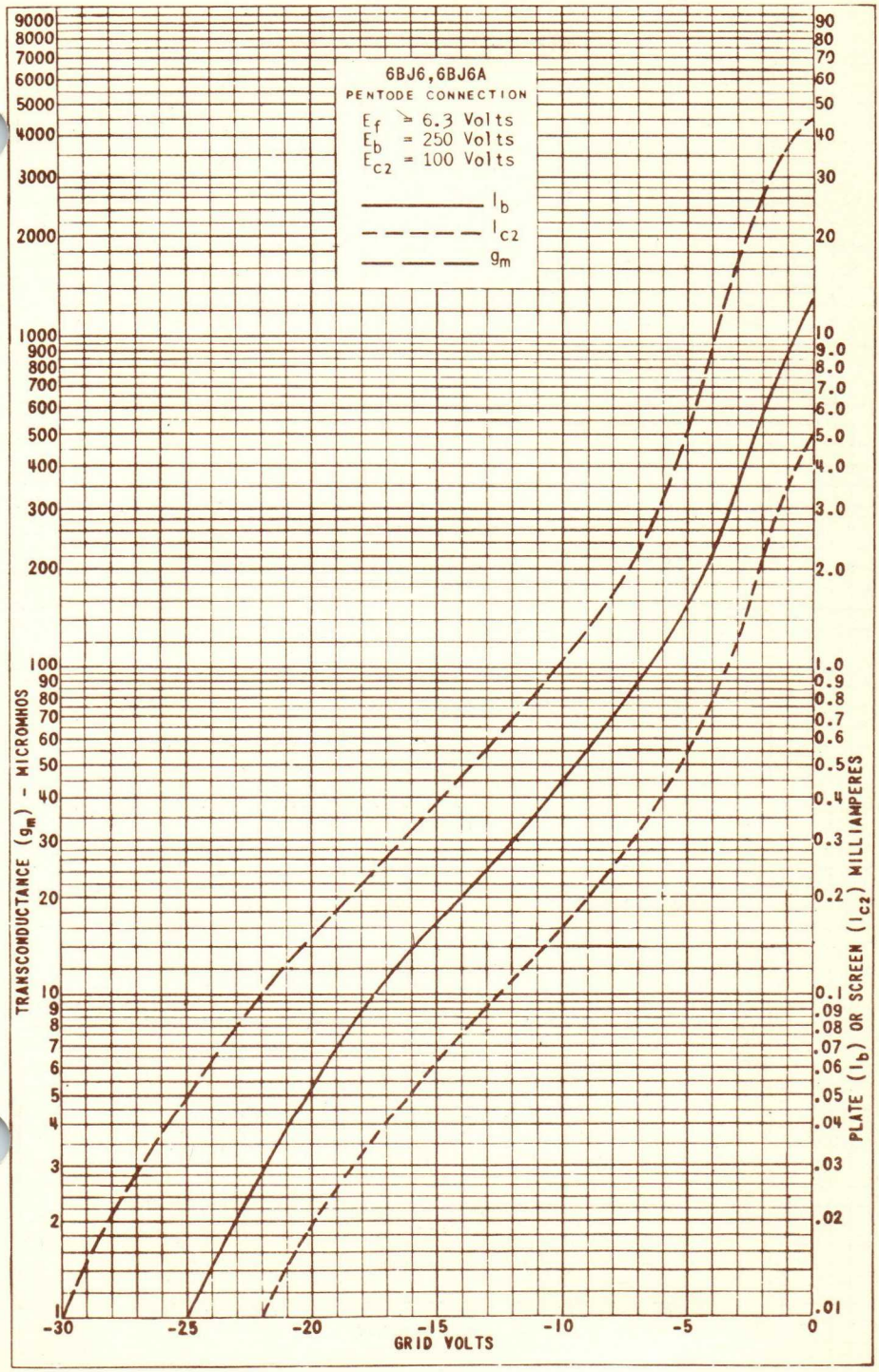

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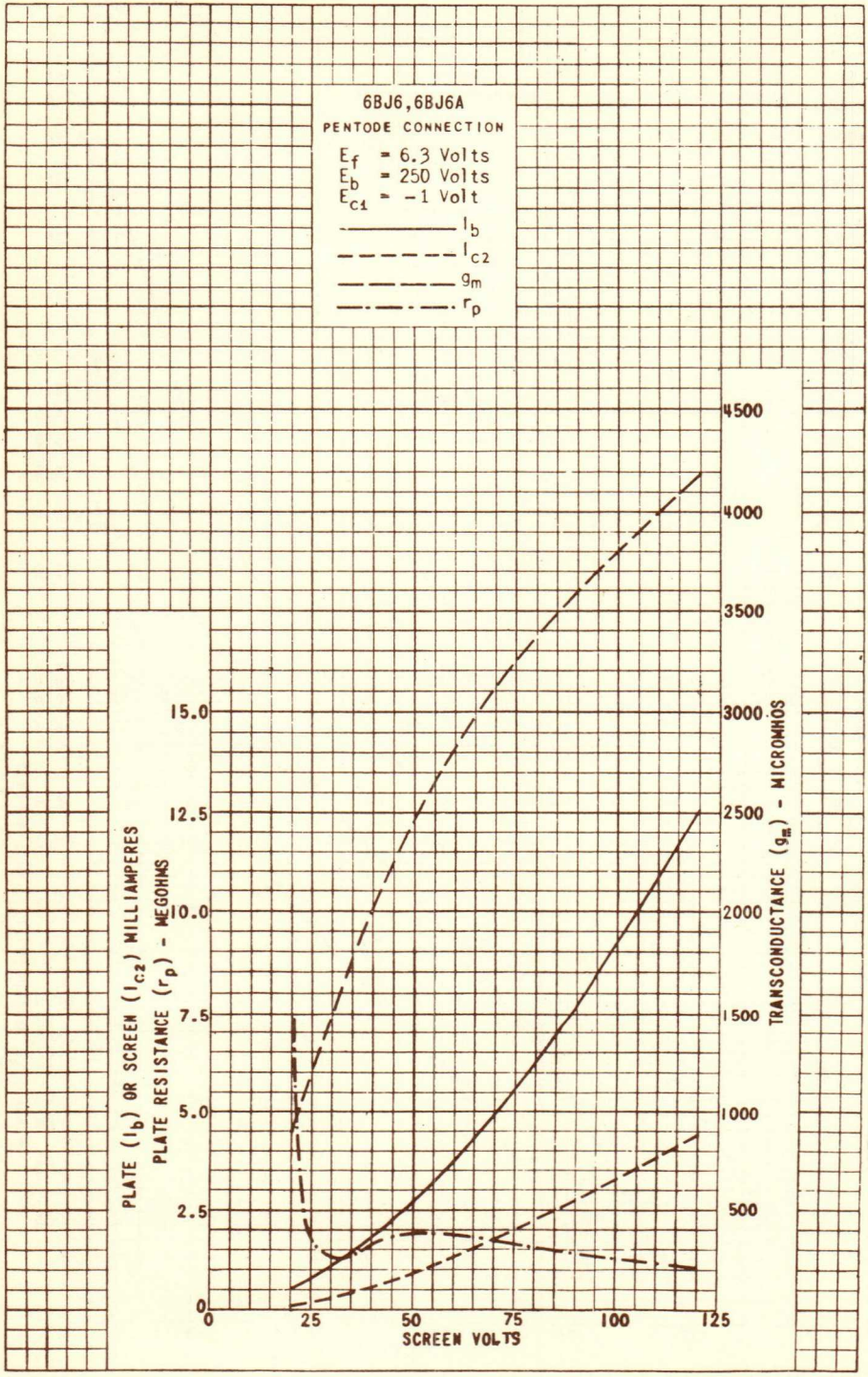
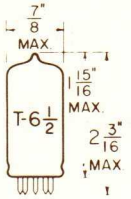

6BJ6, 6BJ6A
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c1} = −1 Volt
I_b
I_{c2}
g_m
r_p
PLATE (I_b) OR SCREEN (I_{c2}) MILLIAMPERES
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
SCREEN VOLTS
0
2.5
5.0
7.5
10.0
12.5
15.0
500
1000
1500
2000
2500
3000
3500
4000
4500
25
50
75
100
125

TUNG-SOL

TRIPLE DIODE

MINIATURE TYPE

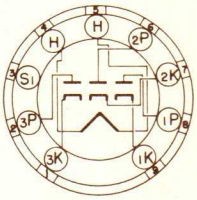


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AX

THE 6BJ7 IS A TRIPLE DIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS PRIMARILY INTENDED FOR USE AS A DC RESTORER IN EACH OF THE THREE SIGNAL CHANNELS OF COLOR TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

PLATE #1 TO CATHODE #1, HEATER & INTERNAL SHIELD	3.0	μμf
PLATE #2 TO CATHODE #2, HEATER & INTERNAL SHIELD	2.6	μμf
PLATE #3 TO CATHODE #3, HEATER & INTERNAL SHIELD	2.6	μμf
CATHODE #1 TO PLATE #1, HEATER & INTERNAL SHIELD	4.0	μμf
CATHODE #2 TO PLATE #2, HEATER & INTERNAL SHIELD	3.8	μμf
CATHODE #3 TO PLATE #3, HEATER & INTERNAL SHIELD	4.0	μμf
PLATE #1 TO PLATE #2	0.055	μμf
PLATE #2 TO PLATE #3	0.036	μμf
PLATE #3 TO PLATE #1	0.036	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

TV DC RESTORER SERVICE

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	330	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	330	VOLTS
MAXIMUM PEAK PLATE CURRENT (EACH PLATE)	10	MA.
MAXIMUM DC OUTPUT CURRENT (EACH PLATE)	1.0	MA.
TUBE VOLTAGE DROP (EACH SECTION) I_b = 10 MA. (DC)	2.7	VOLTS

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→ INDICATES A CHANGE.

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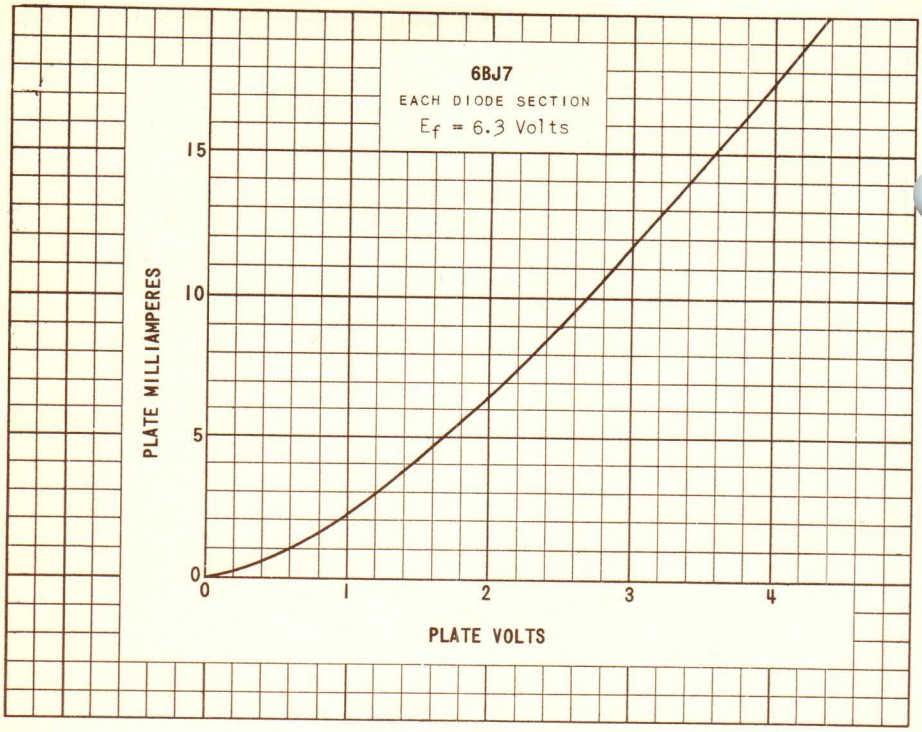
6BJ7


6BJ7
EACH DIODE SECTION
E_f = 6.3 Volts
PLATE MILLIAMPERES
15
10
5
0
0
1
2
3
4
PLATE VOLTS

TUNG-SOL

DOUBLE DIODE TRIODE

MINIATURE TYPE

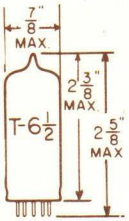
COATED UNIPOTENTIAL CATHODE

HEATER

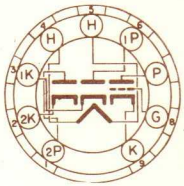
6.3 VOLTS 0.6±6% AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9ER

THE 6BJ8 IS A MEDIUM-MU TRIODE AND A DOUBLE DIODE IN ONE ENVELOPE USING THE 9 PIN MINIATURE CONSTRUCTION. EACH SECTION HAS ITS OWN CATHODE. IT IS DESIGNED FOR USE AS A PHASE SPLITTER, PHASE COMPARATOR AND HORIZONTAL DEFLECTION OSCILLATOR IN 600 MA. SERIES HEATER OPERATED RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

TRIODE SECTION		
GRID TO PLATE: G TO P	2.6	μμf
INPUT: G TO (H+TK)	2.8	μμf
OUTPUT: P TO (H+TK)	0.31	μμf
DIODE SECTION		
#1 PLATE TO TRIODE GRID (MAX.)	.070	μμf
#2 PLATE TO TRIODE GRID (MAX.)	.11	μμf
#1 CATHODE TO ALL: $_1$DK TO (H+TK+$_2$DK+TP+$_1$DP+TG+$_2$DP)	4.8	μμf
#2 CATHODE TO ALL: $_2$DK TO (H+TK+$_1$DK+TP+$_1$DP+$_2$DP+TG)	4.8	μμf
#1 PLATE TO #2 PLATE (MAX.)	.060	μμf
#1 PLATE TO #1 CATHODE + HEATER: $_1$DP TO ($_1$DK+H)	1.9	μμf
#2 PLATE TO #2 CATHODE + HEATER: $_2$DP TO ($_2$DK+H)	1.9	μμf
#1 CATHODE TO #1 PLATE+HEATER: $_1$DK TO ($_1$DP+H)	4.6	μμf
#2 CATHODE TO #2 PLATE+HEATER: $_2$DK TO ($_2$DP+H)	4.6	μμf
#1 PLATE TO ALL: $_1$DP TO (H+TK+$_1$DK+$_2$DK+TP+$_2$DP+TG)	3.0	μμf
#2 PLATE TO ALL: $_2$DP TO (H+TK+$_1$DK+$_2$DK+TP+$_1$DP+TG)	3.0	μμf

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RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

EACH SECTION

	CLASS A_1 AMPLIFIER	VERTICAL[B] DEFLECTION AMPLIFIER	
HEATER VOLTAGE	6.3		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
HEATER WARM-UP TIME (APPROX.)[C]	11.0		SECONDS
TRIODE SECTION			
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	---	VOLTS
MAXIMUM POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---	1 200	VOLTS
MAXIMUM PLATE DISSIPATION[D]	4.0	4.0	WATTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	---	275	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	22	22	MA.
MAXIMUM PEAK CATHODE CURRENT	---	77	MA.
MAXIMUM GRID CIRCUIT RESISTANCE: SELF BIAS	---	2.2	MEGOHMS
DIODE SECTION			
MAXIMUM PEAK PLATE CURRENT (EACH PLATE)	54		MA.
MAXIMUM DC CURRENT (EACH PLATE)	9		MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3 ←		VOLTS
HEATER CURRENT	0.6±6% ←		AMP.
TRIODE SECTION			
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	−9	VOLTS
PLATE RESISTANCE (APPROX.)	4 700	7 150	OHMS
TRANSCONDUCTANCE	4 700	2 800	μMHOS
AMPLIFICATION FACTOR	22	20	
PLATE CURRENT	13.5	8.0	MA.
PLATE CURRENT AT E_c = −12.5 VOLTS (DC)	---	1.7	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 μAMP.	−7	−18	VOLTS
DIODE SECTION			
AVERAGE CURRENT (EACH PLATE) AT 10 VOLTS (DC)		50	MA.
VOLTAGE DROP (EACH SECTION) AT I_b = 9 MA. (DC)		2.6	VOLTS

[B] 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 NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

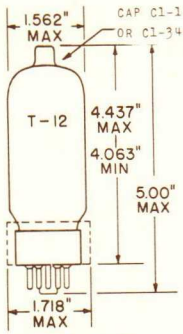
[C] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE

[D] 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.

→ INDICATES A CHANGE.

TUNG-SOL

TRIODE

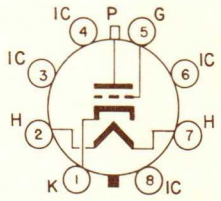


GLASS BULB
SMALL CAP
SHORT MEDIUM SHELL
8 PIN OCTAL B8-126 OR B8-72
OUTLINE DRAWING
JEDEC 12-36

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±0.6 VOLTS 200 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8GC

THE 6BK4 IS A SHARP CUT-OFF BEAM TRIODE. IT IS DESIGNED FOR THE VOLTAGE REGULATION OF HIGH VOLTAGE, LOW CURRENT DC POWER SUPPLIES IN COLOR TELEVISION.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE	0.03	pf
GRID TO CATHODE AND HEATER	2.6	pf
PLATE TO CATHODE AND HEATER	1.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VOLTAGE CONTROL SERVICE

MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	220	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	NOT RECOMMENDED	
MAXIMUM DC PLATE VOLTAGE	27 000	VOLTS
MAXIMUM UNREGULATED DC SUPPLY VOLTAGE	60 000	VOLTS
MAXIMUM GRID VOLTAGE:		
DC VALUE	-135	VOLTS
PEAK VALUE (FOR DURATION OF 20 SEC. MAX. DURING EQUIPMENT WARM-UP)	-440	VOLTS
MAXIMUM DC PLATE CURRENT	1.6	MA.
MAXIMUM PLATE DISSIPATION	25	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE[A]	3	MEGOHMS

[A] FOR USE WITH "FLYBACK TRANSFORMER" HIGH VOLTAGE SUPPLY.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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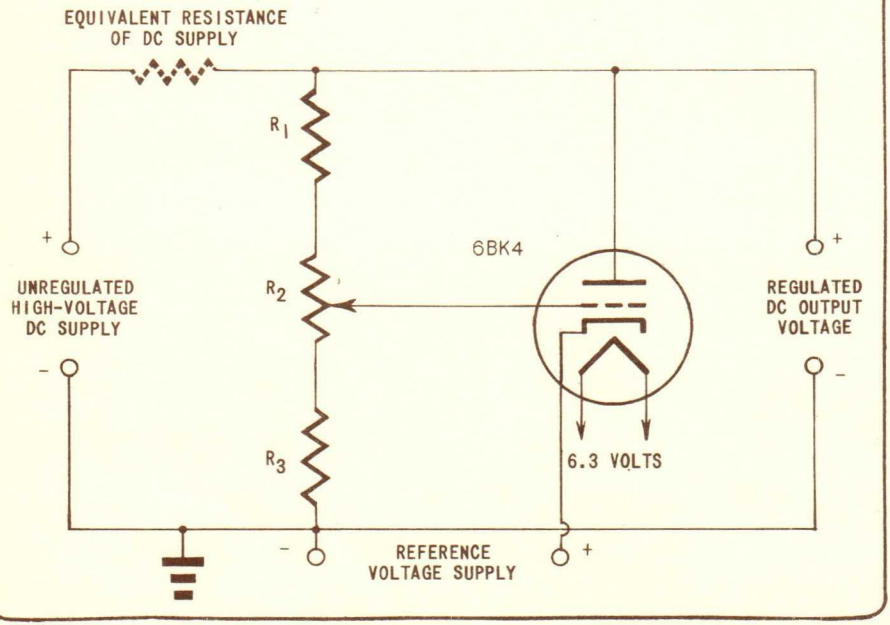
TUNG-SOL

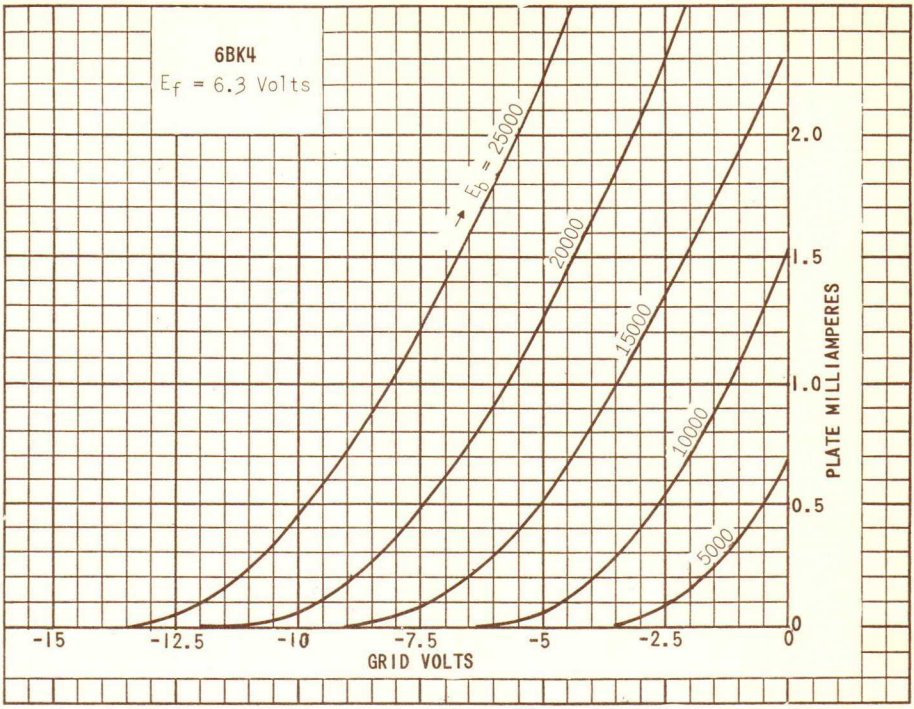
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

SHUNT VOLTAGE-REGULATOR TUBE
IN ACCOMPANYING CIRCUIT

UNREGULATED SUPPLY:		
DC VOLTAGE	→ 36 000	VOLTS
EQUIVALENT RESISTANCE	11	MEGOHMS
VOLTAGE DIVIDER VALUES:		
R_1 (5 WATTS)	220	MEGOHMS
R_2 (2 WATTS)	1	MEGOHM
R_3 (1/2 WATT)	820 000	OHMS
REFERENCE VOLTAGE SUPPLY:		
DC VALUE	200	VOLTS
EQUIVALENT RESISTANCE	1 000	OHMS
EFFECTIVE GRID-PLATE TRANSCONDUCTANCE	200	μMHOS
DC PLATE CURRENT:		
FOR LOAD CURRENT OF 0 MA.	1 000	μAMP.
FOR LOAD CURRENT OF 1 MA.	45	μAMP.
REGULATED DC OUTPUT VOLTAGE:		
FOR LOAD CURRENT OF 0 MA.	25 000	VOLTS
FOR LOAD CURRENT OF 1 MA.	24 500	VOLTS
AMPLIFICATION FACTOR (APPROX.)	2 000	





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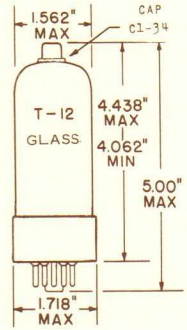
TUNG-SOL

TRIODE

OUTLINE DRAWING

JEDEC 12-36

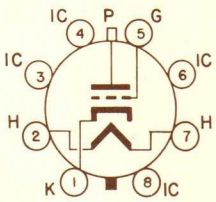


BASE SHORT MEDIUM SHELL
8 PIN OCTAL
JEDEC B8-118

FOR HIGH - VOLTAGE
SHUNT REGULATOR SERVICE

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 8GC



BOTTOM VIEW

THE 6BK4A IS A SHARP CUT-OFF BEAM TRIODE FOR HIGH-VOLTAGE, LOW-CURRENT APPLICATION SHUNT REGULATION OF THE HIGH VOLTAGE, DC POWER SUPPLIED IN COLOR TELEVISION RECEIVERS. EXCEPT FOR ALLOWABLE PLATE DISSIPATION, THIS TYPE IS THE SAME AS THE 6BK4

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: G TO P	0.03	pf
GRID TO CATHODE AND HEATER: G TO (K + H)	2.6	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	1.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	200	MA
LIMITS OF APPLIED VOLTAGE - AC OR DC		6.3 ± 0.6	VOLTS
MAXIMUM HEATER - CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		NOT RECOMMENDED	

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MAXIMUM RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

MAXIMUM DC PLATE VOLTAGE	27,000	VOLTS
MAXIMUM UNREGULATED DC SUPPLY VOLTAGE	60,000	VOLTS
MAXIMUM NEGATIVE GRID VOLTAGE:		
DC VALUE	135	VOLTS
PEAK VALUE (FOR DURATION OF 20 SEC. MAX. DURING EQUIPMENT WARM-UP)	440	VOLTS
MAXIMUM PLATE DISSIPATION	30	WATTS
MAXIMUM DC PLATE CURRENT	1.6	MA
MAXIMUM GRID CIRCUIT RESISTANCE	3	MEGOHMS

FOR USE WITH "FLYBACK TRANSFORMER" HIGH VOLTAGE SUPPLY.

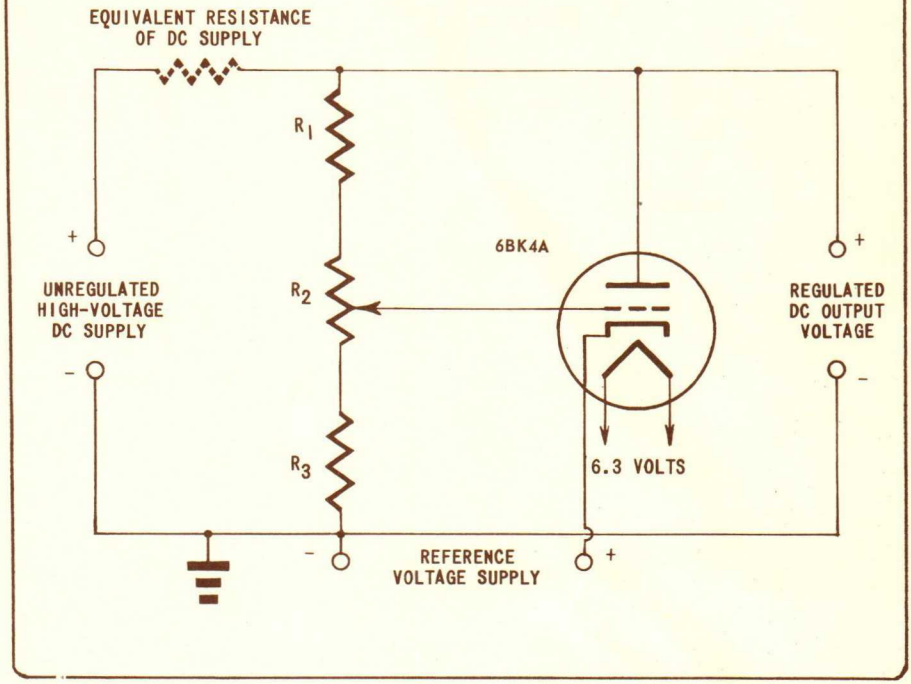
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

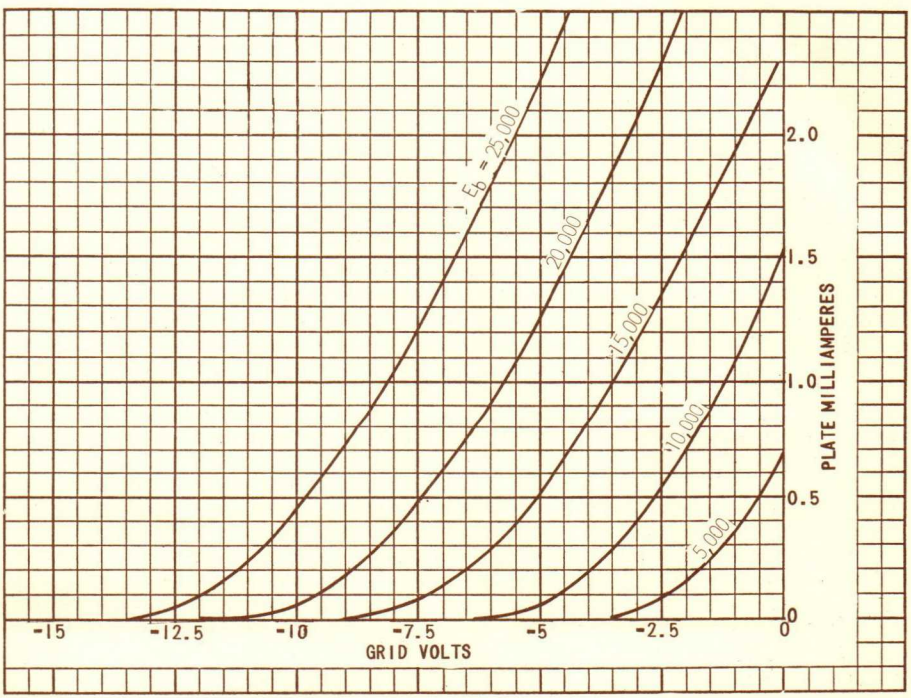
SHUNT VOLTAGE - REGULATOR TUBE

IN ACCOMPANYING CIRCUIT

UNREGULATED SUPPLY:		
DC VOLTAGE	36,000	VOLTS
EQUIVALENT RESISTANCE	11	MEGOHMS
VOLTAGE DIVIDER VALUES:		
R_1 (5 WATTS)	220	MEGOHMS
R_2 (2 WATTS)	1	MEGOHM
R_3 (½ WATT)	820,000	OHMS
REFERENCE VOLTAGE:		
DC VALUE	200	VOLTS
EQUIVALENT RESISTANCE OF SUPPLY	1,000	OHMS
EFFECTIVE GRID-PLATE TRANSCONDUCTANCE	200	μMHOS
DC PLATE CURRENT:		
FOR LOAD CURRENT OF OMA.	1,000	μAMP.
FOR LOAD CURRENT OF 1 MA.	45	μAMP.
REGULATED DC OUTPUT VOLTAGE:		
FOR LOAD CURRENT OF O MA.	25,000	VOLTS
FOR LOAD CURRENT OF 1 MA.	24,500	VOLTS

TUNG-SOL





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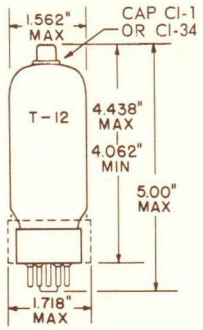
TUNG-SOL

OUTLINE DRAWING
JEDEC 12-36



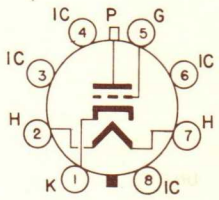
GLASS BULB
BASE 8 PIN OCTAL
JEDEC B8-71
OR B 8-118

BEAM TRIODE
FOR
D.C. POWER SUPPLIES
IN
COLOR TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 8GC



BOTTOM VIEW
PINS 3, 4, 6 AND 8 SHOULD NOT BE USED AS TIE POINTS

THE 6BK4B IS A HIGH-VOLTAGE, LOW-CURRENT BEAM TRIODE IN A DOUBLE-ENDED T-12 GLASS ENVELOPE. IT IS ESPECIALLY DESIGNED FOR USE AS A SHUNT VOLTAGE-REGULATOR IN THE HIGH-VOLTAGE POWER SUPPLY CIRCUITS OF COLOR TELEVISION RECEIVERS. EXCEPT FOR HIGHER PLATE DISSIPATION AND PEAK HEATER-CATHODE VOLTAGE CAPABILITY, THE 6BK4B IS ELECTRICALLY AND MECHANICALLY SIMILAR TO THE 6BK4A, AND IS UNILATERALLY INTERCHANGEABLE WITH THE 6BK4 AND THE 6BK4A.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE	0.03	pf
GRID TO CATHODE AND HEATER	2.6	pf
PLATE TO CATHODE AND HEATER	1.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	200	mA
LIMITS OF APPLIED VOLTAGE-AC OR DC		6.3±0.6	VOLTS
HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		450	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		NOT RECOMMENDED	

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

SHUNT VOLTAGE-REGULATOR SERVICE

DC PLATE VOLTAGE	27,000	VOLTS
UNREGULATED DC SUPPLY VOLTAGE	60,000	VOLTS
GRID VOLTAGE:		
NEGATIVE DC VALUE	135	VOLTS
NEGATIVE PEAK VALUE FOR 20 SECONDS MAX. DURING EQUIPMENT WARM-UP	440	VOLTS

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MAXIMUM RATINGS (Continued)

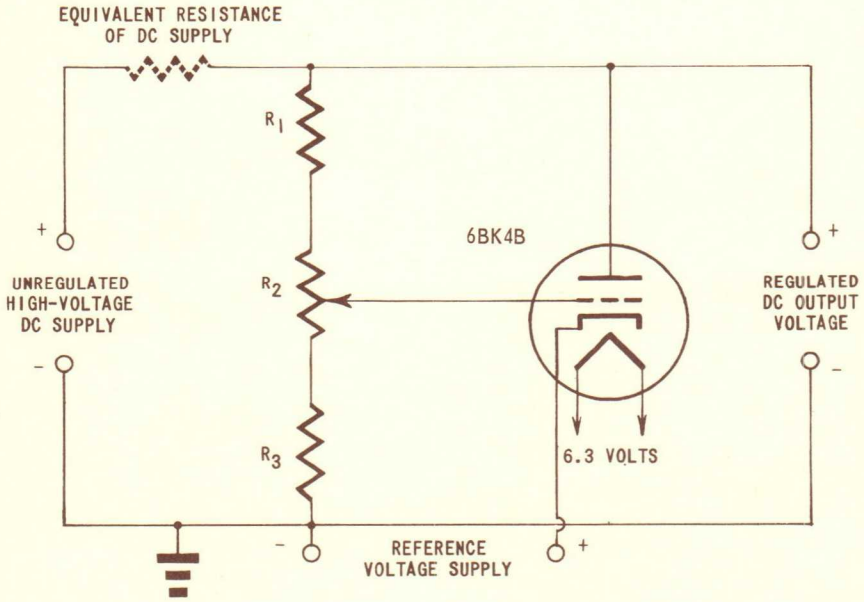
DC PLATE CURRENT	1.6	VOLTS
PLATE DISSIPATION	40	WATTS
GRID-CIRCUIT RESISTANCE	3	MEGOHMS

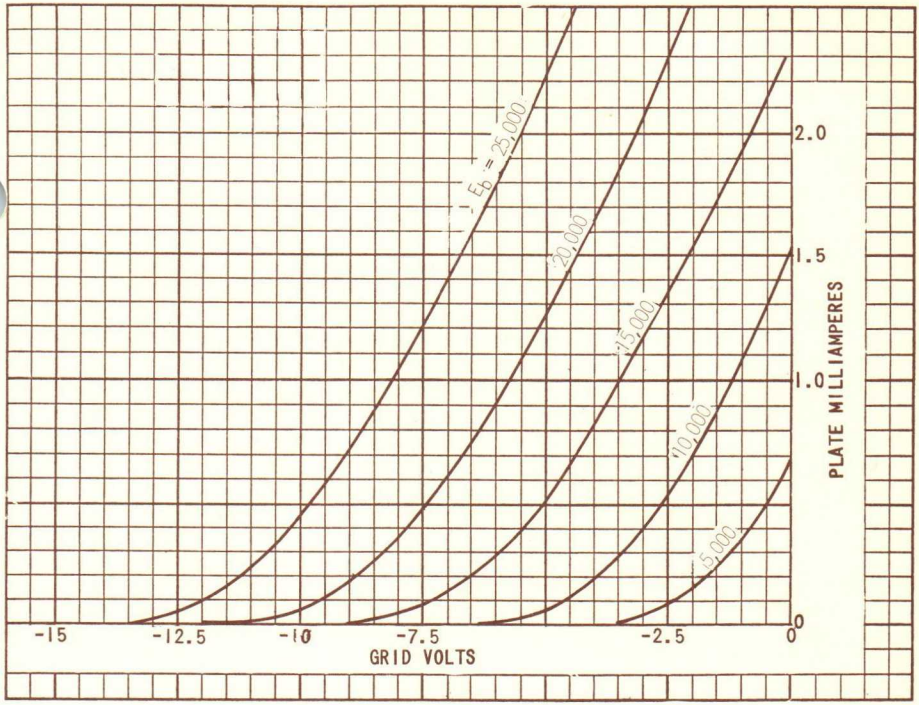
TYPICAL OPERATION

AS SHUNT VOLTAGE-REGULATOR TUBE IN ACCOMPANYING CIRCUIT

UNREGULATED SUPPLY:		
DC VOLTAGE	36,000	VOLTS
EQUIVALENT RESISTANCE	11	MEGOHMS
VOLTAGE DIVIDER VALUES:		
R_1 (5 WATTS)	220	MEGOHMS
R_2 (2 WATTS)	1	MEGOHM
R_3 (1/3 WATT)	0.82	MEGOHM
REFERENCE VOLTAGE SUPPLY:		
DC VALUE	200	VOLTS
EQUIVALENT RESISTANCE	1,000	OHMS
EFFECTIVE GRID-PLATE TRANSCONDUCTANCE	200	μMHOS
DC PLATE CURRENT:		
FOR LOAD CURRENT OF 0 mA	1,000	μA
FOR LOAD CURRENT OF 1 mA	45	μA
REGULATED DC OUTPUT VOLTAGE:		
FOR LOAD CURRENT OF 0 mA	25,000	VOLTS
FOR LOAD CURRENT OF 1 mA	24,500	VOLTS

SHUNT VOLTAGE-REGULATOR CIRCUIT





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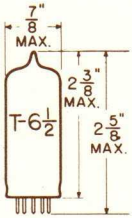
TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

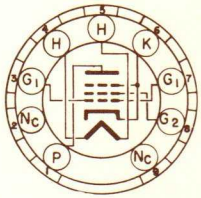
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 1.2 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9BQ

THE 6BK5 IS A BEAM POWER AMPLIFIER UTILIZING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE IN THE POWER OUTPUT STAGE OF TELEVISION AND RADIO RECEIVERS. IN WHICH ONLY SMALL DRIVING VOLTAGES ARE AVAILABLE. IT CAN ALSO BE USED AS A VIDEO AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE: G_1 TO P	0.06	μμf
INPUT: G_1 TO ($H+K+G_2+G_3$)	13	μμf
OUTPUT: P TO ($H+K+G_2+G_3$)	5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	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
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	250	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	9	WATTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.1	MEGOHM
CATHODE BIAS OPERATION	0.5	MEGOHM

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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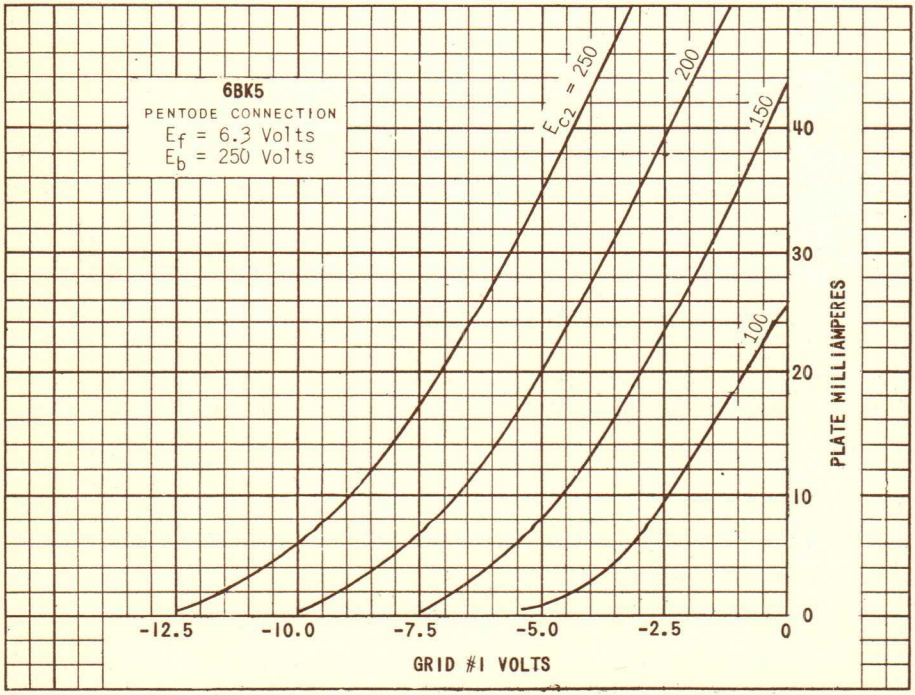
TUNG-SOL

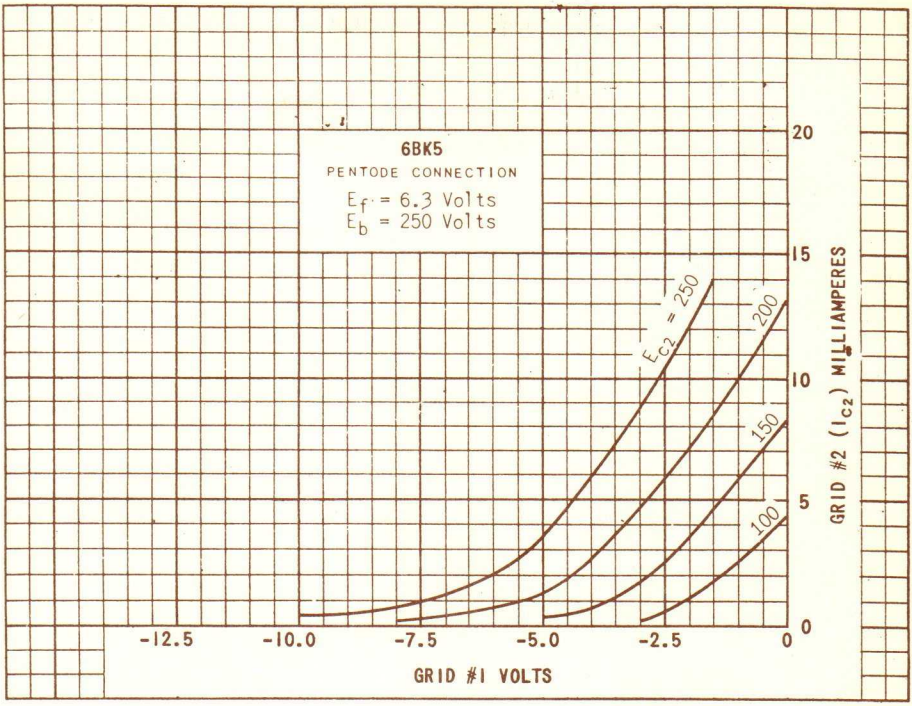
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	−5	VOLTS
PEAK AF GRID #1 VOLTAGE	5	VOLTS
PLATE RESISTANCE (APPROX.)	100 000	OHMS
TRANSCONDUCTANCE	8 500	µMHOS
ZERO-SIGNAL PLATE CURRENT	35	MA.
MAXIMUM SIGNAL PLATE CURRENT (APPROX.)	37	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (APPROX.)	10	MA.
LOAD RESISTANCE	6 500	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	7	PERCENT
POWER OUTPUT	3.5	WATTS





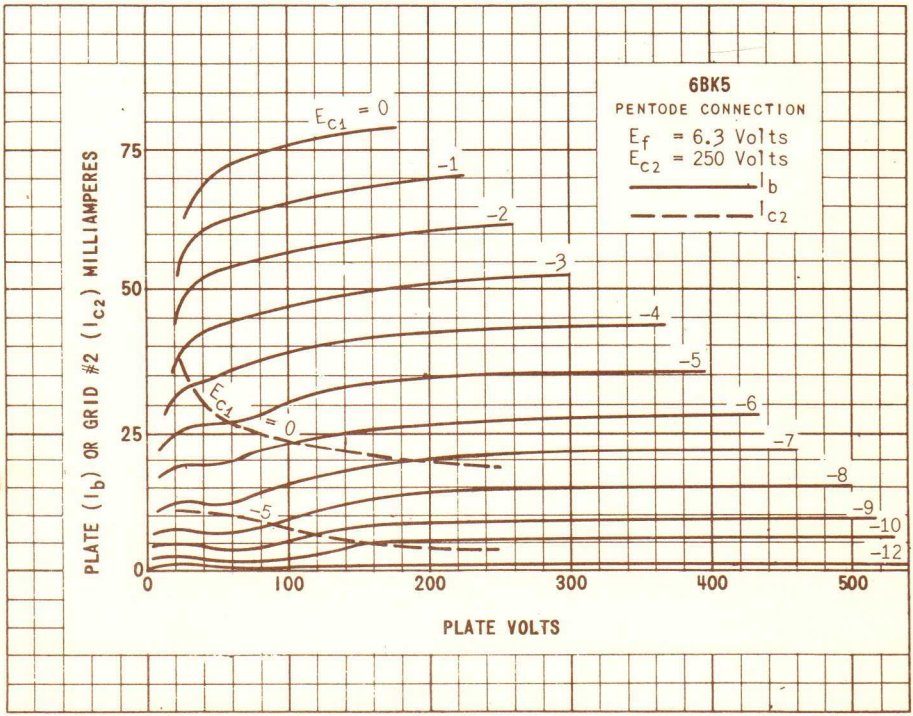


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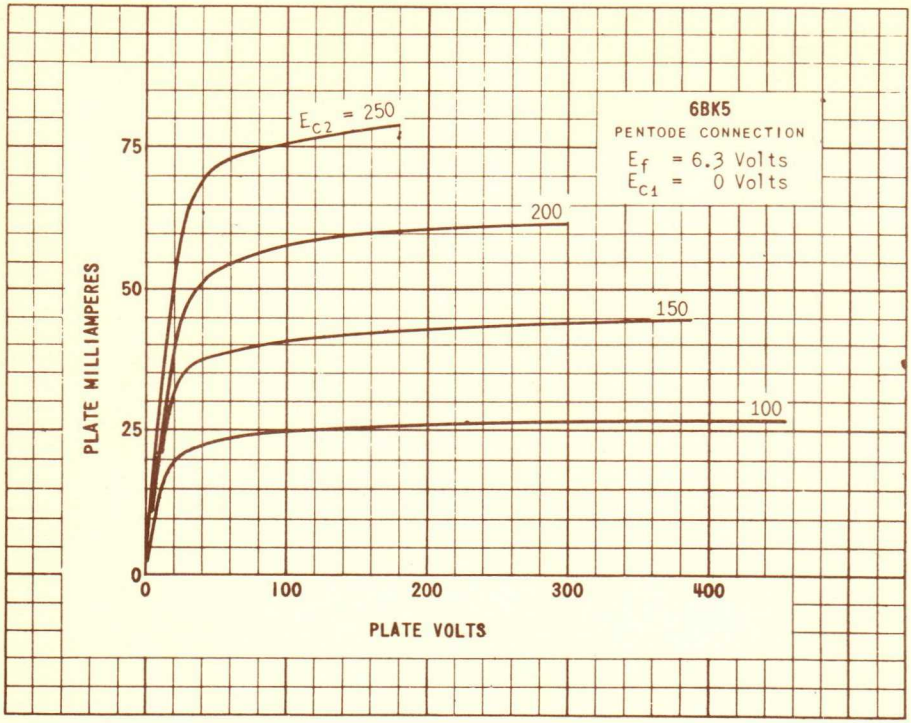
PLATE
3187

6BK5 (25BK5)



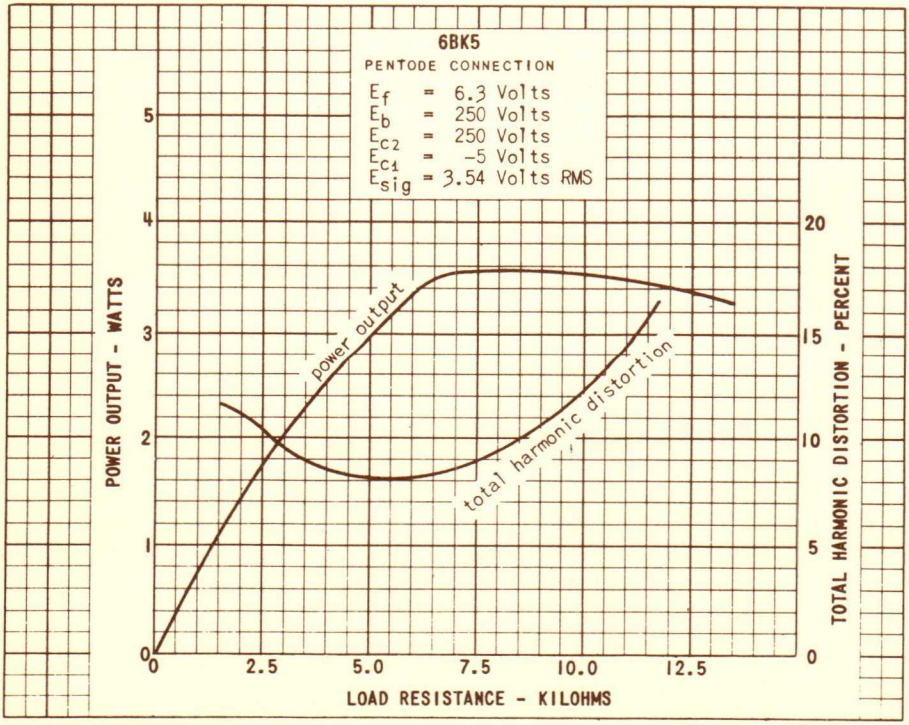


PLATE 3188

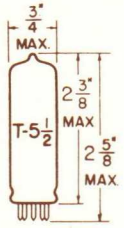
TENTATIVE DATA

(12BK6,26BK6)6BK6

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

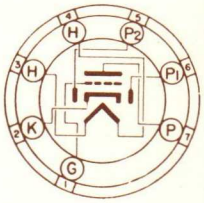
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 300 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

78T

THE 6BK6 IS A HIGH-MU DOUBLE DIODE TRIODE USING THE 7 PIN MINIATURE CONSTRUCTION. THE HIGH PERVEANCE DIODES GIVE GOOD RECTIFICATION EFFICIENCY AT LOW SIGNALS AND THE DIODE SHIELDING REDUCES UNDESIRABLE AUDIO COUPLING BETWEEN DIODES AND TRIODE.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
DIODE #1 OR DIODE #2 TO CATHODE: (1P OR 2P TO K)	1	1	μμf
DIODE #1 TO GRID: (1P TO G)	0.013	0.01	μμf

[A] WITH RMA SHIELD #316 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
AVERAGE DIODE CURRENT EACH PLATE WITH 10 VOLTS DC APPLIED	4	MA.
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
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	1 250	1 600	μMHOS
AMPLIFICATION FACTOR	100	100	

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PLATE 2332

FEB. 1 1950

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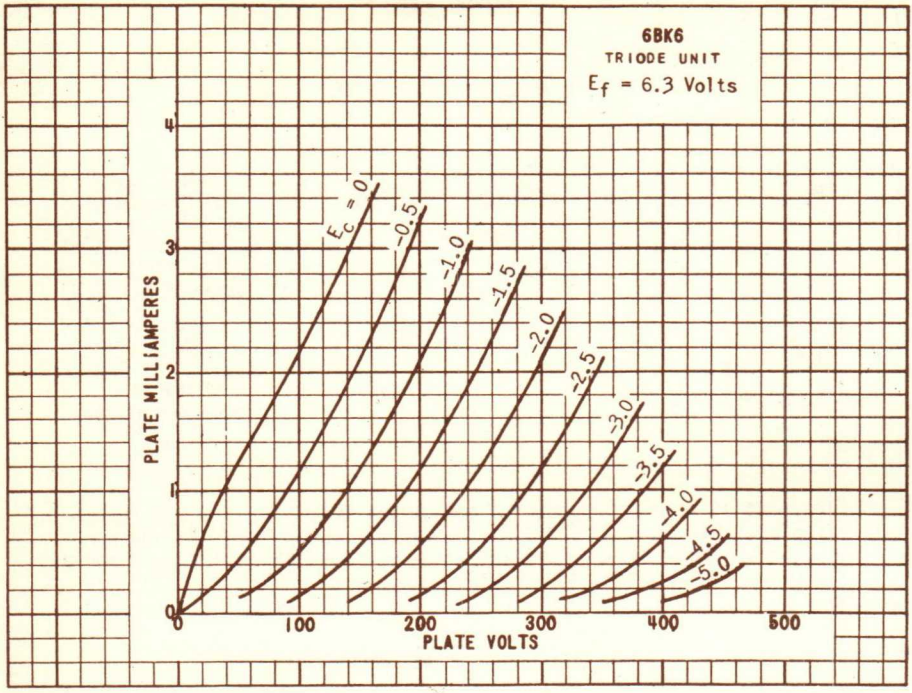
6BK6 (12BK6, 26BK6)



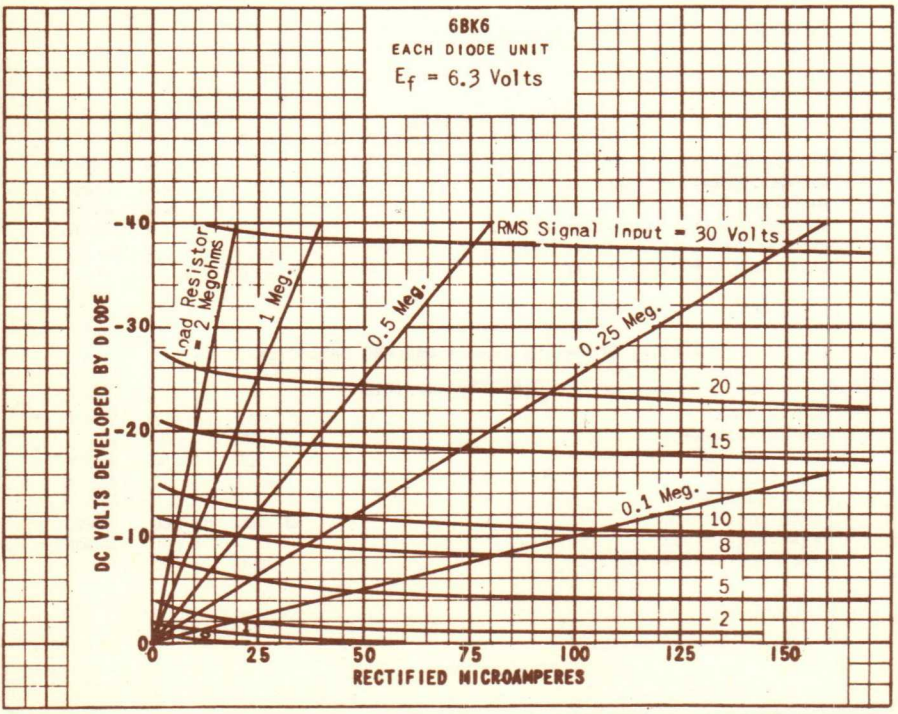


PLATE 2333
FEB. 1 1950

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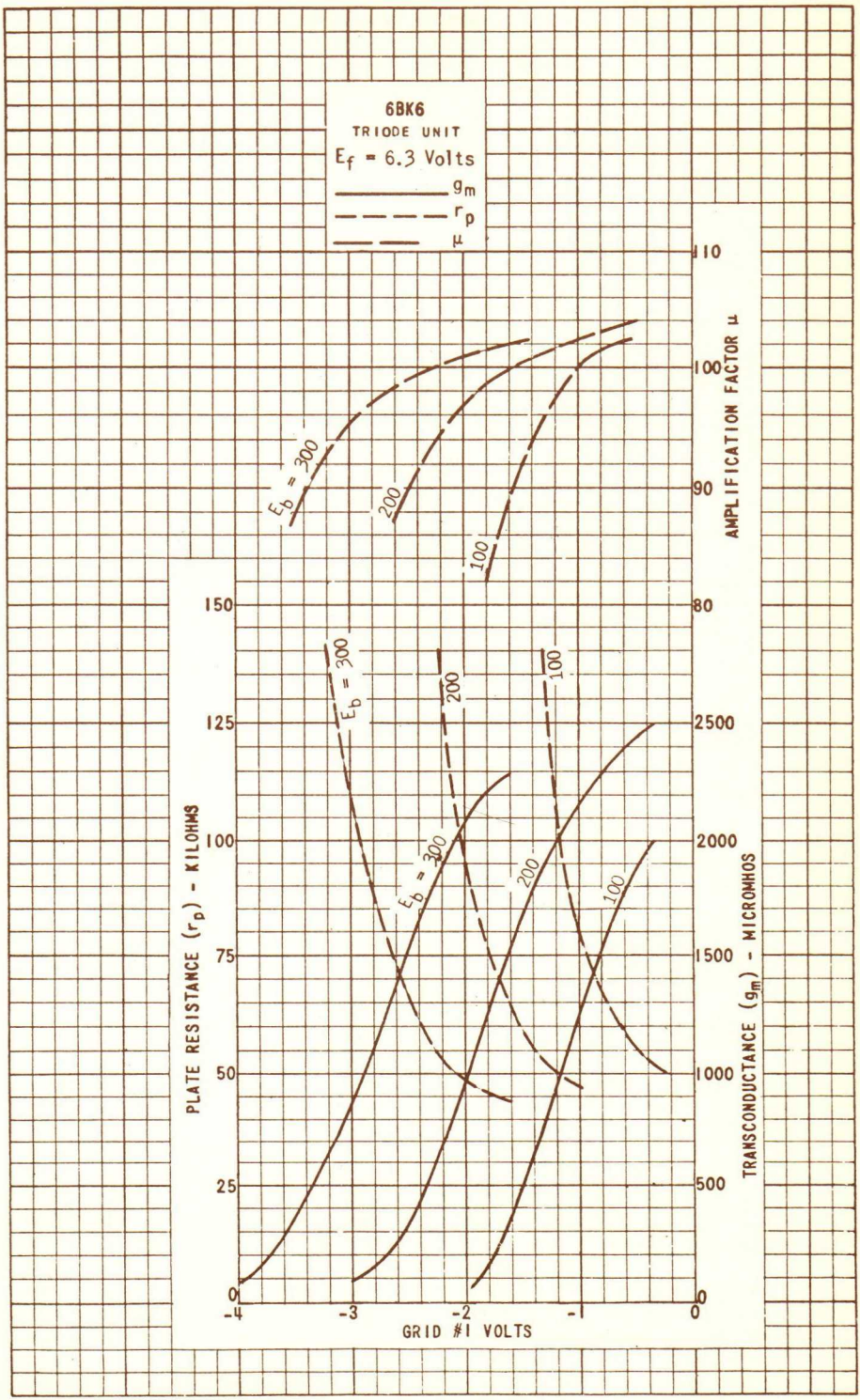

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PLATE
2334
FEB. 1
1950

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TUNG-SOL

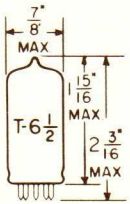
TWIN TRIODE

MINIATURE TYPE

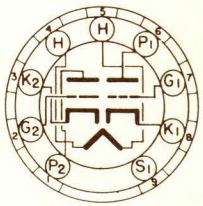
COATED UNIPOTENTIAL CATHODES

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AJ
IT IS RECOMMENDED THAT
PIN #9 BE GROUNDED

THE 6BK7A AND 6BK7B ARE MINIATURE DOUBLE TRIODES DESIGNED PRIMARILY FOR USE AS CASCODE AMPLIFIERS AT FREQUENCIES BELOW APPROXIMATELY 300 MEGACYCLES. THE PERFORMANCE OF THE TUBES AS CASCODE AMPLIFIERS IS CHARACTERIZED BY HIGH GAIN AND A LOW NOISE FIGURE. THERMAL CHARACTERISTICS OF THE HEATER OF THE 6BK7B ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER WARM-UP TIME AND HEATER-CATHODE VOLTAGE RATINGS, THE TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	SECTION 1	SECTION 2	
GRID TO PLATE	1.8	1.8	μμf
INPUT	3.0	3.0	μμf
OUTPUT	1.0	0.9	μμf
HEATER TO CATHODE	2.8	3.0	μμf
GRID TO GRID (MAX.)	0.004		μμf
PLATE TO PLATE (MAX.)	0.075		μμf
GROUNDED GRID OPERATION			
PLATE TO CATHODE	0.22	0.22	μμf
INPUT	6.0	6.0	μμf
OUTPUT	2.4	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	EACH SECTION	
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:[A] ←		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION	2.7	WATTS
HEATER WARM-UP TIME (APPROX.)* (6BK7B ONLY)	11.0	SECONDS

[A] WHEN THE 6BK7A IS USED AS A CASCODE AMPLIFIER AND THE TWO SECTIONS ARE CONNECTED IN SERIES; THE HEATER-CATHODE VOLTAGE OF THE GROUNDED-GRID STAGE MAY BE AS HIGH AS 250 VOLTS MAXIMUM WITH RESPECT TO THE CATHODE AND AS HIGH AS 300 VOLTS MAXIMUM FOR THE 6BK7B.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ HEATER CATHODE VOLTAGE FOR 6BK7A, NOW IDENTICAL TO 6BK7B.

→ INDICATES A CHANGE.

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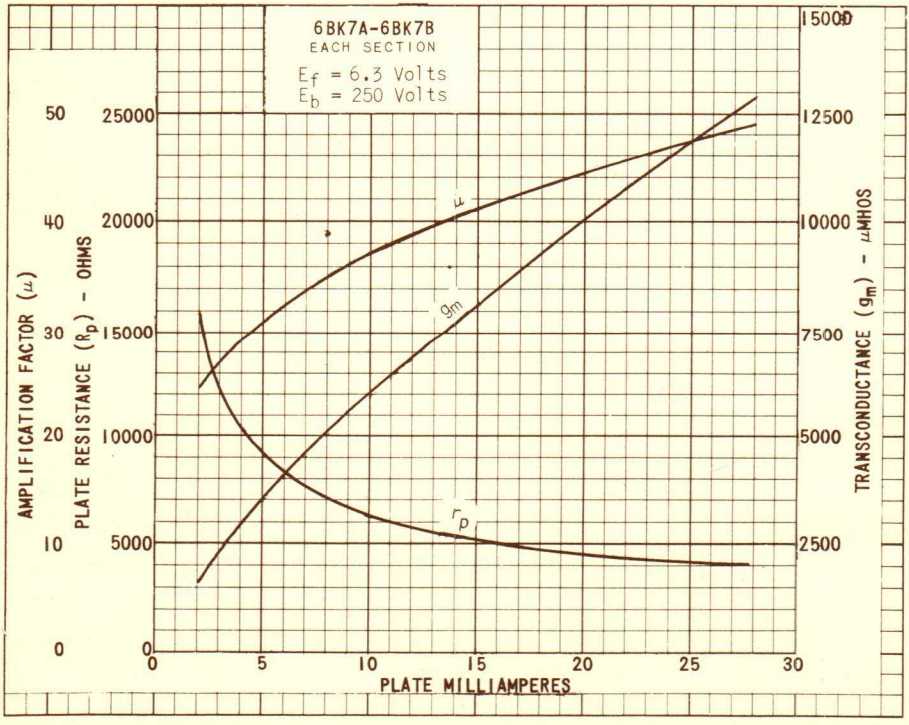
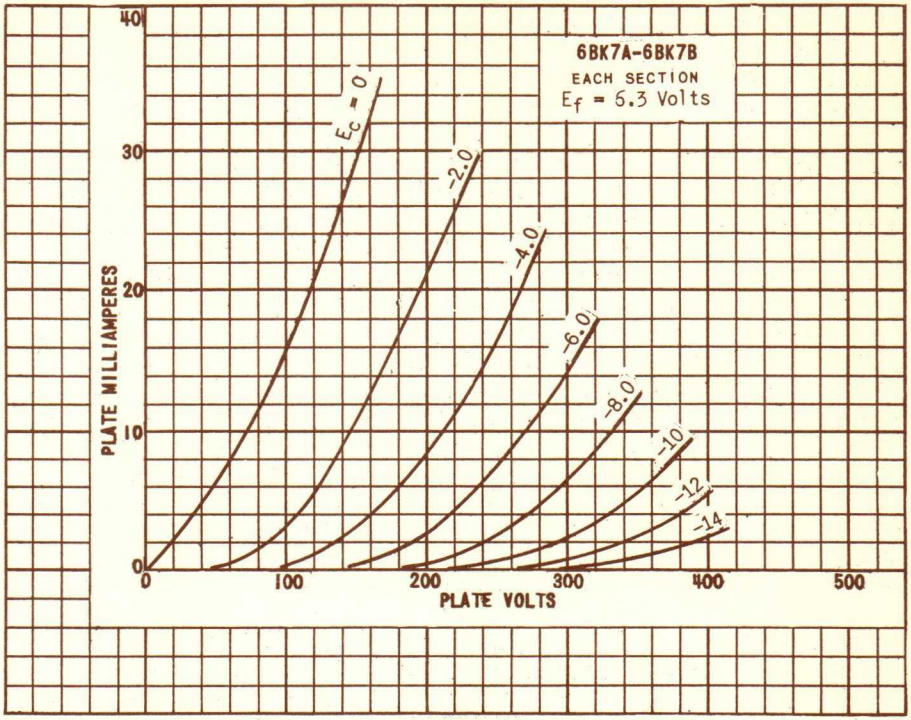
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

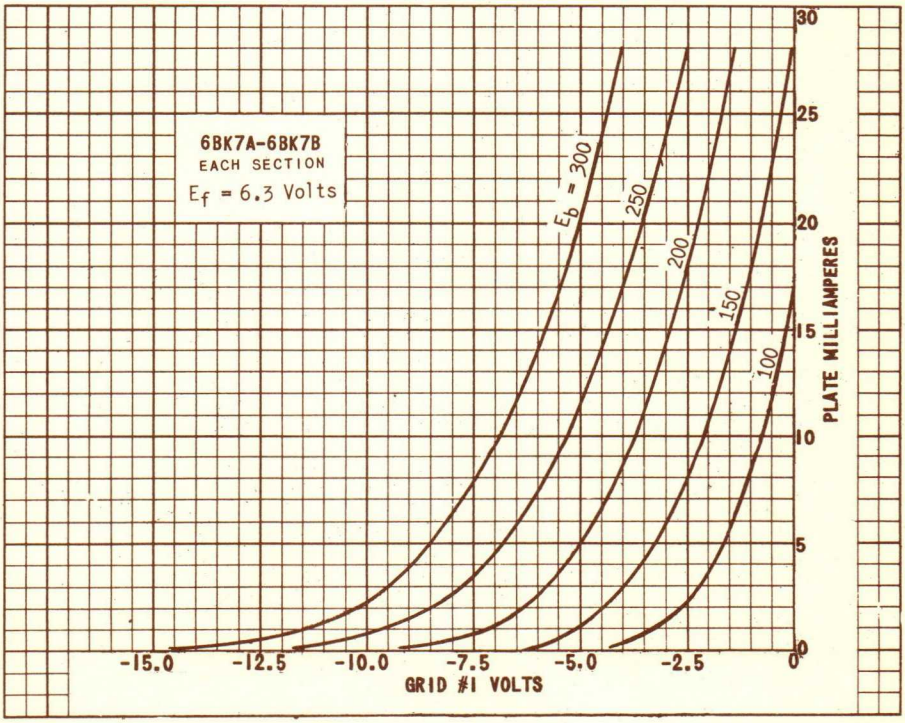
CLASS A_1 AMPLIFIER – EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
AMPLIFICATION FACTOR	43	
PLATE RESISTANCE (APPROX.)	4 600	OHMS
TRANSCONDUCTANCE	9 300	µMHOS
PLATE CURRENT	18	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 µA.	−11	VOLTS
NOISE FIGURE[B]	7	DECIBELS

[B] AS MEASURED IN A CASCODE AMPLIFIER WHICH OPERATES AT A PLATE SUPPLY VOLTAGE OF 250 VOLTS, A PLATE CURRENT OF 18 MA., A FREQUENCY OF 200 MEGACYCLES, A STAGE BANDWIDTH OF 7 MEGACYCLES, AND AN EFFECTIVE NOISE BANDWIDTH OF 3.5 MEGACYCLES.







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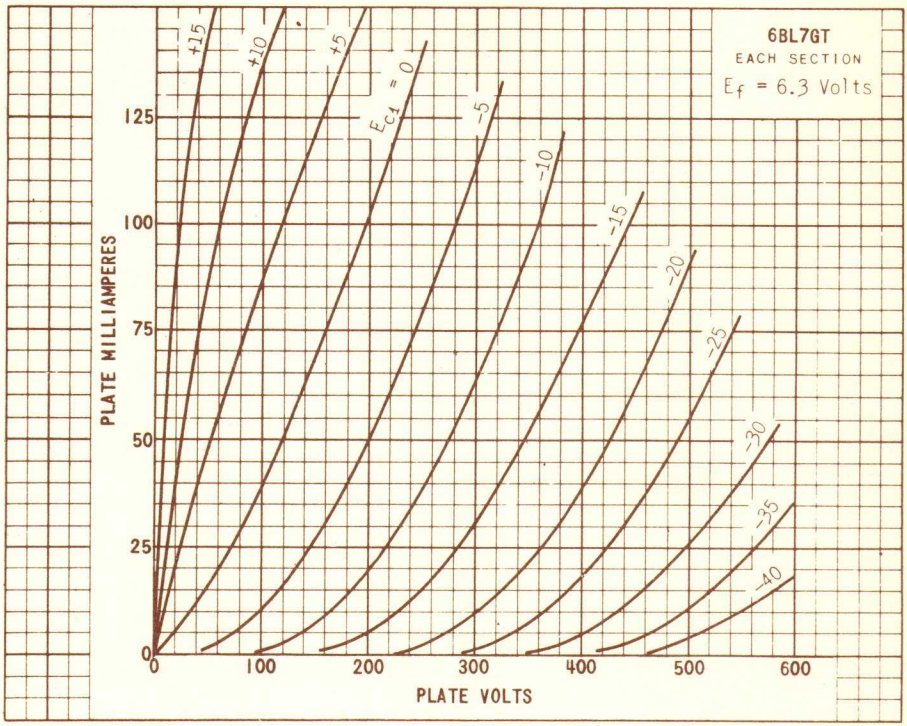

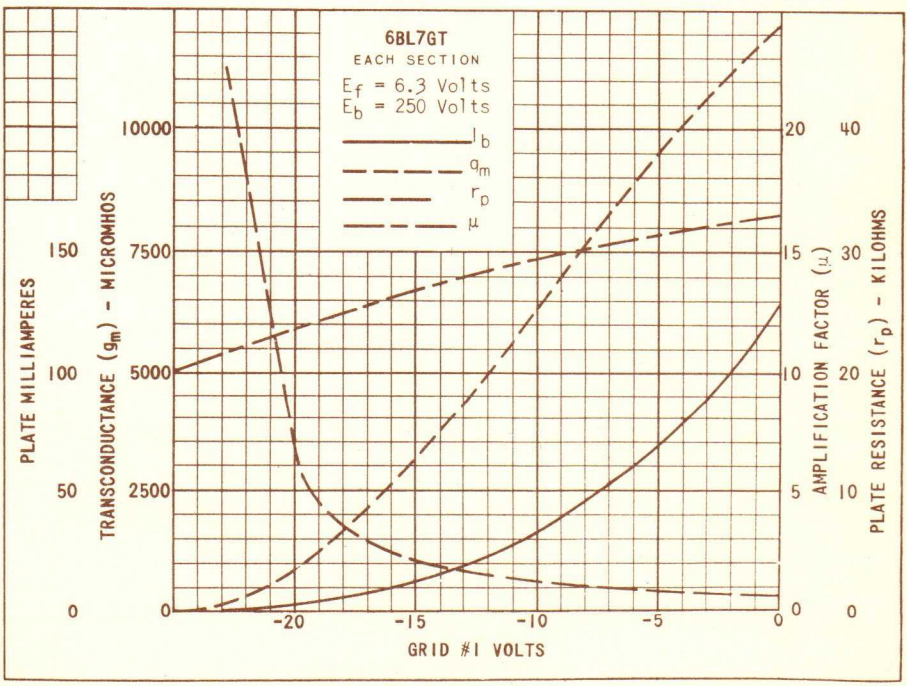

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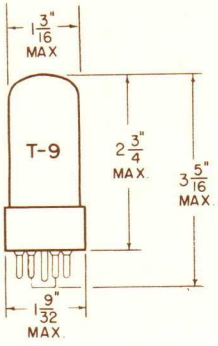
TWIN TRIODE

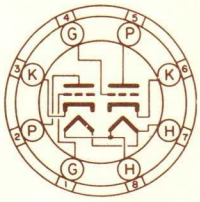


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.5 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE-SHELL
8 PIN OCTAL
8BD

THE 6BL7GTA COMBINES TWO INDEPENDENT HIGH PERVEANCE LOW-MU TRIODES IN ONE ENVELOPE. IT IS SUITABLE FOR USE AS A COMBINED VERTICAL DEFLECTION SWEEP GENERATOR AND DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS USING PICTURE TUBES WITH WIDE DEFLECTION ANGLES. IT IS INTERCHANGEABLE WITH THE 6BL7GT BUT DIFFERS FROM IT IN HAVING AN IMPROVED SECTION 1 FOR INCREASED LIFE AS AN OSCILLATOR, AND CONTROLLED ZERO-BIAS PLATE CURRENT IN BOTH SECTIONS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.
WITHOUT EXTERNAL SHIELD

	SEC. #1	SEC. #2	
GRID TO PLATE	6.0	6.0	μμf
INPUT	4.2	4.6	μμf
OUTPUT	0.9	0.9	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
EACH SECTION

	VERTICAL[AB] OSCILLATOR SERVICE	VERTICAL[B] DEFLECTION AMPLIFIER	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	500	500	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	---	2 000[C]	VOLTS
MAXIMUM PEAK NEGATIVE GRID-VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION (EACH PLATE)	10	10[D]	WATTS
MAXIMUM TOTAL PLATE DISSIPATION (BOTH PLATES)	12	12	WATTS
MAXIMUM DC CATHODE CURRENT	60	60	MA.
MAXIMUM PEAK CATHODE CURRENT	210	210	MA.
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

EACH SECTION

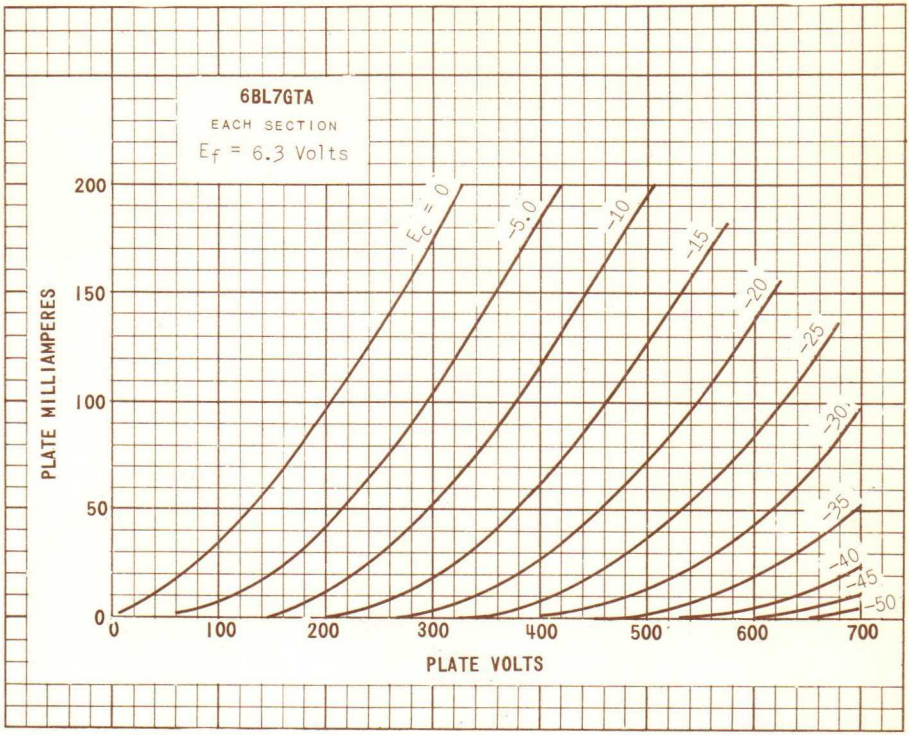
HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	1.5	1.5	1.5	AMP.
PLATE VOLTAGE	150	250	250	VOLTS
GRID VOLTAGE	0	-17	-9.0	VOLTS
AMPLIFICATION FACTOR	---	---	15	
PLATE RESISTANCE (APPROX.)	---	---	2 150	OHMS
TRANSCONDUCTANCE	---	---	7 000	μMHOS
PLATE CURRENT	65	4.0	40	MA.
GRID VOLTAGE (APPROX.)				
I_b = 50 μAMPS.	---	---	-23	VOLTS

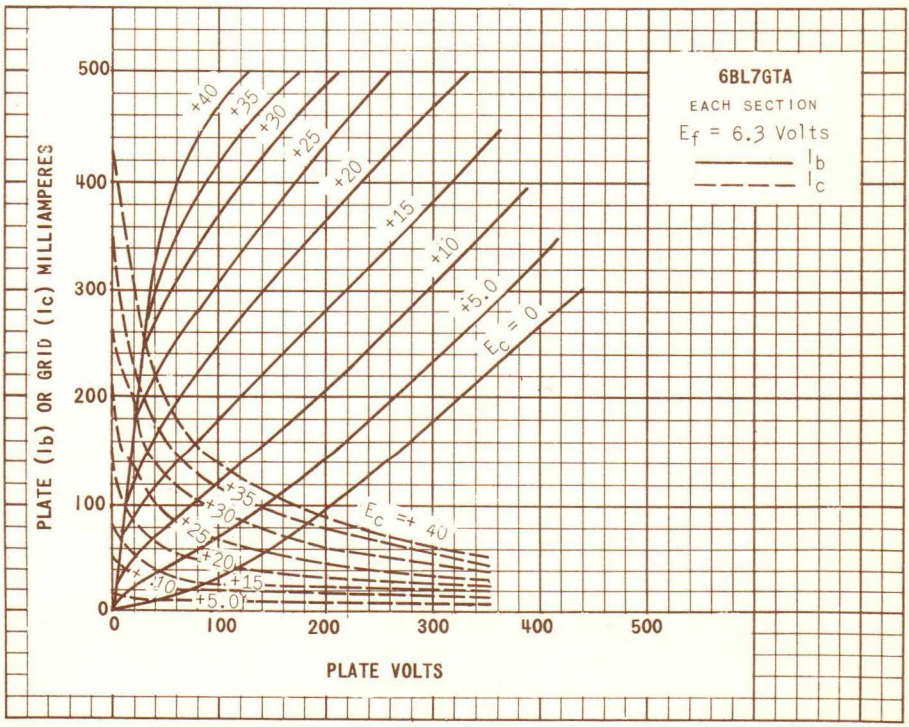
[A] SECTION 1 IS RECOMMENDED FOR VERTICAL OSCILLATOR SERVICE.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C] ABSOLUTE-MAXIMUM VALUE.

[D] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.





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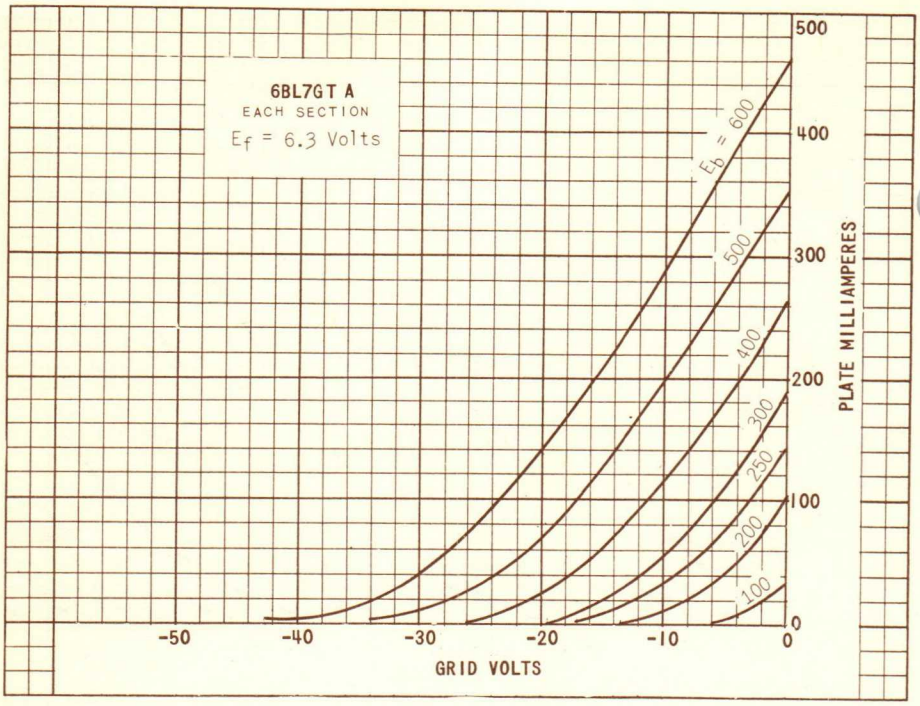
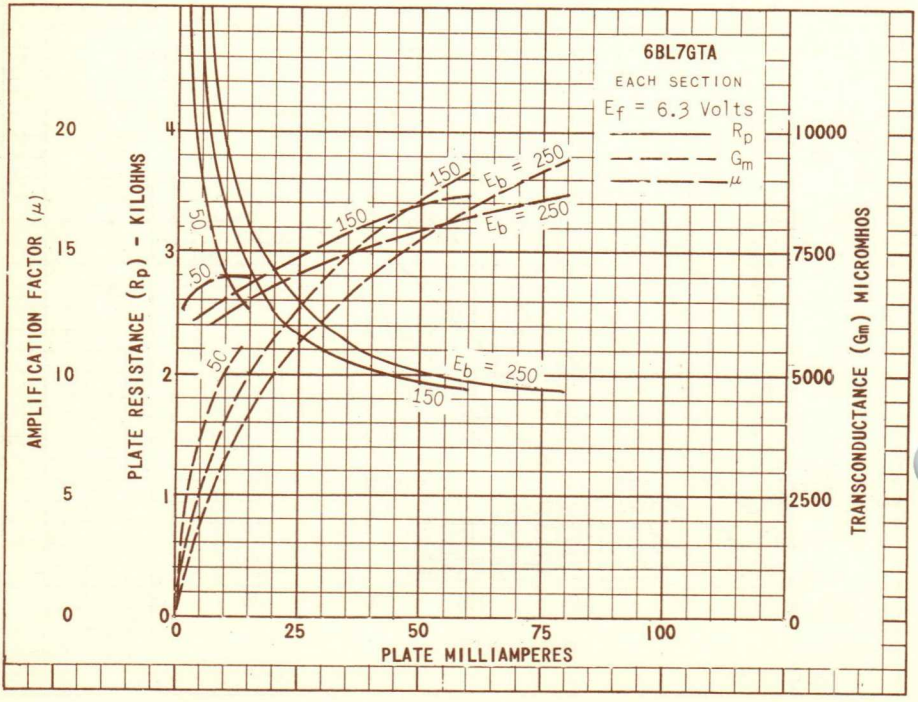

6BL7GT A
EACH SECTION
Ef = 6.3 Volts
Eb = 600
500
400
300
250
200
100
500
400
300
200
100
0
PLATE MILLIAMPERES
-50
-40
-30
-20
-10
0
GRID VOLTS


6BL7GTA
EACH SECTION
Ef = 6.3 Volts
Rp
Gm
μ
AMPLIFICATION FACTOR (μ)
20
15
10
5
0
PLATE RESISTANCE (Rp) - KILOHMS
4
3
2
1
0
150
Eb = 250
50
150
Eb = 250
50
50
Eb = 250
150
10000
7500
5000
2500
0
TRANSCONDUCTANCE (Gm) MICROMHOS
0
25
50
75
100
PLATE MILLIAMPERES

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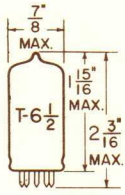
TRIODE PENTODE

MINIATURE TYPE



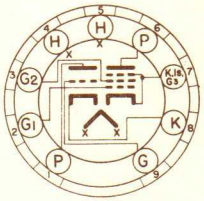
GLASS BULB
6-2

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.45 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

9DC

THE 6BL8 IS A TRIODE-PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A FREQUENCY CHANGER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	TRIODE SECTION	PENTODE SECTION	
INPUT CAPACITANCE	2.5	5.5	pf
OUTPUT CAPACITANCE	1.8	3.8	pf
PLATE TO GRID #1 (MAX.)		0.025	pf
PLATE TO GRID	1.5		pf
BETWEEN PENTODE AND TRIODE SECTIONS:			
PENTODE PLATE TO TRIODE PLATE (MAX.)		0.07	pf
PENTODE PLATE TO TRIODE GRID (MAX.)		0.02	pf
PENTODE GRID TO TRIODE PLATE (MAX.)		0.16	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE SECTION	PENTODE SECTION	
MAXIMUM PLATE VOLTAGE	250	250	VOLTS
MAXIMUM PLATE DISSIPATION	1.5	1.7	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5		MEGOHM
MAXIMUM GRID #2 VOLTAGE AT A CATHODE CURRENT OF 14 MAMPS		175	VOLTS
MAXIMUM GRID #2 VOLTAGE AT A CATHODE CURRENT LESS THAN 10 MAMPS		200	VOLTS
MAXIMUM GRID #2 VOLTAGE WITHOUT CURRENT		550	VOLTS
MAXIMUM GRID #2 DISSIPATION AT A PLATE DISSIPATION MORE THAN 1.2 WATTS		0.5	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH AUTOMATIC BIAS		1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH FIXED BIAS		0.5	MEGOHM
MAXIMUM CATHODE CURRENT	14	14	MAMPS
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE	100	100	VOLTS

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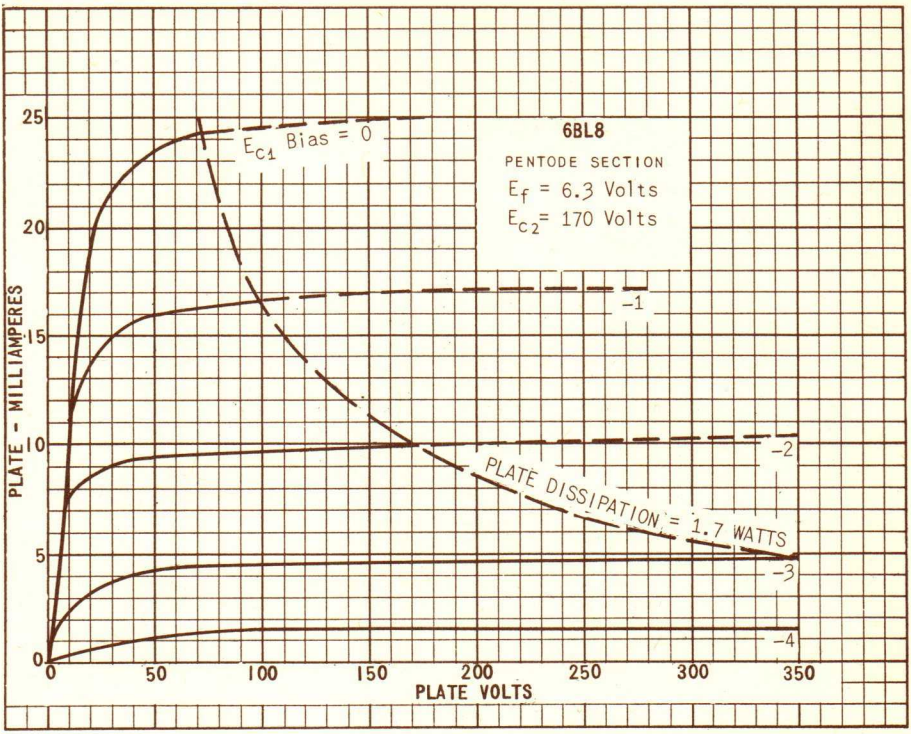
TYPICAL CHARACTERISTICS

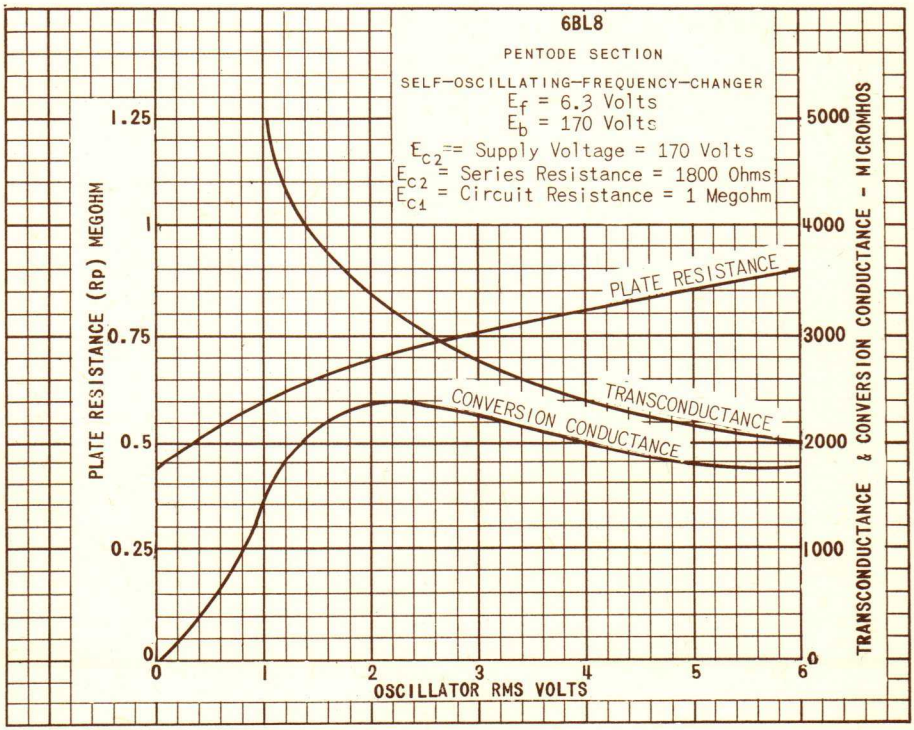
	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	100	170	VOLTS
GRID #1 VOLTAGE	−2	−2	VOLTS
PLATE CURRENT	14	10	MAMPS
GRID #2 CURRENT		2.8	MAMPS
TRANSCONDUCTANCE	5000	6200	μMHOS
PLATE RESISTANCE		0.4	MEGOHM
AMPLIFICATION FACTOR	20		
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1		47	
INPUT RESISTANCE AT 50 MC		10 000	OHMS
EQUIVALENT NOISE RESISTANCE		1 500	OHMS
GRID #2 VOLTAGE		170	VOLTS

OPERATING CHARACTERISTICS
FOR USE AS MIXER

PLATE VOLTAGE	170	170	VOLTS
GRID #2 VOLTAGE	170	170	VOLTS
GRID #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	MAMPS
GRID #2 CURRENT	2.0	1.5	MAMPS
GRID #1 CURRENT	25	0	μAMP
CONVERSION CONDUCTANCE	2200	2100	μMHOS
PLATE RESISTANCE	0.8	0.87	MEGOHM

OPTIMUM PEAK CATHODE CURRENT OF THE TRIODE SECTION IS FRAME OUTPUT APPLICATION. TO ALLOW FOR TUBE SPREAD, FOR DETERIORATION DURING LIFE AND FOR EMISSION DROP AT UNDERHEATING THE SET SHOULD BE DESIGNED SO THAT WITH A PEAK CATHODE CURRENT OF 100 MA IT STILL OPERATES SATISFACTORILY. IT IS RECOMMENDED THAT THE AMPLITUDE OF THE PEAK CURRENTS OCCURRING WITH FRESH TUBES BE LIMITED AUTOMATICALLY.





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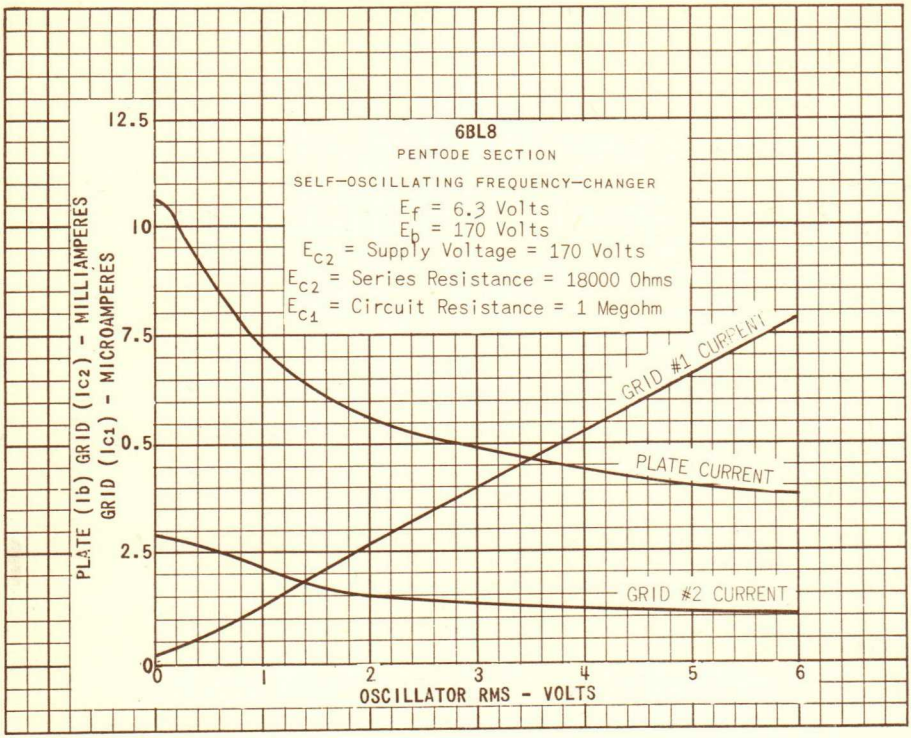
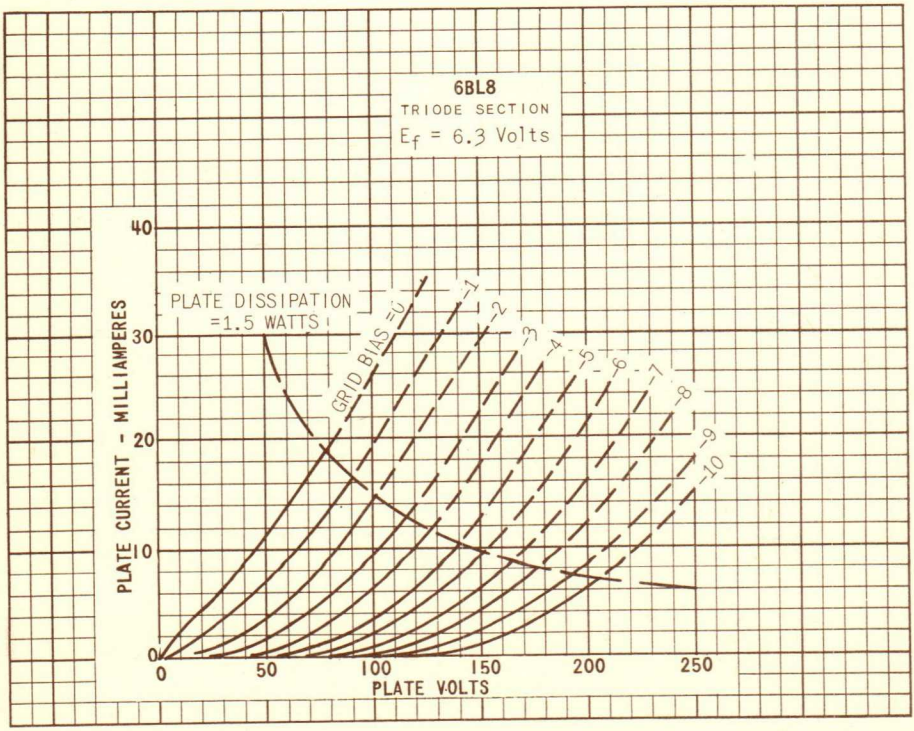
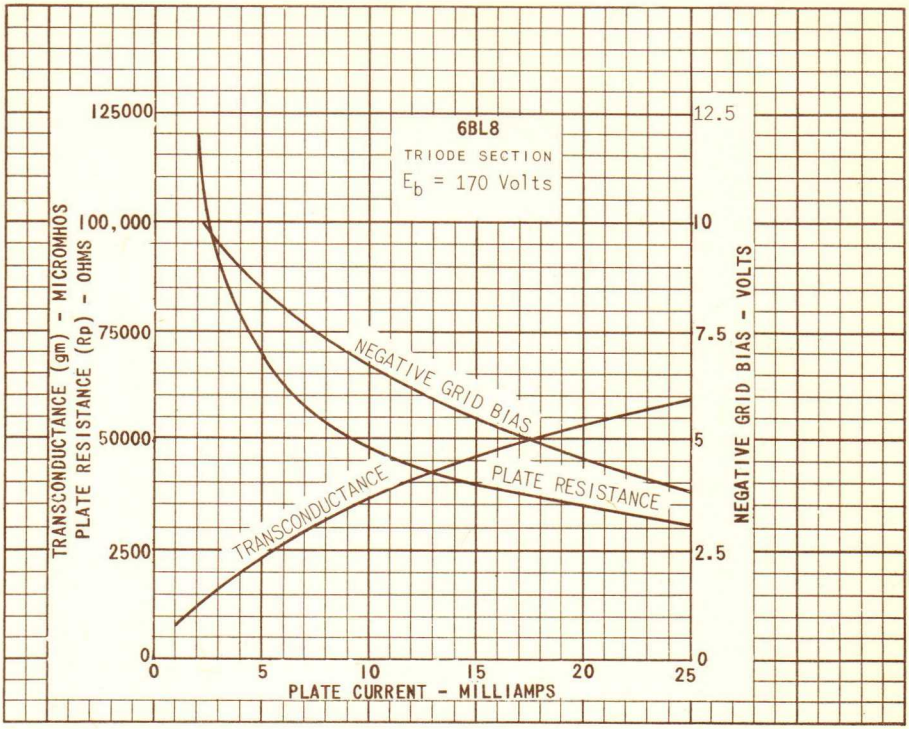

6BL8
PENTODE SECTION
SELF-OSCILLATING FREQUENCY-CHANGER
E_f = 6.3 Volts
E_b = 170 Volts
E_{c2} = Supply Voltage = 170 Volts
E_{c2} = Series Resistance = 18000 Ohms
E_{c1} = Circuit Resistance = 1 Megohm
PLATE (Ib) GRID (Ic2) - MILLIAMPERES
GRID (Ic1) - MICROAMPERES
12.5
10
7.5
0.5
2.5
0
GRID #1 CURRENT
PLATE CURRENT
GRID #2 CURRENT
0
1
2
3
4
5
6
OSCILLATOR RMS - VOLTS


6BL8
TRIODE SECTION
E_f = 6.3 Volts
PLATE CURRENT - MILLIAMPERES
40
30
20
10
0
PLATE DISSIPATION
=1.5 WATTS
GRID BIAS =0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
0
50
100
150
200
250
PLATE VOLTS



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NOTES

A MAXIMUM PULSE DURATION 4% OF ONE CYCLE WITH A MAXIMUM OF 0.8 MILLI SECOND.

B PEAK PLATE CURRENT OF THE PENTODE SECTION IN VERTICAL OUTPUT APPLICATION.
TO ALLOW FOR TUBE SPREAD AND FOR DETERIORATION DURING LIFE THE CIRCUIT SHOULD BE DESIGNED AROUND A PEAK PLATE CURRENT NOT EXCEEDING 85 MAMPS AT A PLATE VOLTAGE OF 50 VOLTS AND A GRID #2 VOLTAGE OF 170 VOLTS. AT UNDERHEATING (HEATER VOLTAGE 5.3 VOLTS) A PEAK ANODE CURRENT OF 70 MAMPS SHOULD BE TAKEN INTO CONSIDERATION AT A PLATE VOLTAGE OF 50 VOLTS AND A GRID #2 VOLTAGE OF 170 VOLTS, AND A PEAK ANODE CURRENT OF 80 MAMPS AT A PLATE VOLTAGE OF 50 VOLTS AND A GRID #2 OF 190 VOLTS. THE PEAK PLATE CURRENT OF AN AVERAGE NEW TUBE IS 135 MAMPS AT A PLATE VOLTAGE OF 50 VOLTS, A GRID #2 VOLTAGE OF 170 VOLTS AND A GRID #1 CURRENT OF 0.3 MICROAMPERES.

C OPTIMUM PEAK CATHODE CURRENT AS FRAME OSCILLATOR.
TO ALLOW FOR TUBE SPREAD, FOR DETERIORATION DURING LIFE AND FOR EMISSION DROP AT UNDERHEATING THE SET SHOULD BE DESIGNED SO THAT WITH A PEAK CATHODE OF 100 MILLIAMPS IT STILL OPERATES SATISFACTORILY (MAX. PULSE DURATION 4% OF A CYCLE, WITH A MAXIMUM OF 0.8 MILLISEC). IT IS RECOMMENDED THAT THE AMPLITUDE OF THE PEAK CURRENTS OCCURRING WITH FRESH TUBES BE LIMITED AUTOMATICALLY TO THIS MAX. VALUE OF 100 MILLI-AMPS (e. g. BY NON-BYPASSED RESISTOR IN THE GRID OR ANODE LEAD.

D WITH GRID CURRENT BIASING THE MAXIMUM PERMISSABLE VALUE OF THE GRID CIRCUIT RESISTANCE IS 22 MEGOHMS.
MAXIMUM A.F. OUTPUT VOLTAGE.

MICROPHONY AND HUM.

THE TRIODE SECTION CAN BE USED WITHOUT SPECIAL PRECAUTIONS AGAINST MICROPHONY AND HUM IN CIRCUITS WITH A 5% LOUDSPEAKER WHEN THE INPUT VOLTAGE REQUIRED FOR AN OUTPUT POWER OF 50 MWATTS OF THE OUTPUT TUBE IS HIGHER THAN 10 MVOLTS. THE A.C. VOLTAGE BETWEEN HEATER PIN 4 AND THE CATHODE SHOULD NOT EXCEED 6.3 VOLTS (RMS) IN THIS CASE AND THE GRID CIRCUIT IMPEDANCE AT 50 C/S SHOULD NOT EXCEED 0.5 MEGOHM.

→ INDICATES A CHANGE.

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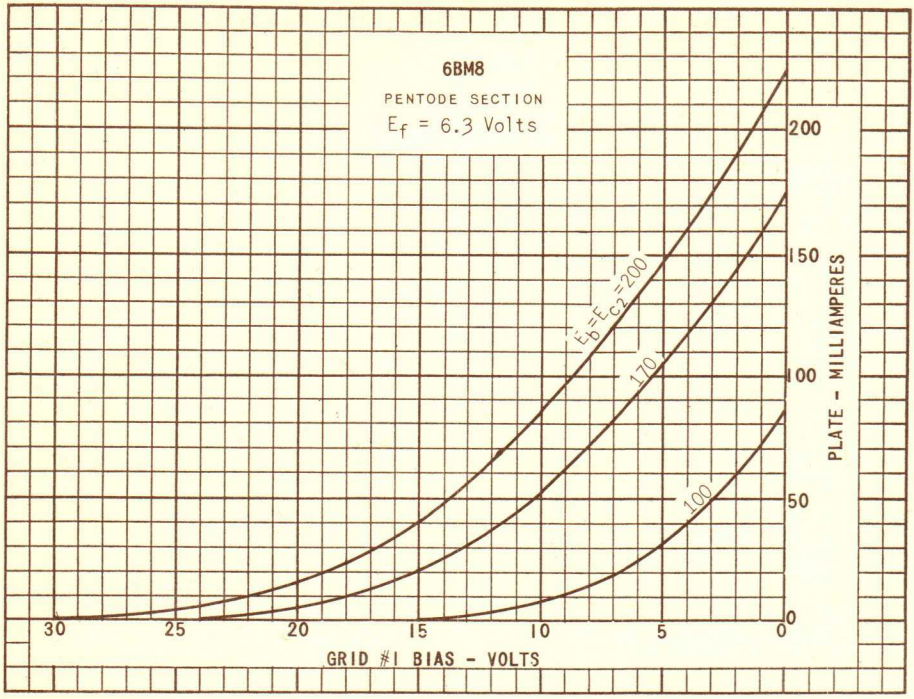
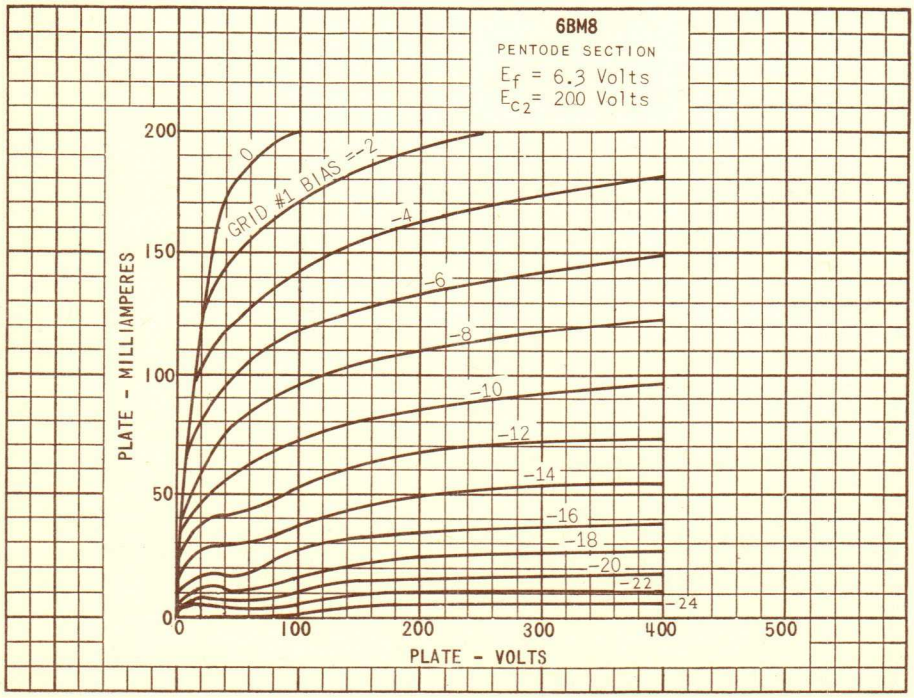
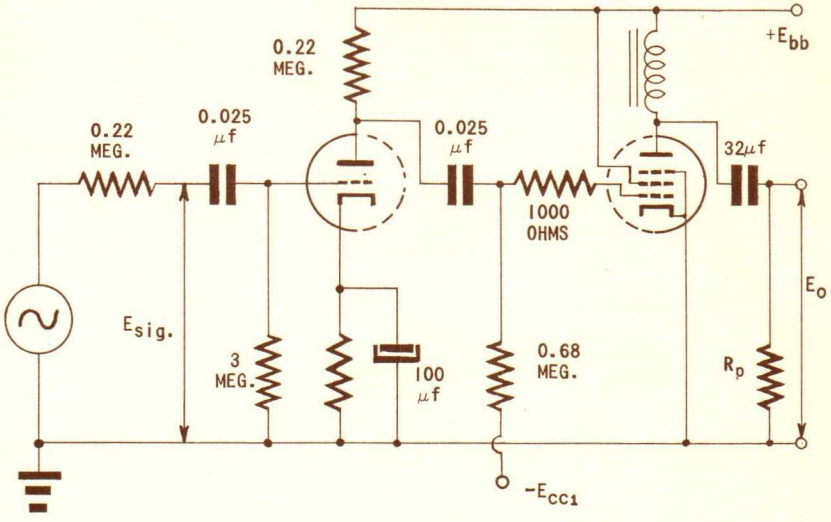

6BM8
PENTODE SECTION
E_f = 6.3 Volts
$E_b=E_{c2}$=200
170
100
200
150
100
50
0
PLATE - MILLIAMPERES
30
25
20
15
10
5
0
GRID #1 BIAS - VOLTS


6BM8
PENTODE SECTION
E_f = 6.3 Volts
E_{c2}= 200 Volts
GRID #1 BIAS =
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
200
150
100
50
0
PLATE - MILLIAMPERES
0
100
200
300
400
500
PLATE - VOLTS



CIRCUIT DIAGRAM OF TRIODE SECTION AS A.F. AMPLIFIER AND PENTODE SECTION AS TRANSFORMER-LESS AUDIO OUTPUT TUBE.

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TUNG-SOL

TRIODE

MINIATURE TYPE

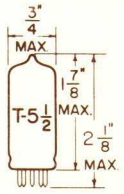
COATED UNIPOTENTIAL CATHODE

HEATER

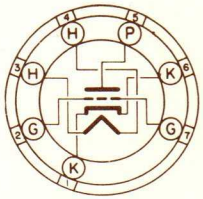
6.3±10% VOLTS 0.2 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7EG

THE 6BN4 AND 6BN4A ARE MINIATURE MEDIUM-MU TRIODES DESIGNED FOR USE AS RADIO-FREQUENCY AMPLIFIERS IN VHF TELEVISION TUNERS. EXCEPT FOR THE HIGHER TRANSCONDUCTANCE AND LOWER PLATE RESISTANCE OF THE 6BN4A, THE TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #316

GRID TO PLATE	1.2	μμf
INPUT	3.2	μμf
OUTPUT	1.4	μμf
HEATER TO CATHODE	2.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHMS
HEATER WARM-UP TIME*	11	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.2	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE-BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	43	
PLATE RESISTANCE (APPROX.) FOR 6BN4	6 300	OHMS
PLATE RESISTANCE (APPROX.) FOR 6BN4A	5 400	OHMS
TRANSCONDUCTANCE (FOR 6BN4)	6 800	μMHOS
TRANSCONDUCTANCE (FOR 6BN4A)	7700 ←	μMHOS
PLATE CURRENT	9.0	MA.
GRID VOLTAGE (APPROX.) I_b = 100 μAMPS.	-6	VOLTS

→ INDICATES A CHANGE.

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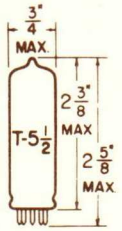
PENTODE
MINIATURE TYPE

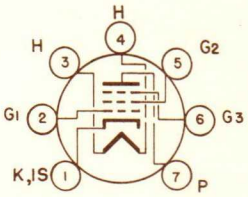


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

GATED-BEAM DISCRIMINATOR
FOR FM AND INTERCARRIER
TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7DF

THE 6BN6 IS A GATED BEAM DISCRIMINATOR TUBE USING THE MINIATURE CONSTRUCTION. IT IS DESIGNED TO PERFORM THE COMBINED OPERATION OF DETECTOR AND AUDIO-VOLTAGE AMPLIFIER IN FM RECEIVERS WITH HEATER TRANSFORMER OR WITH 300 MA. SERIES STRING HEATER SUPPLY.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #1 TO ALL	4.2	pf
GRID #3 TO ALL	3.3	pf
GRID #1 TO GRID #3 (MAX.)	0.004	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	
CURRENT OPERATION		300±30	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
HEATER WARM-UP TIME (APPROX.)*		11	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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MAXIMUM RATINGS ←

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE SUPPLY VOLTAGE	330	VOLTS
GRID VOLTAGE	110	VOLTS
PEAK POSITIVE LIMITER-GRID VOLTAGE	60	VOLTS
DC CATHODE CURRENT	13	MA.

TYPICAL OPERATING CHARACTERISTICS ←

LIMITER-DISCRIMINATOR SERVICE

INPUT-SIGNAL CENTER FREQUENCY	10.7	10.7	4.5	MEGACYCLES
FREQUENCY DEVIATION	±75	±75	±25	KCYCLES
PLATE-SUPPLY VOLTAGE	85	285	270	VOLTS
PLATE VOLTAGE	63	122	121	VOLTS
ACCELERATOR VOLTAGE	55	100	100	VOLTS
CATHODE-BIAS RESISTOR (VARIABLE) [A]	200-400	200-400	200-400	OHMS
PLATE LOAD RESISTOR	85000	330000	330000	OHMS
PLATE LINEARITY RESISTOR	470	1500	1000	OHMS
INTEGRATING CAPACITOR	0.002	0.001	0.001	μf
COUPLING CAPACITOR	0.25	0.01	0.25	μf
MINIMUM SIGNAL VOLTAGE FOR LIMITING ACTION, RMS [B]	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 [A]	1.25	2.0	2.0	VOLTS
AM REJECTION AT Esig=2.0V., RMS	31	20	25	DECIBELS
AM REJECTION AT Esig=3.0V., 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

[A] THE CATHODE RESISTOR SHOULD BE ADJUSTED FOR MAXIMUM AM REJECTION IN THE OUTPUT OF LIMITER-DISCRIMINATOR STAGE AT THE SPECIFIED SIGNAL LEVEL. AM REJECTION IS MEASURED WITH AN APPLIED SIGNAL CONTAINING 30-PERCENT AMPLITUDE MODULATION AND 30-PERCENT FREQUENCY MODULATION.

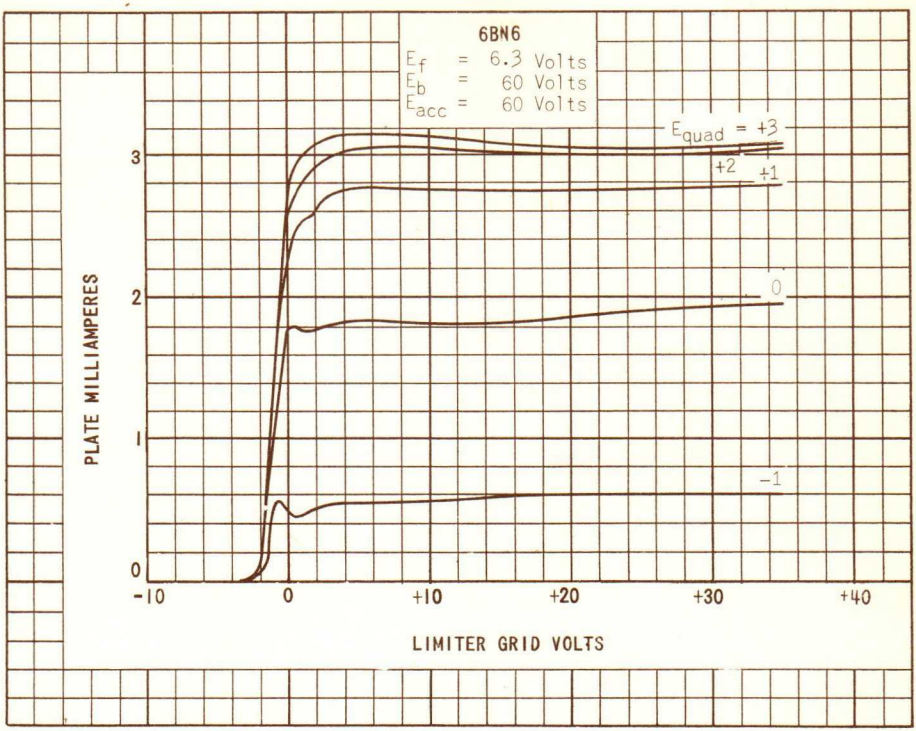
[B] AT SIGNAL LEVELS ABOVE SPECIFIED VALUE, LIMITING IS WITHIN ±2 DECIBELS.

ADEQUATE SHIELDING BETWEEN COMPONENTS OF THE LIMITER GRID AND THE QUADRATURE GRID MUST BE USED TO INSURE PROPER PHASING OF THE VOLTAGE DEVELOPED ON THE QUADRATURE GRID.

STANDARD DE-EMPHASEIS REQUIREMENTS FOR FM ARE INCLUDED.

THE Q OF THE QUADRATURE GRID CIRCUIT SHOULD BE HIGH ENOUGH TO DEVELOP A MINIMUM OF 4 VOLTS (RMS) SIGNAL WITH 2 VOLTS (RMS) OF THE CENTER-FREQUENCY SIGNAL APPLIED TO THE LIMITER GRID. IT IS RECOMMENDED THAT THE COIL BE SHUNTED BY A MINIMUM OF 10 μμf. THE CAPACITANCE MAY BE COMPOSED OF TUBE INPUT CAPACITANCE, STRAY CAPACITANCE, AND DISTRIBUTED CAPACITANCE, AS WELL AS PHYSICAL CAPACITANCE.

→ INDICATES A CHANGE.



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DOUBLE-DIODE TRIODE

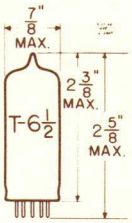
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

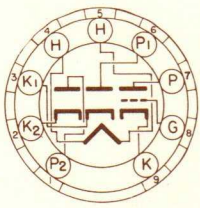
HEATER

6.3±10% VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9ER

THE 6BN8 IS A HIGH MU TRIODE DOUBLE DIODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TUBE HAS SEPARATE CATHODE CONNECTIONS FOR EACH SECTION AND IS INTENDED FOR APPLICATIONS IN BOTH MONOCHROME AND COLOR TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

TRIODE SECTION		
GRID TO PLATE: (G TO P)	2.5	μμf
INPUT: G TO (H +TK)	3.6	μμf
OUTPUT: P TO (H +TK)	0.25	μμf
DIODE SECTION		
#1 PLATE TO TRIODE GRID (MAX.)	0.060	μμf
#2 PLATE TO TRIODE GRID (MAX.)	0.10	μμf
#1 CATHODE TO ALL: 1DK TO (H+TK+2DK+TP+1DP+TG+2DP)	5.0	μμf
#2 CATHODE TO ALL: 2DK TO (H+TK+1DK+TP+1DP+2DP+TG)	5.0	μμf
#1 PLATE TO #2 PLATE (MAX.)	0.070	μμf
#1 PLATE TO #1 CATHODE + HEATER: 1DP TO (1DK+ H)	1.9	μμf
#2 PLATE TO #2 CATHODE + HEATER: 2DP TO (2DK+ H)	1.9	μμf
#1 CATHODE TO #1 PLATE + HEATER: 1DK TO (1DP+ H)	4.8	μμf
#2 CATHODE TO #2 PLATE + HEATER: 2DK TO (2DP+ H)	4.8	μμf
#1 PLATE TO ALL: 1DP TO (H+TK+1DK+2DK+TP+2DP+TG)	3.0	μμf
#2 PLATE TO ALL: 2DP TO (H+TK+1DK+2DK+TP+1DP+TG)	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

HEATER VOLTAGE	→ 6.3±10%	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
HEATER WARM-UP TIME [A]	11	SECONDS

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

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RATINGS – CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

TRIODE SECTION		
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.7 ←	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	MEGOHM
DIODE SECTION		
MAXIMUM PEAK PLATE CURRENT, (EACH PLATE)	54	MA.
MAXIMUM DC CURRENT, (EACH PLATE)	9	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

TRIODE SECTION			
HEATER VOLTAGE	→ 6.3±10%	6.3±10%	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-3	VOLTS
PLATE RESISTANCE (APPROX.)	21 000	28 000	OHMS
TRANSCONDUCTANCE	3 500	2 500	μMHOS
AMPLIFICATION FACTOR	75	70	
PLATE CURRENT	1.5	1.6	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA	-2.5	-5.5	VOLTS
DIODE SECTION			
AVERAGE CURRENT (EACH PLATE) AT 10 VOLTS DC		50	MA.
VOLTAGE DROP (EACH SECTION) AT I_b=9 MA DC		2.6	VOLTS

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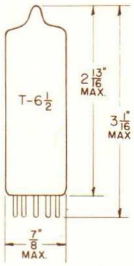
PENTODE



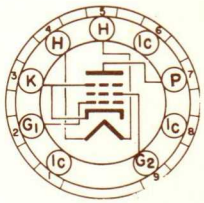
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.76 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

9 PIN BASE

9CV

THE 6BQ5 IS AN OUTPUT PENTODE DESIGNED FOR APPLICATION IN MEDIUM POWER HI-FI AMPLIFIERS. A PAIR OF TUBES IN CLASS AB, PUSH-PULL CONVENTIONAL OPERATION YIELDS AN OUTPUT OF UP TO 17 WATTS AT 4% DISTORTION (WITHOUT FEEDBACK). IN SINGLE-ENDED OPERATION A POWER OUTPUT OF 5.7 WATTS CAN BE OBTAINED.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELEMENTS	10.8	μμf
PLATE TO ALL OTHER ELEMENTS	6.5	μμf
PLATE TO GRID #1 (MAX.)	0.5	μμf
GRID #1 TO HEATER (MAX.)	0.25	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE[A]	300	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT PLATE CURRENT	550	VOLTS
MAXIMUM PLATE DISSIPATION[A]	12	WATTS
MAXIMUM GRID #2 VOLTAGE [A]	300	VOLTS
MAXIMUM GRID #2 VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM GRID #2 DISSIPATION	2	WATTS
MAXIMUM GRID #2 PEAK DISSIPATION	4	WATTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	100	VOLTS
MAXIMUM GRID CURRENT STARTING POINT		
MAXIMUM GRID #1 VOLTAGE WHEN GRID #1 CURRENT IS 0.3 μAMP.	-1.3	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH AUTOMATIC BIAS	1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH FIXED BIAS	0.3	MEGOHM
MAXIMUM CATHODE CURRENT	65	MA.
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE	100	VOLTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A, ONE TUBE

HEATER VOLTAGE			6.3			VOLTS
HEATER CURRENT			0.76			AMP.
PLATE VOLTAGE			250			VOLTS
GRID #2 VOLTAGE			250			VOLTS
GRID #1 BIAS			-7.3			VOLTS
CATHODE RESISTOR			135			OHMS
PLATE LOAD RESISTANCE			5200			OHMS
INPUT A.F. VOLTAGE(RMS)	0	0.3	3.4	4.3	4.7	VOLTS
PLATE CURRENT	48	---	---	49.5	49.2	MA.
GRID #2 CURRENT	5.5	---	---	10.8	11.6	MA.
TRANSCONDUCTANCE	11300	---	---	----	---	µMHOS
PLATE RESISTANCE	38000	---	---	---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---	---	---	---	
MAX. SIGNAL POWER OUTPUT[B]	0	0.05	4.5	5.7	6.0[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---	6.8	10	---	PERCENT
SECOND HARMONIC[B]	---	---	3.0	2.0	---	PERCENT
THIRD HARMONIC[B]	---	---	5.8	9.5	---	PERCENT

PLATE VOLTAGE			250			VOLTS
GRID #2 VOLTAGE			250			VOLTS
GRID #1 BIAS			-7.3			VOLTS
CATHODE RESISTOR			135			OHMS
PLATE LOAD RESISTANCE			4500			OHMS
INPUT A.F. VOLTAGE (RMS)	0	0.3	3.5	4.4	4.8	VOLTS
PLATE CURRENT	48	---	---	50.6	50.5	MA.
GRID #2 CURRENT	5.5	---	---	10	11	MA.
TRANSCONDUCTANCE	11300	---	---	---	---	µMHOS
PLATE RESISTANCE	38000	---	---	---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---	---	---	---	
MAX. SIGNAL POWER OUTPUT[B]	0	0.05	4.5	5.7	6.0[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---	7.5	10	---	PERCENT
SECOND HARMONIC[B]	---	---	5.7	5.0	---	PERCENT
THIRD HARMONIC[B]	---	---	4.5	8	---	PERCENT

PLATE VOLTAGE			250			VOLTS
GRID #2 VOLTAGE			250			VOLTS
GRID #1 BIAS			-8.4			VOLTS
CATHODE RESISTOR			210			OHMS
PLATE LOAD RESISTANCE			7000			OHMS
INPUT A.F. VOLTAGE(RMS)	0	0.3		3.5	5.5	VOLTS
PLATE CURRENT	36	---		36.8	36	MA.
GRID #2 CURRENT	4.1	---		8.5	14.6	MA.
TRANSCONDUCTANCE	10000	---		---	---	µMHOS
PLATE RESISTANCE	40000	---		---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---		---	---	
MAX. SIGNAL POWER OUTPUT[B]	0	0.05		4.2	5.6[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---		10	---	PERCENT
SECOND HARMONIC[B]	---	---		1.7	---	PERCENT
THIRD HARMONIC[B]	---	---		8.7	---	PERCENT

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - cont'd.

CLASS A, ONE TUBE - CONT'D.

PLATE VOLTAGE			250		VOLTS
GRID #2 VOLTAGE			210		VOLTS
GRID #1 BIAS			-6.4		VOLTS
CATHODE RESISTOR			160		OHMS
PLATE LOAD RESISTANCE			7000		OHMS
INPUT A.F. VOLTAGE(RMS.)	0	0.3	3.4	3.8	VOLTS
PLATE CURRENT	36	---	36.6	36.5	MA.
GRID #2 CURRENT	3.9	---	7.3	8.0	MA.
TRANSCONDUCTANCE	10400	---	---	---	μMHOS
PLATE RESISTANCE	40000	---	---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---	---	---	OHMS
MAX. SIGNAL POWER OUTPUT [B]	0	0.05	4.3	4.7[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---	.10	---	PERCENT
SECOND HARMONIC[B]	---	---	1.8	---	PERCENT
THIRD HARMONIC[B]	---	---	9.3	---	PERCENT

CLASS B, TWO TUBES

PLATE VOLTAGE		250		300	VOLTS
GRID #2 VOLTAGE		250		300	VOLTS
GRID #1 BIAS		-11.6		-14.7	VOLTS
LOAD RESISTANCE, PLATE TO PLATE		8000		8000	
INPUT A.F. VOLTAGE (RMS)	0	8	0	10	VOLTS
PLATE CURRENT	2x10	2x37.5	2x7.5	2x46	MA.
GRID #2 CURRENT	2x1.1	2x7.5	2x0.8	2x11	MA.
MAX. SIGNAL POWER OUTPUT	0	11	0	17	WATTS
TOTAL HARMONIC DISTORTION	---	3	---	4	PERCENT

CLASS AB, TWO TUBES

PLATE VOLTAGE		250		300	VOLTS
GRID #2 VOLTAGE		250		300	VOLTS
COMMON CATHODE RESISTOR		130		130	OHMS
LOAD RESISTANCE, PLATE TO PLATE		8000		8000	OHMS
INPUT A.F. VOLTAGE (RMS)	0	8	0	10	VOLTS
PLATE CURRENT	2x31	2x37.5	2x36	2x46	MA.
GRID #2 CURRENT	2x3.5	2x7.5	2x4	2x11	MA.
MAX. SIGNAL POWER OUTPUT	0	11	0	17	WATTS
TOTAL HARMONIC DISTORTION	---	3	---	4	PERCENTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - cont'd.

CLASS A IN TRIODE CONNECTION

(GRID #2 CONNECTED TO PLATE)

PLATE VOLTAGE	250	VOLTS
CATHODE RESISTOR	270	OHMS
PLATE LOAD RESISTANCE	3500	OHMS
ZERO-SIGNAL PLATE CURRENT	34	MA.
INPUT A.F. VOLTAGE (RMS)	6.7	VOLTS
MAX. SIGNAL PLATE CURRENT	36	MA.
MAX. SIGNAL POWER OUTPUT	1.95	WATTS
TOTAL HARMONIC DISTORTION	9	PERCENTS
INPUT A.F. VOLTAGE AT A POWER OUTPUT OF 50 MWATTS (RMS)	1.0	VOLT

CLASS AB, TWO TUBES IN TRIODE CONNECTION

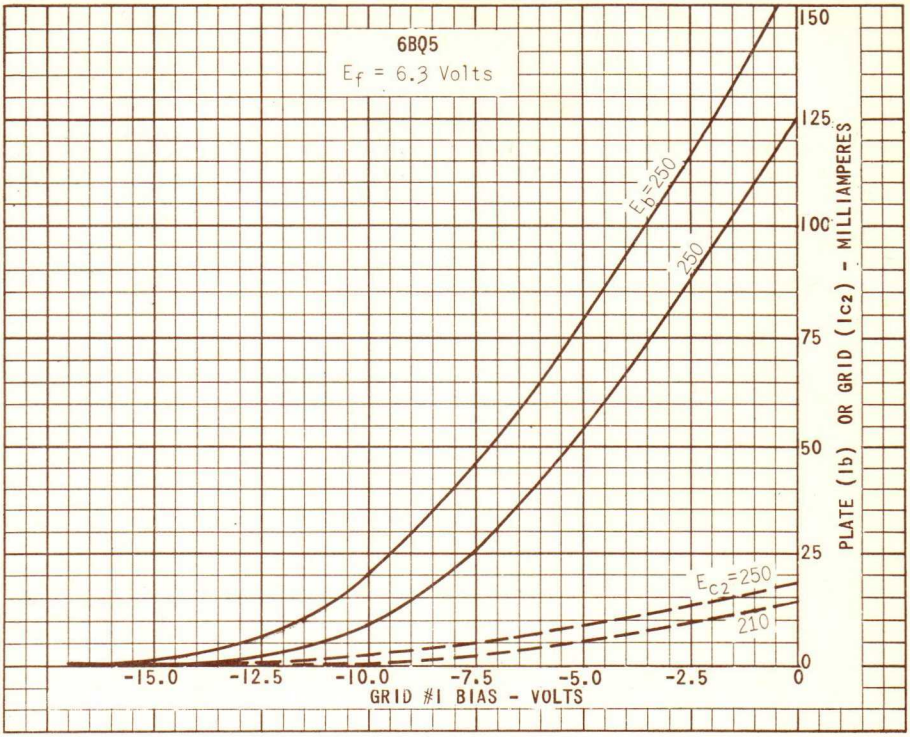
(GRID #2 CONNECTED TO PLATES)

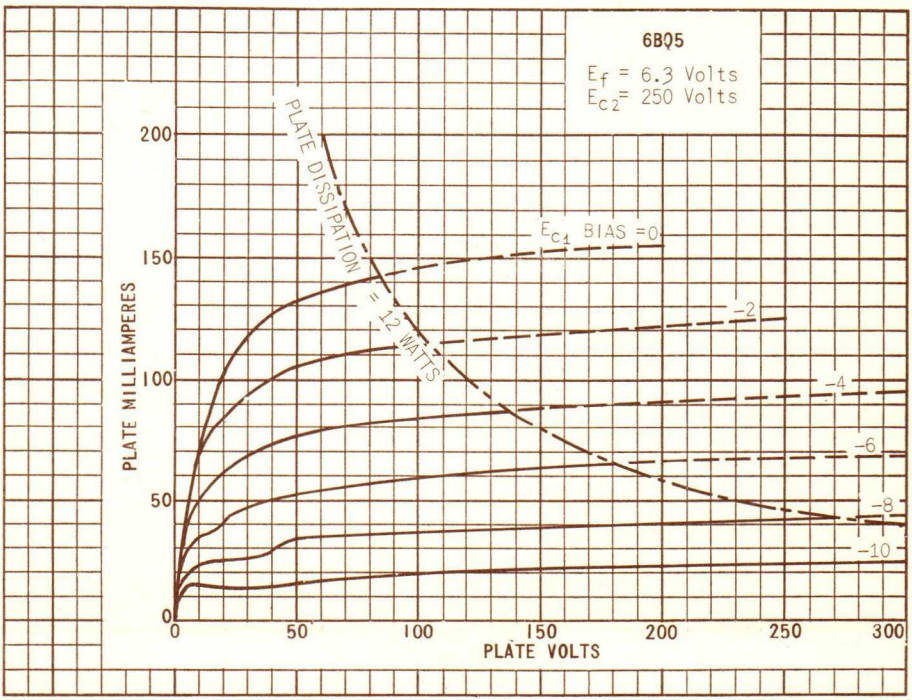
PLATE VOLTAGE	250	300	VOLTS
COMMON CATHODE RESISTOR	270	270	OHMS
LOAD RESISTANCE (PLATE TO PLATE)	10 000	10 000	OHMS
ZERO-SIGNAL PLATE CURRENT	2x20	2x24	MA.
INPUT A.F. VOLTAGE (RMS)	8.3	10	VOLTS
MAX. SIGNAL PLATE CURRENT	2x21.7	2x26	MA.
MAX. SIGNAL POWER OUTPUT	3.4	5.2	WATTS
TOTAL HARMONIC DISTORTION	2.5	2.5	PERCENTS
INPUT A.F. VOLTAGE AT A POWER OUTPUT OF 50 MWATTS (RMS.)	0.95	0.9	VOLTS

[A] WHEN THE HEATER AND POSITIVE VOLTAGES ARE OBTAINED FROM A STORAGE BATTERY BY MEANS OF A VIBRATOR, THE MAX. VALUES OF THE PLATE AND GRID #2 VOLTAGES ARE 250 VOLTS AND THAT OF THE PLATE DISSIPATION 9 WATTS.

[B] MEASURED WITH FIXED BIAS.

[C] POWER OUTPUT AT START OF POSITIVE GRID CURRENT.





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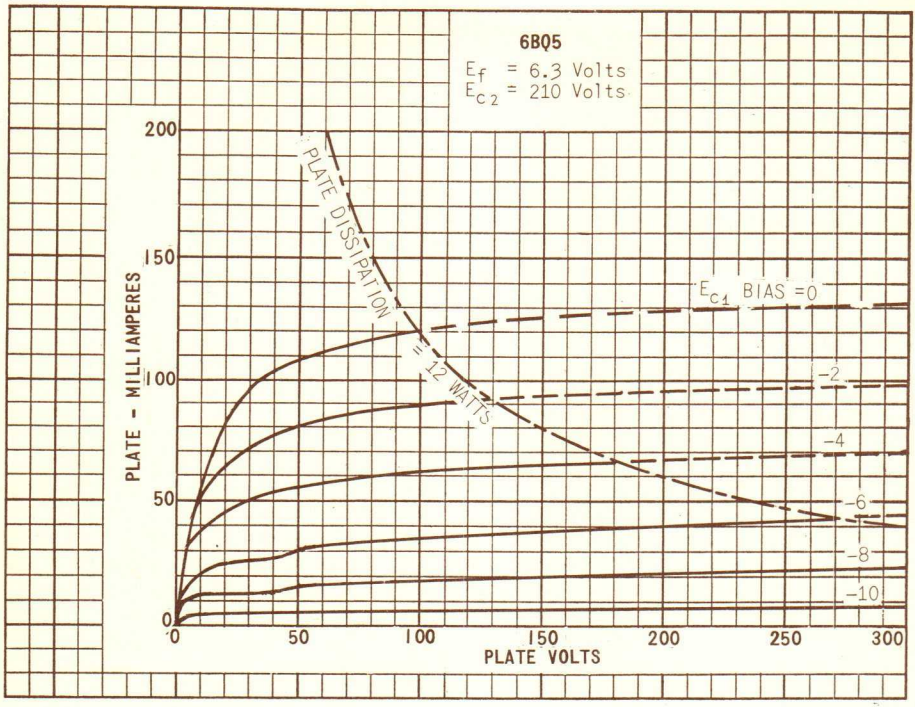
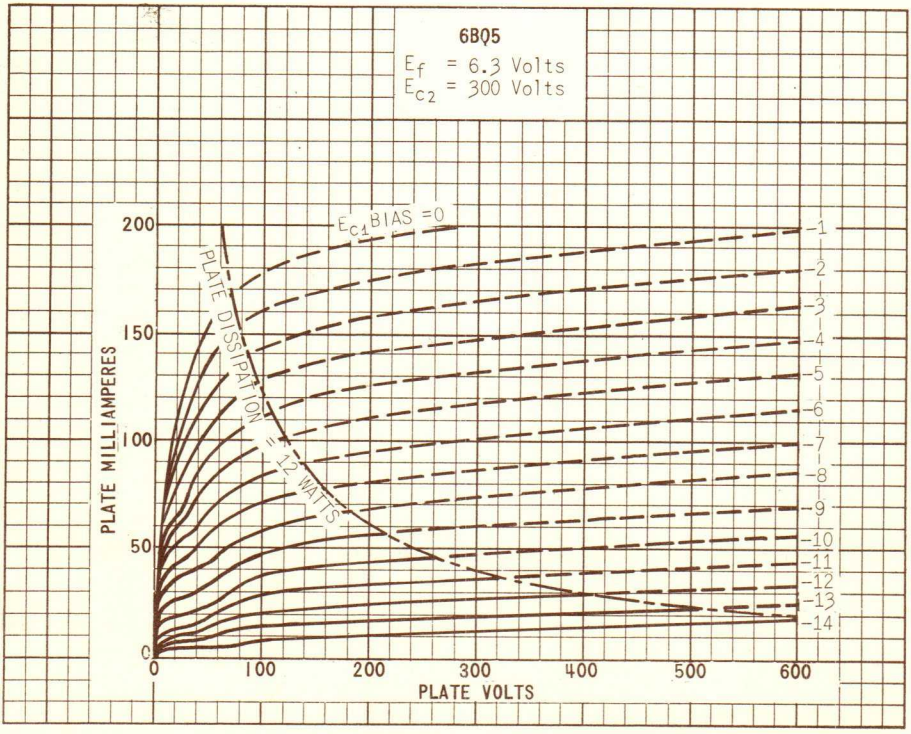
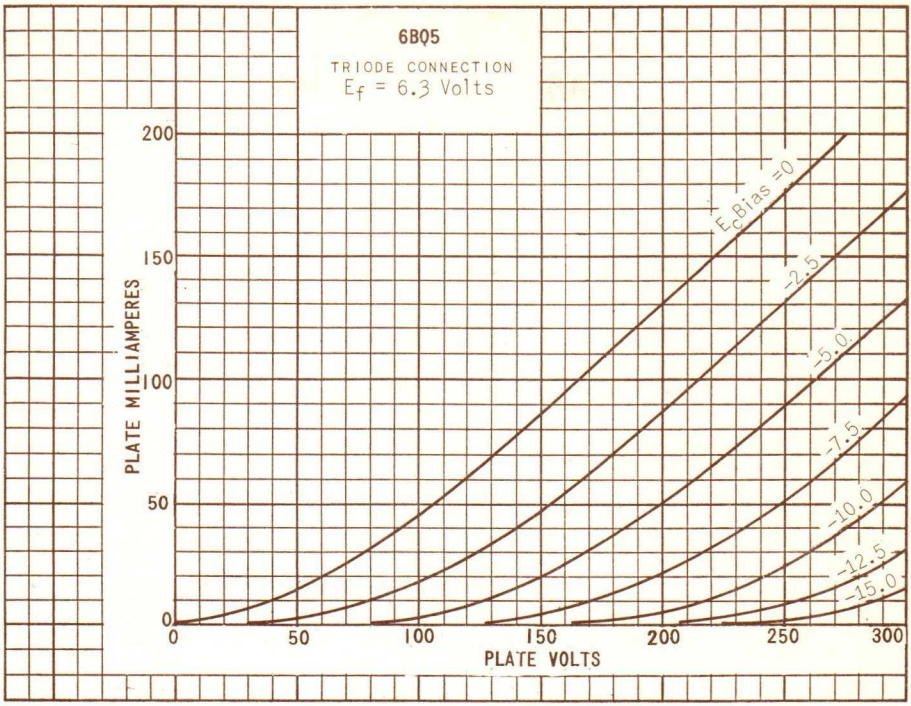
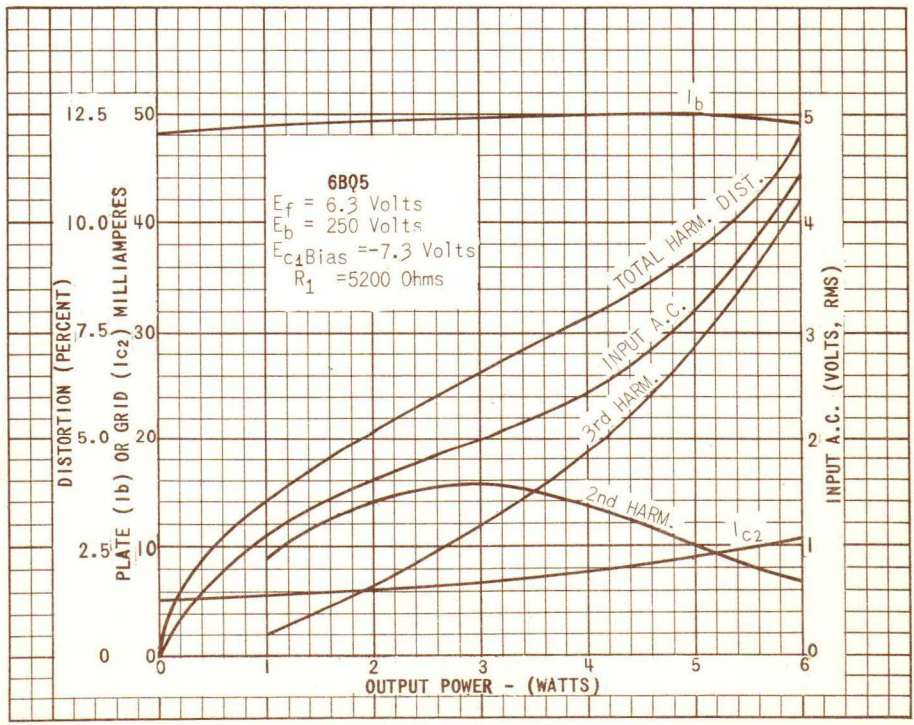
TENTATIVE DATA









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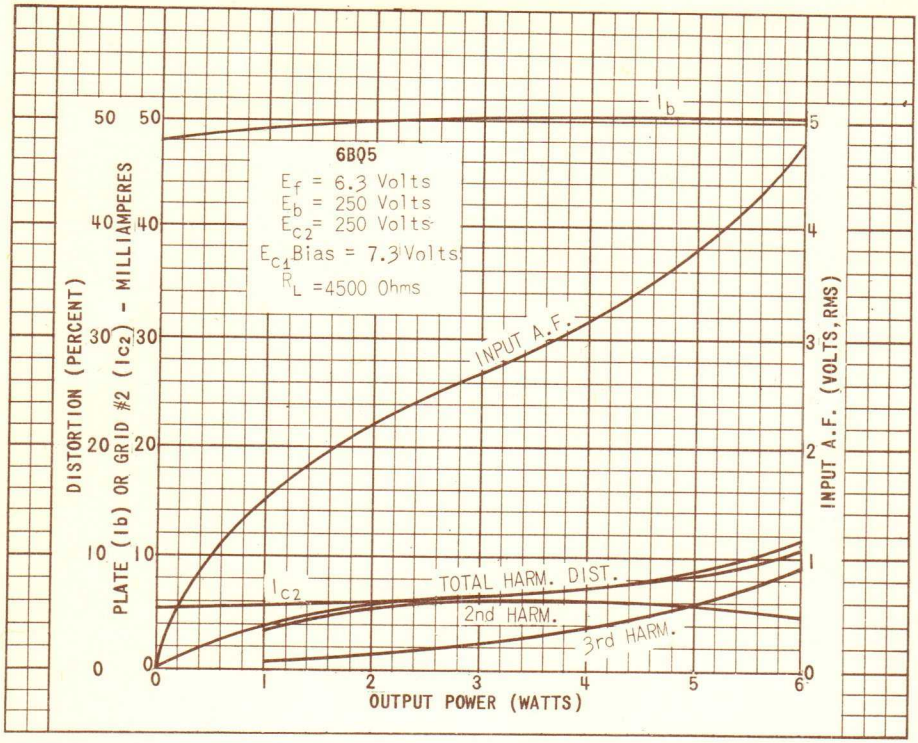

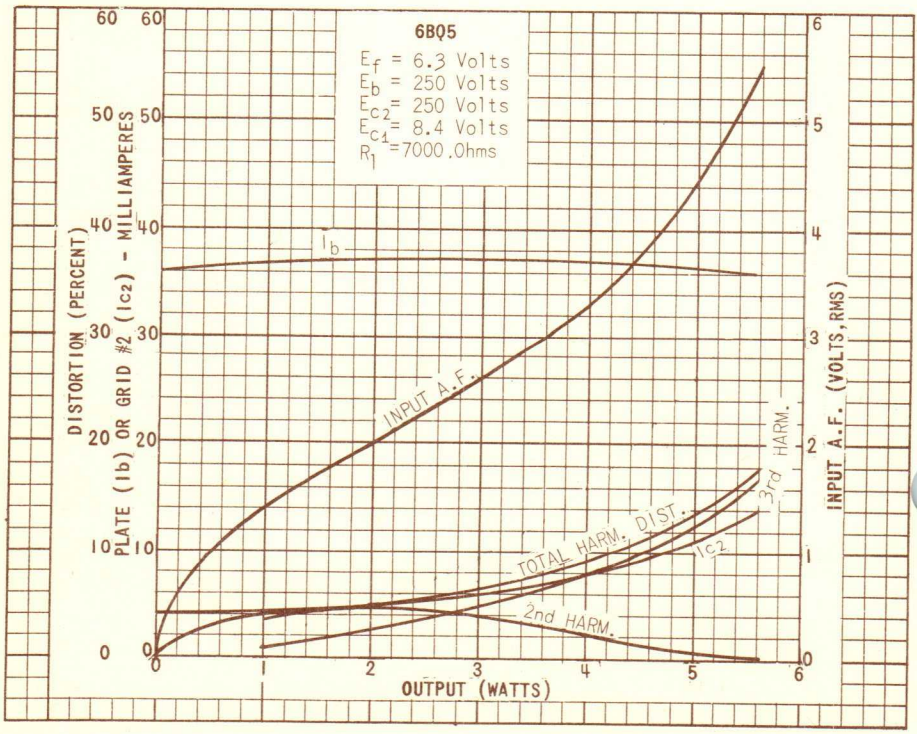

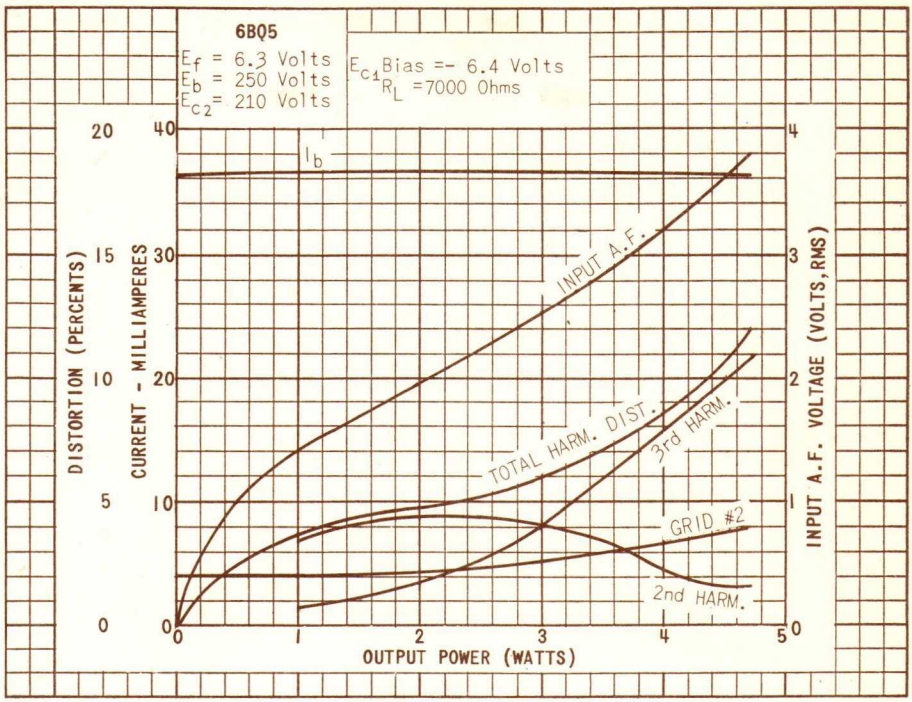

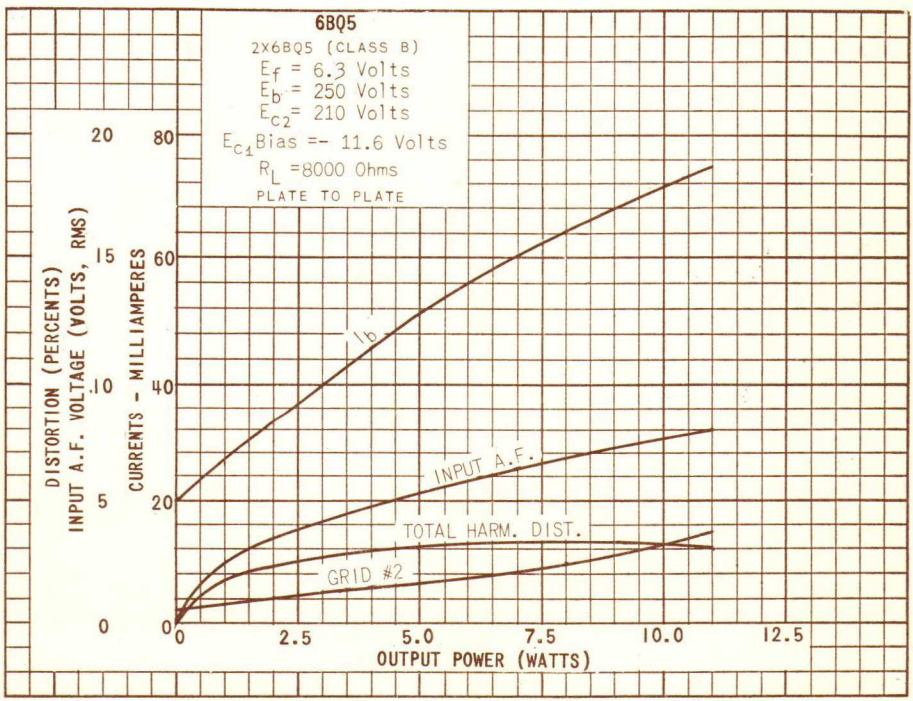

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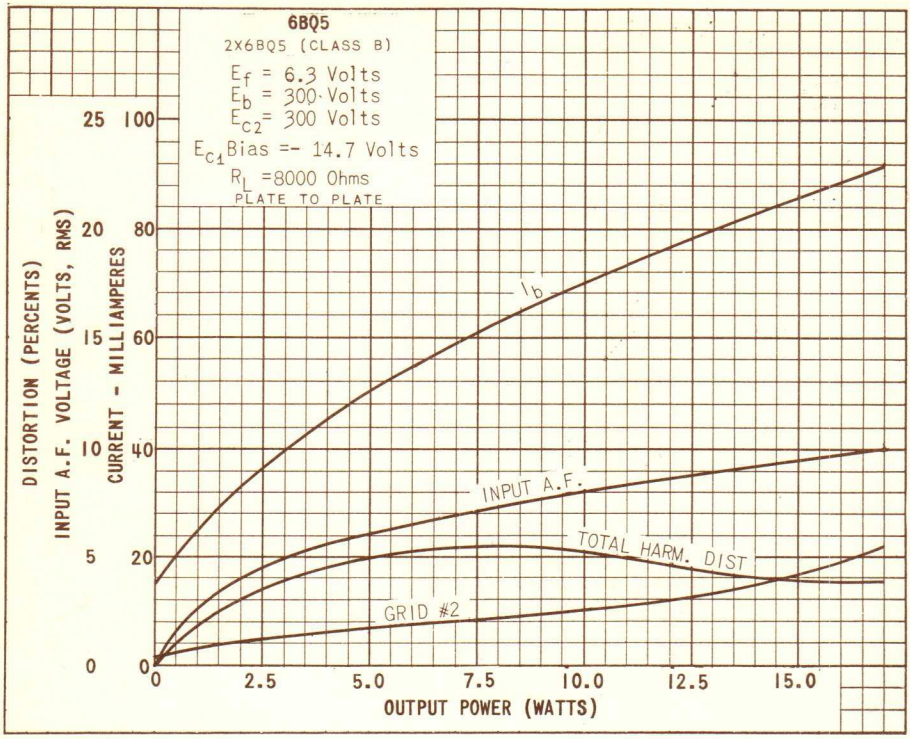
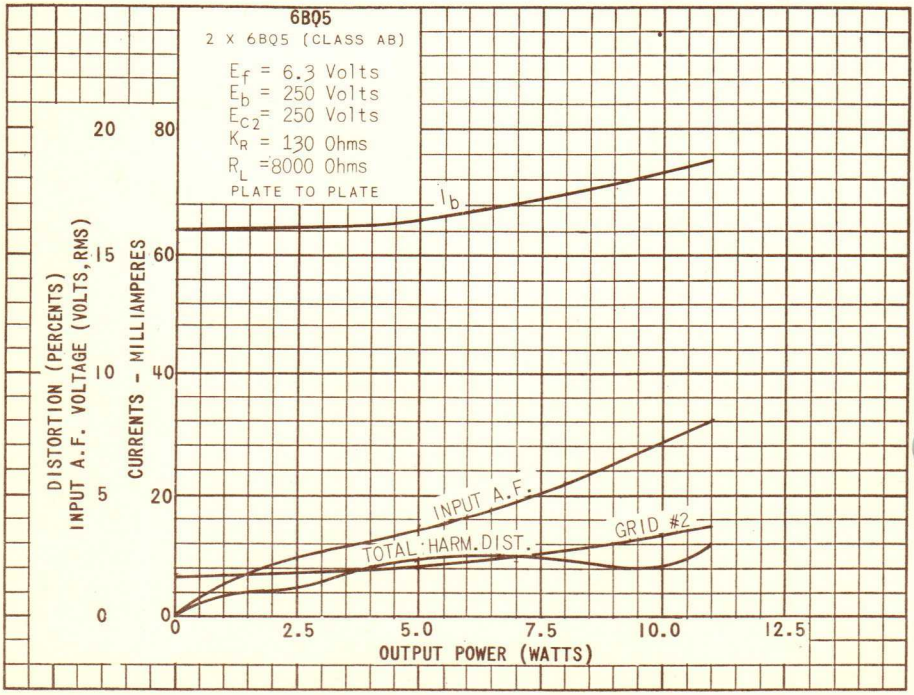
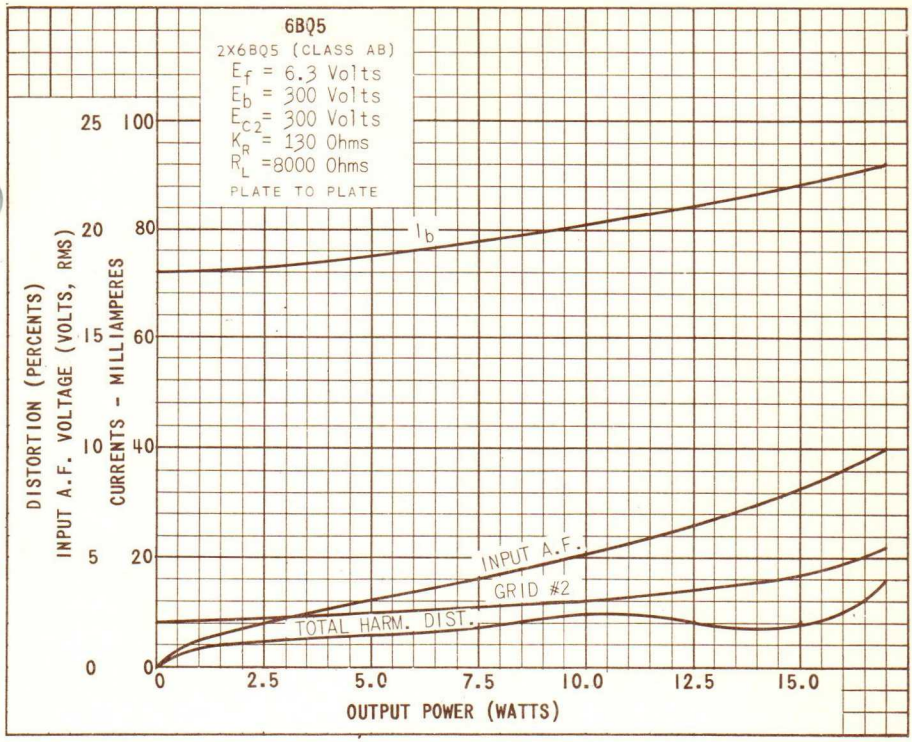
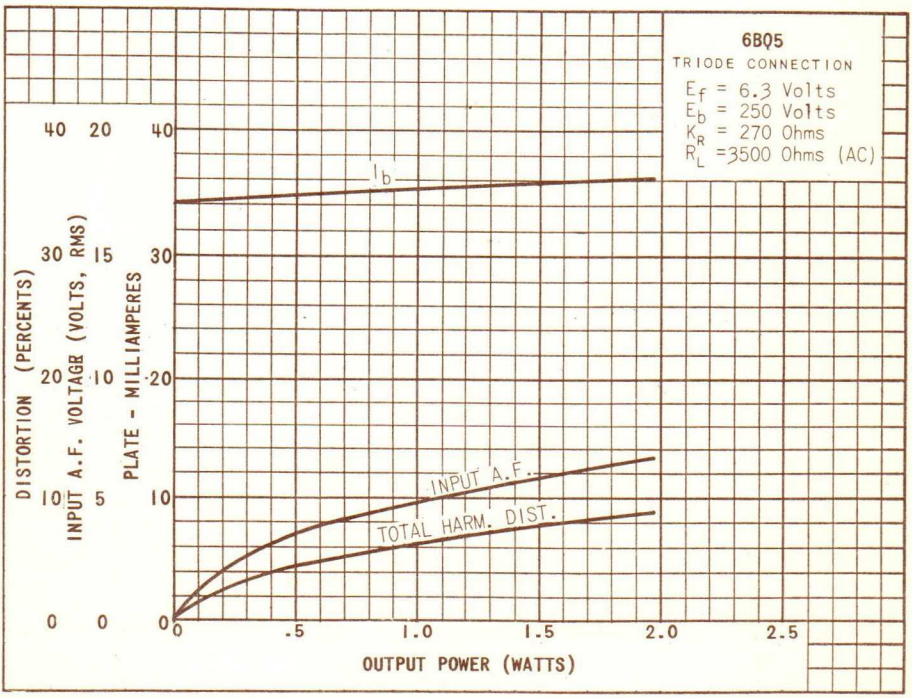
TENTATIVE DATA









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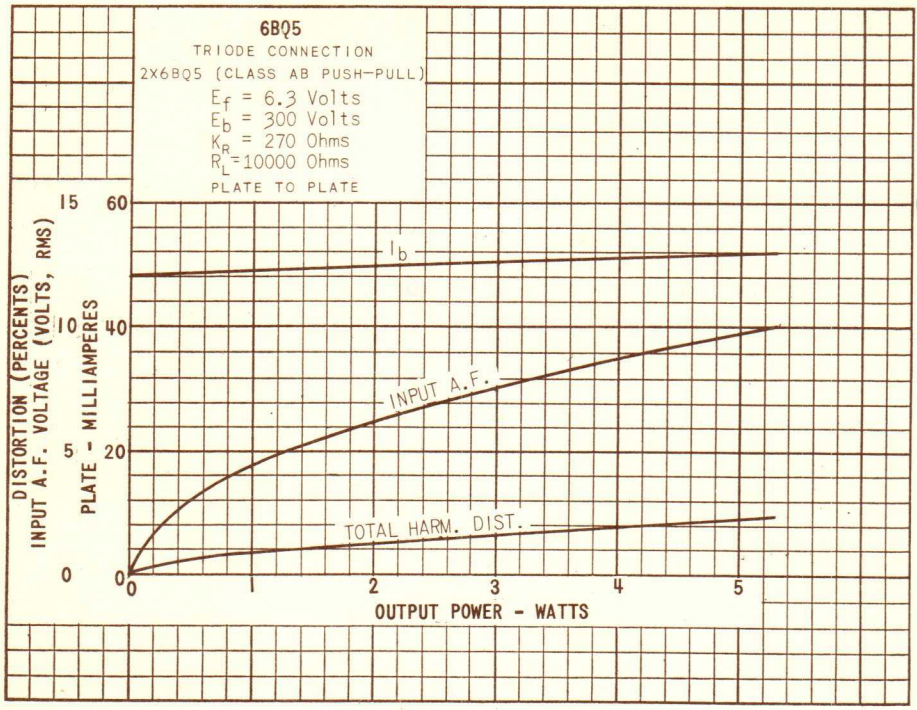
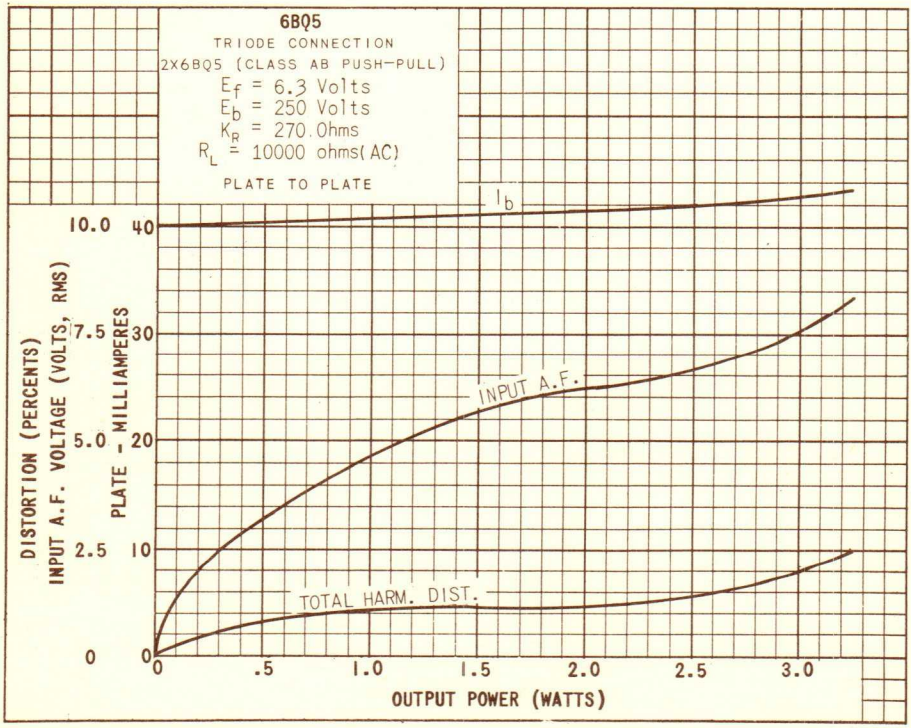

6BQ5
TRIODE CONNECTION
2X6BQ5 (CLASS AB PUSH-PULL)
E_f = 6.3 Volts
E_b = 300 Volts
K_R = 270 Ohms
R_L = 10000 Ohms
PLATE TO PLATE
I_b
INPUT A.F.
TOTAL HARM. DIST.
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
PLATE - MILLIAMPERES
OUTPUT POWER - WATTS
0
5
10
15
20
40
60
1
2
3
4


6BQ5
TRIODE CONNECTION
2X6BQ5 (CLASS AB PUSH-PULL)
E_f = 6.3 Volts
E_b = 250 Volts
K_R = 270 Ohms
R_L = 10000 ohms(AC)
PLATE TO PLATE
I_b
INPUT A.F.
TOTAL HARM. DIST.
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
PLATE - MILLIAMPERES
OUTPUT POWER (WATTS)
0
2.5
5.0
7.5
10.0
10
20
30
40
.5
1.0
1.5
2.0
2.5
3.0

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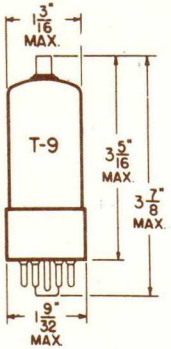
BEAM PENTODE

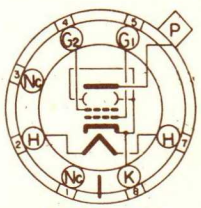


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
6AM

THE 6BQ6GT IS A BEAM PENTODE DESIGNED SPECIFICALLY FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS USING MAGNETIC DEFLECTION. THE PLATE IS BROUGHT OUT TO A TOP CAP FOR ISOLATION OF THE HIGH VOLTAGE AND CONVENIENCE IN CIRCUIT LAYOUT. ITS ELECTRICAL CHARACTERISTICS ARE SUCH AS TO PROVIDE GOOD PERFORMANCE WHERE THE SUPPLY VOLTAGES ARE LIMITED.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE: (G_1 TO P)	0.6	μμf
INPUT: G_1 TO (H+K+G_2+BP)	15	μμf
OUTPUT: P TO (H+K+G_2+BP)	7.5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	6.3	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
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST + POWER SUPPLY)	550	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	5 500	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM PLATE DISSIPATION[B]	11	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	175	VOLTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220°	CENTIGRADE

[A] 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 NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[B] 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.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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PLATE 3142
FEB. 1 1953

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PENTODE CONNECTION:[C]		
PLATE CURRENT	55	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5 500	UMHOS
PLATE RESISTANCE	20 000	OHMS
ZERO-BIAS:[D]		
PLATE CURRENT	225	MA.
GRID #2 CURRENT	25	MA.
CUT-OFF:[E]		
GRID #1 VOLTAGE (APPROX.)	-46	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	4.3	

[C] WITH E_b = 250 VOLTS, E_{C2} = 150 VOLTS AND E_{C1} = -22.5 VOLTS.

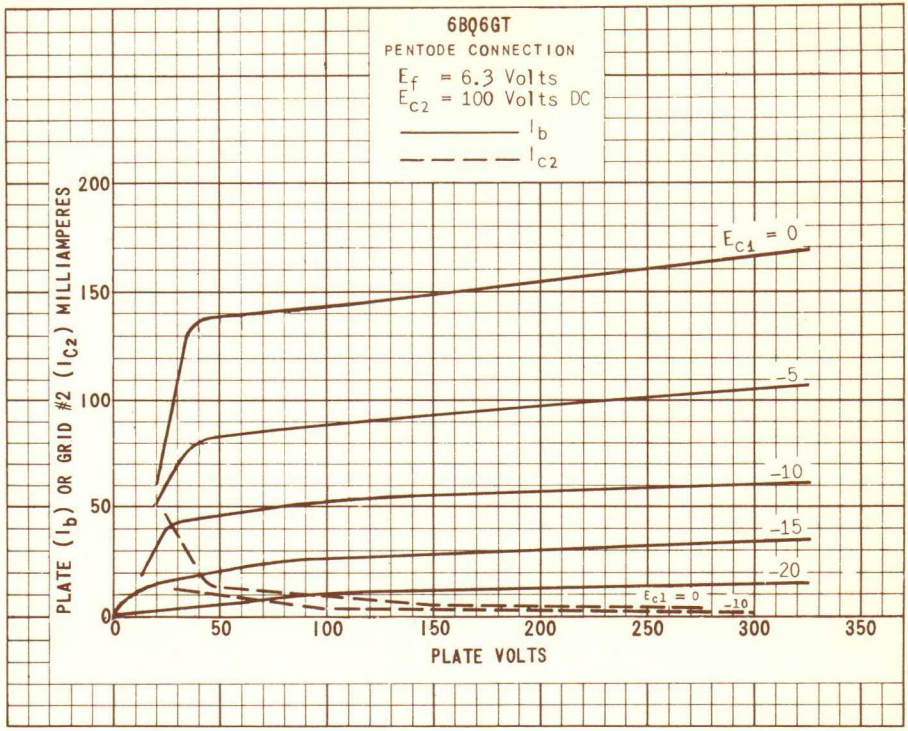
[D] WITH E_b = 60 VOLTS AND E_{C2} = 150 VOLTS.

[E] FOR I_b = 1 MA. WITH E_b = 250 VOLTS AND E_{C2} = 150 VOLTS

[F] WITH E_b = E_{C2} = 150 VOLTS AND E_{C1} = -22.5 VOLTS.

→INDICATES A CHANGE OR ADDITION.

PLATE 3143
FEB. 1 1953



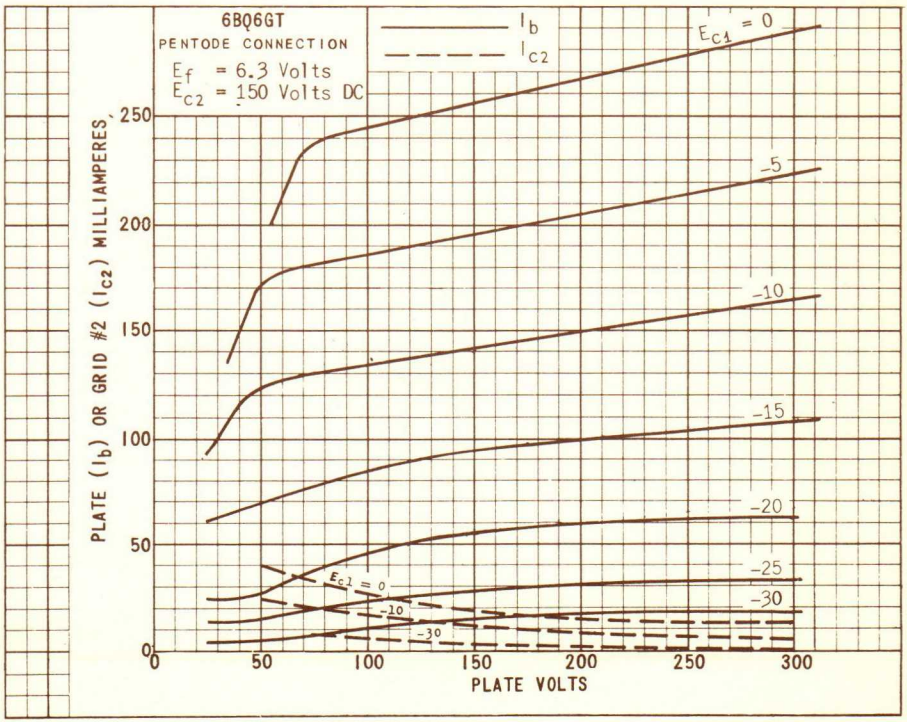


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PLATE
2337
FEB. 1
1950

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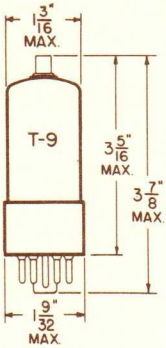
PENTODE

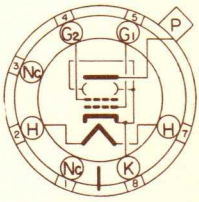


GLASS BULB
SKIRTED
MINIATURE CAP

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
OR
SHORT INTERMEDIATE SHELL
7 PIN OCTAL
6AM

THE 6BQ6GTB IS A BEAM POWER AMPLIFIER DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE	0.6	μμf
INPUT	15	μμf
OUTPUT	7	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES
(UNLESS OTHERWISE SPECIFIED)

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	6.3	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
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	600	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAX.)	6 000	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM PLATE DISSIPATION[B]	11	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220	°C

[A] 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 NOT TO EXCEED 15% OF A SCANNING CYCLE.

[B] 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.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PENTODE OPERATION:[C]		
PLATE CURRENT	57	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5 900	μMHOS
PLATE RESISTANCE	14 500	OHMS
ZERO BIAS:[D]		
PLATE CURRENT	260	MA.
GRID #2 CURRENT	26	MA.
CUTOFF:[E]		
GRID #1 VOLTAGE (APPROX.)	-43	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	4.3	

SIMILAR TYPE REFERENCE: Except for heater characteristics, the 6BQ6GTB is identical to the 17BQ6GTB.

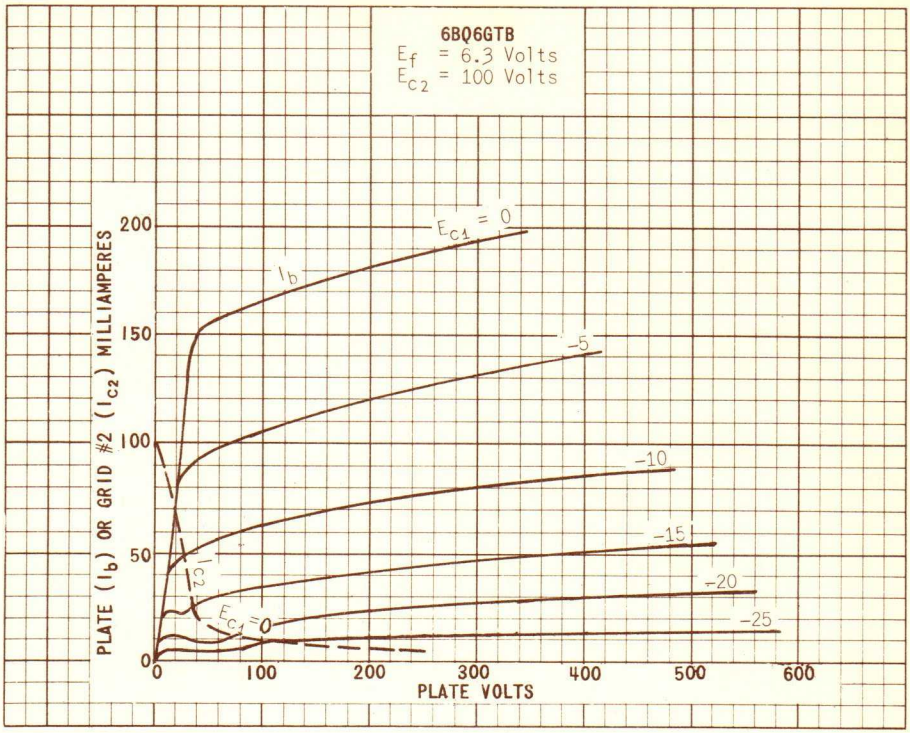
THE ELECTRICAL DATA AND PIN CONNECTION FOR TYPE 6BQ6GTB ARE IDENTICAL WITH THOSE OF TYPES 6BQ6GA AND 6CU6.

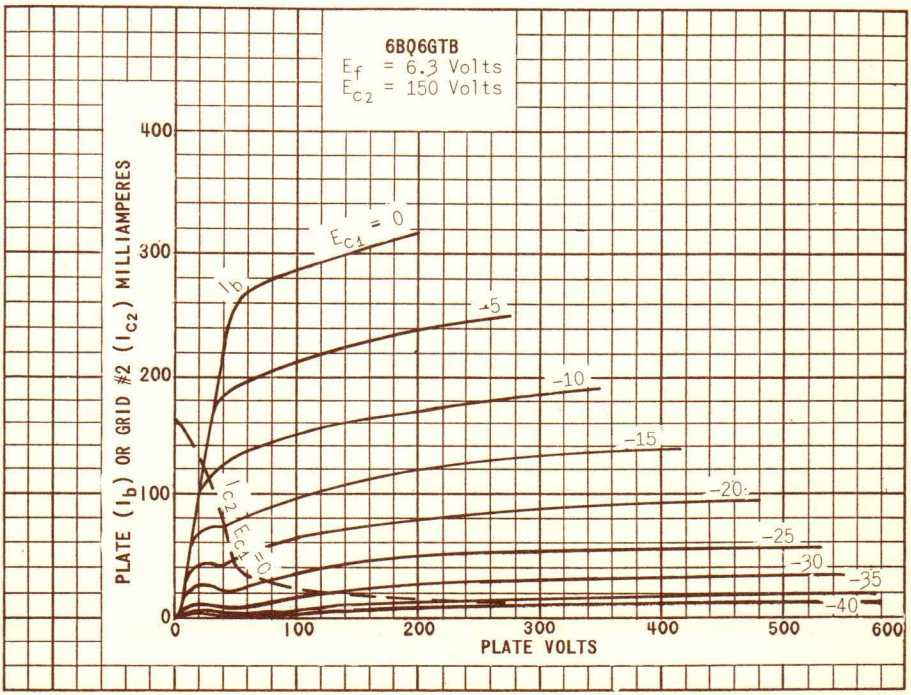
[C] WITH E_b = 250V, E_{c2} = 150V, AND E_{c1} = -22.5V.

[D] WITH E_B = 60V. AND E_{C2} = 150V. (INSTANTANEOUS VALUES)

[E] FOR I_b = 1 MA. WITH E_b = 250V. AND E_{c2} = 150V.

[F] WITH E_b = E_{c2} = 150V. AND E_{c1} = -22.5V.





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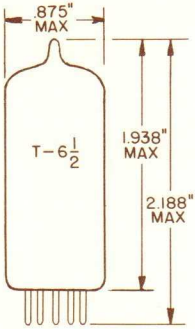
DOUBLE TRIODE

MINIATURE TYPE



GLASS BULB

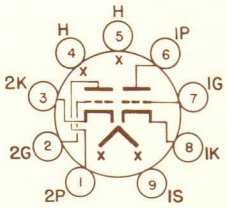
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

FOR USE AS

VHF VOLTAGE AMPLIFIER

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9AJ

THE 6BQ7 COMBINES TWO INDEPENDENT MEDIUM-MU INDIRECTLY HEATED CATHODE TYPE TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. LOW INTERELECTRODE CAPACITANCES, HIGH TRANSCONDUCTANCE AND SHIELDING BETWEEN THE TWO SECTIONS ADAPT IT FOR USE IN THE GROUNDED-CATHODE INPUT/GROUNDED-GRID OUTPUT OR CASCODE CIRCUIT PROVIDING LOW TUBE NOISE AND GOOD STABILITY AS A VHF VOLTAGE AMPLIFIER.

→ DIRECT INTERELECTRODE CAPACITANCES [A]

	#1 TRIODE		#2 TRIODE	
GRID TO PLATE: (G TO P)	1.15		1.15	pf
PLATE TO CATHODE: (P TO K) MAX.	0.15		0.15	pf
HEATER TO CATHODE: (H TO K)	2.20		2.30	pf
#1 TRIODE INPUT: G TO (H + K + I.S.)	2.85		------	pf
#2 TRIODE INPUT: K TO (H + G + I.S.) [B]	------		4.95	pf
#1 TRIODE OUTPUT: P TO (H + K + I.S.)	1.35		------	pf
#2 TRIODE OUTPUT: P TO (H + G + I.S.) [B]	------		2.27	pf
#1 TRIODE PLATE TO #2 TRIODE PLATE: (1P TO 2P) MAX.		0.010		pf
#2 TRIODE PLATE TO #1 TRIODE PLATE & GRID: (2P TO 1P + 1G) MAX.		0.024		pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	400	MA.
HEATER SUPPLY LIMITS: VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE [C]			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			200	VOLTS

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE[C]	250	VOLTS
PLATE DISSIPATION	2	WATTS
CATHODE CURRENT	20	MA.
GRID CIRCUIT RESISTANCE *	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER- EACH UNIT

PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
PLATE CURRENT	9	MA.
AMPLIFICATION FACTOR	35	
TRANSCONDUCTANCE	6000	μMHOS
PLATE RESISTANCE	5800	OHMS
GRID VOLTAGE (APPROX.)		
FOR Ib = 10 μA	−10	VOLTS

A
EXTERNAL SHIELD 315 CONNTECTED TO CATHODE

B
READ AS GROUNDED GRID AMPLIFIER.

C
THIS RATING MAY BE AS HIGH AS 300 VOLTS UNDER CUTOFF CONDITIONS, IN GROUNDED-GRID CIRCUIT WITH DIRECT COUPLED DRIVE.

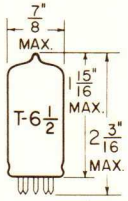
* INDICATES AN ADDITION

→ INDICATES A CHANGE.

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

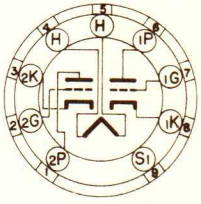


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN NOVAL
9AJ

THE 6BQ7A IS A MEDIUM-MU DOUBLE TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS THE FIRST RF AMPLIFIER TUBE IN TUNERS OF VHF TELEVISION RECEIVERS OR AS A LOW NOISE IF PRE-AMPLIFIER TUBE IN UHF TELEVISION RECEIVERS EMPLOYING A CRYSTAL MIXER. HIGH TRANSCONDUCTANCE, LOW INPUT CAPACITANCE, LOW INPUT LOADING AND LOW PLATE TO CATHODE CAPACITANCE MAKES IT ESPECIALLY USEFUL IN THE DIRECT-COUPLED RF STAGE OF TELEVISION RECEIVERS UTILIZING A DRIVEN RF-GROUNDED-GRID AMPLIFIER OR THE CASCODE TYPE OF CIRCUIT.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315

	UNIT #1	UNIT #2	
GRID TO PLATE	1.15	1.15	μμf
INPUT	2.85	----	μμf
INPUT (GROUNDED GRID)	----	4.95	μμf
OUTPUT	1.35	----	μμf
OUTPUT (GROUNDED GRID)	----	2.27	μμf
PLATE TO CATHODE (MAX.)	0.15	0.15	μμf
HEATER TO CATHODE	2.65	2.70	μμf
PLATE OF UNIT #1 TO PLATE OF UNIT #2 (MAX.)	0.010		μμf
PLATE OF UNIT #2 TO PLATE AND GRID OF UNIT #1 (MAX.)	0.024		μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

	DESIGN CENTER VALUES	
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM PLATE VOLTAGE	250[A]	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHM

[A] UNDER CUT-OFF CONDITIONS, IN RF-GROUNDED-GRID CIRCUITS WITH DIRECT-COUPLED DRIVE, IT IS PERMISSIBLE FOR THIS VOLTAGE TO BE AS HIGH AS 300 VOLTS.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH UNIT

	DESIGN CENTER VALUES	
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	39	
PLATE RESISTANCE	6 100	OHMS
TRANSCONDUCTANCE	6 400	µMHOS
PLATE CURRENT	9	MA.
GRID VOLTS (APPROX.) FOR I_b = 10 µAMP.	−10	VOLTS

PUSH–PULL RF GROUNDED GRID CIRCUIT – EACH UNIT

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	150	VOLTS
GRID VOLTAGE (OBTAINED FROM CATHODE RESISTOR)	−2	VOLTS
CATHODE RESISTOR (COMMON TO BOTH UNITS)	100	OHMS
PLATE CURRENT	10	MA.

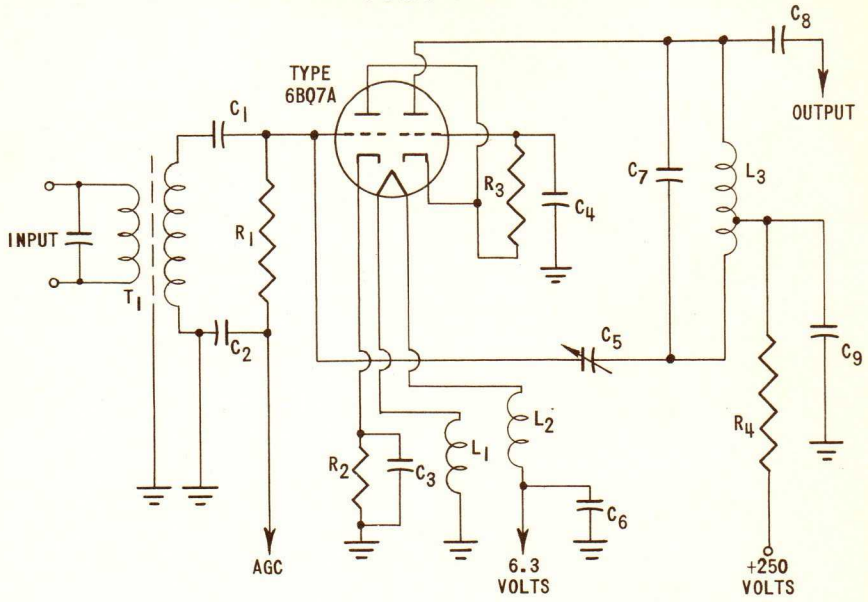
RF GROUNDED GRID CIRCUIT WITH DIRECT–COUPLED DRIVE

UNIT #1 (DRIVER TUBE) IS DIRECTLY COUPLED TO UNIT #2 (DRIVEN RF-GROUNDED-GRID AMPLIFIER TUBE) AS SHOWN IN ACCOMPANYING CIRCUIT.

	UNIT #1	UNIT #2	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.4	0.4	AMP.
PEAK HEATER CATHODE VOLTAGE: HEATER NEGATIVE WITH RESPECT TO CATHODE	1	250	VOLTS
PLATE SUPPLY VOLTAGE	250	250	VOLTS
PLATE VOLTAGE	135	115	VOLTS
GRID VOLTAGE	−1	---	VOLTS
GRID RESISTOR	---	0.5	MEGOHM
PLATE CURRENT	10	10	MA.
GRID CURRENT	0	0	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 µAMP.	−14	---	VOLTS

→INDICATES A CHANGE.

TUNG-SOL

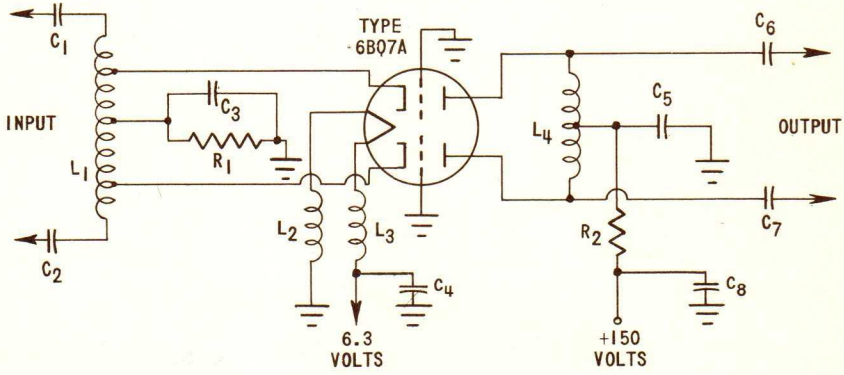


C1: 33 uuf, 400 VOLTS
C2: 1000 uuf, 400 VOLTS
C3: 1000 uuf, 400 VOLTS
C4: 1000 uuf, 400 VOLTS
C5: 0.5 to 1.5 uuf, 400 VOLTS
C6: 1000 uuf, 400 VOLTS
C7: 2 uuf, 400 VOLTS
C8: 33 uuf, 400 VOLTS
C9: 1000 uuf, 400 VOLTS

L1, L2: BIFILAR CHOKES, EACH 10 TURNS NO. 18 ENAMEL WIRE 1/4" COIL FORM
L3: TUNED CIRCUIT ELEMENT OF TUNER. VALUE DEPENDS ON DISTRIBUTED CIRCUIT CAPACITANCES. TO DETERMINE TAP POINT, TAP DOWN TO 80 TO 90% OF TOTAL NUMBER OF TURNS

R1: 10000 OHMS, 0.5 WATT
R2: 100 OHMS, 0.5 WATT
R3: 500000 OHMS, 0.5 WATT
R4: 100 OHMS, 0.5 WATT
T1: TUNED CIRCUIT ELEMENT OF TUNER. VALUE DEPENDS ON DISTRIBUTED CIRCUIT CAPACITANCES.

DRIVEN RF-GROUNDED GRID AMPLIFIER CIRCUIT WITH DIRECT COUPLED DRIVE



C1 C2 C3 C4 C5: 1000 uuf, 400 VOLTS
C6 C7: 100 uuf, 400 VOLTS
C8: 1000 uuf, 400 VOLTS

L1 L4: TUNED CIRCUIT ELEMENTS OF TUNER. VALUES DEPEND ON DISTRIBUTED CIRCUIT CAPACITANCES.

L2 L3: BIFILAR CHOKES, EACH 10 TURNS OF NO. 18 ENAMEL WIRE, 1/4" COIL FORM.
R1 R2: 100 OHMS, 0.5 WATT

PUSH-PULL RF GROUNDED-GRID CIRCUIT

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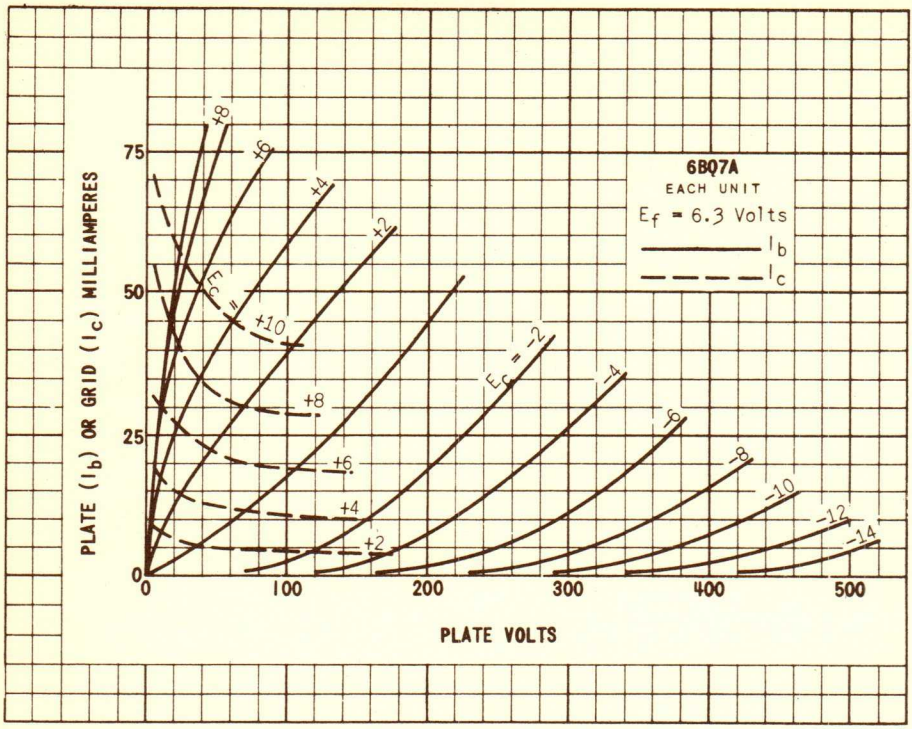
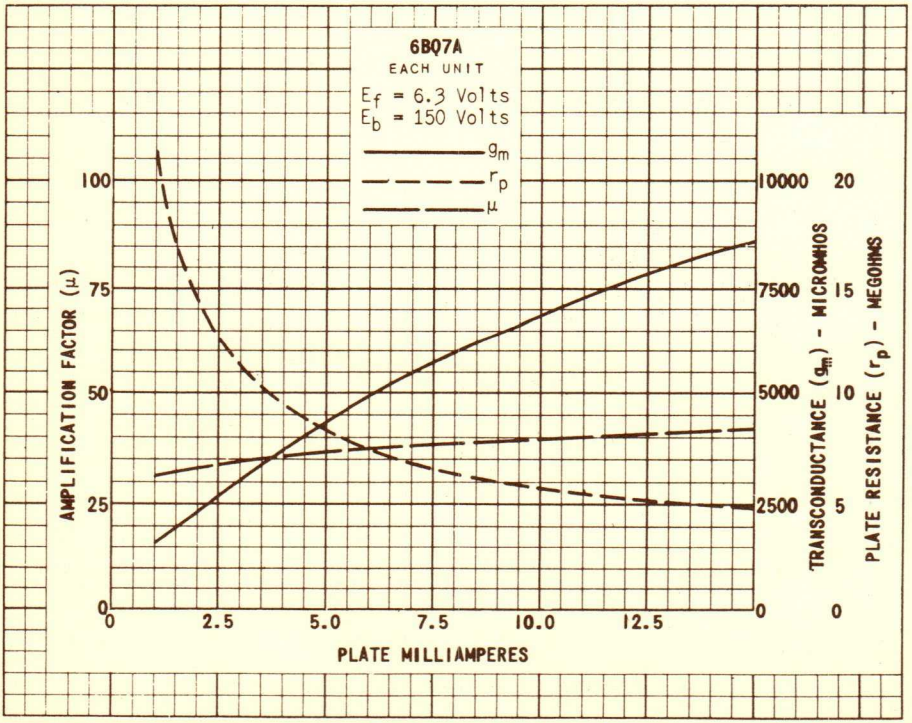
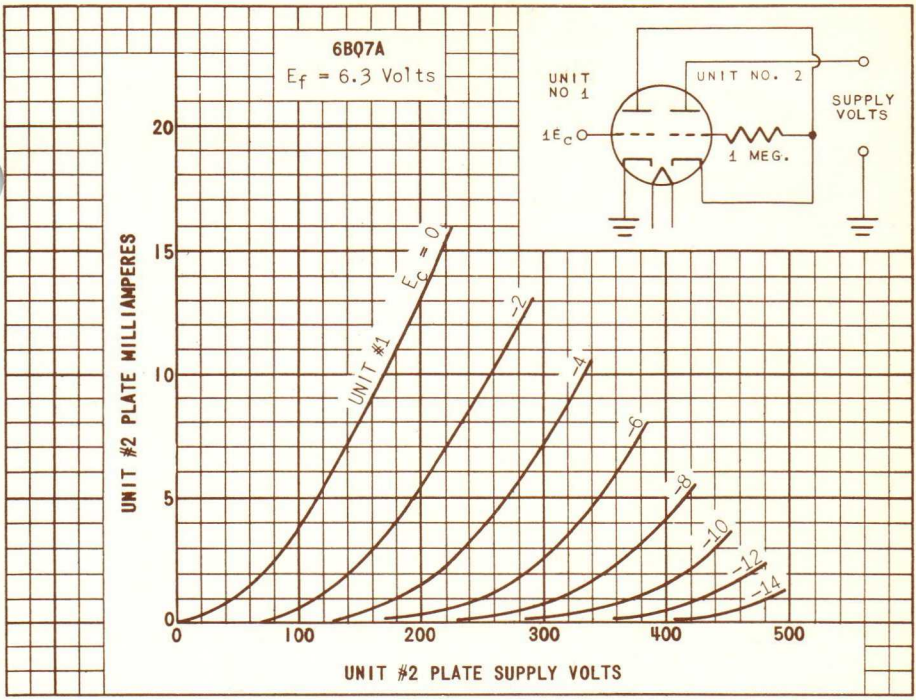
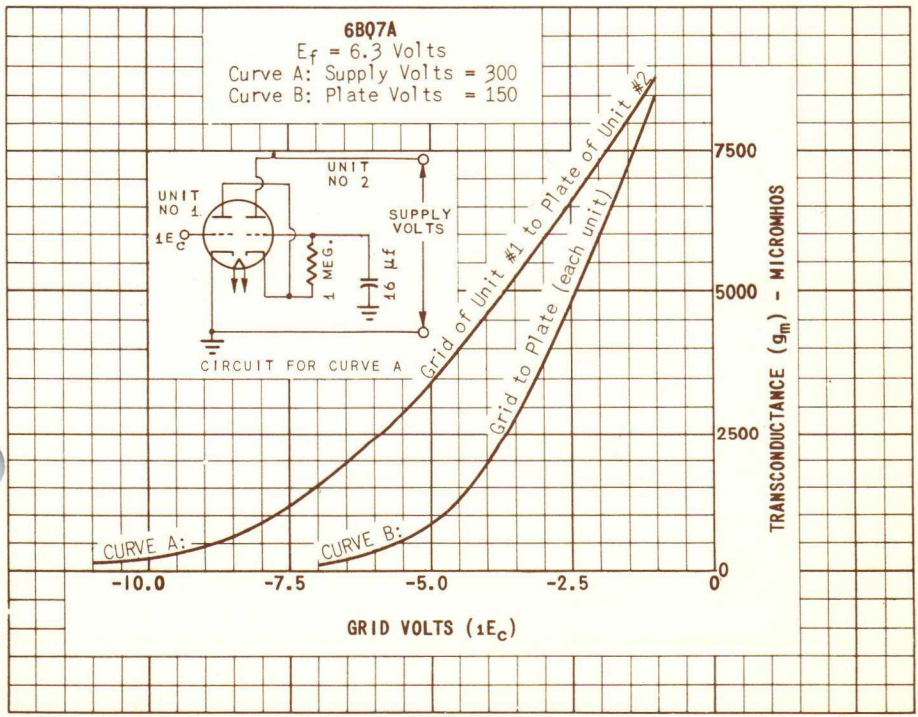
6BQ7A


6BQ7A
EACH UNIT
E_f = 6.3 Volts
I_b
I_c
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
200
300
400
500
+8
+6
+4
+2
E_c = +10
E_c = -2
-4
-6
-8
-10
-12
-14


6BQ7A
EACH UNIT
E_f = 6.3 Volts
E_b = 150 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - MEGOHMS
PLATE MILLIAMPERES
0
25
50
75
100
2500
5000
7500
10000
0
5
10
15
20
2.5
5.0
7.5
10.0
12.5

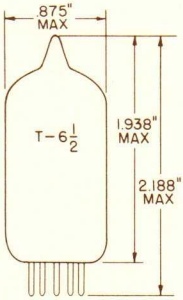

6BQ7A
E_f = 6.3 Volts
UNIT NO 1
UNIT NO. 2
SUPPLY VOLTS
1 MEG.
$1E_c$
UNIT #2 PLATE MILLIAMPERES
UNIT #1
E_c = 0
-2
-4
-6
-8
-10
-12
-14
0
5
10
15
20
0
100
200
300
400
500
UNIT #2 PLATE SUPPLY VOLTS


6BQ7A
E_f = 6.3 Volts
Curve A: Supply Volts = 300
Curve B: Plate Volts = 150
UNIT NO 1
UNIT NO 2
SUPPLY VOLTS
1 MEG.
16 µf
$1E_c$
CIRCUIT FOR CURVE A
Grid of Unit #1 to Plate of Unit #2
Grid to Plate (each unit)
CURVE A:
CURVE B:
TRANSCONDUCTANCE (g_m) - MICROMHOS
7500
5000
2500
0
-10.0
-7.5
-5.0
-2.5
0
GRID VOLTS ($1E_c$)

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

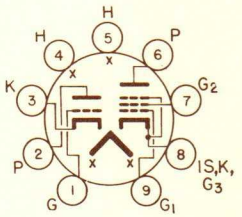


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

FOR USE IN
FM AND TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM

JEDEC 9FA

THE 6BR8A IS A TRIODE-PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TUBE MAY BE USED AS A LOCAL OSCILLATOR PENTODE MIXER FOR FM OR TELEVISION RECEIVERS OR IN THE MANY COMBINED FUNCTIONS IN SUCH RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED RROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE (Pg1 TO Pp) MAX.	0.010	0.020	pf
PENTODE INPUT: Pg1 TO (H+Pg2+Pk,g3,i.s.)	4.6	4.6	pf
PENTODE OUTPUT: Pp TO (H+Pg2+Pk,g3,i.s.)	3.2	2.4	pf
PENTODE CATHODE TO HEATER: H TO (Pk,g3,i.s.)	2.4[B]	2.4	pf
TRIODE GRID TO TRIODE PLATE: (Tg TO Tp)	1.8	1.8	pf
TRIODE INPUT: Tg TO (Tk+H+Pk,g3,i.s.)	2.8	2.8	pf
TRIODE OUTPUT: Tp TO (Tk+H+Pk,g3,i.s.)	2.0	1.5	pf
TRIODE CATHODE TO HEATER (Tk TO H)	2.4[B]	2.4	pf
PENTODE GRID TO TRIODE PLATE (Pg TO Tp) (MAX.)	0.20	0.20	pf
PENTODE PLATE TO TRIODE PLATE (Pp TO Tp) (MAX)	.02	0.10	pf

[A] EXTERNAL SHIELD 315 CONNECTED TO PIN 4.

[B] EXTERNAL SHIELD 315 CONNECTED TO PIN 6.

* INDICATES AN ADDITION.

INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	MA.
HEATER WARM-UP TIME [C]		11	SECONDS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION (HEATER IN PARALLEL)		6.3±0.6	VOLTS
CURRENT OPERATION (HEATER IN SERIES)		450±25	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

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE PLATE VOLTAGE	330	VOLTS
TRIODE PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	SEE J5-C4-2	
PENTODE PLATE DISSIPATION	3.0	WATTS
GRID 2 DISSIPATION	0.55	WATT
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	2.5	WATTS

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

	TRIODE	PENTODE	
PLATE VOLTAGE	125	125	VOLTS
GRID 2 VOLTAGE	----	110	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	7500	5000	μMHOS
PLATE CURRENT	13.5	9.5	MA.
GRID 2 CURRENT	----	3.5	MA.
PLATE RESISTANCE (APPROX.)	----	0.2	MEGOHM
AMPLIFICATION FACTOR	40	----	
GRID 1 VOLTAGE (APPROX.) FOR Ib=20 μA	-9	-9	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb=100 V: Ec2=70V)	----	6000	μMHOS

[C] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

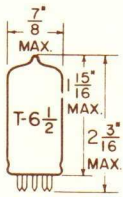
TUNG-SOL

TWIN TRIODE

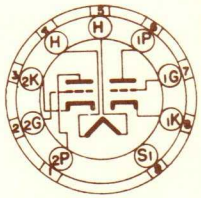
MINIATURE TYPE
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL-BUTTON NOVAL
9 PIN BASE
9AJ

THE 6BS8 IS A 9-PIN MINIATURE TWIN TRIODE DESIGNED FOR USE AS A LOW-NOISE VHF AMPLIFIER IN CASCODE OPERATION. THIS TYPE HAS HIGH GAIN AND HIGH CASCODE TRANSCONDUCTANCE. IT IS DESIGNED FOR OPERATION WITH SECTION 2 (PINS 1, 2, AND 3) AS INPUT SECTION OF THE CASCODE CIRCUIT.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315

	UNIT 1	UNIT 2	
GRID TO PLATE	1.15	1.15	μμf
PLATE TO CATHODE (MAX.)	0.15	0.15	μμf
HEATER TO CATHODE	2.60	2.6	μμf
INPUT	2.60		μμf
OUTPUT	1.2		μμf
PLATE OF UNIT 1 TO PLATE OF UNIT 2 (MAX.)		0.010	μμf
PLATE OF UNIT 2 TO PLATE AND GRID OF UNIT 1 (MAX.)		0.024	μμf
GROUNDED GRID OPERATION:			
INPUT		5.0	μμf
OUTPUT		2.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
CLASS A_1 AMPLIFIER - EACH UNIT

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	150	VOLTS
MAXIMUM DC CATHODE CURRENT	20	MA.
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM CIRCUIT VALUE: (EACH UNIT)		
GRID CIRCUIT RESISTANCE	0.5	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMPERE
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	36	
PLATE RESISTANCE	5000	OHMS
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA	-7 (SEC. 2 ONLY)	VOLTS
TRANSCONDUCTANCE	7200	μMHOS

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CONTINUED FROM PRECEDING PAGE

TYPICAL CASCODE CONDITIONS AND CHARACTERISTICS

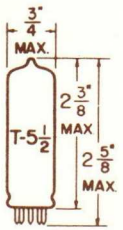
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMPERE
PLATE SUPPLY VOLTAGE	250	VOLTS
GRID VOLTAGE	-1	VOLTS
PLATE CURRENT	16	MA.
GRID VOLTAGE (APPROX.) FOR G_m = 50 μMHOS	-6	VOLTS
TRANSCONDUCTANCE	10 000	μMHOS

→ INDICATES A CHANGE.

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

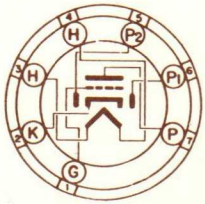


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

THE 6BT6 IS A COMBINED HIGH-MU TRIODE VOLTAGE AMPLIFIER AND DOUBLE DIODE DETECTOR USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED TO PROVIDE ADEQUATE OUTPUT VOLTAGE TO DRIVE MOST BEAM POWER TUBES TO FULL POWER OUTPUT. THE HIGH PERVEANCE DIODES GIVE GOOD RECTIFICATION EFFICIENCY AT LOW SIGNAL LEVELS AND THE LOW DIODE TO TRIODE GRID CAPACITANCE REDUCES TROUBLE FROM AUDIO COUPLING BETWEEN THE TWO SECTIONS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
DIODE #1 TO CATHODE: (1P TO K)	1	1	μμf
DIODE #2 TO CATHODE: (2P TO K)	1	1	μμf
DIODE #1 TO GRID: (1P TO G)	0.01	0.013	μμf

[A] WITH RMA SHIELD #316 CONNECTED TO CATHODE

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
AVERAGE DIODE CURRENT EACH PLATE WITH 10 VOLTS DC APPLIED	4	MA.
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-3	VOLTS
PLATE CURRENT	0.8	1	MA.
PLATE RESISTANCE	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	μMHOS
AMPLIFICATION FACTOR	70	70	

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PLATE 2302
JAN. 1 1950

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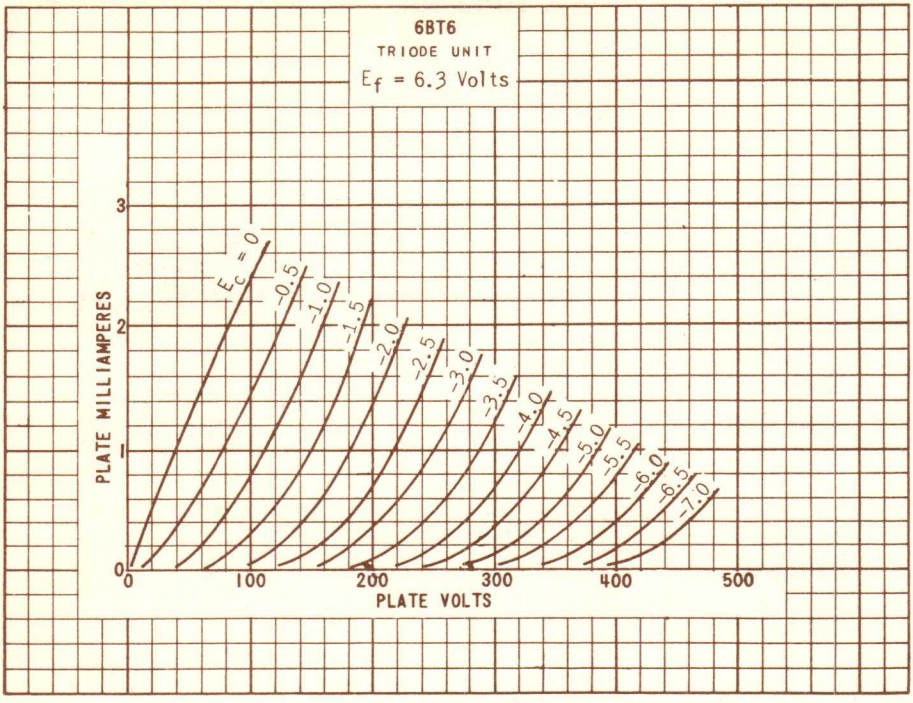
6BT6 (12BT6)



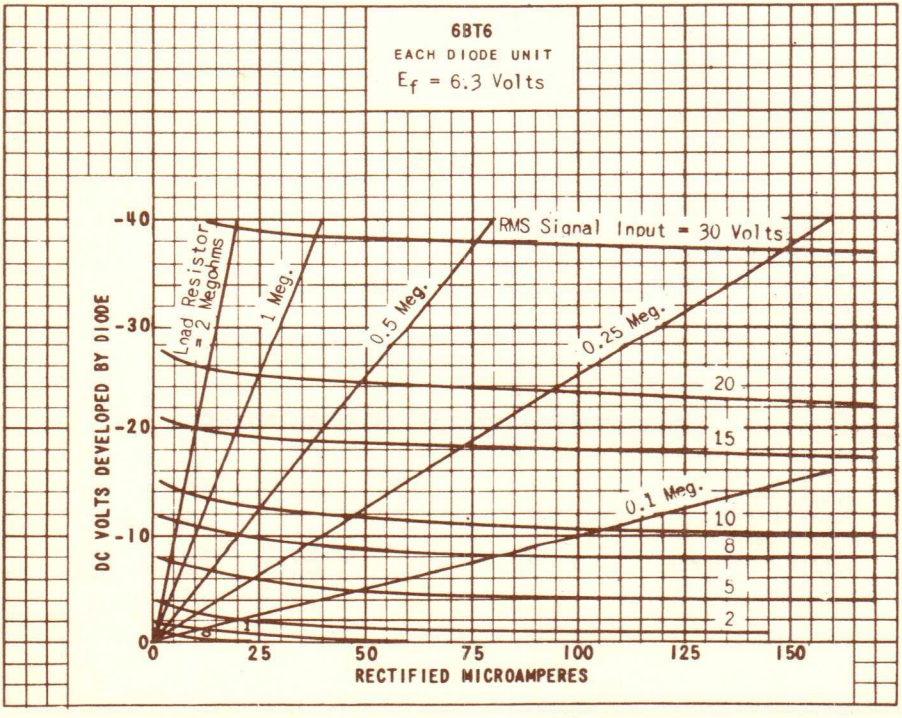


PLATE 2303
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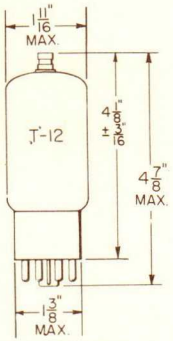
TUNG-SOL



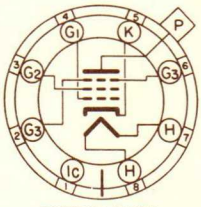
GLASS BULB
SMALL CAP
WITH GROOVE

PENTODE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MEDIUM-SHELL
8 PIN OCTAL

THE 6BU5 IS A HIGH VOLTAGE BEAM PENTODE DESIGNED PRIMARILY FOR USE AS A SHUNT VOLTAGE REGULATOR IN THE HIGH VOLTAGE POWER SUPPLY OF COLOR TELEVISION RECEIVERS. IT HAS LOW CURRENT REQUIREMENTS AND EXHIBITS A SHARP CUT-OFF CHARACTERISTIC.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.024	μμf
INPUT	3.0	μμf
OUTPUT	0.9	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

TV HIGH VOLTAGE REGULATOR SERVICE

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	20 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	100	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION	20	WATTS
MAXIMUM GRID #2 DISSIPATION	0.1	WATT
MAXIMUM CATHODE CURRENT	2.5	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	SEE RATING CHART	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	20 000	20 000	VOLTS
SUPPRESSOR VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE	70	70	VOLTS
GRID #1 VOLTAGE	-3.4	-2.4	VOLTS
PLATE CURRENT	0.55	1.0	MA.
GRID #2 CURRENT	---	0.4	MA.
GRID #1 VOLTAGE (APPROX.) I_b = 30 μAMP.	---	-6.5	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

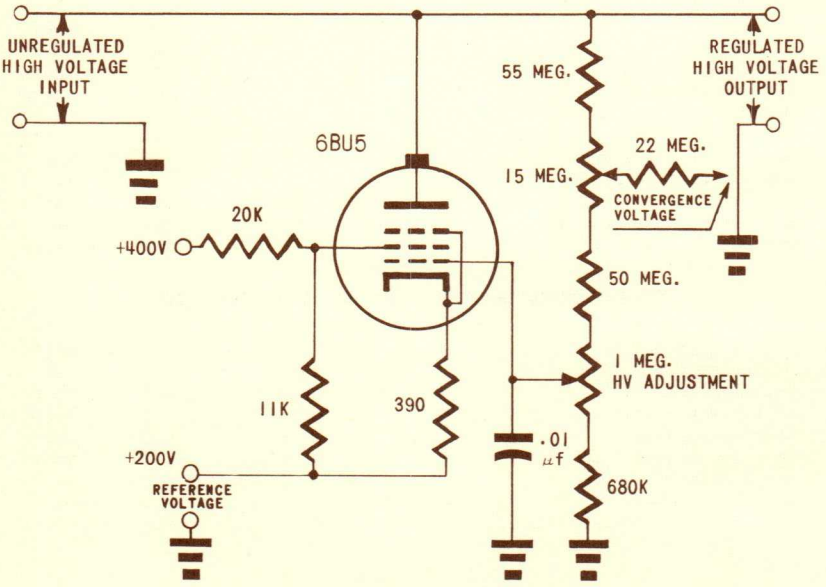
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D

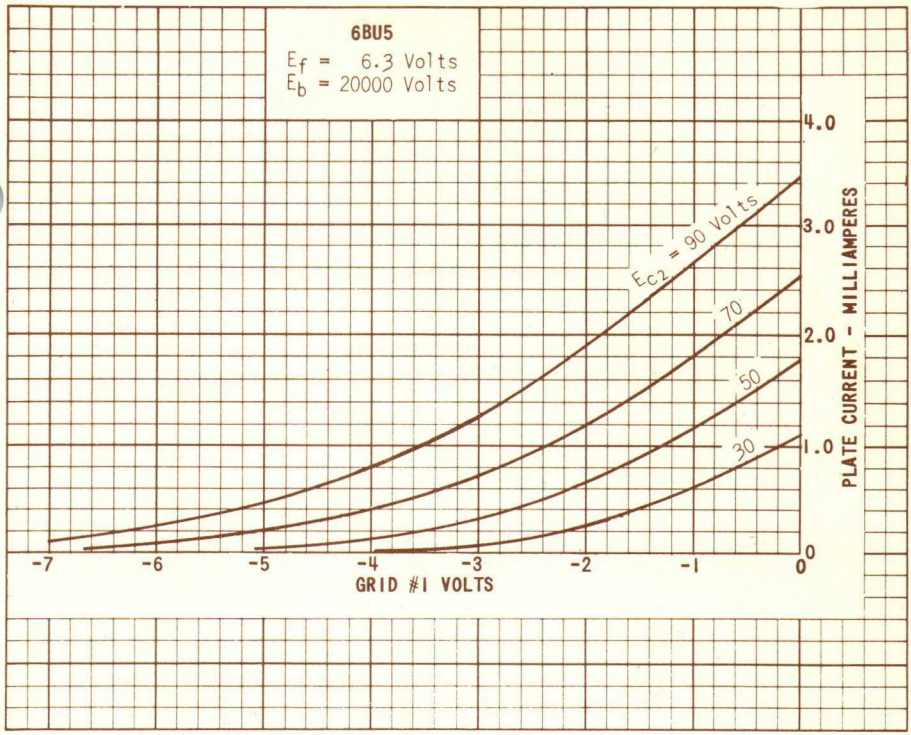
TV HIGH-VOLTAGE REGULATOR SERVICE

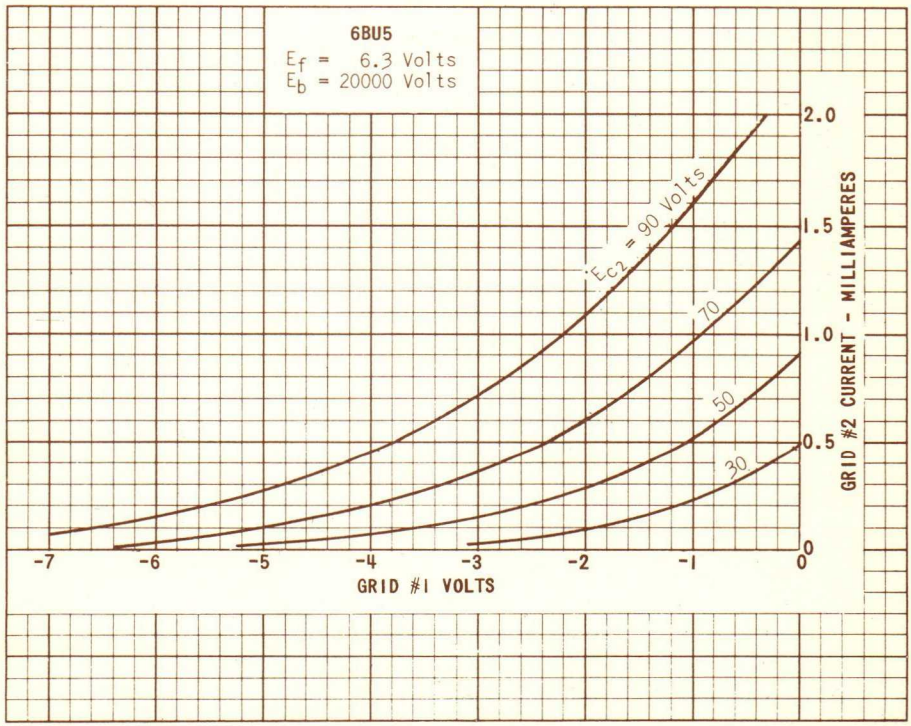
SEE CIRCUIT DIAGRAM

HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.15		AMP.
UNREGULATED DC SUPPLY VOLTAGE	29 900		VOLTS
EQUIVALENT RESISTANCE OF UNREGULATED SUPPLY	8.5		MEGOHMS
GRID #2 VOLTAGE	70		VOLTS
DC REFERENCE VOLTAGE	200		VOLTS
SUPPRESSOR VOLTAGE	0		VOLTS
DC LOAD CURRENT	0	1.0	MA.
DC PLATE CURRENT	1.0	0.05	MA.
DC GRID #2 CURRENT	0.5	0.03	MA.
REGULATED DC OUTPUT VOLTAGE	20 000	19 600	VOLTS

NOTE: HIGH VOLTAGE OPERATION OF THE 6BU5 CAN RESULT IN THE PRODUCTION OF X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS THESE TUBES ARE ADEQUATELY SHIELDED. THE NEED FOR THIS PRECAUTION SHOULD BE CONSIDERED IN EQUIPMENT DESIGN. RELATIVELY SIMPLE SHIELDING SHOULD PROVE ADEQUATE.







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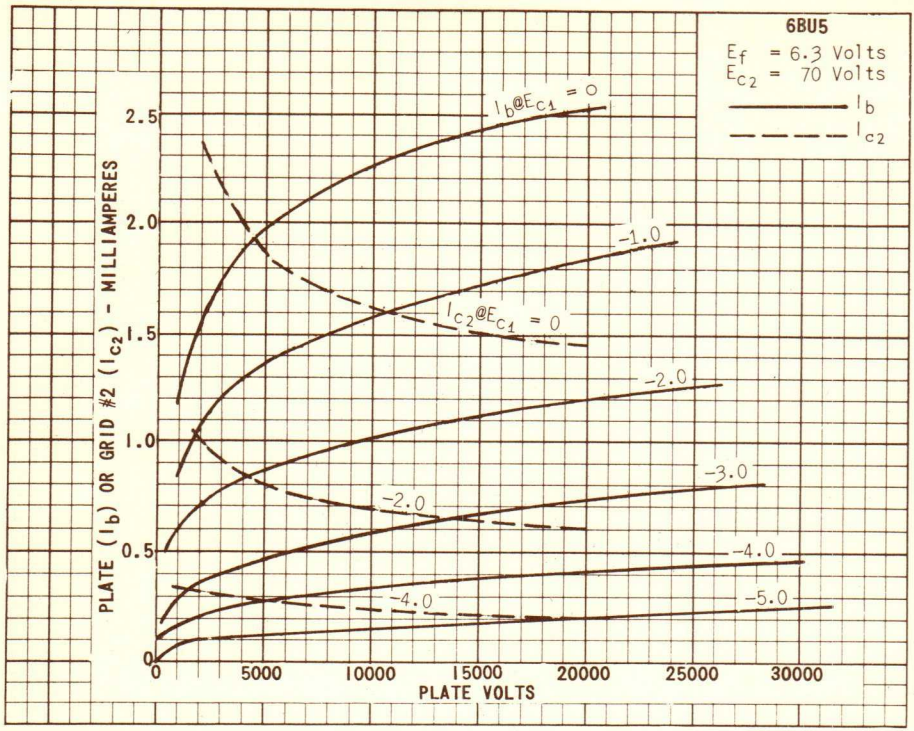

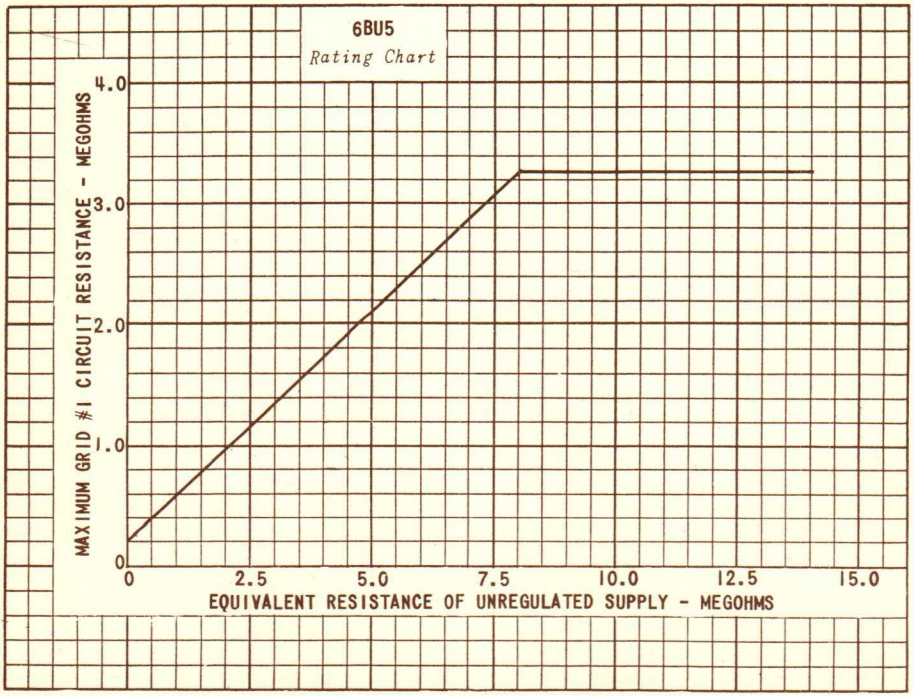

PLATE #4296 MARCH 1, 1955 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

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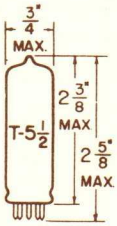
DOUBLE-DIODE TRIODE

MINIATURE TYPE

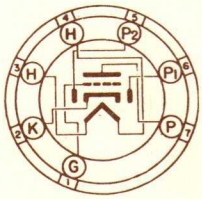


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

THE 6BU6 IS A COMBINED LOW-MU TRIODE VOLTAGE AMPLIFIER AND DOUBLE DIODE DETECTOR USING THE 7 PIN MINIATURE CONSTRUCTION. THE LOW AMPLIFICATION FACTOR OF THE TRIODE PERMITS LARGE VALUES OF OUTPUT SIGNAL WITH LOW DISTORTION. THE HIGH PERVEANCE DIODES GIVE GOOD RECTIFICATION EFFICIENCY AT LOW SIGNALS AND THE DIODE SHIELDING REDUCES UNDESIRABLE AUDIO COUPLING BETWEEN DIODES AND TRIODE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
DIODE #1 OR DIODE #2 TO CATHODE	1	1	μμf
DIODE #1 TO GRID	0.01	0.013	μμf

[A] WITH RMA SHIELD #316 CONNECTED TO CATHODE

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
AVERAGE DIODE CURRENT EACH PLATE WITH 10 VOLTS DC APPLIED	4	MA.
AVERAGE DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-3	-9	VOLTS
SELF BIAS RESISTOR	770	950	OHMS
PLATE CURRENT	3.9	9.5	MA.
PLATE RESISTANCE	11 000	8 500	OHMS
TRANSCONDUCTANCE	1 500	1 900	μMHOS
AMPLIFICATION FACTOR	16.5	16	
LOAD RESISTANCE	---	10 000	OHMS
TOTAL HARMONIC DISTORTION	---	6.5	PERCENT
POWER OUTPUT	---	300	MW.

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PLATE 2304
JAN. 1 1950

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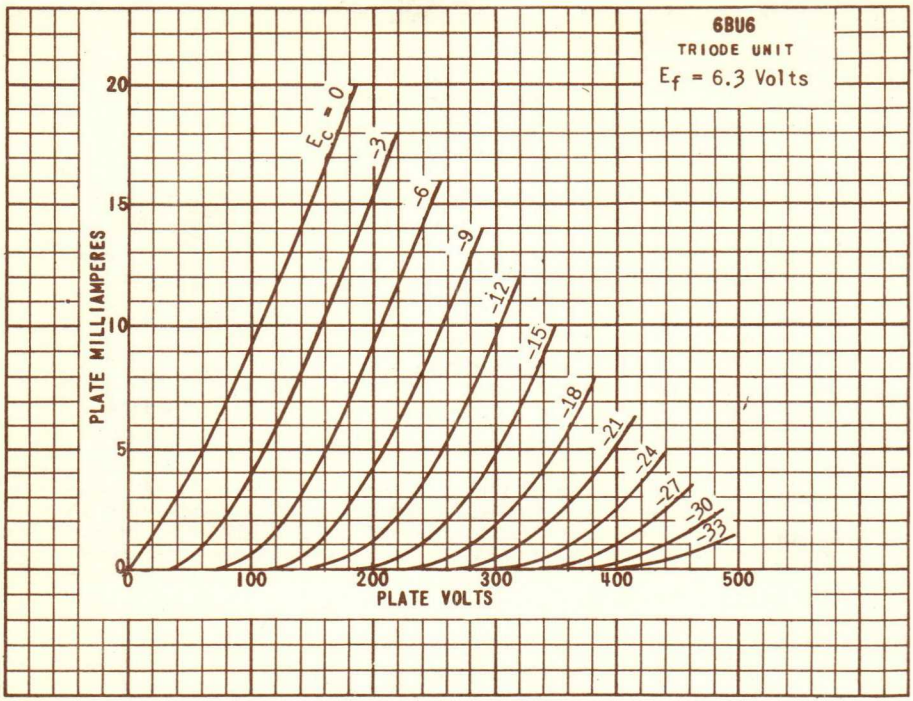
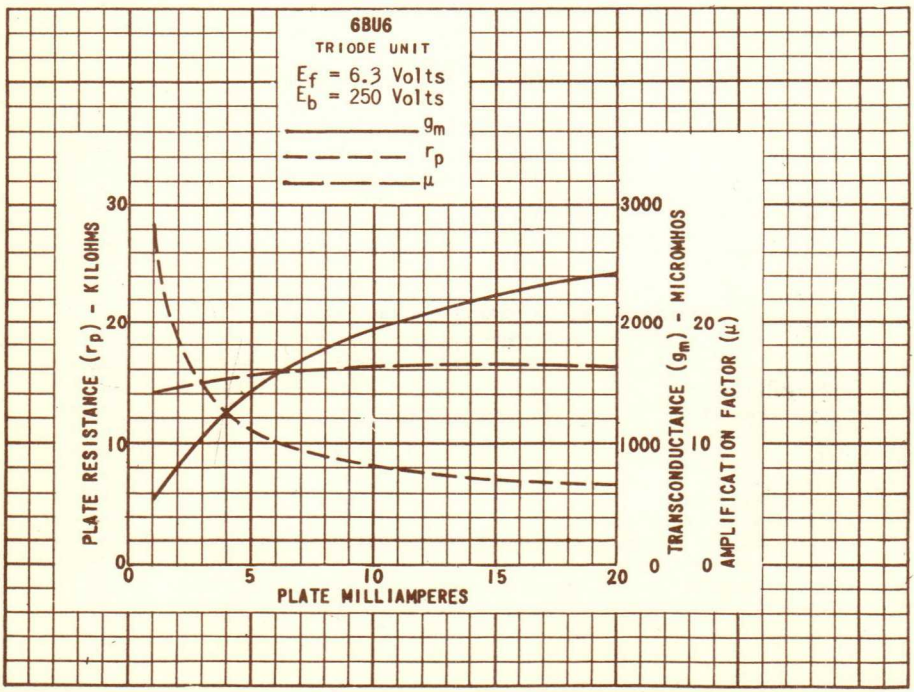
6BU6 (12BU6)





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JAN. 1 1950

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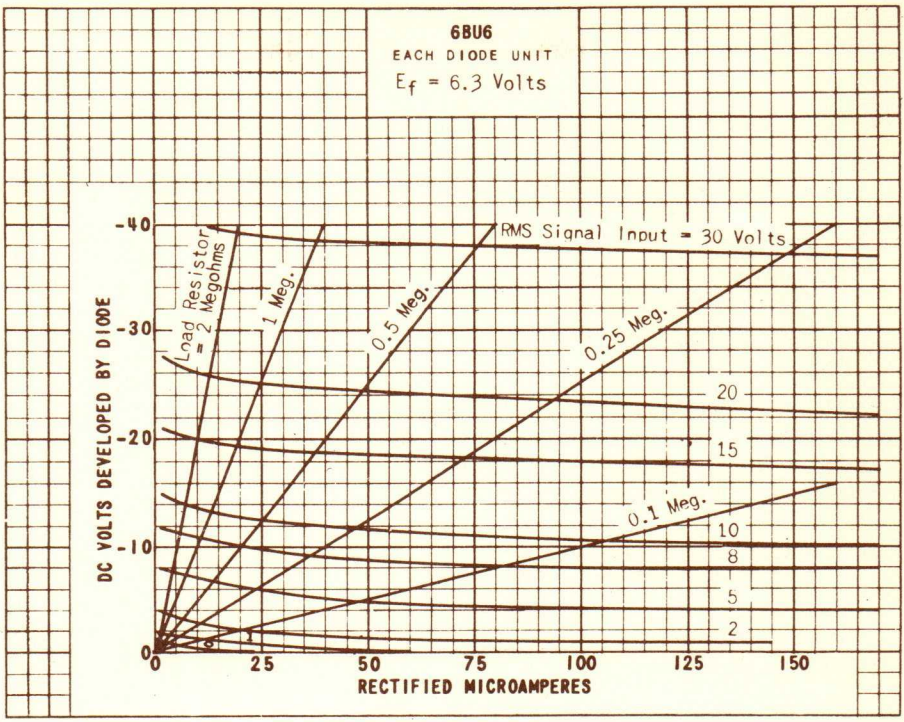

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PLATE
2306
JAN. 1
1950

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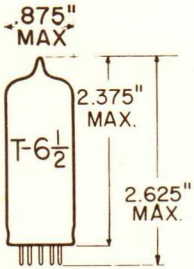
TUNG-SOL

TWIN PENTODE

MINIATURE TYPE



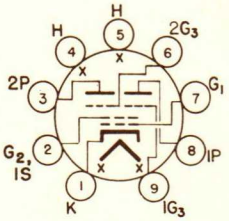
GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

HEATER

6.3±0.6 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9FG

THE 6BU8 IS A MINIATURE MULTISECTION TUBE WHICH INCORPORATES SEPARATE PLATES AND NUMBER 3 GRIDS FOR THE TWO SECTIONS TOGETHER WITH A COMMON SCREEN, NUMBER 1 GRID, AND CATHODE. THE TUBE IS INTENDED FOR USE AS A COMBINED SYNC-AGC TUBE IN TELEVISION RECEIVERS. IN THIS SERVICE, WHEN USED IN CONJUNCTION WITH SUITABLE CIRCUITRY, ONE SECTION OF THE 6BU8 FUNCTIONS AS SYNC SEPARATOR AND SYNC CLIPPER, WHILE THE OTHER SECTION IS USED TO GENERATE THE AUTOMATIC-GAIN-CONTROL VOLTAGE. IN ADDITION, BY UTILIZING THE COMMON, #1 GRID, NOISE PULSES CAN BE SUPPRESSED FROM BOTH SYNCHRONIZING AND AUTOMATIC-GAIN-CONTROL CIRCUITS. EXCEPT FOR HEATER RATINGS, THE 6BU8 IS IDENTICAL TO THE 3BU8.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE, (EACH SECTION)	1.9	pf
GRID #1 TO ALL	6.0	pf
GRID #3 TO ALL (EACH SECTION)	3.6	pf
PLATE TO ALL (EACH SECTION)	3.0	pf
GRID #3 (SECTION 1) TO GRID #3 (SECTION 2) MAX.	0.015	pf

RATINGS

→ DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

MAXIMUM PLATE VOLTAGE (EACH SECTION)	300	VOLTS
MAXIMUM SCREEN VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE (EACH SECTION)	3.0	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM PEAK POSITIVE GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.1	WATTS
MAXIMUM SCREEN DISSIPATION	0.75	WATTS
MAXIMUM DC CATHODE CURRENT	12	MA.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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RATINGS – CONT'D

DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

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
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHMS
MAXIMUM GRID #3 CIRCUIT RESISTANCE (EACH SECTION)	0.5	MEGOHMS
HEATER WARM–UP TIME*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

BOTH SECTIONS OPERATING

PLATE VOLTAGE (EACH SECTION)	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE (EACH SECTION)	−10	0	VOLTS
GRID #1 VOLTAGE	**	**	
PLATE CURRENT (EACH SECTION)		2.2	MA.
SCREEN CURRENT	6.5	3.3	MA.
CATHODE CURRENT	6.6	7.8	MA.

EACH SECTION SEPARATELY [A]

PLATE VOLTAGE	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	**	VOLTS
GRID #3 TRANSCONDUCTANCE	---	180	μMHOS
GRID #1 TRANSCONDUCTANCE	1 500	---	μMHOS
PLATE CURRENT	---	2.2	MA.
GRID #3 VOLTAGE (APPROX.) I_b=100μAMPS	---	−4.5	VOLTS
GRID #1 VOLTAGE (APPROX.) I_b=100μAMPS	---	2.3	VOLTS

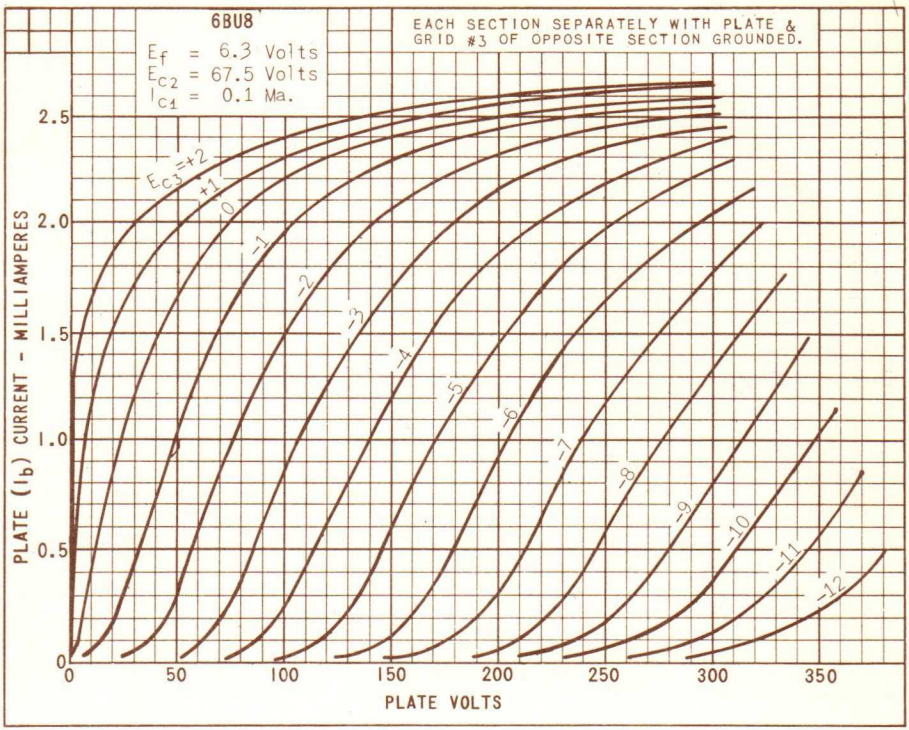
*HEATER WARM–UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

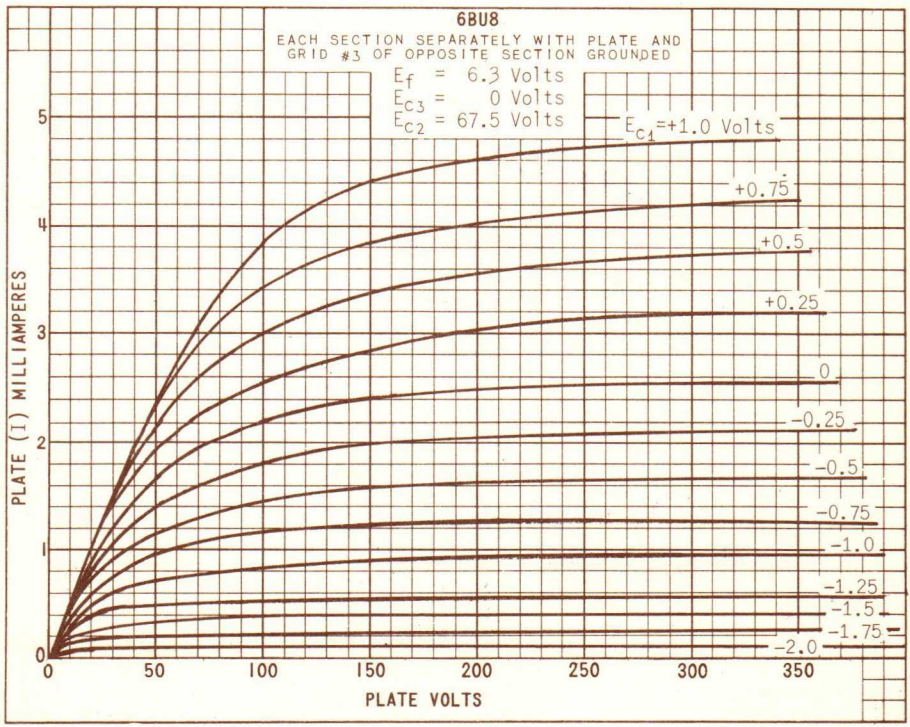
** WITH GRID CURRENT ADJUSTED FOR 100 μAMPS D–C.

A WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED.

DESIGN–MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN–MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY–VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm–up time the 6BU8 is identical to the 3BU8.*





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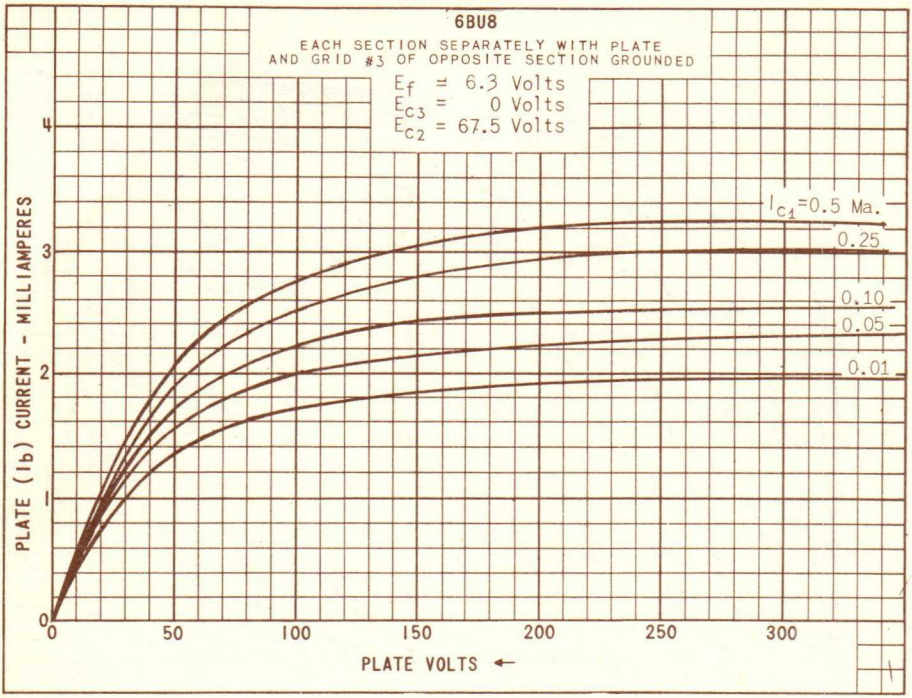
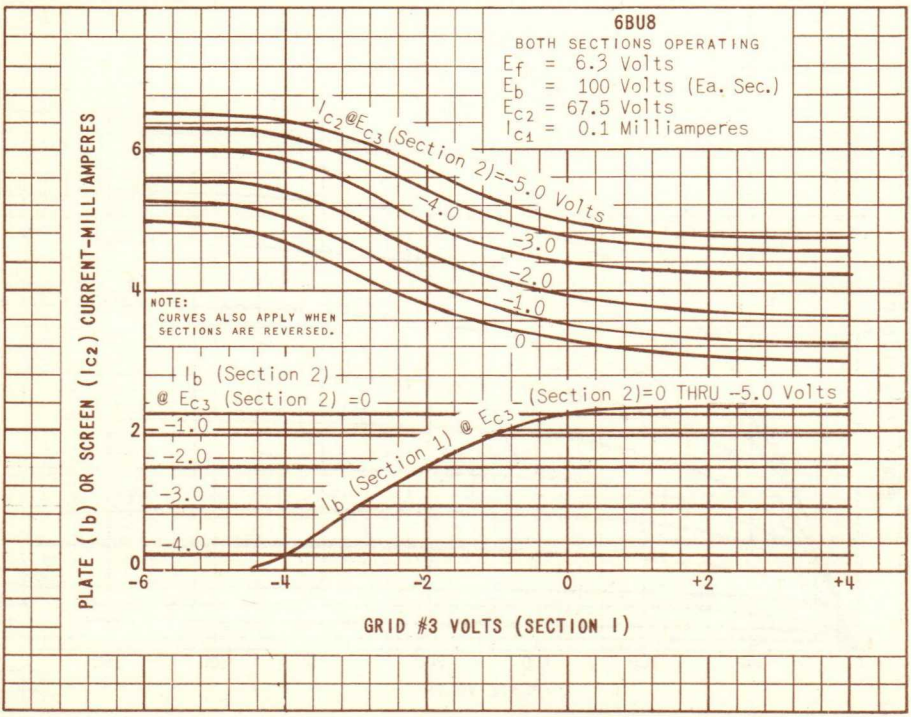
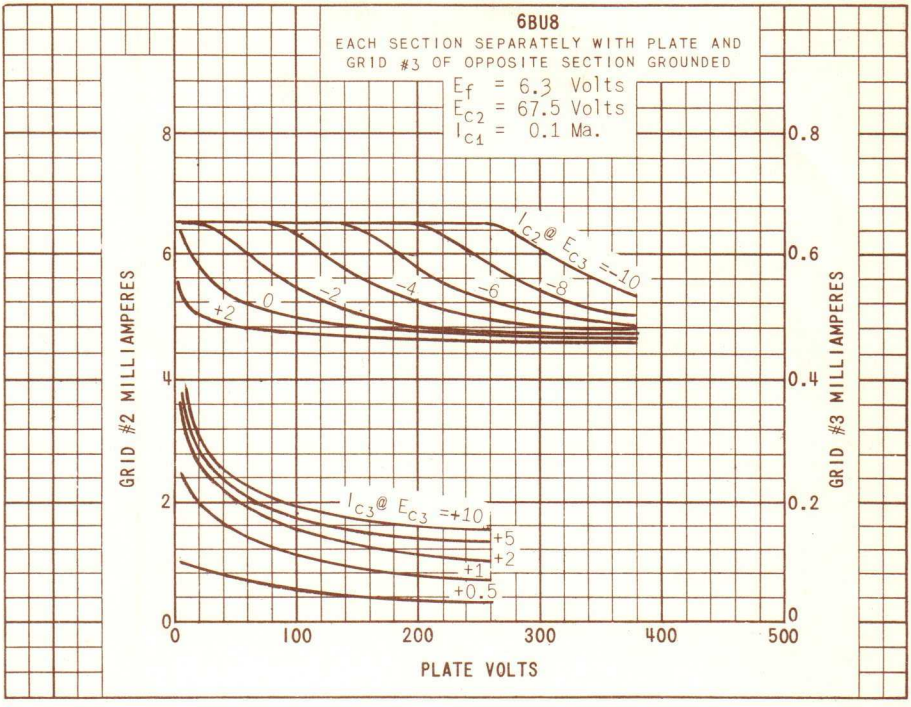
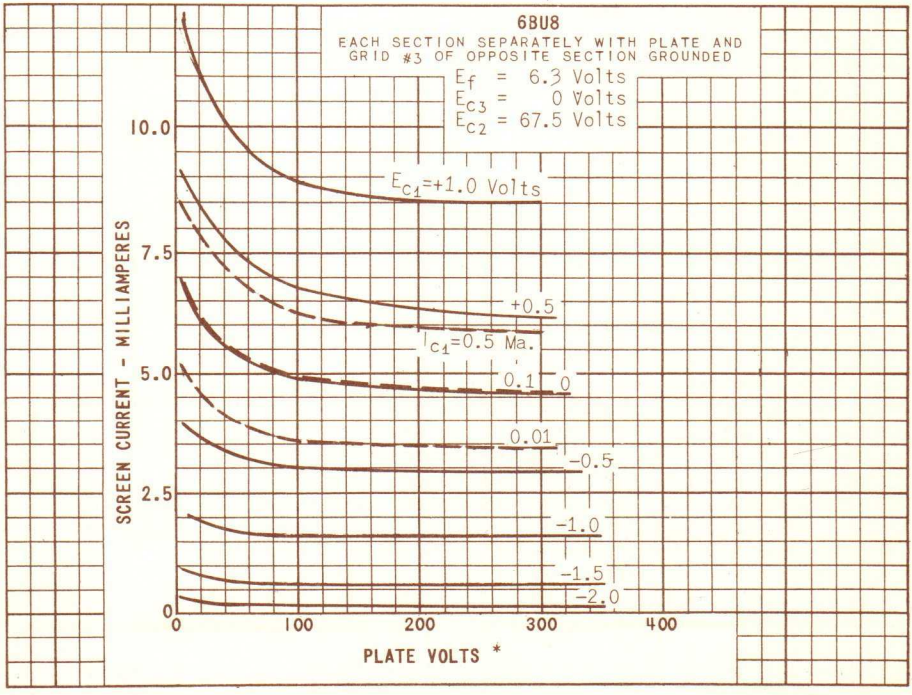

6BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 6.3 Volts
E_{c3} = 0 Volts
E_{c2} = 67.5 Volts
I_{c_1}=0.5 Ma.
0.25
0.10
0.05
0.01
PLATE (I_b) CURRENT - MILLIAMPERES
PLATE VOLTS ←
0
50
100
150
200
250
300
1
2
3
4


6BU8
BOTH SECTIONS OPERATING
E_f = 6.3 Volts
E_b = 100 Volts (Ea. Sec.)
E_{c2} = 67.5 Volts
I_{c_1} = 0.1 Milliamperes
I_{c2}@E_{c3} (Section 2)=-5.0 Volts
-4.0
-3.0
-2.0
-1.0
0
NOTE:
CURVES ALSO APPLY WHEN SECTIONS ARE REVERSED.
I_b (Section 2) @ E_{c3} (Section 2) =0
-1.0
-2.0
-3.0
-4.0
I_b (Section 1) @ E_{c3} (Section 2)=0 THRU -5.0 Volts
PLATE (I_b) OR SCREEN (I_{c2}) CURRENT-MILLIAMPERES
GRID #3 VOLTS (SECTION 1)
-6
-4
-2
0
+2
+4
2
4
6





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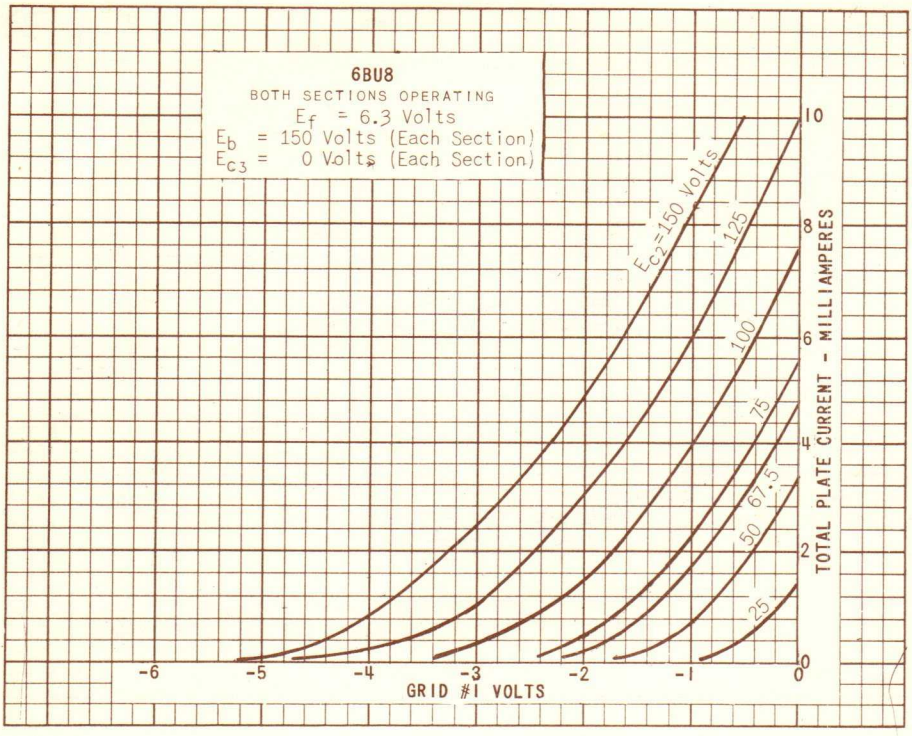
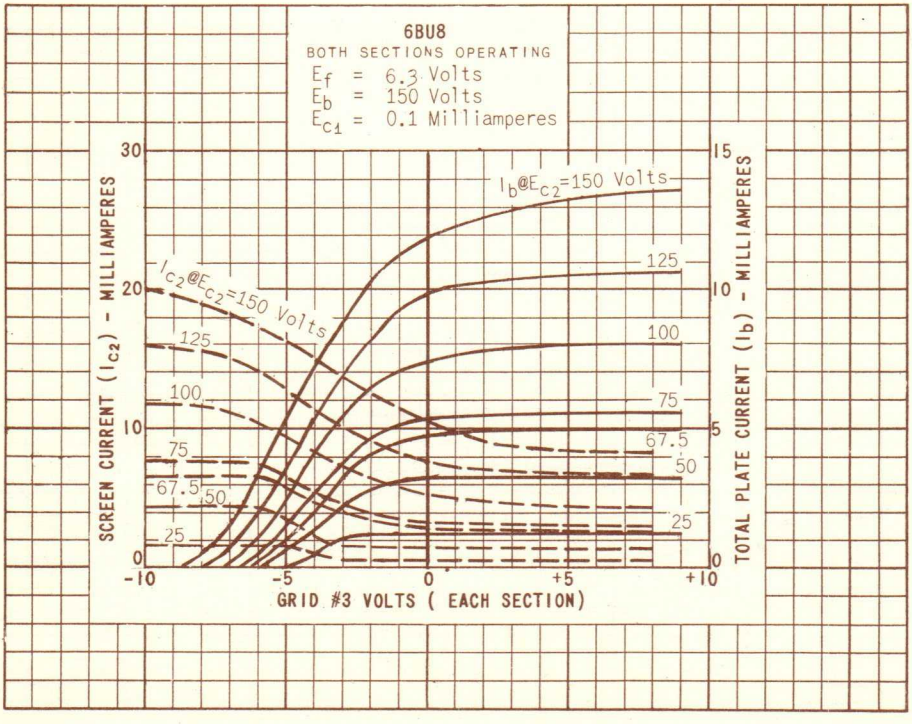
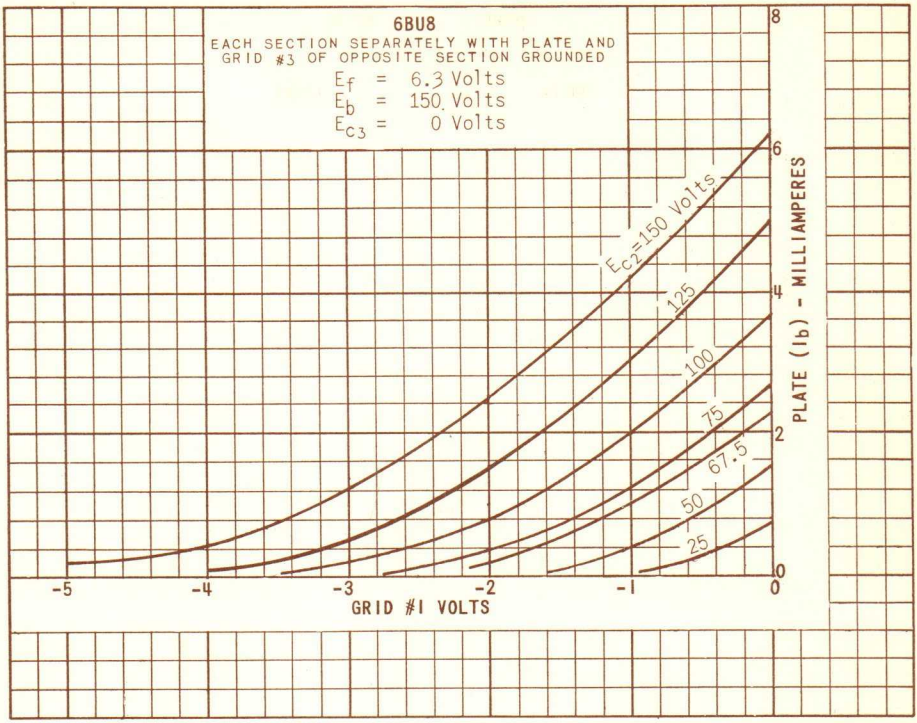
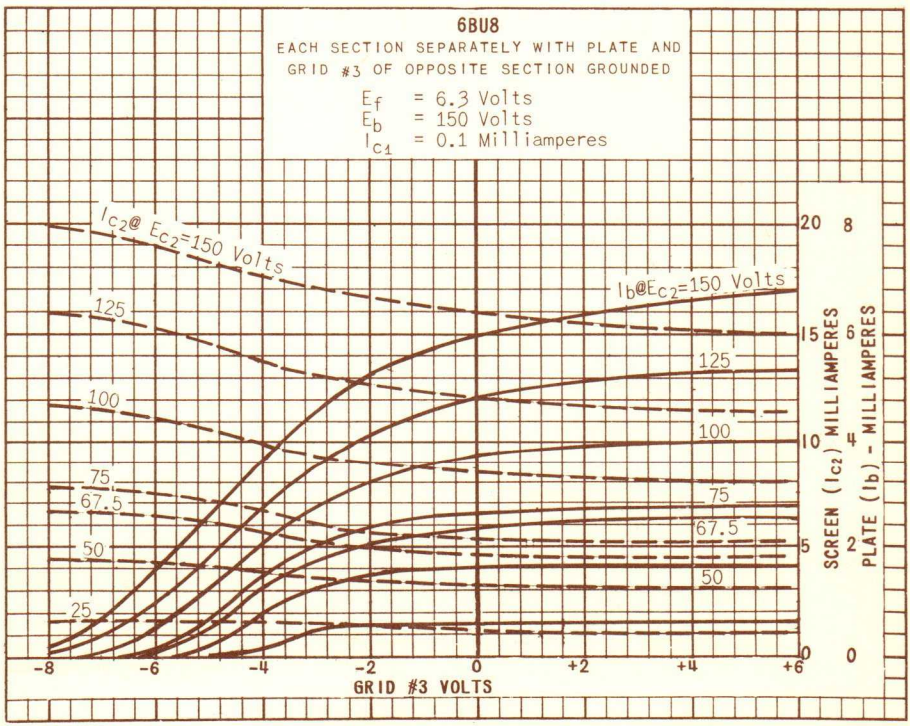

6BU8
BOTH SECTIONS OPERATING
E_f = 6.3 Volts
E_b = 150 Volts (Each Section)
E_{c3} = 0 Volts (Each Section)
E_{c_2}=150 Volts
125
100
75
67.5
50
25
TOTAL PLATE CURRENT - MILLIAMPERES
0
2
4
6
8
10
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


6BU8
BOTH SECTIONS OPERATING
E_f = 6.3 Volts
E_b = 150 Volts
E_{c_1} = 0.1 Milliamperes
I_b@E_{c_2}=150 Volts
125
100
75
67.5
50
25
I_{c_2}@E_{c_2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT (I_{c_2}) - MILLIAMPERES
TOTAL PLATE CURRENT (I_b) - MILLIAMPERES
0
10
20
30
0
5
10
15
-10
-5
0
+5
+10
GRID #3 VOLTS (EACH SECTION)





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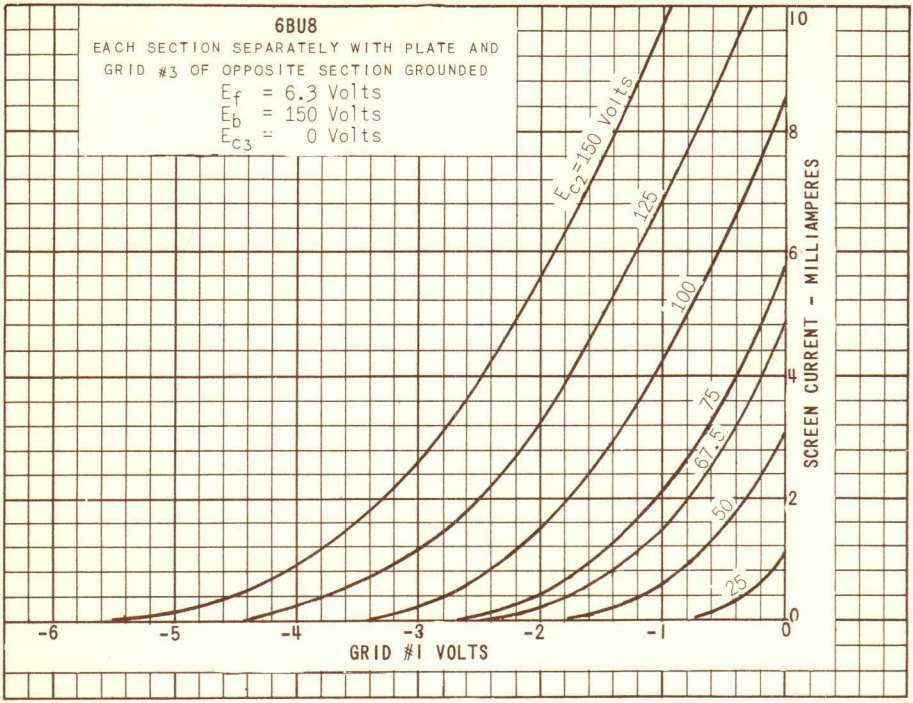
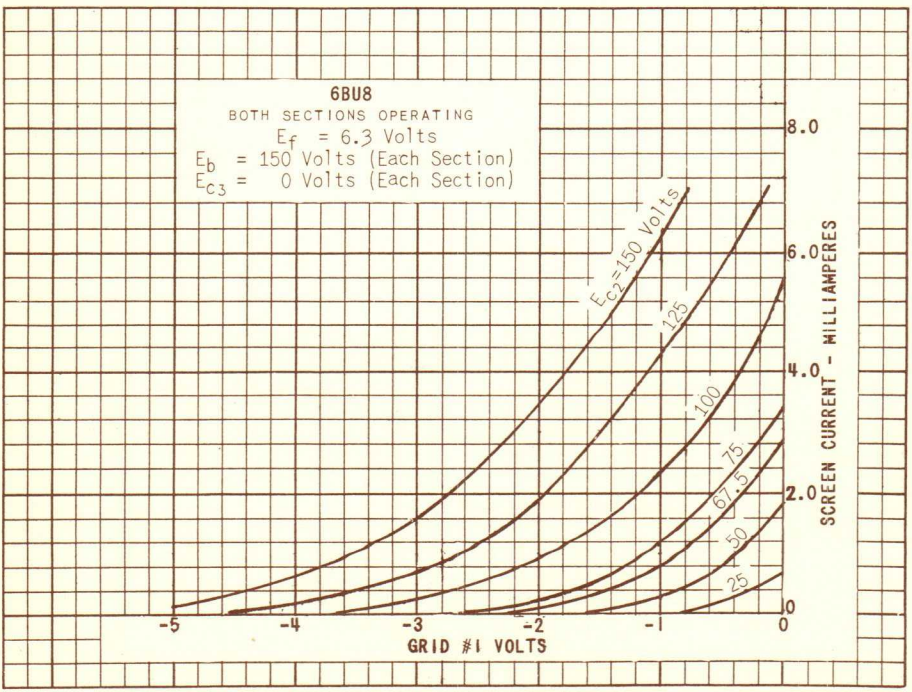
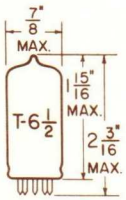

6BU8
EACH SECTION SEPARATELY WITH PLATE AND
GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 6.3 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT - MILLIAMPERES
10
8
6
4
2
0
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


6BU8
BOTH SECTIONS OPERATING
E_f = 6.3 Volts
E_b = 150 Volts (Each Section)
E_{c3} = 0 Volts (Each Section)
E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT - MILLIAMPERES
8.0
6.0
4.0
2.0
0
-5
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

DUPLEX-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

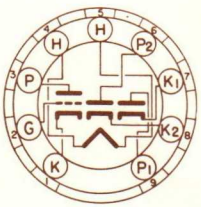
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 ± 10% VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE

9FJ

THE 6BV8 IS A MINIATURE DUPLEX-DIODE MEDIUM MU TRIODE IN WHICH SEPARATE CATHODE AND PLATE CONNECTIONS ARE PROVIDED FOR EACH DIODE SECTION. THE TUBE IS INTENDED PRIMARILY FOR SERVICE AS A COMBINED SYNCHRONOUS DETECTOR AND CHROMINANCE AMPLIFIER IN COLOR TELEVISION RECEIVERS. THE HIGH PERVEANCE CHARACTERISTIC OF THE TRIODE SECTION ADAPTS THE TUBE PARTICULARLY TO THIS SERVICE. IT IS ALSO SUITABLE FOR USE AS A COMBINED FM DETECTOR AND AUDIO-FREQUENCY VOLTAGE AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE GRID TO PLATE	2.0	μμf
TRIODE INPUT	3.6	μμf
TRIODE OUTPUT	0.4	μμf
GRID TO DIODE #1 PLATE (MAX.)	0.03	μμf
GRID TO DIODE #2 PLATE (MAX.)	0.07	μμf
DIODE #1 PLATE TO DIODE #1 CATHODE & HEATER	2.4	μμf
DIODE #2 PLATE TO DIODE #2 CATHODE & HEATER	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.7	WATTS
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
MAXIMUM GRID CIRCUIT RESISTANCE		
FIXED BIAS	0.1	MEGOHMS
CATHODE BIAS	0.5	MEGOHMS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EA.DIODE)	10	MA.
HEATER WARM-UP TIME*	11.0	SECONDS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

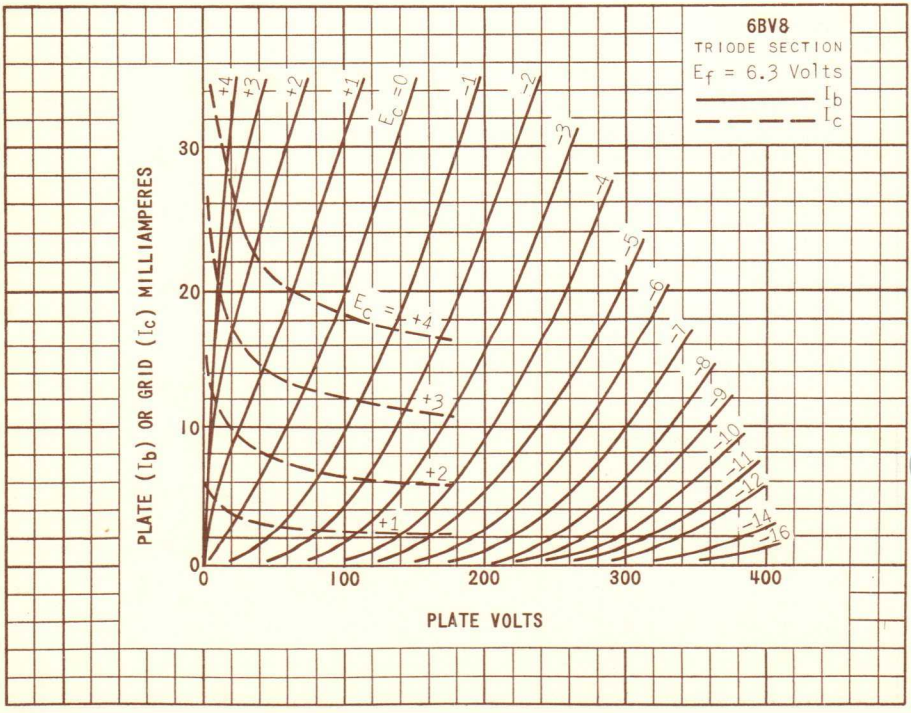
CONTINUED FROM PRECEDING PAGE

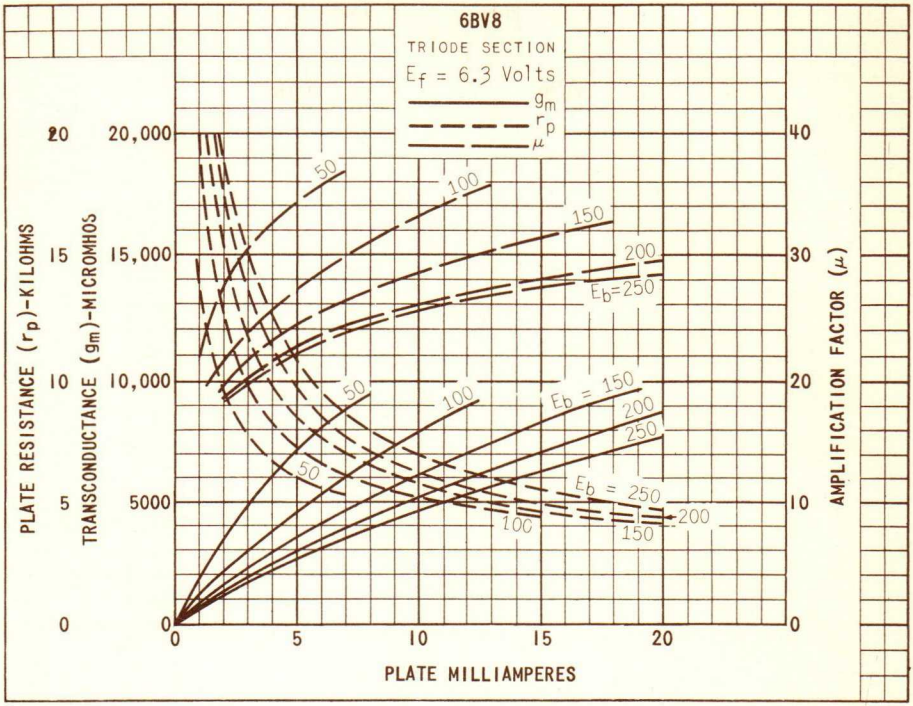
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

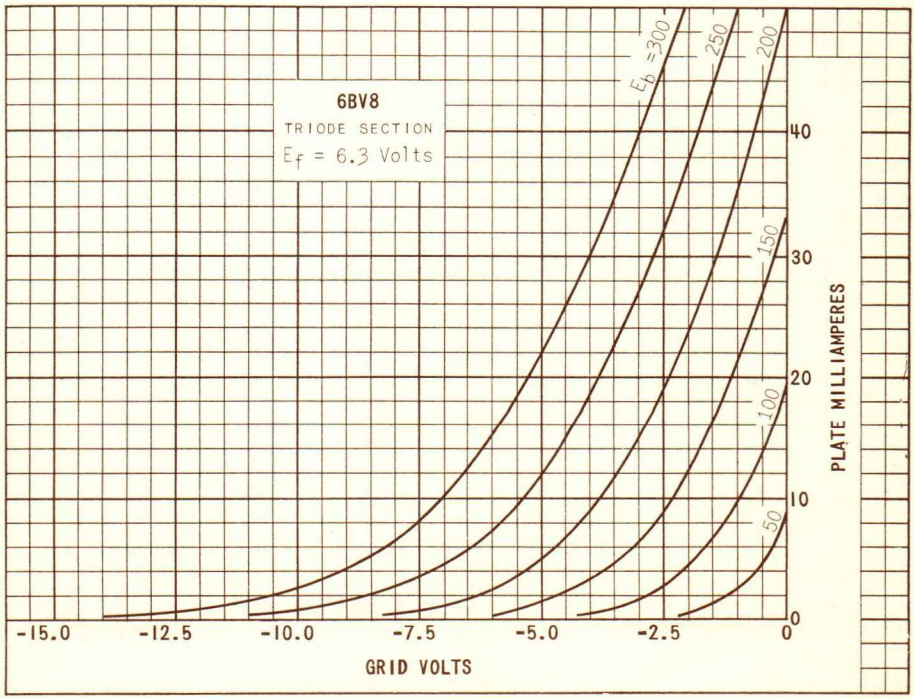
HEATER VOLTAGE	6.3±10%	6.3±10%	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	75	200	VOLTS
GRID VOLTAGE	0	---	VOLTS
CATHODE-BIAS RESISTOR	---	330	OHMS
AMPLIFICATION FACTOR	---	33	
PLATE RESISTANCE (APPROX.)	---	5 900	OHMS
TRANSCONDUCTANCE	---	5 600	μMHOS
PLATE CURRENT	14	11	MA.
GRID VOLTAGE (APPROX.)			
I_b = 100 μAMPS	---	-11	VOLTS
AVERAGE DIODE CURRENT (EACH DIODE) WITH 5.0 VOLTS DC APPLIED	---	23	MA.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.







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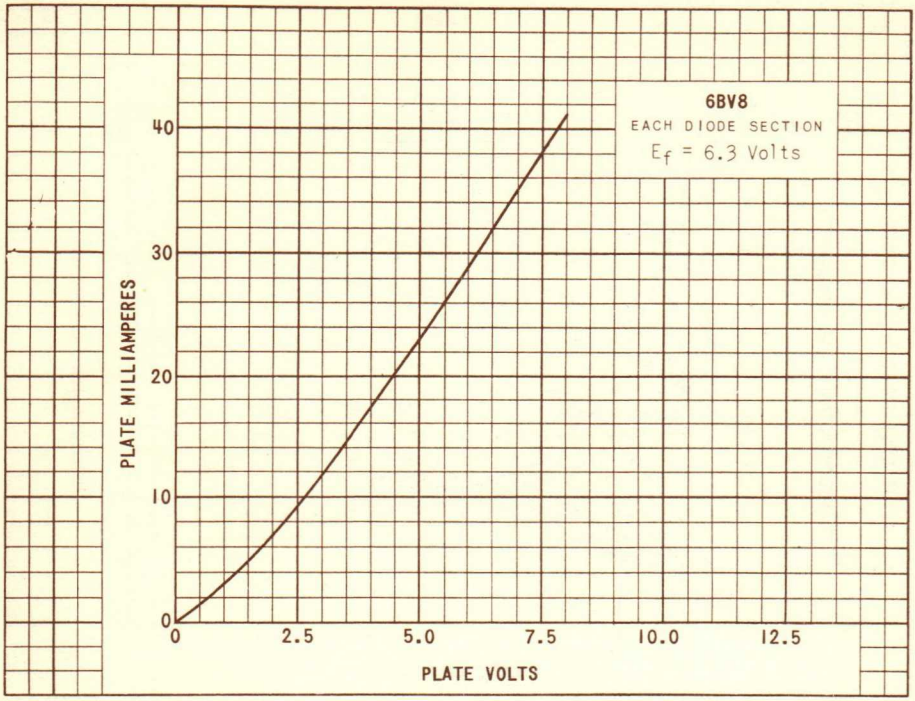


CLASS A RESISTANCE-COUPLED AMPLIFIER

TRIODE SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

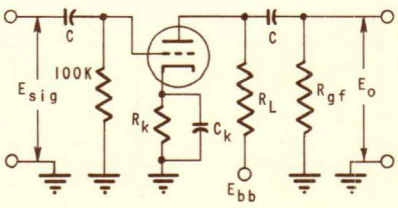
R_L	R_{gf}	E_{bb} = 90 Volts			E_{bb} = 180 Volts			E_{bb} = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	1600	7.5	18	1500	16	20	1500	28	21
0.10	0.24	1900	7.8	19	1900	22	21	1900	38	21
0.24	0.24	4200	9.4	18	3600	19	19	3600	33	20
0.24	0.51	5100	12	19	4300	26	20	4200	42	22
0.51	0.51	9200	10	18	7800	22	19	7500	36	20
0.51	1.0	11000	13	18	10000	28	19	9400	46	20

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	E_{bb} = 90 Volts			E_{bb} = 180 Volts			E_{bb} = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2000	11	17	1400	24	20	1100	39	22
0.10	0.24	2500	15	18	1800	31	21	1600	53	22
0.24	0.24	5300	13	18	3700	28	20	3200	45	21
0.24	0.51	6100	16	18	4700	33	20	4100	57	21
0.51	0.51	8100	14	17	8000	28	19	7100	48	20
0.51	1.0	13000	17	18	10000	34	19	9300	59	20

NOTES:

1. E_o is maximum RMS voltage output for approximately five percent total harmonic distortion.
2. Gain is measured for an output voltage of two volts RMS.
3. R_k is in ohms; R_L and R_{gf} are in megohms.
4. Coupling capacitors (C) should be selected to give desired frequency response. R_k should be adequately by-passed.



TUNG-SOL

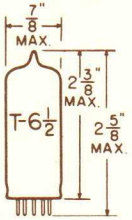
DOUBLE DIODE

MINIATURE TYPE

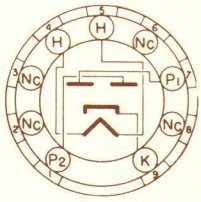
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 900 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9DJ

THE 6BW4 IS A MINIATURE CATHODE TYPE FULL WAVE RECTIFIER FEATURING RELATIVELY HIGH OUTPUT CURRENT CAPABILITIES. EXCEPT FOR HEATER RATINGS IT IS IDENTICAL TO THE 12BW4.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

RECTIFIER SERVICE

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1275	VOLTS
MAXIMUM AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS) (SEE RATING CHART #1)	450	VOLTS
MAXIMUM DC OUTPUT CURRENT	SEE RATING CHART #1	
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE (SEE RATING CHART #2)	350	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT EACH PLATE (SEE RATING CHART #3)	2.0	AMP.
MAXIMUM HEATER CATHODE VOLTAGE: HEATER NEGATIVE, DC	450	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER

	CAPACITOR INPUT FILTER	CHOKE INPUT FILTER	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	900	900	MA.
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)[A]	325	450	VOLTS
FILTER INPUT CAPACITOR	40	---	μf
FILTER INPUT CHOKE	---	10	HENRYS
EFFECTIVE PLATE SUPPLY RESISTANCE EACH PLATE	82	---	OHMS
DC OUTPUT CURRENT	100	100	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	330	360	VOLTS
TUBE VOLTAGE DROP TUBE CONDUCTING: 100 MA. EACH PLATE	40	40	VOLTS

[A] AC PLATE VOLTAGE IS MEASURED WITHOUT LOAD.

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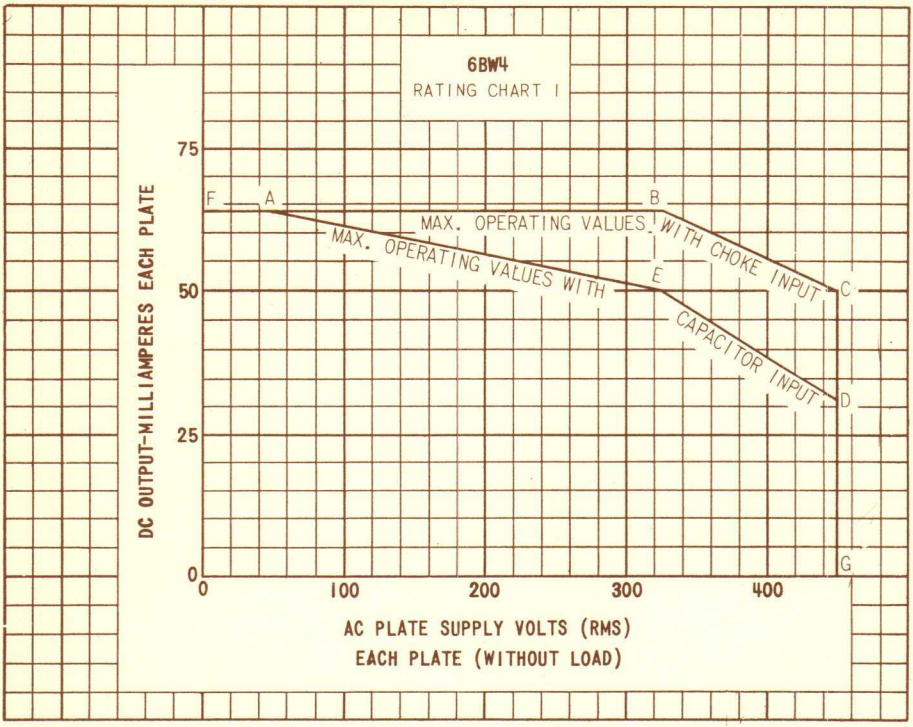
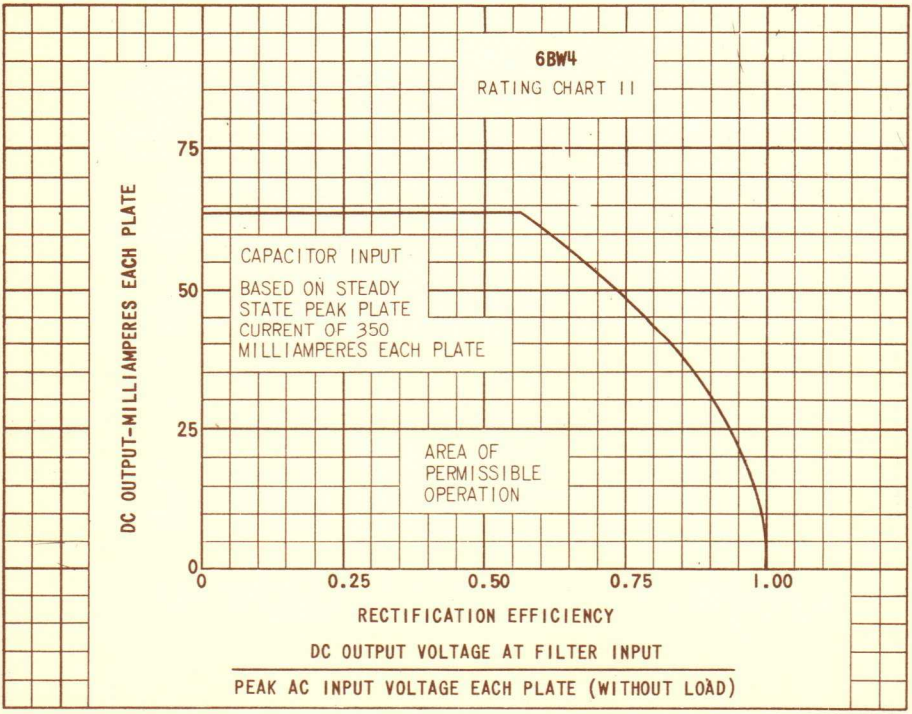
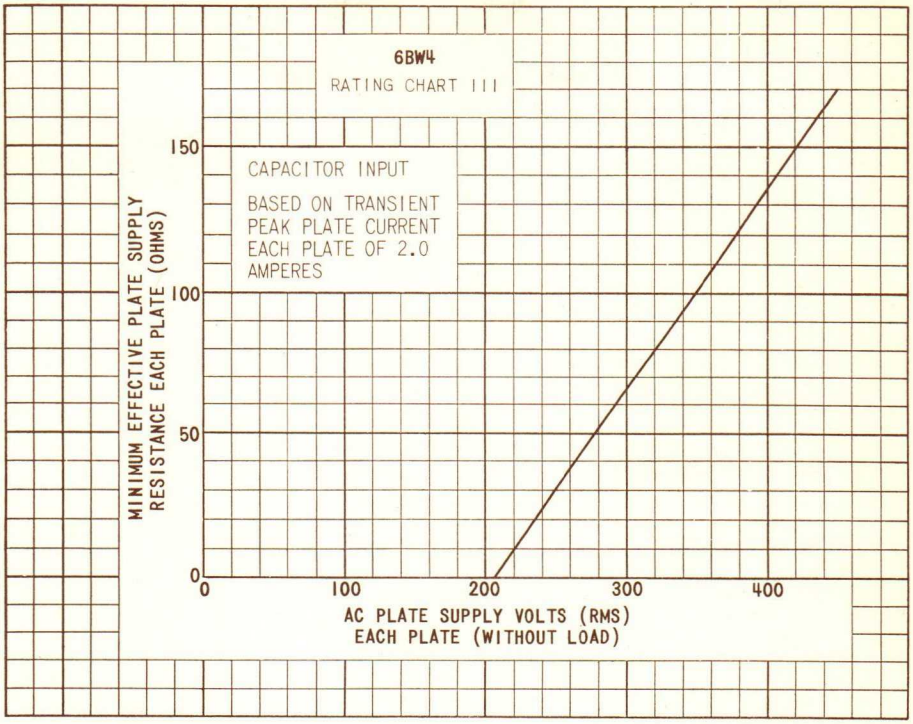

6BW4
RATING CHART I
DC OUTPUT-MILLIAMPERES EACH PLATE
75
50
25
0
F
A
B
C
D
E
G
MAX. OPERATING VALUES WITH CHOKE INPUT
MAX. OPERATING VALUES WITH CAPACITOR INPUT
0
100
200
300
400
AC PLATE SUPPLY VOLTS (RMS)
EACH PLATE (WITHOUT LOAD)


6BW4
RATING CHART II
DC OUTPUT-MILLIAMPERES EACH PLATE
75
50
25
0
CAPACITOR INPUT
BASED ON STEADY STATE PEAK PLATE CURRENT OF 350 MILLIAMPERES EACH PLATE
AREA OF PERMISSIBLE OPERATION
0
0.25
0.50
0.75
1.00
RECTIFICATION EFFICIENCY
DC OUTPUT VOLTAGE AT FILTER INPUT
PEAK AC INPUT VOLTAGE EACH PLATE (WITHOUT LOAD)



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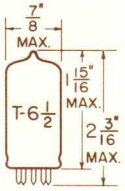
TUNG-SOL

DOUBLE-DIODE PENTODE

MINIATURE TYPE

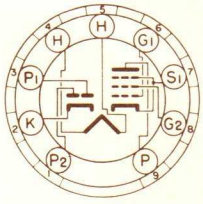


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9HK

THE 6BW8 IS A DOUBLE-DIODE PENTODE IN WHICH SEPARATE CATHODES ARE PROVIDED FOR THE TWO SECTIONS. THE DIODE SECTIONS ARE INTENDED FOR USE PRIMARILY AS A HORIZONTAL PHASE DETECTOR IN TELEVISION RECEIVERS. THE PENTODE SECTION IS SUITABLE FOR USE AS A SOUND IF AMPLIFIER, SOUND LIMITER, AND AUTOMATIC-GAIN-CONTROL KEYER.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE GRID #1 TO PLATE (MAX.)	0.020	μμf
PENTODE INPUT	4.8	μμf
PENTODE OUTPUT	2.6	μμf
GRID #1 TO EACH DIODE PLATE (MAX.)	0.006	μμf
DIODE #1 PLATE TO DIODE CATHODE & HEATER	1.3	μμf
DIODE #2 PLATE TO DIODE CATHODE & HEATER	1.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3 ±6%	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	330	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.55	WATTS
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
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
WITH FIXED BIAS	0.1	MEGOHMS
WITH CATHODE BIAS	0.5	MEGOHMS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EA. SEC.)	5.0	MA.

CONTINUED ON FOLLOWING PAGE

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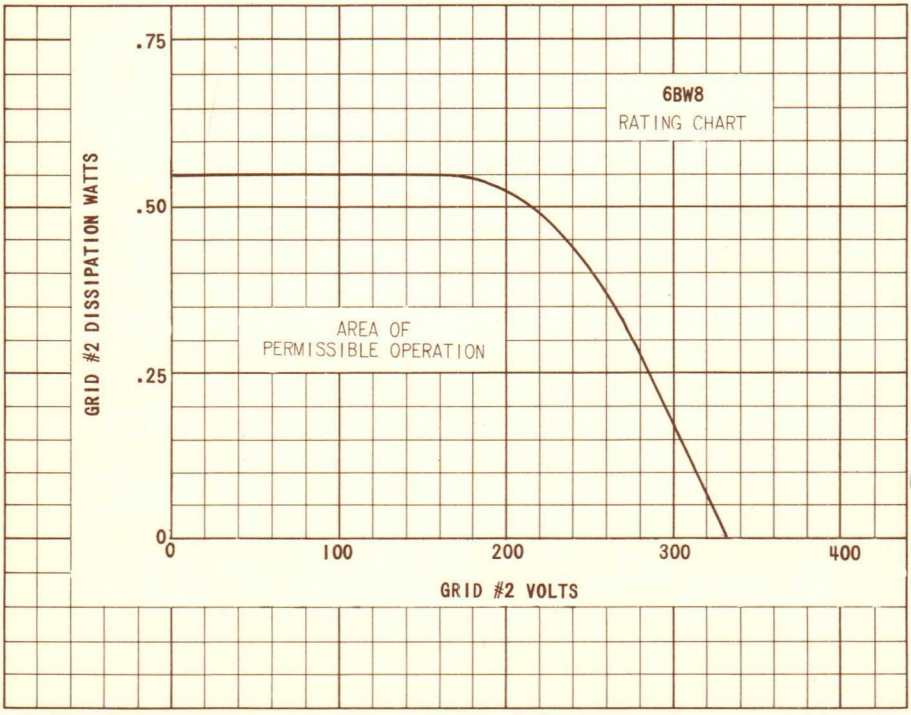
TUNG-SOL

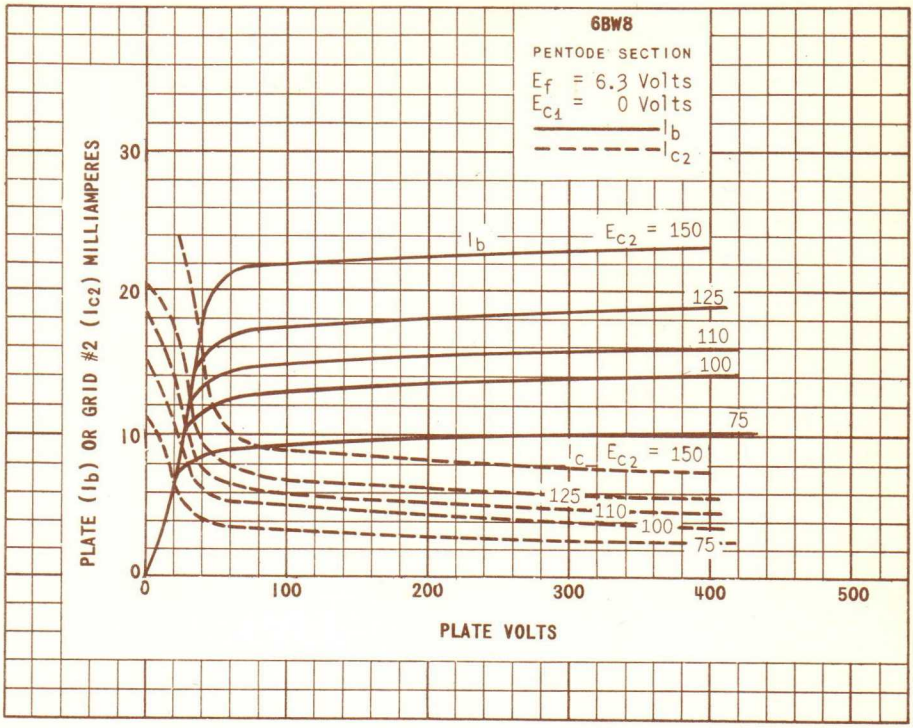
CONTINUED FROM PRECEDING PAGE

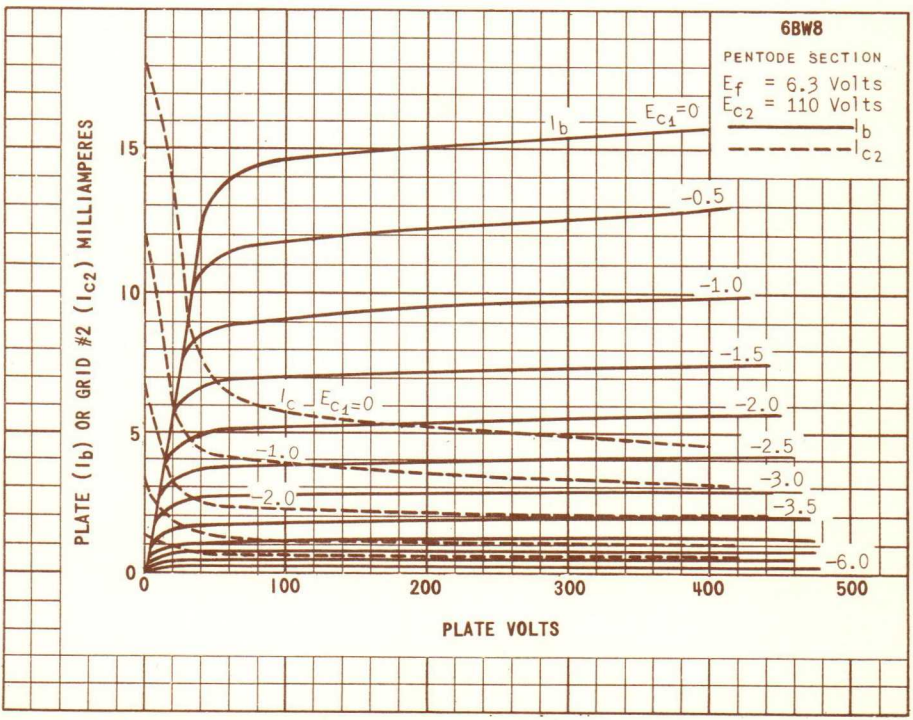
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

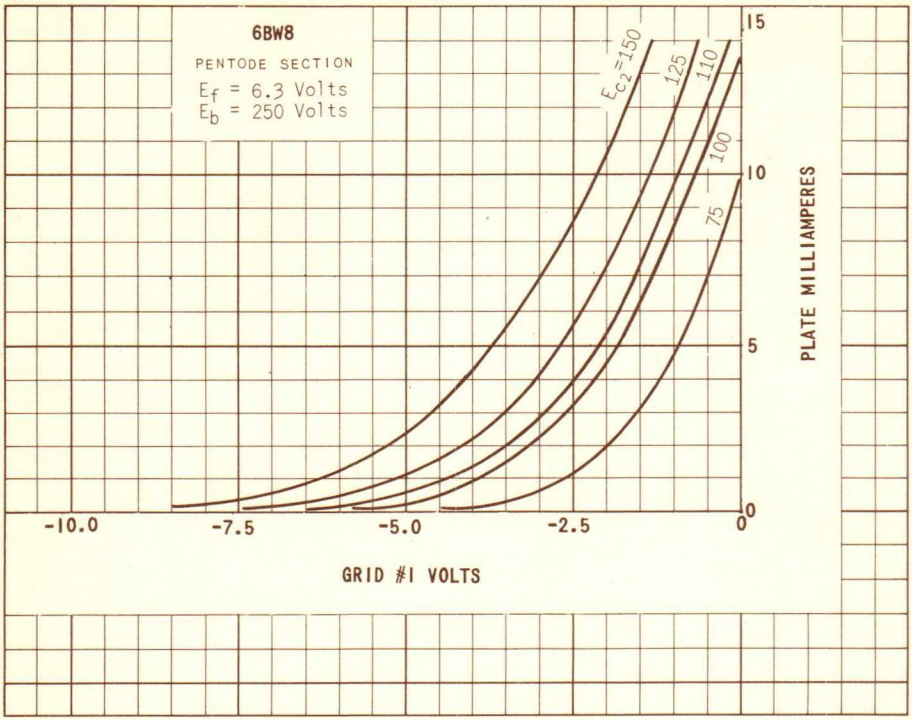
HEATER VOLTAGE	6.3±6%	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	110	VOLTS
CATHODE-BIAS RESISTOR	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHMS
TRANSCONDUCTANCE	5200	μMHOS
PLATE CURRENT	10	MA.
SCREEN CURRENT	3.5	MA.
GRID #1 VOLTAGE (APPROX.) I_b=10 μAMPS	-10	VOLTS
AVERAGE DIODE CURRENT (EACH DIODE) WITH 5 VOLTS DC APPLIED	20	MA.

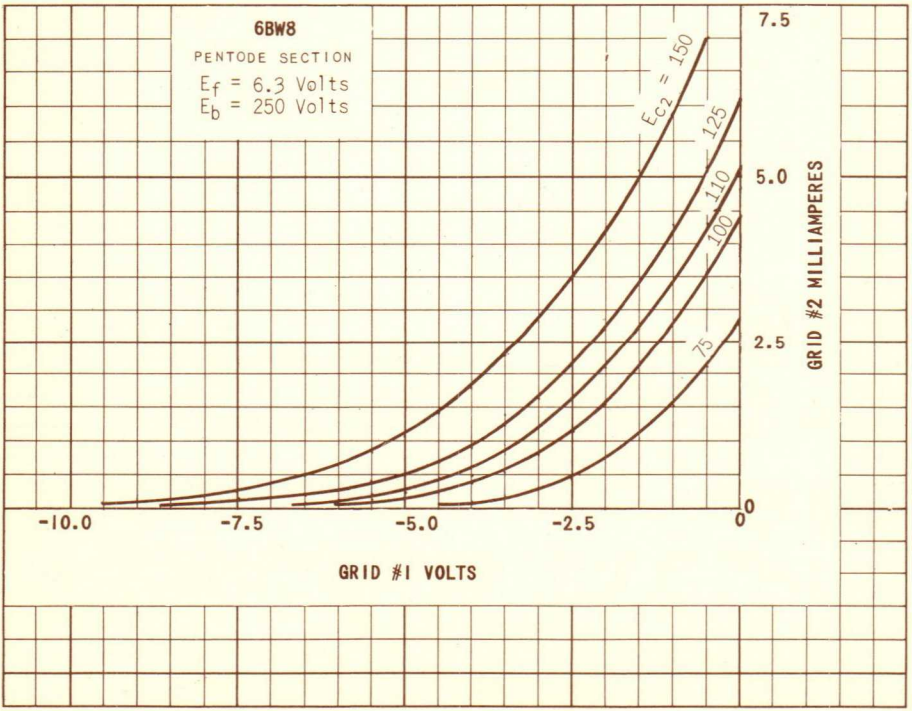
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

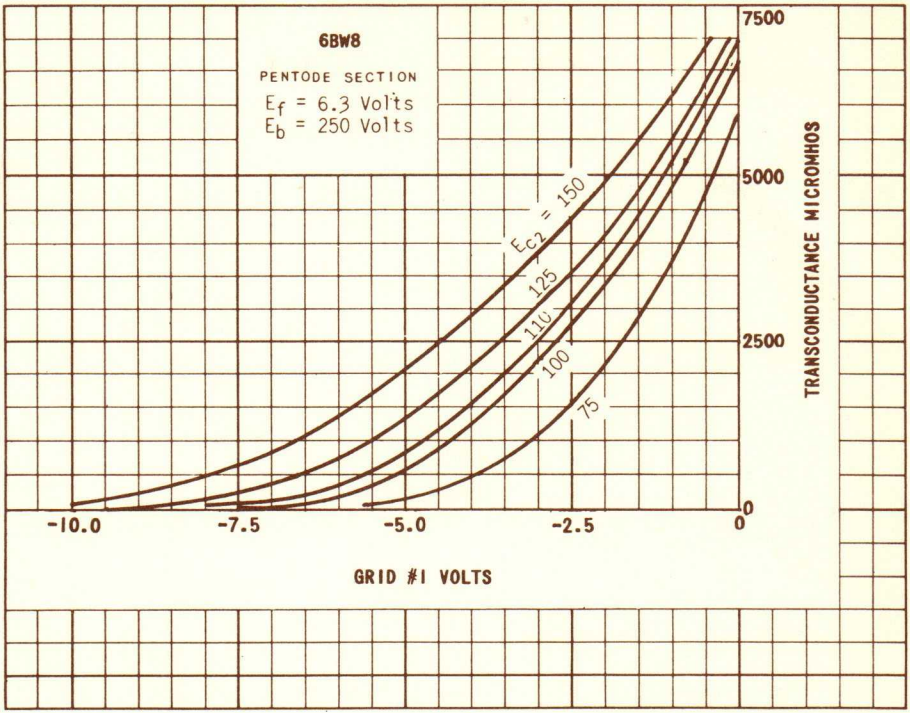


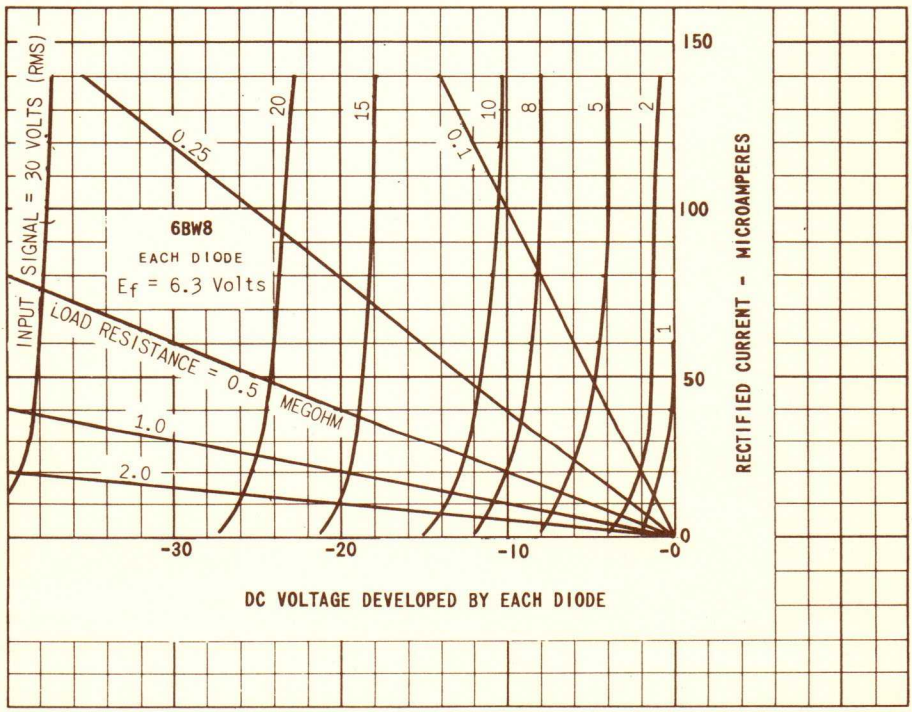

6BW8
PENTODE SECTION
Ef = 6.3 Volts
Ec1 = 0 Volts
Ib
Ic2
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
Ec2 = 150
125
110
100
75
0
10
20
30
100
200
300
400
500


6BW8
PENTODE SECTION
Ef = 6.3 Volts
Ec2 = 110 Volts
Ib
Ic2
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
Ec1=0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-6.0
0
5
10
15
100
200
300
400
500


6BW8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2}=150
125
110
100
75
15
10
5
0
PLATE MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS


6BW8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 150
125
110
100
75
7.5
5.0
2.5
0
GRID #2 MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS





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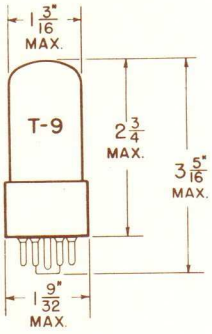
TUNG-SOL

DOUBLE TRIODE

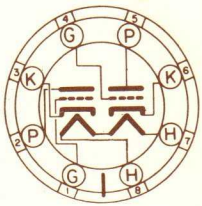


GLASS BULB

COATED UNIPOTENTIAL CATHODES

HEATER
6.3 VOLTS 1.5 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM-VIEW
SHORT INTERMEDIATE SHELL 8 PIN OCTAL
8BD

THE 6BX7GT IS A HIGH PERVEANCE DOUBLE TRIODE DESIGNED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER AND OSCILLATOR IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

	WITHOUT SHIELD	WITH SHIELD[A]	
SECTION I			
GRID TO PLATE: (G TO P)	4.2	4.2	μμf
INPUT: G TO (H+K)	4.4	5	μμf
OUTPUT: P TO (H+K)	1.1	3.4	μμf
SECTION II			
GRID TO PLATE: (G TO P)	4	4	μμf
INPUT: G TO (H+K)	4.8	5	μμf
OUTPUT: P TO (H+K)	1.2	3.2	μμf
GRID TO GRID: (G TO G)	0.11	0.1	μμf
PLATE TO PLATE: (P TO P)	1.5	1.2	μμf

[A] EXTERNAL SHIELD #308 CONNECTED TO CATHODE OF SECTION UNDER TEST.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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CONTINUED FROM PRECEDING PAGE

RATINGS ←

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION AMPLIFIER AND OSCILLATOR[BC]

	OSCILLATOR		AMPLIFIER	
HEATER VOLTAGE		6.3		VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE:				
DC		200		VOLTS
TOTAL DC AND PEAK		200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:				
DC		100		VOLTS
TOTAL DC AND PEAK		200		VOLTS
MAXIMUM DC PLATE VOLTAGE	500		500	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---		2000	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400		250	VOLTS
MAXIMUM DC POSITIVE GRID VOLTAGE	0		0	VDC
MAXIMUM PLATE DISSIPATION[D]	10		10	WATTS
MAXIMUM TOTAL PLATE DISSIPATION		12		WATTS
MAXIMUM AVERAGE CATHODE CURRENT	60		60	MA.
MAXIMUM PEAK CATHODE CURRENT	180		180	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	2.2		2.2	MEGOHMS

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE IN TELEVISION BROADCASTING STATIONS, FEDERAL COMMUNICATIONS COMMISSION". THE DURATION OF THE VOLTAGE PULSE IS NOT TO EXCEED 15% OF ONE SCANNING CYCLE.

[C] WHEN ONE SECTION IS OPERATED AS AN OSCILLATOR IT IS RECOMMENDED THAT SECTION #1 (PINS 4, 5 AND 6) BE USED.

[D] 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.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

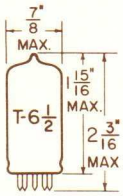
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	1.5		AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #1 VOLTAGE	0	0	VOLTS
CATHODE RESISTOR	0	390	OHMS
PLATE CURRENT	80	42	MA.
TRANSCONDUCTANCE	---	7600	μMHOS
AMPLIFICATION FACTOR	---	10	
PLATE RESISTANCE (APPROX.)	---	1300	OHMS
GRID VOLTAGE FOR I_b = 50 μA	---	-40	VOLTS

→ INDICATES A CHANGE.

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

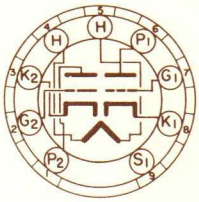


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON NOVAL
9 PIN BASE
9AJ

THE 6BX8 IS A MINIATURE TWIN TRIODE DESIGNED FOR OPERATION AS A CASCODE (VHF) AMPLIFIER IN TELEVISION RECEIVERS WHERE LOW SUPPLY VOLTAGES ARE EMPLOYED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6BX8 IS IDENTICAL TO THE 4BX8.

DIRECT INTERELECTRODE CAPACITANCES[A]

	#1 TRIODE	#2 TRIODE	
GRID TO PLATE (G TO P)	1.4	1.4	μμf
PLATE TO CATHODE (P TO K)	.165	.165	μμf
#2 INPUT: G TO (H+K+I.S.)	---	2.4	μμf
#1 INPUT: K TO (H+G+I.S.)[B]	4.9	---	μμf
#2 OUTPUT: P TO (H+K+I.S.)	---	1.25	μμf
#1 OUTPUT: P TO (H+G+I.S.)[B]	2.6	---	μμf

RATINGS[C]

INTERPRETED ACCORDING TO DESIGN-MAXIMUM VALUES
EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	150	VOLTS
MAXIMUM DC CATHODE CURRENT	20	MA.
MAXIMUM PLATE DISSIPATION	2.0	WATTS
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
MAXIMUM CIRCUIT VALUE: (EACH UNIT)		
GRID CIRCUIT RESISTANCE	0.5	MEGOHM
HEATER WARM-UP TIME*	11.0	SECONDS

[A] EXTERNAL SHIELD #315 CONNECTED TO PIN 9.

[B] READ AS GROUNDED GRID AMPLIFIER.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

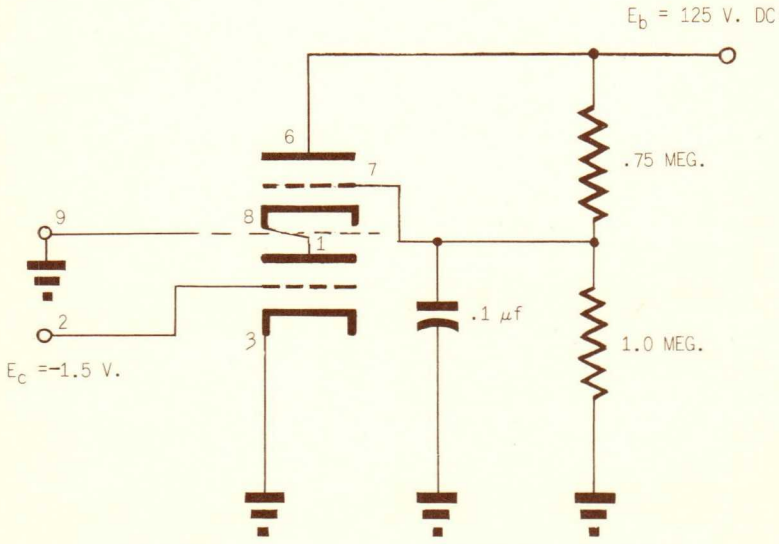
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	65	VOLTS
GRID VOLTAGE	-1.0	VOLTS
AMPLIFICATION FACTOR	25	
PLATE CURRENT	9	MA.
GRID VOLTAGE (APPROX.) FOR Ib = 10 μA	-7	VOLTS
TRANSCONDUCTANCE	6 700	μMHOS

AVERAGE CHARACTERISTICS – CASCODE OPERATION ·

PLATE SUPPLY VOLTAGE	125	VOLTS
GRID VOLTAGE	-.5	VOLTS
PLATE CURRENT	11	MA.
TRANSCONDUCTANCE	7 500	μMHOS

CDESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

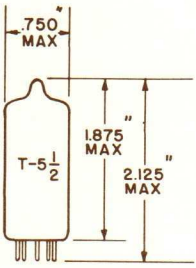


CASCODE TEST CIRCUIT.

TUNG-SOL

HEPTODE

MINIATURE TYPE

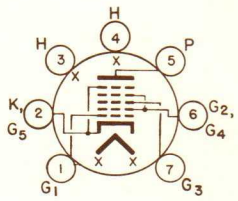


GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

FOR USE
AS A GATED AMPLIFIER IN
TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CH

THE 6BY6 IS A PENTAGRID AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED ESPECIALLY FOR USE AS A GATED AMPLIFIER IN TV RECEIVERS. IN SUCH SERVICE, IT MAY BE USED AS A COMBINED SYNC SEPARATOR AND SYNC CLIPPER.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.08	pf
GRID #3 TO PLATE (MAX.)	0.35	pf
GRID #1 TO GRID #3 (MAX.)	0.22	pf
GRID #1 TO ALL OTHER ELECTRODES AND HEATER	5.4	pf
GRID #3 TO ALL OTHER ELECTRODES AND HEATER	6.9	pf
PLATE TO ALL OTHER ELECTRODES AND HEATER	7.6	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[B]	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

GATED AMPLIFIER SERVICE

PLATE VOLTAGE	→ 330	VOLTS
GRID #2 & #4 VOLTAGE	SEE RATING CHART	
GRID #2 & #4 SUPPLY VOLTAGE	→ 330	VOLTS
GRID #3 VOLTAGE:		
NEGATIVE BIAS VALUE	→ 55	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
POSITIVE PEAK VALUE	→ 27	VOLTS

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TUNG-SOL

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MAXIMUM RATINGS - CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

GATED AMPLIFIER SERVICE

GRID #1 VOLTAGE:		
NEGATIVE BIAS VALUE	→110	VOLTS
PLATE DISSIPATION	→2.3	WATTS
GRID #3 INPUT	0.1	WATT
GRIDS #2 & #4 INPUT:*		
FOR GRIDS #2 & #4 VOLTAGES UP TO 165 VOLTS	1.1	WATTS
FOR GRIDS #2 & #4 VOLTAGES BETWEEN 165 VOLTS AND 330 VOLTS	SEE RATING CHART	
GRID #1 INPUT	0.1	WATT
GRID #1 OR GRID #3 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.5	MEGOHM
CATHODE BIAS OPERATION	1.0	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRIDS #2 & #4 VOLTAGE	100	VOLTS
GRID #3 VOLTAGE	-2.5	VOLTS
GRID #1 VOLTAGE	-2.5	VOLTS
GRID #3 TO PLATE TRANSCONDUCTANCE	500	μMHOS
GRID #1 TO PLATE TRANSCONDUCTANCE	1 900	μMHOS
PLATE CURRENT	6.5	MA.
GRID #2 & #4 CURRENT	9	MA.
GRID #3 VOLTS (APPROX.) FOR I_b = 35 μAMP. AND GRID #1 VOLTS = -4	-15	VOLTS
GRID #1 VOLTS (APPROX.) FOR I_b = 35 μAMP. AND GRID #3 VOLTS = 0	-12	VOLTS

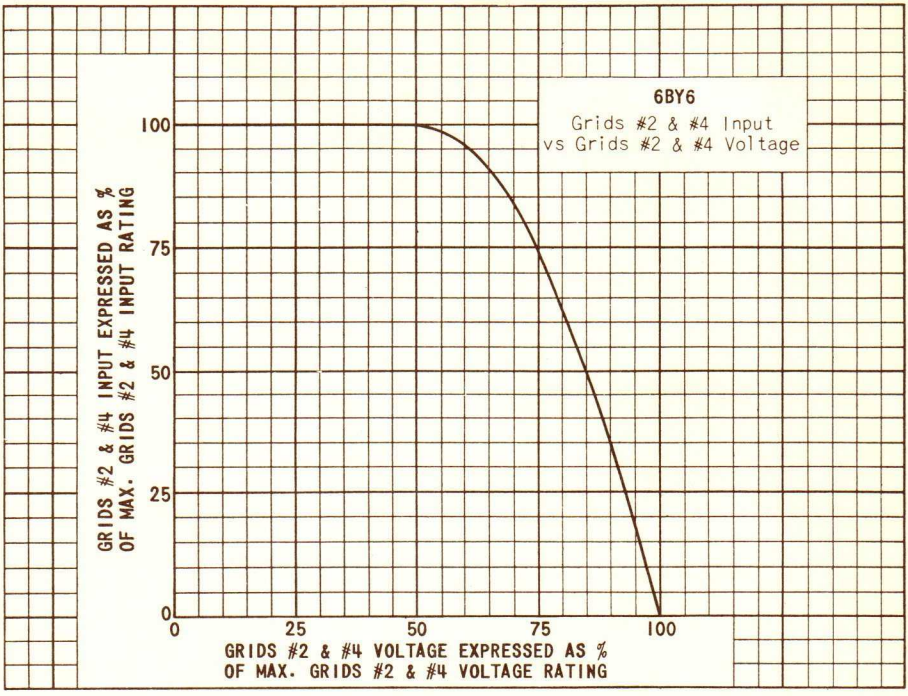
SYNC SEPARATOR AND SYNC CLIPPER

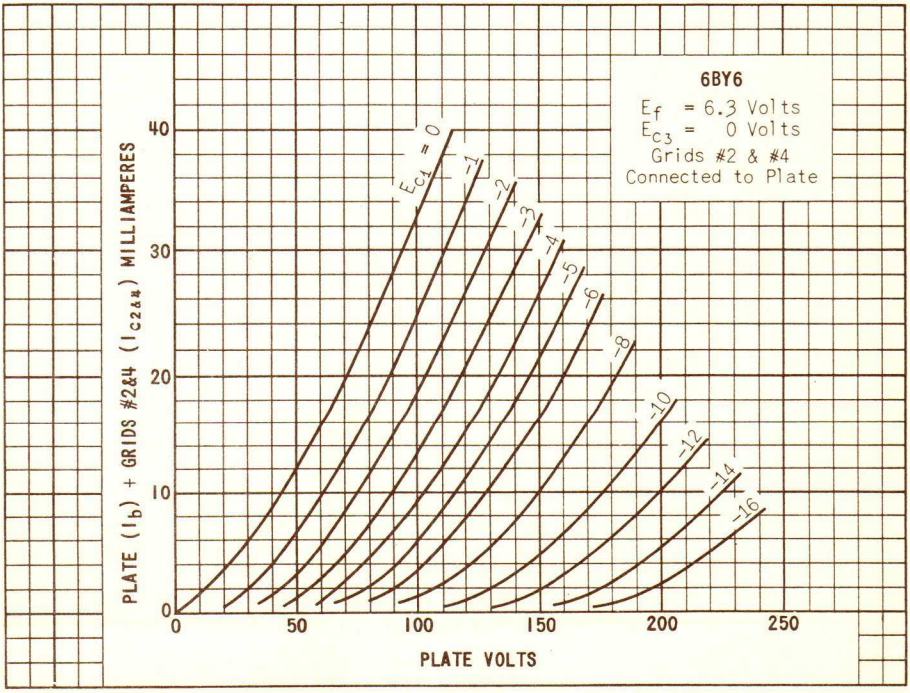
PLATE VOLTAGE	10	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 & #4 VOLTAGE	25	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE CURRENT	1.4	MA.
GRIDS #2 & #4 CURRENT	3.5	MA.
GRID #3 BIAS VOLTS (APPROX.) FOR PLATE VOLTAGE OF 25 VOLTS, GRIDS #2 & #4 VOLTAGE OF 25 VOLTS, GRID #1 VOLTAGE OF 0 VOLTS AND PLATE CURRENT OF 50 μAMP.	-2.5	VOLTS
GRID #1 BIAS VOLTAGE (APPROX.) FOR PLATE VOLTAGE OF 25 VOLTS, GRIDS #2 & #4 VOLTAGE OF 25 VOLTS, GRID #3 VOLTAGE OF 0 VOLTS AND PLATE CURRENT OF 50 μAMP.	-2.3	VOLTS

[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.

* INDICATES AN ADDITION.





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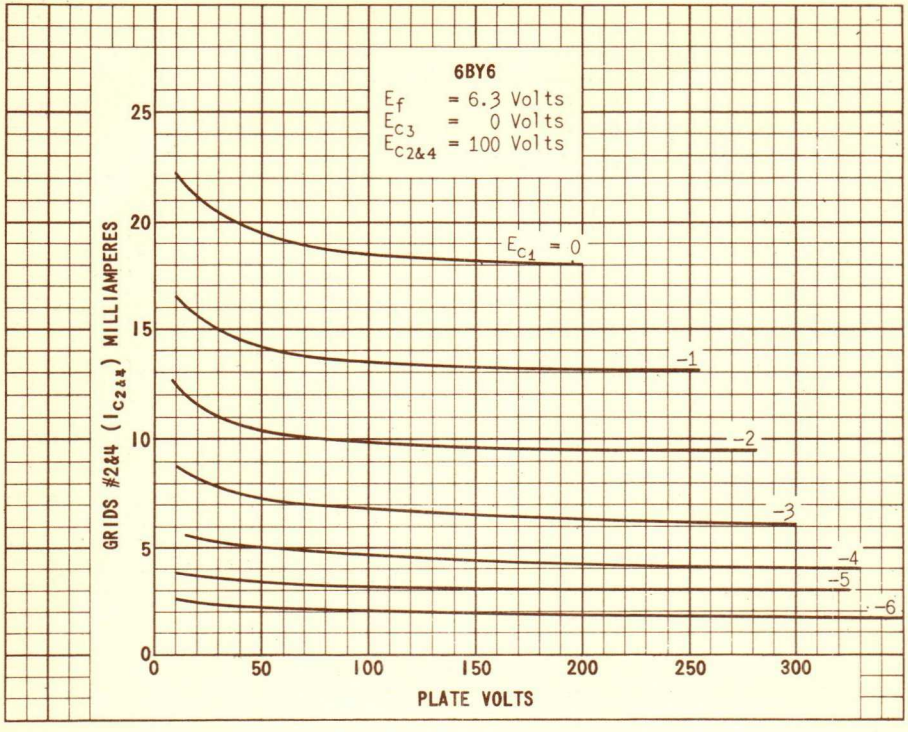
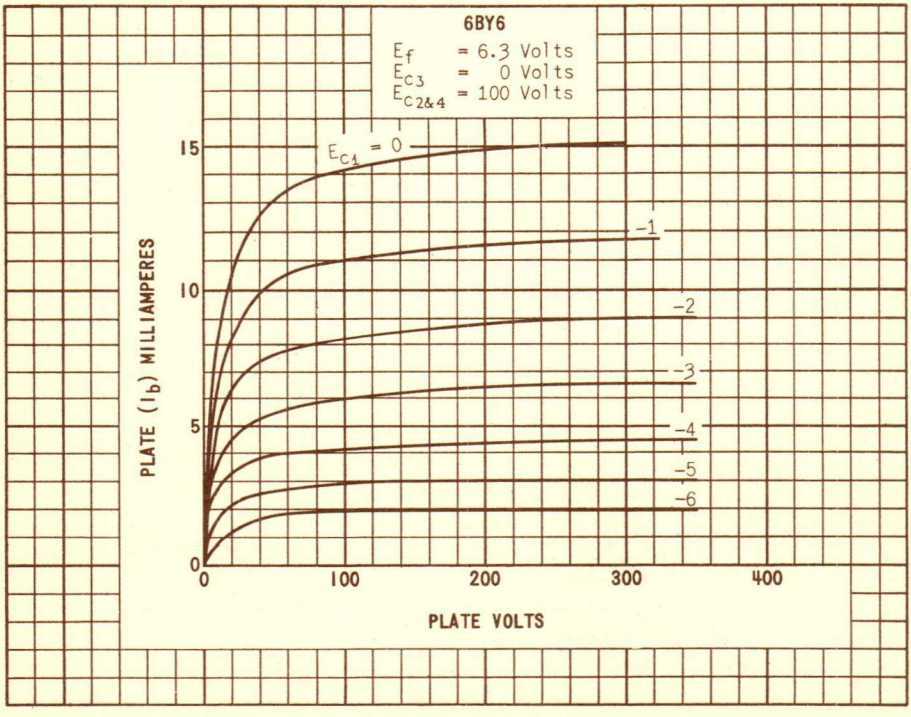
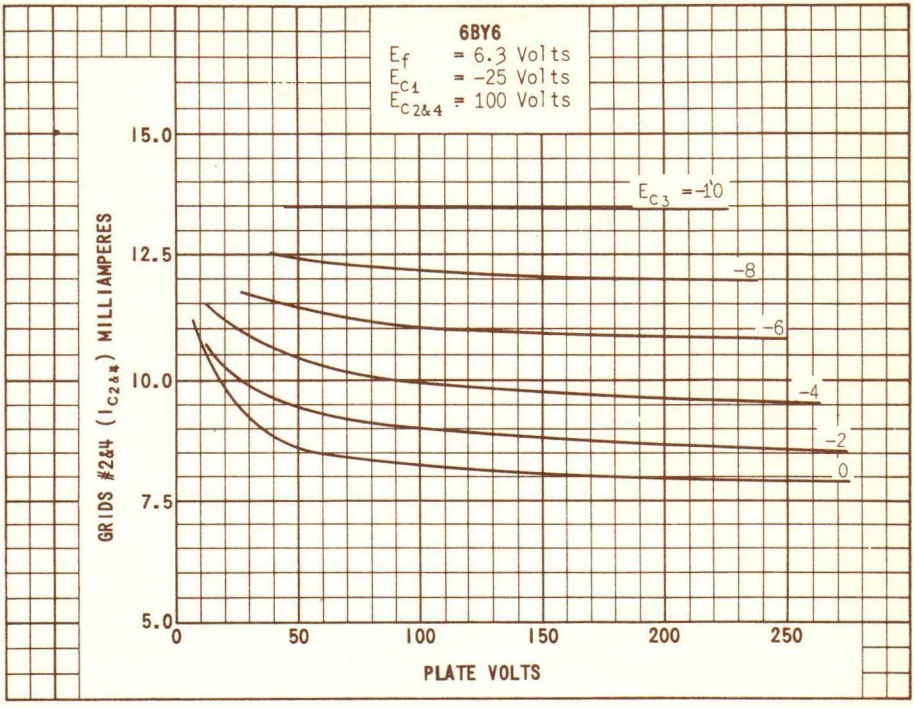
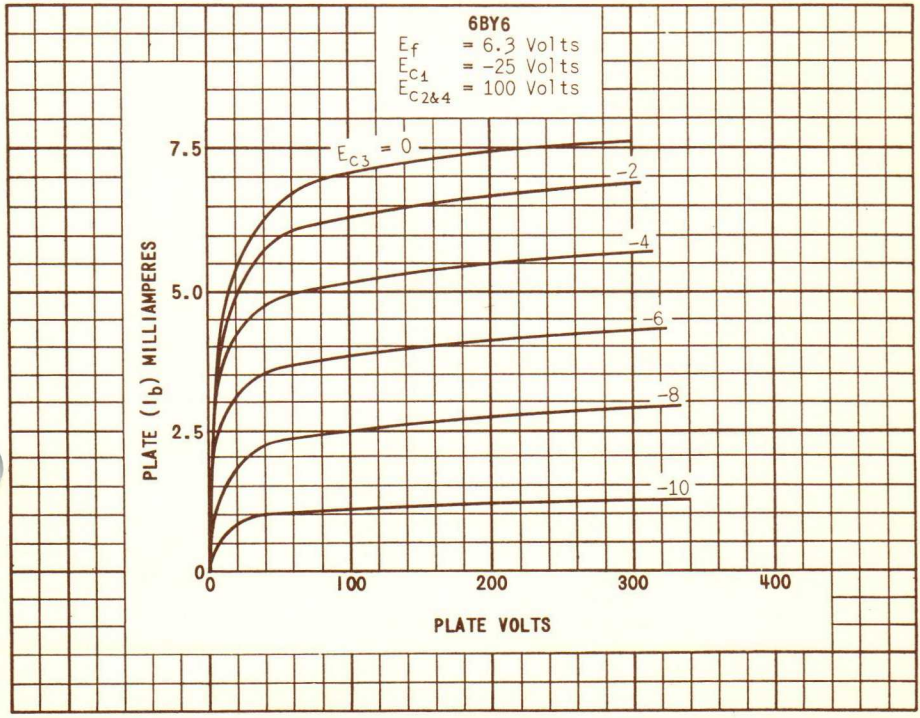
6BY6


6BY6
E_f = 6.3 Volts
E_{c3} = 0 Volts
$E_{c2\&4}$ = 100 Volts
E_{c1} = 0
-1
-2
-3
-4
-5
-6
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
0
5
10
15
20
25
0
50
100
150
200
250
300
PLATE VOLTS


6BY6
E_f = 6.3 Volts
E_{c3} = 0 Volts
$E_{c2\&4}$ = 100 Volts
E_{c1} = 0
-1
-2
-3
-4
-5
-6
PLATE (I_b) MILLIAMPERES
0
5
10
15
0
100
200
300
400
PLATE VOLTS

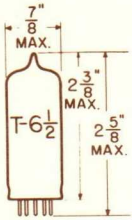

6BY6
E_f = 6.3 Volts
E_{c1} = -25 Volts
$E_{c2\&4}$ = 100 Volts
E_{c3} = -10
-8
-6
-4
-2
0
15.0
12.5
10.0
7.5
5.0
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
0
50
100
150
200
250
PLATE VOLTS


6BY6
E_f = 6.3 Volts
E_{c1} = -25 Volts
$E_{c2\&4}$ = 100 Volts
E_{c3} = 0
-2
-4
-6
-8
-10
7.5
5.0
2.5
0
PLATE (I_b) MILLIAMPERES
0
100
200
300
400
PLATE VOLTS

TUNG-SOL

DIODE-PENTODE

MINIATURE TYPE

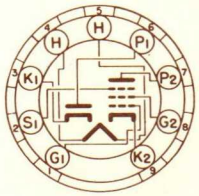


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL GLASS BUTTON
9 PIN BASE

THE 6BY8 IS A MINIATURE HIGH PERVEANCE DIODE, SHARP CUTOFF PENTODE WHOSE DESIGN LENDS ITSELF FOR USE AS AN AMPLIFIER ALONG WITH A HIGH PERVEANCE DIODE SUITABLE FOR USE AS A LIMITER OR A DETECTOR. THE PENTODE SECTION IS SIMILAR TO THE TYPE 6AU6. THE DIODE IS SIMILAR TO ONE SECTION OF A TYPE 6AL5. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES[A]

PENTODE GRID #1 TO PENTODE PLATE (G_1 TO P) (MAX.)	.0035	μμf
PENTODE INPUT: G_1 TO (H+K+G_2+G_3,SH)	5.5	μμf
PENTODE OUTPUT: P TO (H+K+G_2+G_3,SH)	5.0	μμf
DIODE PLATE TO ALL: DP TO (H+Kd+Kp+G_1+G_2+G_3,SH,+P)	4.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

PENTODE SECTION		
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4-2	
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	3	WATTS
MAXIMUM GRID #2 DISSIPATION	.65	WATT
MAXIMUM NEGATIVE GRID #1 VOLTAGE	50	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	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
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[A]EXTERNAL SHIELD #315 CONNECTED TO PIN #9.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS – CONT'D
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DIODE SECTION

MAXIMUM PEAK INVERSE PLATE VOLTAGE	430	VOLTS
MAXIMUM PEAK PLATE CURRENT	180	MA.
MAXIMUM DC CURRENT	45	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

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #2 VOLTAGE	100	150	VOLTS
GRID #3 VOLTAGE	PIN 2 CONNECTED TO PIN 9 AT SOCKET		
CATHODE BIAS RESISTOR	150	68	OHMS
PLATE RESISTANCE (APPROX.)	0.5	1.0	MEGOHM
TRANSCONDUCTANCE	3900	5200	μMHOS
GRID #1 VOLTAGE (APPROX.)			
FOR I_b = 10 μA	−4.2	−6.5	VOLTS
PLATE CURRENT	5.0	10.6	MA.
GRID #2 CURRENT	2.1	4.3	MA.

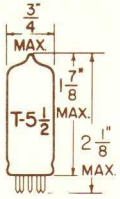
TYPICAL CHARACTERISTICS – DIODE SECTION

AVERAGE DIODE CURRENT AT 10V DC	60	MA.

TUNG-SOL

PENTODE

MINIATURE TYPE

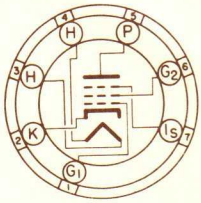


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 6BZ6 IS A HIGH TRANSCONDUCTANCE, SEMI-REMOTE CUT-OFF, PENTODE AMPLIFIER. IT IS DESIGNED FOR SERVICE AS AN AUTOMATIC GAIN CONTROLLED IF AMPLIFIER IN 300 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 3BZ6.

DIRECT INTERELECTRODE CAPACITANCES ←

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G_1 TO P (MAX.)	.015	.025	μμf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	7.0	7.0	μμf
OUTPUT: P TO (H+K+G_2+G_3+IS)	3.0	2.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO CATHODE AT SOCKET.

RATINGS[B]

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

HEATER VOLTAGE	6.3±10% ←	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
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CURVE	
MAXIMUM PLATE DISSIPATION	2.3 ←	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55 ←	WATT
MAXIMUM GRID #2 SUPPLY VOLTAGE	330 ←	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE*	0	VOLTS
		MEGOHM

[B] DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

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→ INDICATES A CHANGE.
* INDICATES AN ADDITION.

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TUNG-SOL

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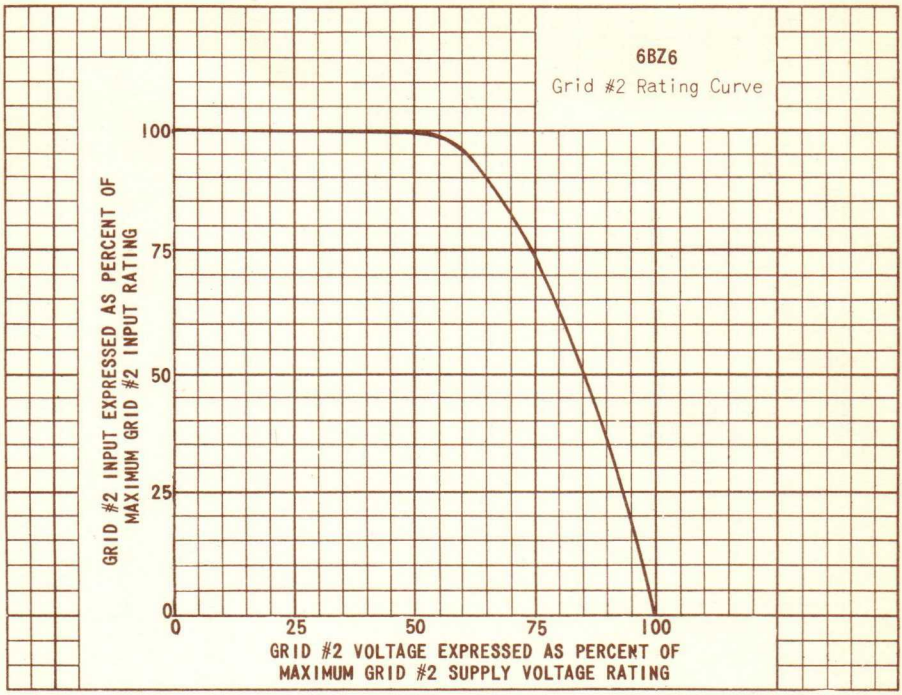
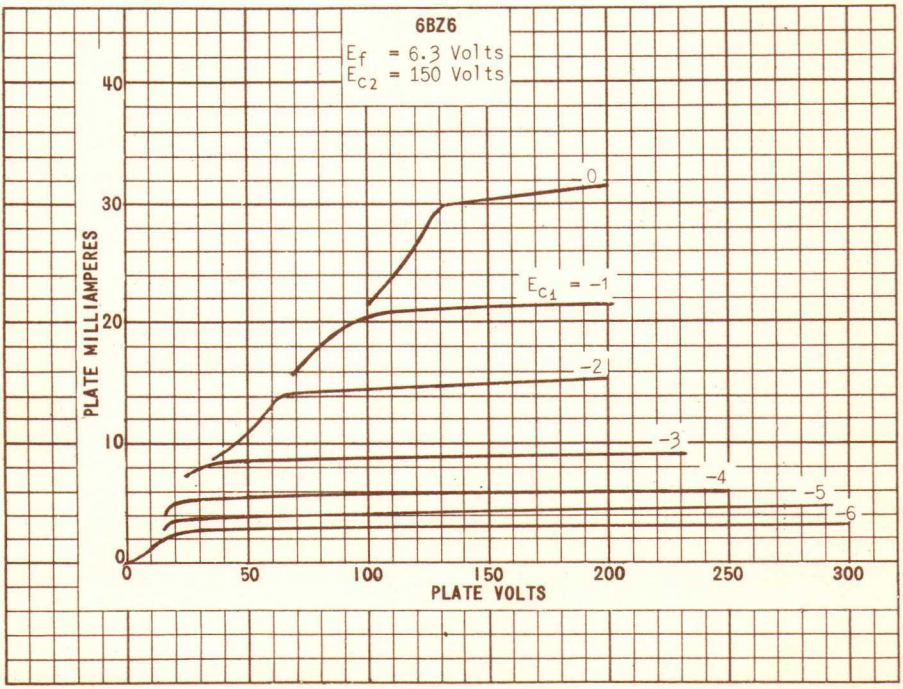
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS ←

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	125	VOLTS
GRID #3 VOLTAGE	PIN #7 CONNECTED TO PIN #2 AT SOCKET	
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.26	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
PLATE CURRENT	14	MA.
GRID #2 CURRENT	3.6	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 50 μMHOS	−19	VOLTS
TRANSCONDUCTANCE (E_{c1}=−4.5 V., Rk=0)	700	μMHOS





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6BZ6

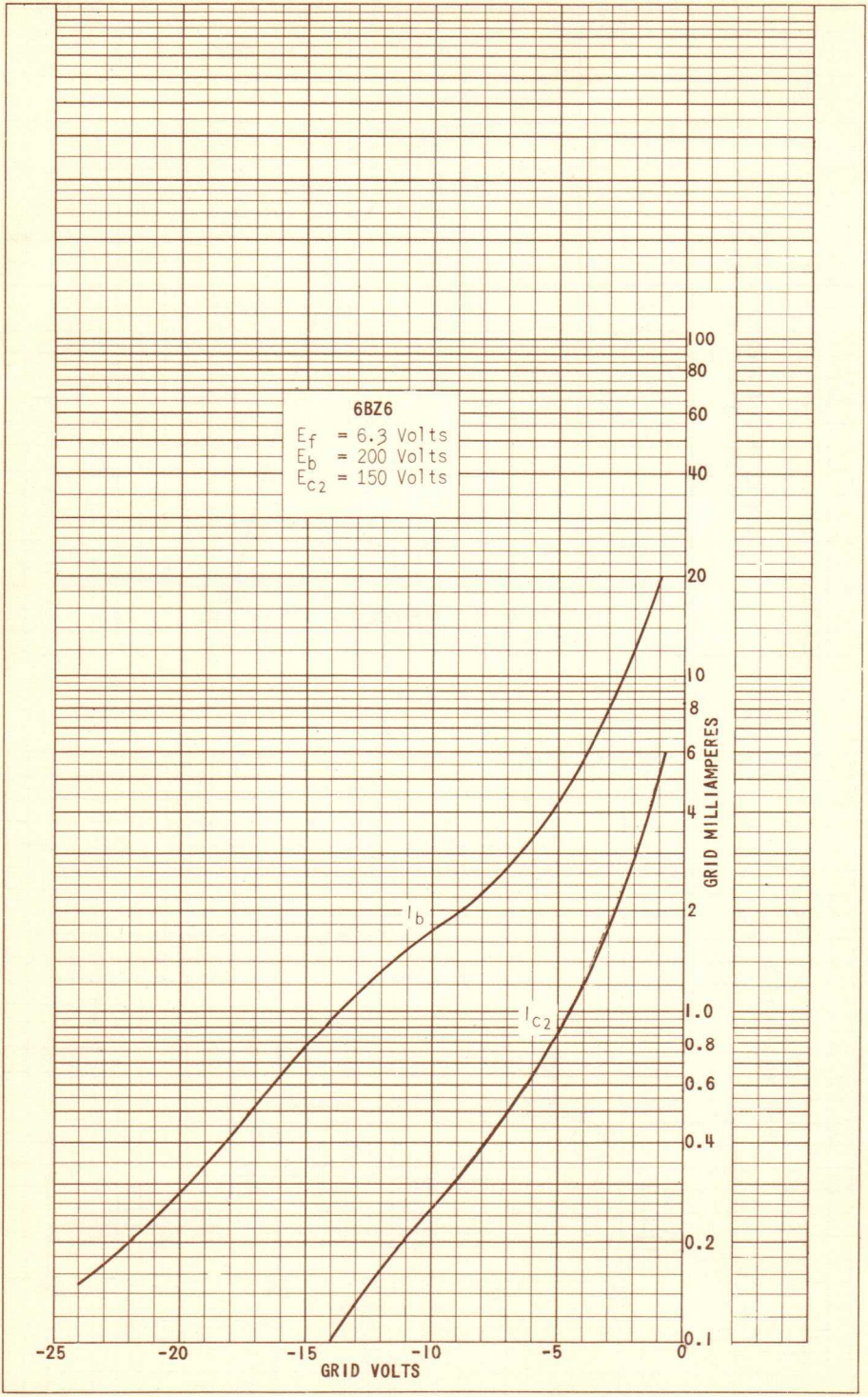
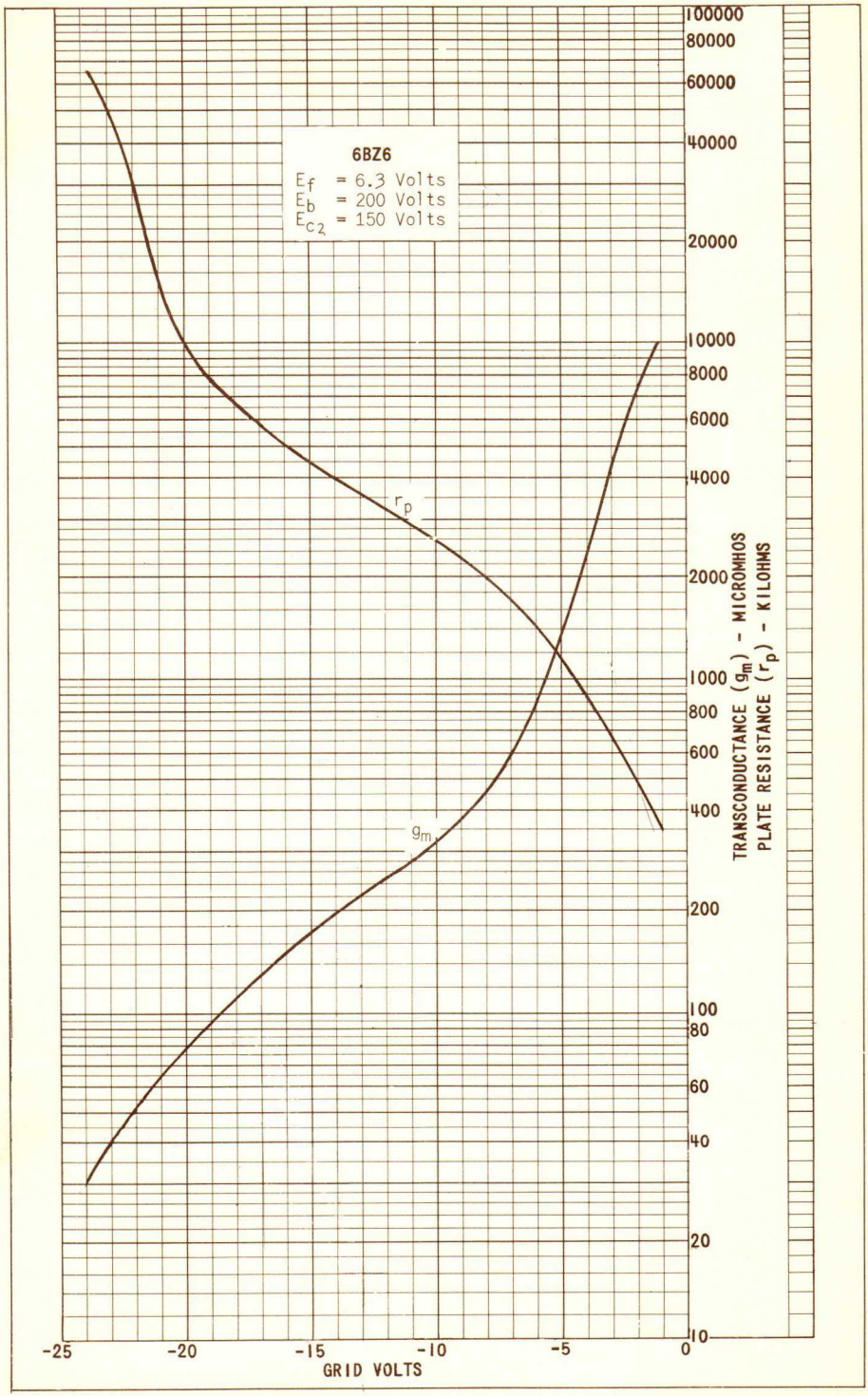


PLATE #3839 JULY 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.



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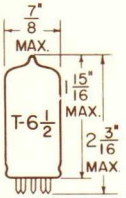
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

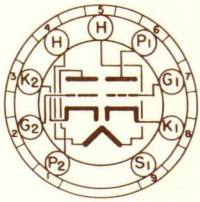


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AJ

THE 6BZ7 IS A MEDIUM MU DOUBLE TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN LOW NOISE VHF CASCODE AMPLIFIER APPLICATIONS.

→DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315

	TRIODE UNIT #1		TRIODE UNIT #2	
GRID TO PLATE: (G TO P)	1.2		1.2	μμf
PLATE TO CATHODE: (P TO K)	0.12		0.12	μμf
HEATER TO CATHODE: (H TO K)	2.6		2.6	μμf
#1 INPUT: G TO (H+K+I.S.)	2.6		---	μμf
#2 INPUT: K TO (H+G+I.S.)*	---		5.0	μμf
#1 OUTPUT: P TO (H+K+I.S.)	1.2		---	μμf
#2 OUTPUT: P TO (H+G+I.S.)*	---		2.2	μμf
#1 PLATE TO #2 PLATE: (1P TO 2P) (MAX.)		0.010		μμf
#2 PLATE TO #1 PLATE & GRID: (2P TO 1P+1G) (MAX.)		0.024		μμf

*READ AS GROUNDED GRID AMPLIFIER.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
EACH TRIODE UNIT

HEATER VOLTAGE	6.3	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
MAXIMUM PLATE VOLTAGE **	250	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHM

** THIS RATING MAY BE AS HIGH AS 300 VOLTS UNDER CUTOFF CONDITIONS, WHEN THE TUBE IS USED AS A CASCODE AMPLIFIER AND THE TWO SECTIONS ARE CONNECTED IN SERIES.

→INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	36	
PLATE RESISTANCE	→ 5 300	OHMS
TRANSCONDUCTANCE	6 800	μMHOS
PLATE CURRENT	10	MA.
GRID VOLTAGE FOR I_b = 100 μA (APPROX.)	→ −7	VOLTS

TUNG-SOL

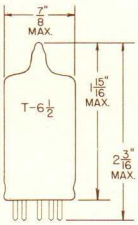
TWIN TRIODE

MINIATURE TYPE

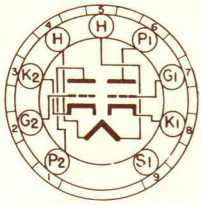
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AJ

THE 6BZ8 IS A MEDIUM MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN LOW NOISE VHF AMPLIFIER CASCODE OPERATION WITH THE SECTION #1 AS THE INPUT SECTION OF THE CASCODE CIRCUIT. WITH THE EXCEPTION OF HEATER WARM-UP TIME AND HEATER CHARACTERISTICS, THE 6BZ8 IS IDENTICAL TO THE 4BZ8.

DIRECT INTERELECTRODE CAPACITANCES
WITH EXTERNAL SHIELD #315

	#1 TRIODE	#2 TRIODE	
GRID TO PLATE (G TO P)	1.15	---	μμf
PLATE TO CATHODE (P TO K)	---	0.15	μμf
#1 TRIODE PLATE TO #2 TRIODE PLATE P_1 TO P_2	.010	---	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	0.1	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER - EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	125	VOLTS
CATHODE RESISTOR	100	OHMS
PLATE RESISTANCE	5 600	OHMS
TRANSCONDUCTANCE	8 000	μMHOS
AMPLIFICATION FACTOR	45	
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR G_m = 50 μMHOS	-13	VOLTS
CASCODE TRANSCONDUCTANCE (E_b 250V E_{c1} -0.5V)	10 000	μMHOS
CASCODE PLATE CURRENT (E_b 250V E_{c1} -0.5V)	15	MA.

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TUNG-SOL

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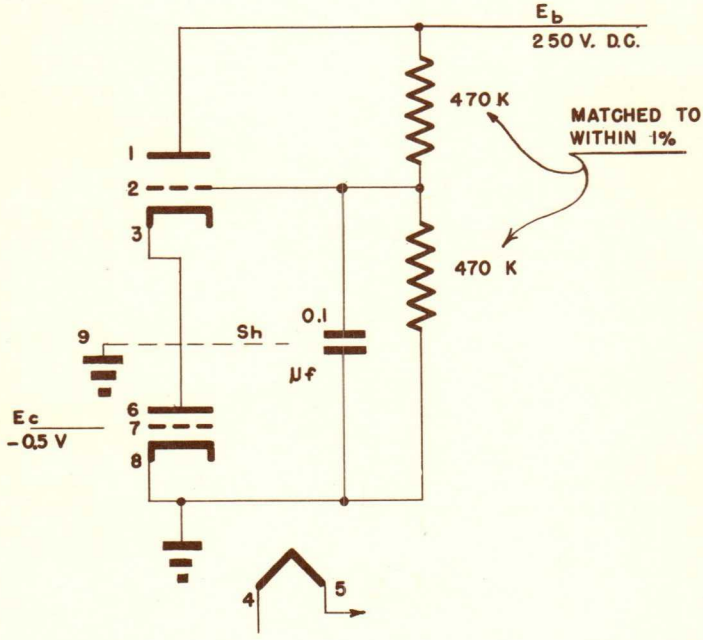
CASCODE TRANSCONDUCTANCE TEST CIRCUIT



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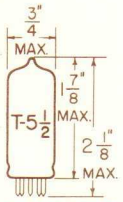
TRIODE

MINIATURE TYPE

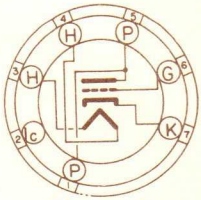


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6BG

THE 6C4 IS A LOW-MU TRIODE VOLTAGE AMPLIFIER OF THE MINIATURE TYPE. IT IS PARTICULARLY USEFUL AS A HIGH FREQUENCY LOW-POWER OSCILLATOR DUE TO ITS HIGH TRANSCONDUCTANCE, LOW CAPACITANCES AND LEAD INDUCTANCES. LOW HEATER POWER REQUIREMENTS MAKE IT ATTRACTIVE FOR USE IN PORTABLE AND ALSO IN SERIES-HEATER CONNECTED CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
GRID TO PLATE: (G TO P)	1.4	1.6	μμf
INPUT: G TO (H+K)	1.8	1.8	μμf
OUTPUT: P TO (H+K)	2.5	1.3	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	CLASS A1 AMPLIFIER	CLASS C TELEGRAPHY	
HEATER VOLTAGE	6.3		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
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	---	-50	VOLTS
MAXIMUM PLATE DISSIPATION	3.5	5	WATTS
MAXIMUM DC PLATE CURRENT	---	25	MA.
MAXIMUM DC GRID CURRENT	---	8	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:			
FIXED BIAS OPERATION	0.25	0.25	MEGOHM
CATHODE BIAS OPERATION	1.0	1.0	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE[B]	0	-8.5	VOLTS
AMPLIFICATION FACTOR	19.5	17	
PLATE RESISTANCE	6 250	7 700	OHMS
TRANSCONDUCTANCE	3 100	2 200	μMHOS
PLATE CURRENT	11.8	10.5	MA.
GRID VOLTAGE FOR I_b = 10 μA. (APPROX.)	-10	-25	VOLTS

[B] TRANSFORMER OR IMPEDANCE-TYPE INPUT COUPLING DEVICES ARE RECOMMENDED TO MINIMIZE RESISTANCE IN THE GRID CIRCUIT.

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← INDICATES A CHANGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS C – TELEGRAPHY[C]

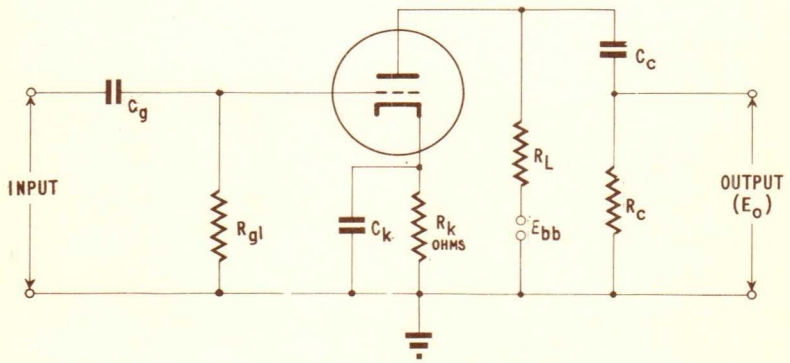
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	300	VOLTS
GRID VOLTAGE	−27	VOLTS
PLATE CURRENT	25	MA.
GRID CURRENT (APPROX.)	7	MA.
GRID DRIVING POWER (APPROX.)	0.35	WATT
POWER OUTPUT (APPROX.)	5.5	WATTS

[C] 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.

RESISTANCE COUPLED AMPLIFIER

R_L MEG.	R_{g1} MEG.	R_c MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	A	0.10	3000	11	12	2000	12	23	1600	13	34
0.10	A	0.24	3300	12	15	2400	12	30	1800	13	40
0.24	A	0.24	7500	12	14	4700	13	25	3600	13	37
0.24	A	0.51	8200	12	16	6200	13	32	4300	13	43
0.51	A	0.51	12000	12	13	8200	13	24	6200	13	33
0.51	A	1.0	13000	12	15	9100	13	28	6800	13	36
0.24	10	0.24	---	13	12	----	15	24	----	16	35
0.24	10	0.51	---	14	15	----	16	28	----	17	49
0.51	10	0.51	---	14	13	----	15	25	----	17	40
0.51	10	1.0	---	14	16	----	16	32	----	17	54

[A] VALUE OF R_{g1} IS NOT CRITICAL.
GAIN MEASURED AT E_o = 2.0 VOLTS RMS OUTPUT.
E_o IS RMS OUTPUT FOR 5% TOTAL HARMONIC DISTORTION.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

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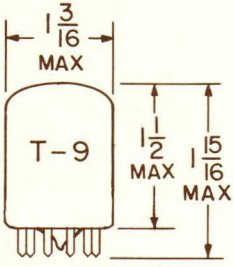
TRIPLE TRIODE



GLASS BULB

BUTTON
12 PIN BASE E12-70

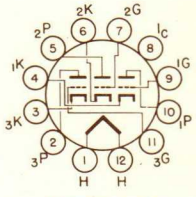
OUTLINE DRAWING
JEDEC 9-62

COATED UNIPOTENTIAL CATHODE

→HEATER NOMINAL

6.3 VOLTS 0.6±0.04 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12BQ

THE 6C10 CONTAINS THREE HIGH-MU TRIODES WITH SEPARATE PIN CONNECTIONS FOR ALL THREE CATHODES, GRIDS AND PLATES IN A COMPACT T-9 GLASS ENVELOPE WITH THE NOVEL 12 PIN BASE.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (EACH SECTION)	1.7	pf
INPUT (EACH SECTION)	1.6	pf
OUTPUT (SECTION 1)	0.30	pf
OUTPUT (SECTION 2)	0.24	pf
OUTPUT (SECTION 3)	0.34	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

EACH SECTION

HEATER VOLTAGE	6.3±0.6	VOLTS
HEATER CURRENT	0.6±0.04	AMP.
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION, EACH PLATE	1.0	WATTS
MAXIMUM TOTAL PLATE DISSIPATION, ALL PLATES	3.0	WATTS
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
HEATER WARM-UP TIME*	11*	SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER
EACH SECTION

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1.0	-2.0	VOLTS
AMPLIFICATION FACTOR	100	100	
PLATE RESISTANCE	80 000	62 500	OHMS
TRANSCONDUCTANCE	1 250	1 600	μMHOS
PLATE CURRENT	0.5	1.2	MA.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A] HEATER VOLTAGE SUPPLY VARIATIONS TO MAINTAIN HEATER VOLTAGE OR CURRENT WITHIN THE SPECIFIED RATINGS.

* THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VALUE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE EQUAL TO 3 TIMES THE RATED HEATER VOLTAGE DIVIDED BY THE RATED HEATER CURRENT.

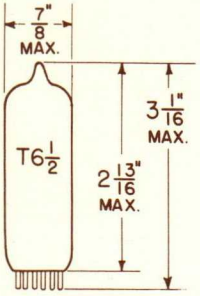
*INDICATES AN ADDITION.

→ INDICATES A CHANGE.

TUNG-SOL

TWIN DIODE

MINIATURE TYPE



GLASS BULB

6-4

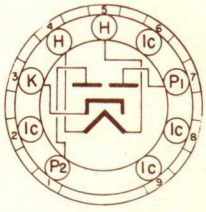
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 1.0 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN, BASE
9M

THE 6CA4 IS A HEATER-CATHODE TWIN DIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR FULL-WAVE RECTIFIER OPERATION, AND ESPECIALLY SUITABLE FOR COMPACT AMPLIFIER DESIGNS.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

RECTIFIER SERVICE

MAXIMUM PEAK INVERSE PLATE VOLTAGE	1200	VOLTS
MAXIMUM AC PLATE-SUPPLY VOLTAGE PER PLATE	SEE RATING CHART #1	
MAXIMUM STEADY STATE PEAK PLATE CURRENT PER PLATE	500	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT PER PLATE, MAXIMUM DURATION 0.2 SECONDS	1.85	AMP.
MAXIMUM DC OUTPUT CURRENT	SEE RATING CHART #1	
MAXIMUM HEATER-CATHODE VOLTAGE: HEATER NEGATIVE WITH RESPECT TO CATHODE	500	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

AC PLATE VOLTAGE PER PLATE, RMS	250	300	350	VOLTS
FILTER INPUT CAPACITOR	50	50	50	μf
TOTAL PLATE-SUPPLY RESISTANCE PER PLATE	150	200	240	OHMS
DC OUTPUT CURRENT	150	150	150	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	245	293	347	VOLTS
TUBE VOLTAGE DROP Ib= 150 MA. DC PER PLATE			20	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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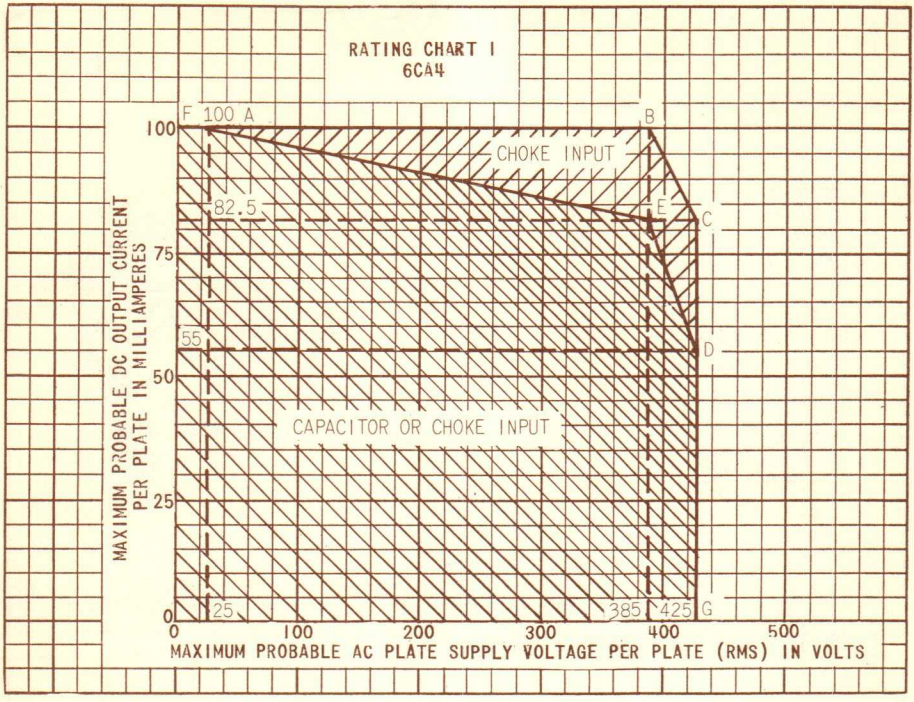
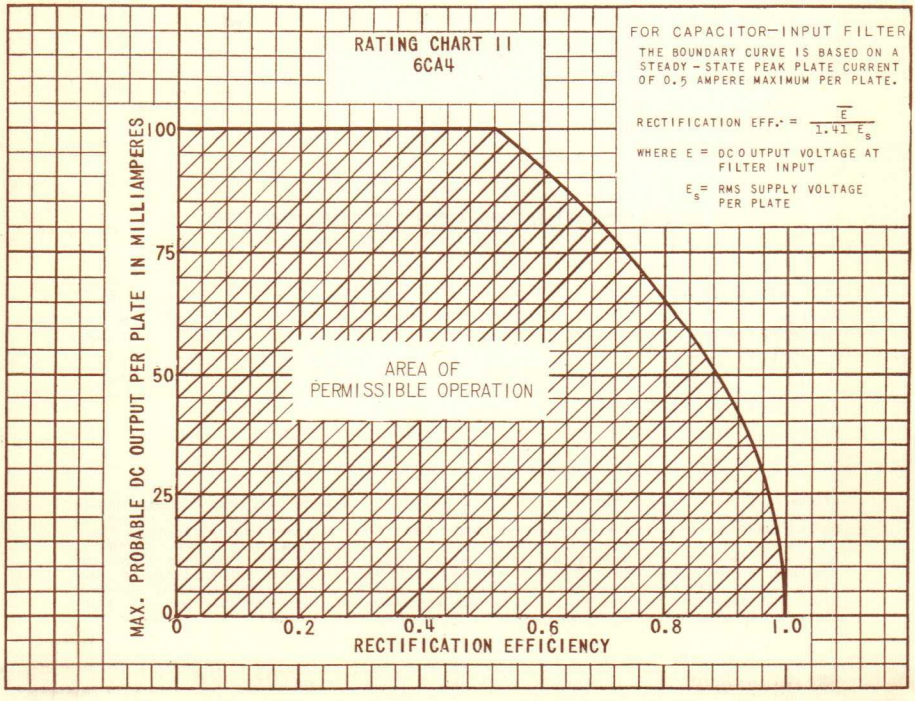
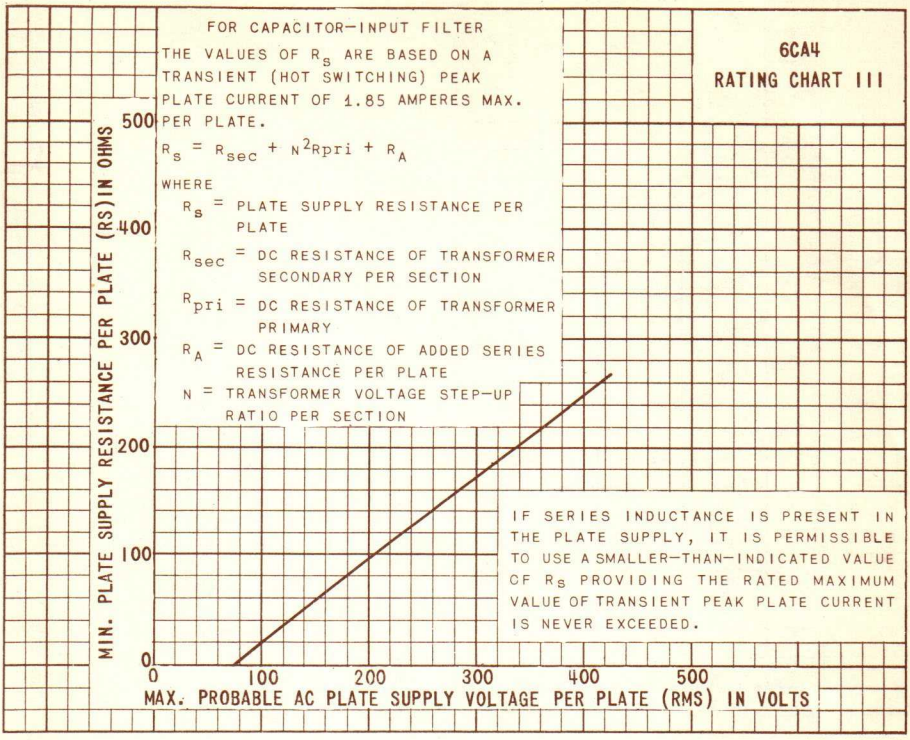
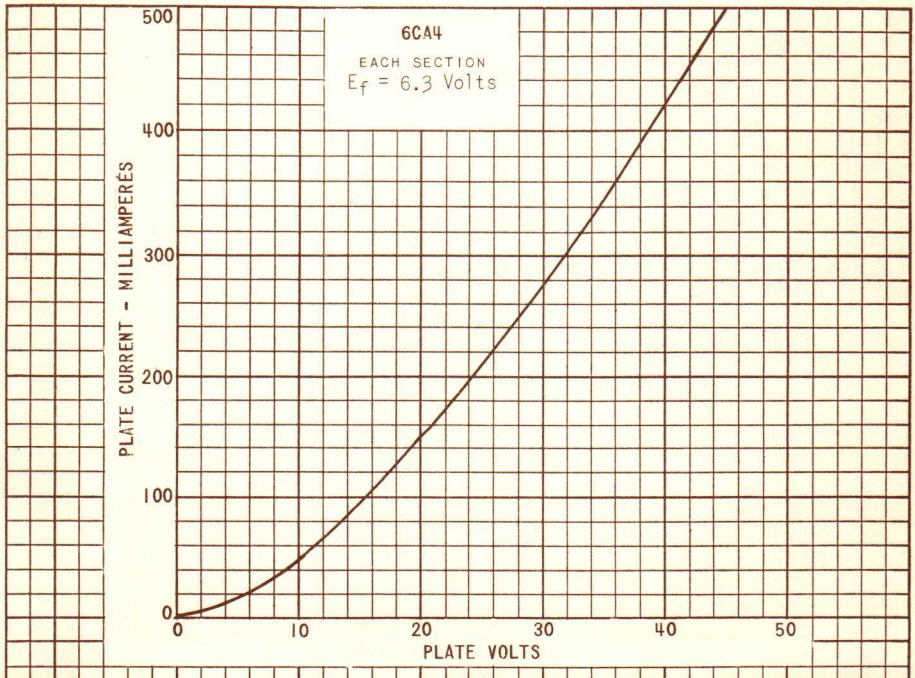

RATING CHART I
6CA4
F 100 A
B
CHOKE INPUT
82.5
E
C
55
D
CAPACITOR OR CHOKE INPUT
25
385
425
G
100
75
50
25
0
0
100
200
300
400
500
MAXIMUM PROBABLE DC OUTPUT CURRENT PER PLATE IN MILLIAMPERES
MAXIMUM PROBABLE AC PLATE SUPPLY VOLTAGE PER PLATE (RMS) IN VOLTS


RATING CHART II
6CA4
FOR CAPACITOR—INPUT FILTER
THE BOUNDARY CURVE IS BASED ON A STEADY-STATE PEAK PLATE CURRENT OF 0.5 AMPERE MAXIMUM PER PLATE.
RECTIFICATION EFF.* = E / 1.41 Es
WHERE E = DC OUTPUT VOLTAGE AT FILTER INPUT
Es = RMS SUPPLY VOLTAGE PER PLATE
AREA OF PERMISSIBLE OPERATION
100
75
50
25
0
0
0.2
0.4
0.6
0.8
1.0
MAX. PROBABLE DC OUTPUT PER PLATE IN MILLIAMPERES
RECTIFICATION EFFICIENCY





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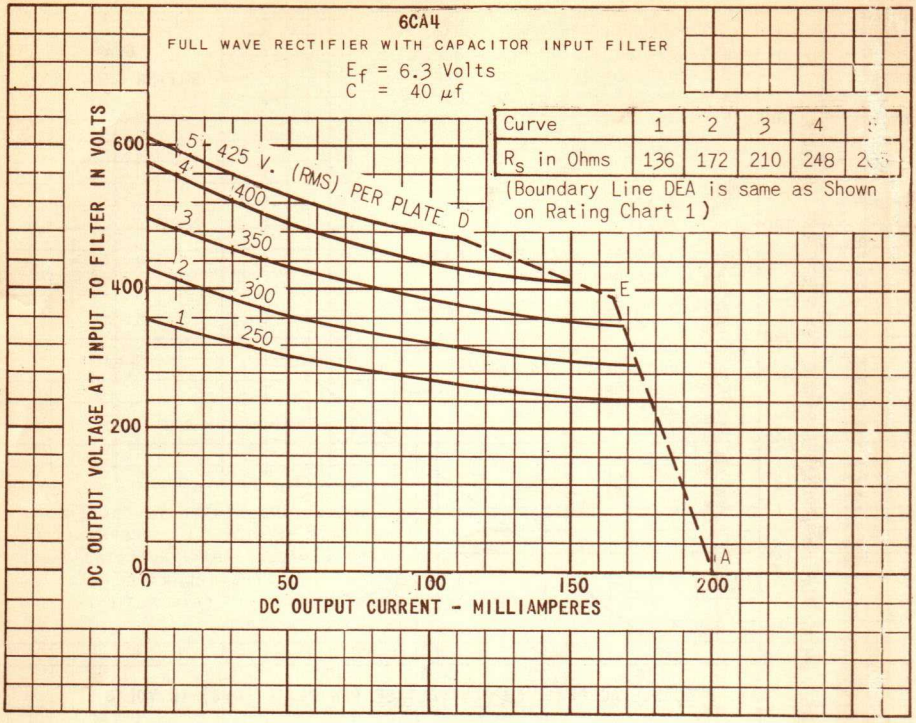
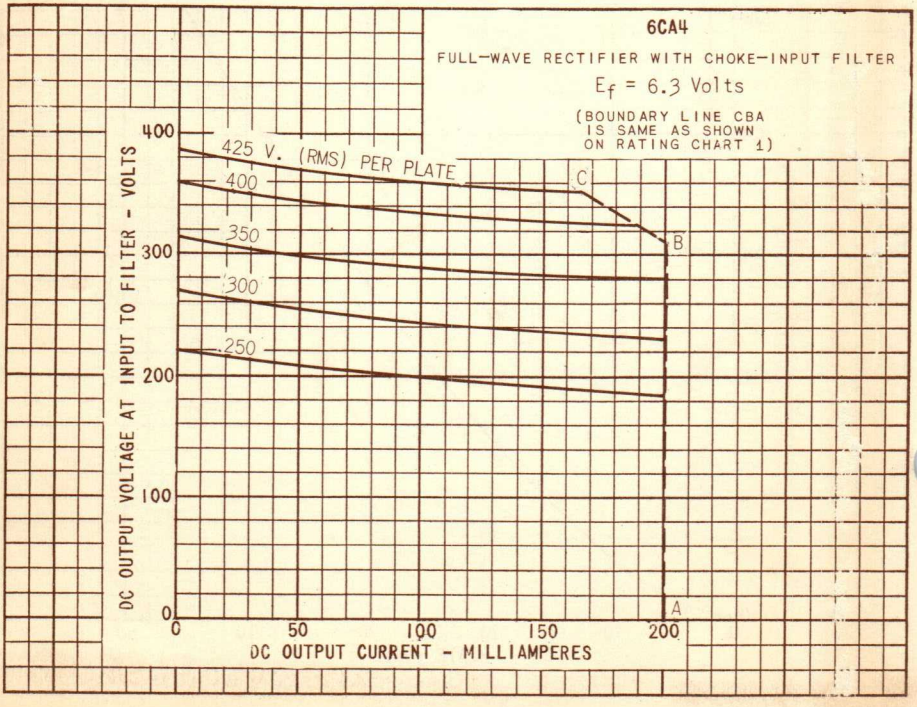

6CA4
FULL WAVE RECTIFIER WITH CAPACITOR INPUT FILTER
E_f = 6.3 Volts
C = 40 μf
Curve | 1 | 2 | 3 | 4 | 5
R_s in Ohms | 136 | 172 | 210 | 248 | 2
(Boundary Line DEA is same as Shown on Rating Chart 1)
DC OUTPUT VOLTAGE AT INPUT TO FILTER IN VOLTS
600
400
200
0
5
4
3
2
1
425 V. (RMS) PER PLATE
400
350
300
250
D
E
A
0
50
100
150
200
DC OUTPUT CURRENT - MILLIAMPERES


6CA4
FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER
E_f = 6.3 Volts
(BOUNDARY LINE CBA IS SAME AS SHOWN ON RATING CHART 1)
DC OUTPUT VOLTAGE AT INPUT TO FILTER - VOLTS
400
300
200
100
0
425 V. (RMS) PER PLATE
400
350
300
250
C
B
A
0
50
100
150
200
DC OUTPUT CURRENT - MILLIAMPERES