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 275C
OCT. 1 1951

TUNG-SOL

INTRODUCTION

These Technical Data Books have been combiled for the use of the Electronics industry. Inclusion of data for a specific tube type does not necessarily mean tnat 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.

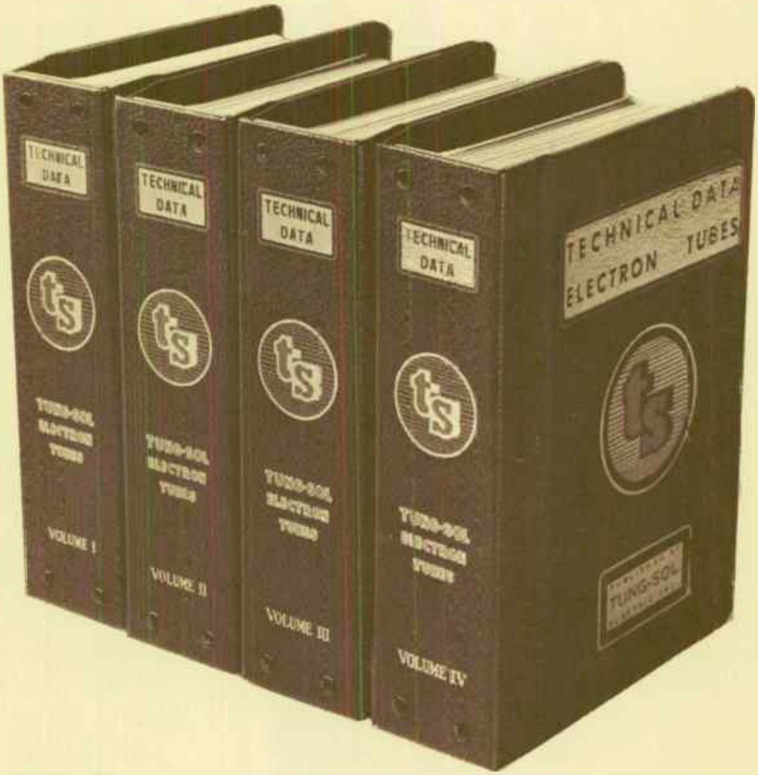
Additional sheets covering new tube types or changes on existing types will be issued on the first of each month. The Main Contents pages will be revised approximately every six months, the Supplemental Contents page will be revised with each monthly issue of sheets.

TUNG-SOL ELECTRIC INC.
ELECTRON TUBE DIVISION
200 BLOOMFIELD AVENUE
ATTENTION: TECHNICAL DATA DEPT.

Price $20.00

Subscription Rate $5.00 Per Year

ADDITIONAL BINDER



The Technical Data Books are being increased from three volumes to four volumes as the present three volumes are now filled to capacity. Subscribers who have all the pages in three volumes may order another binder, marked Volume IV, at any time. The cost of an additional binder is $3.00.

TUNG-SOL

A separate Contents Page listing Cathode Ray Tubes is located at the beginning of the green section.

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

(CONTINUED NEXT PAGE)

*Obsolete types listed in pink section of book only.

CONTENTS

TUNG-SOL

(CONTINUED NEXT PAGE)

TUNG-SOL

(CONTINUED NEXT PAGE)

CONTENTS

TUNG-SOL

(CONTINUED NEXT PAGE)

TUNG-SOL

(CONTINUED NEXT PAGE)

CONTENTS

TUNG-SOL

PLATE NUMBERS REFER TO FRONT OF SHEET ONLY.

TUNG-SOL

SUPPLEMENTAL CONTENTS

THIS SUPPLEMENTAL CONTENTS PAGE WILL BE REVISED WITH EACH MONTHLY ISSUE OF DATA SHEETS. SINCE MAY 1, 1947 SHEETS HAVE BEEN ISSUED ON THE FIRST OF EACH MONTH. TO DO THIS IT HAS BEEN FOUND NECESSARY TO DISCONTINUE THE MONTHLY REVISION OF THE MAIN CONTENTS PAGES. THE MAIN CONTENTS PAGES WILL BE BROUGHT UP TO DATE APPROXIMATELY EVERY SIX MONTHS.

PLEASE RETAIN IN YOUR BOOK THE MAIN CONTENTS PAGES DATED APRIL 1, 1962, IN ADDITION TO THE MOST RECENT SUPPLEMENTAL CONTENTS PAGE DATED AUGUST 1, 1962.

PRINTED IN U.S.A.

* INDICATES AN ADDITION

→ INDICATES A CHANGE.

TUNG-SOL

SUPPLEMENTAL CONTENTS

THIS SUPPLEMENTAL CONTENTS PAGE WILL BE REVISED WITH EACH MONTHLY ISSUE OF DATA SHEETS. SINCE MAY 1, 1947 SHEETS HAVE BEEN ISSUED ON THE FIRST OF EACH MONTH. TO DO THIS IT HAS BEEN FOUND NECESSARY TO DISCONTINUE THE MONTHLY REVISION OF THE MAIN CONTENTS PAGES. THE MAIN CONTENTS PAGES WILL BE BROUGHT UP TO DATE APPROXIMATELY EVERY SIX MONTHS.

PLEASE RETAIN IN YOUR BOOK THE MAIN CONTENTS PAGES DATED APRIL 1, 1962, IN ADDITION TO THE MOST RECENT SUPPLEMENTAL CONTENTS PAGE DATED SEPTEMBER 1, 1962.

* INDICATES AN ADDITION

→ INDICATES A CHANGE.

TUNG-SOL

SUPPLEMENTAL CONTENTS

THIS SUPPLEMENTAL CONTENTS PAGE WILL BE REVISED WITH EACH MONTHLY ISSUE OF DATA SHEETS. SINCE MAY 1, 1947 SHEETS HAVE BEEN ISSUED ON THE FIRST OF EACH MONTH. TO DO THIS IT HAS BEEN FOUND NECESSARY TO DISCONTINUE THE MONTHLY REVISION OF THE MAIN CONTENTS PAGES. THE MAIN CONTENTS PAGES WILL BE BROUGHT UP TO DATE APPROXIMATELY EVERY SIX MONTHS.

PLEASE RETAIN IN YOUR BOOK THE MAIN CONTENTS PAGES DATED APRIL 1, 1962, IN ADDITION TO THE MOST RECENT SUPPLEMENTAL CONTENTS PAGE DATED OCTOBER 1, 1962.

→ INDICATES A CHANGE   *INDICATES AN ADDITION.

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.

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.

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.

PRINTED IN U.S.A.

PLATE 619-1

NOV. 20 1939

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.

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.

SYMBOLS OF TUBE CHARACTERISTICS

C_{gk}	Grid to cathode capacitance (input)
C_{pk}	Plate to cathode capacitance (output)
C_{gp}	Grid to plate caoacitance
E_b	Average or quiescent value ot 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 supoly 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

PLATE 1452
AUG. 31 1944

SYMBOLS OF TUBE ELEMENTS

(AS EMPLOYED IN CONNECTION WITH BASE DIAGRAMS)

USE THIS COLUMN FOR ALL DATA SHEETS DATED PRIOR TO JUNE 15, 1944

G_a	Anode Grid
R	Ray Control Electrode
F	Filament
F_t	Filament Tap
G	Control Grid
H	Heater
H_t	Heater Tap
I_c	Internal Connection
K	Cathode
N_c	No Connection
P	Plate
D_p	Diode Plate
S	Metal Shell
S_i	Internal Shield
X_s	External Shield
T	Target
▮	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

USE THIS COLUMN FOR ALL DATA SHEETS DATED JUNE 15, 1944 AND LATER

A (A_1, A_2, etc.)	Anode
D (D_1, D_2, etc.)	Deflectors, Ray Control Electrode
F	Filament
F_t	Filament Tap
G (G_1, G_2, etc.)	Grid
H	Heater
H_t	Heater Tap
I_c	Internal Connection (Not For External Use)
J	Jumper
K	Cathode
N_c	No Connection
P (P_1, P_2, etc.)	Plate, Diode Plate
S	Shell
S_i	Internal Shield
S_x	External Shield
T	Target
▮	Beam Plate

[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

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 <u>BOGEY ELECTRON DEVICE</u> 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 <u>NO RESPONSIBILITY</u> FOR EQUIPMENT VARIATIONS, ENVIRONMENT VARIATIONS, AND THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS.

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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.

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.

PRINTED IN U. S. A.

TUNG-SOL

TYPES BY CLASSIFICATION

RF - IF AMPLIFIERS

	APPLICATION	HEATER VOLTAGES 1.4	6.3				12.6		150 MILLIAMPERE HEATER CURRENT		300 MILLIAMPERE HEATER CURRENT		600 MILLIAMPERE HEATER CURRENT	
GENERAL PURPOSE	TRIODES	4BQ7A••• 4BZ7••• 5BK7A• 5J6• 26 957* 958*	6AD4 6BC4 6C4 6J4 6K4 6N4	7A4 12H4 37 76 955 5718	5710 5744 9002 XXL		12H4 10DA7		6AD4 6C4 12H4 955 5718 9002		7A4 12H4 37 76			
GENERAL PURPOSE	DOUBLE TRIODES	3A5 3B7 1291 4BX[illegible]••• 5BQ7AΔ	2C51 5BZ7Δ 6AH7GT 6BK7 6BK7A	6BK7B 6BF7 6BQ7A 6BZ7 6BX8	6DA7 6J6 6J6A 7AF7 7F7	7F8 7N7 5670	12AH7GT 12AT7 14AF7/XXD 14F7	14F8 19J6●●	12AH7GT 12AT7 14AF7/XXD 14F7	14F8 19J6	[illegible] 2C51 6AH7GT 6BF7	7AF7 7F7 7F8 12AT7	4BQ7A 4BX[illegible] 4BZ7 5BK7A 5J6	
GENERAL PURPOSE	TETRODES	24A●	7G8 46								7G8 46			
GENERAL PURPOSE	PENTODES	1AD4 1AD5 1AE4 1AF4 1AH4* 1L4 1LC5 1LN5 1N5GT 1P5GT 1T4 1U4 1W5* 3AU6◆ 3BA6◆ 3BC5◆ 3CB6◆ 3CE5◆ 3CF6◆ 3DT6◆ 3E6 4CF5••• 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 12AW6 12BA6 12BD6 12B7 12CN5 12J7GT 12K7GT 12SG7 12SH7 12SH7GT 12SJ7 12SJ7GT 12SK7 12SK7GT 14A7/12B7 14C7	14H7 26CL6**	6BH6 6BJ6 6S7 6S7G 6SS7 6SS7GT 7AG7 7B7 7C7 12AU6 12AW6 12B7 12BA6 12BD6 12J7GT 12K7GT	12SG7 12SH7 12SH7GT 12SJ7 12SJ7GT 12SK7 12SK7GT 14A7/12B7 14C7 14H7 954 956 5840 9001 9003	6AU6 6AU6A 6BA6 6BD6 6C6 6CB6 6CB6A 6CG6 6CE5 6CF6 6D6 6J7 6J7G 6J7GT 6K7 6K7G 6K7GT 6SJ7GT 6SG7 6SH7	6SH7GT 6SJ7 6SJ7GT 6SK7 6SK7GT 6U7G 7A7 7H7 7L7 39/44 77 78 5693	3AU6 3BA6 3BC5 3CB6 3CE5 3CF6 3DT6	
TELEVISION	TRIODES	2AF4●● 2AF4A●● 2BN4Δ 2T4●● 3AF4A‡ [illegible]N4■	6AB4 6AF4 6AF4A 6AJ4	6AM4 6AN4 6BN4	6T4 12A4		12A4		6AB4		12A4		2AF4 2AF4A 2T4	12A4
TELEVISION	DOUBLE TRIODES	4BC8••• 4BS8••• 4CX7••• 5BK7A• 5J6•	6BC8 6BK7 6BK7A 6BS8 6CH7	6CX7 6J6 6J6A 6SN7GTA 6SN7GTB	12AT7		12AT7 12SN7GTA	19J6●●	12AT7	19J6	12AT7 12SN7GTA		4BS8 4CX7 5BK7A 5J6	6SN7GTA 6SN7GTB
TELEVISION	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 6AU6 6AU6A 6BC5 6BZ6 6CB6	6DB6 6DC6 6DE6 12BV7	12BV7	
TELEVISION	HEPTODE	3BY6◆ 3CS6◆	6BY6 6CS6				12CS6		12CS6		6BY6 6CS6		3BY6 3CS6	

Δ 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 ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. NOVEMBER 1, 1956 PLATE [illegible]

	APPLICATION	HEATER VOLTAGES 1.4	HEATER VOLTAGES 5.0	HEATER VOLTAGES 6.3	HEATER VOLTAGES 12.6	150 MILLIAMPERE HEATER CURRENT	300 MILLIAMPERE HEATER CURRENT	600 MILLIAMPERE HEATER CURRENT
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	
AF AMPLIFIERS	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
AF AMPLIFIERS	TETRODES	24A ◆		36			36	
AF AMPLIFIERS	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	
INDICATORS	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.

PRINTED IN U. S. A.

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

TUNG-SOL

TYPES BY CLASSIFICATION

		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 6A3O 6AC5GT 6AJ4 6B4G 6C4 50†			25AC5GT				25AC5GT	
POWER AMPLIFIERS	GENERAL PURPOSE	DOUBLE TRIODES	1G6GT 3C6/XXB	53 3C6/XXB✱	6A6 6AS7G 6AS7GA 6N7 6N7GT 79								
POWER AMPLIFIERS	GENERAL PURPOSE	TETRODES			6005	12K5		28D7▲					
POWER AMPLIFIERS	GENERAL PURPOSE	PENTODES	1A5GT 1AC5 1C5GT 1LA4 1LB4 1S4 1V5• 3A4 3D6 3LE4 3LF4 3V4 3Q4 3S4 5672•	2A5 3A4✱ 3LE4✱ 3Q4 3S4✱ 3V4✱ 47	2E22 6AG7 6AK6 6AN5 6AR5 6CL6 6F6 6F6G 6F6GT 6G6G 6F6GT 6K6GT 7D5 38 41 42 89 5686			25BK5 43			6AK6 6G6G	25A6 25A6GT 25BK5 25B6G 38 43	
POWER AMPLIFIERS	GENERAL PURPOSE	BEAM PENTODES	1Q5G 1Q5GT 1T5GT 3B5GT 3E5 3LF4 3Q5GT	3E5✱ 3LF4✱ 3Q5GT✱ 5A6 5AQ5•• 5V6GT••	6AQ5 6AQ5A 6AR6 6AS5 6BK5 6CA5 6CB5 6CS5 6CU5 6DG6GT 6L6 6L6G 6L6GA 6L6GB 6U6GT 6V5GT 6V6 6V6GT 6V6GTA 6W6GT 6Y6G 6Y6GA 7A5 7C5 5881 5902 5932	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 35A5 50BK5 35C5 35C6GT 50B5 50C5 50C6G 50L6GT	25C6G 25C6GA 25L6 25L6GT 25W6GT	5AQ5 5V6GT 12BK5 12C5 12CA5 12CS5 12CU5 12L6GT 12W6GT
POWER AMPLIFIERS	GENERAL PURPOSE	DIRECT COUPLED			6B5 6N6G			25N6GT				25N6G	
TELEVISION	HORIZONTAL DEFLECTION	BEAM PENTODES			6AU5GT 6AV5GA 6AV5GT 6BD5GT 6BG6G 6BQ6G 6BQ6GA 6BQ6GT 6BQ6GTA 6BQ6GTB 6BU5 6CD6G 6CB5 6CB5A 6CL5 6CU6 6DB5 6DN6 6DQ6 6DQ6A 807	12AV5GA 12BQ6GA 12BQ6GT 12BQ6GTB 12CR5 12CU6 12DQ6 12DQ6A	17AV5GA ◆ 17DQ6 ◆ 19BG6G 19BG6GA	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 6BD4A 6BF5 6BL7GT 6CM6 6CM7 6CS7 6K6GT 6S4A 6SN7GT 6SN7GTA 6W6GT 7AU7• 12A4 12AU7 12B4A 12BH7 12BH7A	12AU7 12A4 12B4A 12BH7 12BH7A 12CM6 12R5 12SN7GT 12W6GT	17R5 ◆				12AU7	7AU7 12A4 12AU7 12B4A 12BH7 12BH7A 12SN7GT	6BD4A 6CS7 6S4A 7AU7 12B4A 12BH7A 12R5 12W6GT

◆ 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.

MULTI-FUNCTION TUBES

APPLICATION	HEATER VOLTAGES 1.4	6.3			12.6	25	35	70	117	150 MILLI-AMPERE HEATER CURRENT	300 MILLI-AMPERE HEATER CURRENT	600 MILLI-AMPERE HEATER CURRENT
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 7C6 7E6 7K7 7X7 8CN7●● 12BR7 75 85	8BN8●● 12AT6 12AV6 12BF6 12BK6 12BR7 12BT6 12BU6 12Q7GT 12SQ7 12SQ7GT 12SR7 12SR7GT 14B6 14E6 14X7	26BK6▲				6AQ6 6ST7 7C6 12AT6 12AV6 12BF6 12BK6 12BT6 12BU6 12Q7GT 12SQ7 12SQ7GT 12SR7 12SR7GT 12SW7 14B6 14E6 14X7	6AQ7GT 6AT6 6AV6 6BF6 6BK6 6BT6 6BU6 6CN7 6Q7 6Q7G 6Q7GT 6R7 6R7GT 6SQ7 6SQ7GT 6SR7 6SR7G 7B6 7E6 7K7 7X7 75 85	3AV6 6BJ8 6CN7
TRIPLE-DIODE TRIODES	5T8 ◆	6R8 6S8GT	6T8 6T8A 6V8		12S8GT	19C8✱✱ 19T8✱✱ 19V8✱✱				12S8GT 19C8 19T8 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 6B8 6B8G 6B8GT 7E7 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 5AT8 5B8 5BE8 5BR8 5CG8 5CM8 5U8 5X8 6AU8 6AW8 6AW8A 6BA8 6BH8 15A8
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.

PRINTED IN U. S. A.

TYPES BY CLASSIFICATION

APPLICATION			HEATER VOLTAGES 1.4	5.0	6.3	12.6	25	35	50	117	150 MILLI-AMPERE HEATER CURRENT	[illegible] MILLI-AMPERE HEATER CURRENT	600 MILLI-AMPERE HEATER CURRENT
CONVERTERS	GENERAL PURPOSE	PENTAGRID HEPTODE OCTODE	1A7GT 1B7GT 1E8 1L6 1LA6 1LC6 1R5 1U6	3BE6●	6A7 6A8 6A8G 6A8GT 6BA7 6BE6 6CS6 6D8G 6SA7 6SA7GT 6SB7Y 7A8 7B8 7Q7 5750	12A8GT 12BA7 12BE6 12SA7 12SA7GT 14B8 14Q7					6D8G 7A8 12A8GT 12BA7 12BE6 12SA7GT 14B8 14Q7	6A7 6A8 6A8G 6A8GT 6BA7 6BE6 6CS6 6SA7 6SA7GT 6SB7Y 7B8 7Q7	3BE6
		TRIODE HEXODES TRIODE HEPTODES			6J8G 6K8 6K8G 6K8GT 7D7 7J7 7S7	12K8 12K8GT 14J7 14S7					7D7 12K8 12K8GT 14J7 14S7	6J8G 6K8 6K8G 6K8GT 7J7 7S7	
		MIXERS			6AS6 6L7 6L7G 5725							6L7 6L7G	
	TELEVISION	DOUBLE TRIODE MIXERS	5J6●●		6BF7 6CG7 6J6 12AT7 12AV7 12AZ7	12AT7 12AV7 12AZ7 14F8					12AT7 14F8	12AT7 6BF7	5J6 6CG7
		PENTODE MIXERS		3BC5●	6AG5 6AK5 6BC5 6CB6							6AG5 6BC5 6CB6	3BC5
		TRIODE PENTODE MIXERS AND OSCILLATORS		5AT8●● 5B8●● 5U8●● 5X8●●	6AT8 6U8 6V8 6X8								5AT8 5B8 5U8 5X8
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	
	FULL-WAVE	DOUBLE DIODES		5AS4 5AU4 5AW4 5AZ4 5R4GY 5R4GYA 5T4 5U4G 5U4GA 5U4GB 5V3 5V4G 5V4GA 5W4G 5W4GT 5X3 5X4G 5X4GA 5Y3G 5Y3GA 5Y3GT 5Y4G 5Y4GA 5Y4GT 5Z3 5Z4 80 83V	6AX5GT 6BW4 6BY5G 6BY5GA 6X4 6X5 6X5GT 6Z5 12Z5 6ZY5G 7X6 7Y4 7Z4 84 6Z4 5852 5896	6Z5 12Z5 12BW4 12X4	25Z5 25Z6 25Z6GT 5839▲ 5903▲		50X6GT 50Y6GT 50Y7GT	117Z6GT	50Y6GT 50Y7GT	5AS4 6ZY5G 12X4 25Z5 25Z6 25Z6GT 5896	
	DETECTORS	DIODES	1A3 1R4 1294		6V3A 7C4 1203A 9004 9006						1A3 1R4 7C4/1203A 9004 9006		
		DOUBLE DIODES	3AL5●		6AL5 6H6 6H6GT 7A6	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 4811

TYPES BY CLASSIFICATION

			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		1B3GT 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.

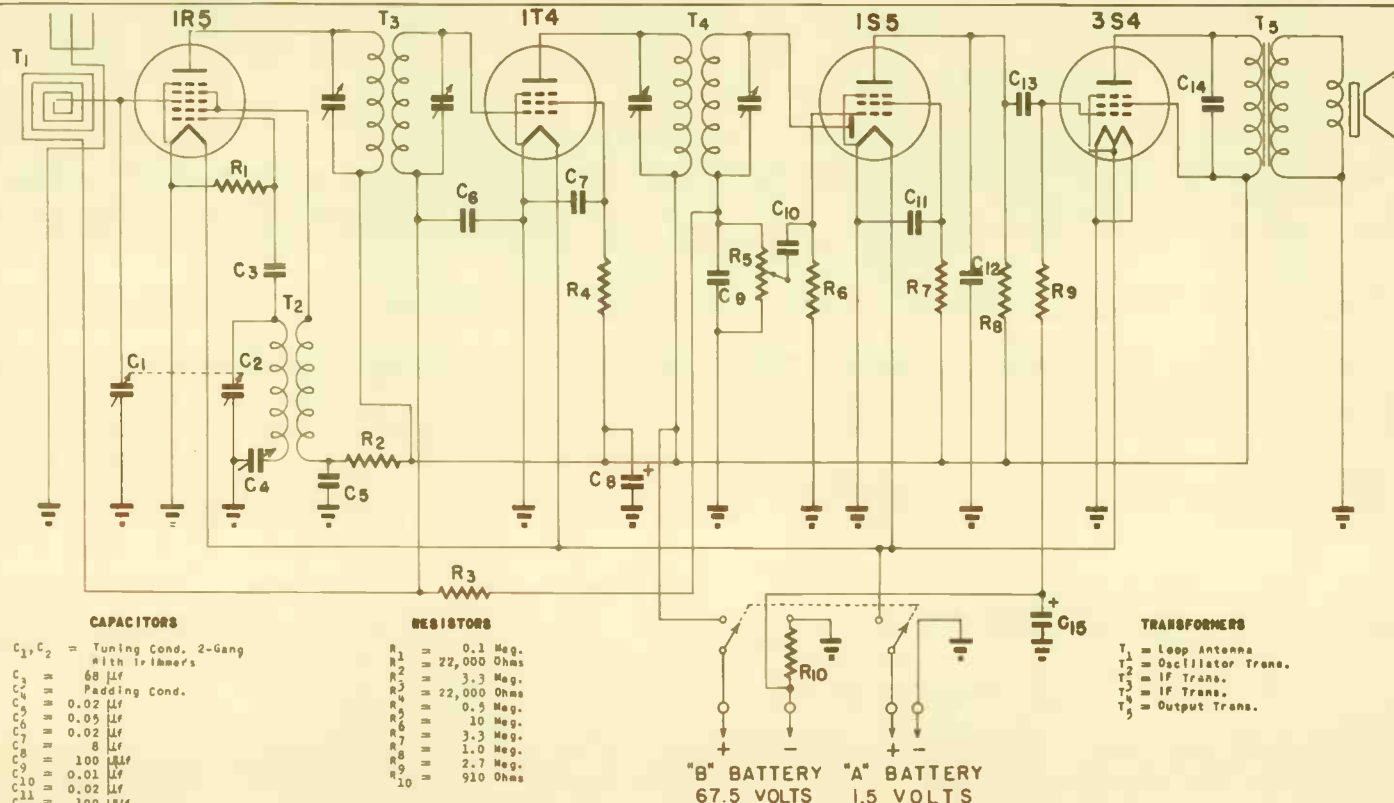
PRINTED IN U.S.A.

PRINTED IN U.S.A.
PLATE 1731
SEPT. 2 1946

4 TUBE PORTABLE SUPERHETERODYNE RECEIVER

TUNG-SOL

TYPICAL CIRCUIT



CAPACITORS

C_1, C_2	=	Tuning Cond. 2-Gang with Trimmers
C_3	=	68 µf
C_4	=	Padding Cond.
C_5	=	0.02 µf
C_6	=	0.05 µf
C_7	=	0.02 µf
C_8	=	8 µf
C_9	=	100 µµf
C_{10}	=	0.01 µf
C_{11}	=	0.02 µf
C_{12}	=	100 µµf
C_{13}	=	0.01 µf
C_{14}	=	0.003 µf
C_{15}	=	25 µf

RESISTORS

R_1	=	0.1 Meg.
R_2	=	22,000 Ohms
R_3	=	3.3 Meg.
R_4	=	22,000 Ohms
R_5	=	0.5 Meg.
R_6	=	10 Meg.
R_7	=	3.3 Meg.
R_8	=	1.0 Meg.
R_9	=	2.7 Meg.
R_{10}	=	910 Ohms

ALL RESISTORS
1/4 WATT SIZE

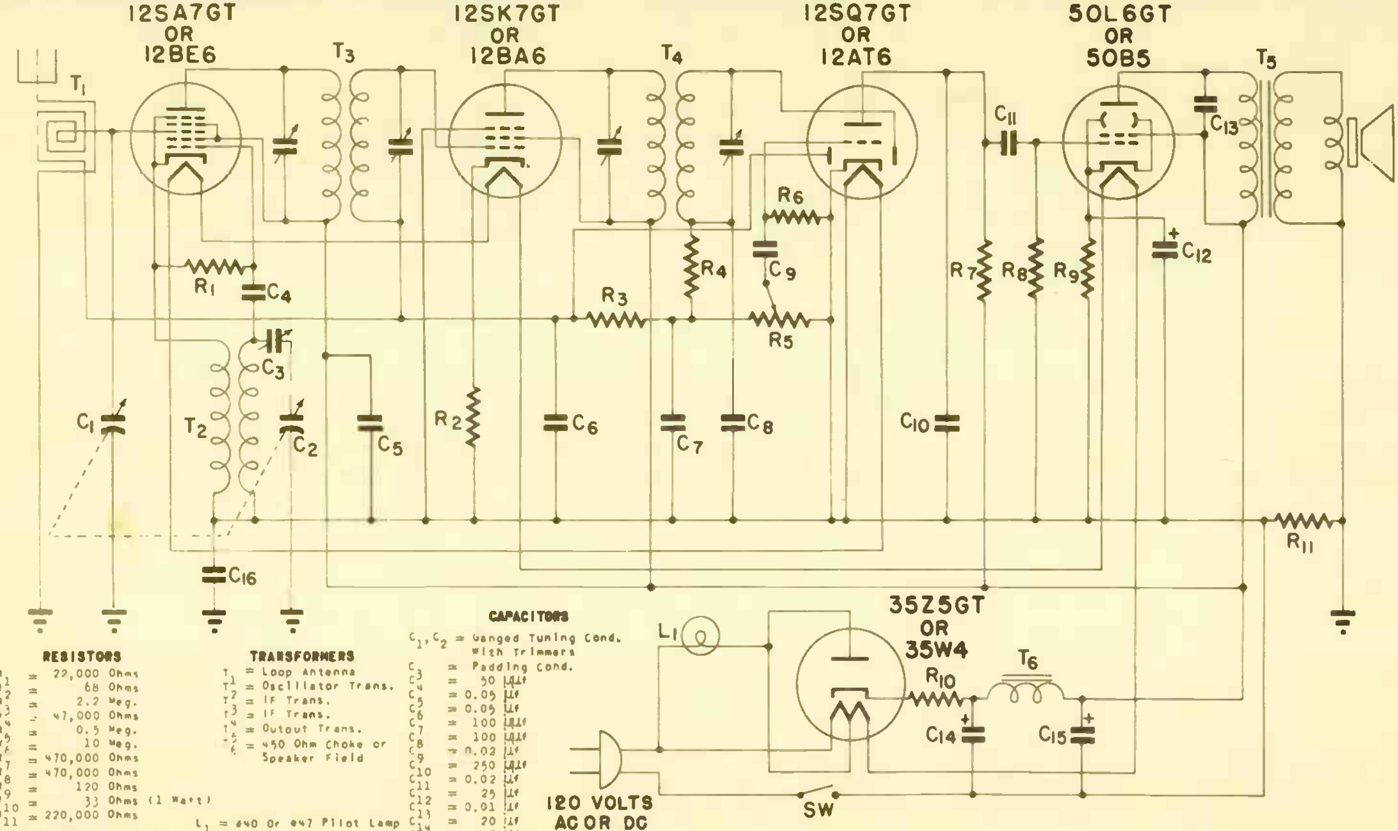
TRANSFORMERS

T_1	=	Loop Antenna
T_2	=	Oscillator Trans.
T_3	=	IF Trans.
T_4	=	IF Trans.
T_5	=	Output Trans.

5 TUBE AC/DC SUPERHETERODYNE RECEIVER

TYPICAL CIRCUIT

TUNG-SOL



RESISTORS

R_1	=	22,000 Ohms
R_2	=	68 Ohms
R_3	=	2.2 Meg.
R_4	=	47,000 Ohms
R_5	=	0.5 Meg.
R_6	=	10 Meg.
R_7	=	470,000 Ohms
R_8	=	470,000 Ohms
R_9	=	120 Ohms
R_{10}	=	33 Ohms (1 Watt)
R_{11}	=	220,000 Ohms

ALL RESISTORS 1/2 WATT EXCEPT AS NOTED.

TRANSFORMERS

T_1	=	Loop Antenna
T_2	=	Oscillator Trans.
T_3	=	IF Trans.
T_4	=	IF Trans.
T_5	=	Output Trans.
T_6	=	450 Ohm Choke or Speaker Field

L_1 = #40 Or #47 Pilot Lamp

Sw = On/Off Switch

CAPACITORS

C_1, C_2	=	Ganged Tuning Cond. With Trimmers
C_3	=	Padding Cond.
C_4	=	50 µµf
C_5	=	0.05 µf
C_6	=	0.05 µf
C_7	=	100 µµf
C_8	=	100 µµf
C_9	=	0.02 µf
C_{10}	=	250 µµf
C_{11}	=	0.02 µf
C_{12}	=	25 µf
C_{13}	=	0.01 µf
C_{14}	=	20 µf
C_{15}	=	40 µf
C_{16}	=	0.2 µf

PLATE 1732
SEPT. 2 1946

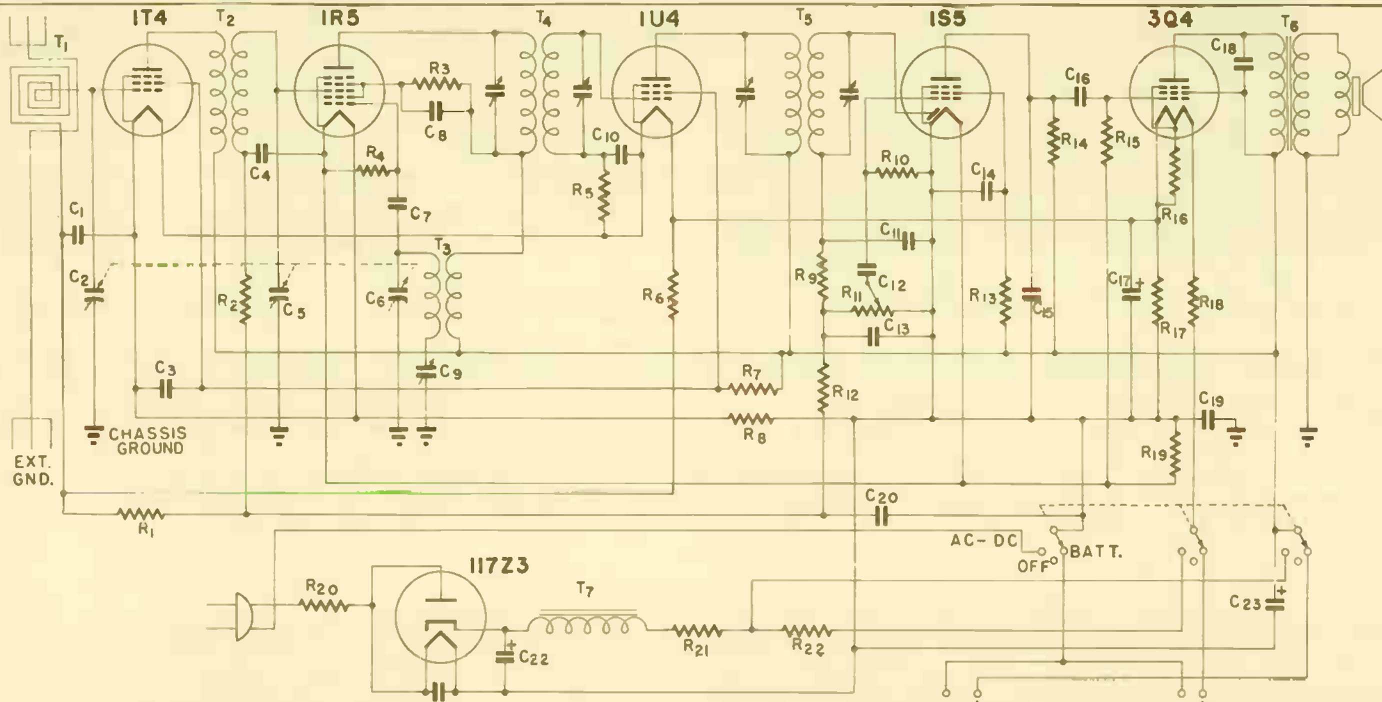
PLATE 1733
SEPT. 2 1946

PRINTED IN U. S. A.

6 TUBE AC/DC BATTERY PORTABLE RECEIVER

TUNG-SOL

TYPICAL CIRCUIT



RESISTORS

R_1 = 0.5 Meg.	R_9 = 47,000 Ohms	R_{16} = 270 Ohms
R_2 = 0.5 Meg.	R_{10} = 10 Meg.	R_{17} = 600 Ohms
R_3 = 10,000 Ohms	R_{11} = 1 Meg. (Vol. Control)	R_{18} = 10 Ohms
R_4 = 0.1 Meg.	R_{12} = 3.3 Meg.	R_{19} = 1000 Ohms
R_5 = 3.3 Meg.	R_{13} = 3.3 Meg.	R_{20} = 33 Ohms (1 Watt)
R_6 = 10 Meg.	R_{14} = 1 Meg.	R_{21} = 270 Ohms (Includes T_7)
R_7 = 15,000 Ohms	R_{15} = 3.3 Meg.	R_{22} = 1700 Ohms (10 Watts)
R_8 = 330 Ohms		

ALL RESISTORS 1/2 WATT SIZE EXCEPT AS NOTED

TRANSFORMERS

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

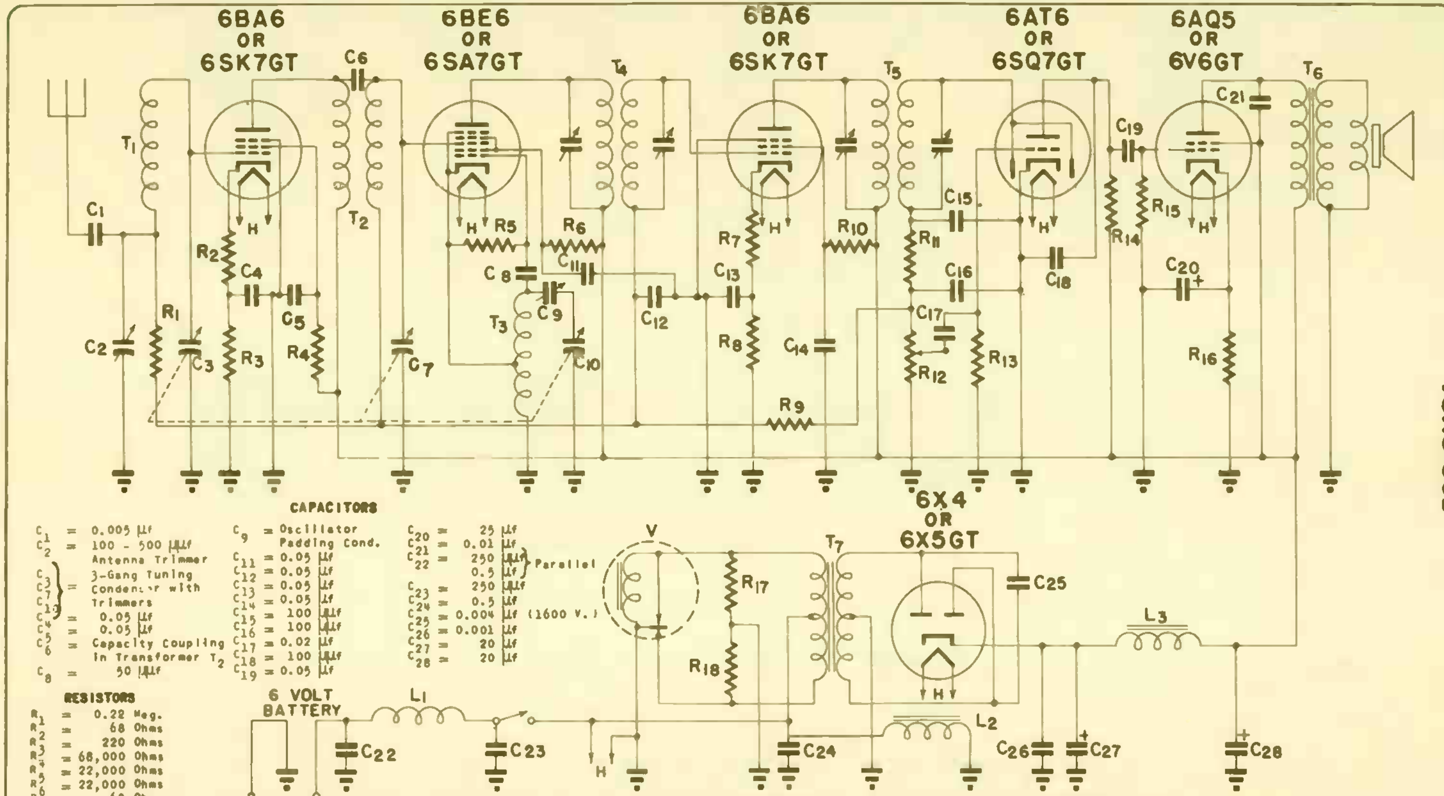
CAPACITORS

C_1 = 0.02 µf	C_9 = Padding Cond.	C_{17} = 100 µf
C_2, C_5, C_6 = 3 Gang Variable With Trimmers	C_{10} = 0.02 µf	C_{18} = 0.002 µf
C_3 = 0.02 µf	C_{11} = 100 µµf	C_{19} = 0.2 µf
C_4 = 0.02 µf	C_{12} = 0.01 µf	C_{20} = 0.05 µf
C_7 = 50 µµf	C_{13} = 100 µµf	C_{21} = 0.05 µf
C_8 = 0.02 µf	C_{14} = 0.05 µf	C_{22} = 40 µf
	C_{15} = 100 µµf	C_{23} = 20 µf
	C_{16} = 0.02 µf	

TUNG-SOL

6 TUBE AUTOMOBILE RECEIVER

TYPICAL CIRCUIT



CAPACITORS

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

RESISTORS

R_1 = 0.22 Meg.
R_2 = 68 Ohms
R_3 = 220 Ohms
R_4 = 68,000 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
R_{12} = 0.5 Meg. (Vol. Control)
R_{13} = 10.0 Meg.
R_{14} = 0.47 Meg.
R_{15} = 0.47 Meg.
R_{16} = 220 Ohms (1 Watt)
R_{17} = 100 Ohms
R_{18} = 100 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 1739
SEPT. 2 1946

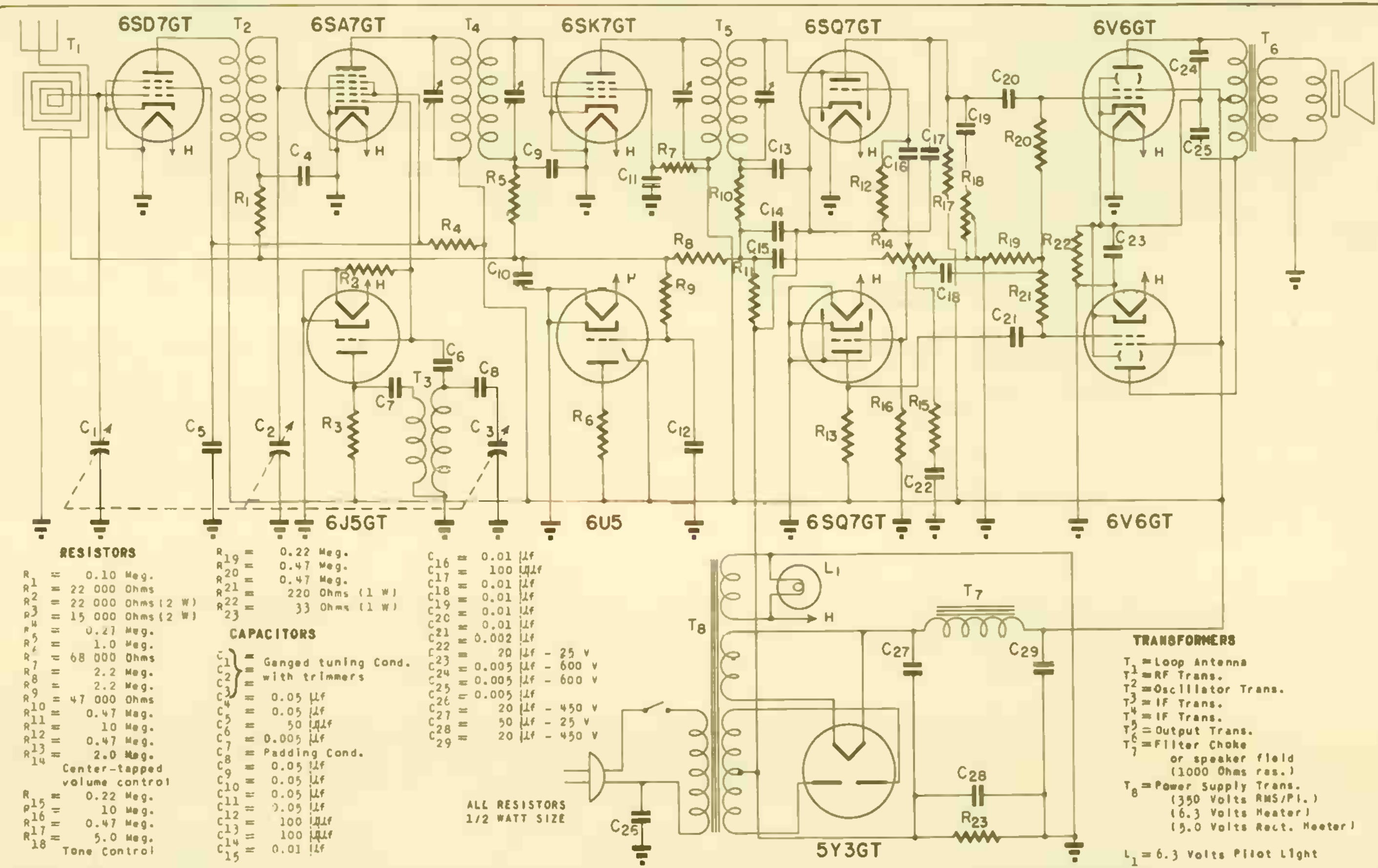
PRINTED IN U.S.A.

PLATE 1839
JULY 1, 1947

10 TUBE AC SUPERHETERODYNE RECEIVER

TUNG-SOL

TYPICAL CIRCUIT



RESISTORS

R_1 = 0.10 Meg.
R_2 = 22 000 Ohms
R_3 = 22 000 Ohms (2 W)
R_4 = 15 000 Ohms (2 W)
R_5 = 0.27 Meg.
R_6 = 1.0 Meg.
R_7 = 68 000 Ohms
R_8 = 2.2 Meg.
R_9 = 2.2 Meg.
R_{10} = 47 000 Ohms
R_{11} = 0.47 Meg.
R_{12} = 10 Meg.
R_{13} = 0.47 Meg.
R_{14} = 2.0 Meg. Center-tapped volume control
R_{15} = 0.22 Meg.
R_{16} = 10 Meg.
R_{17} = 0.47 Meg.
R_{18} = 5.0 Meg. Tone Control
R_{19} = 0.22 Meg.
R_{20} = 0.47 Meg.
R_{21} = 0.47 Meg.
R_{22} = 220 Ohms (1 W)
R_{23} = 33 Ohms (1 W)

CAPACITORS

C_1, C_2, C_3 = Ganged tuning Cond. with trimmers
C_4 = 0.05 µf
C_5 = 0.05 µf
C_6 = 50 µµf
C_7 = 0.005 µf
C_8 = Padding Cond.
C_9 = 0.05 µf
C_{10} = 0.05 µf
C_{11} = 0.05 µf
C_{12} = 0.05 µf
C_{13} = 100 µµf
C_{14} = 100 µµf
C_{15} = 0.01 µf
C_{16} = 0.01 µf
C_{17} = 100 µµf
C_{18} = 0.01 µf
C_{19} = 0.01 µf
C_{20} = 0.01 µf
C_{21} = 0.01 µf
C_{22} = 0.002 µf
C_{23} = 20 µf - 25 V
C_{24} = 0.005 µf - 600 V
C_{25} = 0.005 µf - 600 V
C_{26} = 0.005 µf
C_{27} = 20 µf - 450 V
C_{28} = 50 µf - 25 V
C_{29} = 20 µf - 450 V

ALL RESISTORS 1/2 WATT SIZE

TRANSFORMERS

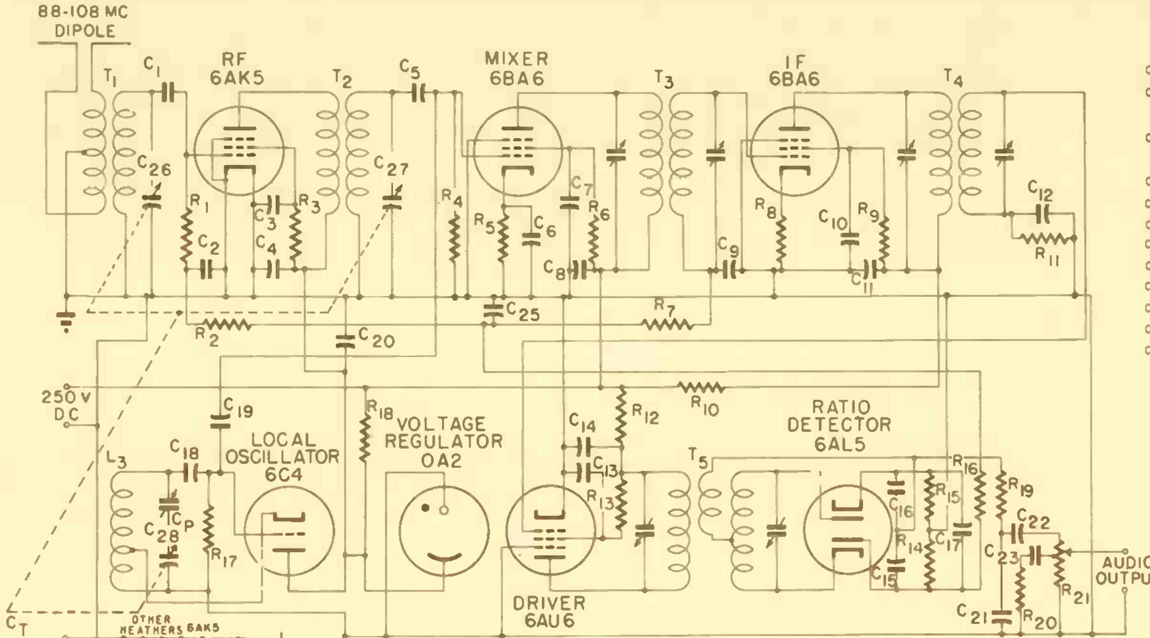
T_1 = Loop Antenna
T_2 = RF Trans.
T_3 = Oscillator Trans.
T_4 = IF Trans.
T_5 = IF Trans.
T_6 = Output Trans.
T_7 = Filter Choke or speaker field (1000 Ohms res.)
T_8 = Power Supply Trans. (350 Volts RMS/Pl.) (6.3 Volts Heater) (5.0 Volts Rect. Heater)

L_1 = 6.3 Volts Pilot Light

TUNG-SOL

FREQUENCY MODULATION TUNER

TYPICAL CIRCUIT



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 µµF
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

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	forward current transfer ratio, output AC short-circuited
h_{fe}	Common emitter	
h_{fc}	Common collector	
h_{oe}, h_{i}	Examples of other corresponding common emitter symbols	
$f_{\alpha b}$	Common base	the frequency at which the magnitude of the small-signal short-circuit forward current transfer ratio is 0.707 of its low frequency value.
$f_{\alpha e}$	Common emitter	
C_{ob}	Collector to base	Capacitance measured across the output terminals with the input AC open-circuited.
C_{oe}	Collector to emitter	
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	These depend on both transistor and circuit parameters
t_r	Rise time	
t_s	Storage time	
t_f	Fall time	
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

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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_{IB2}, V_{CB2}, I_{c2}, I_{c2}

NOTE:

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

PRINTED IN U.S.A.

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

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.

TUBE TYPES 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 Kilohms	Amplification Factor	Load Resistance Ohms	Power Output Watts	Max. A.C. Bias Volts per Plate	Max. Peak Inverse Volts	Max. D.C. Output Ma.	Style	Outline No.	Style	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 Peak Current: 500 Ma. Max. Max. DC Starting Voltage: 95 V. 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		E_{g2} = 180 V. E_{g2} = 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	E_{g2} = 90 V. I_{g2} = 1.2 Ma. Osc. Grid Resistor = 0.2 Meg. I_{g1} = 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	E_{g2}: 90 volts: I_{g2}: 1.2 ma. Osc. grid resistor: 0.2 megohm; I_{g1}: 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**

PRINTED IN U. S. A.

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	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. BIAS 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
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	E_{g2} = 90 V. I_{g2} = 1.6 Ma. I_{g1} = 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	6.3F 0.15	1.4F	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	E_{g2} = 180 V. thru 20,000 Ohms E_{g2} = 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	E_{g2} = 180 V. thru 20,000 Ohms E_{g2} = 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	3Z 3Z	1.3 1.2	2.4 2.5	300 275	500 400	E_{g2} = 180 V. thru 20,000 ohms E_{g2} = 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

1E4G-1H6G

		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 Kilohms	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
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.

PRINTED IN U. S. A.

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

1J5G-1N6G

		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 Kilohms	Amplification Factor	Load Resistance Ohms	Power Output Watts	Max. A.C. Bias Volts per Plate	Max. Peak Inverse Volts	Max. D.C. Output Ma.	Style	Outline No.	Style	Basing	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	Ig₂: 1.2 ma. Ig₁: 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	Eg₂ = 90 V.; Ig₂ = 1.2 Ma.; Ig₁ = 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	5ᶠ 1.6ᶠ	1ᶠ 0.3ᶠ	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	Eg₂ = 45 V.; Ig₂ = 1.4 Ma.; Ig₁ = 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

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

1N6GT-1V5

		Filament				Typical Operating Conditions and Characteristics													Bulb		Base		
																Rectifier Condenser Input							
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	Max. A.C. RMS Volts per Plate	Max. Peak Inverse Volts	Max. D.C. Output Ma.	Style	Outline No.	Style	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.

PRINTED IN U. S. A.

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
1W4	PENTODE	1.4	0.05	FIL.	CLASS A AMPLIFIER	67.5 90	67.5 90	6 9	3.8F 5F	0.8F 1F	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	250		45	60		5250	0.8	4.2	2500	3.5	Grid bias measured from filament center			ST-16	84	MED. 4 PIN	4D	**2A3**
					CLASS AB AMPLIFIER	300		62	80	Current and output for 2 tubes.				3000	15	Load is plate-to-plate							
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	34F	6.5F	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	E_{g2} = 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		^	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.

^ 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

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	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	4FV	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	66A	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† 6.7†	0.6† 0.5†	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†		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		#	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. # Bias obtained thru 220 ohm cathode resistor. † Zero signal.

PRINTED IN U.S.A.

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	MAX. PEAK INVERSE VOLTS	MAX. D.C. OUTPUT MA.	BULB STYLE	OUTLINE NO.	BASE STYLE	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 @ −5.5 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	95		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. @ −5.5 V.						T-5½	4	MIN. 7 PIN	7BD	**4CE5**
4DK6	PENTODE	4.2	0.45*	HEATER	CLASS A AMPLIFIER	125	125	B	12	3.8	9800	Cut-off: 20 µa @ −5.5 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.
C 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.
B 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 4643

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

5AV8-5Y4G

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 IN 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.	BULB: STYLE	OUTLINE NO.	BASE: STYLE	BASING	TYPE
5AV8	TRIODE PENTODE	4.7	0.6*	HEATER	CLASS A AMPLIFIER B / A	200 / 200	150	6 / 0[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.: 55 V.										350	1400	175	T-9	[illegible]	5 PIN OCTAL	5T	5AX4GT
5BE8	TRIODE PENTODE	4.7	0.6*	HEATER	CLASS A AMPLIFIER B / A	150 / 250	110	0[H] / 0[J]	18 / 10	3.5	3500 / 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 TRIODE	5.6	0.45*	HEATER	CLASS A AMPLIFIER	150		[illegible]	10		7200	5	36	Cut-off: 10 µa @ −7 V. (Section 2 Only)					T-5½	[illegible]	MIN. 9 PIN	9AJ	5BS8
5BT8	TWIN DIODE PENTODE	4.7	0.6*	HEATER	GENERAL PURPOSE	200	150	[illegible]	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	0.5*	HEATER	VERTICAL DEFLECTION AMPLIFIER	150 / 150	250	12.5 / 12.5	45 / 49.5	4.5	[illegible] / [illegible]	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 AMPLIFIER B / P	250 / 200	150	[illegible] / [illegible]	1.8 / 8.5	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. T Tetrode section. H Bias obtained thru 220 ohm cathode resistor. G Bias obtained thru 180 ohm cathode resistor. R Bias obtained thru 56 ohm cathode resistor. J Bias obtained thru 68 ohm cathode resistor. • Pin #1 has no connection.

PRINTED IN U.S.A.

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 MHOS	PLATE RESISTANCE KILOHMS	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
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	35F	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	[illegible]	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 W	300 300	200 300	3 3	12.5 12.5	3.2 3.2	5000 5000	700 700	3500 3500						MT-8	17	8 PIN OCTAL	[illegible]	**6AB7**
6AC5GT	TRIODE	6.3	0.4	HEATER	CLASS B AMPLIFIER	250		0	5F	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. P With fixed screen supply. * With series screen resistor.

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

6AE5GT-6AU4GT

		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 Micromhos	Plate Resistance Kilohms	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
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	**	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. ** 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	BULB: OUTLINE NO.	BASE: STYLE	BASE: 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
AB Input section
K Bias obtained thru 120 ohm cathode resistor
E Pentode unit.
BI Grid #1 resistor = 0.22 meg.
A Bias obtained thru 180 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	PLATE VOLTS	SCREEN GRID VOLTS	CONTROL GRID VOLTS (NEG.)	PLATE CURRENT MA	SCREEN CURRENT MA	TRANS-CONDUCTANCE µMHOS	PLATE RESISTANCE K OHMS	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
6BD5GT	BEAM PENTODE	6.3	0.9	HEATER	HORIZONTAL DEFLECTION AMPLIFIER	200	200	12			5000	Peak Neg. Surge Grid 1 Voltage: −200 V. DC Cathode Current: 90 ma.							T-9	45	6 PIN OCTAL	6CK	6BD5GT
						Plate and Grid 2 Supply Voltage DC: 310 V. Peak Pos. Surge Plate Voltage (approx.): 2500 V.																	
6BE8	TRIODE PENTODE	6.3	0.45	HEATER	CLASS A AMPLIFIER [M] [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] [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	[illegible]	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. [L] Bias obtained thru 56 ohm cathode resistor. [AU] Bias obtained thru 68 ohm cathode resistor.
[N] Pentode section. [A] −8 volts @ I_b = 10 µA.

PRINTED IN U.S.A.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., APRIL 1, 1962 PLATE 46436

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. AC BIAS VOLTS PER PLATE	MAX. PEAK INVERSE VOLTS	MAX. D.C. OUTPUT MA.	BULB STYLE	OUTLINE NO.	BASE STYLE	BASING	TYPE
6C6	PENTODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250 100	100 100	3 3	2 2	0.5 0.5	1225 1185	1000 1000 MIN.	Cut-off: at −7 V.						ST-12C	76	SMALL 6 PIN	6F	**6C6**
					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.																	
6C7	DOUBLE DIODE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		9	4.5		1250	16	20						ST-12C	75	SMALL 7 PIN	7G	**6C7**
6C8G	DOUBLE TRIODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250		4.5	3.2		1600	22.5	36	Single section					ST-12	71	8 PIN OCTAL	8G	**6C8G**
6CA5	PENTODE	6.3	1.2	HEATER	CLASS A AMPLIFIER	125 110	125 110	4.5 4.0	37F 32F	4.0F 3.5F	9200 8100	15 16		4500 3500	1.5 1.1				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	100 250	 150	P	8.5 7.7	 1.6	5800 4600	6.9 750	40	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.			90	7.0	6500	6.0							T-12	62	SHORT MED. 8 PIN	8GD	**6CL5**
6CR8	TRIODE PENTODE	6.3	0.45*	HEATER	CLASS A AMPLIFIER D E	125 125	 125	2 0	12 13	 3	4000 7700	5.5 300	22	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	250 100	100 100	3 3	8.2 8	2 2.2	1600 1500	800 250	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	250	100	3	2	0.5	1225								ST-12C	75	SMALL 7 PIN	7H	**6D7**
6D8G	HEPTODE	6.3	0.15	HEATER	CONVERTER	250	100	3	3.5	2.6	550	400							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

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 KILOHMS	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
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. DC Plate Current: 83 Ma. DC Grid #2 Current: 12.3 Ma. Plate Dissipation: 5.1 Watts Grid #1 Input Voltage: Peak To Peak Sawtooth: 74 V. Negative Peaking: 18 V.													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.

PRINTED IN U. S. A.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., APRIL 1, 1962 PLATE 86437

6G6GT-6N4

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 Mhos	Plate Resistance Megohms	Amplification Factor	Load Resistance Ohms	Power Output Watts	Rectifier Condenser Input: Max. A.C. Bias 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
6G6GT	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			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	250	100	3	2	0.5	1225	1000^z	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

TUBES NOT RECOMENDED FOR NEW EQUIPMENT DESIGN

6P5GT-6S7

		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 KILOHMS	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
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**

PRINTED IN U. S. A.

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

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 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	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	Eg1: 0.5 ma. thru 20 000 ohms Eg1: 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	Eg1: 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	10	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

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

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	BASING	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

PRINTED IN U.S.A.

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 µMHOS	PLATE RESISTANCE KILOHMS	AMPLIFICATION FACTOR	LOAD RESISTANCE OHMS	POWER OUTPUT WATTS	RECTIFIER CONDENSER INPUT: MAX. AC 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
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	10.6F 7.6F	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	8.4F 6F	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	41F	3.0F	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	0	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

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., APRIL 1, 1962 PLATE #63

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	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	E_{g1}: 250 V. thru 20,000 ohms E_{g2}: 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

* Bias obtained thru 100 ohm cathode resistor.

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL

PRINTED IN U. S. A.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. APRIL 1, 1962 PLATE #6440

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	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 G	200 200	125	R 5	15 9.5	3.4	7000 3300	150 5.15	 17	Cut-off: 100 µamp. @ −9 V. Cut-off: 100 µamp. @ −14 V.					T-6½	9	Min. 9 Pin	9DX	**8BH8**
8BN8	Double Diode Triode	8.4	0.45*	Heater	Class A Amplifier	100 250		1 3	1.5 1.6		3500 2500	21 70	Cut-off: 10 µamp. @ −2.5 V. Cut-off: 10 µamp. @ −5.5 V.						T-6½	9	Min 9 Pin	9ER	**8BN8**
8SN7GTB	Double Triode	8.4	0.45*	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	**8SN7GTB**
9CL8	Triode Tetrode	9.5	0.3	Heater	Class A Amplifier G D	125 125	 125	K 1.0	15 12	 4.0	8000 5800	5 100	40	Cut-off: 10 µamp. @ −9 V. Cut-off: 10 µamp. @ −10 V.					T-6½	8	Min. 9 Pin	9FX	**9CL8**
9U8A	Triode Pentode	9.45	0.3	Heater	Class A Amplifier H G	250 150	110	B K	10 18	3.5	5200 8500	400 5	 40	Cut-off: 10 µamp. @ −10 V. Cut-off: 10 µamp. @ −12 V.					T-6½	8	Min. 9 Pin	9AE	**9U8A**
9X8	Triode Pentode	9.5	0.3*	Heater	Oscillator G Mixer H	100 250	 150	C D	8.5 7.7	 1.6	5800 4600	6.9 750	40	Cut-off: 10 µamp. @ −10 V. Cut-off: 10 µamp. @ −10 V.					T-6½	8	Min. 9 Pin	9AK	**9X8**
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 G	135 250	135	C E	11.5 7.3	3.2	8000 4400	190 12	 53	Cut-off: 50 µamp. @ −6 V. Cut-off: 10 µamp. @ −10 V.					T-6½	8	Min. 9 Pin	9DA	**10C8**

* 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

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

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	BULB OUTLINE NO.	BASE STYLE	BASE BASING	TYPE
11C5	BEAM PENTODE	11.6	0.45	HEATER	CLASS A AMPLIFIER	110	110	7.5	40F	3F	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	20	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.

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL

PRINTED IN U.S.A.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. APRIL [illegible]

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	BASING	TYPE
12BH7	DOUBLE TRIODE	12.6 6.3	0.3 0.6	HEATER	CLASS A AMPLIFIER	250 85		10.5 0		11.5 20		3100 6200	17 21	Cut-off. 50 µamp. @ Eb = 500 V. and −45 V.					T-6½	9	MIN. 9 PIN	9A	12BH7
					VERTICAL DEFLECTION AMPLIFIER	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.									
12BK5	PENTODE	12.6	0.6*	HEATER	CLASS A AMPLIFIER	250	250	5	35F	3.5F	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	[illegible]	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	0.5		1900	8.5	16	10,000	[illegible]				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	34F	2.2F	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	0.5	HEATER	CLASS A AMPLIFIER	110 200	110 125	7.5 A	49F 46F	4F 2.2F	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
B Pentode section
* Heater warm up time: 11 seconds
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

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
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	49F 46F	4F 2.2F	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. DC Plate Current: 83 mA. DC Grid #2 Current: 12.5 mA. Plate Dissipation: 5.1 Watts Grid #1 Input Voltage: Peak To Peak Sawtooth: 74 V. Negative Peaking: 18 V.													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 AMPLIFIER G	12.6		0A	3.0FD 7.2FN		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

PRINTED IN U.S.A.

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	TRANS. CONDUCTANCE µMHOS	PLATE RESISTANCE KILOHMS	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.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	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: 1 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 1100	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	I_{g1}: 0.5 mA. through 20,000 ohms I_{g1}: 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

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

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

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	MAX. PEAK INVERSE VOLTS	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

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

PRINTED IN U. S. A.

14E6-17H3

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	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**
17AV6GA	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	**17AV6GA**
17CA5	PENTODE	16.8	0.45*	HEATER	CLASS A AMPLIFIER	110 125	110 125	4.0 4.5	32F 37F	3.5F 4.0F	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

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

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

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 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
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. [A] MIXER SERVICE [A]	100 150		[C] [D]	8.5 4.8		5300 1900	7.1 10.2	38 Oscillator Peak Voltage: 3 V. Short Circuit Input conductance at 100 mc.: 96 µmhos.						T-5½	4	MIN. 7 PIN	7BF	**19J6**
19X8	TRIODE PENTODE	19.8	0.15	HEATER	OSCILLATOR [E] MIXER [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.

PRINTED IN U. S. A.

25A6-25D8GT

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: MAX. PEAK INVERSE VOLTS	RECTIFIER: MAX. D.C. OUTPUT MA.	BULB STYLE	BULB OUTLINE NO.	BASE STYLE	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	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	MAX. PEAK INVERSE VOLTS	MAX. D.C. OUTPUT MA.	BULB STYLE	OUTLINE NO.	BASE STYLE	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. DC Plate Current: 83 mA. DC Grid #2 Current: 12.3 mA. Plate Dissipation: 5.1 Watts Grid #1 Input Voltage: Peak To Peak Sawtooth: 74 V. Negative Peaking: 18 V.													T-12	59	SHORT 7 PIN OCTAL	6AM	**25DQ6**
25F5	BEAM PENTODE	25.0	0.15	HEATER	CLASS A AMPLIFIER B / C	110 110	110 110	7.5 8.0	37 78	7.0 13.6	5800	16.0		2500 4500	1.2 2.9				T-5½	5	MIN. 7 PIN	7CV	**25F5**
25N6G	DOUBLE TRIODE	25	0.3	HEATER	CLASS A AMPLIFIER	110	110	0	45	7	2200	11.5	25	2000	2				ST-12C	73	7 PIN OCTAL	7W	**25N6G**
25W4GT	DIODE	25	0.3	HEATER	HALF-WAVE RECTIFIER	Peak Ib-600 mA. max. Hot-Switching Transient Ib for 0.2 sec. max.- 3.5 amp. max.										350	1250	125	T-9	35	6 PIN OCTAL	4CG	**25W4GT**
25X6GT	DOUBLE DIODE	25	0.15	HEATER	HALF-WAVE RECTIFIER											125		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.										125		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.										125		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										235	700	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										235	700	75	MT-8B	20	7 PIN OCTAL	7Q	**25Z6**
26	TRIODE	1.5	1.05	FIL.	CLASS A AMPLIFIER	180		14.5	6.2		1150	7.3	8.3						ST-14	78	MED. 4 PIN	4D	**26**
26A7GT	DOUBLE PENTODE	26.5	0.6	HEATER	CLASS A AMPLIFIER	26.5	26.5	4.5	20	1.9	5700			1500	0.18				T-9	46	8 PIN OCTAL	8BU	**26A7GT**
26BK6	DOUBLE DIODE TRIODE	26.5	0.07	HEATER	CLASS A AMPLIFIER	250		2	1.2		1600	62.5	100						T-5½	5	MIN. 7 PIN	7BT	**26BK6**
26CG6	PENTODE	26.5	0.07	HEATER	CLASS A AMPLIFIER	250	150	8	9	2.3	2000	720	Cutoff: 40 µmhos @ −24 V.						T-5½	4	MIN. 7 PIN	7BK	**26CG6**
27	TRIODE	2.5	1.75	HEATER	CLASS A AMPLIFIER	250 90		21 6	5.2 2.7		975 820	9.25 11.0	9 9						ST-12	70	SMALL 5 PIN	5A	**27**

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

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL

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
28Z5	DOUBLE DIODE	28	0.24	HEATER	FULL-WAVE RECTIFIER	Peak Plate Current per Plate: 300 Ma.										450	1250	100	T-9	30	8 PIN LOC.	6BJ	**28Z5**
30	TRIODE	2	0.06	DC FIL.	CLASS A AMPLIFIER	180		13.5	3.1		900	10.3	9.3						ST-12	70	SMALL 4 PIN	4D	**30**
31	TRIODE	2	0.13	DC FIL.	CLASS A AMPLIFIER	180 135		30 22.5	12.3 8		1050 925	3.6 4.1	3.8 3.8	5700 7000	0.375 0.185				ST-12	70	SMALL 4 PIN	4D	**31**
32	TETRODE	2	0.06	FIL.	CLASS A AMPLIFIER	180	67.5	3	1.7	0.4	650	1200	780						ST-14	79	MED. 4 PIN	4K	**32**
32L7GT	DIODE BEAM PENTODE	32.5	0.3	HEATER	CLASS A AMPLIFIER	90	90	5	38	3	6000	15	90	2600	0.8				T-9	35	8 PIN OCTAL	8Z	**32L7GT**
33	PENTODE	2	0.26	DC FIL.	CLASS A AMPLIFIER	180 135	180 135	18 13.5	22 14.5	5 3	1700 1450	55 50	90 70	6000 7000	1.4 0.7				ST-14	78	MED. 5 PIN	5K	**33**
34	PENTODE	2	0.06	DC FIL.	CLASS A AMPLIFIER	180 135	67.5 67.5	3 3	2.8 2.8	1 1	620 600	1000 600	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	250	90	3 min.	6.5	2.5	1050	400	420	Cutoff: 15 µmhos @ −40 V.					ST-14	79	MED. 5 PIN	5E	**35**
35A5	BEAM PENTODE	35	0.15	HEATER	CLASS A AMPLIFIER	200 110	125 110	0 7.5	43[a] 40[a]	2.0[a] 3.0[a]	6100 5800	34 14		5000 2500	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.										235	700	100	T-9	25	8 PIN LOC.	5AL	**35Y4**
35Z3	DIODE	35	0.15	HEATER	HALF-WAVE RECTIFIER											235	700	100	T-9	30	8 PIN LOC.	4Z	**35Z3**
35Z4GT	DIODE	35	0.15	HEATER	HALF-WAVE RECTIFIER											235	700	100	T-9	35	6 PIN OCTAL	5AA	**35Z4GT**
35Z6G	DOUBLE DIODE	35	0.3	HEATER	HALF-WAVE RECTIFIER	DC Current for Each Section										235	700	110	ST-14	77	7 PIN OCTAL	7Q	**35Z6G**
36	TETRODE	6.3	0.3	HEATER	CLASS A AMPLIFIER	250	90	3	3.2	1.7	1080	550	595						ST-12	72	SMALL 5 PIN	5E	**36**

[a] Zero signal

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., PLATE 1, 1962 PLATE 6445

PRINTED IN U.S.A.

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	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.

PRINTED IN U. S. A.

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 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
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

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

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

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
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	10.5					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**

TUNG-SOL

TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

PRINTED IN U. S. A.

85-713A

		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 KILOHMS	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
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	73	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

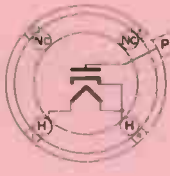
TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. APRIL 1, 1962 PLATE 16447

		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 MMHOS	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
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**

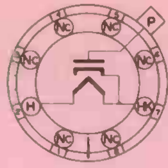
TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL

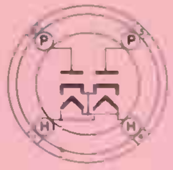
TUNG-SOL



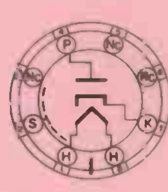
4AB



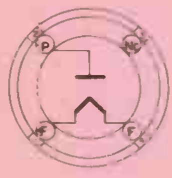
4AC



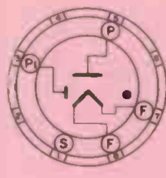
4AD



4AH

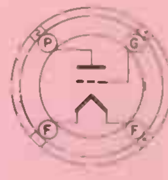


4B

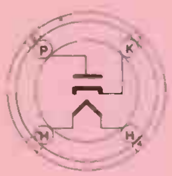


4BU

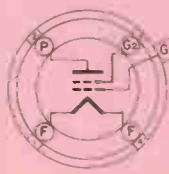
4C



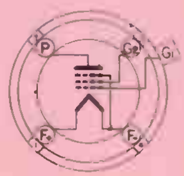
4D



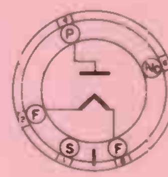
4G



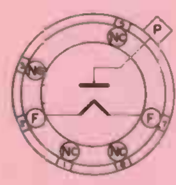
4K



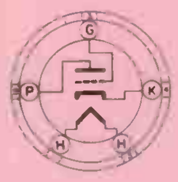
4M



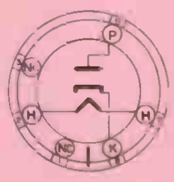
4X



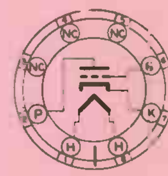
4Y



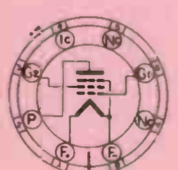
5A



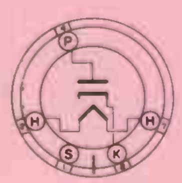
5AA



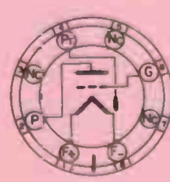
5AC



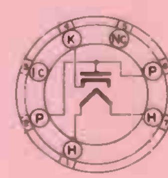
5AD



5AF

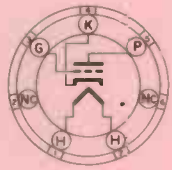


5AG

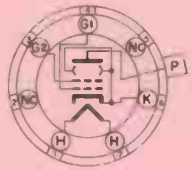


5AM

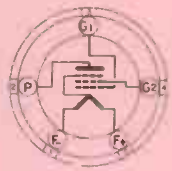
TUNG-SOL



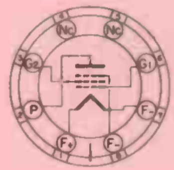
5AS



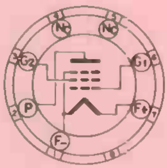
5AZ



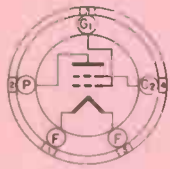
5B



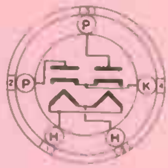
5BF



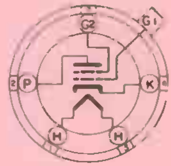
5BZ



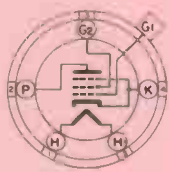
5C



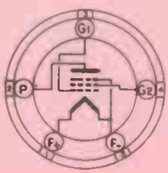
5D



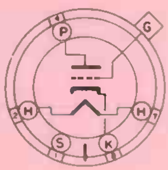
5E



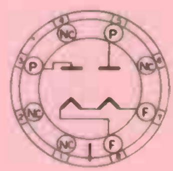
5F



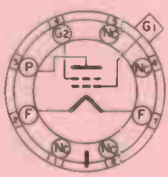
5K



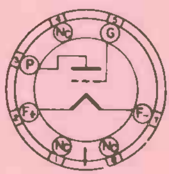
5M



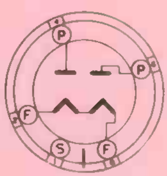
5Q



5R

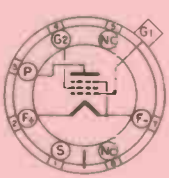


5S

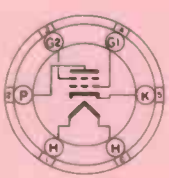


5T

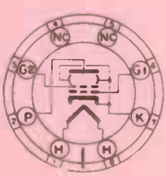
5U



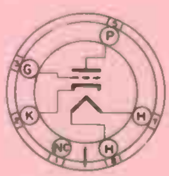
5Y



6A

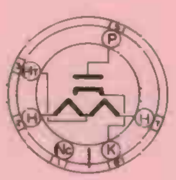


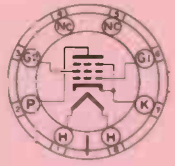
6AA

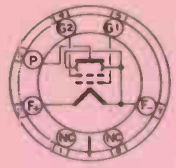


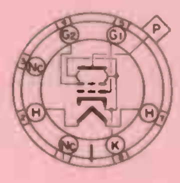
6AB

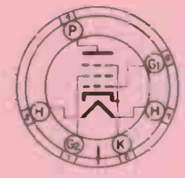
TUNG-SOL

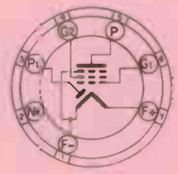

6AD

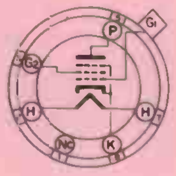

6AE

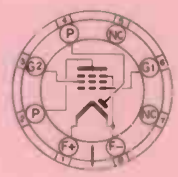

6AF

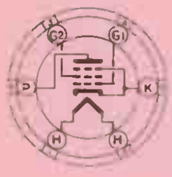

6AM

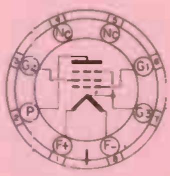

6AP


6AU

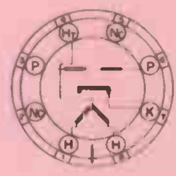

6AW

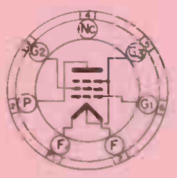

6AX

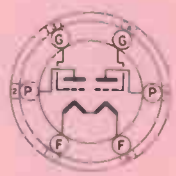

6B


6BA


6BD


6BJ


6BX

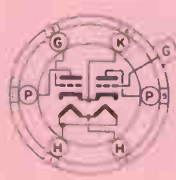

6C

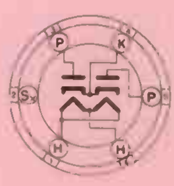

6CN


6D


6F


6G

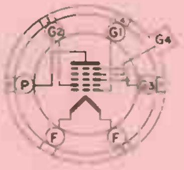

6H


6J

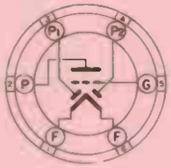
PRINTED IN U.S.A.

BASE DIAGRAMS FOR TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

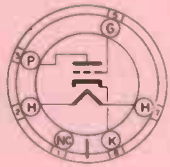
TUNG-SOL



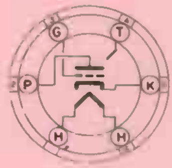
6L



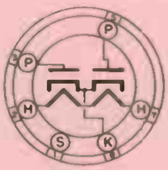
6M



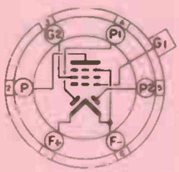
6Q



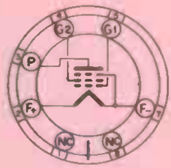
6R



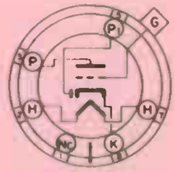
6S



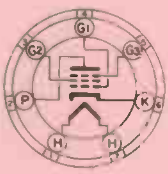
6W



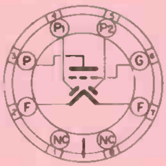
6X



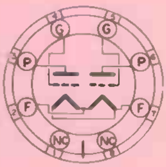
6Y



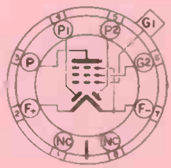
7A



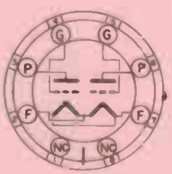
7AA



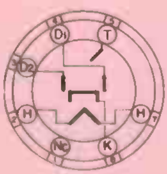
7AB



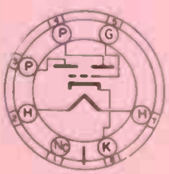
7AD



7AF

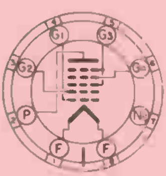


7AG

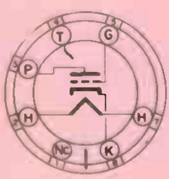


7AH

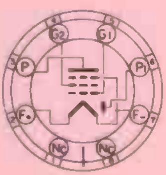
7AJ



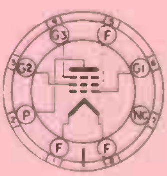
7AK



7AL

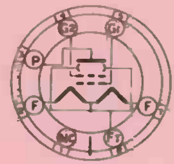


7AM



7AO

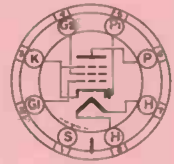
TUNG-SOL



7AP

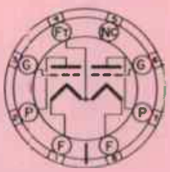
7AU

7AX

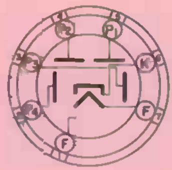


7AZ

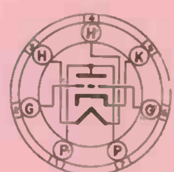
7B



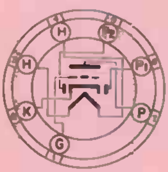
7BE



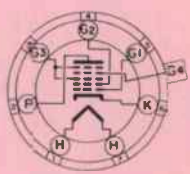
7BJ



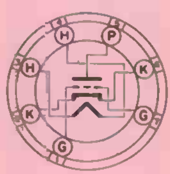
7BK



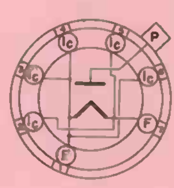
7BT



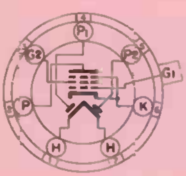
7C



7CA

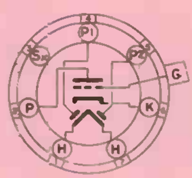


7 CB

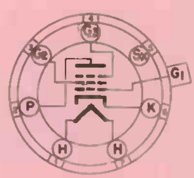


7D

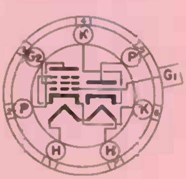
7F



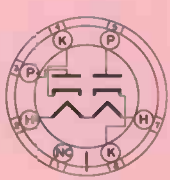
7G



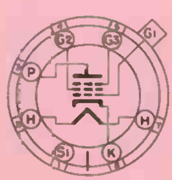
7H



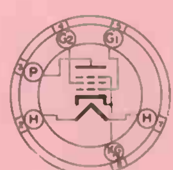
7K



7Q



7R



7 S

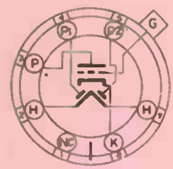
PRINTED IN U.S.A.

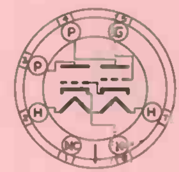
BASE DIAGRAMS FOR TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

TUNG-SOL

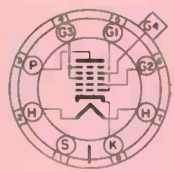

7T

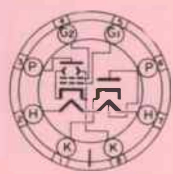

7U

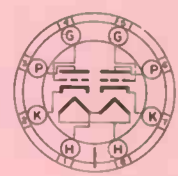

7V


7W

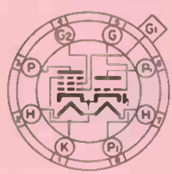

7Z

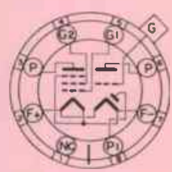

8A

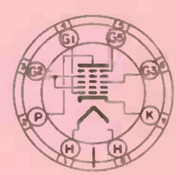

8AB

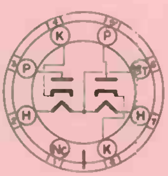

8AC


8AE

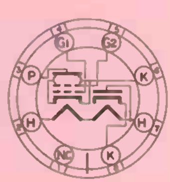

8AF

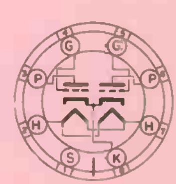

8AJ

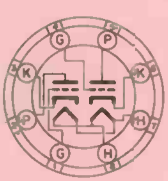

8AL

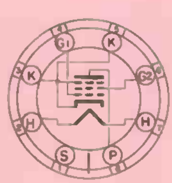

8AN

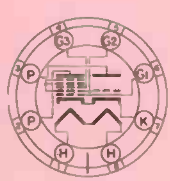

8AS

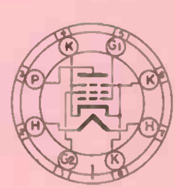

8AV


8B


8BD

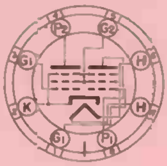

8BK

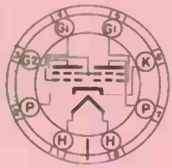

8BL

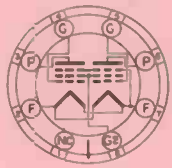

8BO

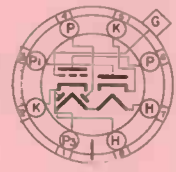
BASE DIAGRAMS FOR TUBES NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

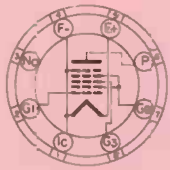
TUNG-SOL

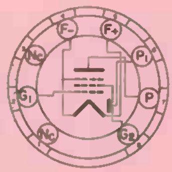

8BU

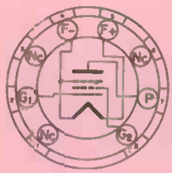

8BV


8C

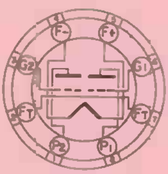

8CB


8CN

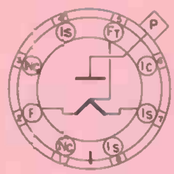

8CO

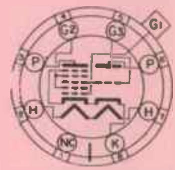

8CP

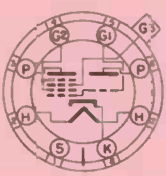

8CQ

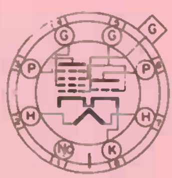

8DL

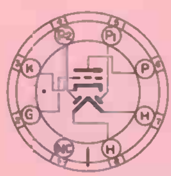

8F

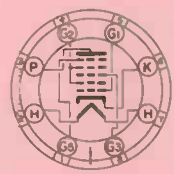

8FV

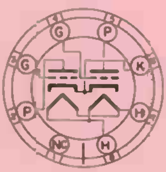

8H


8K

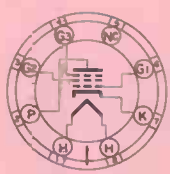

8N


8Q


8R

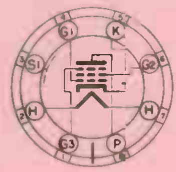

8S


8L

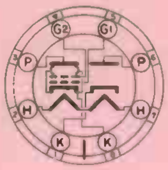

8T


8W

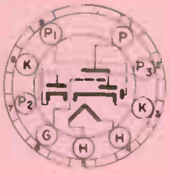
TUNG-SOL



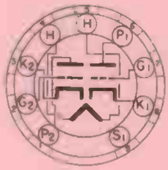
8Y



8Z



9AH



9AJ

BULB TEMPERATURE CURVES

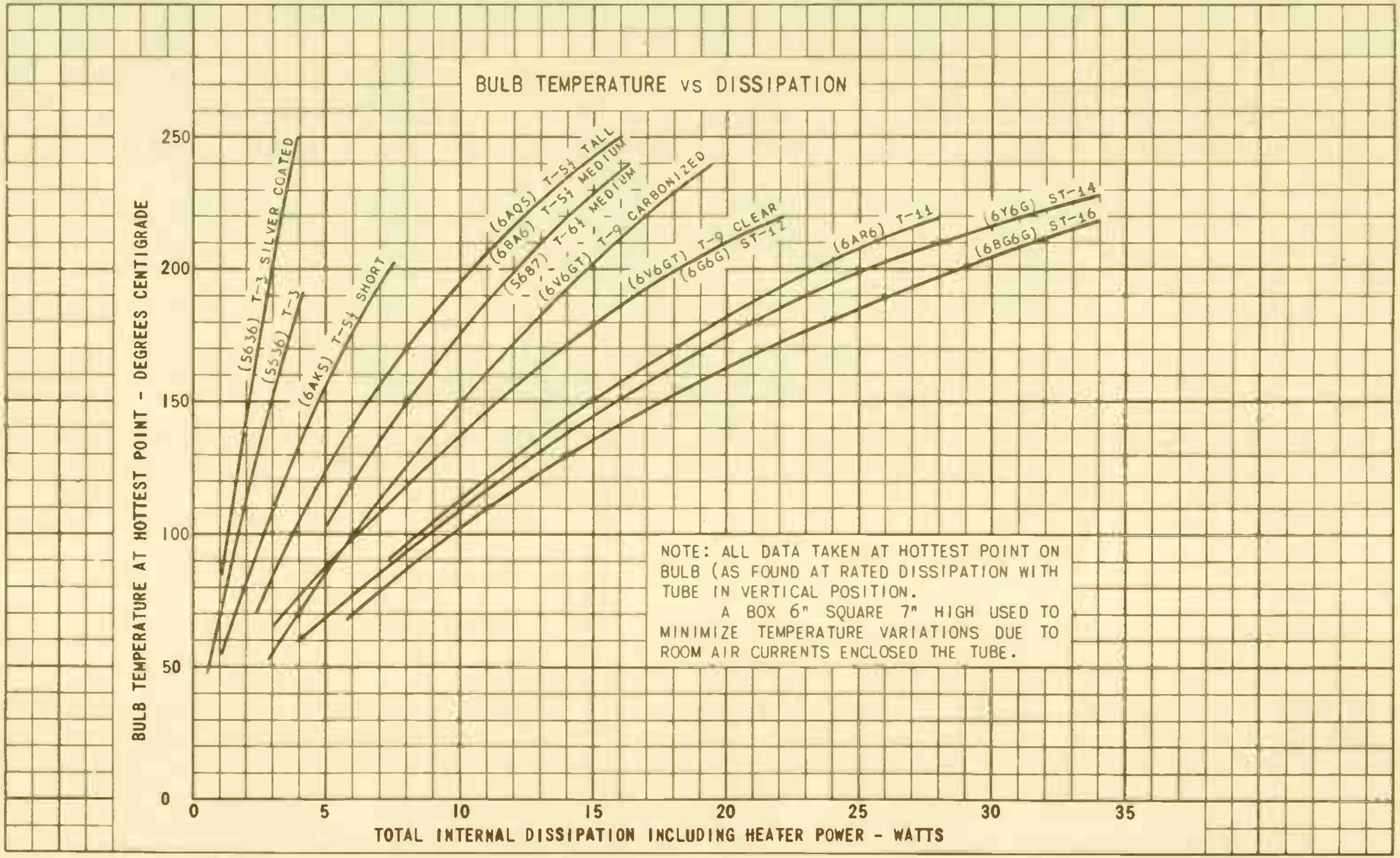
One of the most important factors affecting the useful life of electron tubes is the temperature at which certain parts are required to operate. In the past this has been controlled largely by electrode dissipation ratings. Recently a few, but now increasing number of tube types have been rated for the 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.

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



TUNG-SOL

MILITARY AND INDUSTRIAL TUBE TYPE SECTION

TUNG-SOL

MILITARY AND INDUSTRIAL TUBE TYPE SECTION

TUNG-SOL

MILITARY AND INDUSTRIAL TUBE TYPE SECTION

TUNG-SOL

MILITARY AND INDUSTRIAL TUBE TYPE SECTION

STANDARD ELECTRON TUBES

MIL-STD-200D

MAY 29, 1958

RECEIVING TUBES

FILAMENT VOLTAGE	DIODES	TRIODES	TWIN TRIODES	PENTODES		MIXERS AND CONVERTERS	POWER OUTPUT		RECTIFIERS
				REMOTE	SHARP		PENTODES	TRIODES	
1.25 and 1.4	†1A3	—	†3A5	—	†*1AD4 *1AH4	—	†3B4 3V4 †*5672 †*6088	—	†1B3GT †1Z2
5.0	—	—	—	—	—	—	—	—	†5R4WGA †5Y3WGTA
6.3	*5647 †5726/6AL5W *5829WA †*5896 †*6110	†6C4WA *5703WA *5703WB †*5718 †*5719 *5744WA *5744WB *6222 *6533	†12AT7WA †5670 †5751 *5755 †5814A †*6021 †*6111 †*6112	†5749/6BA6W †*5899 *6206	†6AH6 †6AU6WA †5654/6AK5W *5702WA *5702WB †*5840 *6205	†*5636 †5725/6AS6W †5750/6BE6W *5784WA	†2E30 6AG7Y 6AN5WA 6BG6G †6L6WGB †*5639 †5686 †*5902 †6005/6AQ5W 6094 6384	5687WA †6080WA	†*5641 †6203

TRANSMITTING TUBES

TRIODES	TETRODES	TWIN TETRODES	PULSE MODULATORS	RECTIFIERS			CLIPPER TUBES
				VACUUM	GAS	GRID CONTROL	
100TH 250TH †450TL 811A	†4-400A †4D21 †4-65A †4X150A 4X250 †5933WA	†832A †5894	†3D21A †3E29 †4C35A †4PR60A 5C22/HT-415 †1258 †5948 †5949 †6130	†2X2A †3B24WA †371B 836 1616 †8020	0Z4A/1003 857B 3B 869B †3B28 1005 4B26 5517 †4B32 6C 16B	†C1K 884 *5643 †5684/C3J/A †5685/C6J †5696 †5727/2D21W	†3B29 †4B31

* Subminiature type

† Also U.S. tubes on NATO priority list of electronic tubes (valves).

TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, N. J., U.S.A. JUNE 1, 1959 PLATE 5520

STANDARD ELECTRON TUBES

MICROWAVE TUBES

MAGNETRONS	GAS SWITCHING ATR	GAS SWITCHING TR	KLYSTRONS	DIODES	TRIODES
2J51A	1B35A	1B23	2K22	2B22	5893
†4J50	1B36	1B26	2K26		
4J52A	1B37A	1B27	†2K28		
†4J54-59	1B44	1B50	2K29		
†4J78	1B51	1B55	2K50		
†5586	1B52	1B58A	†6BL6		
5607	1B53	1B63A	726A, B, C		
†5657	1B56	5853	5981		
6027	5792	5863	6310		
	5793	5865	6312		
	5883	5927			
	5921				
	5922				

MISCELLANEOUS TUBES AND SEMICONDUCTOR DEVICES

CATHODE RAY	DIODES (CRYSTALS)	PHOTOTUBES	VOLTAGE REGULATORS
†2BP1	†1N21C	1P21	†OA2WA
3ACP (1A, 7A)	†1N23C		†OB2WA
†3WP1	†1N23CR		†*5644
5AFP (1, 7)	†1N25		5651WA
†5CP (1A, 7A, 12)	†1N26		†*5783WA
†5FP7A	†1N31		*5787WA
5FP14A	†1N32		
5JP1A	†1N53		
5RP (7A, 11A)	†1N78		
7MP7	1N198		
†10KP7	1N253		
12SP7D	1N254		
	1N255		
	1N256		
	1N277		
	1N281		
	1N457		
	1N458		
	1N459		

* Subminiature type.
† Also U.S. tubes on NATO priority list of electronic tubes (valves).

MILITARY, INDUSTRIAL, AND PREMIUM TYPES

The information in this section includes data on tube types not intended for usage in the entertainment field. The industrial types include thyratrons, cold-cathode grid controlled tubes, cold-cathode regulator and reference tubes, series pass tubes for power supply service, etc. The military and premium types include types intended for military and industrial application, such as airborne and mobile equipment, which require the utmost in performance and reliability under severe conditions of mechanical shock and vibration.

Much of the data on premium and military types has been taken from the MIL-E-1C specifications in effect at the time of publication. While all possible precautions have been taken to assure the accuracy of this material, *TUNG-SOL ELECTRIC INC.* assume no liability or responsibility with regard to its use.

TUNG-SOL

SERIES REGULATOR TUBES

POWER DISSIPATION

	Total Plate Dissipation	26 to 30 W.	60 W.	100 W.
	Low Mu	6AS7G 6080WA*	6336 6336A*	7241*
	Medium Mu	5998	6528*	7242*

TYPICAL VALUES FOR REGULATOR SERVICE PER TUBE

Type	Total Plate Current	Range of Tube Voltage Drop	Minimum Tube Drop	Grid Voltage Swing
6080WA*, 6AS7G	200 mA 100	75 v. 200	35 v. 25	50 v. 140
5998	200 100	30 200	45 30	20 52
6336A*, 6336	500 200	50 235	50 35	25 95
6528*	400 200	55 225	70 45	10 35
7241*	750 300	65 270	50 35	25 110
7242*	600 250	80 335	70 40	13 45

OTHER PERTINENT CHARACTERISTICS PER TUBE

Type	Max. Plate Current	Max. Plate Voltage	Mu	Gm	Bulb	Construction
6080WA*, 6AS7G	250. mA	250. V.	2.0	14,000 uM	T12 ST16	Twin Triode
5998	280	275	5.5	28,000	ST16	Twin Triode
6336A*, 6336	800	400	2.7	27,000	TT16	Twin Triode
6528*	600	400	9.0	74,000	TT16	Twin Triode
7241*	1000	400	2.1	40,500	TT18	Single Anode Three Cathodes
7242*	900	400	9.0	111,000	TT18	Single Anode Three Cathodes

*Rugged, long life tubes

CHATHAM ELECTRONICS
Division of Tung-Sol Electric Inc.
5-15-58

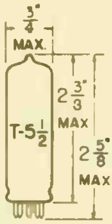
TUNG-SOL

VOLTAGE REGULATOR

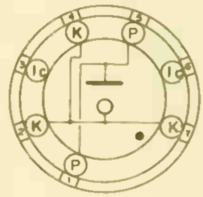
MINIATURE TYPE

COLD-CATHODE GLOW DISCHARGE

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 0A2 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

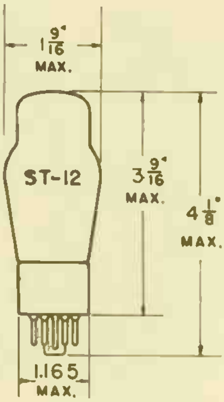
[B] NOT LESS THAN INDICATED SUPPLY VOLTAGE SHOULD BE PROVIDED TO INSURE "STARTING" THROUGHOUT TUBE LIFE.

[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 similar to type OD3/VR150.

PLATE 2018
JUNE 1, 1948

TUNG-SOL

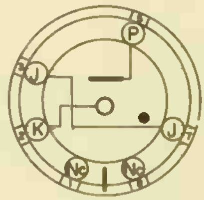


VOLTAGE REGULATOR

COLD CATHODE - GLOW DISCHARGE

GLASS BULB

SMALL SHELL OCTAL 6-PIN BASE



BOTTOM VIEW

THE OA3/VR75, OB3/VR90, OC3/VR105, AND OD3/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

	OA3/VR75	OB3/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

	OC3/VR105	OD3/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.

PRINTED IN U. S. A.

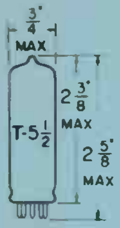
PLATE 1454
AUG. 31 1944

 ELECTRON TUBE DIVISION NEWARK NEW JERSEY, U S A

TUNG-SOL

VOLTAGE REGULATOR

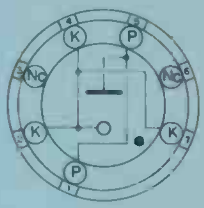
MINIATURE TYPE



GLASS BULB

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE

THE OB2 IS A TWO ELECTRODE, INERT-GAS-FILLED COLD CATHODE MINIATURE TUBE INTENDED FOR USE AS A VOLTAGE REGULATOR. THE TUBE HAS A MAINTAINING VOLTAGE OF APPROXIMATELY 108 VOLTS OVER A CURRENT RANGE OF 5 TO 30 MA. THE OB2 IS EXCELLENT FOR APPLICATIONS WHICH REQUIRE GOOD VOLTAGE REGULATION AND LONG LIFE.

ELECTRICAL DATA

CATHODE	COLD

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2 5/8	INCHES
MAXIMUM SEATED LENGTH	2 3/8	INCHES
MAXIMUM DIAMETER	3/4	INCH
WEIGHT (APPROX.)	0.5	OUNCES
BULB	T-5 1/2	
BASE	SMALL-BUTTON MINIATURE 7-PIN	

RATINGS

ABSOLUTE VALUES

MAXIMUM AVERAGE STARTING CURRENT[A]	75	MA.
MAXIMUM DC CATHODE CURRENT	30	MA.
MINIMUM DC CATHODE CURRENT	5	MA.
MAXIMUM INVERSE VOLTAGE	50	VOLTS
AMBIENT TEMPERATURE	-55 TO +90	°C

[A] AVERAGED OVER STARTING PERIOD NOT EXCEEDING 10 SECONDS. NORMAL OPERATION SHOULD BE CONTINUED FOR AT LEAST TWENTY MINUTES AFTER PASSING THIS CURRENT TO STABILIZE THE TUBE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

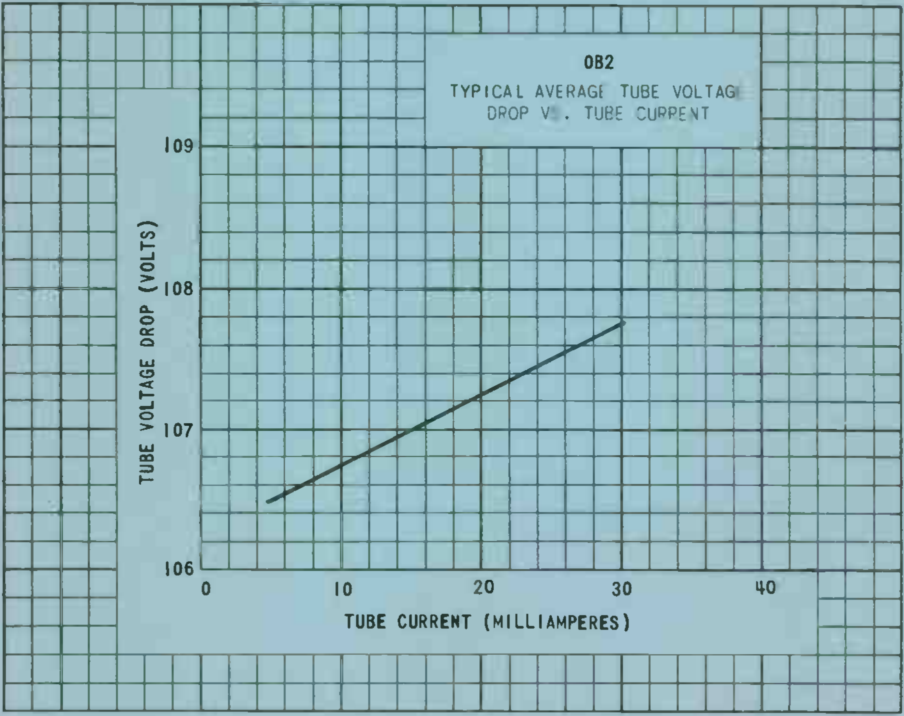
CIRCUIT VALUES

MAXIMUM SHUNT CAPACITOR	0.1	μf
SERIES RESISTOR	SEE OPERATION NOTES	

EQUIPMENT DESIGN AND RANGE VALUES

	MINIMUM VOLTS	AVERAGE VOLTS	MAXIMUM VOLTS
DC ANODE SUPPLY VOLTAGE	133[B]	---	---
ANODE BREAKDOWN VOLTAGE	---	114	133
TUBE VOLTAGE DROP	101	108	114
REGULATION (5 TO 30 MA.)	---	1.1	4

[B] IN ORDER TO ASSURE STARTING THROUGH TUBE LIFE NOT LESS THAN THE SPECIFIED SUPPLY VOLTAGE SHOULD BE PROVIDED.



TUNG-SOL

CONTINUED FROM PRECEDING PAGE

OPERATING NOTES

IN THE OPERATION OF A GLOW TUBE THERE ARE SEVERAL REQUIREMENTS WHICH MUST ALWAYS BE MET. THE FIRST IS THAT THE SUPPLY VOLTAGE MUST ALWAYS BE GREATER THAN THE ANODE BREAKDOWN VOLTAGE AND THE SECOND IS THAT SUFFICIENT RESISTANCE MUST ALWAYS BE PUT IN SERIES WITH THE TUBE IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM AND MAXIMUM VALUES GIVEN IN THE RATINGS.

IN ORDER TO ILLUSTRATE HOW TO CALCULATE THE VALUE OF THE SERIES RESISTANCE A TYPICAL REGULATOR CIRCUIT IS SHOWN IN FIGURE 1.

FROM FIGURE 1 WE SEE THAT V_1 IS THE UNREGULATED SUPPLY VOLTAGE, V_2 IS THE TUBE VOLTAGE DROP ON THE REGULATED VOLTAGE SUPPLIED TO THE LOAD, R_1 IS THE SERIES LIMITING RESISTOR, R_L IS THE VARIABLE LOAD, I_T IS THE TUBE CURRENT AND I_L IS THE LOAD CURRENT.

WE SEE THAT THE TUBE CURRENT WILL BE A MAXIMUM WHEN THE SUPPLY VOLTAGE IS A MAXIMUM (V_1 MAX.); WHEN THE LOAD CURRENT IS A MINIMUM (I_L MIN.); AND WHEN THE TUBE VOLTAGE DROP IS A MINIMUM (V_2 MIN.). THEREFORE THE CONDITIONS WHICH DETERMINE THE LOWER LIMIT FOR THE SERIES RESISTANCE R_1 ARE THAT

$$R_1 > \frac{V_1 \text{ MAX.} - V_2 \text{ MIN.}}{I_T \text{ MAX.} + I_L \text{ MIN.}}$$

IN A LIKE MANNER IT CAN BE SHOWN THAT THE VALUE OF R_1 IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM VALUE REQUIRES THAT

$$R_1 < \frac{V_1 \text{ MIN.} - V_2 \text{ MAX.}}{I_T \text{ MIN.} + I_L \text{ MAX.}}$$

WHEN THESE VALUES HAVE BEEN COMPUTED, ONE SHOULD CHECK TO SEE IF THERE IS SUFFICIENT STARTING VOLTAGE BY THE FOLLOWING RELATION

$$V_1 \text{ MIN.} \frac{R_L}{R_1 + R_L} < V \text{ STARTING}$$

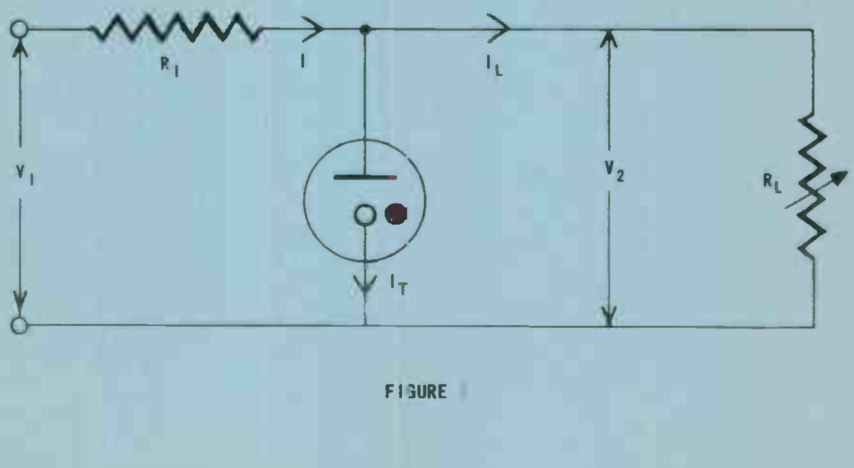
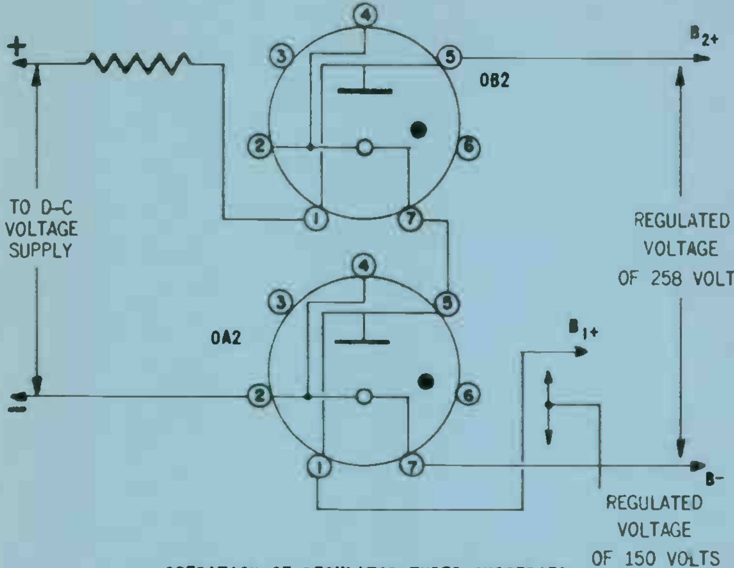


FIGURE 1

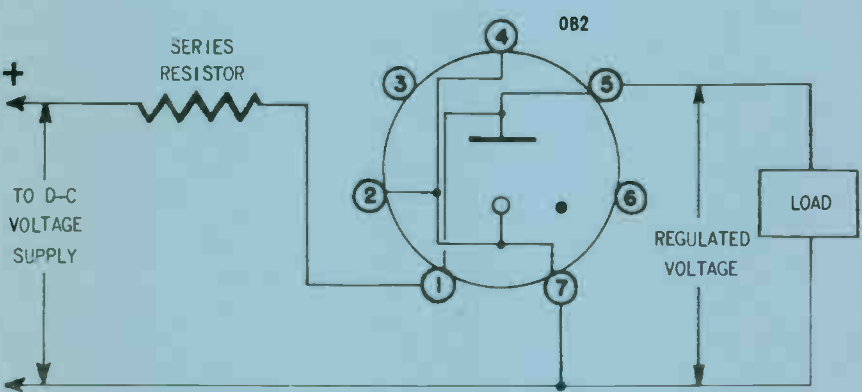
CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE



OPERATION OF REGULATOR TUBES INSSERIES
FIGURE 2



TYPICAL CIRCUIT FOR VOLTAGE REGULATOR
FIGURE 3

CONTINUED ON FOLLOWING PAGE

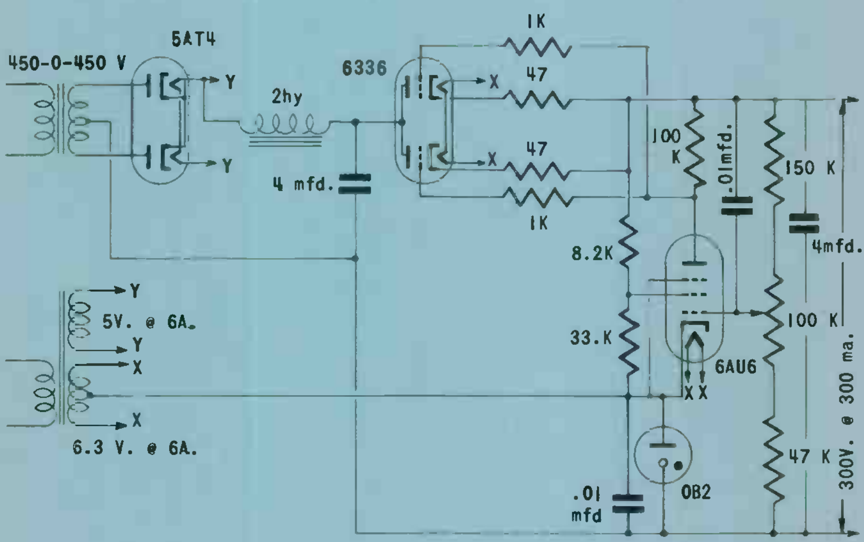
TUNG-SOL

WHEN THESE CALCULATIONS HAVE BEEN MADE AND THERE IS INSUFFICIENT STARTING VOLTAGE, A NEW LOAD CURRENT OF LOWER VALUE MUST BE USED AND THE CALCULATIONS REPEATED.

CIRCUITS WHICH HAVE A CAPACITOR IN SHUNT WITH THE OB2 SHOULD BE LIMITED IN VALUE TO TO 0.1 μf, LARGER VALUES MIGHT CAUSE OSCILLATIONS.

OPERATION OF THE OB2 IN PARALLEL IS NOT RECOMMENDED UNLESS A RESISTANCE OF APPROXIMATELY 100 OHMS IS USED IN SERIES WITH EACH OB2 TO EQUILIZE DIVISION OF CURRENT. HOWEVER, IT SHOULD BE NOTED THAT WHILE THIS ENABLES ONE TO HANDLE MORE LOAD CURRENT IT REDUCES THE REGULATION THAT CAN BE OBTAINED.

IF IT IS DESIRED TO OBTAIN HIGHER REGULATING VOLTAGES, TUBES MAY BE OPERATED IN SERIES AS INDICATED IN FIGURE 2. HOWEVER, CARE SHOULD BE TAKEN TO SEE THAT SUFFICIENT SUPPLY VOLTAGE IS AVAILABLE TO START BOTH TUBES.

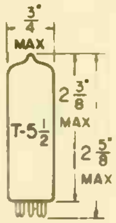


TYPICAL APPLICATION OF OB2
USED IN VOLTAGE REGULATED POWER SUPPLY
FIGURE 4

TUNG-SOL

VOLTAGE-REGULATOR

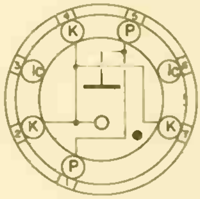
MINIATURE TYPE



GLASS BULB

COLD CATHODE

ANY OPERATING POSITION



BOTTOM VIEW

SMALL-BUTTON MINIATURE 7 PIN BASE

5BO

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

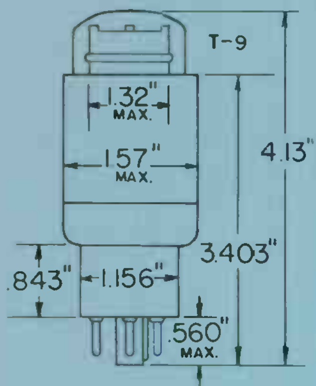
[B] AVERAGED OVER STARTING PERIOD NOT EXCEEDING 10 SECONDS. THIS STARTING PERIOD MUST BE FOLLOWED BY A STEADY-STATE OPERATING CONDITION OF AT LEAST 20 MINUTES, OR TUBE PERFORMANCE WILL BE IMPAIRED.

[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.

TUNG-SOL

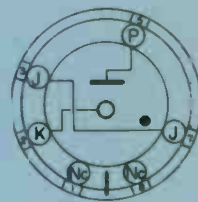
VOLTAGE REGULATOR



GLASS BULB

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
SPECIAL SKIRTED
SMALL SHELL OCTAL
6 PIN

LOW LOSS
PHENOLIC MATERIAL

THE 0C3W IS A TWO ELECTRODE, INERT GAS FILLED COLD CATHODE TUBE INTENDED FOR USE AS A VOLTAGE REGULATOR. THE TUBE HAS A MAINTAINING VOLTAGE OF APPROXIMATELY 105 VOLTS OVER A CURRENT RANGE OF 5 TO 40 MILLIAMPERES.

THE 0C3W IS EXCELLENT FOR APPLICATIONS WHICH REQUIRE GOOD VOLTAGE REGULATION AND LONG LIFE. TUBE ENVELOPE IS FLOATED WITHIN THE BASE SHELL BY A SPONGE RUBBER FILLER. THIS CUSHION DAMPENS VIBRATION AND DECREASES THE TRANSMISSION OF SHOCK TO THE ACTIVE TUBE ELEMENTS. BOTH THE BASING ARRANGEMENT AND HEAVY DUTY PARTS CONSTRUCTION MAKE THE 0C3W ESPECIALLY SUITED FOR USE IN APPLICATIONS WHERE SEVERE MECHANICAL PUNISHMENT WILL BE ENCOUNTERED.

ELECTRICAL DATA

CATHODE	COLD

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL HEIGHT	4 1/8	INCHES
MAXIMUM SEATED HEIGHT	3 3/16	INCHES
MAXIMUM DIAMETER	1 9/16	INCHES
WEIGHT (APPROX.)	2	OUNCES
BULB (SEE OUTLINE)	T-9	
BASE	SPECIAL SKIRTED, SMALL SHELL OCTAL 6-PIN, LOW LOSS PHENOLIC MATERIAL	

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

ABSOLUTE VALUES

MAXIMUM AVERAGE STARTING CURRENT[A]	100	MA.DC
MAXIMUM D.C. CATHODE CURRENT	40	MA.DC
MINIMUM D.C. CATHODE CURRENT	5	MA.DC
AMBIENT TEMPERATURE	-55 TO 70	°C
MAXIMUM ALTITUDE	10 000	FEET
MAXIMUM INVERSE VOLTAGE	-50	VDC
SHOCK IMPACT	900	G/M SEC.
MAXIMUM VIBRATION RATING (D=0.08" @ 50 CPS)	10	G

[A] AVERAGE OVER A STARTING PERIOD NOT EXCEEDING 10 SECONDS. NORMAL OPERATION SHOULD BE CONTINUED FOR AT LEAST TWENTY MINUTES AFTER PASSING THIS CURRENT TO STABILIZE THE TUBE.

ADDITIONAL TESTS TO INSURE RELIABILITY

RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 60° HAMMER ANGLE IN NAVY, FLYWEIGHT,. HIGH IMPACT MACHINE (900 G/MSEC.)

VIBRATION: 10-50-10 CPS, 0.08" TOTAL DISPLACEMENT, IN EACH OF THREE MUTUALLY PERPENDICULAR PLANES. (10 G)

FATIGUE VIBRATION: 25 CPS, 0.08" TOTAL DISPLACEMENT, FOR 32 HOURS IN EACH OF THREE MUTUALLY PERPENDICULAR PLANES (2.5 G).

LIFE TEST 500 HOURS: R_p/I_b = 30 MA. DC

POST SHOCK AND FATIGUE, AND LIFE TEST LIMITS:

IONIZATION VOLTAGE (MAX.)	135	VDC
TUBE VOLTAGE DROP	103 TO 113	VDC
REGULATION (5 TO 40 MA)	4.0	VDC
REGULATION (5 TO 30 MA)	2.5	VDC

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

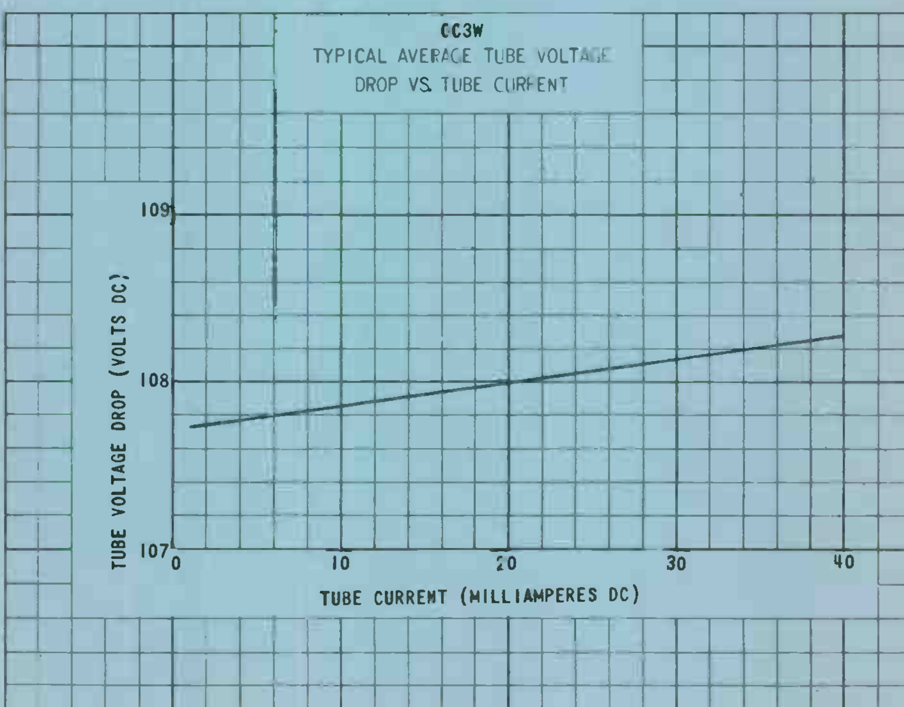
CONTINUED FROM PRECEDING PAGE

EQUIPMENT DESIGN AND RANGE VALUES

	MIN.	AVG.	MAX.	
D.C. ANODE SUPPLY VOLTAGE IN DARKNESS	210[B]	---	---	VOLTS
D.C. ANODE SUPPLY VOLTAGE IN LIGHT	155[B]	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE	---	125	135	VOLTS
TUBE VOLTAGE DROP (1) AT 40 MA.	---	108.5	114	VOLTS
TUBE VOLTAGE DROP (2) AT 30 MA.	---	---	113	VOLTS
TUBE VOLTAGE DROP (3) AT 5 MA.	105	107.8	---	VOLTS
REGULATION	---	0.7	4.0	VOLTS
OSCILLATION (AURAL CHECK)	---	---	---	
NOISE	---	---	15	MVAC
LEAKAGE CURRENT (E_b=50V.DC; R_p= 100 KΩ)	---	---	10	μA
SERIES RESISTOR	C	---	---	
SHUNT CAPACITOR	---	---	0.1	μfd
CURRENT THROUGH INTERCONNECTED LEADS	---	---	2.0	AMP.

[B] IN ORDER TO ASSURE STARTING THROUGH TUBE LIFE NOT LESS THAN THE SPECIFIED SUPPLY VOLTAGE SHOULD BE PROVIDED.

[C] SUFFICIENT SERIES RESISTANCE MUST BE USED TO LIMIT THE CURRENT TO A MAXIMUM OF 40 MA.DC AT THE HIGHEST ANODE SUPPLY VOLTAGE AND TO LIMIT THE CURRENT TO A MINIMUM OF 5 MA.D.C. AT THE LOWEST ANODE SUPPLY VOLTAGE.



TUNG-SOL

CONTINUED FROM PRECEDING PAGE

OPERATING NOTES

IN THE OPERATION OF A GLOW TUBE THERE ARE SEVERAL REQUIREMENTS WHICH MUST ALWAYS BE MET. THE FIRST IS THAT THE SUPPLY VOLTAGE MUST ALWAYS BE GREATER THAN THE ANODE BREAKDOWN VOLTAGE AND THE SECOND IS THAT SUFFICIENT RESISTANCE MUST ALWAYS BE PUT IN SERIES WITH THE TUBE IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM AND MAXIMUM VALUES GIVEN IN THE RATINGS.

IN ORDER TO ILLUSTRATE HOW TO CALCULATE THE VALUE OF THE SERIES RESISTANCE A TYPICAL REGULATOR CIRCUIT IS SHOWN IN FIGURE 1.

FROM FIGURE 1 WE SEE THAT V_1 IS THE UNREGULATED SUPPLY VOLTAGE, V_2 IS THE TUBE VOLTAGE DROP OR THE REGULATED VOLTAGE SUPPLIED TO THE LOAD, R_1 IS THE SERIES LIMITING RESISTOR, R_2 IS THE VARIABLE LOAD, I_T IS THE TUBE CURRENT AND I_L IS THE LOAD CURRENT.

WE SEE THAT THE TUBE CURRENT WILL BE A MAXIMUM WHEN THE SUPPLY VOLTAGE IS A MAXIMUM (V_1 MAX.); WHEN THE LOAD CURRENT IS A MINIMUM (I_L MIN.); AND WHEN THE TUBE VOLTAGE DROP IS A MINIMUM (V_2 MIN.). THEREFORE THE CONDITIONS WHICH DETERMINE THE LOWER LIMIT FOR THE SERIES RESISTANCE R_1 ARE THAT

$$R_1 > \frac{V_1 \text{ MAX.} - V_2 \text{ MIN.}}{I_T \text{ MAX.} + I_L \text{ MIN.}}$$

IN A LIKE MANNER IT CAN BE SHOWN THAT THE VALUE OF R_1 IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM VALUE REQUIRES THAT

$$R_1 < \frac{V_1 \text{ MIN.} - V_2 \text{ MAX.}}{I_T \text{ MIN.} + I_L \text{ MAX.}}$$

WHEN THESE VALUES HAVE BEEN COMPUTED, ONE SHOULD CHECK TO SEE IF THERE IS SUFFICIENT STARTING VOLTAGE BY THE FOLLOWING RELATION

$$V_1 \text{ MIN.} \frac{R_2}{R_1 + R_2} > V \text{ STARTING}$$

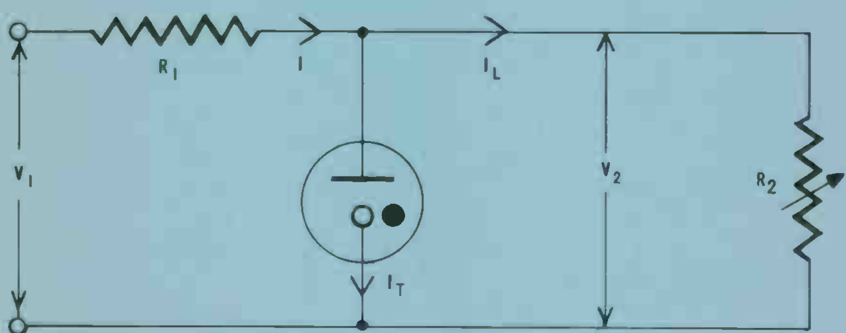


FIGURE 1

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

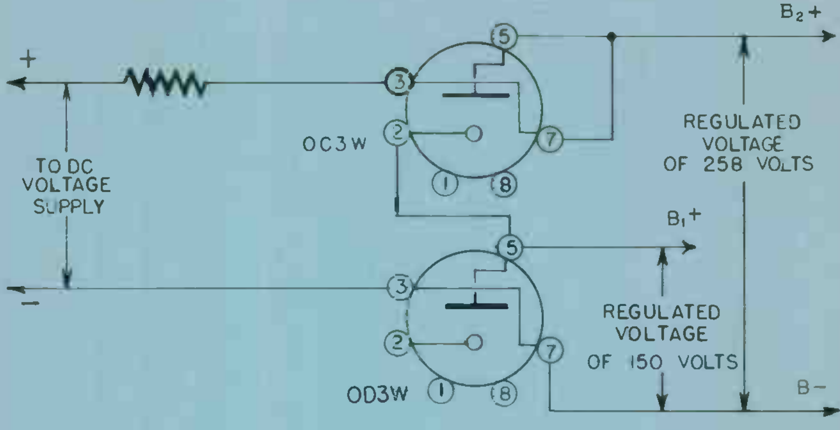


FIGURE 2 - OPERATION OF REGULATOR TUBES IN SERIES

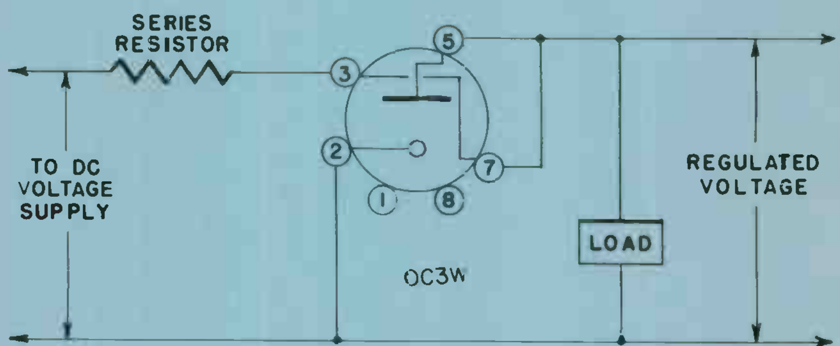


FIGURE 3 - TYPICAL CIRCUIT FOR VOLTAGE REGULATOR

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

WHEN THESE CALCULATIONS HAVE BEEN MADE AND THERE IS INSUFFICIENT STARTING VOLTAGE, A NEW LOAD CURRENT OF LOWER VALUE MUST BE USED AND THE CALCULATIONS REPEATED.

CIRCUITS WHICH HAVE A CAPACITOR IN SHUNT WITH THE OC3W SHOULD BE LIMITED IN VALUE TO 0.1 μf, LARGER VALUES MIGHT CAUSE OSCILLATIONS.

OPERATION OF THE OC3W IN PARALLEL IS NOT RECOMMENDED UNLESS A RESISTANCE OF APPROXIMATELY 100 OHMS IS USED IN SERIES WITH EACH OC3W TO EQUALIZE DIVISION OF CURRENT. HOWEVER, IT SHOULD BE NOTED THAT WHILE THIS ENABLES ONE TO HANDLE MORE LOAD CURRENT IT REDUCES THE REGULATION THAT CAN BE OBTAINED.

IF IT IS DESIRED TO OBTAIN HIGHER REGULATING VOLTAGES, TUBES MAY BE OPERATED IN SERIES AS INDICATED IN FIGURE 2. HOWEVER, CARE SHOULD BE TAKEN TO SEE THAT SUFFICIENT SUPPLY VOLTAGE IS AVAILABLE TO START BOTH TUBES.

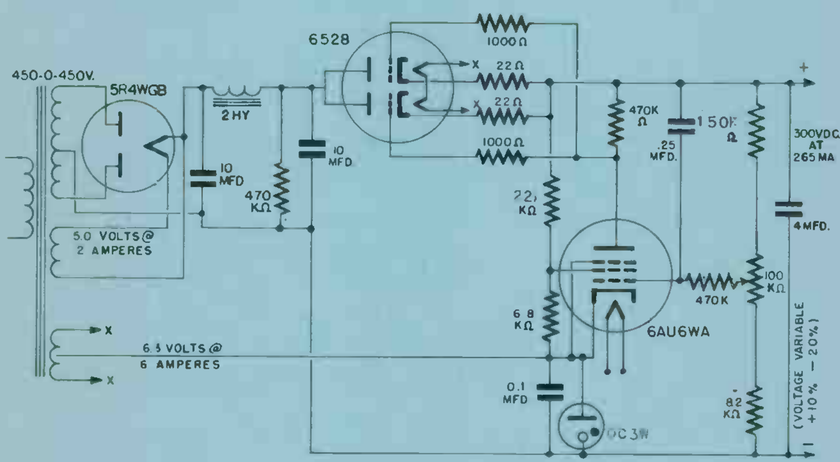
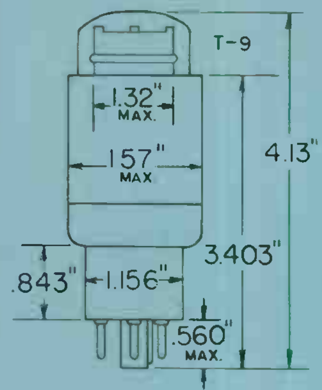


FIGURE 4

TYPICAL APPLICATION OF OC3W USED IN VOLTAGE REGULATED POWER SUPPLY

TUNG-SOL

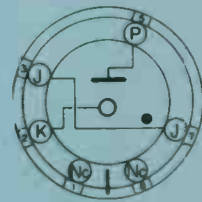
VOLTAGE REGULATOR



GLASS BULB

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

SPECIAL SKIRTED
SMALL SHELL OCTAL
6 PIN

LOW LOSS
PHENOLIC MATERIAL

THE OD3W IS A TWO ELECTRODE, INERT GAS FILLED COLD CATHODE TUBE INTENDED FOR USE AS A VOLTAGE REGULATOR. THE TUBE HAS A MAINTAINING VOLTAGE OF APPROXIMATELY 150 VOLTS OVER A CURRENT RANGE OF 5 TO 40 MILLIAMPERES.

THE OD3W IS EXCELLENT FOR APPLICATIONS WHICH REQUIRE GOOD VOLTAGE REGULATION AND LONG LIFE. TUBE ENVELOPE IS FLOATED WITHIN THE BASE SHELL BY A SPONGE RUBBER FILLER. THIS CUSHION DAMPENS VIBRATION AND DECREASES THE TRANSMISSION OF SHOCK TO THE ACTIVE TUBE ELEMENTS. BOTH THE BASING ARRANGEMENT AND HEAVY DUTY PARTS CONSTRUCTION MAKE THE OD3W ESPECIALLY SUITED FOR USE IN APPLICATIONS WHERE SEVERE MECHANICAL PUNISHMENT WILL BE ENCOUNTERED.

ELECTRICAL DATA

CATHODE	COLD

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL HEIGHT	4 1/8	INCHES
MAXIMUM SEATED HEIGHT	3 9/16	INCHES
MAXIMUM DIAMETER	1 9/16	INCHES
WEIGHT (APPROX.)	2	OUNCES
BULB (SEE OUTLINE)	T-9	
BASE	SPECIAL SKIRTED, SMALL SHELL OCTAL 6-PIN, LOW LOSS PHENOLIC MATERIAL	

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

ABSOLUTE VALUES

MAXIMUM AVERAGE STARTING CURRENT[a]	100	MA.DC
MAXIMUM D.C. CATHODE CURRENT	40	MA.DC
MINIMUM D.C. CATHODE CURRENT	5	MA.DC
AMBIENT TEMPERATURE	-55 TO 70	°C
MAXIMUM ALTITUDE	10 000	FEET
MAXIMUM INVERSE VOLTAGE	-50	VDC
SHOCK IMPACT	900	G/M SEC.
MAXIMUM VIBRATION RATING (10-0.08" @ 50 CPS)	10	G

[a] AVERAGE OVER A STARTING PERIOD NOT EXCEEDING [illegible] SECONDS. NORMAL OPERATION SHOULD BE CONTINUED FOR AT LEAST TWENTY MINUTES AFTER PASSING THIS CURRENT TO STABILIZE THE TUBE.

ADDITIONAL TESTS TO INSURE RELIABILITY

RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 60° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (900 G/MSEC.)

VIBRATION: 10-50-10 CPS, 0.08" TOTAL DISPLACEMENT, IN EACH OF THREE MUTUALLY PERPENDICULAR PLANES. (10 G)

FATIGUE VIBRATION: 25 CPS, 0.08" TOTAL DISPLACEMENT, FOR 32 HOURS IN EACH OF THREE MUTUALLY PERPENDICULAR PLANES (2.5 G).

LIFE TEST 500 HOURS: E_b/I_b = 30 MA. DC

POST SHOCK AND FATIGUE, AND LIFE TEST LIMITS:

IONIZATION VOLTAGE (MAX.)	185	VDC
TUBE VOLTAGE DROP (5 TO 30 MA.)	142 TO 163	VDC
REGULATION (5 TO 40 MA) (MAX.)	5.5	VDC
REGULATION (5 TO 30 MA) (MAX.)	3.5	VDC

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

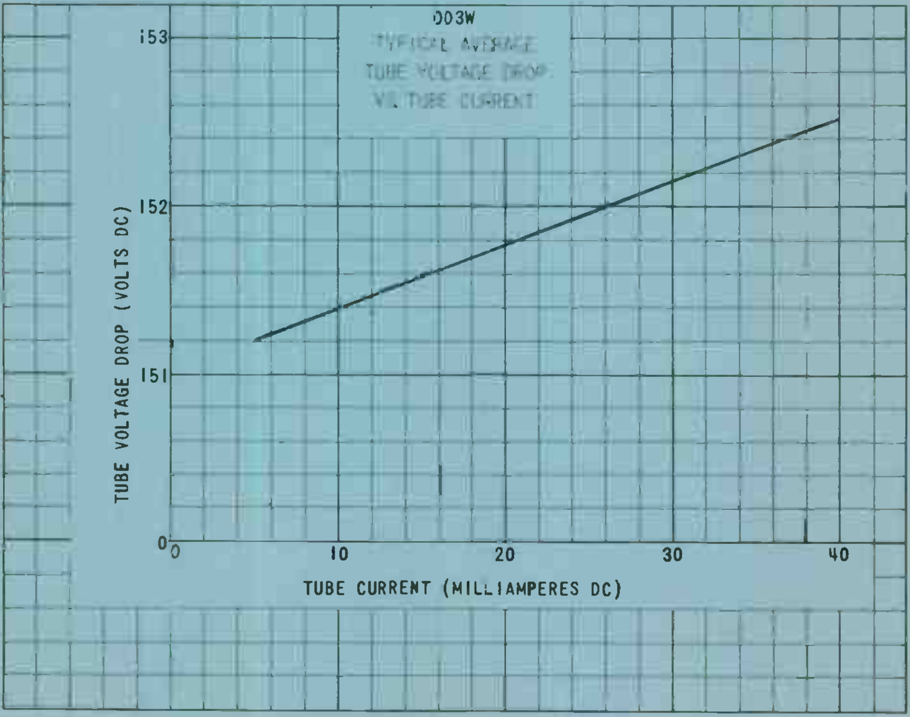
CONTINUED FROM PRECEDING PAGE

EQUIPMENT DESIGN AND RANGE VALUES

	MIN.	AVG.	MAX.	
D.C. ANODE SUPPLY VOLTAGE IN DARKNESS	325[a]	---	---	VOLTS
D.C. ANODE SUPPLY VOLTAGE IN LIGHT	185[a]	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE	---	158	185	VOLTS
TUBE VOLTAGE DROP (1) AT 40 MA.	---	153	165	VOLTS
TUBE VOLTAGE DROP (2) AT 30 MA.	---	---	163	VOLTS
TUBE VOLTAGE DROP (3) AT 5 MA.	142	151	---	VOLTS
REGULATION	---	2.0	5.4	VOLTS
OSCILLATION (AURAL CHECK)	---	---	---	
NOISE	---	0	15	MV.AC
LEAKAGE CURRENT (E_b=50V.DC; R_p=100KΩ)	---	0	10	µA
SERIES RESISTOR	c	---	---	
SHUNT CAPACITOR	---	---	0.1	µfd.
CURRENT THROUGH INTERCONNECTED LEADS	---	---	2.0	AMP.

[a] IN ORDER TO INSURE STARTING THROUGH TUBE LIFE [illegible] THAN THE SPECIFIED SUPPLY VOLTAGE SHOULD BE PROVIDED.

[c] SUFFICIENT SERIES RESISTANCE MUST BE USED TO LIMIT THE CURRENT TO A MAXIMUM OF 40 MA.DC AT THE HIGHEST ANODE SUPPLY VOLTAGE AND TO LIMIT THE CURRENT TO A MINIMUM OF 5 MA.D.C. AT THE LOWEST ANODE SUPPLY VOLTAGE.



TUNG-SOL

CONTINUED FROM PRECEDING PAGE

OPERATING NOTES

IN THE OPERATION OF A GLOW TUBE THERE ARE SEVERAL REQUIREMENTS WHICH MUST ALWAYS BE MET. THE FIRST IS THAT THE SUPPLY VOLTAGE MUST ALWAYS BE GREATER THAN THE ANODE BREAKDOWN VOLTAGE AND THE SECOND IS THAT SUFFICIENT RESISTANCE MUST ALWAYS BE PUT IN SERIES WITH THE TUBE IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM AND MAXIMUM VALUES GIVEN IN THE RATINGS.

IN ORDER TO ILLUSTRATE HOW TO CALCULATE THE VALUE OF THE SERIES RESISTANCE A TYPICAL REGULATOR CIRCUIT IS SHOWN IN FIGURE 1.

FROM FIGURE 1 WE SEE THAT V_1 IS THE UNREGULATED SUPPLY VOLTAGE, V_2 IS THE TUBE VOLTAGE DROP OR THE REGULATED VOLTAGE SUPPLIED TO THE LOAD, R_1 IS THE SERIES LIMITING RESISTOR, R_2 IS THE VARIABLE LOAD, I_T IS THE TUBE CURRENT AND I_L IS THE LOAD CURRENT.

WE SEE THAT THE TUBE CURRENT WILL BE A MAXIMUM WHEN THE SUPPLY VOLTAGE IS A MAXIMUM (V_1 MAX.); WHEN THE LOAD CURRENT IS A MINIMUM (I_L MIN.); AND WHEN THE TUBE VOLTAGE DROP IS A MINIMUM (V_2 MIN.). THEREFORE THE CONDITIONS WHICH DETERMINE THE LOWER LIMIT FOR THE SERIES RESISTANCE R_1 ARE THAT

$$R_1 > \frac{V_1 \text{ MAX.} - V_2 \text{ MIN.}}{I_T \text{ MAX.} + I_L \text{ MIN.}}$$

IN A LIKE MANNER IT CAN BE SHOWN THAT THE VALUE OF R_1 REQUIRED TO LIMIT THE CURRENT TO THE MINIMUM VALUE REQUIRES THAT

$$R_1 < \frac{V_1 \text{ MIN.} - V_2 \text{ MAX.}}{I_T \text{ MIN.} + I_L \text{ MAX.}}$$

WHEN THESE VALUES HAVE BEEN COMPUTED, ONE SHOULD CHECK TO SEE IF THERE IS SUFFICIENT STARTING VOLTAGE BY THE FOLLOWING RELATION

$$V_1 \text{ MIN.} \frac{R_2}{R_1 + R_2} > V \text{ STARTING}$$

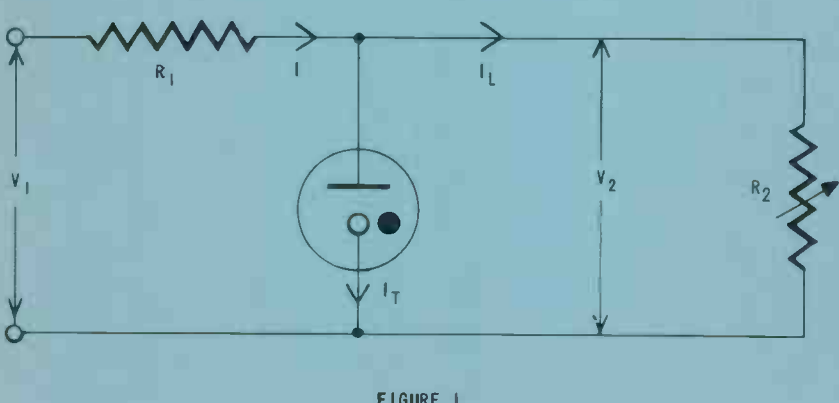


FIGURE 1

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

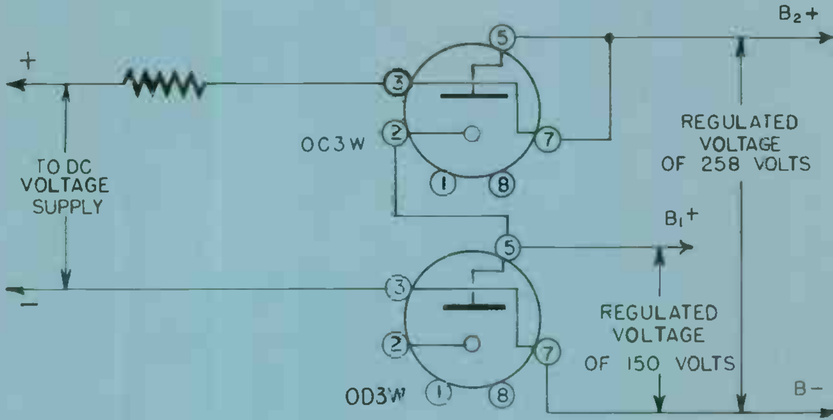


FIGURE 2 - OPERATION OF REGULATOR TUBES IN SERIES

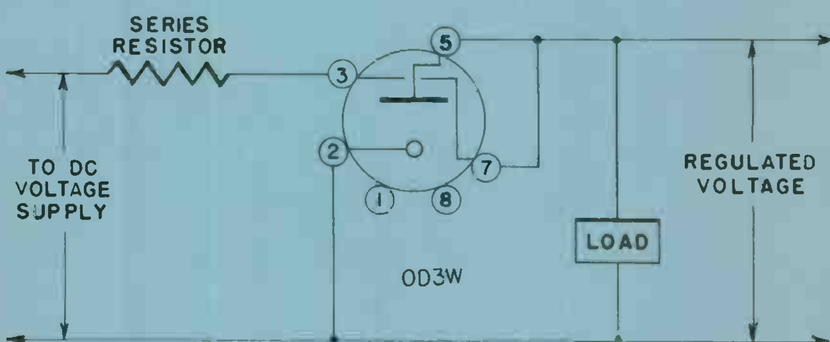


FIGURE 3 - TYPICAL CIRCUIT FOR VOLTAGE REGULATOR

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

WHEN THESE CALCULATIONS HAVE BEEN MADE AND THERE IS INSUFFICIENT STARTING VOLTAGE, A NEW LOAD CURRENT OF LOWER VALUE MUST BE USED AND THE CALCULATIONS REPEATED.

CIRCUITS WHICH HAVE A CAPACITOR IN SHUNT WITH THE OD3W SHOULD BE LIMITED IN VALUE TO 0.1 μf, LARGER VALUES MIGHT CAUSE OSCILLATIONS.

OPERATION OF THE OD3W IN PARALLEL IS NOT RECOMMENDED UNLESS A RESISTANCE OF APPROXIMATELY 100 OHMS IS USED IN SERIES WITH EACH OD3W TO EQUALIZE DIVISION OF CURRENT. HOWEVER, IT SHOULD BE NOTED THAT WHILE THIS ENABLES ONE TO HANDLE MORE LOAD CURRENT IT REDUCES THE REGULATION THAT CAN BE OBTAINED.

IF IT IS DESIRED TO OBTAIN HIGHER REGULATING VOLTAGES, TUBES MAY BE OPERATED IN SERIES AS INDICATED IN FIGURE 2. HOWEVER, CARE SHOULD BE TAKEN TO SEE THAT SUFFICIENT SUPPLY VOLTAGE IS AVAILABLE TO START BOTH TUBES.

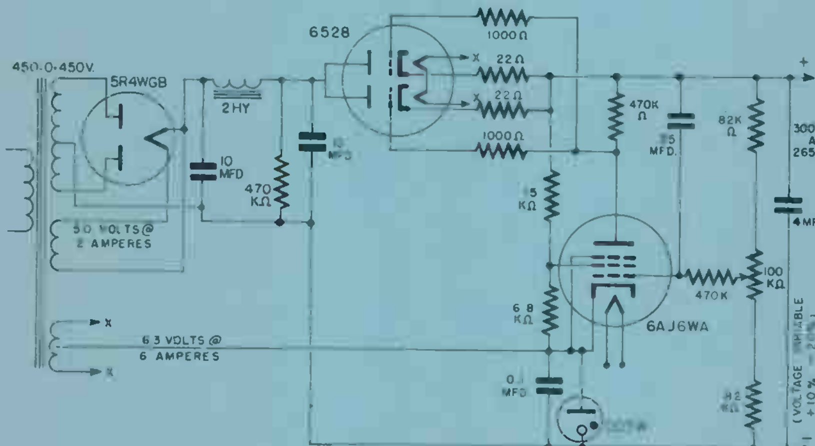


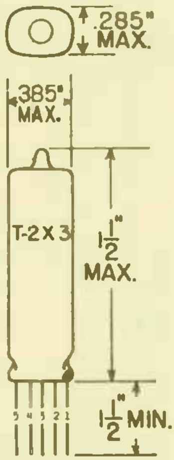
FIGURE 4

TYPICAL APPLICATION OF OD3W USED IN VOLTAGE REGULATED POWER SUPPLY

TUNG-SOL

PENTODE

SUBMINIATURE TYPE

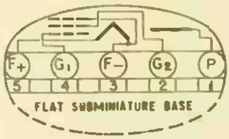


GLASS BULB
RED DOT IS ADJACENT TO LEAD 1

COATED FILAMENT

1.25 VOLTS 0.1 AMP.
AC OR DC

ANY MOUNTING POSITION



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

THE 1AD4 IS A FILAMENT TYPE, SHARP CUT-OFF PENTODE OF SUBMINIATURE CONSTRUCTION DESIGNED FOR RF AND AF APPLICATIONS IN PORTABLE EQUIPMENT. A COATED METAL SHIELD IS USED AND CONNECTED TO LEAD #3. 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

GRID #1 TO PLATE (MAX.)	0.01	μμf
INPUT	4.5	μμf
OUTPUT	4.5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.25	VOLTS
MAXIMUM PLATE VOLTAGE	45	VOLTS
MAXIMUM GRID #2 VOLTAGE	45	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	6.5	MA.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

TUNG-SOL

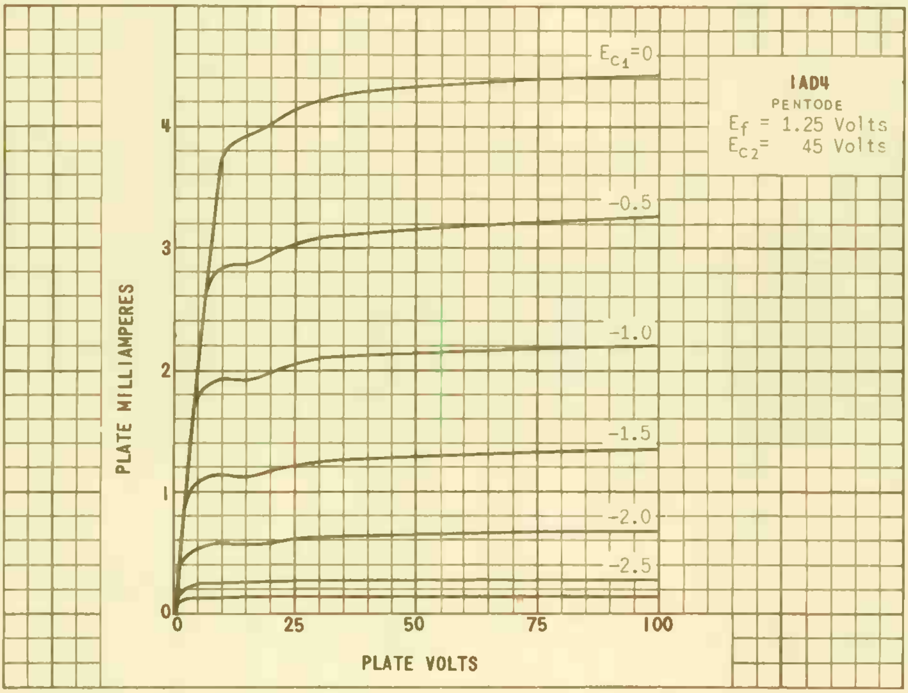
CONTINUED FROM PRECEDING PAGE

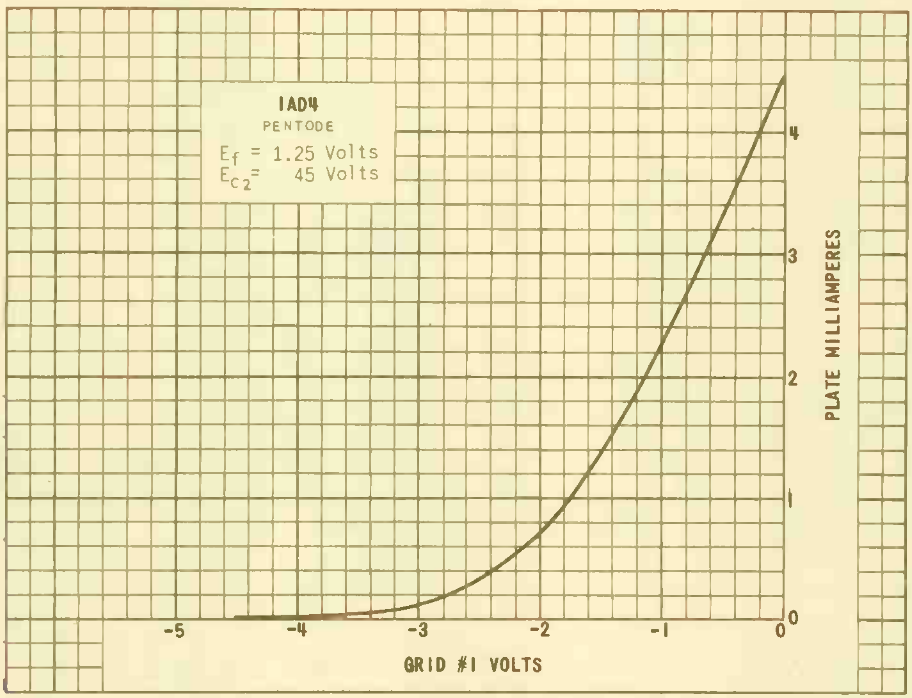
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

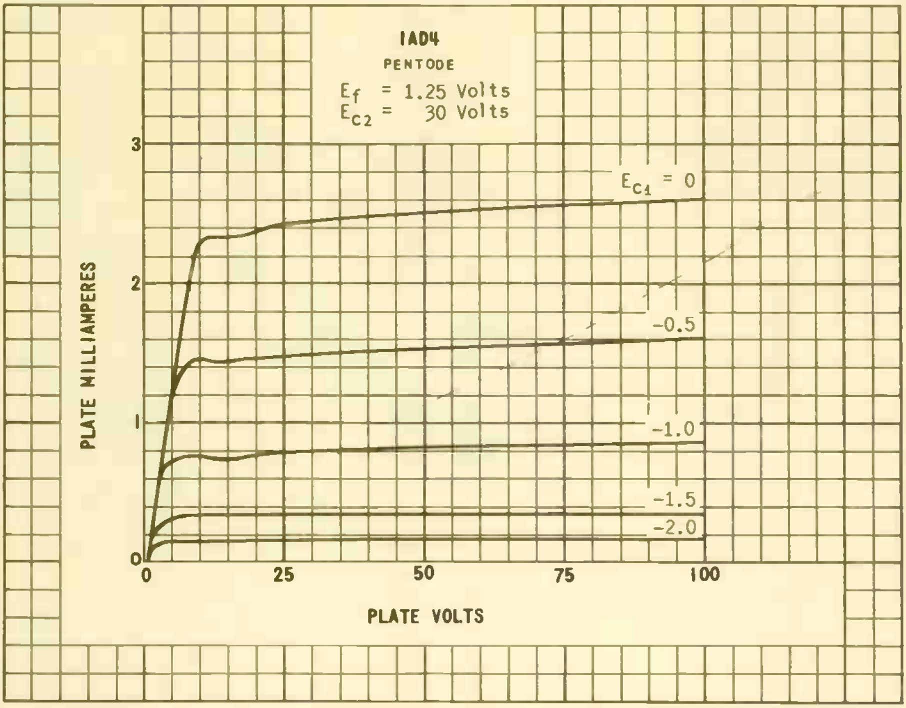
CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.25	VOLTS
FILAMENT CURRENT	0.1	AMP.
PLATE VOLTAGE	45	VOLTS
GRID #2 VOLTAGE	45	VOLTS
GRID #1 VOLTAGE[A]	0	VOLTS
PLATE RESISTANCE (APPROX.)	0.5	MEGOHMS
TRANSCONDUCTANCE	2 000	µMHOS
PLATE CURRENT	3.0	MA.
GRID #2 CURRENT	0.8	MA.
GRID #1 VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE = 10 µMHOS	-3.5	VOLTS

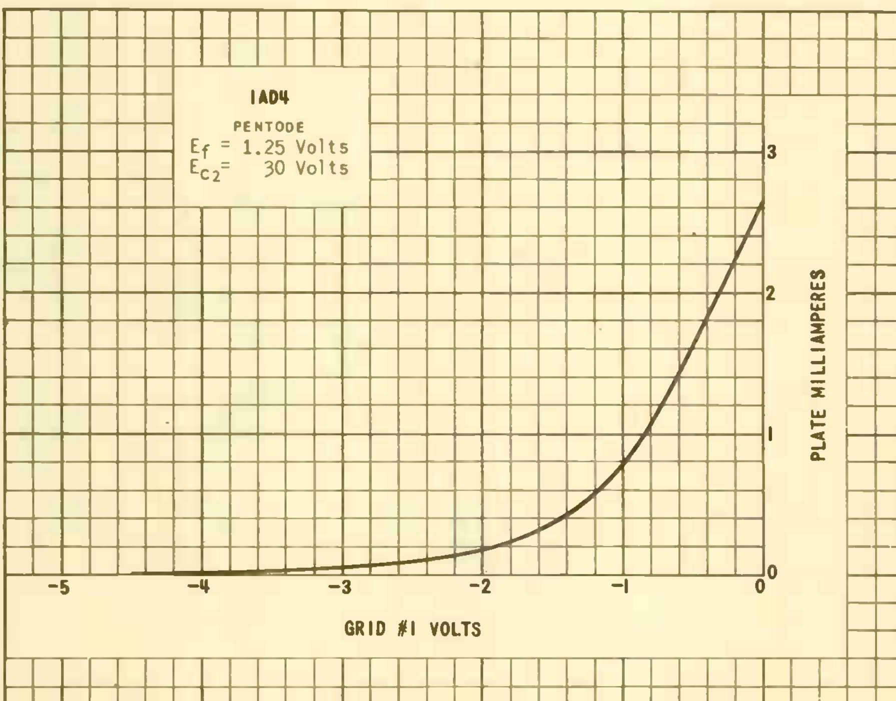
[A]GRID #1 RESISTOR = 2 MEGOHMS.


1AD4
PENTODE
E_f = 1.25 Volts
E_{c_2} = 45 Volts
E_{c_1}=0
-0.5
-1.0
-1.5
-2.0
-2.5
PLATE MILLIAMPERES
0
1
2
3
4
0
25
50
75
100
PLATE VOLTS


1AD4
PENTODE
E_f = 1.25 Volts
E_{c_2} = 45 Volts
PLATE MILLIAMPERES
0
1
2
3
4
-5
-4
-3
-2
-1
0
GRID #1 VOLTS



1AD4
PENTODE
Ef = 1.25 Volts
Ec2 = 30 Volts
Ec1 = 0
-0.5
-1.0
-1.5
-2.0
PLATE MILLIAMPERES
0
1
2
3
0
25
50
75
100
PLATE VOLTS

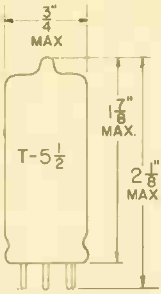


1AD4
PENTODE
Ef = 1.25 Volts
Ec2 = 30 Volts
PLATE MILLIAMPERES
0
1
2
3
-5
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

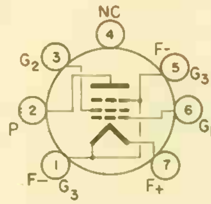
MINIATURE BUTTON
7 PIN BASE E7-1

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

TUNG-SOL

PENTODE

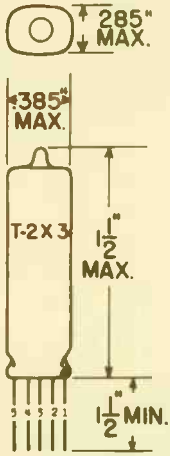
SUBMINIATURE TYPE

COATED FILAMENT

1.25 VOLTS 0.04 AMP.

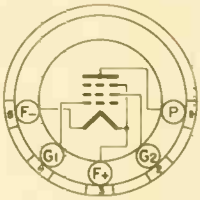
AC OR DC

ANY MOUNTING POSITION



GLASS BULB

COLORED DOT IS ADJACENT TO LEAD 1



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

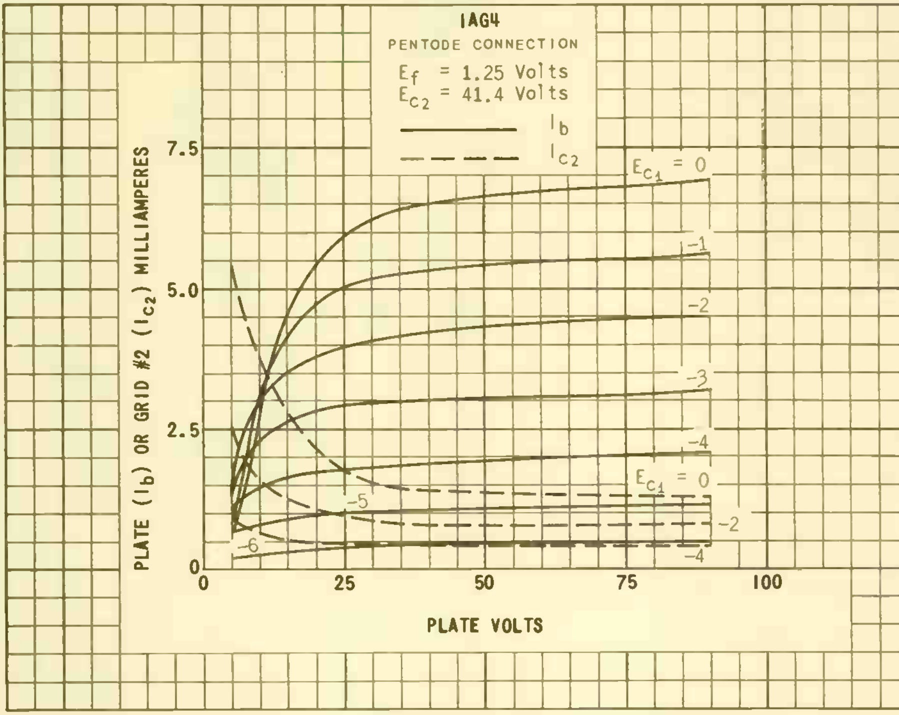
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

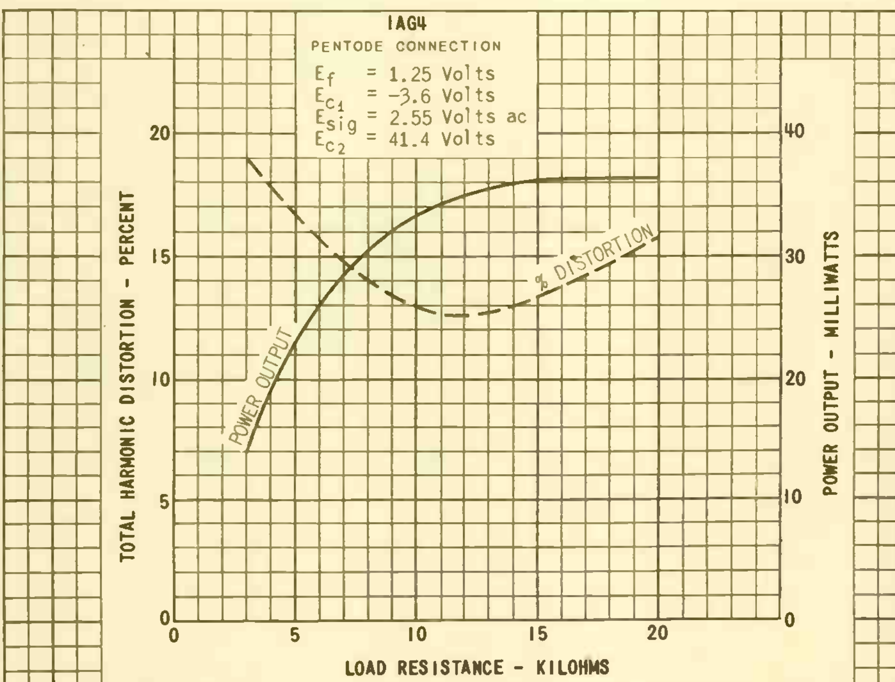
FILAMENT VOLTAGE (DC)	1.25	VOLTS
MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM CATHODE CURRENT (ZERO SIGNAL)	4	MA.

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.

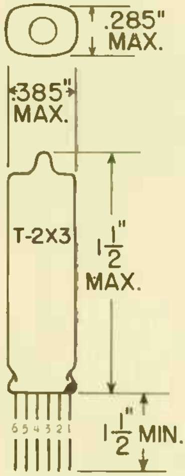

1AG4
PENTODE CONNECTION
E_f = 1.25 Volts
E_{c_2} = 41.4 Volts
I_b
I_{c_2}
E_{c_1} = 0
-1
-2
-3
-4
-5
-6
E_{c_1} = 0
-2
-4
PLATE (I_b) OR GRID #2 (I_{c_2}) MILLIAMPERES
7.5
5.0
2.5
0
0
25
50
75
100
PLATE VOLTS


1AG4
PENTODE CONNECTION
E_f = 1.25 Volts
E_{c_1} = -3.6 Volts
E_{sig} = 2.55 Volts ac
E_{c_2} = 41.4 Volts
POWER OUTPUT
% DISTORTION
TOTAL HARMONIC DISTORTION - PERCENT
20
15
10
5
0
POWER OUTPUT - MILLIWATTS
40
30
20
10
0
0
5
10
15
20
LOAD RESISTANCE - KILOHMS

TUNG-SOL

DIODE PENTODE

SUBMINIATURE TYPE



GLASS BULB

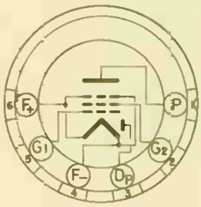
COLORED DOT IS ADJACENT TO LEAD 5

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	$\mu\mu f$
INPUT: G_1 TO ($F+G_2+G_3$)	1.7	$\mu\mu f$
OUTPUT: P TO ($F+G_2+G_3$)	2.4	$\mu\mu f$

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

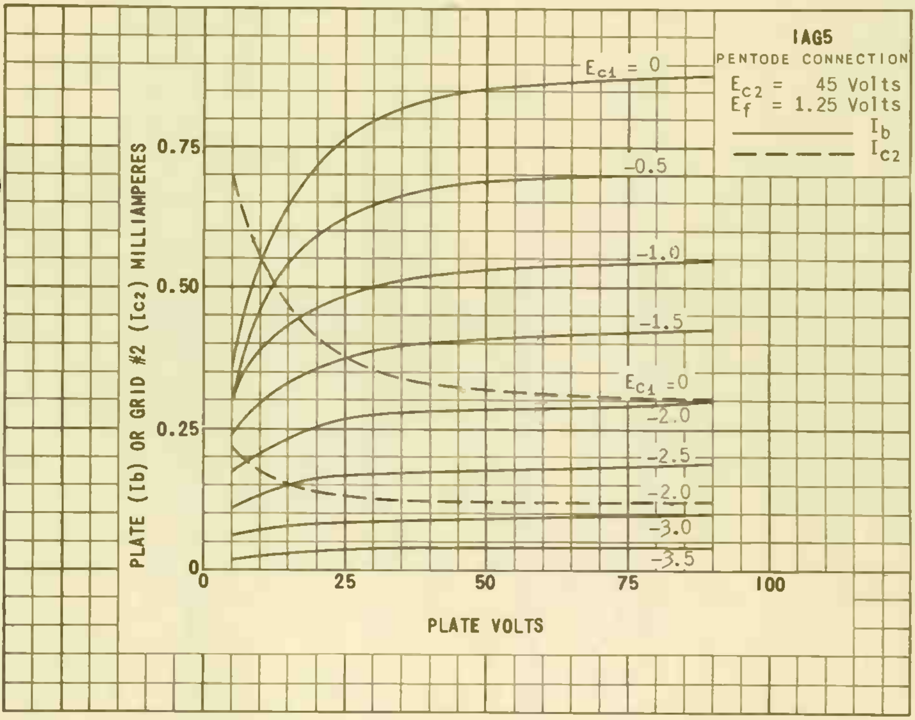
FILAMENT VOLTAGE (DC)	1.25	1.25	VOLTS
FILAMENT CURRENT	.03	.03	AMP.
PLATE VOLTAGE	22.5	45	VOLTS
GRID #2 VOLTAGE	22.5	45	VOLTS
GRID #1 VOLTAGE	0	-2.0	VOLTS
PLATE RESISTANCE	0.7	2.5	MEGOHM
TRANSCONDUCTANCE	235	250	µMHOS
PLATE CURRENT	0.17	0.28	MA.
GRID #2 CURRENT	0.043	0.12	MA.
GRID #1 RESISTOR	5	0	MEGOHM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

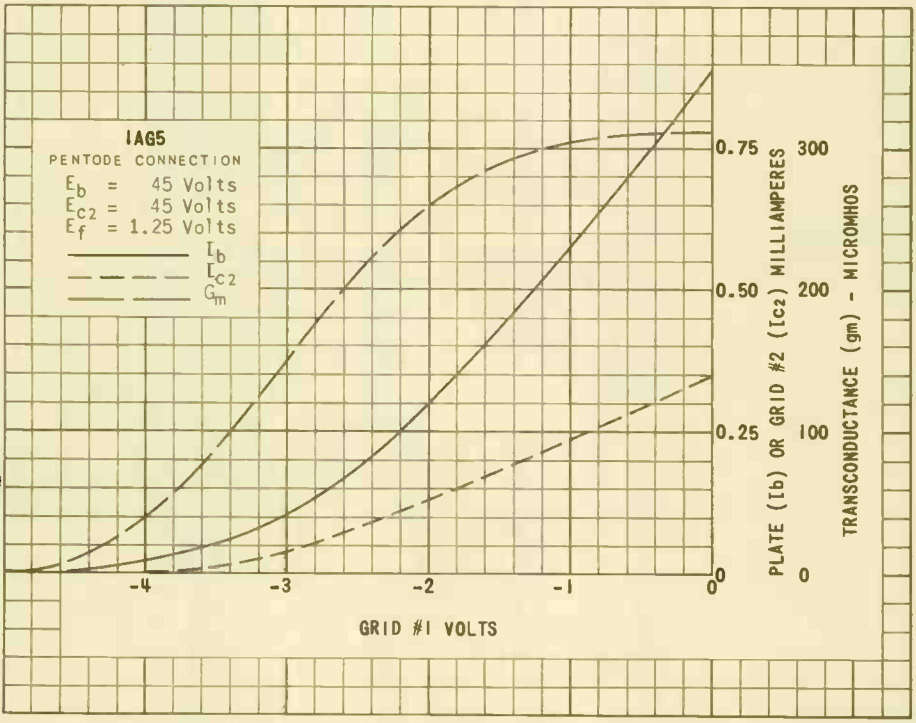
RESISTANCE - COUPLED AMPLIFIER

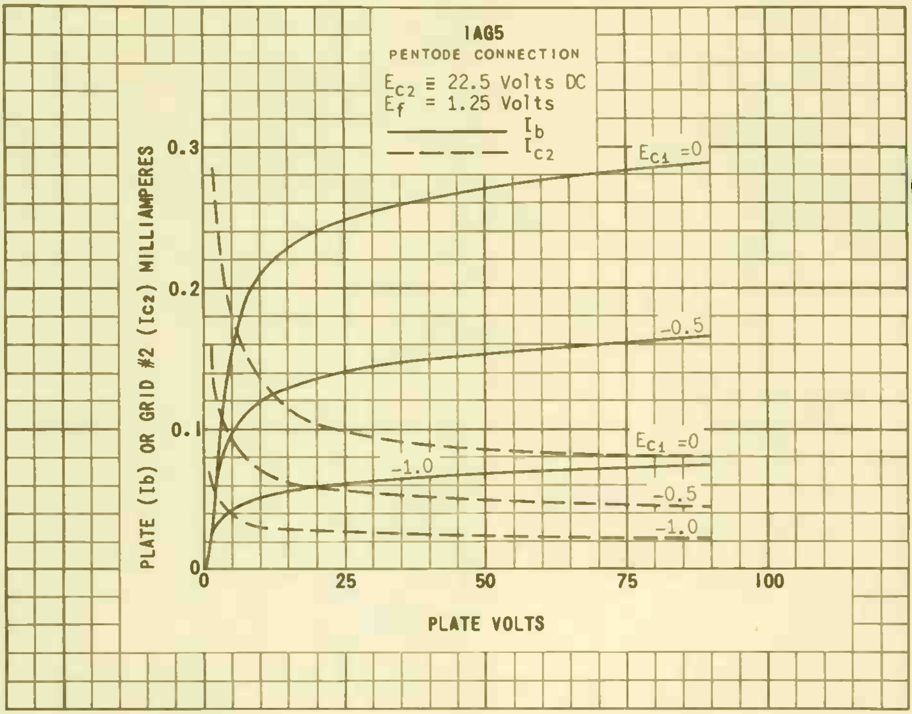
FILAMENT VOLTAGE (DC)	1.25	1.25	VOLTS
FILAMENT CURRENT	.03	.03	AMP.
PLATE SUPPLY VOLTAGE	45	67.5	VOLTS
GRID #2 SUPPLY VOLTAGE	45	67.5	VOLTS
GRID #1 VOLTAGE[B]	0	0	VOLTS
LOAD RESISTANCE	1	1	MEGOHM
SERIES GRID #2 RESISTOR	5	5	MEGOHMS
GRID #2 BY-PASS CONDENSER	0.1	0.1	µf
GRID #1 RESISTOR (FOLLOWING TUBE)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

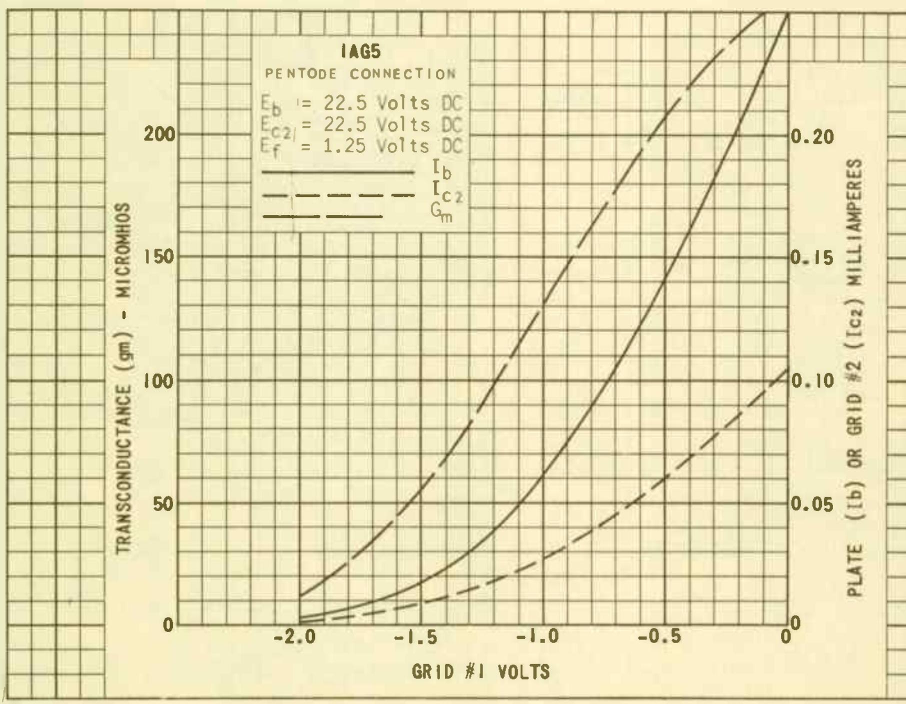
[A] THE DIODE IS LOCATED AT THE NEGATIVE END OF THE FILAMENT.

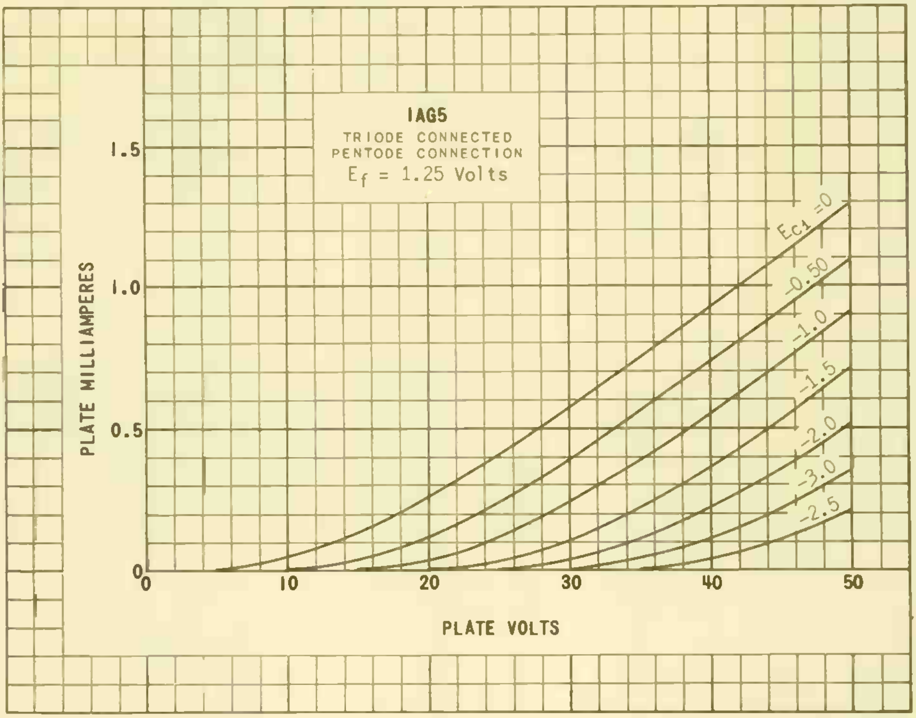
[B] GRID #1 RESISTOR = 5 MEGOHMS.


1AG5
PENTODE CONNECTION
Ec2 = 45 Volts
Ef = 1.25 Volts
Ib
Ic2
Ec1 = 0
-0.5
-1.0
-1.5
Ec1 = 0
-2.0
-2.5
-2.0
-3.0
-3.5
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0.75
0.50
0.25
0
0
25
50
75
100
PLATE VOLTS


1AG5
PENTODE CONNECTION
Eb = 45 Volts
Ec2 = 45 Volts
Ef = 1.25 Volts
Ib
Ic2
Gm
-4
-3
-2
-1
0
GRID #1 VOLTS
0.75
0.50
0.25
0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
300
200
100
0
TRANSCONDUCTANCE (gm) - MICROMHOS


IAG5
PENTODE CONNECTION
Ec2 = 22.5 Volts DC
Ef = 1.25 Volts
Ib
Ic2
Ec1 =0
-0.5
Ec1 =0
-1.0
-0.5
-1.0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0.3
0.2
0.1
0
0
25
50
75
100
PLATE VOLTS

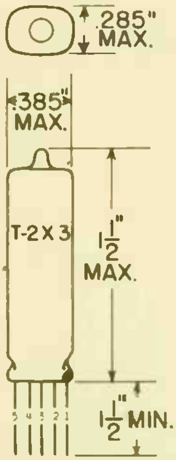

IAG5
PENTODE CONNECTION
Eb = 22.5 Volts DC
Ec2 = 22.5 Volts DC
Ef = 1.25 Volts DC
Ib
Ic2
Gm
TRANSCONDUCTANCE (gm) - MICROMHOS
200
150
100
50
0
-2.0
-1.5
-1.0
-0.5
0
GRID #1 VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0.20
0.15
0.10
0.05
0


1AG5
TRIODE CONNECTED
PENTODE CONNECTION
E_f = 1.25 Volts
E_{c1} =0
-0.50
-1.0
-1.5
-2.0
-3.0
-2.5
PLATE MILLIAMPERES
1.5
1.0
0.5
0
0
10
20
30
40
50
PLATE VOLTS

TUNG-SOL

PENTODE

SUBMINIATURE TYPE



GLASS BULB

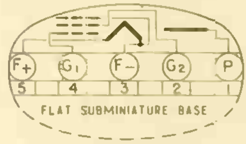
RED DOT IS ADJACENT TO LEAD 1

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

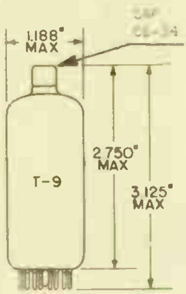
CLASS A_1 AMPLIFIER

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.

TUNG-SOL

DIODE



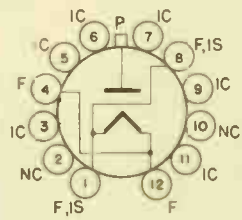
GLASS BULB
BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-90

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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

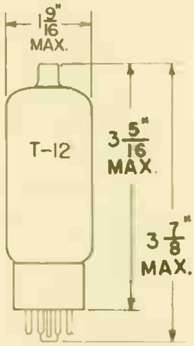
THE FLYBACK PULSE SHOULD BE TAKEN FROM THE HORIZONTAL DEFLECTION CIRCUIT OF A 525 LINE, 30-FRAME TELEVISION SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS" FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15%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



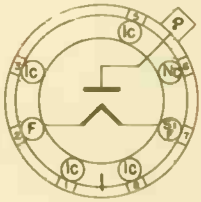
GLASS BULB

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	$\mu\mu f$

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	25 000	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.

CONTINUED ON FOLLOWING PAGE

[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.

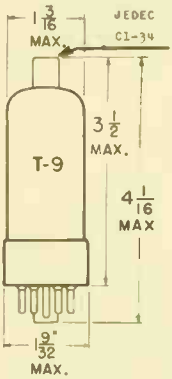
[E]FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

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



GLASS BULB

SEE NOTE "A"

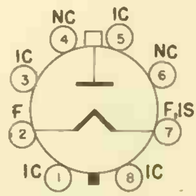
OUTLINE DRAWING
JEDEC 9-51 OR 9-52

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	1.25 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

TUNG-SOL

MAXIMUM RATINGS - CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

RF VOLTAGE RECTIFIER

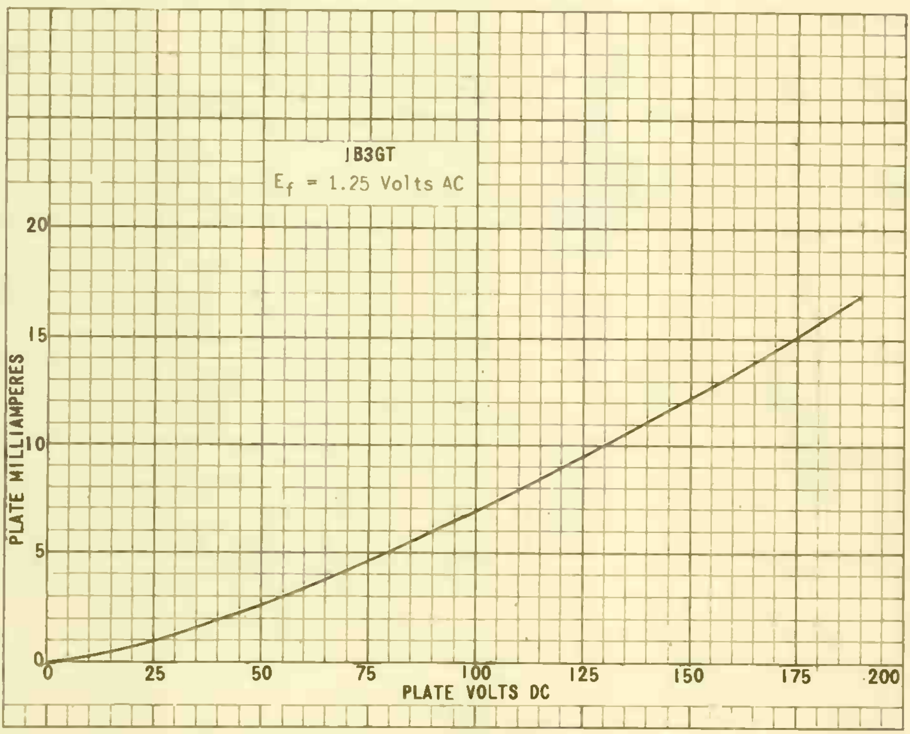
PEAK INVERSE PLATE VOLTAGE	33	KV
PEAK PLATE CURRENT	.35	MA.
AVERAGE PLATE CURRENT	1.1	MA.
FREQUENCY OF SUPPLY VOLTAGE (MAX.)	100	KCS
FREQUENCY OF SUPPLY VOLTAGE (MIN.)	1.5	KCS

A 85-82, 86-8, 86-60, 86-144, 87-166, 87-211, 88-6, 88-50, 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.

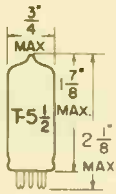
THIS TUBE MAY PRODUCE SOFT X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS ADEQUATELY SHIELDED



TUNG-SOL

DIODE PENTODE

MINIATURE TYPE



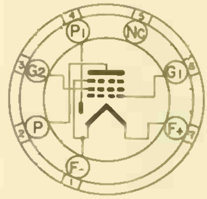
GLASS BULB

COATED FILAMENT

1.4 VOLTS 0.05 AMP.

AC OR DC

ANY MOUNTING POSITION



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	$\mu\mu f$

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

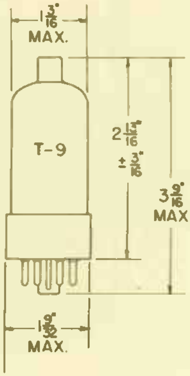
FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	-50	VOLTS
MAXIMUM CATHODE CURRENT	3	MA.
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION	0.25	MA.

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



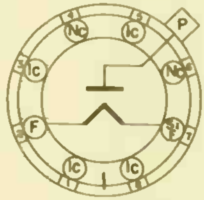
GLASS BULB

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	$\mu\mu f$

CONTINUED ON FOLLOWING PAGE

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.

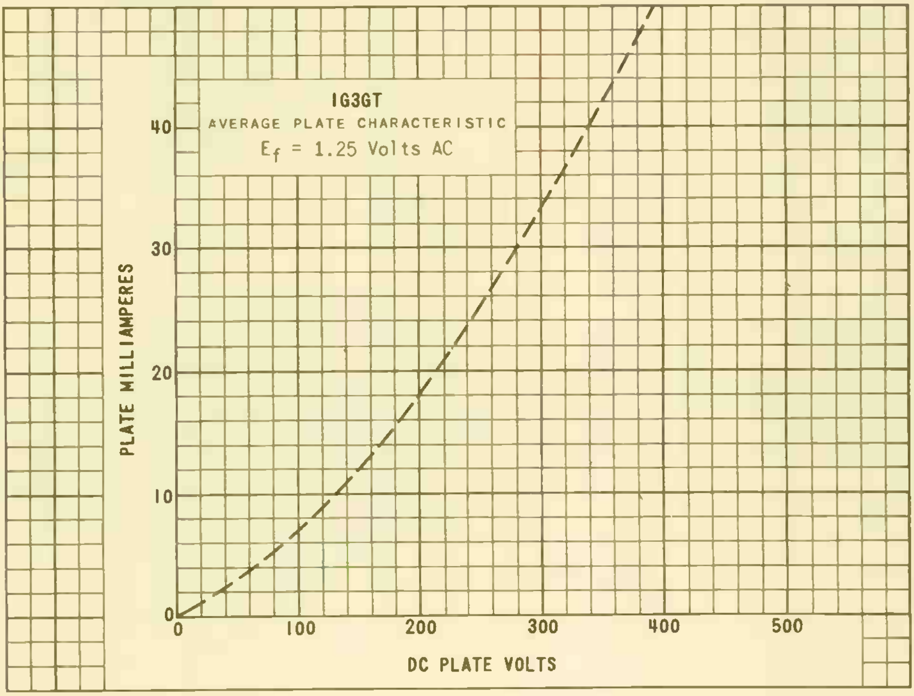
[C] UNDER NO CIRCUMSTANCES SHOULD THIS ABSOLUTE VALUE BE EXCEEDED.

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.

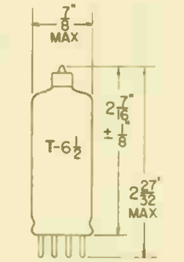
ON THE 5-PIN BASES, THE 6-PIN BASES, AND THE 7-PIN BASE JEDEC #B7-47, PIN 6 IS OMITTED.


IG3GT
AVERAGE PLATE CHARACTERISTIC
E_f = 1.25 Volts AC
PLATE MILLIAMPERES
40
30
20
10
0
0
100
200
300
400
500
DC PLATE VOLTS

TUNG-SOL

DIODE

MINIATURE TYPE



GLASS BULB
TOP CAP—MINIATURE

COATED UNIPOTENTIAL CATHODE

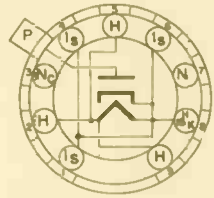
HEATER

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	$\mu\mu f$

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.

TUNG-SOL

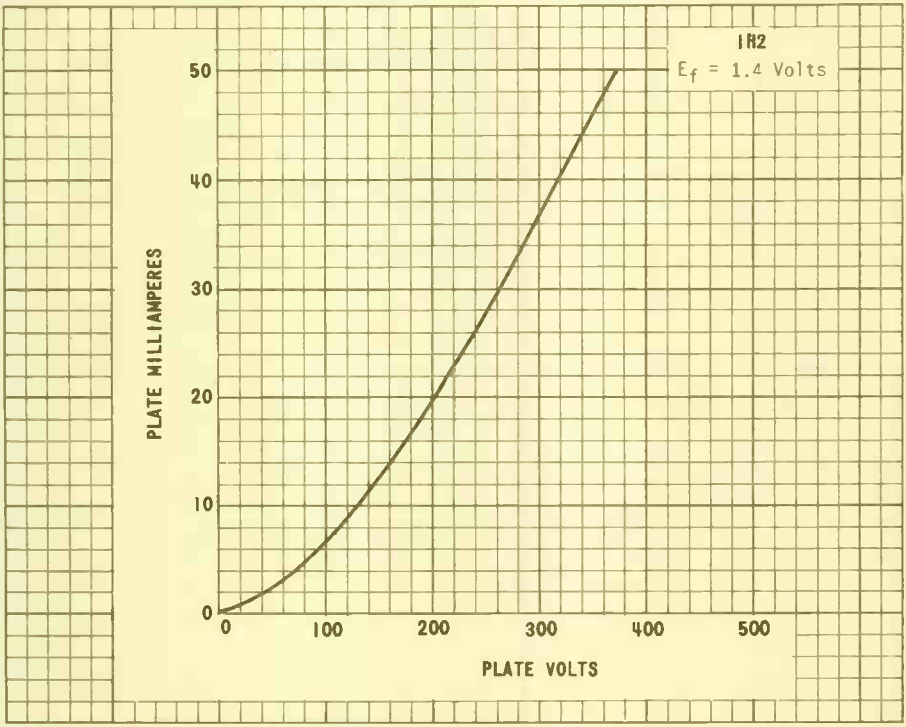
CONTINUED FROM PRECEDING PAGE

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.

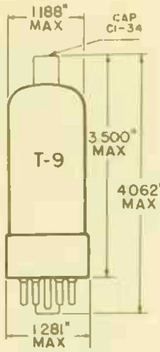
[A]FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

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

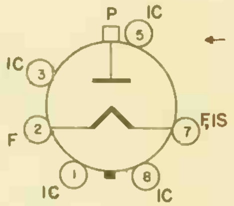
B6-8 INTERMEDIATE SHELL
OR
B6-60 SHORT
INTERMEDIATE SHELL
6 PIN OCTAL

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	$\mu\mu$f

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 A CHANGE.

TUNG-SOL

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.

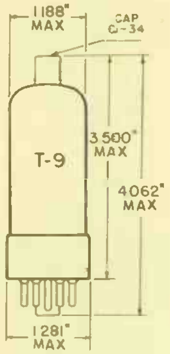
[B] UNDER NO CIRCUMSTANCES SHOULD THE FILAMENT VOLTAGE BE LESS THAN 1.05 VOLTS OR MORE THAN 1.45 VOLTS.

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

DIODE



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

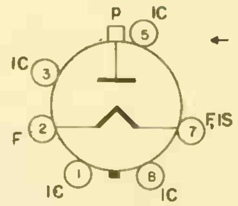
OUTLINE DRAWING
9-53 WITH B6-60 OR
9-54 WITH B6-8

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.

TUNG-SOL

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.

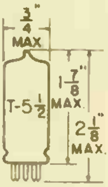
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE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

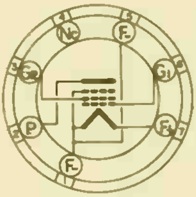


GLASS BULB

COATED FILAMENT

FILAMENT
1.4 VOLTS 0.05 AMPERE
DC

ANY MOUNTING POSITION



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 1850T.

→ INDICATES A CHANGE OR ADDITION.

PLATE 1825
JUNE 2, 1947

PRINTED IN U.S.A.

 ELECTRON TUBE DIVISION NEWARK NEW JERSEY U S A

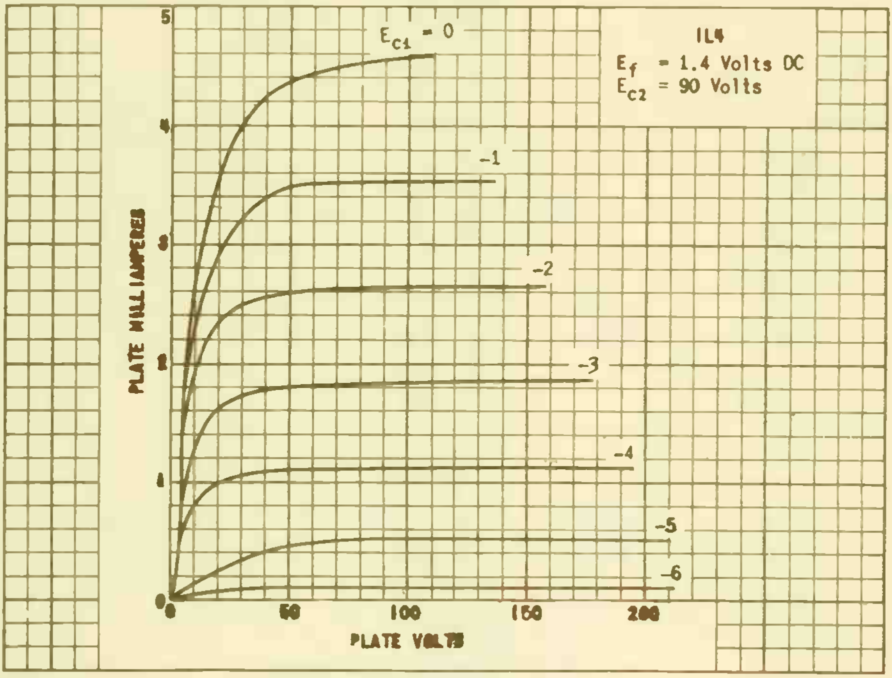


PLATE 1026
JUNE 2, 1947

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

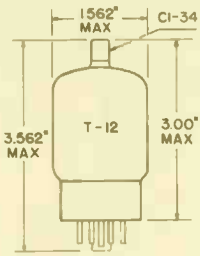
TUNG-SOL

DIODE

COATED FILAMENT

FOR HIGH VOLTAGE
RECTIFIER APPLICATIONS

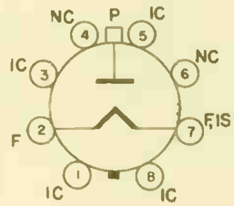
ANY MOUNTING POSITION



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.

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS

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

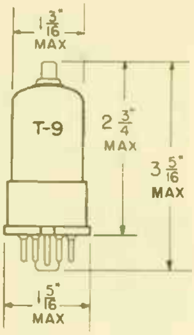
[C]FILAMENT SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN FILAMENT VOLTAGE WITHIN THE SPECIFIED VALUES.

[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

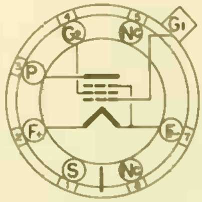


GLASS BULB

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

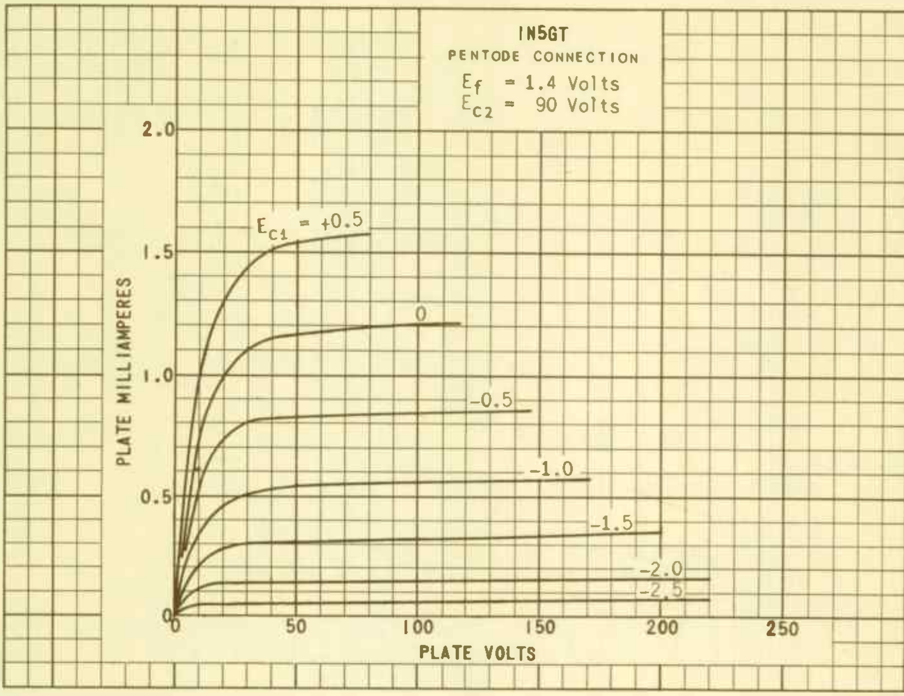
CLASS A_1 AMPLIFIER

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.

PRINTED IN U. S. A.

IN5GT

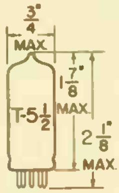


IN5GT
PENTODE CONNECTION
Ef = 1.4 Volts
Ec2 = 90 Volts
Ec1 = +0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
PLATE MILLIAMPERES
2.0
1.5
1.0
0.5
0
50
100
150
200
250
PLATE VOLTS

TUNG-SOL

HEPTODE

MINIATURE TYPE

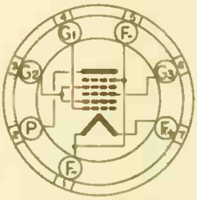


GLASS BULB

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

CONTINUED ON FOLLOWING PAGE

PLATE 3015
SEPT. 1952

PRINTED IN U. S. A.

→ INDICATES A CHANGE OR ADDITION

TUNG-SOL

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

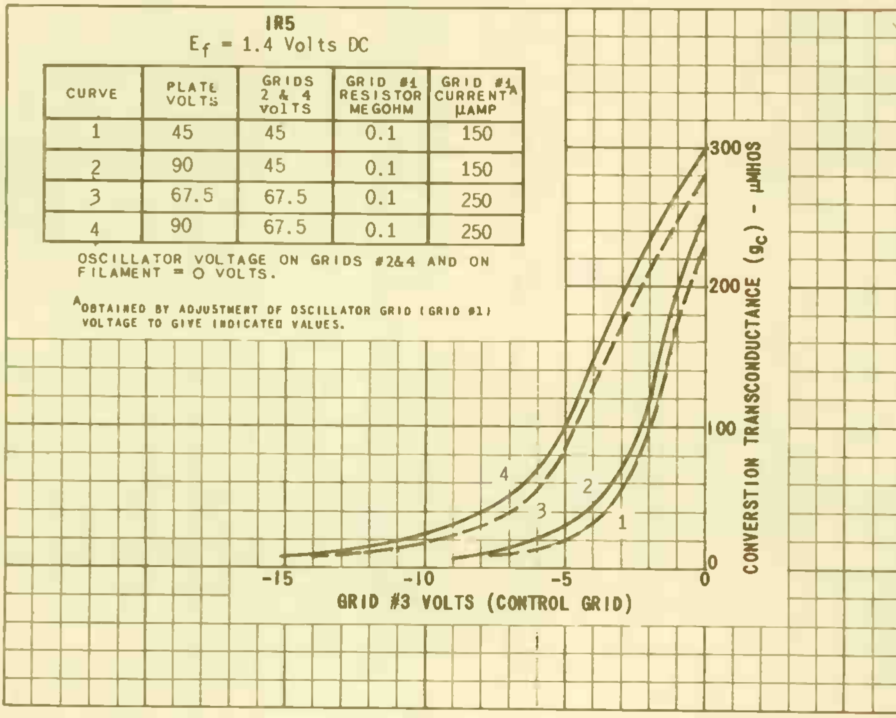
NOT OSCILLATING

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 ←

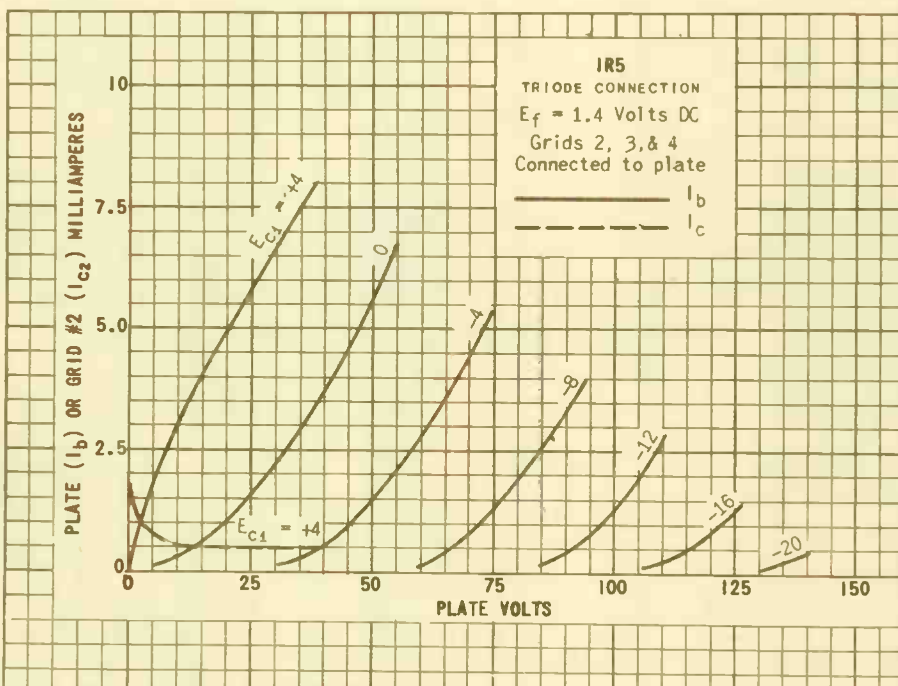
PLATE 3016

SEPT. 1 1952

→INDICATES A CHANGE OR ADDITION.

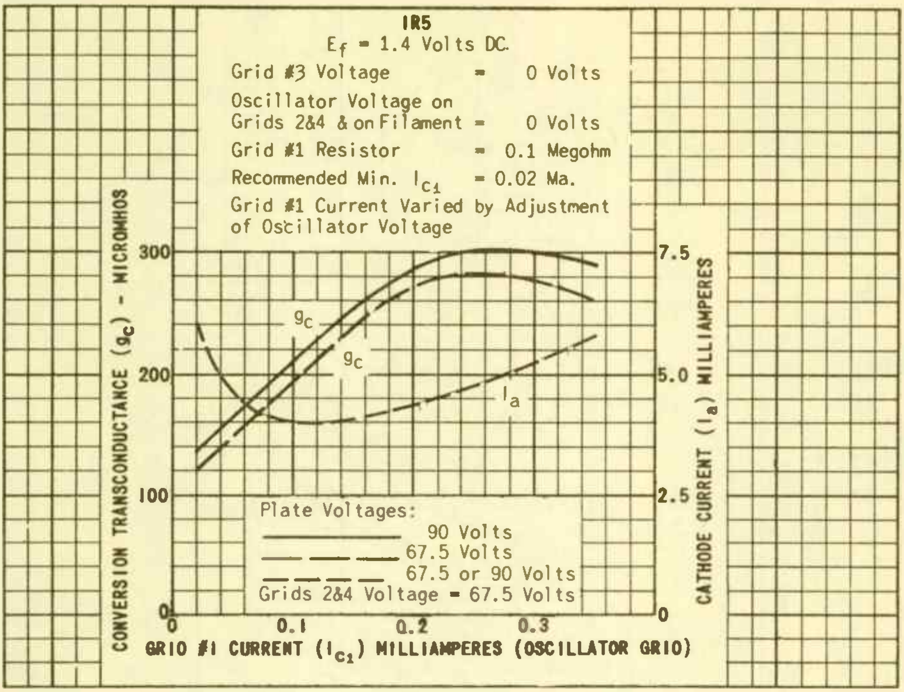


CURVE	PLATE VOLTS	GRIDS 2 & 4 volts	GRID #1 RESISTOR MEGOHM	GRID #1 CURRENT[A] μAMP
1	45	45	0.1	150
2	90	45	0.1	150
3	67.5	67.5	0.1	250
4	90	67.5	0.1	250



PRINTED IN U. S. A.

PLATE 3017
SEPT. 1 1952



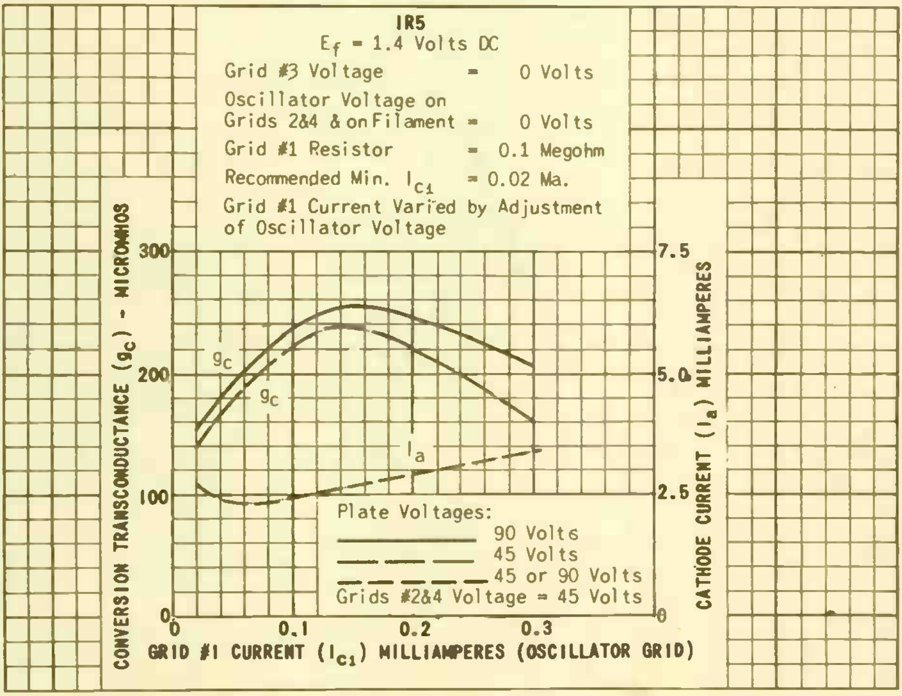
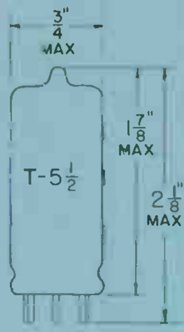


PLATE 3018
SEPT. 1 1952

TUNG-SOL

HEPTODE CONVERTER

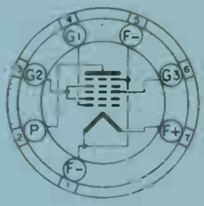
MINIATURE TYPE



GLASS BULB

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON

7AT

THE 1R5WA IS A FILAMENT TYPE HEPTODE CONVERTER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A COMBINED OSCILLATOR AND MIXER IN BATTERY OPERATED EQUIPMENT. ITS PRINCIPAL APPLICATION IS AS A MIXER IN OSCILLATOR SECTIONS OF PORTABLE RECEIVERS. THE 1R5WA IS PARTICULARLY USEFUL IN CIRCUITS WHERE ITS LOW MICROPHONIC NOISE AND VIBRATION OUTPUT ARE ESSENTIAL FOR SPECIALIZED MILITARY EQUIPMENT.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 2)	450	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE TEST-NOTE 3)	2.5	G

RATINGS

AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MIN.	NORM TEST CONDITIONS NOTE 5	NORM. OPERATION NOTE 4	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 6)	Ef:	1.00	1.25	1.25	1.50	Vdc
PLATE VOLTAGE (NOTE 7)	Eb:	---	90	90	100	Vdc
GRID VOLTAGE	Ec1:	---	0	0	---	Vdc
GRID VOLTAGE #2 (NOTE 7)	Ec2	---	45	45	75	Vdc
PLATE DISSIPATION	Pp:	---	---	---	0.1	WATTS
GRID #2 DISSIPATION	Pg(2&4):	---	---	---	0.19	WATTS
GRID RESISTANCE	Rg(1):	---	0.1	0.1	---	MEG.
CONVERSION TRANSCON.	Sc:	---	---	235	---	µMHOS
PLATE CURRENT	Ib1:	---	---	0.90	---	mAdc
GRID VOLTAGE #3	Ec3:	---	0	0	0	Vdc
CATHODE CURRENT	Ik:	---	---	---	6.5	mAdc

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL[1]

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1		COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES							
GRID CURRENT (1): Ec3=−1 Vdc Eg1=15 Vac (NOTE 9)	0.65	Ic3:	0	---	---	---	−0.6	---	μAdc
PLATE CURRENT (1): Eg1=15 Vac (NOTE 9)	0.65	Ib:	0.55	---	---	---	1.25	---	mAdc
CATHODE CURRENT: Eg1=15 Vac; (NOTE 9)	0.65	Ik:	2.25	---	---	---	4.75	---	mAdc
CONVERSION TRANSCONDUCTANCE (1): Eg1=15Vac; Ef = 1.0 Vdc (NOTE 9)	0.65	Sc:	130	---	---	---	340	---	μMHOS
OSCILLATOR GRID CURRENT: Ef=1.0 Vdc; PLATE FLOATING (NOTE 10)	0.65	Ic1:	125	---	---	---	---	---	μAdc
NOISE AND MICROPHONICS: Ebb=Ecc2&4=Ecc3=135 Vdc; Ecal=10.0 mVac Rp=2.2 MEG; Rg2&4 =4MEG; Cg2&4=0.01 μf TO F−; Rg3=8 MEG.	0.65	Eb:	---	---	---	---	17	---	VU
CONTINUITY AND SHORTS: (INOPERATIVES)	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE OUTLINE (6-2)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS, PART 2									
INSULATION OF ELECTRODES: g1-all		Rg-all:	100	---	---	---	---	---	MEG.
p-all	4.0	Rp-all:	100	---	---	---	---	---	MEG.
g3-all		Rg3-all:	100	---	---	---	---	---	MEG.
CONVERSION TRANSCONDUCTANCE (2): Eg1=15 Vac (NOTE 9)	6.5	Sc:	160	---	---	---	340	---	μMHOS
FILAMENT CURRENT:	6.5	If:	44	---	---	---	56	---	mA
CAPACITANCE: WITHOUT SHIELD•		Cg3-all:	4.7	---	---	---	6.9	---	μμf
WITHOUT SHIELD	6.5	Cp-all:	5.0	---	---	---	7.5	---	μμf
WITHOUT SHIELD		Cg3-p:	---	---	---	---	0.45	---	μμf
VIBRATION (1): Rp=10,000 OHMS; Ec1=−5 Vdc; 40 cps; 15g; Rg1=0	6.5	Ep(1):	---	---	---	---	10	---	mVac
VIBRATION (2): F=50cps−3500 cps; Rp=10,000 OHMS; Ec1=−5Vdc; Rg1=0; (NOTE 8)	6.5	Ep(1):	---	---	---	---	25	---	mVac

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL[1] - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG	UAL	MAX.	ALD	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS	COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES								
SHOCK: HAMMER ANGLE= 30°	---	---	---	---	---	---	---	---	---
FATIGUE: G=2.5: F=25 MIN; 60 MAX. FIXED FREQUENCY	6.5	---	---	---	---	---	---	---	---
POST SHOCK AND FATIGUE TEST END POINTS:									
CONVERSION TRANSCONDUCTANCE (2):	---	Sc:	125	---	---	---	---	---	µMHOS
VIBRATION (1):	---	Ep:	---	---	---	---	15	---	mVac
MINIATURE TUBE BASE STRAIN:	---	---	---	---	---	---	---	---	---
GLASS STRAIN:	2.5	---	---	---	---	---	---	---	---

	ALLOWABLE DEF. PER CHARACTER. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	LIMITS MIN	MAX	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS							
INTERMITTENT LIFE TEST Ef=1.25 Vdc; OR Vac WITH EQUIVALENT BIAS: GROUP A; Ecal=-16.0 Vdc; Esig=17.5 Vac; Ec 2&4=67.5 Vac; (NOTE 12)	---	---	---	t:	500	---	HOURS
INTERMITTENT LIFE TEST END POINTS:							
CONVERSION TRANSCONDUCTANCE (2):	---	---	---	Sc:	125	---	µMHOS
OSCILLATOR GRID CURRENT	---	---	---	Ic1:	100	---	µAdc

NOTES

1. CHARACTERISTICS, QUALITY CONTROL PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPH OF MIL-E-1 AND MIL-STD-105A.

2. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES - CONT'D.

3. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

4. THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

5. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTICS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

6. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

7. PLATE AND SCREEN VOLTAGES SHOULD NOT EXCEED THESE VALUES UNDER ANY CIRCUMSTANCES.

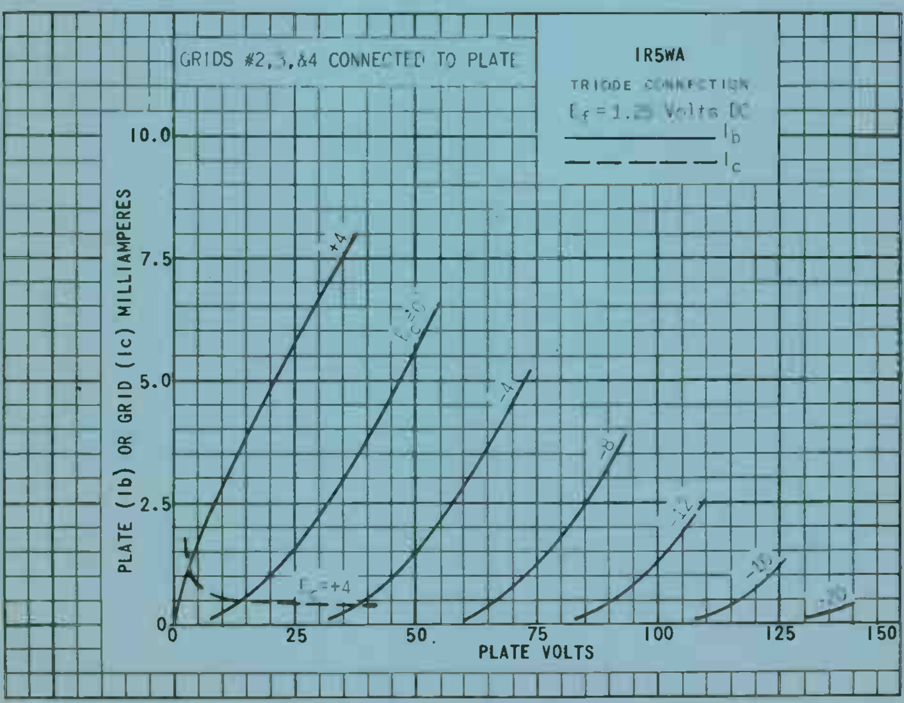
8. THE TUBE UNDER TEST SHALL BE RIGIDLY MOUNTED ON A VIBRATION TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TEST CONDITIONS OF PARAGRAPH 4.9.19.1 OF MIL-E-1 SHALL BE APPLIED AND E_p MONITORED WHILE THE FREQUENCY OF VIBRATION IS CONTINUOUSLY SWEPT FROM 50-3500 CPS AND THE PEAK ACCELERATION CONTROLLED CONSTANT AT 2G. A LOW PASS FILTER WHICH FOLLOWS THE LOAD RESISTOR OF THE TUBE UNDER TEST SHALL HAVE A CUT-OFF FREQUENCY OF 3500 CPS. THE TOTAL TIME OF SWEEP SHALL NOT BE LESS THAN ONE (1) MINUTE.

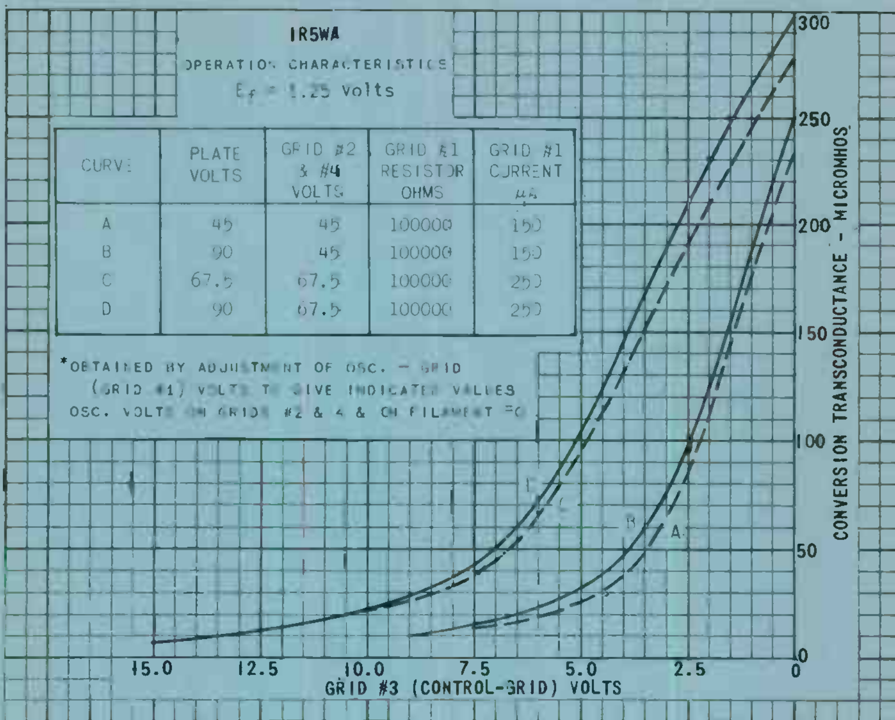
9. FOR RAPID TESTING USE EQUIPMENT WHICH CORRELATES WITH MIL-E-1 PARAGRAPH 4.10.12.

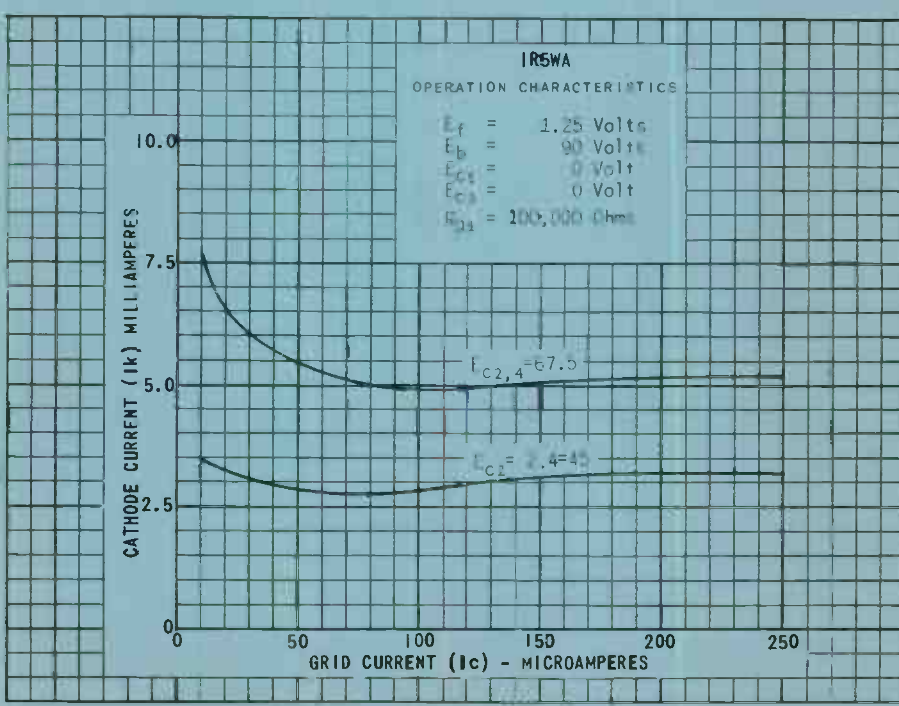
10. WITH CONVERTER OSCILLATOR TEST SET (DRAWING 195-JAN) HAVING Rgl=50,000 OHMS AND WITH GRID TO FILAMENT RESONANT IMPEDANCE ADJUSTED TO 9500 OHMS.

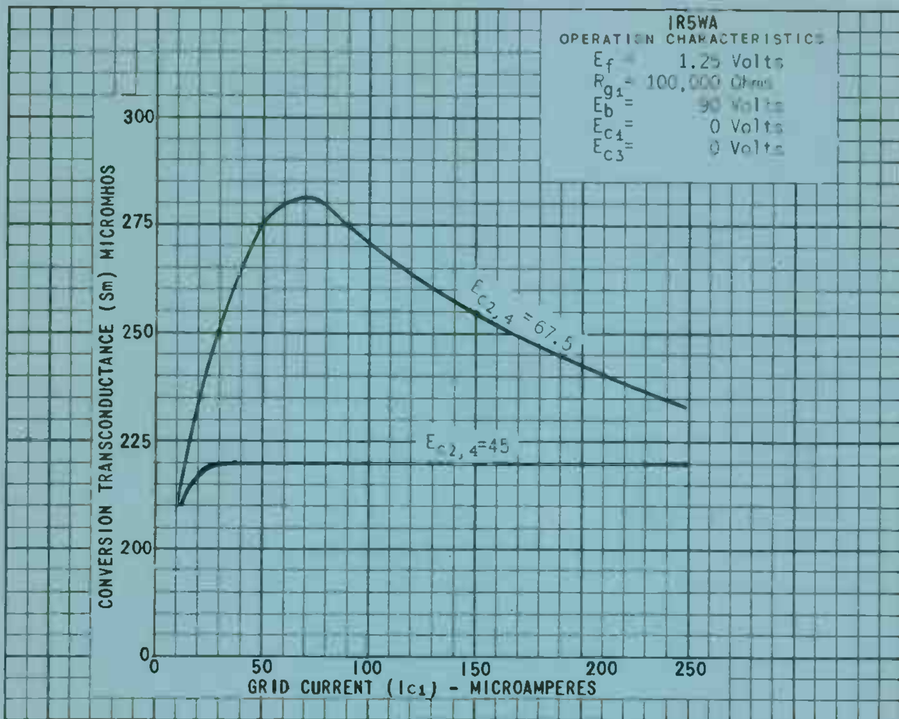
11. TUBES SHALL BE SO SHIELDED THAT OPERATOR PROXIMITY OR MOVEMENT WILL NOT AFFECT OUTPUT READINGS.

12. BIAS OF GRID #1 MAY BE OBTAINED FROM A DC SOURCE OF SELF BIAS.



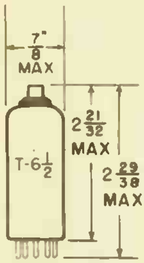

IR5WA
OPERATION CHARACTERISTICS
E_f = 1.25 Volts
CURVE | PLATE VOLTS | GRID #2 & #4 VOLTS | GRID #1 RESISTOR OHMS | GRID #1 CURRENT μA
A | 45 | 45 | 100000 | 150
B | 90 | 45 | 100000 | 150
C | 67.5 | 67.5 | 100000 | 250
D | 90 | 67.5 | 100000 | 250
*OBTAINED BY ADJUSTMENT OF OSC. - GRID (GRID #1) VOLTS TO GIVE INDICATED VALUES OSC. VOLTS ON GRIDS #2 & 4 & ON FILAMENT = 0
D
C
B
A
15.0
12.5
10.0
7.5
5.0
2.5
0
GRID #3 (CONTROL-GRID) VOLTS
300
250
200
150
100
50
0
CONVERSION TRANSCONDUCTANCE - MICROMHOS


IR5WA
OPERATION CHARACTERISTICS
E_f = 1.25 Volts
E_b = 90 Volts
E_{c1} = 0 Volt
E_{c3} = 0 Volt
R_{g1} = 100,000 Ohms
$E_{c2,4}$=67.5
E_{c2}= 2,4=45
10.0
7.5
5.0
2.5
0
CATHODE CURRENT (Ik) MILLIAMPERES
0
50
100
150
200
250
GRID CURRENT (Ic) - MICROAMPERES


IR5WA
OPERATION CHARACTERISTICS
E_f = 1.25 Volts
R_{g1} = 100,000 Ohms
E_b = 90 Volts
E_{c1} = 0 Volts
E_{c3} = 0 Volts
$E_{c2,4}$ = 67.5
$E_{c2,4}$=45
CONVERSION TRANSCONDUCTANCE (Sm) MICROMHOS
300
275
250
225
200
0
0
50
100
150
200
250
GRID CURRENT (I_{c1}) - MICROAMPERES

TUNG-SOL

RECTIFIER



GLASS BULB

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	$\mu\mu f$

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	$\mu\mu f$
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

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.

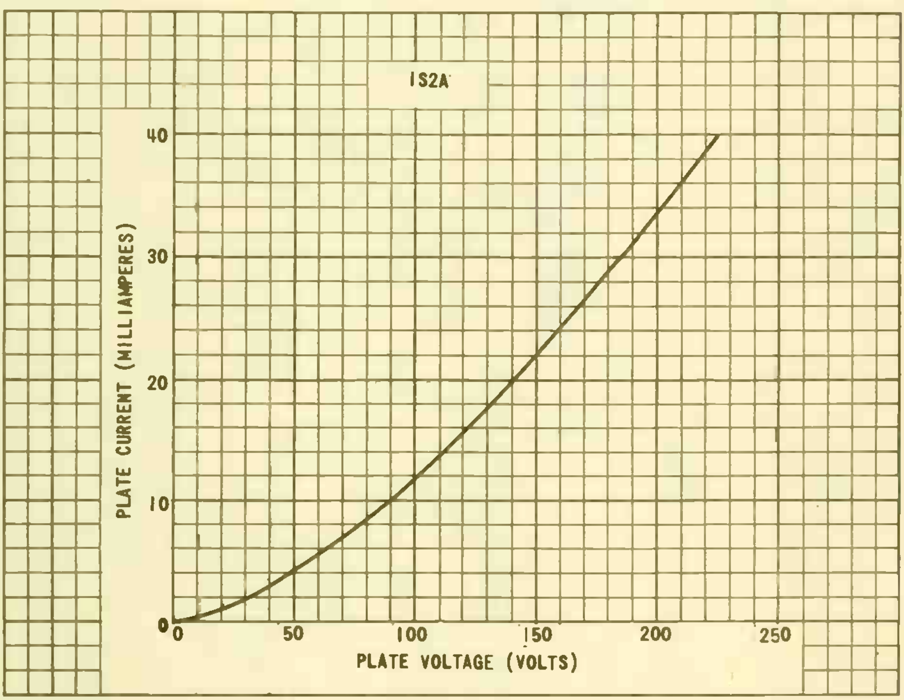
[B] TO PREVENT CORONA IT IS RECOMMENDED TO USE AN ANTI-CORONA RING AROUND THE TUBEHOLDER, WHICH SHOULD BE CONNECTED TO THE CATHODE (PINS 1,4,6 AND 9).

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.

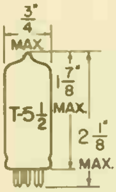
[D] MAXIMUM PULSE DURATION 18% OF A CYCLE, WITH A MAXIMUM OF 18 μSEC.

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



TUNG-SOL

DIODE PENTODE

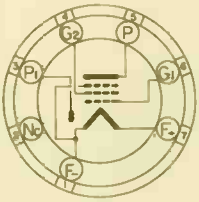


GLASS BULB

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	$\mu\mu f$
DIODE PLATE TO FILAMENT & PIN #2 [B]	1.1	$\mu\mu f$

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.

TUNG-SOL

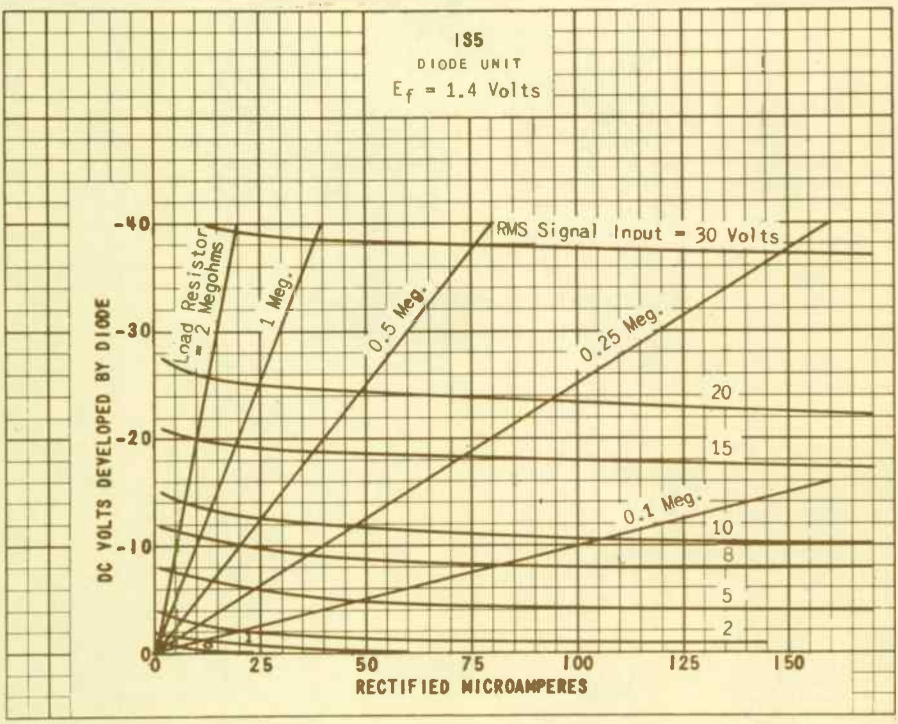
CONTINUED FROM PRECEDING PAGE

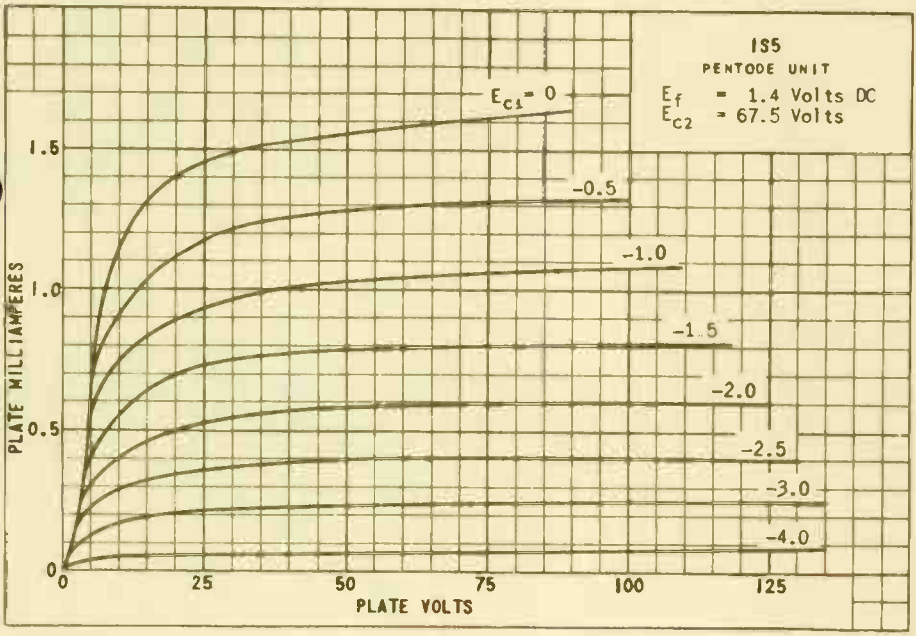
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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	





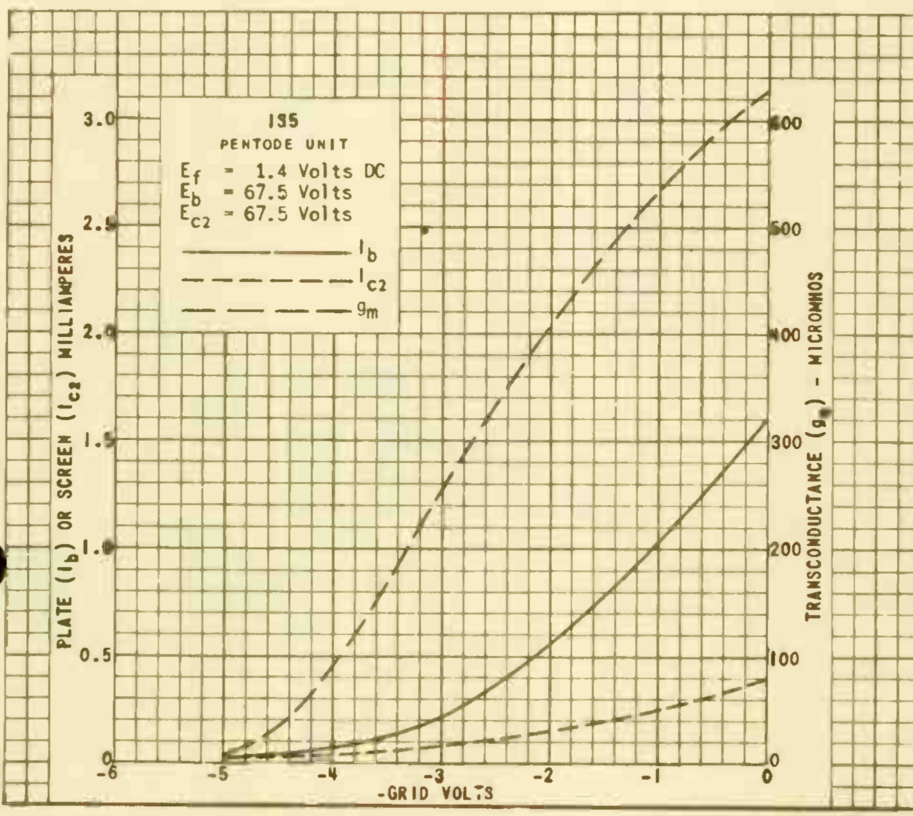
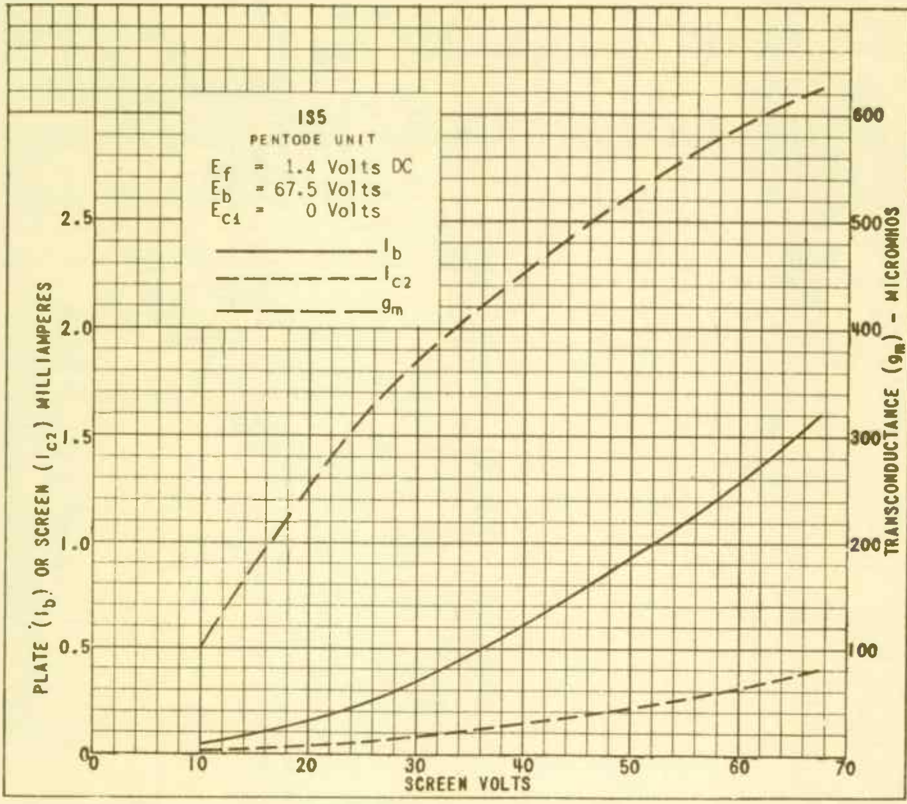


PLATE 1768
FEB. 3, 1947



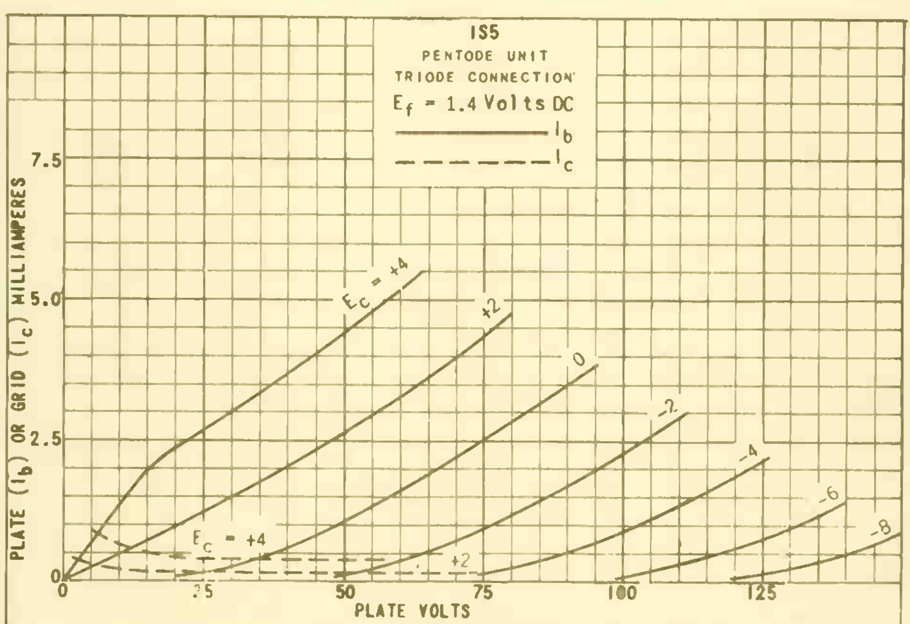
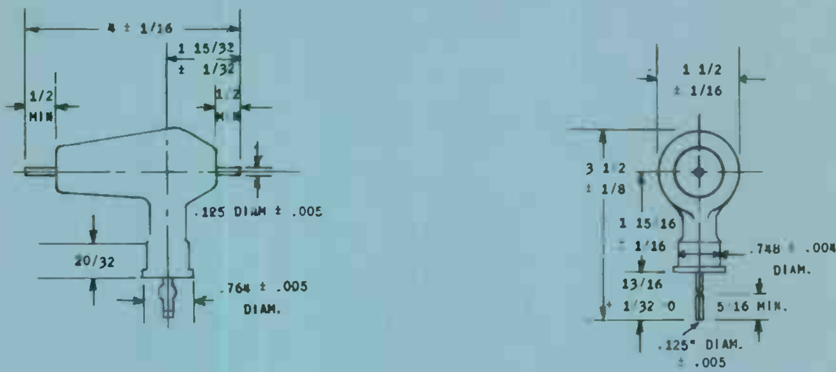


PLATE 1769
FEB. 3, 1947

TUNG-SOL

VACUUM SWITCH



THE 1S22 IS A SINGLE POLE, DOUBLE THROW, HIGH VACUUM SWITCH. THE SWITCH IS ACTUATED MECHANICALLY BY MEANS OF A LEVER ARM EXTENDING THROUGH A FLEXIBLE KOVAR DIAPHRAGM. HIGH CURRENTS AND HIGH VOLTAGES MAY BE SWITCHED WITH A MINIMUM AMOUNT OF SPARKING AND OXIDATION AT THE CONTACT POINTS BECAUSE OF THE "BREAK CLEAN" CHARACTERISTICS OF A VACUUM SWITCH.

THE 1S22 HAS HAD SUCCESSFUL APPLICATION IN AIRBORNE EQUIPMENT PARTICULARLY AS AN ANTENNA SWITCH. IT HAS ALSO FOUND APPLICATION IN EXPLOSIVE ATMOSPHERES, IN CORROSIVE ATMOSPHERES AND IN SAFETY LOAD DUMPING CIRCUITS.

ELECTRICAL DATA

MAXIMUM CONTINUOUS CURRENT, RMS	20	AMPS
MAXIMUM INITIAL CONTACT RESISTANCE	0.05	OHMS

MECHANICAL DATA

	MIN.	MAX.	
ARM TRAVEL (MEASURED 1/2" FROM DIAPHRAGM)	.009	.017	INCHES
ACTUATING FORCE (MEASURED 5/8" FROM DIAPHRAGM)	200	500	GRAMS
MAXIMUM ALLOWABLE ACTUATING FORCE	---	1000	GRAMS

ALTITUDE RATINGS

ALTITUDE	EXTERNAL HOLD-OFF VOLTAGE (RMS)	INTERNAL HOLD-OFF VOLTAGE (RMS) ←
27,000 FT	10,000 VOLTS	10,000 VOLTS
40,000	7,500	10,000
50,000	5,000	10,000

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

INTERRUPTING RATINGS

FOR INFORMATION ONLY

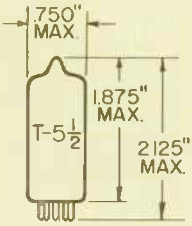
WITH RESISTIVE LOAD AT 10,000 V. RMS AT 60 CPS.

OPERATIONS	AMPERES
1000	10.0
1,000,000	5.0
500,000,000	0.1

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

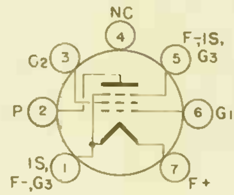
MINIATURE BUTTON
7 PIN BASE E7-1

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

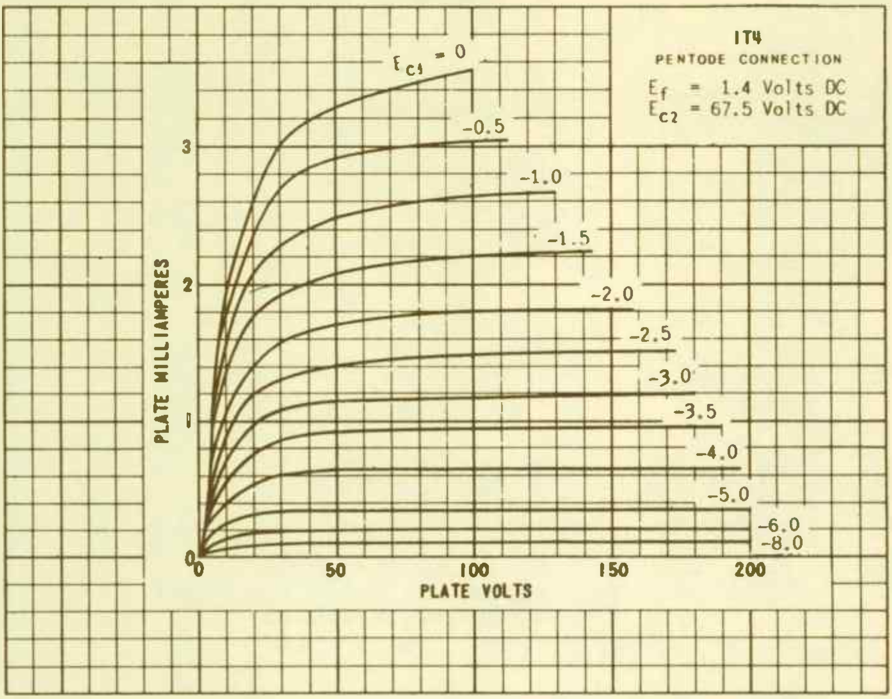
CLASS A_1 AMPLIFIER

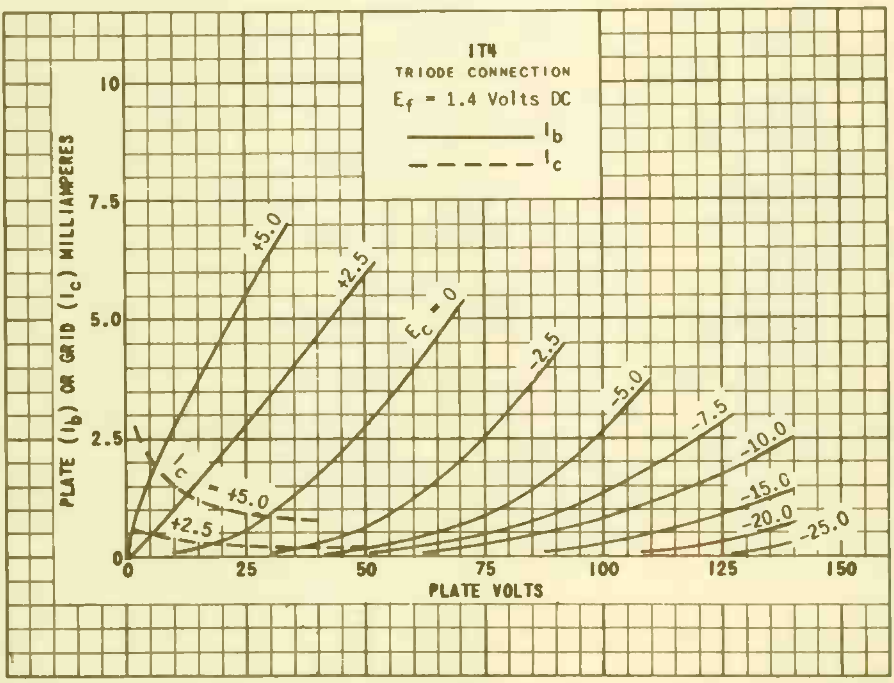
PLATE VOLTAGE	45	67.5	90	90	VOLTS
GRID #2 VOLTAGE	45	67.5	45	67.5	VOLTS
GRID #1 VOLTAGE	0	0	0	0	VOLTS
PLATE RESISTANCE (APPROX.)	0.35	0.25	0.8	0.5	MEGOHM
TRANSCONDUCTANCE	700	875	750	900	µMHOS
PLATE CURRENT	1.7	3.4	1.8	3.5	MA.
GRID #2 CURRENT	0.7	1.5	0.65	1.4	MA.
GRID #1 VOLTAGE FOR g_m = 10 µMHOS	-10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

→ INDICATES A CHANGE.

PRINTED IN U.S.A.

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., FEBRUARY 1, 1962 PLATE #6379


IT4
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
0
1
2
3
0
50
100
150
200
PLATE VOLTS


IT4
TRIODE CONNECTION
E_f = 1.4 Volts DC
I_b
I_c
+5.0
+2.5
E_c = 0
-2.5
-5.0
-7.5
-10.0
-15.0
-20.0
-25.0
I_c = +5.0
+2.5
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
0
2.5
5.0
7.5
10
0
25
50
75
100
125
150
PLATE VOLTS

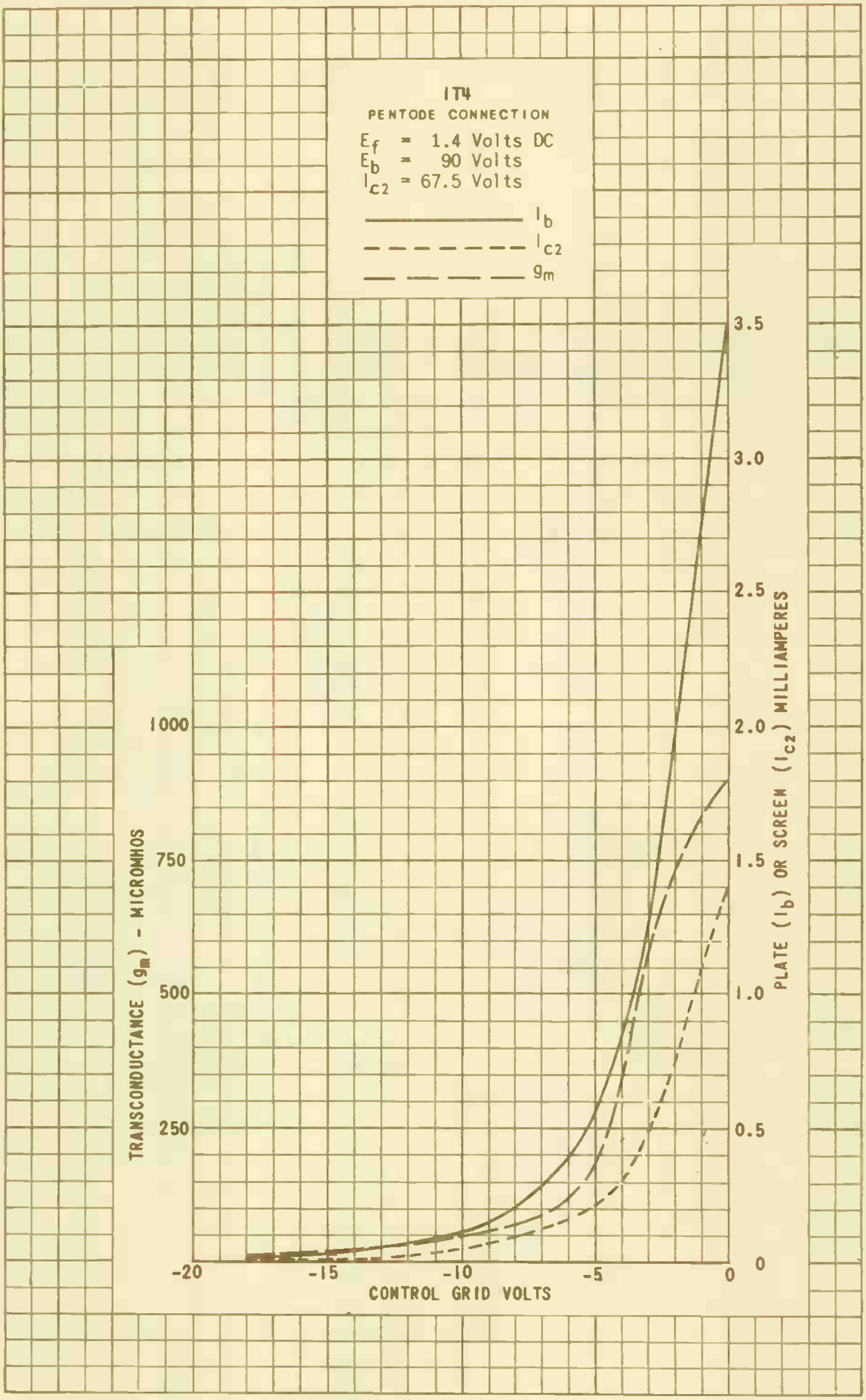


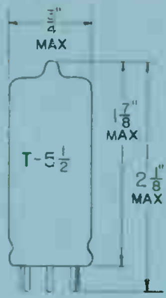
PLATE 1906
NOV. 1, 1947

PRINTED IN U.S.A.

TUNG-SOL

PENTODE

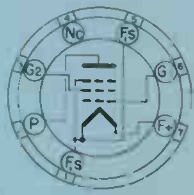
MINIATURE TYPE



GLASS BULB

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

6AR

THE 1T4WA IS A FILAMENT TYPE SEMI-REMOTE CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A RADIO FREQUENCY OR INTERMEDIATE FREQUENCY AMPLIFIER IN BATTERY OPERATED EQUIPMENT WHERE EXTREME CONDITIONS OF MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. THE TUBE IS PARTICULARLY USEFUL IN VOLTAGE AMPLIFIER CIRCUITS WHERE ITS LOW MICROPHONIC NOISE AND VIBRATION OUTPUT ARE ESSENTIAL FOR SPECIALIZED MILITARY ELECTRONIC EQUIPMENT.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST NOTE 2)	450	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HOUR FATIGUE TEST - NOTE 3)	2.5	G

RATINGS

AND NORMAL OPERATION

	MIL E 1 SYMBOL	DES. MIN.	NORM. TEST COND. NOTE 5	NORM. OPERATION NOTE 4	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 6)	Ef:	1.00	1.25	1.25	1.50	Vdc
PLATE VOLTAGE (NOTE 7)	Eb:	---	90	90	100	Vdc
GRID VOLTAGE	Ec1:	---	0	0	---	Vdc
GRID VOLTAGE #2 (NOTE 7)	Ec2:	---	67.5	67.5	75	Vdc
PLATE DISSIPATION	Pp:	---	---	---	0.4	WATTS
GRID #2 DISSIPATION	Pg2:	---	---	---	0.15	WATTS
GRID RESISTANCE	Rg(1):	---	---	---	2.0	MEG.
TRANSCONDUCTANCE	Sm:	---	---	900	---	μMHOS
PLATE CURRENT	Ib1:	--	---	3.5	---	mAdc
CATHODE CURRENT	Ik:	---	---	---	6.5	mAdc

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BDG	UAL	MAX.	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS, PART 1									
COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES									
GRID CURRENT (1): Eb=Ec2=90 Vdc; Ec1=-2.0 Vdc	0.65	Ic1:	0	---	---	---	-1.0	---	μAdc
PLATE CURRENT (1):	0.65	Ib1:	2.3	---	---	---	4.7	---	mAdc
SCREEN GRID CURRENT:	0.65	Ic2:	0.65	---	---	---	2.15	---	mAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	660	---	---	---	1125	---	μMHOS
NOISE AND MICROPHONICS: Ebb=90 Vdc; Ecc2=67.5 Vdc; Ecal=10.0 mVac; Rp=1.0 MEG; Rg2=4.7 MEG; Cg2=0.1 μf; Rg1=0	0.65	EB:	---	---	---	---	17	---	VU
CONTINUITY AND SHORTS: (INOPERATIVES)	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE OUTLINE (6-2)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS, PART 2									
INSULATION OF ELECTRODES: g-all=-100 Vdc	4.0	Rg-all:	100	---	---	---	---	---	MEG.
p-all=-100 Vdc		Rp-all:	100	---	---	---	---	---	MEG.
TRANSCONDUCTANCE (2): Ef=1.0 Vdc; Eb=75 Vdc; Ec2=55 Vdc	6.5	Sm(2):	500	---	---	---	1125	---	μMHOS
TRANSCONDUCTANCE (3): Ec1=-16 Vdc	6.5	Sm(3):	1	---	---	---	50	---	μMHOS
FILAMENT CURRENT:	6.5	If:	44	---	---	---	56	---	mA
GRID VOLTAGE: Ec1/Ic1=0.1 μAdc; Ec2=45 Vdc (NOTE 9)	6.5	Ec(1):	---	---	---	---	2.0	---	Vdc
PLATE CURRENT (2): Ef=1.25 Vdc; Rg=50,000 OHMS; Ec1=25 Vac (NOTE 10)	6.5	Ib:	2.0	---	---	---	---	---	mAdc
PLATE RESISTANCE: Eb=Ec2=45 Vdc	6.5	rp:	0.17	---	---	---	---	---	MEG.
CAPACITANCE: (SHIELD 316)		Cg1p:	---	---	---	---	0.02	---	μμf
CAPACITANCE: (WITHOUT SHIELD)	6.5	Cin:	3.0	---	---	---	4.7	---	μμf
CAPACITANCE: (WITHOUT SHIELD)		Cout:	4.5	---	---	---	8.5	---	μμf
VIBRATION (1): Rp=10,000 OHMS; 40 cps; 15g	6.5	Ep:	---	---	---	---	10	---	mVac
VIBRATION (2): F=40 cps-3500 cps; Rp=10,000 OHMS (NOTE 8)	6.5	Ep(2):	---	---	---	---	20	---	mVac

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS[1] cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOG	UAL	MAX.	ALD	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS									
SHOCK: HAMMER ANGLE 30° (NOTE 2)	---	---	---	---	---	---	---	---	---
FATIGUE: G=2.5; F=25cps MIN; 60 cps MAX.; FIXED FREQUENCY (NOTE 3)	6.5	---	---	---	---	---	---	---	---
POST SHOCK AND FATIGUE TEST END POINTS									
TRANSCONDUCTANCE (1):	---	Sm(1):	570	---	---	---	---	---	µMHOS
VIBRATION (1):	---	E_p:	---	---	---	---	15	---	mVac
MINIATURE TUBE BASE STRAIN:	---	---	---	---	---	---	---	---	---
GLASS STRAIN (THERMAL SHOCK:	2.5	---	---	---	---	---	---	---	---

TEST	ALLOW. DEF. PER CHARACTER. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TEST							
INTERMITTENT LIFE TEST: Ef=1.25 Vdc OR Vac WITH EQUIVALENT BIAS; GROUP A	---	---	---	t:	500	---	HOURS
INTERMITTENT LIFE TEST END POINTS:							
TRANSCONDUCTANCE (1):	---	---		Sm(1):	540	---	µMHOS
GRID CURRENT:	---	---		I_c(1):	---	-1.0	µAdc

NOTES

1. CHARACTERISTICS, QUALITY CONTROL PROCEDURES AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPH OF MIL-E-1, AND MIL-STD-105A.

2. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

3. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

4. THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

5. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTICS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES - cont'd.

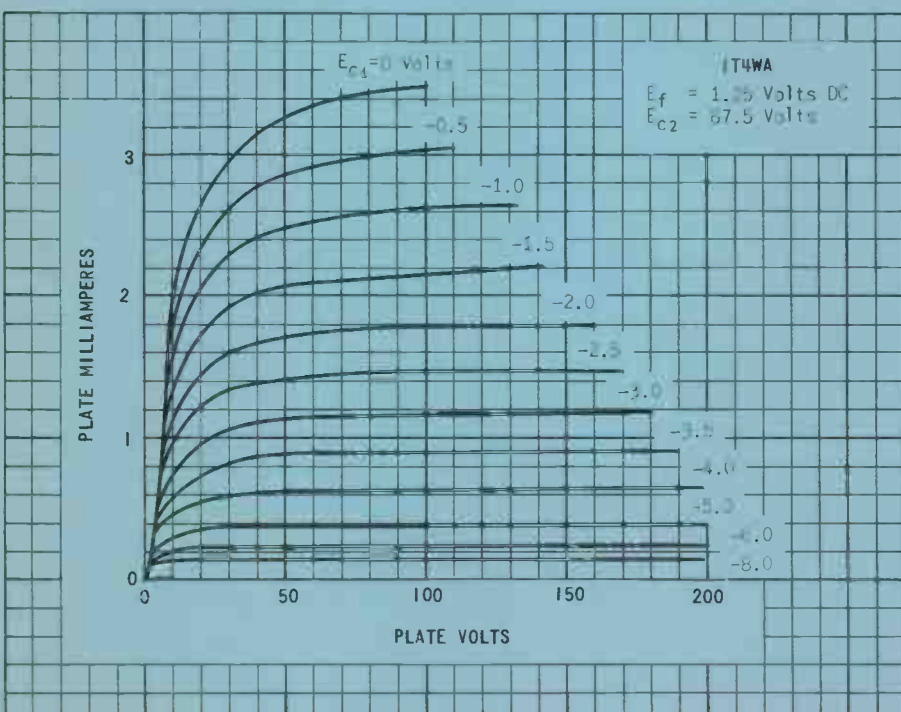
6. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

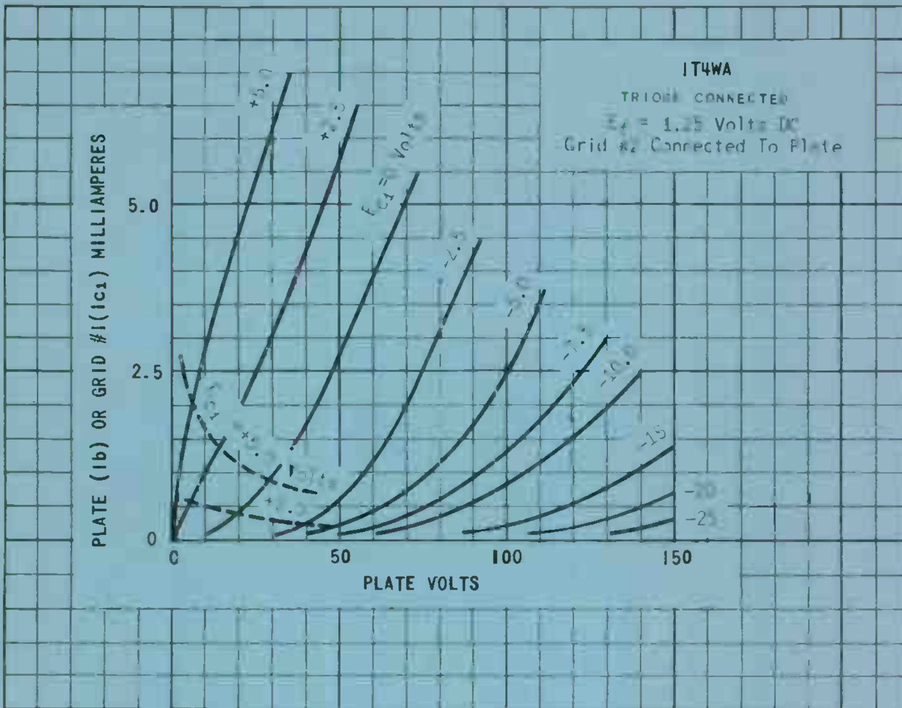
7. PLATE AND SCREEN SUPPLY VOLTAGES SHOULD NOT EXCEED THESE VALUES UNDER ANY CIRCUMSTANCES.

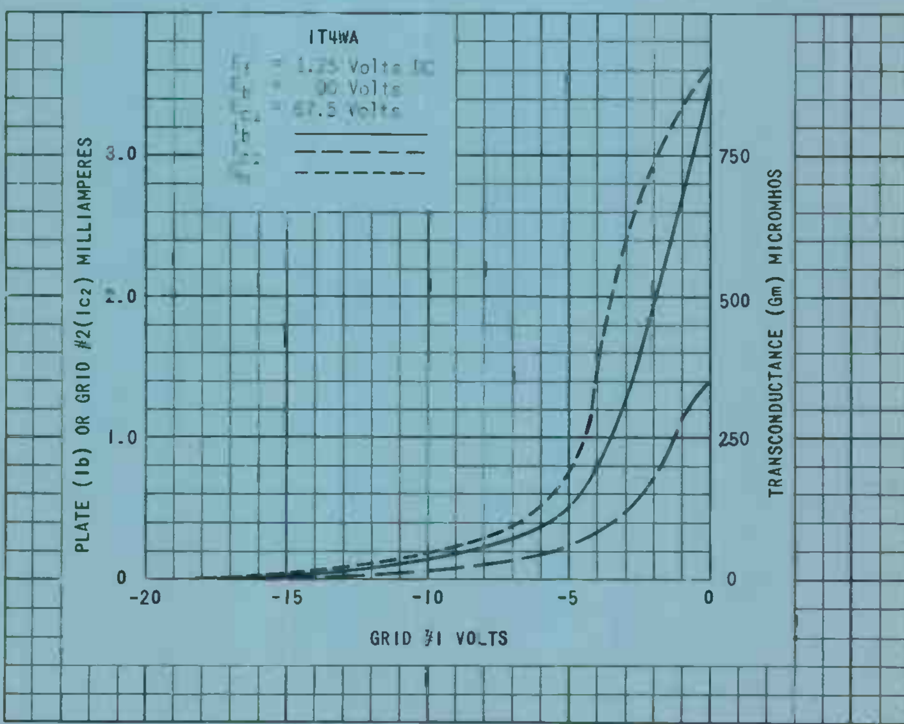
8. THE TUBE UNDER TEST SHALL BE RIGIDLY MOUNTED ON A VIBRATION TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TEST CONDITIONS OF PARAGRAPH 4.9.19.1 OF MIL-E-1 SHALL BE APPLIED AND E_p MONITORED WHILE THE FREQUENCY OF VIBRATION IS CONTINUOUSLY SWEPT FROM 50-3500 CPS AND THE PEAK ACCELERATION CONTROLLED CONSTANT AT 2G. A LOW PASS FILTER WHICH FOLLOWS THE LOAD RESISTOR OF THE TUBE UNDER TEST SHALL HAVE A CUT-OFF FREQUENCY OF 3500 CPS. THE TOTAL TIME OF SWEEP SHALL NOT BE LESS THAN ONE (1) MINUTE.

9. THE VOLTAGE DROP IN THE GRID CURRENT METER SHALL BE INCLUDED IN THE GRID VOLTAGE REQUIRED FOR THE 0.1μAdc GRID CURRENT.

10. THE SIGNAL SHALL BE COUPLED THROUGH A 1μf CONDENSER AND SHALL HAVE A SOURCE IMPEDENCE OF APPROXIMATELY 500 OHMS.



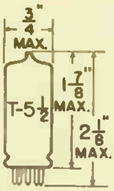

IT4WA
TRIODE CONNECTED
Grid #2 Connected To Plate
E_{c1} = 0 Volts
+5.0
+2.5
-2.5
-5.0
-7.5
-10.0
-15
-20
-25
PLATE (Ib) OR GRID #1(Ic1) MILLIAMPERES
5.0
2.5
0
0
50
100
150
PLATE VOLTS


IT4WA
PLATE (Ib) OR GRID #2(Ic2) MILLIAMPERES
3.0
1.0
0
-20
-15
-10
-5
0
GRID #1 VOLTS
750
500
250
0
TRANSCONDUCTANCE (Gm) MICROMHOS

TUNG-SOL

PENTODE

MINIATURE TYPE

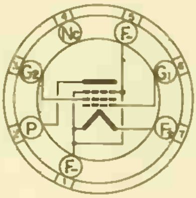


GLASS BULB

COATED FILAMENT

FILAMENT
1.4 VOLTS 50 MA.
DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

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

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM SCREEN VOLTAGE	110	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM CATHODE CURRENT	6.0	MA. →

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD CONNECTED TO NEGATIVE FILAMENT TERMINAL

GRID TO PLATE (MAX.)	0.01	μμf →
INPUT	3.6	μμf
OUTPUT	7.5	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

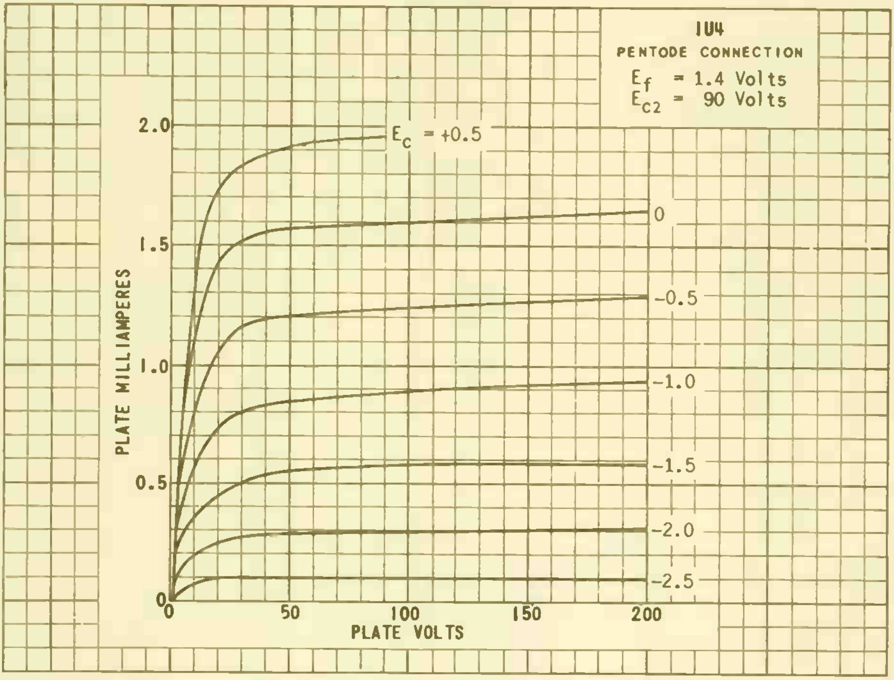
CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.4	VOLTS
FILAMENT CURRENT	50	MA.
PLATE VOLTAGE	90	VOLTS
SCREEN VOLTAGE	90	VOLTS
GRID VOLTAGE	0	VOLTS
PLATE CURRENT	1.6	MA.
SCREEN CURRENT	0.5	MA. →
PLATE RESISTANCE (APPROX.)	1.0	MEGOHMS →
TRANSCONDUCTANCE	900	μMHOS
GRID VOLTAGE FOR i_b = 10 μA	-4.0	VOLTS →

→ INDICATES A CHANGE OR ADDITION.

PLATE 1907
NOV. 1, 1947

PRINTED IN U. S. A.



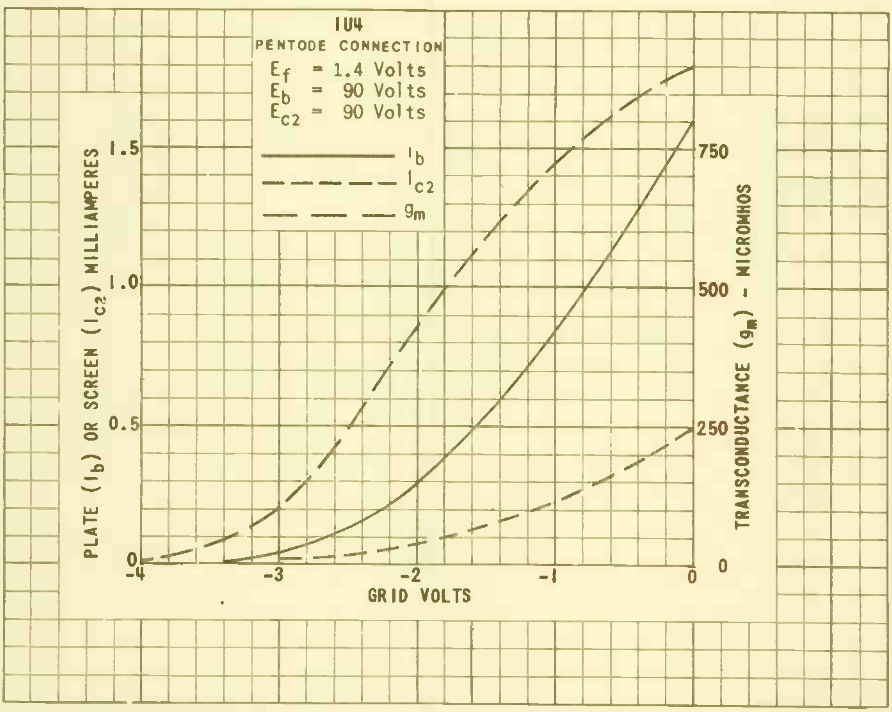
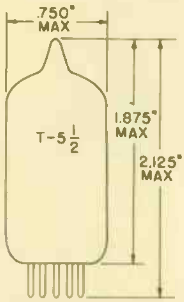


PLATE
1908
NOV. 1,
1947

TUNG-SOL

PENTODE



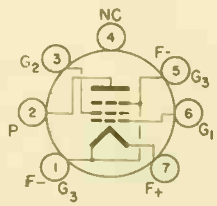
GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

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 RF OR 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

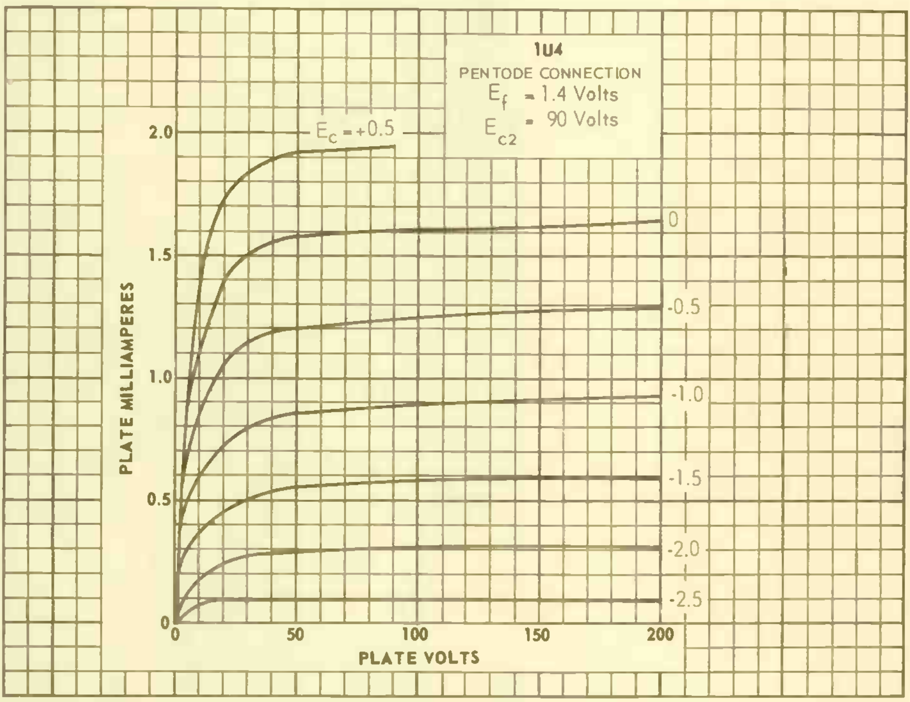
→ INDICATES A CHANGE.

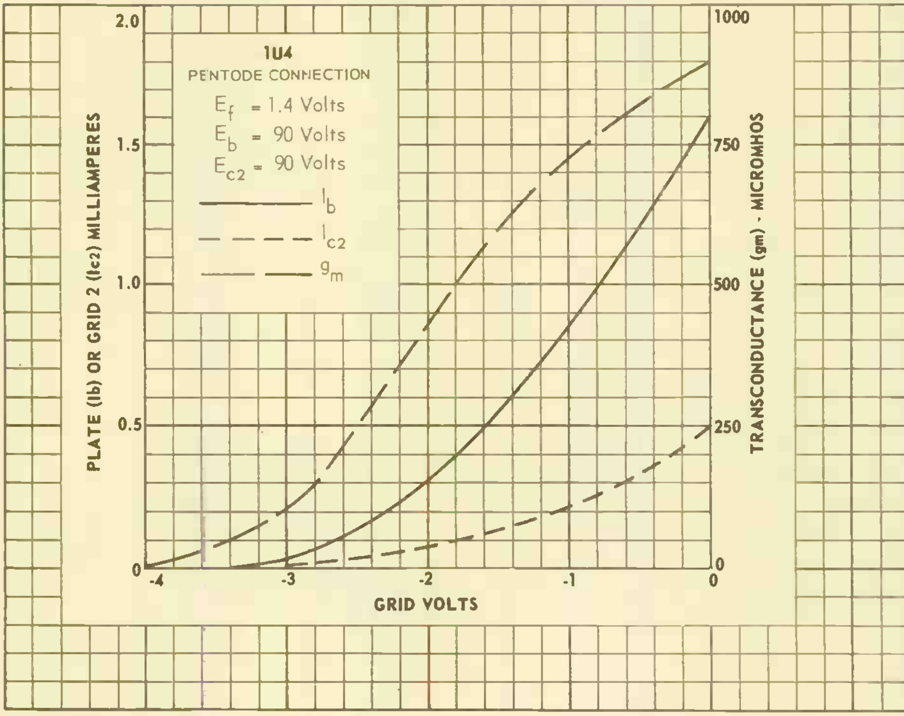
TUNG-SOL

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

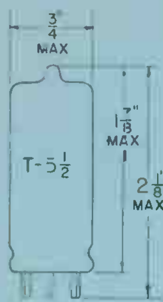



1U4
PENTODE CONNECTION
Ef = 1.4 Volts
Eb = 90 Volts
Ec2 = 90 Volts
Ib
Ic2
gm
PLATE (Ib) OR GRID 2 (Ic2) MILLIAMPERES
TRANSCONDUCTANCE (gm) - MICROMHOS
GRID VOLTS
2.0
1.5
1.0
0.5
0
1000
750
500
250
0
-4
-3
-2
-1
0

TUNG-SOL

PENTODE

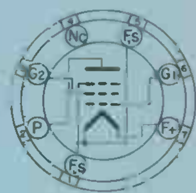
MINIATURE TYPE



GLASS BULB

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

6AR

THE 1U4WA IS A FILAMENT TYPE SHARP CUT-OFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR RF AND AF APPLICATIONS IN PORTABLE EQUIPMENT WHERE EXTREME CONDITIONS OF MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. THE TUBE IS PARTICULARLY USEFUL IN VOLTAGE AMPLIFIER CIRCUITS WHERE ITS LOW MICROPHONIC NOISE AND VIBRATION OUTPUT ARE ESSENTIAL FOR SPECIALIZED MILITARY ELECTRONIC EQUIPMENT.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST - NOTE 2)	450	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE TEST (NOTE 3)	2.5	G

RATINGS

AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MIN.	NORM. TEST CONDITIONS NOTE 5	NORM. OPERATION NOTE 4	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 6)	Ef:	1.00	1.25	1.25	1.50	Vdc
PLATE VOLTAGE (NOTE 7)	Eb:	---	90	90	135	Vdc
GRID VOLTAGE	Ec1:	---	0	0	---	Vdc
GRID VOLTAGE #2 (NOTE 7)	Ec2:	---	90	90	135	Vdc
PLATE DISSIPATION	Pp:	---	---	---	0.17	WATTS
GRID #2 DISSIPATION	Pg2:	---	---	---	0.05	WATTS
GRID RESISTANCE	Rg(1):	---	---	---	2.0	MEG.
TRANSCONDUCTANCE	Sm:	---	---	900	---	µMHOS
PLATE CURRENT	Ib1:	---	---	1.6	---	mAdc
CATHODE CURRENT	Ik:	---	---	---	3.0	mAdc

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL[1]

TEST	AQL %	MIL E-1 SYMBOL	MIN.	LAL	BOG.	UAL	MAX.	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1	COMBINED AQL=1.0 % EXCLUDING MECH. AND INOPERATIVES								
GRID CURRENT (1): Eb=Ec2=135 Vdc; Ec1=−2.0 Vdc	0.65	Ic1:	0	---	---	---	−1.0	---	μAdc
PLATE CURRENT (1):	0.65	Ib1:	1.0	---	---	---	2.1	---	mAdc
SCREEN GRID CURRENT:	0.65	Ic2:	0.28	---	---	---	0.62	---	mAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	720	---	---	---	1080	---	μMHOS
NOISE AND MICROPHONICS: Ebb=Ecc2=90 Vdc: Ecal=10.0mVac;Rp 1.0 MEG.; Rg2=4.7 MEG.; Cg2=0.1 μf	0.65	EB:	---	---	---	---	17	---	VU
CONTINUITY AND SHORTS: (INOPERATIVES)	0.4	---	---	---	---	---	---	---	---
MECHANICAL: (ENVELOPE OUTLINE 6-2)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS- PART 2									
INSULATION OF ELECTRODES: g-all=−100 Vdc	4.0	Rg-all:	100	---	---	---	---	---	MEG.
p-all=−100Vdc		Rp-all:	100	---	---	---	---	---	MEG.
PLATE CURRENT(2): Ec1=−4.5 Vdc	6.5	Ib:	0	---	---	---	30	---	μAdc
TRANSCONDUCTANCE (2): Ef= 1.0 Vdc	6.5	Sm(2):	610	---	---	---	1080	---	μMHOS
FILAMENT CURRENT:	6.5	If:	44	---	---	---	56	---	mA
CAPACITANCE: (SHIELD #316)	6.5	Cg1p:	---	---	---	---	0.02	---	μμf
CAPACITANCE (SHIELD #316)	6.5	Cin:	3.0	---	---	---	4.2	---	μμf
CAPACITANCE (SHIELD #316)	6.5	Cout:	5.6	---	---	---	7.6	---	μμf
VIBRATION (1): Rp=10,000 OHMS; 40 cps;15 g	6.5	Ep:	---	---	---	---	10	---	mVac
VIBRATION (2): f=50 cps 3500 cps; Rp=10,000 OHMS (NOTE 8)	6.5	Ep(2):	---	---	---	---	15	---	mVac
DEGRADATION RATE ACCEPTANCE TESTS									
SHOCK:: HAMMER ANGLE=30° (NOTE 2)	---	---	---	---	---	---	---	---	---
FATIGUE: G=2.5; F 25cps MIN; 60 cps MAX; FIXED FREQUENCY (NOTE 3)	6.5	---	---	---	---	---	---	---	---

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL[1] ; cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BDG.	UAL	MAX.	ALD	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS (CONT'D.)	COMBINED AQL=1.% EXCLUDING MECH. AND INOPERATIVES								
POST SHOCK AND FATIGUE TEST END POINTS:									
TRANSCONDUCTANCE (1)	---	Sm:	540	---	---	---	---	---	µMHOS
VIBRATION	---	Ep	---	---	---	---	15	---	mVac
MINIATURE TUBE BASE STRAIN:	---	---	---	---	---	---	---	---	---
GLASS STRAIN (THERMAL SHOCK):	2.5	---	---	---	---	---	---	---	---

ACCEPTANCE LIFE TESTS	ALLOWABLE DEF. PER CHARACTER. 1st SAMP.	CDMB. SAMP.	AQL %	MIL-E-1 SYM.	MIN.	MAX.	MIL-E-1 UNITS
INTERMITTENT LIFE TEST: Ef=1.25 Vdc; OR Vac WITH EQUIVALENT BIAS; GROUP A	---	---	---	t:	500	---	HOURS
INTERMITTENT LIFE TEST END POINTS							
TRANSCONDUCTANCE (1)	---	---	---	Sm(1):	540	---	µMHOS
GRID CURRENT	---	---	---	Ic(1):	---	−1.0	µAdc

NOTES

1. CHARACTERISTICS, QUALITY CONTROL PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1, AND MIL-STD-105A.

2. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

3. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

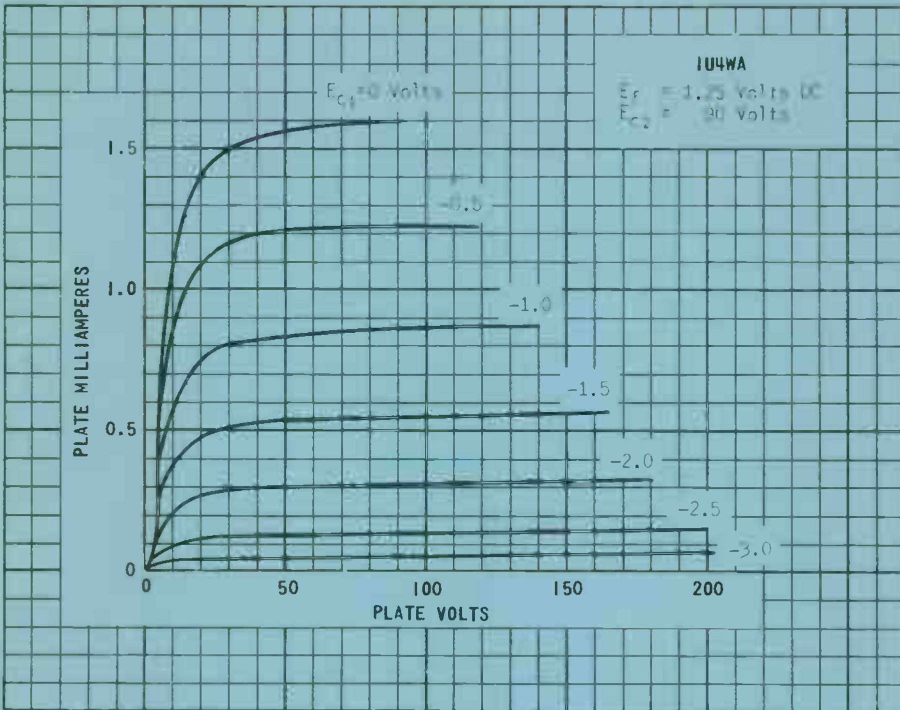
4. THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

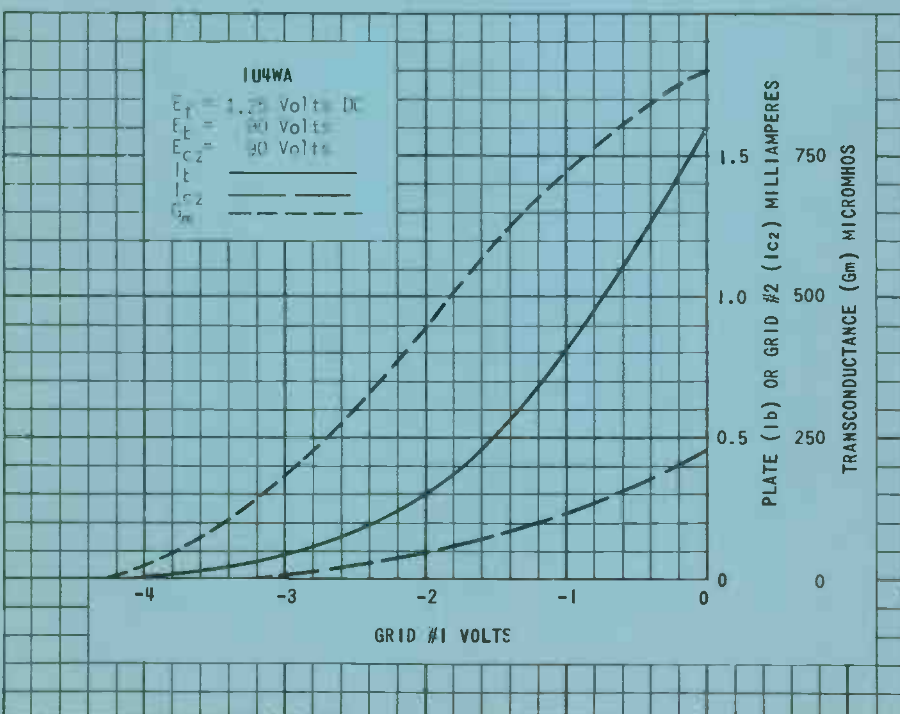
5. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTICS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

6. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

7. PLATE AND SCREEN VOLTAGES SHOULD NOT EXCEED THESE VALUES UNDER ANY CIRCUMSTANCES.

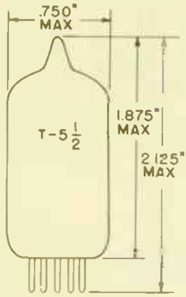
8. THE TUBE UNDER TEST SHALL BE RIGIDLY MOUNTED ON A VIBRATION TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TEST CONDITIONS OF PARAGRAPH 4.9.19.1 OF MIL-E-1 SHALL BE APPLIED AND Ep MONITORED WHILE THE FREQUENCY OF VIBRATION IS CONTINUOUSLY SWEPT FROM 50–3500 CPS AND THE PEAK ACCELERATION CONTROLLED CONSTANT AT 2G. A LOW PASS FILTER WHICH FOLLOWS THE LOAD RESISTOR OF THE TUBE UNDER TEST SHALL HAVE A CUT-OFF FREQUENCY OF 3500 CPS. THE TOTAL TIME OF SWEEP SHALL NOT BE LESS THAN ONE (1) MINUTE.


IU4WA
E_f = 1.25 Volts DC
E_{c2} = 90 Volts
E_{c1} = 0 Volts
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
PLATE MILLIAMPERES
1.5
1.0
0.5
0
50
100
150
200
PLATE VOLTS


IU4WA
E_f = 1.25 Volts DC
E_b = 90 Volts
E_{c2} = 90 Volts
I_b
I_{c2}
G_m
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
TRANSCONDUCTANCE (Gm) MICROMHOS
1.5
750
1.0
500
0.5
250
0
0
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

DIODE PENTODE

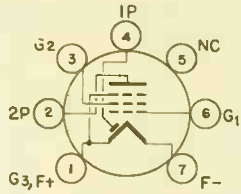


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

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 1.5	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.

PRINTED IN U.S.A.

TUNG-SOL

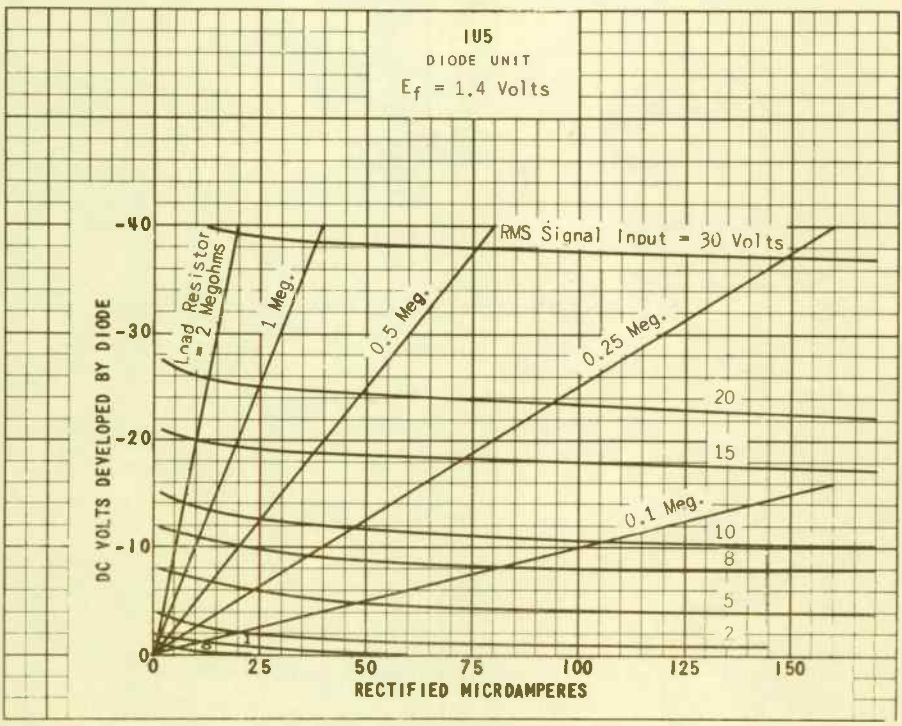
CONTINUED FROM PRECEDING PAGE

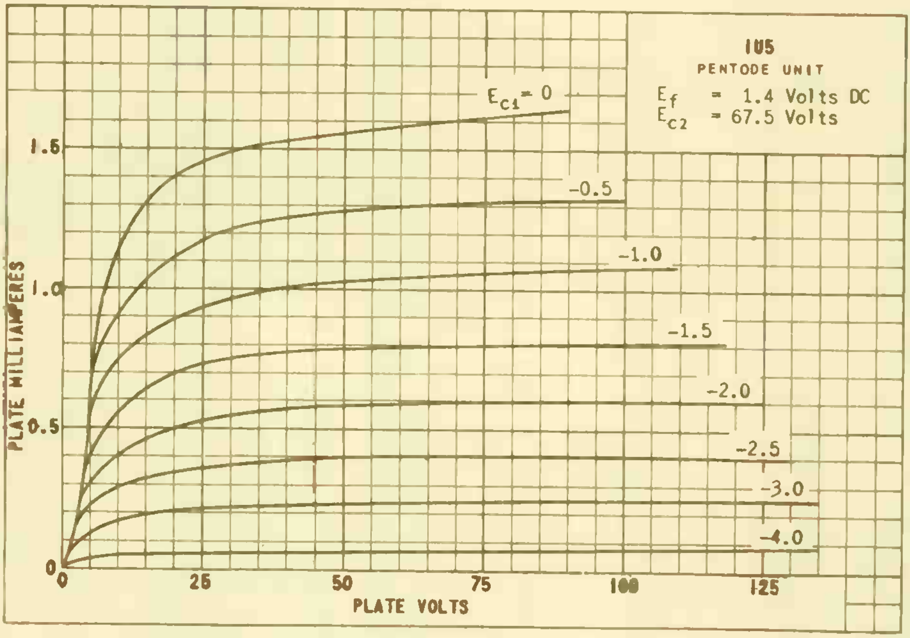
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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	





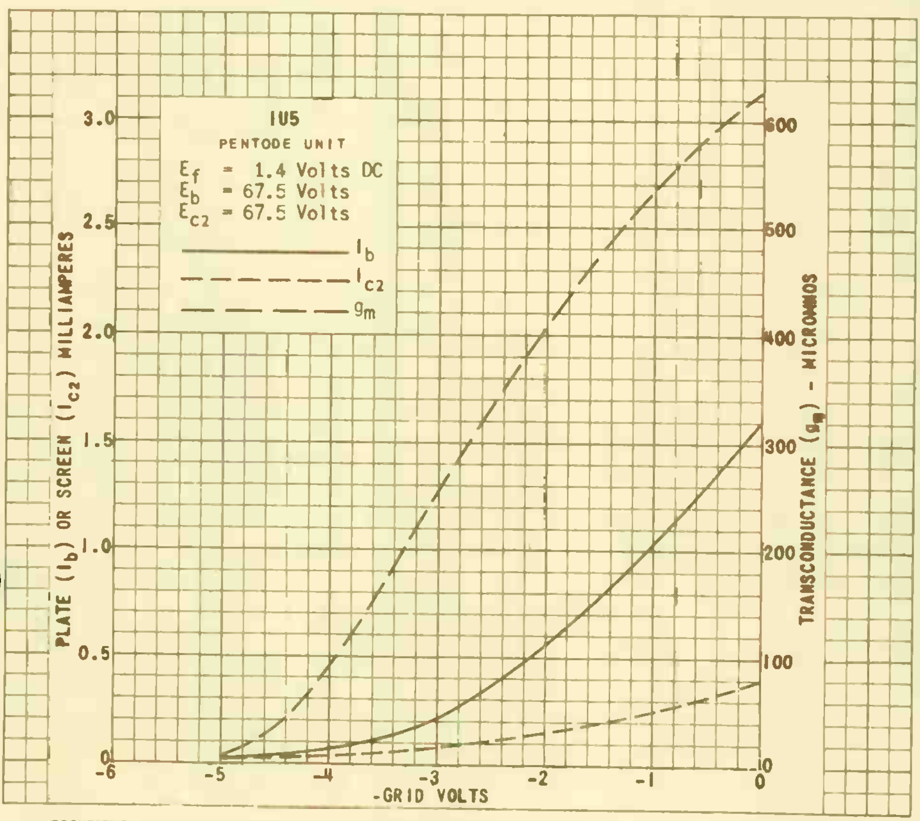
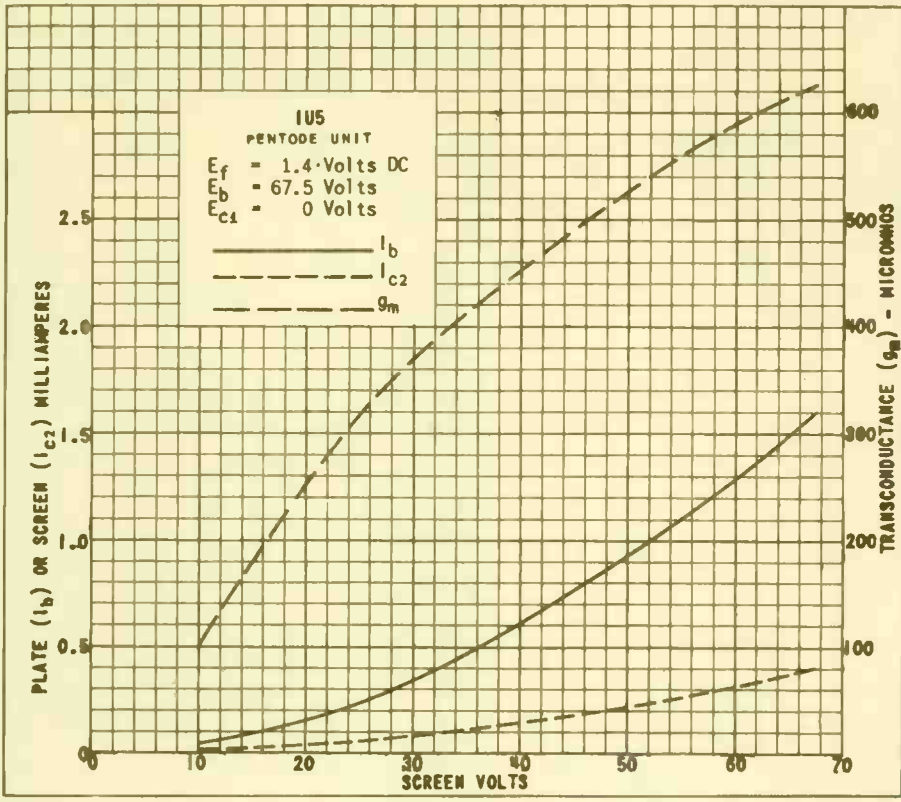


PLATE 1774
FEB. 3, 1947



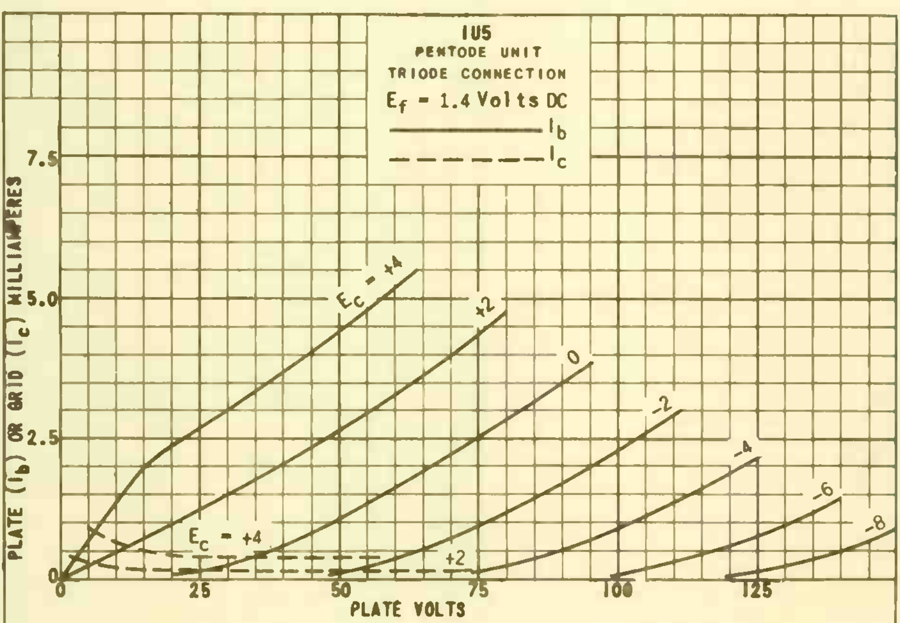


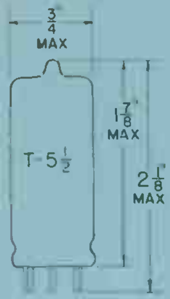
PLATE 1775
FEB. 3, 1947

 ELECTRON TUBE DIVISION NEWARK NEW JERSEY U S A

TUNG-SOL

DIODE PENTODE

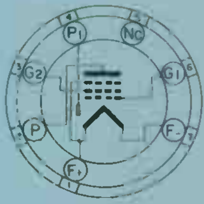
MINIATURE TYPE



GLASS BULB

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

6BW

THE 1U5WA IS A FILAMENT TYPE, SHARP CUT-OFF, DIODE PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. ITS PRINCIPAL APPLICATION IS AS A DIODE DETECTOR, AVC RECTIFIER, AUDIO FREQUENCY AMPLIFIER IN PORTABLE RECEIVERS. THE 1U5WA IS PARTICULARLY USEFUL IN DETECTOR AMPLIFIER CIRCUITS WHERE ITS LOW MICROPHONIC NOISE AND VIBRATION OUTPUT ARE ESSENTIAL FOR SPECIALIZED MILITARY ELECTRONIC EQUIPMENT.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST - NOTE 2)	450	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE TEST-NOTE 3)	2.5	G

RATINGS

AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES MIN.	NORM. TEST CONDITIONS NOTE 5	NORM. OPERATION NOTE 4	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 6)	Ef:	1.00	1.25	1.25	1.50	Vdc
PLATE VOLTAGE (NOTE 7)	Eb:	---	67.5	67.5	100	Vdc
GRID VOLTAGE	Ec1:	---	0	0	0	Vdc
GRID VOLTAGE #2 (NOTE 7)	Ec2:	---	67.5	67.5	100	Vdc
PLATE DISSIPATION	Pp:	---	---	---	0.13	WATTS
GRID #2 DISSIPATION	Pg2:	---	---	---	0.035	WATTS
GRID RESISTANCE	Rg(1):	---	---	---	2.0	MEG.
TRANSCONDUCTANCE	Sm:	---	---	650	---	μMHOS
PLATE CURRENT	Ib1:	---	---	1.6	---	mAdc
CATHODE CURRENT	Ik:	---	---	---	5.0	mAdc
DIODE CURRENT	Iib:	---	---	---	250	μAdc

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL[1]

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1	COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES.								
GRID CURRENT (1): Eb=Ec2=90Vdc; Ec1=-2.5 Vdc	0.65	Ic1:	0	---	---	---	-0.5	---	μAdc
PLATE CURRENT (1):	0.65	Ib1:	1.05	---	---	---	2.15	---	mAdc
SCREEN GRID CURRENT:	0.65	Ic(2):	0.24	---	---	---	0.56	---	mAdc
TRANSCONDUCTANCE (1): Ef=1.0 Vdc	0.65	Sm(1):	380	---	---	---	775	---	μMHOS
AC AMPLIFICATION: Ebb=Ecc2=45 Vdc; Rg2=2.0 MEG; Rg1=10 MEG.; Rp=0.5 MEG.; Esig=0.2 Vac; 0.1μf BETWEEN G2 &-F	0.65	Ep:	6.5	---	---	---	---	---	Vac
EMISSION (DIODE) Eib=10 Vdc	0.65	Lis:	0.5	---	---	---	---	---	mAdc
NOISE AND MICROPHONICS: Ebb=Ecc2=135 Vdc; Ecal=10.0 mVac; Rp=1.0 MEG.; Cg2=0.1 μf; Ec1=0; Rp OF DIODE = 2 MEG. TO GROUND. COUPLE PLATE OF DIODE TO G1 THROUGH A 0.1μf CAPACITOR; Rg1=1.5 MEG.; Rg2-0 1μf (NOTE 9, 10)	0.65	---	---	---	---	---	---	---	---
CONTINUITY AND SHORTS: (INOPERATIVES)	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE OUTLINE (6-2)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS, PART 2									
INSULATION OF ELECTRODES: g1-all=-100 Vdc	4.0	Rg-all:	100	---	---	---	---	---	MEG.
p-all=-100 Vdc		Rp-all:	100	---	---	---	---	---	MEG.
TRANSCONDUCTANCE (2):	6.5	Sm:	525	---	---	---	775	---	μMHOS
FILAMENT CURRENT:	6.5	If:	44	---	---	---	56	---	mA
VIBRATION (1): Rp=10,000 OHMS; F=40 cps; G=15	6.5	Ep(1):	---	---	---	---	10	---	mVac
VIBRATION (2): F=50 cps-3500 cps; Rp=10,000 OHMS (NOTE 8)	6.5	Ep(2):	---	---	---	---	25	---	mVac

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS	COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES								
SHOCK:									
HAMMER ANGLE=30° (NOTE 2)	---	---	---	---	---	---	---	---	---
FATIGUE:									
G=2.5; F=25cps MIN., 60 cps MAX., FIXED FREQUENCY (NOTE 3)	6.5	---	---	---	---	---	---	---	---
POST SHOCK AND FATIGUE TEST END POINTS:									
TRANSCONDUCTANCE (2)	---	Sm:	450	---	---	---	---	---	μMHOS
VIBRATION (1):	---	Ep:	---	---	---	---	15	---	mVac
DIODE EMISSION	---	Iis:	0.2	---	---	---	---	---	mAdc
MINIATURE TUBE BASE STRAIN:	---	---	---	---	---	---	---	---	---
GLASS STRAIN (THERMAL SHOCK):	2.5	---	---	---	---	---	---	---	---

TEST	ALLOW. DEF. PER CHARAC. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS							
INTERMITTENT LIFE TEST:							
Ef=1.25 Vdc OR Vac WITH EQUIVALENT BIAS GROUP A	---	---	---	t:	500	---	HOURS
INTERMITTENT LIFE TEST END POINTS:							
TRANSCONDUCTANCE (2)	---	---	---	Sm(2):	450	---	μMHOS
OR AC AMPLIFICATION	---	---	---	Ep:	5.0	---	Vac
EMISSION (DIODE)	---	---	---	Iis:	0.2	---	mAdc

NOTES

1. CHARACTERISTICS, QUALITY CONTROL PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPH OF MIL-E-1, AND MIL-STD 105A.
2. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.
3. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.
4. THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES

CONT'D.

5. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTICS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

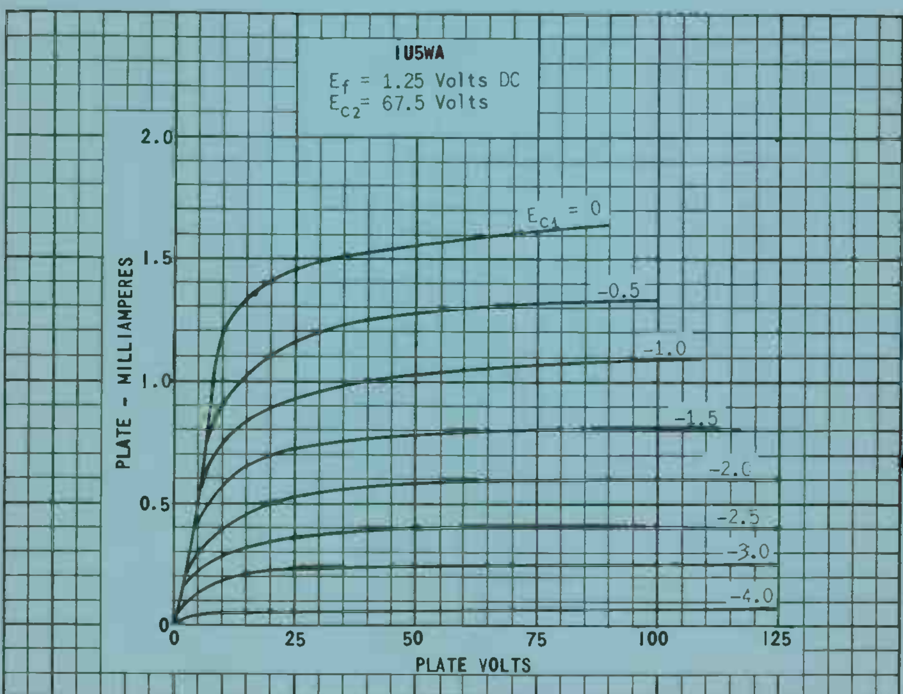
6. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

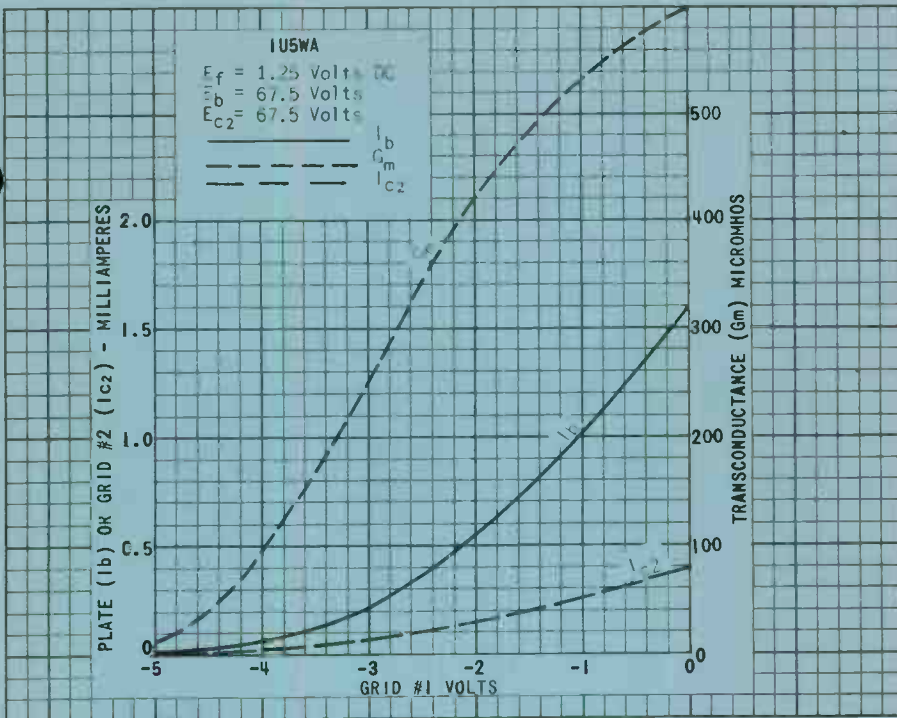
7. PLATE AND SCREEN VOLTAGES SHOULD NOT EXCEED THESE VALUES UNDER ANY CIRCUMSTANCES.

8. THE TUBE UNDER TEST SHALL BE RIGIDLY MOUNTED ON A VIBRATION TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TEST CONDITIONS OF PARAGRAPH 4.9.19.1 OF MIL-E-1 SHALL BE APPLIED AND E_p MONITORED WHILE THE FREQUENCY OF VIBRATION IS CONTINUOUSLY SWEPT FROM 50-3500 CPS AND THE PEAK ACCELERATION CONTROLLED CONSTANT AT 2G. A LOW PASS FILTER WHICH FOLLOWS THE LOAD RESISTOR OF THE TUBE UNDER TEST SHALL HAVE A CUT-OFF FREQUENCY OF 3500 CPS. THE TOTAL TIME OF SWEEP SHALL NOT BE LESS THAN ONE (1) MINUTE.

9. TUBES SHALL BE SO SHIELDED THAT OPERATOR PROXIMITY OR MOVEMENT WILL NOT AFFECT OUTPUT READINGS.

10. THE REJECTION LEVEL SHALL BE SET AT THE VU METER READING OBTAINED DURING CALIBRATION.

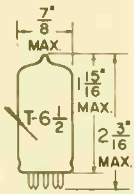



1U5WA
E_f = 1.25 Volts DC
E_b = 67.5 Volts
E_{c2} = 67.5 Volts
I_b
G_m
I_{c2}
PLATE (Ib) OR GRID #2 (Ic2) - MILLIAMPERES
TRANSCONDUCTANCE (Gm) MICROMHOS
GRID #1 VOLTS
-5
-4
-3
-2
-1
0
0.5
1.0
1.5
2.0
100
200
300
400
500

TUNG-SOL

DIODE

MINIATURE TYPE



GLASS BULB

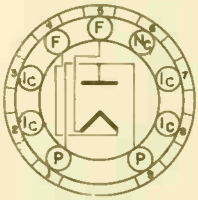
COATED FILAMENT

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	$\mu\mu f$

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FLYBACK VOLTAGE RECTIFIER[B]

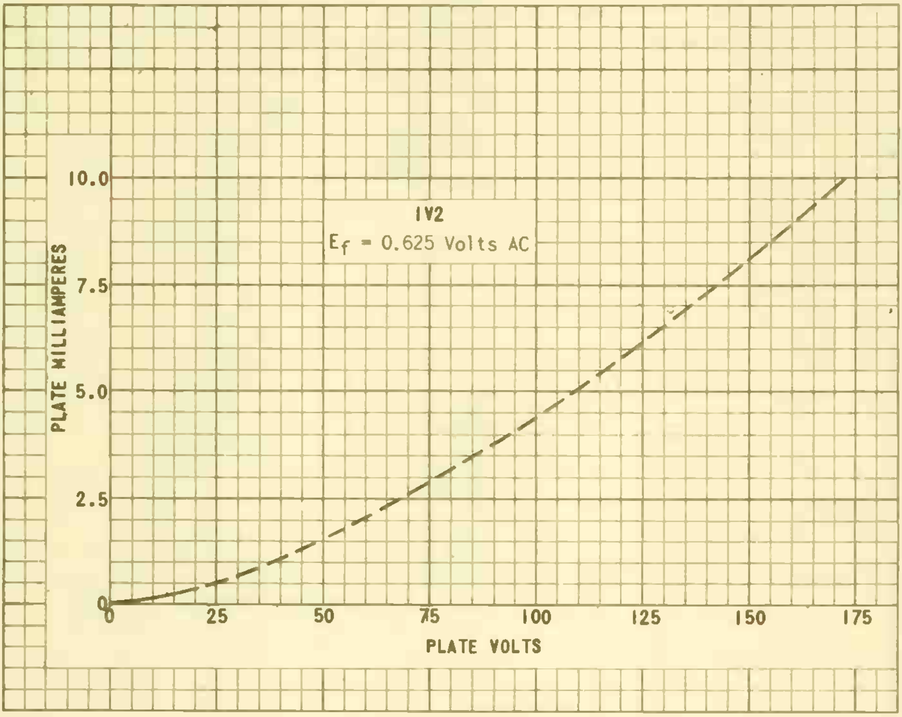
FILAMENT VOLTAGE[C]	0.625	VOLTS
FILAMENT CURRENT	300	MA.
MAXIMUM INVERSE PLATE VOLTAGE		
TOTAL DC AND PEAK (ABSOLUTE MAXIMUM)	8250 ←	VOLTS
DC	7000 ←	VOLTS
MAXIMUM PEAK PLATE CURRENT	11 ←	MA.
MAXIMUM AVERAGE PLATE CURRENT	0.6 ←	MA.
TUBE DROP (APPROX.) WITH 7 MA. PLATE CURRENT)	135	VOLTS

[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

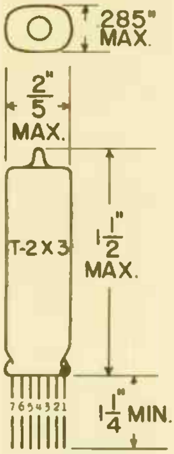


1V2
E_f = 0.625 Volts AC
PLATE MILLIAMPERES
10.0
7.5
5.0
2.5
0
0
25
50
75
100
125
150
175
PLATE VOLTS

TUNG-SOL

TRIODE PENTODE

SUBMINIATURE TYPE

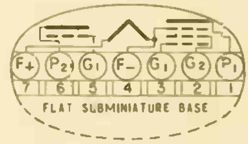


GLASS BULB
RED DOT IS ADJACENT TO LEAD 1

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.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

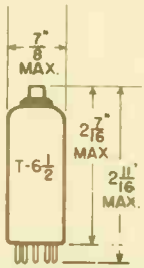
FREQUENCY CONVERTER

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.

TUNG-SOL



GLASS BULB

DIODE

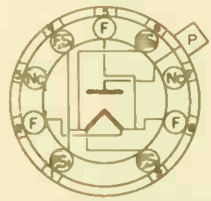
MINIATURE TYPE

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

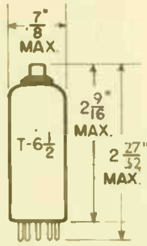
PRINTED IN U. S. A.

PLATE 2238
SEPT. 1 1949

TUNG-SOL

DIODE

MINIATURE TYPE



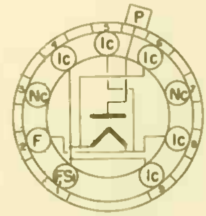
GLASS BULB
SKIRTED
MINIATURE CAP

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.

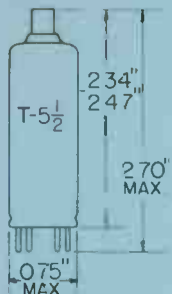
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE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

TUNG-SOL

DIODE

MINIATURE TYPE



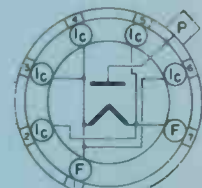
GLASS BULB

FILAMENT

1.25±5% VOLTS 0.265 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON 7 PIN BASE

THE 1Z2 IS A HIGH VOLTAGE LOW CURRENT VACUUM RECTIFIER TUBE IN A MINIATURE BULB. THIS TUBE FEATURES A LOW DRAIN, THORIATED TUNGSTEN FILAMENT WHICH WILL WORK SATISFACTORILY IN FLYBACK AND RF POWER SUPPLY CIRCUITS AS WELL AS WITH CONVENTIONAL TRANSFORMER OR DRY BATTERY FILAMENT SUPPLY. FULL ANODE VOLTAGE MAY BE APPLIED TO A COLD TUBE SIMULTANEOUSLY WITH THE APPLICATION OF FILAMENT VOLTAGE. BECAUSE OF THE SMALL SPACE AND WEIGHT OF THE 1Z2, THIS TUBE IS ESPECIALLY ADAPTABLE TO COMPACT AND PORTABLE EQUIPMENT.

MAXIMUM RATINGS

MAXIMUM PEAK INVERSE PLATE VOLTAGE	15 000	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT	8.5	MA.
MAXIMUM DC OUTPUT CURRENT	1.5	MA.
MAXIMUM SUPPLY VOLTAGE FREQUENCY	300	KCYCLES
MAXIMUM ALTITUDE FOR FULL RATINGS	[illegible] 000	FEET
MINIMUM SUPPLY SOURCE IMPEDANCE (AT EPX = 11 KV)	500 000	OHMS

ELECTRICAL DATA

FILAMENT VOLTAGE	1.25±5%	VOLTS
FILAMENT CURRENT	0.265	AMP.
TUBE VOLTAGE DROP AT 1.5 MA. (APPROX.)	18	VOLTS
TUBE VOLTAGE DROP AT 8.5 MA. (APPROX.)	125	VOLTS
MINIMUM FILAMENT HEATING TIME	0	SECONDS

CONTINUED ON FOLLOWING PAGE

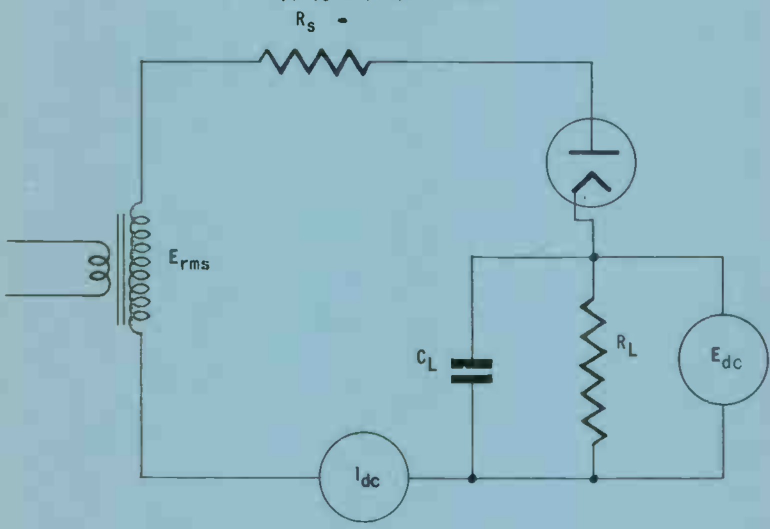
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

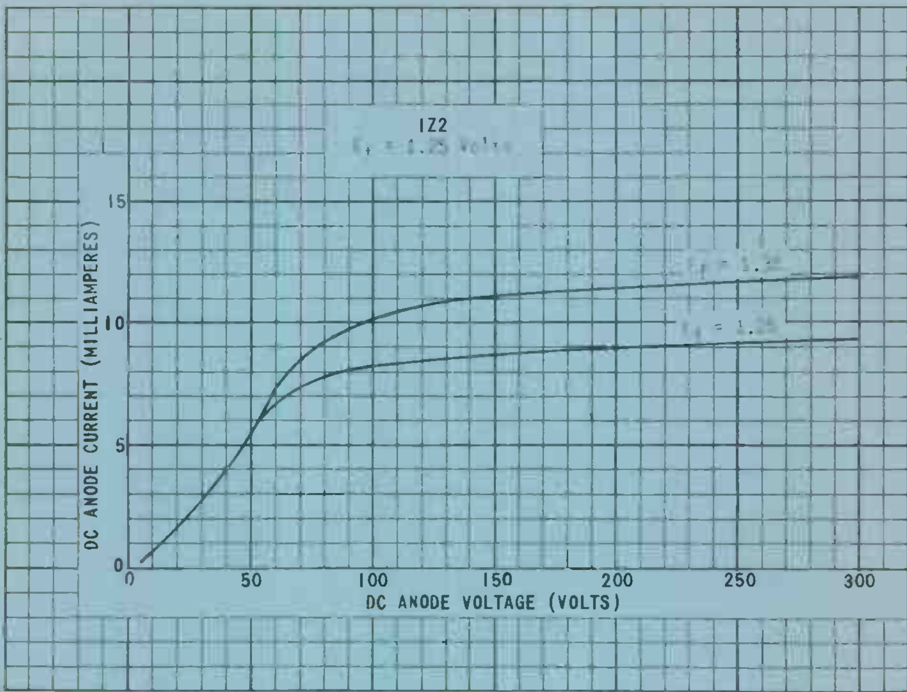
MECHANICAL DATA

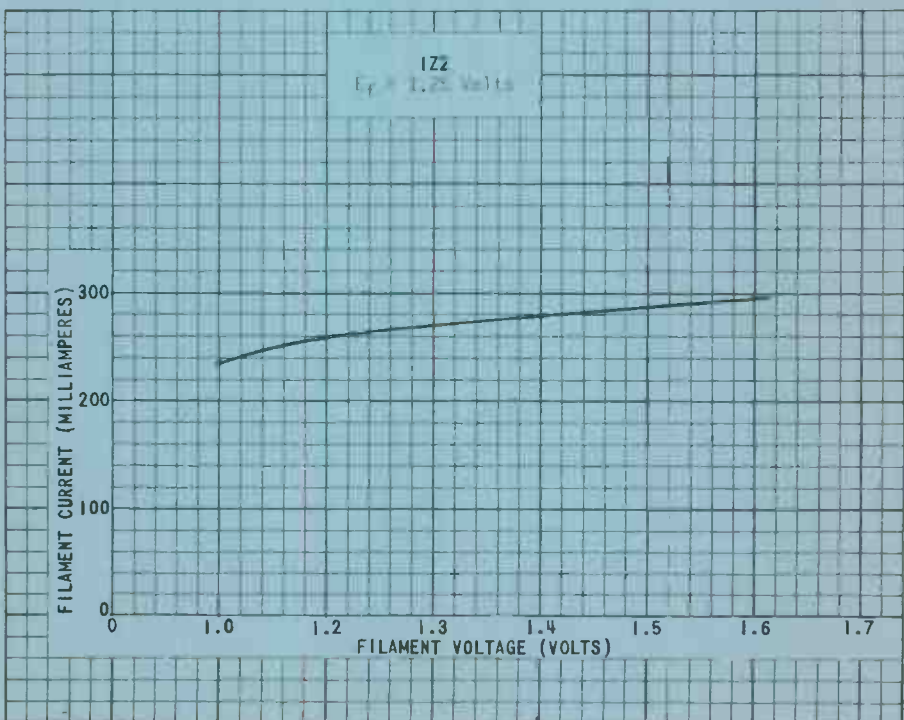
MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2.70	INCHES
SEATED LENGTH	2.34 TO 2.47	INCHES
MAXIMUM DIAMETER	0.75	INCHES
BULB	T-5 1/2	
CAP	SKIRTED MINIATURE	
BASE	MINIATURE BUTTON 7 PIN	
MAXIMUM WEIGHT (NET)	0.5	OUNCES

TYPICAL CIRCUIT VALUES



E_{rms}	R_s	R_L	C_L	E_{dc}	I_{dc}
KILOVOLTS	MEGOHMS	MEGOHMS	mfd	KILOVOLTS	MILLIAMPS
5.3	0.44	274.	.012	4.19	1.5
5.3	0.3	45.	.004	6.3	0.155

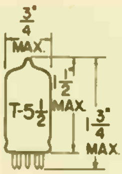

1Z2
15
10
5
0
0
50
100
150
200
250
300
DC ANODE CURRENT (MILLIAMPERES)
DC ANODE VOLTAGE (VOLTS)


1Z2
300
200
100
0
0
1.0
1.2
1.3
1.4
1.5
1.6
1.7
FILAMENT CURRENT (MILLIAMPERES)
FILAMENT VOLTAGE (VOLTS)

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 2AF4A 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	50	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE^A	50	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 25 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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

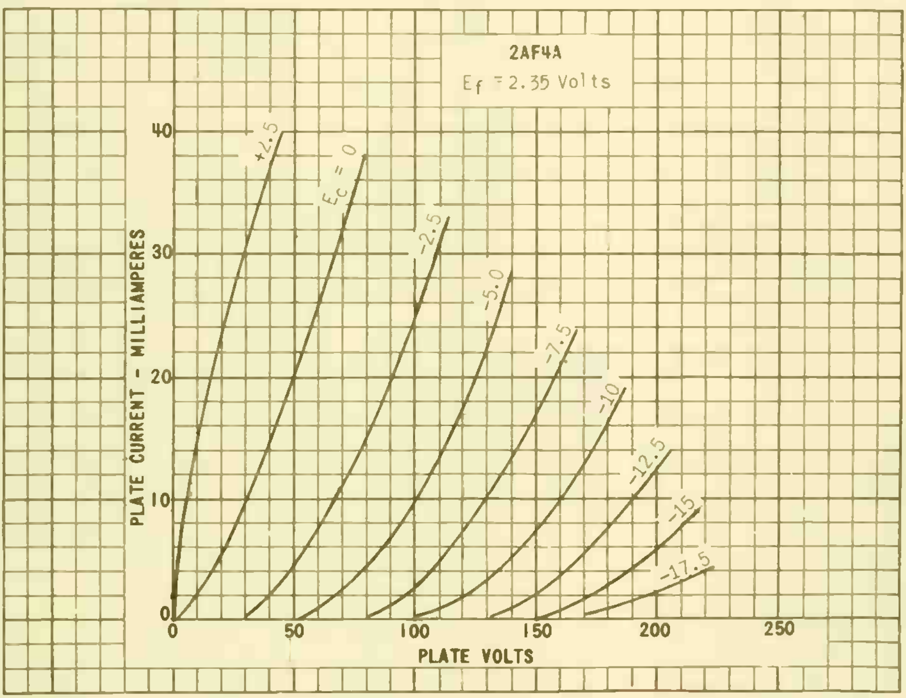
HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	80	VOLTS
CATHODE BIAS RESISTOR	150	OHMS
AMPLIFICATION FACTOR	15	
PLATE RESISTANCE	2 270	OHMS
TRANSCONDUCTANCE	6 600	µMHOS
PLATE CURRENT	16	MA.

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 heater ratings and heater warm-up time the 2AF4A is identical to the 6AF4A.
Except for heater ratings it is identical to the 3AF4A.

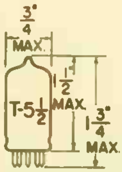
The 2AF4 curves also apply to 2AF4A.



TUNG-SOL

TRIODE

MINIATURE TYPE

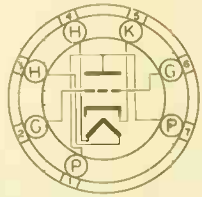


GLASS BULB

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	$\mu\mu$f
GRID TO CATHODE AND HEATER	2.2	$\mu\mu$f
PLATE TO CATHODE AND HEATER	0.45	$\mu\mu$f

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

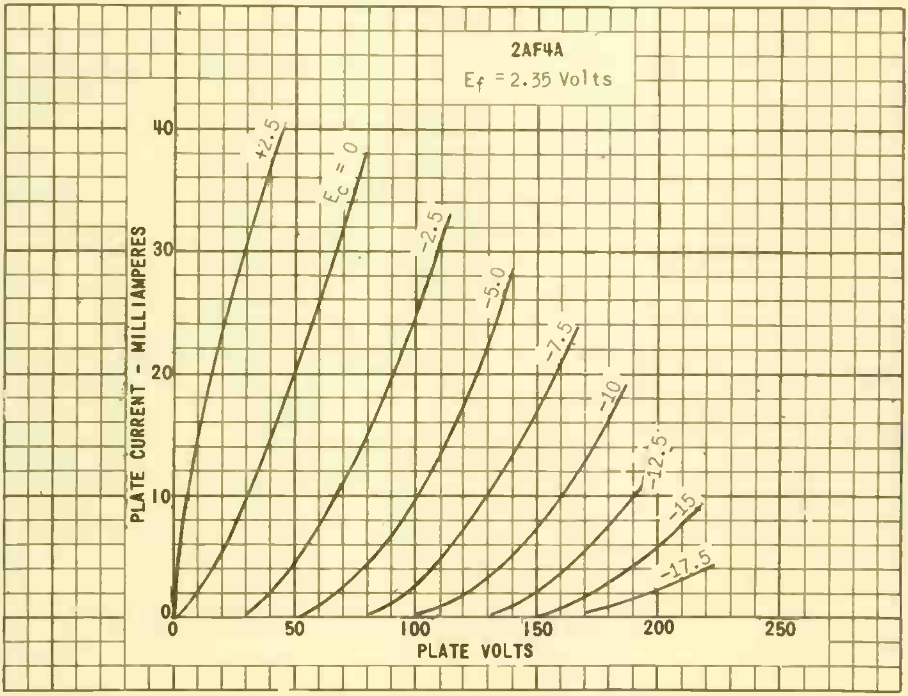
HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	80	VOLTS
CATHODE BIAS RESISTOR	150	OHMS
AMPLIFICATION FACTOR	15	
PLATE RESISTANCE	2 270	OHMS
TRANSCONDUCTANCE	6 600	μMHOS
PLATE CURRENT	16	MA.

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.

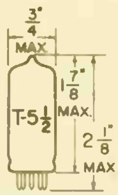
The 2AF4 curves also apply to 2AF4B.



TUNG-SOL

TRIODE

MINIATURE TYPE

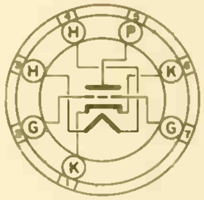


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
2.35 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

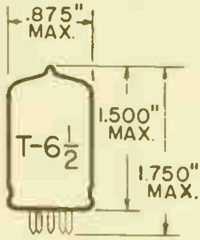
CLASS A_1 AMPLIFIER

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



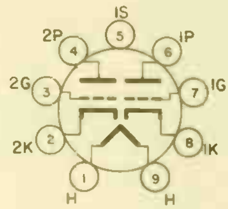
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-1

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	0.05[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.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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.[illegible]	WATTS
CATHODE CURRENT	18	MA.
GRID CIRCUIT RESISTANCE*	1	MEGOHM

→ TYPICAL OPERATING CHARACTERISTICS

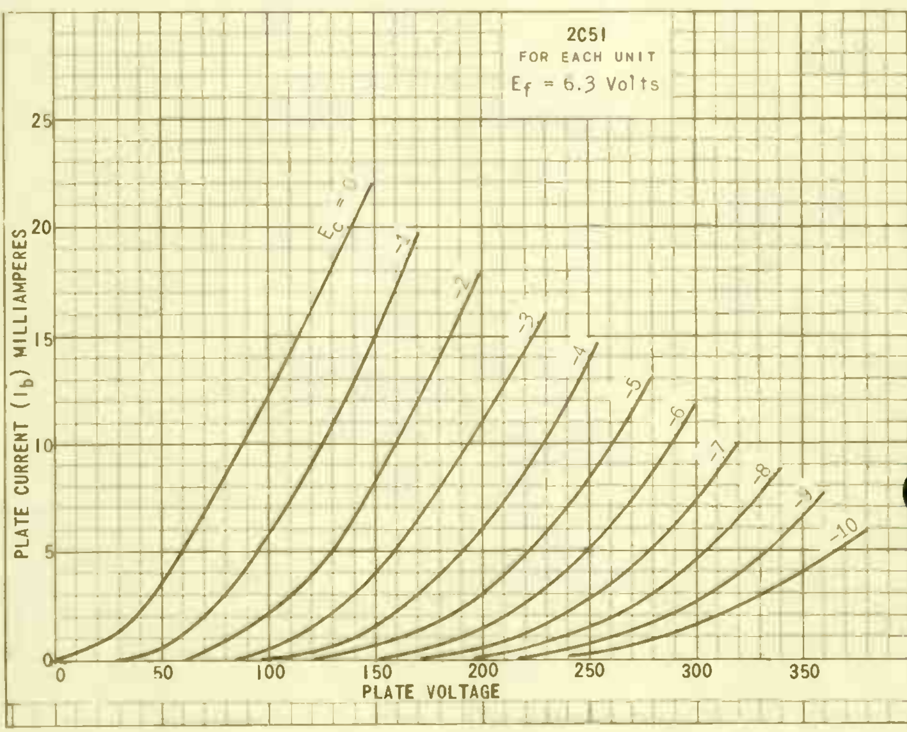
CLASS A_1 AMPLIFIER

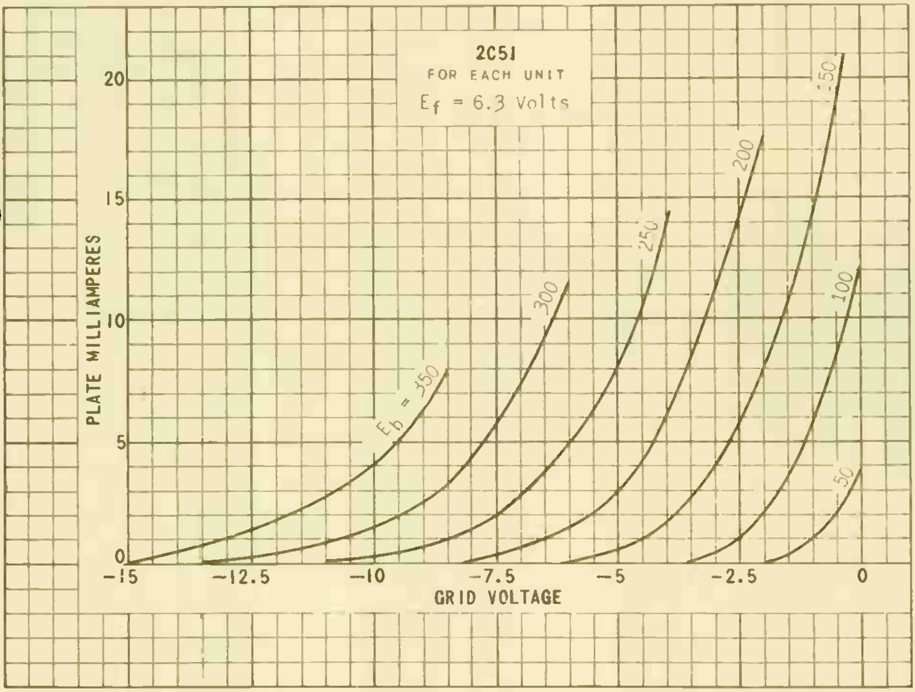
EACH SECTION

PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	240	OHMS
PLATE CURRENT	[illegible].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.





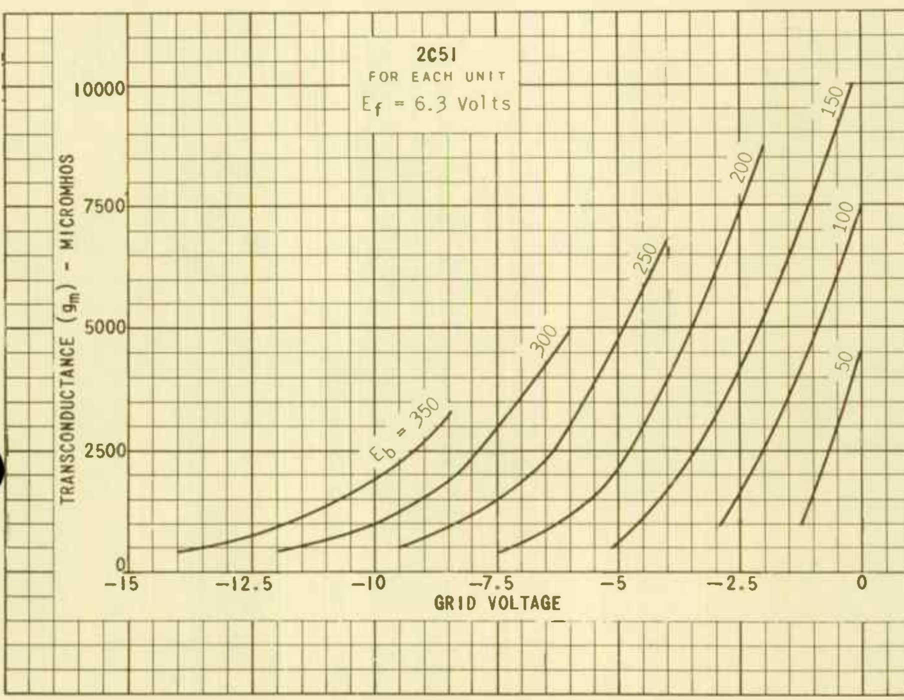
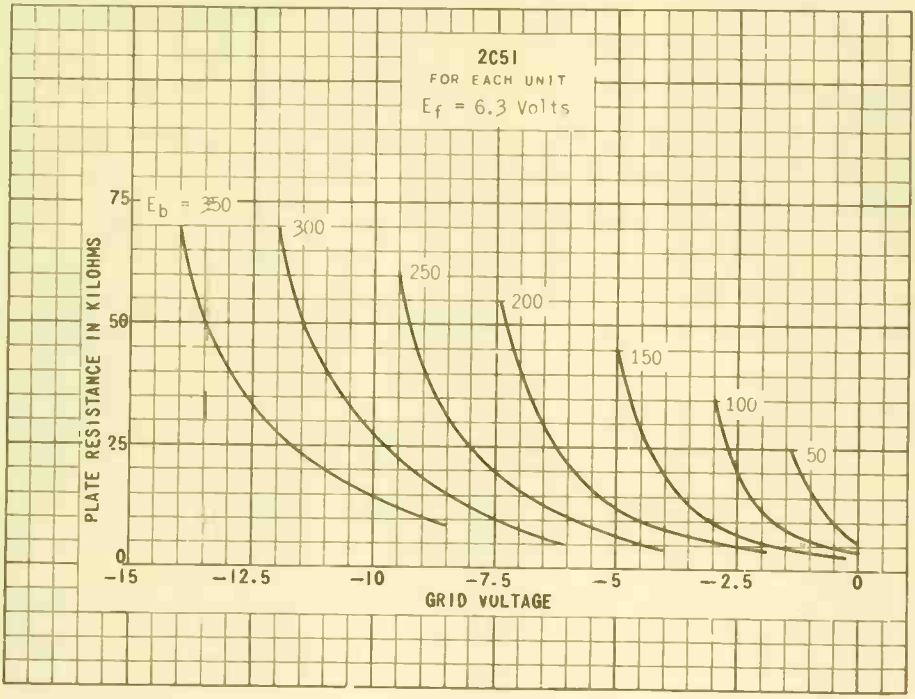


PLATE 2645
MAY 1 1951



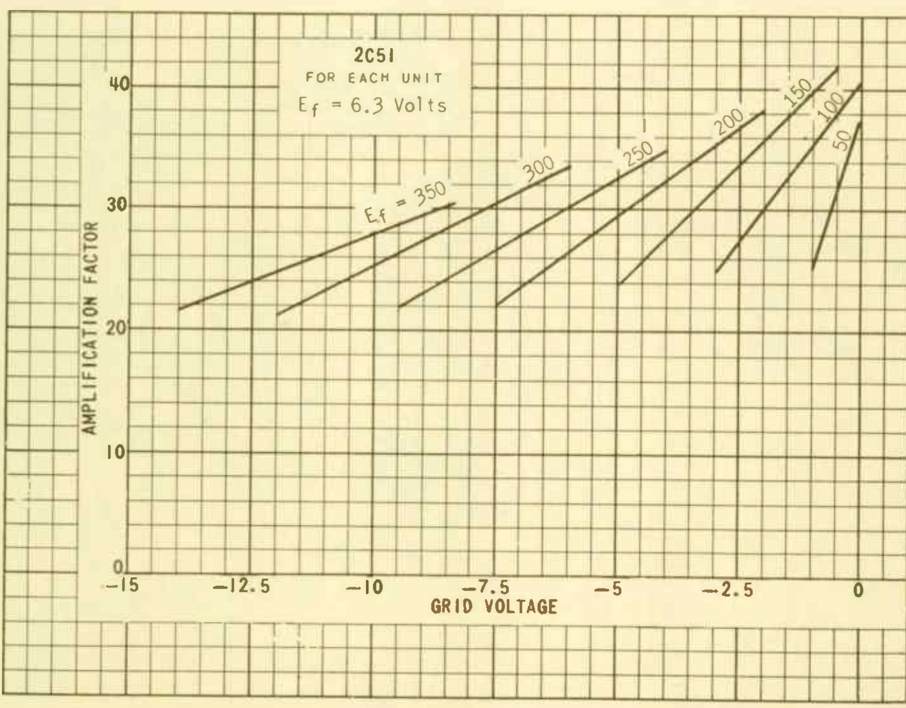
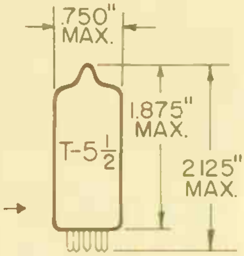


PLATE 2646
MAY 1 1951

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

TUNG-SOL



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

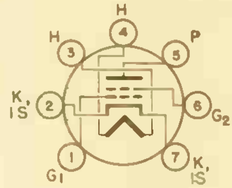
TETRODE

MINIATURE TYPE

COATED UNIPOTENTIAL 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	$\mu\mu f$
INPUT	4.5	$\mu\mu f$
OUTPUT	3.0	$\mu\mu f$

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

PRINTED IN U.S.A.

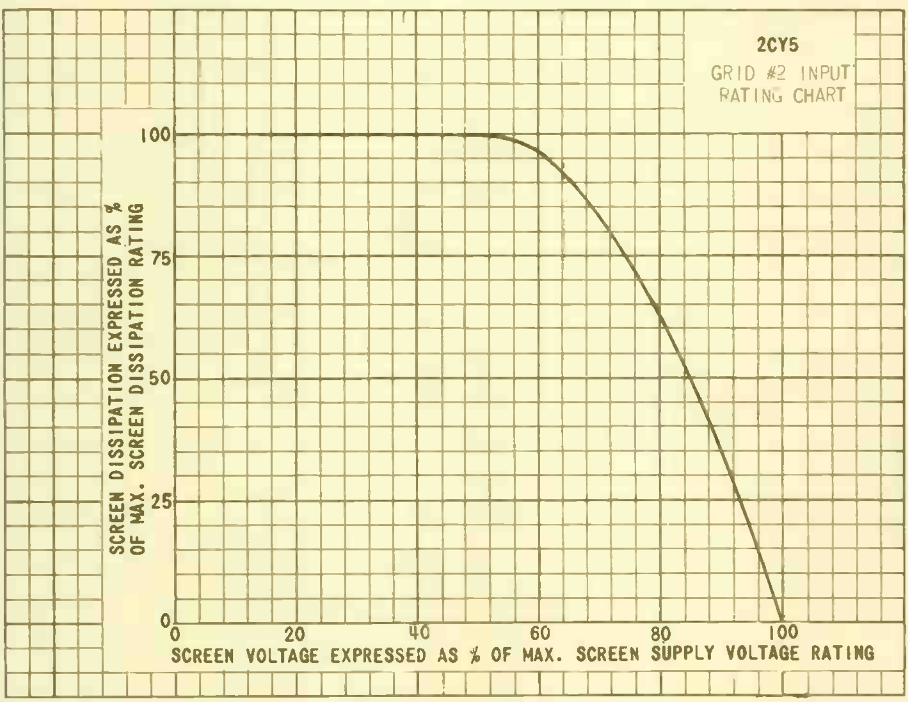
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

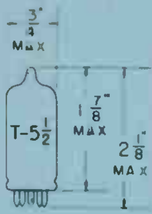
PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	-1	VOLTS
PLATE RESISTANCE	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	µMHOS
GRID #1 CUTOFF BIAS[C]	-6	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	1.5	MA.

[C]PLATE CURRENT 20 µA.



TUNG-SOL

THYRATRON



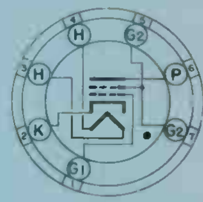
GLASS BULB

HEATER

6.3±10% VOLTS 0.600 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON 7 PIN BASE

7BN

THE 2D21W IS A RUGGEDIZED, XENON FILLED, FOUR ELECTRODE THYRATRON WITH NEGATIVE CONTROL CHARACTERISTICS. THIS TUBE IS ELECTRICALLY EQUIVALENT TO THE POPULAR TYPE 2D21, BUT HAS BEEN RUGGEDIZED THROUGH THE USE OF CERAMIC INSULATORS AND STRONGER ELEMENTS TO PERMIT THE TUBE TO STAND HIGH IMPACT SHOCKS AND VIBRATION. IT HAS FOUND WIDE USAGE AS A SWITCHING TUBE, AS A PULSE MODULATOR, AND IN GRID CONTROLLED RECTIFIER SERVICE. BECAUSE OF ITS SHIELD GRID CONSTRUCTION, THE INPUT OF THE 2D21W WILL WORK DIRECTLY FROM A HIGH IMPEDANCE SOURCE SUCH AS A PHOTOTUBE. THE EFFECTIVE ANODE TO CONTROL GRID CAPACITY MAY BE REDUCED BY CONNECTING PINS #5 & #7 TO #2 AND CONNECTING THE GRID RESISTOR DIRECTLY AT THE SOCKET TERMINAL. THE SMALL SIZE AND LIGHT WEIGHT OF THE 2D21W AND ITS RELATIVE FREEDOM FROM TEMPERATURE RESTRICTIONS MAKE THIS TUBE PARTICULARLY SUITED FOR USE IN COMPACT EQUIPMENT.

ELECTRICAL DATA

HEATER VOLTAGE[A]	6.3±10%	VOLTS
HEATER CURRENT (E_f = 6.3 VOLTS)	0.600	AMP.
MINIMUM CATHODE HEATING TIME	10.	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	0.026	µµFARADS
CONTROL GRID TO CATHODE (&SHIELD GRID) CAPACITANCE	2.4	µµFARADS
ANODE TO CATHODE (&SHIELD GRID) CAPACITANCE	1.6	µµFARADS
DE-IONIZATION TIME, APPROX. (SHIELD TIED TO CATHODE)		
WITH GRID VOLTS = -100, GRID RES. = 1000Ω ANODE VOLTS = 125, ANODE CUR. = 0.1 AMPS.	55	µSECONDS
WITH GRID VOLTS = -10, GRID RES. = 1000Ω ANODE VOLTS = 125, ANODE CUR. = 0.1 AMPS.	75	µSECONDS
IONIZATION TIME, APPROX.	0.5	µSECONDS
ANODE VOLTAGE DROP, APPROX.	8	VOLTS
MAXIMUM CRITICAL GRID CURRENT (AT E_b = 460V RMS)	0.5	µAMPS.

[A] +10%, -5% IN PULSE MODULATOR SERVICE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

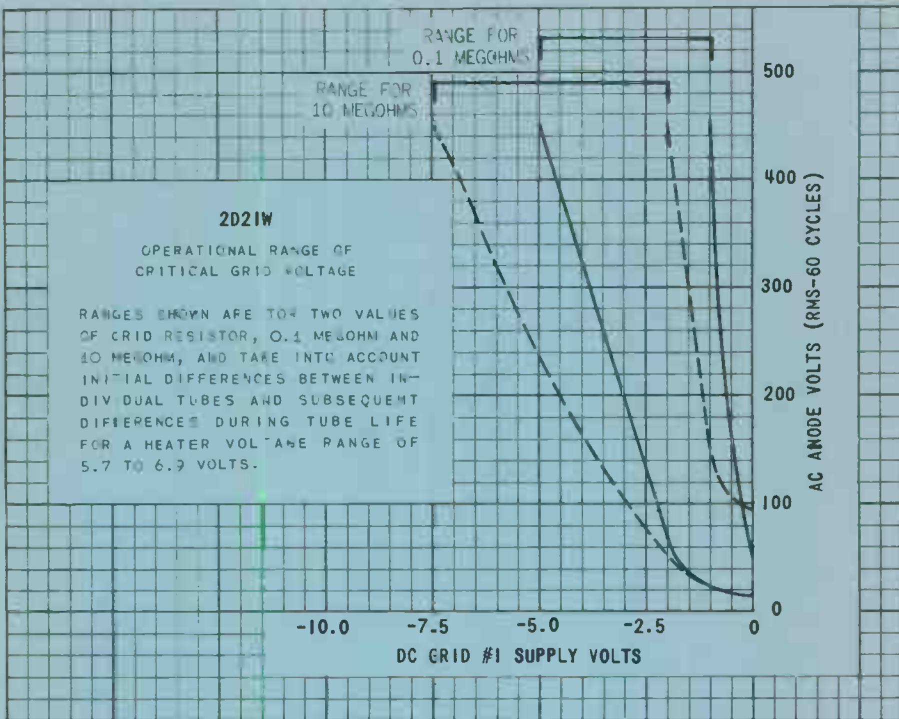
CONTINUED FROM PRECEDING PAGE

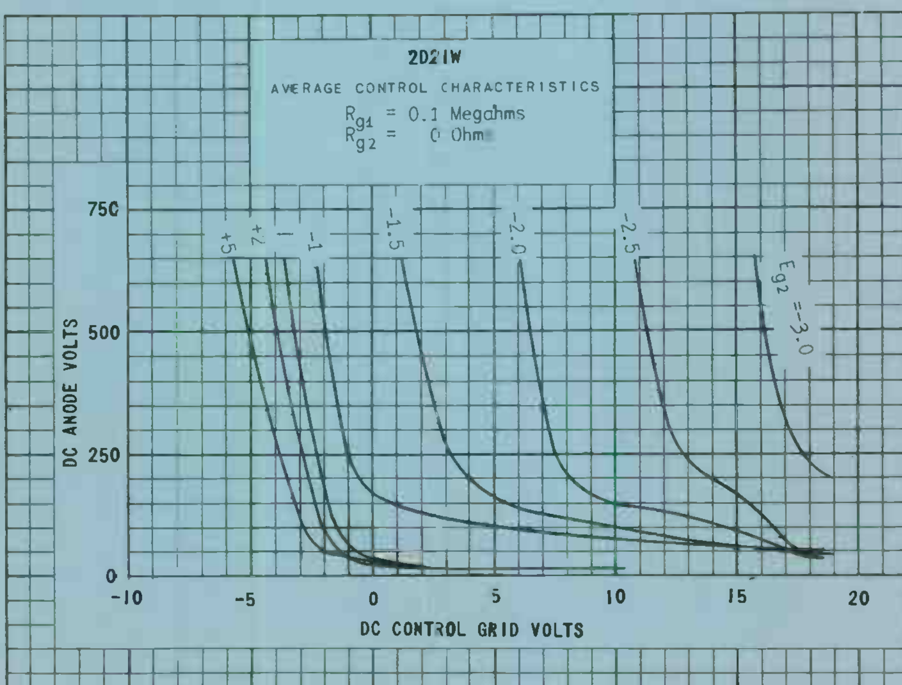
MECHANICAL DATA

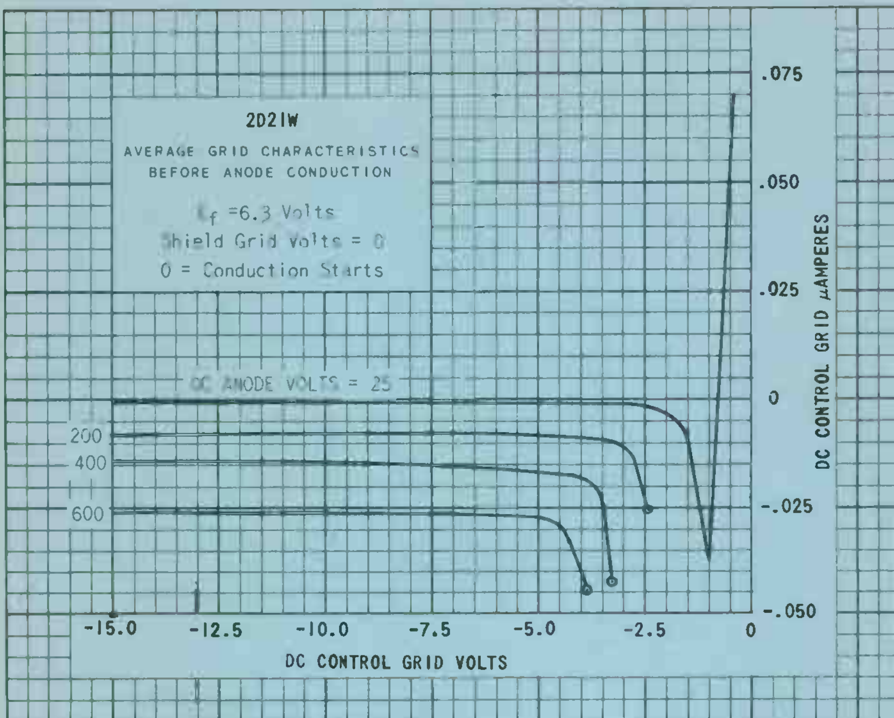
MAXIMUM SHOCK RATING	720	G
MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2.13	INCHES
MAXIMUM SEATED LENGTH	1.88	INCHES
MAXIMUM DIAMETER	0.75	INCHES
BULB	T-5 1/2	
BASE	MINIATURE BUTTON 7 PIN	
WEIGHT (NET)	0.5	OUNCES

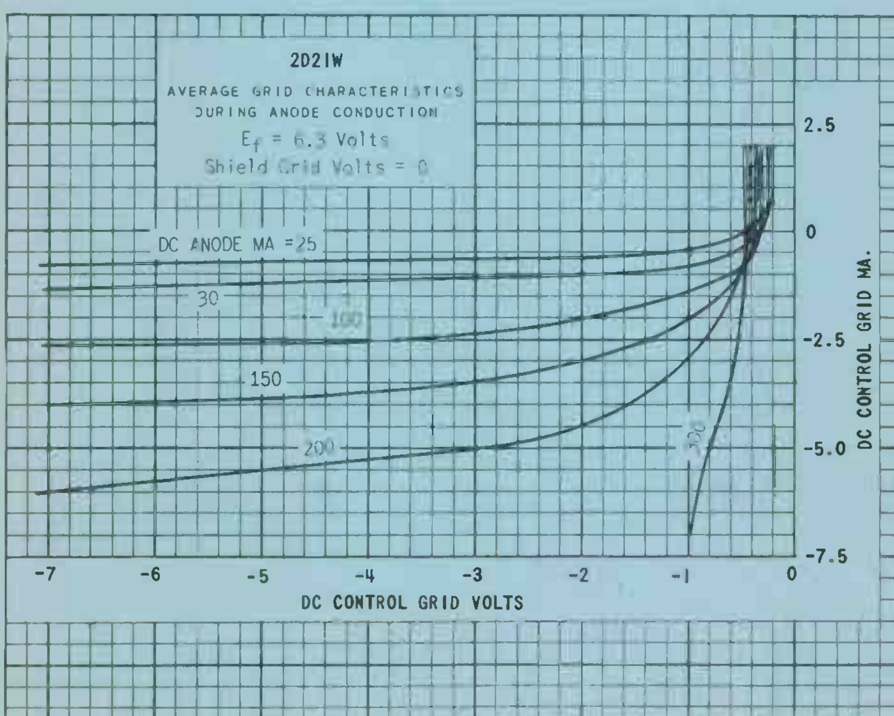
RATINGS
ABSOLUTE VALUES

	RELAY & GRID CONTROLLED RECTIFIER SERVICE	PULSE MODULATOR SERVICE	
MAXIMUM PEAK ANODE VOLTAGE			
INVERSE	1300	100	VOLTS
FORWARD	650	500	VOLTS
MAXIMUM CATHODE CURRENT			
PEAK	0.5	10.	AMPS.
AVERAGE	100.	10.	MA.
SURGE (MAX.DURATION 0.1 SECONDS)	10.	---	AMPS.
MAXIMUM AVERAGE TIME	30.	---	SECONDS
MAXIMUM NEGATIVE CONTROL GRID VOLTAGE			
BEFORE CONDUCTION	-100	-100	VOLTS
DURING CONDUCTION (AVERAGED OVER 30 SEC. MAX.)	-10	-10	VOLTS
MAXIMUM POSITIVE CONTROL GRID CURRENT			
AVERAGE	10	---	MA.
PEAK	---	20	MA.
MAXIMUM NEGATIVE SHIELD GRID VOLTAGE			
BEFORE CONDUCTION	-100	-50	VOLTS
DURING CONDUCTION (AVERAGED OVER 30 SEC. MAX.)	-10	-10	VOLTS
MAXIMUM POSITIVE SHIELD GRID CURRENT			
AVERAGE	10	---	MA.
PEAK	---	20	MA.
MAXIMUM FREQUENCY	---	500	PPS.
MAXIMUM PULSE TIME	---	5	μSECONDS
MAXIMUM RATE OF RISE (AMPS. PER μSECOND)	---	100	
MAXIMUM HEATER CATHODE VOLTAGE			
HEATER NEGATIVE	-100	0	VOLTS
HEATER POSITIVE	25	0	VOLTS
AMBIENT TEMPERATURE LIMITS	-75 TO +90	-75 TO+90	°C
MAXIMUM CONTROL GRID (G1) CIR. RESISTANCE	10	0.5	MEGOHMS
MAXIMUM SHIELD GRID (G2) CIRCUIT RESISTANCE	---	25 000	OHMS
MINIMUM SHIELD GRID (G2) CIRCUIT RESISTANCE	---	2 000	OHMS


RANGE FOR
0.1 MEGOHMS
RANGE FOR
10 MEGOHMS
2D21W
OPERATIONAL RANGE OF
CRITICAL GRID VOLTAGE
RANGES SHOWN ARE FOR TWO VALUES OF GRID RESISTOR, 0.1 MEGOHM AND 10 MEGOHM, AND TAKE INTO ACCOUNT INITIAL DIFFERENCES BETWEEN INDIVIDUAL TUBES AND SUBSEQUENT DIFFERENCES DURING TUBE LIFE FOR A HEATER VOLTAGE RANGE OF 5.7 TO 6.9 VOLTS.
500
400
300
200
100
0
AC ANODE VOLTS (RMS-60 CYCLES)
-10.0
-7.5
-5.0
-2.5
0
DC GRID #1 SUPPLY VOLTS

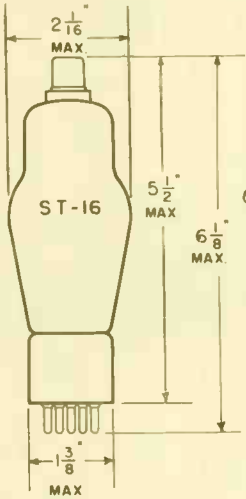

2D21W
AVERAGE CONTROL CHARACTERISTICS
R_{g1} = 0.1 Megohms
R_{g2} = 0 Ohm
750
500
250
0
DC ANODE VOLTS
+5
+2
-1
-1.5
-2.0
-2.5
E_{g2} = -3.0
-10
-5
0
5
10
15
20
DC CONTROL GRID VOLTS


2D21W
AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION
E_f =6.3 Volts
Shield Grid Volts = 0
0 = Conduction Starts
DC ANODE VOLTS = 25
200
400
600
.075
.050
.025
0
-.025
-.050
DC CONTROL GRID μAMPERES
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
DC CONTROL GRID VOLTS


2D21W
AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION
E_f = 6.3 Volts
Shield Grid Volts = 0
DC ANODE MA =25
30
100
150
200
300
2.5
0
-2.5
-5.0
-7.5
DC CONTROL GRID MA.
-7
-6
-5
-4
-3
-2
-1
0
DC CONTROL GRID VOLTS

TUNG-SOL

PENTODE POWER AMPLIFIER OSCILLATOR



MEDIUM METAL CAP

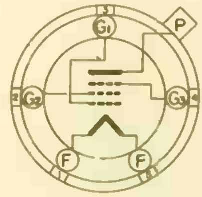
COATED FILAMENT

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.



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.

PRINTED IN U.S.A.

PLATE 1562

FEB. 28 1945

CONTINUED NEXT PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

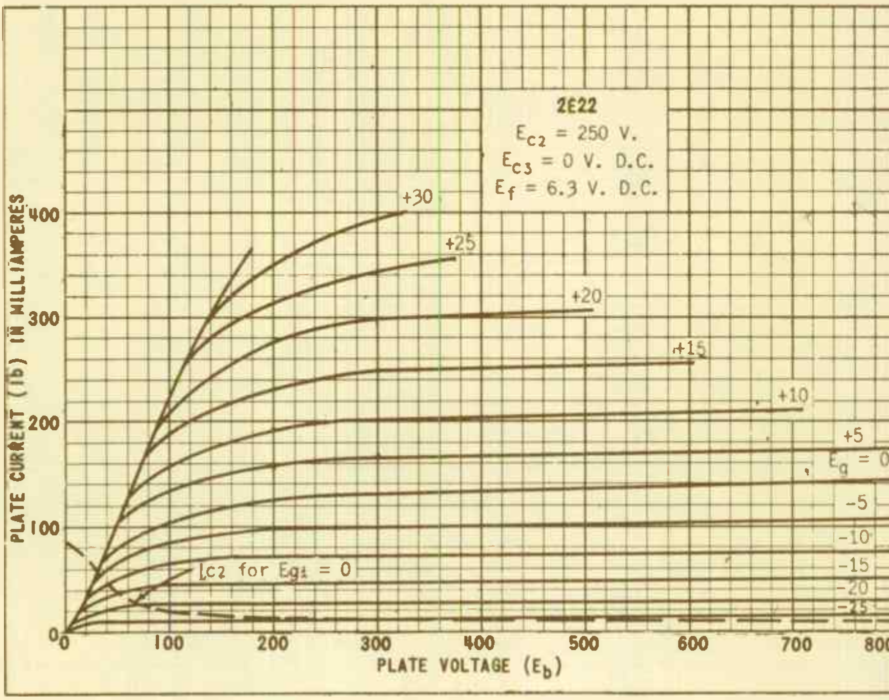
SUPPRESSOR MODULATED CLASS C AMPLIFIER

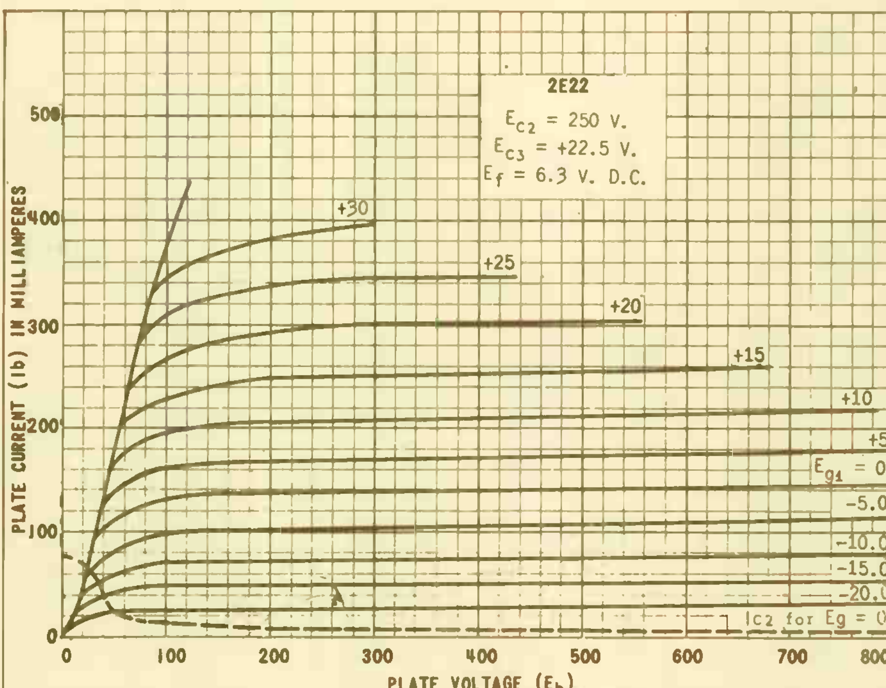
PLATE VOLTAGE	500	750	VOLTS
SCREEN VOLTAGE	250	250	VOLTS
SCREEN RESISTOR	8 500	17 000	OHMS
SUPPRESSOR VOLTAGE	-65	-90	VOLTS
PEAK A-F INPUT	65	90	VOLTS
PEAK R-F GRID VOLTAGE	100	100	VOLTS
PLATE CURRENT	50	55	MA.
SCREEN CURRENT (APPROX.)	29	29	MA.
CONTROL GRID CURRENT (APPROX.)	6.5	6.5	MA.
CONTROL GRID 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.

PLATE 1563
FEB. 28 1945

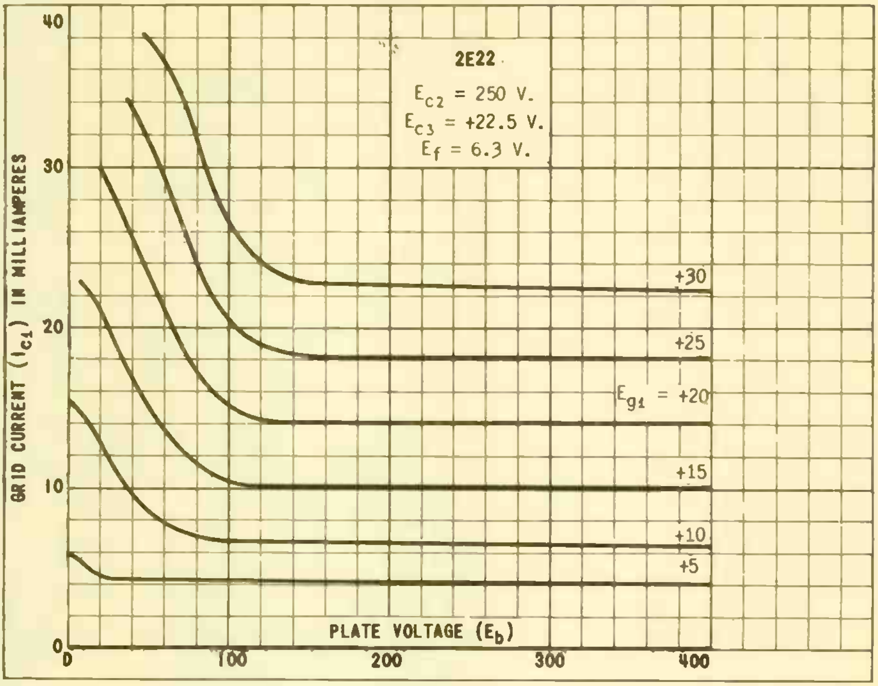




PRINTED IN U. S.

PLATE 1564
FEB. 28 1945

2E22



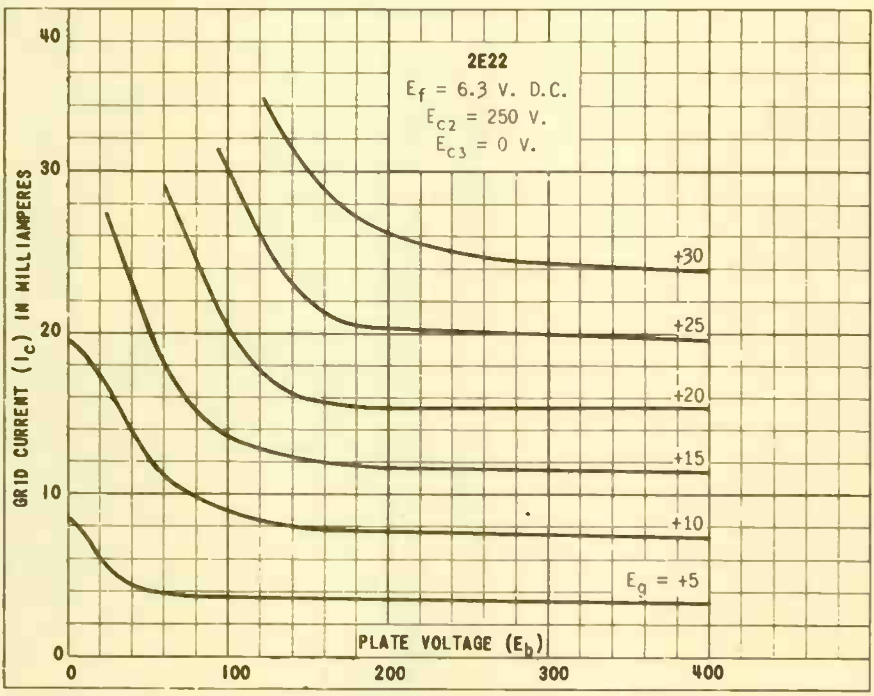
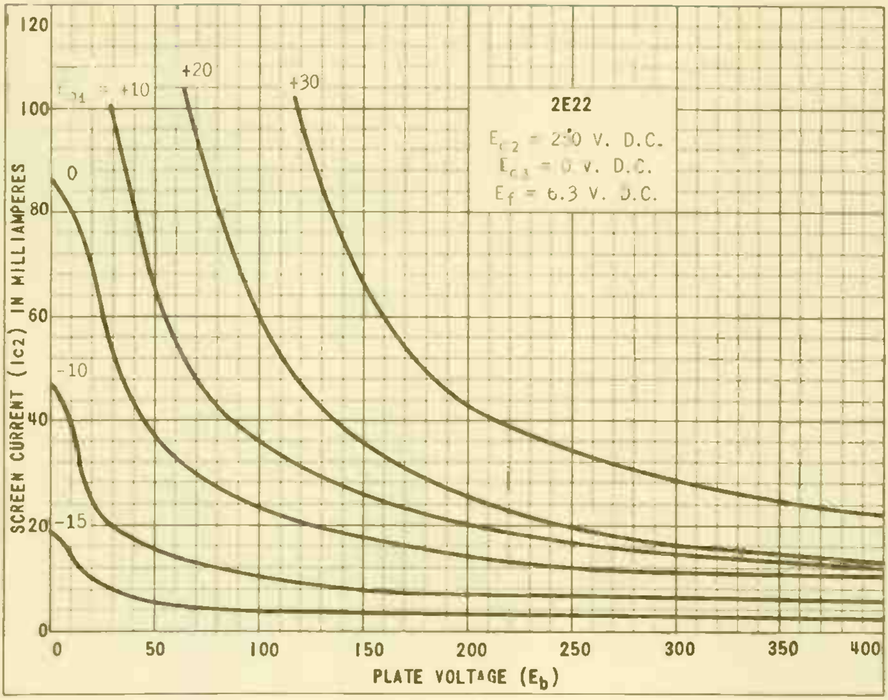
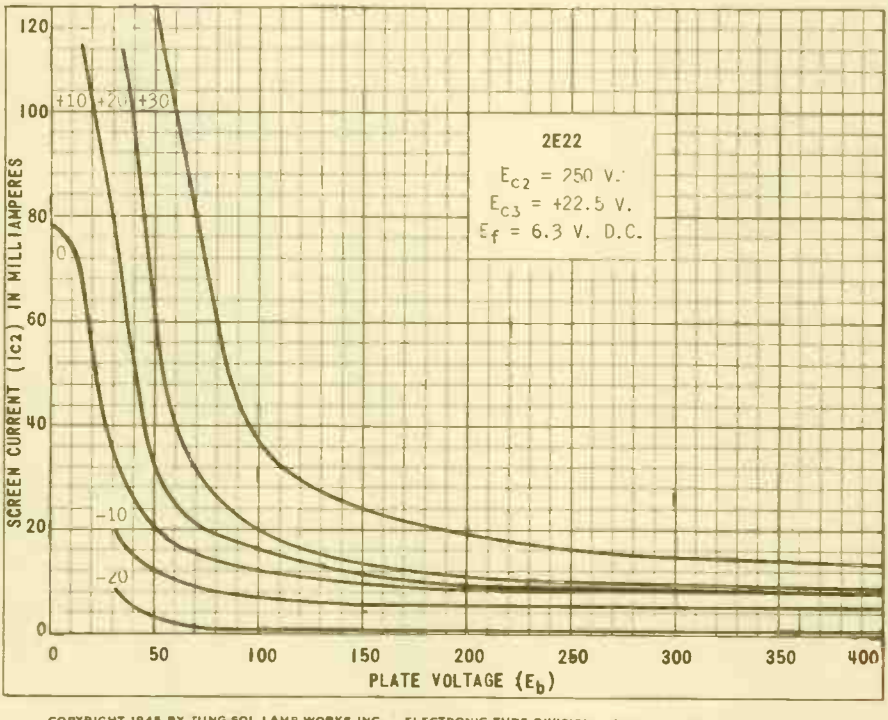


PLATE 1565
FEB. 28 1945





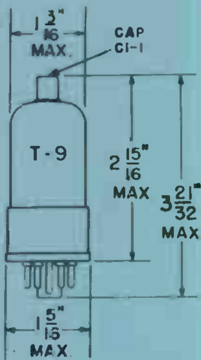
PRINTED IN U.S.A.

PLATE 1566
FEB. 28 1945

TUNG-SOL

BEAM POWER AMPLIFIER

USEFUL WITH FULL INPUT UP TO 125 Mc
AND WITH REDUCED INPUT UP TO 175 Mc



GLASS BULB

SMALL-MICANAL-WAFER
8 PIN OCTAL B8-44
WITH
SLEEVE

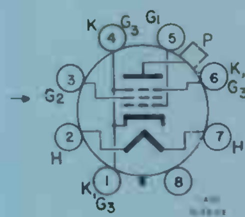
UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.8 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CK

THE 2E26 IS A BEAM POWER AMPLIFIER INTENDED PRIMARILY FOR USE IN FM TRANSMITTERS, EITHER IN LOW POWER DRIVER STAGES, OR IN THE OUTPUT STAGE WHEN ONLY LOW POWER OUTPUT IS REQUIRED. IT IS ALSO USEFUL IN AF POWER AND MODULATOR SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.2	pf
GRID #1 TO CATHODE & GRID #3 & I.S., GRID #2, BASE SLEEVE, AND HEATER	13	pf
PLATE TO CATHODE & GRID #3 & I.S., GRID #2, BASE SLEEVE, AND HEATER	7	pf

RATINGS

ABSOLUTE-MAXIMUM VALUES

AF POWER AMPLIFIER & MODULATOR – CLASS AB_1 [C]

	CCS [A]	ICAS [B]	
MAXIMUM DC PLATE VOLTAGE	600	750	VOLTS
MAXIMUM DC GRID #2 (SCREEN-GRID) VOLTAGE	250	250	VOLTS
MAXIMUM SIGNAL DC PLATE CURRENT [D]	75	75	MA.
MAXIMUM SIGNAL PLATE INPUT [D]	50	57.5	WATTS
MAXIMUM SIGNAL GRID #2 INPUT [D]	2.5	2.5	WATTS
MAXIMUM PLATE DISSIPATION	10	12.5	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	100	VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210		°C

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATION

VALUES ARE FOR 2 TUBES

	CCS[A]	ICAS[B]	
DC PLATE VOLTAGE	500	700	VOLTS
DC GRID #2 VOLTAGE[E,F]	250	235	VOLTS
DC GRID #1 (CONTROL-GRID) VOLTAGE:			
FROM FIXED-BIAS SOURCE	-40	-40	VOLTS
PEAK AF GRID #1 TO GRID #1 VOLTAGE	70	72	VOLTS
ZERO-SIGNAL DC PLATE CURRENT	13	12	MA.
MAX.-SIGNAL DC PLATE CURRENT	120	110	MA.
MAX.-SIGNAL DC GRID #2 CURRENT	10	10	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	8650	14 100	OHMS
MAX.-SIGNAL DRIVING POWER (APPROX.)	0	0	WATTS
MAX.-SIGNAL POWER OUTPUT (APPROX.)	40	50	WATTS

MAXIMUM CIRCUIT VALUES

CCS OR ICAS CONDITIONS

GRID #1 CIRCUIT RESISTANCE:[G]
WITH FIXED BIAS (MAX.) 30 000 OHMS
WITH CATHODE BIAS NOT RECOMMENDED

RATINGS

ABSOLUTE MAXIMUM VALUES

AF POWER AMPLIFIER & MODULATOR — CLASS AB_2[H]

	CCS[A]	ICAS[B]	
MAXIMUM DC PLATE VOLTAGE	600	750	VOLTS
MAXIMUM DC GRID #2 (SCREEN-GRID) VOLTAGE	250	250	VOLTS
MAXIMUM SIGNAL DC PLATE CURRENT[D]	75	75	MA.
MAXIMUM SIGNAL PLATE INPUT[D]	30	37.5	WATTS
MAXIMUM SIGNAL GRID #2 INPUT[D]	2.5	2.5	WATTS
MAXIMUM PLATE DISSIPATION	10	12.5	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	100	VOLTS

TYPICAL OPERATION

VALUES ARE FOR 2 TUBES

	CCS[A]	ICAS[B]	
DC PLATE VOLTAGE	400	500	VOLTS
DC GRID #2 VOLTAGE[E,F]	125	125	VOLTS
DC GRID #1 (CONTROL-GRID) VOLTAGE:			
FROM FIXED-BIAS SOURCE	-15	-15	VOLTS
PEAK AF GRID #1 TO GRID #1 VOLTAGE	60	60	VOLTS
ZERO-SIGNAL DC PLATE CURRENT	20	22	MA.
MAX.-SIGNAL DC PLATE #2 CURRENT	150	150	MA.
MAX.-SIGNAL DC GRID #2 CURRENT	32	32	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	6200	8000	OHMS
MAX.-SIGNAL DRIVING POWER (APPROX.)[J]	0.36	0.36	WATT
MAX.-SIGNAL POWER OUTPUT (APPROX.)	42	54	WATTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM CIRCUIT VALUES
CCS OR ICAS CONDITIONS

GRID #1 CIRCUIT RESISTANCE:[J]		
WITH FIXED BIAS (MAX.)	50000	OHMS
WITH CATHODE BIAS	NOT RECOMMENDED	

RATINGS
ABSOLUTE-MAXIMUM VALUES

PLATE-MODULATED RF POWER AMPLIFIER - CLASS C TELEPHONY
CARRIER CONDITIONS PER TUBE FOR USE WITH A MAXIMUM MODULATION FACTOR OF 1

	CCS[A]	ICAS[B]	IMS[K]	
MAXIMUM DC PLATE VOLTAGE	400	500	600	VOLTS
MAXIMUM DC GRID #2 (SCREEN-GRID) VOLTAGE	200	200	200	VOLTS
MAXIMUM DC GRID #1 (CONTROL-GRID) VOLTAGE	-175	-175	-175	VOLTS
MAXIMUM DC PLATE CURRENT	60	70	70	MA.
MAXIMUM DC GRID #1 CURRENT	3.5	3.5	3.5	MA.
MAXIMUM PLATE INPUT	20	27	37	WATTS
MAXIMUM GRID #2 INPUT	1.7	2.5	2.5	WATTS
MAXIMUM PLATE DISSIPATION	6.7	9	10	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:				
HEATER POSITIVE WITH RESPECT TO CATHODE	100	100	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	100	100	VOLTS

TYPICAL OPERATION

DC PLATE VOLTAGE	400	500	600	VOLTS
DC GRID #2 VOLTAGE[L]	160	185	200	VOLTS
FROM A SERIES RESISTOR OF	32000	35500	40000	OHMS
DC GRID #1 VOLTAGE[M]	-50	-50	-50	VOLTS
FROM A GRID RESISTOR OF	20000	20000	20000	OHMS
PEAK RF GRID #1 VOLTAGE	60	60	60	VOLTS
DC PLATE CURRENT	50	54	60	MA.
DC GRID #2 CURRENT	7.5	9	10	MA.
DC GRID #1 CURRENT (APPROX.)	2.5	2.5	2.5	MA.
DRIVING POWER (APPROX.)	0.15	0.15	0.15	WATT
POWER OUTPUT (APPROX.)	15.5	18	24	WATTS

MAXIMUM CIRCUIT VALUES
CCS, ICAS, OR IMS CONDITIONS

GRID #1 CIRCUIT RESISTANCE[C] (MAX.)	30000	OHMS

RATINGS
ABSOLUTE-MAXIMUM VALUES

RF POWER AMPLIFIER & OSCILLATOR - CLASS C TELEGRAPHY[P]
and
RF POWER AMPLIFIER - CLASS C FM TELEPHONY

	CCS[A]	ICAS[B]	IMS[K]	
MAXIMUM DC PLATE VOLTAGE	500	600	700	VOLTS
MAXIMUM DC GRID #2 (SCREEN-GRID) VOLTAGE	200	200	200	VOLTS
MAXIMUM DC GRID #1 (CONTROL-GRID) VOLTAGE	-175	-175	-175	VOLTS
MAXIMUM DC PLATE CURRENT	75	85	85	MA.
MAXIMUM DC GRID #1 CURRENT	3.5	3.5	3.5	MA.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D.

ABSOLUTE-MAXIMUM VALUES

	CCS[A]	ICAS[B]	IMS[K]	
MAXIMUM PLATE INPUT	30	40	55	WATTS
MAXIMUM GRID #2 INPUT	2.5	2.5	2.5	WATTS
MAXIMUM PLATE DISSIPATION	10	13.5	18.5	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	100	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	100	100	VOLTS

TYPICAL CCS[A] OPERATION

	UP TO 125 Mc		AT 160 Mc	
DC PLATE VOLTAGE	400	500	300	VOLTS
DC GRID #2 VOLTAGE[N]	190	185	170	VOLTS
FROM A SERIES RESISTOR OF	19000	28500	21500	OHMS
DC GRID #1 VOLTAGE[P]	-30	-40	-75	VOLTS
FROM A GRID #1 RESISTOR OF	10000	13500	30000	OHMS
PEAK RF GRID #1 VOLTAGE	41	50	85	VOLTS
DC PLATE CURRENT	75	60	75	MA.
DC GRID #2 CURRENT	11	11	6	MA.
DC GRID #1 CURRENT (APPROX.)	3	3	2.5	MA.
DRIVING POWER (APPROX.)	0.12	0.15	1.5	WATTS
POWER OUTPUT (APPROX.)	20	20	13	WATTS

TYPICAL ICAS[B] OPERATION

	UP TO 125 Mc	AT 160 Mc	
DC PLATE VOLTAGE	600	350	VOLTS
DC GRID #2 VOLTAGE[N]	185	200	VOLTS
FROM A SERIES RESISTOR OF	41500	21500	OHMS
DC GRID #1 VOLTAGE[P]	-45	-90	VOLTS
FROM A GRID #1 RESISTOR OF	15000	30000	OHMS
PEAK RF GRID #1 VOLTAGE	57	105	VOLTS
DC PLATE CURRENT	66	85	MA.
DC GRID #2 CURRENT	10	7	MA.
DC GRID #1 CURRENT (APPROX.)	3	3	MA.
DRIVING POWER (APPROX.)	0.17	2	WATTS
POWER OUTPUT (APPROX.)	27	16.5	WATTS

TYPICAL IMS[K] OPERATION

	UP TO 125 Mc	
DC PLATE VOLTAGE	650	VOLTS
DC GRID #2 VOLTAGE[N]	200	VOLTS
FROM A SERIES RESISTOR OF	45000	OHMS
DC GRID #1 VOLTAGE[P]	-49	VOLTS
FROM A GRID #1 RESISTOR OF	16300	OHMS
PEAK RF GRID #1 VOLTAGE	68	VOLTS
DC PLATE CURRENT	84	MA.
DC GRID #2 CURRENT	10	MA.
DC GRID #1 CURRENT (APPROX.)	3	MA.
DRIVING POWER (APPROX.)	0.2	WATT
POWER OUTPUT (APPROX.)	36	WATTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM CIRCUIT VALUES

CCS, OR ICAS, OR IMS CONDITIONS

GRID #1 CIRCUIT RESISTANCE[G] (MAX.)	50000	OHMS

[A]CONTINUOUS COMMERCIAL SERVICE.

[B]INTERMITTENT COMMERCIAL AND AMATEUR SERVICE.

[C]SUBSCRIPT 1 INDICATES THAT GRID #1 CURRENT DOES NOT FLOW DURING ANY PART OF THE INPUT CYCLE.

[D]AVERAGED OVER ANY AUDIO-FREQUENCY CYCLE OF SINE-WAVE FORM.

[E]PREFERABLY OBTAINED FROM A SEPARATE SOURCE OR FROM THE PLATE VOLTAGE SUPPLY WITH A VOLTAGE DIVIDER.

[F]IN APPLICATIONS REQUIRING THE USE OF GRID #2 VOLTAGES ABOVE 135 VOLTS, PROVISION SHOULD BE MADE FOR THE ADJUSTMENT OF GRID #1 BIAS FOR EACH TUBE SEPARATELY. THE NECESSITY FOR THIS ADJUSTMENT AT THE LOWER GRID #2 VOLTAGES DEPENDS ON THE DISTORTION REQUIREMENTS AND ON WHETHER THE PLATE-DISSIPATION RATING IS EXCEEDED AT ZERO SIGNAL PLATE CURRENT.

[G]THE RESISTANCE INTRODUCED INTO THE GRID #1 CIRCUIT BY THE INPUT COUPLING SHOULD BE HELD TO A LOW VALUE. IN NO CASE SHOULD IT EXCEED THE SPECIFIED MAXIMUM VALUE. TRANSFORMER-OR IMPEDANCE-COUPLING DEVICES ARE RECOMMENDED.

[H]SUBSCRIPT 2 INDICATES THAT GRID #1 CURRENT FLOWS DURING SOME PART OF THE INPUT CYCLE.

[J]DRIVER STAGE SHOULD BE CAPABLE OF SUPPLYING THE SPECIFIED DRIVING POWER AT LOW DISTORTION TO THE #1 GRIDS OF THE AF STAGE. TO MINIMIZE DISTORTION, THE EFFECTIVE RESISTANCE PER GRID #1 CIRCUIT OF THE AF STAGE SHOULD BE HELD AT A LOW VALUE. FOR THIS PURPOSE, THE USE OF TRANSFORMER COUPLING IS RECOMMENDED.

[K]INTERMITTENT MOBILE SERVICE.

[L]OBTAINED PREFERABLY FROM A SEPARATE SOURCE MODULATED ALONG WITH THE PLATE SUPPLY, OR FROM THE MODULATED PLATE SUPPLY THROUGH A SERIES RESISTOR.

[M]OBTAINED FROM GRID #1 RESISTOR OR FROM A COMBINATION OF GRID #1 RESISTOR WITH EITHER FIXED SUPPLY OR CATHODE RESISTOR.

[N]OBTAINED PREFERABLY FROM A SEPARATE SOURCE, OR FROM THE PLATE SUPPLY VOLTAGE WITH A VOLTAGE DIVIDER, OR THROUGH A SERIES RESISTOR. A SERIES GRID #2 RESISTOR SHOULD BE USED ONLY WHEN THE 2E26 IS USED IN A CIRCUIT WHICH IS NOT KEYED. GRID #2 VOLTAGE MUST NOT EXCEED 600 VOLTS UNDER KEY-UP CONDITIONS.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

[P] OBTAINED FROM FIXED SUPPLY, BY GRID #1 RESISTOR, BY CATHODE RESISTOR, OR BY COMBINATION METHODS.

[R] KEY-DOWN CONDITIONS PER TUBE WITHOUT AMPLITUDE MODULATION. AMPLITUDE MODULATION ESSENTIALLY NEGATIVE MAY BE USED IF THE POSITIVE PEAK OF THE AUDIO-FREQUENCY ENVELOPE DOES NOT EXCEED 115% OF THE CARRIER CONDITIONS.

[S] WHEN GRID #1 IS DRIVEN POSITIVE AND THE 2E26 IS OPERATED AT MAXIMUM RATINGS, THE TOTAL DC GRID #1 CIRCUIT RESISTANCE SHOULD NOT EXCEED THE SPECIFIED VALUE OF 30,000 OHMS. IF THIS VALUE IS INSUFFICIENT TO PROVIDE ADEQUATE BIAS, THE ADDITIONAL REQUIRED BIAS MUST BE SUPPLIED BY A CATHODE RESISTOR OR FIXED SUPPLY. FOR OPERATION AT LESS THAN MAXIMUM RATINGS, THE DC GRID #1 CIRCUIT RESISTANCE MAY BE AS HIGH AS 0.1 MEGOHM.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	NOTE	MIN.	MAX.	
HEATER CURRENT	1	0.74	0.86	AMP.
DIRECT INTERELECTRODE CAPACITANCES:				
GRID #1 TO PLATE	2	---	0.2	pf
GRID #1 TO CATHODE & G3 & I.S. G2, BASE SLEEVE AND HEATER	2	11.6	14	pf
PLATE TO CATHODE & GRID #3 & I.S., G2, BASE SLEEVE, AND HEATER	2	6.4	8	pf
PLATE CURRENT	3	25	47	MA.
GRID #2 CURRENT	3	---	4	MA.
USEFUL POWER OUTPUT	4	15	---	WATTS

NOTES:

1. WITH HEATER VOLTS = 6.3 AC.

2. WITHOUT EXTERNAL SHIELD.

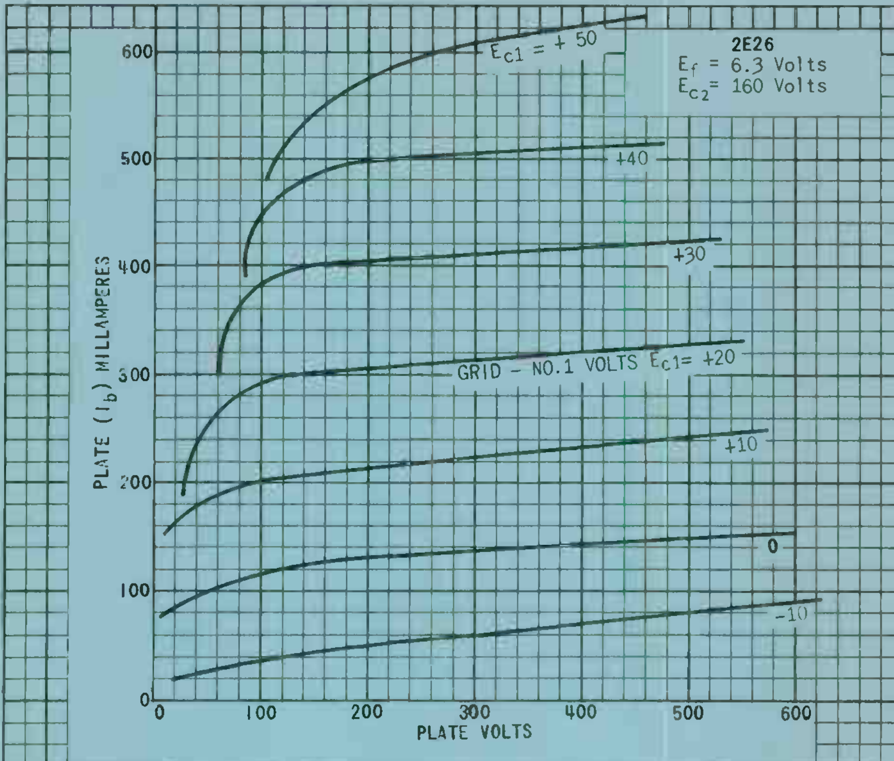
3. WITH HEATER VOLTS = 6.3 AC, DC PLATE VOLTS = 600, DC GRID #2 VOLTS = 185, AND DC GRID #1 VOLTS = -10.

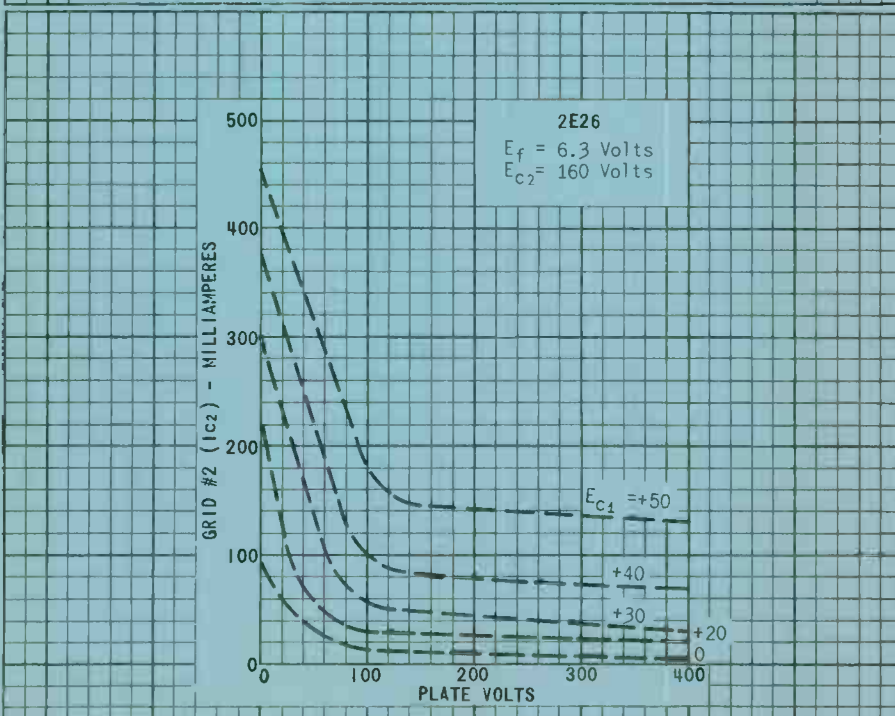
4. IN A SINGLE-TUBE SELF-EXCITED OSCILLATOR CIRCUIT, AND WITH HEATER VOLTS = 6.3 AC, DC PLATE VOLTS = 600, DC GRID #2 VOLTS = 200, GRID #1 RESISTOR (MEGOHMS) = 0.015 ± 10%, DC PLATE MA. = 60 MAXIMUM, DC GRID #1 MA. = 1.8 TO 2.2, AND FREQUENCY (Mc) = 15.

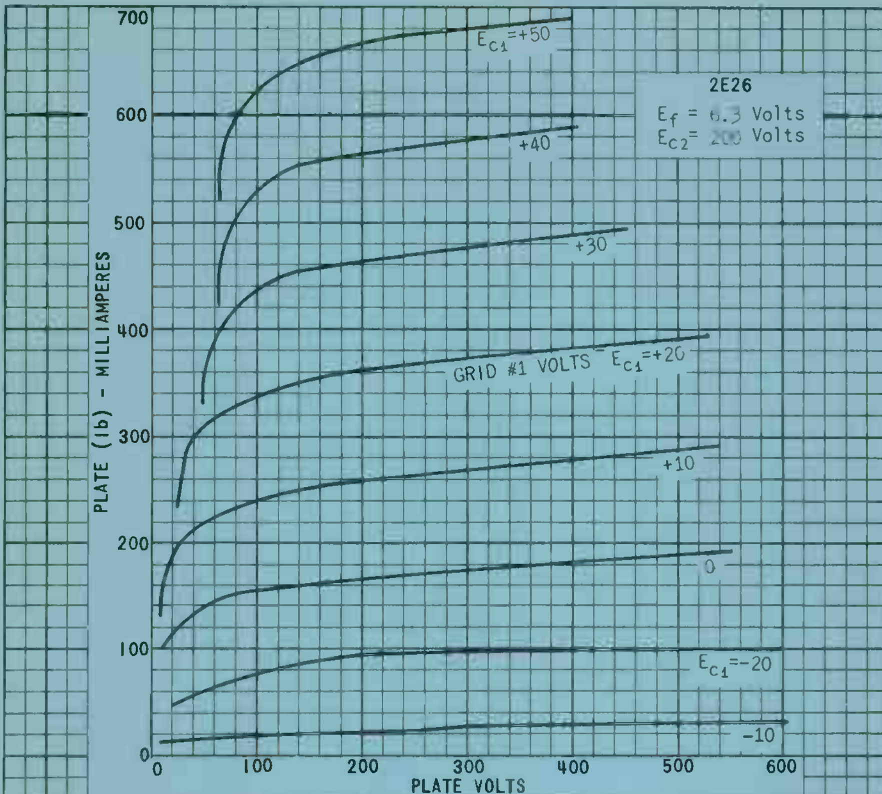
MAXIMUM RATINGS vs OPERATING FREQUENCY

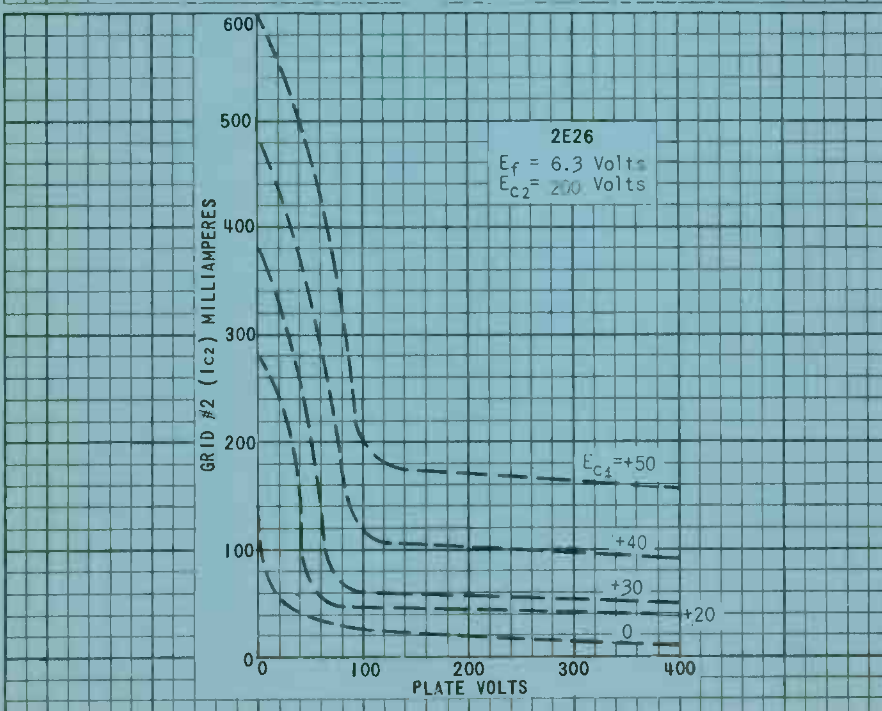
FREQUENCY	125	150	160	175	Mc
MAXIMUM-PERMISSIBLE PERCENTAGE OF MAXIMUM-RATED PLATE VOLTAGE OR PLATE INPUT:					
CLASS C PLATE-MODULATED TELEPHONY	100	85	75	68	PERCENT
CLASS C TELEGRAPHY	100	85	75	68	PERCENT

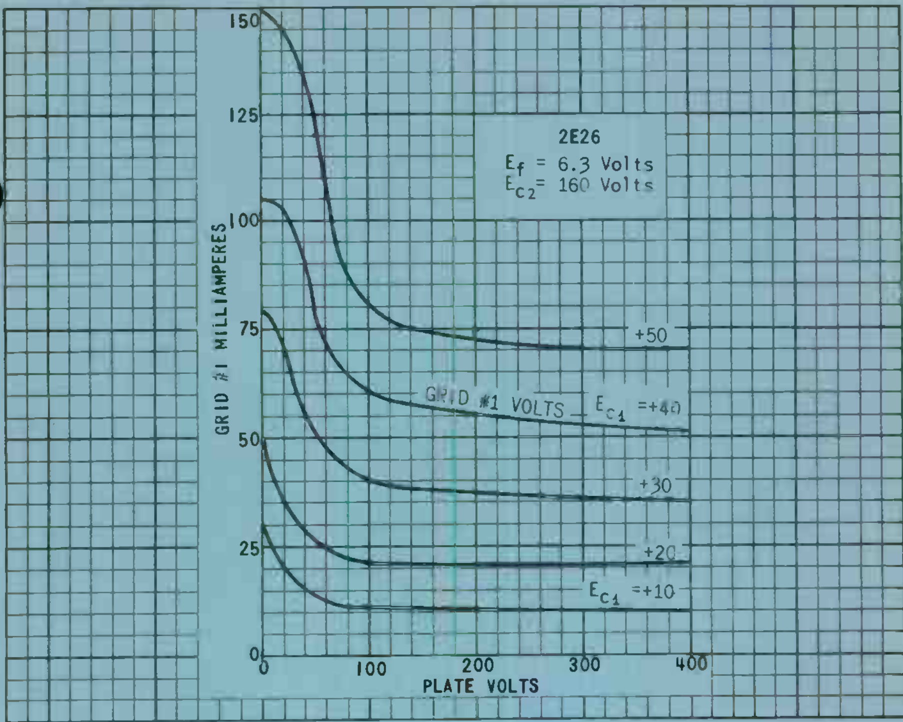
CONTINUED ON FOLLOWING PAGE

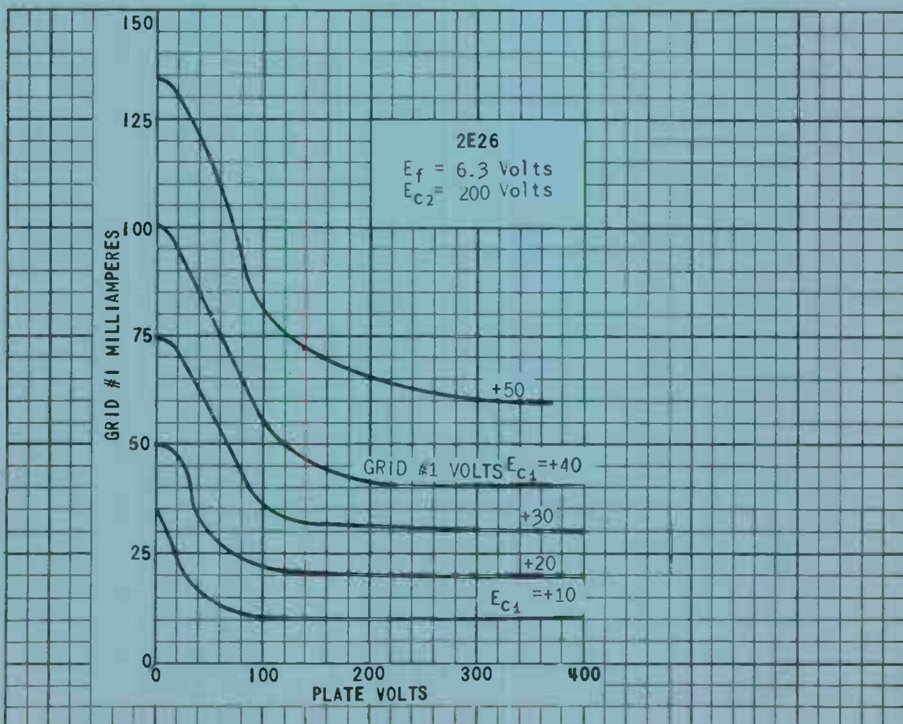

2E26
E_f = 6.3 Volts
E_{c2} = 160 Volts
E_{c1} = + 50
+40
+30
GRID - NO.1 VOLTS E_{c1}= +20
+10
0
-10
PLATE (I_b) MILLAMPERES
PLATE VOLTS


2E26
E_f = 6.3 Volts
E_{c2} = 160 Volts
E_{c1} =+50
+40
+30
+20
0
GRID #2 (I_{c2}) - MILLIAMPERES
PLATE VOLTS


2E26
Ef = 6.3 Volts
Ec2 = 200 Volts
PLATE (Ib) - MILLIAMPERES
PLATE VOLTS
GRID #1 VOLTS Ec1=+20
Ec1=+50
+40
+30
+10
0
Ec1=-20
-10
0
100
200
300
400
500
600
700


2E26
Ef = 6.3 Volts
Ec2 = 200 Volts
GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
Ec1=+50
+40
+30
+20
0
100
200
300
400
500
600


2E26
Ef = 6.3 Volts
Ec2 = 160 Volts
GRID #1 MILLIAMPERES
PLATE VOLTS
GRID #1 VOLTS Ec1 = +40
+50
+30
+20
Ec1 = +10
0
100
200
300
400
25
50
75
100
125
150


2E26
Ef = 6.3 Volts
Ec2 = 200 Volts
GRID #1 MILLIAMPERES
PLATE VOLTS
GRID #1 VOLTS Ec1 = +40
+50
+30
+20
Ec1 = +10
0
100
200
300
400
25
50
75
100
125
150

TUNG-SOL

POWER PENTODE

MINIATURE TYPE

CENTER-TAPPED OXIDE-COATED FILAMENT

CLASS C RF BEAM PENTODE

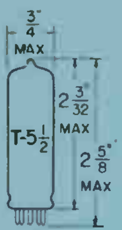
FREQUENCY MULTIPLIER

AF AMPLIFIER & MODULATOR

FOR MOBILE AND

PORTABLE APPLICATIONS

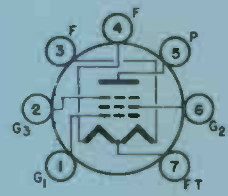
VERTICAL MOUNTING POSITION



MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-3

GLASS BULB



BASING DIAGRAM

JEDEC 7CQ

BOTTOM VIEW

BEAM PLATES SHOULD BE CONNECTED DIRECTLY TO GROUND OR FILAMENT CENTER TAP. IN ANY CIRCUITS THE CENTER TAP SHOULD BE BY-PASSED TO GROUND TO A COMMON POINT TO PROVIDE LOWEST EFFECTIVE FILAMENT INDUCTANCE.

THE 2E30 IS AN INSTANT HEATING 10 WATT MINIATURE BEAM PENTODE POWER TUBE DESIGNED FOR USE IN RF AND AF SERVICE. ITS VERSATILITY PERMITS ITS USE IN ALL STAGES – RF AND AF – OF AN ENTIRE LOW-POWER TRANSMITTER. THE LOW PLATE VOLTAGE REQUIREMENT MAKES IT ESPECIALLY ADAPTABLE TO PORTABLE AND MOBILE APPLICATIONS. IN THIS TYPE OF SERVICE ITS INSTANT HEATING FILAMENT CAN BE TURNED OFF DURING TRANSMITTING STANDBY PERIODS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE	0.18	0.2	pf
INPUT	9.6	9.5	pf
OUTPUT	14	6.6	pf

[A] CLOSE-FITTING SHIELD.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.0 VOLTS	650	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.0±0.6	VOLTS
HEATER WARM-UP TIME (APPROX.)		2	SECONDS
AVERAGE AMPLIFICATION FACTOR (G1 TO G2)		7	

MAXIMUM RATINGS

DESIGN CENTER VALUES – SEE EIA STANDARD RS-239

AF POWER AMPLIFIER AND MODULATOR – CLASS A_1

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	250	VOLTS
MAXIMUM DC GRID #2 INPUT POWER	2.5	WATTS
MAXIMUM DC PLATE DISSIPATION[B]	10	WATTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS – CONT'D.

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AF POWER AMPLIFIER AND MODULATOR – CLASS AB_1

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	250	VOLTS
MAXIMUM DC GRID #2 INPUT VOLTAGE	2.5	WATTS
MAXIMUM DC PLATE DISSIPATION	10	WATTS

AF POWER AMPLIFIER AND MODULATOR – CLASS AB_2

MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM GRID #2 VOLTAGE	275	VOLTS
MAXIMUM PEAK POSITIVE AF GRID #1 VOLTAGE	20	VOLTS
MAXIMUM SIGNAL DC PLATE CURRENT[C]	60	MA.
MAXIMUM SIGNAL PLATE INPUT POWER[C]	15	WATTS
MAXIMUM SIGNAL GRID #2 INPUT POWER[C]	2.5	WATTS
MAXIMUM PLATE DISSIPATION[C]	10	WATTS

RF POWER AMPLIFIER AND OSCILLATOR

CLASS C TELEGRAPHY AND FREQUENCY MODULATION
KEY-DOWN CONDITIONS PER TUBE WITHOUT AMPLITUDE MODULATION

ABSOLUTE VALUES

MAXIMUM DC PLATE VOLTAGE	250	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	250	VOLTS
MAXIMUM GRID #1 VOLTAGE	-150	VOLTS
MAXIMUM DC GRID #1 RESISTOR	100 000	OHMS
MAXIMUM DC PLATE CURRENT	60	MA.
MAXIMUM DC GRID #1 CURRENT	3	MA.
MAXIMUM PEAK POSITIVE RF GRID #1 VOLTAGE	30	VOLTS
MAXIMUM DC PLATE INPUT POWER	15	WATTS
MAXIMUM DC GRID #2 INPUT POWER	2.5	WATTS
MAXIMUM PLATE DISSIPATION	10	WATTS

RF POWER AMPLIFIER – CLASS C TELEPHONY

PLATE AND GRID #2 AMPLITUDE MODULATED
CARRIER CONDITIONS FOR USE WITH A MAX. MODULATION PERCENTAGE OF 100

ABSOLUTE VALUES

MAXIMUM DC PLATE VOLTAGE	200	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #1 VOLTAGE	-150	VOLTS
MAXIMUM GRID #1 RESISTOR	100 000	OHMS
MAXIMUM DC PLATE CURRENT	60	MA.
MAXIMUM DC GRID #1 CURRENT	2.5	MA.
MAXIMUM DC PLATE INPUT POWER[D]	12	WATTS
MAXIMUM DC GRID #2 INPUT POWER[D]	2.5	WATTS
MAXIMUM PLATE DISSIPATION[D]	6.6	WATTS

[B] CLASS AB DISSIPATION RATING IS BASED UPON TUBES HAVING AVERAGE PLATE CURRENT. IN THE CASE OF TUBES WHOSE PLATE CURRENT IS THE MAXIMUM ACCEPTABLE UNDER THE MYTRON TESTING SPECIFICATION DISSIPATION WILL BE GREATER WITH SOMEWHAT HIGHER POWER OUTPUT CAPABILITY

[C] AVERAGED OVER ANY AF CYCLE OF SINE WAVE FORM.

[D] WHEN MODULATED 100% WITH A SINE WAVE, THE AVERAGE POWER INCREASES BY 50%. WITH A COMPLEX WAVE FORM, SUCH AS IS PRODUCED BY SPEECH OR MUSIC, THE AVERAGE POWER INCREASES APPROXIMATELY 20% TO 25%.

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AF POWER AMPLIFIER AND MODULATOR - CLASS A_1 AMPLIFIER

PUSH-PULL AMPLIFIER

UNLESS OTHERWISE SPECIFIED THE VALUES ARE FOR TWO TUBES

DC PLATE VOLTAGE	130	250	180	250	VOLTS
DC GRID #2 VOLTAGE	130	250	180	250	VOLTS
DC GRID #1 VOLTAGE:					
FIXED BIAS VOLTAGE	-10	-16.5	-13	-20	VOLTS
CATHODE BIAS RESISTOR	---	---	400	450	OHMS
PEAK AF GRID #1 VOLTAGE	9	14	11	14	VOLTS
ZERO SIGNAL DC PLATE CURRENT	30	40	30	40	MA.
MAXIMUM SIGNAL DC PLATE CURRENT	32	44	32	44	MA.
ZERO SIGNAL DC GRID #2 CURRENT	2.5	3.3	2.5	3.3	MA.
MAXIMUM SIGNAL DC GRID #2 CURRENT	4.3	7.4	5.2	7.4	MA.
PLATE RESISTANCE	59 000	63 000	59 000	63 000	OHMS
TRANSCONDUCTANCE	3 450	3 700	3 450	3 700	µMHOS
PLATE LOAD RESISTANCE	4 500	4 500	4 500	4 500	OHMS
MAXIMUM SIGNAL PLATE POWER OUTPUT	1.8	4.5	2.25	4.5	WATTS
TOTAL HARMONIC DISTORTION	6.5	8	8	8	PERCENT

PUSH-PULL AMPLIFIER

UNLESS OTHERWISE SPECIFIED THE VALUES ARE FOR TWO TUBES

DC PLATE VOLTAGE	130	250	180	250	VOLTS
DC GRID #2 VOLTAGE	130	250	180	250	VOLTS
DC GRID #1 VOLTAGE:					
FIXED BIAS VOLTAGE	-10	-16.5	-13	-20	VOLTS
CATHODE BIAS RESISTOR	---	---	200	225	OHMS
PEAK AF GRID TO GRID VOLTAGE	18	28	22	28	VOLTS
ZERO SIGNAL DC PLATE VOLTAGE	60	80	60	80	MA.
MAXIMUM SIGNAL DC PLATE CURRENT	64	88	64	88	MA.
ZERO SIGNAL DC GRID #2 CURRENT	5	6.6	5	6.6	MA.
MAXIMUM SIGNAL DC GRID #2 CURRENT	9.6	14.8	10.4	14.8	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	8 000	9 000	8 000	9 000	OHMS
MAXIMUM SIGNAL PLATE POWER OUTPUT	3.6	9	4.5	9	WATTS
TOTAL HARMONIC DISTORTION	5	6	6	6	PERCENT

AF POWER AMPLIFIER AND MODULATOR - CLASS AB_1 AMPLIFIER

UNLESS OTHERWISE SPECIFIED THE VALUES ARE FOR TWO TUBES

DC PLATE VOLTAGE[E]	180	250	250	VOLTS
DC GRID #2 VOLTAGE	180	250	250	VOLTS
DC GRID #1 VOLTAGE[E]	-17.5	-25	-25	VOLTS
PEAK AF GRID TO GRID VOLTAGE	31	45	45	VOLTS
ZERO-SIGNAL DC PLATE CURRENT	38	48	48	MA.
MAXIMUM SIGNAL DC PLATE CURRENT	54	80	82	MA.
ZERO SIGNAL DC GRID #2 CURRENT	2	3	3	MA.
MAXIMUM SIGNAL DC GRID #2 CURRENT	7.6	13.5	10	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	7 000	8 000	6 000	OHMS
MAXIMUM SIGNAL PLATE POWER OUTPUT	5	12.5	10	WATTS
TOTAL HARMONIC DISTORTION	4.5	7.5	3.6	PERCENT

[E] WHEN DC IS USED ON THE FILAMENT, THE BIAS SHOULD BE REDUCED APPROXIMATELY 3½ VOLTS, AND THE GRID RETURN MADE TO THE NEGATIVE LEG OF THE FILAMENT.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D

AF POWER AMPLIFIER AND MODULATOR – CLASS AB_2 AMPLIFIER
UNLESS OTHERWISE SPECIFIED VALUES ARE FOR TWO TUBES

DC PLATE VOLTAGE	180	250	VOLTS
DC GRID #2 VOLTAGE	180	250	VOLTS
DC GRID #1 VOLTAGE	-22.5	-30	VOLTS
PEAK AF GRID TO GRID VOLTAGE	75	87	VOLTS
ZERO SIGNAL DC PLATE CURRENT	16	40	MA.
MAXIMUM SIGNAL DC PLATE CURRENT	100	120	MA.
ZERO SIGNAL DC GRID #2 CURRENT	1	4	MA.
MAXIMUM SIGNAL DC GRID #2 CURRENT	16	20	MA.
MAXIMUM SIGNAL DC GRID #1 CURRENT	3	2.3	MA.
EFFECTIVE PLATE TO PLATE LOAD RESISTANCE	2 500	3 800	OHMS
MAXIMUM SIGNAL GRID #1 DRIVING POWER	0.23	0.2	WATTS
MAXIMUM SIGNAL PLATE POWER OUTPUT	7.4	17	WATTS
TOTAL HARMONIC DISTORTION	3	4	PERCENT

RF POWER AMPLIFIER AND OSCILLATOR
CLASS C TELEGRAPHY AND FREQUENCY MODULATION
KEY-DOWN CONDITIONS PER TUBE WITHOUT AMPLITUDE MODULATION

DC PLATE VOLTAGE	200	250	VOLTS
DC GRID #2 VOLTAGE	200	200	VOLTS
DC GRID #1 VOLTAGE:			
FIXED BIAS VOLTAGE	-46	-50	VOLTS
GRID #1 RESISTOR	20 000	20 000	OHMS
CATHODE BIAS RESISTOR	850	850	OHMS
PEAK RF GRID #1 VOLTAGE	66	72	VOLTS
DC PLATE CURRENT	45	50	MA.
DC GRID #2 CURRENT	10	10	MA.
DC GRID #1 CURRENT	2.3	2.5	VOLTS
GRID #1 DRIVING POWER (APPROX.)	0.15	0.2	WATTS
PLATE POWER OUTPUT (APPROX.)	5	7.5	WATTS

FREQUENCY DOUBLER – 82.5 MC. TO 165 MC.

DC PLATE VOLTAGE	250	250	VOLTS
DC GRID #2 VOLTAGE	220	200	VOLTS
DC GRID #1 VOLTAGE:			
FIXED BIAS VOLTAGE	-100	-70	VOLTS
GRID #1 RESISTOR	70 000	30 000	OHMS
CATHODE BIAS RESISTOR	1 750	1 250	OHMS
PEAK RF GRID #1 VOLTAGE	120	100	VOLTS
DC PLATE CURRENT	50	50	MA.
DC GRID #2 CURRENT	7	5	MA.
DC GRID #1 CURRENT	1.4	2.3	MA.
GRID #1 DRIVING POWER (APPROX.)	0.2	0.5	WATTS
PLATE POWER OUTPUT (APPROX.)[F]	5	4	WATTS
USEFUL POWER OUTPUT (APPROX.)	4	3	WATTS

[F] PLATE POWER OUTPUT INCLUDES CIRCUIT LOSSES AND RF-RADIATION AS WELL AS USEFUL POWER DELIVERED TO THE LOAD.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

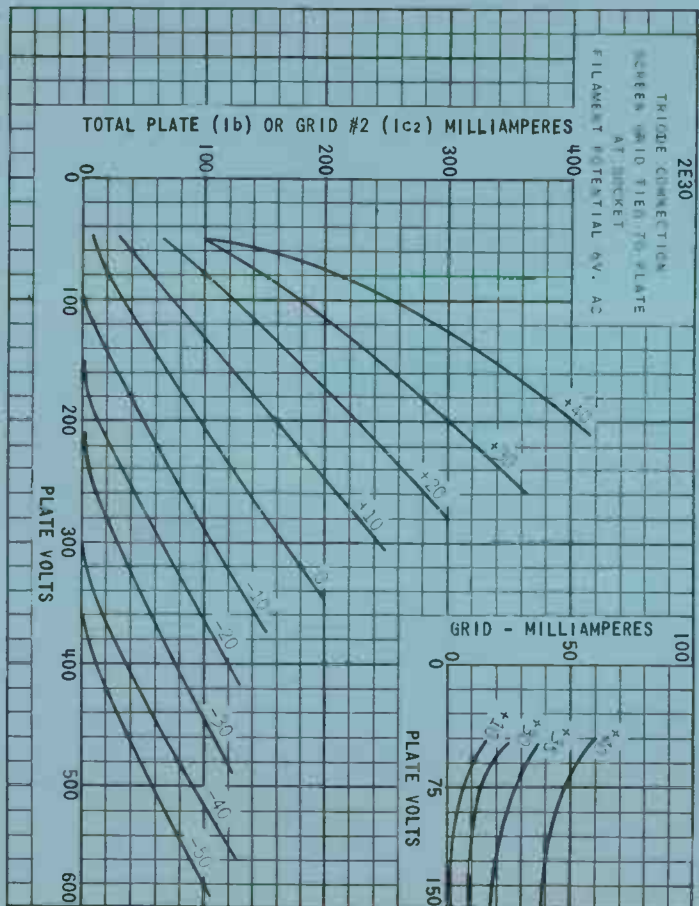
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D

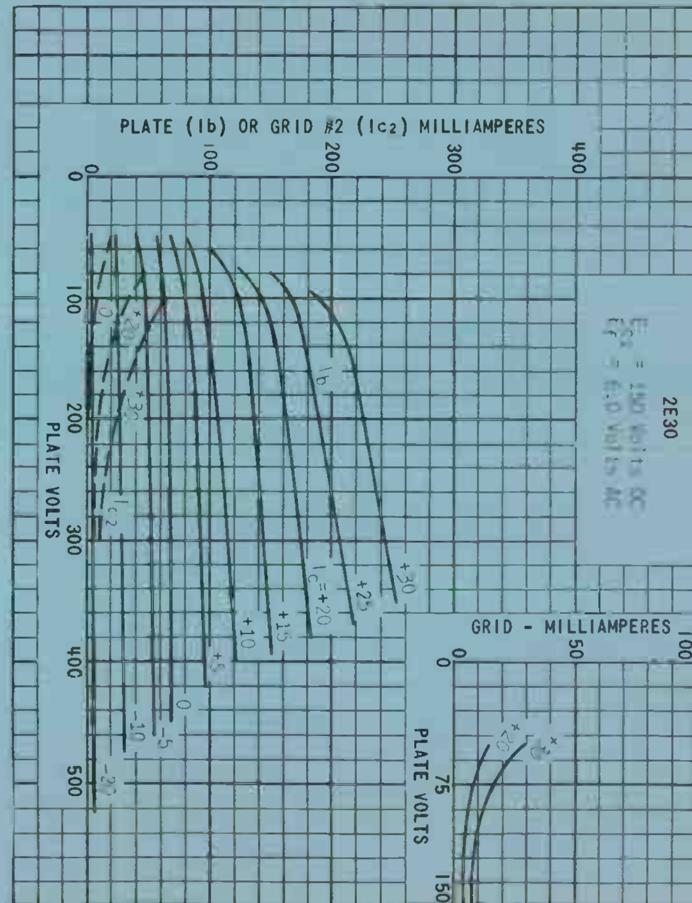
RF POWER AMPLIFIER – CLASS C TELEPHONY

PLATE AND GRID #2 AMPLITUDE MODULATED
CARRIER CONDITIONS FOR USE WITH A MAX. MODULATION PERCENTAGE OF 100

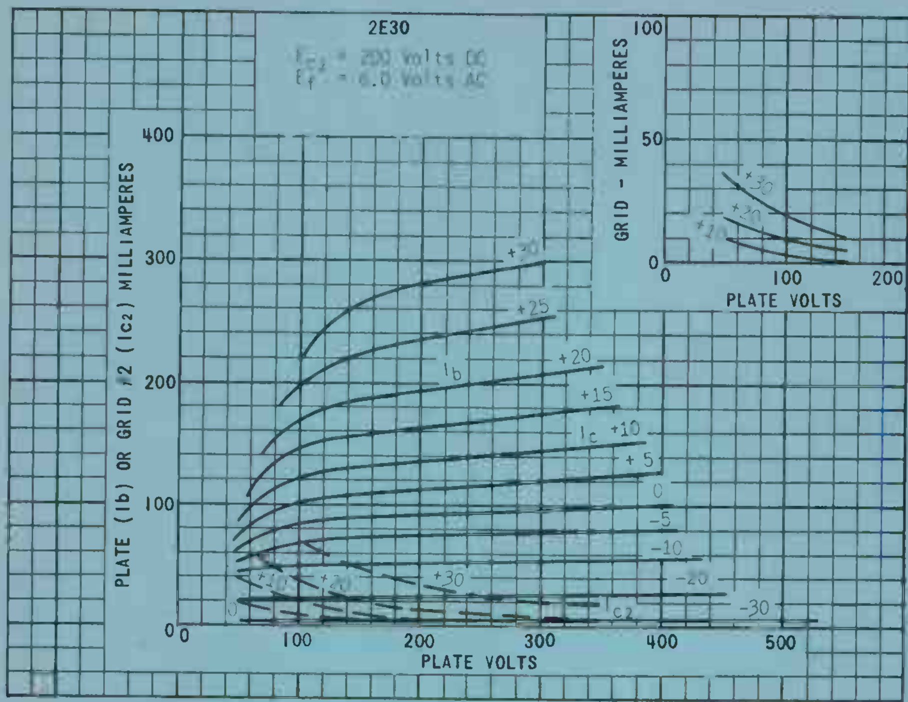
DC PLATE VOLTAGE	200	VOLTS
DC GRID #2 VOLTAGE	200	VOLTS
DC GRID #1 VOLTAGE:		
FIXED BIAS VOLTAGE	-46	VOLTS
GRID #1 RESISTOR	20 000	OHMS
CATHODE BIAS RESISTOR	850	OHMS
PEAK RF GRID #1 VOLTAGE	66	VOLTS
DC PLATE CURRENT	45	MA.
DC GRID #2 CURRENT	10	MA.
DC GRID #1 CURRENT	2.3	MA.
GRID #1 DRIVING POWER (APPROX.)	0.15	WATTS
PLATE POWER OUTPUT (APPROX.)	5	WATTS

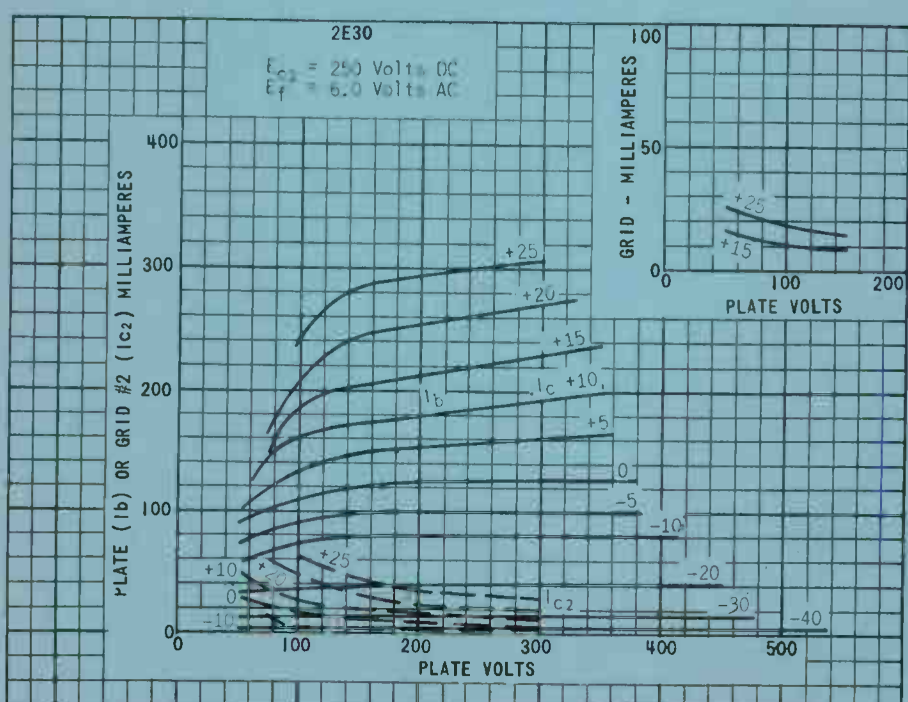
PRINTED IN U.S.A.


2E30
TRIODE CONNECTION
SCREEN GRID TIED TO PLATE
AT SOCKET
FILAMENT POTENTIAL 6V. AC
TOTAL PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
GRID - MILLIAMPERES
PLATE VOLTS


2E30
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
GRID - MILLIAMPERES
PLATE VOLTS

2E30

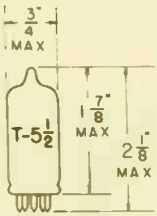

2E30
E_{c2} = 200 Volts DC
E_f = 6.0 Volts AC
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
GRID - MILLIAMPERES
Ib
Ic
Ic2


2E30
E_{c2} = 250 Volts DC
E_f = 6.0 Volts AC
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
GRID - MILLIAMPERES
Ib
Ic
Ic2

TUNG-SOL

TETRODE

MINIATURE TYPE

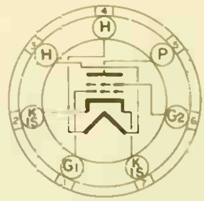


GLASS BULB

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.

CONTINUED ON FOLLOWING PAGE

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

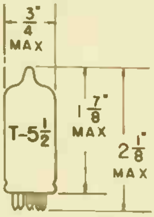
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE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

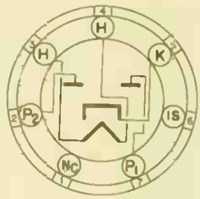


GLASS BULB

COATED UNIPOTENTIAL 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.

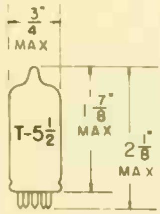
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE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

PRINTED IN U.S.A.

TUNG-SOL

HI-MU TRIODE ←

MINIATURE TYPE



GLASS BULB

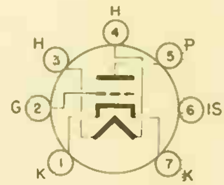
BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

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

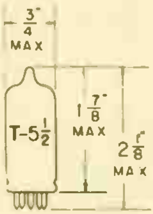
HEATER VOLTAGE	2.3	2.3		VOLTS
HEATER CURRENT	0.60	0.60		AMP.
PLATE VOLTAGE	200			VOLTS
GRID VOLTAGE	-1.2	-3.8	-5.6	VOLTS
PLATE CURRENT	10			MAMPS
TRANSCONDUCTANCE	10 500	500	100	μMHOS
AMPLIFICATION FACTOR	80			
GRID VOLTAGE FOR A CROSS-MODULATION FACTOR OF 1% (RMS)	100	100	100	MV.

PRINTED IN U.S.A.

TUNG-SOL

TRIODE

MINIATURE TYPE



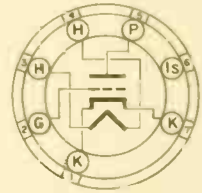
GLASS BULB

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	$\mu\mu f$
INPUT: G TO (H+K+I.S.)	3.2	3.2	$\mu\mu f$
OUTPUT: P TO (H+K+I.S.)	4.0	3.2	$\mu\mu f$

[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

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

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

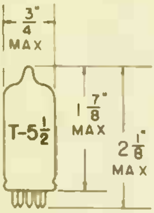
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[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

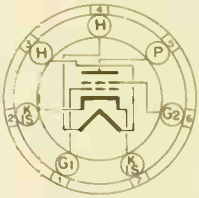
COATED UNIPOTENTIAL CATHODE

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	$\mu\mu$f
INPUT	4.50	$\mu\mu$f
OUTPUT	2.90	$\mu\mu$f

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 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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

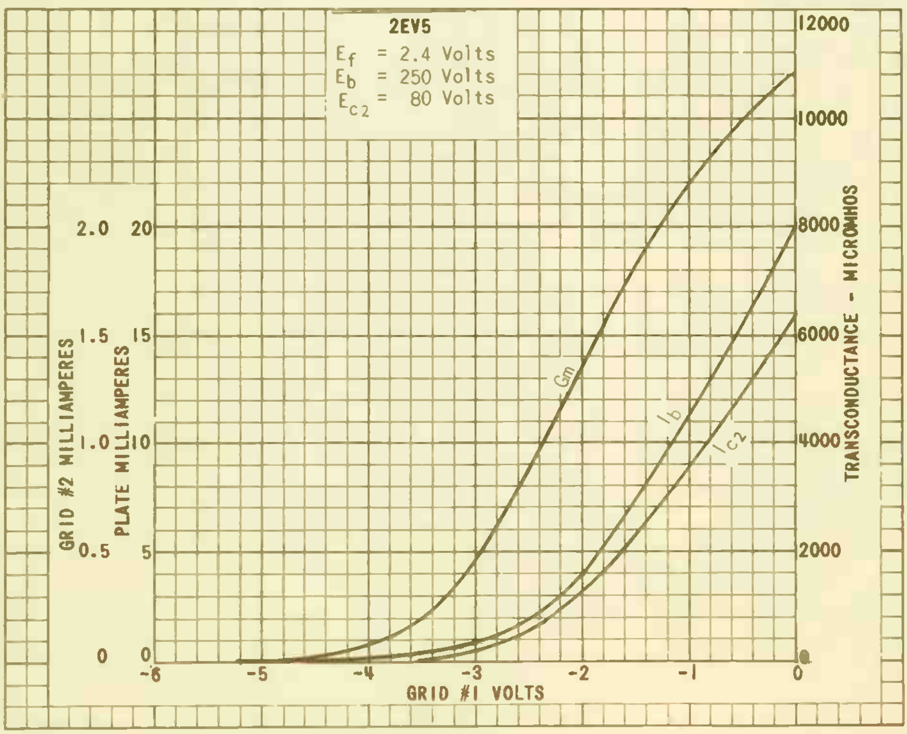
CONTINUED FROM PRECEDING PAGE

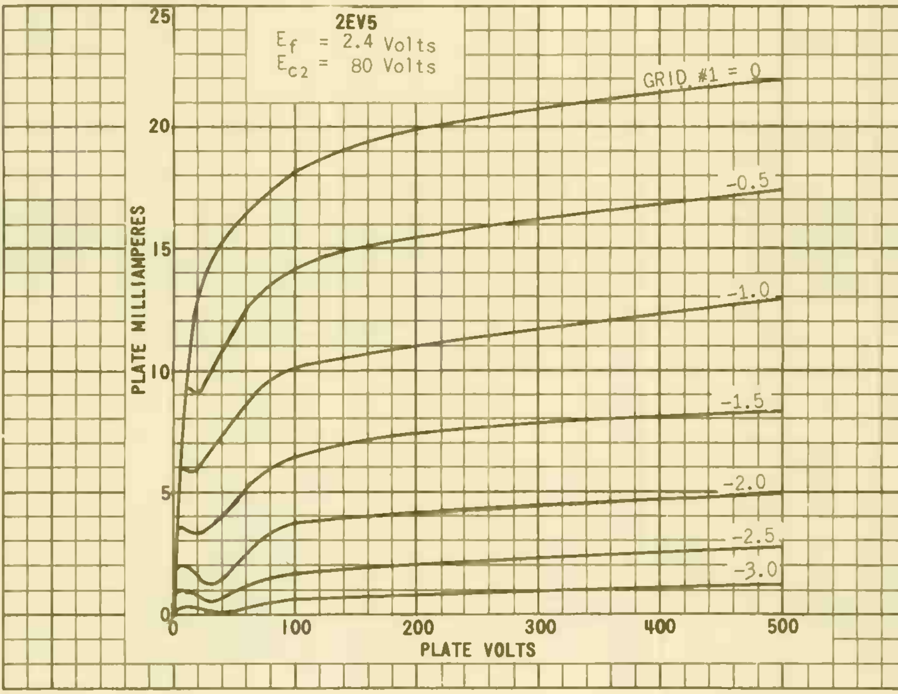
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

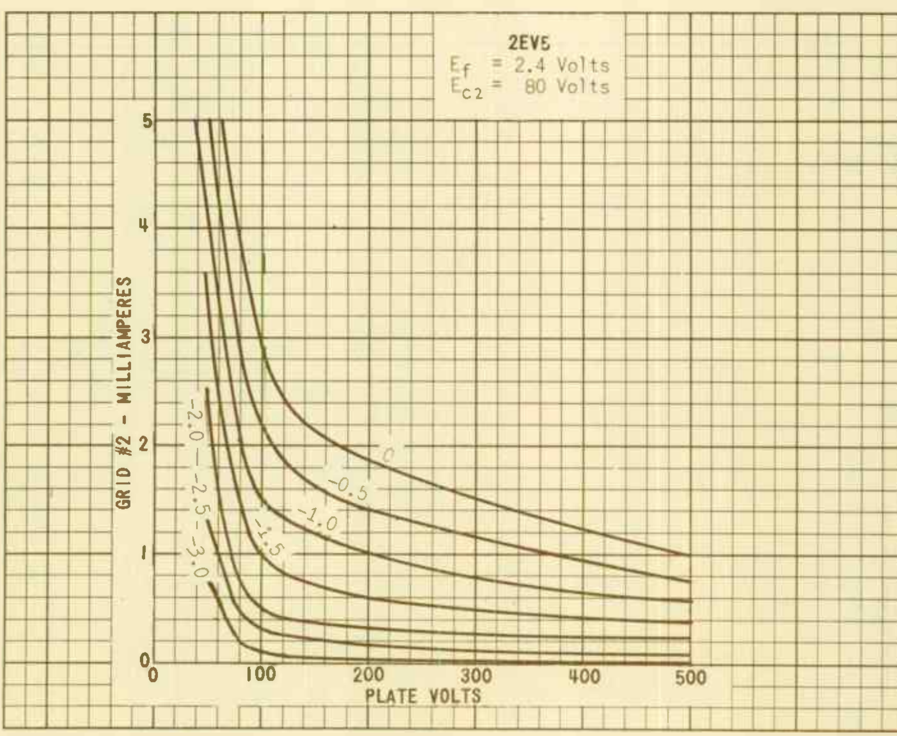
HEATER VOLTAGE	2.4	VOLTS
HEATER CURRENT	0.60	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	−1	VOLTS
PLATE RESISTANCE	0.150	MEGOHM
TRANSCONDUCTANCE	8800	μMHOS
GRID #1 CUTOFF BIAS[C]	4.5	VOLTS
PLATE CURRENT	11.5	MA.
GRID #2 CURRENT	0.90	MA.

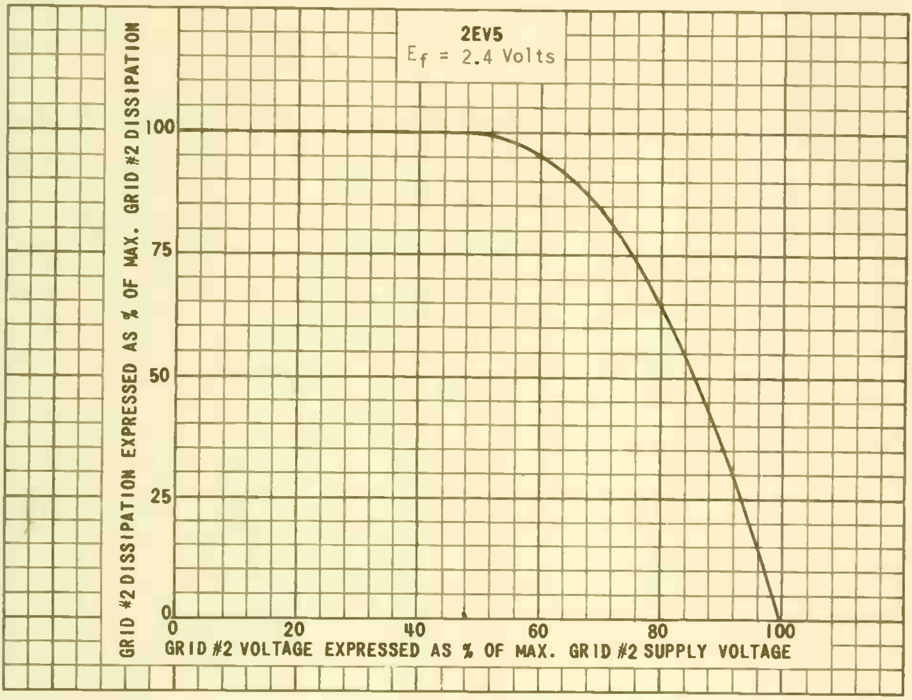
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[C]FOR TRANSCONDUCTANCE OF 100 μMHOS.




2EV5
E_f = 2.4 Volts
E_{c2} = 80 Volts
GRID #1 = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
PLATE MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
5
10
15
20
25

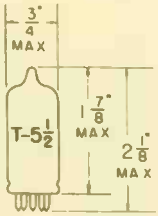

2EV5
E_f = 2.4 Volts
E_{c2} = 80 Volts
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
GRID #2 - MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
1
2
3
4
5


2EV5
E_f = 2.4 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



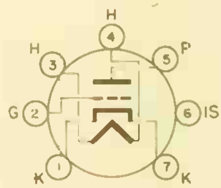
GLASS BULB
SMALL BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

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 SHIELD[A]	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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

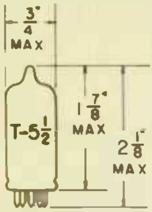
* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VALUE AFTER APPLYING FOUR TIMES THE RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE EQUAL TO THREE TIMES THE RATED HEATER VOLTAGE DIVIDED BY THE 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	$\mu\mu f$
INPUT: G TO (H+K+I.S.+E.S.)	4.8	$\mu\mu f$
OUTPUT: P TO (H+K+I.S.+E.S.)	4.0	$\mu\mu f$
HEATER TO CATHODE	2.8	$\mu\mu f$

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
E_c FOR I_b = 100 μA (APPROX.)	-5	VOLTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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.

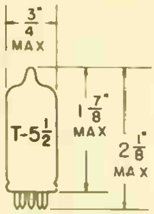
[D] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE/CURRENT WITHIN THE SPECIFIED TOLERANCE.

* 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

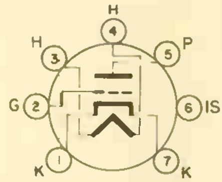
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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.

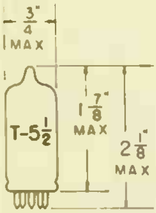
[D]HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE/CURRENT WITHIN THE SPECIFIED TOLERANCE.

*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

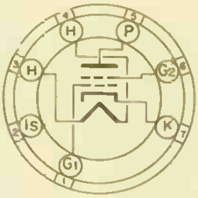
UNIPOTENTIAL CATHODE

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

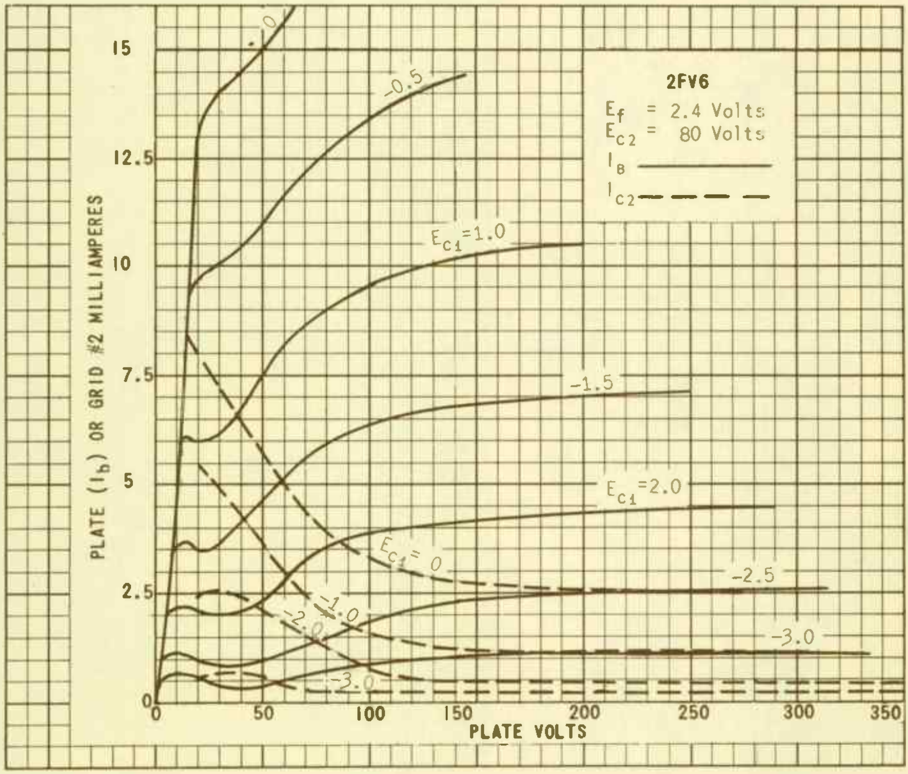
CONTINUED FROM PRECEDING PAGE

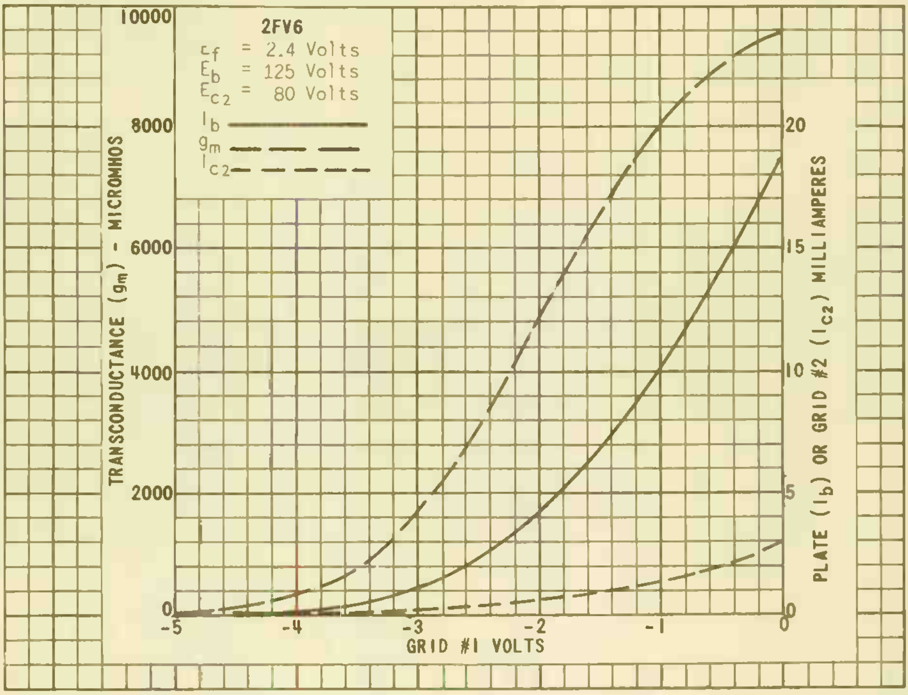
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

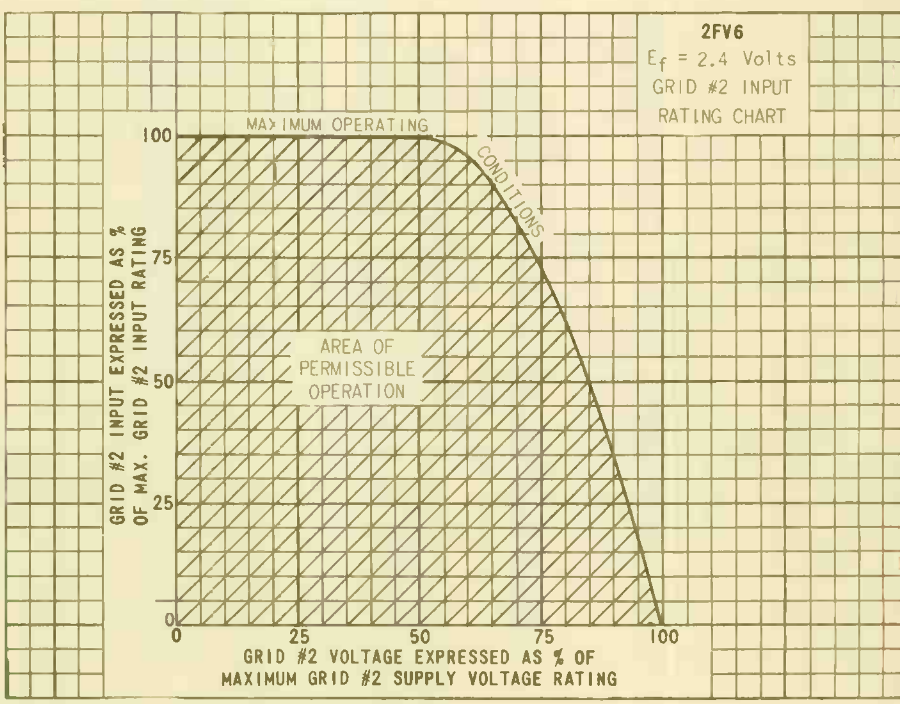
CLASS A_1 AMPLIFIER

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.




2FV6
E_f = 2.4 Volts
E_b = 125 Volts
E_{c2} = 80 Volts
I_b
g_m
I_{c2}
TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
8000
6000
4000
2000
0
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
20
15
10
5
0


2FV6
E_f = 2.4 Volts
GRID #2 INPUT
RATING CHART
MAXIMUM OPERATING CONDITIONS
AREA OF PERMISSIBLE OPERATION
GRID #2 INPUT EXPRESSED AS % OF MAX. GRID #2 INPUT RATING
100
75
50
25
0
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS % OF MAXIMUM GRID #2 SUPPLY VOLTAGE RATING

TUNG-SOL

2FY5

TRIODE

MINIATURE TYPE

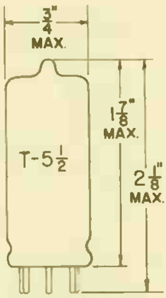
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES SUPPLY

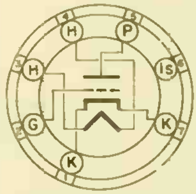
2.4 VOLTS 0.60 AMP.

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

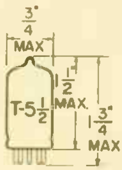
TYPICAL OPERATION

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				

TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

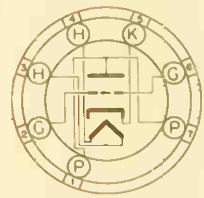
COATED UNIPOTENTIAL CATHODE

HEATER

2.35 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7DK

THE 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	$\mu\mu f$
INPUT	3.3	2.9	$\mu\mu f$
OUTPUT	1.8	0.25	$\mu\mu f$
HEATER TO CATHODE[B]	2.9	3.0	$\mu\mu f$
GRID TO CATHODE[B]	2.6	2.6	$\mu\mu f$
PLATE TO CATHODE[B]	0.18	0.20	$\mu\mu f$
GROUNDED GRID OPERATION			
INPUT	5.7	5.5	$\mu\mu f$
OUTPUT	3.4	1.8	$\mu\mu f$

[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

TUNG-SOL

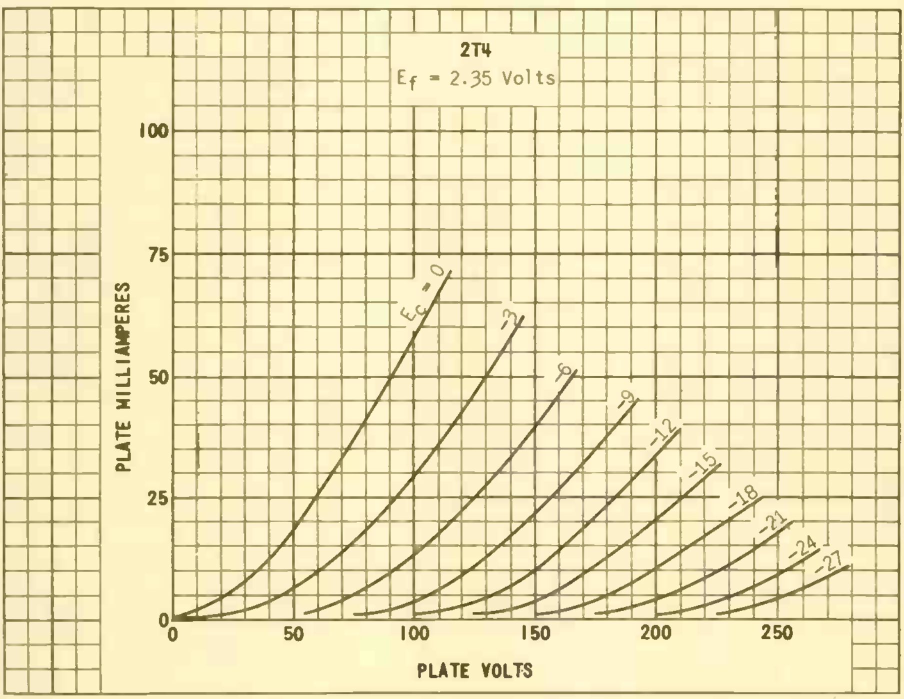
CONTINUED FROM PRECEDING PAGE

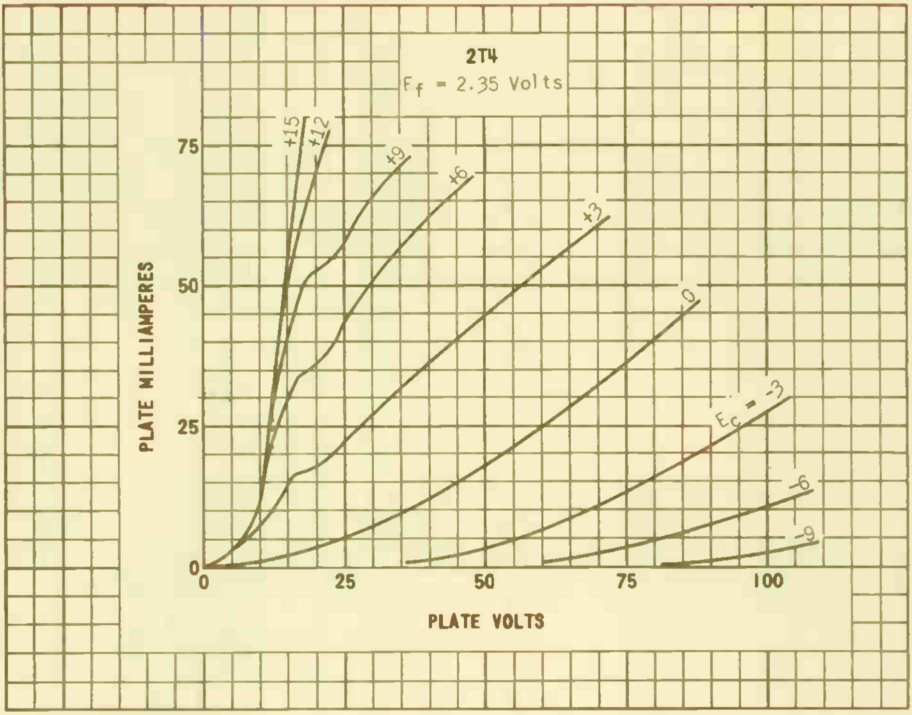
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

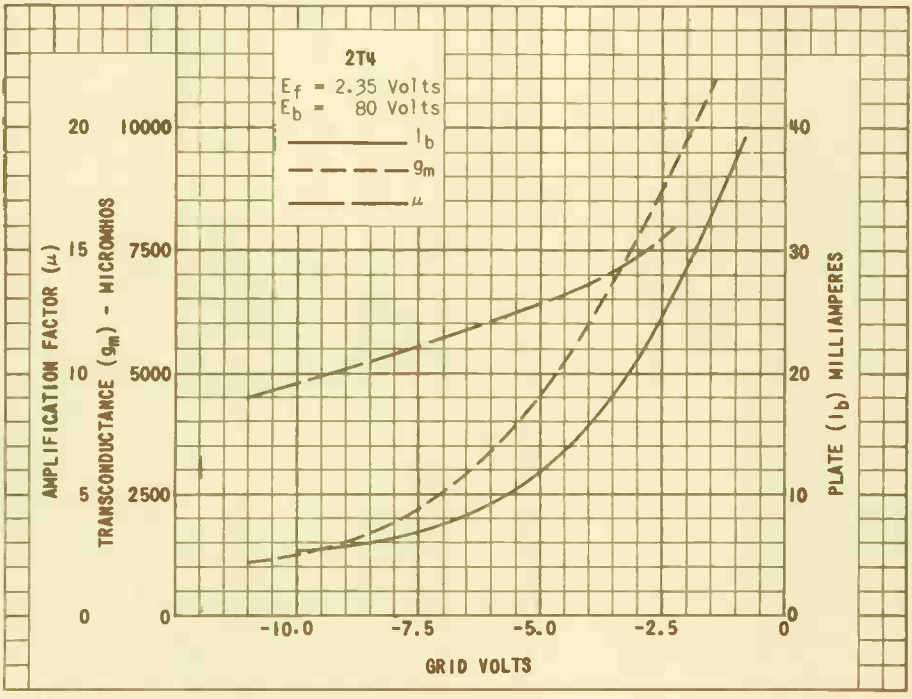
HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	80	VOLTS
CATHODE BIAS RESISTOR	150	OHMS
PLATE CURRENT	18	MA.
TRANSCONDUCTANCE	7 000	μMHOS
AMPLIFICATION FACTOR	13	
PLATE RESISTANCE	1 860	OHMS
GRID VOLTAGE FOR 50 μA. PLATE CURRENT	−15	VOLTS

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.



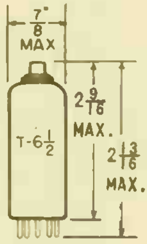

2T4
E_f = 2.35 Volts
PLATE MILLIAMPERES
PLATE VOLTS
+15
+12
+9
+6
+3
0
E_c = -3
-6
-9
0
25
50
75
100


2T4
E_f = 2.35 Volts
E_b = 80 Volts
I_b
g_m
μ
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE (I_b) MILLIAMPERES
GRID VOLTS
-10.0
-7.5
-5.0
-2.5
0

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	$\mu\mu$f

RATINGS

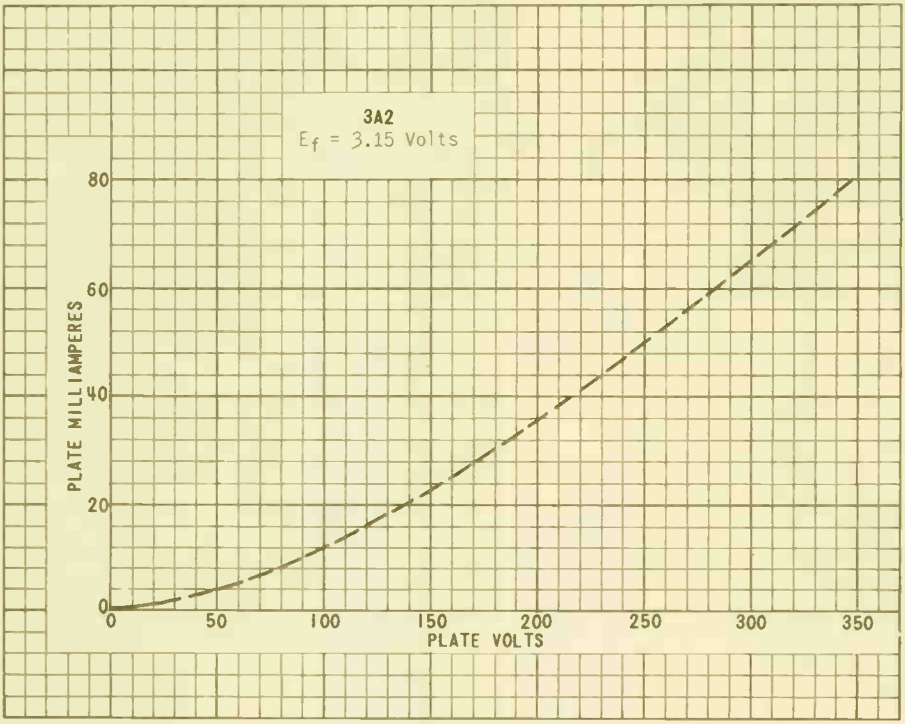
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

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.

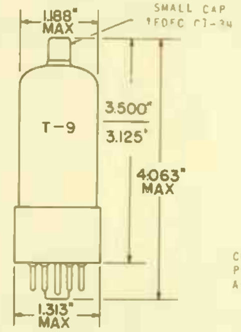
*FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

PRINTED IN U.S.A.


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

6 PIN OCTAL 86-8 & 86-60

COATED UNIPOTENTIAL CATHODE

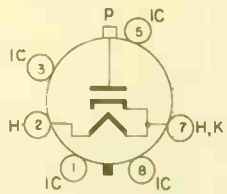
HEATER

3.15 VOLTS 0.22 AMP.

AC

ANY MOUNTING POSITION

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



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8EZ

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

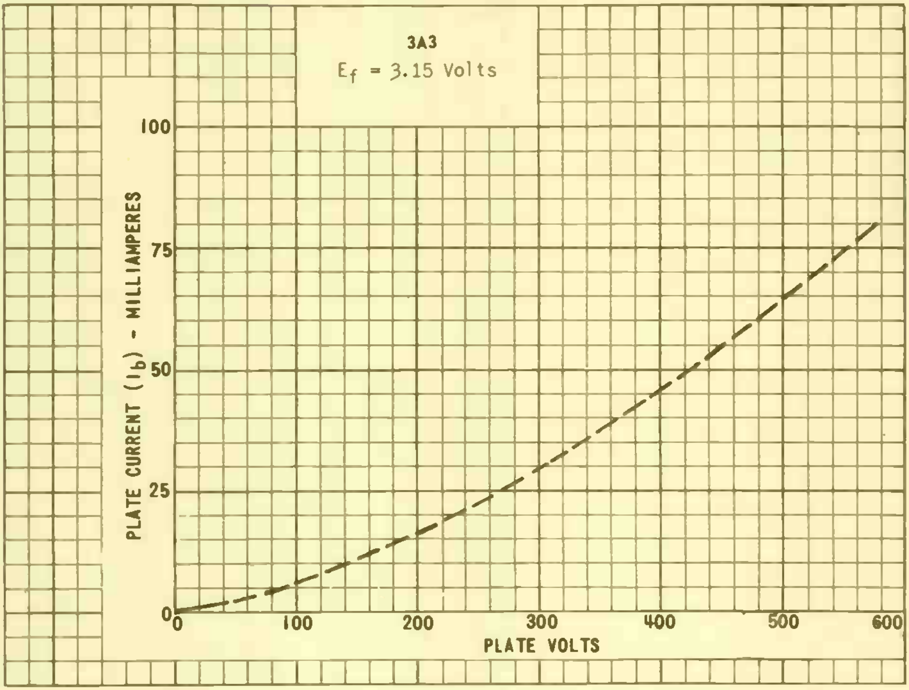
HEATER VOLTAGE	3.15[B]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE[C]	30 000	VOLTS
MAXIMUM PEAK PLATE CURRENT	88	MA.
MAXIMUM AVERAGE PLATE CURRENT	1.7	MA.

[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 525 LINE, 30 FRAME SYSTEM, 15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

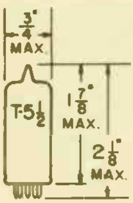
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE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


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

TUNG-SOL

POWER AMPLIFIER PENTODE

MINIATURE TYPE



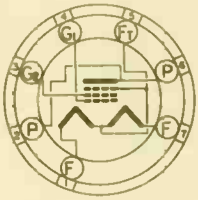
GLASS BULB

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 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

PRINTED IN U. S. A.

PLATE 1744

NOV. 1, 1946

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

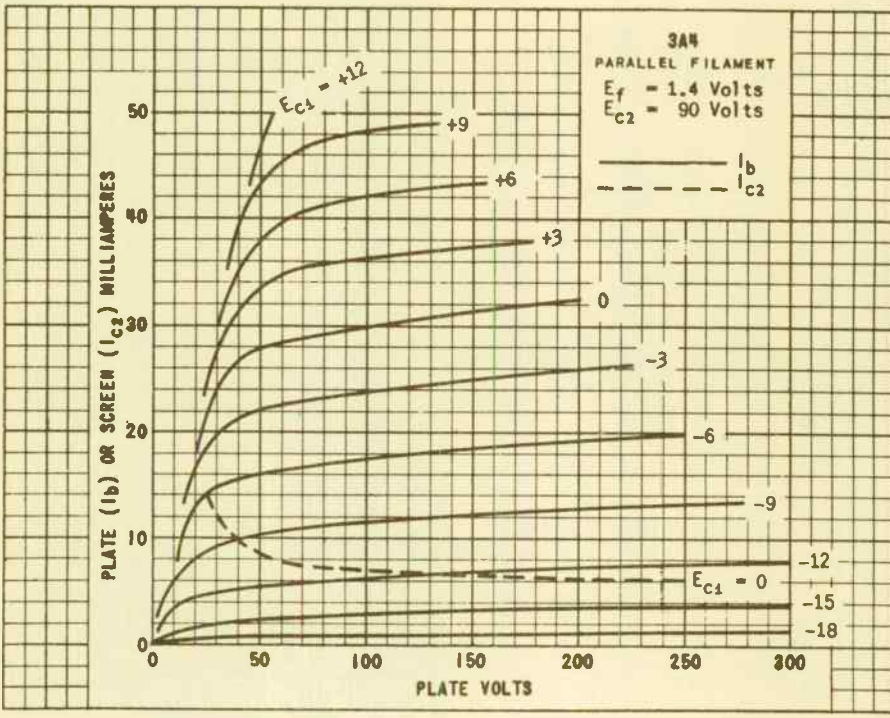
CLASS A_1 AMPLIFIER

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

PLATE 1745
NOV. 1, 1946



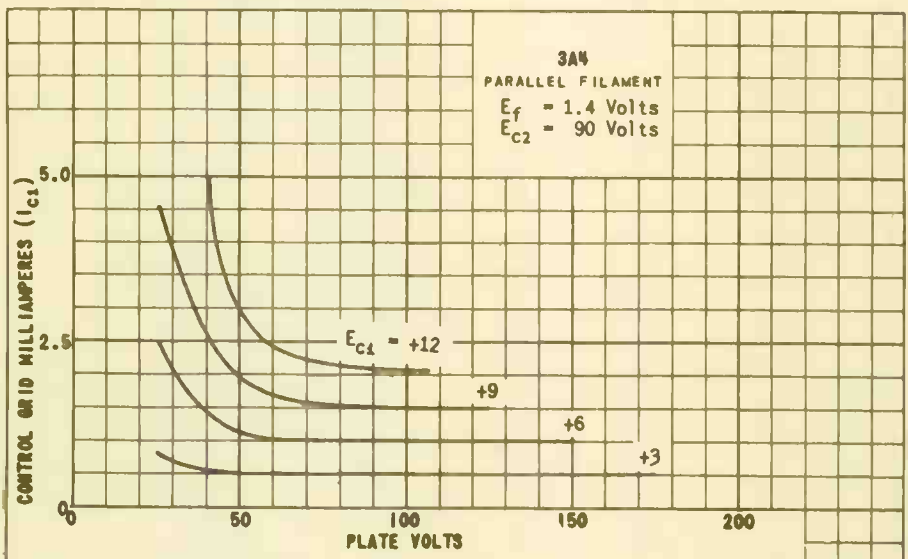


PLATE 1746
NOV. 1, 1946

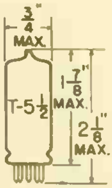
   ELECTRON TUBE DIVISION   NEWARK NEW JERSEY U S A

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

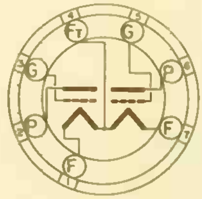
E_f APPLIED BETWEEN PIN 4 AND PINS 1 & 7 TIED TOGETHER.

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

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

PLATE 1909
NOV. 1, 1947

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AF AMPLIFIER

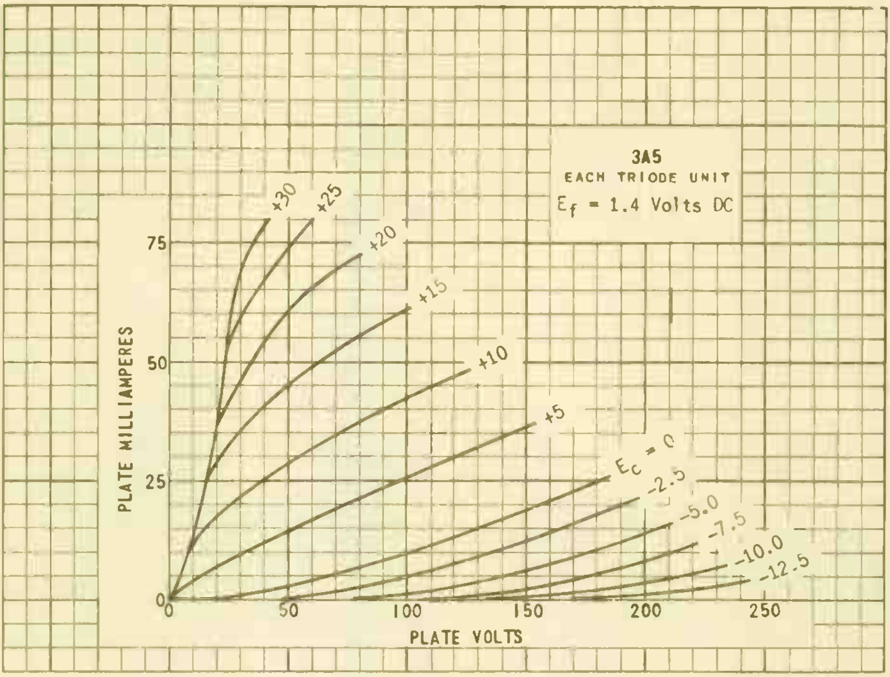
HEATER VOLTAGE	1.4	2.8	VOLTS
HEATER CURRENT	220	110	MA.
PLATE VOLTAGE	90		VOLTS
GRID VOLTAGE	-2.5		VOLTS
PLATE CURRENT	3.7		MA.
PLATE RESISTANCE	8 300		OHMS
TRANSCONDUCTANCE	1 800		μMHOS
AMPLIFICATION FACTOR	15		

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

PLATE 1910
NOV. 1, 1947



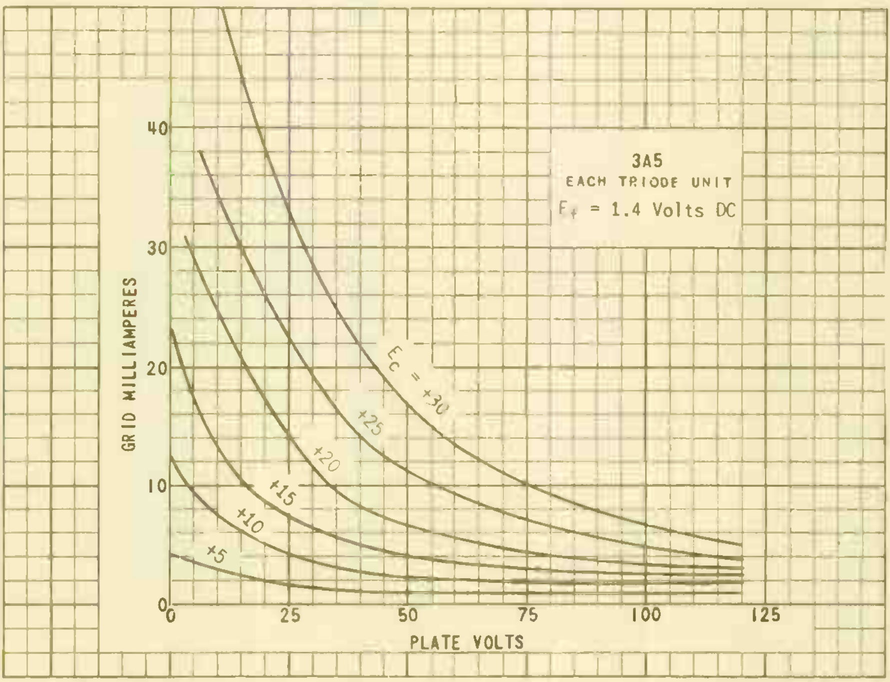
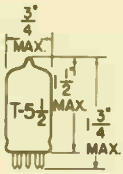


PLATE 1911
NOV. 1, 1947

TUNG-SOL

TRIODE

MINIATURE TYPE

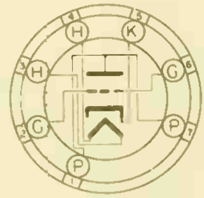


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
3.2 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7DK

THE 3AF4A 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	$\mu\mu f$
GRID TO CATHODE AND HEATER	2.2	$\mu\mu f$
PLATE TO CATHODE AND HEATER	0.45	$\mu\mu f$

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

OSCILLATOR SERVICE

HEATER VOLTAGE	3.2	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	50	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE[A]	50	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 25 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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

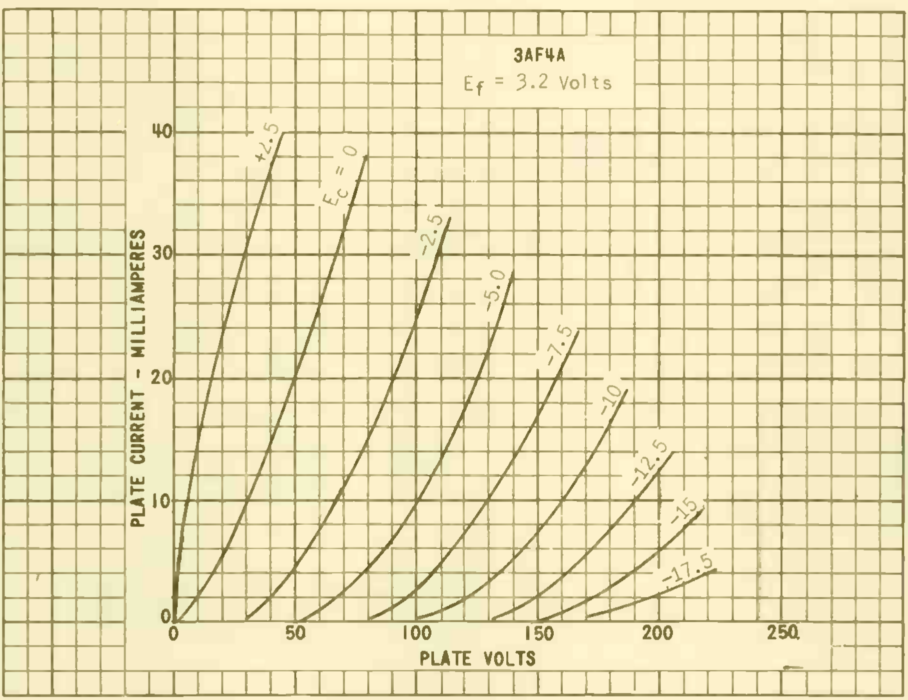
CLASS A_1 AMPLIFIER

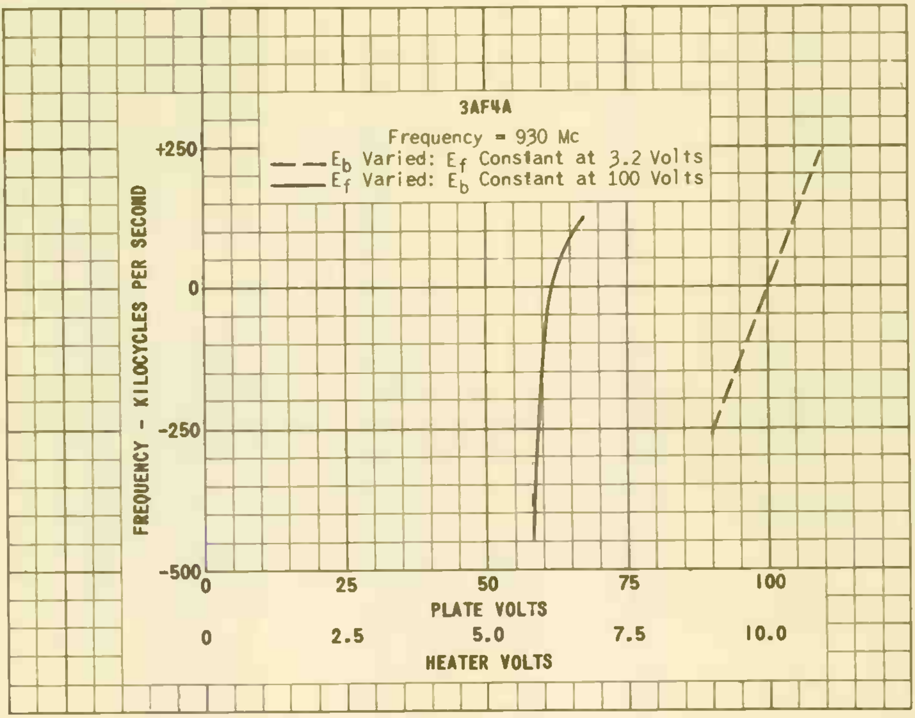
HEATER VOLTAGE	3.2	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	80	VOLTS
CATHODE BIAS RESISTOR	150	OHMS
AMPLIFICATION FACTOR	15	
PLATE RESISTANCE	2 270	OHMS
TRANSCONDUCTANCE	6 600	μMHOS
PLATE CURRENT	16	MA.

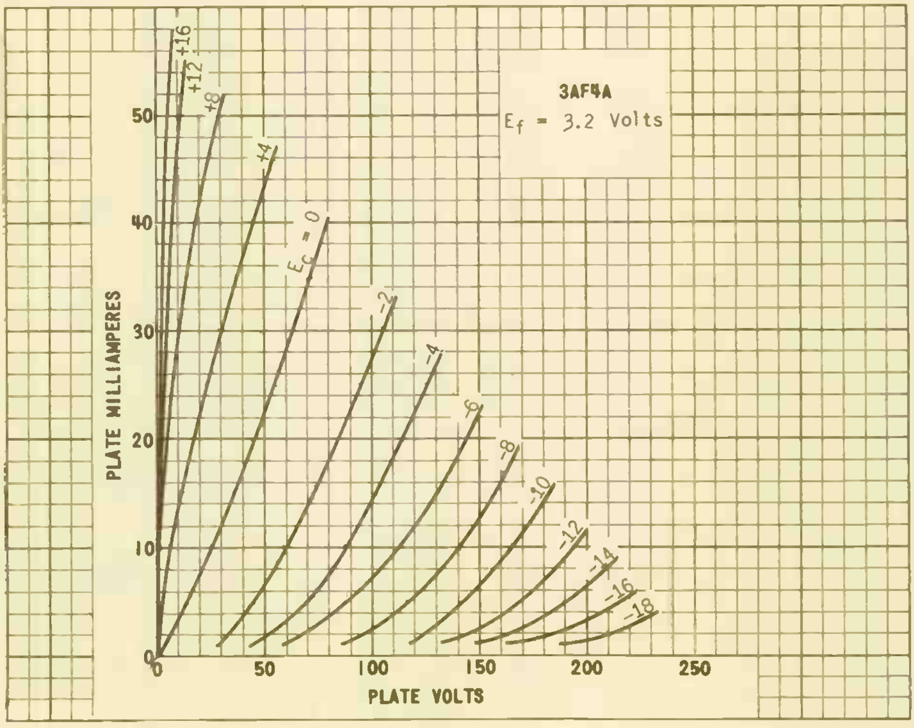
OPERATION AT 950 MC.

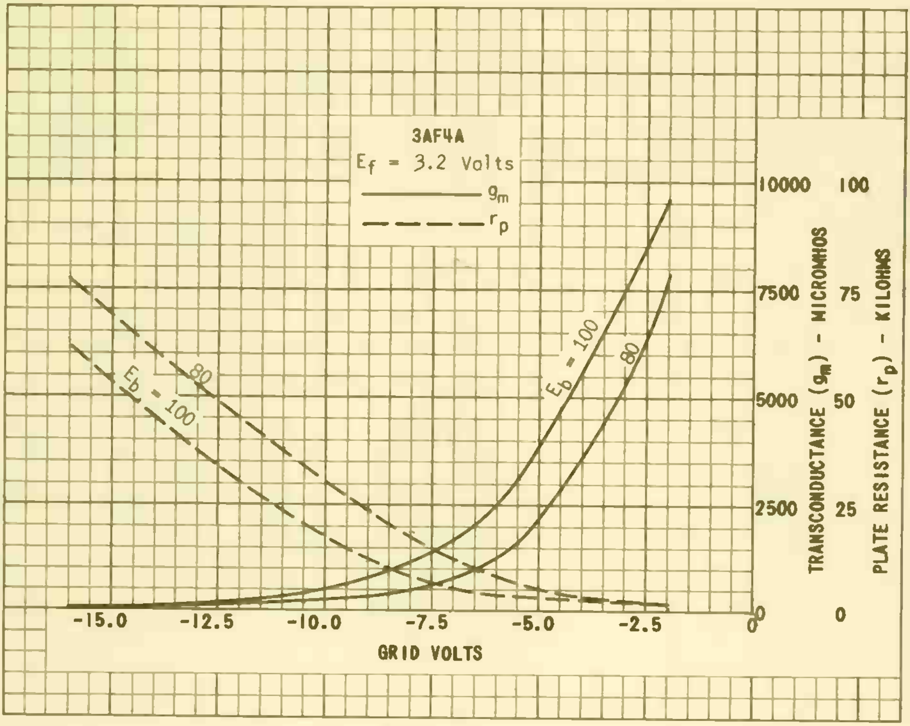
DC PLATE VOLTAGE	100	VOLTS
DC GRID VOLTAGE	−4	VOLTS
FROM A GRID RESISTOR OF	10 000	OHMS
DC PLATE CURRENT	22	MA.
DC GRID CURRENT (APPROX.)	400	μAMP.

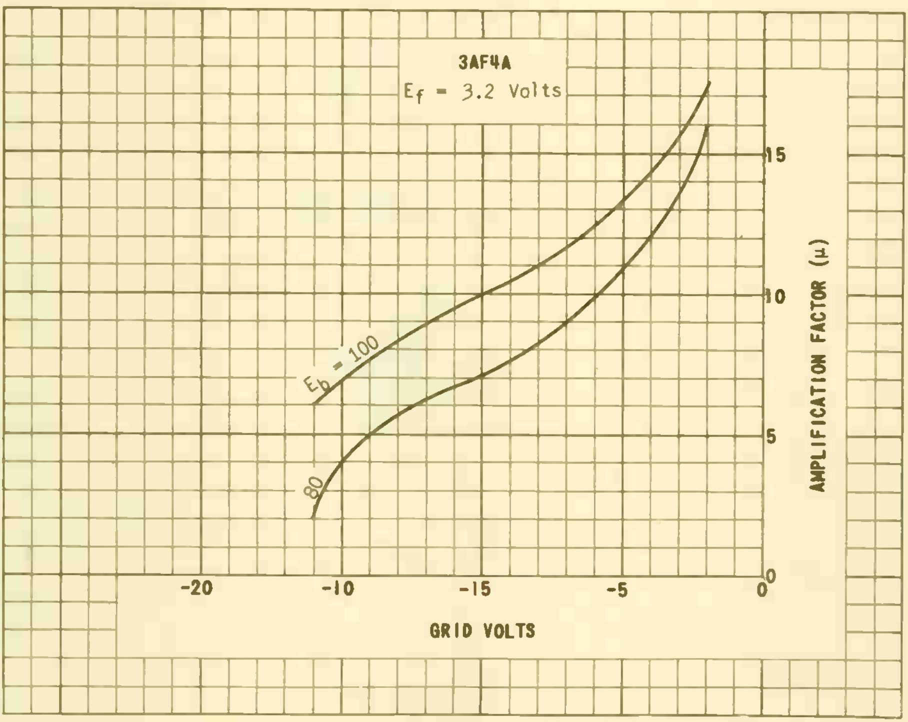
SIMILAR TYPE REFERENCE: Except for heater ratings the 3AF4A is identical to the 6AF4A.




3AF4A
Frequency = 930 Mc
Eb Varied: Ef Constant at 3.2 Volts
Ef Varied: Eb Constant at 100 Volts
FREQUENCY - KILOCYCLES PER SECOND
+250
0
-250
-500
0
25
50
75
100
PLATE VOLTS
0
2.5
5.0
7.5
10.0
HEATER VOLTS


3AF4A
Ef = 3.2 Volts
+16
+12
+8
+4
Ec = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
PLATE MILLIAMPERES
50
40
30
20
10
0
0
50
100
150
200
250
PLATE VOLTS

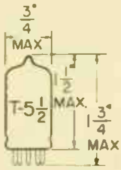

3AF4A
Ef = 3.2 Volts
gm
rp
Eb = 100
80
Eb = 100
80
10000
7500
5000
2500
0
100
75
50
25
0
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE RESISTANCE (rp) - KILOHMS
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID VOLTS


3AF4A
Ef = 3.2 Volts
Eb = 100
80
15
10
5
0
AMPLIFICATION FACTOR (μ)
-20
-10
-15
-5
0
GRID VOLTS

TUNG-SOL

DOUBLE DIODE

MINIATURE TYPE

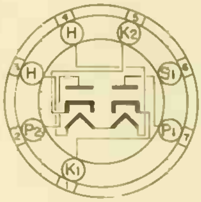


GLASS BULB

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-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH 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

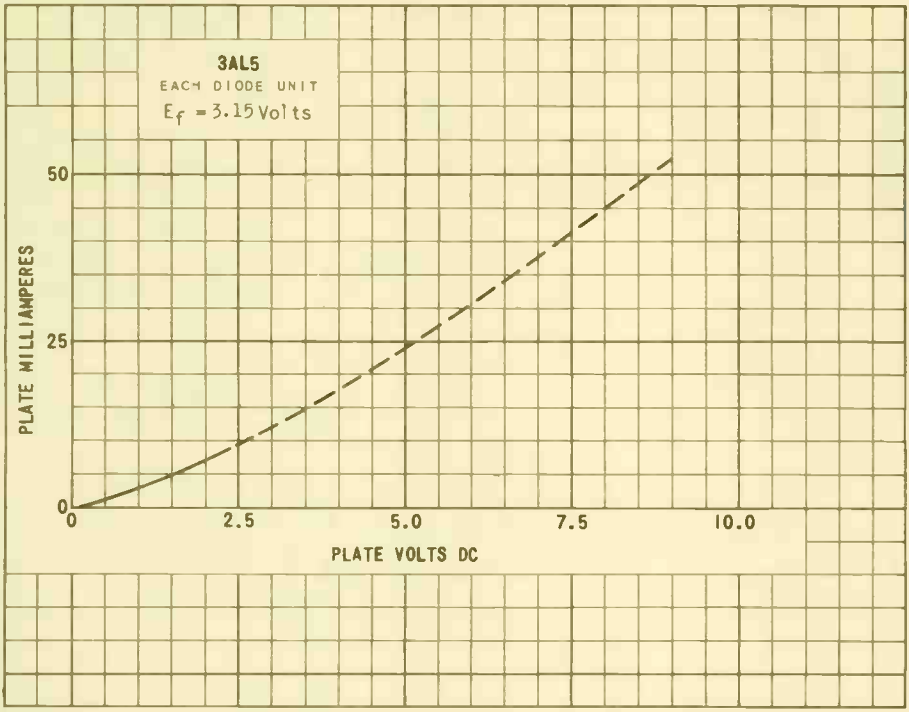
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

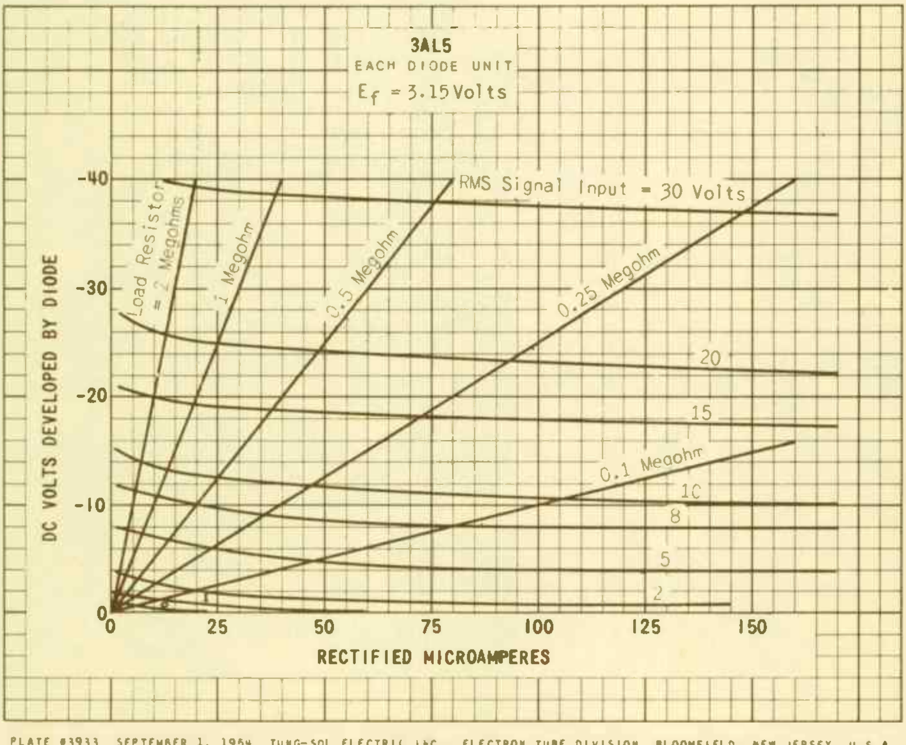
HALF-WAVE RECTIFIER

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

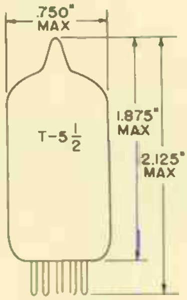
THE RESONANT FREQUENCY OF EACH UNIT OF THE 3AL5 IS 700 MC. (APPROX.)

*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.


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
0
25
50
75
100
125
150
RECTIFIED MICROAMPERES
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

TUNG-SOL



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

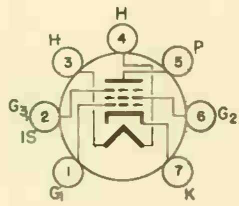
PENTODE

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	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.

PRINTED IN U.S.A.

TUNG-SOL

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

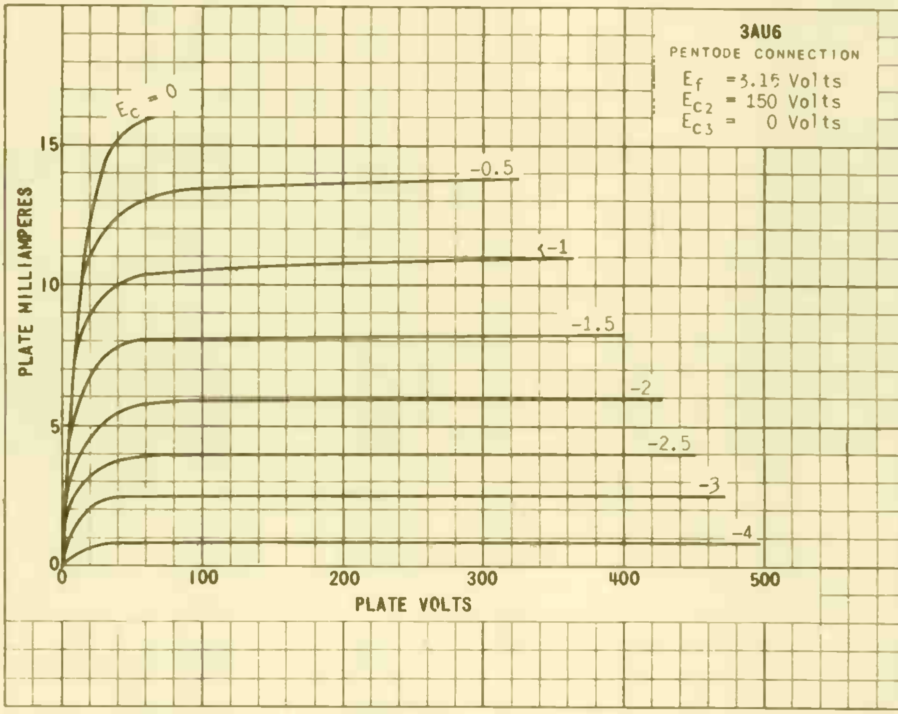
CLASS A_1 AMPLIFIER – TRIODE CONNECTION[C]

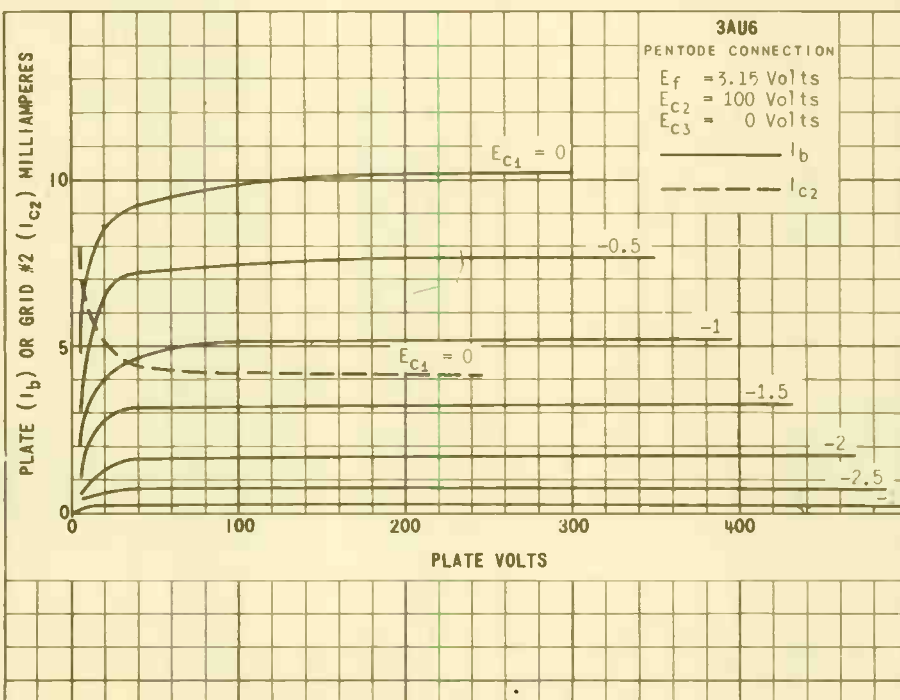
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	PLATE	
CATHODE RESISTOR	330	OHMS
GRID #3 VOLTAGE	PLATE	
TRANSCONDUCTANCE	4 800	µMHOS
PLATE CURRENT	12.2	MA.
AMPLIFICATION FACTOR	36	

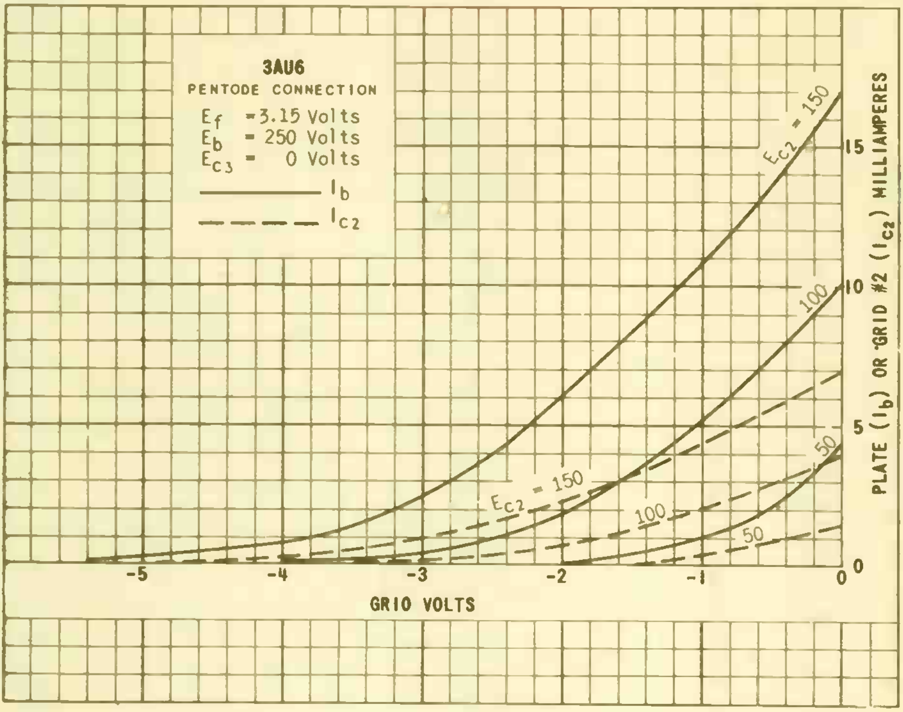
[C]TRIODE CONNECTION: GRID #2 AND GRID #3 CONNECTED TO PLATE.

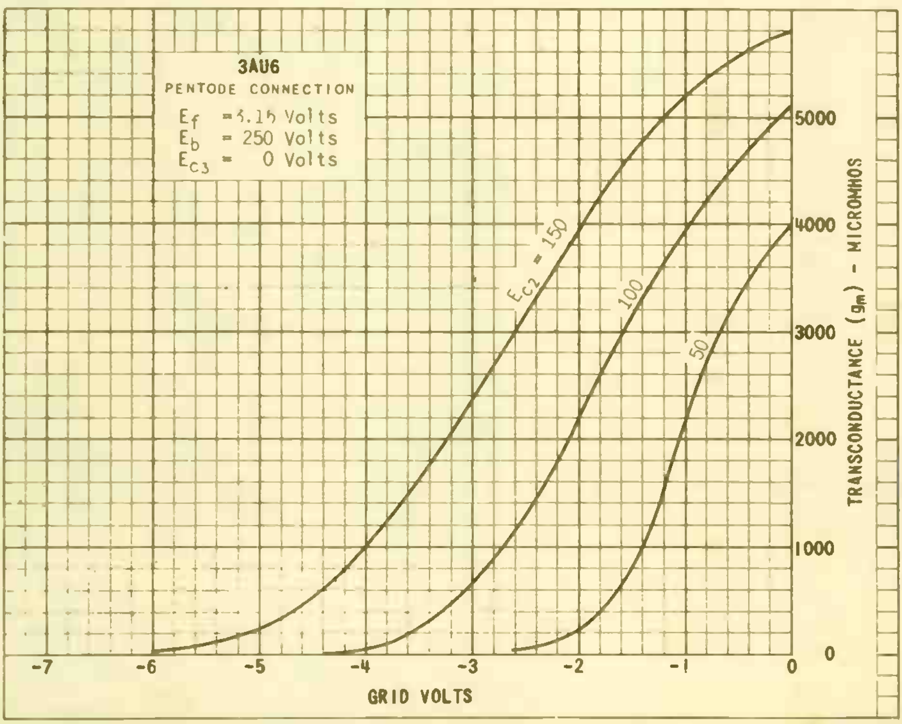
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

•THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.


3AU6
PENTODE CONNECTION
Ef =3.15 Volts
Ec2 = 150 Volts
Ec3 = 0 Volts
Ec = 0
-0.5
-1
-1.5
-2
-2.5
-3
-4
PLATE MILLIAMPERES
0
5
10
15
0
100
200
300
400
500
PLATE VOLTS


3AU6
PENTODE CONNECTION
Ef =3.15 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
Ib
Ic2
Ec1 = 0
-0.5
-1
Ec1 = 0
-1.5
-2
-2.5
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0
5
10
0
100
200
300
400
PLATE VOLTS

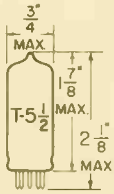

3AU6
PENTODE CONNECTION
Ef = 3.15 Volts
Eb = 250 Volts
Ec3 = 0 Volts
Ib
Ic2
Ec2 = 150
100
50
Ec2 = 150
100
50
-5
-4
-3
-2
-1
0
GRID VOLTS
0
5
10
15
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES


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

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

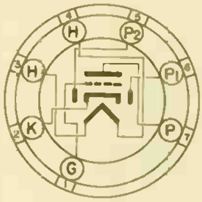


GLASS BULB

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.

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

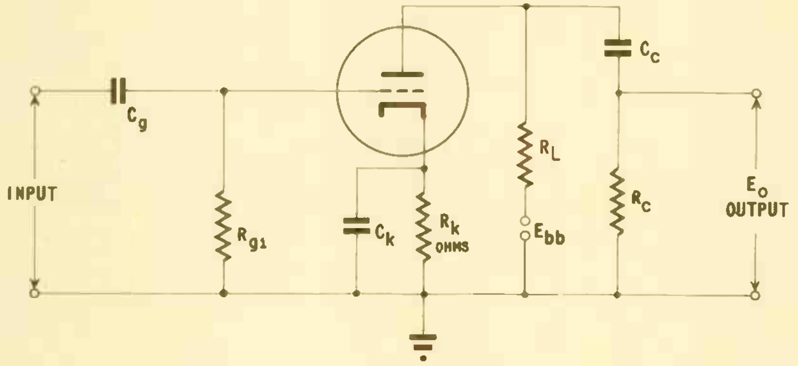
CLASS A_1 AMPLIFIER

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.

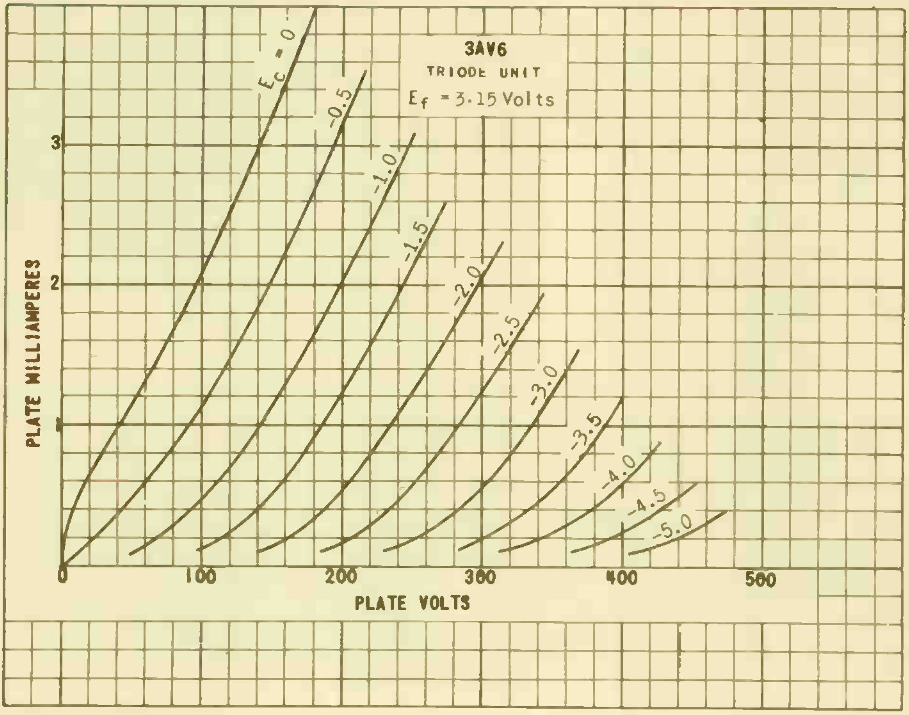
RESISTANCE COUPLED AMPLIFIER

TRIODE UNIT

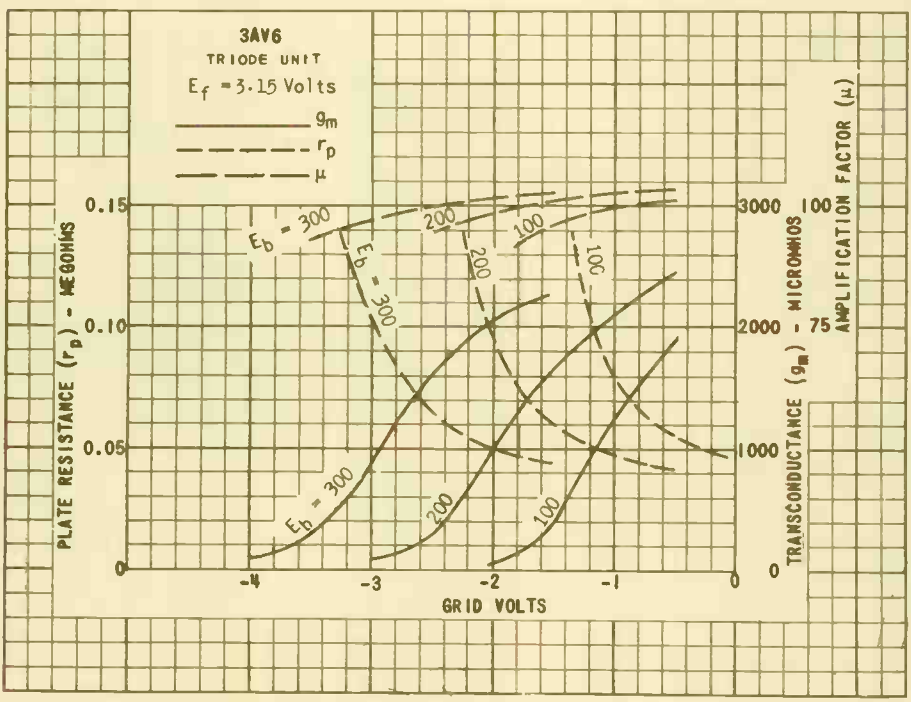
HEATER VOLTAGE	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE SUPPLY VOLTAGE	90	250	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	220 000	470 000	OHMS
CONTROL GRID RESISTOR	10.0	10.0	MEGOHMS
INPUT CONDENSER	0.01	0.01	µf
OUTPUT CONDENSER	0.01	0.01	µf
GRID RESISTOR OF FOLLOWING STAGE	470 000	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	



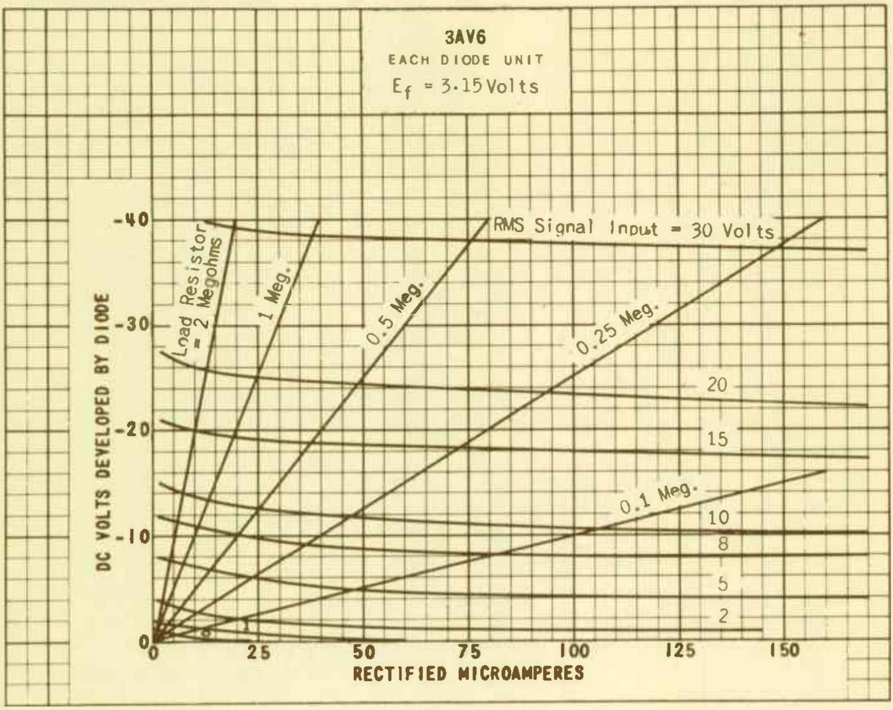
NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.



3AV6
TRIODE UNIT
Ef = 3.15 Volts
Ec = 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
100
200
300
400
500
1
2
3

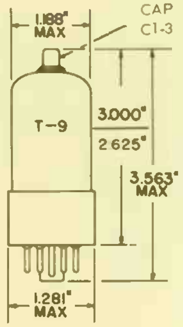


3AV6
TRIODE UNIT
Ef = 3.15 Volts
gm
rp
μ
Eb = 300
200
100
PLATE RESISTANCE (rp) - MEGOHMS
TRANSCONDUCTANCE (gm) - MICROMHOS
AMPLIFICATION FACTOR (μ)
GRID VOLTS
0.15
0.10
0.05
0
3000
2000
1000
100
75
-4
-3
-2
-1


3AV6
EACH DIODE UNIT
E_f = 3.15 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
DC VOLTS DEVELOPED BY DIODE
-40
-30
-20
-10
0
0
25
50
75
100
125
150
RECTIFIED MICROAMPERES

TUNG-SOL

DIODE

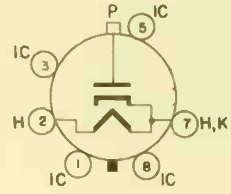


GLASS BULB
INTERMEDIATE SHELL
6 PIN OCTAL B6-8
OR
SHORT INTERMEDIATE SHELL
6 PIN OCTAL
WITH BARRIERS B6-[illegible]

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]

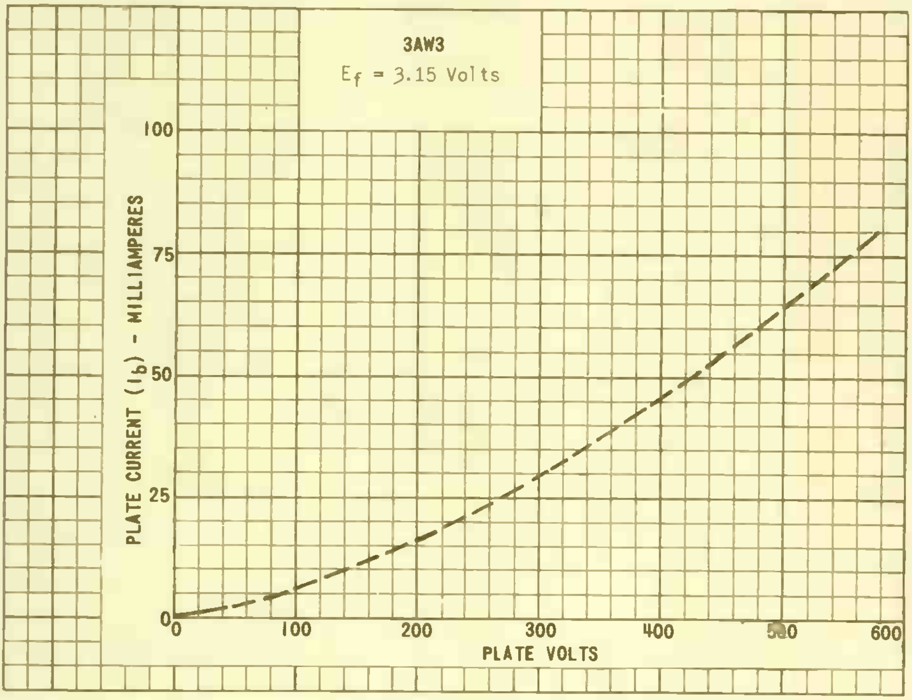
HEATER VOLTAGE[A]	3.15	VOLTS
MAXIMUM INVERSE PLATE VOLTAGE	30,000	VOLTS
MAXIMUM PEAK PLATE CURRENT	88	MA.
MAXIMUM AVERAGE PLATE CURRENT	1.7	MA.
MAXIMUM VOLTAGE PULSE DURATION	10	μSEC.

[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.

CONTINUED ON FOLLOWING PAGE


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

TUNG-SOL

DIODE

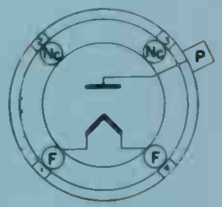
GLASS BULB

FILAMENT

2.5±5% VOLTS 5.0 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL MEDIUM SHELL
4 PIN BAYONET BASE

4P

THE 3B28 IS A XENON FILLED HALF WAVE RECTIFIER FOR USE IN HIGH VOLTAGE CIRCUITS. THE TUBE IS DESIGNED TO OPERATE OVER A WIDE TEMPERATURE RANGE WITHOUT THE NECESSITY OF HEATING OR COOLING DEVICES. ITS HARD GLASS ENVELOPE AND WELL SUPPORTED MOUNT MAKE IT PARTICULARLY SUITED FOR MILITARY AND INDUSTRIAL USE. AS CONTRASTED TO SIMILAR MERCURY-VAPOR TUBES, THE 3B28 MAY BE MOUNTED IN ANY POSITION AND IS NOT SUBJECT TO MERCURY-SPLASH PROBLEMS. ITS EFFICIENT OXIDE COATED FILAMENT IS FAST HEATING. AS CONSISTENT WITH FILAMENTARY GAS AND VAPOR RECTIFIER TUBE PRACTICE, QUADRATURE EXCITATION OF THE FILAMENT IS RECOMMENDED FOR OBTAINING THE LONGEST TUBE LIFE. IN QUADRATURE OPERATION, THE FILAMENT CURRENT IS PHASED TO BE AT A MINIMUM WHEN THE PEAK ANODE CURRENT FLOWS. HOWEVER THE TUBE CARRIES FULL RATINGS FOR IN PHASE OPERATION OF THE FILAMENT.

MAXIMUM RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	5 000	10 000	VOLTS
MAXIMUM PEAK CATHODE CURRENT	2.	1.	AMP.
MAXIMUM AVERAGE CATHODE CURRENT	0.5	0.25	AMP.
MAXIMUM SURGE CATHODE CURRENT	20.	20.	AMP.
(MAXIMUM DURATION TIME 0.1 SECOND)			
MAXIMUM AVERAGING TIME	30.	30.	SECONDS
MAXIMUM SUPPLY FREQUENCY	500	150	CPS
AMBIENT TEMPERATURE LIMITS	−55 TO +75	−55 TO +75	°C

ELECTRICAL DATA

FILAMENT VOLTAGE	2.5±5%	VOLTS
FILAMENT CURRENT AT 2.5 VOLTS	5.0	AMP.
MINIMUM CATHODE HEATING TIME	5.	SECONDS
AVERAGE ANODE VOLTAGE DROP	10.	VOLTS
PEAK ANODE VOLTAGE DROP	14.	VOLTS
CRITICAL ANODE VOLTAGE	50.	VOLTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MECHANICAL DATA

MOUNTING POSITION	ANY	
OVERALL LENGTH	5.87 TO 6.35	INCHES
SEATED LENGTH	5.25 TO 5.73	INCHES
MAXIMUM DIAMETER	2.07	INCHES
BULB	T-16	[illegible]
CAP	MEDIUM METAL, C1-5	
BASE	MEDIUM 4 PIN BAYONET, A4-10	
WEIGHT (NET) MAX.	[illegible]	OUNCES

MAXIMUM CIRCUIT VALUES

FIG.	CIRCUIT	TRANSFORMER	FILAMENT OPERATION	NO. OF TUBES	A.C. SECONDARY VOLTS E_{RMS}	DC OUTPUT (APPROX.)		RIPPLE	
						E_{DC} IN VOLTS	I_{DC} IN AMPERES	VOLTS RMS	FREQ.
1	HALF WAVE SINGLE PHASE	SINGLE PHASE	IN PHASE	1	[illegible]A 3500B	3200 1600	0.25 0.50	3500 1750	f
2	FULL WAVE SINGLE PHASE	SINGLE PHASE CENTER TAP	IN PHASE	2	3500A 1750B	3200 1600	0.50 1.00	1500 750	2f
3	BRIDGE CIRCUIT SINGLE PHASE	SINGLE PHASE	IN PHASE	4	7000A 3500B	6400 3200	0.50 1.00	3000 1500	2f
4	HALF WAVE THREE PHASE	DELTA-WYE	——	3	4000A 2000B	4800 2400	0.75 1.50	860 430	3f
5	FULL WAVE THREE PHASE	DELTA-WYE	QUADRATURE	6	4000A 2000B	9900 4750	0.75 1.50	400 200	6f
6	FULL WAVE THREE PHASE	DELTA-DELTA	QUADRATURE	6	7000A 3500B	9500 4750	0.75 1.50	400 200	6f
7	HALF WAVE SIX PHASE (THREE PHASE SUPPLY)	DELTA-STAR	QUADRATURE	6	3500A 1750B	4800 2400	1.0 2.0	200 100	6f

DC OUTPUT VALUES ARE THOSE SUPPLIED TO A CHOKE INPUT FILTER WITH A PURE SINE WAVE SUPPLY.

A VALUES ARE FOR A MAXIMUM OF [illegible] PEAK INVERSE VOLTAGE PER TUBE AND [illegible] CPS MAXIMUM SUPPLY FREQUENCY.

B VALUES FOR A MAXIMUM OF [illegible] PEAK INVERSE VOLTAGE PER TUBE AND [illegible] CPS MAXIMUM SUPPLY FREQUENCY.

TUNG-SOL

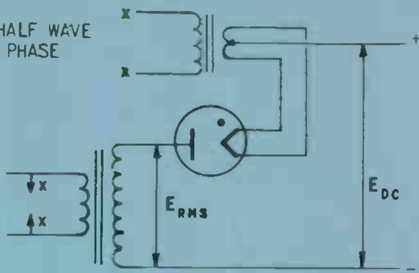


FIGURE 1 - HALF WAVE -SINGLE PHASE

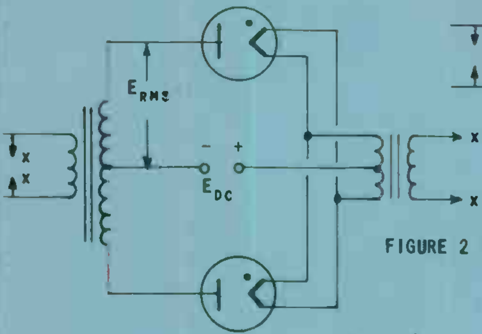


FIGURE 2 - FULL WAVE - SINGLE PHASE

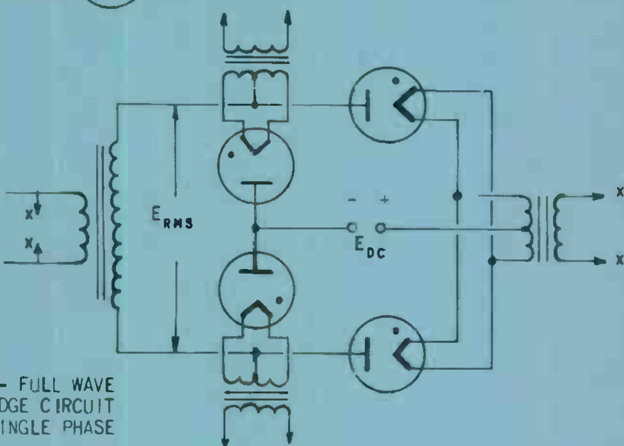


FIGURE 3 - FULL WAVE BRIDGE CIRCUIT -SINGLE PHASE

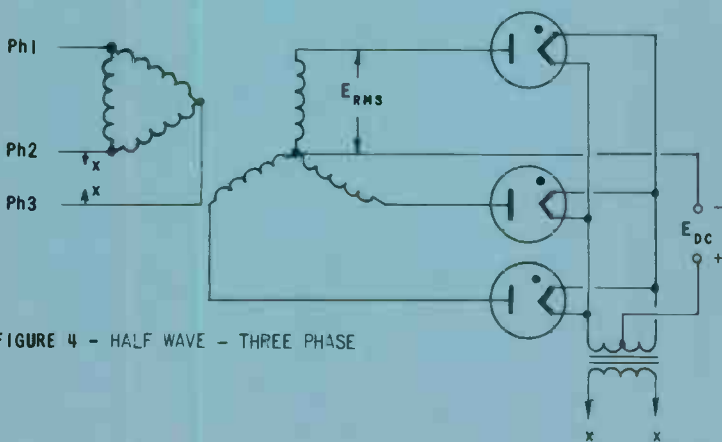


FIGURE 4 - HALF WAVE - THREE PHASE

FIGURE 5 - FULL WAVE-THREE PHASE

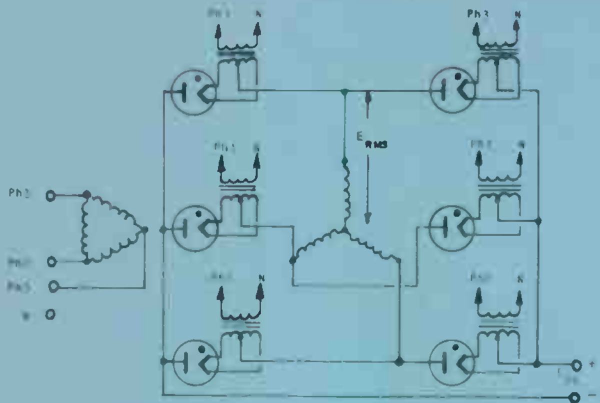


FIGURE 6 - FULL WAVE - THREE PHASE

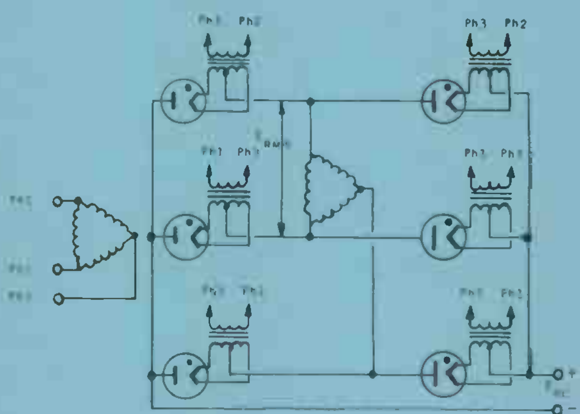
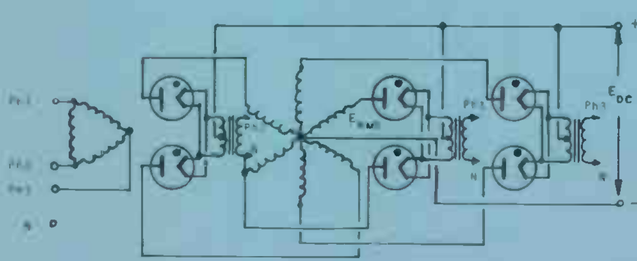


FIGURE 7 - HALF WAVE-SIX PHASE (3 PHASE SUPPLY)



TUNG-SOL

PENTODE

MINIATURE TYPE

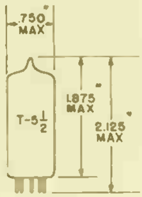
COATED UNIPOTENTIAL CATHODE

HEATER

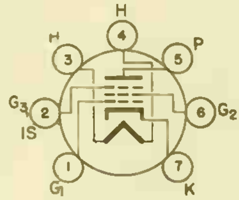
3.15 VOLTS 600±40 MA.

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.

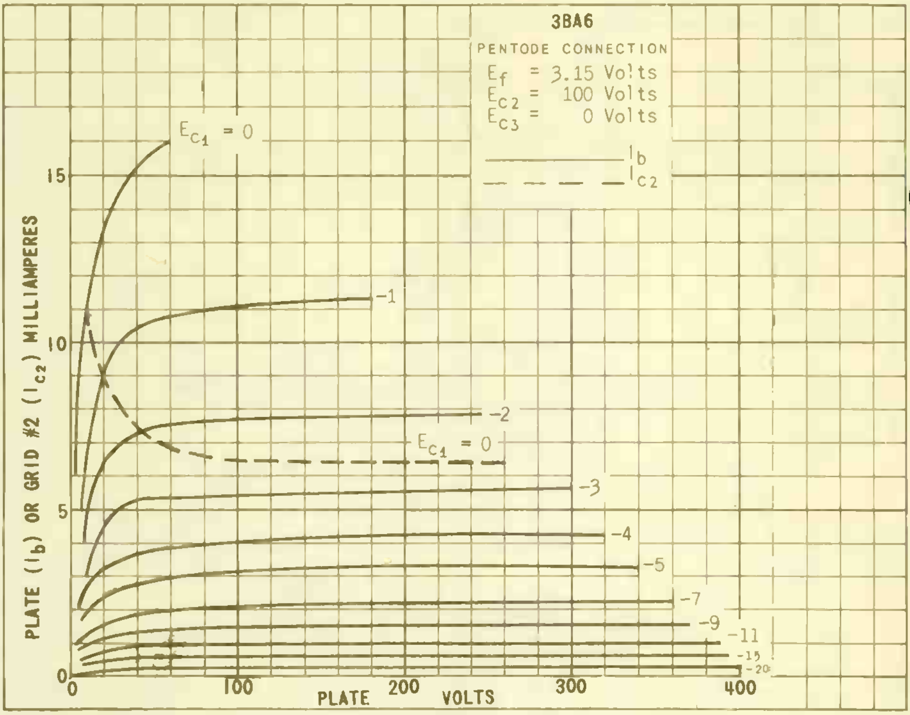
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

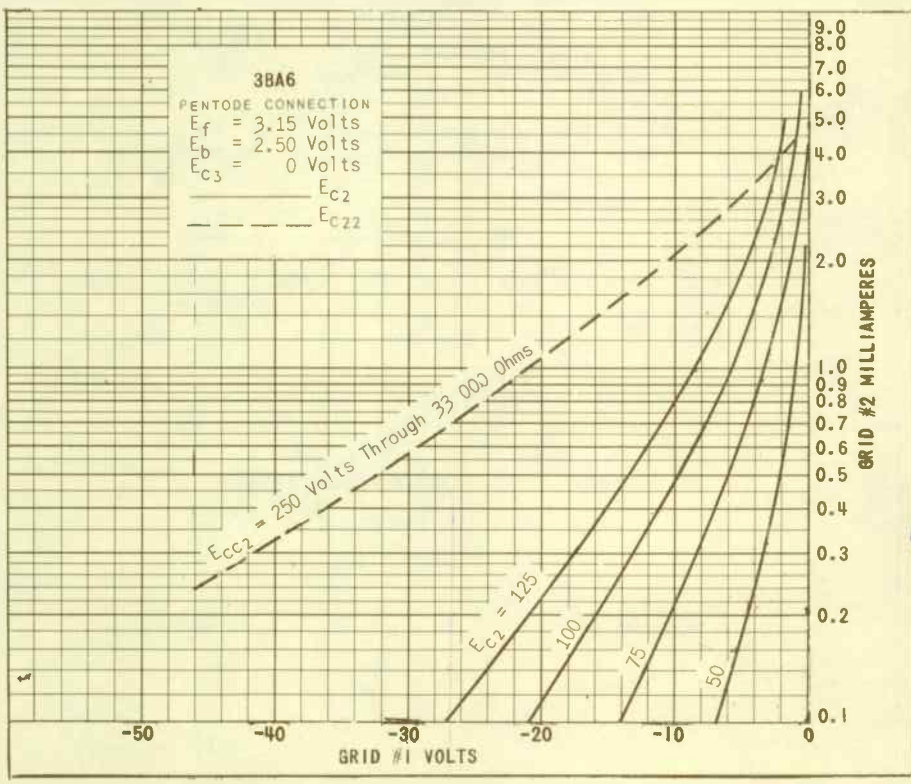
CLASS A_1 AMPLIFIER

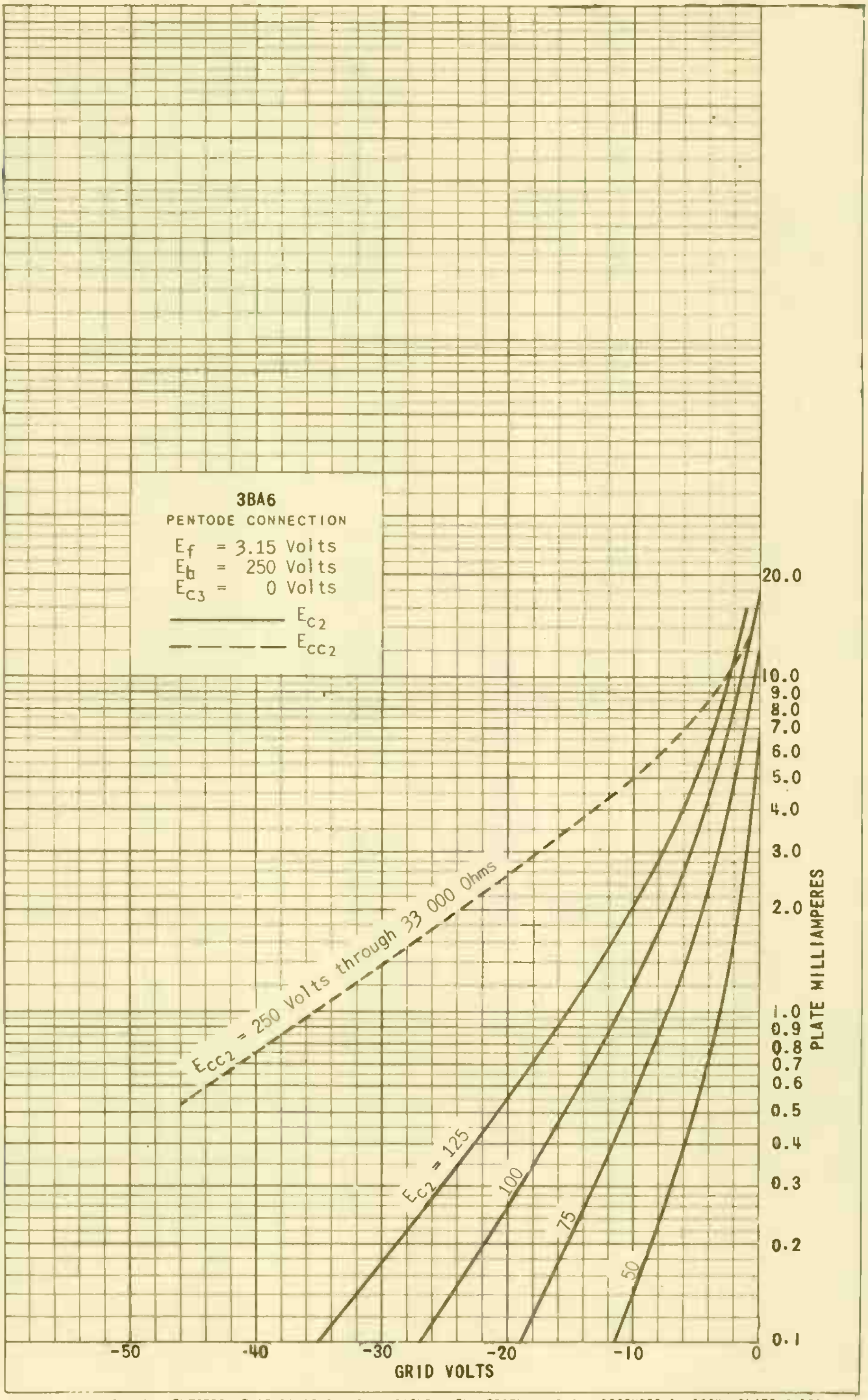
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE	100	100	VOLTS
CATHODE BIAS RESISTOR	68	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	1.0	MEGOHM
TRANSCONDUCTANCE	4 300	4 400	µMHOS
PLATE CURRENT	10.8	11	MA.
GRID #2 CURRENT	4.4	4.2	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 40 µMHOS	-20	-20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

→ INDICATES A CHANGE.

PRINTED IN U.S.A.


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
-50
-40
-30
-20
-10
0
GRID #1 VOLTS
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
GRID #2 MILLIAMPERES



PRINTED IN U.S.A.

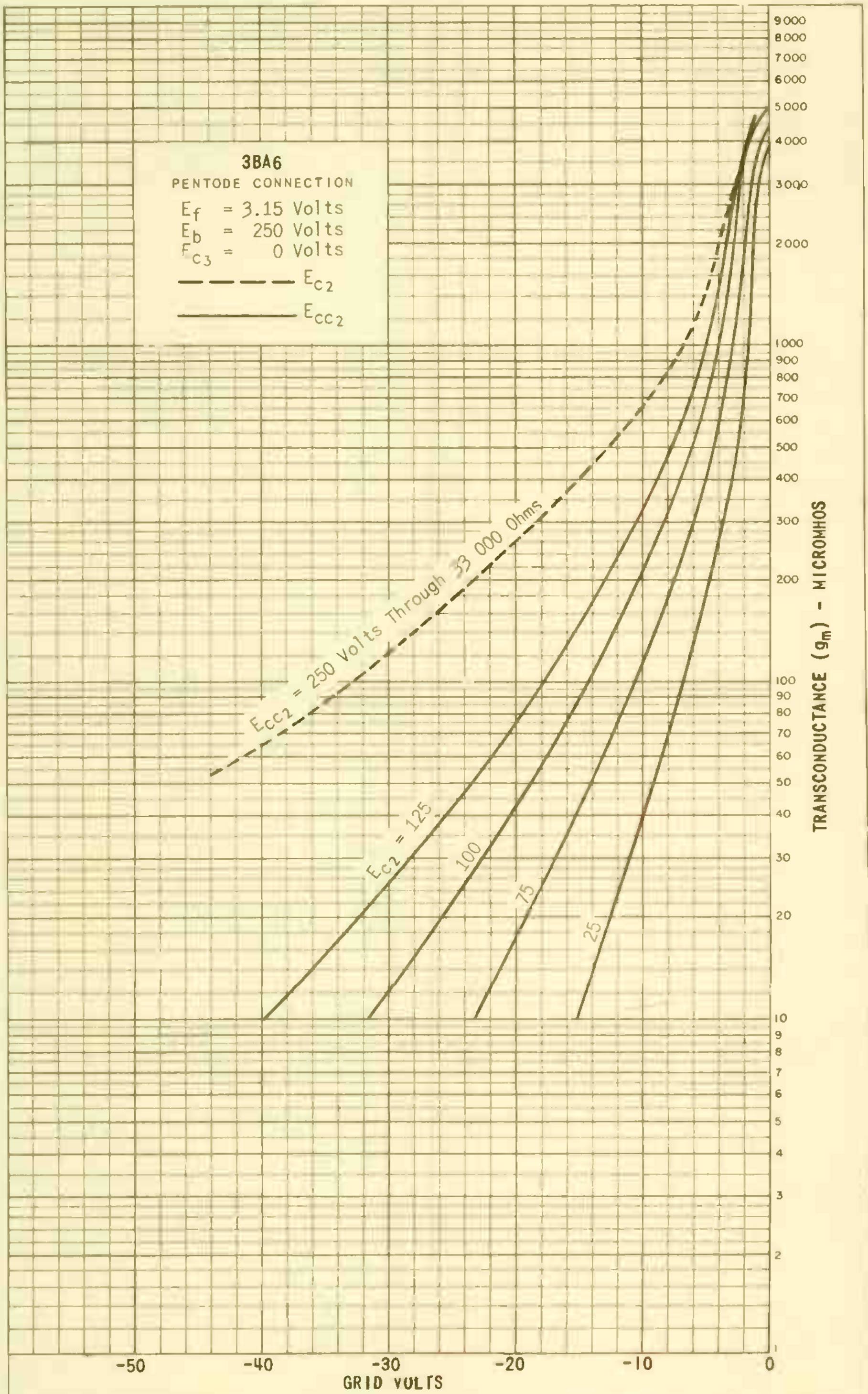


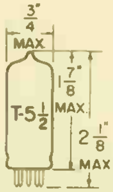
PLATE #4174 DECEMBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

3BC5

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
7BD

THE 3BC5, A HIGH TRANSCONDUCTANCE PENTODE VOLTAGE AMPLIFIER IN THE 7 PIN MINIATURE CONSTRUCTION, 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. 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	3.15	3.15	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.

→ INDICATES A CHANGE.

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

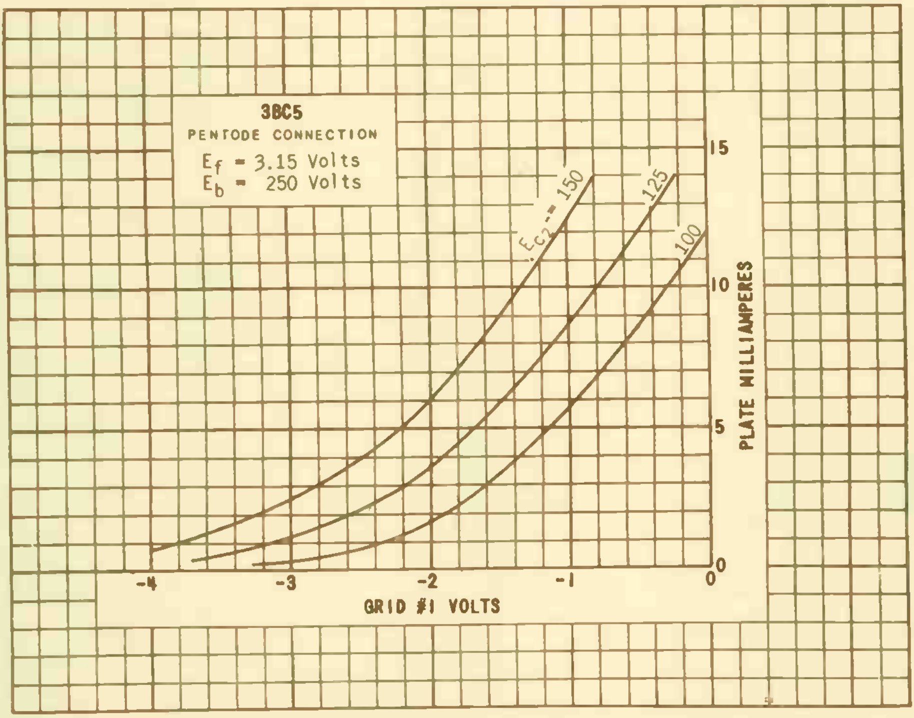
CLASS A_1 AMPLIFIER - PENTODE CONNECTION

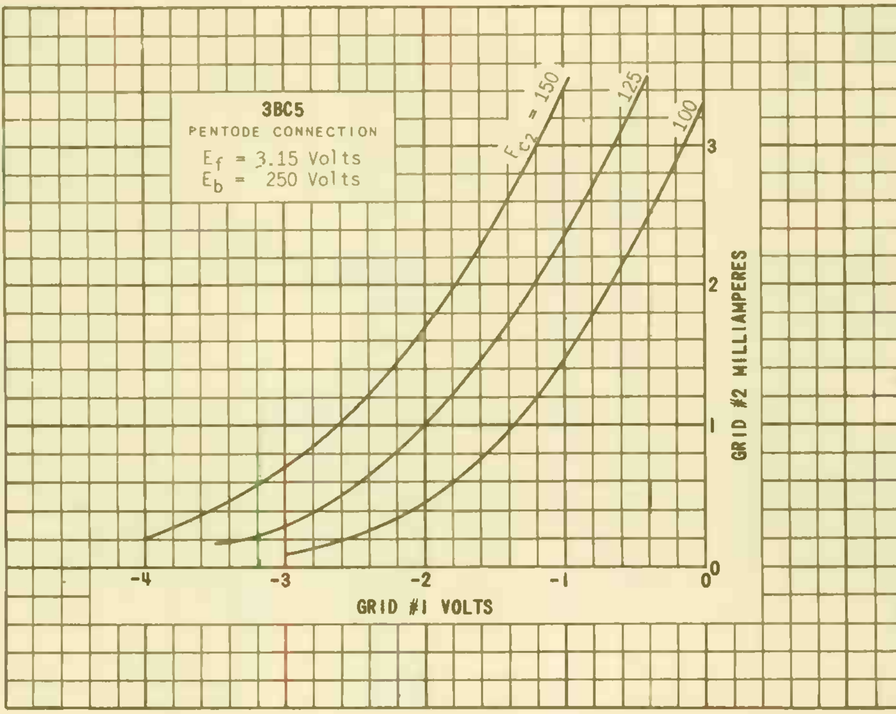
HEATER VOLTAGE	3.15	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	100	125	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE RESISTOR	180	100	180	OHMS
PLATE RESISTANCE (APPROX.)	0.6	0.5	0.8	MEGOHM
TRANSCONDUCTANCE	4900	6100	5700	μMHOS
PLATE CURRENT	4.7	8	7.5	MA.
GRID #2 CURRENT	1.4	2.4	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_{b2} = 10 μA.	-5	-6	-8	VOLTS

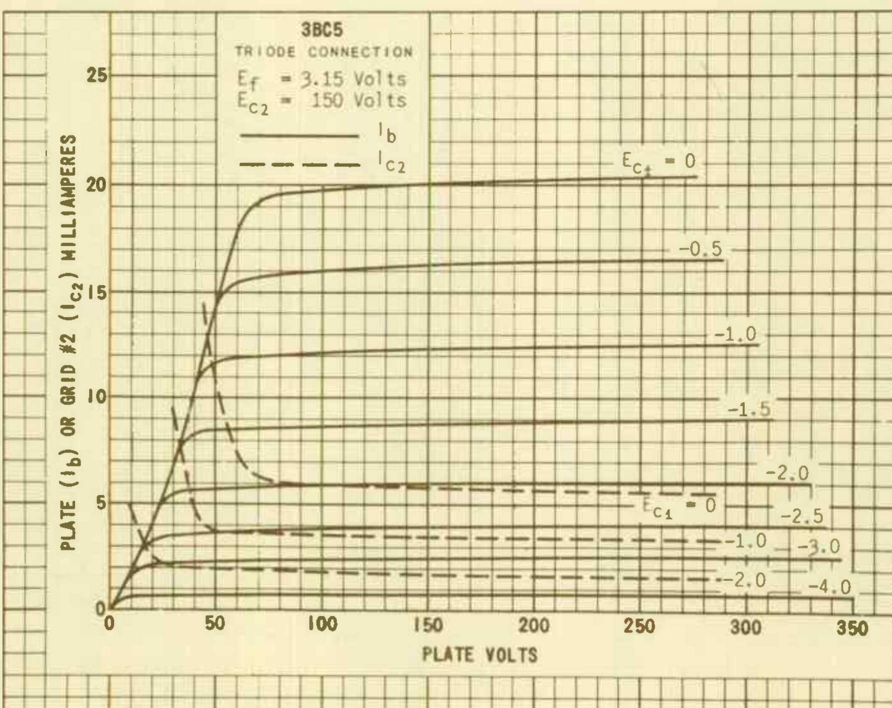
CLASS A_1 AMPLIFIER - TRIODE CONNECTION[B]

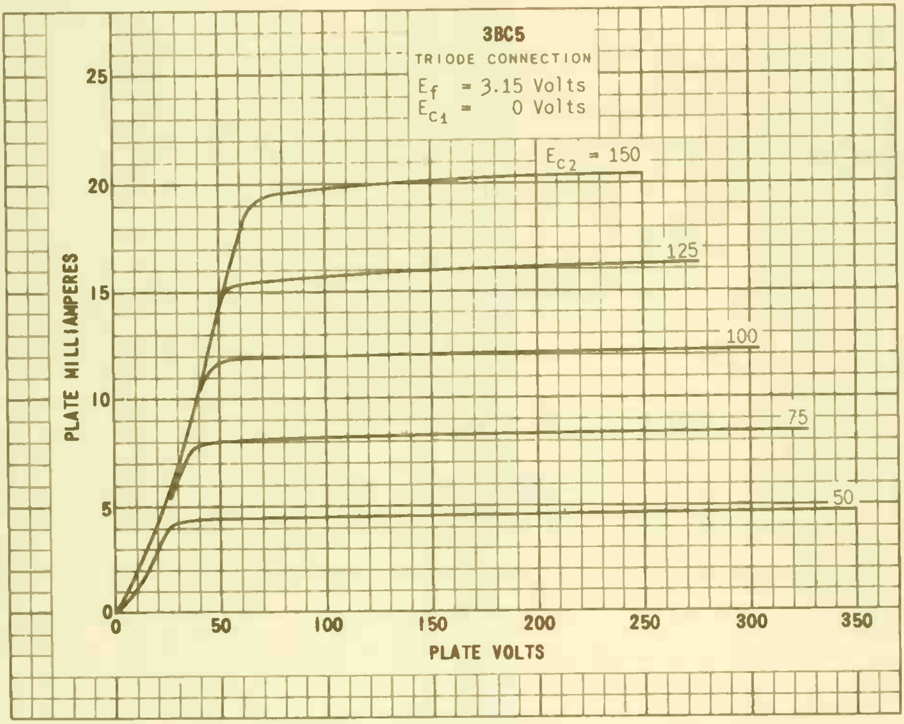
HEATER VOLTAGE	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	250	180	VOLTS
CATHODE RESISTOR	820	330	OHMS
PLATE RESISTANCE (APPROX.)	0.009	0.006	MEGOHM
TRANSCONDUCTANCE	4400	6000	μMHOS
PLATE CURRENT	6	8	MA.
AMPLIFICATION FACTOR	40	42	

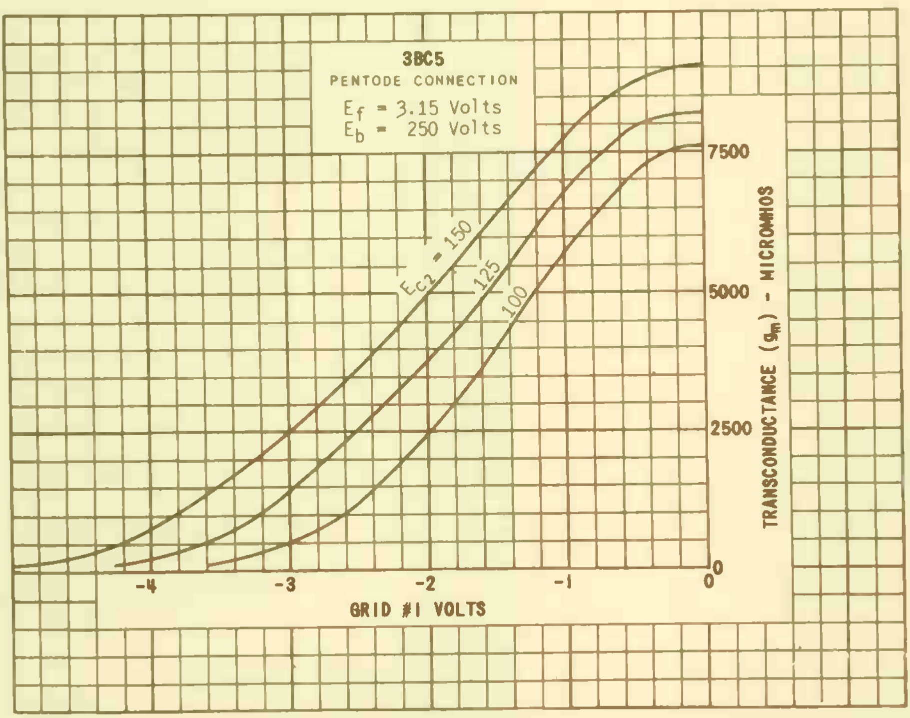
[B] TRIODE CONNECTION G_2 CONNECTED TO PLATE.




3BC5
PENTODE CONNECTION
Ef = 3.15 Volts
Eb = 250 Volts
Ec2 = 150
125
100
GRID #2 MILLIAMPERES
0
1
2
3
-4
-3
-2
-1
0
GRID #1 VOLTS


3BC5
TRIODE CONNECTION
Ef = 3.15 Volts
Ec2 = 150 Volts
Ib
Ic2
Ec1 = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
Ec1 = 0
-1.0
-2.0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0
5
10
15
20
25
0
50
100
150
200
250
300
350
PLATE VOLTS

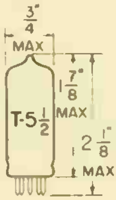

3BC5
TRIODE CONNECTION
Ef = 3.15 Volts
Ec1 = 0 Volts
Ec2 = 150
125
100
75
50
PLATE MILLIAMPERES
0
5
10
15
20
25
0
50
100
150
200
250
300
350
PLATE VOLTS


3BC5
PENTODE CONNECTION
Ef = 3.15 Volts
Eb = 250 Volts
Ec2 = 150
125
100
-4
-3
-2
-1
0
GRID #1 VOLTS
0
2500
5000
7500
TRANSCONDUCTANCE (gm) - MICROMHOS

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

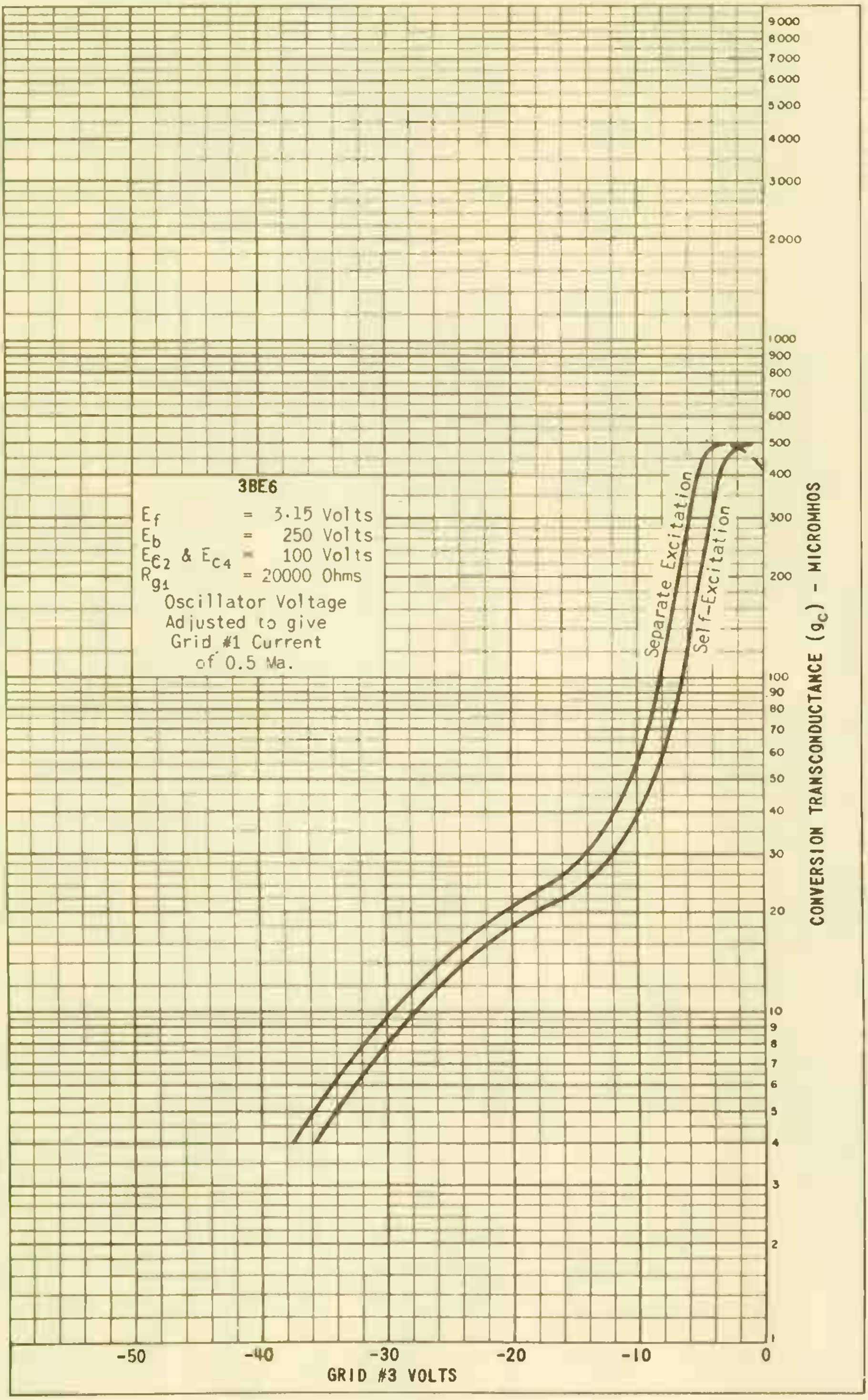
CONVERTER SERVICE - SEPARATE EXCITATION[B]

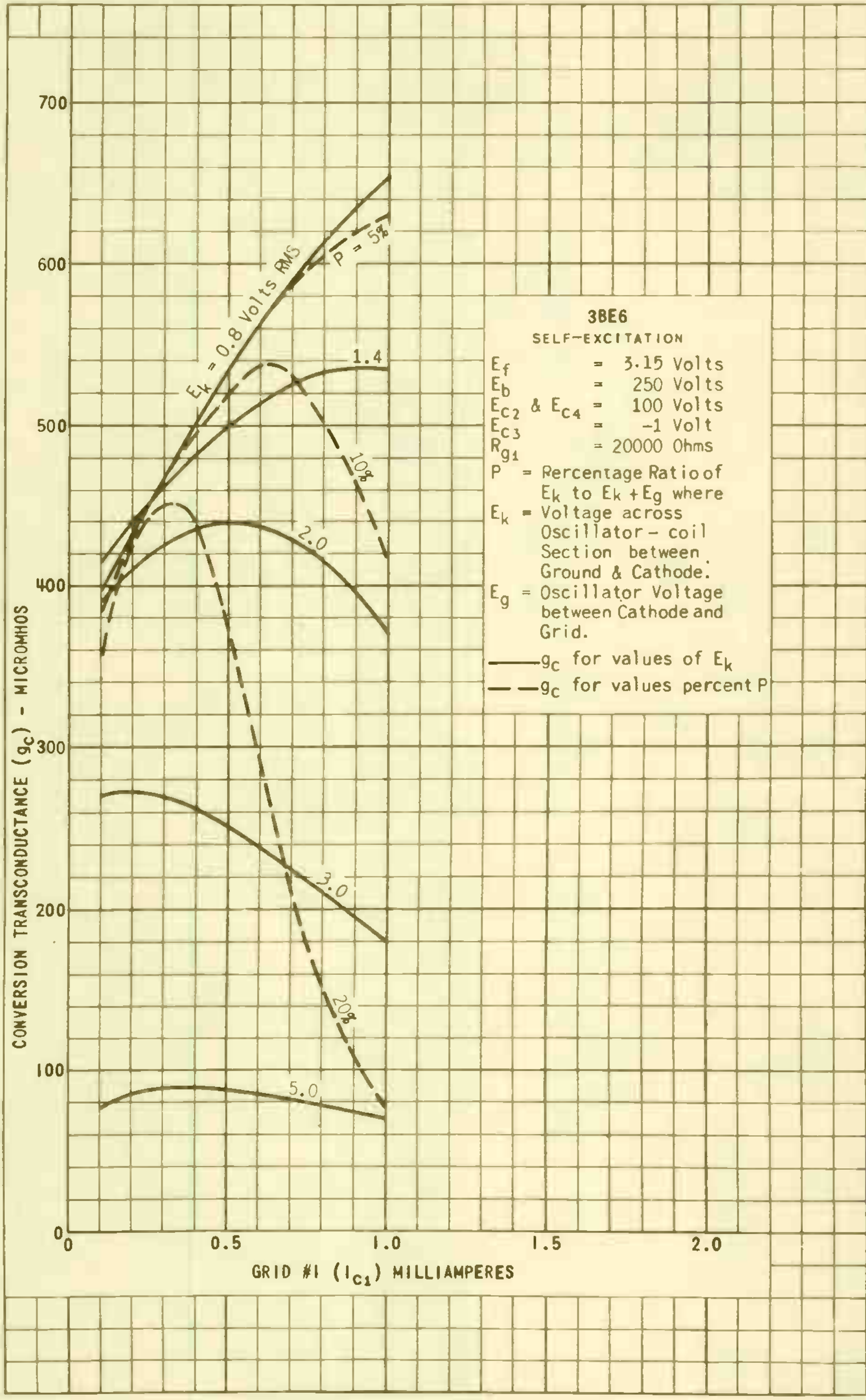
HEATER VOLTAGE	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	-1.5	-1.5	VOLTS
GRIDS #2 AND #4 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID) RMS	10	10	VOLTS
GRID #1 RESISTANCE (OSCILLATOR GRID)	20 000	20 000	OHMS
PLATE RESISTANCE (APPROX.)	0.4	1.0	MEGOHMS
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.

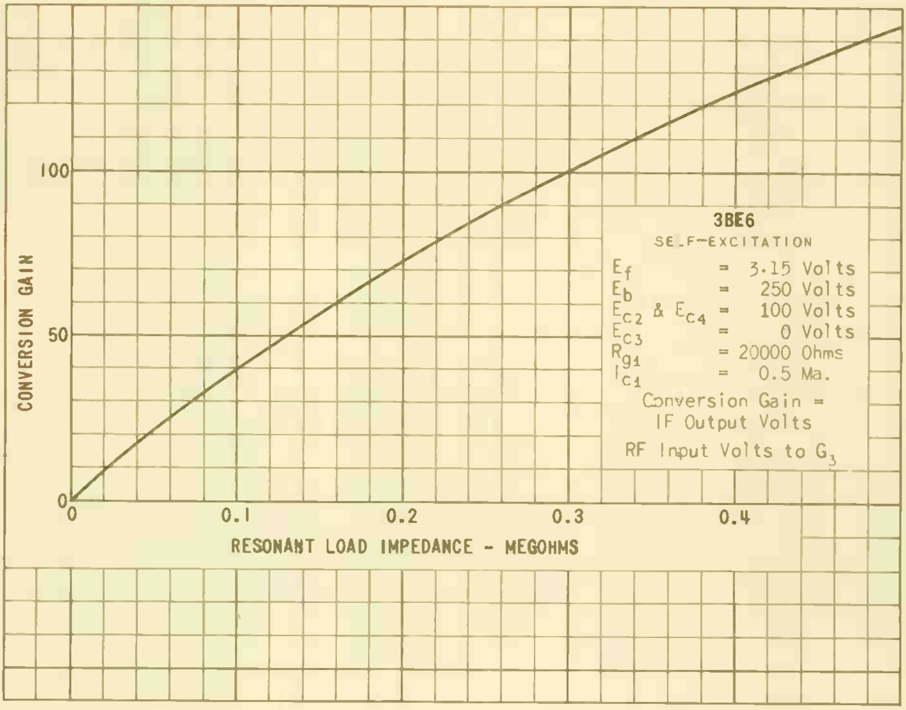
OSCILLATOR CHARACTERISTICS
NOT OSCILLATING

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

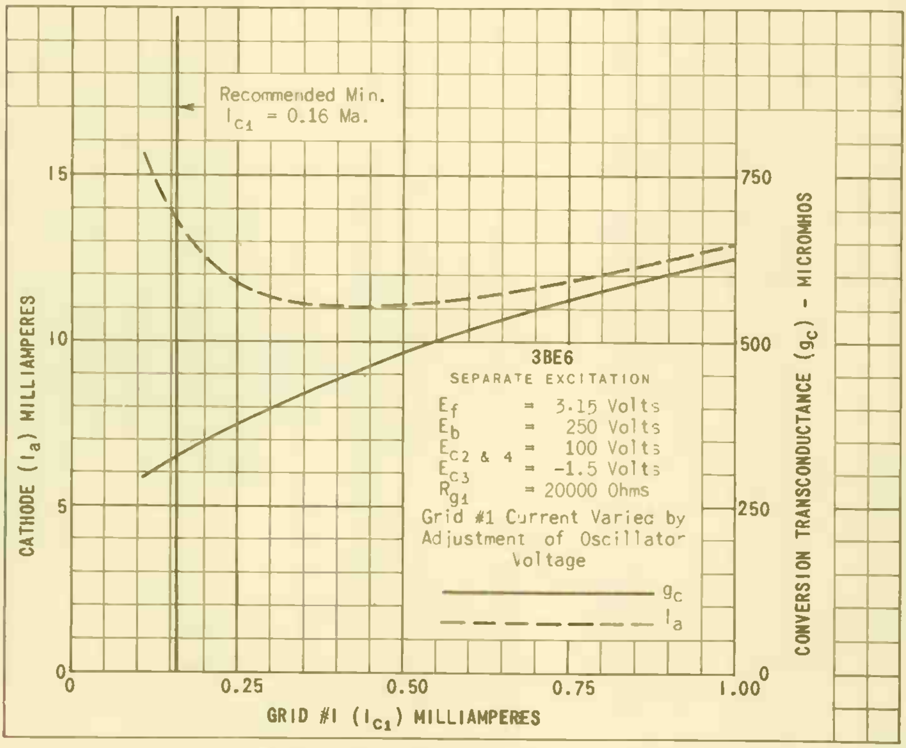

3BE6
E_f = 3.15 Volts
E_b = 250 Volts
E_{c2} & E_{c4} = 100 Volts
R_{g1} = 20000 Ohms
Oscillator Voltage
Adjusted to give
Grid #1 Current
of 0.5 Ma.
Separate Excitation
Self-Excitation
CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
GRID #3 VOLTS
-50
-40
-30
-20
-10
0
9000
8000
7000
6000
5000
4000
3000
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



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
700
600
500
400
300
200
100
0
0
0.5
1.0
1.5
2.0
GRID #1 (I_{c1}) MILLIAMPERES



CONVERSION GAIN
100
50
0
0
0.1
0.2
0.3
0.4
RESONANT LOAD IMPEDANCE - MEGOHMS
3BE6
SELF-EXCITATION
Ef = 3.15 Volts
Eb = 250 Volts
Ec2 & Ec4 = 100 Volts
Ec3 = 0 Volts
Rg1 = 20000 Ohms
Ic1 = 0.5 Ma.
Conversion Gain = IF Output Volts / RF Input Volts to G3



Recommended Min.
Ic1 = 0.16 Ma.
CATHODE (Ia) MILLIAMPERES
15
10
5
0
750
500
250
0
CONVERSION TRANSCONDUCTANCE (gc) - MICROMHOS
0
0.25
0.50
0.75
1.00
GRID #1 (Ic1) MILLIAMPERES
3BE6
SEPARATE EXCITATION
Ef = 3.15 Volts
Eb = 250 Volts
Ec2 & 4 = 100 Volts
Ec3 = -1.5 Volts
Rg1 = 20000 Ohms
Grid #1 Current Varied by Adjustment of Oscillator Voltage
gc
Ia

TUNG-SOL

TRIODE

MINIATURE TYPE

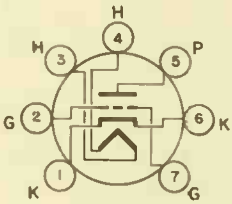
COATED UNIPOTENTIAL CATHODE

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.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

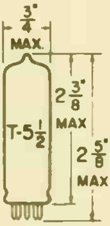
CLASS A_1 AMPLIFIER

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

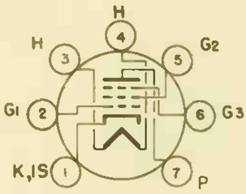


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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 E_{sig}=2.0V., RMS	31	20	25	DECIBELS
AM REJECTION AT E_{sig}=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.

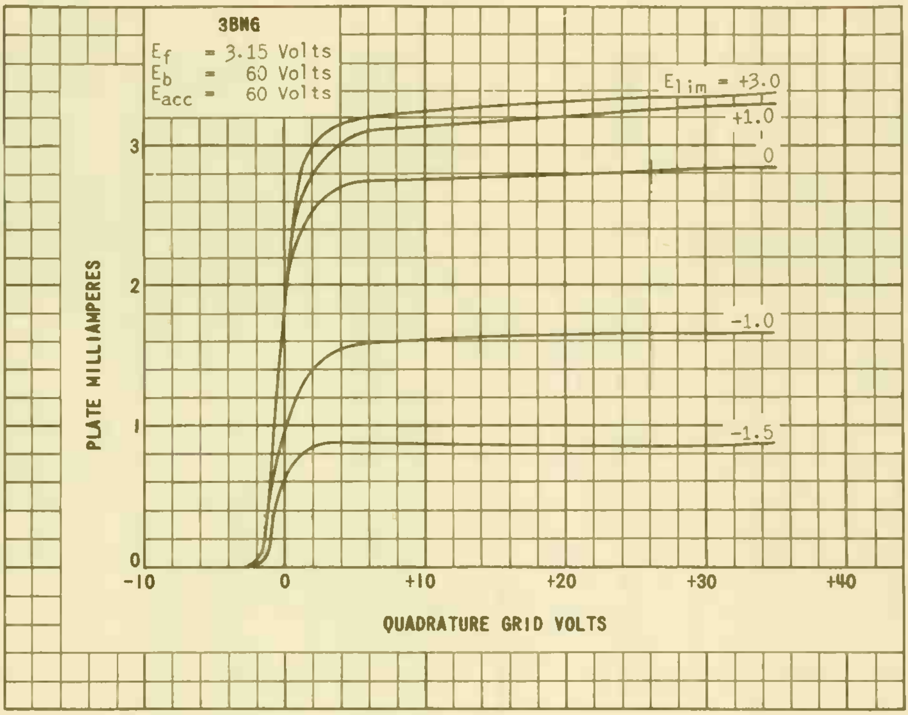
[B] AT SIGNAL LEVELS ABOVE SPECIFIED VALUE, LIMITING IS WITHIN ±2 DECIBELS.

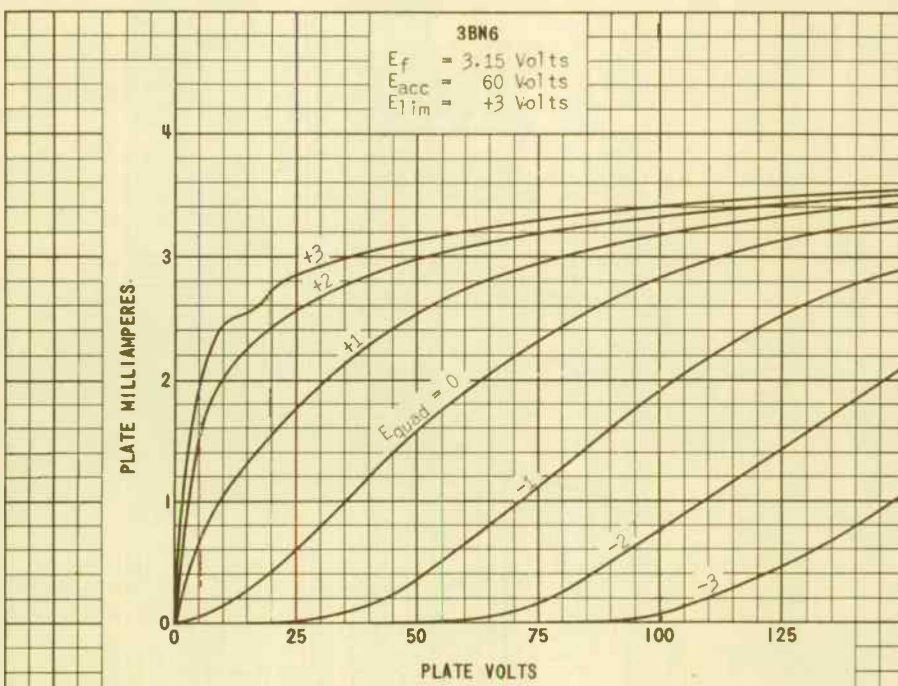
ADEQUATE SHIELDING BETWEEN COMPONENTS OF THE LIMITER GRID AND THE QUADRATURE GRID MUST BE USED TO INSURE PROPER PHASING OF THE VOLTAGE DEVELOPED ON THE QUADRATURE GRID.

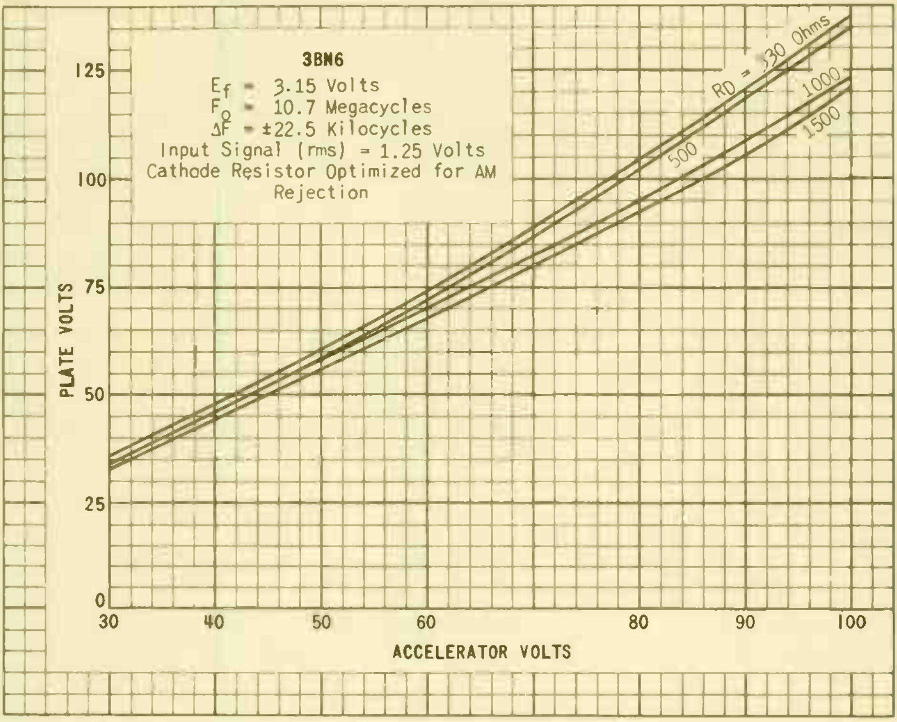
STANDARD DE-EMPHASEIS REQUIREMENTS FOR FM ARE INCLUDED.

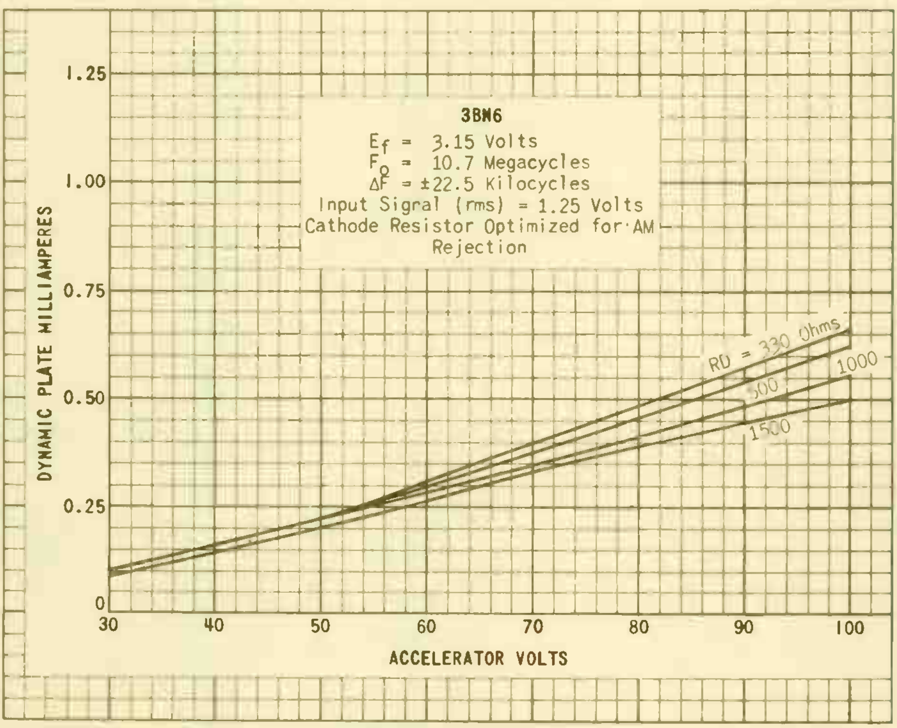
THE Q OF THE QUADRATURE GRID CIRCUIT SHOULD BE HIGH ENOUGH TO DEVELOP A MINIMUM OF 4 VOLTS (RMS) SIGNAL WITH 2 VOLTS (RMS) OF THE CENTER-FREQUENCY SIGNAL APPLIED TO THE LIMITER GRID. IT IS RECOMMENDED THAT THE COIL BE SHUNTED BY A MINIMUM OF 10 μμf. THE CAPACITANCE MAY BE COMPOSED OF TUBE INPUT CAPACITANCE,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

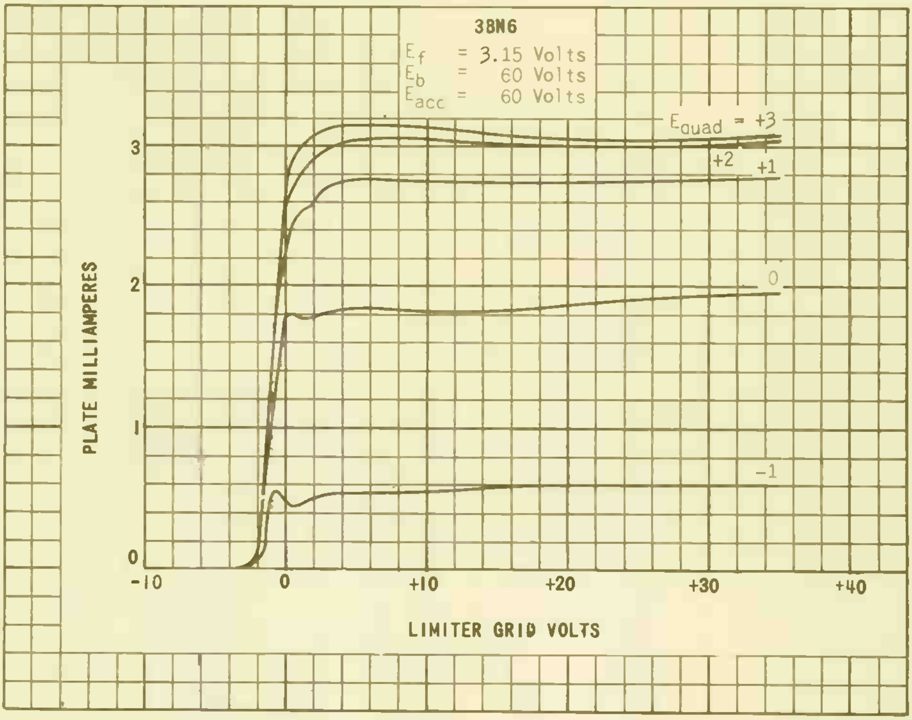
→ INDICATES A CHANGE.


3BN6
E_f = 3.15 Volts
E_b = 60 Volts
E_{acc} = 60 Volts
E_{lim} = +3.0
+1.0
0
-1.0
-1.5
PLATE MILLIAMPERES
QUADRATURE GRID VOLTS


3BN6
E_f = 3.15 Volts
E_{acc} = 60 Volts
E_{lim} = +3 Volts
+3
+2
+1
E_{quad} = 0
-1
-2
-3
PLATE MILLIAMPERES
PLATE VOLTS

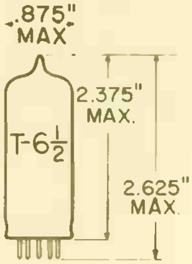

3BN6
Ef = 3.15 Volts
Fo = 10.7 Megacycles
ΔF = ±22.5 Kilocycles
Input Signal (rms) = 1.25 Volts
Cathode Resistor Optimized for AM Rejection
RD = 330 Ohms
500
1000
1500
PLATE VOLTS
0
25
50
75
100
125
30
40
50
60
80
90
100
ACCELERATOR VOLTS


3BN6
Ef = 3.15 Volts
Fo = 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



PRINTED IN U.S.A.

TUNG-SOL



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

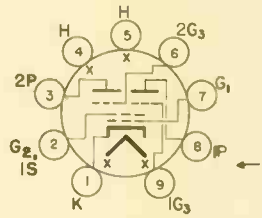
TWIN PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



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

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

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.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS – CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

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

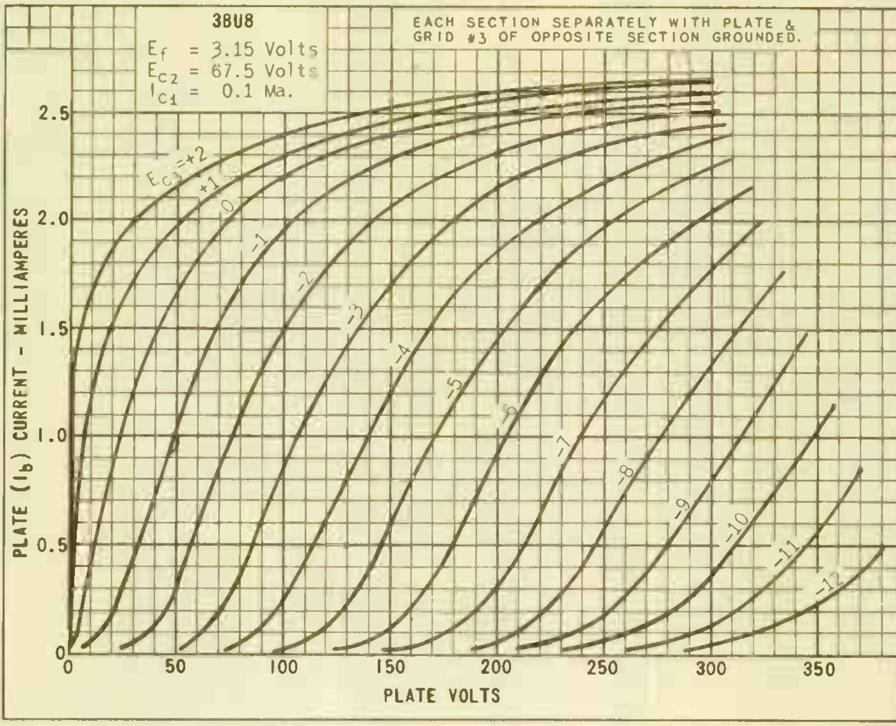
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

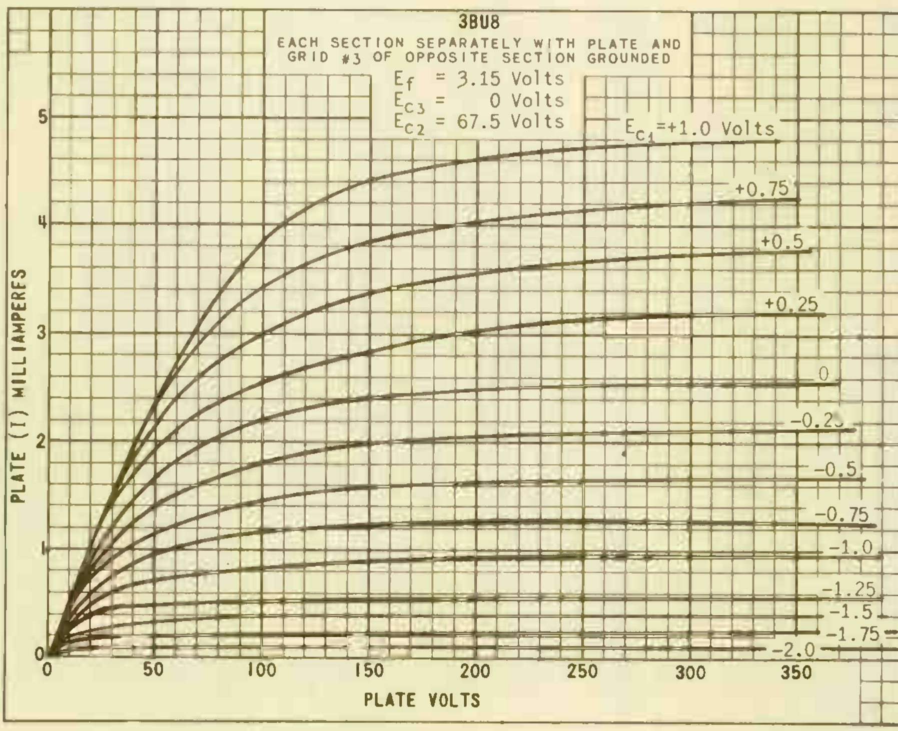
** WITH GRID CURRENT ADJUSTED FOR 100 µAMPS D-C.

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

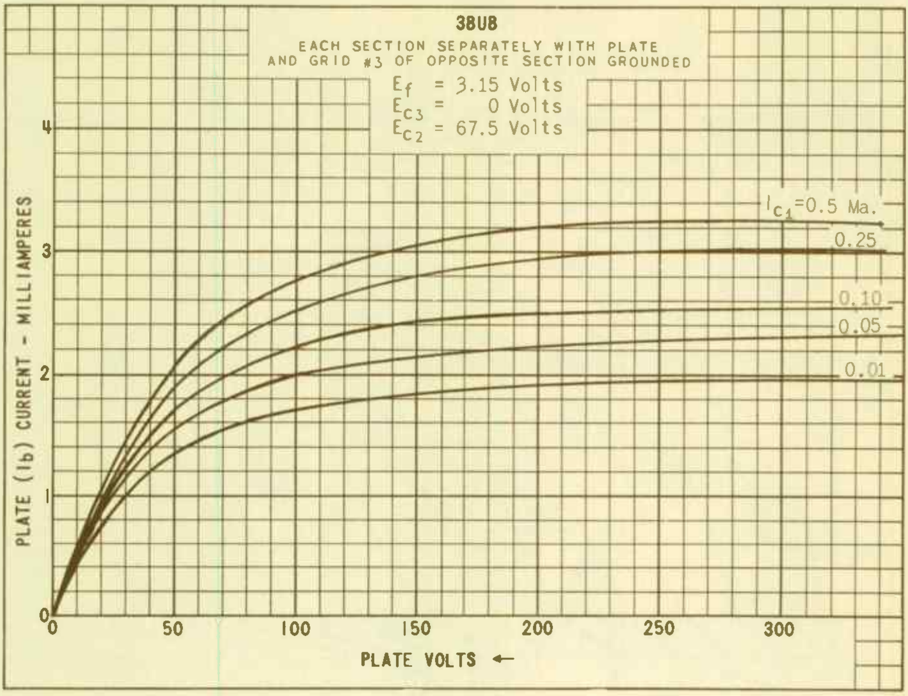
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH 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.

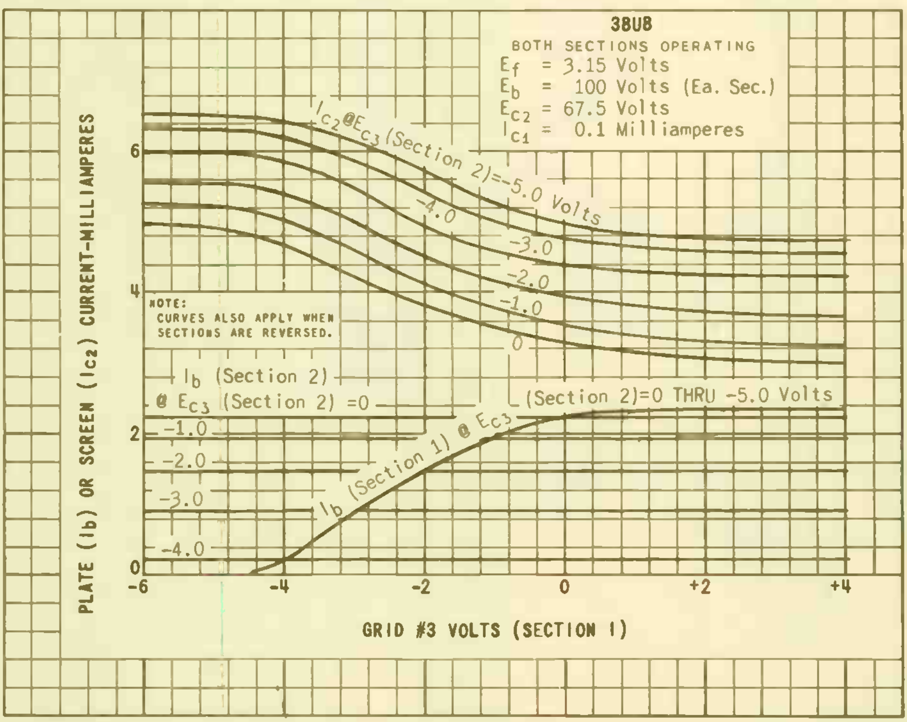
SIMILAR TYPE REFERENCE: Except for heater ratings and heater warm-up time the 3BU8 is identical to the 6BU8.

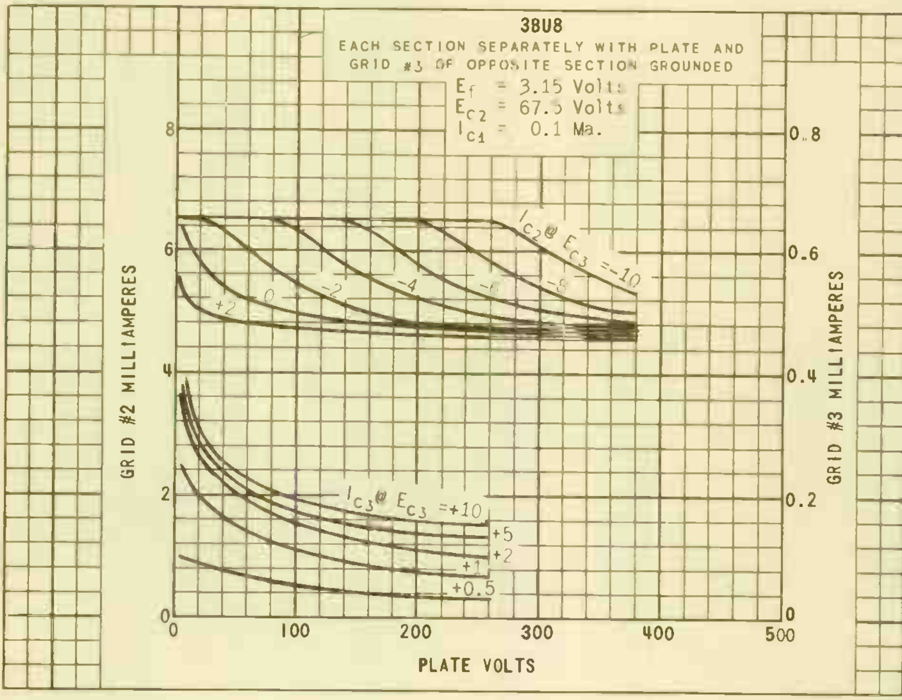


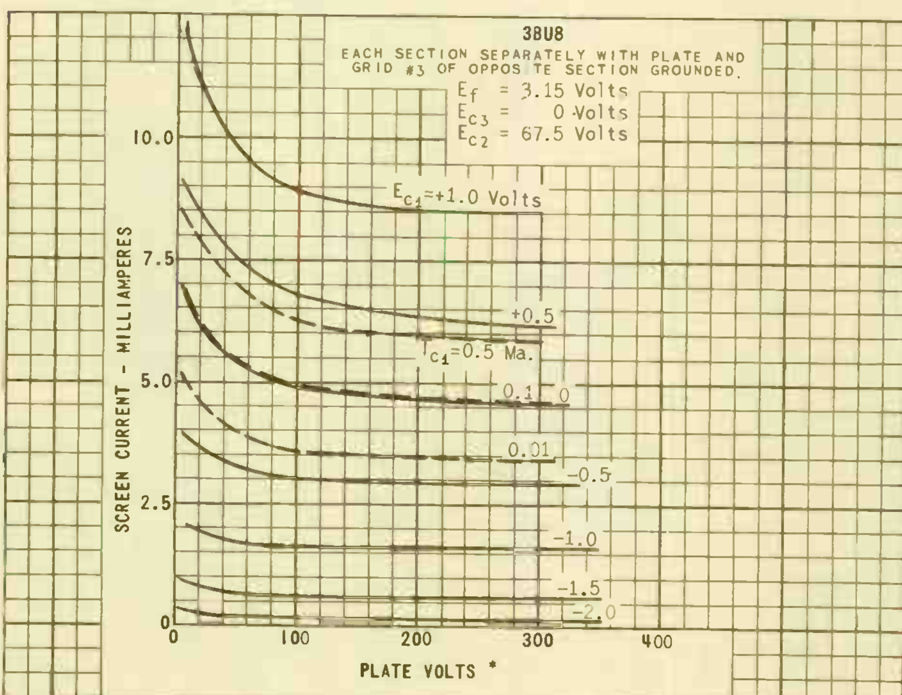


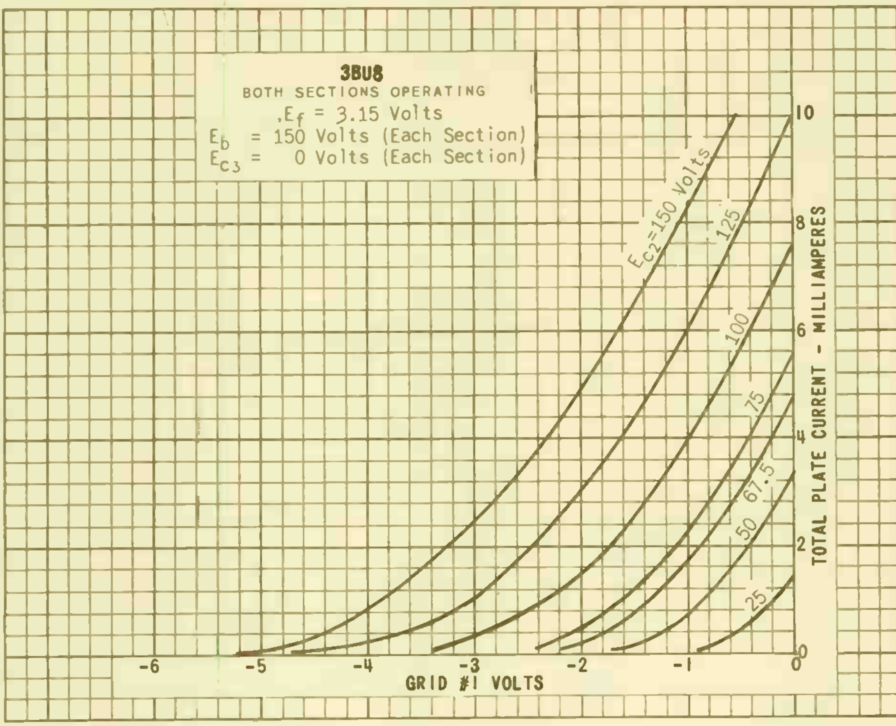
PRINTED IN U. S. A.

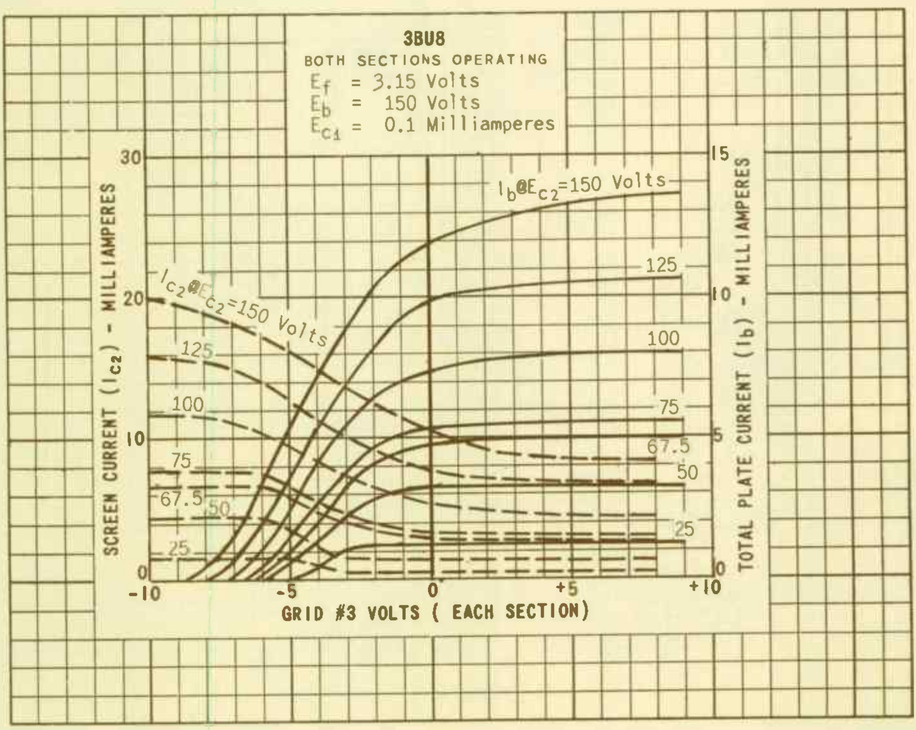

3BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
Ef = 3.15 Volts
Ec3 = 0 Volts
Ec2 = 67.5 Volts
Ic1=0.5 Ma.
0.25
0.10
0.05
0.01
PLATE (Ib) CURRENT - MILLIAMPERES
PLATE VOLTS ←
0
50
100
150
200
250
300
1
2
3
4

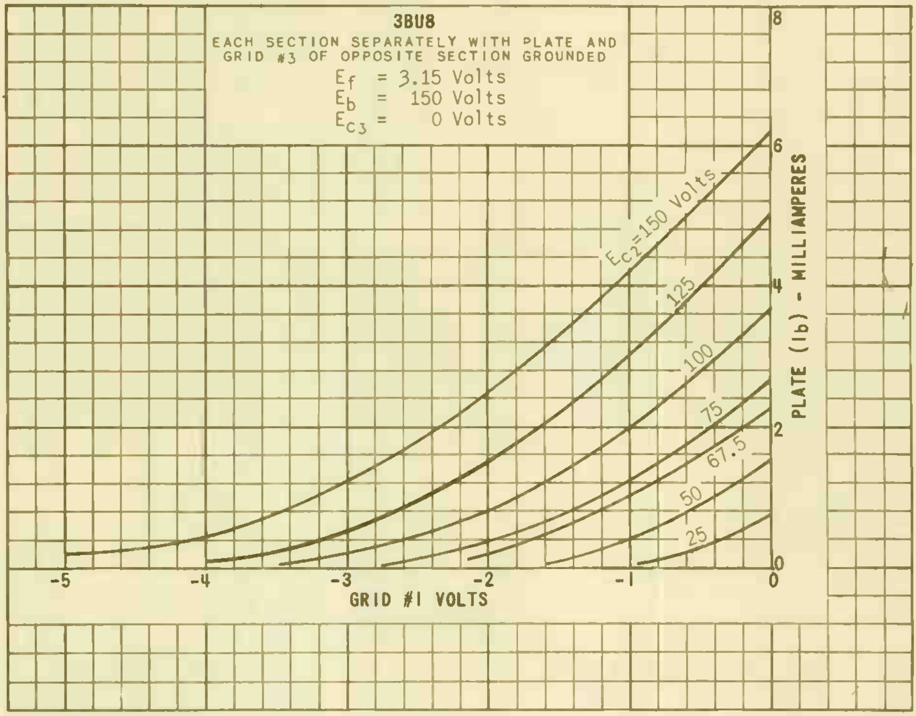

3BU8
BOTH SECTIONS OPERATING
Ef = 3.15 Volts
Eb = 100 Volts (Ea. Sec.)
Ec2 = 67.5 Volts
Ic1 = 0.1 Milliamperes
Ic2 @Ec3 (Section 2)=-5.0 Volts
-4.0
-3.0
-2.0
-1.0
0
NOTE: CURVES ALSO APPLY WHEN SECTIONS ARE REVERSED.
Ib (Section 2)
@ Ec3 (Section 2) =0
-1.0
-2.0
-3.0
-4.0
Ib (Section 1) @ Ec3 (Section 2)=0 THRU -5.0 Volts
PLATE (Ib) OR SCREEN (Ic2) CURRENT-MILLIAMPERES
GRID #3 VOLTS (SECTION 1)
-6
-4
-2
0
+2
+4
2
4
6

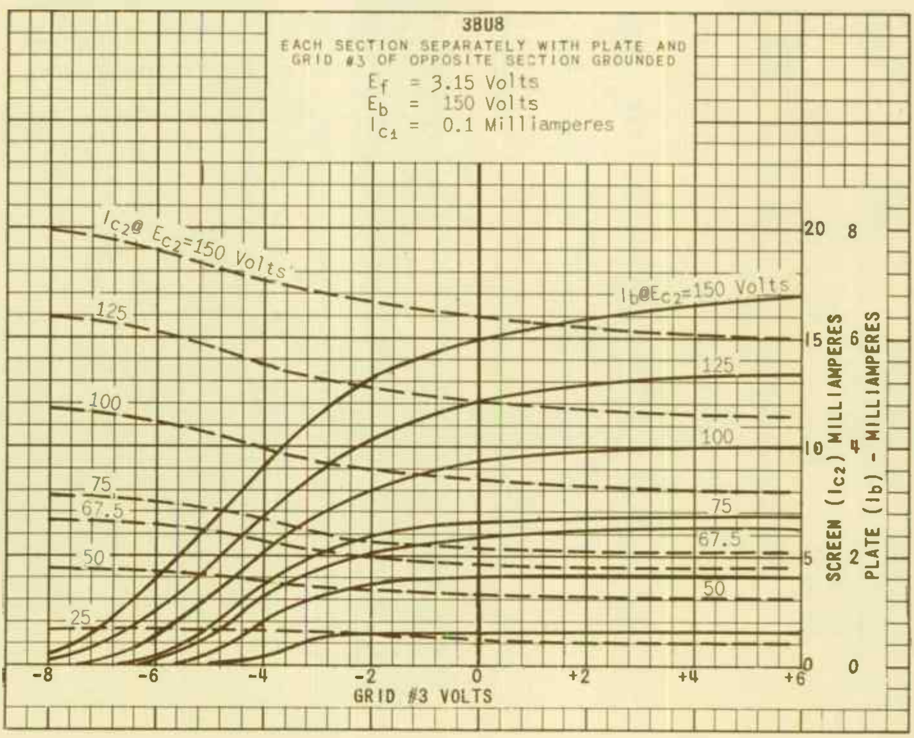

3BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 3.15 Volts
E_{c2} = 67.5 Volts
I_{c1} = 0.1 Ma.
I_{c2} @ E_{c3} = -10
-8
-6
-4
-2
0
+2
I_{c3} @ E_{c3} = +10
+5
+2
+1
+0.5
GRID #2 MILLIAMPERES
GRID #3 MILLIAMPERES
PLATE VOLTS


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
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 *

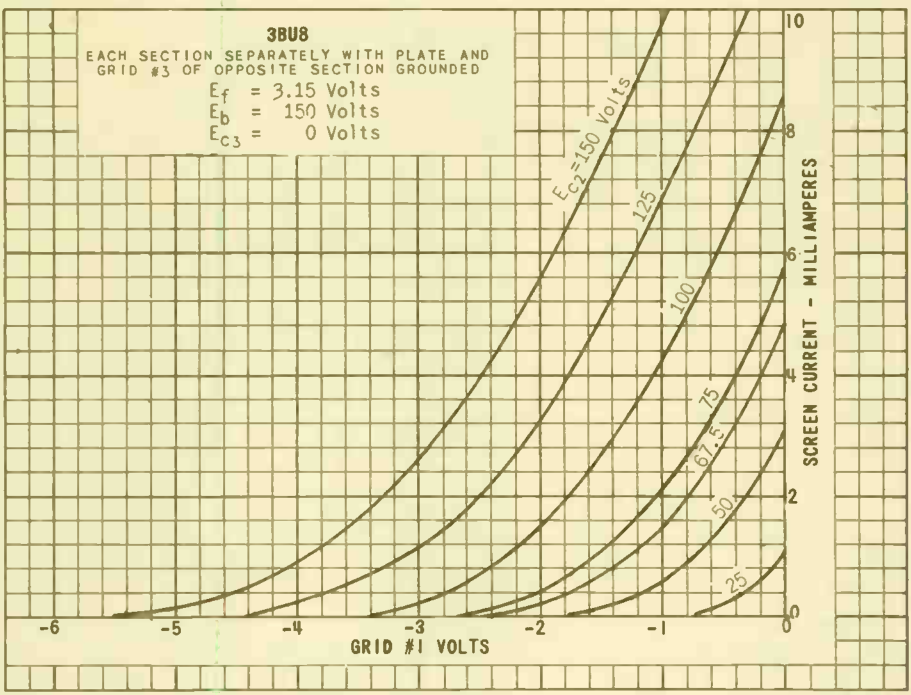

3BU8
BOTH SECTIONS OPERATING
E_f = 3.15 Volts
E_b = 150 Volts (Each Section)
E_{c3} = 0 Volts (Each Section)
E_{c2}=150 Volts
125
100
75
67.5
50
25
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
10
8
6
4
2
0
TOTAL PLATE CURRENT - MILLIAMPERES

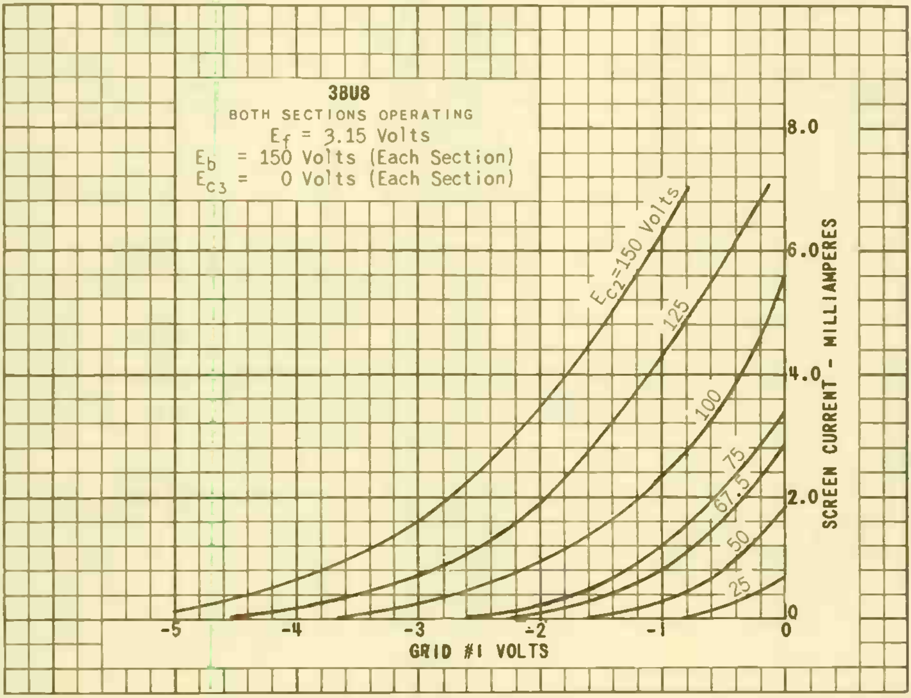

3BU8
BOTH SECTIONS OPERATING
E_f = 3.15 Volts
E_b = 150 Volts
E_{c1} = 0.1 Milliamperes
I_b@E_{c2}=150 Volts
125
100
75
67.5
50
25
I_{c2}@E_{c2}=150 Volts
125
100
75
67.5
50
25
30
20
10
0
SCREEN CURRENT (I_{c2}) - MILLIAMPERES
15
10
5
0
TOTAL PLATE CURRENT (I_b) - MILLIAMPERES
-10
-5
0
+5
+10
GRID #3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





PRINTED IN U. S. A.

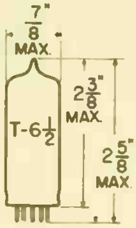

3BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
Ef = 3.15 Volts
Eb = 150 Volts
Ec3 = 0 Volts
Ec2=150 Volts
125
100
75
67.5
50
25
GRID #1 VOLTS
SCREEN CURRENT - MILLIAMPERES
-6
-5
-4
-3
-2
-1
0
10
8
6
4
2
0


3BU8
BOTH SECTIONS OPERATING
Ef = 3.15 Volts
Eb = 150 Volts (Each Section)
Ec3 = 0 Volts (Each Section)
Ec2=150 Volts
125
100
75
67.5
50
25
GRID #1 VOLTS
SCREEN CURRENT - MILLIAMPERES
-5
-4
-3
-2
-1
0
8.0
6.0
4.0
2.0
0

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

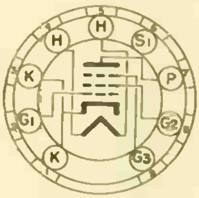
COATED UNIPOTENTIAL CATHODE

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

TUNG-SOL

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

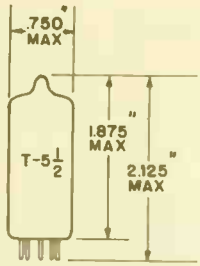
OBSERVATION

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

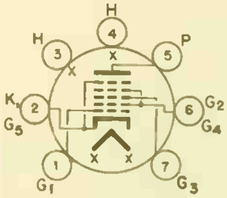
COATED UNIPOTENTIAL CATHODE

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

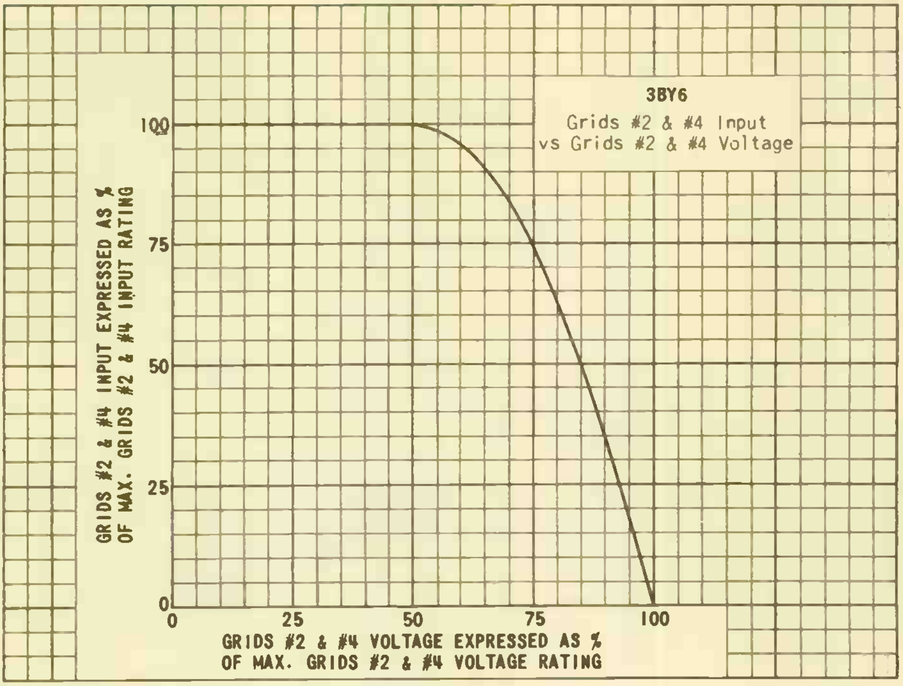
PLATE VOLTAGE	10	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 & #4 VOLTAGE	25	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE CURRENT	1.4	MA.
GRIDS #2 & #4 CURRENT	3.5	MA.
GRID #3 BIAS VOLTS (APPROX.) FOR PLATE VOLTAGE OF 25 VOLTS, GRIDS #2 & #4 VOLTAGE OF 25 VOLTS, GRID #1 VOLTAGE OF 0 VOLTS AND PLATE CURRENT OF 50 µAMP.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

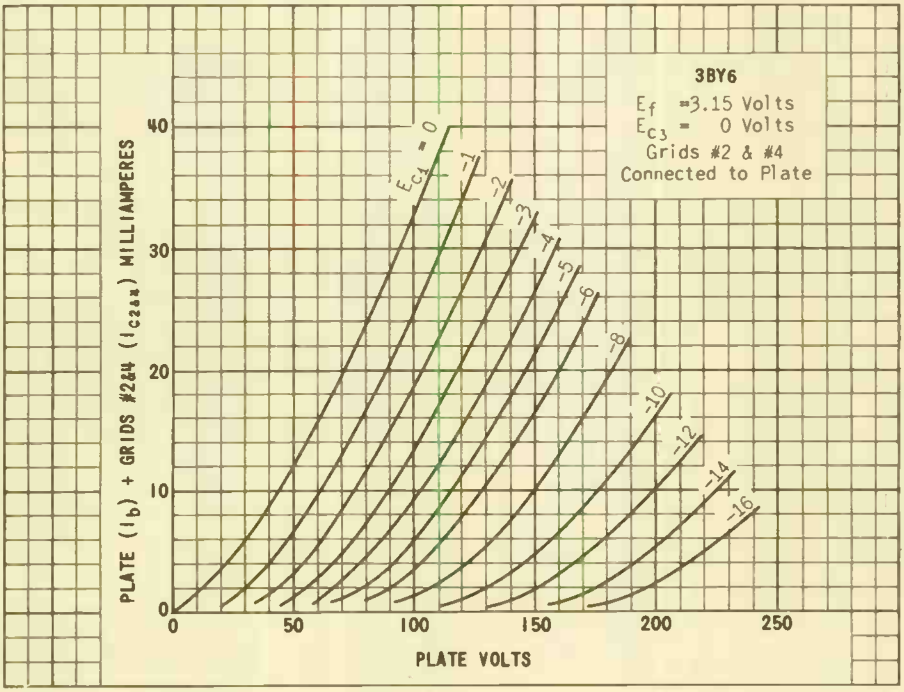
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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

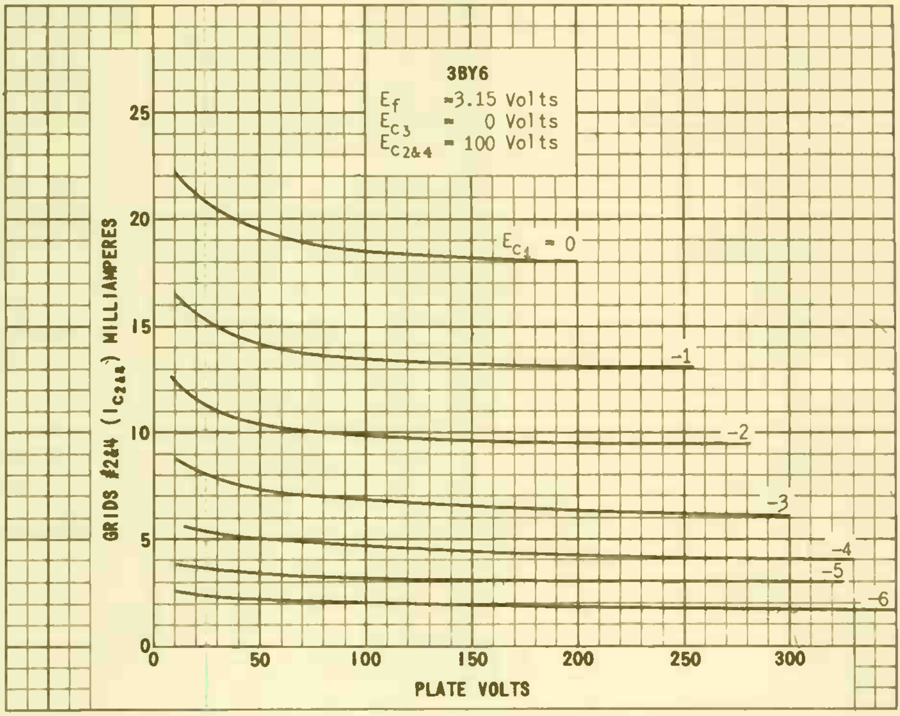
→ INDICATES A CHANGE.

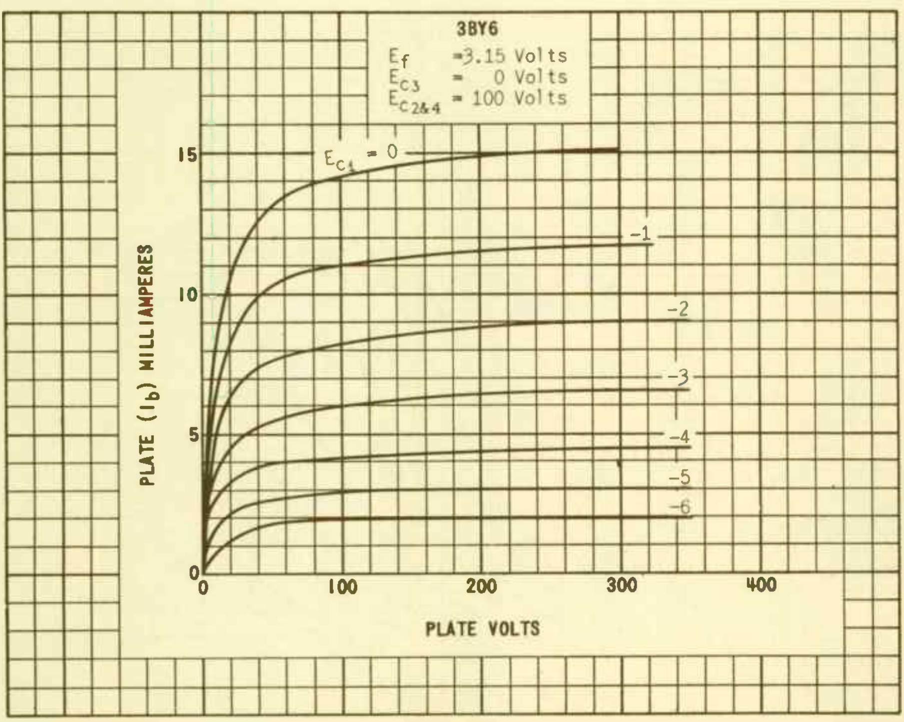
* INDICATES AN ADDITION.

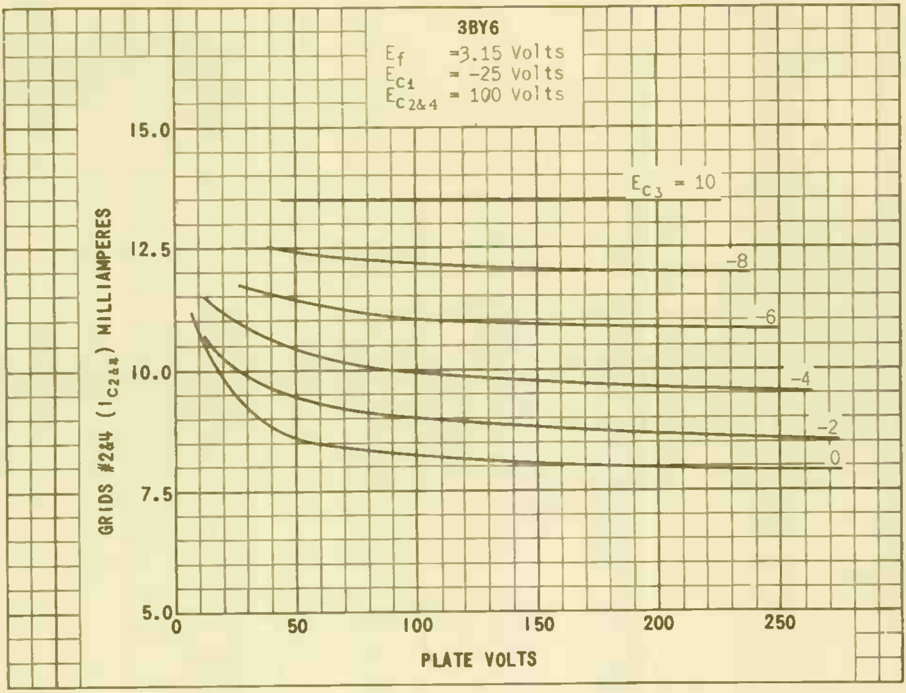

3BY6
Grids #2 & #4 Input
vs Grids #2 & #4 Voltage
GRIDS #2 & #4 INPUT EXPRESSED AS %
OF MAX. GRIDS #2 & #4 INPUT RATING
GRIDS #2 & #4 VOLTAGE EXPRESSED AS %
OF MAX. GRIDS #2 & #4 VOLTAGE RATING
0
25
50
75
100


3BY6
E_f = 3.15 Volts
E_{c3} = 0 Volts
Grids #2 & #4
Connected to Plate
E_{c1} = 0
-1
-2
-3
-4
-5
-6
-8
-10
-12
-14
-16
PLATE (I_b) + GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
50
100
150
200
250

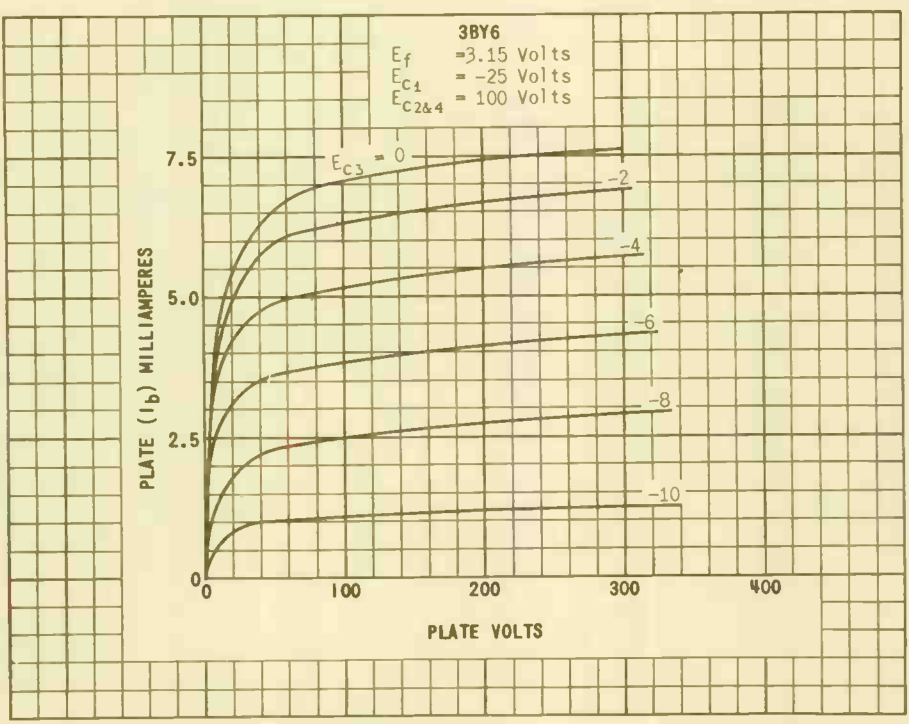
3BY6


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



3BY6
E_f =3.15 Volts
E_{c1} = -25 Volts
$E_{c2\&4}$ = 100 Volts
E_{c3} = 10
-8
-6
-4
-2
0
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
15.0
12.5
10.0
7.5
5.0
0
50
100
150
200
250
PLATE VOLTS

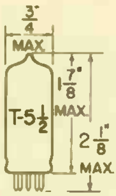


3BY6
E_f =3.15 Volts
E_{c1} = -25 Volts
$E_{c2\&4}$ = 100 Volts
E_{c3} = 0
-2
-4
-6
-8
-10
PLATE (I_b) MILLIAMPERES
7.5
5.0
2.5
0
0
100
200
300
400
PLATE VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

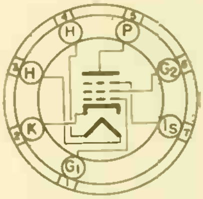


GLASS BULB

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

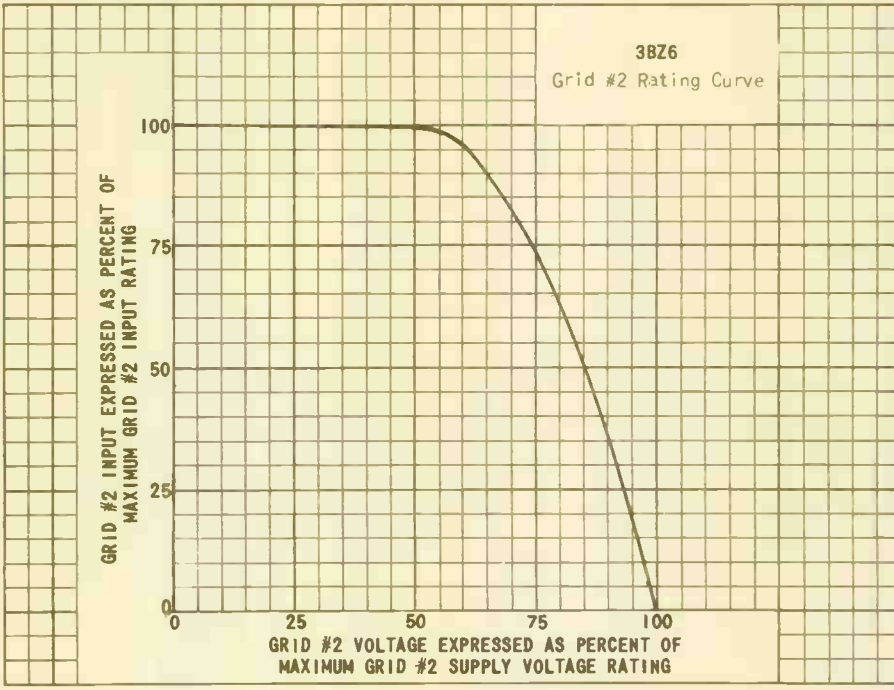
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

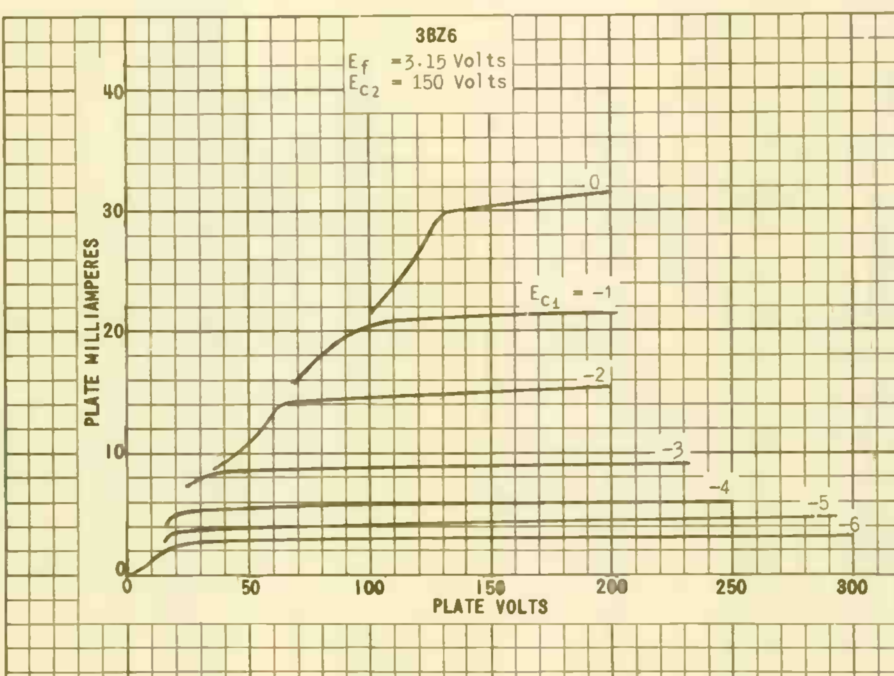
CLASS A_1 AMPLIFIER

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	6 100	μMHOS
PLATE CURRENT	11	MA.
GRID #2 CURRENT	2.6	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 50 μMHOS	−23	VOLTS

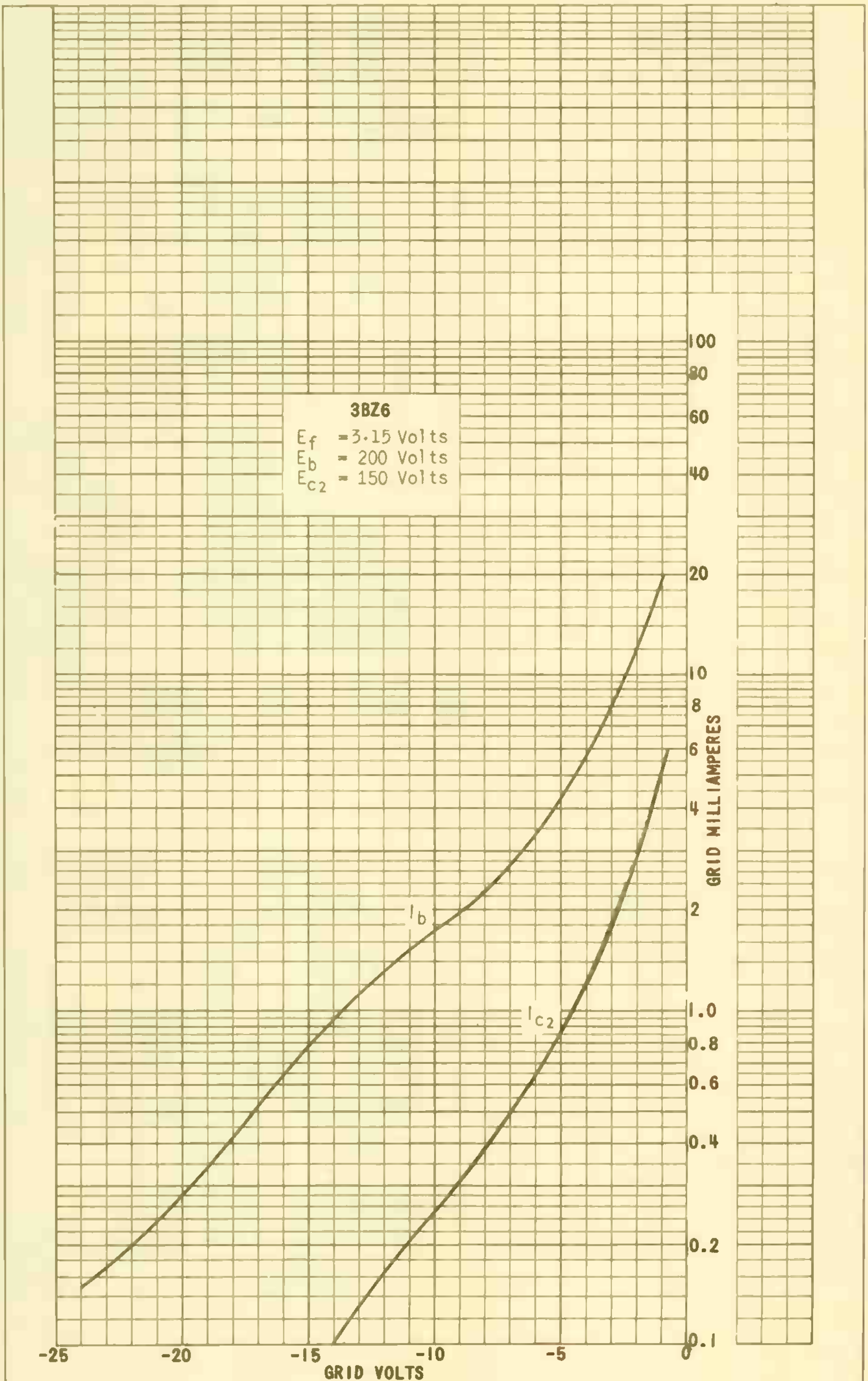
[B] DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT 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.

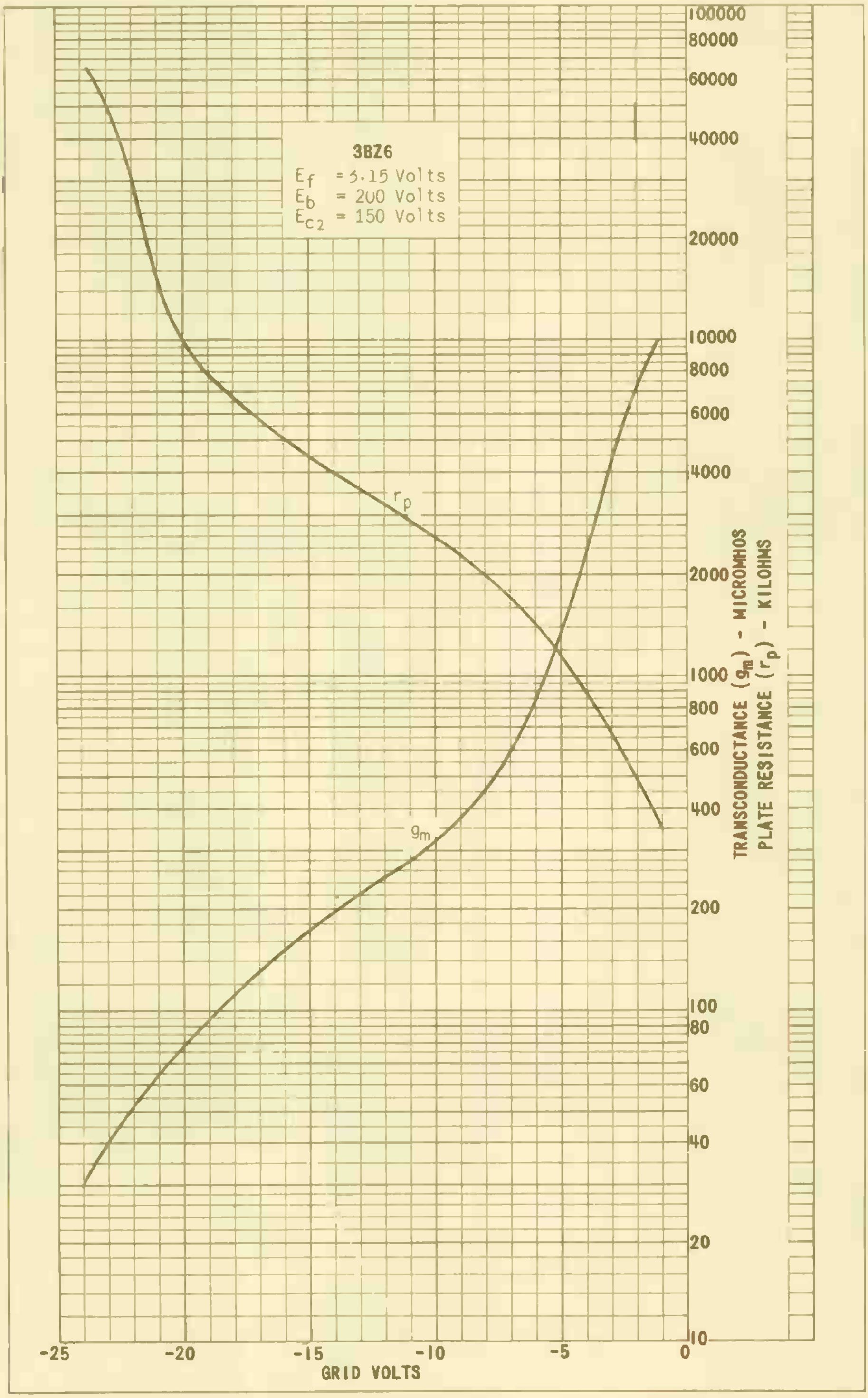
[C] THE DC COMPONENT MUST NOT EXCEED 200 VOLTS.





PRINTED IN U.S.A.


3BZ6
Ef =3.15 Volts
Eb = 200 Volts
Ec2 = 150 Volts
Ib
Ic2
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
Ef = 3.15 Volts
Eb = 200 Volts
Ec2 = 150 Volts
rp
gm
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE RESISTANCE (rp) - KILOHMS
100000
80000
60000
40000
20000
10000
8000
6000
4000
2000
1000
800
600
400
200
100
80
60
40
20
10
-25
-20
-15
-10
-5
0
GRID VOLTS

TUNG-SOL

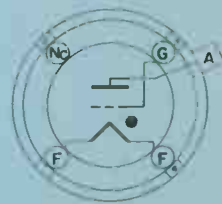
THYRATRON

ARGON AND MERCURY - VAPOR

FILAMENT

AC OR DC

VERTICAL MOUNTING POSITION
(BASE DOWN)



BOTTOM VIEW

GLASS BULB

THE 3C23 IS A THREE ELECTRODE, ARGON AND MERCURY-VAPOR FILLED THYRATRON WITH NEGATIVE CONTROL CHARACTERISTIC DESIGNED FOR GRID CONTROLLED RECTIFIER, MOTOR CONTROL, OR RELAY SERVICE. THE ADDITION OF ARGON GAS TO THE MERCURY-VAPOR ATMOSPHERE PERMITS THE TUBE TO START CONDUCTION AT LOW TEMPERATURES.

THE 3C23 EMPLOYS A MEDIUM, 4-PIN BAYONET BASE.

ELECTRICAL DATA

FILAMENT VOLTAGE	2.5±0.125	VOLTS
FILAMENT CURRENT @ Ef = 2.5 VOLTS	7	AMPS
CATHODE HEATING TIME — MINIMUM	15	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	1.8	µµf
DE-IONIZATION TIME — APPROXIMATE		
ANODE VOLTS = 120, ANODE CURRENT = 1.5 AMPS GRID VOLTS = - 20, GRID RESISTOR = 10,000 OHMS	360	µµf
ANODE VOLTS = 120, ANODE CURRENT = 1.5 AMPS GRID VOLTS = - 500 GRID RESISTOR = 100,000 OHMS	60	µµf
ANODE VOLTAGE DROP — APPROXIMATE		
INITIAL	10	VOLTS
END OF LIFE	20	VOLTS

MECHANICAL DATA

MOUNTING POSITION	VERTICAL BASE DOWN
TYPE OF COOLING	CONVECTION
BULB	ST16
BASE	A4-10 MEDIUM
CAP	C1-5 MEDIUM
NET WEIGHT	3 OUNCES MAXIMUM
SOCKET	MEDIUM 4 PIN BAYONET

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

ABSOLUTE VALUES

	MIN.	MAX.	
PEAK ANODE VOLTAGE			
FORWARD	---	1250	VOLTS
REVERSE	---	1250	VOLTS
GRID VOLTAGE			
PEAK OR DC BEFORE TUBE CONDUCTION	---	-500	VOLTS
AVERAGE DURING TUBE CONDUCTION - NOTE 1	---	-10	VOLTS
ANODE CURRENT			
PEAK	---	6	AMPS.
AVERAGE - NOTE 2	---	1.5	AMPS.
FAULT - FOR DURATION OF 0.1 SEC. MAX. - NOTE 3	---	120	AMPS.
GRID CURRENT			
AVERAGE - NOTE 4	---	+0.01	AMP.
OPERATING FREQUENCY (PER SECOND)	---	420	CYCLES
ALTITUDE	---	10,000	FEET
TEMPERATURE RANGE - NOTE 5	40	80	°C
FILAMENT VOLTAGE	2.37	2.63	VOLTS

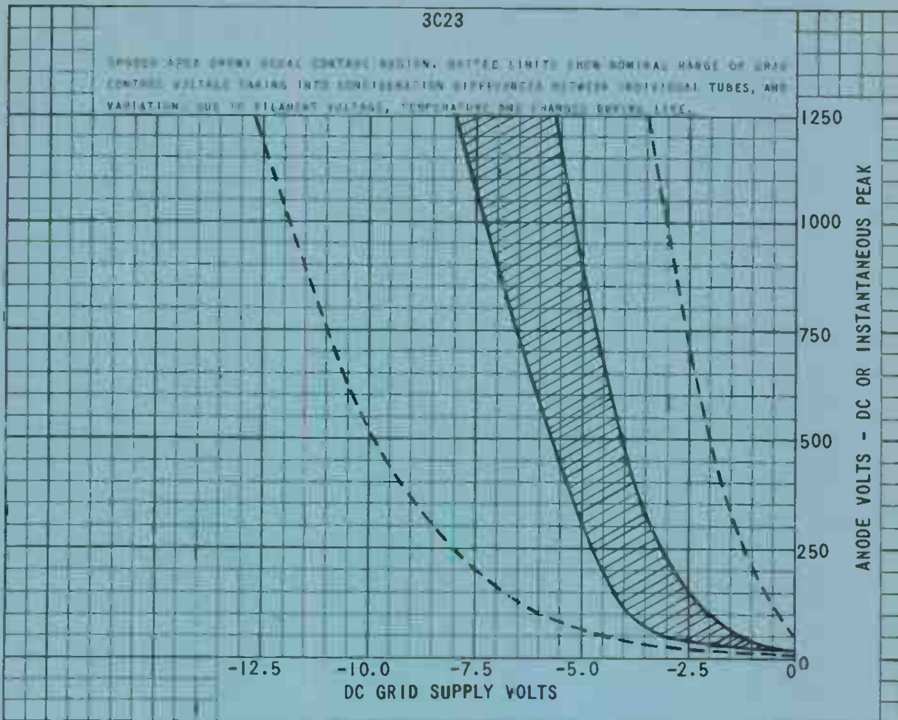
1. AVERAGED OVER ONE CONDUCTING PERIOD.

2. AVERAGED OVER ANY INTERVAL OF FIVE SECONDS MAXIMUM.

3. THE EQUIPMENT DESIGNER SHOULD LIMIT THE SHORT CIRCUIT CURRENT TO 120 AMPERES CIRCUITWISE. IT SHOULD BE UNDERSTOOD THAT WHILE THE TUBE MAY STAND SEVERAL FAULTS AT THIS MAGNITUDE OF CURRENT, EACH FAULT WILL ADVERSELY AFFECT TUBE LIFE.

4. AVERAGED OVER THE PERIOD OF GRID CONDUCTION.

5. THE RECOMMENDED OPERATING RANGE FOR THIS TUBE IS FROM 40° TO 80° CENTIGRADE. OPERATION BETWEEN -55° AND +40° CENTIGRADE AT REDUCED RATINGS, OR "STARTS" IN THIS TEMPERATURE RANGE ARE PERMISSIBLE, BUT WILL RESULT IN CONSIDERABLY SHORTENED LIFE.



OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

APPLICATION NOTES

THYRATRON TUBES, IF CORRECTLY USED, WILL GIVE MANY THOUSANDS OF HOURS OF RELIABLE SERVICE. THE CORRECT USE OF A TUBE INVOLVES AMONG OTHER THINGS ADHERENCE TO THE FOLLOWING RULES:

1. AVOID COLD STARTS. THE HEAT SHIELDED, OXIDE COATED FILAMENT SHOULD BE ENERGIZED BEFORE THE ANODE VOLTAGE IS APPLIED IN ORDER TO OBTAIN MAXIMUM LIFE.

2. AVOID OPERATING THE TUBE OUTSIDE OF THE SPECIFIED FILAMENT VOLTAGE RANGE.

3. AVOID EXCEEDING THE RATED PEAK INVERSE VOLTAGE. EXCESS INVERSE VOLTAGE CAN CAUSE EITHER AN IMMEDIATE FAILURE OR A RAPID DECLINE IN USEFUL LIFE.

NO CLEAR CUT METHOD OF FORETELLING TUBE FAILURE HAS BEEN DEVISED. PERIODIC REPLACEMENT OF A TUBE AS A ROUTINE PREVENTIVE MAINTENANCE DEVICE IS NOT RECOMMENDED AS A TUBE THAT HAS OPERATED FOR SEVERAL THOUSAND HOURS MAY BE GOOD FOR SEVERAL MORE THOUSAND HOURS OF USEFUL OPERATION. QUITE OFTEN MAINTENANCE PERSONNEL CAN, AFTER SOME EXPERIENCE WITH A PIECE OF EQUIPMENT, ANTICIPATE TUBE FAILURE BY OBSERVATION. VISUAL CHECKS OF TUBE (ARC) DROP WILL INDICATE TUBES APPROACHING END OF LIFE. TUBE DROP VOLTAGES CONSIDERABLY HIGHER THAN THAT OF THE LAST READINGS, OR READINGS ABOVE 20 VOLTS INDICATE TUBES THAT MAY SOON FAIL. WHILE SUCH A READING CAN BE TAKEN DIRECTLY AT THE TUBE IN THE OPERATING EQUIPMENT, IT IS A DANGEROUS PRACTICE. THE VOLTAGES AT WHICH THIS TUBE NORMALLY OPERATES ARE LETHAL.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

APPLICATION NOTES - CONT'D.

A MORE PRACTICAL AND EXACT MEASUREMENT IS OBSERVING THE TUBE VOLTAGE DROP IN A TEST JIG WHILE IT PASSES ONE OR TWO HIGH CURRENT PULSES. SUCH A JIG IS ILLUSTRATED IN FIGURE 1. THE OSCILLOSCOPE IS CALIBRATED BY FIRST SETTING SWITCH S2 TO CURRENT CHECK. MOMENTARY CONTACT SWITCH S1 IS THEN TAPPED WHILE CURRENT SET RESISTOR R2 IS ADJUSTED UNTIL A PATTERN 8 VOLTS HIGH APPEARS ON THE OSCILLOSCOPE SCREEN. THIS INDICATES THAT A PEAK CURRENT OF EIGHT AMPERES IS FLOWING THROUGH THE TUBE UNDER TEST AND THROUGH CALIBRATING RESISTOR R3. THE TUBE VOLTAGE DROP CAN THEN BE READ DIRECTLY IN VOLTS ON THE OSCILLOSCOPE SCALE BY SETTING SWITCH S2 TO THE TEST POSITION AND TAPPING SWITCH S1. A NEW TUBE WILL HAVE A VOLTAGE DROP OF APPROXIMATELY 10 VOLTS. A TUBE APPROACHING THE END OF LIFE MAY HAVE A VOLTAGE DROP OF 20 VOLTS.

GRID-CONTROLLED THYRATRONS CAN BE INCORPORATED INTO CIRCUITS TO PROVIDE NUMEROUS SERVICES INCLUDING THE SPEED CONTROL OF DC MOTORS, DC TO AC INVERSION, AC TO DC RECTIFICATION, AND SUPPLYING VARIABLE AC POWER FROM AN AC SOURCE.

FIGURE 2 ILLUSTRATES ONE METHOD OF CONVERTING AC TO DC. THE MAGNITUDE OF THE DC OUTPUT VOLTAGE IS CONTROLLED BY THE VARIABLE RESISTOR WHICH CONTROLS THE FIRING ANGLE, OR GRID VOLTAGE PHASE, OF THE THYRATRONS. THE USE OF THYRATRONS TO SUPPLY A VARIABLE AC OUTPUT FROM A FIXED AC SOURCE IS SHOWN IN FIGURE 3. AGAIN, THE VARIABLE RESISTOR SERVES TO CONTROL THE PHASE ANGLE OF THE APPLIED GRID VOLTAGE AND THUS THE OUTPUT VOLTAGE.

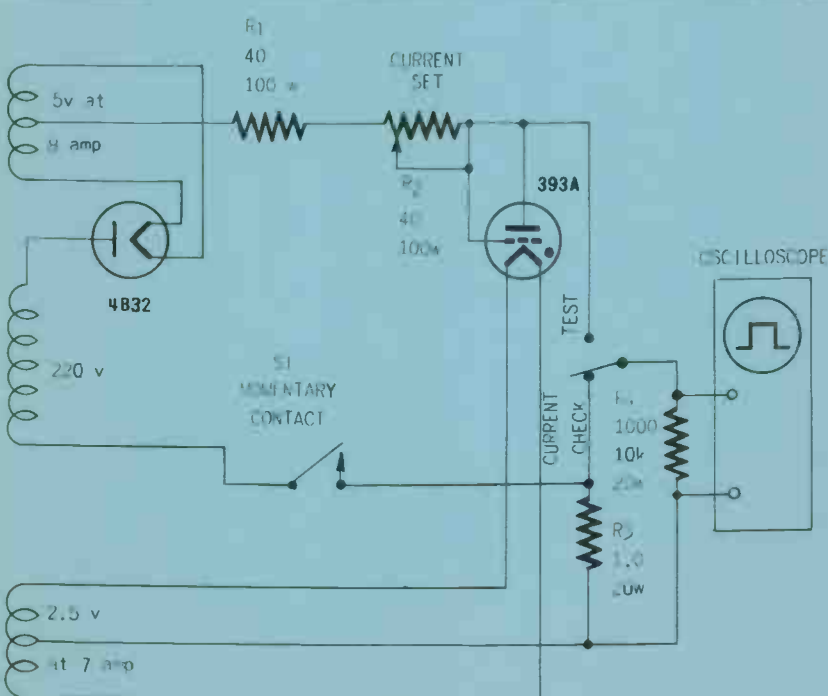


FIGURE 1

TUNG-SOL

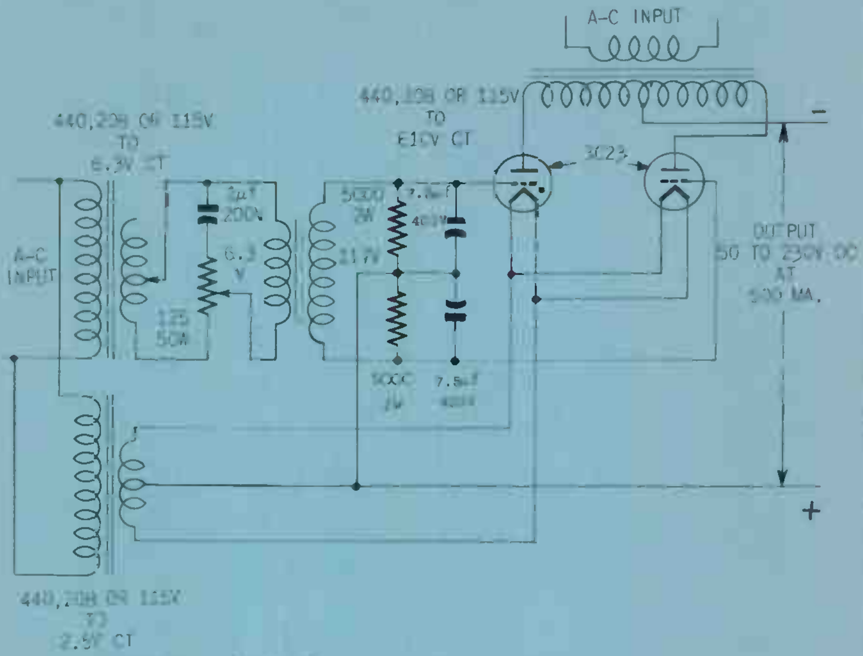


FIG. 2 THYRATRON POWER SUPPLY PROVIDING VARIABLE D-C OUTPUT FROM A-C INPUT

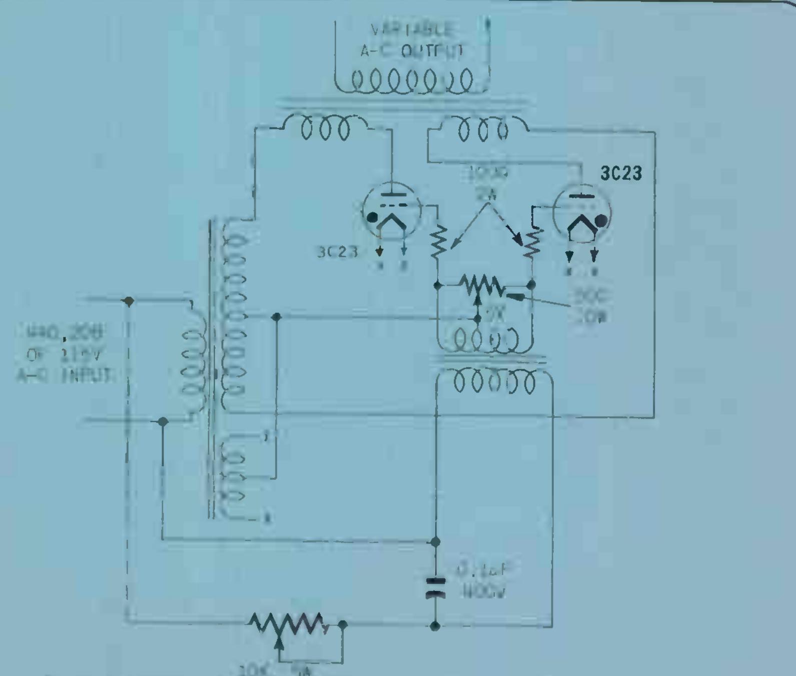
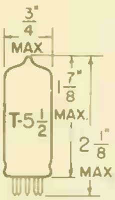


FIG. 3 THYRATRON POWER SUPPLY PROVIDING VARIABLE A-C OUTPUT FROM A-C INPUT

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 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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

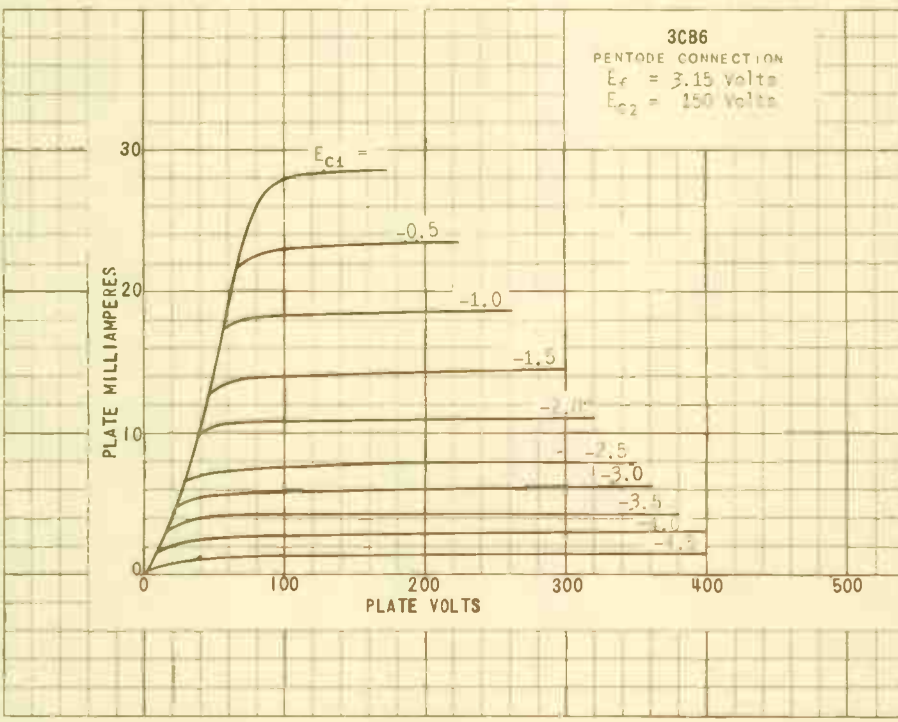
CONTINUED FROM PRECEDING PAGE

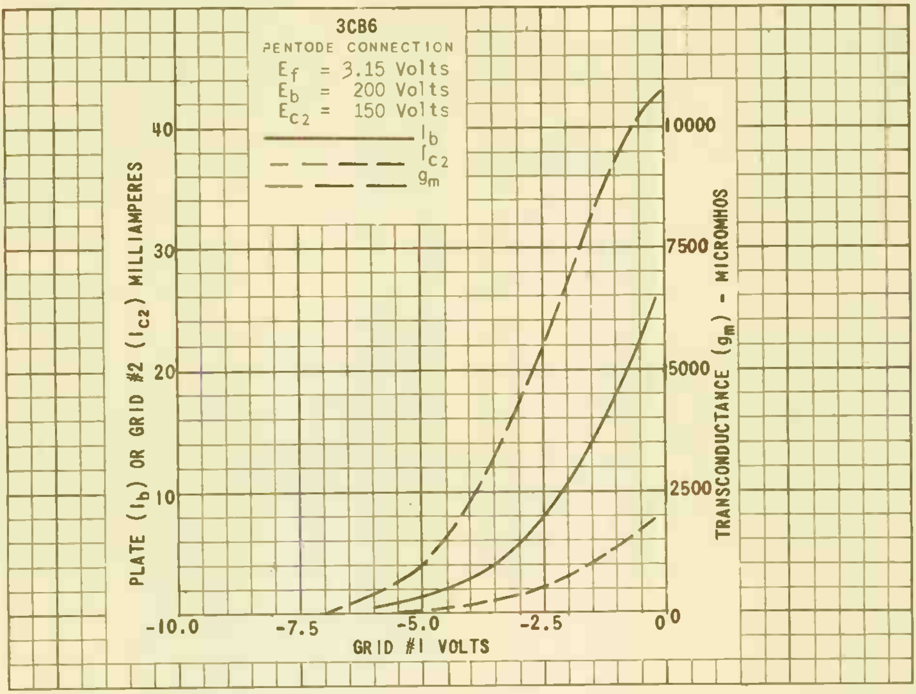
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS ←

HEATER VOLTAGE	3.15	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	120	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	15.0	MA.
GRID #2 CURRENT	3.7	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b=10 µA.	-6.5	VOLTS
PLATE CURRENT AT E_{c1}=-3V., R_k=0	2.6	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.





PRINTED IN U.S.A.

TUNG-SOL

PENTODE

MINIATURE TYPE

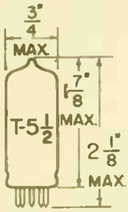
COATED UNIPOTENTIAL CATHODE

HEATER

3.15 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB

BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BD

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

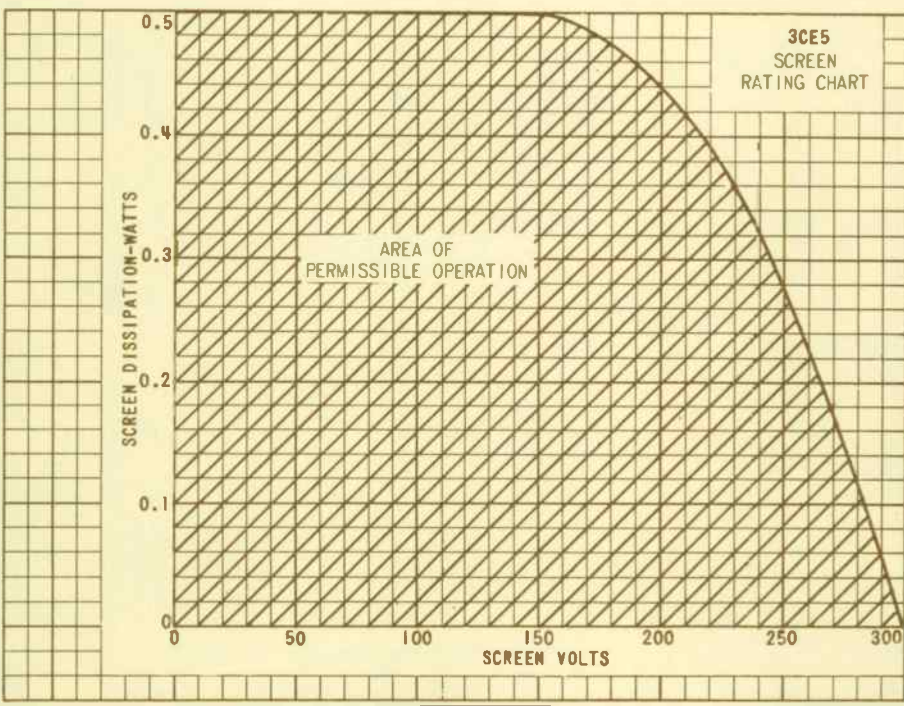
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

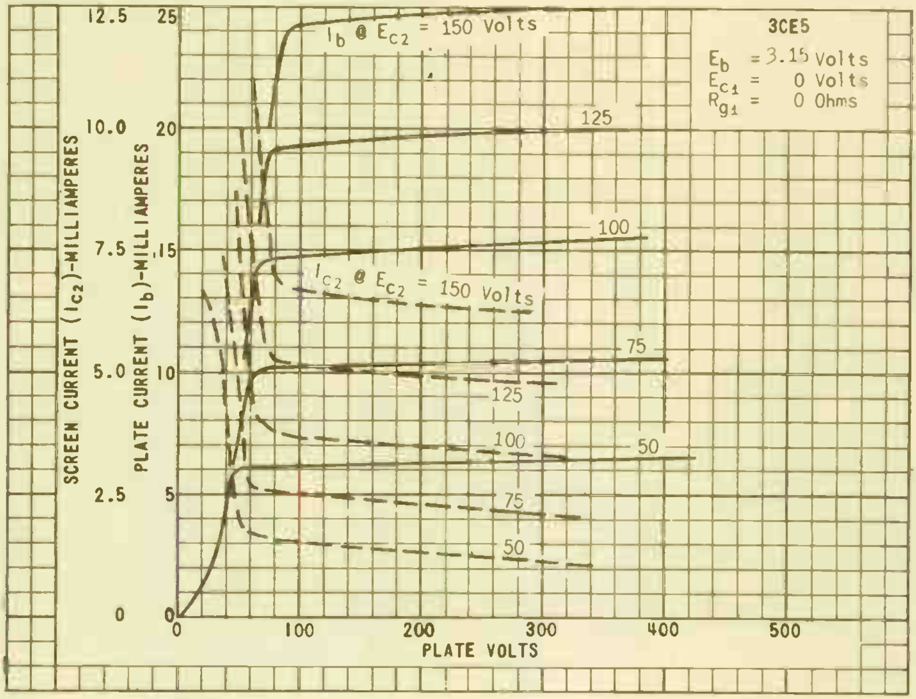
CLASS A_1 AMPLIFIER

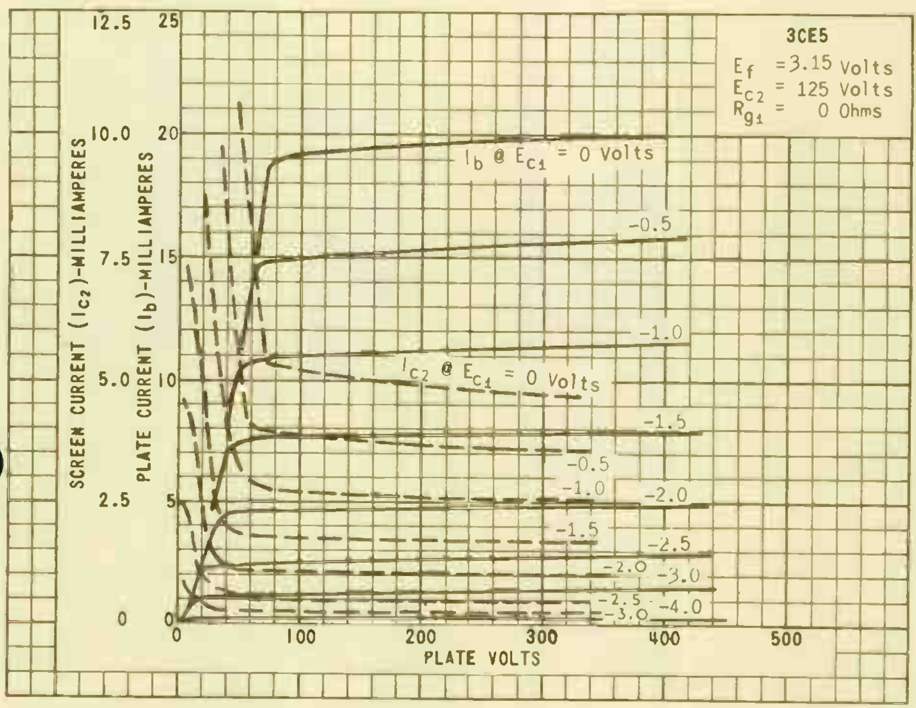
HEATER VOLTAGE	3.15	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	125	VOLTS
SCREEN VOLTAGE	125	VOLTS
* GRID #1 SUPPLY VOLTAGE	-1.0	VOLTS
GRID #1 RESISTOR (BYPASSED)	1.0	MEGOHMS
PLATE RESISTANCE (APPROX.)	0.3	MEGOHMS
TRANSCONDUCTANCE	7 600	μMHOS
PLATE CURRENT	11	MA.
SCREEN CURRENT	2.8 ←	MA.
GRID #1 VOLTAGE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

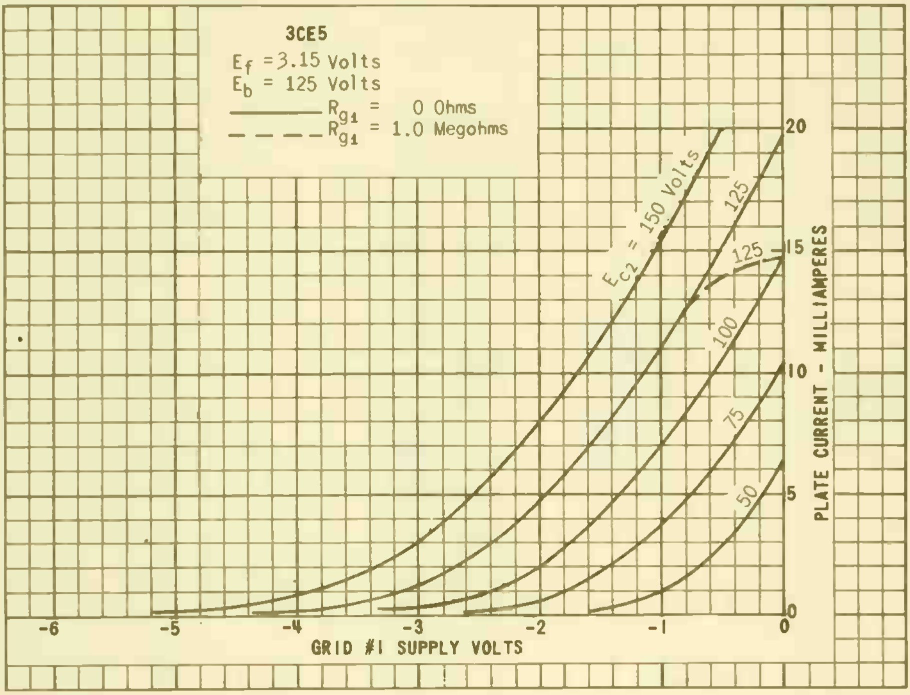
SIMILAR TYPE REFERENCE. *Except for heater ratings, the 3CE5 is identical to the 4CE5 and the 6CE5.*

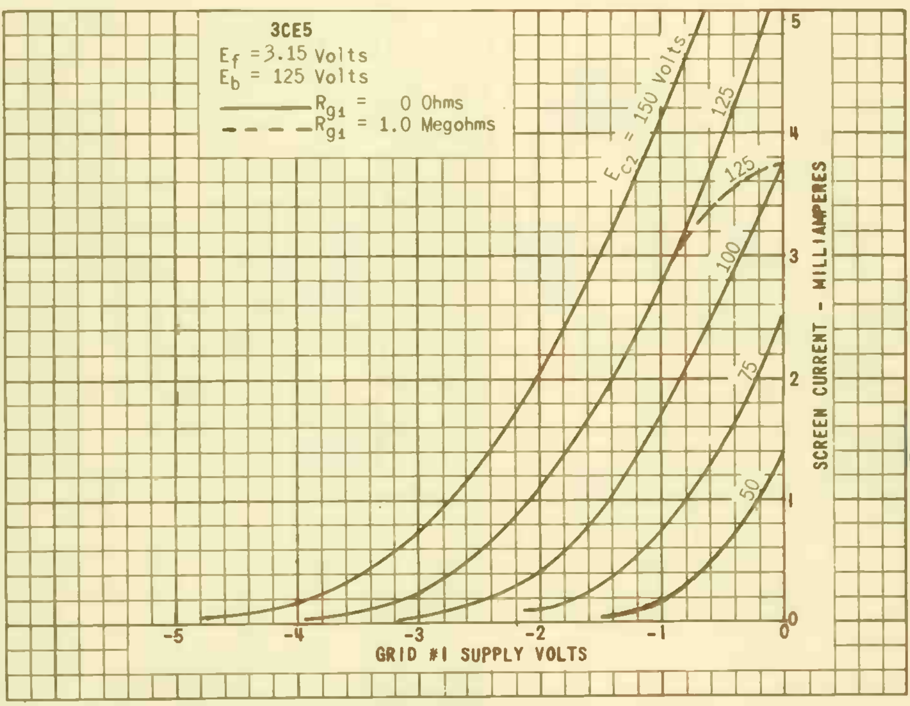
→ INDICATES A CHANGE.
* INDICATES AN ADDITION.

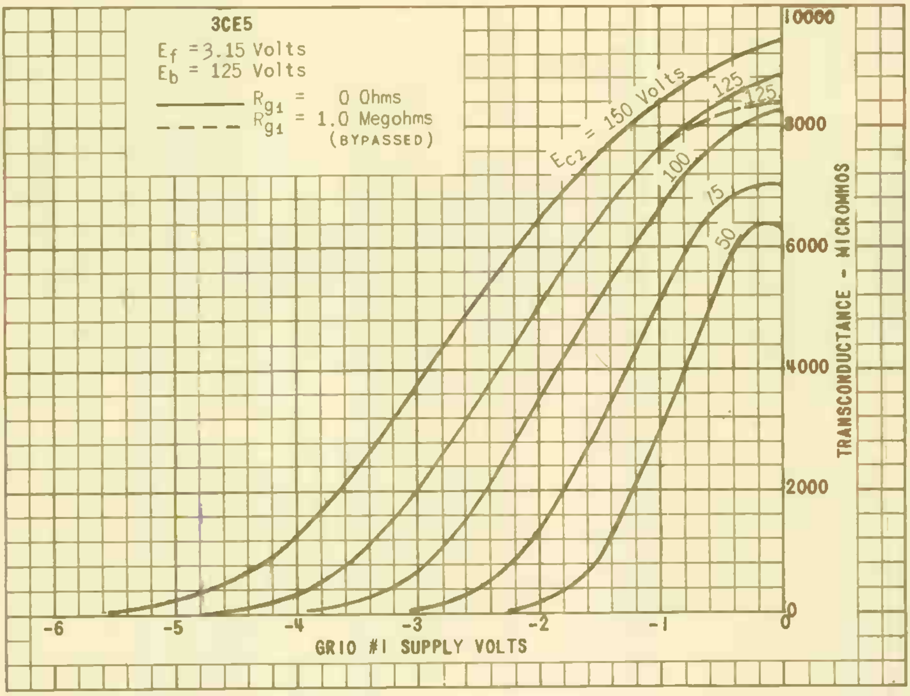



3CE5
Eb = 3.15 Volts
Ec1 = 0 Volts
Rg1 = 0 Ohms
Ib @ Ec2 = 150 Volts
125
100
75
50
Ic2 @ Ec2 = 150 Volts
125
100
75
50
SCREEN CURRENT (Ic2)-MILLIAMPERES
PLATE CURRENT (Ib)-MILLIAMPERES
12.5
10.0
7.5
5.0
2.5
0
25
20
15
10
5
0
0
100
200
300
400
500
PLATE VOLTS


3CE5
Ef = 3.15 Volts
Ec2 = 125 Volts
Rg1 = 0 Ohms
Ib @ Ec1 = 0 Volts
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
Ic2 @ Ec1 = 0 Volts
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
SCREEN CURRENT (Ic2)-MILLIAMPERES
PLATE CURRENT (Ib)-MILLIAMPERES
12.5
10.0
7.5
5.0
2.5
0
25
20
15
10
5
0
0
100
200
300
400
500
PLATE 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
20
15
10
5
0
-6
-5
-4
-3
-2
-1
0
GRID #1 SUPPLY VOLTS
PLATE CURRENT - MILLIAMPERES

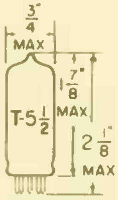

3CE5
E_f = 3.15 Volts
E_b = 125 Volts
R_{g1} = 0 Ohms
R_{g1} = 1.0 Megohms
E_{c2} = 150 Volts
125
125
100
75
50
5
4
3
2
1
0
-5
-4
-3
-2
-1
0
GRID #1 SUPPLY VOLTS
SCREEN CURRENT - MILLIAMPERES


3CE5
E_f = 3.15 Volts
E_b = 125 Volts
R_{g1} = 0 Ohms
R_{g1} = 1.0 Megohms (BYPASSED)
E_{c2} = 150 Volts
125
125
100
75
50
-6
-5
-4
-3
-2
-1
0
GRID #1 SUPPLY VOLTS
10000
8000
6000
4000
2000
0
TRANSCONDUCTANCE - MICROMHOS

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.

CONTINUED ON FOLLOWING PAGE

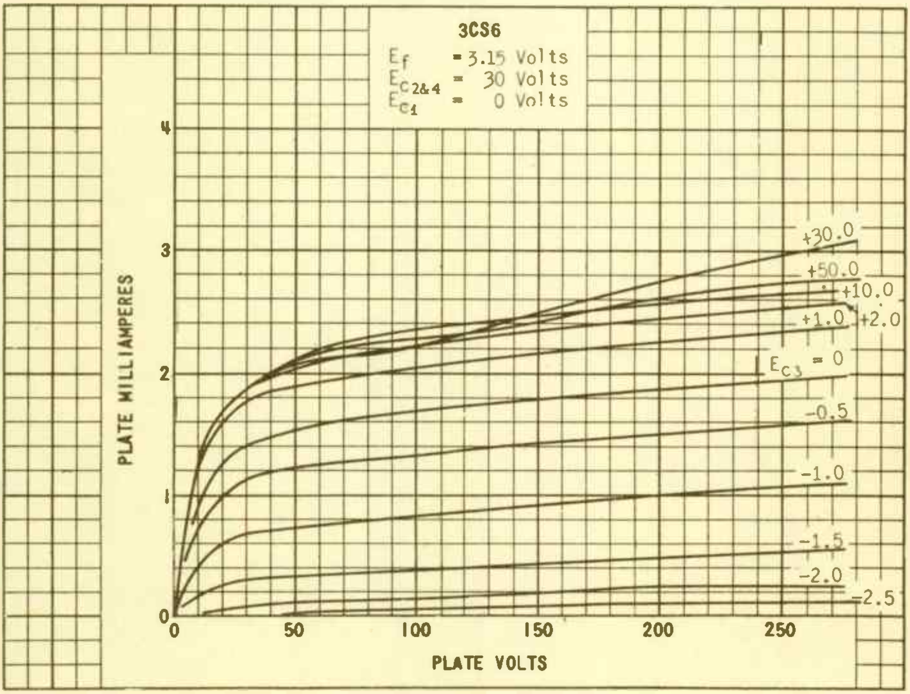
TUNG-SOL

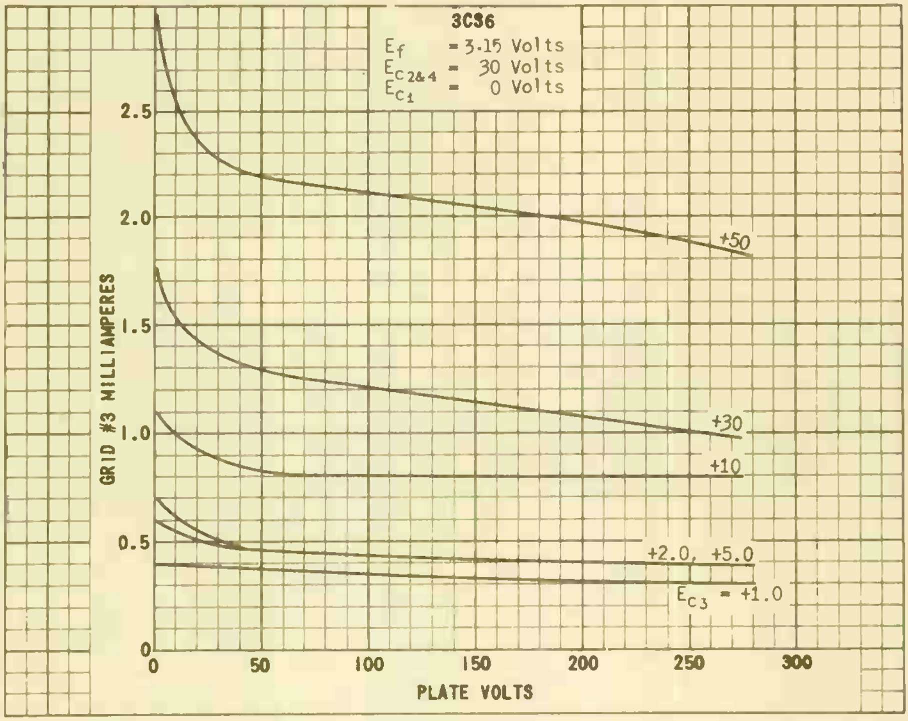
CONTINUED FROM PRECEDING PAGE

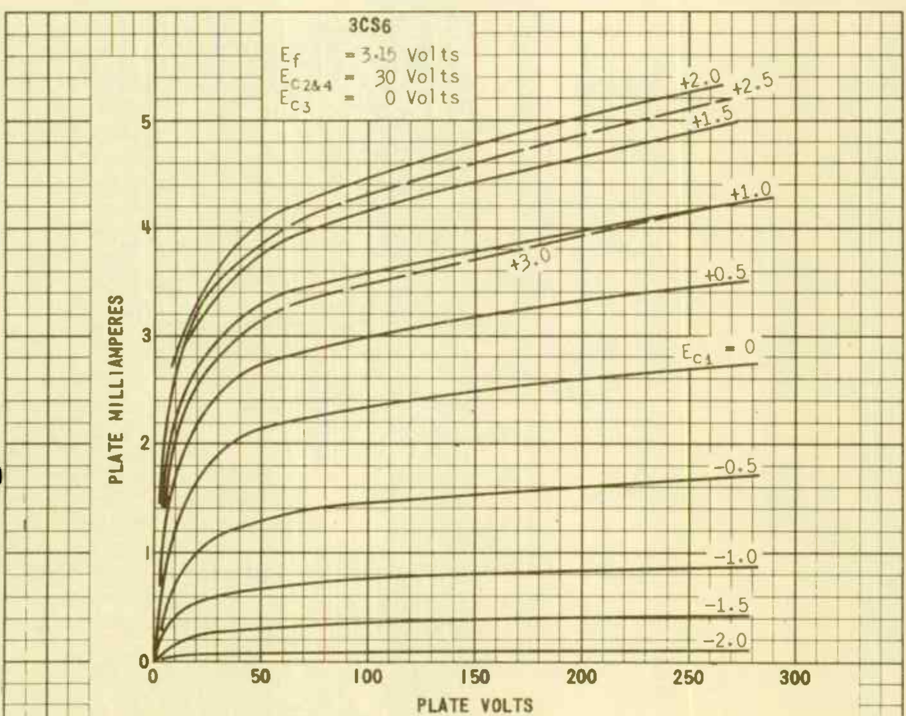
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

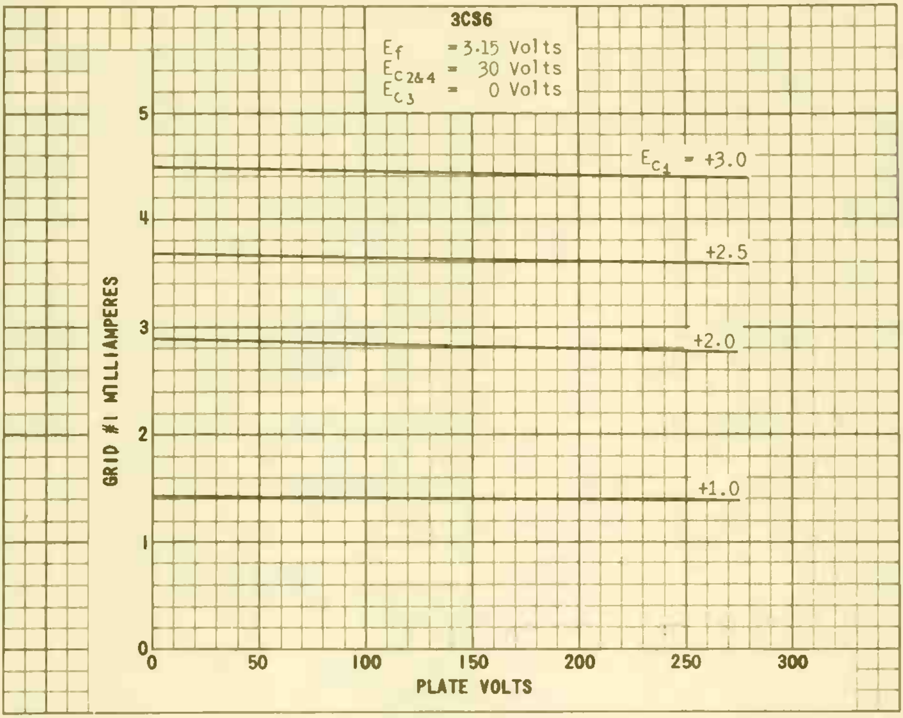
HEATER VOLTAGE	3.15	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	10	100	100	VOLTS
GRID #2 & #4 VOLTAGE	30	30	30	VOLTS
GRID #1 VOLTAGE	0	0	-0	VOLTS
GRID #3 VOLTAGE	0	-1	0	VOLTS
PLATE CURRENT	2.0	0.8	1.0	MA.
GRID #2 & #4 CURRENT	4.5	5.5	1.3	MA.
TRANSCONDUCTANCE (MEASURED BETWEEN GRID #1 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



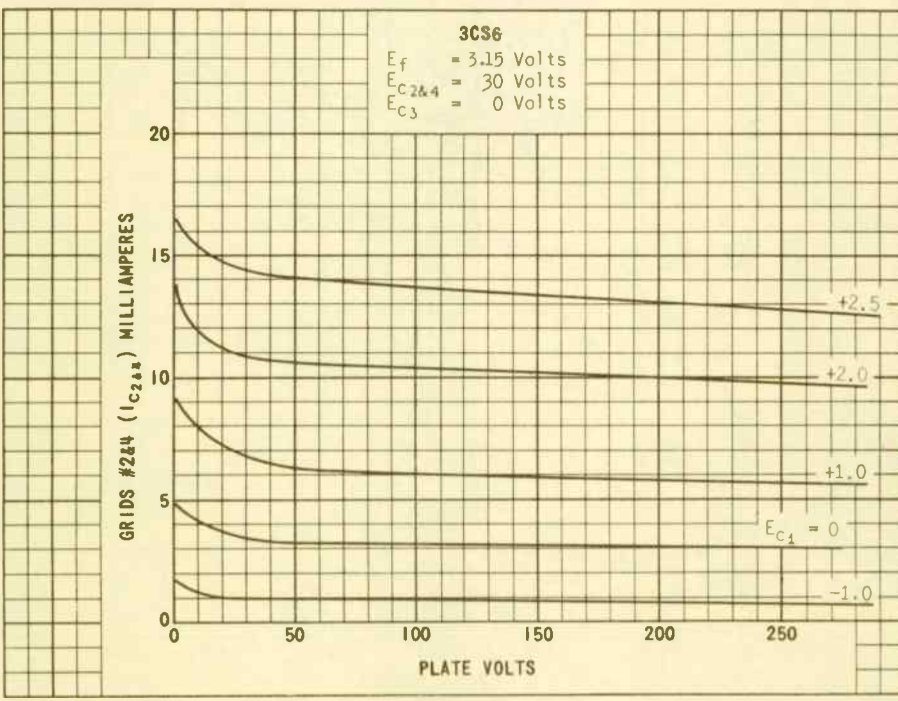
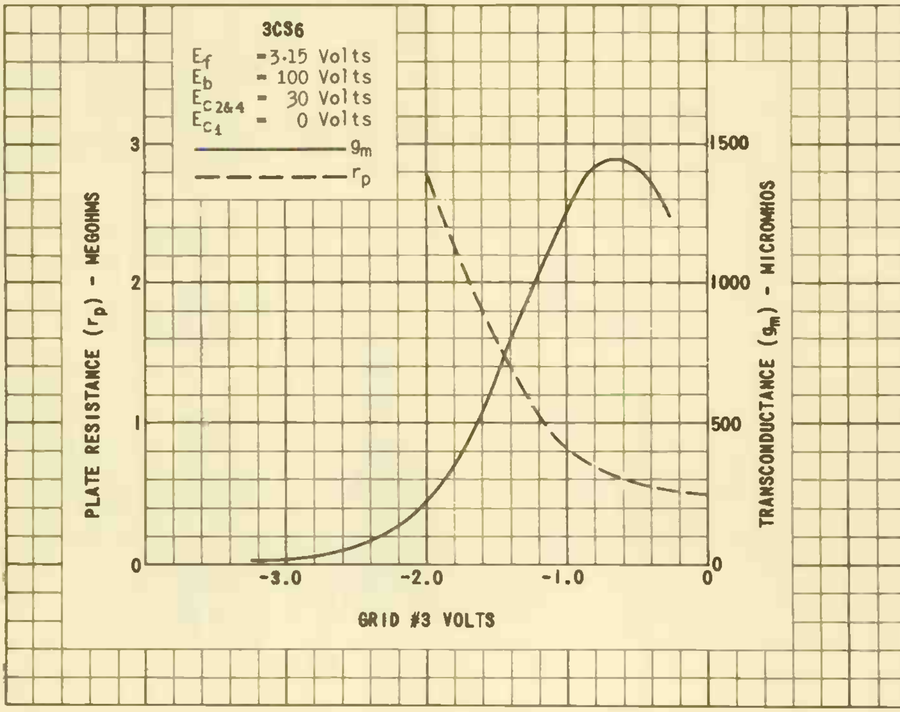
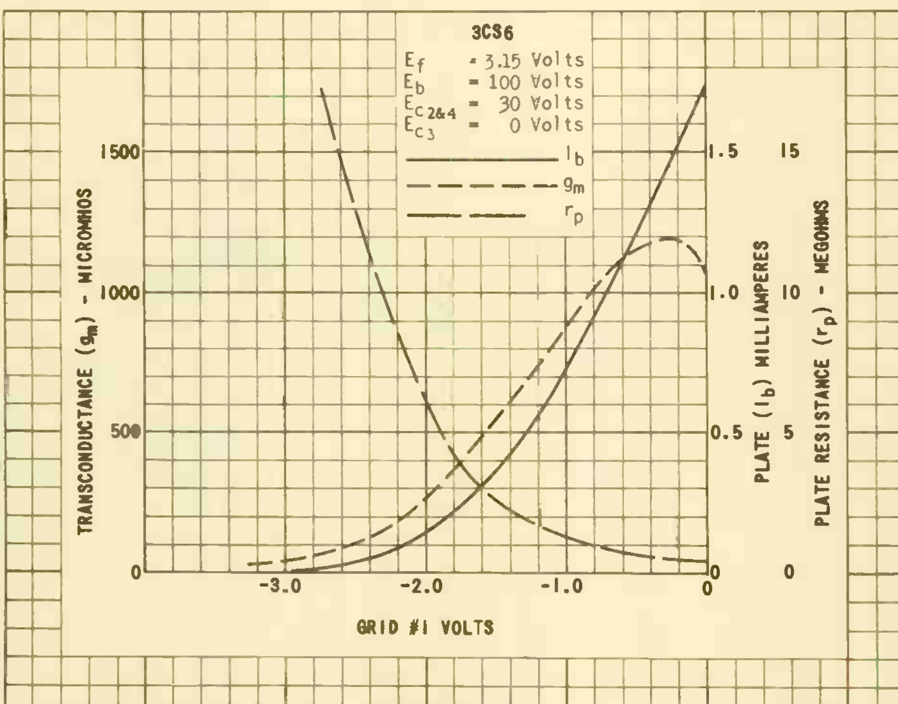
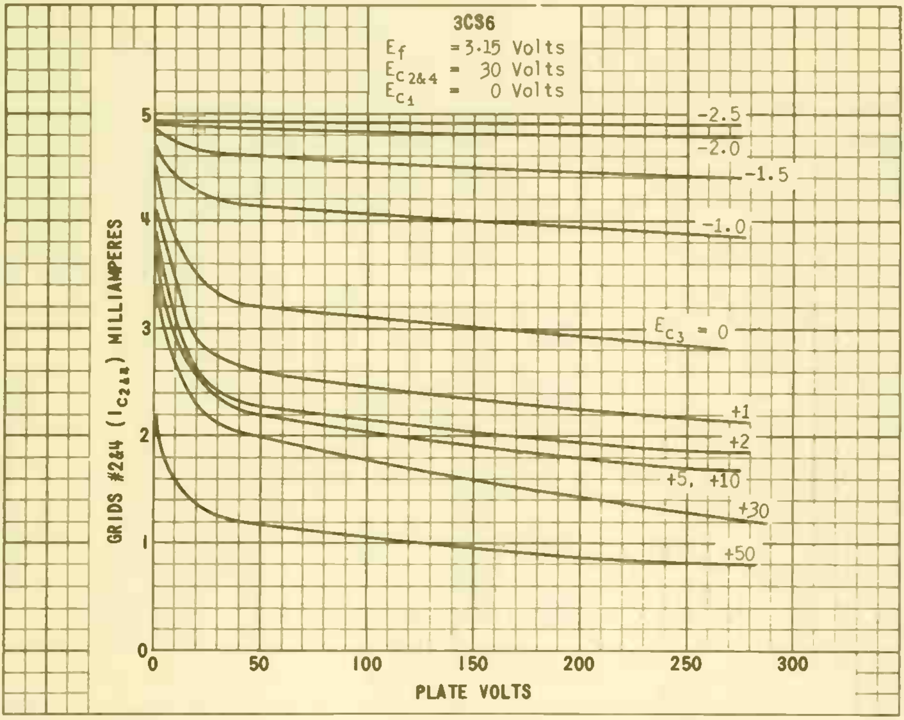


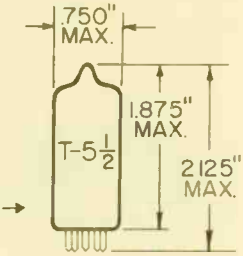
PLATE #4178 DECEMBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.


3CS6
Ef = 3.15 Volts
Eb = 100 Volts
Ec2&4 = 30 Volts
Ec1 = 0 Volts
gm
rp
PLATE RESISTANCE (rp) - MEGOHMS
TRANSCONDUCTANCE (gm) - MICROMHOS
0
1
2
3
0
500
1000
1500
-3.0
-2.0
-1.0
0
GRID #3 VOLTS


3CS6
Ef = 3.15 Volts
Eb = 100 Volts
Ec2&4 = 30 Volts
Ec3 = 0 Volts
Ib
gm
rp
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE (Ib) MILLIAMPERES
PLATE RESISTANCE (rp) - MEGOHMS
0
500
1000
1500
0
0.5
1.0
1.5
0
5
10
15
-3.0
-2.0
-1.0
0
GRID #1 VOLTS


3CS6
E_f = 3.15 Volts
$E_{c\,2\&4}$ = 30 Volts
E_{c_1} = 0 Volts
-2.5
-2.0
-1.5
-1.0
E_{c_3} = 0
+1
+2
+5, +10
+30
+50
GRIDS #2&4 ($I_{c\,2\&4}$) MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
0
50
100
150
200
250
300

TUNG-SOL



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

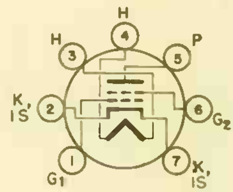
TETRODE

MINIATURE TYPE

COATED UNIPOTENTICAL CATHODE

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

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7EA

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

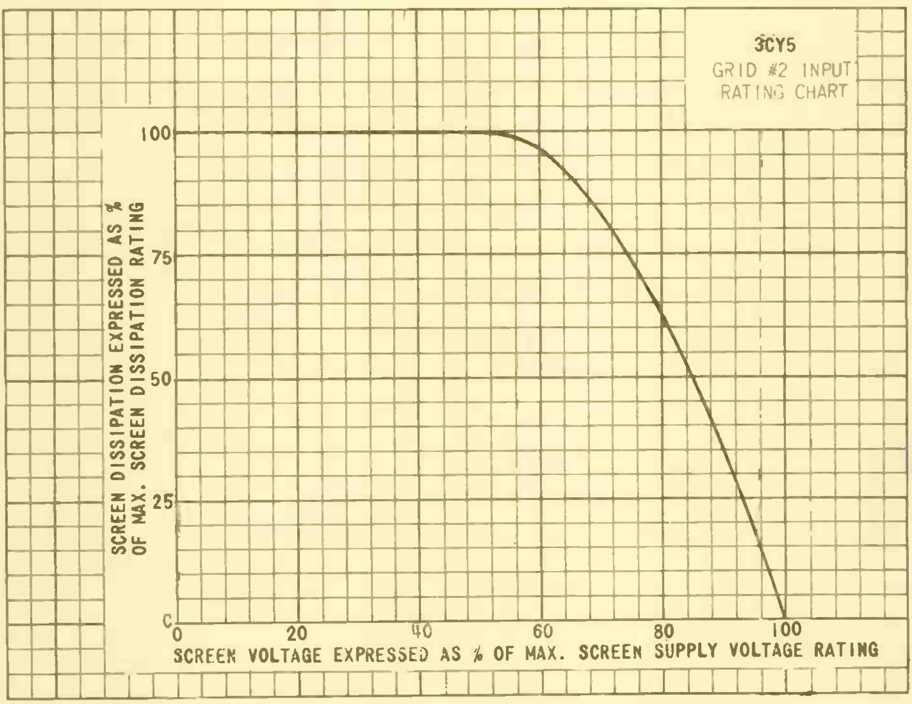
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

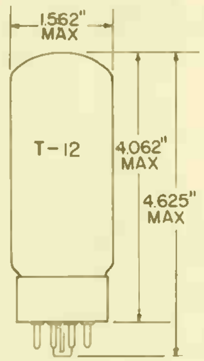
PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	−1	VOLTS
PLATE RESISTANCE	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
GRID #1 CUTOFF BIAS[C]	−6	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	1.5	MA.

[C] PLATE CURRENT 20 μA.



TUNG-SOL

TWIN DIODE



GLASS BULB
SHORT MEDIUM-SHELL
5 PIN OCTAL
B8-120 OR B8-118
OUTLINE DRAWING
JEDEC 12-16

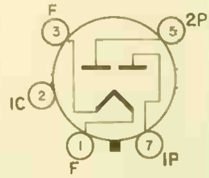
COATED FILAMENT

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 5OE

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

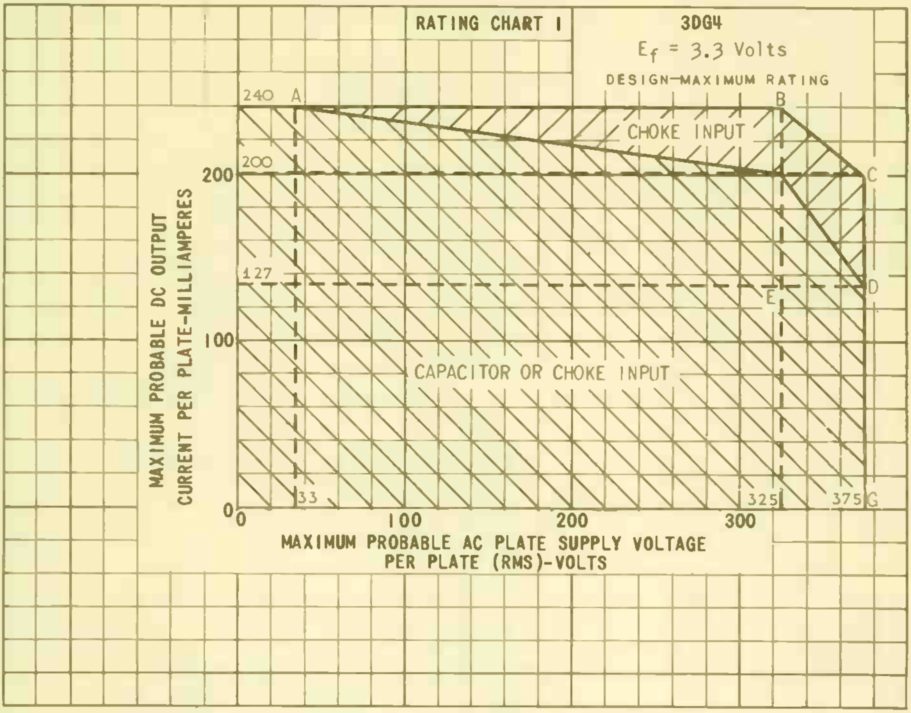
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1050	VOLTS
MAXIMUM AC PLATE-SUPPLY VOLTAGE PER PLATE	SEE RATING CHART	
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	1200	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT PER PLATE,	SEE RATING CHART	
MAXIMUM DURATION 0.2 SECOND	6.5	AMP.
MAXIMUM DC OUTPUT CURRENT		
BULB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

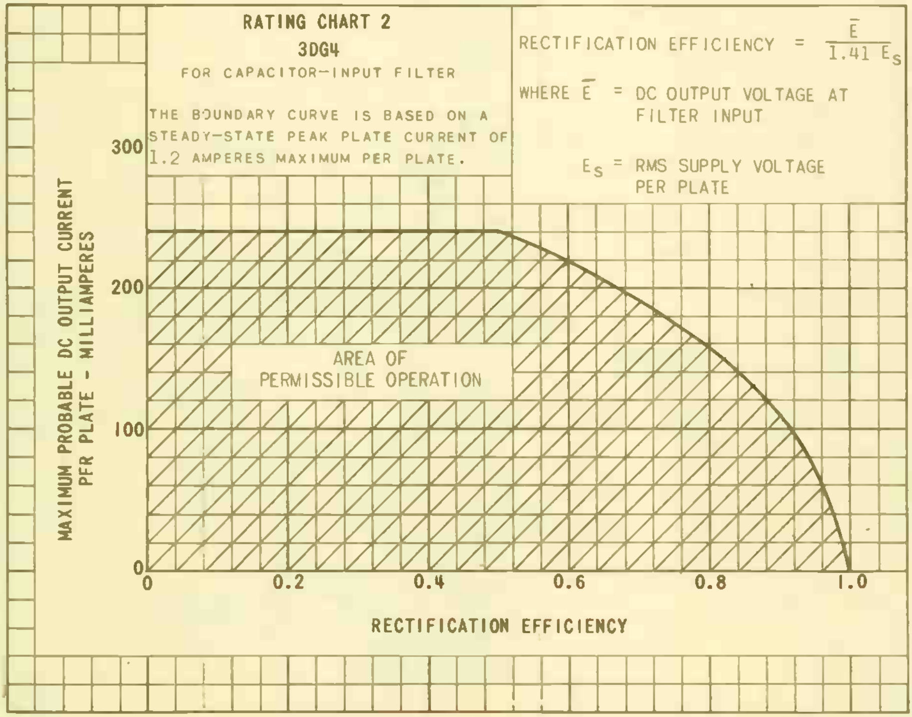
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

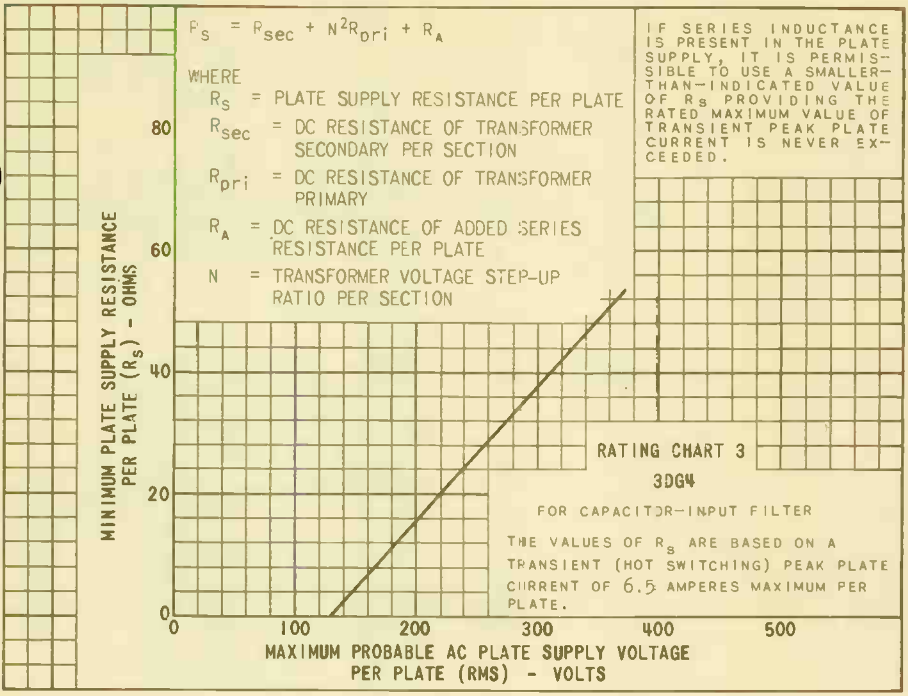
FULL-WAVE RECTIFIER

	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

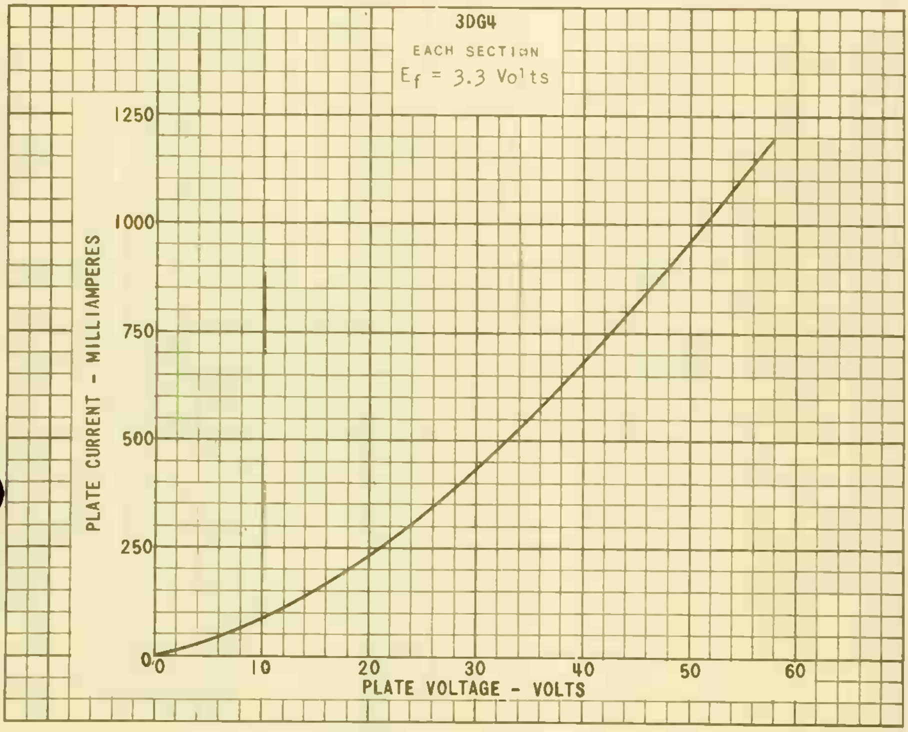
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE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


RATING CHART 1
3DG4
Ef = 3.3 Volts
DESIGN-MAXIMUM RATING
240 A
B
200
C
127
D
E
CHOKE INPUT
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

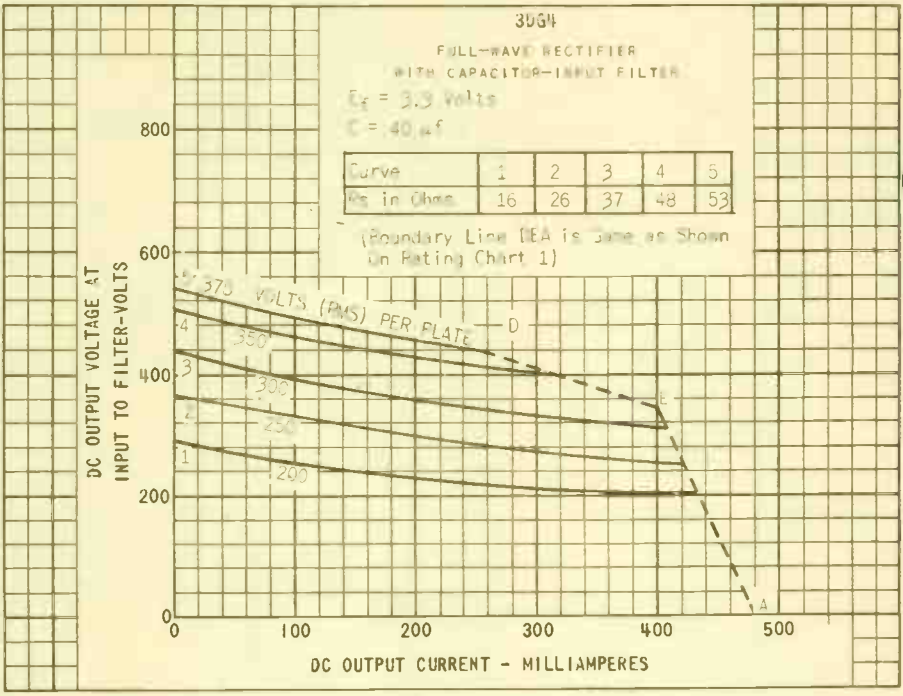

RATING CHART 2
3DG4
FOR CAPACITOR-INPUT FILTER
THE BOUNDARY CURVE IS BASED ON A STEADY-STATE PEAK PLATE CURRENT OF 1.2 AMPERES MAXIMUM PER PLATE.
RECTIFICATION EFFICIENCY = Ē / 1.41 Es
WHERE Ē = DC OUTPUT VOLTAGE AT FILTER INPUT
Es = RMS SUPPLY VOLTAGE PER PLATE
AREA OF PERMISSIBLE OPERATION
0
100
200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

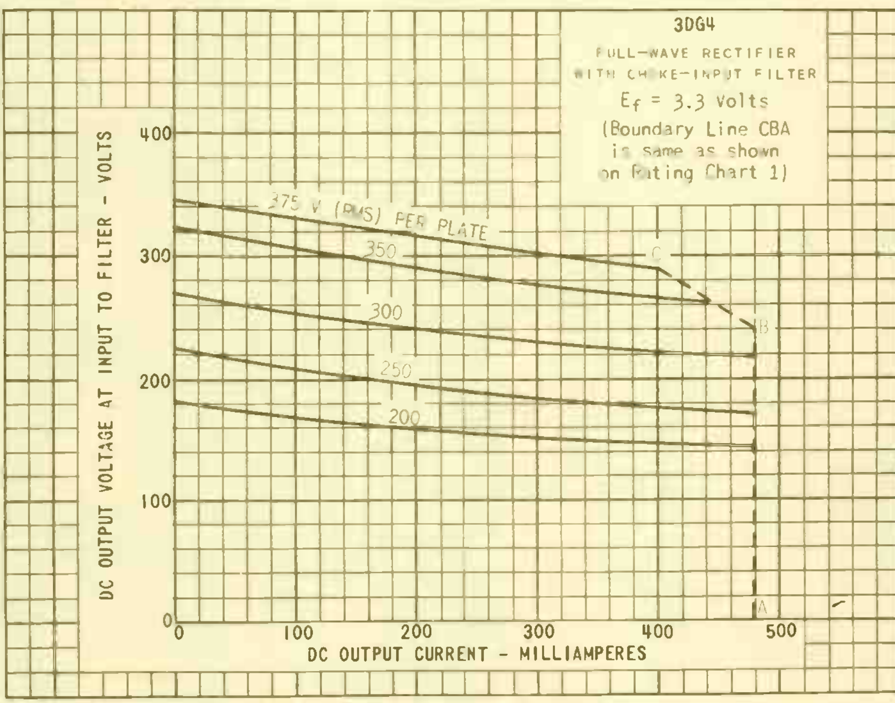


$R_S = R_{sec} + N^2R_{pri} + R_A$
WHERE
R_S = PLATE SUPPLY RESISTANCE PER PLATE
R_{sec} = DC RESISTANCE OF TRANSFORMER SECONDARY PER SECTION
R_{pri} = DC RESISTANCE OF TRANSFORMER PRIMARY
R_A = DC RESISTANCE OF ADDED SERIES RESISTANCE PER PLATE
N = TRANSFORMER VOLTAGE STEP-UP RATIO PER SECTION
IF SERIES 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.
MINIMUM PLATE SUPPLY RESISTANCE PER PLATE (R_S) - OHMS
0
20
40
60
80
0
100
200
300
400
500
MAXIMUM PROBABLE AC PLATE SUPPLY VOLTAGE PER PLATE (RMS) - VOLTS



3DG4
EACH SECTION
E_f = 3.3 Volts
PLATE CURRENT - MILLIAMPERES
0
250
500
750
1000
1250
0
10
20
30
40
50
60
PLATE VOLTAGE - VOLTS

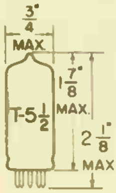

3DG4
FULL-WAVE RECTIFIER
WITH CAPACITOR-INPUT FILTER
E_f = 3.3 Volts
C = 40 μf
Curve 1 2 3 4 5
Rs in Ohms 16 26 37 48 53
(Boundary Line DEA is Same as Shown on Rating Chart 1)
375 VOLTS (RMS) PER PLATE
350
300
250
200
D
E
A
DC OUTPUT VOLTAGE AT INPUT TO FILTER-VOLTS
DC OUTPUT CURRENT - MILLIAMPERES


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

TUNG-SOL

PENTODE

MINIATURE TYPE

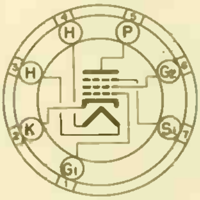


GLASS BULB

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

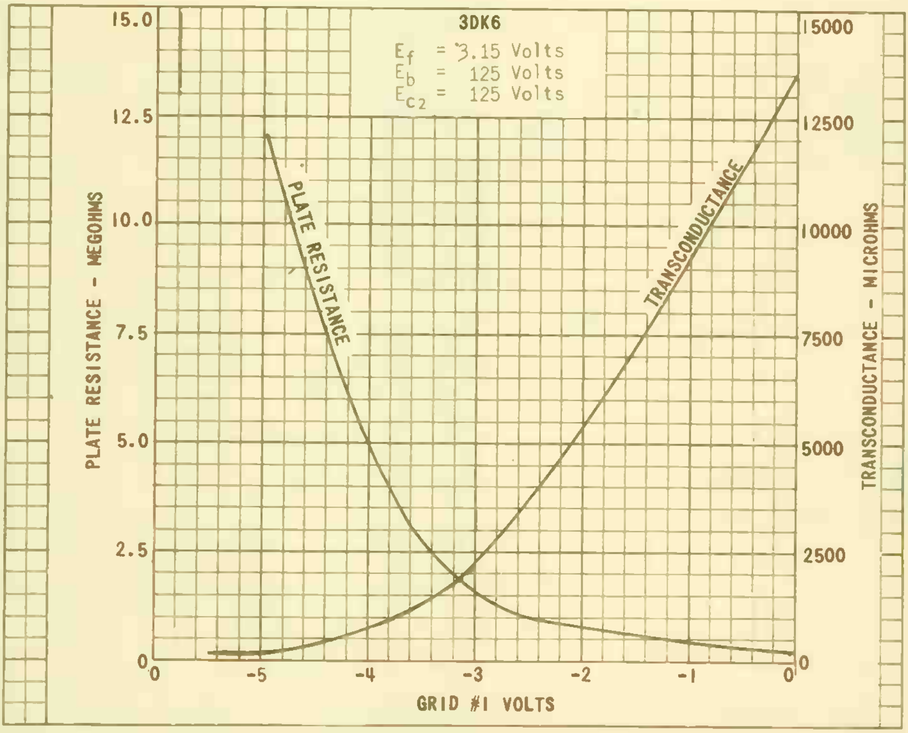
TUNG-SOL

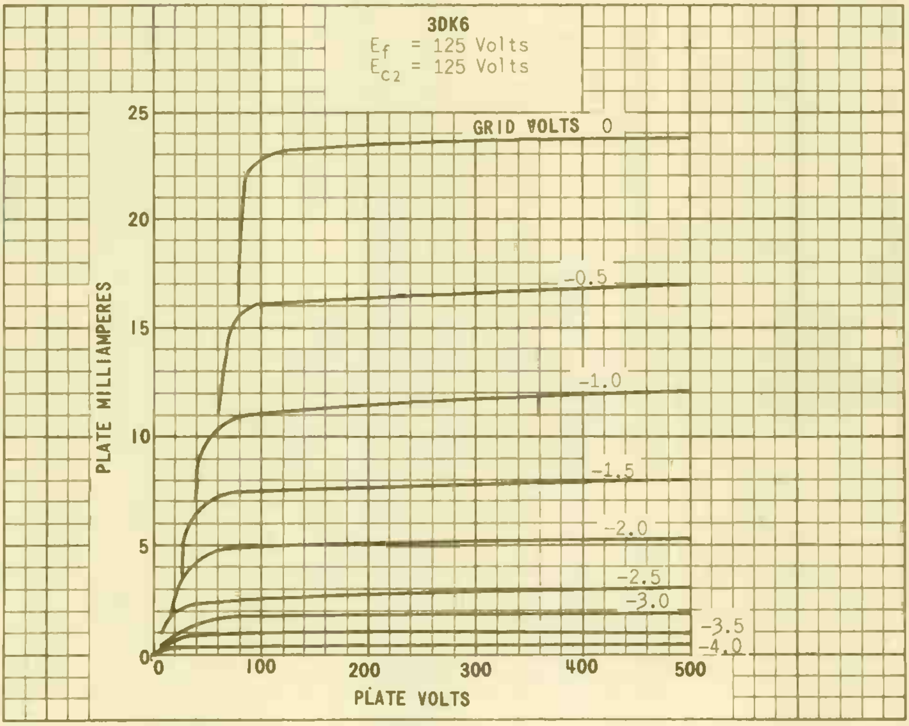
CONTINUED FROM PRECEDING PAGE

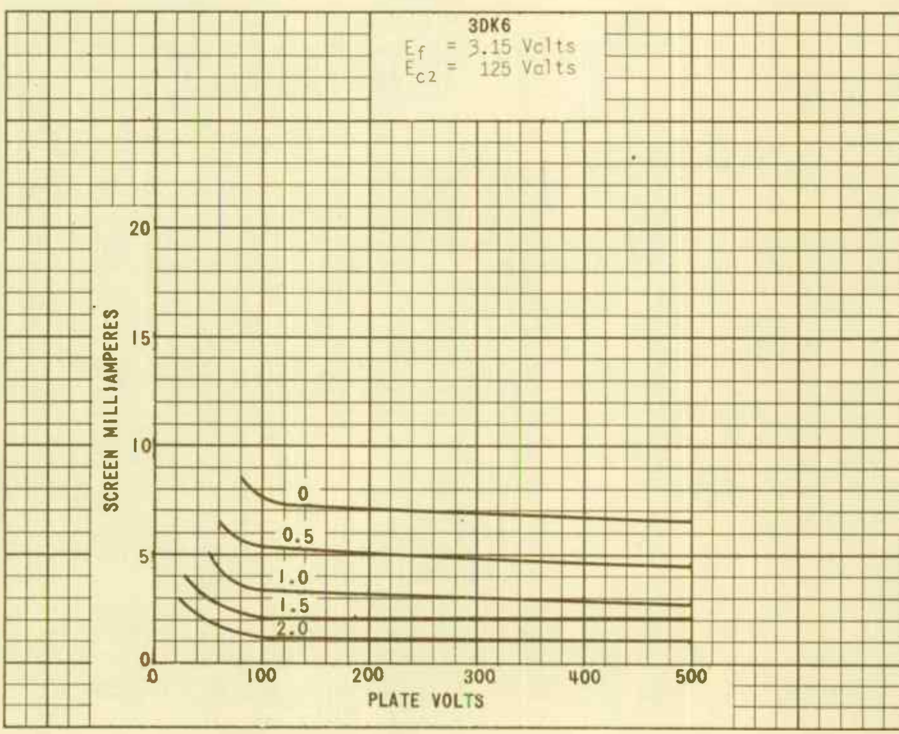
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

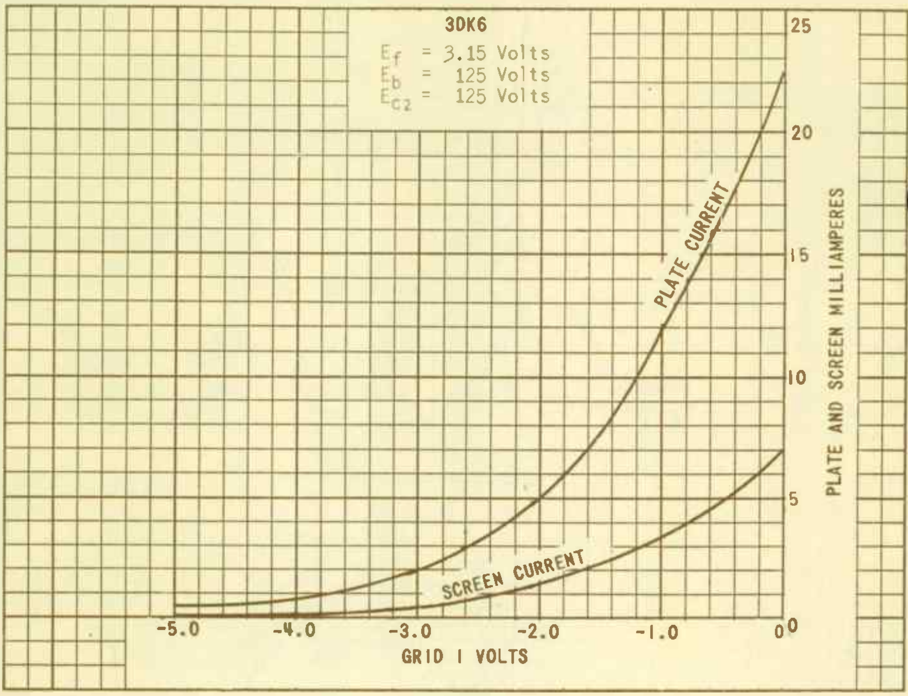
HEATER VOLTAGE	3.15	VOLTS
HEATER CURRENT	0.6±10%	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #3 (SUPPRESSOR)	CONNECTED TO CATHODE AT SOCKET	
GRID #2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)*	0.35	MEGOHM
TRANSCONDUCTANCE	9800	μMHOS
PLATE CURRENT	12.0	MA.
GRID #2 CURRENT	3.8	MA.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

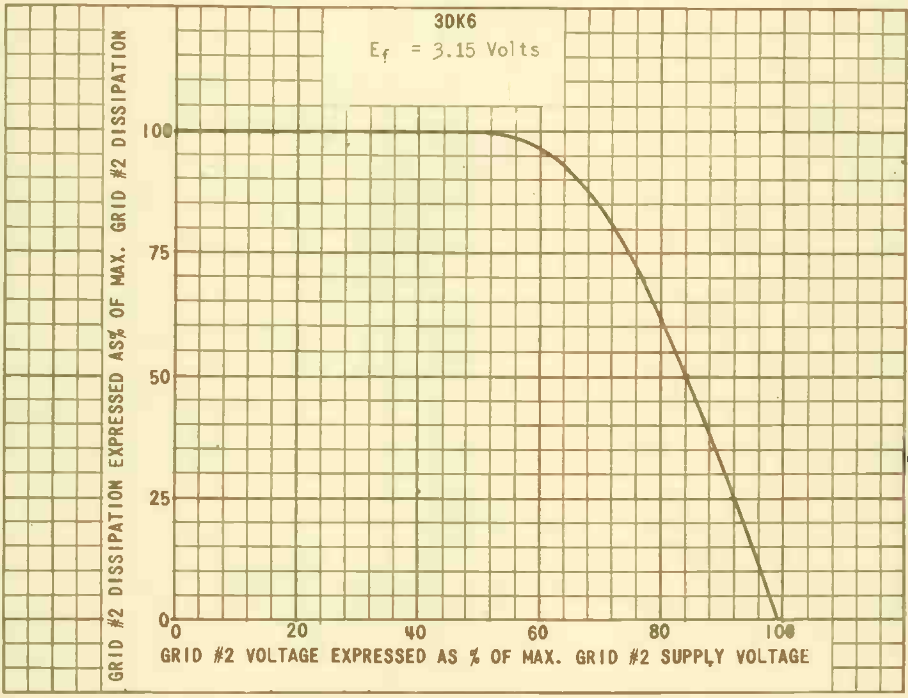
[B] FOR PLATE CURRENT OF 20 μA.




3DK6
E_f = 125 Volts
E_{c2} = 125 Volts
GRID VOLTS 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
PLATE MILLIAMPERES
0
5
10
15
20
25
PLATE VOLTS
0
100
200
300
400
500


3DK6
E_f = 3.15 Volts
E_{c2} = 125 Volts
0
0.5
1.0
1.5
2.0
SCREEN MILLIAMPERES
0
5
10
15
20
PLATE VOLTS
0
100
200
300
400
500

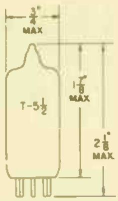

3DK6
E_f = 3.15 Volts
E_b = 125 Volts
E_{c2} = 125 Volts
PLATE CURRENT
SCREEN CURRENT
PLATE AND SCREEN MILLIAMPERES
GRID I VOLTS
-5.0
-4.0
-3.0
-2.0
-1.0
0
0
5
10
15
20
25


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

TUNG-SOL

PENTODE

MINIATURE TYPE



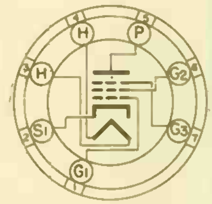
GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6±10% AMP.

AC OR DC

ANY MOUNTING POSITION



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.

TUNG-SOL

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	µMHOS
GRID #3 TO PLATE	515	µMHOS
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10µAMP	-4.5	VOLTS
GRID #3 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10µAMP	-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

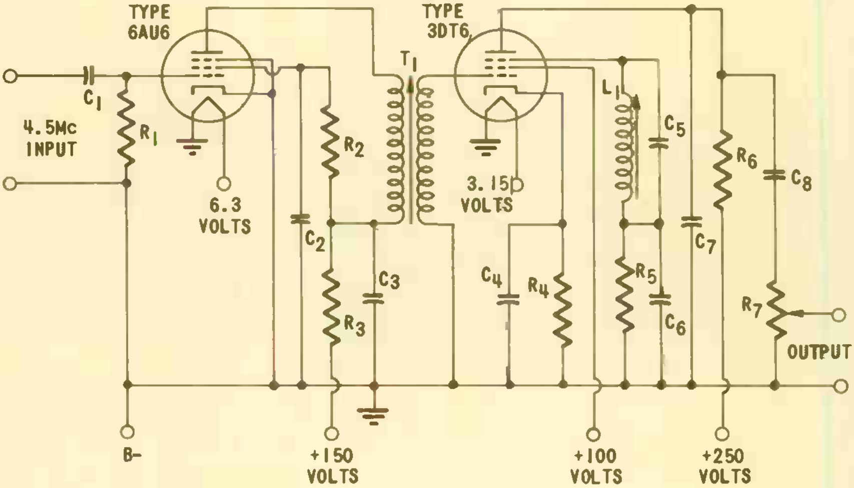
[B] RATIO OF THE AUDIO OUTPUT VOLTAGE PRODUCED BY 30-PERCENT AMPLITUDE MODULATION OF THE 4.5-MC CARRIER FREQUENCY TO THE AUDIO OUTPUT PRODUCED BY ± 25-KC DEVIATION FROM THE 4.5-MC CARRIER FREQUENCY, WITH A MODULATING FREQUENCY OF 400 CPS IN BOTH CASES.

[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

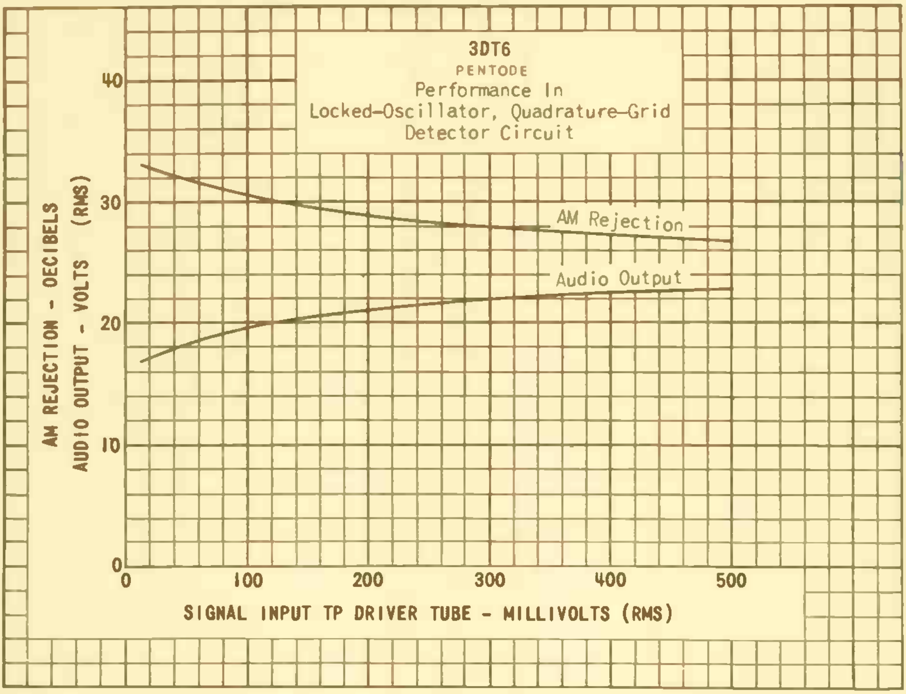
LOCKED-OSCILLATOR, QUADRATURE-GRID DETECTOR CIRCUIT
UTILIZING TYPE 3DT6

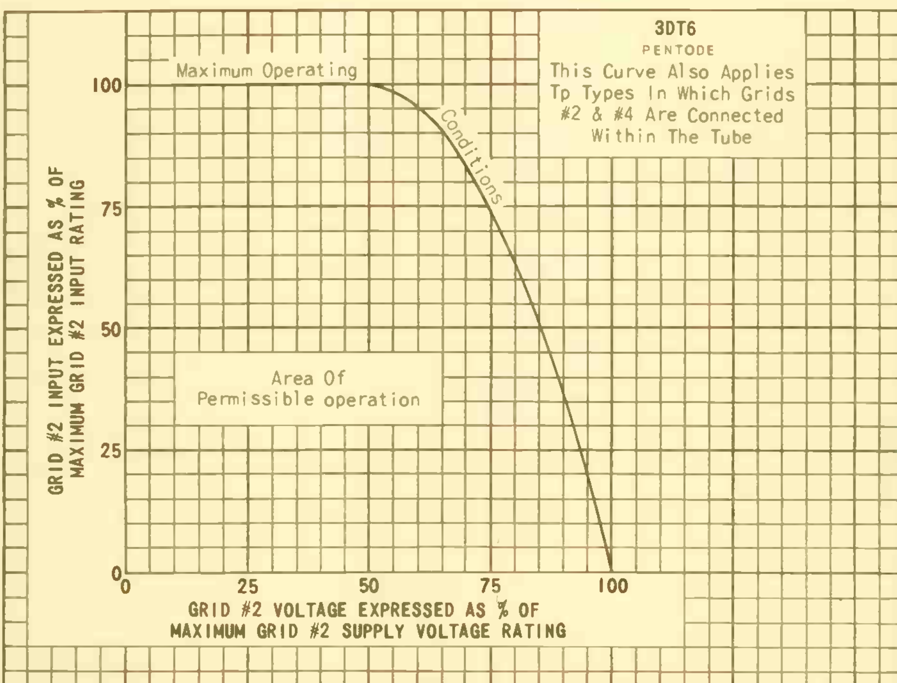


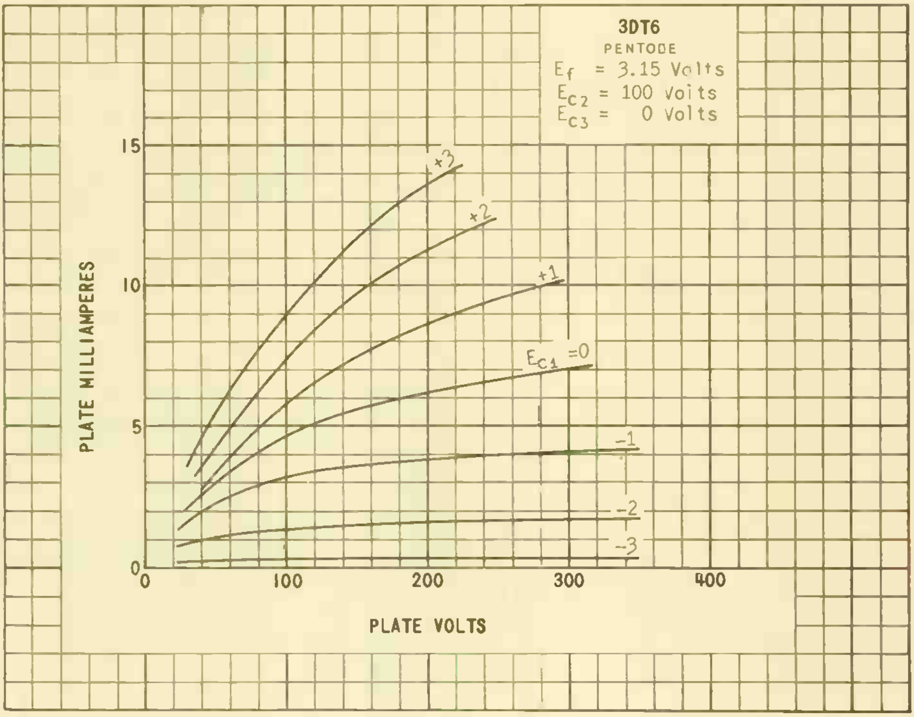
C_1: 47µµf, 400 VOLTS
C_2 C_3: 0.01µf, 400 VOLTS
C_4: 0.01µf, 200 VOLTS
C_5: 18µµf, 200 VOLTS
C_6: 0.05µf, 200 VOLTS
C_7: 100 TO 1000µµf, 400 VOLTS
C_8: 0.01µf, 400 VOLTS

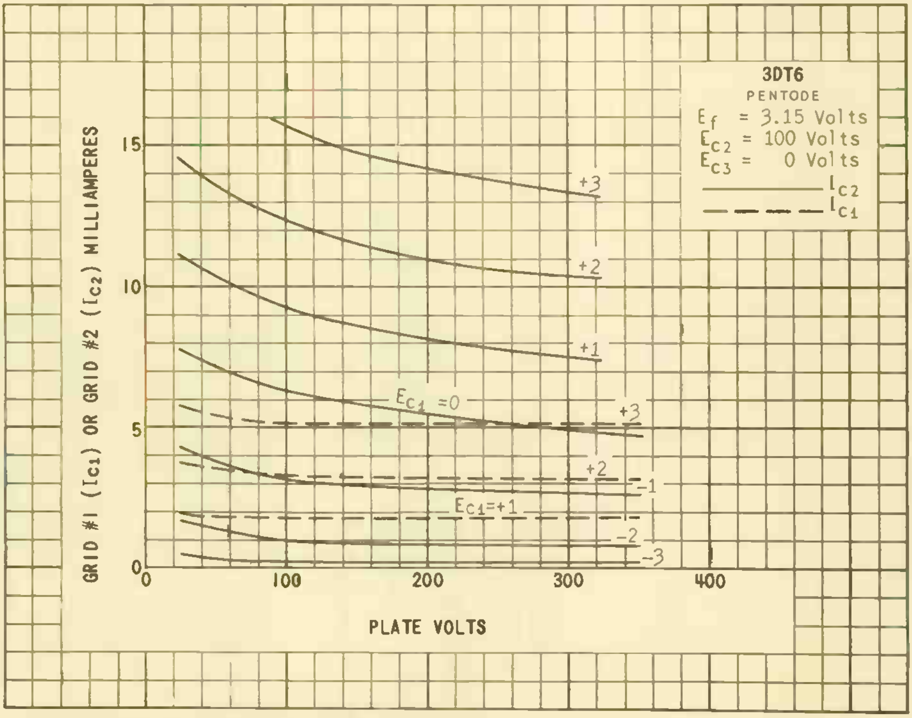
L_1: SLUG-TUNED INDUCTOR WITH Q OF 50 AND TUNEABLE TO 4.5-MC.
R_1: 100000 OHMS, 0.5 WATT
R_2: 12000 OHMS, 0.5 WATT
R_3: 1000 OHMS, 0.5 WATT
R_4: 560 OHMS, 0.5 WATT
R_5: 560000 OHMS, 0.5 WATT

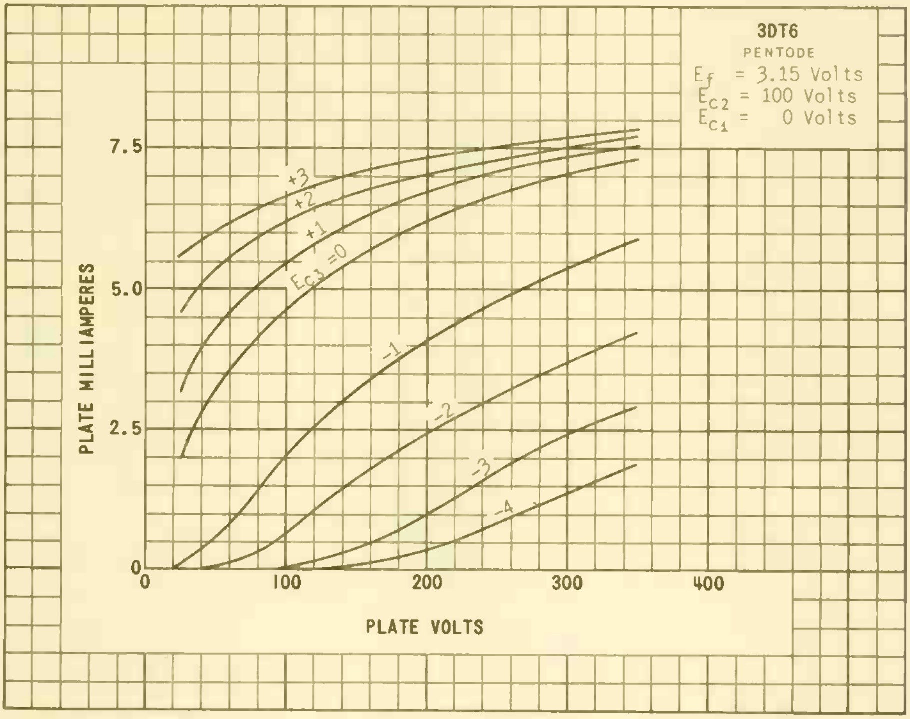
R_6: 270000 OHMS, 0.5 WATT
R_7: 0.5 MEGOHM POTENTIOMETER
T_1: SLUG-TUNED, BIFILAR WOUND IF TRANSFORMER WITH RATIO OF 1:1.5, Q > 60, AND TUNEABLE TO 4.5-MC WITH TUBE AND WIRING CAPACITANCE.

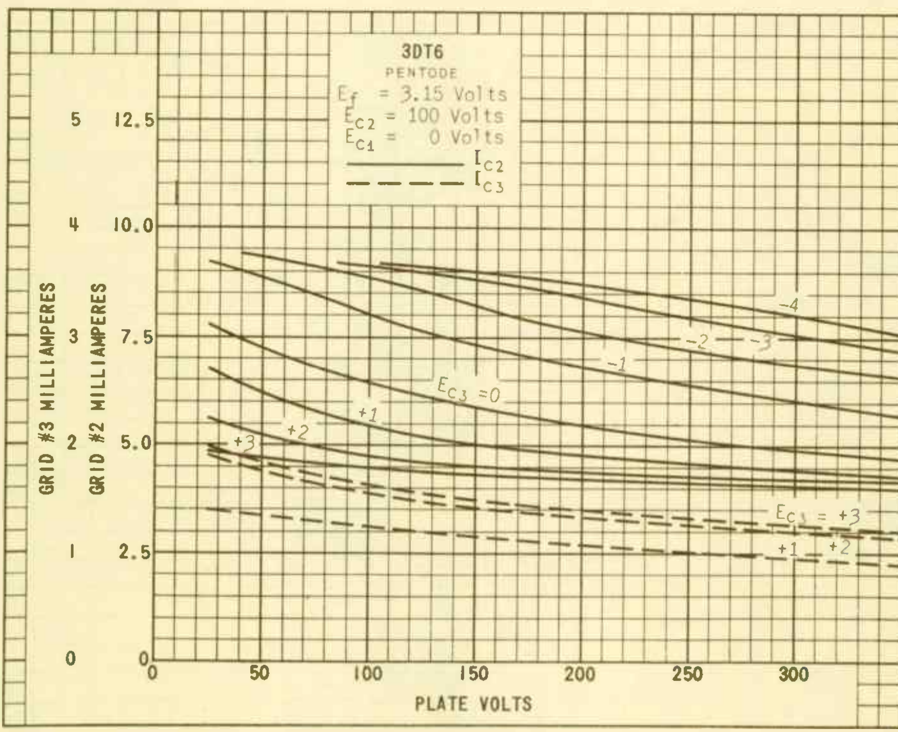

3DT6
PENTODE
Performance In
Locked-Oscillator, Quadrature-Grid
Detector Circuit
AM Rejection
Audio Output
AM REJECTION - DECIBELS
AUDIO OUTPUT - VOLTS (RMS)
0
10
20
30
40
0
100
200
300
400
500
SIGNAL INPUT TP DRIVER TUBE - MILLIVOLTS (RMS)

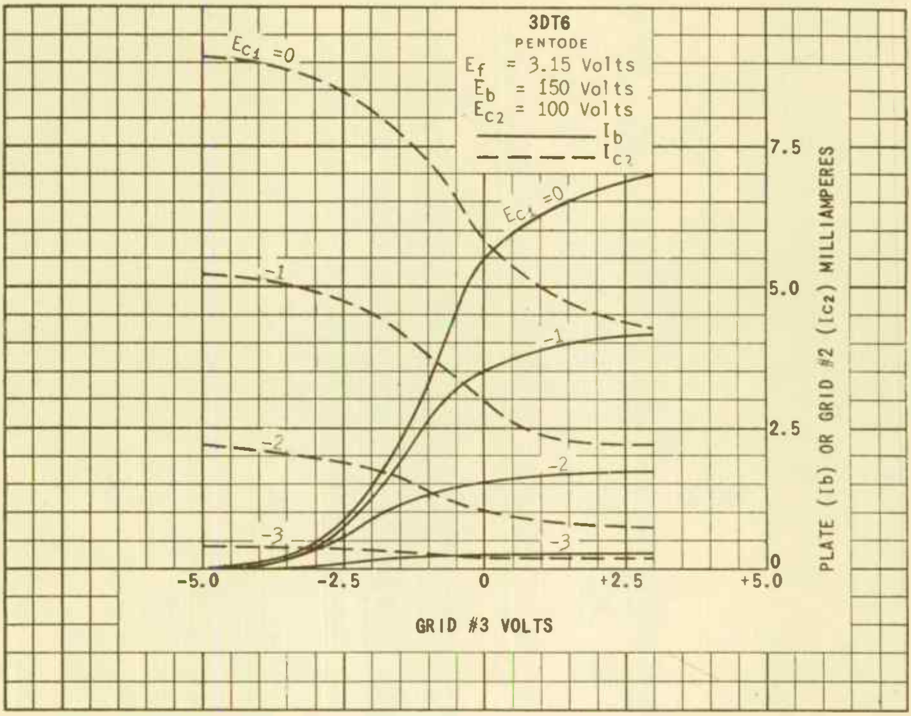

3DT6
PENTODE
This Curve Also Applies
Tp Types In Which Grids
#2 & #4 Are Connected
Within The Tube
Maximum Operating
Conditions
Area Of
Permissible operation
GRID #2 INPUT EXPRESSED AS % OF
MAXIMUM GRID #2 INPUT RATING
0
25
50
75
100
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS % OF
MAXIMUM GRID #2 SUPPLY VOLTAGE RATING

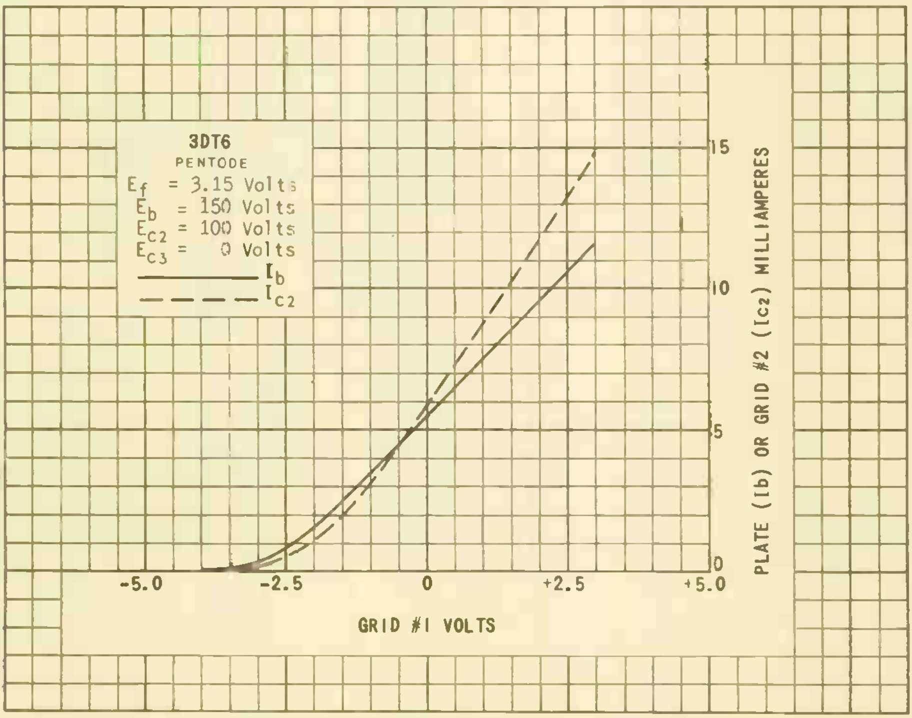

3DT6
PENTODE
Ef = 3.15 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
+3
+2
+1
Ec1 =0
-1
-2
-3
PLATE MILLIAMPERES
15
10
5
0
0
100
200
300
400
PLATE VOLTS


3DT6
PENTODE
Ef = 3.15 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
Ic2
Ic1
+3
+2
+1
Ec1 =0
+3
+2
-1
Ec1=+1
-2
-3
GRID #1 (Ic1) OR GRID #2 (Ic2) MILLIAMPERES
15
10
5
0
0
100
200
300
400
PLATE VOLTS


3DT6
PENTODE
E_f = 3.15 Volts
E_{C2} = 100 Volts
E_{C1} = 0 Volts
+3
+2
+1
E_{C3} =0
-1
-2
-3
-4
PLATE MILLIAMPERES
7.5
5.0
2.5
0
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}
-4
-2
-3
-1
E_{C3} =0
+1
+2
+3
E_{C1} = +3
+1
+2
GRID #3 MILLIAMPERES
GRID #2 MILLIAMPERES
5
4
3
2
1
0
12.5
10.0
7.5
5.0
2.5
0
0
50
100
150
200
250
300
PLATE VOLTS

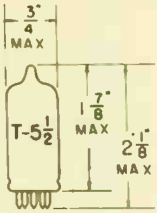

3DT6
PENTODE
Ef = 3.15 Volts
Eb = 150 Volts
Ec2 = 100 Volts
Ib
Ic2
Ec1 =0
-1
-2
-3
-5.0
-2.5
0
+2.5
+5.0
7.5
5.0
2.5
0
GRID #3 VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES


3DT6
PENTODE
Ef = 3.15 Volts
Eb = 150 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
Ib
Ic2
-5.0
-2.5
0
+2.5
+5.0
15
10
5
0
GRID #1 VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES

TUNG-SOL

TETRODE

MINIATURE TYPE

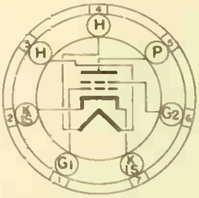


GLASS BULB

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

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

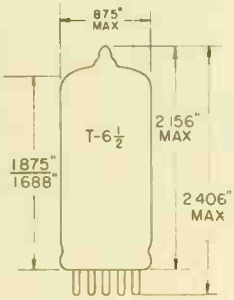
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE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

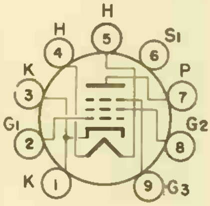


GLASS BULB
MINIATURE
9 PIN BASE E9-1

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

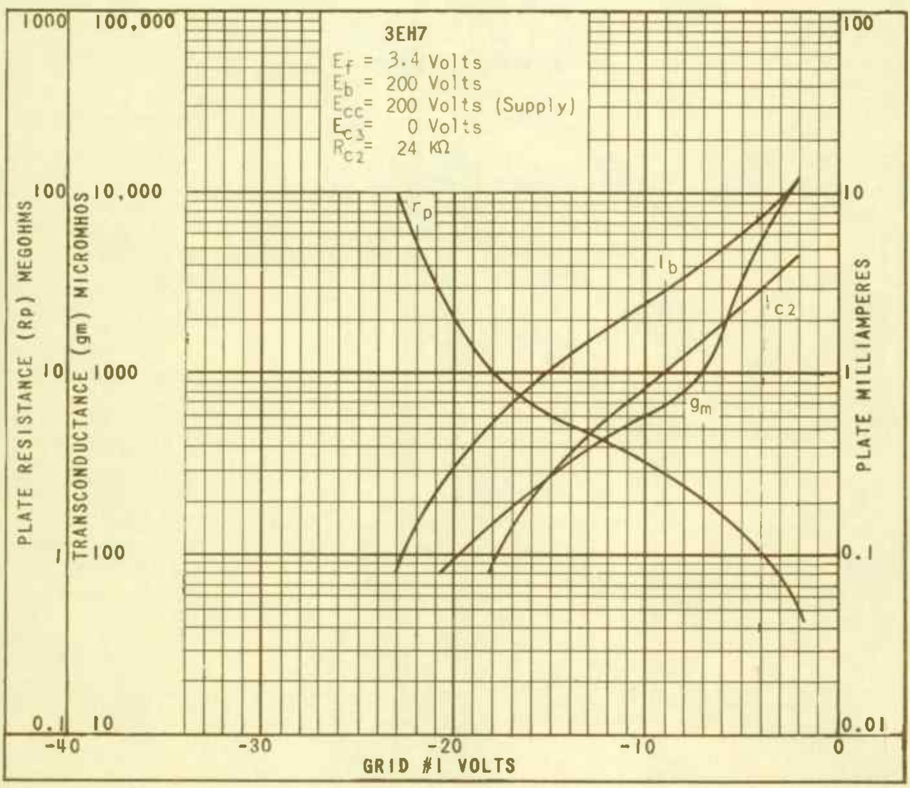
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

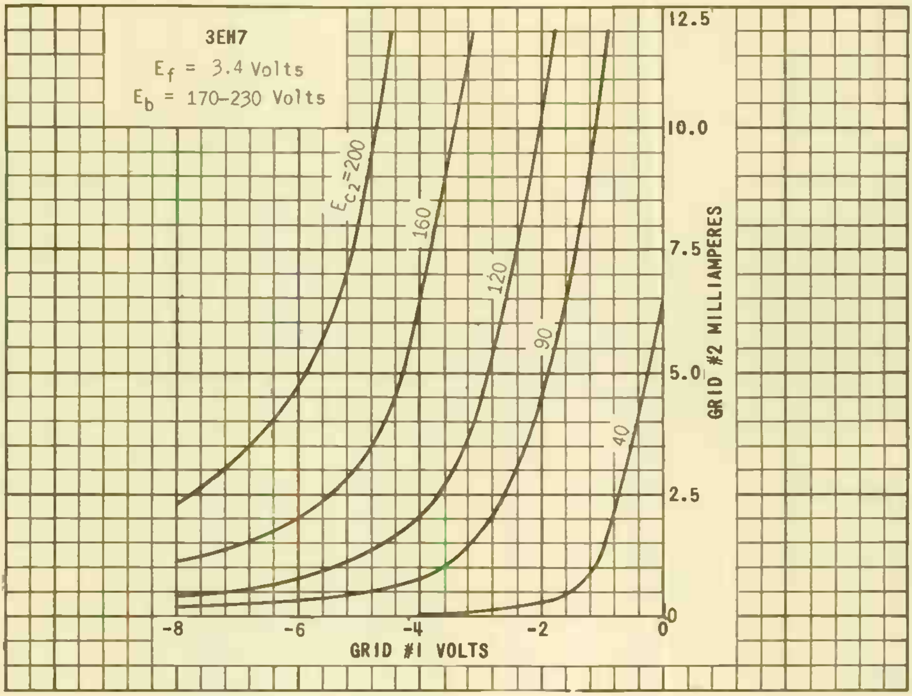
TUNG-SOL

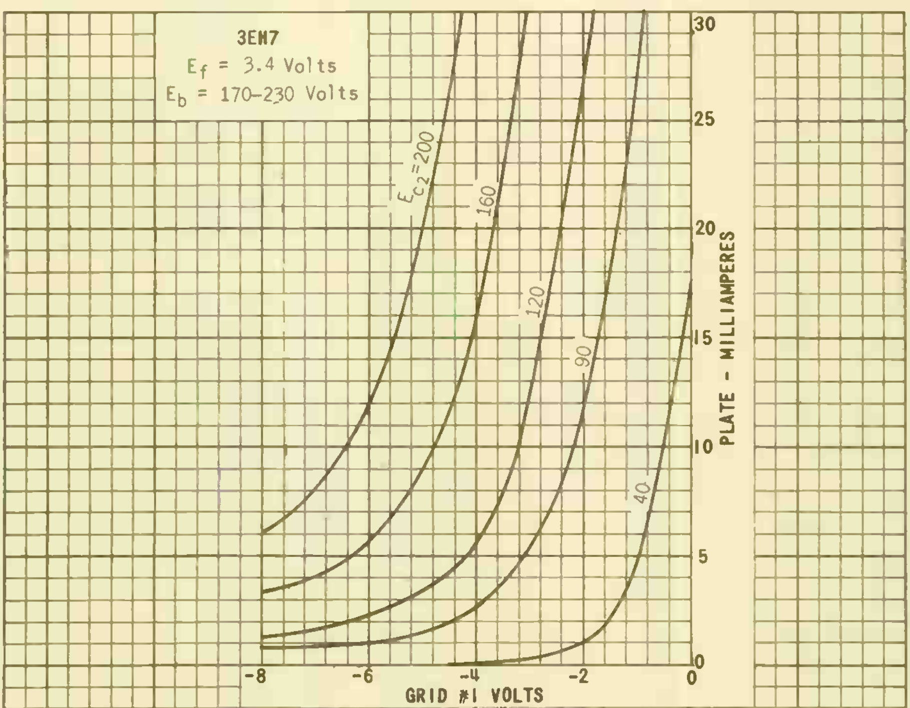
CONTINUED FROM PRECEDING PAGE

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: Ec1 =-6.5		1250	μMHOS
Ec1 =-9.5		625	μMHOS
Ec1 =-19.5		125	μMHOS
GRID #1 VOLTAGE FOR A CROSS-MODULATION FACTOR OF 1%:			
Ec1 =-6.5		100	MV.
Ec1 =-9.5		160	MV.
Ec1 =-19.5		450	MV.



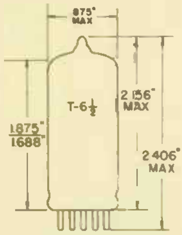

3EH7
E_f = 3.4 Volts
E_b = 170-230 Volts
E_{c_2}=200
160
120
90
40
12.5
10.0
7.5
5.0
2.5
0
-8
-6
-4
-2
0
GRID #1 VOLTS
GRID #2 MILLIAMPERES


3EH7
E_f = 3.4 Volts
E_b = 170-230 Volts
E_{c_2}=200
160
120
90
40
30
25
20
15
10
5
0
-8
-6
-4
-2
0
GRID #1 VOLTS
PLATE - MILLIAMPERES

TUNG-SOL

SHARP CUTOFF PENTODE

MINIATURE TYPE



MINIATURE BUTTON
9 PIN BASE E9-1

OUTLINE DRAWING
SPECIAL

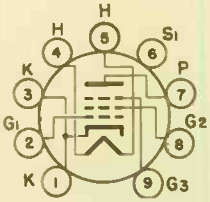
GLASS BULB

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 = O MA.	550	VOLTS
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE WITH Ic2 = O 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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CHARACTERISTICS

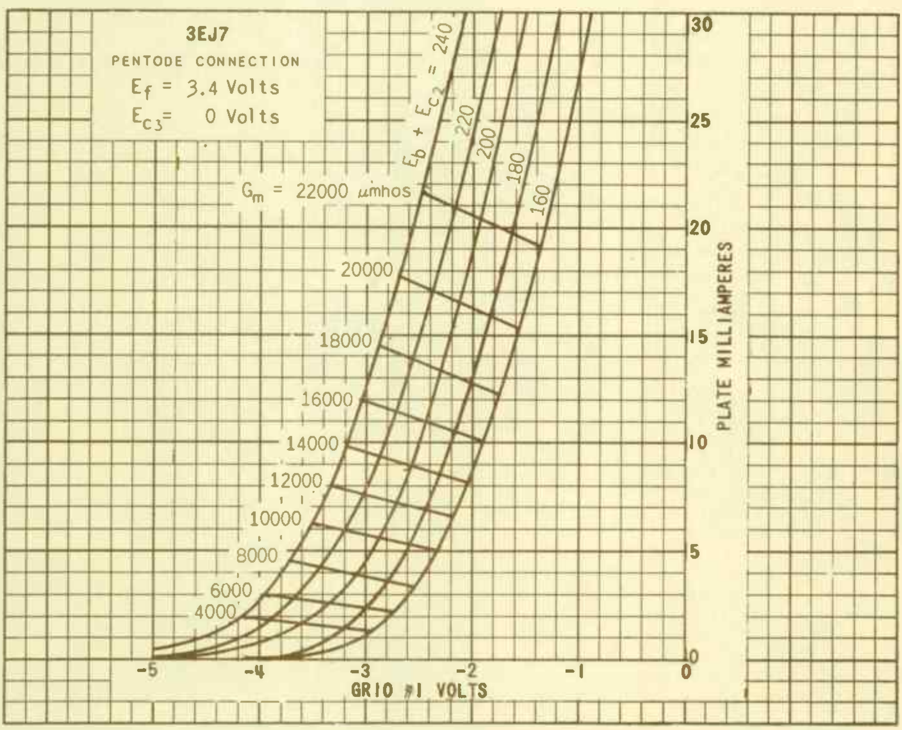
CLASS A_1 AMPLIFIER

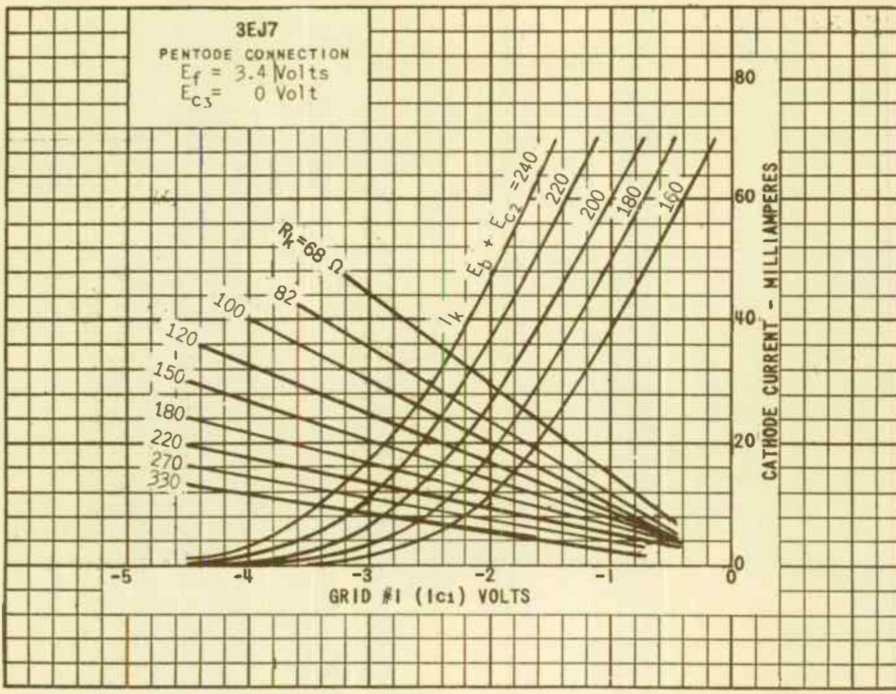
PLATE VOLTAGE	200	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 VOLTAGE	200	VOLTS
GRID #1 VOLTAGE	-2.5	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	4.1	MA.
TRANSCONDUCTANCE	15000	μMHOS
AMPLIFICATION FACTOR (G2 TO G1)	60	
PLATE RESISTANCE (APRROX)	0.35	MEGOHM
GRID #1 IMPEDANCE AT 40 MC	30000	OHMS[C]

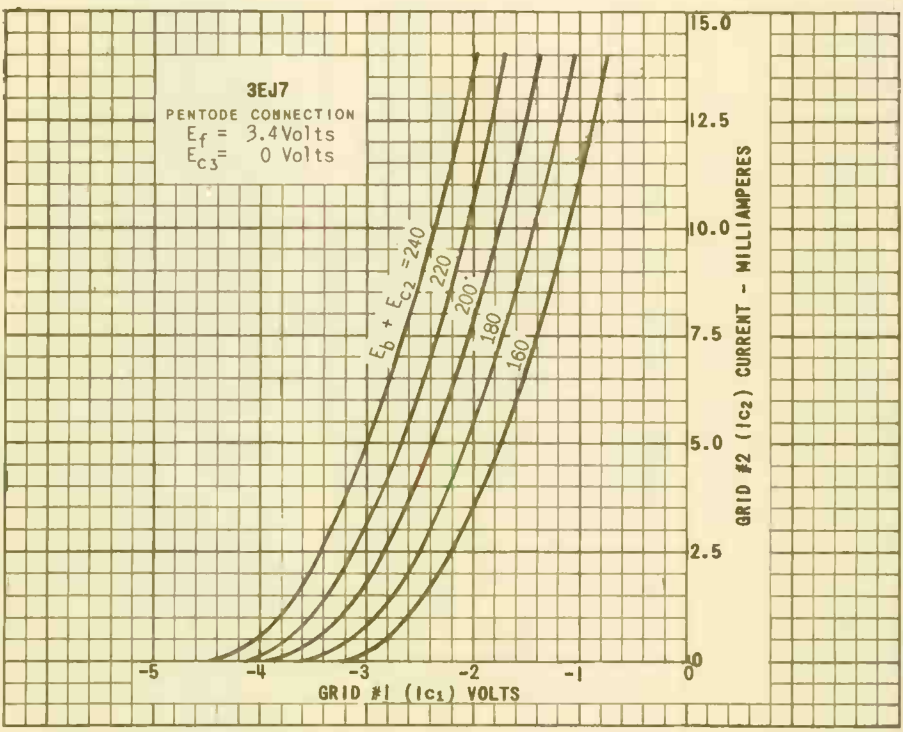
[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

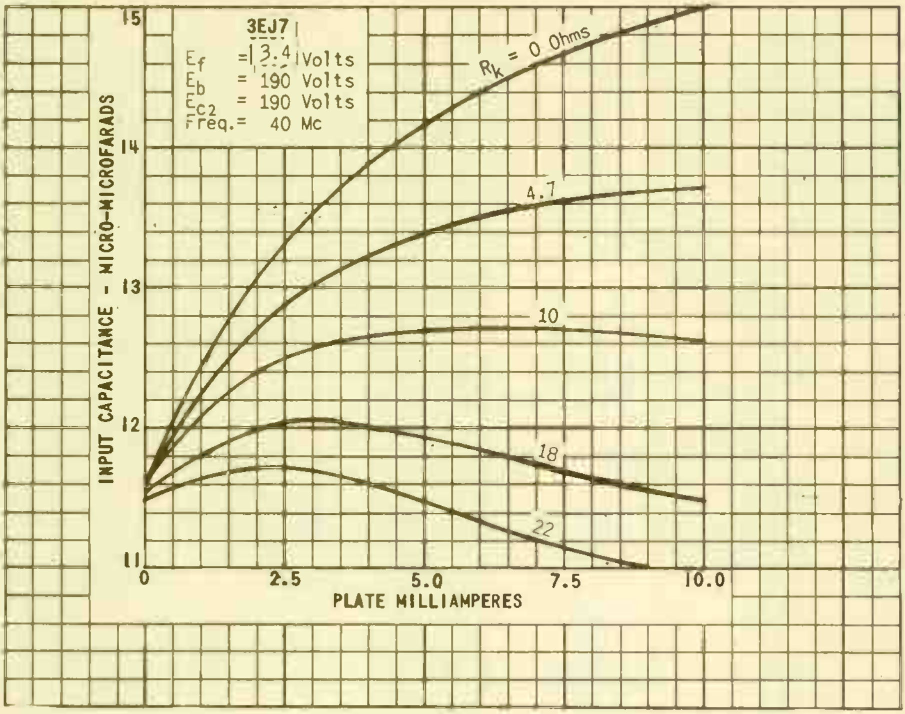
[B] FOR SERIES OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

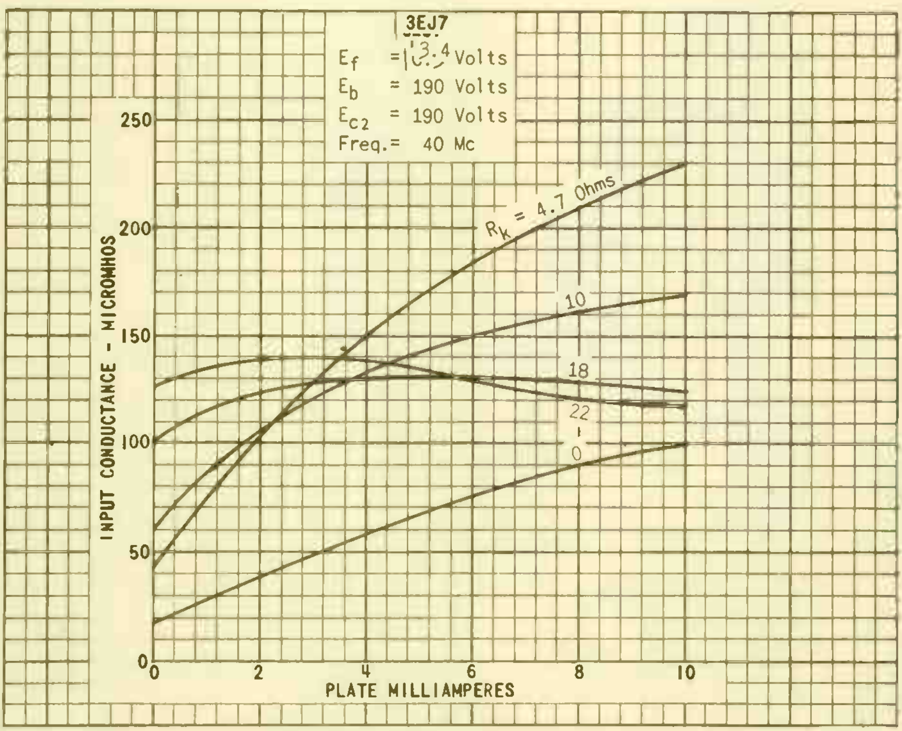
[C] INPUT DAMPING OF TUBE AND TYPICAL CERAMIC SOCKET WITH BOTH CATHODE LEADS TIED DIRECTLY TO GROUND IS ABOUT 10,000 OHMS.




3EJ7
PENTODE CONNECTION
E_f = 3.4 Volts
E_{c3} = 0 Volt
R_k=68 Ω
82
100
120
150
180
220
270
330
I_k
$E_b + E_{c2}$ =240
220
200
180
160
CATHODE CURRENT - MILLIAMPERES
80
60
40
20
0
GRID #1 (I_{c1}) VOLTS
-5
-4
-3
-2
-1
0


3EJ7
PENTODE CONNECTION
E_f = 3.4 Volts
E_{c3} = 0 Volts
$E_b + E_{c2}$ =240
220
200
180
160
GRID #2 (I_{c2}) CURRENT - MILLIAMPERES
15.0
12.5
10.0
7.5
5.0
2.5
0
GRID #1 (I_{c1}) VOLTS
-5
-4
-3
-2
-1
0

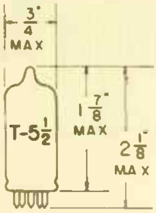

3EJ7
Ef = 3.4 Volts
Eb = 190 Volts
Ec2 = 190 Volts
Freq.= 40 Mc
Rk = 0 Ohms
4.7
10
18
22
INPUT CAPACITANCE - MICRO-MICROFARADS
15
14
13
12
11
0
2.5
5.0
7.5
10.0
PLATE MILLIAMPERES


3EJ7
Ef = 3.4 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

HI-MU TRIODE ←

MINIATURE TYPE



GLASS BULB

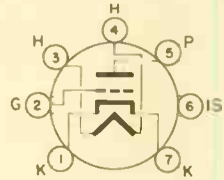
BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

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

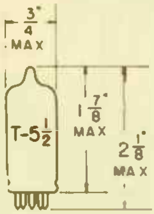
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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.

TUNG-SOL

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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	5.0	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

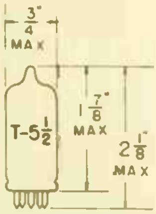
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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

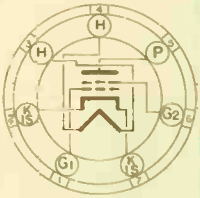
COATED UNIPOTENTIAL CATHODE

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	$\mu\mu f$
INPUT	4.50	$\mu\mu f$
OUTPUT	2.90	$\mu\mu f$

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	MEGOHMS

[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 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.

CONTINUED ON FOLLOWING PAGE

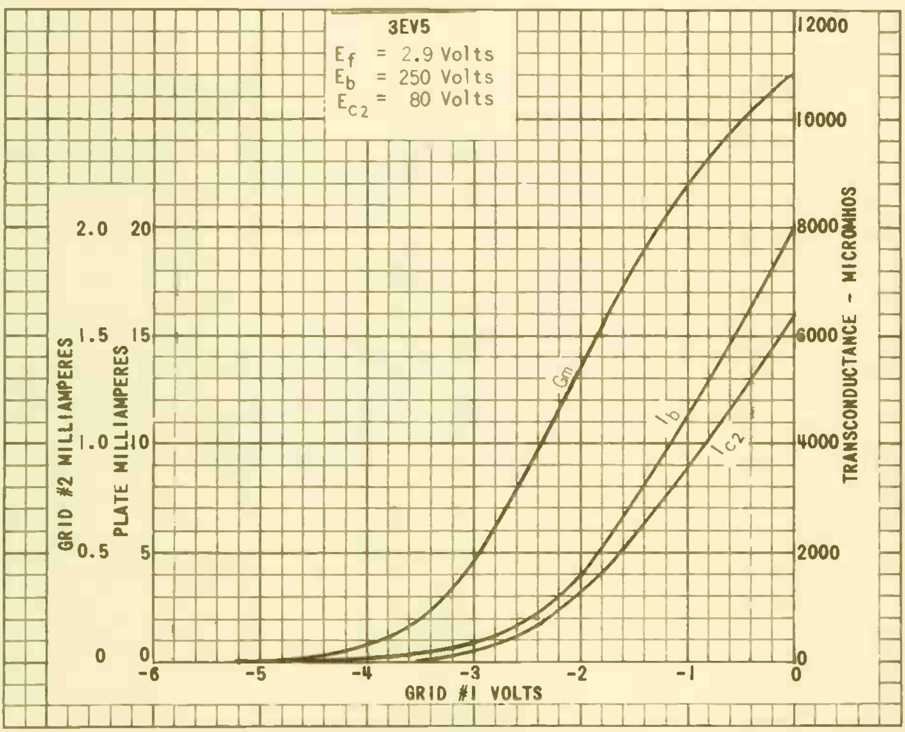
TUNG-SOL

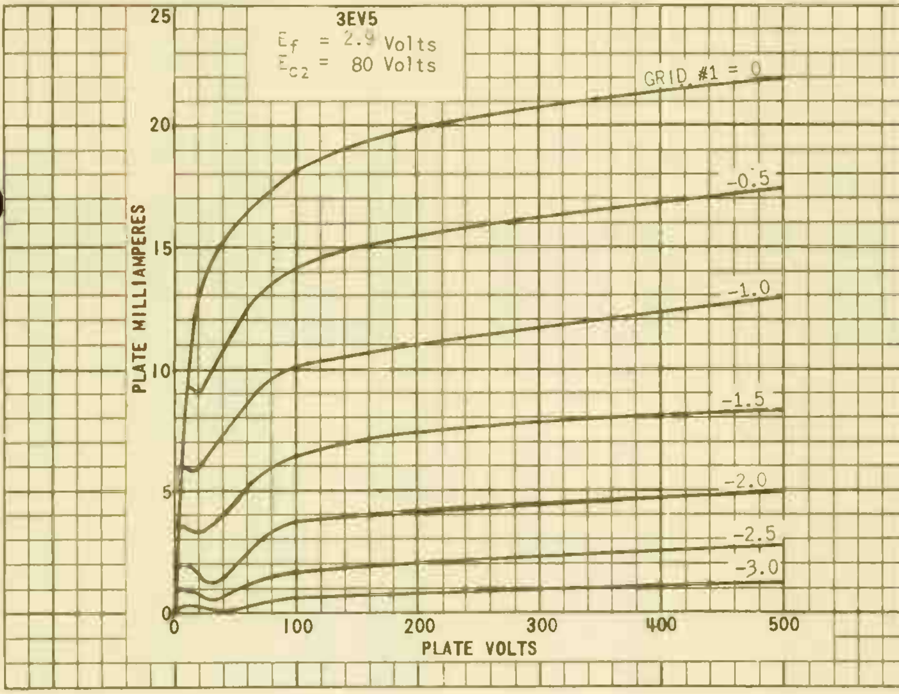
CONTINUED FROM PRECEDING PAGE

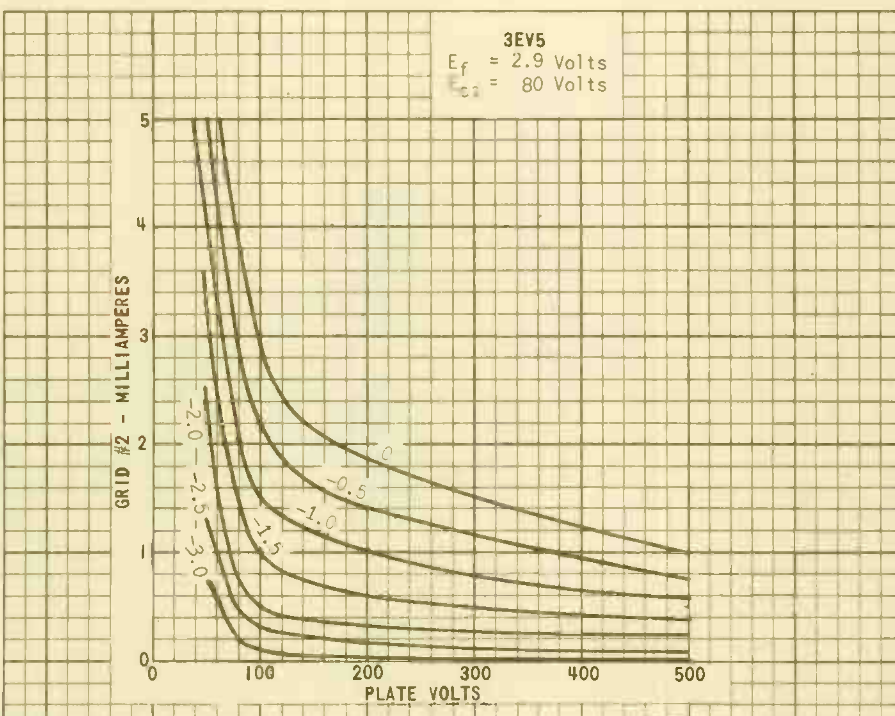
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

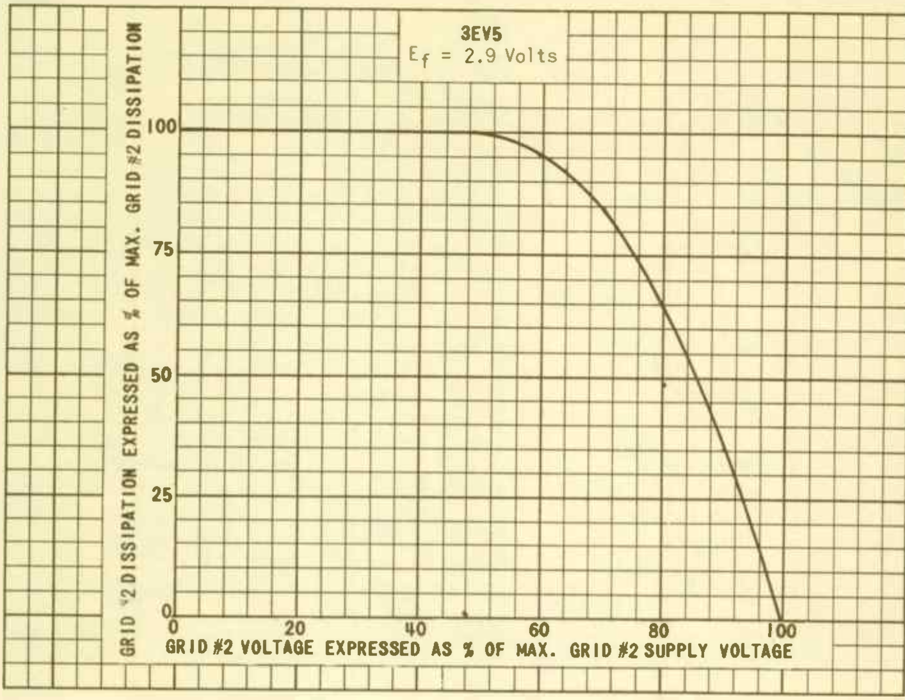
HEATER VOLTAGE	2.9	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	-1	VOLTS
PLATE RESISTANCE	0.150	MEGOHM
TRANSCONDUCTANCE	8800	μMHOS
GRID #1 CUTOFF BIAS[C]	4.5	VOLTS
PLATE CURRENT	11.5	MA.
GRID #2 CURRENT	0.90	MA.

[C]FOR TRANSCONDUCTANCE OF 100 μMHOS.




3EV5
E_f = 2.9 Volts
E_{c2} = 80 Volts
GRID #1 = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
PLATE MILLIAMPERES
0
5
10
15
20
25
0
100
200
300
400
500
PLATE VOLTS


3EV5
E_f = 2.9 Volts
E_{c2} = 80 Volts
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
GRID #2 - MILLIAMPERES
0
1
2
3
4
5
0
100
200
300
400
500
PLATE VOLTS


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

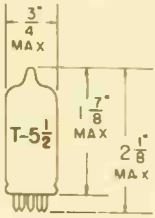
COATED UNIPOTENTIAL CATHODE

HEATER

3.0 VOLTS 0.45±6% AMP.

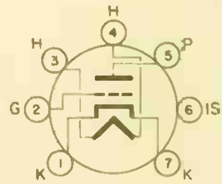
AC OR DC

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.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

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

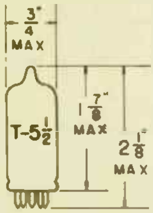
* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VALUE AFTER APPLYING FOUR TIMES THE RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE EQUAL TO THREE TIMES THE RATED HEATER VOLTAGE DIVIDED BY THE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



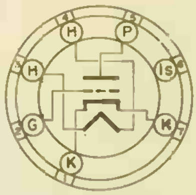
GLASS BULB
5-2

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
E_c FOR I_b = 100 μA (APPROX.)	-5	VOLTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES

[A]THE BOGET VALUE OF VOLTAGE/CURRENT PRECEDING THIS NOTE IS OBTAINED WHEN OPERATING THE HEATER WITH THE SPEC'FIED 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 TTPE 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 SERVICEABILITT OF THE DEVICE, TAKING RESPONSIBILITT 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 SUPPLT-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION EQUIPMENT CONTROL ADJUSTMENT. LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

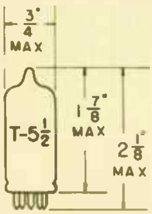
[D]HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE/CURRENT WITHIN THE SPECIFIED TOLERANCE.

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

TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

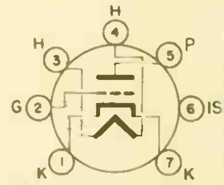
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

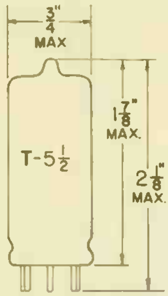
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES SUPPLY

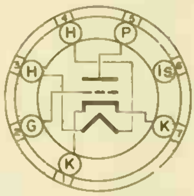
3.1 VOLTS 0.45 AMP.

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

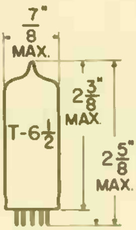
TYPICAL OPERATION

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				

TUNG-SOL

DUAL PENTODE

MINIATURE TYPE



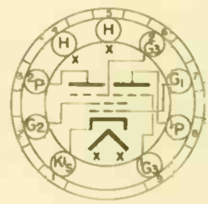
GLASS BULB

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

CONTINUED ON FOLLOWING PAGE

TENTATIVE DATA

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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.

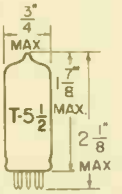
[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE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

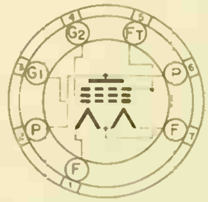


GLASS BULB

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	1.4 VOLTS
50 MA.	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 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.

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.

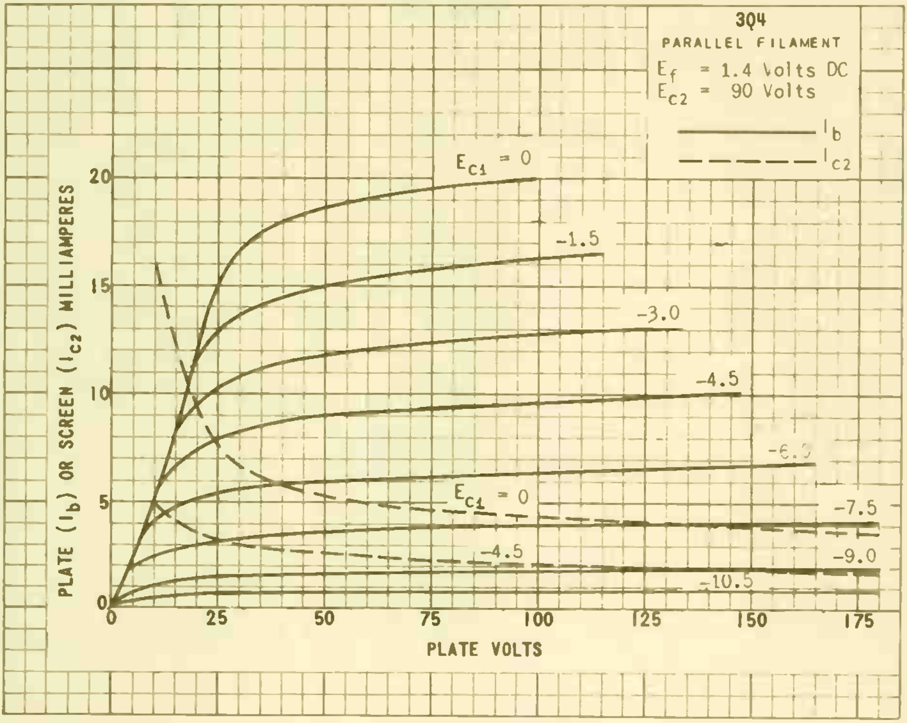
[A] FOR EACH 1.4 VOLT FILAMENT SECTION.

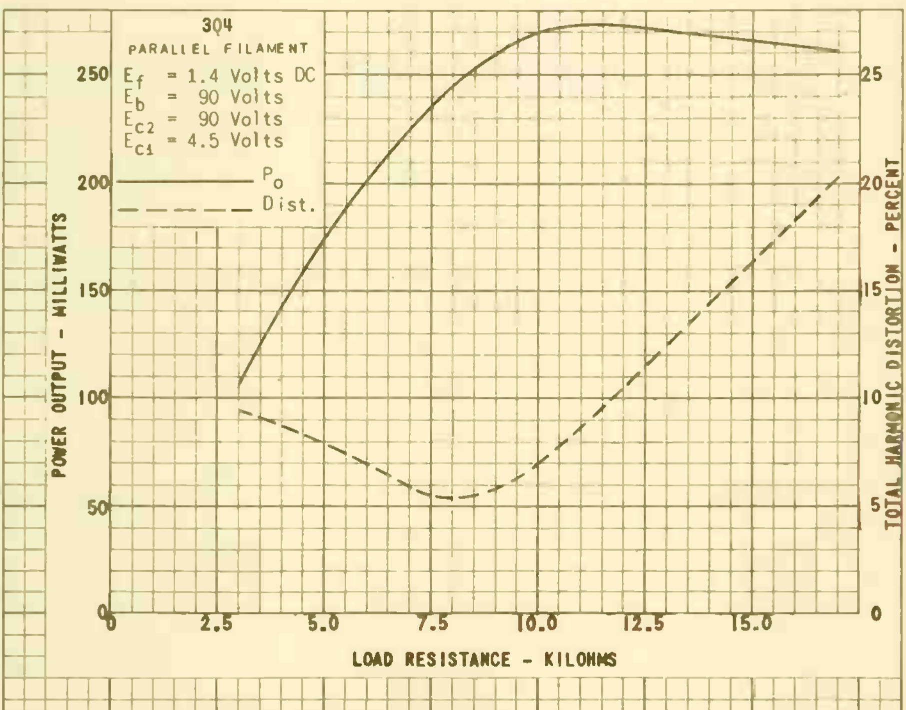
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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.

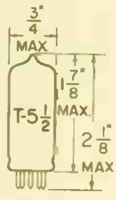

3Q4
PARALLEL FILAMENT
E_f = 1.4 Volts DC
E_{c2} = 90 Volts
I_b
I_{c2}
E_{c1} = 0
-1.5
-3.0
-4.5
-7.5
-9.0
-10.5
PLATE (I_b) OR SCREEN (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
50
75
100
125
150
175


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
TOTAL HARMONIC DISTORTION - PERCENT
LOAD RESISTANCE - KILOHMS
0
50
100
150
200
250
2.5
5.0
7.5
10.0
12.5
15.0
5
10
15
20
25

TUNG-SOL

PENTODE

MINIATURE TYPE

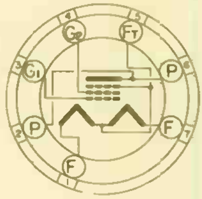


GLASS BULB

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 PIN -F
2.8 VOLTS	1.4 VOLTS
50 MA.	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.

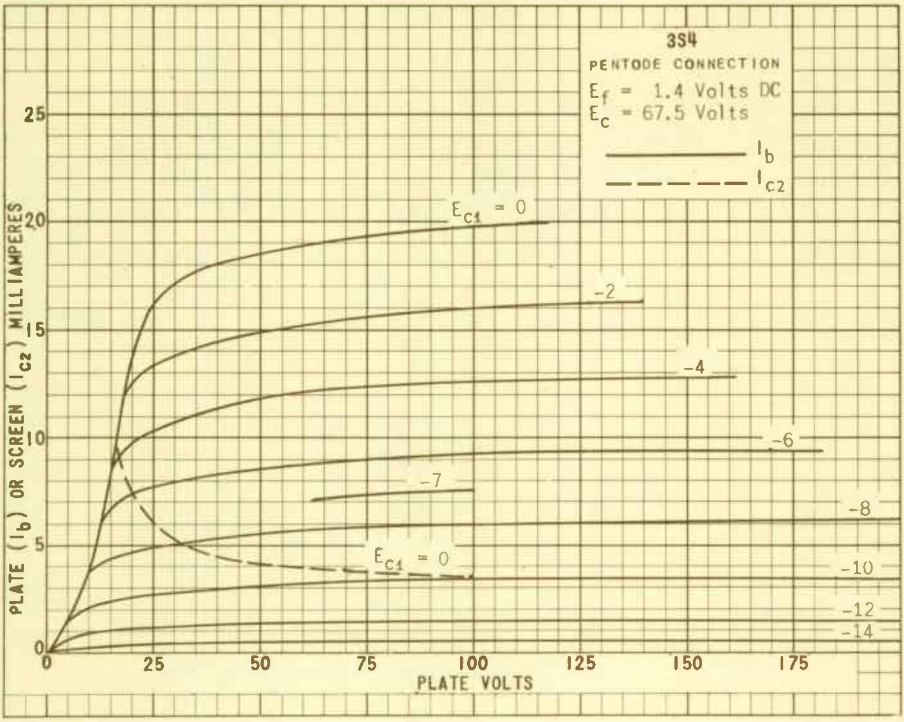
[A] FOR EACH 1.4 FILAMENT SECTION.

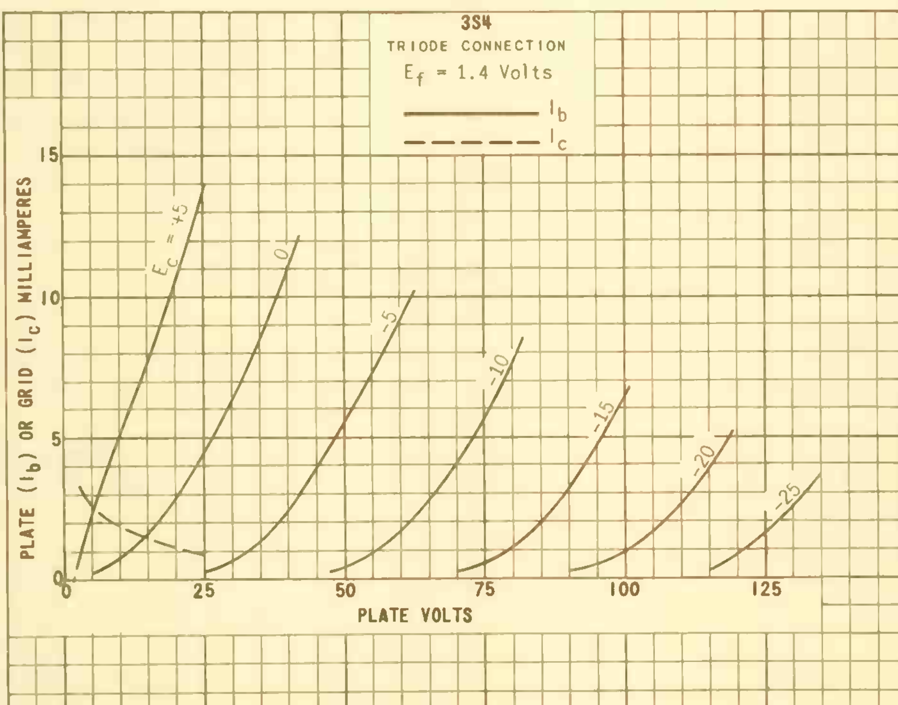
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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.


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


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

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

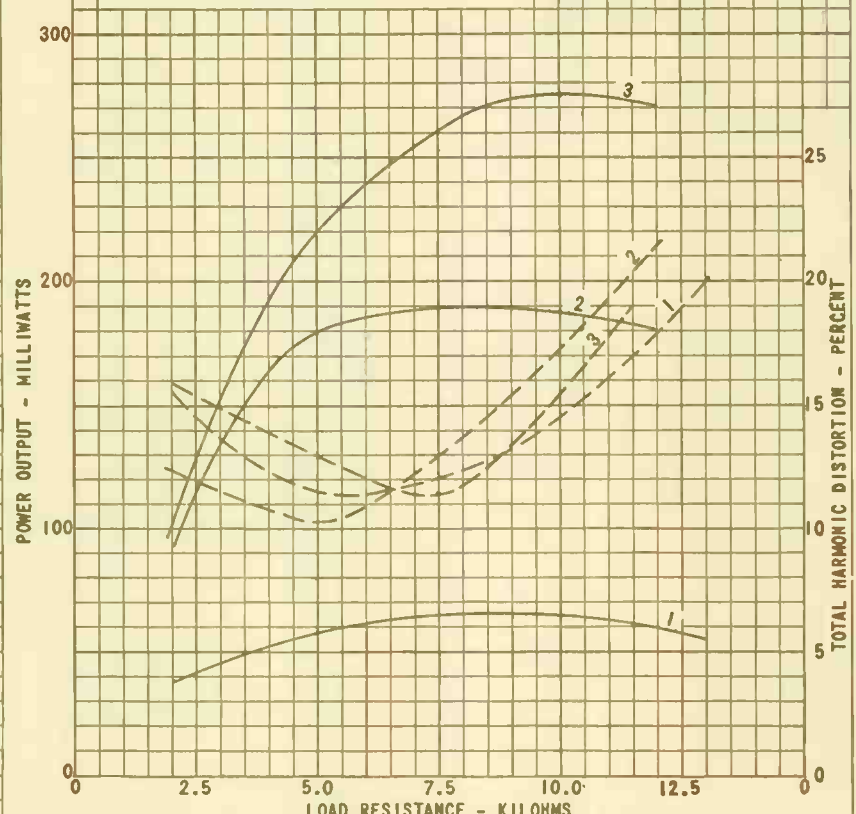
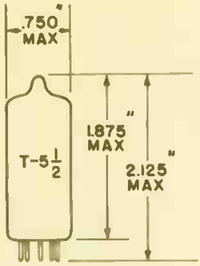


PLATE 1986
MAR. 1, 1948

TUNG-SOL

POWER AMPLIFIER PENTODE

MINIATURE TYPE

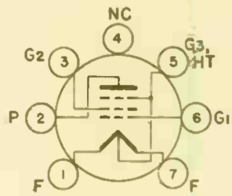


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

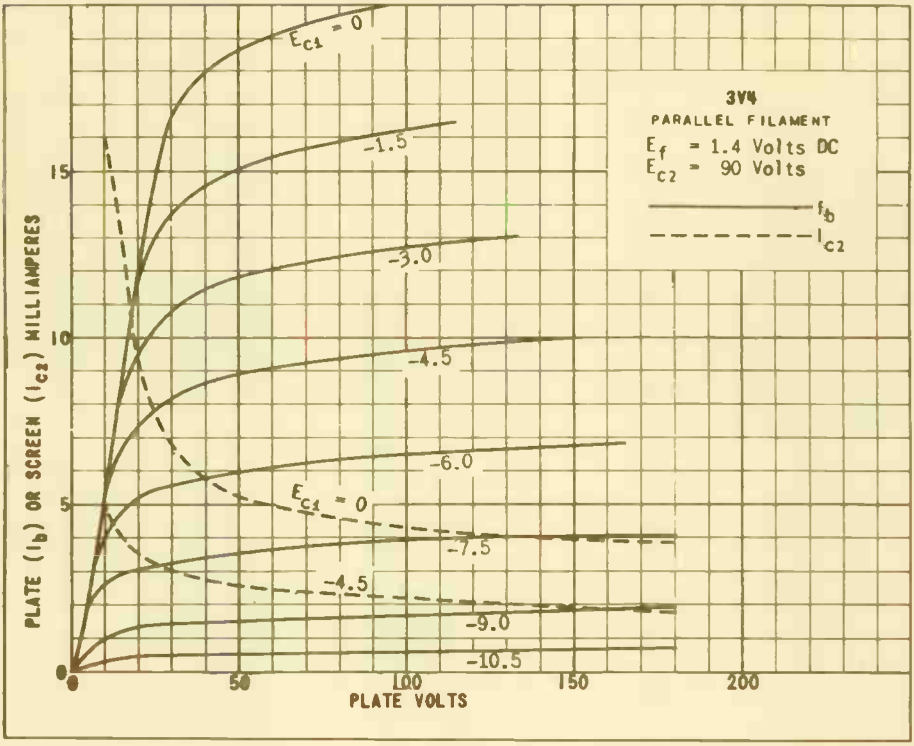
	SERIES	PARALLEL		
FILAMENT VOLTAGE	2.8	1.4	1.4	VOLTS
PLATE VOLTAGE	90	85	90	VOLTS
GRID #2 VOLTAGE	90	85	90	VOLTS
GRID #1 VOLTAGE	-4.5	-5	-4.5	VOLTS
PEAK GRID #1 SIGNAL VOLTAGE	4.5	5	4.5	VOLTS
PLATE CURRENT (AT ZERO SIGNAL)	7.7	6.9	9.5	MA.
GRID #2 CURRENT (AT ZERO SIGNAL)	1.7	1.5	2.1	MA.
PLATE RESISTANCE (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.



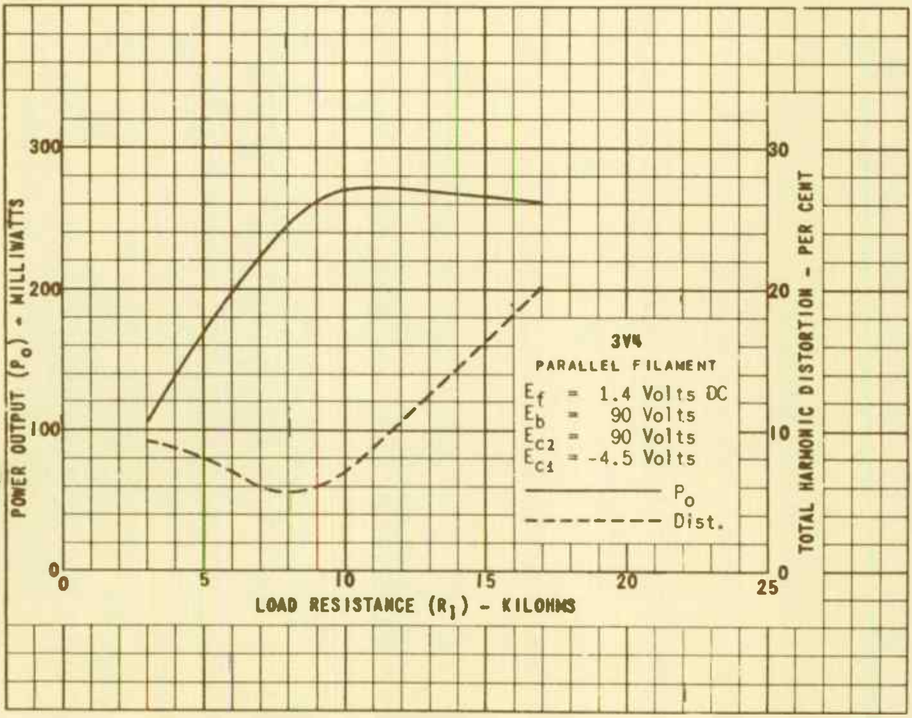


PLATE 1778

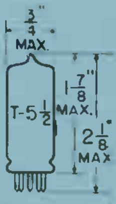
FEB. 3, 1947

TUNG-SOL

POWER AMPLIFIER PENTODE

MINIATURE TYPE

COATED FILAMENT CATHODE



GLASS BULB

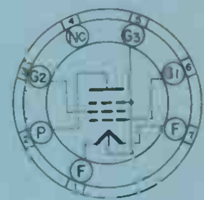
SERIES FILAMENT
E_f APPLIED BETWEEN PINS 1 & 7
E_{g1} REFERRED TO PIN 1

PARALLEL FILAMENT
APPLIED BETWEEN PIN 5 AND PINS 1 & 7 TIED TOGETHER.
REFERRED TO PIN 5

1.25±20% VOLTS 0.1 AMP.

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 [illegible] 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 [illegible].



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

ANY MOUNTING POSITION

THE 3V4WA IS A POWER AMPLIFIER PENTODE UTILIZING THE 7 PIN MINIATURE CONSTRUCTION. IT IS A RUGGEDIZED VERSION OF THE 3V4, MAKING IT SUITABLE FOR MILITARY EQUIPMENT APPLICATIONS.

RATINGS

POWER AMPLIFIER PENTODE

	TEST COND.	ABS. MAX.	
FILAMENT VOLTAGE	1.25	1.25±20%	VOLTS
MAXIMUM PLATE VOLTAGE	90	100	VOLTS
MAXIMUM GRID #1 VOLTAGE	-4.5	---	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	100	VOLTS
MAXIMUM CATHODE CURRENT	---	15	MA.
MAXIMUM ALTITUDE		10 000	FEET

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AF POWER AMPLIFIER - CLASS A_1

	SERIES FILAMENT		PARALLEL FILAMENT	
PLATE VOLTAGE	90	85	90	VOLTS
SCREEN VOLTAGE	90	85	90	VOLTS
GRID VOLTAGE	-4.5	-5	-4.5	VOLTS
PEAK AF GRID VOLTAGE	4.5	5	4.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	7.7	6.9	9.5	MA.
ZERO-SIGNAL SCREEN CURRENT	1.7	1.5	2.1	MA.
LOAD RESISTANCE	10 000	10 000	10 000	OHMS
PLATE RESISTANCE (APPROX.)	0.12	0.12	0.1	MEGOHM
TRANSCONDUCTANCE	2 000	1 575	2 150	µMHOS
MAXIMUM-SIGNAL POWER OUTPUT	0.24	0.25	0.27	WATT
TOTAL HARMONIC DISTORTION	7	10	7	PER CENT

→ INDICATES A CHANGE.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

PERFORMANCE TESTS
(MIL-E-1)

RESONANCE:

THE TUBE UNDER TEST SHALL BE MOUNTED ON A VIBRATION TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. TEST CONDITIONS OF PARAGRAPH 4.9.19.1 OF MIL-E-1 SHALL BE APPLIED AND E_p MONITORED WHILE THE FREQUENCY OF VIBRATION IS CONTINUOUSLY SWEPT FROM 50 TO 4500 CPS AND THE PEAK ACCELERATION CONTROLLED CONSTANT @ 2G. TOTAL TIME OF SWEEP SHALL NOT BE LESS THAN ONE (1) MINUTE. THE MAX. VALUE OF E_p FOR THIS TEST SHALL NOT EXCEED 175 MVAC. THIS TEST SHALL BE CONSIDERED A "DESIGN TEST" AND SHALL BE CONDUCTED @ INSPECTION LEVEL 1A AND AN AQL OF 0.65%.

SHOCK:

TEST CONDITIONS OF PARAGRAPH 4.9.20.5 OF MIL-E-1 SHALL APPLY. HAMMER ANGLE SHALL BE 30°.

FATIGUE:

THE TEST CONDITIONS OF PARAGRAPH 4.9.20.6 OF MIL-E-1 SHALL APPLY.

PERFORMANCE TEST (MIL-E-1/343) DATED AUG. 14, 1953:

THE PERFORMANCE REQUIREMENTS AND APPLICABLE TESTS SHALL BE AS SPECIFIED ON SHEETS 1 & 2 OF MIL-E-1/343 EXCEPT AS FOLLOWS:

(A) ON SHEET 1, (1) THE MAXIMUM E_p FOR THE VIBRATION TEST SHALL READ "50 MVAC" AND (2) SYMBOL "EE" AND THE MAX. VALUE "48 VU" FOR THE AF NOISE AND MICROPHONISM TEST SHALL BE DELETED.

(B) ON SHEET 2, (NOTE 1 SHALL BE CHANGED TO READ: "Ebb=Ecc2=135 VDC; Ec1=0, Rg1=3.3 MEG; Rp=0.27 MEG; Rg2=2.0 MEG (BYPASSED WITH A 0.5 µf CAPACITOR TO -F). SET AMPLIFIER GAIN FOR 50MW OUTPUT WITH Esig=500 MVAC. THE REJECTION LEVEL SHALL BE SET AT THE VU METER READING OBTAINED DURING THE CALIBRATION.

GENERAL:

3V4WA SHALL MEET REQUIREMENTS OF MIL-E-1/343 DATED AUGUST 14, 1953 WITH FOLLOWING EXCEPTIONS.

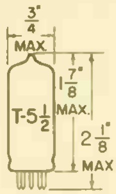
(A) THE FILAMENT SHALL BE MADE OF COATED TUNGSTEN AND NO DAMPER PADS SHALL BE USED.

(B) ABSOLUTE MAXIMUM RATING OF FILAMENT VOLTAGE (Ef) SHALL BE 1.25 ±20% VDC.

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

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

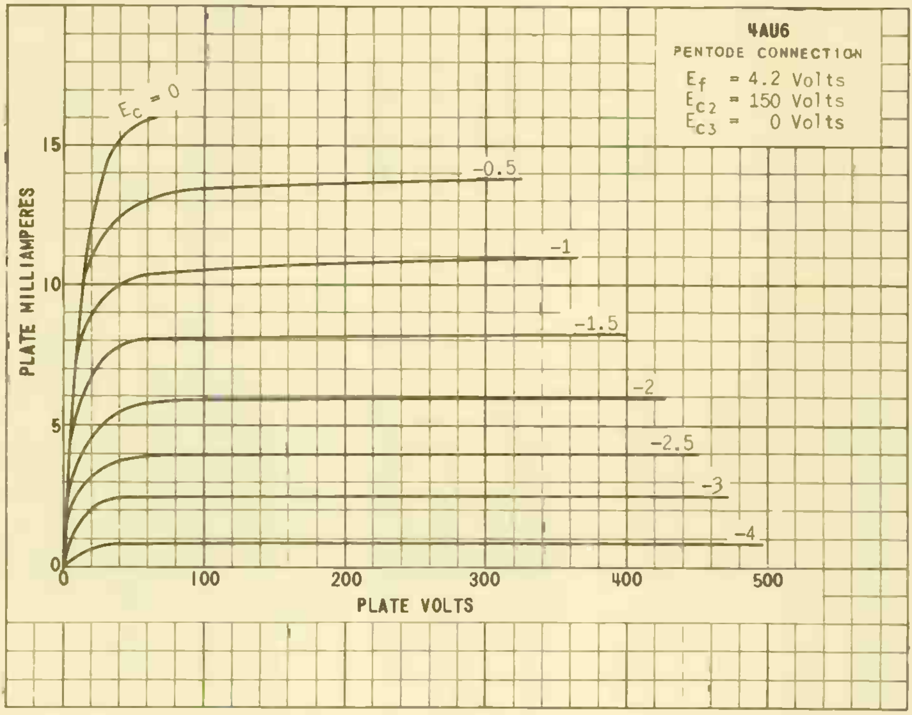
CLASS A_1 AMPLIFIER - PENTODE CONNECTION

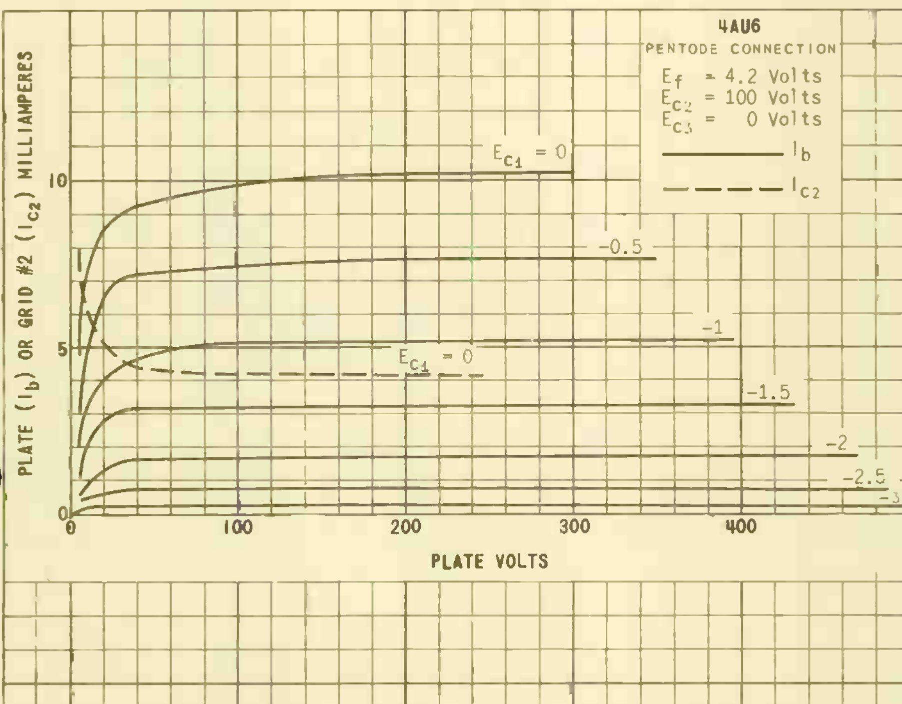
HEATER VOLTAGE	4.2	4.2	4.2	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	100	250	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE BIAS RESISTOR	150	100	68	OHMS
GRID #3 VOLTAGE	PIN #2 CONNECTED TO PIN #7 AT SOCKET			
TRANSCONDUCTANCE	3 900	4 500	5 200	μMHOS
PLATE CURRENT	5	7.6	10.6	MA.
GRID #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

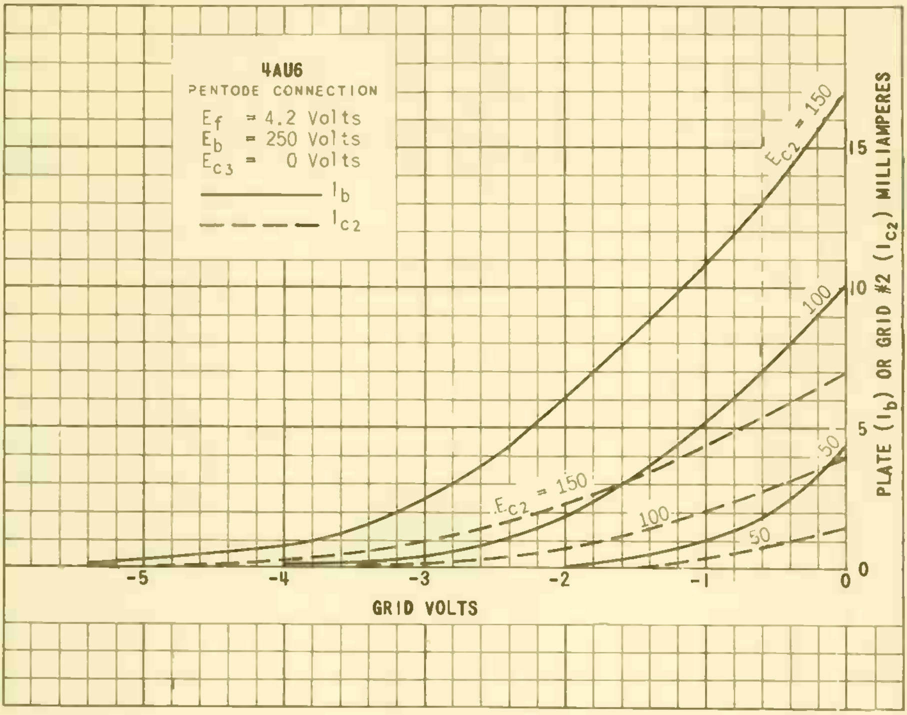
CLASS A_1 AMPLIFIER - TRIODE CONNECTION[C]

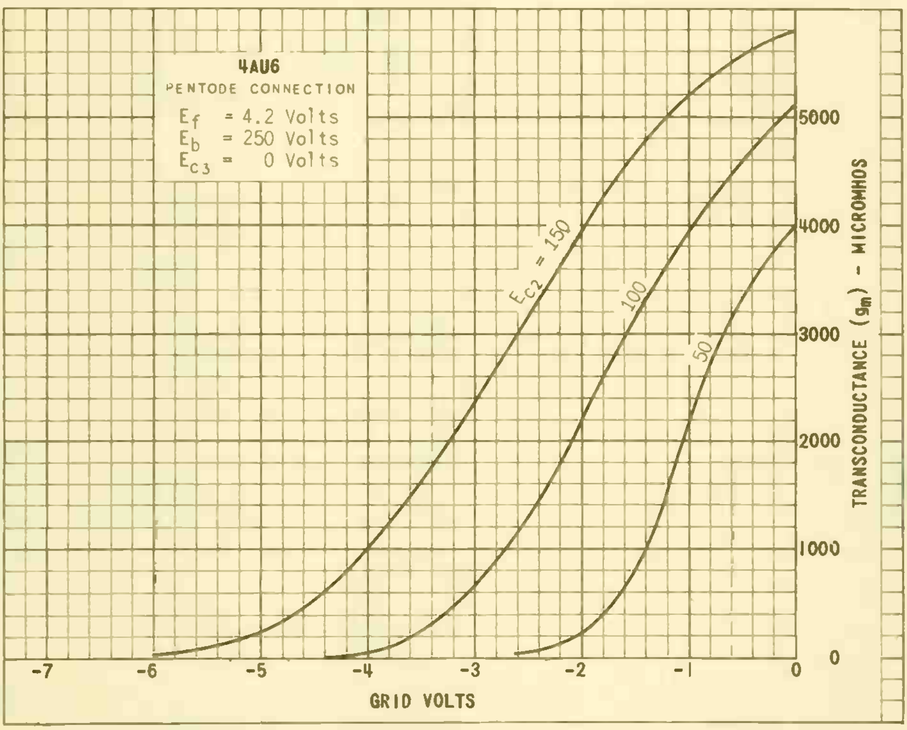
HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	PLATE	
CATHODE RESISTOR	330	OHMS
GRID #3 VOLTAGE	PLATE	
TRANSCONDUCTANCE	4 800	μMHOS
PLATE CURRENT	12.2	MA.
AMPLIFICATION FACTOR	36	

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


4AU6
PENTODE CONNECTION
Ef = 4.2 Volts
Ec2 = 150 Volts
Ec3 = 0 Volts
Ec = 0
-0.5
-1
-1.5
-2
-2.5
-3
-4
PLATE MILLIAMPERES
PLATE VOLTS


4AU6
PENTODE CONNECTION
Ef = 4.2 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
Ib
Ic2
Ec1 = 0
-0.5
-1
Ec1 = 0
-1.5
-2
-2.5
-3
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS

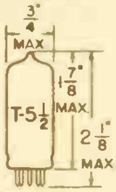

4AU6
PENTODE CONNECTION
E_f = 4.2 Volts
E_b = 250 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c2} = 150
100
50
E_{c2} = 150
100
50
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
15
10
5
0
-5
-4
-3
-2
-1
0
GRID VOLTS


4AU6
PENTODE CONNECTION
E_f = 4.2 Volts
E_b = 250 Volts
E_{c3} = 0 Volts
E_{c2} = 150
100
50
TRANSCONDUCTANCE (g_m) - MICROMHOS
5000
4000
3000
2000
1000
0
-7
-6
-5
-4
-3
-2
-1
0
GRID VOLTS

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON 7 PIN BASE E7-1

OUTLINE DRAWING JEDEC 5-2

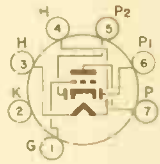
COATED UNIPOTENTIAL CATHODE

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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

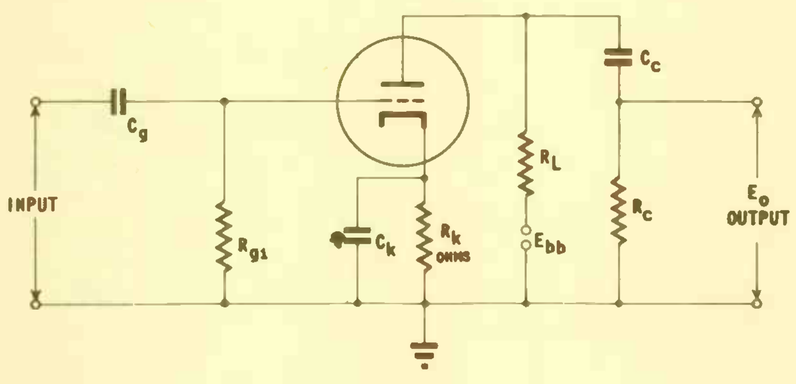
CLASS A_1 AMPLIFIER

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.

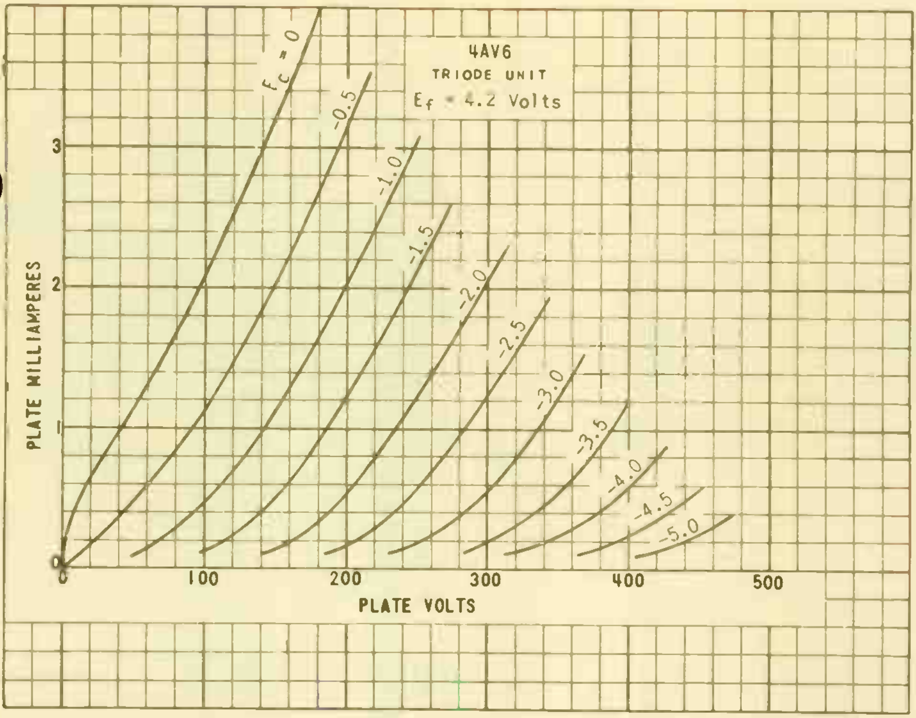
RESISTANCE COUPLED AMPLIFIER

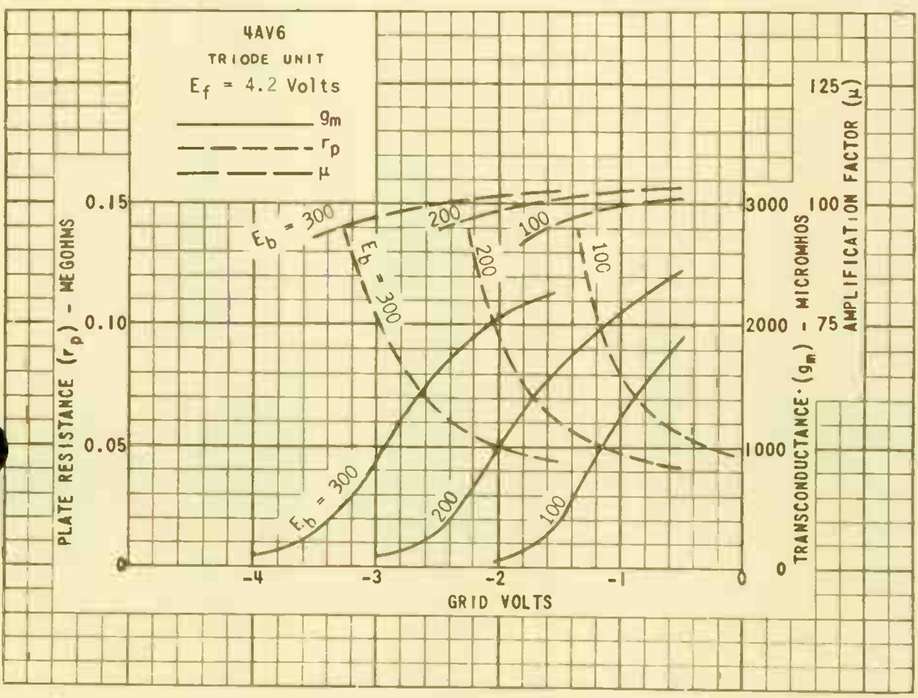
TRIODE UNIT

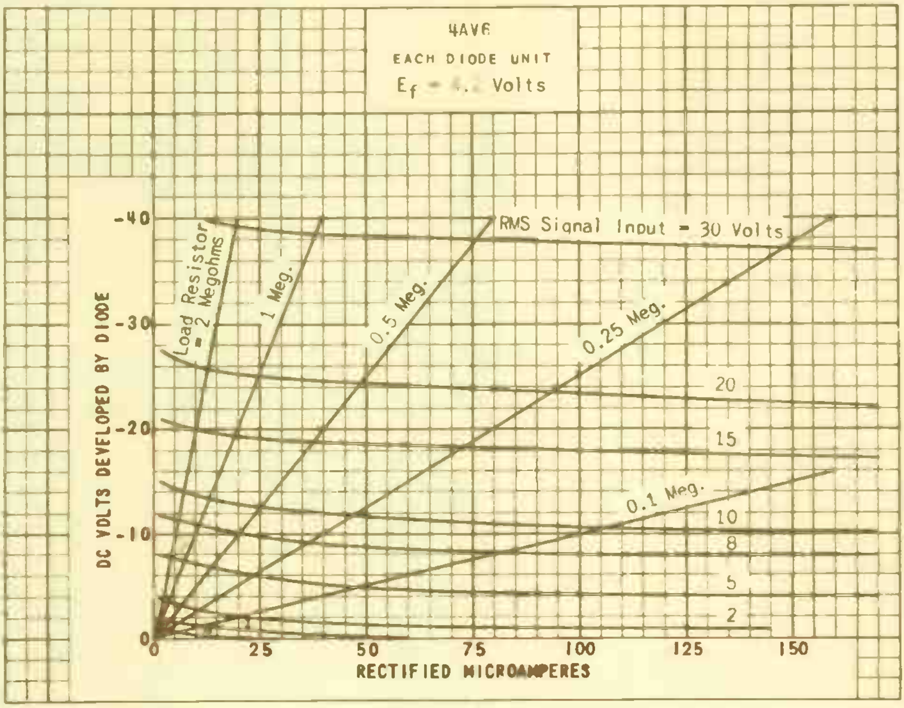
PLATE SUPPLY VOLTAGE	90	250	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	220 000	470 000	OHMS
CONTROL GRID RESISTOR	10.0	10.0	MEGOHMS
INPUT CONDENSER	0.01	0.01	µf
OUTPUT CONDENSER	0.01	0.01	µf
GRID RESISTOR OF FOLLOWING STAGE	470 000	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	1 000	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.

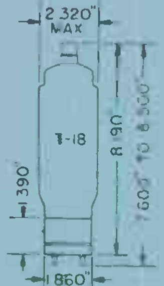

4AV6
TRIODE UNIT
E_f = 4.2 Volts
E_c = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
PLATE MILLIAMPERES
0
1
2
3
0
100
200
300
400
500
PLATE VOLTS


4AV6
TRIODE UNIT
E_f = 4.2 Volts
g_m
r_p
μ
E_b = 300
200
100
E_b = 300
200
100
E_b = 300
200
100
PLATE RESISTANCE (r_p) - MEGOHMS
0
0.05
0.10
0.15
-4
-3
-2
-1
0
GRID VOLTS
TRANSCONDUCTANCE (g_m) - MICROMHOS
0
1000
2000
3000
AMPLIFICATION FACTOR (μ)
75
100
125


4AV6
EACH DIODE UNIT
Volts
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
DC VOLTS DEVELOPED BY DIODE
-40
-30
-20
-10
0
0
25
50
75
100
125
150
RECTIFIED MICROAMPERES

TUNG-SOL

DIODE



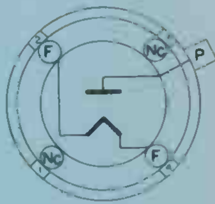
GLASS BULB

FILAMENT

5.0±5% VOLTS 7.25 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

JUMBO BAYONET
4 PIN BASE

4AT

THE 4B32 IS A XENON FILLED HALF WAVE RECTIFIER FOR USE IN HIGH VOLTAGE CIRCUITS. THE TUBE IS DESIGNED TO OPERATE OVER A WIDE TEMPERATURE RANGE WITHOUT THE NECESSITY OF HEATING OR COOLING DEVICES. ITS HARD GLASS ENVELOPE AND WELL SUPPORTED MOUNT MAKE IT PARTICULARLY SUITED FOR MILITARY AND INDUSTRIAL USE. AS CONTRASTED TO SIMILAR MERCURY-VAPOR TUBES, THE 4B32 MAY BE MOUNTED IN ANY POSITION AND IS NOT SUBJECT TO MERCURY-SPLASH PROBLEMS. ITS EFFICIENT OXIDE COATED FILAMENT IS FAST HEATING. AS CONSISTENT WITH FILAMENTARY GAS AND VAPOR RECTIFIER TUBE PRACTICE, QUADRATURE EXCITATION OF THE FILAMENT IS RECOMMENDED FOR OBTAINING THE LONGEST TUBE LIFE. IN QUADRATURE OPERATION, THE FILAMENT CURRENT IS PHASED TO BE AT A MINIMUM WHEN THE PEAK ANODE CURRENT FLOWS. HOWEVER THE TUBE CARRIES FULL RATINGS FOR IN PHASE OPERATION OF THE FILAMENT.

MAXIMUM RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	10 000	VOLTS
MAXIMUM PEAK CATHODE CURRENT	5.0	AMP.
MAXIMUM AVERAGE CATHODE CURRENT	1.25	AMP.
MAXIMUM SURGE CATHODE CURRENT (MAXIMUM DURATION TIME 0.1 SECONDS)	50.	AMP.
MAXIMUM AVERAGING TIME	15.	SECONDS
MAXIMUM SUPPLY FREQUENCY	150.	CPS
AMBIENT TEMPERATURE LIMITS	-55 TO +70°	C

ELECTRICAL DATA

FILAMENT VOLTAGE	5.0±5%	VOLTS
FILAMENT CURRENT AT 5.0 VOLTS	7.25	AMP.
MINIMUM CATHODE HEATING TIME	30.	SECONDS
AVERAGE ANODE VOLTAGE DROP	12.	VOLTS
PEAK ANODE VOLTAGE DROP	16.	VOLTS
CRITICAL ANODE VOLTAGE	50.	VOLTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MECHANICAL DATA

MOUNTING POSITION	ANY	
OVERALL LENGTH	7.6 TO 8.5	INCHES
MAXIMUM DIAMETER	2.32	INCHES
BULB	T-18	[illegible]
CAP	MEDIUM METAL C-1-5	
BASE	JUMBO 4 PIN, A4-29	
WEIGHT (NET) MAX.	7 1/2	OUNCES

MAXIMUM CIRCUIT VALUES

FIG.	CIRCUIT	TRANSFORMER	FILAMENT OPERATION	NO. OF TUBES	A.C. SECONDARY VOLTS E_{RMS}	DC OUTPUT (APPROX.) E_{OC} IN VOLTS	DC OUTPUT (APPROX.) I_{OC} IN AMPERES	RIPPLE VOLTS RMS	RIPPLE FREQ.
1	HALF WAVE SINGLE PHASE	SINGLE PHASE	IN PHASE	1	7000	3200	1.25	3500	f
2	FULL WAVE SINGLE PHASE	SINGLE PHASE CENTER TAP	IN PHASE	2	3500	3200	2.50	1500	2f
3	BRIDGE CIRCUIT SINGLE PHASE	SINGLE PHASE	IN PHASE	4	7000	6400	2.50	3000	2f
4	HALF WAVE THREE PHASE	DELTA-WYE	———	3	4000	4800	3.75	860	3f
5	FULL WAVE THREE PHASE	DELTA-WYE	QUADRATURE	6	4000	9500	3.75	400	6f
6	FULL WAVE THREE PHASE	DELTA-DELTA	QUADRATURE	6	7000	9500	3.75	400	6f
7	HALF WAVE SIX PHASE (THREE PHASE SUPPLY)	DELTA-STAR	QUADRATURE	6	3500	4800	5.0	200	6f

DC OUTPUT VALUES ARE THOSE SUPPLIED TO A CHOKE INPUT FILTER WITH A PURE SINE WAVE SUPPLY.

VALUES ARE FOR A MAXIMUM OF 10KV PEAK INVERSE VOLTAGE PER TUBE AND 150 CPS MAXIMUM SUPPLY FREQUENCY.

TUNG-SOL

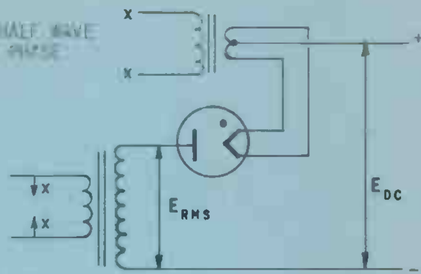


FIGURE 1 - HALF WAVE -SINGLE PHASE

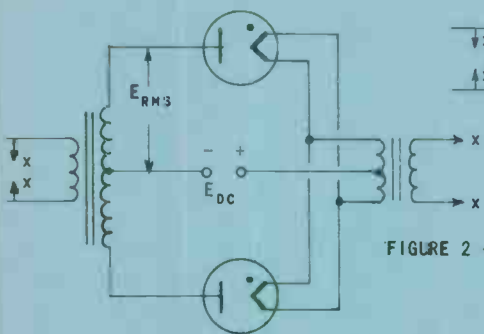


FIGURE 2 - FULL WAVE - SINGLE PHASE

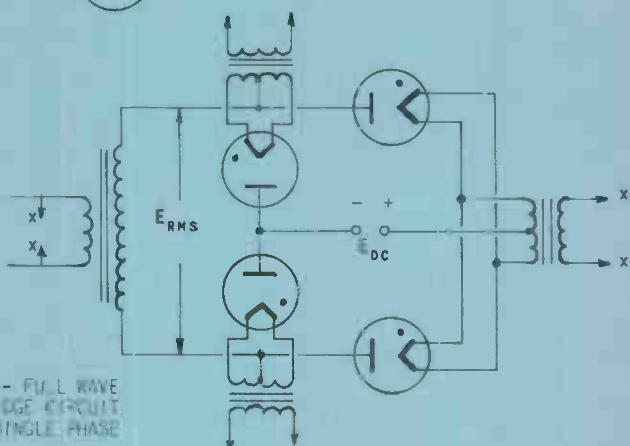


FIGURE 3 - FULL WAVE BRIDGE CIRCUIT -SINGLE PHASE

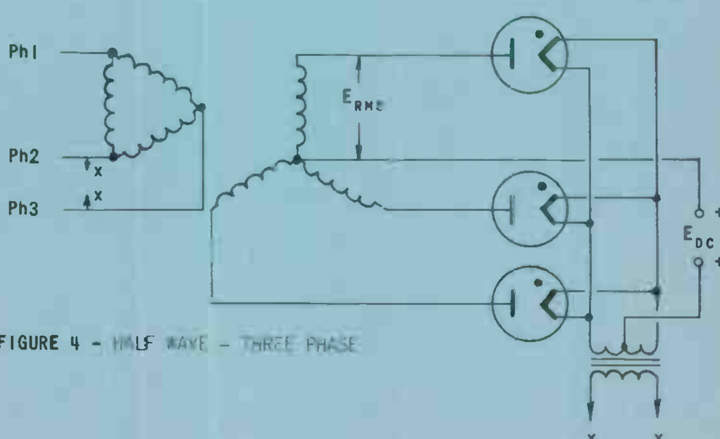


FIGURE 4 - HALF WAVE - THREE PHASE

TUNG-SOL

FIGURE 5 - FULL WAVE-THREE PHASE

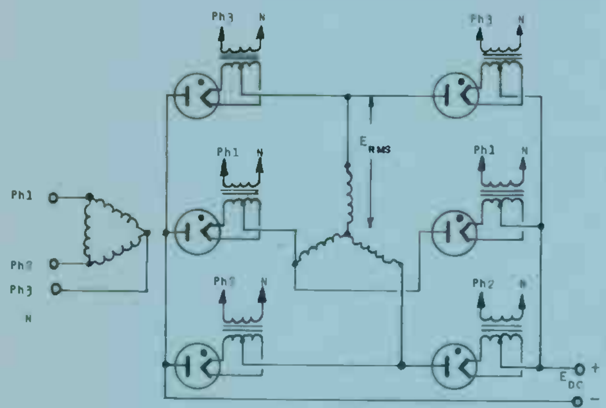


FIGURE 6 - FULL WAVE - THREE PHASE

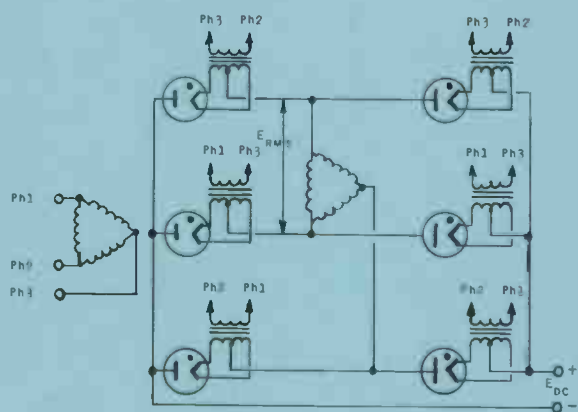
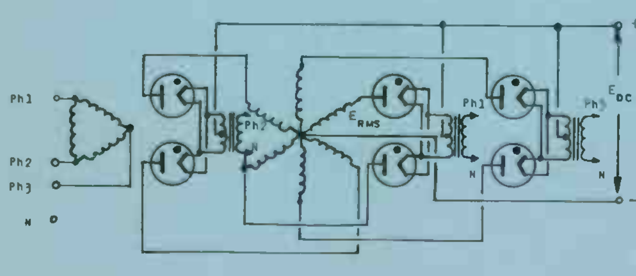


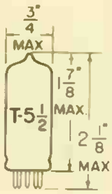
FIGURE 7 - HALF WAVE-SIX PHASE (3 PHASE SUPPLY)



TUNG-SOL

PENTODE

MINIATURE TYPE

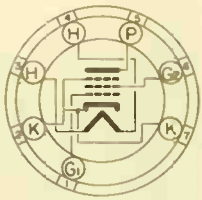


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
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.

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

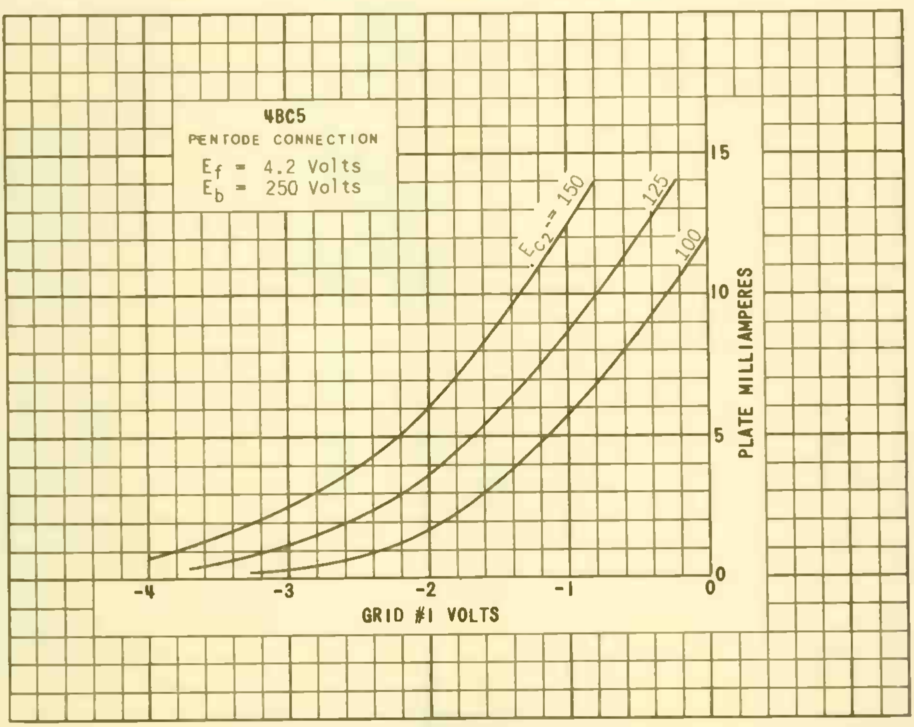
CLASS A_1 AMPLIFIER - PENTODE CONNECTION

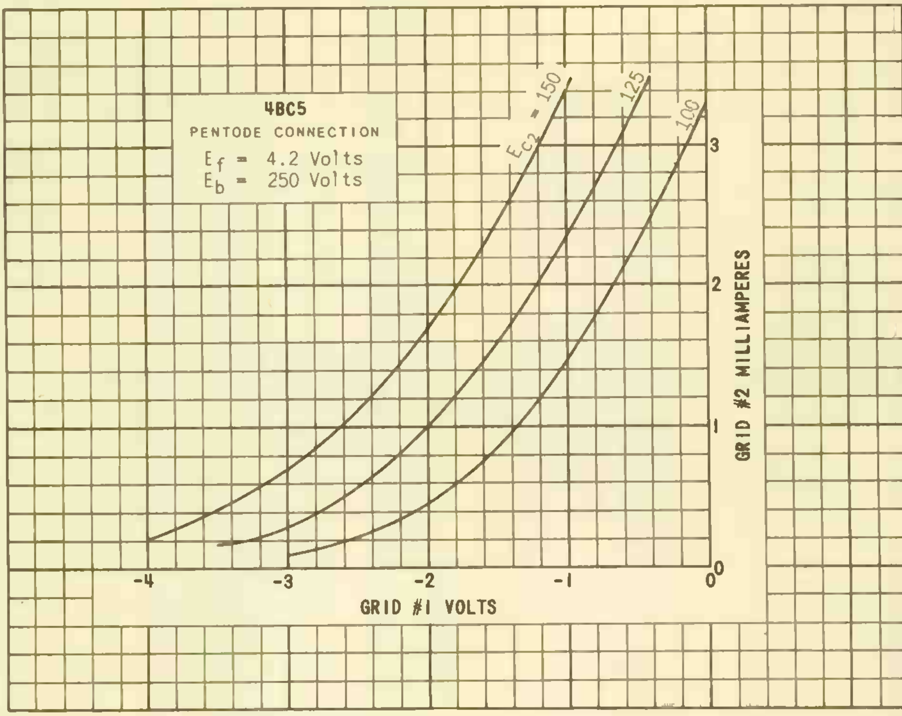
HEATER VOLTAGE	4.2	4.2	4.2	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	100	125	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE RESISTOR	180	100	180	OHMS
PLATE RESISTANCE (APPROX.)	0.6	0.5	0.8	MEGOHM
TRANSCONDUCTANCE	4900	6100	5700	µMHOS
PLATE CURRENT	4.7	8	7.5	MA.
GRID #2 CURRENT	1.4	2.4	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_{b2} = 10 µA.	-5	-6	-8	VOLTS

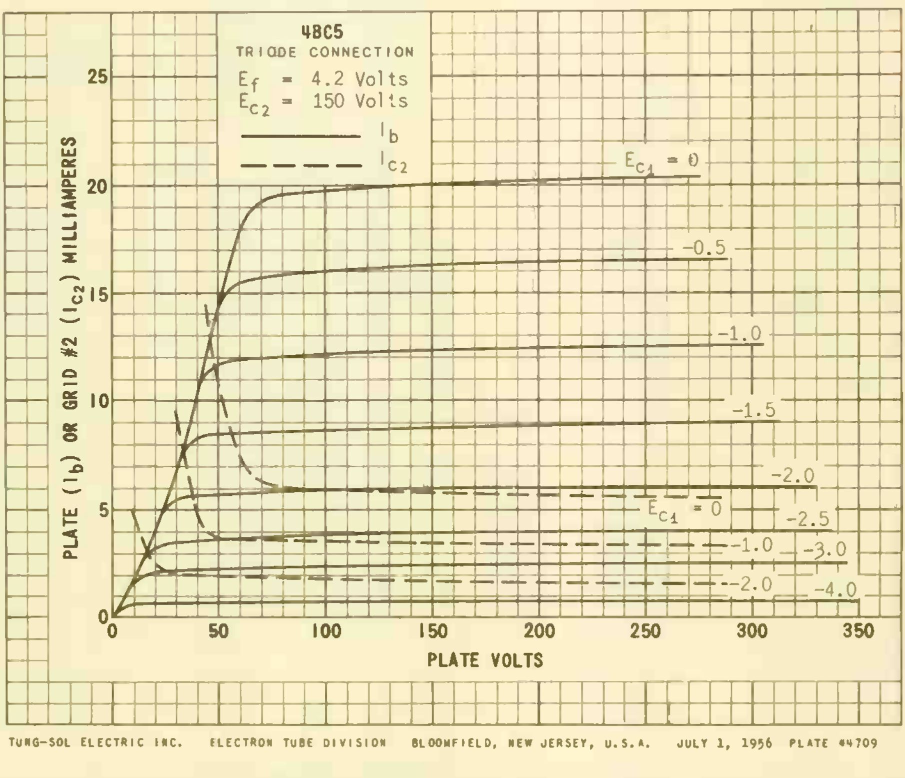
CLASS A_1 AMPLIFIER - TRIODE CONNECTION[B]

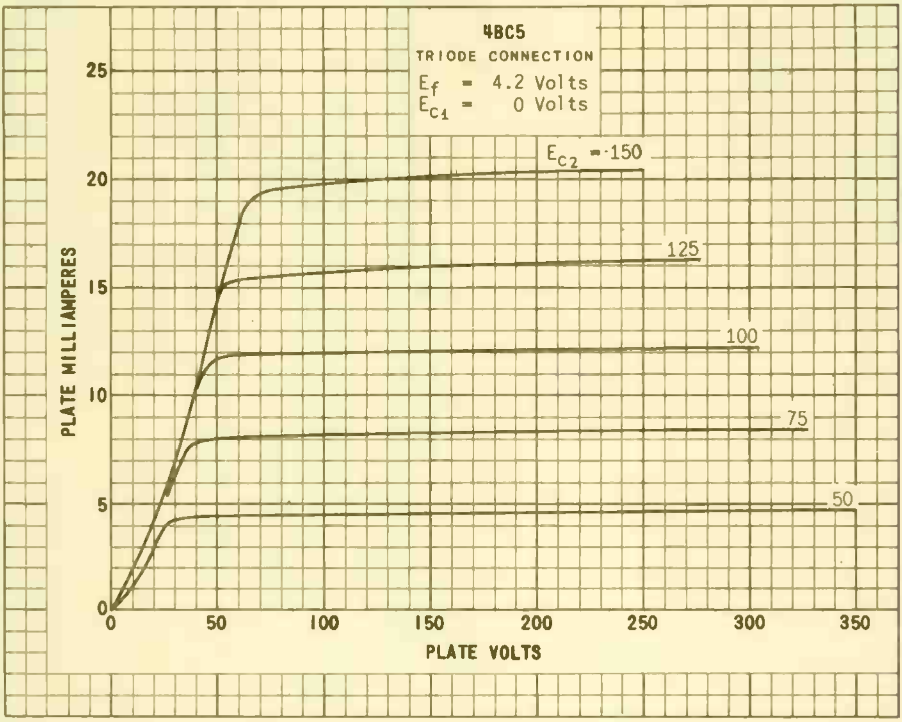
HEATER VOLTAGE	4.2	4.2	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	250	180	VOLTS
CATHODE RESISTOR	820	330	OHMS
PLATE RESISTANCE (APPROX.)	0.009	0.006	MEGOHM
TRANSCONDUCTANCE	4400	6000	µMHOS
PLATE CURRENT	6	8	MA.
AMPLIFICATION FACTOR	40	42	

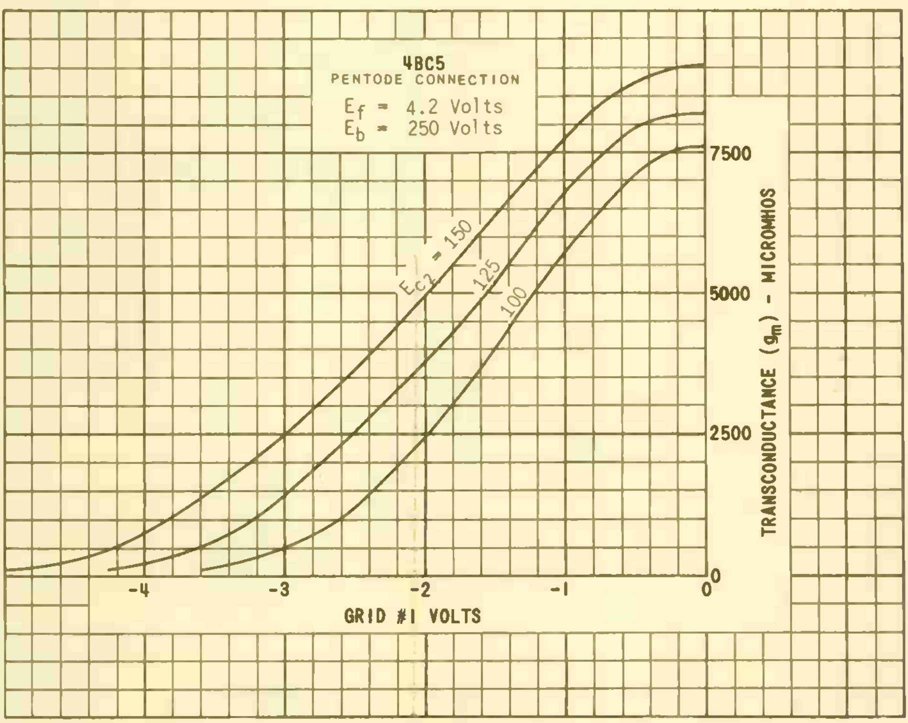
[B] TRIODE CONNECTION G_2 CONNECTED TO PLATE.




4BC5
PENTODE CONNECTION
E_f = 4.2 Volts
E_b = 250 Volts
E_{c_2} = 150
125
100
-4
-3
-2
-1
0
0
1
2
3
GRID #1 VOLTS
GRID #2 MILLIAMPERES


4BC5
TRIODE CONNECTION
E_f = 4.2 Volts
E_{c_2} = 150 Volts
I_b
I_{c2}
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
PLATE VOLTS
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES

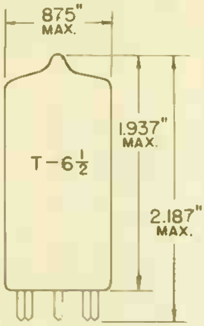

4BC5
TRIODE CONNECTION
Ef = 4.2 Volts
Ec1 = 0 Volts
Ec2 = 150
125
100
75
50
PLATE MILLIAMPERES
0
5
10
15
20
25
0
50
100
150
200
250
300
350
PLATE VOLTS


4BC5
PENTODE CONNECTION
Ef = 4.2 Volts
Eb = 250 Volts
Ec2 = 150
125
100
TRANSCONDUCTANCE (gm) - MICROMHOS
0
2500
5000
7500
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

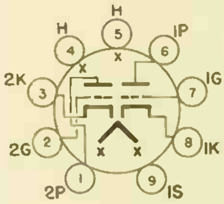


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

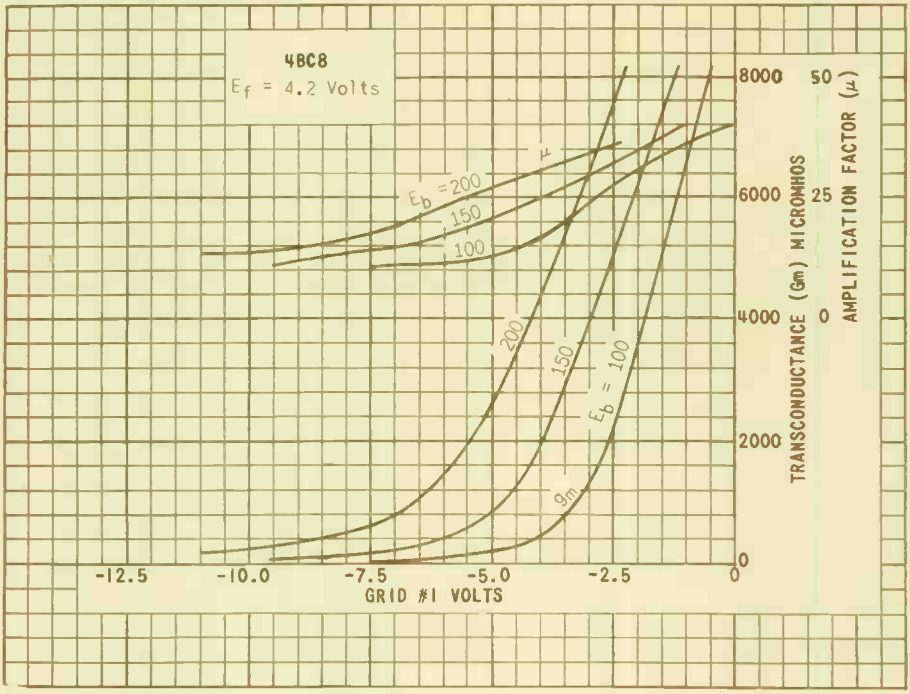
EACH UNIT

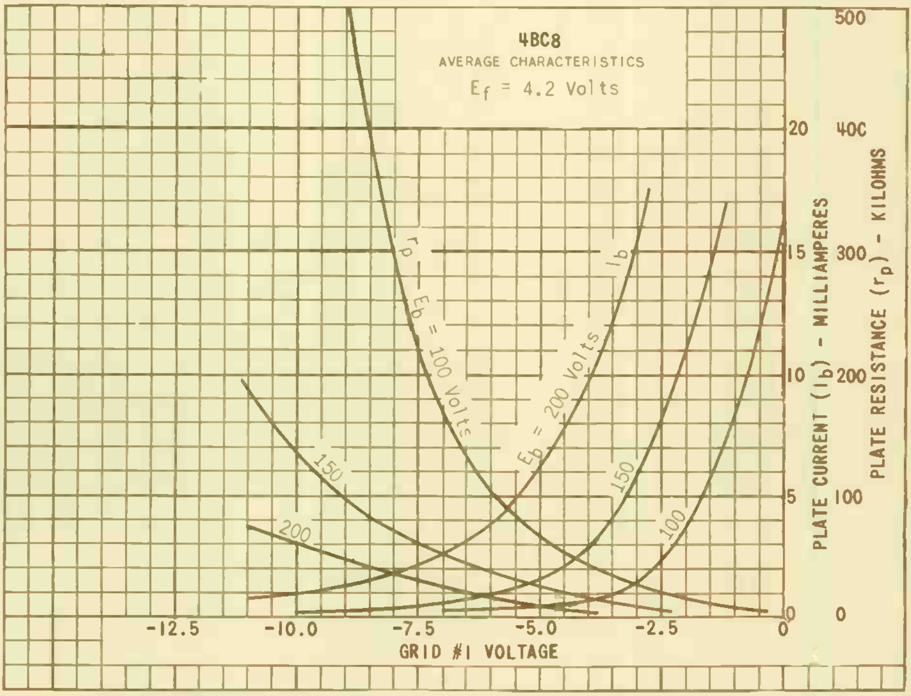
PLATE VOLTAGE	150	VOLTS
CATHODE RESISTOR	220	OHMS
PLATE RESISTANCE *	5300	OHMS
TRANSCONDUCTANCE	6200	μMHOS
AMPLIFICATION FACTOR	35	
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR GM =50 μMHOS	-13	VOLTS

[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.

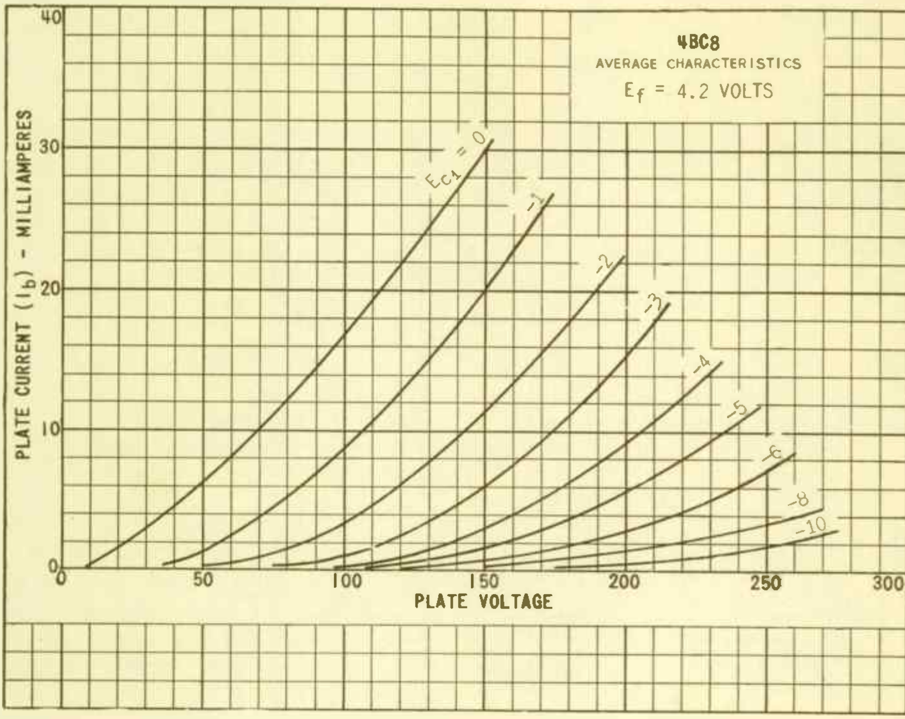
[C] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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.





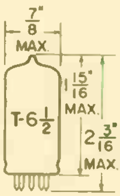
PRINTED IN U. S. A.


4BC8
AVERAGE CHARACTERISTICS
Ef = 4.2 VOLTS
PLATE CURRENT (Ib) - MILLIAMPERES
PLATE VOLTAGE
Ec1 = 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

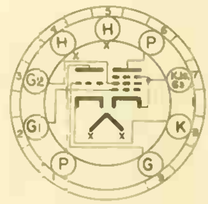
COATED UNIPOTENTIAL CATHODE

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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	

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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.

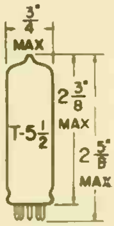
OPTIMUM PEAK CATHODE CURRENT OF THE TRIODE SECTION IN FRAME OUTPUT APPLICATION. TO ALLOW FOR TUBE SPREAD, FOR DETERIORATION DURING LIFE AND FOR EMISSION DROP AT UNDERHEATING THE SET SHOULD BE DESIGNED SO THAT WITH A PEAK CATHODE CURRENT OF 100 MA (MAX. PULSE DURATION 4% OF A CYCLE, WITH A MAXIMUM OF 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.

TUNG-SOL

PENTODE

MINIATURE TYPE

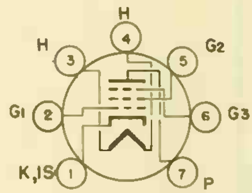


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

GATED-BEAM DISCRIMINATOR
FOR FM AND INTERCARRIER
TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7DF

THE 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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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.

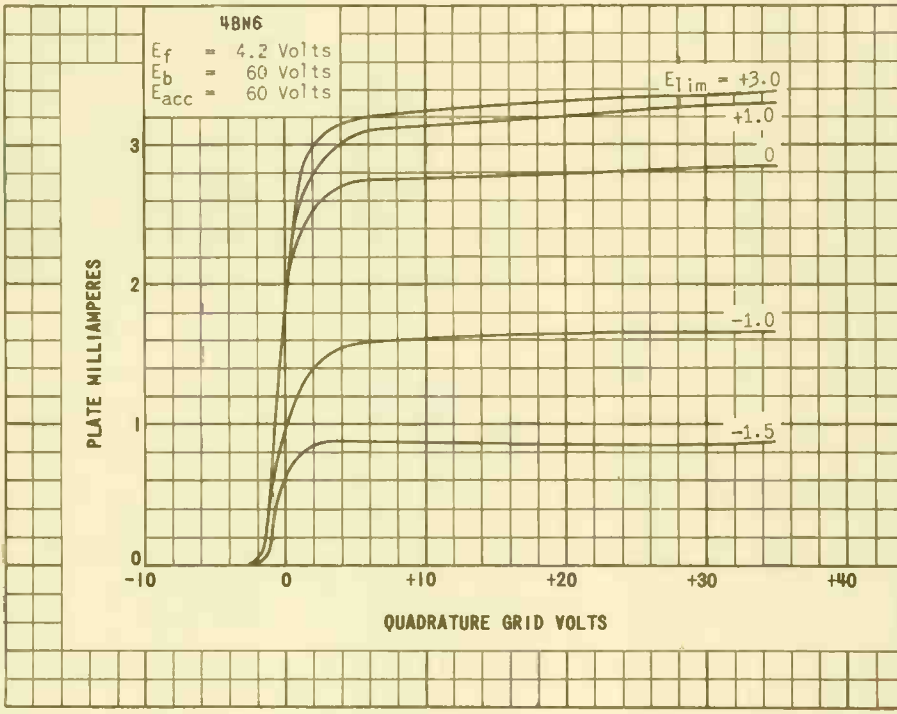
[B] AT SIGNAL LEVELS ABOVE SPECIFIED VALUE, LIMITING IS WITHIN ±2 DECIBELS.

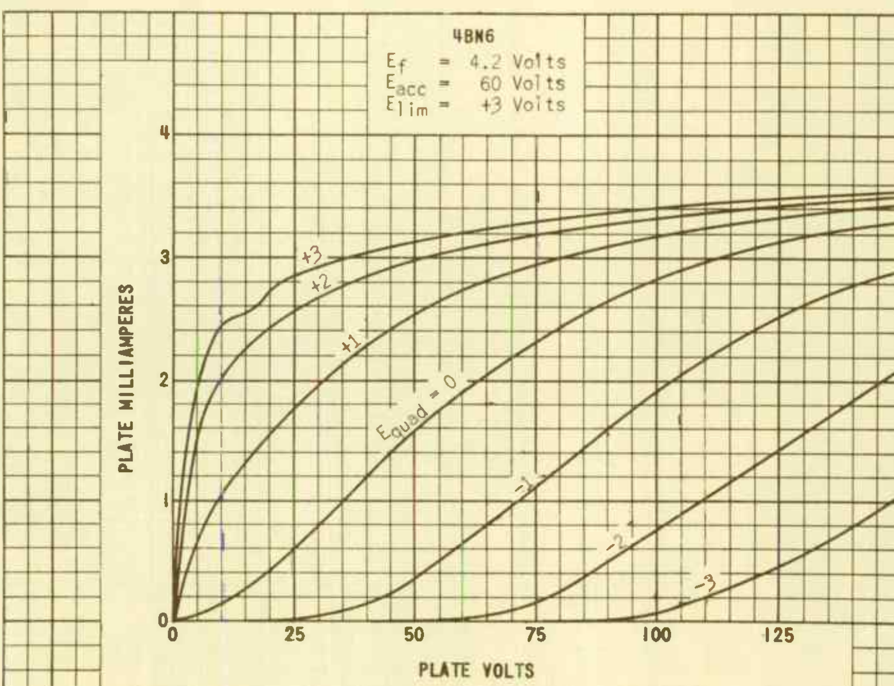
ADEQUATE SHIELDING BETWEEN COMPONENTS OF THE LIMITER GRID AND THE QUADRATURE GRID MUST BE USED TO INSURE PROPER PHASING OF THE VOLTAGE DEVELOPED ON THE QUADRATURE GRID.

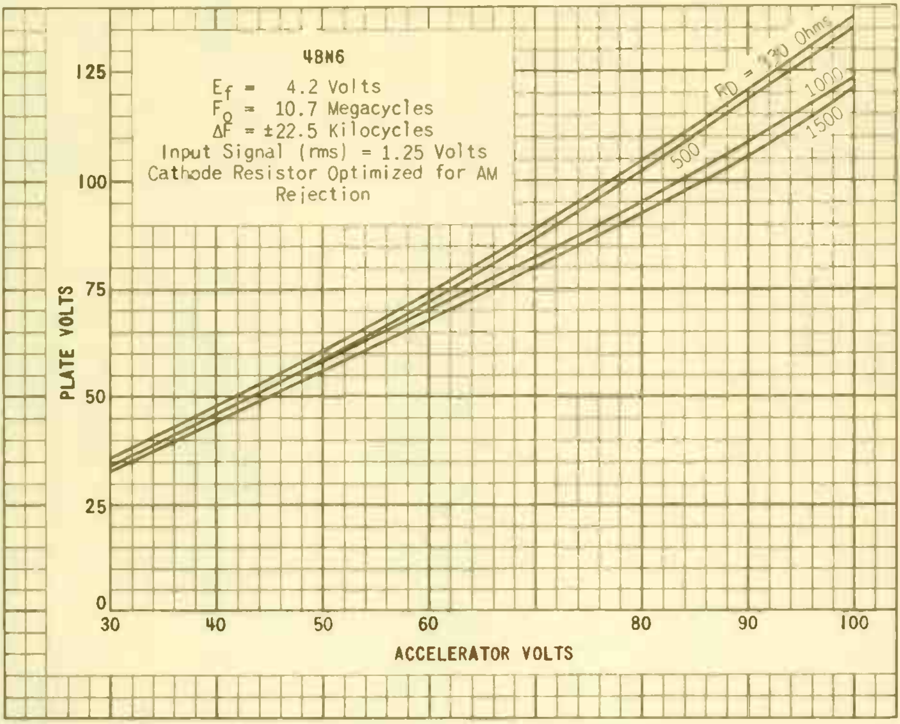
STANDARD DE-EMPHASEIS REQUIREMENTS FOR FM ARE INCLUDED.

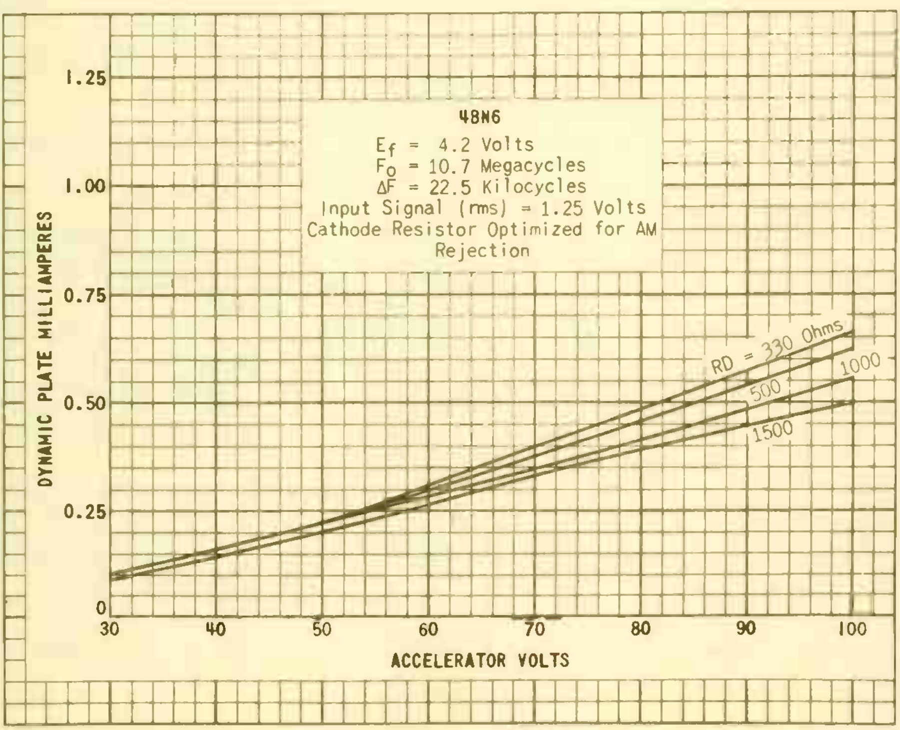
THE Q OF THE QUADRATURE GRID CIRCUIT SHOULD BE HIGH ENOUGH TO DEVELOP A MINIMUM OF 4 VOLTS (RMS) SIGNAL WITH 2 VOLTS (RMS) OF THE CENTER-FREQUENCY SIGNAL APPLIED TO THE LIMITER GRID. IT IS RECOMMENDED THAT THE COIL BE SHUNTED BY A MINIMUM OF 10 μμf. THE CAPACITANCE MAY BE COMPOSED OF TUBE INPUT CAPACITANCE,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

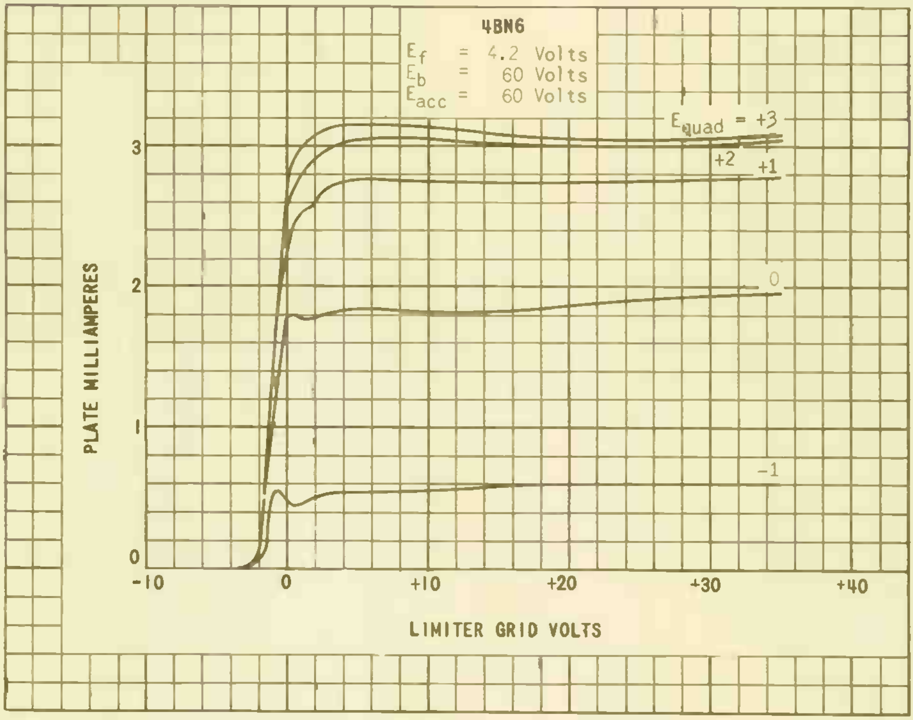
→ INDICATES A CHANGE.


4BN6
E_f = 4.2 Volts
E_b = 60 Volts
E_{acc} = 60 Volts
E_{lim} = +3.0
+1.0
0
-1.0
-1.5
PLATE MILLIAMPERES
0
1
2
3
-10
0
+10
+20
+30
+40
QUADRATURE GRID VOLTS


4BN6
E_f = 4.2 Volts
E_{acc} = 60 Volts
E_{lim} = +3 Volts
+3
+2
+1
E_{quad} = 0
-1
-2
-3
PLATE MILLIAMPERES
0
1
2
3
4
0
25
50
75
100
125
PLATE 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
PLATE VOLTS
0
25
50
75
100
125
ACCELERATOR VOLTS
30
40
50
60
80
90
100

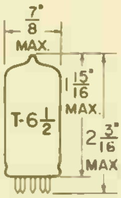

4BN6
E_f = 4.2 Volts
F_o = 10.7 Megacycles
ΔF = 22.5 Kilocycles
Input Signal (rms) = 1.25 Volts
Cathode Resistor Optimized for AM Rejection
RD = 330 Ohms
500
1000
1500
DYNAMIC PLATE MILLIAMPERES
0
0.25
0.50
0.75
1.00
1.25
ACCELERATOR VOLTS
30
40
50
60
70
80
90
100


4BN6
E_f = 4.2 Volts
E_b = 60 Volts
E_{acc} = 60 Volts
E_{quad} = +3
+2
+1
0
-1
PLATE MILLIAMPERES
0
1
2
3
-10
0
+10
+20
+30
+40
LIMITER GRID VOLTS

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.

TUNG-SOL

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

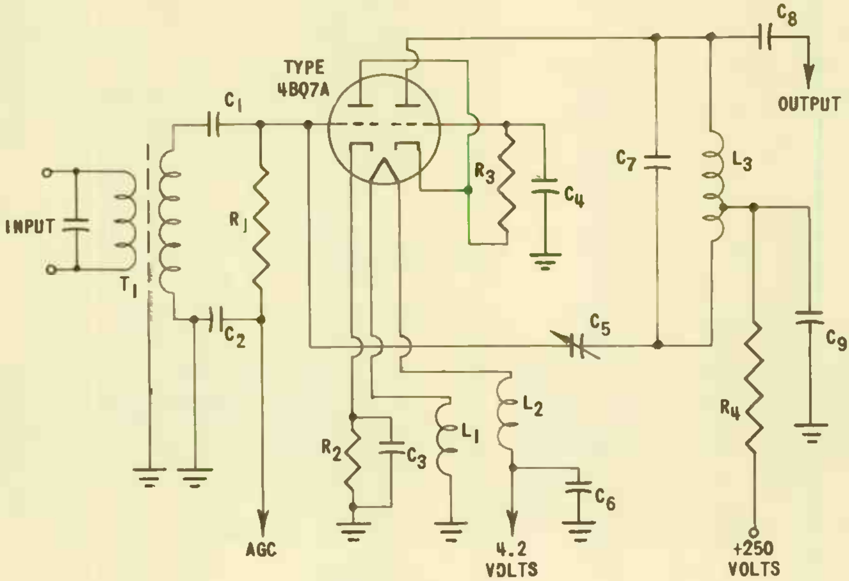
HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	150	VOLTS
GRID VOLTAGE (OBTAINED FROM CATHODE RESISTOR)	-2	VOLTS
CATHODE RESISTOR (COMMON TO BOTH UNITS)	100	OHMS
PLATE CURRENT	10	MA.

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



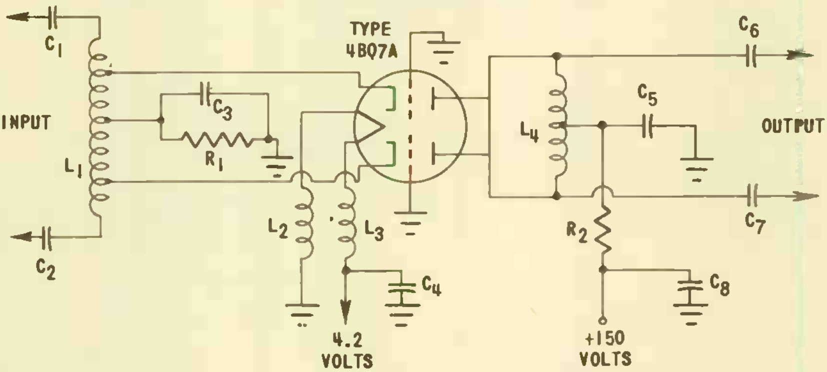
C1: 33 uuf, 400 VOLTS
C2: 1000 uuf, 400 VOLTS
C3: 1000 uuf, 400 VOLTS
C4: 1000 uuf, 400 VOLTS
C5: 0.5 to 1.5 uuf, 400 VOLTS
C6: 1000 uuf, 400 VOLTS
C7: 2 uuf, 400 VOLTS
C8: 33 uuf, 400 VOLTS
C9: 1000 uuf, 400 VOLTS

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

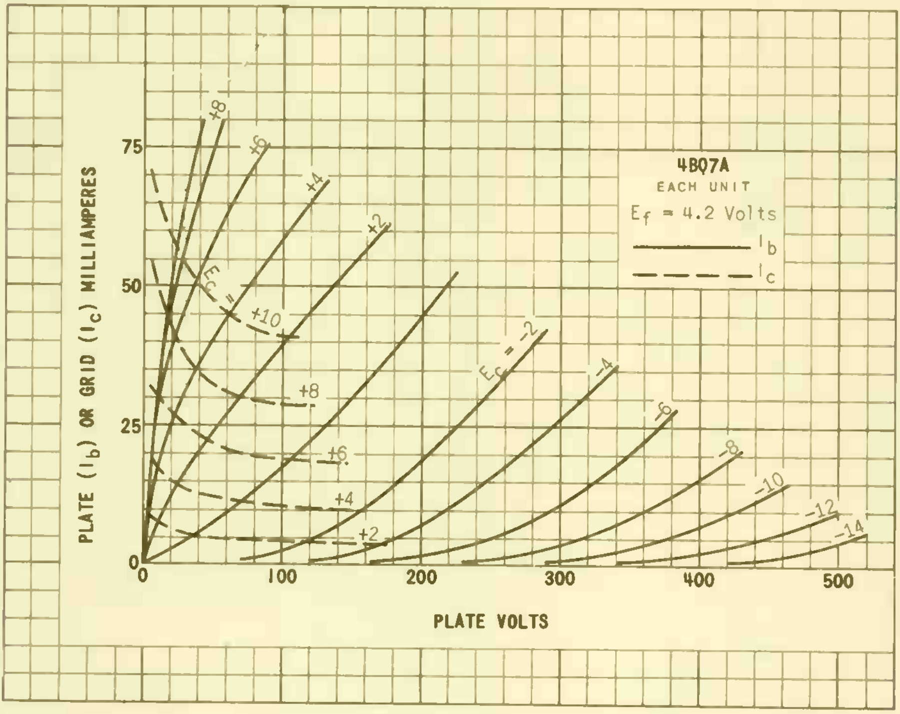


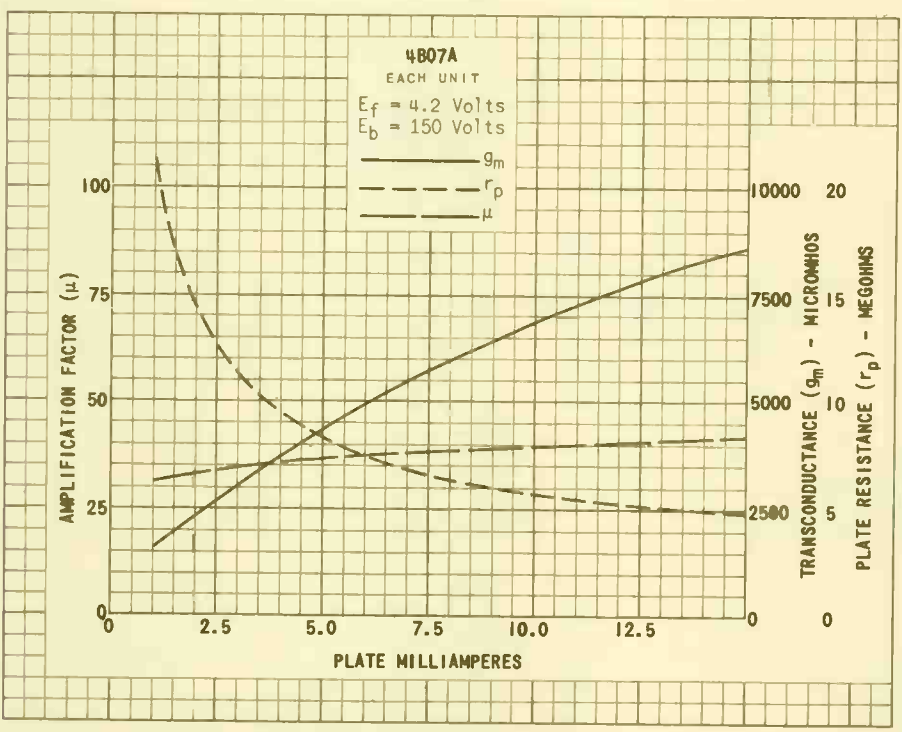
C1 C2 C3 C4 C5: 1000 uuf, 400 VOLTS
C6 C7: 100 uuf, 400 VOLTS
C8: 1000 uuf, 400 VOLTS

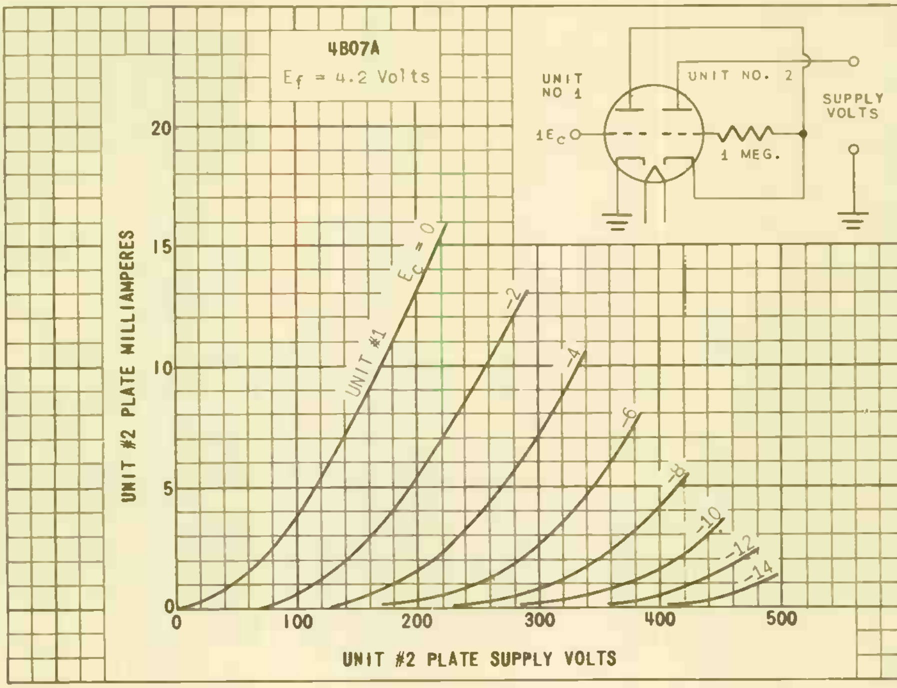
L1 L4: TUNED CIRCUIT ELEMENTS OF TUNER. VALUES DEPEND ON DISTRIBUTED CIRCUIT CAPACITANCES.

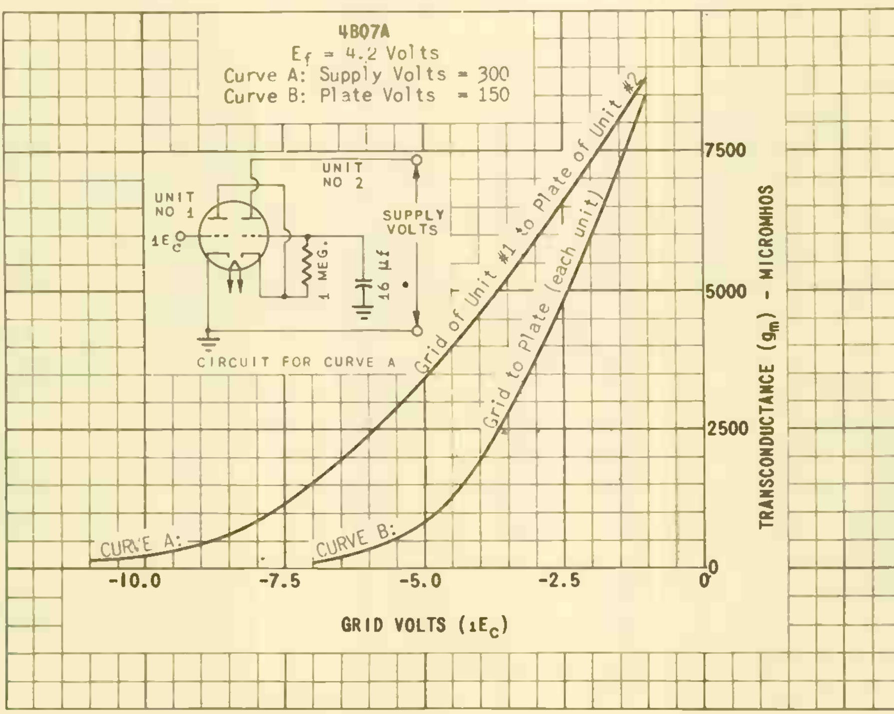
L2 L3: BIFILAR CHOKES, EACH 10 TURNS OF NO. 18 ENAMEL WIRE, 1/4" COIL FORM.
R1 R2: 100 OHMS, 0.5 WATT

PUSH-PULL RF GROUNDED-GRID CIRCUIT


4BQ7A
EACH UNIT
E_f = 4.2 Volts
I_b
I_c
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
E_c = -2
-4
-6
-8
-10
-12
-14
+2
+4
+6
+8
+10
0
25
50
75
100
200
300
400
500


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
2.5
5.0
7.5
10.0
12.5
25
50
75
100
2500
5000
7500
10000
5
10
15
20


4BQ7A
E_f = 4.2 Volts
UNIT NO 1
UNIT NO. 2
SUPPLY VOLTS
1 MEG.
$Ec = 0$
UNIT #1
-2
-4
-6
-8
-10
-12
-14
UNIT #2 PLATE MILLIAMPERES
UNIT #2 PLATE SUPPLY VOLTS
0
100
200
300
400
500
5
10
15
20


4BQ7A
E_f = 4.2 Volts
Curve A: Supply Volts = 300
Curve B: Plate Volts = 150
UNIT NO 1
UNIT NO 2
SUPPLY VOLTS
1 MEG.
16 µf
CIRCUIT FOR CURVE A
Grid of Unit #1 to Plate of Unit #2
Grid to Plate (each unit)
CURVE A:
CURVE B:
-10.0
-7.5
-5.0
-2.5
0
GRID VOLTS ($_1E_c$)
TRANSCONDUCTANCE (g_m) - MICROMHOS
2500
5000
7500

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

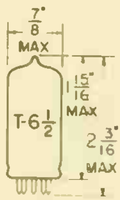
COATED UNIPOTENTIAL CATHODE

HEATER

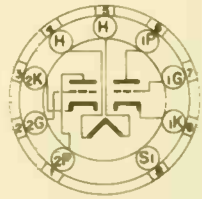
4.5 VOLTS, 0.6 AMP.

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	$\mu\mu f$
PLATE TO CATHODE (MAX.)	0.15	0.15	$\mu\mu f$
HEATER TO CATHODE	2.60	2.6	$\mu\mu f$
INPUT	2.60		$\mu\mu f$
OUTPUT	1.2		$\mu\mu f$
PLATE OF UNIT 1 TO PLATE OF UNIT 2 (MAX.)		0.010	$\mu\mu f$
PLATE OF UNIT 2 TO PLATE AND GRID OF UNIT 1 (MAX.)		0.024	$\mu\mu f$
GROUNDED GRID OPERATION:			
INPUT		5.0	$\mu\mu f$
OUTPUT		2.2	$\mu\mu f$

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL CASCODE CONDITIONS AND CHARACTERISTICS

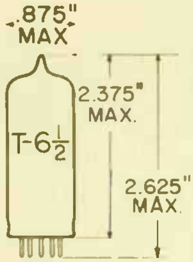
HEATER VOLTAGE	4.5	VOLTS
HEATER CURRENT	0.6	AMPERE
PLATE SUPPLY VOLTAGE	250	VOLTS
GRID VOLTAGE	-1	VOLTS
PLATE CURRENT	16	MA.
GRID VOLTAGE (APPROX.) FOR G_m = 50 μMHOS	-6	VOLTS
TRANSCONDUCTANCE	10 000	μMHOS

→ INDICATES A CHANGE.

TUNG-SOL

TWIN PENTODE

MINIATURE TYPE

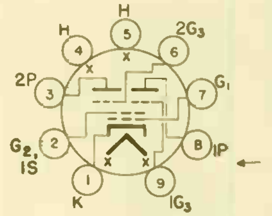


GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 0.45 AMP.
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

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

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.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

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 ^

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

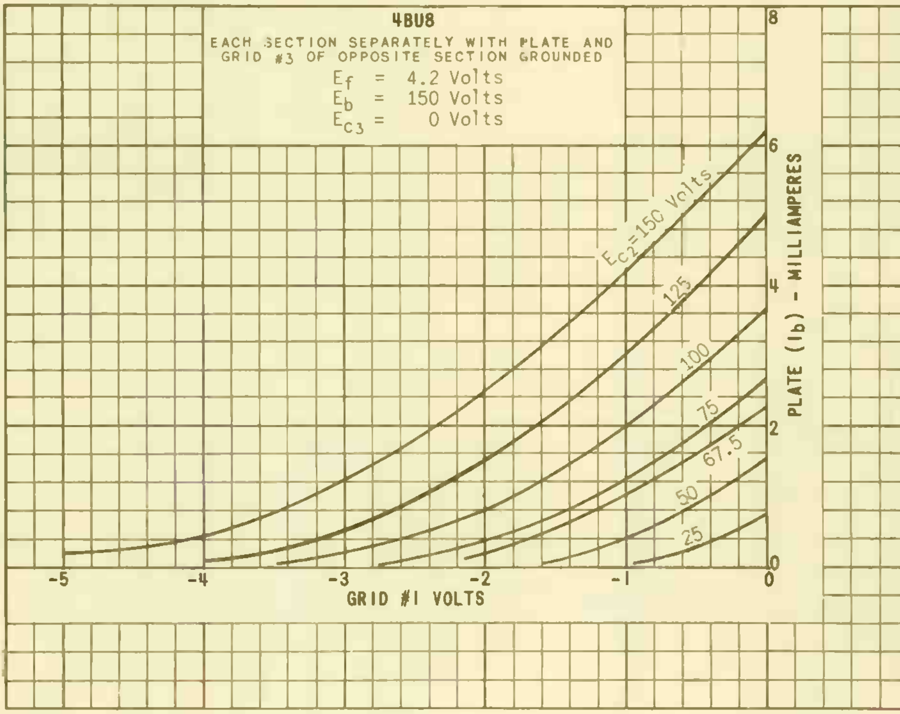
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

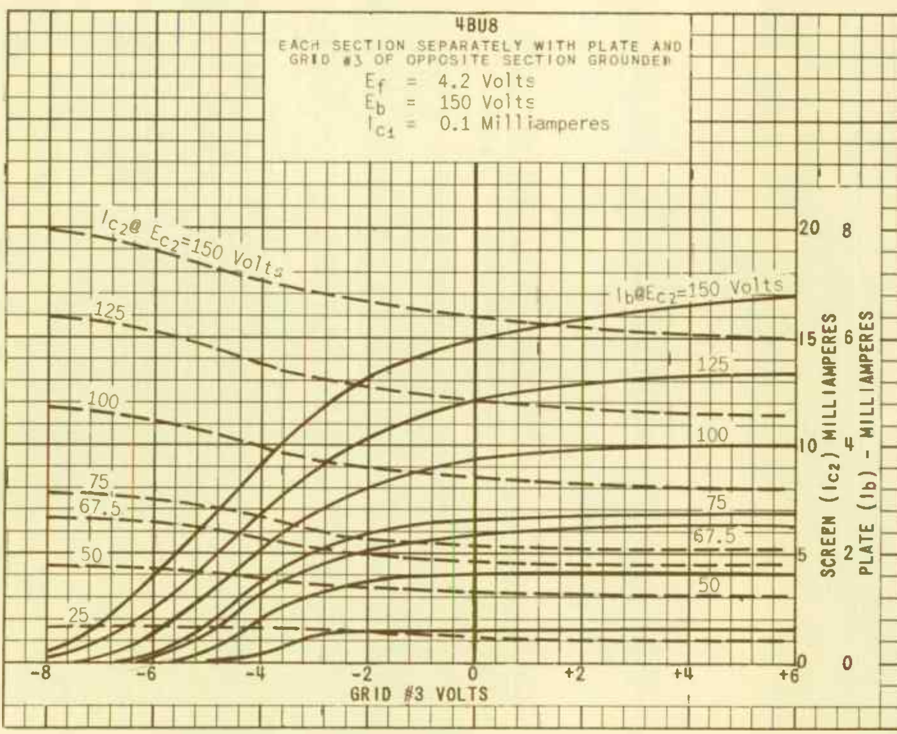
** WITH GRID CURRENT ADJUSTED FOR 100 μAMPS D-C.

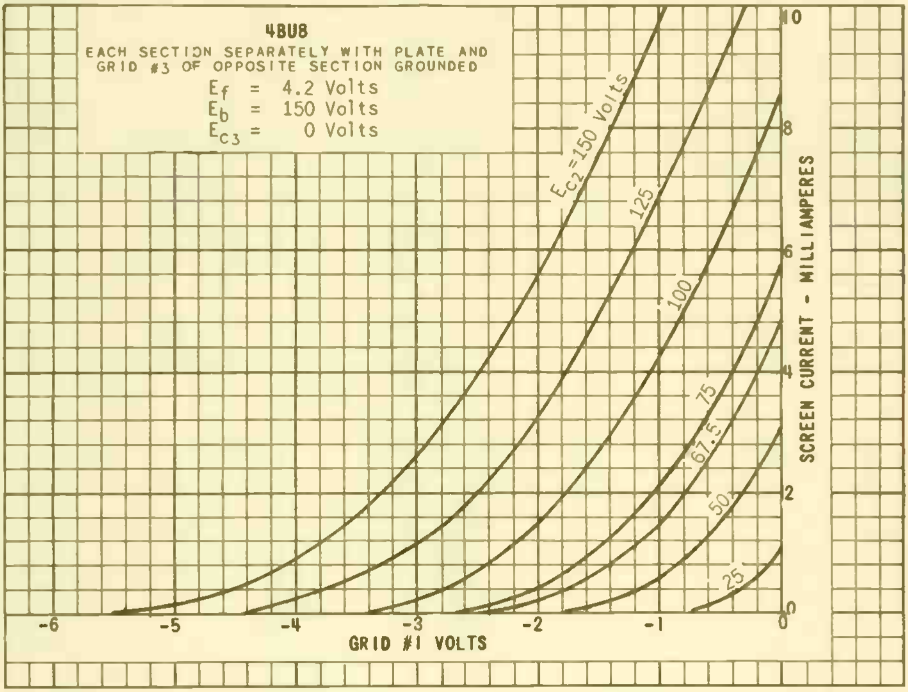
^ WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED.

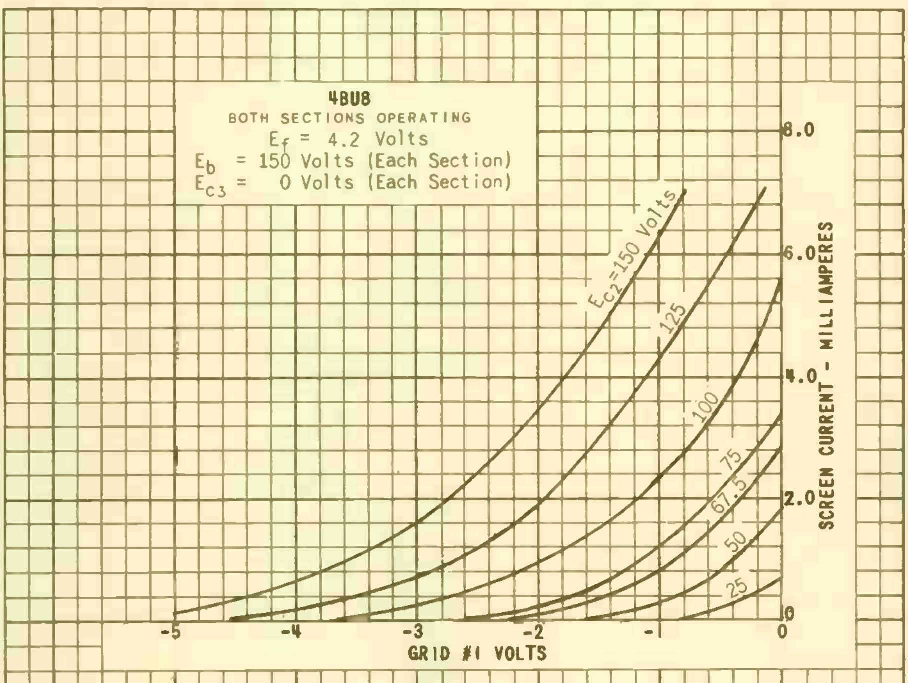
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH 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.

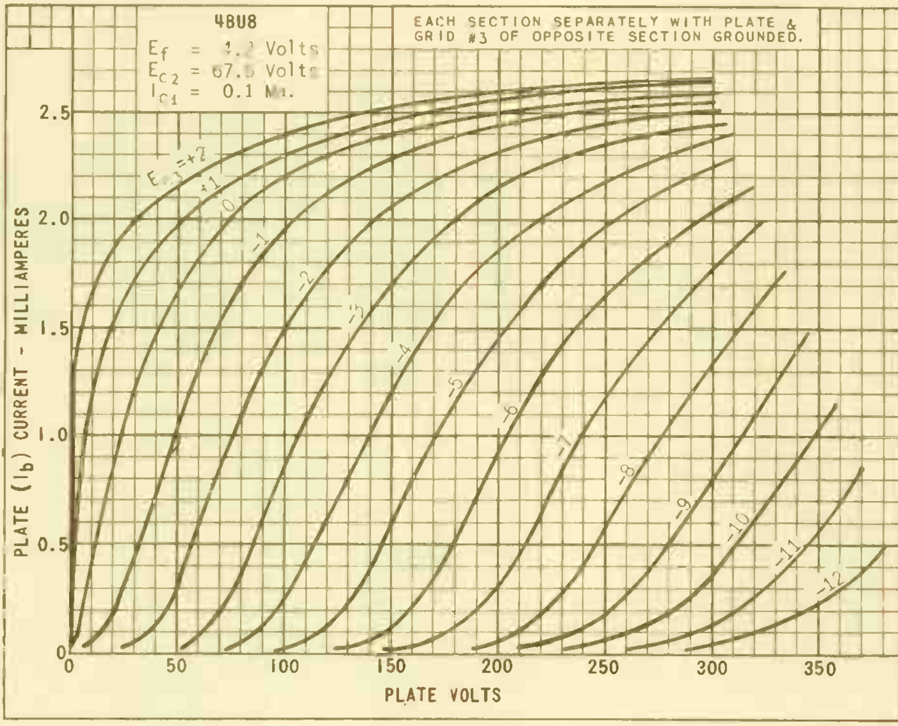
SIMILAR TYPE REFERENCE: Except for heater ratings the 4BU8 is identical to the 6BU8.

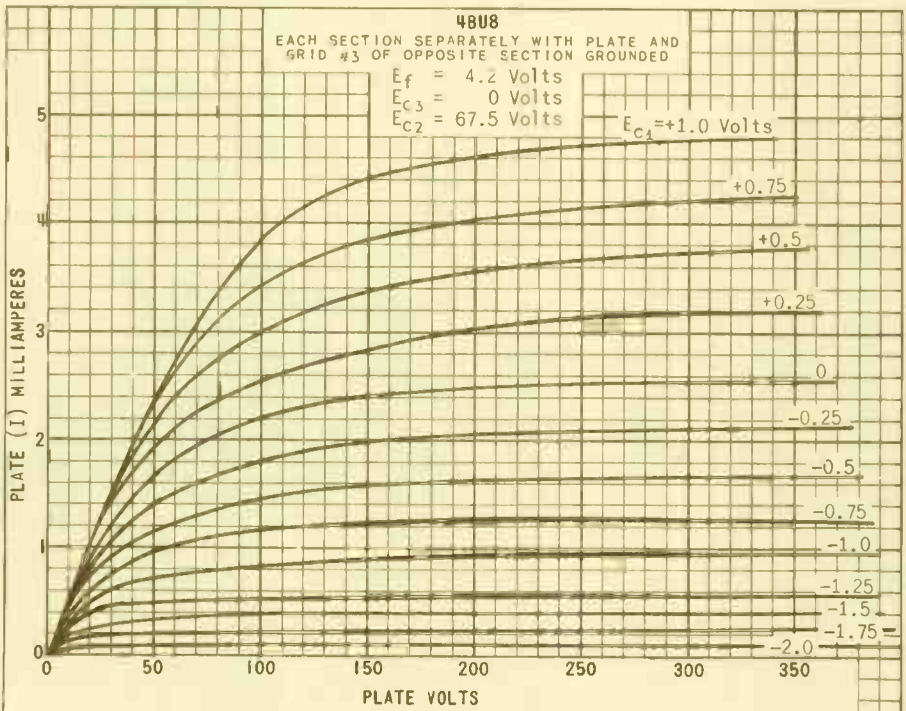

4BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 4.2 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2}=150 Volts
125
100
75
67.5
50
25
PLATE (I_b) - MILLIAMPERES
GRID #1 VOLTS


4BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 4.2 Volts
E_b = 150 Volts
I_{c1} = 0.1 Milliamperes
I_{c2}@ E_{c2}=150 Volts
I_b@E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN (I_{c2}) MILLIAMPERES
PLATE (I_b) - MILLIAMPERES
GRID #3 VOLTS

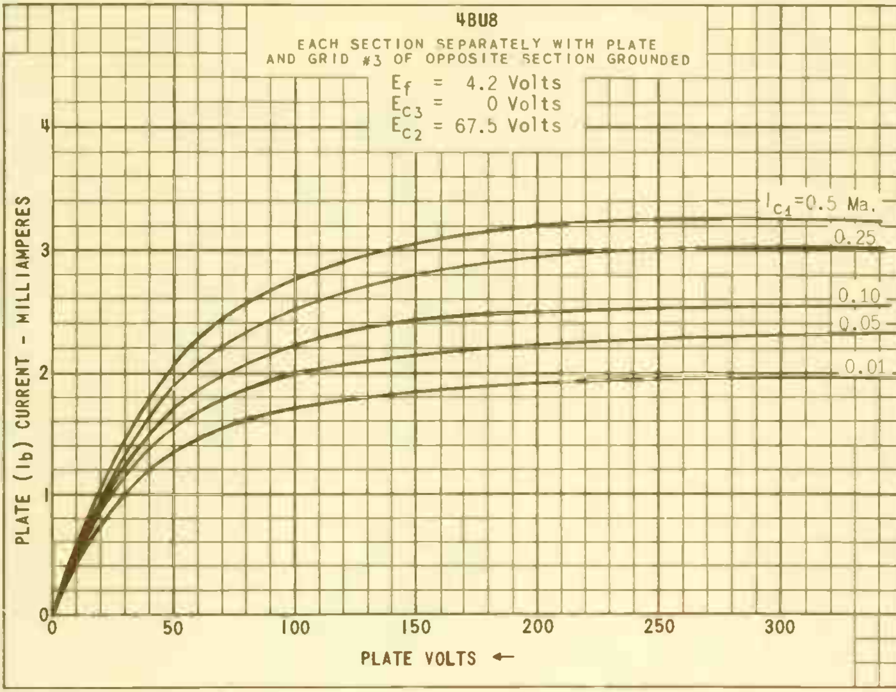

4BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
Ef = 4.2 Volts
Eb = 150 Volts
Ec3 = 0 Volts
Ec2=150 Volts
125
100
75
67.5
50
25
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
0
2
4
6
8
10
SCREEN CURRENT - MILLIAMPERES

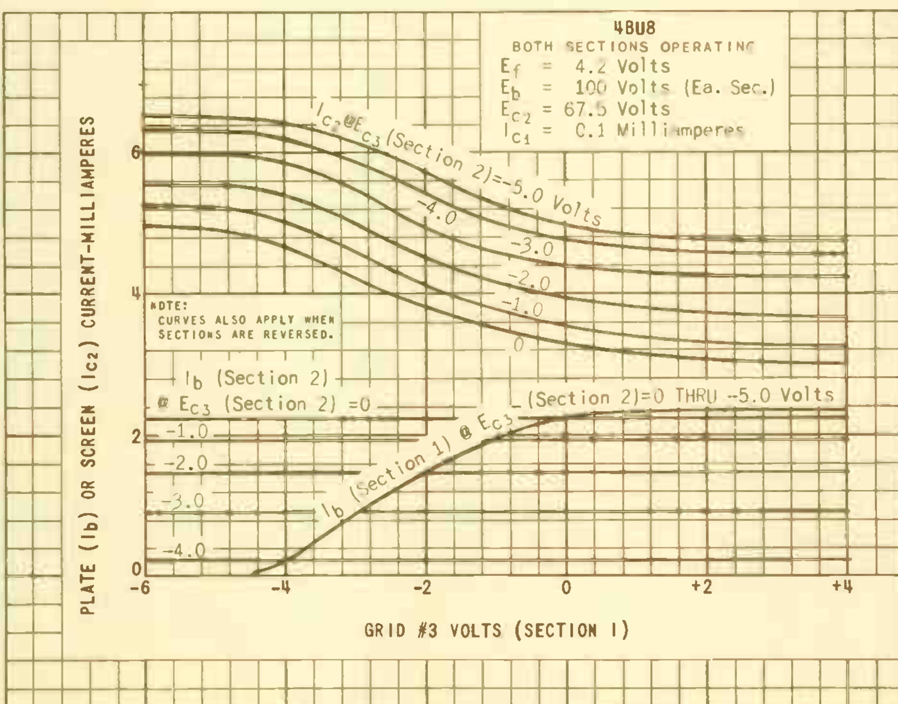

4BU8
BOTH SECTIONS OPERATING
Ef = 4.2 Volts
Eb = 150 Volts (Each Section)
Ec3 = 0 Volts (Each Section)
Ec2=150 Volts
125
100
75
67.5
50
25
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
0
2.0
4.0
6.0
8.0
SCREEN CURRENT - MILLIAMPERES

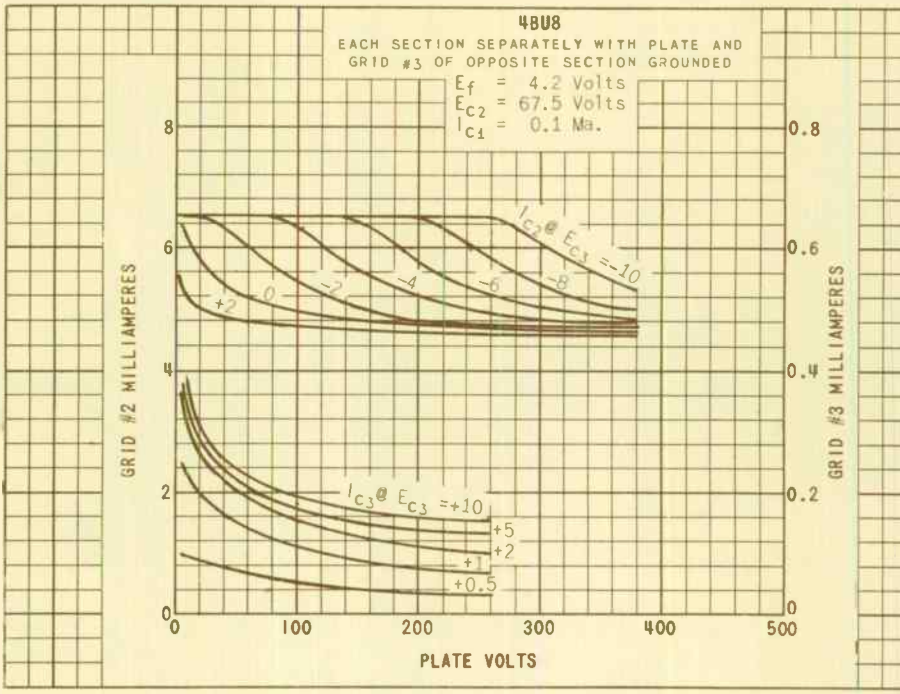


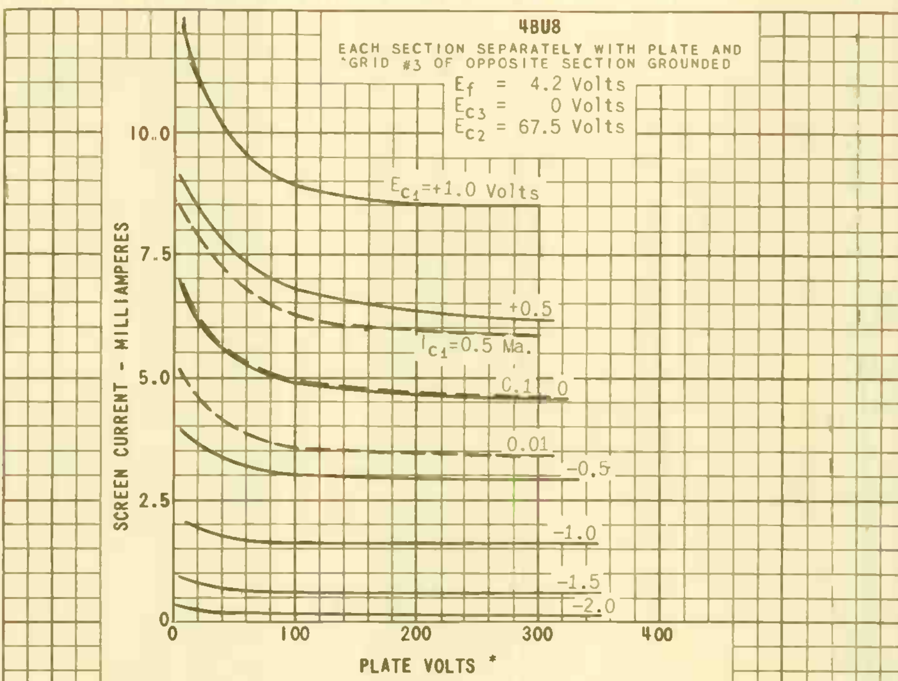


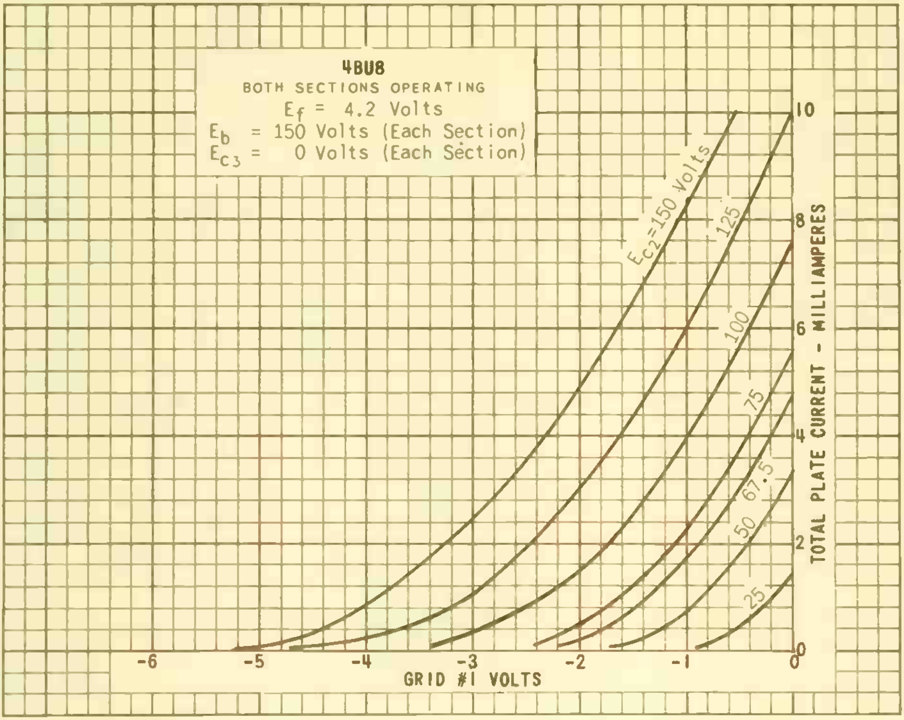
PRINTED IN U. S. A.

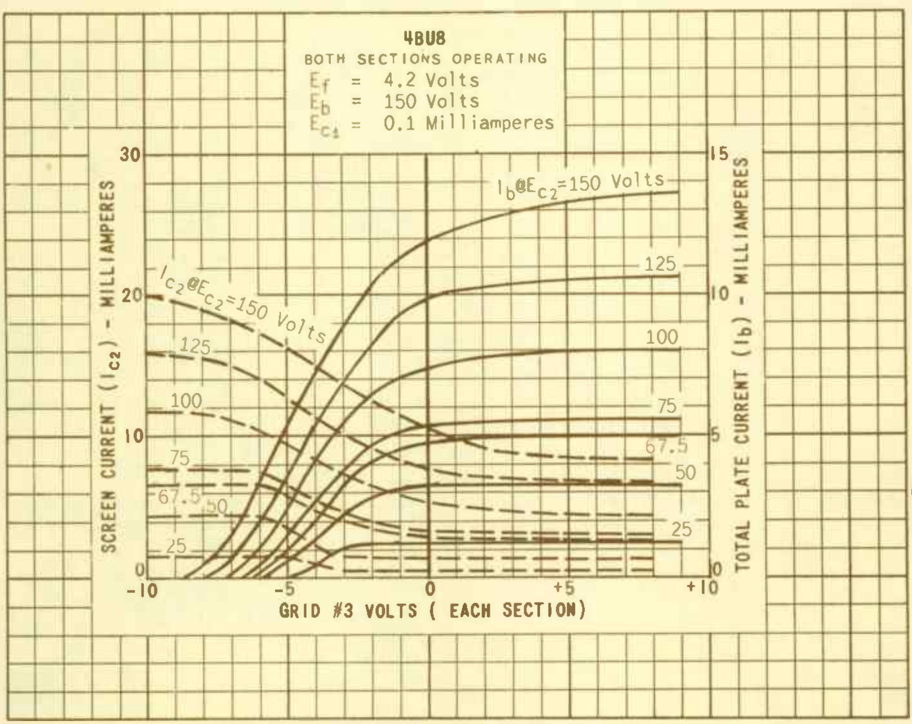

4BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 4.2 Volts
E_{c3} = 0 Volts
E_{c2} = 67.5 Volts
I_{c1}=0.5 Ma.
0.25
0.10
0.05
0.01
PLATE (Ib) CURRENT - MILLIAMPERES
PLATE VOLTS
0
50
100
150
200
250
300
1
2
3
4


4BU8
BOTH SECTIONS OPERATING
E_f = 4.2 Volts
E_b = 100 Volts (Ea. Sec.)
E_{c2} = 67.5 Volts
I_{c1} = 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 (Ib) OR SCREEN (Ic2) 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
100
200
300
400
500
2
4
6
8
0.2
0.4
0.6
0.8


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
100
200
300
400
2.5
5.0
7.5
10.0

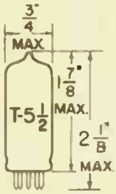

4BU8
BOTH SECTIONS OPERATING
E_f = 4.2 Volts
E_b = 150 Volts (Each Section)
E_{c3} = 0 Volts (Each Section)
E_{c2}=150 Volts
125
100
75
67.5
50
25
TOTAL PLATE CURRENT - MILLIAMPERES
GRID #1 VOLTS


4BU8
BOTH SECTIONS OPERATING
E_f = 4.2 Volts
E_b = 150 Volts
E_{c1} = 0.1 Milliamperes
I_b@E_{c2}=150 Volts
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)

TUNG-SOL

PENTODE

MINIATURE TYPE

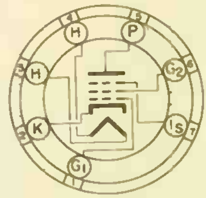


GLASS BULB

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

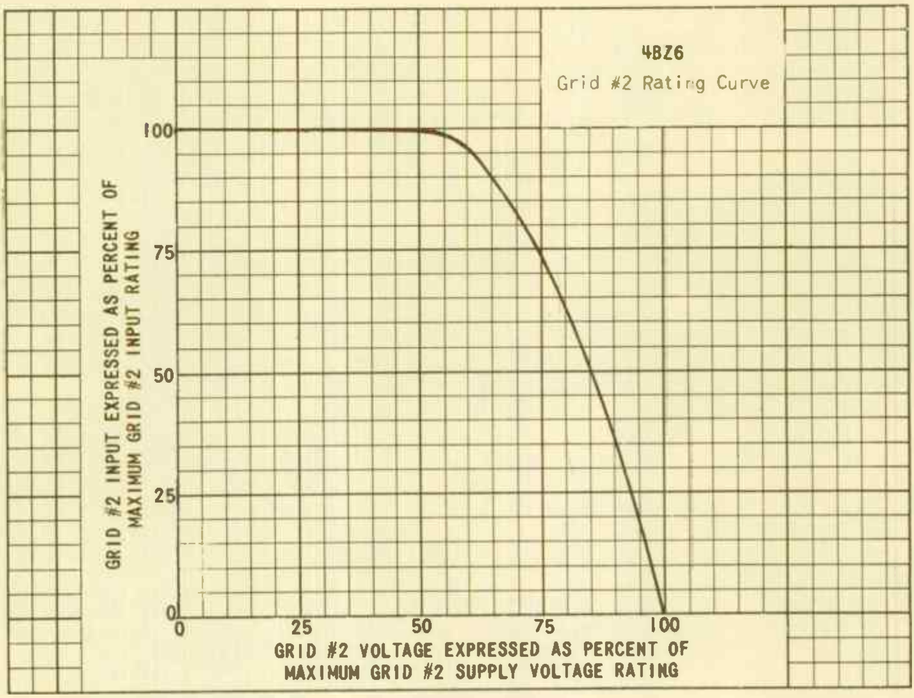
CONTINUED FROM PRECEDING PAGE

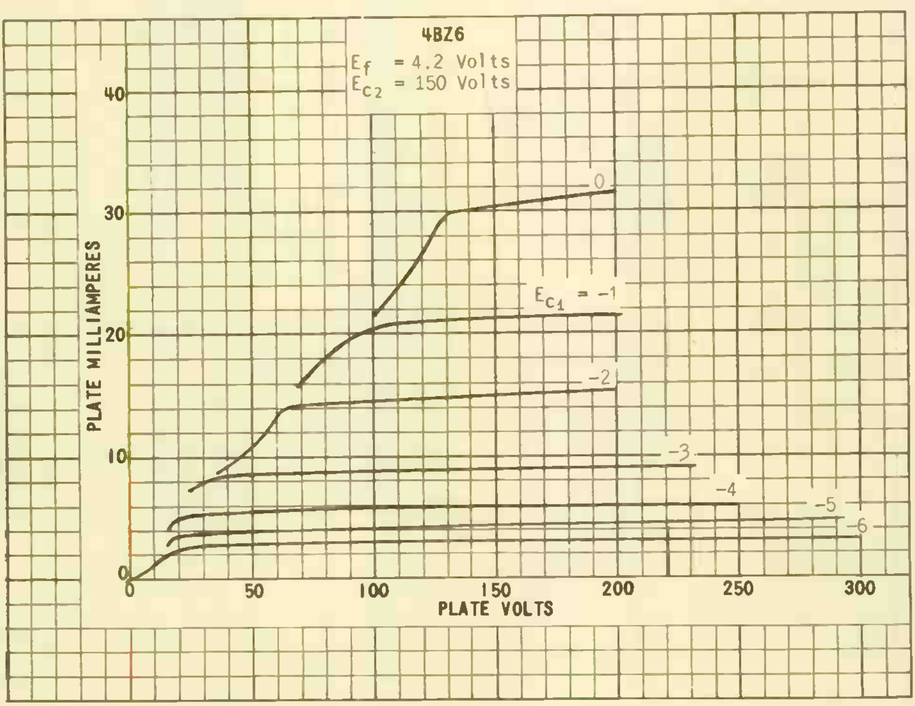
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

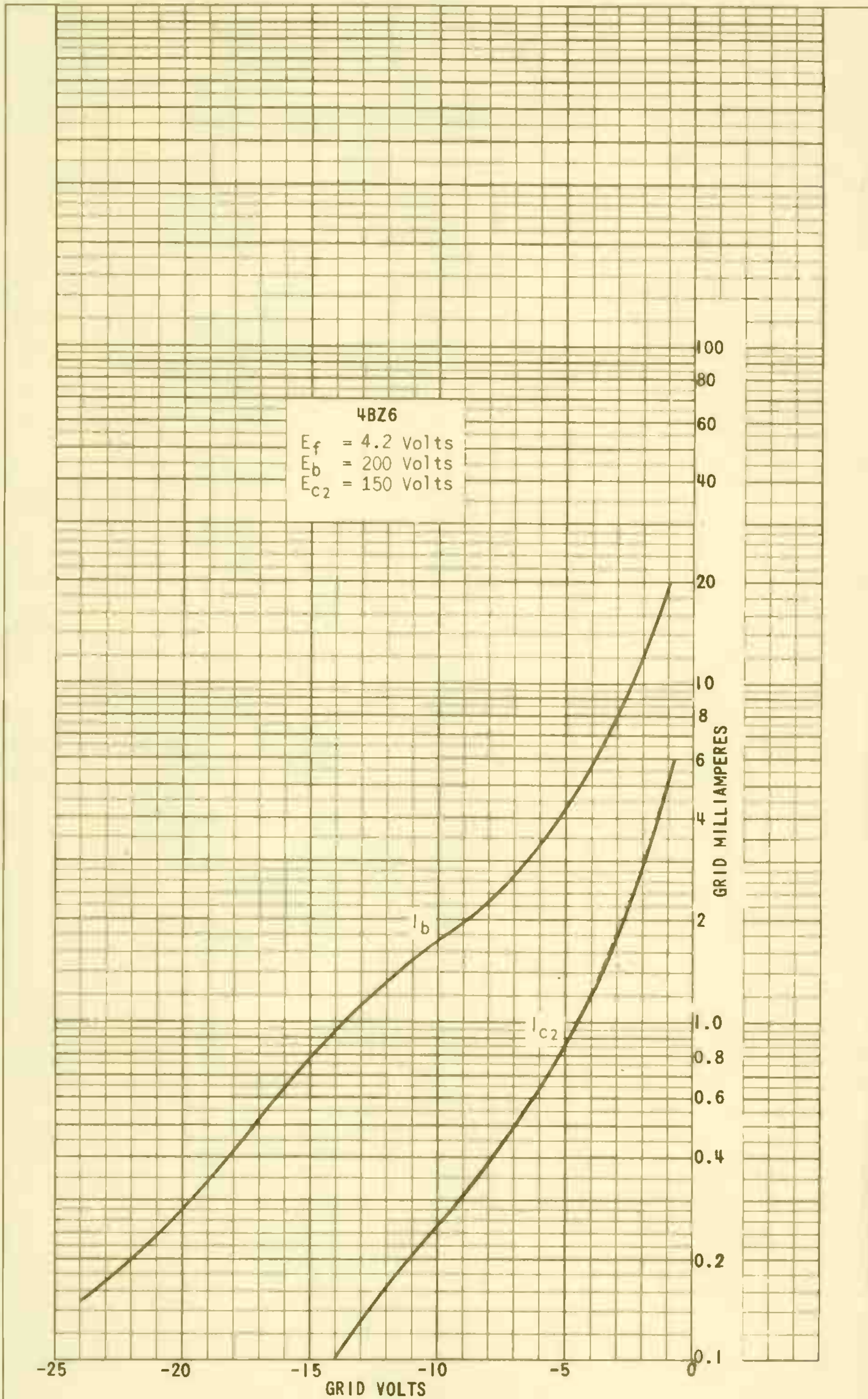
CLASS A_1 AMPLIFIER

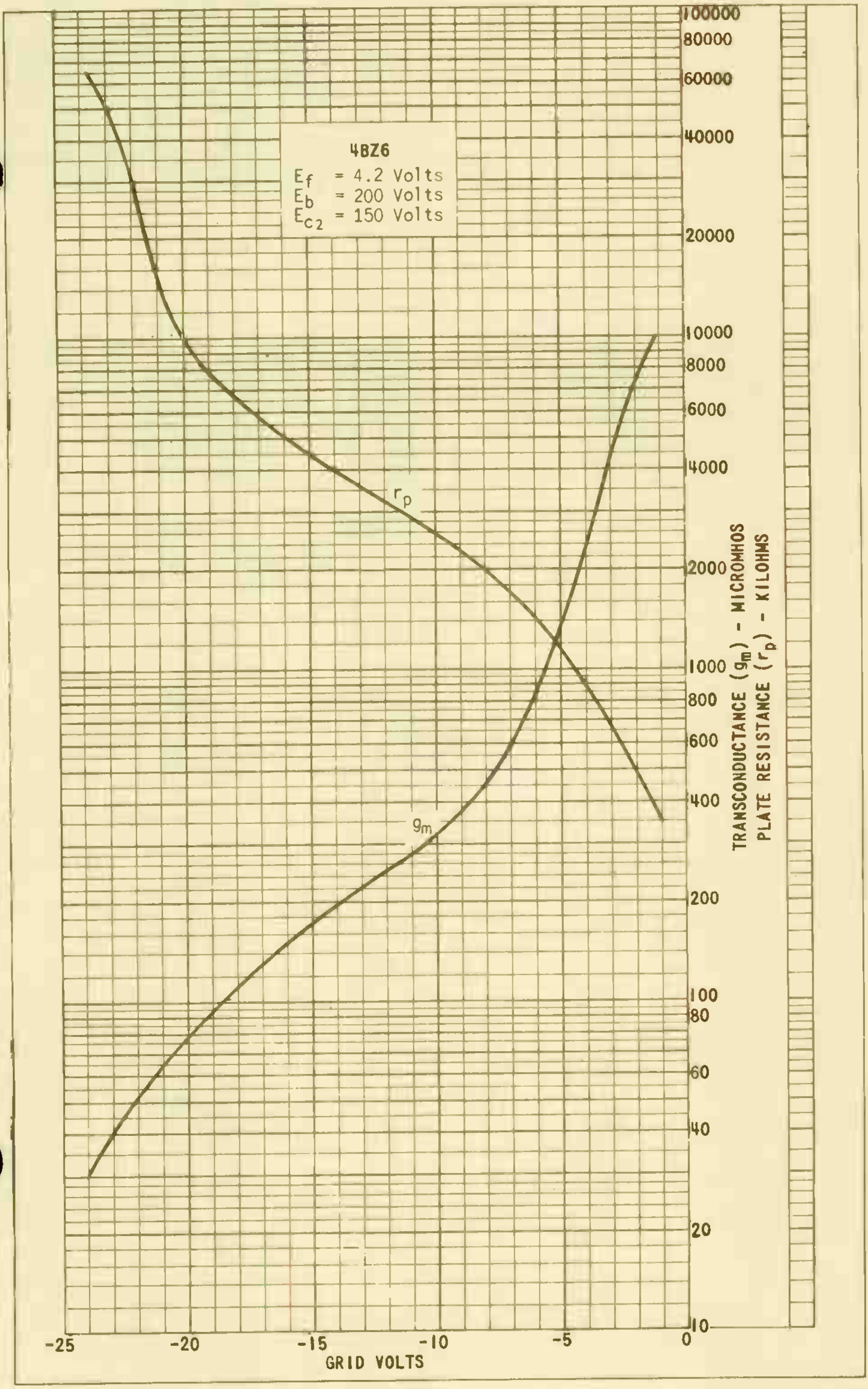
HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.45±6%	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	125	VOLTS
GRID #3 VOLTAGE	PIN #7 CONNECTED TO PIN #2 AT SOCKET	
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.26	MEGOHM
TRANSCONDUCTANCE	8 000	µMHOS
PLATE CURRENT	14	MA.
GRID #2 CURRENT	3.6	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 50 µMHOS	-19	VOLTS
TRANSCONDUCTANCE (Ec_1=-4.5 V., Rk=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.


4BZ6
Grid #2 Rating Curve
GRID #2 INPUT EXPRESSED AS PERCENT OF MAXIMUM GRID #2 INPUT RATING
100
75
50
25
0
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS PERCENT OF MAXIMUM GRID #2 SUPPLY VOLTAGE RATING


4BZ6
Ef = 4.2 Volts
Ec2 = 150 Volts
PLATE MILLIAMPERES
40
30
20
10
0
0
E_{c_1} = -1
-2
-3
-4
-5
-6
0
50
100
150
200
250
300
PLATE VOLTS

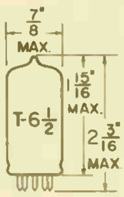

4BZ6
E_f = 4.2 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
GRID MILLIAMPERES
100
80
60
40
20
10
8
6
4
2
1.0
0.8
0.6
0.4
0.2
0.1
GRID VOLTS
-25
-20
-15
-10
-5
0


4BZ6
E_f = 4.2 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
r_p
g_m
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - KILOHMS
100000
80000
60000
40000
20000
10000
8000
6000
4000
2000
1000
800
600
400
200
100
80
60
40
20
10
-25
-20
-15
-10
-5
0
GRID VOLTS

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 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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

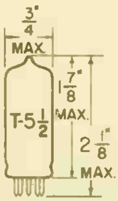
CLASS A_1 AMPLIFIER - EACH TRIODE UNIT

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



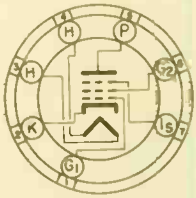
GLASS BULB

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 JS-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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

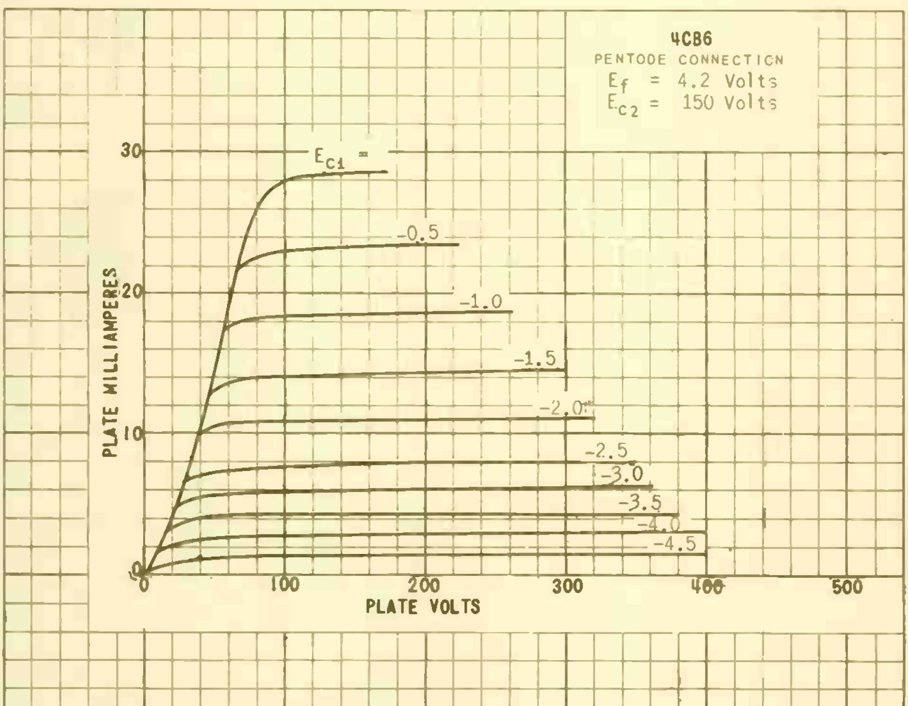
CONTINUED FROM PRECEDING PAGE

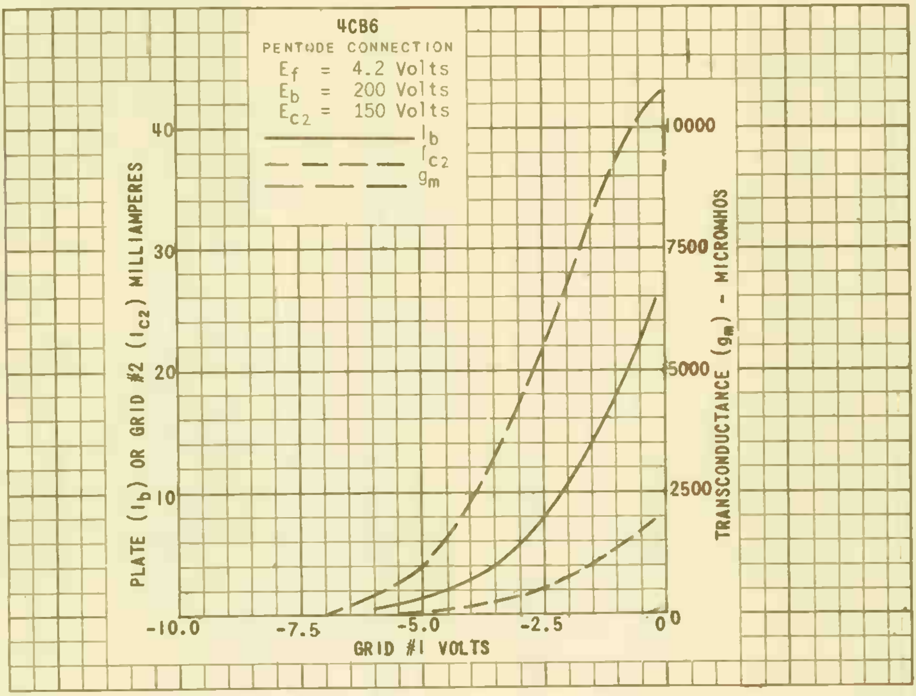
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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.

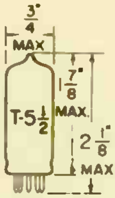



4CB6
PENTODE CONNECTION
E_f = 4.2 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
g_m
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (g_m) - MICROMHOS
GRID #1 VOLTS
40
30
20
10
10000
7500
5000
2500
0
-10.0
-7.5
-5.0
-2.5
0

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.

CONTINUED ON FOLLOWING PAGE

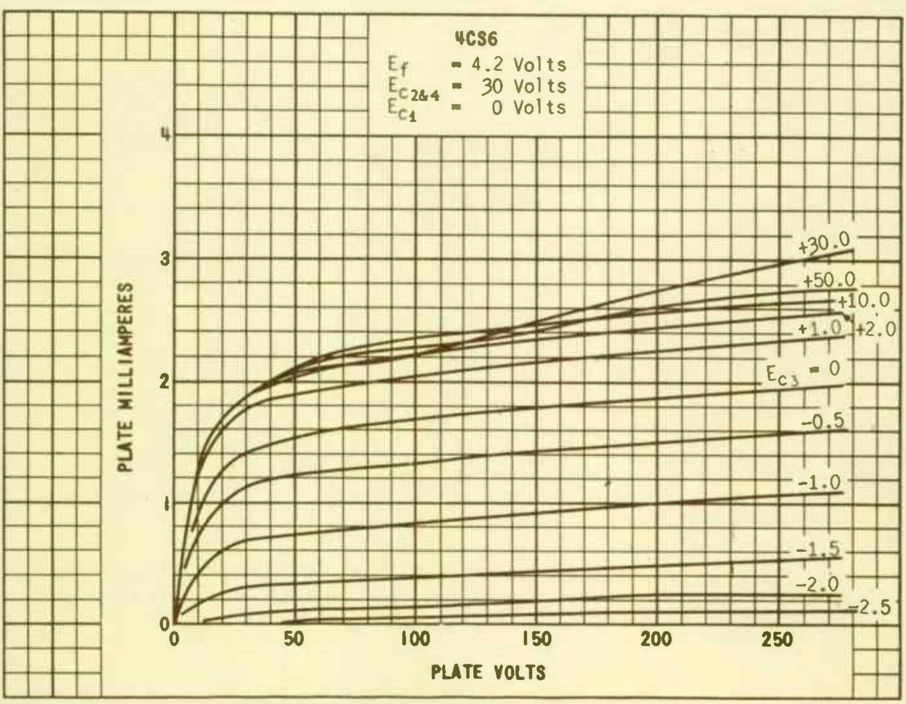
TUNG-SOL

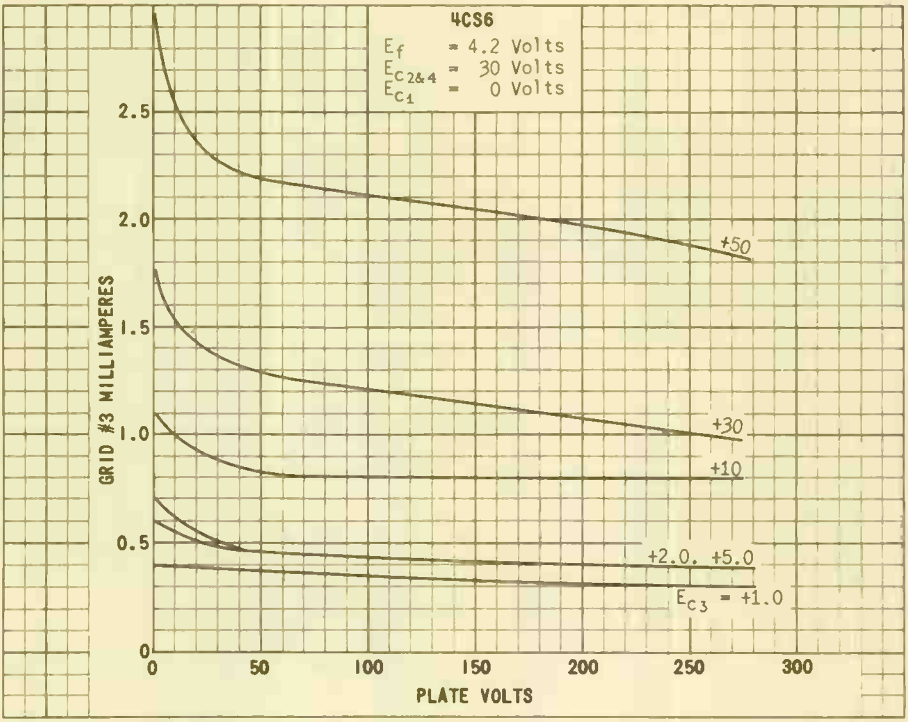
CONTINUED FROM PRECEDING PAGE

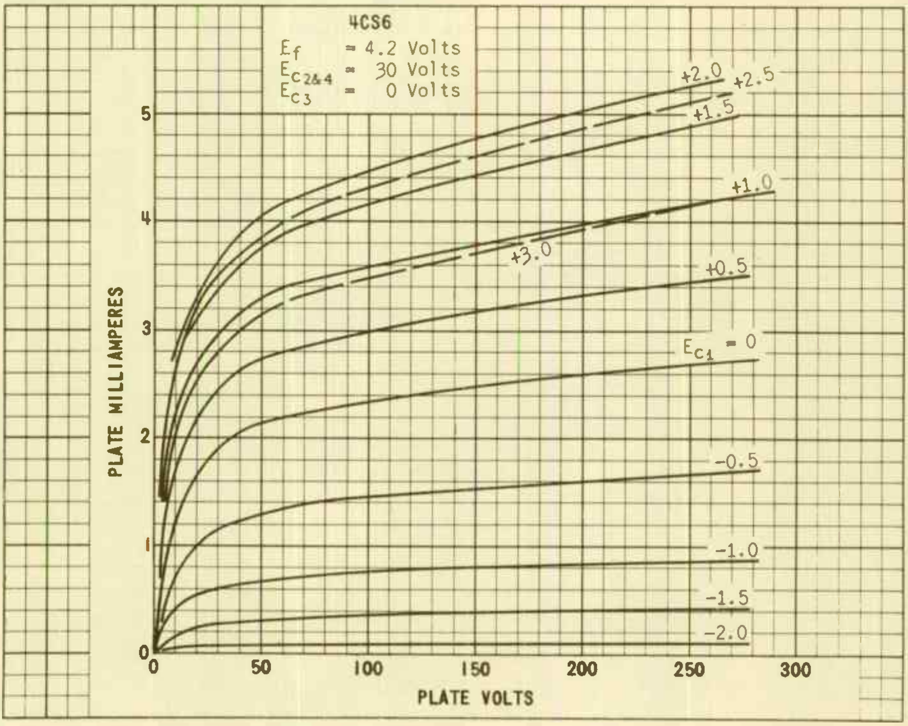
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

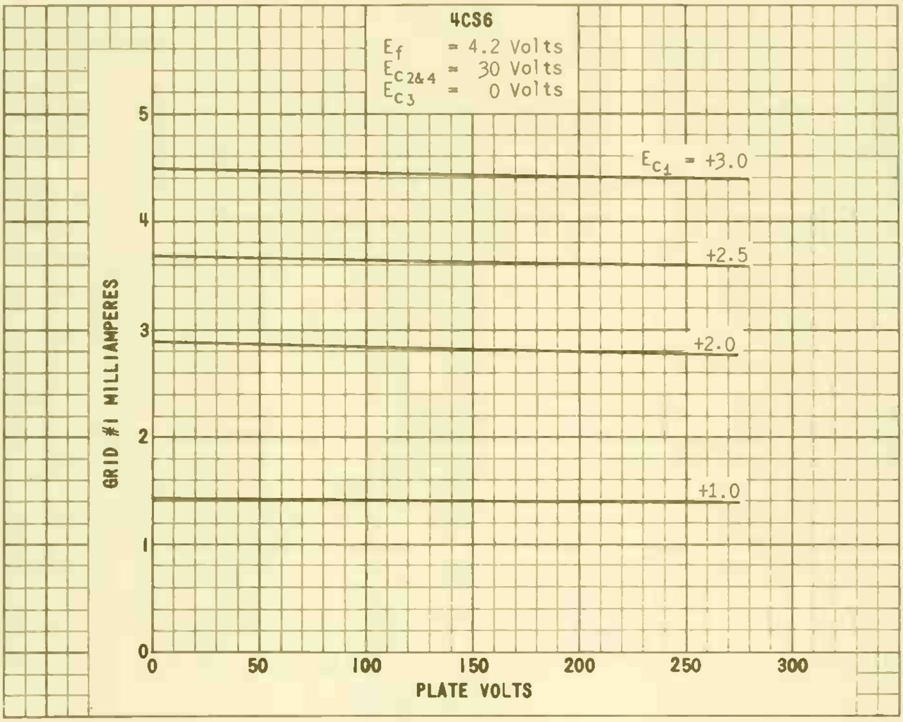
CLASS A_1 AMPLIFIER

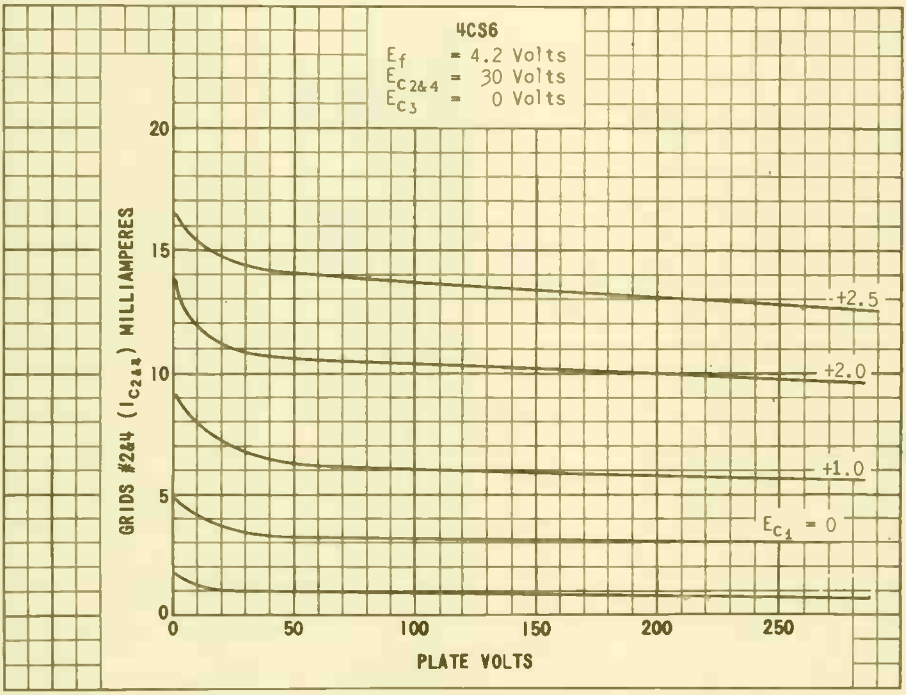
HEATER VOLTAGE	4.2	4.2	4.2	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	10	100	100	VOLTS
GRID #2 & #4 VOLTAGE	30	30	30	VOLTS
GRID #1 VOLTAGE	0	0	-1	VOLTS
GRID #3 VOLTAGE	0	-1	0	VOLTS
PLATE CURRENT	2.0	0.8	1.0	MA.
GRID #2 & #4 CURRENT	4.5	5.5	1.3	MA.
TRANSCONDUCTANCE (MEASURED BETWEEN GRID #1 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

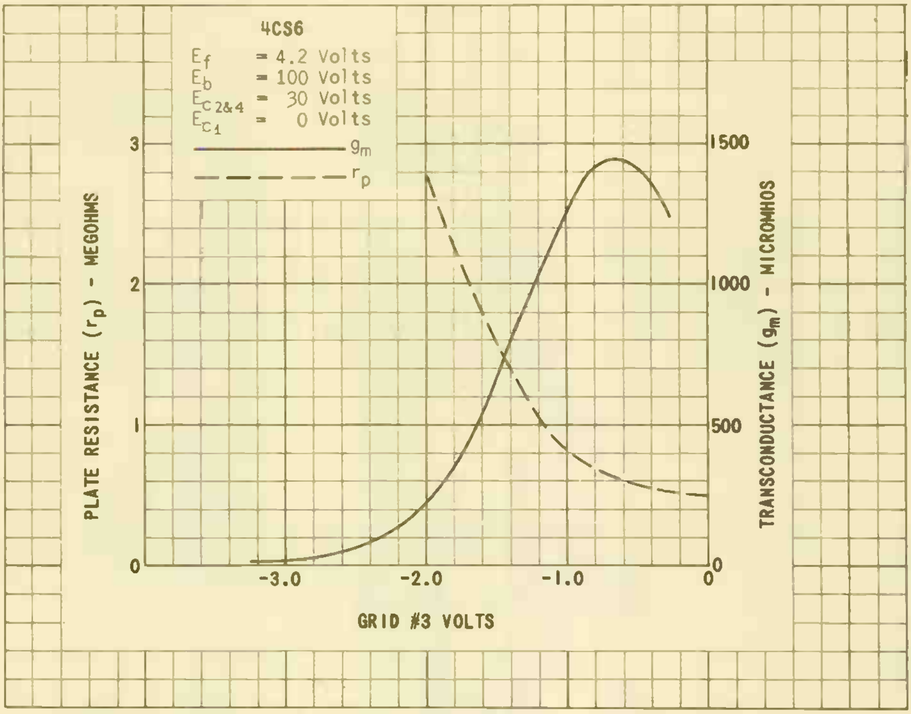


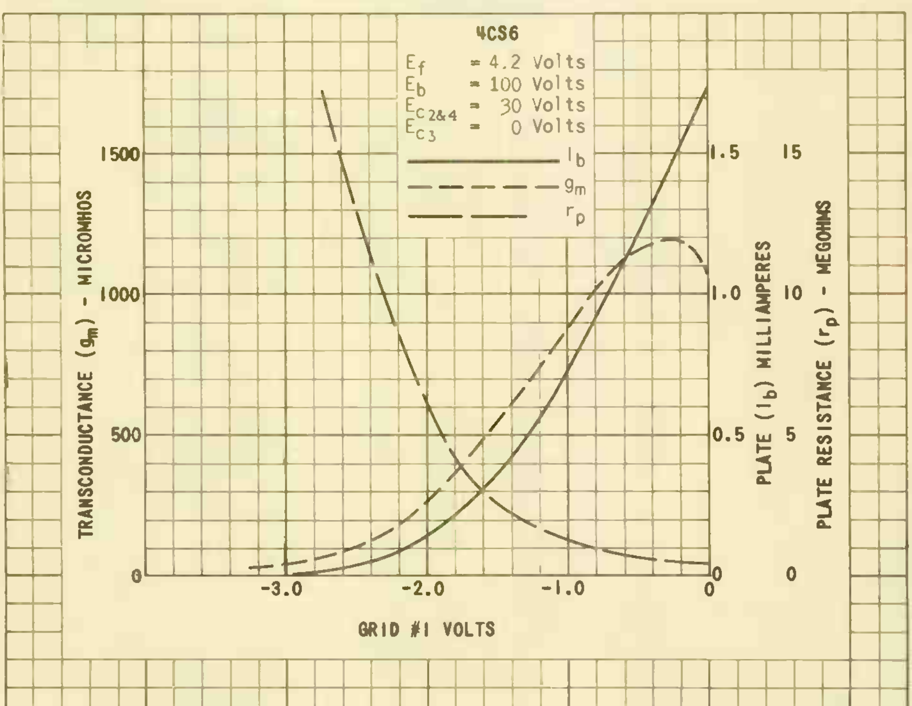

4CS6
E_f = 4.2 Volts
$E_{c2\&4}$ = 30 Volts
E_{c1} = 0 Volts
GRID #3 MILLIAMPERES
2.5
2.0
1.5
1.0
0.5
0
+50
+30
+10
+2.0, +5.0
E_{c3} = +1.0
0
50
100
150
200
250
300
PLATE VOLTS


4CS6
E_f = 4.2 Volts
$E_{c2\&4}$ = 30 Volts
E_{c3} = 0 Volts
PLATE MILLIAMPERES
5
4
3
2
1
0
+2.0
+2.5
+1.5
+1.0
+3.0
+0.5
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
0
50
100
150
200
250
300
PLATE VOLTS

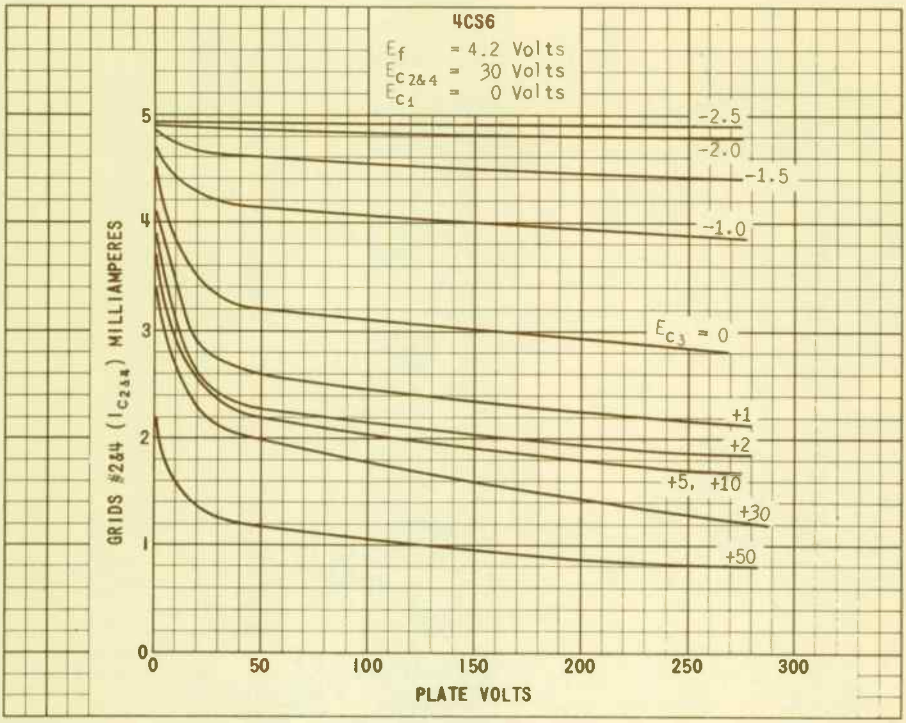

4CS6
E_f = 4.2 Volts
$E_{c2\&4}$ = 30 Volts
E_{c3} = 0 Volts
E_{c1} = +3.0
+2.5
+2.0
+1.0
GRID #1 MILLIAMPERES
0
1
2
3
4
5
0
50
100
150
200
250
300
PLATE VOLTS


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

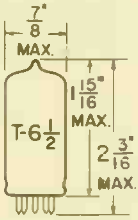

4CS6
Ef = 4.2 Volts
Eb = 100 Volts
Ec2&4 = 30 Volts
Ec1 = 0 Volts
gm
rp
PLATE RESISTANCE (rp) - MEGOHMS
TRANSCONDUCTANCE (gm) - MICROMHOS
3
2
1
0
1500
1000
500
0
-3.0
-2.0
-1.0
0
GRID #3 VOLTS


4CS6
Ef = 4.2 Volts
Eb = 100 Volts
Ec2&4 = 30 Volts
Ec3 = 0 Volts
Ib
gm
rp
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE (Ib) MILLIAMPERES
PLATE RESISTANCE (rp) - MEGOHMS
1500
1000
500
0
1.5
1.0
0.5
0
15
10
5
0
-3.0
-2.0
-1.0
0
GRID #1 VOLTS

4CS6


4CS6
Ef = 4.2 Volts
Ec 2&4 = 30 Volts
Ec1 = 0 Volts
-2.5
-2.0
-1.5
-1.0
Ec3 = 0
+1
+2
+5, +10
+30
+50
GRIDS #2&4 (Ic2&4) MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
0
50
100
150
200
250
300

TUNG-SOL



GLASS BULB

TWIN TRIODE

MINIATURE TYPE

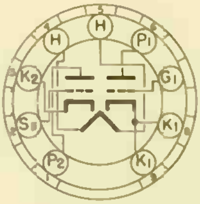
COATED UNIPOTENTIAL CATHODE

HEATER

4.2 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS – CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

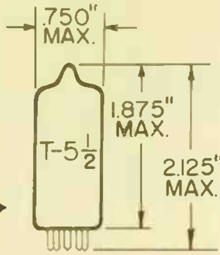
CATHODE CURRENT (MAX.)	20	MA.
GRID CIRCUIT RESISTANCE (MAX.)	0.5	MEGOHM

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 6-2

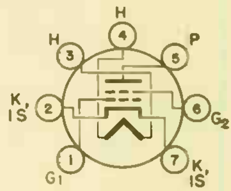
TETRODE

MINIATURE TYPE

COATED UNIPOTENTIAL 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	$\mu\mu f$
INPUT	4.5	$\mu\mu f$
OUTPUT	3.0	$\mu\mu f$

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

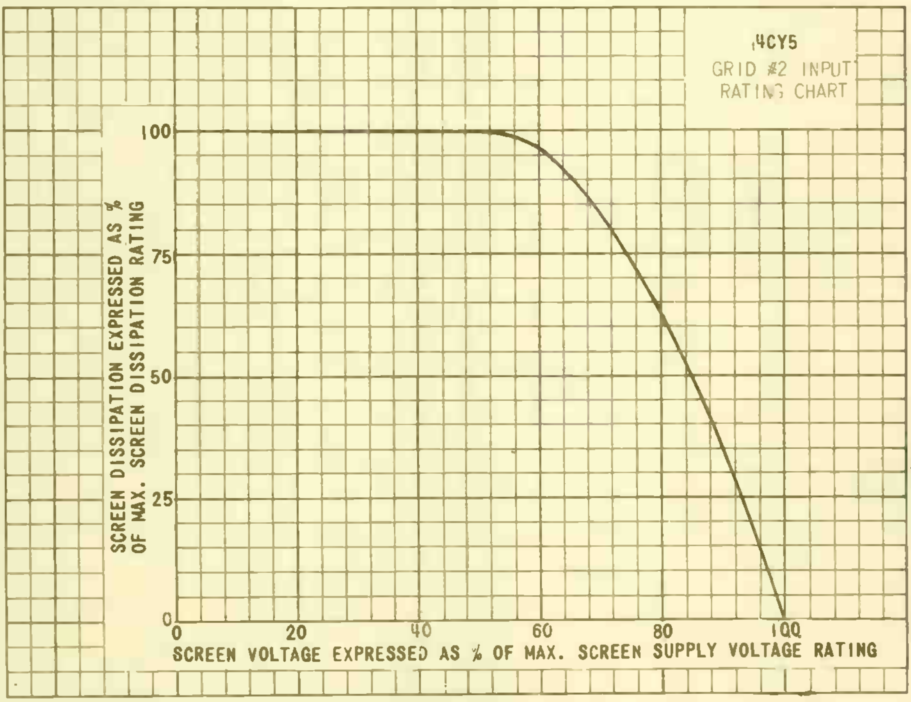
TUNG-SOL

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.

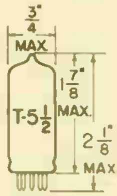
[C] PLATE CURRENT 20 μA.



TUNG-SOL

PENTODE

MINIATURE TYPE

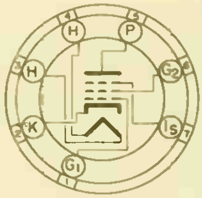


GLASS BULB

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

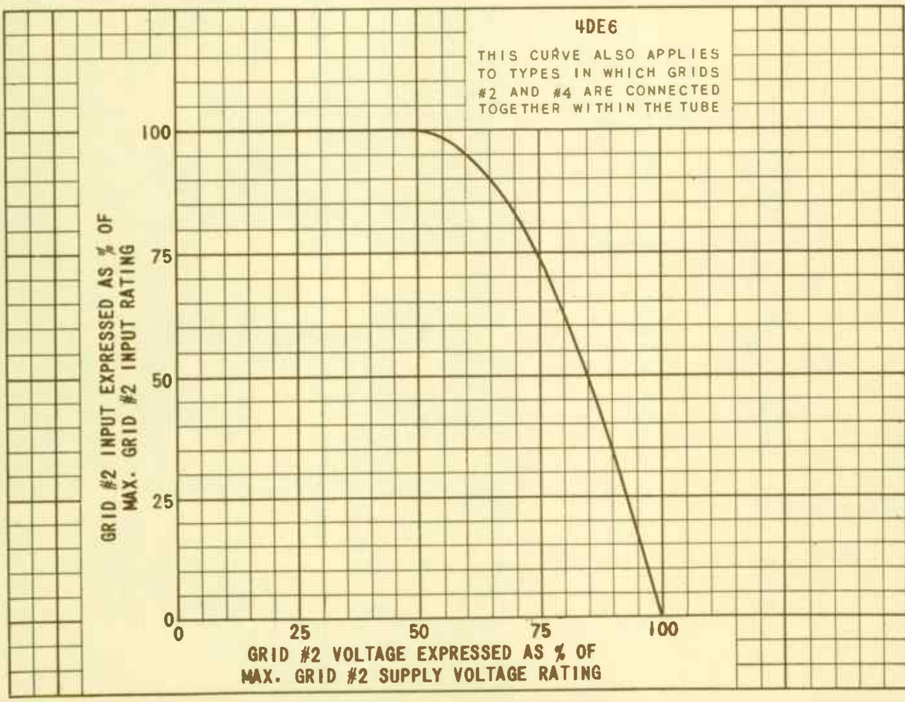
CONTINUED FROM PRECEDING PAGE

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 (Ec1 = -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

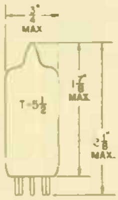
PENTODE

MINIATURE TYPE

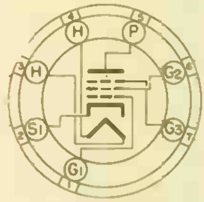
UNIPOTENTIAL CATHODE

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.

TUNG-SOL

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 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:

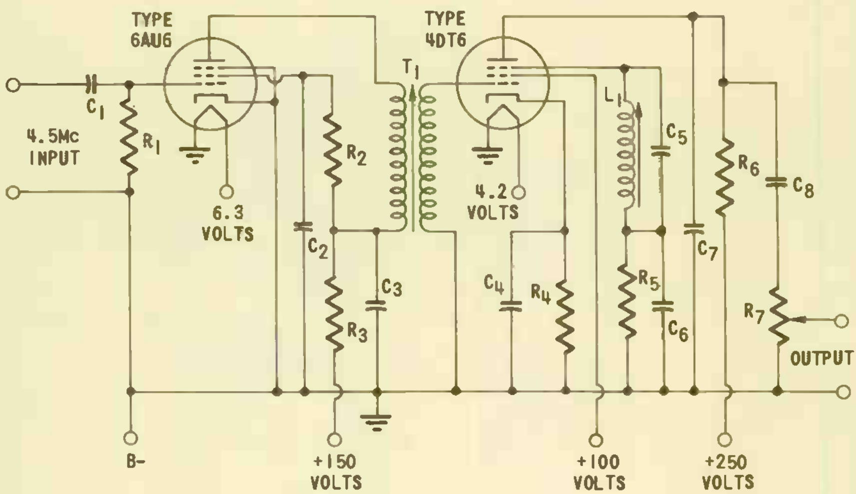
INPUT SIGNAL TO GRID OF DRIVER TUBE	15	200	500	MV RMS
PLATE SUPPLY VOLTAGE	250	250	250	VOLTS
GRID #3 VOLTAGE (OBTAINED FROM A 560000-OHM RESISTOR)	-5	-6	-6.4	VOLTS
GRID #2 SUPPLY VOLTAGE	100	100	100	VOLTS
CATHODE-BIAS RESISTOR	560	560	560	OHMS
PLATE LOAD RESISTOR	0.27	0.27	0.27	MEGOHM
PLATE CURRENT	0.23	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			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.

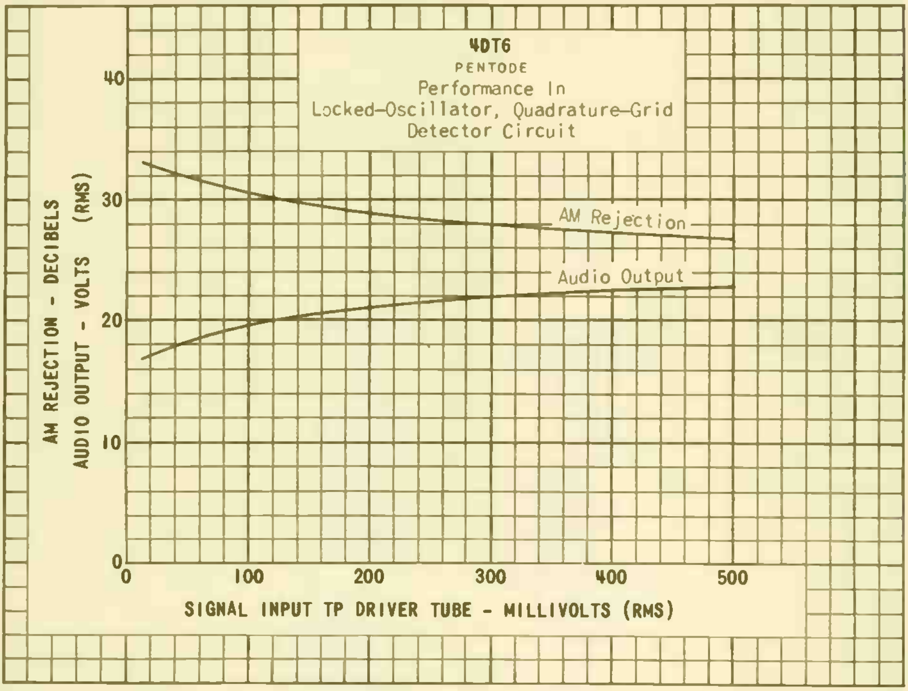
[C] SIGNAL LEVEL AT WHICH DETECTOR CIRCUIT WILL HANDLE THE INDICATED DEVIATION IN FREQUENCY FROM THE MEAN VALUE OF 4.5 MC, BEFORE DISTORTION OCCURS.

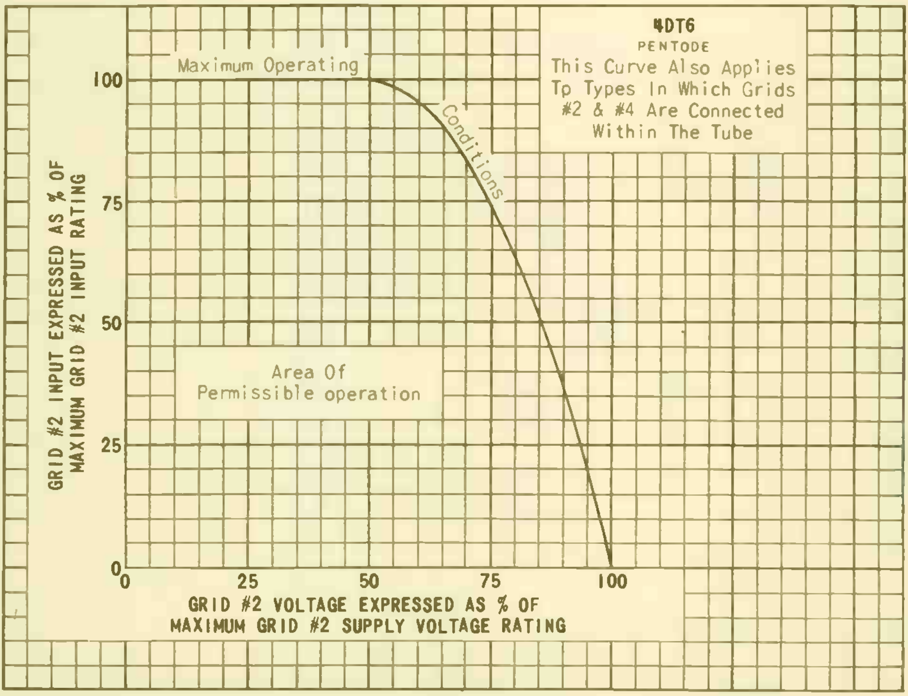
TUNG-SOL

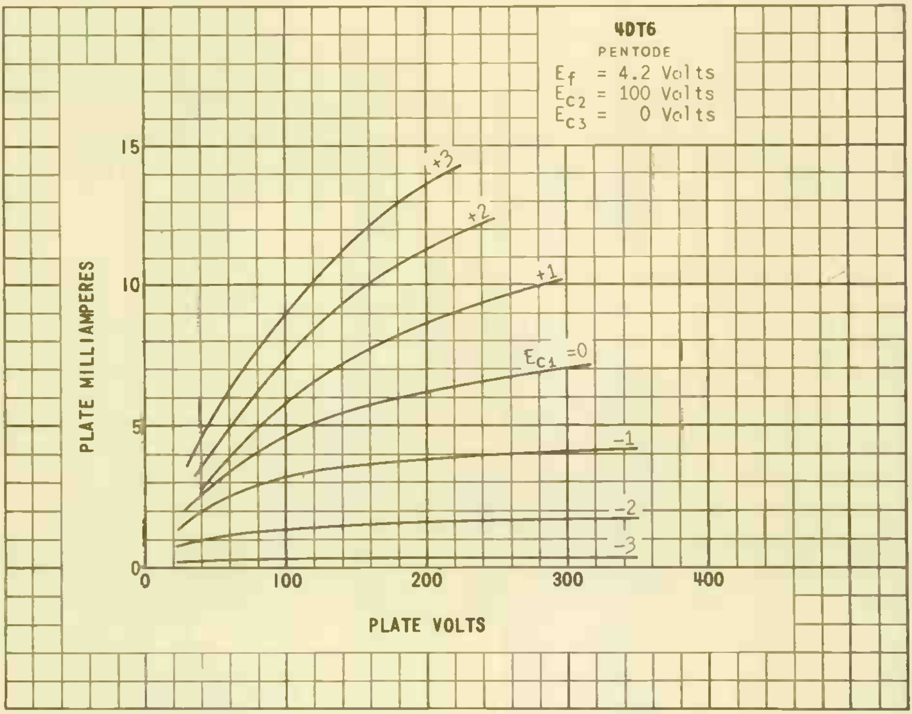
LOCKED-OSCILLATOR, QUADRATURE-GRID DETECTOR CIRCUIT
UTILIZING TYPE 6DT6

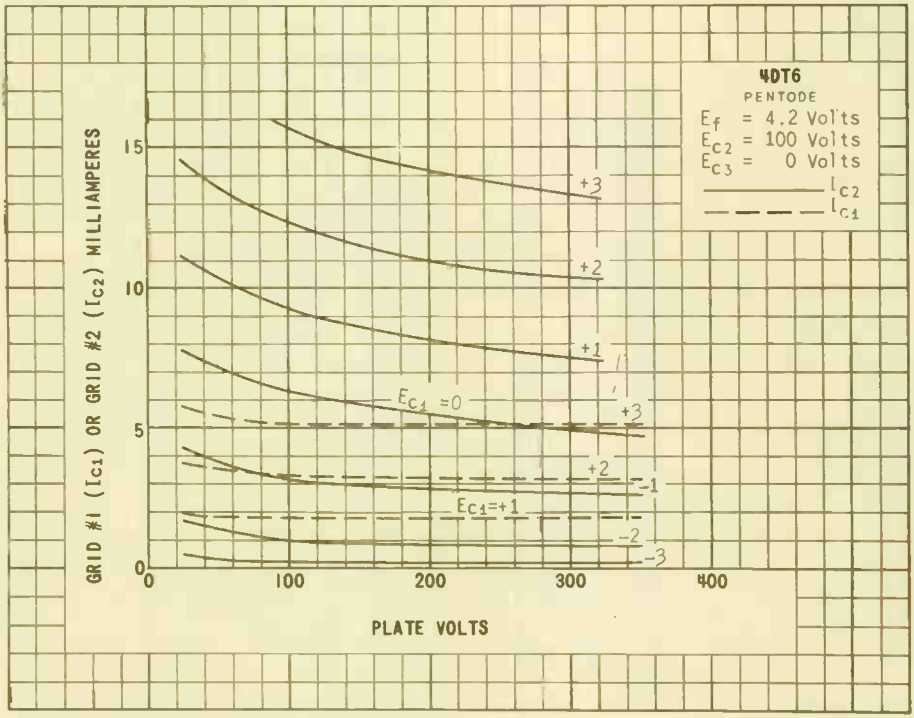


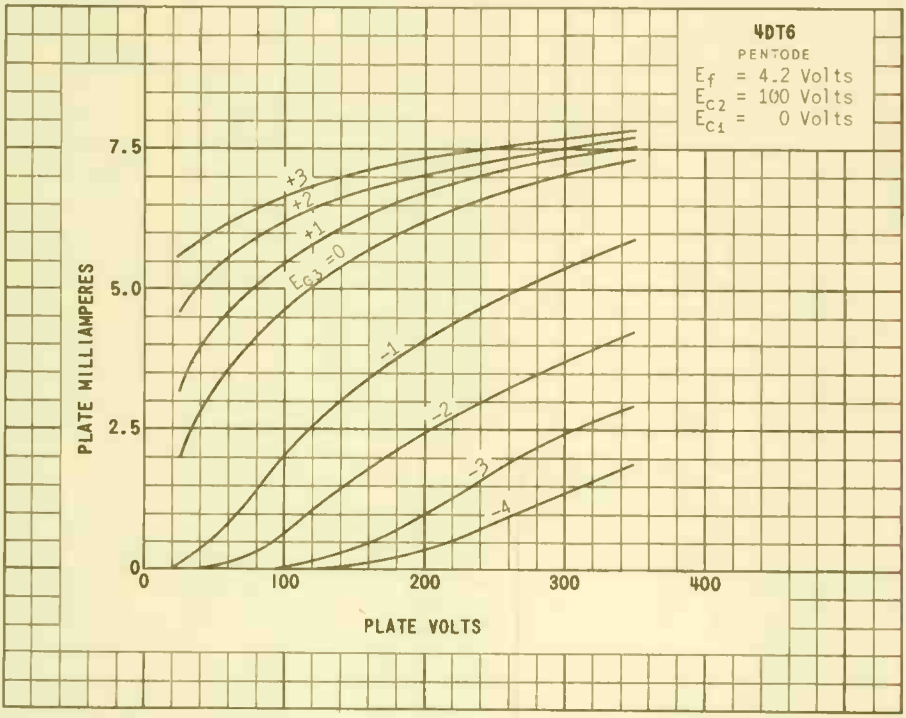
C_1:	47μμf, 400 VOLTS	L_1:	SLUG-TUNED INDUCTOR WITH Q OF 50 AND TUNEABLE TO 4.5-MC.	R_6:	270000 OHMS, 0.5 WATT
C_2 C_3:	0.01μf, 400 VOLTS	R_1:	100000 OHMS, 0.5 WATT	R_7:	0.5 MEGOHM POTENTIOMETER
C_4:	0.01μf, 200 VOLTS	R_2:	12000 OHMS, 0.5 WATT	T_1:	SLUG-TUNED, BIFILAR WOUND IF TRANSFORMER WITH RATIO OF 1:1.5, Q>60, AND TUNEABLE TO 4.5-MC WITH TUBE AND WIRING CAPACITANCE.
C_5:	18μμf, 200 VOLTS	R_3:	1000 OHMS, 0.5 WATT		
C_6:	0.05μf, 200 VOLTS	R_4:	560 OHMS, 0.5 WATT		
C_7:	100 TO 1000μμf, 400 VOLTS	R_5:	560000 OHMS, 0.5 WATT		
C_8:	0.01μf, 400 VOLTS				


4DT6
PENTODE
Performance In
Locked-Oscillator, Quadrature-Grid
Detector Circuit
AM REJECTION - DECIBELS
AUDIO OUTPUT - VOLTS (RMS)
0
10
20
30
40
0
100
200
300
400
500
AM Rejection
Audio Output
SIGNAL INPUT TP DRIVER TUBE - MILLIVOLTS (RMS)

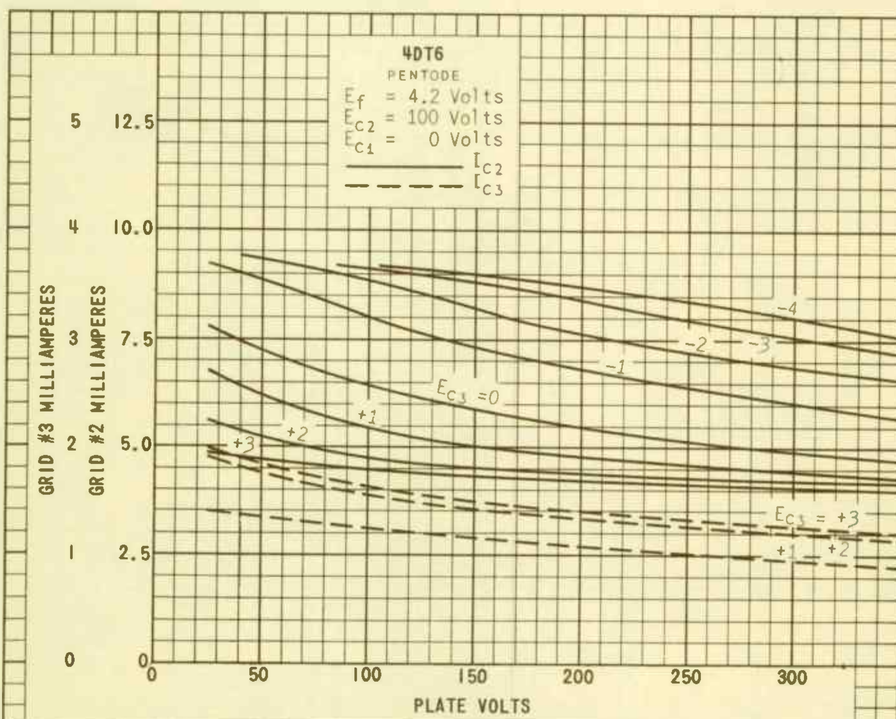

4DT6
PENTODE
This Curve Also Applies
Tp Types In Which Grids
#2 & #4 Are Connected
Within The Tube
Maximum Operating
Conditions
Area Of
Permissible operation
GRID #2 INPUT EXPRESSED AS % OF
MAXIMUM GRID #2 INPUT RATING
0
25
50
75
100
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS % OF
MAXIMUM GRID #2 SUPPLY VOLTAGE RATING


4DT6
PENTODE
Ef = 4.2 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
+3
+2
+1
Ec1 =0
-1
-2
-3
PLATE MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
5
10
15

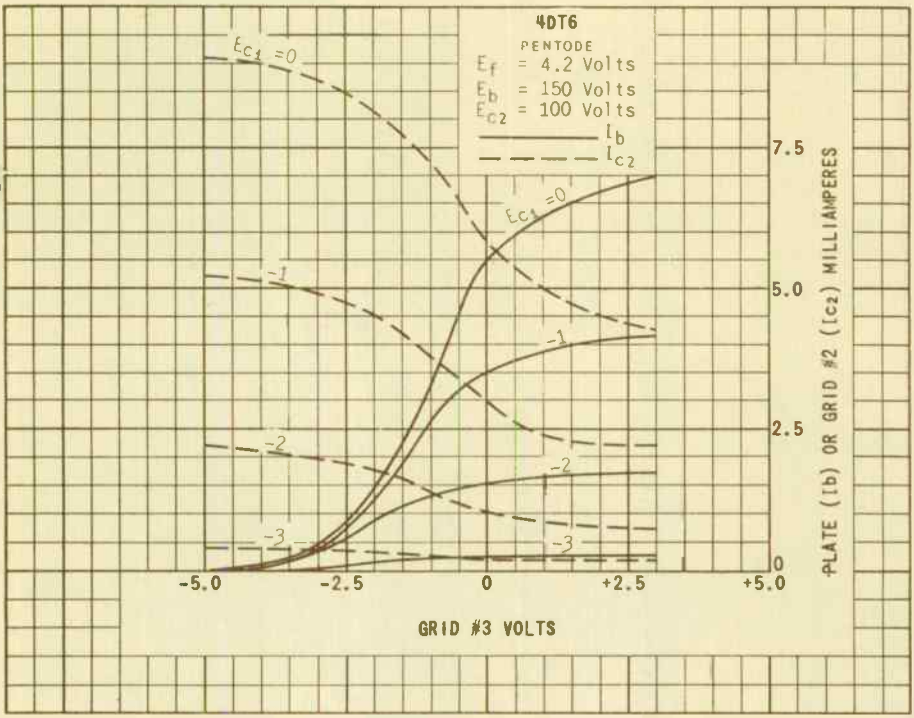

4DT6
PENTODE
Ef = 4.2 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
Ic2
Ic1
+3
+2
+1
Ec1 =0
+3
+2
-1
Ec1=+1
-2
-3
GRID #1 (Ic1) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
5
10
15

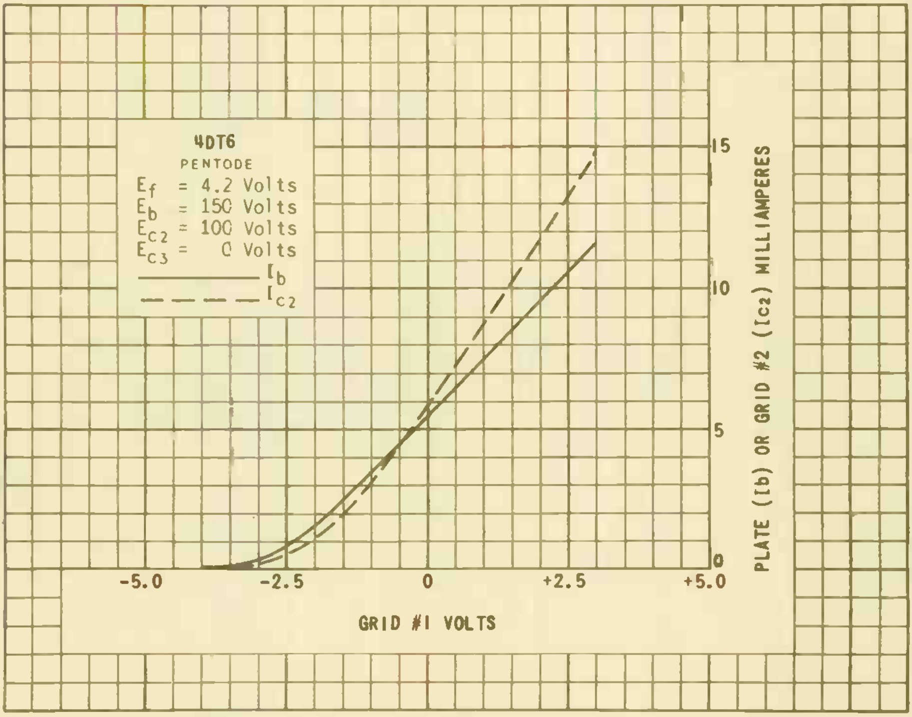


4DT6
PENTODE
E_f = 4.2 Volts
E_{c2} = 100 Volts
E_{c1} = 0 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_{G3} =0
+1
+2
+3
-1
-2
-3
-4



4DT6
PENTODE
E_f = 4.2 Volts
E_{c2} = 100 Volts
E_{c1} = 0 Volts
I_{c2}
I_{c3}
GRID #3 MILLIAMPERES
GRID #2 MILLIAMPERES
PLATE VOLTS
E_{c3} =0
+1
+2
+3
-1
-2
-3
-4
E_{c3} = +3
+1
+2

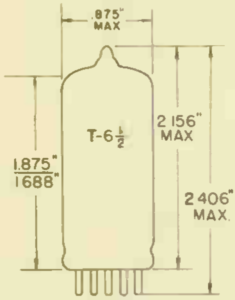

4DT6
PENTODE
Ef = 4.2 Volts
Eb = 150 Volts
Ec2 = 100 Volts
Ib
Ic2
Ec1 =0
-1
-2
-3
7.5
5.0
2.5
0
-5.0
-2.5
0
+2.5
+5.0
GRID #3 VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES


4DT6
PENTODE
Ef = 4.2 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

REMOTE-CUTOFF PENTODE

MINIATURE TYPE

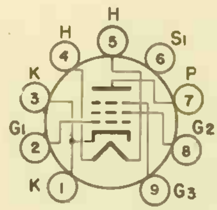


GLASS BULB
MINIATURE
9 PIN BASE E9-1

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

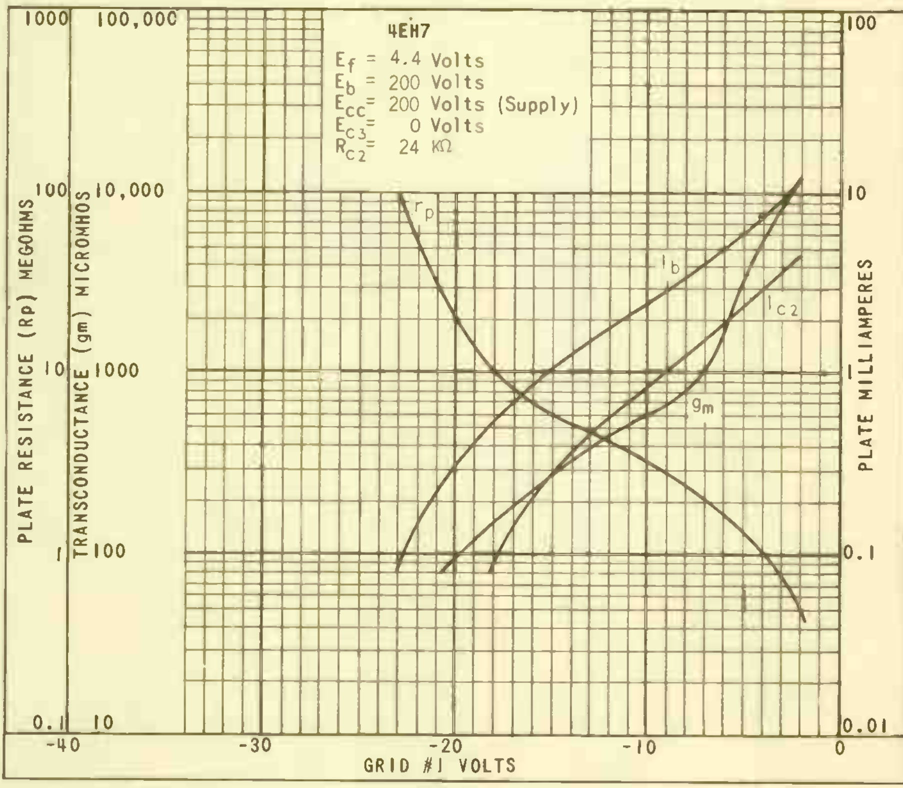
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

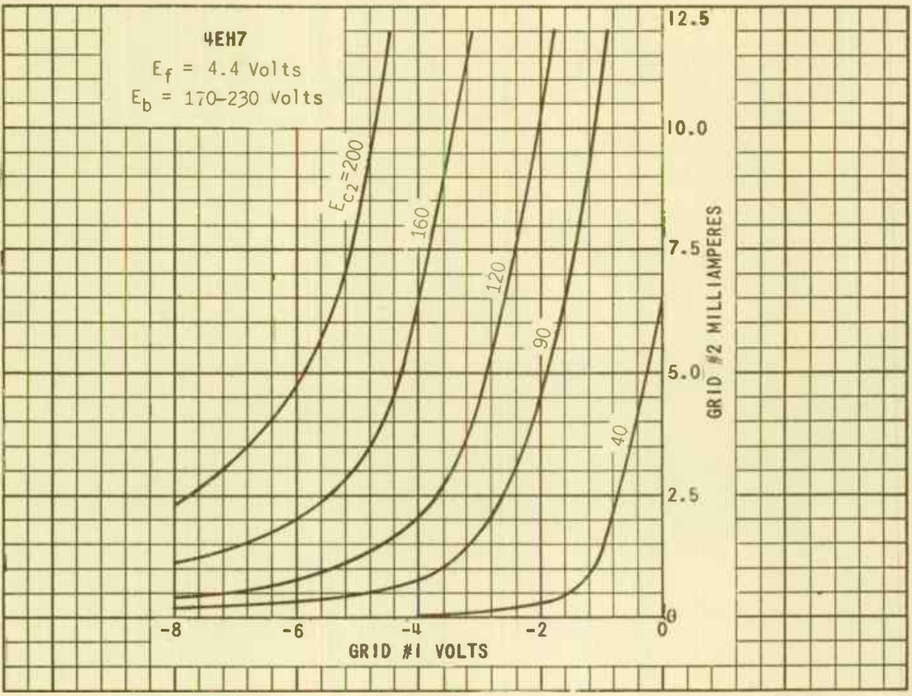
TUNG-SOL

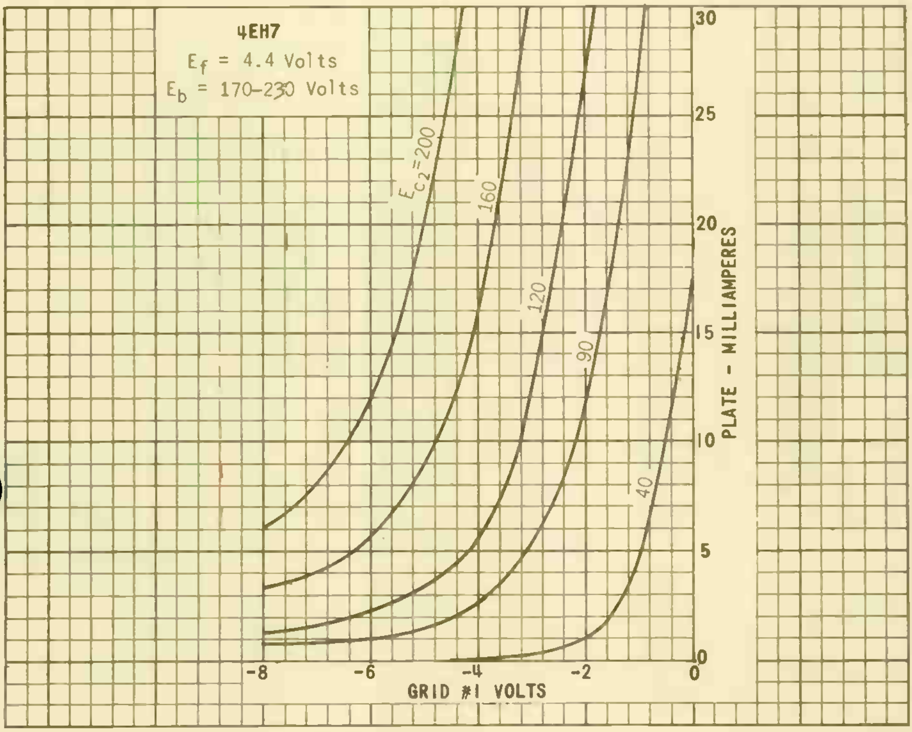
CONTINUED FROM PRECEDING PAGE

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.



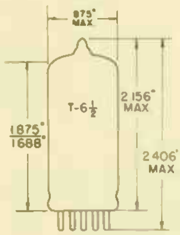

4EH7
E_f = 4.4 Volts
E_b = 170-230 Volts
E_{c2}=200
160
120
90
40
12.5
10.0
7.5
5.0
2.5
0
GRID #2 MILLIAMPERES
-8
-6
-4
-2
0
GRID #1 VOLTS


4EH7
E_f = 4.4 Volts
E_b = 170-230 Volts
E_{c2}=200
160
120
90
40
30
25
20
15
10
5
0
PLATE - MILLIAMPERES
-8
-6
-4
-2
0
GRID #1 VOLTS

TUNG-SOL

SHARP CUTOFF PENTODE

MINIATURE TYPE



MINIATURE BUTTON
9 PIN BASE E9-1

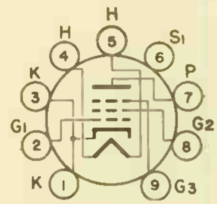
OUTLINE DRAWING
SPECIAL
GLASS BULB

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CHARACTERISTICS

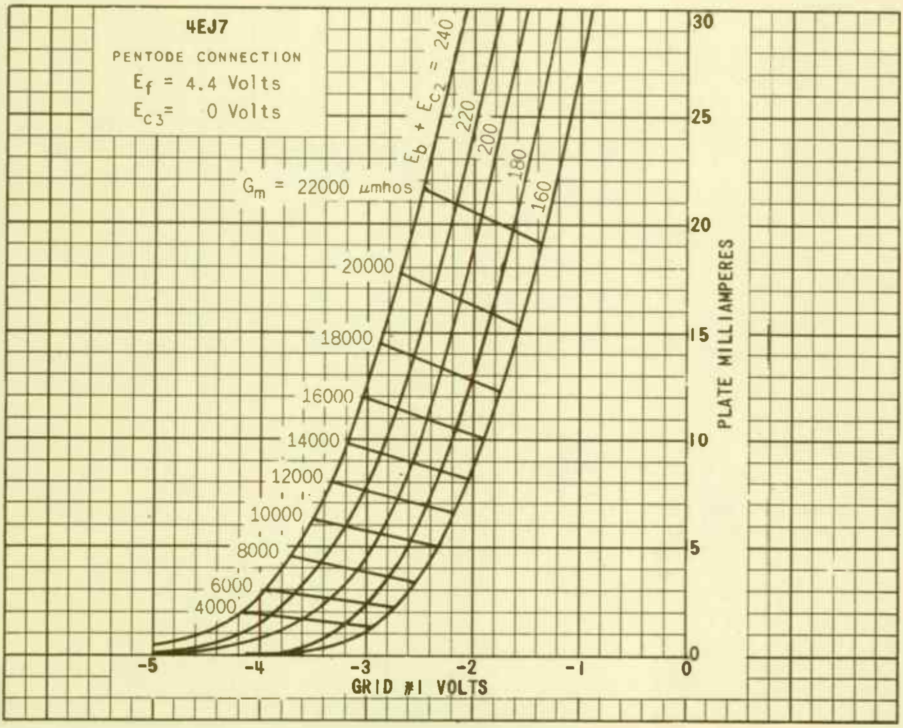
CLASS A_1 AMPLIFIER

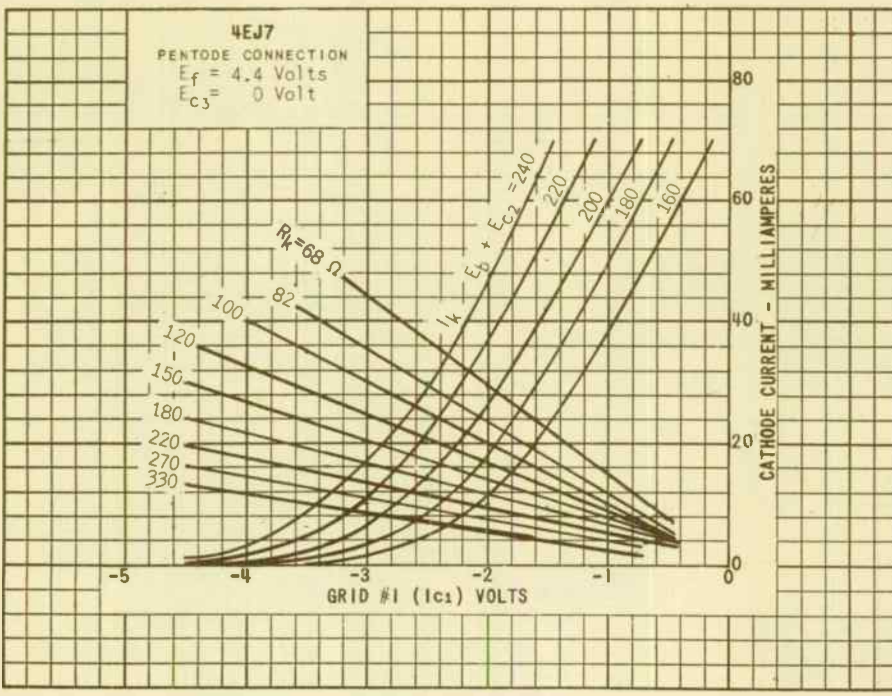
PLATE VOLTAGE	200	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 VOLTAGE	200	VOLTS
GRID #1 VOLTAGE	-2.5	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	4.1	MA.
TRANSCONDUCTANCE	15000	µMHOS
AMPLIFICATION FACTOR (G2 TO G1)	60	
PLATE RESISTANCE (APRROX)	0.35	MEGOHM
GRID #1 IMPEDANCE AT 40 MC	30000	OHMS[C]

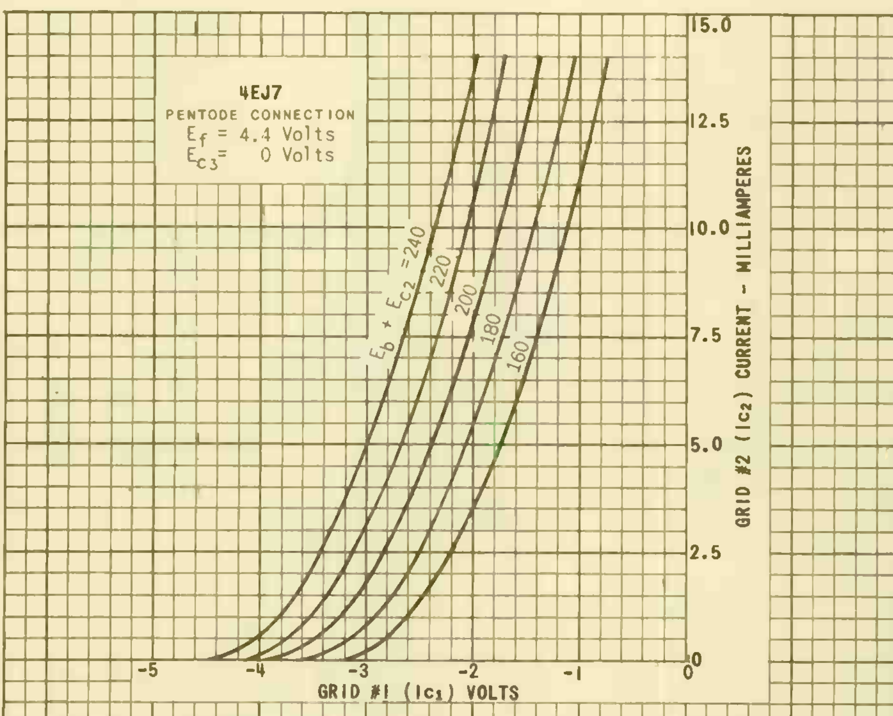
[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[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.

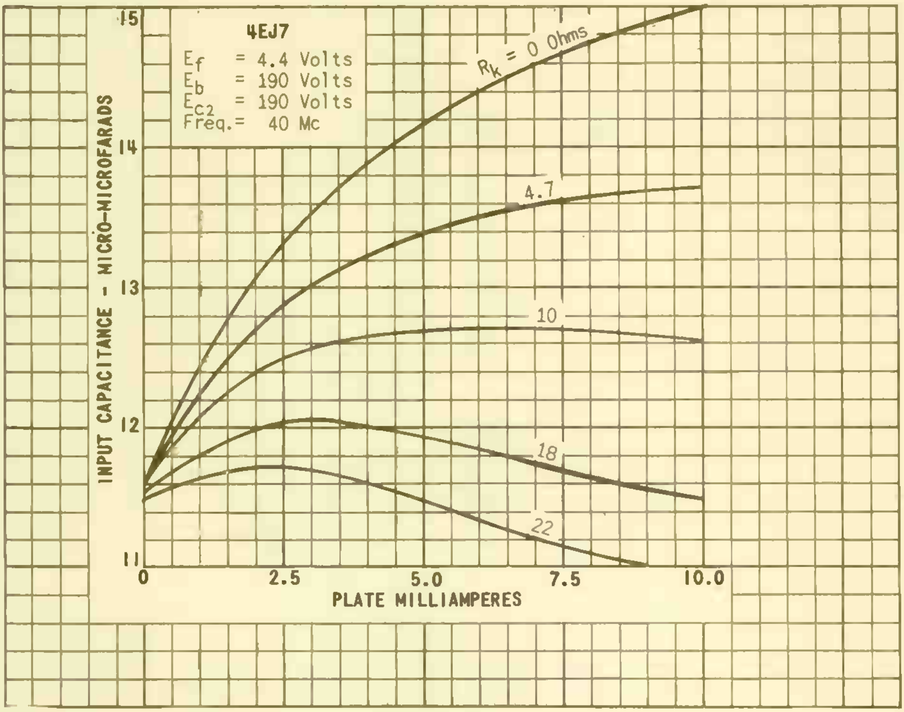
[C] INPUT DAMPING OF TUBE AND TYPICAL CERAMIC SOCKET WITH BOTH CATHODE LEADS TIED DIRECTLY TO GROUND IS ABOUT 10,000 OHMS.

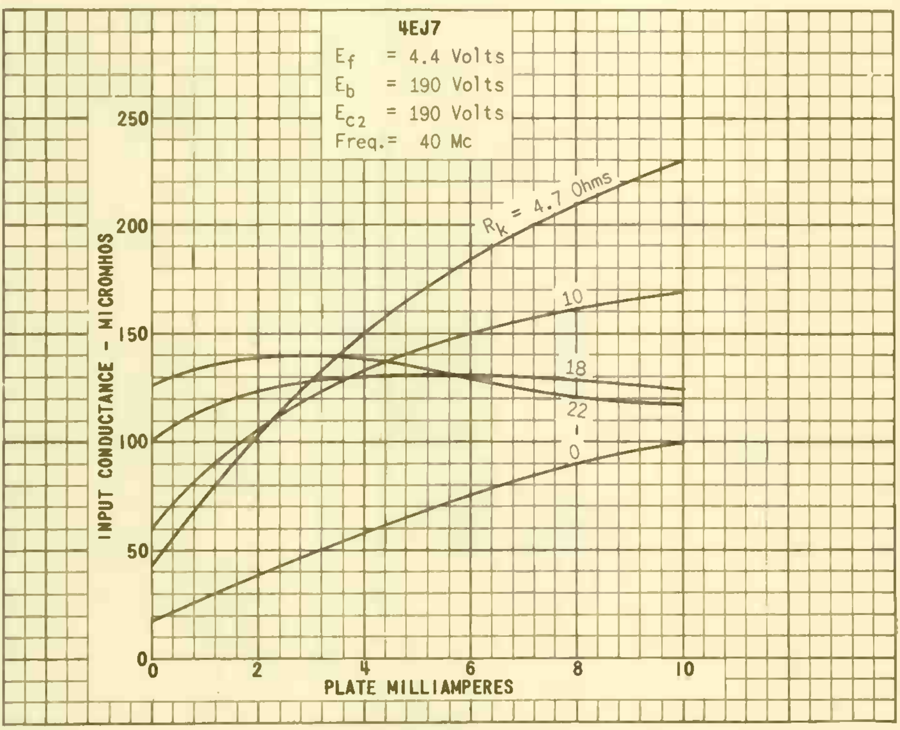






TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., AUGUST 1, 1961 PLATE #6232

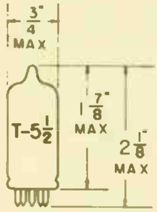

4EJ7
E_f = 4.4 Volts
E_b = 190 Volts
E_{c2} = 190 Volts
Freq.= 40 Mc
R_k = 0 Ohms
4.7
10
18
22
INPUT CAPACITANCE - MICRO-MICROFARADS
11
12
13
14
15
0
2.5
5.0
7.5
10.0
PLATE MILLIAMPERES


4EJ7
E_f = 4.4 Volts
E_b = 190 Volts
E_{c2} = 190 Volts
Freq.= 40 Mc
R_k = 4.7 Ohms
10
18
22
0
INPUT CONDUCTANCE - MICROMHOS
0
50
100
150
200
250
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.

TUNG-SOL

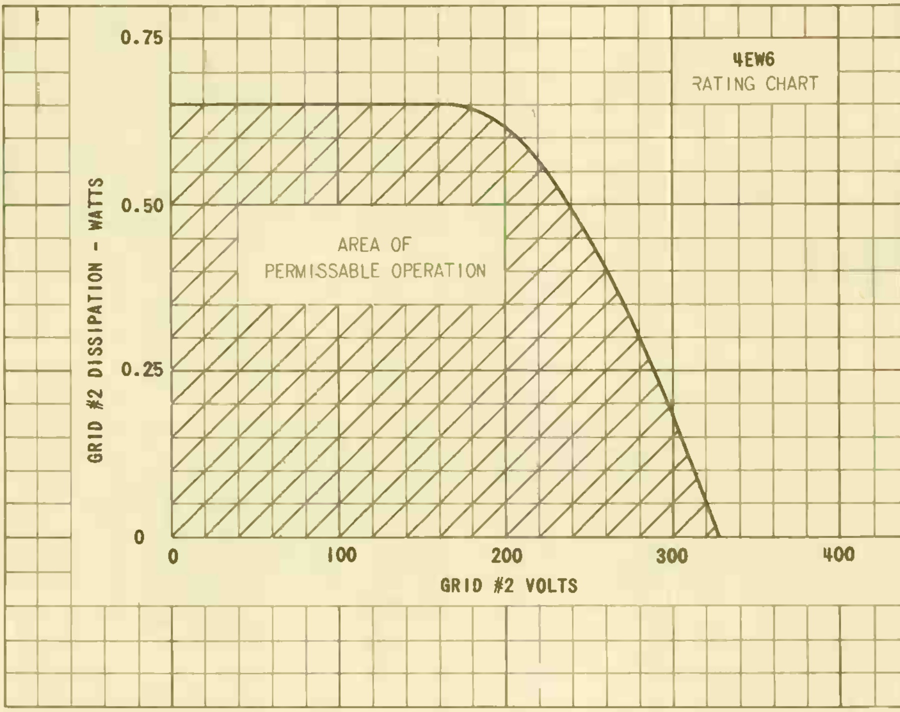
CONTINUED FROM PRECEDING PAGE

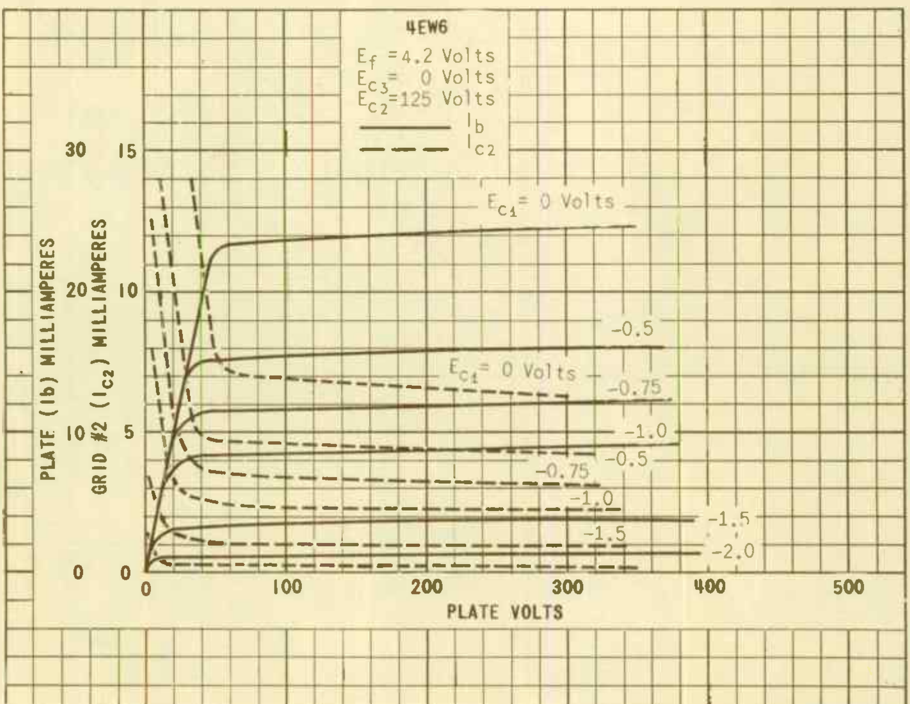
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

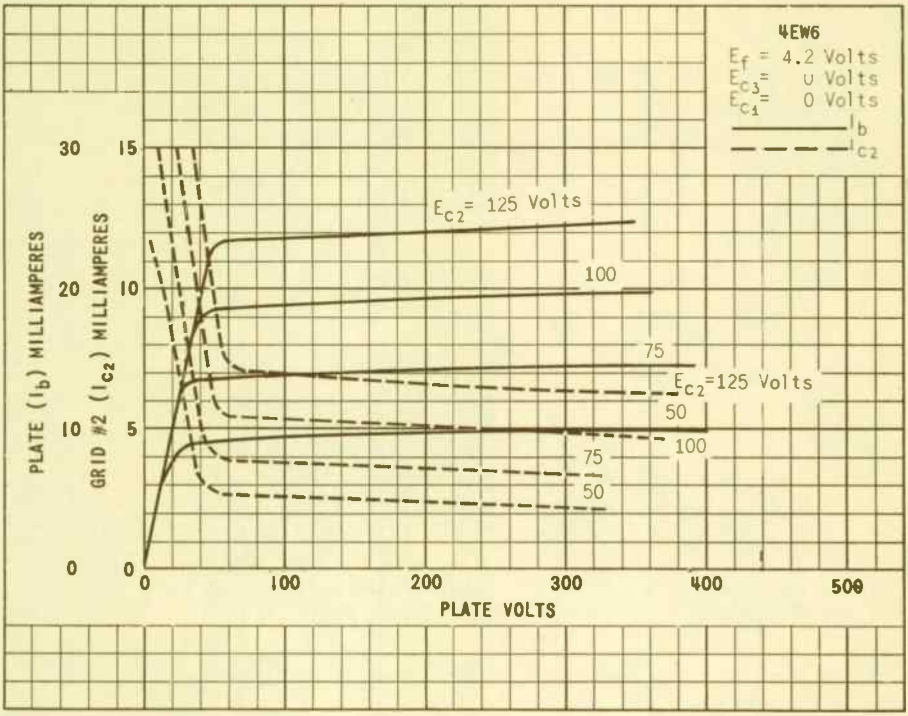
CLASS A_1 AMPLIFIER

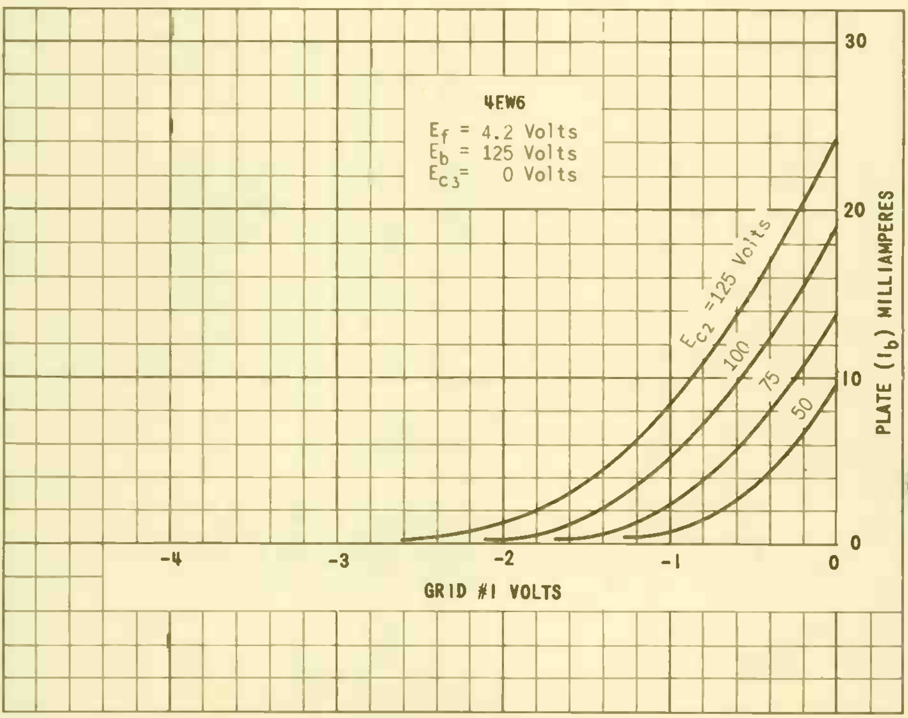
HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.6±6%	AMP.
PLATE VOLTAGE	125	VOLTS
SUPPRESSOR, CONNECTED TO CATHODE AT SOCKET		
SCREEN VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.2	MEGOHMS
TRANSCONDUCTANCE	14 000	µMHOS
PLATE CURRENT	11	MA.
SCREEN CURRENT	3.2	MA.
GRID #1 VOLTAGE (APPROX.) I_b= 20 µAMPS.	-3.5	VOLTS

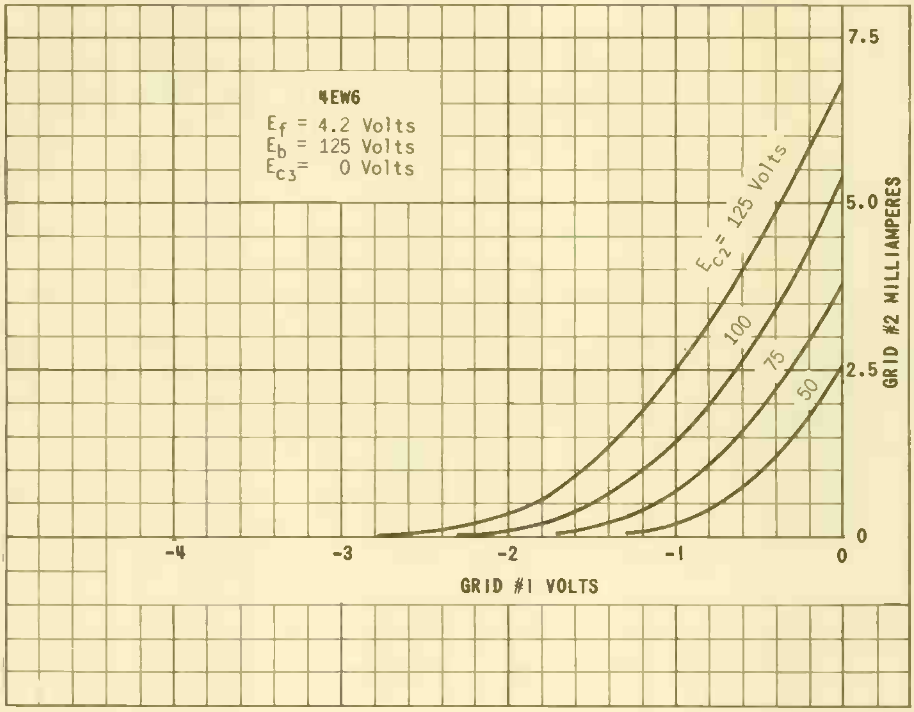
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

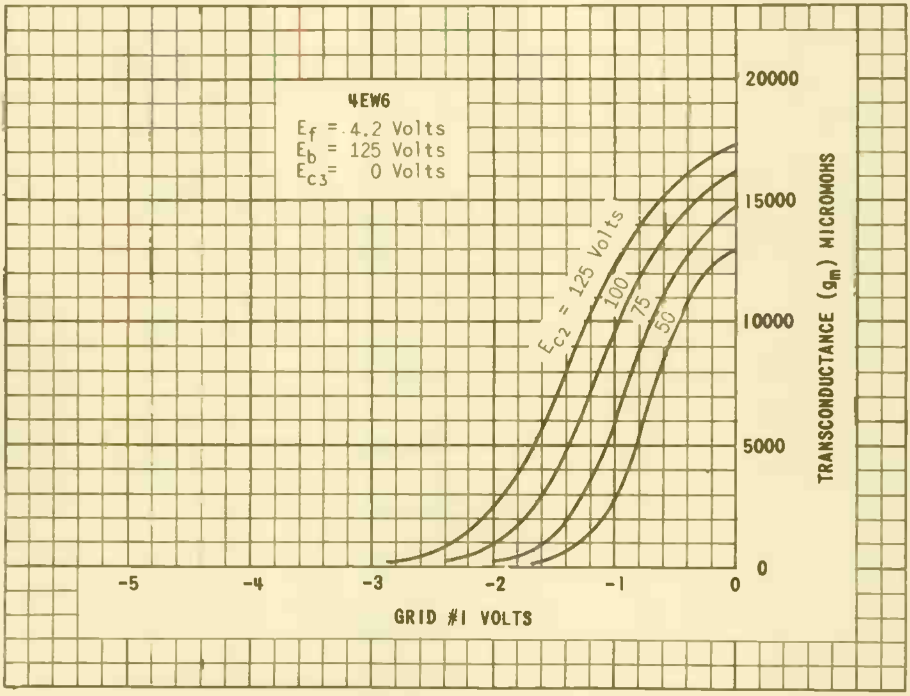

4EW6
RATING CHART
AREA OF
PERMISSABLE OPERATION
GRID #2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
GRID #2 VOLTS


4EW6
E_f = 4.2 Volts
E_{c_3} = 0 Volts
E_{c_2} = 125 Volts
I_b
I_{c2}
E_{c_1} = 0 Volts
-0.5
E_{c_1} = 0 Volts
-0.75
-1.0
-0.5
-0.75
-1.0
-1.5
-1.5
-2.0
PLATE (Ib) MILLIAMPERES
GRID #2 (I_{c2}) MILLIAMPERES
30
20
10
0
15
10
5
0
0
100
200
300
400
500
PLATE VOLTS


4EW6
E_f = 4.2 Volts
E_{c_3} = 0 Volts
E_{c_1} = 0 Volts
I_b
I_{c2}
E_{c2} = 125 Volts
100
75
E_{c2}=125 Volts
50
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #2 (I_{c2}) MILLIAMPERES
30 15
20 10
10 5
0 0
0 100 200 300 400 500
PLATE VOLTS


4EW6
E_f = 4.2 Volts
E_b = 125 Volts
E_{c_3} = 0 Volts
E_{c2} =125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
30
20
10
0
-4 -3 -2 -1 0
GRID #1 VOLTS

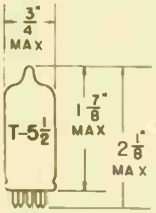

4EW6
E_f = 4.2 Volts
E_b = 125 Volts
E_{c3} = 0 Volts
E_{c2} = 125 Volts
100
75
50
7.5
5.0
2.5
0
GRID #2 MILLIAMPERES
-4
-3
-2
-1
0
GRID #1 VOLTS


4EW6
E_f = 4.2 Volts
E_b = 125 Volts
E_{c3} = 0 Volts
E_{c2} = 125 Volts
100
75
50
20000
15000
10000
5000
0
TRANSCONDUCTANCE (g_m) MICROMOHS
-5
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE



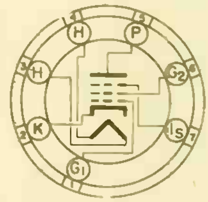
GLASS BULB

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 JS-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 JS-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.

CONTINUED ON FOLLOWING PAGE

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 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 SERVICE 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.

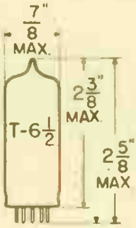
SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time, the 4GM6 is identical to the 5GM6 and the 6GM6.*

*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



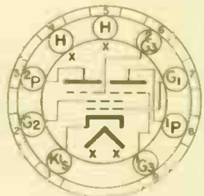
GLASS BULB

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 5GS8 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	5.8	μμf
PLATE (EACH SECTION) TO ALL	5.2	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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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	5.6	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.

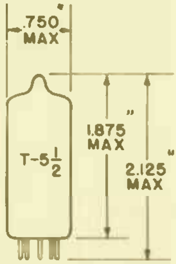
[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE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

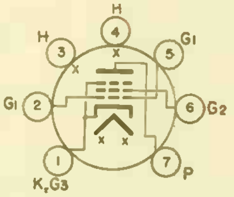


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

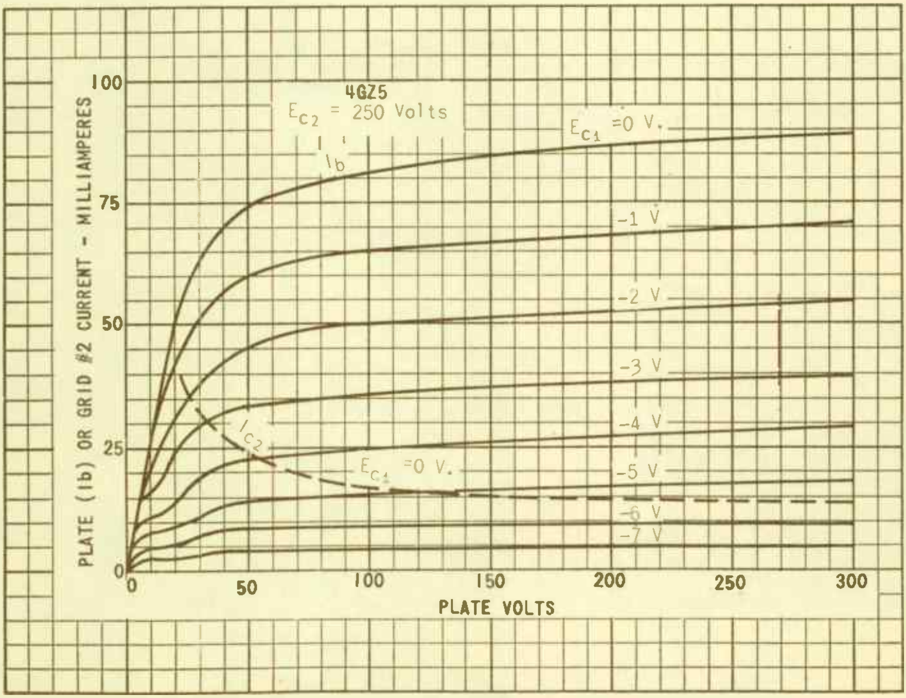
CONTINUED FROM PRECEDING PAGE

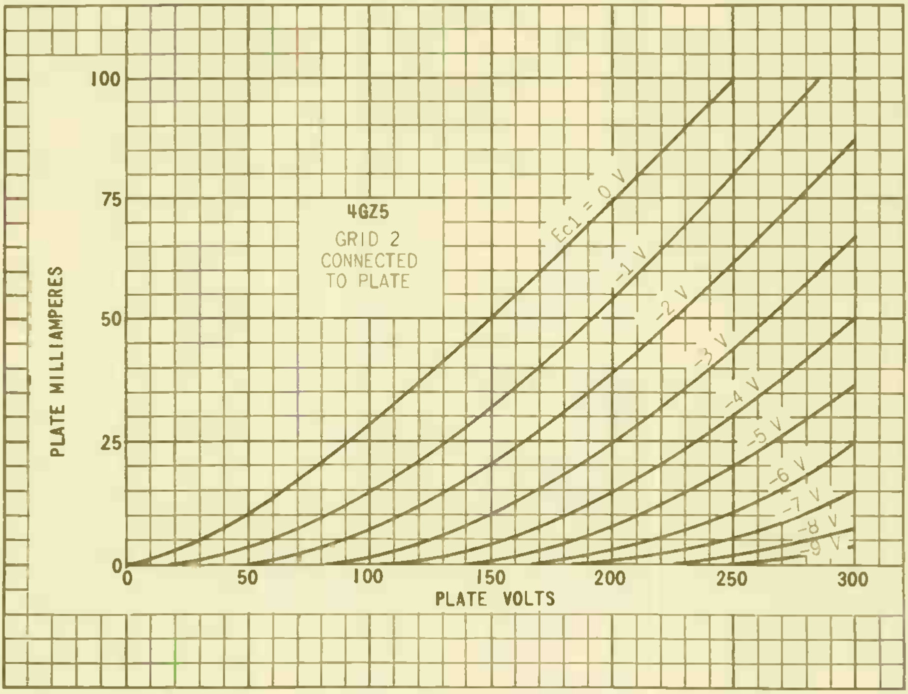
TYPICAL OPERATING CHARACTERISTICS

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.

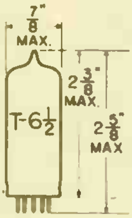



4GZ5
GRID 2
CONNECTED
TO PLATE
PLATE MILLIAMPERES
PLATE VOLTS
Ec1 = 0 V
-1 V
-2 V
-3 V
-4 V
-5 V
-6 V
-7 V
-8 V
-9 V
0
25
50
75
100
0
50
100
150
200
250
300

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE



GLASS BULB

COATED FILAMENT

SERIES FILAMENT	PARALLEL FILAMENT
E_f APPLIED BETWEEN PINS #4 AND #5; E_{g1} REFERRED TO PIN #4	E_f APPLIED BETWEEN PIN #9 AND PINS #4 & #5 TIED TOGETHER. E_{g1} REFERRED TO PIN #9
5.0 VOLTS 230 MA.	2.5 VOLTS 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. IT WILL 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

PLATE 2270
NOV. 1, 1949

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

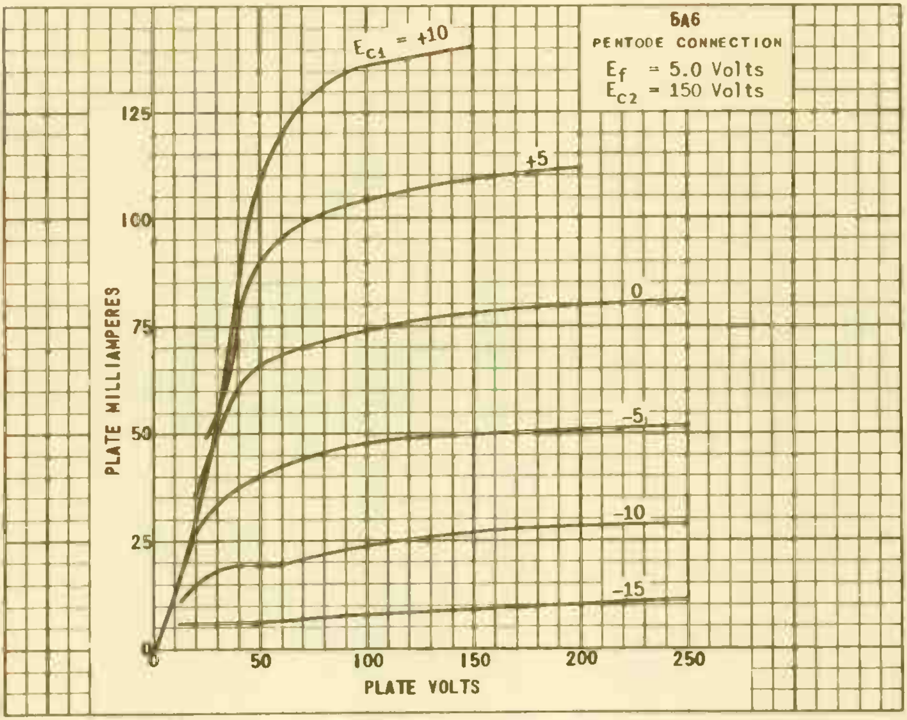
CONTINUED FROM PRECEDING PAGE

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



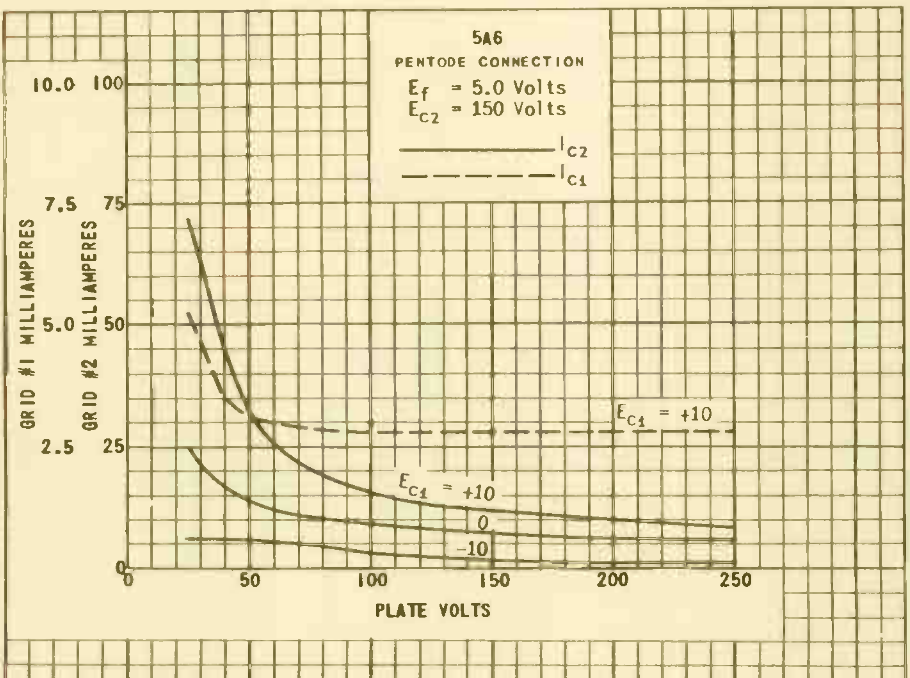
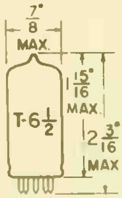


PLATE 2210
JUNE 1, 1949

TUNG-SOL

DIODE PENTODE

MINIATURE TYPE

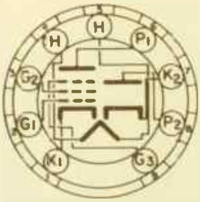


GLASS BULB

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.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

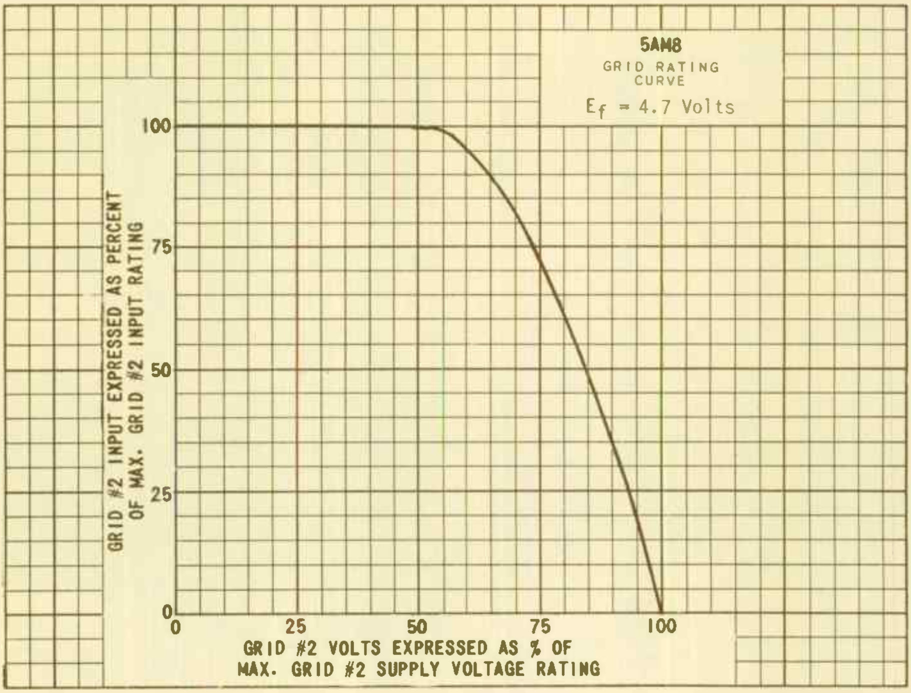
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

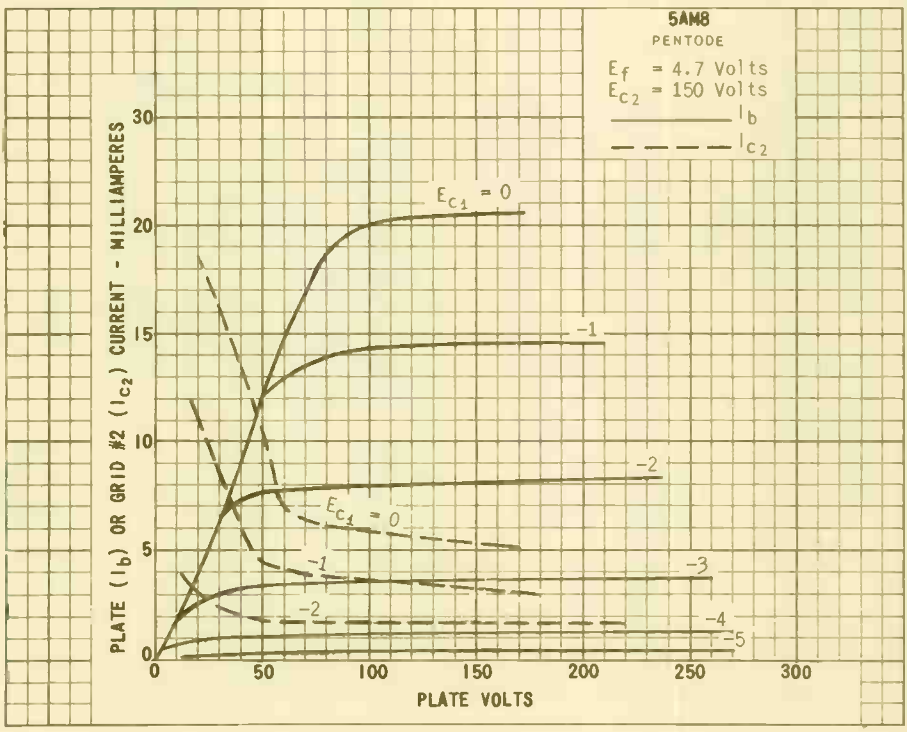
HEATER VOLTAGE	4.7	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	200	VOLTS
GRID #2 VOLTAGE	150	VOLTS
GRID #3 VOLTAGE	0	VOLTS
CATHODE RESISTOR	120	OHMS
PLATE CURRENT	11.5	MA.
GRID #2 CURRENT	2.7	MA.
TRANSCONDUCTANCE	7 000	μMHOS
PLATE RESISTANCE (APPROX.)	0.6	MEGOHM
GRID #1 VOLTAGE FOR I_b = 10 μAMP.	−8	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.

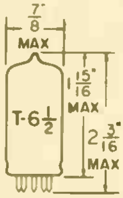

5AM8
GRID RATING CURVE
Ef = 4.7 Volts
100
75
50
25
0
0
25
50
75
100
GRID #2 INPUT EXPRESSED AS PERCENT OF MAX. GRID #2 INPUT RATING
GRID #2 VOLTS EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE RATING


5AM8
PENTODE
Ef = 4.7 Volts
Ec2 = 150 Volts
Ib
Ic2
Ec1 = 0
-1
-2
-3
-4
-5
Ec1 = 0
-1
-2
30
20
15
10
5
0
0
50
100
150
200
250
300
PLATE VOLTS
PLATE (Ib) OR GRID #2 (Ic2) CURRENT - MILLIAMPERES

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

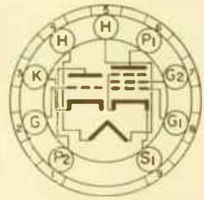


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE

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.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

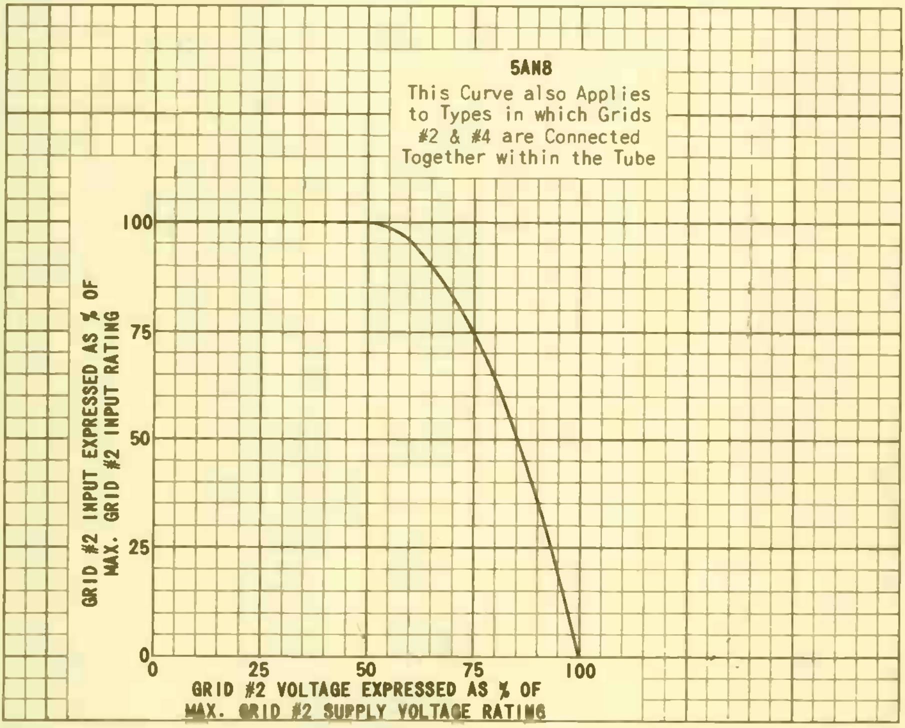
PRINTED IN U.S.A.

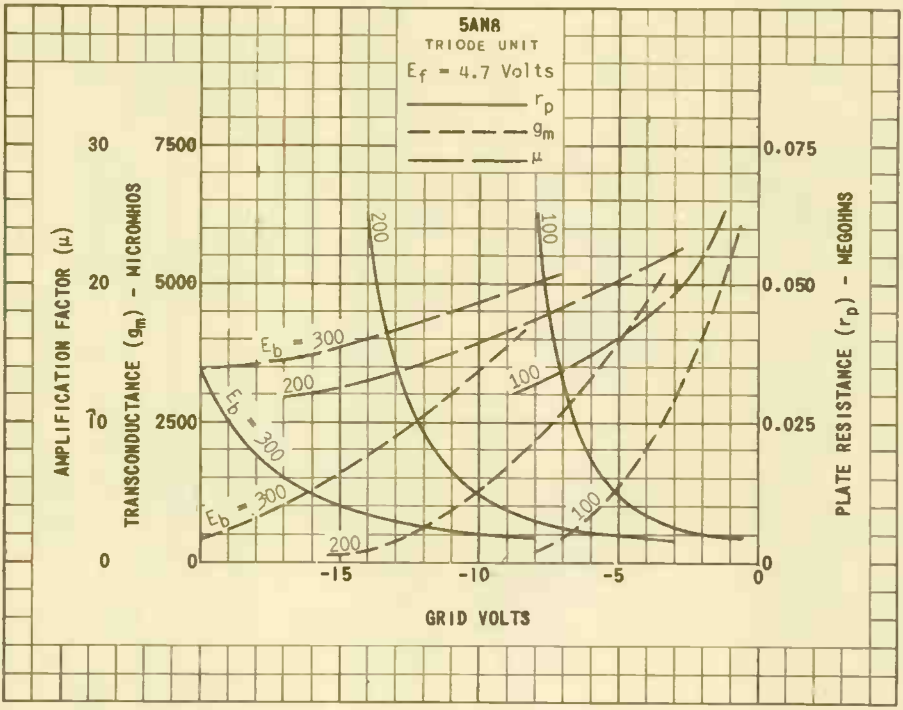
TUNG-SOL

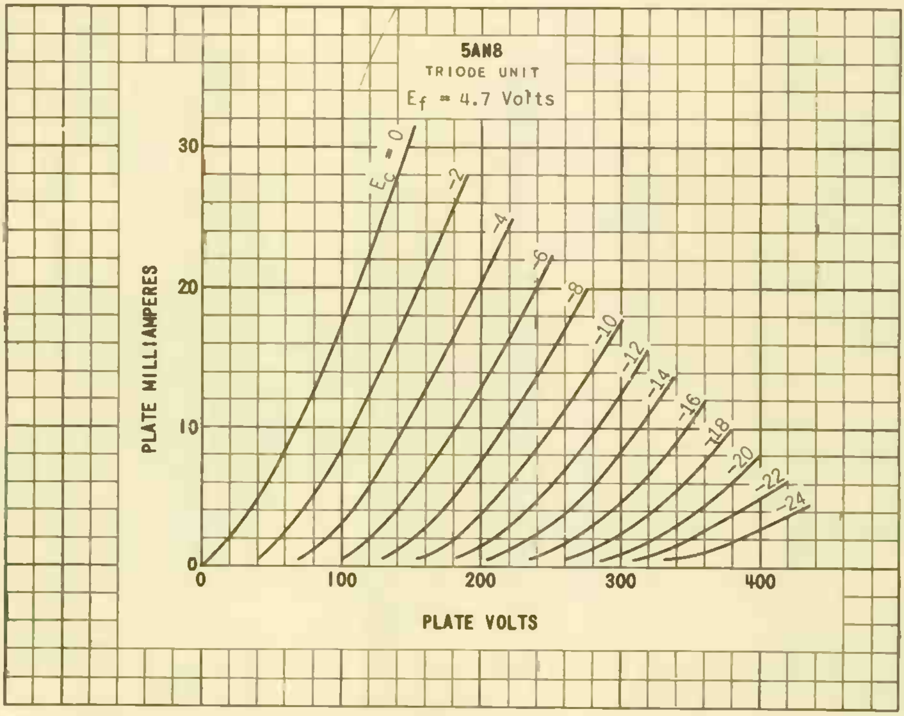
CONTINUED FROM PRECEDING PAGE

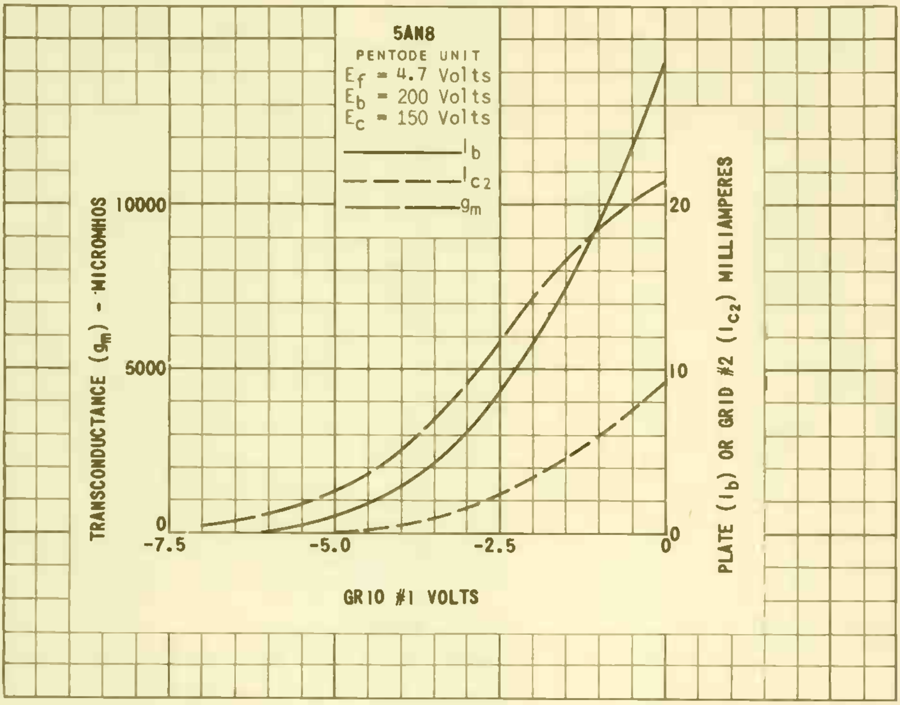
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

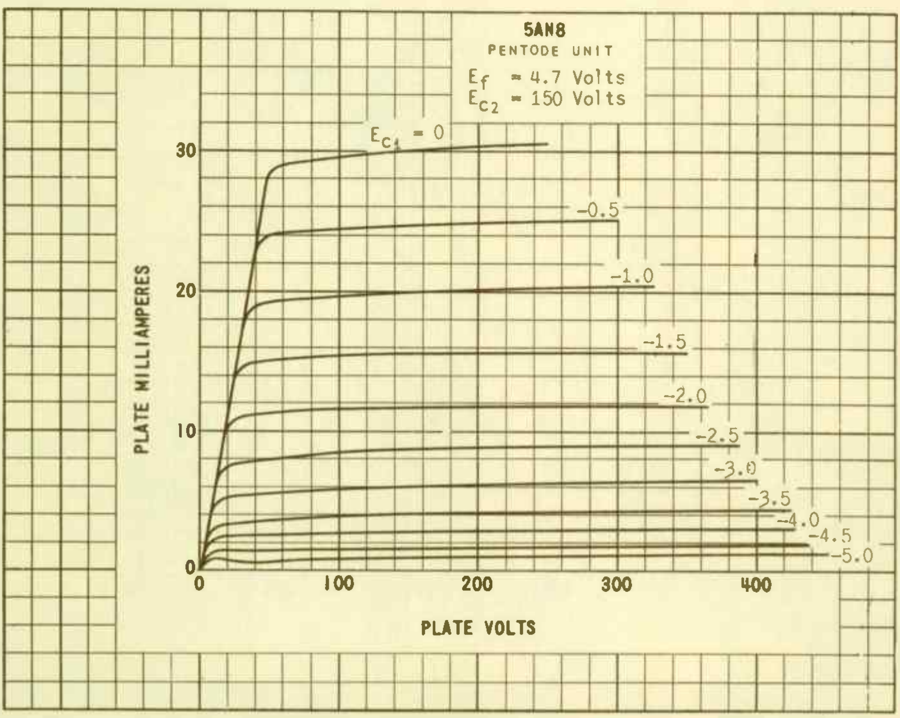
	TRIODE UNIT		PENTODE UNIT	
HEATER VOLTAGE		4.7		VOLTS
HEATER CURRENT		0.6		AMP.
PLATE SUPPLY VOLTAGE	200		200	VOLTS
GRID #2 SUPPLY VOLTAGE	---		150	VOLTS
GRID #1 VOLTAGE	-6		---	VOLTS
CATHODE BIAS RESISTOR	---		180	OHMS
AMPLIFICATION FACTOR	19		---	
PLATE RESISTANCE (APPROX.)	5 750		300 000	OHMS
TRANSCONDUCTANCE	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.




5AN8
TRIODE UNIT
Ef = 4.7 Volts
rp
gm
μ
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE RESISTANCE (rp) - MEGOHMS
GRID VOLTS
Eb = 300
200
100
30
20
10
0
7500
5000
2500
0
0.075
0.050
0.025
0
-15
-10
-5
0


5AN8
TRIODE UNIT
Ef = 4.7 Volts
Ec = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
PLATE MILLIAMPERES
PLATE VOLTS
30
20
10
0
0
100
200
300
400


5AN8
PENTODE UNIT
Ef = 4.7 Volts
Eb = 200 Volts
Ec = 150 Volts
Ib
Ic2
gm
TRANSCONDUCTANCE (gm) - MICROMHOS
10000
5000
0
-7.5
-5.0
-2.5
0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
20
10
GRID #1 VOLTS


5AN8
PENTODE UNIT
Ef = 4.7 Volts
Ec2 = 150 Volts
Ec1 = 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
100
200
300
400
PLATE VOLTS

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

GLASS BULB

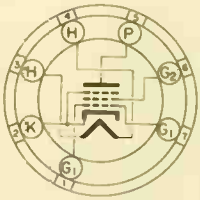
COATED UNIPOTENTIAL CATHODE

HEATER

4.7 VOLTS 0.6±6% AMP.

AC OR DC

ANY MOUNTING POSITION



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

TUNG-SOL

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

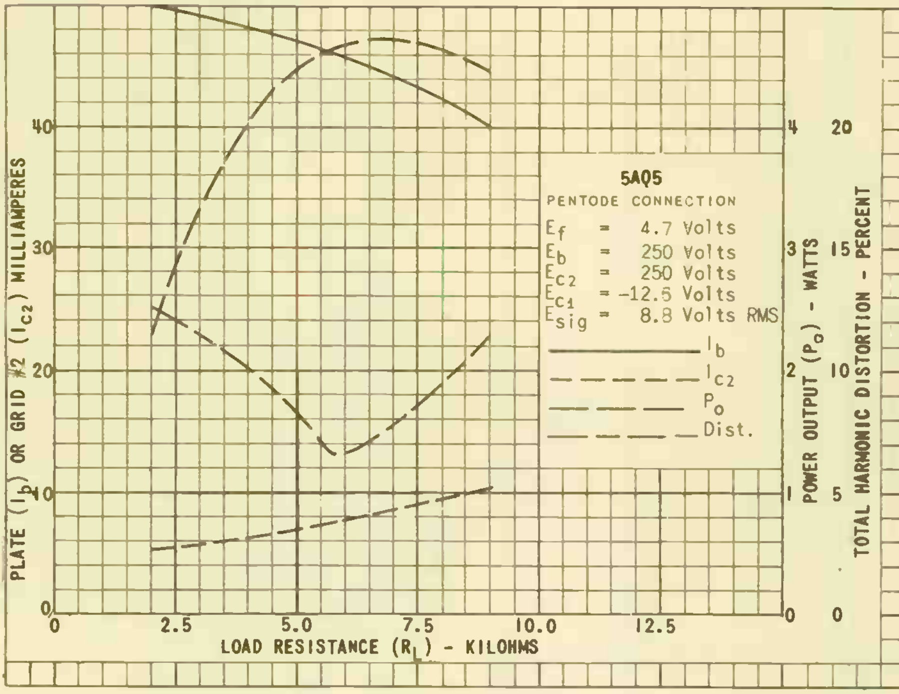
[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

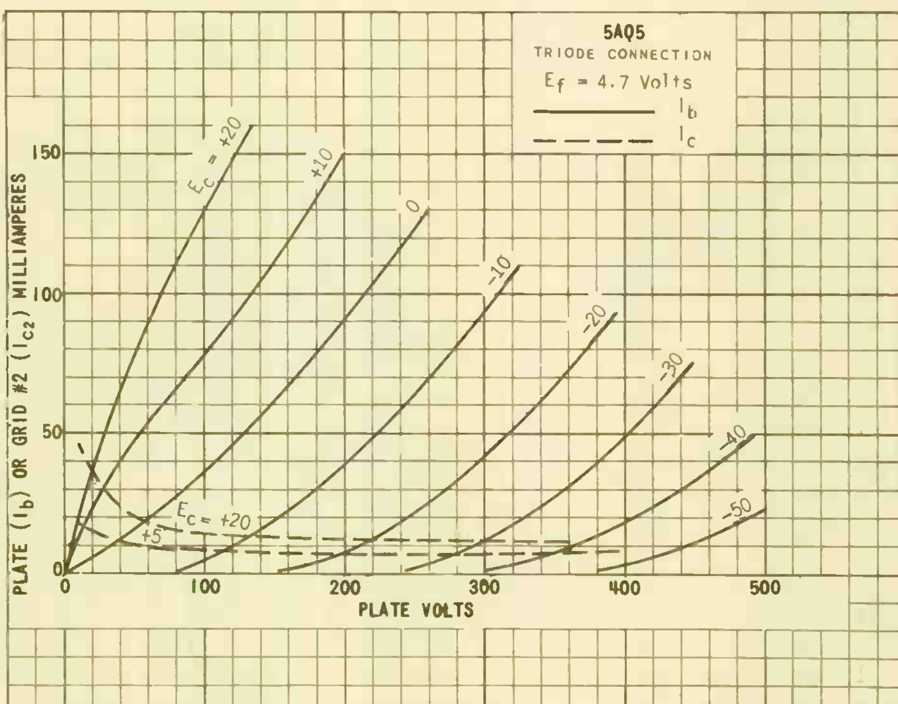
[C] TRIODE CONNECTED.

[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.

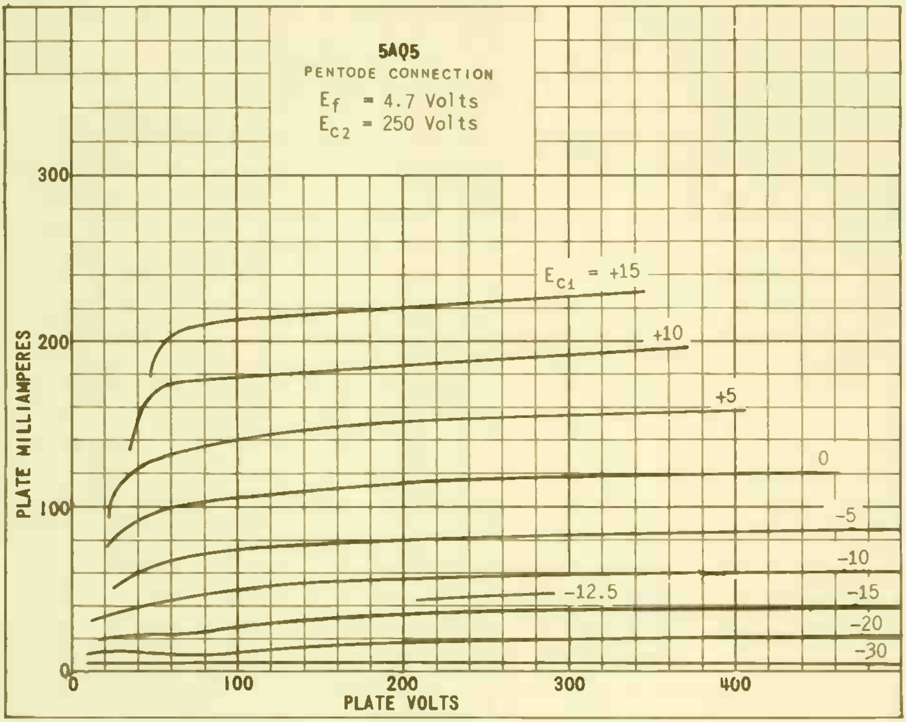
*INDICATES AN ADDITION.

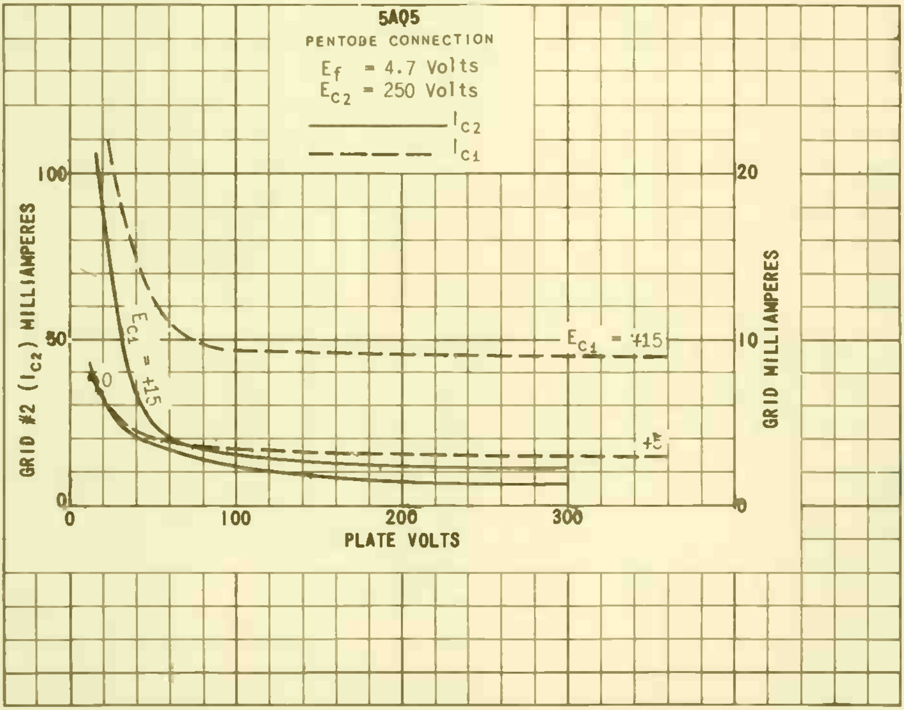
→ INDICATES A CHANGE.





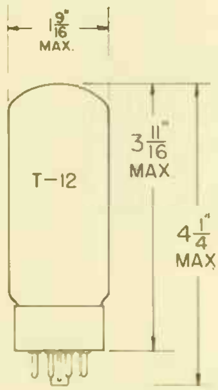
PRINTED IN U. S. A.


5AQ5
PENTODE CONNECTION
Ef = 4.7 Volts
Ec2 = 250 Volts
Ec1 = +15
+10
+5
0
-5
-10
-12.5
-15
-20
-30
PLATE MILLIAMPERES
300
200
100
0
100
200
300
400
PLATE VOLTS


5AQ5
PENTODE CONNECTION
Ef = 4.7 Volts
Ec2 = 250 Volts
Ic2
Ic1
Ec1 = +15
Ec1 = +15
0
GRID #2 (Ic2) MILLIAMPERES
GRID MILLIAMPERES
100
50
0
20
10
100
200
300
PLATE VOLTS

TUNG-SOL

TWIN-DIODE



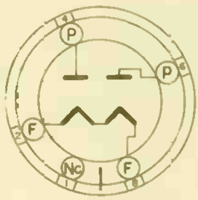
GLASS BULB

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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

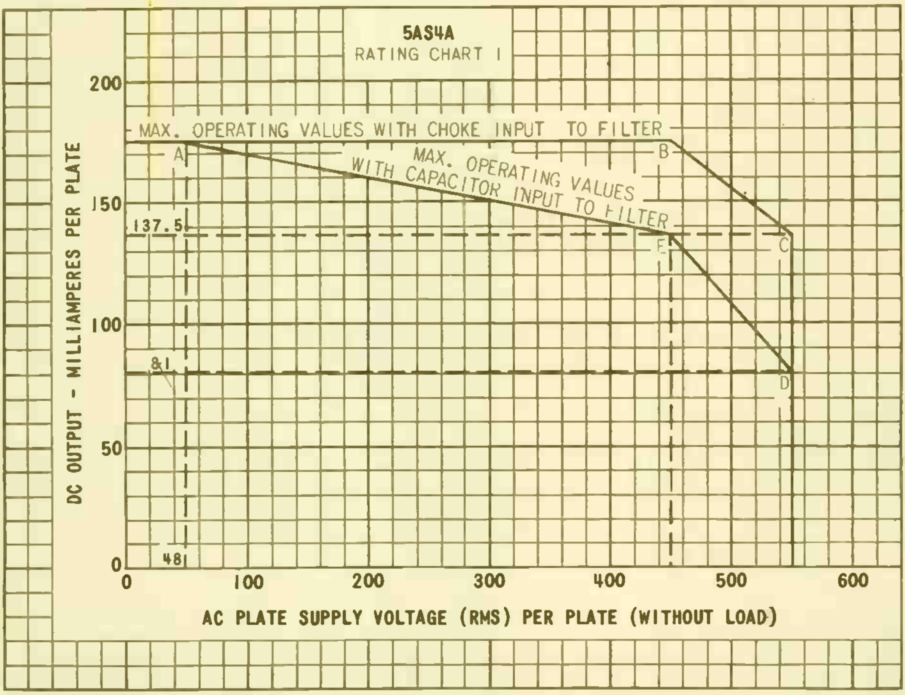
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

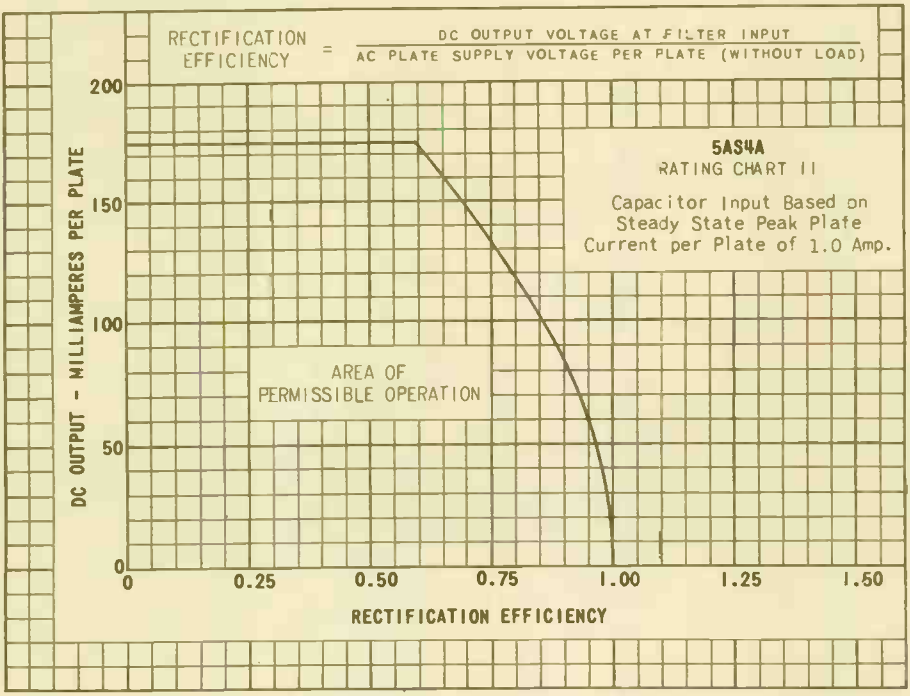
FULL-WAVE RECTIFIER

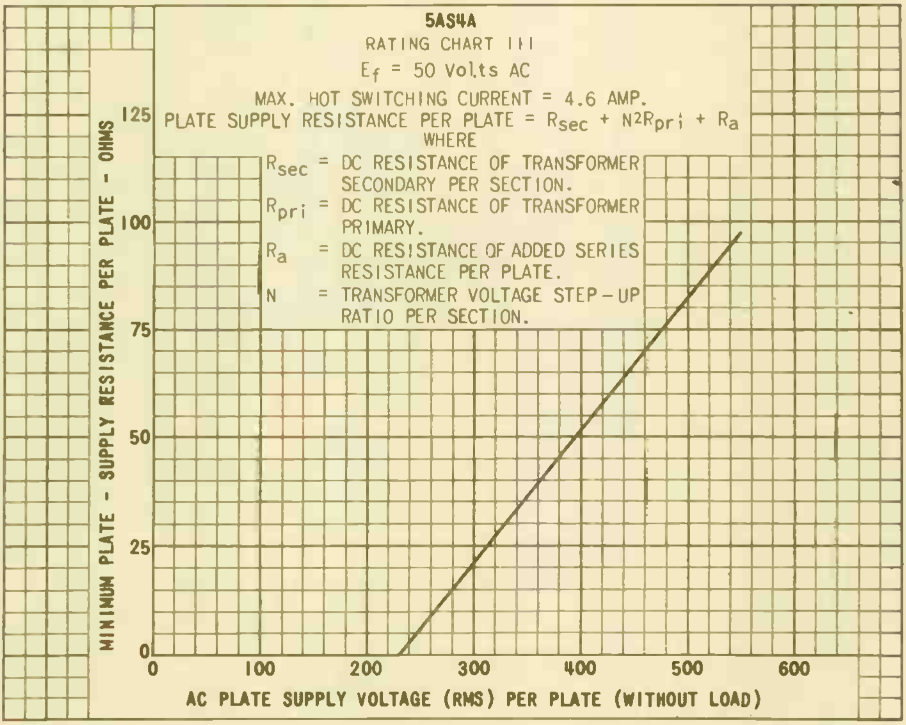
CHOKE-INPUT FILTER

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




RECTIFICATION EFFICIENCY = DC OUTPUT VOLTAGE AT FILTER INPUT / AC PLATE SUPPLY VOLTAGE PER PLATE (WITHOUT LOAD)
5AS4A
RATING CHART II
Capacitor Input Based on Steady State Peak Plate Current per Plate of 1.0 Amp.
AREA OF PERMISSIBLE OPERATION
DC OUTPUT - MILLIAMPERES PER PLATE
0
50
100
150
200
0.25
0.50
0.75
1.00
1.25
1.50
RECTIFICATION EFFICIENCY


5AS4A
RATING CHART III
Ef = 50 Volts AC
MAX. HOT SWITCHING CURRENT = 4.6 AMP.
PLATE SUPPLY RESISTANCE PER PLATE = Rsec + N2Rpri + Ra
WHERE
Rsec = DC RESISTANCE OF TRANSFORMER SECONDARY PER SECTION.
Rpri = DC RESISTANCE OF TRANSFORMER PRIMARY.
Ra = DC RESISTANCE OF ADDED SERIES RESISTANCE PER PLATE.
N = TRANSFORMER VOLTAGE STEP-UP RATIO PER SECTION.
MINIMUM PLATE - SUPPLY RESISTANCE PER PLATE - OHMS
0
25
50
75
100
125
100
200
300
400
500
600
AC PLATE SUPPLY VOLTAGE (RMS) PER PLATE (WITHOUT LOAD)

TUNG-SOL

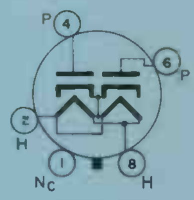
→ HIGH VACUUM FULL-WAVE RECTIFIER

GLASS BULB

UNIPOTENTIAL CATHODE

HEATER

5.0 VOLTS AC 5.5 AMP. DC



BOTTOM VIEW

BASING DIAGRAM
JEDEC 5L

THE 5AT4 IS A POWER RECTIFIER WITH VERY LOW INTERNAL VOLTAGE DROP. IT IS DESIGNED FOR D.C. POWER SUPPLIES THAT REQUIRE HIGH CURRENTS.

RATINGS

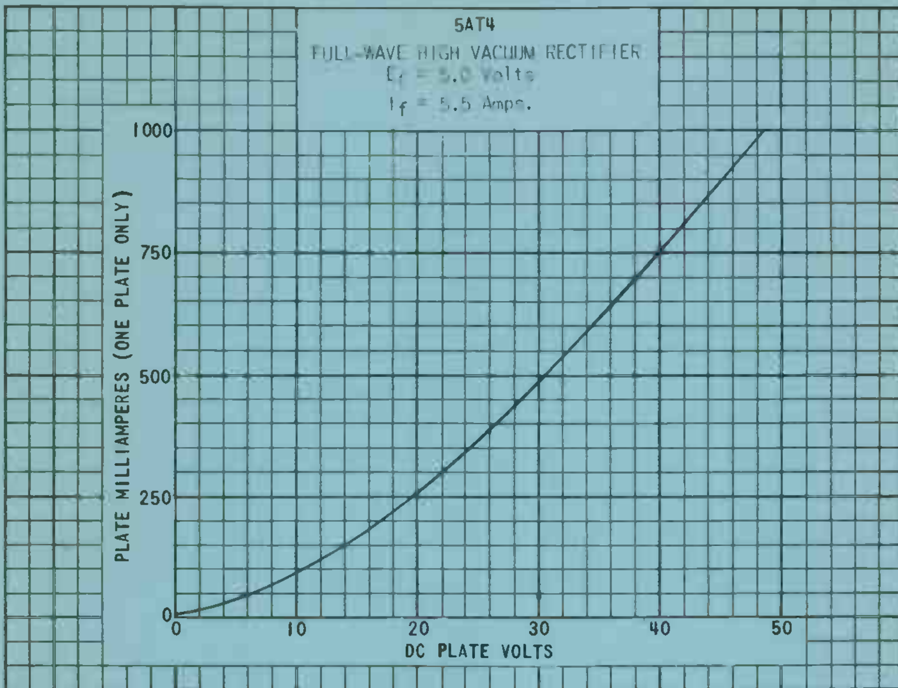
HEATER VOLTAGE	5.0	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	1550	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	2.25	AMPS.

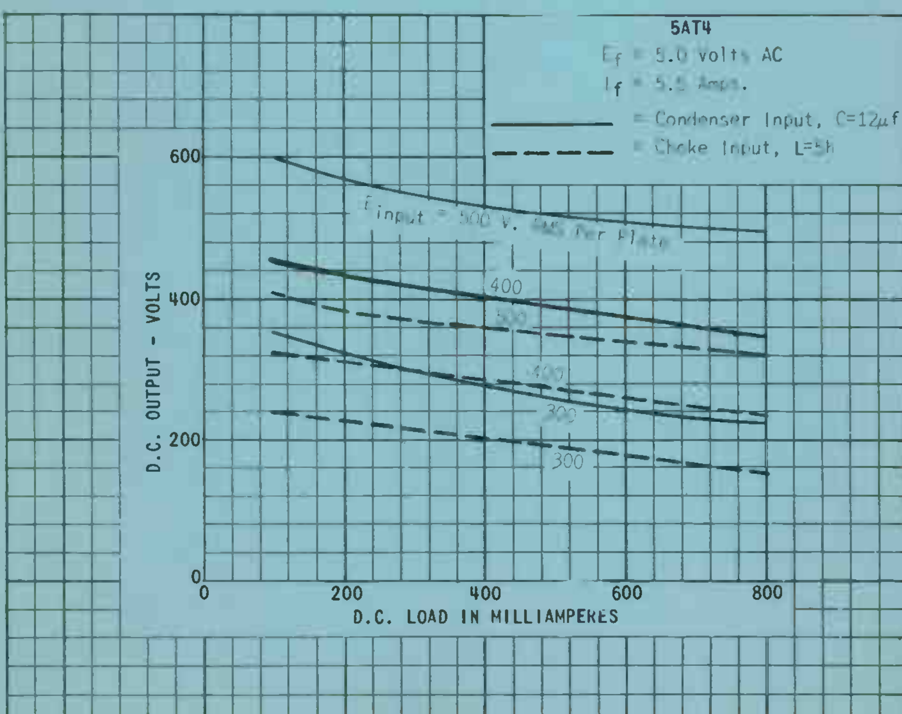
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	550	VOLTS
DC OUTPUT CURRENT, MAX.	800	MA.
MIN. TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE (MAX.)*	75	OHMS
AVERAGE TUBE VOLTAGE DROP AT 400 MA PER PLATE	50	VOLTS
MIN. HEATING TIME	30	SECONDS

*WHEN FILTER CONDENSERS LARGER THAN 40MFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

→ INDICATES A CHANGE.

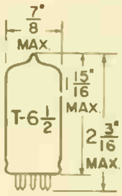

5AT4
FULL-WAVE HIGH VACUUM RECTIFIER
E_f = 5.0 Volts
I_f = 5.5 Amps.
PLATE MILLIAMPERES (ONE PLATE ONLY)
1000
750
500
250
0
0
10
20
30
40
50
DC PLATE VOLTS


5AT4
E_f = 5.0 volts AC
I_f = 5.5 Amps.
= Condenser Input, C=12μf
= Choke Input, L=5h
E_{input} = 500 V. RMS Per Plate
400
500
400
300
300
D.C. OUTPUT - VOLTS
600
400
200
0
0
200
400
600
800
D.C. LOAD IN MILLIAMPERES

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

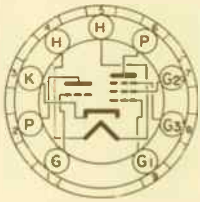


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN NOVAL
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 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

	WITHOUT SHIELD	WITH[A] SHIELD	
TRIODE UNIT:			
GRID TO PLATE	1.5	1.5	μμf
INPUT	2.0	2.4	μμf
OUTPUT	0.5	1.0	μμf
PENTODE UNIT:			
GRID #1 TO PLATE (MAX.)	0.025	0.016	μμf
INPUT	4.5	4.7	μμf
OUTPUT	0.9	1.6	μμf
PENTODE UNIT CONNECTED AS TRIODE:[B]			
GRID #1 TO PLATE	1.3	1.3	μμf
INPUT	3.0	3.3	μμf
OUTPUT	1.7	2.5	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	0.05	0.04	μμf
PENTODE PLATE TO TRIODE PLATE	0.05	0.007	μμf
HEATER TO CATHODE	6.5	6.5[C]	μμf

[A] SHIELD #315 CONNECTED TO CATHODE EXCEPT AS NOTED.

[B] GRID #3 CONNECTED TO CATHODE; GRID #2 CONNECTED TO PLATE.

[C] SHIELD #315 CONNECTED TO GROUND.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CONVERTER SERVICE

	TRIODE UNIT AS OSCILLATOR	PENTODE UNIT AS MIXER	PENTODE UNIT[B] AS TRIODE CONNECTED MIXER	
HEATER VOLTAGE	4.7	4.7	4.7	VOLTS
MAXIMUM PEAK HEATER—CATHODE VOLTAGE: ←				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK	100	100	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC	100	100	100	VOLTS
TOTAL DC AND PEAK	100	100	100	VOLTS
MAXIMUM PLATE VOLTAGE	250	250	250	VOLTS
MAXIMUM GRID #3 VOLTAGE	---	0	---	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	SEE RATING CURVE	---	
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	250	---	VOLTS
MAXIMUM GRID #1 VOLTAGE:				
NEGATIVE BIAS VALUE	40	40	40	VOLTS
POSITIVE BIAS VALUE	0	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.5	2.0	2.4	WATTS
MAXIMUM GRID #2 INPUT	---	0.4	---	WATT
MAXIMUM GRID #1 INPUT	0.5	---	---	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE:				
FIXED BIAS			0.1	MEGOHM
CATHODE BIAS			0.5	MEGOHM
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

	TRIODE UNIT	PENTODE UNIT	PENTODE UNIT[B] CONNECTED AS TRIODE	
HEATER VOLTAGE	4.7	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	100	250	150	VOLTS
GRID #3 VOLTAGE	---	CONNECTED TO CATHODE AT SOCKET	---	VOLTS
GRID #2 VOLTAGE	---	150	---	VOLTS
CATHODE BIAS RESISTOR	100	200	250	OHMS
AMPLIFICATION FACTOR	40	---	42	
PLATE RESISTANCE (APPROX.)	6 900	750 000	7 900	OHMS
TRANSCONDUCTANCE	5 800	4 600	4 000	μMHOS
GRID #1 VOLTAGE (APPROX.)				
FOR I_b = 10 μAMP.	-10	-10	-10	VOLTS
PLATE CURRENT	8.5	7.7	7.8	MA.
GRID #2 CURRENT	---	1.6	---	MA.

[B] GRID #3 CONNECTED TO CATHODE, GRID #2 CONNECTED TO PLATE.

→ INDICATES A CHANGE.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D

CONVERTER SERVICE

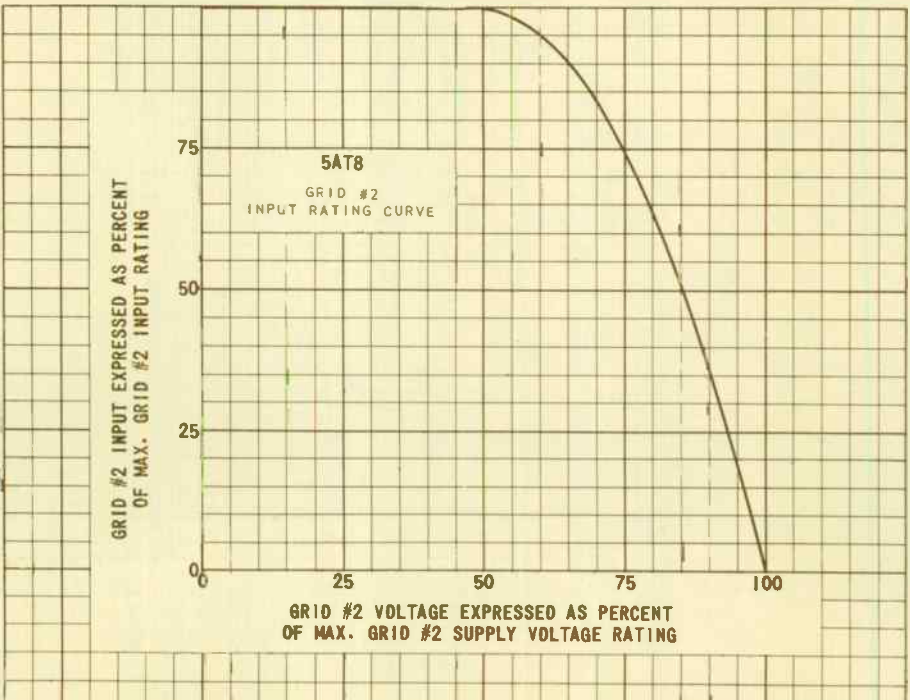
	TRIODE UNIT[D] AS 250 MC. OSCILLATOR	PENTODE[C] UNIT AS MIXER	PENTODE UNIT[E] AS TRIODE CONNECTED MIXER	
HEATER VOLTAGE	4.7	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	150	150	150	VOLTS
GRID #3	---	CONNECTED TO CATHODE AT SOCKET	---	
GRID #2 VOLTAGE	---	150	---	VOLTS
GRID #1 SUPPLY VOLTAGE	---	-3.5	-3.5	VOLTS
OSCILLATOR VOLTAGE (RMS) AT MIXER GRID #1	---	2.6	2.6	VOLTS
GRID #1 CIRCUIT RESISTANCE	---	120 000	120 000	OHMS
GRID RESISTOR	2 700	---	---	OHMS
CONVERSION TRANSCONDUCTANCE	---	2 100	2 800	µMHOS
PLATE CURRENT	13	6.2	7.8	MA.
GRID #2 CURRENT	---	1.8	---	MA.
GRID #1 CURRENT	3.6	---	---	MA.
GRID #1 CURRENT	---	2.0	2.0	µAMP.
POWER OUTPUT (APPROX.)	0.5	---	---	WATT

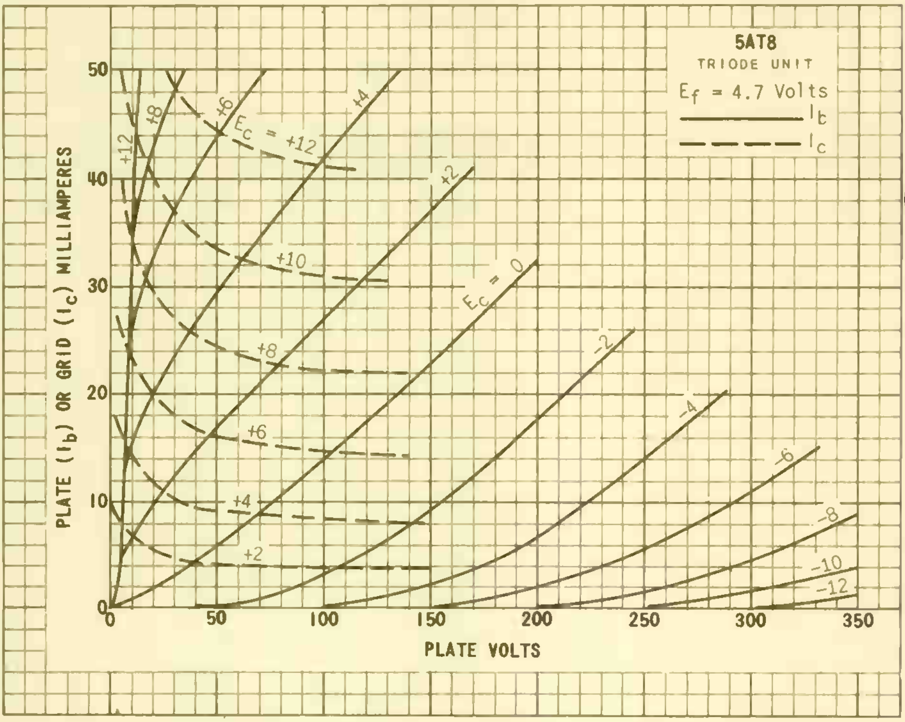
[C] WITH SEPARATE EXCITATION AND TRIODE UNIT GROUNDED.

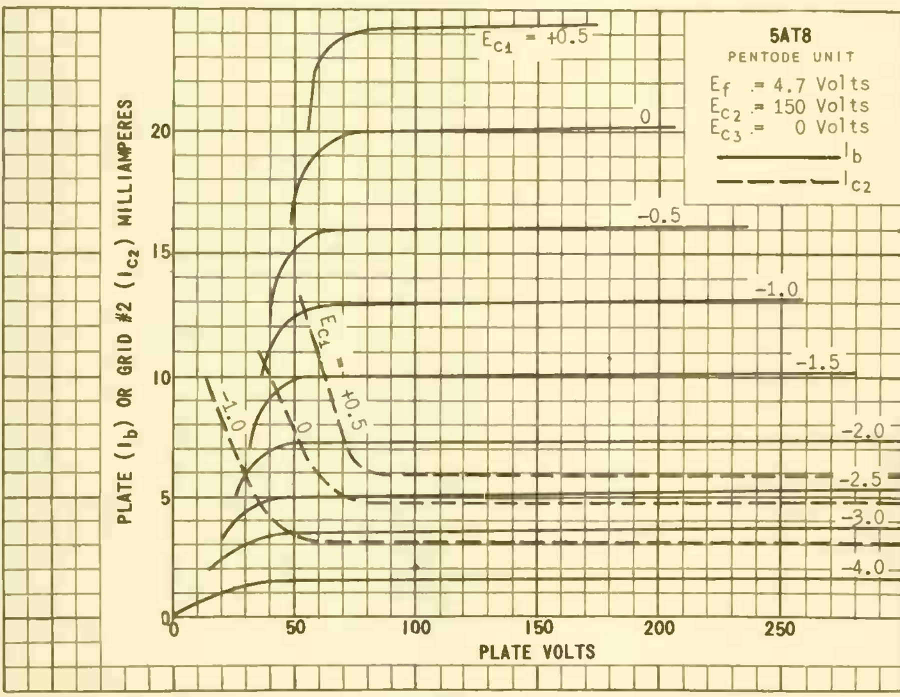
[D] IN TV OR FM RECEIVERS, IT IS GENERALLY DESIRABLE TO OPERATE THE OSCILLATOR WITH LESS POWER INPUT THAN SHOWN IN THE DATA IN ORDER TO AVOID OVER-EXCITATION AND EXCESSIVE OSCILLATOR RADIATION.

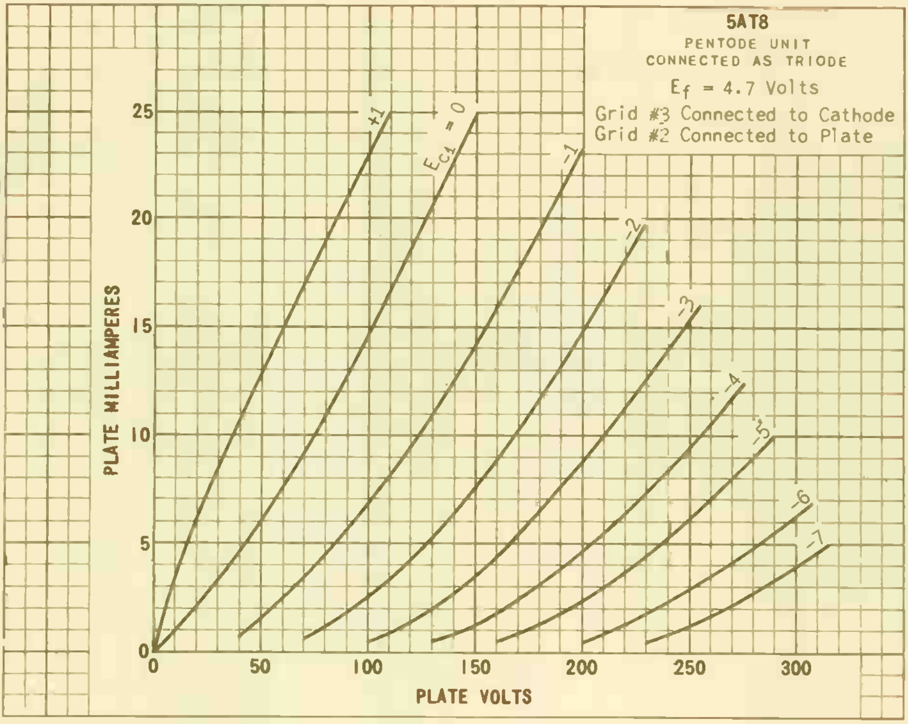
[E] GRID #3 CONNECTED TO CATHODE; GRID #2 CONNECTED TO PLATE.

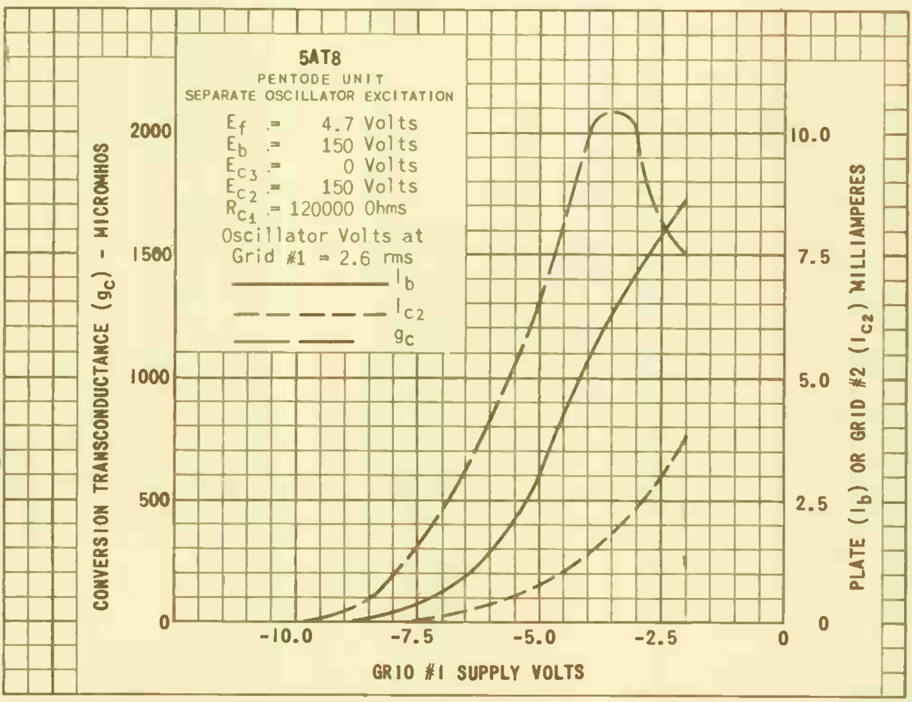
SIMILAR TYPE REFERENCE: The 5AT8 is identical to the 6AT8 except for heater ratings and heater warm-up time.

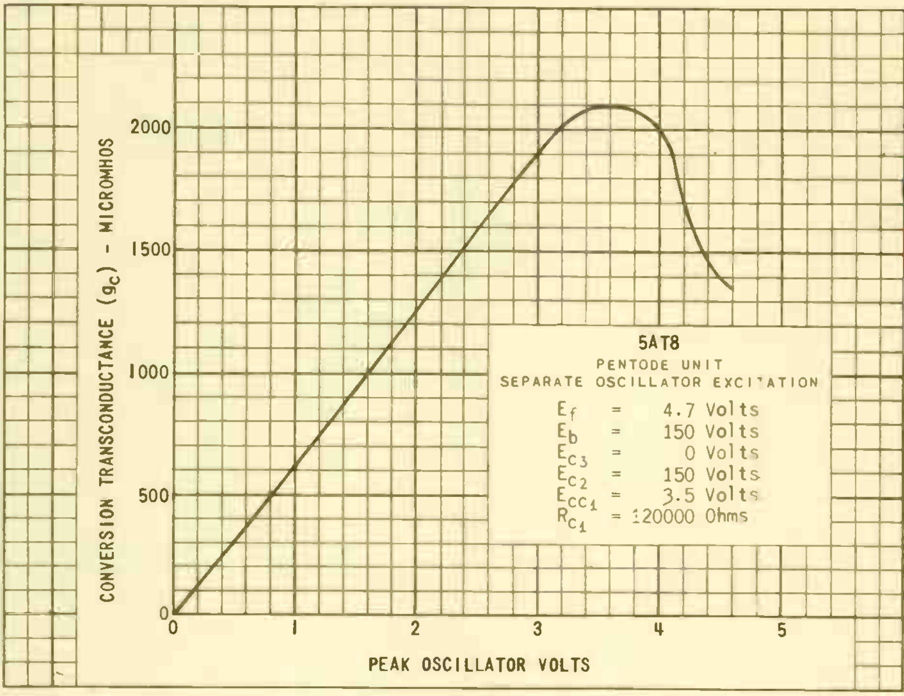


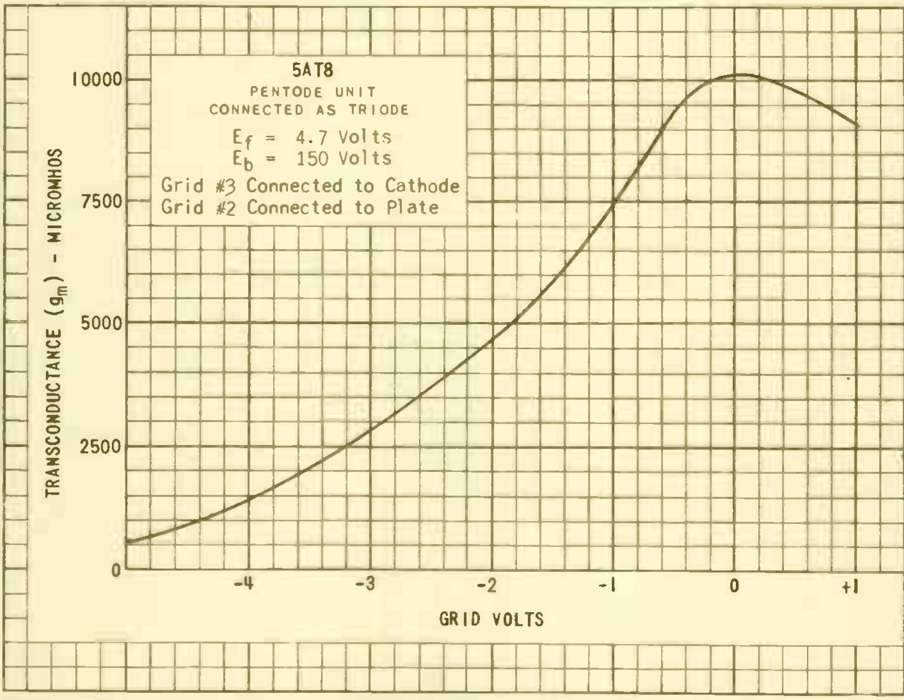

5AT8
TRIODE UNIT
E_f = 4.7 Volts
I_b
I_c
E_c = +12
+10
+8
+6
+4
+2
E_c = 0
-2
-4
-6
-8
-10
-12
+12
+8
+6
+4
+2
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS


5AT8
PENTODE UNIT
E_f = 4.7 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
E_{c1} = +0.5
0
-1.0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS


5AT8
PENTODE UNIT
CONNECTED AS TRIODE
E_f = 4.7 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate
E_{c1} = 0
+1
-1
-2
-3
-4
-5
-6
-7
PLATE MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
50
100
150
200
250
300

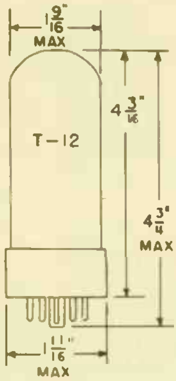

5AT8
PENTODE UNIT
SEPARATE OSCILLATOR EXCITATION
E_f = 4.7 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2} = 150 Volts
R_{c1} = 120000 Ohms
Oscillator Volts at
Grid #1 = 2.6 rms
I_b
I_{c2}
g_c
CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
GRID #1 SUPPLY VOLTS
0
500
1000
1500
2000
2.5
5.0
7.5
10.0
-10.0
-7.5
-5.0
-2.5


5AT8
PENTODE UNIT
SEPARATE OSCILLATOR EXCITATION
E_f = 4.7 Volts
E_b = 150 Volts
E_{c_3} = 0 Volts
E_{c_2} = 150 Volts
E_{cc_1} = 3.5 Volts
R_{c_1} = 120000 Ohms
CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
2000
1500
1000
500
0
0
1
2
3
4
5
PEAK OSCILLATOR VOLTS


5AT8
PENTODE UNIT
CONNECTED AS TRIODE
E_f = 4.7 Volts
E_b = 150 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate
TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
7500
5000
2500
0
-4
-3
-2
-1
0
+1
GRID VOLTS

TUNG-SOL

TWIN DIODE



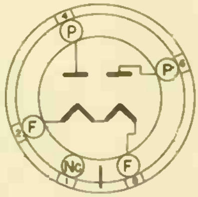
GLASS BULB

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

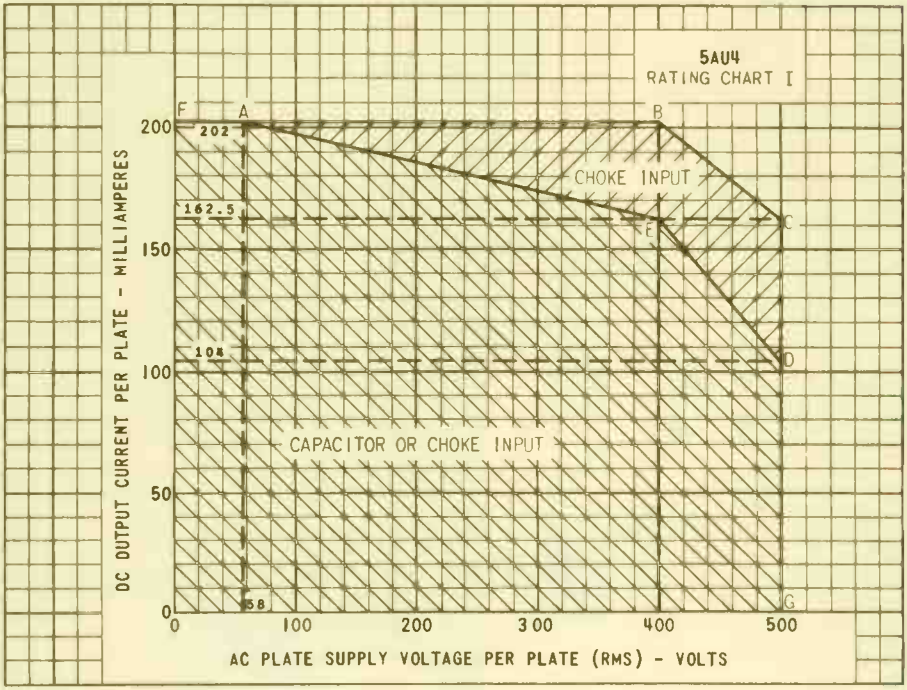
FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

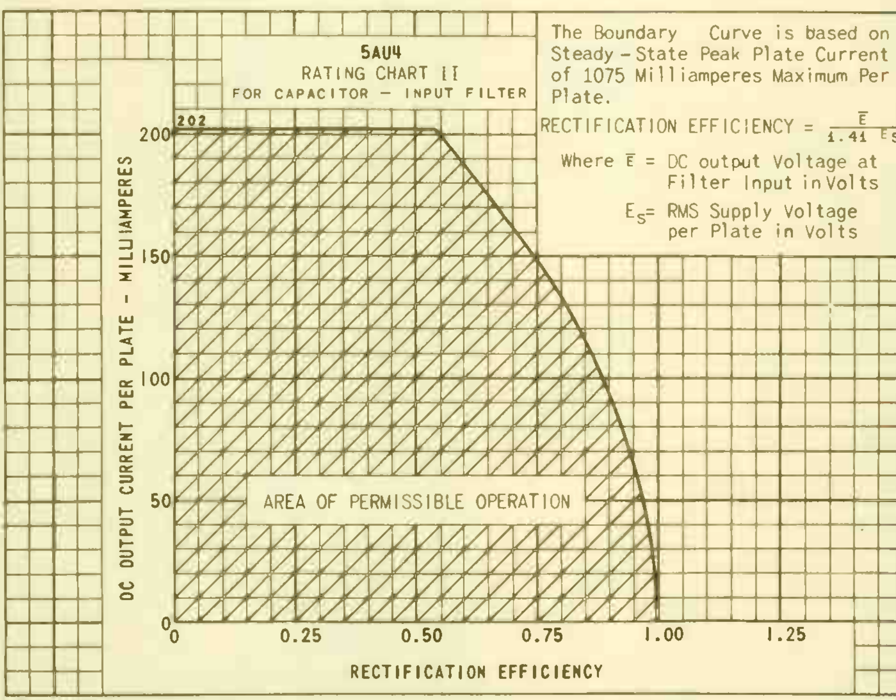
FILAMENT VOLTAGE	5.0		VOLTS
FILAMENT CURRENT	3.75 ←		AMP.
AC PLATE-SUPPLY VOLTAGE (PER PLATE) RMS	300	400	VOLTS
FILTER INPUT CAPACITOR	40	40	μf
TOTAL PLATE-SUPPLY RESISTANCE (PER PLATE)	30	50	OHMS
DC OUTPUT CURRENT	350	325	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	275	395	VOLTS

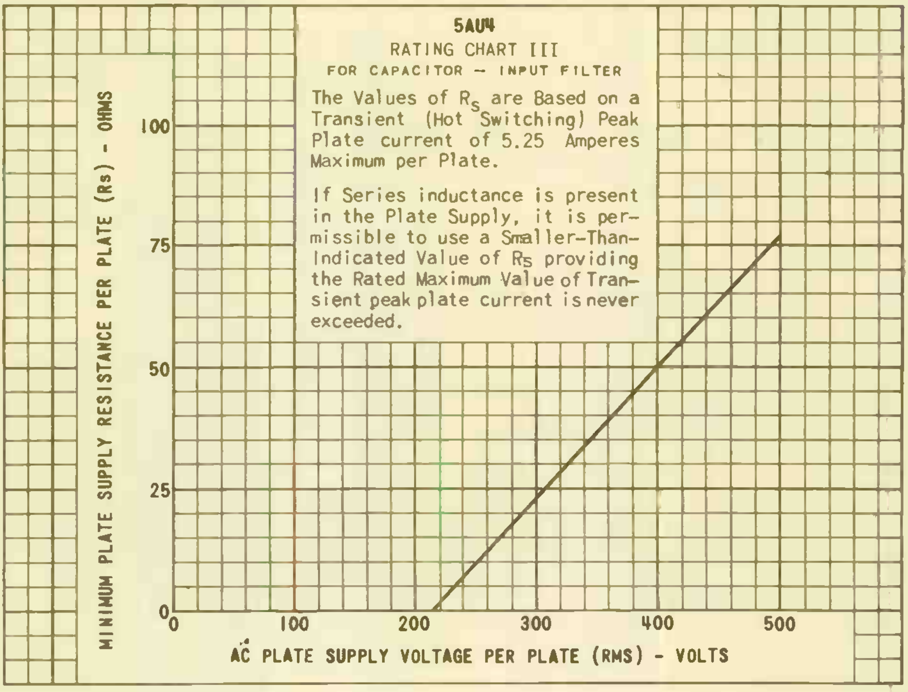
FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER

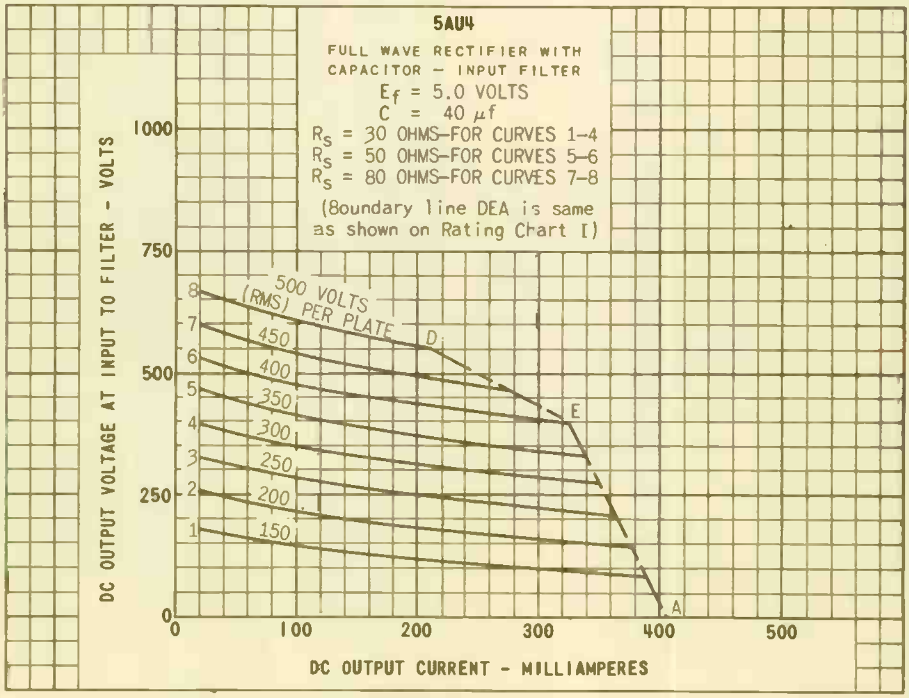
FILAMENT VOLTAGE	5.0	VOLTS
FILAMENT CURRENT	4.5	AMP.
AC PLATE-SUPPLY VOLTAGE (PER PLATE) RMS	500	VOLTS
FILTER INPUT CHOKE	10	HENRYS
DC OUTPUT CURRENT	325	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	395	VOLTS
TUBE VOLTAGE DROP		
I_b = 350 MA. DC (PER PLATE)	50	VOLTS

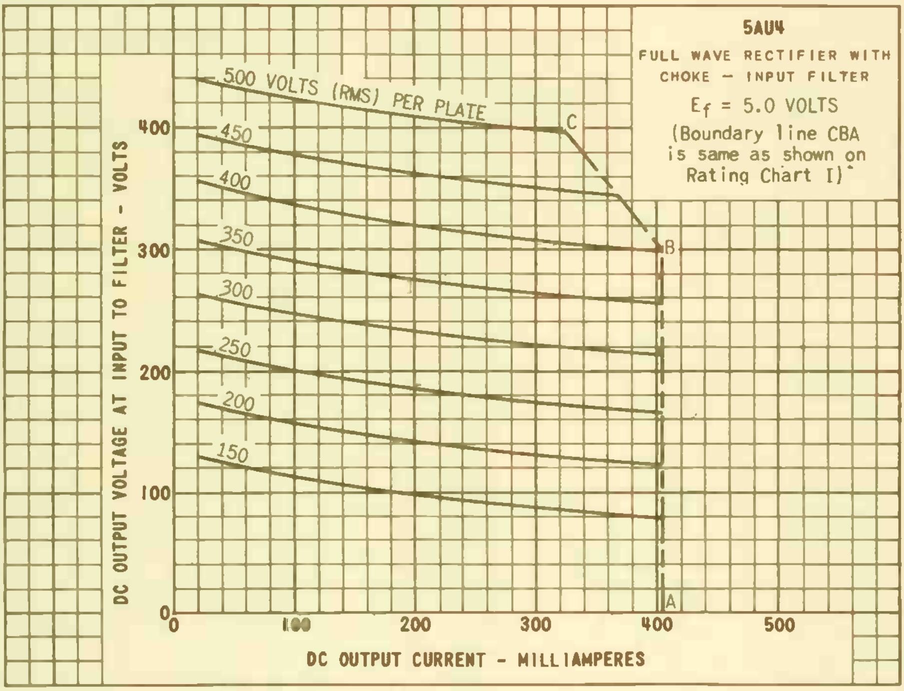
→ INDICATES A CHANGE.

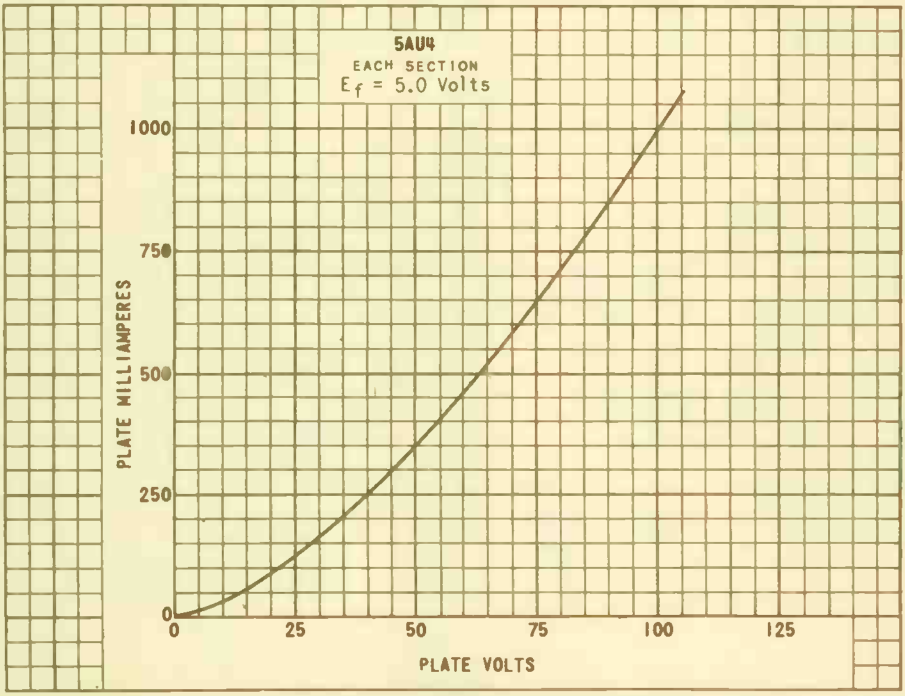

5AU4
RATING CHART I
F
A
B
C
D
E
G
202
162.5
104
58
CHOKE INPUT
CAPACITOR OR CHOKE INPUT
DC OUTPUT CURRENT PER PLATE - MILLIAMPERES
0
50
100
150
200
AC PLATE SUPPLY VOLTAGE PER PLATE (RMS) - VOLTS
0
100
200
300
400
500


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 = $\frac{\bar{E}}{1.41\ E_S}$
Where $\bar{E}$ = DC output Voltage at Filter Input in Volts
E_S = RMS Supply Voltage per Plate in Volts
202
AREA OF PERMISSIBLE OPERATION
DC OUTPUT CURRENT PER PLATE - MILLIAMPERES
0
50
100
150
200
RECTIFICATION EFFICIENCY
0
0.25
0.50
0.75
1.00
1.25


5AU4
RATING CHART III
FOR CAPACITOR — INPUT FILTER
The Values of Rs 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 Rs 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
Ef = 5.0 VOLTS
C = 40 μf
Rs = 30 OHMS—FOR CURVES 1-4
Rs = 50 OHMS—FOR CURVES 5-6
Rs = 80 OHMS—FOR CURVES 7-8
(Boundary line DEA is same as shown on Rating Chart I)
500 VOLTS (RMS) PER PLATE
450
400
350
300
250
200
150
D
E
A
DC OUTPUT VOLTAGE AT INPUT TO FILTER - VOLTS
1000
750
500
250
0
0
100
200
300
400
500
DC OUTPUT CURRENT - MILLIAMPERES

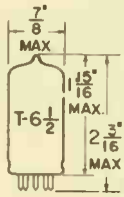

5AU4
FULL WAVE RECTIFIER WITH CHOKE - INPUT FILTER
Ef = 5.0 VOLTS
(Boundary line CBA is same as shown on Rating Chart I)
500 VOLTS (RMS) PER PLATE
450
400
350
300
250
200
150
C
B
A
DC OUTPUT VOLTAGE AT INPUT TO FILTER - VOLTS
0
100
200
300
400
0
100
200
300
400
500
DC OUTPUT CURRENT - MILLIAMPERES


5AU4
EACH SECTION
Ef = 5.0 Volts
PLATE MILLIAMPERES
0
250
500
750
1000
0
25
50
75
100
125
PLATE VOLTS

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

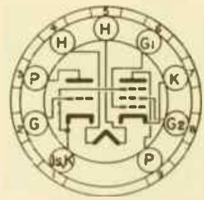


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
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

TUNG-SOL

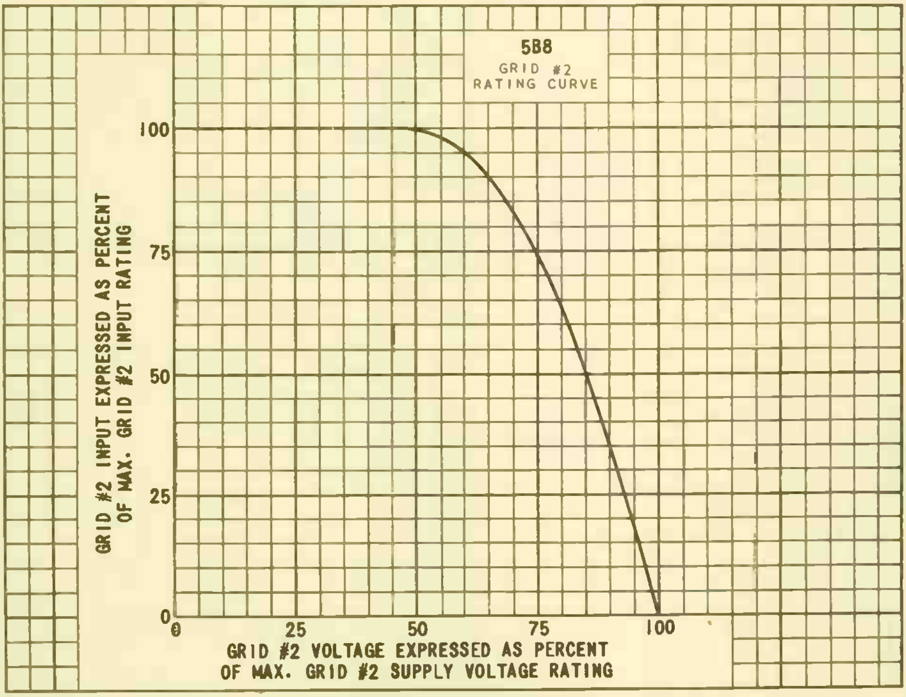
CONTINUED FROM PRECEDING PAGE

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

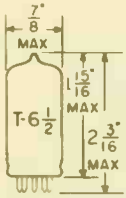
[B] WHEN READING CHARACTERISTICS OF THE PENTODE SECTION, ALL TRIODE ELEMENTS SHALL BE AT GROUND POTENTIAL. THUS, BECAUSE OF INTERNAL CONNECTIONS TO PIN #1, THE PENTODE SUPPRESSOR WILL ALSO BE AT GROUND.



TUNG-SOL

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

TUNG-SOL

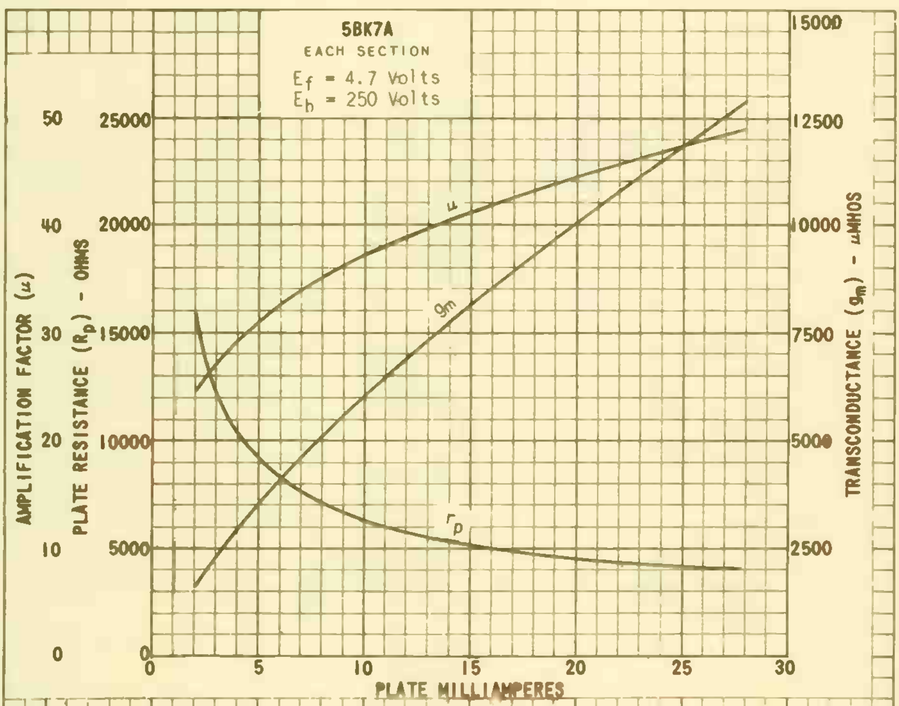
CONTINUED FROM PRECEDING PAGE

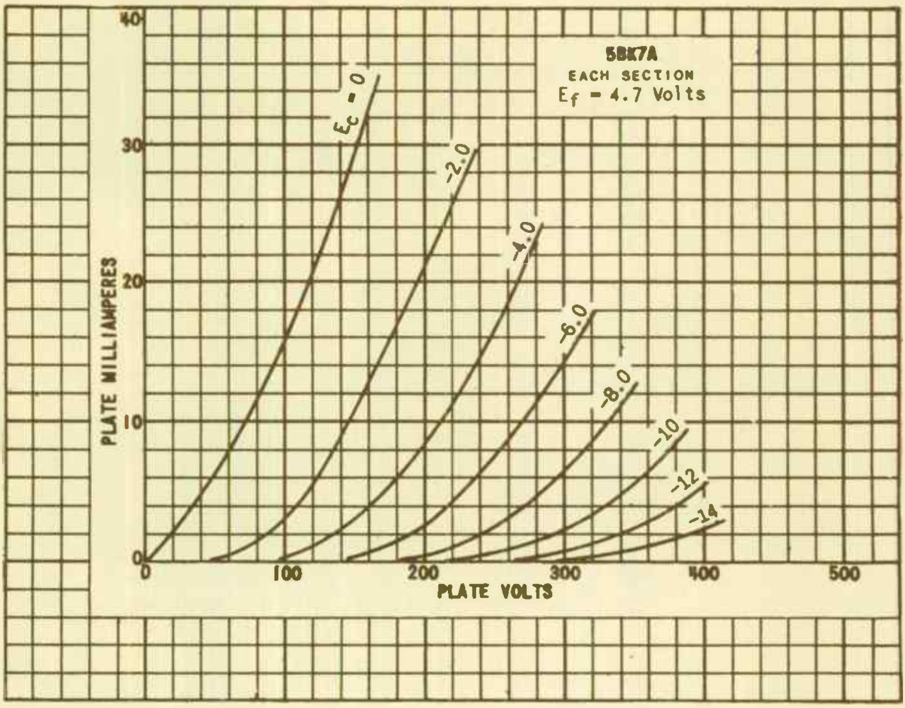
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

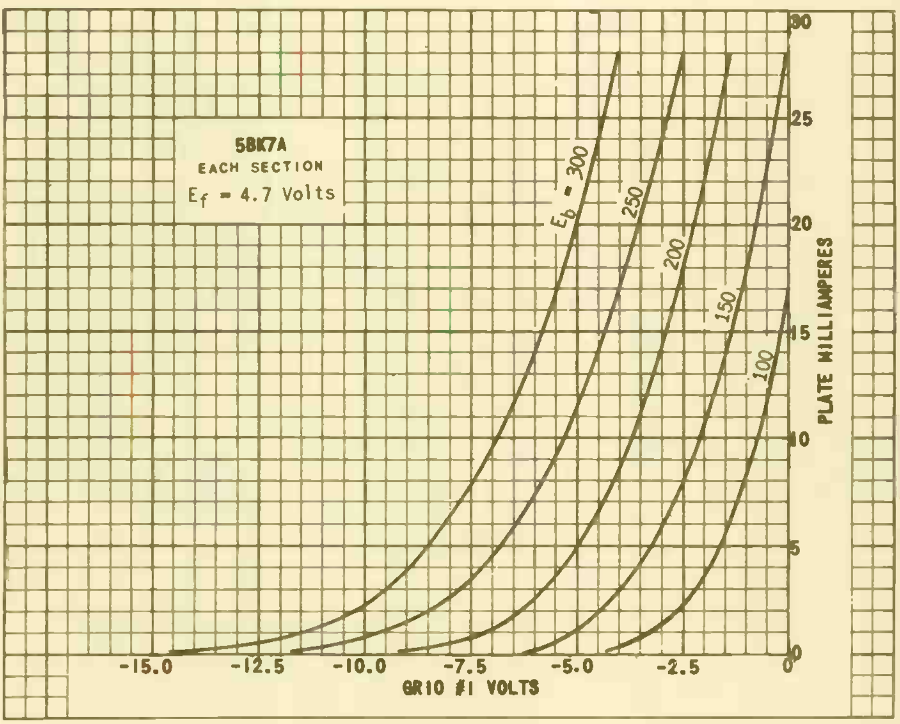
CLASS A_1 AMPLIFIER - EACH SECTION

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.



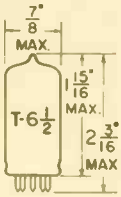

5BK7A
EACH SECTION
Ef = 4.7 Volts
Ec = 0
-2.0
-4.0
-6.0
-8.0
-10
-12
-14
PLATE MILLIAMPERES
40
30
20
10
0
0
100
200
300
400
500
PLATE VOLTS


5BK7A
EACH SECTION
Ef = 4.7 Volts
Eb = 300
250
200
150
100
PLATE MILLIAMPERES
30
25
20
15
10
5
0
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS

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.

CONTINUED ON FOLLOWING PAGE

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.

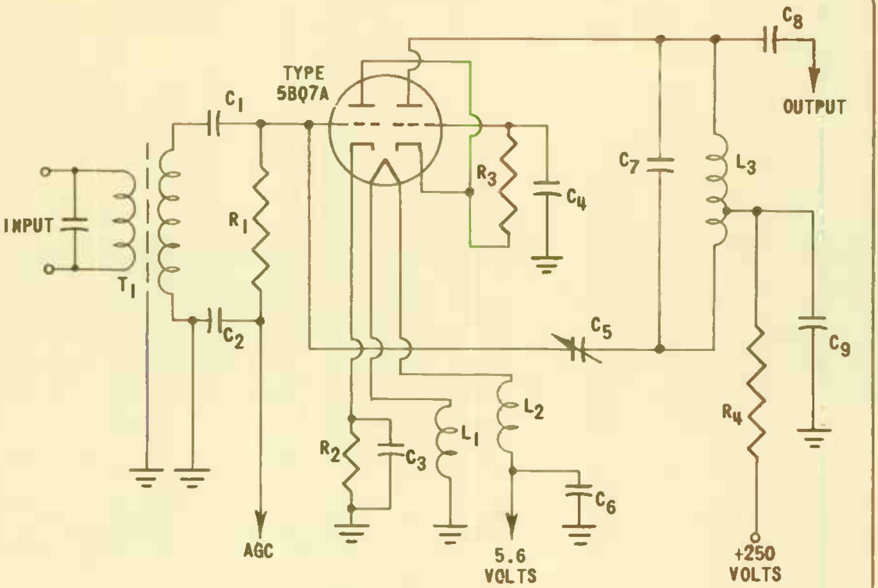
RF GROUNDED GRID CIRCUIT WITH DIRECT-COUPLED DRIVE

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.*

TUNG-SOL

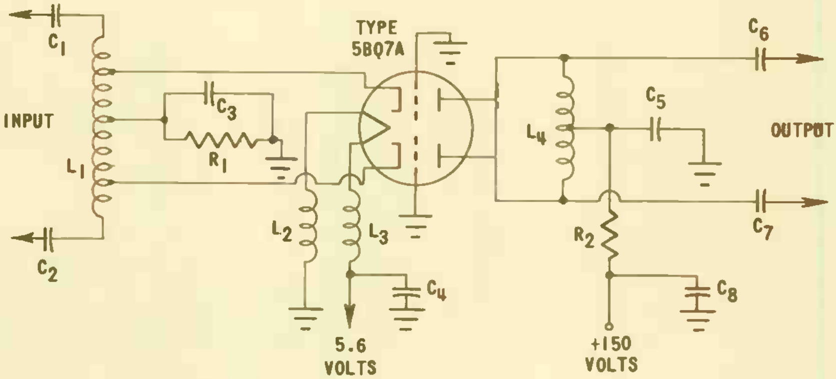


C1: 33 uuf, 400 VOLTS
C2: 1000 uuf, 400 VOLTS
C3: 1000 uuf, 400 VOLTS
C4: 1000 uuf, 400 VOLTS
C5: 0.5 to 1.5 uuf, 400 VOLTS
C6: 1000 uuf, 400 VOLTS
C7: 2 uuf, 400 VOLTS
C8: 33 uuf, 400 VOLTS
C9: 1000 uuf, 400 VOLTS

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

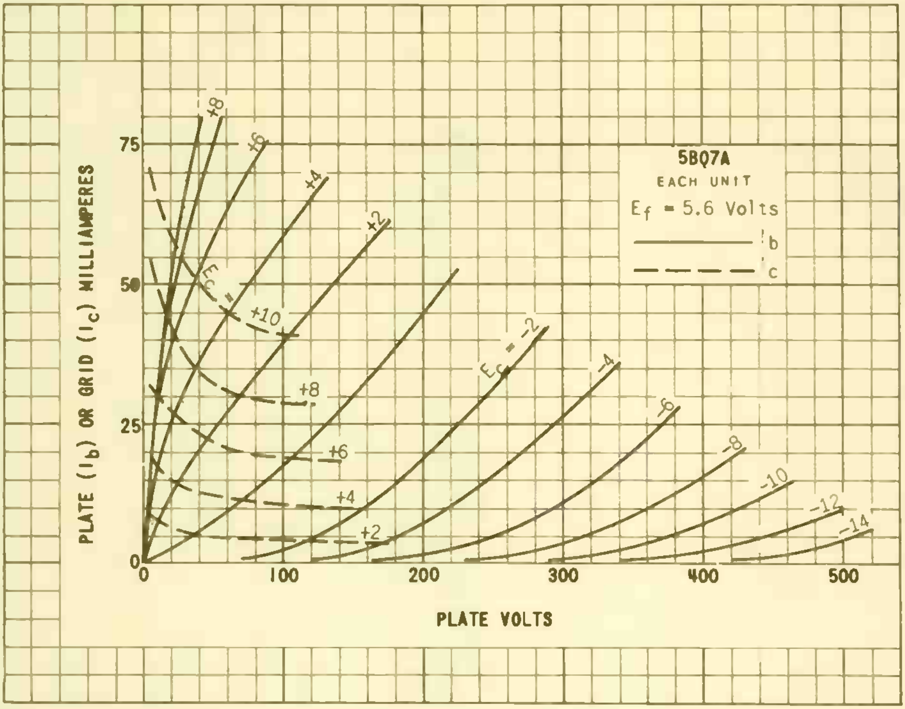


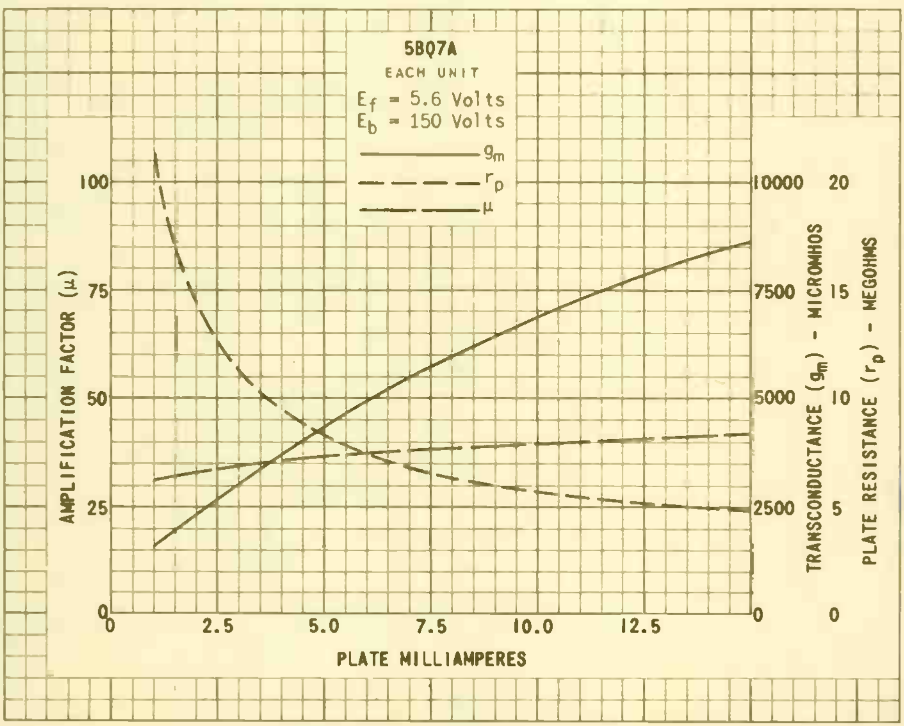
C1 C2 C3 C4 C5: 1000 uuf, 400 VOLTS
C6 C7: 100 uuf, 400 VOLTS
C8: 1000 uuf, 400 VOLTS

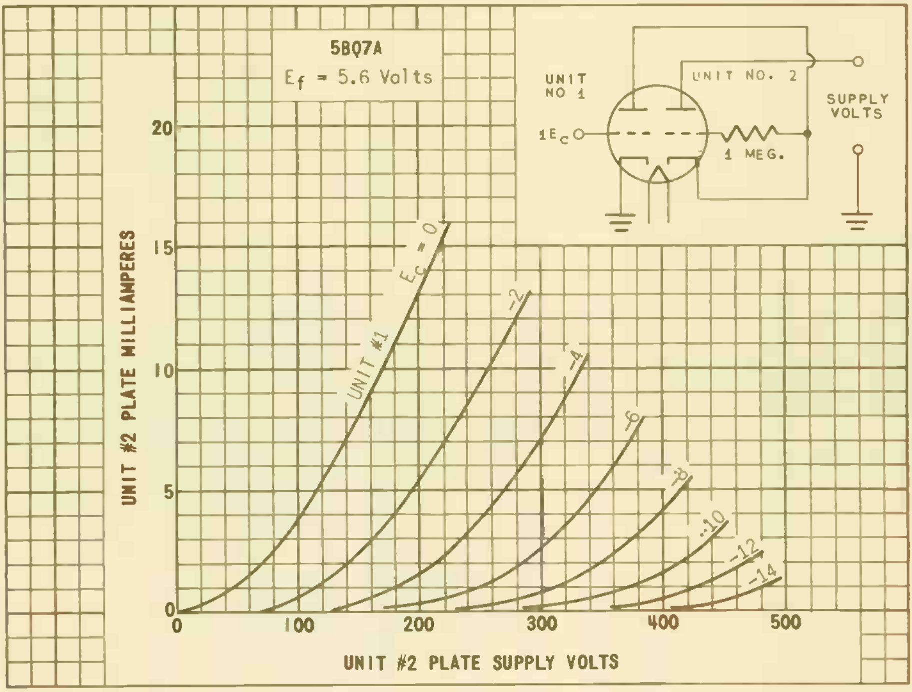
L1 L4: TUNED CIRCUIT ELEMENTS OF TUNER. VALUES DEPEND ON DISTRIBUTED CIRCUIT CAPACITANCES.

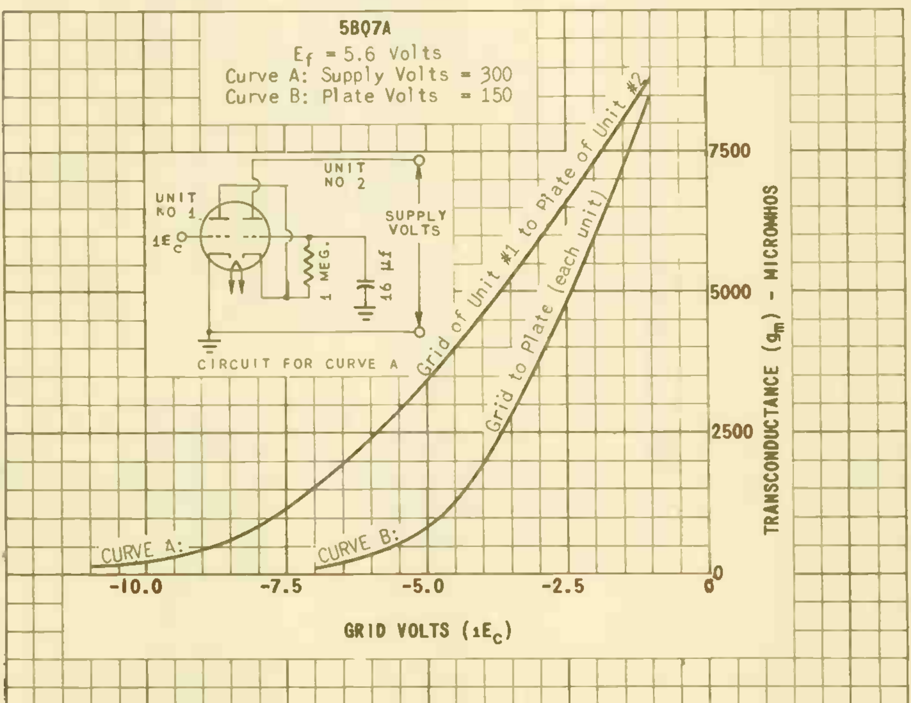
L2 L3: BIFILAR CHOKES, EACH 10 TURNS OF NO. 18 ENAMEL WIRE, 1/4" COIL FORM.
R1 R2: 100 OHMS, 0.5 WATT

PUSH-PULL RF GROUNDED-GRID CIRCUIT


5BQ7A
EACH UNIT
E_f = 5.6 Volts
i_b
i_c
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
E_c = +10
E_c = -2


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

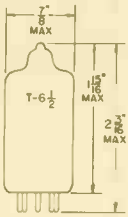

5BQ7A
E_f = 5.6 Volts
UNIT NO 1
UNIT NO. 2
SUPPLY VOLTS
$1E_c$
1 MEG.
UNIT #1
E_c = 0
-2
-4
-6
-8
-10
-12
-14
UNIT #2 PLATE MILLIAMPERES
UNIT #2 PLATE SUPPLY VOLTS
0
5
10
15
20
100
200
300
400
500


5BQ7A
E_f = 5.6 Volts
Curve A: Supply Volts = 300
Curve B: Plate Volts = 150
UNIT NO 1
UNIT NO 2
SUPPLY VOLTS
$1E_c$
1 MEG.
16 µf
CIRCUIT FOR CURVE A
CURVE A: Grid of Unit #1 to Plate of Unit #2
CURVE B: Grid to Plate (each unit)
7500
5000
2500
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
-10.0
-7.5
-5.0
-2.5
0
GRID VOLTS ($1E_c$)

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

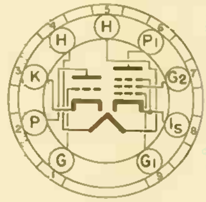


GLASS BULB

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	0.015 MAX.	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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

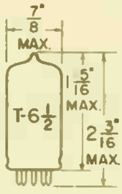
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	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

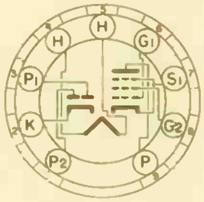


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE

9MK

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.

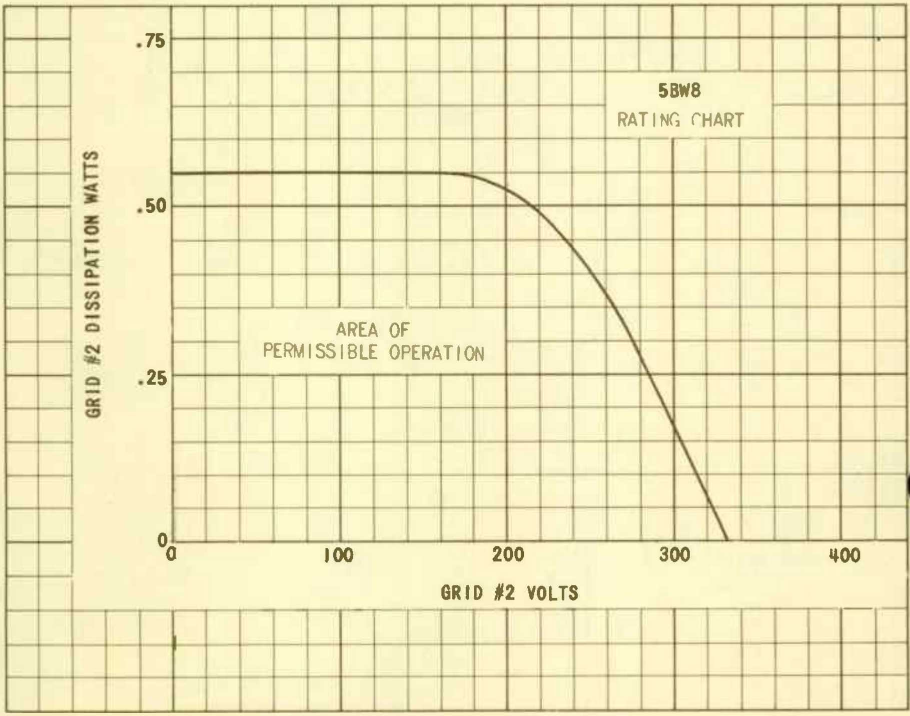
TUNG-SOL

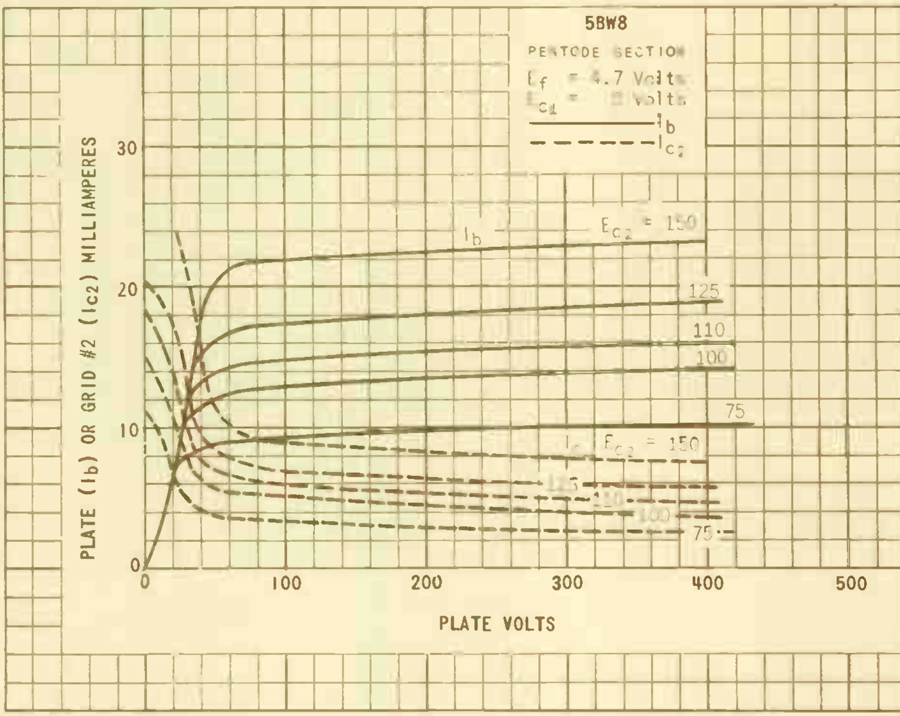
CONTINUED FROM PRECEDING PAGE

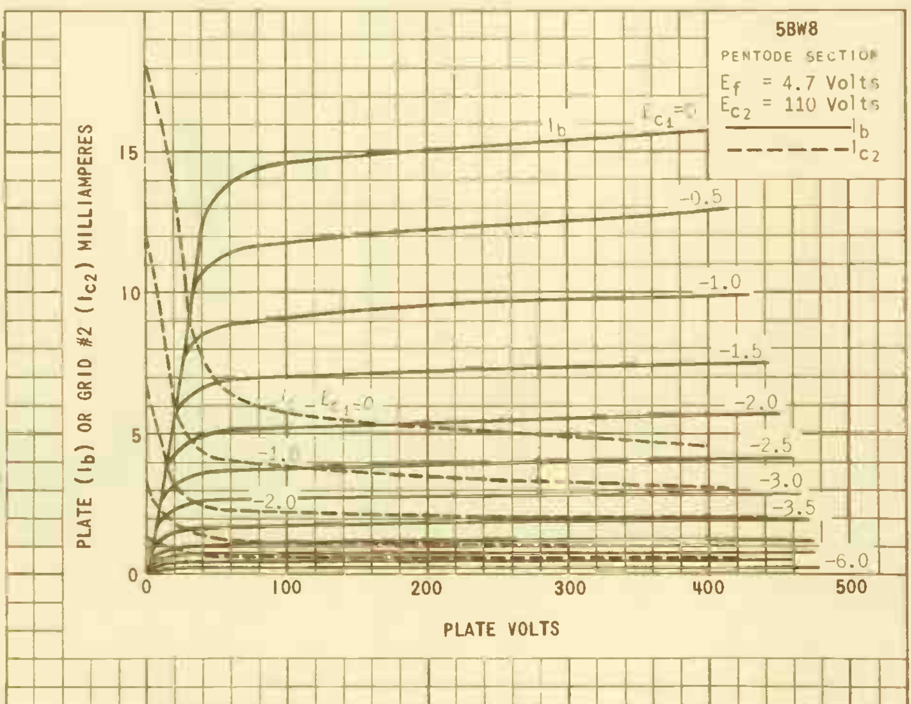
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

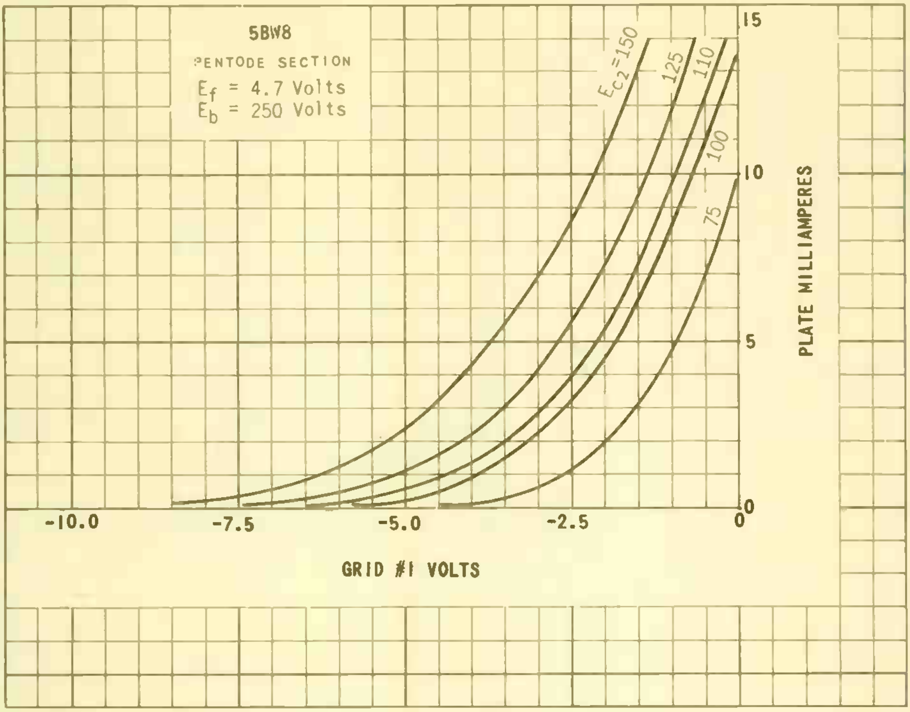
HEATER VOLTAGE	4.7	VOLTS
HEATER CURRENT	0.6±6%	AMP.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	110	VOLTS
CATHODE-BIAS RESISTOR	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHMS
TRANSCONDUCTANCE	5200	μMHOS
PLATE CURRENT	10	MA.
SCREEN CURRENT	3.5	MA.
GRID #1 VOLTAGE (APPROX.) I_b=10 μAMPS	-10	VOLTS
AVERAGE DIODE CURRENT (EACH DIODE) WITH 5 VOLTS DC APPLIED	20	MA.

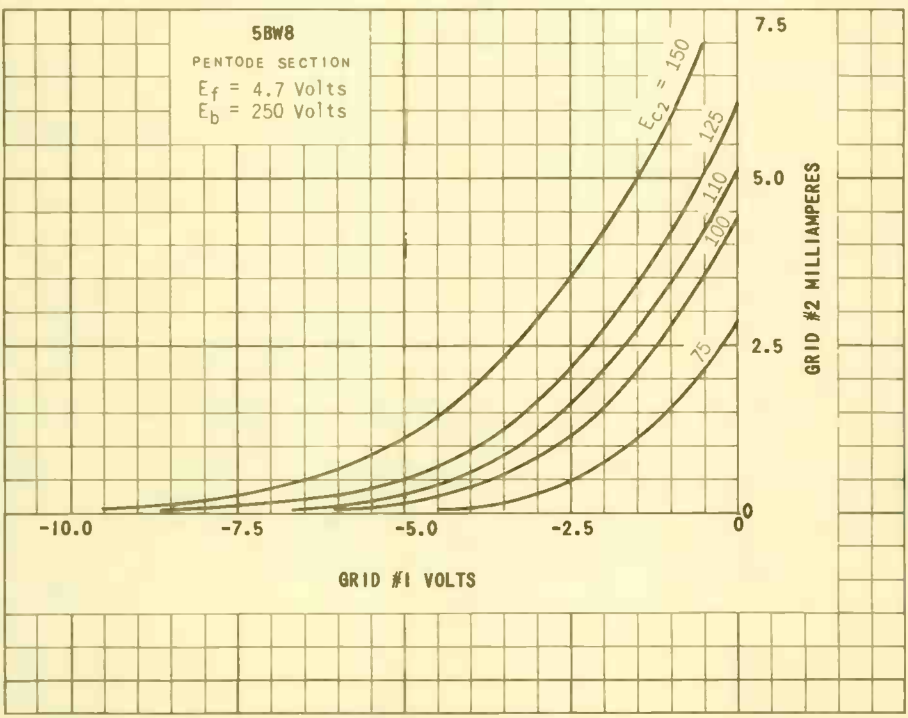
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH 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.

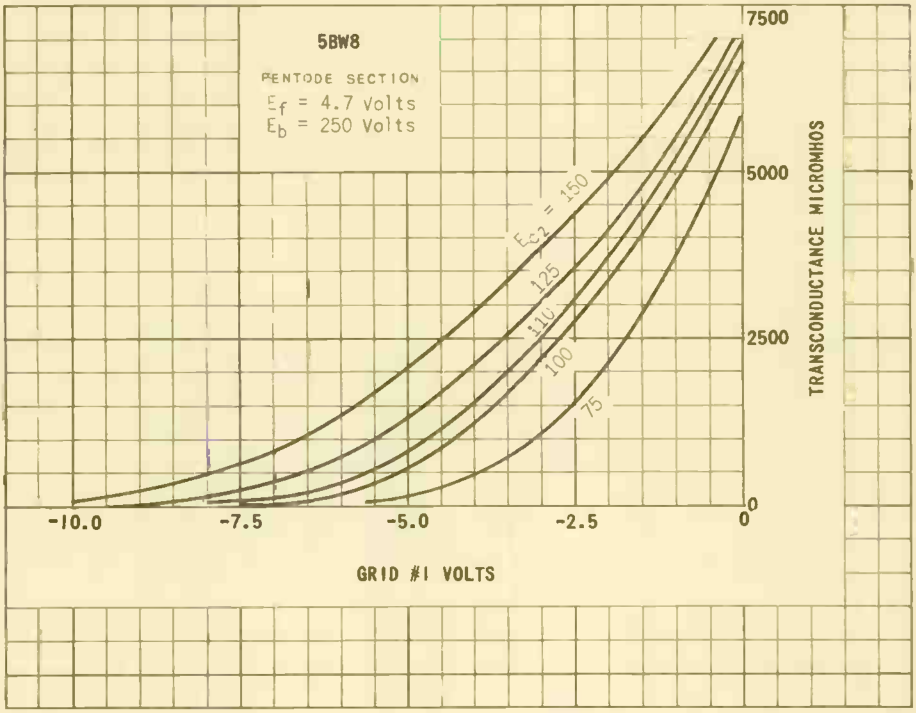


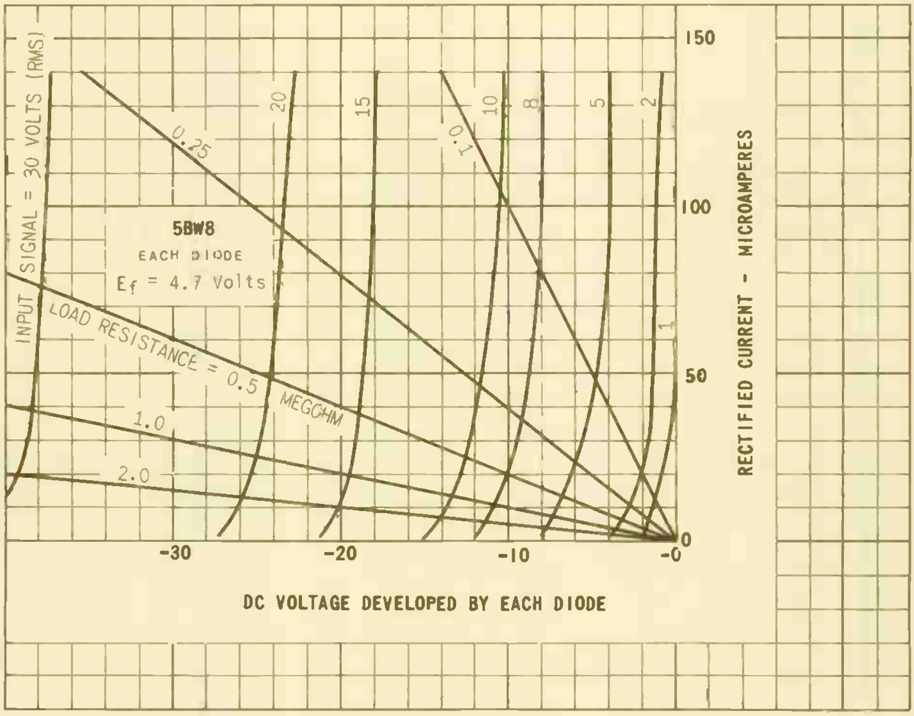

5BW8
PENTODE SECTION
Ef = 4.7 Volts
Ib
Ic2
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
10
20
30
100
200
300
400
500
Ib
Ec2 = 150
125
110
100
75
Ic2
Ec2 = 150
125
110
100
75


5BW8
PENTODE SECTION
Ef = 4.7 Volts
Ec2 = 110 Volts
Ib
Ic2
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
5
10
15
100
200
300
400
500
Ib
Ec1=0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-6.0
Ec1=0
-1.0
-2.0


5BW8
PENTODE SECTION
E_f = 4.7 Volts
E_b = 250 Volts
E_{c_2}=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_{c_2} = 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

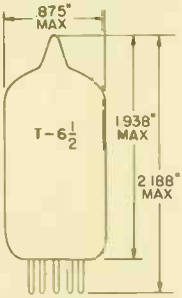

5BW8
PENTODE SECTION
Ef = 4.7 Volts
Eb = 250 Volts
Ec2 = 150
125
110
100
75
7500
5000
2500
0
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS
TRANSCONDUCTANCE MICROMHOS


5BW8
EACH DIODE
Ef = 4.7 Volts
INPUT SIGNAL = 30 VOLTS (RMS)
20
15
10
8
5
2
1
0.25
0.1
LOAD RESISTANCE = 0.5 MEGOHM
1.0
2.0
150
100
50
0
-30
-20
-10
-0
DC VOLTAGE DEVELOPED BY EACH DIODE
RECTIFIED CURRENT - MICROAMPERES

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

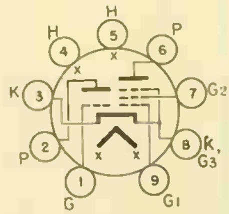


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

FOR USE AS A COMBINED OSCILLATOR AND MIXER IN 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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

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:			
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

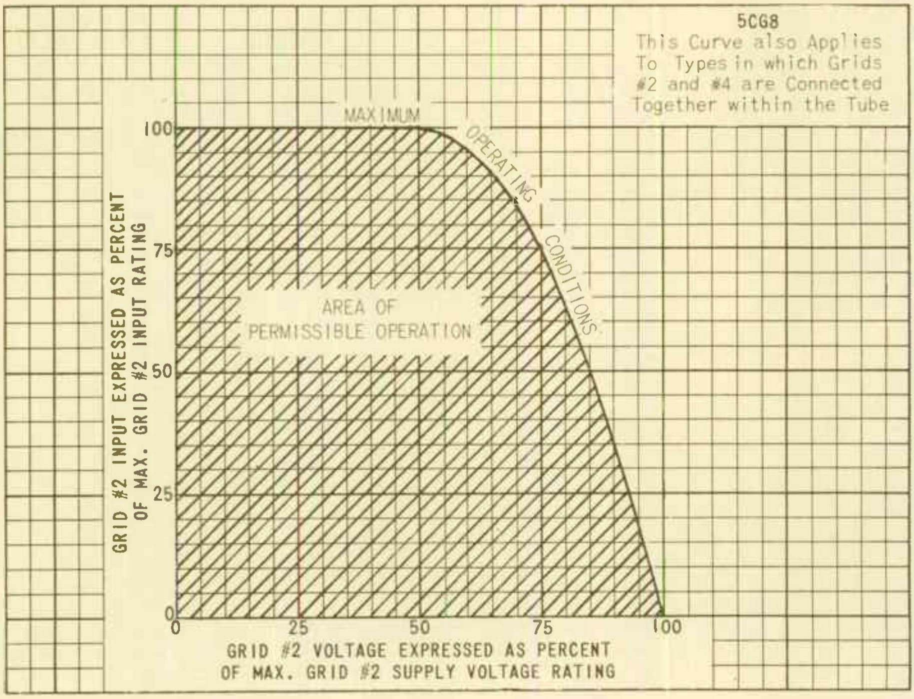
PENTODE PLATE VOLTAGE	275	VOLTS
TRIODE PLATE VOLTAGE	275	VOLTS
GRID 2 SUPPLY VOLTAGE	275	VOLTS
GRID 2 VOLTAGE	SEE J5-C4-2	
PENTODE PLATE DISSIPATION	2.3	WATTS
GRID 2 DISSIPATION	0.45	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	1.7	WATTS

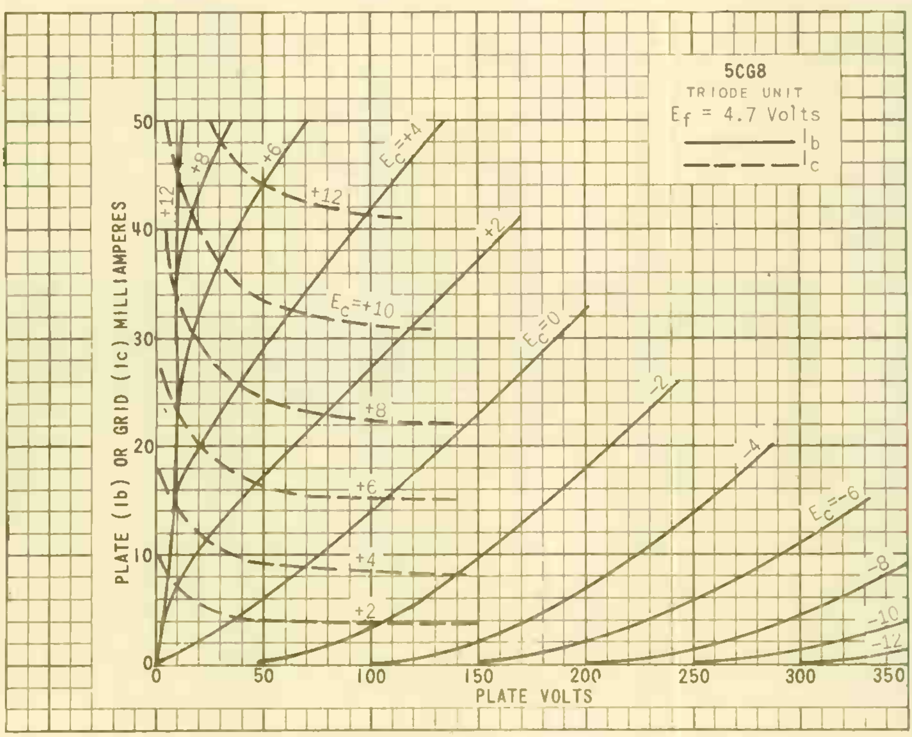
TYPICAL OPERATING CHARACTERISTICS

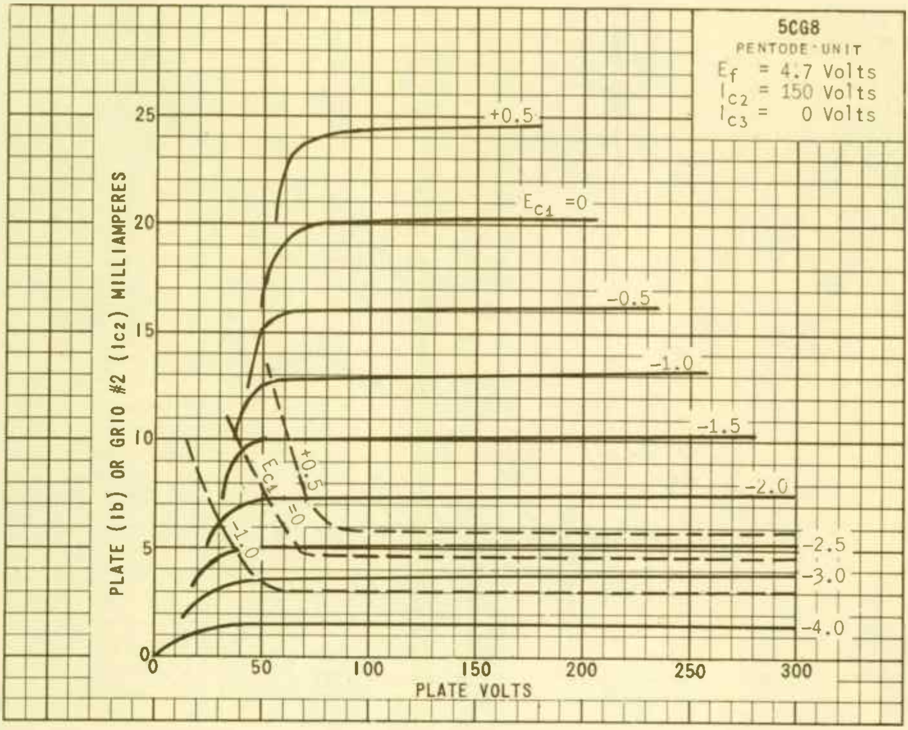
CLASS A1 AMPLIFIER

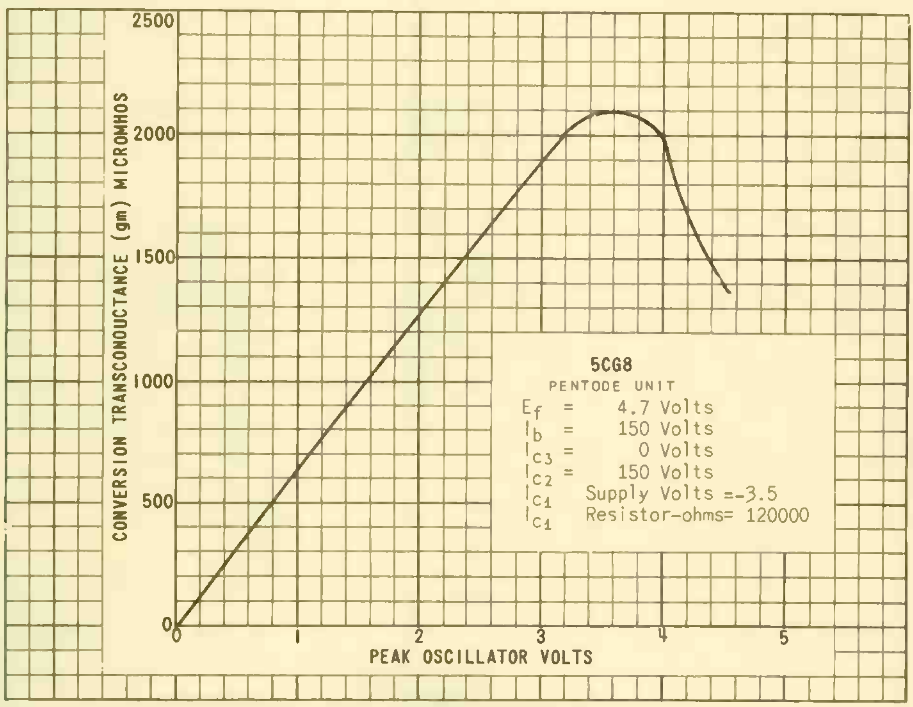
	TRIODE	PENTODE	
PLATE VOLTAGE	125	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO PIN 3 AT SOCKET		
GRID 2 VOLTAGE	----	125	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	6,500	5,500	μMHOS
PLATE CURRENT	12.0	9.0	MA.
GRID 2 CURRENT	----	2.2	MA.
PLATE RESISTANCE (APPROX.)	6,000	300,000	OHMS
AMPLIFICATION 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

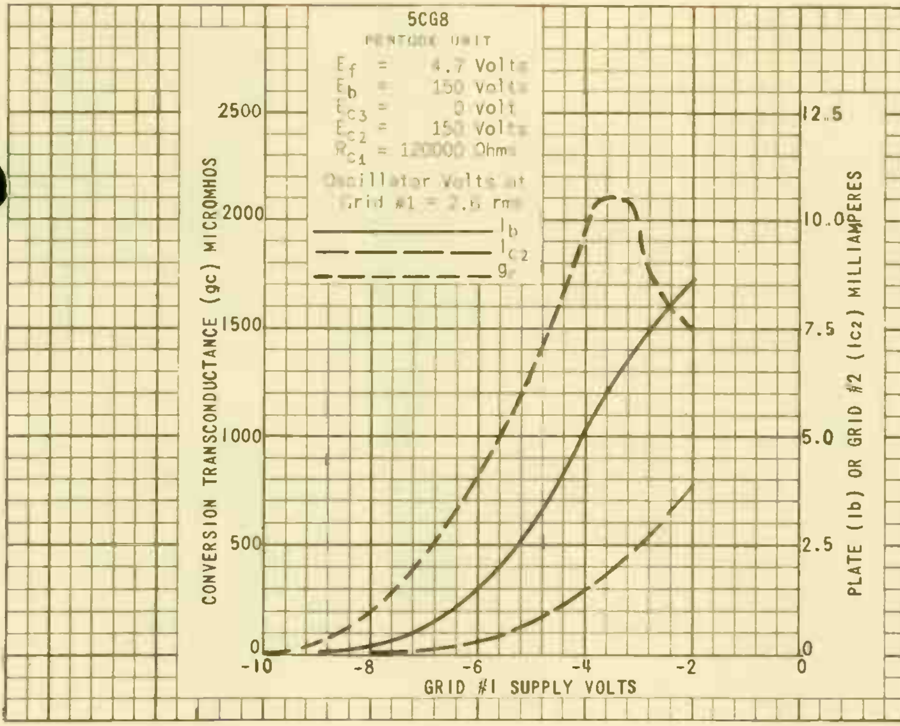
[C] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SEREIS WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.


5CG8
This Curve also Applies To Types in which Grids #2 and #4 are Connected Together within the Tube
MAXIMUM
OPERATING
CONDITIONS
AREA OF PERMISSIBLE OPERATION
GRID #2 INPUT EXPRESSED AS PERCENT OF MAX. GRID #2 INPUT RATING
GRID #2 VOLTAGE EXPRESSED AS PERCENT OF MAX. GRID #2 SUPPLY VOLTAGE RATING
0
25
50
75
100


5CG8
TRIODE UNIT
Ef = 4.7 Volts
Ib
Ic
Ec=+4
+6
+8
+12
+2
Ec=0
-2
-4
Ec=-6
-8
-10
-12
Ec=+10
+8
+6
+4
+2
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
50
100
150
200
250
300
350


5CG8
PENTODE UNIT
Ef = 4.7 Volts
Ic2 = 150 Volts
Ic3 = 0 Volts
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
Ec1 =0
+0.5
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0


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


5CG8
PENTODE UNIT
Ef = 4.7 Volts
Eb = 150 Volts
Ec3 = 0 Volt
Ec2 = 150 Volts
Rc1 = 120000 Ohms
Oscillator Volts at
Grid #1 = 2.5 rms
Ib
Ic2
gc
CONVERSION TRANSCONDUCTANCE (gc) MICROMHOS
2500
2000
1500
1000
500
0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
12.5
10.0
7.5
5.0
2.5
0
-10
-8
-6
-4
-2
0
GRID #1 SUPPLY VOLTS

TUNG-SOL

TRIODE TETRODE

MINIATURE TYPE

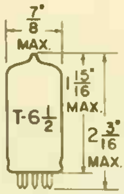
COATED UNIPOTENTIAL CATHODE

HEATER

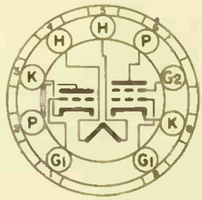
4.7 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



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	$\mu\mu f$
INPUT: G TO (H + K)	2.7	2.7	$\mu\mu f$
OUTPUT: P TO (H + K)	1.2	0.4	$\mu\mu f$
TETRODE:			
GRID TO PLATE (G_1 TO P) (MAX.)	.016	.028	$\mu\mu f$
INPUT: G_1 TO ($H+K+G_2$)	5.0	5.0	$\mu\mu f$
OUTPUT: P TO ($H+K+G_2$)	3.0	2.0	$\mu\mu f$
CATHODE TO HEATER (EITHER SECTION APPROX.)	2.5	2.5	$\mu\mu f$

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

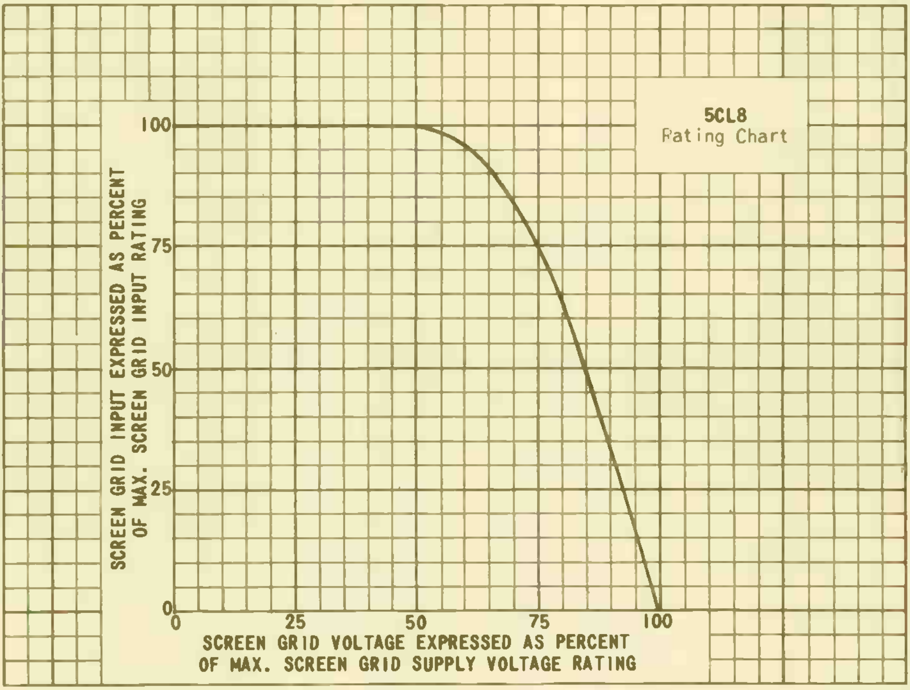
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	TETRODE	
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

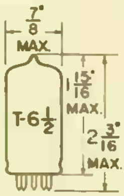
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time the 5CL8 is identical to the 6CL8.*


5CL8
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

TUNG-SOL

TRIODE TETRODE
MINIATURE TYPE

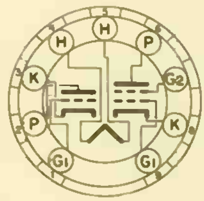


GLASS BULB

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

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

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

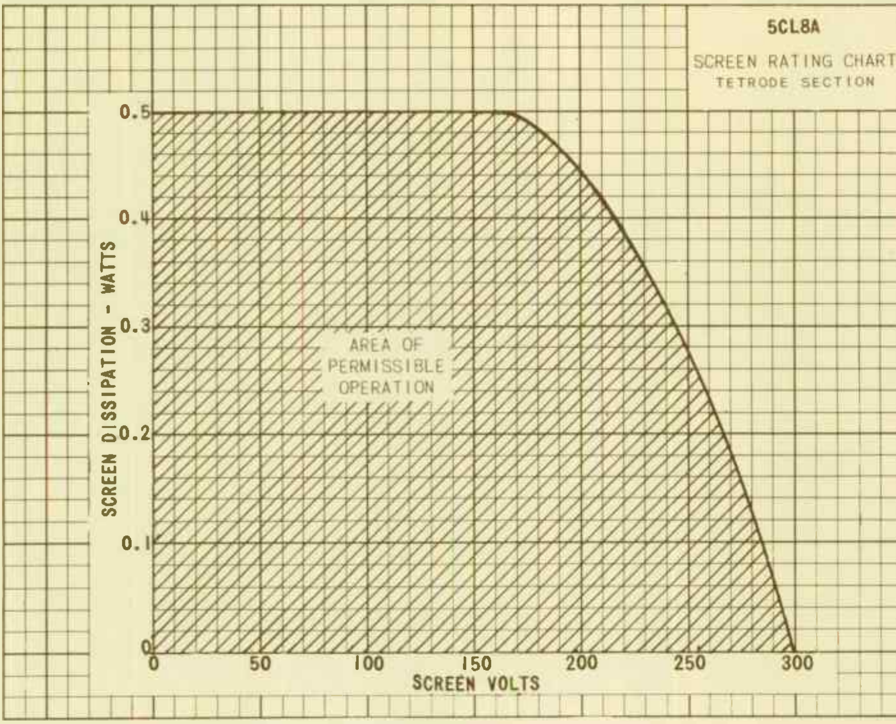
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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.

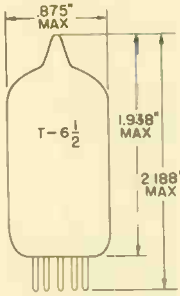
SIMILAR TYPE REFERENCE: Except for heater ratings, the 5CL8A is identical to the 6CL8A.


5CL8A
SCREEN RATING CHART
TETRODE SECTION
0.5
0.4
0.3
0.2
0.1
0
SCREEN DISSIPATION - WATTS
AREA OF
PERMISSIBLE
OPERATION
0
50
100
150
200
250
300
SCREEN VOLTS

TUNG-SOL

TRIODE-TETRODE

MINIATURE TYPE

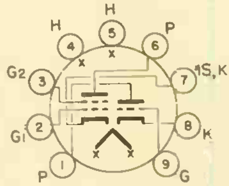


GLASS BULB
SMALL-BUTTON NOVAL
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

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

TUNG-SOL

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.

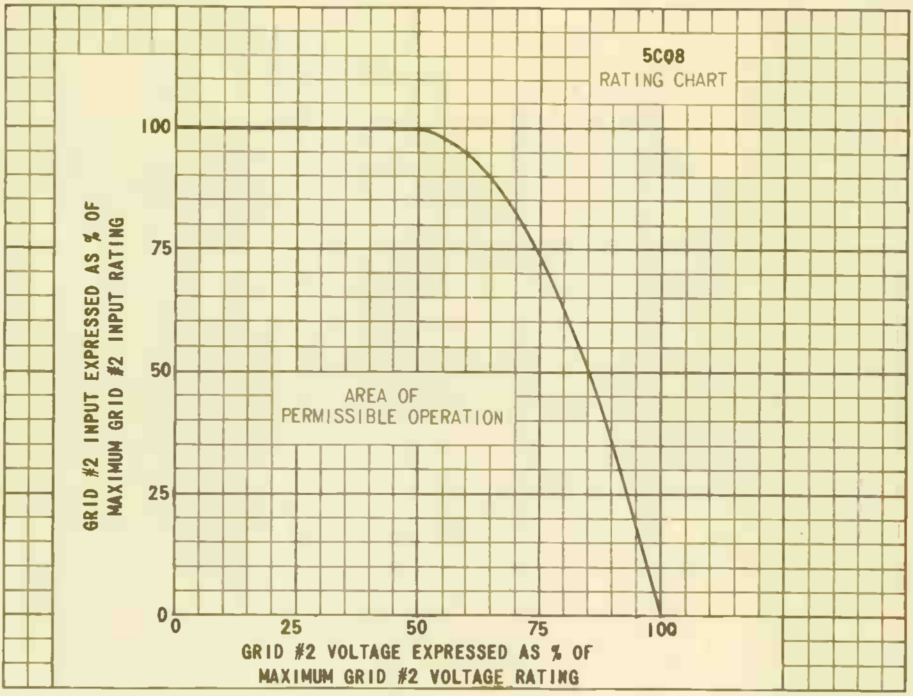
[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF UNIT UNDER TEST.

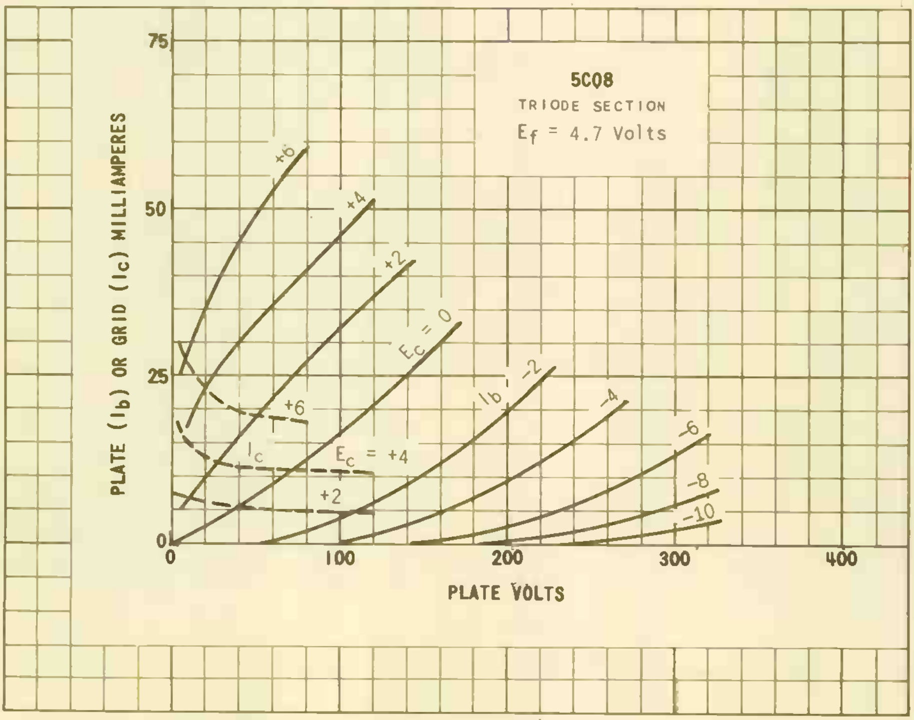
[B] WITH EXTERNAL SHIELD #315 CONNECTED TO GROUND.

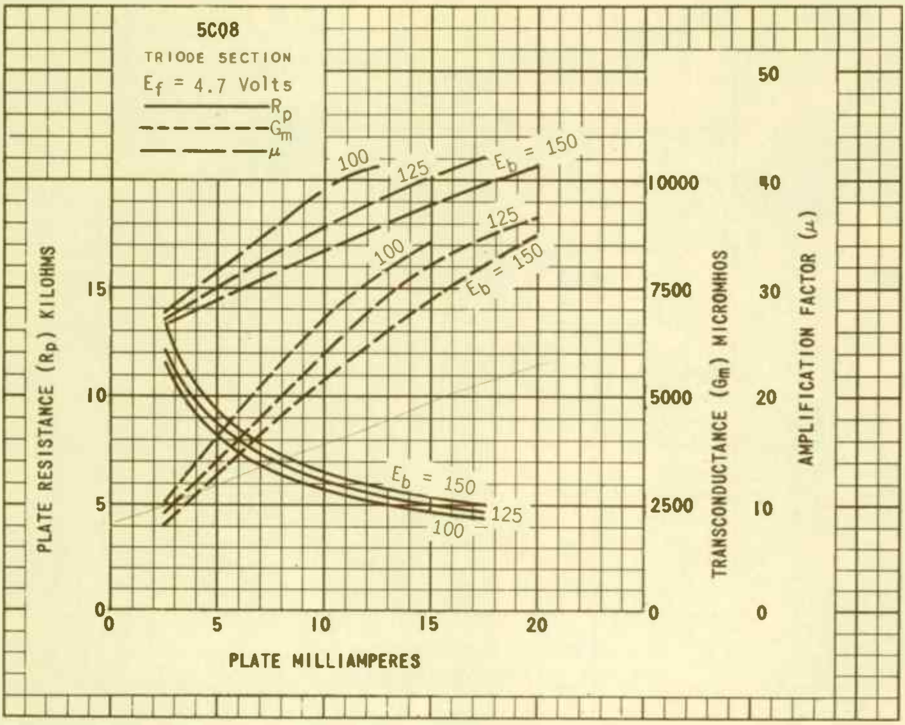
[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

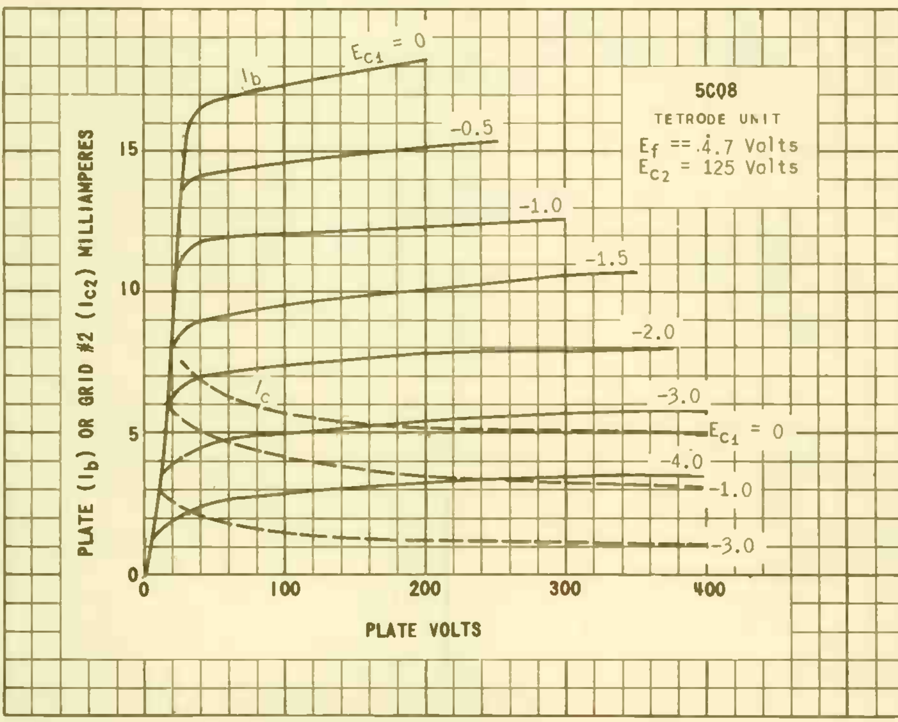
* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

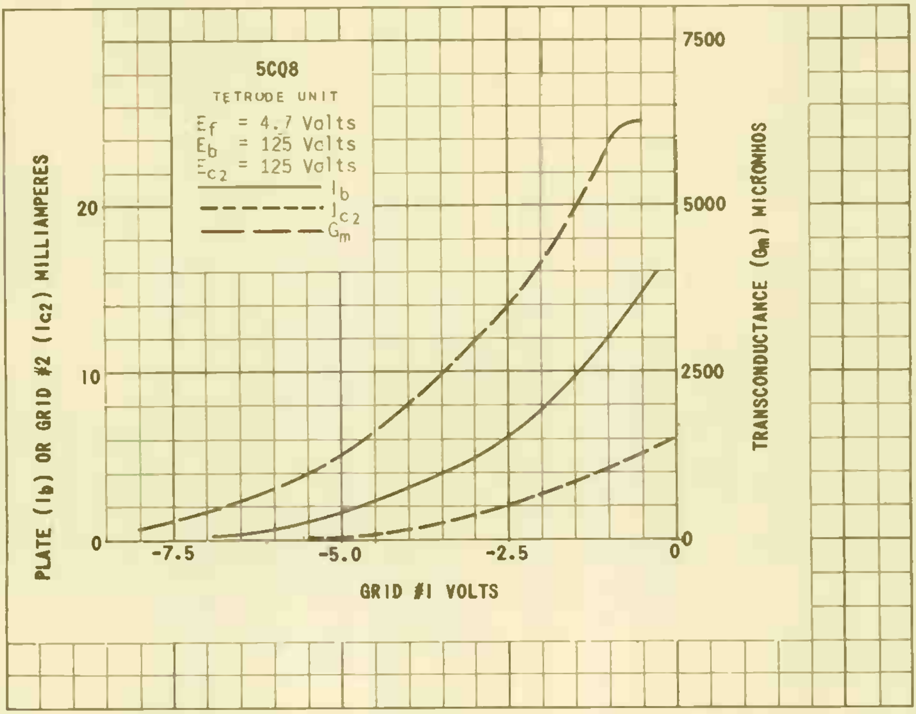
→ INDICATES A CHANGE.


5CQ8
RATING CHART
AREA OF PERMISSIBLE OPERATION
GRID #2 INPUT EXPRESSED AS % OF MAXIMUM GRID #2 INPUT RATING
GRID #2 VOLTAGE EXPRESSED AS % OF MAXIMUM GRID #2 VOLTAGE RATING


5CQ8
TRIODE SECTION
E_f = 4.7 Volts
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS


5CQ8
TRIODE SECTION
Ef = 4.7 Volts
Rp
Gm
μ
100
125
Eb = 150
125
100
Eb = 150
Eb = 150
125
100
PLATE RESISTANCE (Rp) KILOHMS
TRANSCONDUCTANCE (Gm) MICROMHOS
AMPLIFICATION FACTOR (μ)
PLATE MILLIAMPERES
0
5
10
15
20
10000
7500
5000
2500
50
40
30
20
10

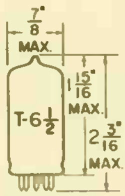

5CQ8
TETRODE UNIT
Ef = 4.7 Volts
Ec2 = 125 Volts
Ib
Ec1 = 0
-0.5
-1.0
-1.5
-2.0
-3.0
-4.0
Ic
Ec1 = 0
-1.0
-3.0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
5
10
15
100
200
300
400


5CQ8
TETRODE UNIT
Ef = 4.7 Volts
Eb = 125 Volts
Ec2 = 125 Volts
Ib
Ic2
Gm
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
TRANSCONDUCTANCE (Gm) MICROMHOS
GRID #1 VOLTS
20
10
0
-7.5
-5.0
-2.5
0
7500
5000
2500
0

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE



GLASS BULB

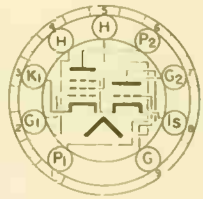
COATED UNIPOTENTIAL CATHODE

HEATER

4.7 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON 9 PIN BASE

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)	2.0	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

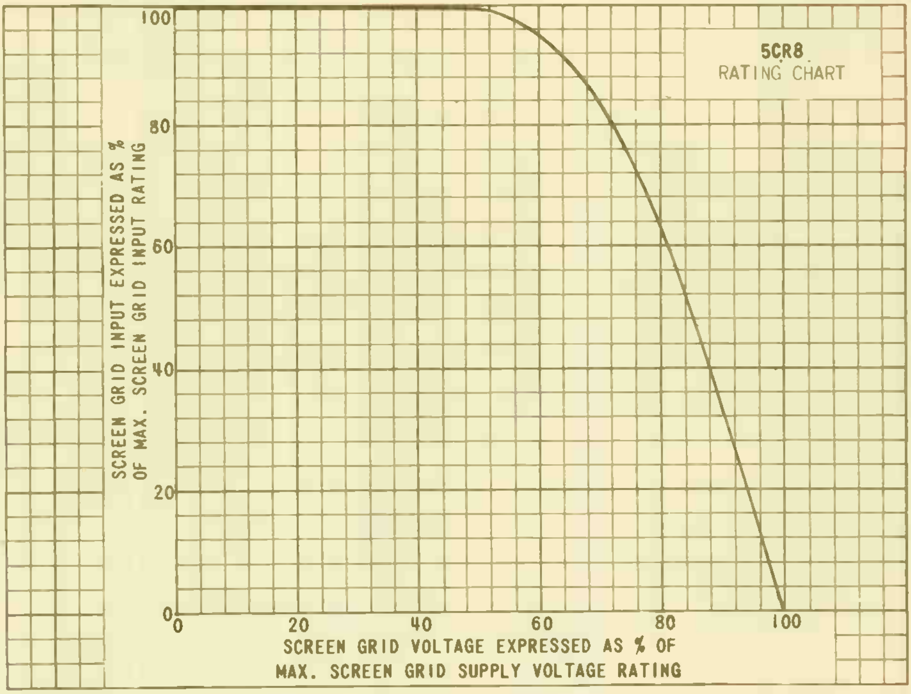
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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 I_b = 10 μA	−13		VOLTS
GRID #1 VOLTAGE (APPROX.) FOR I_b = 20 μA		−6.5	VOLTS
PLATE CURRENT WITH E_{c1} = −3 Vdc, R_K=0		2.8	MA.

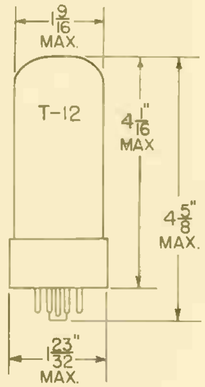
[A] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED 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.


5CR8
RATING CHART
SCREEN GRID INPUT EXPRESSED AS %
OF MAX. SCREEN GRID INPUT RATING
100
80
60
40
20
0
0
20
40
60
80
100
SCREEN GRID VOLTAGE EXPRESSED AS % OF
MAX. SCREEN GRID SUPPLY VOLTAGE RATING

TUNG-SOL

RECTIFIER



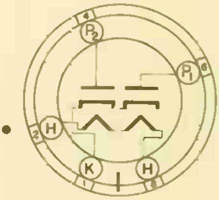
GLASS BULB

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

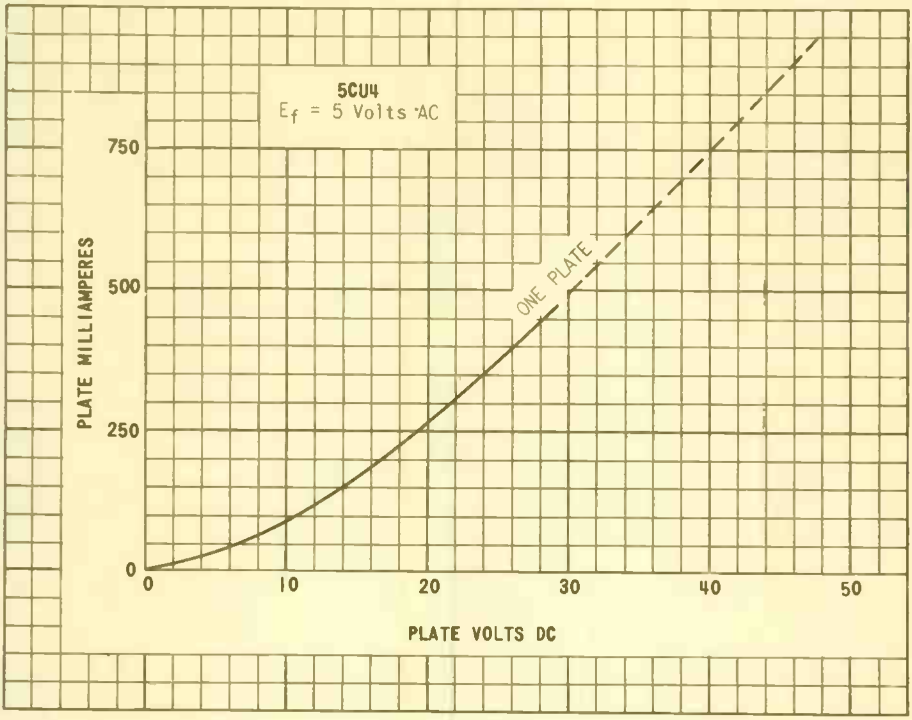
HEATER VOLTAGE	5.0	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	800	VOLTS
MAXIMUM AC PLATE VOLTAGE PER PLATE	285	VOLTS
MAXIMUM DC OUTPUT CURRENT	425	MA.
MAXIMUM STEADY STATE PEAK PLATE CURRENT	1.3	AMP.
MAXIMUM TRANSIENT PEAK PLATE CURRENT EACH PLATE	6.0	AMP.
TUBE VOLTAGE DROP	SEE CURVE	

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

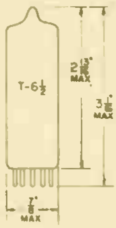
● IN SERVICE, CATHODE SHOULD BE CONNECTED TO HEATER.


5CU4
Ef = 5 Volts AC
PLATE MILLIAMPERES
750
500
250
0
0
10
20
30
40
50
PLATE VOLTS DC
ONE PLATE

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.

TUNG-SOL

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.

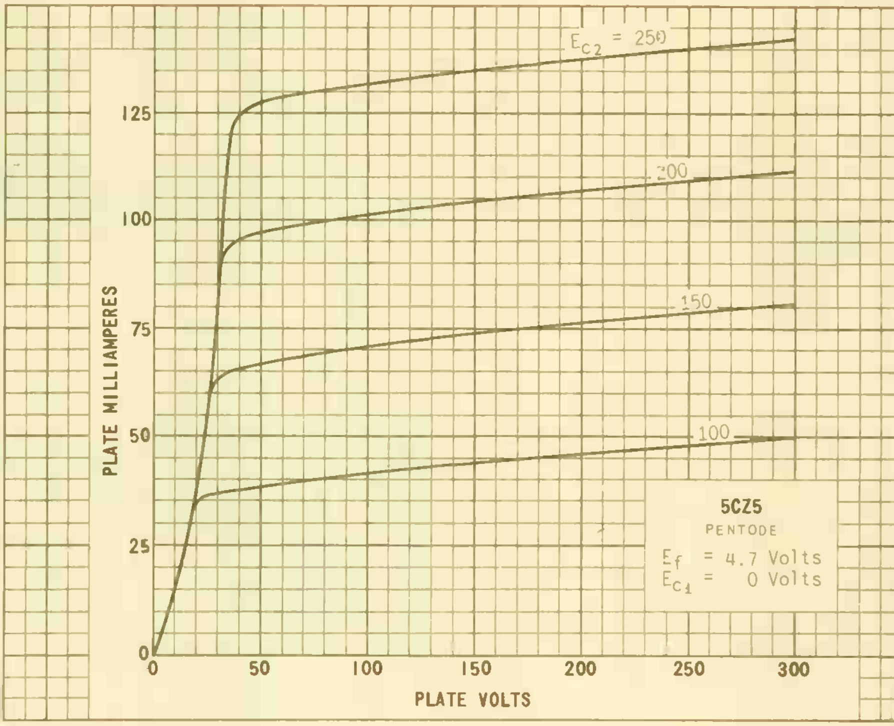
[D] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

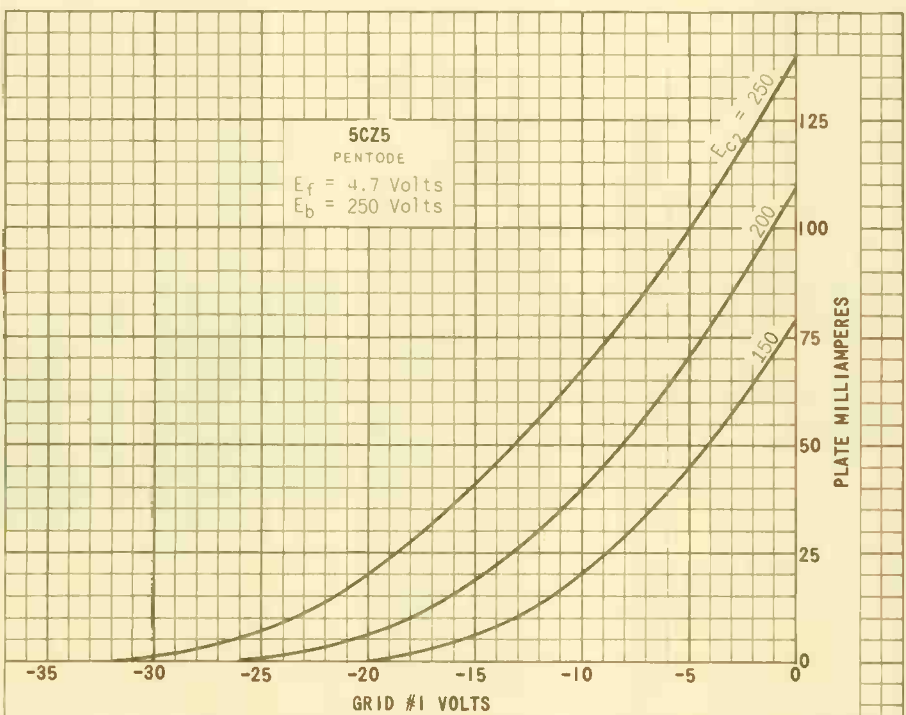
[E] SUBSCRIPT 1 INDICATES THAT GRID #1 CURRENT DOES NOT FLOW DURING ANY PART OF THE INPUT CYCLE.

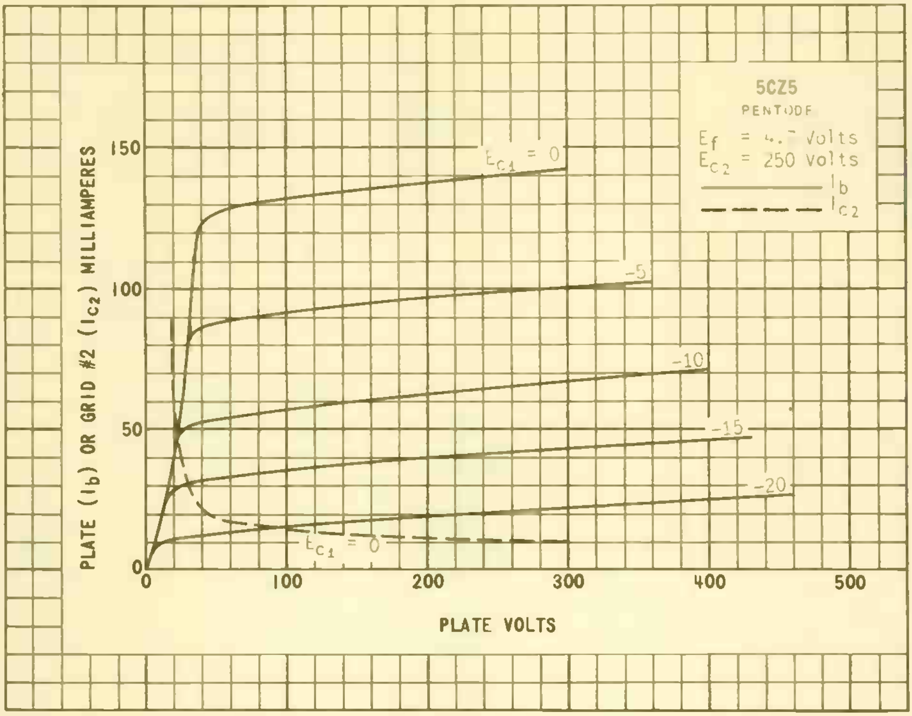
[F] THE TYPE OF INPUT COUPLING NETWORK USED SHOULD NOT INTRODUCE TOO MUCH RESISTANCE IN THE GRID #1 CIRCUIT. TRANSFORMER OR IMPEDANCE-COUPLING DEVICES ARE RECOMMENDED

[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.


E_{c2} = 250
200
150
100
125
100
75
50
25
0
PLATE MILLIAMPERES
0
50
100
150
200
250
300
PLATE VOLTS
5CZ5
PENTODE
E_f = 4.7 Volts
E_{c1} = 0 Volts

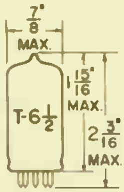

5CZ5
PENTODE
E_f = 4.7 Volts
E_b = 250 Volts
E_{c2} = 250
200
150
125
100
75
50
25
0
PLATE MILLIAMPERES
-35
-30
-25
-20
-15
-10
-5
0
GRID #1 VOLTS


5CZ5
PENTODE
Ef = 4.7 Volts
Ec2 = 250 volts
Ib
Ic2
Ec1 = 0
-5
-10
-15
-20
Ec1 = 0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0
50
100
150
0
100
200
300
400
500
PLATE VOLTS

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

CONTINUED FROM PRECEDING PAGE

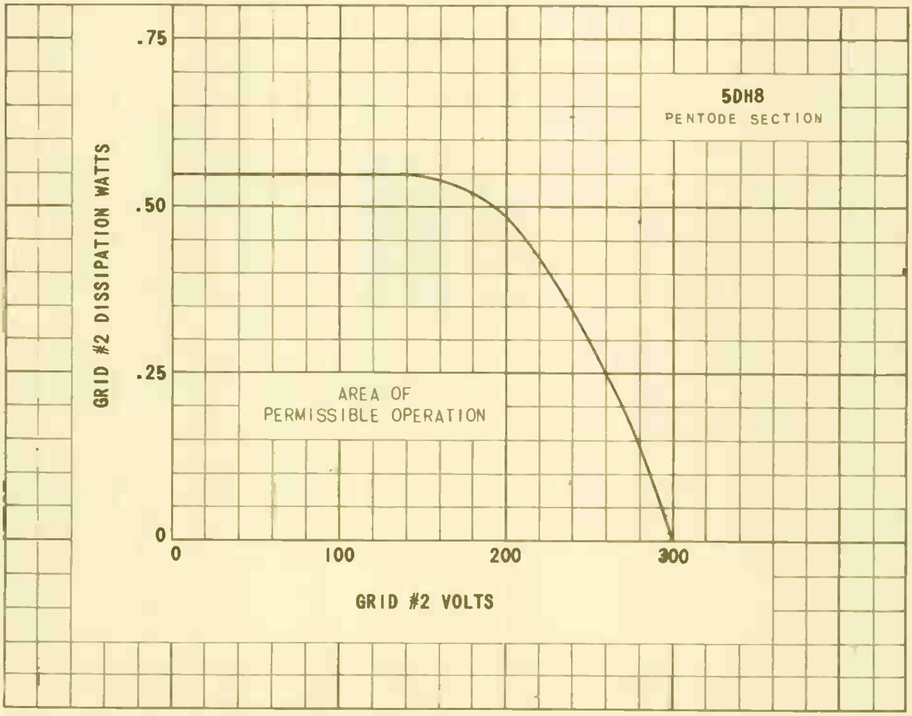
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

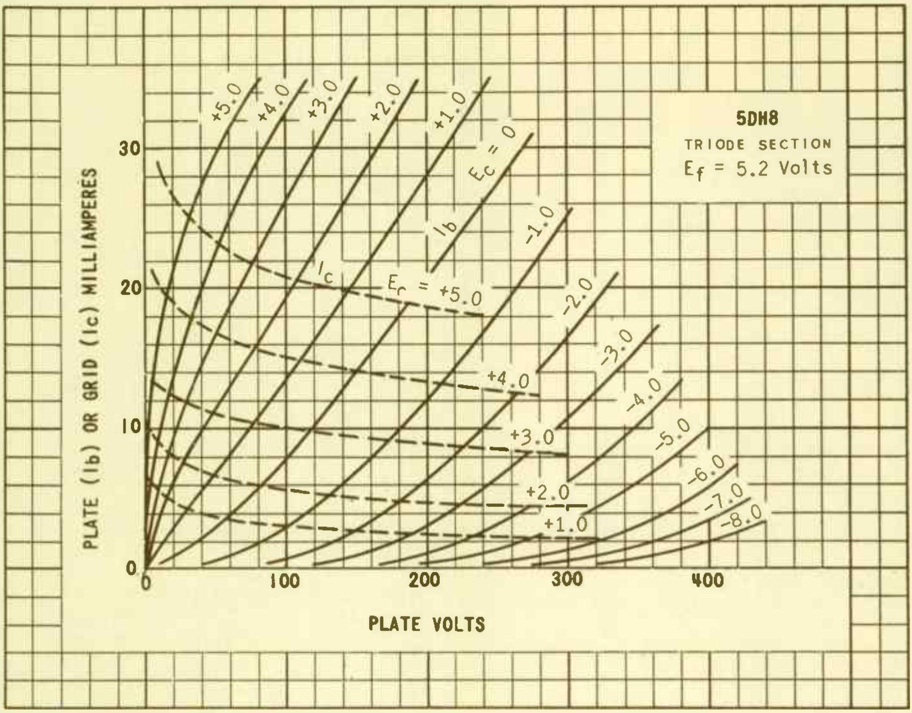
	PENTODE SECTION	TRIODE SECTION	
PLATE RESISTANCE (APPROX.)	150 000	12 000	VOLTS
TRANSCONDUCTANCE	8 600	4 400	μMHOS
PLATE CURRENT	13.5	7.3	MA.
SCREEN CURRENT	3.8	---	MA.
GRID #1 VOLTAGE (APPROX.)			
Ib = 10 μAMPS	---	-10	VOLTS
Ib = 20 μAMPS	-6	---	VOLTS

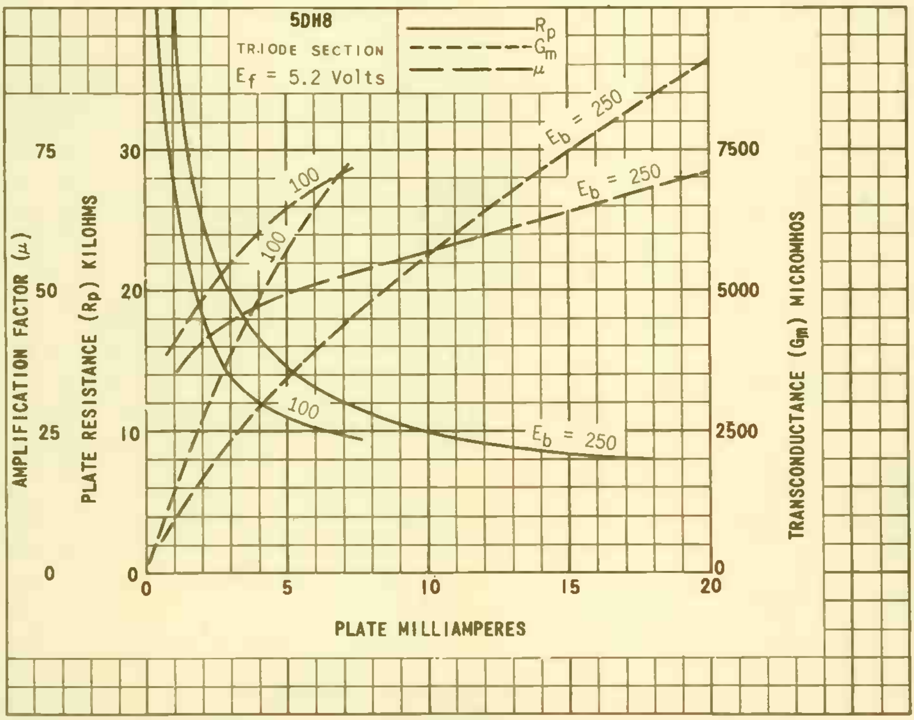
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

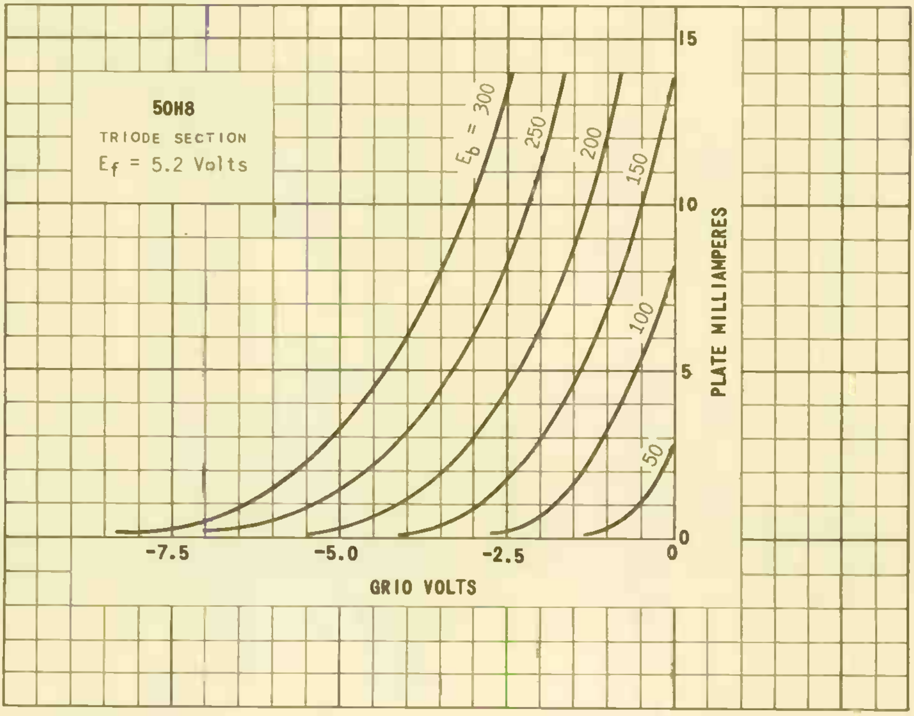
A FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

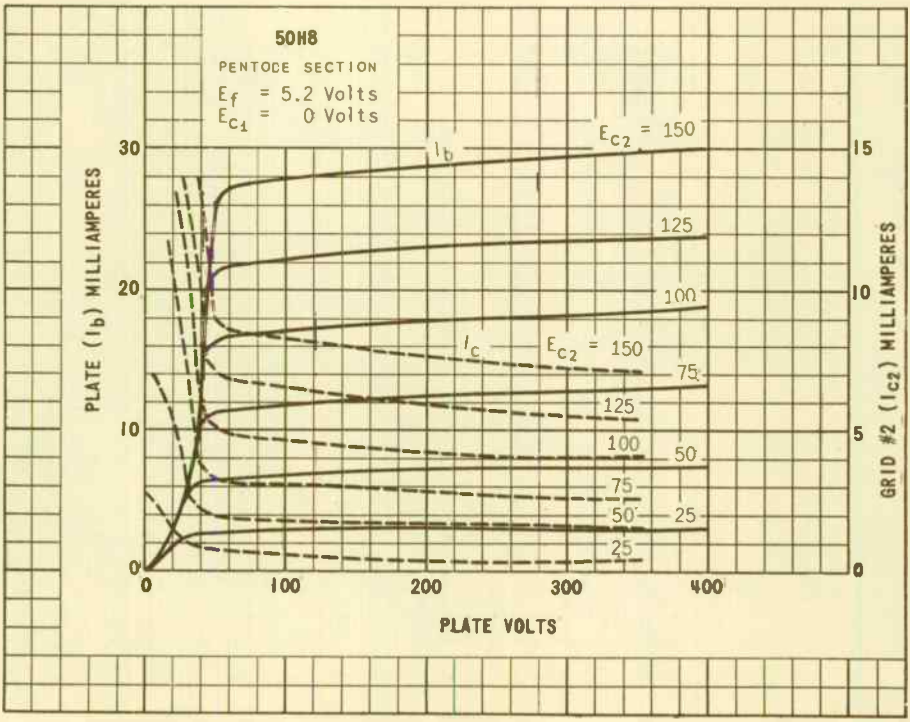
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH 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.

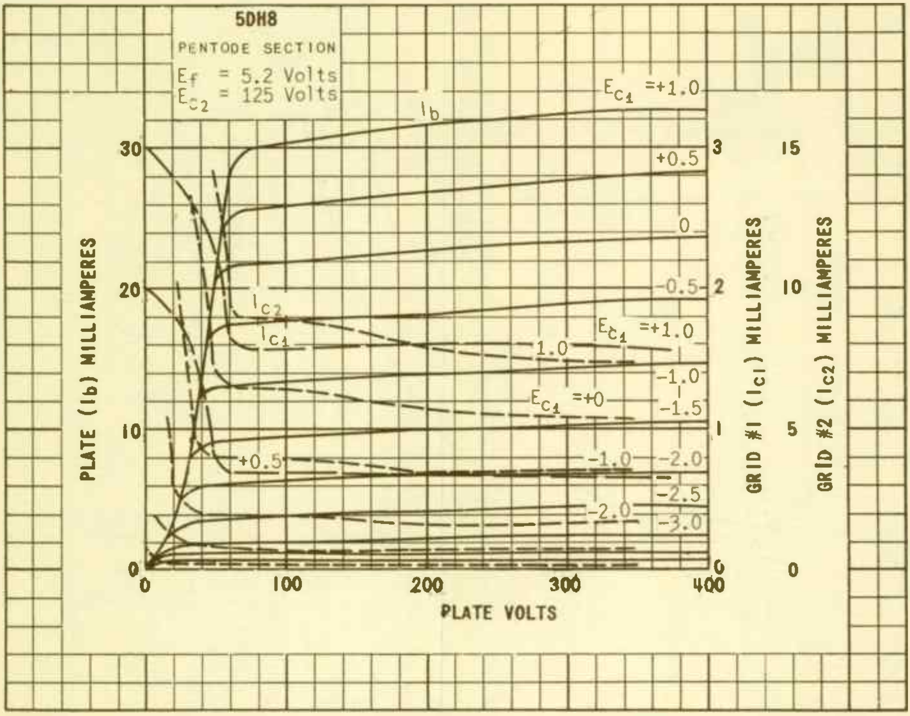


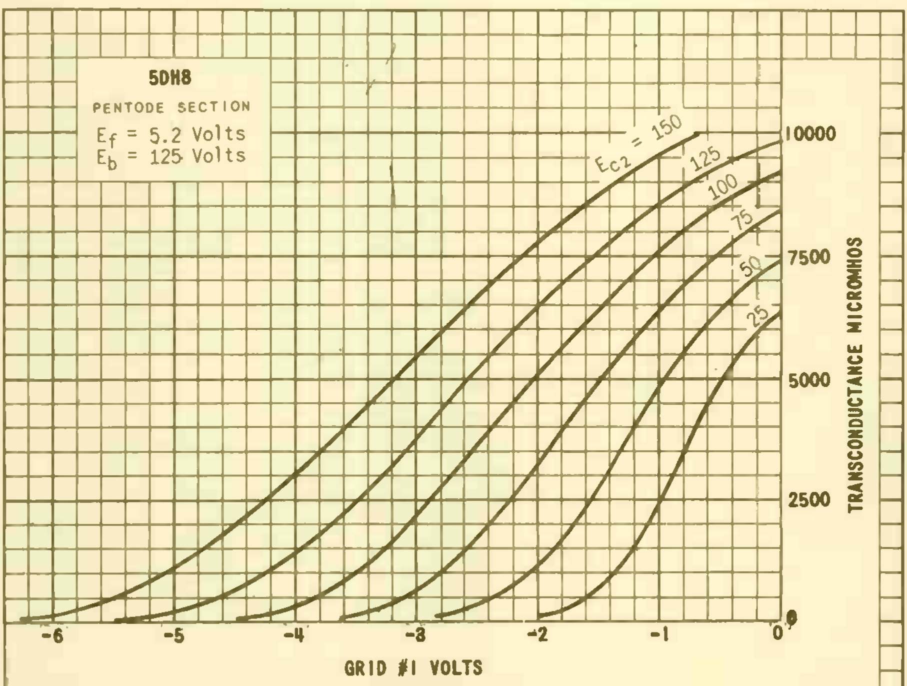

5DH8
TRIODE SECTION
E_f = 5.2 Volts
+5.0
+4.0
+3.0
+2.0
+1.0
E_c = 0
I_b
I_c
E_c = +5.0
-1.0
-2.0
+4.0
-3.0
-4.0
+3.0
-5.0
-6.0
+2.0
-7.0
-8.0
+1.0
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
30
20
10
0
0
100
200
300
400
PLATE VOLTS

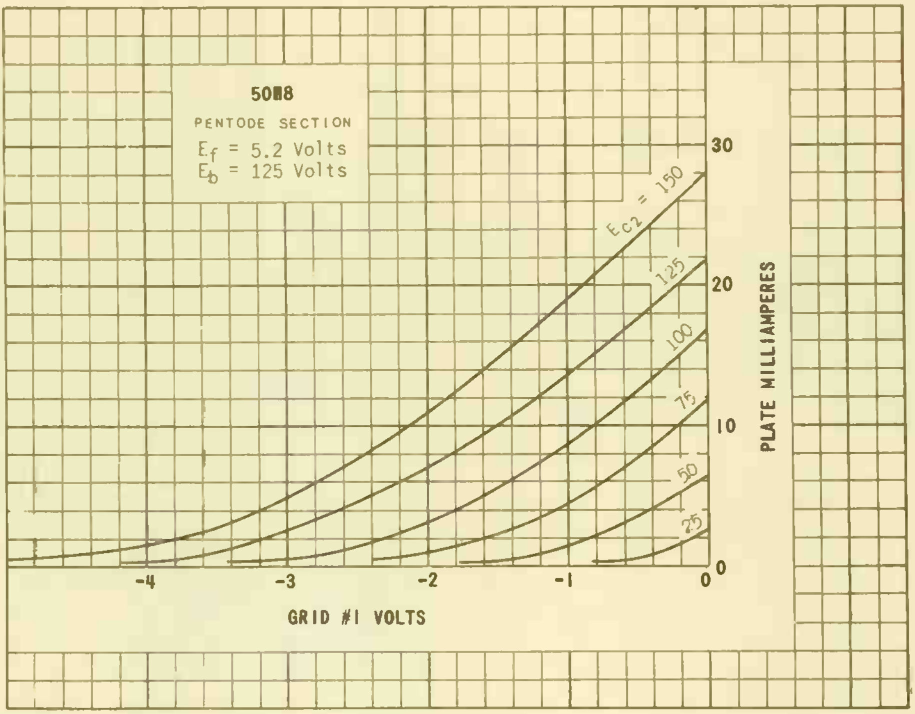

5DH8
TRIODE SECTION
E_f = 5.2 Volts
R_p
G_m
μ
E_b = 250
E_b = 250
100
100
100
E_b = 250
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (R_p) KILOHMS
TRANSCONDUCTANCE (G_m) MICROMHOS
75
50
25
0
30
20
10
0
7500
5000
2500
0
0
5
10
15
20
PLATE MILLIAMPERES

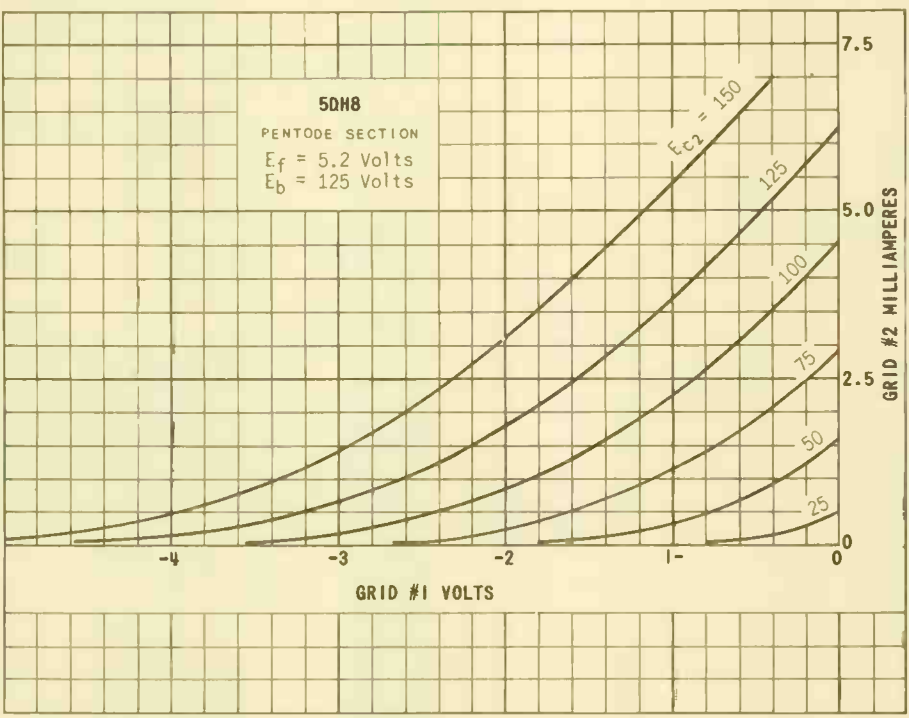

5DH8
TRIODE SECTION
E_f = 5.2 Volts
E_b = 300
250
200
150
100
50
15
10
5
0
PLATE MILLIAMPERES
-7.5
-5.0
-2.5
0
GRID VOLTS


5DH8
PENTODE SECTION
E_f = 5.2 Volts
E_{c_1} = 0 Volts
I_b
E_{c_2} = 150
125
100
75
50
25
I_c
E_{c_2} = 150
125
100
75
50
25
30
20
10
0
PLATE (I_b) MILLIAMPERES
15
10
5
0
GRID #2 (I_{c_2}) MILLIAMPERES
0
100
200
300
400
PLATE VOLTS


5DH8
PENTODE SECTION
Ef = 5.2 Volts
Ec2 = 125 Volts
PLATE (Ib) MILLIAMPERES
GRID #1 (Ic1) MILLIAMPERES
GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
Ib
Ic2
Ic1
Ec1 =+1.0
+0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
Ec1 =+0
+0.5
-1.0
-2.0
1.0
0
100
200
300
400
10
20
30
1
2
3
5
15

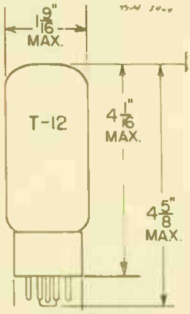

5DH8
PENTODE SECTION
Ef = 5.2 Volts
Eb = 125 Volts
Ec2 = 150
125
100
75
50
25
TRANSCONDUCTANCE MICROMHOS
GRID #1 VOLTS
0
2500
5000
7500
10000
-6
-5
-4
-3
-2
-1


5DH8
PENTODE SECTION
E_f = 5.2 Volts
E_b = 125 Volts
E_{c2} = 150
125
100
75
50
25
PLATE MILLIAMPERES
30
20
10
0
-4
-3
-2
-1
0
GRID #1 VOLTS


5DH8
PENTODE SECTION
E_f = 5.2 Volts
E_b = 125 Volts
E_{c2} = 150
125
100
75
50
25
GRID #2 MILLIAMPERES
7.5
5.0
2.5
0
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

POWER RECTIFIER



GLASS BULB
12-16

COATED FILAMENT CATHODE

FILAMENT

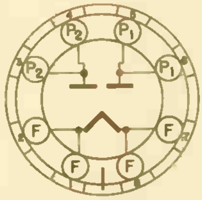
5.0 VOLTS 3.0 AMP.[A]

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

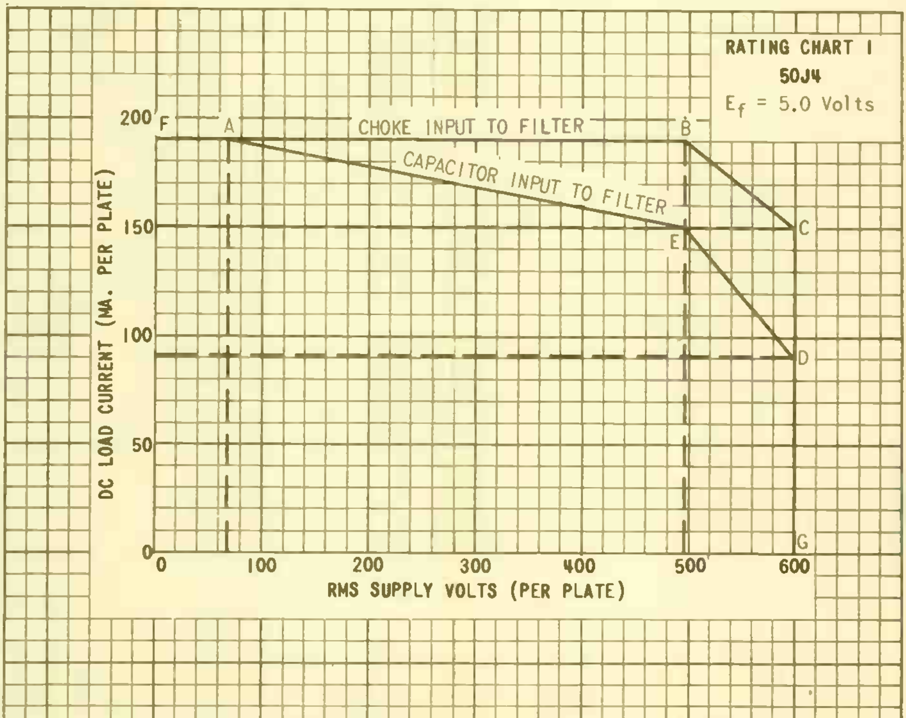
CONTINUED FROM PRECEDING PAGE

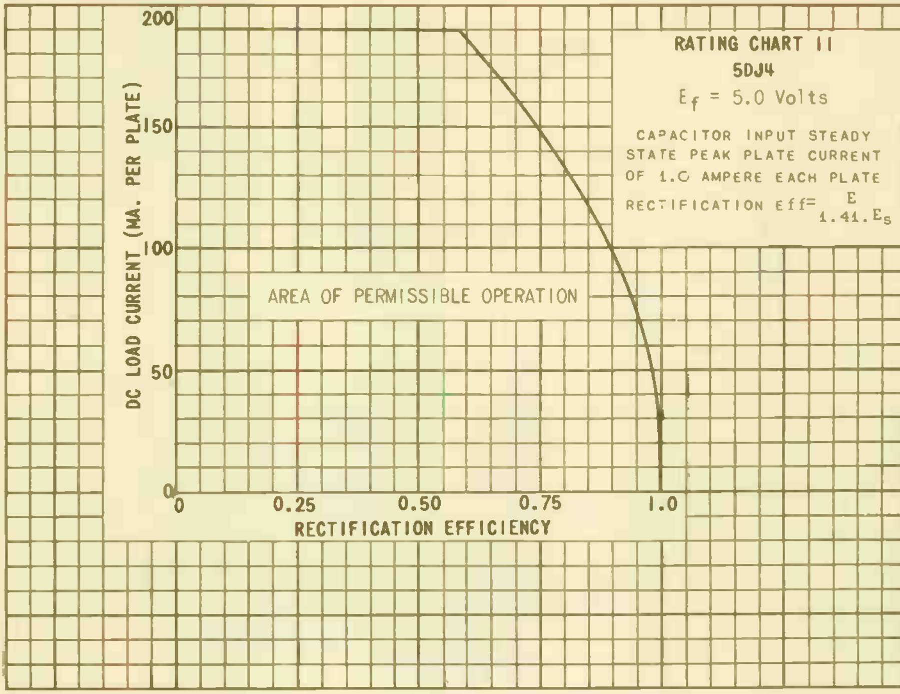
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - cont'd.

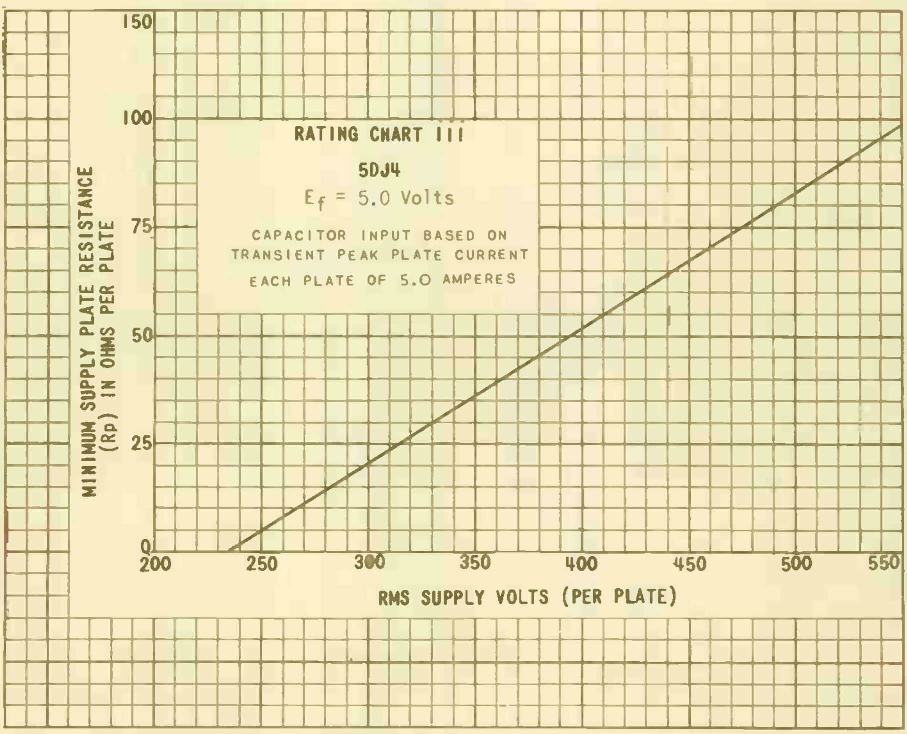
FULL-WAVE RECTIFIER - CHOKE INPUT FILTER

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.

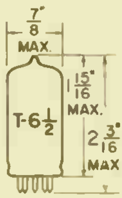



RATING CHART II
5DJ4
E_f = 5.0 Volts
CAPACITOR INPUT STEADY STATE PEAK PLATE CURRENT OF 1.0 AMPERE EACH PLATE
RECTIFICATION eff= $\frac{E}{1.41 . E_s}$
AREA OF PERMISSIBLE OPERATION
DC LOAD CURRENT (MA. PER PLATE)
0
50
100
150
200
0.25
0.50
0.75
1.0
RECTIFICATION EFFICIENCY


RATING CHART III
5DJ4
E_f = 5.0 Volts
CAPACITOR INPUT BASED ON TRANSIENT PEAK PLATE CURRENT EACH PLATE OF 5.0 AMPERES
MINIMUM SUPPLY PLATE RESISTANCE (Rp) IN OHMS PER PLATE
0
25
50
75
100
150
200
250
300
350
400
450
500
550
RMS SUPPLY VOLTS (PER PLATE)

TUNG-SOL

TRIODE PENTODE
MINIATURE TYPE

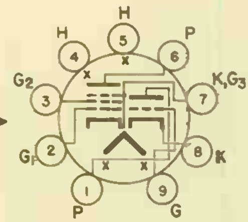


GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

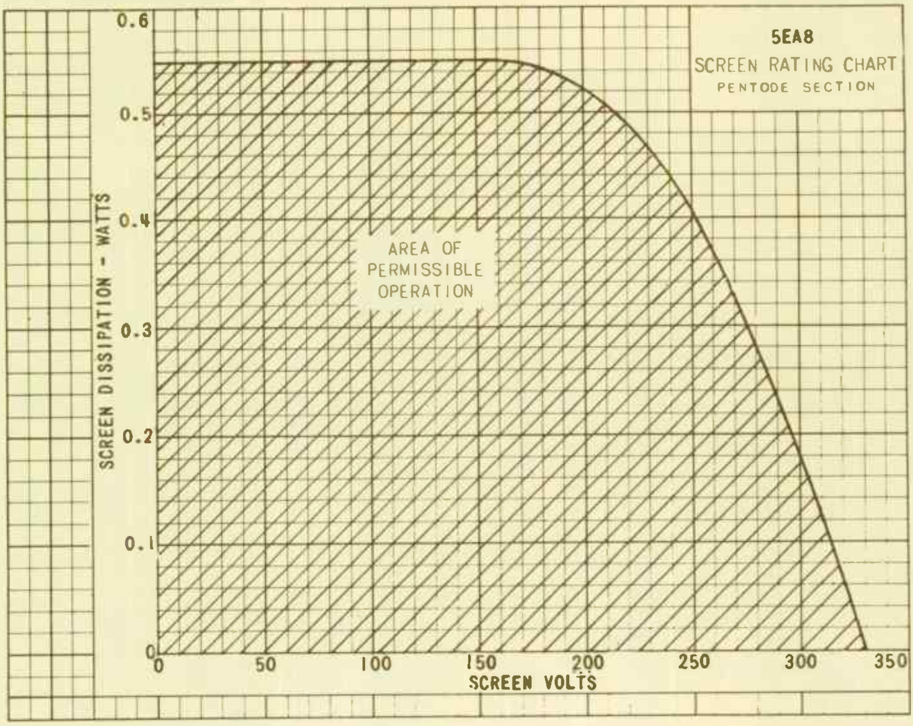
	PENTODE SECTION	TRIODE SECTION	
PLATE VOLTAGE	125	150	VOLTS
SCREEN VOLTAGE	125	---	VOLTS
GRID #1 VOLTAGE	-1.0	---	
CATHODE-BIAS RESISTOR	---	56	OHMS
AMPLIFICATION FACTOR	---	40	
PLATE RESISTANCE (APPROX.)	200 000	5 000	OHMS
TRANSCONDUCTANCE	6 400	8 500	µAMPS
PLATE CURRENT	12	18	MA.
SCREEN CURRENT	4.0	---	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.

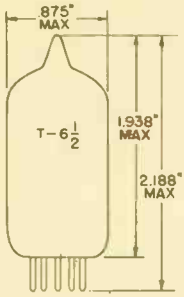
[B] WITH EXTERNAL SHIELD 315 CONNECTED TO GROUND.

*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.


5EA8
SCREEN RATING CHART
PENTODE SECTION
AREA OF
PERMISSIBLE
OPERATION
SCREEN DISSIPATION - WATTS
0.6
0.5
0.4
0.3
0.2
0.1
0
0
50
100
150
200
250
300
350
SCREEN VOLTS

TUNG-SOL



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

TRIODE PENTODE

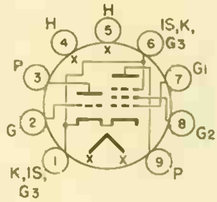
MINIATURE TYPE

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 $(TK+PK+PG_3+I.S.)$	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.

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

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

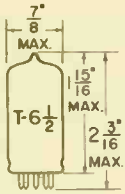
[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

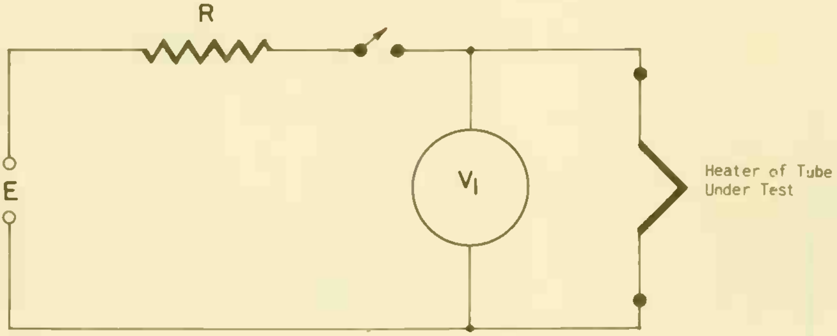
	TRIODE	PENTODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	150	125	VOLTS
GRID #2 VOLTAGE	---	125	VOLTS
CATHODE RESISTOR	56	---	OHMS
GRID #1 VOLTAGE	---	-1.0	VOLT
AMPLIFICATION FACTOR	40.0	---	
TRANSCONDUCTANCE	8500	6400	μMHOS
PLATE RESISTANCE (APPROX.)	5000	80000	OHMS
PLATE 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.

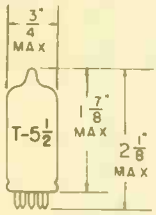
TUNG-SOL



TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

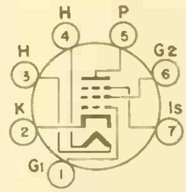
MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER
5.6 VOLTS 0.45±.03 AMP.
AC OR DC

ANY MOUNTING POSITION



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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

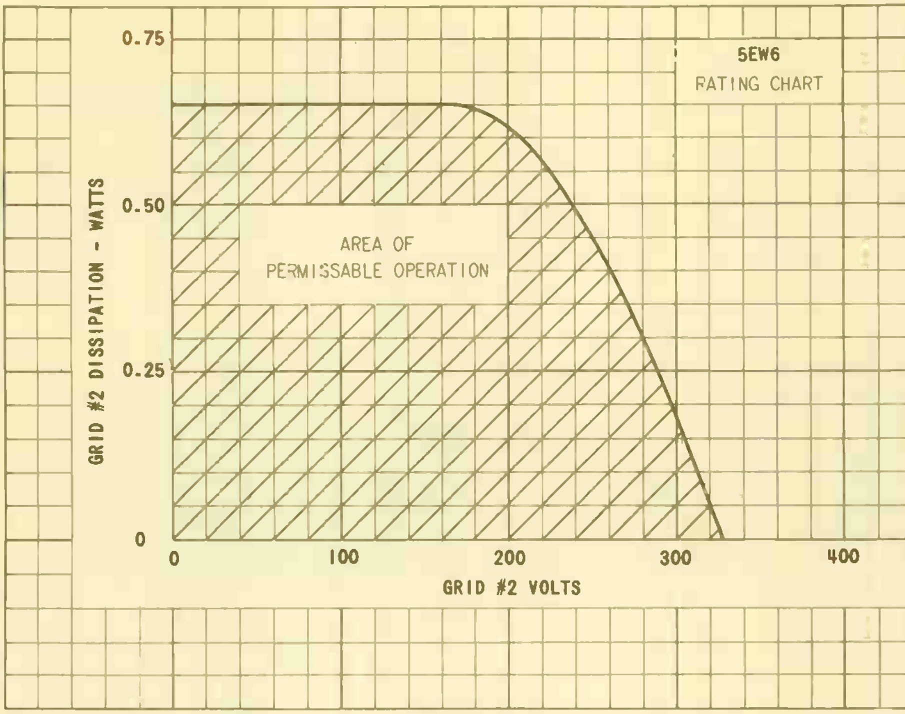
CONTINUED FROM PRECEDING PAGE

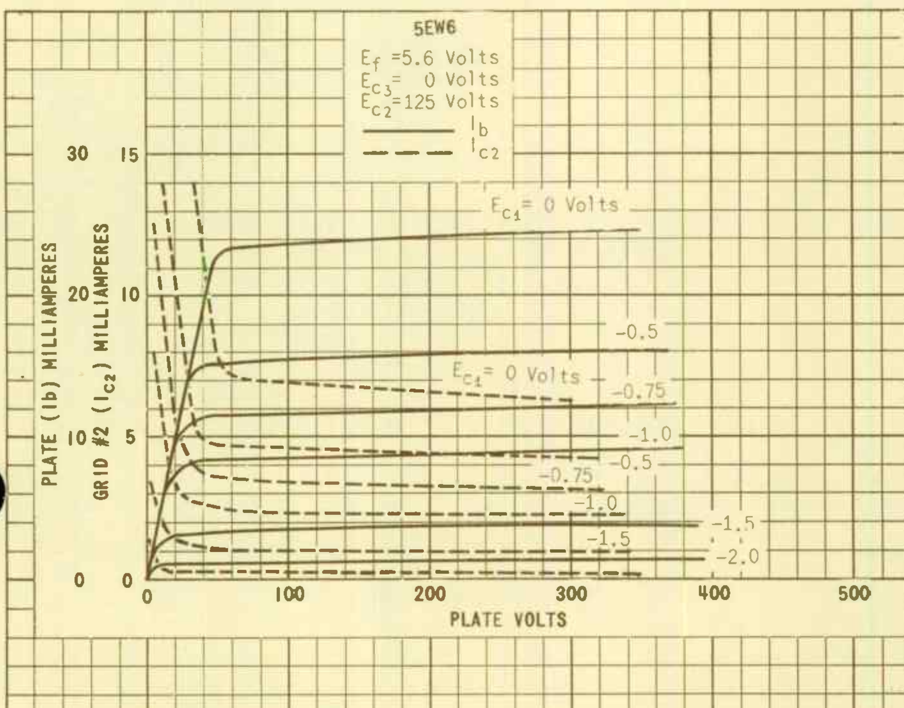
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

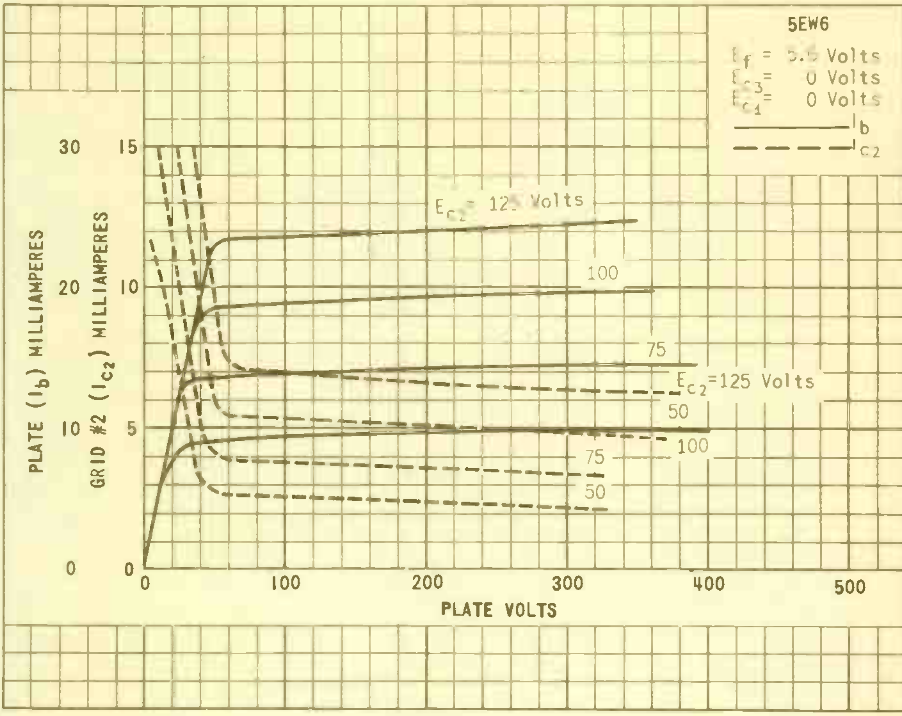
CLASS A_1 AMPLIFIER

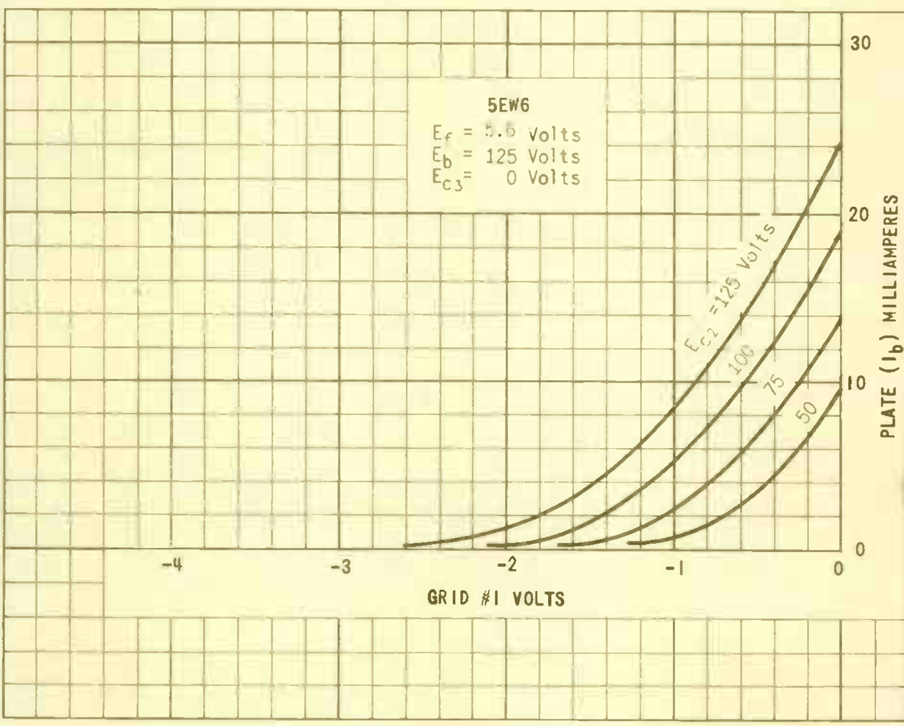
PLATE VOLTAGE	125	VOLTS
SUPPRESSOR, CONNECTED TO CATHODE AT SOCKET		
SCREEN VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.2	MEGOHMS
TRANSCONDUCTANCE	14 000	μMHOS
PLATE CURRENT	11	MA.
SCREEN CURRENT	3.2	MA.
GRID #1 VOLTAGE (APPROX.) I_b= 20 μAMPS.	-3.5	VOLTS

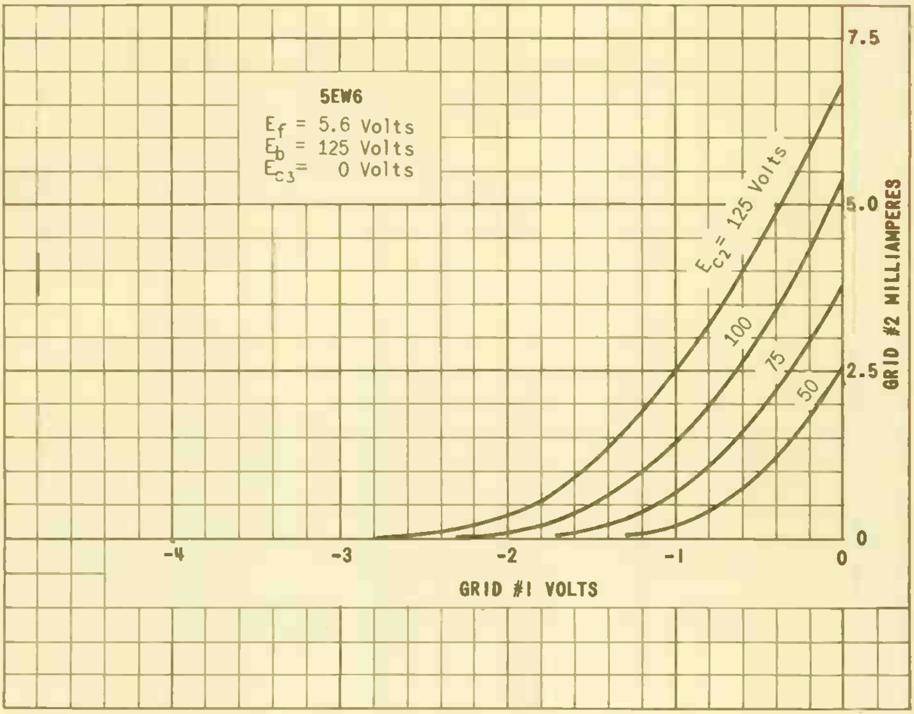
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

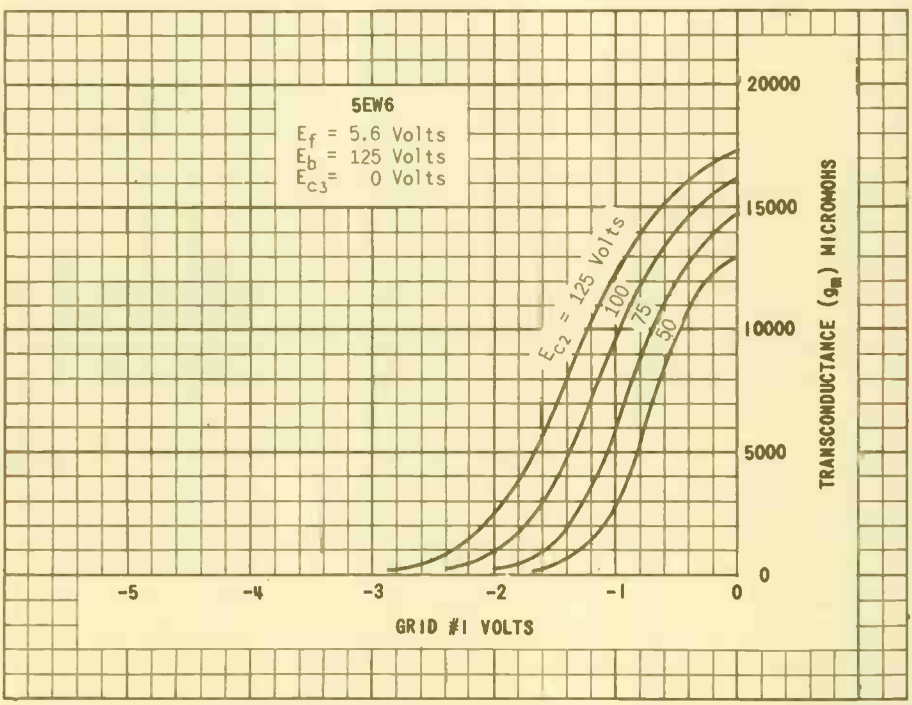

5EW6
RATING CHART
AREA OF
PERMISSABLE OPERATION
GRID #2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
GRID #2 VOLTS


5EW6
Ef =5.6 Volts
Ec3 = 0 Volts
Ec2 =125 Volts
Ib
Ic2
Ec1 = 0 Volts
-0.5
Ec1 = 0 Volts
-0.75
-1.0
-0.5
-0.75
-1.0
-1.5
-1.5
-2.0
PLATE (Ib) MILLIAMPERES
GRID #2 (Ic2) MILLIAMPERES
30
20
10
0
15
10
5
0
0
100
200
300
400
500
PLATE VOLTS


5EW6
E_f = 5.5 Volts
E_{c3} = 0 Volts
E_{c1} = 0 Volts
I_b
I_{c2}
E_{c2} = 125 Volts
100
75
E_{c2}=125 Volts
50
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS


5EW6
E_f = 5.5 Volts
E_b = 125 Volts
E_{c3} = 0 Volts
E_{c2} =125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #1 VOLTS

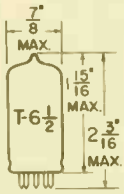

5EW6
E_f = 5.6 Volts
E_b = 125 Volts
E_{c3} = 0 Volts
E_{c2} = 125 Volts
100
75
50
7.5
5.0
2.5
0
GRID #2 MILLIAMPERES
-4
-3
-2
-1
0
GRID #1 VOLTS


5EW6
E_f = 5.6 Volts
E_b = 125 Volts
E_{c3} = 0 Volts
E_{c2} = 125 Volts
100
75
50
20000
15000
10000
5000
0
TRANSCONDUCTANCE (g_m) MICROMOHS
-5
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE



GLASS BULB

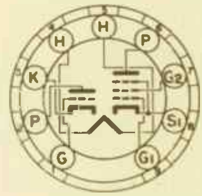
COATED UNIPOTENTIAL CATHODE

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

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

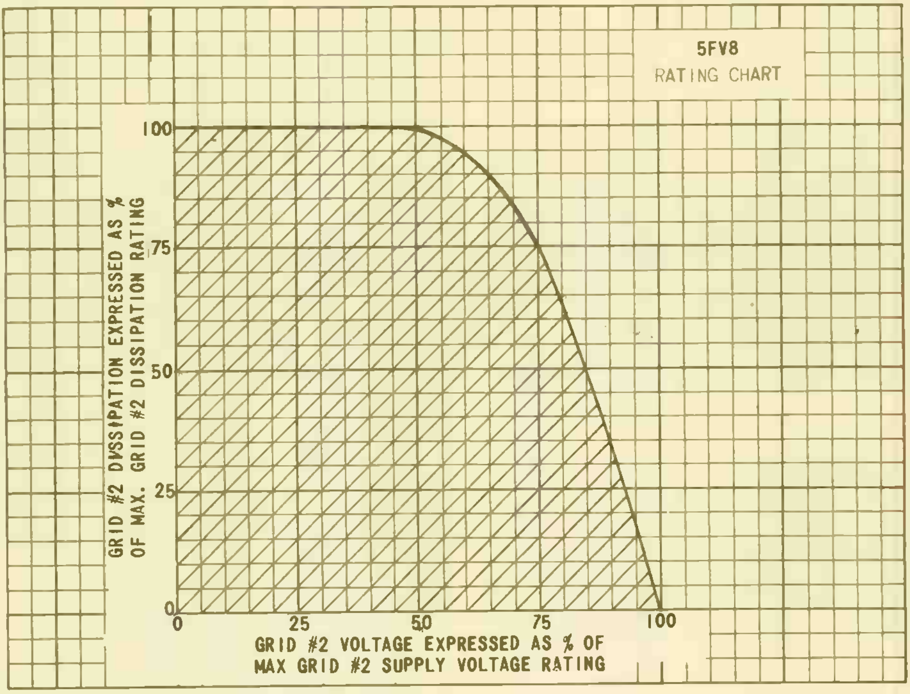
[A] SHIELD #315 TIED TO PIN #4.

[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.

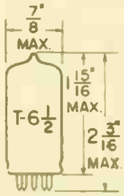
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE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


5FV8
RATING CHART
GRID #2 DISSIPATION EXPRESSED AS %
OF MAX. GRID #2 DISSIPATION RATING
100
75
50
25
0
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS % OF
MAX GRID #2 SUPPLY VOLTAGE RATING

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[C] (HORIZONTAL OSCILLATOR SERVICE)	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.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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.

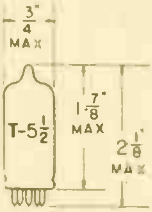
[B] WITH EXTERNAL SHIELD 315 CONNECTED TO GROUND.

[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

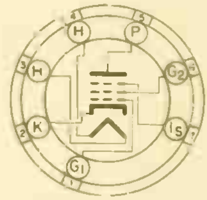
UNIPOTENTIAL CATHODE

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 JS-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 JS-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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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 SERVICE 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

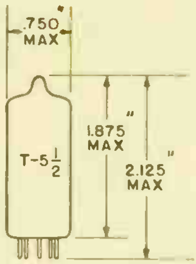
MINIATURE TYPE

UNIPOTENTIAL CATHODE

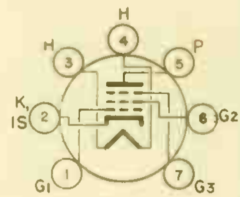
WITH

DUAL CONTROL GRIDS

ANY MOUNTING POSITION



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



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7EN

THE 5GX6 IS A SHARP-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE IN FM SOUND DETECTOR SERVICE. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 5GX6 IS IDENTICAL TO THE 6GX6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.026	pf
GRID #1 TO CATHODE & I.S., GRID 3, GRID 2, & HEATER	8	pf
GRID #1 TO GRID #3	0.12	pf
GRID #3 TO PLATE	1.6	pf
GRID #3 TO CATHODE & I.S., PLATE, GRID 2, GRID 1, & HEATER	6.5	pf

HEATER CHARACTERISTCS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7 VOLTS	600	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
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 (AVERAGE)[B]		11	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

FM SOUND-DETECTOR SERVICE

PLATE VOLTAGE	300	VOLTS
GRID #3 (CONTROL-GRID) VOLTAGE (DC AND PEAK):		
POSITIVE VALUE	25	VOLTS
NEGATIVE VALUE	100	VOLTS
GRID #2 (SCREEN-GRID) SUPPLY VOLTAGE	300	VOLTS
GRID #2 (SCREEN-GRID) VOLTAGE	SEE RATING CHART	
GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
NEGATIVE BIAS VALUE	50	VOLTS
PLATE DISSIPATION	1.7	WATTS
GRID #3 INPUT	0.1	WATT
GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 150 VOLTS	1.0	WATT
FOR GRID #2 VOLTAGES BETWEEN 150 VOLTS AND 300 VOLTS	SEE RATING CHART	

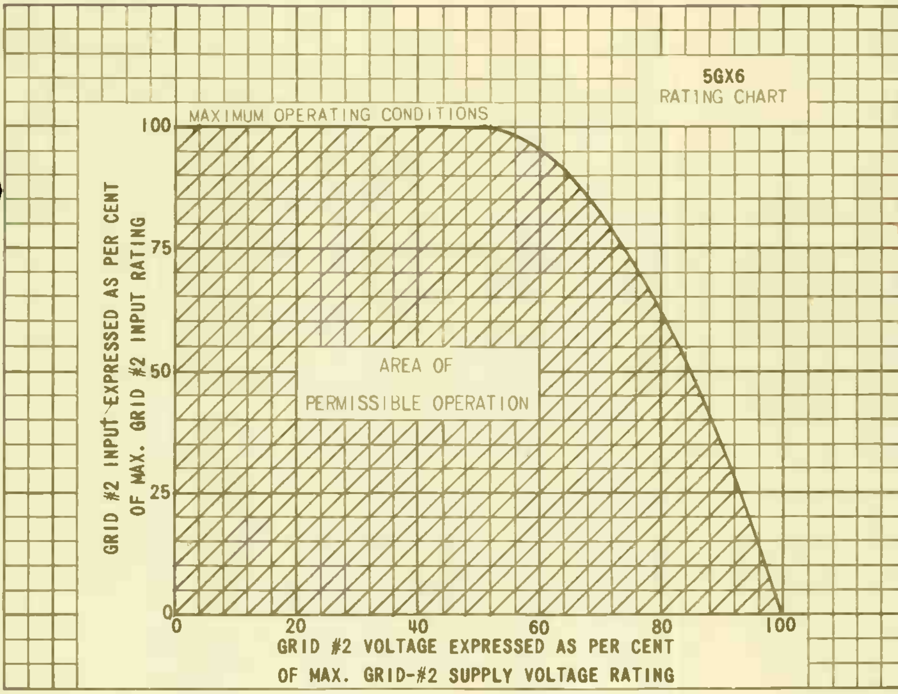
MAXIMUM CIRCUIT VALUES

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

PLATE SUPPLY VOLTAGE	150	VOLTS
GRID #3 SUPPLY VOLTAGE	0	VOLTS
GRID #2 SUPPLY VOLTAGE	100	VOLTS
GRID #1 SUPPLY VOLTAGE	0	VOLTS
CATHODE-BIAS RESISTOR	180	OHMS
PLATE RESISTANCE, APPROX.	0.14	MEGOHM
TRANSCONDUCTANCE, GRID #1 TO PLATE	3700	μMHOS
TRANSCONDUCTANCE, GRID #3 TO PLATE	750	μMHOS
PLATE CURRENT	5.7	MA.
GRID #2 CURRENT	5	MA.
GRID #1 SUPPLY VOLTAGE (APPROX.) FOR PLATE CURRENT OF 20 μA	-4.5	VOLTS
GRID #3 SUPPLY VOLTAGE (APPROX.) FOR PLATE CURRENT OF 20 μA	-7	VOLTS

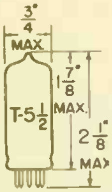
CONTINUED ON FOLLOWING PAGE



PRINTED IN U. S. A.

DOUBLE TRIODE

MINIATURE TYPE



GLASS BULB

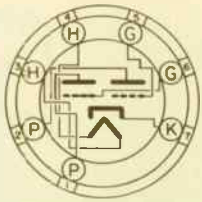
COATED UNIPOTENTIAL CATHODE

HEATER

4.7 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7BF

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	$\mu\mu f$
INPUT (EACH SECTION)	2.2	2.6	$\mu\mu f$
OUTPUT (SECTION 1)	0.4	1.6	$\mu\mu f$
OUTPUT (SECTION 2)	0.4	1.0	$\mu\mu f$

[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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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.

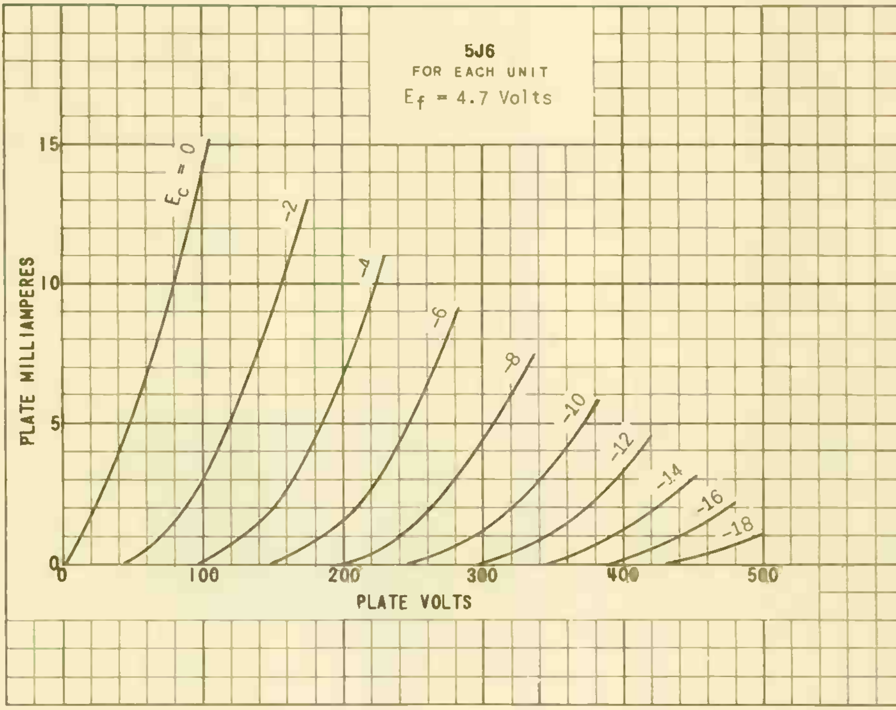
[B] OPERATION WITH FIXED BIAS IS NOT RECOMMENDED.

CLASS C TELEGRAPHY - RF POWER AMPLIFIER AND OSCILLATOR

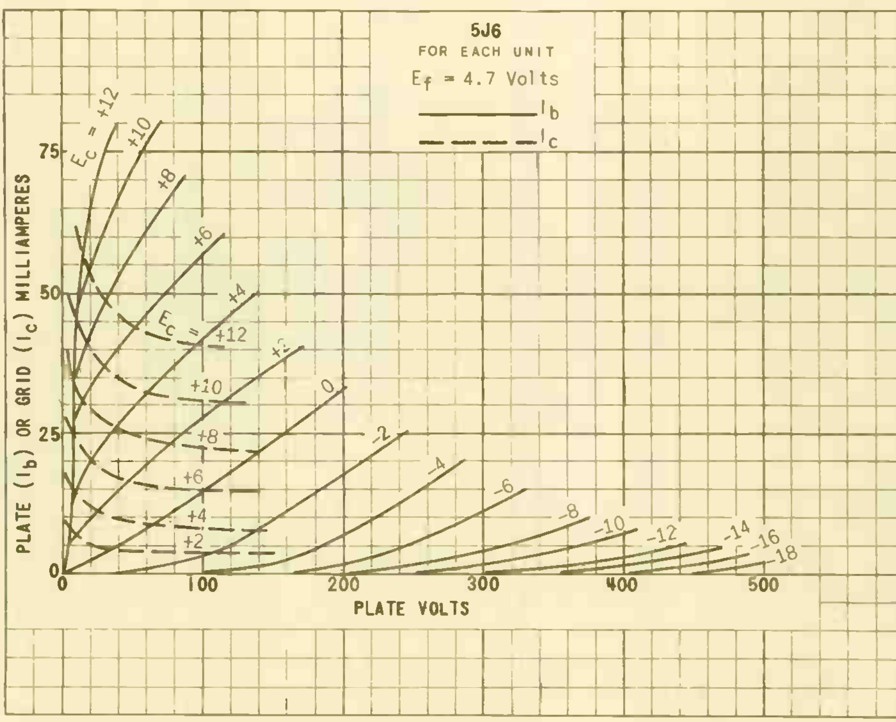
BOTH SECTIONS IN PUSH PULL

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.



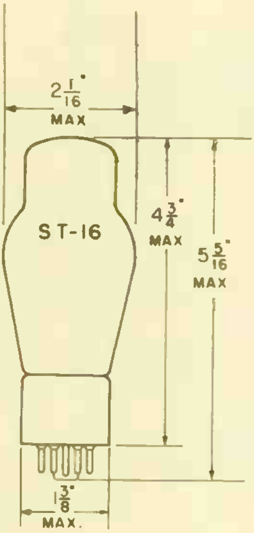
5J6
FOR EACH UNIT
Ef = 4.7 Volts
PLATE MILLIAMPERES
PLATE VOLTS
Ec = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
0
5
10
15
0
100
200
300
400
500



5J6
FOR EACH UNIT
Ef = 4.7 Volts
Ib
Ic
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
Ec = +12
+10
+8
+6
+4
+2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
Ec = +12
+10
+8
+6
+4
+2
0
25
50
75
0
100
200
300
400
500

TUNG-SOL

FULL-WAVE HIGH-VACUUM RECTIFIER



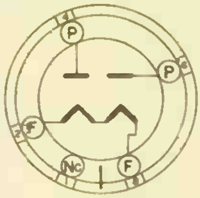
GLASS BULB

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.

CONTINUED ON FOLLOWING PAGE

PLATE 1599
OCT. 15, 1945

 ELECTRON TUBE DIVISION NEWARK NEW JERSEY U S A

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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.

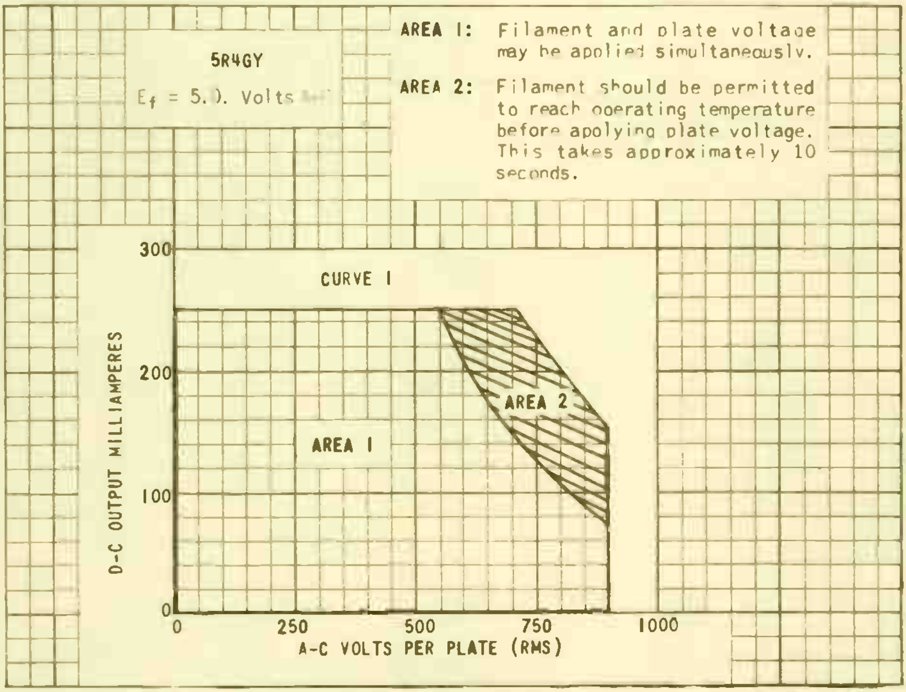
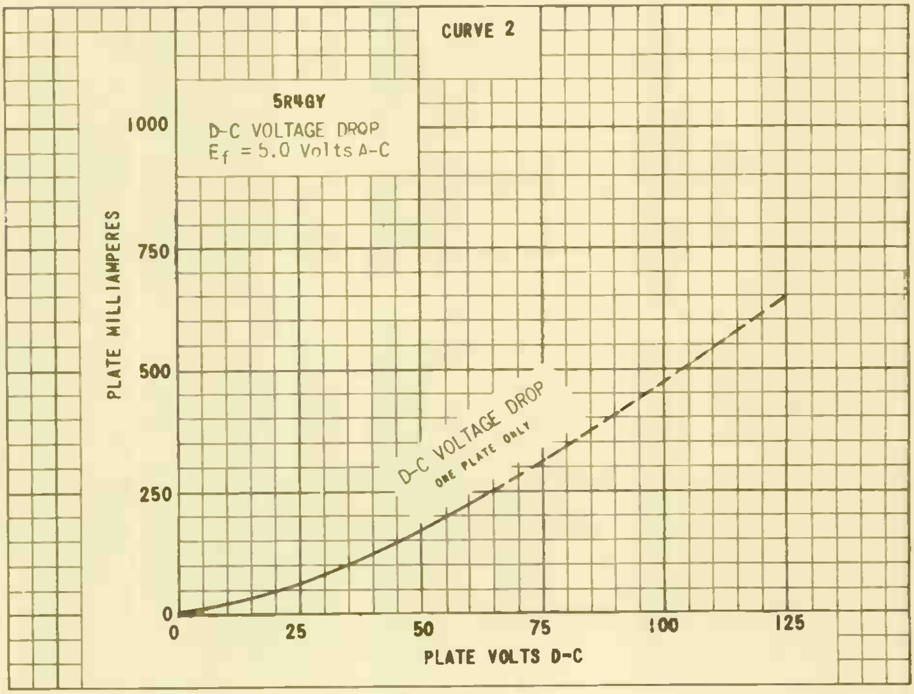
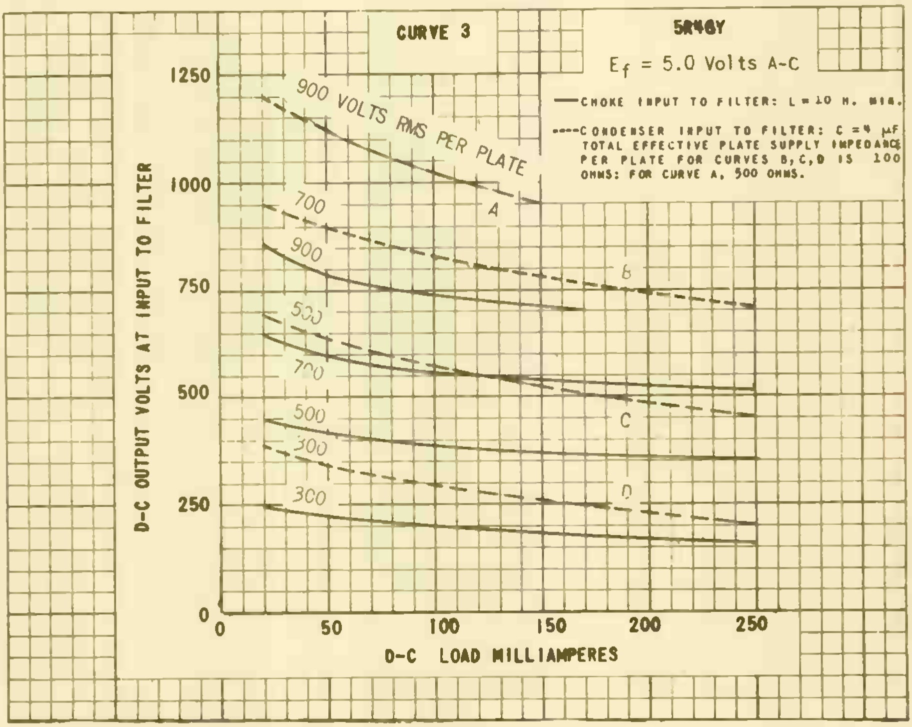


PLATE 1600

OCT. 15, 1945

 ELECTRON TUBE DIVISION NEWARK NEW JERSEY U S A



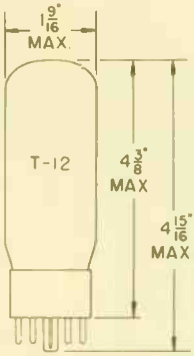


PRINTED IN U. S. A.

PLATE
1601
OCT. 15,
1945

TUNG-SOL

TWIN DIODE



GLASS BULB

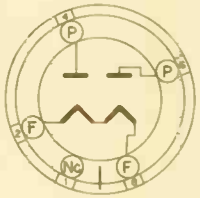
COATED FILAMENT

5.0 VOLTS 2.0 AMP.

AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION PERMITTED IF PINS 1 & 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[E]	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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

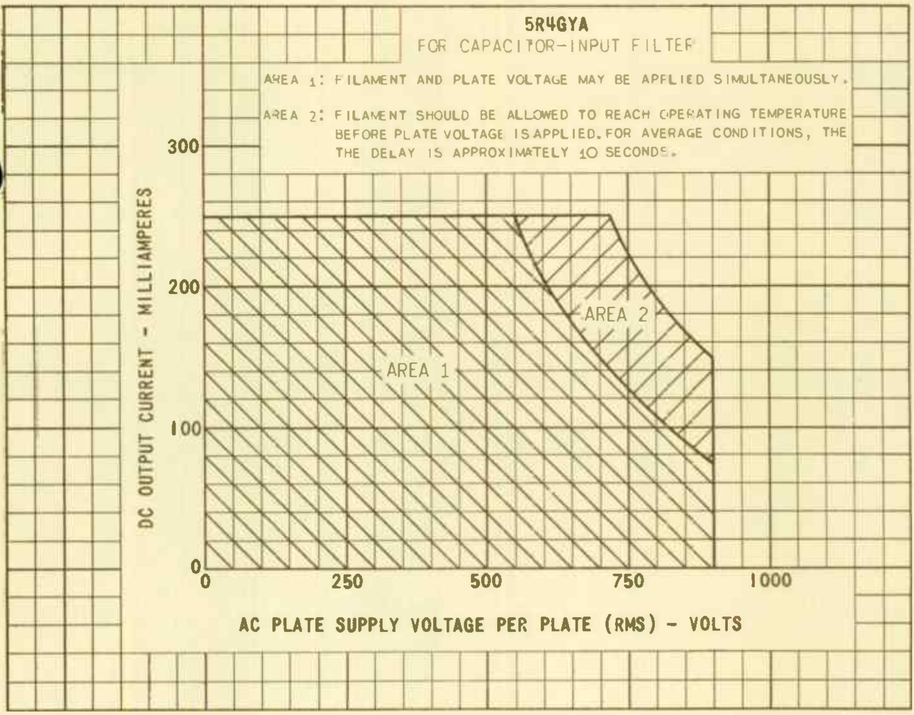
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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

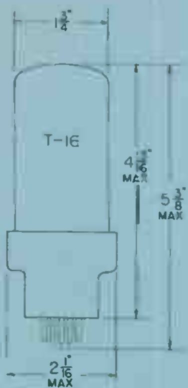
FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER

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


5R4GYA
FOR CAPACITOR-INPUT FILTER
AREA 1: FILAMENT AND PLATE VOLTAGE MAY BE APPLIED SIMULTANEOUSLY.
AREA 2: FILAMENT SHOULD BE ALLOWED TO REACH OPERATING TEMPERATURE BEFORE PLATE VOLTAGE IS APPLIED. FOR AVERAGE CONDITIONS, THE THE DELAY IS APPROXIMATELY 10 SECONDS.
AREA 1
AREA 2
DC OUTPUT CURRENT - MILLIAMPERES
0
100
200
300
0
250
500
750
1000
AC PLATE SUPPLY VOLTAGE PER PLATE (RMS) - VOLTS

TUNG-SOL

FULL WAVE RECTIFIER



GLASS BULB
HARD GLASS

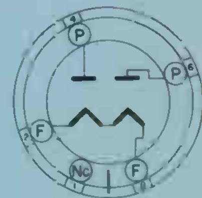
FILAMENT

5.0 VOLTS 2.0 AMP.

AC OR DC

VERTICAL MOUNTING POSITION

TUBE MAY BE OPERATED IN HORIZONTAL POSITION IF PINS #2 AND #8 ARE IN VERTICAL PLANE.



BOTTOM VIEW
SPECIAL SKIRTED
5 PIN OCTAL
5T

THE 5R4WGA IS A HIGH VACUUM FULL WAVE RECTIFIER CAPABLE OF SUPPLYING 900 VDC AT 165MA OR 750 VDC AT 275 MA. THIS TUBE TYPE PROVEN BY MILLIONS NOW IN FIELD USE FEATURES A RUGGED CONSTRUCTION THAT WILL WITHSTAND A SHOCK IMPACT OF 900 G AND HIGH VIBRATIONAL STRESSES.

ONE OF THE DESIGN FEATURES IS THE SHOCK MOUNTING OF THE BULB IN A SKIRTED TYPE BASE BY A RESILIENT SILICONE RUBBER. THUS, ALTHOUGH THE BASE MAY BE SECURELY CLAMPED TO THE CHASSIS, THE TUBE PROPER IS INSULATED AGAINST SHOCKS. THIS TYPE OF BASING ALSO PERMITS OPERATION AT HIGH ALTITUDES WITHOUT FLASH OVER. ANOTHER DESIGN FEATURE IS THE "CROSS PRESS" STEM WHICH KEEPS ELECTROLYSIS TO A MINIMUM WHILE OFFERING A STABLE SUPPORT FOR THE MOUNT STRUCTURE. THE USE OF A HARD GLASS BULB PERMITS THE TUBE TO BE PROCESSED AT HIGH TEMPERATURES DURING MANUFACTURE SO THAT IT WILL REMAIN GAS FREE UNDER THE HIGH TEMPERATURES ENCOUNTERED IN OPERATION. THE LOW DRAIN, FAST HEATING, RUGGED FILAMENT PERMITS INSTANT APPLICATION OF PLATE VOLTAGE OVER A LARGE PORTION OF THE OPERATING CHARACTERISTICS. (SEE CURVES).

ELECTRICAL DATA

FILAMENT VOLTAGE (± 10%) A.C.	5.0	VOLTS
FILAMENT CURRENT A.C.	2.0	AMPS.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATION

	INPUT TO FILTER		
	CHOKE	CAPACITOR	
AC PLATE VOLTAGE RMS PER PLATE	900	700	VAC
INPUT CONDENSER	---	4	Mfd
INPUT CHOKE	10	---	H
EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE	---	100	OHMS
DC OUTPUT CURRENT	165	275	MA.
DC OUTPUT VOLTAGE AT FULL LOAD	840	730	VDC
DC OUTPUT VOLTAGE AT HALF LOAD	860	800	VDC
REGULATION, HALF LOAD TO FULL LOAD	20	70	VDC

MECHANICAL DATA

MOUNTING POSITION	VERTICAL	
MAXIMUM OVERALL HEIGHT	5.41	INCHES
MAXIMUM SEATED HEIGHT	4.75	INCHES
MAXIMUM DIAMETER	2.06	INCHES
BULB, HARD GLASS	T-16	
BASE: SPECIAL SKIRTED OCTAL 5 PIN, GLASS FILLED ALKYD, INSULATION ZONE 5 OR BETTER.	SEE OUTLINE	

MAXIMUM RATING CHART

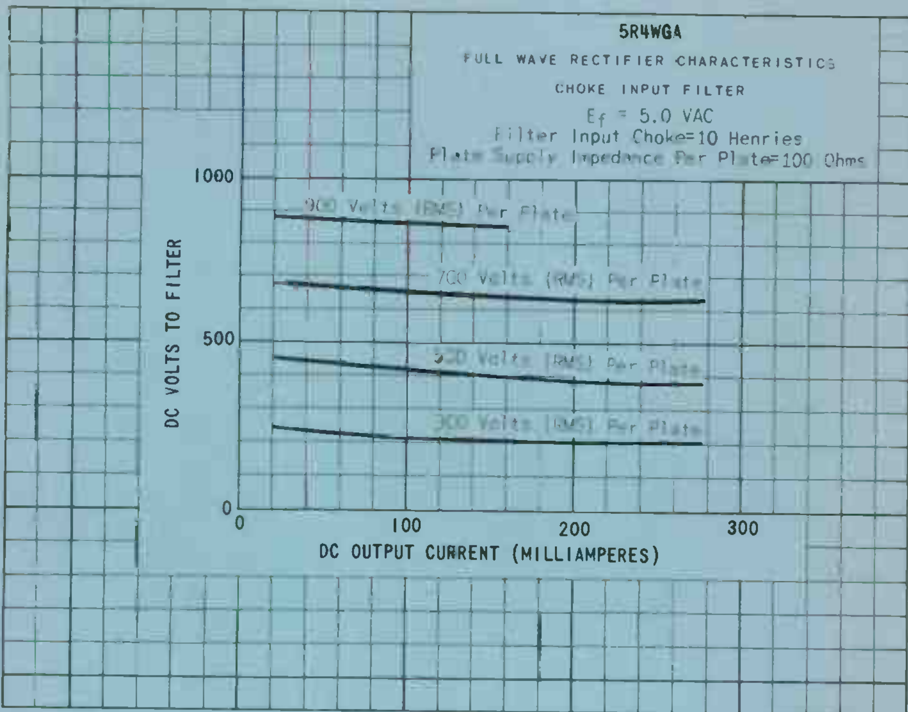
ALTITUDE	FILTER INPUT	PEAK INV. VOLTAGE	VOLTS RMS PER PLATE	MIN. SUPPLY IMPEDANCE PER PLATE
UP TO 30,000 FT.	4 µf	3050v⊕	1070v	575Ω⊕
UP TO 40,000 FT.	4 µf	2150⊕	760	---
	5 H SERIES	2500⊕	885	---
	4 µf	2800⊕	990	575⊕
UP TO 60,000 FT.	4 µf	1850⊕	655	---

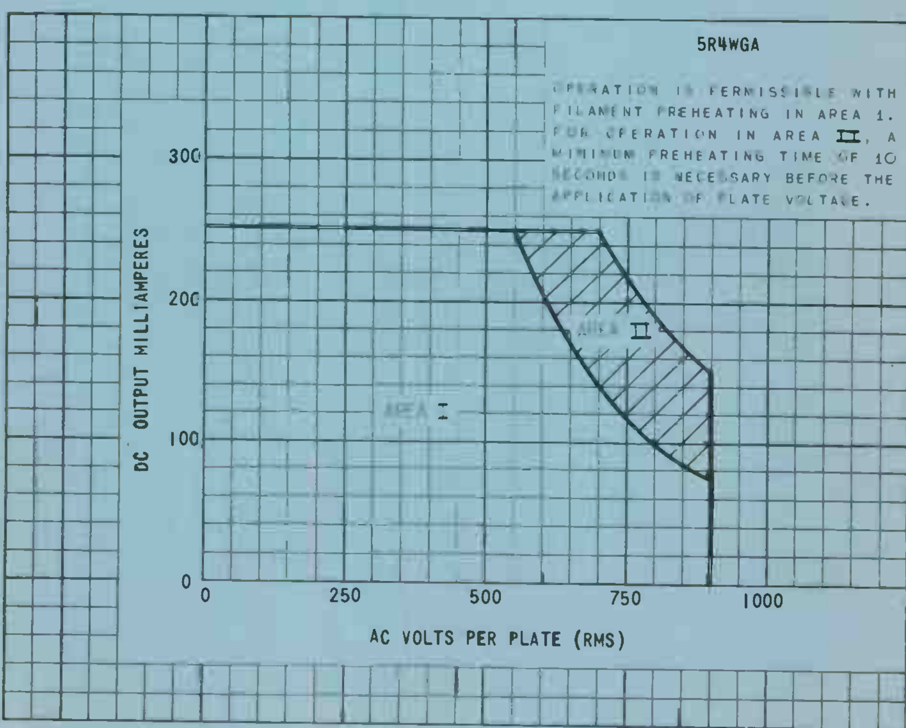
ALTITUDE	PEAK PLATE CURRENT	CURRENT	FULL LOAD VOLTAGE
UP TO 30,000 FT.	0 MA.⊕	0 MA.⊕	1525v
UP TO 40,000 FT.	700⊕	275⊕	770
	---	275⊕	650
	550	165⊕	1100
UP TO 60,000 FT.	700⊕	275⊕	625

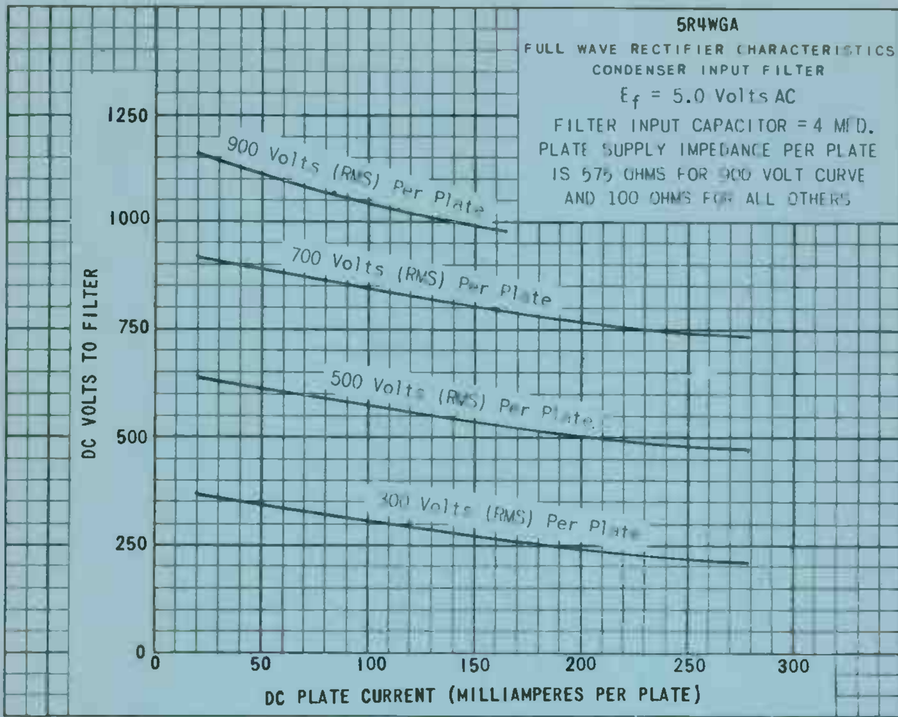
⊕INDICATES MAXIMUM RATINGS; ALL OTHERS INDICATE APPROXIMATE VALUES.

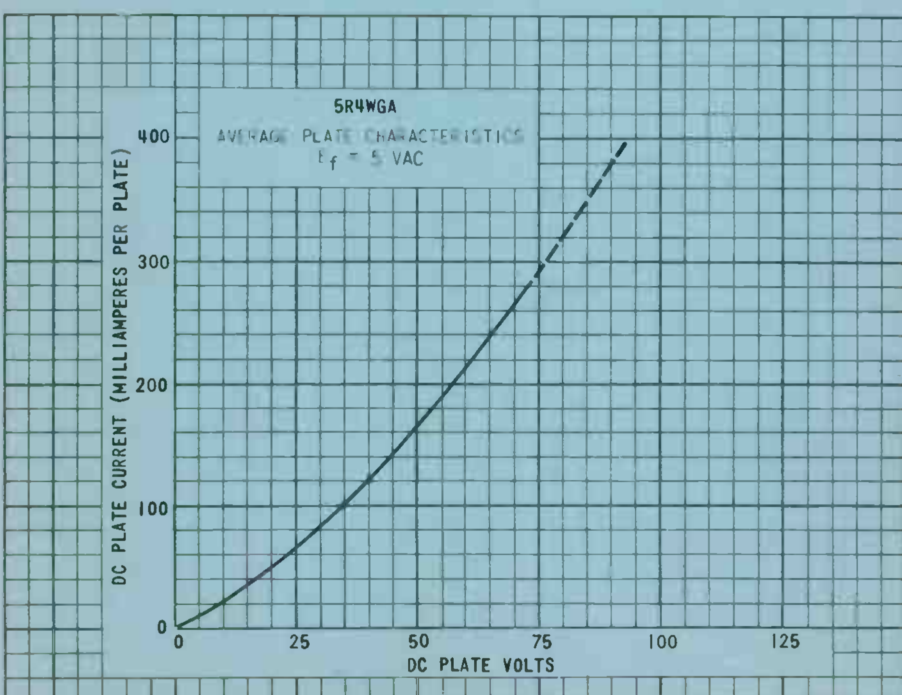
ALL VALUES ARE FOR E_f = 5.0 V. AND 30 SECONDS PREHEATING (NO PREHEATING IS NECESSARY FOR NO LOAD CONDITION). HIGHER VALUES OF FILTER CONDENSER CAPACITY MAY BE USED IF PLATE SUPPLY IMPEDANCE IS INCREASED TO KEEP PEAK PLATE CURRENT WITHIN RATINGS. FILTER VALUES ARE FOR 60 CYCLE OPERATION.

CONTINUED ON FOLLOWING PAGE


5R4WGA
FULL WAVE RECTIFIER CHARACTERISTICS
CHOKE INPUT FILTER
E_f = 5.0 VAC
Filter Input Choke=10 Henries
Plate Supply Impedance Per Plate=100 Ohms
900 Volts (RMS) Per Plate
700 Volts (RMS) Per Plate
500 Volts (RMS) Per Plate
300 Volts (RMS) Per Plate
DC VOLTS TO FILTER
1000
500
0
0
100
200
300
DC OUTPUT CURRENT (MILLIAMPERES)

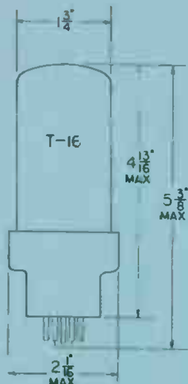

5R4WGA
OPERATION IS PERMISSIBLE WITH FILAMENT PREHEATING IN AREA 1. FOR OPERATION IN AREA II, A MINIMUM PREHEATING TIME OF 10 SECONDS IS NECESSARY BEFORE THE APPLICATION OF PLATE VOLTAGE.
AREA II
AREA I
DC OUTPUT MILLIAMPERES
300
200
100
0
0
250
500
750
1000
AC VOLTS PER PLATE (RMS)


5R4WGA
FULL WAVE RECTIFIER CHARACTERISTICS
CONDENSER INPUT FILTER
E_f = 5.0 Volts AC
FILTER INPUT CAPACITOR = 4 MFD.
PLATE SUPPLY IMPEDANCE PER PLATE
IS 575 OHMS FOR 900 VOLT CURVE
AND 100 OHMS FOR ALL OTHERS
900 Volts (RMS) Per Plate
700 Volts (RMS) Per Plate
500 Volts (RMS) Per Plate
300 Volts (RMS) Per Plate
DC VOLTS TO FILTER
0
250
500
750
1000
1250
0
50
100
150
200
250
300
DC PLATE CURRENT (MILLIAMPERES PER PLATE)


5R4WGA
AVERAGE PLATE CHARACTERISTICS
E_f = 5 VAC
DC PLATE CURRENT (MILLIAMPERES PER PLATE)
0
100
200
300
400
0
25
50
75
100
125
DC PLATE VOLTS

TUNG-SOL

FULL WAVE RECTIFIER



GLASS BULB
HARD GLASS

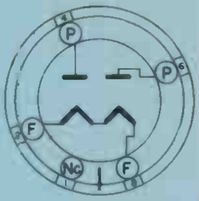
FILAMENT

5.0 VOLTS 2.0 AMP.

AC OR DC

VERTICAL MOUNTING POSITION

TUBE MAY BE OPERATED IN HORIZONTAL POSITION IF PINS # AND #4 ARE IN VERTICAL PLANE.



BOTTOM VIEW
SPECIAL SKIRTED
5 PIN OCTAL
5T

THE 5R4WGB IS A LONG LIFE, RUGGEDIZED, RELIABLE FULL WAVE RECTIFIER TUBE. WHILE SIMILAR IN CONSTRUCTION TO THE POPULAR 5R4WGA, THIS TUBE IS SUBJECTED TO MORE EXACTING REQUIREMENTS IN MANUFACTURE. THIS INCLUDES A 100% CHECK OF WELDS UNDER MAGNIFICATION. EVERY TUBE IS ELECTRICALLY STABILIZED WITH REPEATED COLD STARTS TO WEED OUT TUBES THAT ARE PRONE TO ARCING. THE 5R4WGB IS MADE IN "LOTS" WITH AN ENTIRE LOT BEING REJECTED UPON THE REJECTION OF SAMPLE TUBES. THIS IS OF PARTICULAR IMPORTANCE ON DESTRUCTIVE TESTS.

ONE OF THE DESIGN FEATURES IS THE SHOCK MOUNTING OF THE BULB IN A SKIRTED TYPE BASE BY A RESILIENT SILICONE RUBBER. THUS, ALTHOUGH THE BASE MAY BE SECURELY CLAMPED TO THE CHASSIS, THE TUBE PROPER IS INSULATED AGAINST SHOCKS. THIS TYPE OF BASING ALSO PERMITS OPERATION AT HIGH ALTITUDES WITHOUT FLASH OVER. ANOTHER DESIGN FEATURE IS THE "CROSS PRESS" STEM WHICH KEEPS ELECTROLYSIS TO A MINIMUM WHILE OFFERING A STABLE SUPPORT FOR THE MOUNT STRUCTURE. THE USE OF A HARD GLASS BULB PERMITS THE TUBE TO BE PROCESSED AT HIGH TEMPERATURES DURING MANUFACTURE SO THAT IT WILL REMAIN GAS FREE UNDER THE HIGH TEMPERATURES ENCOUNTERED IN OPERATION. THE LOW DRAIN, FAST HEATING, RUGGED FILAMENT PERMITS INSTANT APPLICATION OF PLATE VOLTAGE OVER A LARGE PORTION OF THE OPERATING CHARACTERISTICS. (SEE CURVES).

ELECTRICAL DATA

FILAMENT VOLTAGE (± 10%) A.C.	5.0	VOLTS
FILAMENT CURRENT A.C.	2.0	AMPS.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATION

	INPUT TO FILTER CHOKE	INPUT TO FILTER CAPACITOR	
AC PLATE VOLTAGE RMS PER PLATE	900	700	VAC
INPUT CONDENSER	---	4	Mfd
INPUT CHOKE	10	---	H
EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE	---	100	OHMS
DC OUTPUT CURRENT	165	275	MA.
DC OUTPUT VOLTAGE AT FULL LOAD	840	730	VDC
DC OUTPUT VOLTAGE AT HALF LOAD	860	800	VDC
REGULATION, HALF LOAD TO FULL LOAD	20	70	VDC

MECHANICAL DATA

MOUNTING POSITION	VERTICAL	
MAXIMUM OVERALL HEIGHT	5.31	INCHES
MAXIMUM SEATED HEIGHT	4.75	INCHES
MAXIMUM DIAMETER	2.06	INCHES
BULB, HARD GLASS	T-16	
BASE: SPECIAL SKIRTED OCTAL 5 PIN, GLASS FILLED ALKYD, INSULATION ZONE 5 OR BETTER.	SEE OUTLINE	

MAXIMUM RATING CHART

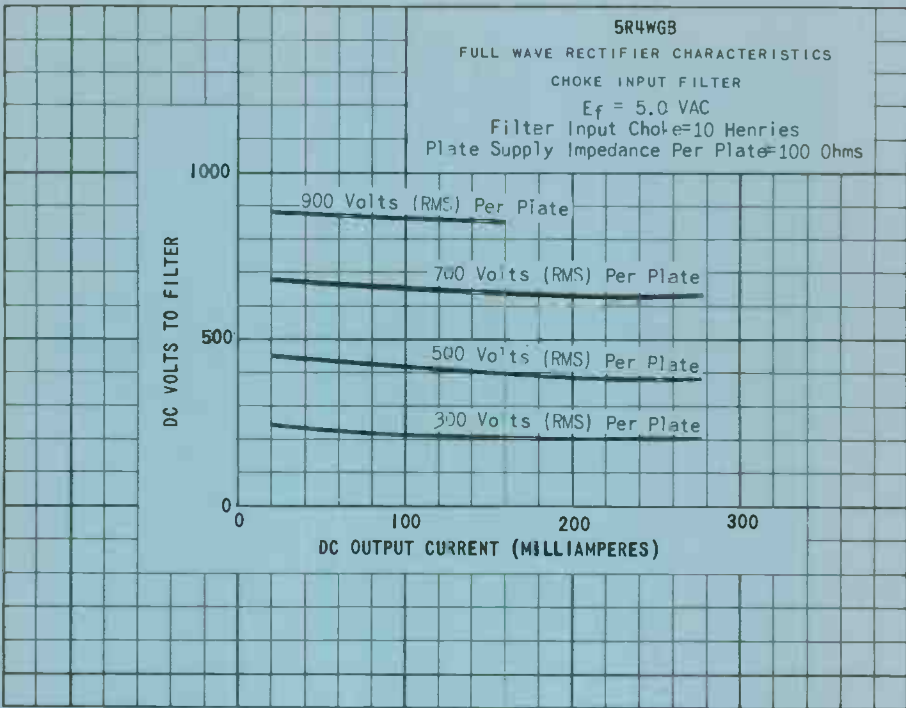
ALTITUDE	FILTER INPUT	PEAK INV. VOLTAGE	VOLTS RMS PER PLATE	MIN. SUPPLY IMPEDANCE PER PLATE
UP TO 30,000 FT.	4 µf	3050v⊕	1070v	575Ω⊕
UP TO 40,000 FT.	4 µf	2150⊕	760	---
	5 HENRIES	2300⊕	815	---
	4 µf	2800⊕	990	575⊕
UP TO 60,000 FT.	4 µf	1850⊕	655	---

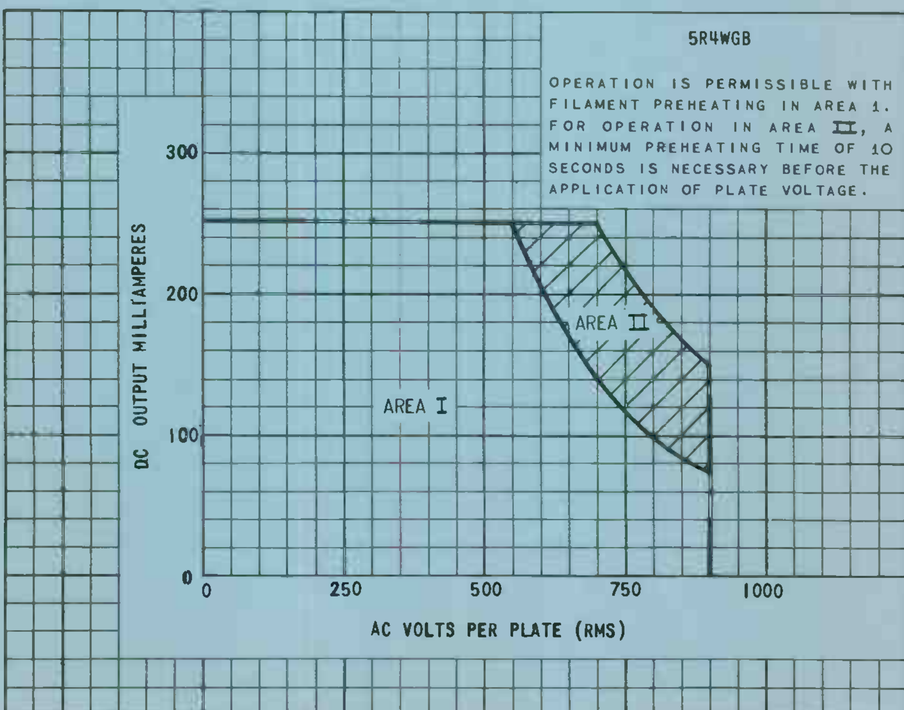
ALTITUDE	PEAK PLATE CURRENT	CURRENT	FULL LOAD VOLTAGE
UP TO 30,000 FT.	0 MA.⊕	0 MA.⊕	1525v
UP TO 40,000 FT.	700⊕	275⊕	770
	---	275⊕	650
	550	165⊕	1100
UP TO 60,000 FT.	700⊕	275⊕	620

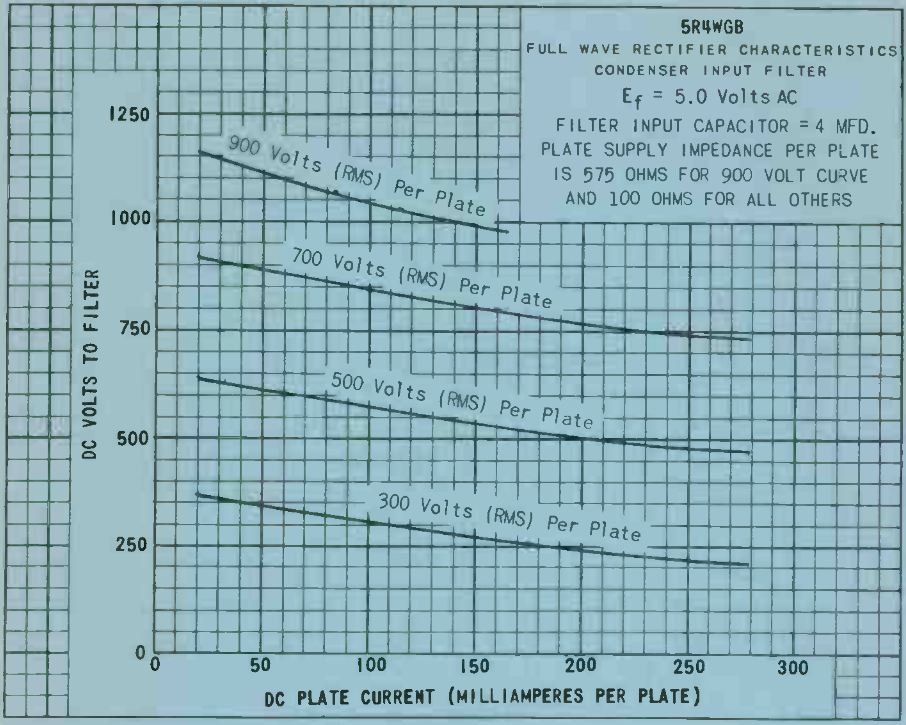
⊕INDICATES MAXIMUM RATINGS; ALL OTHERS INDICATE APPROXIMATE VALUES.

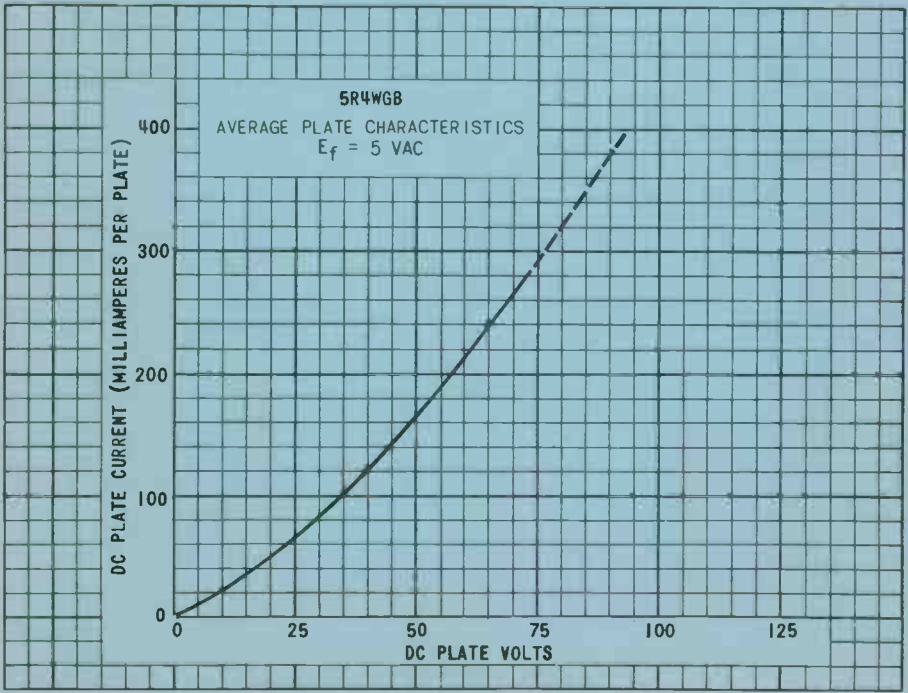
ALL VALUES ARE FOR E_f = 5.0 V. AND 10 SECONDS PREHEATING (NO PREHEATING IS NECESSARY FOR NO LOAD CONDTIONS). HIGHER VALUES OF FILTER CONDENSER CAPACITY MAY BE USED IF PLATE SUPPLY IMPEDANCE IS INCREASED TO KEEP PEAK PLATE CURRENT WITHIN RATINGS. FILTER VALUES ARE FOR 60 CYCLE OPERATION.

CONTINUED ON FOLLOWING PAGE


5R4WGB
FULL WAVE RECTIFIER CHARACTERISTICS
CHOKE INPUT FILTER
E_f = 5.0 VAC
Filter Input Choke=10 Henries
Plate Supply Impedance Per Plate=100 Ohms
900 Volts (RMS) Per Plate
700 Volts (RMS) Per Plate
500 Volts (RMS) Per Plate
300 Volts (RMS) Per Plate
DC VOLTS TO FILTER
1000
500
0
0
100
200
300
DC OUTPUT CURRENT (MILLIAMPERES)


5R4WGB
OPERATION IS PERMISSIBLE WITH FILAMENT PREHEATING IN AREA 1. FOR OPERATION IN AREA II, A MINIMUM PREHEATING TIME OF 10 SECONDS IS NECESSARY BEFORE THE APPLICATION OF PLATE VOLTAGE.
AREA I
AREA II
DC OUTPUT MILLIAMPERES
300
200
100
0
0
250
500
750
1000
AC VOLTS PER PLATE (RMS)


5R4WGB
FULL WAVE RECTIFIER CHARACTERISTICS
CONDENSER INPUT FILTER
E_f = 5.0 Volts AC
FILTER INPUT CAPACITOR = 4 MFD.
PLATE SUPPLY IMPEDANCE PER PLATE IS 575 OHMS FOR 900 VOLT CURVE AND 100 OHMS FOR ALL OTHERS
900 Volts (RMS) Per Plate
700 Volts (RMS) Per Plate
500 Volts (RMS) Per Plate
300 Volts (RMS) Per Plate
DC VOLTS TO FILTER
0
250
500
750
1000
1250
0
50
100
150
200
250
300
DC PLATE CURRENT (MILLIAMPERES PER PLATE)


5R4WGB
AVERAGE PLATE CHARACTERISTICS
E_f = 5 VAC
DC PLATE CURRENT (MILLIAMPERES PER PLATE)
0
100
200
300
400
0
25
50
75
100
125
DC PLATE VOLTS

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

ADDITIONAL TESTS TO INSURE RELIABILITY

ALL TUBES: OPERATION (1): epx = 2800 Vac; FULL WAVE; $Z_{p/p}$ = 500; C_L = 4 mfd; R_L = 7000 OHMS; t_k = 10 I_o > 140 mAdc

OPERATION (2): $E_{pp/p}$ = 850 Vac, FULL WAVE; C_L = 4mfd; R_L = 3500 OHMS, t_k = 10; $Z_{p/p}$ ADJUSTED FOR A BOGIE TUBE TO READ 260 mAdc, AND I_b NOT LESS THAN 630 mA PER PLATE. (A BOGIE TUBE IS A TUBE WITH A DROP OF 75Vdc AT 320 mAdc PER PLATE) I_o > 245 mA.

STABILIZATION: 6 HOURS AT E_F = 5.0Vac; $E_{pp/p}$ = 800 Vac; Io = 300 mAdc; R_L = 3000; t_k = 0 (CYCLED 15 MINUTES ON 5 MINUTES OFF)

RANDOM SAMPLE TESTED FOR THE FOLLOWING:

LOW PRESSURE VOLTAGE BREAKDOWN:

1). $E_{pp/p}$ = 1050Vac; FULL WAVE; R_L/I_o = 165 mAdc; t_k = 10SEC; C_L = 4 mfd, $Z_{ptotal/p}$ = 500 Ω; PRESSURE 140 mm (40000ft.)

2). epx = 1850 Vac; R_L/I_o = 275 mAdc; t_k = 10 SEC; C_L = 4 mfd; Zptotal/p = 200Ω; FULL WAVE; PRESSURE = 55 mm (60000 ft.)

SHOCK: 60° HAMMER ANGLE IN NAVY FLYWEIGHT, HIGH IMPACT MACHINE (900G/mSEC).

FATIGUE: 25 CPS, 0.30" TOTAL DISPLACEMENT, FOR 32 HOURS IN EACH OF THESE MUTUALLY PERPENDICULAR PLANES (2.5 G).

POST SHOCK AND FATIGUE TEST END POINT:
OPERATION (2) I_o > 240 mAdc.

LIFE TEST:

FILAMENT CYCLING: 2000 CYCLES; E_f = 5.5 Vac; 1 MINUTE ON, 1 MINUTE OFF PER CYCLE. (FILAMENT VOLTAGE REGULATION 3% NO LOAD TO FULL LOAD).

INTERMITTENT LIFE TEST

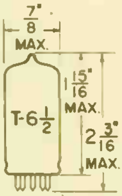
OPERATION (2) 100 HOURS	I_o > 245 mAdc.
OPERATION (2) 500 HOURS	I_o > 240 mAdc.
OPERATION (2) 1000 HOURS	I_o > 240 mAdc.

PRINTED IN U. S. A.

TUNG-SOL

TRIPLE-DIODE TRIODE

MINIATURE TYPE

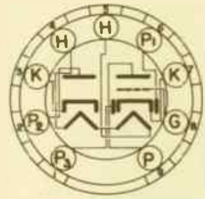


GLASS BULB

COATED UNIPOTENTIAL CATHODES

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

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	

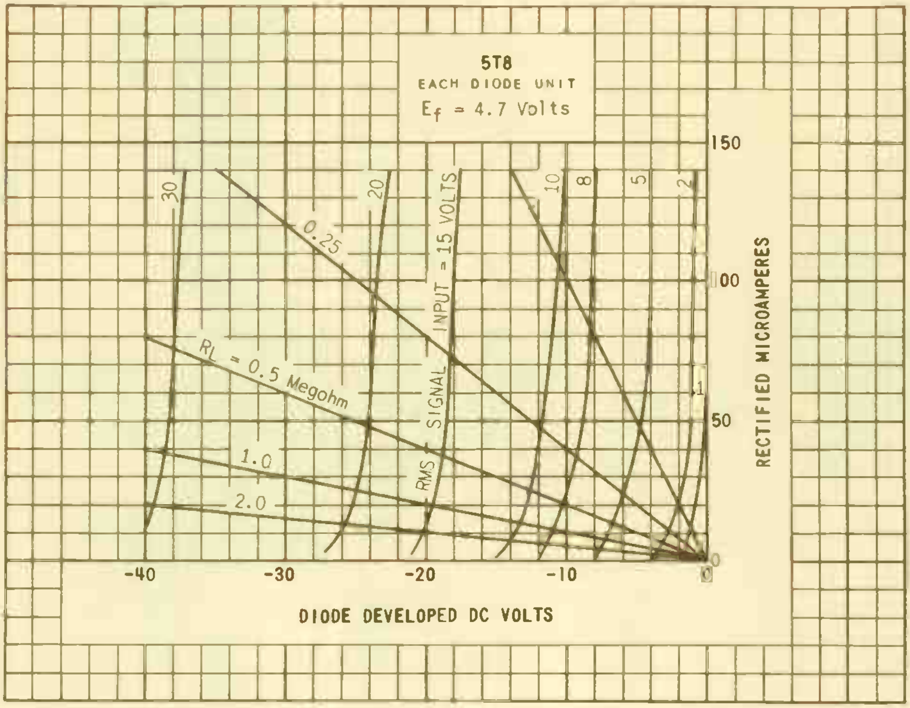
[A] WITH EXTERNAL SHIELD #315 CONNECTED TO PIN #7.

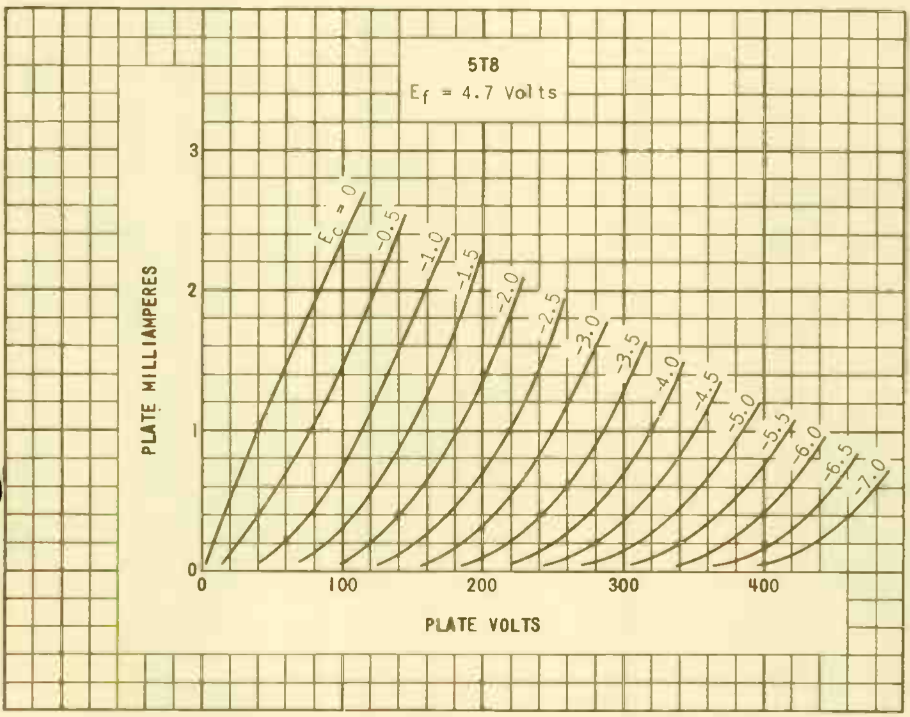
[B] WITH EXTERNAL SHIELD #315 CONNECTED TO PIN #3.

[C] WITH EXTERNAL SHIELD #315 CONNECTED TO PINS #4 AND #5.

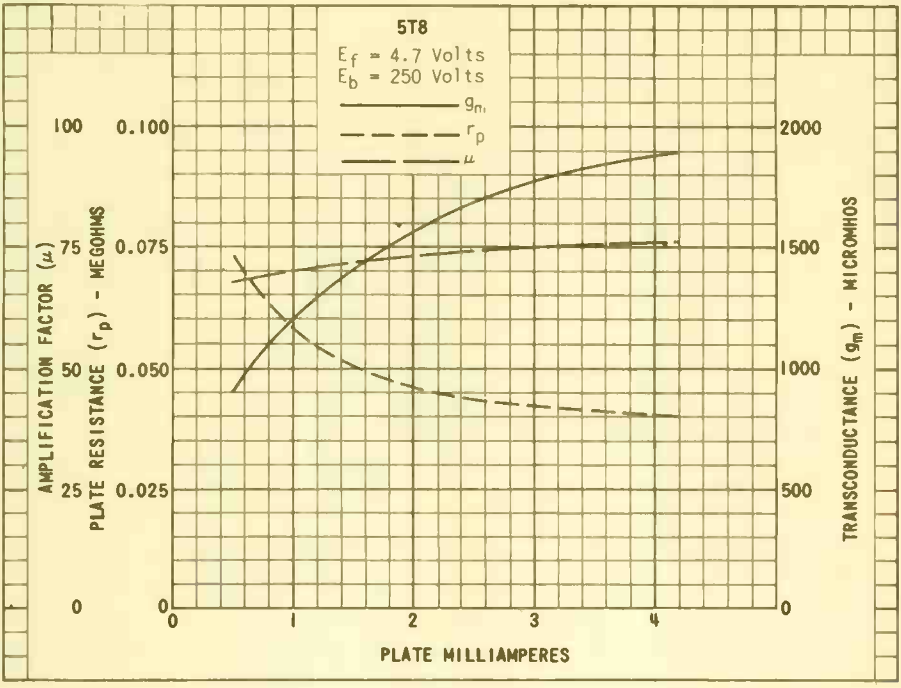
** HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER, IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

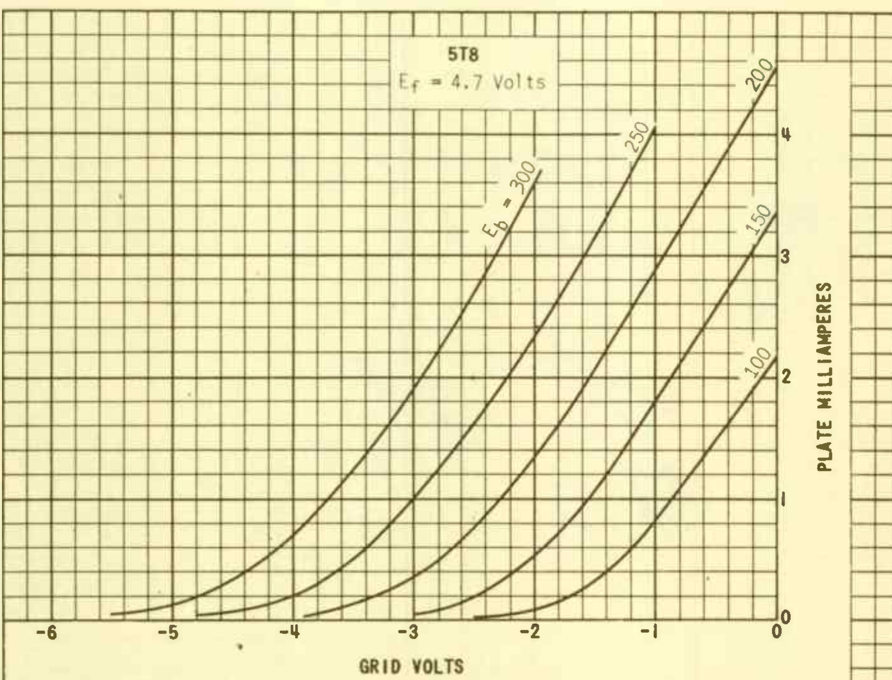
→ INDICATES A CHANGE.


5T8
EACH DIODE UNIT
E_f = 4.7 Volts
RMS SIGNAL INPUT = 15 VOLTS
30
20
10
8
5
2
1
0.25
RL = 0.5 Megohm
1.0
2.0
150
100
50
0
RECTIFIED MICROAMPERES
-40
-30
-20
-10
0
DIODE DEVELOPED DC VOLTS


5T8
E_f = 4.7 Volts
E_c = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-5.5
-6.0
-6.5
-7.0
PLATE MILLIAMPERES
3
2
1
0
0
100
200
300
400
PLATE VOLTS

5T8


5T8
Ef = 4.7 Volts
Eb = 250 Volts
gm
rp
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (rp) - MEGOHMS
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE MILLIAMPERES
100 0.100 2000
75 0.075 1500
50 0.050 1000
25 0.025 500
0 0 0
0 1 2 3 4


5T8
Ef = 4.7 Volts
Eb = 300
250
200
150
100
PLATE MILLIAMPERES
GRID VOLTS
-6 -5 -4 -3 -2 -1 0
0 1 2 3 4

TUNG-SOL

RESISTANCE COUPLED AMPLIFIER

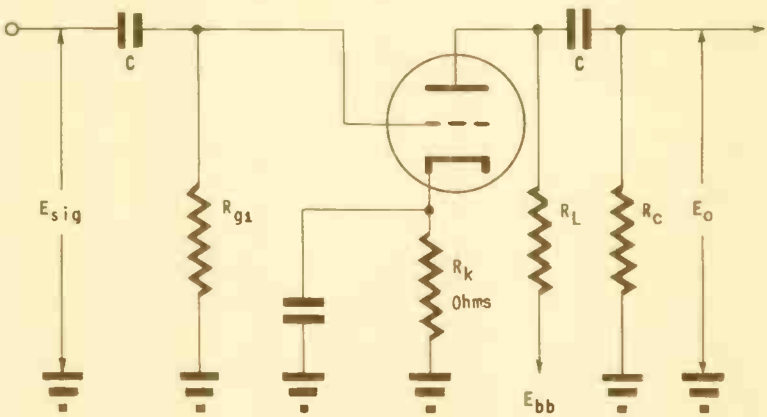
R1 MEG.	Rg1 MEG.	Rc MEG.	Ebb = 90 VOLTS Rk	GAIN	Eo	Ebb = 180 VOLTS Rk	GAIN	Eo	Ebb = 300 VOLTS Rk	GAIN	Eo
0.10	A	0.10	5700	21	7	2400	29	18	1800	33	35
0.10	A	0.24	6100	26	9	2700	34	23	2000	38	42
0.24	A	0.24	9100	30	10	4300	40	24	3000	44	43
0.24	A	0.51	10000	34	13	4700	45	31	3300	49	52
0.51	A	0.51	15000	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.

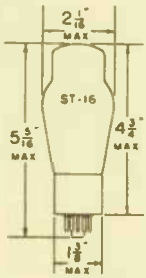
Eo IS RMS OUTPUT AT 5% TOTAL HARMONIC DISTORTION.

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.

TUNG-SOL



5U4G - MEDIUM 5 PIN OCTAL BASE
5X4G - MEDIUM 8 PIN OCTAL BASE

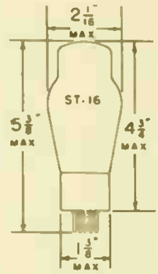
FULL WAVE

HIGH VACUUM RECTIFIER

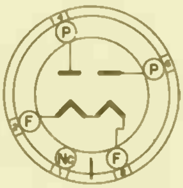
COATED FILAMENT

5.0 VOLTS 3.0 AMPERES
AC

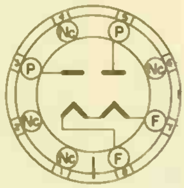
GLASS BULB



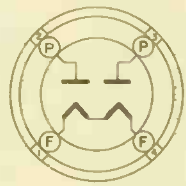
5Z3 - MEDIUM 4 PIN BASE



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

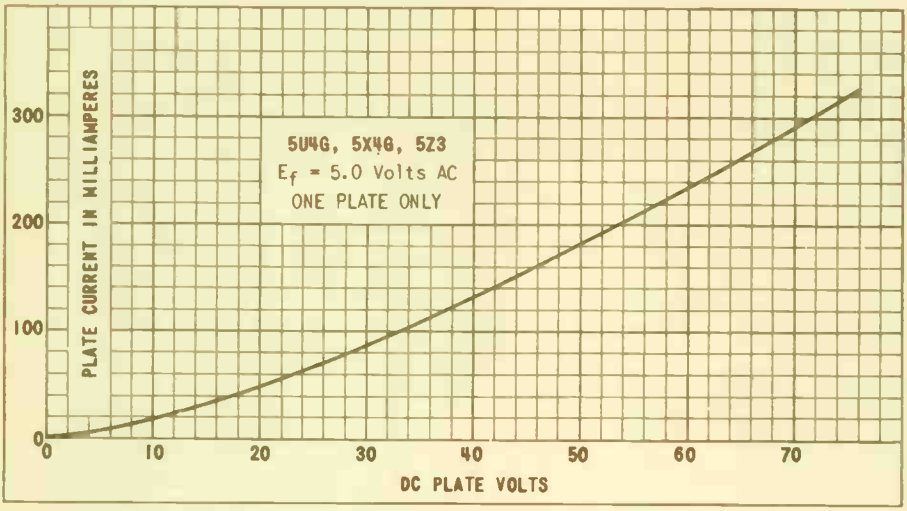
[A] WHEN FILTER CONDENSERS LARGER THAN 40 μfds ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

CONTINUED NEXT PAGE

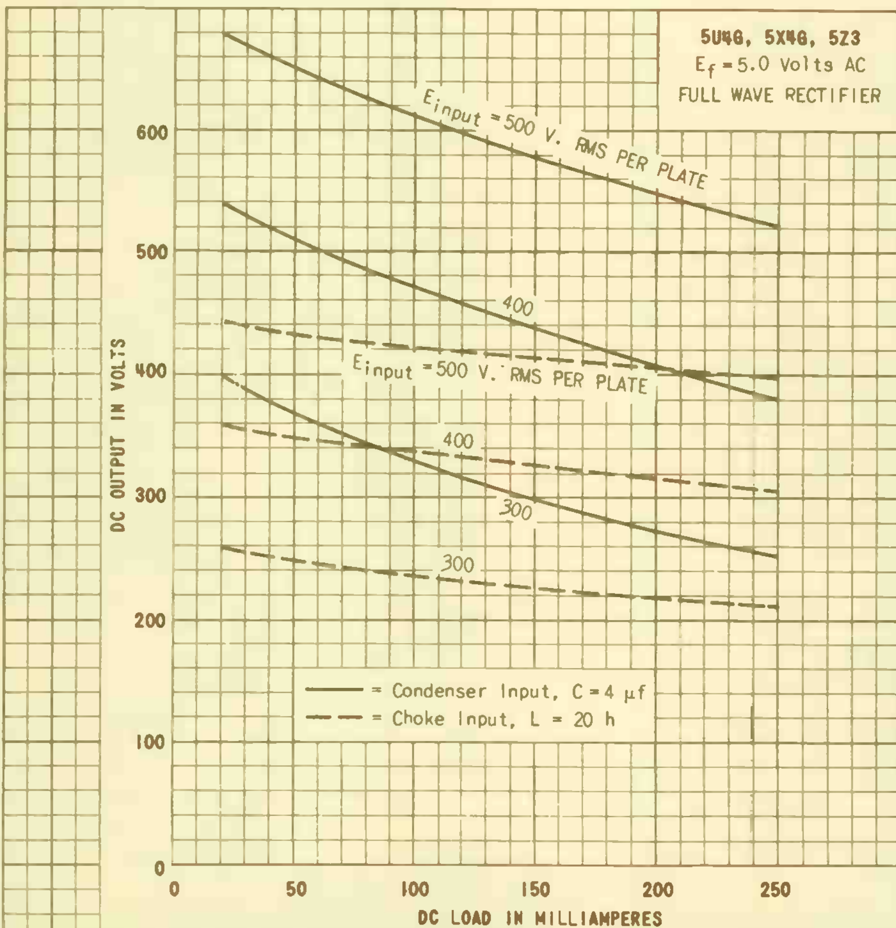
PRINTED IN U.S.A.

PLATE 687-2

JAN. 29 1940



5U4G, 5X4G, 5Z3
E_f = 5.0 Volts AC
ONE PLATE ONLY
PLATE CURRENT IN MILLIAMPERES
0
100
200
300
0
10
20
30
40
50
60
70
DC PLATE VOLTS

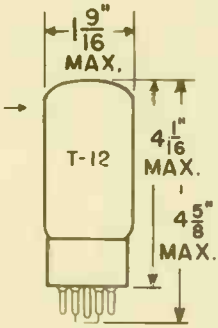


5U4G, 5X4G, 5Z3
E_f = 5.0 Volts AC
FULL WAVE RECTIFIER
E_{input} = 500 V. RMS PER PLATE
400
E_{input} = 500 V. RMS PER PLATE
400
300
300
= Condenser Input, C = 4 μf
= Choke Input, L = 20 h
DC OUTPUT IN VOLTS
0
100
200
300
400
500
600
0
50
100
150
200
250
DC LOAD IN MILLIAMPERES

PLATE
688-1

TUNG-SOL

DOUBLE DIODE



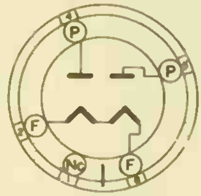
GLASS BULB

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

TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

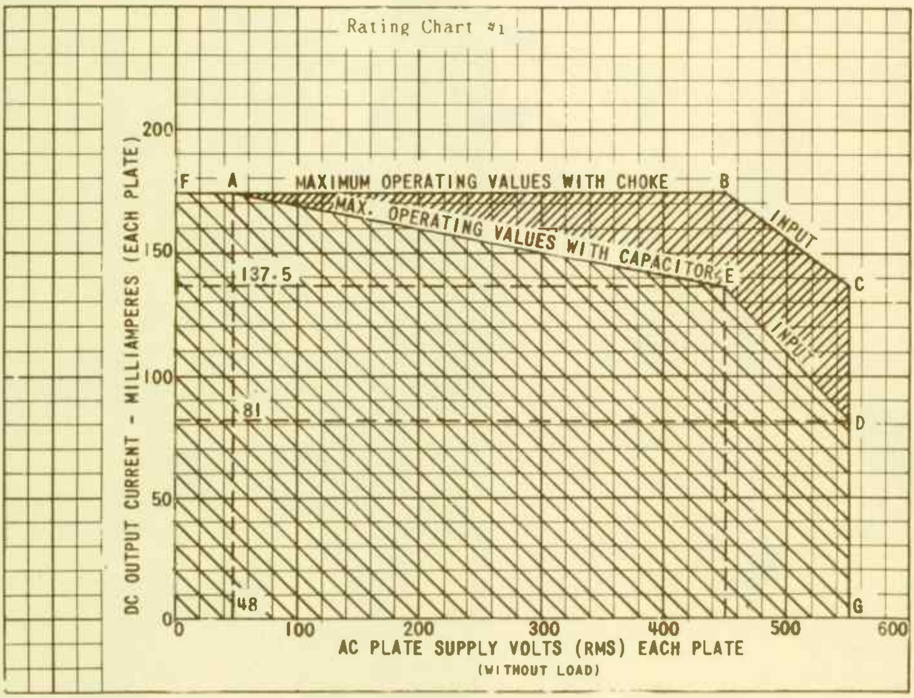
FULL-WAVE RECTIFIER - CAPACITOR INPUT FILTER

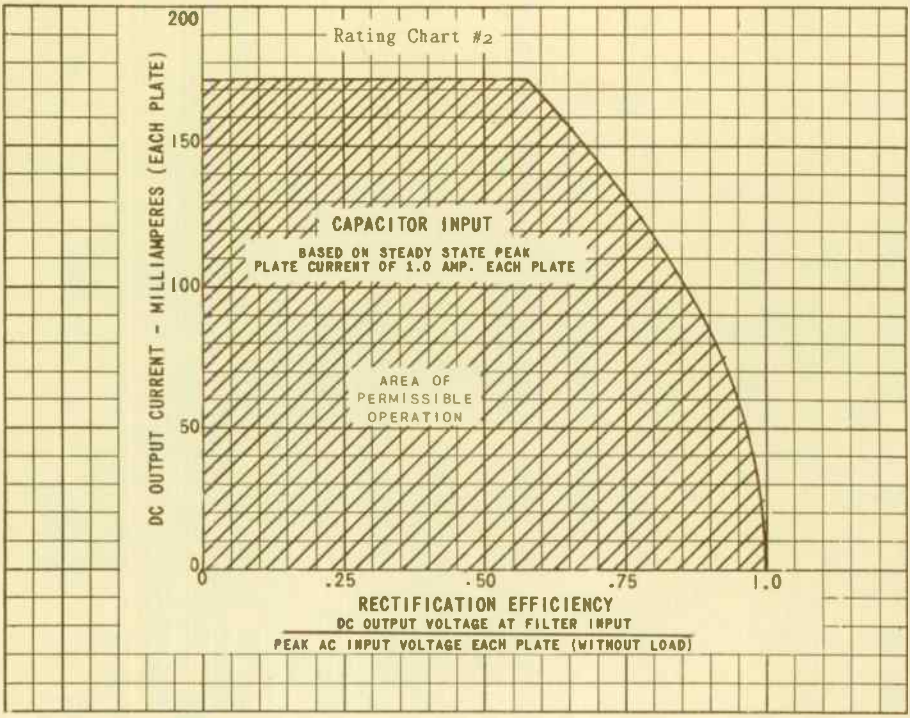
FILAMENT VOLTAGE	5.0		VOLTS
FILAMENT CURRENT	3.0		AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS[B]	300	450	VOLTS
FILTER INPUT CAPACITOR	40	40	μf
EFFECTIVE PLATE-SUPPLY RESISTANCE (EACH PLATE)	21	67	OHMS
DC OUTPUT CURRENT	300	275	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	290	460	VOLTS

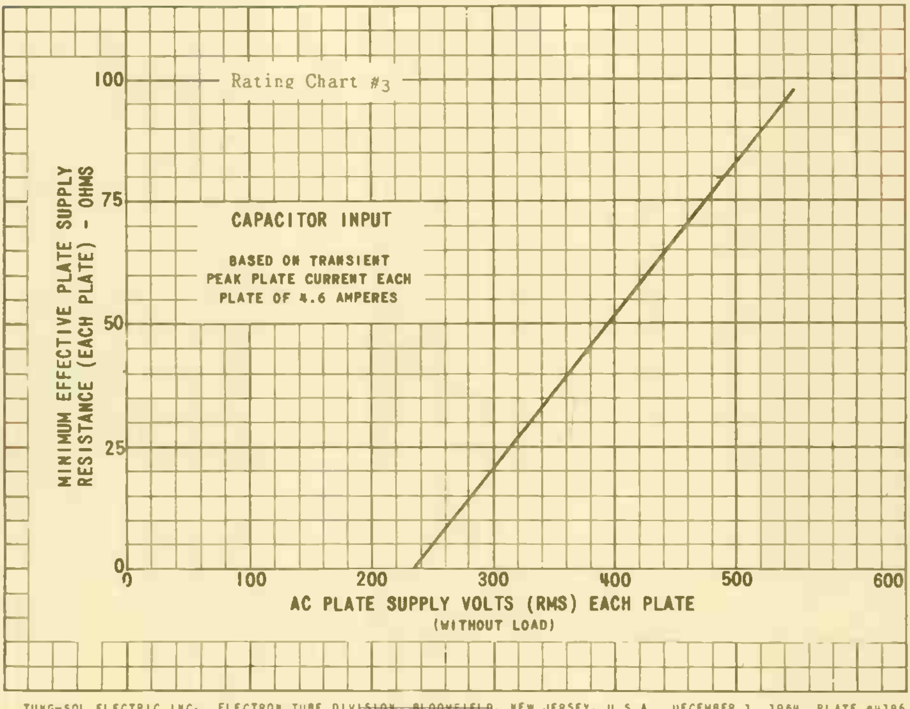
FULL-WAVE RECTIFIER - CHOKE INPUT FILTER

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.




Rating Chart #2
200
150
100
50
0
DC OUTPUT CURRENT - MILLIAMPERES (EACH PLATE)
CAPACITOR INPUT
BASED ON STEADY STATE PEAK
PLATE CURRENT OF 1.0 AMP. EACH PLATE
AREA OF
PERMISSIBLE
OPERATION
0
.25
.50
.75
1.0
RECTIFICATION EFFICIENCY
DC OUTPUT VOLTAGE AT FILTER INPUT
PEAK AC INPUT VOLTAGE EACH PLATE (WITHOUT LOAD)


Rating Chart #3
100
75
50
25
0
MINIMUM EFFECTIVE PLATE SUPPLY
RESISTANCE (EACH PLATE) - OHMS
CAPACITOR INPUT
BASED ON TRANSIENT
PEAK PLATE CURRENT EACH
PLATE OF 4.6 AMPERES
0
100
200
300
400
500
600
AC PLATE SUPPLY VOLTS (RMS) EACH PLATE
(WITHOUT LOAD)

TUNG-SOL

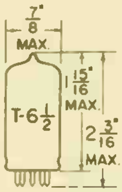
TRIODE PENTODE

MINIATURE TYPE

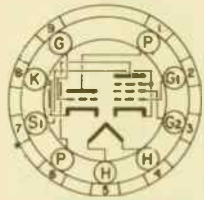
COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AE

THE 5U8 COMBINES TWO ELECTRICALLY INDEPENDENT SECTIONS, A TRIODE AND A PENTODE, IN THE 9 PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. BOTH UNITS ARE CAPABLE OF GOOD PERFORMANCE AT THE HIGH FREQUENCIES. THE TUBE MAY BE USED AS A LOCAL OSCILLATOR-PENTODE MIXER FOR FM OR TELEVISION RECEIVERS OR IN THE MANY COMBINED FUNCTIONS OF SUCH 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 6U8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315	WITHOUT SHIELD	
PENTODE GRID #1 TO PENTODE PLATE: (G_1 TO P)	0.006	0.01 MAX.	µµf
PENTODE INPUT: G_1 TO (H+K&G_3&IS+G_2)	5	5	µµf
PENTODE OUTPUT: P TO (H+K&G_3&IS+G_2)	3.5	2.6	µµf
TRIODE GRID TO TRIODE PLATE: (G TO P)	1.8	1.8	µµf
TRIODE GRID TO CATHODE: G TO (H+K)	2.5	2.5	µµf
TRIODE PLATE TO CATHODE: P TO (H+K)	1	0.4	µµf
CATHODE TO HEATER: (K TO H) EACH SECTION (APPROX.)	3	3	µµf

RATINGS

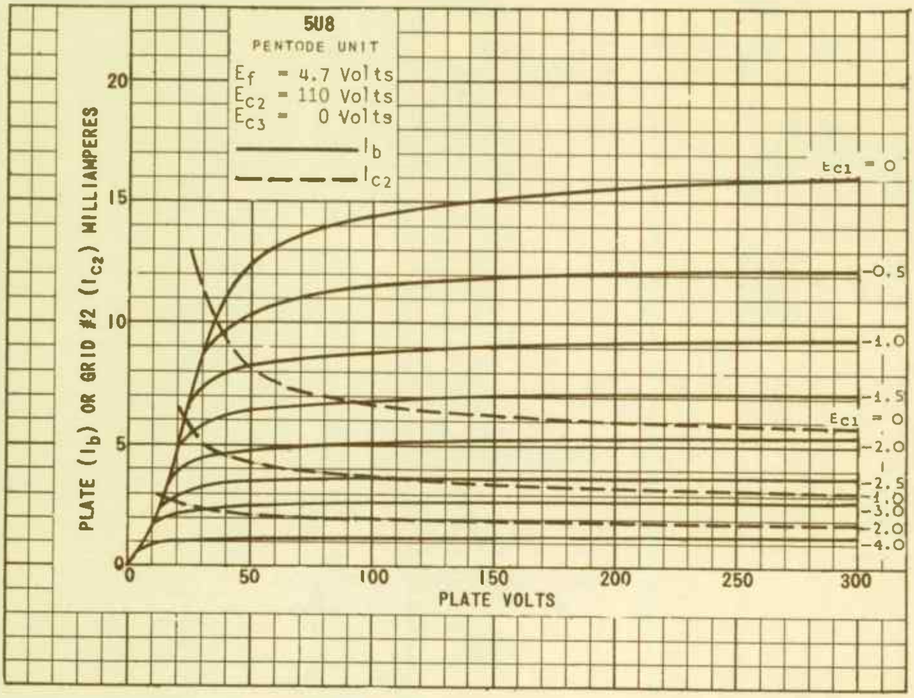
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

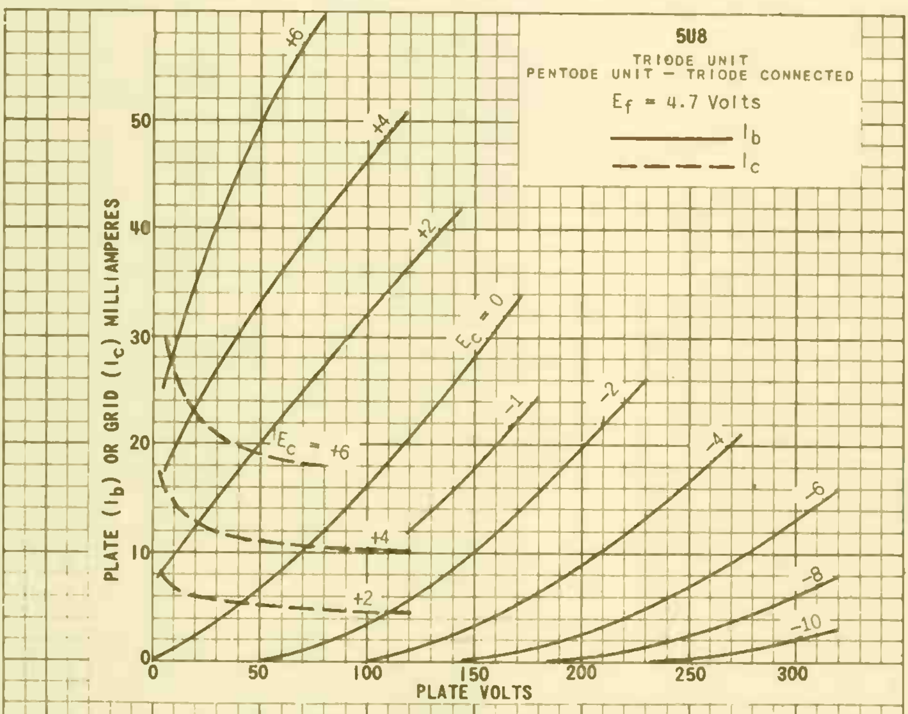
	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	4.7		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 VOLTAGE		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

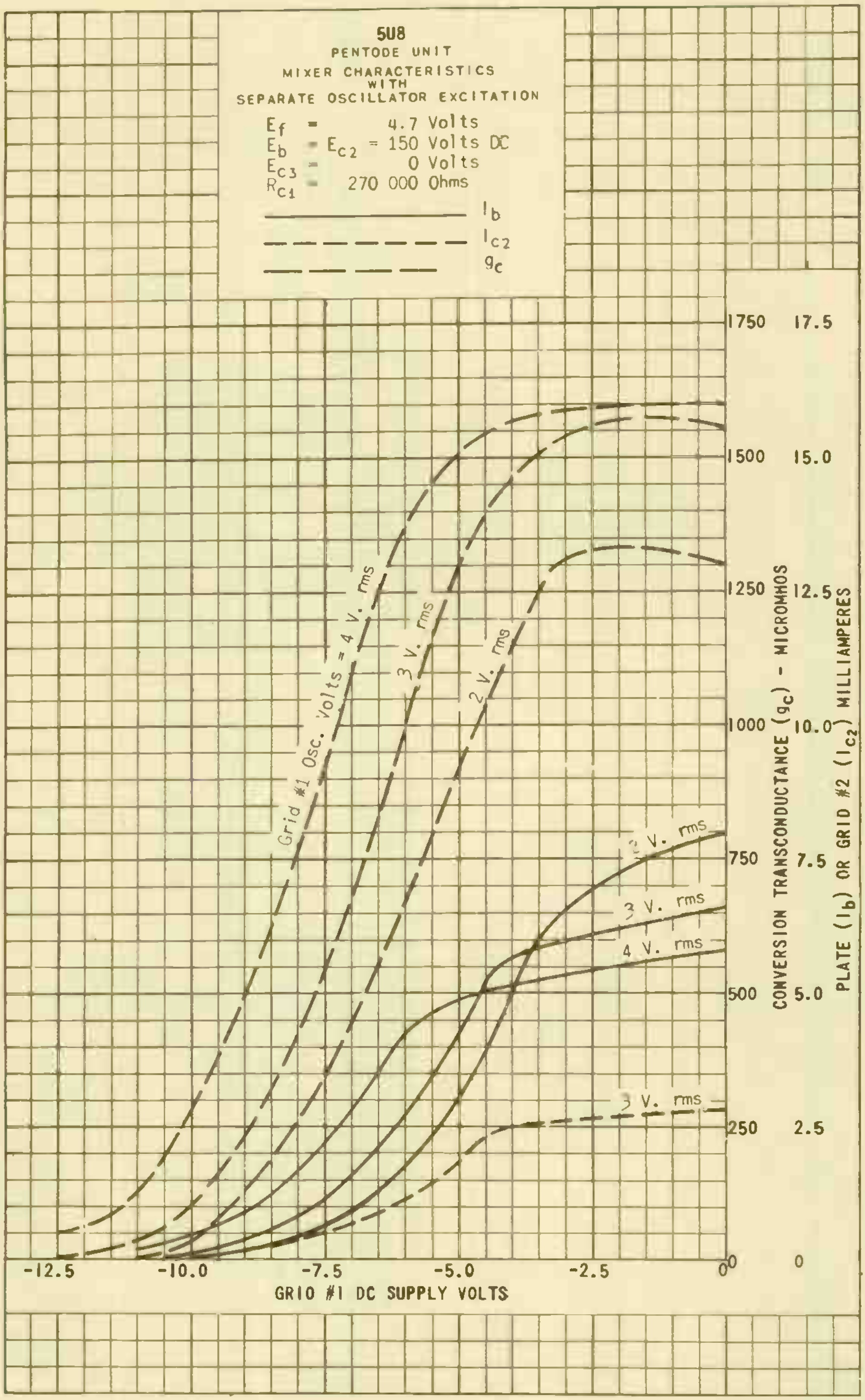
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

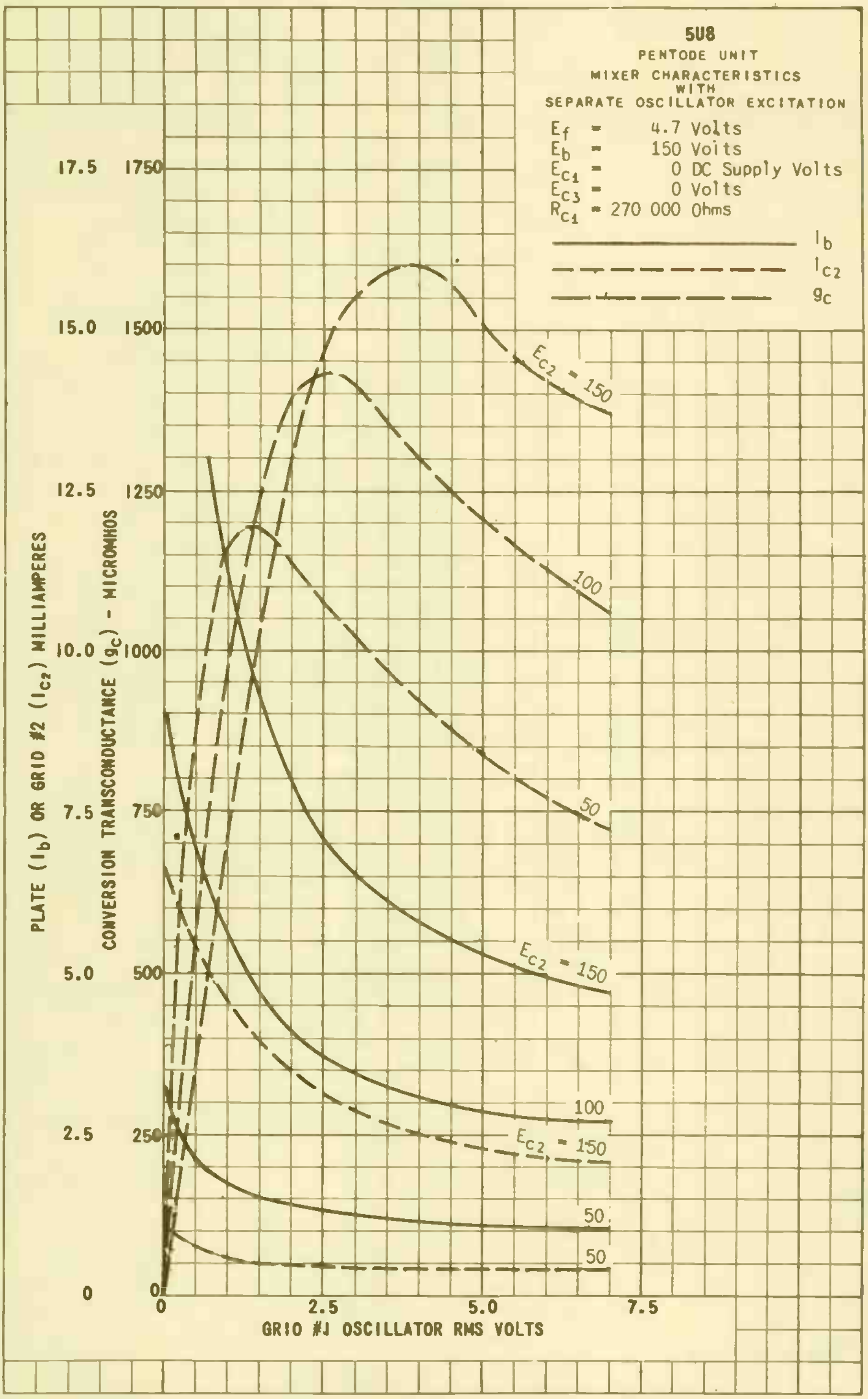
	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	4.7		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	150	250	VOLTS
GRID #2 VOLTAGE	---	110	VOLTS
CATHODE RESISTOR	56	68	OHMS
TRANSCONDUCTANCE	8 500	5 200	µMHOS
PLATE RESISTANCE (APPROX.)	0.005	0.4	MEGOHM
AMPLIFICATION FACTOR	40	---	
PLATE CURRENT	18	10	MA.
GRID #2 CURRENT	---	3.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µA.	-12	-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.


5U8
PENTODE UNIT
E_f = 4.7 Volts
E_{c2} = 110 Volts
E_{c3} = 0 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
E_{c1} = 0
-2.0
-2.5
-1.0
-3.0
-2.0
-4.0


5U8
TRIODE UNIT
PENTODE UNIT – TRIODE CONNECTED
E_f = 4.7 Volts
I_b
I_c
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
+6
+4
+2
E_c = 0
-1
-2
-4
-6
-8
-10
E_c = +6
+4
+2

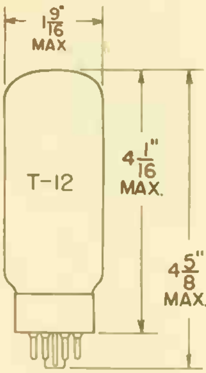

5U8
PENTODE UNIT
MIXER CHARACTERISTICS
WITH
SEPARATE OSCILLATOR EXCITATION
E_f = 4.7 Volts
E_b = E_{c2} = 150 Volts DC
E_{c3} = 0 Volts
R_{c1} = 270 000 Ohms
I_b
I_{c2}
g_c
Grid #1 Osc. Volts = 4 V. rms
3 V. rms
2 V. rms
2 V. rms
3 V. rms
4 V. rms
3 V. rms
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID #1 DC SUPPLY VOLTS
1750
1500
1250
1000
750
500
250
0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0
CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES



5U8
PENTODE UNIT
MIXER CHARACTERISTICS
WITH
SEPARATE OSCILLATOR EXCITATION
E_f = 4.7 Volts
E_b = 150 Volts
E_{c1} = 0 DC Supply Volts
E_{c3} = 0 Volts
R_{c1} = 270 000 Ohms
I_b
I_{c2}
g_c
E_{c2} = 150
100
50
E_{c2} = 150
100
50
E_{c2} = 150
50
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0
1750
1500
1250
1000
750
500
250
0
0
2.5
5.0
7.5
GRID #1 OSCILLATOR RMS VOLTS

TUNG-SOL

TWIN DIODE



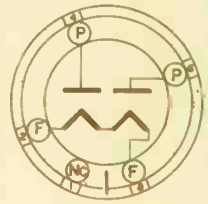
GLASS BULB

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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

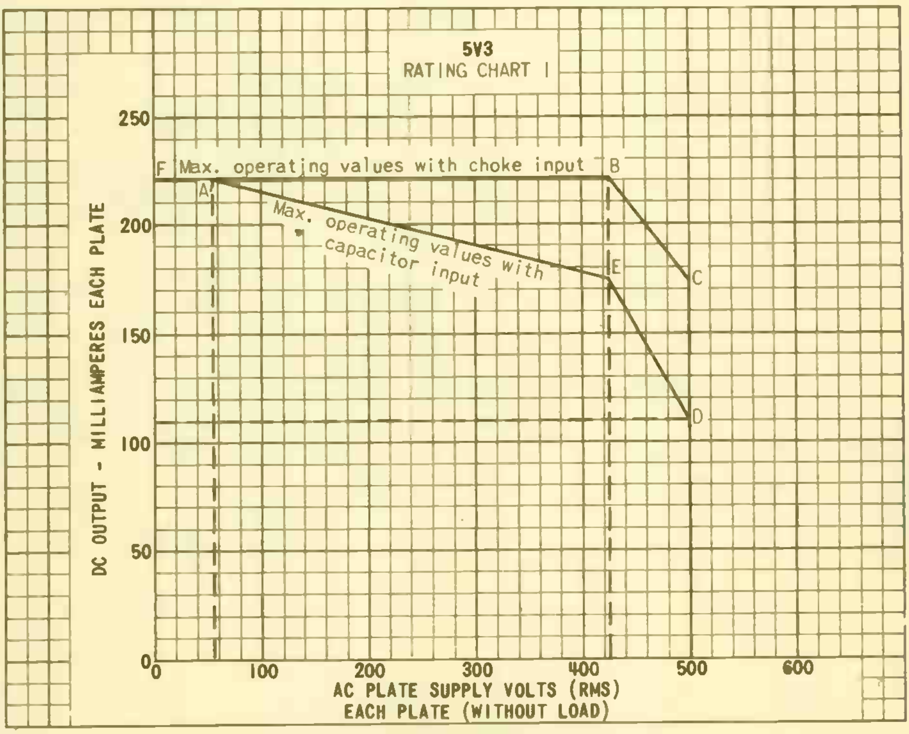
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D.

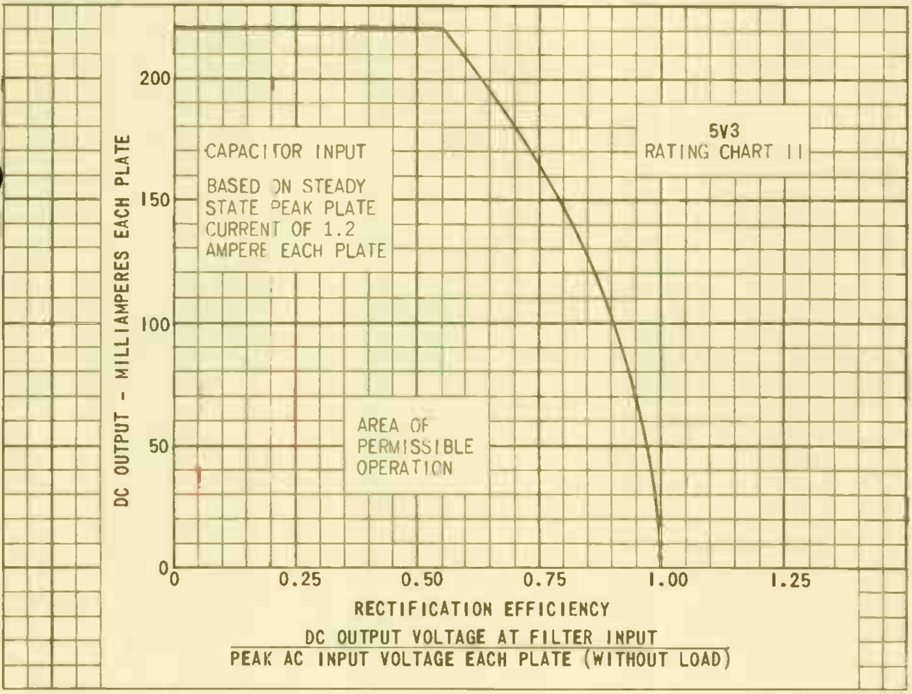
FULL WAVE RECTIFIER – CHOKE INPUT FILTER

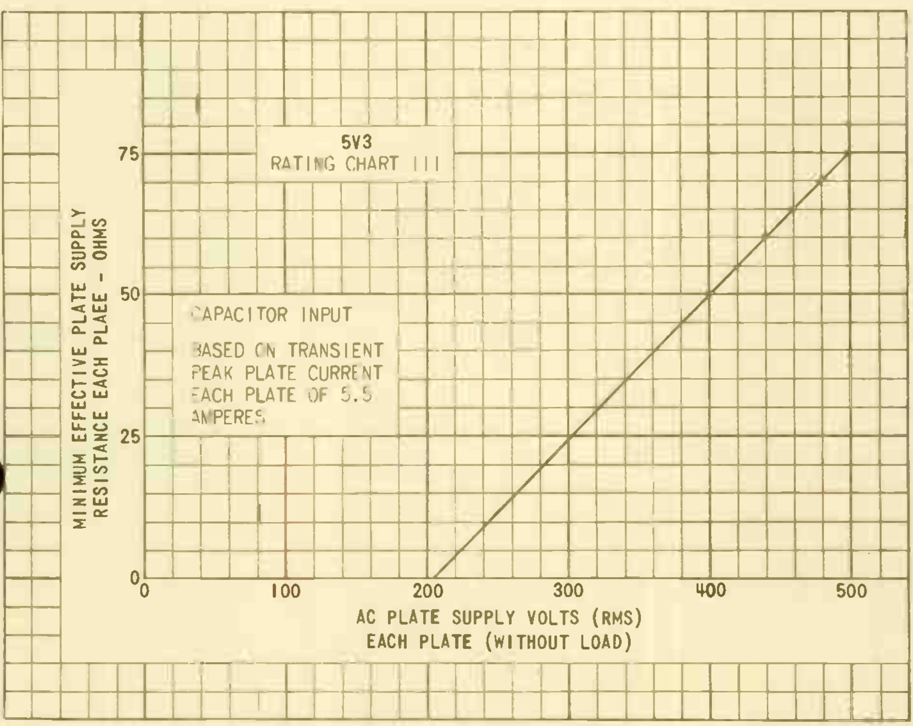
FILAMENT VOLTAGE	5.0	VOLTS
FILAMENT CURRENT	3.8	AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS[C]	500	VOLTS
FILTER INPUT CHOKE	10	HENRYS
DC OUTPUT CURRENT	350	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	385	VOLTS
TUBE VOLTAGE DROP TUBE CONDUCTING 350 MA. (EACH PLATE)*	47	VOLTS

[C] AC PLATE VOLTAGE IS MEASURED WITHOUT LOAD.

*INDICATES AN ADDITION.

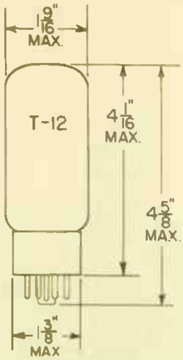



5V3
RATING CHART II
CAPACITOR INPUT
BASED ON STEADY STATE PEAK PLATE CURRENT OF 1.2 AMPERE EACH PLATE
AREA OF PERMISSIBLE OPERATION
DC OUTPUT - MILLIAMPERES EACH PLATE
200
150
100
50
0
0
0.25
0.50
0.75
1.00
1.25
RECTIFICATION EFFICIENCY
DC OUTPUT VOLTAGE AT FILTER INPUT
PEAK AC INPUT VOLTAGE EACH PLATE (WITHOUT LOAD)


5V3
RATING CHART III
CAPACITOR INPUT
BASED ON TRANSIENT PEAK PLATE CURRENT EACH PLATE OF 5.5 AMPERES
MINIMUM EFFECTIVE PLATE SUPPLY RESISTANCE EACH PLAEE - OHMS
75
50
25
0
0
100
200
300
400
500
AC PLATE SUPPLY VOLTS (RMS)
EACH PLATE (WITHOUT LOAD)

TUNG-SOL

TWIN DIODE



GLASS BULB

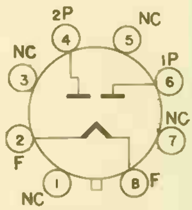
TUBE OUTLINE
JEDEC 12-16

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[C]	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

CONTINUED FROM PRECEDING PAGE

NOTES

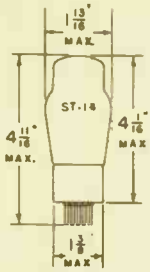
[B]DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE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

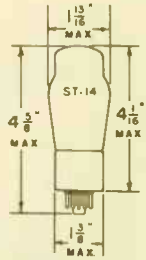
FULL WAVE

HIGH VACUUM RECTIFIER

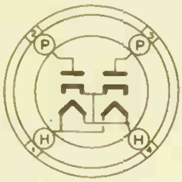
UNIPOTENTIAL CATHODE

HEATER
5.0 VOLTS 2.0 AMPERES
AC

GLASS BULB

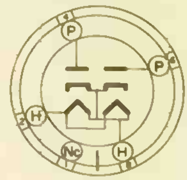


MEDIUM 5 PIN OCTAL BASE
5V4G



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.

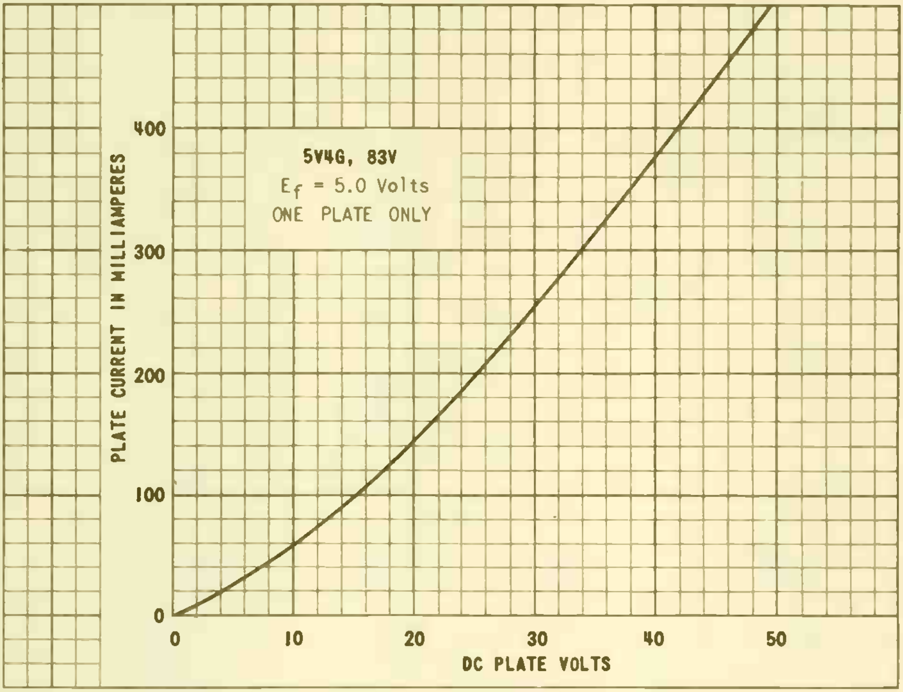
FOR "INTERPRETATION OF RATINGS", REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

PLATE 699-2

FEB. 15 1940

PRINTED IN U.S.A.



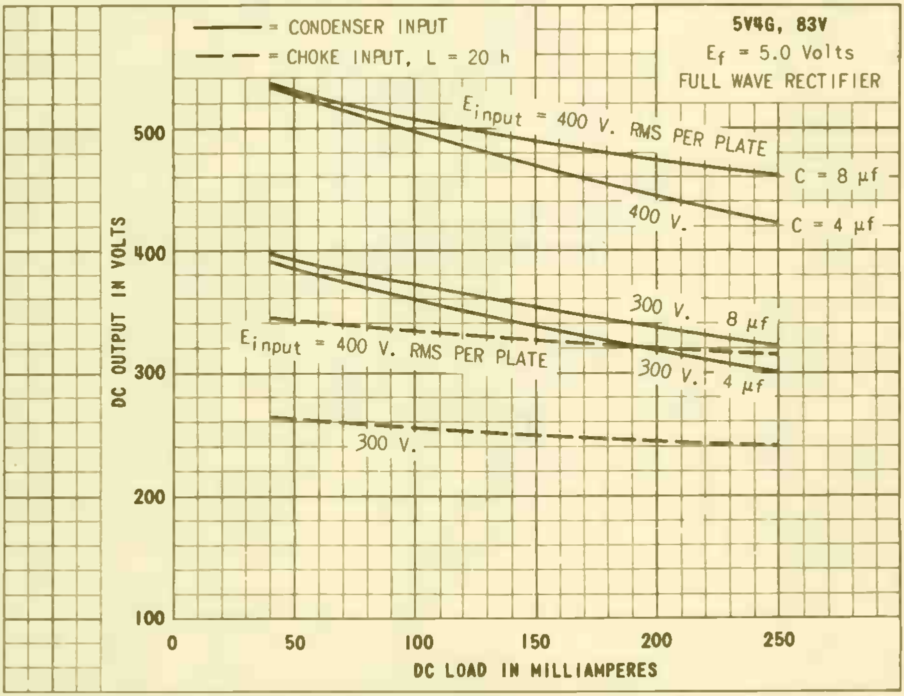
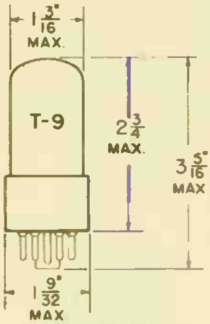


PLATE 700-1

 ELECTRON TUBE DIVISION NEWARK NEW JERSEY U S A

TUNG-SOL

BEAM PENTODE

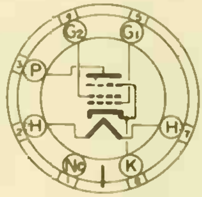


GLASS BULB

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[A,B]

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

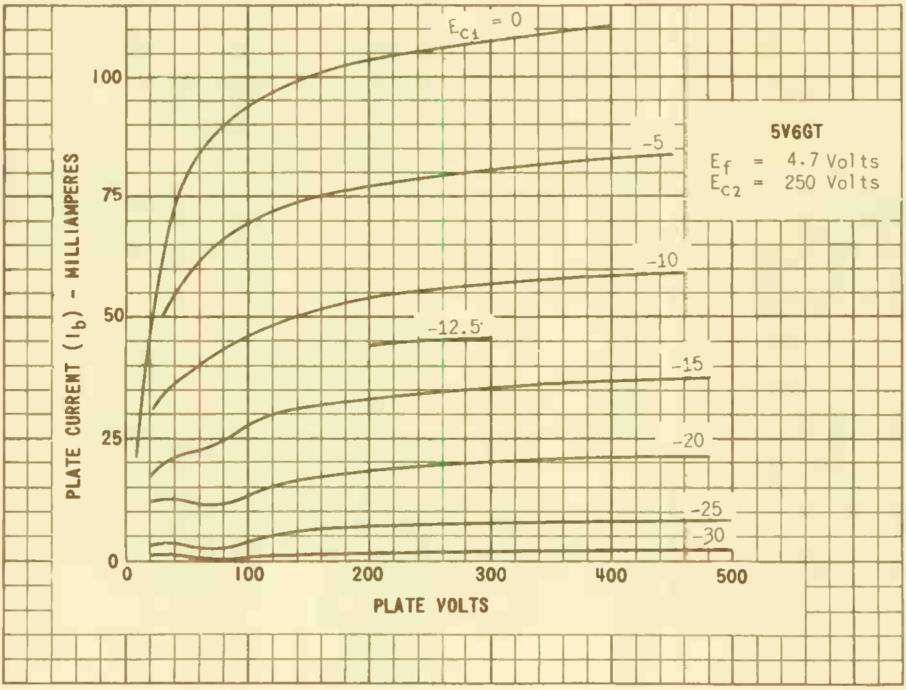
CLASS A_1 AMPLIFIER - PUSH-PULL

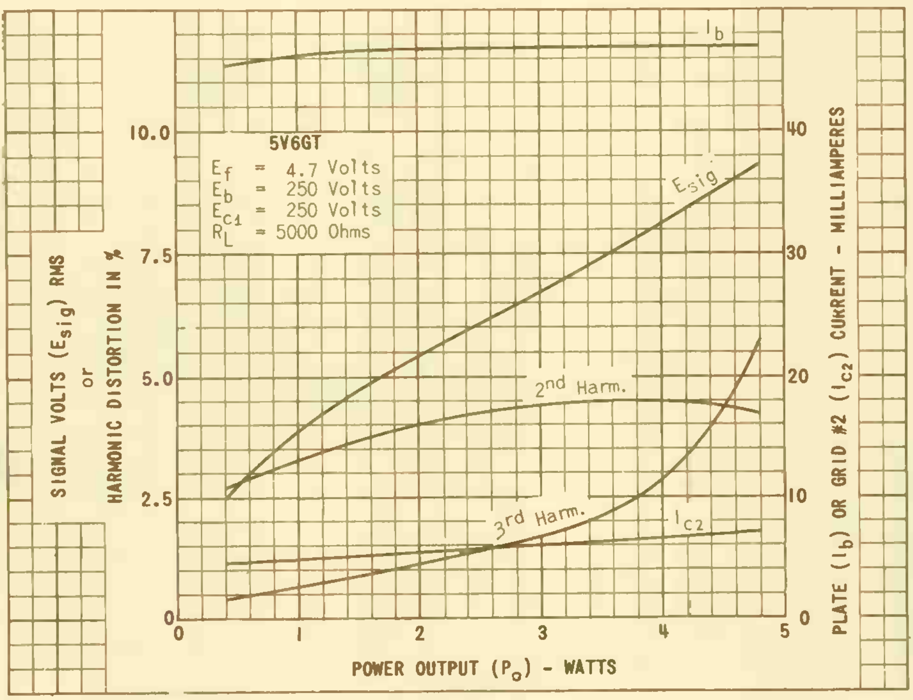
UNLESS OTHERWISE SPECIFIED, VALUES ARE FOR TWO TUBES.

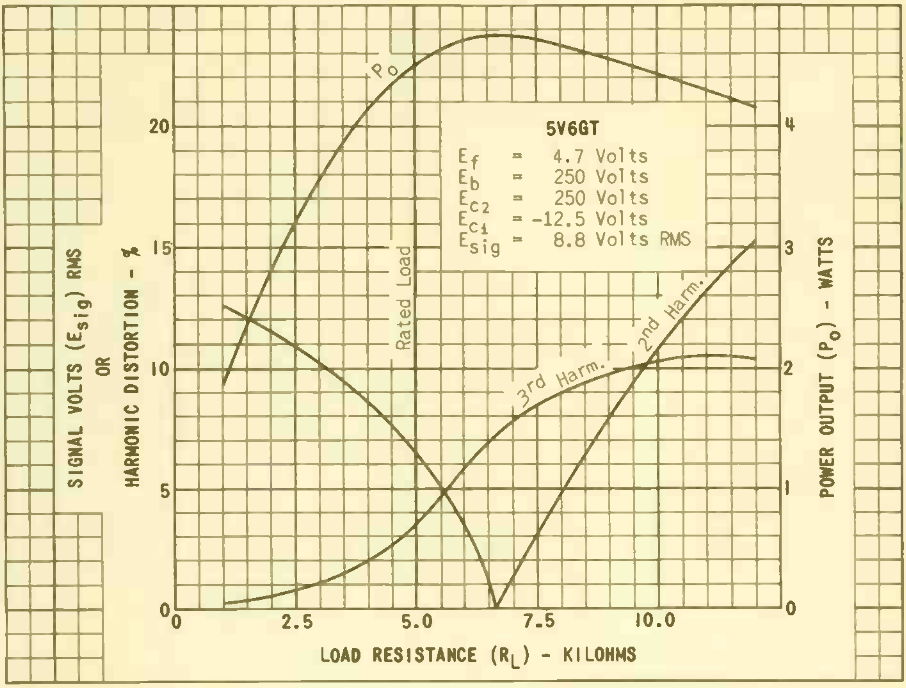
HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	250	285	VOLTS
GRID #2 VOLTAGE	250	285	VOLTS
GRID #1 VOLTAGE	-15	-19	VOLTS
PEAK AF GRID #1 TO GRID #1 VOLTAGE	30	38	VOLTS
ZERO-SIGNAL PLATE CURRENT	70	70	MA.
MAXIMUM-SIGNAL PLATE CURRENT	79	92	MA.
ZERO-SIGNAL GRID #2 CURRENT	5	4	MA.
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

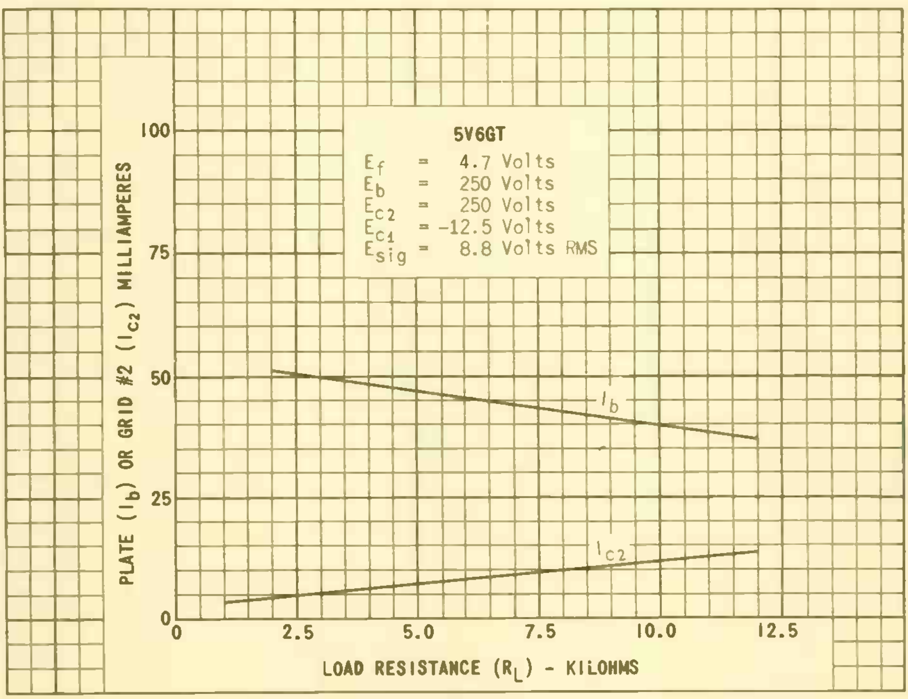
CLASS A_1 AMPLIFIER - TRIODE CONNECTION

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


5V6GT
E_f = 4.7 Volts
E_{c2} = 250 Volts
E_{c1} = 0
-5
-10
-12.5
-15
-20
-25
-30
PLATE CURRENT (I_b) - MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
200
300
400
500


5V6GT
E_f = 4.7 Volts
E_b = 250 Volts
E_{c1} = 250 Volts
R_L = 5000 Ohms
I_b
E_{sig}
2nd Harm.
3rd Harm.
I_{c2}
SIGNAL VOLTS (E_{sig}) RMS
or
HARMONIC DISTORTION IN %
PLATE (I_b) OR GRID #2 (I_{c2}) CURRENT - MILLIAMPERES
POWER OUTPUT (P_o) - WATTS
0
2.5
5.0
7.5
10.0
10
20
30
40
1
2
3
4
5

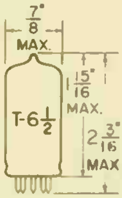

5V6GT
E_f = 4.7 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
E_{c1} = -12.5 Volts
E_{sig} = 8.8 Volts RMS
P_o
Rated Load
3rd Harm.
2nd Harm.
SIGNAL VOLTS (E_{sig}) RMS OR HARMONIC DISTORTION - %
POWER OUTPUT (P_o) - WATTS
LOAD RESISTANCE (R_L) - KILOHMS
0
2.5
5.0
7.5
10.0
5
10
15
20
1
2
3
4


5V6GT
E_f = 4.7 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
E_{c1} = -12.5 Volts
E_{sig} = 8.8 Volts RMS
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
LOAD RESISTANCE (R_L) - KILOHMS
0
2.5
5.0
7.5
10.0
12.5
25
50
75
100

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

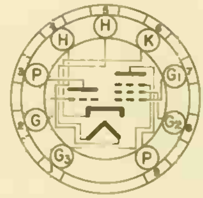


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
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. IT IS ESPECIALLY USEFUL FOR USE 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

	WITHOUT SHIELD	WITH[A] SHIELD	
TRIODE UNIT			
GRID TO PLATE: (G TO P)	1.4	1.4	μμf
INPUT: G TO (H+K)	2.0	2.6	μμf
OUTPUT: P TO (H+K)	0.5	1.0	μμf
PENTODE UNIT			
GRID #1 TO PLATE: (G_1 TO P)	0.09	0.06	μμf
INPUT: G_1 TO ($H+K+G_2+G_3$)	4.3	4.5	μμf
OUTPUT: P TO ($H+K+G_2+G_3$)	0.7	1.4	μμf
PENTODE GRID #1 TRIODE PLATE: (G_1 TO P) MAX.	0.045	0.035	μμf
PENTODE PLATE TO TRIODE PLATE: (P TO P) MAX.	0.040	0.008	μμf
HEATER TO CATHODE: (H TO K)	5.2	5.2	μμf
PENTODE UNIT CONNECTED AS TRIODE[B]			
GRID #1 TO PLATE	1.4	1.3	μμf
INPUT	3.0	3.2	μμf
OUTPUT	1.6	2.0	μμf

[A] EXTERNAL SHIELD #315 CONNECTED TO CATHODE.

[B] GRID #3 CONNECTED TO CATHODE, GRID #2 CONNECTED PLATE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CONVERTER SERVICE

	TRIODE UNIT AS 250 MC. OSCILLATOR	PENTODE UNIT AS MIXER	PENTODE UNIT[C] AS TRIODE CONNECTED MIXER	
HEATER VOLTAGE	4.7	4.7	4.7	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	100	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE ●	100	100	100	VOLTS
MAXIMUM PLATE VOLTAGE	250	250	250	VOLTS
MAXIMUM GRID VOLTAGE:				
NEGATIVE BIAS VOLTAGE	40	40	40	VOLTS
POSITIVE BIAS VOLTAGE	0	0	0	VOLTS
MAXIMUM GRID #3 VOLTAGE	---	0	---	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	SEE GRID #2 INPUT RATING CURVE	---	
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	250	---	VOLTS
MAXIMUM PLATE DISSIPATION	1.5	2.0	2.4	WATTS
MAXIMUM GRID INPUT	0.5	0.4	---	WATT
HEATER WARM-UP TIME (APPROX.) *	11.0	11.0	11.0	SECONDS

HEATER WARM-UP TIME APPLIES TO 6X8A ONLY.

●DC COMPONENT MUST NOT EXCEED 100 VOLTS MAXIMUM.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE UNIT	PENTODE UNIT	PENTODE UNIT CONNECTED AS TRIODE	
HEATER VOLTAGE	4.7	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	100	250	150	VOLTS
GRID #3 VOLTAGE	---	CONNECTED TO CATHODE AT SOCKET		
GRID #2 VOLTAGE	---	150	TIED TO PLATE	VOLTS
CATHODE BIAS RESISTOR	100	200	250	OHMS
AMPLIFICATION FACTOR	40	---	42	
PLATE RESISTANCE (APPROX.)	6 900	750 000	7 900	OHMS
TRANSCONDUCTANCE	5 800	4 600	4 000	µMHOS
PLATE CURRENT	8.5	7.7	7.8	MA.
GRID #2 CURRENT	---	1.6	---	MA.
GRID #1 VOLTAGE FOR PLATE CURRENT OF 10 µAMP. (APPROX.)	-10	-10	-10	VOLTS

[C] GRID #3 CONNECTED TO CATHODE, GRID #2 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.

SIMILAR TYPE REFERENCE: Except for heater ratings, the 5X8 is identical to the 6X8, 6X8A and the 9X8.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

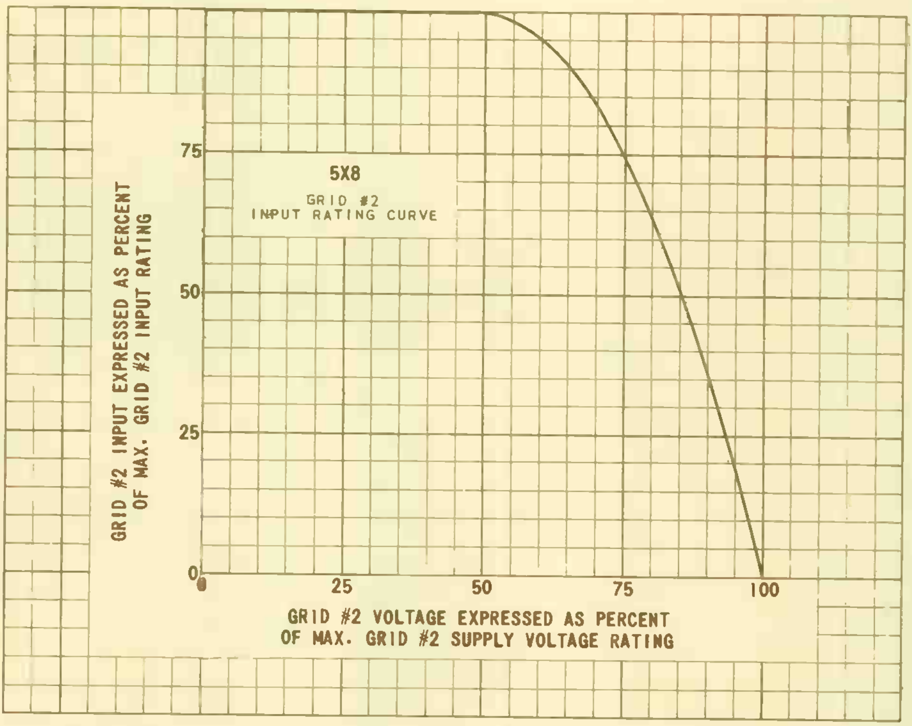
CONVERTER SERVICE

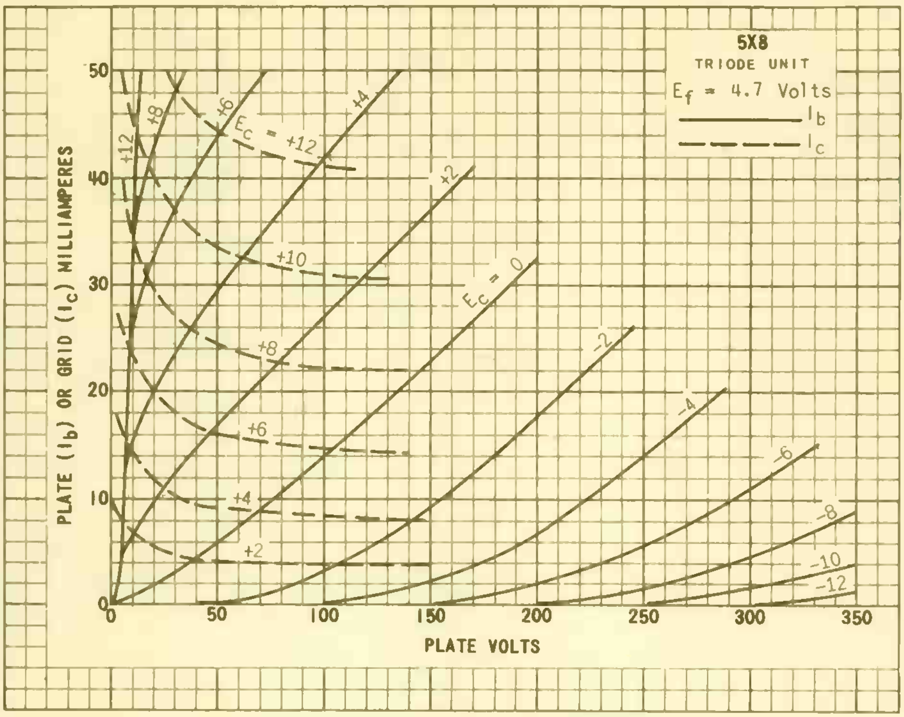
	TRIODE UNIT[D] AS 250 MC. OSCILLATOR	PENTODE[E] UNIT AS MIXER	PENTODE UNIT[F] AS TRIODE CONNECTED MIXER	
HEATER VOLTAGE	4.7	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	150	150	150	VOLTS
GRID #3 VOLTAGE	---	CONNECTED TO CATHODE AT SOCKET	---	
GRID #2 VOLTAGE	---	150	---	VOLTS
MIXER GRID #1 SUPPLY VOLTAGE	---	-3.5	-3.5	VOLTS
OSCILLATOR VOLTAGE AT MIXER GRID #1 (RMS)	---	2.6	2.6	VOLTS
MIXER GRID #1 CIRCUIT RESISTANCE	---	120 000	---	OHMS
GRID #1 CIRCUIT RESISTANCE	---	---	120 000	OHMS
CONVERSION TRANSCONDUCTANCE	---	2 100	2 800	µMHOS
OSCILLATOR GRID RESISTOR	2 700	---	---	OHMS
PLATE CURRENT	13	6.2	7.8	MA.
GRID #2 CURRENT	---	1.8	---	MA.
GRID #1 CURRENT	---	2.0	2.0	µAMP.
GRID CURRENT	3.6	---	---	MA.
POWER OUTPUT (APPROX.)	0.5	---	---	WATT

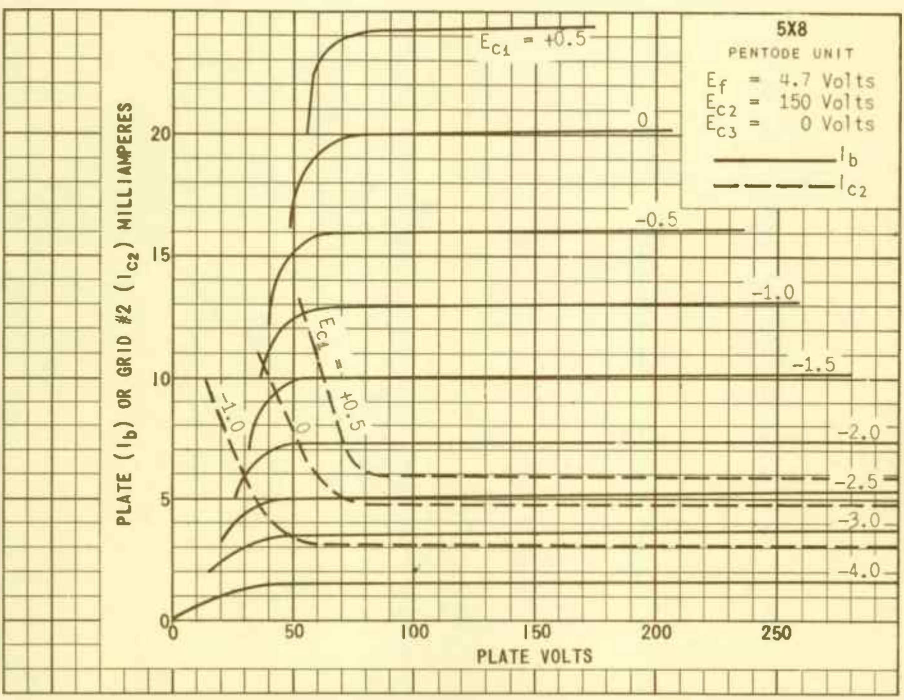
[D] IN FM RECEIVERS, IT IS GENERALLY DESIRABLE TO OPERATE THE OSCILLATOR WITH LESS POWER THAN SHOWN IN THE TABULATED DATA IN ORDER TO AVOID OVER EXCITATION AND EXCESSIVE OSCILLATOR RADIATION.

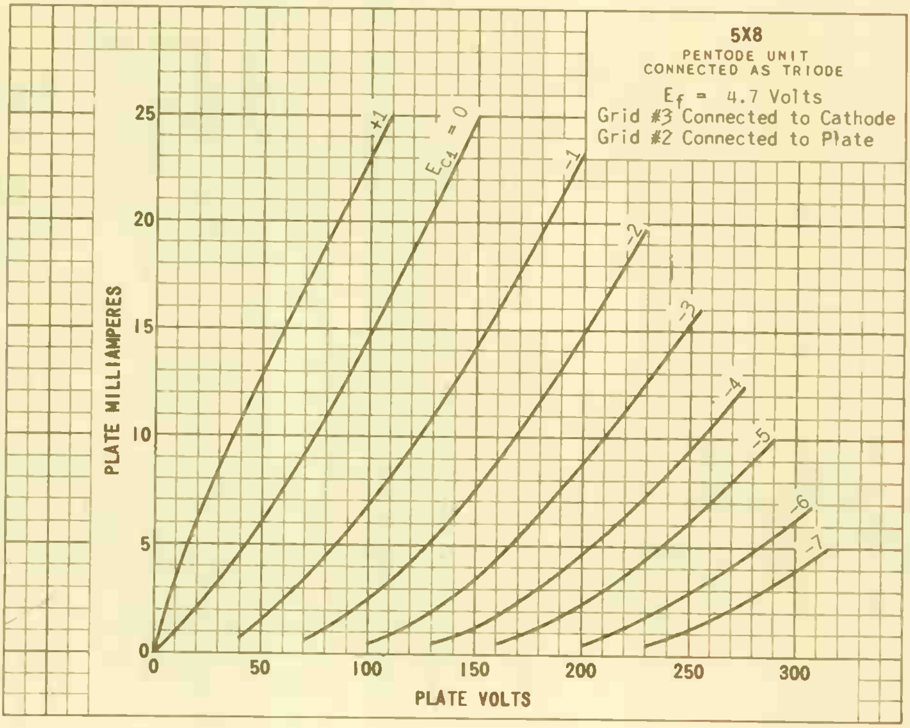
[E] WITH SEPARATE EXCITATION AND TRIODE UNIT GROUNDED.

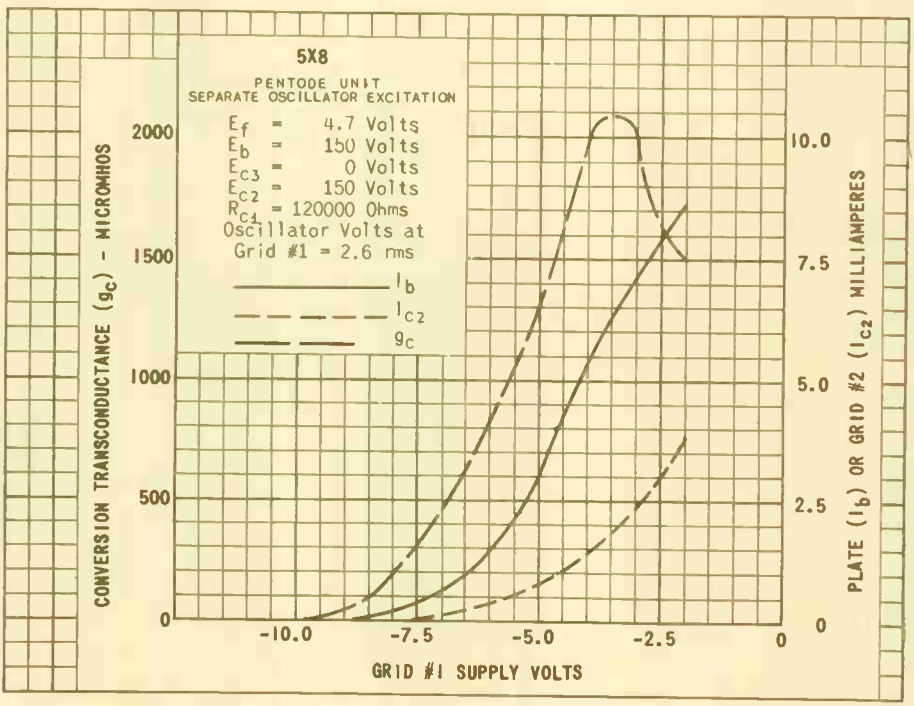
[F] GRID #3 CONNECTED TO CATHODE, GRID #2 CONNECTED TO PLATE

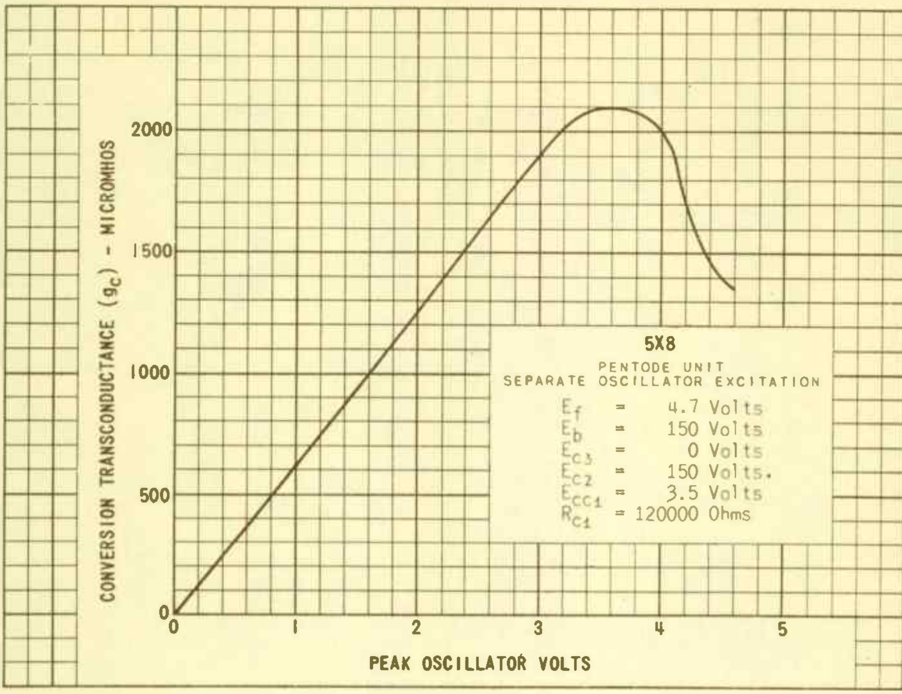


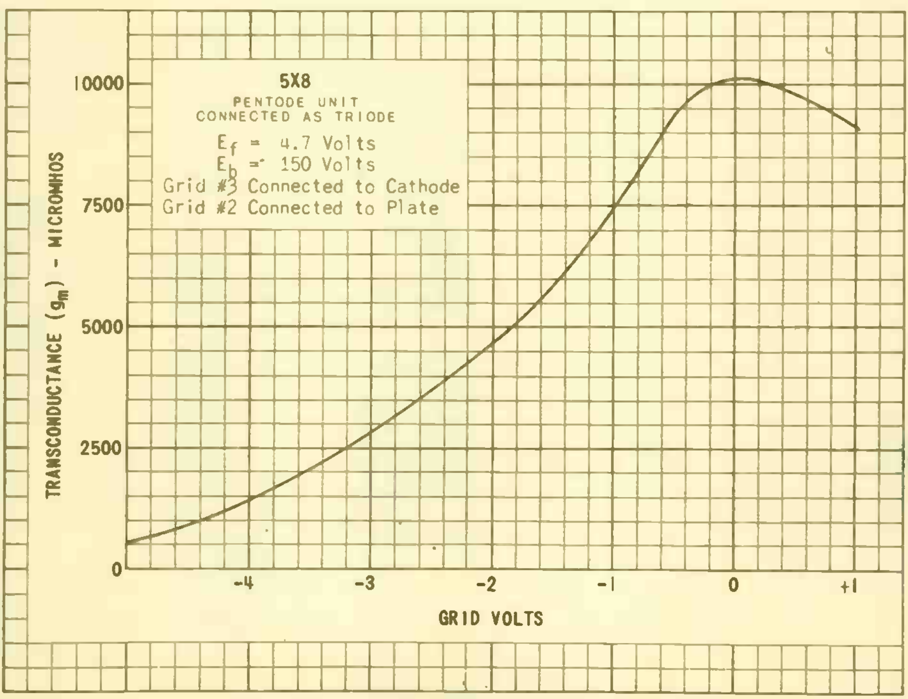

5X8
TRIODE UNIT
Ef = 4.7 Volts
Ib
Ic
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
Ec = +12
+10
+8
+6
+4
+2
Ec = 0
-2
-4
-6
-8
-10
-12
0
50
100
150
200
250
300
350
10
20
30
40
50


5X8
PENTODE UNIT
Ef = 4.7 Volts
Ec2 = 150 Volts
Ec3 = 0 Volts
Ib
Ic2
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
Ec1 = +0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
Ec1 = +0.5
0
-1.0
0
50
100
150
200
250
5
10
15
20


5X8
PENTODE UNIT
CONNECTED AS TRIODE
E_f = 4.7 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate
E_{c1} = 0
+1
-1
-2
-3
-4
-5
-6
-7
PLATE MILLIAMPERES
0
5
10
15
20
25
0
50
100
150
200
250
300
PLATE VOLTS

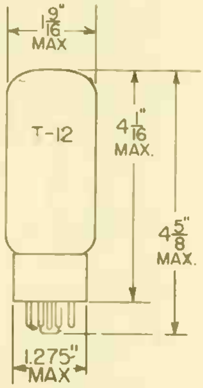

5X8
PENTODE UNIT
SEPARATE OSCILLATOR EXCITATION
E_f = 4.7 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2} = 150 Volts
R_{c1} = 120000 Ohms
Oscillator Volts at
Grid #1 = 2.6 rms
I_b
I_{c2}
g_c
CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
0
500
1000
1500
2000
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
2.5
5.0
7.5
10.0
-10.0
-7.5
-5.0
-2.5
0
GRID #1 SUPPLY VOLTS


2000
1500
1000
500
0
0
1
2
3
4
5
CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
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_{cc1} = 3.5 Volts
R_{c1} = 120000 Ohms


10000
7500
5000
2500
0
-4
-3
-2
-1
0
+1
TRANSCONDUCTANCE (g_m) - MICROMHOS
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

TUNG-SOL

TWIN DIODE



GLASS BULB

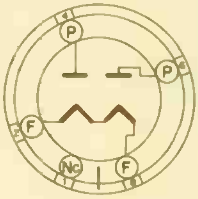
COATED FILAMENT

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

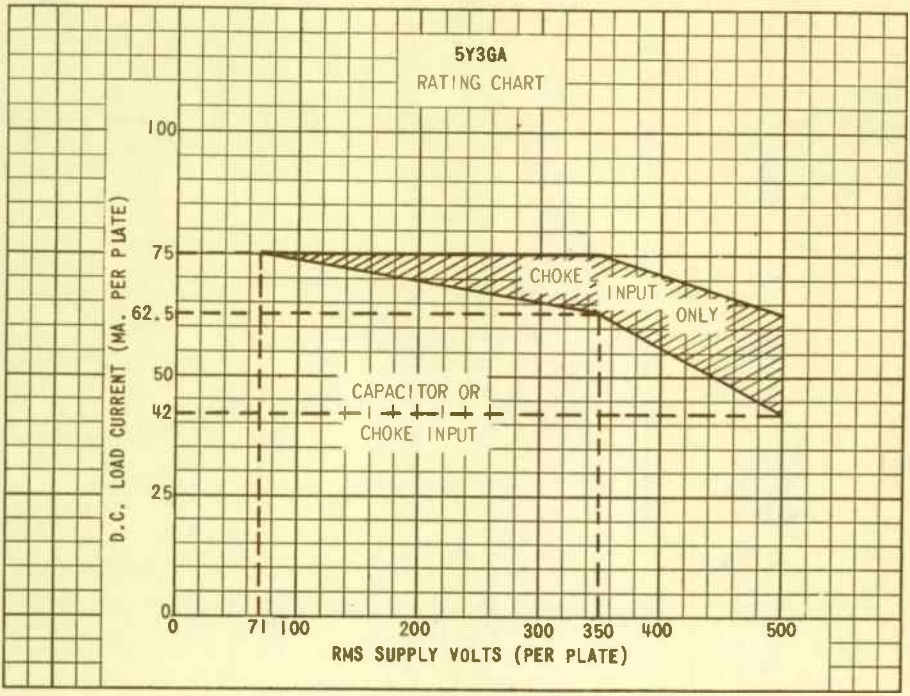
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

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

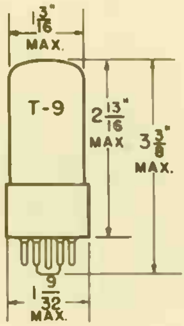
FULL WAVE RECTIFIER SERVICE

	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


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



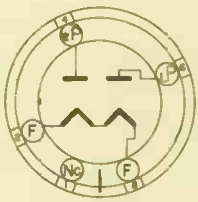
GLASS BULB

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 FILTER 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.

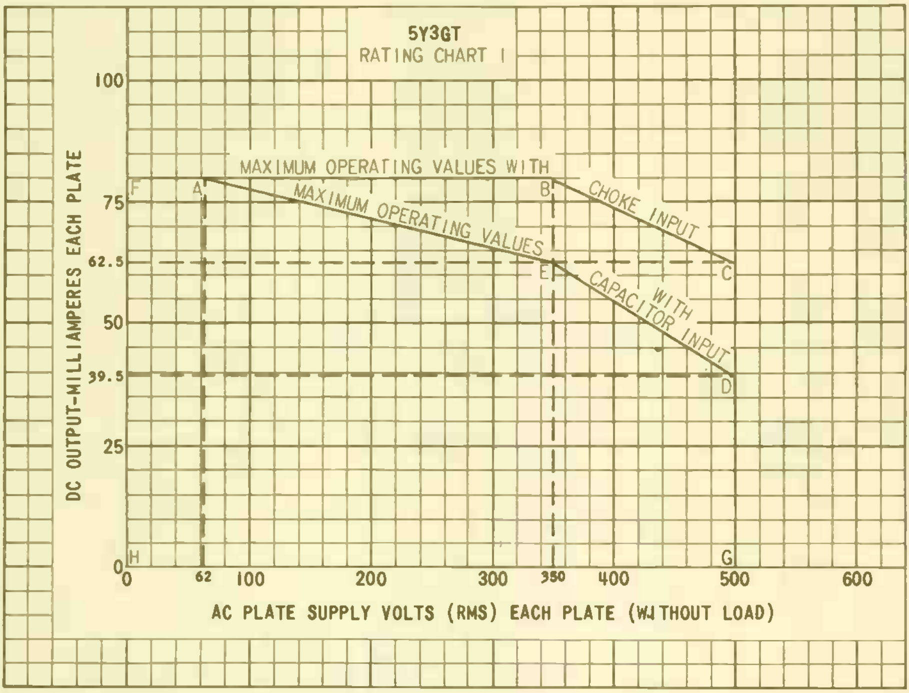
[A] SEE CHART #2

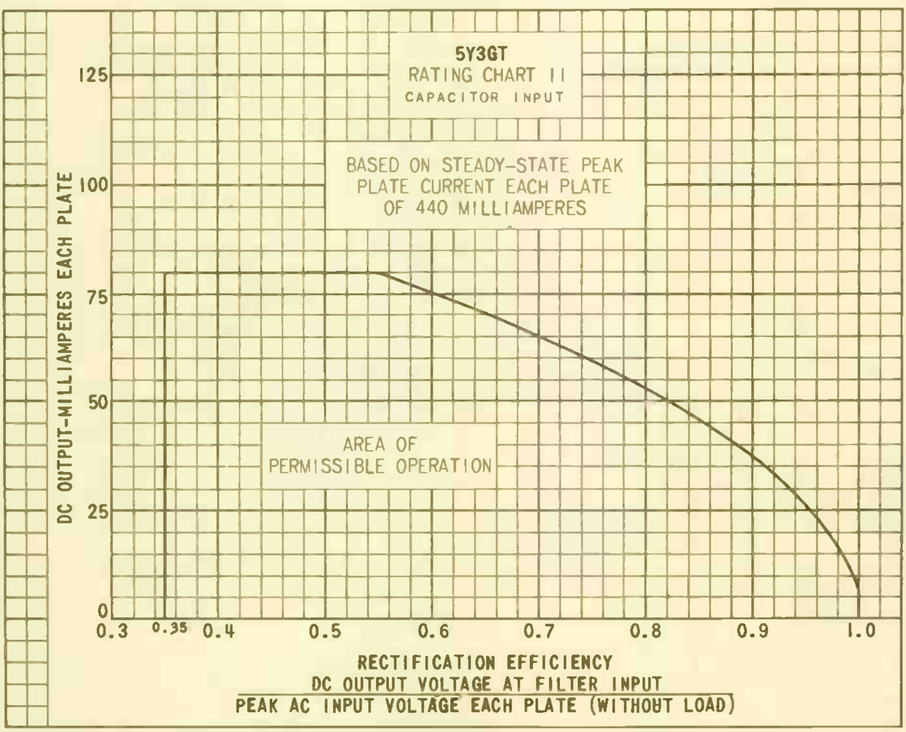
[B] SEE CHART #3

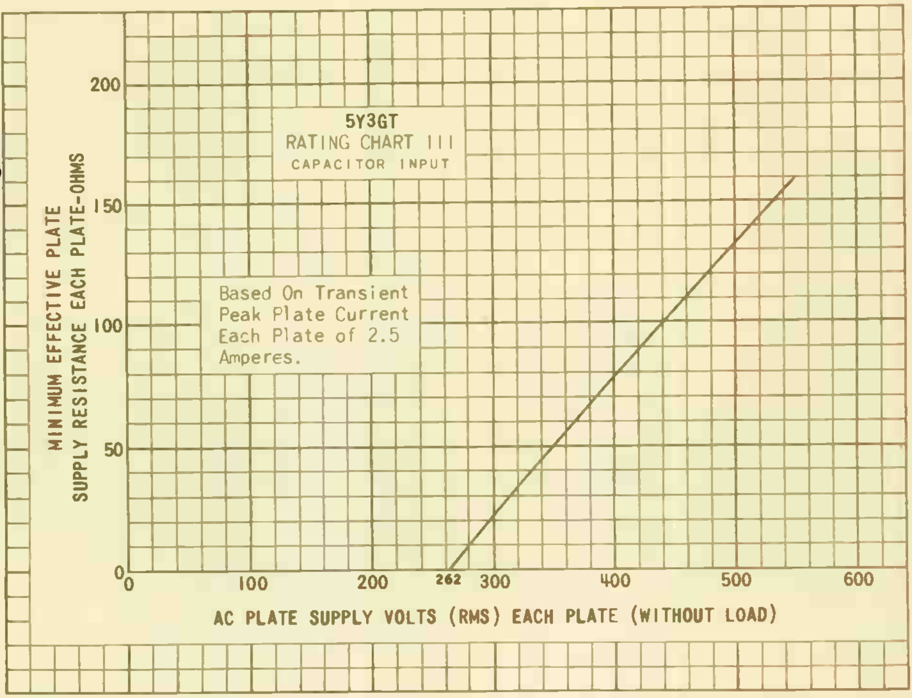
SIMILAR TYPE REFERENCE: Electrically similar to 5Y4G and 80.

⟶ INDICATES A CHANGE.

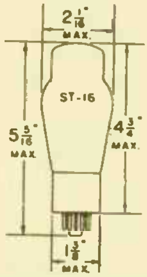
5Y3GT (5Y4G, 80)






5Y3GT
RATING CHART III
CAPACITOR INPUT
Based On Transient Peak Plate Current Each Plate of 2.5 Amperes.
MINIMUM EFFECTIVE PLATE SUPPLY RESISTANCE EACH PLATE-OHMS
0
50
100
150
200
0
100
200
262
300
400
500
600
AC PLATE SUPPLY VOLTS (RMS) EACH PLATE (WITHOUT LOAD)

TUNG-SOL



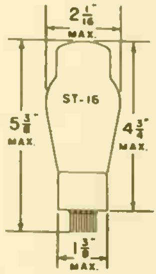
5U4G – MEDIUM 5 PIN OCTAL BASE
5X4G – MEDIUM 8 PIN OCTAL BASE

FULL WAVE
HIGH VACUUM RECTIFIER

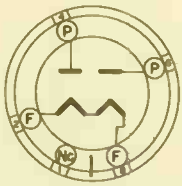
COATED FILAMENT

5.0 VOLTS 3.0 AMPERES
AC

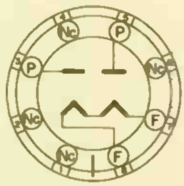
GLASS BULB



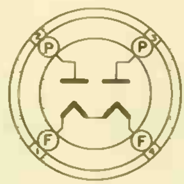
5Z3 – MEDIUM 4 PIN BASE



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

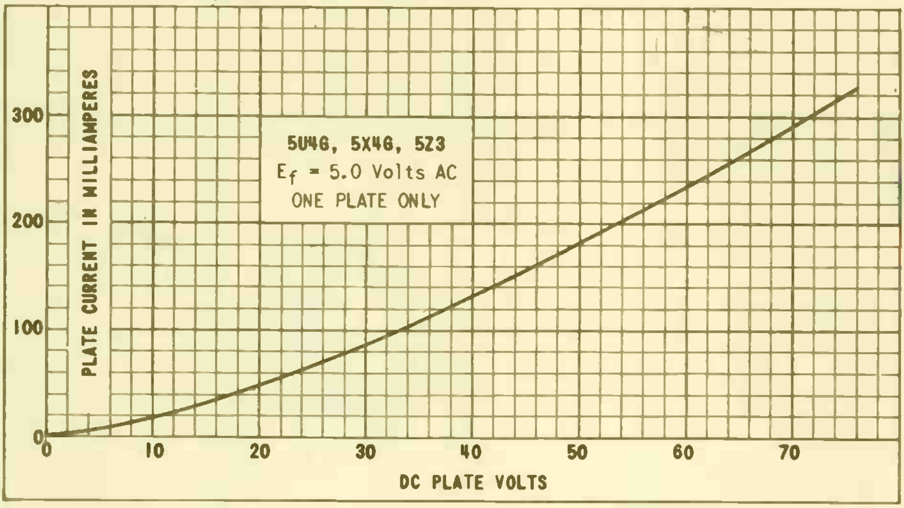
[A] WHEN FILTER CONDENSERS LARGER THAN 40 μfds ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

CONTINUED NEXT PAGE

PRINTED IN U. S. A.

PLATE
691-2

JAN. 29
1940


5U4G, 5X4G, 5Z3
E_f = 5.0 Volts AC
ONE PLATE ONLY
PLATE CURRENT IN MILLIAMPERES
DC PLATE VOLTS
0
100
200
300
0
10
20
30
40
50
60
70

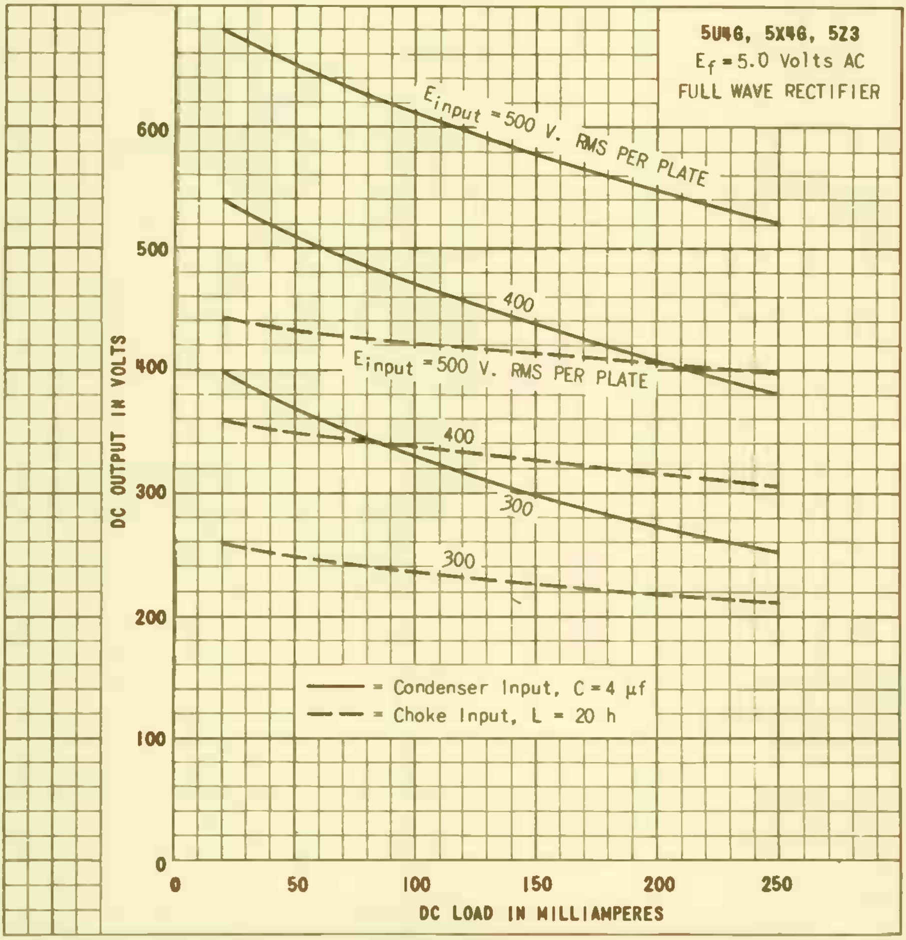

5U4G, 5X4G, 5Z3
E_f = 5.0 Volts AC
FULL WAVE RECTIFIER
E_{input} = 500 V. RMS PER PLATE
400
E_{input} = 500 V. RMS PER PLATE
400
300
300
= Condenser Input, C = 4 µf
= Choke Input, L = 20 h
DC OUTPUT IN VOLTS
DC LOAD IN MILLIAMPERES
0
100
200
300
400
500
600
0
50
100
150
200
250

PLATE 692-1

TUNG-SOL

TRIODE

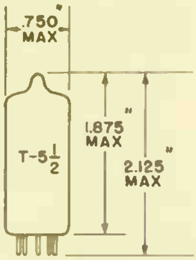
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

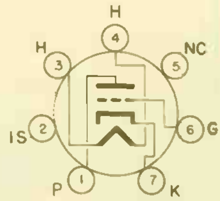
HEATER
6.3 VOLTS 150 MA.
AC OR DC

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

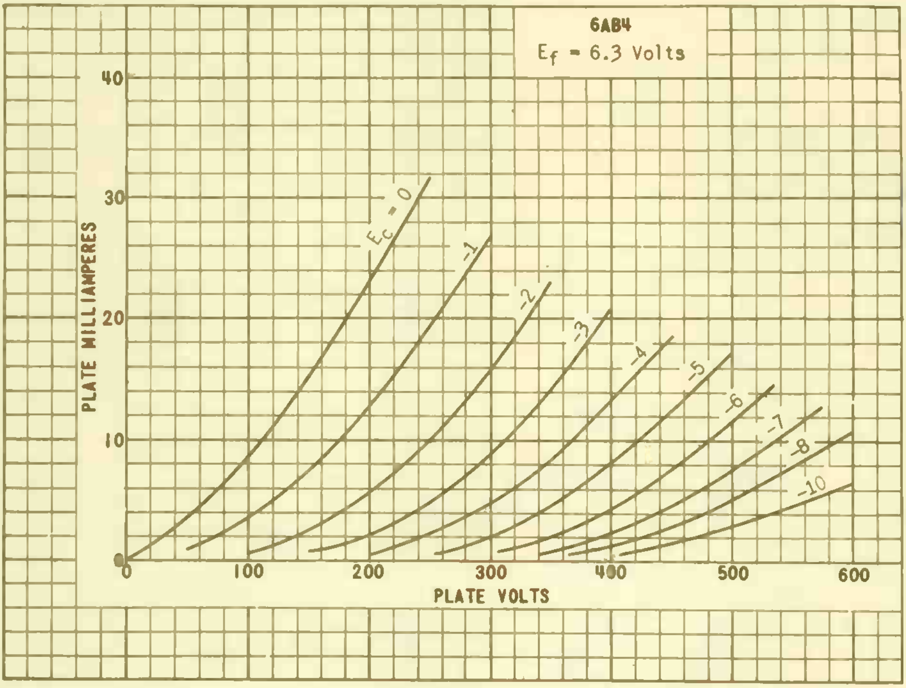
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

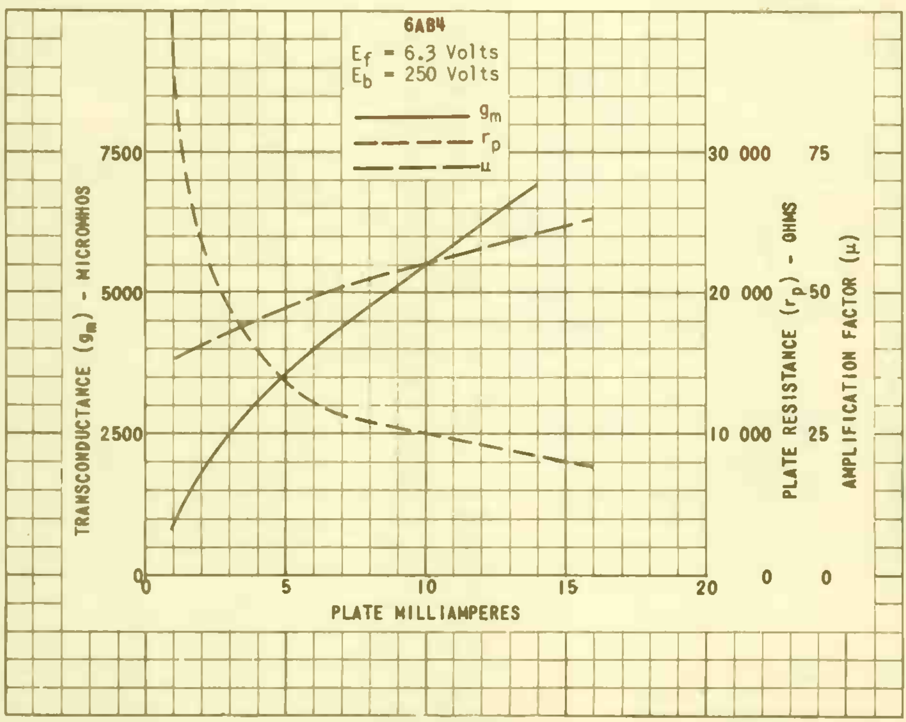
CLASS A_1 AMPLIFIER

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.

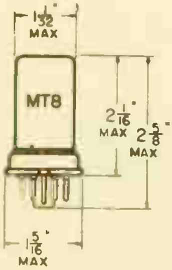
→ INDICATES A CHANGE.


6AB4
Ef = 6.3 Volts
PLATE MILLIAMPERES
0
10
20
30
40
Ec = 0
-1
-2
-3
-4
-5
-6
-7
-8
-10
0
100
200
300
400
500
600
PLATE VOLTS


6AB4
Ef = 6.3 Volts
Eb = 250 Volts
gm
rp
μ
TRANSCONDUCTANCE (gm) - MICROMHOS
0
2500
5000
7500
0
5
10
15
20
PLATE MILLIAMPERES
PLATE RESISTANCE (rp) - OHMS
0
10 000
20 000
30 000
AMPLIFICATION FACTOR (μ)
0
25
50
75

TUNG-SOL

PENTODE



METAL SHELL

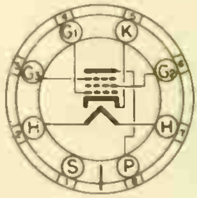
COATED UNIPOTENTIAL CATHODE

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

PLATE 1867
SEPT. 2 1947

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION

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.

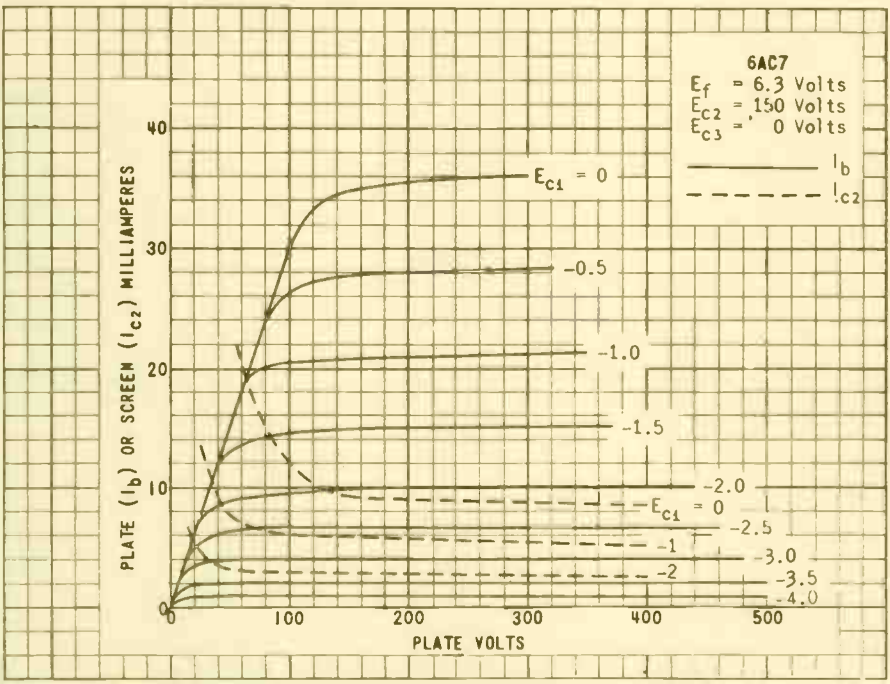
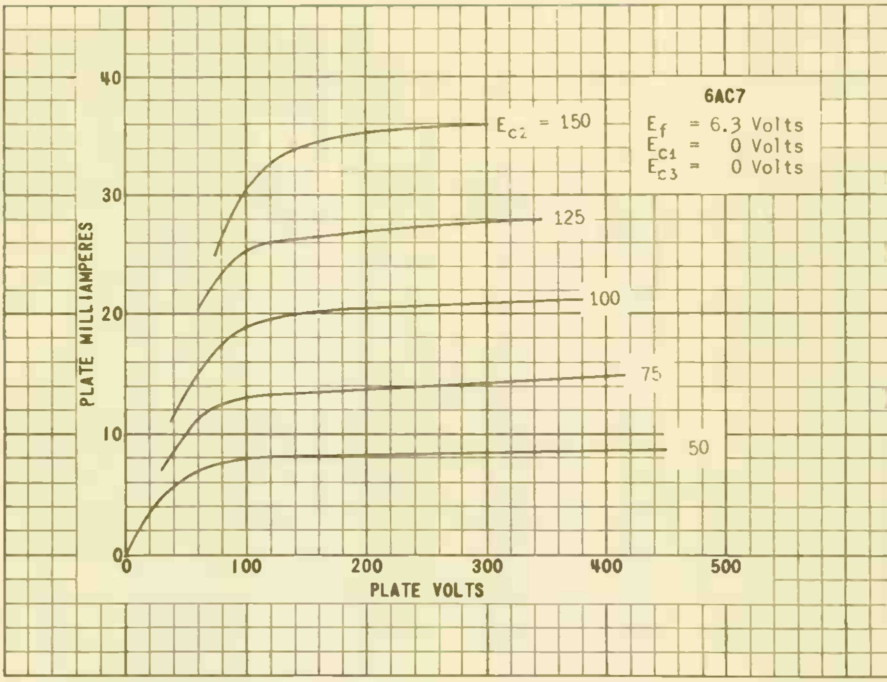
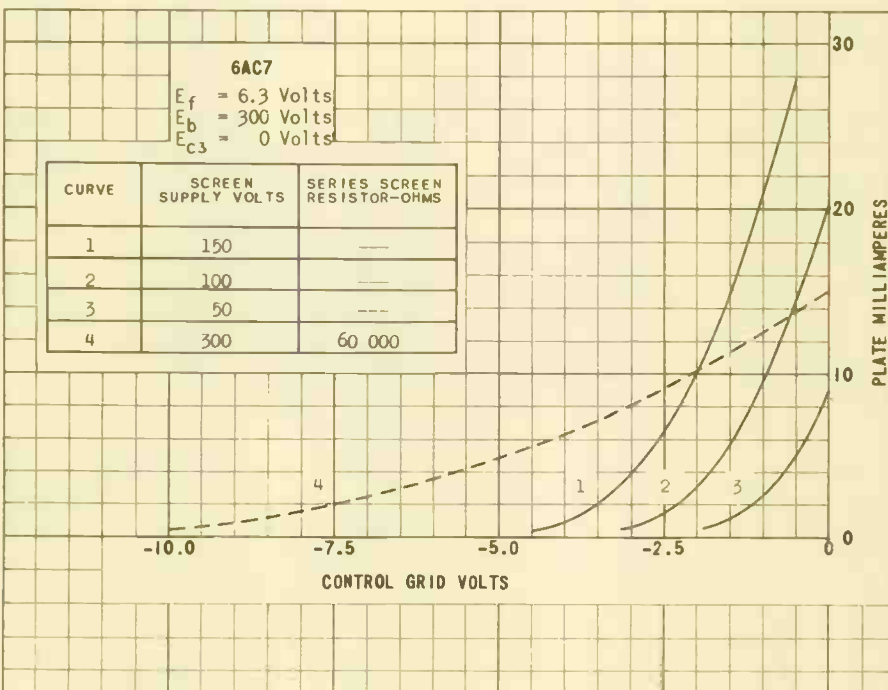


PLATE 1368
SEPT. 2 1947

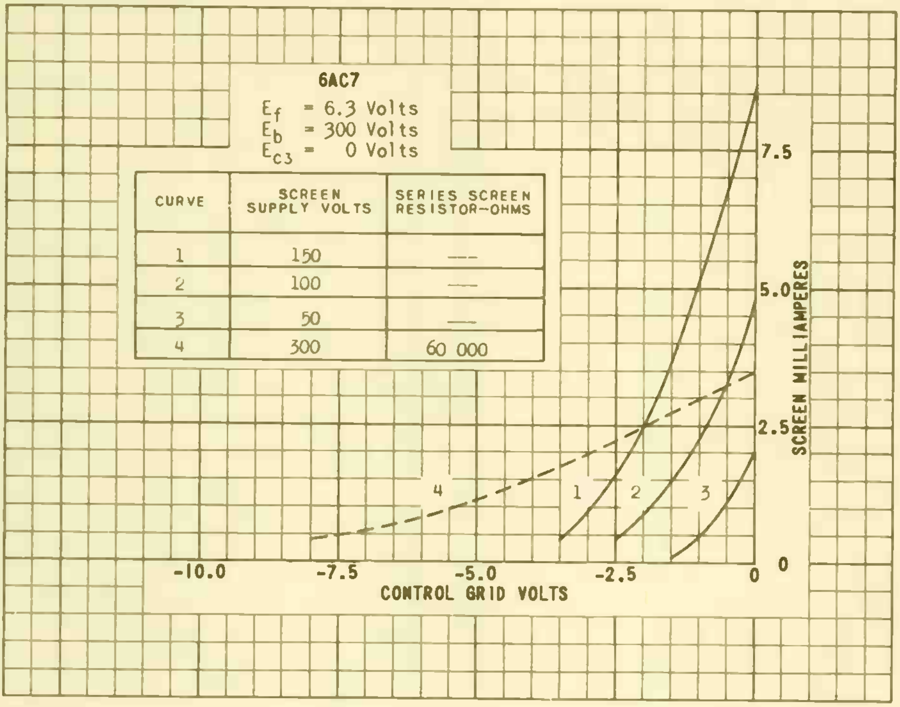




CURVE	SCREEN SUPPLY VOLTS	SERIES SCREEN RESISTOR-OHMS
1	150	---
2	100	---
3	50	---
4	300	60 000

PRINTED IN U.S.A.

PLATE 1869
SEPT. 2 1947



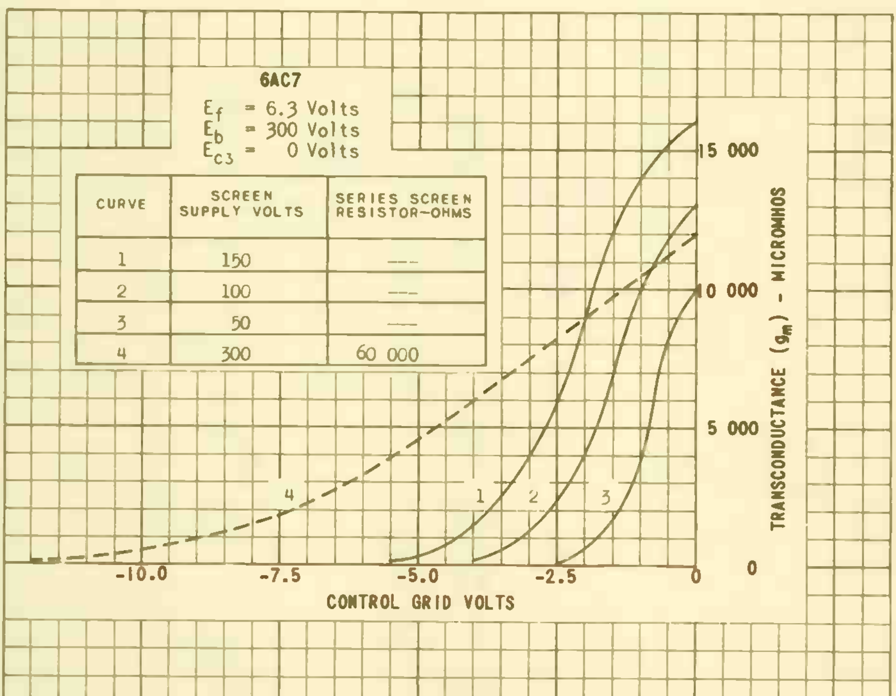
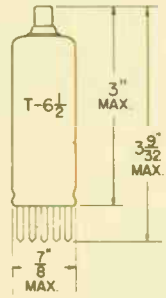


PLATE 1870
SEPT. 2 1947

TUNG-SOL



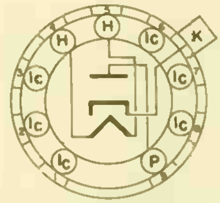
GLASS BULB
SKIRTED MINIATURE

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 PEAK PLATE CURRENT	750	MA.
MAXIMUM PLATE DISSIPATION	6.0	WATTS
MAXIMUM BULB TEMPERATURE	210	°C

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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 DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

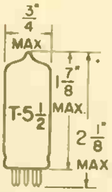
[B] UNLESS OTHERWISE STATED.

[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 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.

TUNG-SOL

TRIODE

MINIATURE TYPE



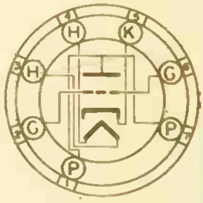
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.225 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

7CK

THE 6AF4 IS A HIGH TRANSCONDUCTANCE TRIODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A LOCAL OSCILLATOR IN UHF TELEVISION RECEIVERS COVERING THE FREQUENCY RANGE OF 470 TO 890 MC.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID TO PLATE: (G TO P)	1.9	μμf
INPUT: G TO (H+K)	2.2	μμf
OUTPUT: P TO (H+K)	0.45	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	OSCILLATOR	
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE	80	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID VOLTAGE	-50	VOLTS
MAXIMUM CATHODE CURRENT	28	MA.
MAXIMUM GRID CURRENT	8	MA.
MAXIMUM PLATE INPUT	2.5	WATTS
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
CATHODE BIAS OPERATION	0.5	MEGOHM
FIXED BIAS OPERATION	NOT RECOMMENDED	

PLATE
554-3

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

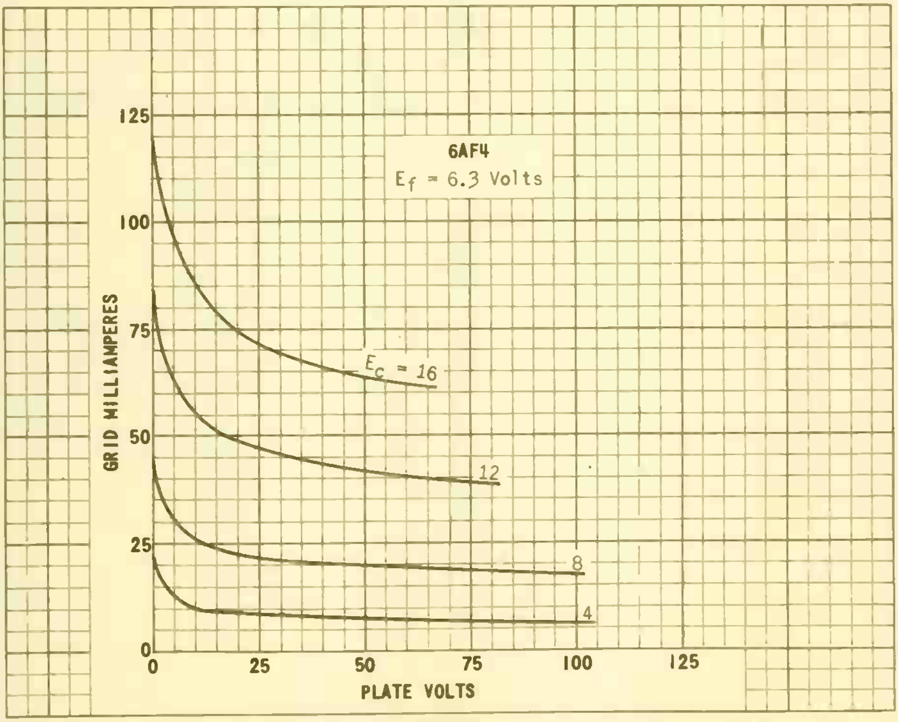
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

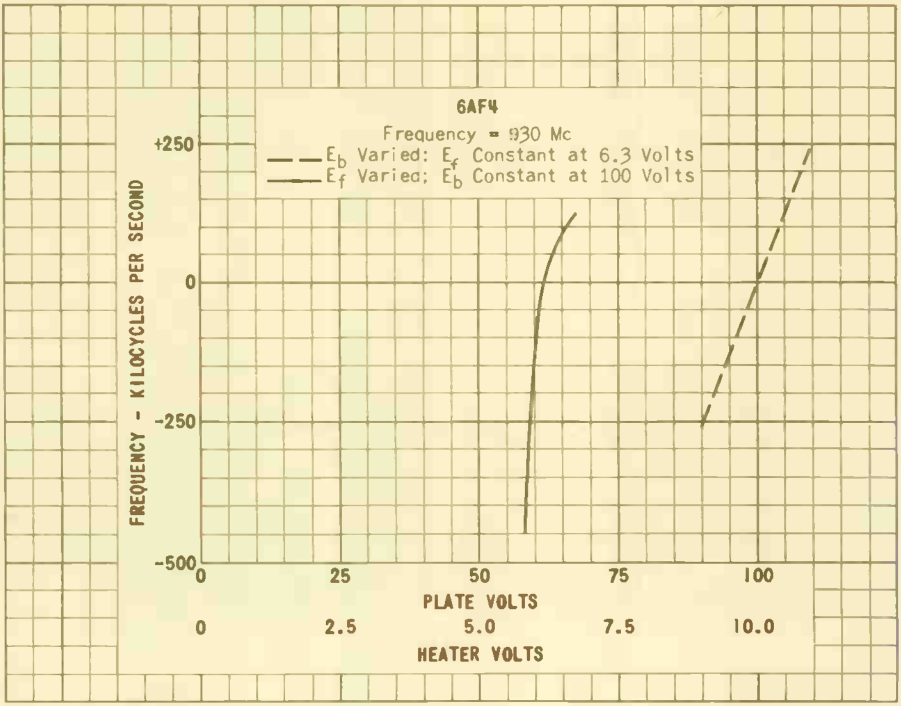
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.225	AMP.
PLATE VOLTAGE	80	VOLTS
CATHODE BIAS RESISTOR	150	OHMS
AMPLIFICATION FACTOR	15	
PLATE RESISTANCE	2 270	OHMS
TRANSCONDUCTANCE	6 600	µMHOS
PLATE CURRENT	16	MA.

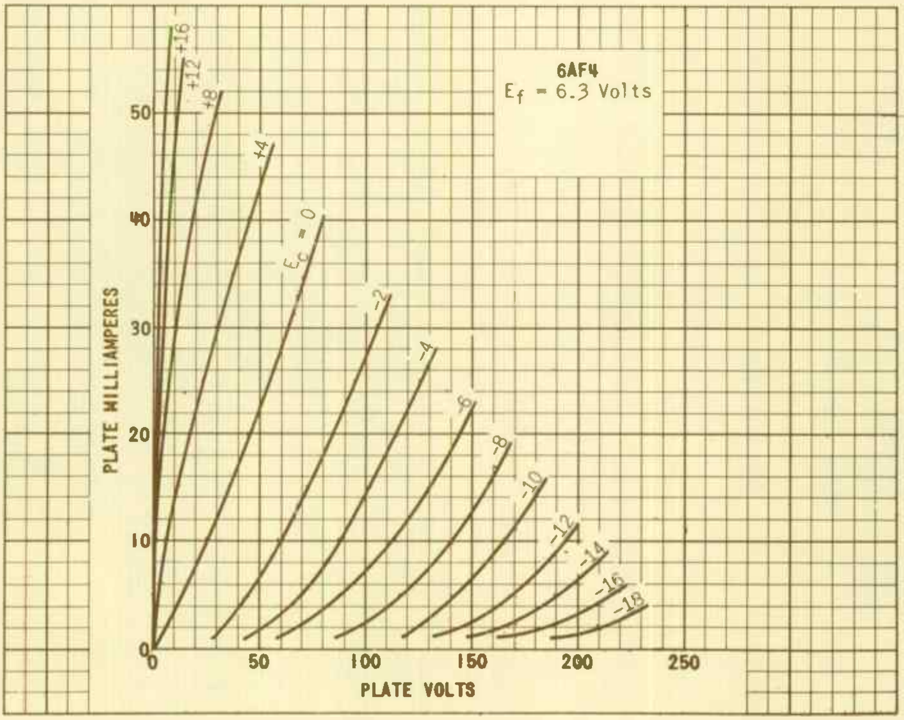
OSCILLATOR AT 950 MEGACYCLES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.225	AMP.
PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	−4	VOLTS
FROM GRID RESISTOR OF	10 000	OHMS
PLATE CURRENT	22	MA.
GRID CURRENT (APPROX.)	400	µAMP.

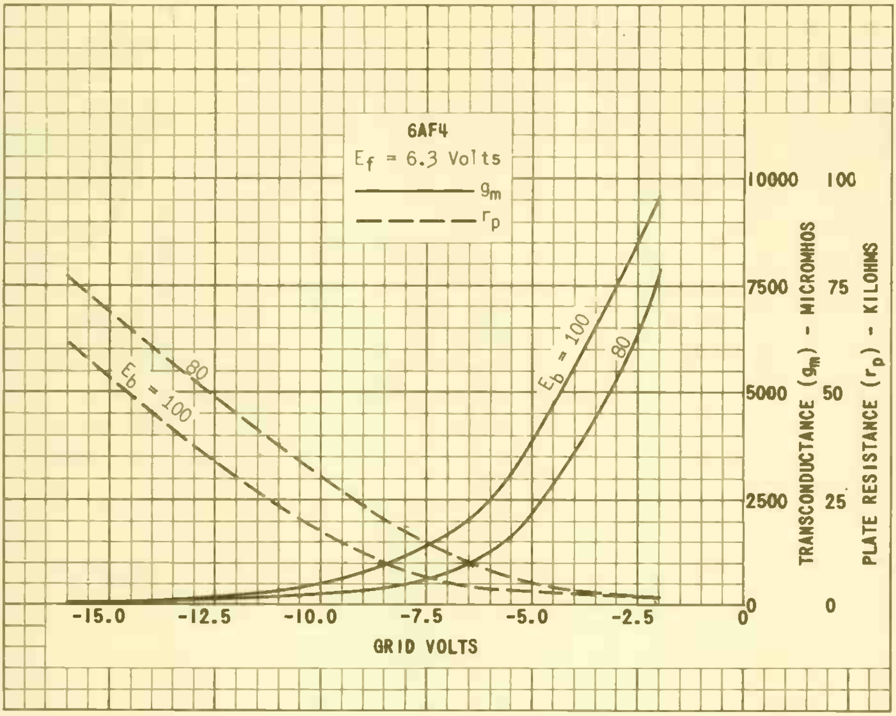


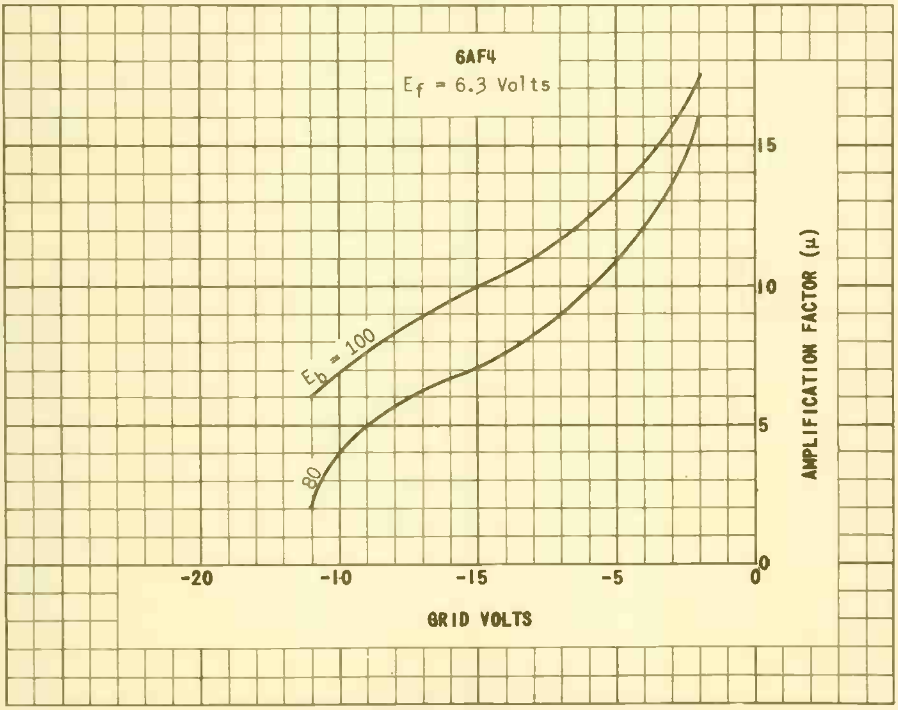


6AF4
Frequency = 930 Mc
Eb Varied: Ef Constant at 6.3 Volts
Ef Varied: Eb Constant at 100 Volts
FREQUENCY - KILOCYCLES PER SECOND
+250
0
-250
-500
0
25
50
75
100
PLATE VOLTS
0
2.5
5.0
7.5
10.0
HEATER VOLTS



6AF4
Ef = 6.3 Volts
+16
+12
+8
+4
Ec = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
PLATE MILLIAMPERES
50
40
30
20
10
0
0
50
100
150
200
250
PLATE VOLTS

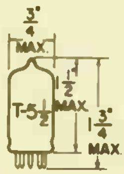

6AF4
E_f = 6.3 Volts
g_m
r_p
E_b = 100
80
E_b = 100
80
10000
7500
5000
2500
0
100
75
50
25
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - KILOHMS
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID VOLTS


6AF4
E_f = 6.3 Volts
E_b = 100
80
15
10
5
0
AMPLIFICATION FACTOR (μ)
-20
-10
-15
-5
0
GRID VOLTS

TUNG-SOL

TRIODE

MINIATURE TYPE

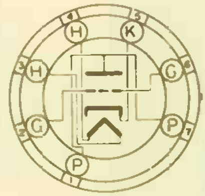


GLASS BULB

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 6AF4A 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. IT IS IDENTICAL TO THE 6AF4 EXCEPT FOR ITS SMALLER SIZE.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID TO PLATE	1.9	$\mu\mu f$
GRID TO CATHODE AND HEATER	2.2	$\mu\mu f$
PLATE TO CATHODE AND HEATER	0.45	$\mu\mu f$

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

OSCILLATOR SERVICE

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	50	VOLTS *
HEATER POSITIVE WITH RESPECT TO CATHODE[A]	50	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

[A] THE DC COMPONENT MUST NOT EXCEED 25 VOLTS.

CONTINUED ON FOLLOWING PAGE

*INDICATES AN ADDITION.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

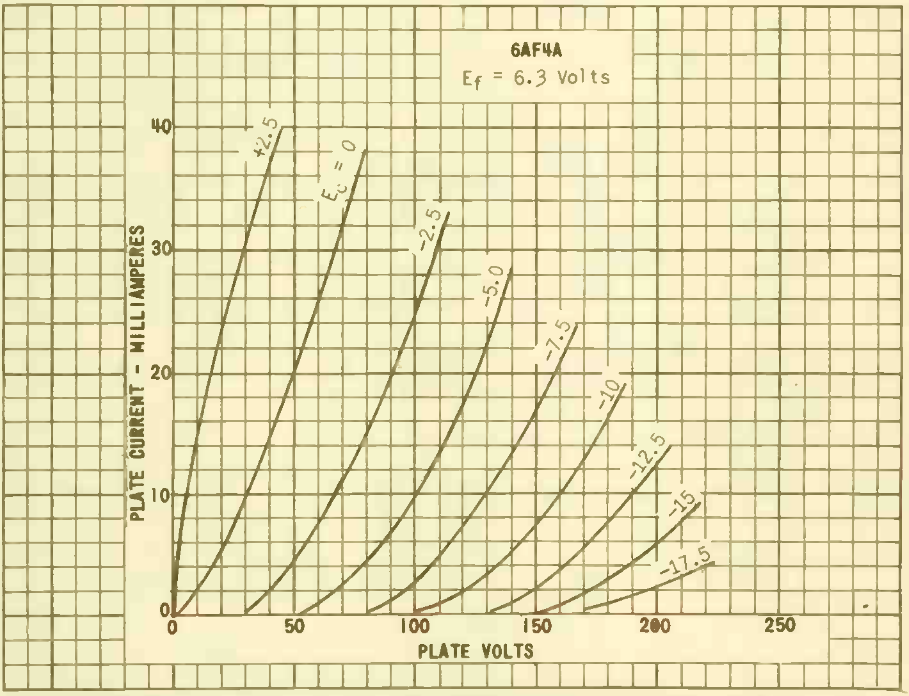
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

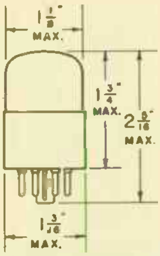
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.225	AMP.
PLATE VOLTAGE	80	VOLTS
CATHODE BIAS RESISTOR	150	OHMS
AMPLIFICATION FACTOR	15	
PLATE RESISTANCE	2 270	OHMS
TRANSCONDUCTANCE	6 600	µMHOS
PLATE CURRENT	16	MA.

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.



TUNG-SOL



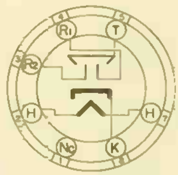
CATHODE RAY TUNING INDICATOR

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.

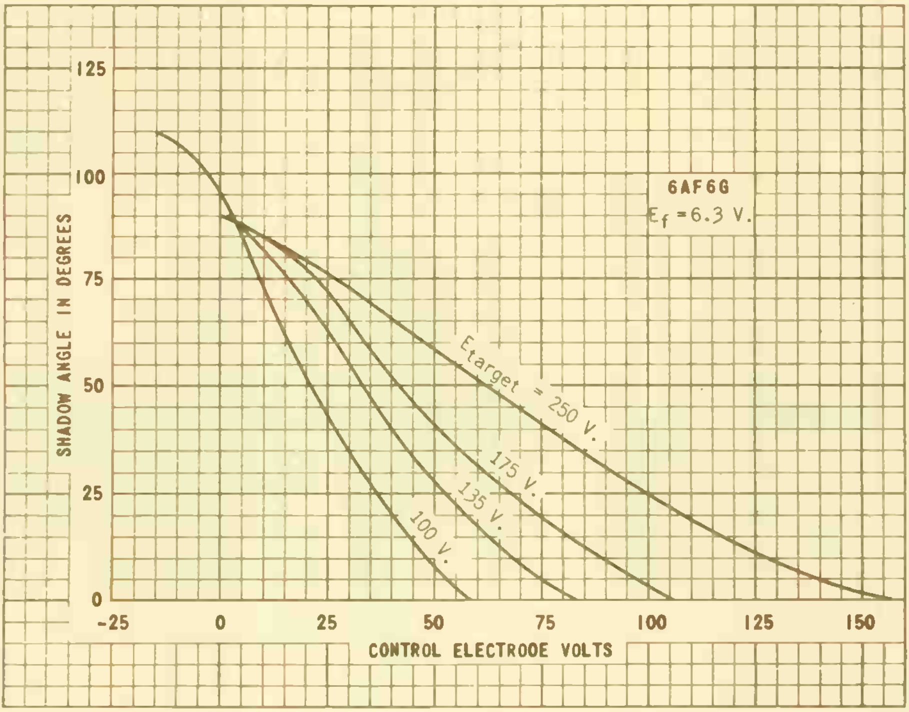
NOTE: A DOUBLE TRIODE, SUCH AS THE 6C8G OR THE 6F8G, CAN BE USED TO OBTAIN TWO SENSITIVITIES FOR A TUNING INDICATOR BY APPLYING FULL A.V.C. VOLTAGE TO ONE TRIODE AND 1/10 OF THE A.V.C. VOLTAGE TO THE OTHER.

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.

PRINTED IN U. S. A.

PLATE 238-I

DEC. 12 1938



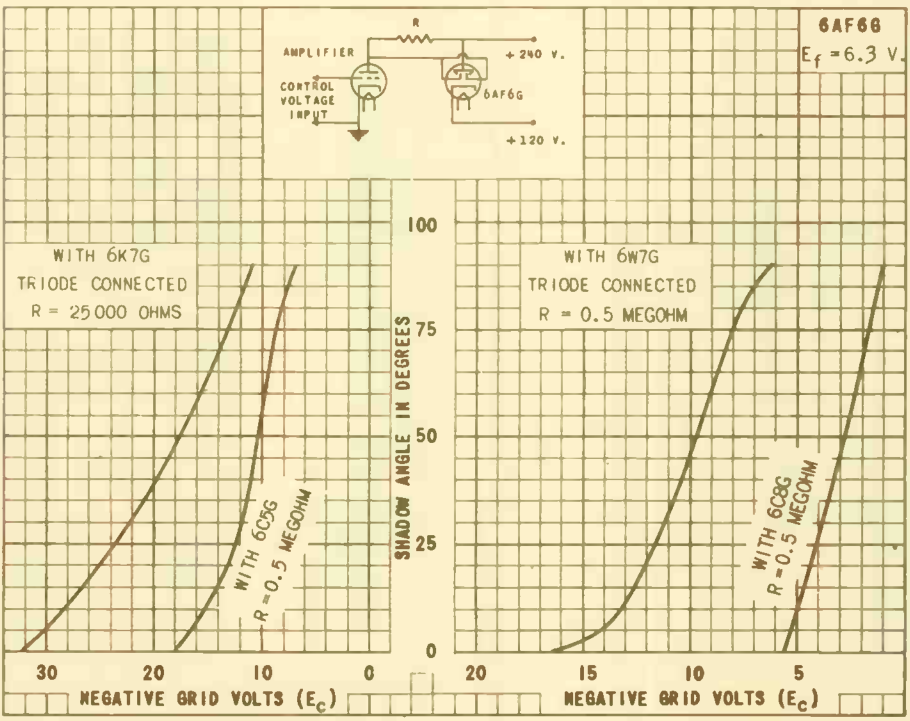
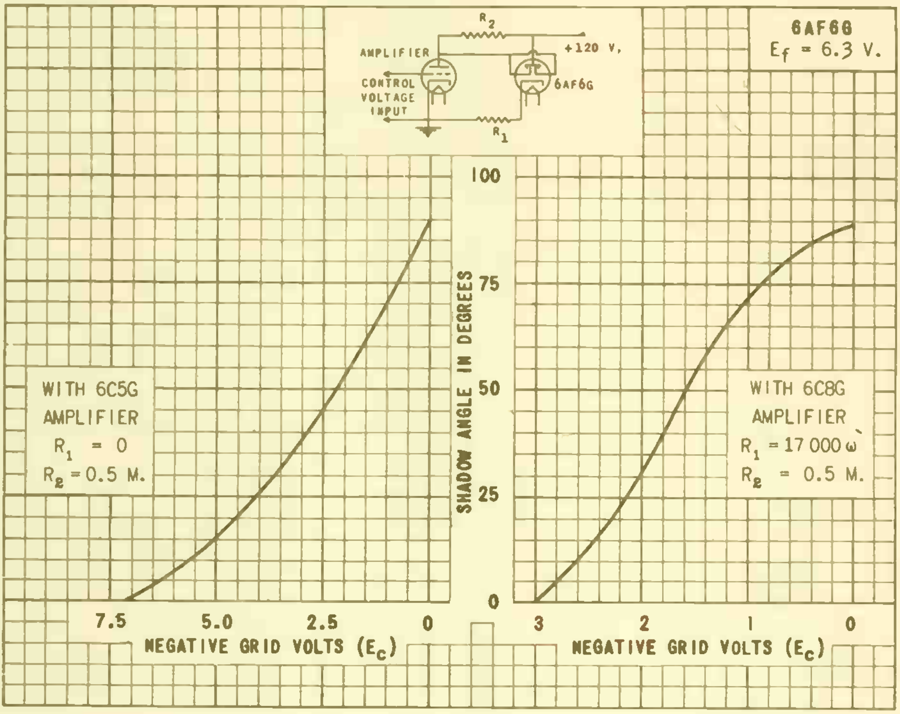


PLATE 263-1

JAN. 3 1939


R2
AMPLIFIER
+120 V.
CONTROL
VOLTAGE
INPUT
6AF6G
R1
6AF6G
Ef = 6.3 V.
100
75
50
25
0
SHADOW ANGLE IN DEGREES
WITH 6C5G
AMPLIFIER
R1 = 0
R2 = 0.5 M.
7.5
5.0
2.5
0
NEGATIVE GRID VOLTS (Ec)
WITH 6C8G
AMPLIFIER
R1 = 17 000 ω
R2 = 0.5 M.
3
2
1
0
NEGATIVE GRID VOLTS (Ec)

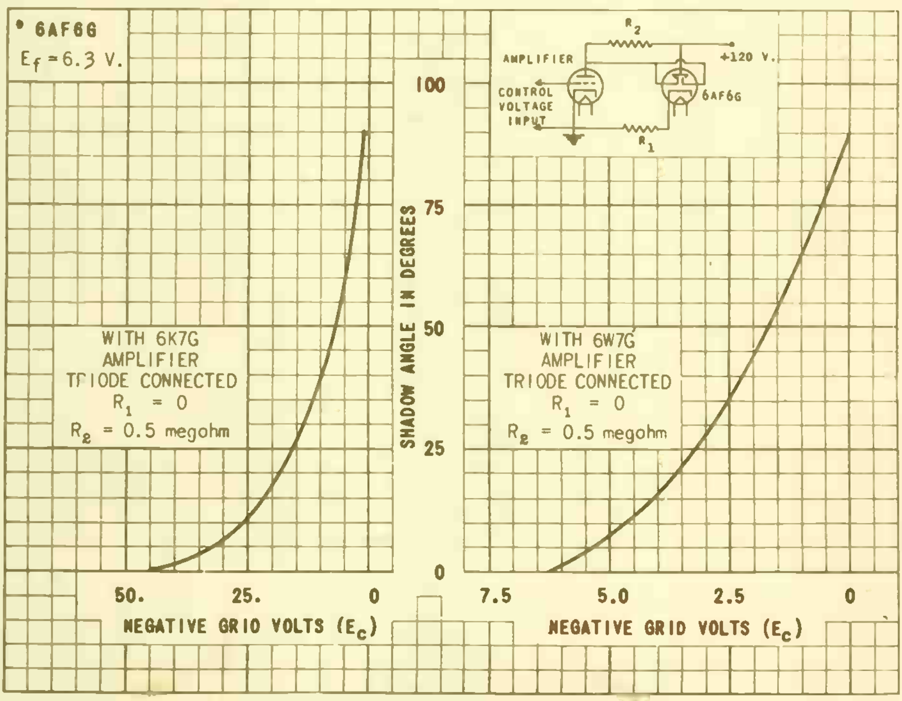
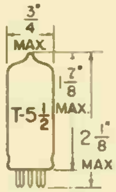

6AF6G
Ef = 6.3 V.
R2
AMPLIFIER
+120 V.
CONTROL
VOLTAGE
INPUT
6AF6G
R1
100
75
50
25
0
SHADOW ANGLE IN DEGREES
WITH 6K7G
AMPLIFIER
TRIODE CONNECTED
R1 = 0
R2 = 0.5 megohm
50.
25.
0
NEGATIVE GRID VOLTS (Ec)
WITH 6W7G
AMPLIFIER
TRIODE CONNECTED
R1 = 0
R2 = 0.5 megohm
7.5
5.0
2.5
0
NEGATIVE GRID VOLTS (Ec)

PLATE 284-1

TUNG-SOL

PENTODE

MINIATURE TYPE

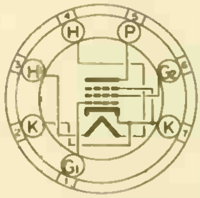


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BD

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.

PLATE
2950

JUNE 1
1952

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

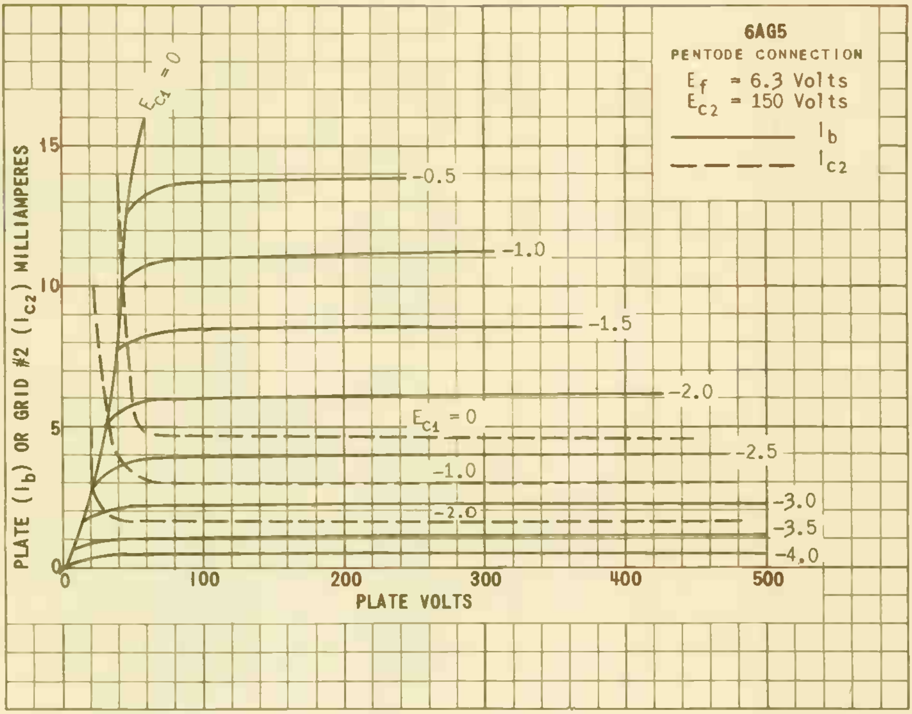
CLASS A_1 AMPLIFIER - TRIODE CONNECTION[C]

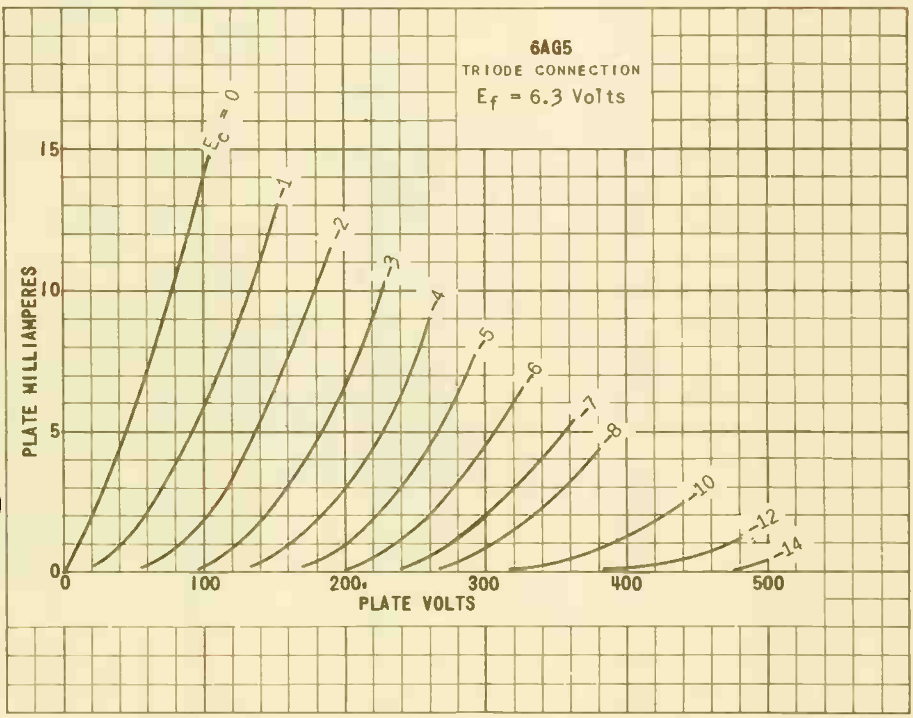
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	250	180	VOLTS
GRID #2 VOLTAGE	PLATE	PLATE	←
CATHODE RESISTOR	820	330	OHMS ←
TRANSCONDUCTANCE	3 800	5 700	µMHOS
PLATE CURRENT	5.5	7	MA.
PLATE RESISTANCE (APPROX.)	0.01	0.008	MEGOHM ←
AMPLIFICATION FACTOR	42	45	

[C] GRID #2 TIED TO PLATE.

PLATE 2951
JUNE 1 1952

→ INDICATES A CHANGE OR ADDITION.





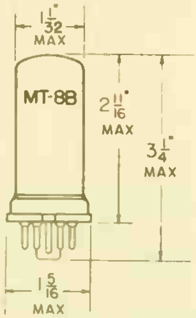
PRINTED IN U. S. A.

PLATE
2952

JUNE 1
1952

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.

TUNG-SOL

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

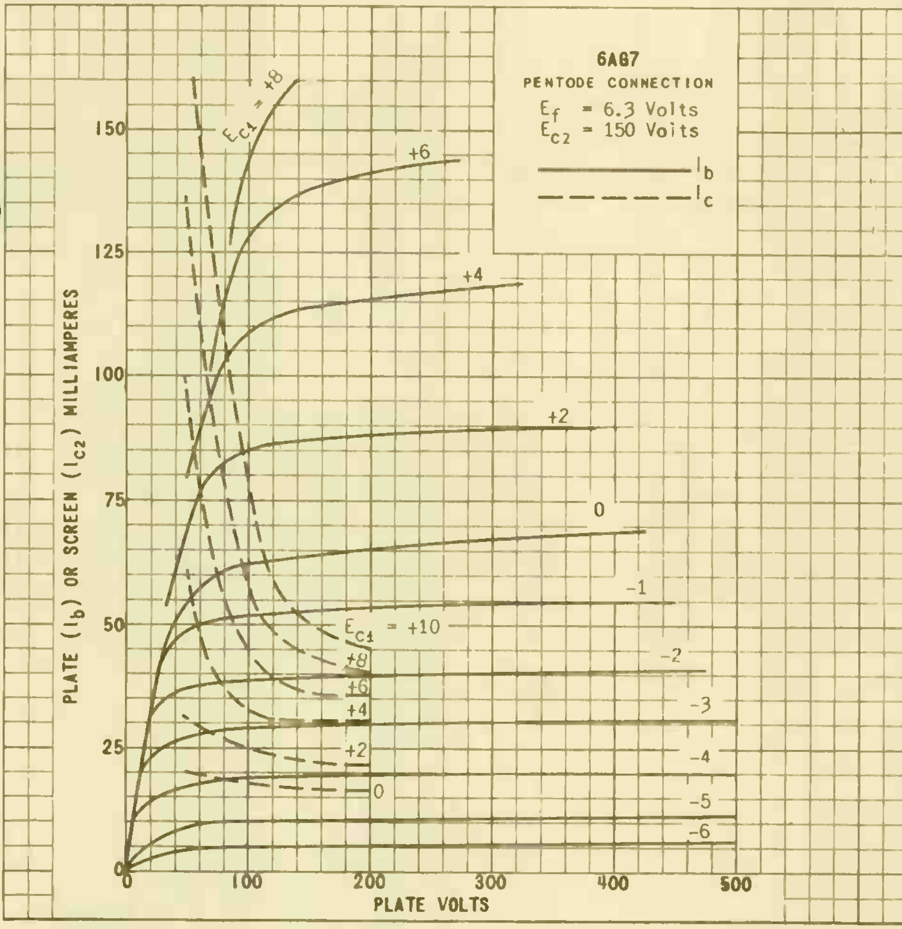
	GRID LEAK BIAS[A]	CATHODE BIAS	
HEATER VOLTAGE	66.3	6.3	VOLTS
HEATER CURRENT	0.65	0.65	AMP.
PLATE SUPPLY VOLTAGE	300	300	VOLTS
GRID #2 VOLTAGE	115[B]	125[C]	VOLTS
GRID #1 VOLTAGE	0[D]	-2	VOLTS
GRID #1 RESISTOR (MINIMUM)	0.25	---	MEGOHM
GRID #1 RESISTOR (MAXIMUM)	0.5	---	MEGOHM
CATHODE RESISTOR (BY-PASSED 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.



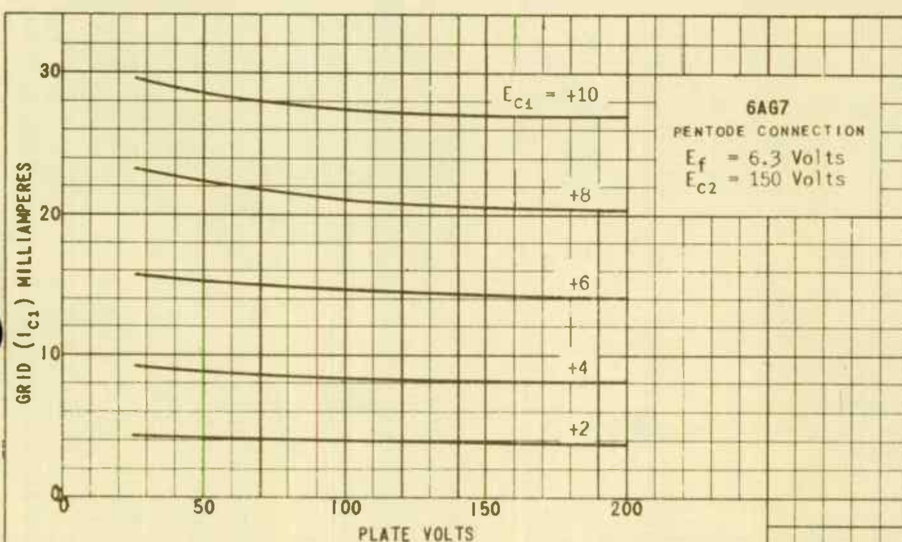
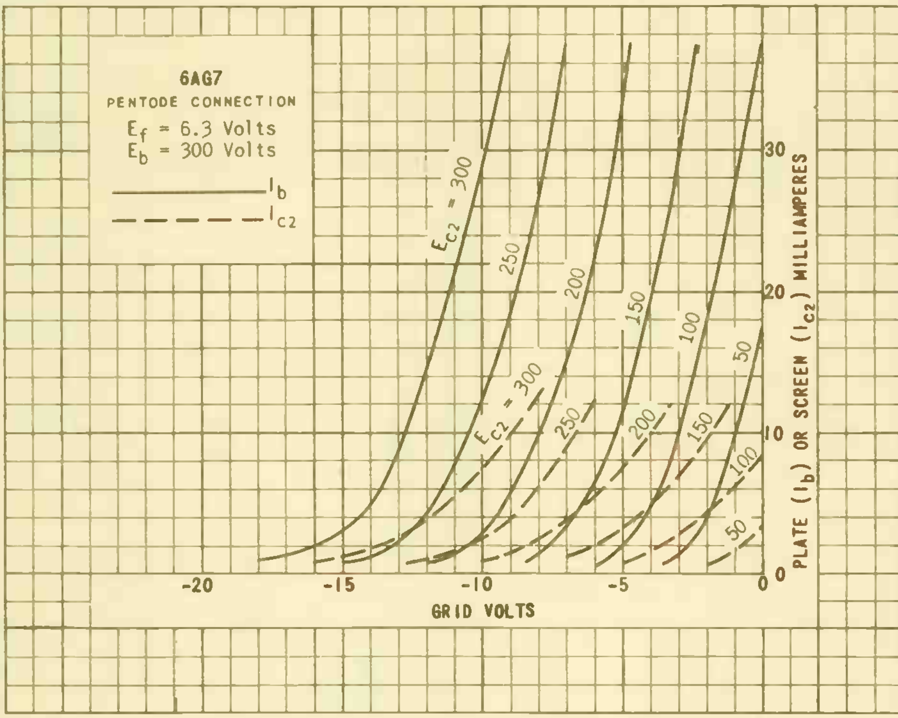


PLATE 1956
FEB. 3 1948

 ELECTRON TUBE DIVISION NEWARK, NEW JERSEY U S A



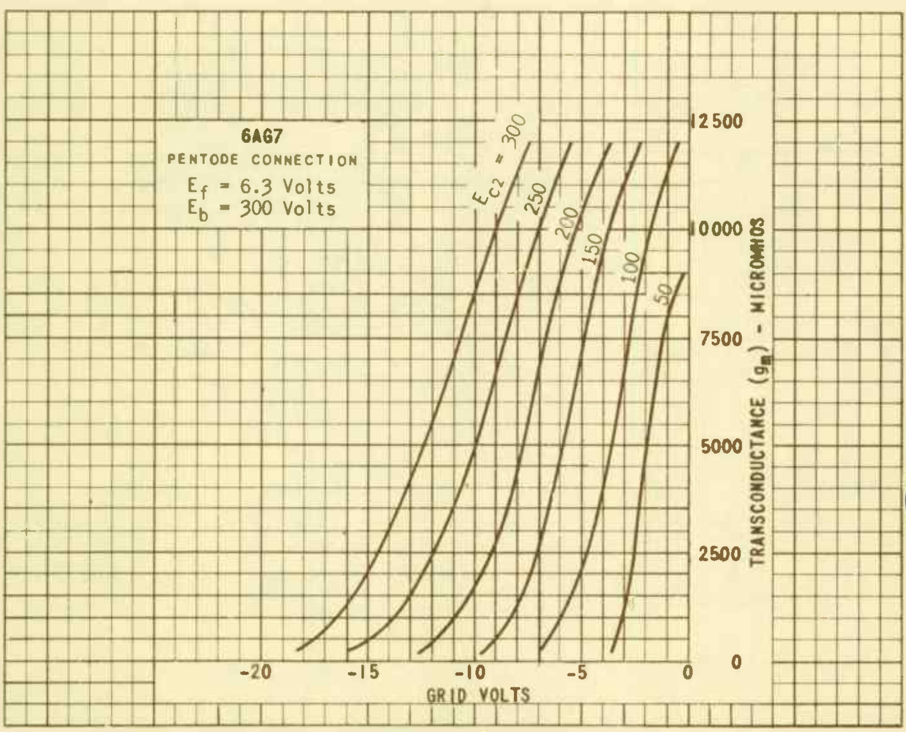
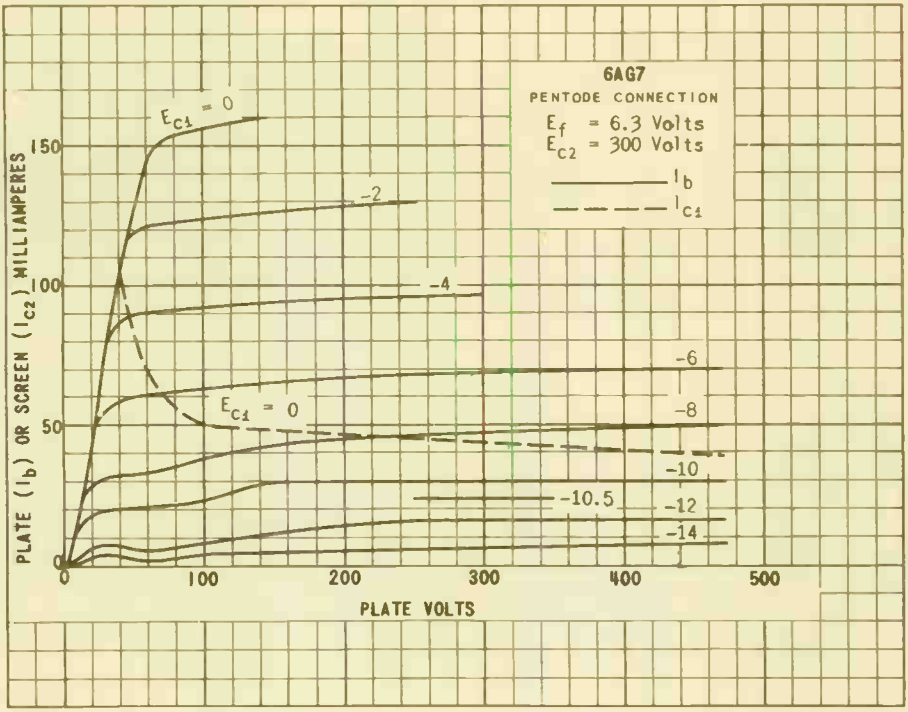


PLATE
1957
FEB. 2,
1948

 ELECTRON TUBE DIVISION NEWARK NEW JERSEY U S A



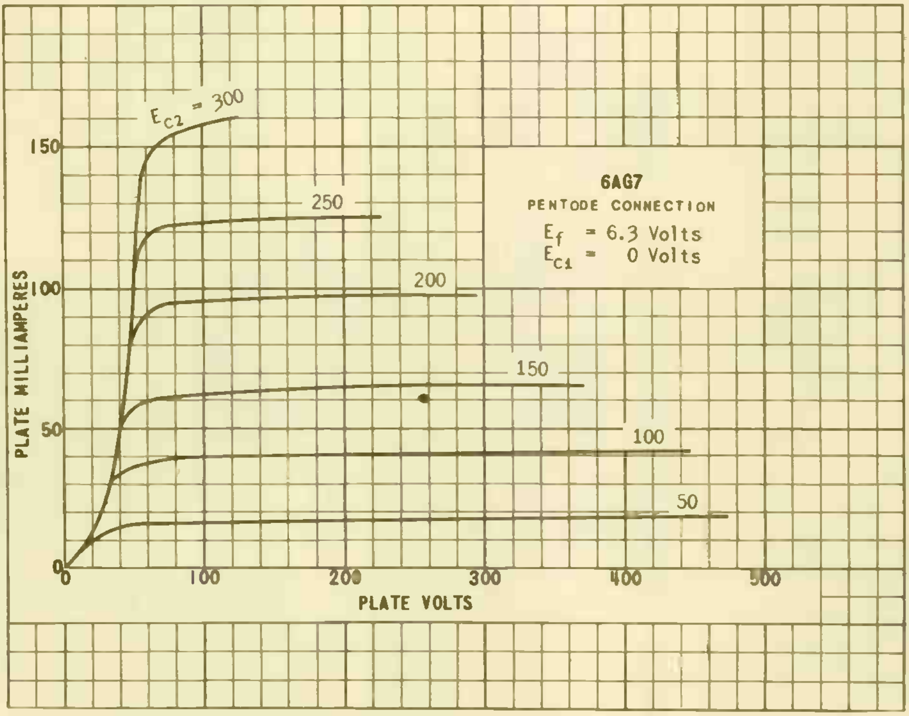
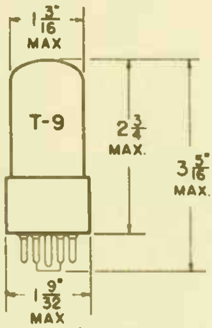


PLATE 1958
FEB. 2, 1948

PRINTED IN U. S. A.

TUNG-SOL

TRIODE

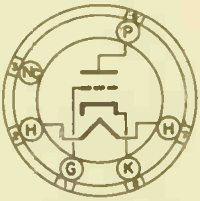


GLASS BULB

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.

PRINTED IN U.S.A.

PLATE 2953
JUNE 1 1952

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

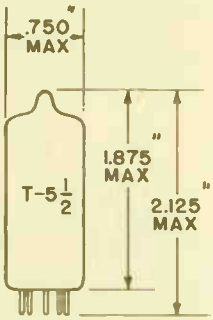
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	750	750	MA.
PLATE VOLTAGE	250	250	VOLTS
GRID VOLTAGE	-33	-23	VOLTS
PLATE CURRENT	5	30	MA.
TRANSCONDUCTANCE		4 500	µMHOS
AMPLIFICATION FACTOR		8	
PLATE RESISTANCE		1 780	OHMS
GRID VOLTAGE FOR 0.5 MA. PLATE CURRENT (APPROX.)		-40	VOLTS

PLATE 2954
JUNE 1 1952

TUNG-SOL

PENTODE

MINIATURE TYPE



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

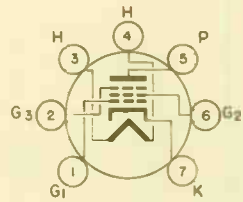
COATED UNIPOTENTIAL CATHODE

FOR

VOLTAGE AMPLIFIER

SERVICE IN T.V. APPLICATIONS

ANY MOUNTING POSITION



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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

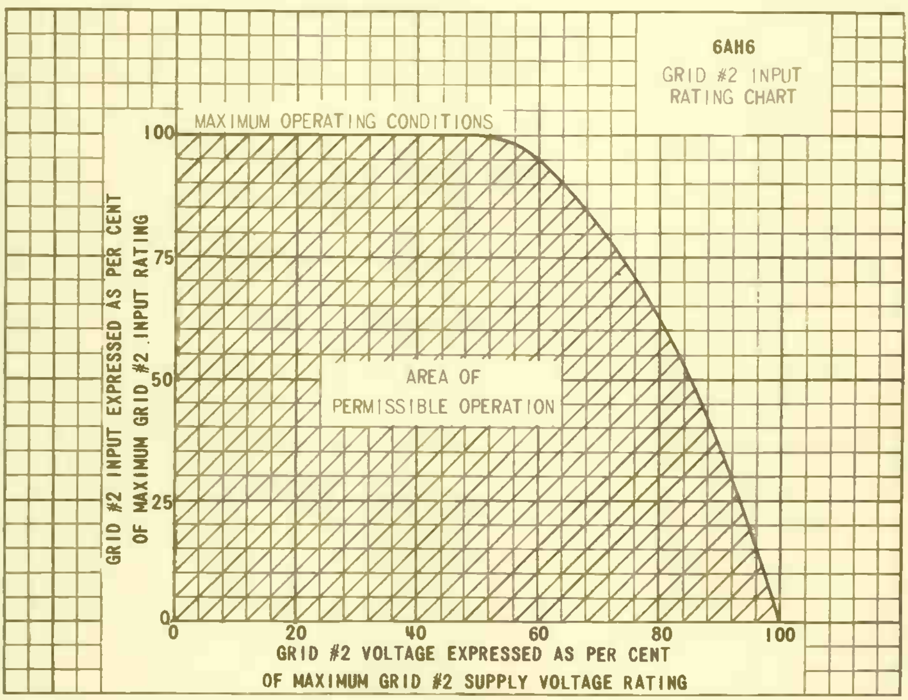
TYPICAL OPERATING CHARACTERISTICS

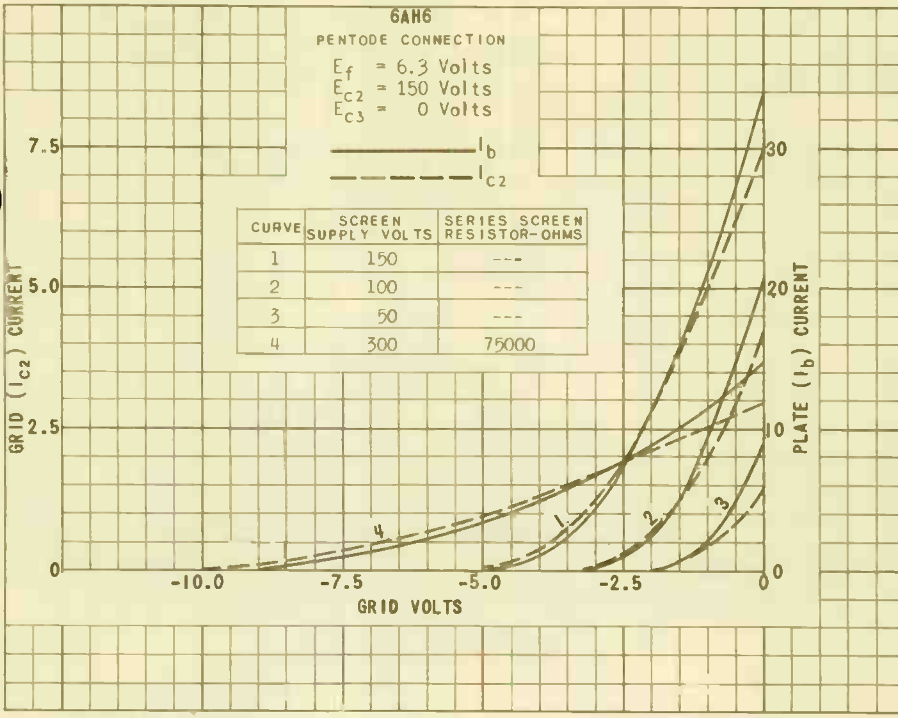
	PENTODE CONNECTED	TRIODE CONNECTED	
PLATE VOLTAGE	300	150	VOLTS
GRID #2 VOLTAGE	150	→ 150	VOLTS
GRID #3 VOLTAGE*	A	150	VOLTS
CATHODE RESISTOR	160	160	OHMS
PLATE RESISTANCE (APPROX.)	0.5	0.0036	MEGOHMS
TRANSCONDUCTANCE	9000	11000	μMHOS
TRANSCONDUCTANCE (GRID #3 TO PLATE)	B	---	
AMPLIFICATION FACTOR	---	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.

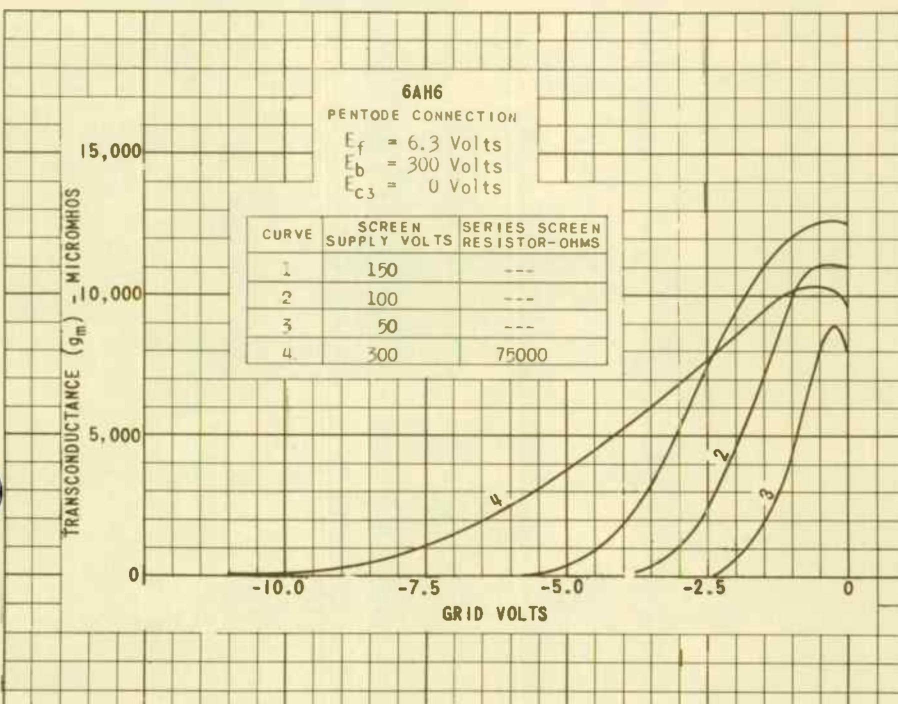
B GRID #3 HAS PRACTICALLY NO CONTROL CHARACTERISTIC AND IT IS NOT INTENDED TO BE USED AS A CONTROL ELECTRODE. ITS TRANSCONDUCTANCE TO THE PLATE IS APPROXIMATELY 2 μMHOS AND THE MU IS 0.7 TO 1.0.

* INDICATES AN ADDITION.
→ INDICATES A CHANGE.



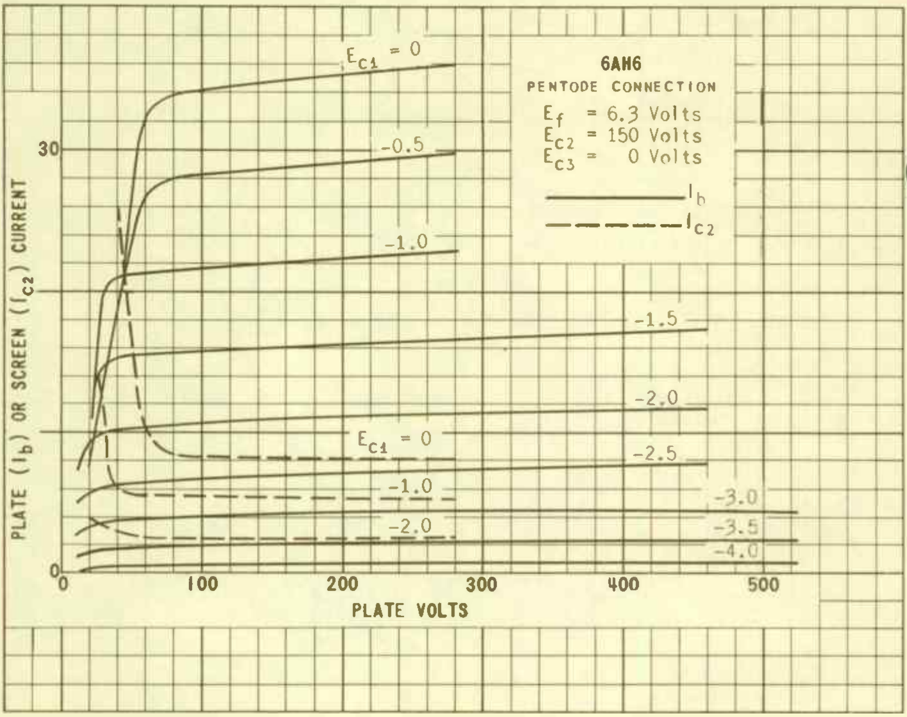


CURVE	SCREEN SUPPLY VOLTS	SERIES SCREEN RESISTOR-OHMS
1	150	---
2	100	---
3	50	---
4	300	75000



CURVE	SCREEN SUPPLY VOLTS	SERIES SCREEN RESISTOR-OHMS
1	150	---
2	100	---
3	50	---
4	300	75000

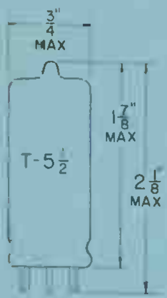
PRINTED IN U.S.A.


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
PLATE (I_b) OR SCREEN (I_{c2}) CURRENT
30
0
0
100
200
300
400
500
PLATE VOLTS

TUNG-SOL

PENTODE

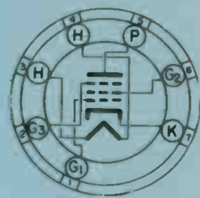
MINIATURE TYPE



GLASS BULB
6-2

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BK

THE 6AH6WA IS A HEATER-CATHODE TYPE, HIGH TRANSCONDUCTANCE, SHARP CUT-OFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A WIDE BAND OR IF AMPLIFIER IN MOBILE AND AIRCRAFT APPLICATIONS.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 3)	450	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR FATIGUE TEST-NOTE #4)	2.5	G
MAXIMUM BULB TEMPERATURE	180	°C

RATINGS

AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MIN.	NORMAL TEST CONDI-TIONS (NOTE 6)	NORMAL OPER-ATION (NOTE 5)	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 7)	Ef	5.7	6.3	6.3	6.9	VOLTS
PLATE VOLTAGE	Eb:	---	300	300	330	Vdc
GRID #1 VOLTAGE	Ec1:	---	0	0	---	Vdc
GRID #2 VOLTAGE	Ec2:	---	150	150	165	Vdc
GRID #3 VOLTAGE	Ec3:	---	0	0	---	Vdc
PLATE DISSIPATION	Pp:	---	---	3.0	3.3	W
GRID #2 DISSIPATION	Pg2:	---	---	0.38	0.45	W
HEATER-CATHODE VOLTAGE	Ehk:	-200	---	100	+200	V
CATHODE CURRENT	Ik:	---	---	12.5	28	mAdc
CATHODE RESISTANCE	Rk:	---	160	160	---	OHMS
PLATE CURRENT (1)	Ib(1):	---	---	10	---	mAdc
GRID #2 CURRENT	Ic2:	---	---	2.8	---	mAdc
TRANSCONDUCTANCE (1)	Sm(1):	---	---	9000	---	µMHOS
PLATE RESISTANCE	rp:	---	---	0.5	---	MEG.

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

TEST	AQL %	MIL-E-1	MIN.	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1		COMBINED AQL=1.0% EXCLUDING MECHANICAL AND INOPERATIVES							
HEATER CURRENT:	0.65	If:	420	432	450	468	480	36	mA
HEATER-CATHODE LEAKAGE: Ehk=+100 Vdc	0.65	Ihk:	---	---	---	---	10	---	µAdc
Ehk=-100 Vdc		Ihk:	---	---	---	---	10	---	µAdc
GRID CURRENT: Rg1=1.0 MEG.	0.65	Ic(1):	---	---	---	---	-2.0	---	µAdc
PLATE CURRENT (1):	0.65	Ib(1):	7.5	8.2	10.0	11.3	12.5	2.5	mAdc
PLATE CURRENT (2): Ec1=-10.0 Vdc	0.65	Ib(2):	---	---	---	---	30	---	µAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	7000	8000	9000	10000	11000	12000	µmhos
SCREEN GRID CURRENT:	0.65	Ic2:	1.5	1.9	2.5	3.1	3.5	1.4	mAdc
CONTINUITY AND SHORTS (INOPERATIVES):	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE T-5½ (6-1)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS PART 2									
INSULATION OF ELECTRODES: Ef=6.3V Eg1-ALL=-100 Vdc	2.5	Rg1-all:	100	---	---	---	---	---	MEG.
Ep-ALL=-300 Vdc		Rp-all:	100	---	---	---	---	---	MEG
PLATE CURRENT (3): Ec1=-5.0 Vdc	2.5	Ib(3):	5	---	---	---	---	---	µAdc
TRANSCONDUCTANCE (2): Ef=5.7 (NOTE 4)	2.5	ΔSm(2):	---	---	---	---	15	---	PERCENT
GRID EMISSION: Ef=7.5V; PREHEAT 5 MINUTES AT Ec1=0 Vdc. TEST AT Ec1=-10 Vdc	2.5	Ic1(2):	---	---	---	---	-2.0	---	µAdc
RF NOISE: Esig=35 mVac; Ck=0.2 µf	2.5	EB:	---	---	---	---	5	---	VU
NOISE AND MICROPHONICS: Ef=6.3 Vac; Ebb=Ecc2=300 Vdc; Ec1=0; Rk=200 OHMS; Ec3 to GROUND; Rp=10,000 OHMS; Rg2=40,000 OHMS; Cg2=1 µf; Ck=1000 µf; Esig=300 mVac.	2.5	EB:	---	---	---	---	17	---	VU

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG	UAL	MAX.	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 2- cont'd.		COMBINED AQL=1.0% EXCLUDING MECHANICAL AND INOPERATIVES							
CAPACITANCE		Cgp:	---	---	---	---	0.035	---	pf
CAPACITANCE (NOTE 2)	6.5	Cin:	8.0	---	10	---	12	---	pf
CAPACITANCE		Cout:	3.0	---	4.0	---	6	---	pf
LOW PRESSURE VOLTAGE BREAKDOWN PRESSURE=55±5mmHg; VOLTAGE =500 Vac.	6.5	---	---	---	---	---	---	---	---
VIBRATION (2): F=25 cps; G=2.5; Rp=2000 OHMS; Ck=1000 µf	2.5	Ep:	---	---	---	---	100	---	mVac
DEGRADATION RATE ACCEPTANCE TESTS									
SHOCK: HAMMER ANGLE=30°; Ehk=+100 Vdc; (NOTE 3)	20	---	---	---	---	---	---	---	---
FATIGUE: 96 HRS; G=2.5 FIXED FREQUENCY; F=25 min., 60 max. (NOTE 4)	6.5	---	---	---	---	---	---	---	---
POST SHOCK AND FATIGUE TEST END POINTS:									
VIBRATION (2): F=25cps; G=2.5; Rp=2000 ohms; Ck=1000 µf	---	Ep:	---	---	---	---	200	---	mVac
HEATER-CATHODE LEAKAGE: Ehk=+100 Vdc	---	Ihk:	---	---	---	---	50	---	µAdc
Ehk=-100 Vdc		Ihk:	---	---	---	---	50	---	µAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:	---	Δ_t Gm(1)	---	---	---	---	20	---	PERCENT
GRID CURRENT (1):	---	Ic1:	---	---	---	---	-4.0	---	µAdc
MINIATURE TUBE BASE STRAIN:	---	---	---	---	---	---	---	---	---
GLASS STRAIN (THERMAL SHOCK)	2.5	---	---	---	---	---	---	---	---
ACCEPTANCE LIFE TESTS									
HEATER CYCLING LIFE TEST: Ef=7.5V; Eb=Ec1=Ec2=Ec3=0V; Ehk=+100 Vdc; 1 min on, 4 min. off.	1.0	---	---	---	---	---	---	---	---

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST ACCEPTANCE LIFE TESTS	ALLOW. DEF. per CHARAC. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
HEATER CYCLING LIFE TEST END POINTS:							
HEATER-CATHODE LEAKAGE:							
Ehk=+100 Vdc			---	Ihk:	---	50	μAdc
Ehk=-100 Vdc			---	Ihk:	---	50	μAdc
1 HOUR STABILITY LIFE TEST: TA=ROOM; Ehk=+135Vdc; Rg1=0.1 meg. min.			---	---	---	---	---
1 HOUR STABILITY LIFE TEST END POINTS;							
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES: (TYPICAL SAMPLE SIZE=50 TUBES)			1.0	Δ_tSm(1):	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST: TA=ROOM; Ehk=+135 Vdc; Rg1=0.1meg. min.			---	---	---	---	---
100 HOUR SURVIAL RATE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE=200 TUBES)			---	---	---	---	---
CONTINUITY AND SHORTS (INOPERATIVES):			0.65	---	---	---	---
TRANSCONDUCTANCE (1):			1.0	Sm(1):	6300	---	μMHOS
INTERMITTENT HIGH TEMPERATURE LIFE TEST: T BULB=+180°C; Ehk=+135 Vdc; Rg1=0.1meg.min.			---	---	---	---	---
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE=20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)							
INOPERATIVES:	1	5	---	---	---	---	---
GRID CURRENT (1):	1	3	---	Ic(1):	0	-2.0	μAdc
HEATER CURRENT:	1	3	---	If:	410	490	mA
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:	1	3	---	Δ_tSm(1):	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 8)	2	5	---	Δ_{Ef}Sm(2):	---	15	PERCENT
HEATER-CATHODE LEAKAGE:							
Ehk=+100 Vdc	1	3	---	Ihk:	---	20	μAdc
Ehk=-100 Vdc			---	Ihk:	---	20	μAdc

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST ACCEPTANCE LIFE TESTS - cont'd.	ALLOWABLE DEF. PER CHARACTER. 1st SAMP.	 COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ELECTRODE INSULATION:							
g1-all	2	5	---	Rg1-all:	50	---	MEG.
p-all			----	Rp-all:	50	---	MEG.
TRANSCONDUCTANCE							
(1) AVG. CHANGE:	---	---	---	Avg.Δ_tSm(1):	---	15	PERCENT
TOTAL DEFECTIVES	4	8	---	---	---	---	---
1000 HOUR INTERMITTENT LIFE TEST END POINTS: (TYPICAL SAMPLE SIZES= 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)	---	---	---	---	---	---	---
INOPERATIVES:	2	5	---	---	---	---	---
GRID CURRENT (1):	2	5	---	Ic1(1):	0	-2.0	μAdc
HEATER CURRENT:	2	5	---	If:	410	490	MA.
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:	2	5	---	Δ_tSm(1):	---	20	PERCENT
HEATER-CATHODE LEAKAGE:							
Ehk=+100 Vdc	2	5	---	Ihk:	---	20	μAdc
Ehk=-100 Vdc			---	Ihk:	---	20	μAdc
TOTAL DEFECTIVES:	5	10	---	---	---	---	---
500 HOUR CATHODE INTERFACE RESISTANCE LIFE TEST: TA=ROOM; Ef=7.5 Vac; Ehk=0; g1, g2, g3 and P FLOATING	---	---	---	---	---	---	---
500 HOUR CATHODE INTERFACE RESISTANCE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE= 20 TUBES 1st SAMPLE, 40 TUBES 2nd SAMPLE)							
INTERFACE RESISTANCE:	1	3	---	ri:	---	25	OHMS

NOTES

1. CHARACTERISTICS, QUALITY CONTROL TEST PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1, "INSPECTION INSTRUCTIONS FOR ELECTRON TUBES" AND MIL-STD-105A.

2. WITH CYLINDRICAL SHIELD #316 CONNECTED TO CATHODE LEAD.

3. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES – CONT'D.

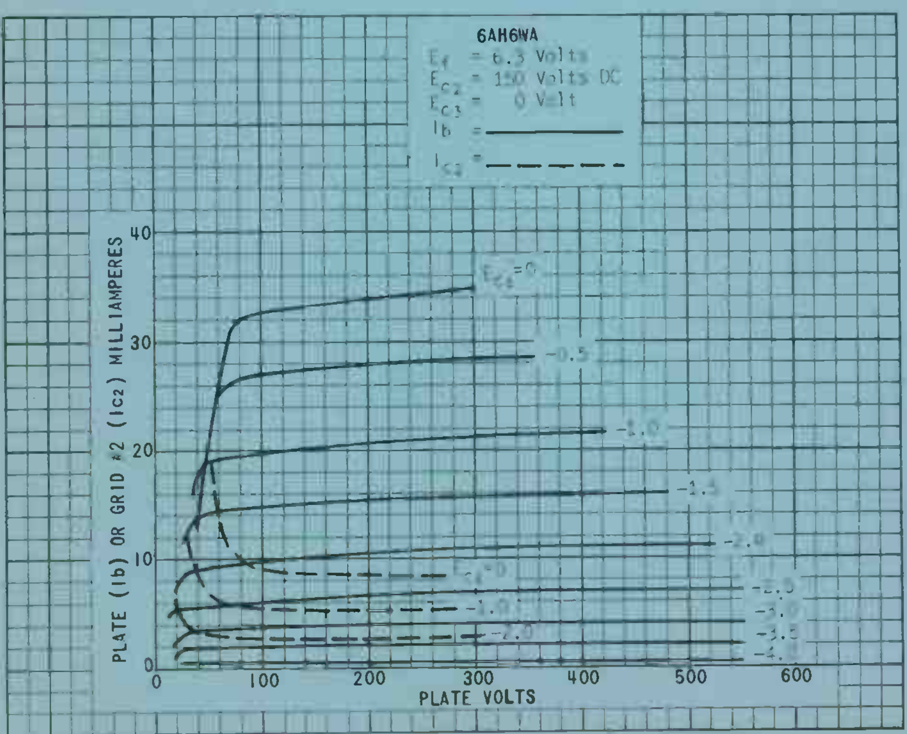
4. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

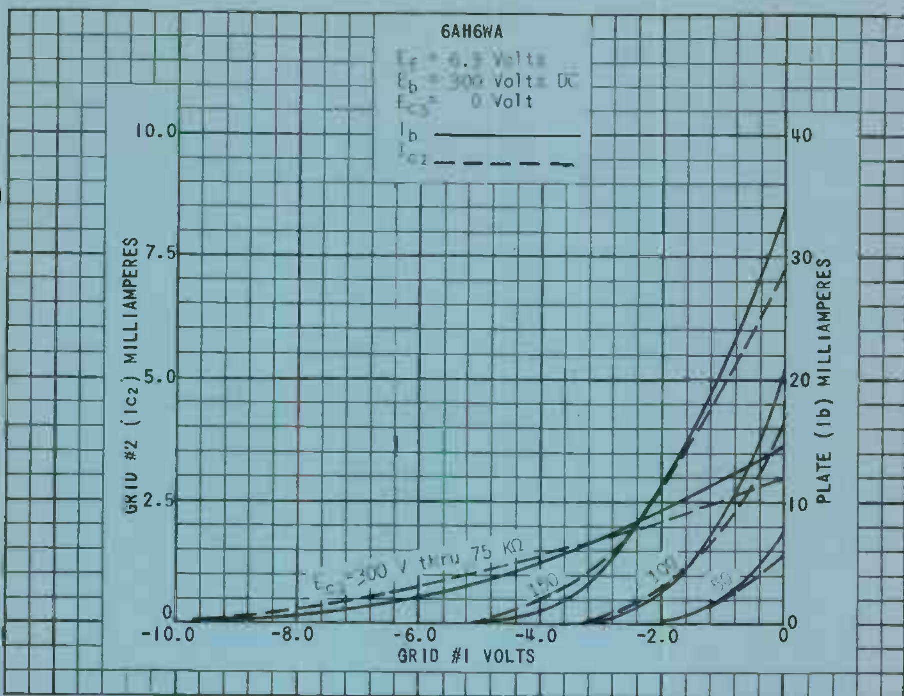
5. THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

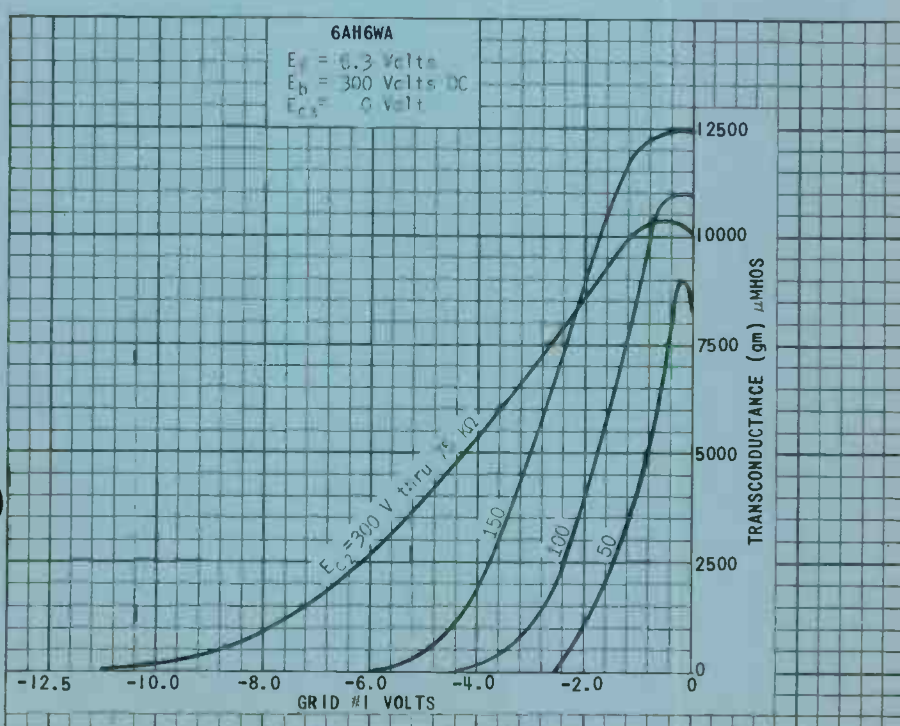
6. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHERWISE STATED UNDER INDIVIDUAL TEST ITEMS.

7. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

8. CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT E_f=6.3 TO THAT VALUE MEASURED AT E_f=5.7 V.



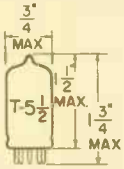

6AH6WA
E_f = 6.3 Volts
E_b = 300 Volts DC
E_{c3} = 0 Volt
I_b
I_{c2}
E_{c2}=300 V thru 75 KΩ
150
100
50
GRID #2 (I_{c2}) MILLIAMPERES
PLATE (I_b) MILLIAMPERES
GRID #1 VOLTS
10.0
7.5
5.0
2.5
0
40
30
20
10
-10.0
-8.0
-6.0
-4.0
-2.0


6AH6WA
E_f = 6.3 Volts
E_b = 300 Volts DC
E_{c3} = 0 Volt
E_{c2}=300 V thru 75 KΩ
150
100
50
TRANSCONDUCTANCE (gm) µMHOS
12500
10000
7500
5000
2500
0
-12.5
-10.0
-8.0
-6.0
-4.0
-2.0
GRID #1 VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

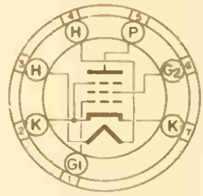


GLASS BULB

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.

PRINTED IN U.S.A.

PLATE 2694

JULY 1 1951

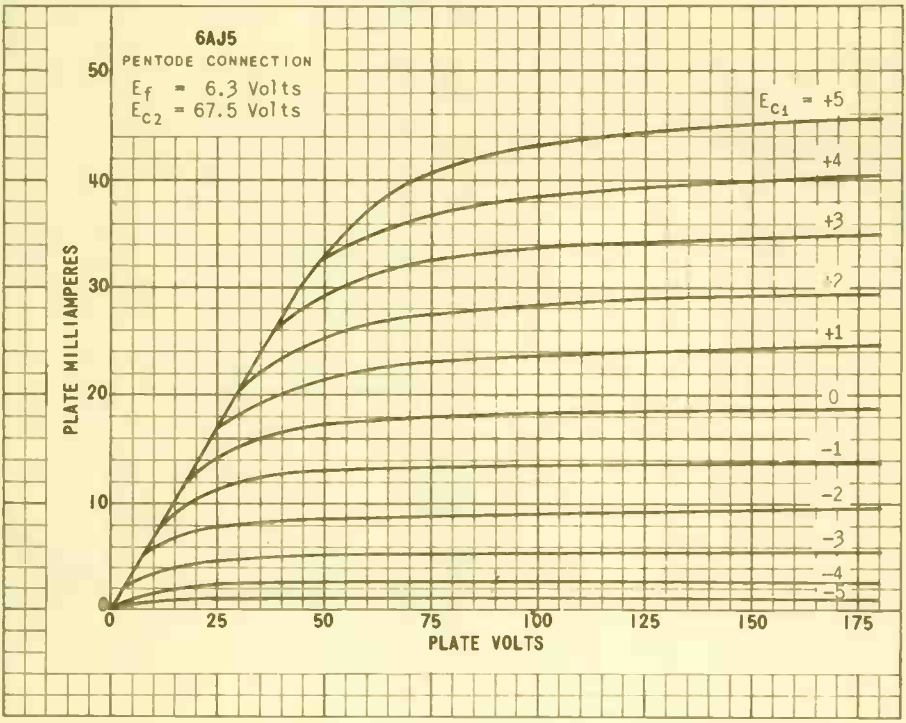
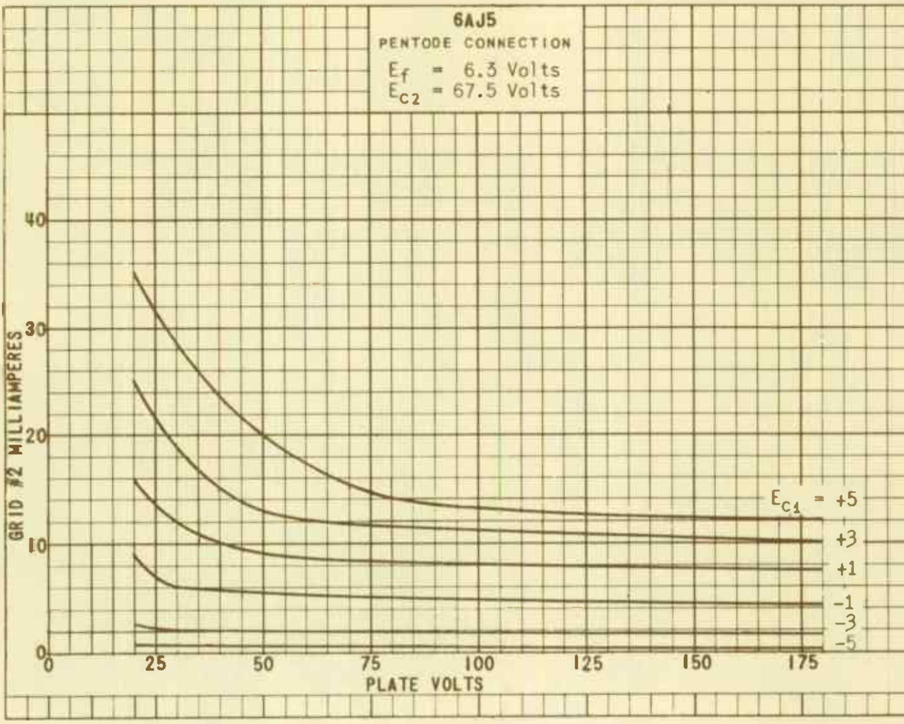


PLATE 2695
JULY 1 1951



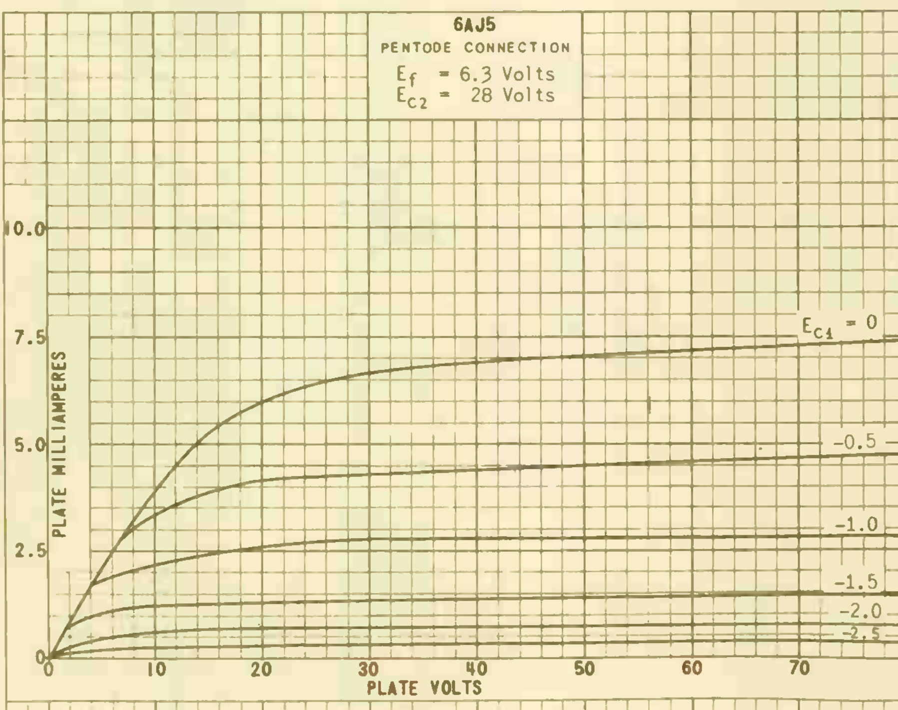


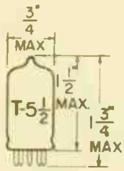
PLATE 2035
JULY 1, 1948

 ELECTRON TUBE DIVISION NEWARK, NEW JERSEY, U S A

TUNG-SOL

PENTODE

MINIATURE TYPE

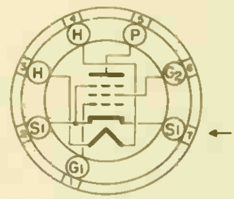


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 175 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BD

THE 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

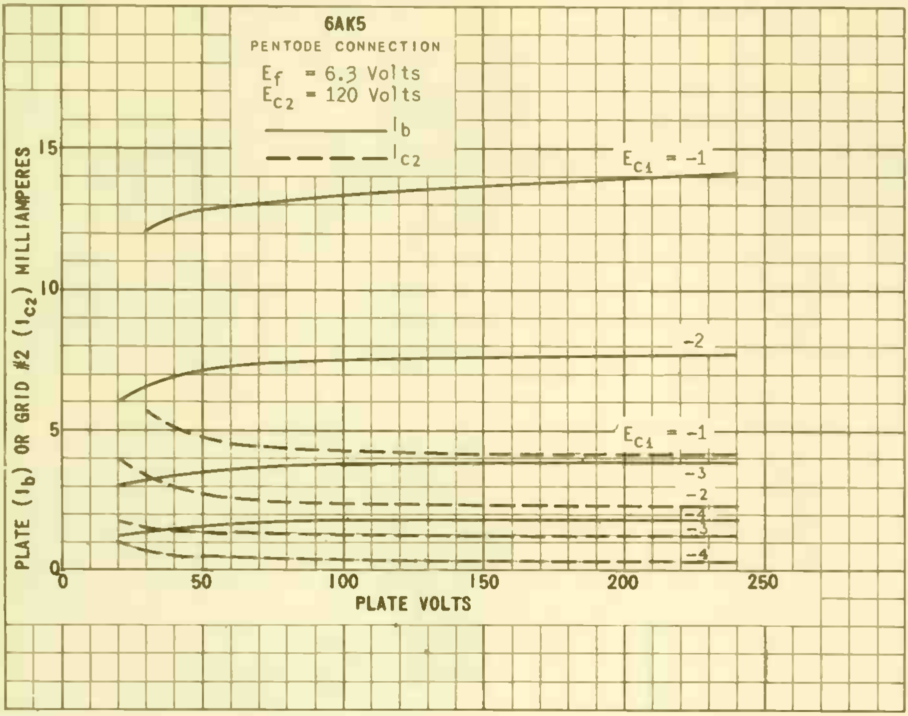
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	120 ←	VOLTS
MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4 ←	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM CATHODE CURRENT	18	MA.

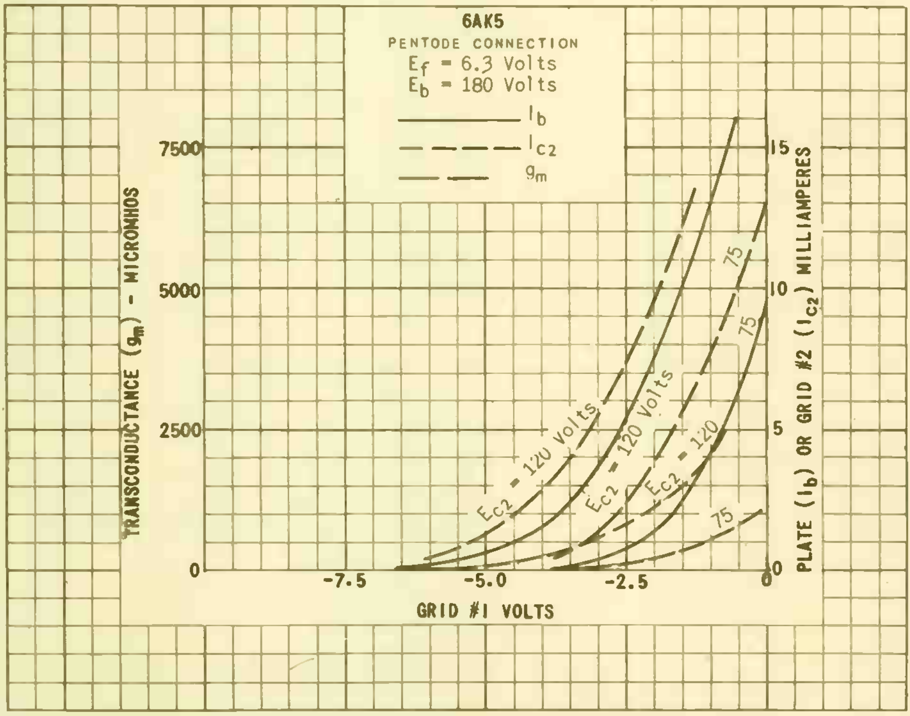
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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.


6AK5
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 120 Volts
I_b
I_{c2}
E_{c1} = -1
-2
E_{c1} = -1
-3
-2
-4
-3
-4
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
5
10
15
0
50
100
150
200
250
PLATE VOLTS


6AK5
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 180 Volts
I_b
I_{c2}
g_m
TRANSCONDUCTANCE (g_m) - MICROMHOS
7500
5000
2500
0
E_{c2} = 120 Volts
E_{c2} = 120 Volts
E_{c2} = 120
75
75
75
-7.5
-5.0
-2.5
0
GRID #1 VOLTS
15
10
5
0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES

TUNG-SOL

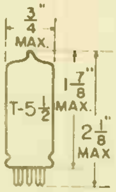
POWER AMPLIFIER PENTODE

MINIATURE TYPE

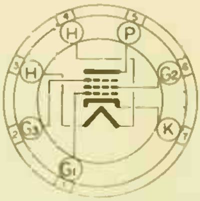
COATED UNIPOTENTIAL CATHODE

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

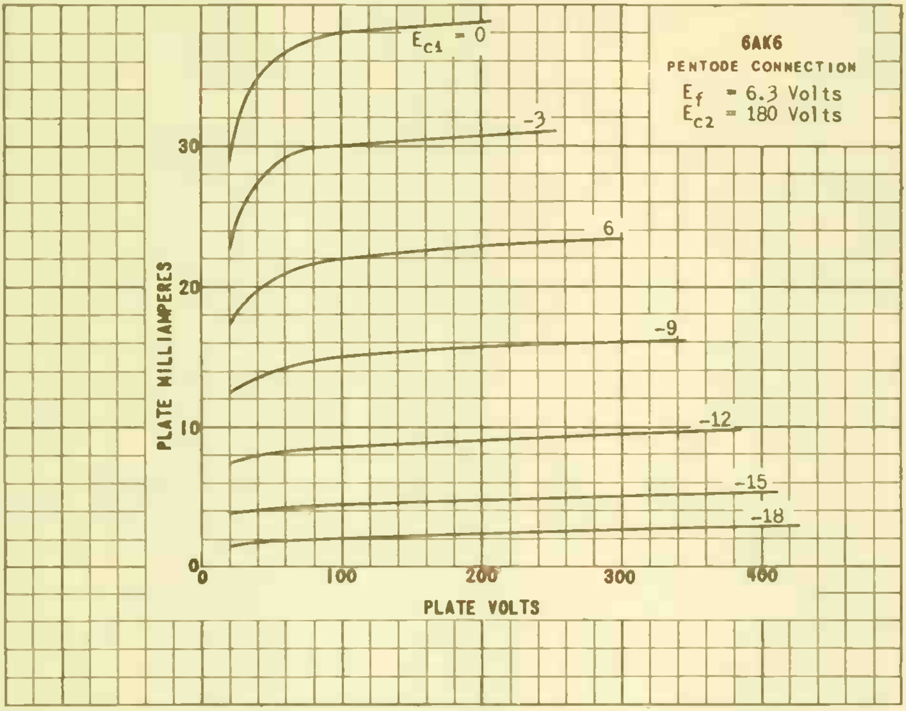
SIMILAR TYPE REFERENCE: Rating and characteristics identical to 6G6G.

→ INDICATES A CHANGE OR ADDITION

PLATE 1779
FEB. 3, 1947

PRINTED IN U.S.A.

6AK6



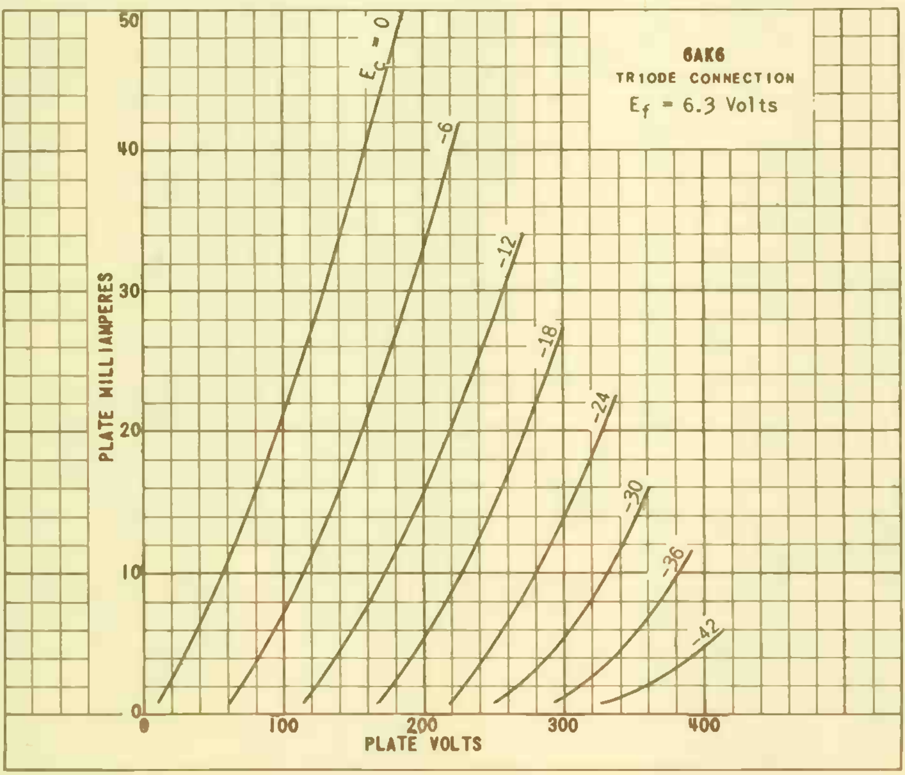
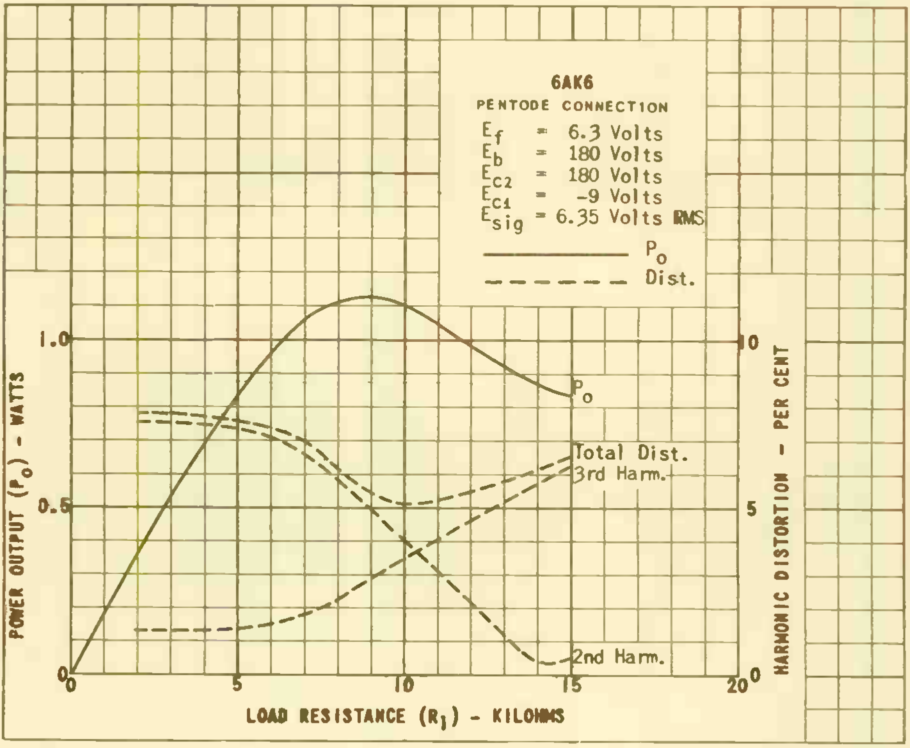
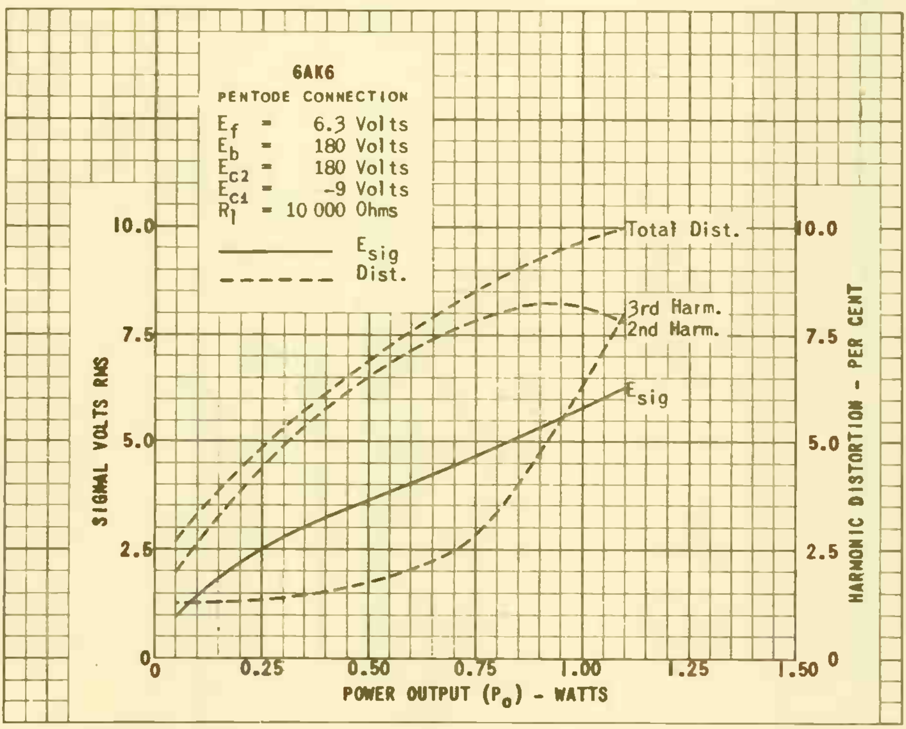


PLATE 1780
FEB. 9, 1947





PRINTED IN U. S. A.

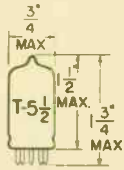
PLATE 1781

FEB. 3, 1947

TUNG-SOL

DOUBLE DIODE

MINIATURE TYPE



GLASS BULB

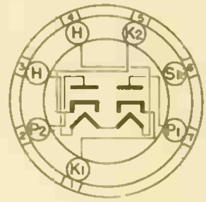
COATED UNIPOTENTIAL CATHODE

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

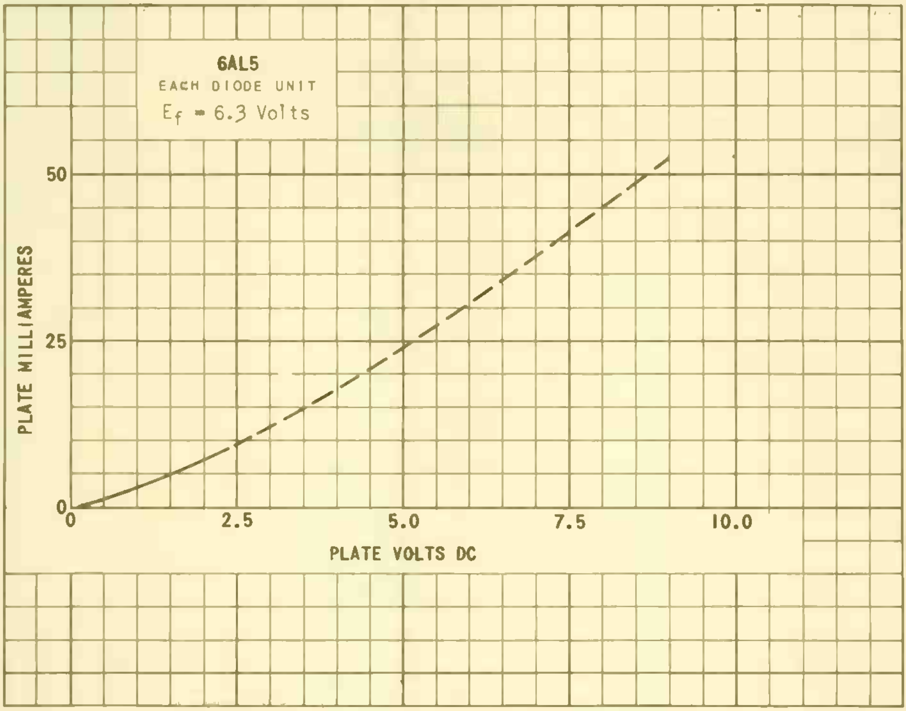
HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.3	AMP.
AVERAGE DIODE CURRENT (EACH UNIT) AT 10 VOLTS DC	60	MA.

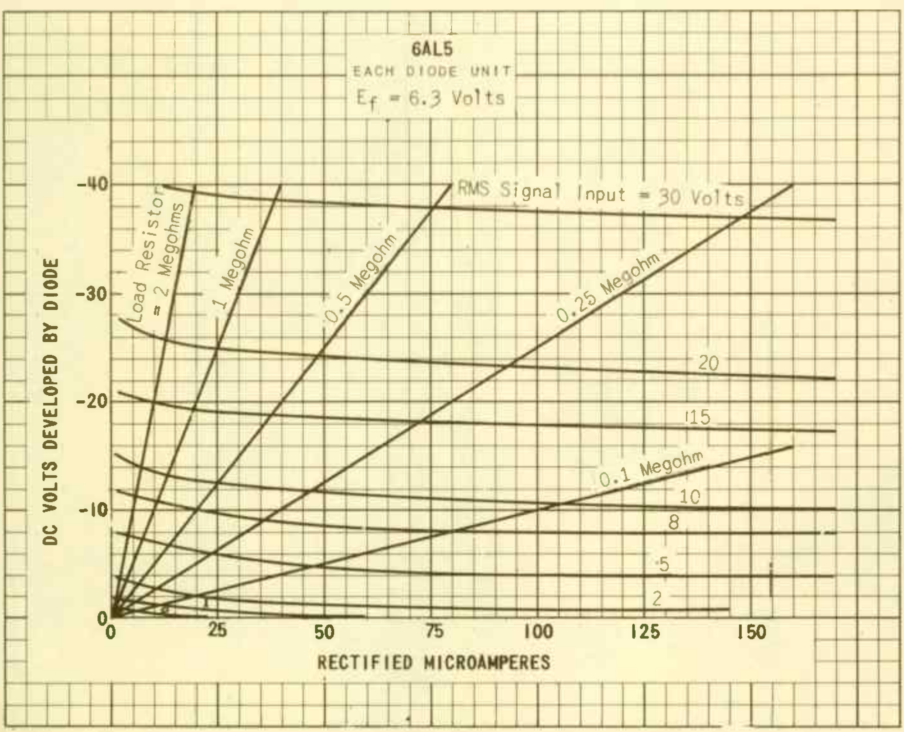
THE RESONANT FREQUENCY OF EACH UNIT OF THE 6AL5 IS 700 MC. (APPROX.)

[A]DC COMPONENT MUST NOT EXCEED 330 VOLTS

[B]DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.

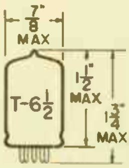

6AL5
EACH DIODE UNIT
E_f = 6.3 Volts
PLATE MILLIAMPERES
0
25
50
0
2.5
5.0
7.5
10.0
PLATE VOLTS DC


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

TRIODE

MINIATURE TYPE

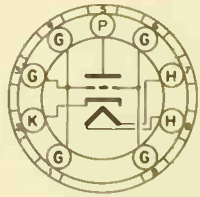


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.225 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9BX

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

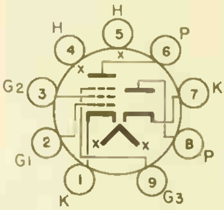
MINIATURE TYPE

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

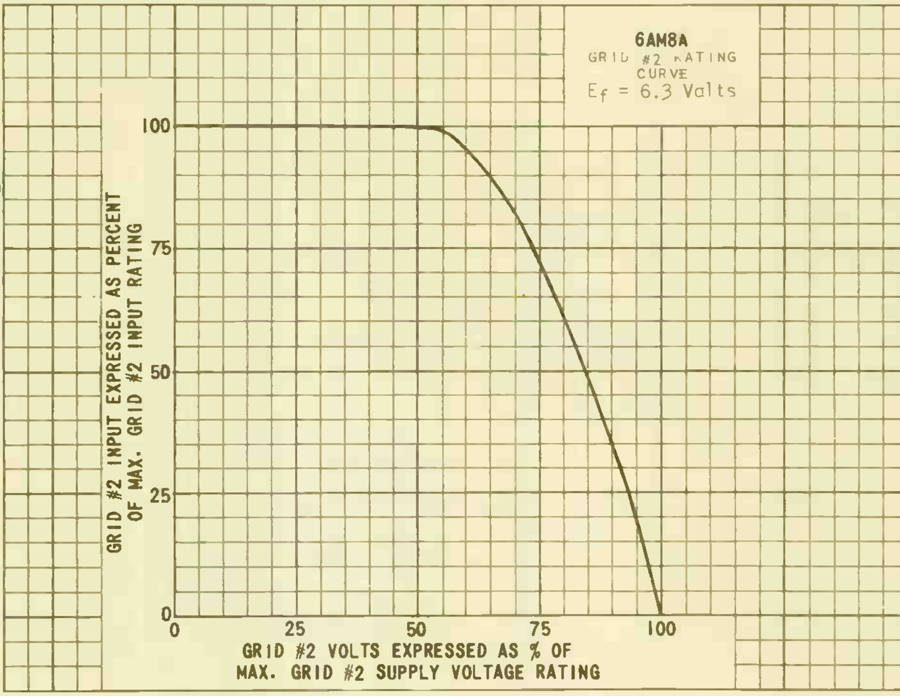
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM PLATE DISSIPATION	3.2	WATTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM 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

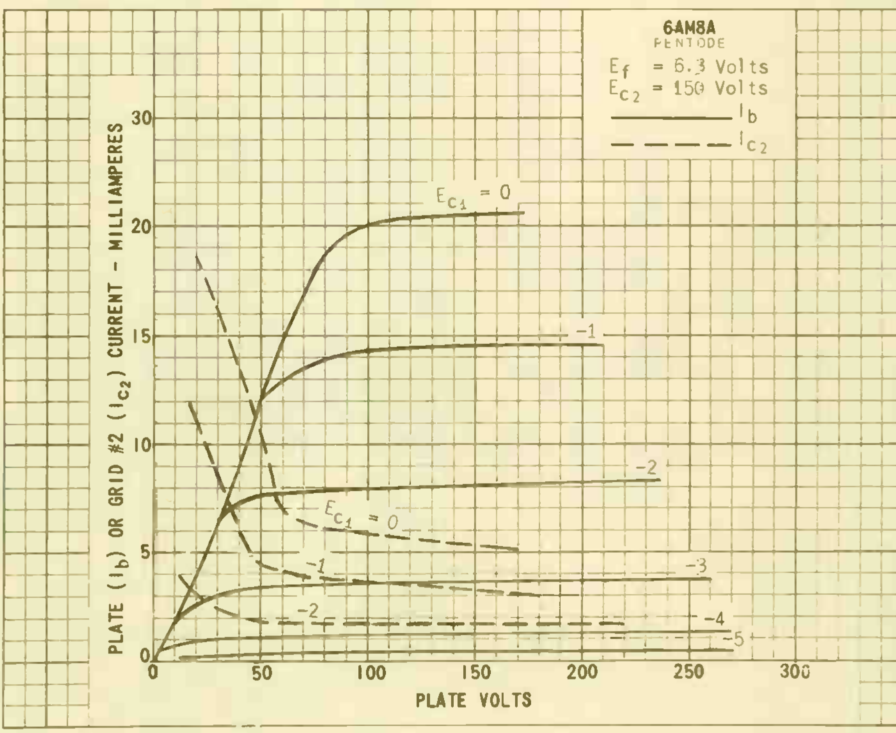
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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	2.0	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.

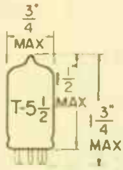

6AM8A
GRID #2 RATING CURVE
E_f = 6.3 Volts
GRID #2 INPUT EXPRESSED AS PERCENT OF MAX. GRID #2 INPUT RATING
100
75
50
25
0
0
25
50
75
100
GRID #2 VOLTS EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE RATING


6AM8A
PENTODE
E_f = 6.3 Volts
E_{c_2} = 150 Volts
I_b
I_{c_2}
E_{c_1} = 0
-1
-2
-3
-4
-5
E_{c_1} = 0
-1
-2
PLATE (I_b) OR GRID #2 (I_{c_2}) CURRENT - MILLIAMPERES
30
20
15
10
5
0
0
50
100
150
200
250
300
PLATE VOLTS

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.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

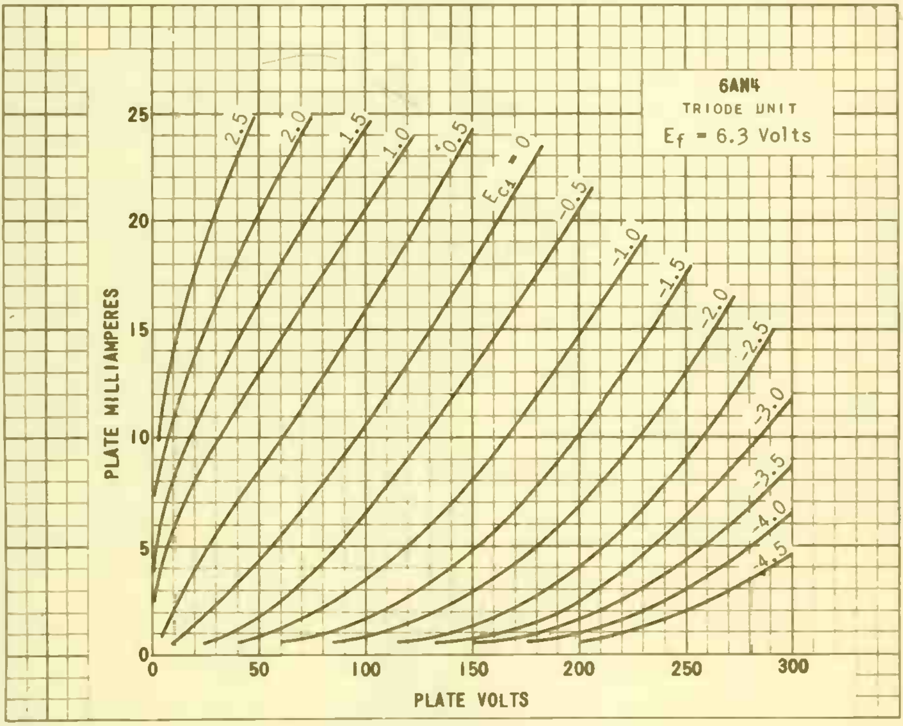
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

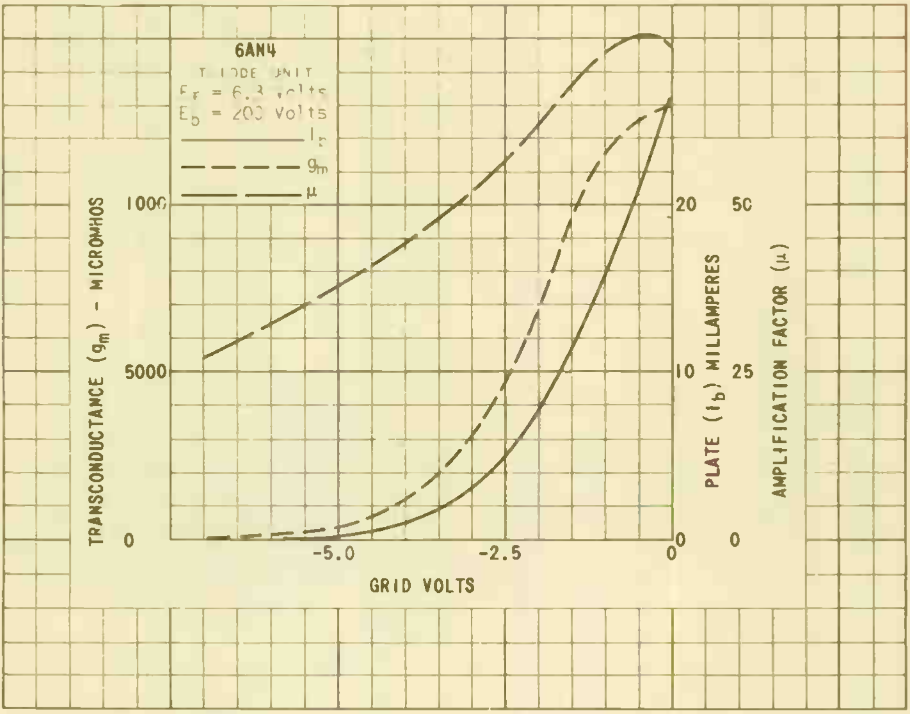
CLASS A_1 AMPLIFIER

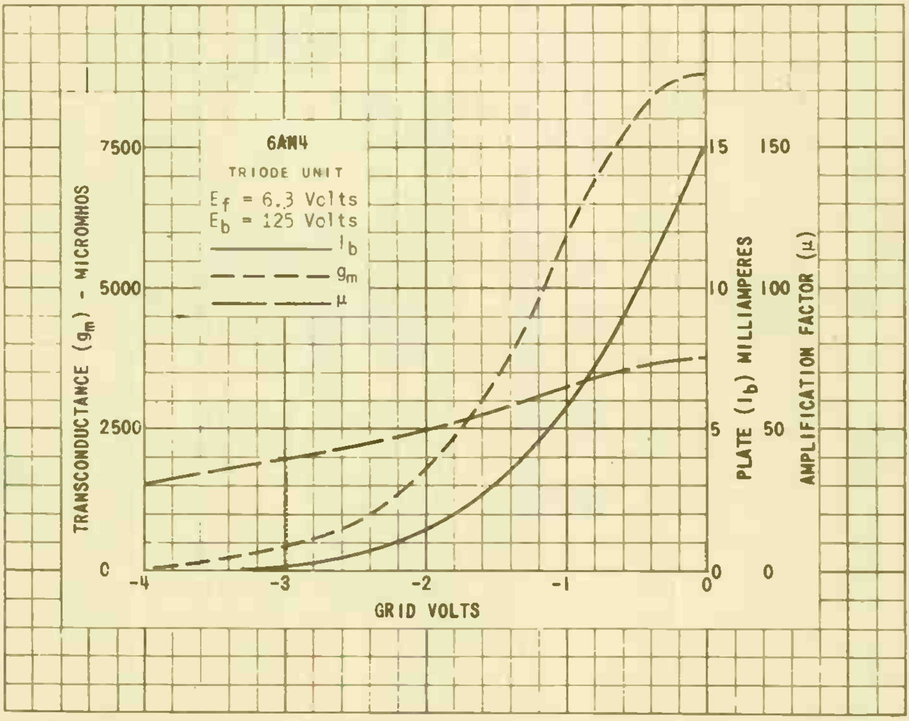
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.225	AMP.
PLATE VOLTAGE	200	VOLTS
CATHODE BIAS RESISTOR	100	OHMS
PLATE CURRENT	13	MA.
TRANSCONDUCTANCE	10 000	µMHOS
AMPLIFICATION FACTOR	70	
GRID VOLTAGE FOR 20 µA. PLATE CURRENT	−7	VOLTS

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



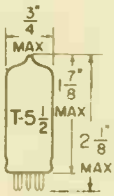

6AN4
TRIODE UNIT
E_f = 6.3 Volts
E_b = 200 Volts
I_b
g_m
μ
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE (I_b) MILLAMPERES
AMPLIFICATION FACTOR (μ)
GRID VOLTS
0
5000
1000
-5.0
-2.5
0
10
20
25
50


6AN4
TRIODE UNIT
E_f = 6.3 Volts
E_b = 125 Volts
I_b
g_m
μ
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE (I_b) MILLAMPERES
AMPLIFICATION FACTOR (μ)
GRID VOLTS
0
2500
5000
7500
-4
-3
-2
-1
0
5
10
15
50
100
150

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

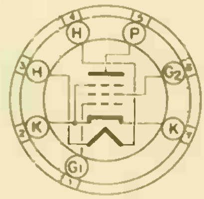
HEATER

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

7BD

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

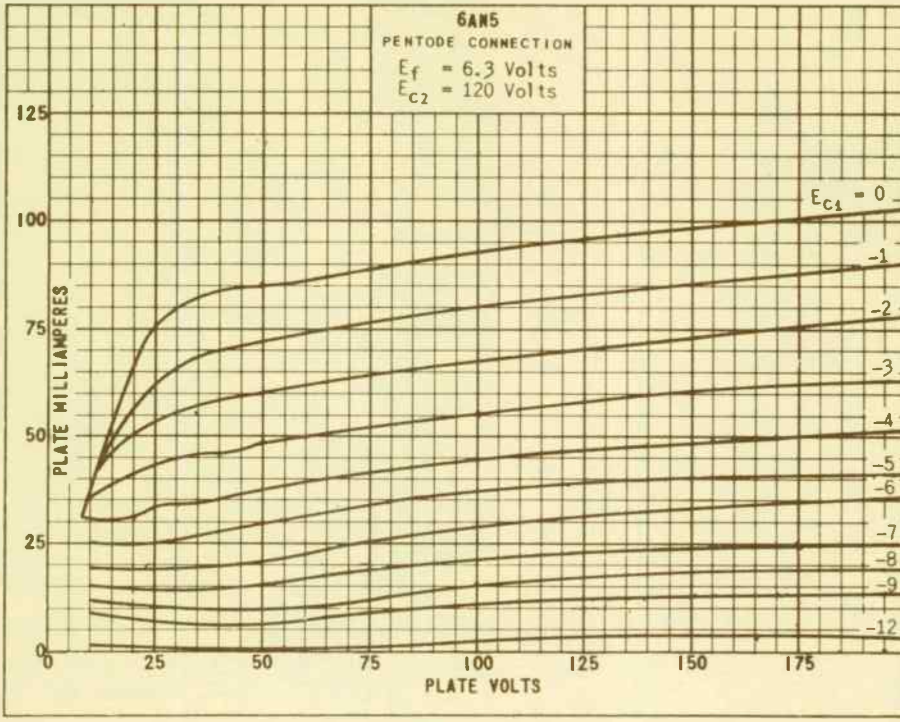
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	450	MA.
PLATE VOLTAGE	120	VOLTS
GRID #2 VOLTAGE	120	VOLTS
CATHODE RESISTOR[A]	120	OHMS
PLATE RESISTANCE (APPROX.)	12 500	OHMS
TRANSCONDUCTANCE	8 000	μMHOS
PLATE CURRENT	35	MA.
GRID #2 CURRENT	12	MA.
LOAD RESISTANCE	2 500	OHMS
POWER OUTPUT	1.3	WATTS
GRID #1 VOLTAGE 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.

PRINTED IN U. S. A.

PLATE 2153

MAR. 1, 1949



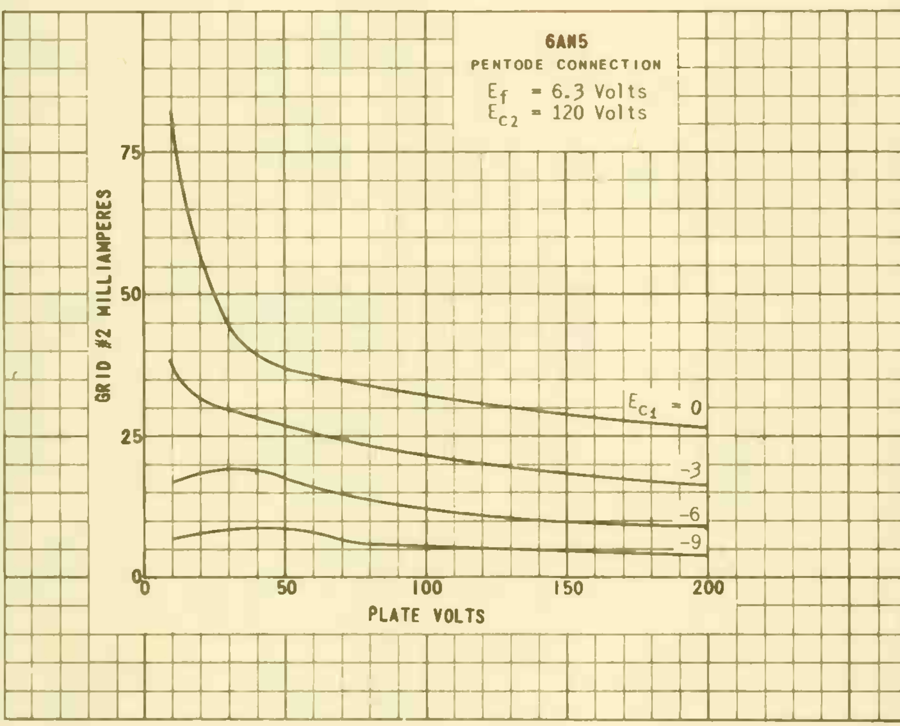
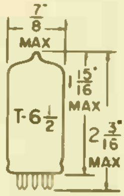


PLATE 2154
MAR. 1, 1949

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

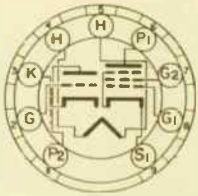


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE

THE 6AN8 AND 6AN8A ARE MEDIUM MU TRIODES AND SHARP-CUTOFF PENTODES IN THE 9-PIN MINIATURE CONSTRUCTION. THE PENTODE SECTIONS MAY BE USED AS IF AMPLIFIERS OR REACTANCE TUBES WHILE THE TRIODE SECTIONS ARE WELL SUITED FOR USE IN LOW FREQUENCY OSCILLATOR SYNC CLIPPER SYNC SEPERATOR AND PHASE SPLITTER CIRCUITS. IN ADDITION, THERMAL CHARACTERISTICS OF THE HEATER OF THE 6AN8A 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 6AN8A, THE TWO TUBES ARE IDENTICAL.

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		6.3		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 (6AN8A) *		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.

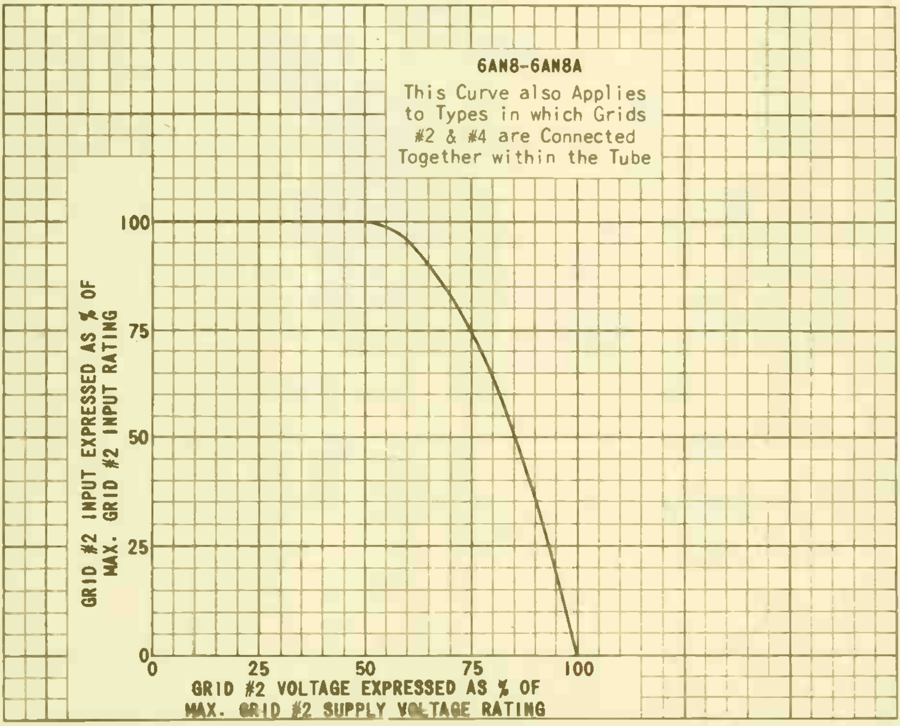
CONTINUED ON FOLLOWING PAGE

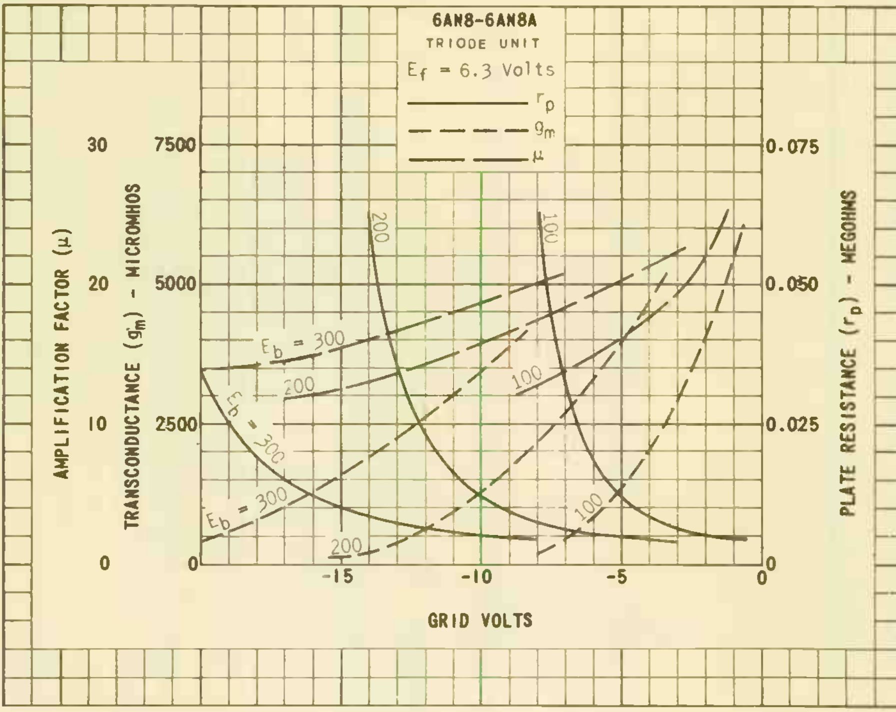
TUNG-SOL

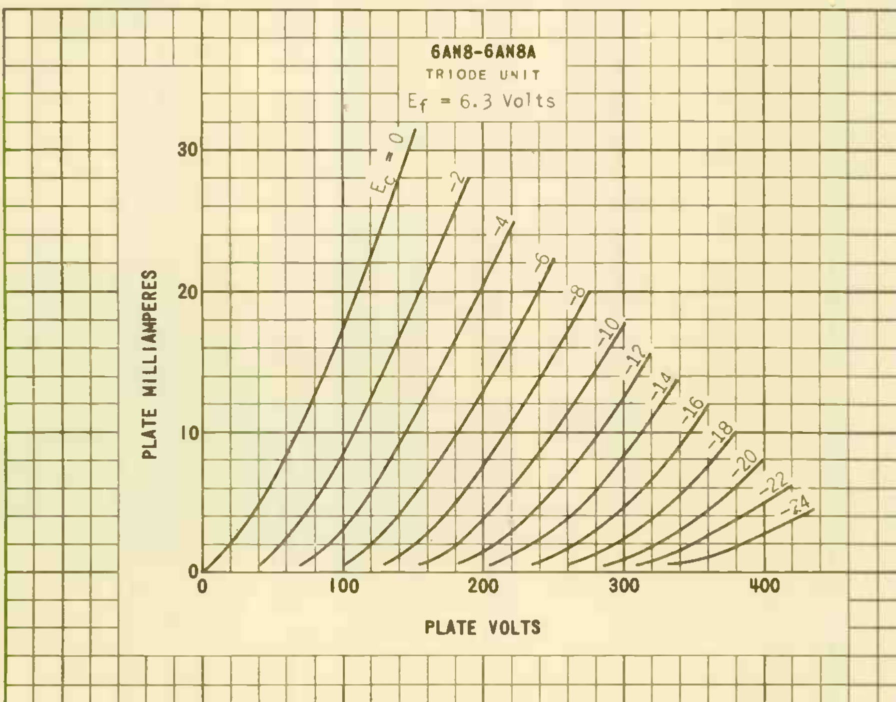
CONTINUED FROM PRECEDING PAGE

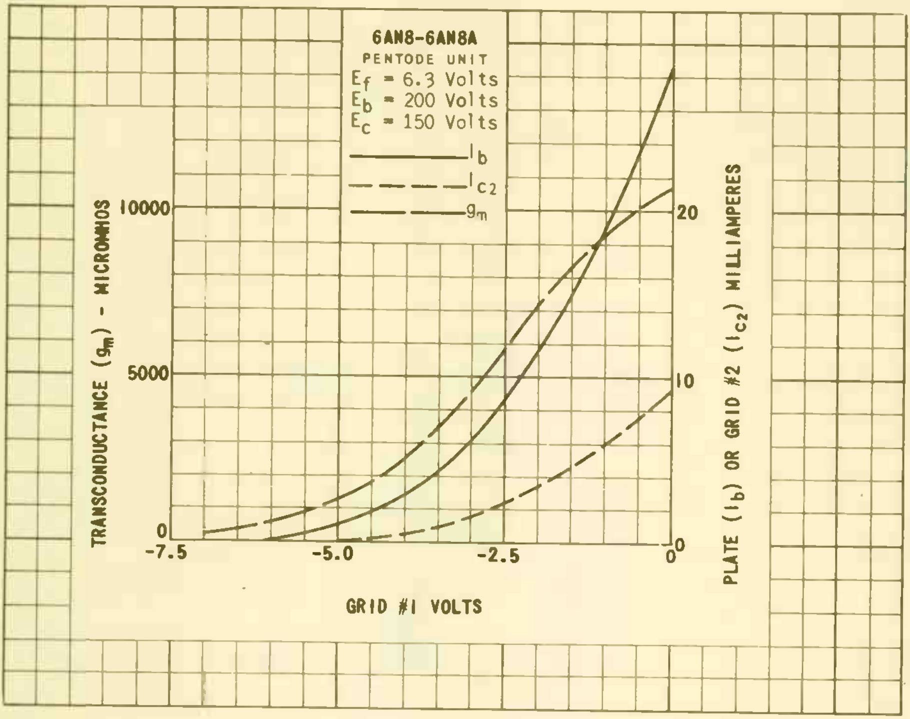
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

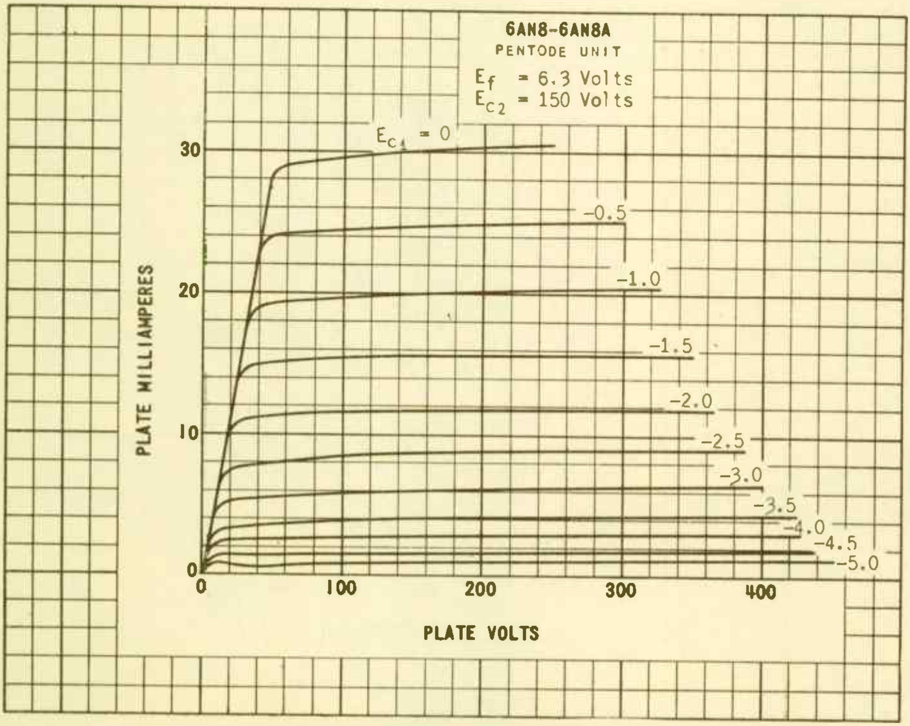
	TRIODE UNIT		PENTODE UNIT	
HEATER VOLTAGE		6.3		VOLTS
HEATER CURRENT		0.45		AMP.
PLATE SUPPLY VOLTAGE	200		200	VOLTS
GRID #2 SUPPLY VOLTAGE	---		150	VOLTS
GRID #1 VOLTAGE	-6		---	VOLTS
CATHODE BIAS RESISTOR	---		180	OHMS
AMPLIFICATION FACTOR	19		---	
PLATE RESISTANCE (APPROX.)	5 750		300 000	OHMS
TRANSCONDUCTANCE	3 300		6 200	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.




6AN8-6AN8A
TRIODE UNIT
Ef = 6.3 Volts
rp
gm
μ
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE RESISTANCE (rp) - MEGOHMS
GRID VOLTS
30
20
10
0
7500
5000
2500
0
0.075
0.050
0.025
0
-15
-10
-5
0
Eb = 300
200
100
Eb = 300
Eb = 300
200
100
200
100


6AN8-6AN8A
TRIODE UNIT
Ef = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
30
20
10
0
0
100
200
300
400
Ec = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24


6AN8-6AN8A
PENTODE UNIT
Ef = 6.3 Volts
Eb = 200 Volts
Ec = 150 Volts
Ib
Ic2
gm
TRANSCONDUCTANCE (gm) - MICROMHOS
10000
5000
0
-7.5
-5.0
-2.5
0
20
10
0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
GRID #1 VOLTS


6AN8-6AN8A
PENTODE UNIT
Ef = 6.3 Volts
Ec2 = 150 Volts
Ec1 = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
30
20
10
0
PLATE MILLIAMPERES
0
100
200
300
400
PLATE VOLTS

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

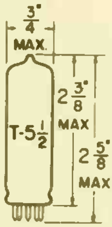
COATED UNIPOTENTIAL CATHODE

HEATER

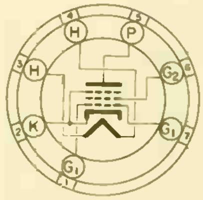
6.3 VOLTS 0.45 AMP.

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

TUNG-SOL

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

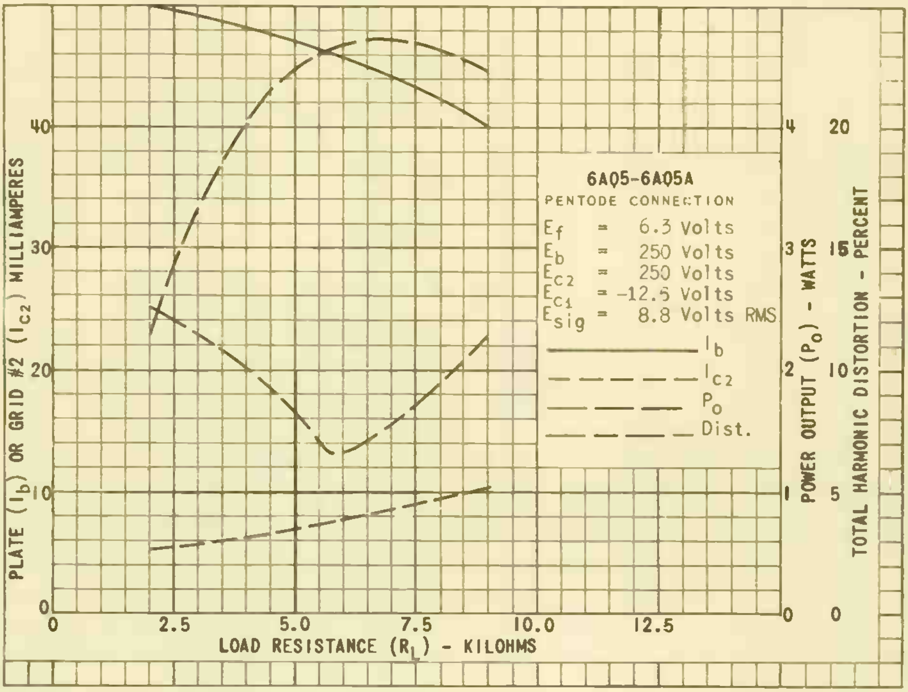
[B]FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

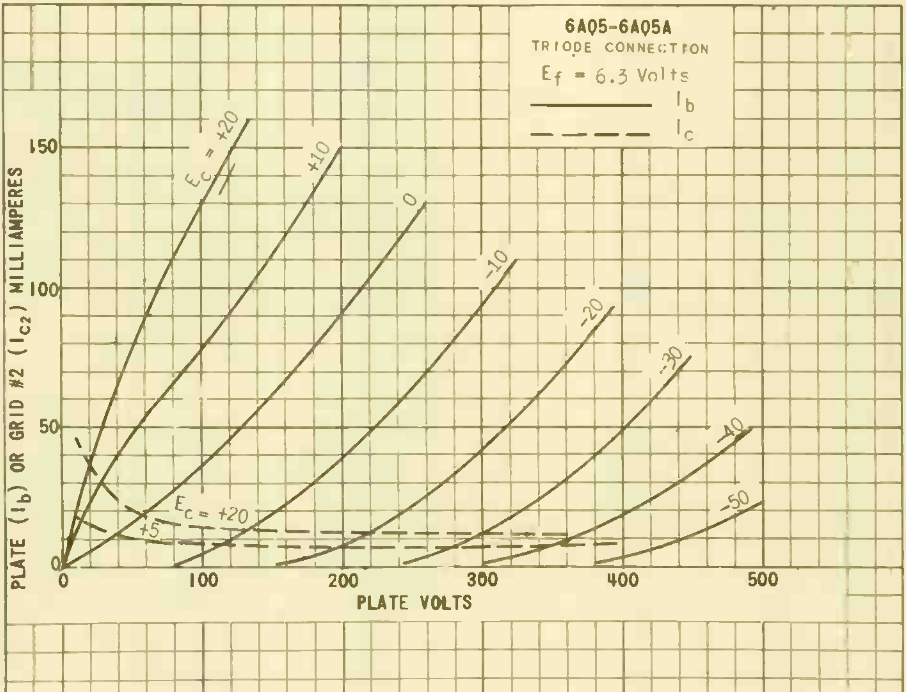
[C]TRIODE CONNECTED.

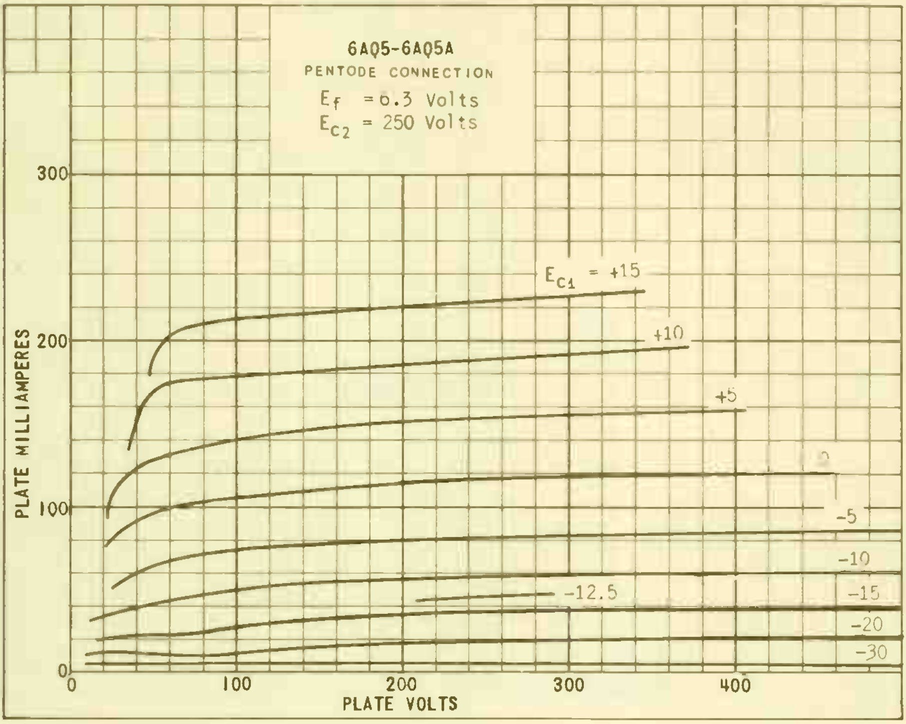
[D]IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

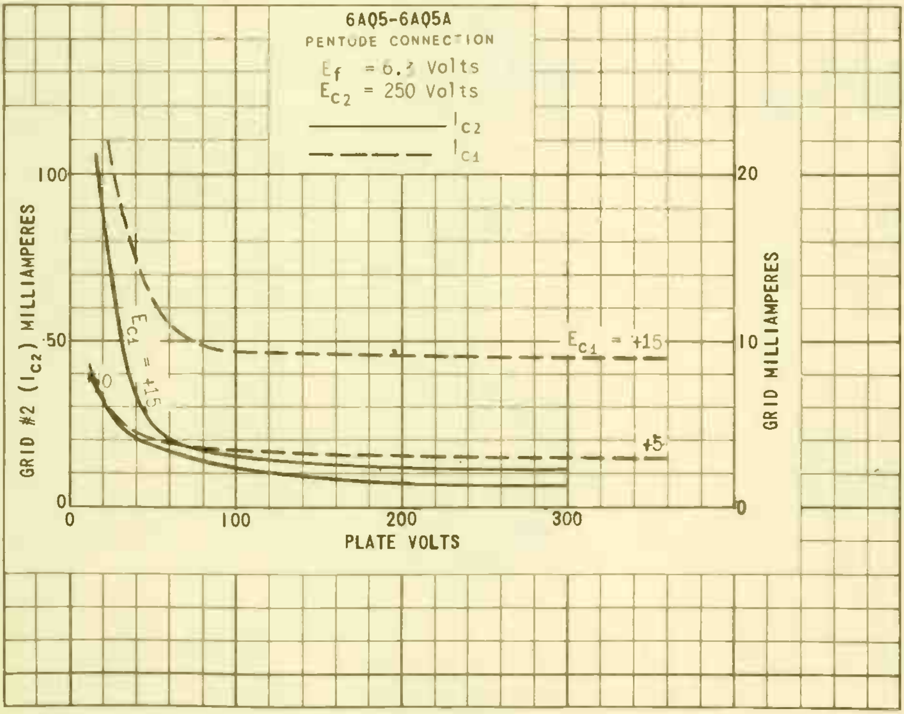
*INDICATES AN ADDITION.

→ INDICATES A CHANGE.


6AQ5-6AQ5A
PENTODE CONNECTION
Ef = 6.3 Volts
Eb = 250 Volts
Ec2 = 250 Volts
Ec1 = -12.5 Volts
Esig = 8.8 Volts RMS
Ib
Ic2
Po
Dist.
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
POWER OUTPUT (Po) - WATTS
TOTAL HARMONIC DISTORTION - PERCENT
LOAD RESISTANCE (RL) - KILOHMS


6AQ5-6AQ5A
TRIODE CONNECTION
Ef = 6.3 Volts
Ib
Ic
Ec = +20
+10
0
-10
-20
-30
-40
-50
Ec = +20
+5
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS

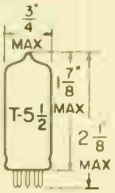

6AQ5-6AQ5A
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 250 Volts
E_{c1} = +15
+10
+5
0
-5
-10
-12.5
-15
-20
-30
PLATE MILLIAMPERES
0
100
200
300
0
100
200
300
400
PLATE VOLTS


6AQ5-6AQ5A
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 250 Volts
I_{c2}
I_{c1}
E_{c1} = +15
E_{c1} = +15
+5
0
GRID #2 (I_{c2}) MILLIAMPERES
GRID MILLIAMPERES
0
50
100
0
10
20
0
100
200
300
PLATE VOLTS

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

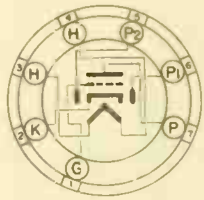


GLASS BULB

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.

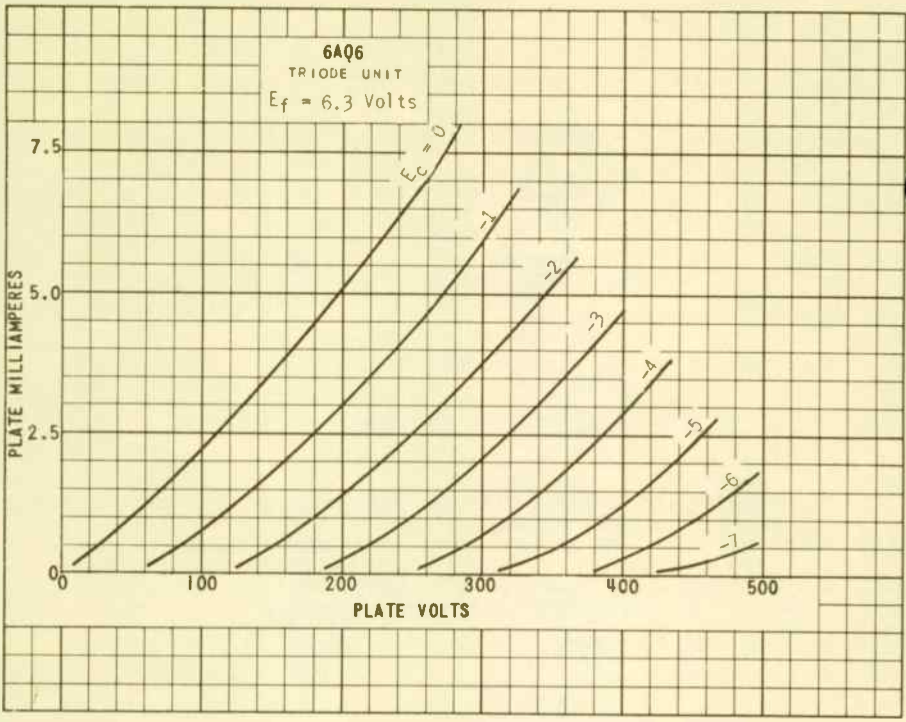
SIMILAR TYPE REFERENCE: Ratings and Characteristics somewhat similar to 6AT6, 6Q7, 6Q7GT, 6SQ7, 6SQ7GT, 7B6, 7C6.

PRINTED IN U. S. A.

PLATE 2036

JULY 1, 1948

6AQ6



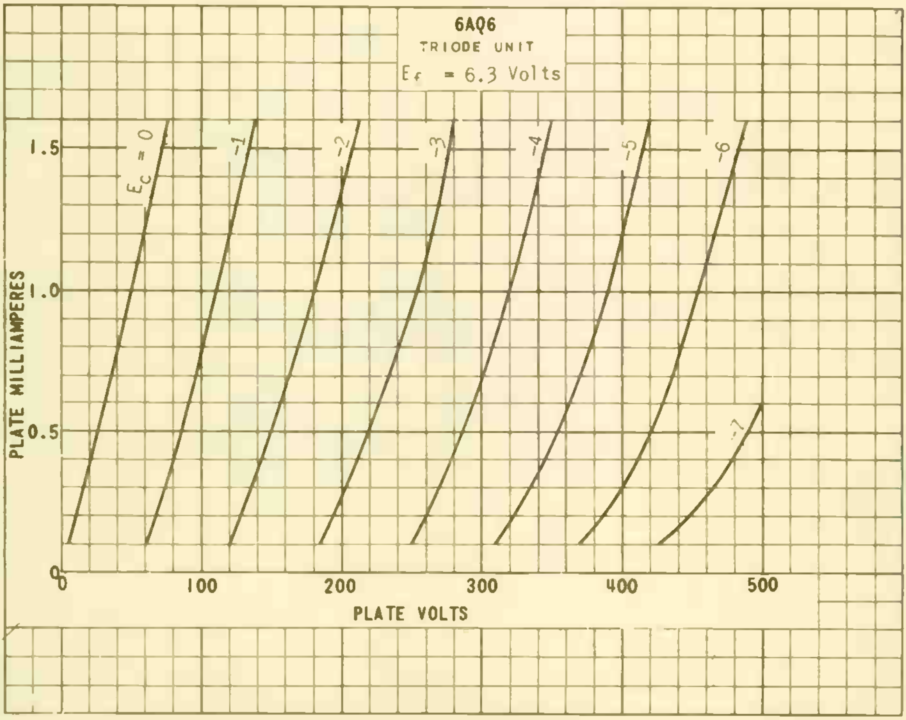


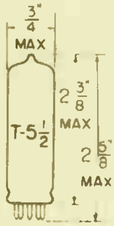
PLATE 2037
JULY 1, 1948

 ... DIVISION NEWARK NEW JERSEY U S A.

TUNG-SOL

PENTODE

MINIATURE TYPE

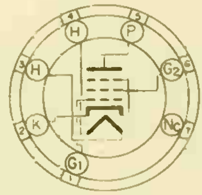


GLASS BULB

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

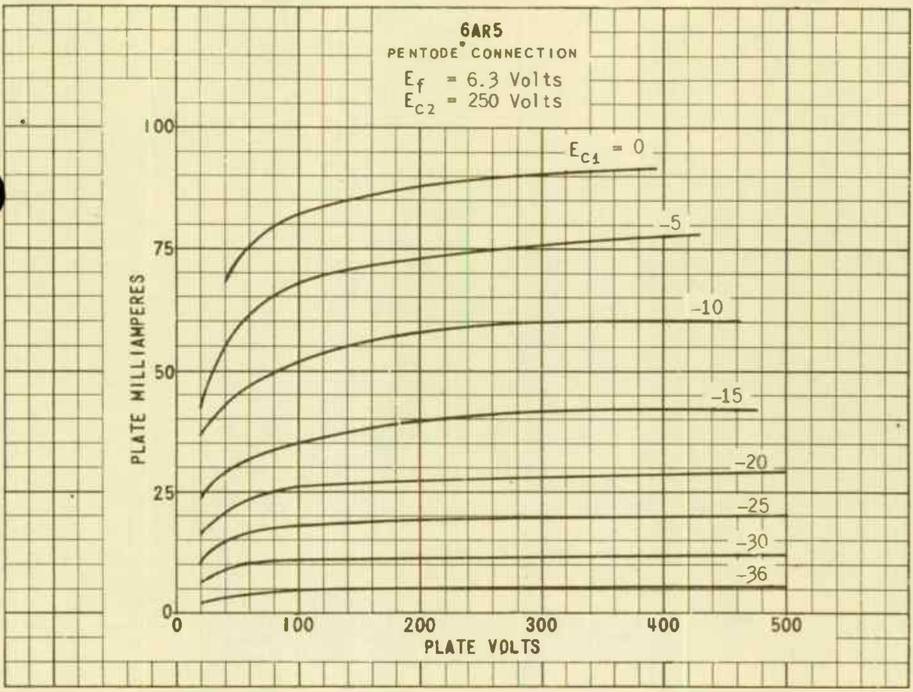
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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

PRINTED IN U S A

PLATE
2010
MAY 3
1948



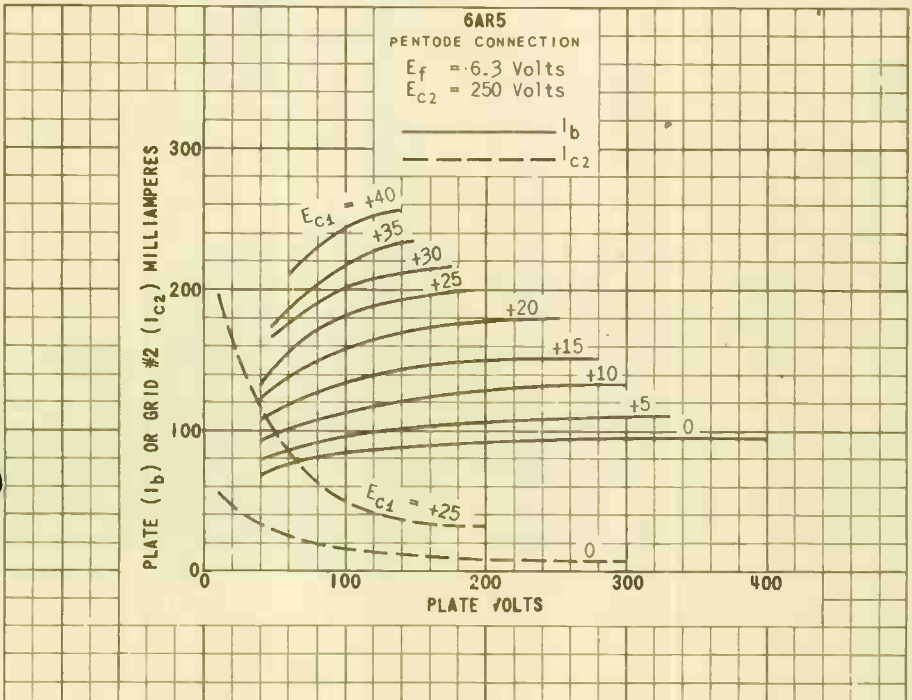
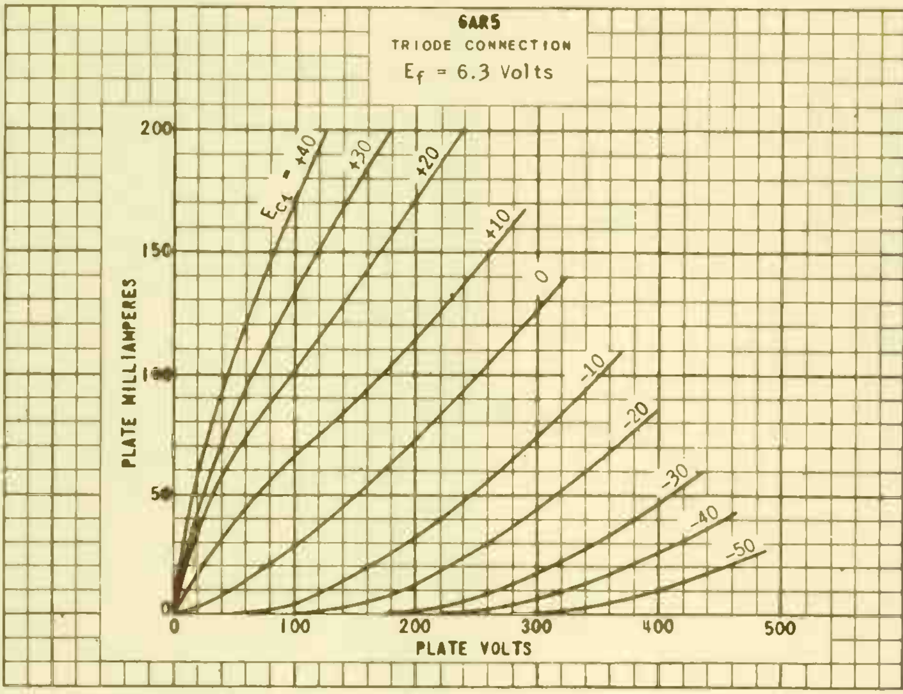


PLATE
2242
SEPT. 1
1949



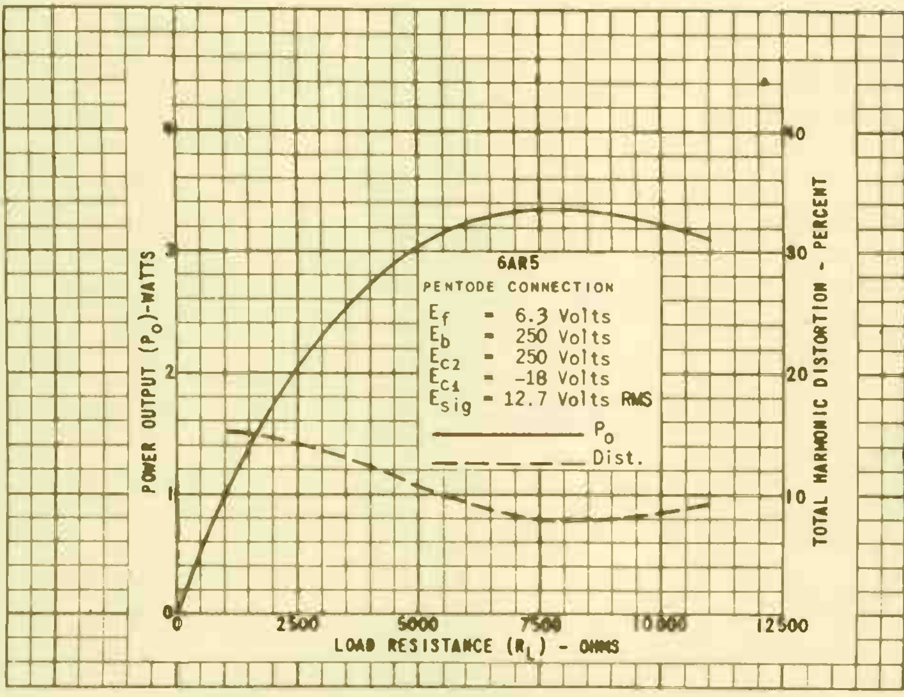
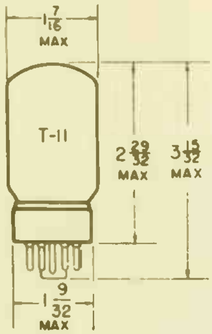


PLATE 2243
SEPT. 1949

TUNG-SOL

BEAM PENTODE



GLASS BULB

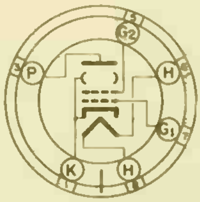
COATED UNIPOTENTIAL CATHODE

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

680

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

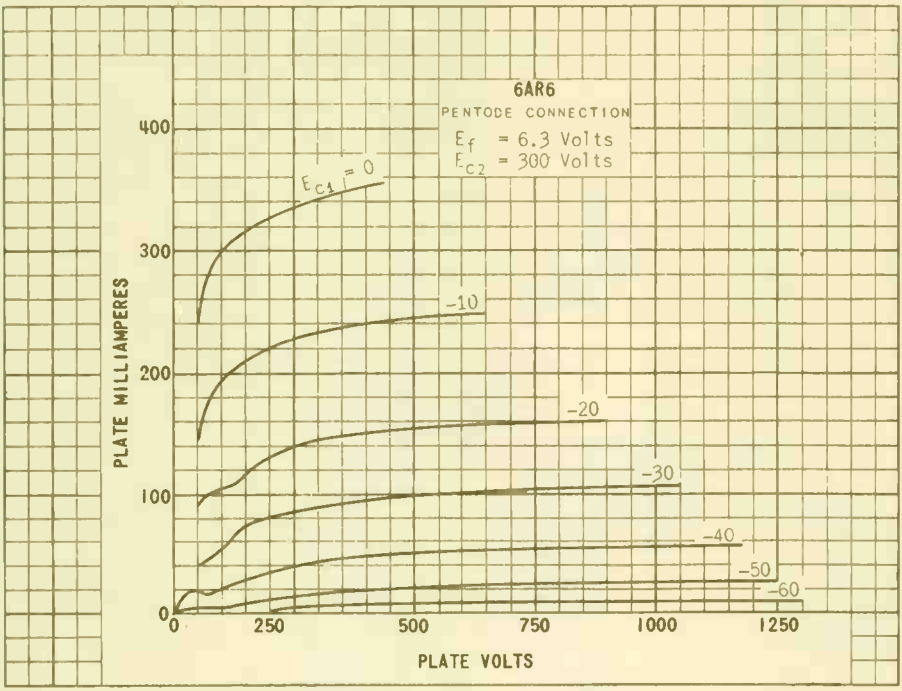
	TRIODE CONNECTION	PENTODE CONNECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	AMP.
DC PLATE VOLTAGE	200	250	VOLTS
DC GRID #2 VOLTAGE	TIED TO PLATE	250	VOLTS
DC GRID #1 VOLTAGE	-12.5	-22.5	VOLTS
GRID #1 CIRCUIT RESISTANCE (MAX.)	100 000	100 000	OHMS
DC PLATE CURRENT	90	77	MA.
GRID #2 CURRENT	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

PRINTED IN U. S. A.

PLATE 2881
MAR. 1 1952

→ INDICATES A CHANGE OR ADDITION.

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



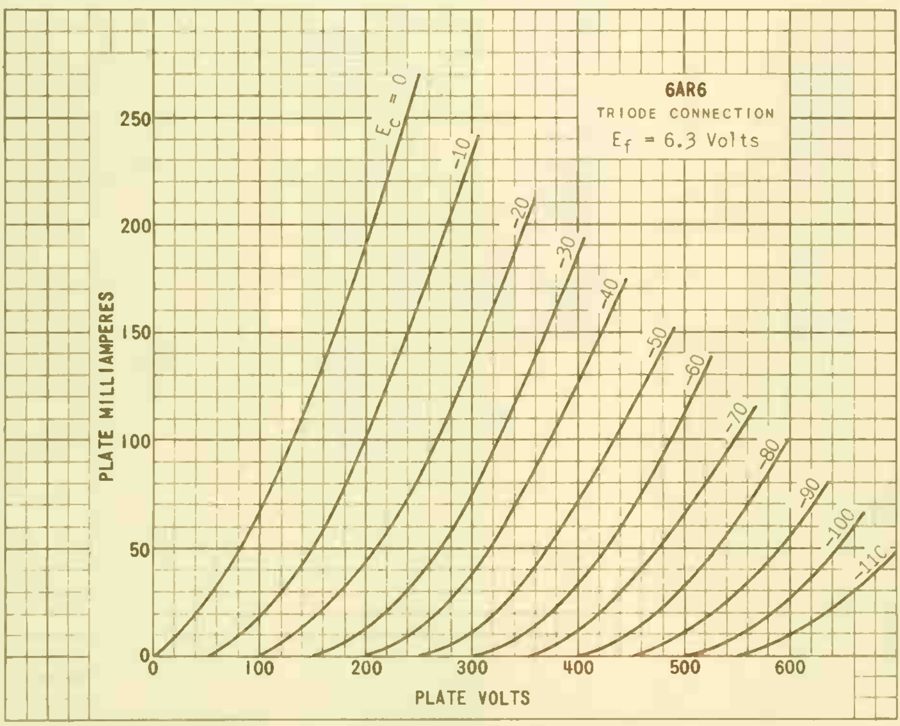
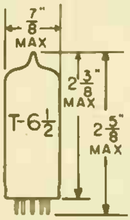


PLATE
2882
MAR. 1
1952

TUNG-SOL

SHEET-BEAM TUBE

MINIATURE TYPE

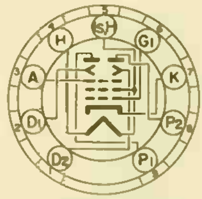


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION

→ 

BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9OP

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.

TUNG-SOL

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

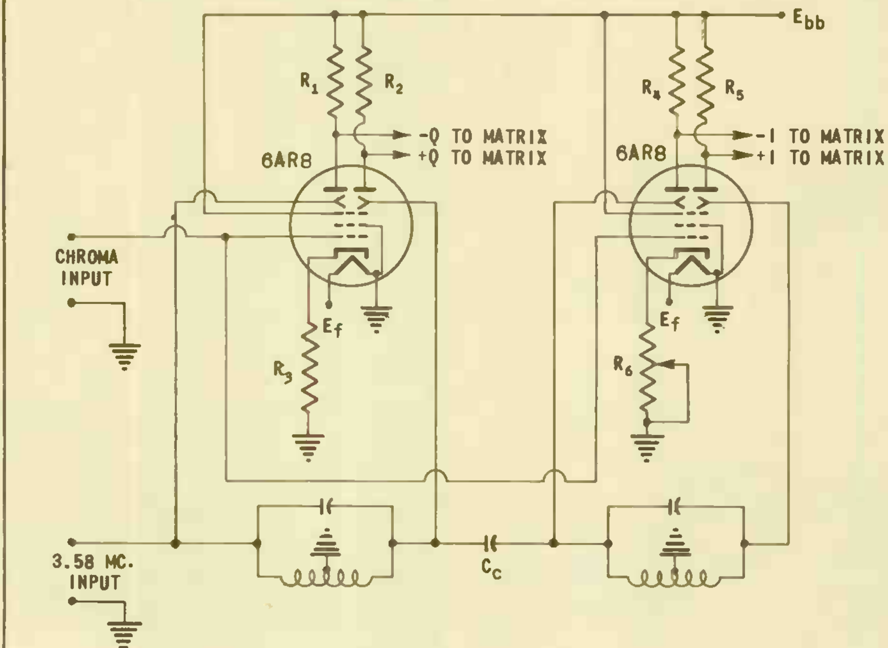
DEFLECTOR CHARACTERISTICS

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.

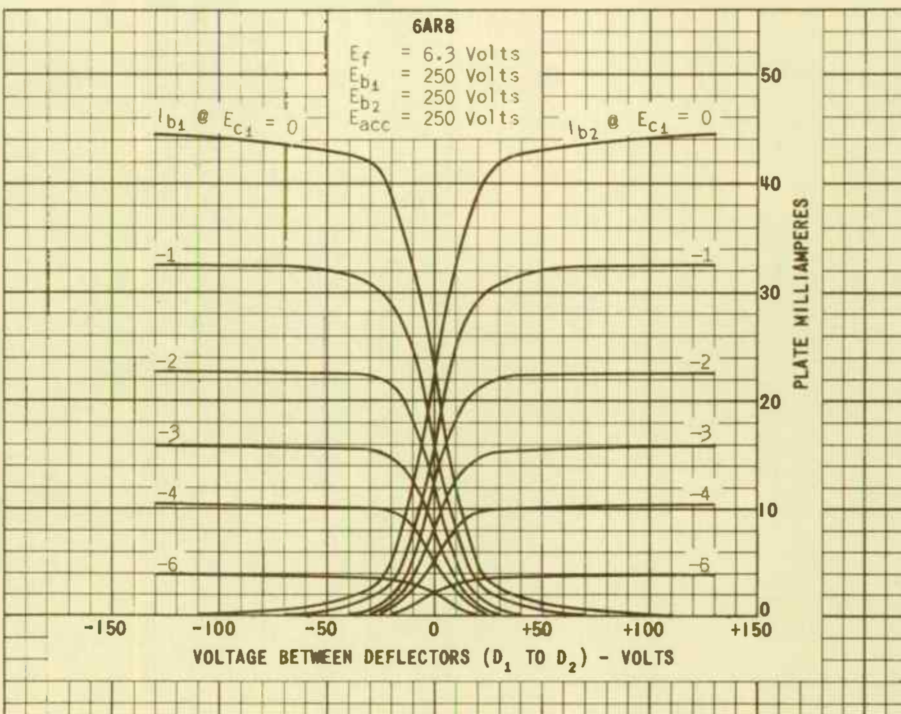
[A] DEFLECTOR SWITCHING VOLTAGE IS DEFINED AS THE TOTAL VOLTAGE CHANGE ON EITHER DEFLECTOR WITH AN EQUAL AND OPPOSITE CHANGE ON THE OTHER DEFLECTOR REQUIRED TO SWITCH THE PLATE CURRENT FROM ONE PLATE TO THE OTHER.

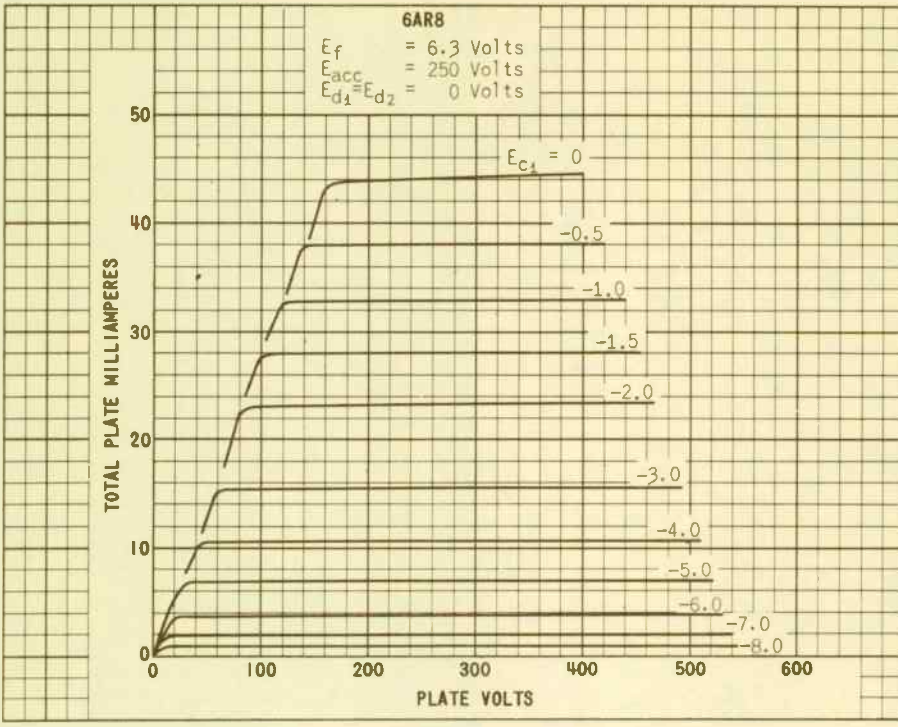
NOTE: THE 6AR8 SHOULD BE SO LOCATED IN THE RECEIVER THAT IT IS NOT SUBJECTED TO STRAY MAGNETIC FIELDS.

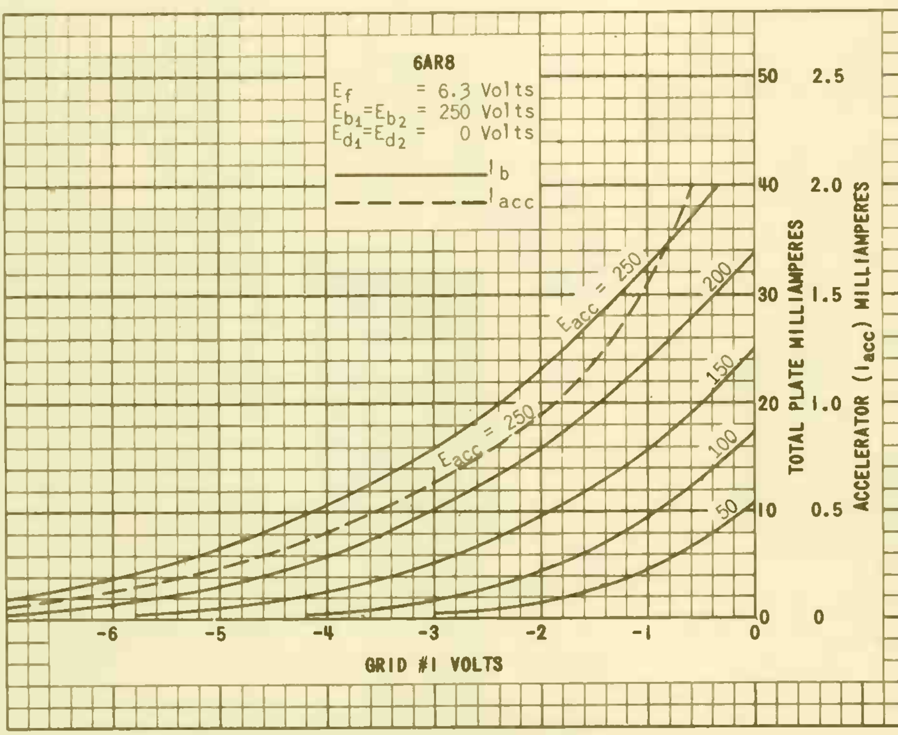
TUNG-SOL



Circuit Diagram of Two 6AR8 Tubes Used as Synchronous Detectors



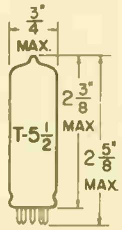

6AR8
Ef = 6.3 Volts
Eacc = 250 Volts
Ed1=Ed2 = 0 Volts
Ec1 = 0
-0.5
-1.0
-1.5
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
TOTAL PLATE MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
50
100
200
300
400
500
600


6AR8
Ef = 6.3 Volts
Eb1=Eb2 = 250 Volts
Ed1=Ed2 = 0 Volts
Ib
Iacc
Eacc = 250
200
150
100
50
TOTAL PLATE MILLIAMPERES
ACCELERATOR (Iacc) 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

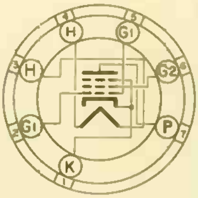
COATED UNIPOTENTIAL CATHODE

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.

TUNG-SOL

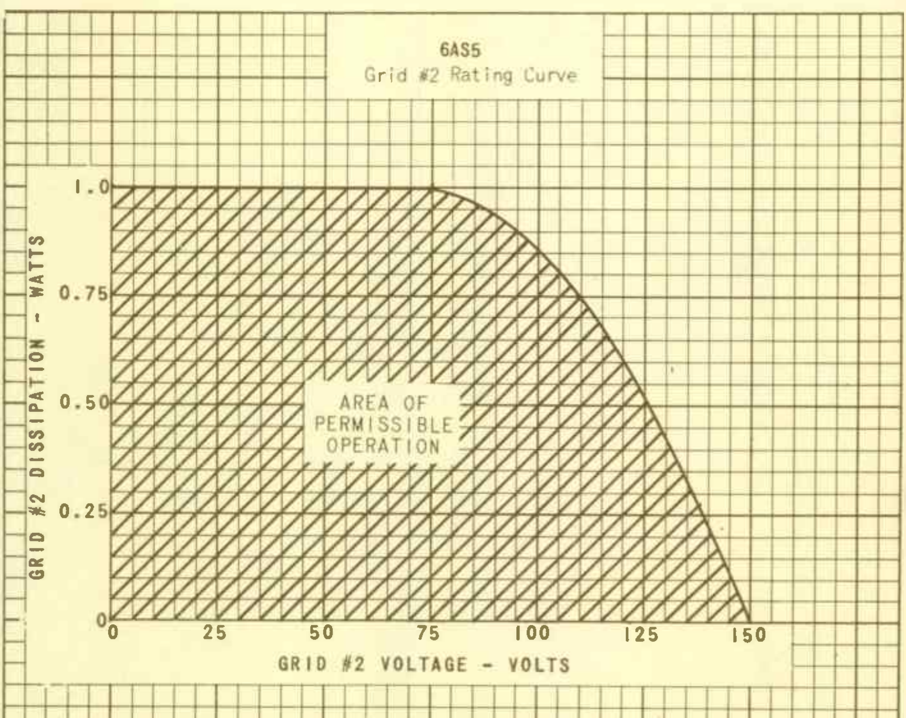
CONTINUED FROM PRECEDING PAGE

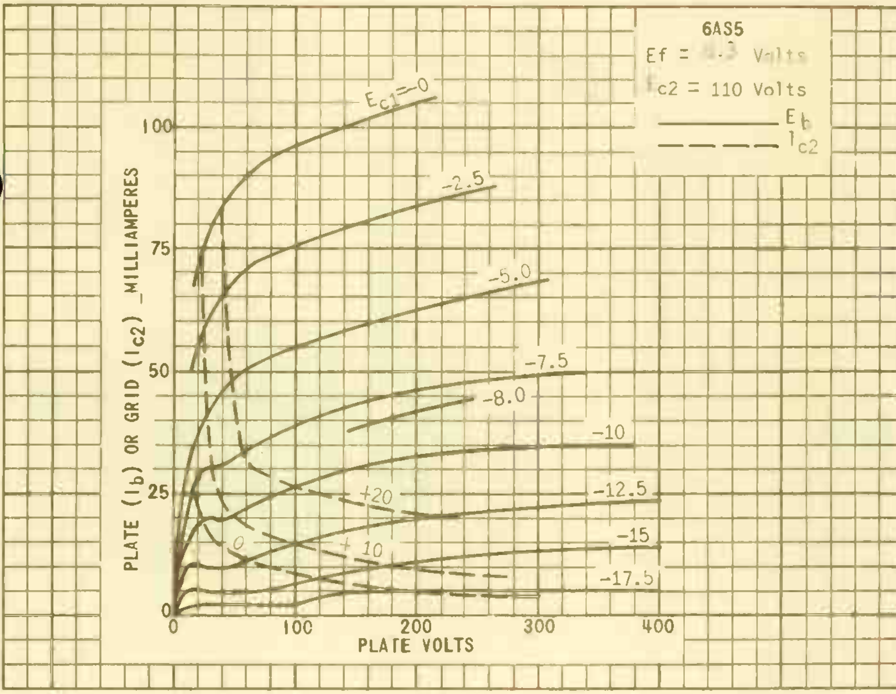
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

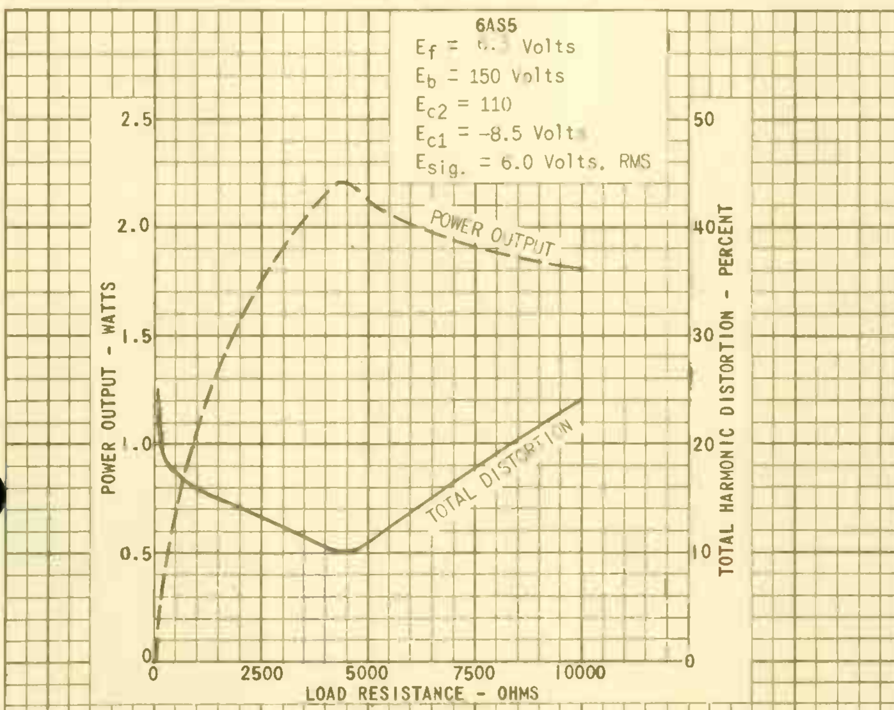
CLASS A_1 AMPLIFIER

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.



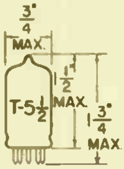

6AS5
Ef = 6.3 Volts
Ec2 = 110 Volts
Eb
Ic2
Ec1=-0
-2.5
-5.0
-7.5
-8.0
-10
-12.5
-15
-17.5
+20
+10
0
PLATE (Ib) OR GRID (Ic2) _MILLIAMPERES
100
75
50
25
0
100
200
300
400
PLATE VOLTS


6AS5
Ef = 6.3 Volts
Eb = 150 Volts
Ec2 = 110
Ec1 = -8.5 Volts
Esig. = 6.0 Volts, RMS
POWER OUTPUT
TOTAL DISTORTION
POWER OUTPUT - WATTS
2.5
2.0
1.5
1.0
0.5
0
TOTAL HARMONIC DISTORTION - PERCENT
50
40
30
20
10
0
2500
5000
7500
10000
LOAD RESISTANCE - OHMS

TUNG-SOL

PENTODE (DUAL CONTROL)

MINIATURE TYPE

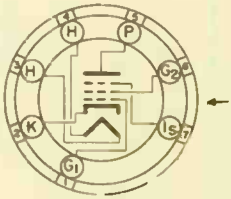


GLASS BULB

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.

TUNG-SOL

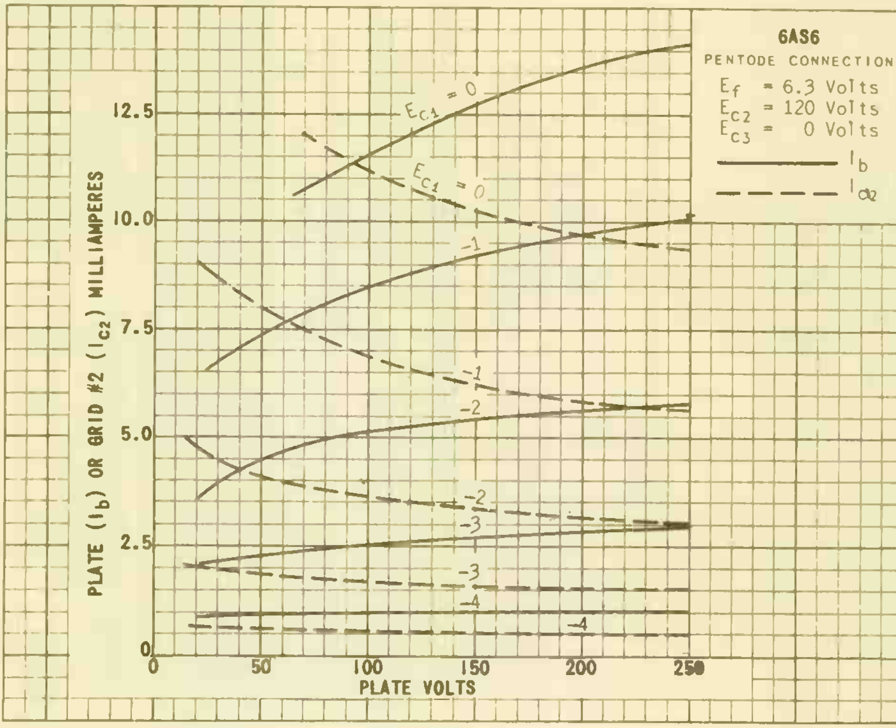
CONTINUED FROM PRECEDING PAGE

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.



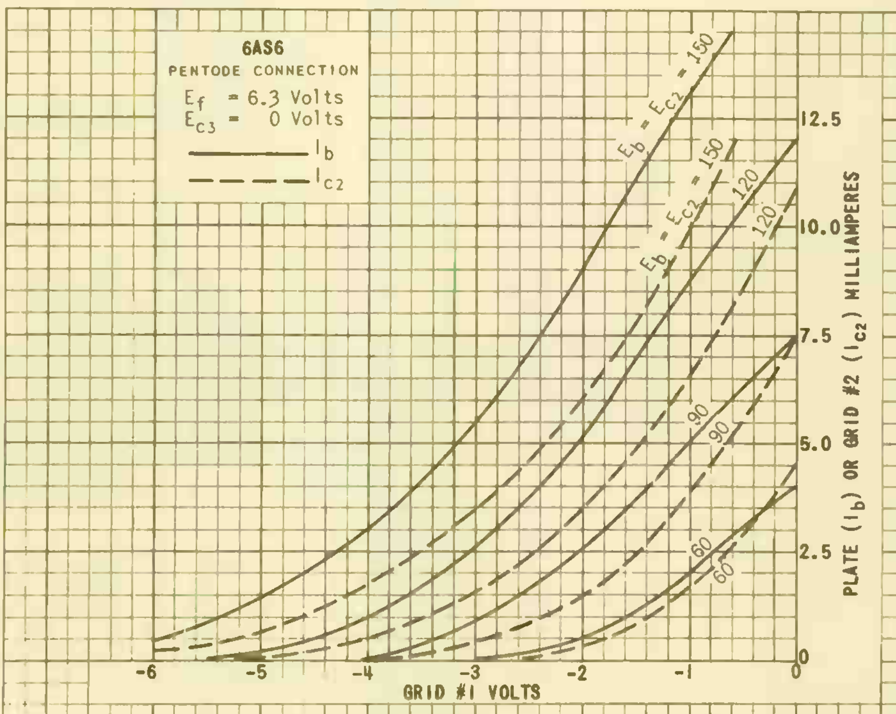
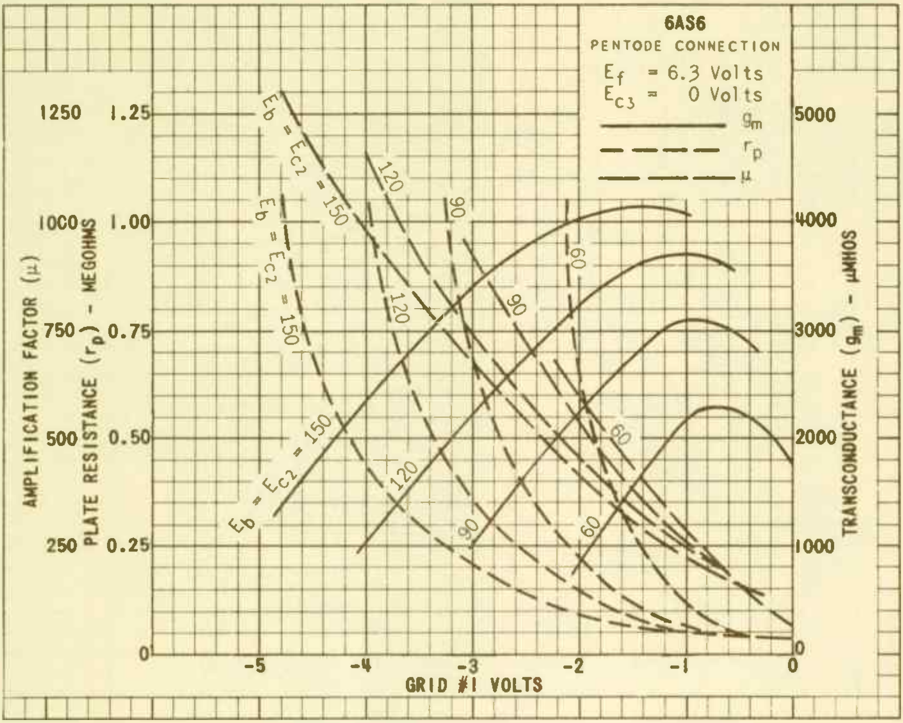


PLATE 2957
JUNE 1 1952



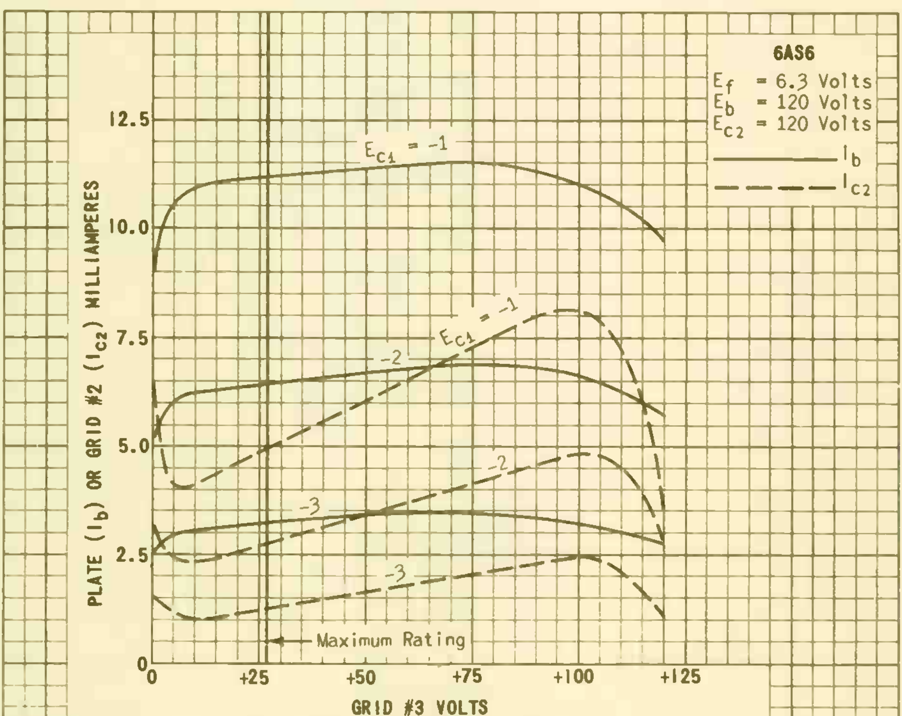
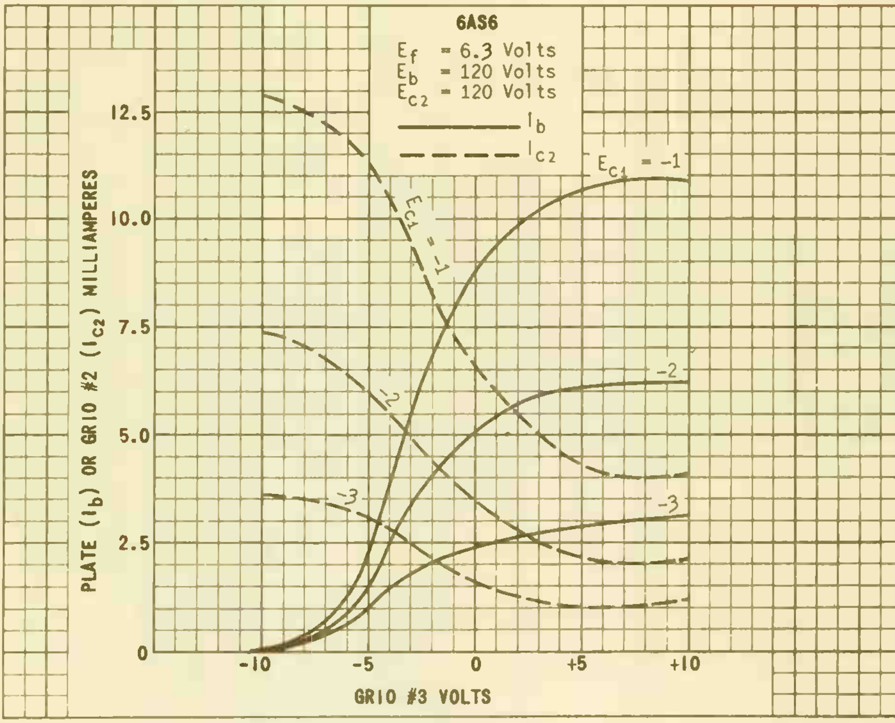
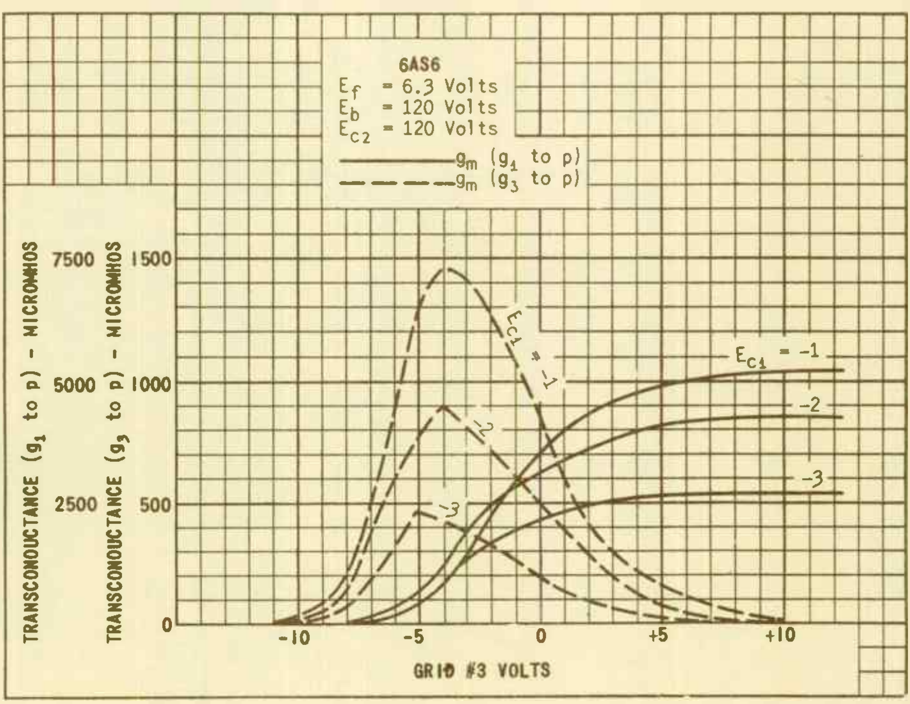


PLATE 2958

JUNE 1 1952



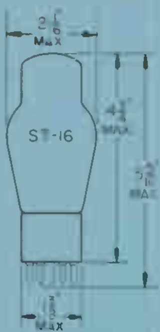


PRINTED IN U. S. A.

PLATE 2959
JUNE 1 1952

TUNG-SOL

TWIN TRIODE



GLASS BULB

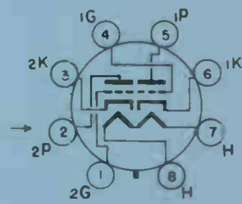
MEDIUM SHELL
8 PIN OCTAL B8-41

HEATER

6.3±10% VOLTS 2.5 AMP.

ANY MOUNTING POSITION

(IF TUBE IS TO BE MOUNTED IN A HORIZONTAL POSITION IT IS RECOMMENDED THAT IT BE MOUNTED SO THAT THE GRID PLANE BE VERTICAL.)



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8BD

THE 6AS7G IS A HIGH CURRENT, TWIN POWER TRIODE WIDELY USED IN ELECTRONICALLY REGULATED POWER SUPPLIES. THE HIGH PERVEANCE OF THIS TUBE PERMITS IT TO PASS LARGE CURRENTS AT LOW PLATE VOLTAGES, THUS PROVIDING FOR EFFICIENT SERIES REGULATION.

ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f=6.3VOLTS)	2.5	AMP.
MINIMUM CATHODE HEATING TIME	30	SECONDS
TRANSCONDUCTANCE (PER SECTION)	7 000	µMHOS
AMPLIFICATION FACTOR	2.0	
INTER-ELECTRODE CAPACITANCES PER TRIODE SECTION:		
GRID TO CATHODE	6.2	µµf
GRID TO PLATE	8.4	µµf
CATHODE TO PLATE	2.2	µµf
HEATER TO CATHODE	7.0	µµf
INTER-ELECTRODE CAPACITANCES BETWEEN TRIODE SECTIONS:		
SECTION 1 GRID TO SECTION 2 GRID	0.9	µµf
SECTION 1 PLATE TO SECTION 2 PLATE	2.2	µµf

MECHANICAL DATA

MOUNTING POSITION	ANY	
BULB	ST-16	
BASE	MEDIUM SHELL OCTAL 8 PIN B8-41 PHENOLIC	
AVERAGE NET WEIGHT	2.5	OUNCES
MAXIMUM VIBRATION RATING (D=.08" @ 25 CPS)	2.5	G

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

ABSOLUTE VALUES

	MIN.	MAX.	
HEATER VOLTAGE	5.7	6.9	VOLTS
PLATE VOLTAGE (DC)	---	275	VOLTS
GRID VOLTAGE (DC)	---	0	VOLTS
HEATER-CATHODE VOLTAGE (DC)	-300	+300	VOLTS
GRID CURRENT PER GRID	---	0	MA.
PLATE CURRENT PER PLATE (DC)	---	125	MA.
(IF SEVERAL TUBE SECTIONS ARE TO BE USED IN PARALLEL WITH EACH OTHER, IT IS RECOMMENDED NOT TO EXCEED 100 MA. PER PLATE)			
POWER DISSIPATION PER PLATE	---	14	WATTS
ENVELOPE TEMPERATURE	---	200	°C
ALTITUDE FOR FULL RATINGS	---	10 000	FEET
CIRCUIT VALUES[A]			
GRID CIRCUIT RESISTANCE FOR CATHODE BIAS OPERATION	---	1.0	MEGOHM
GRID CIRCUIT RESISTANCE FOR FIXED BIAS OR COMBINATION FIXED AND CATHODE BIAS OPERATION	---	0.1	MEGOHM

RANGE OF VALUES

CONDITIONS: $E_f = 6.3V$; $E_b = 135V$; $E_c = 0$: $R_{k/k} = 250\ \Omega$.
BOTH SECTIONS OPERATING.
EACH SECTION READ SEPARATELY.

INDIVIDUAL PLATE CURRENT (DC)	100	150	MA.
INDIVIDUAL SECTION TRANSCONDUCTANCE	5 800	8 200	μMHOS
AMPLIFICATION FACTOR	1.4	2.6	

CONDITIONS: $E_f = 6.3$: $E_b = 250$ VDC. $E_c = -200$ VDC. $R_{k/k} = 0$.

INDIVIDUAL PLATE CURRENT (DC)		10	MA.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

APPLICATION NOTES

THE 6AS7G IS WIDELY USED AS A "PASSING" TUBE OR SERIES REGULATOR IN CONTROLLED POWER SUPPLIES BECAUSE OF ITS HIGH TRANSCONDUCTANCE AT RELATIVELY LOW PLATE VOLTAGES. TO PROVIDE THE DESIRED OUTPUT CURRENT, MANY TRIODE SECTIONS CAN BE PARALLELED. IF TUBE SECTIONS ARE TO BE PARALLELED, HOWEVER, THE DESIGNER IS STRONGLY URGED TO USE SUFFICIENT RESISTANCE IN EACH CATHODE LEG TO EQUALIZE CURRENT DIVISION AMONG THE TRIODE SECTIONS. RECOMMENDED VALUES FOR VARIOUS OPERATING CURRENTS ARE SHOWN ON THE PLATE CHARACTERISTICS CURVE. IF THE OUTPUT CURRENT OF THE SUPPLY IS NOT FIXED, USE THE RESISTANCE INDICATED FOR THE LOWEST CURRENT THAT APPROACHES THE MAXIMUM PLATE DISSIPATION LINE. CATHODE RESISTANCE IS SUPERIOR TO ANODE RESISTANCE BECAUSE IT PROVIDES MORE BIAS ON THE SECTIONS TAKING GREATER PLATE CURRENT. A CATHODE RESISTOR NEED BE ONLY ONE THIRD THE VALUE $\left(\frac{1}{\mu+1}\right)$ OF A PLATE RESISTOR, AND THEREFORE WILL DISSIPATE ONLY ONE THIRD THE POWER. IN ANY CASE, THE ONLY LOSSES INCURRED IN USING A RESISTOR IS THE INSERTION LOSS OF THE RESISTOR ITSELF (LESS THAN ONE WATT) AND THE ADDITIONAL VOLTAGE (LESS THAN 10 VOLTS) NECESSARY FROM THE UNREGULATED SUPPLY. A CATHODE RESISTOR ADDS A SMALL ADDITIONAL LOSS BY CAUSING THE PASSING TUBE TO WORK WITH HIGHER BIAS AND HENCE WITH GREATER TUBE DROP.

A THIRTY SECOND CATHODE WARMUP TIME IS RECOMMENDED BEFORE THE PLATE VOLTAGE IS APPLIED. THIS IS ESPECIALLY NECESSARY IN CIRCUITS WHERE THE AMPLIFIER TUBE PLATE RESISTOR IS RETURNED TO THE PLATE SIDE OF THE PASSING TUBE, AS ILLUSTRATED IN THE SIMPLIFIED CIRCUIT IN FIGURE 1. IN THIS CASE DURING WARMUP THE AMPLIFIER TUBE DRAWS LITTLE CURRENT, THERE IS LITTLE IR DROP ACROSS THE RESISTOR, AND THE GRID OF THE PASSING TUBE IS EFFECTIVELY TIED TO THE PLATE. THE PLATE WILL ATTEMPT TO DRAW EXCESSIVE CURRENT FROM THE PASSING TUBE'S CATHODE AND MAY SERIOUSLY IMPAIR TUBE LIFE. THE CIRCUIT IN FIGURE 2 IS PREFERABLE FROM THE CONSIDERATION OF THE SAFETY OF THE PASSING TUBE BOTH DURING WARMUP AND IN THE EVENT OF TROUBLE IN THE AMPLIFIER CIRCUIT OR IF THE AMPLIFIER TUBE IS REMOVED FROM ITS SOCKET. IT HAS THE ADDITIONAL ADVANTAGE OF PROVIDING A CONSTANT VOLTAGE FOR THE AMPLIFIER CIRCUIT. HOWEVER, IF THE REGULATED OUTPUT IS LOW (BELOW 150 VOLTS) IT WILL BE NECESSARY TO PROVIDE ADDITIONAL NEGATIVE VOLTAGE FOR THE REFERENCE TUBE CIRCUIT. ALSO, IF THE REGULATED OUTPUT VOLTAGE IS TO BE VARIABLE, IT MAY BE NECESSARY TO FOLLOW FIGURE 1.

PASSING TUBE OPERATION CONDITIONS SHOULD BE CHOSEN TO PROVIDE AS LOW A TUBE DROP AS POSSIBLE. A SAFETY MARGIN OF AT LEAST 5 VOLTS FROM THE ZERO BIAS LINE SHOULD BE ALLOWED HOWEVER, FOR VARIATIONS OF INDIVIDUAL TUBES. SUFFICIENT BIAS EXCURSION SHOULD BE ALLOWED FOR OVERCOMING RIPPLE. THE AMPLIFIER CIRCUIT SHOULD BE ABLE TO COUNTERACT THE EFFECT OF UNBALANCE DUE TO TUBE AGING.

A GRID RESISTOR SHOULD BE USED FOR EACH TRIODE SECTION. THIS SHOULD BE ENOUGH TO PREVENT PARASITIC OSCILLATION BUT NOT LARGE ENOUGH TO PREVENT LOSS OF CONTROL DUE TO A SMALL AMOUNT OF "GAS" GRID CURRENT. A VALUE OF GRID RESISTANCE THAT MEETS BOTH THESE CONDITIONS IS 1,000 OHMS. HEATER VOLTAGE SHOULD BE KEPT AS CLOSE AS POSSIBLE TO 6.3 VOLTS AS MEASURED ON THE TUBE PINS. WHEN CONNECTING MANY HIGH DRAIN TUBE HEATERS ACROSS A SINGLE TRANSFORMER, BUS BARS FEEDING FROM "ALTERNATE ENDS" (FIGURE 3) SHOULD BE USED WITH A STRANDED PAIR FEEDING INDIVIDUAL SOCKETS.

TUNG-SOL

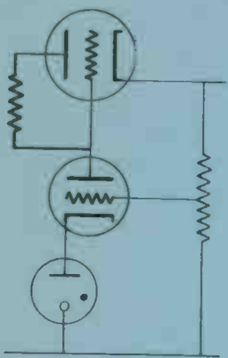


FIGURE 1

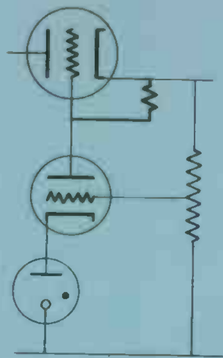


FIGURE 2

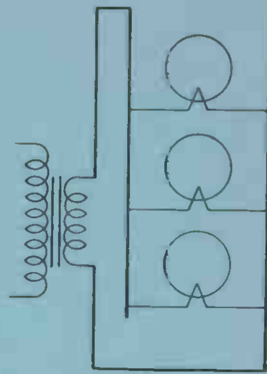
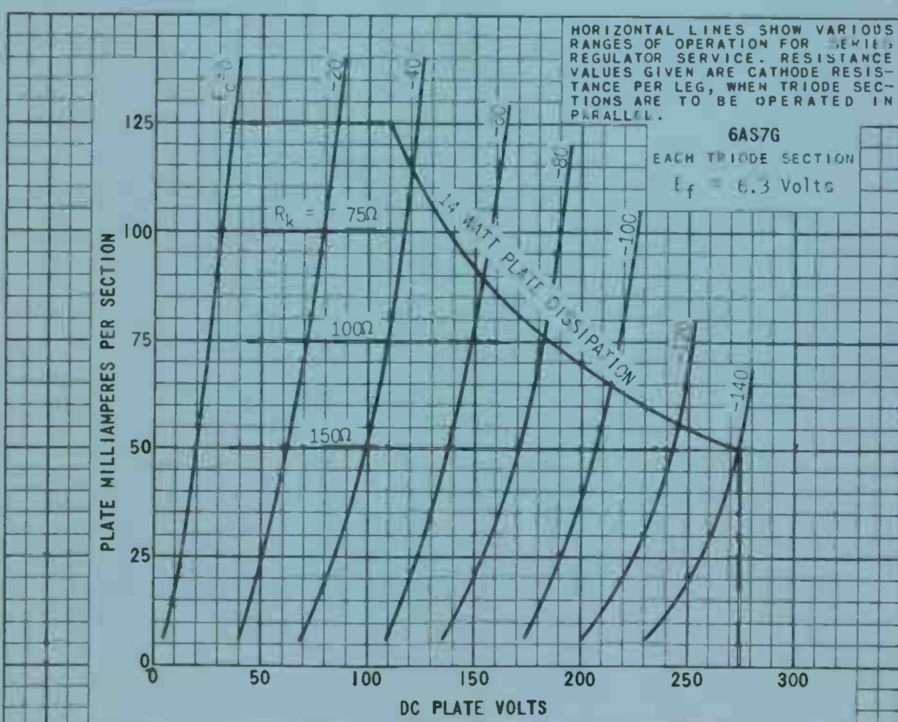
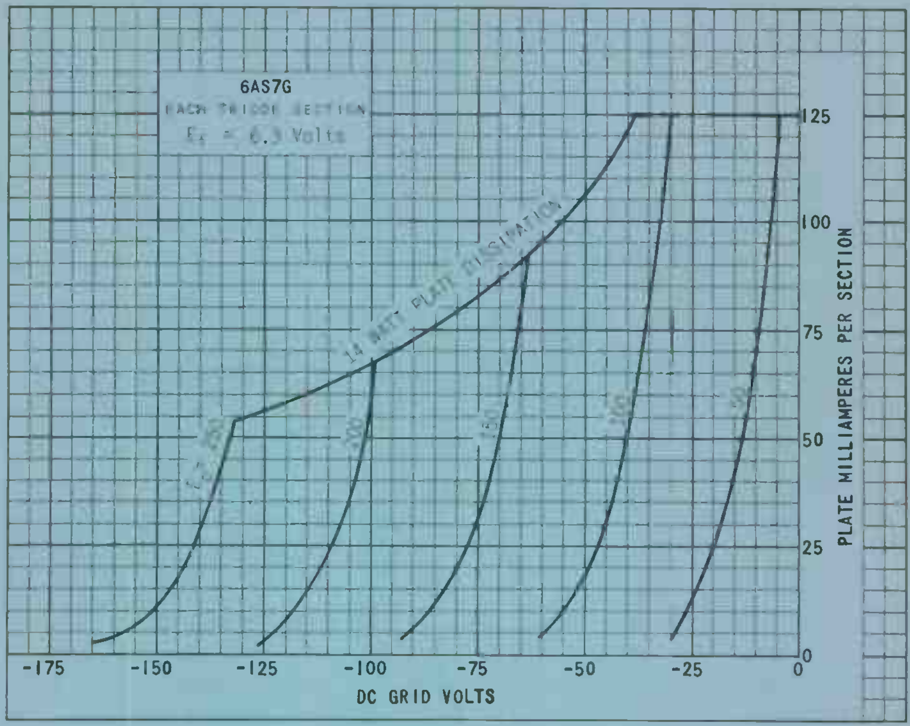
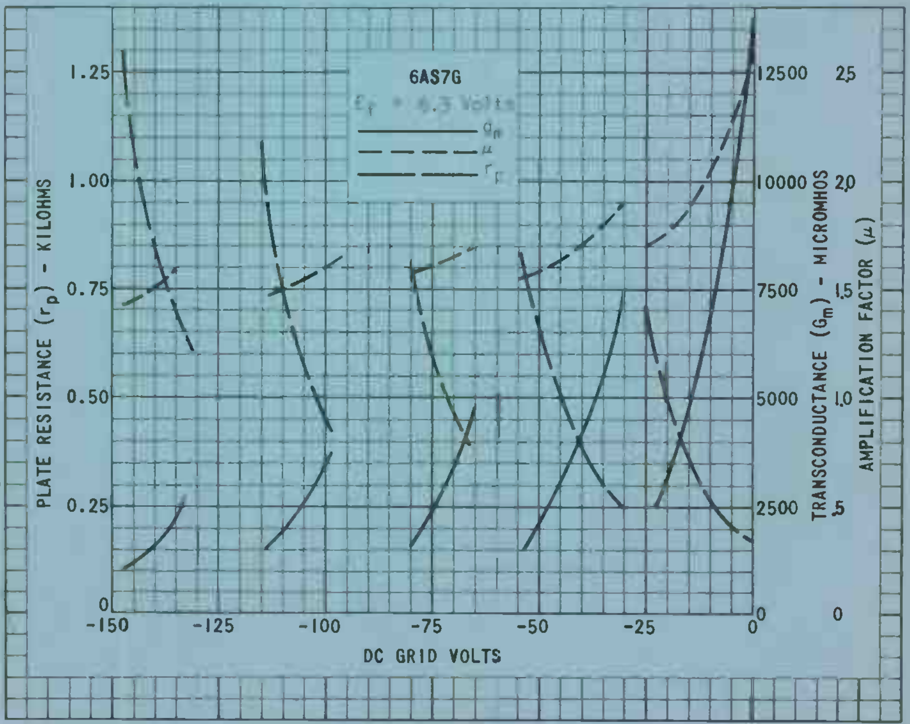


FIGURE 3

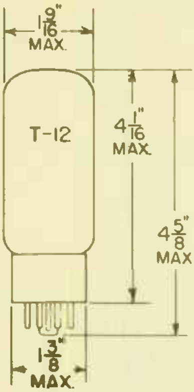



6AS7G
EACH TRIODE SECTION
Ef = 6.3 Volts
14 WATT PLATE DISSIPATION
PLATE MILLIAMPERES PER SECTION
DC GRID VOLTS
-175
-150
-125
-100
-75
-50
-25
0
125
100
75
50
25


6AS7G
Ef = 6.3 Volts
gm
μ
rp
PLATE RESISTANCE (rp) - KILOHMS
TRANSCONDUCTANCE (Gm) - MICROMHOS
AMPLIFICATION FACTOR (μ)
DC GRID VOLTS
1.25
1.00
0.75
0.50
0.25
0
-150
-125
-100
-75
-50
-25
12500
10000
7500
5000
2500
2.5
2.0
1.5
1.0
.5

TUNG-SOL

TWIN TRIODE

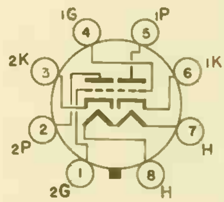


SHORT MEDIUM-SHELL
8 PIN OCTAL B8-110
GLASS BULB

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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

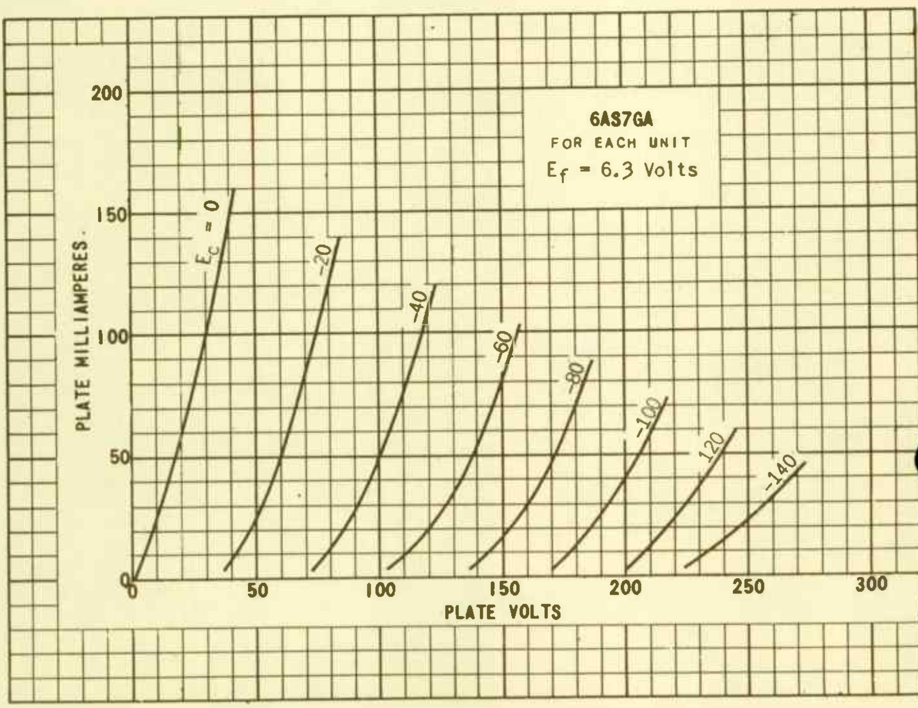
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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

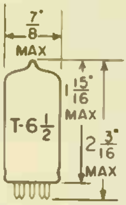
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

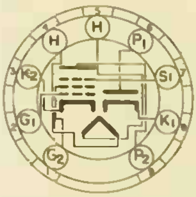
HEATER

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

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

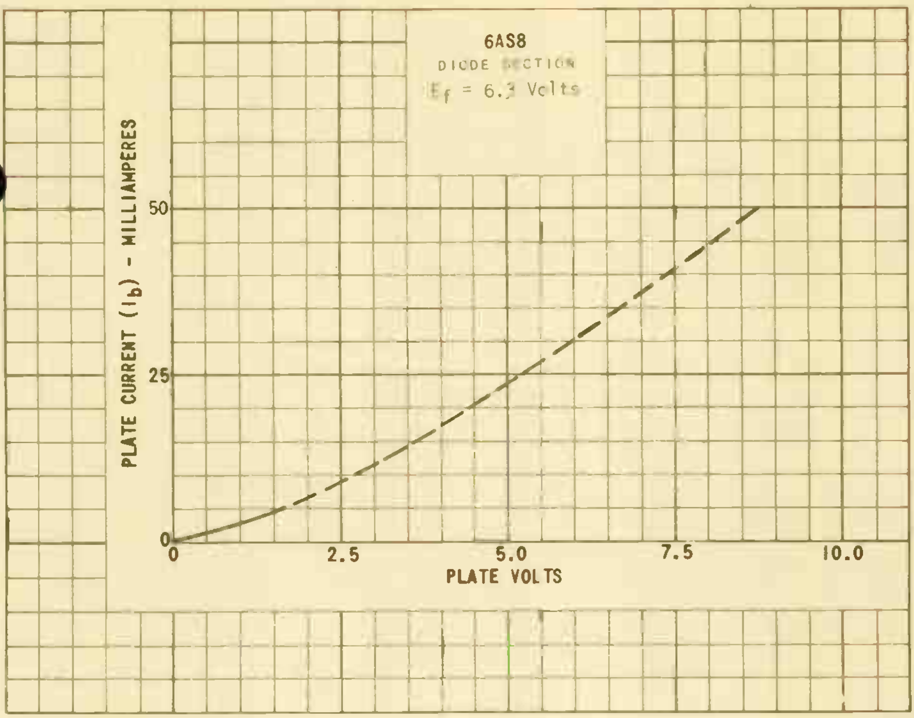
	DIODE UNIT	
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	330	VOLTS
MAXIMUM PEAK PLATE CURRENT	50	MA.
MAXIMUM DC PLATE CURRENT	5	MA.

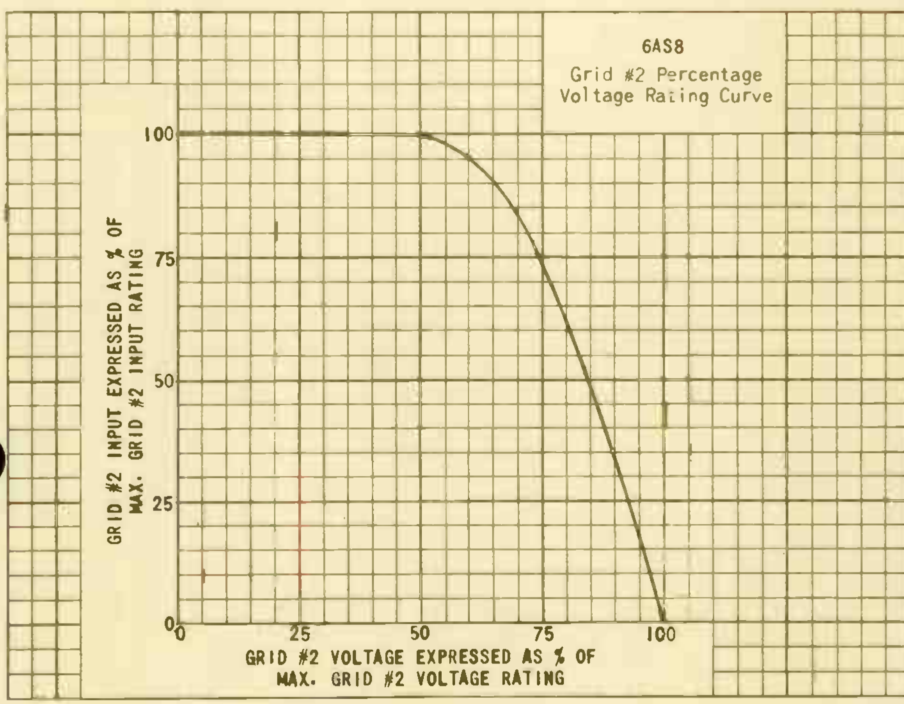
[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

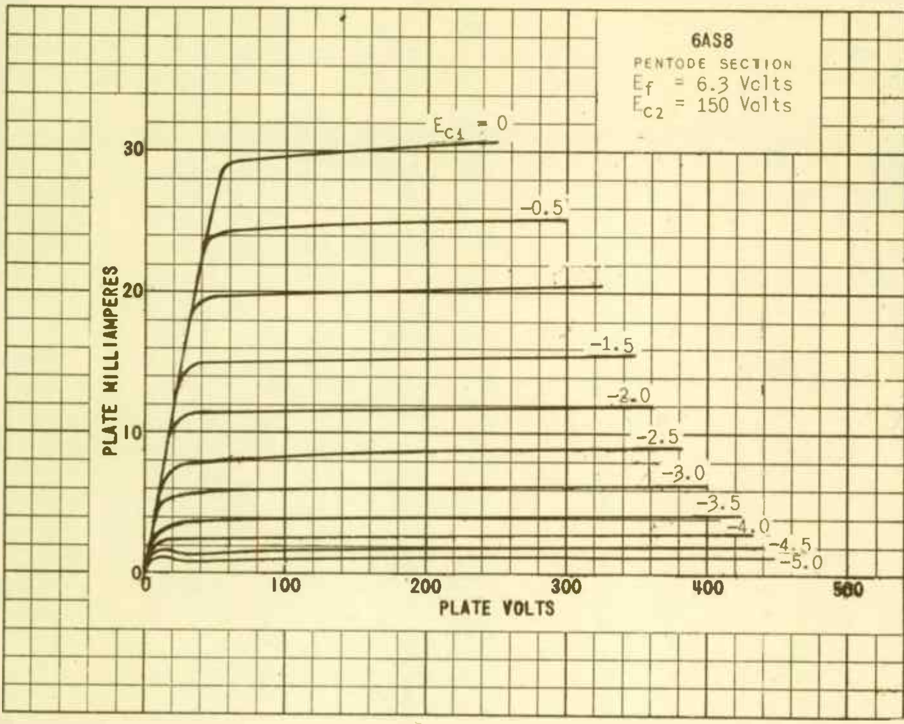
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

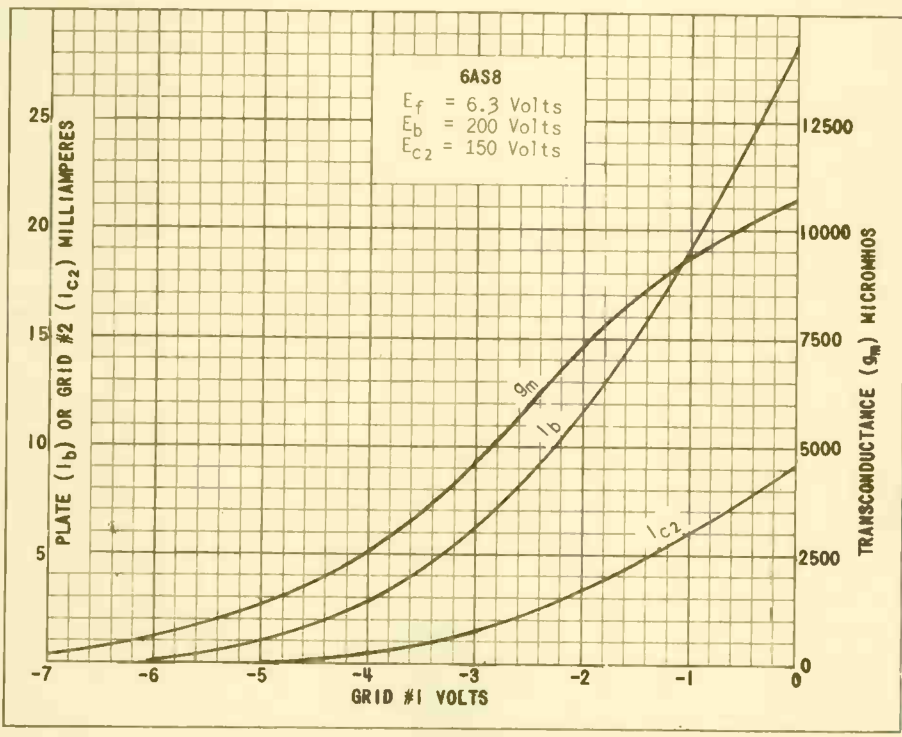
PLATE SUPPLY VOLTAGE	200	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET	
GRID #2 SUPPLY VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	180	OHMS
PLATE RESISTANCE (APPROX.)	300 000	OHMS
TRANSCONDUCTANCE	6 200	μMHOS
GRID #1 BIAS (APPROX.) FOR I_b = 10 μAMP.	-8	VOLTS
PLATE CURRENT	9.5	MA.
GRID #2 CURRENT	3	MA.

→ INDICATES A CHANGE


6AS8
DIODE SECTION
E_f = 6.3 Volts
PLATE CURRENT (I_b) - MILLIAMPERES
0
25
50
0
2.5
5.0
7.5
10.0
PLATE VOLTS


6AS8
Grid #2 Percentage
Voltage Rating Curve
GRID #2 INPUT EXPRESSED AS % OF
MAX. GRID #2 INPUT RATING
0
25
50
75
100
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS % OF
MAX. GRID #2 VOLTAGE RATING

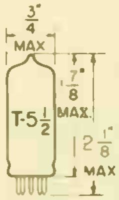

6AS8
PENTODE SECTION
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c1} = 0
-0.5
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
PLATE MILLIAMPERES
0
10
20
30
100
200
300
400
500
PLATE VOLTS


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
5
10
15
20
25
TRANSCONDUCTANCE (g_m) MICROMHOS
0
2500
5000
7500
10000
12500
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

DOUBLE DIODE TRIODE

MINIATURE TYPE

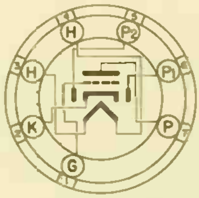


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

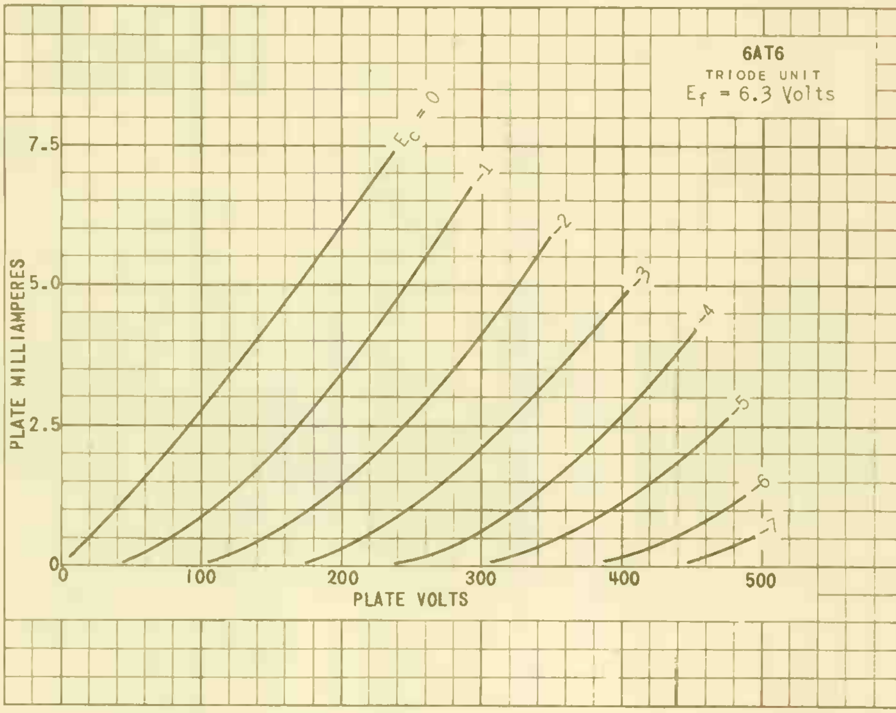
CLASS A_1 AMPLIFIER

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	



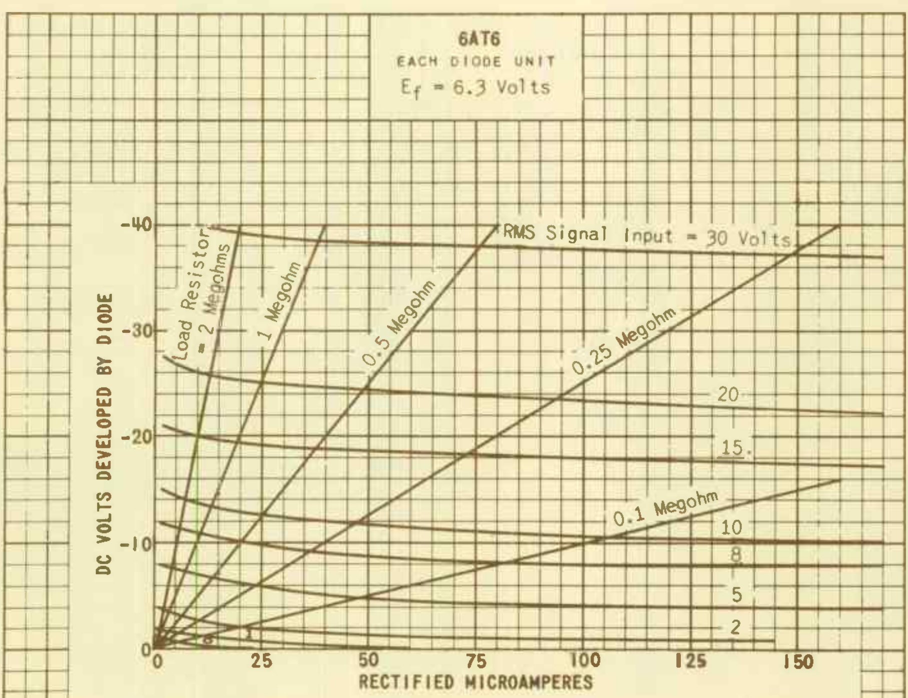


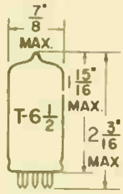
PLATE 3161

PRINTED IN U. S. A.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

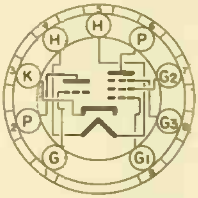


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN NOVAL
90W

THE 6AT8 AND 6AT8A ARE MULTI-UNIT TUBES USING THE 9 PIN MINIATURE CONSTRUCTION. THEY CONTAIN A MEDIUM-MU TRIODE AND SHARP CUT-OFF PENTODE IN ONE ENVELOPE, AND ARE DESIGNED PRIMARILY FOR USE AS COMBINED OSCILLATOR AND MIXER TUBES IN TELEVISION RECEIVERS UTILIZING AN INTERMEDIATE FREQUENCY IN THE ORDER OF 40 MC. THERMAL CHARACTERISTICS OF THE HEATER OF THE 6AT8A 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	
TRIODE UNIT:			
GRID TO PLATE	1.5	1.5	μμf
INPUT	2.0	2.4	μμf
OUTPUT	0.5	1.0	μμf
PENTODE UNIT:			
GRID #1 TO PLATE (MAX.)	0.025	0.016	μμf
INPUT	4.5	4.7	μμf
OUTPUT	0.9	1.6	μμf
PENTODE UNIT CONNECTED AS TRIODE:[B]			
GRID #1 TO PLATE	1.3	1.3	μμf
INPUT	3.0	3.3	μμf
OUTPUT	1.7	2.5	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	0.05	0.04	μμf
PENTODE PLATE TO TRIODE PLATE	0.05	0.007	μμf
HEATER TO CATHODE	6.5	6.5[C]	μμf

[A] SHIELD #315 CONNECTED TO CATHODE EXCEPT AS NOTED.

[B] GRID #3 CONNECTED TO CATHODE; GRID #2 CONNECTED TO PLATE.

[C] SHIELD #315 CONNECTED TO GROUND.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CONVERTER SERVICE

	TRIODE UNIT AS OSCILLATOR	PENTODE UNIT AS MIXER	PENTODE UNIT[B] AS TRIODE CONNECTED MIXER	
HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:●				
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	100	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	100	100	VOLTS
MAXIMUM PLATE VOLTAGE	250	250	250	VOLTS
MAXIMUM GRID #3 VOLTAGE	---	0	---	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	SEE RATING CURVE	---	
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	250	---	VOLTS
MAXIMUM GRID #1 VOLTAGE:				
NEGATIVE BIAS VALUE	40	40	40	VOLTS
POSITIVE BIAS VALUE	0	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.5	2.0	2.4	WATTS
MAXIMUM GRID #2 INPUT	---	0.4	---	WATT
MAXIMUM GRID #1 INPUT	0.5	---	---	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE:				
FIXED BIAS			0.1	MEGOHM
CATHODE BIAS			0.5	MEGOHM
HEATER WARM-UP TIME (APPROX.) (6AT8A ONLY)*		11.0		SECONDS

● VALUE FOR 6AT8A: HEATER NEGATIVE WITH RESPECT TO CATHODE 200 VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE 200 VOLTS
DC COMPONENT MUST NOT EXCEED 100 VOLTS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE UNIT	PENTODE UNIT	PENTODE UNIT[B] CONNECTED AS TRIODE	
HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	100	250	150	VOLTS
GRID #3 VOLTAGE	---	CONNECTED TO CATHODE AT SOCKET	---	VOLTS
GRID #2 VOLTAGE	---	150	---	VOLTS
CATHODE BIAS RESISTOR	100	200	250	OHMS
AMPLIFICATION FACTOR	40	---	42	
PLATE RESISTANCE (APPROX.)	6 900	750 000	7 900	OHMS
TRANSCONDUCTANCE	5 800	4 600	4 000	µMHOS
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µAMP.	-10	-10	-10	VOLTS
PLATE CURRENT	8.5	7.7	7.8	MA.
GRID #2 CURRENT	---	1.6	---	MA.

[B] GRID #3 CONNECTED TO CATHODE, GRID #2 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.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D

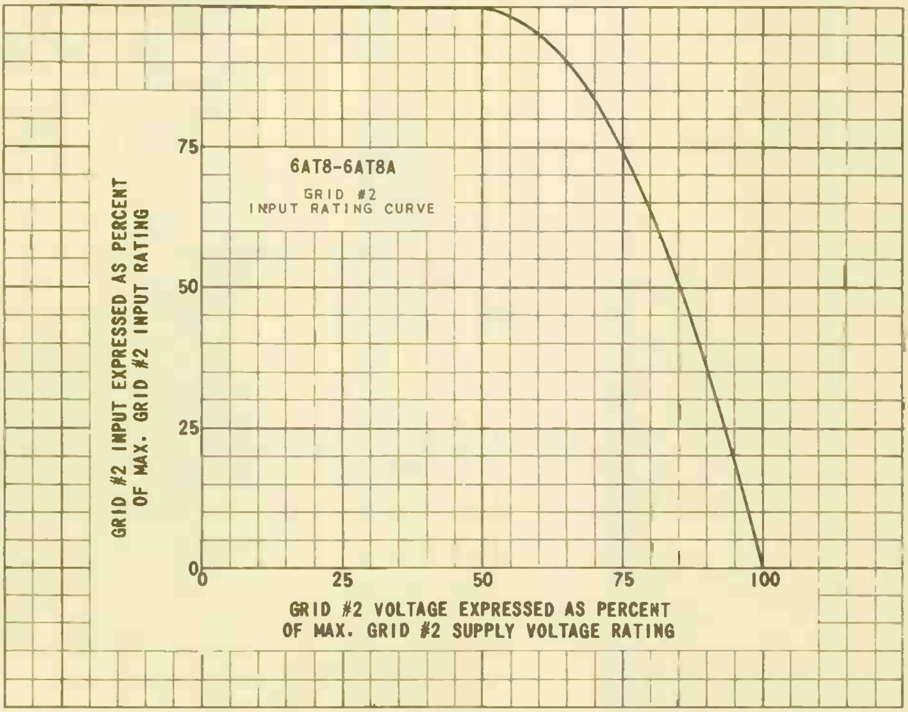
CONVERTER SERVICE

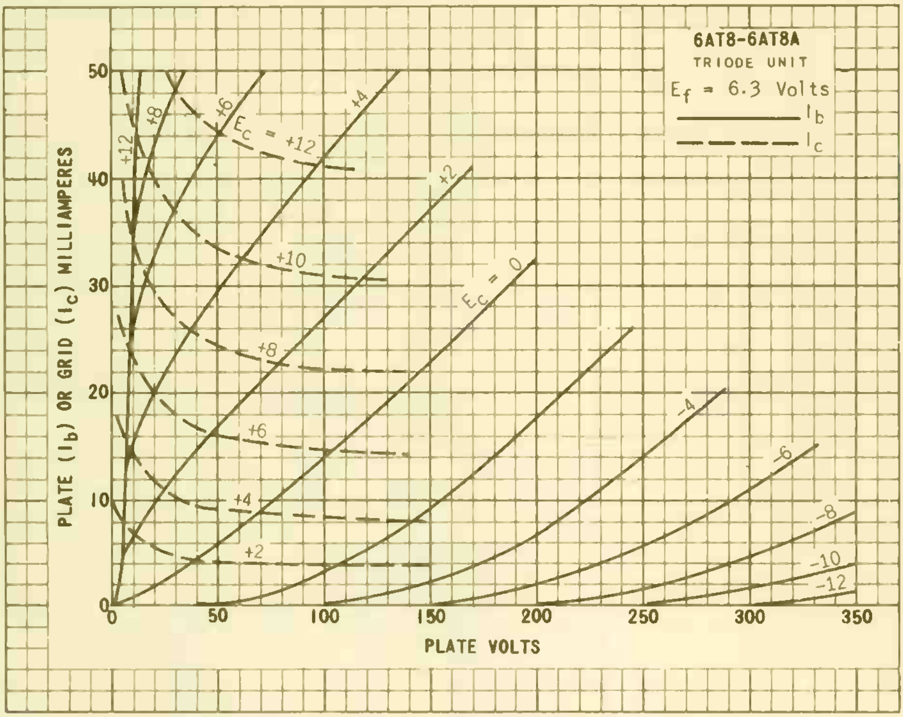
	TRIODE UNIT[D] AS 250 MC. OSCILLATOR	PENTODE[C] UNIT AS MIXER	PENTODE UNIT[E] AS TRIODE CONNECTED MIXER	
HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	150	150	150	VOLTS
GRID #3	---	CONNECTED TO CATHODE AT SOCKET	---	
GRID #2 VOLTAGE	---	150	---	VOLTS
GRID #1 SUPPLY VOLTAGE	---	-3.5	-3.5	VOLTS
OSCILLATOR VOLTAGE (RMS) AT MIXER GRID #1	---	2.6	2.6	VOLTS
GRID #1 CIRCUIT RESISTANCE	---	120 000	120 000	OHMS
GRID RESISTOR	2 700	---	---	OHMS
CONVERSION TRANSCONDUCTANCE	---	2 100	2 800	µMHOS
PLATE CURRENT	13	6.2	7.8	MA.
GRID #2 CURRENT	---	1.8	---	MA.
GRID #1 CURRENT	3.6	---	---	MA.
GRID #1 CURRENT	---	2.0	2.0	µAMP.
POWER OUTPUT (APPROX.)	0.5	---	---	WATT

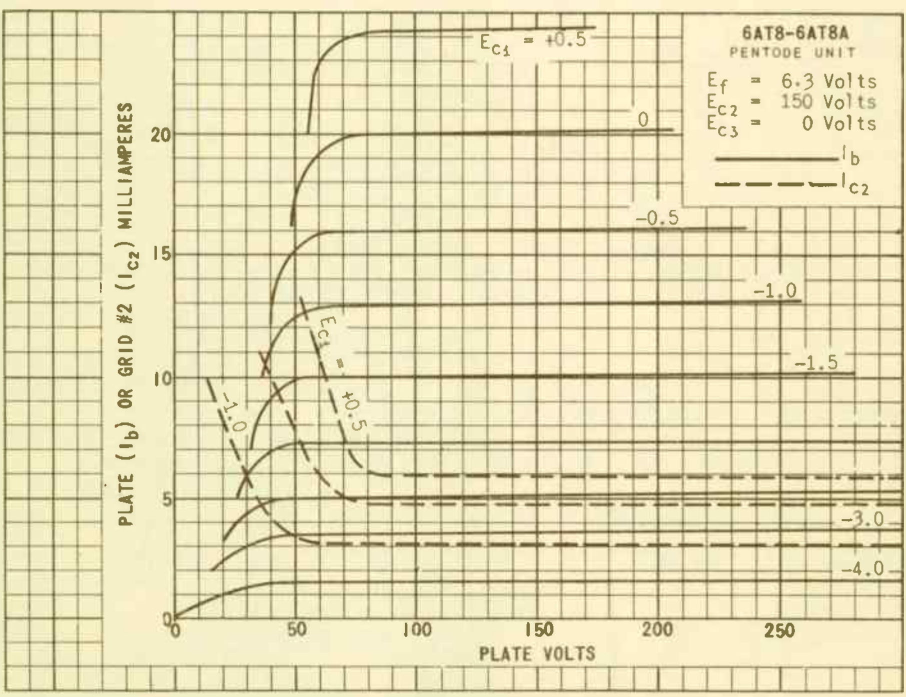
[C] WITH SEPARATE EXCITATION AND TRIODE UNIT GROUNDED.

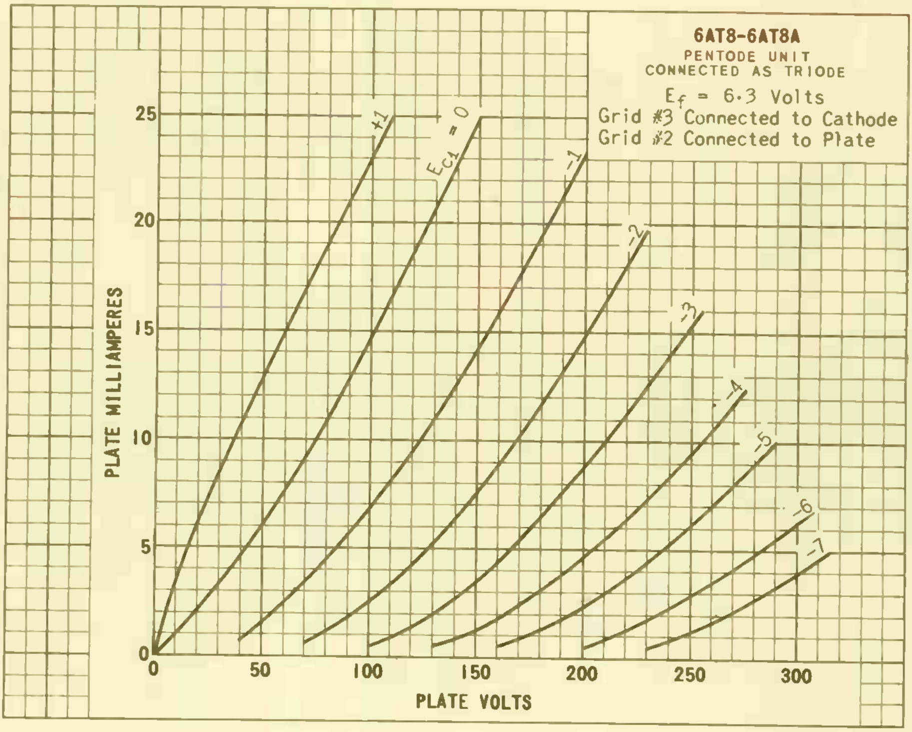
[D] IN TV OR FM RECEIVERS, IT IS GENERALLY DESIRABLE TO OPERATE THE OSCILLATOR WITH LESS POWER INPUT THAN SHOWN IN THE DATA IN ORDER TO AVOID OVER-EXCITATION AND EXCESSIVE OSCILLATOR RADIATION.

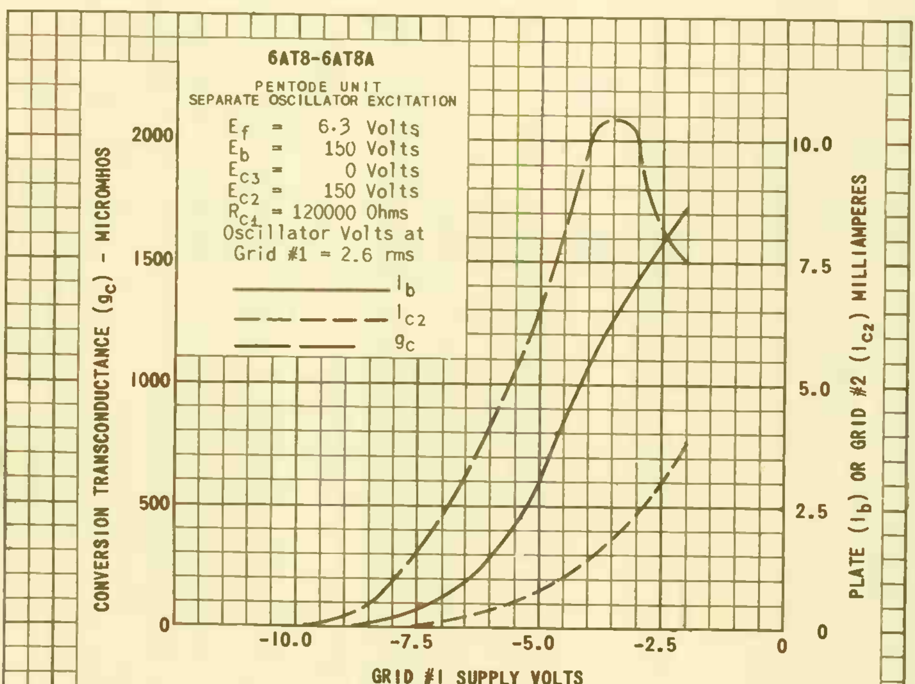
[E] GRID #3 CONNECTED TO CATHODE; GRID #2 CONNECTED TO PLATE.

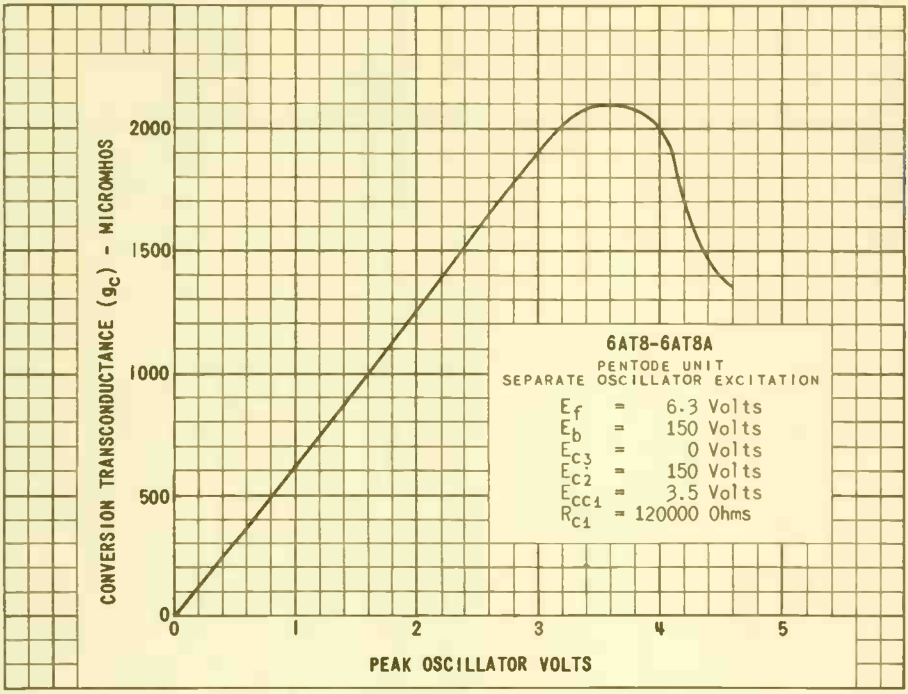


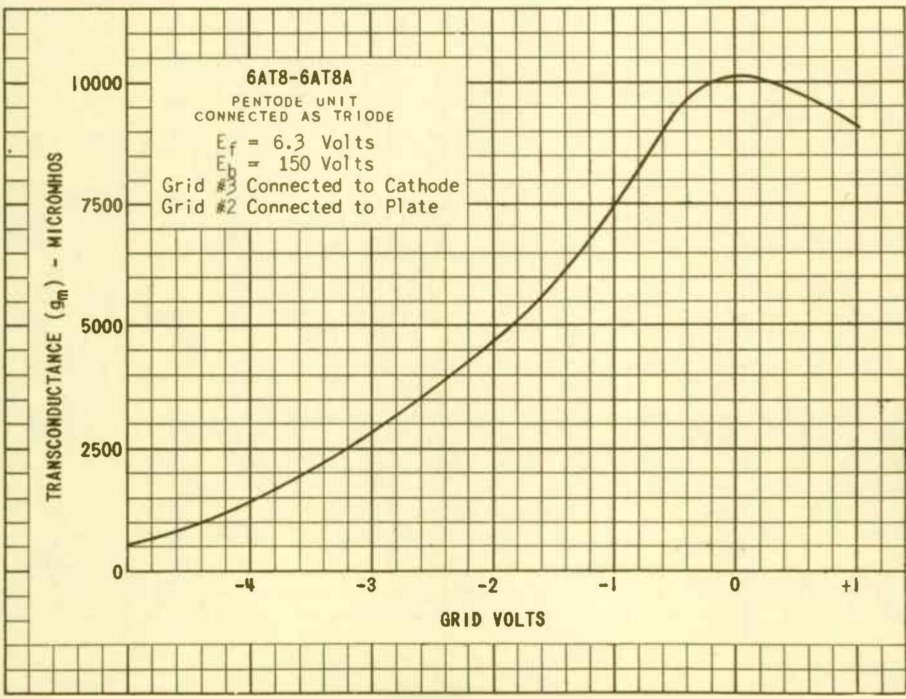

6AT8-6AT8A
TRIODE UNIT
Ef = 6.3 Volts
Ib
Ic
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
Ec = +12
+10
+8
+6
+4
+2
Ec = 0
-4
-6
-8
-10
-12


6AT8-6AT8A
PENTODE UNIT
Ef = 6.3 Volts
Ec2 = 150 Volts
Ec3 = 0 Volts
Ib
Ic2
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
Ec1 = +0.5
0
-0.5
-1.0
-1.5
-3.0
-4.0


6AT8-6AT8A
PENTODE UNIT
CONNECTED AS TRIODE
E_f = 6.3 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate
E_{c1} = 0
+1
-1
-2
-3
-4
-5
-6
-7
PLATE MILLIAMPERES
0
5
10
15
20
25
PLATE VOLTS
0
50
100
150
200
250
300

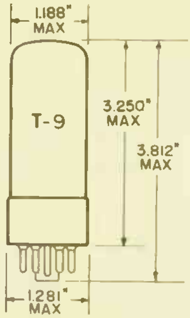

6AT8-6AT8A
PENTODE UNIT
SEPARATE OSCILLATOR EXCITATION
E_f = 6.3 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2} = 150 Volts
R_{c1} = 120000 Ohms
Oscillator Volts at
Grid #1 = 2.6 rms
I_b
I_{c2}
g_c
CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
0
500
1000
1500
2000
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
2.5
5.0
7.5
10.0
GRID #1 SUPPLY VOLTS
-10.0
-7.5
-5.0
-2.5
0


6AT8-6AT8A
PENTODE UNIT
SEPARATE OSCILLATOR EXCITATION
Ef = 6.3 Volts
Eb = 150 Volts
Ec3 = 0 Volts
Ec2 = 150 Volts
Ecc1 = 3.5 Volts
Rc1 = 120000 Ohms
CONVERSION TRANSCONDUCTANCE (gc) - MICROMHOS
2000
1500
1000
500
0
0
1
2
3
4
5
PEAK OSCILLATOR VOLTS


6AT8-6AT8A
PENTODE UNIT
CONNECTED AS TRIODE
Ef = 6.3 Volts
Eb = 150 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate
TRANSCONDUCTANCE (gm) - MICROMHOS
10000
7500
5000
2500
0
-4
-3
-2
-1
0
+1
GRID VOLTS

TUNG-SOL

DIODE

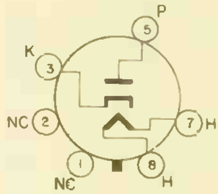


GLASS BULB
SHORT INTERMEDIATE SHELL 5 OR 6 PIN OCTAL WITH EXTERNAL BARRIERS
BASE B5-85 OR B6-60

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

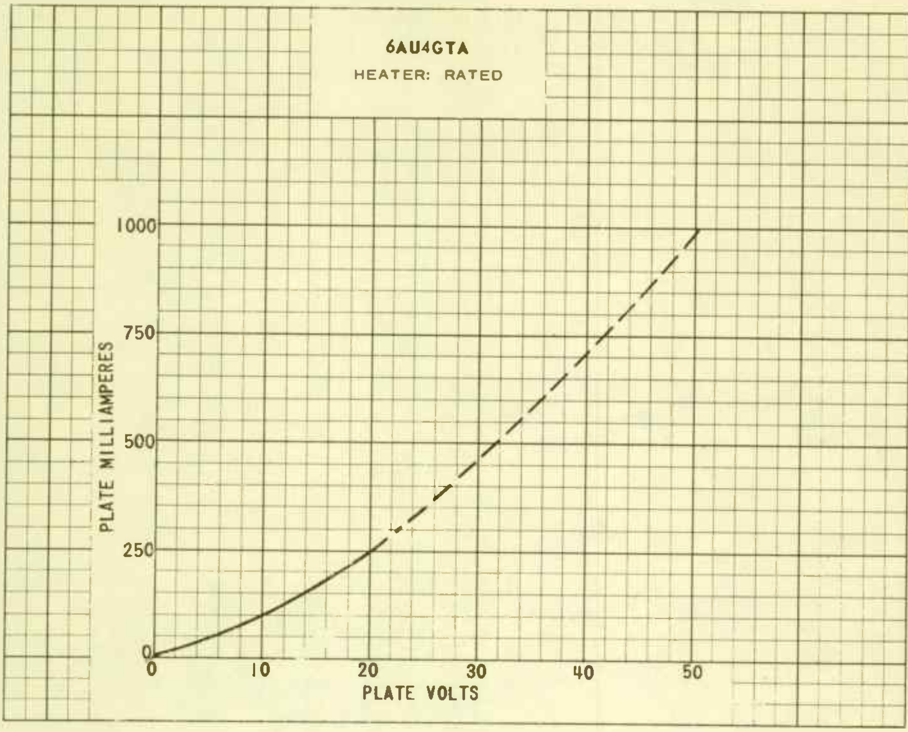
DAMPER DIODE[B]

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.

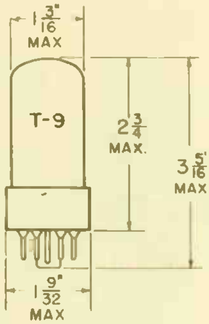
→ INDICATES A CHANGE.

PRINTED IN U.S.A.


6AU4GTA
HEATER: RATED
1000
750
500
250
0
PLATE MILLIAMPERES
0
10
20
30
40
50
PLATE VOLTS

TUNG-SOL

BEAM PENTODE



GLASS BULB

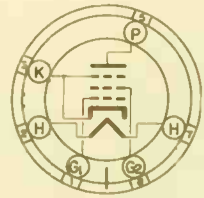
COATED UNIPOTENTIAL CATHODE

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.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

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.[illegible]	

[C] WITH E_b = 115 VOLTS, E_{c2} = 175 VOLTS AND E_{c1} = −[illegible] 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} = −[illegible] VOLTS

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

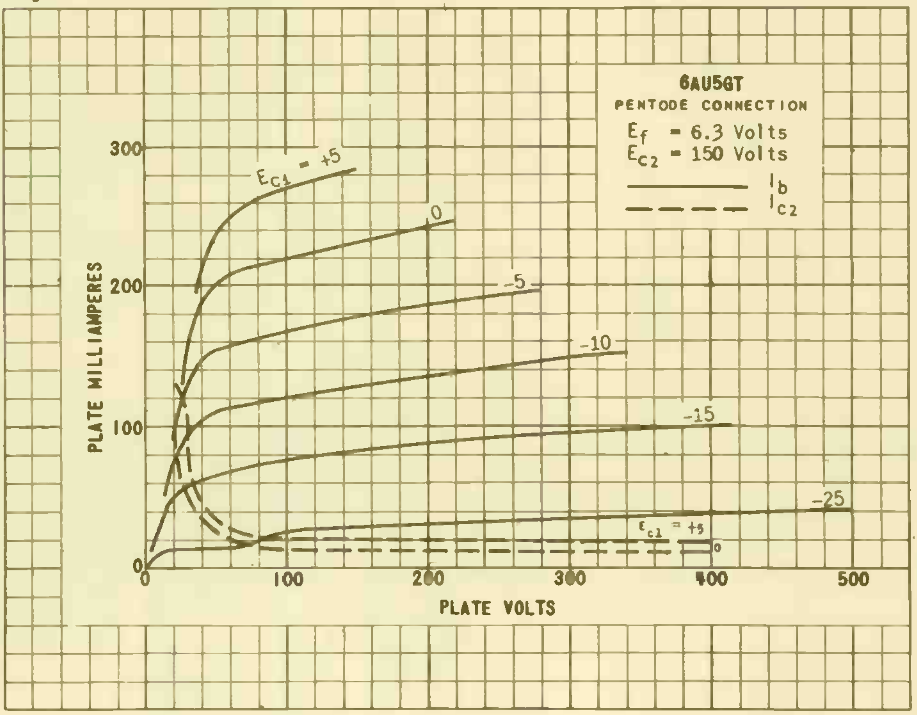
VOLTAGE REGULATOR SERVICE

TRIODE CONNECTION—GRID NO. 2 CONNECTED TO PLATE

MAXIMUM PLATE VOLTAGE	500	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.



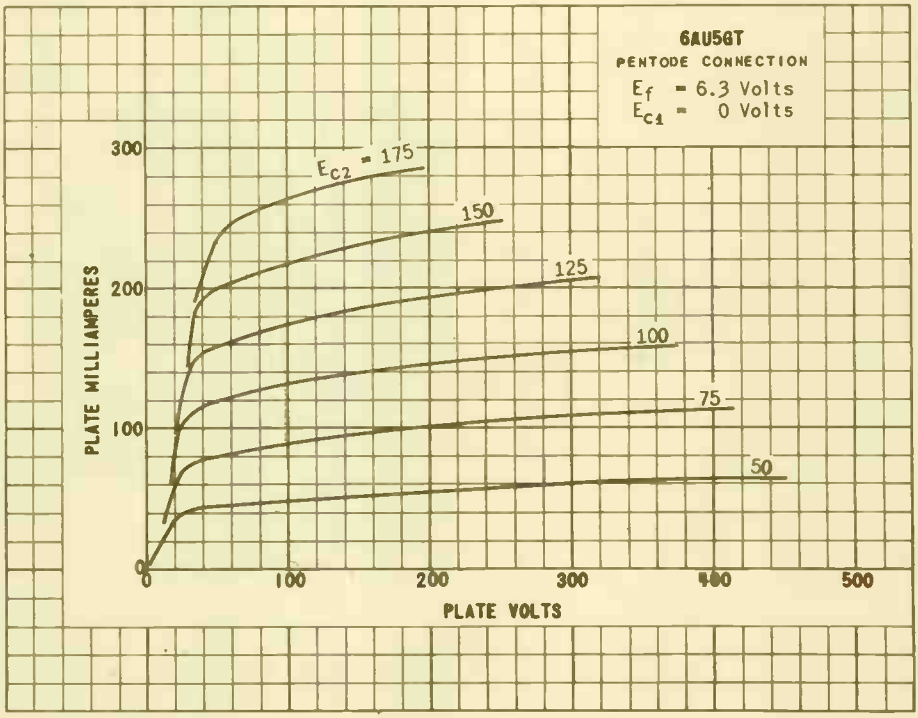
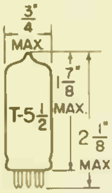


PLATE 2376
APR. 1 1950

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

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	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	6.3	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:[D]			
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	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.)* (6AU6A)	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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - PENTODE CONNECTION

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	0.3	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

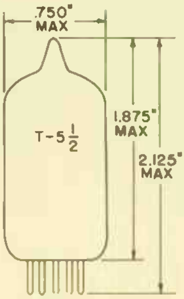
CLASS A_1 AMPLIFIER - TRIODE CONNECTION[C]

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	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.

[D] 6AU6: HEATER NEGATIVE WITH RESPECT TO CATHODE 180 volts
HEATER POSITIVE WITH RESPECT TO CATHODE 100 volts

TUNG-SOL



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

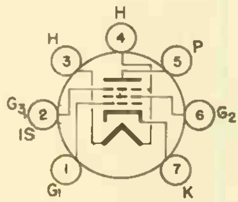
PENTODE

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 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 JS-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 JS-C4-2	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
HEATER WARM-UP TIME (APPROX.) * (6AU6A ONLY)	11.0		SECONDS

→ INDICATES A CHANGE.

PRINTED IN U.S.A.

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

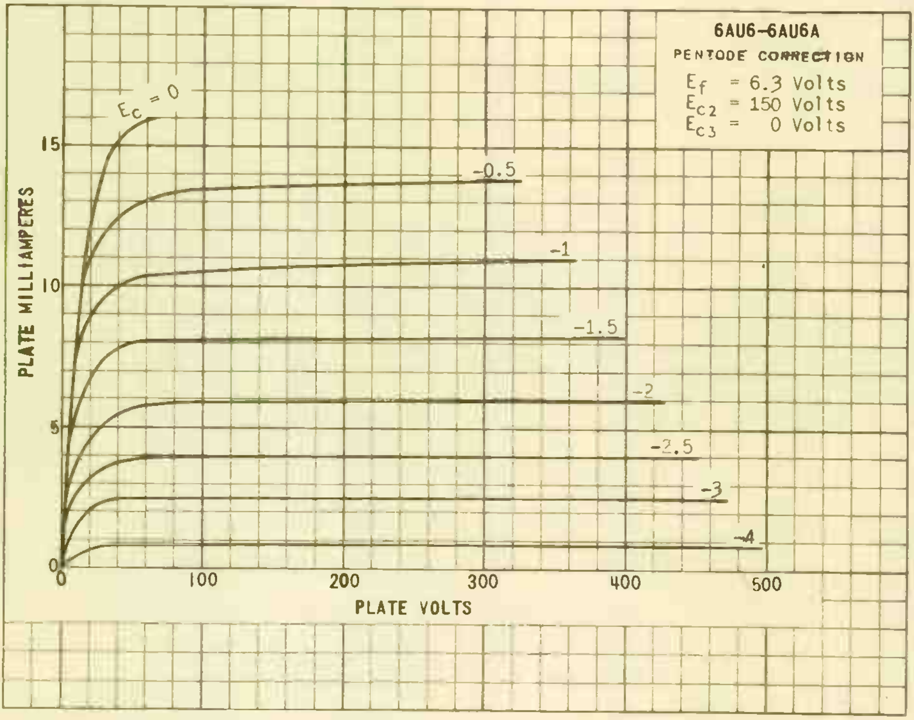
CLASS A_1 AMPLIFIER - TRIODE CONNECTION[c]

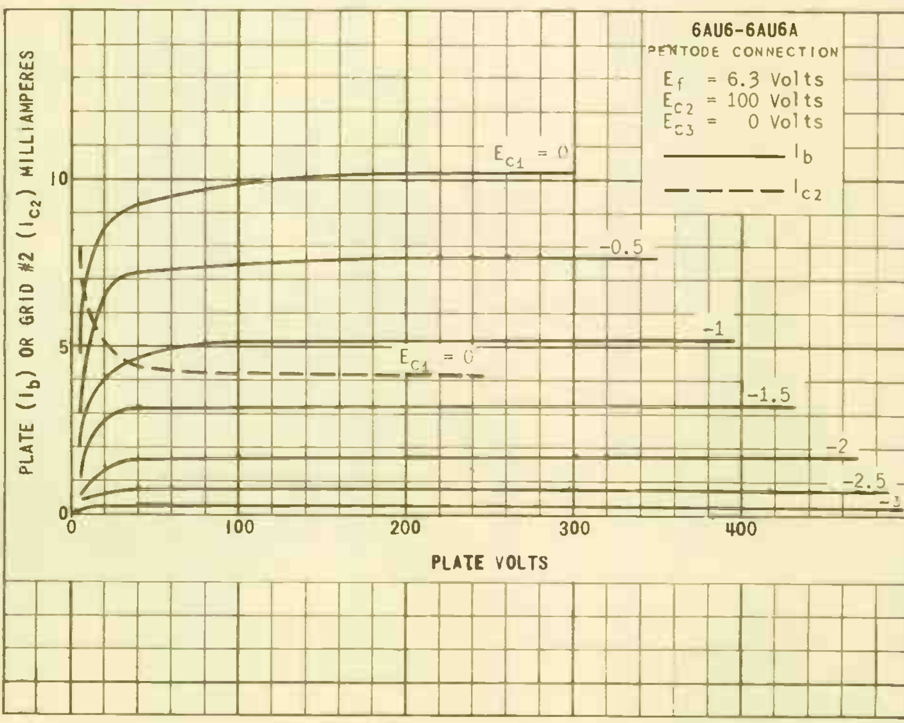
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	PLATE	
CATHODE RESISTOR	330	OHMS
GRID #3 VOLTAGE	PLATE	
TRANSCONDUCTANCE	4 800	μMHOS
PLATE CURRENT	12.2	MA.
AMPLIFICATION FACTOR	36	

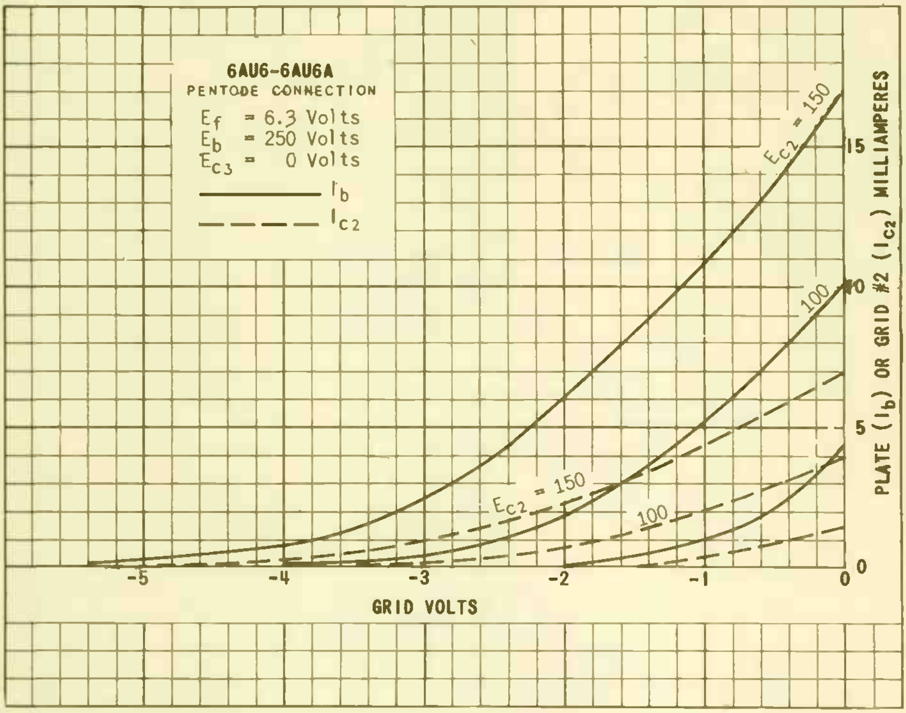
[c]TRIODE CONNECTION: GRID #2 AND GRID #3 CONNECTED TO PLATE.

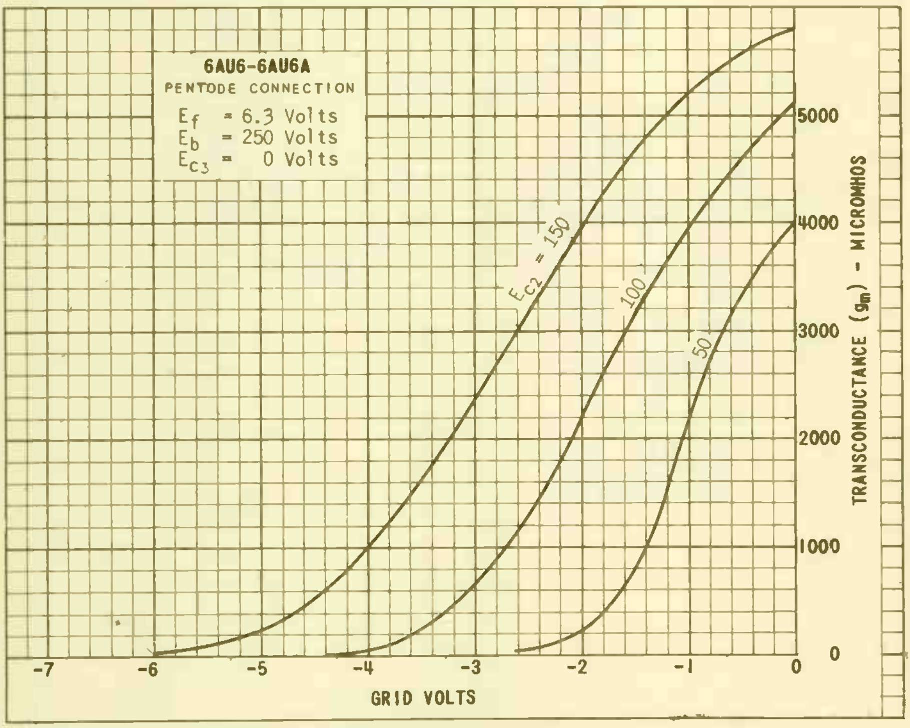
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.


6AU6-6AU6A
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c3} = 0 Volts
E_c = 0
-0.5
-1
-1.5
-2
-2.5
-3
-4
PLATE MILLIAMPERES
15
10
5
0
0
100
200
300
400
500
PLATE VOLTS


6AU6-6AU6A
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 100 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c1} = 0
-0.5
-1
E_{c1} = 0
-1.5
-2
-2.5
-3
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
10
5
0
0
100
200
300
400
PLATE VOLTS


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
GRID VOLTS
0
5
10
15
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
GRID VOLTS
0
1000
2000
3000
4000
5000
TRANSCONDUCTANCE (gm) - MICROMHOS

TUNG-SOL

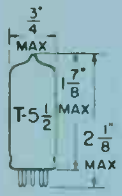
PENTODE

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 6AU6WA IS A RUGGEDIZED SHARP CUT-OFF PENTODE AMPLIFIER IN THE 7-PIN MINIATURE CONSTRUCTION. THE TUBE HAS HIGH TRANSCONDUCTANCE AND LOW GRID-PLATE CAPACITANCE AND IS INTENDED FOR USE AS A VOLTAGE AMPLIFIER OVER THE AF, IF AND RF FREQUENCY RANGES. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS HEATER CURRENT, PLATE CURRENT, SCREEN CURRENT, TRANSCONDUCTANCE, INPUT CAPACITANCE AND OUTPUT CAPACITANCE, ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 6AU6WA IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITH* SHIELD	WITHOUT SHIELD	
MAXIMUM GRID #1 TO PLATE	---	.0035	μμf
INPUT (RATED)	5.5	5.5	μμf
MAXIMUM	---	7.2	μμf
MINIMUM	---	4.8	μμf
OUTPUT (RATED)	5.0	5.0	μμf
MAXIMUM	---	5.9	μμf
MINIMUM	---	3.9	μμf

*SHIELD #316 CONNECTED TO PIN #2

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330	VOLTS
MAXIMUM DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	165	VOLTS
MAXIMUM DC GRID #3 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.7	WATT
MAXIMUM HEATER CATHODE VOLTAGE	±100	VOLTS
MAXIMUM BULB TEMPERATURE	165	°C
MAXIMUM ALTITUDE	10 000	FEET
MAXIMUM SHOCK	450	G/1 msec

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - PENTODE CONNECTION

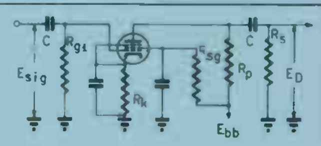
HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	0.3	AMP.
PLATE VOLTAGE	100	250	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE BIAS RESISTOR	150	100	68	OHMS
GRID #3 VOLTAGE	PIN #2 CONNECTED TO PIN #7 AT SOCKET			
TRANSCONDUCTANCE	3900	4500	5200	μMHOS
PLATE CURRENT	5	7.6	10.6	mA
GRID #2 CURRENT	2.1	3	4.3	mA
PLATE RESISTANCE (APPROX.)	0.5	1.5	1	MEGOHM
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA	-4.2	-5.5	-6.5	VOLTS

CLASS A_1 AMPLIFIER - TRIODE CONNECTION[A]

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	PLATE	
CATHODE RESISTOR	330	OHMS
GRID #3 VOLTAGE	PLATE	
TRANSCONDUCTANCE	4800	μMHOS
PLATE CURRENT	12.2	mA
AMPLIFICATION FACTOR	36	

CLASS A RESISTANCE-COUPLED AMPLIFIER

Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts				Ebb = 180 Volts				Ebb = 300 Volts			
			Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo
0.10	0.10	0.1	960	0.14	68	13	610	0.19	96	27	480	0.17	117	47
0.10	0.24	0.1	1000	0.16	93	16	630	0.21	127	35	480	0.16	153	60
0.24	0.24	0.1	2900	0.35	88	12	1700	0.46	115	25	820	0.59	200	44
0.24	0.51	0.1	3600	0.39	108	14	1800	0.53	171	31	960	0.73	229	53
0.51	0.51	0.1	5300	0.92	108	10	4000	0.97	156	23	2100	1.10	227	38
0.51	1.0	0.1	4600	1.10	122	12	3800	1.10	198	25	1800	1.30	296	44
0.24	0.24	10	0	0.42	100	12	0	0.53	157	25	D	0.45	212	44
0.24	0.51	10	0	0.46	118	14	0	0.59	184	31	D	0.70	271	52
0.51	0.51	10	0	0.92	116	11	0	1.10	197	22	0	1.20	280	38
0.51	1.0	10	0	1.00	145	12	0	1.10	238	25	D	1.30	348	42



Note: Coupling capacitors (C) should be adjusted to give desired frequency response. Rk and Rsg should be adequately by-passed.

NOTES: 1. EO 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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_{c3}[B], E_f = 6.3, E_b = 250 Vdc, E_{c1} = 0 Vdc, R_k = 68 OHMS[C], E_{c2} = 150 Vdc
(EXCEPT AS MODIFIED BELOW)

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	275	325	[illegible]	311	275	325	mA
HEATER-CATHODE LEAKAGE (E_{hk} = ±100 Vdc)	---	±10	---	±2	---	±10	μAdc
#1 GRID CURRENT (E_{c1} = -1 Vdc, R_{g1} = 0.25 MEG)	---	-1.0	---	[illegible]	---	-1.0	μAdc
PLATE CURRENT (1)	8.0	15.5	9.1	12.1	---	---	mAdc
TRANSCONDUCTANCE (1)	4150	6250	[illegible]	5180	3600	6250	μMHOS
Δ AVERAGE TRANSCONDUCTANCE (1)	---	---	---	---	---	17	PERCENT
INSULATION OF ELECTRODES[D] (E_f = 6.3V, $E(g_1\text{-all})$ = -100 Vdc, $E(p\text{-all})$ = -300 Vdc)							
$R(g_1\text{-all})$	100	---	---	---	50	---	MEGOHMS
$R(p\text{-all})$	100	---	---	---	50	---	MEGOHMS
PLATE CURRENT (2) (E_{c1} = -9 Vdc, R_p = 0.1 MEG, R_k = 0, C_k = 0)	---	15	---	---	---	---	μAdc
SCREEN GRID CURRENT	2.0	6.0	3.5	5.1	---	---	mAdc
TRANSCONDUCTANCE (2)[E] (E_f = 5.5V)	3900	---	4200	---	---	---	μMHOS
#1 GRID EMISSION[F] (E_f = 7.5V, E_{c1} = -10 Vdc, R_{g1} = 0.25 MEG, R_k = 0, C_k = 0)	---	-2.0	---	---	---	---	μAdc

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[G] (R_p = 2000)	---	300	mVac
VIBRATIONAL FATIGUE[H]	---	---	
MINIATURE TUBE BASE STRAIN[K] (NO VOLTAGES)	---	---	
STABILIZATION INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT	---	---	
SHOCK[L] (HAMMER ANGLE = 30°, E_{hk} = 100 Vdc, R_{g1} = 0.1 MEG, C_k = 0)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	450	mVac
HEATER CATHODE LEAKAGE	---	±30	μAdc
TRANSCONDUCTANCE (1)	3600	---	μMHOS
#1 GRID CURRENT	---	-2.0	μAdc
SHORT AND CONTINUITY[M]	---	---	
RF NOISE[N] (E_{c1} = -1.0 Vdc, E_{sig} = 15 mVac, R_k = 0, C_k = 0)	---	---	
LOW FREQUENCY VIBRATION[P] (R_p = 2000)	---	500	mVac
INTERMITTENT LIFE TEST (E_b = 300 Vdc, E_{c2} = 150 Vdc, E_{hk} = 135 Vdc, R_{g1} = 0.5 MEG, R_k = 80, C_k = 0, 20 TUBES)	---	---	
HEATER CYCLING LIFE TEST (E_f = 7.5V, E_b = E_{c2} = 0, E_{hk} = 135 Vdc)	2000	---	CYCLES
HEATER CYCLING LIFE TEST END POINT HEATER CATHODE LEAKAGE	---	20	μAdc

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

NOTES

[A] GRID #2 AND GRID #3 CONNECTED TO PLATE

[B] TIE GRID #3 TO NEGATIVE TERMINAL OF CATHODE RESISTOR.

[C] THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 5 OHMS AT 60 CYCLES PER SECOND.

[D] SEE MIL-E-1C 4.8.[illegible]

[E] PREHEAT ALL TUBES UNDER THE FOLLOWING CONDITIONS FOR A PERIOD OF 5 MINUTES PRIOR TO TESTING. E_f=[illegible]V, E_b=[illegible]00Vdc, E_{c1}=0, E_{c2}=150Vdc, E_{c3}=0, R_k=80, R_{g1}=0.5 MEG.

[F] PREHEAT ALL TUBES UNDER THE FOLLOWING CONDITIONS FOR A PERIOD OF 5 MINUTES PRIOR TO TESTING. E_f=7.5V, E_b=[illegible]00Vdc, E_{c1}=0, E_{c2}=150Vdc, E_{c3}=0, R_k=80, R_{g1}=0.5MEG. TWO (2) SECONDS SHALL BE THE MAXIMUM TIME BETWEEN PREHEAT AND TEST.

[G] SEE MIL-E-1C 4.9.20.[illegible]

[H] SEE MIL-E-1C 4.9.20.6

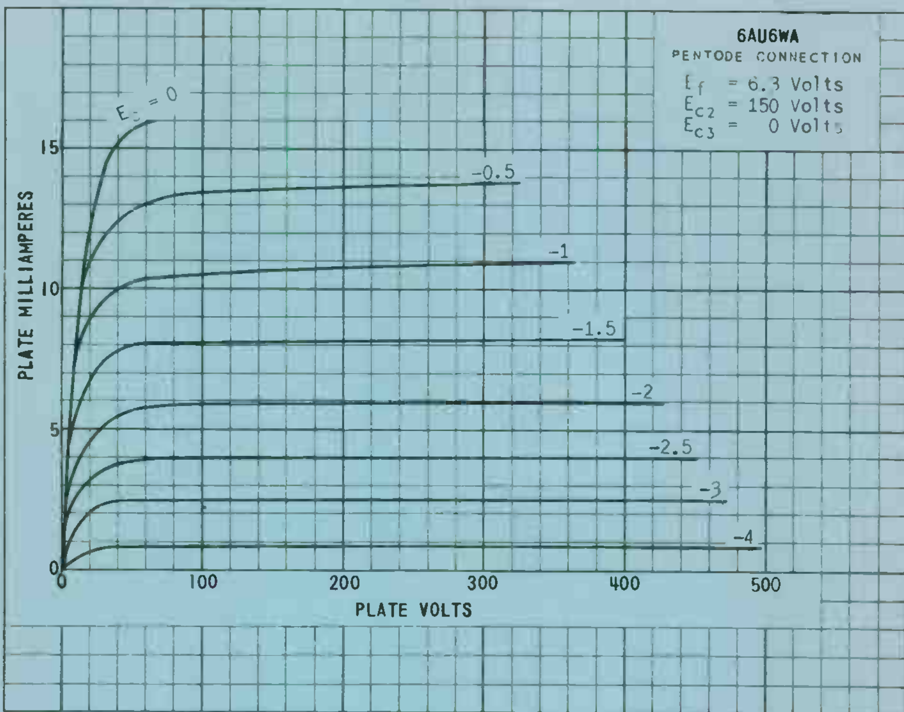
[K] SEE MIL-E-1C 4.9.6.1

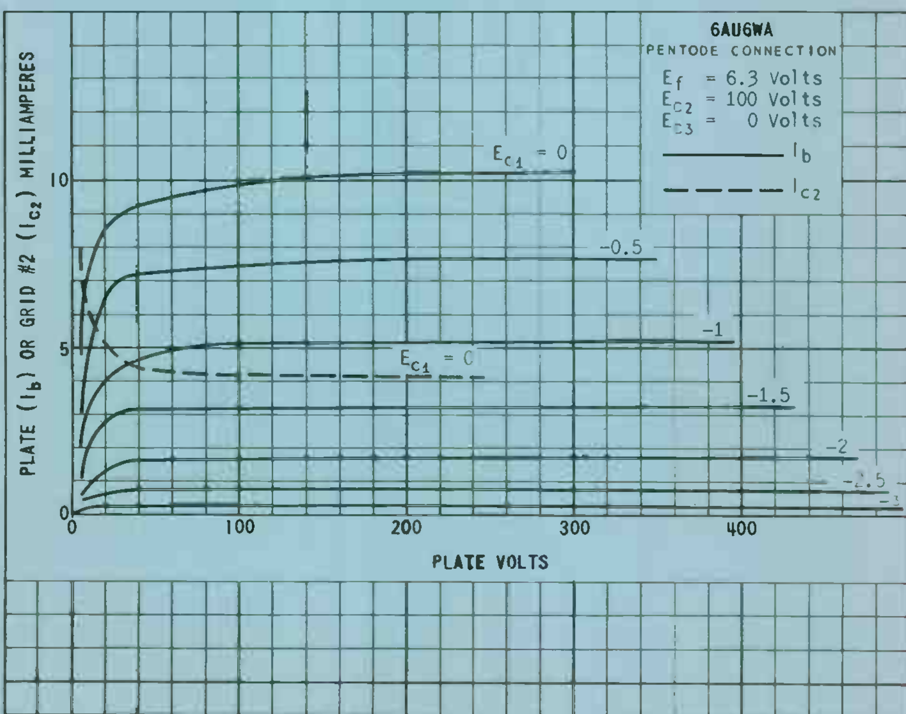
[L] SEE MIL-E-1C 4.9.[illegible]

[M] SEE MIL-E-1C 4.7.[illegible]

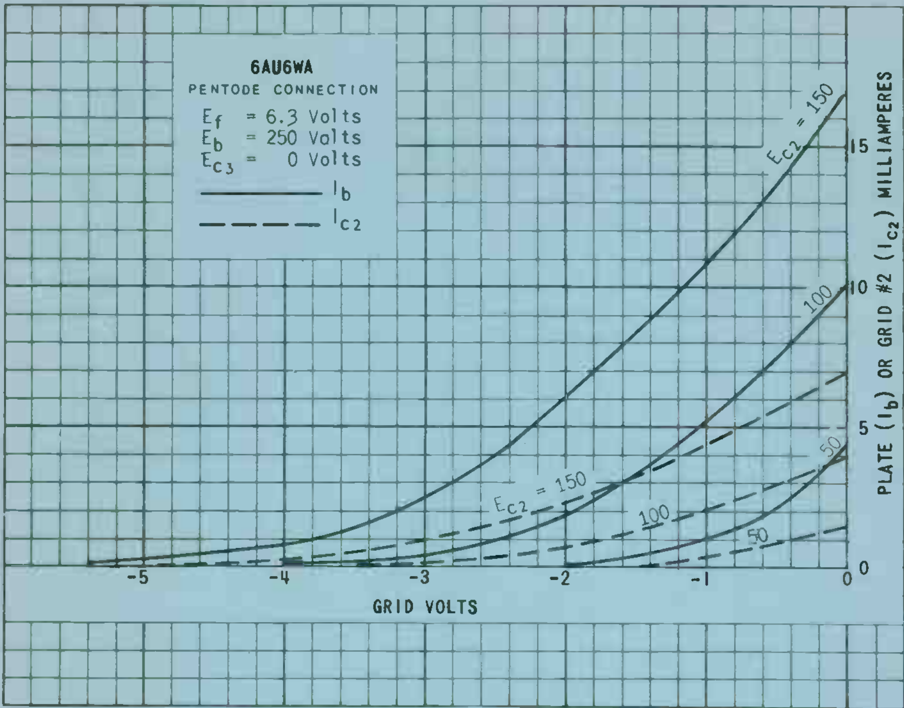
[N] SEE MIL-E-1C 4.10.[illegible].1

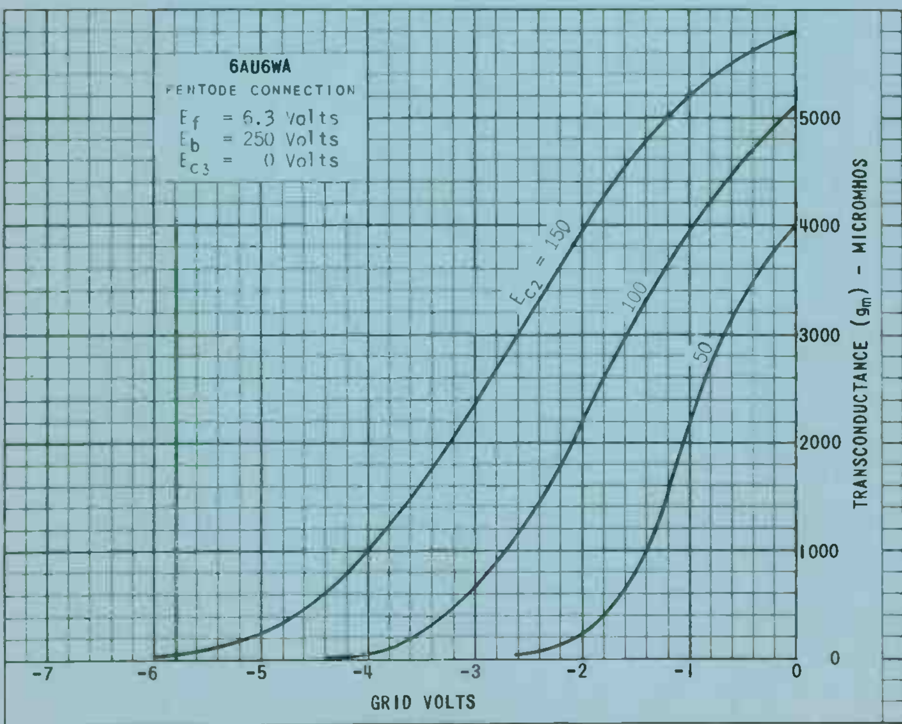
[P] SEE MIL-E-1C 4.9.2[illegible].4


6AU6WA
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c3} = 0 Volts
E_c = 0
-0.5
-1
-1.5
-2
-2.5
-3
-4
PLATE MILLIAMPERES
0
5
10
15
0
100
200
300
400
500
PLATE VOLTS


6AU6WA
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 100 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c1} = 0
-0.5
-1
E_{c1} = 0
-1.5
-2
-2.5
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
5
10
0
100
200
300
400
PLATE VOLTS

6AU6WA
PREMIUM TUBE



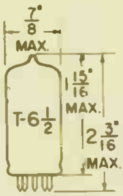


TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE



GLASS BULB

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.

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 AMPLIFIER[B]	VERTICAL DEFLECTION AMPLIFIER[B]	
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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

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

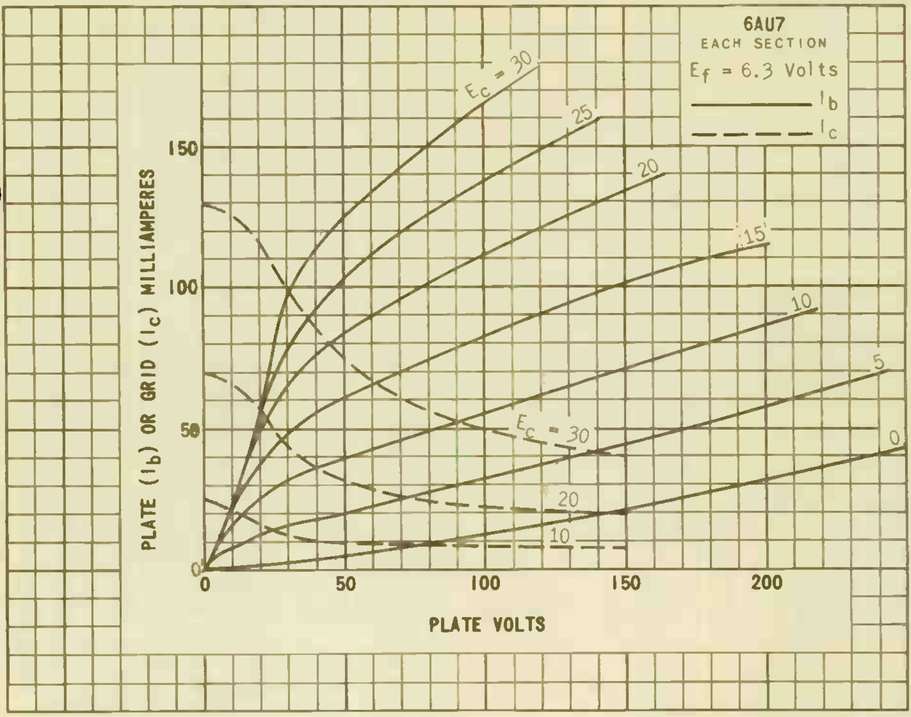
[D] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

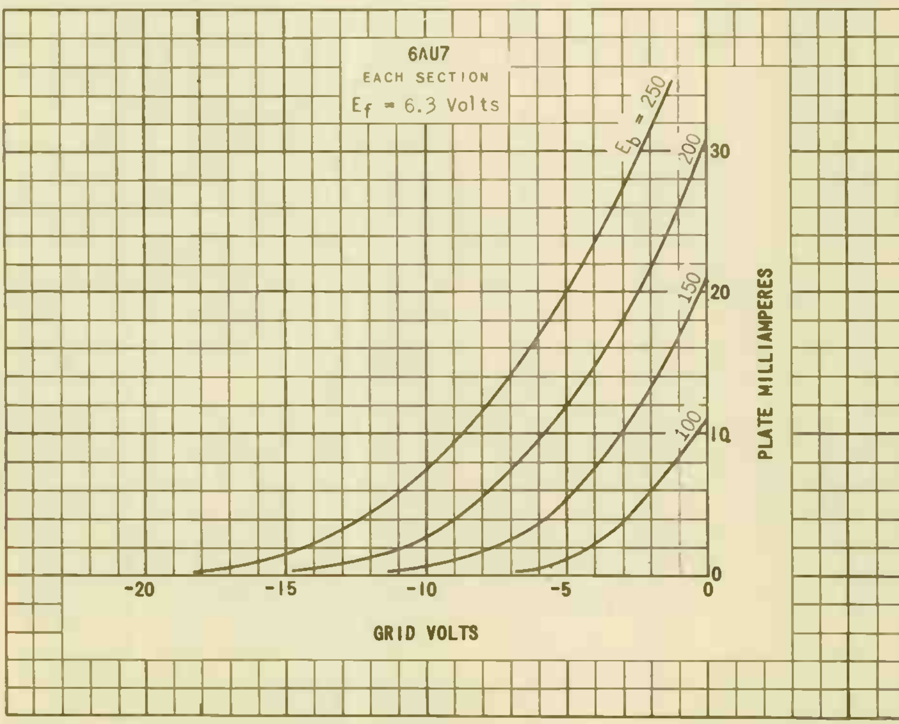
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

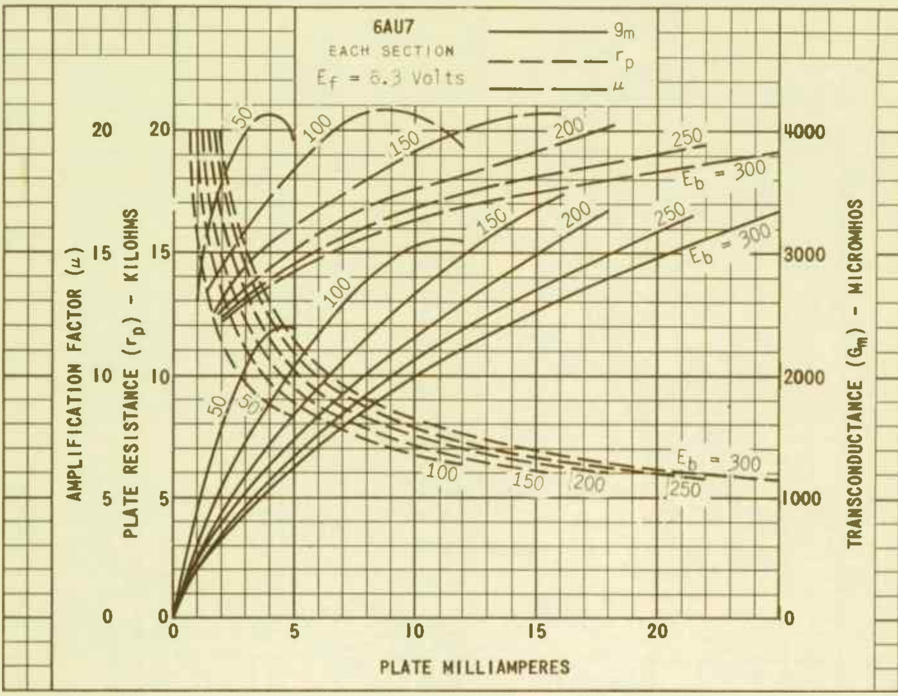
CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

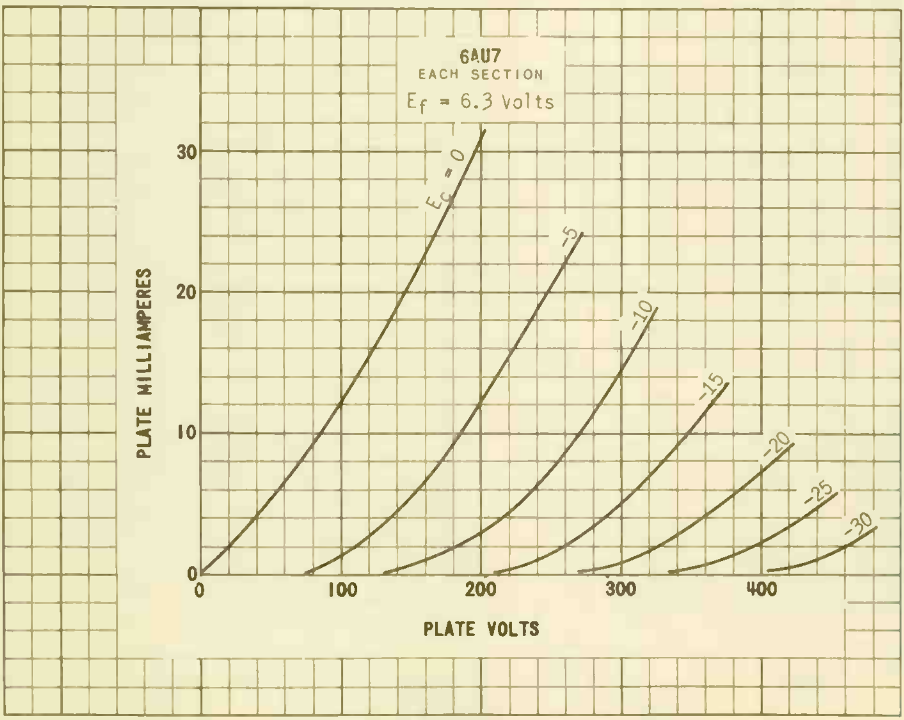
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	0	-8.5	VOLTS
PLATE CURRENT	11.8	10.5	MA.
PLATE RESISTANCE (APPROX.)	6 500	7 700	OHMS
TRANSCONDUCTANCE	3 100	2 200	µMHOS
AMPLIFICATION FACTOR	20	17	
GRID VOLTAGE FOR I_b = 10 µA. (APPROX.)	---	– 24	VOLTS

*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.


6AU7
EACH SECTION
E_f = 6.3 Volts
I_b
I_c
E_c = 30
25
20
15
10
5
0
E_c = 30
20
10
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
150
100
50
0
0
50
100
150
200
PLATE VOLTS


6AU7
EACH SECTION
E_f = 6.3 Volts
E_b = 250
200
150
100
30
20
10
0
PLATE MILLIAMPERES
-20
-15
-10
-5
0
GRID VOLTS


6AU7
EACH SECTION
E_f = 6.3 Volts
g_m
r_p
μ
E_b = 300
250
200
150
100
50
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - KILOHMS
TRANSCONDUCTANCE (G_m) - MICROMHOS
PLATE MILLIAMPERES


6AU7
EACH SECTION
E_f = 6.3 Volts
E_c = 0
-5
-10
-15
-20
-25
-30
PLATE MILLIAMPERES
PLATE VOLTS

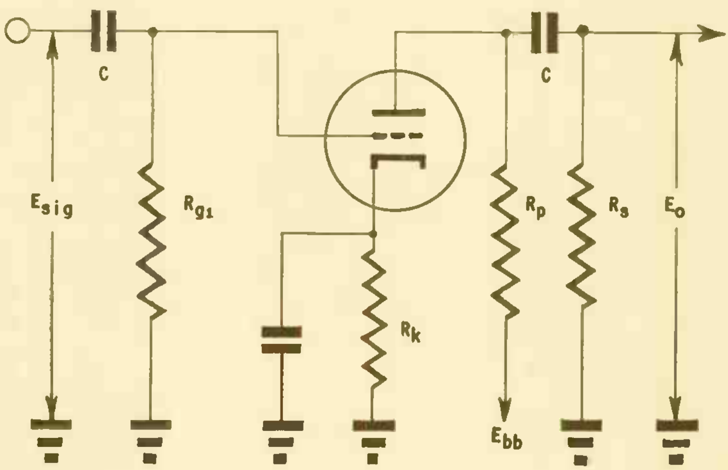
TUNG-SOL

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.

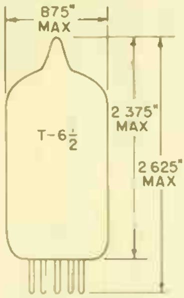


NOTES: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE.
R_k SHOULD BE ADEQUATELY BY-PASSED

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



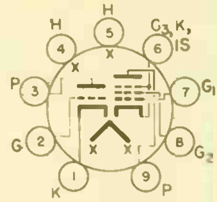
GLASS BULB

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	0.00[illegible]	pf
TRIODE GRID TO PENTODE PLATE	0.002	pf
PENTODE PLATE TO TRIODE PLATE	0.12	pf

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

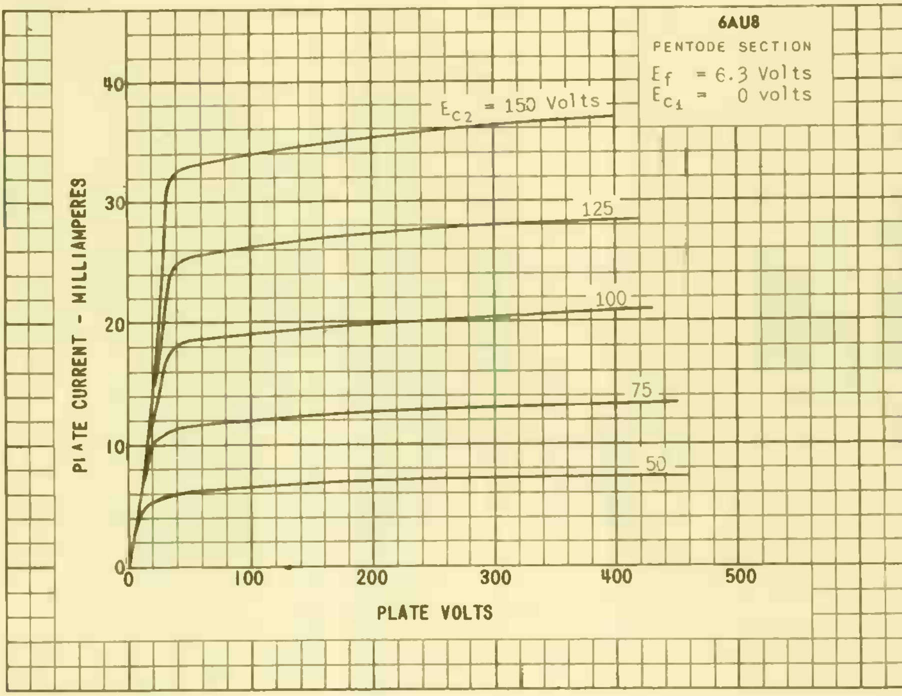
	PENTODE SECTION	TRIODE SECTION	
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	---	VOLTS
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

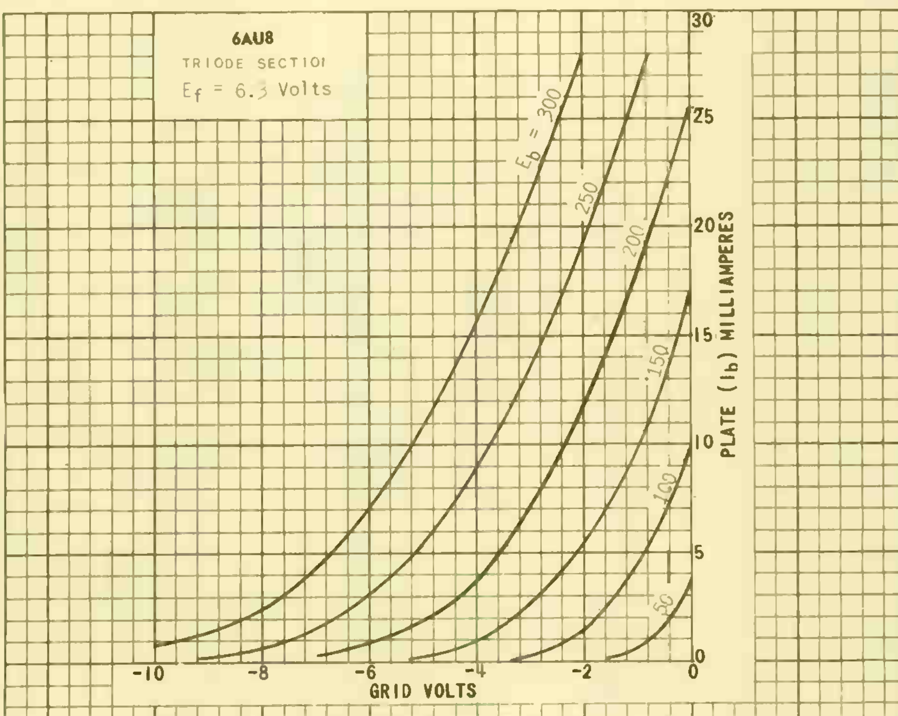
[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

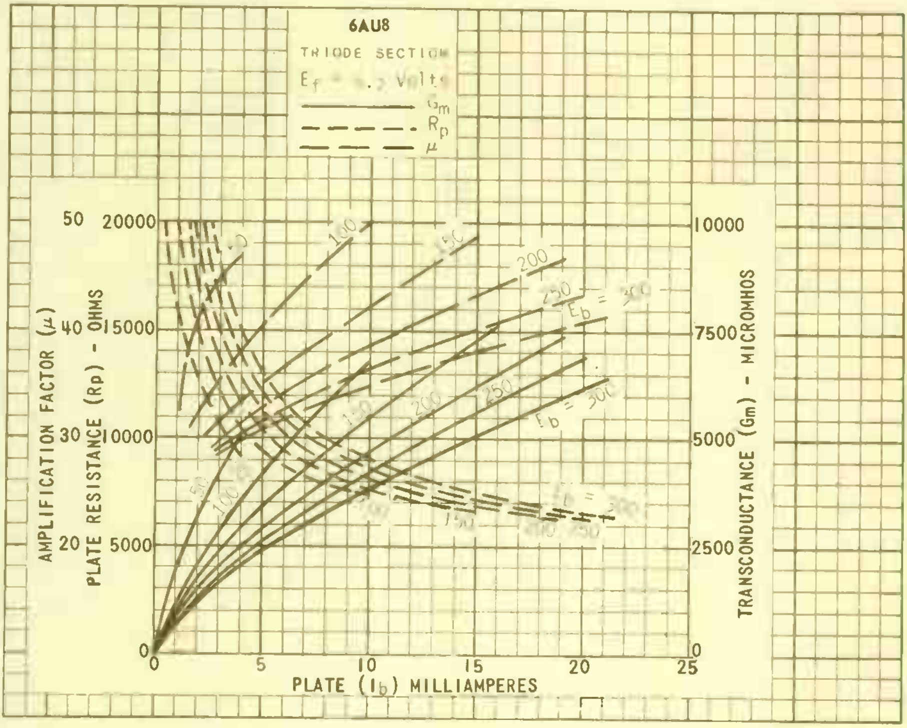
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

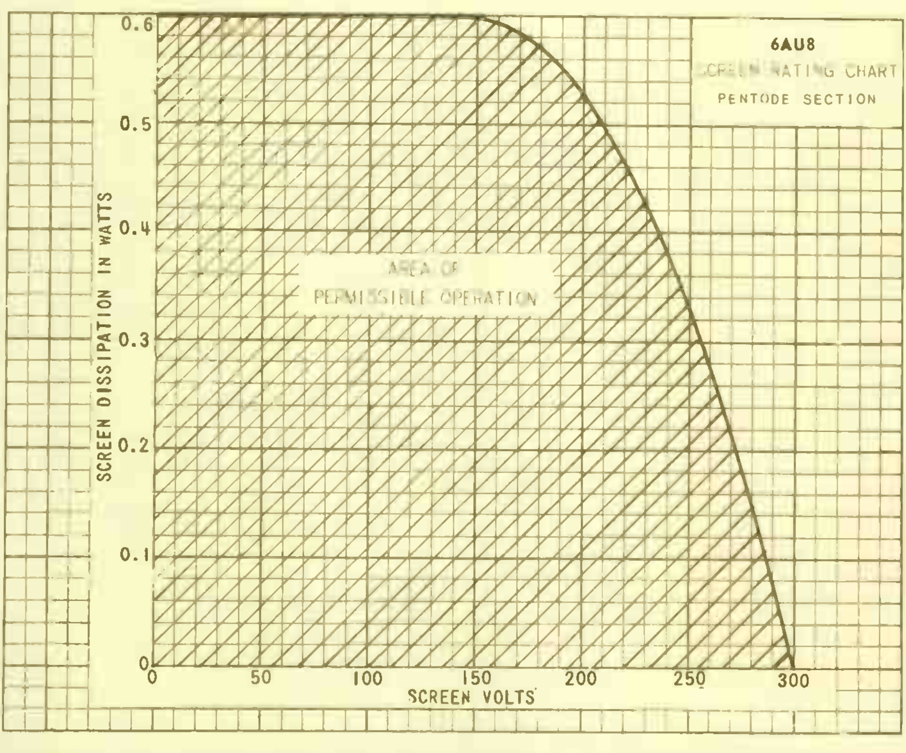
CLASS A_1 AMPLIFIER

	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

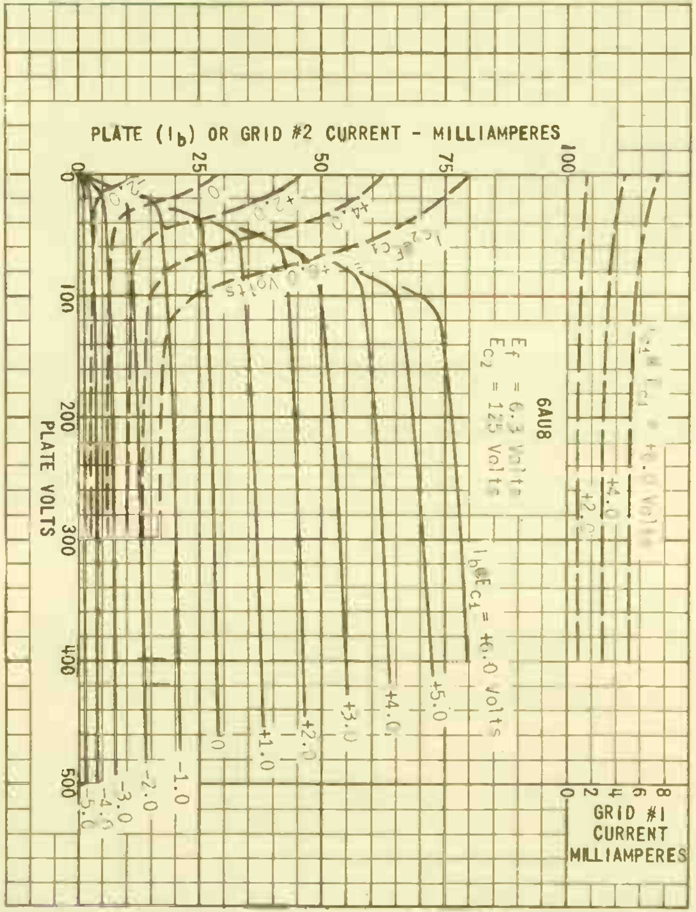

6AU8
PENTODE SECTION
E_f = 6.3 Volts
E_{c1} = 0 volts
E_{c2} = 150 Volts
125
100
75
50
PLATE CURRENT - MILLIAMPERES
0
10
20
30
40
0
100
200
300
400
500
PLATE VOLTS

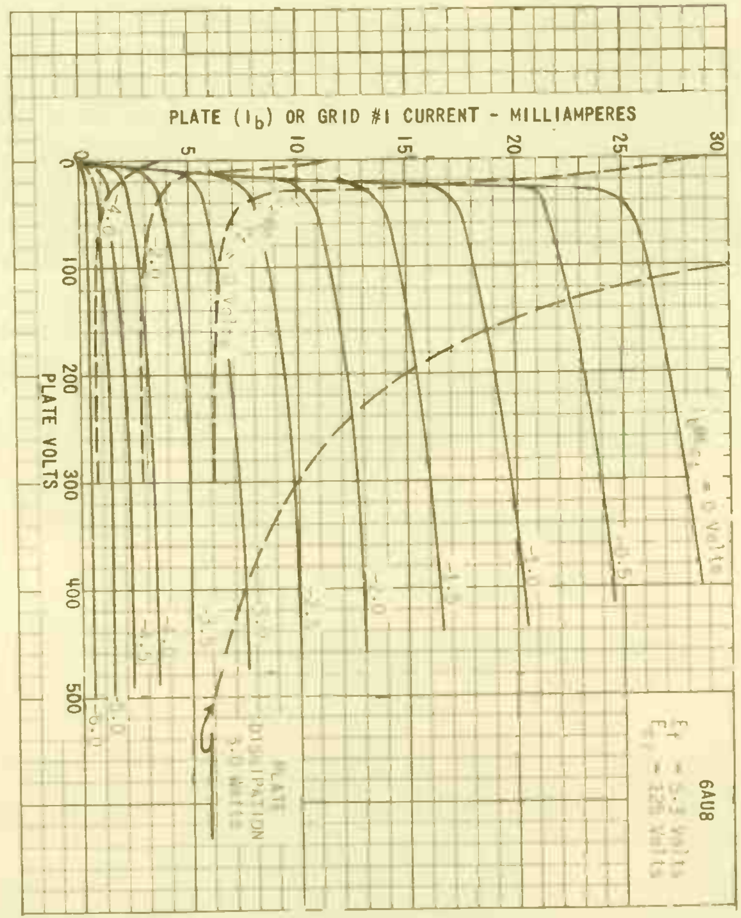

6AU8
TRIODE SECTION
E_f = 6.3 Volts
E_b = 300
250
200
150
100
50
PLATE (I_b) MILLIAMPERES
0
5
10
15
20
25
30
-10
-8
-6
-4
-2
0
GRID VOLTS


6AU8
TRIODE SECTION
G_m
R_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (Rp) - OHMS
TRANSCONDUCTANCE (Gm) - MICROMHOS
PLATE (I_b) MILLIAMPERES
E_b = 300
50
100
150
200
250
50 20000
40 15000
30 10000
20 5000
0
0
5
10
15
20
25
10000
7500
5000
2500
0


6AU8
PENTODE SECTION
AREA OF
PERMISSIBLE OPERATION
SCREEN DISSIPATION IN WATTS
SCREEN VOLTS
0.6
0.5
0.4
0.3
0.2
0.1
0
0
50
100
150
200
250
300

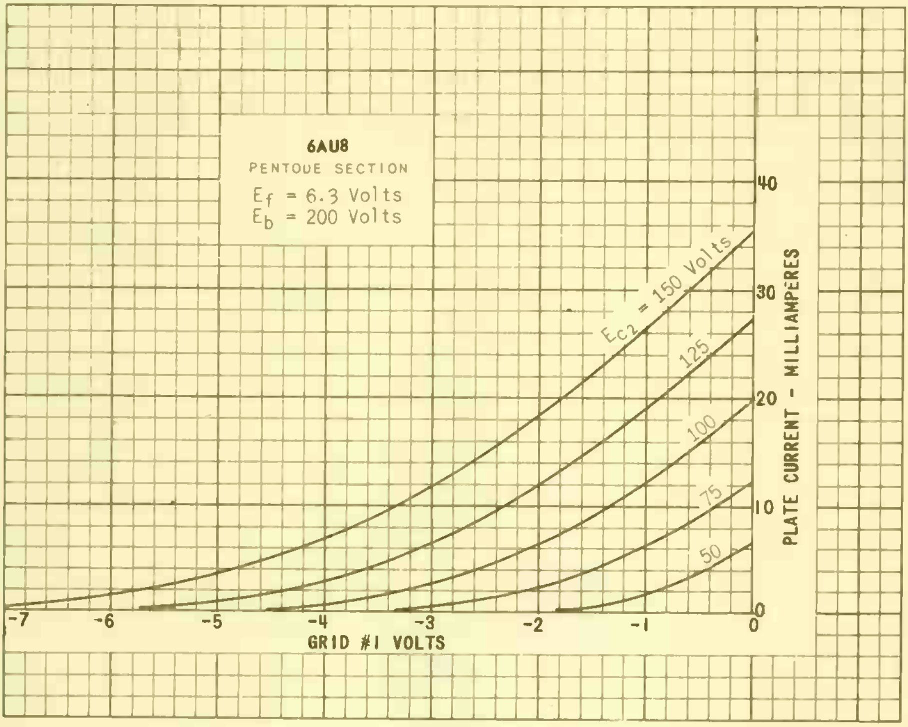
PRINTED IN U.S.A.



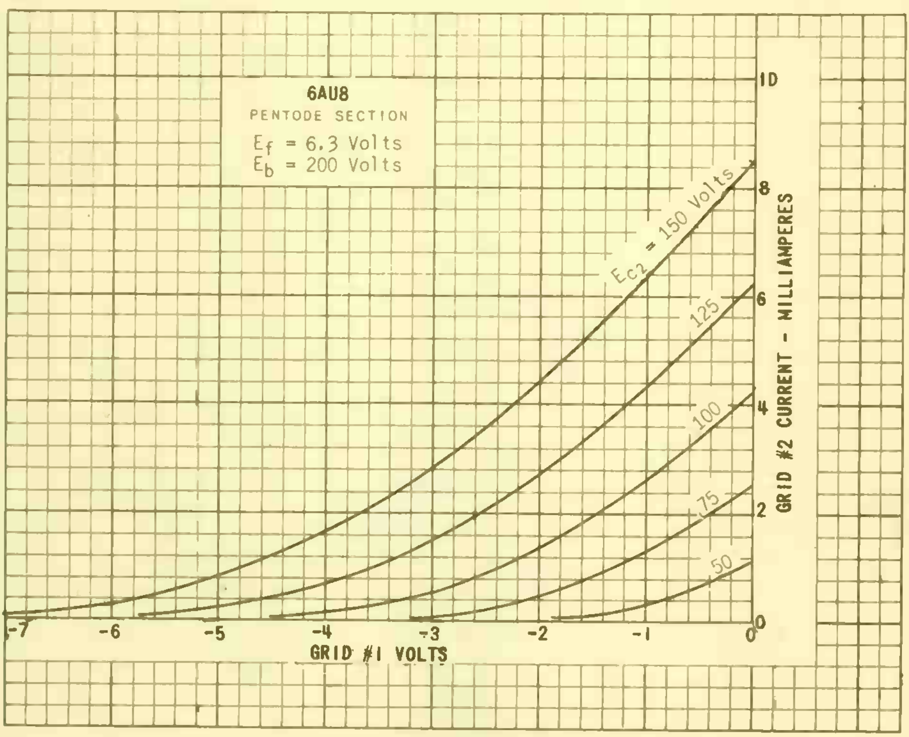


6AU8

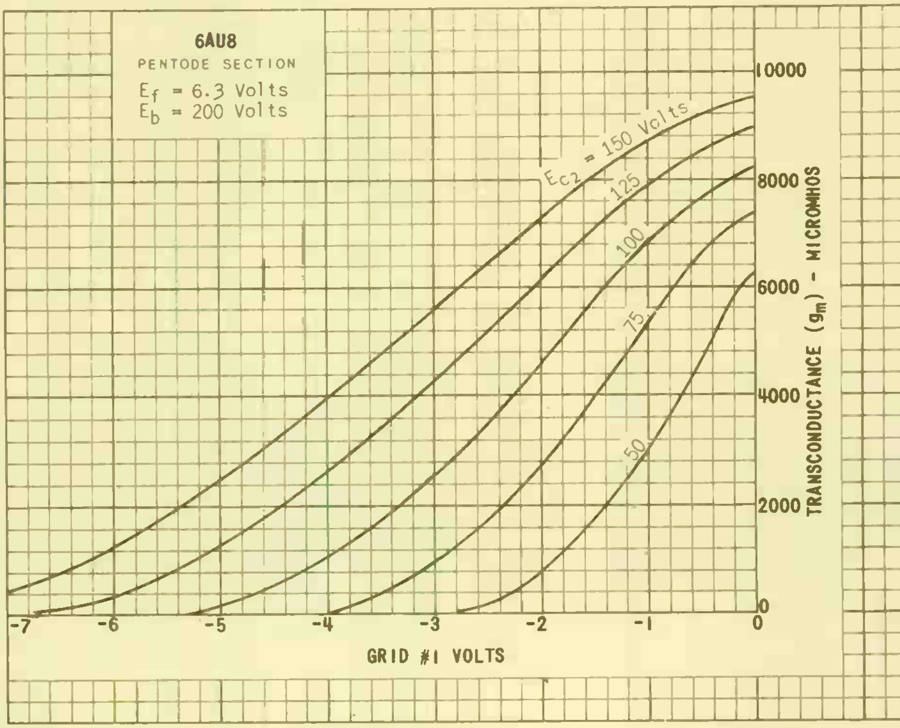
TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. OCTOBER 1, 1962 PLATE #6684

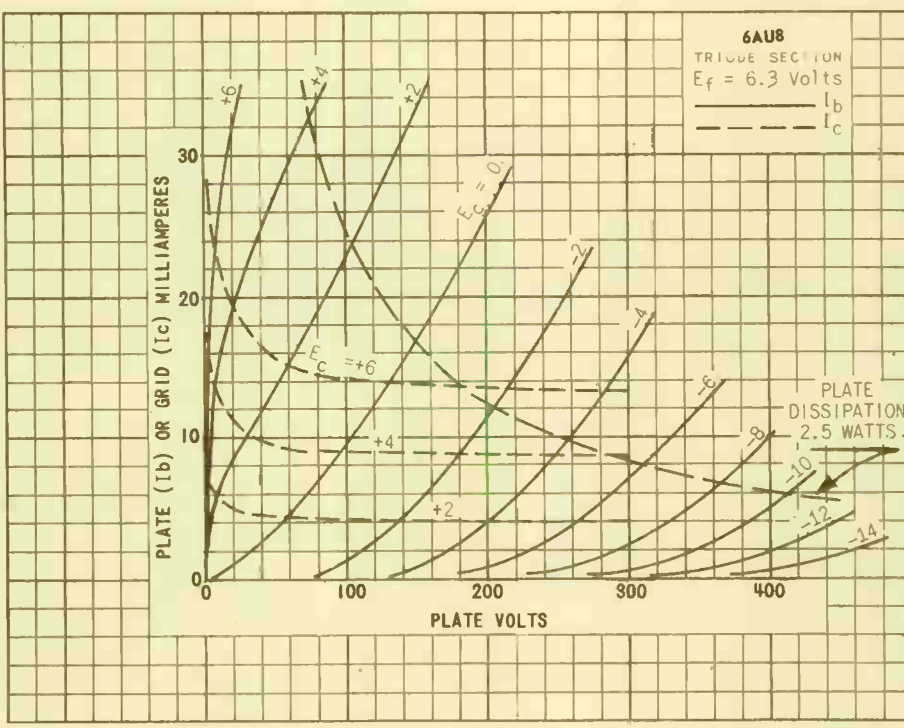


6AU8
PENTOUE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
PLATE CURRENT - MILLIAMPERES
GRID #1 VOLTS



6AU8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
GRID #2 CURRENT - MILLIAMPERES
GRID #1 VOLTS

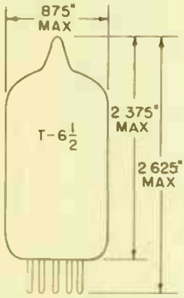

6AU8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c_2} = 150 Volts
125
100
75
50
TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
8000
6000
4000
2000
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


6AU8
TRIODE SECTION
E_f = 6.3 Volts
I_b
I_c
+6
+4
+2
E_c = 0
-2
-4
-6
-8
-10
-12
-14
E_c =+6
+4
+2
PLATE DISSIPATION 2.5 WATTS
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
30
20
10
0
0
100
200
300
400
PLATE VOLTS

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

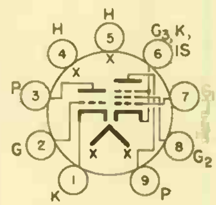


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
JEDEC 6-3

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

TUNG-SOL

→ 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.

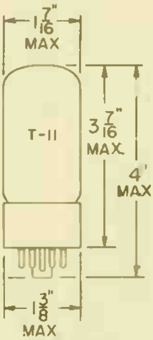
THE 6AU8 CURVES, ALSO, APPLY FOR THE 6AU8A.

→ 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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

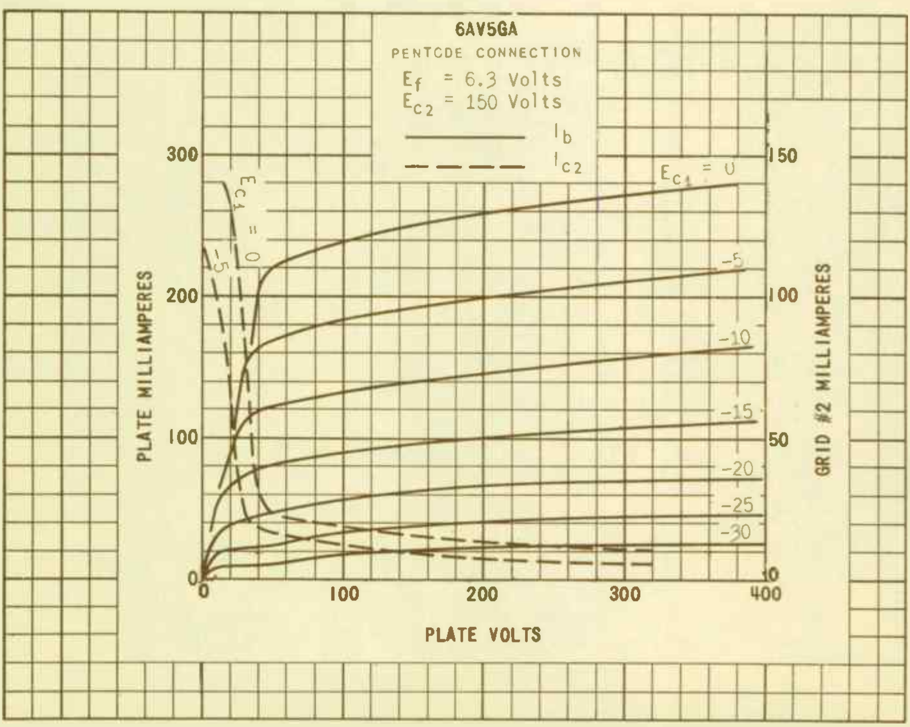
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	1.2		AMP.
PLATE VOLTAGE	60	250	VOLTS
GRID #2 VOLTAGE	150	150	VOLTS
GRID #1 VOLTAGE	0^E	-22.5	VOLTS
PLATE RESISTANCE (APPROX.)	---	14 500 ←	OHMS
TRANSCONDUCTANCE	---	5 900 ←	µMHOS
PLATE CURRENT	260 ←	57 ←	MA.
GRID #2 CURRENT	26 ←	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 1.0 MA.	---	-43 ←	VOLTS
TRIODE AMPLIFICATION FACTOR^F	---	4.5	

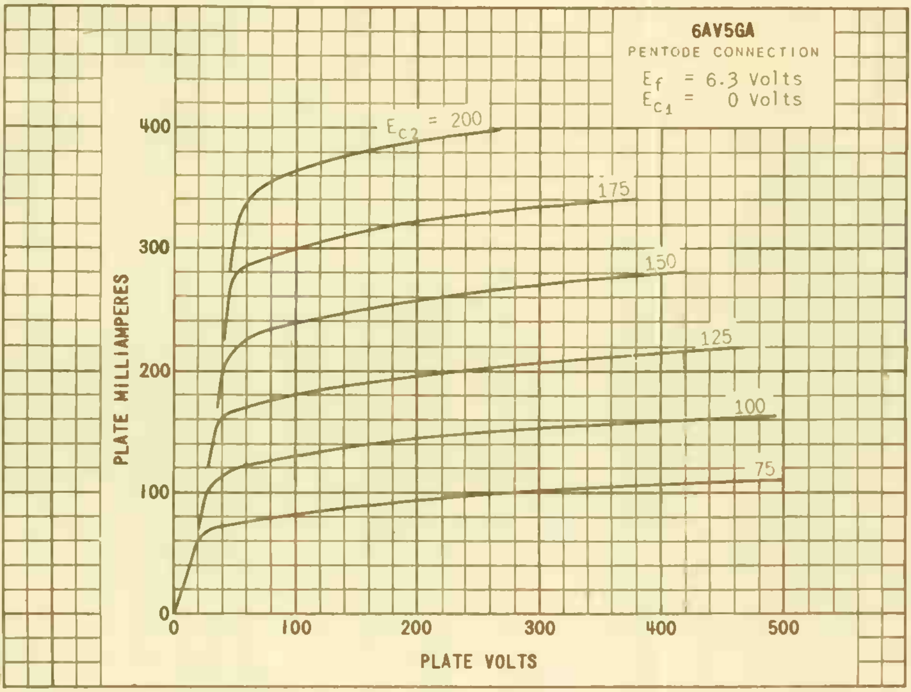
^{E}APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

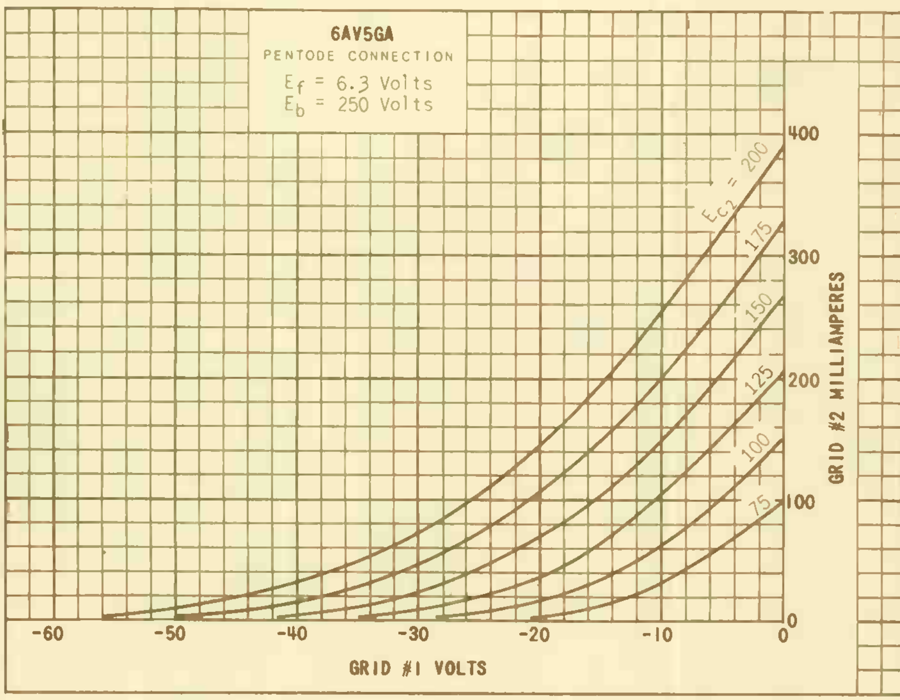
^{F}TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH $E_b = E_{c2} = 150$ VOLTS AND $E_{c1} = -22.5$ VOLTS

SIMILAR TYPE REFERENCE: Except for heater characteristics, the 6AV5GA is identical to the 12AV5GA, 17AV5GA & the 25AV5GA.

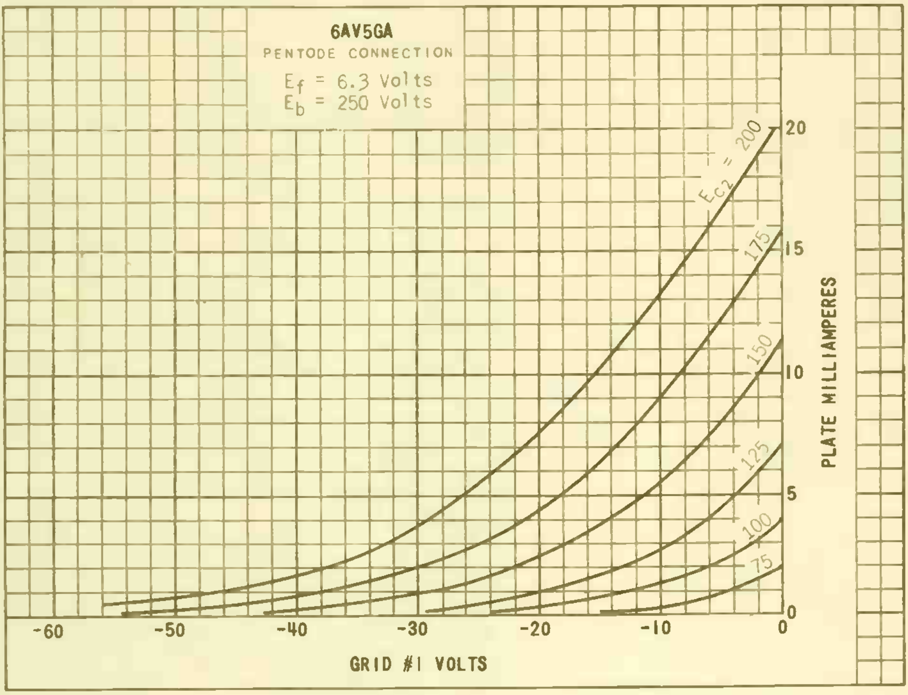
→ INDICATES A CHANGE.




6AV5GA
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c_1} = 0 Volts
E_{c_2} = 200
175
150
125
100
75
PLATE MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500


6AV5GA
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c_2} = 200
175
150
125
100
75
GRID #2 MILLIAMPERES
GRID #1 VOLTS
-60
-50
-40
-30
-20
-10
0
100
200
300
400

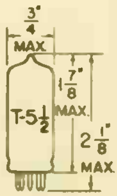
6AV5GA (25AV5GA)



TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

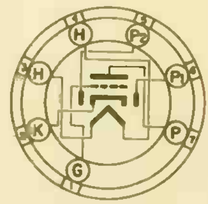
COATED UNIPOTENTIAL CATHODE

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.

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

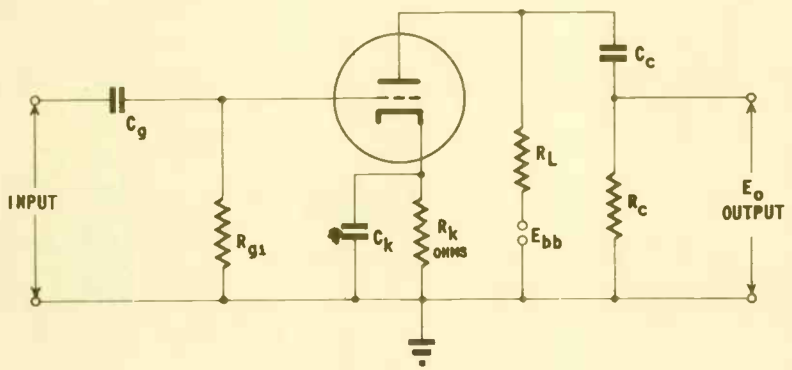
PLATE VOLTAGE	100	250	VOLTS
GRID #1 VOLTAGE	-1	-2	VOLTS
PLATE RESISTANCE	80 000	62 500	OHMS
AMPLIFICATION FACTOR	100	100	
TRANSCONDUCTANCE	1 250	1 600	μMHOS
PLATE CURRENT	0.5	1.2	MA.
AVERAGE DIODE CURRENT AT 10 VOLTS DC (EACH UNIT)	2.0	2.0	MA.

RESISTANCE COUPLED AMPLIFIER

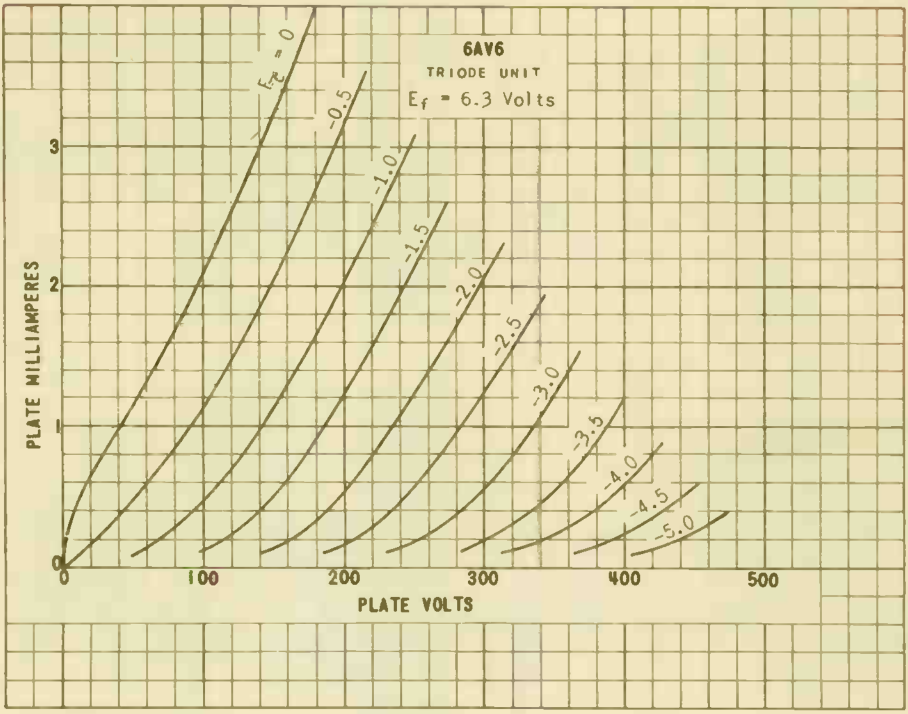
TRIODE UNIT

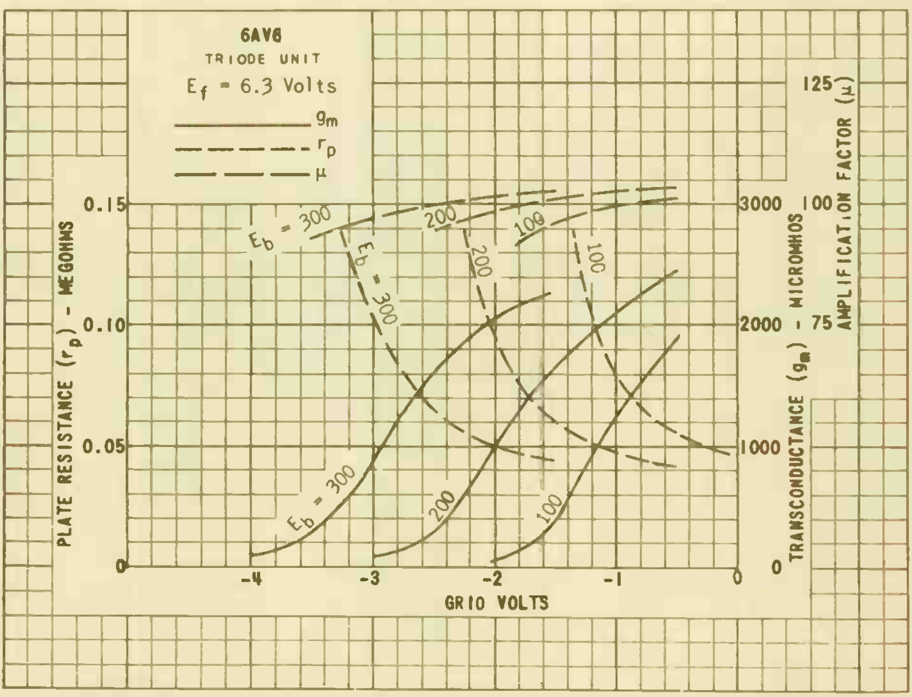
PLATE SUPPLY VOLTAGE	90	250	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	220 000	470 000	OHMS
CONTROL GRID RESISTOR	10.0	10.0	MEGOHMS
INPUT CONDENSER	0.01	0.01	μf
OUTPUT CONDENSER	0.01	0.01	μf
GRID RESISTOR OF FOLLOWING STAGE	470 000	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	1 000	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.





PRINTED IN U. S. A.

PLATE 1961
FEB. 2, 1948

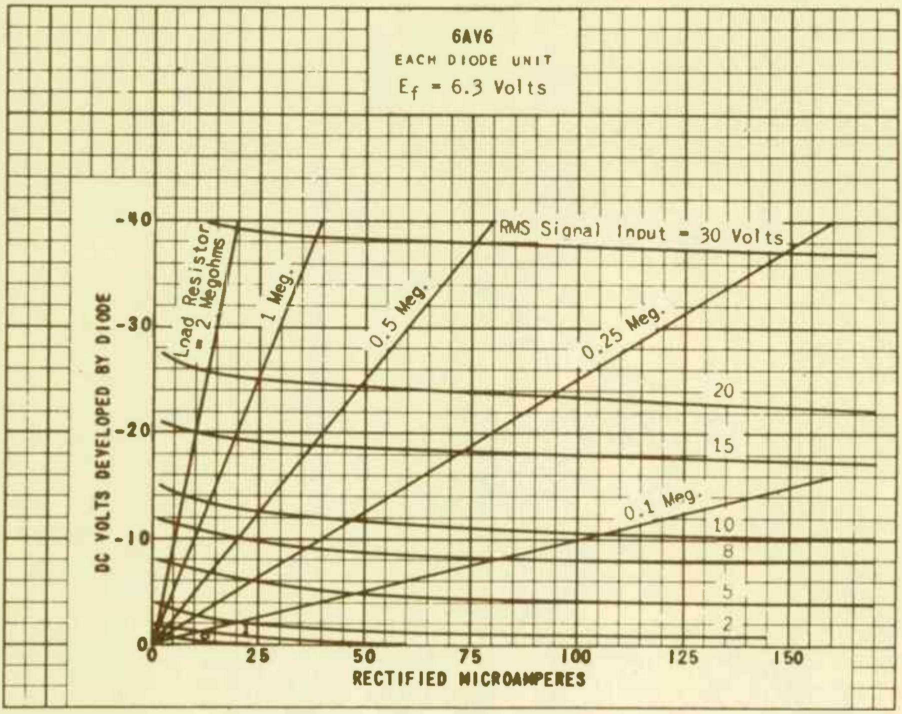
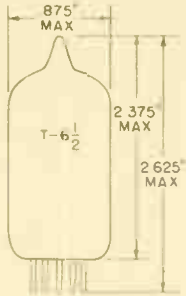


PLATE 1962
FEB. 2, 1948

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



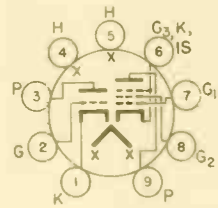
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

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	04	05	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 5	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 3	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP) MAX	005	[illegible]	pf
PENTODE PLATE TO TRIODE PLATE: (PP TO TP) MAX	025	[illegible]	pf

A EXTERNAL SHIELD 315 CONNECTED TO PIN 4 AND PIN 5.

CONTINUED ON FOLLOWING PAGE

→ [illegible]

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

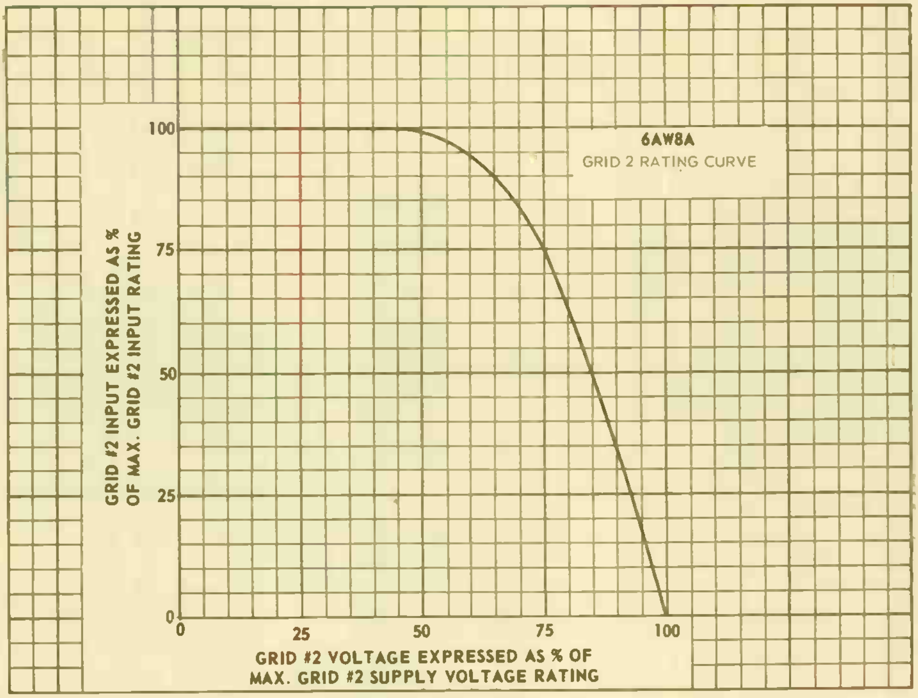
CLASS A1 AMPLIFIER

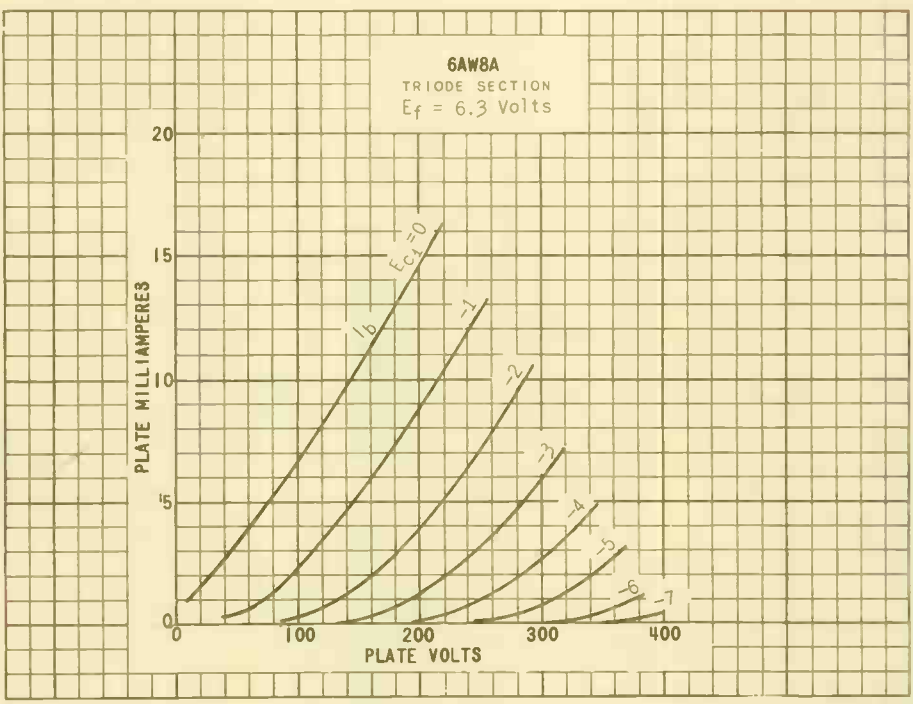
	TRIODE	PENTODE		
PLATE SUPPLY VOLTAGE	200	65	150	VOLTS
GRID 2 SUPPLY VOLTAGE		150	150	VOLTS
GRID 1 VOLTAGE	-2	0		VOLTS
CATHODE BIAS RESISTOR	----	----	150	OHMS
AMPLIFICATION FACTOR	70	----	----	
PLATE RESISTANCE (APPROX.)		----	200	KOHMS
TRANSCONDUCTANCE	4000	----	9500	μMHOS
PLATE CURRENT	4.0	46	15.0	MA.
GRID 2 CURRENT		15	3.5	MA.
GRID 1 VOLTAGE (APPROX.)				
FOR Ib = 20 μA	-5		-8	VOLTS

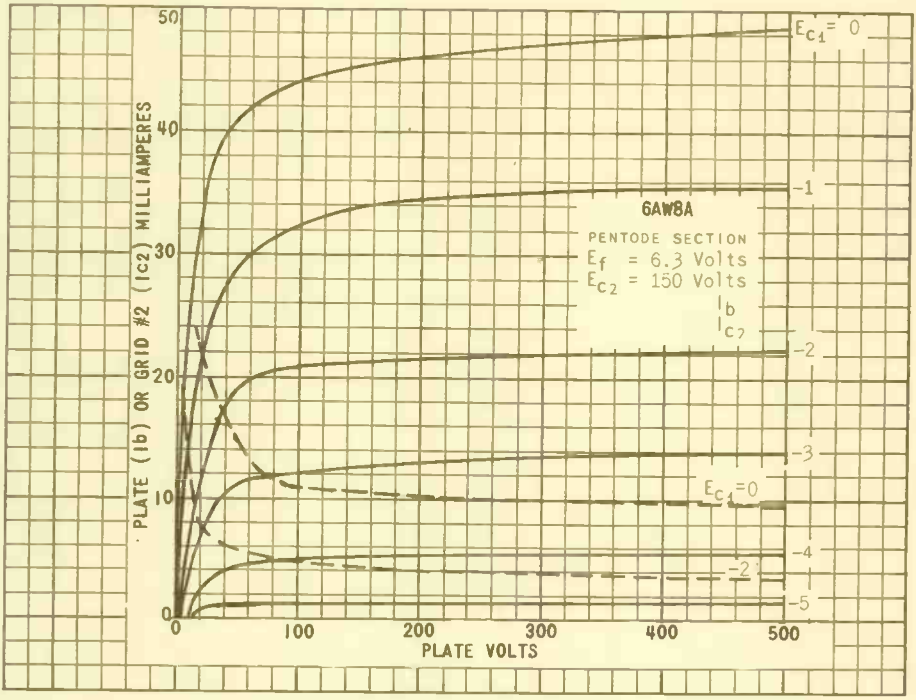
[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SEREIS WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[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 RESTRICTEC TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED TOLERANCE.

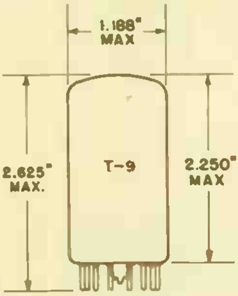

6AW8A
GRID 2 RATING CURVE
GRID #2 INPUT EXPRESSED AS % OF MAX. GRID #2 INPUT RATING
100
75
50
25
0
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE RATING


6AW8A
TRIODE SECTION
Ef = 6.3 Volts
PLATE MILLIAMPERES
20
15
10
5
0
Ec1=0
Ib
-1
-2
-3
-4
-5
-6
-7
0
100
200
300
400
PLATE VOLTS


6AW8A
PENTODE SECTION
Ef = 6.3 Volts
Ec2 = 150 Volts
Ib
Ic2
Ec1 = 0
-1
-2
-3
-4
-5
Ec1=0
-2
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
50
40
30
20
10
0
0
100
200
300
400
500
PLATE VOLTS

TUNG-SOL

DIODE



GLASS BULB
BUTTON
12 PIN BASE E12-70

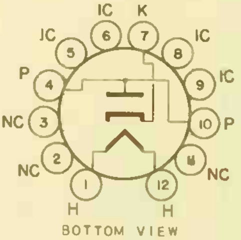
OUTLINE DRAWING
JEDEC 9-59

COATED UNIPOTENTIAL CATHODE

FOR
DAMPING DIODE APPLICATIONS
IN TV RECEIVERS

AC OR DC

ANY MOUNTING POSITION



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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS[B]

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

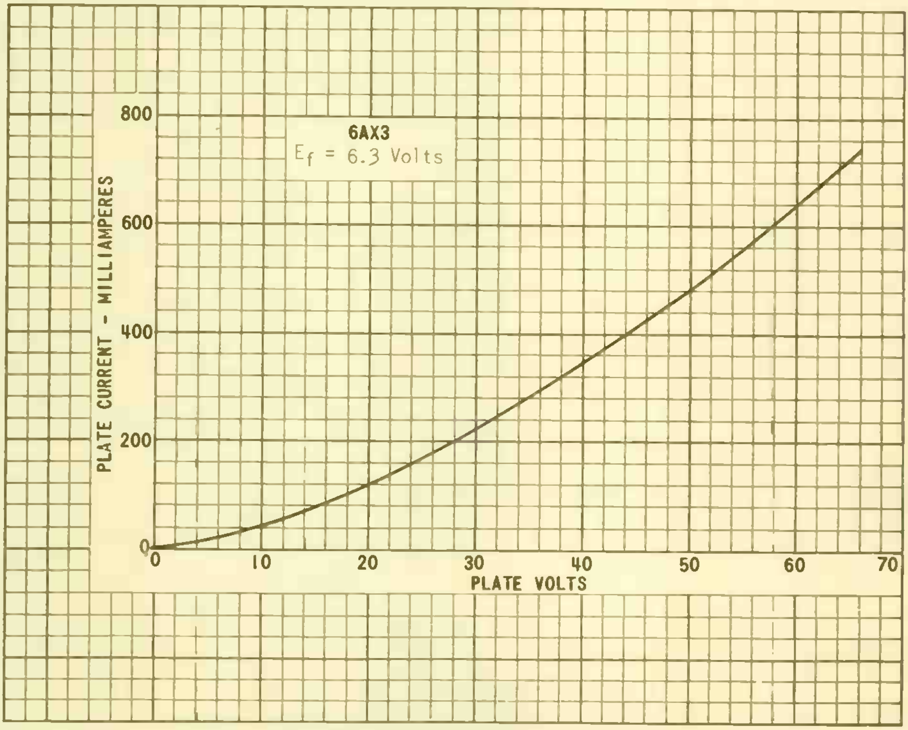
TV DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	5.3	WATTS
STEADY-STATE PEAK PLATE CURRENT	1000	MA.
DC OUTPUT	165	MA.

AVERAGE CHARACTERISTICS

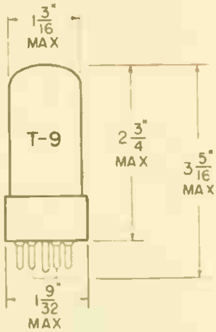
TUBE VOLTAGE DROP		
I_b = 250 MILLIAMPERES DC	32	VOLTS

[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

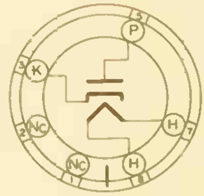


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE
SHELL 6 PIN OCTAL
4CG

PINS #1, 2, 4, & 6 SHALL NOT BE USED AS TIE POINTS. *

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.

HEATER TO CATHODE: H TO K	4.0	μμf	
PLATE TO CATHODE AND HEATER: P TO (K+H)	5.0	μμf	*
CATHODE TO PLATE AND HEATER: K TO (P+H)	8.5	μμf	*

RATINGS[A]

INTERPRETED ACCORDING TO RMA STANDARD M8-210

DAMPER DIODE[B]

HEATER VOLTAGE	6.3	VOLTS	
HEATER CURRENT	1.2	AMP.	
MAXIMUM PEAK INVERSE PLATE VOLTAGE (ABSOLUTE MAX.)	4 400	VOLTS	*
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE (ABSOLUTE MAX.)			
DC	900	VOLTS	
TOTAL DC AND PEAK	4 400	VOLTS	*
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	VOLTS	
TOTAL DC AND PEAK	300	VOLTS	*
MAXIMUM DC PLATE CURRENT	125	MA.	
MAXIMUM PEAK PLATE CURRENT	750	MA.	
MAXIMUM PLATE DISSIPATION	4.8	WATTS	
TUBE VOLTAGE DROP (WITH TUBE CONDUCTING 250 MA.)	32	VOLTS	

[A] DESIGN CENTER VALUES EXCEPT WHERE ABSOLUTE MAXIMUM IS STATED.

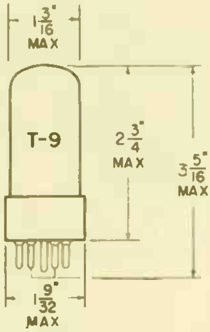
[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE HORIZONTAL VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE. POWER RECTIFIER OPERATION IS NOT RECOMMENDED.

*INDICATES AN ADDITION.

PRINTED IN U. S. A.

TUNG-SOL

DIODE



GLASS BULB

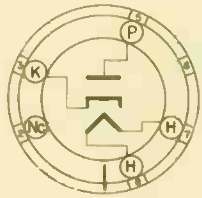
COATED UNIPOTENTIAL CATHODE

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

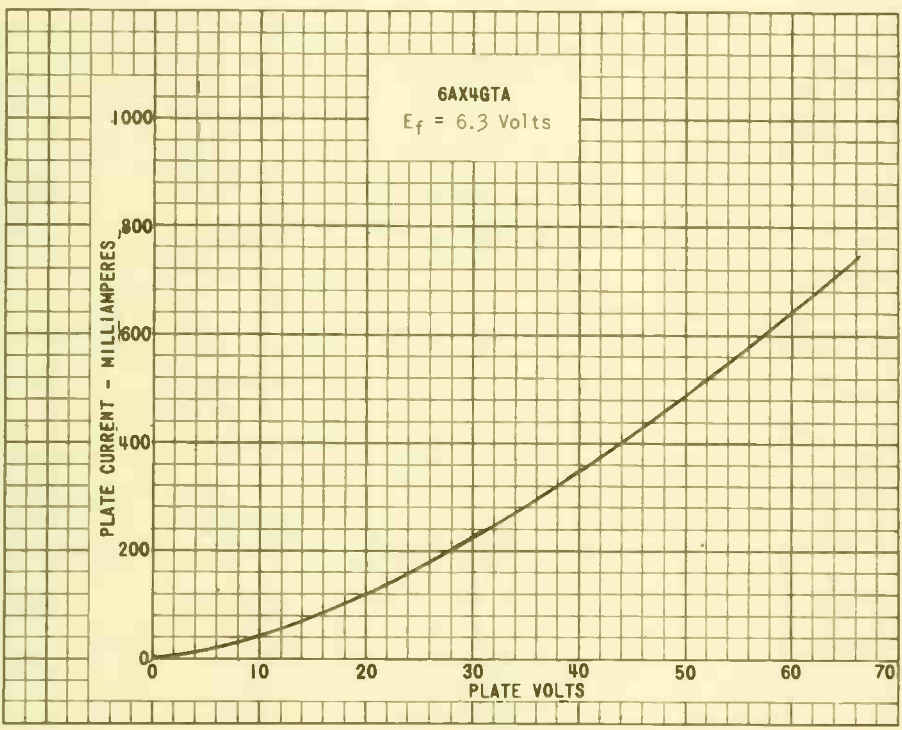
HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	1.2	AMP.
TUBE VOLTAGE DROP I_b=250 MA. DC	32	VOLTS

NOTE:

OPERATION OF THIS TUBE AS A POWER RECTIFIER IS NOT RECOMMENDED.

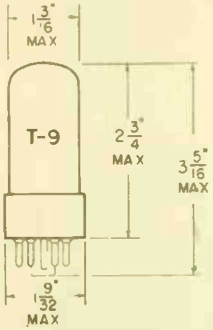
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

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



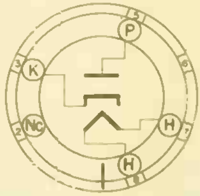
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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:

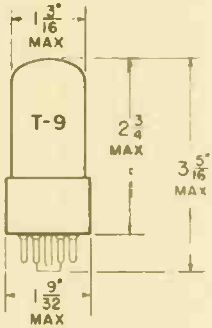
OPERATION OF THIS TUBE AS A POWER RECTIFIER IS NOT RECOMMENDED.

[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

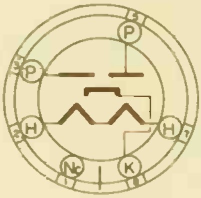
COATED UNIPOTENTIAL CATHODE

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]	2.5	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.

PLATE 2221

SEPT. 1 1951

→ INDICATES A CHANGE OR ADDITION.

CONTINUED ON FOLLOWING PAGE

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

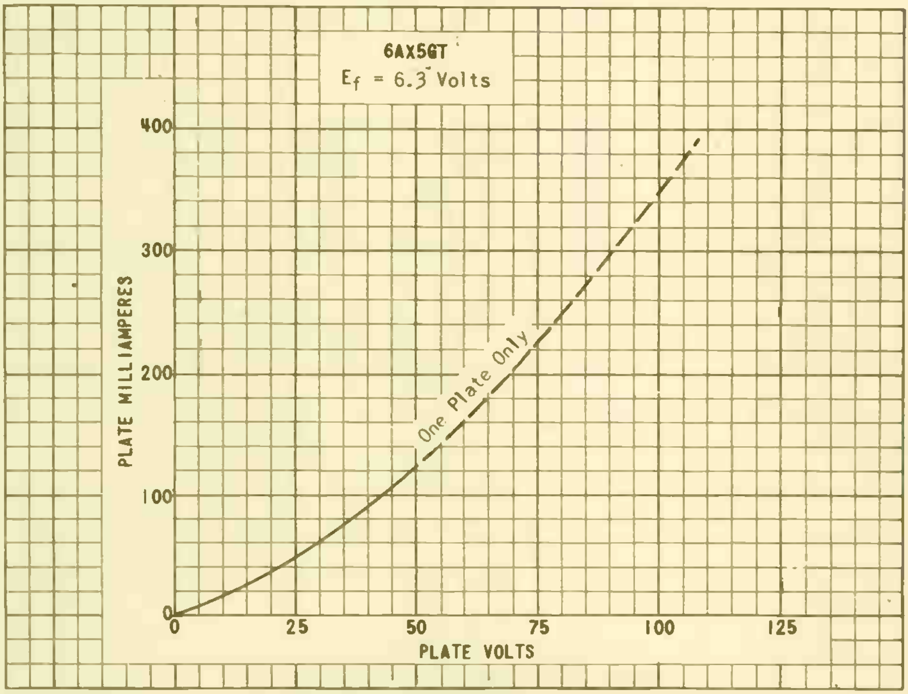


PLATE 2722
SEPT. 1 1951

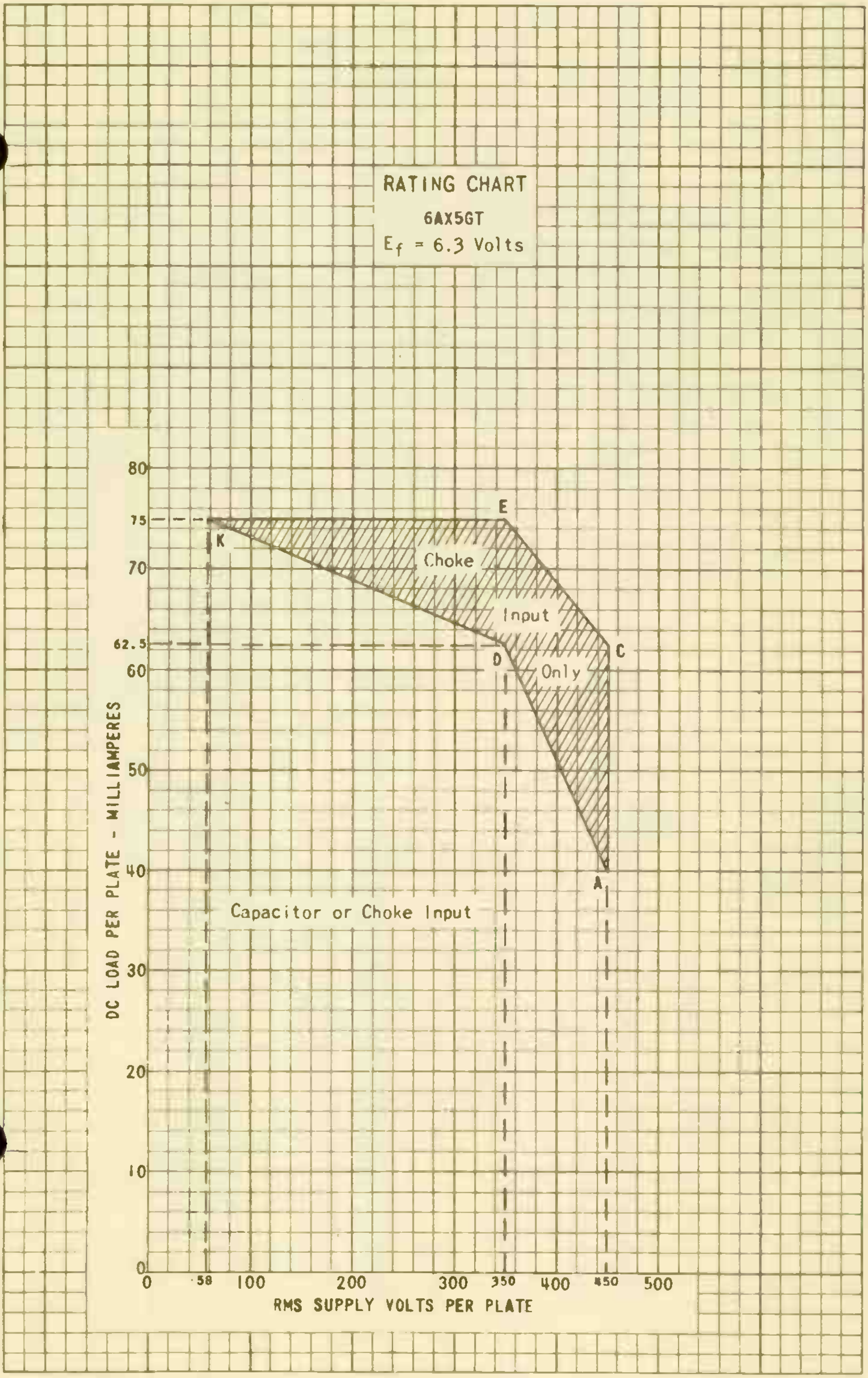


PLATE
2379
APR. 1
1950

6AX5GT

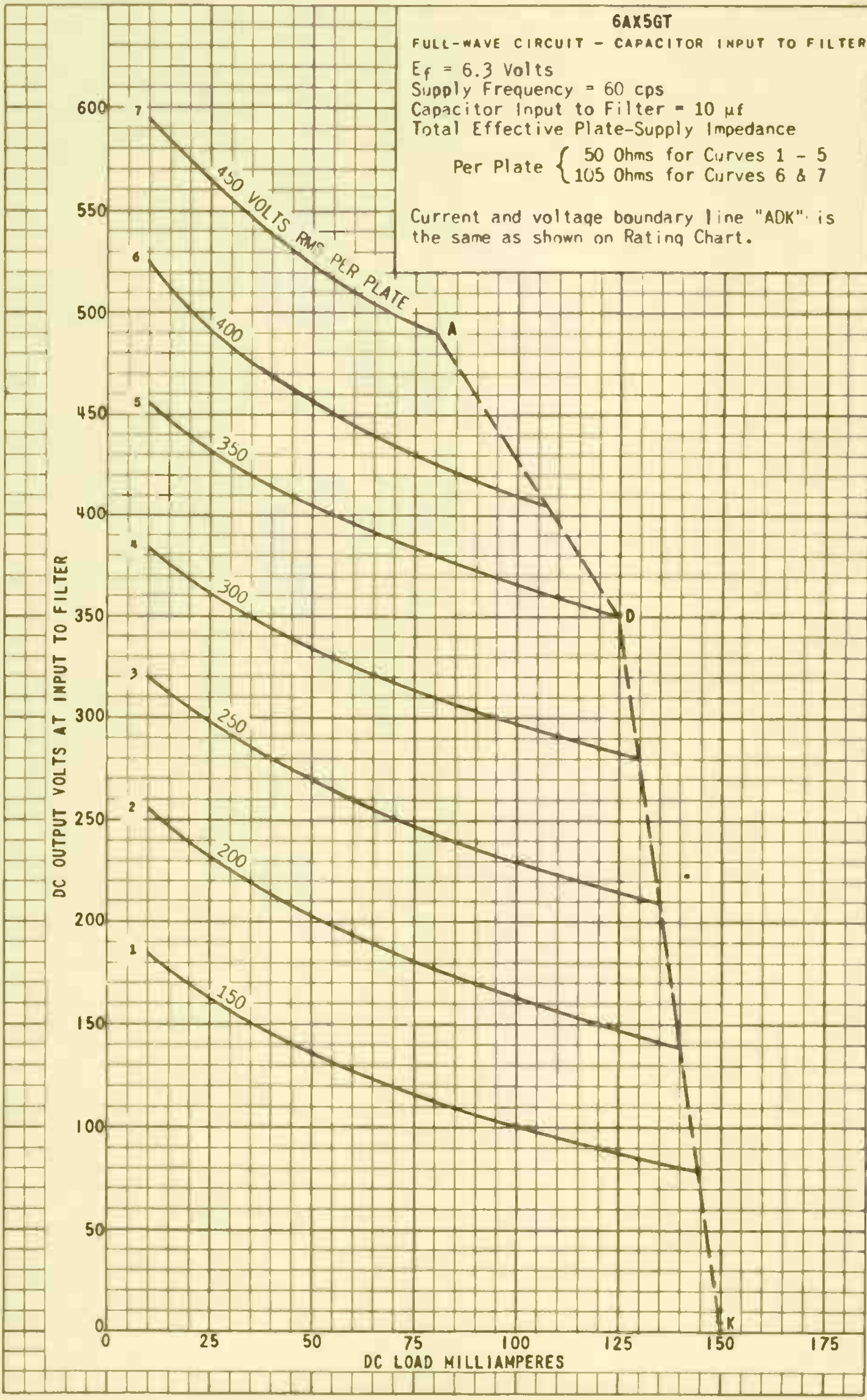


PLATE 2380
APR. 1 1950

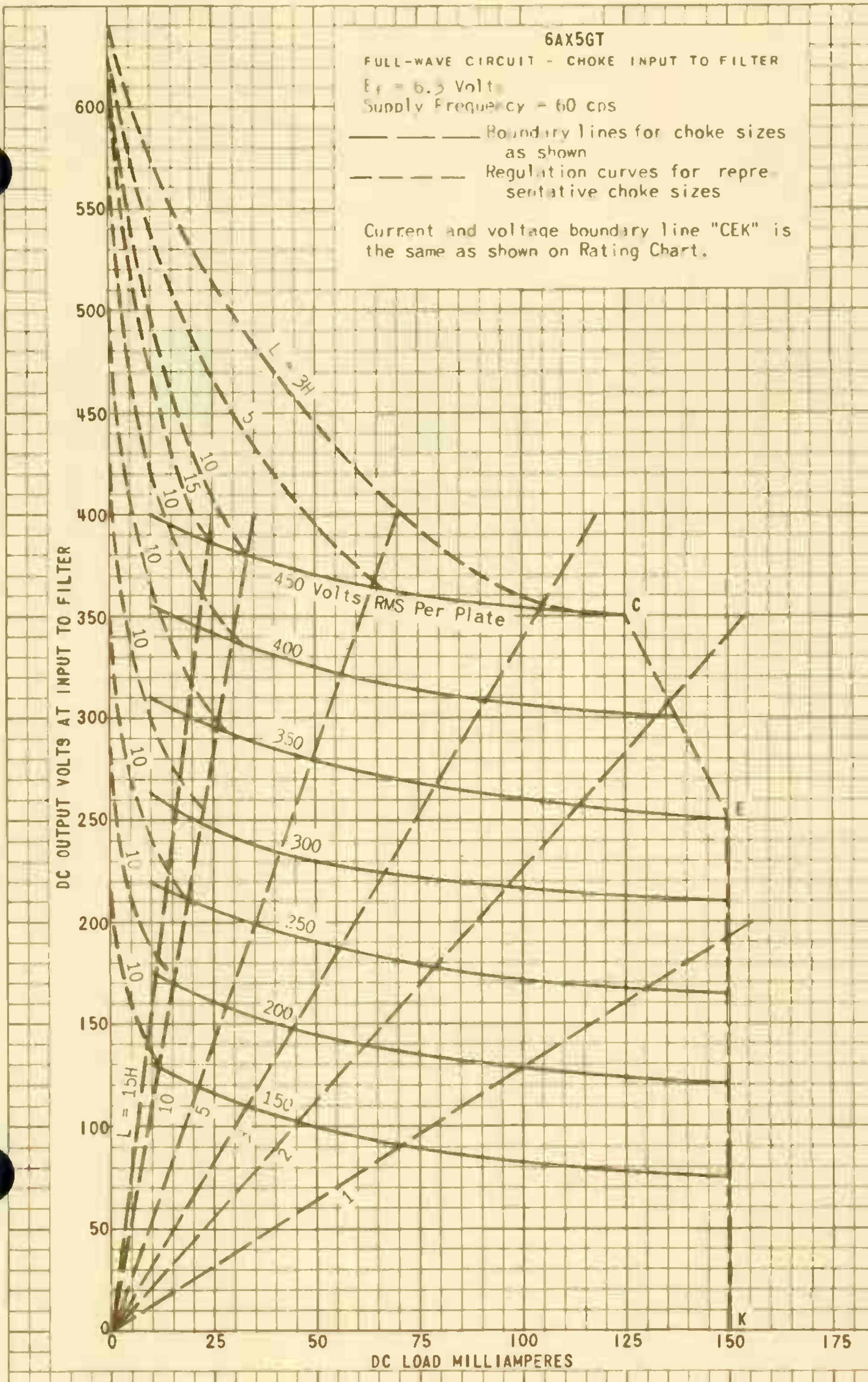


PLATE 2381
APR. 1 1950

PRINTED IN U S A

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER

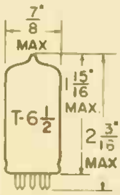
SERIES	PARALLEL
6.3 VOLTS	3.15 VOLTS
0.3 AMP.	0.6 AMP.

AC OR DC

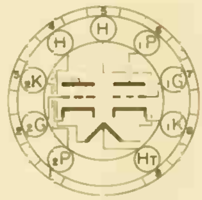
ANY MOUNTING POSITION

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.



GLASS BULB



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

HEATER VOLTAGE	3.15	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	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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

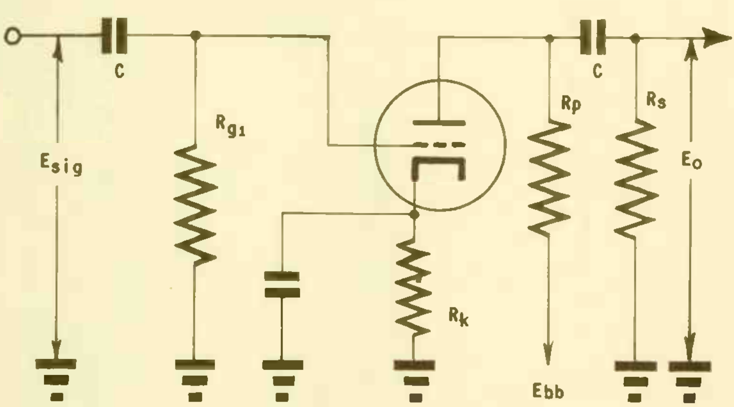
CLASS A_1 AMPLIFIER – EACH SECTION

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.

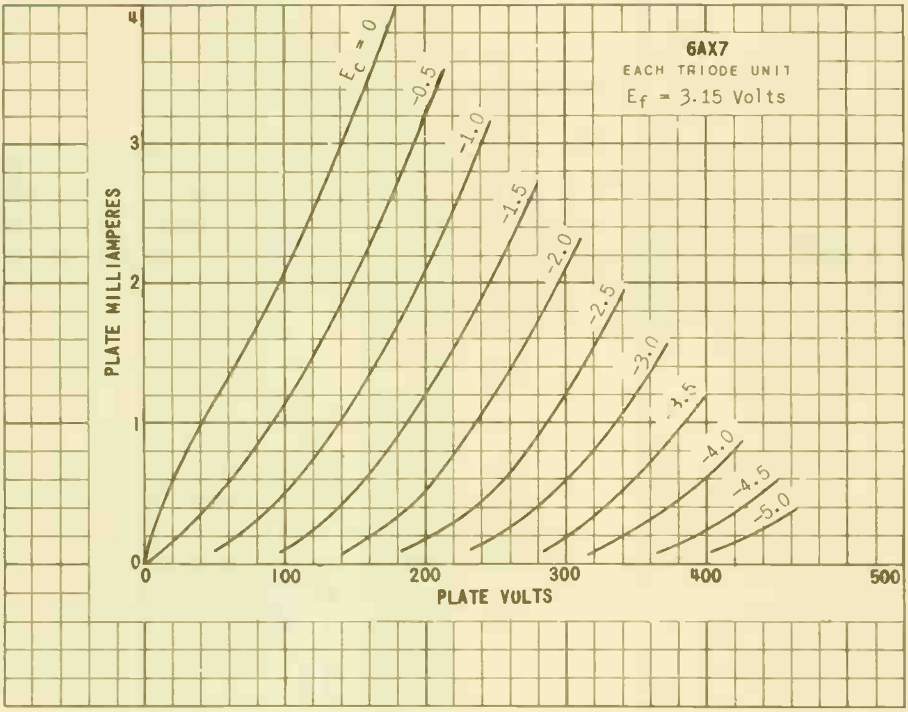
RESISTANCE COUPLED AMPLIFIER

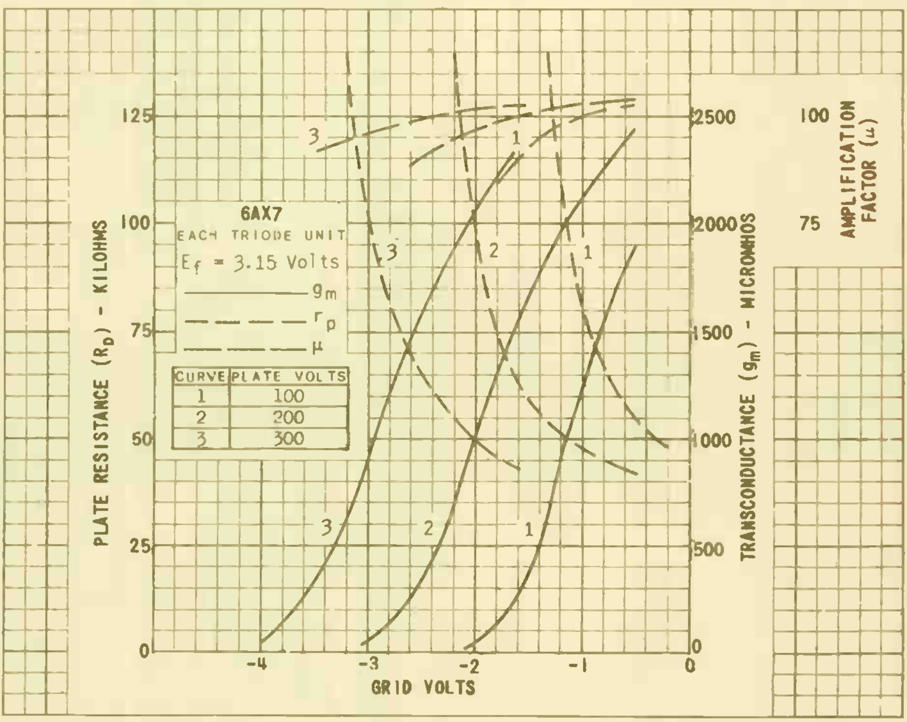
R_p MEG.	R_s MEG.	R_{g1} MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	0.10	0.1	1700	31	5.0	1000	40	15	760	43	30
0.10	0.24	0.1	2000	38	6.9	1100	46	20	900	50	40
0.24	0.24	0.1	3500	43	6.5	2000	54	18	1600	58	37
0.24	0.51	0.1	3900	49	8.6	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

Eo 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.

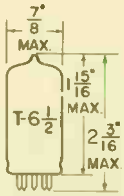

6AX7
EACH TRIODE UNIT
Ef = 3.15 Volts
Ec = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
PLATE MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
100
200
300
400
500


6AX7
EACH TRIODE UNIT
Ef = 3.15 Volts
gm
rp
μ
CURVE PLATE VOLTS
1 100
2 200
3 300
PLATE RESISTANCE (Rp) - KILOHMS
TRANSCONDUCTANCE (gm) - MICROMHOS
AMPLIFICATION FACTOR (μ)
GRID VOLTS
0
25
50
75
100
125
500
1000
1500
2000
2500
75
100
-4
-3
-2
-1
0

PLA 554

TUNG-SOL

TRIODE PENTODE

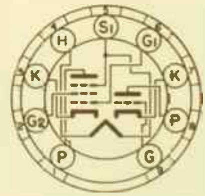


GLASS BULB

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	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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

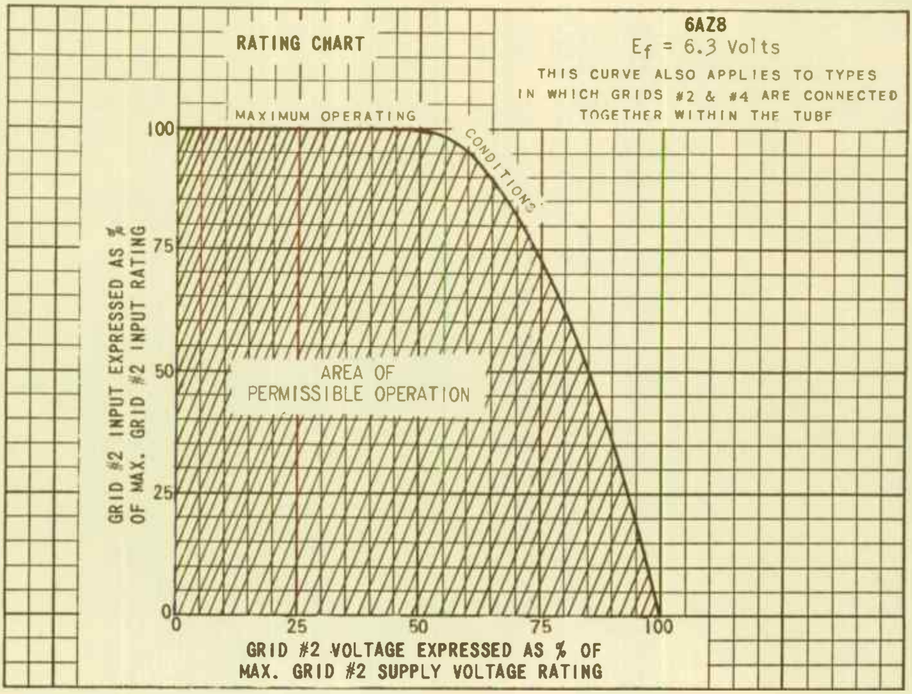
CLASS A_1 AMPLIFIER

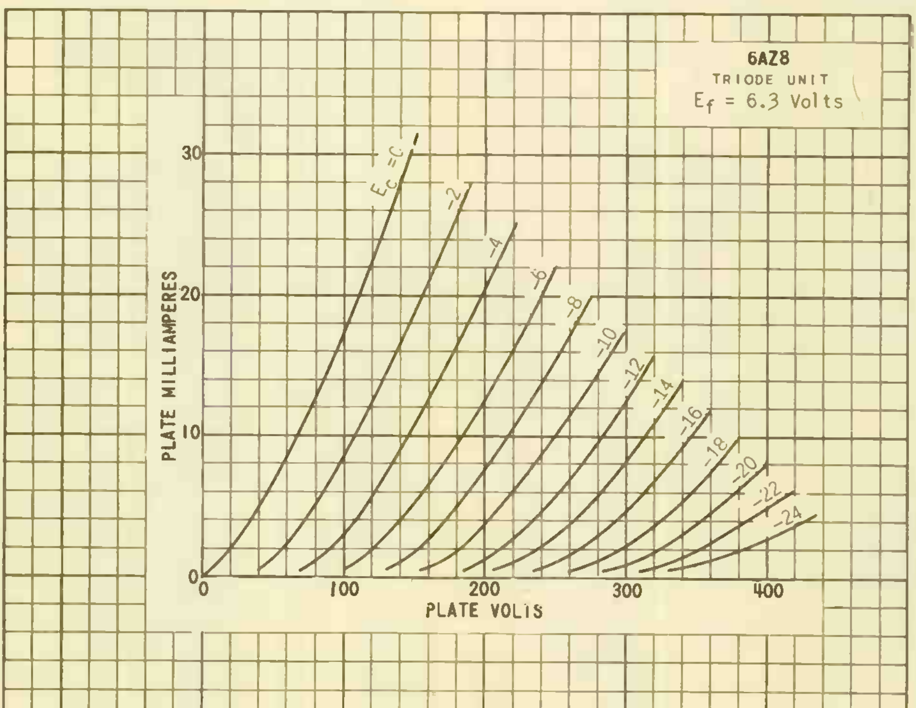
	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.45		AMP.
PLATE SUPPLY VOLTAGE	200	200	VOLTS
GRID #2 SUPPLY VOLTAGE	---	150	VOLTS
GRID #1 VOLTAGE	-6	---	VOLTS
CATHODE-BIAS RESISTOR	---	180	OHMS
AMPLIFICATION FACTOR	19	---	
PLATE RESISTANCE (APPROX.)	5 750	300 000	OHMS
TRANSCONDUCTANCE	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

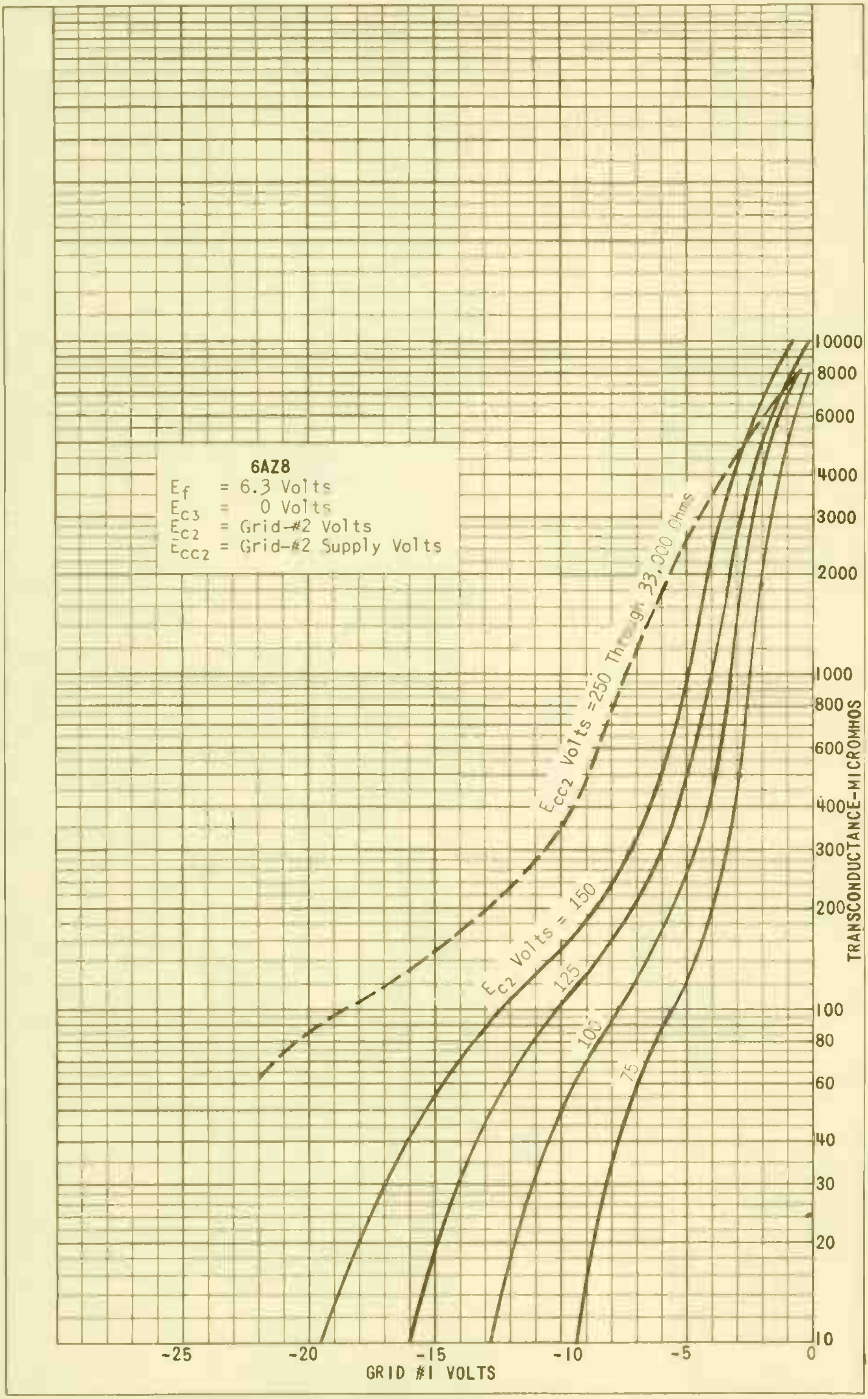
[A] THE HEATER-CATHODE VOLTAGE SHOULD NOT EXCEED THE VALUE OF THE OPERATING CATHODE BIAS BECAUSE THE VOLTAGE BETWEEN THE HEATER AND CATHODE IS ALSO APPLIED BETWEEN THE CATHODE AND GRID #3. THE NET RESULT IS TO MAKE GRID #3 NEGATIVE WITH RESPECT TO CATHODE WITH POSSIBLE CHANGE IN TUBE CHARACTERISTICS.

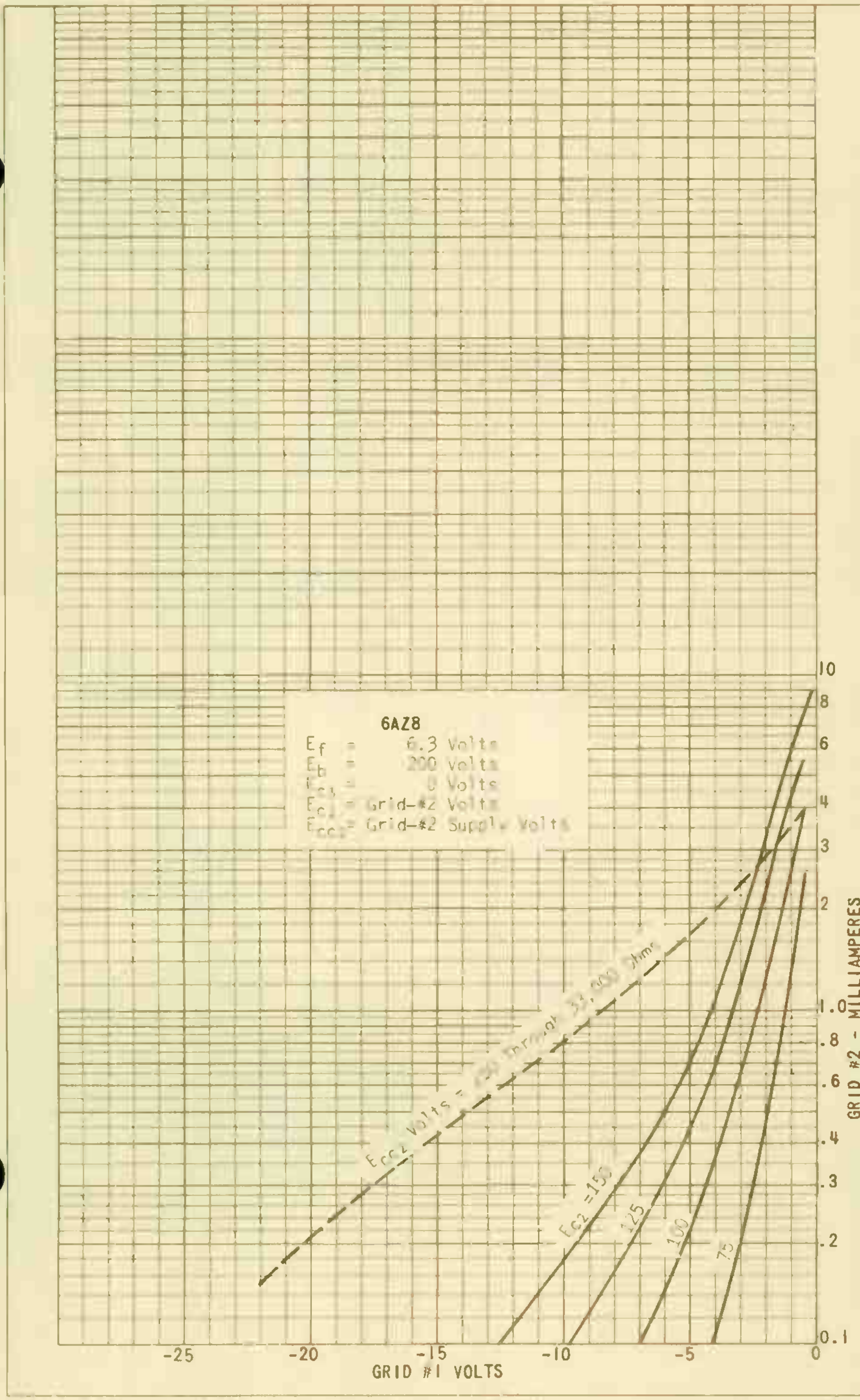
[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

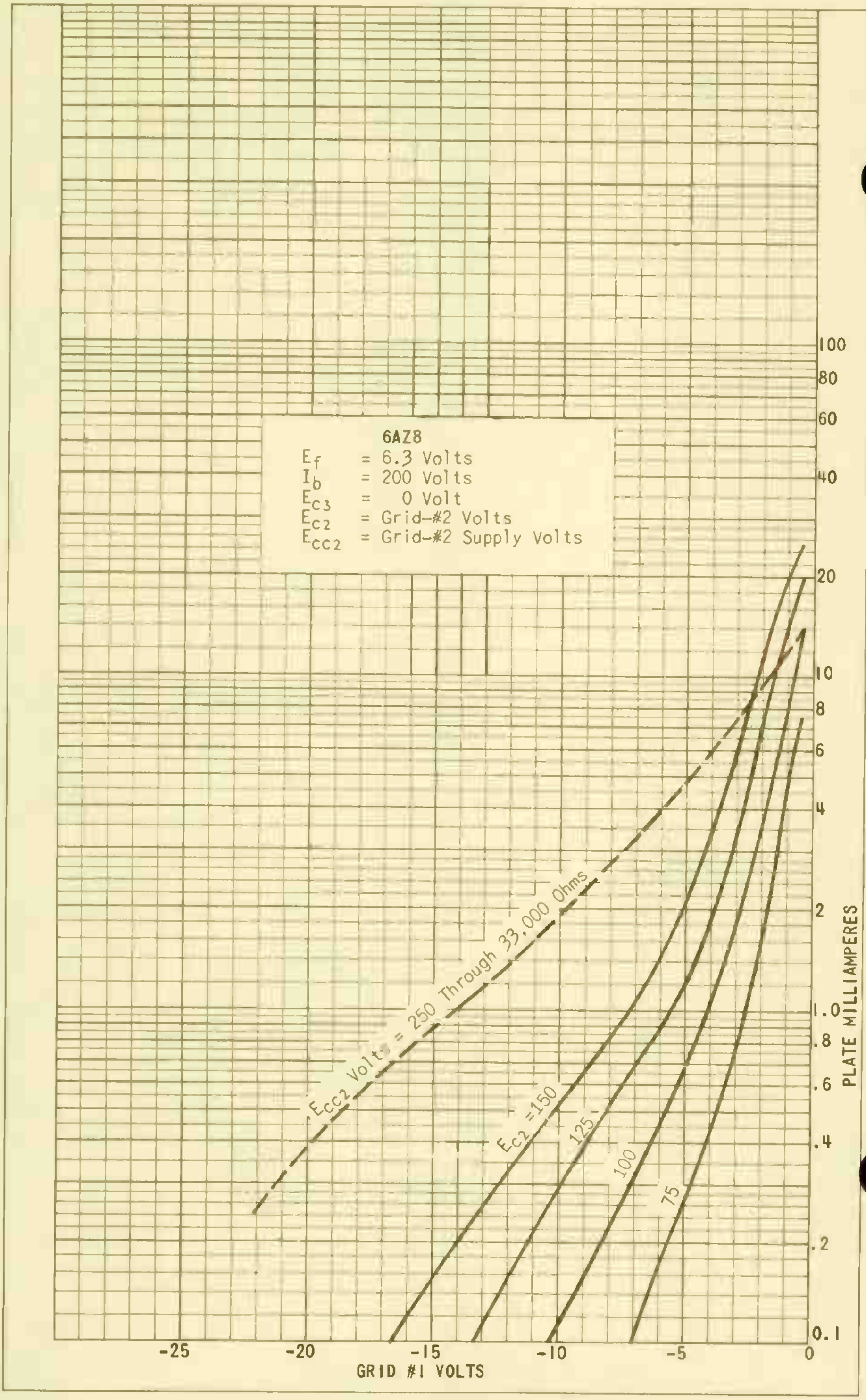
[C] IF EITHER UNIT IS OPERATED AT MAXIMUM RATED CONDITIONS, GRID #1 CIRCUIT RESISTANCES FOR BOTH UNITS SHOULD NOT EXCEED THE STATED VALUES.

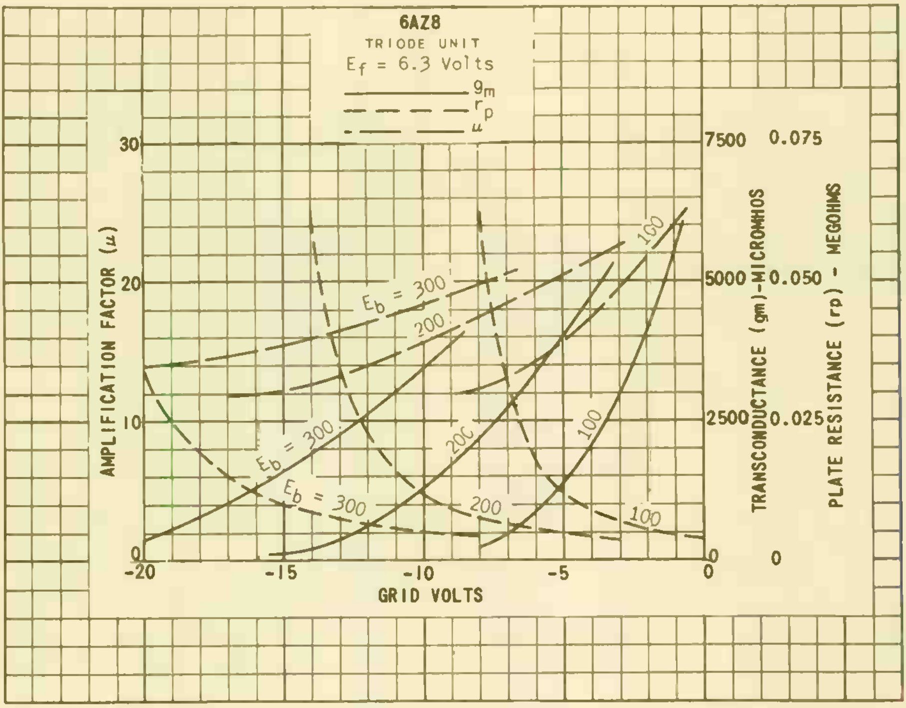

RATING CHART
6AZ8
E_f = 6.3 Volts
THIS CURVE ALSO APPLIES TO TYPES IN WHICH GRIDS #2 & #4 ARE CONNECTED TOGETHER WITHIN THE TUBE
MAXIMUM OPERATING CONDITIONS
AREA OF PERMISSIBLE OPERATION
GRID #2 INPUT EXPRESSED AS % OF MAX. GRID #2 INPUT RATING
GRID #2 VOLTAGE EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE RATING
100
75
50
25
0
0
25
50
75
100

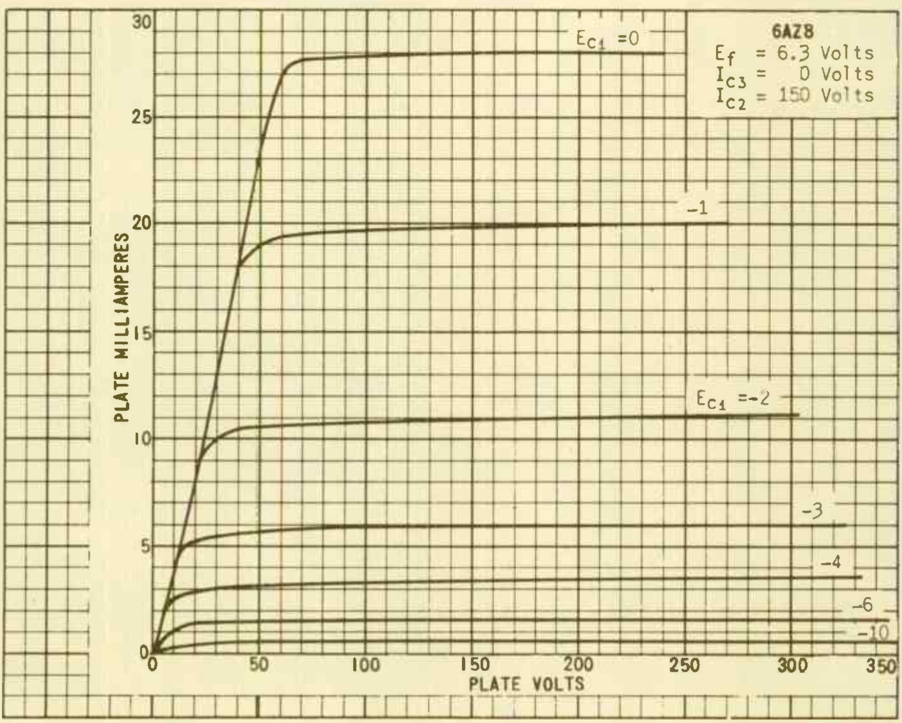

6AZ8
TRIODE UNIT
E_f = 6.3 Volts
E_c = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
PLATE MILLIAMPERES
PLATE VOLTS
30
20
10
0
0
100
200
300
400


6AZ8
E_f = 6.3 Volts
E_{c3} = 0 Volts
E_{c2} = Grid-#2 Volts
E_{cc2} = Grid-#2 Supply Volts
E_{cc2} Volts = 250 Through 33,000 Ohms
E_{c2} Volts = 150
125
100
75
-25
-20
-15
-10
-5
0
GRID #1 VOLTS
10
20
30
40
60
80
100
200
300
400
600
800
1000
2000
3000
4000
6000
8000
10000
TRANSCONDUCTANCE-MICROMHOS

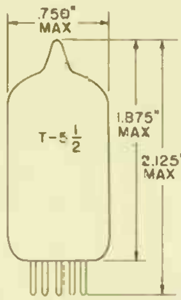

6AZ8
E_f = 6.3 Volts
E_b = 200 Volts
E_{c_3} = 0 Volts
E_{c_2} = Grid-#2 Volts
E_{cc_2} = Grid-#2 Supply Volts
E_{cc_2} Volts = 450 through 33,000 ohms
E_{c_2} =150
125
100
75
GRID #2 - MILLIAMPERES
10
8
6
4
3
2
1.0
.8
.6
.4
.3
.2
0.1
-25
-20
-15
-10
-5
0
GRID #1 VOLTS


6AZ8
Ef = 6.3 Volts
Ib = 200 Volts
Ec3 = 0 Volt
Ec2 = Grid-#2 Volts
Ecc2 = Grid-#2 Supply Volts
Ecc2 Volts = 250 Through 33,000 Ohms
Ec2 =150
125
100
75
PLATE MILLIAMPERES
100
80
60
40
20
10
8
6
4
2
1.0
.8
.6
.4
.2
0.1
GRID #1 VOLTS
-25
-20
-15
-10
-5
0


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
7500
5000
2500
0.075
0.050
0.025
30
20
10
0
-20
-15
-10
-5


6AZ8
E_f = 6.3 Volts
I_{c3} = 0 Volts
I_{c2} = 150 Volts
E_{c1} =0
-1
E_{c1} =-2
-3
-4
-6
-10
PLATE MILLIAMPERES
PLATE VOLTS
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

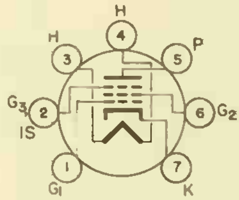
COATED UNIPOTENTIAL CATHODE

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 #5-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 #5-C4	

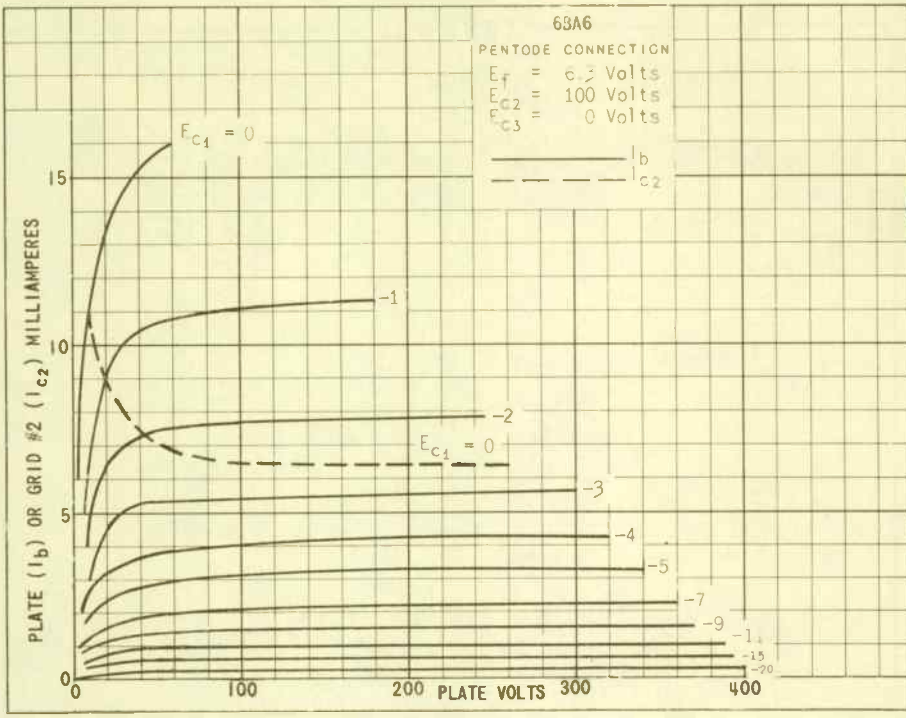
[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

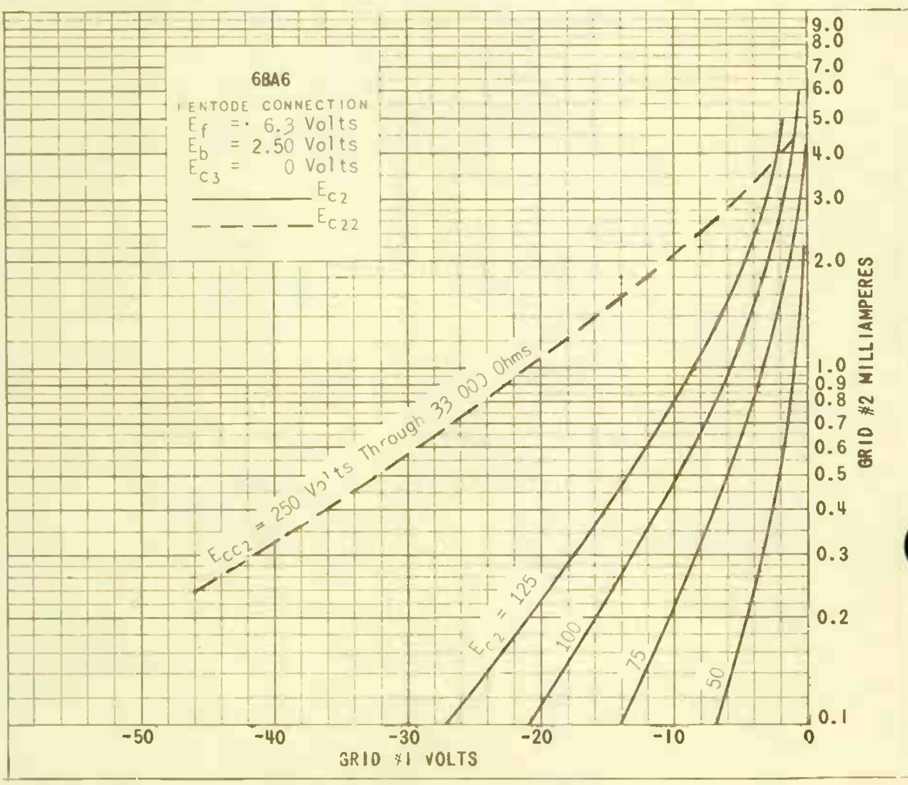
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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.


6BA6
PENTODE CONNECTION
Ef = 6.3 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
15
10
5
0
0
100
200
300
400
PLATE VOLTS


6BA6
PENTODE CONNECTION
Ef = 6.3 Volts
Eb = 250 Volts
Ec3 = 0 Volts
Ec2
Ec22
Ecc2 = 250 Volts Through 33 000 Ohms
Ec2 = 125
100
75
50
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
GRID #2 MILLIAMPERES
-50
-40
-30
-20
-10
0
GRID #1 VOLTS

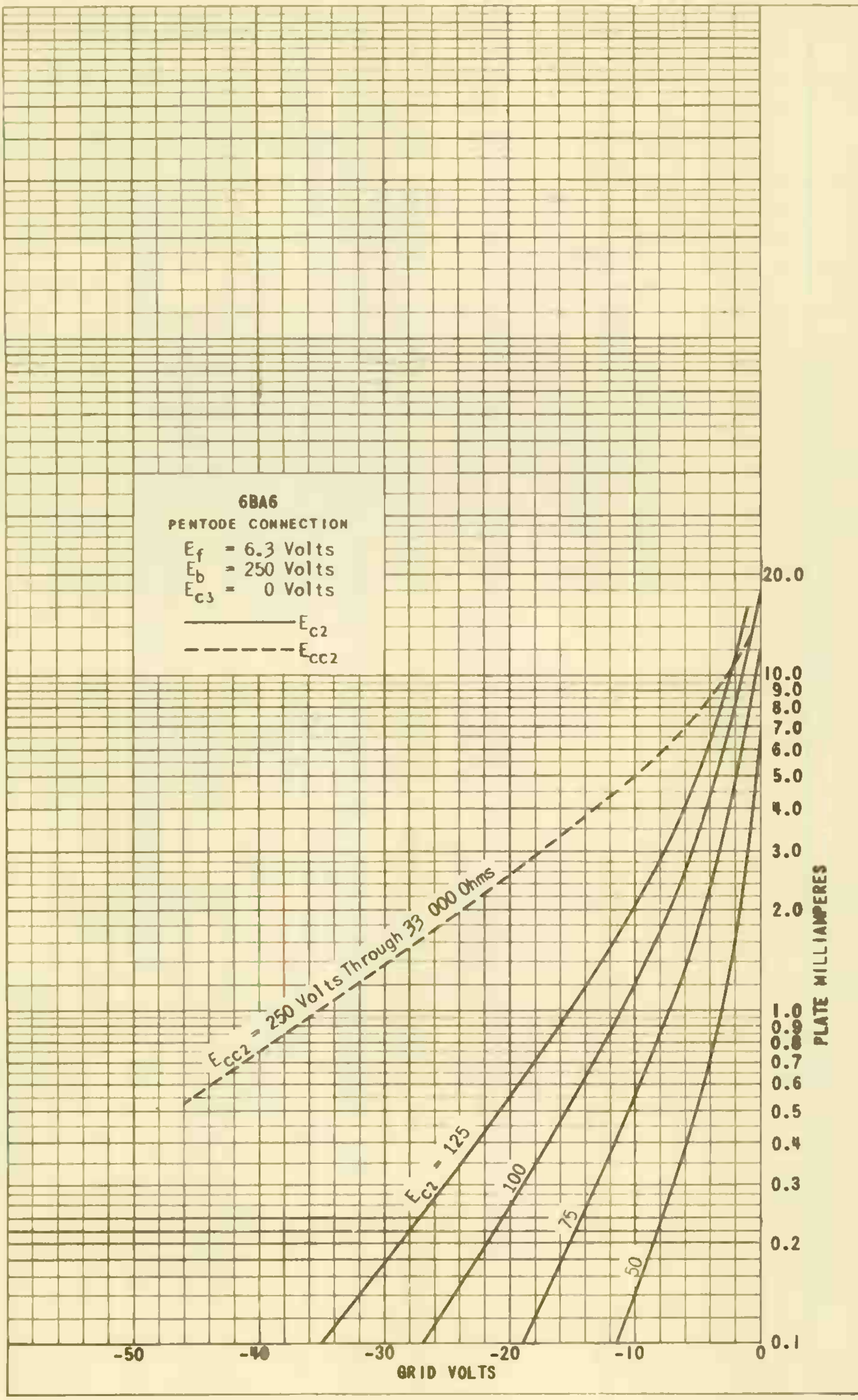


PLATE 1791
MAY 1 1947

PRINTED IN U S A

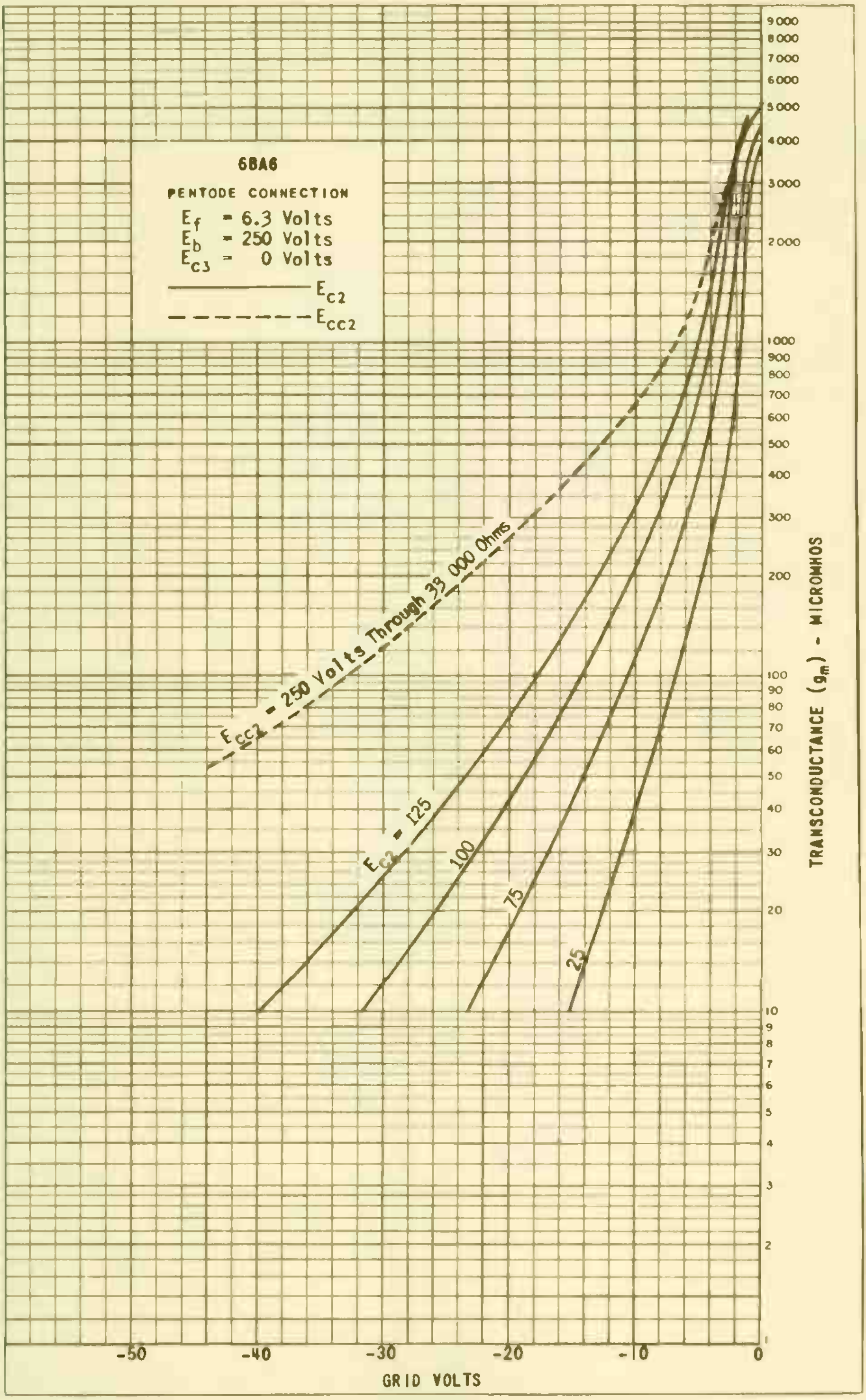


PLATE 1792
MAY 1 1947

 ELECTRON TUBE DIVISION NEWARK NEW JERSEY U-S A

TUNG-SOL

HEPTODE

MINIATURE TYPE

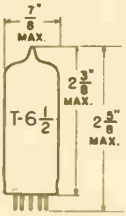
UNIPOTENTIAL CATHODE

HEATER

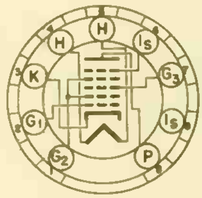
6.3 VOLTS 300 MA.

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.

PRINTED IN U. S. A.

PLATE 2079

OCT. 1, 1948

CONTINUED ON FOLLOWING PAGE

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

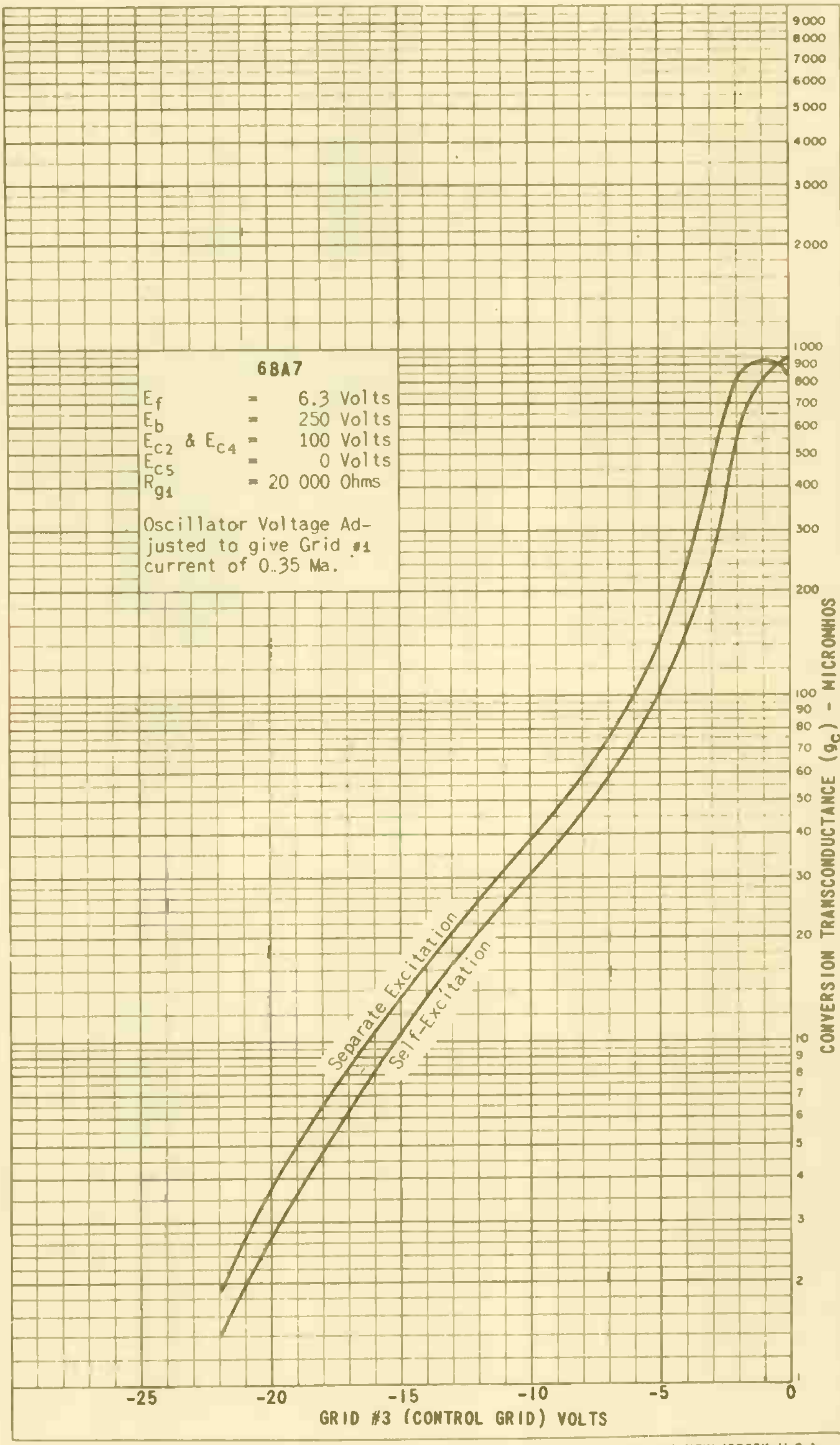
NOT OSCILLATING

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

OCT. 1, 1948



 ELECTRONIC TUBE DIVISION NEWARK, NEW JERSEY U S A

PLATE 2081
OCT. 1, 1948

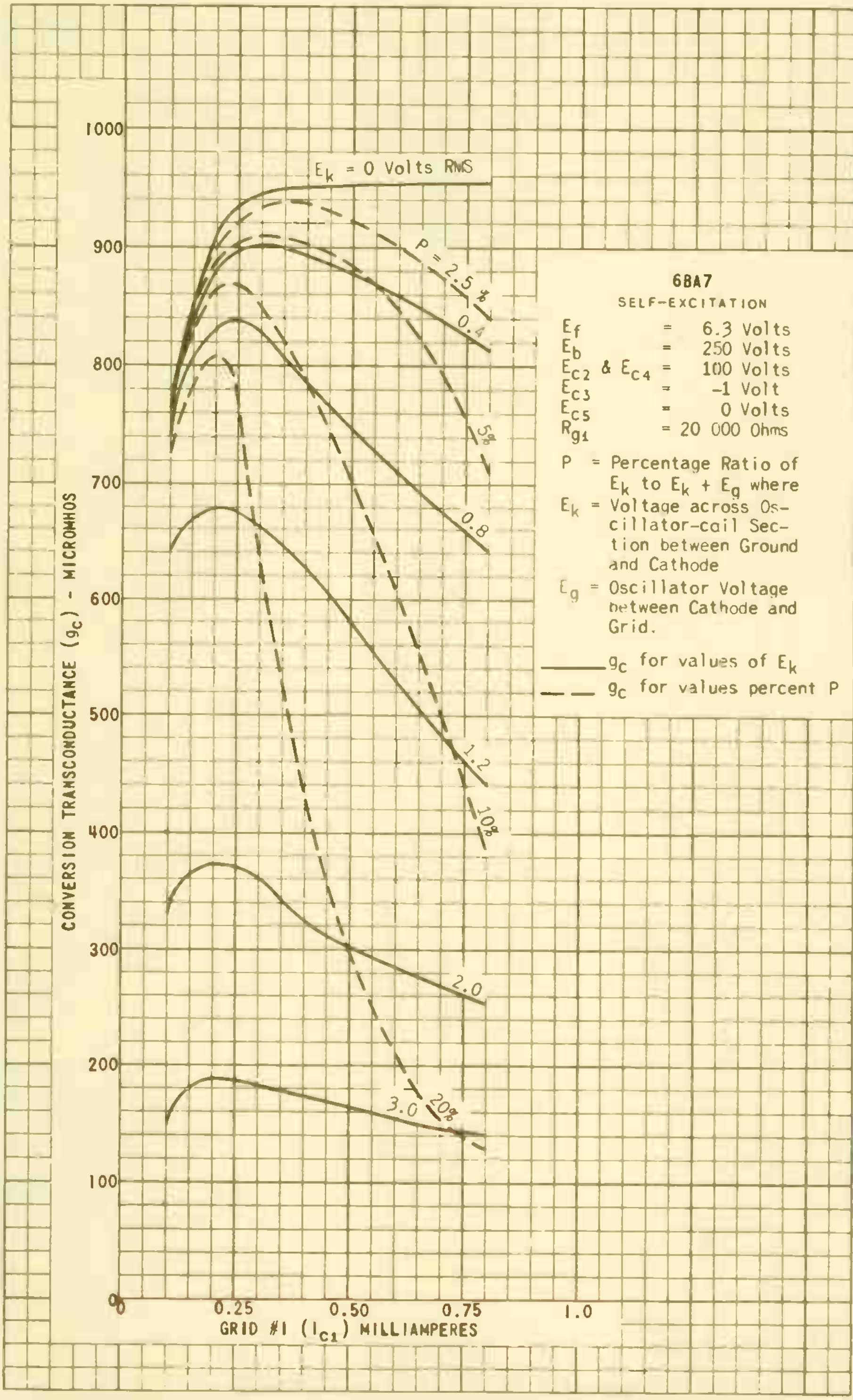
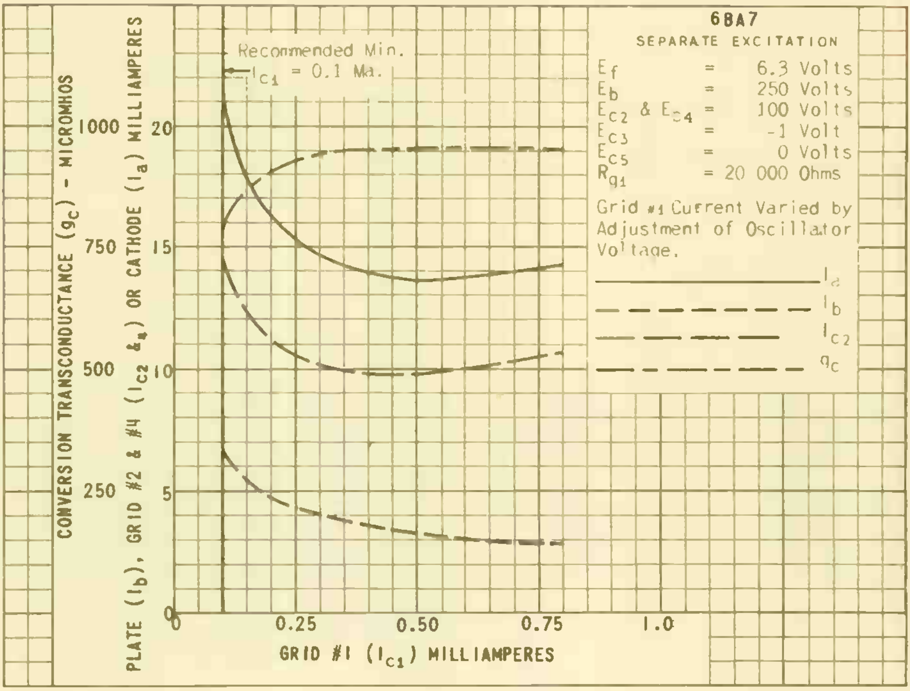


PLATE 2082

OCT. 1, 1948



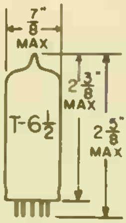
PRINTED IN U.S.A.

PLATE 2083
OCT. 1, 1948

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

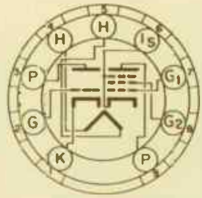


GLASS BULB

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 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

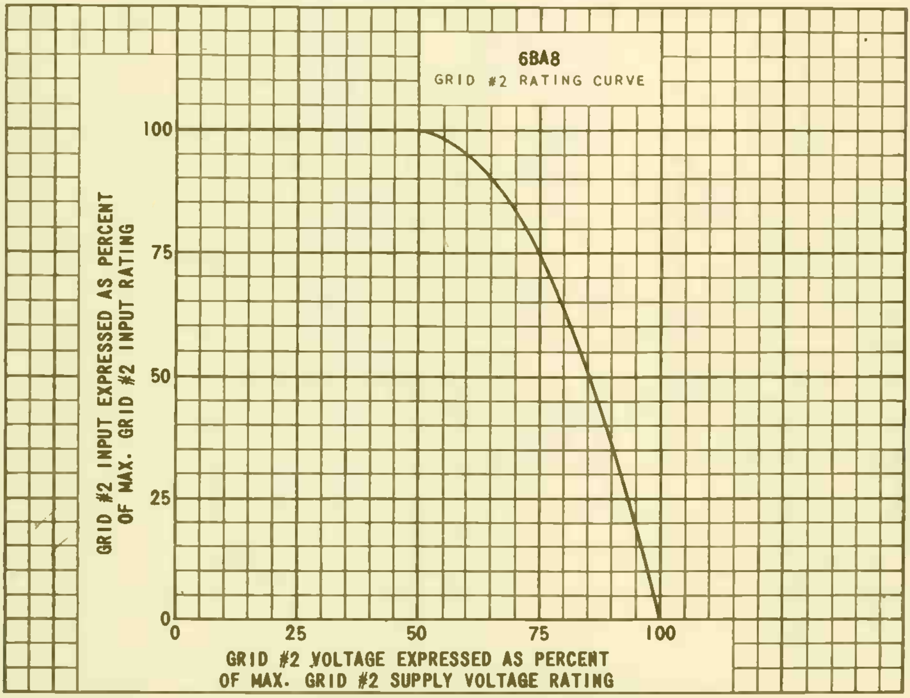
TUNG-SOL

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



TUNG-SOL

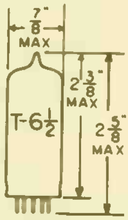
TRIODE PENTODE

MINIATURE TYPE

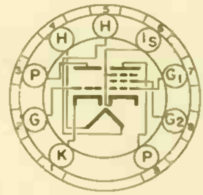
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9DX

THE 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	µµf
INPUT: G TO (H + K)	2.7	2.5	µµf
OUTPUT: P TO (H + K)	1.9	0.4	µµf
PENTODE			
GRID TO PLATE: (G_1 TO P)	0.03	0.04	µµf
INPUT: G TO ($H+K+G_2+G_3+I.S.$)	10.0	10.0	µµf
OUTPUT: P TO ($H+K+G_2+G_3+I.S.$)	4.5	3.6	µµf
COUPLING			
PENTODE GRID #1 TO TRIODE PLATE	0.003	0.006	µµf
PENTODE PLATE TO TRIODE GRID	0.006	0.016	µµf
PENTODE PLATE TO TRIODE PLATE	0.023	0.150	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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

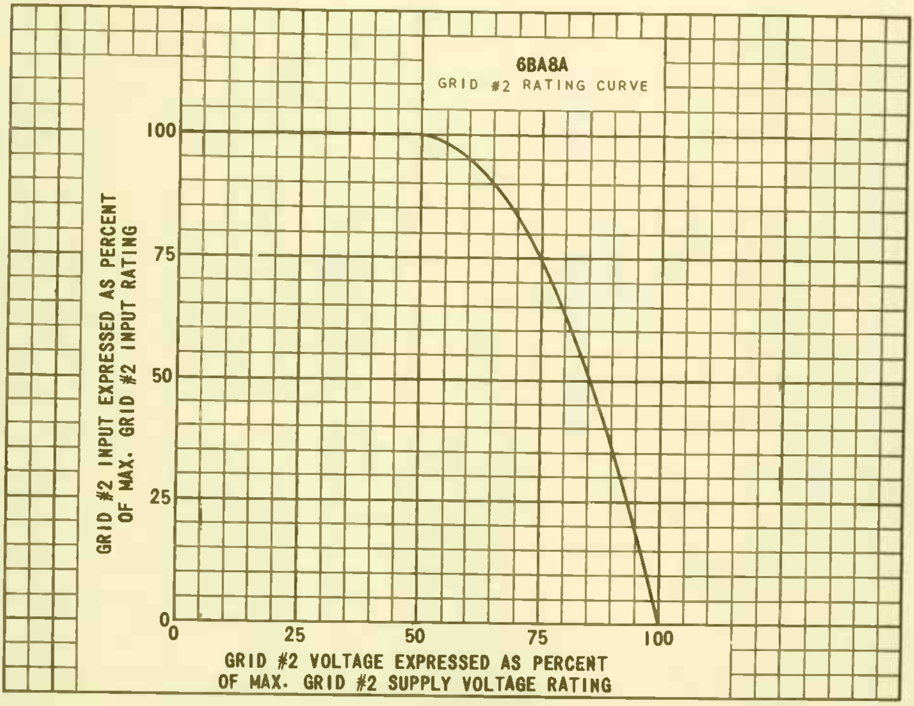
CONTINUED FROM PRECEDING PAGE

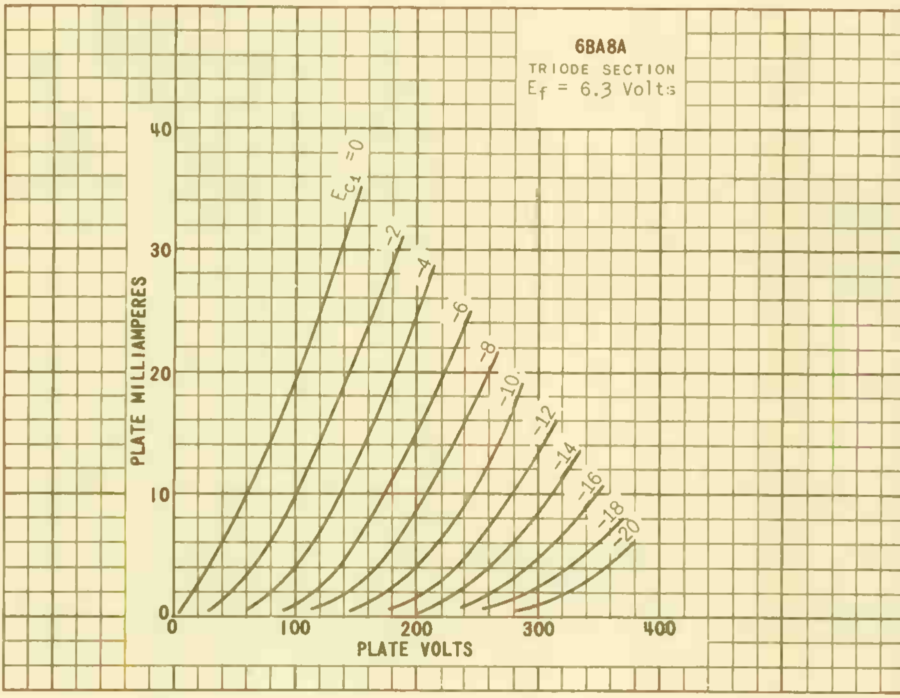
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

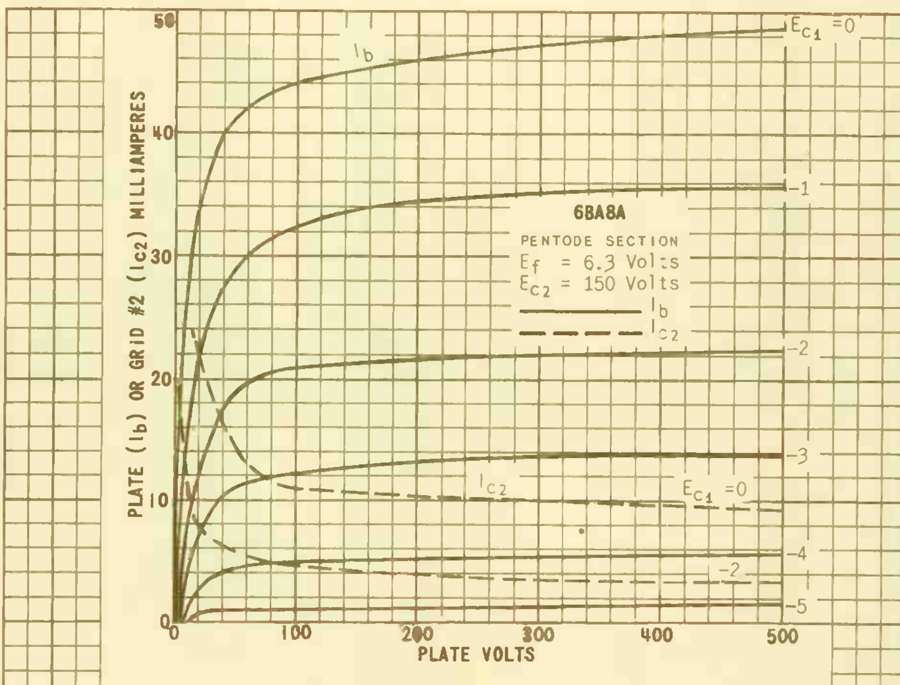
CLASS A_1 AMPLIFIER

	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
ZERO BIAS: WITH E_b =65V., AND E_{c2} =150 V., (INSTANTANEOUS VALUES)			
PLATE CURRENT		42	MA.
GRID #2 CURRENT		12.5	MA.

SIMILAR TYPE REFERENCE: 6BA8.







TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. MAY 1, 1957 PLATE #4986

TUNG-SOL

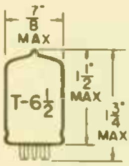
TRIODE

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

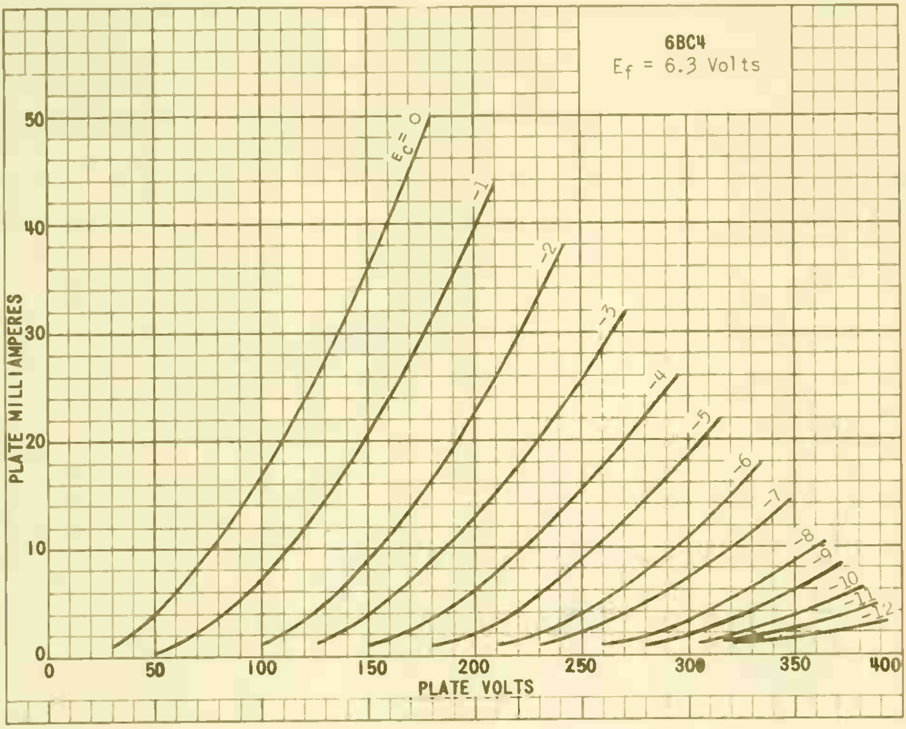
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	75	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	75	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM CATHODE CURRENT	25	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM
FOR FIXED-BIAS OPERATION	NOT RECOMMENDED	

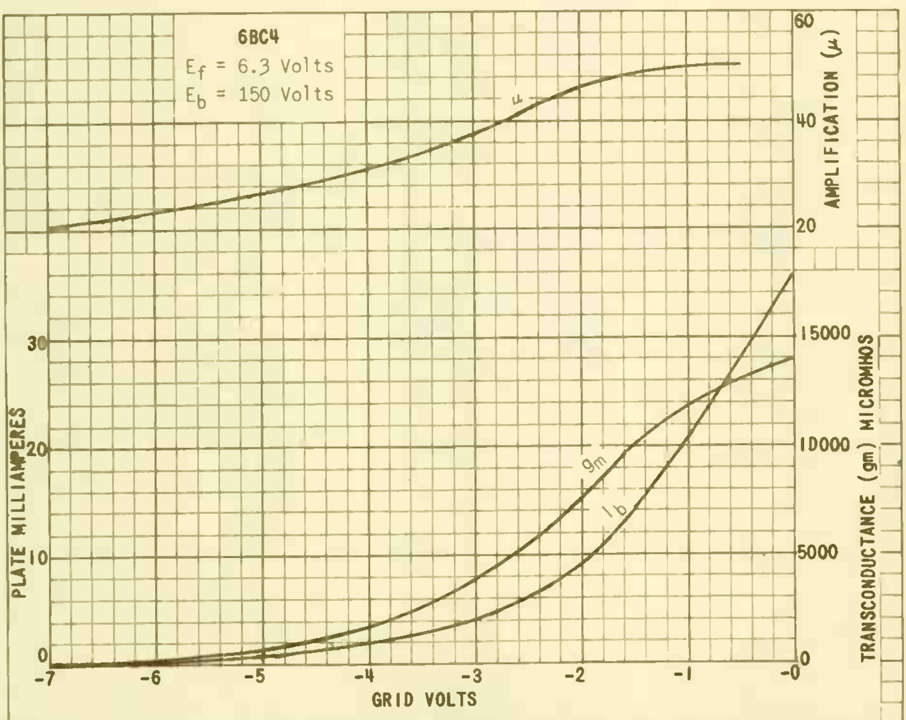
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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

PRINTED IN U.S.A.

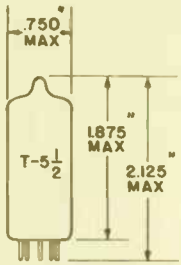

6BC4
E_f = 6.3 Volts
E_c = 0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
PLATE MILLIAMPERES
0
10
20
30
40
50
PLATE VOLTS
0
50
100
150
200
250
300
350
400


6BC4
E_f = 6.3 Volts
E_b = 150 Volts
μ
g_m
I_b
PLATE MILLIAMPERES
0
10
20
30
AMPLIFICATION (μ)
20
40
60
TRANSCONDUCTANCE (gm) MICROMHOS
0
5000
10000
15000
GRID VOLTS
-7
-6
-5
-4
-3
-2
-1
-0

TUNG-SOL

PENTODE

MINIATURE TYPE

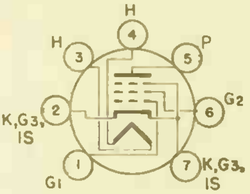


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

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

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

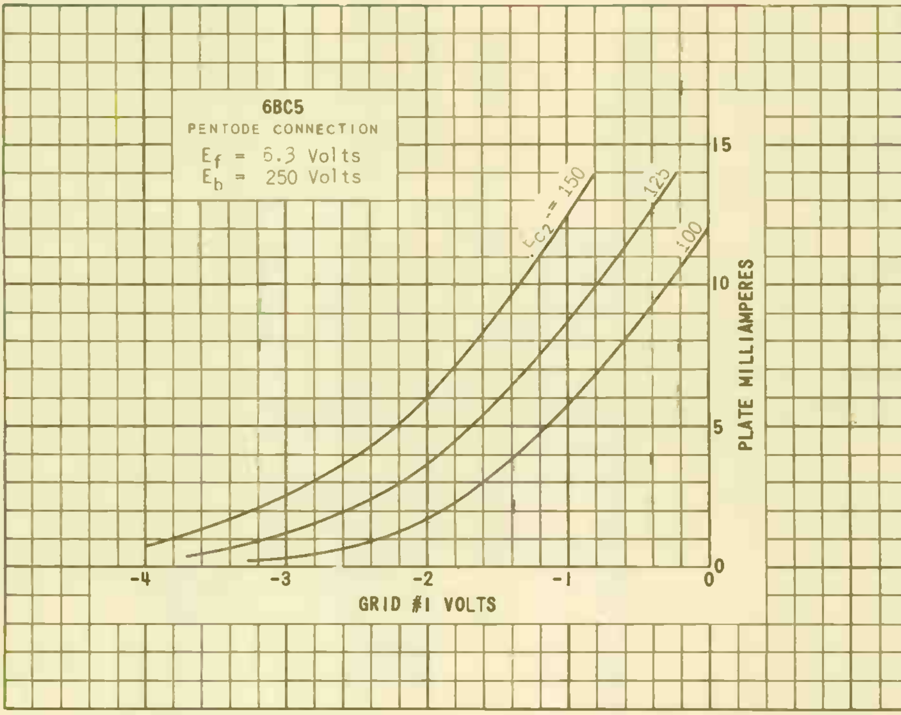
CLASS A_1 AMPLIFIER

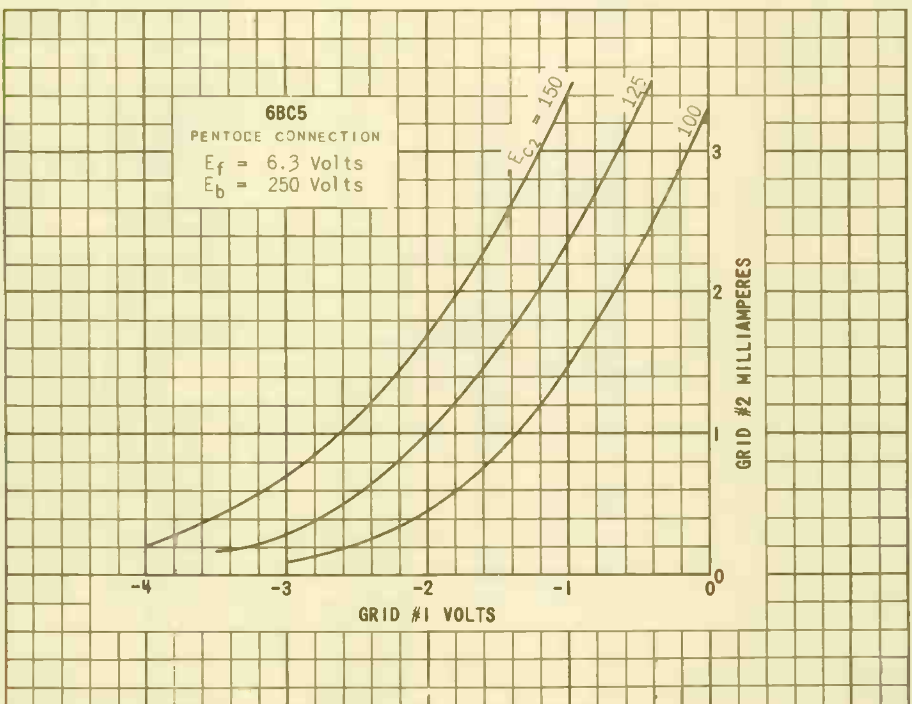
	TRIODE [C]		PENTODE			
PLATE VOLTAGE	250	180	100	125	250	VOLTS
GRID #2 VOLTAGE	PLATE	PLATE	100	125	150	VOLTS
CATHODE RESISTOR	820	330	180	100	180	OHMS
TRANSCONDUCTANCE	4400	6000	4900	6100	5700	μMHOS
PLATE RESISTANCE (APPROXIMATELY)	.009	.006	0.6	0.5	0.8	MEGOHM
AMPLIFICATION FACTOR	40	42	---	---	---	
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

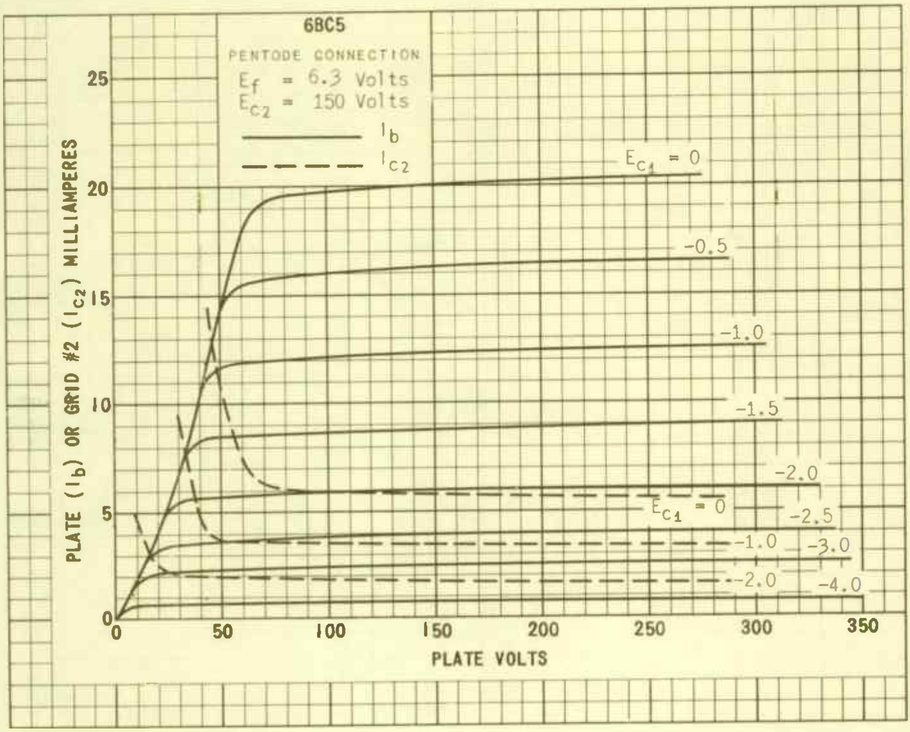
[C] G2 TIED TO PLATE.

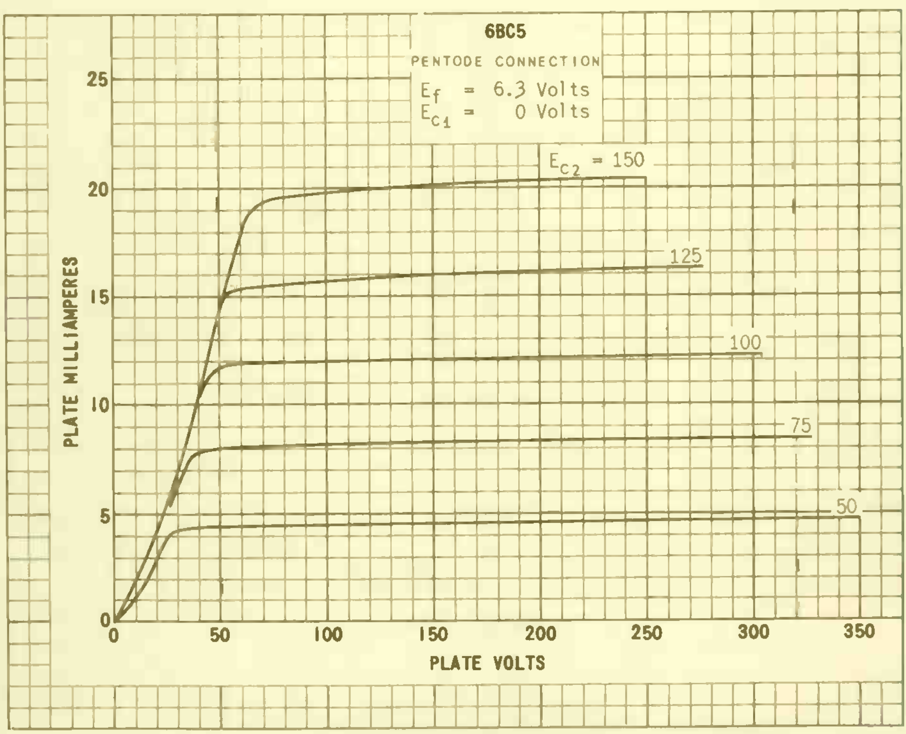
[D] TOTAL CURRENT FLOWING TO PLATE + G2.

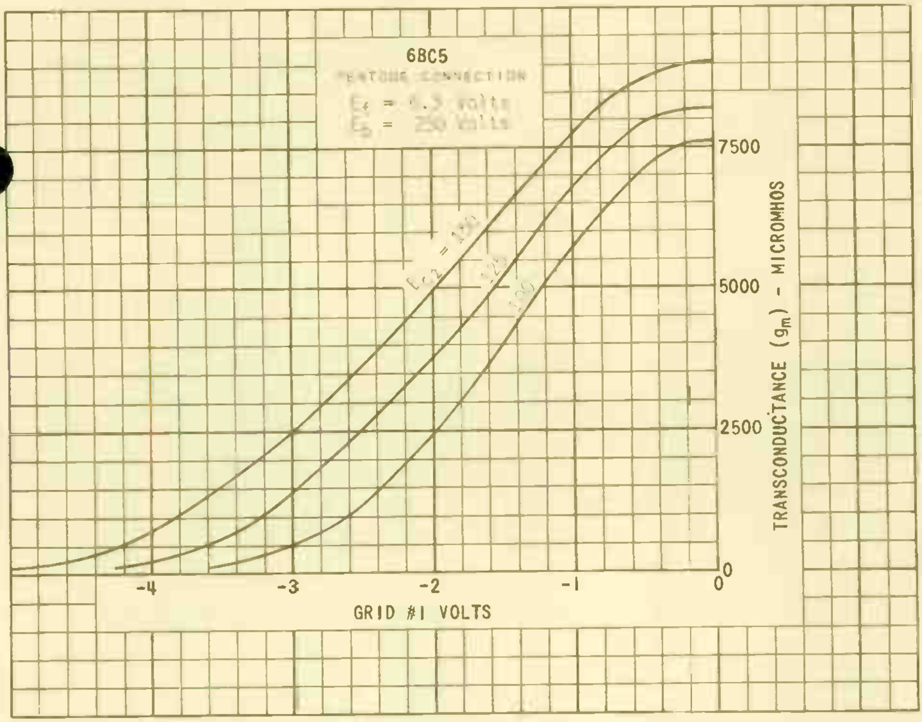
→ INDICATES A CHANGE.

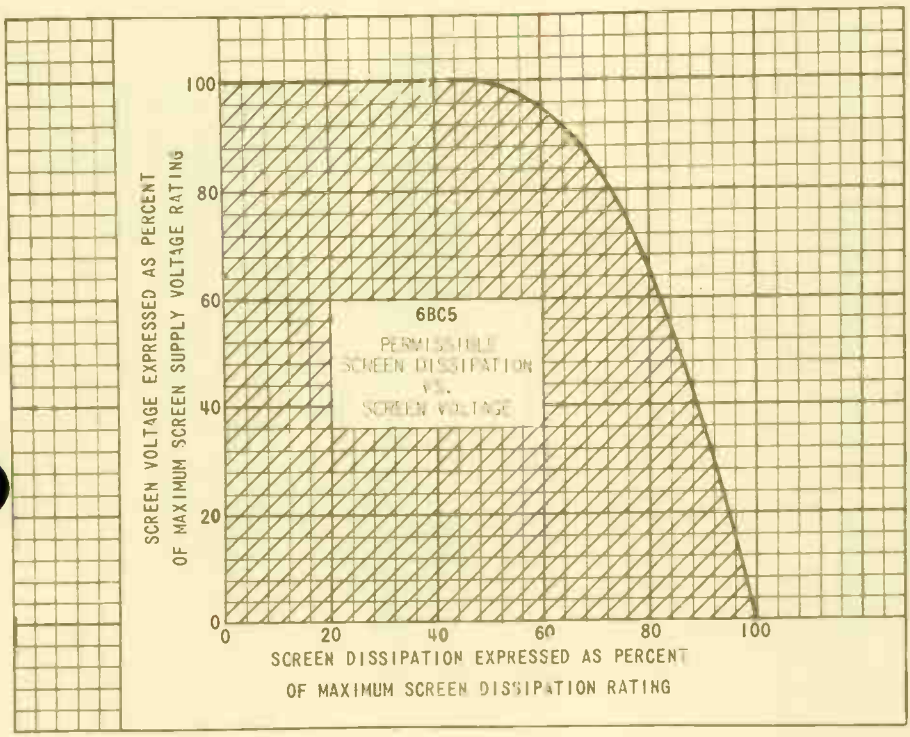

6BC5
PENTODE CONNECTION
Ef = 6.3 Volts
Eb = 250 Volts
Ec2 = 150
125
100
15
10
5
0
PLATE MILLIAMPERES
-4
-3
-2
-1
0
GRID #1 VOLTS


6BC5
PENTODE CONNECTION
Ef = 6.3 Volts
Eb = 250 Volts
Ec2 = 150
125
100
3
2
1
0
GRID #2 MILLIAMPERES
-4
-3
-2
-1
0
GRID #1 VOLTS


6BC5
PENTODE CONNECTION
Ef = 6.3 Volts
Ec2 = 150 Volts
Ib
Ic2
Ec1 = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
Ec1 = 0
-1.0
-2.0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
50
100
150
200
250
300
350


6BC5
PENTODE CONNECTION
Ef = 6.3 Volts
Ec1 = 0 Volts
Ec2 = 150
125
100
75
50
PLATE MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
50
100
150
200
250
300
350

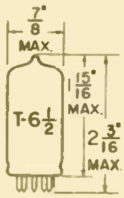

6BC5
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 150
125
100
7500
5000
2500
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
-4
-3
-2
-1
0
GRID #1 VOLTS


6BC5
PERMISSIBLE
SCREEN DISSIPATION
VS.
SCREEN VOLTAGE
100
80
60
40
20
0
SCREEN VOLTAGE EXPRESSED AS PERCENT
OF MAXIMUM SCREEN SUPPLY VOLTAGE RATING
0
20
40
60
80
100
SCREEN DISSIPATION EXPRESSED AS PERCENT
OF MAXIMUM SCREEN DISSIPATION RATING

TUNG-SOL

TRIPLE DIODE

MINIATURE TYPE

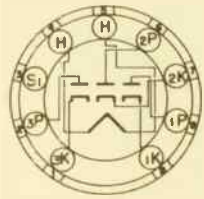


GLASS BULB

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.

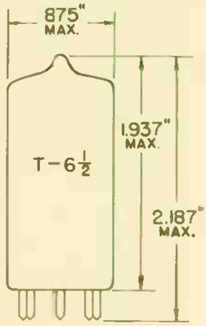
NOTE: RATIO OF $\frac{ID3}{ID1}$ AND/OR $\frac{ID1}{ID3}$ SHALL NOT BE GREATER THAN 1.3 AT E_D = 5 VOLTS.

PLATE 2477
OCT. 1 1950

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

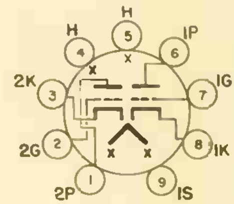


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

CASCODE AMPLIFIER
FOR SERIES STRING VHF
TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9AJ

THE 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

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. OCTOBER 1, 1961 PLATE #6281

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

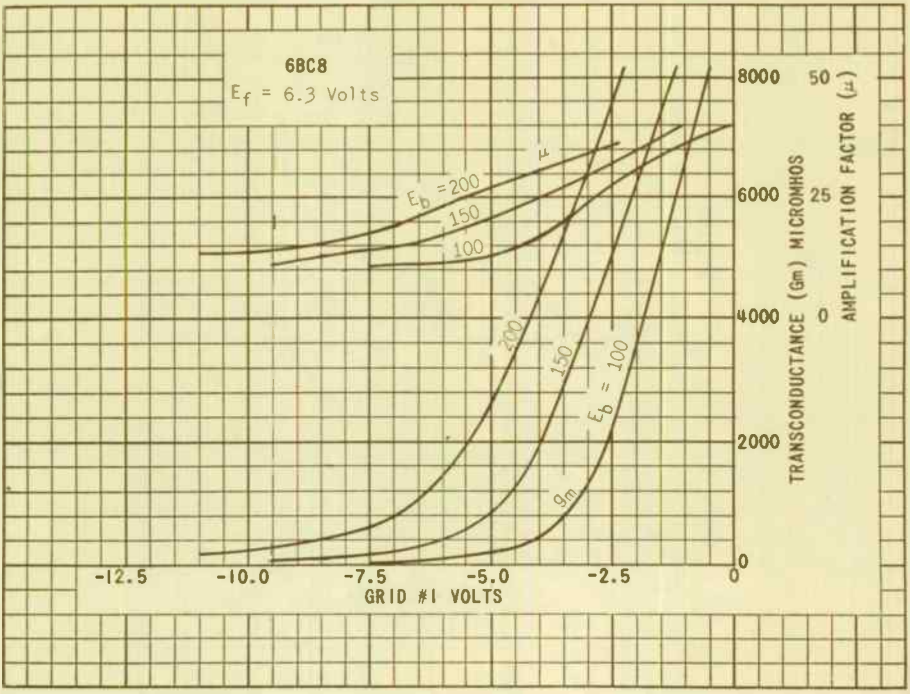
CLASS A_1 AMPLIFIER

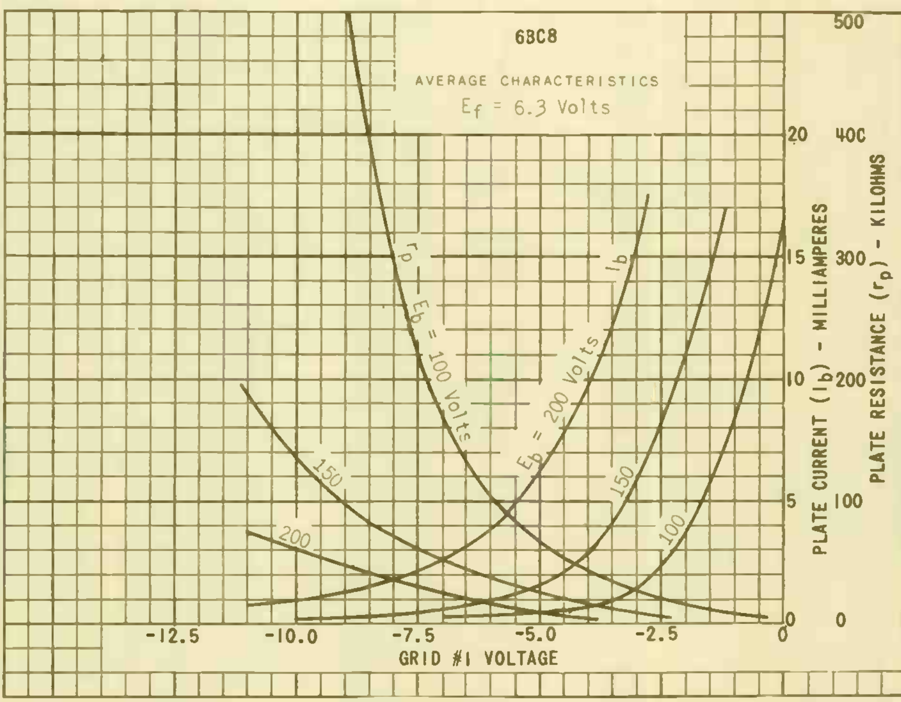
EACH UNIT

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

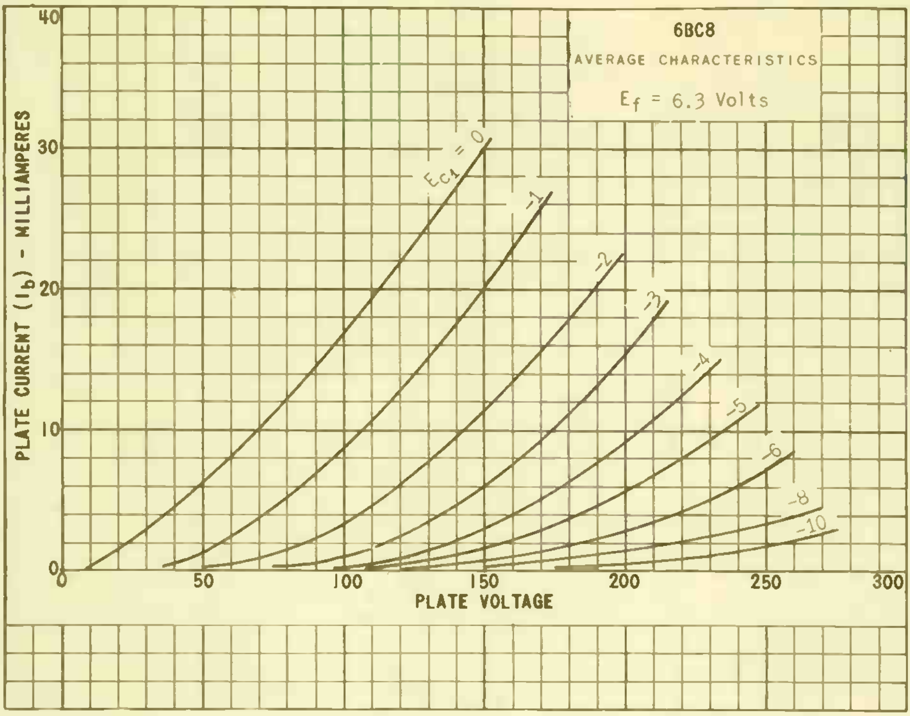
[B]THIS RATING MAY BE AS HIGH AS 300 VOLTS UNDER CUTOFF CONDITIONS WHEN THE TUBE IS USED AS A CASCODE AMPLIFIER AND THE TWO SECTIONS ARE CONNECTED IN SERIES.

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.



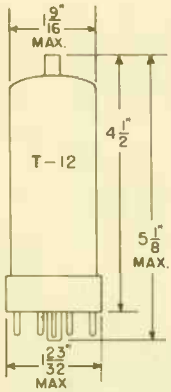


TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. OCTOBER 1, 1961 PLATE #6282


6BC8
AVERAGE CHARACTERISTICS
Ef = 6.3 Volts
Ec1 = 0
-1
-2
-3
-4
-5
-6
-8
-10
PLATE CURRENT (Ib) - MILLIAMPERES
PLATE VOLTAGE
0
10
20
30
40
50
100
150
200
250
300

TUNG-SOL

BEAM TRIODE

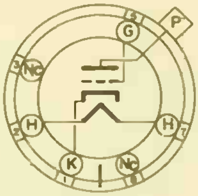


GLASS BULB
SMALL CAP

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	

CONTINUED ON FOLLOWING PAGE

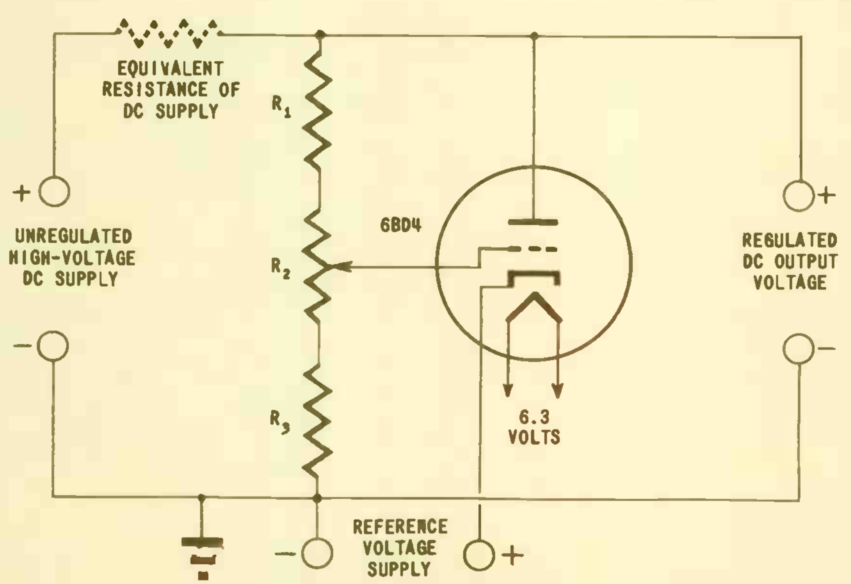
TUNG-SOL

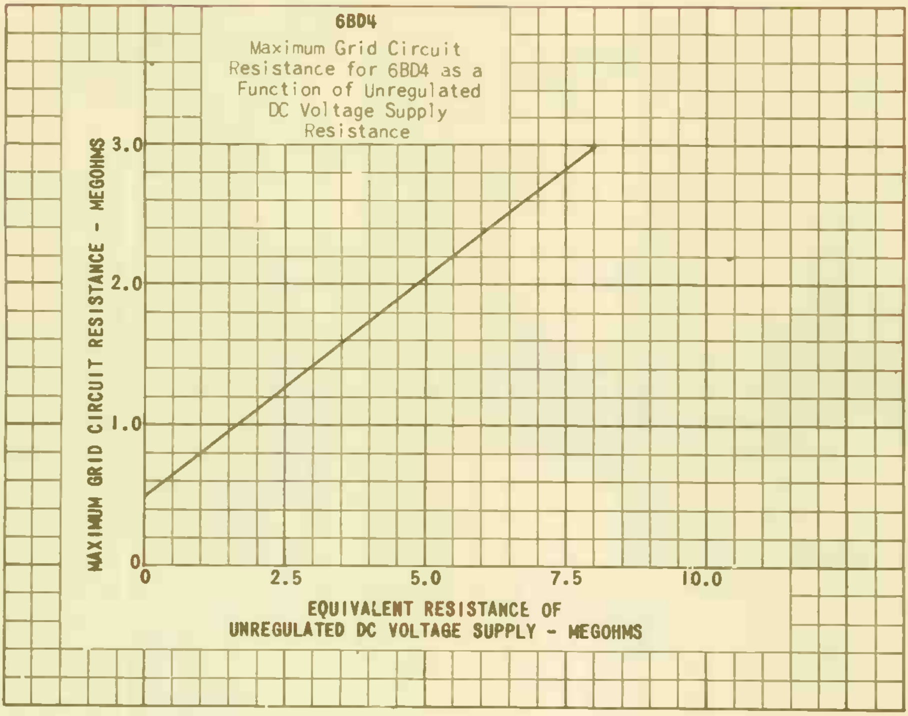
CONTINUED FROM PRECEDING PAGE

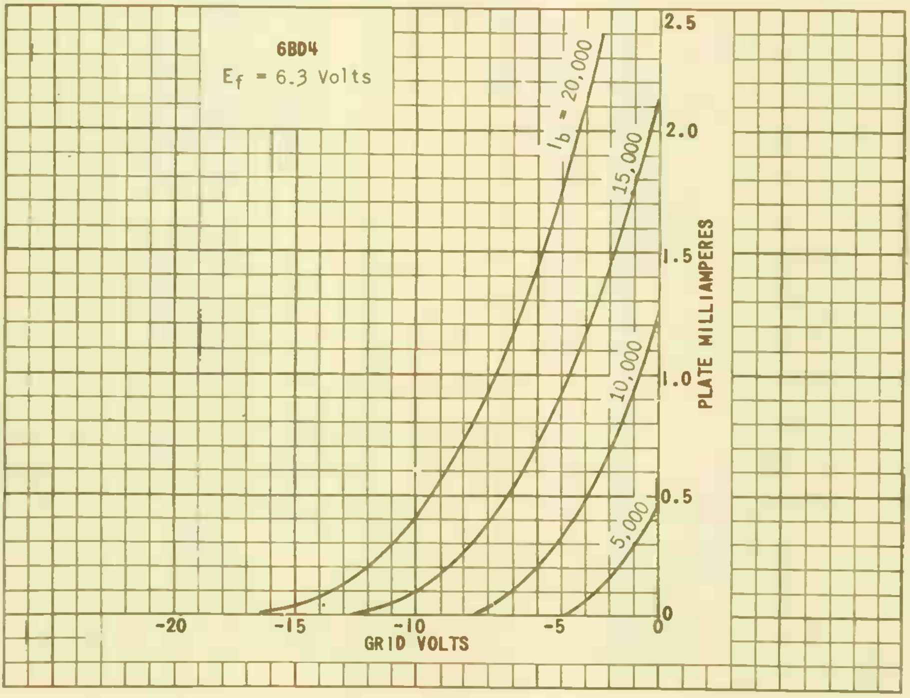
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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




6BD4
Maximum Grid Circuit Resistance for 6BD4 as a Function of Unregulated DC Voltage Supply Resistance
MAXIMUM GRID CIRCUIT RESISTANCE - MEGOHMS
3.0
2.0
1.0
0
0
2.5
5.0
7.5
10.0
EQUIVALENT RESISTANCE OF UNREGULATED DC VOLTAGE SUPPLY - MEGOHMS


6BD4
Ef = 6.3 Volts
Ib = 20,000
15,000
10,000
5,000
2.5
2.0
1.5
1.0
0.5
0
PLATE MILLIAMPERES
-20
-15
-10
-5
0
GRID VOLTS

TUNG-SOL

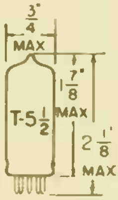
PENTODE

MINIATURE TYPE

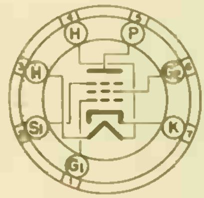
COATED UNIPOTENTIAL CATHODE

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 M8-210

DESIGN CENTER VALUES

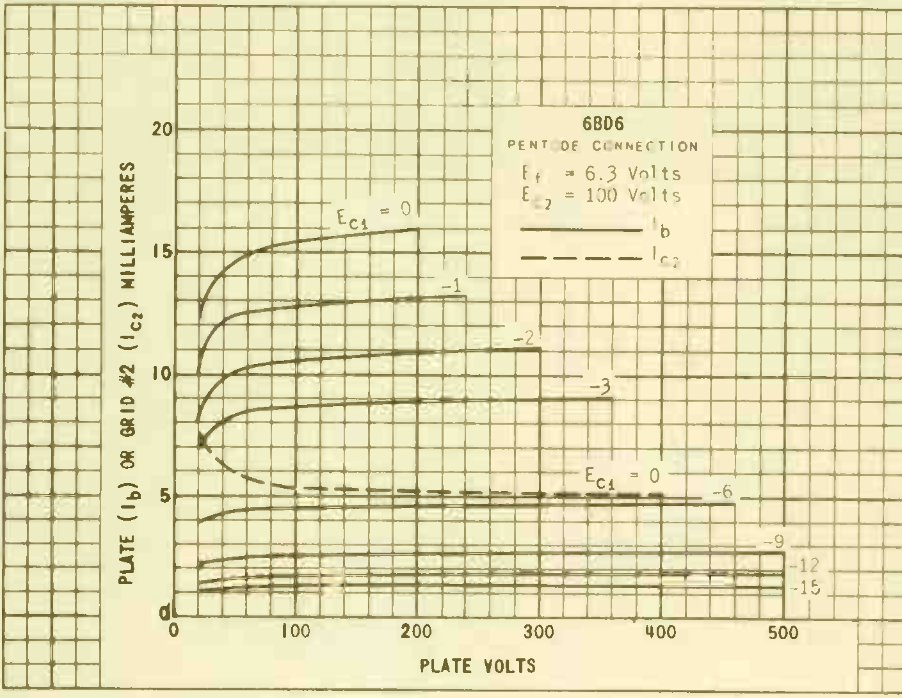
HEATER VOLTAGE	6.3	VOLTS	
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	90	VOLTS	*
HEATER POSITIVE WITH RESPECT TO CATHODE	90	VOLTS	*
MAXIMUM PLATE VOLTAGE	300	VOLTS	
MAXIMUM GRID #2 VOLTAGE	125	VOLTS	
MAXIMUM PLATE DISSIPATION	3.0	WATTS	←
MAXIMUM GRID #2 DISSIPATION	0.4	WATT	
MAXIMUM CATHODE CURRENT	14	MA.	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS *

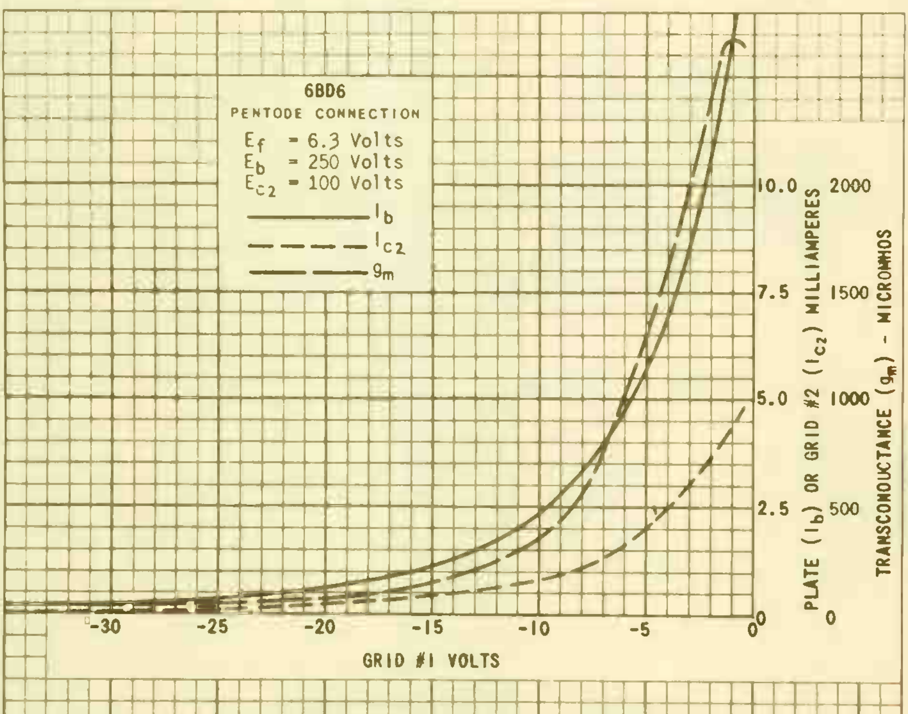
CLASS A_1 AMPLIFIER

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.



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
0
5
10
15
20
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
100
200
300
400
500
PLATE VOLTS

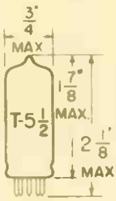


6BD6
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 100 Volts
I_b
I_{c2}
g_m
-30
-25
-20
-15
-10
-5
0
GRID #1 VOLTS
0
2.5
5.0
7.5
10.0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
500
1000
1500
2000
TRANSCONDUCTANCE (g_m) - MICROMHOS

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

CONTINUED FROM PRECEDING PAGE

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.

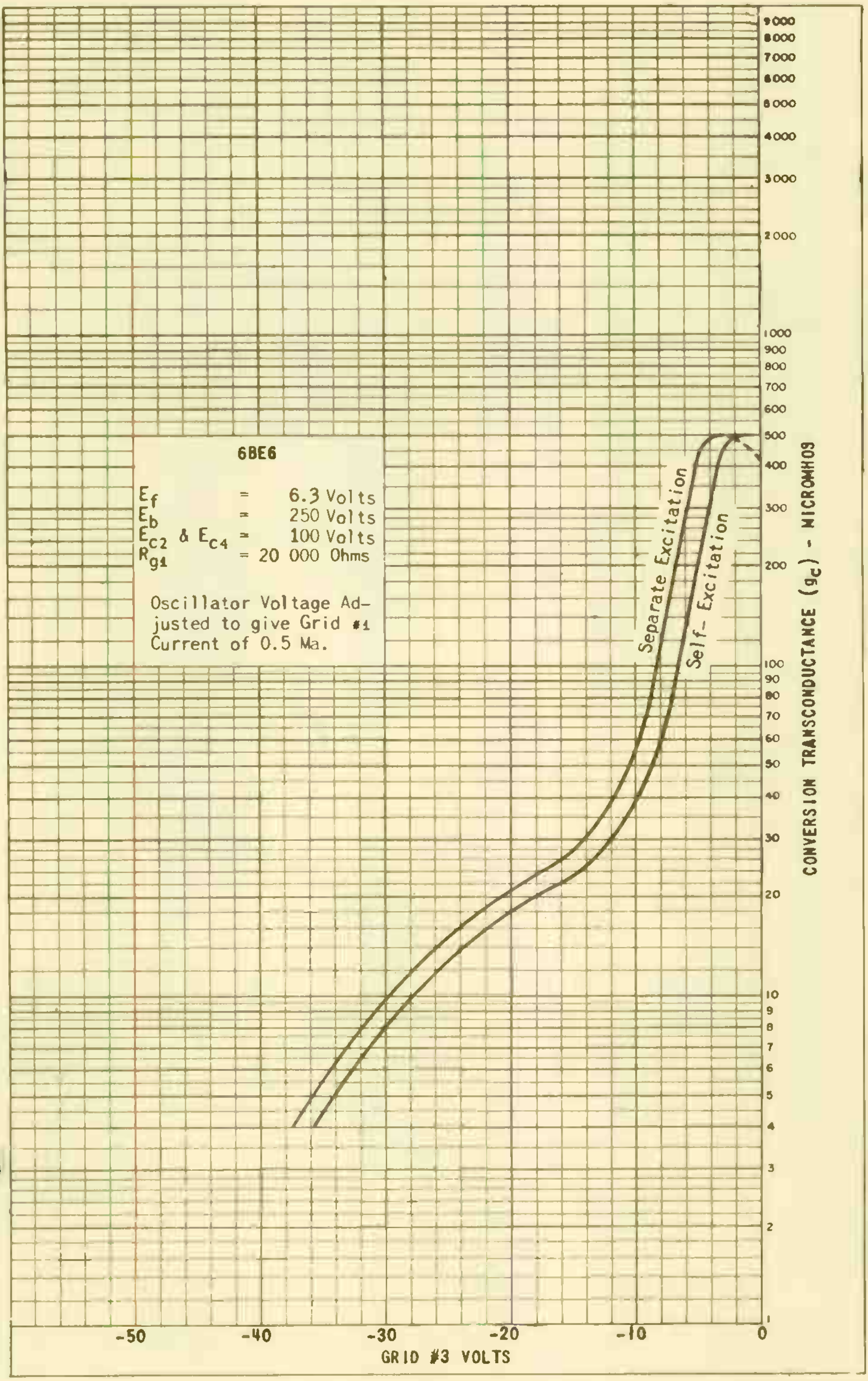


PLATE 2050
AUG. 2, 1946

 ELECTRONIC TUBE DIVISION NEWARK NEW JERSEY U S A

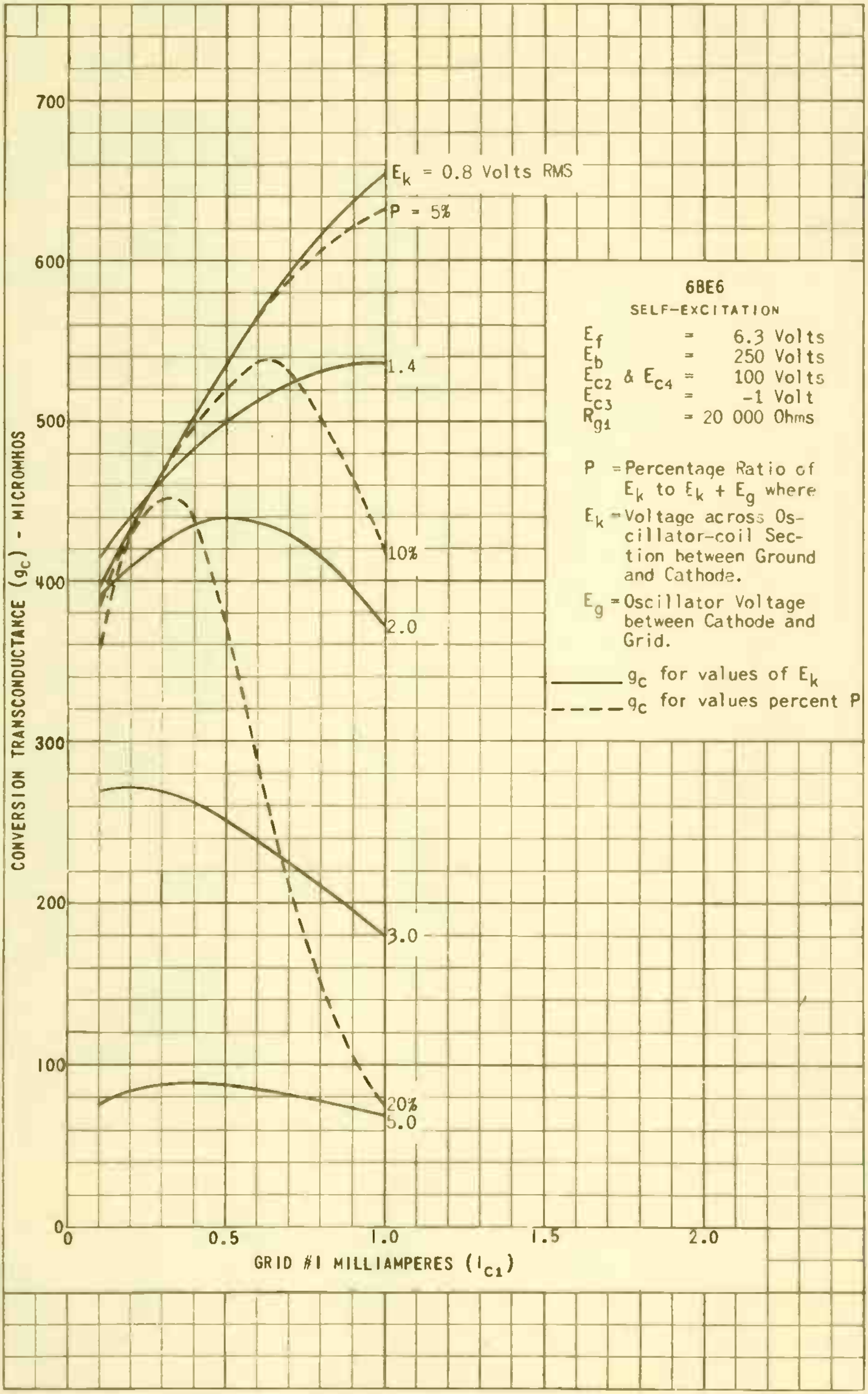
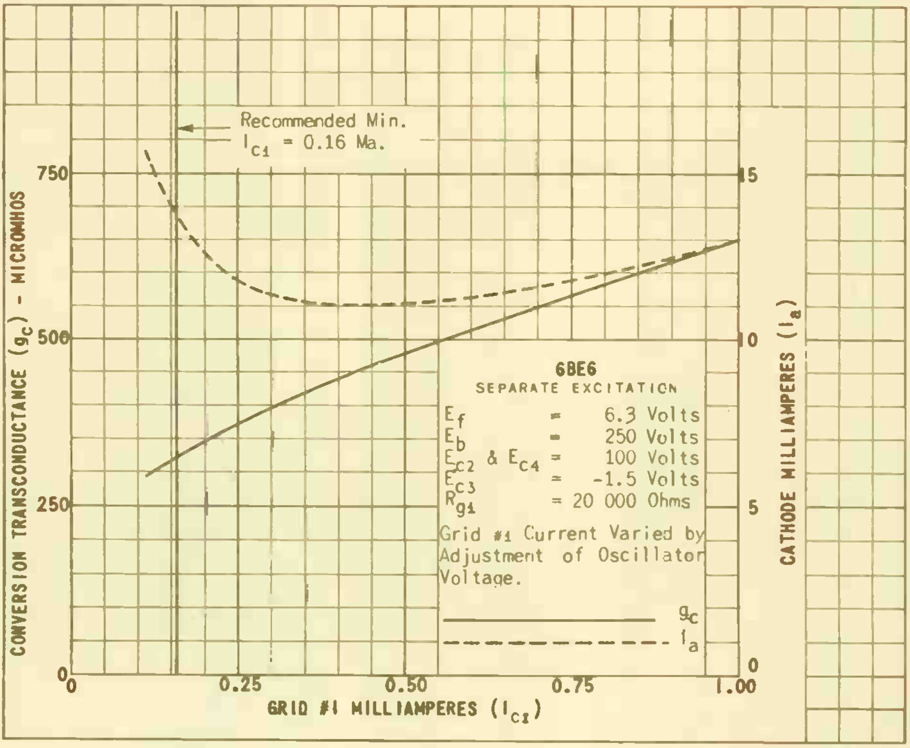
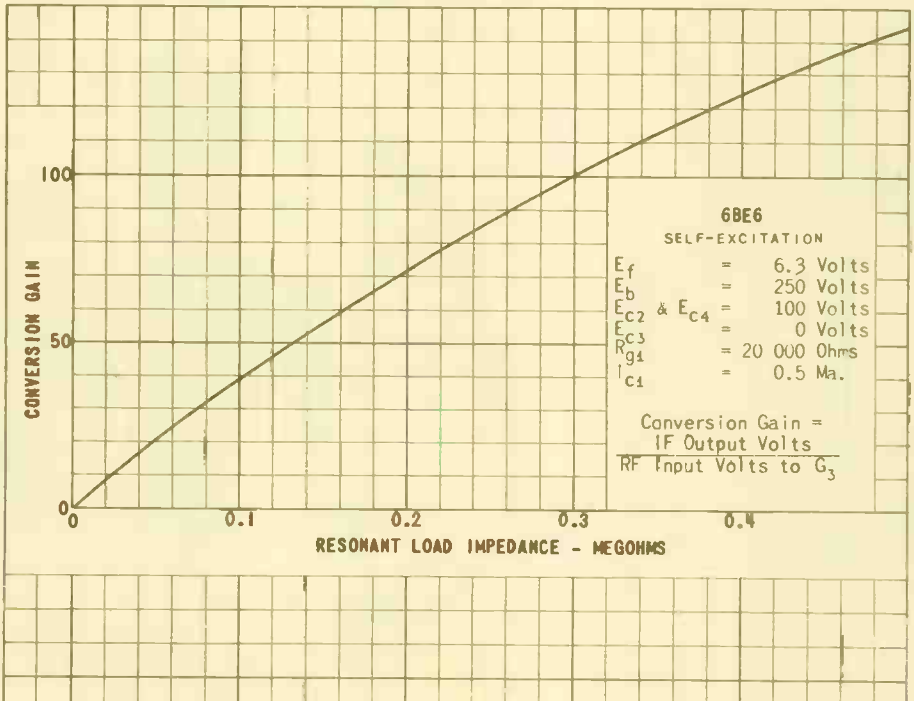


PLATE 2051
AUG. 2, 1948





PRINTED IN U. S. A.

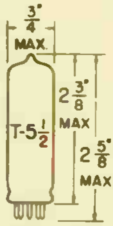
PLATE 2052

AUG. 2, 1948

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
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

TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. MARCH 1, 1959 PLATE #5438

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

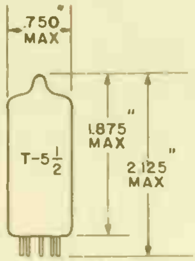
CLASS A_1 AMPLIFIER - SINGLE TUBE

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

TUNG-SOL



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

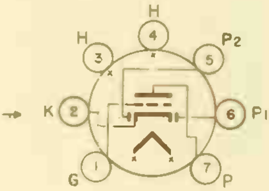
DOUBLE-DIODE TRIODE

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 SHIELD [A]	
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	0.86		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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

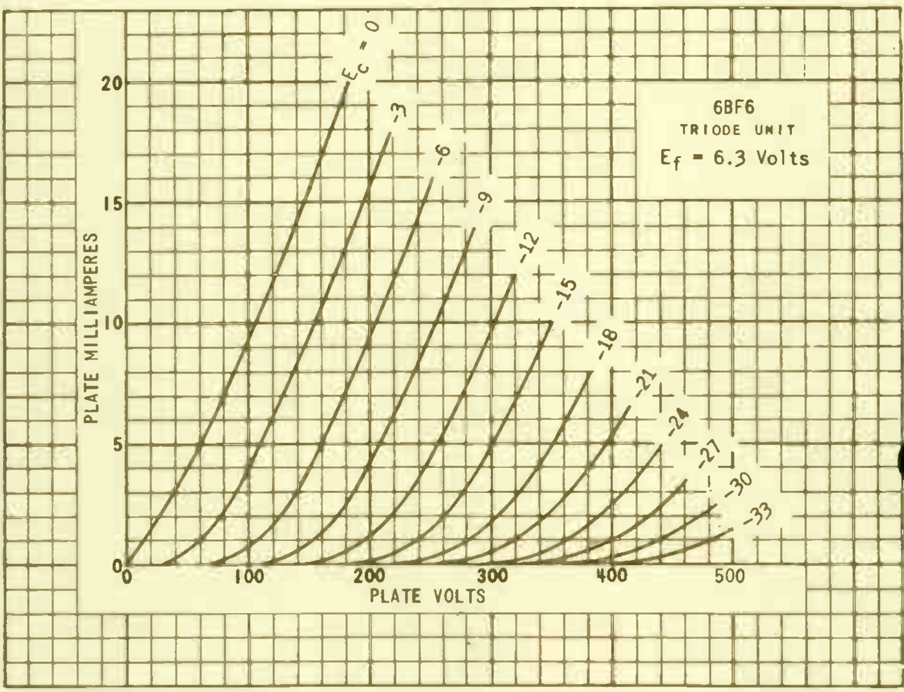
DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	300	VOLTS
PLATE DISSIPATION	2.5	WATTS
AVERAGE DIODE CURRENT EACH UNIT FOR CONTINUOUS OPERATION	1.0	MA.

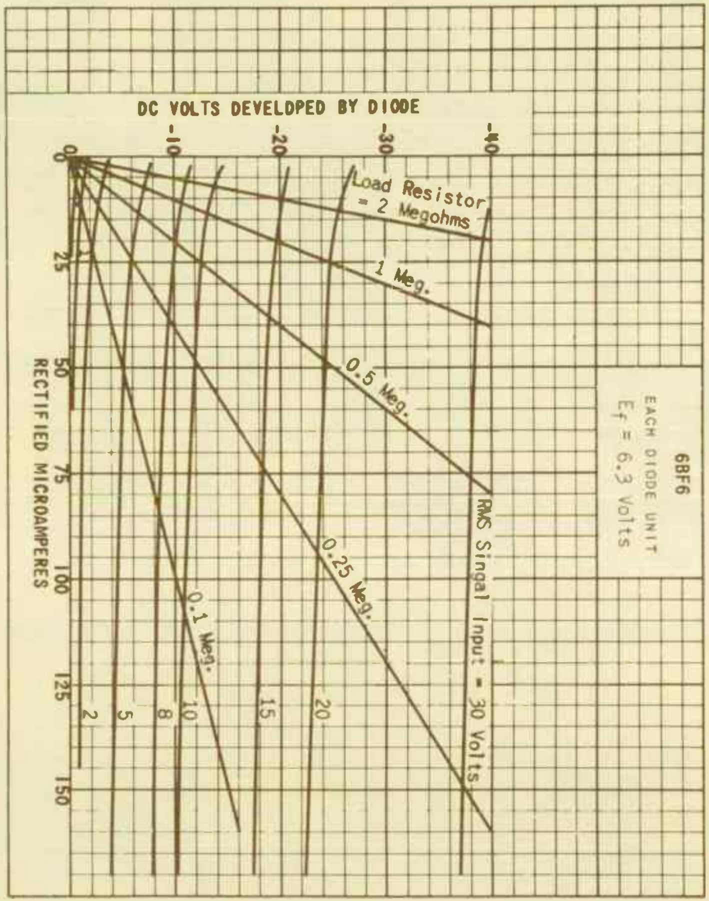
TYPICAL OPERATING CHARACTERISTICS

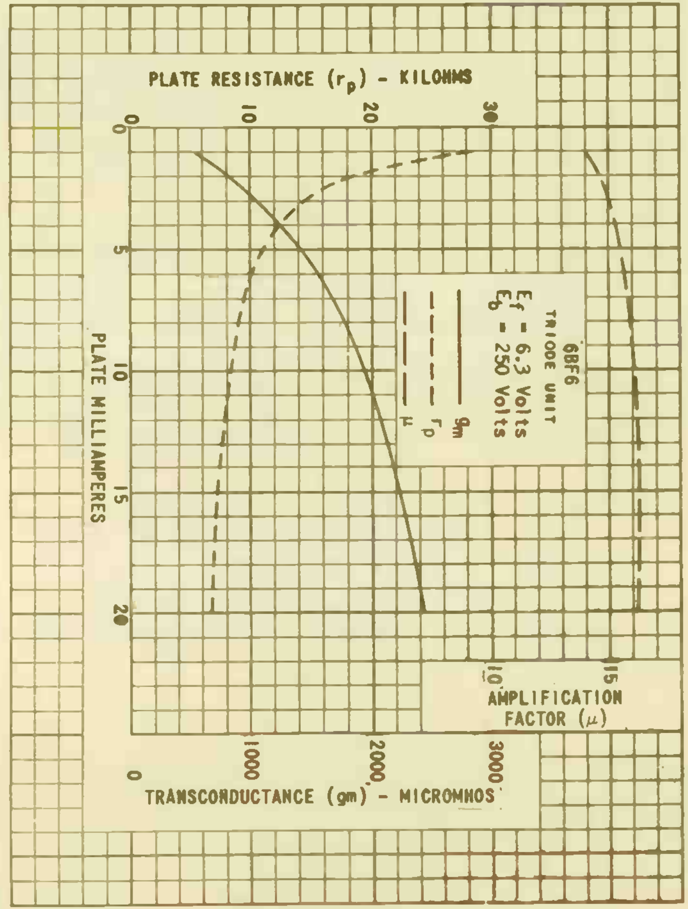
CLASS A_1 AMPLIFIER

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.



PRINTED IN U. S. A.





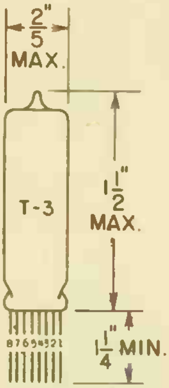
TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., AUGUST 1, 1961 PLATE #6236

6BF6

TUNG-SOL

DOUBLE TRIODE

SUBMINIATURE TYPE

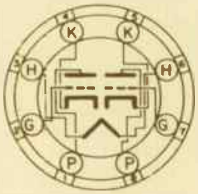


GLASS BULB

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

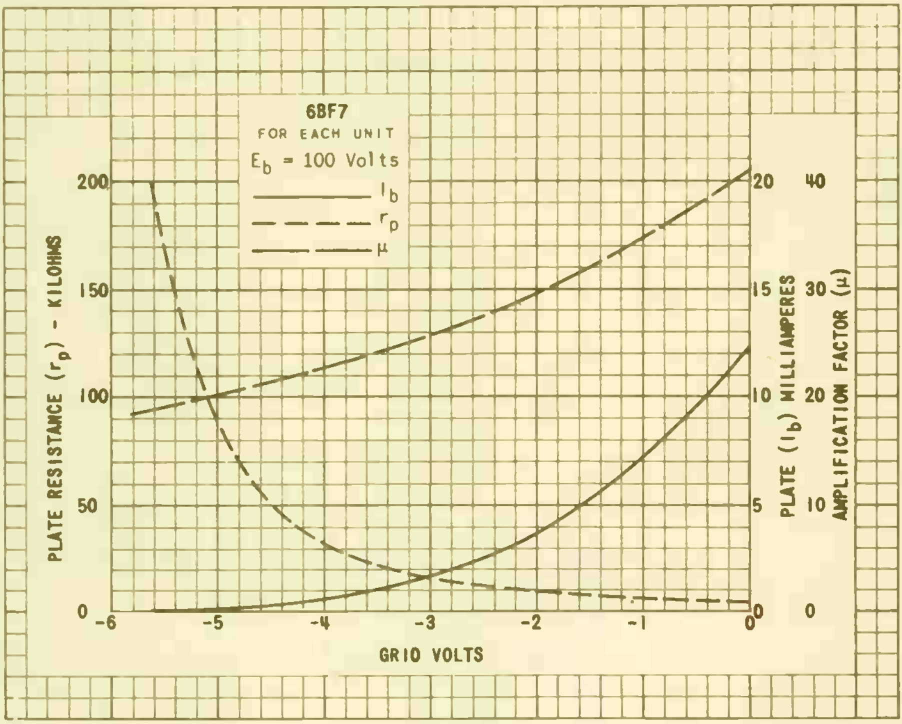
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.0	WATT

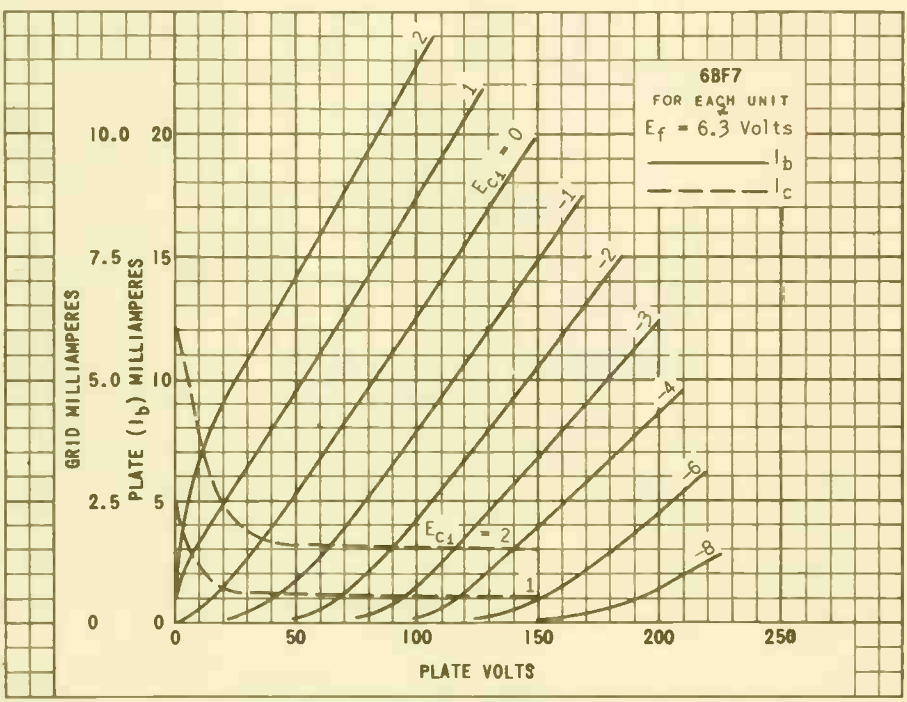
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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

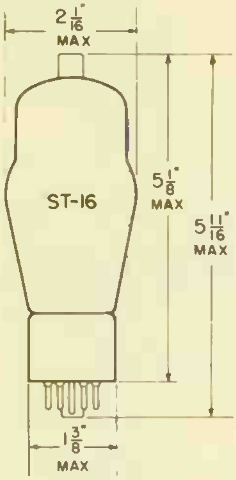
PRINTED IN U.S.A.


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
E_{c1} = 0
2
1
-1
-2
-3
-4
-6
-8
E_{c1} = 2
1
GRID MILLIAMPERES
PLATE (I_b) MILLIAMPERES
PLATE VOLTS
10.0
7.5
5.0
2.5
0
20
15
10
5
0
0
50
100
150
200
250

TUNG-SOL

BEAM PENTODE

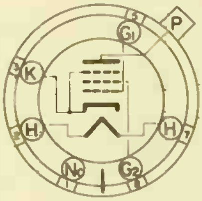


GLASS BULB
SMALL CAP

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: (C_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

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS ←

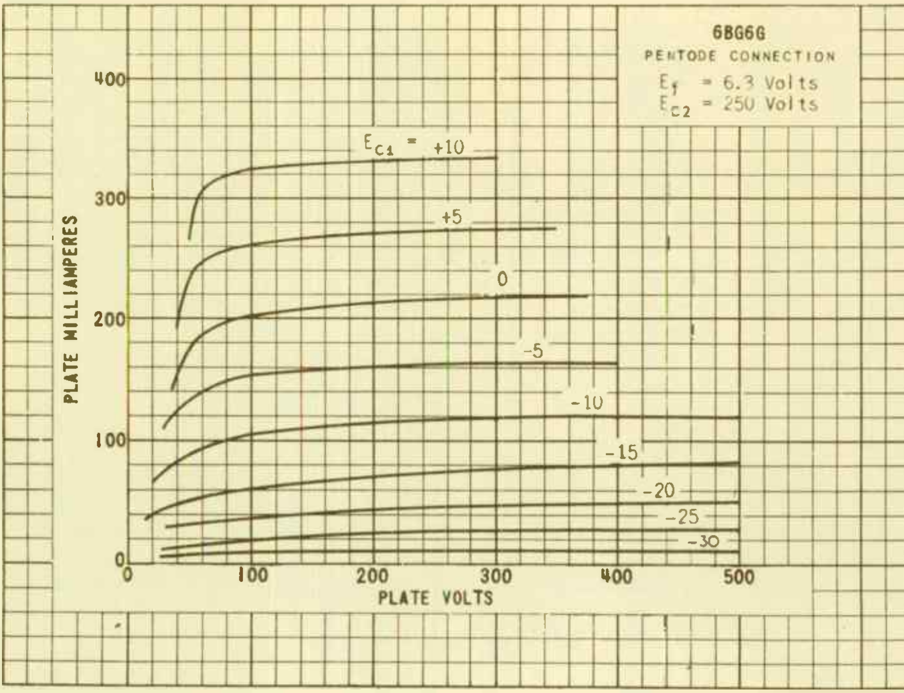
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.9	AMP.
PENTODE OPERATION: WITH E_b=250 V., E_{c2}=250V., & E_{c1}=−15V.		
PLATE CURRENT	75	MA.
GRID #2 CURRENT	4	MA.
TRANSCONDUCTANCE	6 000	μMHOS
PLATE RESISTANCE	25 000	OHMS
ZERO BIAS: WITH E_b =60V. & E_{c2}=250V. (INSTANTANEOUS VALUES)		
PLATE CURRENT	180	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.



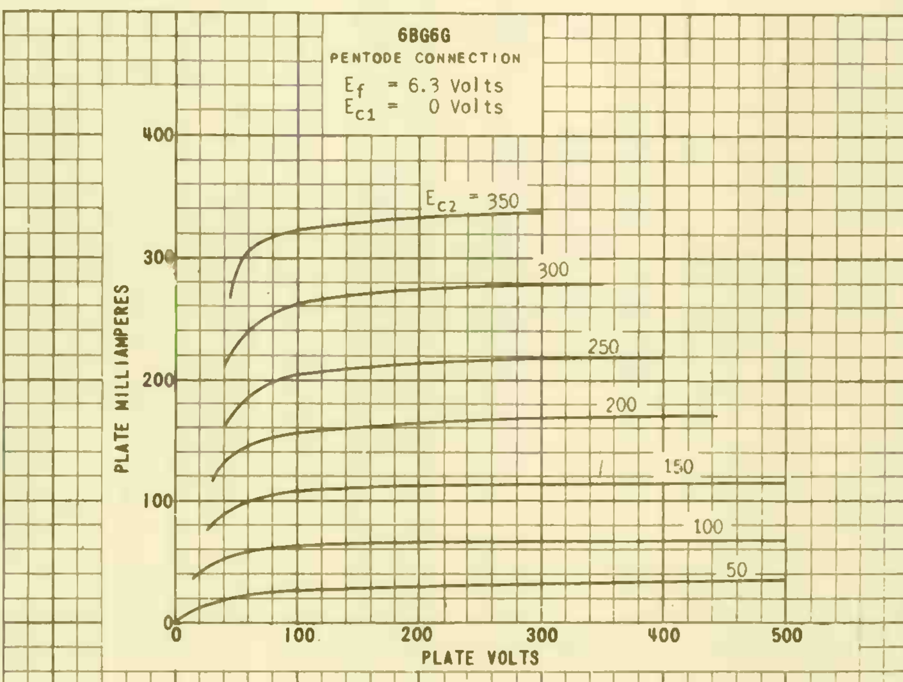


PLATE 2166
APR. 1, 1949

6BG6G

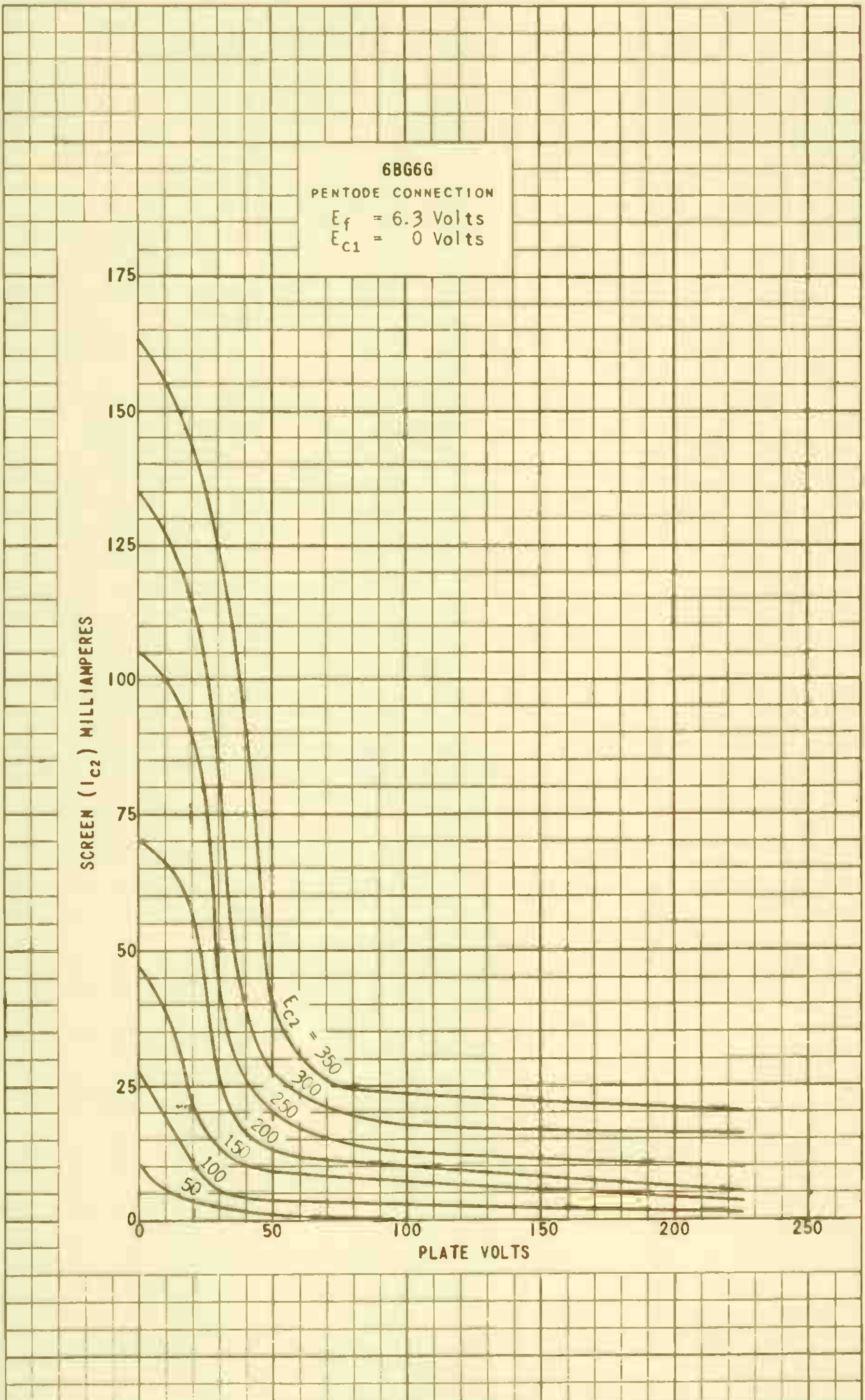
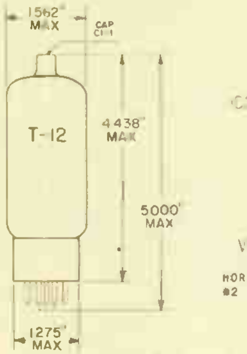


PLATE 2267
APR. 1, 1949

     ELECTRON TUBE DIVISION   NEWARK NEW JERSEY U S A

TUNG-SOL

BEAM POWER PENTODE



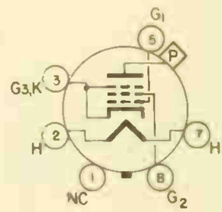
GLASS BULB
B8-110 OR B8-120 OR B8-123 ←
SHORT MEDIUM SHELL
6 PIN OCTAL WITH
EXTERNAL BARRIERS

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

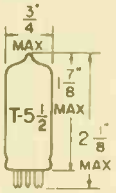
PLATE VOLTAGE	60	250	VOLTS
GRID #2 VOLTAGE	250	250	VOLTS
PLATE CURRENT	180	75	MA.
GRID #2 CURRENT	18	4.0	MA.
GRID #1 VOLTAGE	0	−15	VOLTS
PLATE RESISTANCE (APPROX.)		25 000	OHMS
TRANSCONDUCTANCE		6 000	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR I_b=1.0 MA.		−45	VOLTS
TRIODE AMPLIFICATION FACTOR[C]		8.0	

[C] TRIODE CONNECTED (GRID #2 TIED TO PLATE): $E_b = E_{c2} = 250$ VOLTS AND $E_{c1} = -15$ VOLTS.

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 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

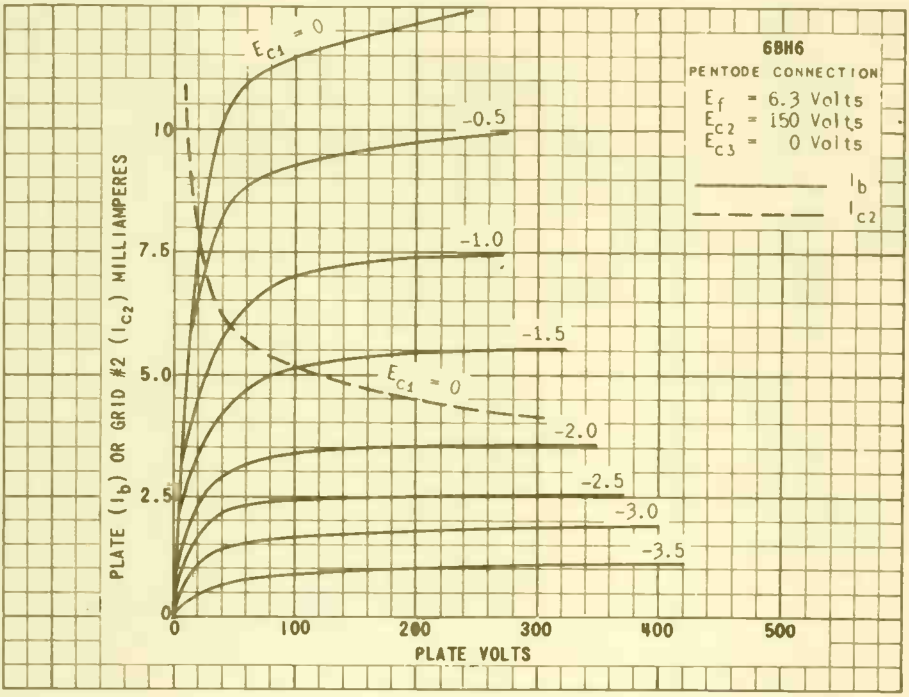
CLASS A_1 AMPLIFIER

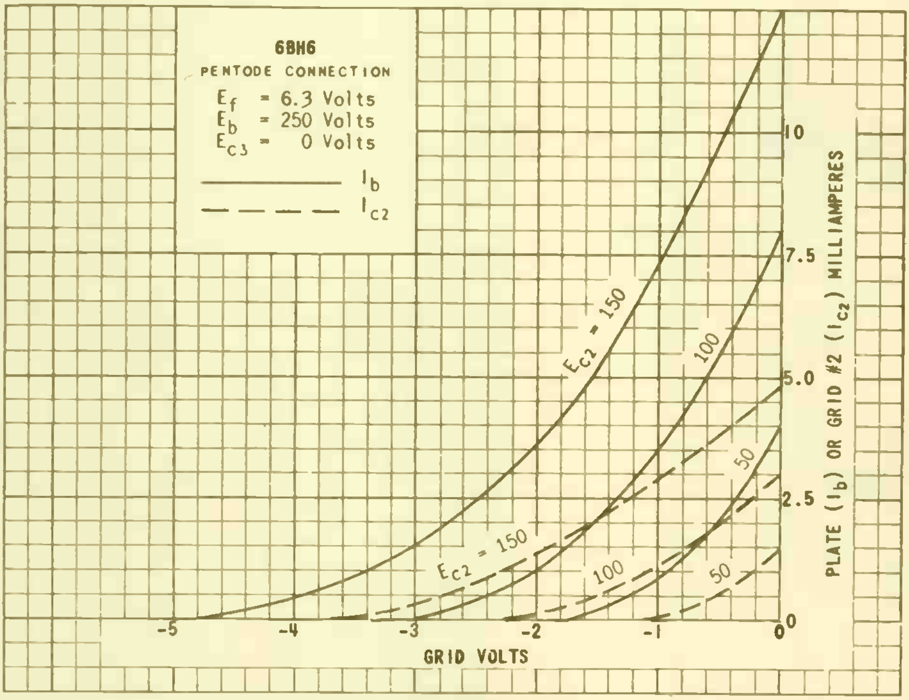
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	PIN #7 CONNECTED TO PIN #2 AT SOCKET		
GRID #2 VOLTAGE	100	150	VOLTS
GRID #1 VOLTAGE	-1	-1	VOLT
PLATE RESISTANCE (APPROX.)	0.7	1.4	MEGOHMS
TRANSCONDUCTANCE	3 400	4 600	μMHOS
PLATE CURRENT	3.6	7.4	MA.
GRID #2 CURRENT	1.4	2.9	MA.
GRID #1 VOLTAGE FOR I_b = 10 μA.	-5	-7.7	VOLTS

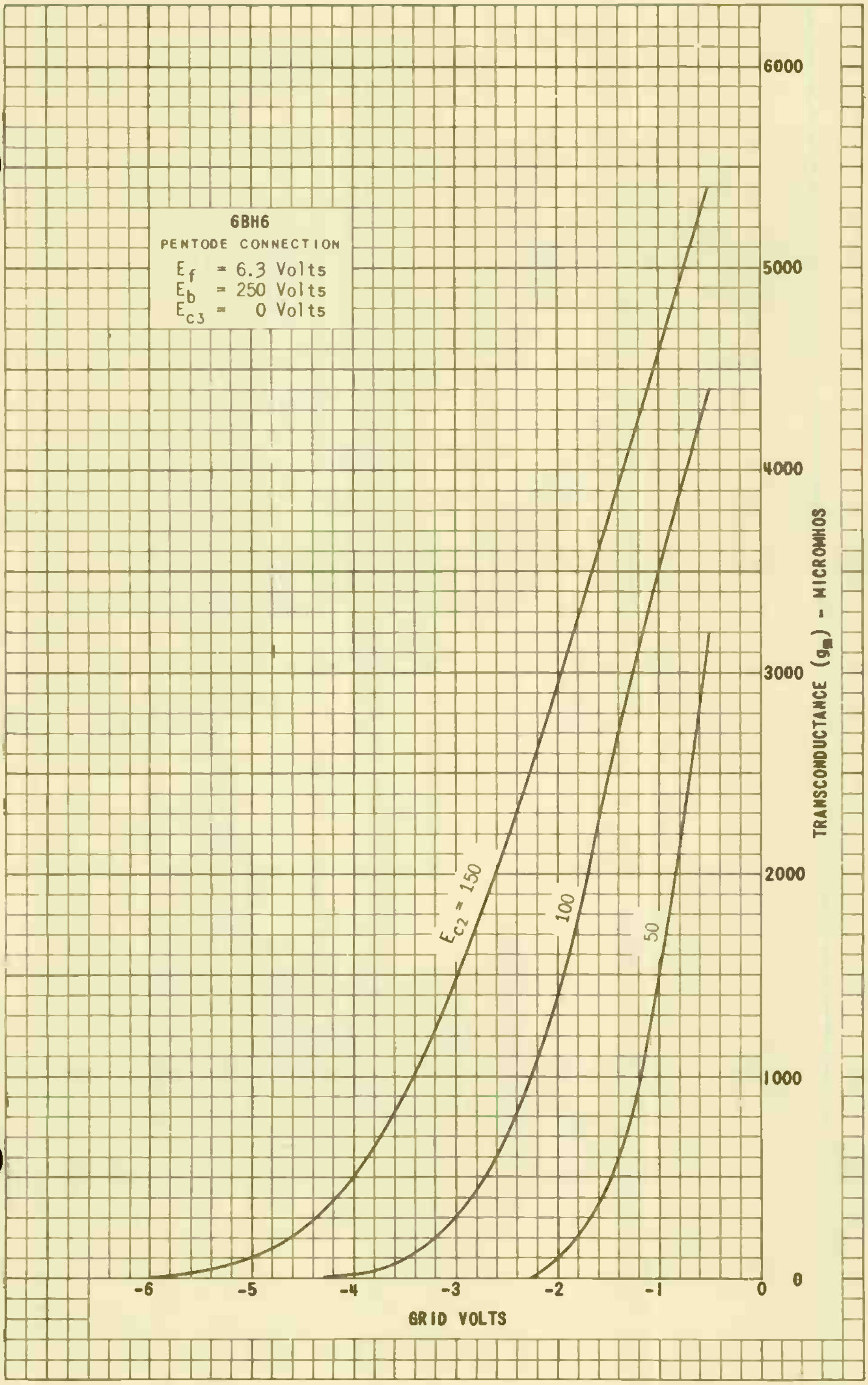
→ INDICATES A CHANGE OR ADDITION.

PRINTED IN U.S.A.

PLATE 2669
JUNE 1 1951


6BH6
PENTODE CONNECTION
Ef = 6.3 Volts
Ec2 = 150 Volts
Ec3 = 0 Volts
Ib
Ic2
Ec1 = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
Ec1 = 0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
2.5
5.0
7.5
10


6BH6
PENTODE CONNECTION
Ef = 6.3 Volts
Eb = 250 Volts
Ec3 = 0 Volts
Ib
Ic2
Ec2 = 150
100
50
Ec2 = 150
100
50
GRID VOLTS
-5
-4
-3
-2
-1
0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
10
7.5
5.0
2.5
0



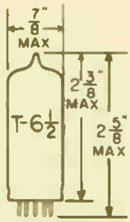
PRINTED IN U. S. A.

PLATE 1924
DEC. 1, 1947

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

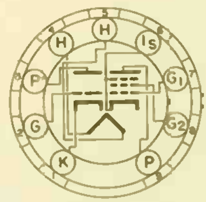


GLASS BULB

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

PRINTED IN U.S.A.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

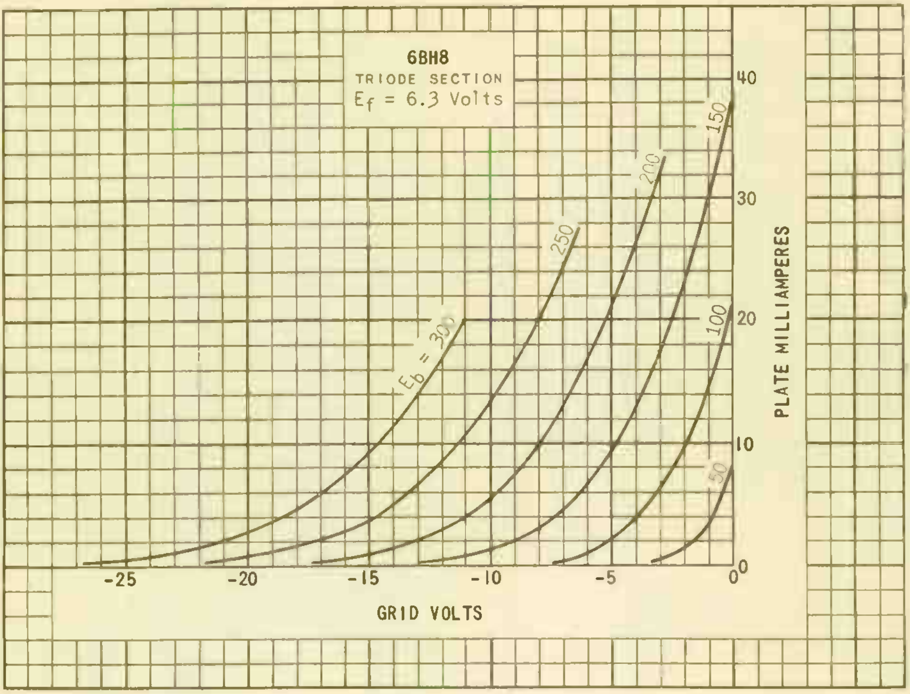
CLASS A_1 AMPLIFIER

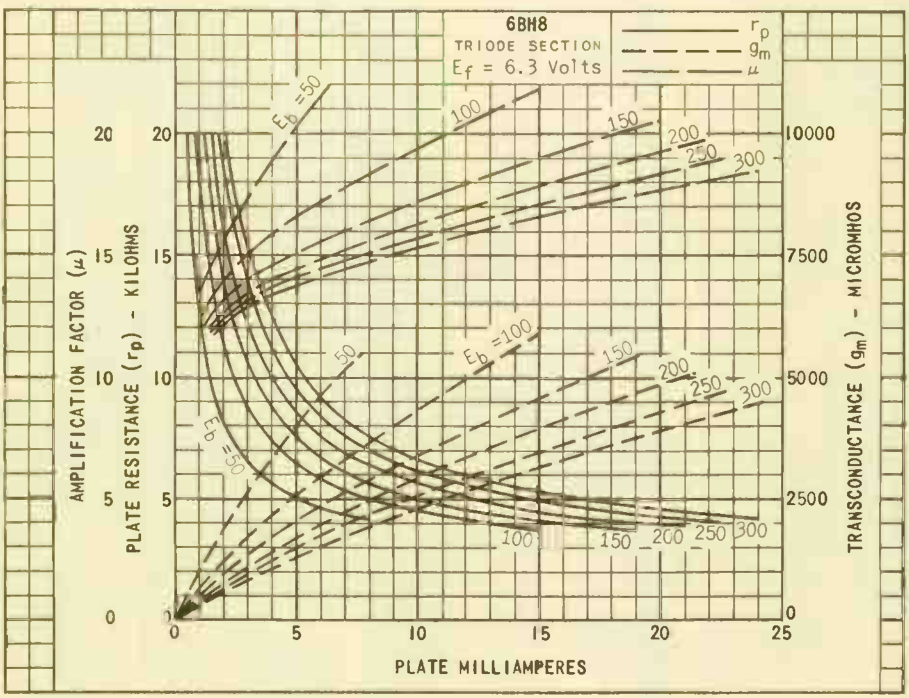
	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	200	150	VOLTS
GRID #2 VOLTAGE	125	---	VOLTS
CATHODE BIAS RESISTOR	82	---	OHMS
AMPLIFICATION FACTOR	---	17	
PLATE RESISTANCE (APPROX.)	150 000	5 150	OHMS
TRANSCONDUCTANCE	7 000	3 300	µMHOS
PLATE CURRENT	15	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

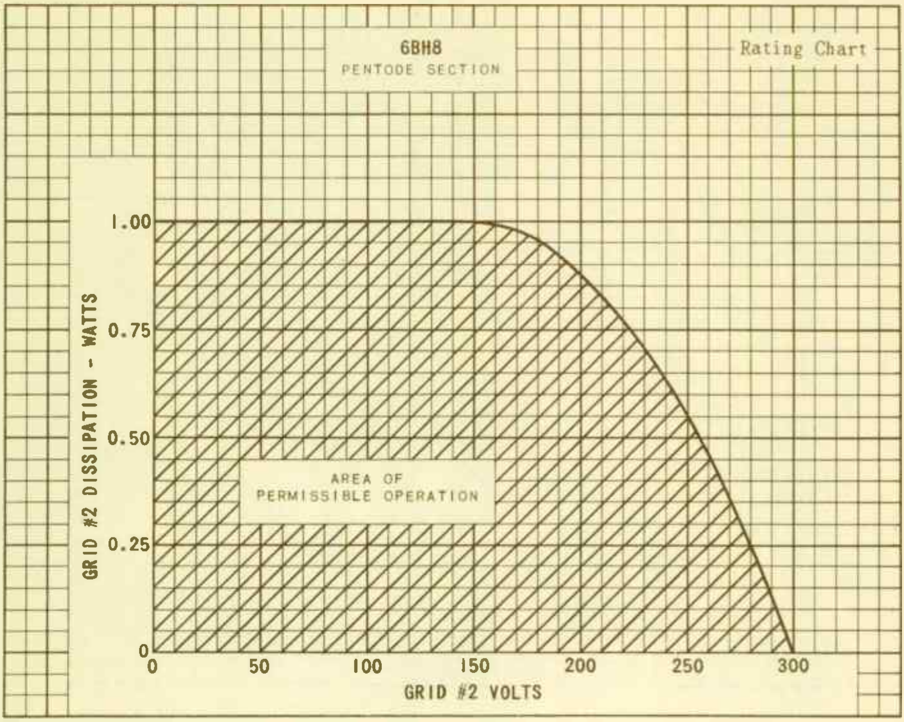
NOTE:

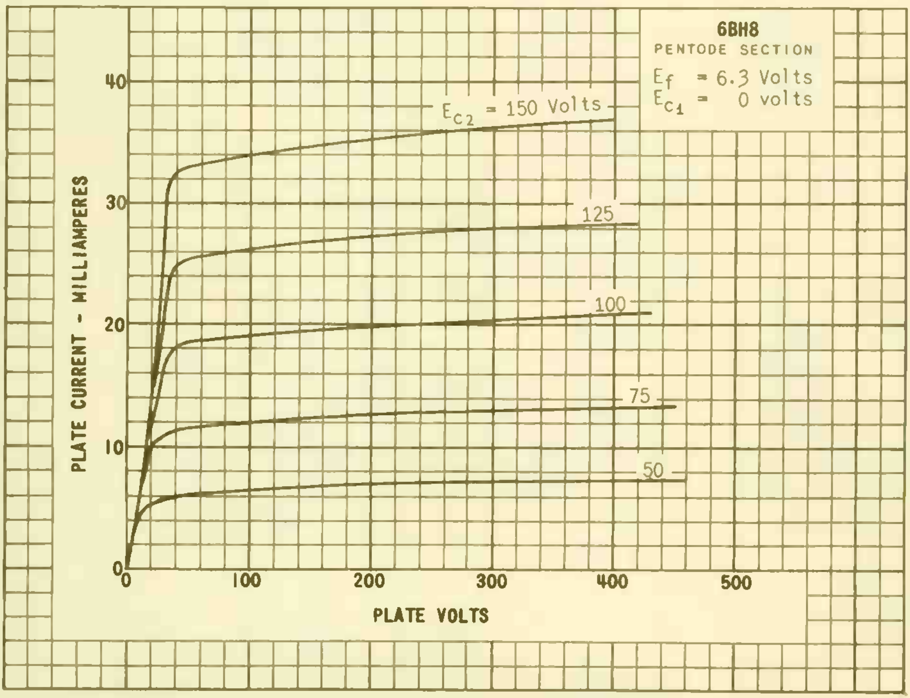
THE TRIODE SECTION OF THE 6BH8 MAY BE DIODE-CONNECTED AND EMPLOYED AS A HIGH-PERVEANCE DIODE IN VIDEO-DETECTOR APPLICATIONS. THE DIODE OPERATION CAN BE OBTAINED EITHER WITH THE TRIODE GRID CONNECTED TO THE TRIODE PLATE AND THE COMBINATION OPERATED AS THE PLATE OF THE DIODE, OR WITH THE TRIODE PLATE GROUNDED AND THE TRIODE GRID OPERATED AS THE PLATE OF THE DIODE.

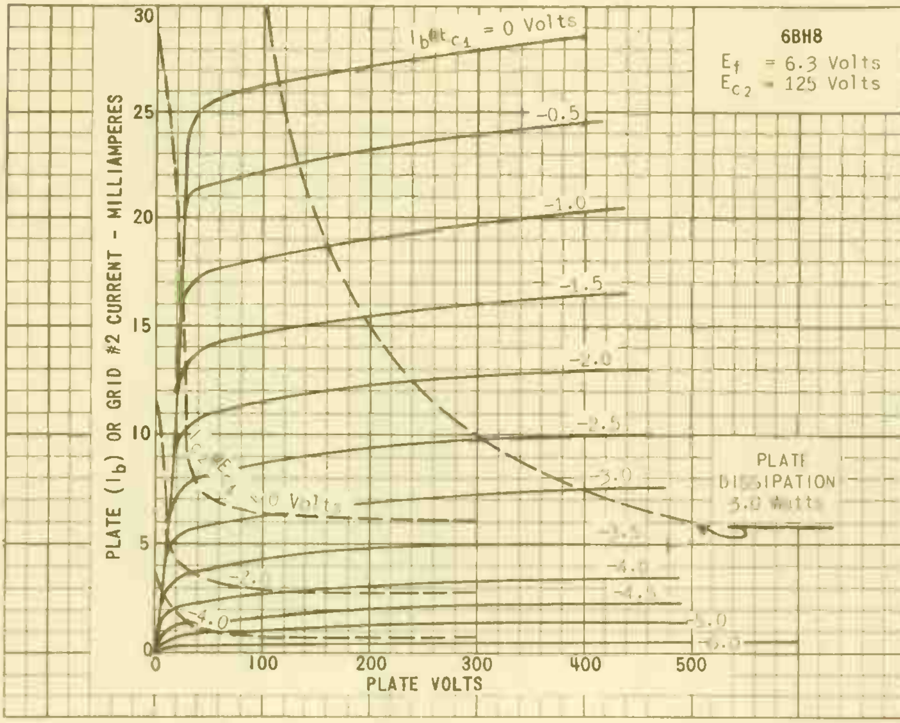
SIMILAR TYPE REFERENCE: EXCEPT FOR THE ELECTRICAL CHARACTERISTICS OF THE TRIODE SECTION, THE 6BH8 IS IDENTICAL TO THE 6AU8.

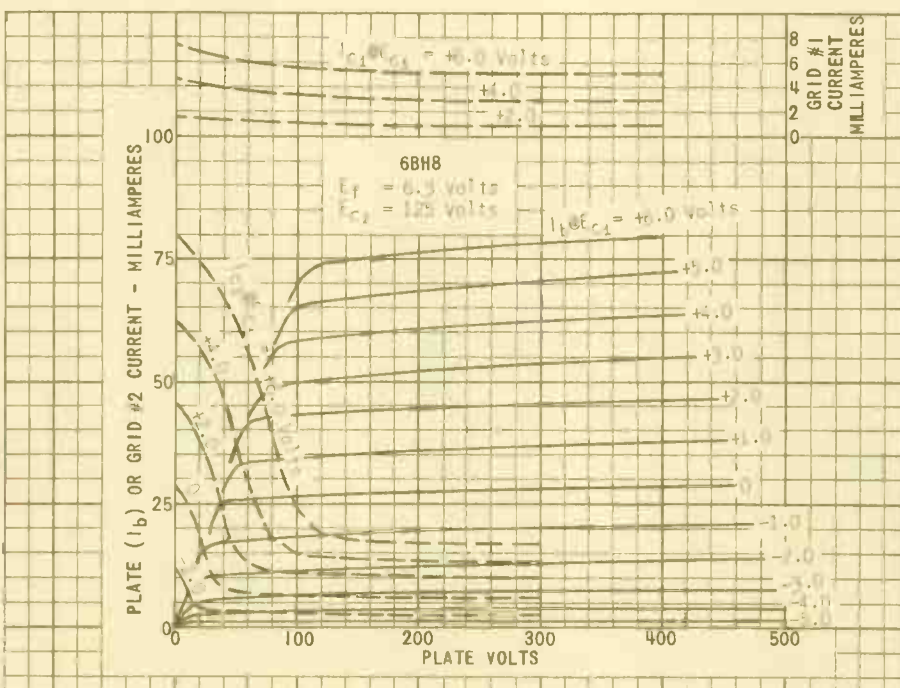

6BH8
TRIODE SECTION
E_f = 6.3 Volts
E_b = 300
250
200
150
100
50
PLATE MILLIAMPERES
40
30
20
10
0
-25
-20
-15
-10
-5
0
GRID VOLTS

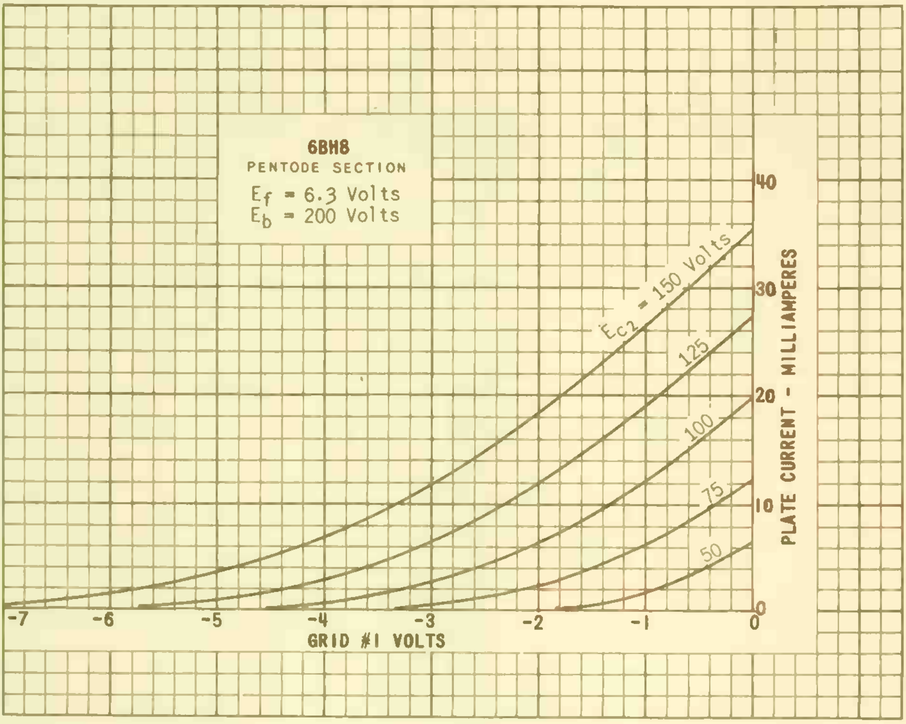

6BH8
TRIODE SECTION
E_f = 6.3 Volts
r_p
g_m
μ
E_b =50
100
150
200
250
300
E_b =100
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - KILOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
7500
5000
2500
0
PLATE MILLIAMPERES

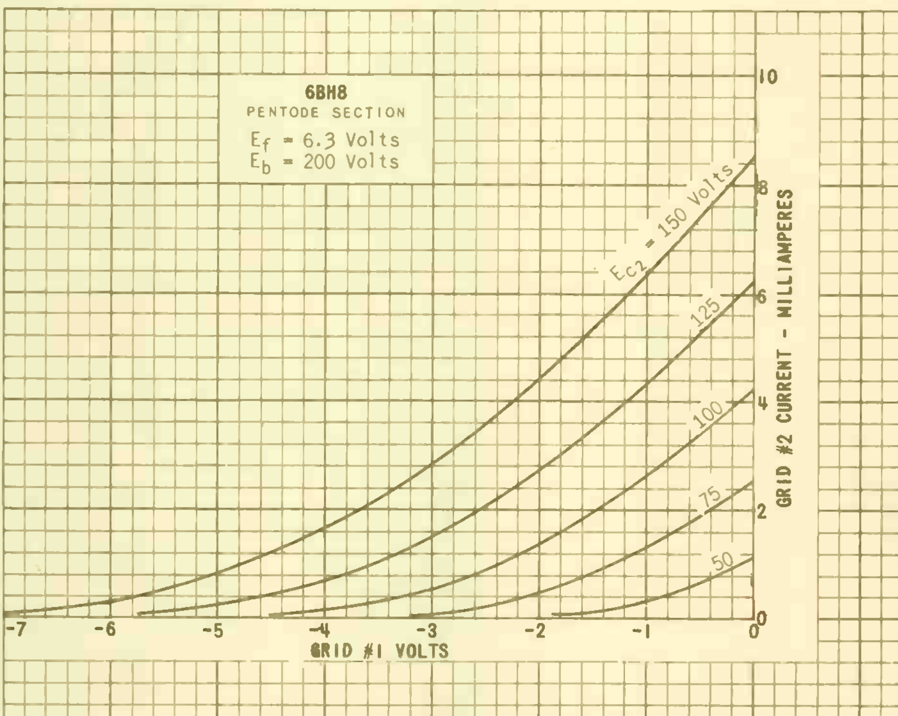

6BH8
PENTODE SECTION
Rating Chart
AREA OF
PERMISSIBLE OPERATION
GRID #2 DISSIPATION - WATTS
1.00
0.75
0.50
0.25
0
0
50
100
150
200
250
300
GRID #2 VOLTS

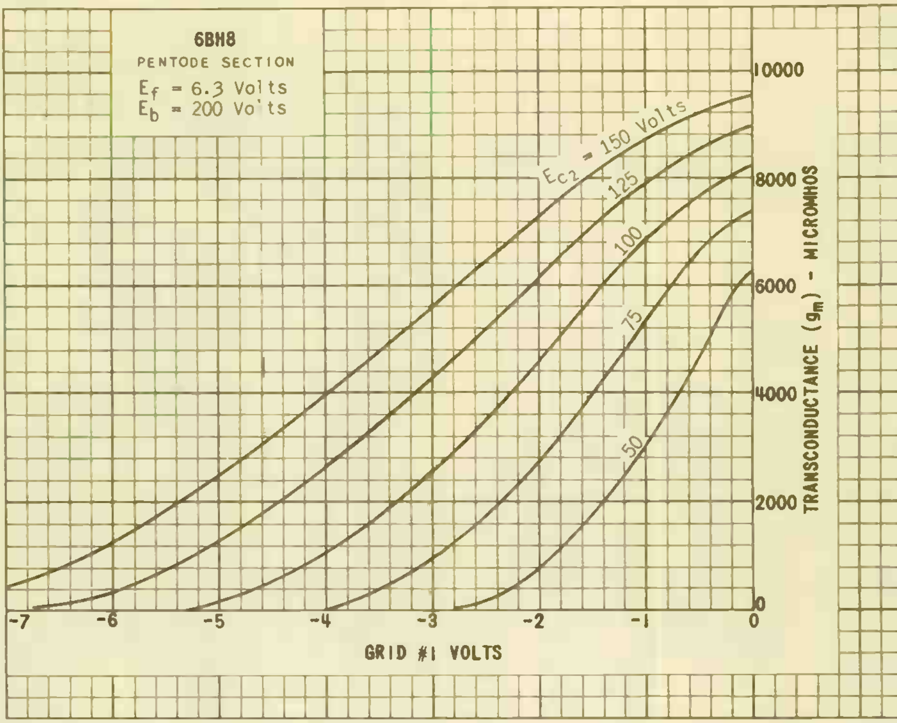

6BH8
PENTODE SECTION
E_f = 6.3 Volts
E_{c_1} = 0 volts
E_{c_2} = 150 Volts
125
100
75
50
PLATE CURRENT - MILLIAMPERES
40
30
20
10
0
0
100
200
300
400
500
PLATE VOLTS

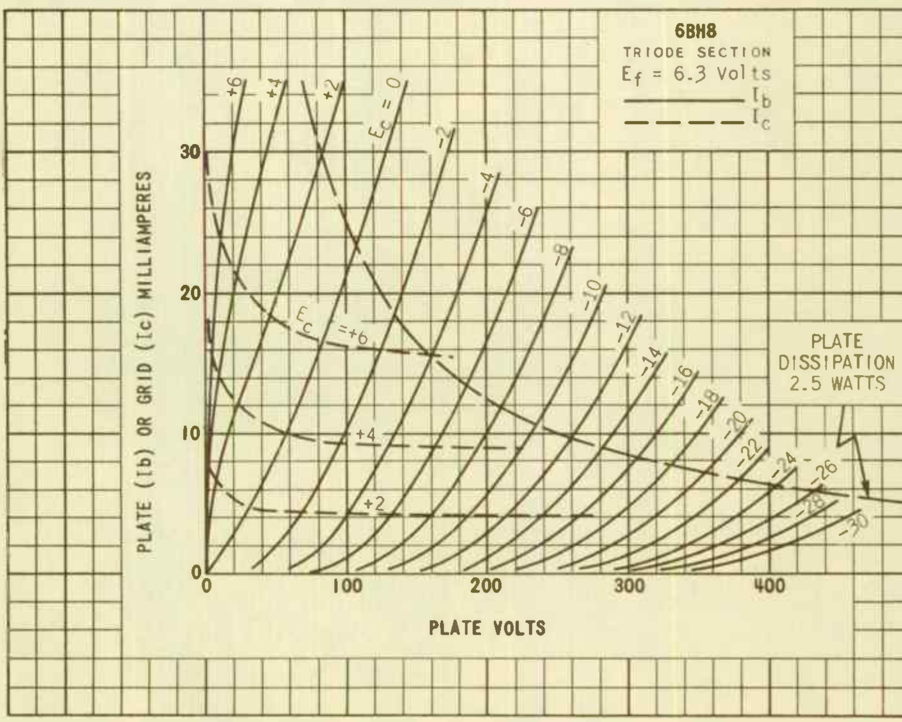

6BH8
E_f = 6.3 Volts
E_{c_2} = 125 Volts
I_b @ E_{c_1} = 0 Volts
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-6.0
I_{c_2} @ E_{c_1} = 0 Volts
-2.0
-4.0
PLATE DISSIPATION 3.0 Watts
PLATE (I_b) OR GRID #2 CURRENT - MILLIAMPERES
PLATE VOLTS


6BH8
E_f = 6.3 Volts
E_{c_2} = 125 Volts
I_{c_1} @ E_{c_1} = +6.0 Volts
+4.0
+2.0
GRID #1 CURRENT MILLIAMPERES
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
PLATE (I_b) OR GRID #2 CURRENT - MILLIAMPERES
PLATE VOLTS


6BH8
PENTODE SECTION
Ef = 6.3 Volts
Eb = 200 Volts
Ec2 = 150 Volts
125
100
75
50
40
30
20
10
0
PLATE CURRENT - MILLIAMPERES
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


6BH8
PENTODE SECTION
Ef = 6.3 Volts
Eb = 200 Volts
Ec2 = 150 Volts
125
100
75
50
10
8
6
4
2
0
GRID #2 CURRENT - MILLIAMPERES
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS

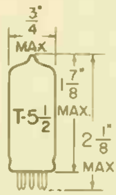

6BH8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c_2} = 150 Volts
125
100
75
50
TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
8000
6000
4000
2000
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


6BH8
TRIODE SECTION
E_f = 6.3 Volts
I_b
I_c
+6
+4
+2
E_c = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
E_c = +6
+4
+2
PLATE DISSIPATION 2.5 WATTS
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
30
20
10
0
0
100
200
300
400
PLATE VOLTS

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

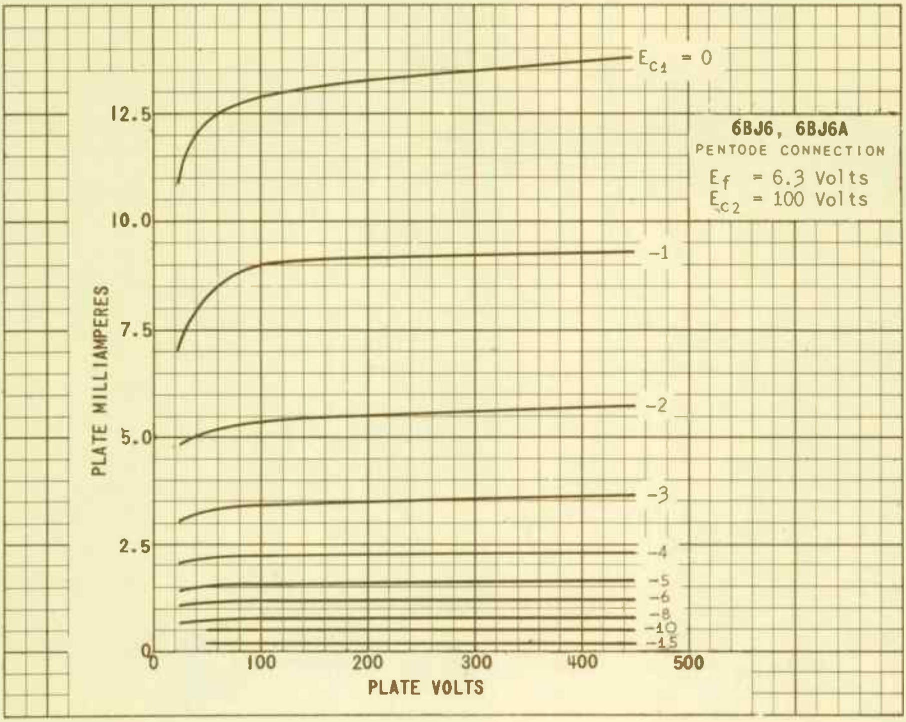
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

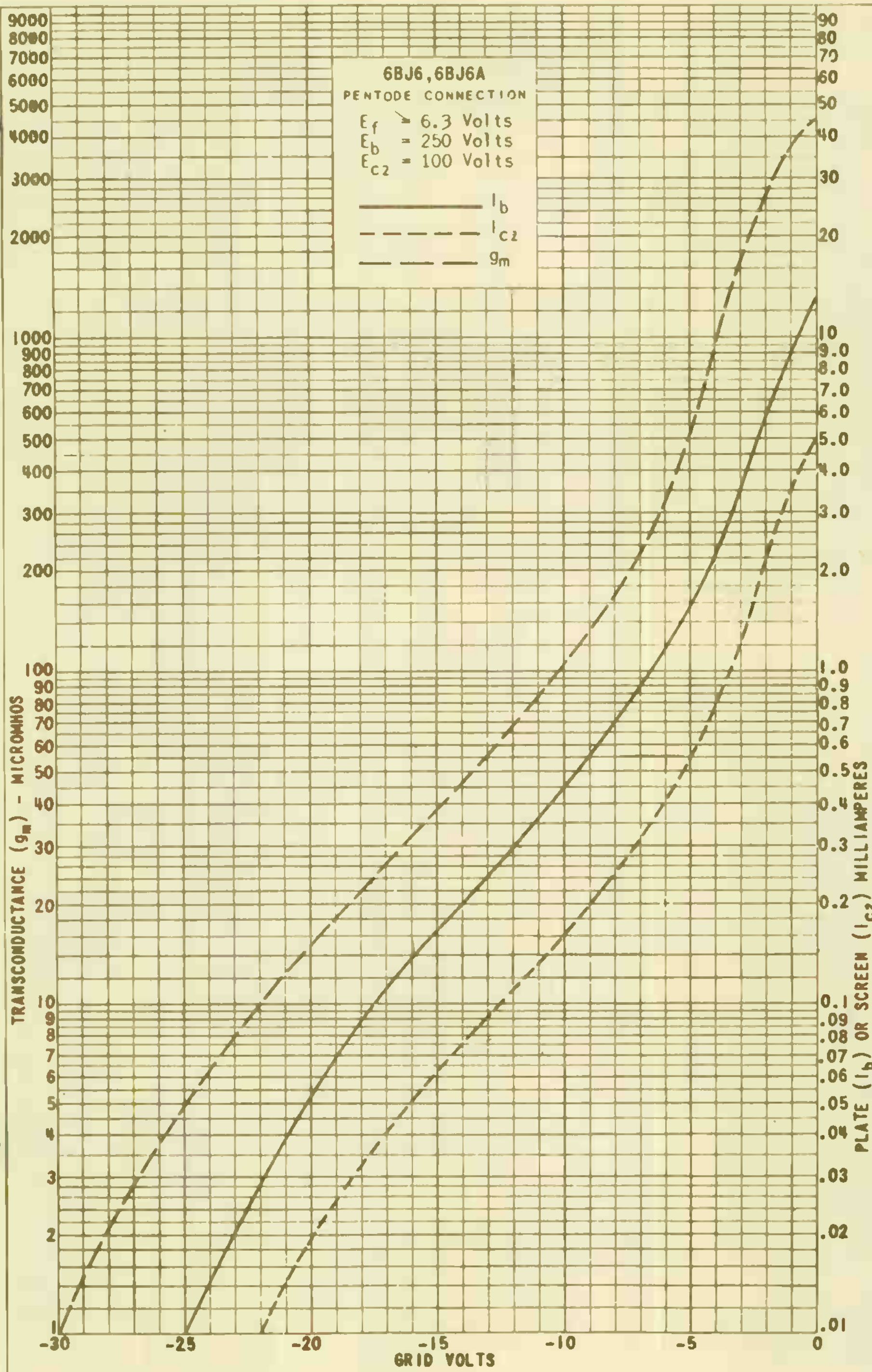
CLASS A_1 AMPLIFIER

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	1.3	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

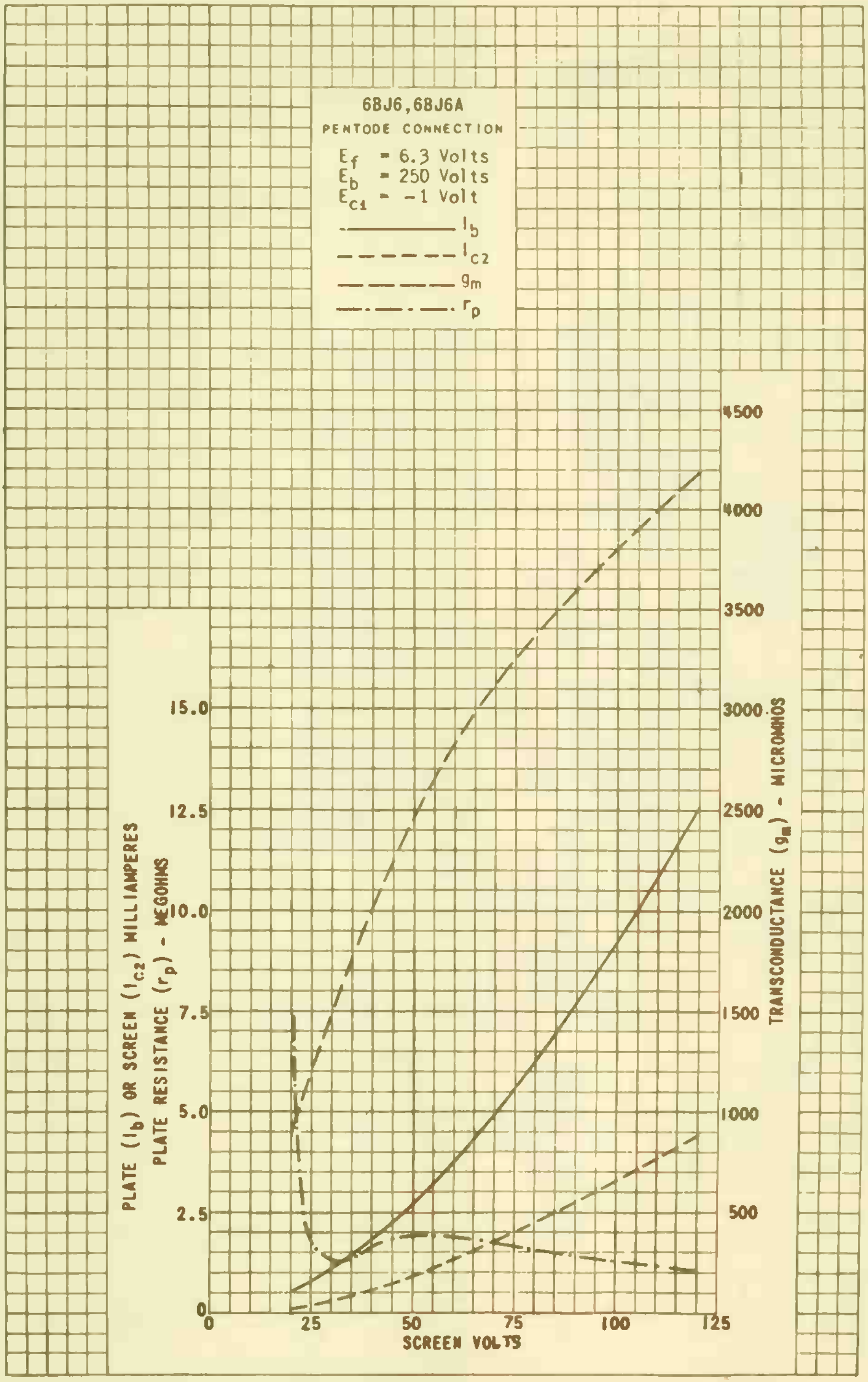
THE INTERFACE IMPEDANCE CONTROL CONSISTS OF A LIFE TEST CONDUCTED FOR 500 HOURS WITH THE FILAMENT OPERATING WITH 6.9 VOLT. IMPOSED. THE OTHER TUBE ELEMENTS ARE UNCONNECTED SIMULATING OPERATION AT CUTOFF CONDITIONS. FOLLOWING LIFE TEST THE SAMPLE TUBES ARE MEASURED AT CONDITIONS Ef=5.7V; Eb= Ec2= Ec3= 70Vdc; AND Ec1 ADJUSTED FOR Ib=4.0 mAdc. THE MAXIMUM ALLOWABLE VALUE FOR INTERFACE IMPEDANCE IS 70 OHMS. **(NOTE IS FOR 6BJ6A ONLY)**

PRINTED IN U.S.A.


6BJ6, 6BJ6A
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 100 Volts
E_{c1} = 0
-1
-2
-3
-4
-5
-6
-8
-10
-15
PLATE MILLIAMPERES
12.5
10.0
7.5
5.0
2.5
0
0
100
200
300
400
500
PLATE VOLTS



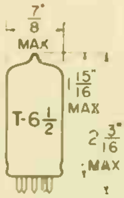
6BJ6,6BJ6A
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 100 Volts
I_b
I_{c2}
g_m
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE (I_b) OR SCREEN (I_{c2}) MILLIAMPERES
GRID VOLTS


6BJ6, 6BJ6A
PENTODE CONNECTION
Ef = 6.3 Volts
Eb = 250 Volts
Ec1 = -1 Volt
Ib
Ic2
gm
rp
PLATE (Ib) OR SCREEN (Ic2) MILLIAMPERES
PLATE RESISTANCE (rp) - MEGOHMS
0
2.5
5.0
7.5
10.0
12.5
15.0
TRANSCONDUCTANCE (gm) - MICROMHOS
500
1000
1500
2000
2500
3000
3500
4000
4500
SCREEN VOLTS
0
25
50
75
100
125

TUNG-SOL

TRIPLE DIODE

MINIATURE TYPE

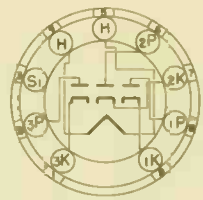


GLASS BULB

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

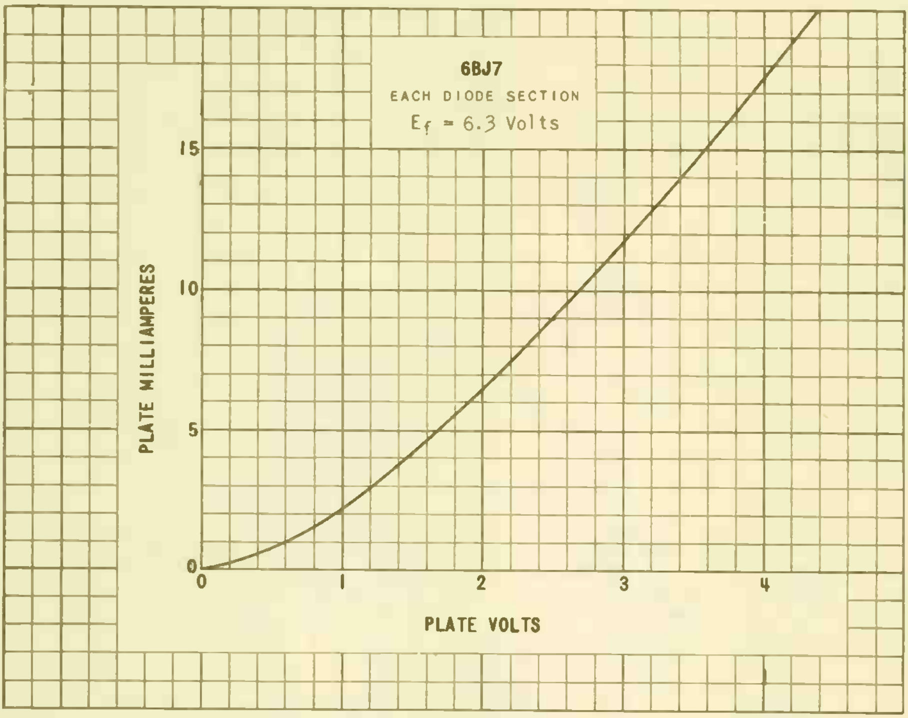
RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

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

CONTINUED ON FOLLOWING PAGE

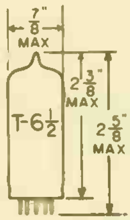
→ INDICATES A CHANGE.


6BJ7
EACH DIODE SECTION
E_f = 6.3 Volts
PLATE MILLIAMPERES
0
5
10
15
0
1
2
3
4
PLATE VOLTS

TUNG-SOL

DOUBLE DIODE TRIODE

MINIATURE TYPE

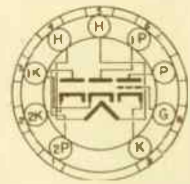


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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.

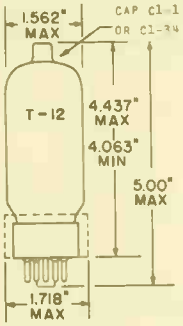
[C] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF TS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE

[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

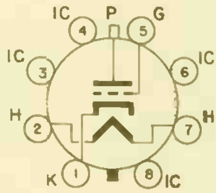
SHORT MEDIUM SHELL
8 PIN OCTAL B8-[illegible] OR B8-[illegible]

OUTLINE DRAWING
JEDEC 12-[illegible]

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	50 000	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.

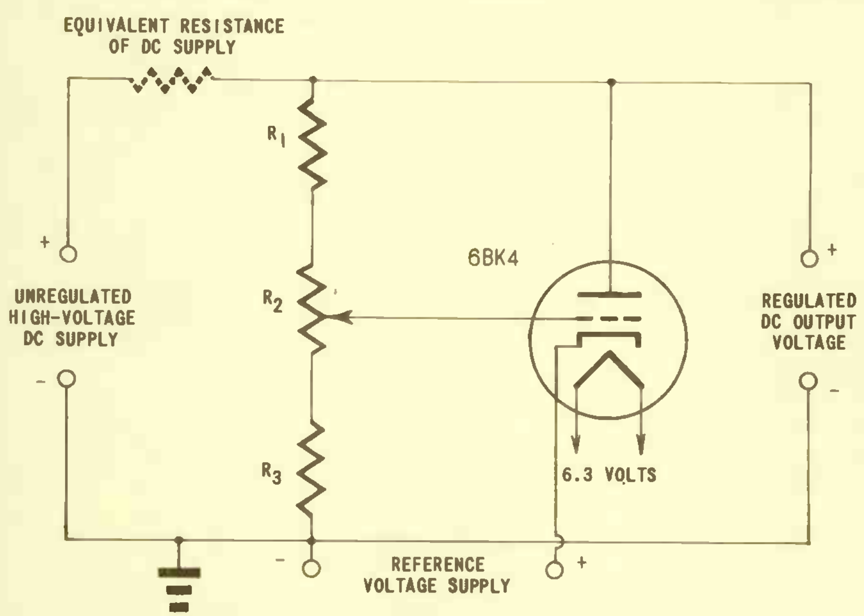
TUNG-SOL

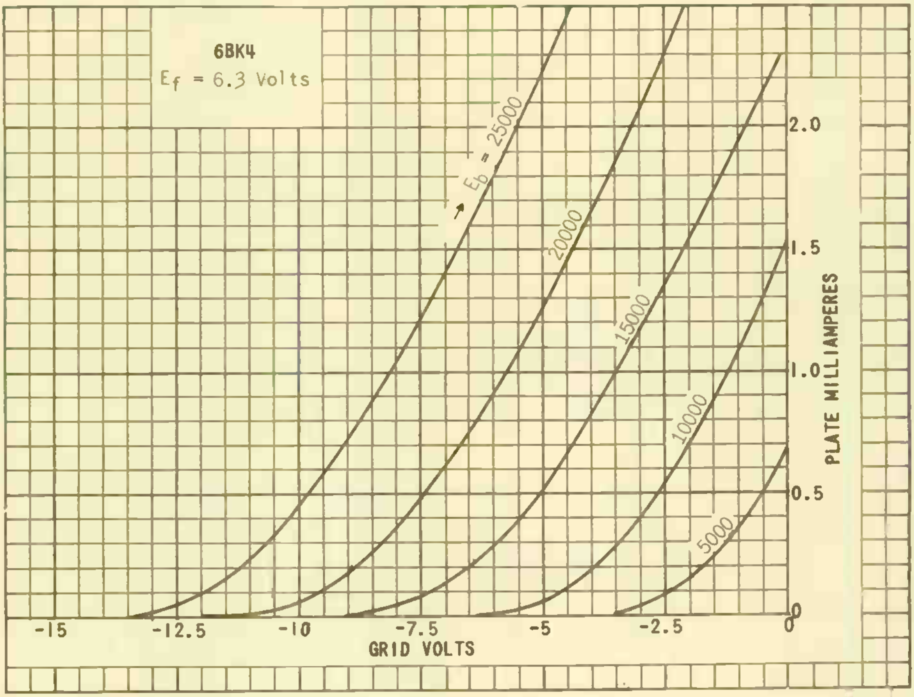
CONTINUED FROM PRECEDING PAGE

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	

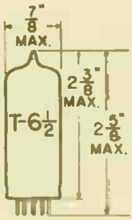



6BK4
E_f = 6.3 Volts
E_b = 25000
20000
15000
10000
5000
PLATE MILLIAMPERES
2.0
1.5
1.0
0.5
0
-15
-12.5
-10
-7.5
-5
-2.5
0
GRID VOLTS

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

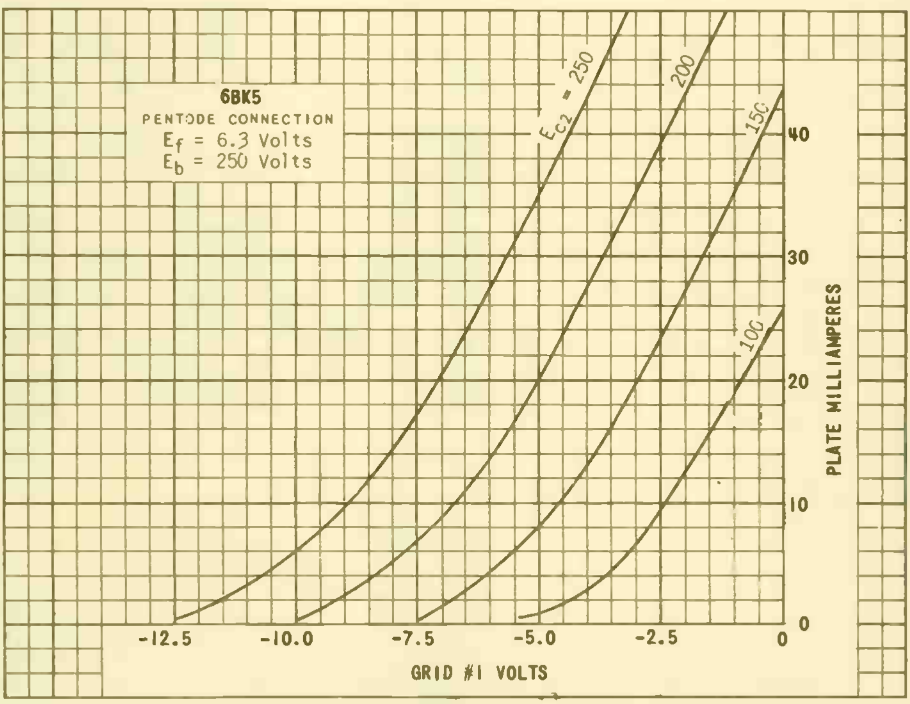
TUNG-SOL

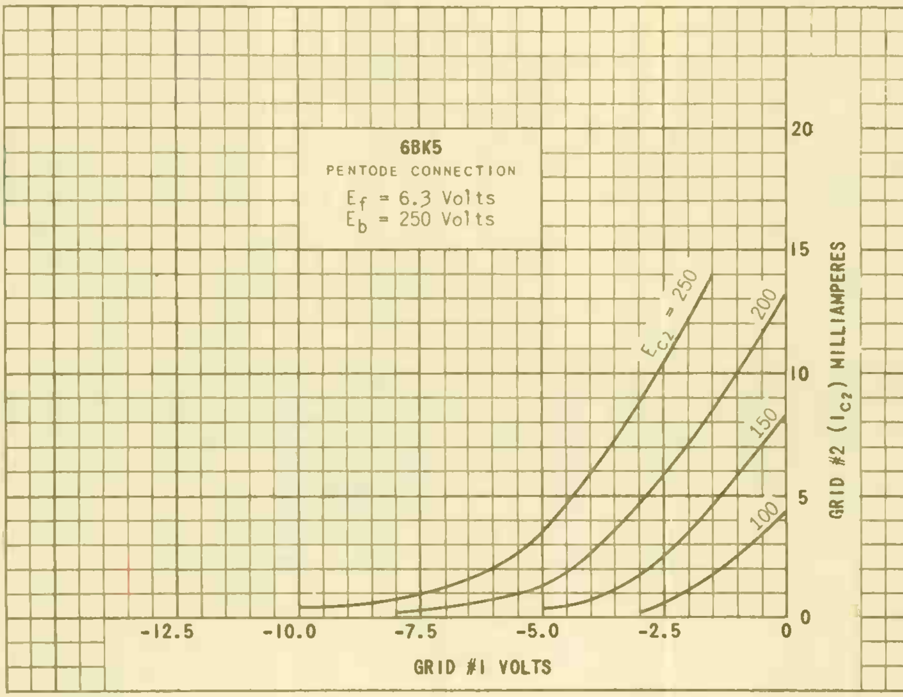
CONTINUED FROM PRECEDING PAGE

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




6BK5
PENTODE CONNECTION
Ef = 6.3 Volts
Eb = 250 Volts
Ec2 = 250
200
150
100
20
15
10
5
0
-12.5
-10.0
-7.5
-5.0
-2.5
GRID #1 VOLTS
GRID #2 (Ic2) MILLIAMPERES

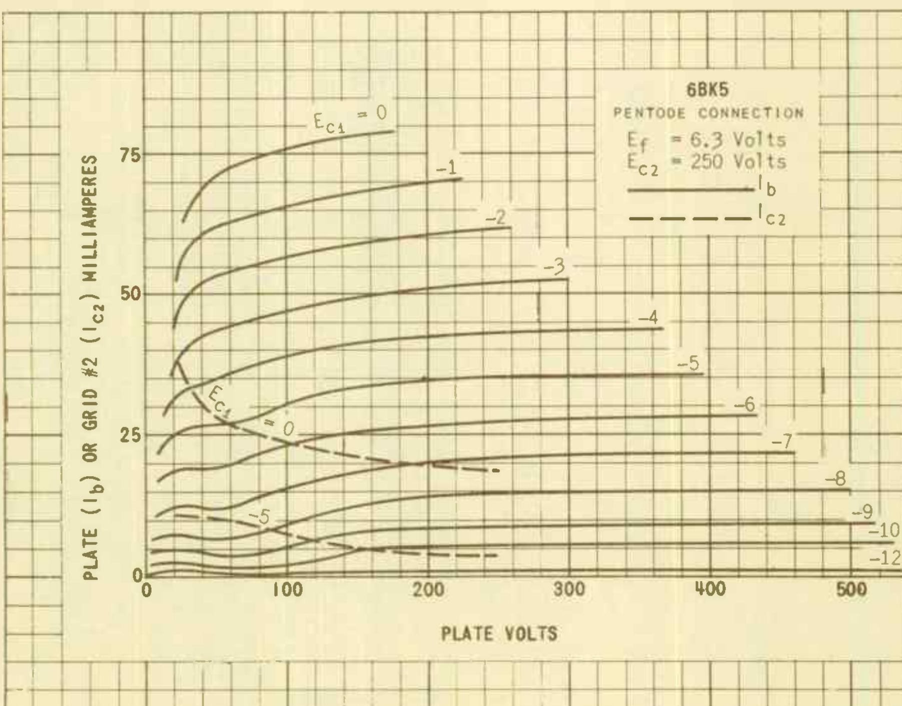
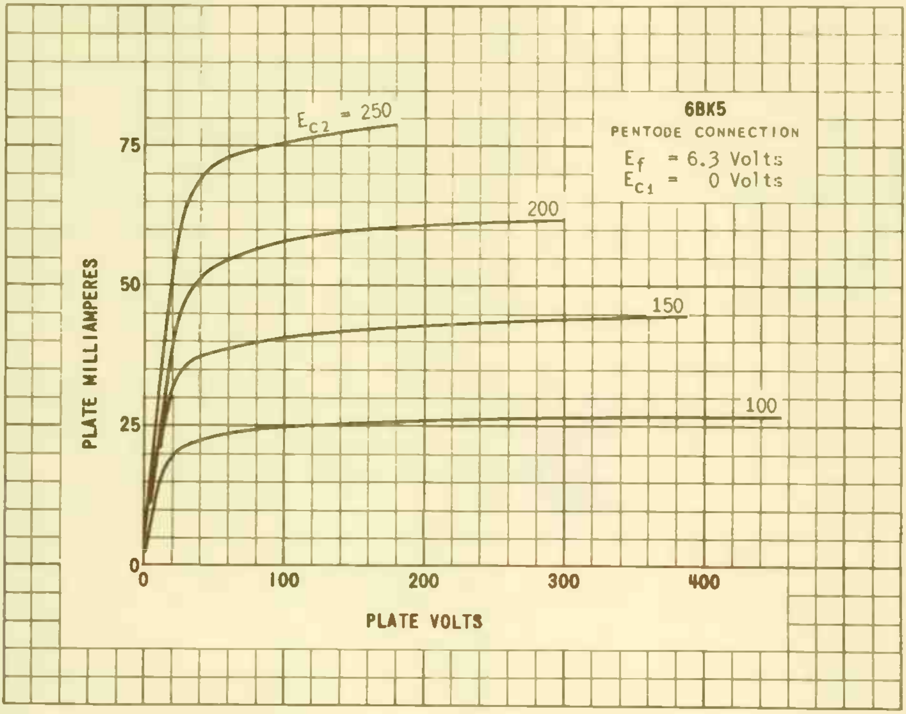

6BK5
PENTODE CONNECTION
Ef = 6.3 Volts
Ec2 = 250 Volts
Ib
Ic2
Ec1 = 0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-12
Ec1 = 0
-5
75
50
25
0
100
200
300
400
500
PLATE VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES

PLATE 3187

6BK5 (25BK5)



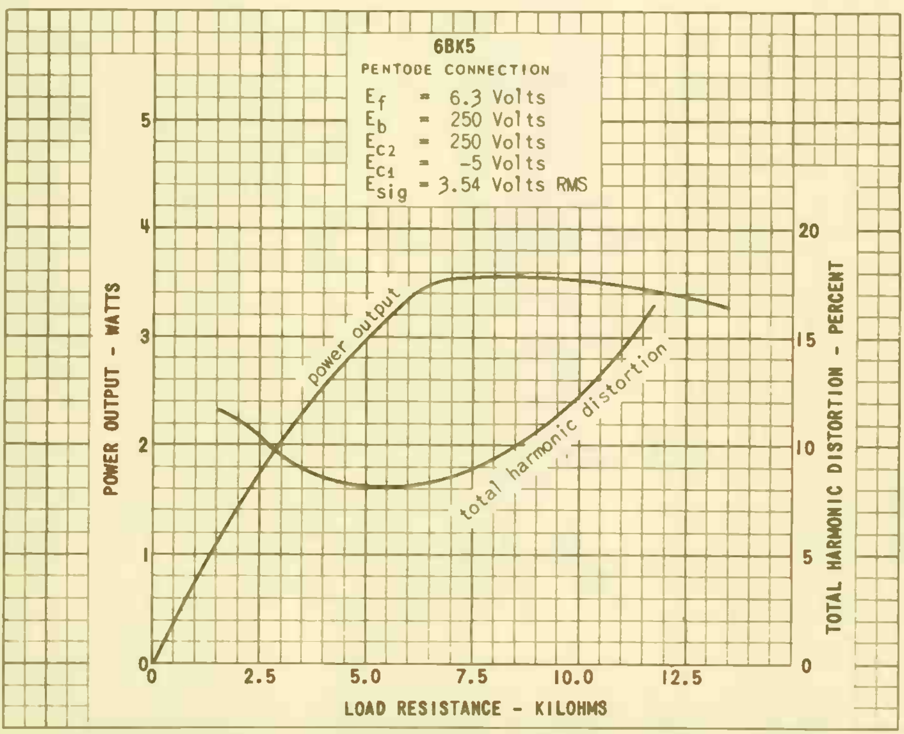
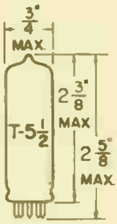


PLATE 3188

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

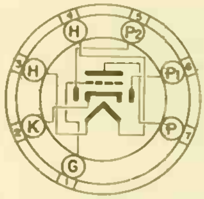


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

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

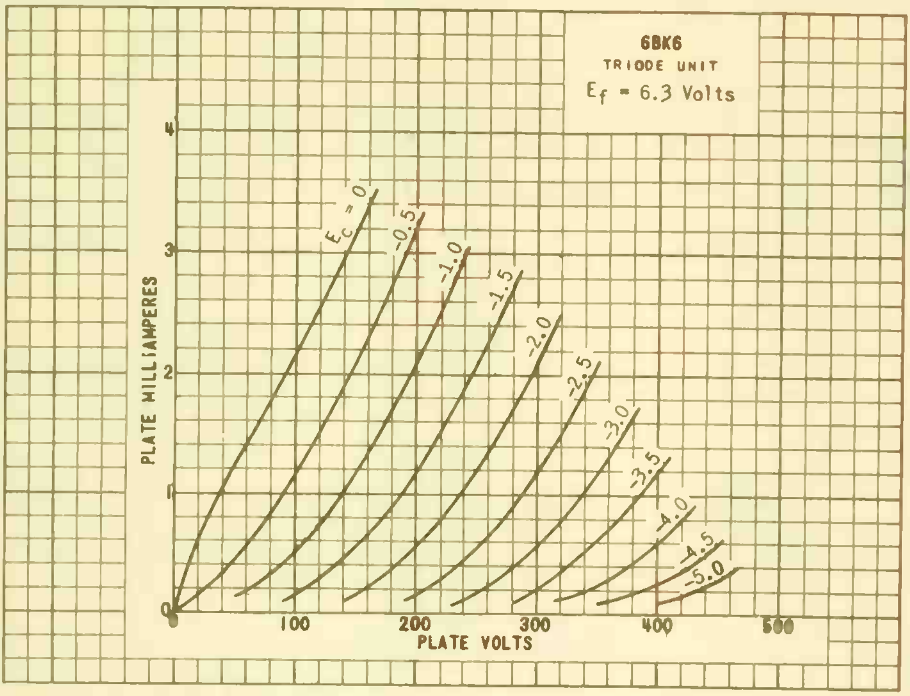
CLASS A_1 AMPLIFIER

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	

PRINTED IN U. S. A.

PLATE 2332
FEB. 1 1950

6BK6 (12BK6, 26BK6)



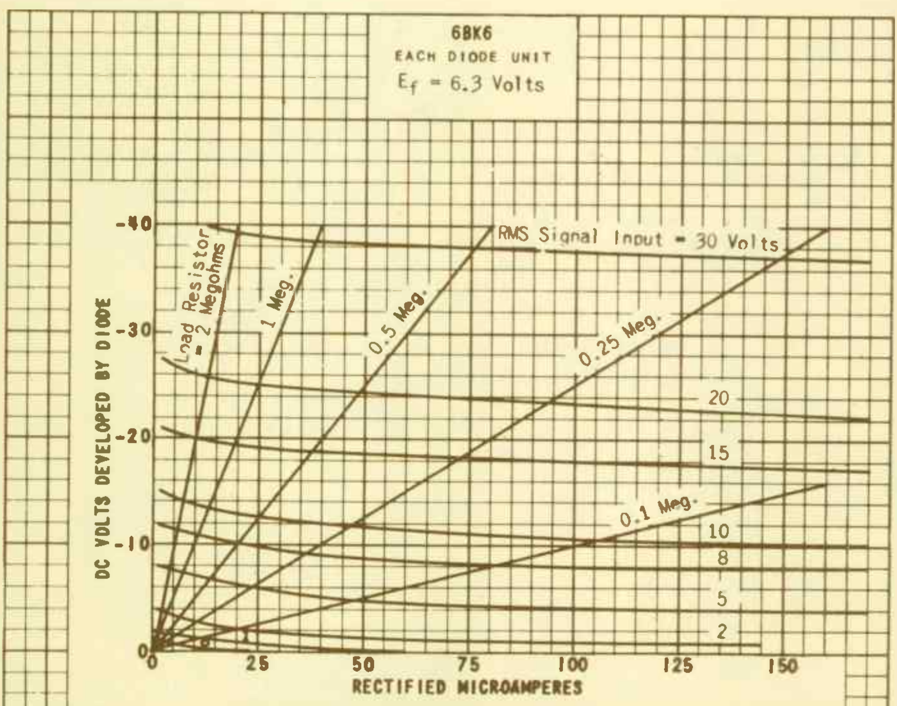


PLATE 2333
FEB. 1 1950

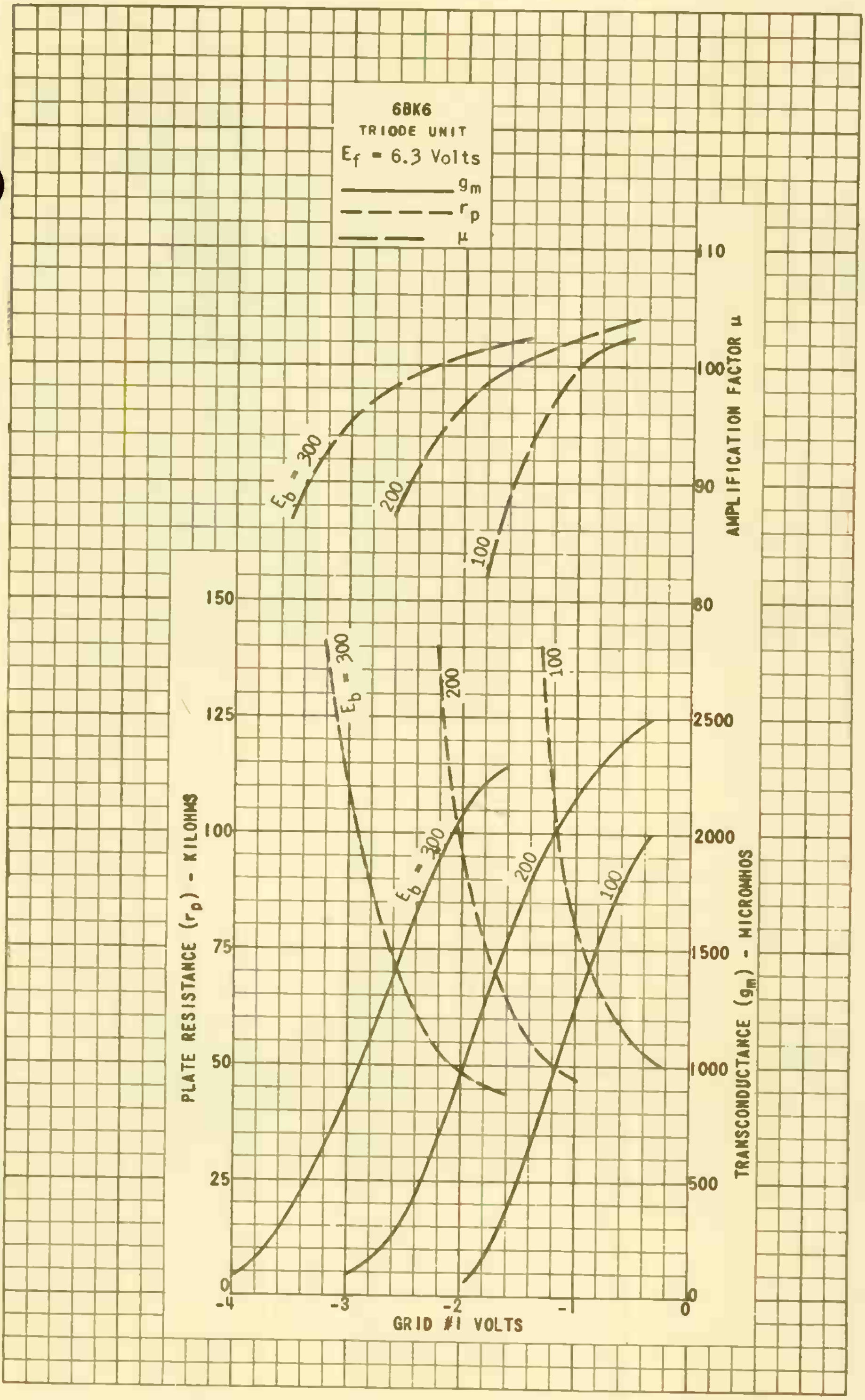
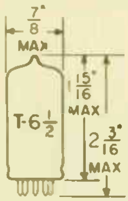


PLATE 2334
FEB. 1 1950

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODES

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

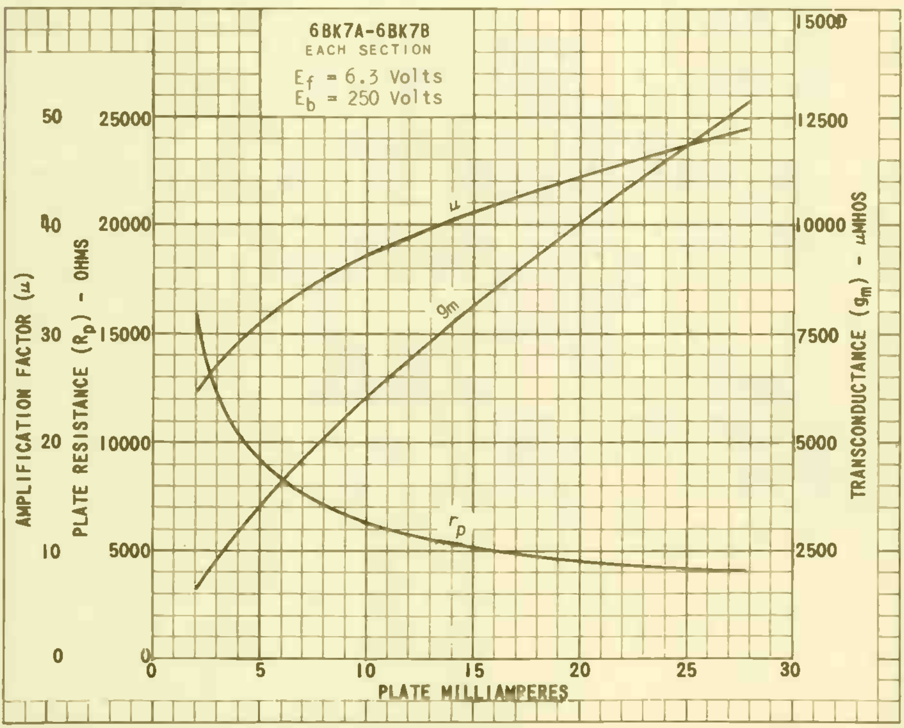
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - EACH SECTION

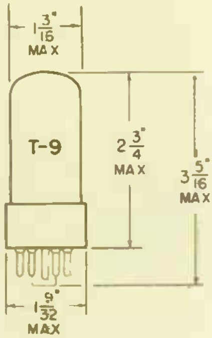
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
AMPLIFICATION FACTOR	43	
PLATE RESISTANCE (APPROX.)	4 600	OHMS
TRANSCONDUCTANCE	9 300	μMHOS
PLATE CURRENT	18	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA.	-11	VOLTS
NOISE FIGURE[B]	7	DECIBELS

[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.



TUNG-SOL

TWIN TRIODE

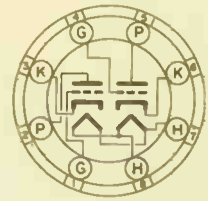


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.5 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE-SHELL
8 PIN OCTAL
880

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	$\mu\mu f$
INPUT	4.2	4.6	$\mu\mu f$
OUTPUT	0.9	0.9	$\mu\mu f$

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

EACH SECTION

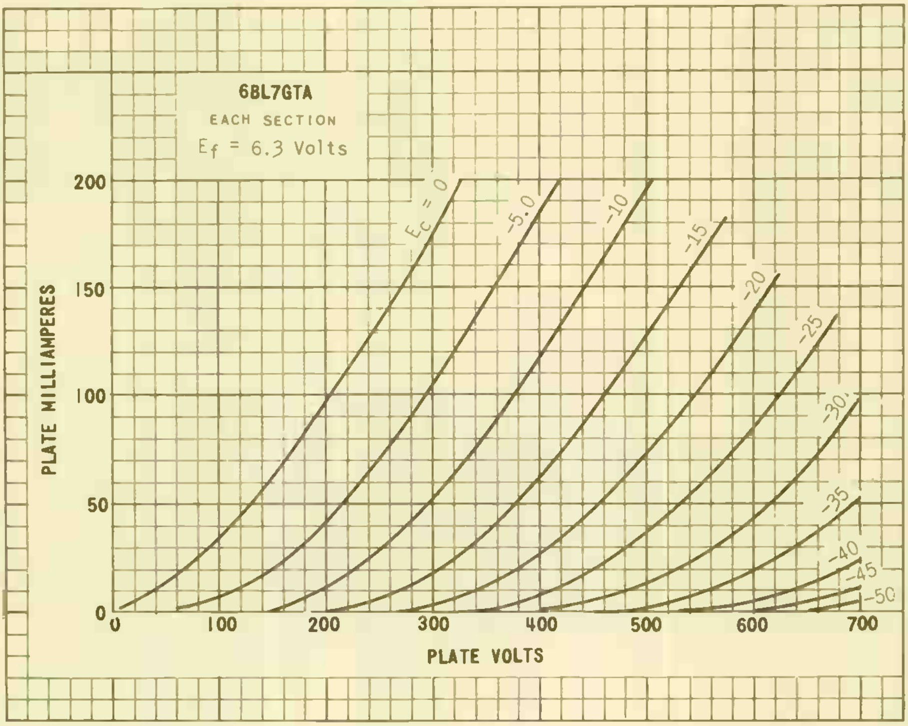
HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	1.5	1.5	1.5	AMP.
PLATE VOLTAGE	150	250	250	VOLTS
GRID VOLTAGE	0	-17	-9.0	VOLTS
AMPLIFICATION FACTOR	---	---	15	
PLATE RESISTANCE (APPROX.)	---	---	2 150	OHMS
TRANSCONDUCTANCE	---	---	7 000	μMHOS
PLATE CURRENT	65	4.0	40	MA.
GRID VOLTAGE (APPROX.) I_b = 50 μAMPS.	---	---	-23	VOLTS

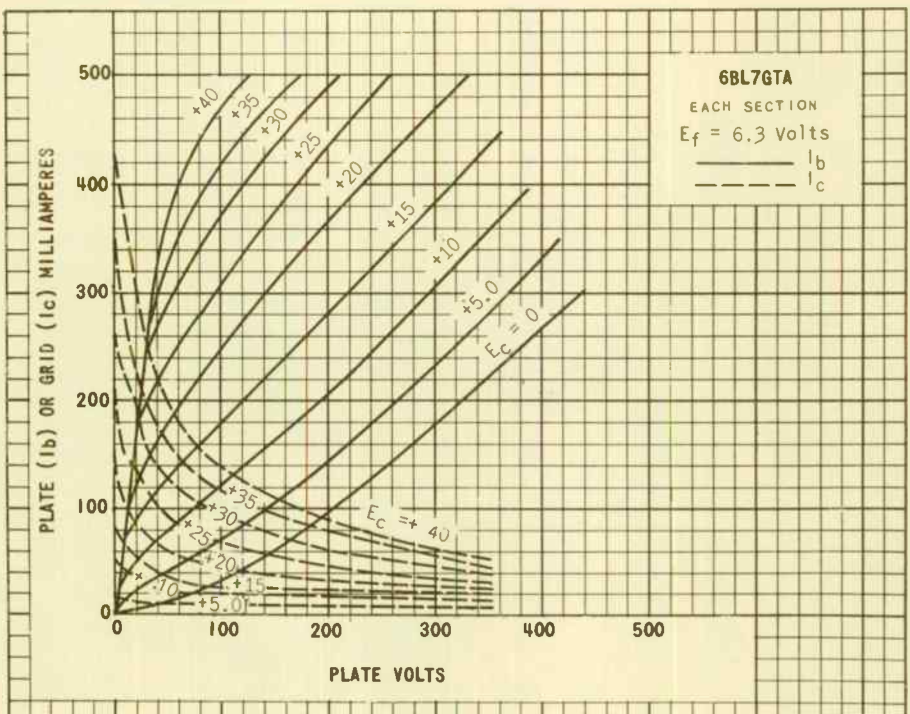
[A] SECTION 1 IS RECOMMENDED FOR VERTICAL OSCILLATOR SERVICE.

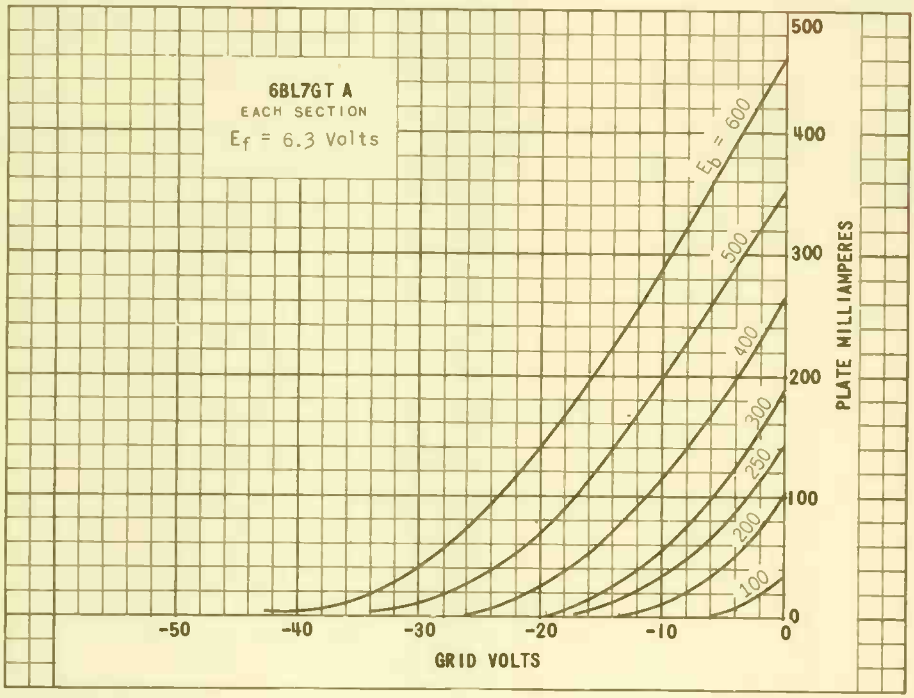
[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

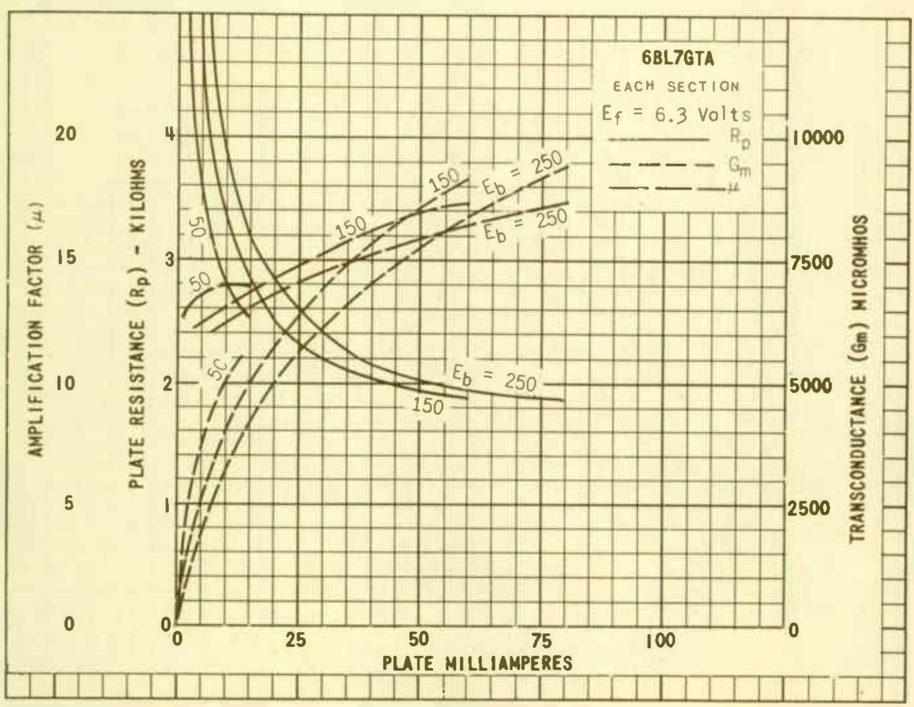
[C] ABSOLUTE-MAXIMUM VALUE.

[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.


6BL7GTA
EACH SECTION
E_f = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
Ec = 0
-5.0
-10
-15
-20
-25
-30
-35
-40
-45
-50
0
50
100
150
200
0
100
200
300
400
500
600
700


6BL7GTA
EACH SECTION
E_f = 6.3 Volts
I_b
I_c
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
+40
+35
+30
+25
+20
+15
+10
+5.0
Ec = 0
Ec =+ 40
0
100
200
300
400
500


6BL7GT A
EACH SECTION
E_f = 6.3 Volts
E_b = 600
500
400
300
250
200
100
PLATE MILLIAMPERES
500
400
300
200
100
0
-50
-40
-30
-20
-10
0
GRID VOLTS


6BL7GTA
EACH SECTION
E_f = 6.3 Volts
R_p
G_m
μ
AMPLIFICATION FACTOR (μ)
20
15
10
5
0
PLATE RESISTANCE (R_p) - KILOHMS
4
3
2
1
0
150
E_b = 250
150
E_b = 250
50
50
50
E_b = 250
150
10000
7500
5000
2500
0
TRANSCONDUCTANCE (Gm) MICROMHOS
0
25
50
75
100
PLATE MILLIAMPERES

TUNG-SOL

TRIODE PENTODE

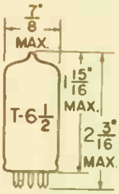
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.45 AMP.

ANY MOUNTING POSITION



GLASS BULB
6-2

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A..DECEMBER 1, 1960 PLATE #6046

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

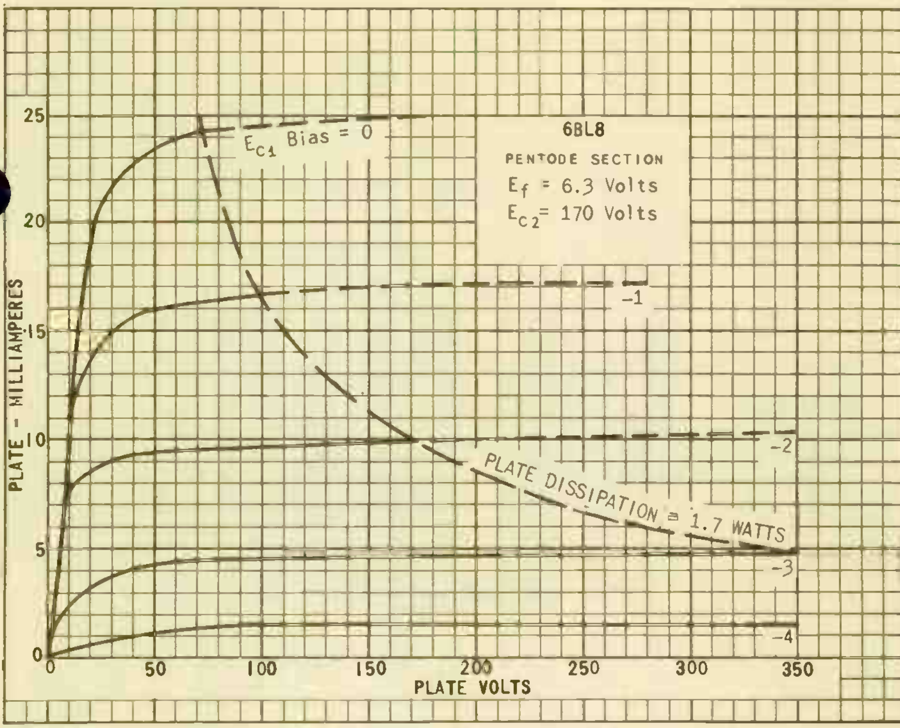
TYPICAL CHARACTERISTICS

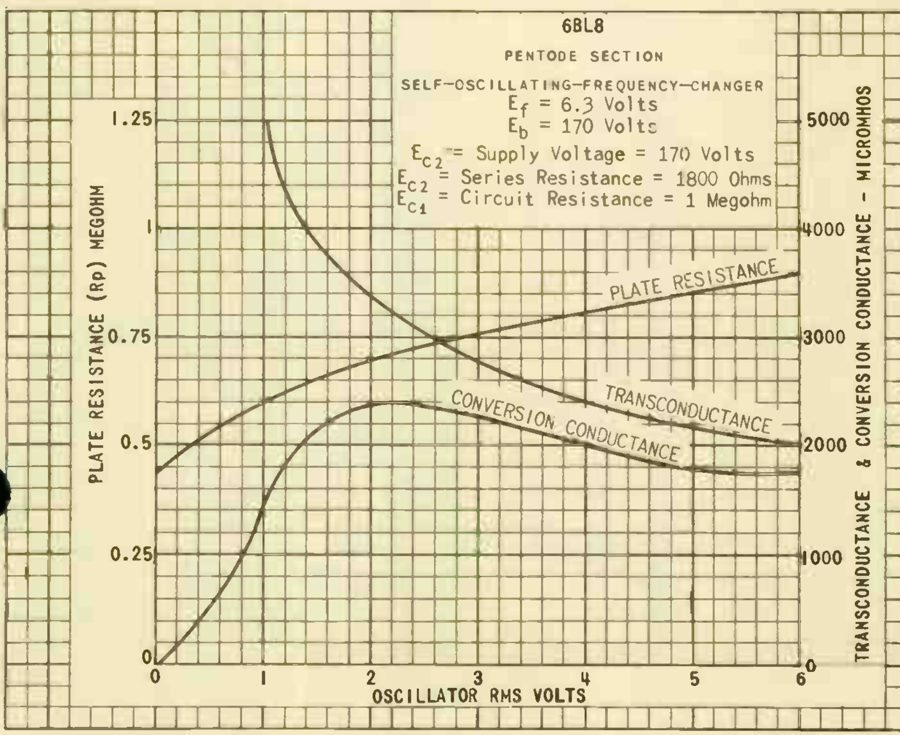
	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	100	170	VOLTS
GRID #1 VOLTAGE	−2	−2	VOLTS
PLATE CURRENT	14	10	MAMPS
GRID #2 CURRENT		2.8	MAMPS
TRANSCONDUCTANCE	5000	6200	µMHOS
PLATE RESISTANCE		0.4	MEGOHM
AMPLIFICATION FACTOR	20		
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1		47	
INPUT RESISTANCE AT 50 MC		10 000	OHMS
EQUIVALENT NOISE RESISTANCE		1 500	OHMS
GRID #2 VOLTAGE		170	VOLTS

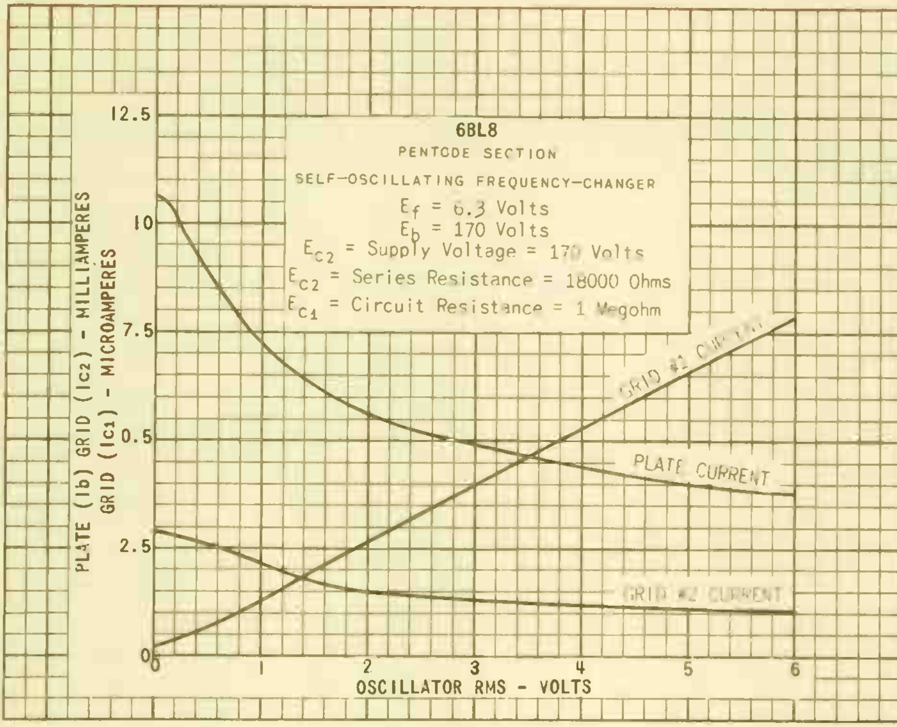
OPERATING CHARACTERISTICS
FOR USE AS MIXER

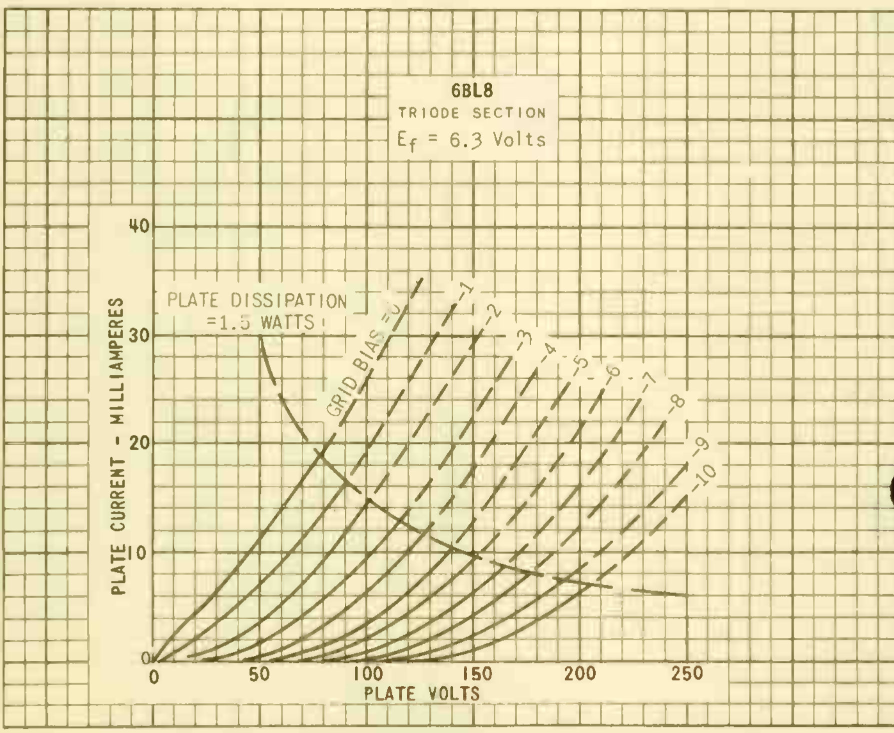
PLATE VOLTAGE	170	170	VOLTS
GRID #2 VOLTAGE	170	170	VOLTS
GRID #1 CIRCUIT RESISTANCE	0.1	0.1	MEGOHM
CATHODE RESISTOR	330	820	OHMS
OSCILLATOR VOLTAGE , RMS	3.5	3.5	VOLTS
PLATE CURRENT	6.5	5.2	MAMPS
GRID #2 CURRENT	2.0	1.5	MAMPS
GRID #1 CURRENT	25	0	µAMP
CONVERSION CONDUCTANCE	2200	2100	µMHOS
PLATE RESISTANCE	0.8	0.87	MEGOHM

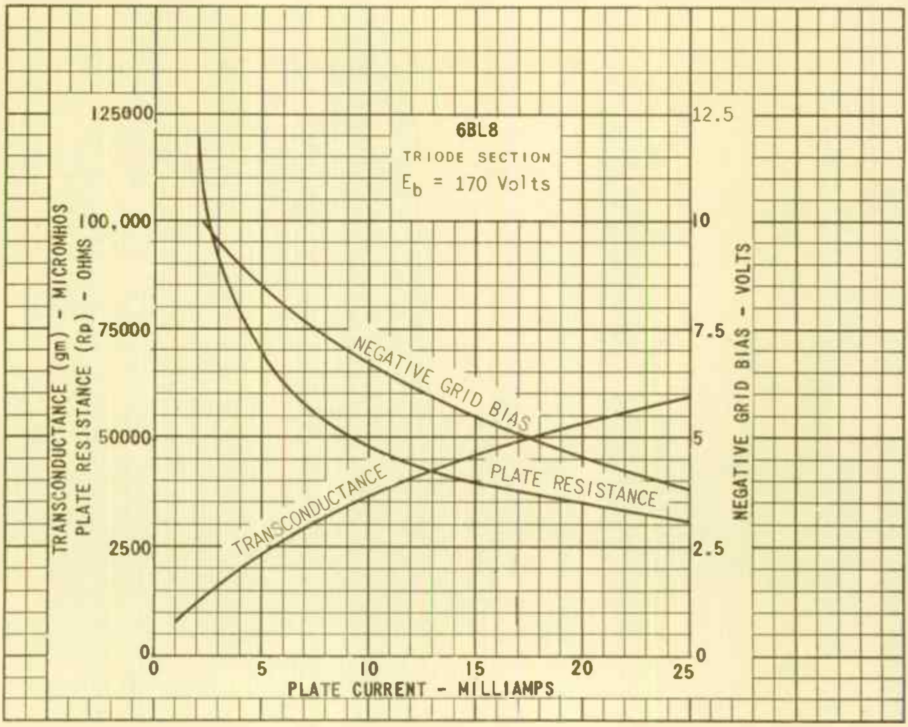
OPTIMUM PEAK CATHODE CURRENT OF THE TRIODE SECTION IS FRAME OUTPUT APPLICATION. TO ALLOW FOR TUBE SPREAD, FOR DETERIORATION DURING LIFE AND FOR EMISSION DROP AT UNDERHEATING THE SET SHOULD BE DESIGNED SO THAT WITH A PEAK CATHODE CURRENT OF 100 MA IT STILL OPERATES SATISFACTORILY. IT IS RECOMMENDED THAT THE AMPLITUDE OF THE PEAK CURRENTS OCCURRING WITH FRESH TUBES BE LIMITED AUTOMATICALLY.


6BL8
PENTODE SECTION
E_f = 6.3 Volts
E_{c2} = 170 Volts
E_{c1} Bias = 0
-1
-2
-3
-4
PLATE DISSIPATION = 1.7 WATTS
PLATE - MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
50
100
150
200
250
300
350


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 = 1800 Ohms
E_{c1} = Circuit Resistance = 1 Megohm
PLATE RESISTANCE
TRANSCONDUCTANCE
CONVERSION CONDUCTANCE
PLATE RESISTANCE (Rp) MEGOHM
TRANSCONDUCTANCE & CONVERSION CONDUCTANCE - MICROMHOS
OSCILLATOR RMS VOLTS
0
0.25
0.5
0.75
1
1.25
1000
2000
3000
4000
5000
2
3
4
5
6


6BL8
PENTODE SECTION
SELF-OSCILLATING FREQUENCY-CHANGER
Ef = 6.3 Volts
Eb = 170 Volts
Ec2 = Supply Voltage = 170 Volts
Ec2 = Series Resistance = 18000 Ohms
Ec1 = Circuit Resistance = 1 Megohm
GRID #1 CURRENT
PLATE CURRENT
GRID #2 CURRENT
PLATE (Ib) GRID (Ic2) - MILLIAMPERES
GRID (Ic1) - MICROAMPERES
12.5
10
7.5
0.5
2.5
0
1
2
3
4
5
6
OSCILLATOR RMS - VOLTS

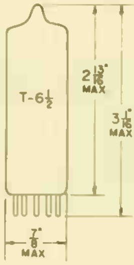

6BL8
TRIODE SECTION
Ef = 6.3 Volts
PLATE DISSIPATION
=1.5 WATTS
GRID BIAS = 0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
PLATE CURRENT - MILLIAMPERES
40
30
20
10
0
50
100
150
200
250
PLATE VOLTS


6BL8
TRIODE SECTION
E_b = 170 Volts
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE RESISTANCE (Rp) - OHMS
NEGATIVE GRID BIAS - VOLTS
PLATE CURRENT - MILLIAMPS
NEGATIVE GRID BIAS
PLATE RESISTANCE
TRANSCONDUCTANCE
125000
100,000
75000
50000
2500
0
12.5
10
7.5
5
2.5
0
0
5
10
15
20
25

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



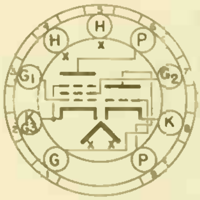
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.78 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

9EX

THE 6BM8 IS A TRIODE-PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TRIODE SECTION IS DESIGNED FOR USE AS A VERTICAL OSCILLATOR, AN AF VOLTAGE AMPLIFIER AND THE PENTODE SECTION IS DESIGNED FOR USE AS A VERTICAL OUTPUT AND AUDIO OUTPUT TUBE.

DIRECT INTERELECTRODE CAPACITANCES

TRIODE SECTION		
GRID TO ALL OTHER ELEMENTS EXCEPT PLATE	2.7	μμf
PLATE TO ALL OTHER ELEMENTS EXCEPT GRID	4.0	μμf
PLATE TO GRID	4.0	μμf
GRID TO HEATER (MAX.)	0.1	μμf
PENTODE SECTION		
GRID #1 TO ALL OTHER ELEMENTS	9.3	μμf
PLATE TO ALL OTHER ELEMENTS	8	μμf
GRID #1 TO PLATE (MAX.)	0.3	μμf
GRID #1 TO HEATER (MAX.)	0.3	μμf
BETWEEN TRIODE AND PENTODE SECTIONS		
TRIODE PLATE TO PENTODE GRID #1 (MAX.)	0.02	μμf
TRIODE GRID TO PENTODE PLATE (MAX.)	0.02	μμf
TRIODE GRID TO PENTODE GRID #1 (MAX.)	0.025	μμf
TRIODE PLATE TO PENTODE PLATE (MAX.)	0.25	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

PENTODE SECTION		
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT PLATE CURRENT	900	VOLTS
MAXIMUM PLATE VOLTAGE	600	VOLTS
MAXIMUM PEAK PLATE VOLTAGE A	2500	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	500	VOLTS
MAXIMUM PEAK PLATE CURRENT B		

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D.
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

PENTODE SECTION CONT'D.

MAXIMUM PLATE DISSIPATION AT A PLATE VOLTAGE LOWER THAN 250 VOLTS	7	WATTS
MAXIMUM PLATE DISSIPATION AT A PLATE VOLTAGE HIGHER THAN 250 VOLTS	5	WATTS
MAXIMUM GRID #2 VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM GRID #2 VOLTAGE	300	VOLTS
MAXIMUM GRID #2 DISSIPATION	1.8	WATTS
MAXIMUM PEAK GRID #2 DISSIPATION	3.2	WATTS
MAXIMUM CATHODE CURRENT	50	MAMPS
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH CATHODE RESISTOR	2	MEGOHMS
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH FIXED BIAS	1	MEGOHM
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE	100	VOLTS
MAXIMUM CIRCUIT RESISTANCE BETWEEN HEATER AND CATHODE	20 000	OHMS

TRIODE SECTION

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT PLATE CURRENT	550	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PEAK PLATE VOLTAGE[A]	600	VOLTS
MAXIMUM PLATE DISSIPATION	1	WATT
MAXIMUM CATHODE CURRENT	15	MAMPS
MAXIMUM PEAK CATHODE CURRENT[C]		
MAXIMUM GRID CIRCUIT RESISTANCE WITH CATHODE RESISTOR[D]	2	MEGOHMS
MAXIMUM GRID CIRCUIT RESISTANCE WITH FIXED BIAS	1	MEGOHM
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE	100	VOLTS
MAXIMUM CIRCUIT RESISTANCE BETWEEN HEATER AND CATHODE	20 000	OHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PENTODE SECTION

HEATER VOLTAGE			6.3		VOLTS
HEATER CURRENT			0.78		AMP.
AC VOLTAGE GRID #1 (RMS)	3.8	6.0	5.8	6.6	VOLTS
ZERO-SIGNAL PLATE CURRENT	26	41	35	35	MAMPS
ZERO-SIGNAL GRID #2 CURRENT	5.0	8.0	6.5	7.0	MAMPS
TRIODE AMPLIFICATION FACTOR	10	9.5	9.5	9.5	
TRANSCONDUCTANCE	6800	7500	6800	6400	μMHOS
PLATE RESISTANCE (APPROX.)	15 000	16 000	20 500	20 000	OHMS
LOAD RESISTANCE	3900	3900	5600	5600	OHMS
OUTPUT POWER AT A DISTORTION OF 10%	1.05	3.3	3.4	3.5	WATTS

VERTICAL OUTPUT AMPLIFIER

TRIODE SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.78	AMP.
PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	0	VOLT
PLATE CURRENT	3.5	MAMPS
TRANSCONDUCTANCE	2500	μMHOS
AMPLIFICATION FACTOR	70	

CONTINUED ON FOLLOWING PAGE

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.

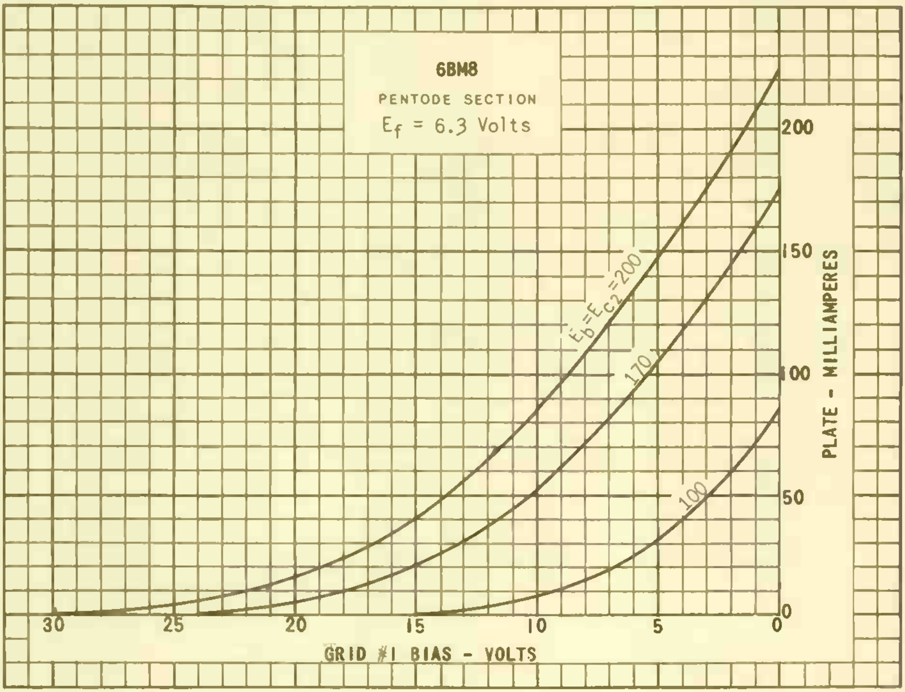
D WITH GRID CURRENT BIASING THE MAXIMUM PERMISSABLE VALUE OF THE GRID CIRCUIT RESISTANCE IS 22 MEGOHMS.
MAXIMUM A.F. OUTPUT VOLTAGE.

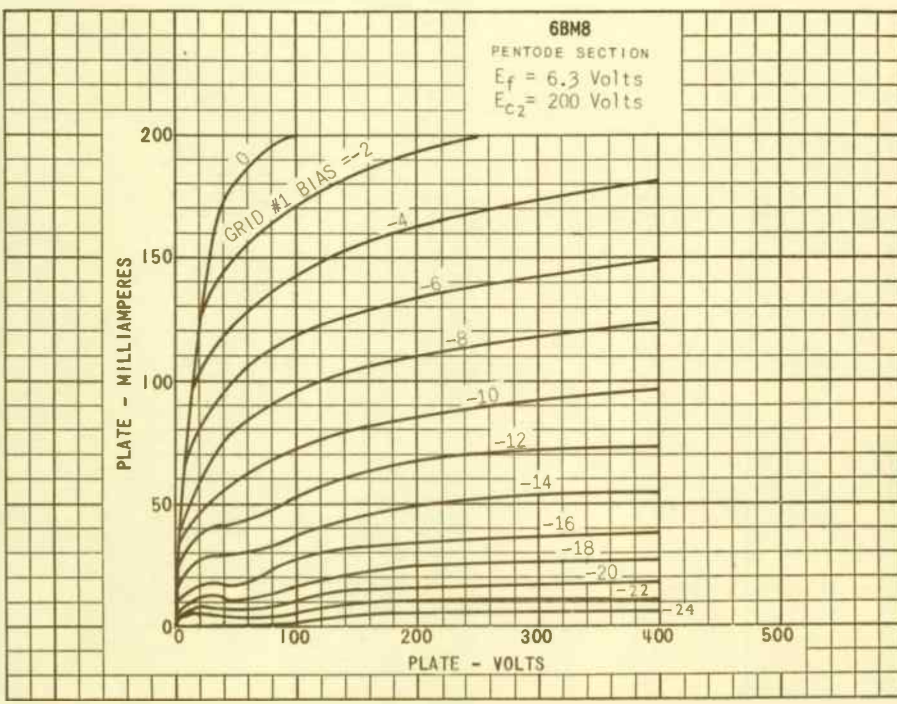
MICROPHONY AND HUM.

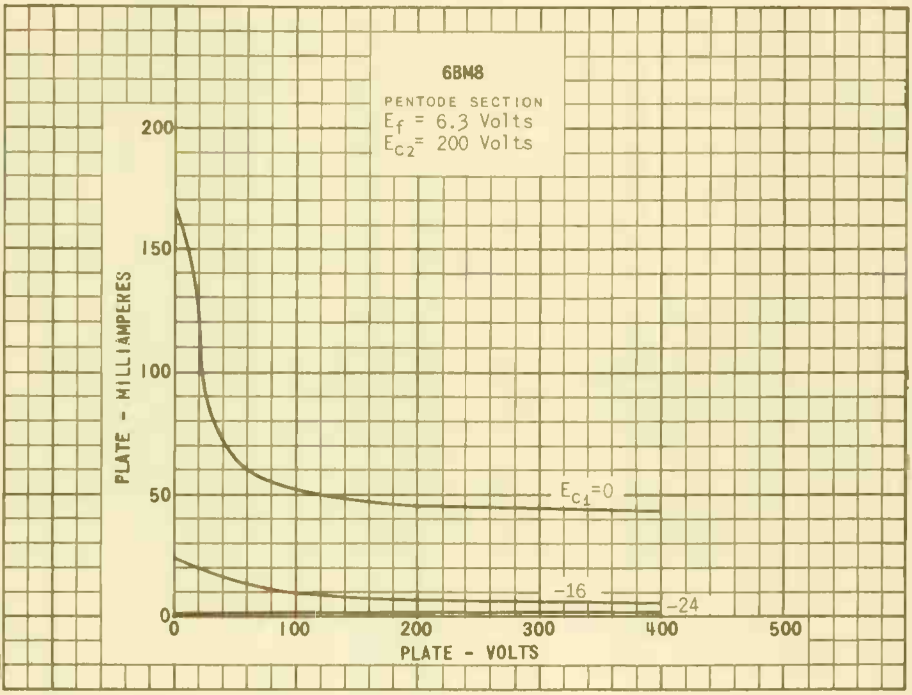
THE TRIODE SECTION CAN BE USED WITHOUT SPECIAL PRECAUTIONS AGAINST MICROPHONY AND HUM IN CIRCUITS WITH A 5% LOUDSPEAKER WHEN THE INPUT VOLTAGE REQUIRED FOR AN OUTPUT POWER OF 50 MWATTS OF THE OUTPUT TUBE IS HIGHER THAN 10 MVOLTS. THE A.C. VOLTAGE BETWEEN HEATER PIN 4 AND THE CATHODE SHOULD NOT EXCEED 6.3 VOLTS (RMS) IN THIS CASE AND THE GRID CIRCUIT IMPEDANCE AT 50C/S SHOULD NOT EXCEED 0.5 MEGOHM.

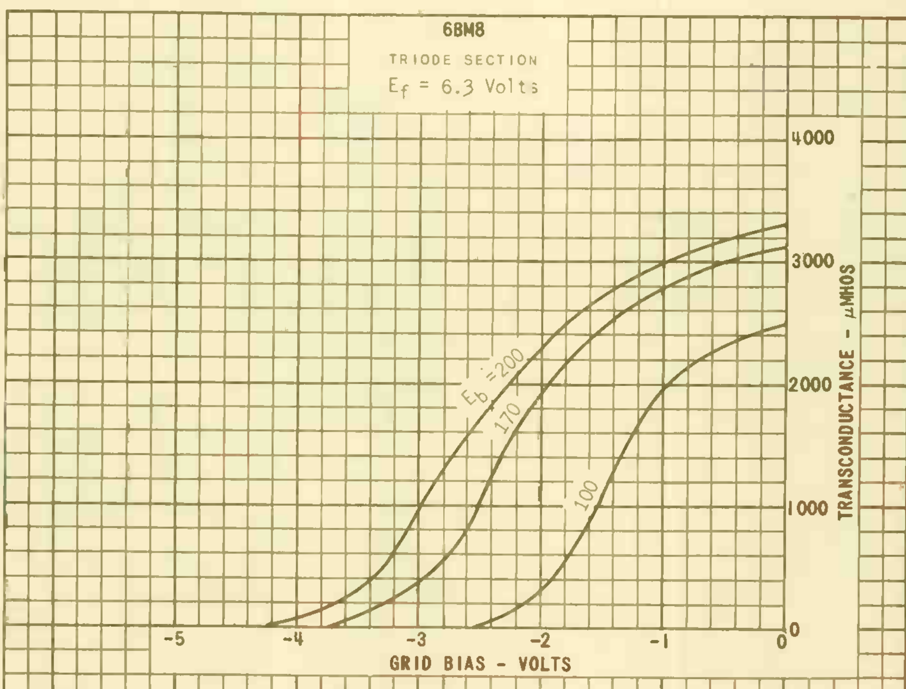
→ INDICATES A CHANGE.

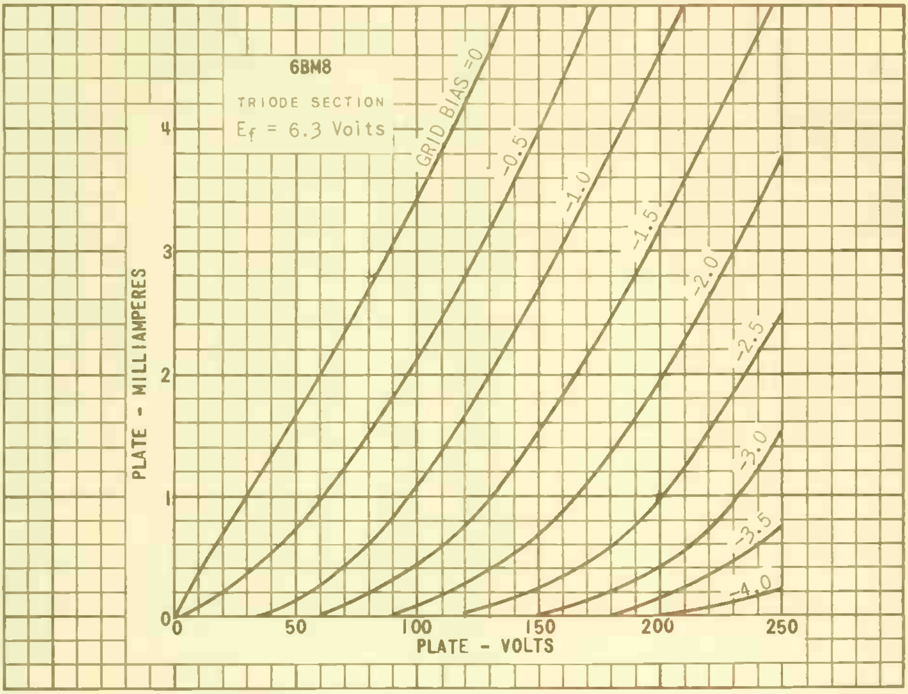
PRINTED IN U.S.A.

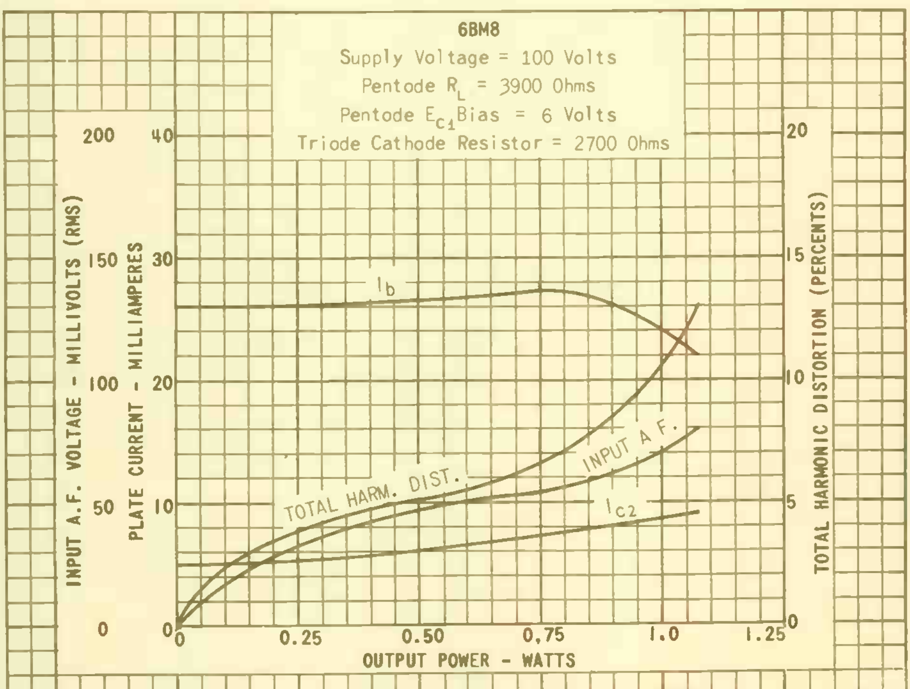

6BM8
PENTODE SECTION
E_f = 6.3 Volts
$E_b = E_{c2} = 200$
170
100
PLATE - MILLIAMPERES
0
50
100
150
200
GRID #1 BIAS - VOLTS
30
25
20
15
10
5
0


6BM8
PENTODE SECTION
E_f = 6.3 Volts
E_{c2} = 200 Volts
0
GRID #1 BIAS = -2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
PLATE - MILLIAMPERES
0
50
100
150
200
PLATE - VOLTS
0
100
200
300
400
500

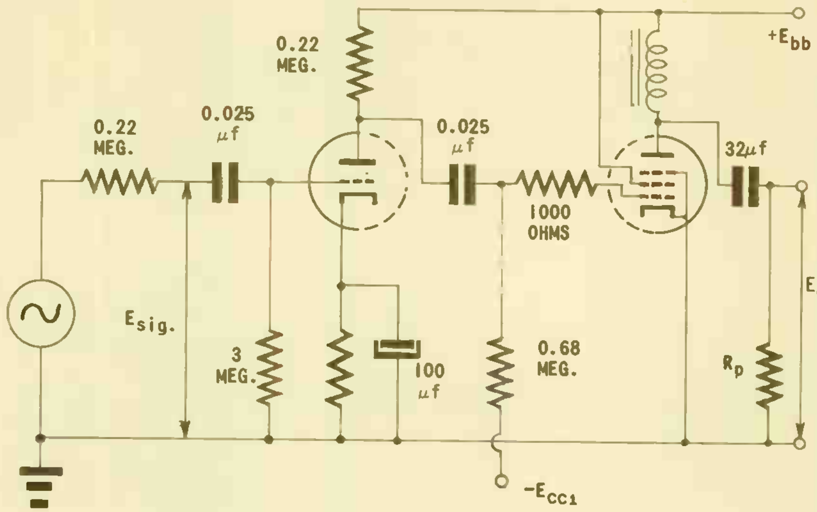

6BM8
PENTODE SECTION
E_f = 6.3 Volts
E_{c_2} = 200 Volts
PLATE - MILLIAMPERES
0
50
100
150
200
PLATE - VOLTS
0
100
200
300
400
500
E_{c_1}=0
-16
-24


6BM8
TRIODE SECTION
E_f = 6.3 Volts
E_b =200
170
100
GRID BIAS - VOLTS
-5
-4
-3
-2
-1
0
TRANSCONDUCTANCE - μMHOS
0
1000
2000
3000
4000


6BM8
TRIODE SECTION
E_f = 6.3 Volts
GRID BIAS = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
PLATE - MILLIAMPERES
0
1
2
3
4
0
50
100
150
200
250
PLATE - VOLTS


6BM8
Supply Voltage = 100 Volts
Pentode R_L = 3900 Ohms
Pentode E_{c1} Bias = 6 Volts
Triode Cathode Resistor = 2700 Ohms
INPUT A.F. VOLTAGE - MILLIVOLTS (RMS)
0
50
100
150
200
PLATE CURRENT - MILLIAMPERES
0
10
20
30
40
TOTAL HARMONIC DISTORTION (PERCENTS)
0
5
10
15
20
I_b
TOTAL HARM. DIST.
INPUT A.F.
I_{c2}
0
0.25
0.50
0.75
1.0
1.25
OUTPUT POWER - WATTS

TUNG-SOL



CIRCUIT DIAGRAM OF TRIODE SECTION AS A.F. AMPLIFIER AND PENTODE SECTION AS TRANSFORMER-LESS AUDIO OUTPUT TUBE.

TUNG-SOL

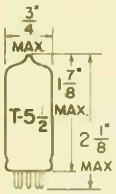
TRIODE

MINIATURE TYPE

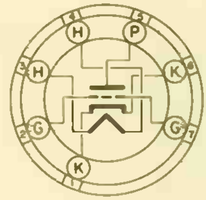
COATED UNIPOTENTIAL CATHODE

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.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

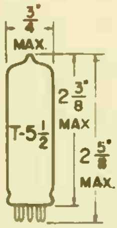
HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.2	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE-BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	43	
PLATE RESISTANCE (APPROX.) FOR 6BN4	6 300	OHMS
PLATE RESISTANCE (APPROX.) FOR 6BN4A	5 400	OHMS
TRANSCONDUCTANCE (FOR 6BN4)	6 800	μMHOS
TRANSCONDUCTANCE (FOR 6BN4A)	7700 ←	μMHOS
PLATE CURRENT	9.0	MA.
GRID VOLTAGE (APPROX.) I_b = 100 μAMPS.	-6	VOLTS

→ INDICATES A CHANGE.

TUNG-SOL

PENTODE

MINIATURE TYPE

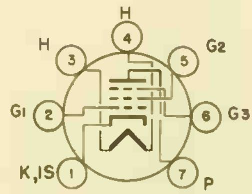


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

GATED-BEAM DISCRIMINATOR
FOR FM AND INTERCARRIER
TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7DF

THE 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±0.5	
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.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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.

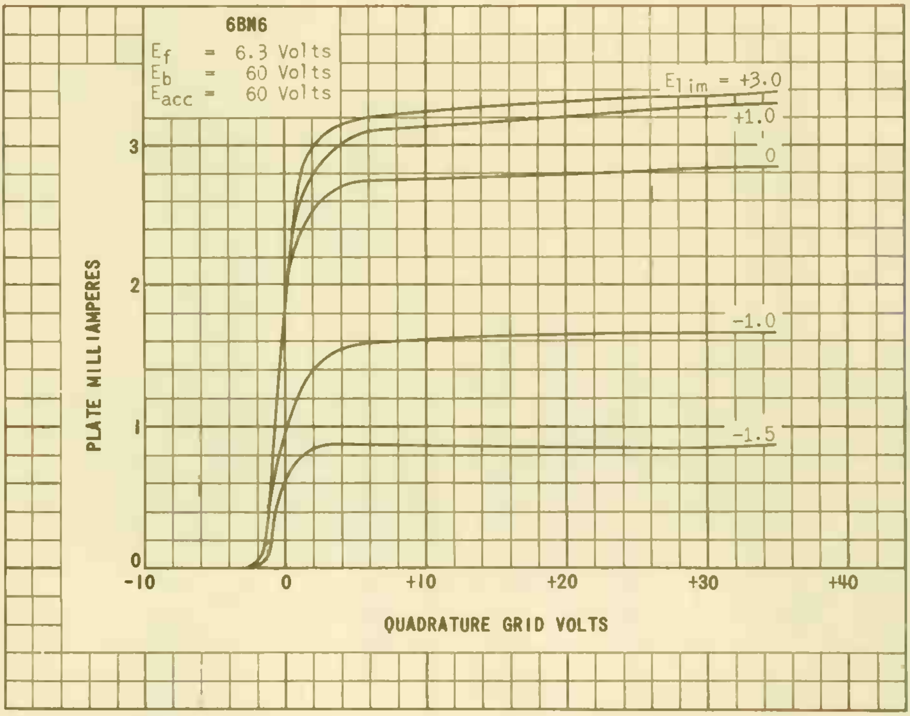
[B] AT SIGNAL LEVELS ABOVE SPECIFIED VALUE, LIMITING IS WITHIN ±2 DECIBELS.

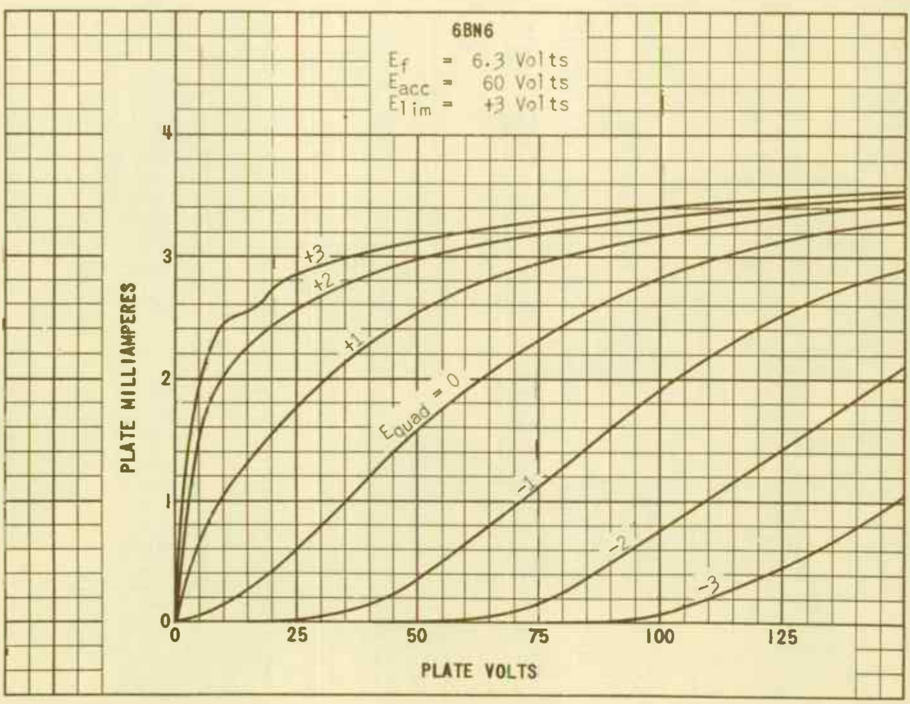
ADEQUATE SHIELDING BETWEEN COMPONENTS OF THE LIMITER GRID AND THE QUADRATURE GRID MUST BE USED TO INSURE PROPER PHASING OF THE VOLTAGE DEVELOPED ON THE QUADRATURE GRID.

STANDARD DE-EMPHASEIS REQUIREMENTS FOR FM ARE INCLUDED.

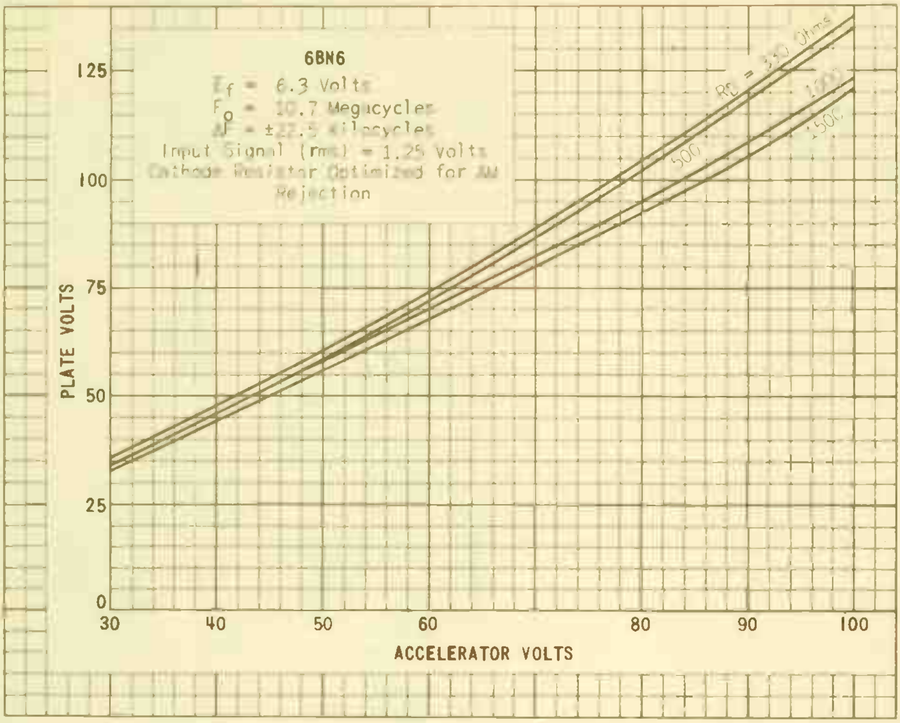
THE Q OF THE QUADRATURE GRID CIRCUIT SHOULD BE HIGH ENOUGH TO DEVELOP A MINIMUM OF 4 VOLTS (RMS) SIGNAL WITH 2 VOLTS (RMS) OF THE CENTER-FREQUENCY SIGNAL APPLIED TO THE LIMITER GRID. IT IS RECOMMENDED THAT THE COIL BE SHUNTED BY A MINIMUM OF 10 μμf. THE CAPACITANCE MAY BE COMPOSED OF TUBE INPUT CAPACITANCE,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

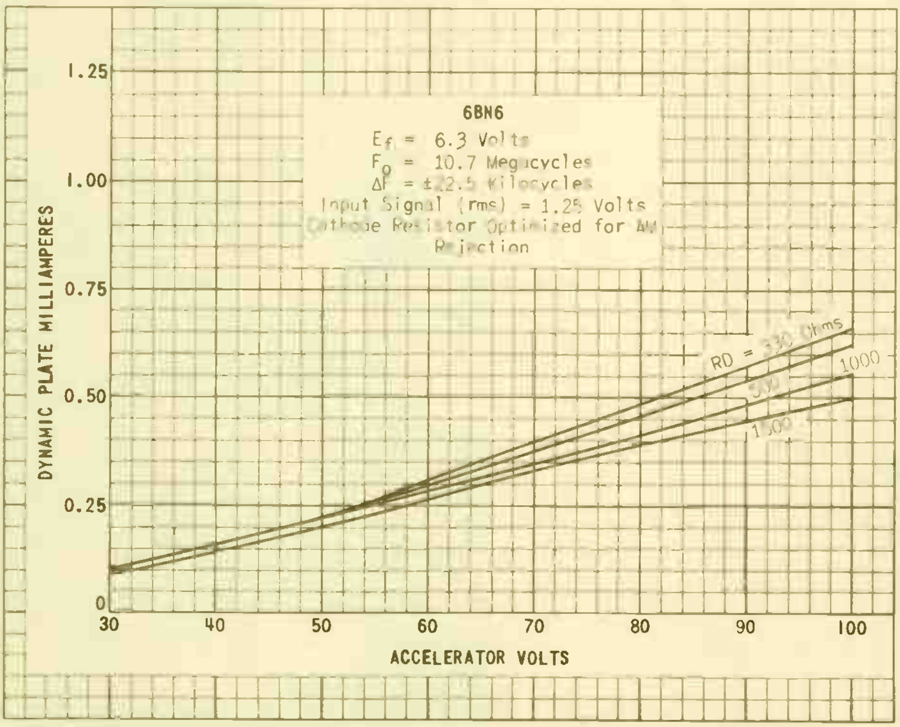
→ INDICATES A CHANGE.

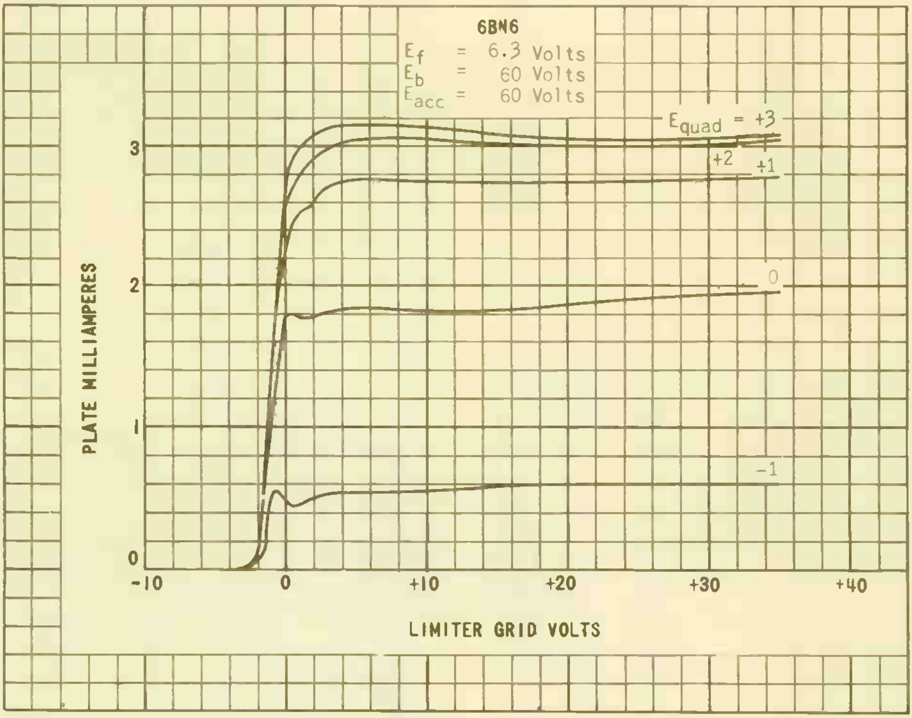




TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. OCTOBER 1, 1954 PLATE #4052


6BN6
Ef = 6.3 Volts
Fo = 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


6BN6
Ef = 6.3 Volts
Fo = 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


6BN6
E_f = 6.3 Volts
E_b = 60 Volts
E_{acc} = 60 Volts
E_{quad} = +3
+2
+1
0
-1
PLATE MILLIAMPERES
0
1
2
3
-10
0
+10
+20
+30
+40
LIMITER GRID VOLTS

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

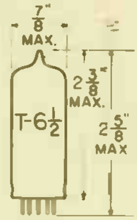
COATED UNIPOTENTIAL CATHODE

HEATER

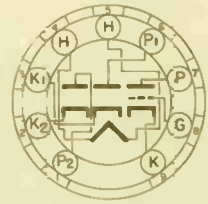
6.3±10% VOLTS 0.6 AMP.

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: $_1$DK TO (H+TK+$_2$DK+TP+$_1$DP+TG+$_2$DP)	5.0	μμf
#2 CATHODE TO ALL: $_2$DK TO (H+TK+$_1$DK+TP+$_1$DP+$_2$DP+TG)	5.0	μμf
#1 PLATE TO #2 PLATE (MAX.)	0.070	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)	4.8	μμf
#2 CATHODE TO #2 PLATE + HEATER: $_2$DK TO ($_2$DP+ H)	4.8	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

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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.

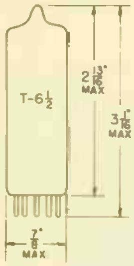
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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

TUNG-SOL

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., MARCH 1, 1960 PLATE #5791

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

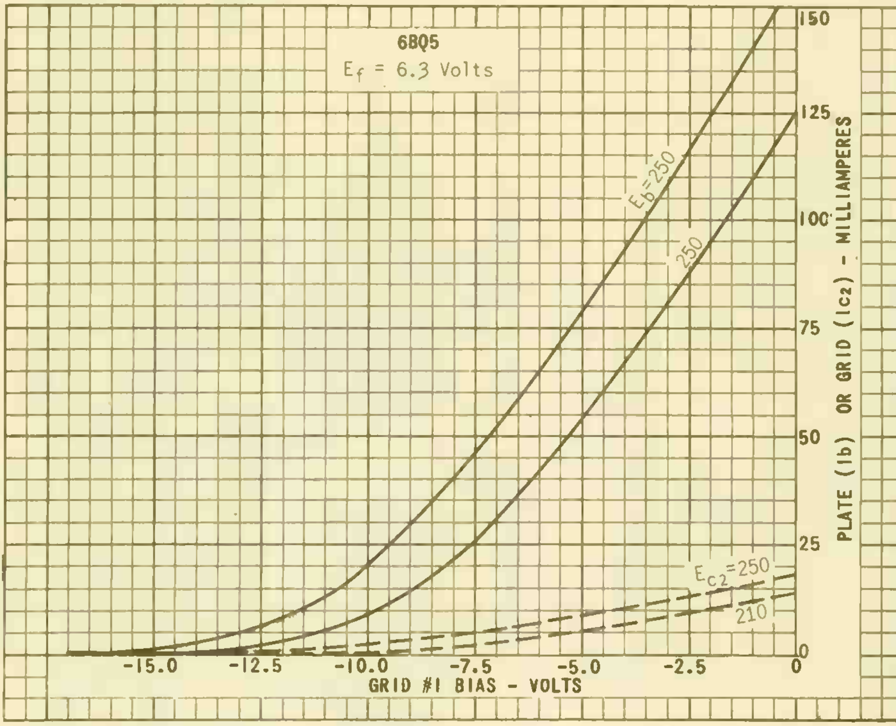
(GRID #2 CONNECTED TO PLATES)

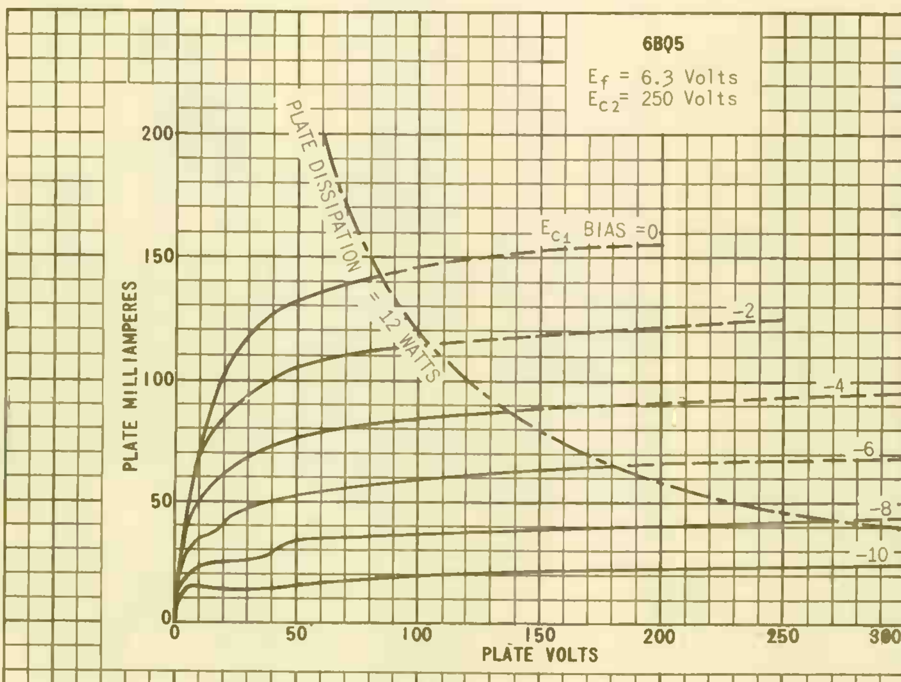
PLATE VOLTAGE	250	300	VOLTS
COMMON CATHODE RESISTOR	270	270	OHMS
LOAD RESISTANCE (PLATE TO PLATE)	10 000	10 000	OHMS
ZERO-SIGNAL PLATE CURRENT	2x20	2x24	MA.
INPUT A.F. VOLTAGE (RMS)	8.3	10	VOLTS
MAX. SIGNAL PLATE CURRENT	2x21.7	2x26	MA.
MAX. SIGNAL POWER OUTPUT	3.4	5.2	WATTS
TOTAL HARMONIC DISTORTION	2.5	2.5	PERCENTS
INPUT A.F. VOLTAGE AT A POWER OUTPUT OF 50 MWATTS (RMS.)	0.95	0.9	VOLTS

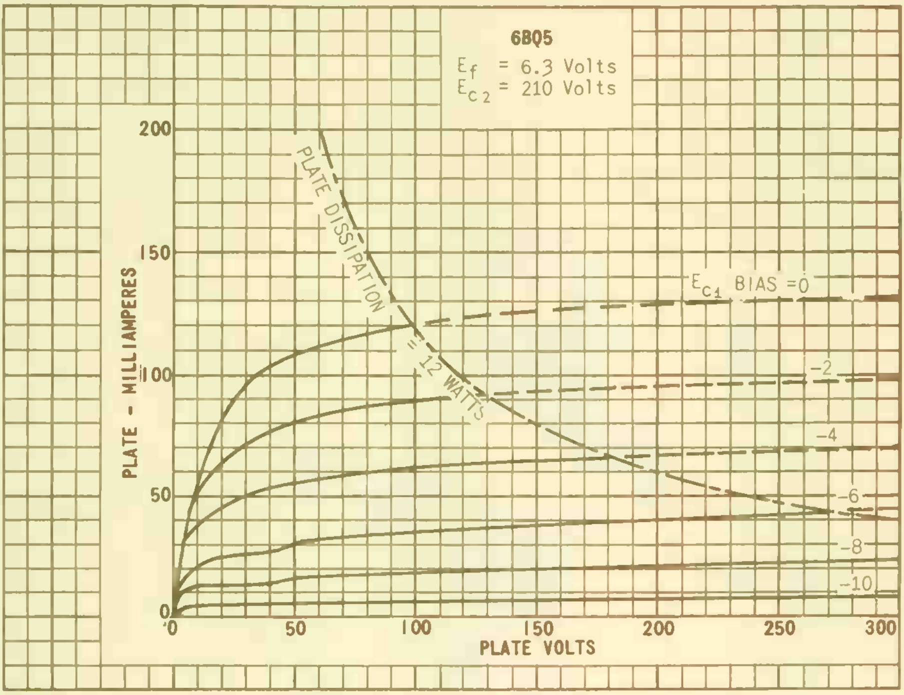
[A] WHEN THE HEATER AND POSITIVE VOLTAGES ARE OBTAINED FROM A STORAGE BATTERY BY MEANS OF A VIBRATOR, THE MAX. VALUES OF THE PLATE AND GRID #2 VOLTAGES ARE 250 VOLTS AND THAT OF THE PLATE DISSIPATION 9 WATTS.

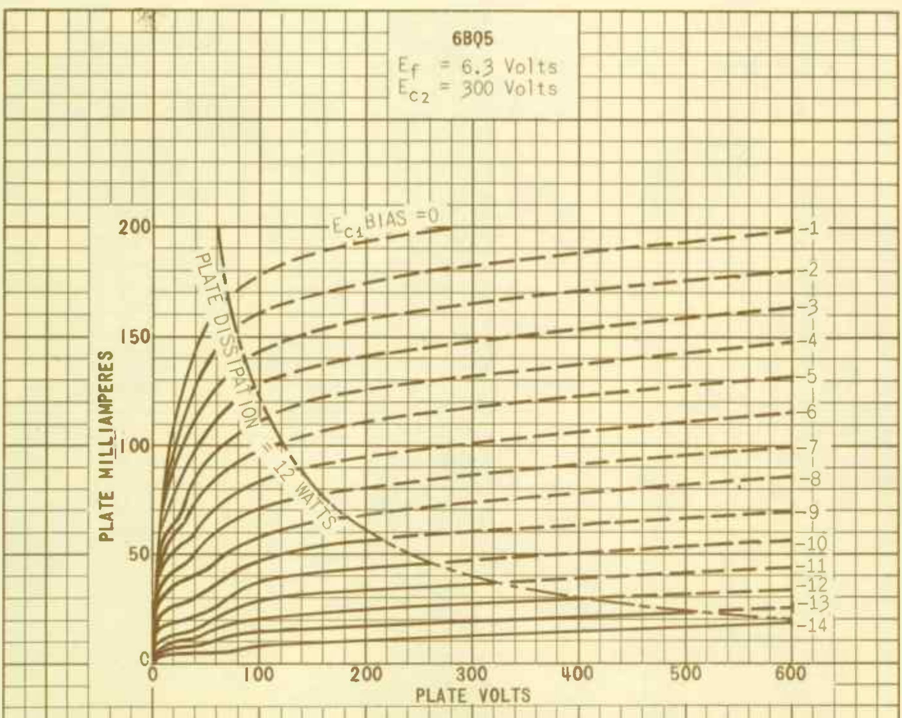
[B] MEASURED WITH FIXED BIAS.

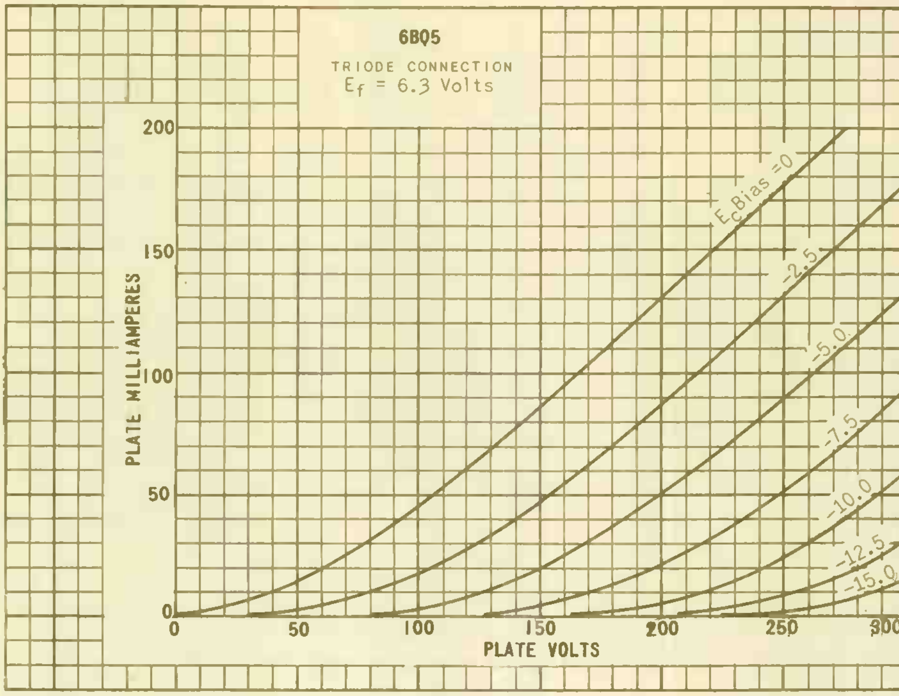
[C] POWER OUTPUT AT START OF POSITIVE GRID CURRENT.

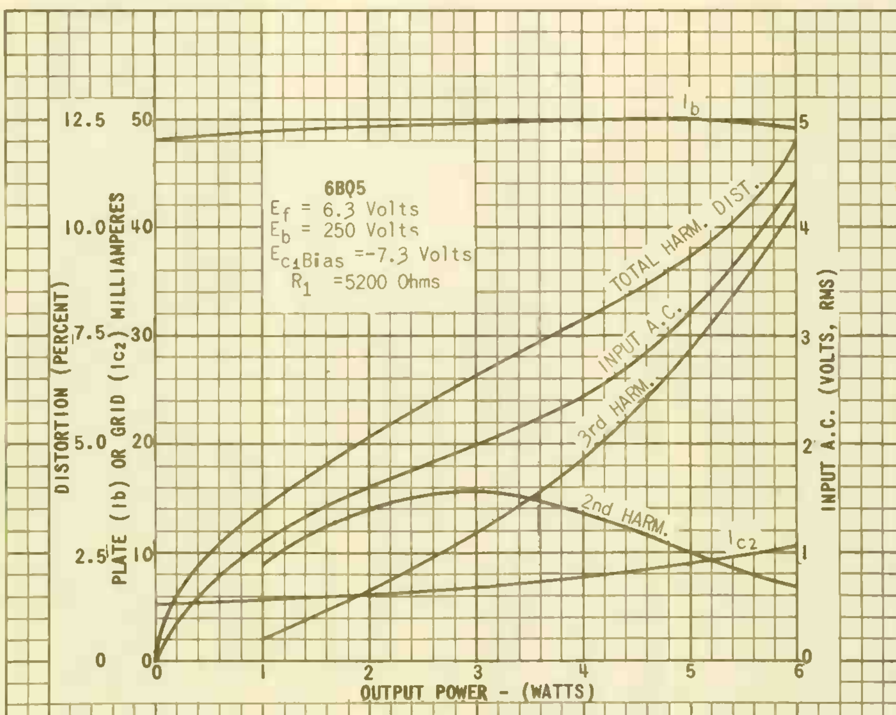

6BQ5
E_f = 6.3 Volts
E_b=250
250
E_{c2}=250
210
150
125
100
75
50
25
0
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID #1 BIAS - VOLTS
PLATE (Ib) OR GRID (Ic2) - MILLIAMPERES

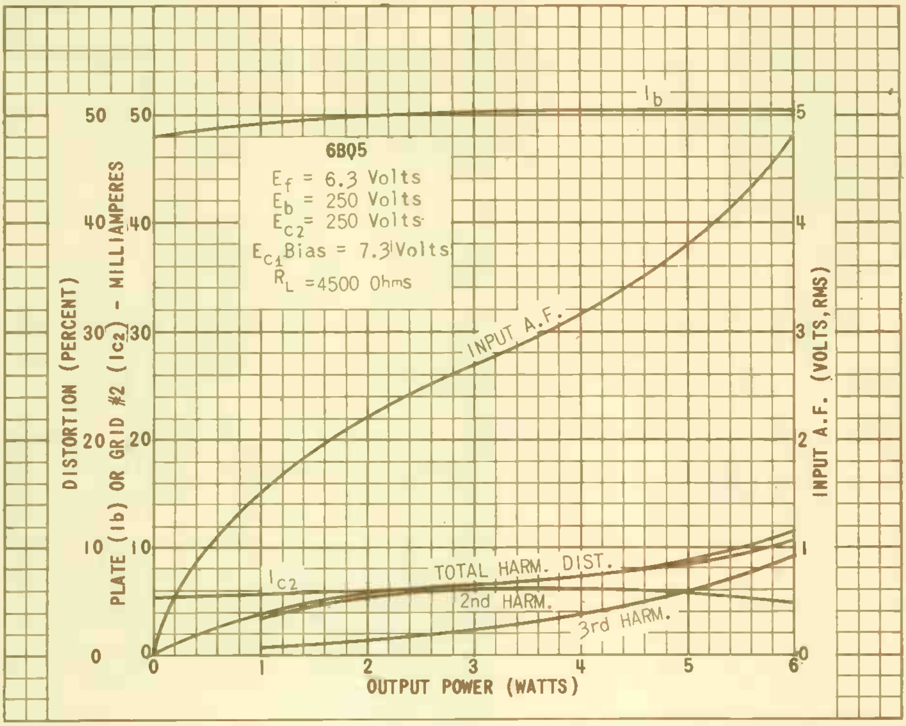

6BQ5
E_f = 6.3 Volts
E_{c2}= 250 Volts
PLATE DISSIPATION = 12 WATTS
E_{c1} BIAS =0
-2
-4
-6
-8
-10
200
150
100
50
0
PLATE MILLIAMPERES
0
50
100
150
200
250
300
PLATE VOLTS

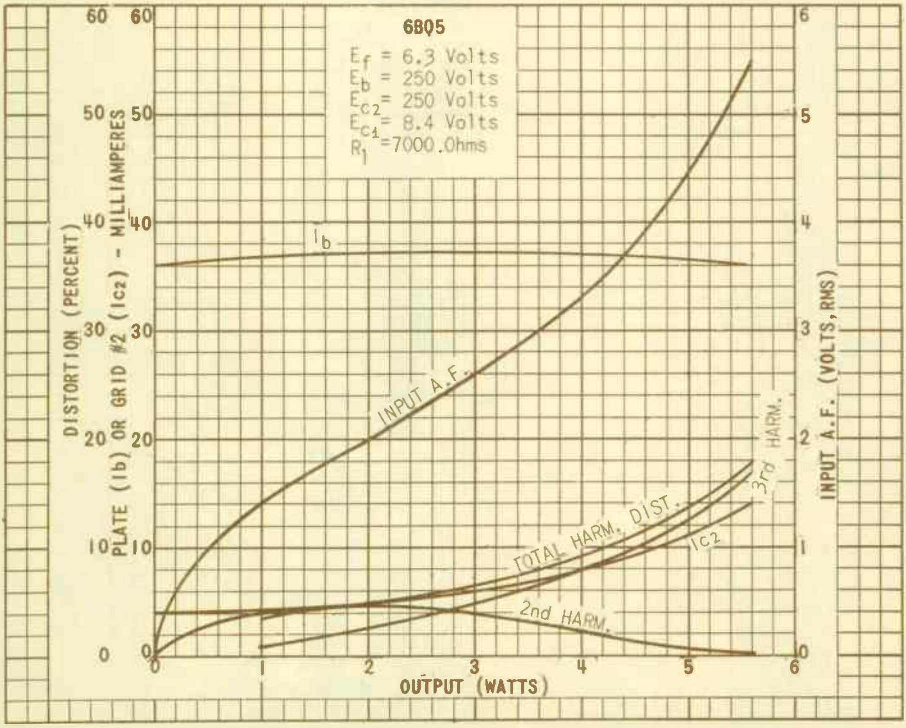

6BQ5
Ef = 6.3 Volts
Ec2 = 210 Volts
PLATE - MILLIAMPERES
PLATE VOLTS
PLATE DISSIPATION = 12 WATTS
Ec1 BIAS = 0
-2
-4
-6
-8
-10
0
50
100
150
200
250
300

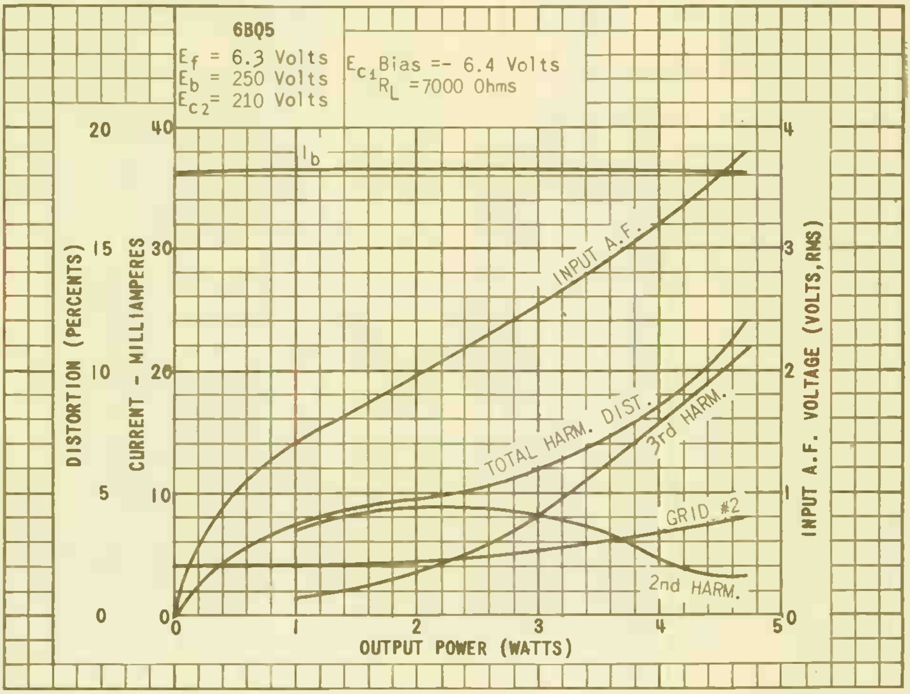

6BQ5
Ef = 6.3 Volts
Ec2 = 300 Volts
PLATE MILLIAMPERES
PLATE VOLTS
PLATE DISSIPATION = 12 WATTS
Ec1 BIAS = 0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
0
50
100
150
200
300
400
500
600

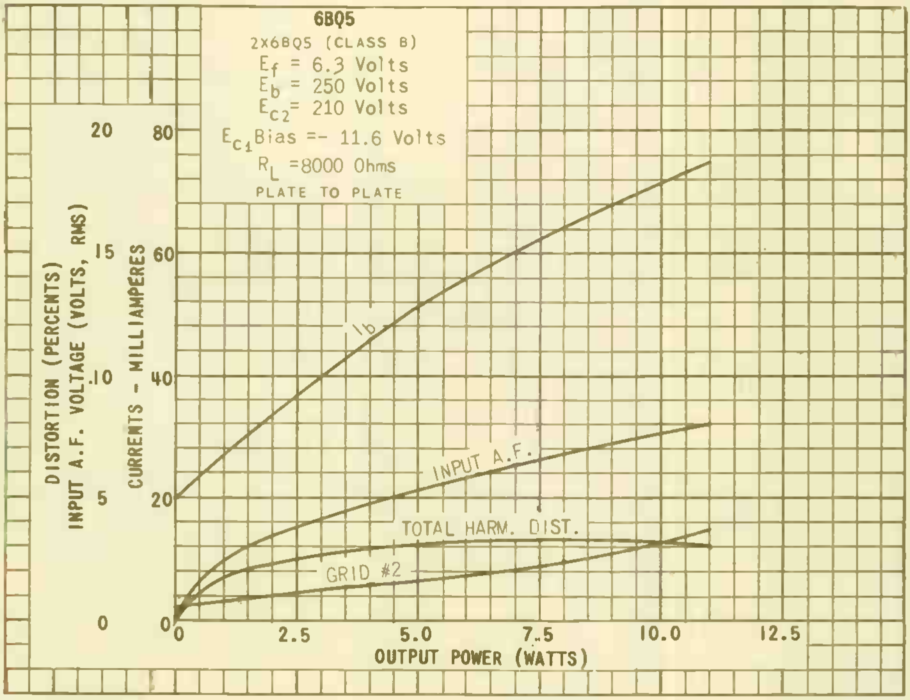

6BQ5
TRIODE CONNECTION
Ef = 6.3 Volts
PLATE MILLIAMPERES
200
150
100
50
0
PLATE VOLTS
0
50
100
150
200
250
300
EcBias =0
-2.5
-5.0
-7.5
-10.0
-12.5
-15.0

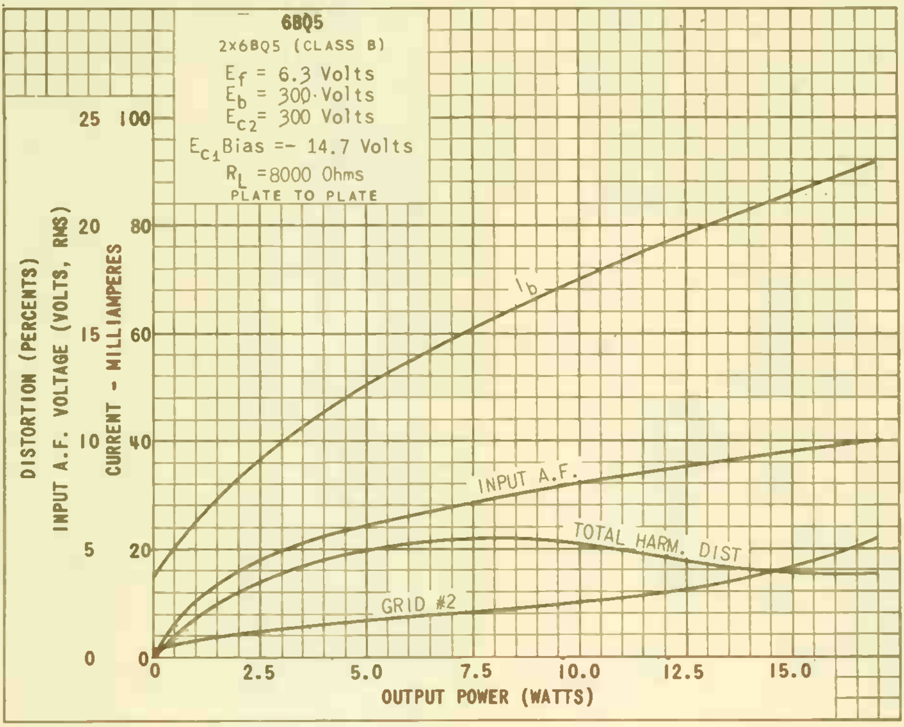

6BQ5
Ef = 6.3 Volts
Eb = 250 Volts
Ec1Bias =-7.3 Volts
R1 =5200 Ohms
DISTORTION (PERCENT)
12.5
10.0
7.5
5.0
2.5
0
PLATE (Ib) OR GRID (Ic2) MILLIAMPERES
50
40
30
20
10
0
INPUT A.C. (VOLTS, RMS)
5
4
3
2
1
0
OUTPUT POWER - (WATTS)
0
1
2
3
4
5
6
Ib
TOTAL HARM. DIST.
INPUT A.C.
3rd HARM.
2nd HARM.
Ic2

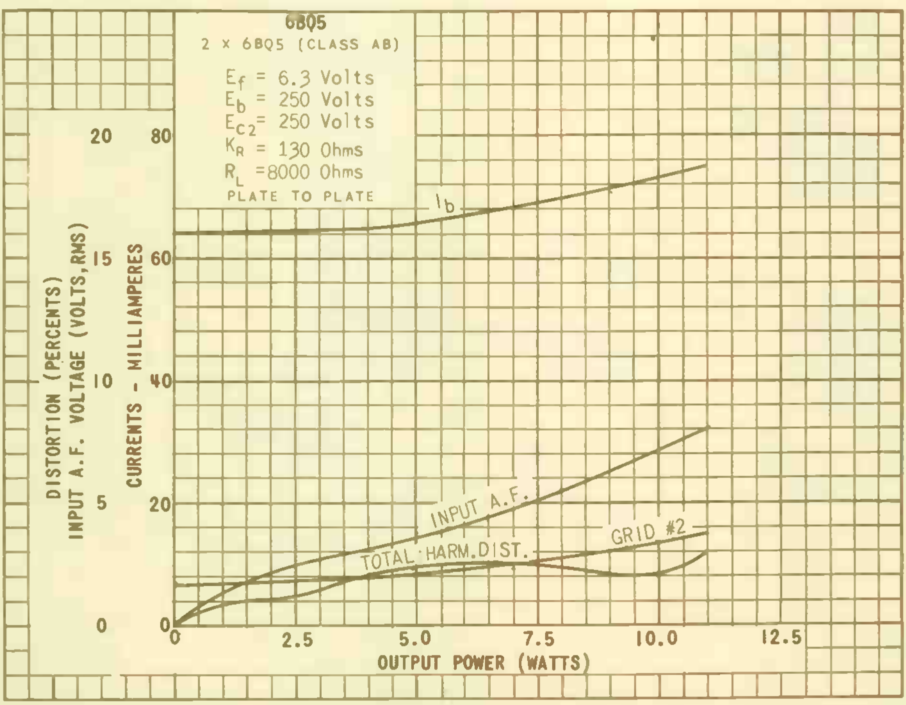

6BQ5
Ef = 6.3 Volts
Eb = 250 Volts
Ec2 = 250 Volts
Ec1 Bias = 7.3 Volts
RL = 4500 Ohms
Ib
INPUT A.F.
TOTAL HARM. DIST.
Ic2
2nd HARM.
3rd HARM.
DISTORTION (PERCENT)
PLATE (Ib) OR GRID #2 (Ic2) - MILLIAMPERES
INPUT A.F. (VOLTS, RMS)
OUTPUT POWER (WATTS)

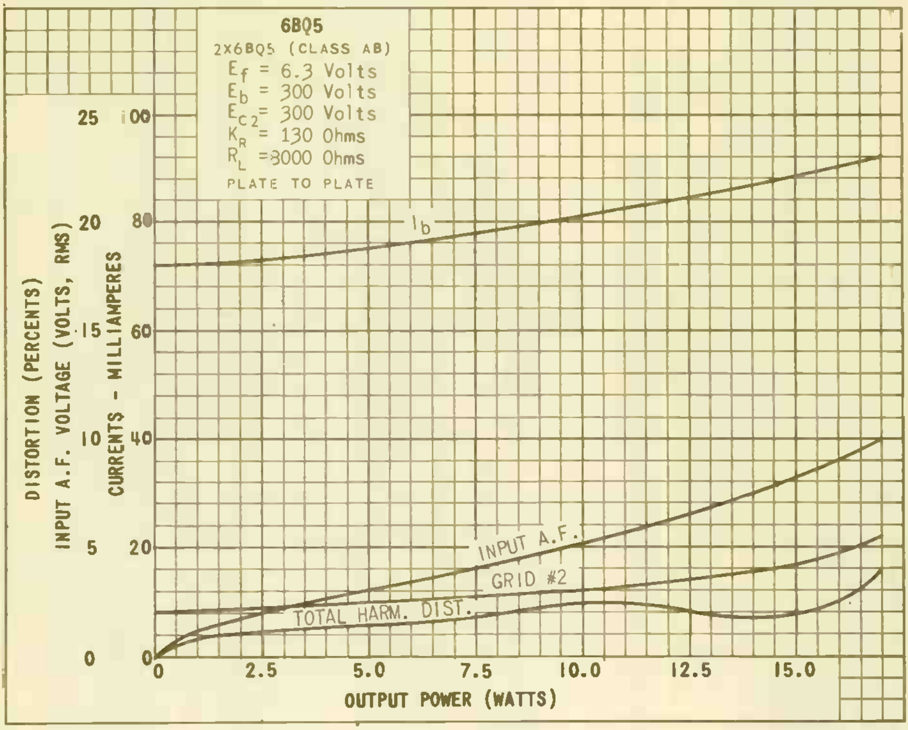

6BQ5
Ef = 6.3 Volts
Eb = 250 Volts
Ec2 = 250 Volts
Ec1 = 8.4 Volts
R1 = 7000 Ohms
Ib
INPUT A.F.
TOTAL HARM. DIST.
3rd HARM.
Ic2
2nd HARM.
DISTORTION (PERCENT)
PLATE (Ib) OR GRID #2 (Ic2) - MILLIAMPERES
INPUT A.F. (VOLTS, RMS)
OUTPUT (WATTS)

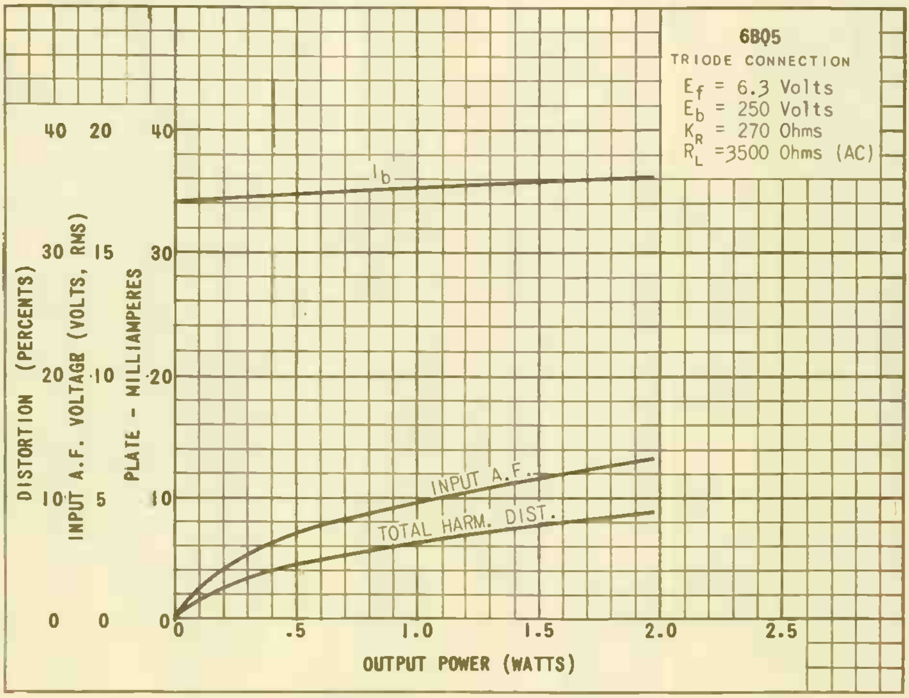

6BQ5
Ef = 6.3 Volts
Eb = 250 Volts
Ec2 = 210 Volts
Ec1 Bias = - 6.4 Volts
RL = 7000 Ohms
Ib
INPUT A.F.
TOTAL HARM. DIST.
3rd HARM.
GRID #2
2nd HARM.
DISTORTION (PERCENTS)
CURRENT - MILLIAMPERES
INPUT A.F. VOLTAGE (VOLTS, RMS)
OUTPUT POWER (WATTS)

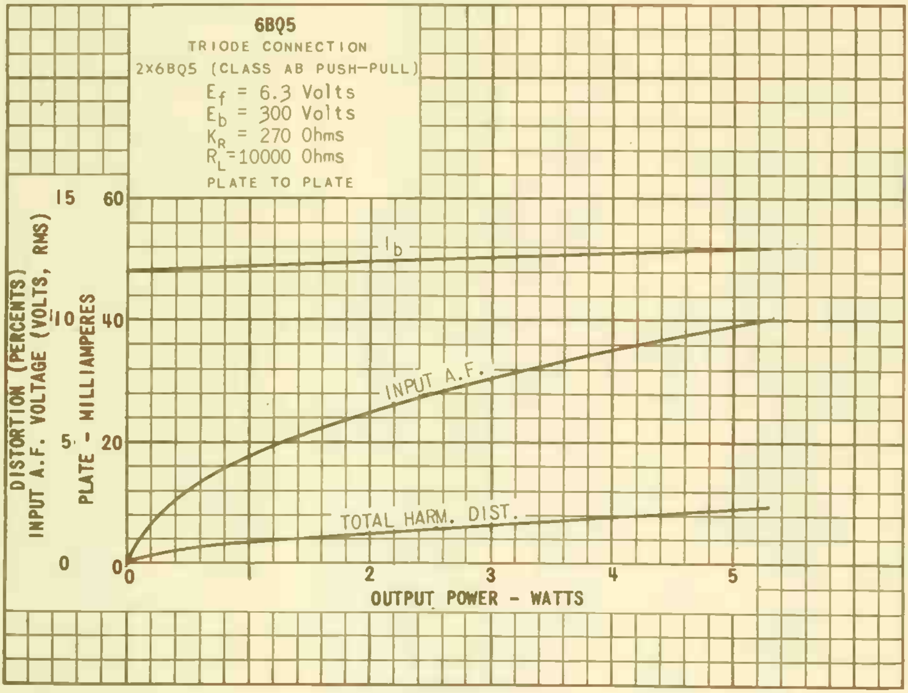

6BQ5
2X6BQ5 (CLASS B)
Ef = 6.3 Volts
Eb = 250 Volts
Ec2 = 210 Volts
Ec1 Bias = - 11.6 Volts
RL = 8000 Ohms
PLATE TO PLATE
Ib
INPUT A.F.
TOTAL HARM. DIST.
GRID #2
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
CURRENTS - MILLIAMPERES
OUTPUT POWER (WATTS)

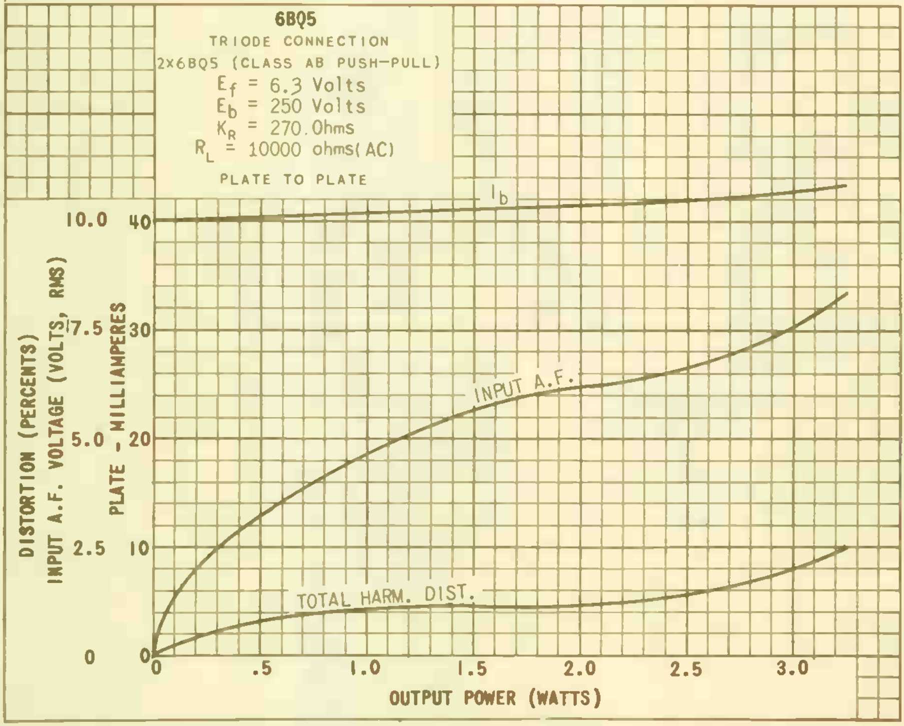

6BQ5
2x6BQ5 (CLASS B)
Ef = 6.3 Volts
Eb = 300 Volts
Ec2 = 300 Volts
Ec1 Bias = - 14.7 Volts
RL = 8000 Ohms
PLATE TO PLATE
Ib
INPUT A.F.
TOTAL HARM. DIST
GRID #2
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
CURRENT - MILLIAMPERES
25 100
20 80
15 60
10 40
5 20
0 0
0 2.5 5.0 7.5 10.0 12.5 15.0
OUTPUT POWER (WATTS)


6BQ5
2 x 6BQ5 (CLASS AB)
Ef = 6.3 Volts
Eb = 250 Volts
Ec2 = 250 Volts
KR = 130 Ohms
RL = 8000 Ohms
PLATE TO PLATE
Ib
INPUT A.F.
TOTAL HARM. DIST.
GRID #2
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
CURRENTS - MILLIAMPERES
20 80
15 60
10 40
5 20
0 0
0 2.5 5.0 7.5 10.0 12.5
OUTPUT POWER (WATTS)


6BQ5
2X6BQ5 (CLASS AB)
E_f = 6.3 Volts
E_b = 300 Volts
E_{c2} = 300 Volts
K_R = 130 Ohms
R_L = 8000 Ohms
PLATE TO PLATE
I_b
INPUT A.F.
GRID #2
TOTAL HARM. DIST.
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
CURRENTS - MILLIAMPERES
OUTPUT POWER (WATTS)
0 2.5 5.0 7.5 10.0 12.5 15.0
0 5 10 15 20 25
0 20 40 60 80 100

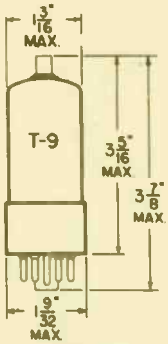

6BQ5
TRIODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
K_R = 270 Ohms
R_L = 3500 Ohms (AC)
I_b
INPUT A.F.
TOTAL HARM. DIST.
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
PLATE - MILLIAMPERES
OUTPUT POWER (WATTS)
0 .5 1.0 1.5 2.0 2.5
0 10 20 30 40
0 5 10 15 20
0 10 20 30 40


6BQ5
TRIODE CONNECTION
2x6BQ5 (CLASS AB PUSH-PULL)
Ef = 6.3 Volts
Eb = 300 Volts
KR = 270 Ohms
RL = 10000 Ohms
PLATE TO PLATE
Ib
INPUT A.F.
TOTAL HARM. DIST.
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
PLATE - MILLIAMPERES
15
10
5
0
60
40
20
0
0
2
3
4
5
OUTPUT POWER - WATTS


6BQ5
TRIODE CONNECTION
2x6BQ5 (CLASS AB PUSH-PULL)
Ef = 6.3 Volts
Eb = 250 Volts
KR = 270 Ohms
RL = 10000 ohms(AC)
PLATE TO PLATE
Ib
INPUT A.F.
TOTAL HARM. DIST.
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
PLATE - MILLIAMPERES
10.0
7.5
5.0
2.5
0
40
30
20
10
0
0
.5
1.0
1.5
2.0
2.5
3.0
OUTPUT POWER (WATTS)

TUNG-SOL

BEAM PENTODE

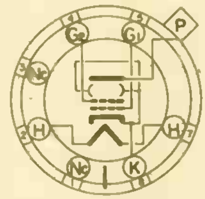


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE 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.

PLATE 3142
FEB. 1 1953

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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.
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.

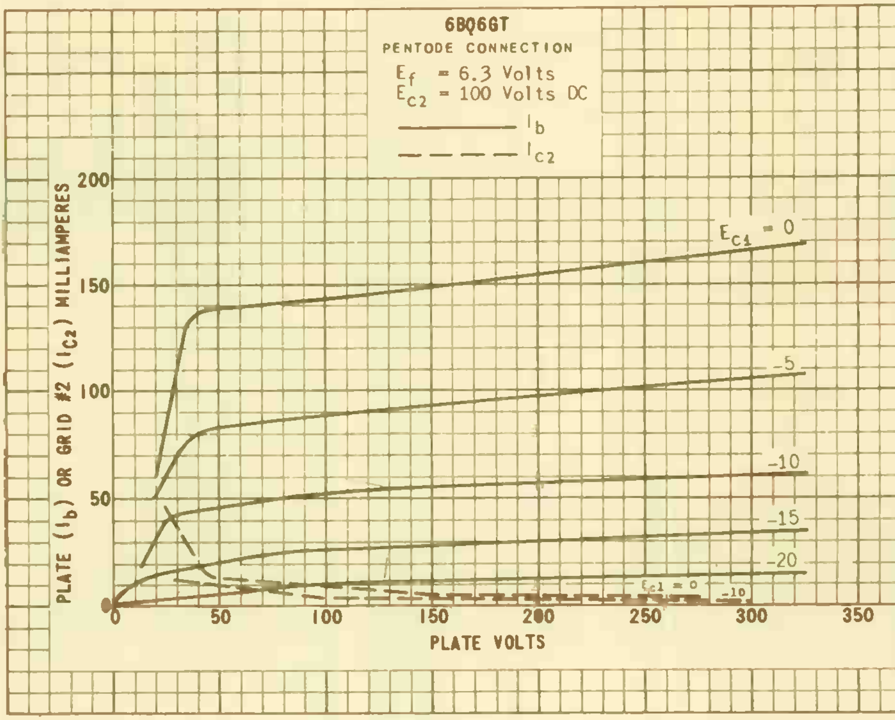
[D] WITH E_b = 60 VOLTS AND E_{C2} = 150 VOLTS.

[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



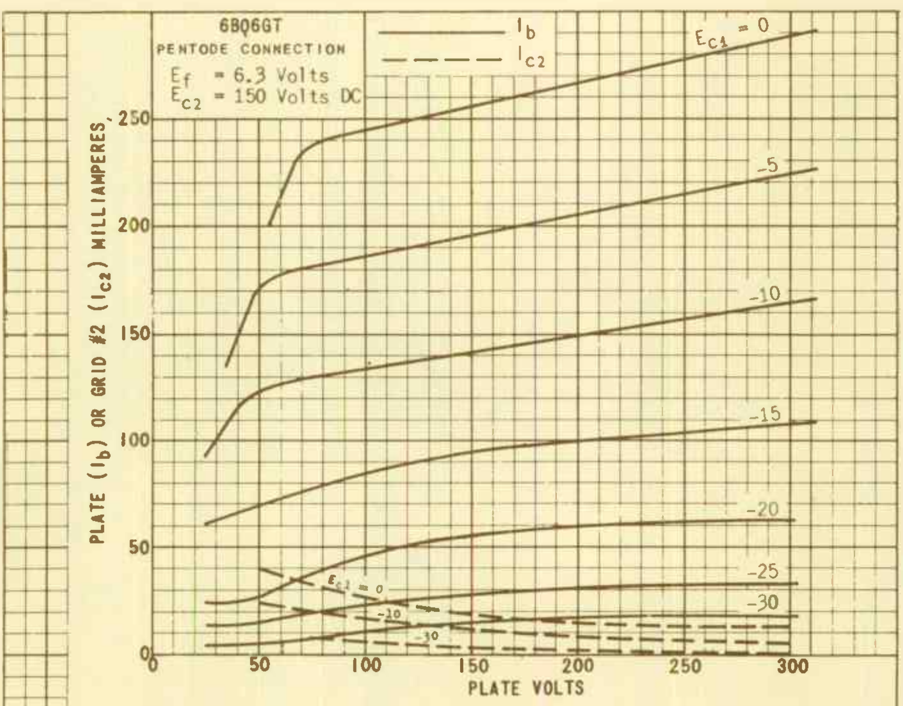
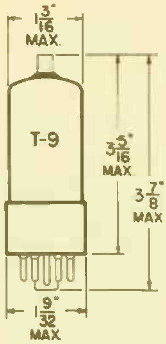


PLATE
2337
FEB. 1
1950

TUNG-SOL

PENTODE

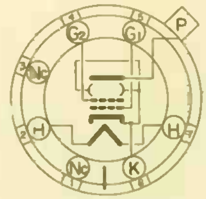


GLASS BULB
SKIRTED
MINIATURE CAP

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

TUNG-SOL

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.*

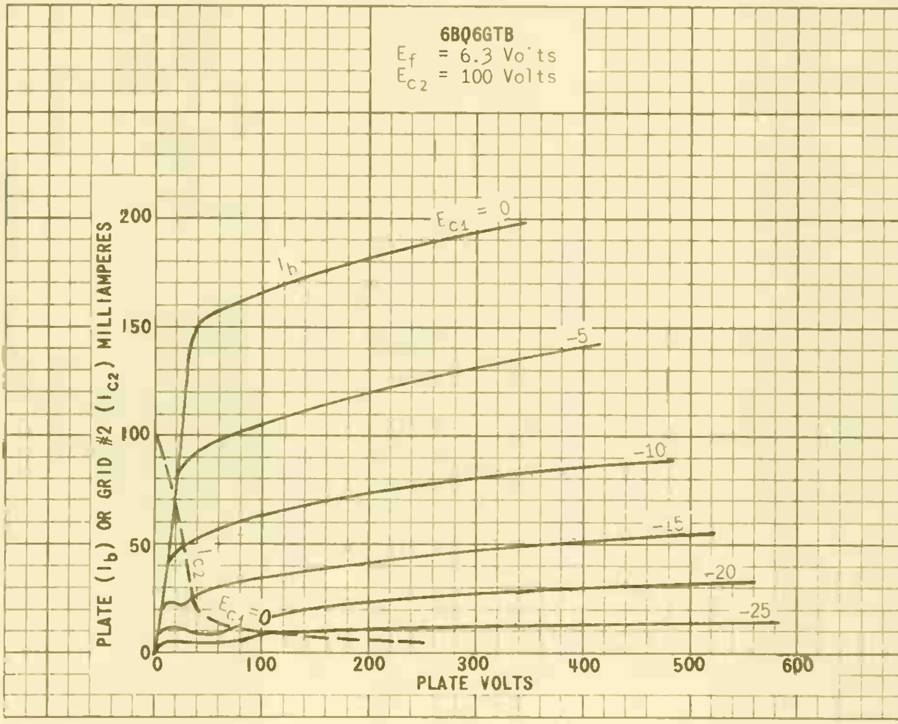
THE ELECTRICAL DATA AND PIN CONNECTION FOR TYPE 6BQ6GTB ARE IDENTICAL WITH THOSE OF TYPES 6BQ6GA AND 6CU6.

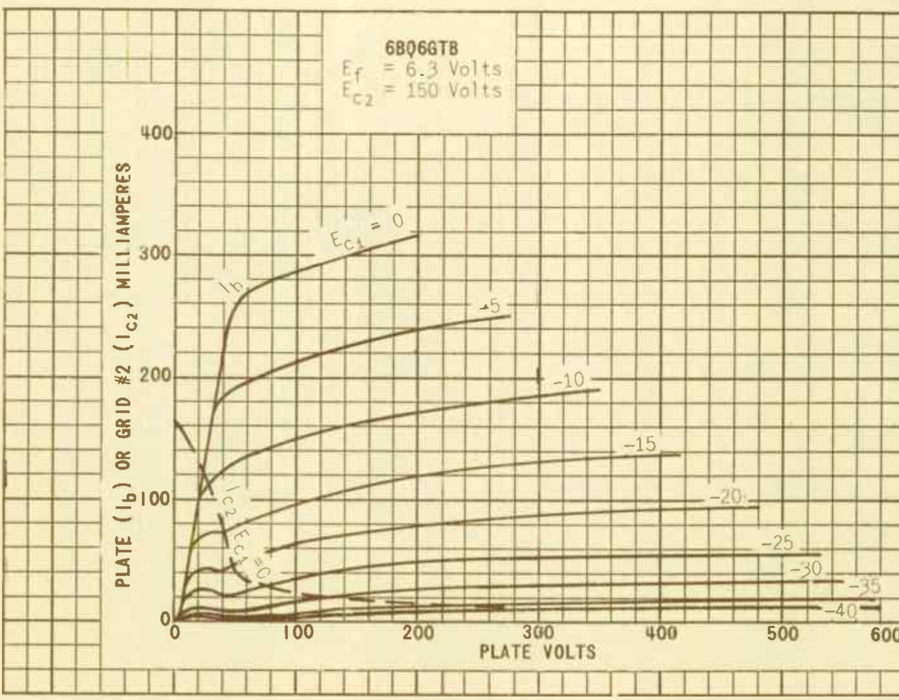
[C] WITH E_b = 250V, E_{c2} = 150V, AND E_{c1} = −22.5V.

[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.





TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. MARCH 1, 1958 PLATE #5203

TUNG-SOL

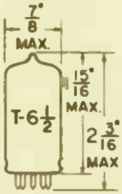
DOUBLE TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 400 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB

BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
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 CIRCUIT PROVIDING LOW TUBE NOISE AND GOOD STABILITY AS A VHF VOLTAGE AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315

	UNIT #1	UNIT #2	
GRID TO PLATE: (G TO P)	1.15	1.15	μμf
INPUT: G TO (H+K)	2.55	—	μμf
INPUT (GROUNDED GRID): K TO (H+G)	—	4.75	μμf
OUTPUT: P TO (H+K)	1.3	—	μμf
OUTPUT (GROUNDED GRID): P TO (H+G)	—	2.4	μμf
PLATE TO CATHODE: (P TO K)	0.12	0.12	μμf
HEATER TO CATHODE: (H+K)	2.3	2.3	μμf
PLATE OF UNIT #1 TO PLATE OF UNIT #2: (1P TO 2P)	0.006		μμf
PLATE OF UNIT #2 TO PLATE AND GRID OF UNIT #1: 2P TO (1P+1S)	0.014		μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

EACH TRIODE UNIT

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	200	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - EACH TRIODE UNIT

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	400	MA.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
PLATE RESISTANCE	5 800	OHMS
TRANSCONDUCTANCE	6 000	μMHOS
AMPLIFICATION FACTOR	35	
PLATE CURRENT	9	MA.
MAXIMUM PLATE CURRENT FOR GRID VOLTS = -10	100	μA.

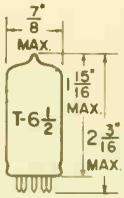
PLATE 2523
DEC. 1 1950

PRINTED IN U.S.A.

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

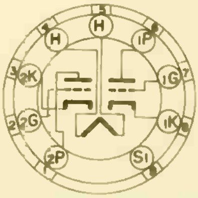


GLASS BULB

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

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.

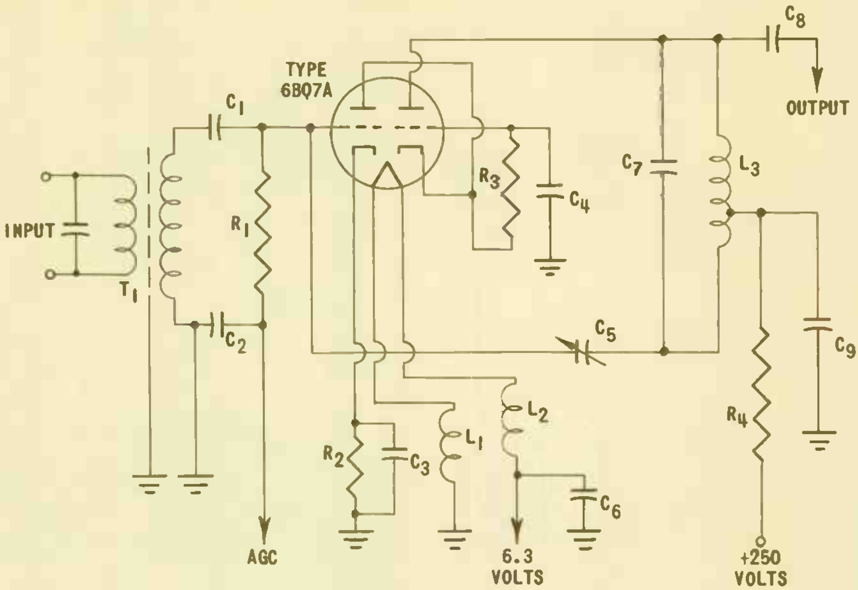
RF GROUNDED GRID CIRCUIT WITH DIRECT-COUPLED DRIVE

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

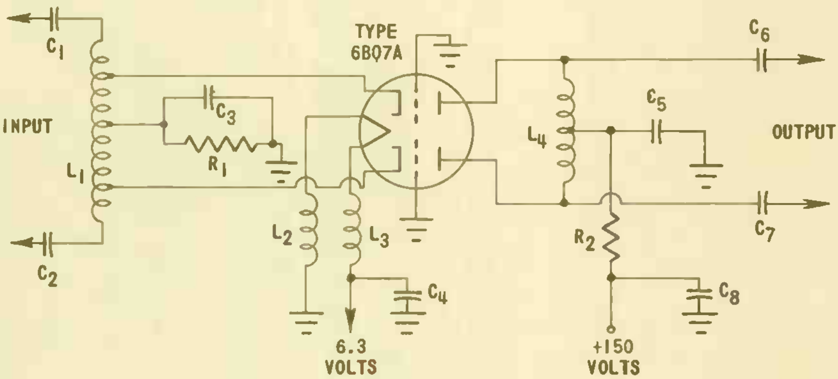


C1: 33 uuf, 400 VOLTS
C2: 1000 uuf, 400 VOLTS
C3: 1000 uuf, 400 VOLTS
C4: 1000 uuf, 400 VOLTS
C5: 0.5 to 1.5 uuf, 400 VOLTS
C6: 1000 uuf, 400 VOLTS
C7: 2 uuf, 400 VOLTS
C8: 33 uuf, 400 VOLTS
C9: 1000 uuf, 400 VOLTS

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

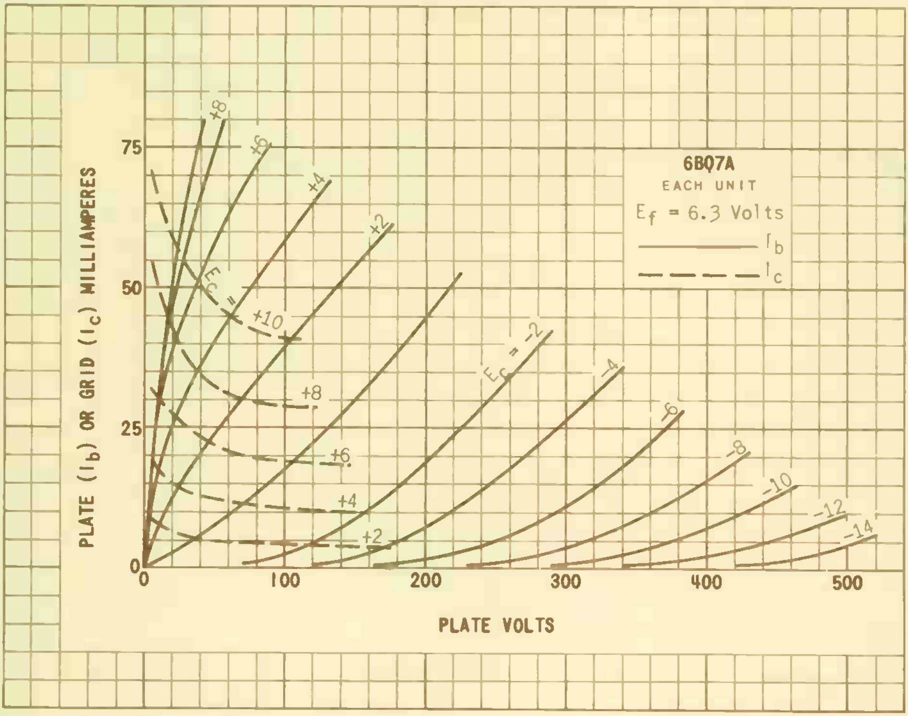


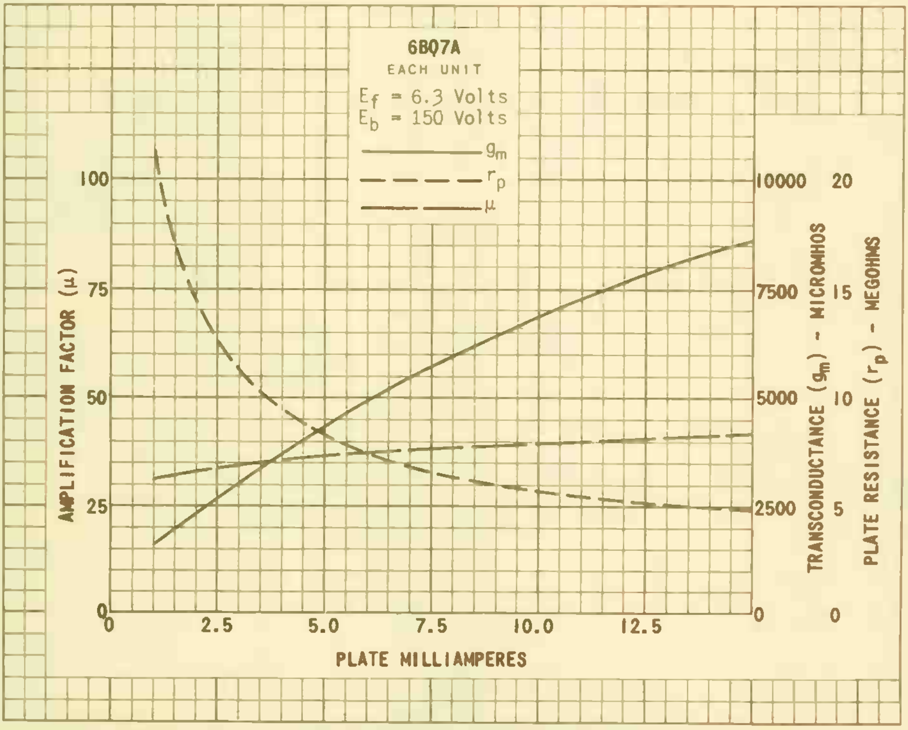
C1 C2 C3 C4 C5:
1000 uuf, 400 VOLTS
C6 C7:
100 uuf, 400 VOLTS
C8: 1000 uuf, 400 VOLTS

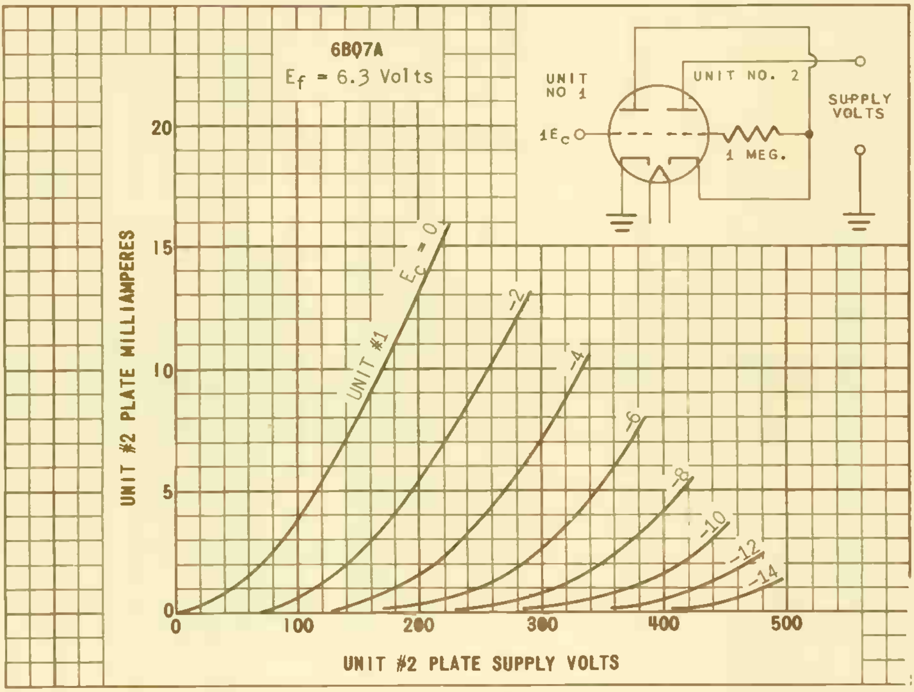
L1 L4: TUNED CIRCUIT ELEMENTS OF TUNER. VALUES DEPEND ON DISTRIBUTED CIRCUIT CAPACITANCES.

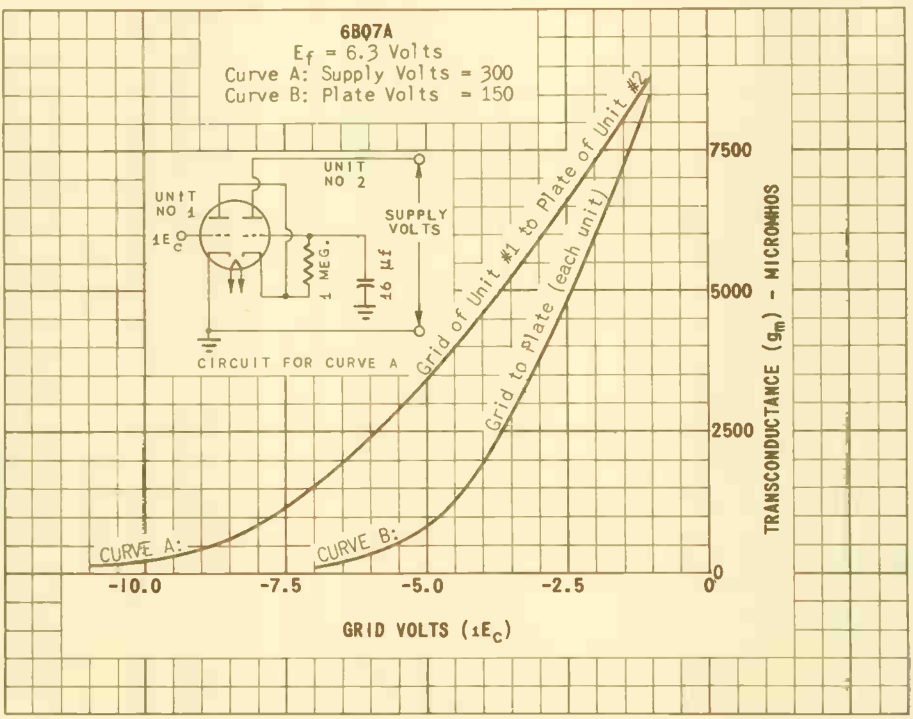
L2 L3: BIFILAR CHOKES, EACH 10 TURNS OF NO. 18 ENAMEL WIRE, 1/4" COIL FORM.
R1 R2: 100 OHMS, 0.5 WATT

PUSH-PULL RF GROUNDED-GRID CIRCUIT


6BQ7A
EACH UNIT
Ef = 6.3 Volts
Ib
Ic
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
Ec = +10
+8
+6
+4
+2
Ec = -2
-4
-6
-8
-10
-12
-14
0
25
50
75
100
200
300
400
500


6BQ7A
EACH UNIT
Ef = 6.3 Volts
Eb = 150 Volts
gm
rp
μ
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE RESISTANCE (rp) - 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

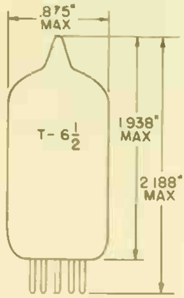

6BQ7A
Ef = 6.3 Volts
UNIT NO 1
UNIT NO. 2
SUPPLY VOLTS
1Ec
1 MEG.
Ec = 0
UNIT #1
-2
-4
-6
-8
-10
-12
-14
UNIT #2 PLATE MILLIAMPERES
0
5
10
15
20
0
100
200
300
400
500
UNIT #2 PLATE SUPPLY VOLTS


6BQ7A
Ef = 6.3 Volts
Curve A: Supply Volts = 300
Curve B: Plate Volts = 150
UNIT NO 1
UNIT NO 2
1Ec
1 MEG.
16 µf
SUPPLY VOLTS
CIRCUIT FOR CURVE A
Grid of Unit #1 to Plate of Unit #2
Grid to Plate (each unit)
CURVE A:
CURVE B:
7500
5000
2500
0
TRANSCONDUCTANCE (gm) - MICROMHOS
-10.0
-7.5
-5.0
-2.5
0
GRID VOLTS (1Ec)

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

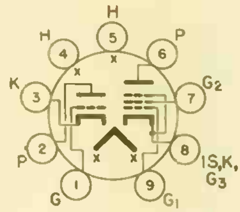


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

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 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	0.010	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.)	2.4B	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)	2.4B	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

TUNG-SOL

CONTINUEO FROM PRECEOING PAGE

HEATER CHARACTERISTICS AND RATINGS

OESIGN MAXIMUM VALUES - SEE EIA STANOARO 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

OESIGN MAXIMUM VALUES - SEE EIA STANOARO 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

	TRIOOE	PENTOOE	
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 OEFINED 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.

CONTINUEO ON FOLLOWING PAGE

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

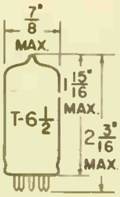
COATED UNIPOTENTIAL CATHODE

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL CASCODE CONDITIONS AND CHARACTERISTICS

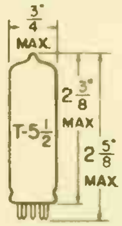
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMPERE
PLATE SUPPLY VOLTAGE	250	VOLTS
GRID VOLTAGE	-1	VOLTS
PLATE CURRENT	16	MA.
GRID VOLTAGE (APPROX.) FOR G_m = 50 μMHOS	-6	VOLTS
TRANSCONDUCTANCE	10 000	μMHOS

→ INDICATES A CHANGE.

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

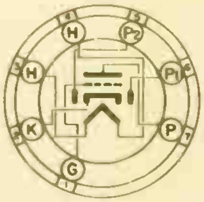


GLASS BULB

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.

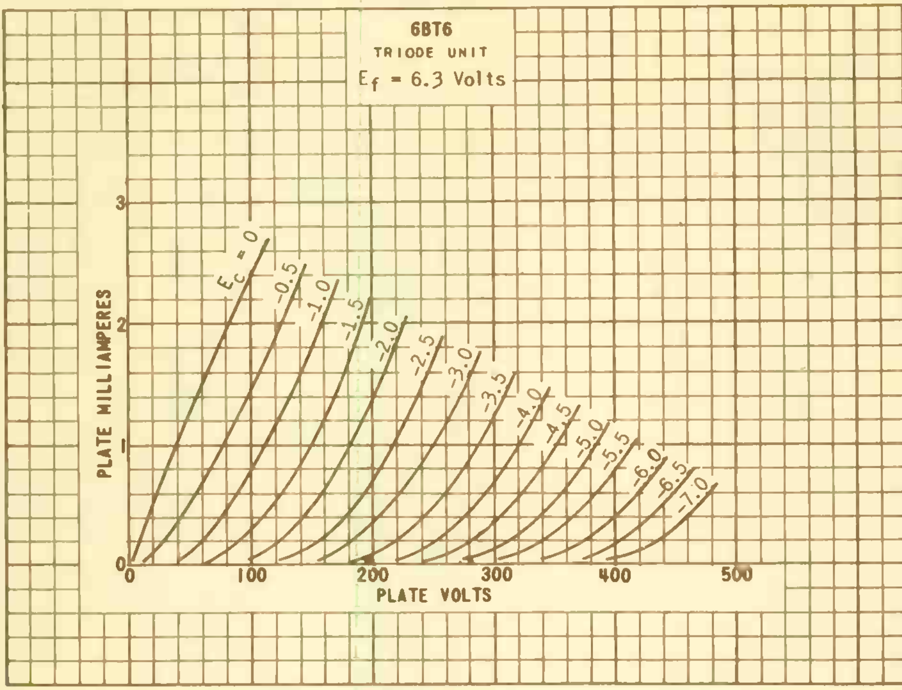
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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	

PLATE 2302
JAN. 1 1950

PRINTED IN U.S.A.

6BT6 (12BT6)



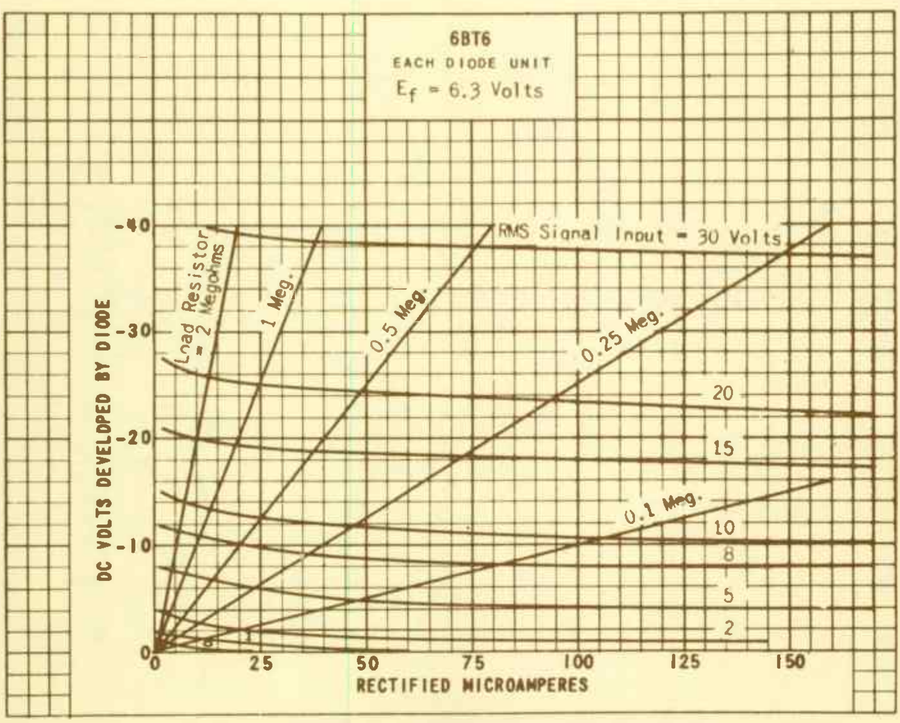
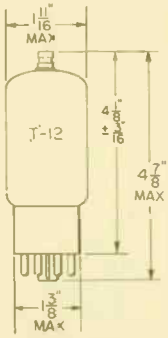


PLATE 2303
JAN. 1 1950

TUNG-SOL



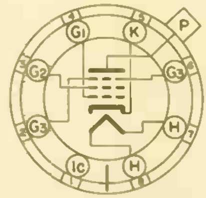
GLASS BULB
SMALL CAP
WITH GROOVE

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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

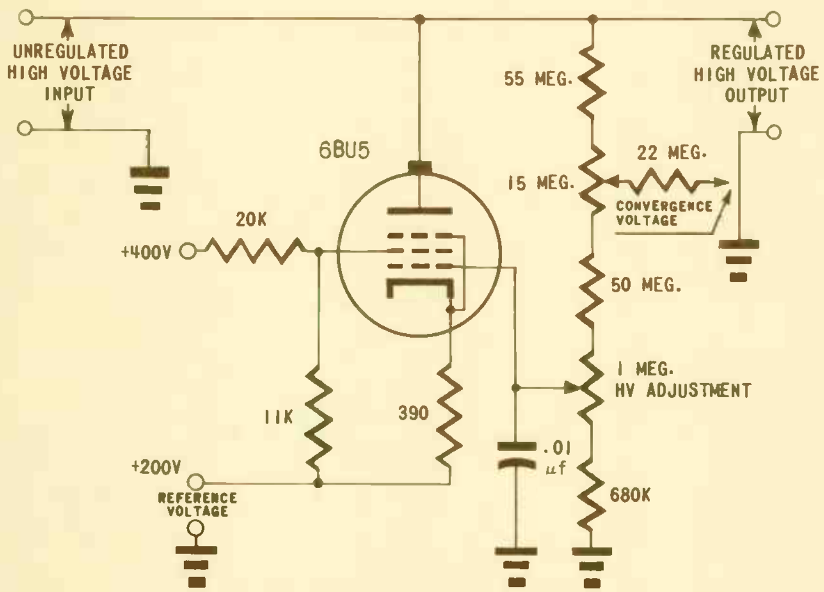
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D

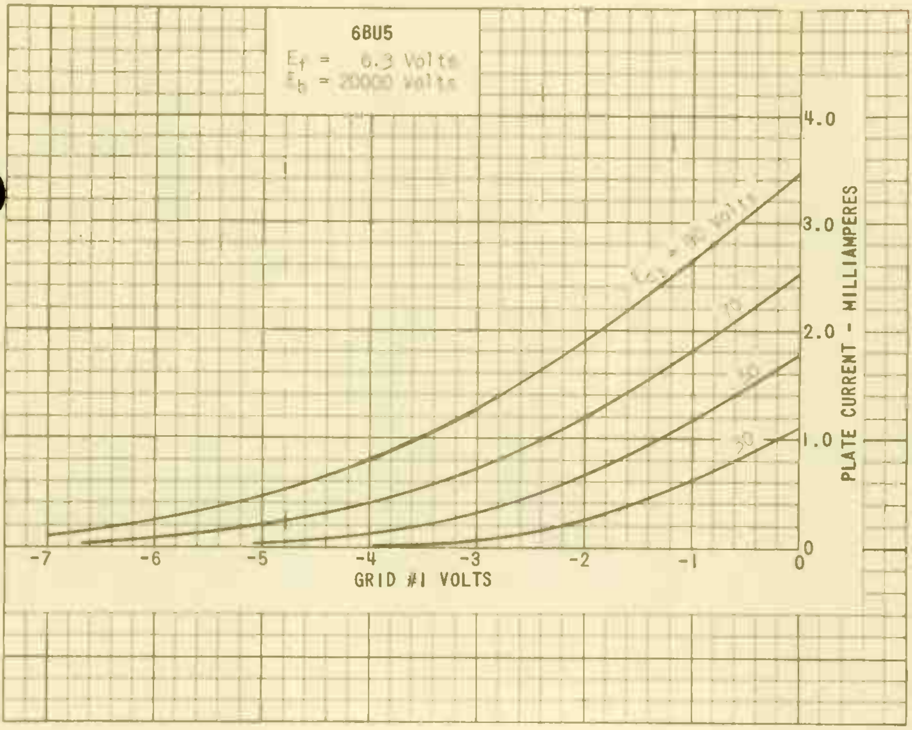
TV HIGH-VOLTAGE REGULATOR SERVICE

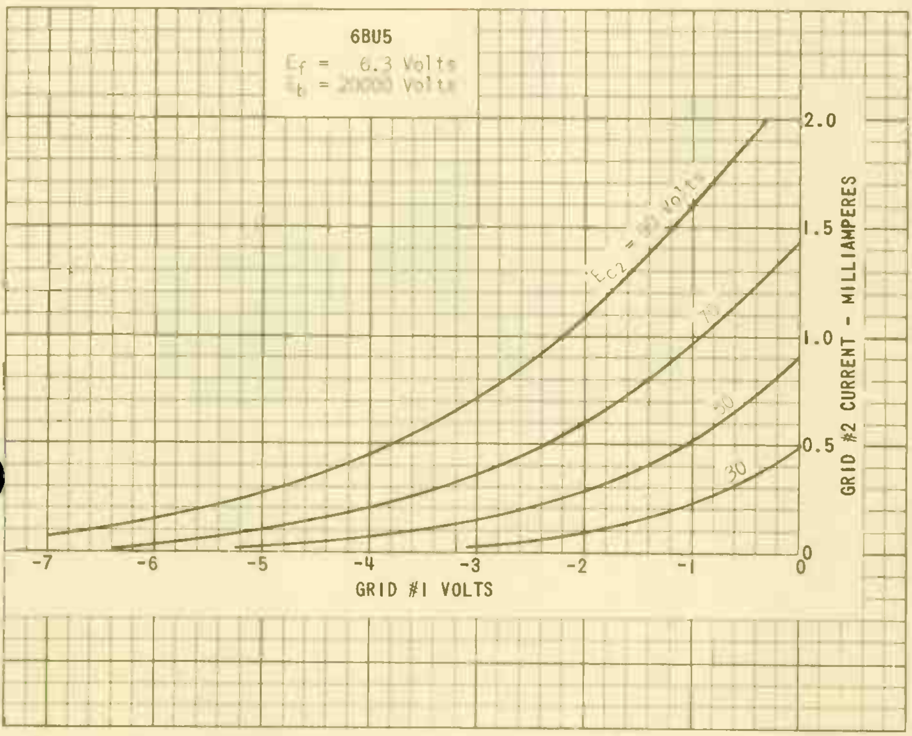
SEE CIRCUIT DIAGRAM

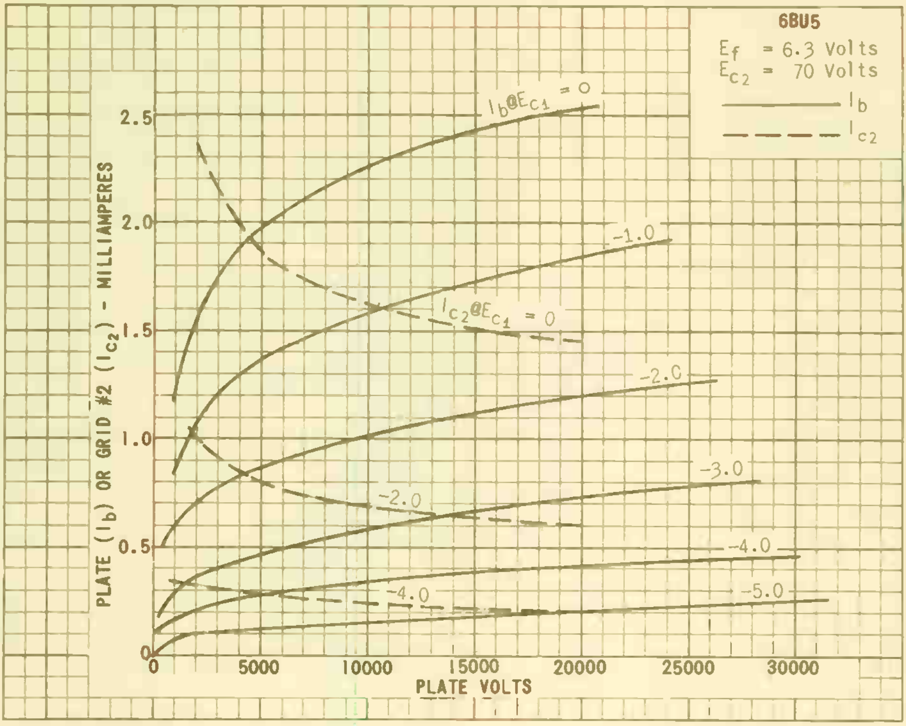
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.15		AMP.
UNREGULATED DC SUPPLY VOLTAGE	29 900		VOLTS
EQUIVALENT RESISTANCE OF UNREGULATED SUPPLY	8.5		MEGOHMS
GRID #2 VOLTAGE	70		VOLTS
DC REFERENCE VOLTAGE	200		VOLTS
SUPPRESSOR VOLTAGE	0		VOLTS
DC LOAD CURRENT	0	1.0	MA.
DC PLATE CURRENT	1.0	0.05	MA.
DC GRID #2 CURRENT	0.5	0.03	MA.
REGULATED DC OUTPUT VOLTAGE	20 000	19 600	VOLTS

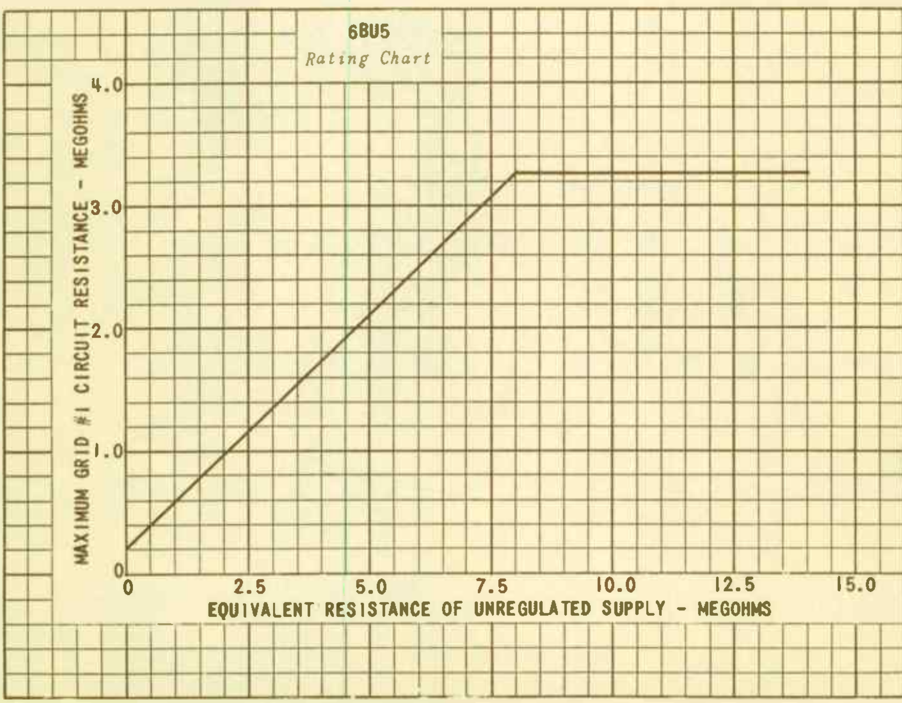
NOTE: HIGH VOLTAGE OPERATION OF THE 6BU5 CAN RESULT IN THE PRODUCTION OF X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS THESE TUBES ARE ADEQUATELY SHIELDED. THE NEED FOR THIS PRECAUTION SHOULD BE CONSIDERED IN EQUIPMENT DESIGN. RELATIVELY SIMPLE SHIELDING SHOULD PROVE ADEQUATE.




6BU5
E_f = 6.3 Volts
E_b = 20000 Volts
E_{c2} = 90 Volts
70
50
30
PLATE CURRENT - MILLIAMPERES
4.0
3.0
2.0
1.0
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


6BU5
E_f = 6.3 Volts
E_b = 20000 Volts
E_{c2} = 90 Volts
70
50
30
GRID #2 CURRENT - MILLIAMPERES
2.0
1.5
1.0
0.5
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS

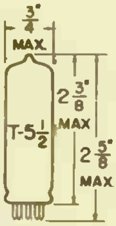

6BU5
Ef = 6.3 Volts
Ec2 = 70 Volts
Ib
Ic2
Ib@Ec1 = 0
Ic2@Ec1 = 0
-1.0
-2.0
-3.0
-4.0
-5.0
PLATE (Ib) OR GRID #2 (Ic2) - MILLIAMPERES
PLATE VOLTS
0
5000
10000
15000
20000
25000
30000
0.5
1.0
1.5
2.0
2.5


6BU5
Rating Chart
MAXIMUM GRID #1 CIRCUIT RESISTANCE - MEGOHMS
EQUIVALENT RESISTANCE OF UNREGULATED SUPPLY - MEGOHMS
0
2.5
5.0
7.5
10.0
12.5
15.0
1.0
2.0
3.0
4.0

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

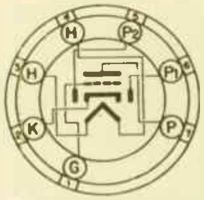


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

THE 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.

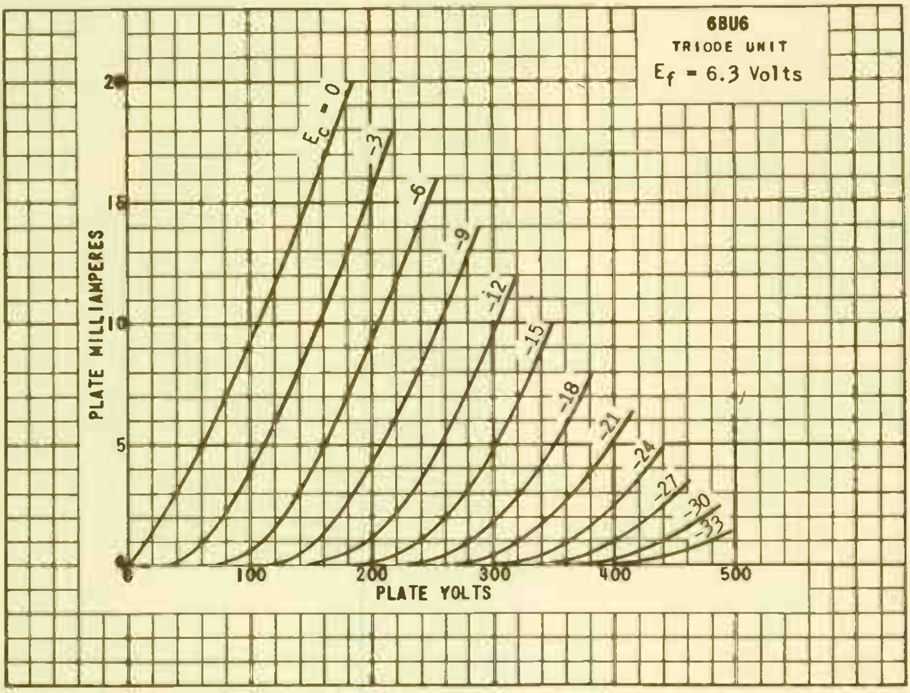
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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.

PRINTED IN U. S. A.

PLATE 2304
JAN. 1 1950



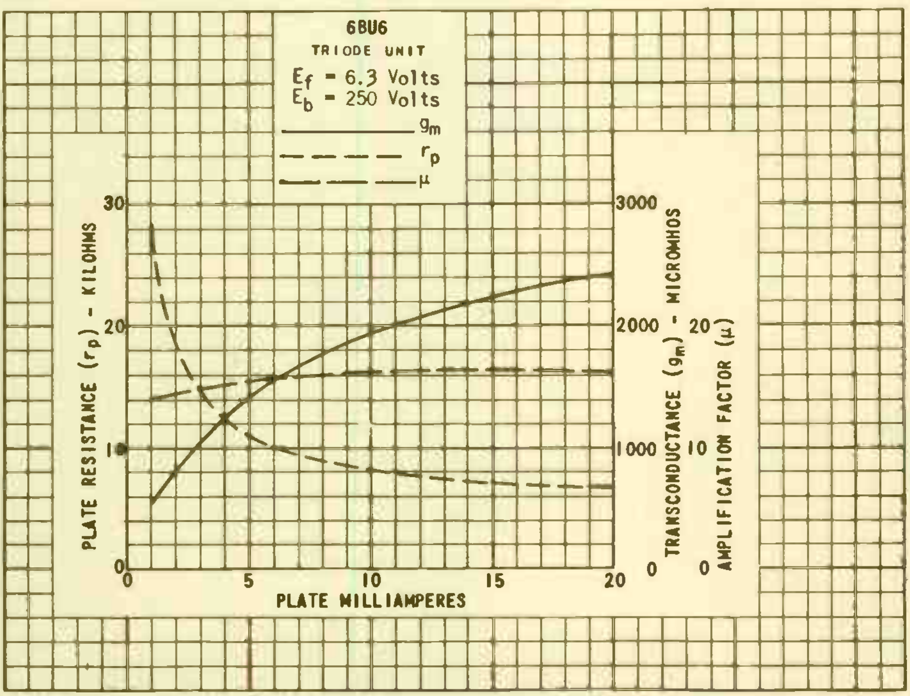


PLATE 2305
JAN. 1 1950

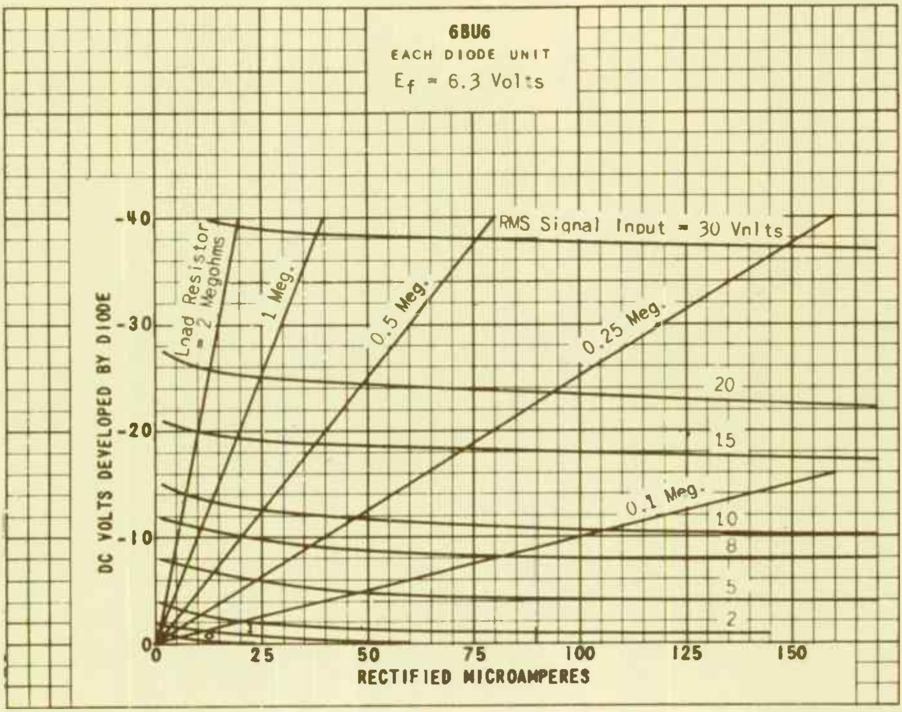


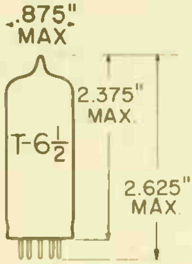
PLATE 2306

JAN. 1 1950

TUNG-SOL

TWIN PENTODE

MINIATURE TYPE

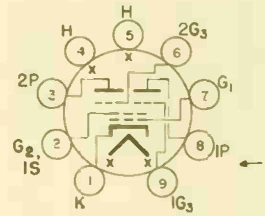


GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 0.3 AMP.
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

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

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.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS – CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

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

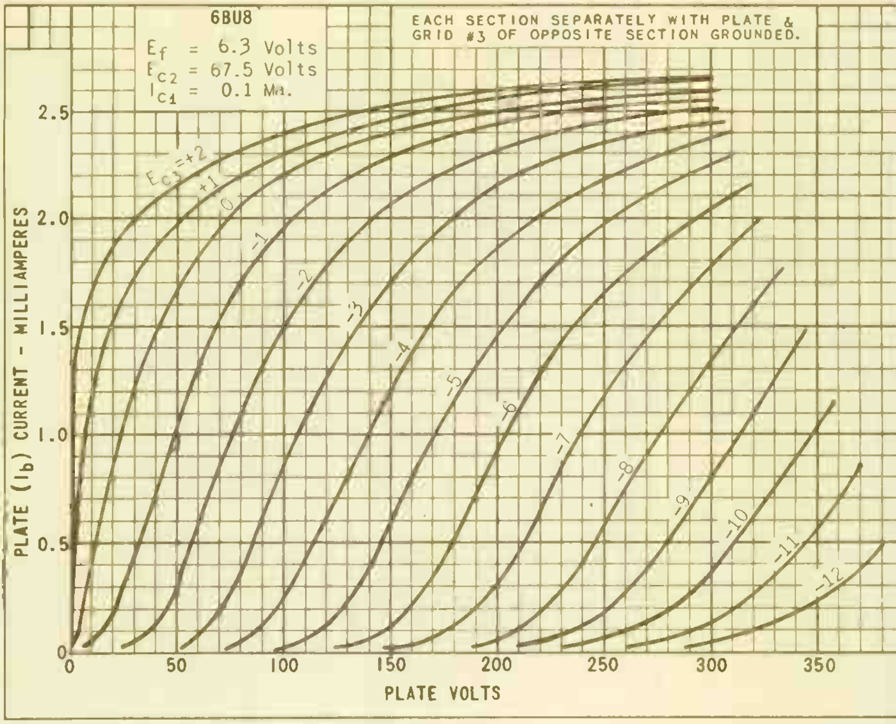
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

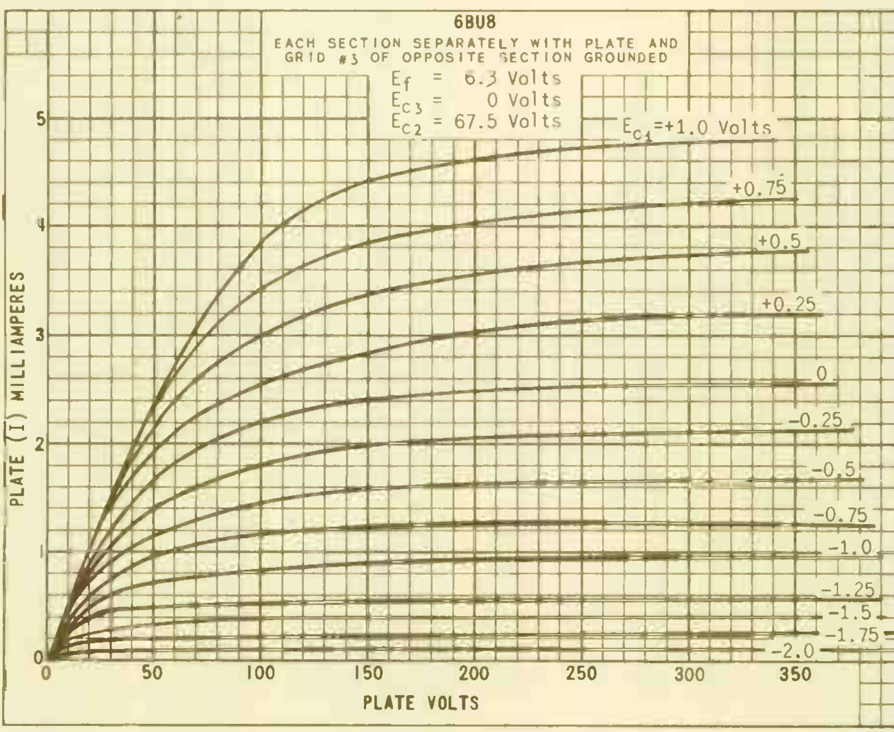
**WITH GRID CURRENT ADJUSTED FOR 100 μAMPS D-C.

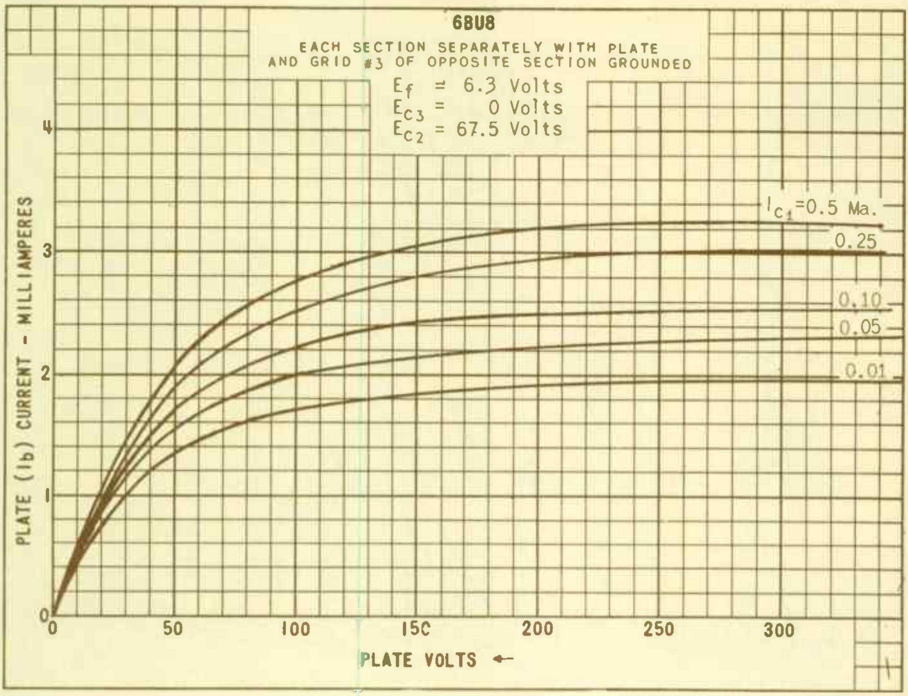
A WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED.

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.

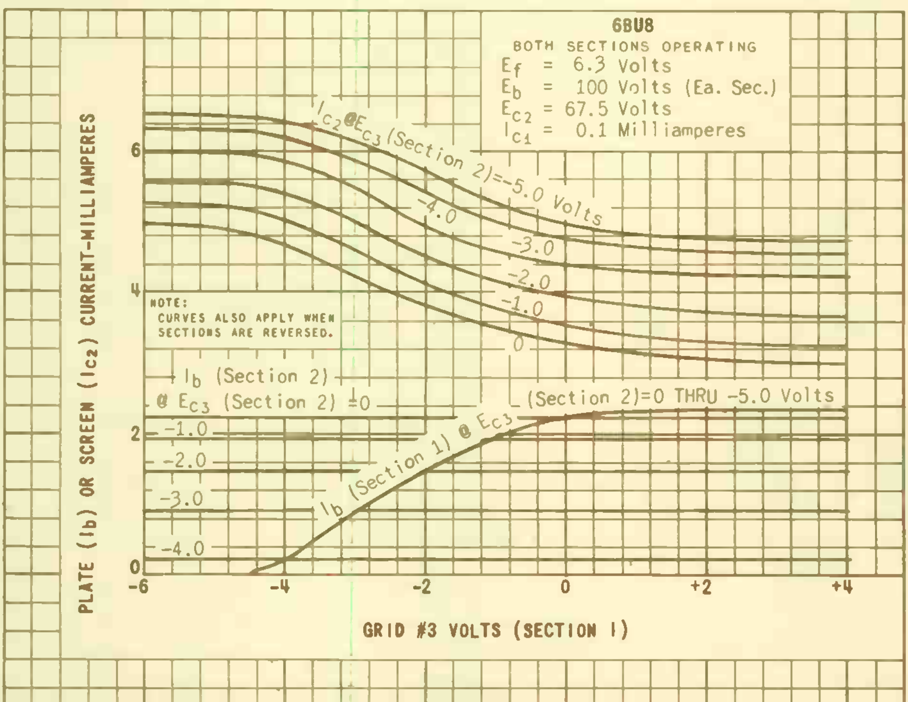
SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time the 6BU8 is identical to the 3BU8.*


6BU8
E_f = 6.3 Volts
E_{c2} = 67.5 Volts
I_{c1} = 0.1 Ma.
EACH SECTION SEPARATELY WITH PLATE & GRID #3 OF OPPOSITE SECTION GROUNDED.
E_{c3}=+2
+1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
2.5
2.0
1.5
1.0
0.5
0
PLATE (I_b) CURRENT - MILLIAMPERES
0
50
100
150
200
250
300
350
PLATE VOLTS

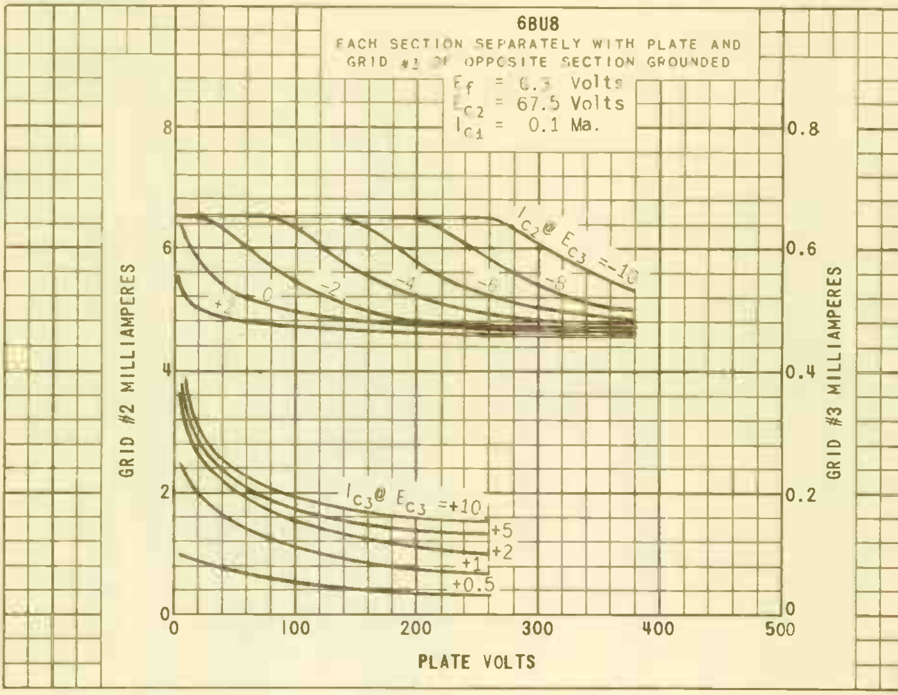

6BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 6.3 Volts
E_{c3} = 0 Volts
E_{c2} = 67.5 Volts
E_{c1}=+1.0 Volts
+0.75
+0.5
+0.25
0
-0.25
-0.5
-0.75
-1.0
-1.25
-1.5
-1.75
-2.0
5
4
3
2
1
0
PLATE (I) MILLIAMPERES
0
50
100
150
200
250
300
350
PLATE VOLTS

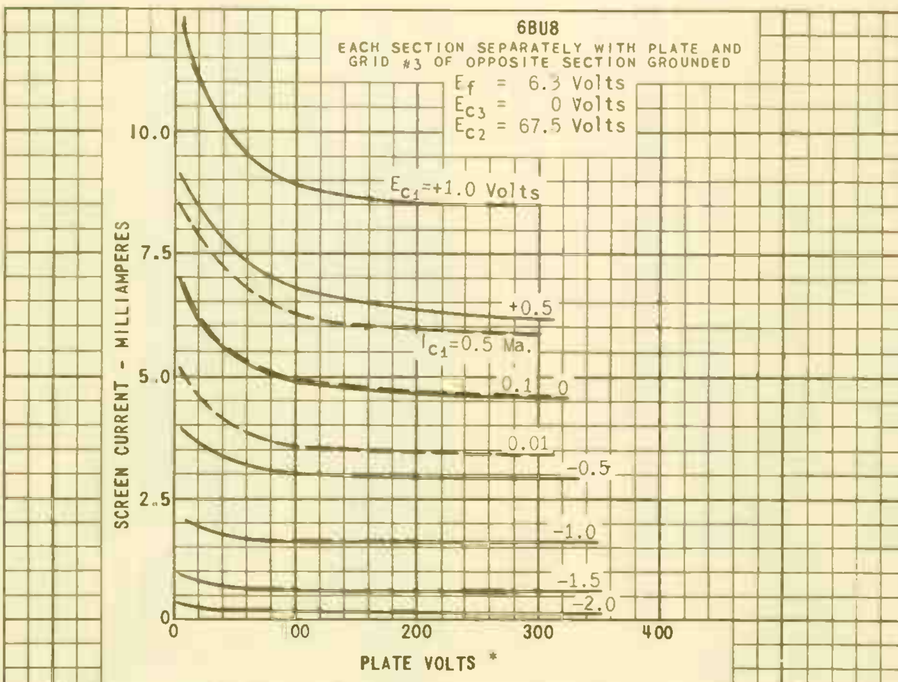


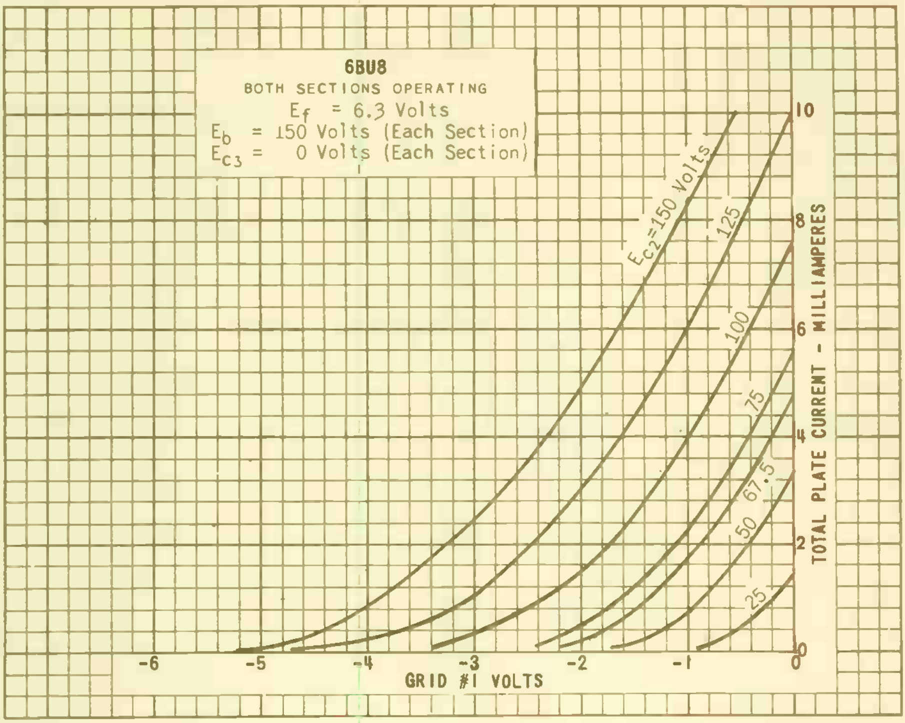
6BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
Ef = 6.3 Volts
Ec3 = 0 Volts
Ec2 = 67.5 Volts
Ic1=0.5 Ma.
0.25
0.10
0.05
0.01
PLATE (Ib) CURRENT - MILLIAMPERES
PLATE VOLTS

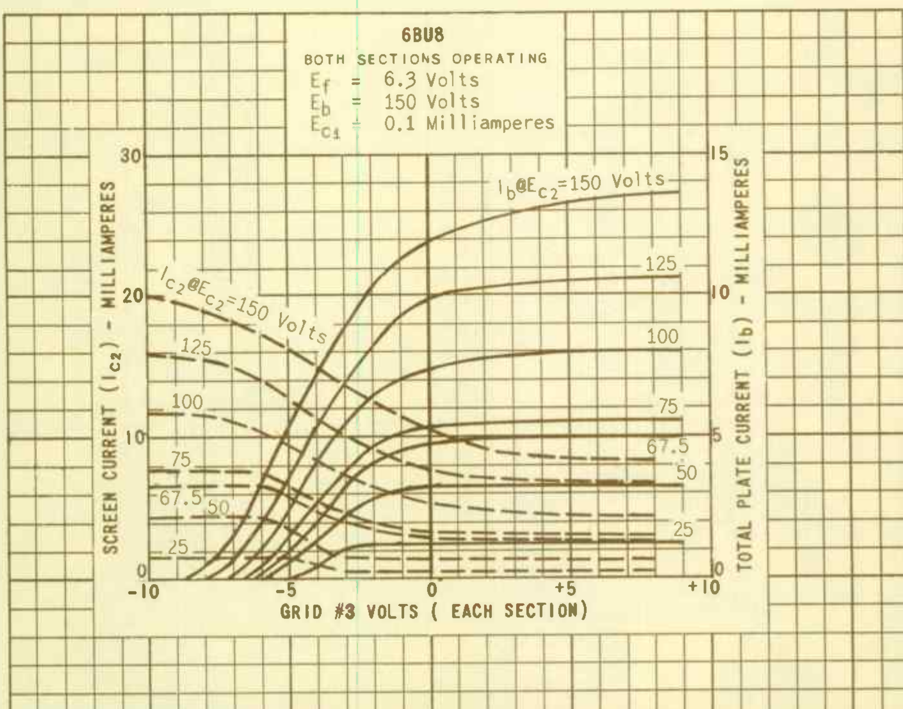


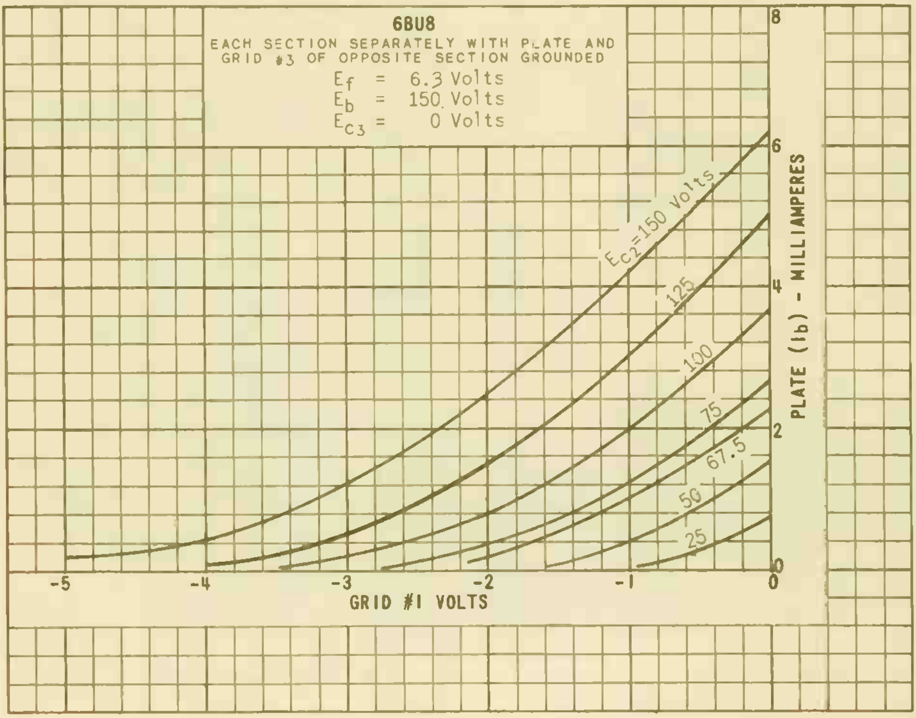
6BU8
BOTH SECTIONS OPERATING
Ef = 6.3 Volts
Eb = 100 Volts (Ea. Sec.)
Ec2 = 67.5 Volts
Ic1 = 0.1 Milliamperes
Ic2 @Ec3 (Section 2)=-5.0 Volts
-4.0
-3.0
-2.0
-1.0
0
NOTE:
CURVES ALSO APPLY WHEN SECTIONS ARE REVERSED.
Ib (Section 2)
@ Ec3 (Section 2) =0
-1.0
-2.0
-3.0
-4.0
Ib (Section 1) @ Ec3 (Section 2)=0 THRU -5.0 Volts
PLATE (Ib) OR SCREEN (Ic2) CURRENT-MILLIAMPERES
GRID #3 VOLTS (SECTION 1)

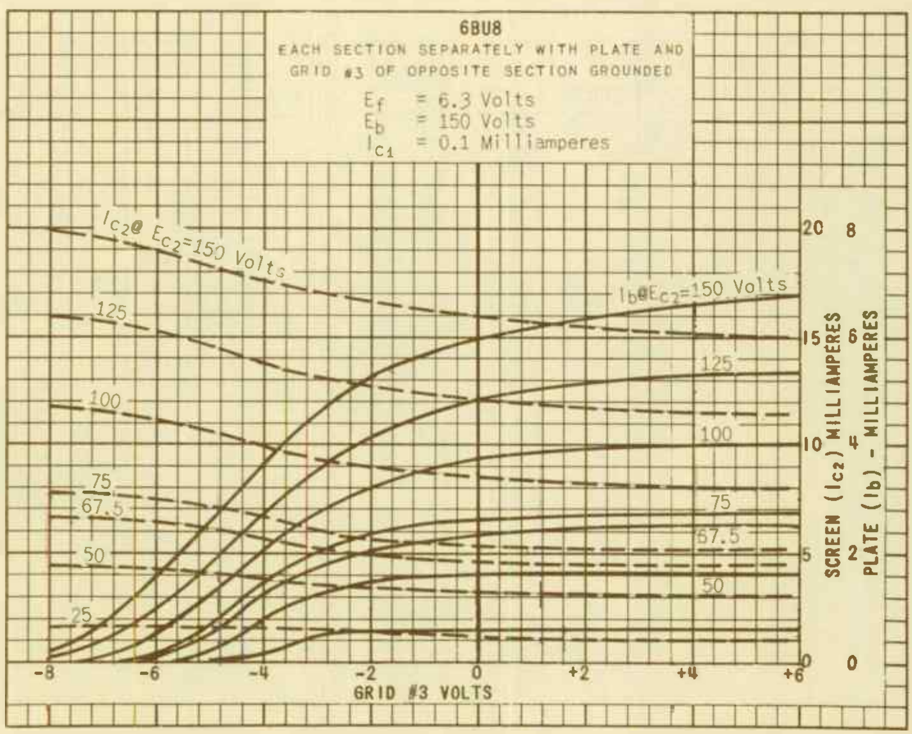

6BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
Ef = 6.3 Volts
Ec2 = 67.5 Volts
Ic1 = 0.1 Ma.
Ic2 @ Ec3 = -10
-8
-6
-4
-2
0
+2
Ic3 @ Ec3 = +10
+5
+2
+1
+0.5
GRID #2 MILLIAMPERES
GRID #3 MILLIAMPERES
0
2
4
6
8
0.2
0.4
0.6
0.8
100
200
300
400
500
PLATE VOLTS

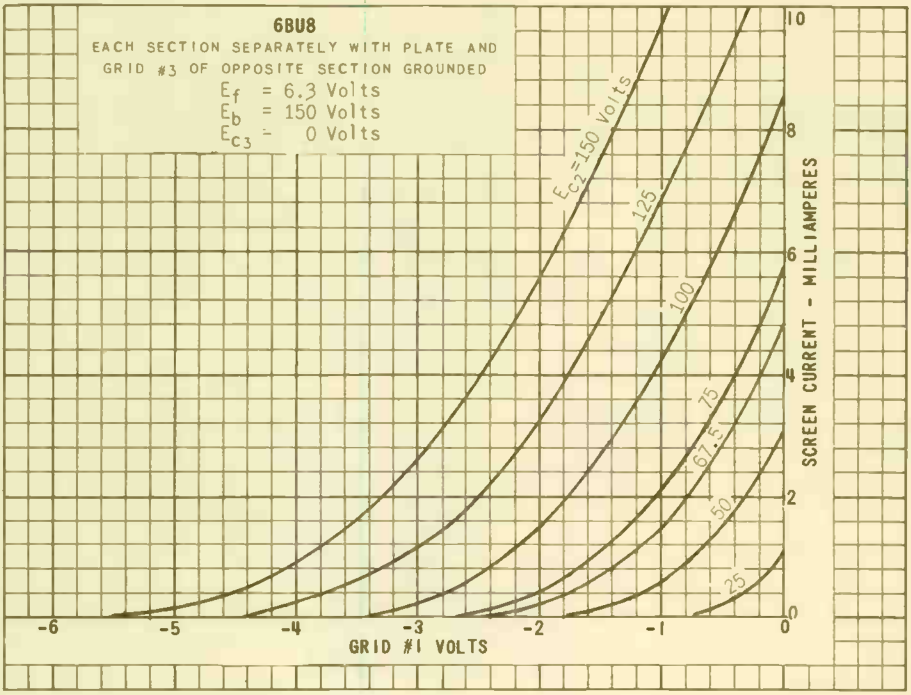

6BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
Ef = 6.3 Volts
Ec3 = 0 Volts
Ec2 = 67.5 Volts
Ec1=+1.0 Volts
+0.5
Ic1=0.5 Ma.
0.1
0
0.01
-0.5
-1.0
-1.5
-2.0
SCREEN CURRENT - MILLIAMPERES
0
2.5
5.0
7.5
10.0
100
200
300
400
PLATE VOLTS *

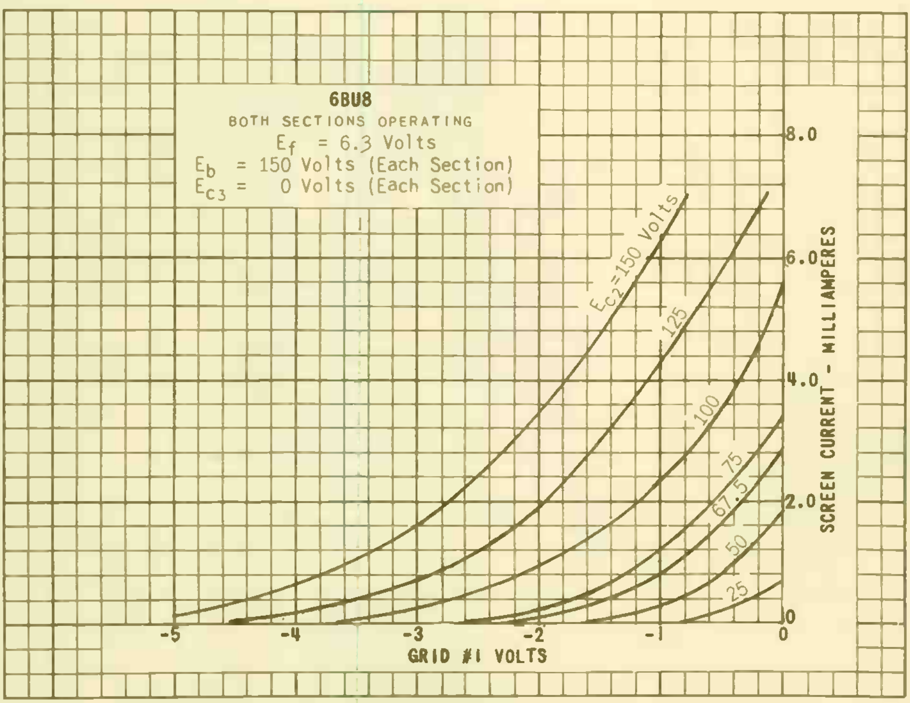

6BU8
BOTH SECTIONS OPERATING
Ef = 6.3 Volts
Eb = 150 Volts (Each Section)
Ec3 = 0 Volts (Each Section)
Ec2=150 Volts
125
100
75
67.5
50
25
TOTAL PLATE CURRENT - MILLIAMPERES
GRID #1 VOLTS


6BU8
BOTH SECTIONS OPERATING
Ef = 6.3 Volts
Eb = 150 Volts
Ec1 = 0.1 Milliamperes
Ib@Ec2=150 Volts
125
100
75
67.5
50
25
Ic2@Ec2=150 Volts
SCREEN CURRENT (Ic2) - MILLIAMPERES
TOTAL PLATE CURRENT (Ib) - MILLIAMPERES
GRID #3 VOLTS (EACH SECTION)


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
PLATE (Ib) - MILLIAMPERES
8
6
4
2
0
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


6BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 6.3 Volts
E_b = 150 Volts
I_{c1} = 0.1 Milliamperes
I_{c2}@ E_{c2}=150 Volts
I_b@E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN (I_{c2}) MILLIAMPERES
PLATE (Ib) - MILLIAMPERES
20
15
10
5
0
8
6
4
2
0
-8
-6
-4
-2
0
+2
+4
+6
GRID #3 VOLTS

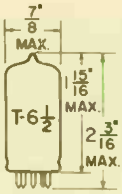

6BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
Ef = 6.3 Volts
Eb = 150 Volts
Ec3 = 0 Volts
Ec2=150 Volts
125
100
75
67.5
50
25
10
8
6
4
2
0
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
SCREEN CURRENT - MILLIAMPERES


6BU8
BOTH SECTIONS OPERATING
Ef = 6.3 Volts
Eb = 150 Volts (Each Section)
Ec3 = 0 Volts (Each Section)
Ec2=150 Volts
125
100
75
67.5
50
25
8.0
6.0
4.0
2.0
0
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
SCREEN CURRENT - MILLIAMPERES

TUNG-SOL

DUPLEX-DIODE TRIODE

MINIATURE TYPE

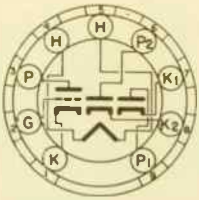


GLASS BULB

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

TUNG-SOL

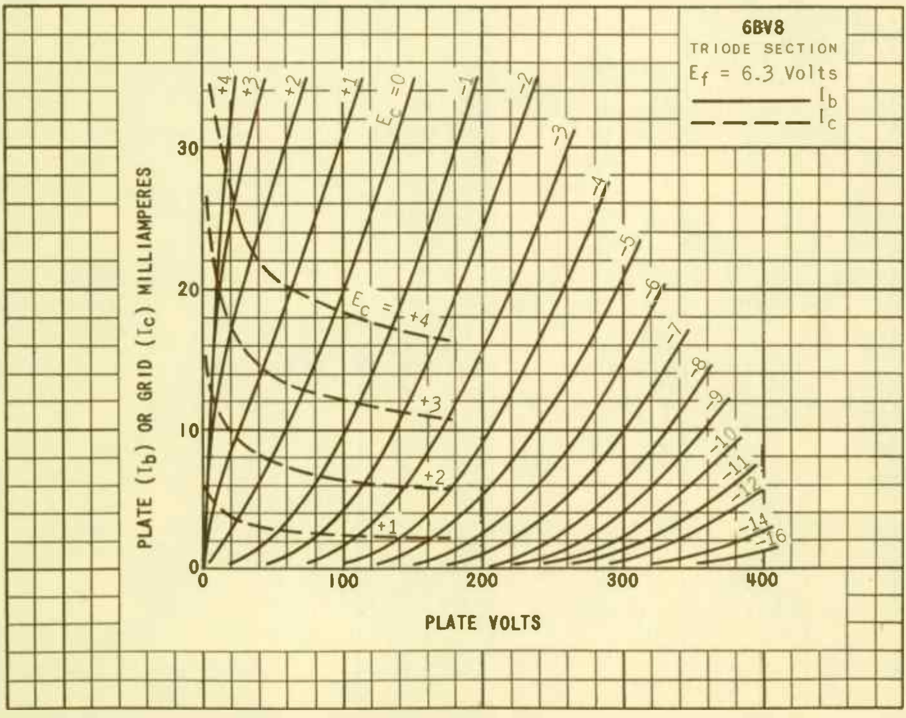
CONTINUED FROM PRECEDING PAGE

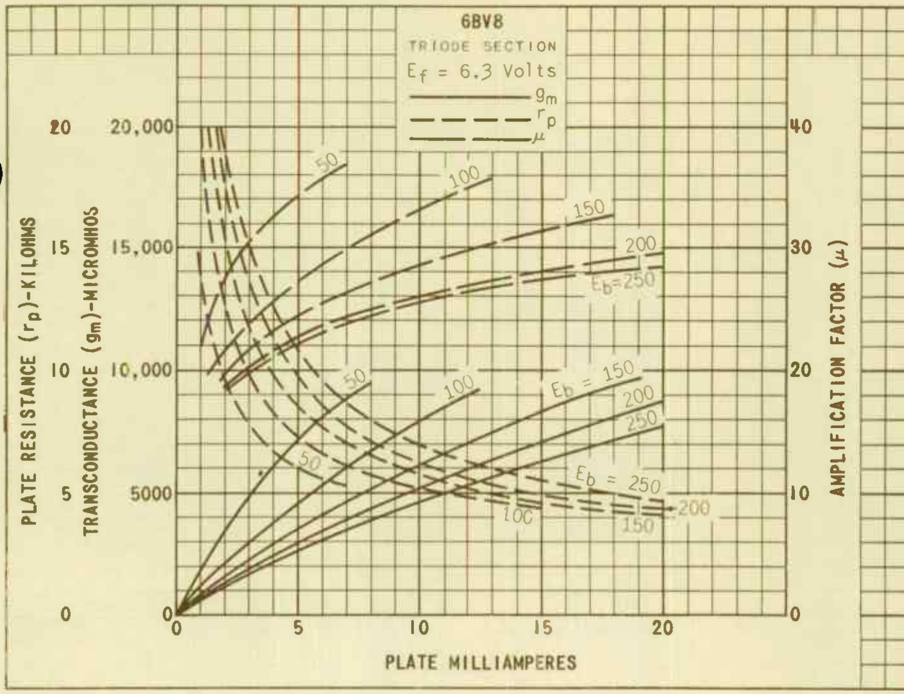
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

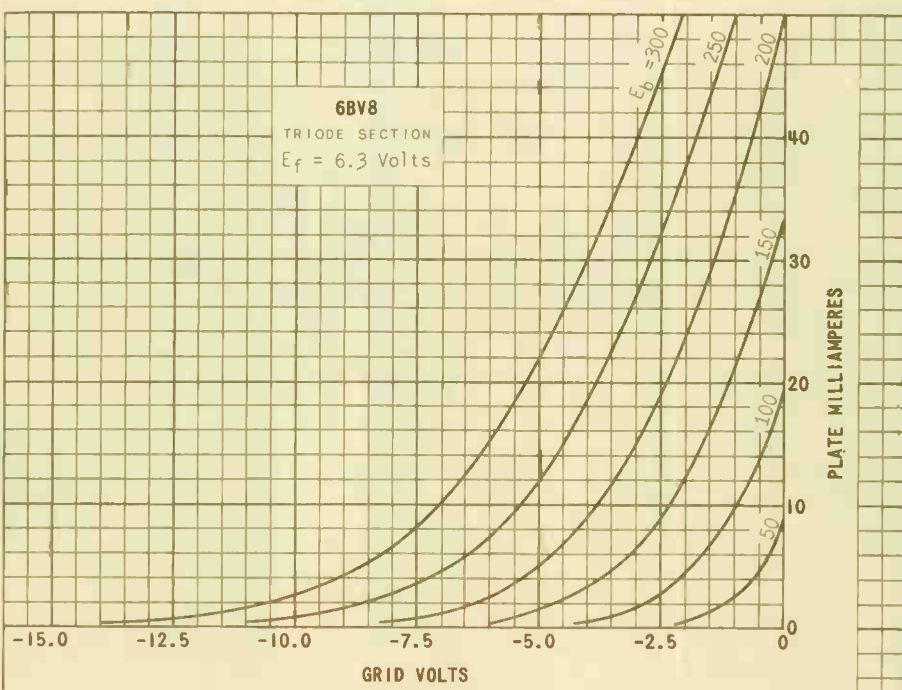
HEATER VOLTAGE	6.3±10%	6.3±10%	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	75	200	VOLTS
GRID VOLTAGE	0	---	VOLTS
CATHODE-BIAS RESISTOR	---	330	OHMS
AMPLIFICATION FACTOR	---	33	
PLATE RESISTANCE (APPROX.)	---	5 900	OHMS
TRANSCONDUCTANCE	---	5 600	μMHOS
PLATE CURRENT	14	11	MA.
GRID VOLTAGE (APPROX.) I_b = 100 μAMPS	---	-11	VOLTS
AVERAGE DIODE CURRENT (EACH DIODE) WITH 5.0 VOLTS DC APPLIED	---	23	MA.

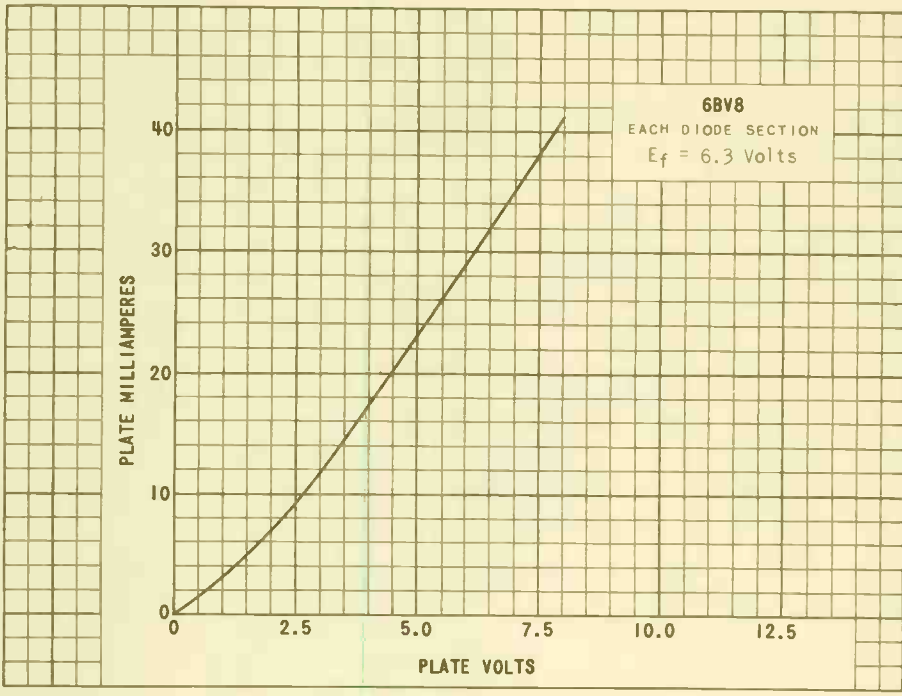
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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.




6BV8
TRIODE SECTION
E_f = 6.3 Volts
g_m
r_p
μ
PLATE RESISTANCE (r_p)-KILOHMS
TRANSCONDUCTANCE (g_m)-MICROMHOS
AMPLIFICATION FACTOR (μ)
PLATE MILLIAMPERES
E_b = 150
E_b = 250
E_b=250
50
100
150
200
250
0
5
10
15
20
5000
10,000
15,000
20,000
30
40


6BV8
TRIODE SECTION
E_f = 6.3 Volts
E_b =300
250
200
150
100
50
PLATE MILLIAMPERES
GRID VOLTS
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
10
20
30
40



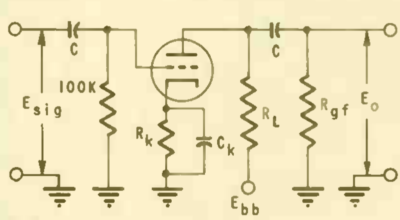
CLASS A RESISTANCE-COUPLED AMPLIFIER

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

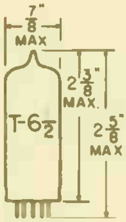
DOUBLE DIODE

MINIATURE TYPE

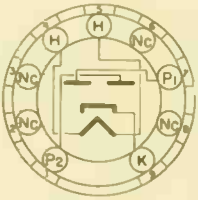
COATED UNIPOTENTIAL CATHODE

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

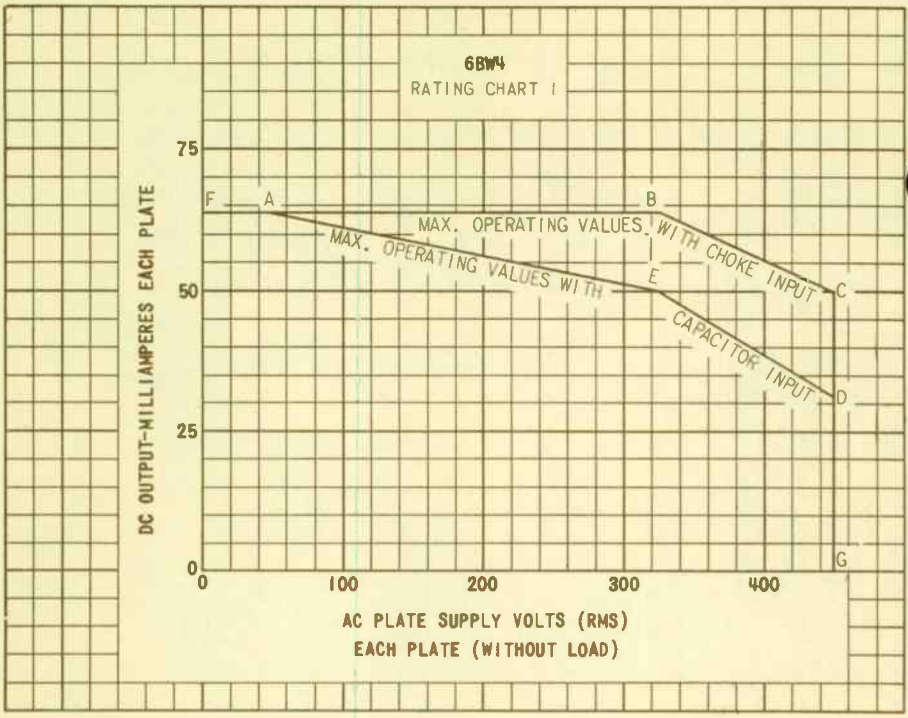
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1275	VOLTS
MAXIMUM AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS) (SEE RATING CHART #1)	450	VOLTS
MAXIMUM DC OUTPUT CURRENT	SEE RATING CHART #1	
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE (SEE RATING CHART #2)	350	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT EACH PLATE (SEE RATING CHART #3)	2.0	AMP.
MAXIMUM HEATER CATHODE VOLTAGE: HEATER NEGATIVE, DC	450	VOLTS

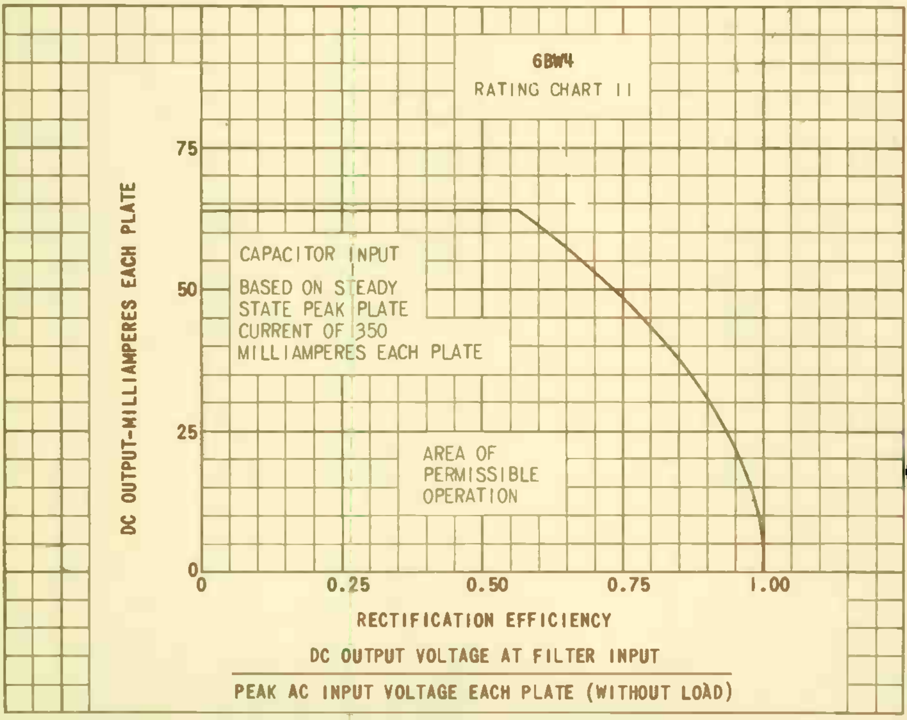
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

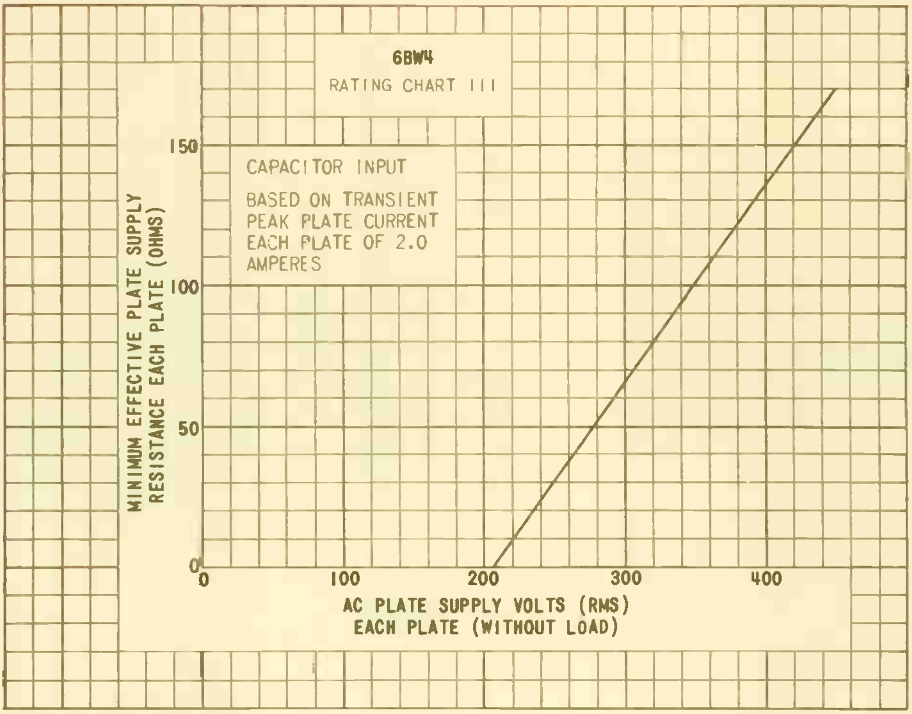
FULL WAVE RECTIFIER

	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.


6BW4
RATING CHART I
75
50
25
0
0
100
200
300
400
F
A
B
C
D
E
G
MAX. OPERATING VALUES WITH CHOKE INPUT
MAX. OPERATING VALUES WITH CAPACITOR INPUT
DC OUTPUT-MILLIAMPERES EACH PLATE
AC PLATE SUPPLY VOLTS (RMS)
EACH PLATE (WITHOUT LOAD)

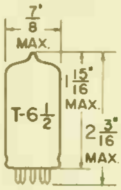

6BW4
RATING CHART II
75
50
25
0
0
0.25
0.50
0.75
1.00
CAPACITOR INPUT
BASED ON STEADY STATE PEAK PLATE CURRENT OF 350 MILLIAMPERES EACH PLATE
AREA OF PERMISSIBLE OPERATION
DC OUTPUT-MILLIAMPERES EACH PLATE
RECTIFICATION EFFICIENCY
DC OUTPUT VOLTAGE AT FILTER INPUT
PEAK AC INPUT VOLTAGE EACH PLATE (WITHOUT LOAD)


6BW4
RATING CHART III
CAPACITOR INPUT
BASED ON TRANSIENT PEAK PLATE CURRENT EACH PLATE OF 2.0 AMPERES
MINIMUM EFFECTIVE PLATE SUPPLY RESISTANCE EACH PLATE (OHMS)
0
50
100
150
0
100
200
300
400
AC PLATE SUPPLY VOLTS (RMS) EACH PLATE (WITHOUT LOAD)

TUNG-SOL

DOUBLE-DIODE PENTODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
5.3±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

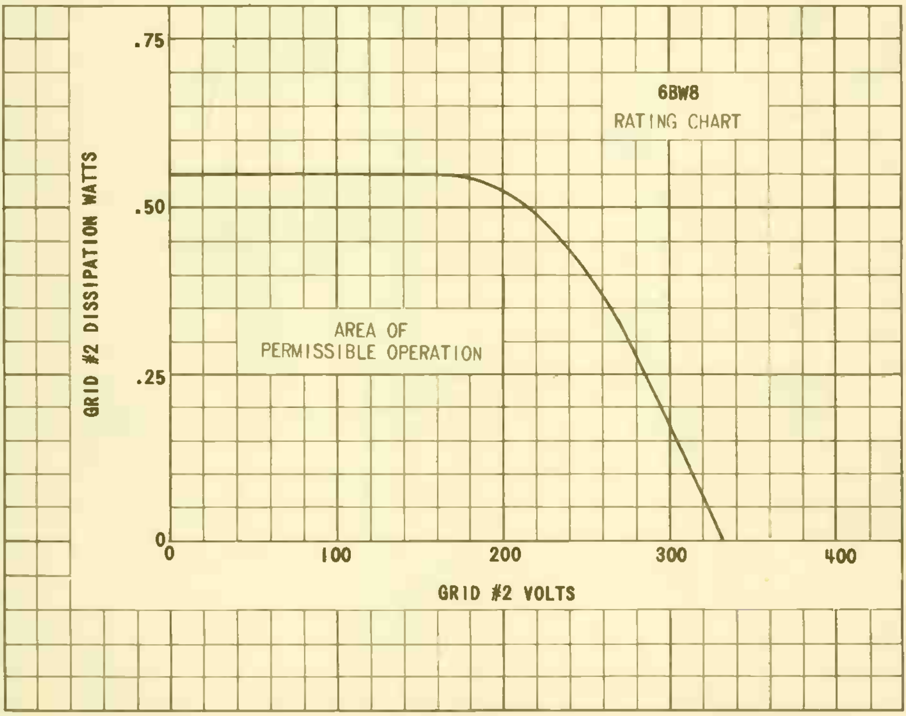
TUNG-SOL

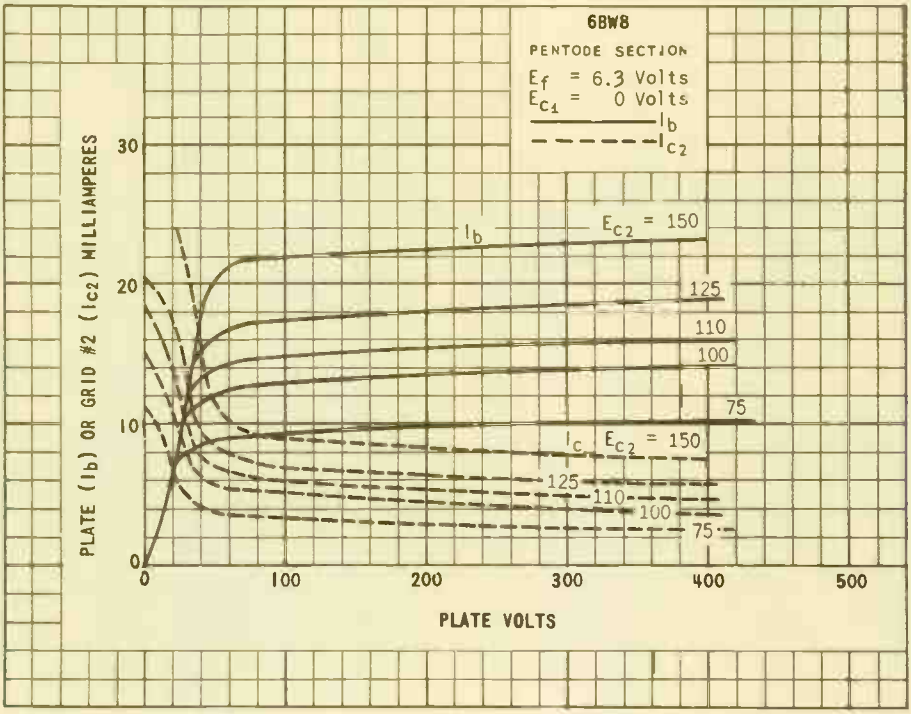
CONTINUED FROM PRECEDING PAGE

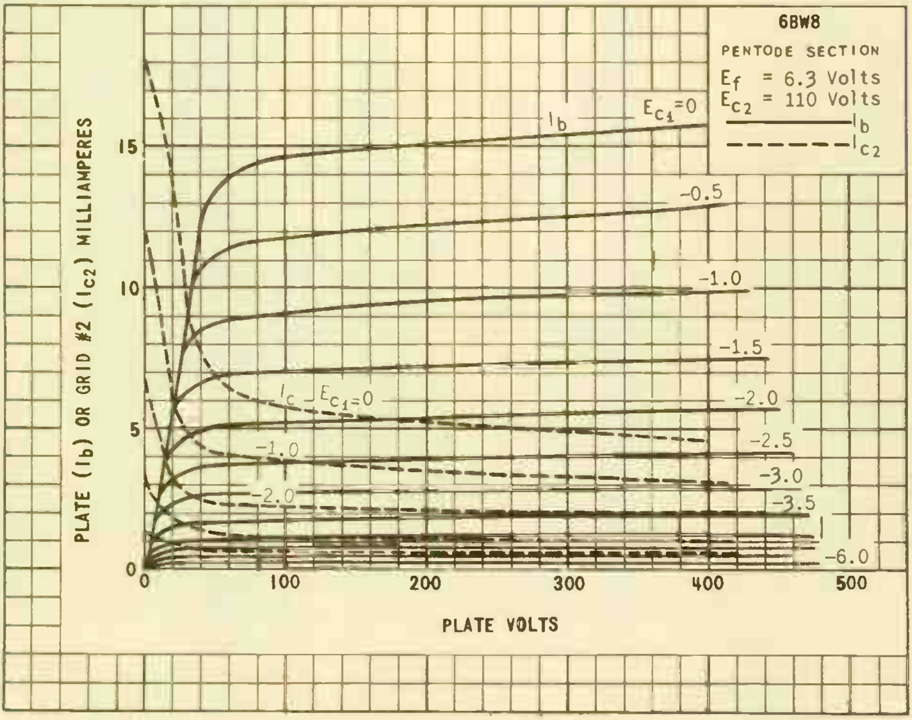
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

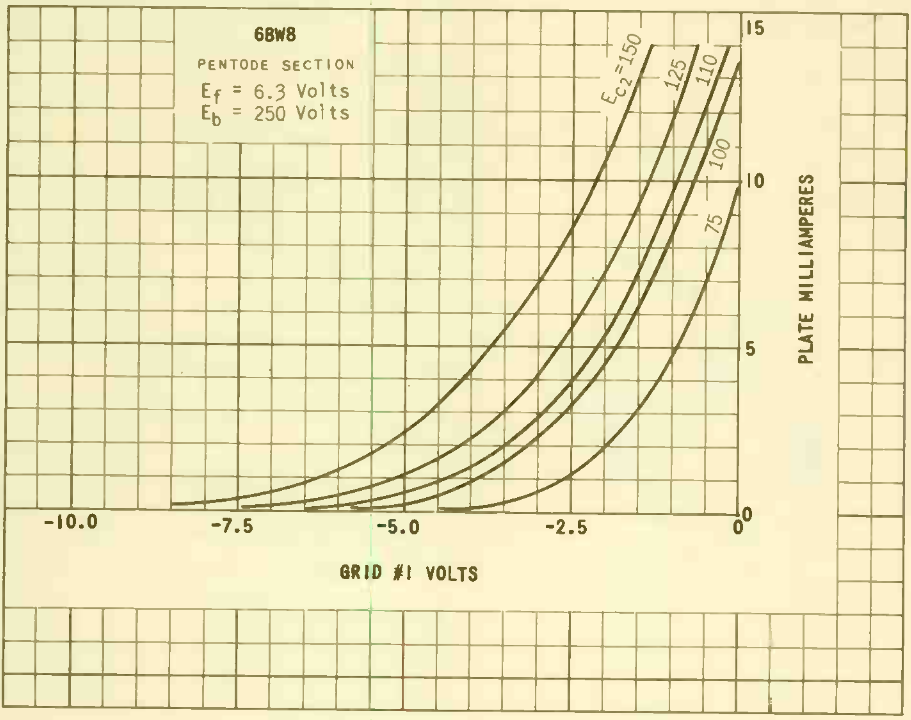
HEATER VOLTAGE	6.3±6%	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	110	VOLTS
CATHODE-BIAS RESISTOR	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHMS
TRANSCONDUCTANCE	5200	μMHOS
PLATE CURRENT	10	MA.
SCREEN CURRENT	3.5	MA.
GRID #1 VOLTAGE (APPROX.) $I_b = 10$ μAMPS	−10	VOLTS
AVERAGE DIODE CURRENT (EACH DIODE) WITH 5 VOLTS DC APPLIED	20	MA.

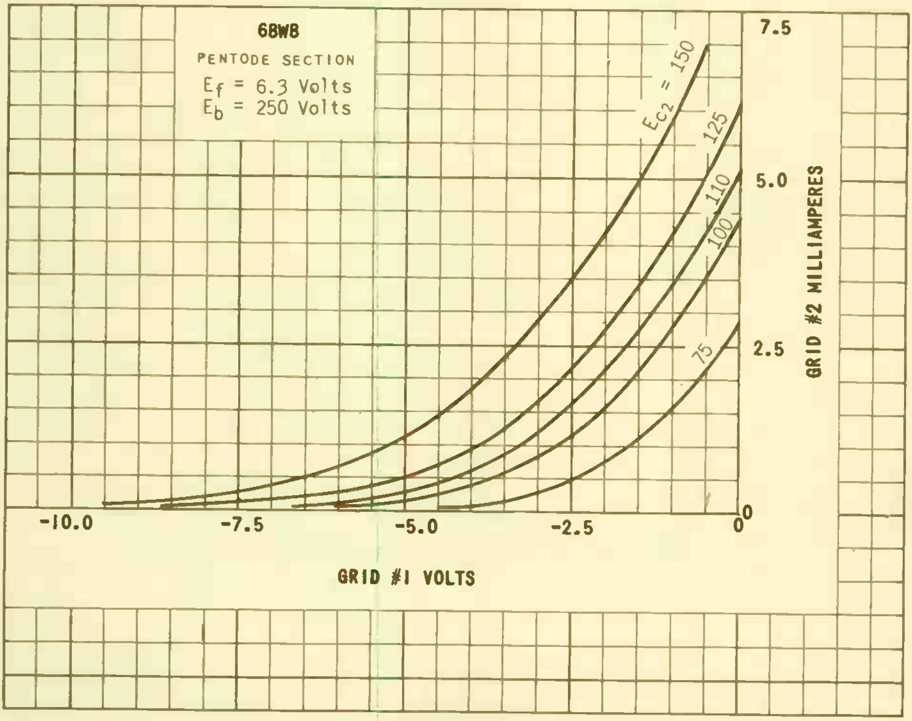
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH 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.

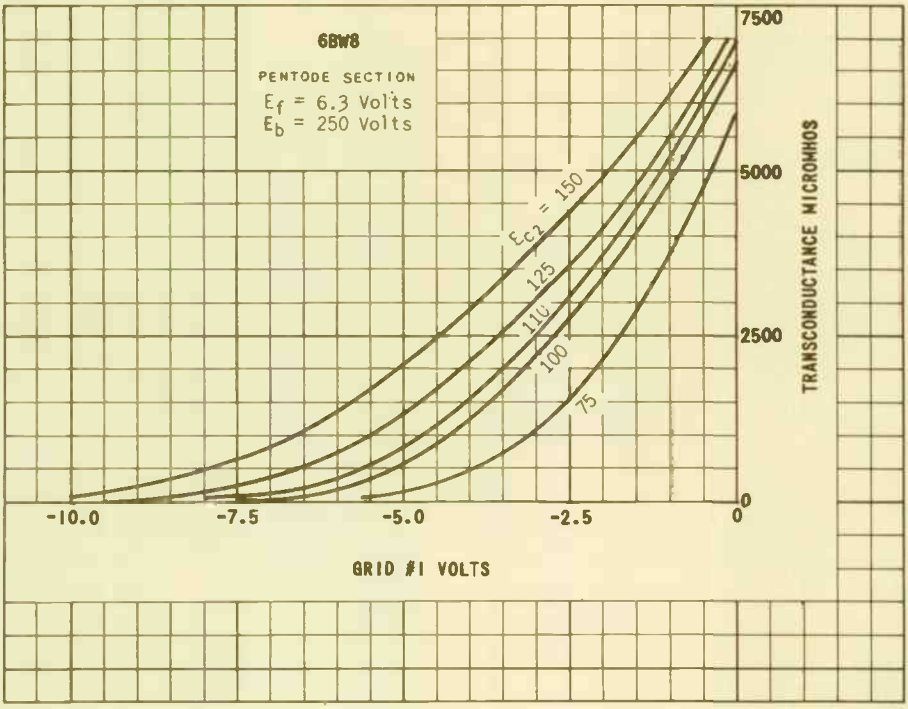


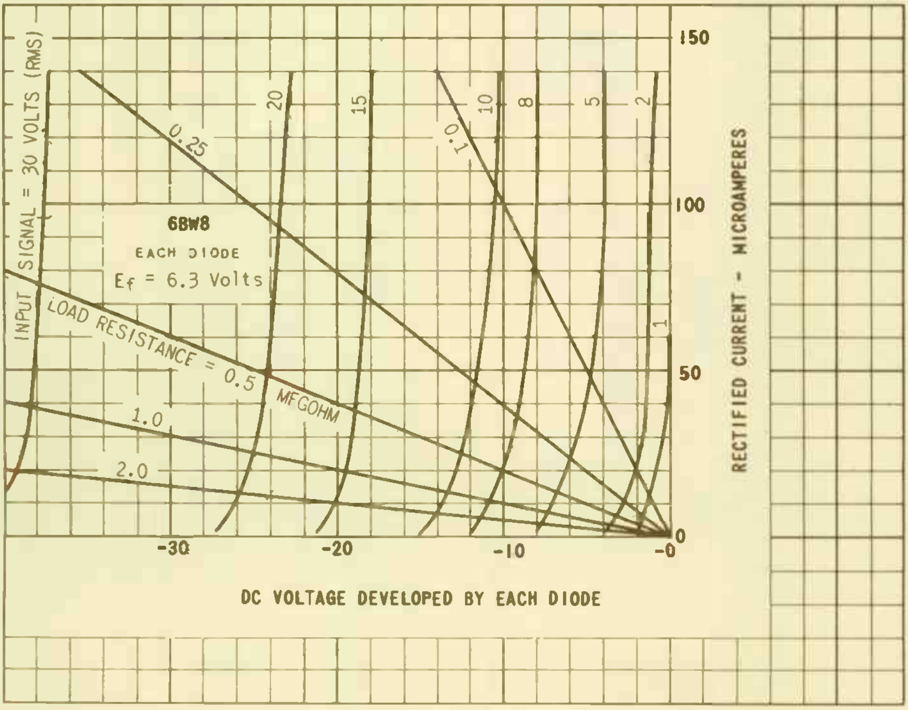

6BW8
PENTODE SECTION
Ef = 6.3 Volts
Ec1 = 0 Volts
Ib
Ic2
Ib
Ec2 = 150
125
110
100
75
Ic Ec2 = 150
125
110
100
75
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
10
20
30
0
100
200
300
400
500


6BW8
PENTODE SECTION
Ef = 6.3 Volts
Ec2 = 110 Volts
Ib
Ic2
Ib
Ec1=0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-6.0
Ic Ec1=0
-1.0
-2.0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
5
10
15
0
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

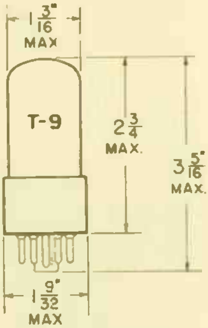

6BW8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 150
125
110
100
75
7.5
5.0
2.5
0
GRID #2 MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS


6BW8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 150
125
110
100
75
7500
5000
2500
0
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS
TRANSCONDUCTANCE MICROMHOS


6BW8
EACH DIODE
E_f = 6.3 Volts
INPUT SIGNAL = 30 VOLTS (RMS)
20
15
10
8
5
2
1
0.25
1.0
LOAD RESISTANCE = 0.5 MEGOHM
1.0
2.0
150
100
50
0
-30
-20
-10
-0
DC VOLTAGE DEVELOPED BY EACH DIODE
RECTIFIED CURRENT - MICROAMPERES

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.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS ←

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION AMPLIFIER AND OSCILLATOR[B,C]

	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

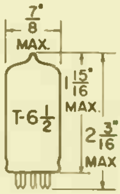
HEATER VOLTAGE		6.3		VOLTS
HEATER CURRENT		1.5		AMP.
PLATE VOLTAGE	100		250	VOLTS
GRID #1 VOLTAGE	0		0	VOLTS
CATHODE RESISTOR	0		390	OHMS
PLATE CURRENT	80		42	MA.
TRANSCONDUCTANCE	---		7600	μMHOS
AMPLIFICATION FACTOR	---		10	
PLATE RESISTANCE (APPROX.)	---		1300	OHMS
GRID VOLTAGE FOR I_b = 50 μA	---		-40	VOLTS

→ INDICATES A CHANGE.

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

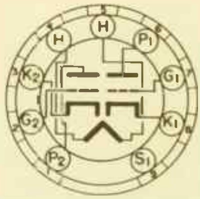


GLASS BULB

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	$\mu\mu f$
PLATE TO CATHODE (P TO K)	.165	.165	$\mu\mu f$
#2 INPUT: G TO (H+K+I.S.)	---	2.4	$\mu\mu f$
#1 INPUT: K TO (H+G+I.S.)[B]	4.9	---	$\mu\mu f$
#2 OUTPUT: P TO (H+K+I.S.)	---	1.25	$\mu\mu f$
#1 OUTPUT: P TO (H+G+I.S.)[B]	2.6	---	$\mu\mu f$

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

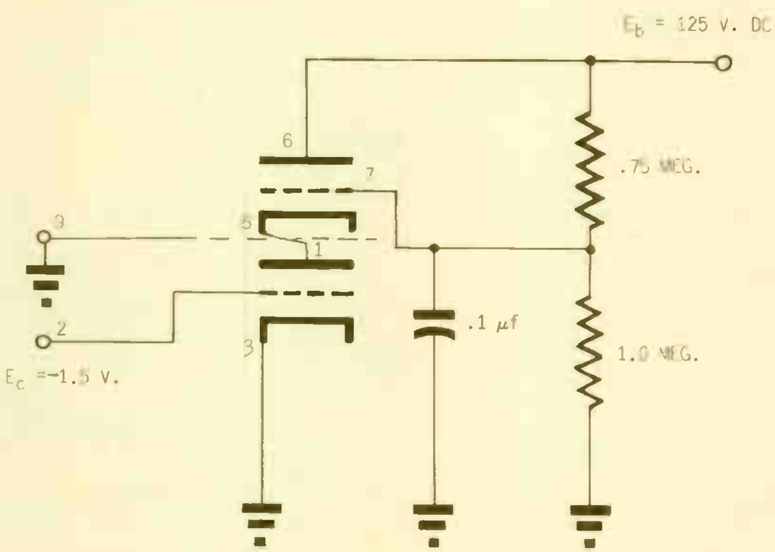
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	65	VOLTS
GRID VOLTAGE	-1.0	VOLTS
AMPLIFICATION FACTOR	25	
PLATE CURRENT	9	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA	-7	VOLTS
TRANSCONDUCTANCE	6 700	μMHOS

AVERAGE CHARACTERISTICS – CASCODE OPERATION ·

PLATE SUPPLY VOLTAGE	125	VOLTS
GRID VOLTAGE	-.5	VOLTS
PLATE CURRENT	11	MA.
TRANSCONDUCTANCE	7 500	μMHOS

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 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.

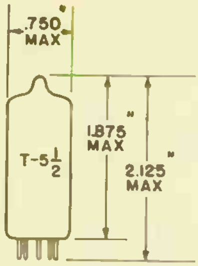


CASCODE TEST CIRCUIT.

TUNG-SOL

HEPTODE

MINIATURE TYPE

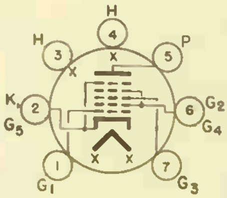


GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

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

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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	→ 2.5	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

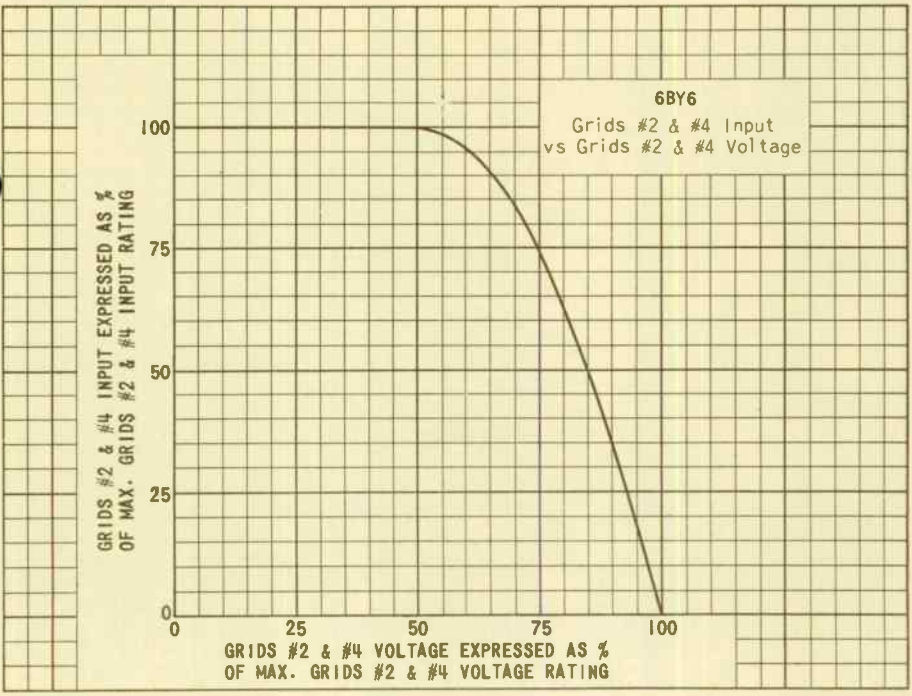
PLATE VOLTAGE	250	VOLTS
GRIDS #2 & #4 VOLTAGE	100	VOLTS
GRID #3 VOLTAGE	-2.5	VOLTS
GRID #1 VOLTAGE	-2.5	VOLTS
GRID #3 TO PLATE TRANSCONDUCTANCE	500	μMHOS
GRID #1 TO PLATE TRANSCONDUCTANCE	1 900	μMHOS
PLATE CURRENT	6.5	MA.
GRID #2 & #4 CURRENT	9	MA.
GRID #3 VOLTS (APPROX.) FOR I_b = 35 μAMP. AND GRID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

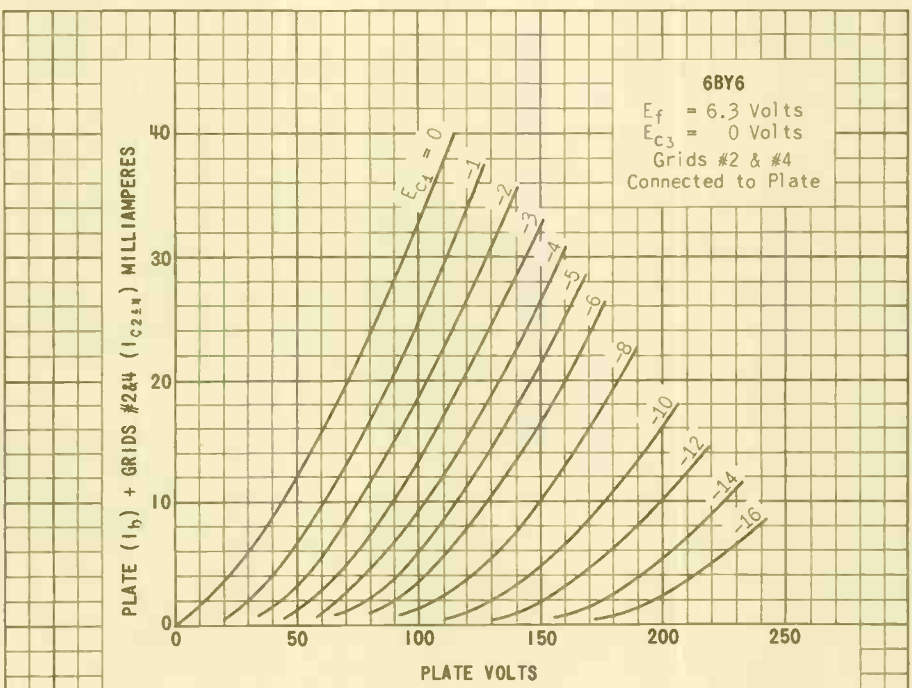
SYNC SEPARATOR AND SYNC CLIPPER

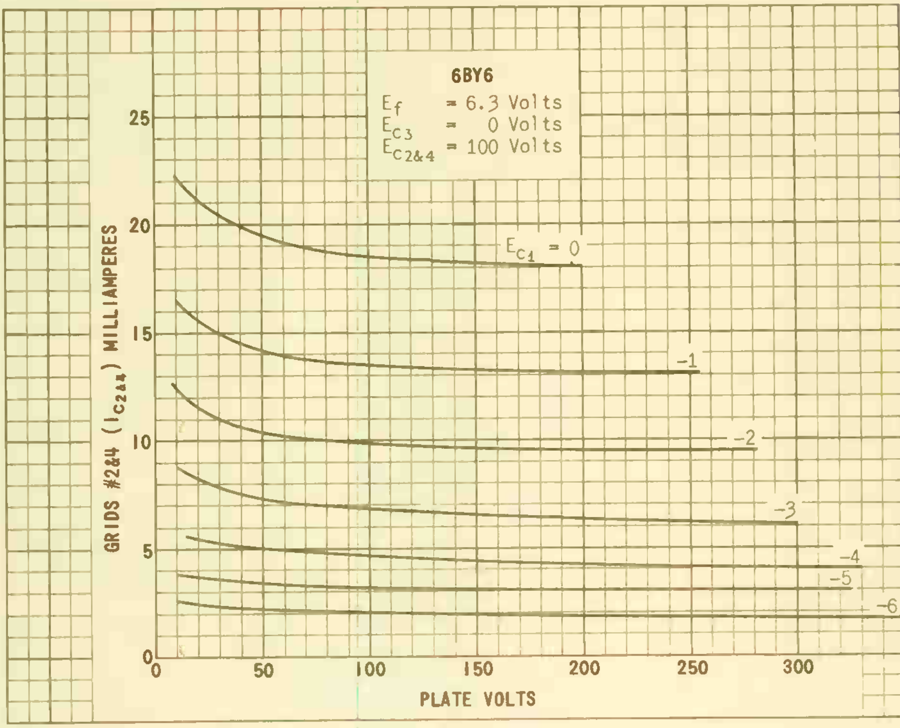
PLATE VOLTAGE	10	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 & #4 VOLTAGE	25	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE CURRENT	1.4	MA.
GRIDS #2 & #4 CURRENT	3.5	MA.
GRID #3 BIAS VOLTS (APPROX.) FOR PLATE VOLTAGE OF 25 VOLTS, GRIDS #2 & #4 VOLTAGE OF 25 VOLTS, GRID #1 VOLTAGE OF 0 VOLTS AND PLATE CURRENT OF 50 μAMP.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

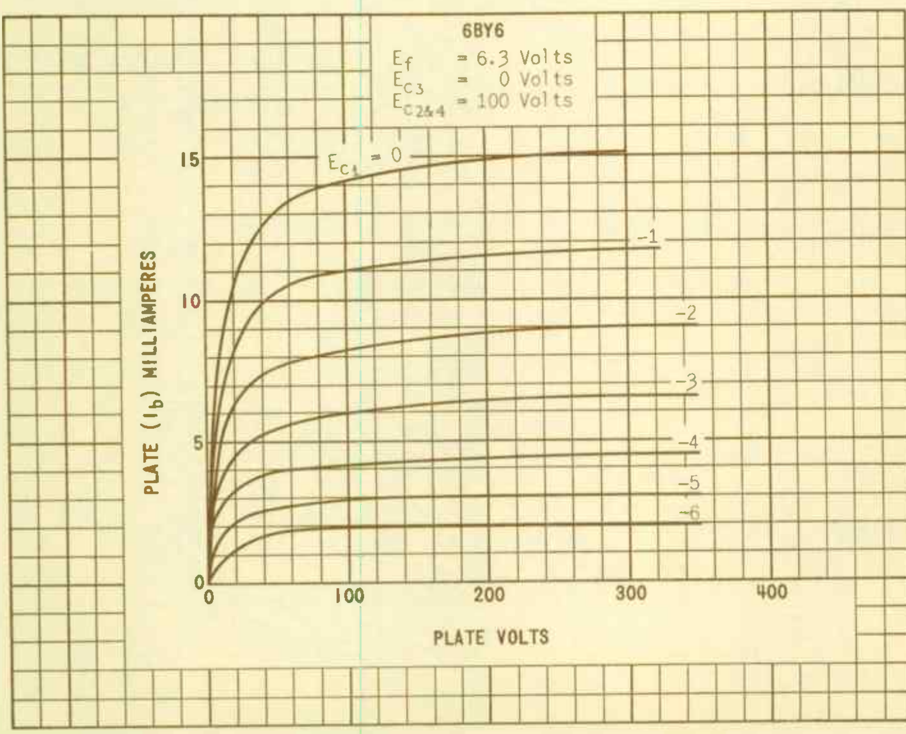
*THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

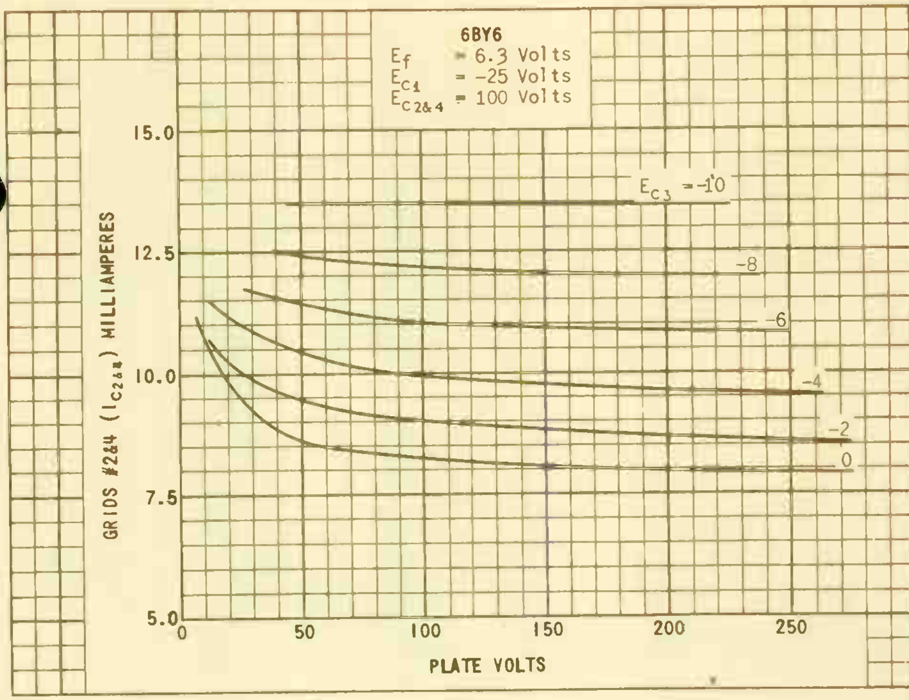
→ INDICATES A CHANGE. * INDICATES AN ADDITION.

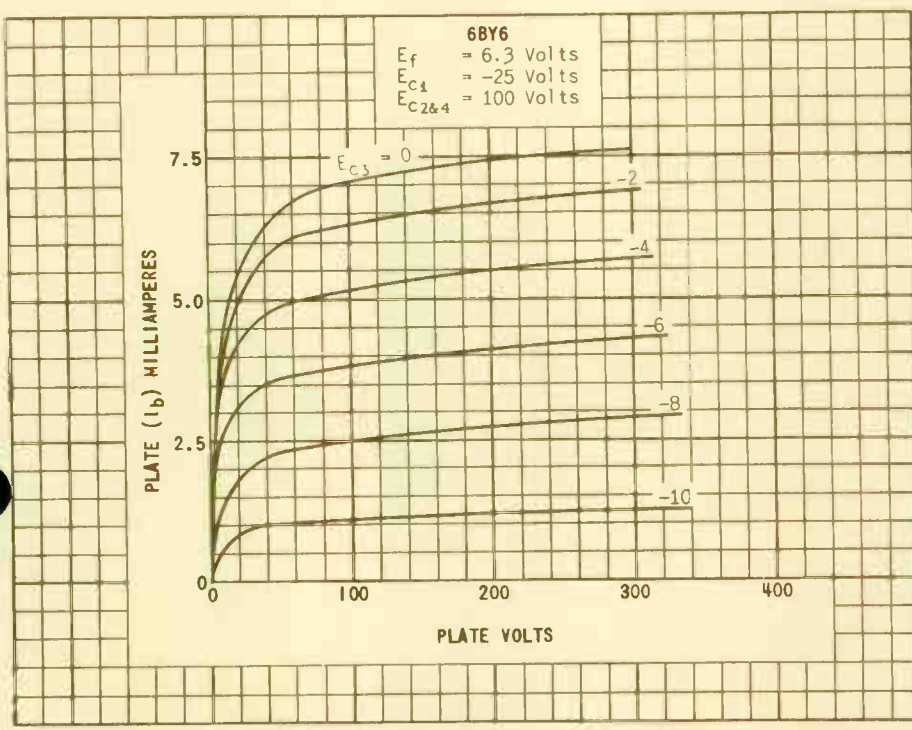

6BY6
Grids #2 & #4 Input
vs Grids #2 & #4 Voltage
GRIDS #2 & #4 INPUT EXPRESSED AS %
OF MAX. GRIDS #2 & #4 INPUT RATING
0
25
50
75
100
GRIDS #2 & #4 VOLTAGE EXPRESSED AS %
OF MAX. GRIDS #2 & #4 VOLTAGE RATING


6BY6
E_f = 6.3 Volts
E_{c3} = 0 Volts
Grids #2 & #4
Connected to Plate
E_{c1} = 0
-1
-2
-3
-4
-5
-6
-8
-10
-12
-14
-16
PLATE (I_b) + GRIDS #2&4 (I_{c2+4}) MILLIAMPERES
0
10
20
30
40
0
50
100
150
200
250
PLATE VOLTS


6BY6
Ef = 6.3 Volts
Ec3 = 0 Volts
Ec2&4 = 100 Volts
Ec1 = 0
-1
-2
-3
-4
-5
-6
GRIDS #2&4 (Ic2&4) MILLIAMPERES
0
5
10
15
20
25
50
100
150
200
250
300
PLATE VOLTS


6BY6
Ef = 6.3 Volts
Ec3 = 0 Volts
Ec2&4 = 100 Volts
Ec1 = 0
-1
-2
-3
-4
-5
-6
PLATE (Ib) MILLIAMPERES
0
5
10
15
100
200
300
400
PLATE VOLTS

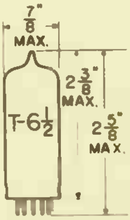

6BY6
E_f = 6.3 Volts
E_{c1} = -25 Volts
$E_{c2\&4}$ = 100 Volts
E_{c3} = -10
-8
-6
-4
-2
0
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
15.0
12.5
10.0
7.5
5.0
0
50
100
150
200
250
PLATE VOLTS


6BY6
E_f = 6.3 Volts
E_{c1} = -25 Volts
$E_{c2\&4}$ = 100 Volts
E_{c3} = 0
-2
-4
-6
-8
-10
PLATE (I_b) MILLIAMPERES
7.5
5.0
2.5
0
0
100
200
300
400
PLATE VOLTS

TUNG-SOL

DIODE-PENTODE

MINIATURE TYPE

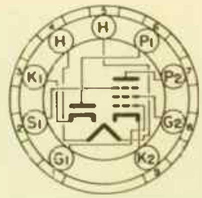


GLASS BULB

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	$\mu\mu f$
PENTODE INPUT: G_1 TO ($H+K+G_2+G_3$,SH)	5.5	$\mu\mu f$
PENTODE OUTPUT: P TO ($H+K+G_2+G_3$,SH)	5.0	$\mu\mu f$
DIODE PLATE TO ALL: DP TO ($H+K_d+K_p+G_1+G_2+G_3$,SH,+P)	4.8	$\mu\mu f$

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.

CONTINUED ON FOLLOWING PAGE

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.

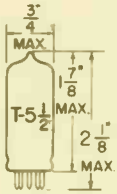
TYPICAL CHARACTERISTICS - DIODE SECTION

AVERAGE DIODE CURRENT AT 10V DC	60	MA.

TUNG-SOL

PENTODE

MINIATURE TYPE

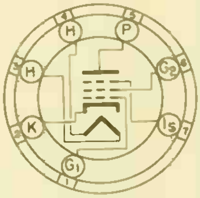


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
5.3 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	$\mu\mu f$
INPUT: G_1 TO $(H+K+G_2+G_3+IS)$	7.0	7.0	$\mu\mu f$
OUTPUT: P TO $(H+K+G_2+G_3+IS)$	3.0	2.0	$\mu\mu f$

[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.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

* INDICATES AN ADDITION.

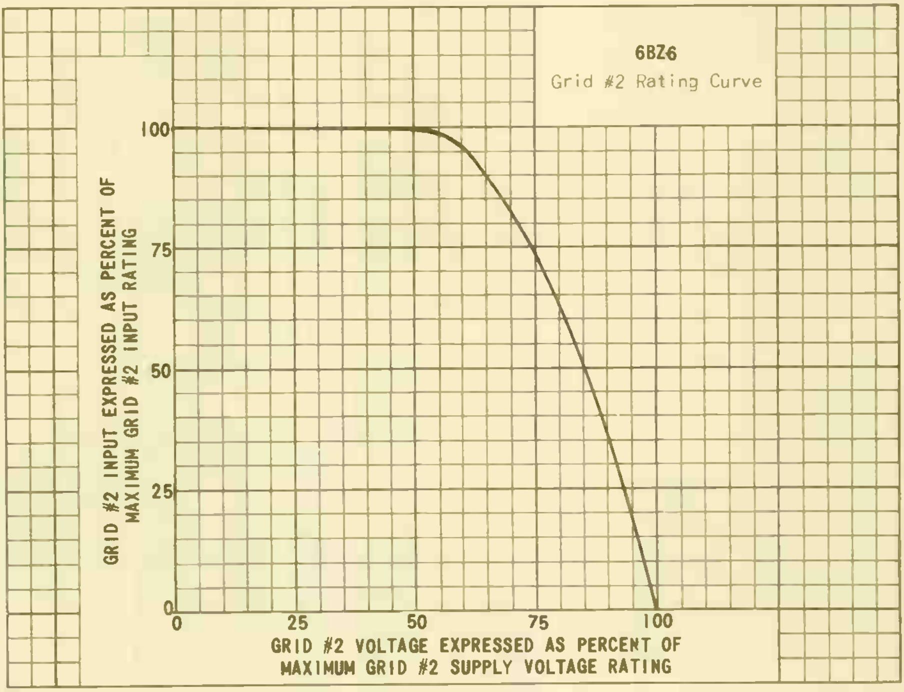
TUNG-SOL

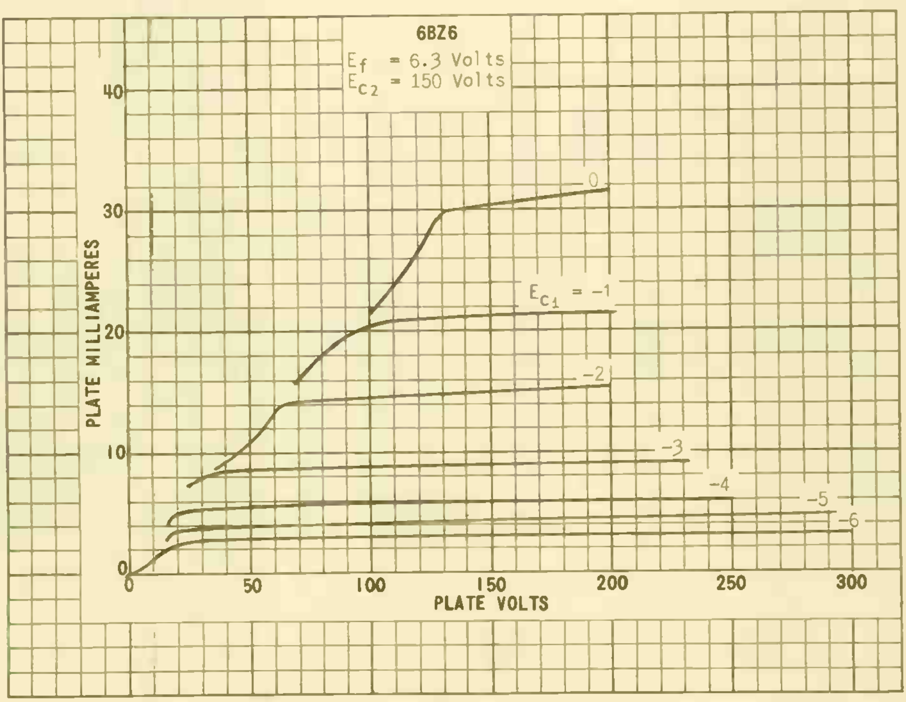
CONTINUED FROM PRECEDING PAGE

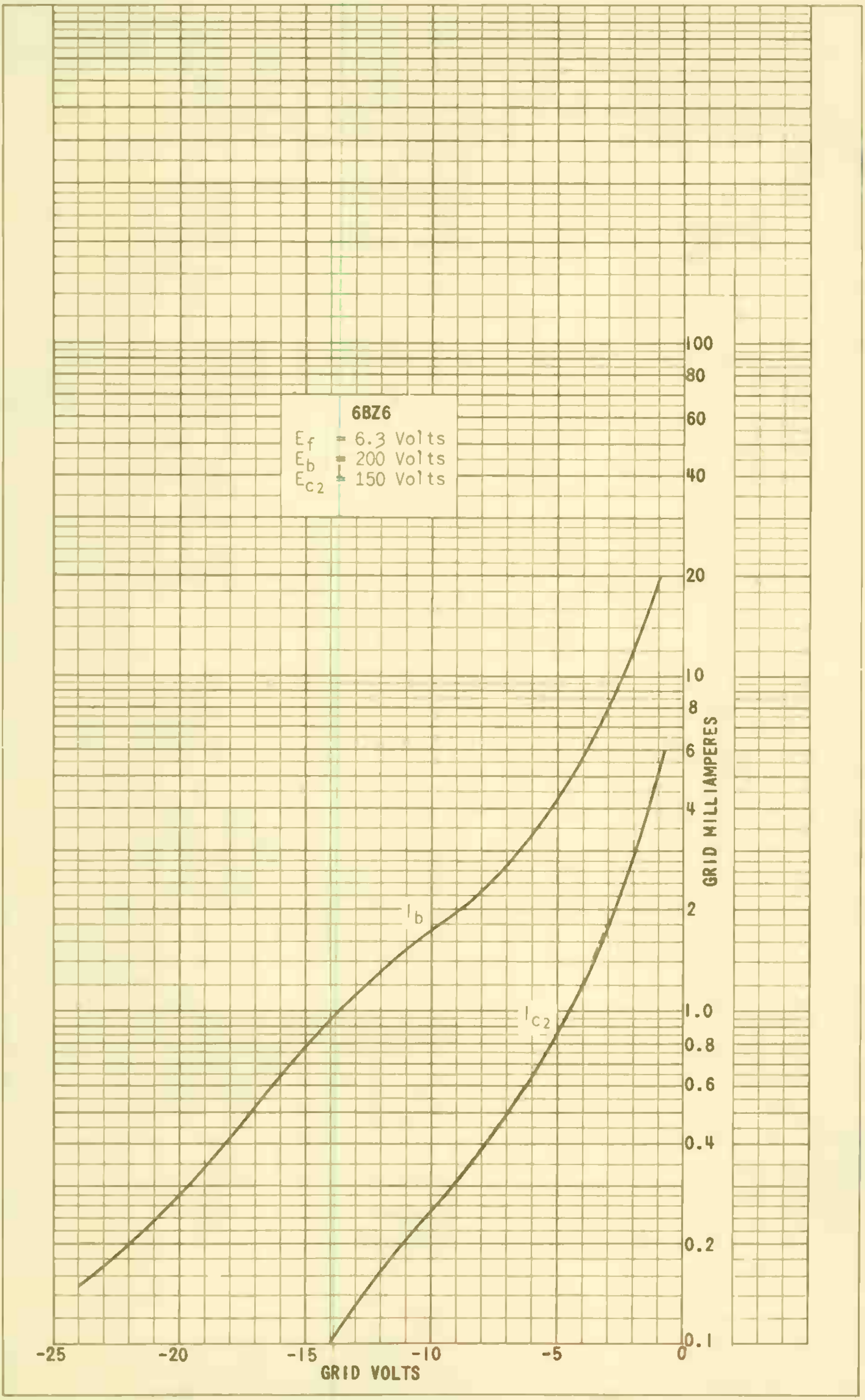
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS ←

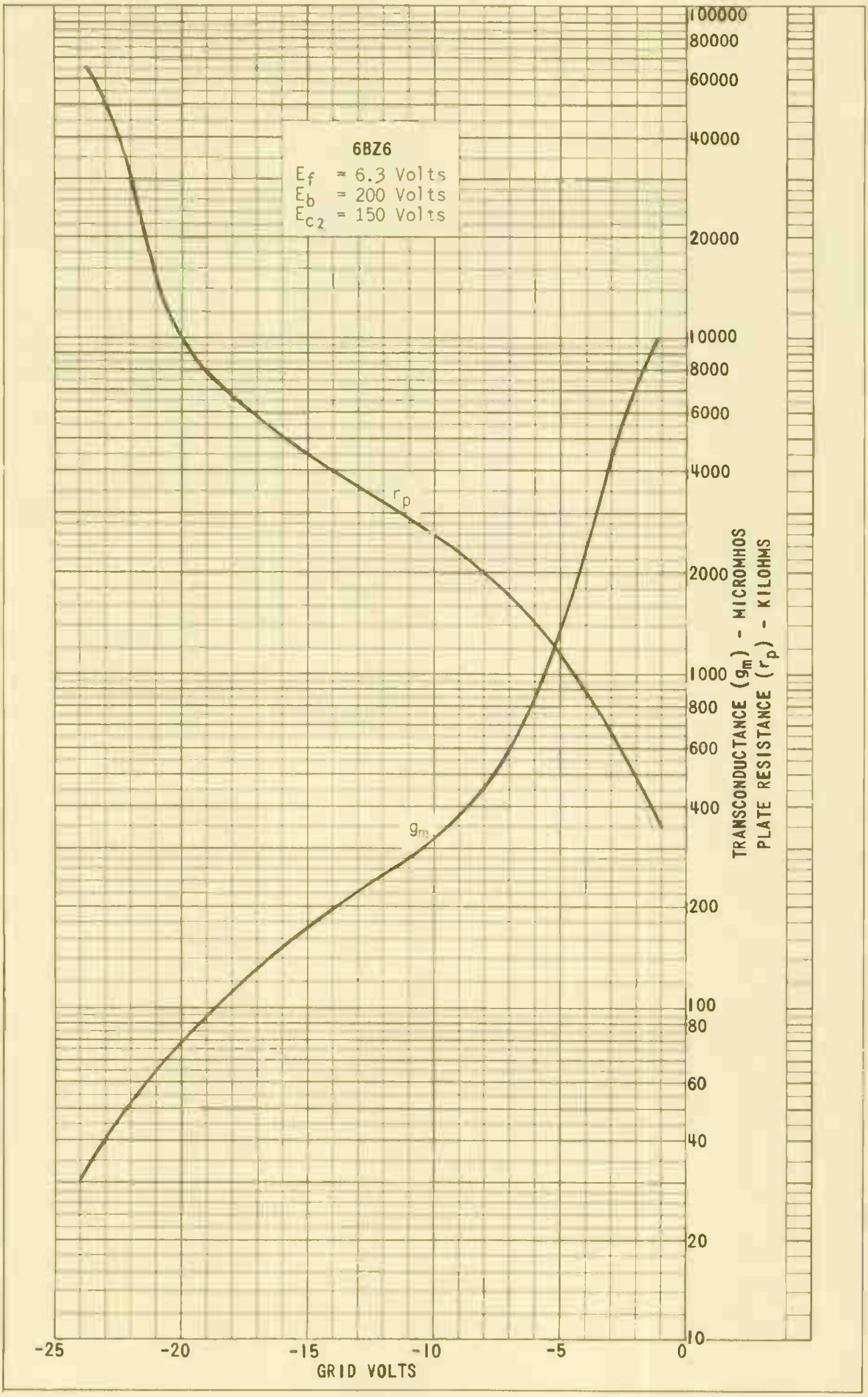
CLASS A_1 AMPLIFIER

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 (Ec_1=−4.5 V., Rk=0)	700	μMHOS


6BZ6
Grid #2 Rating Curve
GRID #2 INPUT EXPRESSED AS PERCENT OF MAXIMUM GRID #2 INPUT RATING
100
75
50
25
0
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS PERCENT OF MAXIMUM GRID #2 SUPPLY VOLTAGE RATING


6BZ6
Ef = 6.3 Volts
Ec2 = 150 Volts
PLATE MILLIAMPERES
40
30
20
10
0
0
50
100
150
200
250
300
PLATE VOLTS
0
Ec1 = -1
-2
-3
-4
-5
-6

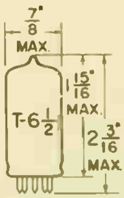

6BZ6
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
GRID MILLIAMPERES
100
80
60
40
20
10
8
6
4
2
1.0
0.8
0.6
0.4
0.2
0.1
-25
-20
-15
-10
-5
0
GRID VOLTS


6BZ6
E_f = 6.3 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
-25
-20
-15
-10
-5
0
GRID VOLTS
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - KILOHMS

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

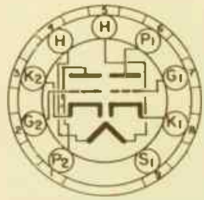


GLASS BULB

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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

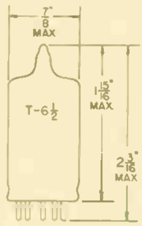
COATED UNIPOTENTIAL CATHODE

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	---	$\mu\mu$f
PLATE TO CATHODE (P TO K)	---	0.15	$\mu\mu$f
#1 TRIODE PLATE TO #2 TRIODE PLATE P_1 TO P_2	.010	---	$\mu\mu$f

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

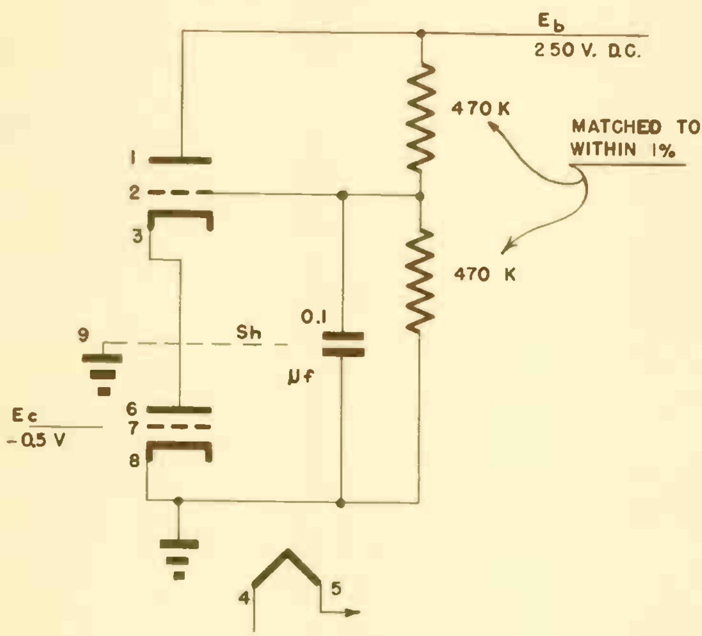
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	125	VOLTS
CATHODE RESISTOR	100	OHMS
PLATE RESISTANCE	5 600	OHMS
TRANSCONDUCTANCE	8 000	μMHOS
AMPLIFICATION FACTOR	45	
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR G_m = 50 μMHOS	-13	VOLTS
CASCODE TRANSCONDUCTANCE (E_b 250V E_{c1} -0.5V)	10 000	μMHOS
CASCODE PLATE CURRENT (E_b 250V E_{c1} -0.5V)	15	MA.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

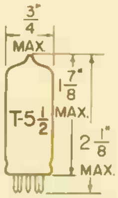
CASCODE TRANSCONDUCTANCE TEST CIRCUIT



TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

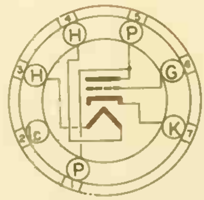
COATED UNIPOTENTIAL CATHODE

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 SHIELD[A]	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.

CONTINUED ON FOLLOWING PAGE

← INDICATES A CHANGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS C – TELEGRAPHY[C]

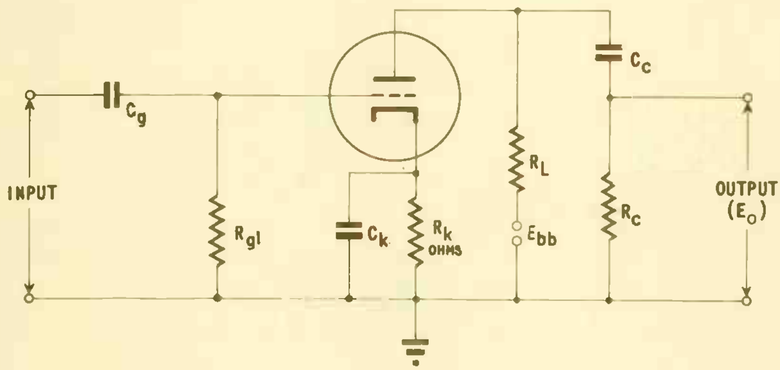
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	300	VOLTS
GRID VOLTAGE	−27	VOLTS
PLATE CURRENT	25	MA.
GRID CURRENT (APPROX.)	7	MA.
GRID DRIVING POWER (APPROX.)	0.35	WATT
POWER OUTPUT (APPROX.)	5.5	WATTS

[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.

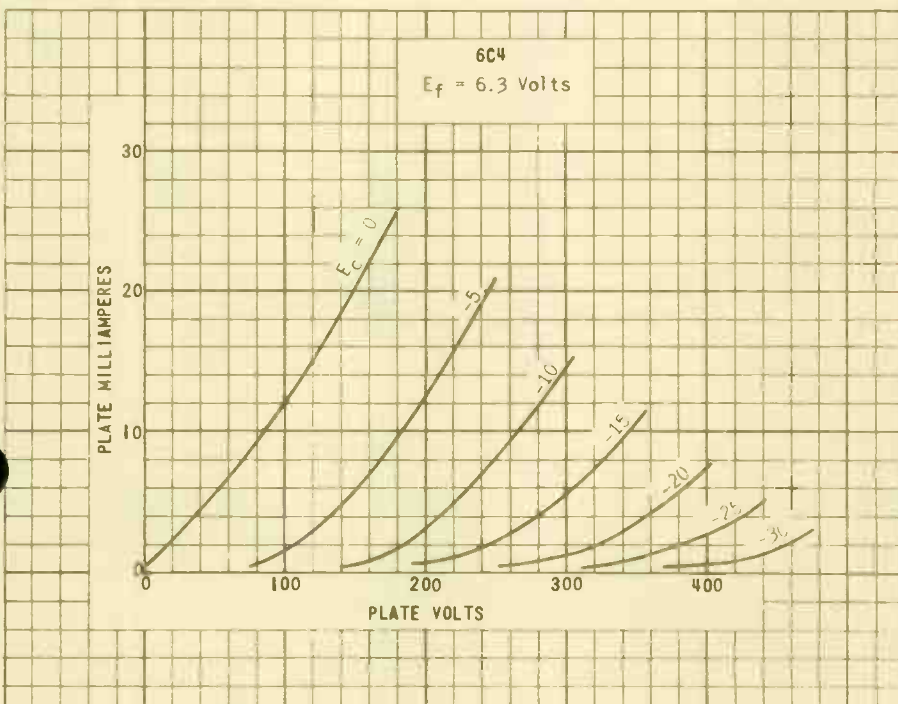


PLATE 1965
Ed. 1948

6C4

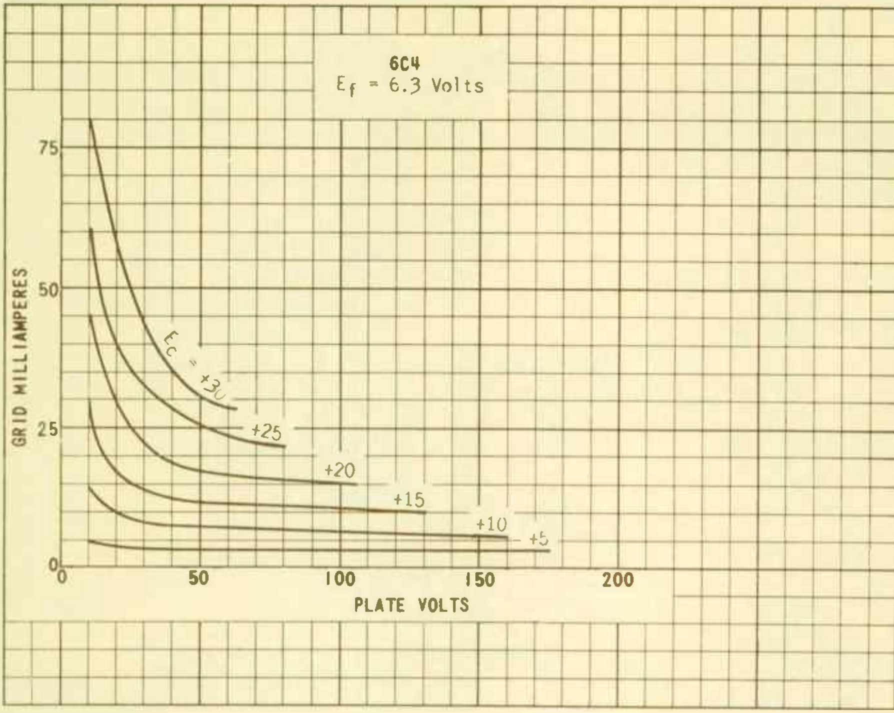
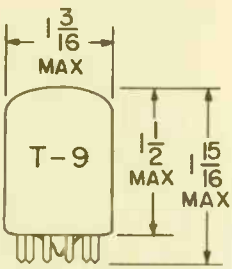


PLATE
1966
FEB. 2,
1948

TUNG-SOL

TRIPLE TRIODE



GLASS BULB

BUTTON
12 PIN BASE E12-70

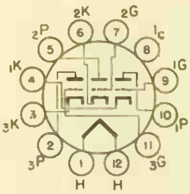
OUTLINE DRAWING
JEDEC 9-62

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

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

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.

^ 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.

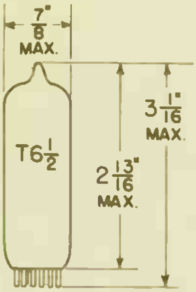
*INDICATES AN ADDITION.

→ 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

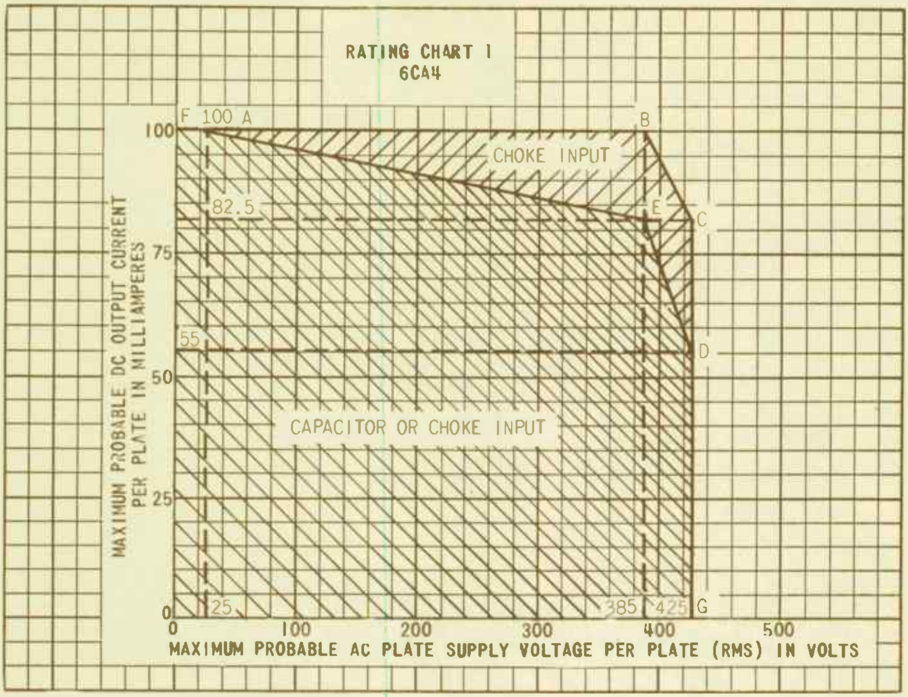
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1200	VOLTS
MAXIMUM AC PLATE-SUPPLY VOLTAGE PER PLATE	SEE RATING CHART #1	
MAXIMUM STEADY STATE PEAK PLATE CURRENT PER PLATE	500	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT PER PLATE, MAXIMUM DURATION 0.2 SECONDS	1.85	AMP.
MAXIMUM DC OUTPUT CURRENT	SEE RATING CHART #1	
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	500	VOLTS

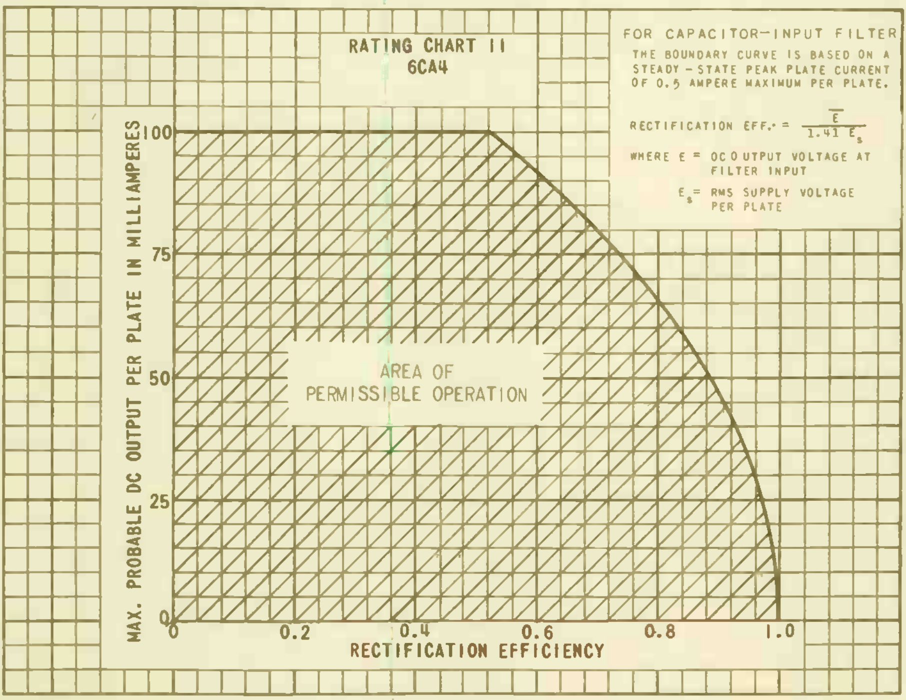
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

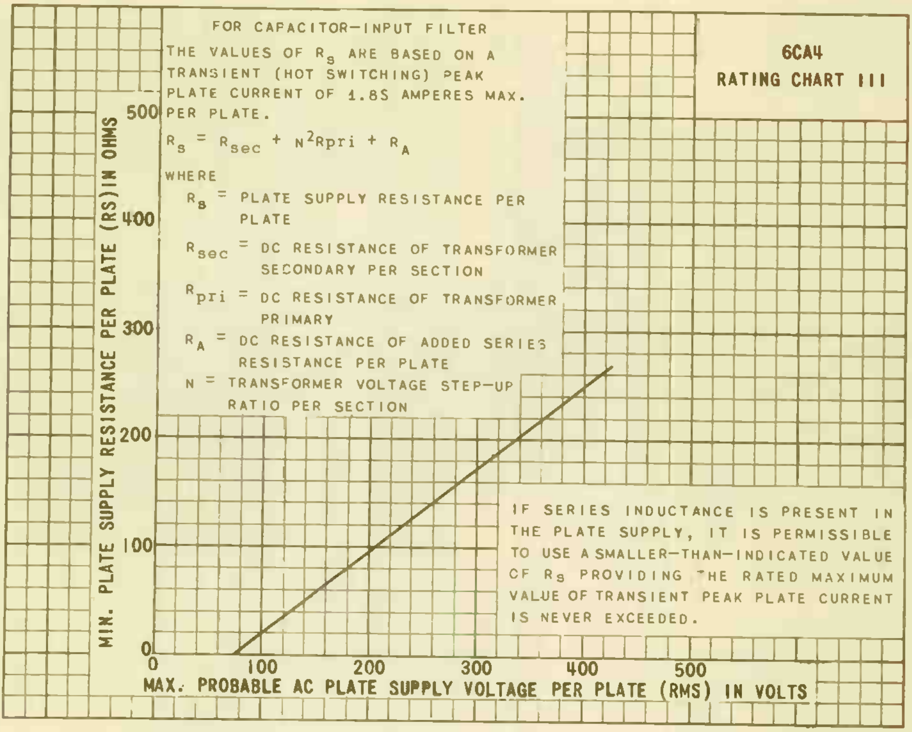
FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

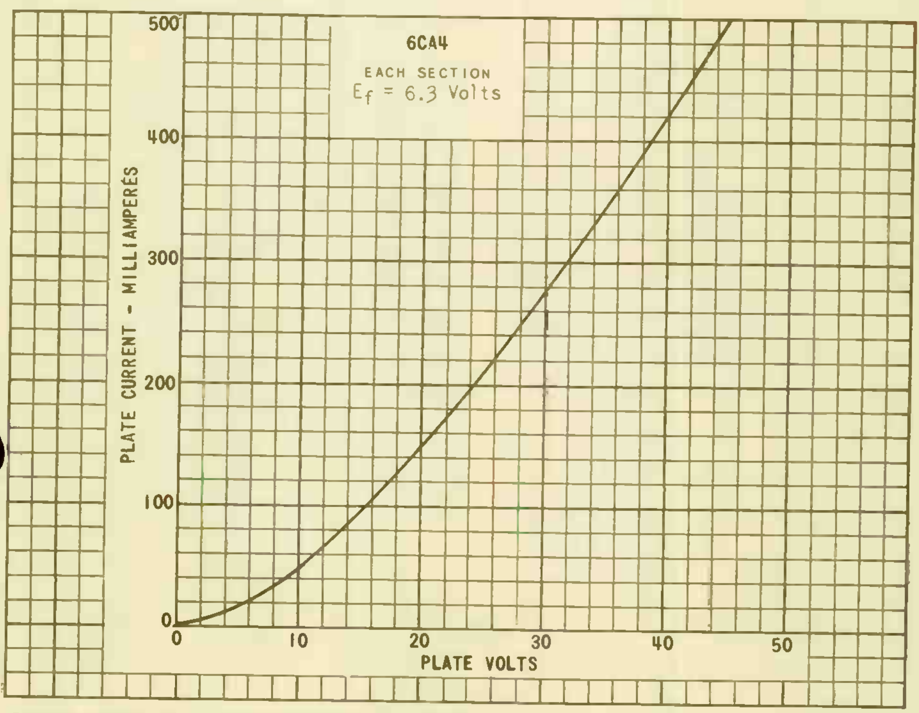
AC PLATE VOLTAGE PER PLATE, RMS	250	300	350	VOLTS
FILTER INPUT CAPACITOR	50	50	50	μf
TOTAL PLATE-SUPPLY RESISTANCE PER PLATE	150	200	240	OHMS
DC OUTPUT CURRENT	150	150	150	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	245	293	347	VOLTS
TUBE VOLTAGE DROP				
Ib= 150 MA. DC PER PLATE			20	VOLTS

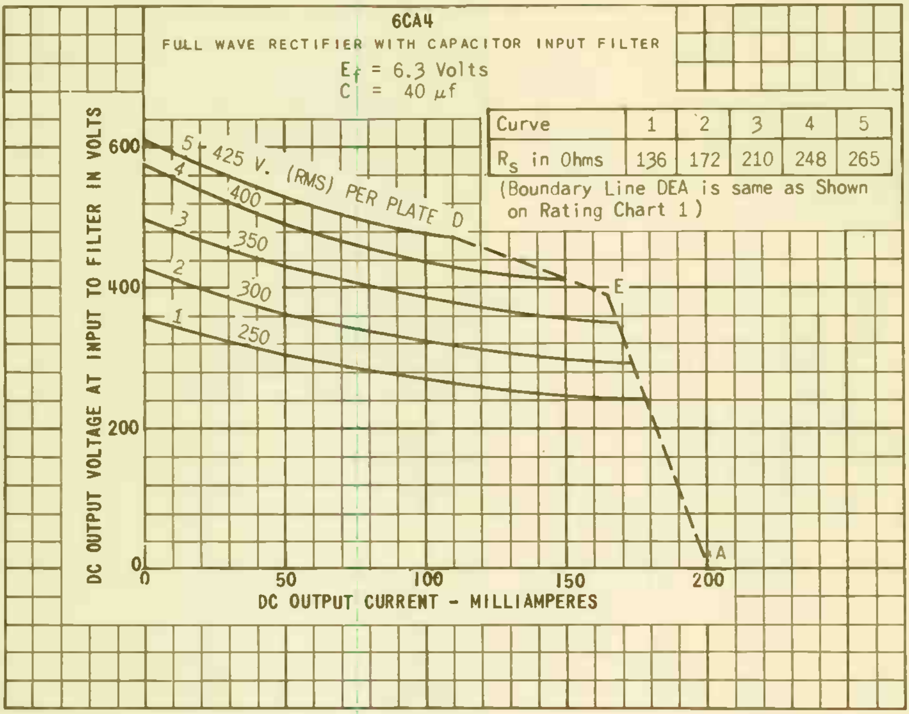
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE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

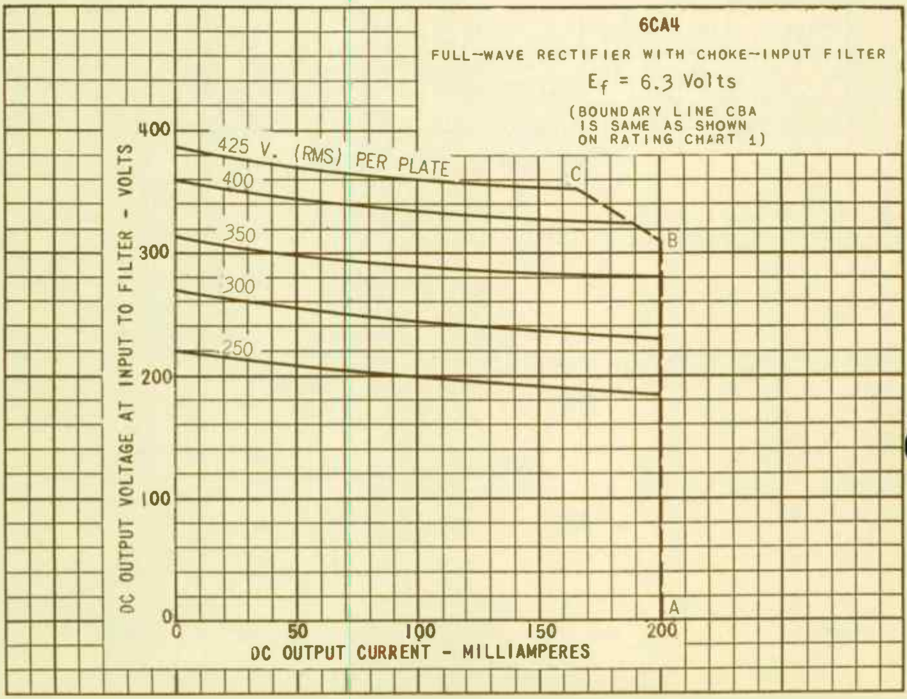

RATING CHART I
6CA4
F 100 A
B
CHOKE INPUT
82.5
E
C
55
D
CAPACITOR OR CHOKE INPUT
25
385
425
G
MAXIMUM PROBABLE DC OUTPUT CURRENT PER PLATE IN MILLIAMPERES
MAXIMUM PROBABLE AC PLATE SUPPLY VOLTAGE PER PLATE (RMS) IN VOLTS
0
25
50
75
100
0
100
200
300
400
500


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. = $\frac{\bar{E}}{1.41\ E_s}$
WHERE E = DC OUTPUT VOLTAGE AT FILTER INPUT
E_s = RMS SUPPLY VOLTAGE PER PLATE
AREA OF PERMISSIBLE OPERATION
MAX. PROBABLE DC OUTPUT PER PLATE IN MILLIAMPERES
RECTIFICATION EFFICIENCY
0
25
50
75
100
0
0.2
0.4
0.6
0.8
1.0


FOR CAPACITOR-INPUT FILTER
THE VALUES OF R_s ARE BASED ON A TRANSIENT (HOT SWITCHING) PEAK PLATE CURRENT OF 1.8S AMPERES MAX. PER PLATE.
$R_s = R_{sec} + N^2 R_{pri} + R_A$
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
6CA4
RATING CHART III
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.
MIN. PLATE SUPPLY RESISTANCE PER PLATE (RS) IN OHMS
0
100
200
300
400
500
0
100
200
300
400
500
MAX. PROBABLE AC PLATE SUPPLY VOLTAGE PER PLATE (RMS) IN VOLTS


6CA4
EACH SECTION
E_f = 6.3 Volts
PLATE CURRENT - MILLIAMPERES
0
100
200
300
400
500
0
10
20
30
40
50
PLATE VOLTS

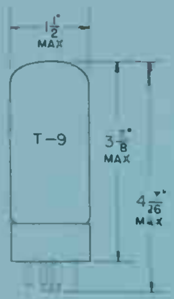

6CA4
FULL WAVE RECTIFIER WITH CAPACITOR INPUT FILTER
E_f = 6.3 Volts
C = 40 μf
Curve 1 2 3 4 5
R_s in Ohms 136 172 210 248 265
(Boundary Line DEA is same as Shown on Rating Chart 1)
425 V. (RMS) PER PLATE
400
350
300
250
D
E
A
DC OUTPUT VOLTAGE AT INPUT TO FILTER IN VOLTS
DC OUTPUT CURRENT - MILLIAMPERES
0
200
400
600
50
100
150


6CA4
FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER
E_f = 6.3 Volts
(BOUNDARY LINE CBA IS SAME AS SHOWN ON RATING CHART 1)
425 V. (RMS) PER PLATE
400
350
300
250
C
B
A
DC OUTPUT VOLTAGE AT INPUT TO FILTER - VOLTS
DC OUTPUT CURRENT - MILLIAMPERES
0
100
200
300
400
50
150

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 1.5 AMPS.

AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW
8 PIN OCTAL

8ET

THE 6CA7 IS A POWER PENTODE OF THE GLASS OCTAL TYPE. THIS TUBE IS SUITABLE FOR ALL APPLICATIONS WHICH REQUIRE PEAK POWERS OF UP TO 11 WATTS FROM A SINGLE TUBE OR UP TO 100 WATTS FROM TWO TUBES IN THE NORMAL PUSH-PULL ARRANGEMENT. IT IS EQUALLY SUITABLE FOR DOMESTIC AMPLIFIERS AND PUBLIC ADDRESS EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELEMENTS EXCEPT PLATE	15.5	μμf
PLATE TO ALL OTHER ELEMENTS EXCEPT GRID #1	7.2	μμf
PLATE TO GRID #1 (MAX.)	1.0	μμf
GRID #1 TO HEATER (MAX.)	1.0	μμf
HEATER TO CATHODE	11	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	800	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT PLATE CURRENT	2000	VOLTS
MAXIMUM PLATE DISSIPATION	25	WATTS
MAXIMUM PLATE DISSIPATION WITHOUT INPUT SIGNAL	27.5	WATTS
MAXIMUM GRID #2 VOLTAGE	425	VOLTS
MAXIMUM GRID #2 VOLTAGE WITHOUT PLATE CURRENT	800	VOLTS
MAXIMUM GRID #2 DISSIPATION	8	WATTS
CATHODE CURRENT	150	MAMPS
MAXIMUM GRID CURRENT STARTING POINT. GRID #1 VOLTAGE WHEN GRID #1 CURRENT IS 0.3μAMP	-1.3	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (CLASS A & AB)	0.7	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (CLASS B)	0.5	MEGOHM
MAXIMUM EXTERNAL RESISTANCE BETWEEN HEATER AND CATHODE	20000	OHMS
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE	100	VOLTS

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A - ONE TUBE

HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	1.5		AMPS.
SUPPLY VOLTAGE	265	265	VOLTS
PLATE VOLTAGE	250	250	VOLTS
GRID #2 SERIES RESISTOR	2000	0	OHMS
GRID #3 VOLTAGE	0	0	VOLT
GRID #1 BIAS	−14.5	−13.5	VOLTS
PLATE CURRENT	70	100	MAMPS
GRID #2 CURRENT	10	15	MAMPS
TRANSCONDUCTANCE	9000	11000	μMHOS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	11	11	
PLATE RESISTANCE	18000	15000	OHMS
PLATE LOAD RESISTANCE	3000	2000	OHMS
INPUT VOLTAGE (RMS)	9.3	8.7	VOLTS
MAX. SIGNAL POWER OUTPUT	8	1[illegible]	WATTS
TOTAL HARMONIC DISTORTION	10	10	PERCENTS
INPUT VOLTAGE FOR POWER OUTPUT OF 50 MWATTS (RMS)	0.65	0.5	VOLT

CLASS B - TWO TUBES

SUPPLY VOLTAGE 425 VOLTS

COMMON GRID #2 RESISTOR		1000		OHMS
GRID #1 BIAS		−38		VOLTS
GRID #3 VOLTAGE		0		VOLT
INPUT BOLTAGE (RMS)	0	27	27	VOLTS
LOAD RESISTANCE, PLATE TO PLATE	–	3400	4000	OHMS
SUPPLY VOLTAGE	425	425	400	VOLTS
PLATE VOLTAGE	420	400	375	VOLTS
PLATE CURRENT	2X30	2X120	2X100	MAMPS
GRID #2 CURRENT	2X4.4	2X25	2X25	MAMPS
MAX. SIGNAL POWER OUTPUT	0	55	45	WATTS
TOTAL HARMONIC DISTORTION	–	5	6	PERCENTS

CLASS B - TWO TUBES

SUPPLY BOLTAGE 375 VOLTS

COMMON GRID #2 RESISTOR		470		OHMS
GRID #1 BIAS		−32		VOLTS
GRID #3 VOLTAGE		0		VOLT
INPUT VOLTAGE (RMS)	0	22.7	22.7	VOLTS
LOAD RESISTANCE, PLATE TO PLATE	–	2800	3800	OHMS
SUPPLY VOLTAGE	375	375	350	VOLTS
PLATE VOLTAGE	370	350	325	VOLTS
PLATE CURRENT	2X35	2X120	2X93	MAMPS
GRID #2 CURRENT	2X4.7	2X25	2X25	MAMPS
MAX. SIGNAL POWER OUTPUT	0	44	36	WATTS
TOTAL HARMOINIC DISTORTION	–	5	6	PERCENTS

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
(CONT'D.)

CLASS B - TWO TUBES

SUPPLY VOLTAGE 500 400 VOLTS

COMMON GRID #2 RESISTOR		750		OHMS
GRID #1 BIAS		-36		VOLTS
GRID #3 VOLTAGE		0		VOLT
INPUT VOLTAGE (RMS)	0	25.8	25.8	VOLTS
LOAD RESISTANCE, PLATE TO PLATE	–	4000	5000	OHMS
PLATE SUPPLY VOLTAGE	500	500	475	VOLTS
PLATE VOLTAGE	495	475	450	VOLTS
GRID #2 SUPPLY VOLTAGE	400	400	375	VOLTS
PLATE CURRENT	2X30	2X125	2X102	MAMPS
GRID #2 CURRENT	2X4	2X25	2X25	MAMPS
MAX. SIGNAL POWER OUTPUT	0	70	58	WATTS
TOTAL HARMONIC DISTORTION	–	5	6	PERCENTS

CLASS B - TWO TUBES

SUPPLY VOLTAGE 800 400 VOLTS

COMMON GRID #2 RESISTOR		750		OHMS
GRID #1 BIAS		-39		VOLTS
GRID #3 VOLTAGE		0		VOLT
INPUT VOLTAGE (RMS)	0	23.4	23.4	VOLTS
LOAD RESISTANCE, PLATE TO PLATE	–	11000	11000	OHMS
PLATE SUPPLY VOLTAGE	800	800	750	VOLTS
PLATE VOLTAGE	795	775	725	VOLTS
GRID #2 SUPPLY VOLTAGE	400	400	375	VOLTS
PLATE CURRENT	2X25	2X91	2X84	MAMPS
GRID #2 CURRENT	2X3	2X19	2X19	MAMPS
MAX. SIGNAL POWER OUTPUT	0	100	90	WATTS
TOTAL HARMONIC DISTORTION	–	5	6	PERCENTS

CLASS AB - TWO TUBES

SUPPLY VOLTAGE 375 VOLTS

LOAD RESISTANCE, PLATE TO PLATE	3400		OHMS
COMMON GRID #2 RESISTOR	470		OHMS
CATHODE RESISTOR	130		OHMS
GRID #3 VOLTAGE	0		VOLT
INPUT VOLTAGE (RMS)	0	21	VOLTS
SUPPLY VOLTAGE	375	375	VOLTS
PLATE VOLTAGE +VOLTAGE ACROSS CATHODE RESISTOR	355	350	VOLTS
PLATE CURRENT	2X75	2X95	MAMPS
GRID #2 CURRENT	2X11.5	2X22.5	MAMPS
MAX. SIGNAL POWER OUTPUT	0	35	WATTS
TOTAL HARMONIC DISTORTION	–	5	PERCENTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

(CONT'D.)

IN TRIODE CONNECTION

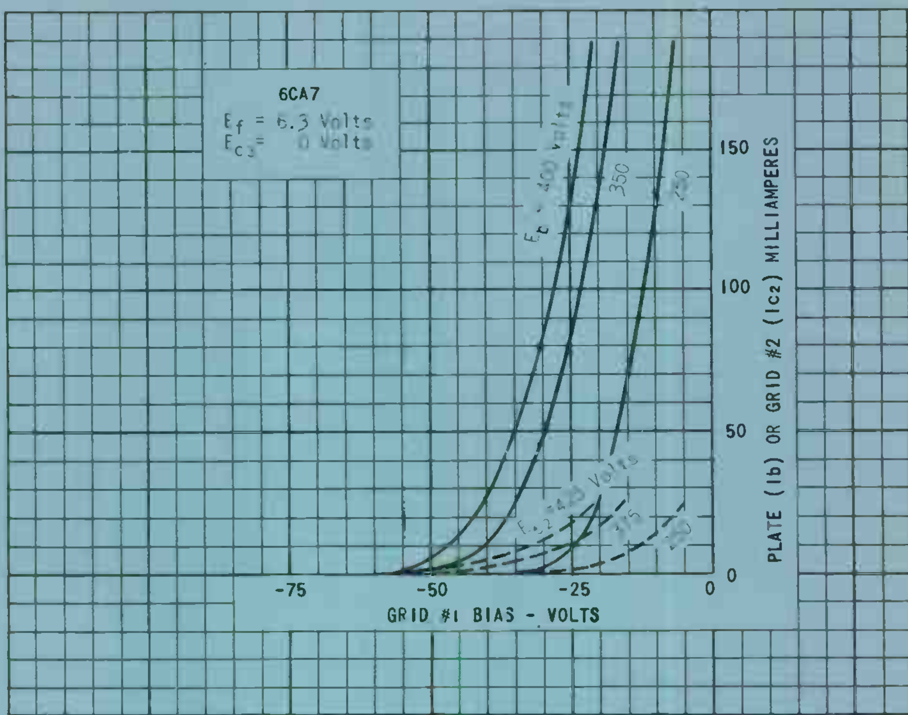
(GRID #2 CONNECTED TO PLATE)
CLASS A, ONE TUBE, SUPPLY VOLTAGE 375 VOLTS

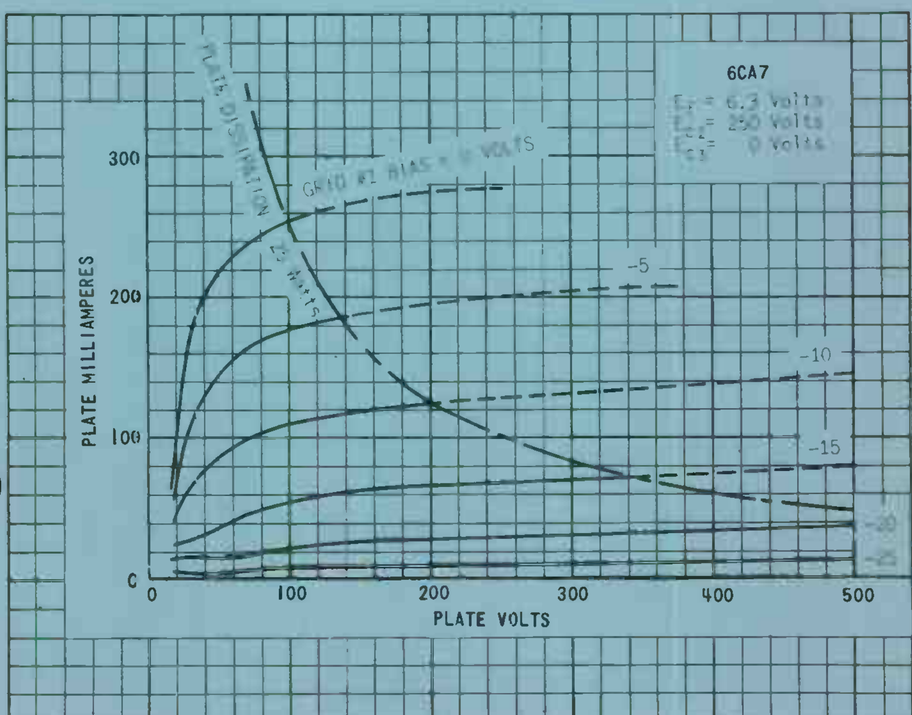
SUPPLY VOLTAGE	375	VOLTS
GRID #3 VOLTAGE	0	VOLT
CATHODE RESISTOR	370	OHMS
LOAD RESISTANCE	3000	OHMS
INPUT VOLTAGE (RMS)	18.9	VOLTS
PLATE CURRENT	70	MAMPS
MAX. SIGNAL POWER OUTPUT	6	WATTS
TOTAL HARMONIC DISTORTION	8	PERCENTS
INPUT VOLTAGE FOR POWER OUTPUT OF 50 MILLIWATTS (RMS)	1.7	VOLTS

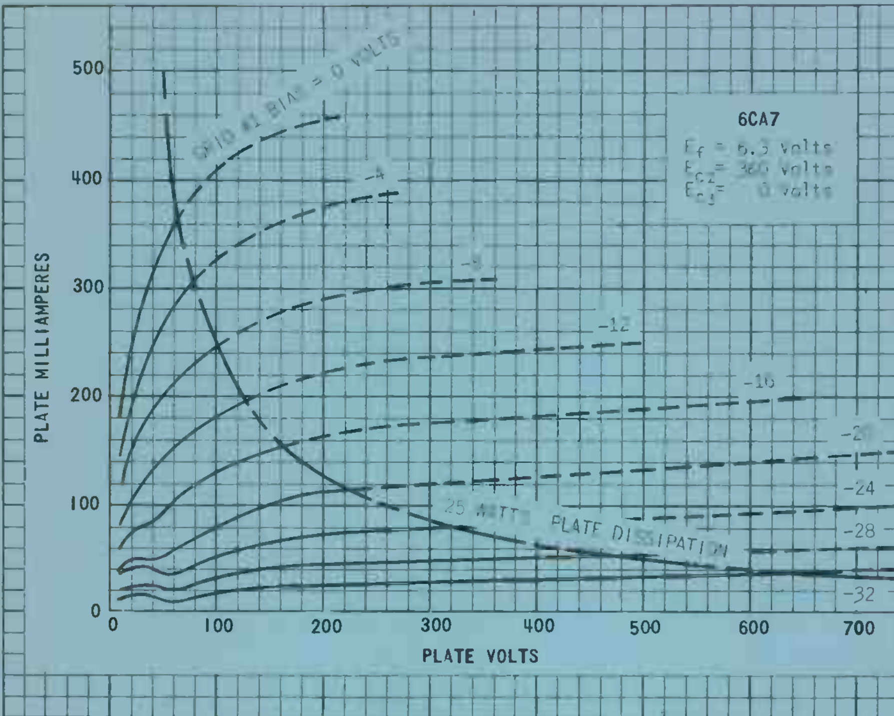
IN TRIODE CONNECTION

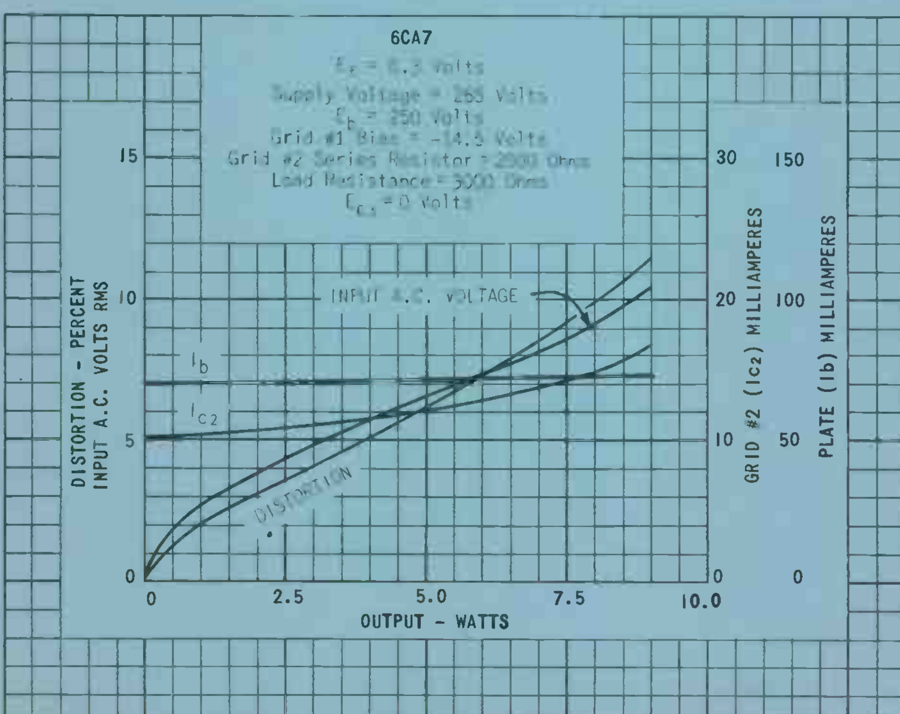
(GRID #2 CONNECTED TO PLATE)
CLASS AB, TWO TUBES, SUPPLY VOLTAGE 400 VOLTS

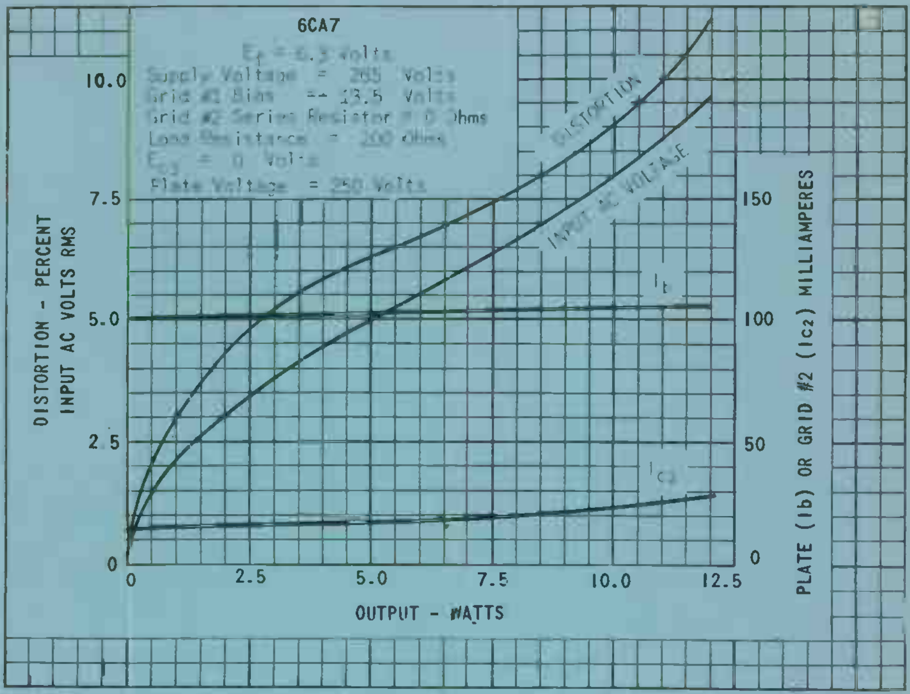
SUPPLY VOLTAGE	400		VOLTS
GRID #3 VOLTAGE	0		VOLT
CATHODE RESISTOR	220		OHMS
LOAD RESISTANCE, PLATE TO PLATE	5000		OHMS
INPUT VOLTAGE (RMS)	0	22	VOLTS
PLATE CURRENT	2X65	2X71	MAMPS
MAX. SIGNAL POWER OUTPUT	0	16.5	WATTS
TOTAL HARMONIC DISTORTION	–	3	PERCENTS

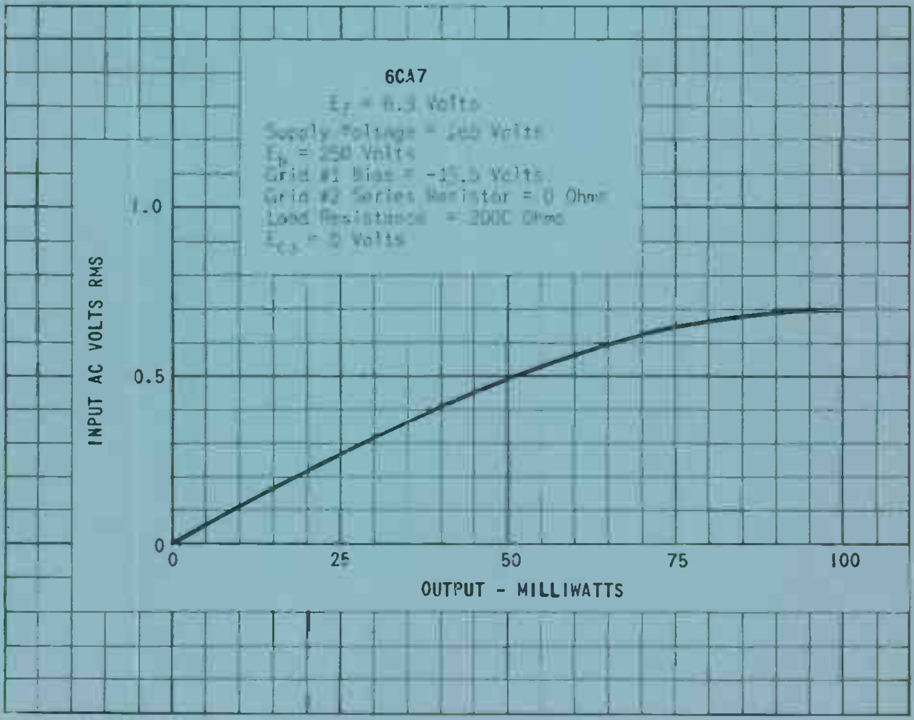

6CA7
E_f = 6.3 Volts
E_{c3} = 0 Volts
E_b = 400 Volts
350
250
E_{c2} = 400 Volts
275
250
150
100
50
0
-75
-50
-25
0
GRID #1 BIAS - VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES

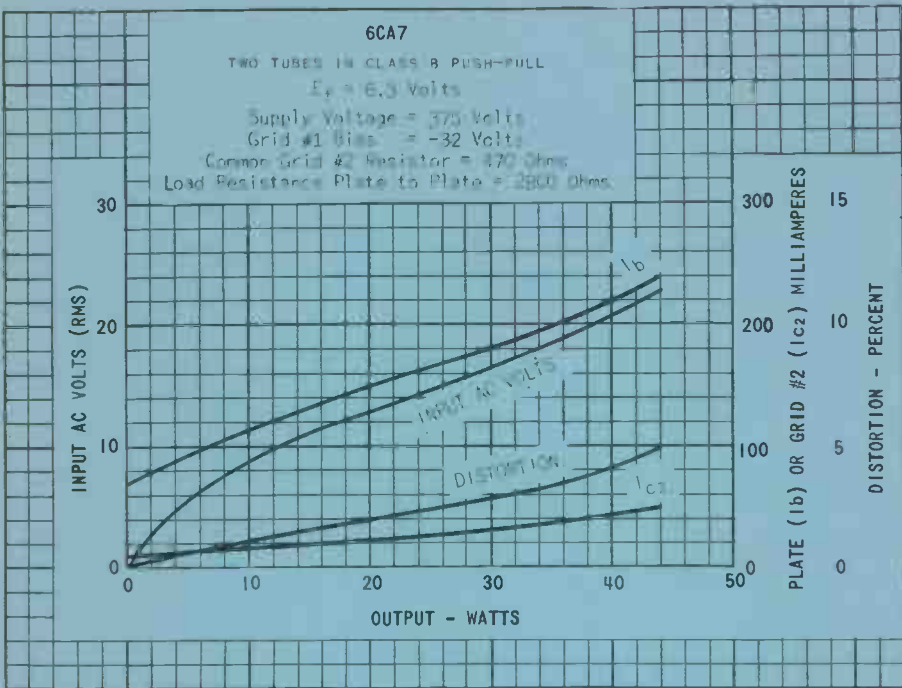

6CA7
E_f = 6.3 Volts
E_{c2} = 250 Volts
E_{c3} = 0 Volts
PLATE DISSIPATION 25 Watts
GRID #1 BIAS = 0 VOLTS
-5
-10
-15
-20
-25
300
200
100
0
0
100
200
300
400
500
PLATE VOLTS
PLATE MILLIAMPERES

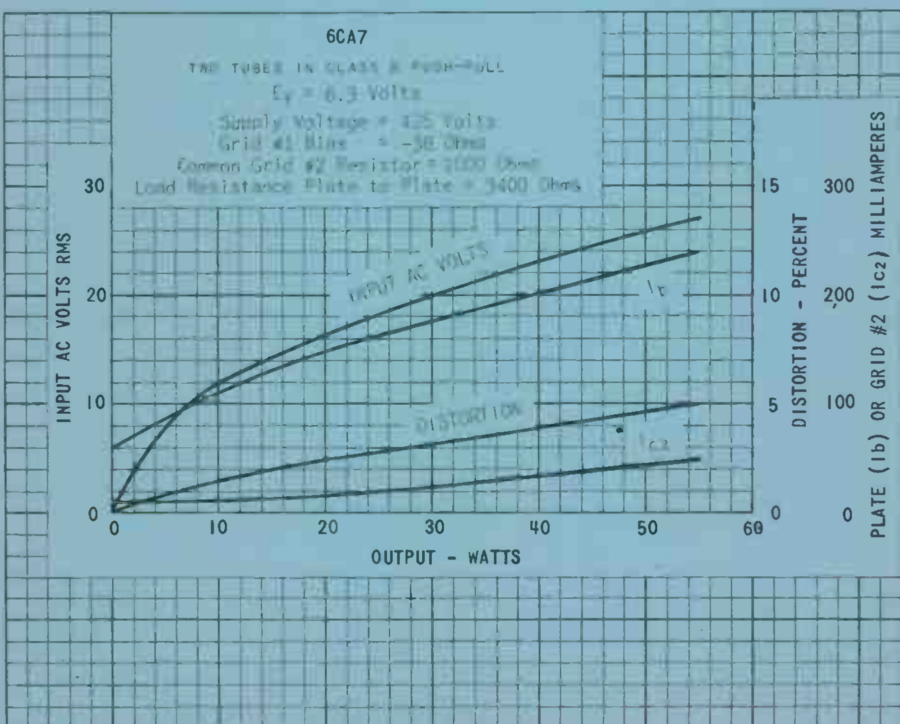

6CA7
Ef = 6.3 Volts
Ec2 = 360 Volts
Ec3 = 0 Volts
GRID #1 BIAS = 0 VOLTS
-4
-8
-12
-16
-20
-24
-28
-32
25 WATTS PLATE DISSIPATION
PLATE MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
600
700

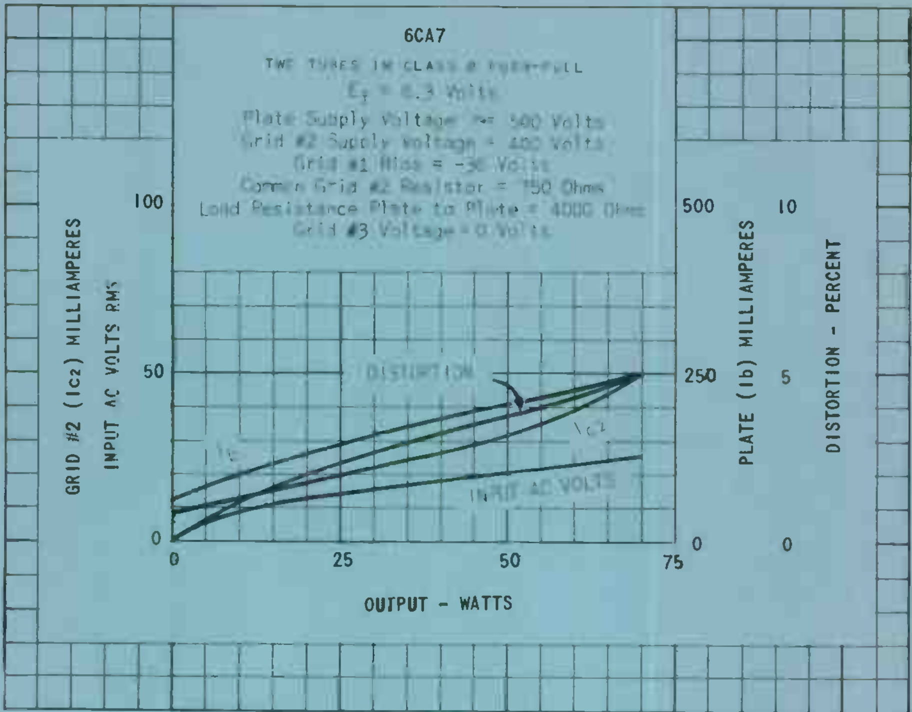

6CA7
Ef = 6.3 Volts
Supply Voltage = 265 Volts
Eb = 250 Volts
Grid #1 Bias = -14.5 Volts
Grid #2 Series Resistor = 2000 Ohms
Load Resistance = 3000 Ohms
Ec3 = 0 Volts
INPUT A.C. VOLTAGE
Ib
Ic2
DISTORTION
DISTORTION - PERCENT
INPUT A.C. VOLTS RMS
GRID #2 (Ic2) MILLIAMPERES
PLATE (Ib) MILLIAMPERES
OUTPUT - WATTS
0
2.5
5.0
7.5
10.0

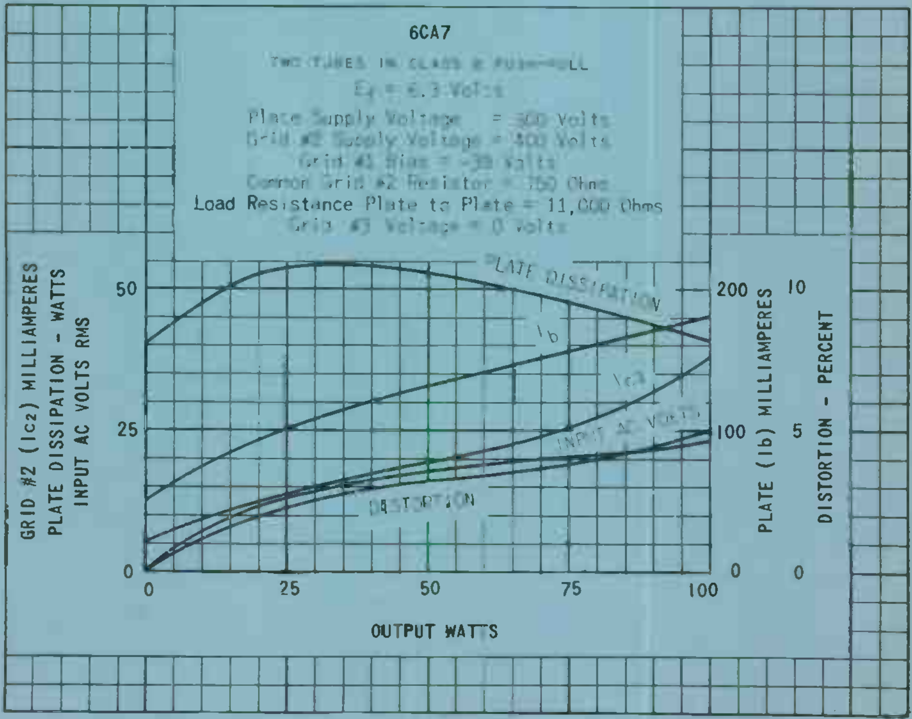

6CA7
Supply Voltage = 265 Volts
Grid #1 Bias = -13.5 Volts
Plate Voltage = 250 Volts
DISTORTION
INPUT AC VOLTAGE
I_b
I_{c2}
DISTORTION - PERCENT
INPUT AC VOLTS RMS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
OUTPUT - WATTS
0
2.5
5.0
7.5
10.0
12.5
0
50
100
150

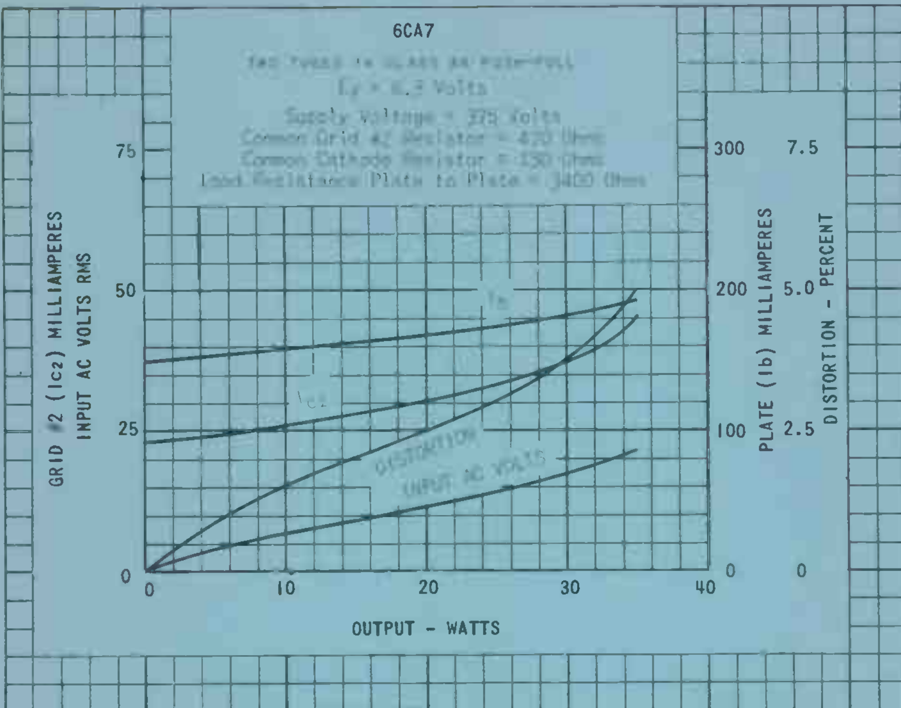

6CA7
E_f = 6.3 Volts
Supply Voltage = 265 Volts
E_b = 250 Volts
Grid #1 Bias = -13.5 Volts
Grid #2 Series Resistor = 0 Ohms
Load Resistance = 2000 Ohms
E_{c3} = 0 Volts
INPUT AC VOLTS RMS
OUTPUT - MILLIWATTS
0
0.5
1.0
0
25
50
75
100

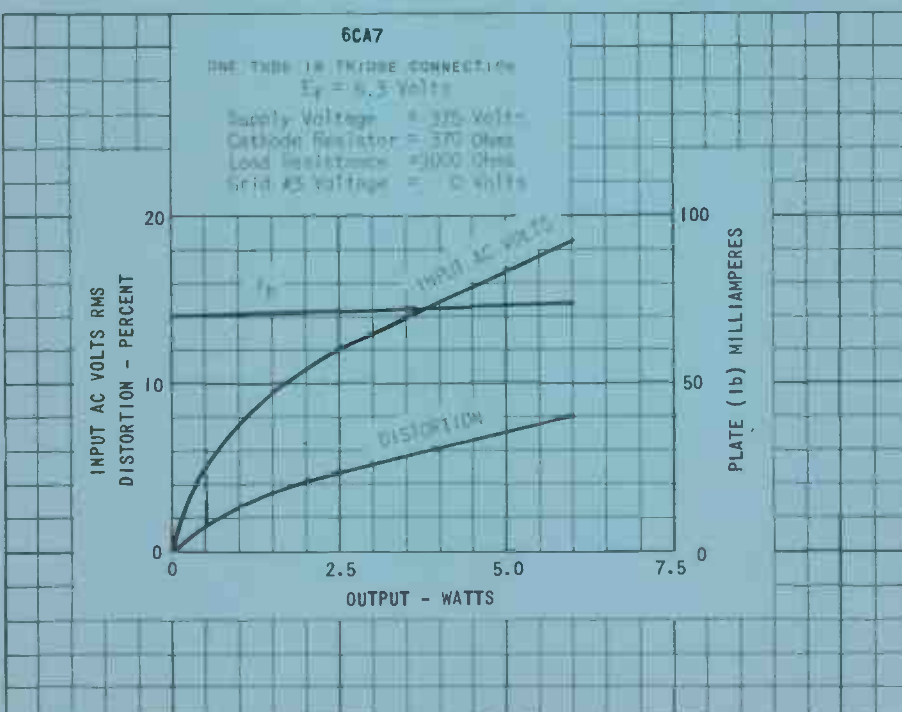

6CA7
TWO TUBES IN CLASS B PUSH-PULL
Ef = 6.3 Volts
Supply Voltage = 375 Volts
Grid #1 Bias = -32 Volts
Common Grid #2 Resistor = 470 Ohms
Load Resistance Plate to Plate = 2800 Ohms
INPUT AC VOLTS (RMS)
0
10
20
30
Ib
INPUT AC VOLTS
DISTORTION
Ic2
0
10
20
30
40
50
OUTPUT - WATTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0
100
200
300
DISTORTION - PERCENT
0
5
10
15

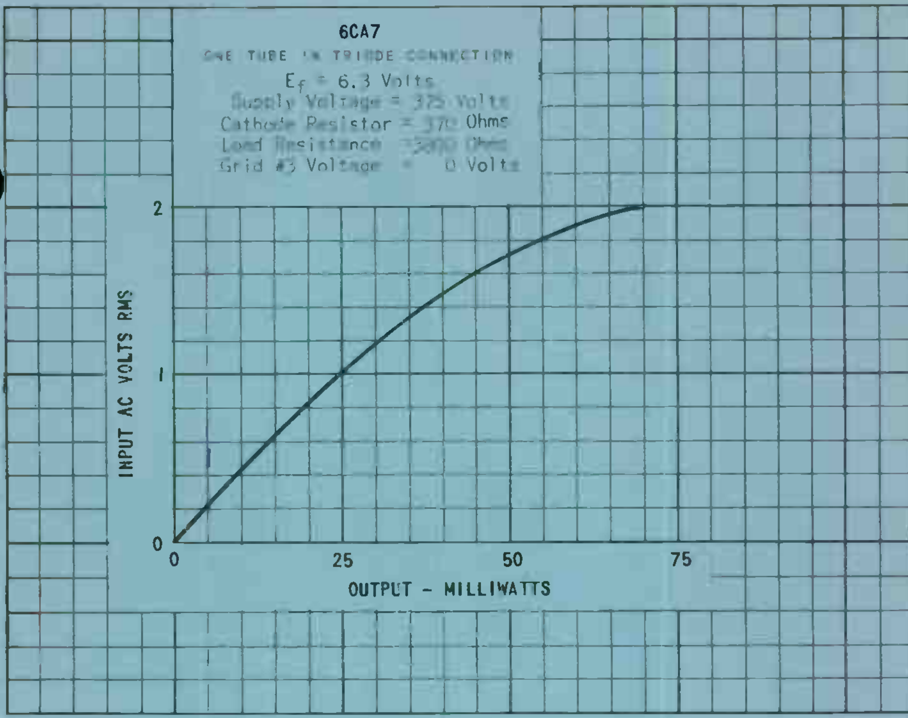

6CA7
TWO TUBES IN CLASS B PUSH-PULL
Ef = 6.3 Volts
Supply Voltage = 425 Volts
Grid #1 Bias = -38 Ohms
Common Grid #2 Resistor = 1000 Ohms
Load Resistance Plate to Plate = 3400 Ohms
INPUT AC VOLTS RMS
0
10
20
30
INPUT AC VOLTS
Ib
DISTORTION
Ic2
0
10
20
30
40
50
60
OUTPUT - WATTS
DISTORTION - PERCENT
0
5
10
15
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0
100
200
300


6CA7
Load Resistance Plate to Plate = 4000 Ohms
Grid #3 Voltage = 0 Volts
DISTORTION
Ic2
Ib
INPUT AC VOLTS
GRID #2 (Ic2) MILLIAMPERES
INPUT AC VOLTS RMS
PLATE (Ib) MILLIAMPERES
DISTORTION - PERCENT
OUTPUT - WATTS
100
50
0
500
250
0
10
5
0
0
25
50
75

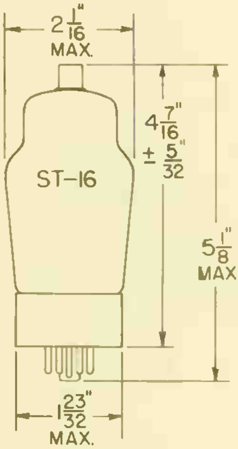

6CA7
Load Resistance Plate to Plate = 11,000 Ohms
PLATE DISSIPATION
Ib
Ic2
INPUT AC VOLTS
DISTORTION
GRID #2 (Ic2) MILLIAMPERES
PLATE DISSIPATION - WATTS
INPUT AC VOLTS RMS
PLATE (Ib) MILLIAMPERES
DISTORTION - PERCENT
OUTPUT WATTS
50
25
0
200
100
0
10
5
0
0
25
50
75
100


6CA7
TWO TUBES IN CLASS AB PUSH-PULL
Ef = 6.3 Volts
Supply Voltage = 375 Volts
Common Grid #2 Resistor = 470 Ohms
Common Cathode Resistor = 130 Ohms
Load Resistance Plate to Plate = 3400 Ohms
GRID #2 (Ic2) MILLIAMPERES
INPUT AC VOLTS RMS
75
50
25
0
Ib
Ic2
DISTORTION
INPUT AC VOLTS
0
10
20
30
40
OUTPUT - WATTS
300
200
100
0
PLATE (Ib) MILLIAMPERES
7.5
5.0
2.5
0
DISTORTION - PERCENT


6CA7
ONE TUBE IN TRIODE CONNECTION
Ef = 6.3 Volts
Supply Voltage = 375 Volts
Cathode Resistor = 370 Ohms
Load Resistance = 3000 Ohms
Grid #3 Voltage = 0 Volts
INPUT AC VOLTS RMS
DISTORTION - PERCENT
20
10
0
Ib
INPUT AC VOLTS
DISTORTION
0
2.5
5.0
7.5
OUTPUT - WATTS
100
50
0
PLATE (Ib) MILLIAMPERES


6CA7
ONE TUBE IN TRIODE CONNECTION
E_f = 6.3 Volts
Supply Voltage = 375 Volts
Cathode Resistor = 370 Ohms
Load Resistance
Grid #3 Voltage = 0 Volts
INPUT AC VOLTS RMS
0
1
2
0
25
50
75
OUTPUT - MILLIWATTS

TUNG-SOL

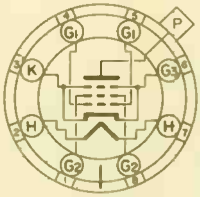


GLASS BULB
SMALL CAP

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 2.5 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT JUMBO SHELL
8 PIN OCTAL
8GD

THE 6CB5 IS A HIGH-PERVEANCE BEAM POWER TUBE. IT IS DESIGNED FOR USE AS A HORIZONTAL-DEFLECTION AMPLIFIER TUBE IN COLOR TELEVISION. ITS FEATURES INCLUDE LOW AMPLIFICATION, HIGH PLATE CURRENT AT LOW PLATE VOLTAGE, AND A HIGH OPERATING RATIO OF PLATE CURRENT TO GRID #2 CURRENT.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.8	μμf
INPUT	24	μμf
OUTPUT	10	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HORIZONTAL DEFLECTION AMPLIFIER[B]

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	VOLTS
DC COMPONENT	100	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE (DC AND BOOST)	700	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	6 800[D]	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE	-1 500	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200	VOLTS
MAXIMUM DC GRID #1 VOLTAGE	-50	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID #1 VOLTAGE	-200	VOLTS
MAXIMUM DC PLATE CURRENT	200	MA.
MAXIMUM GRID #2 INPUT	3.6	WATTS
MAXIMUM PLATE DISSIPATION	23	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM

[A] EXCEPT AS NOTED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS", FEDERAL COMMUNICATIONS COMMISSION.

[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.

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

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

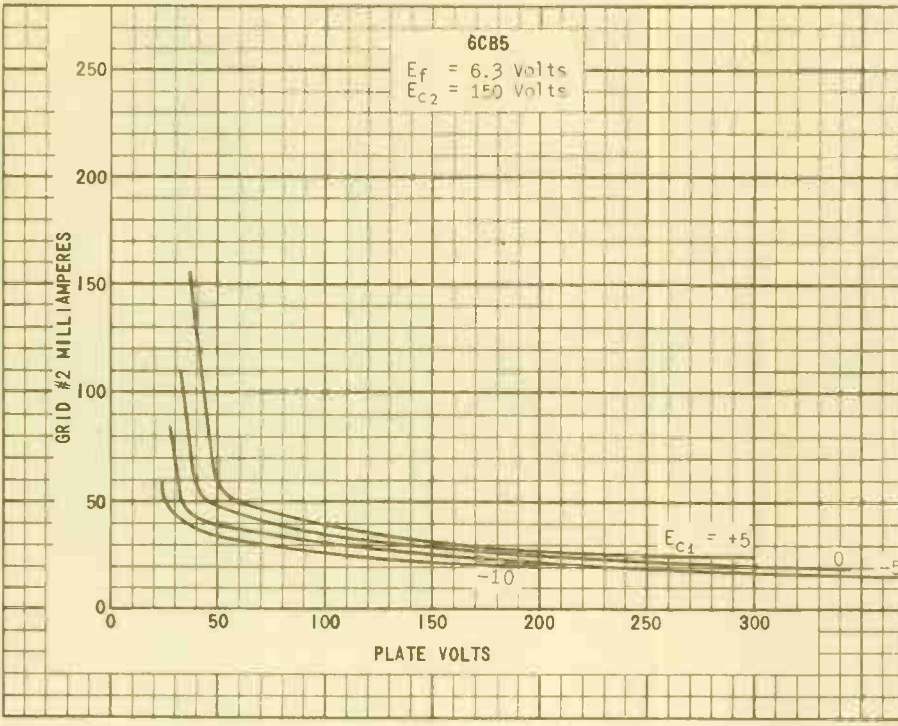
TUNG-SOL

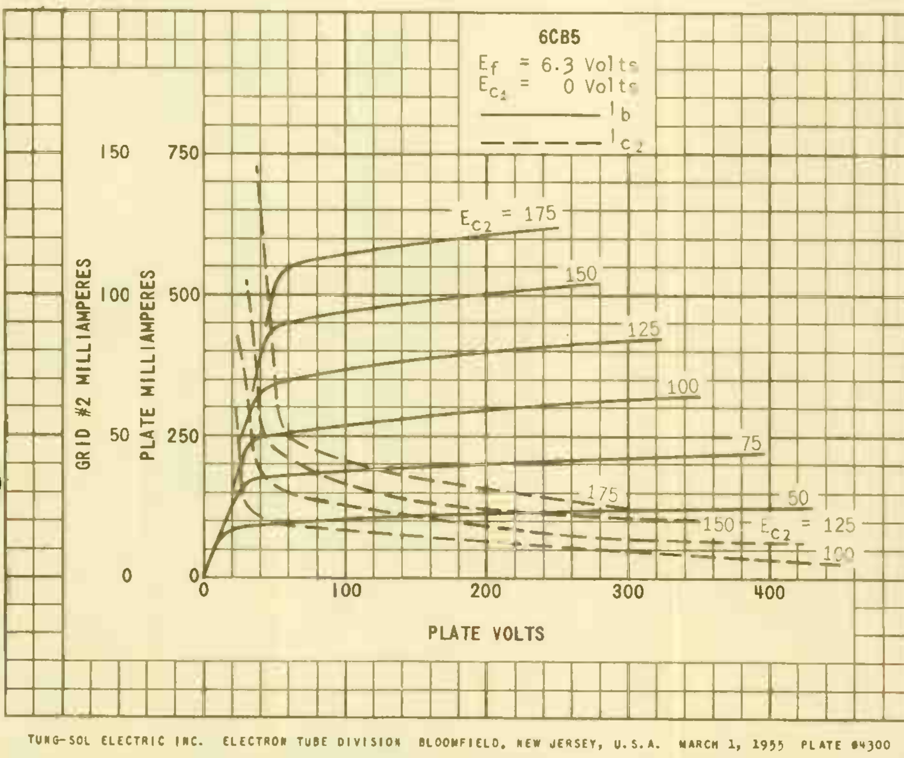
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

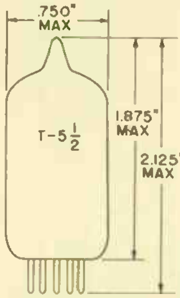
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	2.5	AMP.
PLATE VOLTAGE	175	VOLTS
GRID #2 VOLTAGE	175	VOLTS
GRID #1 VOLTAGE	-30	VOLTS
AMPLIFICATION FACTOR (G_2 TO G_1)	3.8	
PLATE RESISTANCE (APPROX.)	5 000	OHMS
TRANSCONDUCTANCE	8 800	μMHOS
GRID BIAS (APPROX.) FOR I_b = 1 MA.	-60	VOLTS
PLATE CURRENT	90	MA.
GRID #2 CURRENT	6	MA.


6CB5
E_f = 6.3 Volts
E_{c_2} = 150 Volts
GRID #2 MILLIAMPERES
250
200
150
100
50
0
E_{c_1} = +5
0
-5
-10
0
50
100
150
200
250
300
PLATE VOLTS


6CB5
E_f = 6.3 Volts
E_{c_1} = 0 Volts
I_b
I_{c_2}
GRID #2 MILLIAMPERES
150
100
50
0
PLATE MILLIAMPERES
750
500
250
0
E_{c_2} = 175
150
125
100
75
50
175
150
E_{c_2} = 125
100
0
100
200
300
400
PLATE VOLTS

TUNG-SOL



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-2

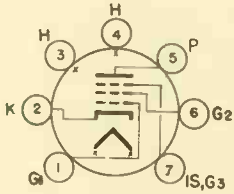
PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±0.6 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION

→ 

BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CM

THE 6CB6 AND 6CB6A ARE SHARP CUTOFF PENTODES USING THE MINIATURE BUTTON 7 PIN BASE. THEY ARE ESPECIALLY DESIGNED FOR USE AS IF AMPLIFIERS OPERATING AT FREQUENCIES ABOVE 20MC, BUT THEY ARE ALSO WELL SUITED FOR USE AS RF AMPLIFIERS IN VHF TELEVISION TUNERS. IN ADDITION, THERMAL CHARACTERISTICS OF THE 6CB6A 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 THE TWO TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES

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

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

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

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.)* (6CB6A -ONLY)	11.0	SECONDS

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

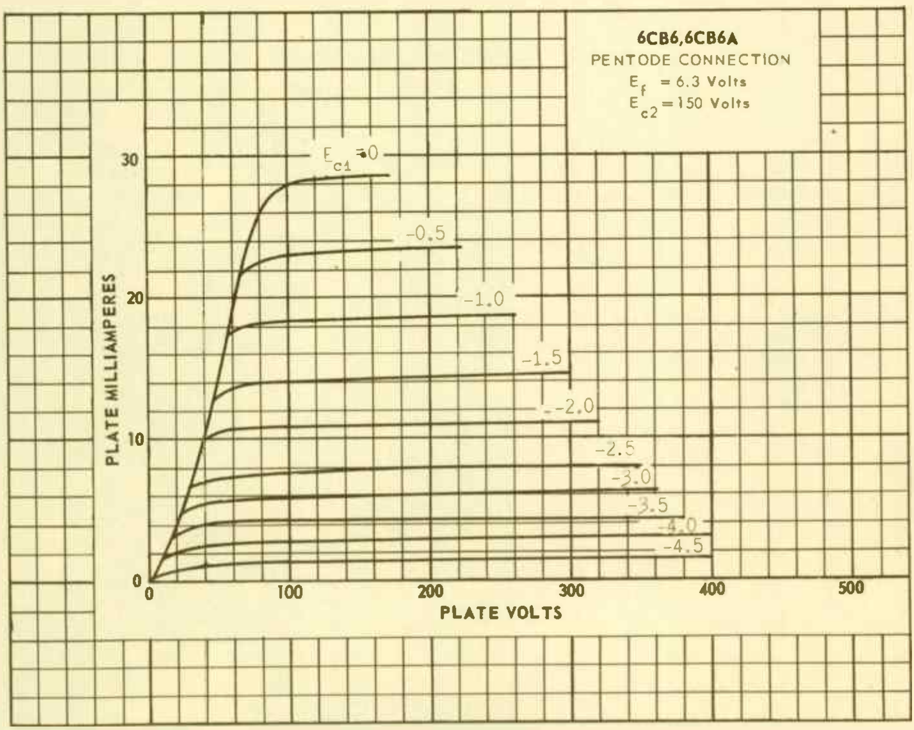
CONTINUED FROM PRECEDING PAGE

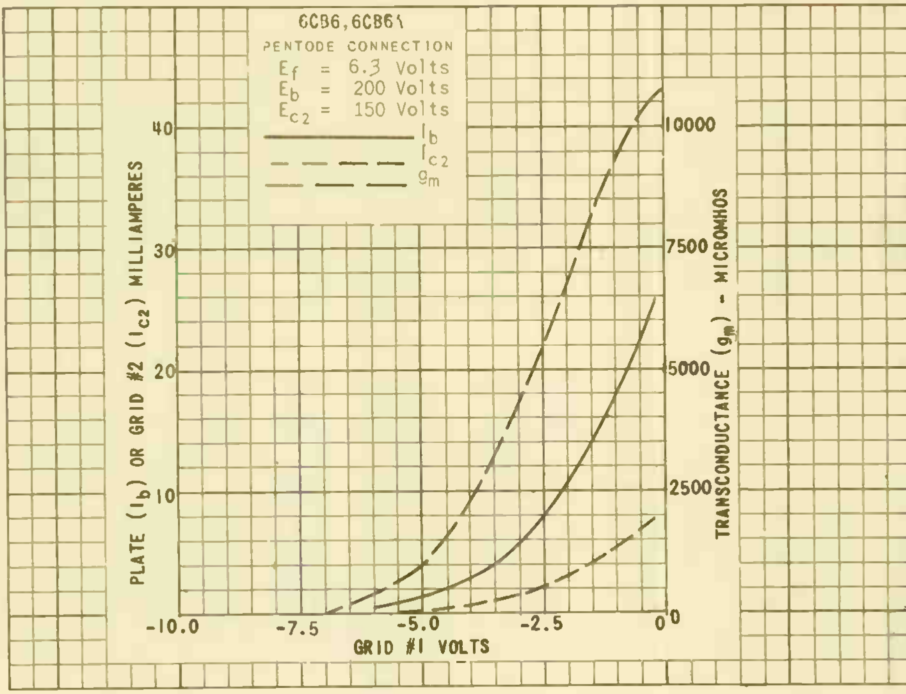
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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.

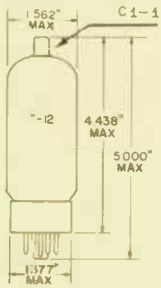




PRINTED IN U. S. A.

TUNG-SOL

BEAM PENTODE

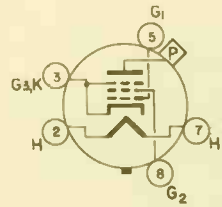


GLASS BULB
B8-10 OR B5-12
→ SHORT MEDIUM SHELL
8-PIN WITH
EXTERNAL BARRIERS

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 2.5 AMP.
AC OR DC

VERTICAL MOUNTING POSITION
HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 7 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5BT

THE 6CD6GA IS A BEAM PENTODE DESIGNED FOR USE AS A HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. FEATURES OF THIS TUBE ARE AN EXTREMELY HIGH PERVEANCE, HIGH PLATE CURRENT AT LOW PLATE AND SCREEN VOLTAGES AND A HIGH RATIO OF PLATE TO SCREEN CURRENT.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	1.1	pf
INPUT	22	pf
OUTPUT	8.5	pf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[B]

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 DC PLATE-SUPPLY VOLTAGE		
(BOOST + DC POWER SUPPLY)	700	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	7 000	VOLTS
MAXIMUM NEGATIVE PULSE PLATE VOLTAGE	1 500	VOLTS
MAXIMUM GRID #2 VOLTAGE	175	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION[C]	20	WATTS
MAXIMUM GRID #2 DISSIPATION	3.0	WATTS
MAXIMUM DC CATHODE CURRENT	200	MA.
MAXIMUM PEAK CATHODE CURRENT	700	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	225	°C

[A]UNLESS OTHERWISE SPECIFIED.

[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.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	60	175	VOLTS
GRID #2 VOLTAGE	100	175	VOLTS
GRID #1 VOLTAGE	0^D	−30	VOLTS
PLATE RESISTANCE (APPROX.)	---	7 200	OHMS
TRANSCONDUCTANCE	---	7 700	µMHOS
PLATE CURRENT	230	75	MA.
GRID #2 CURRENT	21	5.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 1.0 MA.	---	−55	VOLTS
TRIODE AMPLIFICATION FACTOR^E	---	3.9	

^{D}APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

^{E}TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH $E_b = E_{c2}$ = 175 VOLTS AND E_{c1} = −30 VOLTS.

SIMILAR TYPE REFERENCE: *The 6CD6GA may be used as a replacement for the 6CD6G; it differs from the 6CD6G by employing a straight-sided T-12 envelope and incorporating increased maximum ratings for plate dissipation, pulse plate voltage, and bulb temperature.*

TUNG-SOL

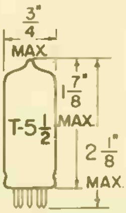
PENTODE

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
7BD

THE 6CE5 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 6CE5 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	6.3	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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

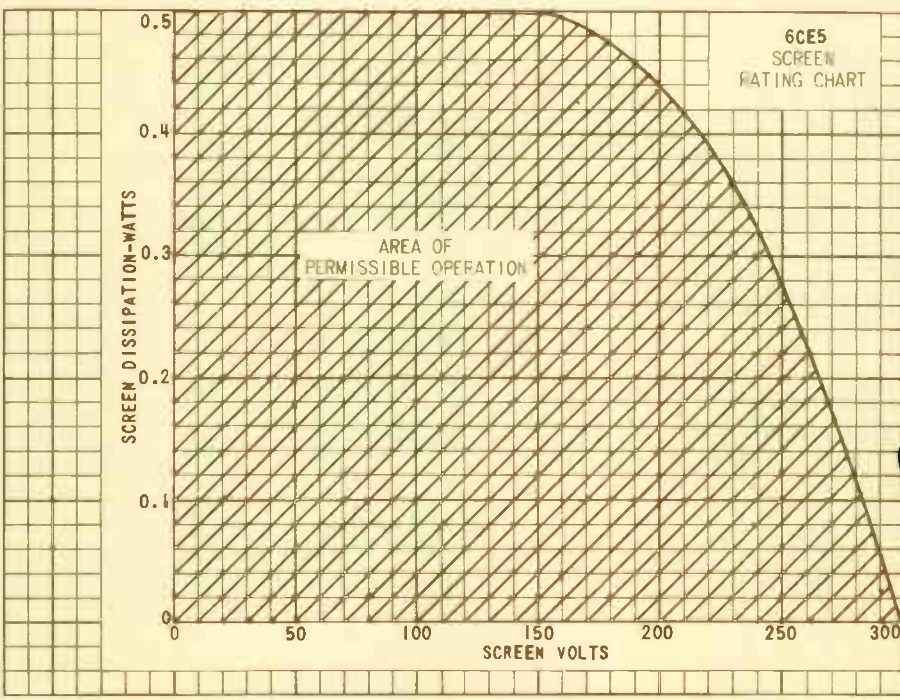
CLASS A_1 AMPLIFIER

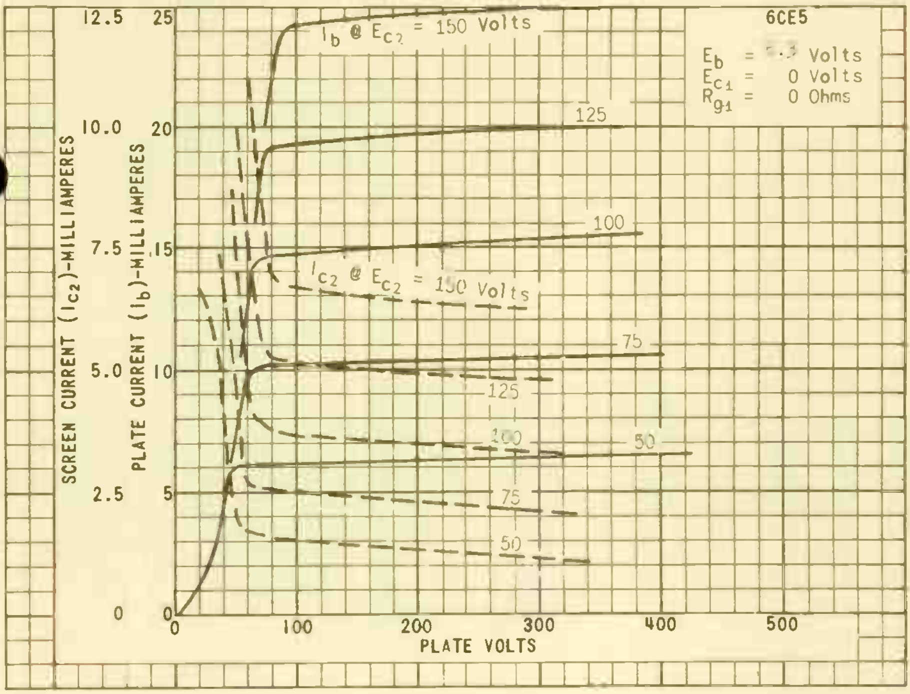
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE VOLTAGE	125	VOLTS
SCREEN VOLTAGE	125	VOLTS
* GRID #1 SUPPLY VOLTAGE	-1.0	VOLTS
GRID #1 RESISTOR (BYPASSED)	1.0	MEGOHMS
PLATE RESISTANCE (APPROX.)	0.3	MEGOHMS
TRANSCONDUCTANCE	7 600	µMHOS
PLATE CURRENT	11	MA.
SCREEN CURRENT	2.8 ←	MA.
GRID #1 VOLTAGE (APPROX.) Ib = 35 µAMPS.	-5.0	VOLTS

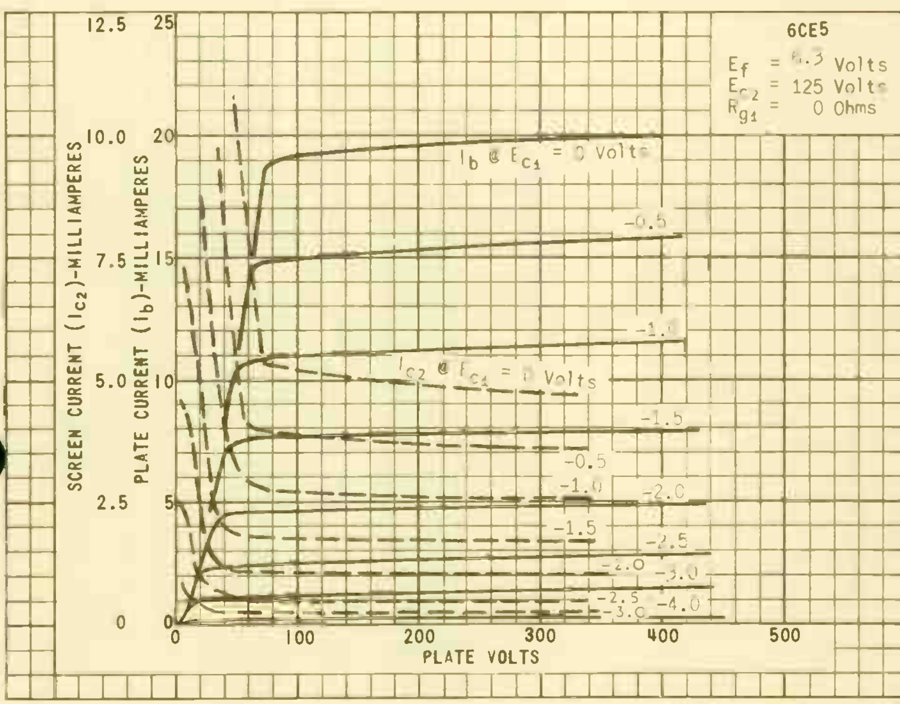
SIMILAR TYPE REFERENCE: Except for heater ratings, the 6CE5 is identical to the 3CE5 and the 4CE5.

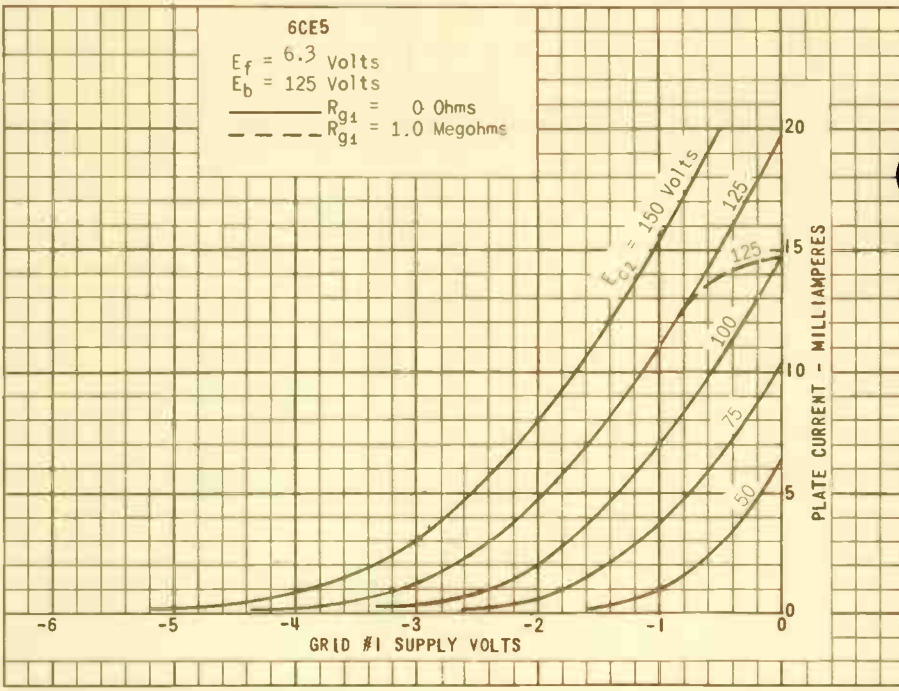
→ INDICATES A CHANGE.

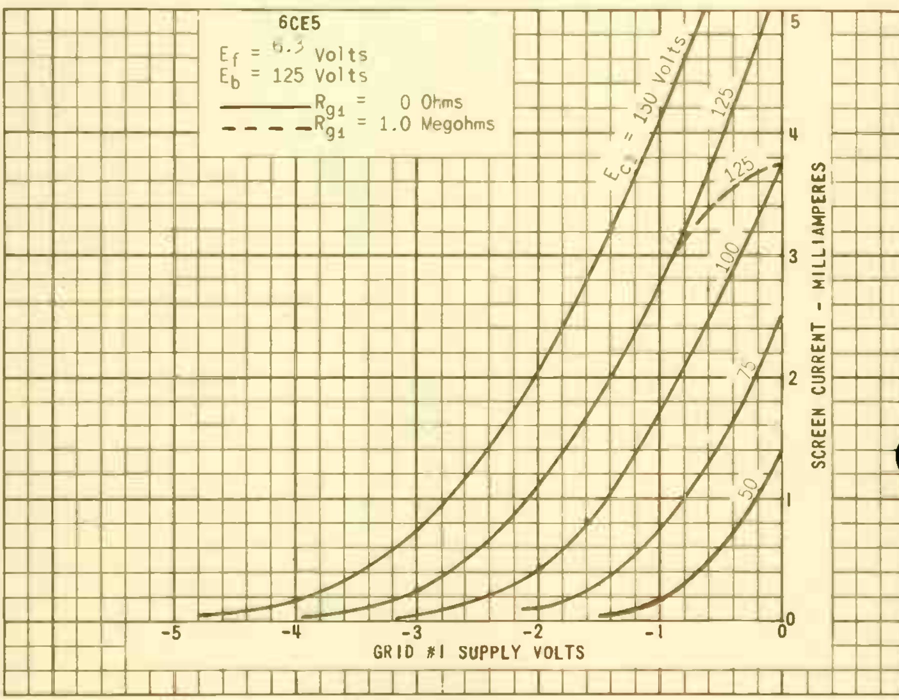
* INDICATES AN ADDITION.

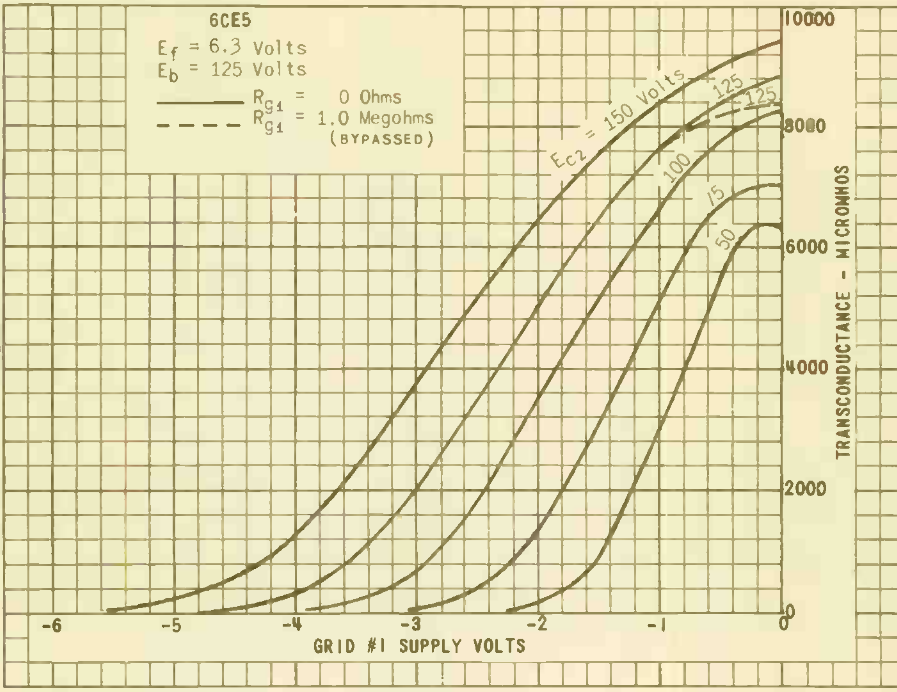



6CE5
E_{c1} = 0 Volts
R_{g1} = 0 Ohms
I_b @ E_{c2} = 150 Volts
125
100
75
50
I_{c2} @ E_{c2} = 150 Volts
125
100
75
50
SCREEN CURRENT (I_{c2})-MILLIAMPERES
PLATE CURRENT (I_b)-MILLIAMPERES
12.5
10.0
7.5
5.0
2.5
0
25
20
15
10
5
0
100
200
300
400
500
PLATE VOLTS


6CE5
E_{c2} = 125 Volts
R_{g1} = 0 Ohms
-0.5
-1.5
-2.0
-2.5
-3.0
-4.0
-0.5
-1.5
-2.0
-2.5
-3.0
SCREEN CURRENT (I_{c2})-MILLIAMPERES
PLATE CURRENT (I_b)-MILLIAMPERES
12.5
10.0
7.5
5.0
2.5
0
25
20
15
10
5
0
100
200
300
400
500
PLATE VOLTS


6CE5
E_f = 6.3 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
-6
-5
-4
-3
-2
-1
0
GRID #1 SUPPLY VOLTS
PLATE CURRENT - MILLIAMPERES

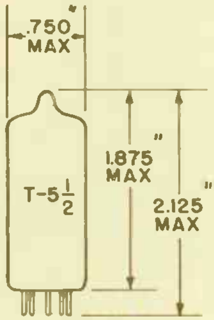

6CE5
E_f = 6.3 Volts
E_b = 125 Volts
R_{g1} = 0 Ohms
R_{g1} = 1.0 Megohms
E_{c2} = 150 Volts
125
125
100
75
50
5
4
3
2
1
0
-5
-4
-3
-2
-1
0
GRID #1 SUPPLY VOLTS
SCREEN CURRENT - MILLIAMPERES


6CE5
E_f = 6.3 Volts
E_b = 125 Volts
R_{g1} = 0 Ohms
R_{g1} = 1.0 Megohms
(BYPASSED)
E_{c2} = 150 Volts
125
125
100
75
50
10000
8000
6000
4000
2000
0
TRANSCONDUCTANCE - MICROMHOS
-6
-5
-4
-3
-2
-1
0
GRID #1 SUPPLY VOLTS

TUNG-SOL

PENTODE

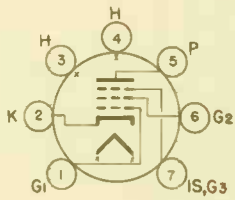
MINIATURE TYPE



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

COATED UNIPOTENTIAL CATHODE
FOR
IF AND RF APPLICATIONS IN
T.V. RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CM

THE 6CF6 IS A SHARP CUT-OFF PENTODE ESPECIALLY DESIGNED FOR USE IN GAIN CONTROLLED VIDEO *IF* STAGES OPERATING AT FREQUENCIES IN THE ORDER OF 40 MEGACYCLES. IT IS ALSO WELL SUITED FOR USE AS AN *RF* AMPLIFIER IN *VHF* TELEVISION TUNERS. IT FEATURES CONTROLLED PLATE-CURRENT CUT-OFF AND VERY HIGH TRANSCONDUCTANCE COMBINED WITH LOW CAPACITANCE VALUES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G1 TO P) MAX.	→ 0.015	→ 0.025	pf
INPUT: G1 TO (H+K+G2+G3+I.S.)	6.5	6.5	pf
OUTPUT: P TO (H+K+G2+G3+I.S.)	3.0	2.0	pf

[A] EXTERNAL SHIELD 316 CONNECTED TO PIN 2.

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			
TOTAL DC AND PEAK		→ 200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		→ 100	VOLTS
TOTAL DC AND PEAK		→ 200	VOLTS

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

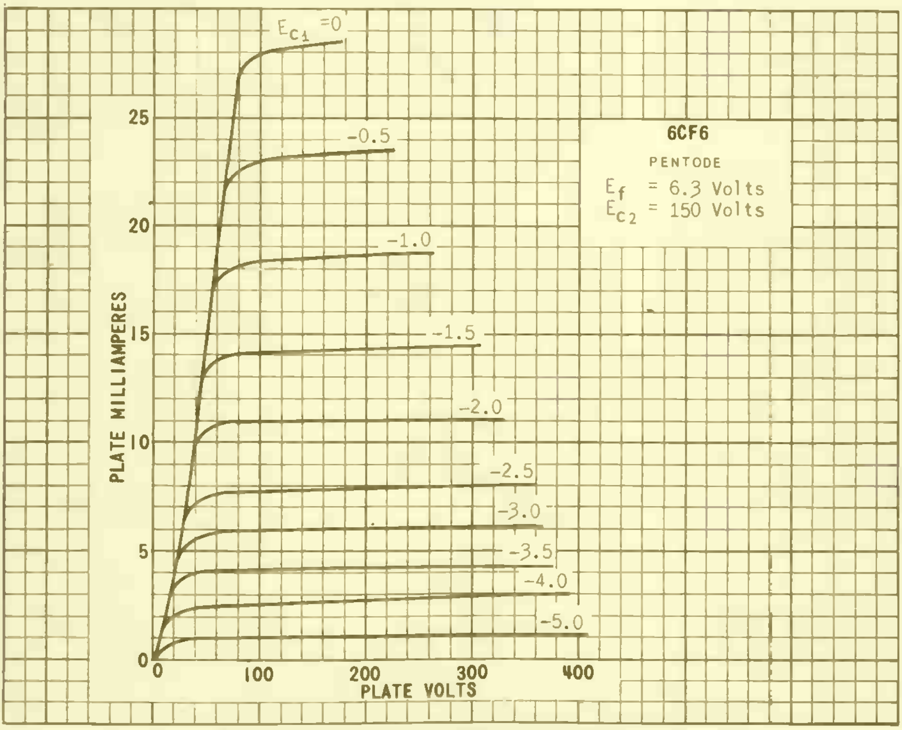
PLATE VOLTAGE	330	VOLTS
GRID #2 VOLTAGE	SEE RATING CHART	
GRID #2 SUPPLY VOLTAGE	330	VOLTS
PLATE DISSIPATION	→ 2.3	WATTS
GRID #2 DISSIPATION	0.55	WATT
POSITIVE DC GRID #1 VOLTAGE	0	VOLTS

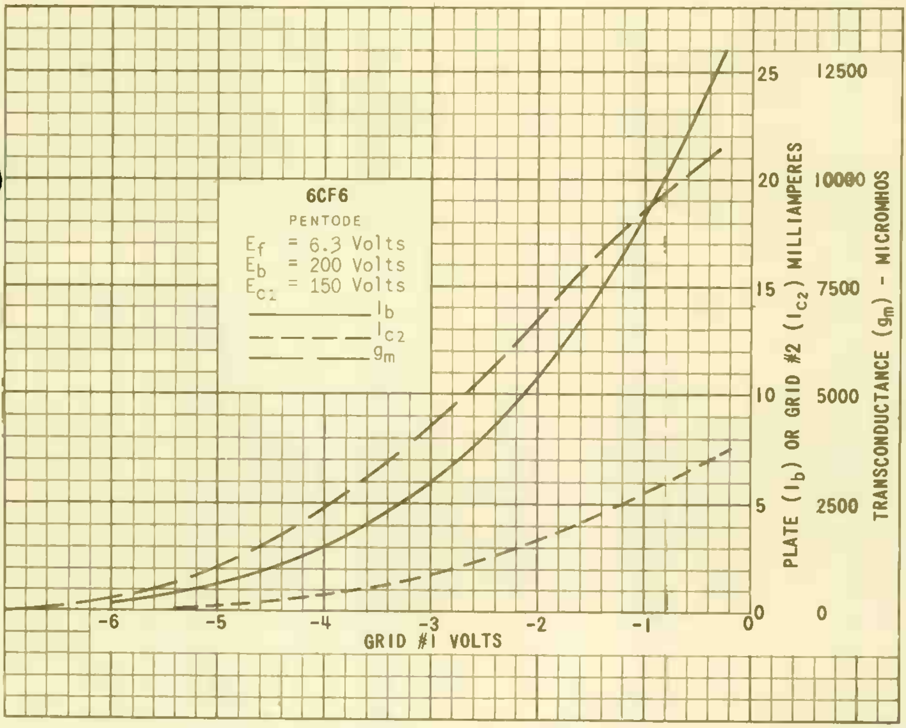
→ TYPICAL OPERATING CHARACTERISTICS

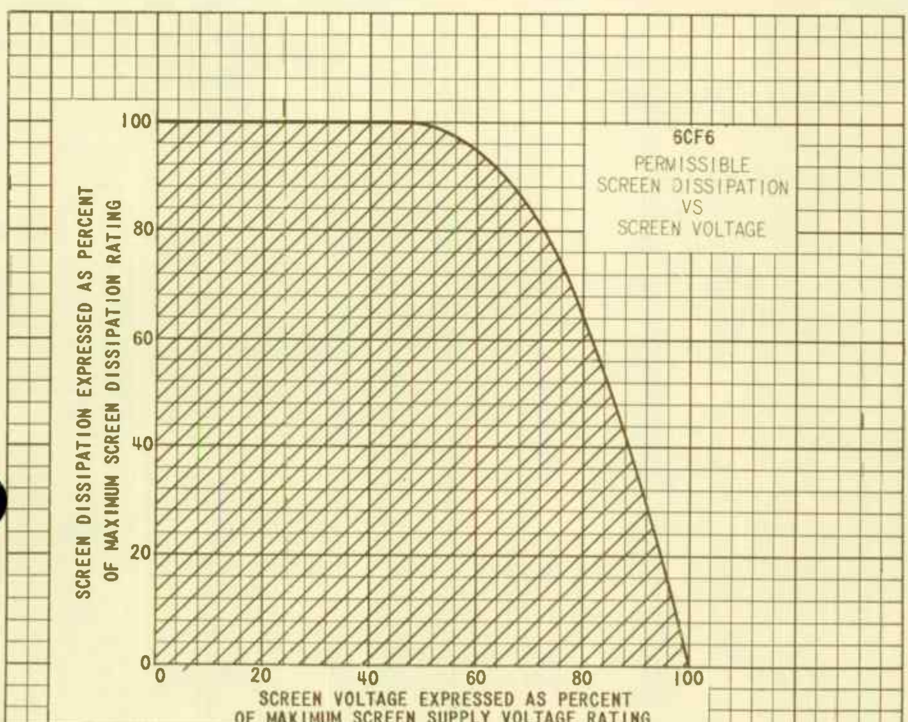
CLASS A_1 AMPLIFIER

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.)	0.3	MEGOHM
TRANSCONDUCTANCE	7800	µMHOS
PLATE CURRENT	12.5	MA.
GRID #2 CURRENT	3.7	MA.
GRID #1 VOLTAGE (APPROX.) FOR Ib =20 µA	-6.0	VOLTS
PLATE CURRENT AT Ec1=-3V., Rk =0	2.2	MA.

→ INDICATES A CHANGE.




6CF6
PENTODE
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
g_m
GRID #1 VOLTS
-6
-5
-4
-3
-2
-1
0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
5
10
15
20
25
TRANSCONDUCTANCE (g_m) - MICROMHOS
0
2500
5000
7500
10000
12500


6CF6
PERMISSIBLE
SCREEN DISSIPATION
VS
SCREEN VOLTAGE
SCREEN DISSIPATION EXPRESSED AS PERCENT
OF MAXIMUM SCREEN DISSIPATION RATING
0
20
40
60
80
100
SCREEN VOLTAGE EXPRESSED AS PERCENT
OF MAXIMUM SCREEN SUPPLY VOLTAGE RATING

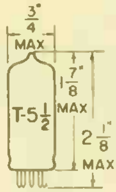
TENTATIVE DATA

6CG6

TUNG-SOL

PENTODE

MINIATURE TYPE

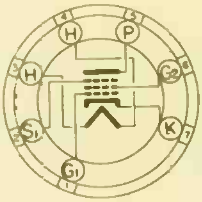


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BK

THE 6CG6 IS A HEATER-CATHODE TYPE SEMI-REMOTE CUTOFF PENTODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS SUITABLE FOR USE AS A GENERAL PURPOSE IF AMPLIFIER WHERE AUTOMATIC VOLUME CONTROL POTENTIAL IS AVAILABLE.

DIRECT INTERELECTRODE CAPACITANCES

VALUES APPLY BOTH WITH AND WITHOUT SHIELD #316 CONNECTED TO PINS #2 AND #7

GRID TO PLATE: (G_1 TO P) MAX.	0.008	μμf
INPUT: G_1 TO ($H+K+G_2+G_3$& IS)	5	μμf
OUTPUT: P TO ($H+K+G_2+G_3$& IS)	5	μμf

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 VOLTAGE	150	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	4	WATTS
MAXIMUM GRID #2 DISSIPATION	0.75	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

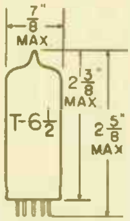
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #3 VOLTAGE	PIN #2 CONNECTED TO PIN #7 AT SOCKET	
GRID #2 VOLTAGE	150	VOLTS
GRID #1 VOLTAGE	-8	VOLTS
PLATE RESISTANCE	0.72	MEGOHM
TRANSCONDUCTANCE	2 000	μMHOS
PLATE CURRENT	9	MA.
GRID #2 CURRENT	2.3	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 40 μMHOS	-24	VOLTS

→ INDICATES A CHANGE.

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

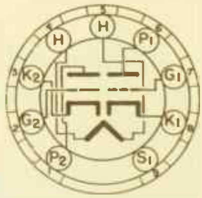


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON NOVAL
9 PIN BASE

9AJ

THE 6CG7 IS A GENERAL PURPOSE, MEDIUM-MU TWIN TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED PARTICULARLY FOR USE AS A VERTICAL DEFLECTION OSCILLATOR AND HORIZONTAL DEFLECTION OSCILLATOR IN TELEVISION RECEIVERS. THIS TYPE IS DESIGNED WITH A 600 MA. HEATER HAVING A CONTROLLED WARM-UP TIME TO INSURE DEPENDABLE PERFORMANCE IN TELEVISION RECEIVERS EMPLOYING A SINGLE SERIES-CONNECTED HEATER STRING INCLUDING THE HEATER OF THE PICTURE TUBE. IT MAY ALSO BE USED AS A PHASE INVERTER, MULTIVIBRATOR, SYNCHRONIZING SEPARATOR AND AMPLIFIER, AND RESISTANCE COUPLED AMPLIFIER IN ELECTRONIC EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

	UNIT 1	UNIT 2	
GRID TO PLATE: G TO P	4.0	4.0	μμf
INPUT: G TO (K+H& IS)	2.3	2.3	μμf
OUTPUT: P TO (K+H& IS)	2.2	2.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

EACH UNIT

	CLASS A_1 AMPLIFIER	
HEATER VOLTAGE	6.3±10% ←	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE[A]	200	VOLTS
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM GRID VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION:		
EACH PLATE	4.0 ←	WATTS
BOTH PLATES (BOTH UNITS OPERATING)	5.7 ←	WATTS
MAXIMUM CATHODE CURRENT	22 ←	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	1.0	MEGOHMS
HEATER WARM-UP TIME (APPROX.)[B]	11.0	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 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.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS[C] – CONT'D

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

EACH UNIT

	VERTICAL DEFLECTION OSCILLATOR	HORIZONTAL DEFLECTION OSCILLATOR	
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[D]		VOLTS
MAXIMUM DC PLATE VOLTAGE	330 ←	330 ←	VOLTS
MAXIMUM NEGATIVE PULSE GRID VOLTAGE	440[E] ←	660[F] ←	VOLTS
MAXIMUM CATHODE CURRENT:			
PEAK	77 ←	330 ←	MA.
DC	22 ←	22 ←	MA.
MAXIMUM PLATE DISSIPATION:			
EACH PLATE	4.0 ←	4.0 ←	WATTS
BOTH PLATES (BOTH UNITS OPERATING)	5.7 ←	5.7 ←	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE:			
FIXED BIAS, GRID-RESISTOR BIAS OR CATHODE-BIAS OPERATION	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)[G]	11.0		SECONDS

[C] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS", FEDERAL COMMUNICATIONS COMMISSION.

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

[E] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15 PERCENT OF ONE VERTICAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM; 15 PERCENT OF ONE VERTICAL SCANNING CYCLE IS 2.5 MILLISECONDS.

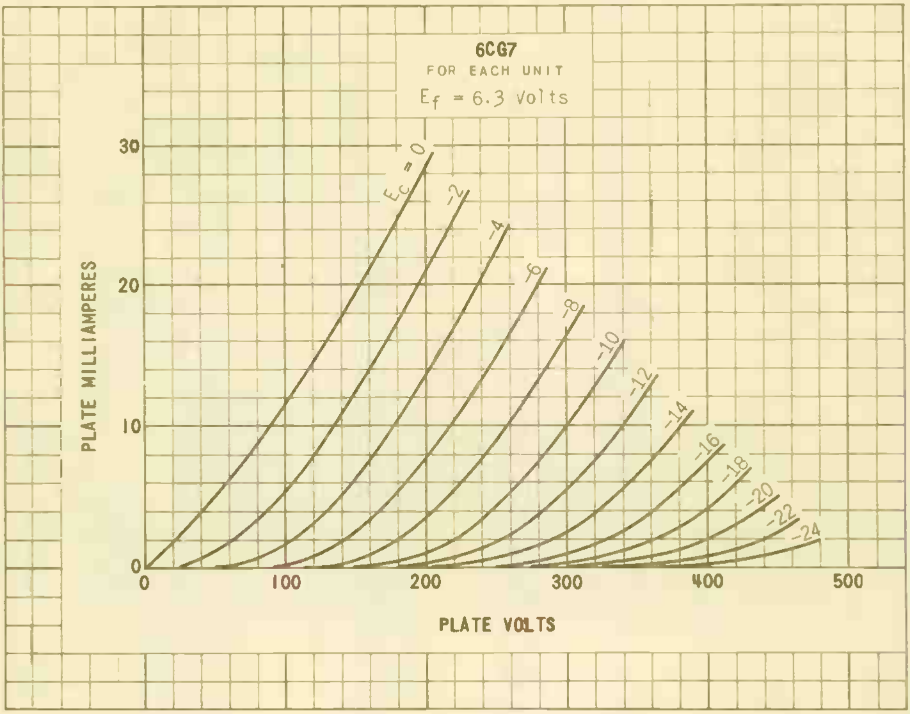
[F] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15 PERCENT OF ONE HORIZONTAL SCANNING CYCLE IN A 525-LINE, 30-FRAME SYSTEM; 15 PERCENT OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

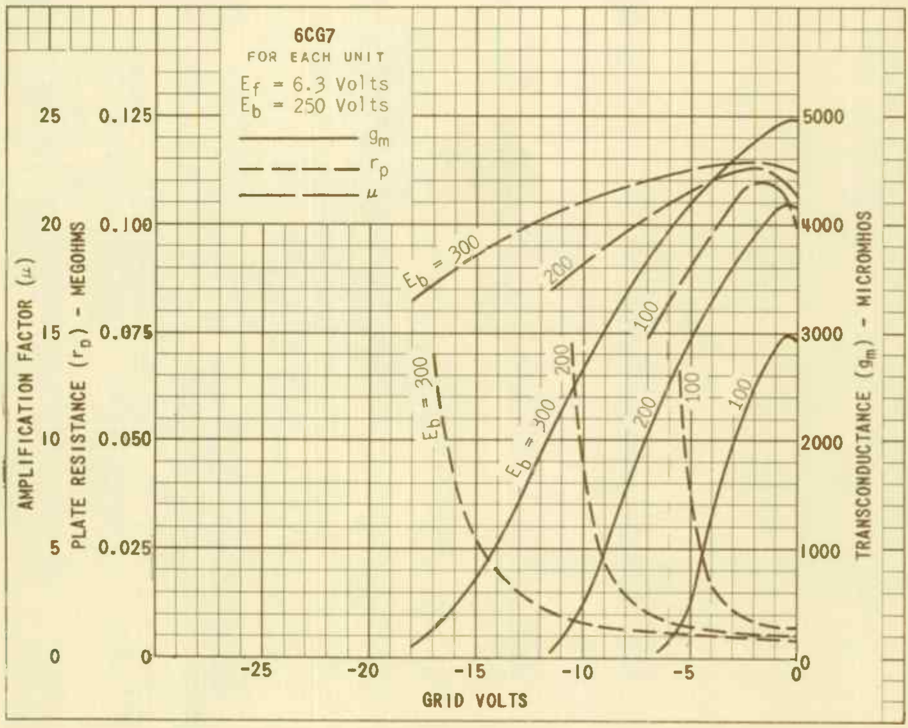
[G] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

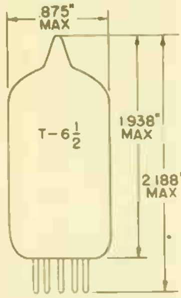
EACH UNIT

	CLASS A_1 AMPLIFIER		
HEATER VOLTAGE	6.3±10%		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	-8	VOLTS
AMPLIFICATION FACTOR	20	20	
PLATE RESISTANCE (APPROX.)	6700	7700	OHMS
TRANSCONDUCTANCE	3000	2600	μMHOS
GRID VOLTAGE (APPROX.)			
FOR I_b = 10 μAMP.	-7	-18	VOLTS
PLATE CURRENT OR GRID VOLTAGE OF -12.5 VOLTS	---	1.3	MA.
PLATE CURRENT	10	9	MA.


6CG7
FOR EACH UNIT
E_f = 6.3 Volts
E_c = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
PLATE MILLIAMPERES
PLATE VOLTS
0
10
20
30
0
100
200
300
400
500


6CG7
FOR EACH UNIT
E_f = 6.3 Volts
E_b = 250 Volts
g_m
r_p
μ
E_b = 300
200
100
E_b = 300
200
100
E_b = 300
200
100
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
GRID VOLTS
0
5
10
15
20
25
0
0.025
0.050
0.075
0.100
0.125
0
1000
2000
3000
4000
5000
-25
-20
-15
-10
-5
0

TUNG-SOL



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

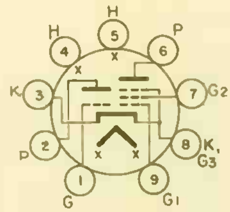
TRIODE PENTODE

MINIATURE TYPE

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 450±30 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9GF

THE 6CG8A CONTAINS A MEDIUM-MU TRIODE AND SHARP CUTOFF PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS A COMBINED OSCILLATOR AND MIXER IN 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

	WITHOUT EXTERNAL SHIELD	WITH EXTERNAL SHIELD[A]	
TRIODE UNIT:			
GRID TO PLATE	1.5	1.5	pf
GRID TO CATHODE & HEATER	2.6	3	pf
PLATE TO CATHODE & HEATER	0.05	1	pf
PENTODE UNIT:			
GRID #1 TO PLATE (MAX.)	0.03	0.016	pf
GRID #1 TO CATHODE & GRID #3, GRID #2, AND HEATER	4.8	5	pf
PLATE TO CATHODE & GRID #3, GRID #2, AND HEATER	0.9	1.6	pf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	0.05	0.04	pf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.05	0.007	pf
HEATER TO CATHODE	5.5	5.5[B]	pf

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE. [B] WITH EXTERNAL SHIELD #31[illegible] CONNECTED TO GROUND

→ 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:		
FOR GRID #2 VOLTAGES UP TO 137.5 V.	0.45	WATTS
FOR GRID #2 VOLTAGES BETWEEN 137.5 & 275 V.	SEE J5-C4-2	

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS - cont'd.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

POSITIVE DC PENTODE GRID #1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	1.7	WATTS
HEATER-CATHODE VOLTAGE;		
HEATER NEGATIVE WITH 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	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.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

TYPICAL OPERATION

	TRIODE UNIT[E] AS 250-MC OSCILLATOR	PENTODE[D] AS UNIT MIXER	
PLATE VOLTAGE	150	150	VOLTS
GRID #2 VOLTAGE	---	150	VOLTS
MIXER GRID #1 SUPPLY VOLTAGE	---	-3.5	VOLTS
OSCILLATOR VOLTAGE AT MIXER GRID #1 (RMS)	---	2.6	VOLTS
MIXER GRID #1 CIRCUIT RESISTANCE	---	120 000	OHMS
OSCILLATOR GRID RESISTOR	2700	---	OHMS
CONVERSION TRANSCONDUCTANCE	---	2 100	μMHOS
PLATE CURRENT	13	6.2	MA.
GRID #2 CURRENT	---	1.8	MA.
GRID #1 CURRENT	3.6	---	MA.
GRID #1 CURRENT	---	2	μAMP
OSCILLATOR POWER OUTPUT (APPROX.)	0.5	---	WATT

MAXIMUM CIRCUIT VALUES:

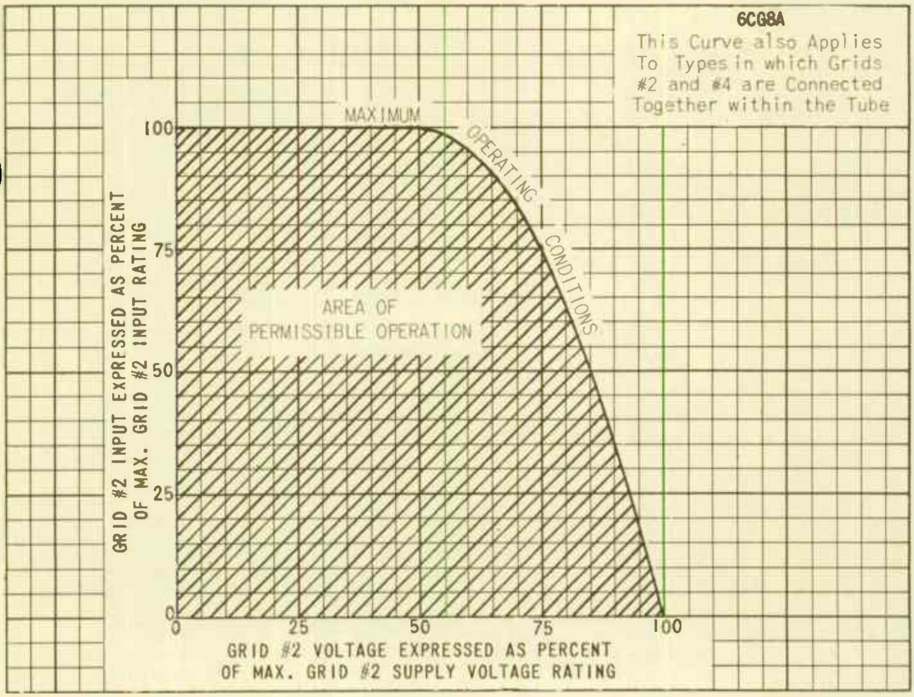
GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION (MAX.)	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION (MAX.)	0.5	MEGOHM

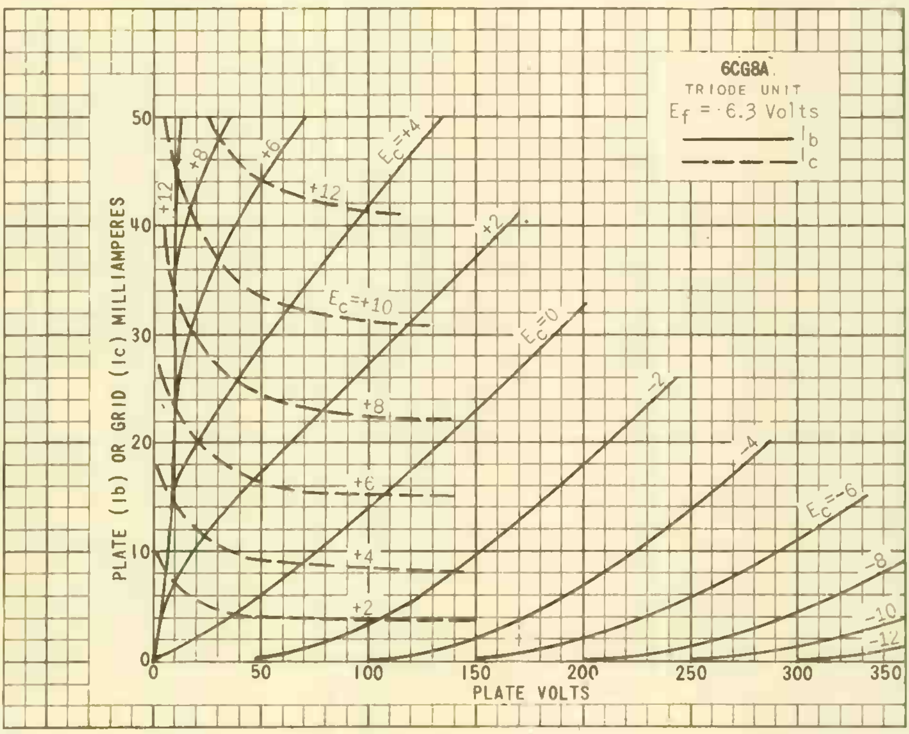
CHARACTERISTICS

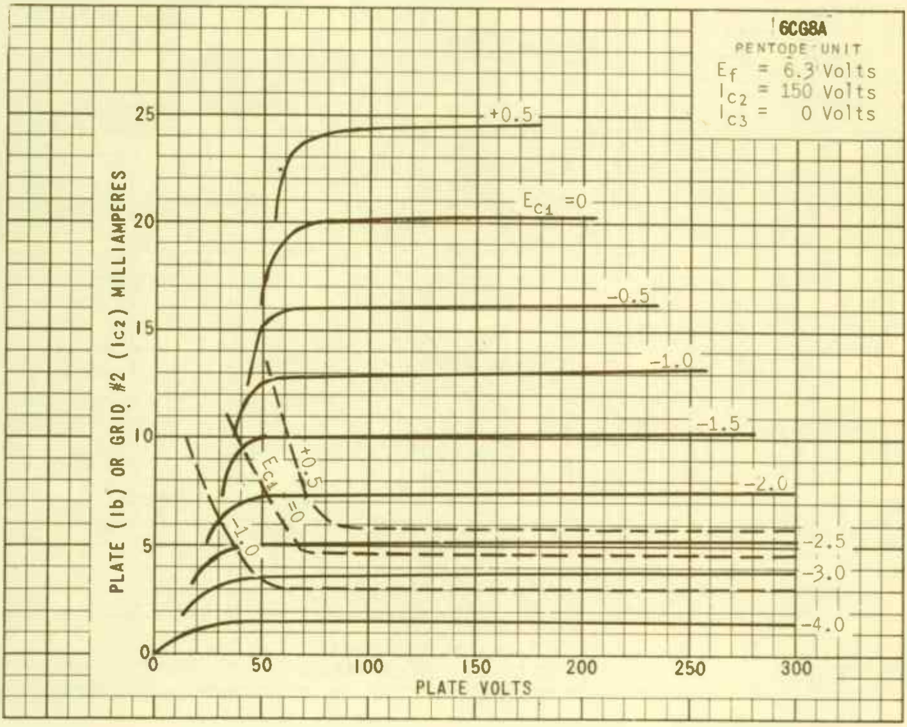
	TRIODE UNIT	PENTODE UNIT	
PLATE VOLTAGE	100	250	VOLTS
GRID #2 VOLTAGE	---	150	VOLTS
CATHODE-BIAS RESISTOR	100	200	OHMS
AMPLIFICATION FACTOR	40	---	
PLATE RESISTANCE (APPROX.)	6900	750 000	OHMS
TRANSCONDUCTANCE	5800	4 600	μMHOS
GRID #1 VOLTAGE (APPROX.)			
FOR PLATE CURRENT OF 10 μAMP	-10	-10	VOLTS
PLATE CURRENT	8.5	7.7	MA.
GRID #2 CURRENT	---	1.6	MA.

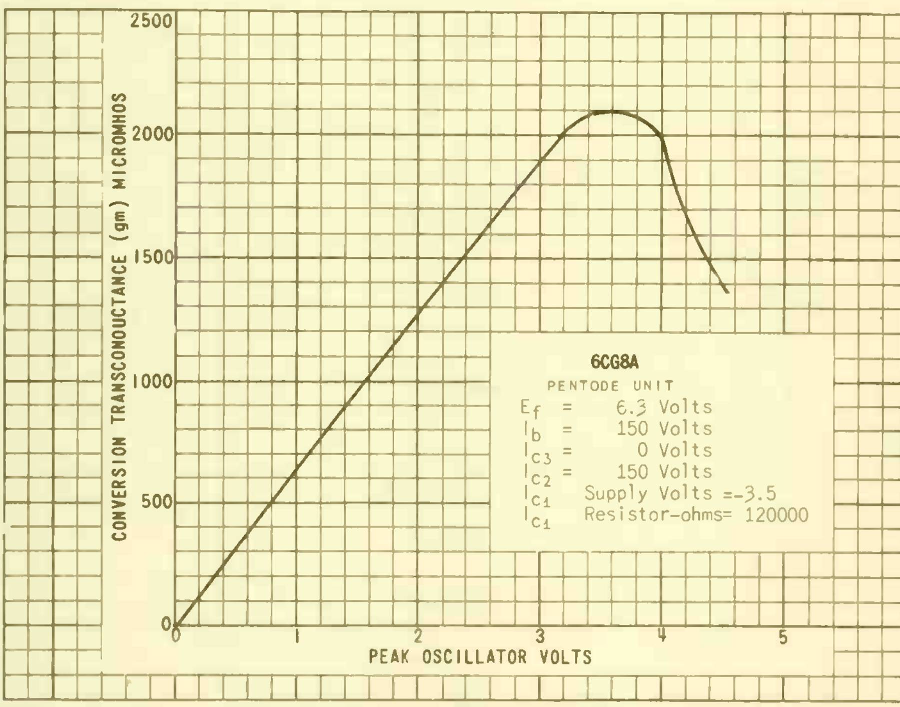
[D] WITH SEPARATE EXCITATION AND TRIODE UNIT GROUNDED.

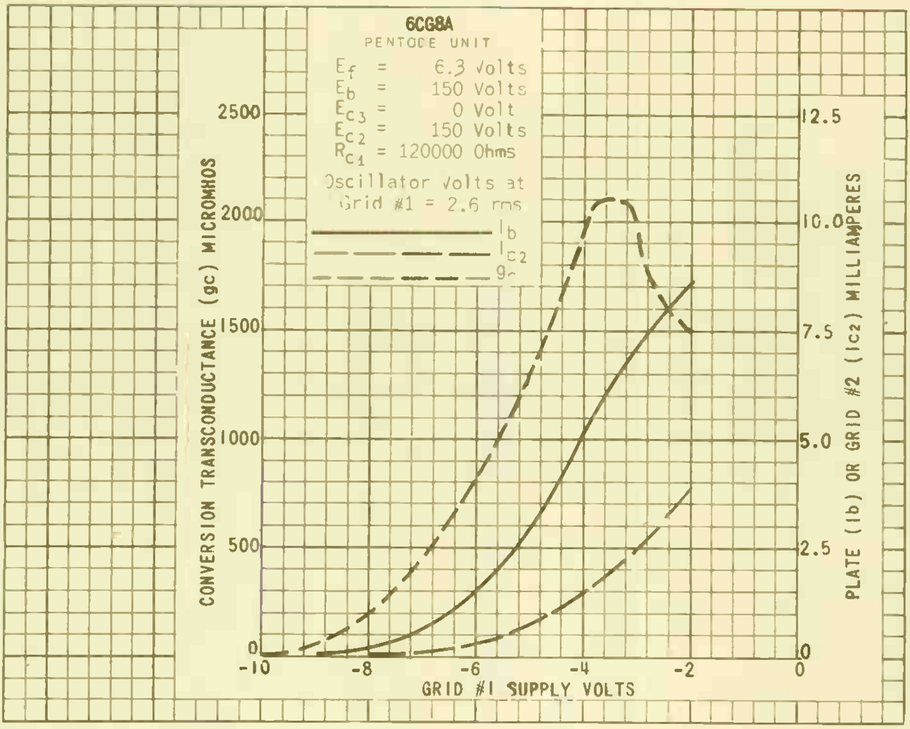
[E] IN TV OR FM RECEIVERS, IT IS GENERALLY DESIRABLE TO OPERATE THE OSCILLATOR WITH LESS POWER INPUT THAN SHOWN IN THE TABULATED DATA IN ORDER TO AVOID OVER-EXCITATION AND EXCESSIVE OSCILLATOR RADIATION.


6CG8A
This Curve also Applies To Types in which Grids #2 and #4 are Connected Together within the Tube
MAXIMUM OPERATING CONDITIONS
AREA OF PERMISSIBLE OPERATION
GRID #2 INPUT EXPRESSED AS PERCENT OF MAX. GRID #2 INPUT RATING
GRID #2 VOLTAGE EXPRESSED AS PERCENT OF MAX. GRID #2 SUPPLY VOLTAGE RATING
0
25
50
75
100


6CG8A
TRIODE UNIT
E_f = 6.3 Volts
I_b
I_c
E_c=+4
+2
E_c=0
-2
-4
E_c=-6
-8
-10
-12
+6
+8
+12
E_c=+10
+4
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
50
100
150
200
250
300
350


6CG8A
PENTODE UNIT
Ef = 6.3 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
-1.0
+0.5
0
5
10
15
20
25
50
100
150
200
250
300


6CG8A
PENTODE UNIT
Ef = 6.3 Volts
Ib = 150 Volts
Ic3 = 0 Volts
Ic2 = 150 Volts
Ic1 Supply Volts =-3.5
Ic1 Resistor-ohms= 120000
CONVERSION TRANSCONDUCTANCE (gm) MICROMHOS
PEAK OSCILLATOR VOLTS
0
500
1000
1500
2000
2500
1
2
3
4
5



6CG8A
PENTODE UNIT
E_f = 6.3 Volts
E_b = 150 Volts
E_{c3} = 0 Volt
E_{c2} = 150 Volts
R_{c1} = 120000 Ohms
Oscillator Volts at Grid #1 = 2.6 rms
I_b
I_{c2}
g_c
CONVERSION TRANSCONDUCTANCE (gc) MICROMHOS
0
500
1000
1500
2000
2500
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0
2.5
5.0
7.5
10.0
12.5
-10
-8
-6
-4
-2
0
GRID #1 SUPPLY VOLTS

TUNG-SOL

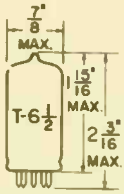
TWIN TRIODE

MINIATURE TYPE

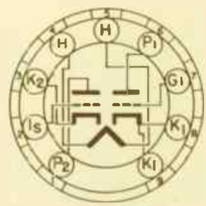
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9FC ←

BECAUSE OF THE CONNECTION OF THE INTERNAL SHIELD, SECTION 1 (PINS 6, 7, 8, AND 9) MUST BE USED AS THE INPUT OR GROUNDED-CATHODE SECTION.

THE 6CH7 IS A MEDIUM MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS A CASCODE RF AMPLIFIER IN VHF TELEVISION TUNERS. THE ELECTRICAL CHARACTERISTICS OF THE TUBE ARE ESSENTIALLY EQUIVALENT TO THOSE OF THE 6BZ7 FROM WHICH IT DIFFERS PRIMARILY IN BASING. BECAUSE OF THE REVISED BASING, THE 6CH7 EXHIBITS AN IMPROVED NOISE FIGURE IN CASCODE SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315 CONNECTED TO HEATER UNLESS OTHERWISE SPECIFIED

	SECTION #1		SECTION #2	
GRID TO PLATE	1.1		---	μμf
INPUT	2.4		---	μμf
OUTPUT	0.8		---	μμf
HEATER TO CATHODE	2.8[A]		2.8[A]	μμf
GRID TO GRID (MAX.)		0.15		μμf
PLATE TO PLATE (MAX.)		0.015		μμf
PLATE TO CATHODE (MAX.)	0.15		0.15	μμf
GROUNDED-GRID INPUT	---		5.5	μμf
GROUNDED-GRID OUTPUT	---		2.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	250[B]	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM DC CATHODE CURRENT	20	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[B]	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHMS

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO GROUND.

[B] THIS RATING MAY BE AS HIGH AS 300 VOLTS MAXIMUM UNDER CUTOFF CONDITIONS WHEN THE TUBE IS USED AS A CASCODE AMPLIFIER AND THE TWO SECTIONS ARE CONNECTED IN SERIES.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - EACH SECTION

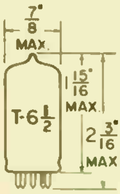
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE-BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	36	
PLATE RESISTANCE (APPROXIMATE)	5 300	OHMS
TRANSCONDUCTANCE	6 800	µMHOS
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROXIMATE) I_b=100 µAMP.	-7	VOLTS

SIMILAR TYPE REFERENCE: 6BZ7

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

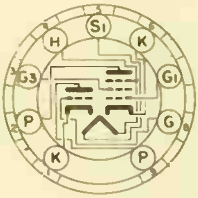


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON NOVAL
9 PIN BASE
9FT

THE 6CH8 IS A GENERAL PURPOSE MULTIUNIT TUBE OF THE 9 PIN MINIATURE CONSTRUCTION CONTAINING A MEDIUM MU TRIODE AND SHARP CUTOFF PENTODE IN ONE ENVELOPE. IT IS INTENDED FOR A WIDE VARIETY OF APPLICATIONS IN BLACK AND WHITE AND COLOR TELEVISION RECEIVERS. THE PENTODE UNIT MAY BE USED AS AN INTERMEDIATE FREQUENCY AMPLIFIER, VIDEO AMPLIFIER, AGC AMPLIFIER AND AS A REACTANCE TUBE WHILE THE TRIODE UNIT 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	1.6	μμf
GRID TO CATHODE, HEATER & GRID #3 AND INTERNAL SHIELD	1.9	μμf
PLATE TO CATHODE, HEATER & GRID #3 AND INTERNAL SHIELD	1.6	μμf
PENTODE UNIT:		
GRID #1 TO PLATE (MAX.)	0.025	μμf
GRID #1 TO HEATER & INTERNAL SHIELD & GRID #3, GRID #2, & CATHODE	7	μμf
PLATE TO HEATER & INTERNAL SHIELD & GRID #3, GRID #2, & CATHODE	2.25	μμf
PENTODE GRID #1 TO TRIODE PLATE	0.02	μμf
PENTODE PLATE TO TRIODE PLATE	0.04	μμf
TRIODE GRID TO PENTODE PLATE	0.005	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #3 VOLTAGE POSITIVE VALUE	---	0	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	300	VOLTS
MAXIMUM GRID #2 (SCREEN) VOLTAGE	---	SEE FIGURE #1	

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS – CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:			
POSITIVE BIAS VALUE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.6	2	WATTS
MAXIMUM GRID #2 INPUT:			
FOR GRID #2 VOLTAGES UP TO 150 VOLTS	---	0.5	WATT
FOR GRID #2 VOLTAGES BETWEEN 150 & 300V.	---	SEE FIGURE 1	
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	---[A]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[B]	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:*			
FOR CATHODE-BIAS OPERATION	1.0	1.0	MEGOHM
FOR FIXED-BIAS OPERATION	0.5	0.25	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

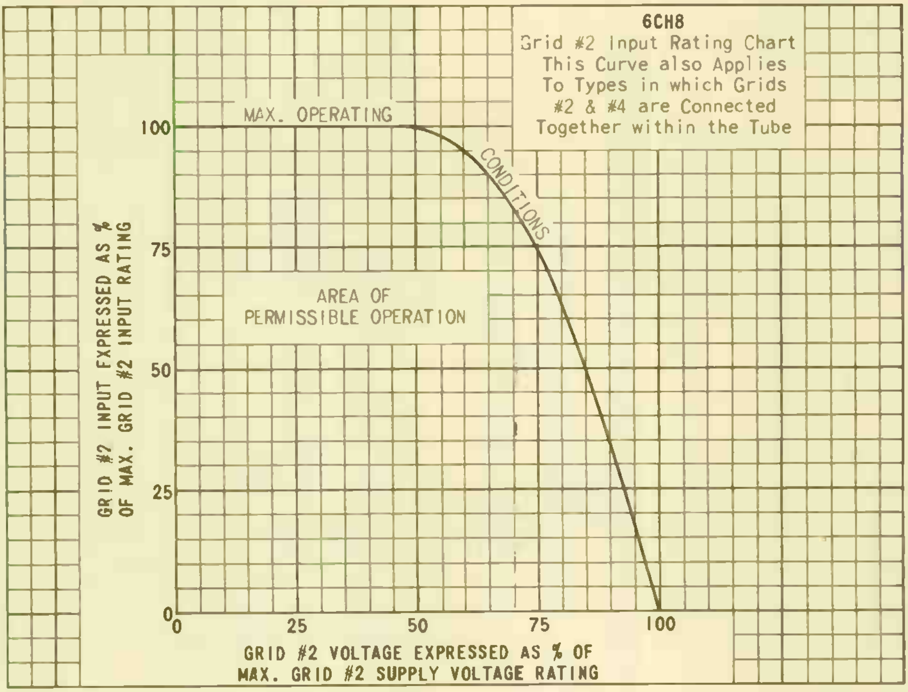
CLASS A_1 AMPLIFIER

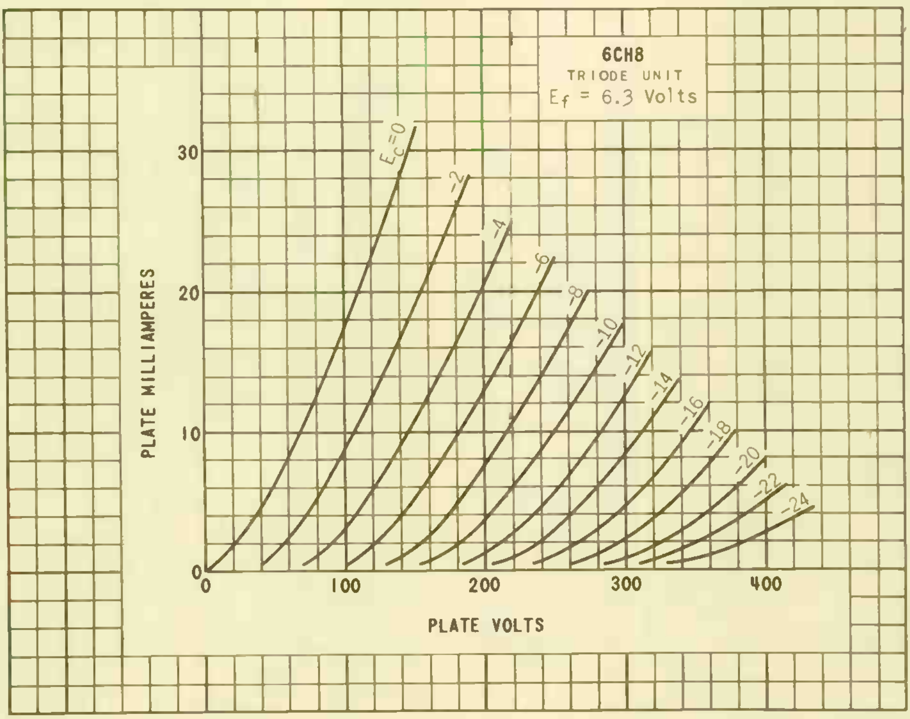
	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE SUPPLY VOLTAGE	200	200	VOLTS
GRID #3 SUPPLY VOLTAGE	---	0	VOLTS
GRID #2 SUPPLY VOLTAGE	---	150	VOLTS
GRID #1 VOLTAGE	-6	---	VOLTS
CATHODE-BIAS RESISTOR	---	180	OHMS
AMPLIFICATION FACTOR	19	---	
PLATE RESISTANCE (APPROX.)	5 750	300 000	OHMS
TRANSCONDUCTANCE	3 300	6 200	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-19	-8	VOLTS
PLATE CURRENT	13	9.5	MA.
GRID #2 CURRENT	---	2.8	MA.

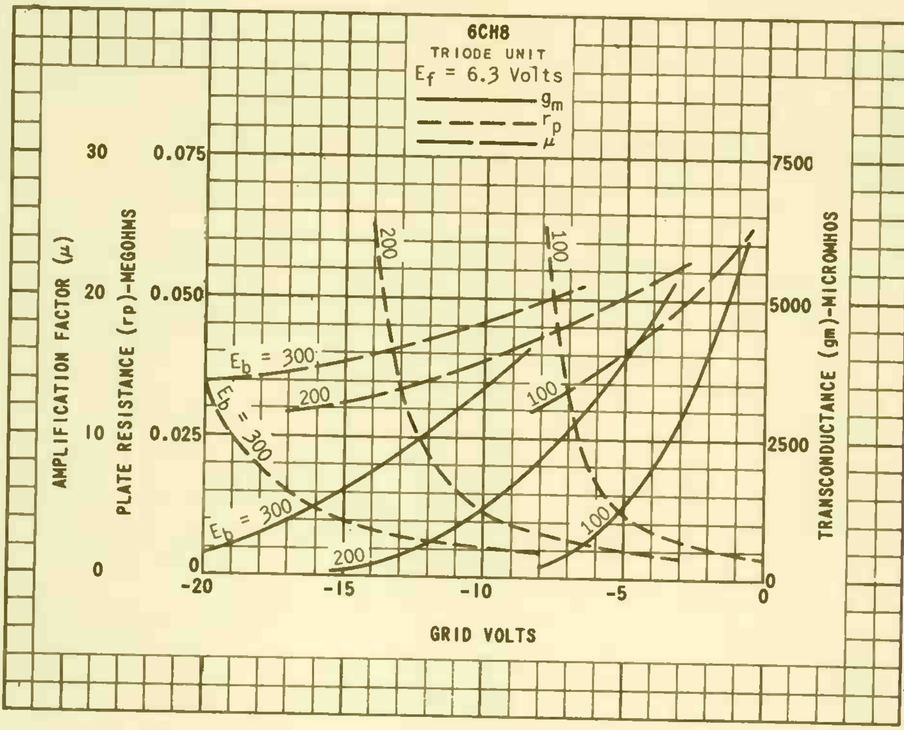
[A] THE HEATER-CATHODE VOLTAGE SHOULD NOT EXCEED THE VALUE OF THE OPERATING CATHODE BIAS BECAUSE THE VOLTAGE BETWEEN THE HEATER AND CATHODE IS ALSO APPLIED BETWEEN THE CATHODE AND GRID #3. THE NET RESULT IS TO MAKE GRID #3 NEGATIVE WITH RESPECT TO CATHODE WITH POSSIBLE CHANGE IN TUBE CHARACTERISTICS.

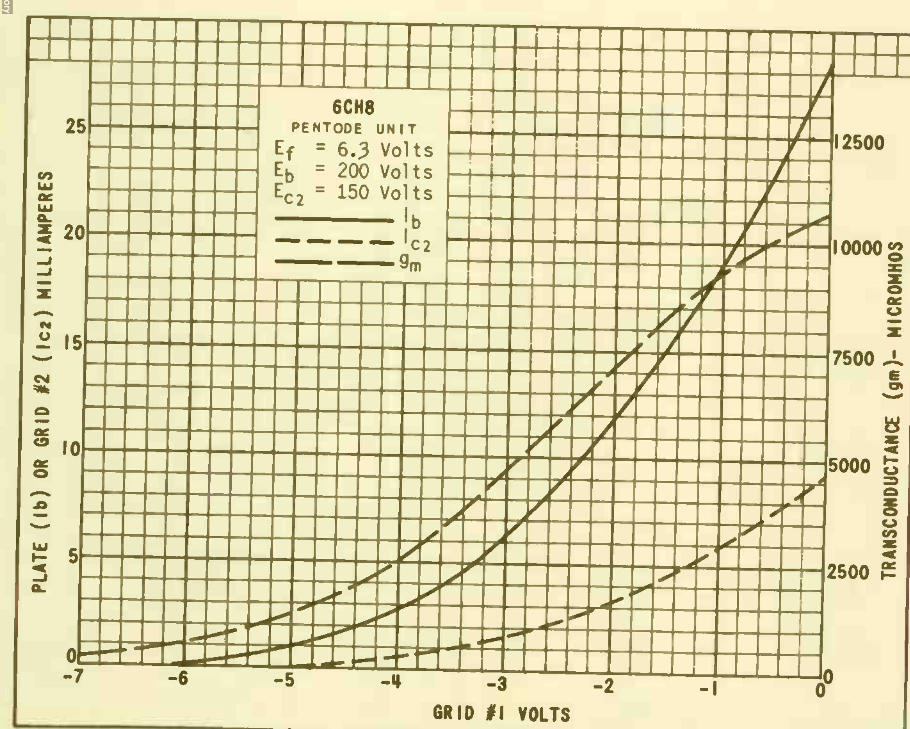
[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

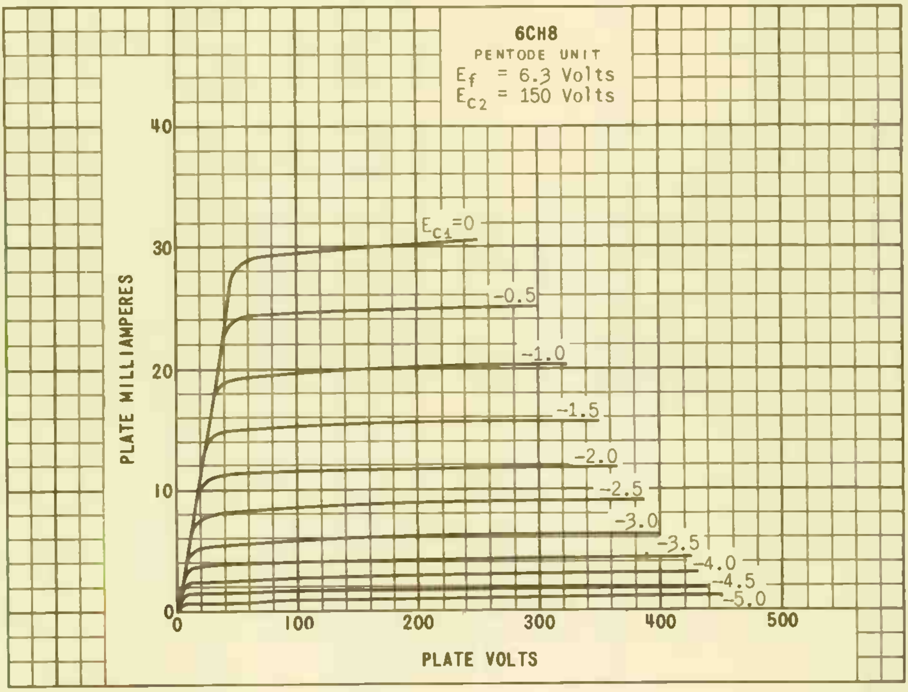
* IF EITHER UNIT IS OPERATED AT MAXIMUM RATED CONDITIONS, GRID-#1-CIRCUIT RESISTANCE FOR BOTH UNITS SHOULD NOT EXCEED THE STATED VALUES.


6CH8
Grid #2 Input Rating Chart
This Curve also Applies
To Types in which Grids
#2 & #4 are Connected
Together within the Tube
MAX. OPERATING
CONDITIONS
AREA OF
PERMISSIBLE OPERATION
GRID #2 INPUT EXPRESSED AS %
OF MAX. GRID #2 INPUT RATING
GRID #2 VOLTAGE EXPRESSED AS % OF
MAX. GRID #2 SUPPLY VOLTAGE RATING
0
25
50
75
100


6CH8
TRIODE UNIT
E_f = 6.3 Volts
E_c=0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
PLATE MILLIAMPERES
PLATE VOLTS
0
10
20
30
100
200
300
400

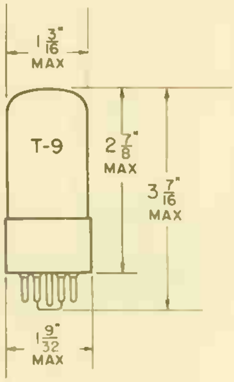

6CH8
TRIODE UNIT
E_f = 6.3 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (rp)-MEGOHMS
TRANSCONDUCTANCE (gm)-MICROMHOS
GRID VOLTS
E_b = 300
E_b = 300
E_b = 300
200
200
200
100
100
100
30
20
10
0
0.075
0.050
0.025
0
7500
5000
2500
0
-20
-15
-10
-5
0


6CH8
PENTODE UNIT
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
g_m
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
TRANSCONDUCTANCE (gm)- MICROMHOS
GRID #1 VOLTS
25
20
15
10
5
0
12500
10000
7500
5000
2500
0
-7
-6
-5
-4
-3
-2
-1
0


6CH8
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
40
30
20
10
0
0
100
200
300
400
500
PLATE VOLTS

TUNG-SOL

TRIODE

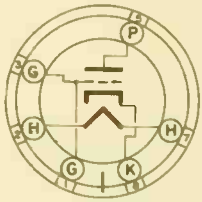


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.25 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE
SHELL 6 PIN OCTAL
8JB

THE 6CK4 IS A LOW MU TRIODE INTENDED FOR USE PRIMARILY AS A VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. CONTAINED IN A T-9 ENVELOPE, THE TUBE HAS A HIGH ZERO-BIAS PLATE CURRENT.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE (G TO P)	6.5	$\mu\mu f$
INPUT: G TO (H+K)	8.0	$\mu\mu f$
OUTPUT: P TO (H+K)	1.8	$\mu\mu f$

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	550	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	2 000	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	12.0	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	100	MA.
MAXIMUM PEAK CATHODE CURRENT	350	MA.
MAXIMUM GRID CIRCUIT RESISTANCE		
SELF BIAS	2.2	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH 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

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	1.25		AMP.
PLATE VOLTAGE	250		VOLTS
GRID #1 VOLTAGE	−28	←	VOLTS
PLATE CURRENT	40	←	MA.
TRANSCONDUCTANCE	5 500	←	μMHOS
AMPLIFICATION FACTOR	6.6	←	
PLATE RESISTANCE (APPROX.)	1 200	←	OHMS
GRID VOLTAGE FOR I_b = 0.5 MA.	−50		VOLTS
PLATE CURRENT AT E_c = −38 Vdc.	10		MA.
ZERO BIAS PLATE CURRENT: E_b = 100 V; E_c = O (INSTANTANEOUS VALUES)	125		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.

[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.

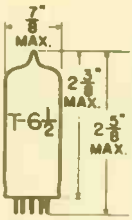
[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

→ INDICATES A CHANGE.

TUNG-SOL

PENTODE

MINIATURE TYPE

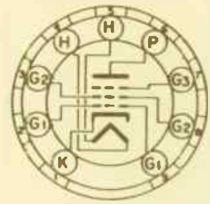


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.65 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE

THE 6CL6 IS A POWER PENTODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED ESPECIALLY FOR USE IN THE FINAL VIDEO STAGE OF TELEVISION RECEIVERS. FEATURES OF THIS TUBE ARE LOW CAPACITANCES AND HIGH OUTPUT CAPABILITY. IT IS ALSO USEFUL AS A WIDE-BAND AMPLIFIER TUBE IN INDUSTRIAL AND LABORATORY EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.120	μμf
INPUT	11	μμf
OUTPUT	5.5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM 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 PLATE SUPPLY VOLTAGE	300	VOLTS
MAXIMUM GRID #3 VOLTAGE	0	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CURVE	
MAXIMUM GRID #1 VOLTAGE:		
POSITIVE BIAS VOLTAGE	0	VOLTS
NEGATIVE BIAS VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION	7.5	WATTS
MAXIMUM GRID #2 INPUT	1.7	WATTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	200	°C

PLATE 3019
SEPT. 1 1952

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.65	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID #2 VOLTAGE	150	VOLTS
GRID #1 VOLTAGE	-3	VOLTS
PEAK AF GRID #1 SIGNAL VOLTAGE	3	VOLTS
ZERO SIGNAL DC PLATE CURRENT	30	MA.
MAXIMUM SIGNAL DC PLATE CURRENT	31	MA.
ZERO SIGNAL DC GRID #2 CURRENT	7	MA.
MAXIMUM SIGNAL DC GRID #2 CURRENT	7.2	MA.
PLATE RESISTANCE (APPROX.)	0.15	MEGOHMS
TRANSCONDUCTANCE	11 000	µMHOS
LOAD RESISTANCE	7 500	OHMS
TOTAL HARMONIC DISTORTION	8	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	2.8	WATTS
GRID #1 VOLTAGE FOR PLATE CURRENT OF 10 µAMP. (APPROX.)	-14	VOLTS

4 MC. BANDWIDTH VIDEO AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.65	AMP.
PLATE SUPPLY VOLTAGE	300	VOLTS
GRID #3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID #2 SUPPLY VOLTAGE	300	VOLTS
GRID #1 BIAS VOLTAGE	-2	VOLTS
PEAK TO PEAK GRID #1 SIGNAL VOLTAGE	3	VOLTS
GRID #2 RESISTOR	24 000	OHMS
GRID #1 RESISTOR	0.1	MEGOHM
LOAD RESISTOR	3 900	OHMS
ZERO SIGNAL PLATE CURRENT	30	MA.
ZERO SIGNAL GRID #2 CURRENT	7.0	MA.
PEAK TO PEAK VOLTAGE OUTPUT	132	VOLTS

PLATE 3020
SEPT. 1952

TUNG-SOL

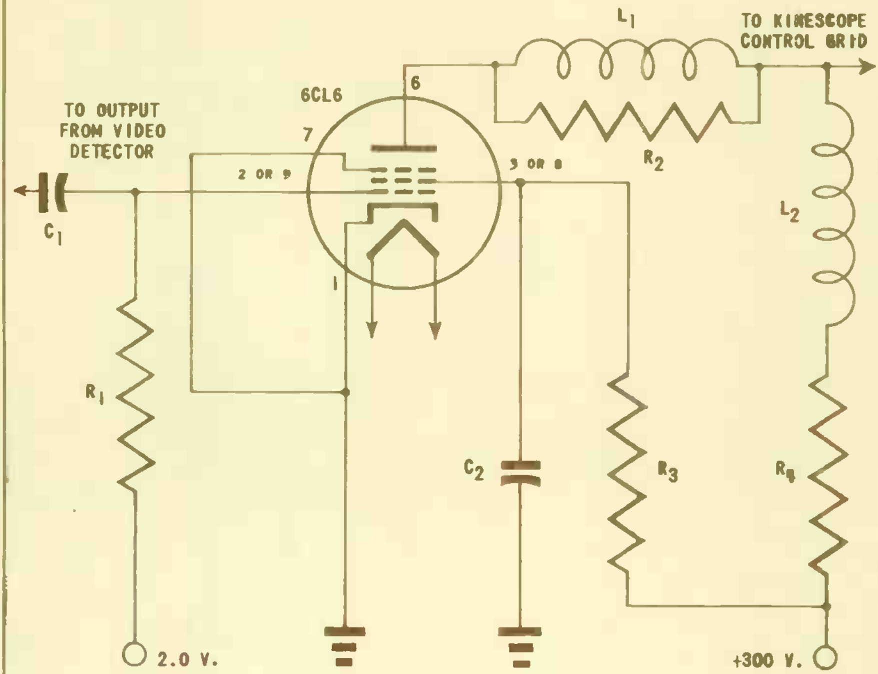
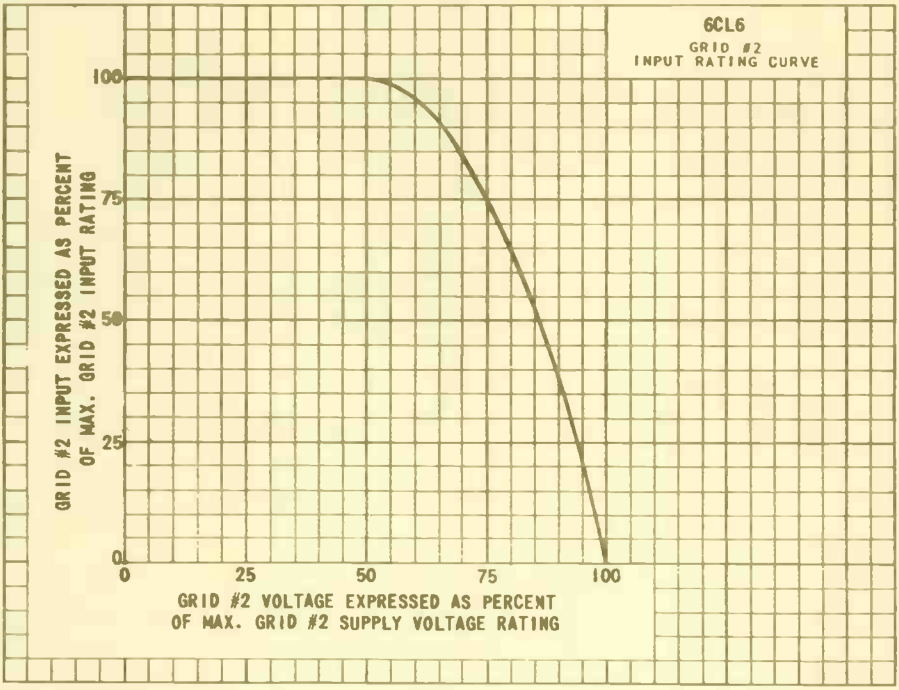


PLATE 3021
SEPT. 1 1952

6CL6



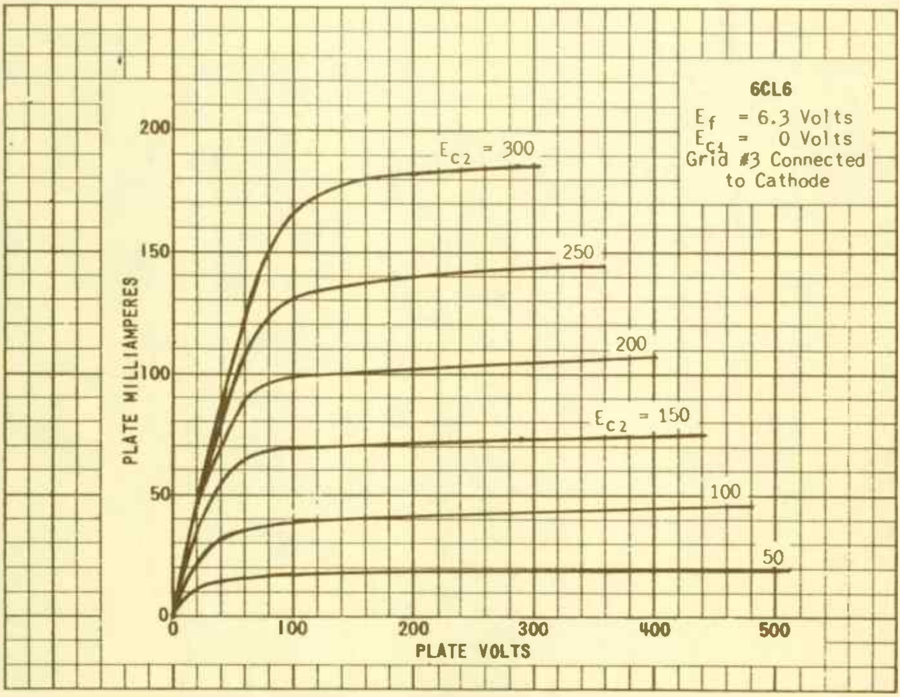
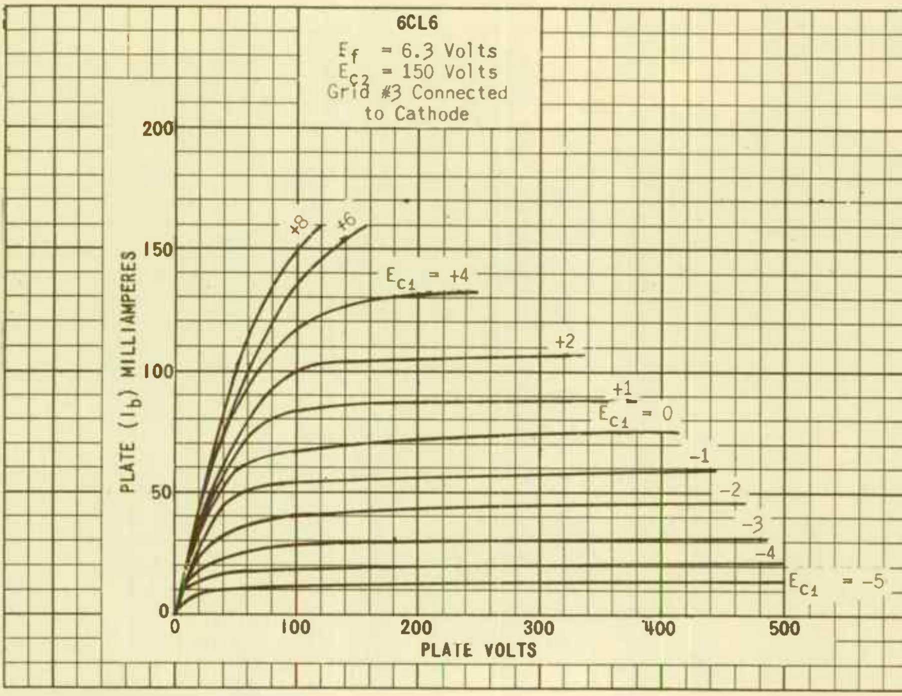
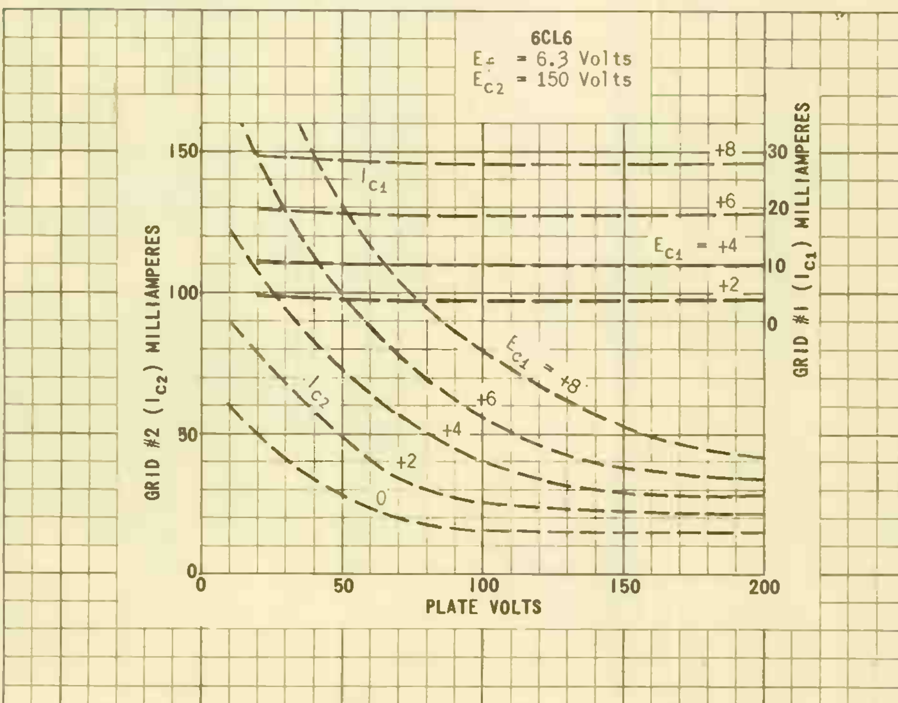
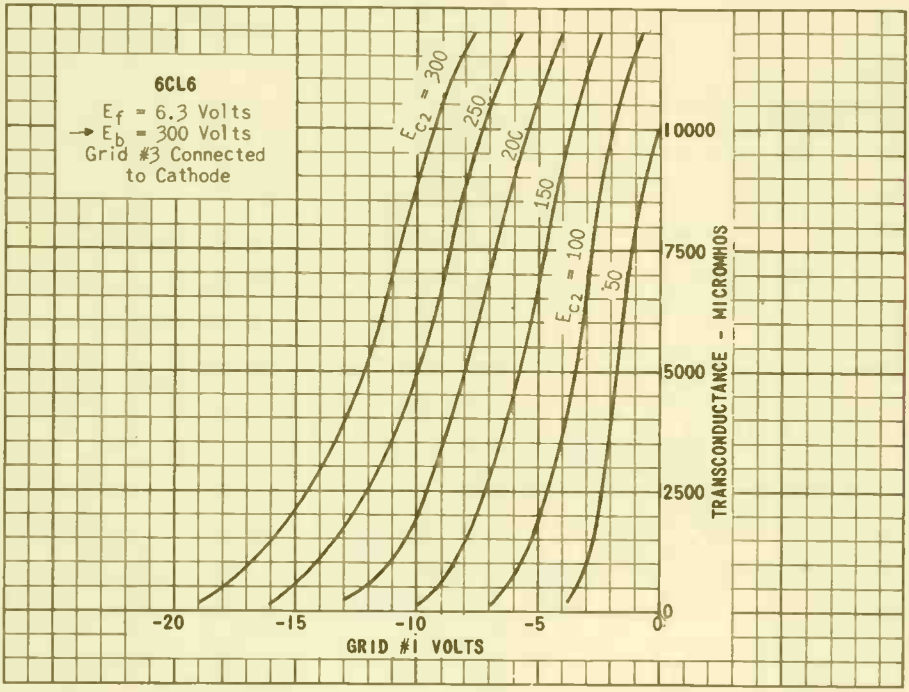


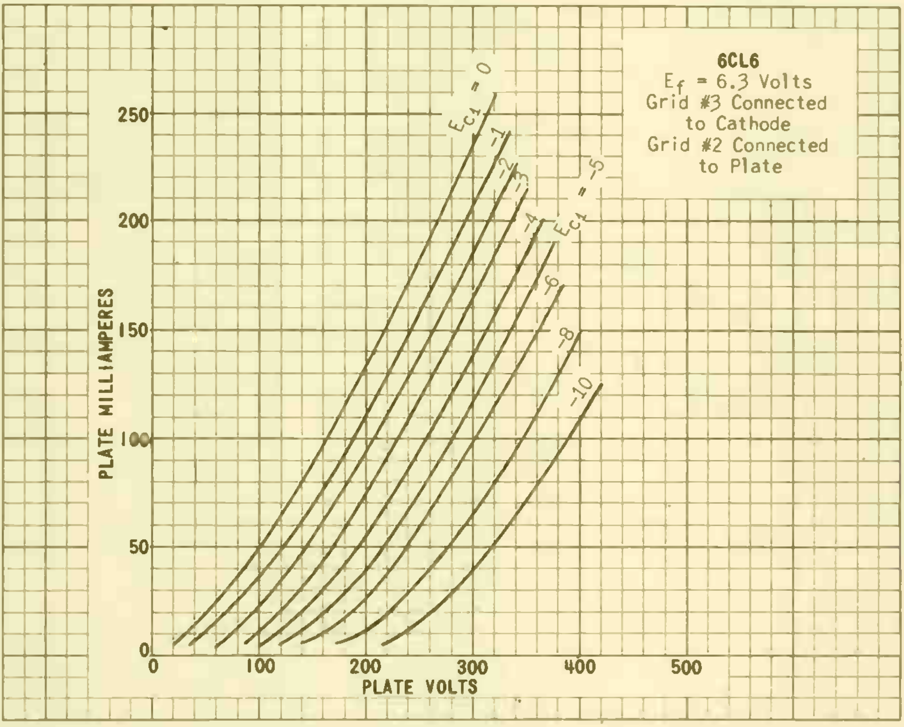
PLATE
3022
SEPT. 1
1952


6CL6
Ef = 6.3 Volts
Ec2 = 150 Volts
Grid #3 Connected to Cathode
PLATE (Ib) MILLIAMPERES
PLATE VOLTS
Ec1 = +4
+8
+6
+2
+1
Ec1 = 0
-1
-2
-3
-4
Ec1 = -5
0
100
200
300
400
500
50
150


6CL6
Ef = 6.3 Volts
Ec2 = 150 Volts
GRID #2 (Ic2) MILLIAMPERES
GRID #1 (Ic1) MILLIAMPERES
PLATE VOLTS
Ic1
Ic2
+8
+6
Ec1 = +4
+2
Ec1 = +8
+6
+4
+2
0
0
50
100
150
200
10
20
30

6CL6

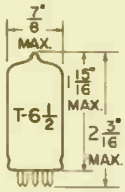

6CL6
E_f = 6.3 Volts
→ E_b = 300 Volts
Grid #3 Connected to Cathode
E_{c2} = 300
250
200
150
E_{c2} = 100
50
10000
7500
5000
2500
0
TRANSCONDUCTANCE - MICROMHOS
-20
-15
-10
-5
0
GRID #1 VOLTS


6CL6
E_f = 6.3 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate
E_{c1} = 0
-1
-2
-3
-4
E_{c1} = -5
-6
-8
-10
250
200
150
100
50
0
PLATE MILLIAMPERES
0
100
200
300
400
500
PLATE VOLTS

TUNG-SOL

TRIODE TETRODE

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
9FX

*THE 6CL8 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 6CL8 IS IDENTICAL TO THE 5CL8.

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	6.3	6.3	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

*INDICATES AN ADDITION.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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[A]	11.0*		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

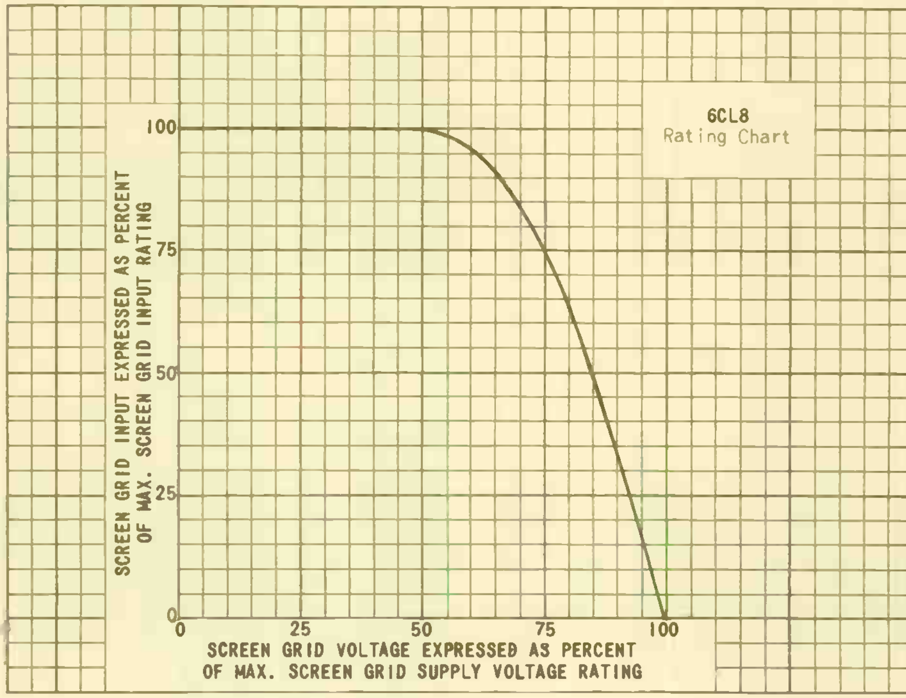
CLASS A_1 AMPLIFIER

	TRIODE	TETRODE	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	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

[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 6CL8 is identical to the 5CL8.

*INDICATES AN ADDITION.

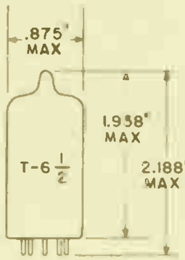


PRINTED IN U.S.A.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



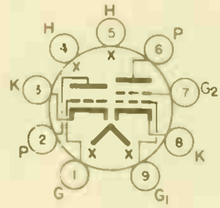
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

FOR

VHF TELEVISION TUNER
APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9FX

THE 6CL8A IS A SHARP CUTOFF TETRODE AND MEDIUM-MU TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE, PRIMARILY AS A COMBINED TRIODE OSCILLATOR AND TETRODE MIXER 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. IT IS UNILATERALLY INTER-CHANGEABLE, BOTH ELECTRICALLY AND MECHANICALLY, WITH THE 6CL8 AND DIFFERS PRIMARILY FROM THE 6CL8 IN HAVING A TETRODE SECTION WITH LOWER GRID-PLATE CAPACITANCE AND HIGHER TRANSCONDUCTANCE. EXCEPT FOR HEATER RATINGS, THE 6CL8A IS IDENTICAL TO THE 5CL8A.

→ DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
TETRODE:			
GRID #1 TO PLATE: (G1 TO P) (MAX.)	0.01	0.02	pf
INPUT: G1 TO (K+G2+H+I.S.)	5.0	5.0	pf
OUTPUT: P TO (K+G2+H+I.S.)	3.0	2.0	pf
CATHODE TO HEATER: (K TO H)	3.0[B]	3.0	pf
TRIODE:			
GRID TO PLATE: (G TO P)	1.8	1.8	pf
INPUT: G TO (TK+TEK+H+I.S.)	2.8	2.8	pf
OUTPUT: G TO (TK+TEK+H+I.S.)	2.0	1.5	pf
CATHODE TO HEATER: (TK TO H)	3.0[B]	3.0	pf
TETRODE GRID #1 TO TRIODE PLATE (TEG1 TO TP) (MAX.)	0.01	0.015	pf
TETRODE PLATE TO TRIODE PLATE (TEP TO TP) (MAX.)	0.05	0.15	pf

[A] EXTERNAL SHIELD #315 CONNECTED TO PIN #4.

[B] EXTERNAL SHIELD #315 CONNECTED TO PIN #6.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±27	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[A]		11	SECONDS

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

TETRODE PLATE VOLTAGE	330	VOLTS
TRIODE PLATE VOLTAGE	330	VOLTS
GRID #2 SUPPLY VOLTAGE	330	VOLTS
GRID #2 VOLTAGE	SEE RATING CHART	
TETRODE PLATE DISSIPATION	3.0	WATTS
GRID #2 DISSIPATION	0.55	WATT
POSITIVE DC TETRODE GRID #1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	2.5	WATTS
TETRODE GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.25	MEGOHM
CATHODE BIAS	1.0	MEGOHM
TRIODE GRID CIRCUIT RESISTANCE:		
FIXED BIAS	0.5	MEGOHM
CATHODE BIAS	1.0	MEGOHM

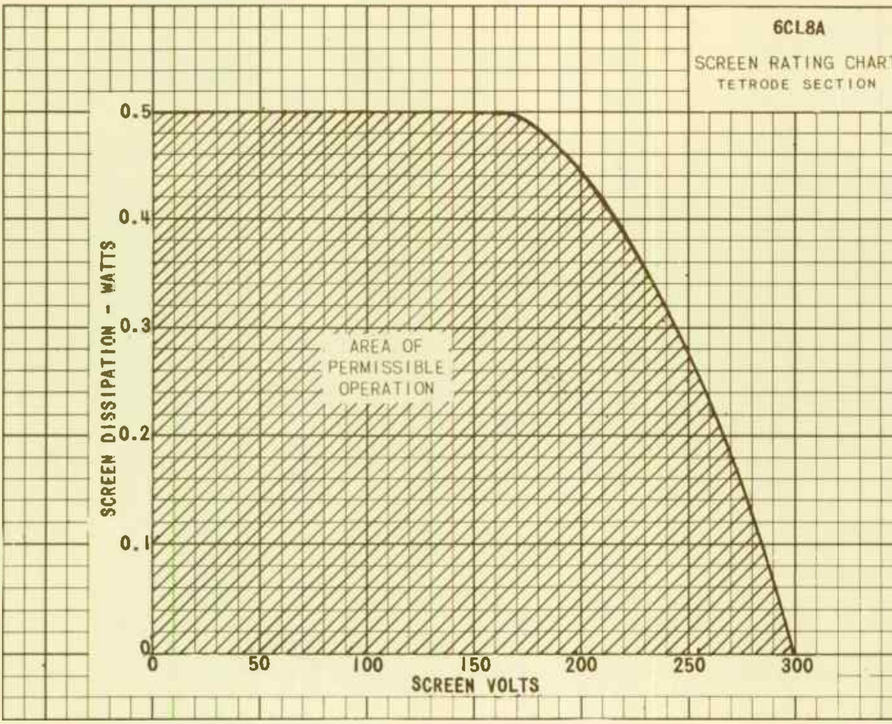
→ TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	TETRODE	
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE	---	125	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	8000	6500	μMHOS
PLATE CURRENT	14.0	12.0	MA.
GRID #2 CURRENT	---	4.0	MA.
PLATE RESISTANCE (APPROX.)	5000Ω	0.2	MEGOHM
AMPLIFICATION FACTOR	40	---	
GRID #1 VOLTAGE (APPROX.) FOR $I_b = 20\ \mu A$	-9	-9	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH $E_b = 100$ V, $E_{c2} = 70$ V.)	---	7000	μMHOS

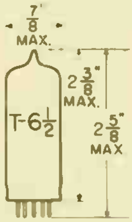
[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES THE RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.


6CL8A
SCREEN RATING CHART
TETRODE SECTION
AREA OF
PERMISSIBLE
OPERATION
SCREEN DISSIPATION - WATTS
0.5
0.4
0.3
0.2
0.1
0
0
50
100
150
200
250
300
SCREEN VOLTS

TUNG-SOL

BEAM PENTODE
MINIATURE TYPE

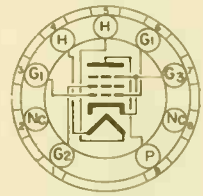


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9CK

THE 6CM6 IS A BEAM POWER AMPLIFIER USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A GENERAL PURPOSE AUDIO POWER AMPLIFIER OR VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVER SWEEP CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: G TO P	0.7	μμf
INPUT: G_1 TO $(H+K+G_2\&G_3)$	8.0	μμf
OUTPUT: P TO $(H+K+G_2\&G_3)$	8.5	μμf

RATINGS[A]
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION AMPLIFIER[B]

	PENTODE CONNECTION	TRIODE CONNECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER POSITIVE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE			
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAX.)	2	2	KV.
MAXIMUM DC GRID #2 VOLTAGE	285	---	VOLTS
MAXIMUM PLATE DISSIPATION[C]	8	→ 9.0	WATTS
MAXIMUM GRID #2 DISSIPATION[C]	1.75	---	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	250	250	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	40	40	MA.
MAXIMUM PEAK CATHODE CURRENT	120	120	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE (CATHODE BIAS)	2.2	2.2	MEGOHMS

[A] THESE ARE DESIGN CENTER VALUES EXCEPT WHERE ABSOLUTE MAXIMUM IS INDICATED.

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

[C] IN STAGES OPERATING WITH A GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CLASS A_1 AMPLIFIER

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	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - SINGLE TUBE

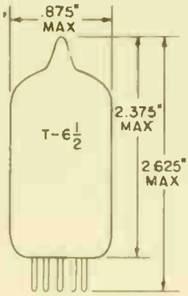
HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	180	250	315	VOLTS
GRID #2 VOLTAGE	180	250	225	VOLTS
GRID #1 VOLTAGE	-8.5	-12.5	-13.0	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	12.5	13.0	VOLTS
ZERO-SIGNAL PLATE CURRENT	29	45	34	MA.
MAXIMUM SIGNAL PLATE CURRENT	30	47	35	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.0	4.5	2.2	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	4.0	7.0	6.0	MA.
PLATE RESISTANCE	50	50	80	KILOHMS
TRANSCONDUCTANCE	3 700	4 100	3 750	μMHOS
LOAD RESISTANCE	5 500	5 000	8 500	OHMS
POWER OUTPUT (MAXIMUM SIGNAL)	2.0	4.5	5.5	WATTS
TOTAL HARMONIC DISTORTION	8	8	12	PERCENT

TRIODE CONNECTED*

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 (APPROX.) FOR I_b = 0.5 MA	-37	VOLTS

*INDICATES AN ADDITION.

TUNG-SOL



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

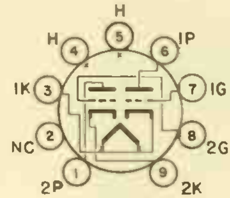
DOUBLE TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODES

HEATER
6.3 VOLTS 600±40 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9ES

THE 6CM7 IS A MEDIUM-MU DOUBLE TRIODE OF THE 9 PIN MINIATURE TYPE CONTAINING TWO DISSIMILAR TRIODES IN ONE ENVELOPE. IT IS INTENDED FOR USE AS A VERTICAL DEFLECTION 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 – APPROX.

WITH NO EXTERNAL SHIELD

	UNIT #1 OSCILLATOR	UNIT #2 AMPLIFIER	
GRID TO PLATE	3.8	3	pf
GRID TO CATHODE AND HEATER	2	3.5	pf
PLATE TO CATHODE AND HEATER	0.5	0.4	pf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

	UNIT #1 VERTICAL DEFLECTION OSCILLATOR		UNIT #2 VERTICAL DEFLECTION AMPLIFIER	
MAXIMUM PEAK HEATER–CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE		200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[C]		VOLTS
MAXIMUM DC PLATE VOLTAGE	→ [illegible]		550	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE[D]	→ [illegible]		220	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE[D]			[illegible]	VOLTS
MAXIMUM CATHODE CURRENT:				
PEAK	→ 77		77	MA.
AVERAGE	→ 17		22	MA.
MAXIMUM PLATE DISSIPATION	→ 1.4[illegible]		5.0	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE:				
CATHODE BIAS	2.2		2.5	MEGOHMS
FIXED BIAS	2.2		1.0	MEGOHMS
GRID RESISTOR BIAS	2.2		---	MEGOHMS
HEATER WARM-UP TIME (APPROX.)[F]		11.0		SECONDS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS", FEDERAL COMMUNICATIONS COMMISSION.

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

[D] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15% OF ONE VERTICAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM 15% OF ONE VERTICAL SCANNING CYCLE IS 2.5 MILLISECONDS.

[F] 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

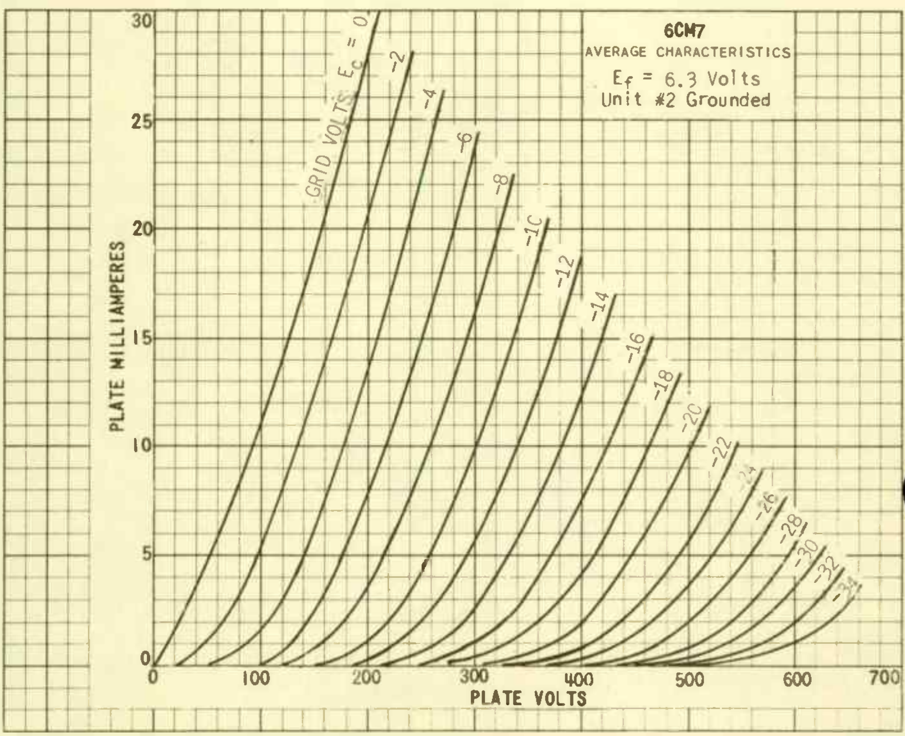
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

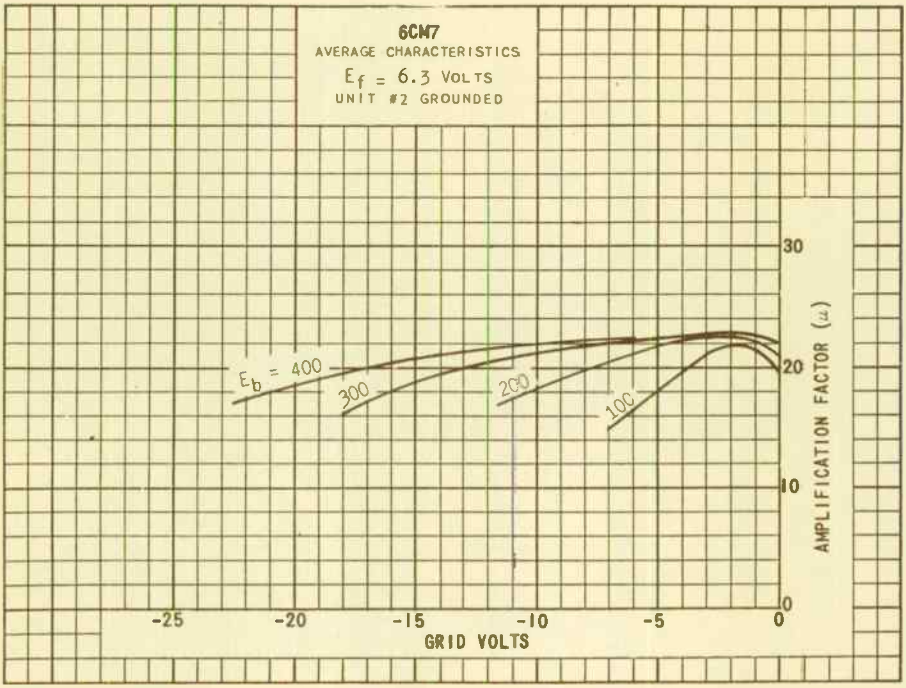
CLASS A_1 AMPLIFIER

	UNIT #1 OSCILLATOR	UNIT #2 AMPLIFIER	
PLATE VOLTAGE	200	250	VOLTS
GRID VOLTAGE	−7	−8	VOLTS
AMPLIFICATION FACTOR	21	18	
PLATE RESISTANCE (APPROX.)	10 500	4 100	OHMS
TRANSCONDUCTANCE	2 000	4 400	μMHOS
PLATE CURRENT	5	20	MA.
PLATE CURRENT FOR GRID VOLTAGE OF −10 VOLTS	1	---	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA.	14	---	VOLTS

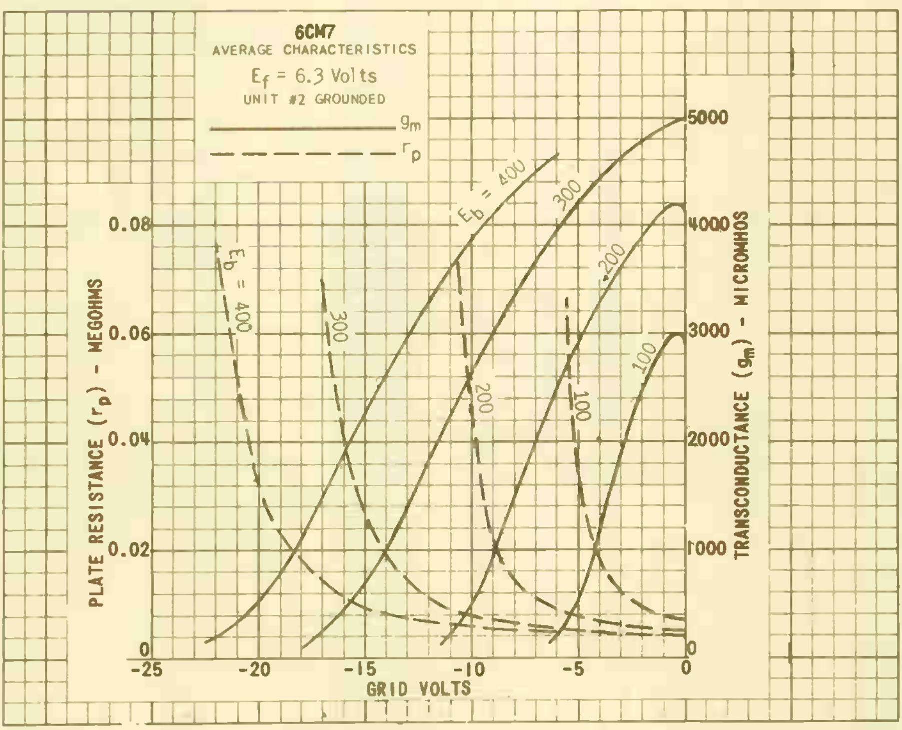
SIMILAR TYPE REFERENCE: Except for heater ratings, the 6CM7 is identical to the 8CM7.

→ INDICATES A CHANGE.

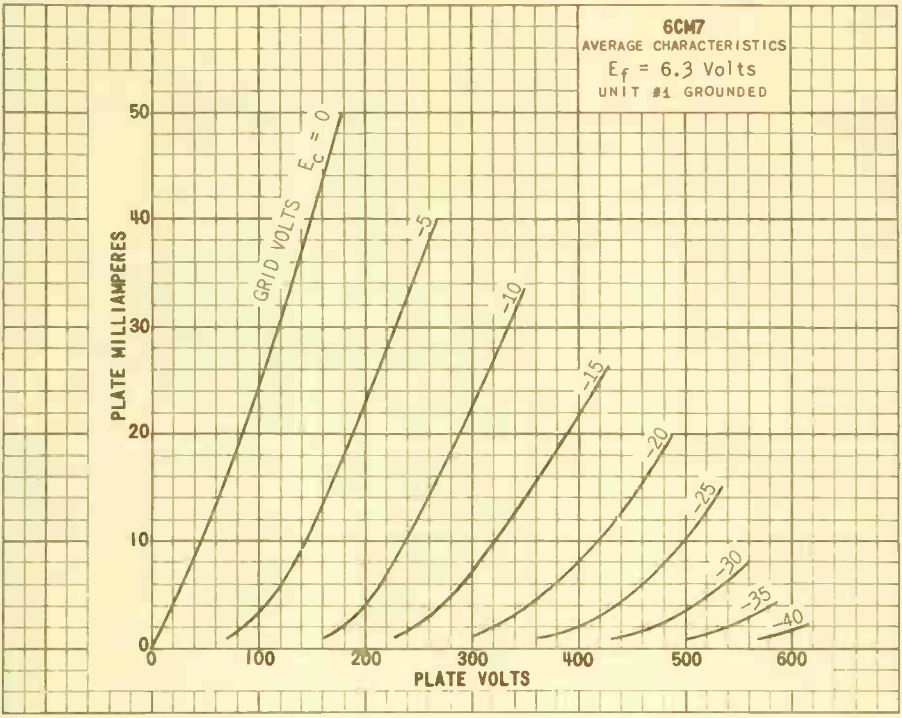


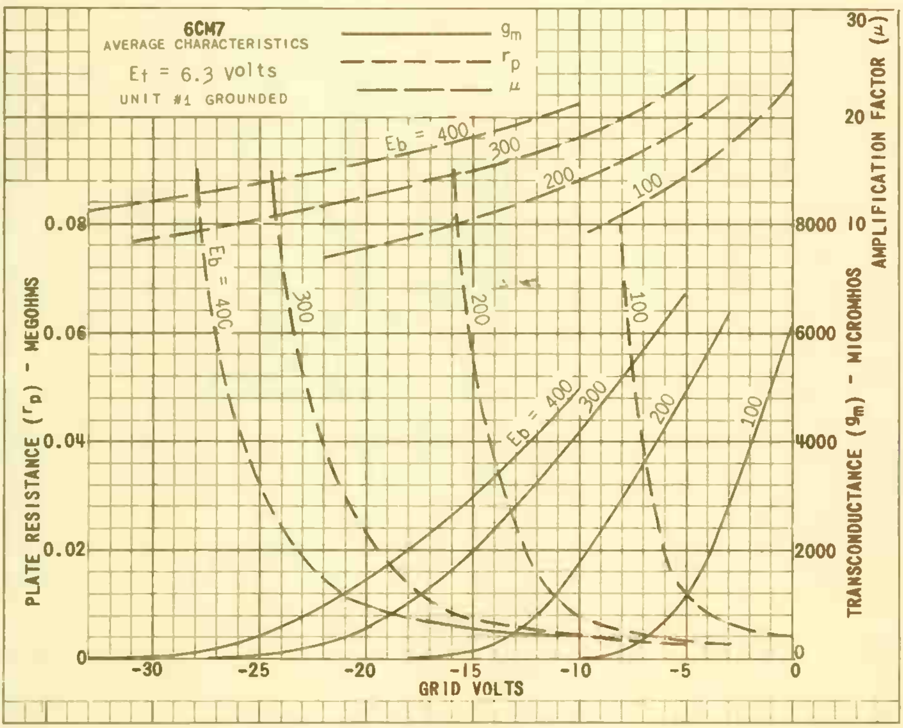


6CM7
AVERAGE CHARACTERISTICS
E_f = 6.3 VOLTS
UNIT #2 GROUNDED
E_b = 400
300
200
100
30
20
10
0
AMPLIFICATION FACTOR (μ)
-25
-20
-15
-10
-5
0
GRID VOLTS



6CM7
AVERAGE CHARACTERISTICS
E_f = 6.3 Volts
UNIT #2 GROUNDED
g_m
r_p
E_b = 400
300
200
100
E_b = 400
300
200
100
0.08
0.06
0.04
0.02
0
PLATE RESISTANCE (r_p) - MEGOHMS
5000
4000
3000
2000
1000
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
-25
-20
-15
-10
-5
0
GRID VOLTS

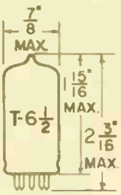

6CM7
AVERAGE CHARACTERISTICS
E_f = 6.3 Volts
UNIT #1 GROUNDED
GRID VOLTS E_c = 0
-5
-10
-15
-20
-25
-30
-35
-40
PLATE MILLIAMPERES
0
10
20
30
40
50
0
100
200
300
400
500
600
PLATE VOLTS


6CM7
AVERAGE CHARACTERISTICS
E_f = 6.3 volts
UNIT #1 GROUNDED
g_m
r_p
μ
E_b = 400
300
200
100
E_b = 400
300
200
100
E_b = 400
300
200
100
PLATE RESISTANCE (r_p) - MEGOHMS
0
0.02
0.04
0.06
0.08
TRANSCONDUCTANCE (g_m) - MICROMHOS
0
2000
4000
6000
8000
AMPLIFICATION FACTOR (μ)
0
10
20
30
-30
-25
-20
-15
-10
-5
0
GRID VOLTS

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

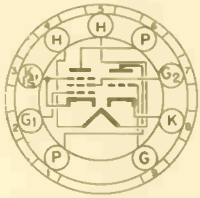


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE

9FZ

THE 6CM8 IS A MULTIUNIT TUBE OF THE 9-PIN MINIATURE CONSTRUCTION CONTAINING A HIGH-MU TRIODE AND SHARP CUTOFF PENTODE IN ONE ENVELOPE. THE PENTODE SECTION MAY BE USED AS AN INTERMEDIATE FREQUENCY AMPLIFIER, AGC AMPLIFIER AND REACTANCE TUBE. 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 6CM8 IS IDENTICAL TO THE 5CM8.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

TRIODE SECTION		
GRID TO PLATE G TO P	1.9	μμf
INPUT G TO (H+K)	1.6	μμf
OUTPUT P TO (H+K)	0.22	μμf
PENTODE SECTION		
GRID #1 TO PLATE G_1 TO P (MAX.)	0.04 ←	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.)	2.6	μμf
COUPLING		
PENTODE PLATE TO TRIODE GRID (MAX.)	0.01	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	0.15	μμf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.10	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	6.3		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	1.0	2.0	WATTS
MAXIMUM GRID #2 DISSIPATION		0.5	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
SELF BIAS		1.0	MEGOHM
FIXED BIAS		0.25	MEGOHM

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS — CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE		PENTODE	
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 (APPROX.)*		11.0		SECONDS

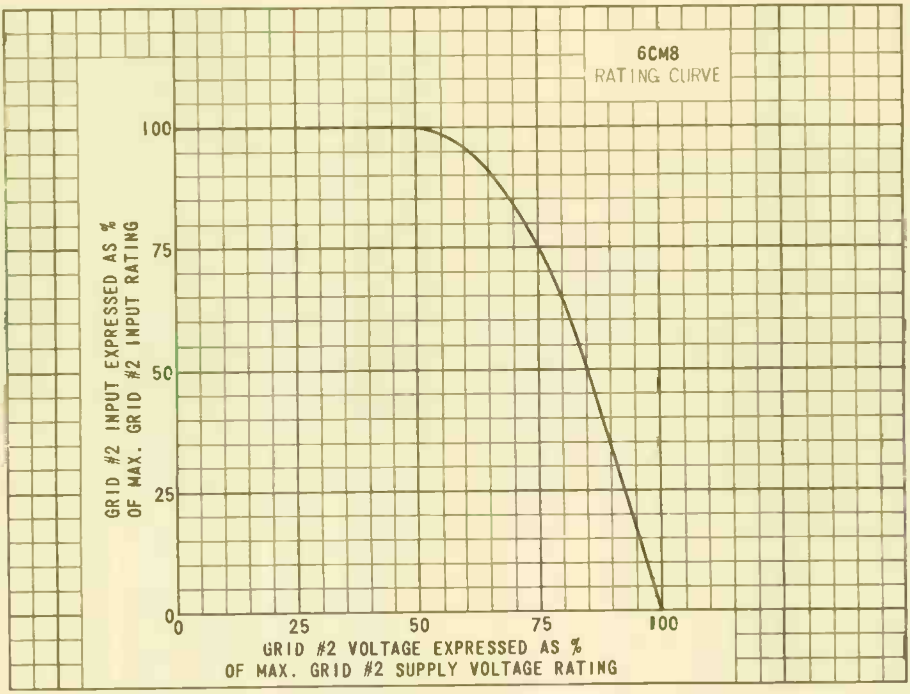
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE		PENTODE	
HEATER VOLTAGE		6.3		VOLTS
HEATER CURRENT		0.45		AMP.
PLATE SUPPLY VOLTAGE	250		200	VOLTS
GRID #2 VOLTAGE			150	VOLTS
GRID #1 VOLTAGE	−2		0	VOLTS
CATHODE BIAS RESISTOR			180	OHMS
PLATE CURRENT	1.8		9.5	MA.
GRID #2 CURRENT			2.8	MA.
AMPLIFICATION FACTOR	100			
PLATE RESISTANCE (APPROX.)	50 000		600 000	OHMS
TRANSCONDUCTANCE	2 000		6 200	µMHOS
GRID #1 VOLTAGE FOR $I_b = 10 \mu A$ (APPROX.)			−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.

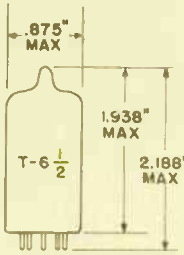
—▸ INDICATES A CHANGE.


6CM8
RATING CURVE
100
75
50
25
0
GRID #2 INPUT EXPRESSED AS %
OF MAX. GRID #2 INPUT RATING
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS %
OF MAX. GRID #2 SUPPLY VOLTAGE RATING

TUNG-SOL

DUPLEX-DIODE TRIODE

MINIATURE TYPE



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

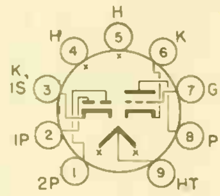
HEATER

SERIES	PARALLEL
6.3±0.6 VOLTS	3.15 VOLTS
300 MA.	600±40 MA.

AC OR DC

ANY MOUNTING POSITION

CONTROL OF HEATER WARM-UP TIME APPLIES ONLY TO PARALLEL CONNECTION.



BOTTOM VIEW
BASING DIAGRAM

JEDEC 9EN

THE 6CN7 IS A DUPLEX DIODE HIGH-MU TRIODE IN WHICH SEPARATE CATHODES ARE PROVIDED FOR THE DIODE AND TRIODE SECTIONS. IT IS INTENDED PRIMARILY FOR SERVICE AS A COMBINED HORIZONTAL PHASE DETECTOR AND REACTANCE TUBE 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 6CN7 IS IDENTICAL TO THE 8CN7.

DIRECT INTERELELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE GRID TO PLATE	1.8	pf
TRIODE INPUT	1.5	pf
TRIODE OUTPUT	0.5	pf
GRID TO EACH DIODE PLATE	0.006	pf
DIODE #1 PLATE TO DIODE CATHODE AND HEATER	3.6	pf
DIODE #2 PLATE TO DIODE CATHODE AND HEATER	3.6	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

MAXIMUM PLATE VOLTAGE	→ 330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	[illegible]	VOLTS
MAXIMUM PLATE DISSIPATION	→ 1.1	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO EITHER CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO EITHER CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION, (EACH DIODE)	→ 5.5	MA.
HEATER WARM-UP TIME[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.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

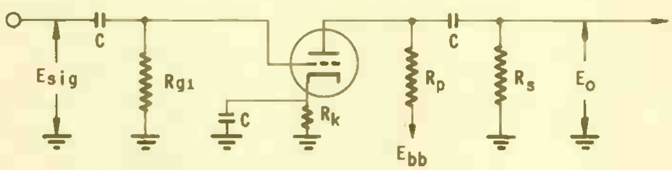
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1.0	-3.0	VOLTS
AMPLIFICATION FACTOR	70	70	
PLATE RESISTANCE (APPROX.)	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	µMHOS
PLATE CURRENT	0.8	1.0	MA.
AVERAGE DIODE CURRENT (EACH DIODE) WITH 5.0 VOLTS DC APPLIED		20	MA.

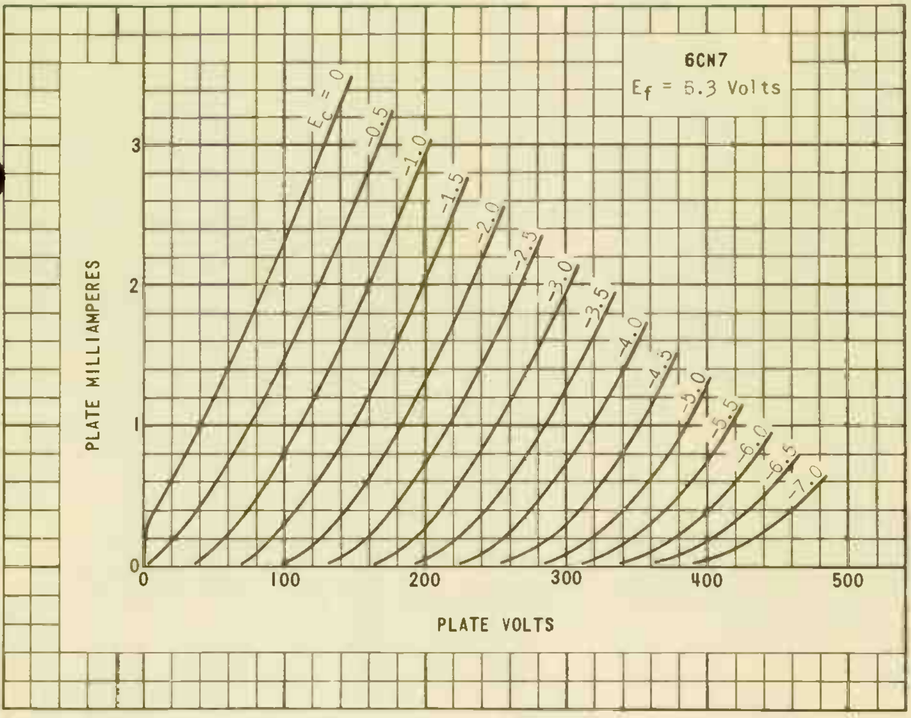
CLASS A RESISTANCE - COUPLED AMPLIFIER

Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
			Rk	Gain	Eo	Rk	Gain	Eo	Rk	Gain	Eo
0.10	0.10	0.10	5700	21	7.0	2400	29	18	1800	33	35
0.10	0.24	0.10	6100	26	9.0	2700	34	23	2000	38	42
0.24	0.24	0.10	9100	30	10	4300	40	24	3000	44	43
0.24	0.51	0.10	10000	34	13	4700	45	31	3300	49	52
0.51	0.51	0.10	15000	37	14	7500	47	28	5600	51	50
0.51	1.0	0.10	16000	40	16	8200	50	35	6200	55	60
0.24	0.24	10	0	31	5.0	0	44	19	0	48	40
0.24	0.51	10	0	37	7.0	0	49	25	0	52	52
0.51	0.51	10	0	39	7.5	0	51	22	0	54	44
0.51	1.0	10	0	42	10	0	54	28	0	58	56

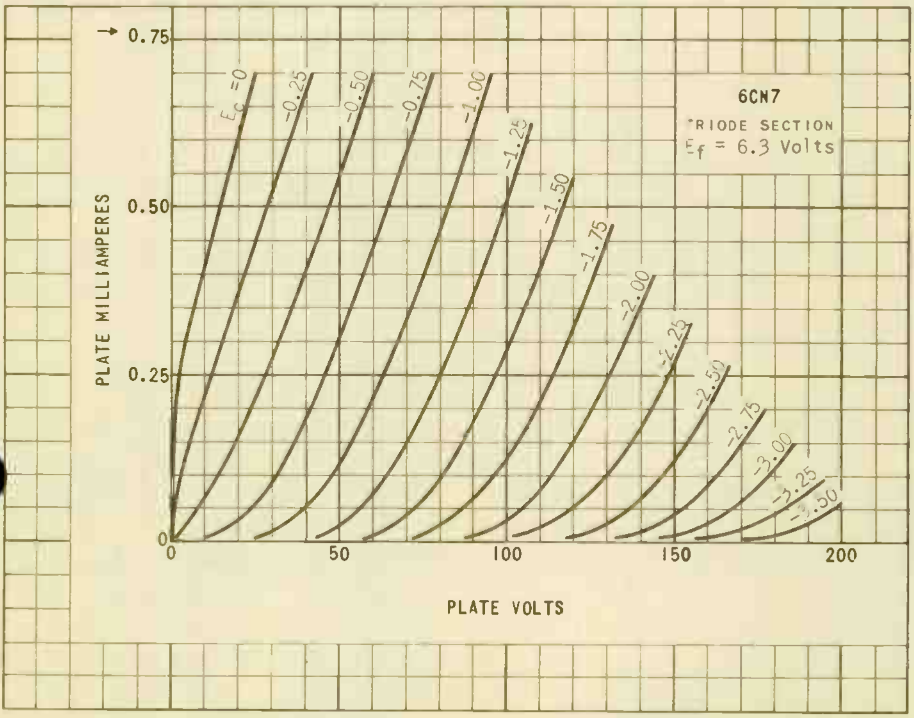
Eo IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT TOTAL HARMONIC DISTORTION.
GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.
FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.



NOTE: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. Rk SHOULD BE ADEQUATELY BY-PASSED.

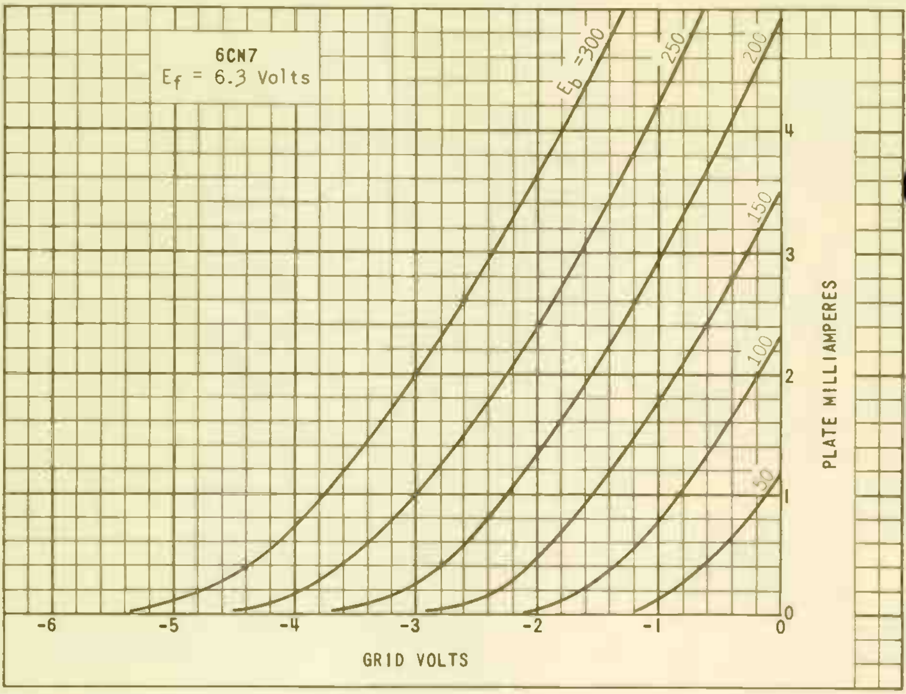


→ INDICATES A CHANGE.

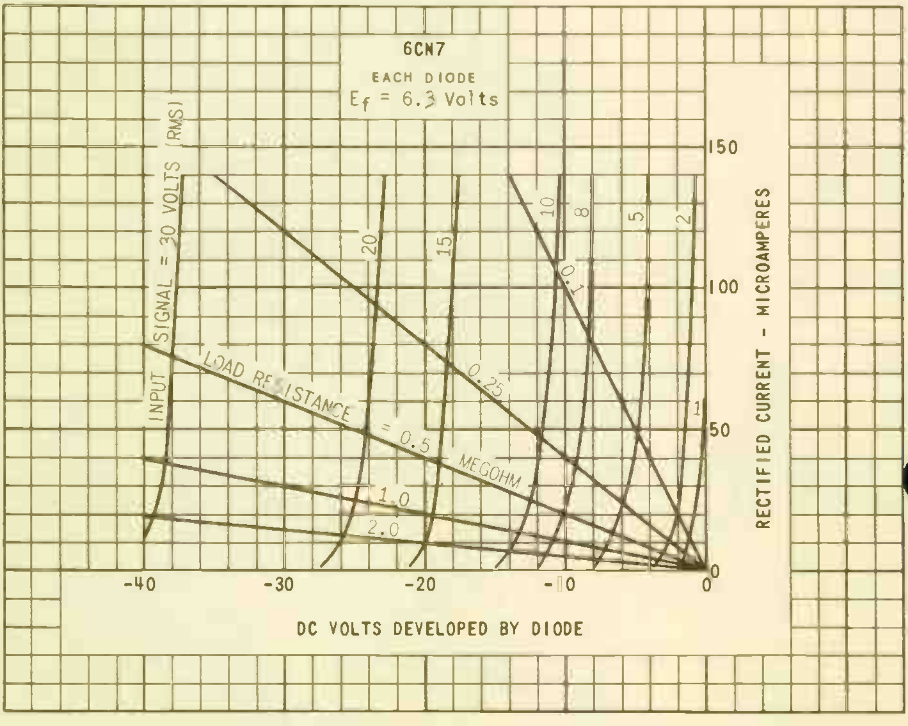


PRINTED IN U. S. A.

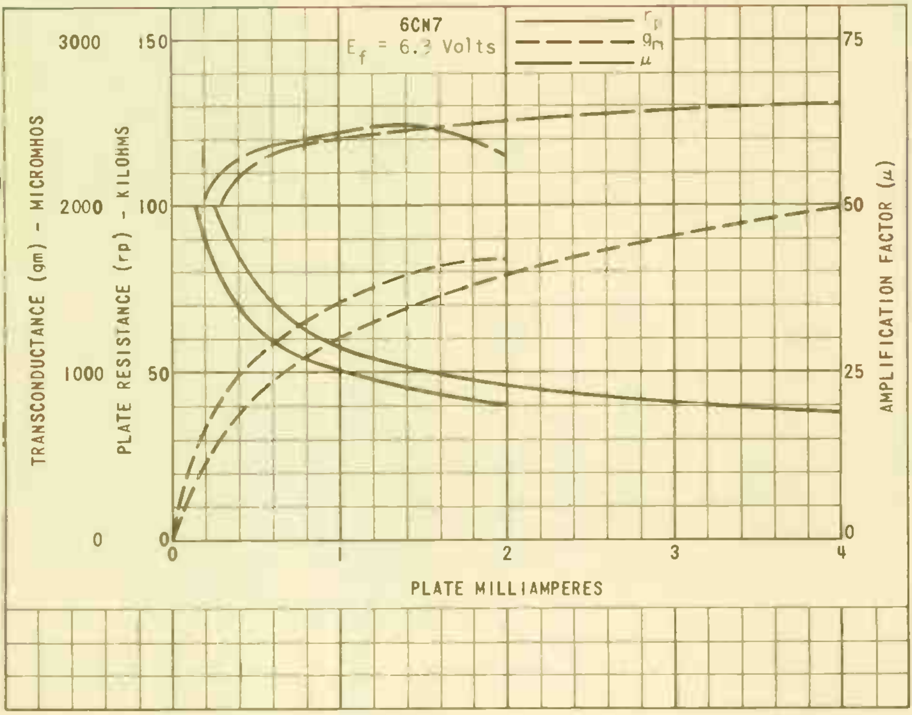
6CN7



6CN7
E_f = 6.3 Volts
E_b =300
250
200
150
100
50
4
3
2
1
0
PLATE MILLIAMPERES
-6
-5
-4
-3
-2
-1
0
GRID VOLTS

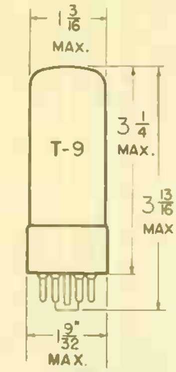


6CN7
EACH DIODE
E_f = 6.3 Volts
INPUT SIGNAL = 30 VOLTS (RMS)
20
15
10
8
5
2
1
1.0
0.25
LOAD RESISTANCE = 0.5 MEGOHM
1.0
2.0
150
100
50
0
RECTIFIED CURRENT - MICROAMPERES
-40
-30
-20
-10
0
DC VOLTS DEVELOPED BY DIODE


6CN7
E_f = 6.3 Volts
r_p
g_m
μ
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE RESISTANCE (rp) - KILOHMS
AMPLIFICATION FACTOR (μ)
PLATE MILLIAMPERES
3000
2000
1000
0
150
100
50
0
75
50
25
0
1
2
3
4

TUNG-SOL

DIODE



GLASS BULB

SHORT INTERMEDIATE SHELL
OCTAL JEDEC B5-85
OR
INTERMEDIATE SHELL
OCTAL JEDEC B5-147

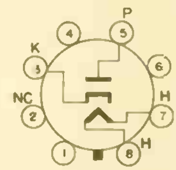
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±0.6 VOLTS 1.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 4CG

THE 6CQ4 IS AN INDIRECTLY-HEATED HALF-WAVE RECTIFIER DESIGNED PRIMARILY FOR TELEVISION DAMPING DIODE SERVICE IN HORIZONTAL DEFLECTION CIRCUITS. TUBE VOLTAGE DROP AND DC PLATE CURRENT RATINGS HAVE BEEN ESTABLISHED WHICH PERMITS SINGLE TUBE OPERATION IN LOW B+ AS WELL AS WIDE DEFLECTION ANGLE TV SYSTEMS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

HEATER-TO-CATHODE	4.0	pf
PLATE-TO-CATHODE AND HEATER	8.5	pf
CATHODE-TO-PLATE AND HEATER	11.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

DAMPER SERVICE[B]

HEATER VOLTAGE	6.3±0.6	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	5500	VOLTS
MAXIMUM PEAK PLATE CURRENT	1200	MA.
MAXIMUM DC PLATE CURRENT	190	MA.
MAXIMUM PLATE DISSIPATION	6.5	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC COMPONENT	900	VOLTS
TOTAL DC AND PEAK	5500	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP Ib = 250 MA. DC	25	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.

B

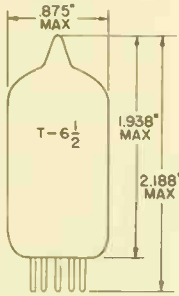
FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

THE JEDEC B5 - 35 AND B5-147 BASES SPECIFIED FOR USE WITH THE 6CQ4, DO NOT HAVE PINS IN BASE POSITIONS #1, #4 & #6, HOWEVER POSITIONS 1 & 6 HAVE INTERNAL CONNECTIONS TERMINATING IN STEM LEADS. BASE TERMINAL POSITION 2 HAS A BASE PIN WHICH MAY BE CONNECTED TO A STEM LEAD. BECAUSE OF THE CLOSE PROXIMITY OF STEM LEADS TO THE SOCKET PIN CLIPS WHEN THE TUBE IS SEATED IN THE SOCKET, CIRCUIT TIE POINTS SHOULD NOT BE MADE TO SOCKET TERMINALS 1, 2, 4 & 6 UNLESS ADEQUATE PRECAUTIONS ARE TAKEN AGAINST VOLTAGE BREAKDOWN IN BOTH THE TUBE BASE AND THE SOCKET. TO REDUCE THE POSSIBILITY OF ARCOVER, IT IS RECOMMENDED SOCKET CLIPS FOR POSITIONS 1, 2, 4 & 6 BE REMOVED FROM THE DAMPER TUBE SOCKET.

TUNG-SOL

TRIODE-TETRODE

MINIATURE TYPE

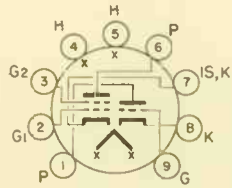


GLASS BULB
SMALL-BUTTON NOVAL
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 450±30 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9GE

THE 6CQ8 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

TUNG-SOL

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.

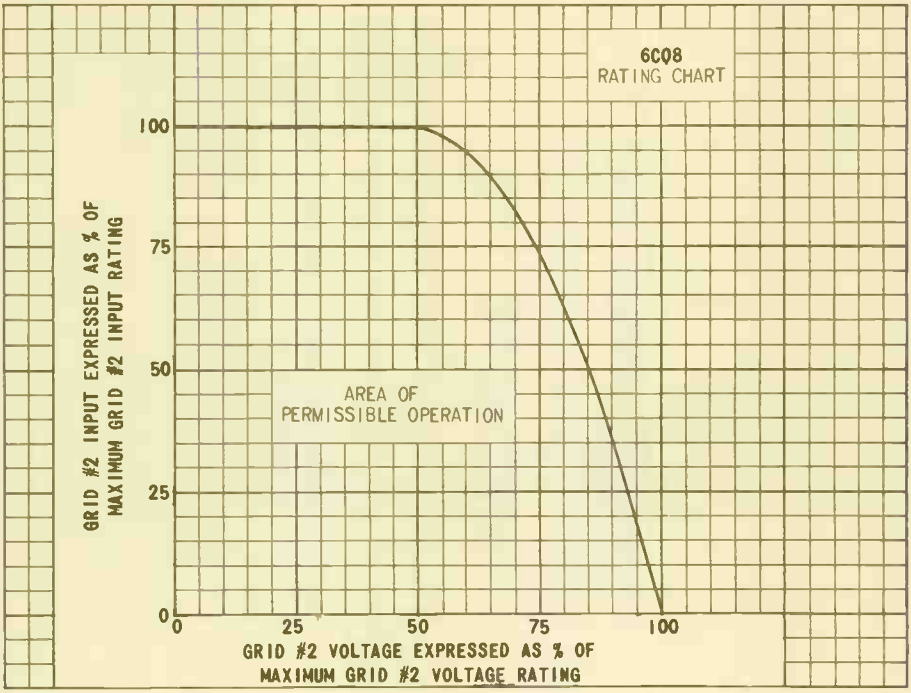
[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF UNIT UNDER TEST.

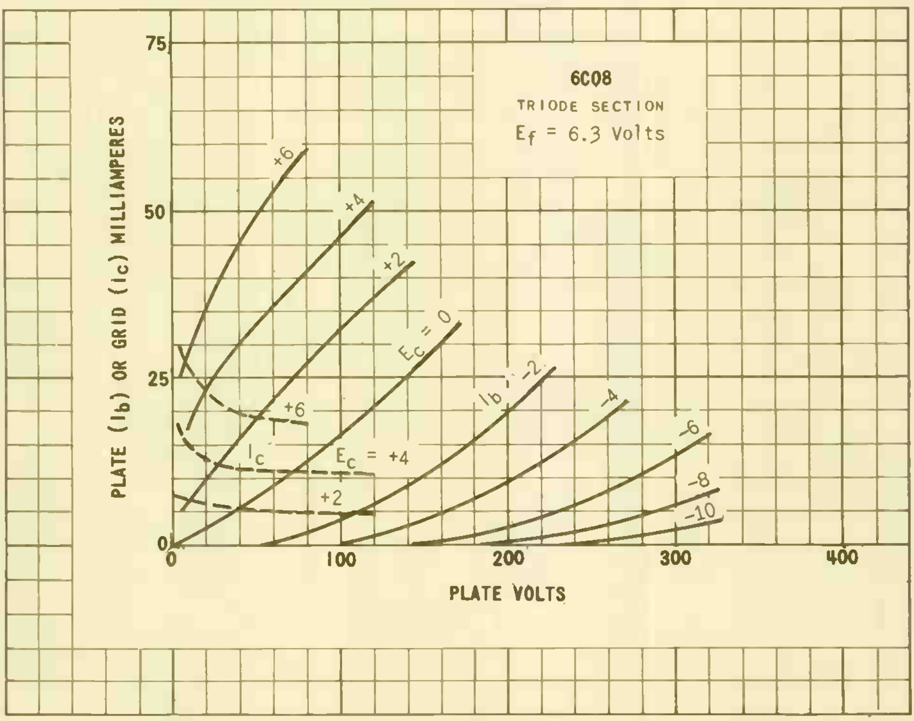
[B] WITH EXTERNAL SHIELD #315 CONNECTED TO GROUND.

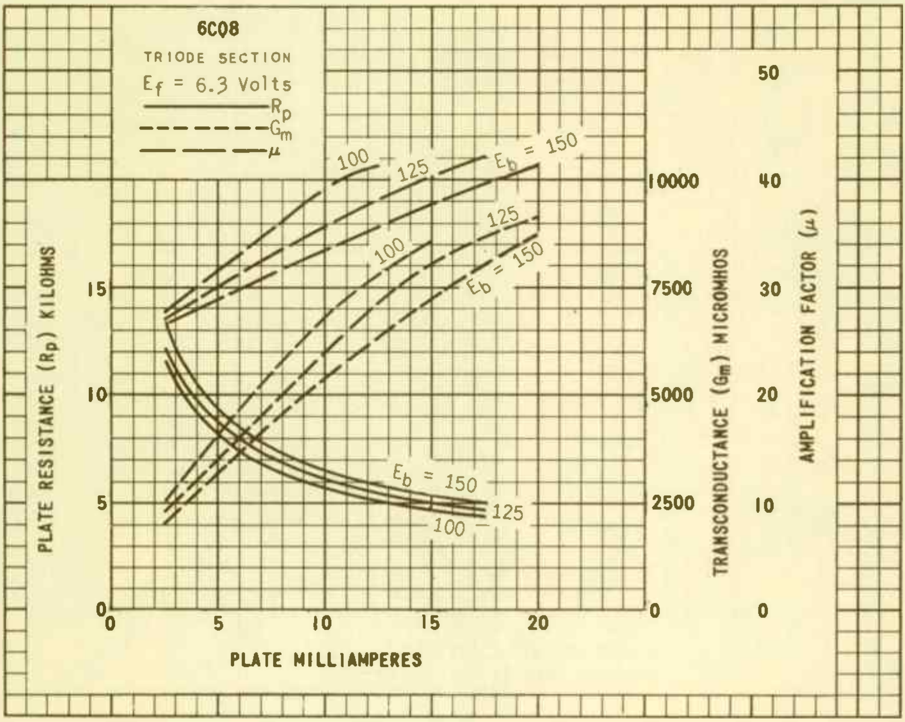
[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

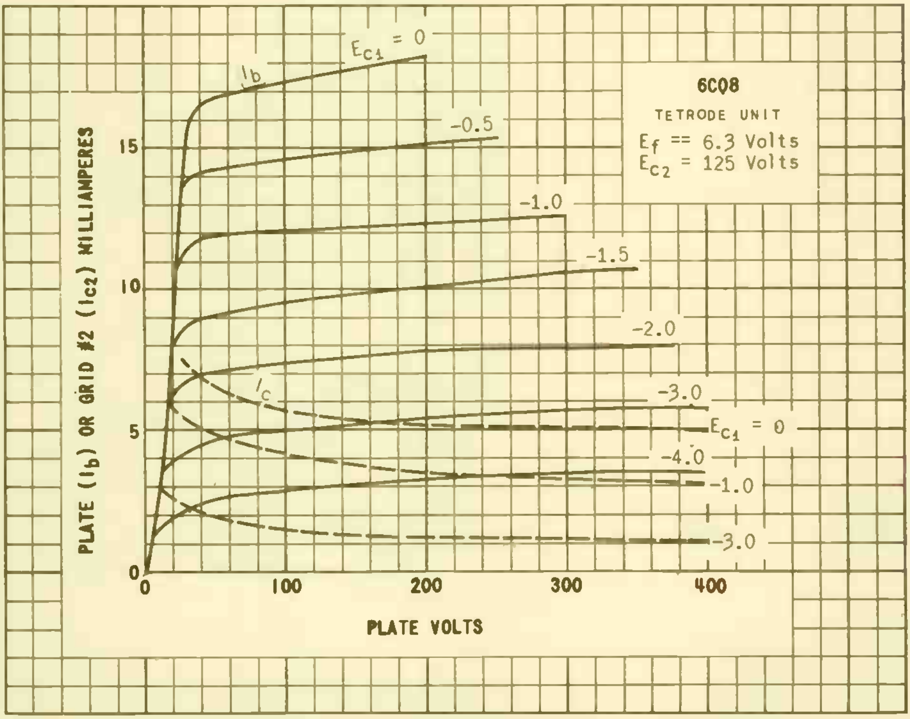
* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

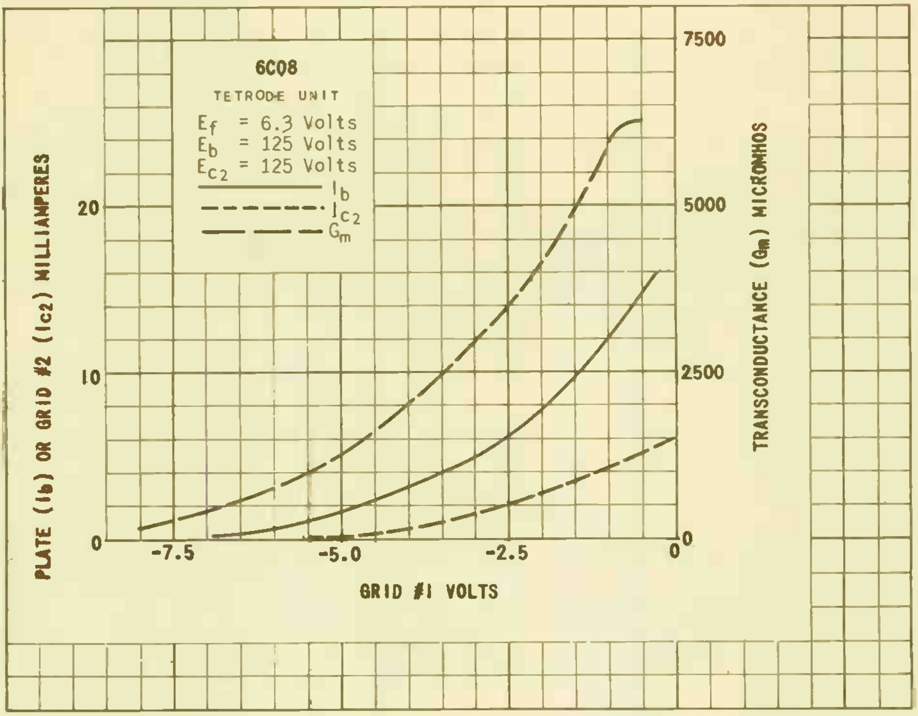
→ INDICATES A CHANGE.


6CQ8
RATING CHART
100
75
50
25
0
0
25
50
75
100
AREA OF
PERMISSIBLE OPERATION
GRID #2 INPUT EXPRESSED AS % OF
MAXIMUM GRID #2 INPUT RATING
GRID #2 VOLTAGE EXPRESSED AS % OF
MAXIMUM GRID #2 VOLTAGE RATING


6CQ8
TRIODE SECTION
Ef = 6.3 Volts
75
50
25
0
0
100
200
300
400
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
+6
+4
+2
Ec = 0
Ib
-2
-4
-6
-8
-10
+6
Ic
Ec = +4
+2


6CQ8
TRIODE SECTION
Ef = 6.3 Volts
Rp
Gm
μ
Eb = 150
125
100
PLATE RESISTANCE (Rp) KILOHMS
TRANSCONDUCTANCE (Gm) MICROMHOS
AMPLIFICATION FACTOR (μ)
PLATE MILLIAMPERES
0 5 10 15 20
0 2500 5000 7500 10000
0 10 20 30 40 50

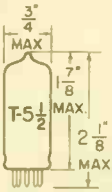

6CQ8
TETRODE UNIT
Ef == 6.3 Volts
Ec2 = 125 Volts
Ec1 = 0
-0.5
-1.0
-1.5
-2.0
-3.0
-4.0
Ib
Ic
Ec1 = 0
-1.0
-3.0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0 100 200 300 400
0 5 10 15


6CQ8
TETRODE UNIT
E_f = 6.3 Volts
E_b = 125 Volts
E_{c_2} = 125 Volts
I_b
I_{c2}
G_m
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
TRANSCONDUCTANCE (Gm) MICROMHOS
GRID #1 VOLTS
20
10
0
7500
5000
2500
0
-7.5
-5.0
-2.5
0

TUNG-SOL

DIODE PENTODE

MINIATURE TYPE

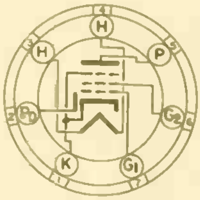


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7EA

THE 6CR6 IS A COMBINED SINGLE DETECTOR DIODE AND REMOTE CUT-OFF PENTODE WITH A COMMON CATHODE IN THE 7 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS INTENDED FOR USE AS AN AUDIO AMPLIFIER IN WHICH AVC VOLTAGE IS APPLIED TO THE CONTROL GRID FOR IMPROVED OVER-ALL RECEIVER AVC.

RATINGS

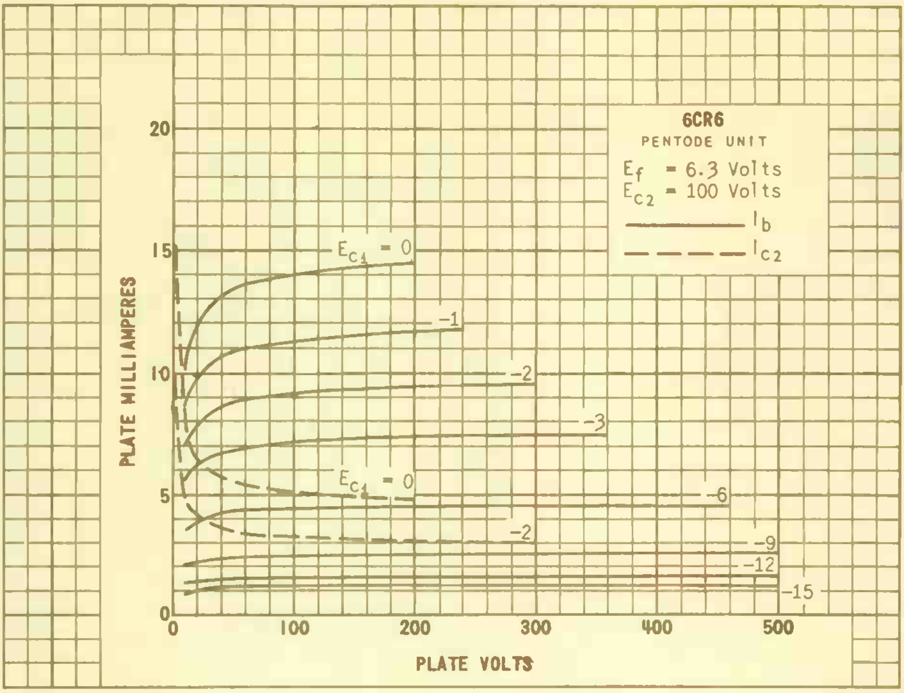
INTERPRETED ACCORDING TO RMA STANDARD M8-210

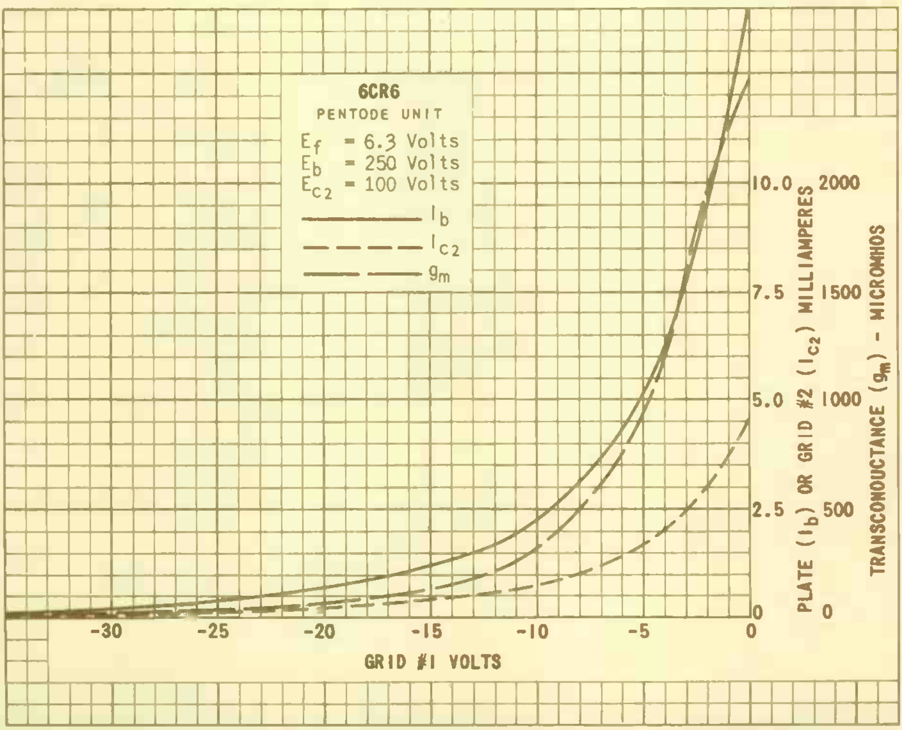
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	100	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.3	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.0	MEGOHM
AVERAGE DIODE CURRENT WITH 10 VOLTS DC APPLIED	2.0	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	100	VOLTS
GRID #1 VOLTAGE	-2	VOLTS
PLATE CURRENT	9.5	MA.
GRID #2 CURRENT	3.0	MA.
TRANSCONDUCTANCE	1950	µMHOS
PLATE RESISTANCE (APPROX.)	0.2	MEGOHM
GRID #1 VOLTAGE (APPROX.) FOR G_m = 10 µMHOS	-40	VOLTS

PRINTED IN U.S.A.

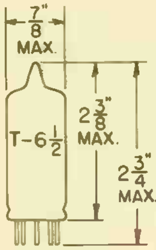

6CR6
PENTODE UNIT
E_f = 6.3 Volts
E_{c2} = 100 Volts
I_b
I_{c2}
E_{c1} = 0
-1
-2
-3
E_{c1} = 0
-6
-2
-9
-12
-15
PLATE MILLIAMPERES
0
5
10
15
20
0
100
200
300
400
500
PLATE VOLTS


6CR6
PENTODE UNIT
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 100 Volts
I_b
I_{c2}
g_m
-30
-25
-20
-15
-10
-5
0
GRID #1 VOLTS
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
2.5
5.0
7.5
10.0
TRANSCONDUCTANCE (g_m) - MICROMHOS
0
500
1000
1500
2000

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE



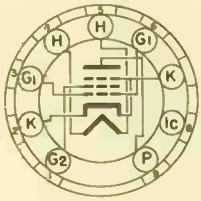
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9CK

THE 6CS5 IS A MINIATURE BEAM PENTODE DESIGNED FOR USE IN AUDIO POWER OUTPUT STAGES WHERE THE SUPPLY VOLTAGE IS FURNISHED DIRECTLY FROM THE POWER LINES BY THE USE OF A SINGLE DIODE RECTIFIER. ELECTRICALLY THE 6CS5 IS SIMILAR TO THE 6W6GT AND IS CAPABLE OF DEVELOPING THE SAME POWER OUTPUT. EXCEPT FOR HEATER RATINGS, THE 6CS5 IS IDENTICAL TO THE 12CS5.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: G_1 TO P	0.5	μμf
INPUT: G_1 TO $(K+H+G_2+B.P.)$	15	μμf
OUTPUT: P TO $(K+H+G_2+B.P.)$	9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
FIXED BIAS	0.1	MEGOHM
SELF BIAS	0.5	MEGOHM
MAXIMUM PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE*	200	VOLTS

*DC COMPONENT MUST NOT EXCEED 100 VOLTS.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

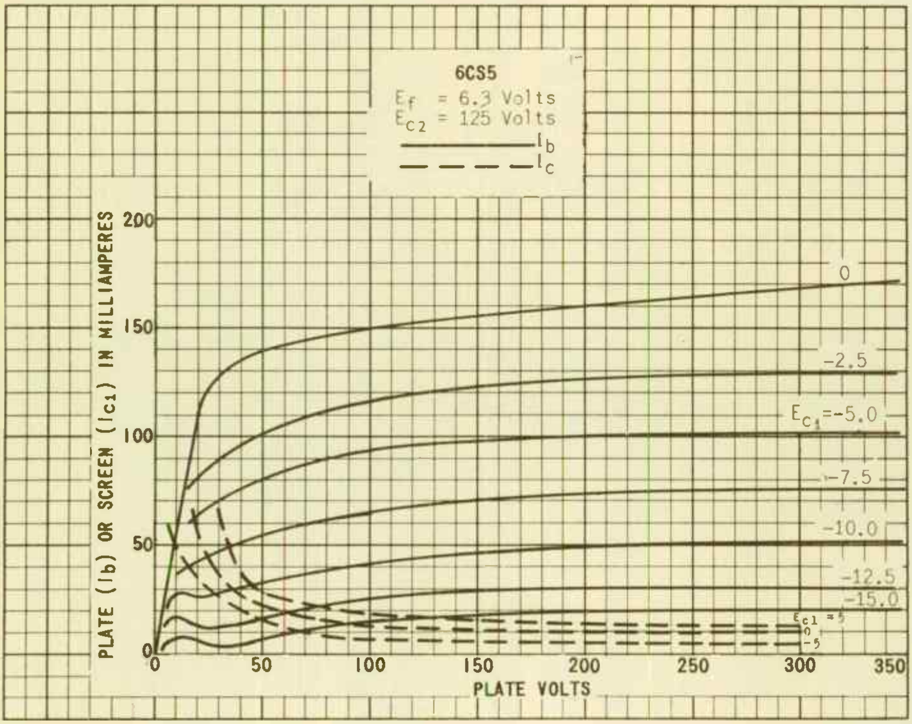
CLASS A_1 AMPLIFIER

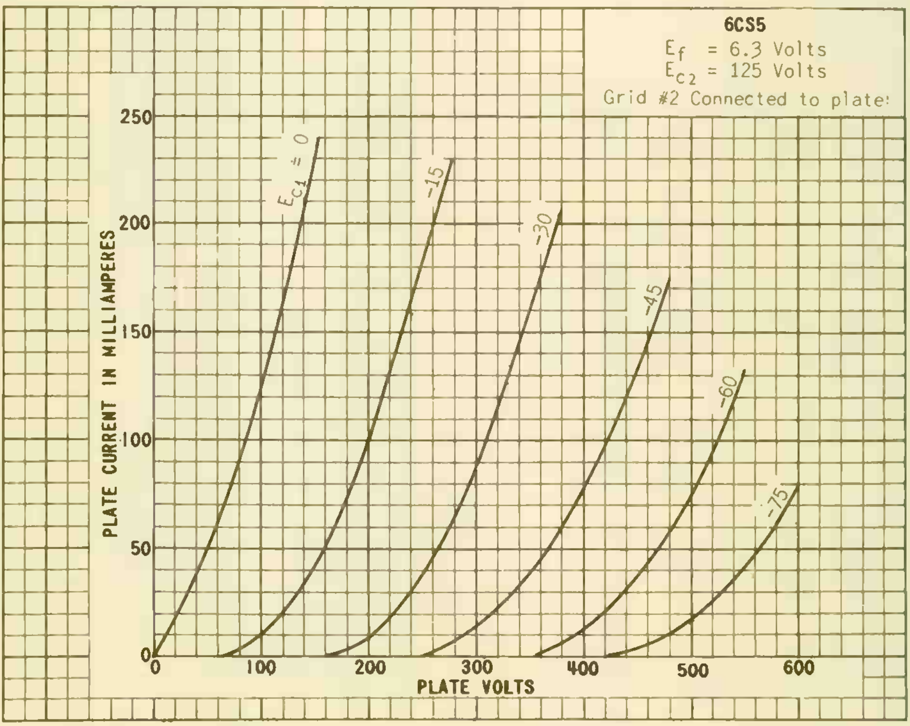
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	AMP.
PLATE VOLTAGE	110	200	VOLTS
GRID #2 (SCREEN) VOLTAGE	110	125	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	-7.5	---	VOLTS
CATHODE BIAS RESISTOR	---	180	OHMS
PLATE RESISTANCE (APPROX.)	13 000	28 000	OHMS
TRANSCONDUCTANCE	8 000	8 000	μMHOS
GRID #1 INPUT VOLTAGE, PEAK AF	7.5	8.5	VOLTS
PLATE CURRENT, ZERO SIGNAL	49	46	MA.
PLATE CURRENT, (MAX. SIGNAL)	50	47	MA.
GRID #2 CURRENT, ZERO SIGNAL	4	2.2	MA.
GRID #2 CURRENT, (MAX. SIGNAL)	10	8.5	MA.
LOAD RESISTANCE IMPEDANCE	2 000	4 000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT
POWER OUTPUT, (MAX. SIGNAL)	2.1	3.8	WATTS

TRIODE CONNECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PLATE & GRID #2 VOLTAGE ($P+G_2$ TIED TOGETHER)	225	VOLTS
GRID #1 VOLTAGE	-30	VOLTS
PLATE RESISTANCE	1 500	OHMS
TRANSCONDUCTANCE	3 800	μMHOS
PLATE CURRENT	22	MA.
AMPLIFICATION FACTOR	6.2	
GRID #1 VOLTAGE (APPROX.) FOR I_b = 0.5 MA.	-42	VOLTS

SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time the 6CS5 is identical to the 12CS5.*

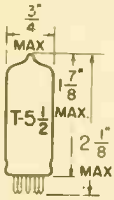

6CS5
Ef = 6.3 Volts
Ec2 = 125 Volts
Ib
Ic
0
-2.5
Ec1=-5.0
-7.5
-10.0
-12.5
-15.0
Ec1 = 5
0
-5
PLATE (Ib) OR SCREEN (Ic1) IN MILLIAMPERES
200
150
100
50
0
50
100
150
200
250
300
350
PLATE VOLTS


6CS5
Ef = 6.3 Volts
Ec2 = 125 Volts
Grid #2 Connected to plate
Ec1 = 0
-15
-30
-45
-60
-75
PLATE CURRENT IN MILLIAMPERES
250
200
150
100
50
0
100
200
300
400
500
600
PLATE VOLTS

TUNG-SOL

HEPTODE

MINIATURE TYPE

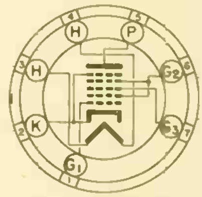


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CH

THE 6CS6 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.

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	6.3	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	1.0	WATT
MAXIMUM GRID #2 & #4 DISSIPATION:		
FOR GRID #2 & GRID #4 VOLTAGES UP TO 150 VOLTS	1.0	VOLTS
FOR GRID #2 & GRID #4 VOLTAGES BETWEEN 150 & 300V.[A]		
MAXIMUM CATHODE CURRENT	14	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM GRID #3 CIRCUIT RESISTANCE	2.2	MEGOHMS

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

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

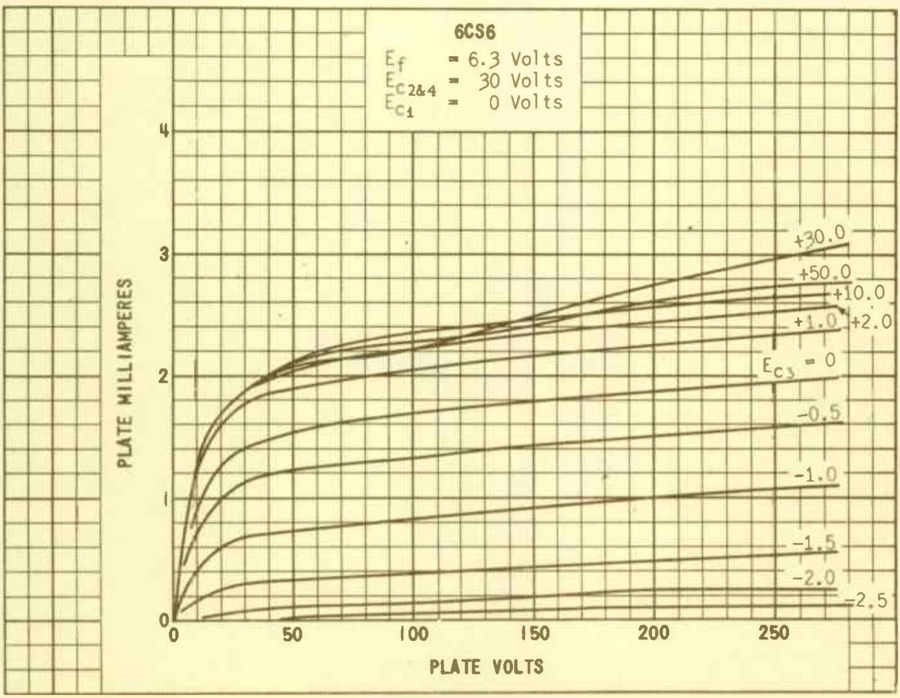
TUNG-SOL

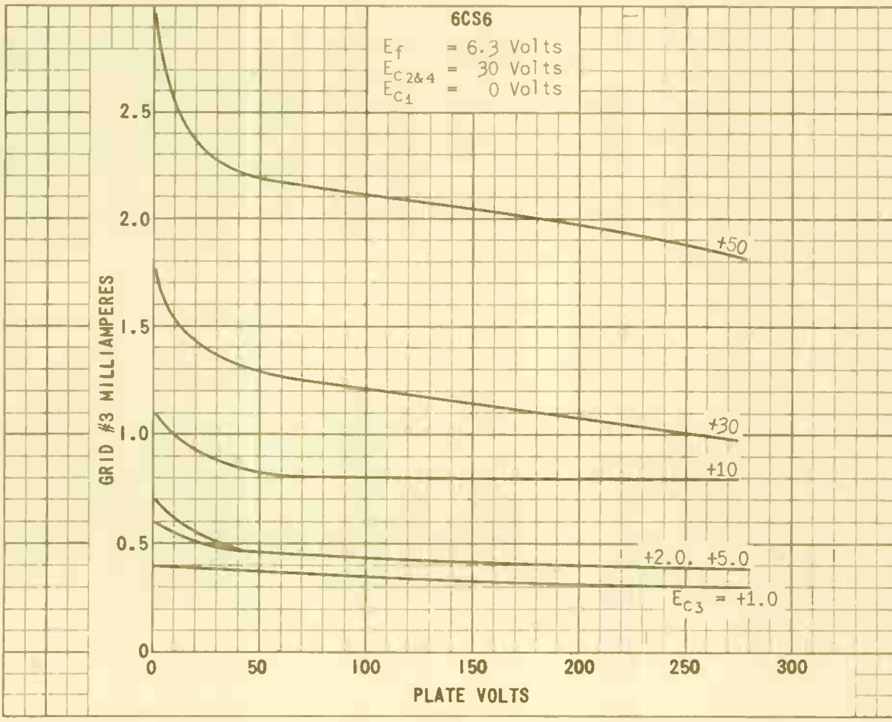
CONTINUED FROM PRECEDING PAGE

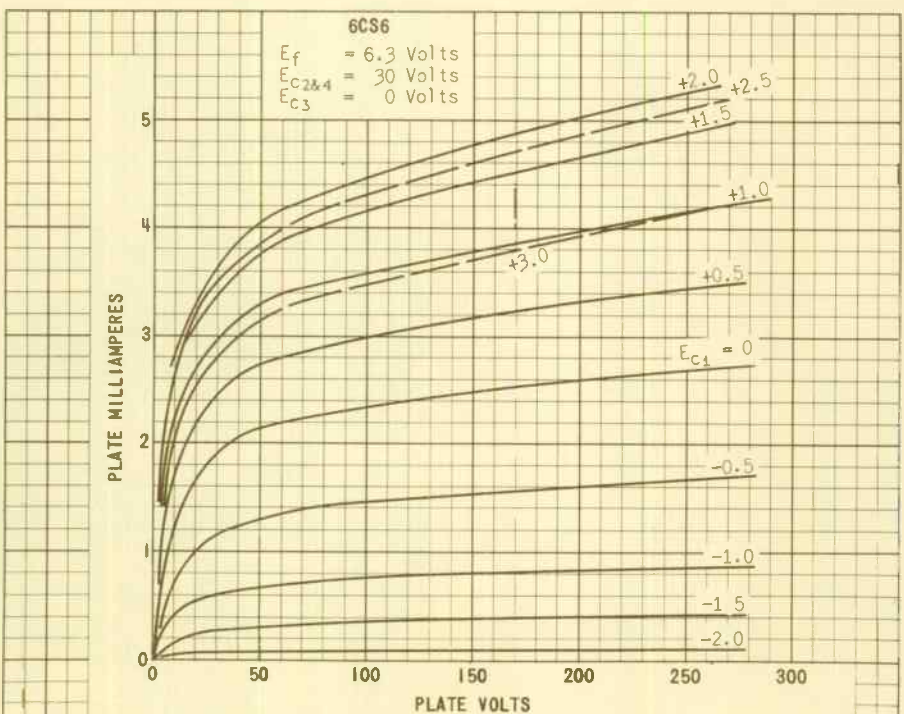
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

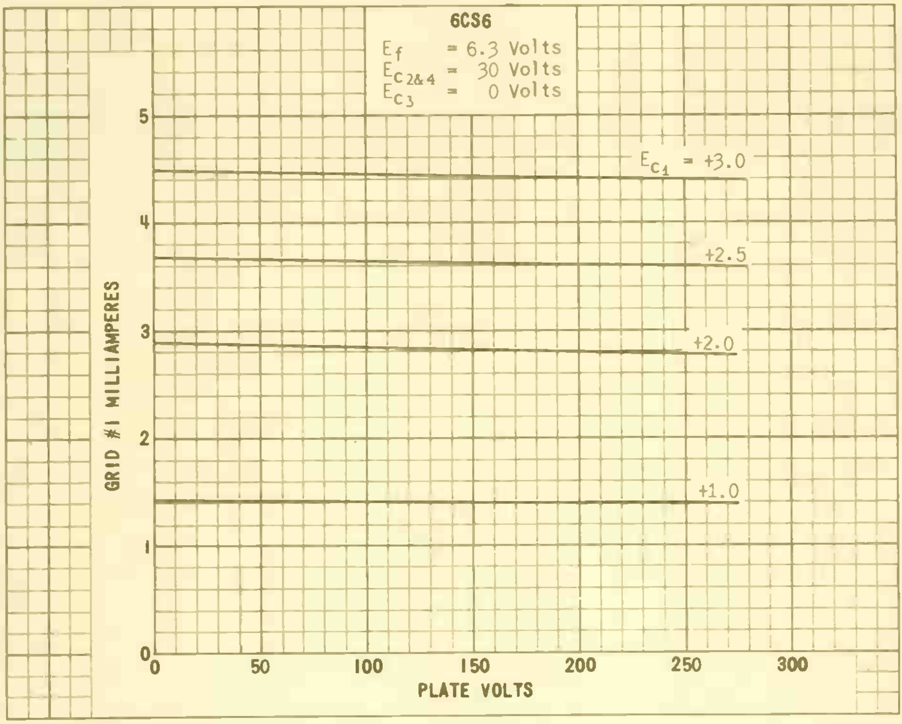
CLASS A_1 AMPLIFIER

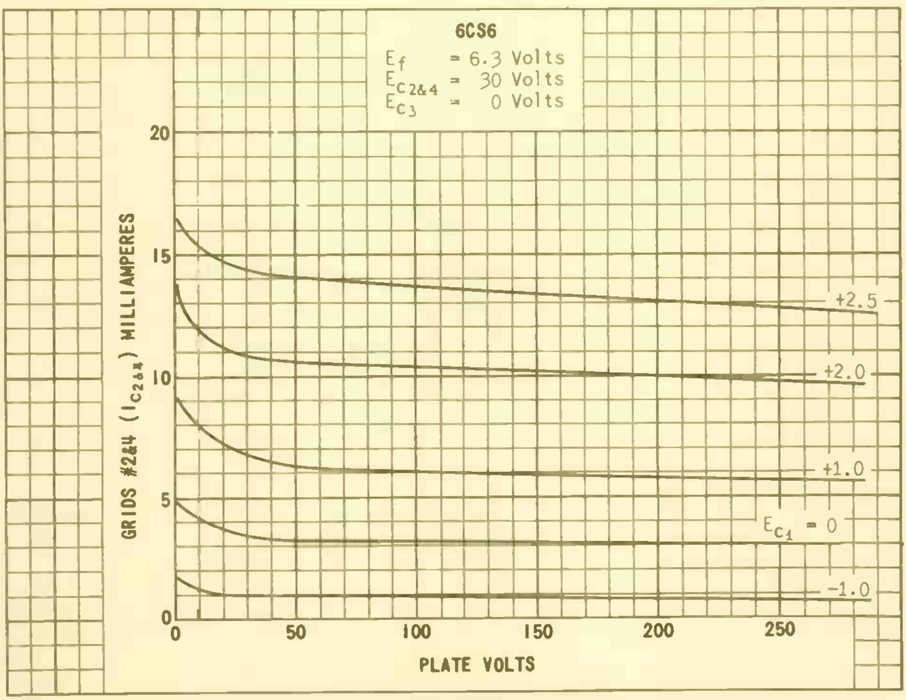
HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	0.3	AMP.
PLATE VOLTAGE	10	100	100	VOLTS
GRID #2 & #4 VOLTAGE	30	30	30	VOLTS
GRID #1 VOLTAGE	0	0	-1	VOLTS
GRID #3 VOLTAGE	0	-1	0	VOLTS
PLATE CURRENT	2.0	0.8	1.0	MA.
GRID #2 & #4 CURRENT	4.5	5.5	1.3	MA.
TRANSCONDUCTANCE (MEASURED BETWEEN GRID #1 AND PLATE)	---	---	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

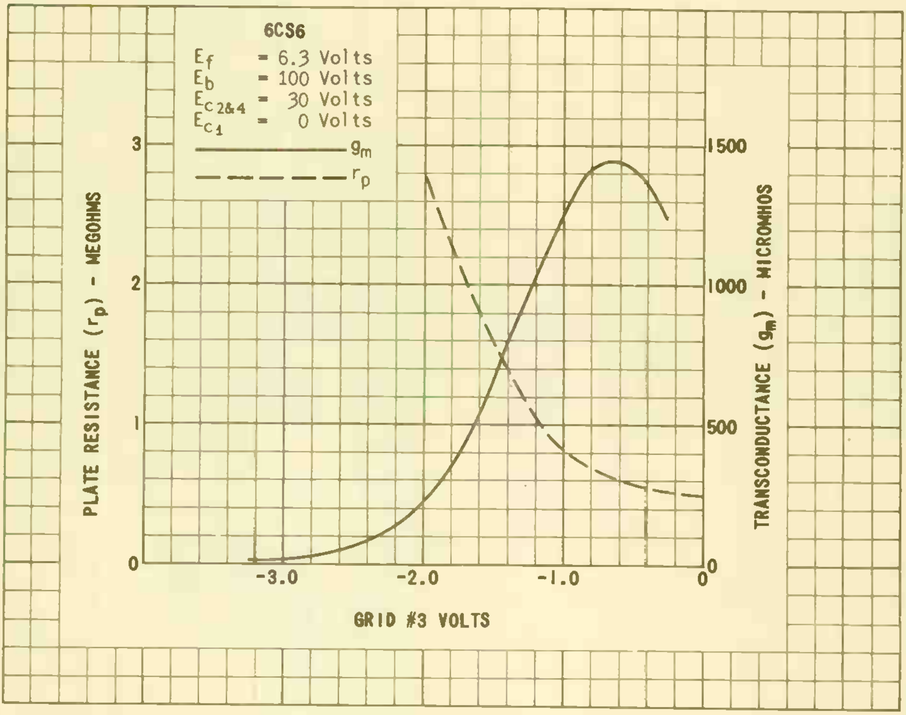


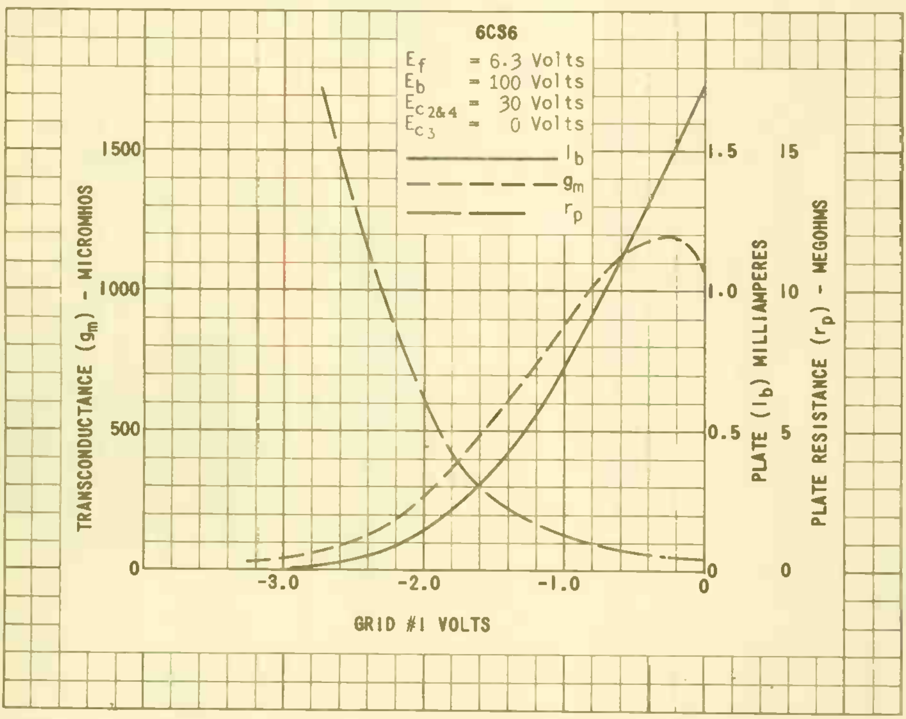

6CS6
E_f = 6.3 Volts
$E_{c2\&4}$ = 30 Volts
E_{c1} = 0 Volts
GRID #3 MILLIAMPERES
0
0.5
1.0
1.5
2.0
2.5
+50
+30
+10
+2.0, +5.0
E_{c3} = +1.0
0
50
100
150
200
250
300
PLATE VOLTS

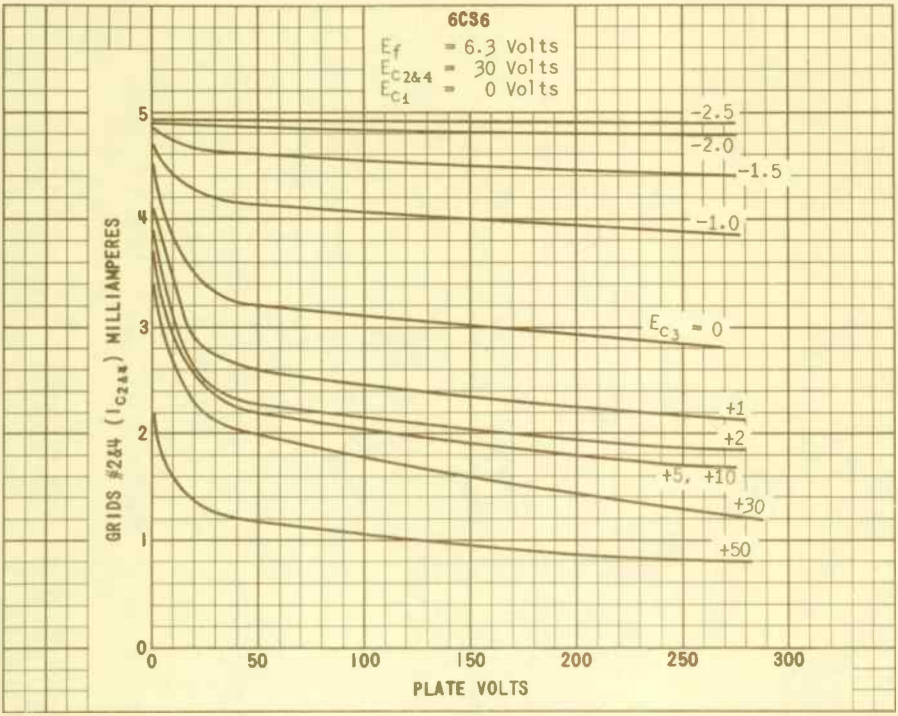

6CS6
E_f = 6.3 Volts
$E_{c2\&4}$ = 30 Volts
E_{c3} = 0 Volts
PLATE MILLIAMPERES
0
1
2
3
4
5
+2.0
+2.5
+1.5
+1.0
+3.0
+0.5
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
0
50
100
150
200
250
300
PLATE VOLTS


6CS6
E_f = 6.3 Volts
$E_{c\,2\&4}$ = 30 Volts
$E_{c\,3}$ = 0 Volts
E_{c_1} = +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


6CS6
E_f = 6.3 Volts
$E_{c\,2\&4}$ = 30 Volts
$E_{c\,3}$ = 0 Volts
+2.5
+2.0
+1.0
E_{c_1} = 0
-1.0
GRIDS #2&4 ($I_{c\,2\&4}$) MILLIAMPERES
0
5
10
15
20
0
50
100
150
200
250
PLATE VOLTS


6CS6
E_f = 6.3 Volts
E_b = 100 Volts
$E_{c\,2\&4}$ = 30 Volts
E_{c_1} = 0 Volts
g_m
r_p
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
GRID #3 VOLTS
3
2
1
0
1500
1000
500
0
-3.0
-2.0
-1.0
0

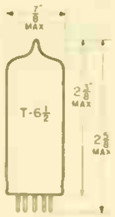

6CS6
E_f = 6.3 Volts
E_b = 100 Volts
$E_{c\,2\&4}$ = 30 Volts
E_{c_3} = 0 Volts
I_b
g_m
r_p
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE (I_b) MILLIAMPERES
PLATE RESISTANCE (r_p) - MEGOHMS
GRID #1 VOLTS
1500
1000
500
0
1.5
1.0
0.5
0
15
10
5
0
-3.0
-2.0
-1.0
0


6CS6
Ef = 6.3 Volts
Ec2&4 = 30 Volts
Ec1 = 0 Volts
-2.5
-2.0
-1.5
-1.0
Ec3 = 0
+1
+2
+5, +10
+30
+50
GRIDS #2&4 (IC2&4) MILLIAMPERES
0
1
2
3
4
5
0
50
100
150
200
250
300
PLATE VOLTS

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

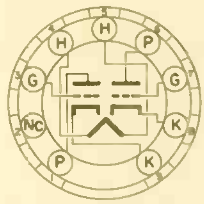


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9EF

THE 6CS7 IS A DOUBLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. SECTION #1 IS INTENDED FOR OPERATION AS A VERTICAL DEFLECTION OSCILLATOR AND SECTION #2 AS A VERTICAL DEFLECTION AMPLIFIER. THERMAL CHARACTERISTICS 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 #1 A	TRIODE #2	
GRID TO PLATE (G TO P)	2.6	2.6	μμf
INPUT: G TO (K+H+E.S.)	1.8	3.0	μμf
OUTPUT: P TO (K+H+E.S.)	0.5	0.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER B

	TRIODE #1 A OSCILLATOR		TRIODE #2 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
MAXIMUM DC PLATE VOLTAGE	500		500	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAX.)			2 200	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400		250	VOLTS
MAXIMUM PLATE DISSIPATION C	1.25		6.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	20		30	MA.
MAXIMUM PEAK CATHODE CURRENT	70		105	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2		2.2	MEGOHMS
HEATER WARM-UP TIME D		11		SECONDS

A TRIODE #1 CONNECTS TO PINS #6, #7 AND #8. TRIODE #2 CONNECTS TO PINS #1, #3 AND #9.

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 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 ABSENCE OF EXCITATION.

D 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

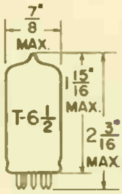
	TRIODE #1[A]	TRIODE #2	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	250	250	VOLTS
GRID VOLTAGE	-8.5	-10.5	VOLTS
PLATE CURRENT	10.5	19.0	MA.
TRANSCONDUCTANCE	2 200	4 500	μMHOS
AMPLIFICATION FACTOR	17.0	15.5	
PLATE RESISTANCE	7 700	3 450	OHMS
PLATE CURRENT AT E_c=-16 VOLTS		3.0	MA.
GRID VOLTAGE FOR I_b=10μA	-24		VOLTS
GRID VOLTAGE FOR I_b=50μA		-22	VOLTS

[A] TRIODE #1 CONNECTS TO PINS #6, #7 AND #8. TRIODE #2 CONNECTS TO PINS #1, #3 AND #9.

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

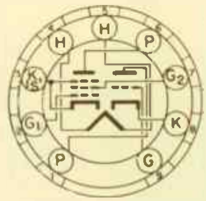


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9FZ

THE 6CS8 IS A TRIODE-PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS DESIGNED FOR TELEVISION IF AND THE TRIODE FOR GENERAL PURPOSE 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 THE BASING AND THE "DIRECT INTERELECTRODE CAPACITANCES", THE 6CS8 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)	1.9	μμf
OUTPUT: P TO (H + K)	0.26	μμf
PENTODE:		
GRID #1 TO PLATE: G_1 TO P (MAX.)	0.020	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.)	0.12	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	0.15	μμf
PENTODE PLATE TO TRIODE GRID (MAX.)	0.012	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	6.3	6.3	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	6.3	6.3	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

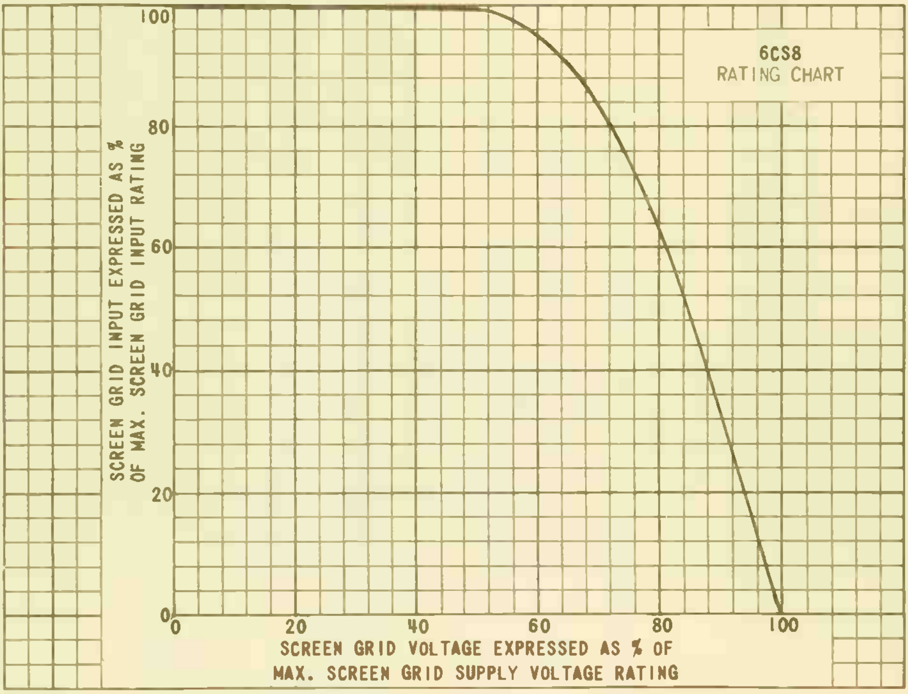
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

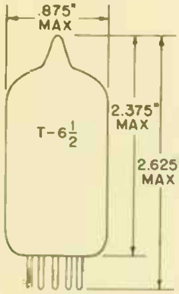
	TRIODE	PENTODE	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE		125	VOLTS
GRID #1 VOLTAGE	-2	0	VOLTS
CATHODE BIAS RESISTOR		56	OHMS
PLATE CURRENT	12	13	MA.
GRID #2 CURRENT		3	MA.
AMPLIFICATION FACTOR	22		
TRANSCONDUCTANCE	4 000	7 700	μMHOS
PLATE RESISTANCE (APPROX.)	5 500	300 000	OHMS
GRID #1 VOLTAGE (APPROX.) FOR $I_b = 10\ \mu A$	-13		VOLTS
GRID #1 VOLTAGE (APPROX.) FOR $I_b = 20\ \mu A$		-6.5	VOLTS
PLATE CURRENT WITH $E_{c1} = -3$ Vdc, $R_K = 0$		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.


6CS8
RATING CHART
100
80
60
40
20
0
0
20
40
60
80
100
SCREEN GRID INPUT EXPRESSED AS % OF MAX. SCREEN GRID INPUT RATING
SCREEN GRID VOLTAGE EXPRESSED AS % OF MAX. SCREEN GRID SUPPLY VOLTAGE RATING

TUNG-SOL



GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 6-3

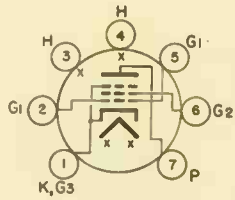
BEAM PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±0.6 VOLTS 1200 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 6CU5 IS A MINIATURE BEAM POWER PENTODE DESIGNED FOR USE IN THE AUDIO OUTPUT STAGE OF TELEVISION RECEIVERS. HIGH-POWER SENSITIVITY AND HIGH EFFICIENCY AT LOW PLATE AND SCREEN VOLTAGES ENABLE THE 6CU5 TO PROVIDE RELATIVELY HIGH POWER OUTPUT. EXCEPT FOR HEATER RATINGS, THE 6CU5 IS IDENTICAL TO THE 12CU5.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	pf
GRID #1 TO CATHODE & GRID #3, HEATER, AND GRID #2	13.0	pf
PLATE TO CATHODE & GRID #3, HEATER, AND GRID #2	8.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE [A]	200		VOLTS
MAXIMUM PLATE VOLTAGE	150	←	VOLTS
MAXIMUM GRID #2 (SCREEN) VOLTAGE	130	←	VOLTS
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:			
POSITIVE BIAS VALUE	0		VOLTS
MAXIMUM PLATE DISSIPATION		←	WATTS
MAXIMUM GRID #2 INPUT	1.4	←	WATTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	220		°C

→ INDICATES A CHANGE.

[A] DC COMPONENT MUST NOT EXCEED 100 VOLTS.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

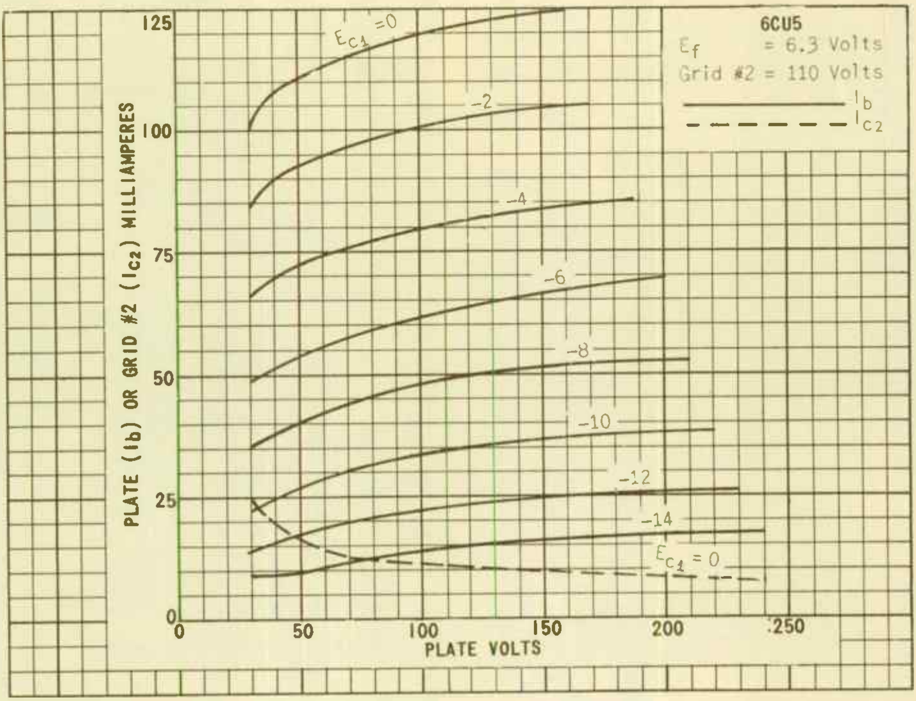
CLASS A_1 AMPLIFIER

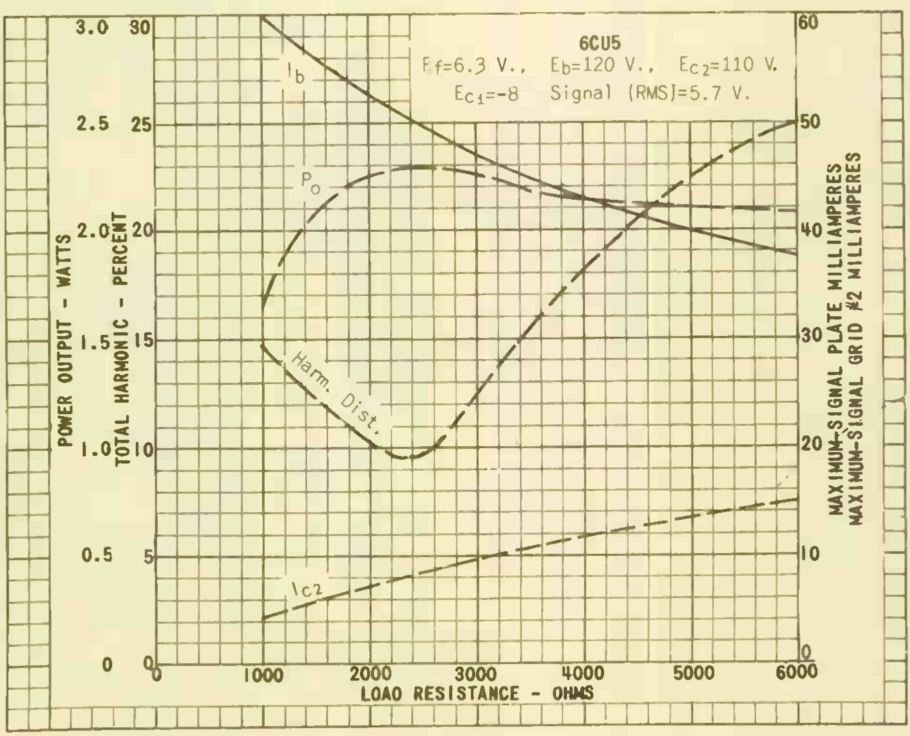
PLATE VOLTAGE	120	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-8	VOLTS
PEAK AF GRID #1 VOLTAGE	8	VOLTS
ZERO-SIGNAL PLATE CURRENT	49	MA.
MAXIMUM-SIGNAL PLATE CURRENT	50	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	8.5	MA.
PLATE RESISTANCE (APPROX.)	10 000	OHMS
TRANSCONDUCTANCE	7 500	μMHOS
LOAD RESISTANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
SIGNAL POWER OUTPUT (MAX.-)	2.3	WATTS

MAXIMUM CIRCUIT VALUES

GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION (MAX.)	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION (MAX.)	0.5	MEGOHM

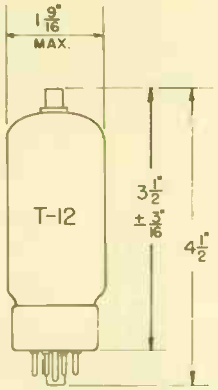
SIMILAR TYPE REFERENCE: Except for heater warm-up time and heater ratings, the 6CU5 is identical to the 12CU5.


6CU5
E_f = 6.3 Volts
Grid #2 = 110 Volts
I_b
I_{c2}
E_{c1} = 0
-2
-4
-6
-8
-10
-12
-14
E_{c1} = 0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
25
50
75
100
125
0
50
100
150
200
250
PLATE VOLTS


6CU5
E_f=6.3 V., E_b=120 V., E_{c2}=110 V.
E_{c1}=-8 Signal (RMS)=5.7 V.
I_b
P_o
Harm. Dist.
I_{c2}
POWER OUTPUT - WATTS
0
0.5
1.0
1.5
2.0
2.5
3.0
TOTAL HARMONIC - PERCENT
0
5
10
15
20
25
30
MAXIMUM-SIGNAL PLATE MILLIAMPERES
MAXIMUM-SIGNAL GRID #2 MILLIAMPERES
0
10
20
30
40
50
60
0
1000
2000
3000
4000
5000
6000
LOAD RESISTANCE - OHMS

TUNG-SOL

PENTODE

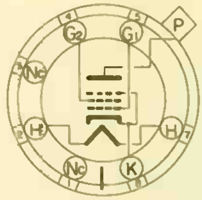


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM SHELL
7 PIN OCTAL
6AM

THE 6CU6 IS A BEAM-POWER TUBE INTENDED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. IT IS DESIGNED TO PROVIDE LONGER LIFE AT HIGH-LINE CONDITIONS AND INCREASED RUGGEDNESS TO WITHSTAND MOMENTARY OVERLOADS.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

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	←	μμf

RATINGS[A]

INTERPRETED ACCORDING TO RETMA STANDARD M8-210

HORIZONTAL DEFLECTION AMPLIFIER[B]

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)	600	←	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	6 000		VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 250		VOLTS
MAXIMUM PLATE DISSIPATION[C]	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] DESIGN CENTER VALUES 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 MUST NOT EXCEED 15% (10 MICROSECONDS) 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.

CONTINUED ON FOLLOWING PAGE.

→ INDICATES A CHANGE.

TUNG-SOL

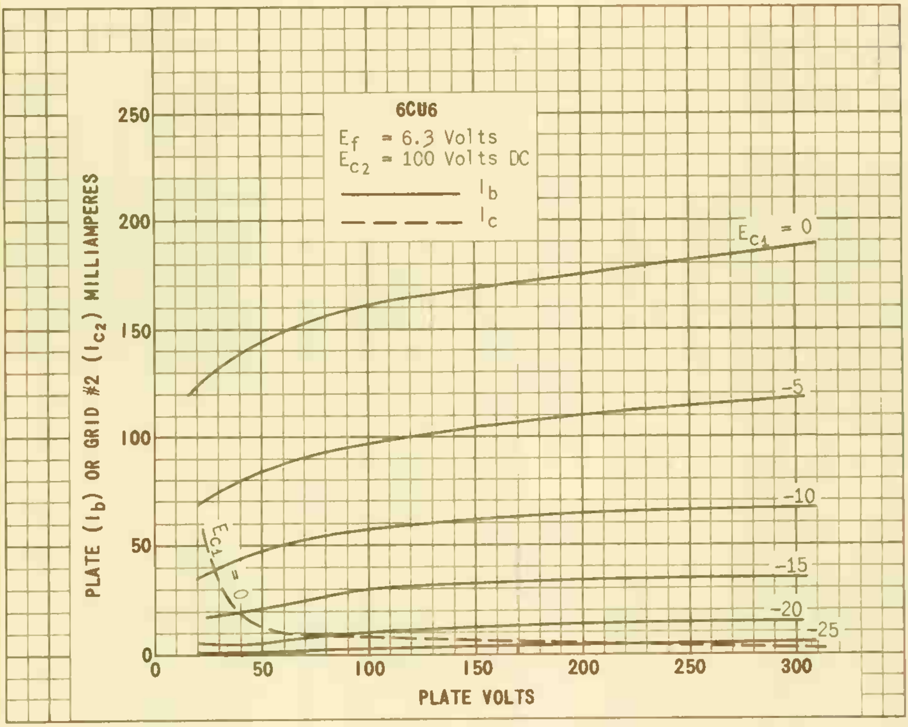
CONTINUED FROM PRECEDING PAGE

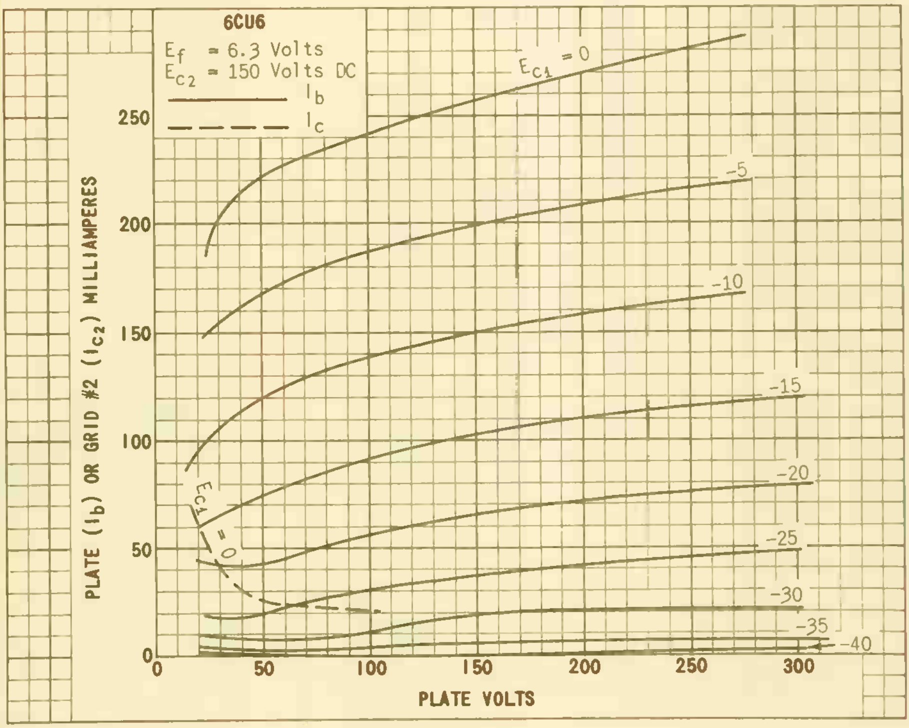
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS ←

PENTODE OPERATION: WITH E_b = 250V., E_{c2} = 150V. AND E_{c1} = -22.5V.		
PLATE CURRENT	57	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5 900	μMHOS
PLATE RESISTANCE (APPROX.)	14 500	OHMS
ZERO BIAS: WITH E_b = 60V. AND E_{c2} = 150V. (INSTANTANEOUS VALUES)		
PLATE CURRENT	260	MA.
GRID #2 CURRENT	26	MA.
CUT-OFF: FOR I_b = 1 MA., WITH E_b = 250V. AND E_{c2} = 150V.		
GRID #1 VOLTAGE (APPROX.)	-43	VOLTS
TRIODE μ: WITH E_b = E_{c2} = 150V. AND E_{c1} = -22.5V.	4.3	

SIMILAR TYPE REFERENCE. Except for heater operation the 6CU6 is identical to the 12CU6 and 25CU6. It is a rugged replacement for the 6BQ6GT.

→ INDICATES A CHANGE.

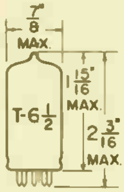

6CU6
E_f = 6.3 Volts
E_{c2} = 100 Volts DC
I_b
I_c
E_{c1} = 0
-5
-10
-15
-20
-25
E_{c1} = 0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
50
100
150
200
250
300
PLATE VOLTS


6CU6
E_f = 6.3 Volts
E_{c2} = 150 Volts DC
I_b
I_c
E_{c1} = 0
-5
-10
-15
-20
-25
-30
-35
-40
E_{c1} = 0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
50
100
150
200
250
300
PLATE VOLTS

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

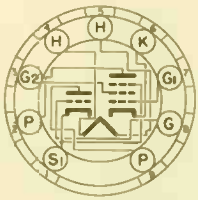


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN NOVAL
9GM

THE 6CU8 IS A GENERAL-PURPOSE MEDIUM-MU TRIODE AND SHARP-CUTOFF PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR A WIDE VARIETY OF APPLICATIONS IN BLACK-AND-WHITE 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

WITHOUT EXTERNAL SHIELD

TRIODE UNIT:		
GRID TO PLATE	1.6	μμf
GRID TO: (K+3PG+H+I.S.)	1.9	μμf
PLATE TO: (K+3PG+H+I.S.)	1.6	μμf
PENTODE UNIT:		
GRID #1 TO PLATE (MAX.)	0.025	μμf
GRID #1 TO: (K+G2&G4+TK+H+I.S)	7	μμf
PLATE TO: (K+G2&G3+TK+H+I.S.)	2.4	μμf
PENTODE GRID #1 TO TRIODE PLATE	0.02	μμf
PENTODE PLATE TO TRIODE PLATE	0.04	μμf
TRIODE GRID TO PENTODE PLATE	0.005	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	300	VOLTS
MAXIMUM GRID #2 (SCREEN GRID VOLTAGE)	---	SEE RATING CHART	
MAXIMUM GRID #1 (CONTROL GRID) VOLTAGE:			
POSITIVE BIAS VALUE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.6	2	VOLTS
MAXIMUM GRID #2 INPUT:			
FOR GRID #2 VOLTAGES UP TO 150 V.	---	0.5	WATT
FOR GRID #2 VOLTAGES BETWEEN 150 & 300V	---	SEE RATING CHART	

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS -CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM PEAK HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	200[A]	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

MAXIMUM CIRCUIT VALUE

	TRIODE UNIT	PENTODE UNIT	
MAXIMUM 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 CONDITIONS AND CHARACTERISTICS

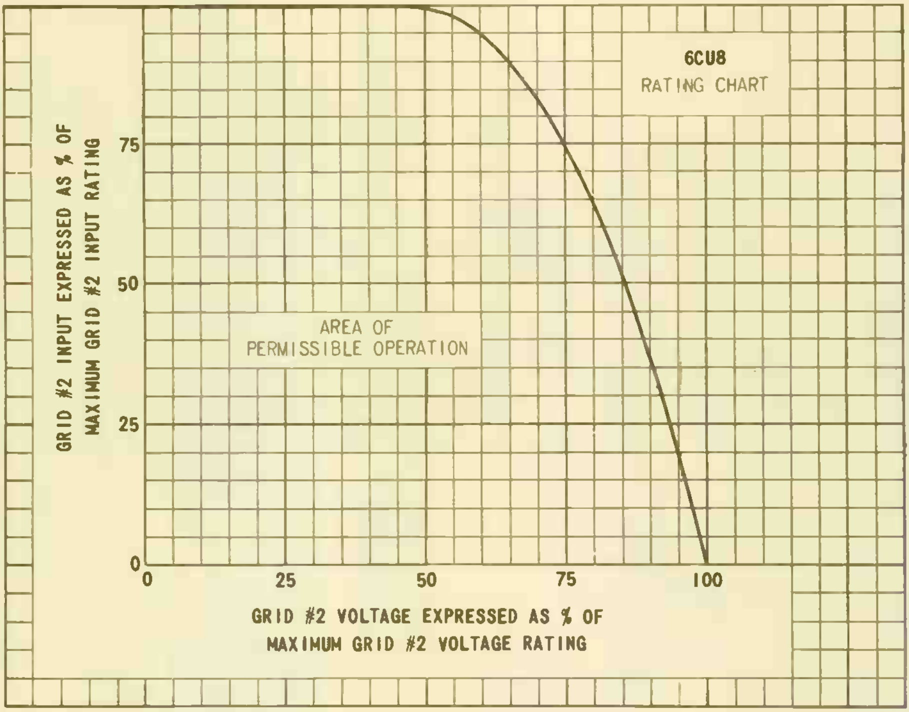
CLASS A_1 AMPLIFIER

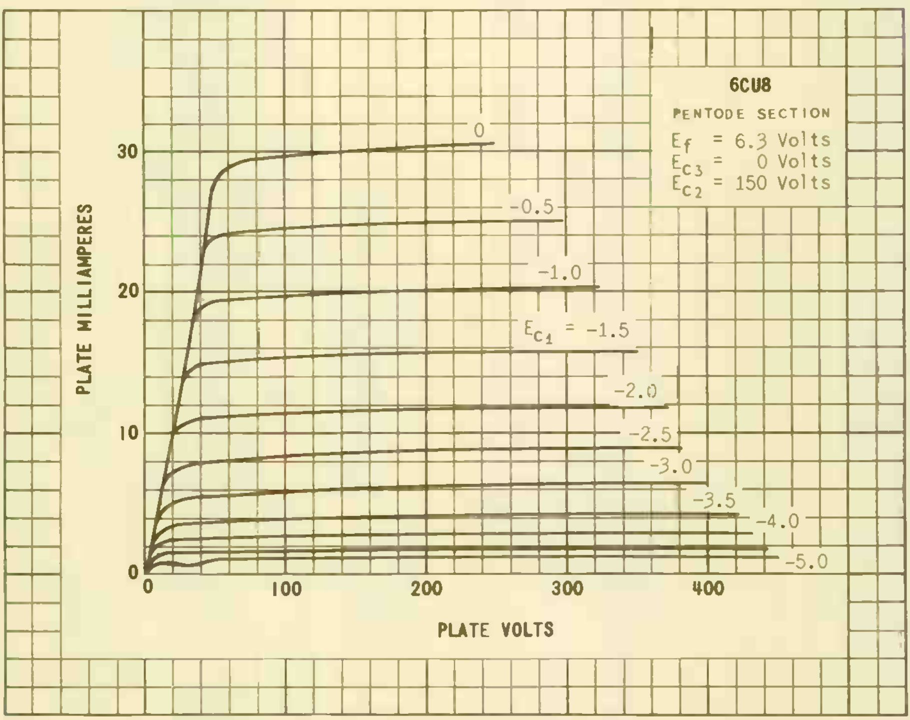
	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE SUPPLY VOLTAGE	200	200	VOLTS
GRID #2 SUPPLY VOLTAGE	---	150	VOLTS
GRID #1 VOLTAGE	-6	---	VOLTS
CATHODE-BIAS RESISTOR	---	180	OHMS
AMPLIFICATION FACTOR	19	---	
PLATE RESISTANCE (APPROX.)	5 750	300 000	OHMS
TRANSCONDUCTANCE	3 300	6 200	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP.	-19	-8	VOLTS
PLATE CURRENT	13	9.5	MA.
GRID #2 CURRENT	---	2.8	MA.

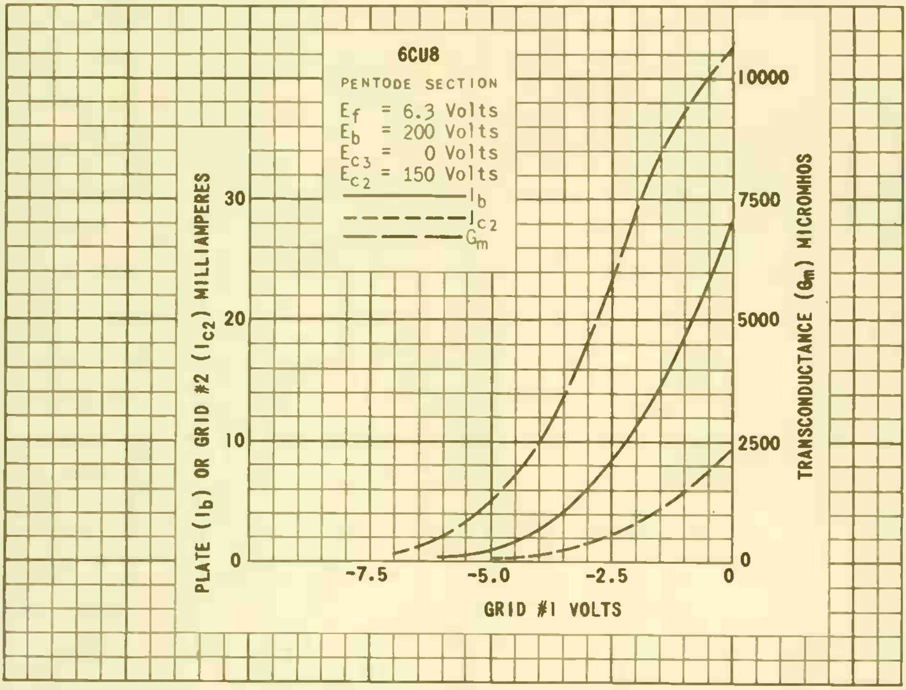
[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

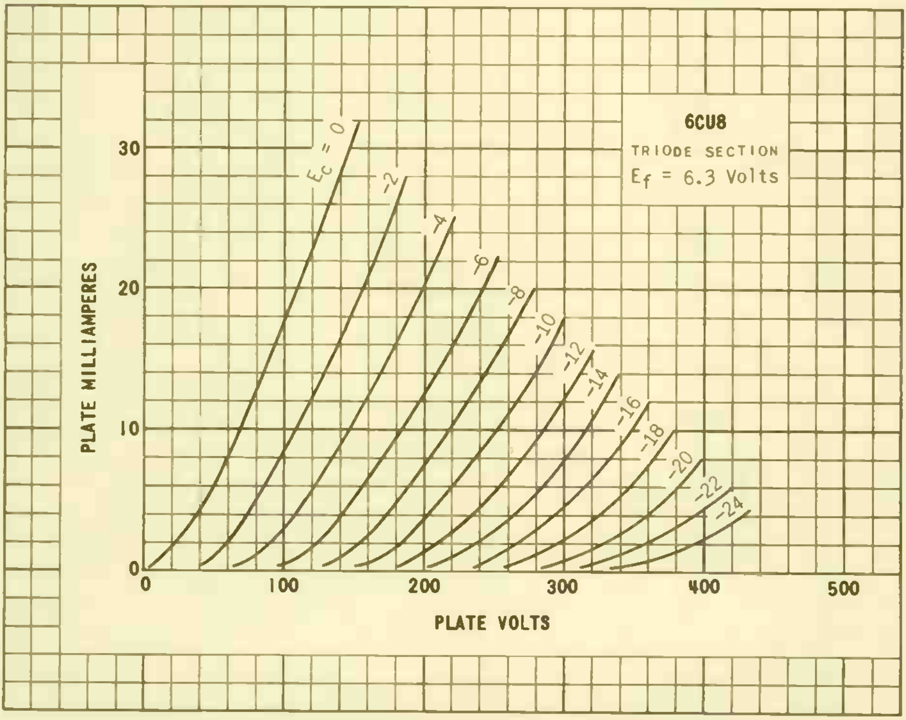
[B] IF EITHER UNIT IS OPERATED AT MAXIMUM RATED CONDITIONS, GRID-#1-CIRCUIT RESISTANCES FOR BOTH UNITS SHOULD NOT EXCEED THE STATED VALUES.

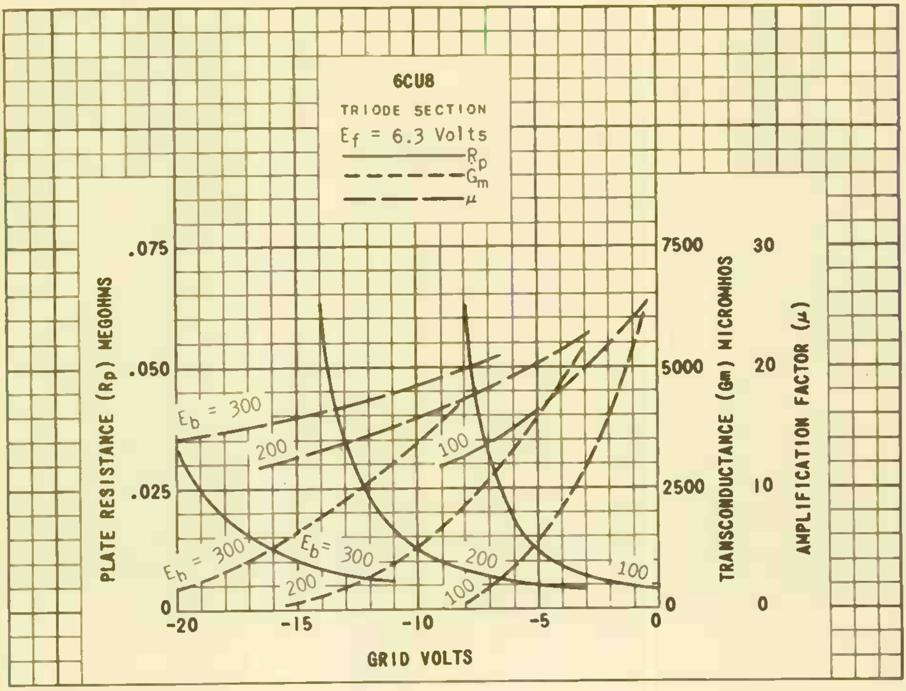
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.


6CU8
RATING CHART
AREA OF
PERMISSIBLE OPERATION
GRID #2 INPUT EXPRESSED AS % OF
MAXIMUM GRID #2 INPUT RATING
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS % OF
MAXIMUM GRID #2 VOLTAGE RATING


6CU8
PENTODE SECTION
E_f = 6.3 Volts
E_{c_3} = 0 Volts
E_{c_2} = 150 Volts
0
-0.5
-1.0
E_{c_1} = -1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-5.0
PLATE MILLIAMPERES
0
10
20
30
0
100
200
300
400
PLATE VOLTS

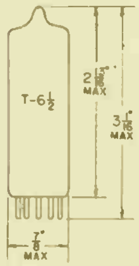

6CU8
PENTODE SECTION
Ef = 6.3 Volts
Eb = 200 Volts
Ec3 = 0 Volts
Ec2 = 150 Volts
Ib
Ic2
Gm
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0
10
20
30
TRANSCONDUCTANCE (Gm) MICROMHOS
0
2500
5000
7500
10000
-7.5
-5.0
-2.5
0
GRID #1 VOLTS


6CU8
TRIODE SECTION
Ef = 6.3 Volts
Ec = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
PLATE MILLIAMPERES
0
10
20
30
0
100
200
300
400
500
PLATE VOLTS


6CU8
TRIODE SECTION
E_f = 6.3 Volts
R_p
G_m
μ
PLATE RESISTANCE (R_p) MEGOHMS
.075
.050
.025
0
TRANSCONDUCTANCE (Gm) MICROMHOS
7500
5000
2500
0
AMPLIFICATION FACTOR (μ)
30
20
10
0
E_b = 300
200
100
E_b = 300
200
100
E_b = 300
200
100
-20
-15
-10
-5
0
GRID VOLTS

TUNG-SOL

PENTODE



GLASS BULB
E9-1 BASE

OUTLINE DRAWING
JEDEC 6-4

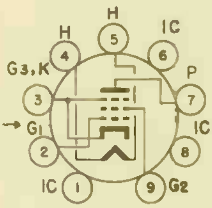
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.76 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9CV

THE 6CW5 IS AN A.F. OUTPUT PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN SINGLE-ENDED PUSH-PULL OUTPUT STAGES.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELEMENTS	12	μμf
PLATE TO ALL OTHER ELEMENTS	6.0	μμf
PLATE TO GRID #1 (MAX.)	0.6	μμf
GRID #1 TO HEATER (MAX.)	0.25	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT PLATE CURRENT	550	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM GRID #2 DISSIPATION	1.75	WATTS
MAXIMUM GRID #2 PEAK DISSIPATION	6	WATTS
MAXIMUM CATHODE CURRENT	100	MAMPS
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH AUTOMATIC BIAS	1	MEGOHM
MAXIMUM PEAK CATHODE TO HEATER VOLTAGE (CATHODE POSITIVE WITH RESPECT TO THE HEATER)	300	VOLTS
DC COMPONENT OF SAME	150	VOLTS
MAXIMUM CATHODE TO HEATER VOLTAGE (CATHODE NEGATIVE WITH RESPECT TO HEATER)	100	VOLTS
MAXIMUM CIRCUIT RESISTANCE BETWEEN HEATER AND CATHODE	20 000	OHMS

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.76	AMP.
PLATE VOLTAGE	170	VOLTS
GRID #2 VOLTAGE	170	VOLTS
GRID #1 VOLTAGE	-12.5	VOLTS
PLATE CURRENT	70	MAMPS
GRID #2 CURRENT	5	MAMPS
TRANSCONDUCTANCE	10 000	µMHOS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	8	
PLATE RESISTANCE	23 000	OHMS

OPERATING CHARACTERISTICS

CLASS A, ONE TUBE

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.76	AMP.
PLATE VOLTAGE	170	VOLTS
GRID #2 VOLTAGE	170	VOLTS
GRID #1 BIAS	-12.5	VOLTS
LOAD RESISTANCE	2400	OHMS
ZERO-SIGNAL PLATE CURRENT	70	MAMPS
ZERO-SIGNAL GRID #2 CURRENT	5	MAMPS
INPUT AF VOLTAGE (RMS)	7.0	VOLTS
MAX. SIGNAL PLATE CURRENT	70	MAMPS.
MAX. SIGNAL GRID #2 CURRENT	22	MAMPS
MAX. POWER OUTPUT	5.6	WATTS
TOTAL HARMONIC DISTORTION AT MAX. POWER OUTPUT	10	PERCENTS
INPUT AF VOLTAGE AT A POWER OUTPUT OF 50 MWATTS (RMS)	0.5	VOLTS

SINGLE-ENDED PUSH-PULL; TWO TUBES, SINGLE TONE[A]

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.76	AMP.
SUPPLY VOLTAGE	300	VOLTS
LOAD RESISTANCE	1000	OHMS
ZERO-SIGNAL CATHODE CURRENT	69	MAMPS
INPUT AF VOLTAGE (RMS)	5.7	VOLTS
MAX. SIGNAL CATHODE CURRENT	67	MAMPS
MAX. POWER OUTPUT	4.8	WATTS
TOTAL HARMONIC DISTORTION AT MAX. POWER OUTPUT	9.3	PERCENTS
INPUT AF VOLTAGE AT A POWER OUTPUT OF 50 MWATTS (RMS)	0.55	VOLTS

SINGLE-ENDED PUSH-PULL; TWO TUBES, DOUBLE TONE[A]

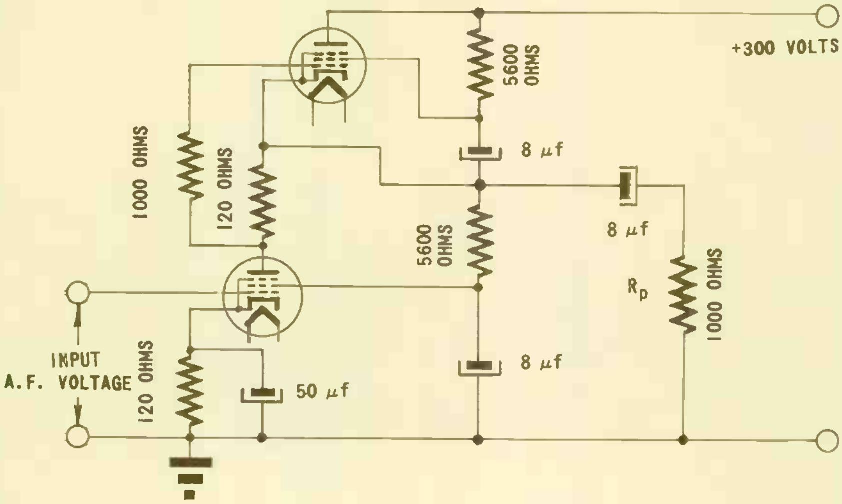
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.76	AMP.
SUPPLY VOLTAGE	300	VOLTS
LOAD RESISTANCE	1000	OHMS
ZERO-SIGNAL CATHODE CURRENT	69	MAMPS
INPUT AF VOLTAGE FOR EACH TONE SEPARATELY (RMS)	2.85	VOLTS
MAX. SIGNAL CATHODE CURRENT	67	MAMPS
MAX. POWER OUTPUT	5.9	WATTS
TOTAL HARMONIC DISTORTION AT MAX. POWER OUTPUT	8.5	PERCENTS

[A] SEE CIRCUIT DIAGRAM AND REMARK ON FOLLOWING PAGE

TUNG-SOL

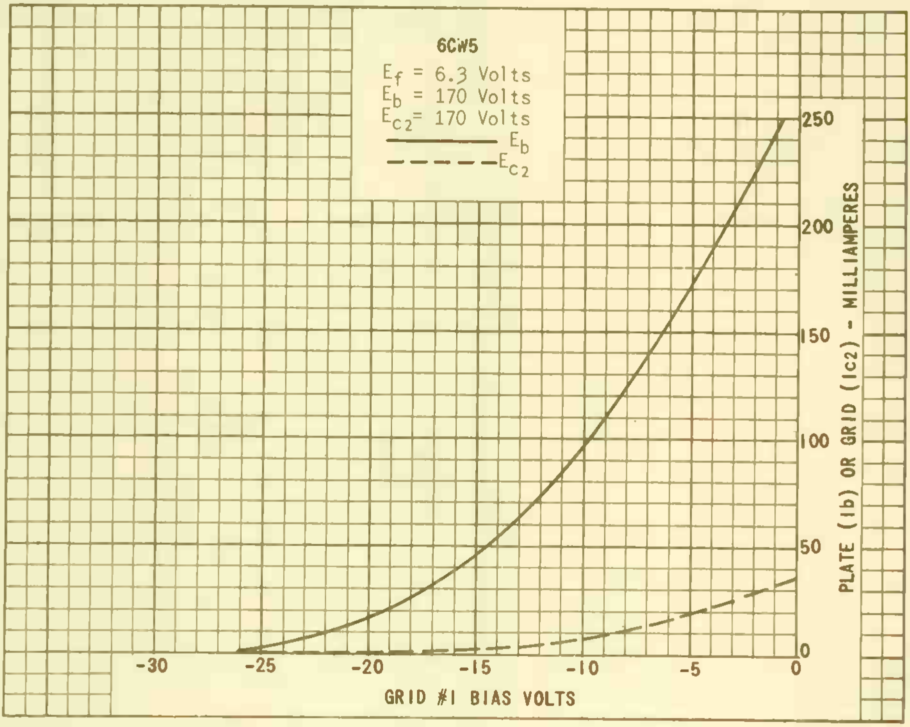
CONTINUED FROM PRECEDING PAGE

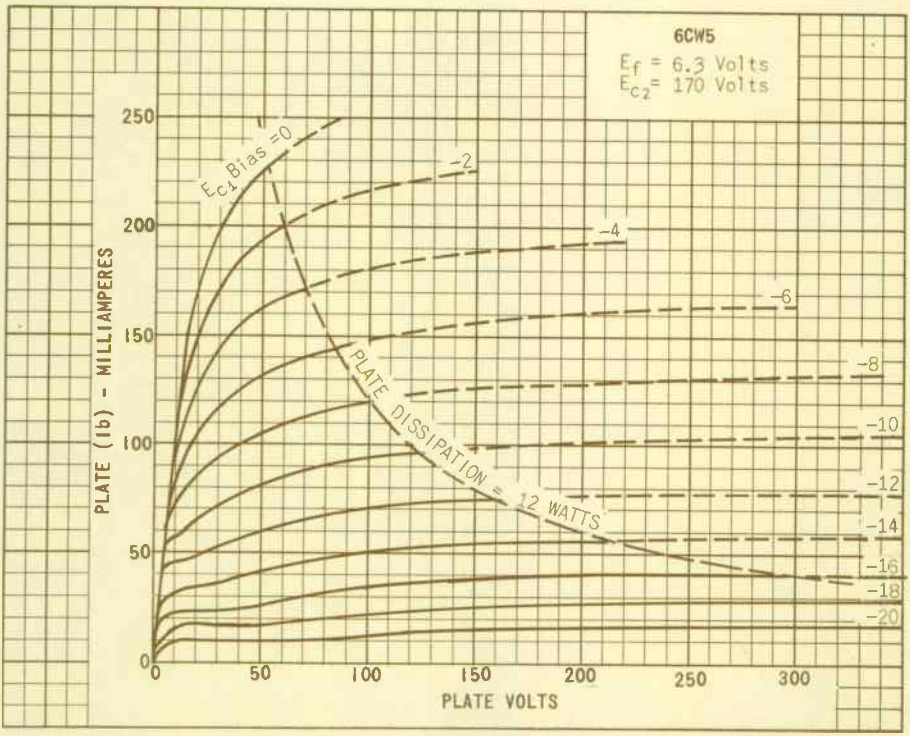
CIRCUIT DIAGRAM
OF
SINGLE-ENDED PUSH-PULL OUTPUT STAGE

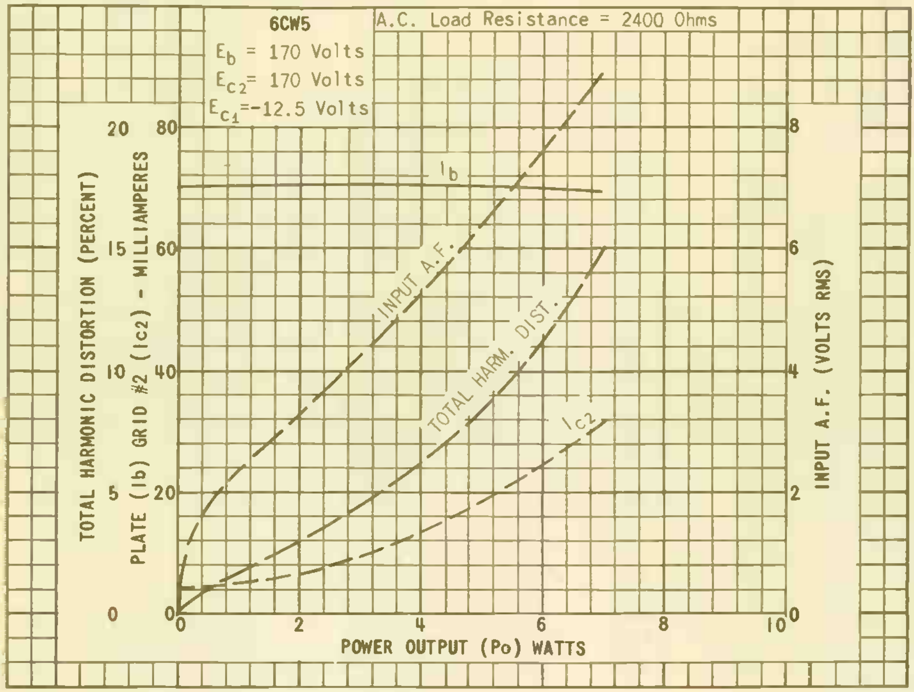


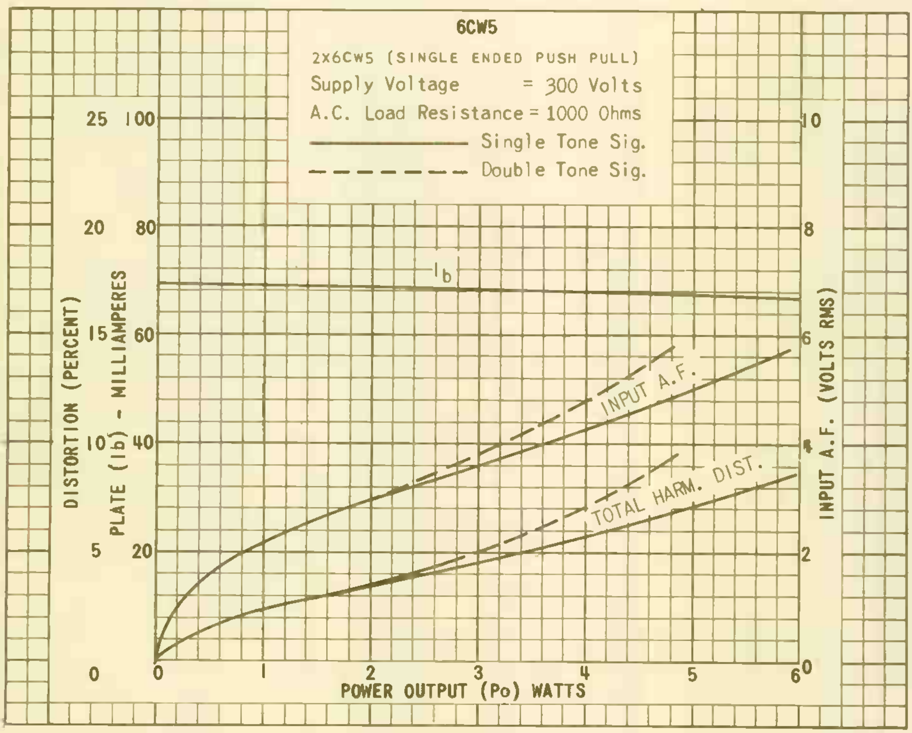
REMARK

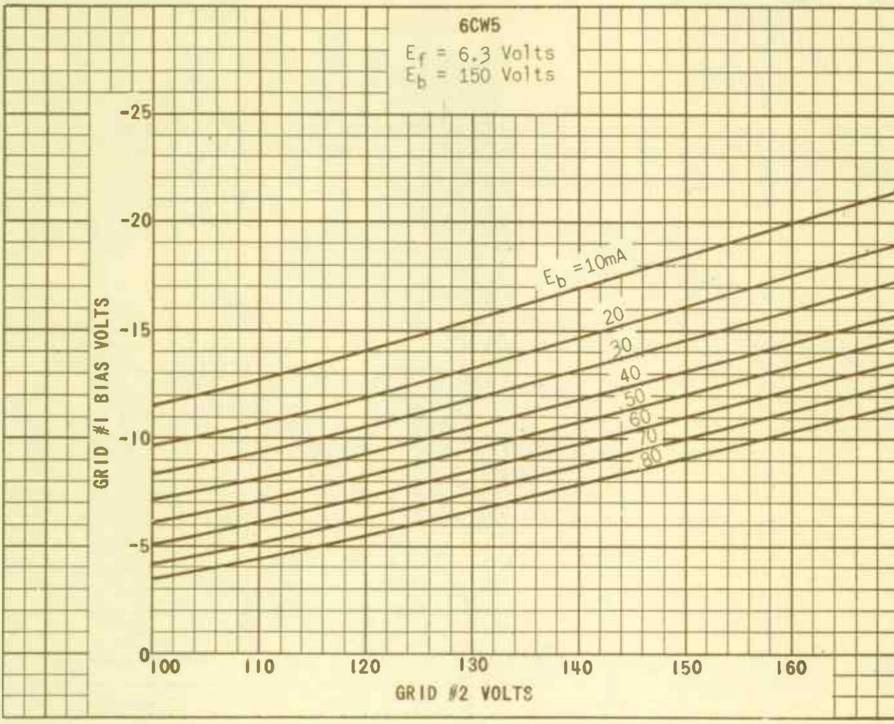
SINGLE TONE DATA ARE OBTAINED WITH A PURE SINUSOIDAL INPUT VOLTAGE. HOWEVER, SUCH AN INPUT VOLTAGE IS IN GENERAL NOT REPRESENTATIVE FOR THE REPRODUCTION OF MUSIC AND SPEECH, SINCE A PURELY SINUSOIDAL TONE SELDOM OCCURS. THE DOUBLE TONE DATA ARE OBTAINED WITH TWO SINUSOIDAL SIGNALS OF DIFFERENT FREQUENCIES BUT OF THE SAME AMPLITUDE. THIS APPEARS TO BE FAR BETTER IN AGREEMENT WITH PRACTICE. IN THE CASE OF FULL DRIVE WITH TWO SINUSOIDAL SIGNALS DIFFERENT IN FREQUENCY BUT HAVING THE SAME AMPLITUDE THE OUTPUT POWER IS ABOUT HALF THE VALUE OBTAINED AT FULL DRIVE WITH A SINGLE SINUSOIDAL INPUT VOLTAGE OF TWICE THIS AMPLITUDE. TO MAKE COMPARISON POSSIBLE THE OBTAINED OUTPUT POWER WITH DOUBLE TONE IS THEREFORE MULTIPLIED BY 2.

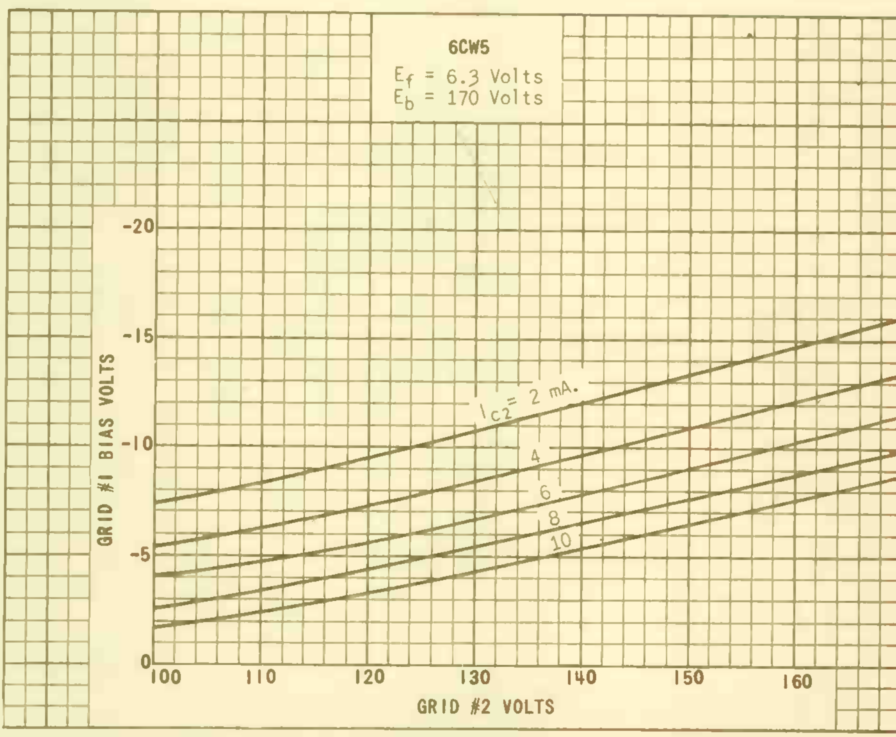

6CW5
E_f = 6.3 Volts
E_b = 170 Volts
E_{c2} = 170 Volts
E_b
E_{c2}
PLATE (Ib) OR GRID (Ic2) - MILLIAMPERES
0
50
100
150
200
250
-30
-25
-20
-15
-10
-5
0
GRID #1 BIAS VOLTS


6CW5
E_f = 6.3 Volts
E_{c2} = 170 Volts
E_{c1} Bias = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
PLATE DISSIPATION = 12 WATTS
PLATE (Ib) - MILLIAMPERES
0
50
100
150
200
250
0
50
100
150
200
250
300
PLATE VOLTS


6CW5
E_b = 170 Volts
E_{c2} = 170 Volts
E_{c1} = -12.5 Volts
A.C. Load Resistance = 2400 Ohms
TOTAL HARMONIC DISTORTION (PERCENT)
PLATE (Ib) GRID #2 (Ic2) - MILLIAMPERES
INPUT A.F. (VOLTS RMS)
POWER OUTPUT (Po) WATTS
Ib
INPUT A.F.
TOTAL HARM. DIST.
Ic2
0 5 10 15 20
0 20 40 60 80
0 2 4 6 8 10


6CW5
2x6CW5 (SINGLE ENDED PUSH PULL)
Supply Voltage = 300 Volts
A.C. Load Resistance = 1000 Ohms
Single Tone Sig.
Double Tone Sig.
DISTORTION (PERCENT)
PLATE (Ib) - MILLIAMPERES
INPUT A.F. (VOLTS RMS)
POWER OUTPUT (Po) WATTS
Ib
INPUT A.F.
TOTAL HARM. DIST.
0 5 10 15 20 25
0 20 40 60 80 100
0 2 4 6 8 10
0 1 2 3 4 5 6


6CW5
E_f = 6.3 Volts
E_b = 150 Volts
E_b =10mA
20
30
40
50
60
70
80
GRID #1 BIAS VOLTS
-25
-20
-15
-10
-5
0
100
110
120
130
140
150
160
GRID #2 VOLTS


6CW5
E_f = 6.3 Volts
E_b = 170 Volts
I_{c2} = 2 mA.
4
6
8
10
GRID #1 BIAS VOLTS
-20
-15
-10
-5
0
100
110
120
130
140
150
160
GRID #2 VOLTS

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

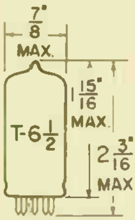
COATED UNIPOTENTIAL CATHODE

HEATER

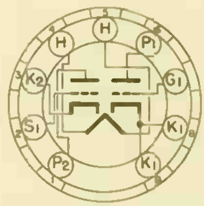
6.3 VOLTS 0.4 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

SMALL BUTTON 9 PIN BASE

9FC

THE 6CX7 IS A MEDIUM MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR OPERATION AS A CASCODE (VHF) AMPLIFIER. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, IT IS IDENTICAL TO THE 4CX7.

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	6.3	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

[A] SHIELD #315 CONNECTED TO GROUND.

[C] UNDER CUTOFF CONDITIONS WHEN THE TUBE IS USED AS A CASCODE AMPLIFIER, THIS RATING MAY BE AS HIGH AS 300 VOLTS MAXIMUM.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D.
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
EACH SECTION

CATHODE CURRENT (MAX.)	20	MA.
GRID CIRCUIT RESISTANCE (MAX.)	0.5	MEGOHM

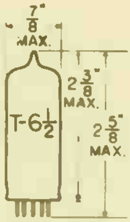
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER - EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	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

TRIODE-PENTODE

MINIATURE TYPE



GLASS BULB

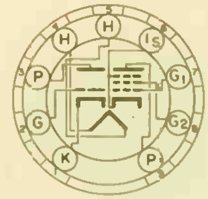
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.75 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON 9 PIN BASE

9DX

THE 6CX8 IS A SHARP-CUTOFF PENTODE AND A MEDIUM-MU TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS INTENDED PRIMARILY FOR USE AS A VIDEO AMPLIFIER. THE TRIODE SECTION IS SUITABLE FOR A 4.5 MEGACYCLE SOUND IF AMPLIFIER, SWEEP OSCILLATOR, SYNC SEPARATOR, SYNC AMPLIFIER, OR SYNC CLIPPER. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6CX8 IS IDENTICAL TO THE 8CX8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE SECTION:		
GRID #1 TO PLATE	0.06	μμf
INPUT	9.0	μμf
OUTPUT	4.4	μμf
TRIODE SECTION:		
GRID TO PLATE	4.4	μμf
INPUT	2.2	μμf
OUTPUT	0.38	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	.005	μμf
TRIODE GRID TO PENTODE PLATE (MAX.)	.018	μμf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.17	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	6.3±10%	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	330	---	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	5.0	2.0	WATTS
MAXIMUM SCREEN DISSIPATION	1.1	---	WATTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. SEPTEMBER 1, 1957 PLATE #5061

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

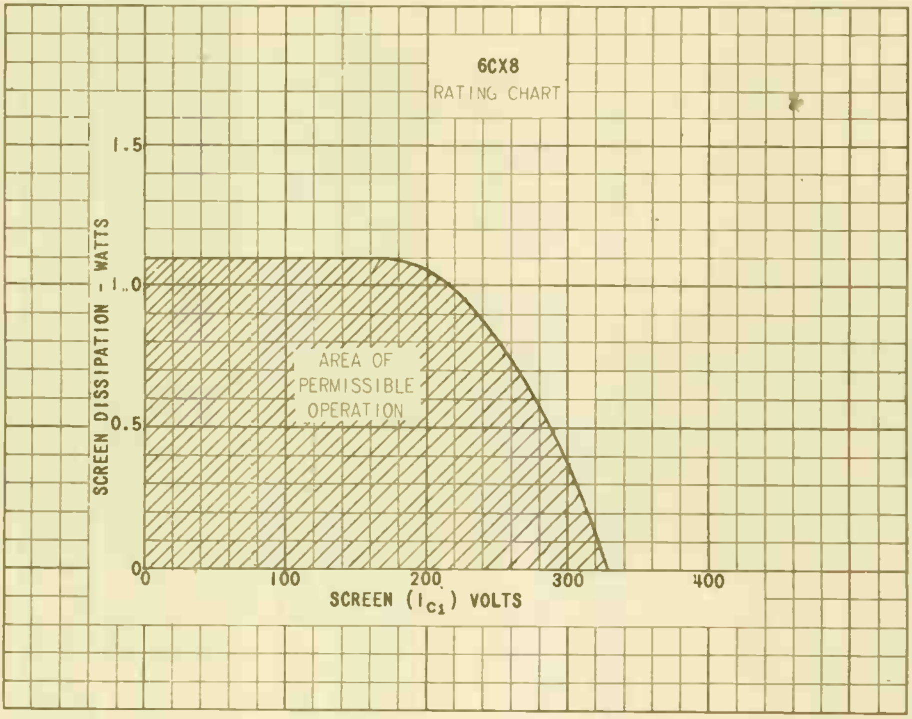
	PENTODE SECTION	TRIODE SECTION	
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
WITH FIXED BIAS	0.25	0.5	MEGOHMS
WITH CATHODE BIAS	1.0	1.0	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

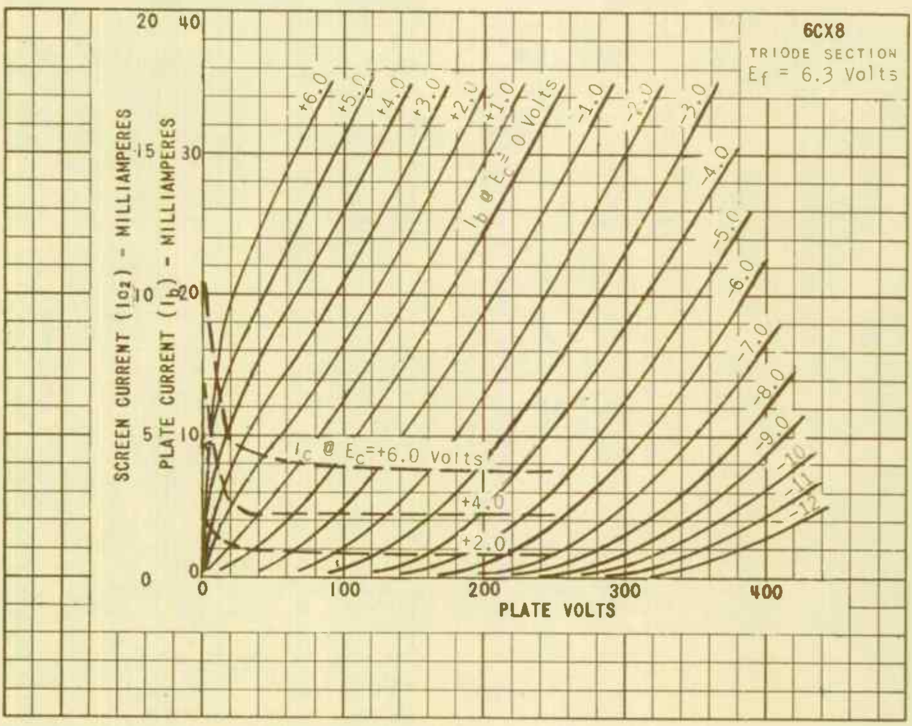
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

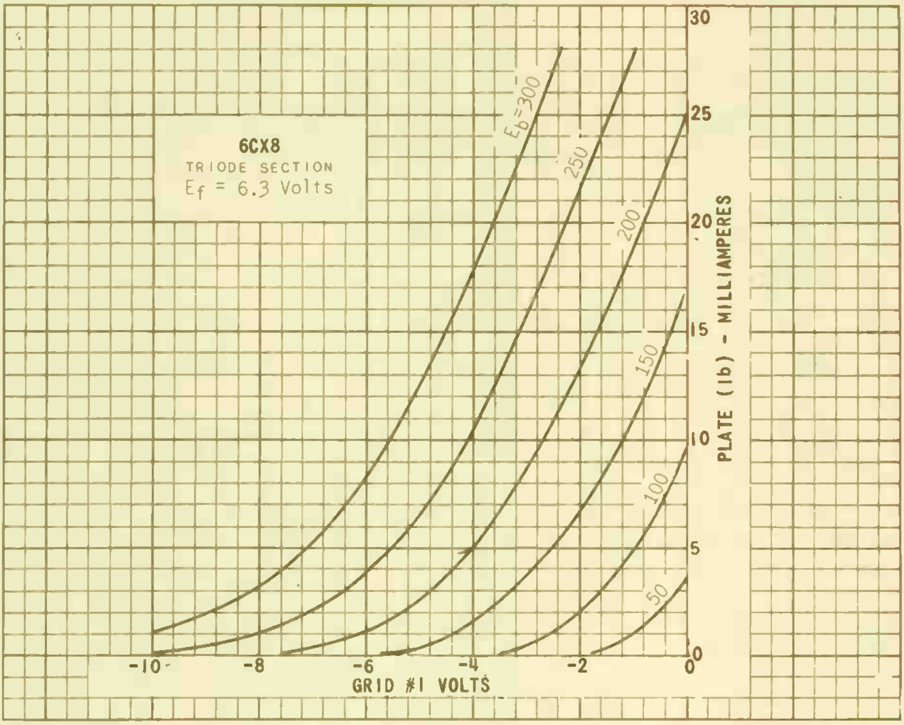
CLASS A_1 AMPLIFIER

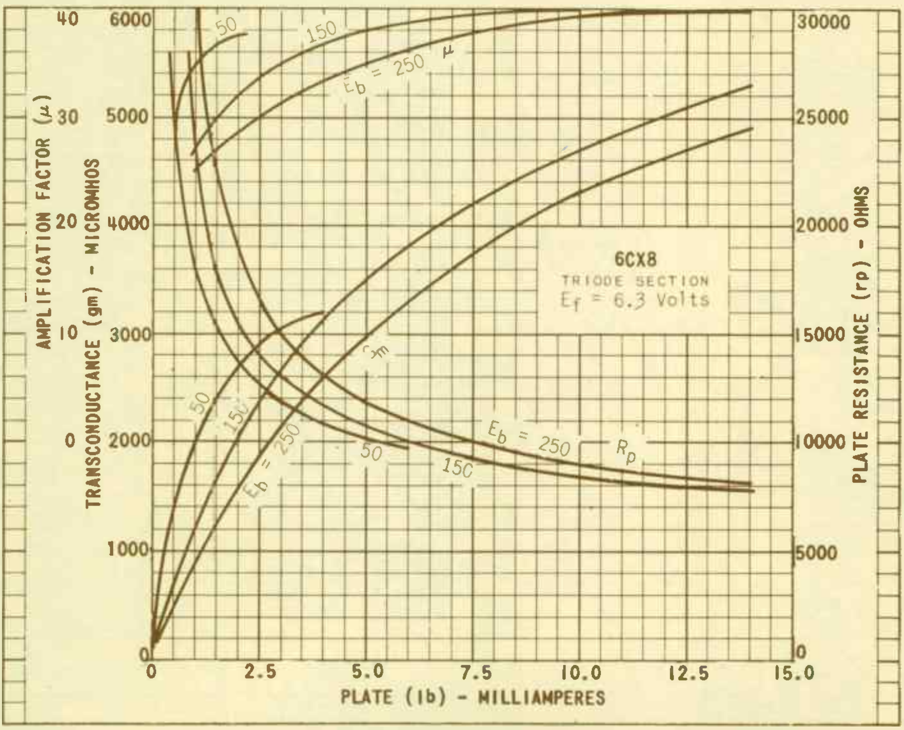
		PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	6.3±10%	6.3±10%	6.3±10%	VOLTS
HEATER CURRENT	0.75	0.75	0.75	AMP.
PLATE VOLTAGE	40	200	150	VOLTS
SCREEN VOLTAGE	125	125	---	VOLTS
GRID #1 VOLTAGE	0[A]	---	---	VOLTS
CATHODE-BIAS RESISTOR	---	68	150	OHMS
AMPLIFICATION FACTOR	---	---	40	
PLATE RESISTANCE (APPROX.)	---	70 000	8 700	OHMS
TRANSCONDUCTANCE	---	10 000	4 600	μMHOS
PLATE CURRENT	40	24	9.2	MA.
SCREEN CURRENT	15.5	5.2	---	MA.
GRID #1 VOLTAGE (APPROX.)				
Ib = 100μA.	---	-8.5	-5.0	VOLTS

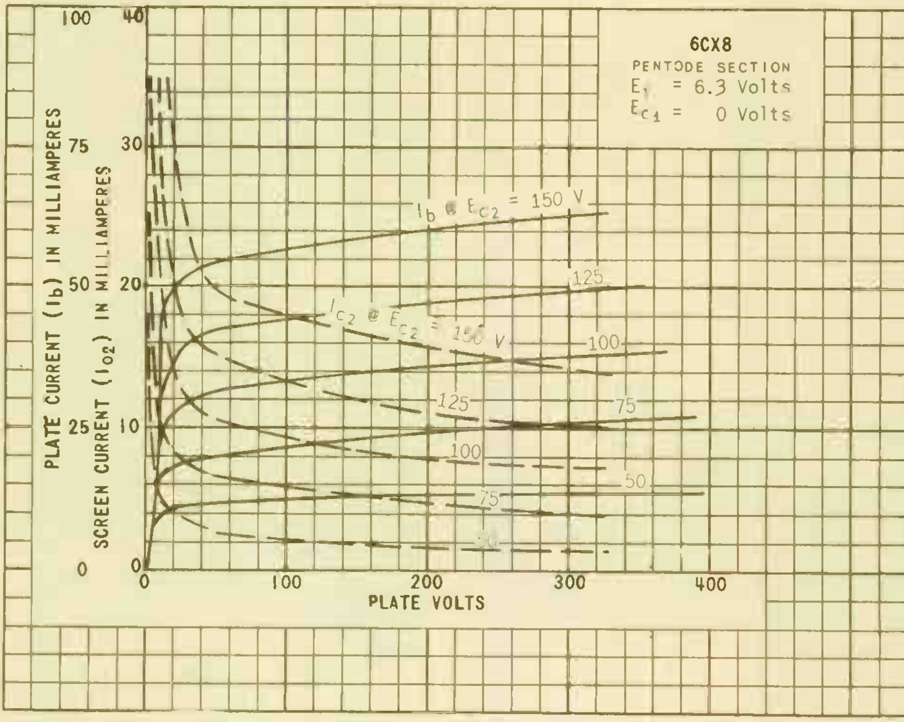
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH 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.

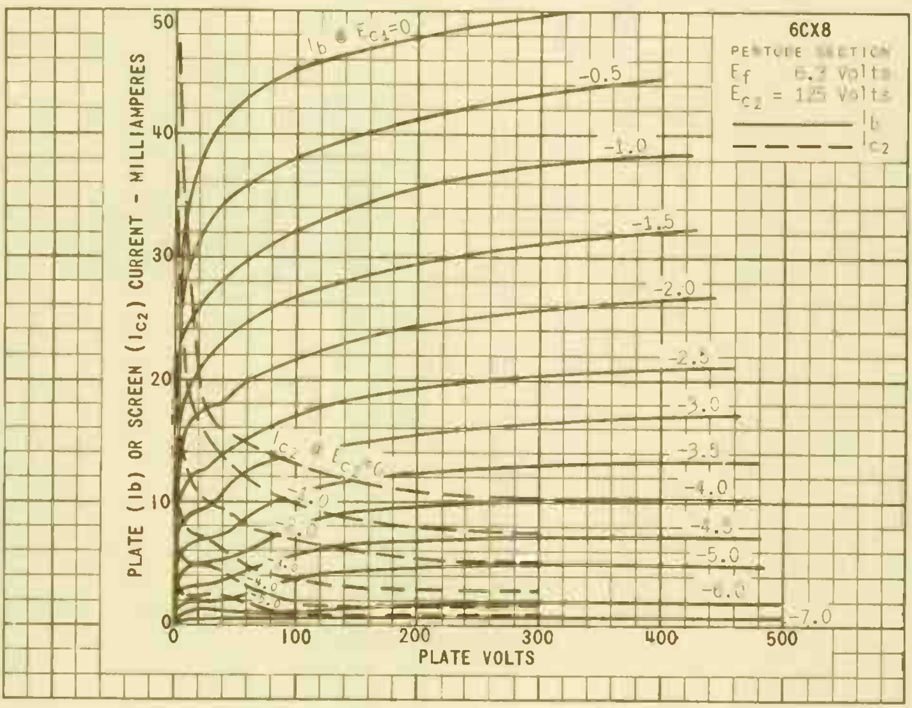

6CX8
RATING CHART
SCREEN DISSIPATION - WATTS
1.5
1.0
0.5
0
AREA OF
PERMISSIBLE
OPERATION
0
100
200
300
400
SCREEN (E_{C1}) VOLTS

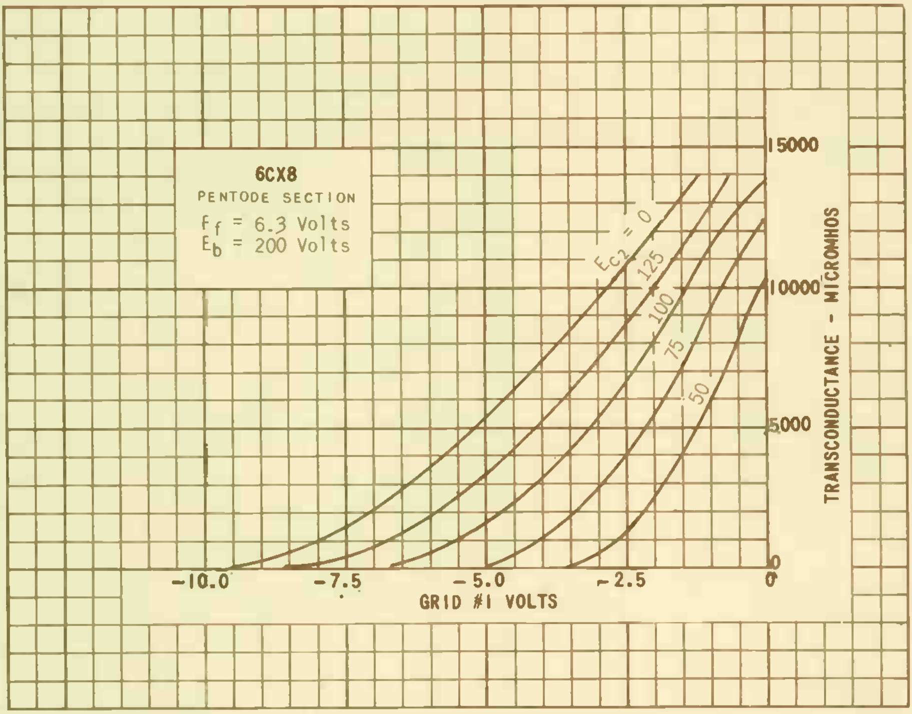

6CX8
TRIODE SECTION
E_f = 6.3 Volts
SCREEN CURRENT (I_{C2}) - MILLIAMPERES
PLATE CURRENT (I_b) - MILLIAMPERES
20 40
15 30
10 20
5 10
0 0
+6.0
+5.0
+4.0
+3.0
+2.0
+1.0
I_b @ E_c = 0 Volts
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10
-11
-12
I_c @ E_c=+6.0 Volts
+4.0
+2.0
0
100
200
300
400
PLATE VOLTS

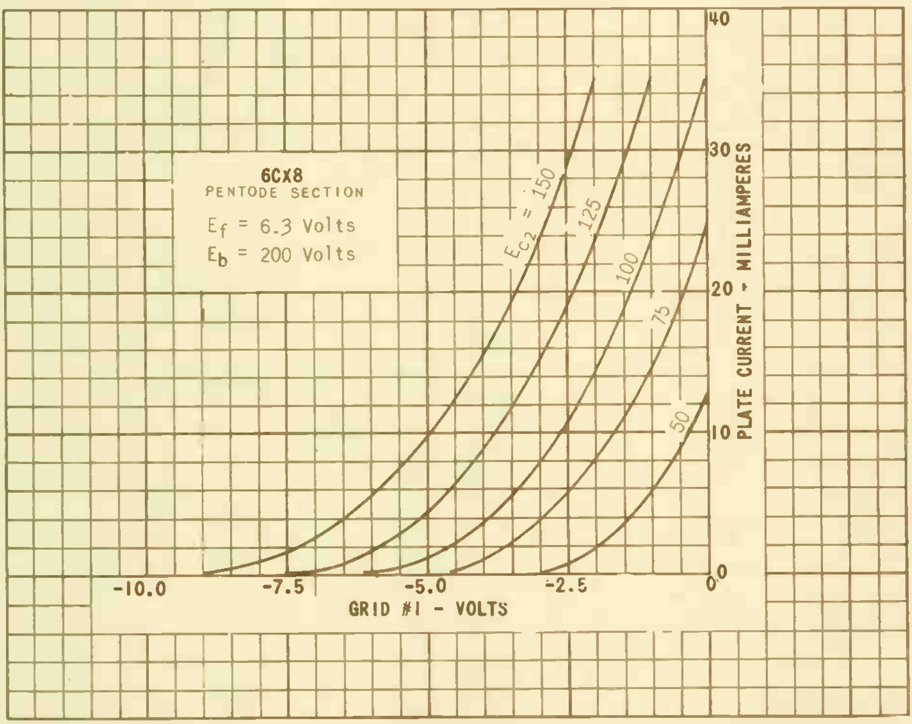

6CX8
TRIODE SECTION
Ef = 6.3 Volts
Eb=300
250
200
150
100
50
PLATE (Ib) - MILLIAMPERES
30
25
20
15
10
5
0
-10
-8
-6
-4
-2
0
GRID #1 VOLTS

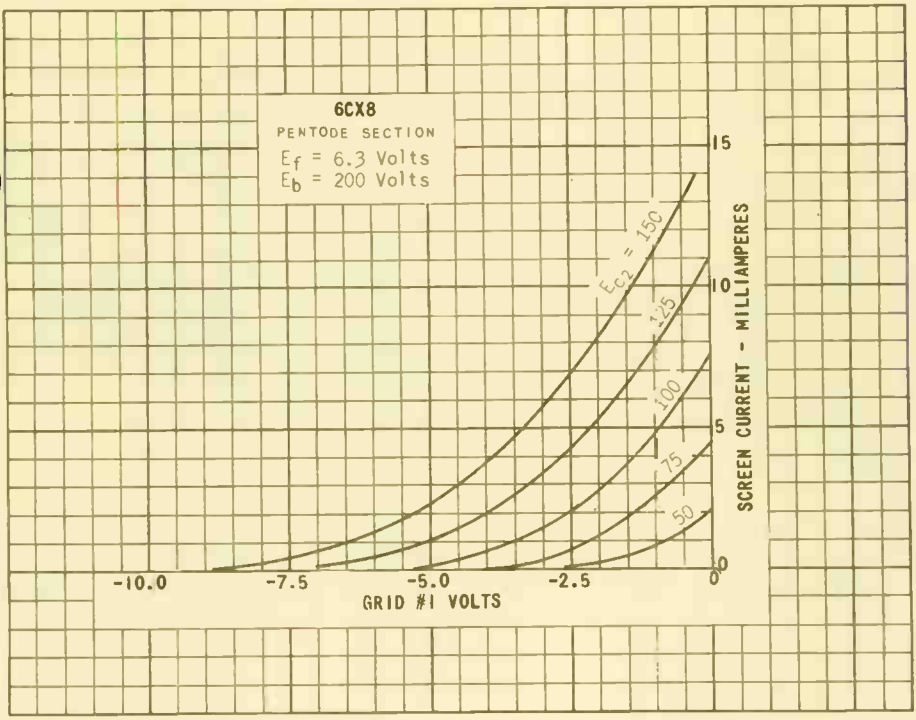

6CX8
TRIODE SECTION
Ef = 6.3 Volts
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE RESISTANCE (rp) - OHMS
PLATE (Ib) - MILLIAMPERES
Eb = 250 μ
150
50
gm
Eb = 250
15C
50
Eb = 250 Rp
40
30
20
10
0
6000
5000
4000
3000
2000
1000
0
30000
25000
20000
15000
10000
5000
0
0
2.5
5.0
7.5
10.0
12.5
15.0


6CX8
PENTODE SECTION
Ef = 6.3 Volts
Ec1 = 0 Volts
Ib @ Ec2 = 150 V
125
100
75
50
Ic2 @ Ec2 = 150 V
125
100
75
PLATE CURRENT (Ib) IN MILLIAMPERES
SCREEN CURRENT (Ic2) IN MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
10
20
30
40
25
50
75
100

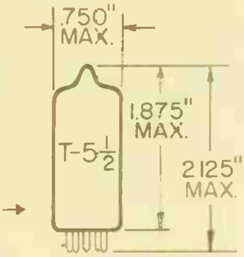

6CX8
PENTODE SECTION
Ef = 6.3 Volts
Ec2 = 125 Volts
Ib
Ic2
Ib @ Ec1=0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-6.0
-7.0
Ic2 @ Ec1=0
PLATE (Ib) OR SCREEN (Ic2) CURRENT - MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
10
20
30
40
50


6CX8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c_2} = 0
125
100
75
50
15000
10000
5000
0
TRANSCONDUCTANCE - MICROMHOS
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS


6CX8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c_2} = 150
125
100
75
50
40
30
20
10
0
PLATE CURRENT - MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 - VOLTS


6CX8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150
125
100
75
50
15
10
5
0
SCREEN CURRENT - MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS

TUNG-SOL



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 6-2

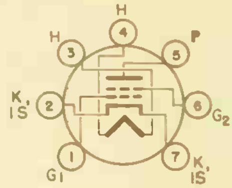
TETRODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±0.6 VOLTS 0.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7EW

THE 6CY5 IS A SHARP-CUTOFF TETRODE IN THE 7-PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR SERVICE IN VHF TUNERS OF TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6CY5 IS IDENTICAL TO THE 2CY5, 3CY5 AND 4CY5.

DIRECT INTERELECTRODE CAPACITANCES[A]

GRID #1 TO PLATE	0.03	$\mu\mu f$
INPUT	4.5	$\mu\mu f$
OUTPUT	3.0	$\mu\mu f$

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

[A] WITH SHIELD #316 CONNECTED TO CATHODE.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

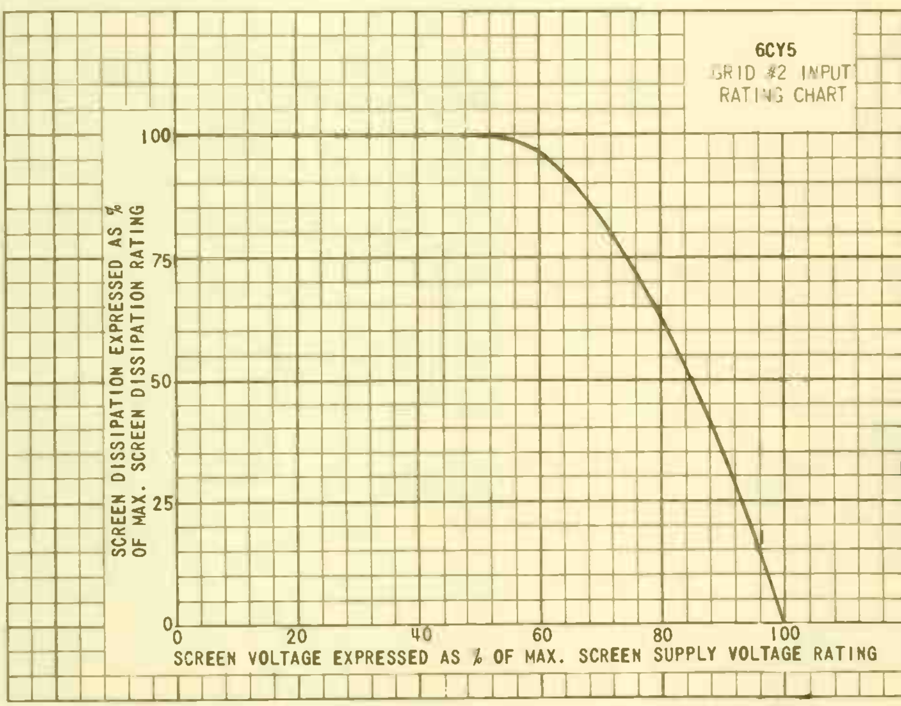
TUNG-SOL

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.

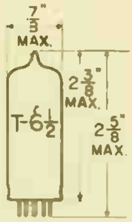
[C] PLATE CURRENT 20 μA.



TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

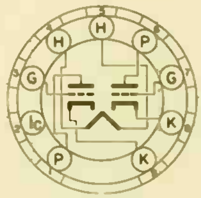


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 0.75 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE

9LG ←

THE 6CY7 IS A DISSIMILAR DOUBLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION AND IS INTENDED FOR USE AS A COMBINED VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6CY7 IS IDENTICAL TO THE 8CY7.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.●

	SEC. 1	SEC. 2	
GRID TO PLATE	1.8	4.4	μμf
INPUT	1.5	5.0	μμf
OUTPUT	0.30	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	VERTICAL-OSCILLATOR SERVICE (SEC. 1) B	VERTICAL-DEFLECTION AMPLIFIER (SEC. 2) B	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	350	350	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	---	1 800	VOLTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	5.5 A	WATTS
MAXIMUM DC CATHODE CURRENT	---	35	MA.
MAXIMUM DC PEAK CATHODE CURRENT	---	120	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
MAXIMUM GRID CIRCUIT RESISTANCE			
WITH FIXED BIAS	2.2	---	MEGOHMS
WITH CATHODE BIAS	2.2	2.2	MEGOHMS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

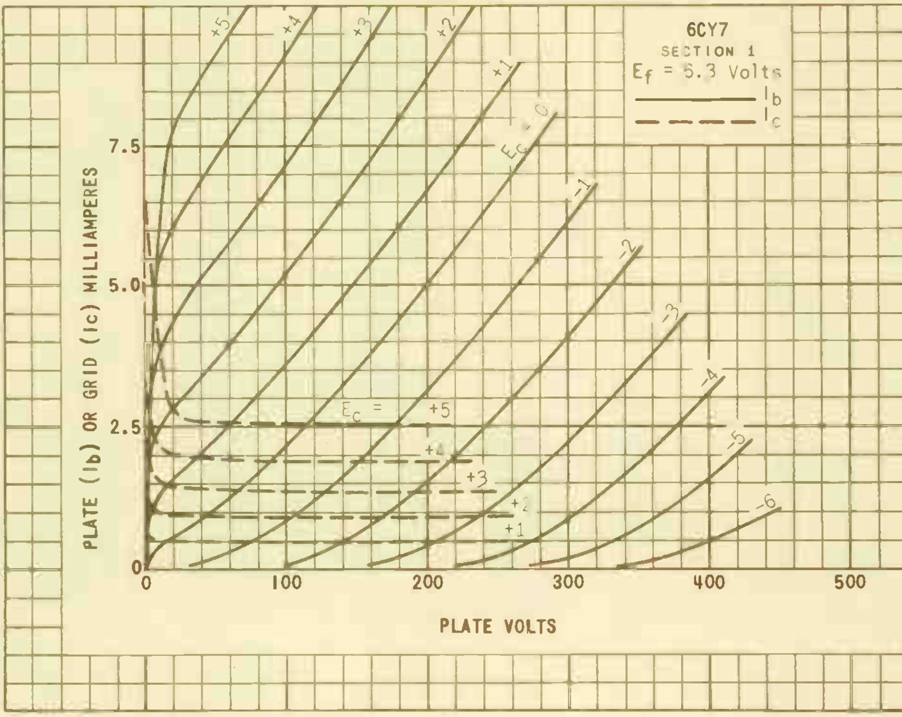
	SECTION 1 (OSCILLATOR)		SECTION 2 (AMPLIFIER)	
HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.75	0.75	0.75	AMP.
PLATE VOLTAGE	250	60	150	VOLTS
GRID VOLTAGE	-3.0	0	---	VOLTS
CATHODE-BIAS RESISTOR	---	---	620	OHMS
AMPLIFICATION FACTOR	68	---	5.0	
PLATE RESISTANCE (APPROX.)	52 000	---	920	OHMS
TRANSCONDUCTANCE	1 300	---	5 400	µMHOS
PLATE CURRENT	1.2	80	30	MA.
PLATE CURRENT (APPROX.) E_c=-30V.	---	---	3.5	MA.
GRID VOLTAGE (APPROX.) I_b=200 µA.	---	---	-40	VOLTS
GRID VOLTAGE (APPROX.) I_b=10 µA.	-5.5	---	---	VOLTS

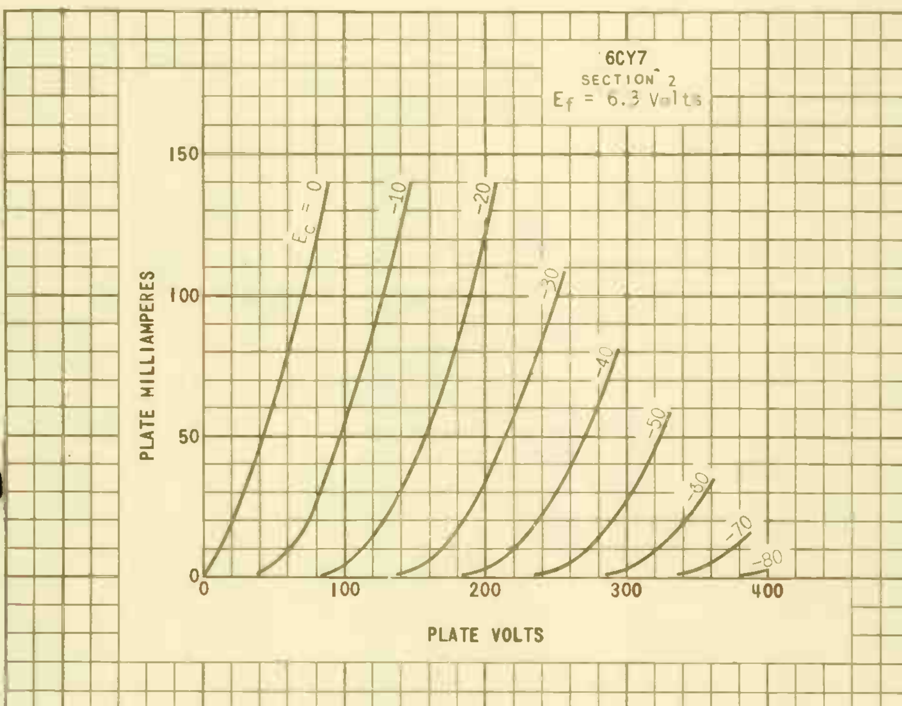
⊕ WITHOUT EXTERNAL SHIELD.

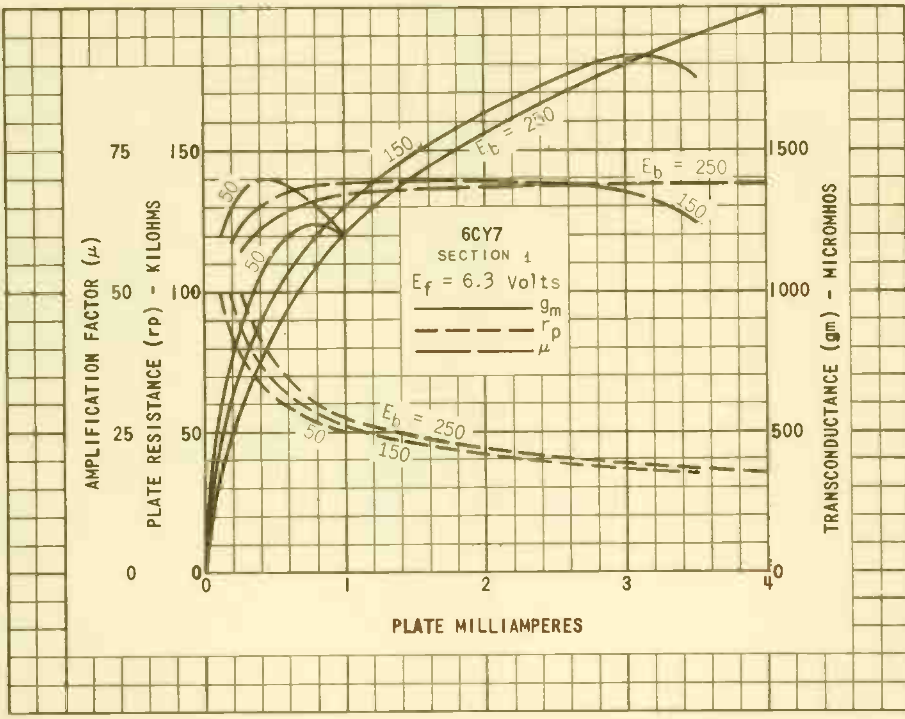
A IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

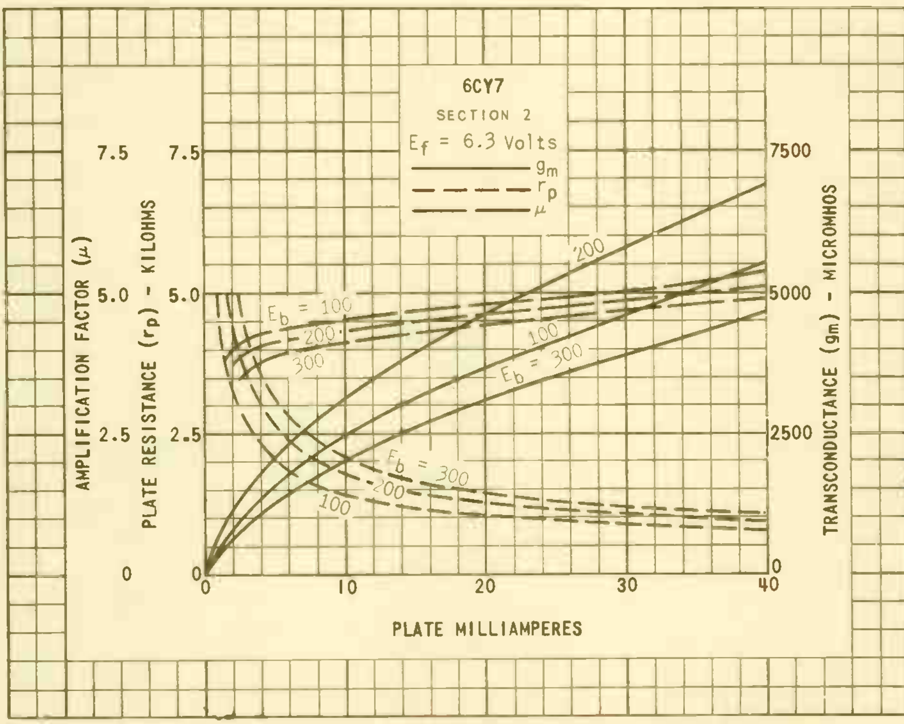
B FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

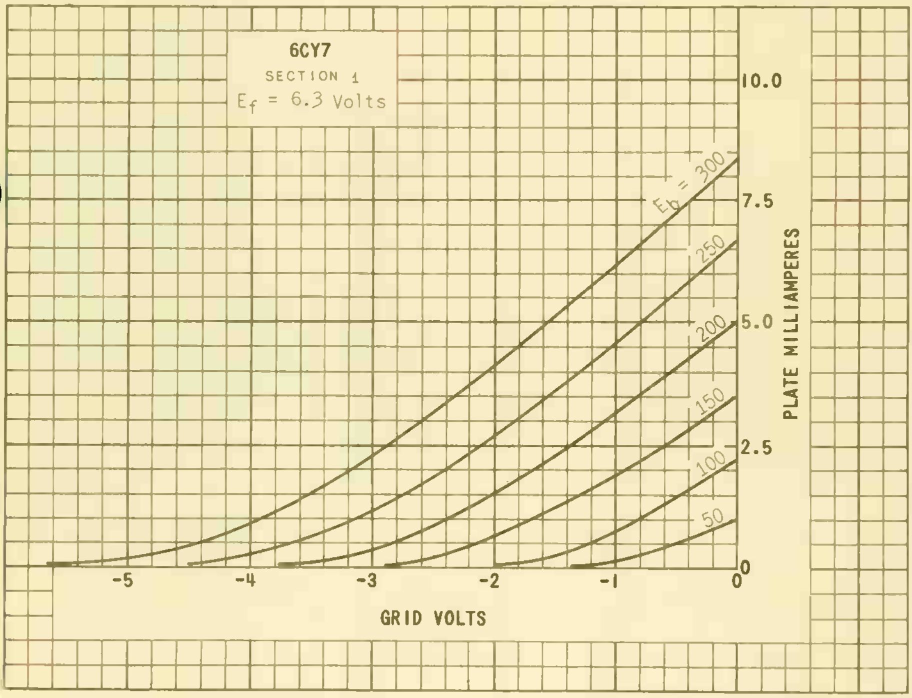
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH 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.

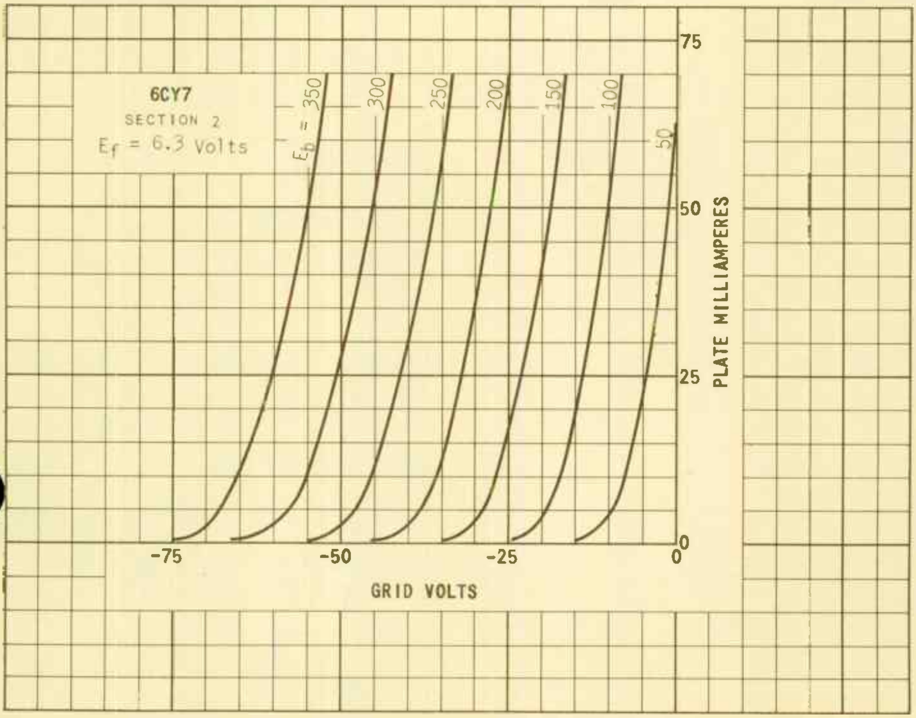

6CY7
SECTION 1
E_f = 6.3 Volts
I_b
I_c
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
E_c = 0
E_c = +5


6CY7
SECTION 2
E_f = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_c = 0


6CY7
SECTION 1
Ef = 6.3 Volts
gm
rp
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (rp) - KILOHMS
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE MILLIAMPERES
75 150
50 100
25 50
0 0
1500
1000
500
0
0 1 2 3 4
Eb = 250
150
50
Eb = 250
150
50
Eb = 250
50
150


6CY7
SECTION 2
Ef = 6.3 Volts
gm
rp
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (rp) - KILOHMS
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE MILLIAMPERES
7.5 7.5
5.0 5.0
2.5 2.5
0 0
7500
5000
2500
0
0 10 20 30 40
Eb = 100
200
300
200
100
Eb = 300
Eb = 300
200
100

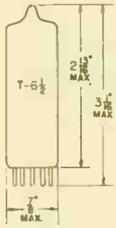

6CY7
SECTION 1
E_f = 6.3 Volts
E_b = 300
250
200
150
100
50
PLATE MILLIAMPERES
10.0
7.5
5.0
2.5
0
-5
-4
-3
-2
-1
0
GRID VOLTS


6CY7
SECTION 2
E_f = 6.3 Volts
E_b = 350
300
250
200
150
100
50
PLATE MILLIAMPERES
75
50
25
0
-75
-50
-25
0
GRID VOLTS

TUNG-SOL

BEAM POWER PENTODE

MINIATURE TYPE

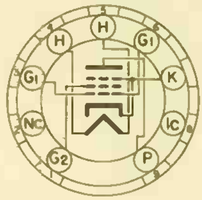


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN NOVAL

9HN

THE 6CZ5 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+G3+G2+H)	9.0 ←	μμf
PLATE TO: (K+G3+G2+H)	6.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VERTICAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	6.3	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.

TUNG-SOL

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	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	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.

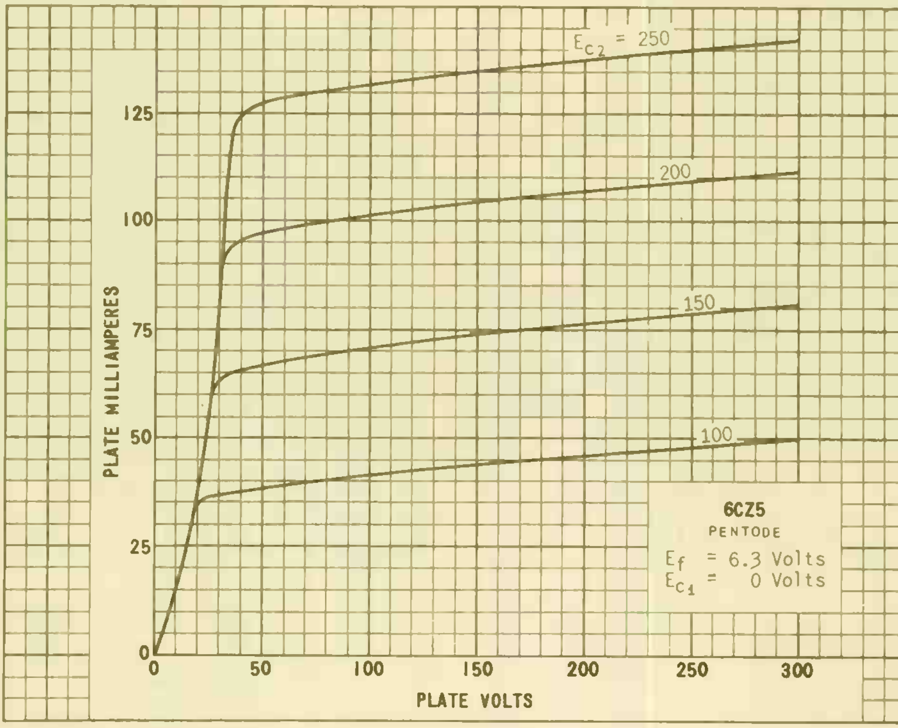
[D] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

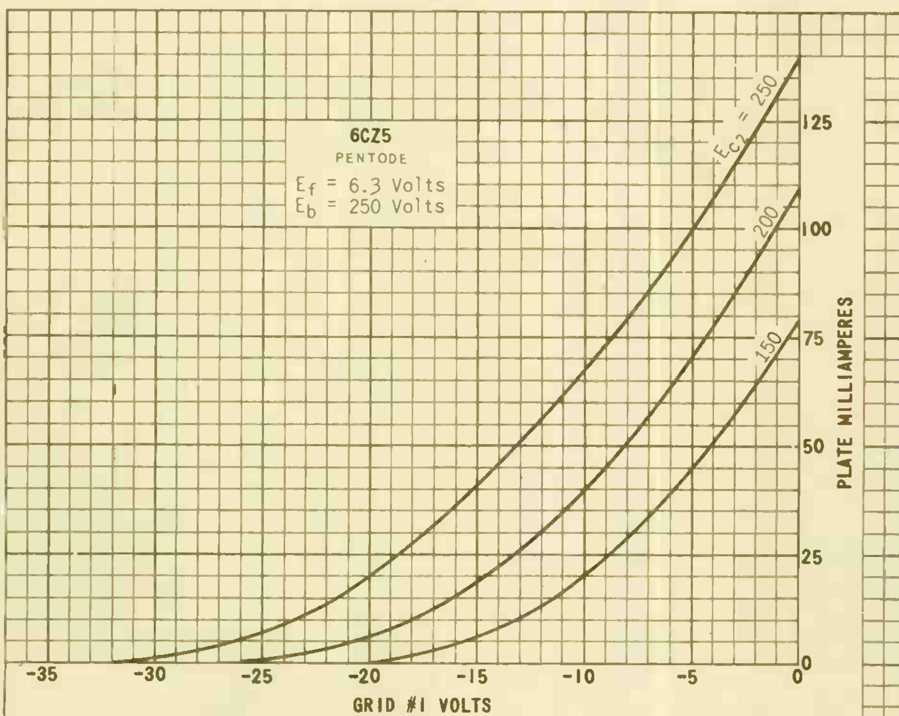
[E] SUBSCRIPT 1 INDICATES THAT GRID #1 CURRENT DOES NOT FLOW DURING ANY PART OF THE INPUT CYCLE.

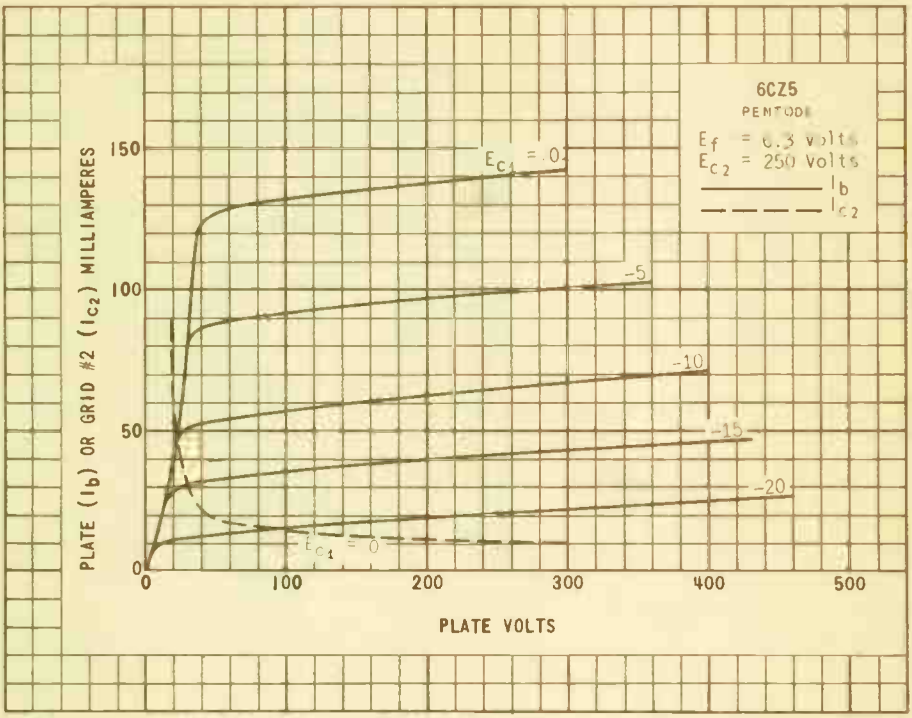
[F] THE TYPE OF INPUT COUPLING NETWORK USED SHOULD NOT INTRODUCE TOO MUCH RESISTANCE IN THE GRID #1 CIRCUIT. TRANSFORMER OR IMPEDANCE-COUPLING DEVICES ARE RECOMMENDED

[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.


E_{c_2} = 250
200
150
100
PLATE MILLIAMPERES
125
100
75
50
25
0
0
50
100
150
200
250
300
PLATE VOLTS
6CZ5
PENTODE
E_f = 6.3 Volts
E_{c_1} = 0 Volts


6CZ5
PENTODE
E_f = 6.3 Volts
E_b = 250 Volts
E_{c_2} = 250
200
150
PLATE MILLIAMPERES
125
100
75
50
25
0
-35
-30
-25
-20
-15
-10
-5
0
GRID #1 VOLTS


6CZ5
PENTODE
E_f = 6.3 volts
E_{c_2} = 250 Volts
I_b
I_{c2}
E_{c_1} = 0
-5
-10
-15
-20
E_{c_1} = 0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
50
100
150
0
100
200
300
400
500
PLATE VOLTS