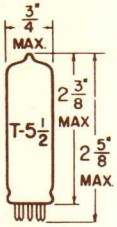
TECHNICAL DATA
ELECTRON TUBES

PUBLISHED BY
TUNG-SOL
ELECTRIC INC.

TUNG-SOL

TRIODE

MINIATURE TYPE

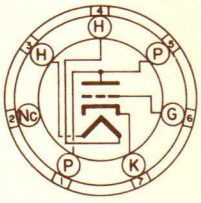


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6BG

THE 12G4 IS A MEDIUM MU TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. ITS ELECTRICAL CHARACTERISTICS ARE IDENTICAL WITH THOSE OF TYPE 12J5GT.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
GRID TO PLATE	3.4	3.4	μμf
INPUT	2.4	2.6	μμf
OUTPUT	0.9	3.2	μμf

[A] WITH SHIELD #308 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

DESIGN CENTER VALUES

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

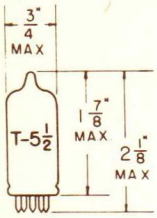
HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	-8	VOLTS
PLATE CURRENT	10	9	MA.
TRANSCONDUCTANCE	3 000	2 600	μMHOS
AMPLIFICATION FACTOR	20	20	
GRID VOLTAGE FOR 10 μA. PLATE CURRENT	-7	-18	VOLTS

PRINTED IN U. S. A.

TUNG-SOL

HEPTODE

MINIATURE TYPE



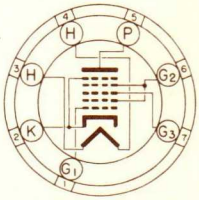
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CH

THE 12GA6 IS A MINIATURE HEPTODE PRIMARILY INTENDED TO PERFORM THE COMBINED FUNCTIONS OF MIXER AND OSCILLATOR IN AUTOMOBILE RADIO RECEIVERS. THE TUBE IS SPECIALLY DESIGNED TO OPERATE WITH PLATE AND SCREEN VOLTAGES SUPPLIED DIRECTLY FROM A 12-VOLT STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
GRID #3 TO ALL	8.0	8.0	μμf
PLATE TO ALL	13	8.0	μμf
GRID #1 TO ALL	5.0	5.0	μμf
CATHODE TO ALL EXCEPT GRID #1	20	15	μμf
GRID #3 TO PLATE, MAX.	0.25	0.3	μμf
GRID #1 TO GRID #3 , MAX.	0.15	0.15	μμf
GRID #1 TO PLATE, MAX.	0.05	0.1	μμf
GRID #1 TO CATHODE	2.5	2.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE[B]	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	16	VOLTS
MAXIMUM SCREEN VOLTAGE	16	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE	16	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	16	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	16	VOLTS
MAXIMUM GRID #3 CIRCUIT RESISTANCE	10	MEG.

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

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	12.6	VOLTS
SCREEN VOLTAGE	12.6	VOLTS
GRID #3 SUPPLY VOLTAGE	0	VOLTS
GRID #3 RESISTOR (BYPASSED)	2.2	MEG.
GRID #1 VOLTAGE, RMS, APPROX.	1.6	VOLTS
GRID #1 RESISTOR	33000	OHMS
PLATE RESISTANCE, APPROX.	1.0	MEG.
CONVERSION TRANSCONDUCTANCE	140	μMHOS
PLATE CURRENT	0.30	MA.
SCREEN CURRENT	0.80	MA.
GRID #1 CURRENT	0.060	MA.
GRID #3 VOLTAGE, APPROX. Gc =5 μMHOS	−3	VOLTS
GRID #3 VOLTAGE, APPROX. Gc = 20 μMHOS	−2.5	VOLTS

OSCILLATOR CHARACTERISTICS – NOT OSCILLATING

PLATE VOLTAGE	12.6	VOLTS
SCREEN, CONNECTED TO PLATE		
SCREEN VOLTAGE	0	VOLTS
GRID #3 VOLTAGE	0	VOLTS
AMPLIFICATION FACTOR[C]	9.0	
TRANSCONDUCTANCE[C]	2400	μMHOS
CATHODE CURRENT	3.6	MA.
GRID #1 VOLTAGE, APPROX. Ib =10 μAMPS.	−3.3	VOLTS

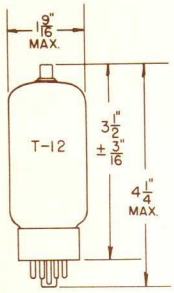
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY TUBE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THESE VALUES ARE CHOSEN BY THE TUBE MANUFACTURER TO PROVIDE ACCEPTABLE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

[B] WHEN USED IN AUTOMOBILE SERVICE FROM A 12 VOLT SOURCE, UNDER NO CIRCUMSTANCES SHOULD THE HEATER VOLTAGE BE LESS THAN 10.0 VOLTS OR MORE THAN 15.9 VOLTS. THESE EXTREME VARIATIONS IN HEATER VOLTAGE MAY BE TOLERATED FOR SHORT PERIODS; HOWEVER, OPERATION AT OR NEAR THESE ABSOLUTE LIMITS IN HEATER VOLTAGE NECESSARILY INVOLVES SACRIFICE IN PERFORMANCE AT LOW HEATER-VOLTAGE AND IN LIFE EXPECTANCY AT HIGH HEATER VOLTAGE. EQUIPMENT RELIABILITY CAN BE SIGNIFICANTLY INCREASED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.

[C] BETWEEN GRID #1 AND GRID NUMBERS 2 & 4 CONNECTED TO PLATE.

TUNG-SOL

PENTODE



GLASS BULB

HEATER

12.6 VOLTS 0.6 AMP.

ANY MOUNTING POSITION

BOTTOM VIEW
SHORT MEDIUM OCTAL
WITH EXTERNAL BARRIERS

8JX

THE 12GC6 IS A HEATER-CATHODE TYPE BEAM PENTODE DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. IT HAS EXTREMELY HIGH PERVEANCE, SUCH THAT THE DESIGN OF WIDE-ANGLE DEFLECTION SYSTEMS IS MADE POSSIBLE WITHOUT THE NECESSITY OF USING AN EXPENSIVE DEFLECTION AMPLIFIER TUBE. EXCEPT FOR HEATER CHARACTERISTICS, THE 12GC6 IS IDENTICAL TO THE6GC6.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE: (G1 TO P)	0.55	μμf
INPUT: G1 TO (H+K+G2+B.P)	15	μμf
OUTPUT: P TO (H+K+G2+B.P.)	7.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE (BOOST+DC POWER SUPPLY)	770	VOLTS
MAXIMUM GRID #2 VOLTAGE	220	VOLTS
MAXIMUM PLATE DISSIPATION[B]	17.5	WATTS
MAXIMUM GRID #2 DISSIPATION	4.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	175	MA.
MAXIMUM PEAK CATHODE CURRENT	550	MA.
MAXIMUM PEAK POSITIVE PLATE VOLTAGE	6500	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1500	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	330	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.0	MEG.
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220	°C
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH 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*	11.0	SECONDS

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	150	VOLTS
GRID #1 VOLTAGE	-22.5	VOLTS
PLATE CURRENT	75	MA.
GRID #2 CURRENT	2.4	MA.
TRIODE AMPLIFICATION FACTOR[C]	4.1	
TRANSCONDUCTANCE	6600	μMHOS
PLATE RESISTANCE	20000	OHMS
GRID #1 VOLTAGE (APPROX.) FOR Ib= 1 MA. (APPROX.)	-46	VOLTS
ZERO-BIAS: WITH Eb=60 V., AND Ec2 = 150 V.(INSTANTANEOUS VALUE)		
PLATE CURRENT	345	MA.
GRID #2 CURRENT	30	MA.
CUTOFF: FOR Ib= 1MA. WITH E_b =5000 V., AND Ec2 = 150 V (APPROX. VALUE)	-100	VOLTS

A. FOR OPERATION IN A 525 LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARD 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 GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

C. Eb=Ec2=150 VOLTS.

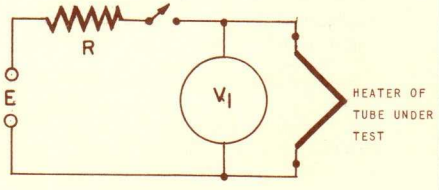
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE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

* 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).

E = 50 Volts (RMS or DC)

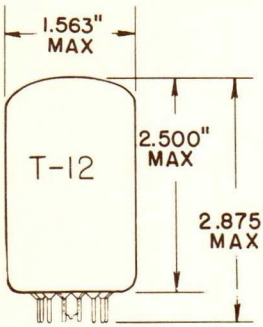
V_1 = 10.0 Volts (RMS or DC)

R = 63 Ohms



TUNG-SOL

BEAM PENTODE
COMPACTRON



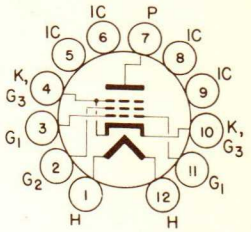
GLASS BULB

BUTTON
12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12-56

COATED UNIPOTENTIAL CATHODE

FOR HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS IN T.V. RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12BJ

THE 12GE5 IS A BEAM-POWER PENTODE IN THE COMPACT 12 PIN, T-12 CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.
EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 12GE5 IS IDENTICAL TO THE 6GE5.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: (G1 TO P)	0.34	pf
INPUT: G1 TO ($H+K+G2+B.P.$)	16	pf
OUTPUT: P TO ($H+K+G2+B.P.$)	7.0	pf

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

AVERAGE CHARACTERISTICS	12.6 VOLTS	600	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME[□]		11	SECONDS

□HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 50% 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.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE•

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY))	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1500	VOLTS
GRID #2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID #1 VOLTAGE	330	VOLTS
PLATE DISSIPATION[A]	17.5	WATTS
GRID #2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	175	MA.
PEAK CATHODE CURRENT	550	MA.
GRID #1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	60	250	VOLTS
GRID #2 VOLTAGE	150	150	VOLTS
GRID #1 VOLTAGE	0[B]	-22.5	VOLTS
PLATE RESISTANCE, APPROX.	---	20,000	OHMS
TRANSCONDUCTANCE	---	6600	μMHOS
PLATE CURRENT	345	75	MA.
GRID #2 CURRENT	33	2.4	MA.
GRID #1 VOLTAGE, APPROX. I_b = 1.0 MA.	---	-46	VOLTS
TRIODE AMPLIFICATION FACTOR G2 TIED TO PLATE, $E_b = E_{c2}$ =150 V., E_{c1} =-22.5 V.	---	4.1	

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

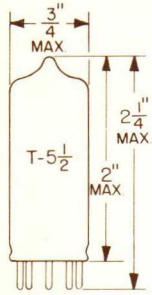
A IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

B APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

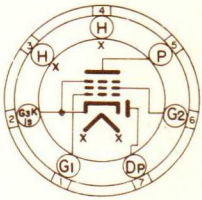
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7FW

THE 12GN6 IS A REMOTE-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS A HIGH GAIN R.F. OR I.F. AMPLIFIER AND A DEMODULATOR DIODE BOTH ON A COMMON CATHODE. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 12GN6 IS IDENTICAL TO THE 6GN6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH [A] SHIELD	WITHOUT SHIELD	
GRID #1 TO PLATE (MAX.)	.0035	.0035	μμf
INPUT	5.5	5.5	μμf
OUTPUT	5.5	5.0	μμf
COUPLING DIODE PLATE TO GRID (MAX.)	.05	.05	μμf

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

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	300	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.6	WATTS
MAXIMUM DIODE CURRENT (CONTINUOUS OPERATION)	1.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	---	VOLTS
TOTAL DC PLUS PEAK	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC PLUS PEAK	100	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

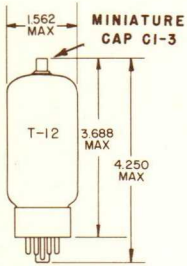
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	100	250	VOLTS
SUPPRESSOR, CONNECTED TO CATHODE AT SOCKET			
SCREEN VOLTAGE	100	100	VOLTS
CATHODE-BIAS RESISTOR	68	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	1.0	MEGOHMS
TRANSCONDUCTANCE	4300	4400	μMHOS
PLATE CURRENT	10.8	11	MA.
SCREEN CURRENT	4.4	4.2	MA.
GRID #1 VOLTAGE (APPROX.) G_m = 40 μMHOS	-20	-20	VOLTS
AVERAGE DIODE CURRENT AT 10V D.C.	1.5	1.5	MA.

TUNG-SOL

BEAM PENTODE



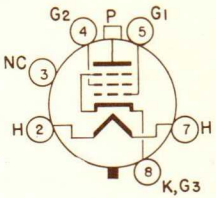
GLASS BULB

SHORT MEDIUM SHELL
5 OR 6 PIN OCTAL WITH
EXTERNAL BARRIERS
STYLE B: B6-122 OR B5-190

FOR
HORIZONTAL-DEFLECTION-AMPLIFIER
CIRCUITS IN TELEVISION RECEIVERS

ANY MOUNTING POSITION

PIN #3 IS OMITTED WHEN B5-190 BASE IS USED



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6AM

THE 12GW6 IS A BEAM POWER PENTODE EMPLOYING A T-12 ENVELOPE. IT IS DESIGNED ESPECIALLY FOR USE IN HORIZONTAL-DEFLECTION-AMPLIFIER CIRCUITS OF TELEVISION RECEIVERS WHICH OPERATE WITH LOW PLATE SUPPLY VOLTAGES.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	pf
GRID #1 TO CATHODE, GRID #3, GRID #2 & HEATER	17	pf
PLATE TO CATHODE, GRID #3, GRID #2 & HEATER	7	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6	VOLTS	600	MA.
HEATER WARM-UP TIME*			11	SECONDS
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

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
PEAK POSITIVE-PULSE PLATE VOLTAGE [B]	6500	VOLTS
PEAK NEGATIVE-PULSE PLATE VOLTAGE	1500	VOLTS
DC GRID #2 VOLTAGE	220	VOLTS
DC GRID #1 VOLTAGE	-55	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS-CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PEAK NEGATIVE-PULSE GRID #1 VOLTAGE	330	VOLTS
CATHODE CURRENT:		
PEAK	550	MA.
AVERAGE	175	MA.
PLATE DISSIPATION[C]	17.5	WATTS
GRID #2 INPUT	3.5	WATTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	240	°C

MAXIMUM CIRCUIT VALUES:

GRID #1 CIRCUIT RESISTANCE[C]	1.0	MEGOHM

CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	60	250	VOLTS
GRID #2 VOLTAGE	150	150	VOLTS
GRID #1 VOLTAGE	0	-22.5	VOLTS
MU-FACTOR, GRID #2 TO GRID #1 WITH PLATE CONNECTED TO GRID #2, PLATE VOLTS = GRID #2 VOLTS =150, AND GRID #1 VOLTS =-22.5	---	4.4	
PLATE RESISTANCE (APPROX.)	---	15000	OHMS
TRANSCONDUCTANCE	---	7100	μMHOS
PLATE CURRENT	→390[D]	70	MA.
GRID #2 CURRENT	32[D]	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 1 MA.		42	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
THE DC COMPONENT MUST NOT EXCEED 100 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 POLSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.
15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

C
IN STAGES OPERATING WITH GRID-RESISTOR BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

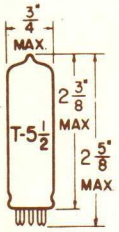
D
THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RECURRENT WAVE FORM SUCH THAT THE CATHODE CURRENT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

→ INDICATES A CHANGE.

TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

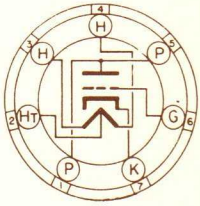
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS	6.3 VOLTS
0.15 AMP.	0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7DW

THE 12H4 IS A MINIATURE GENERAL PURPOSE TRIODE VOLTAGE AMPLIFIER. FEATURING A HEATER CONSTRUCTION WHICH PERMITS OPERATION AT EITHER 6 OR 12 VOLTS SUPPLY. THIS TUBE IS NOT PARTICULARLY SUITED TO HIGH FREQUENCY SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE	3.4	3.4	μμf
INPUT	2.6	2.4	μμf
OUTPUT	3.2	0.9	μμf

[A] SHIELD #316 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DESIGN CENTER VALUES

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE	±90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
DC PLATE VOLTAGE	90	250	VOLTS
DC GRID VOLTAGE	0	−8	VOLTS
PLATE CURRENT	10	9	MA.
TRANSCONDUCTANCE	3 000	2 600	μMHOS
AMPLIFICATION FACTOR	20	20	
GRID VOLTAGE FOR 10 μA. PLATE CURRENT	−7	−18	VOLTS

SIMILAR TYPE REFERENCE: Electrically similar to 1/2 of type 6SN7GT.

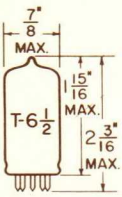
→ INDICATES A CHANGE.

PRINTED IN U. S. A.

TUNG-SOL

DOUBLE-DIODE-TETRODE

MINIATURE TYPE

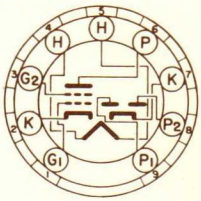


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.325 AMP. ←
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9GC

THE 12J8 IS A MINIATURE DOUBLE-DIODE TETRODE DESIGNED FOR USE IN AUTOMOBILE RECEIVERS. IT IS RATED FOR OPERATION FROM A 12.0 VOLT BATTERY SOURCE.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

TETRODE

GRID TO PLATE	0.70 ←	μμf
INPUT: G_1 TO (H+TK+G_2)	10.5 ←	μμf
OUTPUT: P TO (H+TK+G_2)	4.4 ←	μμf
		μμf
#2 DIODE PLATE TO TETRODE GRID #1 (MAX.)	0.015	μμf
#1 DIODE PLATE TO TETRODE GRID #1 (MAX.)	0.04	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE[A]	12.6	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	30	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	30	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM GRID #2 VOLTAGE	30	VOLTS
MAXIMUM GRID #1 RESISTANCE	10	MEGOHMS
MAXIMUM AVERAGE DIODE CURRENT (EACH DIODE)	5.0	MA.

[A] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

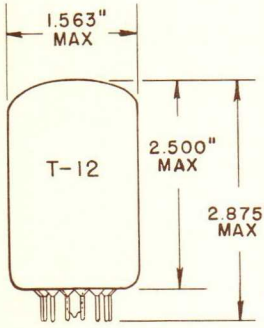
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.325 ←	AMP.
GRID #1 VOLTAGE	0	VOLTS
GRID #2 VOLTAGE	12.6	VOLTS
GRID #1 RESISTOR	2.2	MEGOHMS
GRID #1 RESISTOR BYPASS CONDENSER	1.0	μf
TRANSCONDUCTANCE	5 500 ←	μMHOS
PLATE RESISTANCE (APPROX.)	6 000 ←	OHMS
ZERO SIGNAL PLATE CURRENT	12 ←	MA.
ZERO SIGNAL GRID #2 CURRENT	1.5 ←	MA.
AF GRID #1 VOLTAGE (RMS)	1.6	VOLTS
LOAD RESISTANCE	2 700 ←	OHMS
MAXIMUM SIGNAL POWER OUTPUT	20	MW.
TOTAL HARMONIC DISTORTION	5	PERCENT
AVERAGE #1 DIODE CURRENT AT 5 VOLTS DC	8.5	MA.
AVERAGE #2 DIODE CURRENT AT 5 VOLTS DC	12.0	MA.

TUNG-SOL

PENTODE

COMPACTRON



GLASS BULB
12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12-56

BEAM PENTODE

FOR

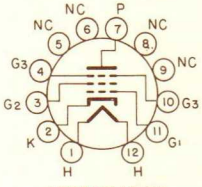
HORIZONTAL-DEFLECTION

AMPLIFIER APPLICATIONS

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12FK

THE 12JN6 IS A BEAM-POWER PENTODE IN THE T-12 COMPACTRON CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. A SEPARATE CONNECTION IS PROVIDED FOR THE BEAM PLATES (GRID 3) TO MINIMZE "SNIVETS".
EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 12JN6 IS IDENTICAL TO THE 6JN6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: G1 TO P	0.34	pf
INPUT: G1 TO (H + K + G2 + G3)	16	pf
OUTPUT: P TO (H + K + G2 + G3)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	600	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	MA.
MAXIMUM HEATER - CATHODE VOLTAGE:			
HEATER NEG. W/ RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POS. W/ RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DC PLATE - SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY).	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6,500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1,500	VOLTS
POSITIVE DC GRID 3 VOLTAGE	70	VOLTS
GRID 2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION [A]	17.5	WATTS
GRID 2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	175	MA.
PEAK CATHODE CURRENT	550	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

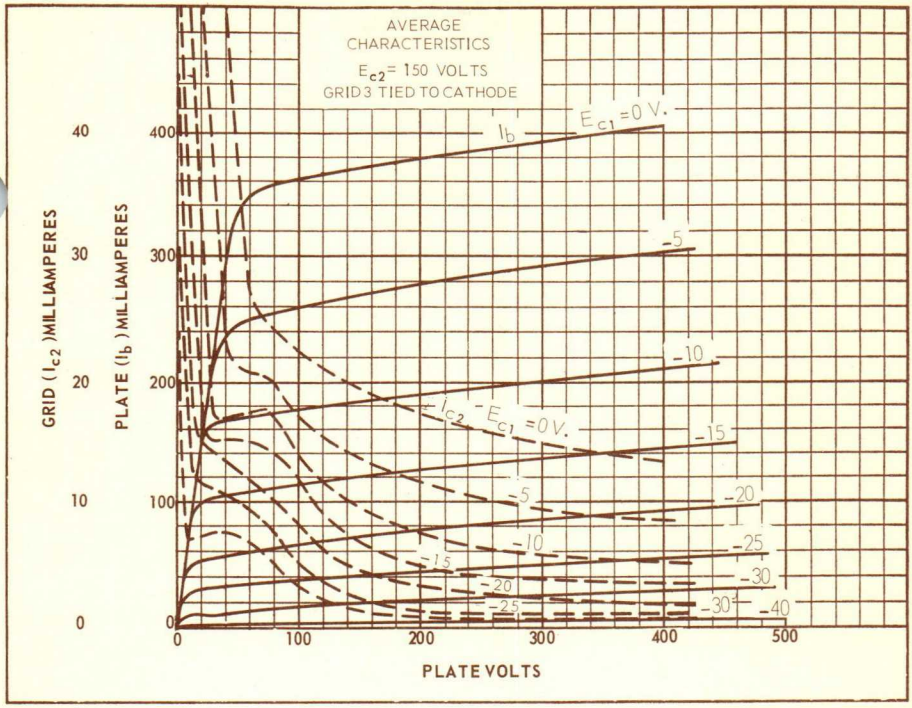
A - IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

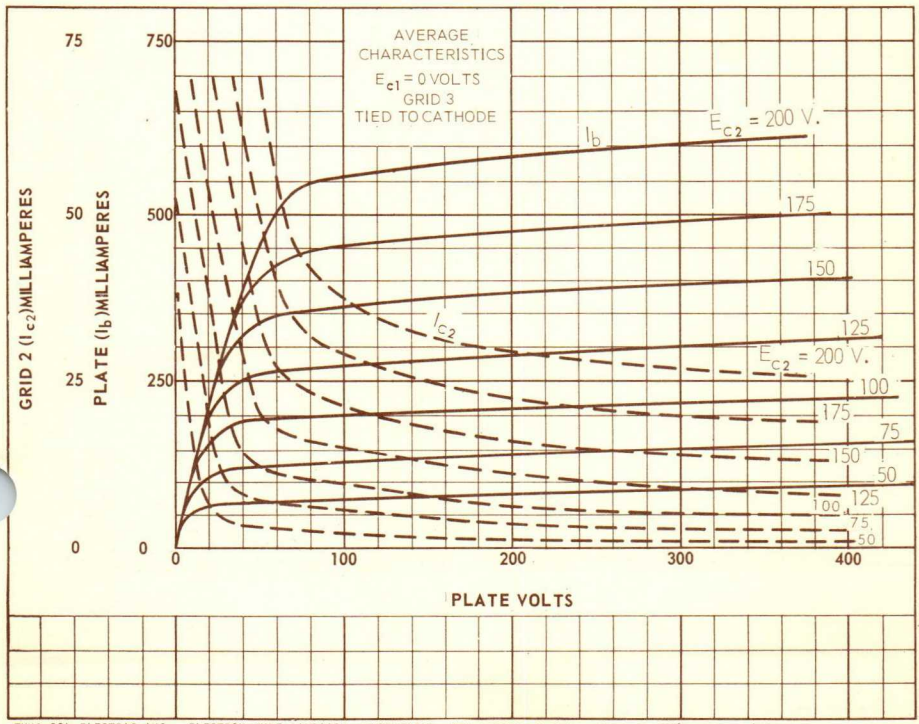
CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	5,000	60	250	VOLTS
GRID 3 - CONNECTED TO CATHODE AT SOCKET				
GRID 2 VOLTAGE	150	150	150	VOLTS
GRID 1 VOLTAGE	–	0 [B]	–22.5	VOLTS
PLATE CURRENT	–	345	65	MA.
GRID 2 CURRENT	–	27	1.8	MA.
TRANSCONDUCTANCE	–	–	7,300	μMHOS
PLATE RESISTANCE - APPROX.	–	–	18,000	OHMS
GRID 1 VOLTAGE AT I_b = 1.0 MA. - APPROX.	–100	–	–42	VOLTS
TRIODE AMPLIFICATION FACTOR [C]	–	–	4.4	

B - APPLIED FOR SHORT INTERVAL (2 SECONDS) SO AS NOT TO DAMAGE TUBE.

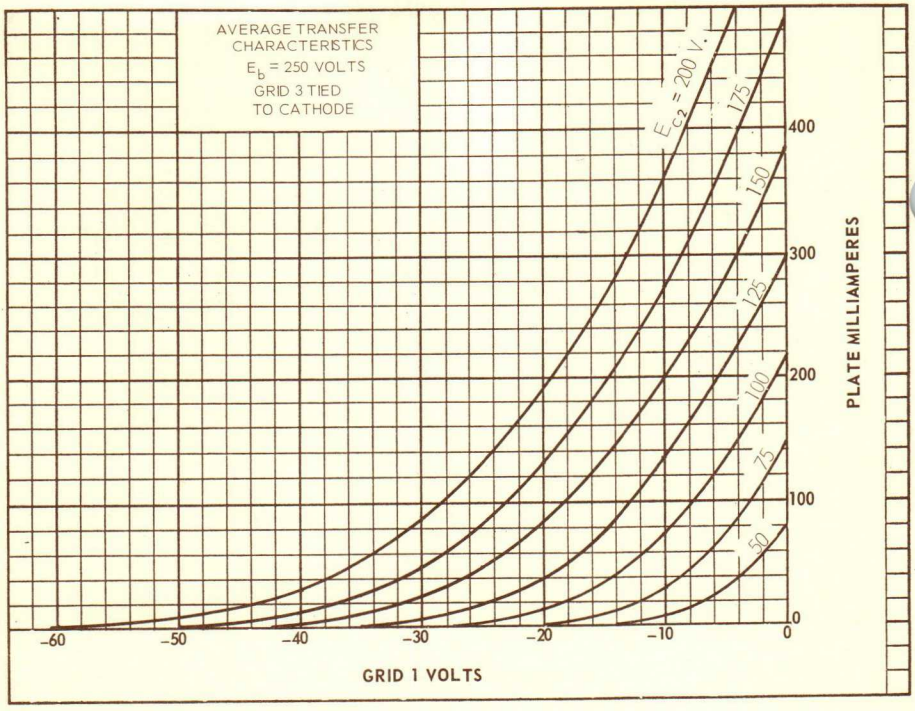
C - TRIODE CONNECTION (GRID 2 TIED TO PLATE) WITH $E_b = E_{c2} =$ 150 VOLTS AND $E_{c1} =$ -22.5 VOLTS

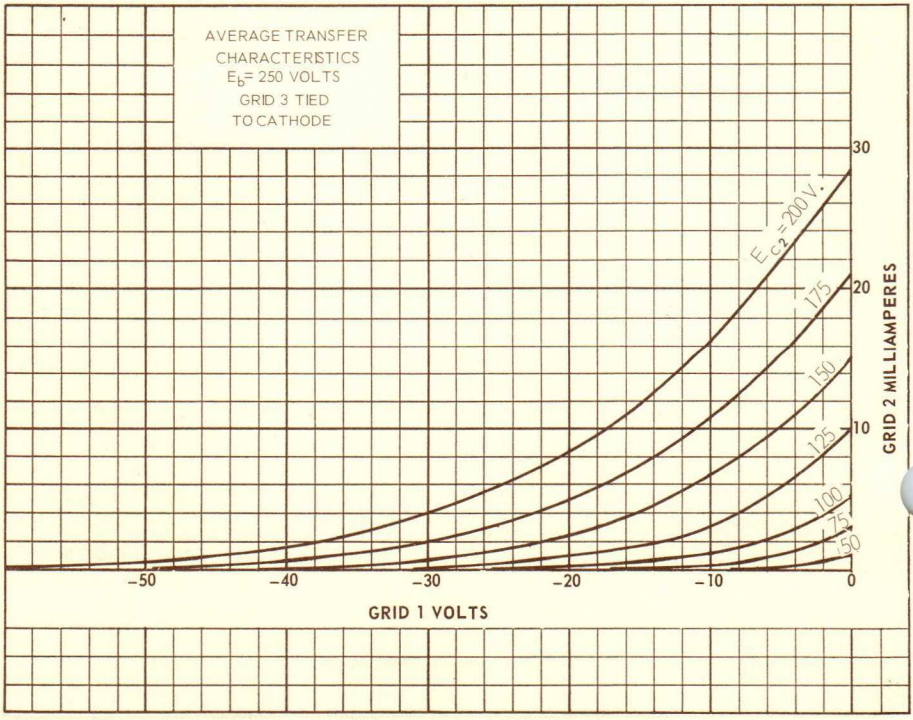




PRINTED IN U.S.A.

12JN6


AVERAGE TRANSFER
CHARACTERISTICS
E_b = 250 VOLTS
GRID 3 TIED
TO CATHODE
E_{c2} = 200 V.
175
150
125
100
75
50
400
300
200
100
0
PLATE MILLIAMPERES
-60
-50
-40
-30
-20
-10
0
GRID 1 VOLTS


AVERAGE TRANSFER
CHARACTERISTICS
E_b= 250 VOLTS
GRID 3 TIED
TO CATHODE
E_{c2}=200 V.
175
150
125
100
75
50
30
20
10
GRID 2 MILLIAMPERES
-50
-40
-30
-20
-10
0
GRID 1 VOLTS

TUNG-SOL

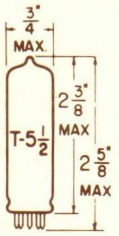
TETRODE

MINIATURE TYPE

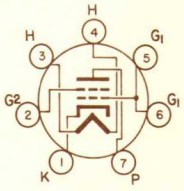
COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.40 AMP.
AC OR DC

ANY MOUNTING POSITION



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



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7FD

THE 12K5 IS A TETRODE WITH A UNIPOTENTIAL CATHODE IN THE 7-PIN MINIATURE CONSTRUCTION DESIGNED FOR SPACE-CHARGE GRID OPERATION. IT IS INTENDED FOR USE AS A POWER AMPLIFIER DRIVER WHERE THE HEATER, PLATE AND SPACE-CHARGE GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES*
WITHOUT EXTERNAL SHIELD

INPUT: G2 TO (K+H+G1)	13.0	pf
OUTPUT: P TO (K+H+G1)	1.8	pf
GRID TO PLATE: G2 TO P	11.0	pf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE (ABS. MAX.)	16	VOLTS
MAXIMUM NEGATIVE GRID #2 VOLTAGE	20	VOLTS
MAXIMUM GRID #2 CIRCUIT RESISTANCE	10	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE	±30	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER - SINGLE TUBE

PLATE VOLTAGE	12.6	VOLTS
GRID #2 (CONTROL GRID) VOLTAGE [B]	-0.5	VOLTS
GRID #1 (SPACE-CHARGE GRID) VOLTAGE	12.6	VOLTS
PLATE CURRENT	40	MA.
GRID #1 (SPACE-CHARGE GRID) CURRENT	75	MA.
PLATE RESISTANCE	480	OHMS
AMPLIFICATION FACTOR [C]	7.2	
TRANSCONDUCTANCE [C]	15 000	μMHOS

*INDICATES AN ADDITION.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

TYPICAL OPERATION

CLASS A_1 AMPLIFIER - SINGLE TUBE

HEATER VOLTAGE	12.6	VOLTS
PLATE VOLTAGE	12.6	VOLTS
GRID #2 (CONTROL GRID) VOLTAGE[D]	-2.0	VOLTS
GRID #1 (SPACE-CHARGE GRID) VOLTAGE	12.6	VOLTS
PEAK AF GRID #2 VOLTAGE	2.5	VOLTS
AF SIGNAL SOURCE RESISTANCE	100 000	OHMS
LOAD RESISTANCE	800	OHMS
PLATE CURRENT	8.0	MA.
GRID #1 (SPACE-CHARGE GRID) CURRENT	75	MA.
TOTAL HARMONIC DISTORTION (MAX.)	10	PERCENT
POWER OUTPUT	40	MW.

[A]THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

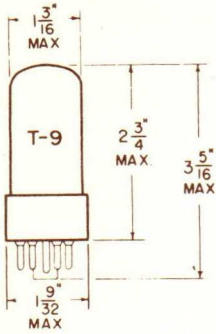
[B]AVERAGE CONTACT POTENTIAL DEVELOPED ACROSS A 2.2 MEGOHM RESISTOR.

[C]FROM GRID #2 TO PLATE

[D]OBTAINED ACROSS A 2.2 MEG. RESISTOR BY GRID #2 RECTIFICATION IN WHICH CASE THE ZERO SIGNAL PLATE CURRENT IS APPROXIMATELY 40 MA.

TUNG-SOL

BEAM PENTODE

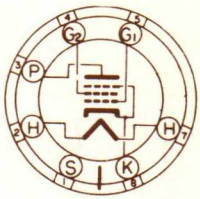


GLASS BULB

COATED UNIPOTENTIAL CATHODE.

HEATER
12.6 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL WAFER
7 PIN OCTAL
7S

THE 12L6GT IS A BEAM PENTODE DESIGNED FOR SERVICE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT DELIVERS A HIGH POWER OUTPUT WITH HIGH POWER SENSITIVITY FROM LOW SUPPLY VOLTAGES. 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 RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 25L6GT.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
→ MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.1	MEGOHMS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

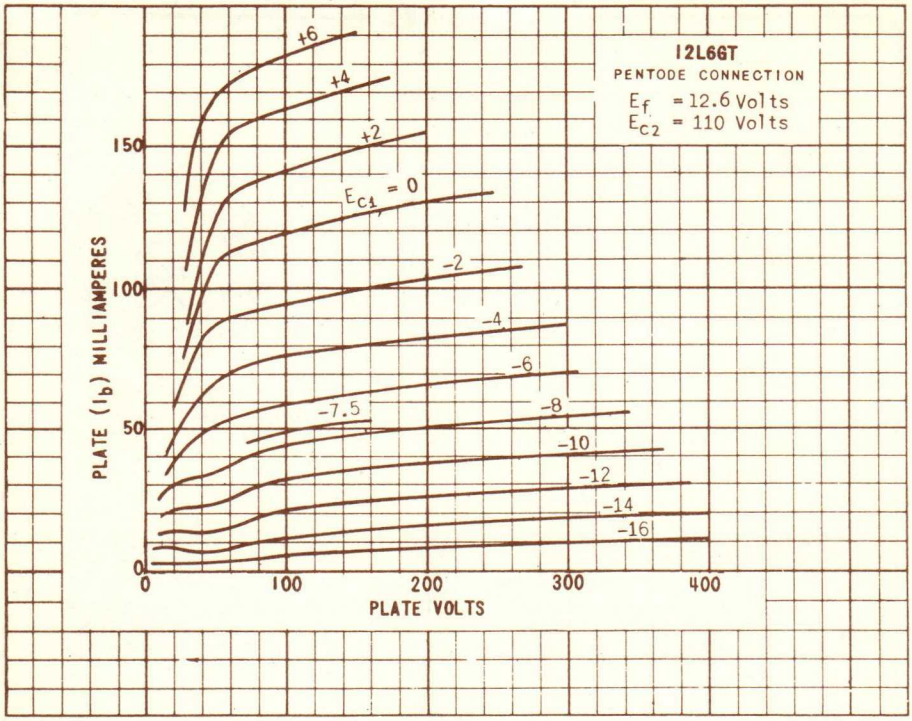
CLASS A_1 AMPLIFIER

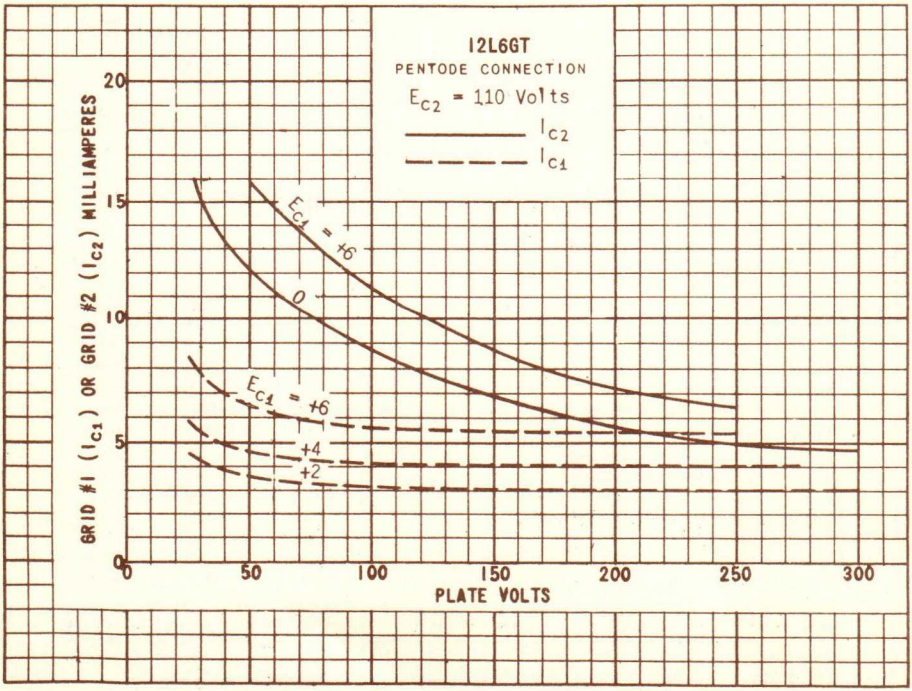
HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	110	200	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-7.5	0	VOLTS
CATHODE BIAS RESISTOR	0	180	OHMS
PEAK AF GRID #1 VOLTAGE	7.5	8.5	VOLTS
PLATE RESISTANCE (APPROX.)	13 000	28 000	OHMS
TRANSCONDUCTANCE	8 000	8 000	µMHOS
ZERO-SIGNAL PLATE CURRENT	49	46	MA.
MAXIMUM-SIGNAL PLATE CURRENT	50	47	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	2.2	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	10	8.5	MA.
LOAD RESISTANCE	2 000	4 000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT
POWER OUTPUT	2.1	3.8	WATTS

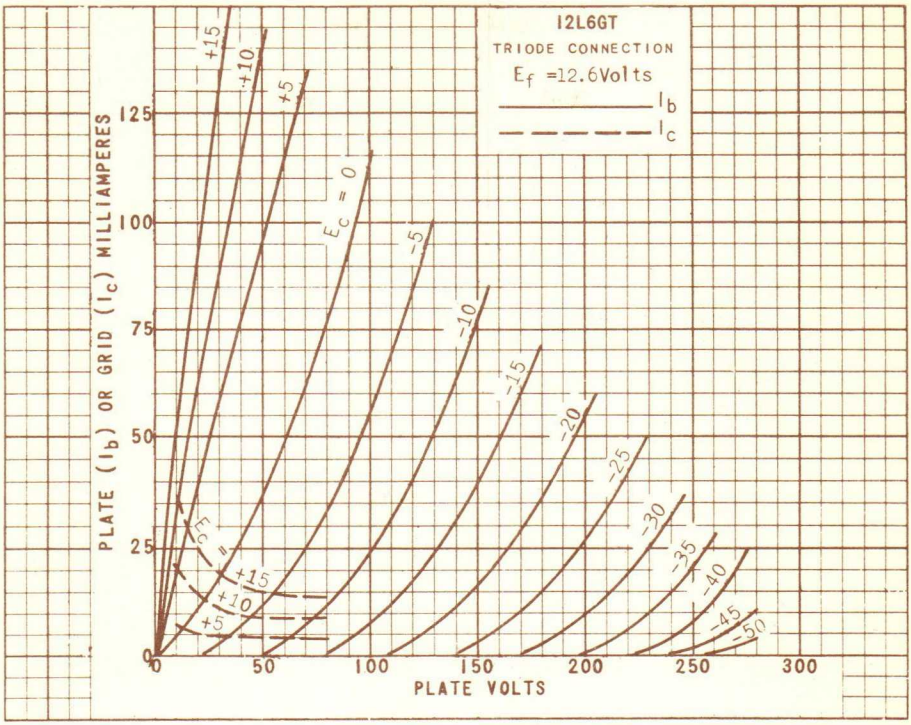
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

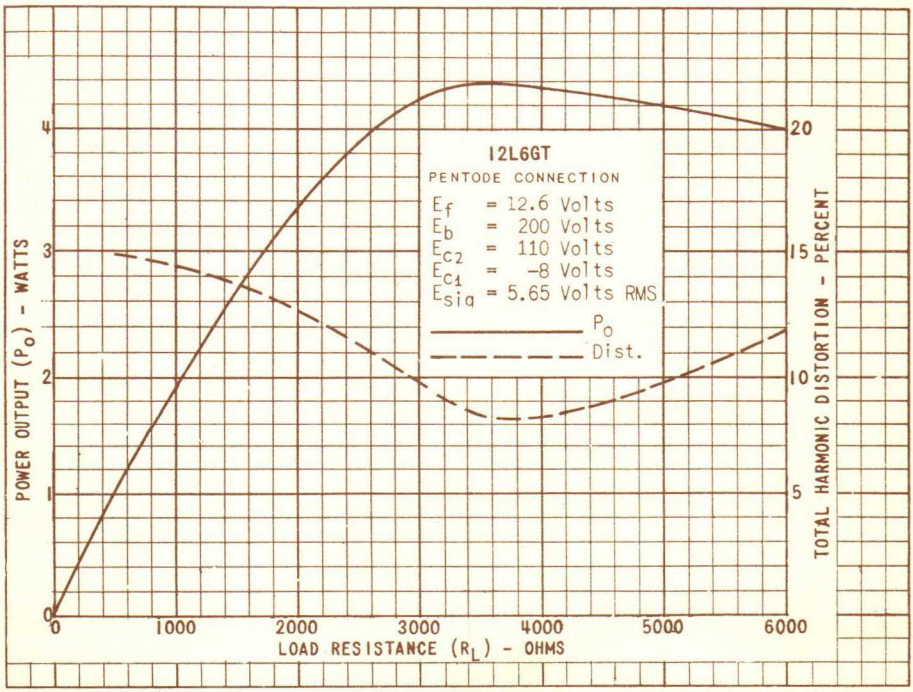
→ INDICATES A CHANGE.

PRINTED IN U.S.A.


12L6GT
PENTODE CONNECTION
E_f = 12.6 Volts
E_{c2} = 110 Volts
PLATE (I_b) MILLIAMPERES
PLATE VOLTS
+6
+4
+2
E_{c1} = 0
-2
-4
-6
-7.5
-8
-10
-12
-14
-16
0
50
100
150
200
300
400


12L6GT
PENTODE CONNECTION
E_{c2} = 110 Volts
I_{c2}
I_{c1}
GRID #1 (I_{c1}) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
E_{c1} = +6
0
E_{c1} = +6
+4
+2
0
5
10
15
20
50
100
150
200
250
300

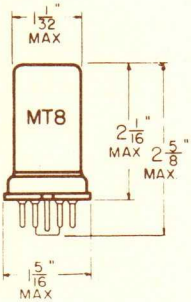




PRINTED IN U.S.A.

TUNG-SOL

PENTODE

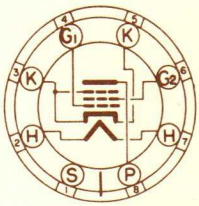


METAL SHELL

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL WAFER
8 PIN OCTAL

THE 12SG7 IS A SEMI-REMOTE CUT OFF PENTODE VOLTAGE AMPLIFIER IN THE OCTAL METAL CONSTRUCTION. IT FEATURES HIGH TRANSCONDUCTANCE WITH LOW GRID-PLATE CAPACITANCE AND A DUAL CATHODE CONNECTION TO MINIMIZE EFFECTS OF COMMON CATHODE CIRCUIT COUPLING.

DIRECT INTERELECTRODE CAPACITANCES

	12SG7[A]	
GRID TO PLATE: (G TO P) MAX.	0.003	μμf
INPUT: G_1 TO (H+K&G_3+G_2)	8.5	μμf
OUTPUT: P TO (H+K&G_3+G_2)	7	μμf

[A] WITH SHELL CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MINIMUM EXTERNAL GRID #1 VOLTAGE	-0	VOLTS
MAXIMUM PLATE DISSIPATION	3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATT

CONTINUED ON NEXT PAGE

PRINTED IN U.S.A.

PLATE 2064
AUG. 2, 1948

COPYRIGHT 1948 BY TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION NEWARK, NEW JERSEY, U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

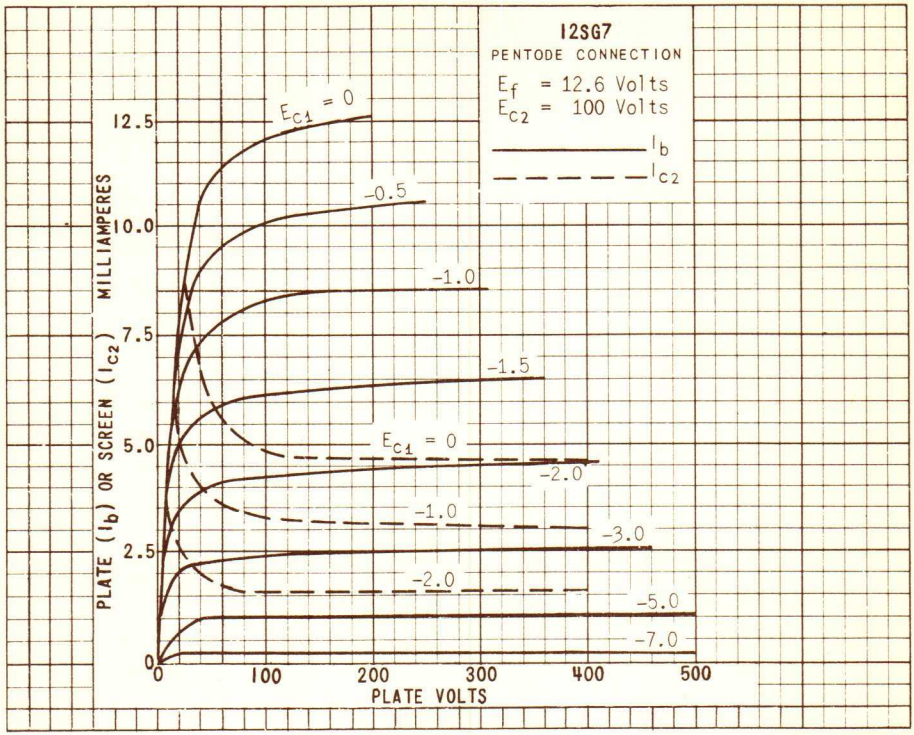
CLASS A_1 AMPLIFIER

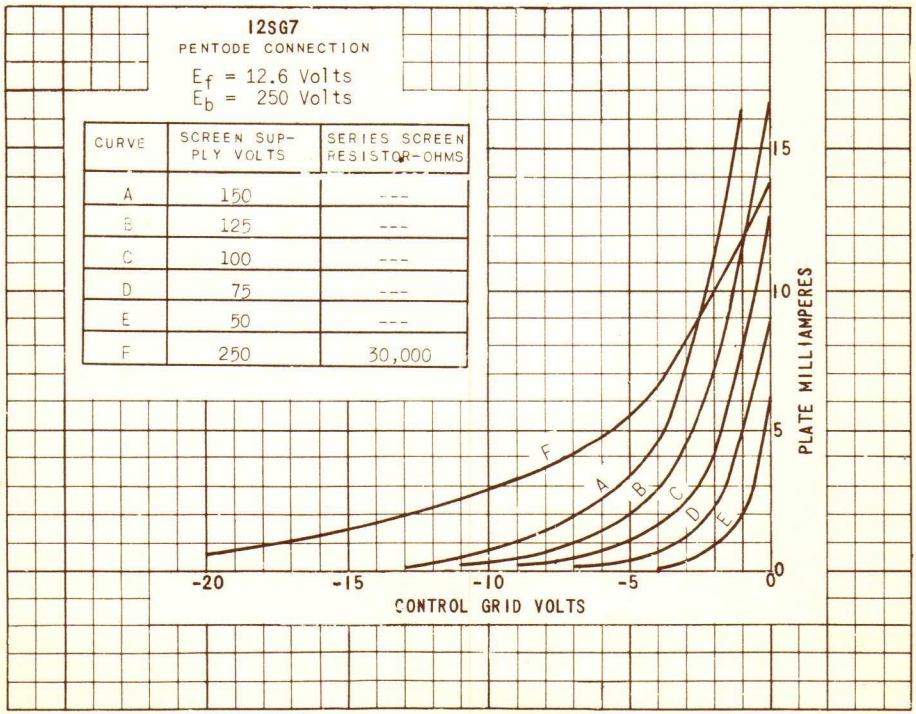
HEATER VOLTAGE	12.6	12.6	12.6	VOLTS
HEATER CURRENT	150	150	150	MA.
PLATE VOLTAGE	100	250	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
GRID #1 VOLTAGE	-1	-1	-2.5	VOLTS
SELF BIAS RESISTOR	90	60	190	OHMS
PLATE RESISTANCE (APPROX.)	0.25	0.9	[C]	MEGOHM
TRANSCONDUCTANCE	4100	4700	4000	µMHOS
PLATE CURRENT	8.2	11.8	9.2	MA.
GRID #2 CURRENT	3.2	4.4	3.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR g_m = 40 µMHOS	-11.5	-14	-17.5	VOLTS

[C] GREATER THAN 1.0 MEGOHM.

PLATE 2065
AUG. 2, 1948

COPYRIGHT 1948 BY TUNG-SOL ELECTRIC INC.





CURVE	SCREEN SUPPLY VOLTS	SERIES SCREEN RESISTOR-OHMS
A	150	---
B	125	---
C	100	---
D	75	---
E	50	---
F	250	30,000

PRINTED IN U. S. A.

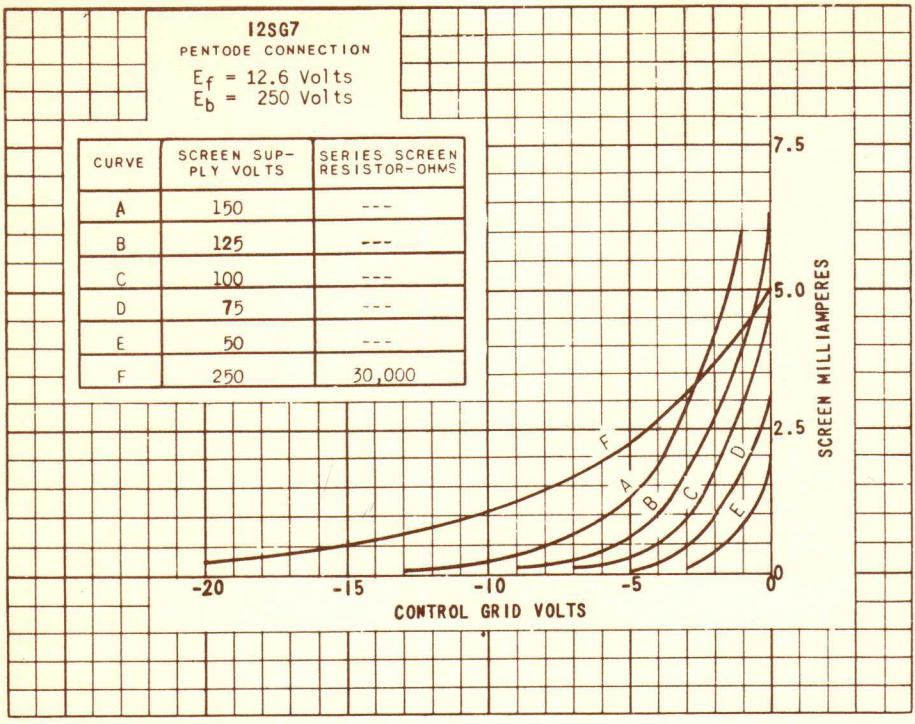
PLATE 2066
AUG. 2, 1948

COPYRIGHT 1948 BY TUNG-SOL ELECTRIC INC.

12SG7 (6SG7, 6SG7GT)

12SG7
PENTODE CONNECTION
E_f = 12.6 Volts
E_b = 250 Volts

CURVE	SCREEN SUPPLY VOLTS	SERIES SCREEN RESISTOR-OHMS
A	150	---
B	125	---
C	100	---
D	75	---
E	50	---
F	250	30,000



12SG7
PENTODE CONNECTION
E_f = 12.6 Volts
E_b = 250 Volts

CURVE	SCREEN SUPPLY VOLTS	SERIES SCREEN RESISTOR-OHMS
A	150	---
B	125	---
C	100	---
D	75	---
E	50	---
F	250	30,000

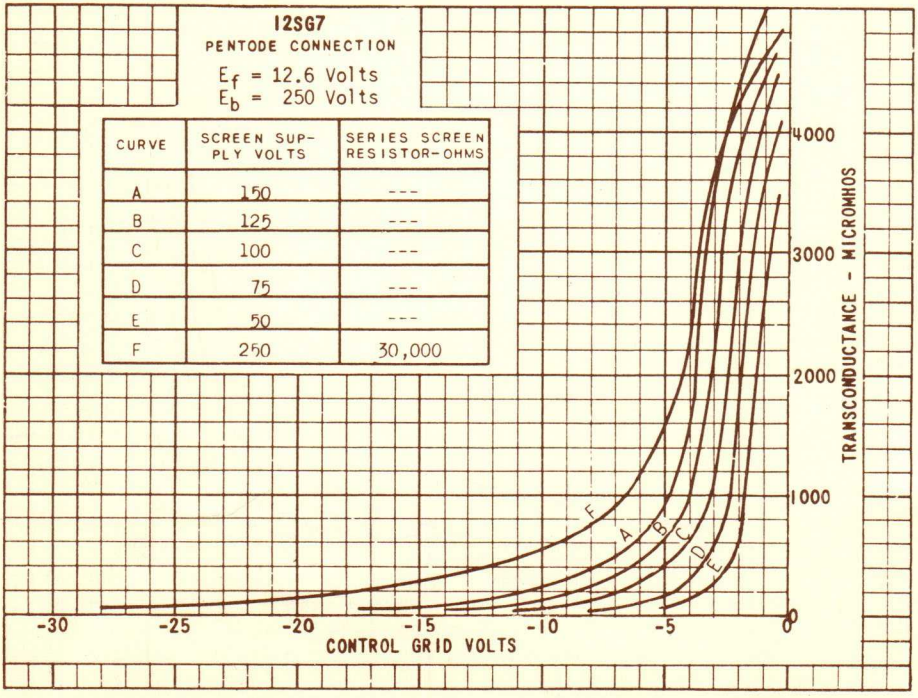
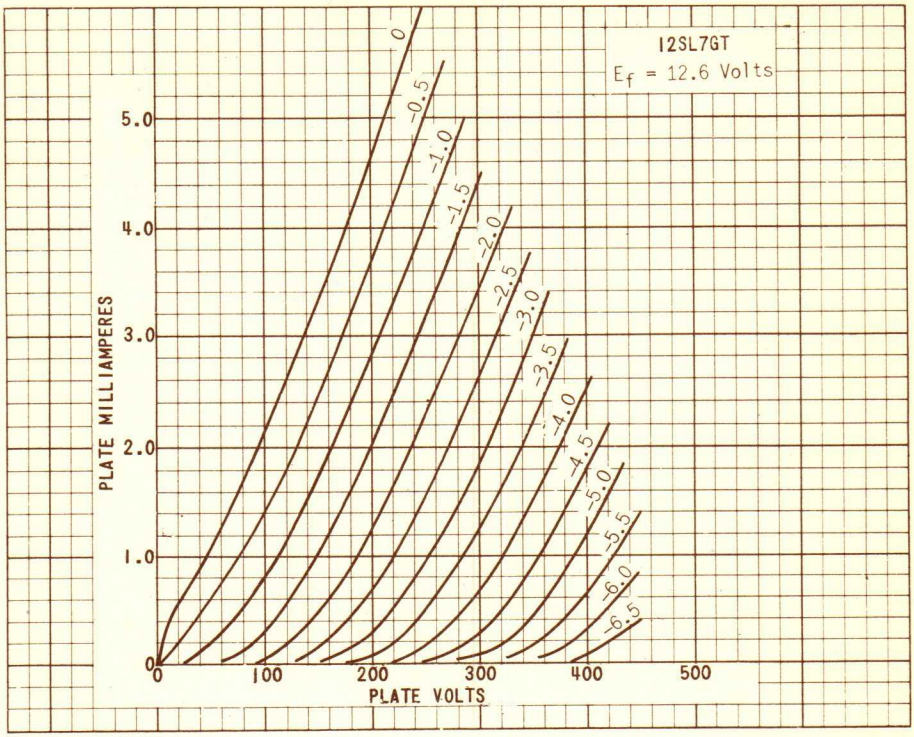
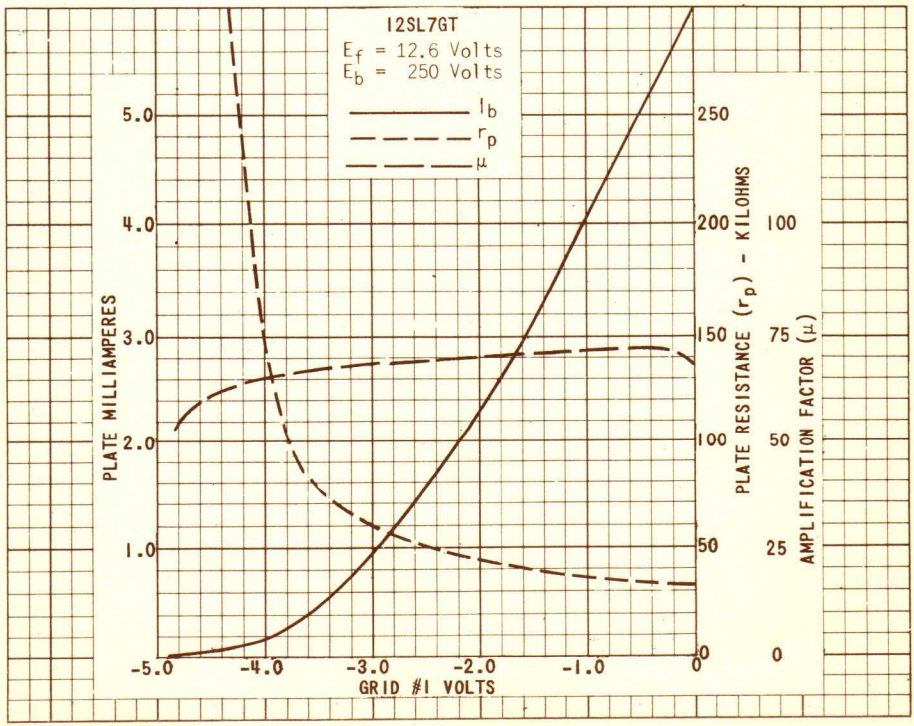


PLATE 2067
AUG. 2, 1948

COPYRIGHT 1948 BY TUNG-SOL ELECTRIC INC ELECTRON TUBE DIVISION NEWARK NEW JERSEY U S A

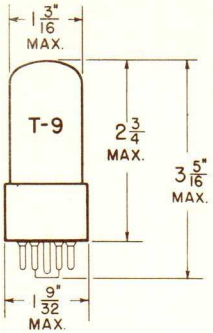




PRINTED IN U. S. A.

TUNG-SOL

DOUBLE TRIODE

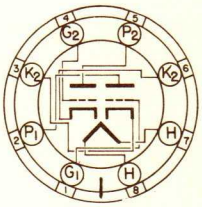


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
8 PIN OCTAL
8BD

THE 12SN7GT COMBINES TWO MEDIUM-MU TRIODES IN ONE ENVELOPE. IT IS DESIGNED FOR USE AS A RESISTANCE COUPLED AMPLIFIER, OR COMBINED VERTICAL OSCILLATOR AND VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

	SECTION 1[A]	SECTION 2[B]	
GRID TO PLATE	3.8	4.0	μμf
INPUT	2.8	3.0	μμf
OUTPUT	0.8	1.2	μμf

[A] CONNECTED TO PINS 4, 5 AND 6.

[B] CONNECTED TO PINS 1, 2 AND 3.

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[C]

EACH SECTION[C]

	CLASS A_1 AMPLIFIER	VERTICAL[D] DEFLECTION AMPLIFIER	
HEATER VOLTAGE	12.6		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
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---	1 200	VOLTS
MAXIMUM PLATE DISSIPATION			
EACH PLATE	3.5	3.5	WATTS
BOTH PLATES	5.0	5.0	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	---	250	VOLTS
MAXIMUM CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	---	70	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	---	MEGOHMS
CATHODE BIAS	---	2.2	MEGOHMS

[C] UNLESS OTHER WISE SPECIFIED.

[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 MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

RATINGS – CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	VERTICAL[E] DEFLECTION OSCILLATOR	HORIZONTAL[E] DEFLECTION OSCILLATOR	
HEATER VOLTAGE	12.6		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
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM PLATE DISSIPATION			
EACH PLATE	3.5	3.5	WATTS
BOTH PLATES	5.0	5.0	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	600	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	70	300	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2	2.2	MEGOHMS

[E] 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.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

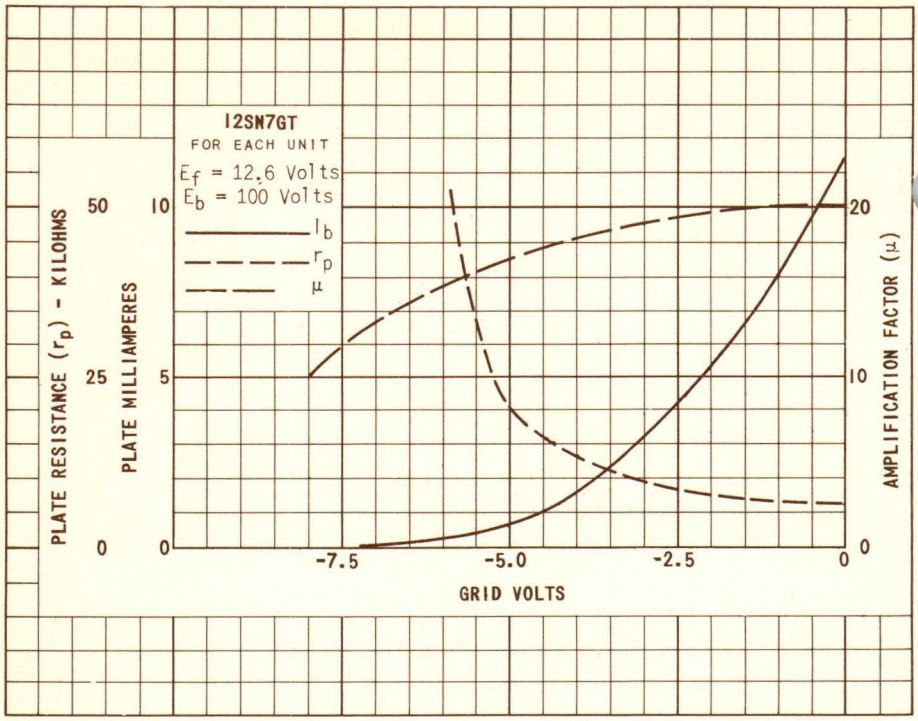
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	-8.0	VOLTS
PLATE CURRENT	10	9.0	MA.
PLATE RESISTANCE (APPROX.)	6 700	7 700	OHMS
TRANSCONDUCTANCE	3 000	2 600	μMHOS
AMPLIFICATION FACTOR	20	20	
PLATE CURRENT AT E_c = -12.5 VOLTS	---	1.3	MA.
GRID VOLTAGE FOR I_b = 10 μA. (APPROX.)	-7.0	-18	MA.

TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD NEW JERSEY, U.S.A. NOVEMBER 1, 1954 PLATE #4114

PRINTED IN U. S. A.

12SN7GT (6SN7GT)



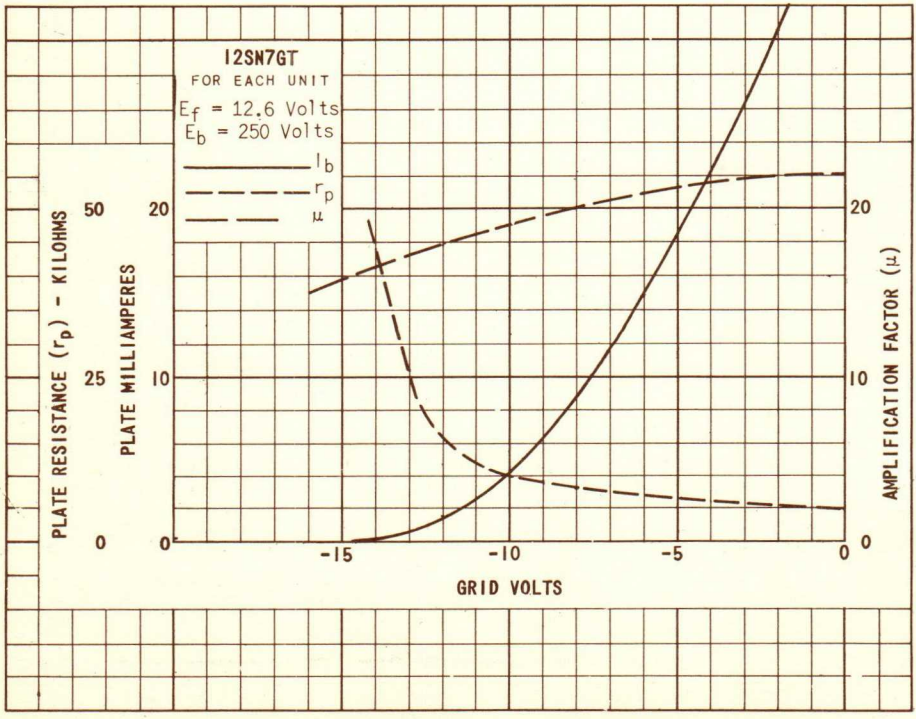
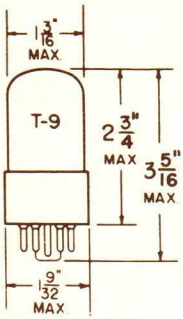


PLATE #4115 NOVEMBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

DOUBLE TRIODE

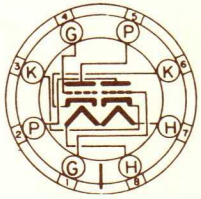


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
8 PIN OCTAL
8BD

THE 12SN7GTA IS A MEDIUM-MU DOUBLE TRIODE SUITABLE FOR USE IN A WIDE VARIETY OF GENERAL-PURPOSE AMPLIFIER AND PHASE-INVERTER APPLICATIONS. IT IS ALSO USEFUL AS A BLOCKING OSCILLATOR, MULTIVIBRATOR, OR VERTICAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. EXCEPT FOR HEATER AND HEATER WARM-UP TIME RATINGS, THE 12SN7GTA IS IDENTICAL TO THE 6SN7GTB.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	TRIODE 1	TRIODE 2	
GRID TO PLATE: G TO P	4.0	3.8	μμf
INPUT: G TO (H+K)	2.2	2.6	μμf
OUTPUT: P TO (H+K)	0.7	0.7	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH UNIT

	CLASS A_1 AMPLIFIER	VERTICAL[A] DEFLECTION AMPLIFIER	
HEATER VOLTAGE	12.6		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
MAXIMUM PLATE VOLTAGE	450	450	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---	1 500	VOLTS
MAXIMUM PLATE DISSIPATION:			
EACH PLATE	5.0	5.0[B]	WATTS
BOTH PLATES	7.5	7.5[B]	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	---	250	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	---	70	MA.
MAXIMUM GRID CIRCUIT RESISTANCE			
CATHODE BIAS	1.0	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.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS – CONT'D

	VERTICAL[C] DEFLECTION OSCILLATOR	HORIZONTAL[C] DEFLECTION OSCILLATOR	
HEATER VOLTAGE	12.6		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
MAXIMUM DC PLATE VOLTAGE	450	450	VOLTS
MAXIMUM PLATE DISSIPATION:			
EACH PLATE	5.0	5.0	WATTS
BOTH PLATES	7.5	7.5	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	600	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	70	300	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2	2.2	MEGOHMS

[C] 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

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH UNIT

HEATER VOLTAGE	12.6		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	-8	VOLTS
PLATE CURRENT	10	9	MA.
AMPLIFICATION FACTOR	20	20	
PLATE RESISTANCE (APPROX.)	6 700	7 700	OHMS
TRANSCONDUCTANCE	3 000	2 600	μMHOS
PLATE CURRENT	10	9.0	MA.
GRID VOLTAGE FOR I_b = 10 μA. (APPROX.)	-7.0	-18	VOLTS

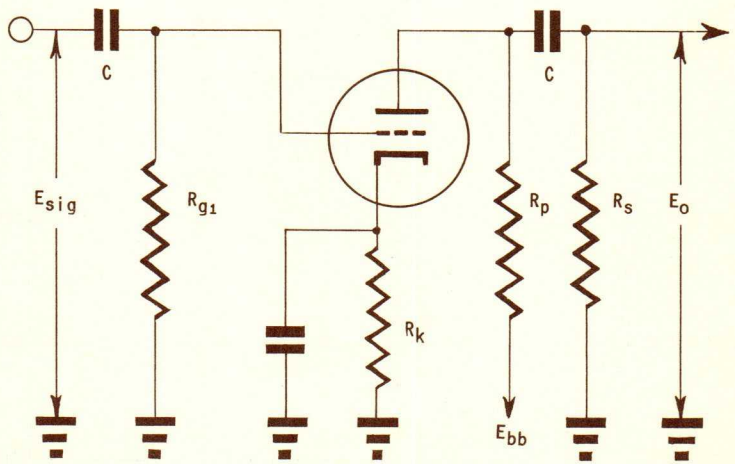
TUNG-SOL

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	3900	10	10	3600	11	20	3500	11	30
0.10	0.24	0.10	5000	11	14	4700	12	27	4400	12	41
0.24	0.24	0.10	9400	11	13	8700	11	25	8700	12	38
0.24	0.51	0.10	11000	11	17	11000	12	32	11000	12	48
0.51	0.51	0.10	19000	11	15	18000	12	29	18000	12	43
0.51	1.0	0.10	24000	11	19	23000	12	37	23000	12	54
0.24	0.24	10	0	14	12	0	16	20	0	17	28
0.24	0.51	10	0	14	16	0	16	28	0	17	40
0.51	0.51	10	0	14	15	0	15	26	0	16	38
0.51	1.0	10	0	14	19	0	16	35	0	16	52

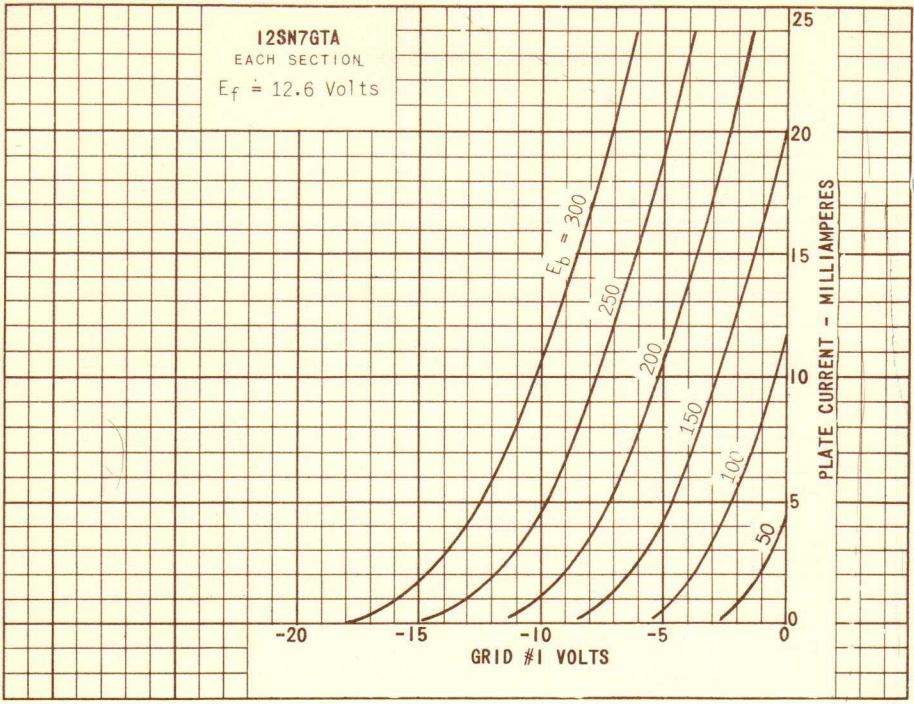
NOTES: 1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT (5%) TOTAL HARMONIC DISTORTION.
2. GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.
3. FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.

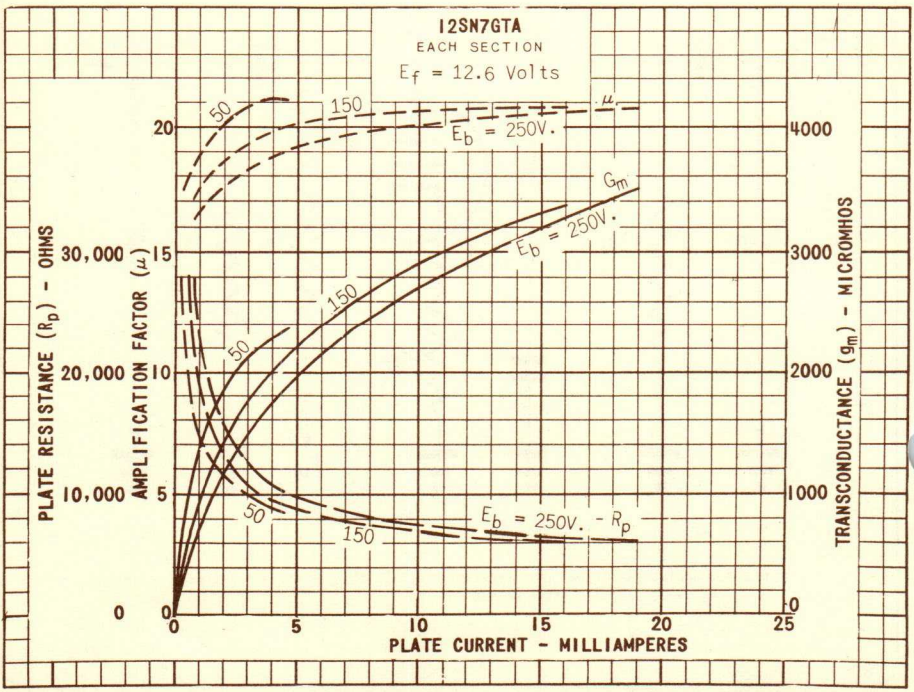


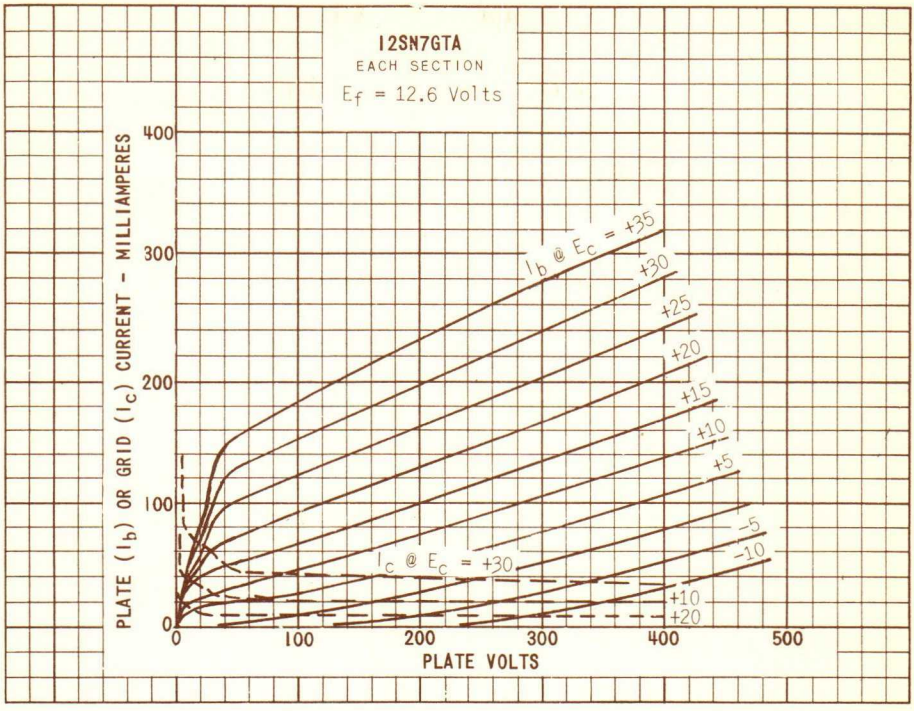
NOTES: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE.
R_k SHOULD BE ADEQUATELY BY-PASSED

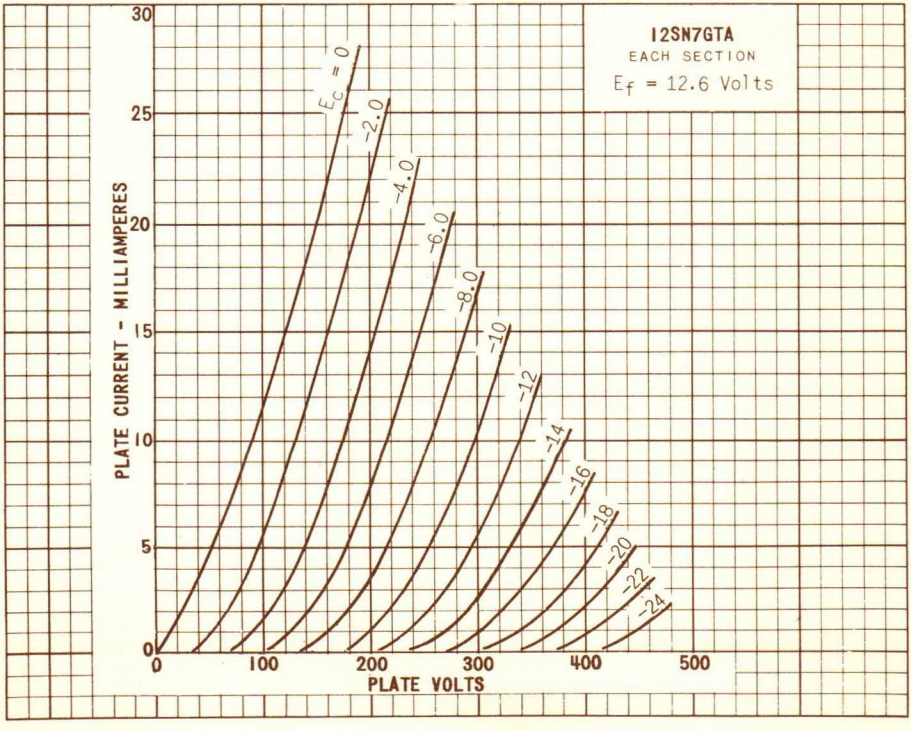
PRINTED IN U.S.A.

12SN7GTA


12SN7GTA
EACH SECTION
E_f = 12.6 Volts
E_b = 300
250
200
150
100
50
-20
-15
-10
-5
0
GRID #1 VOLTS
25
20
15
10
5
0
PLATE CURRENT - MILLIAMPERES


12SN7GTA
EACH SECTION
E_f = 12.6 Volts
50
150
μ
E_b = 250V.
G_m
E_b = 250V.
150
50
50
150
E_b = 250V. - R_p
PLATE RESISTANCE (R_p) - OHMS
30,000
20,000
10,000
0
AMPLIFICATION FACTOR (μ)
20
15
10
5
0
4000
3000
2000
1000
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
0
5
10
15
20
25
PLATE CURRENT - MILLIAMPERES





PRINTED IN U.S.A.

TUNG-SOL

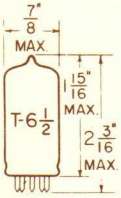
DOUBLE TRIODE

MINIATURE TYPE

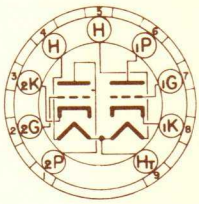
COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9A

THE 12U7 CONTAINS TWO INDEPENDENT MEDIUM MU TRIODES WITH UNIPOTENTIAL CATHODES IN THE 9-PIN MINIATURE CONSTRUCTION. EACH SECTION IS INTENDED FOR USE AS A GENERAL PURPOSE TRIODE WHERE THE HEATER AND PLATE POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315	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

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
CLASS A_1 AMPLIFIER

HEATER VOLTAGE* (APPLIED TO PINS #4 & #5)	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±30	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM CATHODE CURRENT	15	MA.
MAXIMUM GRID CIRCUIT RESISTANCE		
FIXED BIAS OPERATION	0.25	MEGOHM
CATHODE BIAS OPERATION	1.0	MEGOHM

*THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

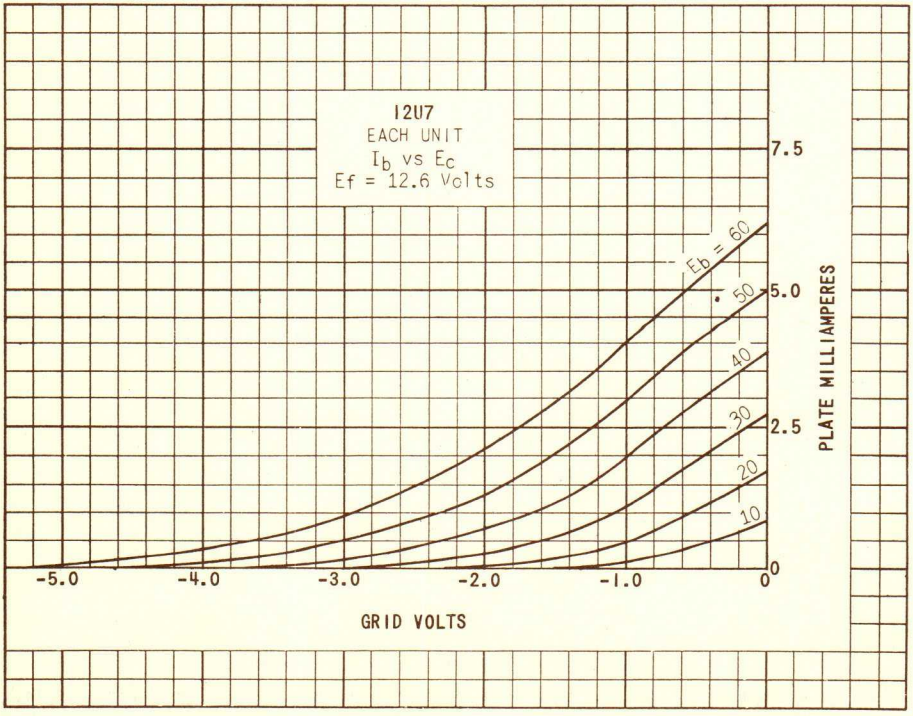
TUNG-SOL

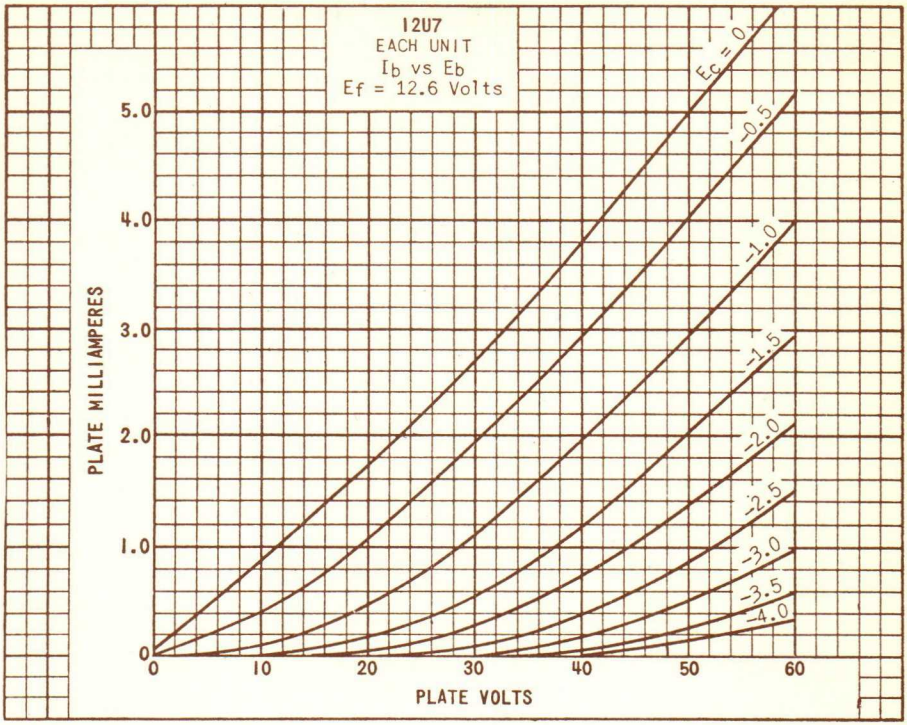
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH SECTION

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	12.6	VOLTS
GRID VOLTAGE	0	VOLTS
PLATE CURRENT	1.0	MA.
PLATE RESISTANCE (APPROX.)	12 500	OHMS
TRANSCONDUCTANCE	1 600	μMHOS
AMPLIFICATION FACTOR	20	
GRID VOLTAGE FOR I_b= 10 μA (APPROX.)	-1.5	VOLTS

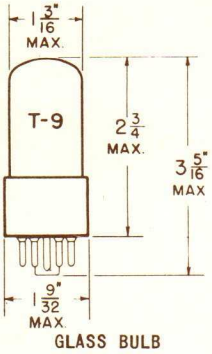




PRINTED IN U. S. A.

TUNG-SOL

BEAM PENTODE

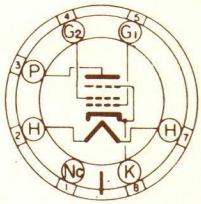


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.225 AMP
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
7AC

THE 12V6GT IS A BEAM POWER AMPLIFIER, DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AC AND STORAGE BATTERY OPERATED RECEIVERS. IT HAS HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT WITH COMPARATIVELY LOW SUPPLY VOLTAGES.

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	12.6	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	100 ←	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
TOTAL DC AND PEAK	100 ←	VOLTS
MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 DISSIPATION	2	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.1	MEGOHM
CATHODE BIAS OPERATION	0.5	MEGOHM

VERTICAL DEFLECTION AMPLIFIER – TRIODE CONNECTION[AB]

HEATER VOLTAGE	12.6	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

[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.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – SINGLE TUBE

HEATER VOLTAGE	12.6	12.6	12.6	VOLTS
HEATER CURRENT	0.225	0.225	0.225	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

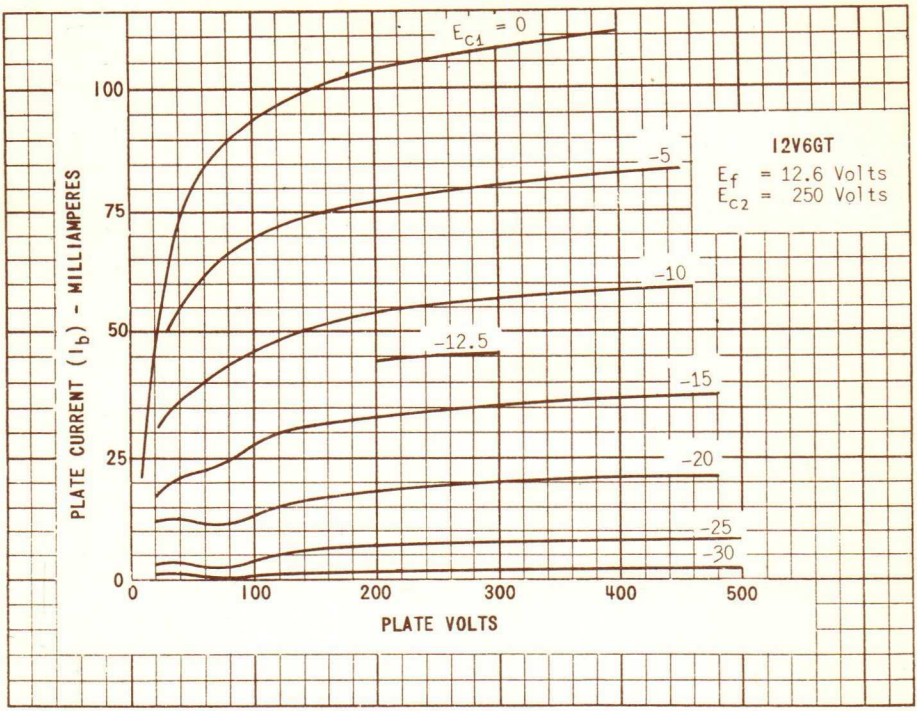
CLASS A_1 AMPLIFIER – PUSH-PULL

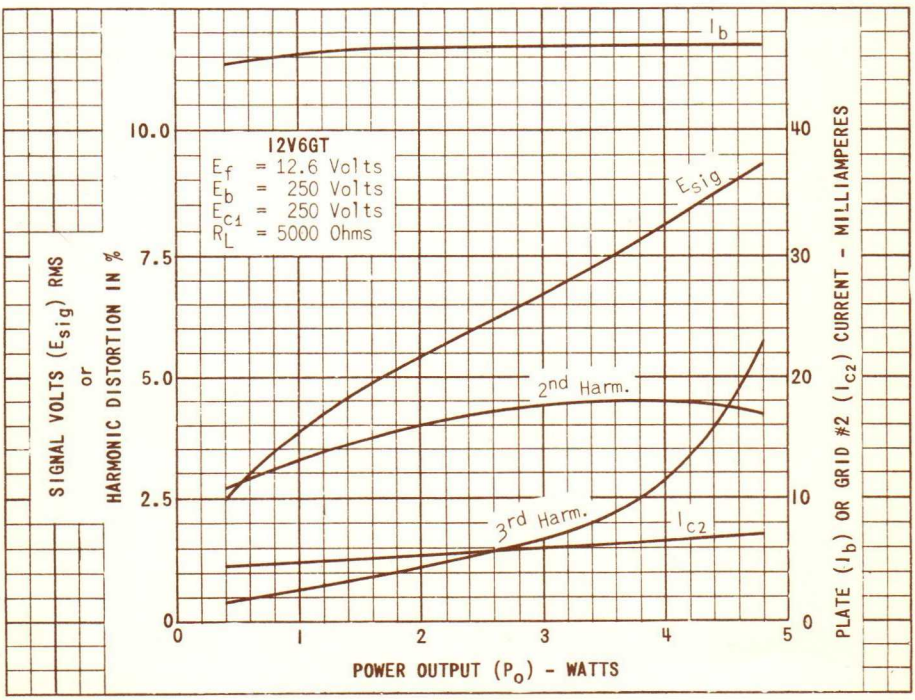
UNLESS OTHERWISE SPECIFIED, VALUES ARE FOR TWO TUBES.

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.225	0.225	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	12.6	VOLTS
HEATER CURRENT	0.225	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





PRINTED IN U. S. A.

PLATE
2995
JULY 1
1952

COPYRIGHT 1952 BY TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

12V6GT (6V6GT)

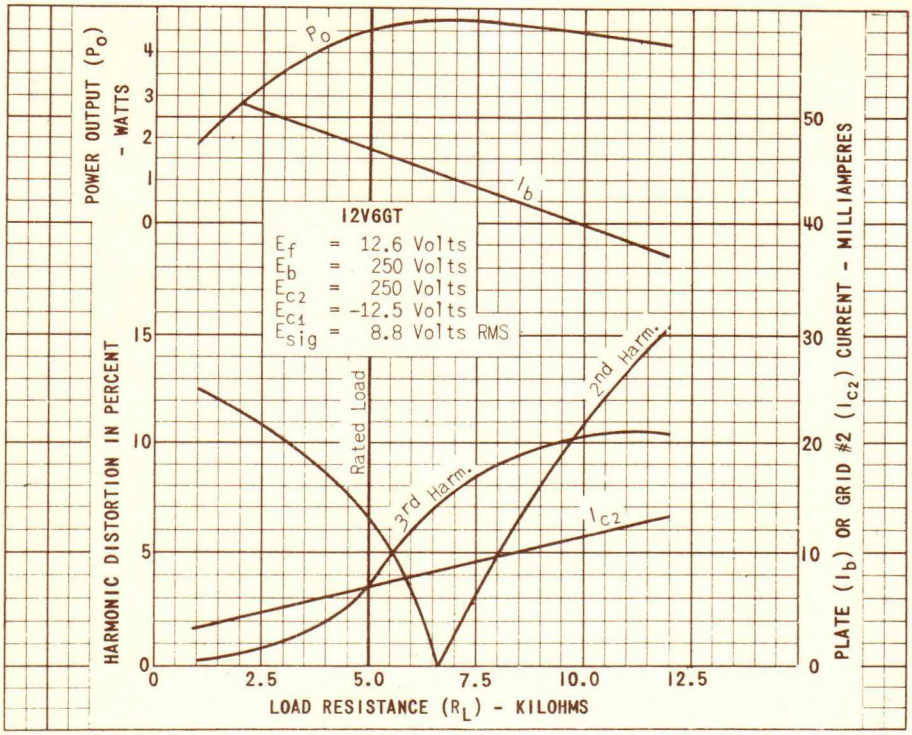


PLATE
2996
JULY 1
1952

COPYRIGHT 1952 BY TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

TUNG-SOL

BEAM PENTODE

COATED UNIOPTENTIAL CATHODE

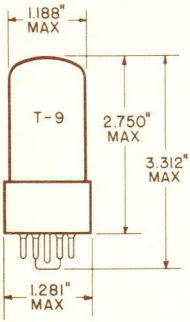
FOR USE AS A VERTICAL

DEFLECTION AMPLIFIER

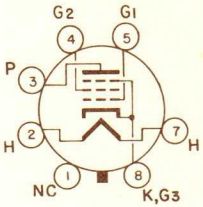
IN TV RECEIVERS

AC OR DC

ANY MOUNTING POSITION



GLASS BULB
INTERMEDIATE SHELL OCTAL
B6-81 OR B7-7
OR
SHORT INTERMEDIATE
SHELL OCTAL
B6-84 OR B7-59
OUTLINE DRAWING
JEDEC 9-11 OR 9-41



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7AC

THE 12W6GT IS A BEAM PENTODE POWER AMPLIFIER. IT IS INTENDED FOR SERVICE AS A VERTICAL SCANNING OUTPUT TUBE 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 TATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO TYPE 6W6GT.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID TO PLATE: (G1 TO P)	0.5	pf
INPUT: G1 TO (H+K+G2+G3)	15	pf
OUTPUT: P TO (H+K+G2+G3)	9.0	pf

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

AVERAGE CHARACTERISTICS	12.6 VOLTS	600	MA.
HEATER WARM-UP TIME*		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC		200	VOLTS
TOTAL DC AND PEAK		300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

CLASS A1 AMPLIFIER

PLATE VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	165	VOLTS
PLATE DISSIPATION	12	WATTS
GRID 2 DISSIPATION	1.35	WATTS
GRID 1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM

VERTICAL DEFLECTION AMPLIFIER[A,B]

	TRIODE CONNECTED	PENTODE CONNECTED	
DC PLATE VOLTAGE	330	330	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	1200	1500	VOLTS
DC GRID 2 VOLTAGE		165	VOLTS
PLATE DISSIPATION	8.5	8	WATTS
GRID 2 DISSIPATION		1.2	WATT
PEAK NEGATIVE PULSE GRID 1 VOLTAGE	275	275	VOLTS
AVERAGE CATHODE CURRENT	65	65	MA.
PEAK CATHODE CURRENT	195	195	MA.
GRID 1 CIRCUIT RESISTANCE			
CATHODE BIAS	2.2	2.2	MEGOHMS

→ INDICATES A CHANGE.

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER - SINGLE TUBE

PLATE VOLTAGE	110	200	VOLTS
GRID 2 VOLTAGE	110	125	VOLTS
GRID 1 VOLTAGE	-7.5	----	VOLTS
CATHODE BIAS RESISTOR	----	180	OHMS
PEAK AF GRID 1 VOLTAGE	7.5	8.5	VOLTS
PLATE RESISTOR (APPROX.)	13,000	28,000	OHMS
TRANSCONDUCTANCE	8,000	8,000	μMHOS
ZERO-SIGNAL PLATE CURRENT	49	46	MA.
MAXIMUM-SIGNAL PLATE CURRENT (APPROX.)	50	47	MA.
ZERO-SIGNAL GRID 2 CURRENT	4.0	2.2	MA.
MAXIMUM-SIGNAL GRID 2 CURRENT (APPROX.)	10	8.5	MA.
LOAD RESISTANCE	2,000	4,000	OHMS
TOTAL HARMONIC DISTORTION	10	10	PERCENT
POWER OUTPUT	2.1	3.8	WATTS

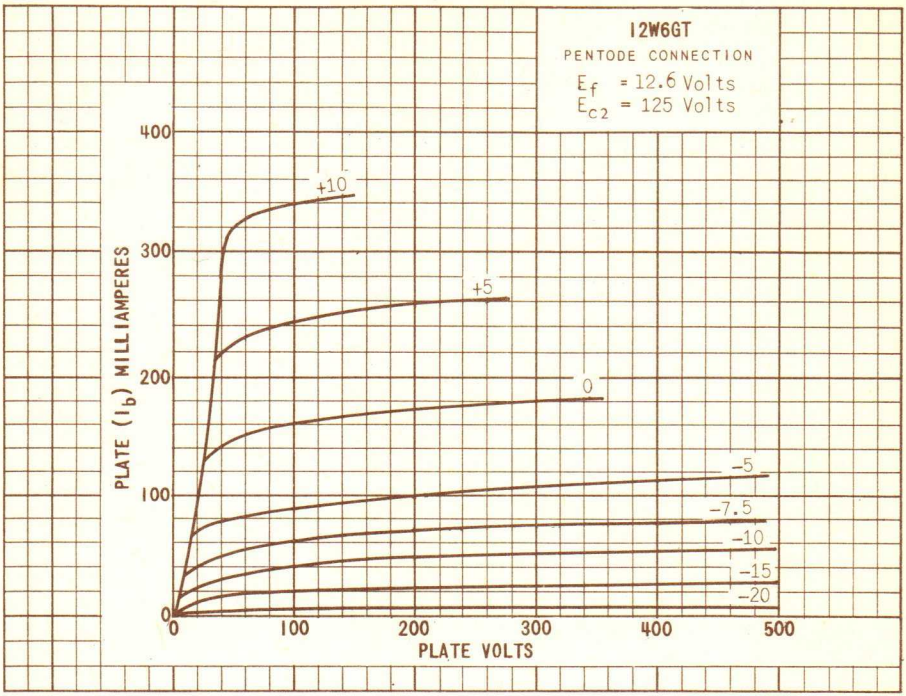
TRIODE CONNECTION

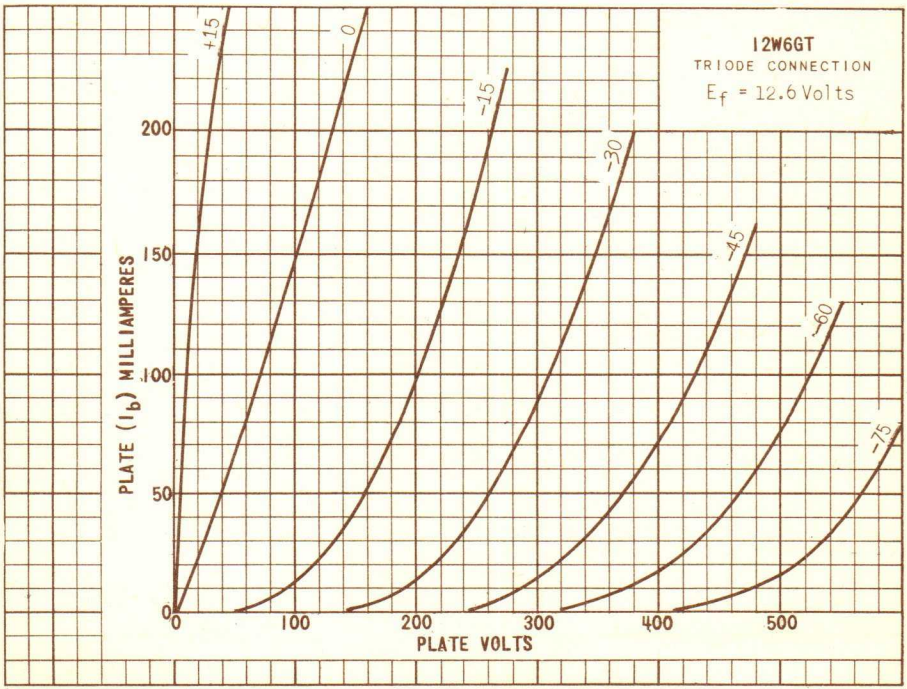
PLATE VOLTAGE	225	VOLTS
GRID VOLTAGE	-30	VOLTS
AMPLIFICATION FACTOR	6.2	
PLATE RESISTANCE (APPROX.)	1,600	OHMS
TRANSCONDUCTANCE	3,800	μMHOS
PLATE CURRENT	22	MA.
GRID VOLTAGE FOR Ib=0.5 MA. (APPROX.)	-42	VOLTS

[A] TRIODE CONNECTION - GRID #2 TIED TO PLATE.

[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.

* 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 HEATER OPERATING RESISTANCE.





PRINTED IN U. S. A.

12W6GT

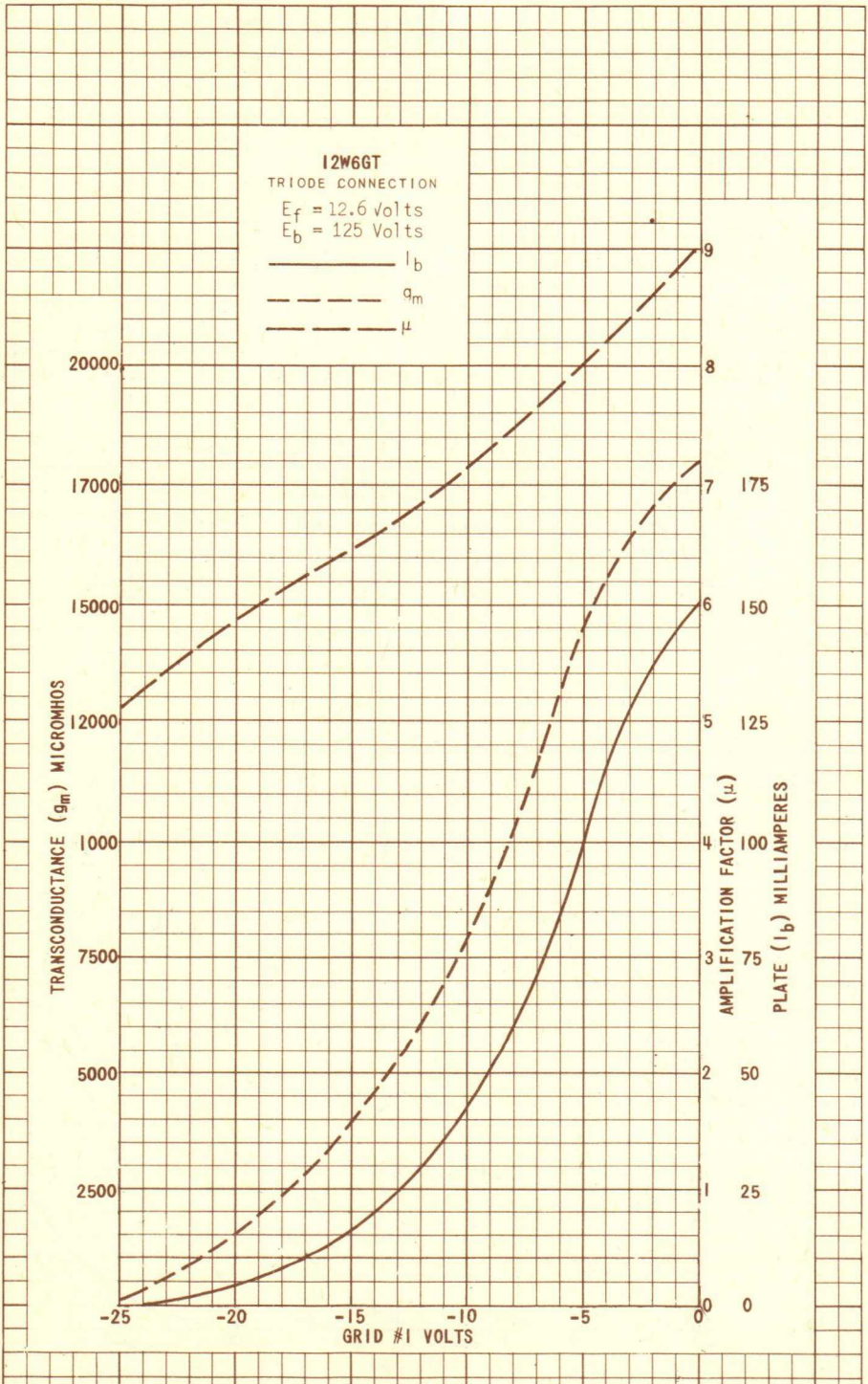
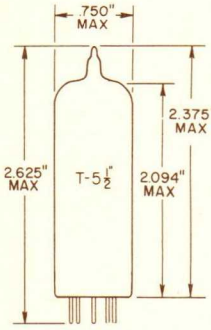


PLATE #3928 AUGUST 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

MINIATURE TYPE

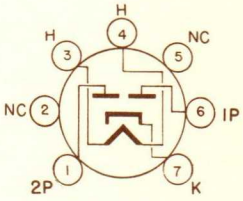


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

FULL WAVE RECTIFIER

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5BS

THE 12X4 IS A HEATER-CATHODE TYPE POWER RECTIFIER IN THE MINIATURE CONSTRUCTION. ITS LOW VOLTAGE DROP AND SMALL SIZE ADAPT IT TO USE WITH VIBRATOR-TYPE INVERTERS IN AUTOMOBILE RECEIVERS.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	300	MA.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 70 MA EACH PLATE)		22	VOLTS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION [A]		12.6±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC		450	VOLTS
TOTAL DC AND PEAK		450	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

PEAK INVERSE PLATE VOLTAGE	1250	VOLTS
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)	SEE CHART I	
DC OUTPUT CURRENT EACH PLATE	SEE CHART I	
STEADY STATE PEAK PLATE CURRENT EACH PLATE (SEE CHART II)	245	MA.
TRANSIENT PEAK PLATE CURRENT EACH PLATE (SEE CHART III)	1.1	AMP.
VIBRATOR OPERATION (MINIMUM DUTY CYCLE OF 75%)		
DC OUTPUT VOLTAGE (AT FILTER INPUT)	350	VOLTS
DC OUTPUT CURRENT EACH PLATE	45	MA.

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

→ TYPICAL OPERATING CHARACTERISTICS

FULL-WAVE RECTIFIER

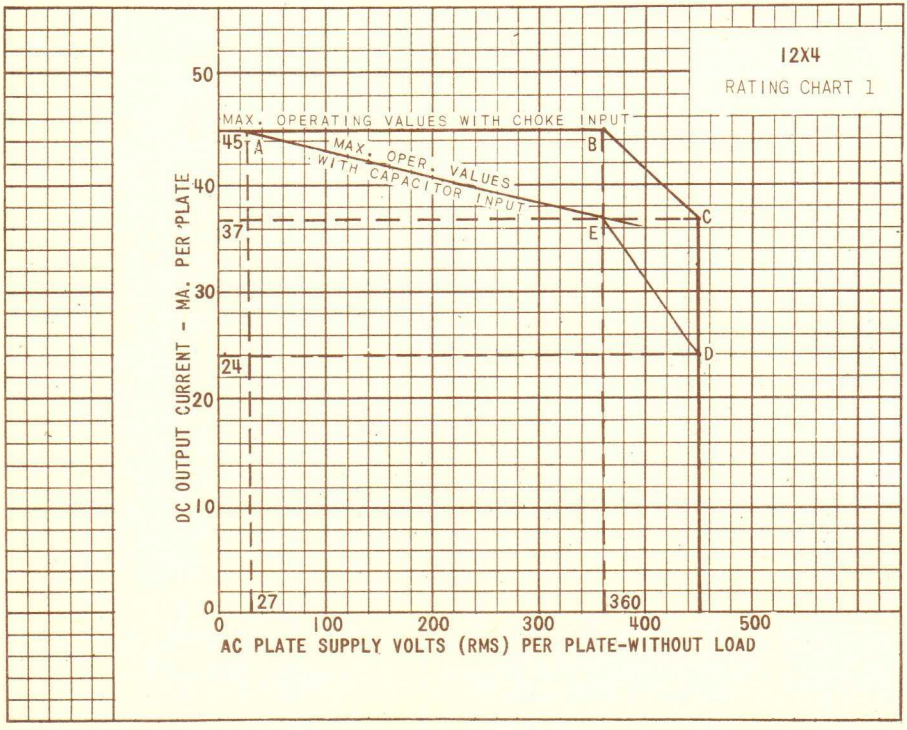
	SINE WAVE OPERATION INPUT TO FILTER		VIBRATOR OPERATION INPUT TO FILTER	
	CAPACITOR	CHOKE	CAPACITOR	
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)[B]	325	400	---	VOLTS
INPUT CAPACITOR	10	---	10	μf
INPUT CHOKE	---	10	---	HENRYS
EFFECTIVE PLATE SUPPLY IMPEDANCE EACH PLATE	525	---		OHMS
DC OUTPUT CURRENT	70	70	70	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT (APPROX.)	310	340	240	VOLTS

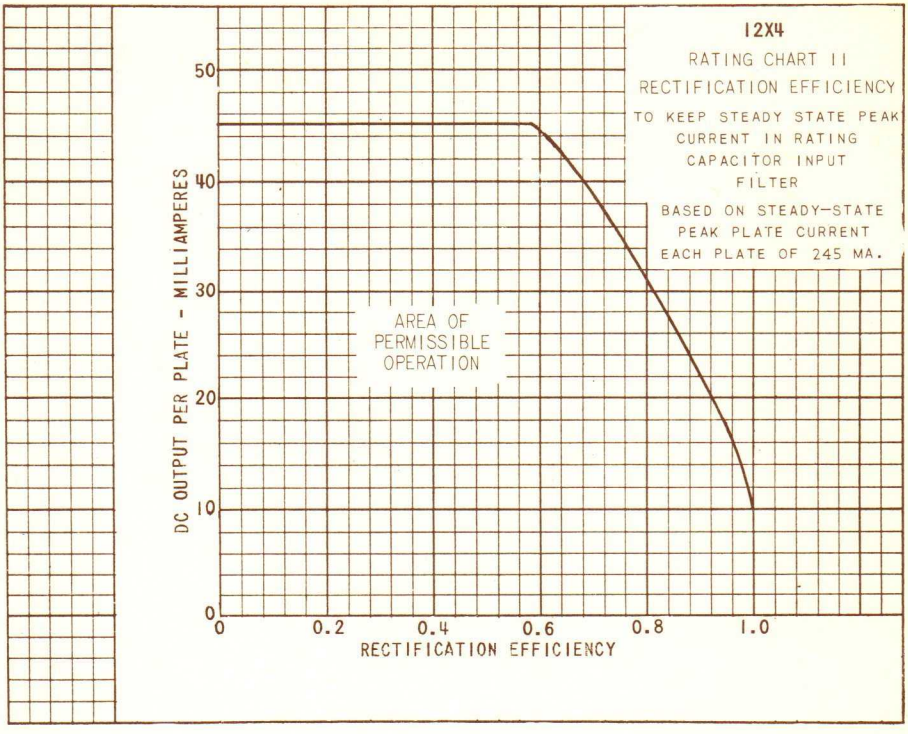
A
WHEN USED IN AUTOMOTIVE SERVICE FROM A 12 VOLT BATTERY SOURCE, THE PERMISSIBLE RANGE IN HEATER VOLTAGE IS FROM 10.0 TO 15.9 VOLTS.

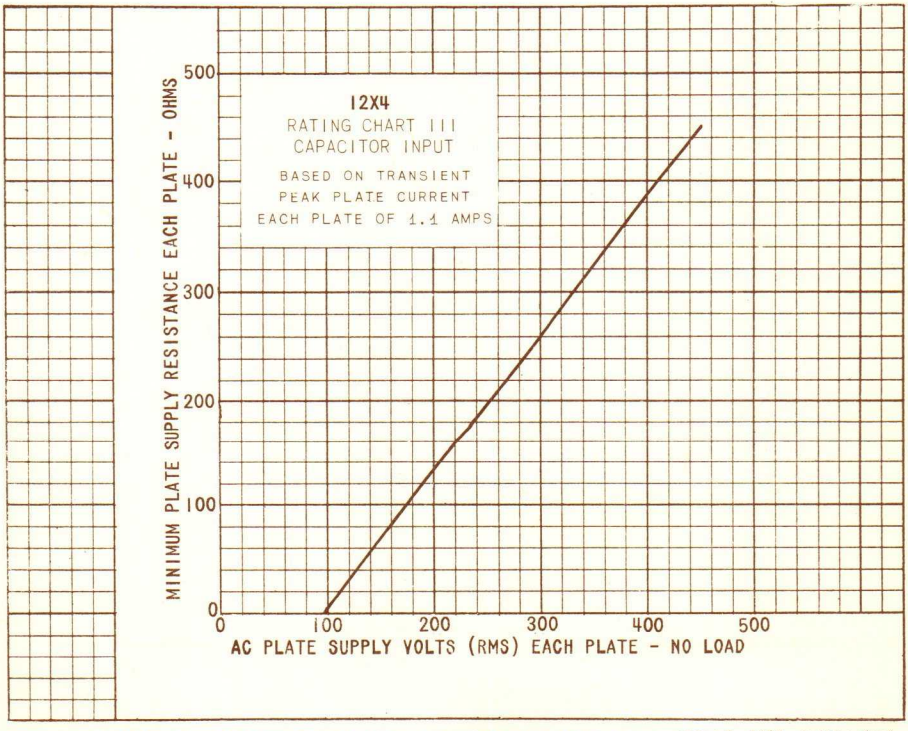
B
AC PLATE SUPPLY VOLTAGE IS MEASURED WITHOUT LOAD.

→INDICATES A CHANGE.

SIMILAR TYPE REFERENCE: Except for heater ratings, the 12X4 is identical to the 6X4.





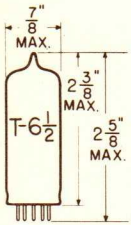


PRINTED IN U.S.A.

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



GLASS BULB

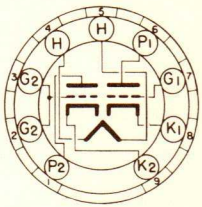
COATED UNIPOTENTIAL CATHODE

HEATER

13.0 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9HF

THE 13DE7 IS A MINIATURE DOUBLE TRIODE IN THE 9-PIN MINIATURE CONSTRUCTION. SECTION #1 IS INTENDED FOR USE AS A VERTICAL DEFLECTION OSCILLATOR HAVING MEDIUM MU AND SECTION #2 IS INTENDED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER WITH LOW MU. 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 13DE7 IS IDENTICAL TO THE 10DE7.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: (G TO P)	4.0	8.5	μμf
INPUT: G TO (H+K)	2.2	5.5	μμf
OUTPUT: P TO (H+K)	0.52	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[A]

	TRIODE #1 OSCILLATOR	TRIODE #2 AMPLIFIER	
HEATER VOLTAGE	13.0	13.0 ←	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE[B]			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM DC PLATE VOLTAGE	330	275	
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	---	1500 ←	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.5	7.0	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	22	50	MA.
MAXIMUM PEAK CATHODE CURRENT	77	175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE			
SELF BIAS	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE #1	TRIODE #2	
HEATER VOLTAGE		13.0 ←	VOLTS
HEATER CURRENT		0.45	AMP.
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-11	-17.5	VOLTS
PLATE CURRENT	5.5	35	MA.
TRANSCONDUCTANCE	2000	6500	μMHOS
AMPLIFICATION FACTOR	17.5	6.0	
PLATE RESISTANCE (APPROX.)	8750	925	
GRID VOLTAGE FOR Ib = 10 μA	-20	---	VOLTS
GRID VOLTAGE FOR Ib = 50 μA	---	-44	VOLTS
PLATE CURRENT AT Ec =-24 Vdc	---	10	MA.
ZERO BIAS PLATE CURRENT Eb = 60V; Ec = 0 (INSTANTANEOUS VALUES)	---	80	MA.

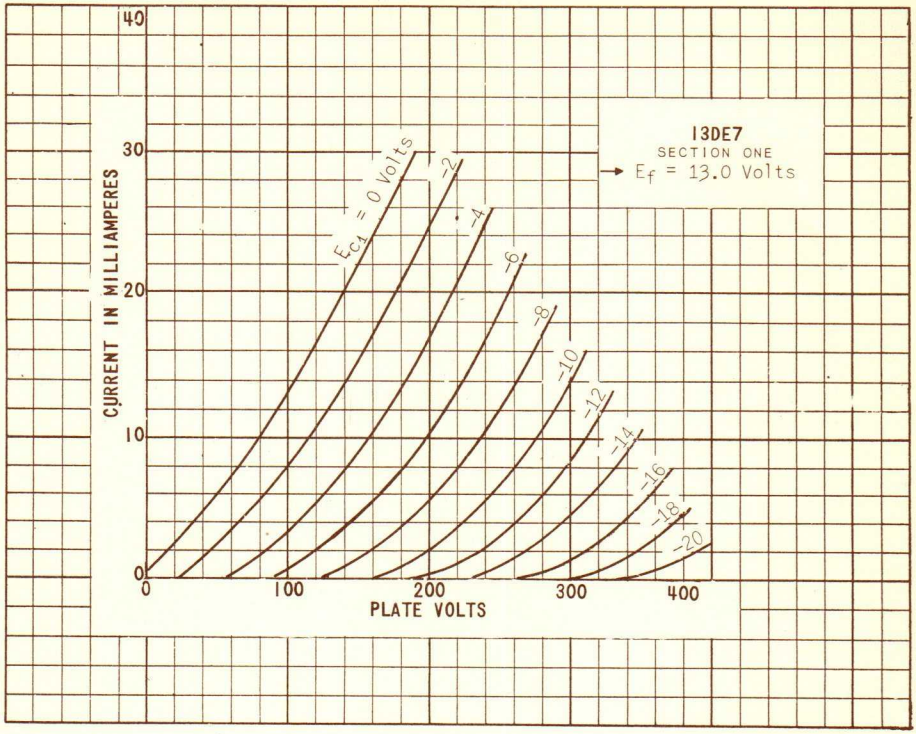
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

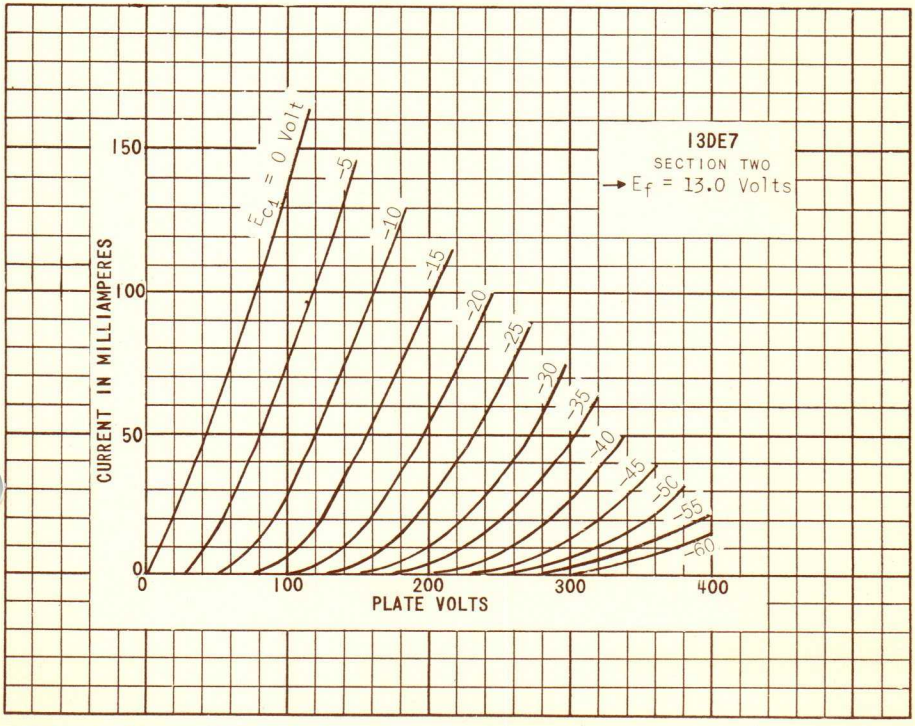
[B] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED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

[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.

→ INDICATES A CHANGE.



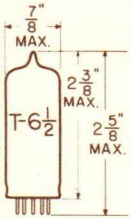


PRINTED IN U.S.A.

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

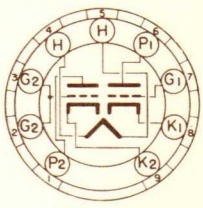


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
13.0 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9HF

THE 13DR7 IS A DOUBLE TRIODE WITH DISSIMILAR SECTIONS IN THE 9-PIN MINIATURE CONSTRUCTION. SECTION #1 HAS A HIGH MU AND IS INTENDED FOR USE AS A VERTICAL DEFLECTION OSCILLATOR. SECTION #2 HAS A LOW MU AND IS DESIGNED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER. EXCEPT FOR HEATER RATINGS, THE 13DR7 IS IDENTICAL TO THE 6DR7.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: (G TO P)	4.5	8.5	μμf
INPUT: G TO (H+K)	2.2	5.5	μμf
OUTPUT: P TO (H+K)	0.34	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[A]

	TRIODE #1 OSCILLATOR	TRIODE #2 AMPLIFIER	
HEATER VOLTAGE	13.0	13.0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE[B]			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM DC PLATE VOLTAGE	330	275	
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	---	1500	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.0	7.0	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	20	50	MA.
MAXIMUM PEAK CATHODE CURRENT	70	175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE			
SELF BIAS	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE #1	TRIODE #2	
HEATER VOLTAGE	13.0		VOLTS
HEATER CURRENT	0.45		AMP.
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-3	-17.5	VOLTS
PLATE CURRENT	1.4	35	MA.
TRANSCONDUCTANCE	1600	6500	μMHOS
AMPLIFICATION FACTOR	68	6.0	
PLATE RESISTANCE (APPROX.)	40 000	925	
GRID VOLTAGE FOR Ib = 10 μA	5.5	---	VOLTS
GRID VOLTAGE FOR Ib = 50 μA	---	-44	VOLTS
PLATE CURRENT AT Ec =-24 Vdc	---	10	MA.
ZERO BIAS PLATE CURRENT			
Eb = 60V; Ec = 0 (INSTANTANEOUS VALUES)	---	80	MA.

[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.

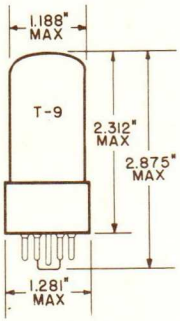
[B] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED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

[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.

TUNG-SOL

DOUBLE TRIODE



GLASS BULB
SHORT INTERMEDIATE SHELL
8 PIN OCTAL B8-58
OUTLINE DRAWING
JEDEC 9-37

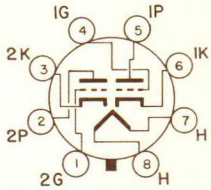
COATED UNIPOTENTIAL CATHODE

HEATER

13.0 VOLTS 450 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8BD

THE 13EM7 CONTAINS TWO DISSIMILAR TRIODES IN ONE ENVELOPE. SECTION 1 HAS A HIGH MU AND IS INTENDED FOR USE AS A VERTICAL DEFLECTION OSCILLATOR. SECTION 2 HAS A LOW MU AND IS INTENDED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER. EXCEPT FOR HEATER CHARACTERISTICS, THE 13EM7 IS IDENTICAL TO THE 6EM7.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	SEC.#1 [D]	SEC.#2 [D]	
GRID TO PLATE	4.8	10	pf
INPUT: G TO (H + K)	2.2	7.0	pf
OUTPUT: P TO (H + K)	0.6	1.8	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM
(EXCEPT AS NOTED)

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[A]

	SEC.#1 [D] OSCILLATOR	SEC.#2 [D] AMPLIFIER	
MAXIMUM DC PLATE VOLTAGE	330	330	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE(ABS.MAX)	---	1500	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.5	10	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	22	50	MA.
MAXIMUM PEAK CATHODE CURRENT	77	175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	2.2	2.2	MEGOHMS

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESING MAXIMUM SYSTEM
(EXCEPT AS NOTED)

VERTICAL DEFLRCTION OSCILLATOR AND 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
HEATER WARM-UP TIME* (APPROX.)	11.0	VOLTS

AVERAGE CHARACTERISTICS

	SEC. #1[D]	SEC. #2[D]	
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-3	-20	VOLTS
PLATE CURRENT	1.4	50	MA.
TRANSCONDUCTANCE	1 600	7 200	μMHOS
AMPLIFICATION FACTOR	64 ←	5.4	
PLATE RESISTANCE (APPROX.)	40 000	750	OHMS
Ec FOR Ib =10 μA (APPROX.)	-5.5	---	VOLTS
Ec FOR Ib =100μA (APPROX.)	---	-45	VOLTS
Ib AT Ec =-28 Vdc APPROX.	---	10	MA.

INSTANTANEOUS PLATE KNEE VALUES (SECTION #2)
Eb = 60 V; Ec =0
Ib = 95 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.

[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.

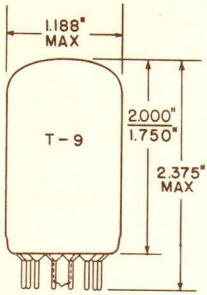
[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DE ICE MA UFACTURER CHOOSES THESE VALUES TO PROVIDE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

[D] SECTION #1 CONNECTS TO PINS 4, 5 AND 6.

TUNG-SOL

DUAL PENTODE



GLASS BULB
BUTTON 12 PIN
BASE E12-70
OUTLINE DRAWING
JEDEC 9-58

COMPACTRON

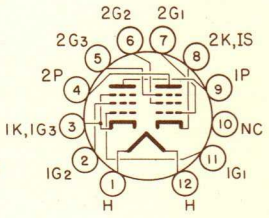
FOR

DISCRIMINATOR AND

AUDIO POWER OUTPUT SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12BT

THE 13J10 IS A GATED-BEAM DISCRIMINATOR PENTODE AND A BEAM PENTODE IN THE T-9 COMPACTRON CONSTRUCTION. SECTION 2 THE GATED-BEAM DISCRIMINATOR PENTODE IS SUITABLE FOR FM AND TV LIMITER AND DISCRIMINATOR APPLICATIONS AND SECTION 1 THE BEAM PENTODE FOR AUDIO POWER OUTPUT SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

DISCRIMINATOR SECTION: (SECTION 2)		
GRID 1 TO GRID 3	0.01	pf
GRID 1 TO ALL	4.0	pf
GRID 3 TO ALL	3.2	pf
OUTPUT SECTION: (SECTION 1)		
GRID 1 TO PLATE	0.2	pf
INPUT:	11	pf
OUTPUT:	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	13.2 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SEC.
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.

	DISCRIMINATOR SECTION	OUTPUT SECTION	
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

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

OUTPUT SECTION 1

PLATE VOLTAGE	275	VOLTS
GRID 2 VOLTAGE	275	VOLTS
PLATE DISSIPATION	10	WATTS
GRID 2 DISSIPATION	2.0	WATTS
GRID 1 CIRCUIT RESISTANCE		
WITH FIXED BIAS	0.25	MEGOHM
WITH CATHODE BIAS	0.5	MEGOHM

DISCRIMINATOR SECTION 2

PLATE SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	110	VOLTS
PEAK POSITIVE GRID 1 VOLTAGE	60	VOLTS
CATHODE CURRENT - DC	13	MA.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

OUTPUT SECTION 1

PLATE VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	250	VOLTS
GRID - NUMBER 1 VOLTAGE	−8.0	VOLTS
PEAK AF GRID - NUMBER 1 VOLTAGE	8.0	VOLTS
ZERO-SIGNAL PLATE CURRENT	35	MA.
MAXIMUM - SIGNAL PLATE CURRENT	39	MA.
ZERO-SIGNAL GRID 2 CURRENT	2.5	MA.
MAXIMUM - SIGNAL GRID 2 CURRENT	7.0	MA.
TRANSCONDUCTANCE	6,500	μMHOS
PLATE RESISTANCE, APPROXIMATE	100,000	OHMS
LOAD RESISTANCE	5,000	OHMS
TOTAL HARMONIC DISTORTION, APPROXIMATE	10	PERCENT
MAXIMUM - SIGNAL POWER OUTPUT	4.2	WATTS

DISCRIMINATOR SECTION 2

INPUT-SIGNAL CENTER FREQUENCY	10.7	10.7	4.5	Mc/s
FREQUENCY DEVIATION	±75	±75	±25	Kc/s
PLATE-SUPPLY VOLTAGE	85	285	270	VOLTS
PLATE VOLTAGE	62	122	121	VOLTS
GRID 2 VOLTS	55	100	100	VOLTS
CATHODE-BIAS RESISTOR (VARIABLE) SEE BELOW	200-400	200-400	200-400	OHMS
PLATE LOAD RESISTOR	85,000	330,000	330,000	OHMS
PLATE LINEARITY RESISTOR	470	1,500	1,000	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	1.25	1.25	1.25	VOLTS
AT SIGNAL LEVELS ABOVE THIS VALUE, LIMITING IS WITHIN ± 3 dbs				
PLATE CURRENT-DC	0.25	0.49	0.44	MA.
ACCELERATOR CURRENT	4.1	9.8	10	MA.
INPUT SIGNAL LEVEL FOR AM REJECTION ADJUSTMENT	1.25	2.0	2.0	VOLTS
AM REJECTION AT ESIG = 2.0 VOLTS, RMS	31	20	25	DECIBELS
AM REJECTION AT ESIG = 3.0 VOLTS, RMS	30	29	30	DECIBELS
TOTAL HARMONIC DISTORTION	2.0	1.6	1.8	PERCENT
PEAK AUDIO OUTPUT VOLTAGE	6.0	16.6	16.8	VOLTS

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

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-EMPHASIS REQUIREMENTS FOR FM ARE INCLUDED.

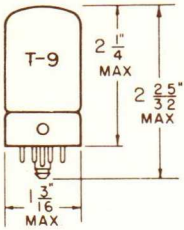
THE Q OF THE QUADRATURE GRID CIRCUIT SHOULD BE HIGH ENOUGH TO DEVELOP A MINIMUM OF 4 VOLTS (RMS) SIGNAL WITH 2 VOLTS(RMS) OF THE CENTER-FREQUENCY SIGNAL APPLIED TO THE LIMITER GRID. IT IS RECOMMENDED THAT THE COIL BE SHUNTED BY A MINIMUM OF 10pf. THE CAPACITANCE MAY BE COMPOSED OF TUBE INPUT CAPACITANCE,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

TENTATIVE DATA

(7A7) 14A7/12B7

TUNG-SOL

PENTODE

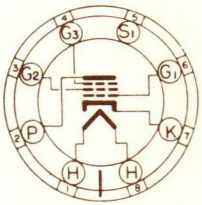


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE
8V

THE 14A7/12B7 IS A PENTODE VOLTAGE AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR RF OR IF SERVICE IN AC/DC RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES
WITH RMA SHIELD #308 CONNECTED TO CATHODE

GRID TO PLATE: (G_1 TO P)	0.003	µµf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	6	µµf
OUTPUT: P TO (H+K+G_2+G_3+IS)	7	µµf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MINIMUM EXTERNAL GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	4	WATTS
MAXIMUM GRID #2 DISSIPATION	0.4	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	PIN #4 AND PIN #5 CONNECTED TO PIN #8		
GRID #2 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE	-1	-3	VOLTS
SELF BIAS RESISTOR	60	260	OHMS
PLATE RESISTANCE (APPROX.)	0.12	0.8	MEGOHM
TRANSCONDUCTANCE	2350	2000	µMHOS
PLATE CURRENT	13	9.2	MA.
GRID #2 CURRENT	4	2.6	MA.
GRID #1 VOLTAGE FOR G_m = 10 µMHOS (APPROX.)	-35	-35	VOLTS

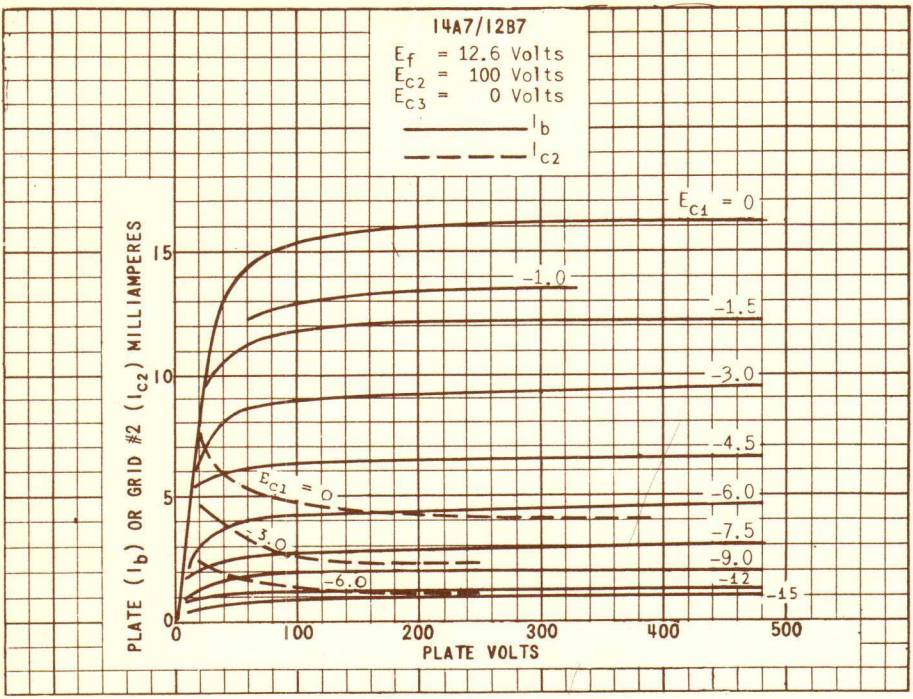
→ INDICATES A CHANGE OR ADDITION

PRINTED IN U. S. A.

PLATE 2409
MAY 1 1950

COPYRIGHT 1950 BY TUNG-SOL LAMP WORKS INC. ELECTRONIC TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

14A7/12A7 (7A7)



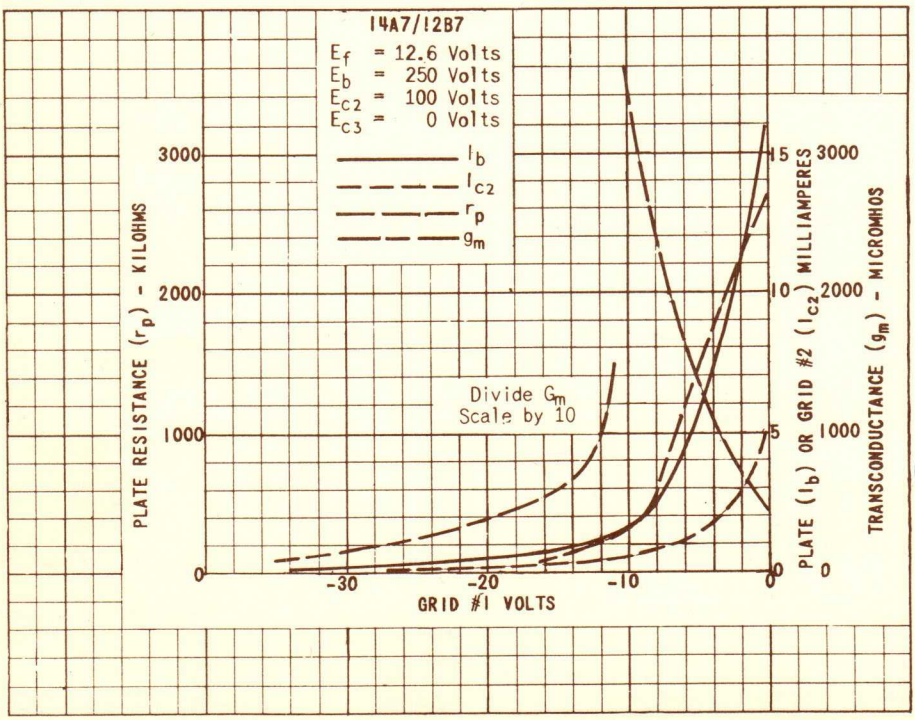
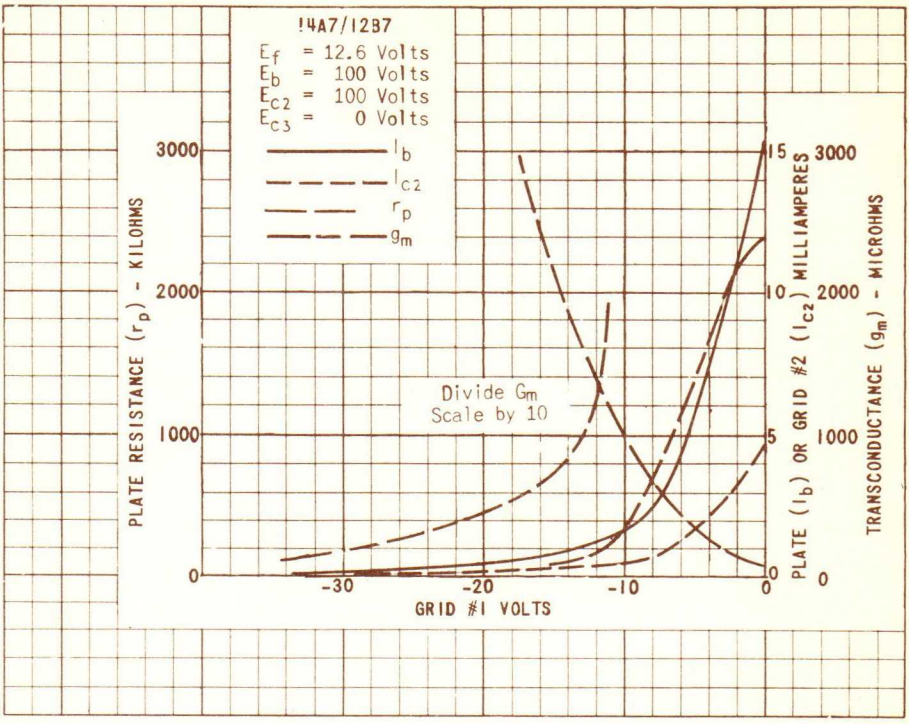


PLATE 2410
MAY 1 1950

COPYRIGHT 1950 BY TUNG-SOL LAMP WORKS INC. ELECTRONIC TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.



PRINTED IN U. S. A.

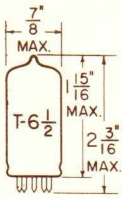
PLATE
2411
MAY 1
1950

COPYRIGHT 1950 BY TUNG-SOL LAMP WORKS INC. ELECTRONIC TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

TUNG-SOL

DUPLEX-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

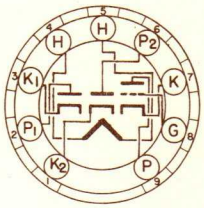
COATED UNIPOTENTIAL CATHODE

HEATER

14±10% VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN, BASE

9KR

THE 14GT8 IS A DUPLEX-DIODE, HIGH-MU TRIODE DESIGNED FOR USE AS AN FM DETECTOR AND AF VOLTAGE AMPLIFIER. IT HAS SEPARATE CATHODES FOR EACH OF THE DIODE SECTIONS AND THE TRIODE SECTION.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE GRID TO PLATE	1.8	μμf
TRIODE INPUT	1.6	μμf
TRIODE OUTPUT	0.24	μμf
GRID TO DIODE #1 PLATE, MAX.	0.09	μμf
GRID TO DIODE #2 PLATE, MAX.	0.07	μμf
DIODE #1 INPUT	2.4	μμf
DIODE #2 INPUT	2.4	μμf
DIODE #1 CATHODE TO ALL	6.5	μμf
DIODE #2 CATHODE TO ALL	6.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	14±10%	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.1	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 DIODE CURRENT FOR CONTINUOUS OPERATION, EACH DIODE	5.0	MA.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

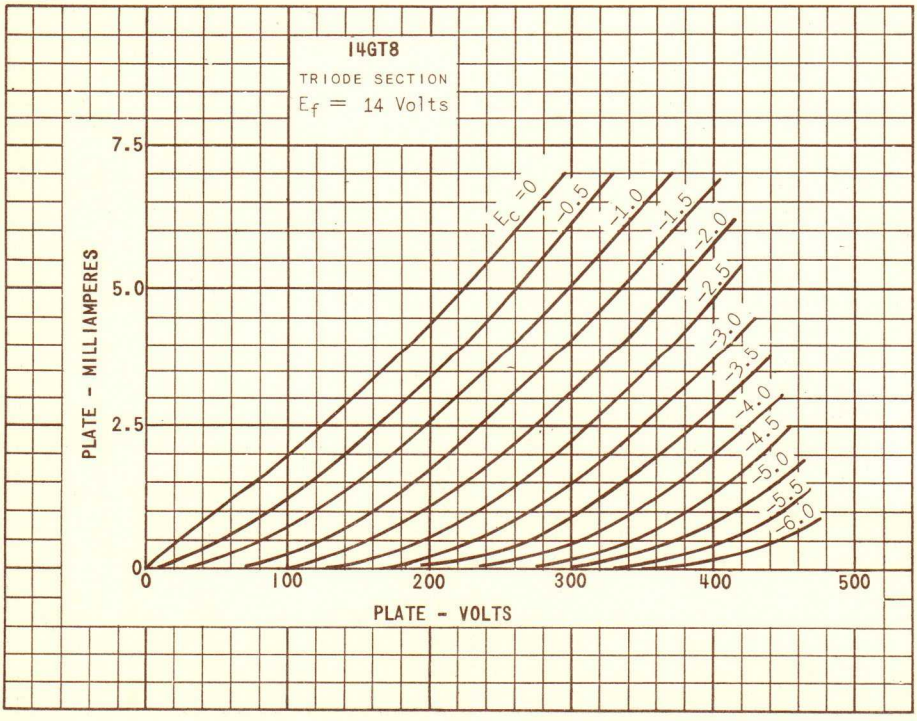
CONTINUED FROM PRECEDING PAGE

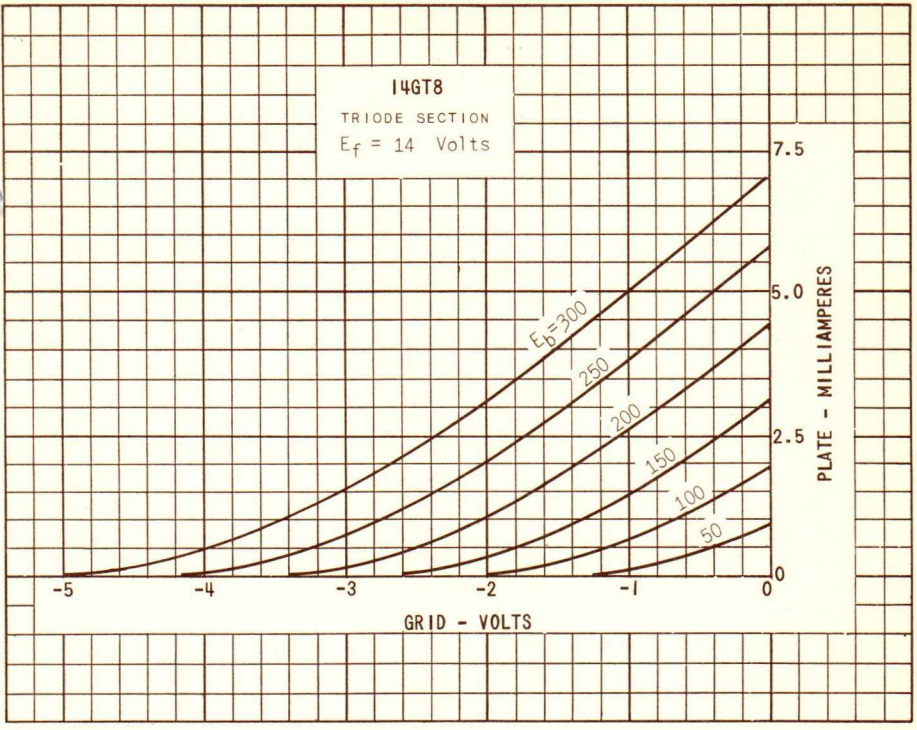
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

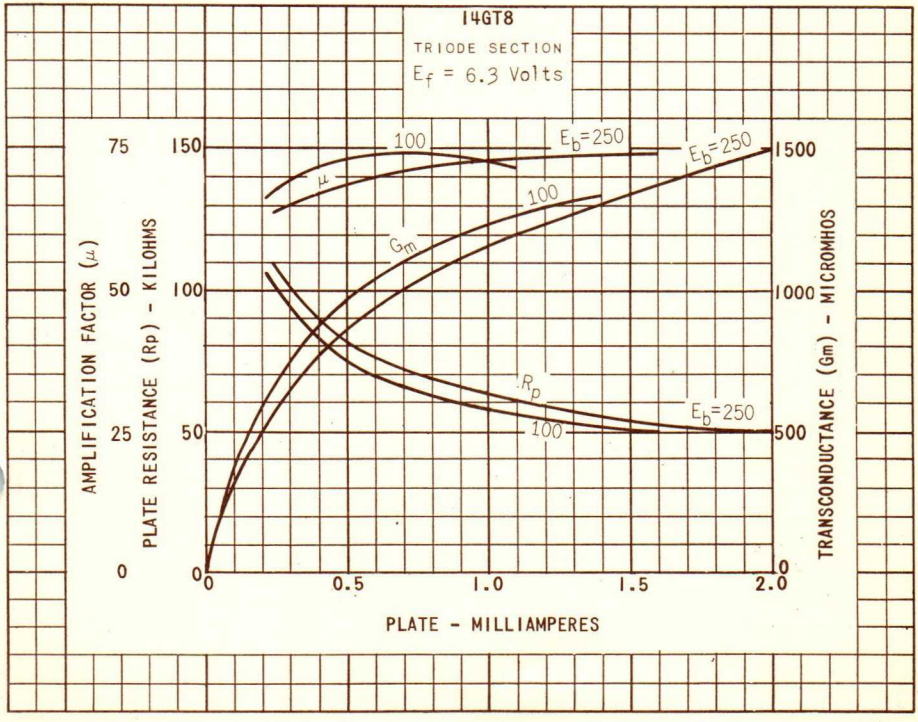
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	14±10%	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	−3.0	VOLTS
AMPLIFICATION FACTOR	72	
PLATE RESISTANCE, APPROX.	72 000	OHMS
TRANSCONDUCTANCE	1 000	μMHOS
PLATE CURRENT	0.7	MA.
AVERAGE DIODE CURRENT, EACH DIODE WITH 5.0 VOLTS DC APPLIED	18	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.

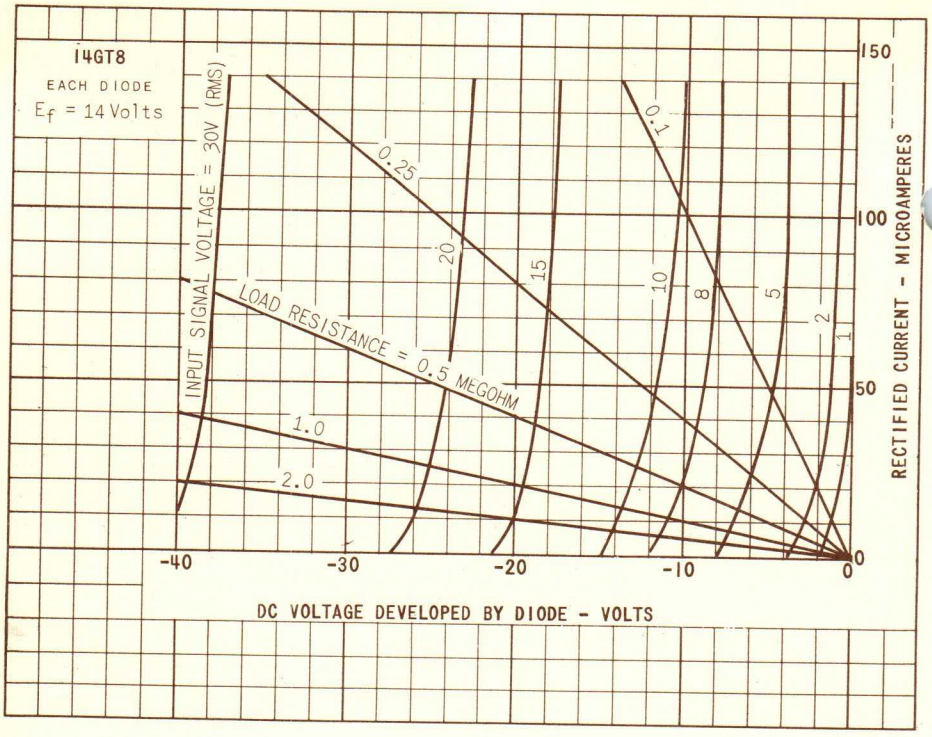






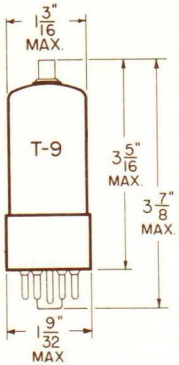
PRINTED IN U.S.A.

TENTATIVE DATA



TUNG-SOL

TRIODE PENTODE

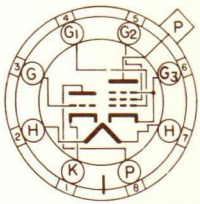


GLASS BULB
SKIRTED MINIATURE CAP

COATED UNIPOTENTIAL CATHODE

HEATER
15.0 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL 8 PIN OCTAL
8GS

THE 15A8 IS A MEDIUM MU TRIODE AND BEAM PENTODE DESIGNED FOR USE AS A COMBINED VERTICAL DEFLECTION OSCILLATOR AND 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 – APPROX.

	TRIODE	PENTODE	
GRID #1 TO PLATE	3.4	0.7	μμf
INPUT	2.6	11	μμf
OUTPUT	0.9	5.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
HEATER VOLTAGE	15.0		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
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 VOLTAGE		150	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	10	WATTS
MAXIMUM GRID #2 DISSIPATION		1.25	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
FIXED BIAS	1.0	0.1	MEGOHM
SELF BIAS		0.5	MEGOHM
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.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

RATINGS – CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[B]

	TRIODE AS OSCILLATOR	PENTODE AS TRIODE CONNECTED AMPLIFIER[C]	
HEATER VOLTAGE	15.0		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
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAXIMUM)		1 200	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID #1 VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION [D]	2.5	7.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	20	40	MA.
MAXIMUM PEAK CATHODE CURRENT	70	140	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
SELF BIAS	2.2	2.2	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE		PENTODE	PENTODE TRIODE CONNECTED[C]	
HEATER VOLTAGE	15.0	15.0	15.0	15.0	VOLTS
HEATER CURRENT	0.6	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	90	250	110	225	VOLTS
GRID #1 VOLTAGE	0	-8	-7.5	-30	VOLTS
GRID #2 VOLTAGE			110		VOLTS
PLATE CURRENT	9	9	45	25	MA.
TRANSCONDUCTANCE	2 600	2 600	7 300	3 800	μMHOS
AMPLIFICATION FACTOR	20	20		6.0	
PLATE RESISTANCE (APPROX.)	7 700	7 700	13 000	1 600	OHMS
PLATE CURRENT AT E_c=-12.5V.		2.3			MA.
PLATE CURRENT AT E_c=-38V.				7.4	MA.
GRID #1 VOLTAGE FOR I_b=50μA	-6.3	-17			VOLTS
GRID #1 VOLTAGE FOR I_b=0.5 MA.				-46	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 MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

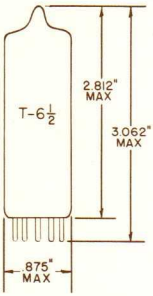
[C] GRID #2 CONNECTED TO PLATE.

[D] 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.

TUNG-SOL

PENTODE

MINIATURE TYPE



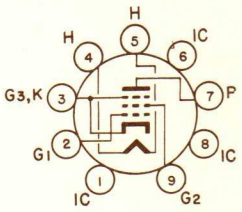
GLASS BULB

BASE E9-1
OUTLINE DRAWING
JEDEC 6-4

COATED UNIPOTENTIAL CATHODE

AUDIO OUTPUT TUBE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9CV

THE 15CW5 IS AN A.F. OUTPUT PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN COMBINED PHASE INVERTER AND PUSH-PULL APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELEMENTS EXCEPT PLATE	11.8	pf
PLATE TO ALL OTHER ELEMENTS EXCEPT GRID #1	6.0	pf
PLATE TO GRID #1 (MAX.)	0.6	pf
GRID #1 TO HEATER (MAX.)	0.25	pf

HEATER CHARACTERISTICS AND RATINGS

AVERAGE CHARACTERISTICS	15 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		300±20	MA.

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	250	VOLTS
PLATE VOLTAGE WITHOUT PLATE CURRENT	550	VOLTS
PLATE DISSIPATION	12	WATTS
GRID #2 VOLTAGE	200	VOLTS
GRID #2 VOLTAGE WITHOUT CURRENT	550	VOLTS
GRID #2 DISSIPATION	1.75	WATTS
GRID #2 PEAK DISSIPATION	6	WATTS
CATHODE CURRENT	100	MAMPS
GRID #1 CIRCUIT RESISTANCE WITH AUTOMATIC BIAS	1	MEGOHM
VOLTAGE BETWEEN HEATER AND CATHODE	200	VOLTS
PEAK VOLTAGE BETWEEN HEATER AND CATHODE (CATHODE POSITIVE WITH RESPECT TO HEATER) [A]	300	VOLTS
CIRCUIT RESISTANCE BETWEEN CATHODE AND HEATER	20 000	OHMS

[A] FOR SINGLE-ENDED PUSH-PULL APPLICATIONS: DC COMPONENT MAX. 150 VOLTS.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL CHARACTERISTICS

PLATE VOLTAGE	100	170	200	VOLTS
GRID #2 VOLTAGE	100	170	---	VOLTS
GRID #2 SUPPLY VOLTAGE	---	---	200	VOLTS
GRID #2 SERIES RESISTOR (NOT BYPASSED)	---	---	470	OHMS
GRID #1 BIAS	-6.7	-12.5	-17.3	VOLTS
PLATE CURRENT	43	70	60	MAMPS
GRID #2 CURRENT	3.0	5.0	4.1	MAMPS
TRANSCONDUCTANCE	9 000	10 000	8 800	μMHOS
PLATE RESISTANCE	23 000	23 000	28 000	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	8	8	8	

OPERATING CHARACTERISTICS

CLASS A
ONE TUBE

PLATE VOLTAGE	100	170	200	VOLTS
GRID #2 VOLTAGE	100	170	---	VOLTS
GRID #2 SUPPLY VOLTAGE	---	---	200	VOLTS
GRID #2 SERIES RESISTOR (NOT BYPASSED)	---	---	470	OHMS
GRID #1 BIAS	-6.7	-12.5	-17.3	VOLTS
PLATE LOAD RESISTANCE	2400	2400	2400	OHMS
INPUT AF GRID #1 VOLTAGE, RMS	4.3	7.0	7.8	VOLTS
ZERO-SIGNAL PLATE CURRENT	43	70	60	MAMPS
MAX.-SIGNAL PLATE CURRENT	43	70	62.5	MAMPS
ZERO-SIGNAL GRID #2 CURRENT	3.0	5.0	4.1	MAMPS
MAX.-SIGNAL GRID #2 CURRENT	11	22	12.5	MAMPS
TOTAL HARMONIC DISTORTION	10	10	10	PERCENT
POWER OUTPUT	1.9	5.6	5.2	WATTS

OPERATING CHARACTERISTICS

TWO TUBES

	CLASS B PUSH PULL		CLASS AB PUSH PULL		
PLATE VOLTAGE	100	170	100	170	VOLTS
GRID #2 VOLTAGE	100	170	100	170	VOLTS
GRID #1 BIAS	-11.4	-20.5			OHMS
COMMON CATHODE RESISTOR			135	120	OHMS
LOAD RESISTANCE PLATE TO PLATE	3500	3500	3500	3500	OHMS
INPUT AF GRID #1 VOLTAGE, RMS	7.9	14.6	7.0	13.1	VOLTS
ZERO-SIGNAL PLATE CURRENT	2x10	2x15	2x29	2x56.5	MAMPS
MAX.-SIGNAL PLATE CURRENT	2x30.5	2x57.5	2x31	2x57.5	MAMPS
ZERO-SIGNAL GRID #2 CURRENT	2x0.55	2x0.7	2x1.6	2x3.0	MAMPS
MAX.-SIGNAL GRID #2 CURRENT	2x7.1	2x20.5	2x7,0	2x20.5	MAMPS
TOTAL HARMONIC DISTORTION	2.8	4.8	3.0	4.5	PERCENT
POWER OUTPUT	3.7	13.5	3.6	13.0	WATTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

OPERATING CHARACTERISTICS IN TRIODE CONNECTION

CLASS A

ONE TUBE

(GRID #2 CONNECTED TO PLATE)

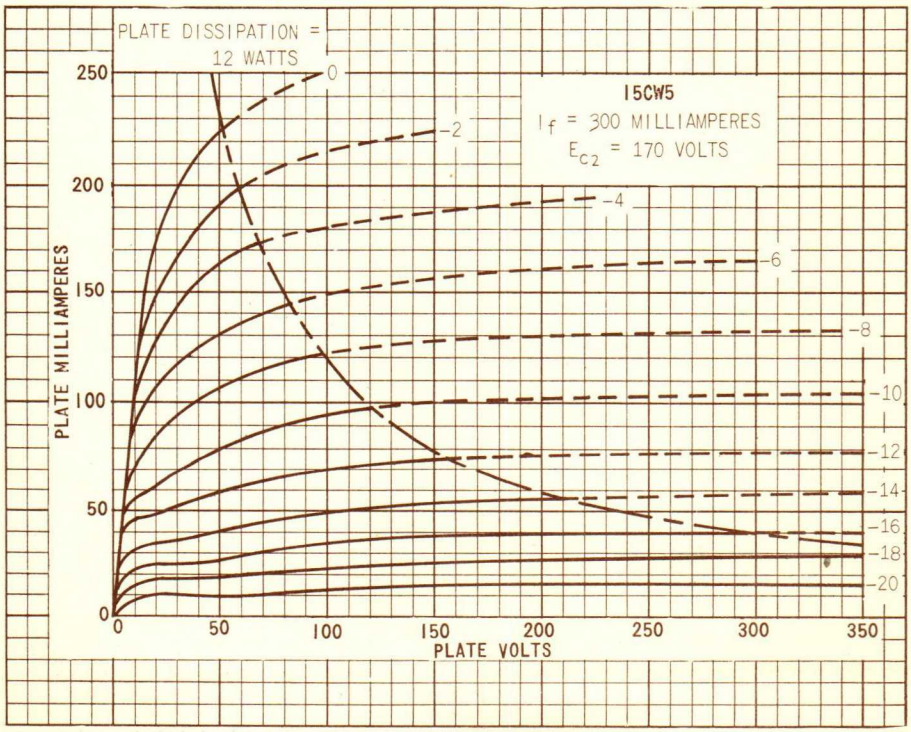
PLATE VOLTAGE	100	170	VOLTS
GRID BIAS	-8.0	-15.1	VOLTS
PLATE LOAD RESISTANCE	1200	1200	OHMS
INPUT AF GRID VOLTAGE, RMS	5.7	10.8	VOLTS
ZERO-SIGNAL PLATE CURRENT	30	50	MAMPS
MAX.-SIGNAL PLATE CURRENT	36.1	62	MAMPS
TOTAL HARMONIC DISTORTION	10	10	PERCENTS
POWER OUTPUT	0.52	2.1	WATTS

CLASS AB PUSH PULL

TWO TUBES

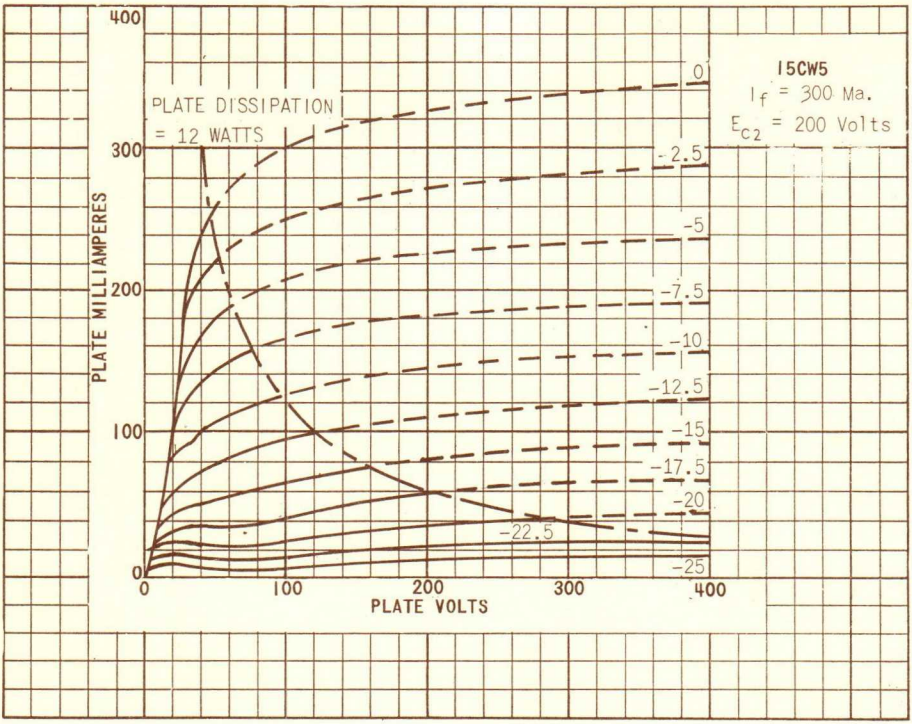
(GRID #2 CONNECTED TO PLATE)

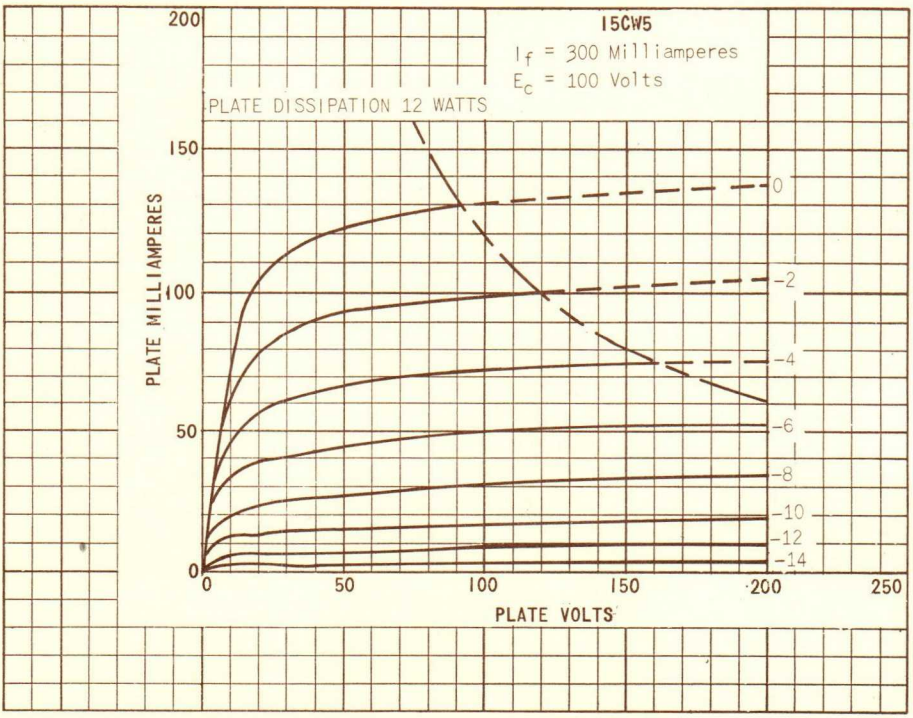
PLATE VOLTAGE	100	170	VOLTS
CATHODE RESISTOR	270	270	OHMS
LOAD RESISTANCE, PLATE TO PLATE	3500	3500	OHMS
INPUT AF GRID VOLTAGE, RMS	7.3	13.4	VOLTS
ZERO-SIGNAL PLATE CURRENT	2x18	2x32.5	MAMPS
MAX.-SIGNAL PLATE CURRENT	2x20	2x36	MAMPS
TOTAL HARMONIC DISTORTION	3.2	3.8	PERCENTS
OUTPUT POWER	1.0	3.9	WATTS

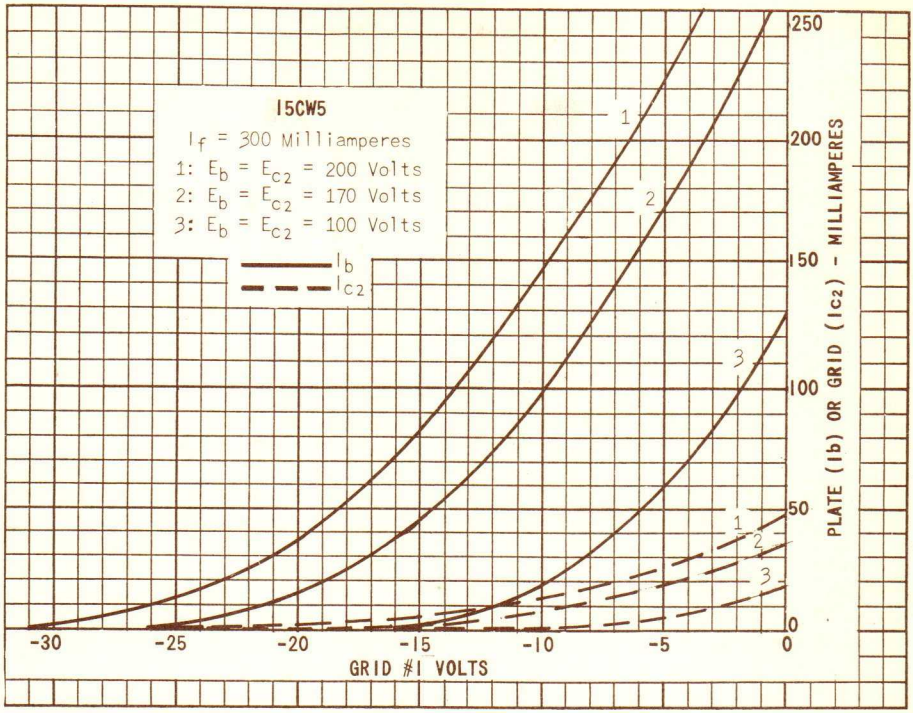


PRINTED IN U.S.A.

15CW5


15CW5
I_f = 300 Ma.
E_{c2} = 200 Volts
PLATE DISSIPATION
= 12 WATTS
PLATE MILLIAMPERES
PLATE VOLTS
0
-2.5
-5
-7.5
-10
-12.5
-15
-17.5
-20
-22.5
-25
400
300
200
100
0
100
200
300
400

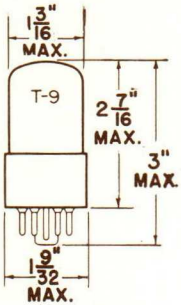

15CW5
I_f = 300 Milliamperes
E_c = 100 Volts
PLATE DISSIPATION 12 WATTS
PLATE MILLIAMPERES
PLATE VOLTS
0
-2
-4
-6
-8
-10
-12
-14
200
150
100
50
0
50
100
150
200
250



PRINTED IN U. S. A.

TUNG-SOL

DOUBLE-TRIODE

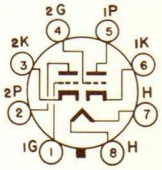


GLASS BULB
INTERMEDIATE SHELL
8 PIN OCTAL 88-6
OUTLINE DRAWING

COATED UNIPOTENTIAL CATHODE

HEATER
14.8 VOLTS[D] 0.45±0.03 AMP.[E]
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8BD

THE 15EA7 IS A DISSIMILAR DOUBLE-TRIODE DESIGNED FOR USE AS A COMBINED VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER IN TELEVISION RECEIVERS. SECTION ONE, A HIGH-MU TRIODE, IS INTENDED FOR SERVICE AS AN OSCILLATOR; SECTION TWO, A LOW-MU, HIGH PERVEANCE TRIODE, IS INTENDED FOR SERVICE AS AN AMPLIFIER. EXCEPT FOR HEATER RATINGS, AND HEATER WARM-UP TIME, THE 15EA7 IS IDENTICAL TO THE 6EA7.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

	SECTION 1	SECTION 2	
GRID TO PLATE	4.0	8.0	μμf
INPUT	2.2	6.0	μμf
OUTPUT	0.6	1.3	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	VERTICAL OSCILLATOR SERVICE (SECTION 1)[A]	VERTICAL DEFLECTION AMPLIFIER (SECTION 2)[A]	
HEATER VOLTAGE	14.8		VOLTS
MAXIMUM ALLOWABLE HEATER VOLTAGE	5.7 to 6.9		VOLTS
MAXIMUM DC PLATE VOLTAGE	350	550	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	---	1500	VOLTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	10[B]	WATTS
MAXIMUM DC CATHODE CURRENT	---	50	MA.
MAXIMUM PEAK CATHODE CURRENT	---	175	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	1.0	1.0	MEGOHMS
WITH CATHODE BIAS	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME*	11		SECONDS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

	SECTION 1 (OSCILLATOR)	SECTION 2 (AMPLIFIER)		
PLATE VOLTAGE	250	60	175	VOLTS
GRID VOLTAGE	-3.0	0[C]	-25	VOLTS
AMPLIFICATION FACTOR	66	---	5.5	
PLATE RESISTANCE (APPROX.)	30 000	---	920	OHMS
TRANSCONDUCTANCE	2 200	---	6 000	μMHOS
PLATE CURRENT	2.0	100	40	MA.
GRID VOLTAGE (APPROX.) I_b = 20 μAMPS.	5.3	---	---	VOLTS
GRID VOLTAGE (APPROX.) I_b = 200 μAMPS.	---	---	-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.

[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.

[C] APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

* 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.

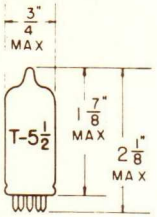
[D] HEATER VOLTAGE AT BOGEY HEATER CURRENT.

[E] FOR SERIES HEATER OPERATION, THE EQUIPMENT DESIGNER SHALL DESIGN THE EQUIPMENT SO THAT HEATER CURRENT IS CENTERED AT THE SPECIFIED BOGEY VALUE, WITH HEATER SUPPLY VARIATIONS RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED TOLERANCE.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

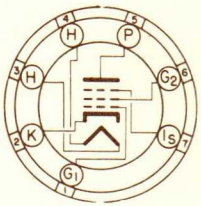
COATED UNIPOTENTIAL CATHODE

HEATER

15.0 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7CM

THE 15EW6 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, THE 15EW6 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 CURRENT[B]	0.150±0.009	AMP.
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

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

PRINTED IN U. S. A.

TUNG-SOL

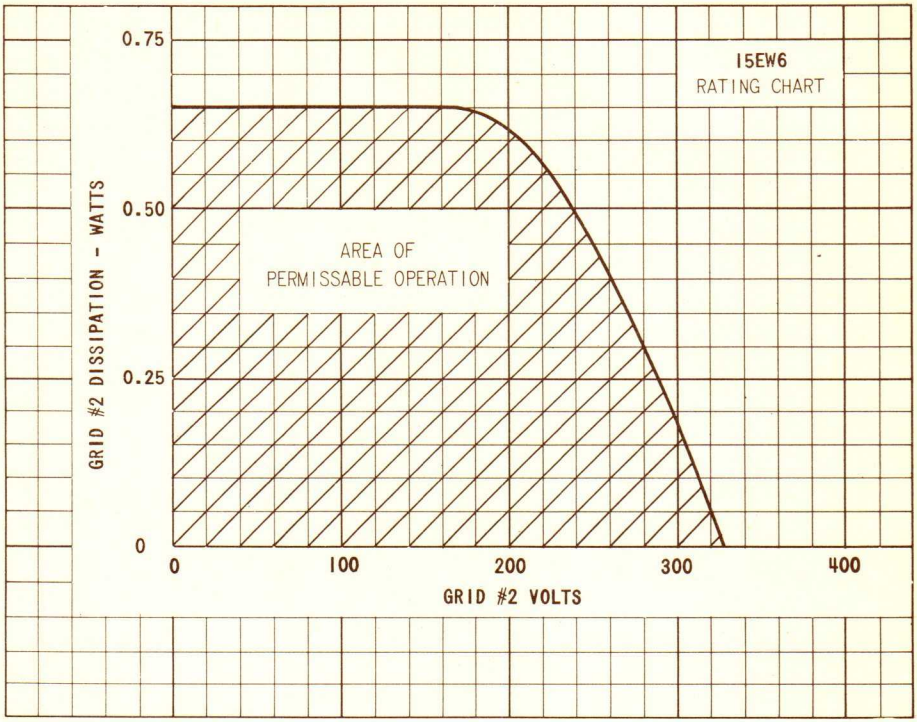
CONTINUED FROM PRECEDING PAGE

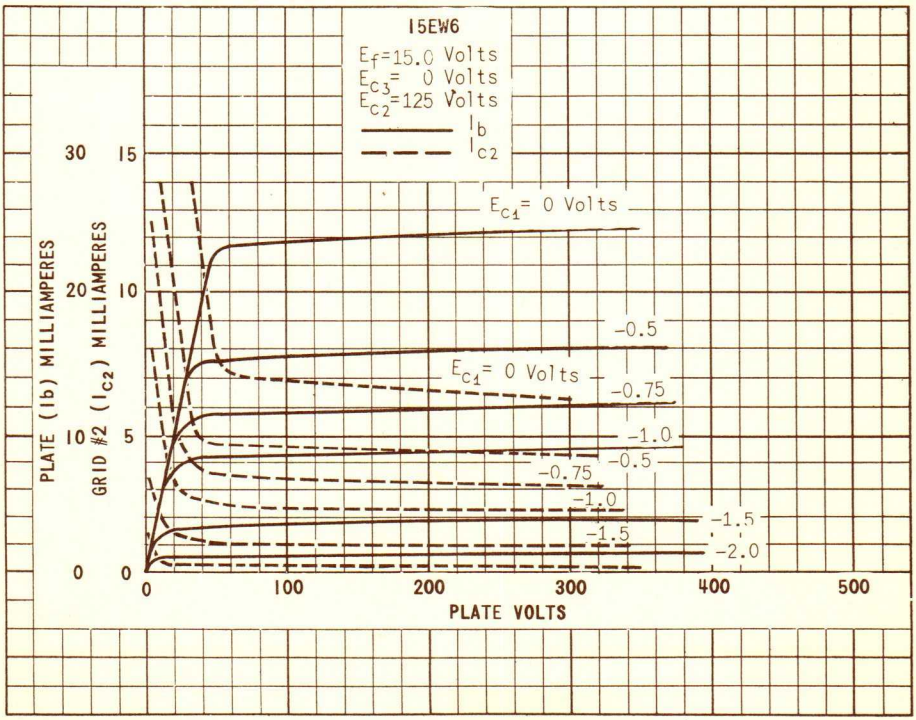
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

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

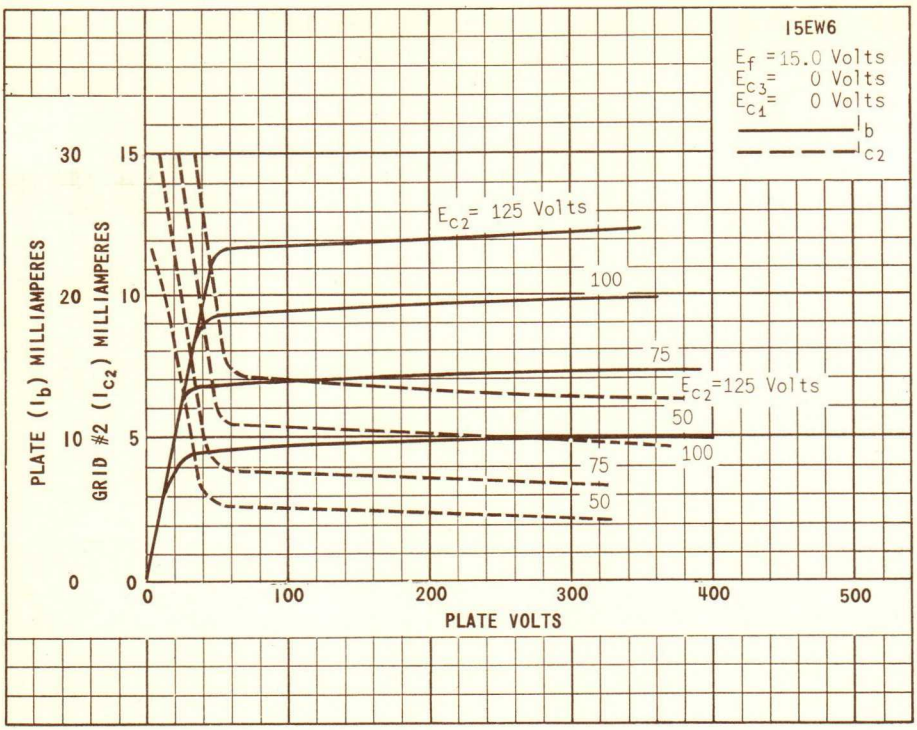
[B]THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE FILAMENT VOLTAGE IS CENTERED AT THE SPECIFIED BOGEY VALUE.

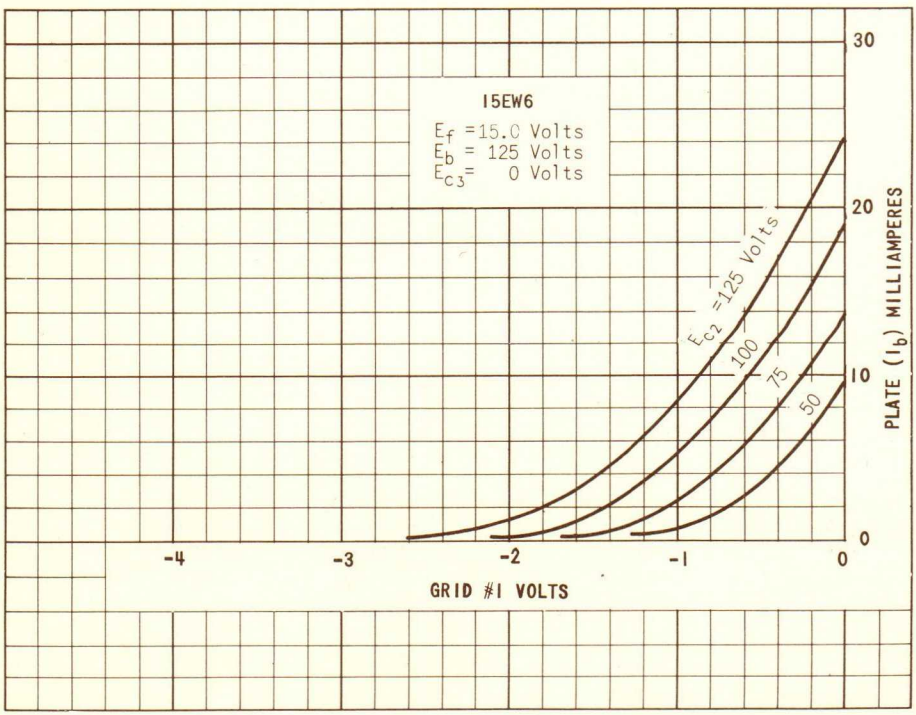


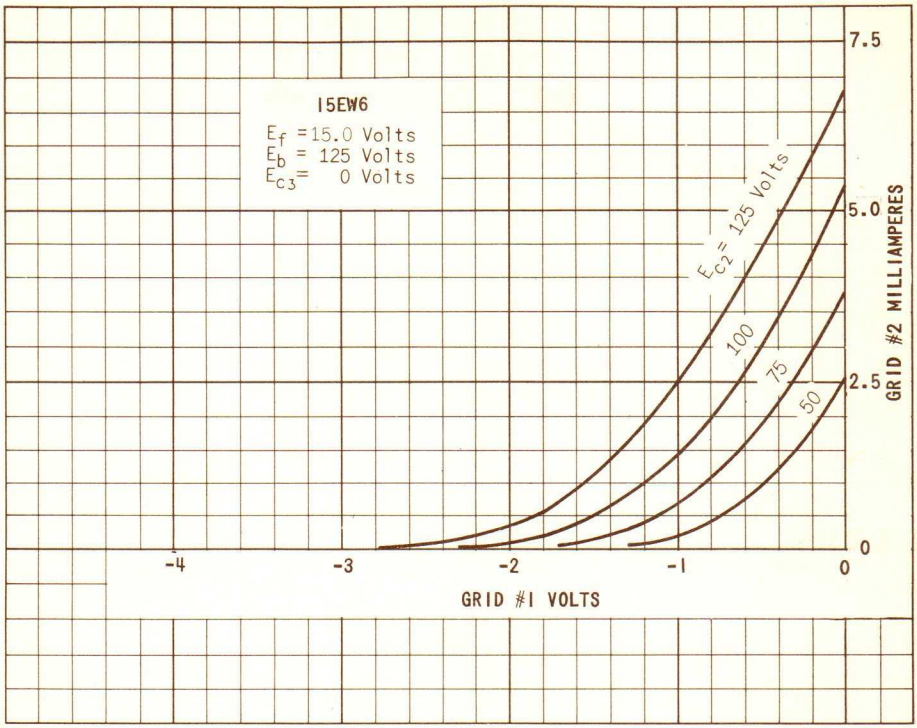


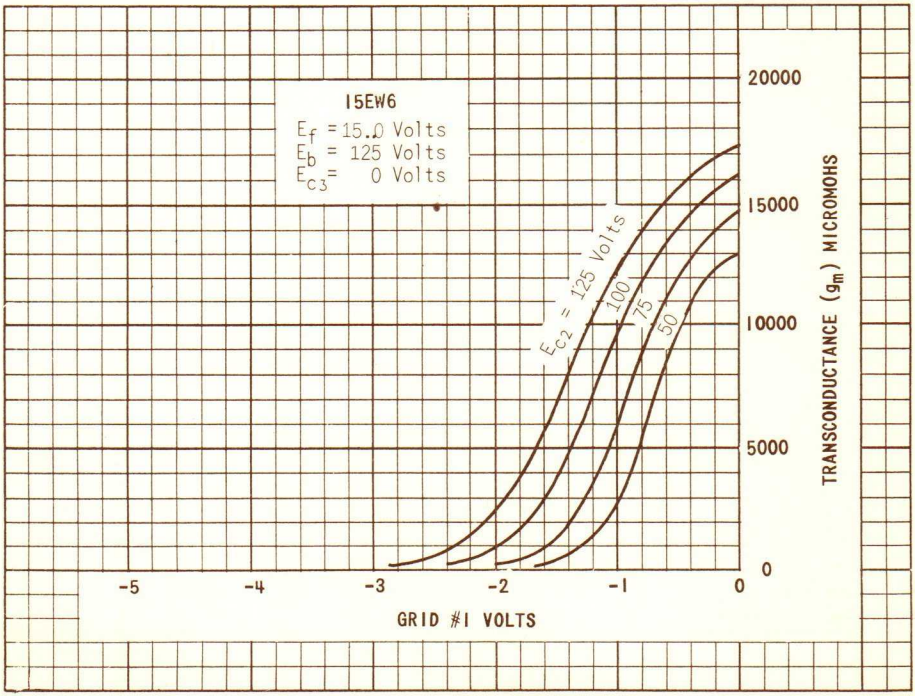
PRINTED IN U. S. A.

15EW6


15EW6
E_f = 15.0 Volts
E_{c3} = 0 Volts
E_{c1} = 0 Volts
I_b
I_{c2}
E_{c2} = 125 Volts
100
75
50
E_{c2} = 125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
30
0
100
200
300
400
500


15EW6
E_f = 15.0 Volts
E_b = 125 Volts
E_{c3} = 0 Volts
E_{c2} = 125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #1 VOLTS
0
10
20
30
-4
-3
-2
-1
0



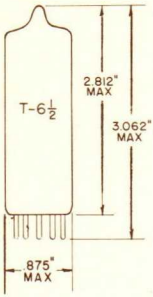


PRINTED IN U. S. A.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-4

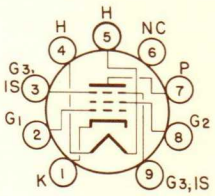
COATED UNIPOTENTIAL CATHODE

AUDIO AMPLIFIER

FOR

HEATER SERIES STRING OPERATION

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9GK

THE 16GK6 IS A POWER PENTODE AUDIO AMPLIFIER IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF HIGH QUALITY AUDIO AMPLIFIERS. EXCEPT FOR HEATER RATINGS, THE 16GK6 IS IDENTICAL TO THE 6GK6.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: G1 TO P (MAX.)	.14	pf
INPUT: G1 TO ALL	10.0	pf
OUTPUT: P TO ALL	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.0 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		300±20	MA.
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		100	VOLTS
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.

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 VOLTAGE	330[B]	VOLTS
PLATE SUPPLY VOLTAGE	605	VOLTS
GRID #2 VOLTAGE	330	VOLTS
GRID #2 SUPPLY VOLTAGE	605	VOLTS
NEGATIVE GRID #1 VOLTAGE	100	VOLTS
PLATE DISSIPATION	13.2[B]	WATTS
GRID #2 DISSIPATION (AVERAGE)	2	WATTS
GRID #2 DISSIPATION, PEAK	4	WATTS
CATHODE CURRENT (AVERAGE)	65	MA.
GRID #1 VOLTAGE FOR GRID CURRENT STARTING POINT WITH I_{c1} = 0.3 μA.	-1.3	VOLTS
GRID CIRCUIT RESISTANCE:		
FIXED BIAS	0.3	MEGOHM
SELF BIAS	1.0	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID #2 (SCREEN) VOLTAGE	250	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	-7.3	VOLTS
CATHODE BIAS RESISTOR	135	OHMS
PLATE RESISTANCE (APPROX.)	38000	OHMS
TRANSCONDUCTANCE	11300	μMHOS
PLATE CURRENT ZERO SIGNAL	48	MA.
GRID #2 CURRENT, ZERO SIGNAL	5.5	MA.
LOAD RESISTANCE	5200	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT
POWER OUTPUT, MAXIMUM SIGNAL	5.7	WATTS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1 ZERO SIGNAL	19	

PUSH PULL AMPLIFIER - VALUES FOR TWO TUBES

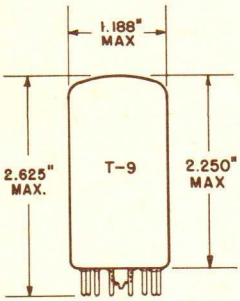
	CLASS AB		CLASS B		
PLATE VOLTAGE	250	300	250	300	VOLTS
GRID #2 (SCREEN) VOLTAGE	250	300	250	300	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	---	---	-11.6	-14.7	VOLTS
CATHODE BIAS RESISTOR	130	130	---	---	OHMS
GRID TO GRID INPUT VOLTAGE PEAK A-F	22.4	28	22.4	28	VOLTS
PLATE CURRENT, ZERO SIGNAL	62	72	20	15	MA.
PLATE CURRENT, MAXIMUM SIGNAL	75	92	75	92	MA.
GRID #2 CURRENT, ZERO SIGNAL	7	8	2.2	1.6	MA.
GRID #2 CURRENT, MAXIMUM SIGNAL	15	22	15	22	MA.
LOAD RESISTANCE, PLATE-TO-PLATE	8000	8000	8000	8000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	3	4	3	4	PERCENT
POWER OUTPUT, MAXIMUM SIGNAL	11	17	11	17	WATTS

[B] WHEN THE HEATER AND POSITIVE VOLTAGE ARE OBTAINED FROM A STORAGE BATTERY BY MEANS OF A VIBRATOR THE MAXIMUM VALUES OF THE PLATE AND GRID 2 VOLTAGES ARE 275 VOLTS AND THE PLATE DISSIPATION IS 9.9 WATTS.

TUNG-SOL

DIODE

COMPACTRON

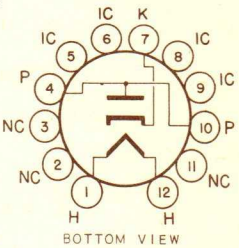


GLASS BULB
BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-59

COATED UNIPOTENTIAL CATHODE

DAMPING DIODE APPLICATIONS IN TV RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12BL

THE 17AX3 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	16.8 VOLTS	450	MA.
HEATER WARM-UP TIME*		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION[A]		450±30	MA.
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] FOR SERIES HEATER OPERATION, THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE HEATER CURRENT IS AT THE SPECIFIED BOGEY VALUE, WITH HEATER SUPPLY VARIATIONS RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED TOLERANCE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

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.

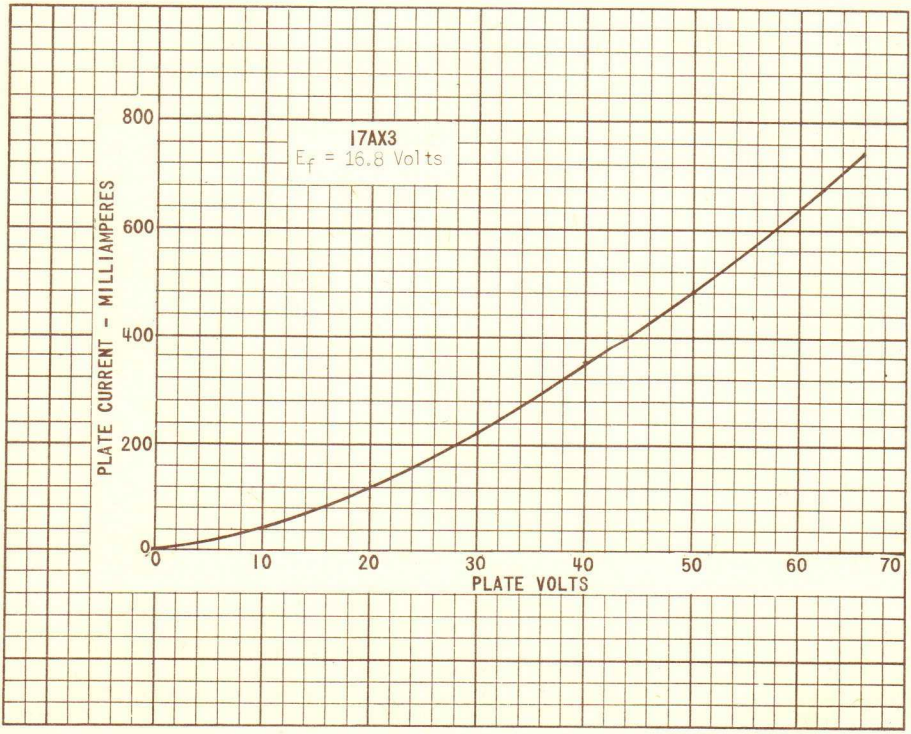
AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP		
I_b = 250 MILLIAMPERES DC	32	VOLTS

SIMILAR TYPE REFERENCE: Except for heater ratings, the 17AX3 is identical to the 6AX3 and the 12AX3.

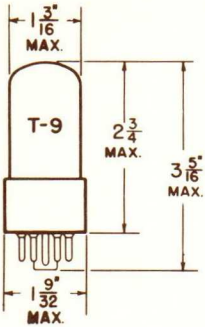
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[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

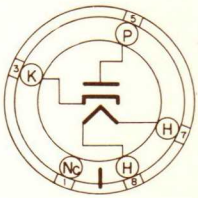


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
16.8 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL 6 PIN OCTAL
4CG

THE 17AX4GT IS A HEATER-CATHODE TYPE DIODE DESIGNED FOR USE IN HORIZONTAL FREQUENCY DAMPER SERVICE IN 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. 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 17AX4GT IS IDENTICAL TO THE 6AX4GT.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

HEATER TO CATHODE	7.5	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

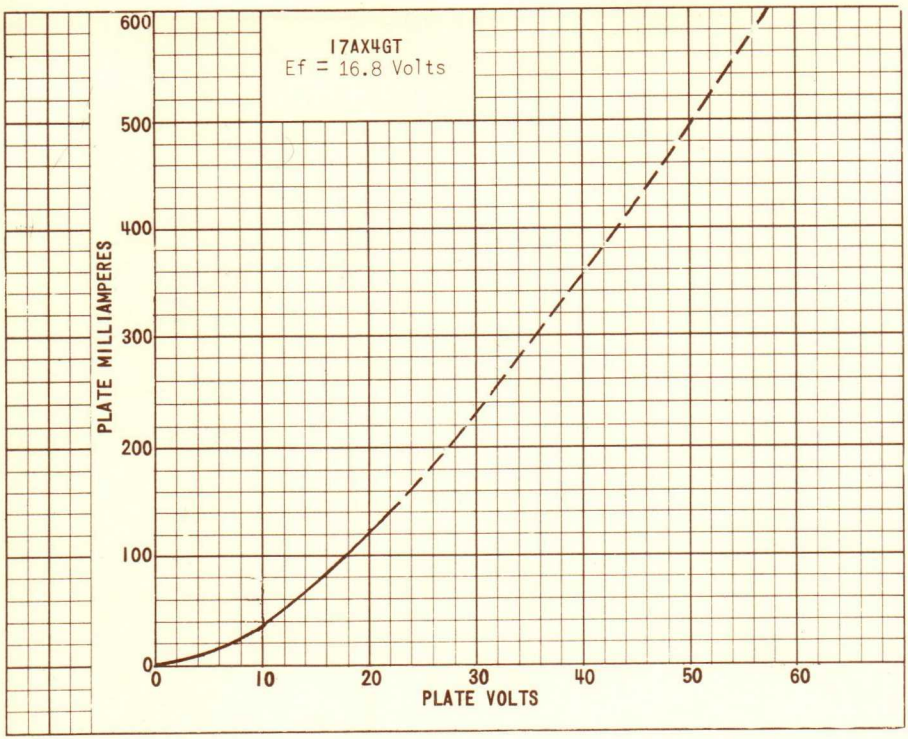
DESIGN CENTER VALUES		
HEATER VOLTAGE	16.8	VOLTS
HEATER CURRENT	0.45	AMP.
MAXIMUM HEATER CATHODE VOLTAGE;		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC COMPONENT	900[B]	VOLTS
TOTAL DC AND PEAK	4400[B]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE[A]	4000	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT	600	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT[C]	3.0	AMP.
MAXIMUM DC OUTPUT CURRENT	125	MA.
TUBE VOLTAGE DROP (WITH TUBE CONDUCTING 250 MA.)	32	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] APPLICABLE WHERE THE DUTY CYCLE OF THE VOLTAGE PULSE DOES NOT EXCEED 15% OF ONE SCANNING CYCLE, AND ITS DURATION IS LIMITED TO 10 MICROSECONDS.

[C] THIS RATING APPLIES TO HOT SWITCHING WHERE TRANSIENT DURATION DOES NOT EXCEED 0.2 SECONDS.

[B] VALUE GIVEN IS TO BE CONSIDERED AS AN ABSOLUTE MAXIMUM RATING. IN THIS CASE, THE COMBINED EFFECT OF SUPPLY-VOLTAGE VARIATION, MANUFACTURING VARIATION INCLUDING COMPONENTS IN THE EQUIPMENT, AND ADJUSTMENT OF EQUIPMENT CONTROLS SHOULD NOT CAUSE THE RATED VALUE TO BE EXCEEDED.

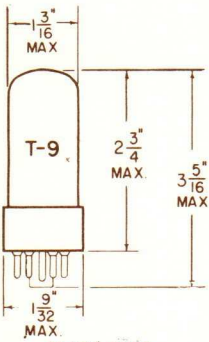
PRINTED IN U.S.A.



*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.

TUNG-SOL

DIODE



GLASS BULB

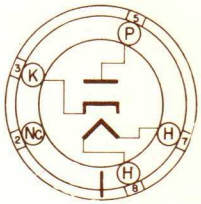
COATED UNIPOTENTIAL CATHODE

HEATER

16.8 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE-SHELL
5 PIN OCTAL

4CG

THE 17AX4GTA 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. EXCEPT FOR HEATER CHARACTERISTICS, TYPE 17AX4GTA IS IDENTICAL TO THE 6AX4GTB AND THE 12AX4GTB.

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	16.8	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	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

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	16.8	VOLTS
HEATER CURRENT[B]	0.45	AMP.
TUBE VOLTAGE DROP I_b=250 MA. DC	32	VOLTS

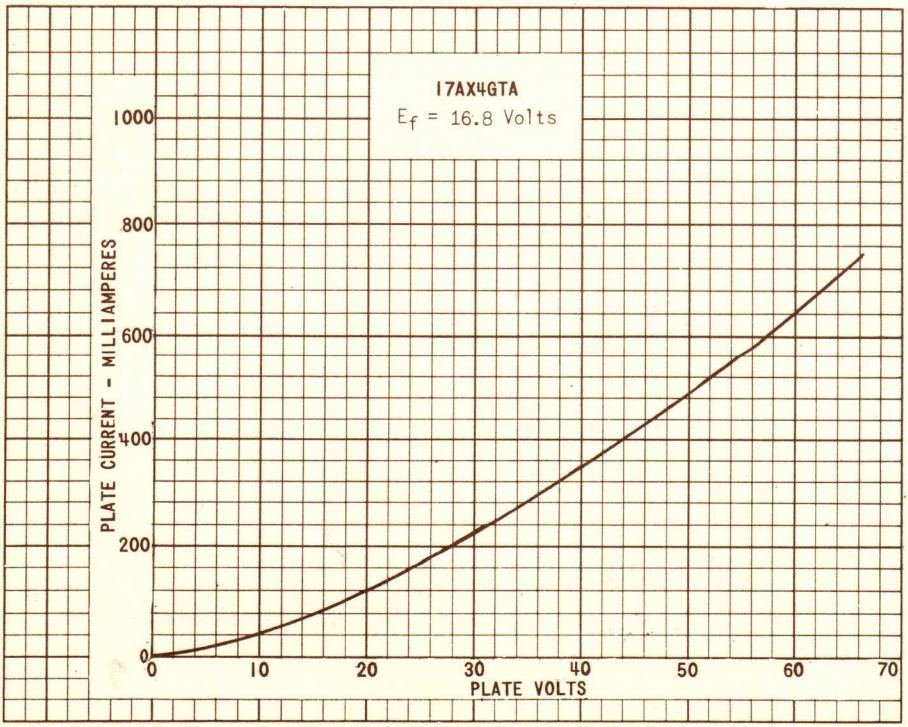
NOTE:

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.

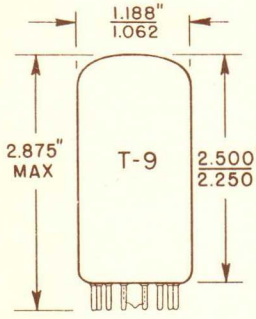
[B]FOR SERIES HEATER OPERATION, EQUIPMENT SHOULD BE SO DESIGNED SO THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.



TUNG-SOL

DIODE

COMPACTRON

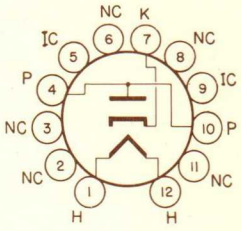


GLASS BULB
BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-60

FOR TV DAMPING
DIODE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12GA ←
SOCKET TERMINALS 5,6,8 AND 9 SHOULD NOT BE USED AS TIE POINTS. IT IS FURTHER RECOMMENDED THAT THE SOCKET CLIPS FOR THESE PINS BE REMOVED.

THE 17BE3 IS A COMPACTRON, SINGLE HEATER-CATHODE TYPE DIODE INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL DEFLECTION CIRCUIT OF TELEVISION RECEIVERS.

EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 17BE3 IS IDENTICAL TO THE 6BE3 AND THE 12BE3.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P + H)	10	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	8.0	pf
HEATER TO CATHODE: (H TO K)	3.4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8	VOLTS	450	MA
HEATER WARM-UP TIME[A]			11	SECONDS
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			450 ± 30	MA
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
DC COMPONENT			900	VOLTS
TOTAL DC AND PEAK			5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT			100	VOLTS
TOTAL DC AND PEAK			300	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES [B] - SEE EIA STANDARD RS-239

TV. DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	6.5	WATTS
STEADY STATE PEAK PLATE CURRENT	1200	MA
DC OUTPUT CURRENT	200	MA

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP, Ib = 350 MA. DC	25	VOLTS

A

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

B

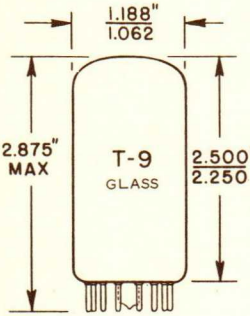
FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

TUNG-SOL

DIODE

COMPACTRON

OUTLINE DRAWING
JEDEC 9-60



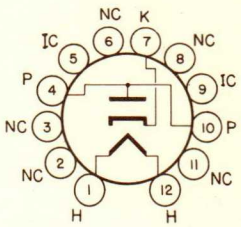
BASE 12 PIN BUTTON
JEDEC E12-70

FOR TV DAMPING
DIODE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 12GA



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12GA
SOCKET TERMINALS 5,6,8 AND 9 SHOULD NOT BE USED AS TIE POINTS. IT IS FURTHER RECOMMENDED THAT THE SOCKET CLIPS FOR THESE PINS BE REMOVED.

THE 17BE3A IS A COMPACTRON, SINGLE HEATER-CATHODE TYPE DIODE INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL DEFLECTION CIRCUIT OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 17BE3A IS IDENTICAL TO THE 6BE3A AND THE 12BE3A. THE VOLTAGE DROP OF THIS TYPE IS LOWER THAN THAT OF THE 17BE3.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P + H)	10	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	8.0	pf
HEATER TO CATHODE: (H TO K)	3.4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8	VOLTS	450	MA
HEATER WARM-UP TIME SEE BELOW			11	SECONDS
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			450 ± 30	MA
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

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.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

TV DAMPER SERVICE SEE BELOW

PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	6.5	WATTS
STEADY STATE PEAK PLATE CURRENT	1200	MA
DC OUTPUT CURRENT	200	MA

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

AVERAGE CHARACTERISTICS

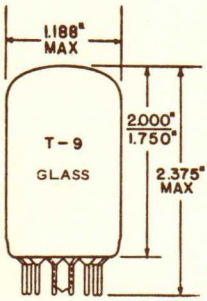
TUBE VOLTAGE DROP, Ib = 350 MA. DC	22.5	VOLTS

TUNG-SOL

DUAL PENTODE

COMPACTRON

OUTLINE
JEDEC 9-58



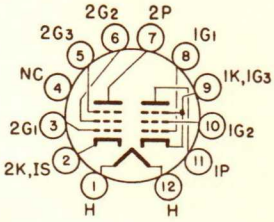
BASE 12 PIN BUTTON
JEDEC E12-70

FOR
FM DETECTOR
AND AUDIO OUTPUT
IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 12EZ



BOTTOM VIEW

THE TUNG-SOL 17BF11 IS A 12-PIN T-9 COMPACTRON CONTAINING TWO DISSIMILAR PENTODES. SECTION 1 IS A POWER PENTODE FOR AUDIO APPLICATION. SECTION 2 IS A DUAL CONTROL PENTODE INTENDED FOR USE AS FM DETECTOR IN TV CIRCUITS. ELECTRICALLY, SECTION 2 IS SIMILAR TO TYPE 6DT6. EXCEPT FOR HEATER CHARACTERISTICS, THE 17BF11 IS IDENTICAL TO THE 6BF11.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE 1 - GRID 1 TO PLATE	0.24	pf
INPUT: (G1 TO H + K + I.S. + G_2)	13	pf
OUTPUT: (P TO H + K + I.S. + G_2)	10	pf
PENTODE 2 - GRID 1 TO PLATE	0.036	pf
GRID 1 TO ALL (G1 TO H + K + I.S. + G_2 + G_3 + P)	6.5	pf
GRID 3 TO PLATE	3.2	pf
GRID 3 TO ALL (G_3 TO H + K + I.S. + G_1 + G_2 + P)	8.0	pf
GRID 1 TO GRID 3	0.11	pf
COUPLING - PLATE TO PLATE	0.13	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	0.45	AMPS.
HEATER WARM-UP TIME		11	SEC.
LIMITS OF SUPPLIED CURRENT		0.45 ± 0.03	AMPS.
MAXIMUM HEATER-CATHODE VOLTAGE-BOTH SECTIONS			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

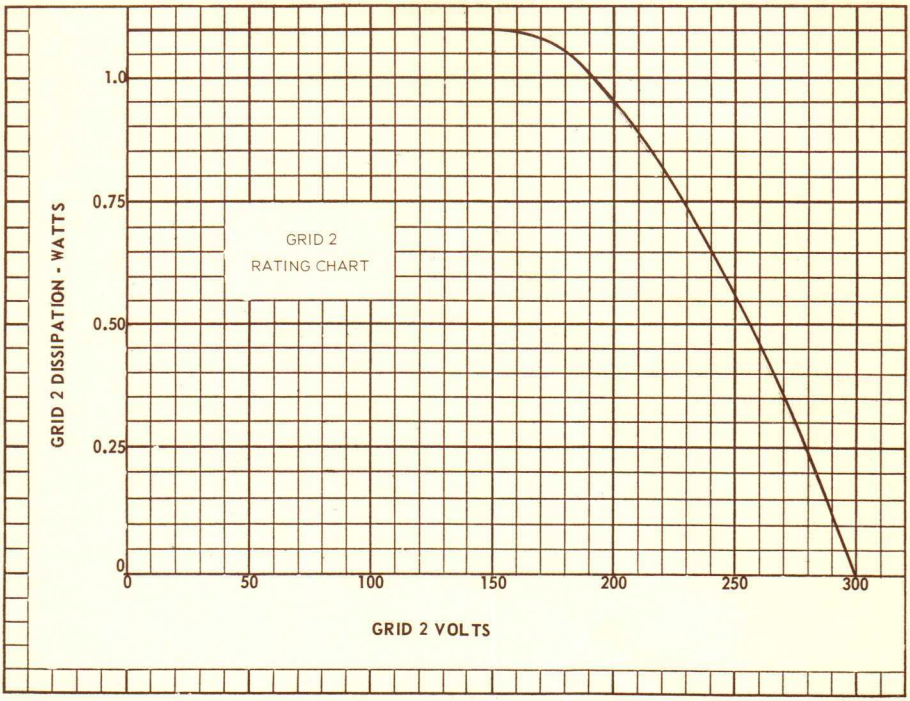
	SECTION 1	SECTION 2	
PLATE VOLTAGE	165	330	VOLTS
GRID 2 VOLTAGE	150	-	VOLTS
GRID 2 SUPPLY VOLTAGE	-	330	VOLTS
POSITIVE DC GRID 3 VOLTAGE	-	28	VOLTS
PLATE DISSIPATION	6.5	1.7	WATTS
GRID 2 DISSIPATION	1.8	SEE CHART	WATTS
UP TO 150 VOLTS	-	1.1	WATTS
CATHODE CURRENT	65	-	MA
GRID 1 CIRCUIT RESISTANCE			
FIXED BIAS	0.25	-	MEGOHMS
SELF BIAS	0.5	-	MEGOHMS

AVERAGE CHARACTERISTICS

	SECTION 1	SECTION 2	
PLATE VOLTAGE	145	150	VOLTS
GRID 2 VOLTAGE	110	100	VOLTS
GRID 3 VOLTAGE	-	0	VOLTS
GRID 1 VOLTAGE	-6.0	0	VOLTS
CATHODE RESISTOR	-	560	OHMS
PLATE CURRENT	36	1.3	MA
GRID 2 CURRENT	3.0	2.0	MA
TRANSCONDUCTANCE GRID 1 TO PLATE	8,600	1,000	μMHOS
GRID 3 TO PLATE	-	400	μMHOS
PLATE RESISTANCE - APPROX.	0.03	0.15	MEGOHMS
GRID 1 VOLTAGE FOR I_b = 10 μA	-	-4.5	VOLTS
GRID 3 VOLTAGE FOR I_b = 10 μA	-	-4.5	VOLTS

TYPICAL OPERATION - CLASS A1 POWER AMPLIFIER

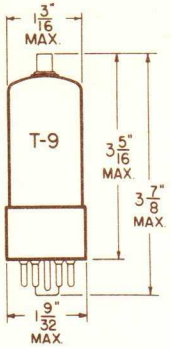
	SECTION 1	
PLATE VOLTAGE	145	VOLTS
GRID 2 VOLTAGE	110	VOLTS
GRID 1 VOLTAGE	-6.0	VOLTS
PEAK AUDIO GRID 1 VOLTAGE	6.0	VOLTS
LOAD RESISTANCE	3,000	OHMS
MAXIMUM SIGNAL PLATE CURRENT	40	MA
MAXIMUM SIGNAL GRID 2 CURRENT	9.0	MA
TOTAL HARMONIC DISTORTION	10	%
POWER OUTPUT	2.4	WATTS



PRINTED IN U. S. A.

TUNG-SOL

PENTODE

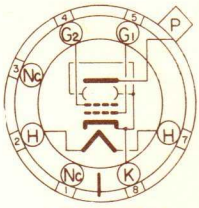


GLASS BULB
SKIRTED
MINIATURE CAP

COATED UNIPOTENTIAL CATHODE

HEATER
16.8 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
OR
SHORT INTERMEDIATE SHELL
7 PIN OCTAL
6AM

THE 17BQ6GTB 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	16.8	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
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[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.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTADE 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

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	16.8	VOLTS
HEATER CURRENT	0.45	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	

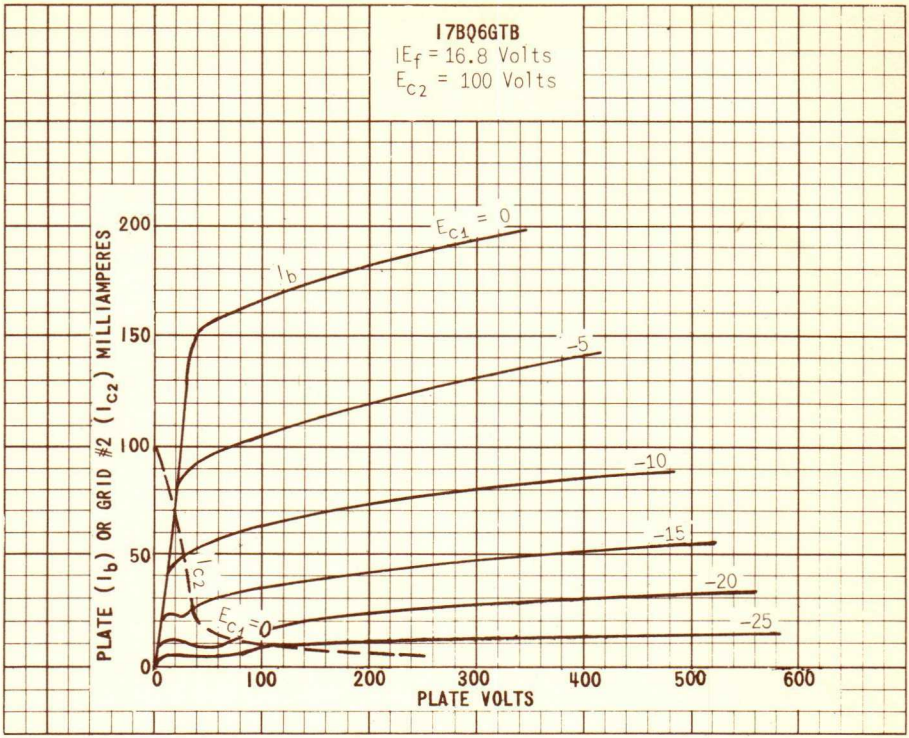
SIMILAR TYPE REFERENCE: Except for heater characteristics, the 17BQ6GTB is identical to the 6BQ6GTB.

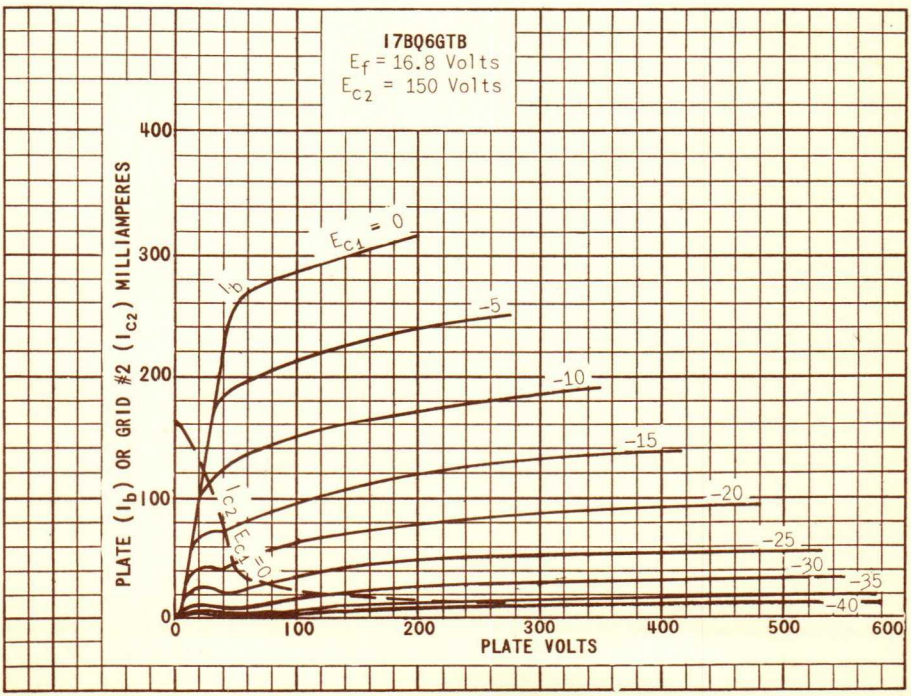
[C] WITH E_b = 250V, E_{c2} = 150V, AND E_{c1} = -22.5V.

[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.





PRINTED IN U.S.A.

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

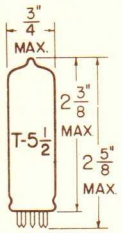
COATED UNIPOTENTIAL CATHODE

HEATER

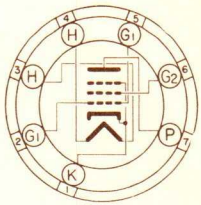
16.8 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BUB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7CV

THE 17C5 IS A BEAM POWER AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. BECAUSE OF ITS HIGH POWER SENSITIVITY AT LOW PLATE-SCREEN VOLTAGE, IT IS PARTICULARLY ADAPTABLE TO AC/DC RECEIVER 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. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 17C5 IS IDENTICAL TO THE 50C5.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

GRID TO PLATE: G_1 TO P	0.6 ←	μμf
INPUT: G_1 TO (H+K&G_3+G_2)	13.0 ←	μμf
OUTPUT: P TO (H+K&G_3+G_2)	8.5 ←	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	16.8	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		
DC COMPONENT	200	VOLTS
TOTAL DC AND PEAK	300	VOLTS
MAXIMUM PLATE VOLTAGE	135	VOLTS
MAXIMUM GRID #2 VOLTAGE	117	VOLTS
MAXIMUM PLATE DISSIPATION	6.0 ←	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0*	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
MAXIMUM BULB TEMPERATURE		
(AT HOTTEST POINT ON BULB SURFACE)	220 ←	°C
HEATER WARM-UP TIME*	11.0	SECONDS

ALL ELECTRICAL DATA EXCEPT HEATER CHARACTERISTICS FOR TYPE 17C5 ARE IDENTICAL WITH THOSE OF TYPES 12C5, 12CU5, 50C5, 25C5, AND 50B5.

*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 AN ADDITION.

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

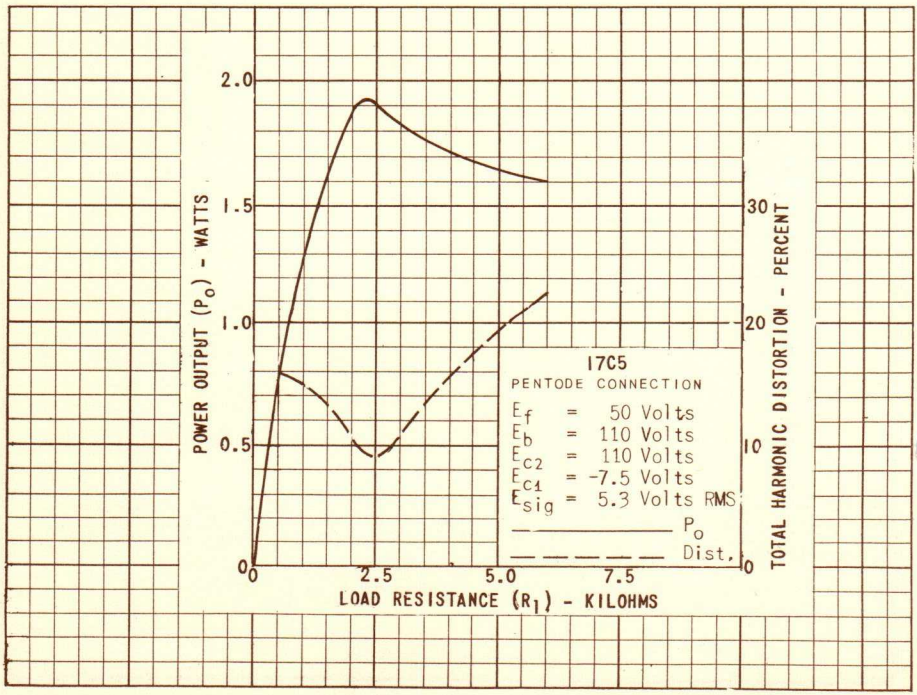
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

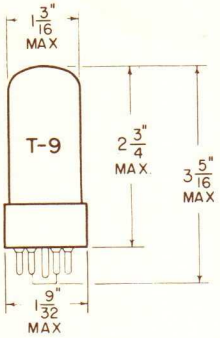
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	16.8	VOLTS
HEATER CURRENT	0.45	AMP.
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.
ZERO-SIGNAL GRID #2 CURRENT	4	MA.
MAXIMUM SIGNAL PLATE CURRENT	50	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
MAXIMUM SIGNAL POWER OUTPUT	2.3 ←	WATTS



TUNG-SOL

DIODE

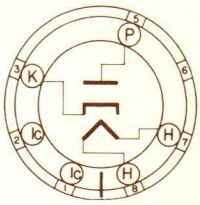


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
16.8 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW •
INTERMEDIATE SHELL
OR
SHORT INTERMEDIATE SHELL
8 PIN OCTAL
4CG

THE 17D4 IS AN INDIRECTLY-HEATED HALF WAVE RECTIFIER DESIGNED FOR SERVICE AS A DAMPING DIODE IN HORIZONTAL DEFLECTION CIRCUITS OF 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.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

HEATER TO CATHODE	3.0	μμf
PLATE TO CATHODE & HEATER[A]	6.0	μμf
CATHODE TO PLATE & HEATER[A]	8.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM – UNLESS OTHERWISE INDICATED

DAMPER SERVICE[B]

HEATER VOLTAGE	16.8	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
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 PEAK INVERSE VOLTAGE	4 400	VOLTS
MAXIMUM DC PLATE CURRENT	155	MA.
MAXIMUM DC PLATE CURRENT (DESIGN CENTER SYSTEM)	145	MA.
MAXIMUM PEAK PLATE CURRENT	900	MA.
MAXIMUM PLATE DISSIPATION	5.5	WATTS
TUBE VOLTAGE DROP WITH Ib= 250 MA.	22	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

•PINS 1, 2, 4, & 6 MUST NOT BE USED AS TIE POINTS.

[A] TIE UNUSED PINS AND METAL PART TO HEATER.

[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 OF THE HORIZONTAL VOLTAGE PULSE NOT TO EXCEED 15% OF ONE SCANNING CYCLE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

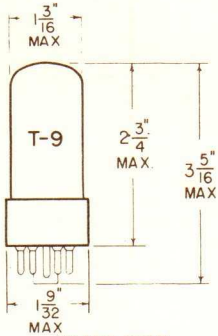
CONTINUED FROM PRECEDING PAGE

*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.

TUNG-SOL

DIODE



GLASS BULB

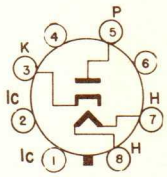
INTERMEDIATE SHELL B5-85 OR
SHORT INTERMEDIATE SHELL B6-60
8 PIN OCTAL

OUTLINE DRAWING
JEDEC 9-41

UNIPOTENTIAL CATHODE

HEATER
16.8 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW •

BASING DIAGRAM

JEDEC 4CG

THE 17D4 IS AN INDIRECTLY-HEATED HALF WAVE RECTIFIER DESIGNED FOR SERVICE AS A DAMPING DIODE IN HORIZONTAL DEFLECTION CIRCUITS OF 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.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

HEATER TO CATHODE	3.0	pf
PLATE TO CATHODE & HEATER[A]	6.0	pf
CATHODE TO PLATE & HEATER[A]	8.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM — UNLESS OTHERWISE INDICATED

DAMPER SERVICE[B]

HEATER VOLTAGE	16.8	VOLTS
HEATER CURRENT	→0.45	AMP.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
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 PEAK INVERSE VOLTAGE	4 400	VOLTS
MAXIMUM DC PLATE CURRENT	155	MA.
MAXIMUM DC PLATE CURRENT (DESIGN CENTER SYSTEM)	145	MA.
MAXIMUM PEAK PLATE CURRENT	900	MA.
MAXIMUM PLATE DISSIPATION	5.5	WATTS
TUBE VOLTAGE DROP WITH Ib= 250 MA.	22	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

•PINS 1, 2, 4, & 6 MUST NOT BE USED AS TIE POINTS.

[A] TIE UNUSED PINS AND METAL PART TO HEATER.

[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 OF THE HORIZONTAL VOLTAGE PULSE NOT TO EXCEED 15% OF ONE SCANNING CYCLE.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

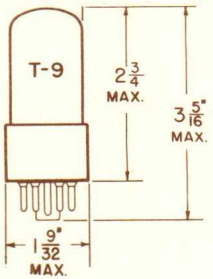
CONTINUED FROM PRECEDING PAGE

*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.

TUNG-SOL

DIODE



GLASS BULB

INTERMEDIATE SHELL
5 PIN OCTAL B5-85
OUTLINE DRAWING
JEDEC 9-41

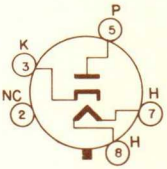
UNIPOTENTIAL CATHODE

HEATER

16.8 VOLTS .450±.030 AMPS.

ANY MOUNTING POSITION

[A] SOCKET PINS 1, 2, 4 & 6 MUST NOT BE USED AS TIE POINTS.



BOTTOM VIEW[A]

BASING DIAGRAM
JEDEC 4CG

THE 17D4A IS A SINGLE INDIRECTLY-HEATED DIODE INTENDED FOR USE IN TELEVISION HORIZONTAL FREQUENCY DAMPER SERVICE. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES 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	3.0	pf
CATHODE TO PLATE AND HEATER: K TO (P+ H)	9.0	pf
PLATE TO CATHODE AND HEATER: P TO (K +H)	7.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER CURRENT[C]	.450±.030	AMPS.
MAXIMUM PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
MAXIMUM DC PLATE CURRENT	185	MA.
MAXIMUM STEADY STATE PEAK PLATE CURRENT	900	MA.
MAXIMUM PLATE DISSIPATION	8.0	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE[D]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	1000	VOLTS
TOTAL DC AND PEAK	5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE (AT 0.45 AMP.)	16.8	VOLTS
HEATER CURRENT	.450±.030	AMP.
TUBE VOLTAGE DROP (WITH TUBE CONDUCTING PLATE CURRENT --340 MA.)	30	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.

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

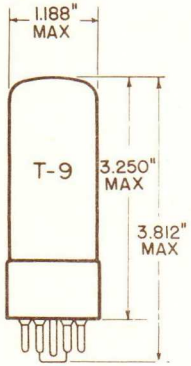
[C] THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE HEATER CURRENT IS AT THE SPECIFIED BOGIE VALUE. HEATER SUPPLY VARIATIONS SHOULD BE RESTRICTED SO THAT THE HEATER CURRENT WILL BE MAINTAINED WITHIN THE SPECIFIED TOLERANCE.

[D] 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.

* 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

HALF-WAVE VACUUM RECTIFIER



GLASS BULB
JEDEC GROUP 1 B5-85
SHORT
INTERMEDIATE-SHELL
5 PIN OCTAL
WITH EXTERNAL BARRIERS

PINS 1, 4, & 6 ARE OMITTED

OUTLINE DRAWING
JEDEC 9-44

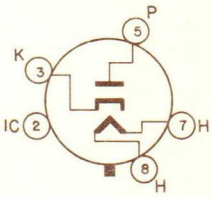
UNIPOTENTIAL CATHODE

HEATER

17.0 VOLTS 600 ± 40 MA. ←

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 4CG

THE 17DE4 IS A HALF-WAVE VACUUM RECTIFIER OF THE GLASS-OCTAL TYPE. IT IS DESIGNED SPECIFICALLY FOR USE AS A DAMPER DIODE IN HORIZONTAL-DEFLECTION CIRCUITS OF BLACK-AND-WHITE TELEVISION RECEIVERS.

EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 17DE4 IS IDENTICAL TO THE 6DE4 AND 22DE4.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER AND CATHODE	8.5	pf
CATHODE TO HEATER AND PLATE	11.5	pf
HEATER TO CATHODE	4	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

DAMPER SERVICE

MAXIMUM PEAK INVERSE PLATE VOLTAGE	5500[A]	VOLTS
MAXIMUM PEAK PLATE CURRENT	1100	MA.
MAXIMUM DC PLATE CURRENT	180	MA.
MAXIMUM PLATE DISSIPATION	6.5	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	5500[B]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	300[C]	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

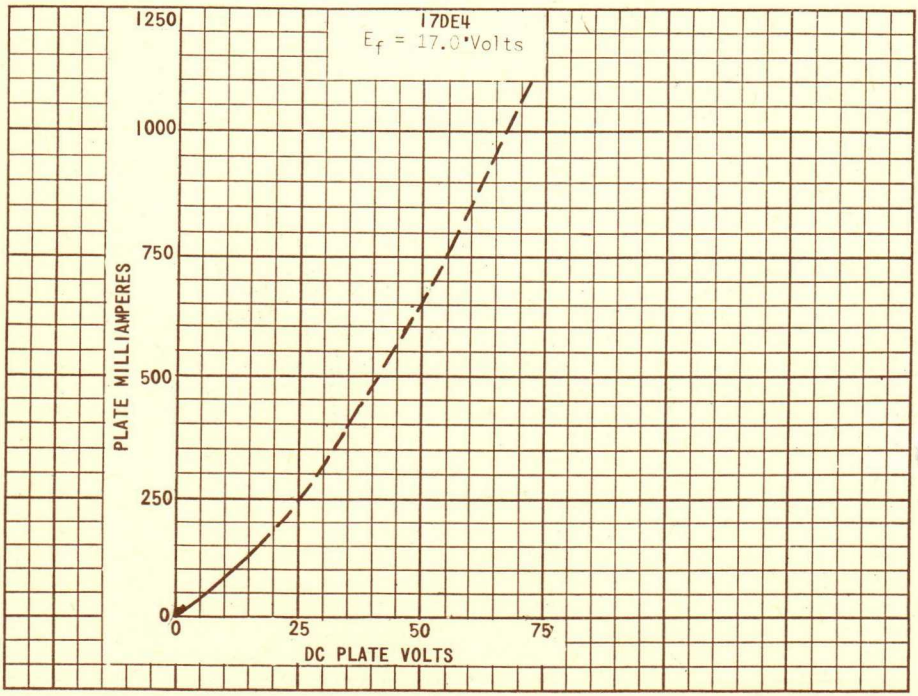
NOTES

[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] THE DC COMPONENT MUST NOT EXCEED 900 VOLTS.

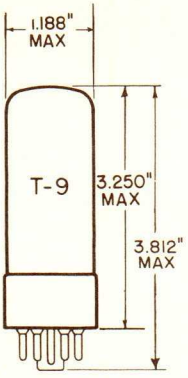
[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

*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.



TUNG-SOL

DIODE



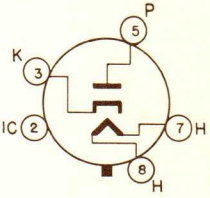
GLASS BULB
SHORT INTERMEDIATE SHELL
5 PIN OCTAL WITH
EXTERNAL BARRIERS
B5 - 85
OUTLINE DRAWING
JEDEC 9-44

UNIPOTENTIAL CATHODE

FOR DAMPER SERVICE IN

TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 4CG

THE 17DM4 IS A HALF-WAVE VACUUM RECTIFIER EMPLOYING A T-9 ENVELOPE. IT IS DESIGNED SPECIFICALLY FOR USE AS A DAMPER DIODE IN HORIZONTAL-DEFLECTION CIRCUITS OF BLACK-AND-WHITE TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 17DM4 IS IDENTICAL TO THE 6DM4 AND THE 12DM4.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER AND CATHODE	8.5	pf
CATHODE TO HEATER AND PLATE	11.5	pf
HEATER TO CATHODE	4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±27	MA.
MAXIMUM PEAK HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		5000[A]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		300[B]	VOLTS
HEATER WARM-UP TIME (AVERAGE)[C]		11	SECONDS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIUM VALUES - SEE EIA STANDARD RS-239

DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5000[D]	VOLTS
PEAK PLATE CURRENT	1100	MA.
DC PLATE CURRENT	175	MA.
PLATE DISSIPATION	6.5	WATTS

CHARACTERISTICS

TUBE VOLTAGE DROP FOR PLATE CURRENT OF 400 MA. APPROXIMATE	35	VOLTS

[A] THE DC COMPONENT MUST NOT EXCEED 900 VOLTS.

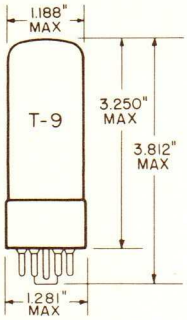
[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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

[D] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS 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. (15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.)

TUNG-SOL

DIODE



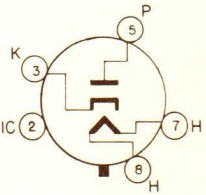
GLASS BULB

SHORT INTERMEDIATE SHELL
5 PIN OCTAL BASE B5-85
OUTLINE DRAWING
JEDEC 9-44

FOR DAMPER SERVICE IN TELEVISION RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 4CG

SOCKET TERMINALS 1,2,4 & 6, SHOULD NOT BE USED AS TIE POINTS.

THE 17DM4A IS AN INDIRECTLY-HEATED HALF-WAVE RECTIFIER EMPLOYING A T-9 ENVELOPE. IT IS DESIGNED SPECIFICALLY FOR USE AS A DAMPER DIODE IN HORIZONTAL DEFLECTION CIRCUITS OF TELEVISION RECEIVERS.

EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 17DM4A IS IDENTICAL TO THE 6DM4A AND THE 12DM4A.

ALSO, THE 17DM4A IS IDENTICAL TO THE 17DM4 EXCEPT FOR HIGHER PLATE CURRENT RATINGS.

DIRECT INTERELECTRODE CAPACITANCES

HEATER TO CATHODE	4	pf
PLATE TO CATHODE	8.5	pf
CATHODE TO PLATE AND HEATER	11.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8	VOLTS	450	MA.
HEATER WARM-UP TIME[A]			11	SECONDS
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			450 ± 30	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			900	VOLTS
TOTAL DC AND PEAK			5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			100	
TOTAL DC AND PEAK			300	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 THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

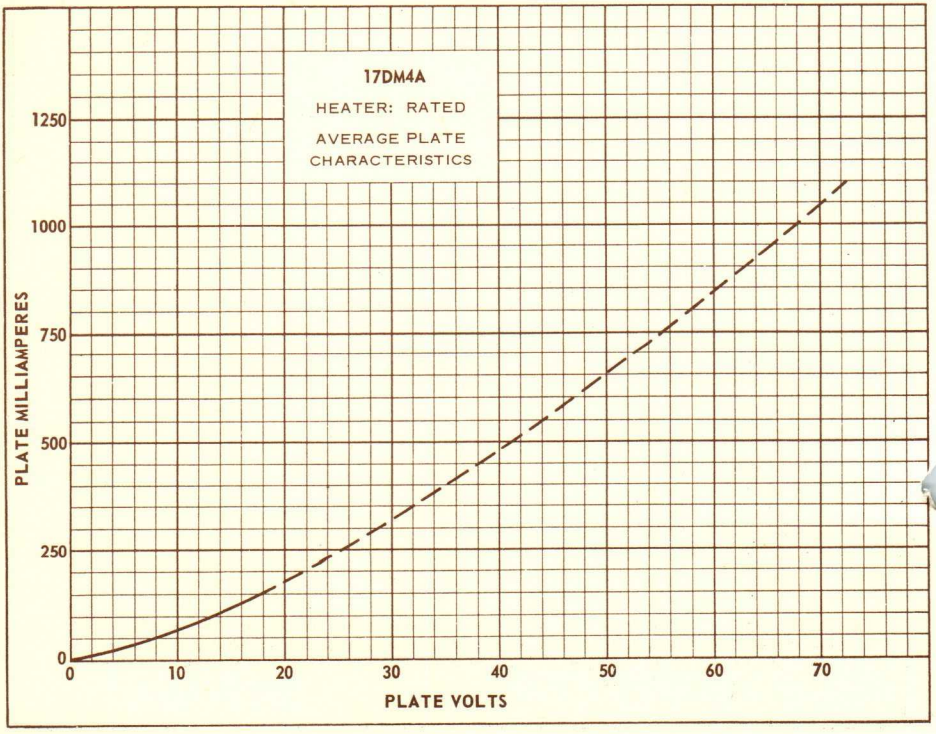
DAMPER SERVICE[B]

PEAK INVERSE VOLTAGE	5000	VOLTS
PEAK PLATE CURRENT	1200	MA.
DC PLATE CURRENT	200	MA.
PLATE DISSIPATION	6.5	WATTS

CHARACTERISTICS

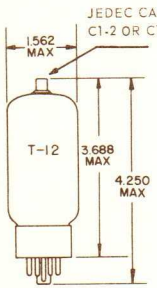
VOLTAGE DROP AT Ib = 400 MA.	35	VOLTS

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.



TUNG-SOL

BEAM PENTODE



GLASS BUBL

SKIRTED MINIATURE

SHORT MEDIUM-SHELL
6 PIN OCTAL B6-122,
B6-148 OR
7 PIN OCTAL
B7-111, B7-119 OR B5-190

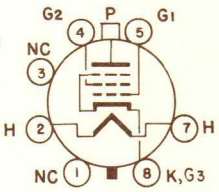
OUTLINE DRAWING
JEDEC 12-51

COATED UNIPOTENTIAL CATHODE

FOR HORIZONTAL DEFLECTION AMPLIFIER APPLICATIONS IN TELEVISION RECEIVERS

ANY MOUNTING POSITION

PIN #2 IS OMITTED WHEN EITHER A B6-122 OR B6-148 BASE IS USED



BASING DIAGRAM
JEDEC 6AM

THE 17DQ6A IS A HIGH-PERVEANCE BEAM POWER PENTODE DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER TUBE IN HIGH EFFICIENCY DEFLECTION CIRCUITS 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 TUBES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME AND HEATER RATINGS THE 17DQ6A IS IDENTICAL TO THE 6DQ6A.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (G TO P)	0.5	pf
INPUT: (G1 TO H+K, BP + G2)	15.0	pf
OUTPUT: (P TO H+K, BP + B2)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±30	MA.
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
HEATER WARM-UP TIME, APPROX.*		11	SECONDS

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL DEFLECTION AMPLIFIER[A]

PLATE SUPPLY VOLTAGE, DC (BOOST+DC POWER SUPPLY)	770	VOLTS
PLATE VOLTAGE, PEAK PULSE, POSITIVE	6000	VOLTS
PLATE VOLTAGE, PEAK PULSE, NEGATIVE	1500	VOLTS
PLATE DISSIPATION,[B]	18	WATTS
GRID #1 VOLTAGE, PEAK PULSE, NEGATIVE	330	VOLTS
GRID #2 VOLTAGE, DC	220	VOLTS
GRID #2 DISSIPATION	3.6	WATTS
CATHODE CURRENT, AVERAGE	155	MA.
CATHODE CURRENT, PEAK	540	MA.
GRID #1 CIRCUIT RESISTANCE,[B]	1.0	MEGOHM
BULB TEMPERATURE, (AT HOTTEST POINT)	220	°C

AVERAGE CHARACTERISTICS

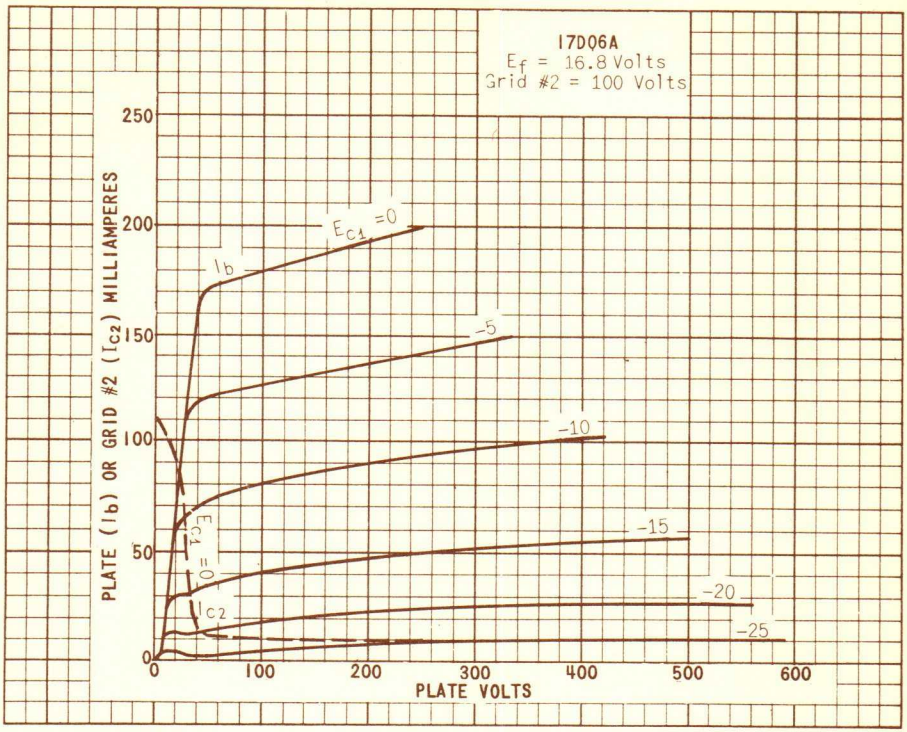
PENTODE OPERATION: Eb = 250V, Ec2 = 150V, Ec1 = -22.5V.		
PLATE CURRENT	55	MA.
GRID #2 CURRENT	1.5	MA.
TRANSCONDUCTANCE	6600	μMHOS
PLATE RESISTANCE, APPROX.	20,000	OHMS
ZERO BIAS: Eb = 60V, Ec2 = 150V. (INSTANTANEOUS VALUES)		
PLATE CURRENT	315	MA.
GRID #2 CURRENT	25	MA.
CUTOFF: Ib = 1 MA, Eb = 250 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-40	VOLTS
CUTOFF: Ib = 1 Ma, Eb = 5000 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-100	VOLTS
TRIODE MU: Eb = Ec2 = 150 V, Ec1 = -22.5 V.	4.5	

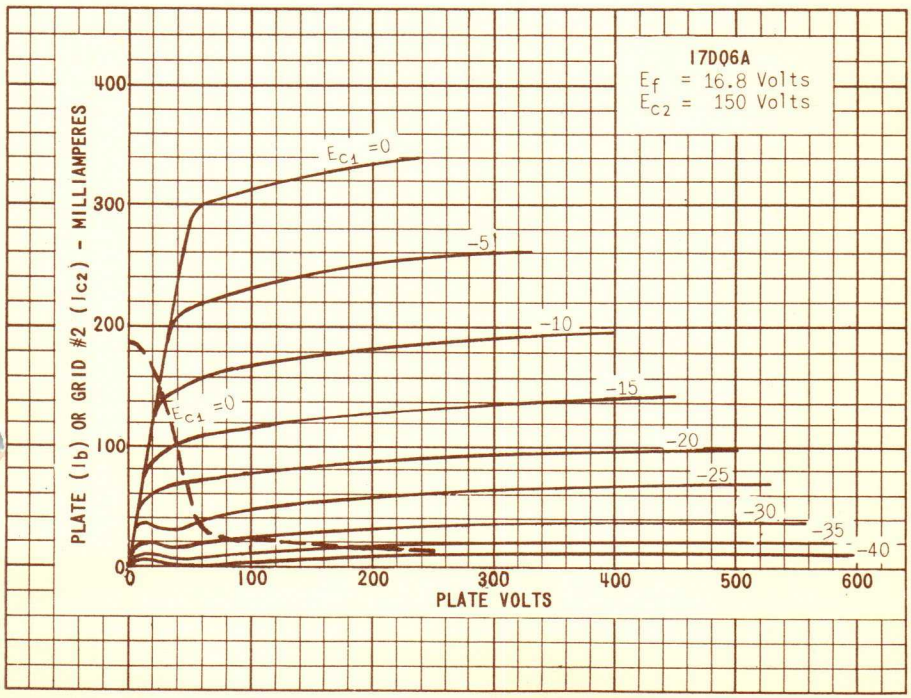
→ INDICATES A CHANGE.

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.

*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.

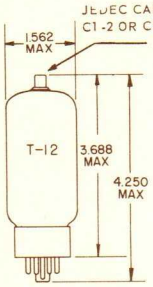




PRINTED IN U. S. A.

TUNG-SOL

BEAM PENTODE



GLASS BULB

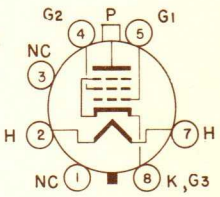
SKIRTED MINIATURE
SHORT MEDIUM-SHELL
6 PIN OCTAL B6-122,
B6-148 OR
7 PIN OCTAL
B7-111, B7-119 OR B5-190 ←
OUTLINE DRAWING
JEDEC 12-51

COATED UNIPOTENTIAL CATHODE

FOR HORIZONTAL DEFLECTION AMPLIFIER APPLICATIONS IN TELEVISION RECEIVERS

ANY MOUNTING POSITION

PIN #1 IS OMITTED WHEN EITHER A B6-122 OR B6-148 BASE IS USED



BASING DIAGRAM
JEDEC 6AM

THE 17DQ6B IS A BEAM POWER PENTODE PRIMARILY DESIGNED FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. ITS HIGH ZERO-BIAS PLATE CURRENT AT LOW PLATE AND SCREEN VOLTAGES MAKES THE TUBE WELL SUITED FOR USE IN RECEIVERS THAT OPERATE AT LOW PLATE-SUPPLY VOLTAGES. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 17DQ6B IS IDENTICAL TO THE 6DQ6B.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (G TO P)	0.5	pf
INPUT: (G1 TO H+K, BP + G2)	15.0	pf
OUTPUT: (P TO H+K, BP + B2)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±30	MA.
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
HEATER WARM-UP TIME, APPROX.*		11	SECONDS

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL DEFLECTION AMPLIFIER[A]

PLATE SUPPLY VOLTAGE, DC (BOOST+DC POWER SUPPLY)	770	VOLTS
PLATE VOLTAGE, PEAK PULSE, POSITIVE	6500	VOLTS
PLATE VOLTAGE, PEAK PULSE, NEGATIVE	1500	VOLTS
PLATE DISSIPATION,[B]	18	WATTS
GRID #1 VOLTAGE, PEAK PULSE, NEGATIVE	330	VOLTS
GRID #2 VOLTAGE, DC	220	VOLTS
GRID #2 DISSIPATION	3.6	WATTS
CATHODE CURRENT, AVERAGE	175	MA.
CATHODE CURRENT, PEAK	610	MA.
GRID #1 CIRCUIT RESISTANCE,[B]	1.0	MEGOHM
BULB TEMPERATURE, (AT HOTTEST POINT)	220	°C

AVERAGE CHARACTERISTICS

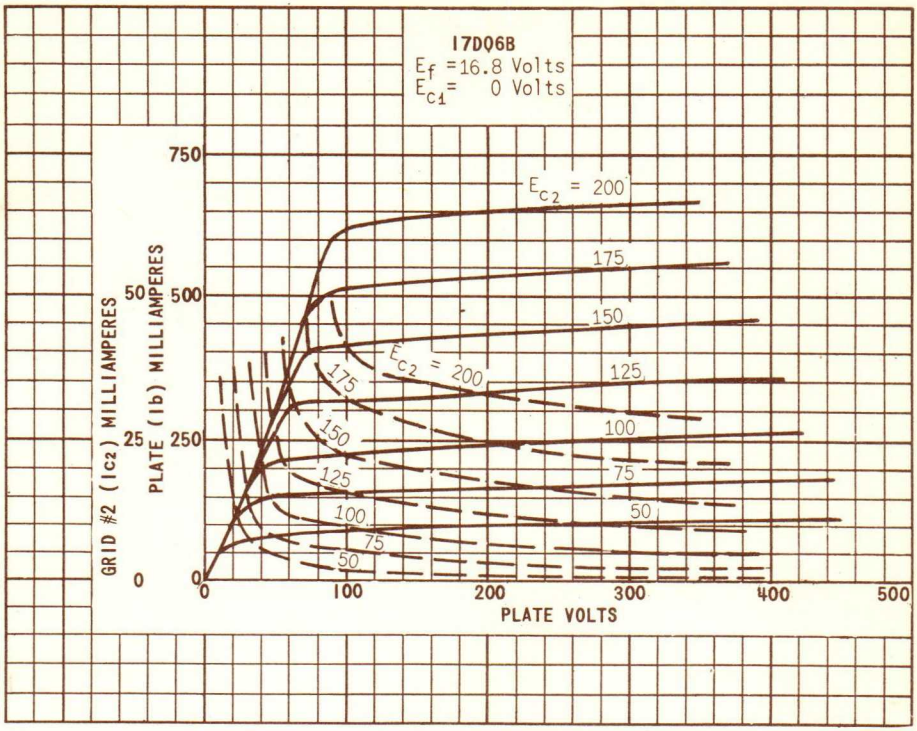
PENTODE OPERATION: Eb =250V, Ec2 =150V, Ec1=-22.5V.		
PLATE CURRENT	65	MA.
GRID #2 CURRENT	1.8	MA.
TRANSCONDUCTANCE	7300	μMHOS
PLATE RESISTANCE, APPROX.	18,000	OHMS
ZERO BIAS: Eb = 60V, Ec2 = 150V. (INSTANTANEOUS VALUES)		
PLATE CURRENT	345	MA.
GRID #2 CURRENT	27	MA.
CUTOFF: Ib = 1 MA, Eb = 250 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-42	VOLTS
CUTOFF: Ib = 1 Ma, Eb = 5000 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-100	VOLTS
TRIODE MU: Eb = Ec2 = 150 V, Ec1 =-22.5 V.	4.4	

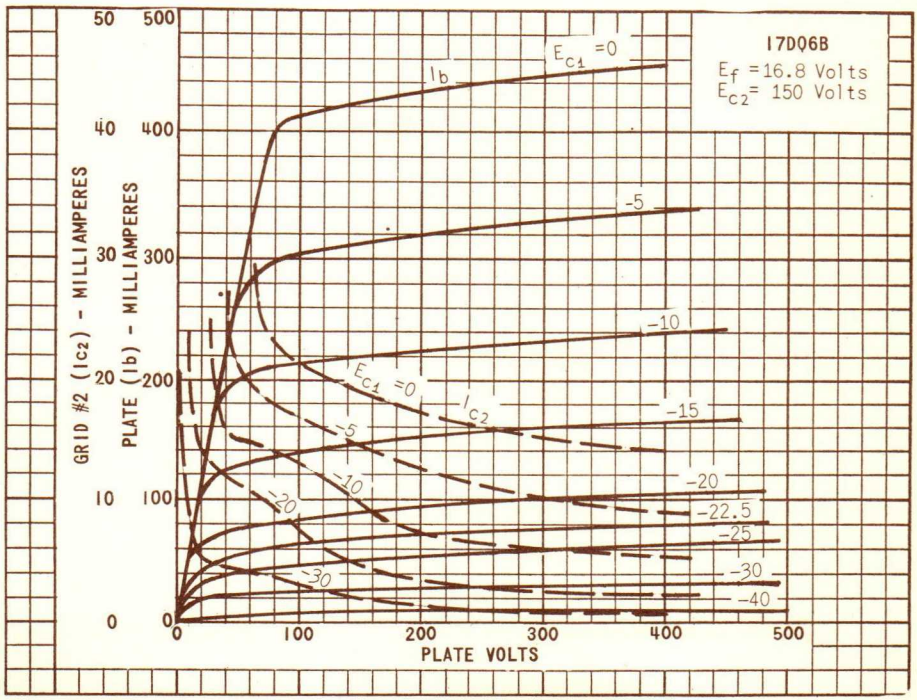
→ INDICATES A CHANGE.

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.

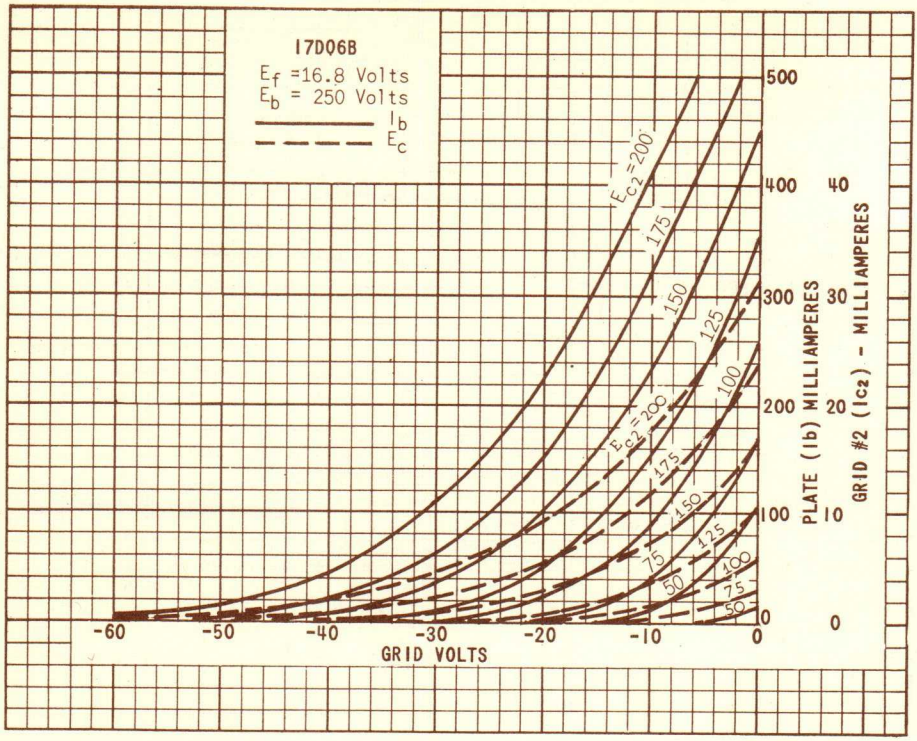
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





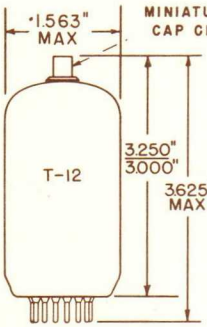
PRINTED IN U. S. A.

17DQ6B


17DQ6B
E_f =16.8 Volts
E_b = 250 Volts
I_b
E_c
E_{c2}=200
175
150
125
100
75
50
500
400
300
200
100
0
40
30
20
10
0
PLATE (Ib) MILLIAMPERES
GRID #2 (I_{c2}) - MILLIAMPERES
-60
-50
-40
-30
-20
-10
0
GRID VOLTS

TUNG-SOL

BEAM PENTODE



GLASS BULB
BUTTON
12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12-79

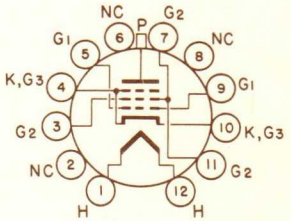
FOR

TV HORIZONTAL DEFLECTION

AMPLIFIER APPLICATIONS

ANY MOUNTING POSITION

COATED UNIPOTENTIAL CATHODE



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12DR

THE 17GV5 IS A COMPACTRON BEAM-POWER PENTODE EMPLOYING A 12 PIN T-12 ENVELOPE. IT IS DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: (G1 TO P)	0.6	pf
INPUT: G1 TO (H+K+G2+B.P)	16	pf
OUTPUT: P TO (H+K+G2+B.P.)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	450	MA.
HEATER WARM-UP TIME [A]		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±30	MA.
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1500	VOLTS
GRID 2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION[B]	17.5	WATTS
GRID 2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	175	MA.
PEAK CATHODE CURRENT	550	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	C

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	5000	60	250	VOLTS
GRID 2 VOLTAGE	150	150	150	VOLTS
GRID 1 VOLTAGE	----	0[C]	-22.5	VOLTS
PLATE RESISTANCE, APPROX.	----	----	18000	OHMS
TRANSCONDUCTANCE	----	----	7300	μMHOS
PLATE CURRENT	----	345	65	MA.
GRID 2 CURRENT	----	27 ←	1.8	MA.
GRID 1 VOLTAGE, APPROX. Ib=1.0 MA.	-100	----	-42	VOLTS
TRIODE AMPLIFICATION FACTOR[D]	----	----	4.4	

A

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

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.

C

APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

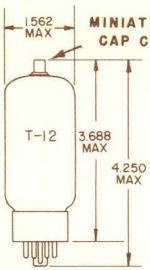
D

TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH Eb=Ec2=150 VOLTS AND Ec1=-22.5 VOLTS

→ INDICATES A CHANGE.

TUNG-SOL

BEAM PENTODE



GLASS BULB

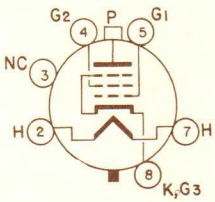
SHORT MEDIUM SHELL
5 OR 6 PIN OCTAL WITH
EXTERNAL BARRIERS
B6-122 OR B5-190

FOR
HORIZONTAL-DEFLECTION-AMPLIFIER
CIRCUITS IN TELEVISION RECEIVERS

UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

PIN #3 IS OMITTED WHEN B5-190 BASE IS USED



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6AM

THE 17GW6 IS A BEAM POWER PENTODE EMPLOYING A T-12 ENVELOPE. IT IS DESIGNED ESPECIALLY FOR USE IN HORIZONTAL-DEFLECTION-AMPLIFIER CIRCUITS OF TELEVISION RECEIVERS WHICH OPERATE WITH LOW PLATE SUPPLY VOLTAGES.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	pf
GRID #1 TO CATHODE, GRID #3, GRID #2 & HEATER	17	pf
PLATE TO CATHODE, GRID #3, GRID #2 & HEATER	7	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	450	MA.
HEATER WARM-UP TIME*		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±30	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200 [A]	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
PEAK POSITIVE-PULSE PLATE VOLTAGE [B]	6500	VOLTS
PEAK NEGATIVE-PULSE PLATE VOLTAGE	1500	VOLTS
DC GRID #2 VOLTAGE	220	VOLTS
DC GRID #1 VOLTAGE	-55	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS-CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PEAK NEGATIVE-PULSE GRID #1 VOLTAGE	330	VOLTS
CATHODE CURRENT:		
PEAK	550	MA.
AVERAGE	175	MA.
PLATE DISSIPATION[C]	17.5	WATTS
GRID #2 INPUT	3.5	WATTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	240	°C

MAXIMUM CIRCUIT VALUES:

GRID #1 CIRCUIT RESISTANCE[C]	1.0	MEGOHM

CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	60	250	VOLTS
GRID #2 VOLTAGE	150	150	VOLTS
GRID #1 VOLTAGE	0	-22.5	VOLTS
MU-FACTOR, GRID #2 TO GRID #1 WITH PLATE CONNECTED TO GRID #2, PLATE VOLTS = GRID #2 VOLTS =150, AND GRID #1 VOLTS =-22.5	---	4.4	
PLATE RESISTANCE (APPROX.)	---	15000	OHMS
TRANSCONDUCTANCE	---	7100	μMHOS
PLATE CURRENT	→390[D]	70	MA.
GRID #2 CURRENT	32[D]	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 1 MA.		42	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 THE DC COMPONENT MUST NOT EXCEED 100 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 POLSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.
15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

C IN STAGES OPERATING WITH GRID-RESISTOR BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

D THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RECURRENT WAVE FORM SUCH THAT THE CATHODE CURRENT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

SIMILAR TYPE REFERENCE:

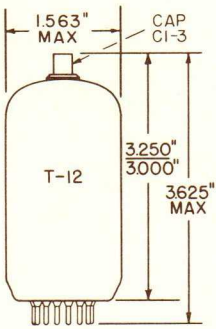
Except for heater characteristics, the 17GW6 is identical to the 6GW6 and the 12GW6.

→ INDICATES A CHANGE.

TUNG-SOL

PENTODE

COMPACTRON



GLASS BULB
12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12-56

BEAM PENTODE

FOR

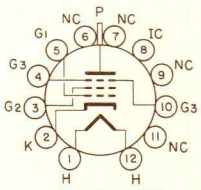
HORIZONTAL-DEFLECTION

AMPLIFIER APPLICATIONS

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12FK

THE 17JM6 IS A BEAM-POWER PENTODE IN THE T-12 COMPACTRON CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. A SEPARATE CONNECTION IS PROVIDED FOR THE BEAM PLATES (GRID 3) TO MINIMZE "SNIVETS".
EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 17JM6 IS IDENTICAL TO THE 6JM6.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: G1 TO P	0.34	pf
INPUT: G1 TO (H + K + G2 + G3)	16	pf
OUTPUT: P TO (H + K + G2 + G3)	7.0	pf

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

AVERAGE CHARACTERISTICS	16.8	450	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.
MAXIMUM HEATER - CATHODE VOLTAGE:			
HEATER NEG. W/ RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POS. W/ RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DC PLATE - SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY).	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6,500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1,500	VOLTS
POSITIVE DC GRID 3 VOLTAGE	70	VOLTS
GRID 2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION [A]	17.5	WATTS
GRID 2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	175	MA.
PEAK CATHODE CURRENT	550	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

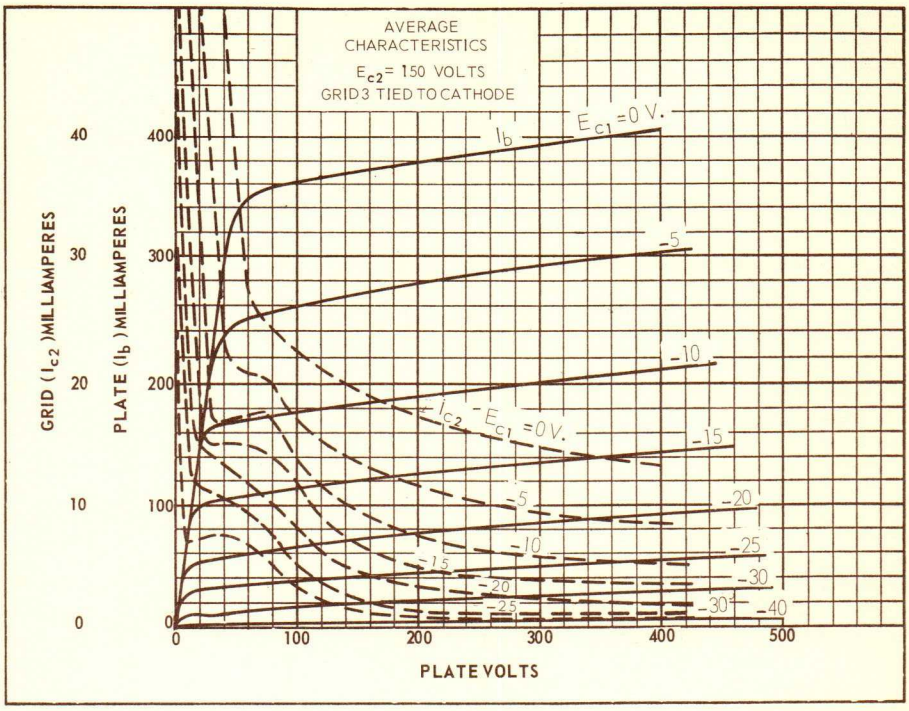
A - IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

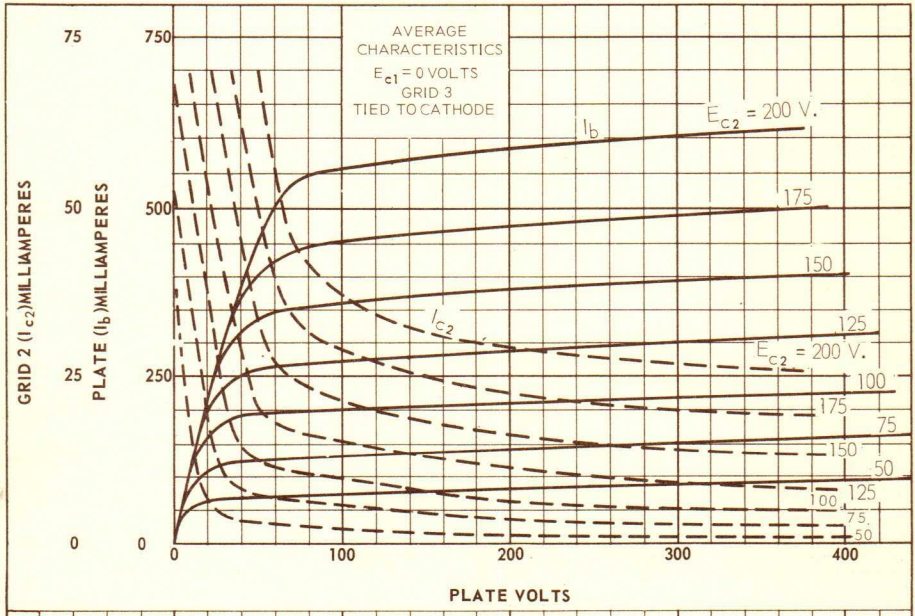
CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	5,000	60	250	VOLTS
GRID 3 - CONNECTED TO CATHODE AT SOCKET				
GRID 2 VOLTAGE	150	150	150	VOLTS
GRID 1 VOLTAGE	–	0 [B]	-22.5	VOLTS
PLATE CURRENT	–	345	65	MA.
GRID 2 CURRENT	–	27	1.8	MA.
TRANSCONDUCTANCE	–	–	7,300	μMHOS
PLATE RESISTANCE - APPROX.	–	–	18,000	OHMS
GRID 1 VOLTAGE AT I_b = 1.0 MA. - APPROX.	-100	–	-42	VOLTS
TRIODE AMPLIFICATION FACTOR [C]	–	–	4.4	

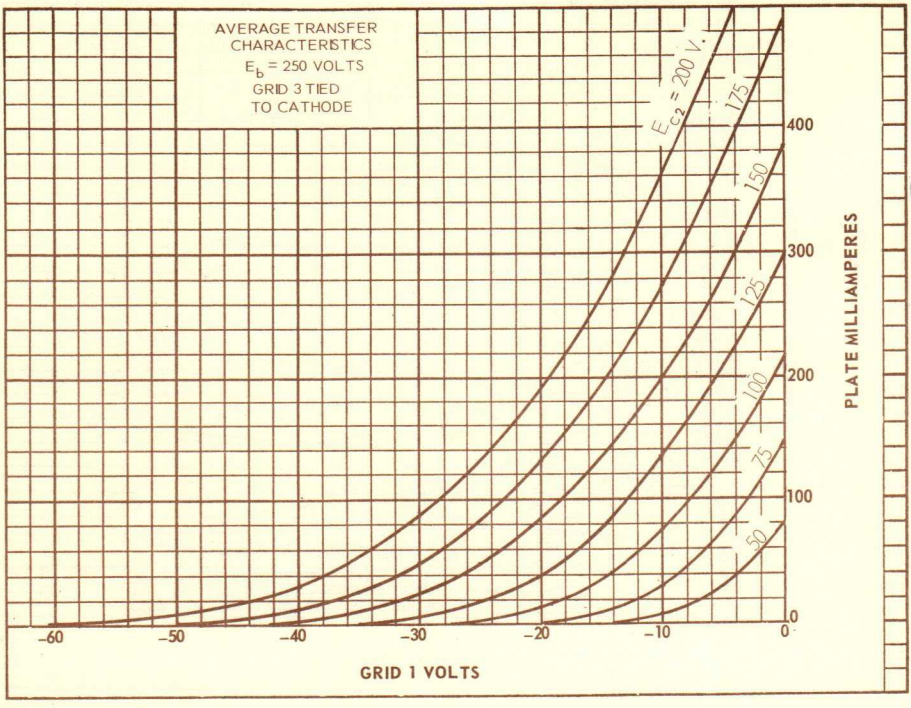
B - APPLIED FOR SHORT INTERVAL (2 SECONDS) SO AS NOT TO DAMAGE TUBE.

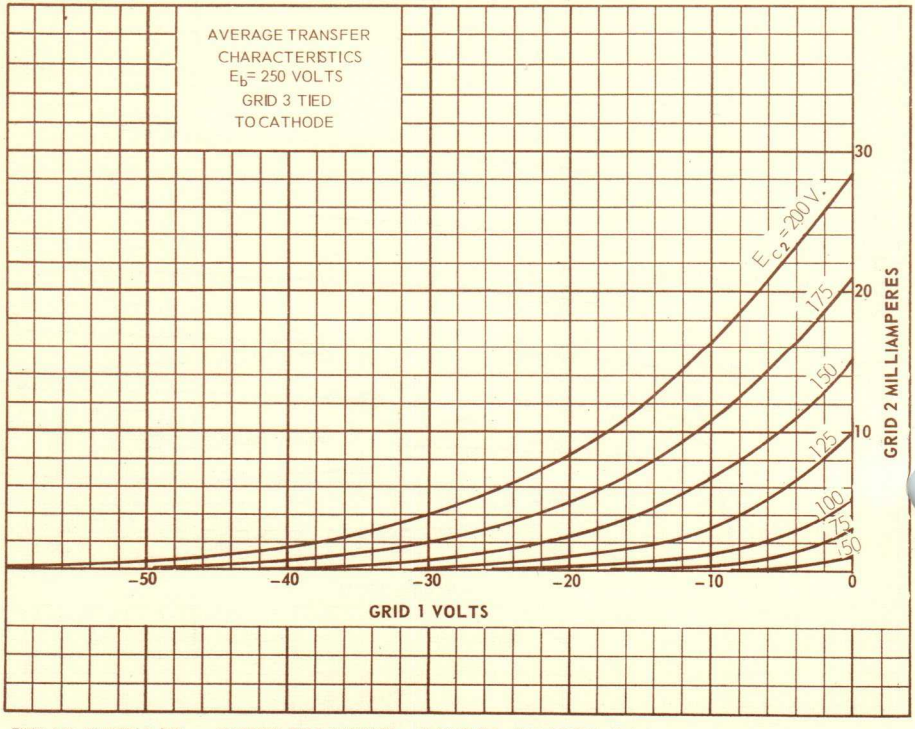
C - TRIODE CONNECTION (GRID 2 TIED TO PLATE) WITH $E_b = E_{c2} =$ 150 VOLTS AND $E_{c1} =$ -22.5 VOLTS





PRINTED IN U. S. A.


AVERAGE TRANSFER
CHARACTERISTICS
E_b = 250 VOLTS
GRID 3 TIED
TO CATHODE
E_{c_2} = 200 V.
175
150
125
100
75
50
400
300
200
100
0
PLATE MILLIAMPERES
-60
-50
-40
-30
-20
-10
0
GRID 1 VOLTS


AVERAGE TRANSFER
CHARACTERISTICS
E_b = 250 VOLTS
GRID 3 TIED
TO CATHODE
E_{c_2} = 200 V.
175
150
125
100
75
50
30
20
10
0
GRID 2 MILLIAMPERES
-50
-40
-30
-20
-10
0
GRID 1 VOLTS

TUNG-SOL

TRIODE-PENTODE

COMPACTRON

MEDIUM-MU TRIODE AND BEAM PENTODE

FOR

VERTICAL-DEFLECTION OSCILLATOR

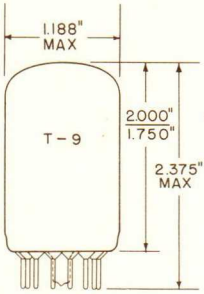
AND VERTICAL-DEFLECTION AMPLIFIER

SERVICE

IN T.V. APPLICATIONS

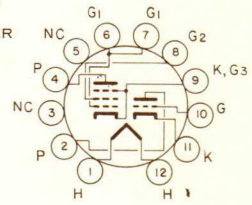
COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB

BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-58



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12 DZ

THE 17JZ8 IS A MEDIUM - MU TRIODE AND A BEAM PENTODE IN THE 12 PIN COMPACTRON CONSTRUCTION. THE TRIODE IS DESIGNED FOR SERVICE AS A VERTICAL-DEFLECTION OSCILLATOR AND THE PENTODE AS A VERTICAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE SECTION	
GRID 1 TO PLATE (g TO p)	0.34 pf
INPUT: G1 TO (H + K + G_2 + G_3)	11 pf
OUTPUT: P TO (H + K + G_2 + G_3)	7.0 pf
TRIODE SECTION	
GRID TO PLATE (G TO P)	3.6 pf
INPUT: G TO (H + K)	2.2 pf
OUTPUT: P TO (H + K)	0.7 pf

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUE - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	450	MA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450, ± 30	MA
HEATER-CATHODE VOLTAGE:			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

	TRIODE SECTION	PENTODE SECTION	
	VERTICAL OSCILLATOR [A] SERVICE	VERTICAL DEFLECTION [A] AMPLIFIER SERVICE	
PLATE VOLTAGE - DC	250	250	VOLTS
PEAK PULSE PLATE VOLTAGE		2,000	VOLTS
GRID 2 VOLTAGE		200	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	400	150	VOLTS
PLATE DISSIPATION	1.0	7.0 [B]	WATTS
GRID 2 DISSIPATION		1.8	WATTS
CATHODE CURRENT - DC	20	70	MA
PEAK CATHODE CURRENT	70	245	MA
GRID 1 CIRCUIT RESISTANCE			
WITH FIXED BIAS	1.0	1.0	MEGOHMS
WITH CATHODE BIAS	2.0	2.0	MEGOHMS

A FOR OPERATION IN A 525 - LINE, 30 - FRAME TELEVISION SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING 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.

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND TYPICAL OPERATION

	TRIODE SECTION	PENTODE SECTION		
PLATE VOLTAGE	150	45	120	VOLTS
GRID 2 VOLTAGE		110	110	VOLTS
GRID 1 VOLTAGE	-5.0	0 C	-8.0	VOLTS
PLATE CURRENT	5.5	122	46	MA
GRID 2 CURRENT		16.5	3.5	MA
AMPLIFICATION FACTOR	20			
TRANSCONDUCTANCE	2,350		7,100	μMHOS
PLATE RESISTANCE - APPROX.	8.5		11.7	KOHMS
GRID 1 VOLTAGE FOR I_b = 10 μA APPROX.	-11		-25	VOLTS

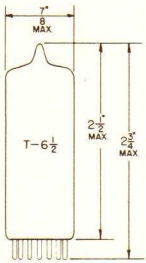
C APPLIED FOR SHORT INTERVAL (2 SECONDS) SO AS NOT TO DAMAGE TUBE.

PRINTED IN U. S. A.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

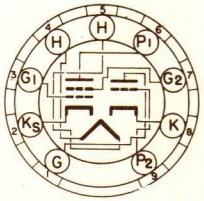
COATED UNIPOTNETIAL CATHODE

HEATER

18.0 VOLTS 0.30 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
9 PIN BASE

THE 18DZ8 IS A HIGH-MU TRIODE, POWER PENTODE IN THE MINIATURE 9 PIN CONSTRUCTION. IT IS DESIGNED AS A TWO STAGE AUDIO FREQUENCY AMPLIFIER WHERE THE PLATE SUPPLY VOLTAGE IS OBTAINED FROM A SINGLE HALF-WAVE RECTIFIER DIRECTLY FROM THE 120 VOLT AC LINE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	18.0		VOLTS
MAXIMUM PLATE VOLTAGE	150	150	VOLTS
MAXIMUM PLATE DISSIPATION	.75	6.5	WATTS
MAXIMUM GRID (2) VOLTAGE	---	135	VOLTS
MAXIMUM GRID (2) DISSIPATION	---	1.5	WATTS
MAXIMUM DC HEATER-CATHODE POTENTIAL	110	110	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	5.0	0.5	MEGOHMS
MAXIMUM CATHODE CURRENT	5.0	60.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200		VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE		PENTODE	
HEATER VOLTAGE	18.0			VOLTS
HEATER CURRENT	0.30			AMP.
PLATE VOLTAGE	120	---	145	VOLTS
GRID #2 VOLTAGE	---		120	VOLTS
GRID #1 VOLTAGE	0		0	VOLTS
CATHODE RESISTOR	1500		180	OHMS
PLATE CURRENT	0.8		45	MA.
GRID #2 CURRENT	---		6	MA.
TRANSCONDUCTANCE	1400		7500	μMHOS
LOAD RESISTANCE	---		2500	OHMS
GRID CUTOFF VOLTAGE FOR 20μA	-2.5		---	VOLTS
AMPLIFICATION FACTOR	100		---	
POWER OUTPUT	---		2.0	WATTS

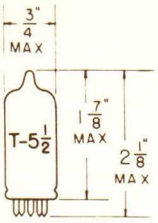
SIMILAR TYPE REFERENCE: Except for heater ratings the 18DZ8 is identical to the 6DZ8, 9DZ8, 12DZ8, and the 35DZ8.

PRINTED IN U.S.A.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

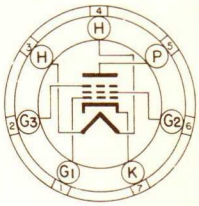
COATED UNIPOTENTIAL CATHODE

HEATER

18 VOLTS 0.10 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7CC

THE 18FW6 IS A SEMI REMOTE CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS A 100 MA HEATER AND IS DESIGNED FOR RF AND IF APPLICATIONS IN AC/DC TYPE RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES [A]

GRID #1 TO PLATE (MAX.)	.0035	μμf
INPUT	5.5	μμf
OUTPUT	5.0	μμf

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

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	18	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE	100	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.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

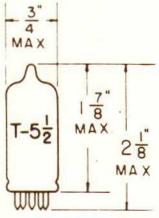
HEATER VOLTAGE	18	VOLTS
HEATER CURRENT	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID #3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID #2 VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR	68	OHMS
PLATE CURRENT	11	MA.
GRID #2 CURRENT	4.4	MA.
TRANSCONDUCTANCE	4400	μMHOS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHM
GRID #1 VOLTAGE FOR gm = 25 μMHOS	-20	VOLTS

PRINTED IN U.S.A.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

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

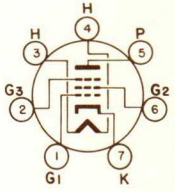
COATED UNIPOTENTIAL CATHODE

HEATER

18 VOLTS 0.10 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CC

THE 18FW6A IS A SEMI REMOTE CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS EXPECIALLY SUITED FOR USE IN AC/DC RADIOS THAT EMPLOY 100 MA. SERIES CONNECTED HEATERS. EXCEPT FOR HEATER RATINGS, THE 18FW6A IS IDENTICAL TO THE 18FW6.

DIRECT INTERELECTRODE CAPACITANCES [A]

GRID #1 TO PLATE (MAX.)	.0035	pf
INPUT	5.5	pf
OUTPUT	5.0	pf

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

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER CURRENT [C]	0.100±0.006	AMP.
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATTS
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*	20	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE (SERIES OPERATION)	18	VOLTS
HEATER CURRENT [B] (SERIES OPERATION)	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID #3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID #2 VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR	68	OHMS
PLATE CURRENT	11	MA.
GRID #2 CURRENT	4.4	MA.
TRANSCONDUCTANCE	4400	μMHOS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHM
GRID #1 VOLTAGE FOR gm = 25 μMHOS	-20	VOLTS

PRINTED IN U.S.A.

[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.

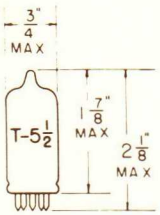
[C] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED VALUES.

*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.

TUNG-SOL

PENTAGRID AMPLIFIER

MINIATURE TYPE

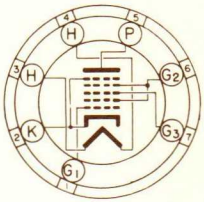


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
18 VOLTS 0.10 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CH

THE 18FX6 IS A DUAL CONTROL PENTAGRID AMPLIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS A 100 MA HEATER AND IS DESIGNED FOR CONVERTER APPLICATIONS IN AC/DC TYPE RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID #3 TO PLATE (MAX.)	0.25	0.30	μμf
GRID #3 TO GRID #1 (MAX.)	0.15	0.15	μμf
GRID #3 INPUT: G3 TO (H+K+G1+G2+4+G5+P)	7.0	7.0	μμf
GRID #1 INPUT: G1 TO (H+K+G2+4+G3+G5+P)	5.5	5.5	μμf
OUTPUT: P TO (H+K+G1+G2+4+G3+G5)	13.0	8.0	μμf
GRID #1 TO CATHODE	3.0	3.0	μμf
CATHODE TO ALL ELECTRODES EXCEPT GRID #1	20.0	15.0	μμf
GRID #1 TO PLATE	0.05	0.1	μμf

[A] SHIELD #316 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	18	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM #2 & GRID #4 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 & GRID #4 VOLTAGE	110	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM GRID #2 & GRID #4 DISSIPATION	1.2	WATT
MAXIMUM HEATER-CATHODE VOLTAGE	100	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.

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

SEPARATE EXCITATION

HEATER VOLTAGE	18	VOLTS
HEATER CURRENT	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID #2 VOLTAGE	100	VOLTS
GRID #3 VOLTAGE	-1.5	VOLTS
GRID #1 RESISTANCE	20 000	OHMS
GRID #1 CURRENT	0.5	MA.
PLATE CURRENT	2.3	MA.
GRID #2 CURRENT	6.2	MA.
CONVERSION TRANSCONDUCTANCE	480	μMHOS
PLATE RESISTANCE (APPROX.)	0.4	MEGOHM
CATHODE CURRENT	9	MA.
GRID #3 VOLTAGE (APPROX.) FOR G_c = 10 μMHOS	-21	VOLTS

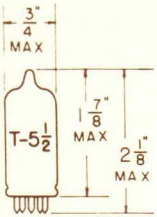
OSCILLATOR SECTION – NON OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE	0	VOLTS
GRID #2 CONNECTED TO PLATE	100	VOLTS
CATHODE CURRENT	24	MA.
TRANSCONDUCTANCE BETWEEN GRID #1, GRID #2 & GRID #4 CONNECTED TO PLATE	7000	μMHOS
AMPLIFICATION FACTOR BETWEEN GRID #1, GRID #2 & #4 CONNECTED TO PLATE	22	
GRID #1 VOLTAGE (APPROX.) FOR I_b = 20 μA	-9.2	VOLTS

TUNG-SOL

PENTAGRID AMPLIFIER

MINIATURE TYPE



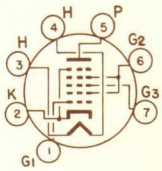
GLASS BULB

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

COATED UNIPOTENTIAL CATHODE

HEATER
18 VOLTS 0.10 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CH

THE 18FX6A IS A DUAL CONTROL PENTAGRID AMPLIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY SUITED FOR USE IN AC/DC RADIOS THAT EMPLOY 100 MA. SERIES CONNECTED HEATERS. EXCEPT FOR HEATER RATINGS, THE 18FX6A IS IDENTICAL TO THE 18FX6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID #3 TO PLATE (MAX.)	0.25	0.30	μμf
GRID #3 TO GRID #1 (MAX.)	0.15	0.15	μμf
GRID #3 INPUT: G3 TO (H+K+G1+G2+4+G5+P)	7.0	7.0	μμf
GRID #1 INPUT: G1 TO (H+K+G2+4+G3+G5+P)	5.5	5.5	μμf
OUTPUT: P TO (H+K+G1+G2+4+G3+G5)	13.0	8.0	μμf
GRID #1 TO CATHODE	3.0	3.0	μμf
CATHODE TO ALL ELECTRODES EXCEPT GRID #1	20.0	15.0	μμf
GRID #1 TO PLATE	0.05	0.1	μμf

[A] SHIELD #316 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER CURRENT [C]	0.100±0.006	AMP.
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM #2 & GRID #4 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 & GRID #4 VOLTAGE	110	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM GRID #2 & GRID #4 DISSIPATION	1.2	WATT
MAXIMUM HEATER–CATHODE VOLTAGE	100	VOLTS
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*	20	SECONDS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

SEPARATE EXCITATION

HEATER VOLTAGE (SERIES OPERATION)	18	VOLTS
HEATER CURRENT[D] (SERIES OPERATION)	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID #2 VOLTAGE	100	VOLTS
GRID #3 VOLTAGE	-1.5	VOLTS
GRID #1 RESISTANCE	20 000	OHMS
GRID #1 CURRENT	0.5	MA.
PLATE CURRENT	2.3	MA.
GRID #2 CURRENT	6.2	MA.
CONVERSION TRANSCONDUCTANCE	480	μMHOS
PLATE RESISTANCE (APPROX.)	0.4	MEGOHM
CATHODE CURRENT	9	MA.
GRID #3 VOLTAGE (APPROX.) FOR G_c = 10 μMHOS	-21	VOLTS

OSCILLATOR SECTION – NON OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE	0	VOLTS
GRID #2 CONNECTED TO PLATE	100	VOLTS
CATHODE CURRENT	24	MA.
TRANSCONDUCTANCE BETWEEN GRID #1, GRID #2 & GRID #4 CONNECTED TO PLATE	7000	μMHOS
AMPLIFICATION FACTOR BETWEEN GRID #1, GRID #2 & #4 CONNECTED TO PLATE	22	
GRID #1 VOLTAGE (APPROX.) FOR I_b = 20 μA	-9.2	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.

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

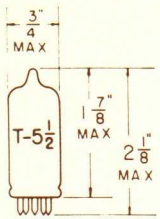
[D]FOR SERIES OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

*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 TRIODE

MINIATURE TYPE



GLASS BULB

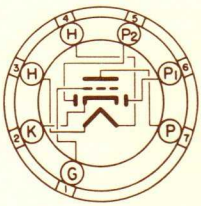
COATED UNIPOTENTIAL CATHODE

HEATER

18 VOLTS 0.10 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7BT

THE 18FY6 IS A MINIATURE HIGH MU TRIODE DOUBLE DIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS A 100 MA. HEATER AND IS DESIGNED FOR DETECTOR AMPLIFIER APPLICATIONS IN AC/DC TYPE RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD	WITHOUT SHIELD	
GRID TO PLATE	1.8	1.8	μμf
INPUT	2.4	2.4	μμf
OUTPUT	2	0.22	μμf
GRID TO DIODE #2 PLATE (MAX.)	0.2	0.2	μμf

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

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	18	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM POSITIVE GRID VOLTAGE	0	VOLTS
MAXIMUM DIODE PLATE CURRENT (EACH DIODE)	1.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE	100	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	18	VOLTS
HEATER CURRENT	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	-1	VOLTS
PLATE CURRENT	0.6	MA.
PLATE RESISTANCE	77 000	OHMS
TRANSCONDUCTANCE	1 300	μMHOS
AMPLIFICATION FACTOR	100	
AVERAGE DIODE CURRENT (EA.DIODE) WITH 10V. APPLIED[C]	2.0	MA.

[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.

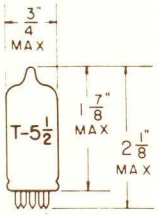
[C] TEST CONDITION ONLY.

PRINTED IN U.S.A.

TUNG-SOL

DOUBLE DIODE TRIODE

MINIATURE TYPE



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

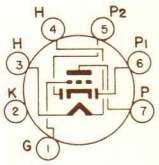
COATED UNIPOTENTIAL CATHODE

HEATER

18 VOLTS 0.10 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

BASING DIAGRAM
JEDEC 7BT

THE 18FY6A IS A HIGH MU TRIODE DOUBLE DIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY SUITED FOR USE IN AC/DC RADIOS THAT EMPLOY 100 MA. SERIES CONNECTED HEATERS. EXCEPT FOR HEATER RATINGS, THE 18FY6A IS IDENTICAL TO THE 18FY6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD	WITHOUT SHIELD	
GRID TO PLATE	1.8	1.8	μμf
INPUT	2.4	2.4	μμf
OUTPUT	2	0.22	μμf
GRID TO DIODE #2 PLATE (MAX.)	0.2	0.2	μμf

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

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER CURRENT[C]	0.100±0.006	AMPS.
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM POSITIVE GRID VOLTAGE	0	VOLTS
MAXIMUM DIODE PLATE CURRENT (EACH DIODE)	1.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER WARM-UP TIME *	20	SECONDS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE (SERIES OPERATION)	18	VOLTS
HEATER CURRENT [D] (SERIES OPERATION)	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	−1	VOLTS
PLATE CURRENT	0.6	MA.
PLATE RESISTANCE	77 000	OHMS
TRANSCONDUCTANCE	1 300	μMHOS
AMPLIFICATION FACTOR	100	
AVERAGE DIODE CURRENT (EA.DIODE) WITH 10V. APPLIED [E]	2.0	MA.

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

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

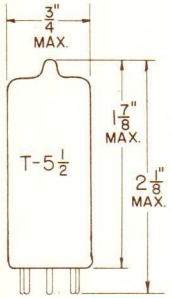
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[E] TEST CONDITION ONLY.

TUNG-SOL

PENTODE

MINIATURE TYPE

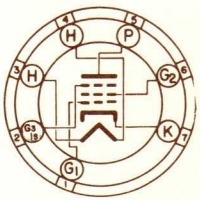


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
18 VOLTS 0.10 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7BK

THE 18GD6 IS A SHARP-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT FEATURES A 100 MILLIAMPERE HEATER AND IS DESIGNED FOR RF AND IF APPLICATIONS IN AC/DC TYPE RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACTTANCES[A]

GRID #1 TO PLATE (MAX.)	.0035	μμf
INPUT: G1 TO (H+K+G2+G3+I.S.)	6.0	μμf
OUTPUT: P TO (H+K+G2+G3+I.S.)	5.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM [B]

HEATER VOLTAGE	18	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE [B]	100	VOLTS

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN 7 (CATHODE)

[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.

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

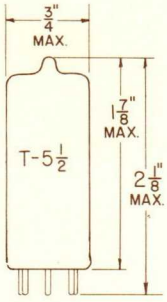
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	18	VOLTS
HEATER CURRENT	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID #3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID #2 VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR	150	OHMS
PLATE CURRENT	5	MA.
GRID #2 CURRENT	2.0	MA.
TRANSCONDUCTANCE	4300	μMHOS
PLATE RESISTANCE (APPROX.)	0.5	MEGOHM
E_{c1} FOR I_b = 10 μA (APPROX.)	-4.7	VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE



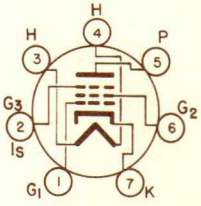
GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER NOMINAL

18 VOLTS[B] 0.10 AMP.

SERIES OPERATION
AC OR DC
ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7BK

THE 18GD6A IS A SHARP-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT FEATURES A 100 MILLIAMPERE HEATER AND IS DESIGNED FOR RF AND IF APPLICATIONS IN AC/DC TYPE RADIO RECEIVERS OR OTHER ELECTRONIC EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES[A]

GRID #1 TO PLATE (MAX.)	.0035	pf
INPUT: G1 TO (H+K+G2+G3+I.S.)	6.0	pf
OUTPUT: P TO (H+K+G2+G3+I.S.)	5.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM
SEE EIA STANDARD RS-239

HEATER CURRENT[C]	0.100±0.006	AMPS.
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE	100	VOLTS
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*	20	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.

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE		100	VOLTS
GRID #3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET		
GRID #2 VOLTAGE		100	VOLTS
CATHODE BIAS RESISTOR		150	OHMS
PLATE CURRENT		5	MA.
GRID #2 CURRENT		2.0	MA.
TRANSCONDUCTANCE		4300	μMHOS
PLATE RESISTANCE (APPROX.)		0.5	MEGOHM
E_{c1} FOR I_b = 10 μA (APPROX.)		-4.7	VOLTS

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

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

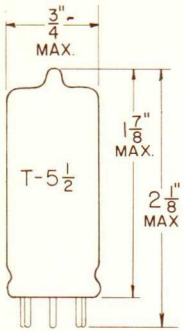
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

SIMILAR TYPE REFERENCE: *Except for heater warm-up time, the 18GD6A is identical to the 18GD6.*

TUNG-SOL

TRIODE DOUBLE DIODE

MINIATURE TYPE



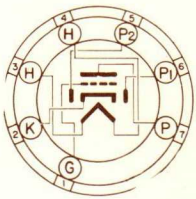
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

18 VOLTS 0.10 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7BT

THE 18GE6 IS A HIGH MU TRIODE DOUBLE DIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT FEATURES 100 MILLIAMPERE HEATER AND IS DESIGNED FOR DETECTOR-AMPLIFIER APPLICATIONS IN AC/DC TYPE RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE	1.8	μμf
INPUT: G TO (H + K)	2.4	μμf
OUTPUT: P TO (H + K)	0.2	μμf
GRID TO DIODE #2 PLATE (MAX.)	0.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

HEATER VOLTAGE	18	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM DIODE PLATE CURRENT, (EACH DIODE)	1.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE[A]	100	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	18	VOLTS
HEATER CURRENT	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	−1	VOLTS
PLATE CURRENT	1.0	MA.
PLATE RESISTANCE	40 000	OHMS
TRANSCONDUCTANCE	1 700	μMHOS
AMPLIFICATION FACTOR	70	
AVERAGE DIODE CURRENT, EACH DIODE[B] WITH 10 VOLTS DC APPLIED	2.0	MA.

[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.

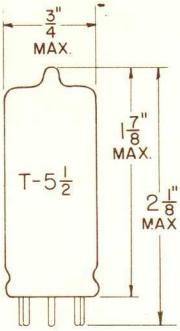
[B] TEST CONDITION ONLY.

PRINTED IN U. S. A.

TUNG-SOL

TRIODE DOUBLE DIODE

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-2

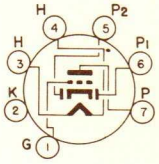
COATED UNIPOTENTIAL CATHODE

HEATER

18 VOLTS[B] 0.10 AMP.

SERIES OPERATION

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7BT

THE 18GE6A IS A HIGH MU TRIODE DOUBLE DIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT FEATURES 100 MILLIAMPERE HEATER AND IS DESIGNED FOR DETECTOR-AMPLIFIER APPLICATIONS IN AC/DC TYPE RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE	1.8	pf
INPUT: G TO (H + K)	2.4	pf
OUTPUT: P TO (H + K)	0.2	pf
GRID TO DIODE #2 PLATE (MAX.)	0.2	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

HEATER CURRENT[C]	0.100±0.006	AMPS.
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM DIODE PLATE CURRENT, (EACH DIODE)	1.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE[A]	100	VOLTS
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*	20	SECONDS

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

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	−1	VOLTS
PLATE CURRENT	1.0	MA.
PLATE RESISTANCE	40 000	OHMS
TRANSCONDUCTANCE	1 700	μMHOS
AMPLIFICATION FACTOR	70	
AVERAGE DIODE CURRENT, EACH DIODE[D] WITH 10 VOLTS DC APPLIED	2.0	MA.

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

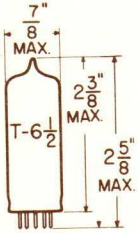
[D]TEST CONDITION ONLY.

*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 REATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

SIMILAR TYPE REFERENCE: *Except for heater-warm-up time, the 18GE6A is identical to the 18GE6.*

TUNG-SOL

TRIODE-PENTODE
MINIATURE TYPE



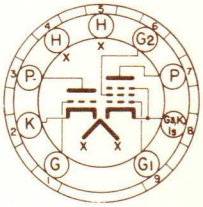
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

18.0 VOLTS 0.30 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9ME

THE 18HB8 IS A TRIODE-PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR AUDIO APPLICATIONS IN STEREO AND MONAURAL SOUND EQUIPMENT. EXCEPT FOR HEATER RATINGS, THE 18HB8 IS IDENTICAL TO THE 35HB8.

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE[A]	18.0		VOLTS
MAXIMUM PLATE VOLTAGE	150	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	135	VOLTS
MAXIMUM CATHODE CURRENT	5	50	MA.
MAXIMUM PLATE DISSIPATION	0.75	6.5	WATTS
MAXIMUM GRID #2 DISSIPATION	---	1.5	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE:			
FIXED BIAS	0.1		MEGOHM
CATHODE BIAS	0.47		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

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	18.0		VOLTS
HEATER CURRENT	0.30		AMP.
PLATE VOLTAGE	115	115	VOLTS
GRID #2 VOLTAGE	---	115	VOLTS
PEAK AF GRID #1 VOLTAGE	---	6.0	VOLTS
CATHODE RESISTOR	410	150	OHMS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

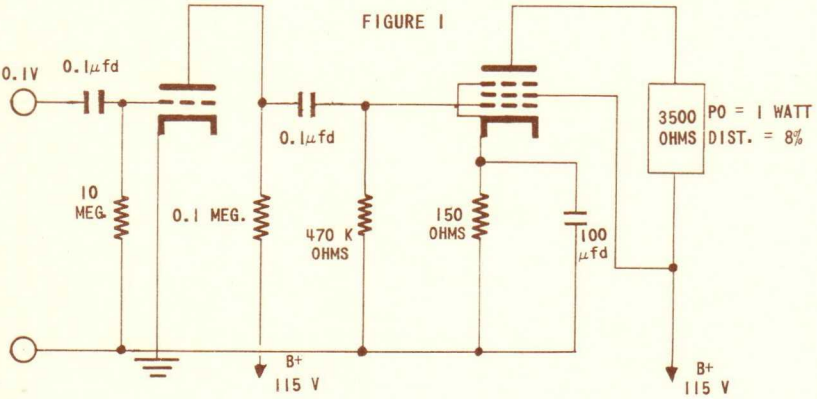
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS (cont'd.)

	TRIODE SECTION		PENTODE SECTION	
HEATER VOLTAGE		18.0		VOLTS
HEATER CURRENT		0.30		AMP.
ZERO-SIGNAL PLATE CURRENT	2.5		33	MA.
MAX.-SIGNAL PLATE CURRENT	---		32	MA.
ZERO-SIGNAL GRID #2 CURRENT	---		7.5	MA.
MAX.-SIGNAL GRID #2 CURRENT	---		10	MA.
TRANSCONDUCTANCE	3900		6250	μMHOS
AMPLIFICATION FACTOR	74		---	
LOAD RESISTANCE	---		3500	OHMS
MAX.-SIGNAL POWER OUTPUT	---		1.0	WATT
TOTAL HARMONIC DISTORTION (APPROX.)	---		8	PERCENT

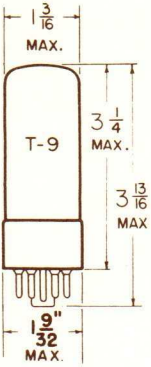
[A] THE HEATER SHOULD BE CONNECTED WITH PIN #4 CLOSEST TO THE GROUND END OF THE HEATER STRING.

FIGURE 1



TUNG-SOL

DIODE



GLASS BULB

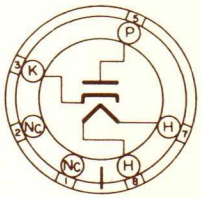
COATED UNIPOTENTIAL CATHODE

HEATER

18.9 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SHORT INTERMEDIATE SHELL 5 OR 6 PIN OCTAL

SOCKET TERMINALS #1, #2, #4 AND #6 SHOULD NOT BE USED AS TIE POINTS. PIN #1 OMITTED ON 5-PIN BASE.

4CG

THE 19AU4 AND 19AU4GTA ARE SINGLE INDIRECTLY-HEATED DIODES INTENDED FOR USE IN TELEVISION HORIZONTAL FREQUENCY DAMPER SERVICE. THEY ARE DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES OF LINE FREQUENCY BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS ARE NORMALLY ENCOUNTERED IN "DIRECT DRIVE" CIRCUITS. EXCEPT FOR THE HIGHER MAXIMUM DC OUTPUT CURRENT AND PEAK PLATE CURRENT OF THE 19AU4GTA, THE TWO TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES [C]

HEATER TO CATHODE: (H TO K)	4.0	μμf
PLATE TO CATHODE AND HEATER: P TO (H+K)	8.5	μμf
CATHODE TO PLATE AND HEATER: K TO (P+H)	11.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DAMPER DIODE [B]

HEATER VOLTAGE	18.9	VOLTS
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 190 [A]	175	MA.
MAXIMUM STEADY STATE PEAK PLATE CURRENT 1 150	1 050	MA.
MAXIMUM PLATE DISSIPATION	6.0	WATTS
AVERAGE TUBE VOLTAGE DROP (WITH TUBE CONDUCTING 350 MA.)	25	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

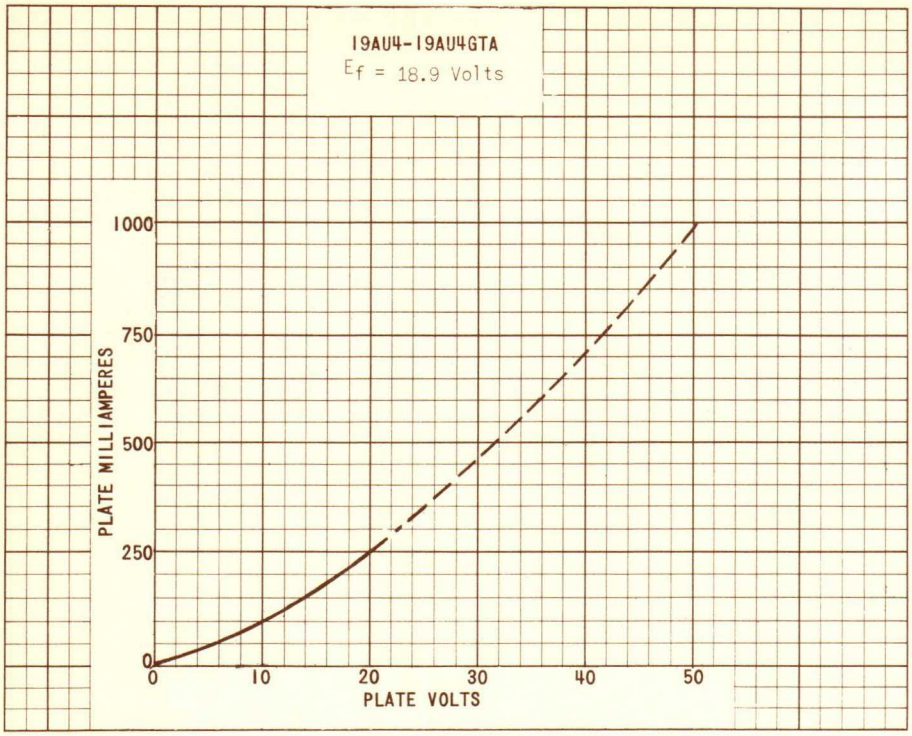
[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE HORIZONTAL VOLTAGE PULSE, NOT TO EXCEED 15% OF SCANNING CYCLE.

* 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] VALUES FOR 19AU4GTA.

[C] WITHOUT EXTERNAL SHIELD.

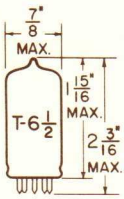
PRINTED IN U.S.A.


19AU4-19AU4GTA
Ef = 18.9 Volts
PLATE MILLIAMPERES
1000
750
500
250
0
0
10
20
30
40
50
PLATE VOLTS

TUNG-SOL

TRIODE TETRODE

MINIATURE TYPE



GLASS BULB

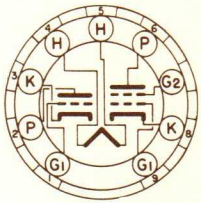
COATED UNIPOTENTIAL CATHODE

HEATER

18.9 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9FX

THE 19CL8A 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. EXCEPT FOR HEATER RATINGS, THE 19CL8A 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	18.9	18.9	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

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS—CONT'D.

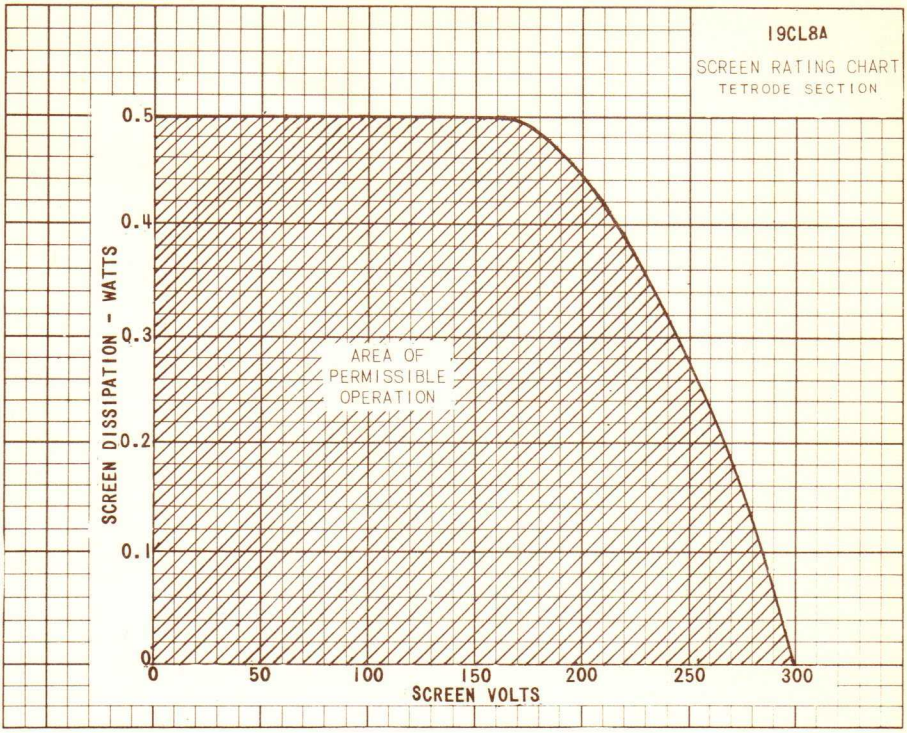
	TRIODE	TETRODE	
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.5	0.25	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME[A]	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

		TETRODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	18.9	18.9	18.9	VOLTS
HEATER CURRENT	0.15	0.15	0.15	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.

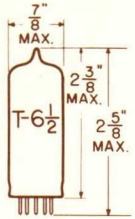


PRINTED IN U. S. A.

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

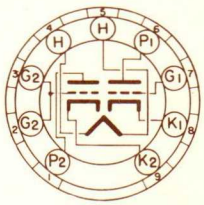


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
19.4 VOLTS 0.30 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9HF

THE 19DE7 IS A MINIATURE DOUBLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. SECTION #1 IS INTENDED FOR USE AS A VERTICAL DEFLECTION OSCILLATOR HAVING MEDIUM MU AND SECTION #2 IS INTENDED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER WITH LOW MU. EXCEPT FOR HEATER RATINGS THE 19DE7 IS IDENTICAL TO THE 6DE7.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: (G TO P)	4.0	8.5	μμf
INPUT: G TO (H+K)	2.2	5.5	μμf
OUTPUT: P TO (H+K)	0.52	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[A]

	TRIODE #1 OSCILLATOR	TRIODE #2 AMPLIFIER	
HEATER VOLTAGE	19.4	19.4	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE[B]			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM DC PLATE VOLTAGE	330	275	
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	---	1500	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.5	7.0	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	22	50	MA.
MAXIMUM PEAK CATHODE CURRENT	77	175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE			
SELF BIAS	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

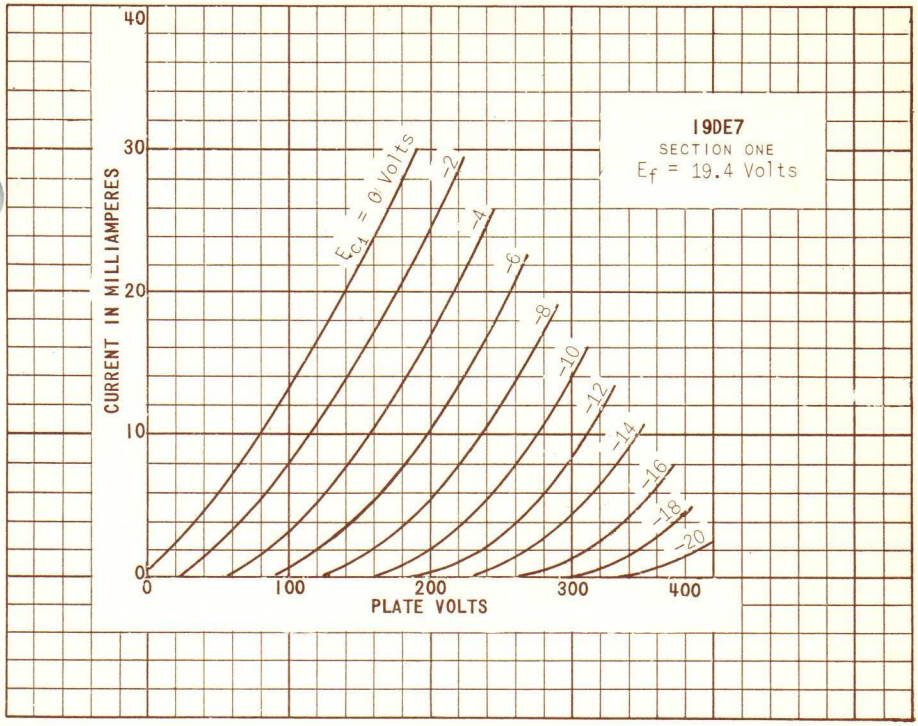
	TRIODE #1	TRIODE #2	
HEATER VOLTAGE	19.4		VOLTS
HEATER CURRENT	0.30		AMP.
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-11	-17.5	VOLTS
PLATE CURRENT	5.5	35	MA.
TRANSCONDUCTANCE	2000	6500	μMHOS
AMPLIFICATION FACTOR	17.5	6.0	
PLATE RESISTANCE (APPROX.)	8750	925	
GRID VOLTAGE FOR Ib = 10 μA	-20	---	VOLTS
GRID VOLTAGE FOR Ib = 50 μA	---	-44	VOLTS
PLATE CURRENT AT Ec =-24 Vdc	---	10	MA.
ZERO BIAS PLATE CURRENT Eb = 60V; Ec = 0 (INSTANTANEOUS VALUES))	---	80	MA.

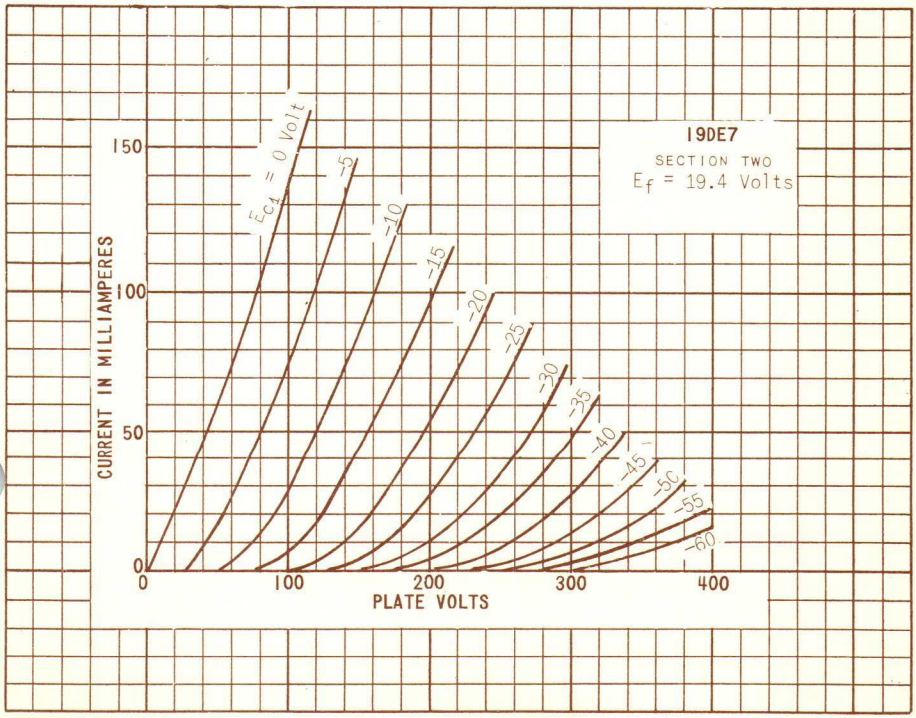
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] 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.

[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.



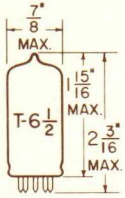


PRINTED IN U. S. A.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

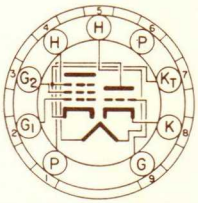
COATED UNIPOTENTIAL CATHODE

HEATER

18.9 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE
9AE

THE 19EA8 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 19EA8 IS IDENTICAL TO THE 6EA8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
PENTODE SECTION:			
GRID #1 TO PLATE (MAX.)	0.01	0.02	μμf
INPUT	5.0	5.0	μμf
OUTPUT	3.4	2.6	μμf
TRIODE SECTION:			
GRID TO PLATE	1.7	1.7	μμf
INPUT	3.2	3.0	μμf
OUTPUT	1.1	0.3	μμf
HEATER TO CATHODE (EACH SECTION) [B]	3.0	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	18.9	18.9	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

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	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

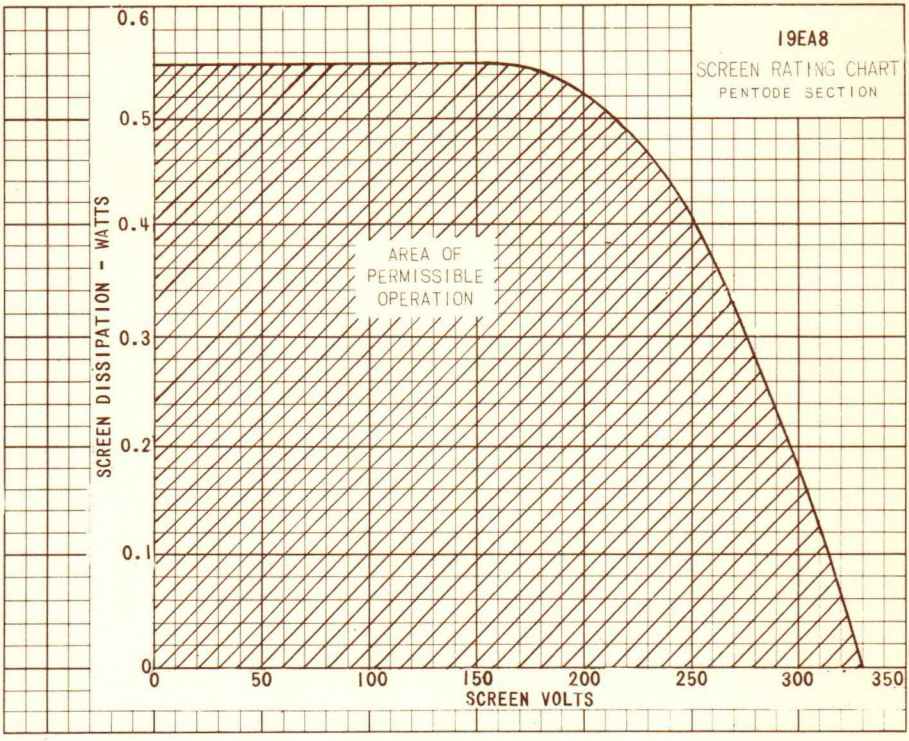
AVERAGE CHARACTERISTICS

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	18.9	18.9	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
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.)	80 000	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.

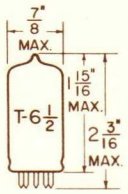
*HEATER WARM–UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.



PRINTED IN U. S. A.

TUNG-SOL

TRIPLE TRIODE
MINIATURE TYPE



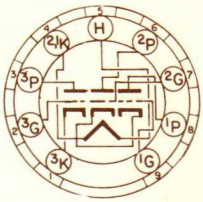
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

18.9±10% VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9KA

THE 19EZ8 IS A HIGH MU, TRIPLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE CATHODES OF SECTIONS 1 AND 2 HAVE A COMMON CONNECTION WITH ONE SIDE OF THE HEATER. THE CATHODE OF SECTION 3 IS BROUGHT OUT TO A SEPARATE BASE PIN.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE (EACH SECTION)	1.5	1.5	μμf
INPUT (EACH SECTION)	2.6	2.4	μμf
OUTPUT, SECTION #1	1.4	0.21	μμf
OUTPUT, SECTION #2	1.2	0.4	μμf
OUTPUT, SECTION #3	1.2	0.36	μμf
HEATER TO CATHODE, SECTION #3	0.15	0.17	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

EACH SECTION

HEATER VOLTAGE	18.9±10%	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION (EACH PLATE)	2.0	WATTS
MAXIMUM TOTAL PLATE DISSIPATION (ALL PLATES)	5.0	WATTS
MAXIMUM HEATER–CATHODE VOLTAGE (SECTION 3):		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF SECTION UNDER TEST.

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

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

EACH SECTION

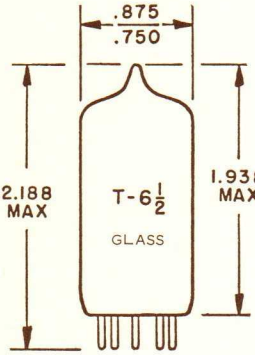
PLATE VOLTAGE	125	VOLTS
GRID VOLTAGE	-1.0	VOLTS
AMPLIFICATION FACTOR	57	
PLATE RESISTANCE (APPROX.)	13 600	OHMS
TRANSCONDUCTANCE	4 200	μMHOS
PLATE CURRENT	4.2	MA.
GRID VOLTAGE (APPROX.) I_b= 20 μAMPS.	-4	VOLTS

TUNG-SOL

TRIPLE DIODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 6-2



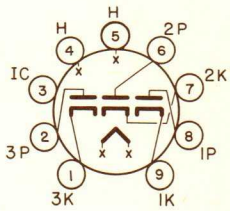
BUTTON 9 PIN BASE
JEDEC E9-1

FOR
AM AND FM
DETECTION

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9QM



BOTTOM VIEW

THE 19GQ7 IS A TRIPLE HIGH PERVEANCE DIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS AN AM DETECTOR AND FM RADIO-DETECTOR OR DISCRIMINATOR.

DIRECT INTERELECTRODE CAPACITANCES

PLATE INPUT EACH UNIT: P TO (K+H)	2.05	pf
CATHODE INPUT EACH UNIT: K TO (P+H)	3.10	pf
PLATE, UNIT #1 TO PLATE, UNIT #2	0.47	pf
PLATE, UNIT #1 TO PLATE, UNIT #3	0.47	pf
PLATE, UNIT #2 TO PLATE, UNIT #3	0.05	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	18.9 VOLTS	150	mA
LIMITS OF SUPPLIED CURRENT		150 ± 9	mA
PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		330	VOLTS
DC COMPONENT		330	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

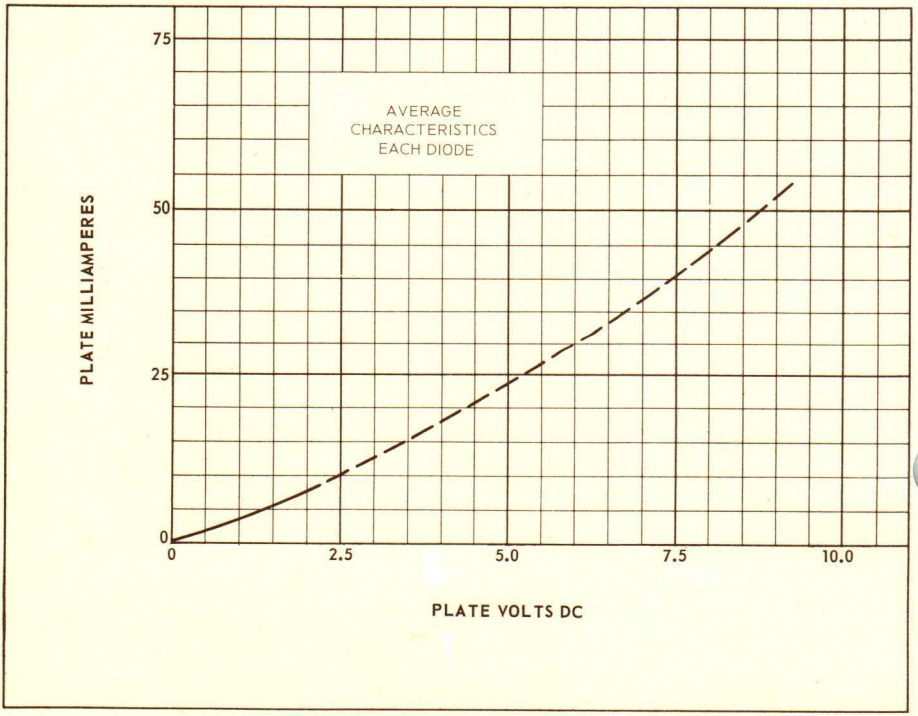
MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PEAK INVERSE VOLTAGE	330	VOLTS
AC PLATE VOLTAGE RMS - EACH PLATE	117	VOLTS
STEADY STATE PEAK PLATE CURRENT - EACH PLATE	54	mA
DC OUTPUT CURRENT - EACH PLATE	9	mA
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDENCE - EACH PLATE	300	OHMS

CHARACTERISTICS

TUBE VOLTAGE DROP AT 60 mA	10	VOLTS
RESONANT FREQUENCY - EACH UNIT	APPROX. 700	Mc/s

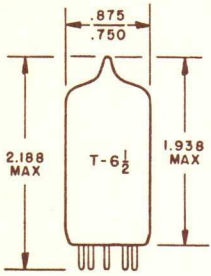


TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 6-2

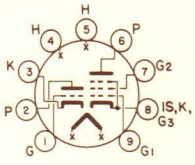


SMALL BUTTON BASE
9 PIN JEDEC E9-1

FOR
APPLICATIONS IN
FM OR TV RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9FA



BOTTOM VIEW

THE 19JN8 IS A SHARP-CUTOFF PENTODE AND MEDIUM-MU TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS INTENDED FOR OSCILLATOR SERVICE IN THE HORIZONTAL DEFLECTION SYSTEM OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 19JN8 IS IDENTICAL TO THE 6JN8.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE

PENTODE SECTION:			
GRID 1 TO PLATE: (G1 TO P)	MAX.	0.01	pf
INPUT: G_1 TO (H + K + G_2 + G_3 + I.S.)		5.5	pf
OUTPUT: P TO (H + K + G_2 + G_3 + I.S.)		3.4	pf
TRIODE SECTION:			
GRID TO PLATE: (G TO P)		1.7	pf
INPUT: G TO (H + TK + PK + PG3 + I.S.)		3.2	pf
OUTPUT: P TO (H + TK + PK + PG3 + I.S.)		2.2	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	18.9 VOLTS	150	mA
LIMITS OF SUPPLIED CURRENT		150 ± 10	mA
HEATER-CATHODE VOLTAGE: EACH SECTION:			
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

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

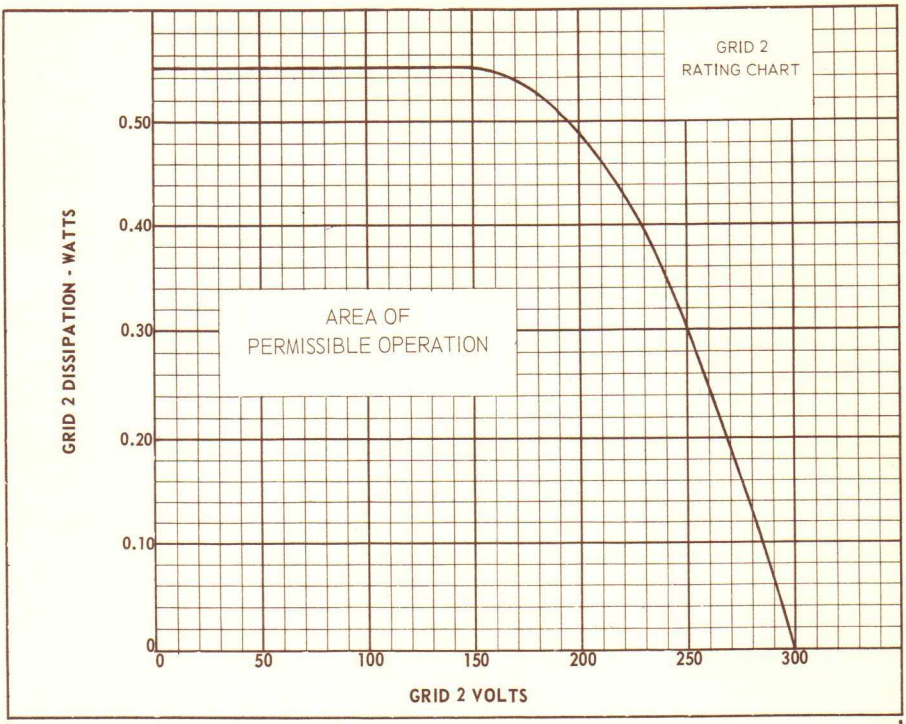
MAXIMUM RATINGS

DESIGN - MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	300	300	VOLTS
GRID 2 SUPPLY VOLTAGE	–	300	VOLTS
GRID 2 VOLTAGE	–	SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
PLATE DISSIPATION	2.5	2.5	WATTS
GRID 2 DISSIPATION	–	0.55	WATTS
GRID 1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS	2.2	2.2	MEGOHMS
WITH CATHODE BIAS	2.2	2.2	MEGOHMS

AVERAGE CHARACTERISTICS AND TYPICAL OPERATION

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	125	125	VOLTS
GRID 2 VOLTAGE	–	125	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
PLATE CURRENT	13.5	12	mA
GRID 2 CURRENT	–	4.0	mA
TRANSCONDUCTANCE	8,500	7,500	μMHOS
AMPLIFICATION FACTOR	46	–	
PLATE RESISTANCE	5,400	200,000	OHMS
GRID 1 VOLTAGE (APPROX.) FOR I_b = 10 μA	-8	-8	VOLTS



PRINTED IN U.S.A.

TUNG-SOL

TRIPLE-DIODE TRIODE

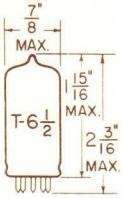
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODES

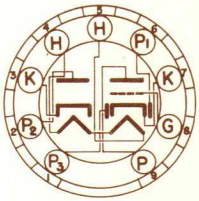
HEATER

18.9 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE GLASS BUTTON
9 PIN BASE
9E

THE 19T8 COMPRISES THREE HIGH PERVEANCE DIODES AND A HIGH-MU TRIODE IN ONE ENVELOPE WITH THE 9 PIN MINIATURE CONSTRUCTION. 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.

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	18.9	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	90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	90	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	18.9	18.9	VOLTS
HEATER CURRENT	0.15	0.15	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	

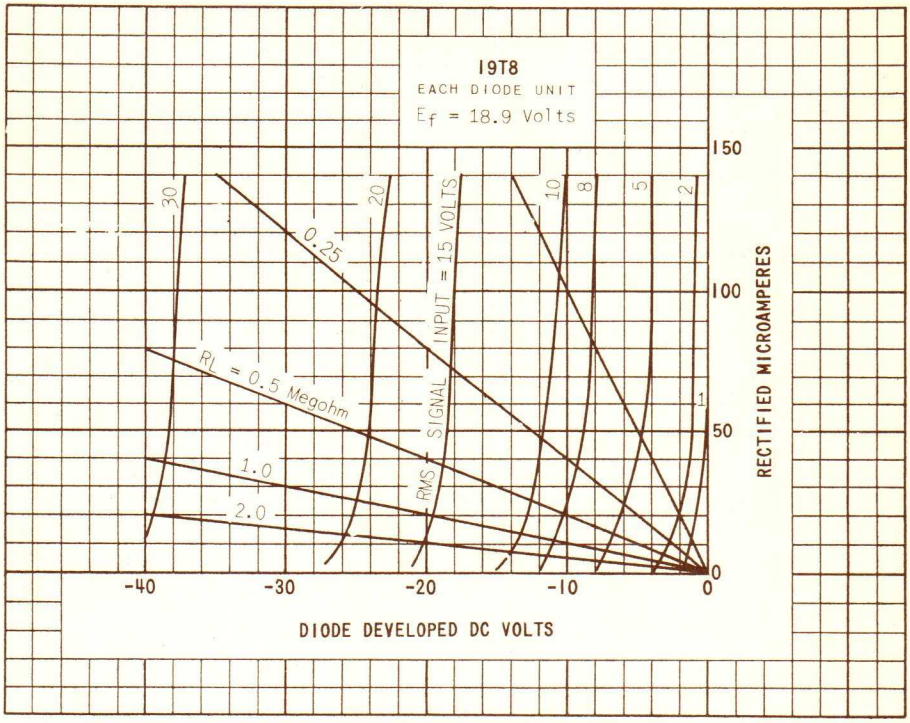
[A] WITH EXTERNAL SHIELD #315 CONNECTED TO PIN #7, EXCEPT AS NOTED.

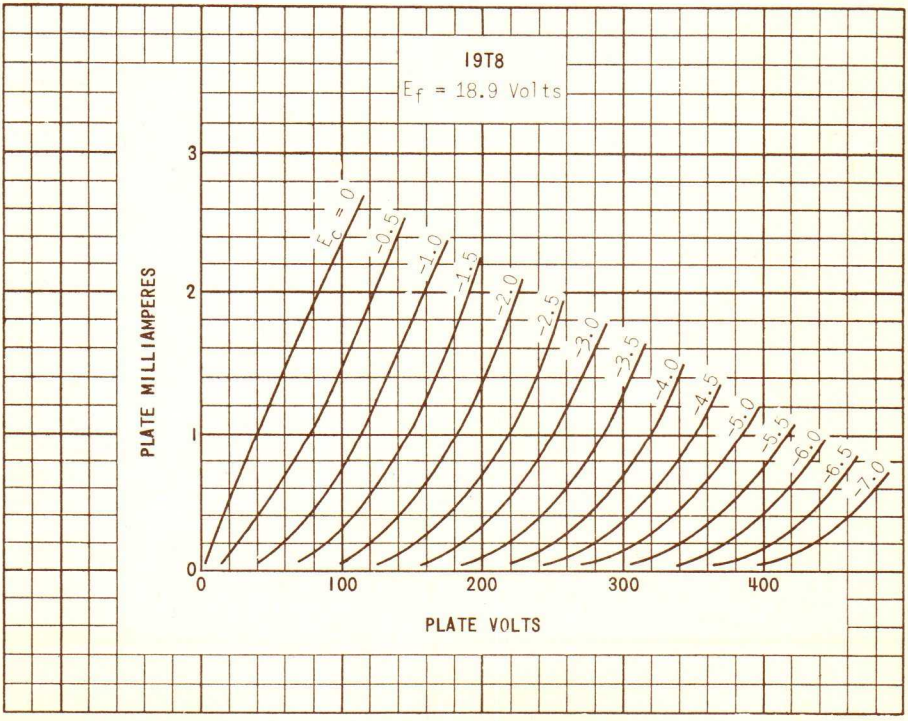
[B] WITH EXTERNAL SHIELD #315 CONNECTED TO PIN #3.

[C] WITH EXTERNAL SHIELD #315 CONNECTED TO PINS #4 AND #5.

→ INDICATES A CHANGE..

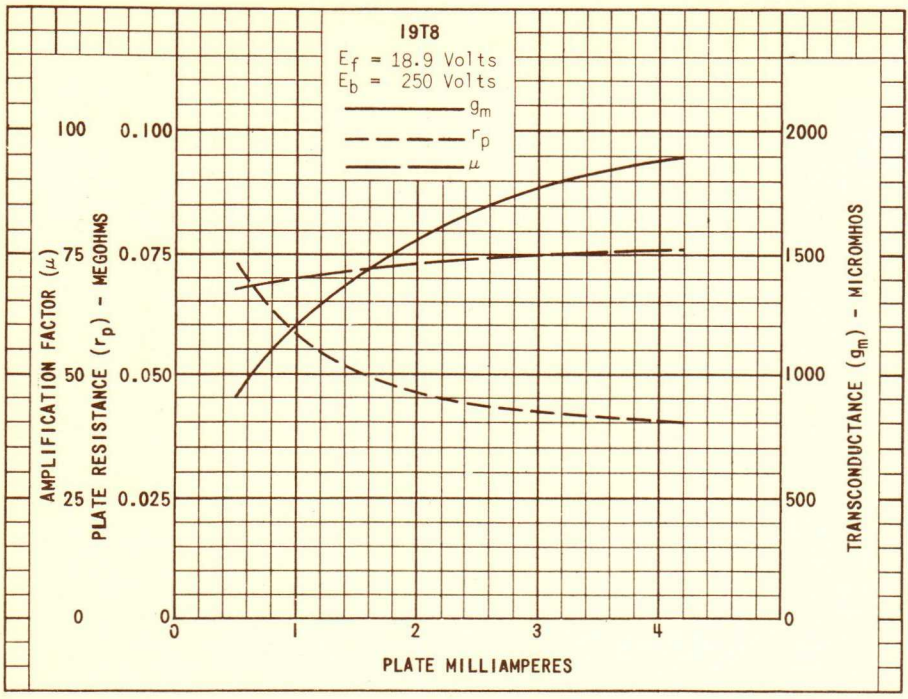
* INDICATES AN ADDITION.

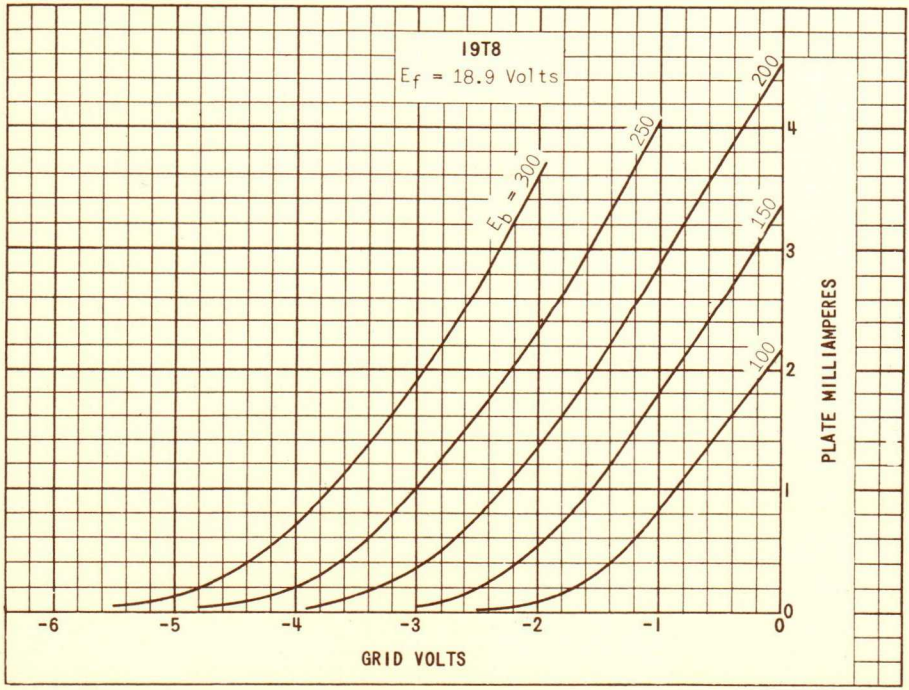




PRINTED IN U.S.A.

19T8


19T8
E_f = 18.9 Volts
E_b = 250 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE MILLIAMPERES
100
75
50
25
0
0.100
0.075
0.050
0.025
0
2000
1500
1000
500
0
0
1
2
3
4


19T8
E_f = 18.9 Volts
E_b = 300
250
200
150
100
PLATE MILLIAMPERES
GRID VOLTS
-6
-5
-4
-3
-2
-1
0
4
3
2
1
0

RESISTANCE COUPLED AMPLIFIER

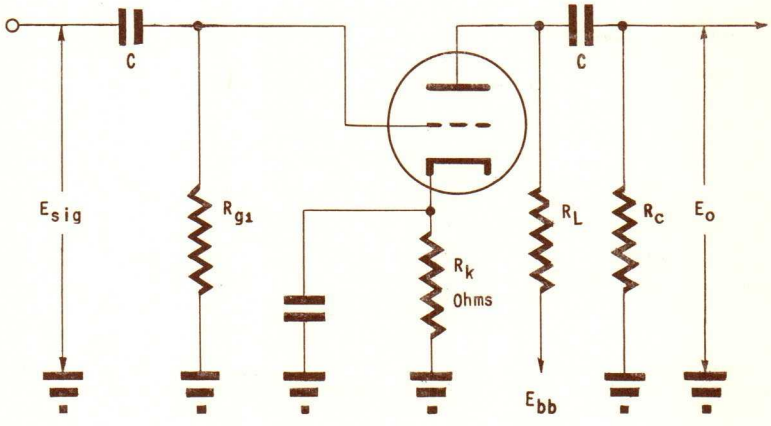
R1	Rg1	Rc	Ebb = 90 VOLTS			Ebb = 180 VOLTS			Ebb = 300 VOLTS		
MEG.	MEG.	MEG.	Rk	GAIN	Eo	Rk	GAIN	Eo	Rk	GAIN	Eo
0.10	A	0.10	5700	21	7	2400	29	18	1800	33	35
0.10	A	0.24	6100	26	9	2700	34	23	2000	38	42
0.24	A	0.24	9100	30	10	4300	40	24	3000	44	43
0.24	A	0.51	10000	34	13	4700	45	31	3300	49	52
0.51	A	0.51	15000	37	14	7500	47	28	5600	51	50
0.51	A	1	16000	40	16	8200	50	35	6200	55	60
0.24	10	0.24	—	31	5.0	—	44	19	—	48	40
0.24	10	0.51	—	37	7.0	—	49	25	—	52	52
0.51	10	0.51	—	39	7.5	—	51	22	—	54	44
0.51	10	1	—	42	10	—	54	28	—	58	56

[A] VALUE OF Rg1 IS NOT CRITICAL.

*Rk TAKEN TO NEAREST RMA VALUE FOR EACH CASE INSTEAD OF ABSOLUTE OPTIMUM VALUE.

Eo IS RMS OUTPUT AT 5% TOTAL HARMONIC DISTORTION.

GAIN MEASURED AT Eo = 2.0 VOLTS RMS OUTPUT.



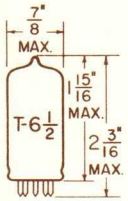
NOTE: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. Rk SHOULD BE ADEQUATELY BY-PASSED.

PRINTED IN U.S.A.

TUNG-SOL

TRIPLE-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

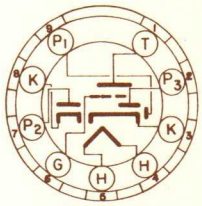
COATED UNIPOTENTIAL CATHODE

HEATER

18.9 VOLTS 150 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9AH

THE 19V8 COMPRISES TWO HIGH PERVEANCE DIODES, A MEDIUM PERVEANCE DIODE, AND A HIGH-MU TRIODE IN ONE ENVELOPE WITH THE 9 PIN MINIATURE BASE. ONE OF THE HIGH PERVEANCE DIODES 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.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

DIODE #1 TO GRID:	(1P TO G) MAX.	0.1	μμf
DIODE #2 TO GRID:	(2P TO G) MAX.	0.2	μμf
DIODE #3 TO GRID:	(3P TO G) MAX.	0.02	μμf
DIODE #1 TO ALL:	1P TO (H+K+G+P+2P+3P)	1.3	μμf
DIODE #2 TO ALL:	2P TO (H+K+G+P+1P+3P)	5.3	μμf
DIODE #3 TO ALL:	3P TO (H+K+G+P+1P+2P)	5.3	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	18.9	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1	WATT
MAXIMUM DIODE #2, DIODE #3, CURRENT FOR CONTINUOUS OPERATION	10	MA.
MAXIMUM DIODE #1 CURRENT FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	18.9	18.9	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	−1	−3	VOLTS
PLATE RESISTANCE (APPROX.)	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	μMHOS
AMPLIFICATION FACTOR	70	70	
PLATE CURRENT	0.8	1	MA.
AVERAGE DIODE #2 OR DIODE #3 WITH 5 VOLTS DC APPLIED	40		MA.
RATIO OF $\frac{ID3}{ID2}$ OR $\frac{ID2}{ID3}$ WITH 5 VOLTS APPLIED (MAX.)	1.5		
DIODE #2 OR DIODE #3 CURRENT THROUGH 40,000 OHMS WITH NO VOLTAGE APPLIED (MAX.)	24		μA.
AVERAGE DIODE #1 CURRENT WITH 10 VOLTS DC APPLIED	2		MA.
HEATER TO ALL CATHODES WITH ± 100 VOLTS APPLIED (MAX.)	5		μA.

PRINTED IN U. S. A.

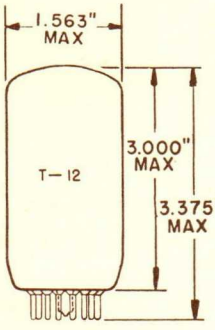
PLATE 2541
DEC. 1 1950

COPYRIGHT 1950 BY TUNG-SOL LAMP WORKS INC. ELECTRONIC TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

TUNG-SOL

PENTODE

COMPACTRON

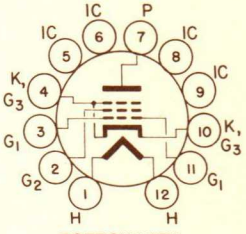


GLASS BULB

BUTTON 12 PIN
BASE E12-74
OUTLINE DRAWING
JEDEC 12-58

BEAM PENTODE
FOR
HORIZONTAL-DEFLECTION
AMPLIFIER
APPLICATIONS
IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12 BJ

THE 21HB5 IS A BEAM PENTODE IN THE T-12 COMPACTRON CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN T.V. RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 21HB5 IS IDENTICAL TO THE 6HB5.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: (G1 TO P)	0.4	pf
INPUT: G1 TO (H + K + G2 + G3)	22	pf
OUTPUT: P TO (H + K + G3 + G3)	9.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	21.0 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.
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

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED ON PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6,000	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1,500	VOLTS
GRID 2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION [A]	18	WATTS
GRID 2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	230	MA.
PEAK CATHODE CURRENT	800	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

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.

CHARACTERISTICS AND TYPICAL OPERATION

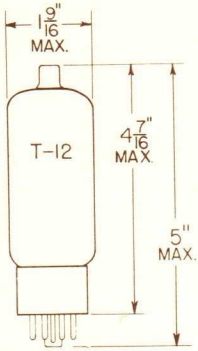
PLATE VOLTAGE	5,000	60	130	VOLTS
GRID 2 VOLTAGE	130	130	130	VOLTS
GRID 1 VOLTAGE	-	0 [B]	-20	VOLTS
PLATE CURRENT	-	410	50	MA.
GRID 2 CURRENT	-	24	1.75	MA.
TRANSCONDUCTANCE	-	-	9,100	μMHOS
PLATE RESISTANCE	-	-	Approx. 11,000	OHMS
GRID 1 VOLTAGE FOR I_b = 1.0 MA. -APPROX.	-66	-	-33	VOLTS
TRIODE AMPLIFICATION FACTOR [C]	-	-	4.7	

B- APPLIED FOR SHORT INTERVAL (2 SECONDS) SO AS NOT TO DAMAGE TUBE.

C- TRIODE CONNECTION (GRID 2 TIED TO PLATE) WITH $E_b = E_{c2} = 130$ VOLTS AND $E_{c1} = -20$ VOLTS.

TUNG-SOL

BEAM PENTODE



GLASS BULB

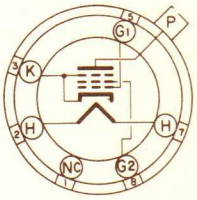
HEATER

21.5 VOLTS 0.6 AMP.

AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 7 ARE IN A VERTICAL PLANE



BOTTOM VIEW

SHORT MEDIUM-SHELL 5 PIN OCTAL WITH EXTERNAL BARRIERS

5BT

THE 21EX6 IS A BEAM-POWER PENTODE DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS WHICH INCORPORATE LARGE-DEFLECTION-ANGLE PICTURE TUBES. FEATURES OF THE TUBE INCLUDE AN EXTREMELY HIGH PERVEANCE, HIGH PLATE CURRENT AT LOW PLATE AND SCREEN VOLTAGES, AND A HIGH RATIO OF PLATE TO SCREEN CURRENT. EXCEPT FOR HEATER RATINGS, THE 21EX6 IS IDENTICAL TO THE 6EX6.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

GRID #1 TO PLATE	1.1	μμf
INPUT	22	μμf
OUTPUT	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[A]

HEATER VOLTAGE	21.5	VOLTS
MAXIMUM DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	7000	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE (ABS. MAX.)	1500	VOLTS
MAXIMUM SCREEN VOLTAGE	195	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	220	VOLTS
MAXIMUM PLATE DISSIPATION[B]	22	WATTS
MAXIMUM SCREEN DISSIPATION	3.5	WATTS
MAXIMUM DC CATHODE CURRENT	220	MA.
MAXIMUM PEAK CATHODE CURRENT	770	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 #1 CIRCUIT RESISTANCE	0.47	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	225	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	21.5	21.5	21.5	VOLTS
HEATER CURRENT	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	60	60	175	VOLTS
SCREEN VOLTAGE	125	150	175	VOLTS
GRID #1 VOLTAGE	0[C]	0[C]	-30	VOLTS
PLATE RESISTANCE (APPROX.)			8500	OHMS
TRANSCONDUCTANCE			7700	μMHOS
PLATE CURRENT	360	460	67	MA.
SCREEN CURRENT	30	45	3.3	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 1.0 MA.			-50	VOLTS
TRIODE AMPLIFICATION FACTOR WITH $E_b = E_{c2}$ = 175V.			4.2	
GRID #1 VOLTAGE WITH E_b=5000V. FOR I_b=1.0 MA.	-88	-94	-101	VOLTS

[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.

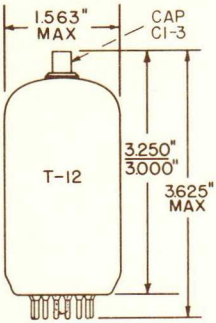
[C] APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

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

TUNG-SOL

PENTODE

COMPACTRON



GLASS BULB
BUTTON 12 PIN
BASE E12-74
OUTLINE DRAWING
JEDEC 12-79

BEAM PENTODE

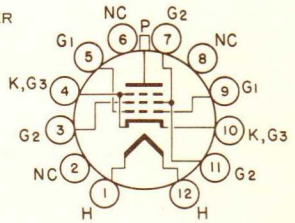
FOR

HORIZONTAL-DEFLECTION AMPLIFIER

APPLICATIONS IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12 DR

THE 21GY5 IS A BEAM-POWER PENTODE IN THE 12 PIN COMPACTRON CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: (G1 TO P)	0.7	pf
INPUT: G1 TO (H + K + G2 + G3)	22	pf
OUTPUT: P TO (H + K + G2 + BP)	9.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	21 VOLTS	450	MA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF APPLIED CURRENT		450 ± 30	MA
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

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE
DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6,500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1,500	VOLTS
GRID 2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION [A]	18	WATTS
GRID2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	230	MA
PEAK CATHODE CURRENT	800	MA
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	^{o}C

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.

CHARACTERISTICS

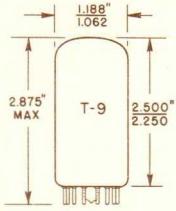
PLATE VOLTAGE	5,000	60	130	VOLTS
GRID 2 VOLTAGE	130	130	130	VOLTS
GRID 1 VOLTAGE	-	0 [B]	-20	VOLTS
PLATE CURRENT	-	410	50	MA
GRID 2 CURRENT		24	1.75	MA
PLATE RESISTANCE	-	-(APPROX.)11,000		OHMS
TRANSCONDUCTANCE			9,100	MICROMHOS
GRID 1 VOLTAGE FOR I_b = 1.0 MA (APPROX.)	-66	-	-33	VOLTS
TRIODE AMPLICATION FACTOR [C]			4.7	

B- APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

C- TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH Eb = Ec2 = 130 VOLTS AND Ec1 = -20 VOLTS

TUNG-SOL

DIODE
COMPACTRON



GLASS BULB

BUTTON 12 PIN
BASE E12-70
OUTLINE DRAWING
JEDEC 9-60

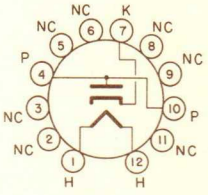
FOR

TV DAMPING

DIODE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12BL

SOCKET TERMINALS 3, 6, 7, AND 10 SHOULD NOT BE USED AS THE POINTS

THE 22BW3 IS A HEATER-CATHODE TYPE DIODE IN THE T-9 COMPACTRON CONSTRUCTION. IT IS INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL DEFLECTION CIRCUIT OF TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P + H)	8.5	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	6.0	pf
HEATER TO CATHODE: H TO K	3.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	22.4	VOLTS	450	MA.
HEATER WARM-UP TIME		Approx.	11	SECONDS
LIMITS OF SUPPLIED CURRENT	450 ± 30			MA.
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

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

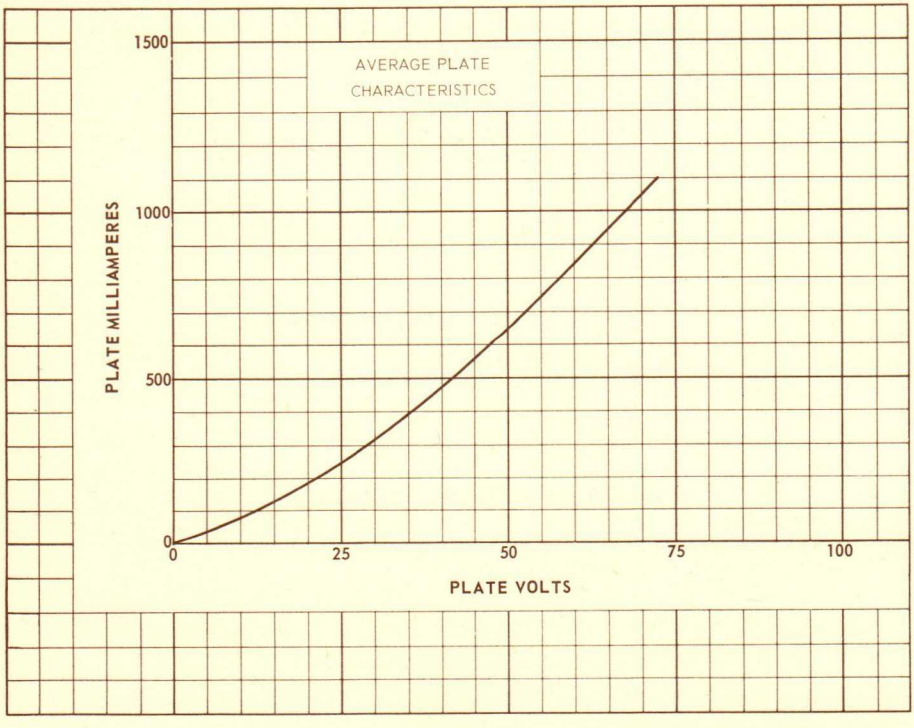
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

TV DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5,000	VOLTS
PLATE DISSIPATION	6.5	WATTS
STEADY - STATE PEAK PLATE CURRENT	1,100	MA.
DC OUTPUT CURRENT	175	MA.

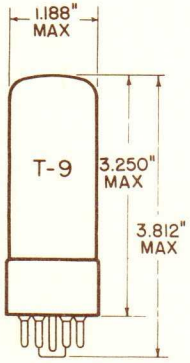
AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP FOR I_b = 350 MADC	32	VOLTS



TUNG-SOL

HALF-WAVE VACUUM RECTIFIER



GLASS BULB
JEDEC GROUP 1 B5-85
SHORT
INTERMEDIATE-SHELL
5 PIN OCTAL
WITH EXTERNAL BARRIERS

PINS 1, 4, & 6 ARE OMITTED

OUTLINE DRAWING
JEDEC 9-44

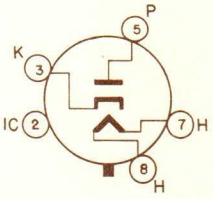
UNIPOTENTIAL CATHODE

HEATER

22.4 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 4CG

THE 22DE4 IS A HALF-WAVE VACUUM RECTIFIER OF THE GLASS-OCTAL TYPE. IT IS DESIGNED SPECIFICALLY FOR USE AS A DAMPER DIODE IN HORIZONTAL-DEFLECTION CIRCUITS OF BLACK-AND-WHITE TELEVISION RECEIVERS.

EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 22DE4 IS IDENTICAL TO THE 6DE4 AND 17DE4.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER AND CATHODE	8.5	μμf
CATHODE TO HEATER AND PLATE	11.5	μμf
HEATER TO CATHODE	4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

DAMPER SERVICE

MAXIMUM PEAK INVERSE PLATE VOLTAGE	→ 5500[A]	VOLTS
MAXIMUM PEAK PLATE CURRENT	1100	MA.
MAXIMUM DC PLATE CURRENT	→ 180	MA.
MAXIMUM PLATE DISSIPATION	6.5	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	→ 5500[B]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	300[C]	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

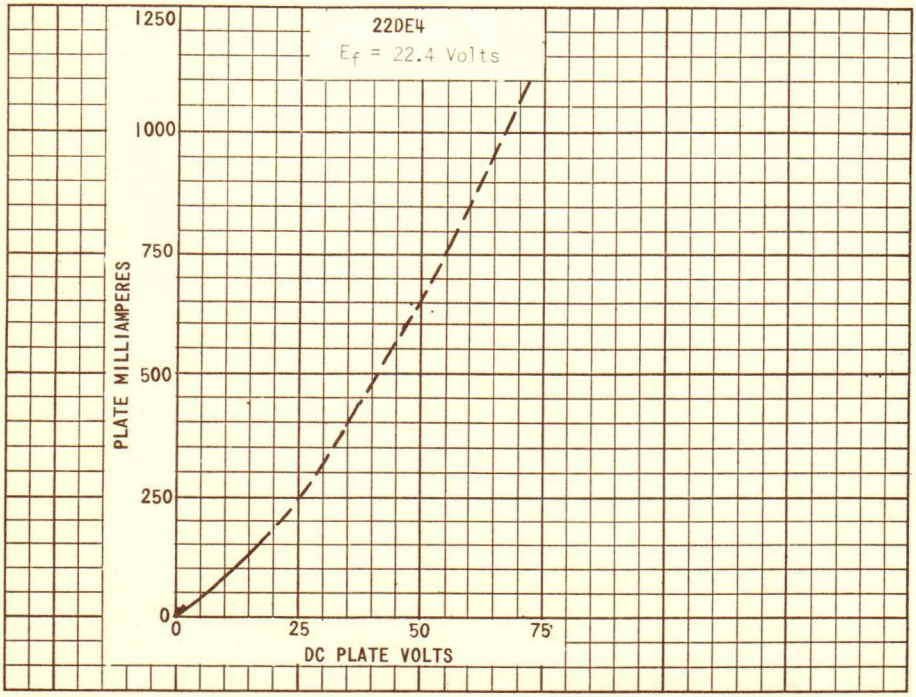
NOTES

[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] THE DC COMPONENT MUST NOT EXCEED 900 VOLTS.

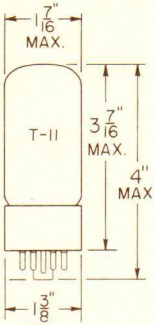
[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

*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.



TUNG-SOL

PENTODE



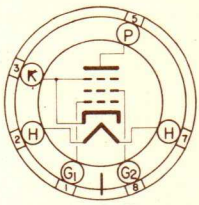
GLASS BULB

THE MAX. DIAMETER OF THE T-12 BULB IS 1 9/16"

COATED UNIPOTENTIAL CATHODE

HEATER
25.0 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM SHELL
6 PIN OCTAL
6CK

THE 25AV5GA 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	25.0	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

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

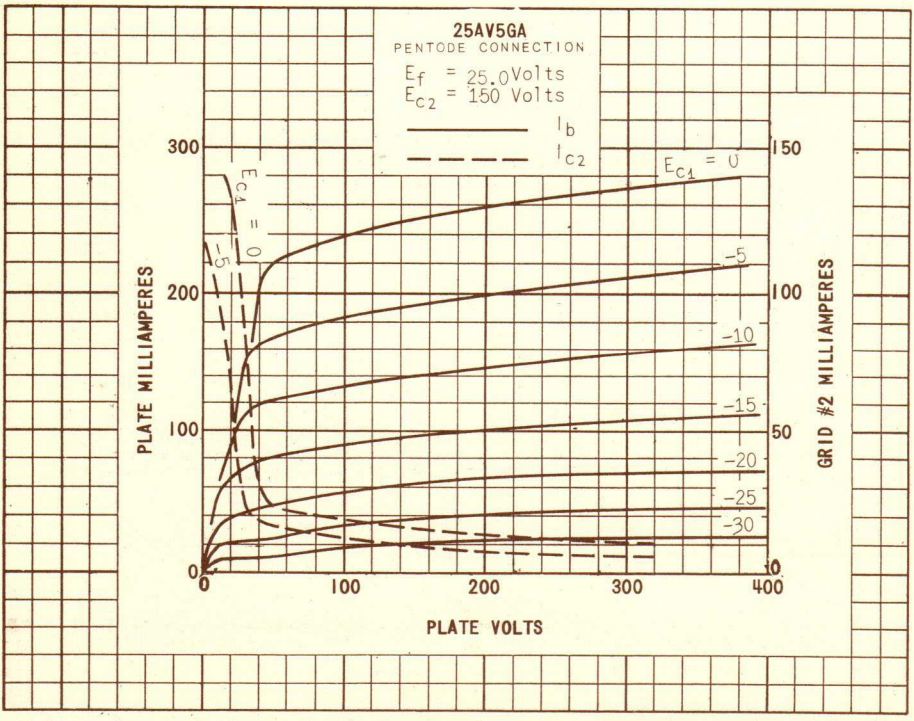
HEATER VOLTAGE	25.0		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	60	250	VOLTS
GRID #2 VOLTAGE	150	150	VOLTS
GRID #1 VOLTAGE	0[E]	-22.5	VOLTS
PLATE RESISTANCE (APPROX.)	---	14 500 ←	OHMS
TRANSCONDUCTANCE	---	5 900 ←	μMHOS
PLATE CURRENT	260 ←	57 ←	MA.
GRID #2 CURRENT	26 ←	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 1.0 MA.	---	-43 ←	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	---	4.3	

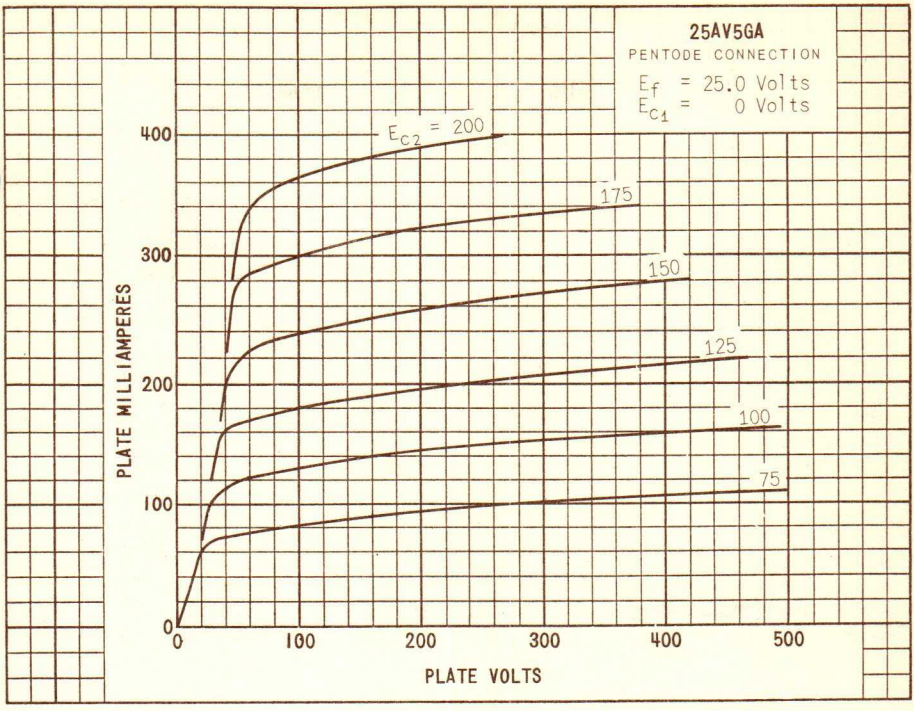
[E] APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

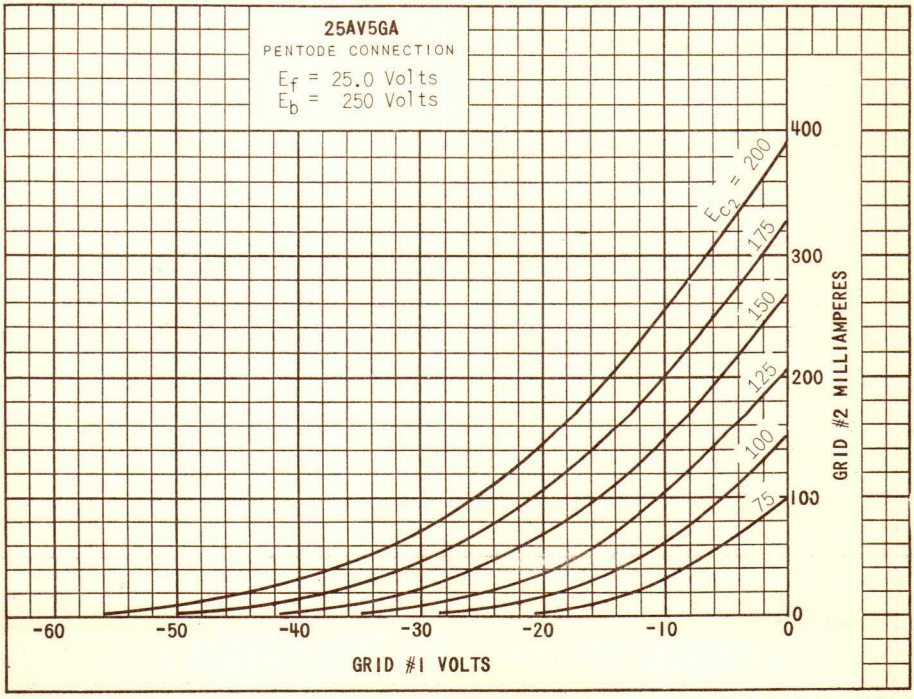
[F] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH $E_b = E_{c2} = 150$ VOLTS AND $E_{c1} = -22.5$ VOLTS

SIMILAR TYPE REFERENCE: Except for heater characteristics, the 25AV5GA is identical to the 6AV5GA, 12AV5GA & the 17AV5GA.

→ INDICATES A CHANGE.

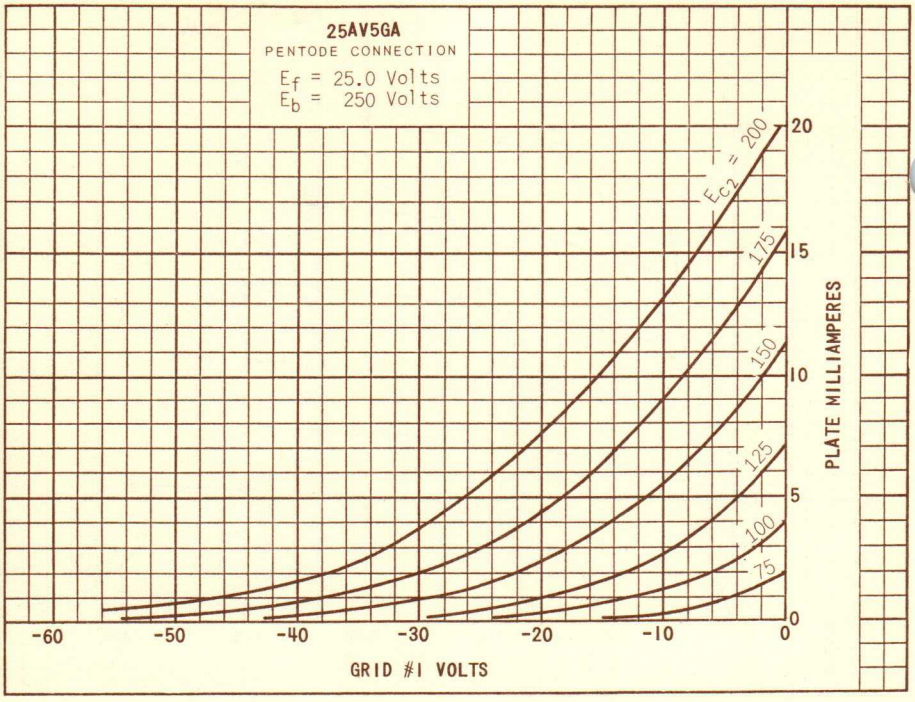






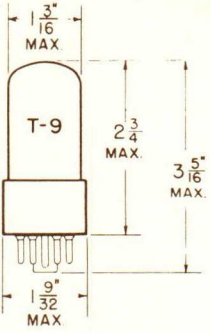
PRINTED IN U. S. A.

25AV5GA (6AV5GA)



TUNG-SOL

BEAM PENTODE

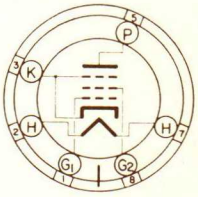


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
6 PIN OCTAL
6CK

THE 25AV5GT IS A BEAM POWER AMPLIFIER INTENDED PRIMARILY FOR OPERATION WITH RELATIVELY LOW SUPPLY VOLTAGE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. IT IS DESIGNED TO WITHSTAND HIGH-SURGE PLATE VOLTAGES FOR RELATIVELY SHORT PERIODS OF TIME. IT CAN BE USED WITH DIRECT OR WITH TRANSFORMER HORIZONTAL-YOKE DRIVE.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE: (G_1 TO P)	0.7	μμf
INPUT: G_1 TO (H+K+G_2+G_3)	14	μμf
OUTPUT: P TO (H+K+G_2+G_3)	7.0	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)	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

→ INDICATES A CHANGE OR ADDITION.

PRINTED IN U.S.A.

PLATE
3138
JAN. 1
1953

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PENTODE OPERATION:[C]		
PLATE CURRENT	55	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5 500	µMHOS ←
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.

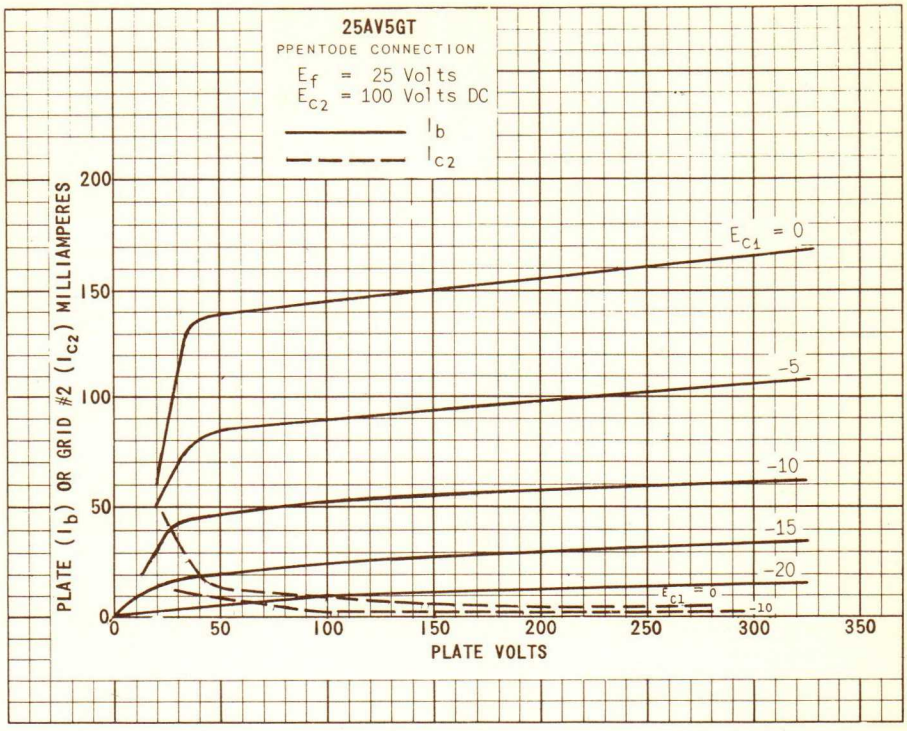
[D] WITH E_b = 60 VOLTS AND E_{C2} = 150 VOLTS (INSTANEOUS VALUES).

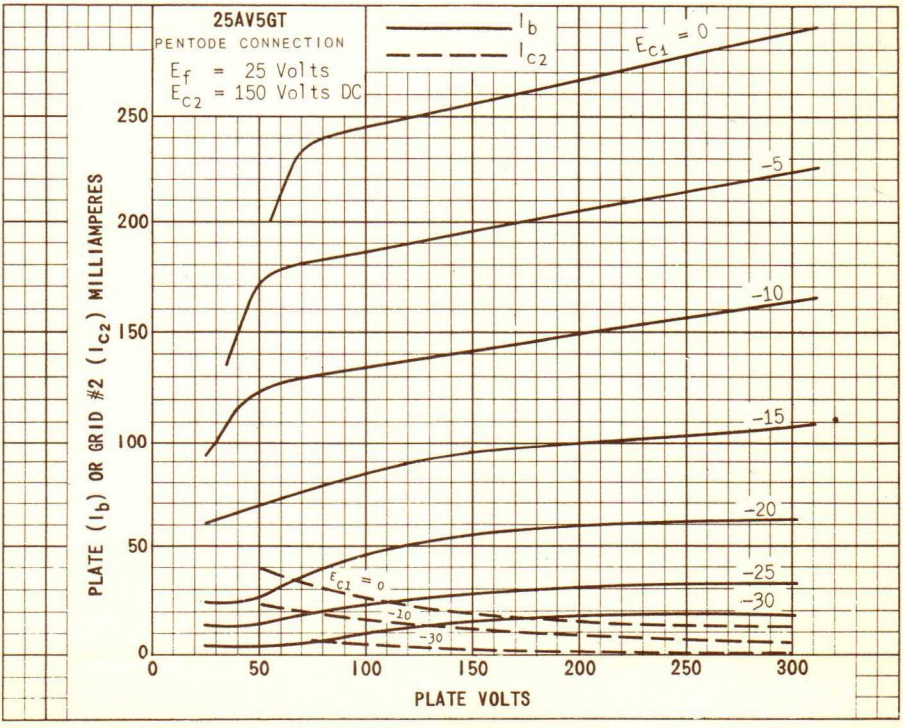
[E] FOR I_b = 1 MA. WITH E_b = 250 VOLTS AND E_{C2} = 150 VOLTS.

[F] WITH E_b = E_{C2} = 150 VOLTS AND E_{C1} = -22.5 VOLTS.

→INDICATES A CHANGE OR ADDITION.

PLATE 3139
JAN. 1 1953



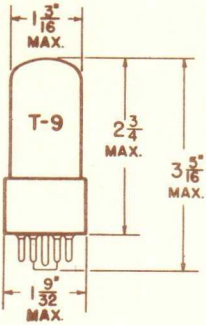


PRINTED IN U. S. A.

PLATE
3140
JAN. 1
1953

TUNG-SOL

DIODE

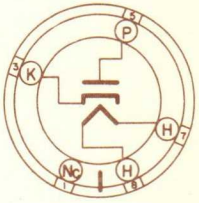


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL 6 PIN OCTAL
4CG

THE 25AX4GT IS A HEATER–CATHODE TYPE DIODE DESIGNED FOR USE IN HORIZONTAL FREQUENCY DAMPER SERVICE IN 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
WITH NO EXTERNAL SHIELD

HEATER TO CATHODE	7.5	μμf

RATINGS
INTERPRETED ACCORDING TO RETMA STANDARD M8-210

DESIGN CENTER VALUES

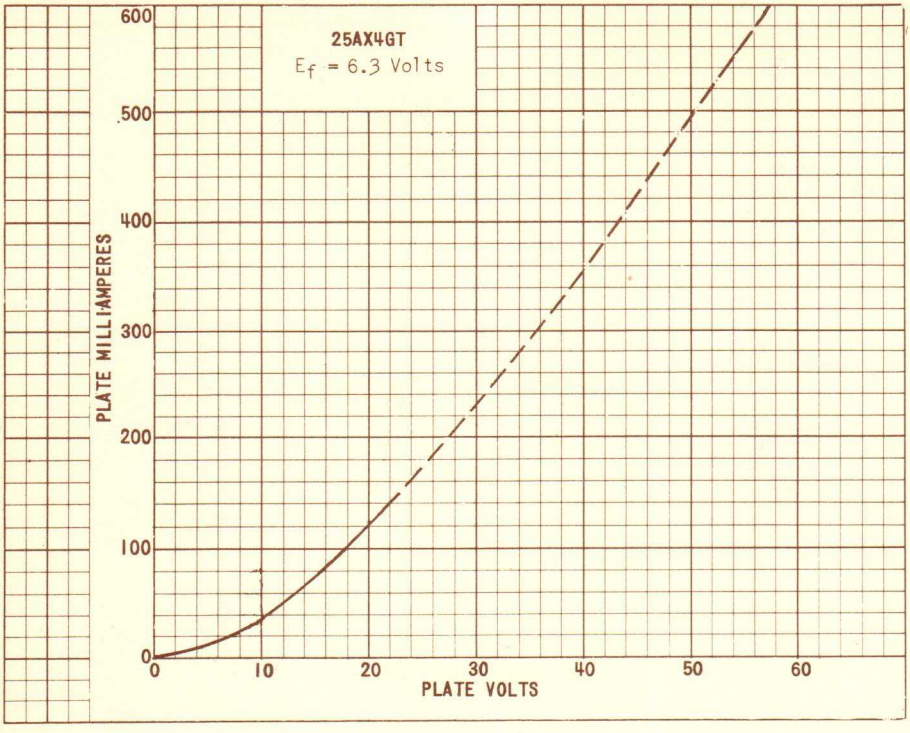
HEATER VOLTAGE	25	VOLTS
HEATER CURRENT	0.3	AMP.
MAXIMUM PEAK HEATER CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE	4 000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE[A]	4 000	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT	600	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT[B]	3.0	AMP.
MAXIMUM DC OUTPUT CURRENT	125	MA.
TUBE VOLTAGE DROP (WITH TUBE CONDUCTING 250 MA.)	32	VOLTS

[A] APPLICABLE WHERE THE DUTY CYCLE OF THE VOLTAGE PULSE DOES NOT EXCEED 15% OF ONE SCANNING CYCLE, AND ITS DURATION IS LIMITED TO 10 MICROSECONDS.

[B] THIS RATING APPLIES TO HOT SWITCHING WHERE TRANSIENT DURATION DOES NOT EXCEED 0.2 SECONDS.

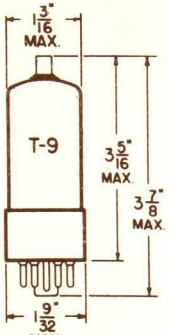
PRINTED IN U.S.A.

25AX4GT


25AX4GT
E_f = 6.3 Volts
PLATE MILLIAMPERES
600
500
400
300
200
100
0
0
10
20
30
40
50
60
PLATE VOLTS

TUNG-SOL

BEAM PENTODE

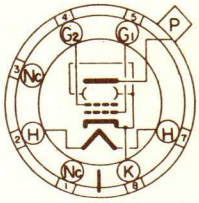


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25.0 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
6AM

THE 25BQ6GT 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	25.0	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
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST + POWER SUPPLY)	550	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	5 500	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM PLATE DISSIPATION[B]	11	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	175	VOLTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220°	CENTIGRADE

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

[B] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

PRINTED IN U.S.A.

PLATE 3150
FEB. 1 1953

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	25.0	VOLTS
HEATER CURRENT	0.3	AMP.
PENTODE CONNECTION:[C]		
PLATE CURRENT	55	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5 500	µMHOS
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.

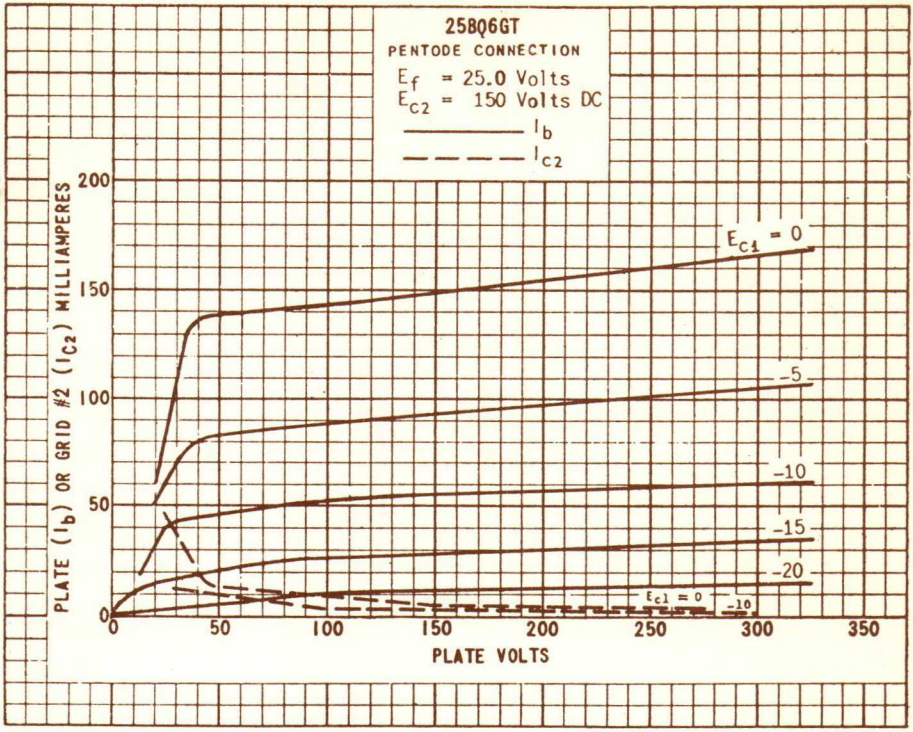
[D] WITH E_b = 60 VOLTS AND E_{C2} = 150 VOLTS.

[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 3151 FEB. 1 1953



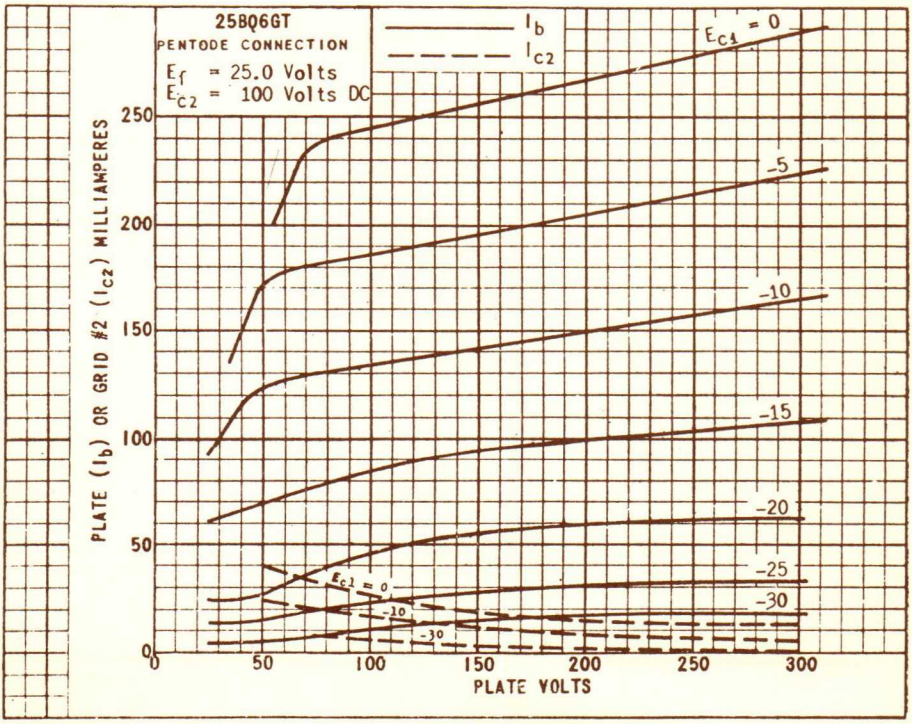


PLATE
2347
FEB. 1
1950

COPYRIGHT 1950 BY TUNG-SOL LAMP WORKS INC ELECTRONIC TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

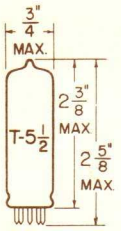
HEATER

25±10% VOLTS 0.30 AMP.

AC OR DC

ANY MOUNTING POSITION

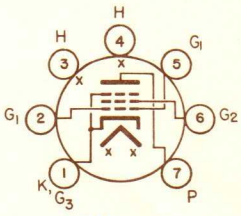
FOR SERIES STRING



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING

JEDEC 5-3



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 25C5 IS A HEATER-CATHODE TYPE, BEAM PENTODE OF MINIATURE CONSTRUCTION DESIGNED FOR USE AS A POWER AMPLIFIER IN THE OUTPUT STAGE OF AC-DC RECEIVERS. EXCEPT FOR HEATER RATINGS THE 25C5 IS IDENTICAL TO THE 50C5.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITH NO EXTERNAL SHIELD

GRID TO PLATE: G_1 TO P	0.6	μμf
INPUT: G_1 TO (H+K&G_3+G_2)	13.0	μμf
OUTPUT: P TO (H+K&G_3+G_2)	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER CURRENT	300±20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	7	WATTS
MAXIMUM GRID #2 DISSIPATION	1.4	WATTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
MAXIMUM BULB TEMPERATURE		
(AT HOTTEST POINT ON BULB SURFACE)	220	°C

ALL ELECTRICAL DATA EXCEPT HEATER CHARACTERISTICS FOR TYPE 25C5 ARE IDENTICAL WITH THOSE OF TYPES 12C5. 12CU5. 17C5, 50C5 AND 50B5.

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

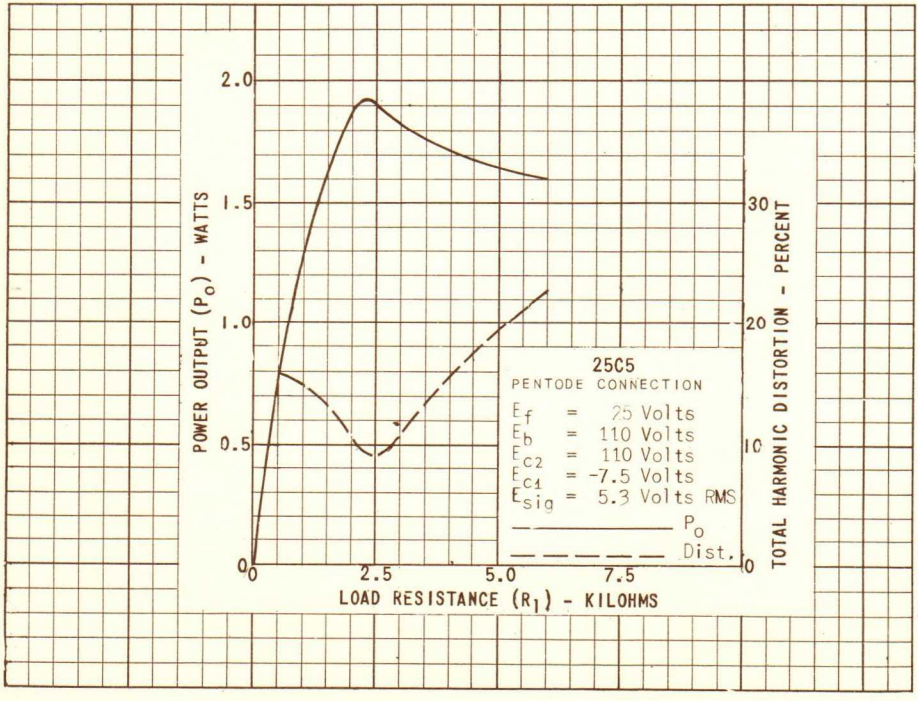
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

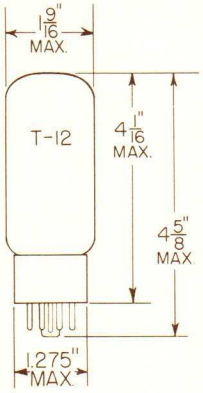
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	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.
ZERO-SIGNAL GRID #2 CURRENT	4	MA.
MAXIMUM SIGNAL PLATE CURRENT	50	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
MAXIMUM SIGNAL POWER OUTPUT	2.3	WATTS



TUNG-SOL

BEAM PENTODE

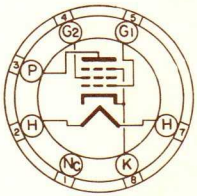


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM SHELL
7 PIN OCTAL
7S

THE 25C6GA IS A BEAM POWER AMPLIFIER HAVING HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT AT COMPARATIVELY LOW DC SUPPLY VOLTAGES. EXCEPT FOR HEATER RATINGS, THE 25C6GA IS IDENTICAL TO THE 50C6GA.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	25	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM PLATE DISSIPATION	12.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.75	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
SELF BIAS	0.5	MEGOHM

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

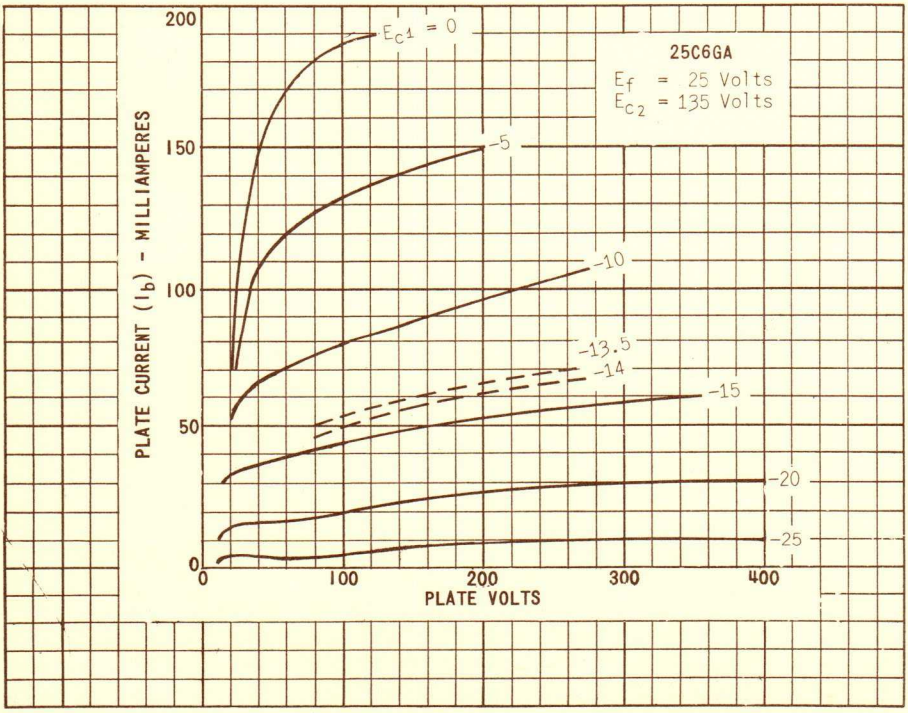
TUNG-SOL

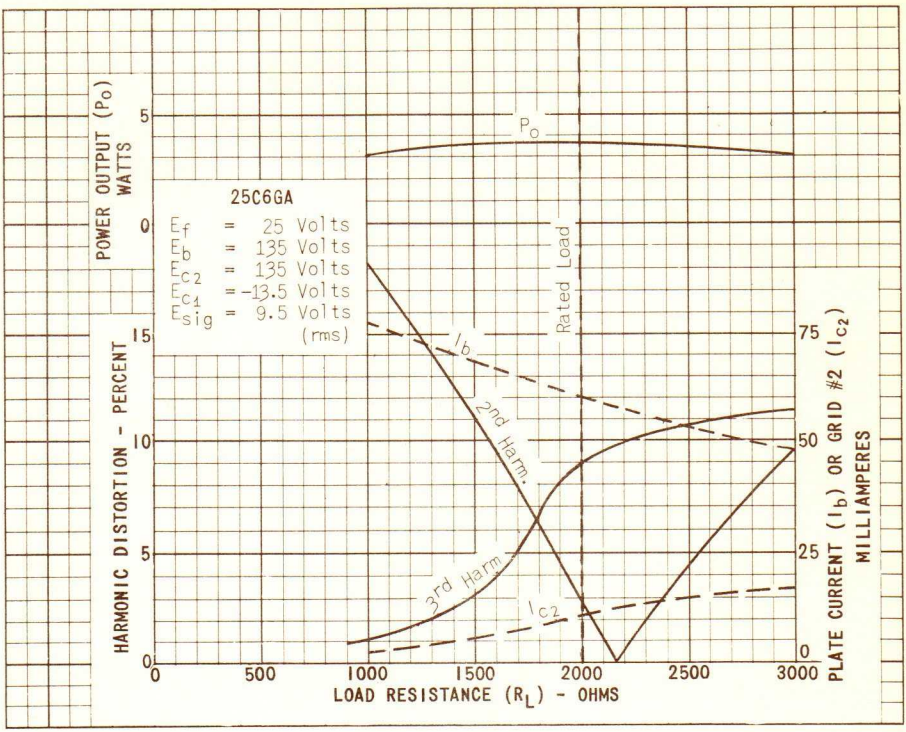
CONTINUED FROM PRECEDING PAGE

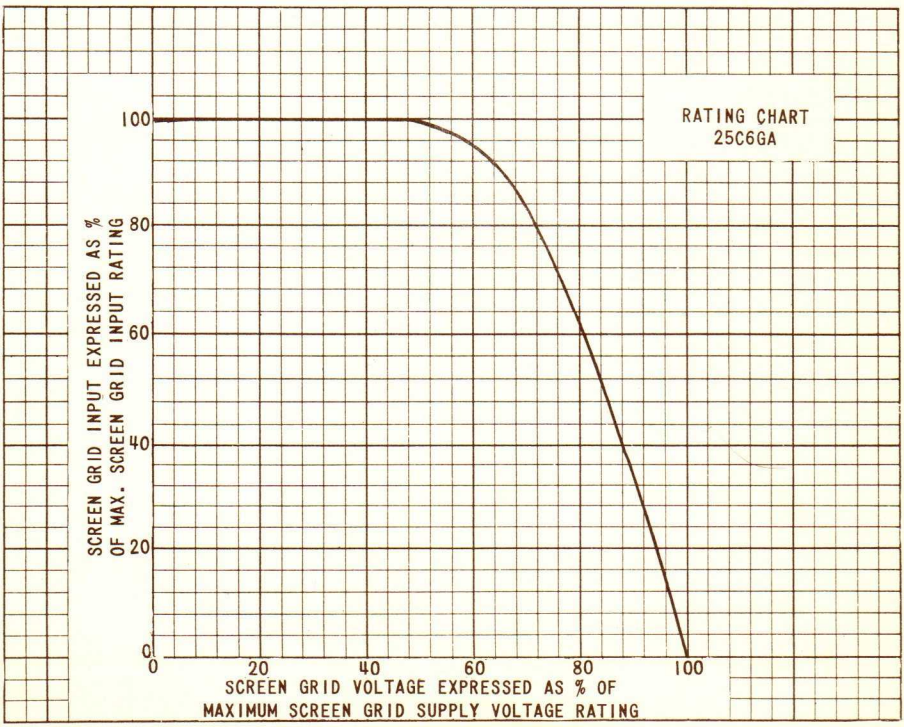
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	25		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	135	200	VOLTS
GRID #2 VOLTAGE	135	135	VOLTS
GRID #1 VOLTAGE	-13.5	-14	VOLTS
PEAK AF GRID #1 VOLTAGE	13.5	14	VOLTS
ZERO SIGNAL PLATE CURRENT	58	61	MA.
MAXIMUM SIGNAL PLATE CURRENT	60	66	MA.
ZERO SIGNAL GRID #2 CURRENT	3.5	2.2	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	11.5	9	MA.
TRANSCONDUCTANCE	7 000	7 100	μMHOS
PLATE RESISTANCE (APPROX.)	9 300	18 300	OHMS
LOAD RESISTANCE	2 000	2 600	OHMS
MAXIMUM SIGNAL POWER OUTPUT	3.6	6	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT





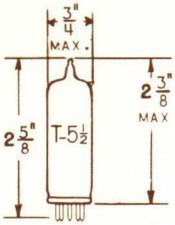


PRINTED IN U. S. A.

TUNG-SOL

PENTODE

MINIATURE TYPE



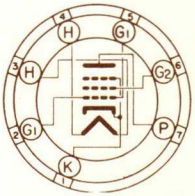
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

25 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CV

THE 25CA5 IS A BEAM PENTODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE IN THE AUDIO FREQUENCY POWER OUTPUT STAGE OF TELEVISION AND RADIO RECEIVERS. IT FEATURES HIGH POWER SENSITIVITY AT RELATIVELY LOW PLATE AND SCREEN VOLTAGES. EXCEPT FOR HEATER RATINGS IT IS IDENTICAL TO THE 6CA5.

DIRECT INTERELECTRODE CAPACITANCES

*WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	μμf
INPUT	15	μμf
OUTPUT	9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	25	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	130	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	5.0	WATTS
MAXIMUM GRID #2 DISSIPATION	1.4	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
BULB TEMPERATURE AT HOTTEST POINT	180	°C

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

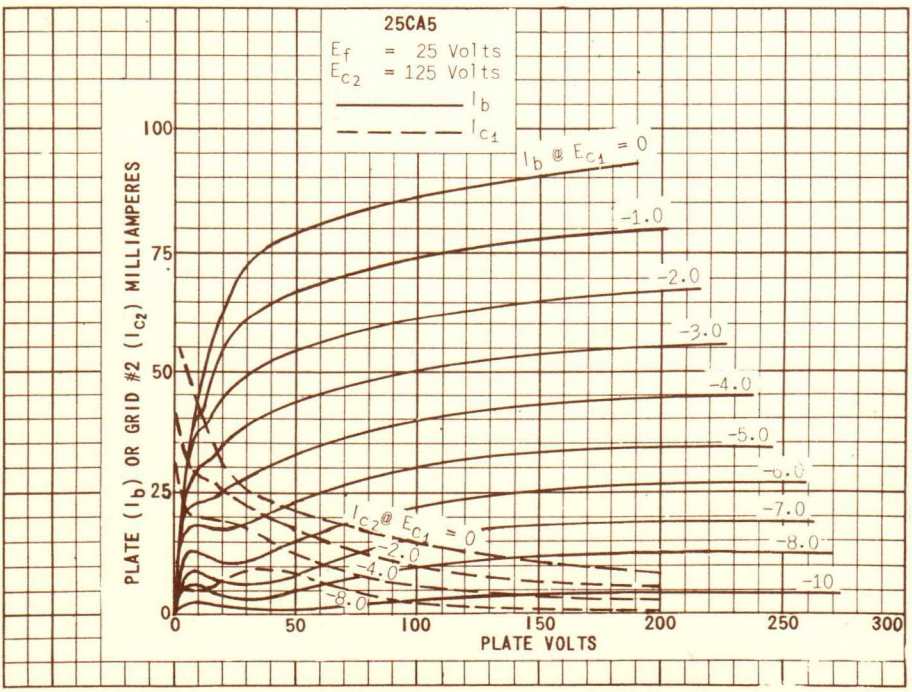
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

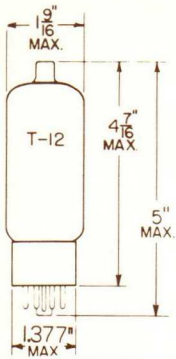
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	25		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	110	125	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-4.0	-4.5	VOLTS
PEAK AF GRID #1 VOLTAGE	4.0	4.5	VOLTS
PLATE RESISTANCE (APPROX.)	16 000	15 000	OHMS
TRANSCONDUCTANCE	8 100	9 200	μMHOS
ZERO-SIGNAL PLATE CURRENT	32	37	MA.
MAXIMUM SIGNAL PLATE CURRENT (APPROX.)	31	36	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.5	4.0	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (APPROX.)	7.5	11	MA.
LOAD RESISTANCE	3 500	4 500	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	5	6	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.1	1.5	WATTS



TUNG-SOL

BEAM PENTODE



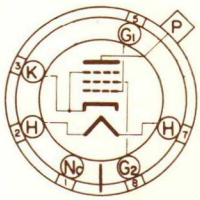
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.6 AMP.
AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 7 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
SHORT MEDIUM-SHELL
8 PIN OCTAL
5BT

THE 25CD6GB IS A BEAM PENTODE DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN 600 MA. SERIES HEATER OPERATED 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. 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

GRID #1 TO PLATE	1.1	μμf
INPUT	22	μμf
OUTPUT	8.5	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[B]

HEATER VOLTAGE	25	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 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
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[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.

* 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

HEATER VOLTAGE	25		VOLTS
HEATER CURRENT	0.6		AMP.
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	

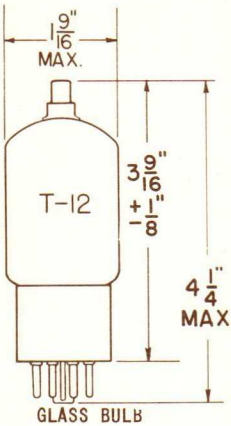
[D] APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

[E] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH $E_b = E_{c2}$ = 175 VOLTS AND E_{c1} = -30 VOLTS.

SIMILAR TYPE REFERENCE: The 25CD6GB is identical to the 6CD6GA except for heater ratings and heater warm-up time.

TUNG-SOL

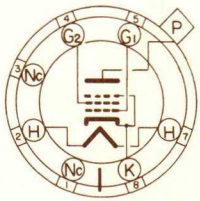
PENTODE



COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
6AM

THE 25CU6 IS A BEAM POWER AMPLIFIER DESIGNED FOR USE AS THE HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS EMPLOYING SERIES-STRING HEATER ARRANGEMENTS.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE: G_1 TO P	0.55	μμf
INPUT: G_1 TO ($H+K+G_2+BP$)	15.0	μμf
OUTPUT: P TO ($H+K+G_2+BP$)	7.0	μμf

RATINGS[A]

INTERPRETED ACCORDING TO RETMA STANDARD M8-210

HORIZONTAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	25	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)	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	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	°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.

PRINTED IN U. S. A.

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	55	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5 500	μMHOS
PLATE RESISTANCE (APPROX.)	20 000	OHMS
ZERO BIAS: WITH E_b = 60V. AND E_{c2} = 150V. (INSTANTANEOUS VALUES)		
PLATE CURRENT	225	MA.
GRID #2 CURRENT	25	MA.
CUT-OFF: FOR I_b = 1 MA., WITH E_b = 250V. AND E_{c2} = 150V.		
GRID #1 VOLTAGE (APPROX.)	-46	VOLTS
TRIODE μ: WITH E_b = E_{c2} = 150V. AND E_{c1} = 22.5V.	4.3	

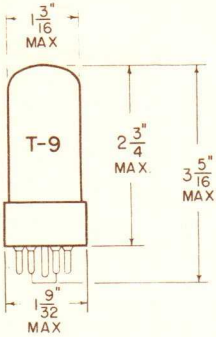
HORIZONTAL DEFLECTION AMPLIFIER – SCANNING 70° CRT

HEATER VOLTAGE	25	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE SUPPLY VOLTAGE	310	VOLTS
AVERAGE PLATE VOLTAGE (BOOST + SUPPLY)	540	VOLTS
PEAK POSITIVE PLATE VOLTAGE (DC COMPONENT + PULSE)	4.6	KV.
AVERAGE PLATE CURRENT	79	MA.
PEAK PLATE CURRENT	270	MA.
PLATE DISSIPATION	7	WATTS
GRID #2 VOLTAGE	140	VOLTS
GRID #2 CURRENT	11±2	MA.
GRID #2 DISSIPATION	1.57	WATTS
GRID INPUT VOLTAGE:		
PEAK TO PEAK	130	VOLTS
SAWTOOTH COMPONENT	65	VOLTS
ANODE VOLTAGE CRT	15.7	KV.
ANODE CURRENT CRT	100	μA.

SIMILAR TYPE REFERENCE: Except for heater operation the 25CU6 is identical to the 6CU6 and 12CU6.

TUNG-SOL

DIODE



GLASS BULB

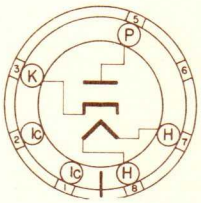
UNIPOTENTIAL CATHODE

HEATER

25.0 VOLTS 0.30 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW •

INTERMEDIATE SHELL

OR

SHORT INTERMEDIATE SHELL

8 PIN OCTAL

4CG

THE 25D4 IS AN INDIRECTLY-HEATED HALF WAVE RECTIFIER DESIGNED FOR SERVICE AS A DAMPING DIODE IN HORIZONTAL DEFLECTION CIRCUITS OF 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.

HEATER TO CATHODE	3.0	μμf
PLATE TO CATHODE & HEATER[A]	6.0	μμf
CATHODE TO PLATE & HEATER[A]	8.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM - UNLESS OTHERWISE INDICATED

DAMPER SERVICE[B]

HEATER VOLTAGE	25.0	VOLTS
HEATER CURRENT	0.30	AMP.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
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 PEAK INVERSE VOLTAGE	4 400	VOLTS
MAXIMUM DC PLATE CURRENT	155	MA.
MAXIMUM DC PLATE CURRENT (DESIGN CENTER SYSTEM)	145	MA.
MAXIMUM PEAK PLATE CURRENT	900	MA.
MAXIMUM PLATE DISSIPATION	5.5	WATTS
TUBE VOLTAGE DROP WITH Ib= 250 MA.	22	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

•PINS 1, 2, 4, & 6 MUST NOT BE USED AS TIE POINTS.

[A] TIE UNUSED PINS AND METAL PART TO HEATER.

[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 OF THE HORIZONTAL VOLTAGE PULSE NOT TO EXCEED 15% OF ONE SCANNING CYCLE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

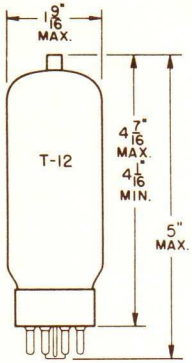
CONTINUED FROM PRECEDING PAGE

*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.

TUNG-SOL

PENTODE

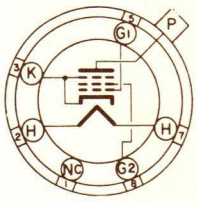


GLASS BULB
SMALL CAP

COATED UNIPOTENTIAL CATHODE

HEATER
25.0 VOLTS 0.6 AMP.
AC OR DC

VERTICAL MOUNTING POSITION
HORIZONTAL OPERATION PERMITTED IF PLANE OF PINS 1 AND 3 IS VERTICAL



BOTTOM VIEW
SHORT-MEDIUM SHELL
8 PIN OCTAL
5BT

THE 25DN6 IS A BEAM POWER AMPLIFIER INTENDED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS HAVING LOW B SUPPLY VOLTAGE. 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.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID #1 TO PLATE	0.8	μμf
INPUT	22	μμf
OUTPUT	11.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES[A]

HORIZONTAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	25.0	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
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	700	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	6 600	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE	1 500	VOLTS
MAXIMUM PLATE DISSIPATION[C]	15	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	200	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	175	VOLTS
MAXIMUM GRID #2 DISSIPATION	3.0	WATTS
MAXIMUM AVERAGE 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
HEATER WARM-UP TIME (APPROX.)[D]	11.0	SECONDS

[A] UNLESS OTHERWISE INDICATED.

[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.

[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

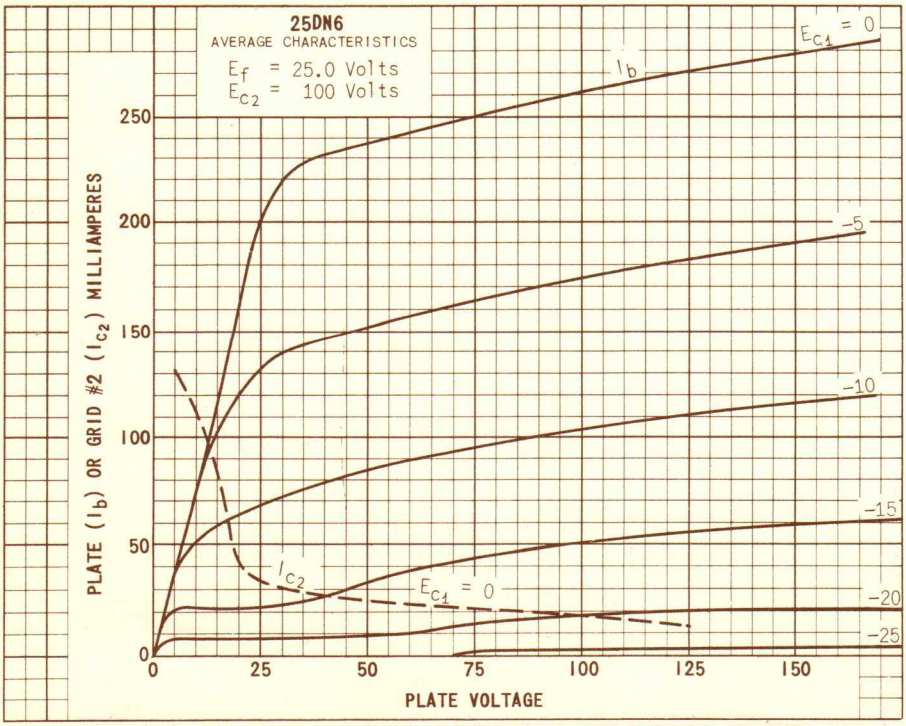
PRINTED IN U.S.A.

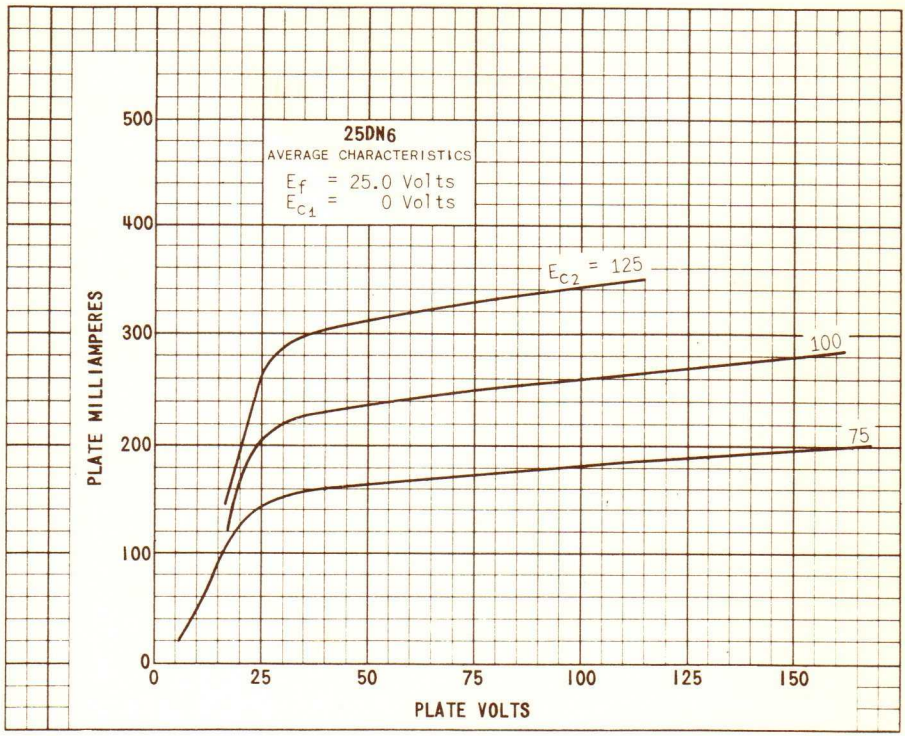
TUNG-SOL

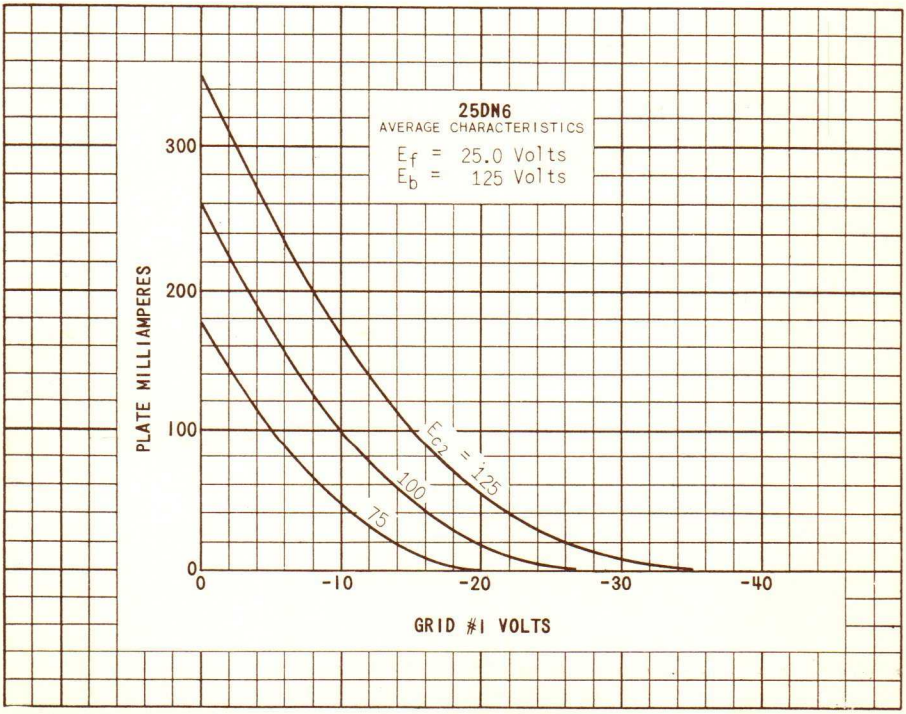
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	25.0	VOLTS
HEATER CURRENT	0.6	AMP.
PENTODE OPERATION: WITH E_b = 125 VOLTS, E_{c2} = 125 VOLTS AND E_{c1} = -18 VOLTS.		
PLATE CURRENT	70	MA.
GRID #2 CURRENT	6.3	MA.
TRANSCONDUCTANCE	9 000	μMHOS
PLATE RESISTANCE (APPROX.)	4 000	OHMS
ZERO-BIAS: WITH E_b = 50 VOLTS, E_{c2} = 100 VOLTS & E_{c1} = 0 VOLTS (INSTANTANEOUS VALUES)		
PLATE CURRENT	240	MA.
GRID #2 CURRENT	30	MA.
CUT-OFF: FOR I_b = 0.5 MA. WITH E_b = 125 VOLTS AND E_{c2} = 125 VOLTS		
GRID #1 VOLTAGE (APPROX.)	-36	VOLTS
TRIODE AMPLIFICATION FACTOR; WITH E_b = E_{c2} = 125 V. & E_{c1} = -18 V.	4.35	




25DN6
AVERAGE CHARACTERISTICS
E_f = 25.0 Volts
E_{c_1} = 0 Volts
E_{c_2} = 125
100
75
PLATE MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
0
25
50
75
100
125
150


25DN6
AVERAGE CHARACTERISTICS
E_f = 25.0 Volts
E_b = 125 Volts
E_{c_2} = 125
100
75
PLATE MILLIAMPERES
GRID #1 VOLTS
0
100
200
300
0
-10
-20
-30
-40

25DN6

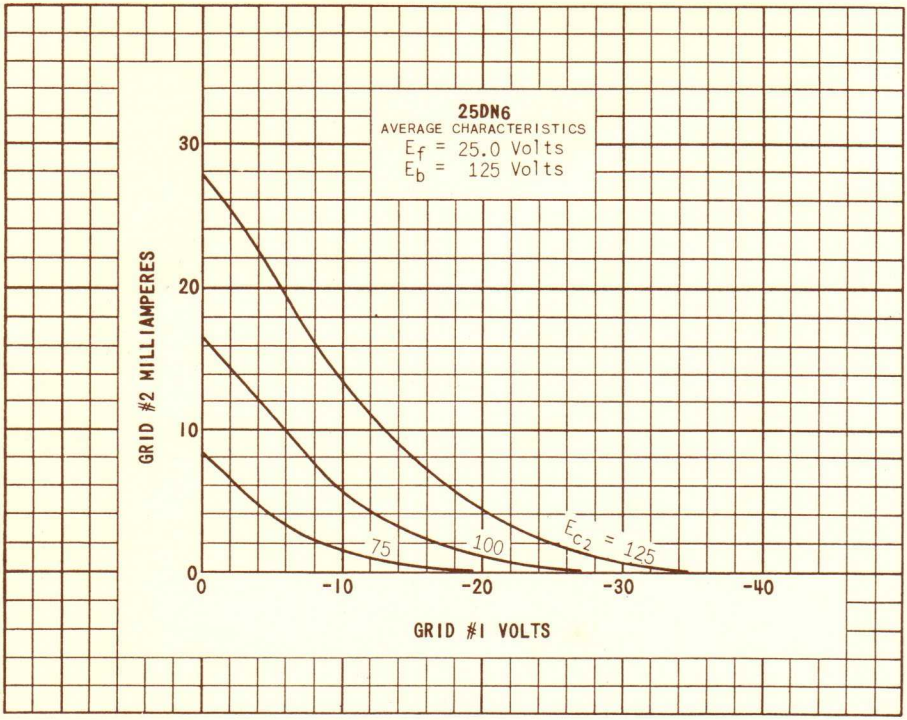
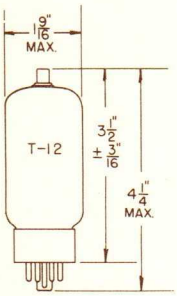


PLATE #4386 JUNE 1, 1955 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

BEAM POWER PENTODE

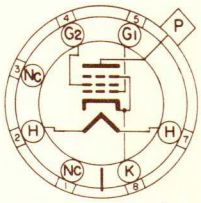


GLASS BULB
SKIRTED MINIATURE CAP

UNIPOTENTIAL CATHODE

HEATER
25.0 VOLTS 0.30 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM-SHELL
7 PIN OCTAL
WITH EXTERNAL BARRIERS

6AM

THE 25DQ6A IS A HIGH-PERVEANCE BEAM POWER PENTODE DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER TUBE IN HIGH EFFICIENCY DEFLECTION CIRCUITS 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 TUBES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME AND HEATER RATINGS THE 25DQ6A IS IDENTICAL TO THE 6DQ6A.

DIRECT INTERELECTRODE CAPACITANCES—APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.55	μμf
GRID #1 TO CATHODE & GRID #3, HEATER AND GRID #2	15	μμf
PLATE TO CATHODE & GRID #3, HEATER AND GRID #2	7	μμf

RATINGS [A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
HORIZONTAL DEFLECTION AMPLIFIER

HEATER VOLTAGE	25.0	VOLTS
MAXIMUM PLATE VOLTAGE:		
DC (INCLUDING BOOST)	700	VOLTS
PEAK POSITIVE-PULSE (ABSOLUTE MAX.) [B]	6 000 [C]	VOLTS
PEAK NEGATIVE-PULSE [B]	1 375	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC	-50	VOLTS
PEAK NEGATIVE-PULSE	300	VOLTS
MAXIMUM CATHODE CURRENT:		
DC	140	MA.
PEAK	440	MA.
MAXIMUM GRID #2 INPUT	3	WATTS

[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".

[B] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15% OF ONE HORIZONTAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15% OF THE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

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

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS[A]– CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER

MAXIMUM PLATE DISSIPATION[D]	15	WATTS
MAXIMUM PEAK HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	220	°C
MAXIMUM CIRCUIT VALUES:		
GRID #1 CIRCUIT RESISTANCE:		
FOR GRID RESISTOR–BIAS OPERATION[D]	1.0	MEGOHM
HEATER WARM–UP TIME (AVERAGE)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

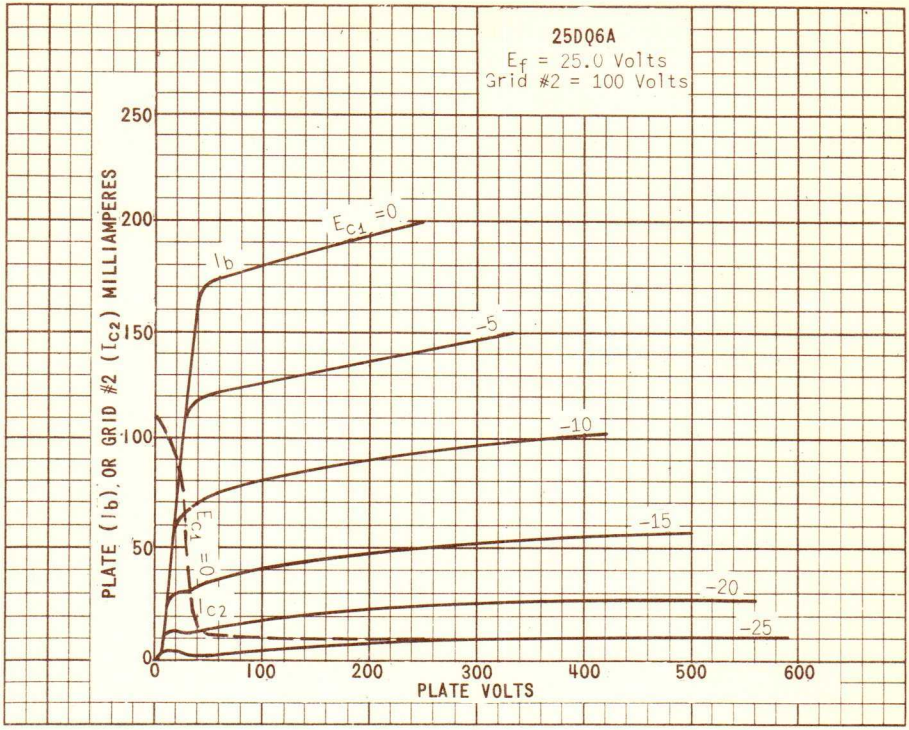
HEATER VOLTAGE	25.0	25.0	25.0	VOLTS
HEATER CURRENT	0.30	0.30	0.30	AMP.
PLATE VOLTAGE	60	150	250	VOLTS
GRID #2 VOLTAGE	150	150	150	VOLTS
GRID #1 VOLTAGE	0	-22.5	-22.5	VOLTS
MU–FACTOR, GRID #2 TO GRID #1	---	4.1	---	
PLATE RESISTANCE (APPROX.)	---	---	20 000	OHMS
TRANSCONDUCTANCE	---	---	6 600	μMHOS
PLATE CURRENT	300[E]	---	75	MA.
GRID #2 CURRENT	27[E]	---	2.4	MA.
GRID #1 VOLTAGE (APPROX.)				
FOR PLATE CURRENT OF 1 MA.	---	---	-46	VOLTS

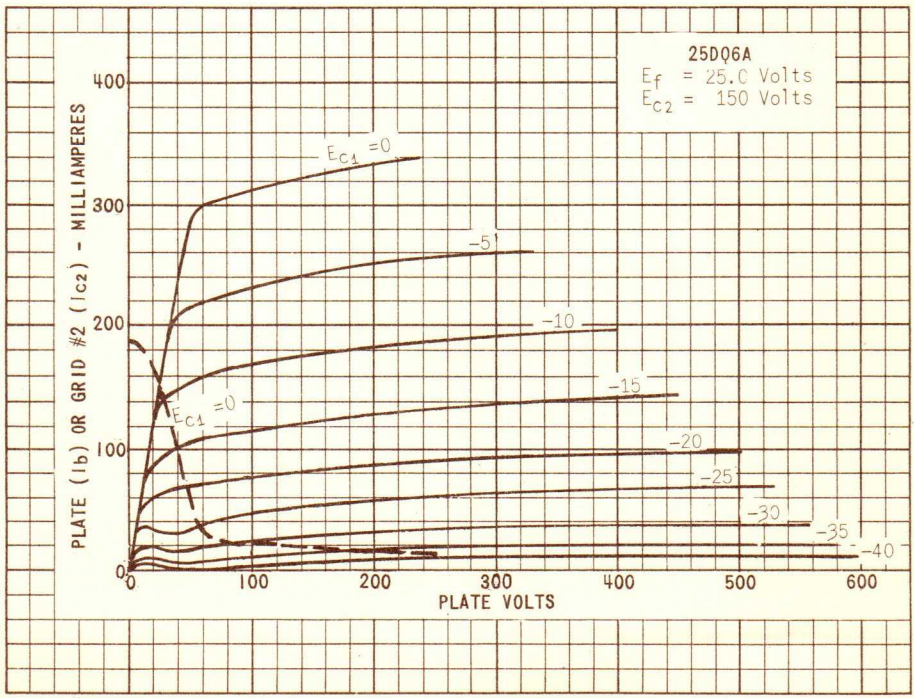
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS; FEDERAL COMMUNICATIONS COMMISSION".

[D] IT IS ESSENTIAL THAT THE PLATE DISSIPATION BE LIMITED IN THE EVENT OF LOSS OF GRID SIGNAL. FOR THIS PURPOSE, SOME PROTECTIVE MEANS SUCH AS A CATHODE RESISTOR OF SUITABLE VALUE SHOULD BE EMPLOYED.

[E] THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RECURRENT 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.



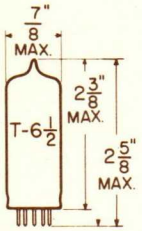


PRINTED IN U. S. A.

TUNG-SOL

BEAM-POWER PENTODE

MINIATURE TYPE

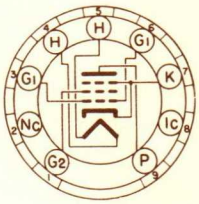


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25.0 VOLTS 0.30 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE
SMALL-BUTTON
9 PIN BASE
9HN

THE 25DT5 IS A BEAM POWER PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A VERTICAL DEFLECTION OUTPUT AMPLIFIER IN TELEVISION RECEIVERS UTILIZING A 110° DEFLECTION ANGLE PICTURE TUBE AND A B^+ SUPPLY VOLTAGE OF 250 VOLTS. IT HAS HIGH ZERO BIAS PLATE CURRENT AND A HIGH PLATE CURRENT TO GRID #2 CURRENT RATIO. 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. EXCEPT FOR HEATER RATINGS AND WARM-UP TIME, THE 25DT5 IS IDENTICAL TO THE 6DT5.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.57	μμf
INPUT	12.5	μμf
OUTPUT	4.9	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION SERVICE[B]

DEFLECTING 110° PICTURE TUBE

HEATER VOLTAGE	25.0	VOLTS
MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	2 200	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID #1 VOLTAGE	-250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	9.0	WATTS
MAXIMUM GRID #2 DISSIPATION	2.0	WATTS
MAXIMUM CATHODE CURRENT:		
AVERAGE	55	MA.
PEAK	190	MA.
MAXIMUM HEATER POSITIVE OR NEGATIVE WITH RESPECT TO CATHODE (TOTAL DC AND PEAK)	200	VOLTS
MAXIMUM GRID #1 CIRCUIT VALUES		
FIXED BIAS	0.5	MEGOHM
CATHODE BIAS	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	25.0	25.0	25.0	VOLTS
HEATER CURRENT	0.30	0.30	0.30	AMP.
PLATE VOLTAGE	60	80 ←	250	VOLTS
GRID #2 (SCREEN) VOLTAGE	150	250	250	VOLTS
GRID #1 VOLTAGE	0[E]	0[E]	-16.5	VOLTS
TRANSCONDUCTANCE	---	---	6 200	μMHOS
PLATE CURRENT	→ 95	195[F]	44	MA.
GRID #2 CURRENT	→ 8.5	19[F]	1.5	MA.
GRID #1 CUTOFF VOLTAGE[G]	---	---	-35	VOLTS

[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.

[E] APPLIED FOR SHORT INTERVAL (MAXIMUM OF 2 SECONDS) SO AS NOT TO DAMAGE TUBE.

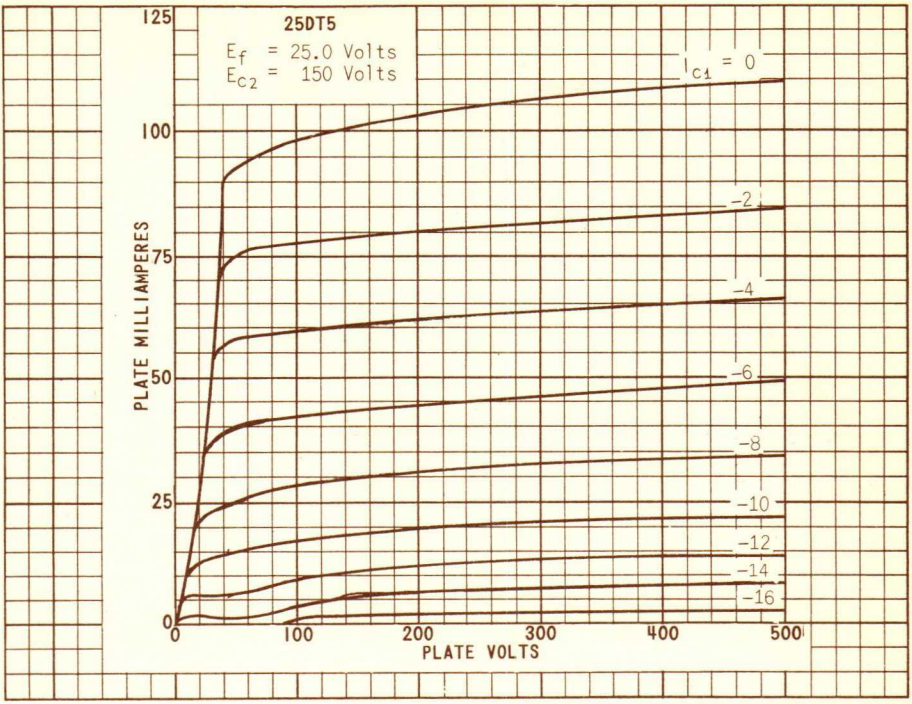
[F] THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RE-CURRENT WAVEFORM SUCH THAT THE PLATE DISSIPATION AND GRID #2 INPUT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

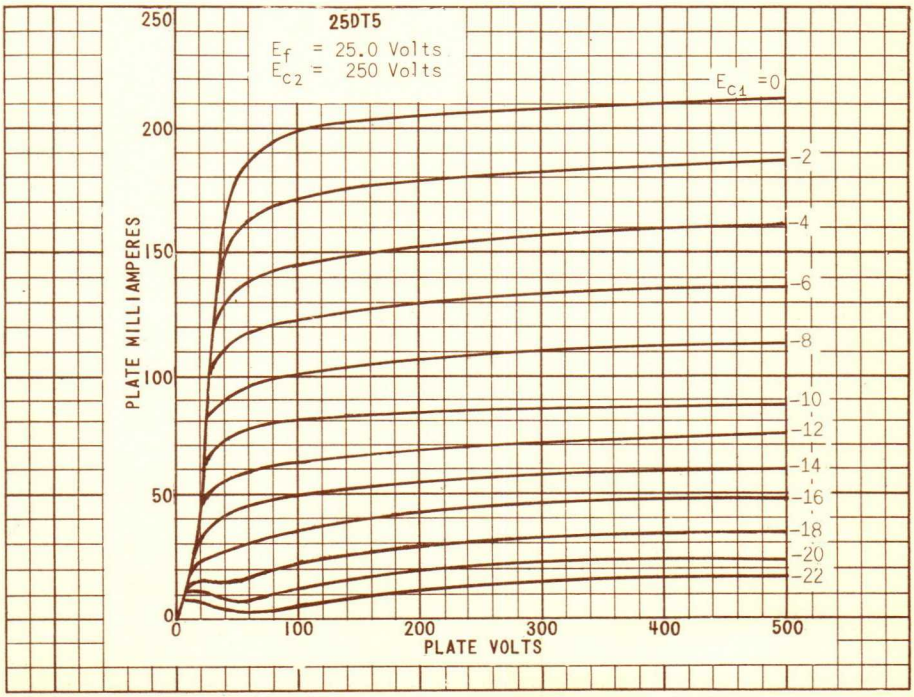
[G] FOR PLATE CURRENT OF 100 μAMPERES.

* 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.

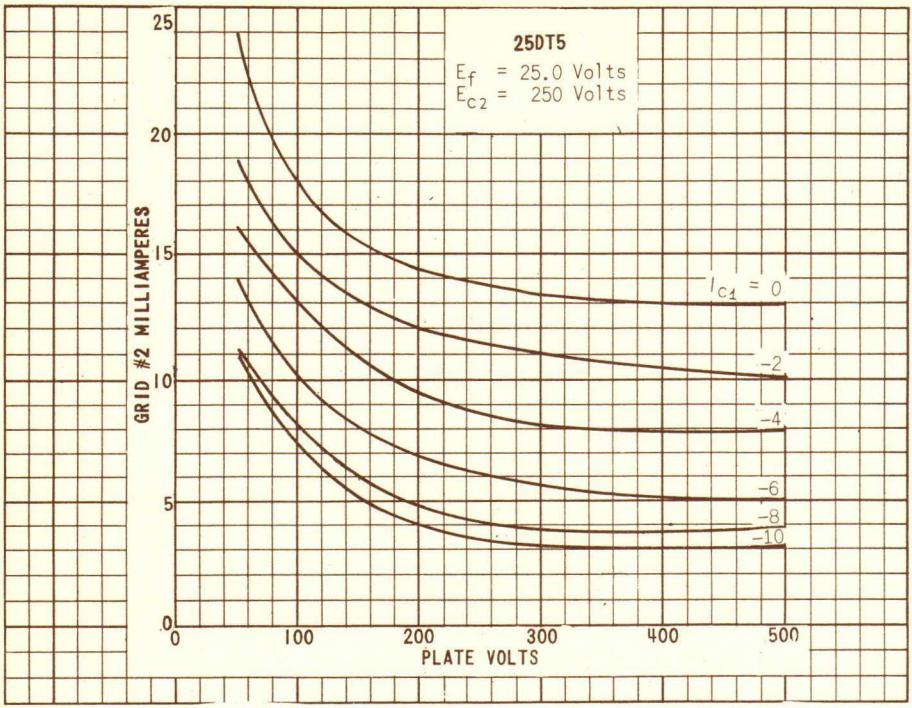
⊕ DC COMPONENT MUST NOT EXCEED 100 VOLTS.

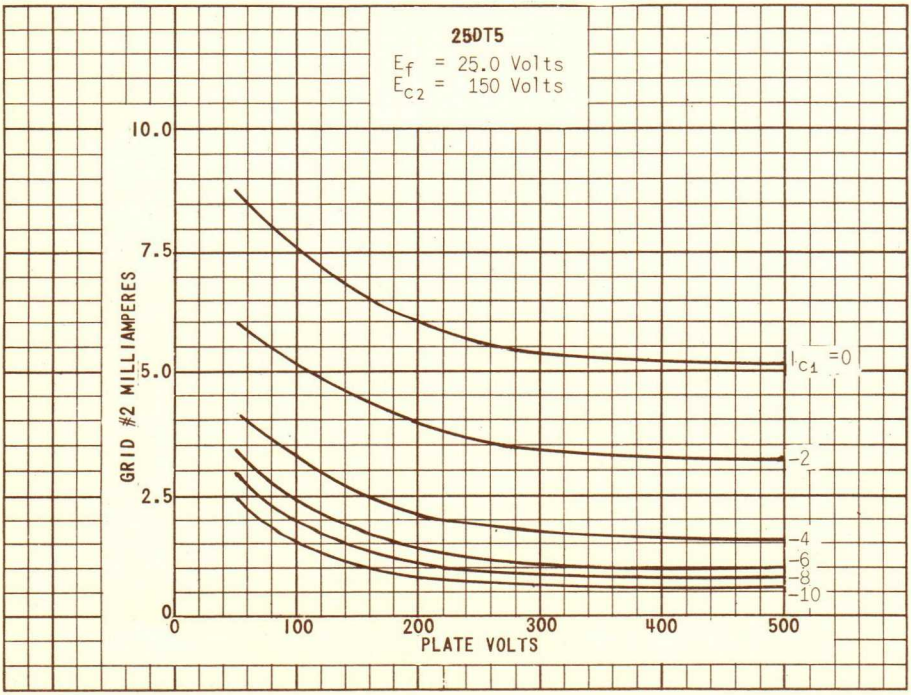
→ INDICATES A CHANGE.





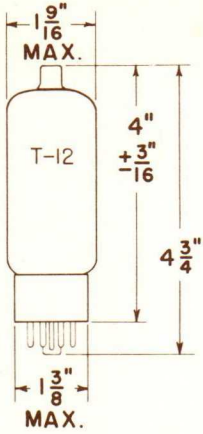
PRINTED IN U.S.A.


25DT5
E_f = 25.0 Volts
E_{c2} = 250 Volts
GRID #2 MILLIAMPERES
PLATE VOLTS
I_{c1} = 0
-2
-4
-6
-8
-10
0
5
10
15
20
25
100
200
300
400
500


25DT5
E_f = 25.0 Volts
E_{c2} = 150 Volts
GRID #2 MILLIAMPERES
PLATE VOLTS
I_{c1} =0
-2
-4
-6
-8
-10
0
2.5
5.0
7.5
10.0
100
200
300
400
500

TUNG-SOL

BEAM PENTODE

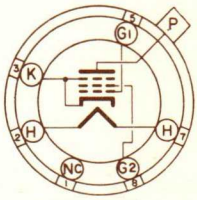


GLASS BULB
SMALL TOP CAP

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM-SHELL
8 PIN OCTAL
5BT

THE 25EC6 IS A BEAM POWER PENTODE DESIGNED FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER TUBE IN TELEVISION RECEIVERS THAT EMPLOY 110 DEGREE-DEFLECTION PICTURE TUBES. IT HAS ELECTRICAL CHARACTERISTICS SIMILAR TO THOSE OF THE 25CD6GB AND 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 - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	μμf
INPUT	24	μμf
OUTPUT	10	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[A]

HEATER VOLTAGE	25	VOLTS
MAXIMUM DC PLATE-SUPPLY VOLTAGE (BOOST+DC POWER SUPPLY)	700	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	7 000	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE	1 500	VOLTS
MAXIMUM SCREEN VOLTAGE	175	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION[B]	10	WATTS
MAXIMUM SCREEN DISSIPATION	4.0	WATTS
MAXIMUM DC CATHODE CURRENT	200	MA.
MAXIMUM PEAK CATHODE CURRENT	700	MA.

[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.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS--CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[A]

MAXIMU		
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 GRID-LEAK BIAS	1.5	MEGOHMS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	225	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE		25		VOLTS
HEATER CURRENT		0.6±6%		AMP.
PLATE VOLTAGE	60		135	VOLTS
SCREEN VOLTAGE	135		135	VOLTS
GRID #1 VOLTAGE	0[C]		-22.5	VOLTS
PLATE RESISTANCE (APPROX.)	---		4 700	OHMS
TRANSCONDUCTANCE	---		7 500	μMHOS
PLATE CURRENT	350		70	MA.
SCREEN CURRENT	40		4.5	MA.
GRID #1 VOLTAGE (APPROX.)				
I_b =1.0 MA.	---		-42	VOLTS
TRIODE AMPLIFICATION FACTOR[D]	---		3.8	

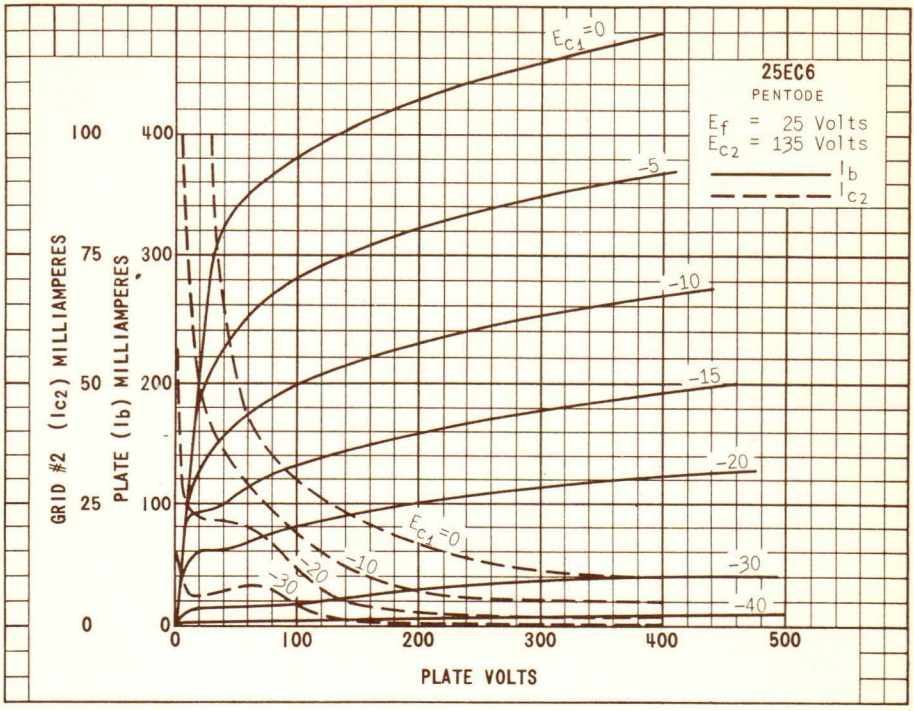
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

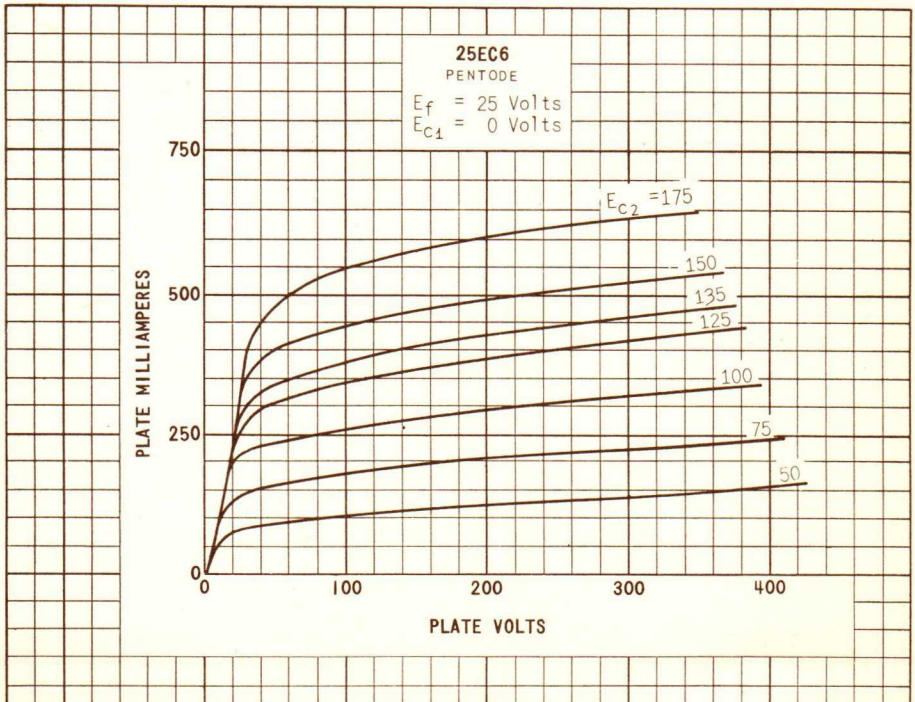
[C] APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

[D] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH Eb=Ec2=135 VOLTS AND Ec1=-22.5 VOLTS.

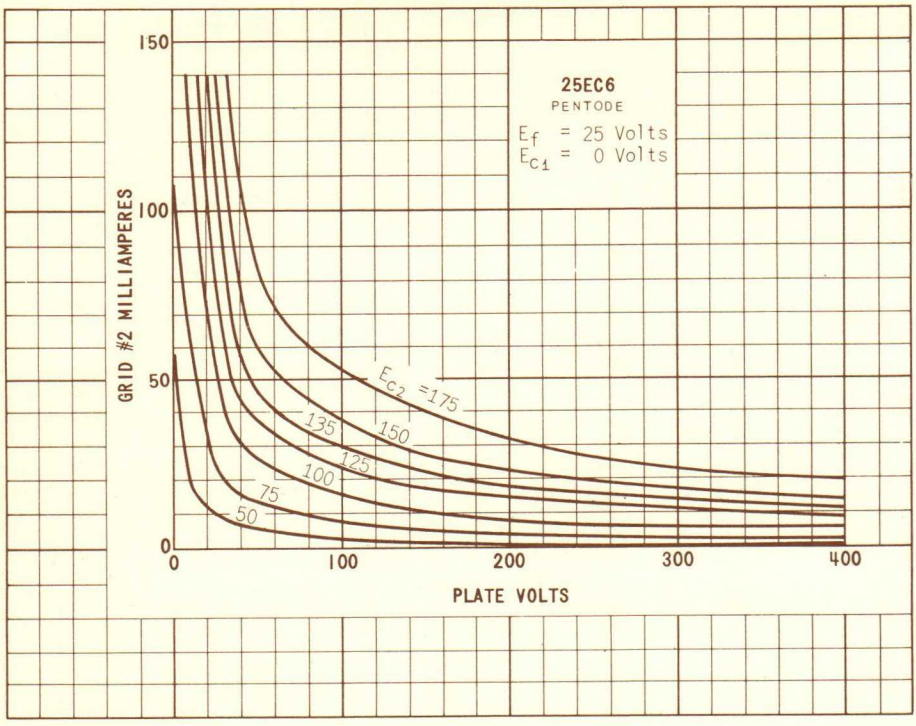
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

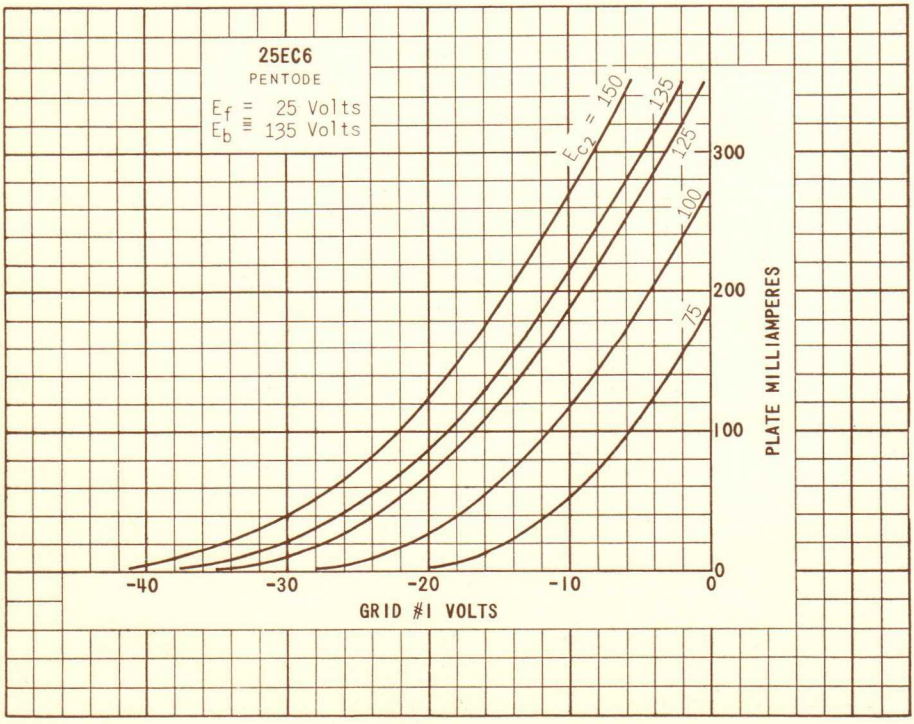
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH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

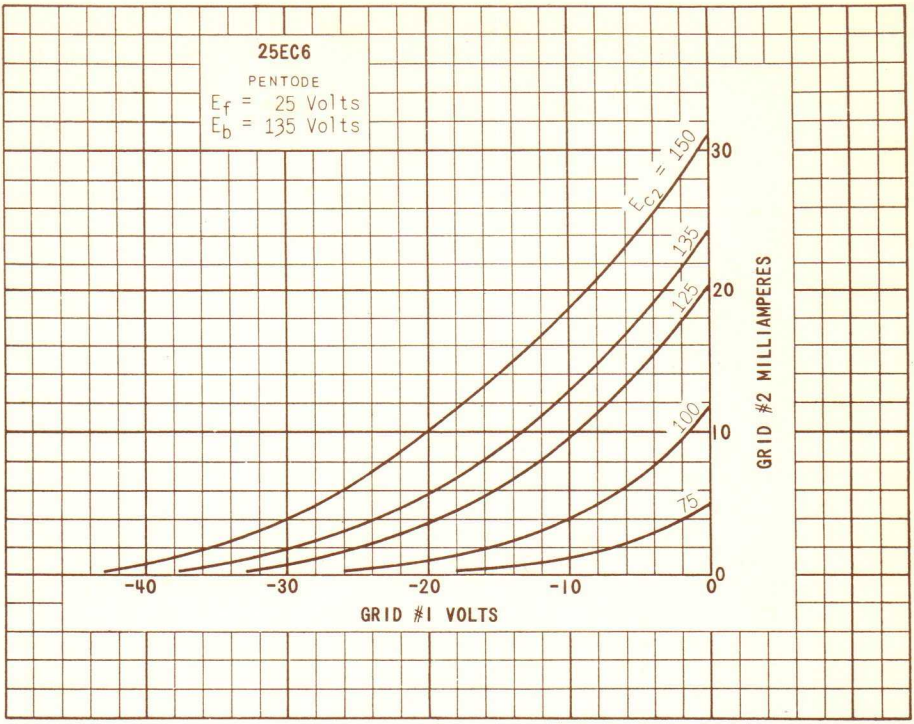




PRINTED IN U. S. A.


25EC6
PENTODE
E_f = 25 Volts
E_{c1} = 0 Volts
GRID #2 MILLIAMPERES
150
100
50
0
E_{c2} =175
150
135
125
100
75
50
0
100
200
300
400
PLATE VOLTS


25EC6
PENTODE
E_f = 25 Volts
E_b = 135 Volts
E_{c2} = 150
135
125
100
75
300
200
100
0
PLATE MILLIAMPERES
-40
-30
-20
-10
0
GRID #1 VOLTS

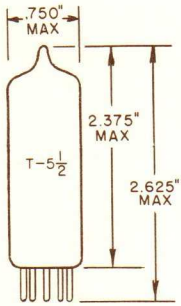


PRINTED IN U. S. A.

TUNG-SOL

PENTODE

MINIATURE TYPE

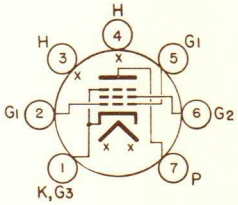


GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

FOR USE IN
AUDIO OUTPUT STAGES OF
RADIO AND TV RECEIVERS
AND PHONOGRAPHS

UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 25EH5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS BEEN SPECIFICALLY DESIGNED FOR USE IN THE AUDIO OUTPUT STAGE OF RADIO AND TELEVISION RECEIVERS AND PHONOGRAPHS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, IT IS IDENTICAL TO THE 6EH5, 12EH5 AND THE 50EH5.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	0.65	pf
GRID 1 TO CATHODE & GRID 3, HEATER & GRID 2	17	pf
PLATE TO CATHODE & GRID 3, HEATER & GRID 2	9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	25	VOLTS	300	MA.
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			300 ± 20	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			200 [B]	VOLTS

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

PRINTED IN U. S. A.

TUNG-SOL

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AMPLIFIER

PLATE VOLTAGE	→ 150	VOLTS
GRID 2 (SCREEN-GRID) VOLTAGE	→ 130	VOLTS
PLATE DISSIPATION	→ 5.5	WATTS
GRID 2 INPUT	→ 2	WATTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	220	°C
GRID 1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

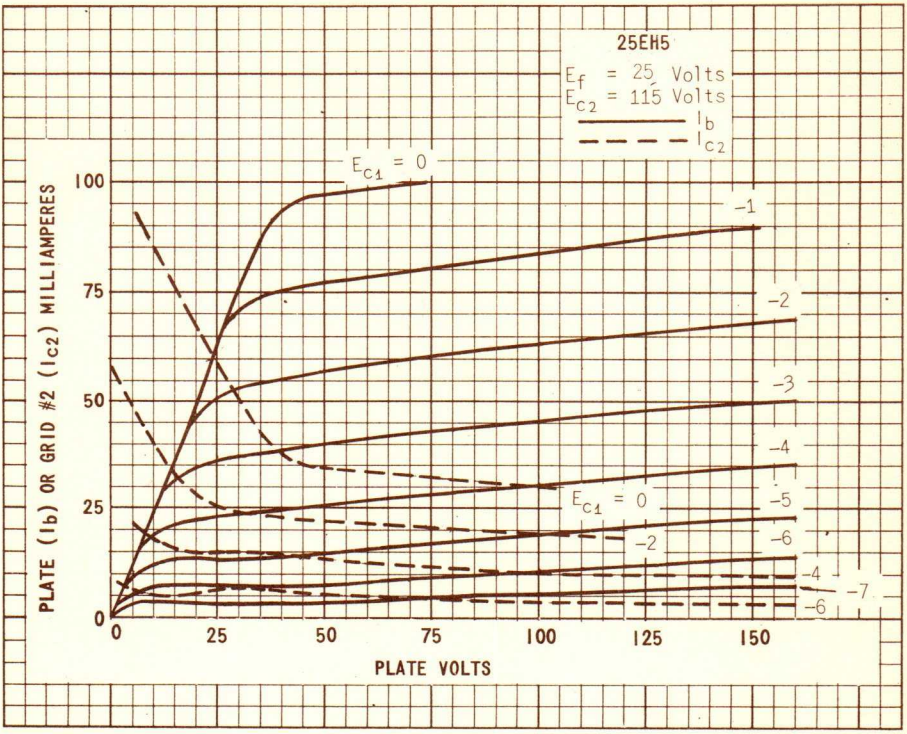
PLATE SUPPLY VOLTAGE	110	VOLTS
GRID 2 SUPPLY VOLTAGE	115	VOLTS
CATHODE RESISTOR	62	OHMS
PEAK AF GRID 1 VOLTAGE	3	VOLTS
ZERO-SIGNAL PLATE CURRENT	42	MA.
SIGNAL PLATE CURRENT (MAX.)	42	MA.
ZERO-SIGNAL GRID 2 CURRENT	11.5	MA.
SIGNAL GRID 2 CURRENT (MAX.)	14.5	MA.
TRANSCONDUCTANCE	14,600	μMHOS
PLATE RESISTANCE (APPROX.)	11,000	OHMS
LOAD RESISTANCE	3,000	OHMS
TOTAL HARMONIC DISTORTION	7	PERCENT
SIGNAL POWER OUTPUT (MAX.)	1.4	WATTS

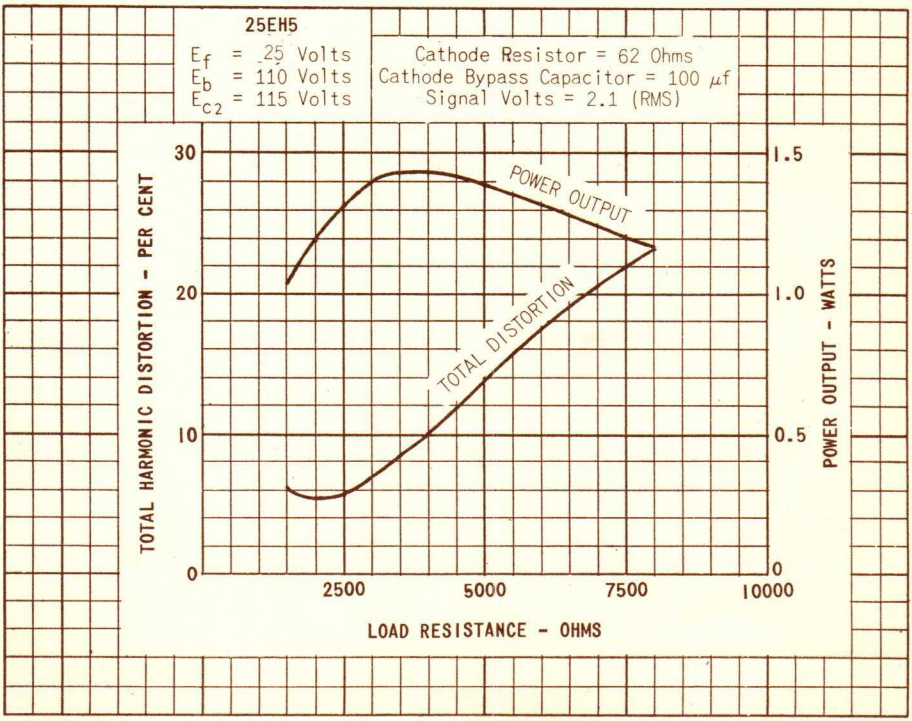
PUSH-PULL AF POWER AMPLIFIER - CLASS AB1

VALUES ARE FOR TWO TUBES

PLATE SUPPLY VOLTAGE	140	VOLTS
GRID 2 SUPPLY VOLTAGE	120	VOLTS
CATHODE RESISTOR	68	OHMS
PEAK AF GRID 1 TO GRID 1 VOLTAGE	9.4	VOLTS
ZERO-SIGNAL PLATE CURRENT	47	MA.
MAX. SIGNAL PLATE CURRENT	51	MA.
ZERO-SIGNAL GRID 2 CURRENT	11	MA.
MAX.-SIGNAL GRID 2 CURRENT	17.7	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	6000	OHMS
TOTAL HARMONIC DISTORTION	5	PERCENT
MAX.-SIGNAL POWER OUTPUT	3.8	WATTS.

→ INDICATES A CHANGE.

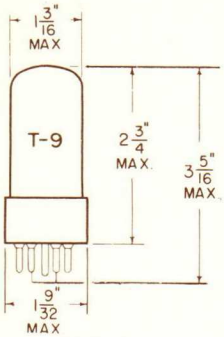




PRINTED IN U. S. A.

TUNG-SOL

BEAM PENTODE

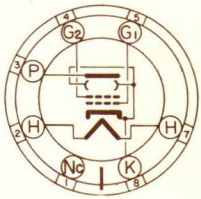


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE SHELL
7 PIN OCTAL
7AC

THE 25L6GT IS DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AC/DC RECEIVERS. IT DELIVERS A HIGH POWER OUTPUT WITH HIGH POWER SENSITIVITY FROM LOW SUPPLY VOLTAGES.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	25	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
DC AND PEAK	200	VOLTS

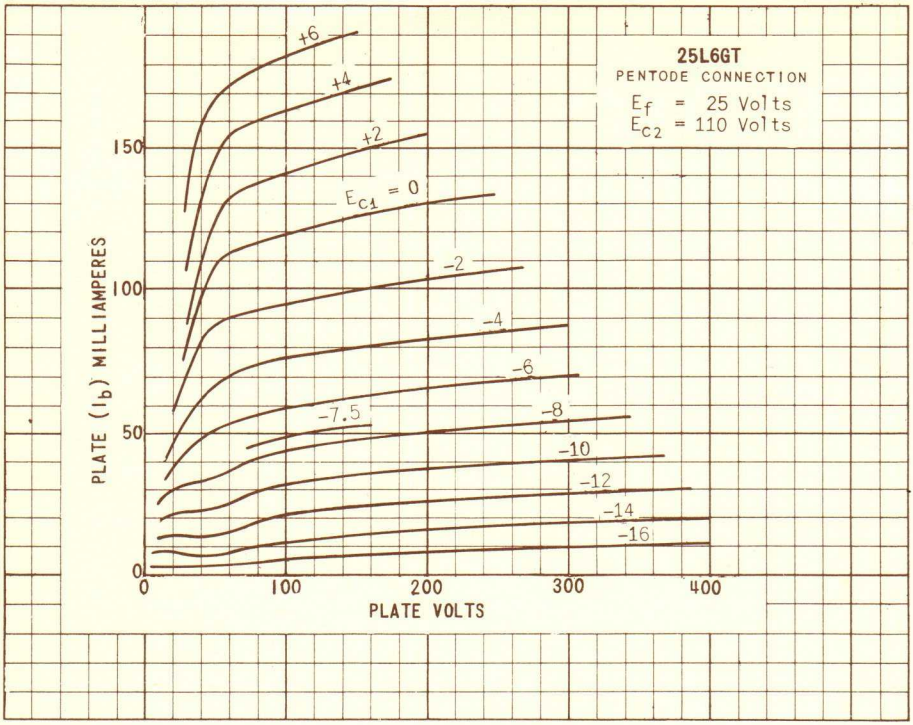
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

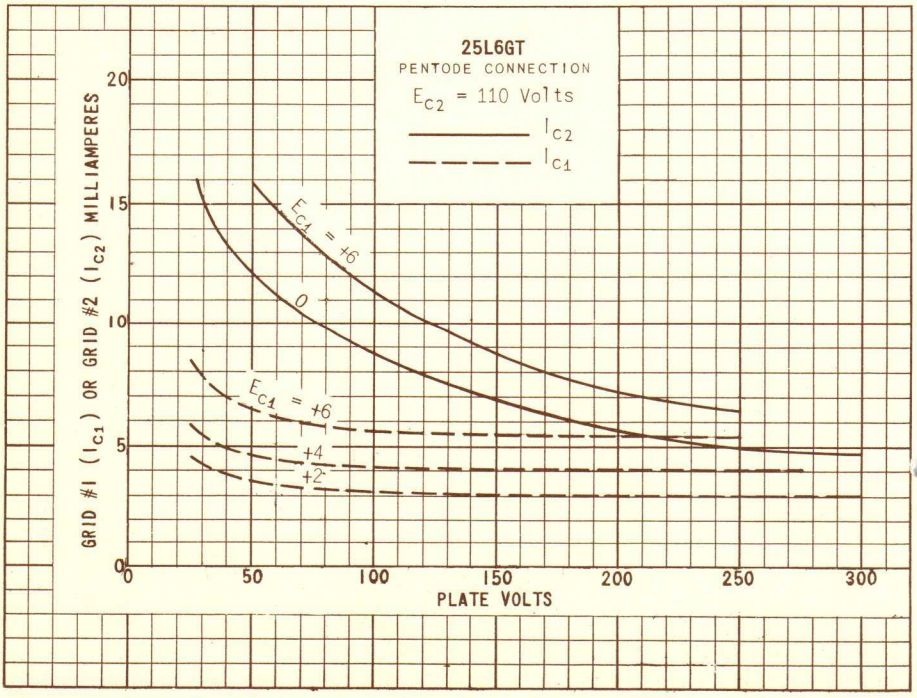
CLASS A_1 AMPLIFIER

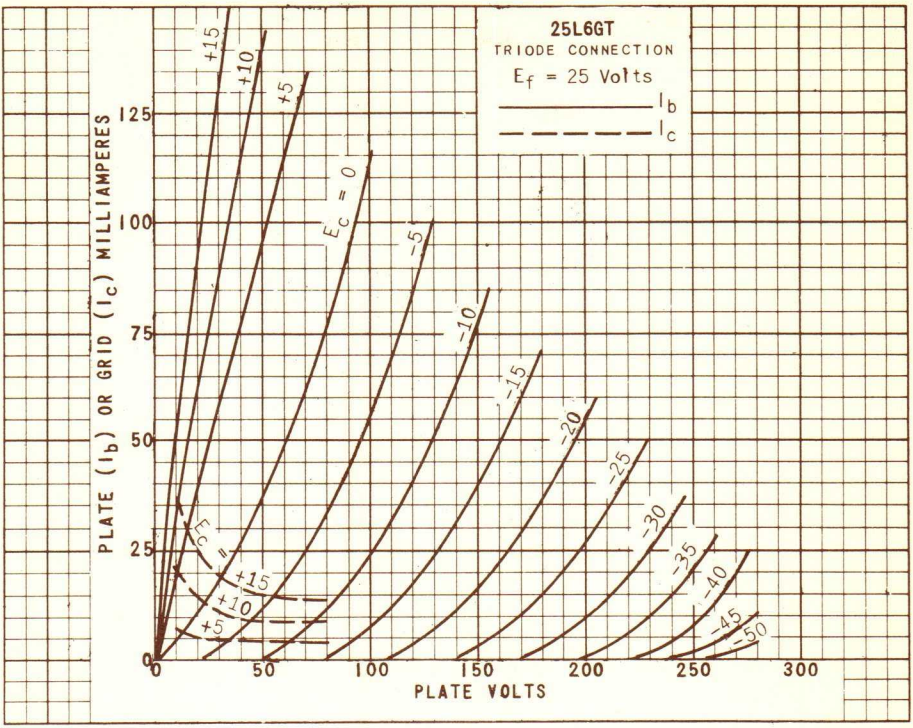
HEATER VOLTAGE	25	25	VOLTS
HEATER CURRENT	0.3	0.3 ←	AMP.
PLATE VOLTAGE	110	200	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-7.5	0	VOLTS
CATHODE BIAS RESISTOR	0	180	OHMS
PEAK AF GRID #1 VOLTAGE	7.5	8.5	VOLTS
PLATE RESISTANCE (APPROX.)	13 000	28 000	OHMS
TRANSCONDUCTANCE	8 000	8 000	µMHOS
ZERO-SIGNAL PLATE CURRENT	49	46	MA.
MAXIMUM-SIGNAL PLATE CURRENT	50	47	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	2.2	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	10	8.5	MA.
LOAD RESISTANCE	2 000	4 000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT
POWER OUTPUT	2.1	3.8	WATTS

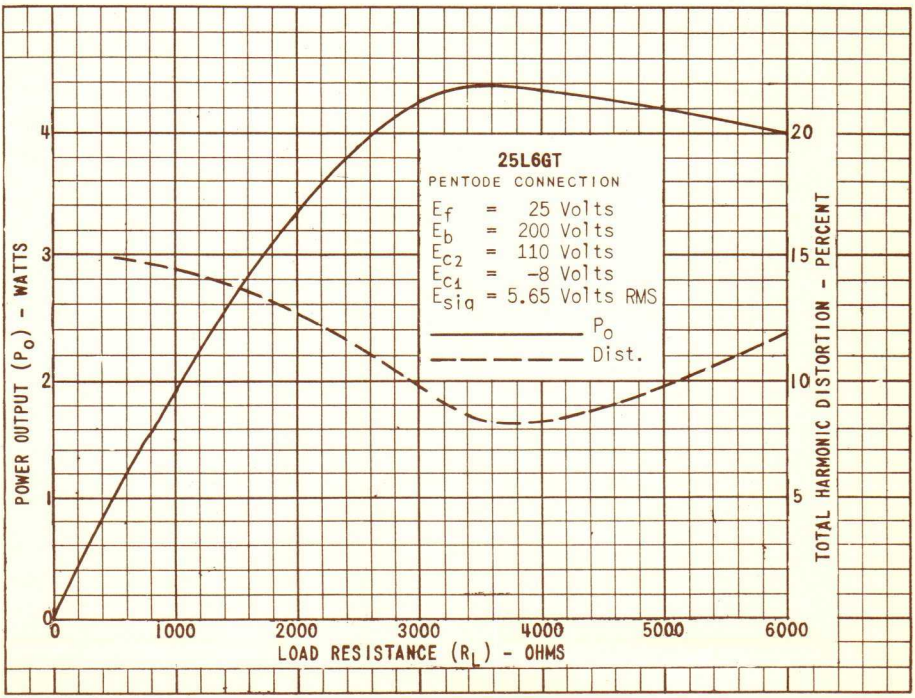
→ INDICATES A CHANGE.

PRINTED IN U.S.A.


25L6GT
PENTODE CONNECTION
E_f = 25 Volts
E_{c2} = 110 Volts
+6
+4
+2
E_{c1} = 0
-2
-4
-6
-7.5
-8
-10
-12
-14
-16
PLATE (I_b) MILLIAMPERES
0
50
100
150
0
100
200
300
400
PLATE VOLTS


25L6GT
PENTODE CONNECTION
E_{c2} = 110 Volts
I_{c2}
I_{c1}
E_{c1} = +6
0
E_{c1} = +6
+4
+2
GRID #1 (I_{c1}) OR GRID #2 (I_{c2}) MILLIAMPERES
0
5
10
15
20
0
50
100
150
200
250
300
PLATE VOLTS

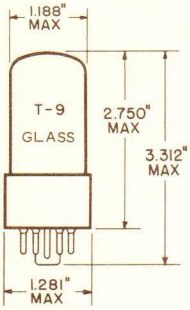




PRINTED IN U.S.A.

TUNG-SOL

OUTLINE DRAWING
JEDEC 9-11 OR 9-41



INTERMEDIATE SHELL OCTAL
BASE 5 PIN JEDEC B5-82
OR 6 PIN JEDEC B6-8
OR SHORT INTERMEDIATE OCTAL
BASE 5 PIN JEDEC B5-85 OR
6 PIN JEDEC B6-60

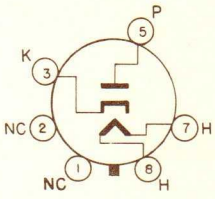
DIODE

FOR
DAMPING SERVICE
IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 4CG



BOTTOM VIEW

THE 25W4GT IS AN INDIRECTLY HEATED HALF-WAVE RECTIFIER IN THE T-9 OCTAL CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS THE DAMPING DIODE IN DIRECT-DRIVE SWEEP CIRCUITS IN TELEVISION RECEIVERS. IT MAY ALSO BE USED IN CONVENTIONAL RECTIFIER APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

HEATER TO CATHODE	11	pf
PLATE TO CATHODE AND HEATER	6.0	pf
CATHODE TO PLATE AND HEATER	17	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN CENTER VALUES (EXCEPT AS NOTED) - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	25 VOLTS	300	mA
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC - ABSOLUTE MAXIMUM		500	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN CENTER VALUES (EXCEPT AS NOTED) - SEE EIA STANDARD RS-239

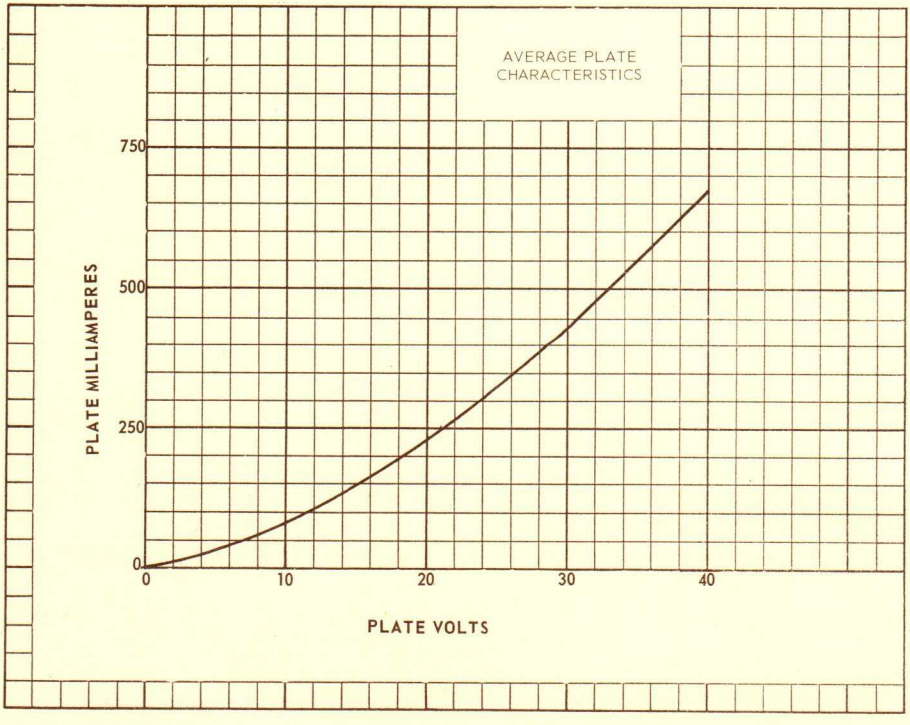
DAMPER SERVICE SEE NOTE

PEAK INVERSE PLATE VOLTAGE - ABSOLUTE MAXIMUM	3,850	VOLTS
PLATE DISSIPATION	3.5	WATTS
STEADY STATE PEAK CURRENT	750	mA
DC PLATE CURRENT	125	mA

NOTE - FOR OPERATION IN A 525 LINE, 30 FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION." THE DUTY CYCLE OF THE HORIZONTAL VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

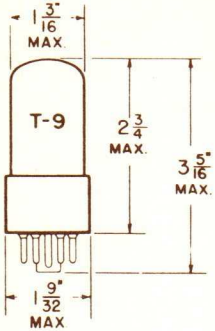
CHARACTERISTICS

TUBE VOLTAGE DROP FOR I_b = 250 mA	21	VOLTS



TUNG-SOL

BEAM PENTODE

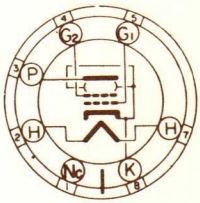


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
7AC

THE 25W6GT IS A BEAM PENTODE POWER AMPLIFIER DESIGNED SPECIFICALLY FOR USE AS A VERTICAL SCANNING OUTPUT TUBE IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE: (G_1 TO P) MAX.	0.5	μμf
INPUT: G_1 TO (H+K+BP+G_2)	15	μμf
OUTPUT: P TO (H+K+BP+G_2)	9.0	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

	CLASS A1 AMPLIFIER	VERTICAL DEFLECTION AMPLIFIER [AB]	
HEATER VOLTAGE	25	25	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	150	---	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---	1 200	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	---	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	10	7.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	---	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	---	40	MA.
MAXIMUM PEAK CATHODE CURRENT	---	140	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:			
FIXED BIAS OPERATION	0.1	---	MEGOHMS
CATHODE BIAS OPERATION	0.5	2.2	MEGOHMS

[A] TRIODE CONNECTION - GRID #2 TIED TO PLATE.

[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

PRINTED IN U.S.A.

PLATE
3152
FEB. 1
1953

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

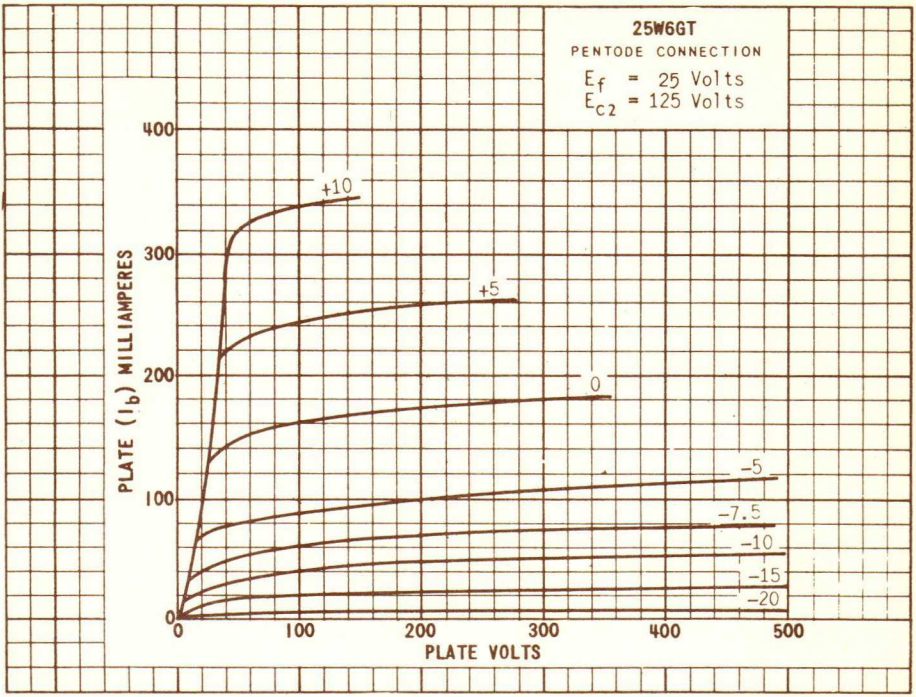
HEATER VOLTAGE	25	25	VOLTS
HEATER CURRENT	0.3	0.3	AMP.
PLATE VOLTAGE	110	200	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-7.5	---	VOLTS
CATHODE BIAS RESISTOR	---	180	OHMS
PEAK AF GRID #1 VOLTAGE	7.5	8.5	VOLTS
PLATE RESISTOR (APPROX.)	13 000	28 000	OHMS
TRANSCONDUCTANCE	8 000	8 000	µMHOS
ZERO-SIGNAL PLATE CURRENT	49	46	MA.
MAXIMUM-SIGNAL PLATE CURRENT (APPROX.)	50	47	MA.
ZERO-SIGNAL GRID #2 CURRENT	4.0	2.2	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT (APPROX.)	10	8.5	MA.
LOAD RESISTANCE	2 000	4 000	OHMS
TOTAL HARMONIC DISTORTION	10	10	PERCENT
POWER OUTPUT	2.1	3.8	WATTS

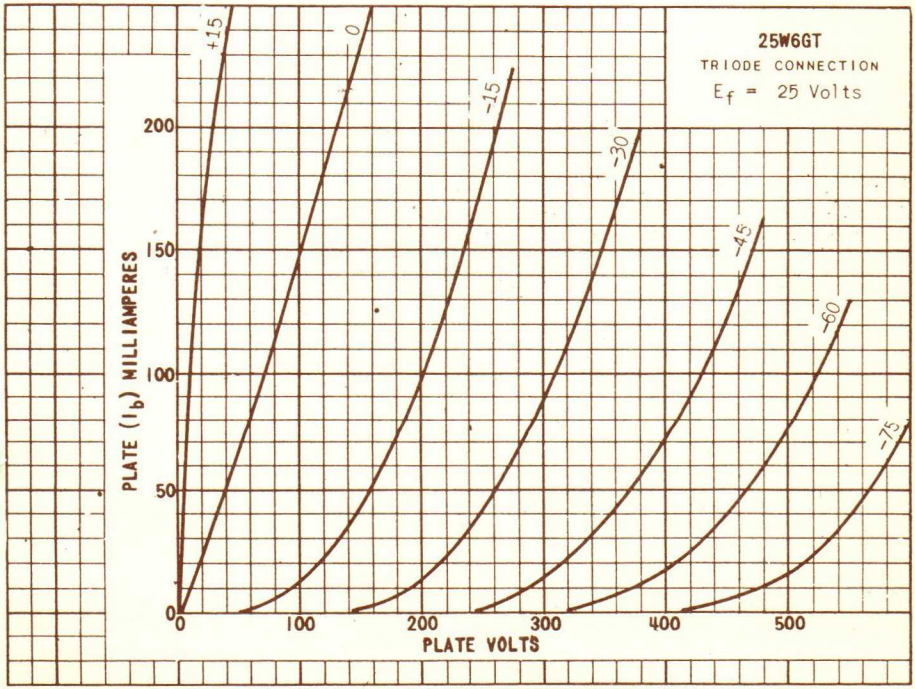
TRIODE CONNECTION[C]

HEATER VOLTAGE	25	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE VOLTAGE	225	VOLTS
GRID VOLTAGE	-30	VOLTS
AMPLIFICATION FACTOR	6.2	
PLATE RESISTANCE[1] (APPROX.)	1 600	OHMS
TRANSCONDUCTANCE	3 800	µMHOS
PLATE CURRENT	22	MA.
GRID VOLTAGE FOR I_b = 0.5 MA. (APPROX.)	-42	VOLTS

[C] GRID #2 TIED TO PLATE.

PLATE 3153 FEB. 1 1953





PRINTED IN U.S.A.

25W6GT (25W6GT)

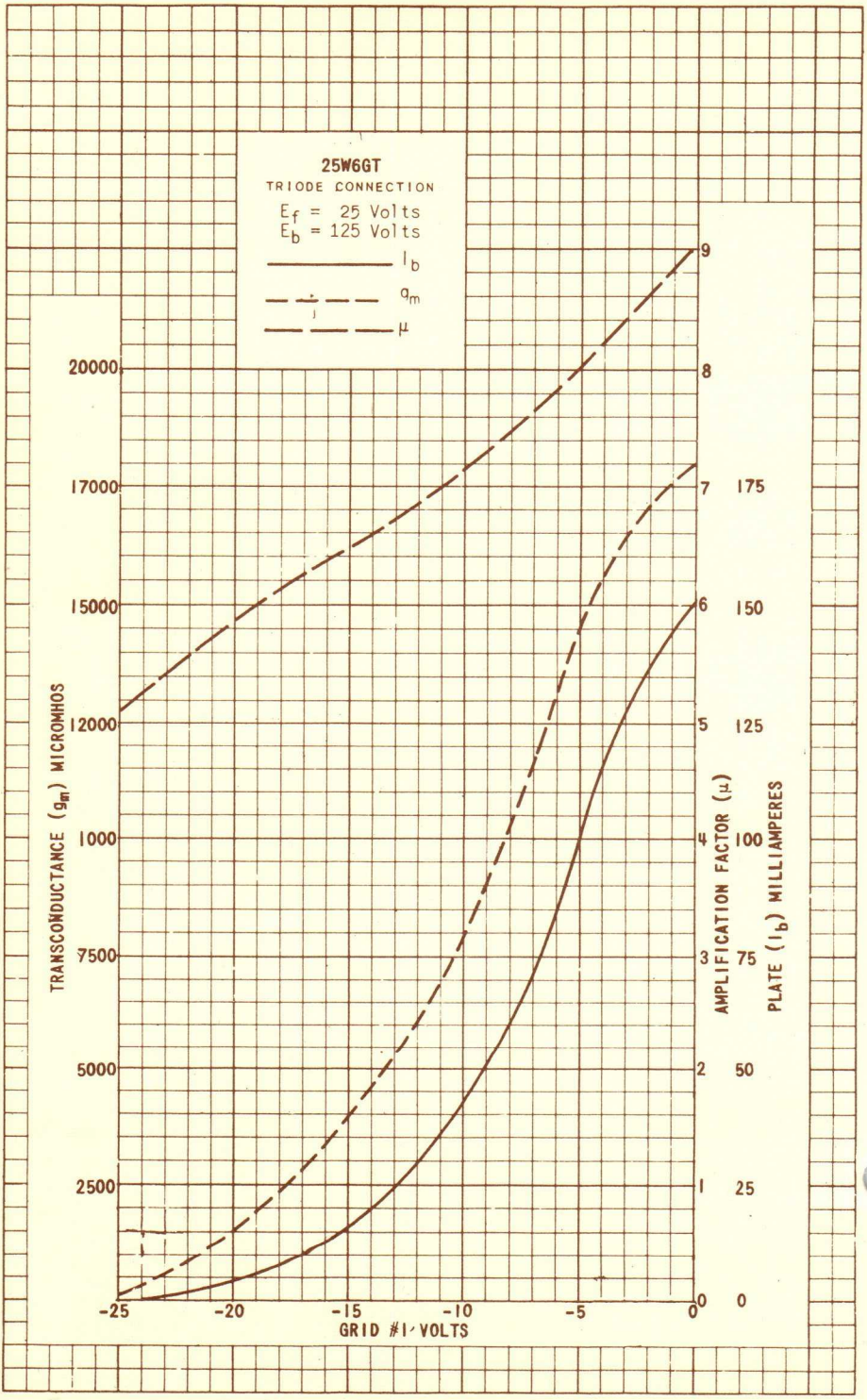
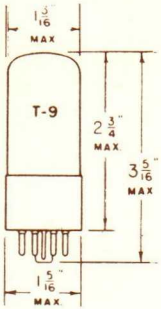


PLATE 3155
FEB. 1 1953

TUNG-SOL

TWIN DIODE HIGH VACUUM RECTIFIER

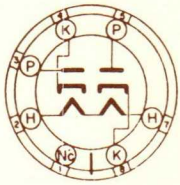
VOLTAGE DOUBLER



UNIPOTENTIAL CATHODES

HEATER
25 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



G-7Qa
BOTTOM VIEW

INTERMEDIATE 7 PIN OCTAL BASE

THE TUNG-SOL 25Z6GT/G IS DESIGNED PRIMARILY FOR SERVICE AS A POWER RECTIFIER IN AC – DC RECEIVERS. TWO SEPARATE RECTIFIER SECTIONS PERMIT USING THE TUBE AS A VOLTAGE DOUBLER, FULL WAVE RECTIFIER OR HALF WAVE RECTIFIER. FOR HALF-WAVE OPERATION THE TWO SECTIONS MAY BE OPERATED SEPARATELY, OR IN PARALLEL TO REDUCE TUBE DROP. ITS RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL TO THOSE OF THE 25Z5 AND 25Z6.

RATINGS:

MAXIMUM AC PLATE VOLTAGE (RMS)	235	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	350	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	700	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	450	MA.
TUBE VOLTAGE DROP AT 150 MA. PER PLATE	22	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

VOLTAGE DOUBLER

	HALF WAVE	FULL WAVE	
AC VOLTAGE PER PLATE (RMS) MAX.	117	117	VOLTS
DC OUTPUT CURRENT MAX.	75	75	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.A	30	15	OHMS

NOTE: THIS DOUBLE-BRANDED TUBE, 25Z6GT/G, REPLACES EITHER THE 25Z6G OR THE 25Z6GT.

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

PLATE 930-M

DEC. 30 1940

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

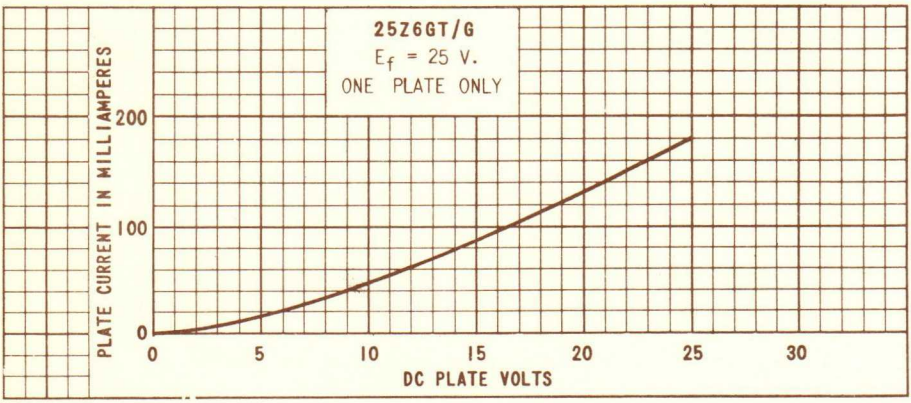
COPYRIGHT 1940 BY TUNG-SOL LAMP WORKS INC. RADIO TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

25Z6GT/G

TUNG-SOL

HALF-WAVE RECTIFIER

AC VOLTAGE PER PLATE (RMS)	117	150	235 MAX.	VOLTS
DC OUTPUT CURRENT PER PLATE MAX.	75	75	75	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.A	15	40	100	OHMS



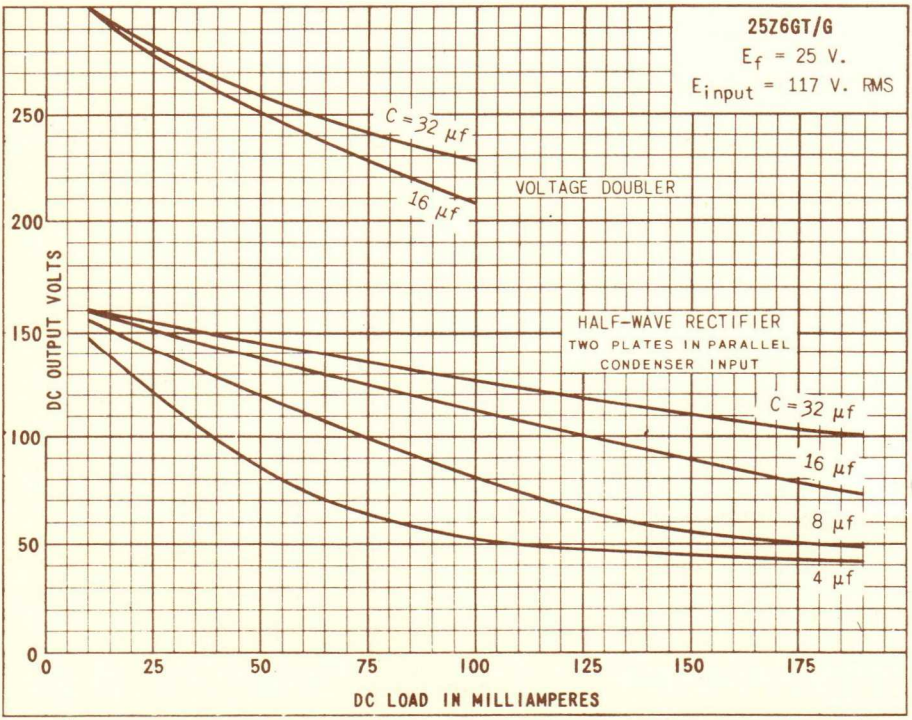


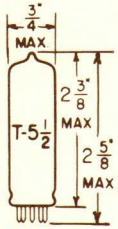
PLATE
931-4

COPYRIGHT 1940 BY TUNG-SOL LAMP WORKS INC. RADIO TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

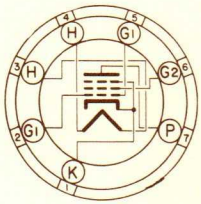
COATED UNIPOTENTIAL CATHODE

HEATER

32 VOLTS 0.10 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7CV

THE 32ET5 IS A BEAM POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS A 100 MA HEATER AND IS DESIGNED FOR USE IN AC/DC RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	μμf
INPUT: G TO (H+K+G2+G3)	12	μμf
OUTPUT: P TO (H+K+G2+G3)	6.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

HEATER VOLTAGE	32	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:	0.10	AMP.
HEATER NEGATIVE WITH 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	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	5.4	WATTS
MAXIMUM GRID #2 DISSIPATION	1.2	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM

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.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

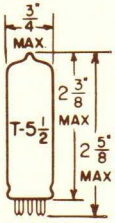
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	32	VOLTS
HEATER CURRENT	0.10	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	30	MA.
ZERO-SIGNAL GRID #2 CURRENT	2.8	MA.
TRANSCONDUCTANCE	5500	μMHOS
PLATE RESISTANCE (APPROX.)	21 500	OHMS
LOAD RESISTANCE	2800	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	1.2	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT

TUNG-SOL

PENTODE

MINIATURE TYPE



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

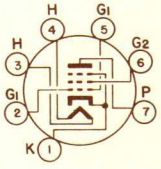
COATED UNIPOTENTIAL CATHODE

HEATER

32 VOLTS 0.10 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CV

THE 32ET5A IS A BEAM POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY SUITED FOR USE IN AC/DC RADIOS THAT EMPLOY 100 MILLI-AMPERE SERIES CONNECTED HEATERS. EXCEPT FOR HEATER RATINGS, THE 32ET5A IS IDENTICAL TO THE 32ET5.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	μμf
INPUT: G TO (H+K+G2+G3)	12	μμf
OUTPUT: P TO (H+K+G2+G3)	6.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

HEATER CURRENT[B]	0.100±0.006	AMPS.
MAXIMUM HEATER-CATHODE VOLTAGE:	0.10	AMP.
HEATER NEGATIVE WITH 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	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	5.4	WATTS
MAXIMUM GRID #2 DISSIPATION	1.2	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
HEATER WARM-UP TIME*	20	SECONDS

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.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE (SERIES OPERATION)	32	VOLTS
HEATER CURRENT[C] (SERIES OPERATION)	0.10	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	30	MA.
ZERO-SIGNAL GRID #2 CURRENT	2.8	MA.
TRANSCONDUCTANCE	5500	μMHOS
PLATE RESISTANCE (APPROX.)	21 500	OHMS
LOAD RESISTANCE	2800	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	1.2	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT

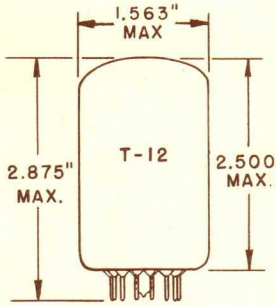
[C]FOR SERIES OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

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

TUNG-SOL

DIODE-PENTODE



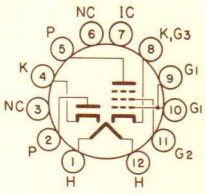
COMPACTRON

HIGH-PERVEANCE

DIODE
AND BEAM POWER PENTODE
FOR
TELEVISION APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
BUTTON 12 PIN
BASE E12-74
OUTLINE DRAWING
JEDEC 12-56

BOTTOM VIEW
BASING DIAGRAM
JEDEC 12 FN
SOCKET TERMINALS
3,6,7 SHOULD NOT
BE USED AS TIE POINTS

THE 33GY7 IS A HIGH-PERVEANCE DIODE AND A BEAM-POWER PENTODE IN THE T-12 COMPACTRON CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS THE DAMPING DIODE AND THE PENTODE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

DIODE SECTION		
CATHODE TO PLATE AND HEATER: K TO (P + H)	8.5	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	5.5	pf
HEATER TO CATHODE: (H TO K)	3.2	pf
PENTODE SECTION		
GRID 1 TO PLATE: (G1 TO P)	0.2	pf
INPUT: G1 TO (H + K + G2 + G3)	17	pf
OUTPUT: P TO (H + K + G2 + G3)	7.0	pf

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	33.6 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.
HEATER-CATHODE VOLTAGE	DIODE SECTION	PENTODE SECTION	
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC COMPONENT	400		VOLTS
TOTAL DC AND PEAK	4,200	200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

BULB TEMPERATURE AT HOTTEST POINT	200	^{0} C
DIODE SECTION		
PEAK INVERSE PLATE VOLTAGE	4,200	VOLTS
PLATE DISSIPATION [B]	3.8	WATTS
STEADY-STATE PEAK PLATE CURRENT	810	MA.
DC OUTPUT CURRENT	135	MA.
PENTODE SECTION		
DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	400	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	5,000	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	0	VOLTS
GRID 2 VOLTS	150	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION	9.0	WATTS
GRID 2 DISSIPATION	3.0	WATTS
DC CATHODE CURRENT	155	MA.
PEAK CATHODE CURRENT	540	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS

A- 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.

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

CONTINUED FROM PRECEDING PAGE

AVERAGE CHARACTERISTICS

PENTODE SECTION

PLATE VOLTAGE		5,000	60	130	VOLTS
GRID 2 VOLTAGE		130	130	130	VOLTS
GRID 1 VOLTAGE		-	0 [C]	-22.5	VOLTS
PLATE CURRENT		-	320	48	MA.
GRID 2 CURRENT		-	22	2.9	MA.
TRANSCONDUCTANCE		-	-	6,500	μMHOS
PLATE RESISTANCE	(Approx.)	-	-	10,000	OHMS
GRID 1 VOLTAGE FOR I_b = 1.0 MA.	(Approx.)	-80	-	-40	VOLTS
TRIODE AMPLIFICATION FACTOR [D]		-	-	4.0	

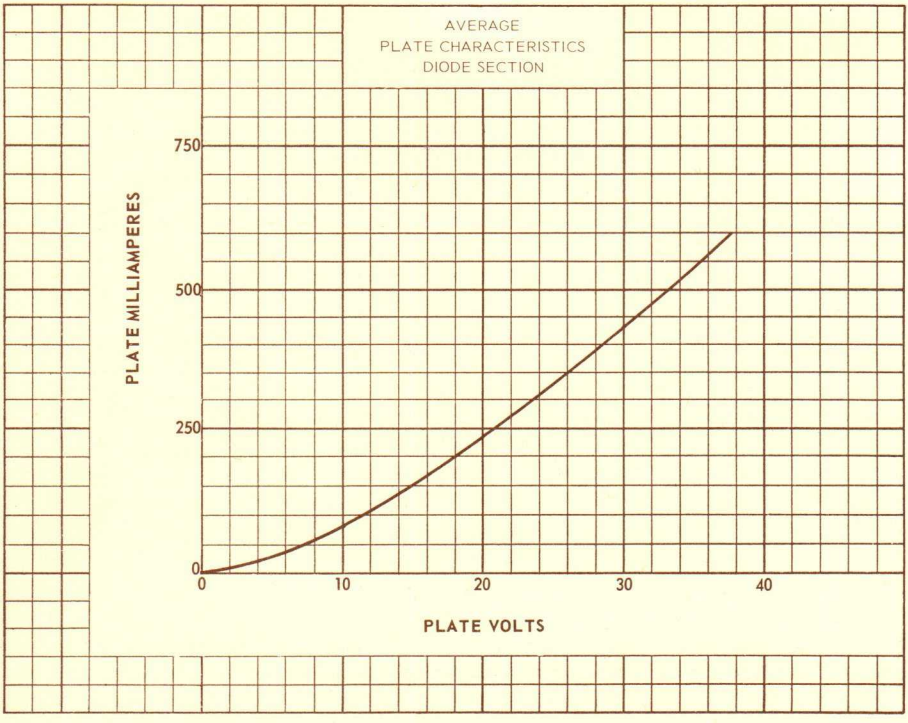
DIODE SECTION

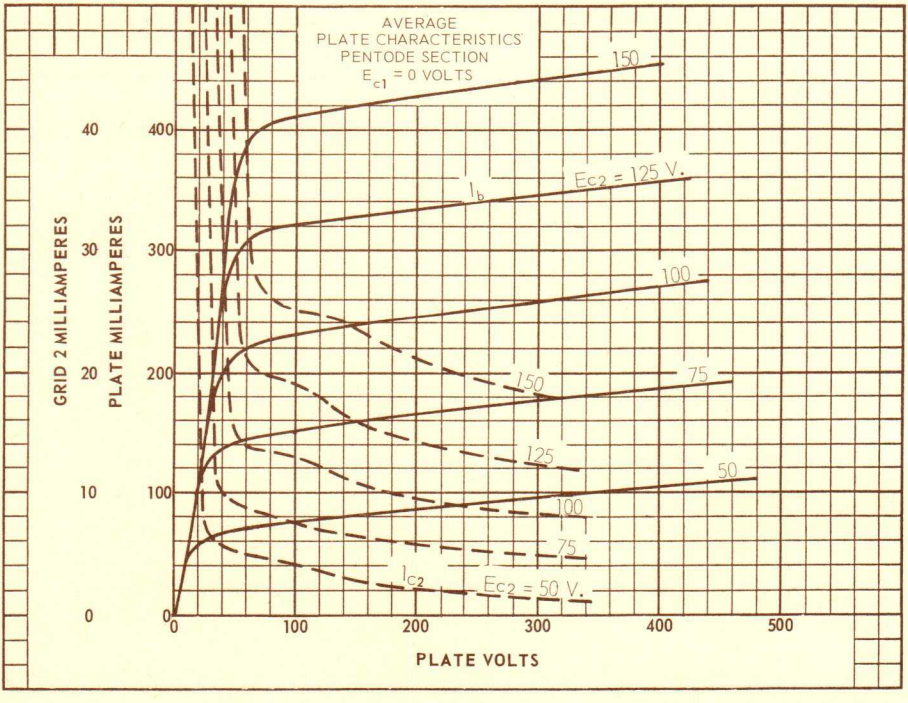
TUBE VOLTAGE DROP FOR I_b = 250 MA.				21	VOLTS

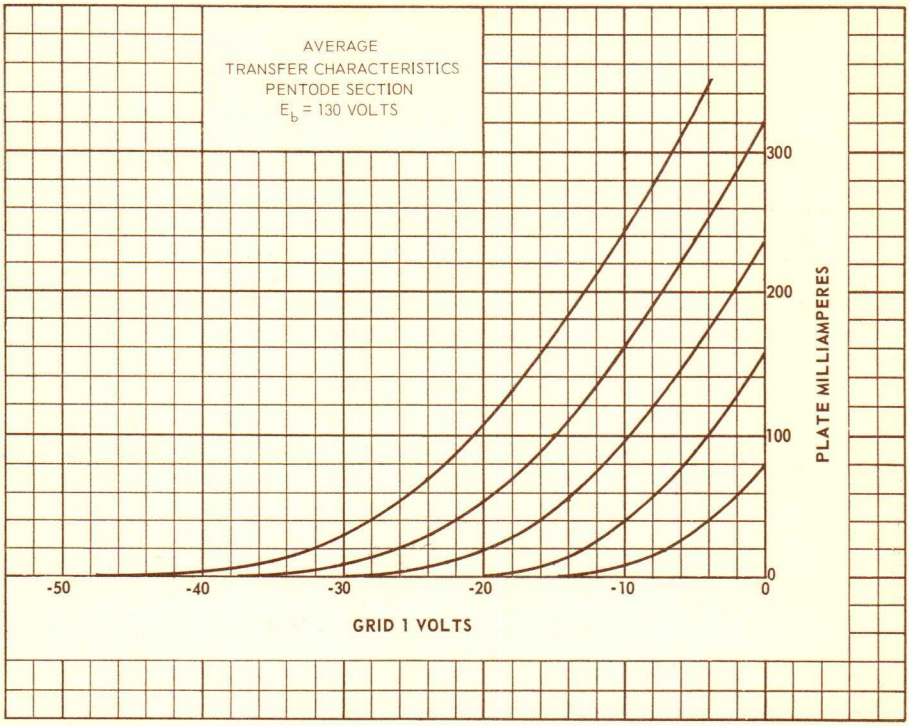
C- APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.
D- TRIODE CONNECTION (GRID 2 TIED TO PLATE) WITH $E_b = E_{c2} = 130$ VOLTS AND $E_{c1} = -22.5$ VOLTS.

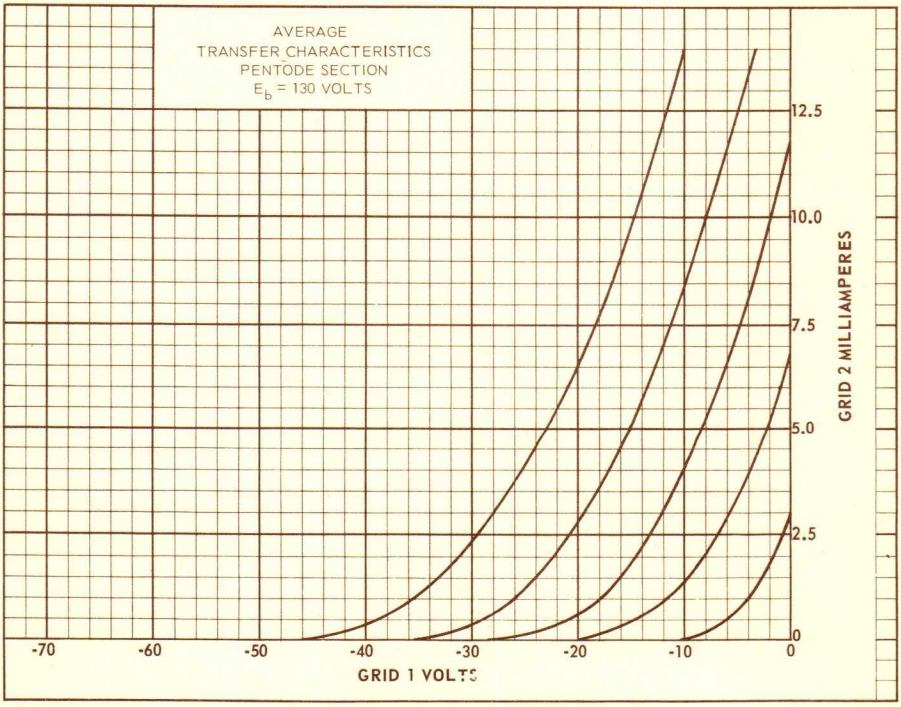
PRINTED IN U. S. A.

33GY7


AVERAGE
PLATE CHARACTERISTICS
DIODE SECTION
PLATE MILLIAMPERES
750
500
250
0
0
10
20
30
40
PLATE VOLTS


AVERAGE
PLATE CHARACTERISTICS
PENTODE SECTION
E_{c1} = 0 VOLTS
GRID 2 MILLIAMPERES
PLATE MILLIAMPERES
40
30
20
10
0
400
300
200
100
0
150
I_b
E_{c2} = 125 V.
100
150
75
125
50
100
75
I_{c2}
E_{c2} = 50 V.
0
100
200
300
400
500
PLATE VOLTS



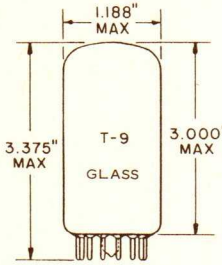


PRINTED IN U. S. A.

TUNG-SOL

DIODE
COMPACTRON

OUTLINE



BASE 12 PIN BUTTON
JEDEC E12-70

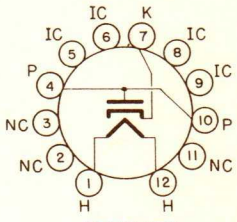
FOR

T.V. DAMPER SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 12FX



BOTTOM VIEW

THE TUNG-SOL 34CD3 IS AN INDIRECTLY-HEATED DIODE IN COMPACTRON CONSTRUCTION. IT IS INTENDED FOR USE IN DAMPER SERVICE OF TELEVISION HORIZONTAL DEFLECTION CIRCUITS. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS NORMALLY ENCOUNTERED IN "DIRECT DRIVE" CIRCUITS. ITS HIGH CURRENT CAPABILITY MAKES IT PARTICULARLY SUITABLE FOR COLOR TELEVISION APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P+H)	16	pf
PLATE TO CATHODE AND HEATER: P TO (K+H)	13	pf
HEATER TO CATHODE: H TO K	4.6	pf

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

AVERAGE CHARACTERISTICS	34.5 VOLTS	450	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	mA
MAXIMUM HEATER CATHODE VOLTAGE *			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC		1,000	VOLTS
TOTAL DC AND PEAK		6,000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		300	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

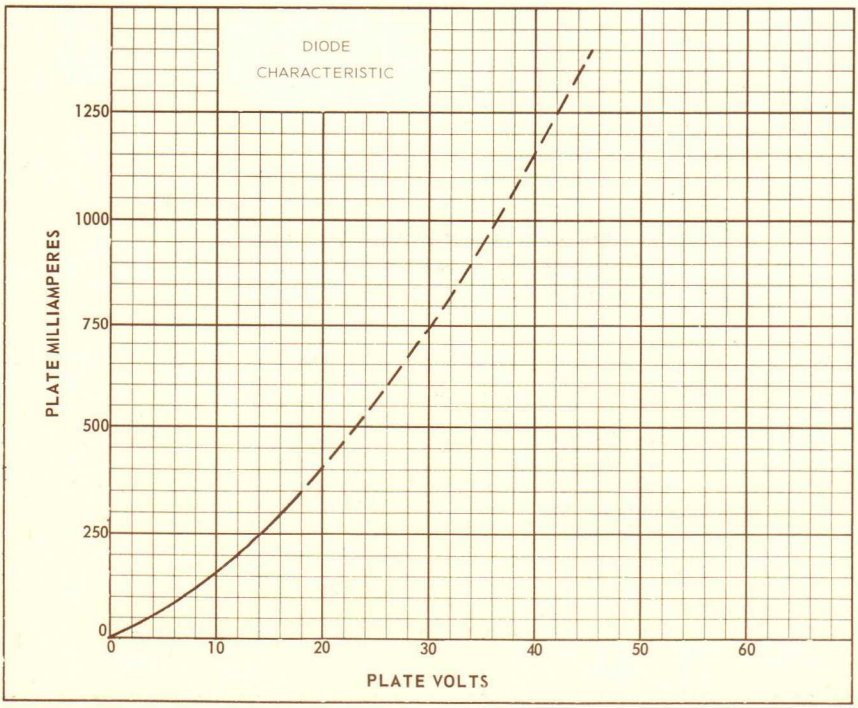
DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

DAMPER DIODE SERVICE *		
PEAK INVERSE PLATE VOLTAGE	6,000	VOLTS
DC OUTPUT CURRENT	350	MA.
STEADY STATE PEAK PLATE CURRENT	1,500	MA.
PLATE DISSIPATION	12	WATTS

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP	SEE GRAPH BELOW

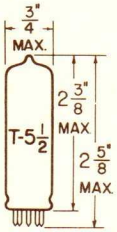
* FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE IS NOT EXCEED 15 PER CENT OF A SCANNING CYCLE.



TUNG-SOL

BEAM POWER TUBE

MINIATURE TYPE

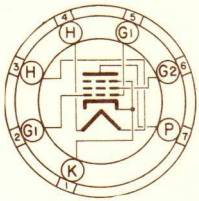


GLASS BULB
5-3

COATED UNIPOTENTIAL CATHODE

HEATER
34 VOLTS 0.10 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE

7CV

THE 34GD5 IS A BEAM POWER TUBE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN AUDIO AMPLIFIER TUBE IN AC/DC RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	pf
GRID #1 TO K,G3,H &G2	12	pf
PLATE TO K,G3,H & G2	9	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

HEATER CURRENT[B]	0.100±.006	AMP.
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	5	WATTS
MAXIMUM GRID #2 INPUT	1.1	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	250	°C

MAXIMUM CIRCUIT VALUES

GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION (MAX.)	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION (MAX.)	0.5	MEGOHM

CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS
(CONT'D.)

CLASS A_1 AMPLIFIER

ZERO-SIGNAL PLATE CURRENT	35	MA.
ZERO-SIGNAL GRID #2 CURRENT	3	MA.
PLATE RESISTANCE (APPROX.)	13000	OHMS
TRANSCONDUCTANCE	5700	μMHOS
LOAD RESISTANCE	2500	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT
MAX.-SIGNAL POWER OUTPUT	1.4	WATTS

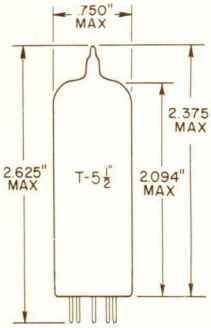
[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[B] THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE FILAMENT VOLTAGE IS CENTERED AT THE SPECIFIED BOGEY VALUE.

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

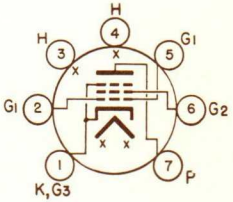


GLASS BULB
SMALL BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

UNIPOTENTIAL CATHODE

AUDIO OUTPUT AMPLIFIER
FOR SERIES STRING OPERATION

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 34GD5A IS A BEAM POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN AUDIO OUTPUT AMPLIFIER IN AC/DC RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	pf
GRID #1 TO CATHODE & GRID #3, #2 &HEATER	12	pf
PLATE TO CATHODE & GRID #3, #2, & HEATER	9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	34 VOLTS	100	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		100±6	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, (APPROX.)[B]		20	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

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	150	VOLTS
GRID #2 VOLTAGE	130	VOLTS
PLATE DISSIPATION	5	WATTS
GRID #2 INPUT	1.1	WATTS
GRID #1 (CONTROL GRID) VOLTAGE:		
NEGATIVE BIAS VALUE	50	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	250	°C

MAXIMUM CIRCUIT VALUES

GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

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	35	MA.
ZERO-SIGNAL GRID #2 CURRENT	3	MA.
PLATE RESISTANCE (APPROX.)	13,000	OHMS
TRANSCONDUCTANCE	5700	μMHOS
LOAD RESISTANCE	2500	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT
MAX.-SIGNAL POWER OUTPUT	1.4	WATTS

TUNG-SOL

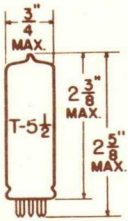
BEAM POWER AMPLIFIER

MINIATURE TYPE

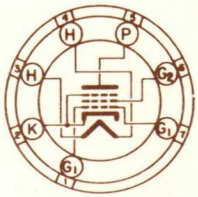
UNIPOTENTIAL CATHODE

HEATER
35 VOLTS 0.015 AMPERE
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 35B5 IS A BEAM POWER AMPLIFIER IN THE MINIATURE CONSTRUCTION. BECAUSE OF ITS HIGH POWER SENSITIVITY AT LOW PLATE-SCREEN VOLTAGE, IT IS PARTICULARLY ADAPTABLE TO AC/DC RECEIVER APPLICATIONS.

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	35	VOLTS
HEATER CURRENT	0.15	AMP.
MAXIMUM PLATE VOLTAGE	117	VOLTS
MAXIMUM SCREEN VOLTAGE	117	VOLTS
MAXIMUM PLATE DISSIPATION	4.5	WATTS
MAXIMUM SCREEN DISSIPATION	1.0	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE	150	VOLTS

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITH NO EXTERNAL SHIELD

GRID TO PLATE	0.4	μμf
INPUT	11	μμf
OUTPUT	6.5	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	110	VOLTS
SCREEN VOLTAGE	110	VOLTS
CONTROL GRID VOLTAGE	-7.5	VOLTS
PEAK AF GRID VOLTAGE	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	40	MA.
ZERO-SIGNAL SCREEN CURRENT (APPROX.)	3	MA.
MAXIMUM SIGNAL PLATE CURRENT	41	MA.
MAXIMUM SIGNAL SCREEN CURRENT (APPROX.)	7	MA.
GRID CIRCUIT RESISTANCE (MAX.):		
FOR FIXED BIAS	0.1	MEGOHM
FOR CATHODE-BIAS	0.5	MEGOHM
LOAD RESISTANCE	2 500	OHMS
PLATE RESISTANCE	14 000	OHMS
TRANSCONDUCTANCE	5 800	μMHOS
MAXIMUM SIGNAL POWER OUTPUT	1.5	WATTS
TOTAL HARMONIC DISTORTION	10	PERCENT

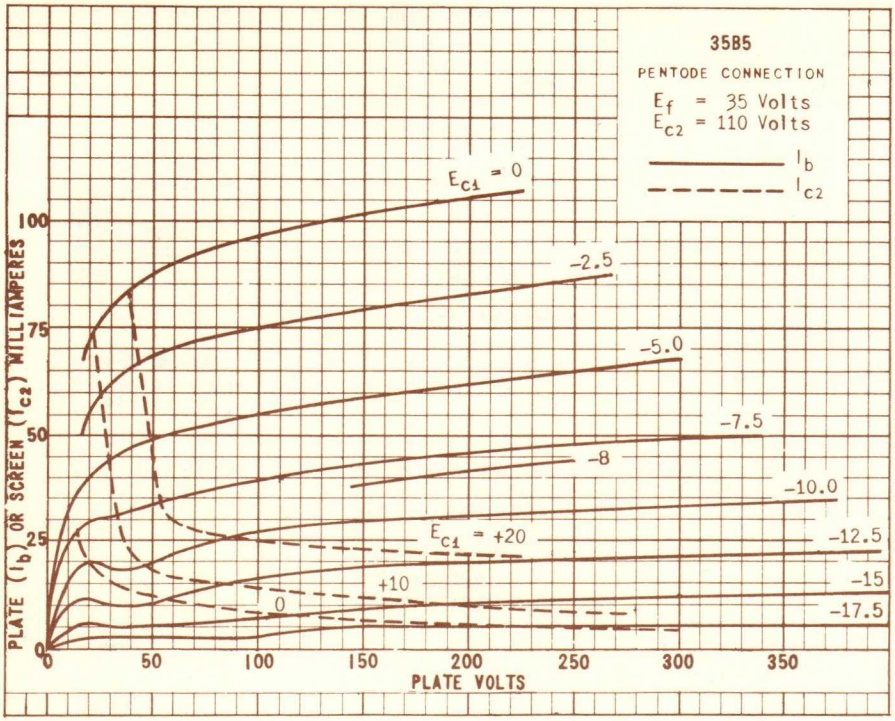
SIMILIAR TYPE REFERENCE: *Within its ratings identical to 35L6GT. Except for heater ratings, somewhat similiar to types 7A5, 50B5.*

PRINTED IN U.S.A.

PLATE 1835
JUNE 2, 1947

COPYRIGHT 1947 BY TUNG-SOL ELECTRIC INC

35B5



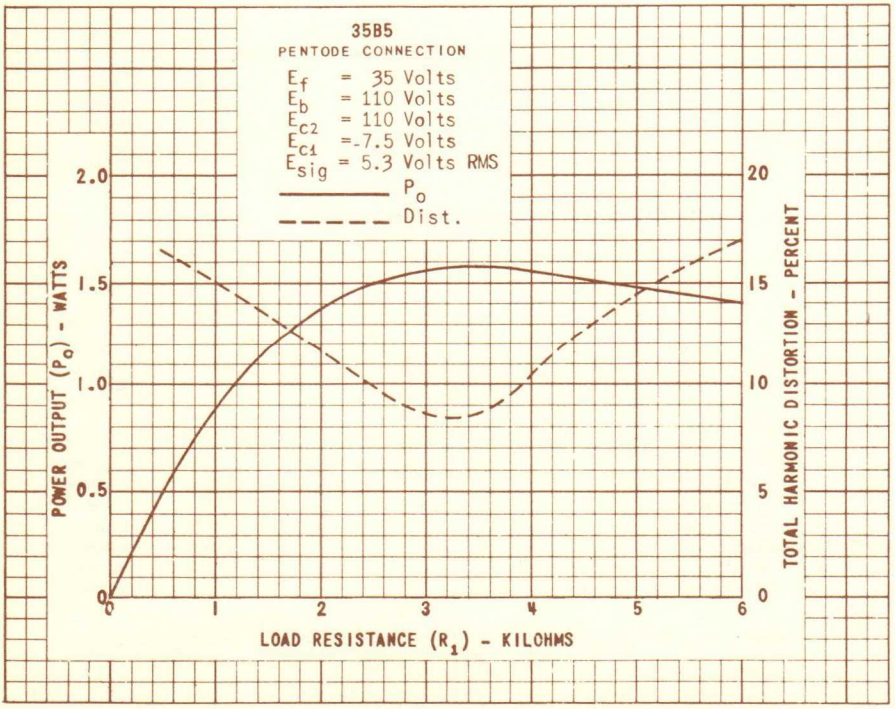


PLATE 1836
JUNE 2, 1947

COPYRIGHT 1947 BY TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION NEWARK NEW JERSEY U.S.A.

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

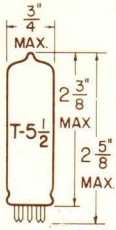
UNIPOTENTIAL CATHODE

HEATEP

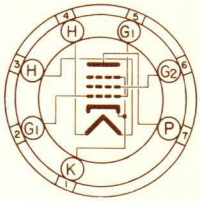
35±10% VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

THE 35C5 IS A BEAM POWER AMPLIFIER IN THE MINIATURE CONSTRUCTION. BECAUSE OF ITS HIGH POWER SENSITIVITY AT LOW PLATE-SCREEN VOLTAGE, IT IS PARTICULARLY ADAPTABLE TO AC/DC RECEIVER APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITH NO EXTERNAL SHIELD

GRID TO PLATE: (G TO P)	0.60	μμf
GRID #1 TO CATHODE & GRID #3, GRID #2 & HEATER	12*	μμf
PLATE TO CATHODE & GRID #3, GRID #2 & HEATER	9*	μμf

RATINGS ←

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	35±10%	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	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	5.2	WATTS
MAXIMUM GRID #2 DISSIPATION	1.1	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.1	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	250	°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

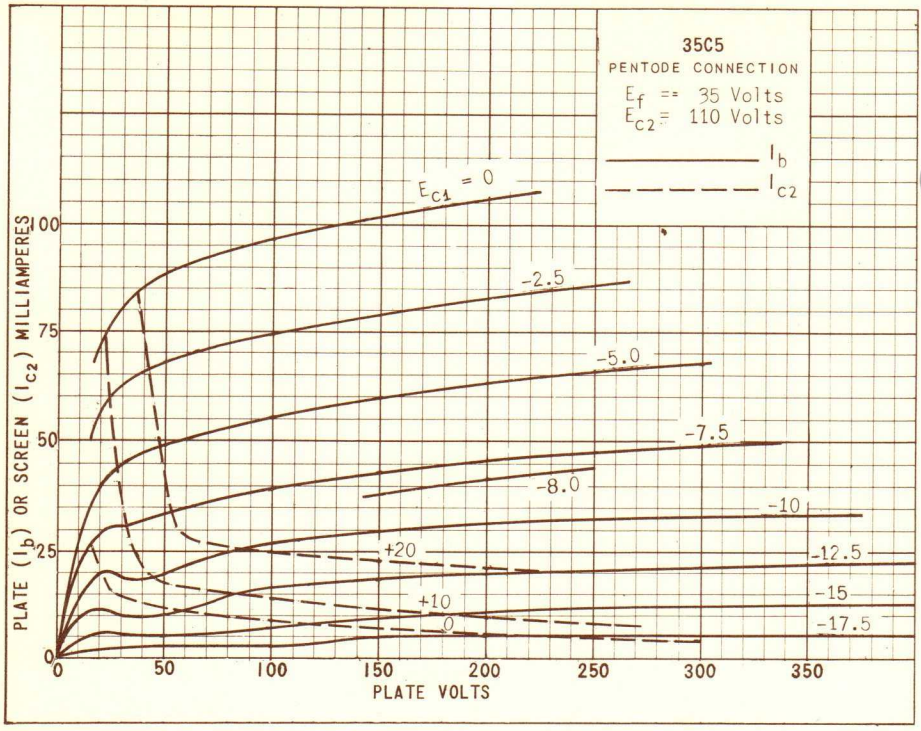
CLASS A_1 AMPLIFIER

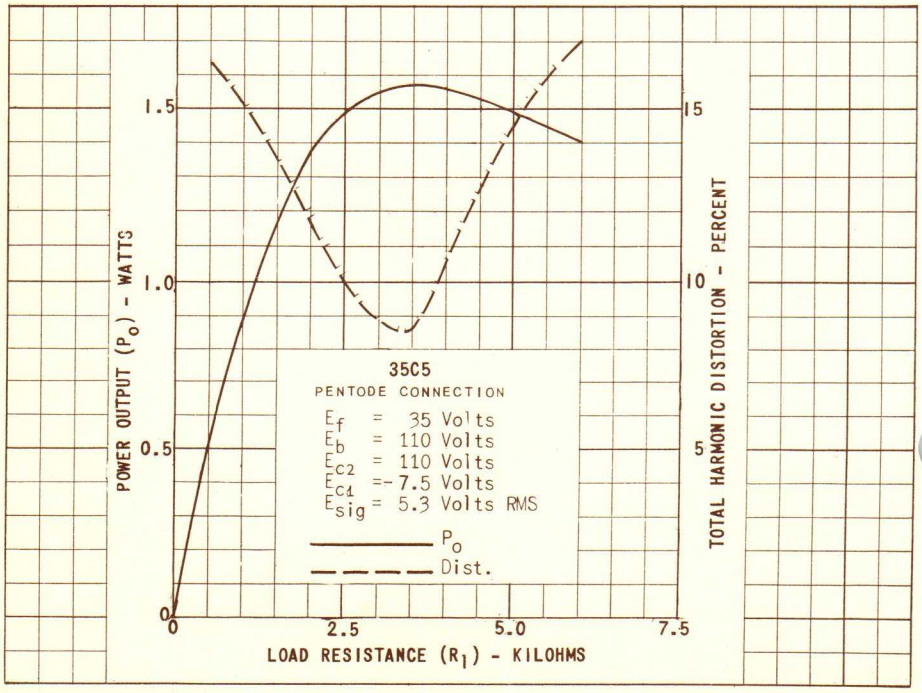
HEATER VOLTAGE	35±10%	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	40	MA.
ZERO-SIGNAL GRID #2 CURRENT (NOMINAL)	3	MA.
MAXIMUM SIGNAL PLATE CURRENT	41	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	7	MA.
TRANSCONDUCTANCE	5 800	MICROMHOS
LOAD RESISTANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.5	WATTS

[A] DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.

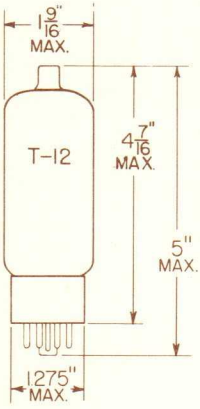
PRINTED IN U.S.A.


35C5
PENTODE CONNECTION
E_f = 35 Volts
E_{c2} = 110 Volts
I_b
I_{c2}
E_{c1} = 0
-2.5
-5.0
-7.5
-8.0
-10
-12.5
-15
-17.5
+20
+10
0
PLATE (I_b) OR SCREEN (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
0
50
100
150
200
250
300
350


35C5
PENTODE CONNECTION
E_f = 35 Volts
E_b = 110 Volts
E_{c2} = 110 Volts
E_{c1} = -7.5 Volts
E_{sig} = 5.3 Volts RMS
P_o
Dist.
POWER OUTPUT (P_o) - WATTS
TOTAL HARMONIC DISTORTION - PERCENT
LOAD RESISTANCE (R_l) - KILOHMS
0
0.5
1.0
1.5
5
10
15
0
2.5
5.0
7.5

TUNG-SOL

BEAM PENTODE



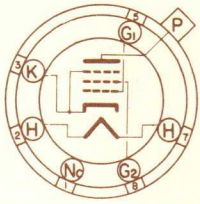
GLASS BULB
SMALL CAP

COATED UNIPOTENTIAL CATHODE

HEATER
35 VOLTS 0.45 AMP.
AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 7 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
SHORT MEDIUM-SHELL
8 PIN OCTAL
5BT

THE 35CD6GA IS A BEAM PENTODE DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN 450 MA. SERIES HEATER OPERATED 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. 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

GRID #1 TO PLATE	1.1	μμf
INPUT	22	μμf
OUTPUT	8.5	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[B]

HEATER VOLTAGE	35	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 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

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[B]

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
HEATER WARM-UP TIME*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	35		VOLTS
HEATER CURRENT	0.45		AMP.
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	

[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.

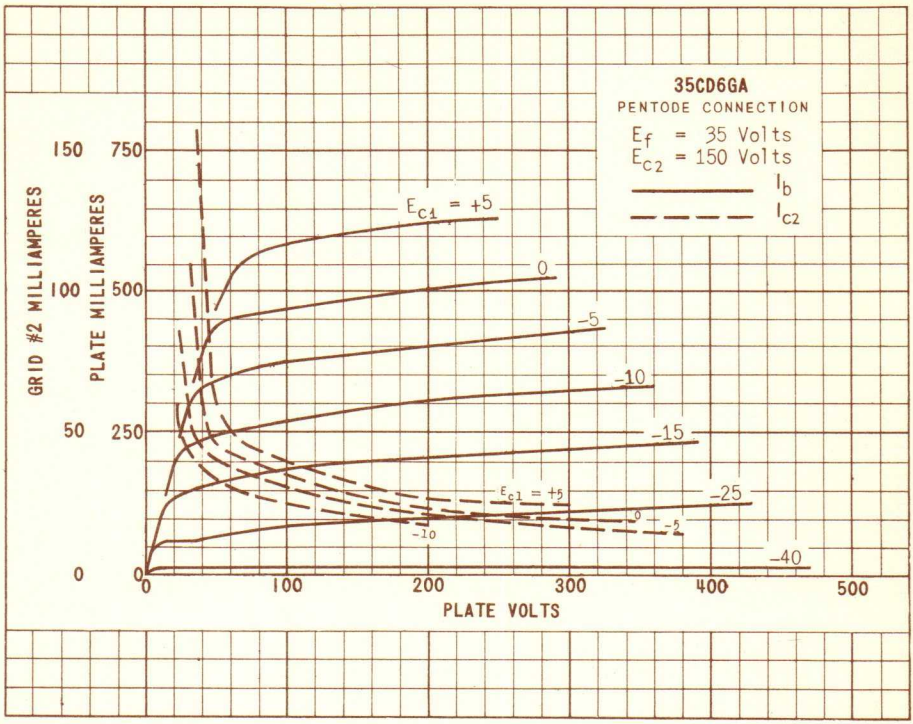
[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

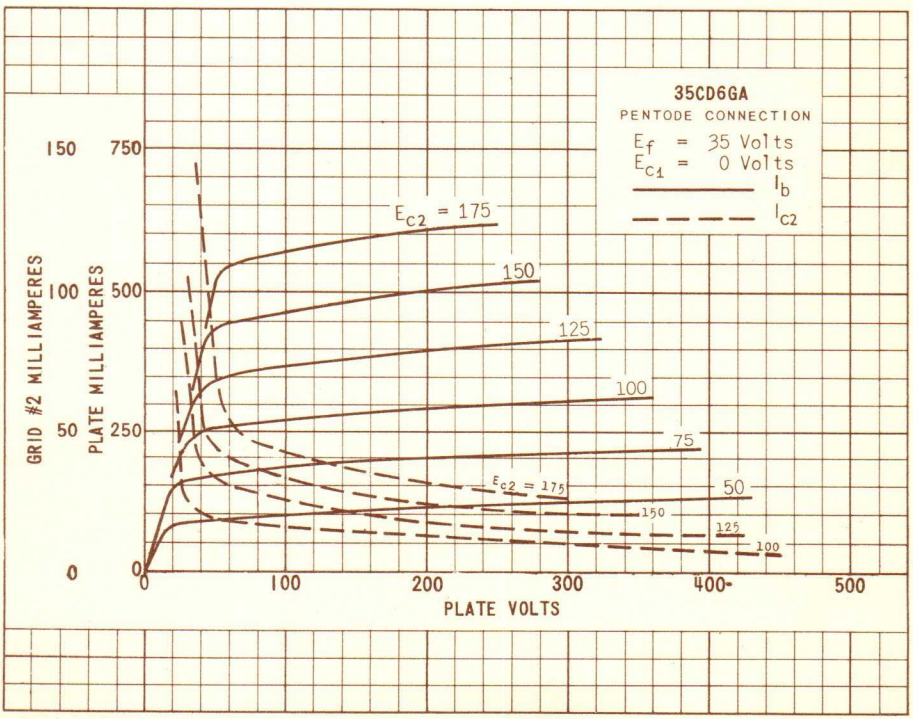
[D] APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

[E] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH $E_b = E_{c2}$ = 175 VOLTS AND E_{c1} = -30 VOLTS.

* 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 35CD6GA is identical to the 6CD6GA.



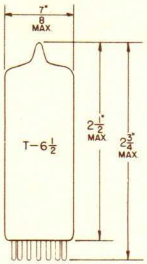


PRINTED IN U. S. A.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

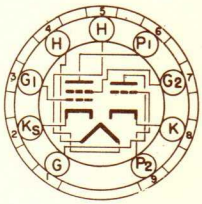
COATED UNIPOTNETIAL CATHODE

HEATER

35 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
9 PIN BASE

THE 35DZ8 IS A HIGH-MU TRIODE, POWER PENTODE IN THE MINIATURE 9 PIN CONSTRUCTION. IT IS DESIGNED AS A TWO STAGE AUDIO FREQUENCY AMPLIFIER WHERE THE PLATE SUPPLY VOLTAGE IS OBTAINED FROM A SINGLE HALF-WAVE RECTIFIER DIRECTLY FROM THE 120 VOLT AC LINE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE			VOLTS
MAXIMUM PLATE VOLTAGE	150	150	VOLTS
MAXIMUM PLATE DISSIPATION	.75	6.5	WATTS
MAXIMUM GRID (2) VOLTAGE	---	135	VOLTS
MAXIMUM GRID (2) DISSIPATION	---	1.5	WATTS
MAXIMUM DC HEATER-CATHODE POTENTIAL	110	110	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	5.0	0.5	MEGOHMS
MAXIMUM CATHODE CURRENT	5.0	60.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200		VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE	PENTODE	
HEATER VOLTAGE	35		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	120 ---	145	VOLTS
GRID #2 VOLTAGE	---	120	VOLTS
GRID #1 VOLTAGE	0	0	VOLTS
CATHODE RESISTOR	1500	180	OHMS
PLATE CURRENT	0.8	45	MA.
GRID #2 CURRENT	---	6	MA.
TRANSCONDUCTANCE	1400	7500	μMHOS
LOAD RESISTANCE	---	2500	OHMS
GRID CUTOFF VOLTAGE FOR 20μA	-2.5	---	VOLTS
AMPLIFICATION FACTOR	100	---	
POWER OUTPUT	---	2.0	WATTS

SIMILAR TYPE REFERENCE: Except for heater ratings the 35DZ8 is identical to the 6DZ8, 9DZ8, 12DZ8 and the 18DZ8.

PRINTED IN U. S. A.

TUNG-SOL

PENTODE

MINIATURE TYPE

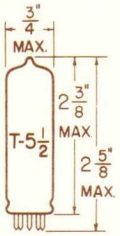
COATED UNIPOTENTIAL CATHODE

HEATER

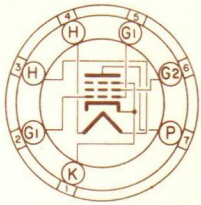
35 VOLTS 0.15 AMP.

AC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE
7CV

THE 35EH5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN AUDIO OUTPUT TUBE. THE 35EH5 IS SIMILAR TO THE 50EH5.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	.65	μμf
INPUT: G1 TO (H+K+G2+G3)	17.0	μμf
OUTPUT: P TO (H+K+G2+G3)	9.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	35	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	5.0	WATTS
MAXIMUM GRID #2 INPUT	1.75	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE (FIXED BIAS)	.1	MEGOHM
MAXIMUM GRID CIRCUIT RESISTANCE (CATHODE BIAS)	.5	MEGOHM
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

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

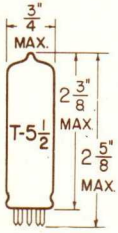
HEATER VOLTAGE	35	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	115	VOLTS
CATHODE RESISTOR	62	OHMS
PEAK H.F. GRID #1 VOLTAGE	3	VOLTS
PLATE RESISTANCE (APPROX.)	14 000	OHMS
TRANSCONDUCTANCE	12 000	μMHOS
ZERO-SIGNAL PLATE CURRENT	32.0	MA.
MAX. SIGNAL PLATE CURRENT	32.0	MA.
ZERO-SIGNAL GRID #2 CURRENT	7.2	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	12.0	MA.
LOAD RESISTANCE	3 000	OHMS
TOTAL DISTORTION	8.0	PERCENT
POWER OUTPUT	1.2	WATTS

PRINTED IN U.S.A.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

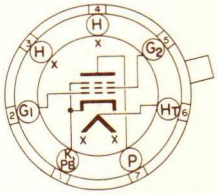
COATED UNIPOTENTIAL CATHODE

HEATER

35±10% VOLTS 0.15 AMP.

AC OR DC[A]

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON

7 PIN BASE

7FZ

THE 35GL6 IS A BEAM PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE IN THE AUDIO-FREQUENCY POWER OUTPUT STAGE OF RADIO RECEIVERS. THE 35GL6 IS TAPPED TO PERMIT OPERATION OF A PANEL LAMP.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	μμf
INPUT	14	μμf
OUTPUT	9.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	35±10%	VOLTS
HEATER-TAP VOLTAGE WHEN PANEL LAMP FAILS, RMS	14	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM SCREEN VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	5.5	WATTS
MAXIMUM SCREEN DISSIPATION	1.1	WATTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
WITH FIXED BIAS	0.1	MEGOHM
WITH CATHODE BIAS	0.5	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	225	°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.

[A] OPERATION WITHOUT PANEL LAMP.

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[A]	35±10%	VOLTS
HEATER-TAP VOLTAGE[A]	7.0	VOLTS
HEATER CURRENT[A]	0.15	AMP.
PLATE VOLTAGE	110	VOLTS
SCREEN VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	−7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS
PLATE RESISTANCE, APPROX.	12 000	OHMS
TRANSCONDUCTANCE	7 500	μMHOS
ZERO-SIGNAL PLATE CURRENT	45	MA.
MAXIMUM-SIGNAL PLATE CURRENT	47	MA.
ZERO-SIGNAL SCREEN CURRENT	3.0	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	9.0	MA.
LOAD RESISTANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION, APPROX.	8	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	1.8	WATTS

THE 35GL6 HAS A HEATER TAP, WHICH MAY BE USED FOR OPERATING A 6.3 VOLT, 150 MILLIAMPERE PANEL LAMP IN EQUIPMENT EMPLOYING SEMICONDUCTOR RECTIFIERS. THE TABLE BELOW GIVES THE REQUIRED VALUES OF PANEL-LAMP SHUNTING RESISTOR FOR VARIOUS RECTIFIER LOAD CURRENTS.

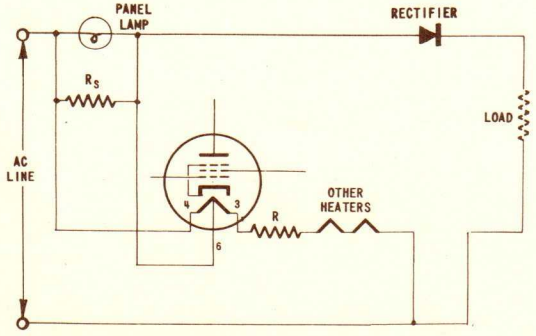
SHUNTING RESISTOR REQUIRED WITH PANEL LAMP #40 OR #47

(SEE TYPICAL CIRCUIT)

HEATER VOLTAGE (PIN 3 TO PIN 4)	32	32	32	32	32	32	32	VOLTS
HEATER-TAP VOLTAGE (PIN 4 TO PIN 6)	5.0	5.4	5.5	5.5	5.5	5.5	5.5	VOLTS
HEATER CURRENT (BETWEEN PINS 3 & 6)	150	150	150	150	150	150	150	MA.
PANEL-LAMP SHUNTING RESISTOR	---	---	370	175	120	88	73	OHMS
RECTIFIER LOAD CURRENT[B]	60	70	80	90	100	110	120	MA.

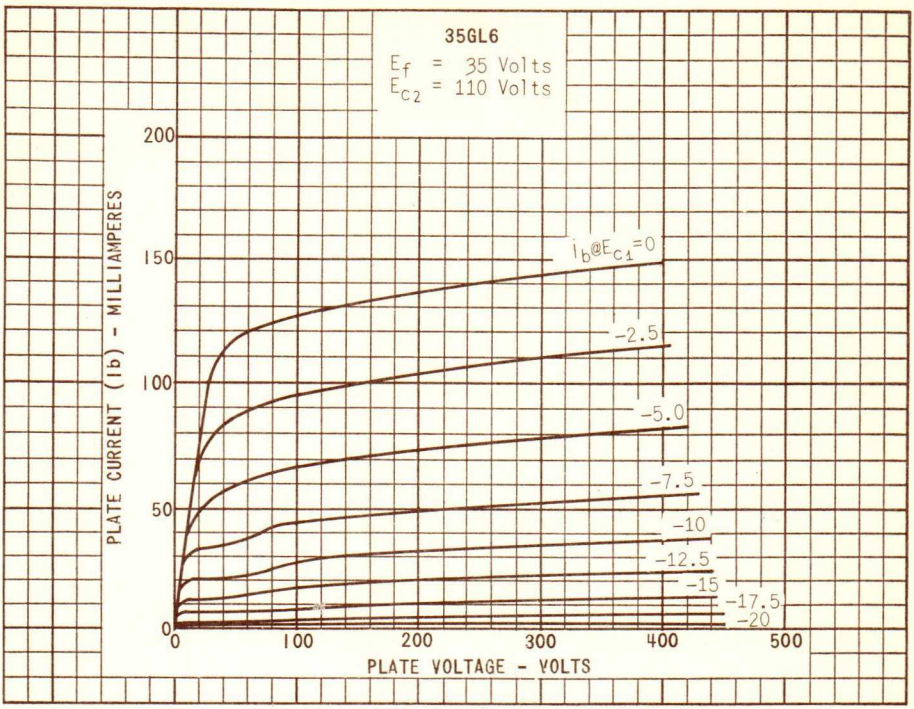
[B] HIGHER LOAD CURRENTS WILL REQUIRE SMALLER VALUES OF PANEL-LAMP SHUNTING RESISTOR. FOR MAXIMUM PANEL-LAMP LIFE, THE SHUNTING RESISTOR SHOULD BE SELECTED TO ALLOW A PANEL-LAMP VOLTAGE OF 5.5 VOLTS WITH FULL RECTIFIER LOAD CURRENT.

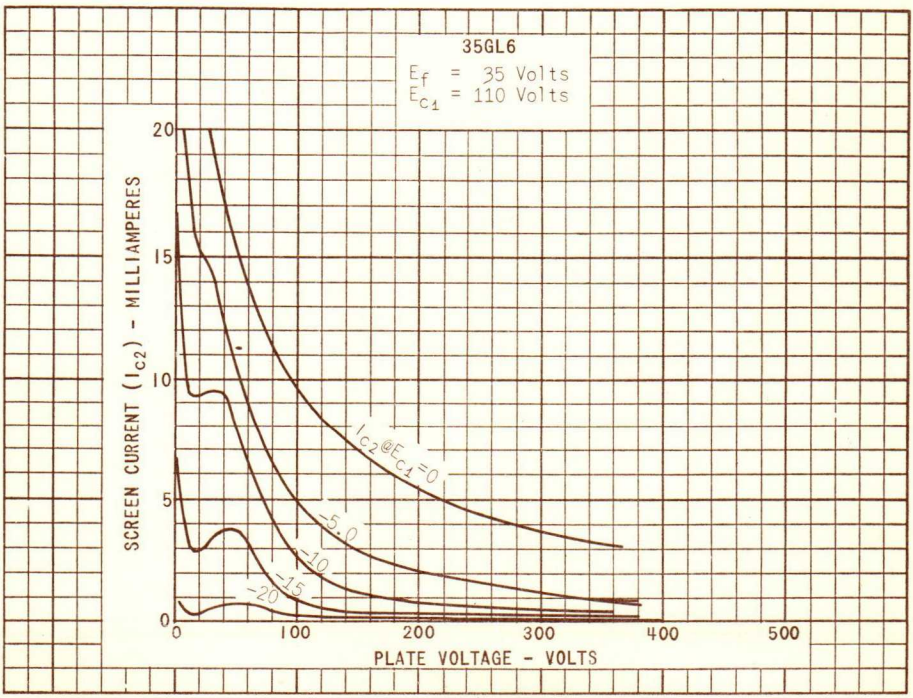
TYPICAL CIRCUIT FOR OPERATION WITH PANEL LAMP



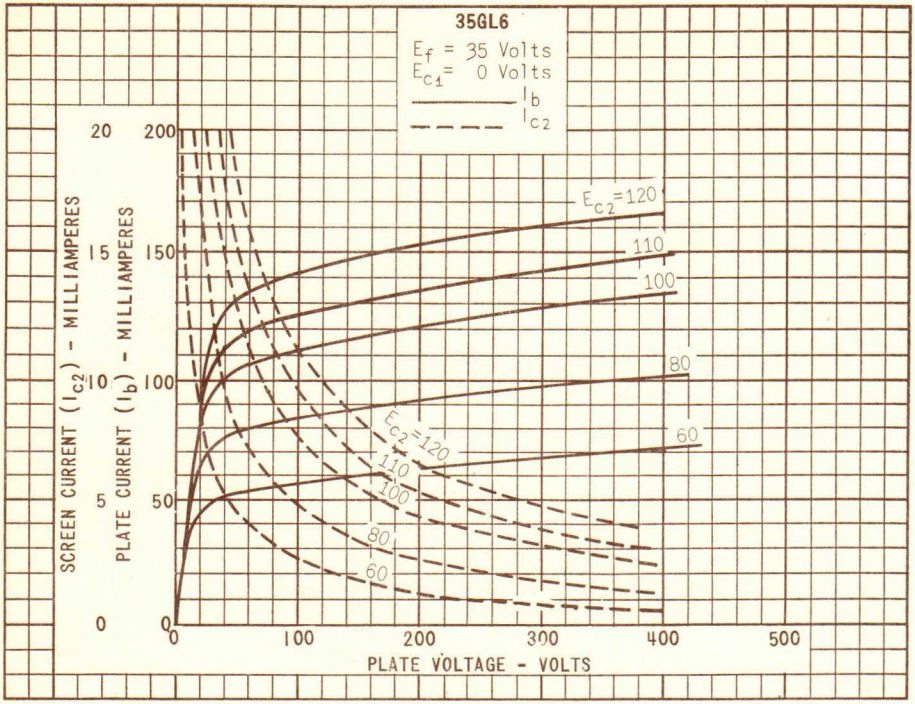
R_S = PANEL-LAMP SHUNTING RESISTOR.

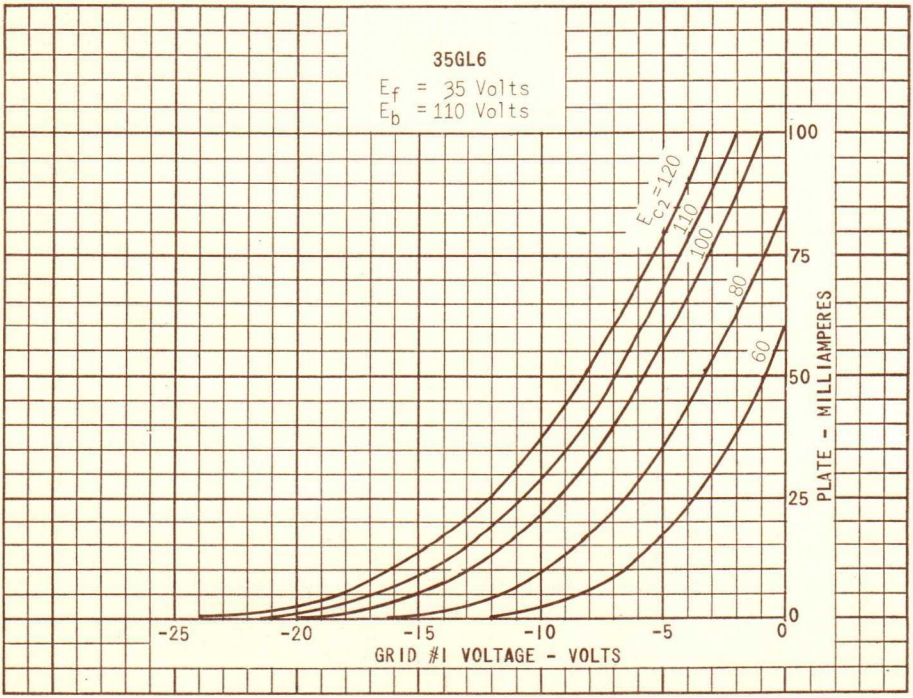
DROP ACROSS R AT 0.15 AMPERE SHOULD EQUAL DEFFERENCE BETWEEN LINE VOLTAGE AND TOTAL OF ALL RATED HEATER VOLTAGES.

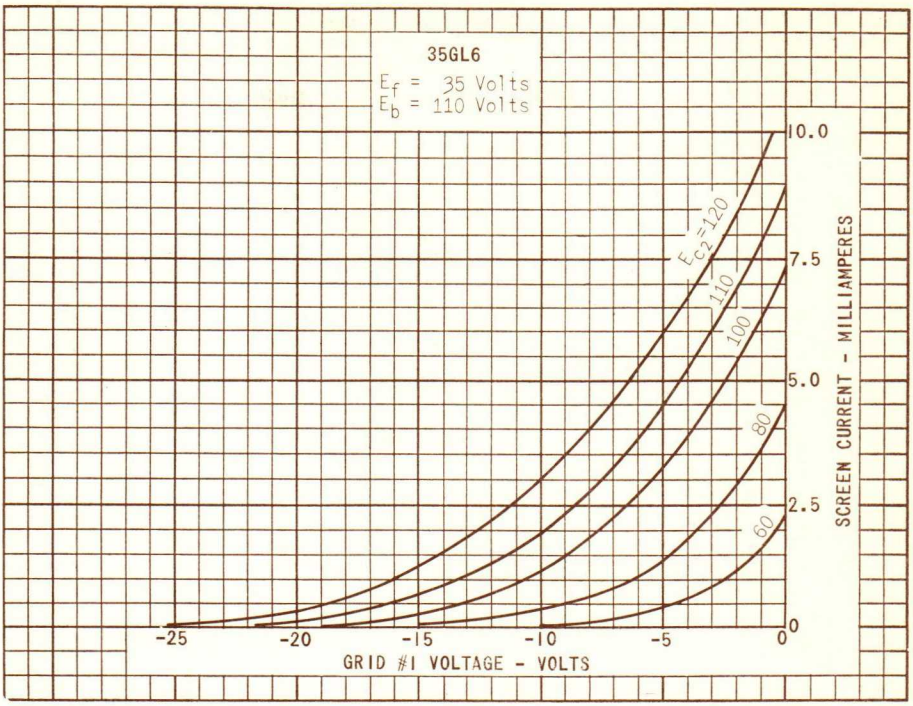


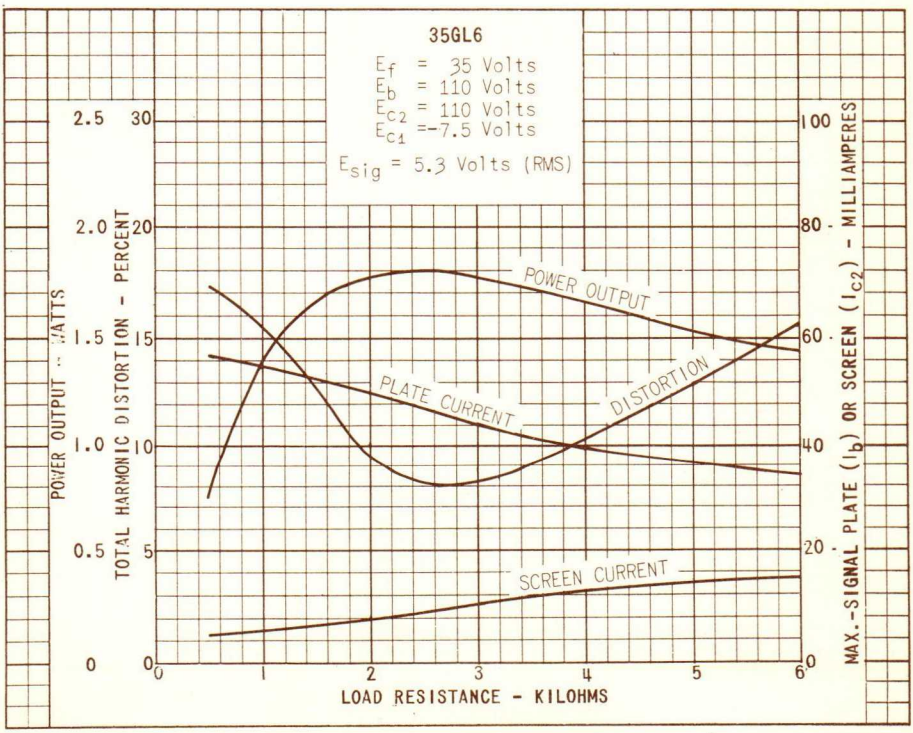


PRINTED IN U.S.A.


35GL6
E_f = 35 Volts
E_{c_1} = 0 Volts
I_b
I_{c_2}
E_{c_2}=120
110
100
80
60
SCREEN CURRENT (I_{c_2}) - MILLIAMPERES
PLATE CURRENT (I_b) - MILLIAMPERES
PLATE VOLTAGE - VOLTS
0
5
10
15
20
50
100
150
200
300
400
500

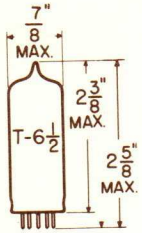

35GL6
E_f = 35 Volts
E_b = 110 Volts
E_{c_2}=120
110
100
80
60
PLATE - MILLIAMPERES
GRID #1 VOLTAGE - VOLTS
-25
-20
-15
-10
-5
0
25
50
75
100


35GL6
E_f = 35 Volts
E_b = 110 Volts
E_{c2}=120
110
100
80
60
10.0
7.5
5.0
2.5
0
SCREEN CURRENT - MILLIAMPERES
-25
-20
-15
-10
-5
0
GRID #1 VOLTAGE - VOLTS


35GL6
E_f = 35 Volts
E_b = 110 Volts
E_{c2} = 110 Volts
E_{c1} =-7.5 Volts
E_{sig} = 5.3 Volts (RMS)
POWER OUTPUT - WATTS
TOTAL HARMONIC DISTORTION - PERCENT
MAX.-SIGNAL PLATE (I_b) OR SCREEN (I_{c2}) - MILLIAMPERES
POWER OUTPUT
PLATE CURRENT
DISTORTION
SCREEN CURRENT
LOAD RESISTANCE - KILOHMS

TUNG-SOL

TRIODE-PENTODE
MINIATURE TYPE

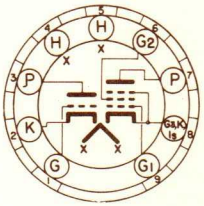


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
35.0 VOLTS 0.15 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9ME

THE 35HB8 IS A TRIODE-PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR AUDIO APPLICATIONS IN STEREO AND MONAURAL SOUND EQUIPMENT. EXCEPT FOR HEATER RATINGS, THE 35HB8 IS IDENTICAL TO THE 18HB8.

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE[A]	35.0		VOLTS
MAXIMUM PLATE VOLTAGE	150	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	135	VOLTS
MAXIMUM CATHODE CURRENT	5	50	MA.
MAXIMUM PLATE DISSIPATION	0.75	6.5	WATTS
MAXIMUM GRID #2 DISSIPATION	---	1.5	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE:			
FIXED BIAS	0.1		MEGOHM
CATHODE BIAS	0.47		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

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	35.0		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	115	115	VOLTS
GRID #2 VOLTAGE	---	115	VOLTS
PEAK AF GRID #1 VOLTAGE	---	6.0	VOLTS
CATHODE RESISTOR	410	150	OHMS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

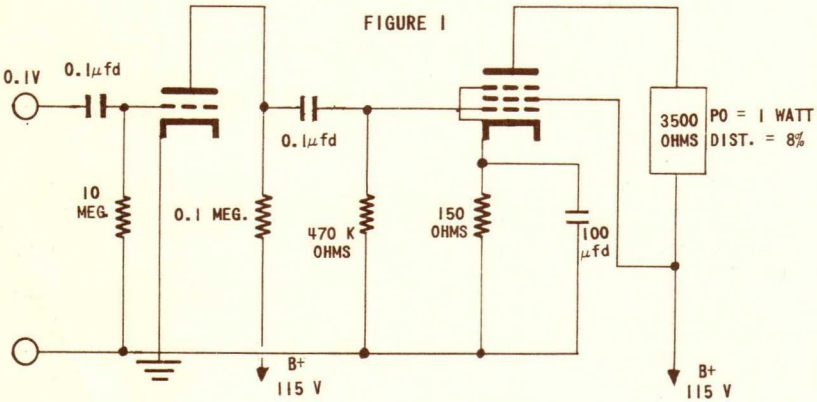
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS (cont'd.)

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE		35.0	VOLTS
HEATER CURRENT		0.15	AMP.
ZERO-SIGNAL PLATE CURRENT	2.5	33	MA.
MAX.-SIGNAL PLATE CURRENT	---	32	MA.
ZERO-SIGNAL GRID #2 CURRENT	---	7.5	MA.
MAX.-SIGNAL GRID #2 CURRENT	---	10	MA.
TRANSCONDUCTANCE	3900	6250	μMHOS
AMPLIFICATION FACTOR	74	---	
LOAD RESISTANCE	---	3500	OHMS
MAX.-SIGNAL POWER OUTPUT	---	1.0	WATT
TOTAL HARMONIC DISTORTION (APPROX.)	---	8	PERCENT

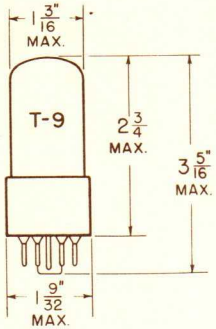
[A] THE HEATER SHOULD BE CONNECTED WITH PIN #4 CLOSEST TO THE GROUND END OF THE HEATER STRING.

FIGURE 1



TUNG-SOL

BEAM PENTODE

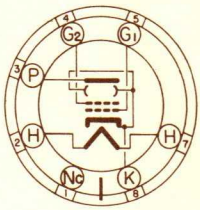


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
35 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
7AC

THE 35L6GT IS A BEAM POWER AMPLIFIER DESIGNED PRIMARILY FOR SERVICE IN THE OUTPUT STAGE OF AC DC RECEIVERS EMPLOYING 150 MA. HEATER TUBES. IT DELIVERS HIGH POWER OUTPUT WITH HIGH POWER SENSITIVITY FROM LOW SUPPLY VOLTAGES.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	35	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM PLATE DISSIPATION	8.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.1	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

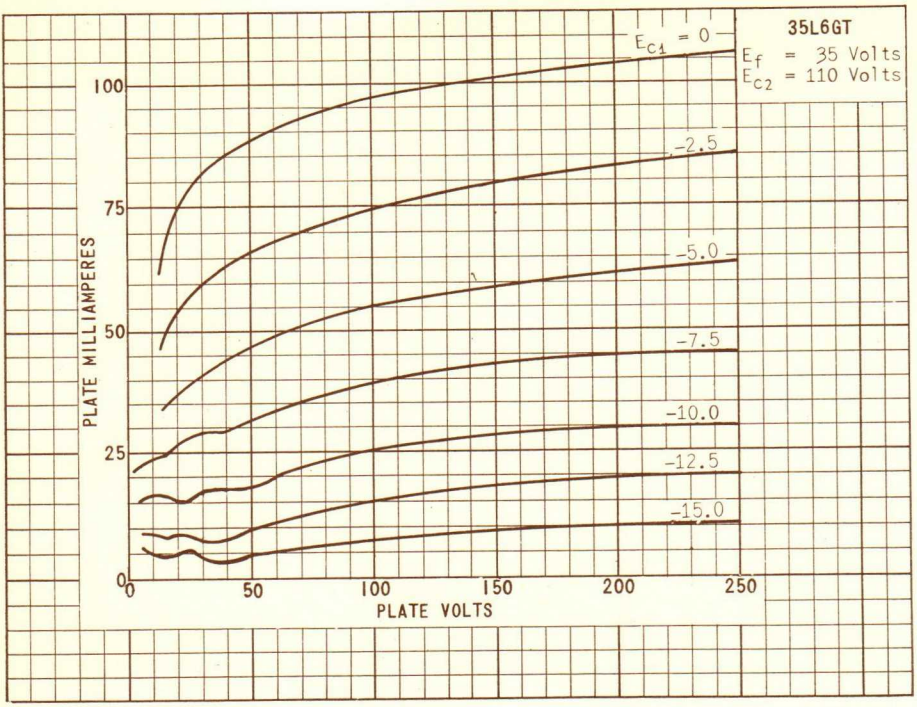
CLASS A_1 AMPLIFIER

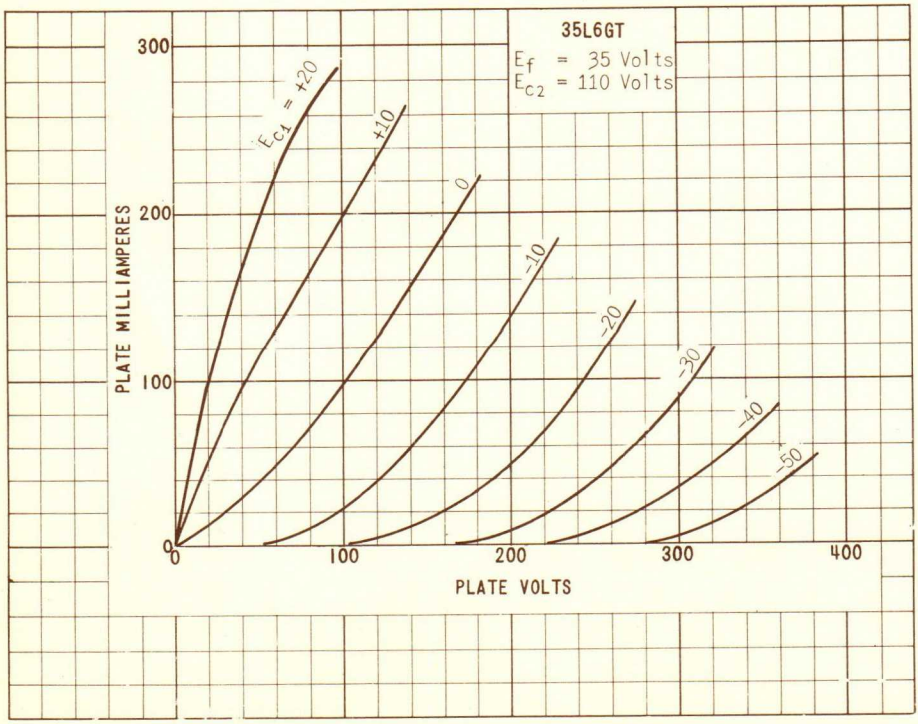
HEATER VOLTAGE	35	35		VOLTS
HEATER CURRENT	150	150		MA.
PLATE VOLTAGE	110	200		VOLTS
GRID #2 VOLTAGE	110	125		VOLTS
GRID #1 VOLTAGE	-7.5	0		VOLTS
CATHODE BIAS RESISTOR	0	180	←	OHMS
PEAK AF SIGNAL VOLTAGE	7.5	8		VOLTS
PLATE RESISTANCE (APPROX.)	14 000	34 000		OHMS
TRANSCONDUCTANCE	5 800	6 100		µMHOS
ZERO-SIGNAL PLATE CURRENT	40	43		MA.
ZERO-SIGNAL GRID #2 CURRENT	3	2		MA.
MAXIMUM-SIGNAL PLATE CURRENT	41	43		MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	7	5.5		MA.
LOAD RESISTANCE	2 500	5 000		OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10		PERCENT
POWER OUTPUT	1.5	3		WATTS

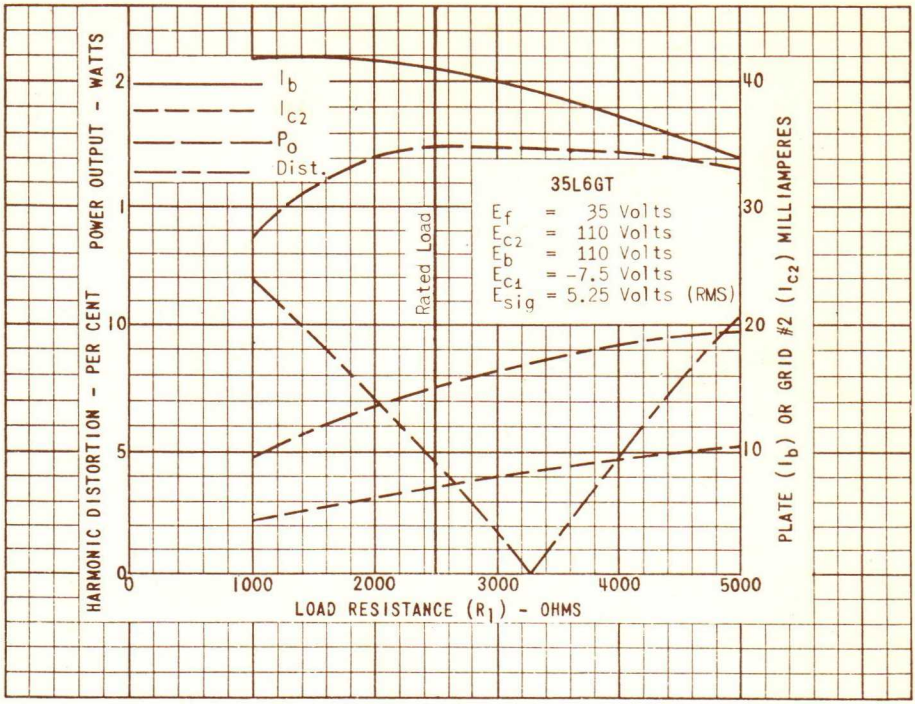
→ INDICATES A CHANGE.

PRINTED IN U.S.A.

35L6GT


35L6GT
E_f = 35 Volts
E_{c2} = 110 Volts
E_{c1} = 0
-2.5
-5.0
-7.5
-10.0
-12.5
-15.0
PLATE MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
0
50
100
150
200
250


35L6GT
E_f = 35 Volts
E_{c2} = 110 Volts
E_{c1} = +20
+10
0
-10
-20
-30
-40
-50
PLATE MILLIAMPERES
PLATE VOLTS
0
100
200
300
0
100
200
300
400



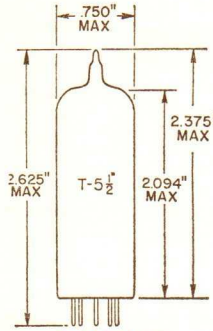
PRINTED IN U. S. A.

PLATE 2158
MAR. 1, 1949

COPYRIGHT 1949 BY TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

TUNG-SOL

DIODE
MINIATURE TYPE



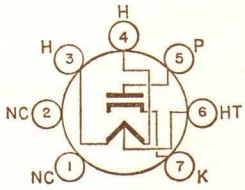
GLASS BULB

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

COATED UNIPTOENTIAL CATHODE

HALF-WAVE RECTIFIER

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5BQ

THE 35W4 IS A MINIATURE CATHODE TYPE, HALF-WAVE RECTIFIER DESIGNED FOR SERVICE IN AC/DC RECEIVERS. THE TAPPED HEATER PERMITS OPERATION OF A PANEL LAMP. IT IS RECOMMENDED THAT THE PLATE CURRENT PASS THROUGH THE PANEL LAMP AND THE TAPPED SECTION OF THE HEATER. THIS IS ACCOMPLISHED BY CONNECTING PLATE TO THE HEATER TAP.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	35 VOLTS	150	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION (WITHOUT PANEL LAMP)		35±3.5	VOLTS
(WITH #40 OR#47 PANEL LAMP)		32±3.2	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		360	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		360	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	WITHOUT PANEL LAMP	WITH #40 OR #47 PANEL LAMP	
HEATER VOLTAGE:			
ENTIRE HEATER (PINS #3 & #4)	35	32	VOLTS
PANEL LAMP SECTION (PINS #4 & #6)	7.5	5.5	VOLTS
HEATER CURRENT:			
BETWEEN PINS #3 & #4	150	---	MA.
BETWEEN PINS #3 & #6	---	150	MA.
PEAK INVERSE VOLTAGE	→360		VOLTS
STEADY-STATE PEAK PLATE CURRENT	→660		MA.
PANEL LAMP SECTION VOLTAGE WHEN LAMP FAILS	→ 17		VOLTS
STEADY STATE DC OUTPUT CURRENT:			
WITH PANEL LAMP AND NO SHUNTING RESISTOR	→ 66		MA.
WITH PANEL LAMP AND SHUNTING RESISTOR	→100		MA.
WITHOUT PANEL LAMP	→110		MA.
VALUE OF PANEL LAMP SHUNTING RESISTOR:			
FOR DC OUTPUT CURRENT OF 70 MA.	800		OHMS
FOR DC OUTPUT CURRENT OF 80 MA.	400		OHMS
FOR DC OUTPUT CURRENT OF 90 MA.	250		OHMS
TUBE VOLTAGE DROP MEASURED WITH TUBE CONDUCTING 200 MA. DC PLATE CURRENT	18		VOLTS

→ INDICATES A CHANGE.

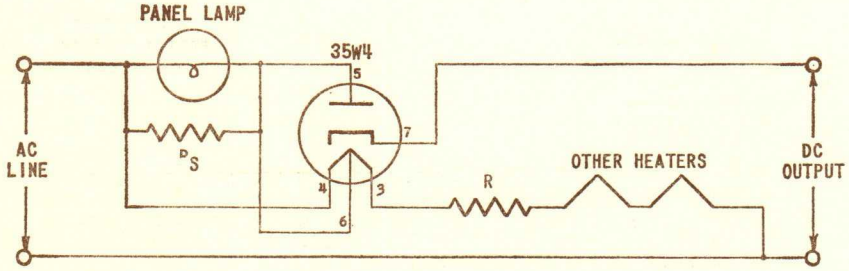
PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

WITH #40 OR #47 PANEL LAMP IN CIRCUIT WITH CAPACITOR INPUT TO FILTER

HEATER VOLTAGE	32	32	32	32	VOLTS
HEATER CURRENT	150	150	150	150	MA.
AC PLATE SUPPLY VOLTAGE	117	117	117	117	VOLTS
FILTER INPUT CAPACITOR	40	40	40	40	µF
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	15	15	15	15	OHMS
PANEL-LAMP SHUNTING RESISTOR	---	300	150	100	OHMS
DC OUTPUT CURRENT	60	70	80	90	MA.

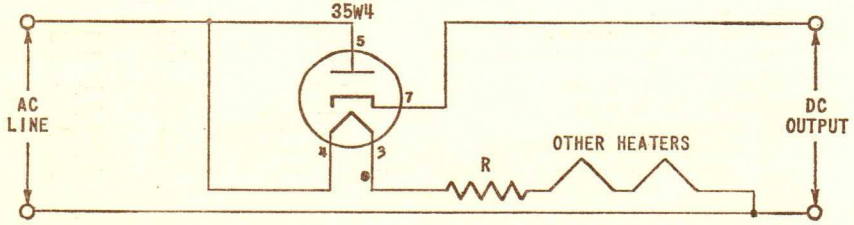


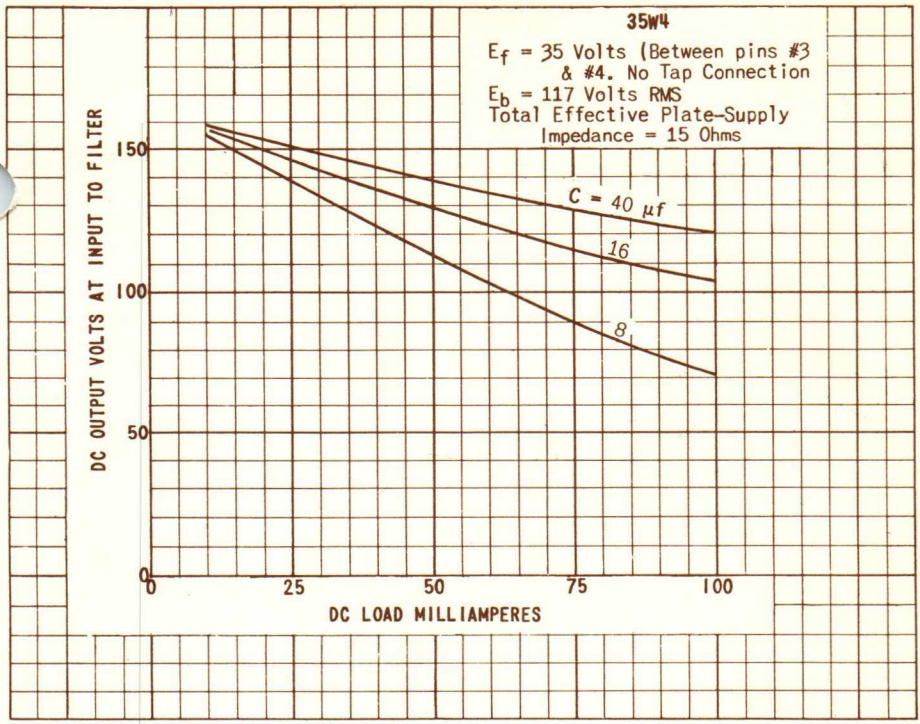
DROP ACROSS R AND ALL HEATERS (WITH PANEL LAMP) SHOULD EQUAL 117 VOLTS AT 0.15 AMPERE. R_s = SHUNTING RESISTOR REQUIRED WHEN DC OUTPUT CURRENT EXCEEDS 60 MILLIAMPERES.

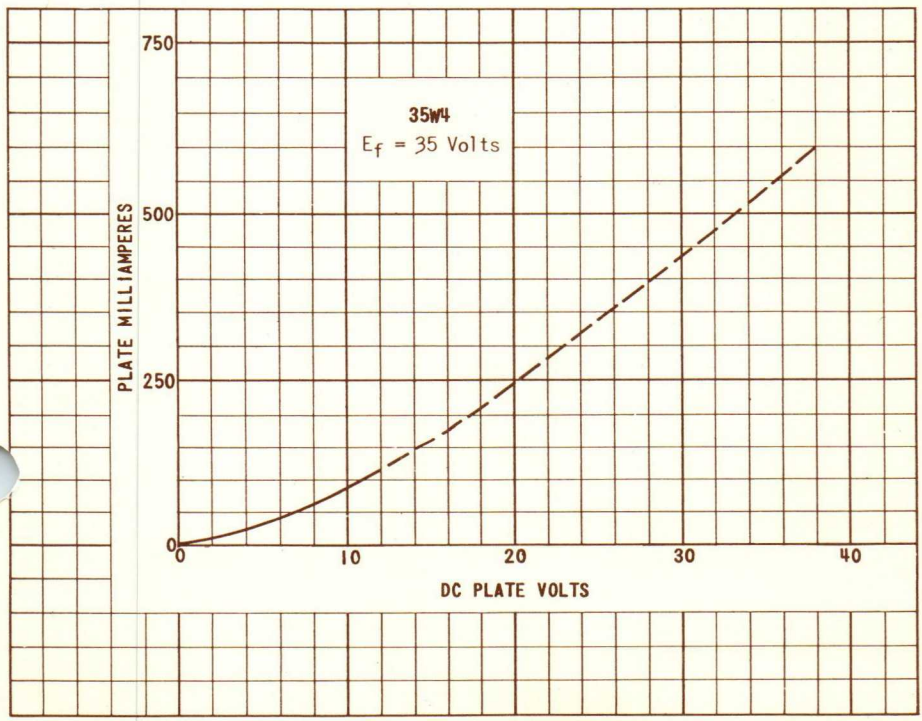
HALF-WAVE RECTIFIER-CAPACITOR INPUT TO FILTER

WITHOUT PANEL LAMP

HEATER VOLTAGE	35	VOLTS
HEATER CURRENT	150	MA.
AC PLATE SUPPLY VOLTAGE RMS	117	VOLTS
FILTER INPUT CAPACITOR	15	µf
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	15	OHMS
DC OUTPUT VOLTAGE AT INPUT TO FILTER (APPROX.)		
AT 50 MA. (HALF LOAD)	135	VOLTS
AT 100 MA. (FULL LOAD)	120	VOLTS
DC OUTPUT CURRENT	100	MA.
VOLTAGE REGULATION (APPROX.) FROM HALF-LOAD TO FULL LOAD	20	VOLTS







PRINTED IN U.S.A.

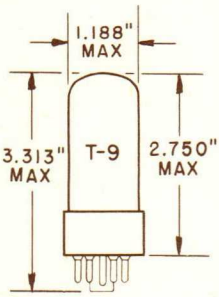
PLATE 2213
JUNE 1, 1949

COPYRIGHT 1949 BY TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION NEWARK, NEW JERSEY U.S.A.

TUNG-SOL

DIODE

MINIATURE TYPE



GLASS BULB

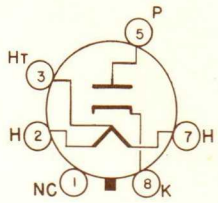
INTERMEDIATE SHELL
6 PIN OCTAL B6-8
OUTLINE 9-11
SHORT INTERMEDIATE SHELL
6 PIN OCTAL B6-60
OUTLINE 9-41

FOR USE AS A POWER

RECTIFIER IN AC/DC RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 6AD

THE HEATER SECTION
CONNECTED BETWEEN
PINS 2 & 3 IS DESIGNED
AS SHUNT FOR PILOT LIGHT

THE 35Z5GT IS DESIGNED FOR USE AS A RECTIFIER IN AC-DC RECEIVERS. IT FEATURES A 35 VOLT 150 MA. HEATER HAVING A TAP BROUGHT OUT SO THAT WITH PROPER EXTERNAL CONNECTIONS, THE SHORT SECTION OF THE HEATER SERVES AS A BALLAST RESISTOR FOR A PANEL LAMP. IT IS RECOMMENDED THAT THE PLATE CURRENT OF THE RECTIFIER BE PASSED THROUGH THE PANEL LAMP IN PARALLEL WITH THE SHORT SECTION OF THE HEATER, WHICH IS ACCOMPLISHED BY CONNECTING THE PLATE OF THE RECTIFIER TO THE TAP ON THE HEATER.

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS				
PINS 2 AND 7	35	VOLTS	150	MA.
VOLTAGE BETWEEN PINS 2 AND 3			7.5	VOLTS
LIMITS OF SUPPLIED CURRENT			150±10	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			350	VOLTS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AC PLATE VOLTAGE, RMS	235	VOLTS
PEAK INVERSE VOLTAGE	700	VOLTS
STEADY STATE PEAK PLATE CURRENT	600	MA.
PANEL LAMP SECTION RMS, VOLTAGE WHEN PANEL LAMP FAILS	15	VOLTS
STEADY-STATE DC OUTPUT CURRENT:		
WITH PANEL LAMP AND NO SHUNTING RESISTOR	60	MA.
WITH PANEL LAMP AND SHUNTING RESISTOR	90	MA.
WITHOUT PANEL LAMP	100	MA.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS - CONT'D.

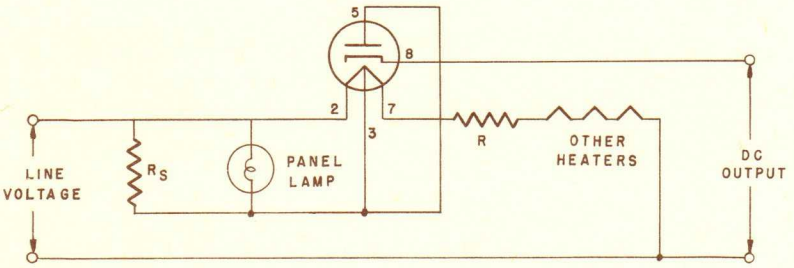
DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

VALUE OF PANEL LAMP SHUNTING RESISTOR:		
FOR DC OUTPUT CURRENT OF 70 MA.	800	OHMS
FOR DC OUTPUT CURRENT OF 80 MA.	400	OHMS
FOR DC OUTPUT CURRENT OF 90 MA.	250	OHMS
TUBE VOLTAGE DROP WITH TUBE CONDUCTING 200 MA DC PLATE CURRENT	18	VOLTS

TYPICAL OPERATING CHARACTERISTICS

WITH #40 OR #47 PANEL LAMP IN CIRCUIT WITH CAPACITOR INPUT TO FILTER

AC PLATE SUPPLY VOLTAGE, RMS	117	117	117	117	235	VOLTS
FILTER INPUT CAPACITOR	40	40	40	40	40	μf
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	15	15	15	15	100	OHMS
PANEL LAMP SHUNTING RESISTOR	-----	300	150	100	-----	OHMS
DC OUTPUT CURRENT	60	70	80	90	60	MA.

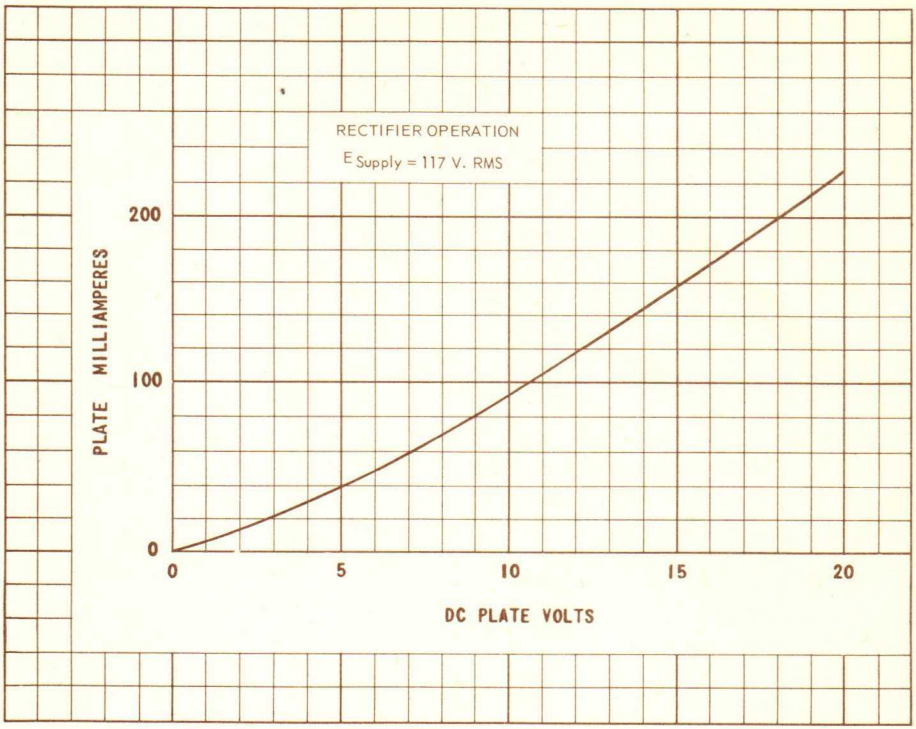


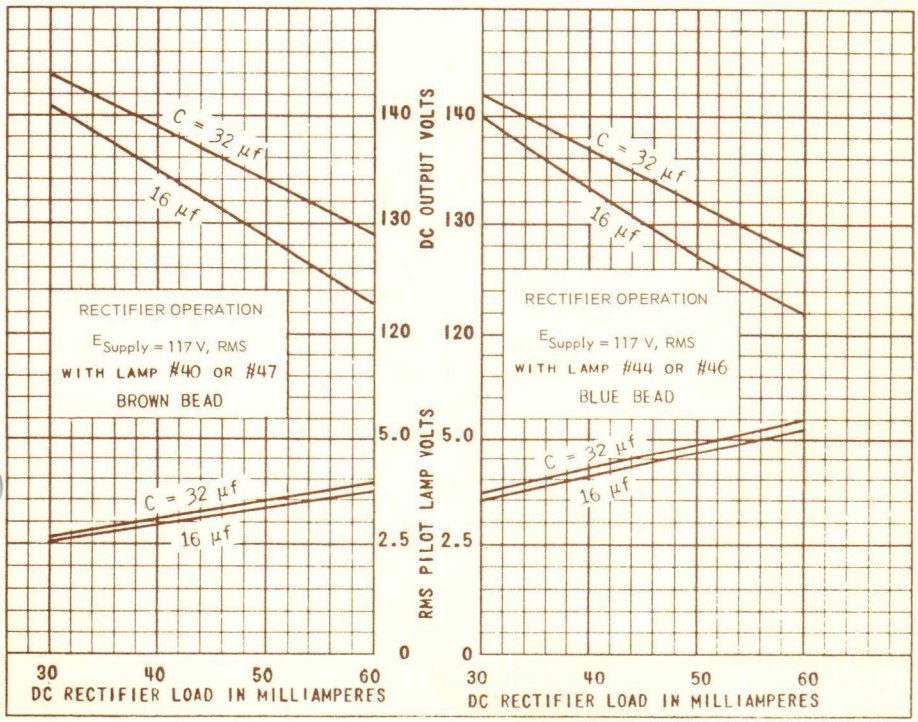
DROP ACROSS R AND ALL HEATERS (WITH PANEL LAMP) SHOULD EQUAL THE LINE VOLTAGE AT 0.15 AMPERE.
R_S = SHUNTING RESISTOR REQUIRED WHEN DC OUTPUT CURRENT EXCEEDS 60 MILLIAMPERES.

HALF-WAVE RECTIFIER - CAPACITOR INPUT TO FILTER

WITHOUT PANEL LAMP

AC PLATE SUPPLY VOLTAGE, RMS	117	235	VOLTS
FILTER INPUT CAPACITOR	40	40	μf
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	15	100	OHMS
DC OUTPUT VOLTAGE AT INPUT TO FILTER (APPROX.):			
AT 50 MA. (HALF LOAD)	140	280	VOLTS
AT 100 MA (FULL LOAD)	120	235	VOLTS
DIFFERENCE (VOLTAGE REGULATION)	20	45	VOLTS
PERCENTAGE REGULATION	14	16	PERCENT
DC OUTPUT CURRENT	100	100	MA.



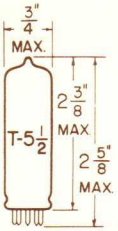


PRINTED IN U. S. A.

TUNG-SOL

HALF-WAVE RECTIFIER

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

36 VOLTS[A] 32 VOLTS[B]

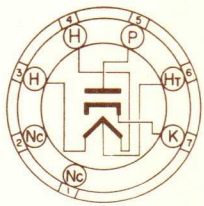
0.10 AMP.

AC OR DC

ANY MOUNTING POSITION

[A] BETWEEN PINS 3 AND 4.

[B] BETWEEN PINS 3 AND 6.



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

5BQ

THE 36AM3 IS A HALF-WAVE RECTIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS A 100 MA. HEATER AND A HEATER TAP-SECTION THAT IS DESIGNED FOR OPERATION IN SERIES WITH THE PLATE SUPPLY INPUT, SERVING AS A CURRENT LIMITING DEVICE.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[D]

HEATER VOLTAGE[C] (BETWEEN PINS 3 & 4)	36	VOLTS
HEATER VOLTAGE (BETWEEN PINS 3 & 6)	32	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	365	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	530	MA.
MAXIMUM STEADY-STATE DC OUTPUT CURRENT	82	MA.
EFFECTIVE PLATE SUPPLY RESISTANCE	SEE NOTE E	
MAXIMUM HEATER-CATHODE VOLTAGE[C]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	350	VOLTS
TOTAL DC AND PEAK	350	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK (ABS. VALUE)	200	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

(SEE DIAGRAM)

HALF WAVE RECTIFIER - CAPACITOR INPUT

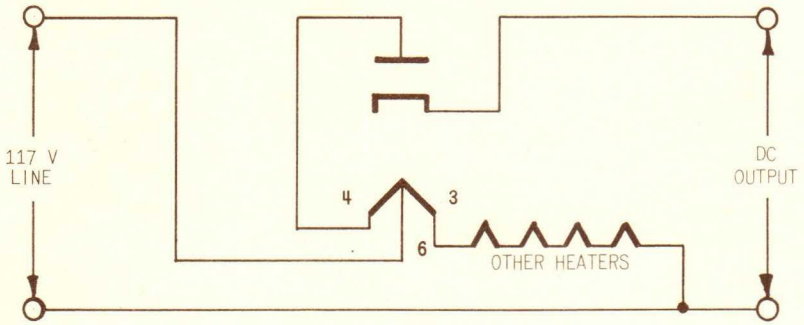
HEATER VOLTAGE[C] (BETWEEN PINS 3 & 4)	36	VOLTS
HEATER VOLTAGE (BETWEEN PINS 3 & 6)	32	VOLTS
HEATER CURRENT	0.10	AMP.
AC PLATE SUPPLY VOLTAGE (RMS)	117	VOLTS
DC OUTPUT CURRENT	75	MA.
DC OUTPUT VOLTAGE	105	VOLTS
EFFECTIVE PLATE SUPPLY RESISTANCE	SEE NOTE E	
INPUT CAPACITOR	40	μf
TUBE VOLTAGE DROP FOR I_b = 150 MA.	20	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

36AM3



TYPICAL APPLICATION

NOTES

[C] THE HEATER IS DESIGNED TO BE USED IN THE CONNECTION SHOWN IN THE DIAGRAM. THE SECTION BETWEEN PINS 4 AND 6 IS INTENDED FOR USE AS A LIMITING RESISTANCE IN THE RECTIFIER PLATE CIRCUIT. THE TUBE IS NOT DESIGNED FOR USE WITH A PILOT LAMP WHERE THE HEATER SECTION BETWEEN PINS 4 AND 6 IS USED AS A PILOT LAMP SHUNT.

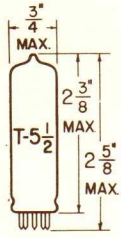
[D] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE 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] THE TUBE SHOULD BE OPERATED WITH THE HEATER SECTION BETWEEN PIN 4 AND 6 IN SERIES WITH THE PLATE CIRCUIT. WITH 82 MADC OUTPUT CURRENT THE RESISTANCE OF THIS SECTION IS APPROXIMATELY 45 OHMS.

TUNG-SOL

HALF-WAVE VACUUM RECTIFIER

MINIATURE TYPE



GLASS BULB

SMALL-BUTTON MINIATURE
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-3

UNIPOTENTIAL CATHODE

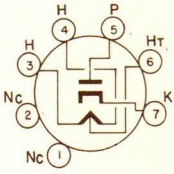
HEATER NOMINAL

36 VOLTS 32 VOLTS

0.10±.006 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 5BQ

THE 36AM3A IS A HALF-WAVE VACUUM RECTIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN AC/DC RECEIVERS. FEATURES OF THE TUBE ARE A LOW TUBE-VOLTAGE DROP AND A 100-MILLIAMPERE HEATER.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HALF-WAVE RECTIFIER

HEATER CURRENT[A]	0.10±.006	AMP.
HEATER VOLTAGE (ENTIRE HEATER - PINS 3 & 4)	36	VOLTS
HEATER VOLTAGE (TAP-SECTION PINS 3 & 6)	32	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	365	VOLTS
MAXIMUM PEAK PLATE CURRENT	530	MA.
MAXIMUM DC OUTPUT CURRENT	82	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	350	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[B]	VOLTS

TYPICAL OPERATION IN ACCOMPANYING HALF-WAVE CIRCUIT

CAPACITOR-INPUT FILTER

AC PLATE-SUPPLY VOLTAGE, RMS	120	VOLTS
FILTER-INPUT CAPACITOR	40	μf
TOTAL EFFECTIVE PLATE-SUPPLY RESISTANCE	A	OHMS
DC OUTPUT CURRENT	75	MA.
DC OUTPUT VOLTAGE AT INPUT TO FILTER (APPROX.)	118	VOLTS
TUBE VOLTAGE DROP FOR PLATE MA. = 150	16	VOLTS

[A] THE HEATER OF THE 36AM3A IS DESIGNED SO THAT THE HEATER SECTION BETWEEN PIN 4 & 6 IS USED AS A LIMITING RESISTANCE IN THE RECTIFIER PLATE CIRCUIT. (SEE TYPICAL HALF-WAVE CIRCUIT).

THIS TYPE IS NOT DESIGNED FOR USE WITH A PANEL LAMP WHERE THE HEATER SECTION BETWEEN PINS 4 & 6 IS USED AS A PANEL-LAMP SHUNT.

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

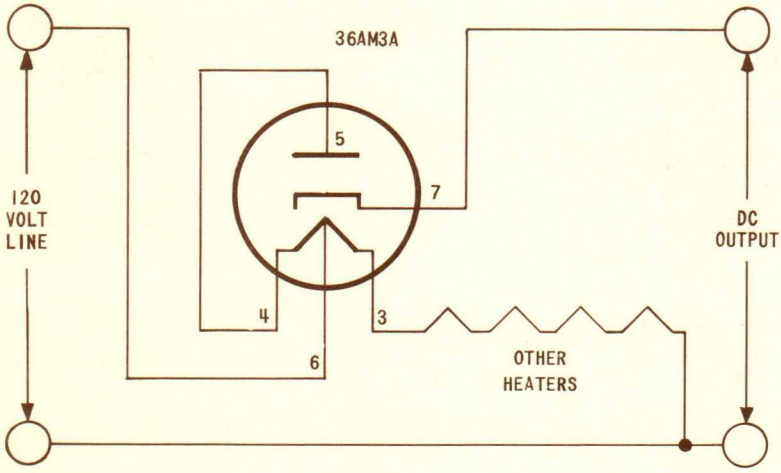
CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

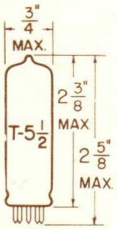
TYPICAL HALF-WAVE CIRCUIT



TUNG-SOL

RECTIFIER

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

HEATER

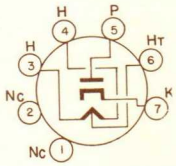
36 VOLTS[A] 32 VOLTS[B,C]

0.10 AMP.

ANY MOUNTING POSITION

[A] PINS 3 AND 4

[B] PINS 3 AND 6



BOTTOM VIEW

BASING DIAGRAM
JEDEC 5BQ

THE 36AM3B IS A HALF-WAVE RECTIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. FEATURES OF THE TUBE ARE A 100 MA. HEATER WITH 20 SECOND WARM-UP TIME. IT HAS A HEATER TAP SECTION (PINS 4 & 6) THAT MAY BE USED AS A LIMITING RESISTANCE IN THE RECTIFIER PLATE CIRCUIT OR AS A PANEL LAMP SHUNT.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE (PINS 3 & 4)	36	VOLTS
HEATER VOLTAGE (PINS 3 & 6)	32	VOLTS
HEATER CURRENT (PINS 3 & 6)[D]	.100±.006	AMP.
MAXIMUM INVERSE VOLTAGE	365	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT	580	MA.
MAXIMUM VOLTAGE (RMS) OF PANEL LAMP SECTION		
WHEN PANEL LAMP FAILS	10	VOLTS
MAXIMUM DC OUTPUT CURRENT		
WITHOUT PANEL LAMP PER CIRCUIT 1	82	MA.
WITH PANLE LAMP PER CIRCUIT 2 AND NO SHUNTING RESISTOR	68	MA.
WITH PANEL LAMP PER CIRCUIT 2 AND SHUNTING RESISTOR	82	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	350	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (PINS 3 & 4)[E]	20	SECONDS

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP WITH PLATE CURRENT = 150 MA.	16	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATION

HALF-WAVE RECTIFIER - CAPACITOR INPUT TO FILTER[F]

WITH PANEL LAMP CM8-54 - CIRCUIT 2

HEATER TAP VOLTAGE (PINS 4 & 6)	3.7	4.0	4.0	4.0	4.0	VOLTS
AC PLATE SUPPLY VOLTAGE, RMS	120	120	120	120	120	VOLTS
EFFECTIVE PLATE SUPPLY RESISTANCE (APPROX.)	20	20	20	20	20	OHMS
PANEL LAMP SHUNTING RESISTOR	0	470	200	130	100	OHMS
DC OUTPUT CURRENT	50	60	65	70	75	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	129	125	124	122	120	VOLTS

TAP SECTION AS LIMITING RESISTANCE[F]

WITHOUT PANEL LAMP - CIRCUIT 1

AC PLATE SUPPLY VOLTAGE	120	120	VOLTS
EFFECTIVE PLATE SUPPLY RESISTANCE	(NOTE G)	(NOTE G)	
FILTER INPUT CAPACITOR	40	40	μf
DC OUTPUT CURRENT	60	75	MA
DC OUTPUT VOLTAGE AT FILTER INPUT	122	113	VOLTS

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

[D] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIED VALUES.

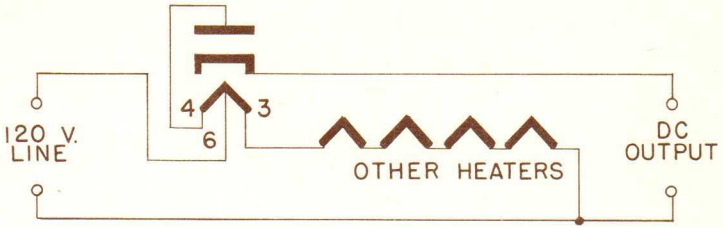
[E] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[F] IN A SERIES STRING ENTERTAINMENT EQUIPMENT COMPLEMENT WITH 100 MILLIAMPERE HEATER CURRENT TUBES DESIGNED FOR A NOMINAL 120 VOLT AC LINE.

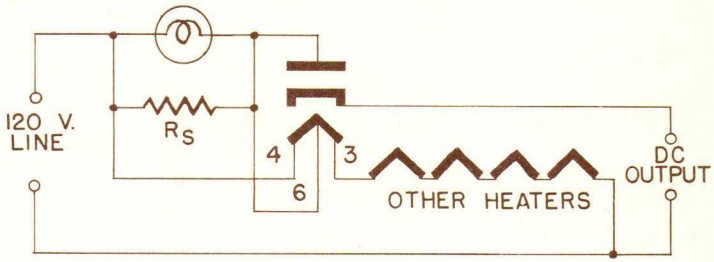
[G] IN THIS MODE OF OPERATION, WITH THE HEATER TAP SECTION BETWEEN PINS 4 AND 6 IN SERIES WITH THE RECTIFIER PLATE CIRCUIT, THE RESISTANCE OF THE TAP SECTION IS APPROXIMATELY 45 OHMS.

TUNG-SOL

CIRCUIT 1



CIRCUIT 2

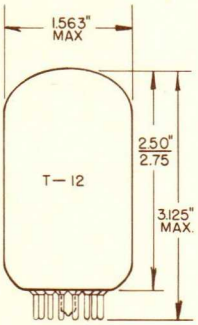


PRINTED IN U.S.A.

TUNG-SOL

DIODE - PENTODE

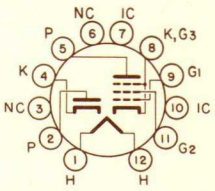
COMPACTRON



GLASS BULB
BUTTON 12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12 - 57

FOR
COMBINED DAMPING
AND AMPLIFIER SERVICE
IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12 FS

THE 38HE7 IS A HIGH-PERVEANCE DIODE AND A BEAM-POWER PENTODE IN THE T-12 COMPACTRON CONSTRUCTION. THE DIODE IS DESIGNED FOR SERVICE AS THE DAMPING DIODE AND THE PENTODE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

DIODE SECTION

CATHODE TO PLATE AND HEATER: K TO (P + H)	8.0	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	7.0	pf
HEATER TO CATHODE: (H TO K)	1.6	pf

PENTODE SECTION

GRID 1 TO PLATE: (G_1 TO P)	0.38	pf
INPUT: G 1 TO (H + K + G_2 + G_3)	19	pf
OUTPUT: P TO (H + K + G_2 + G_3)	8.0	pf

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	37.8	VOLTS	450	MA.
HEATER WARM-UP TIME		APPROX.	11	SECONDS
LIMITS OF SUPPLIED CURRENT			450 ± 30	MA.
HEATER-CATHODE VOLTAGE		DIODE SECTION	PENTODE SECTION	
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT		100	100	VOLTS
TOTAL DC AND PEAK		200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE				
DC COMPONENT		500		
TOTAL DC AND PEAK		4,200	200	VOLTS

RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	500	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	5,000	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	0	VOLTS
GRID 2 VOLTAGE	150	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION	10	WATTS
GRID 2 DISSIPATION	3.5	WATTS
GRID 2 DISSIPATION FOR $P_p \leqq 9$ WATTS	4.0	WATTS
DC CATHODE CURRENT	230	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS

TV DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	4,200	VOLTS
STEADY-STATE PEAK PLATE CURRENT	1,200	MA.
DC OUTPUT CURRENT	200	MA.
BULB TEMPERATURE AT HOTTEST POINT	200	°C

CHARACTERISTICS AND TYPICAL OPERATION

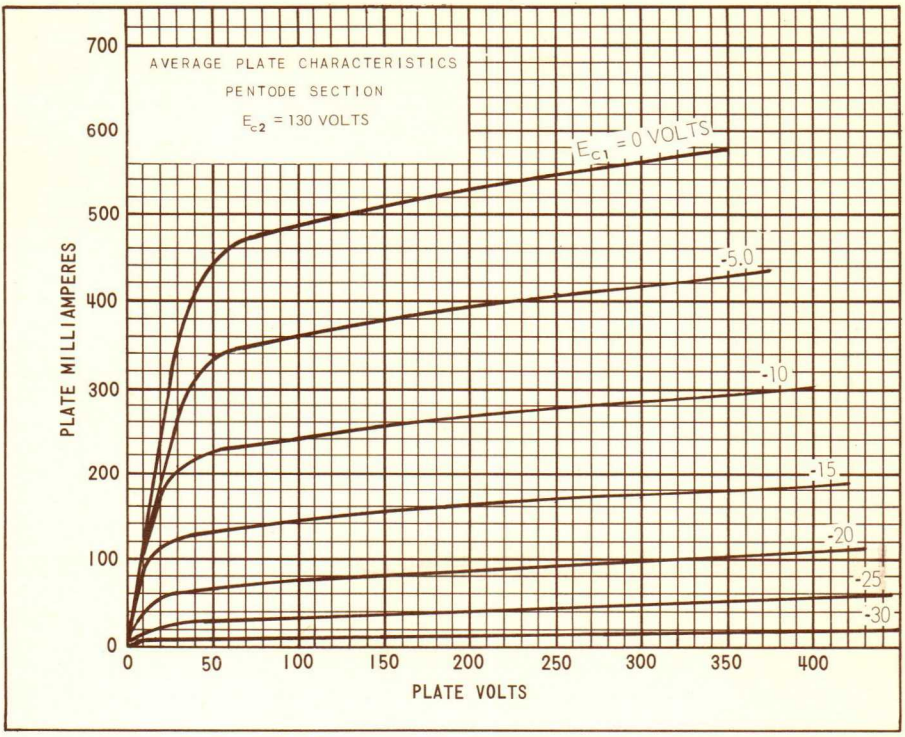
PENTODE SECTION

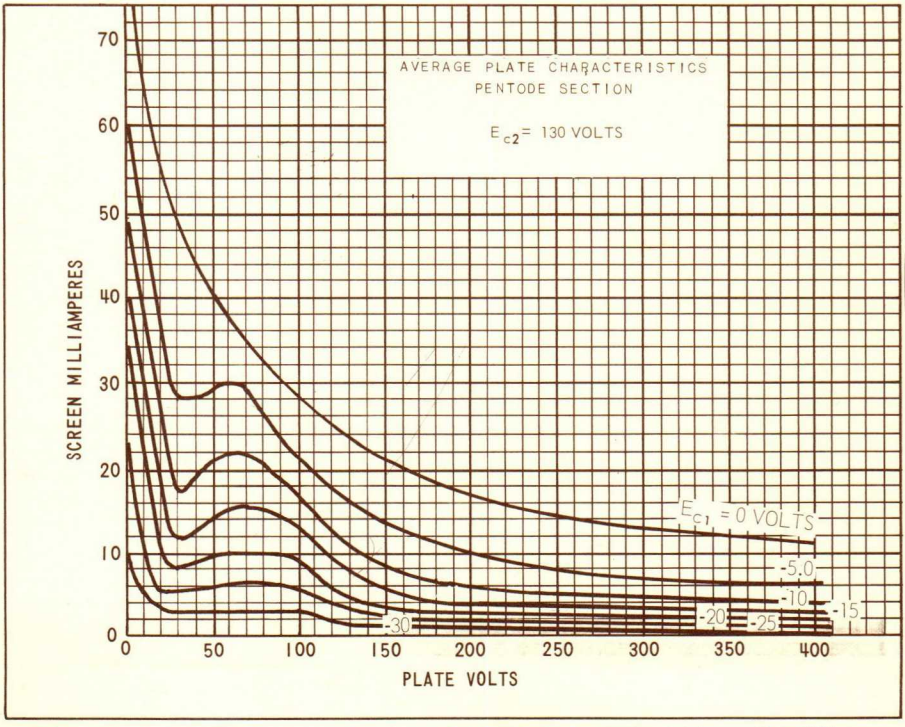
PLATE VOLTAGE	5,000	50	130	VOLTS
GRID 2 VOLTAGE	130	130	130	VOLTS
GRID 1 VOLTAGE	-	0 A	-22	VOLTS
PLATE CURRENT	-	450	60	MA.
GRID 2 CURRENT	-	40	2.8	MA.
TRANSCONDUCTANCE	-	-	8,800	MICROMHOS
TRIODE AMPLIFICATION FACTOR - GRID 2 TIED TO PLATE	-	-	4.2	
GRID 1 VOLTAGE FOR I_b = 1.0 MA. APPROX.	-80	-	-39	VOLTS

DIODE SECTION

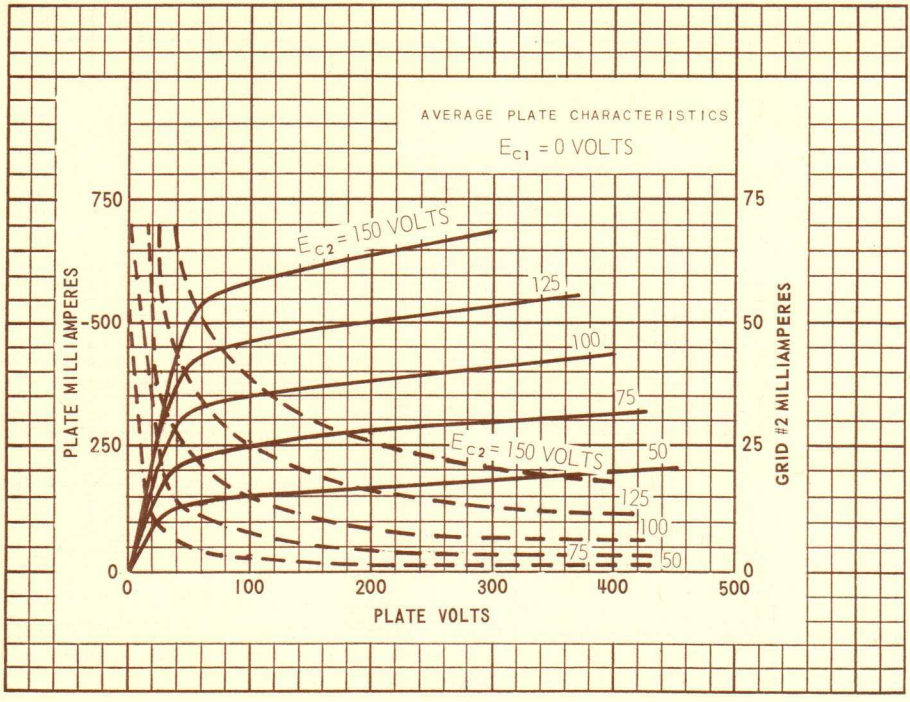
TUBE VOLTAGE DROP FOR I_b = 350 MADC	21	VOLTS

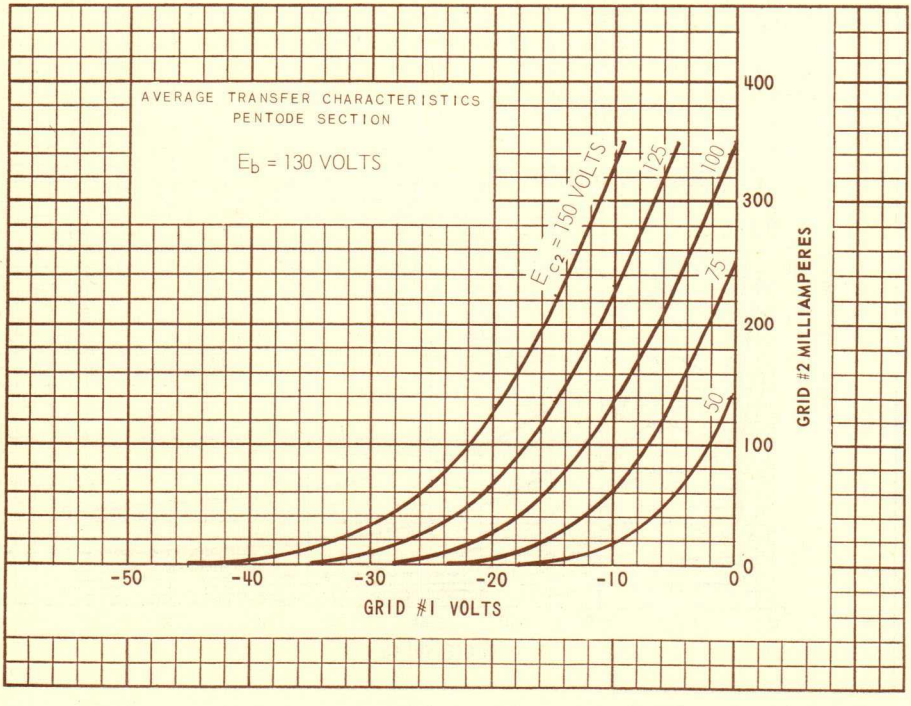
A - APPLIED FOR SHORT INTERVAL (2 SECONDS MAX.) SO AS NOT TO DAMAGE TUBE.

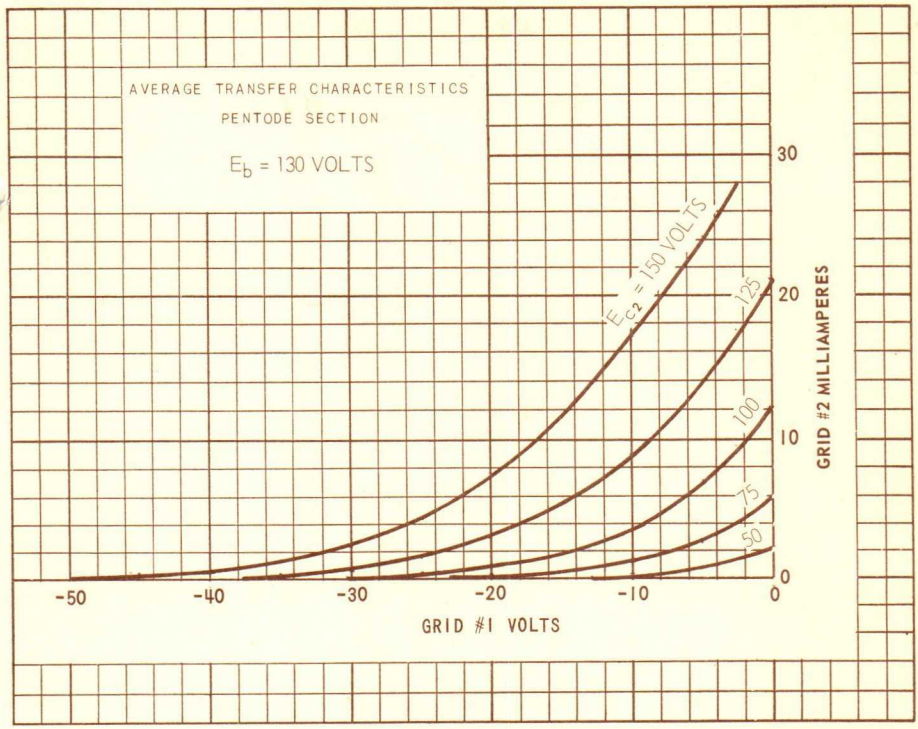


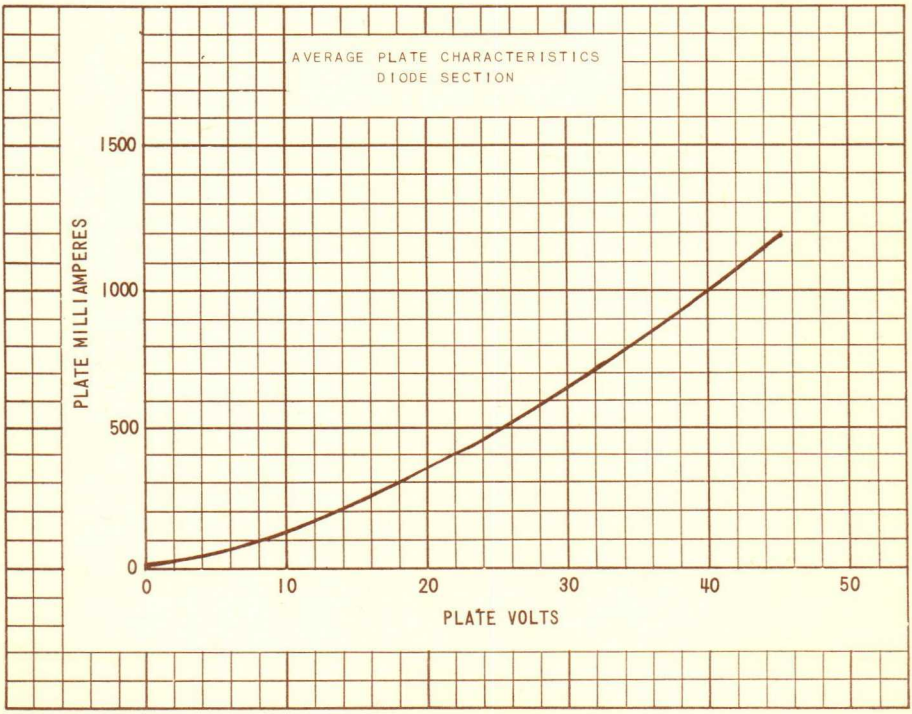


PRINTED IN U. S. A.


AVERAGE PLATE CHARACTERISTICS
E_{c1} = 0 VOLTS
PLATE MILLIAMPERES
750
500
250
0
E_{c2} = 150 VOLTS
125
100
75
50
E_{c2} = 150 VOLTS
125
100
75
50
0
100
200
300
400
500
PLATE VOLTS
75
50
25
0
GRID #2 MILLIAMPERES


AVERAGE TRANSFER CHARACTERISTICS
PENTODE SECTION
E_b = 130 VOLTS
E_{c2} = 150 VOLTS
125
100
75
50
400
300
200
100
0
GRID #2 MILLIAMPERES
-50
-40
-30
-20
-10
0
GRID #1 VOLTS



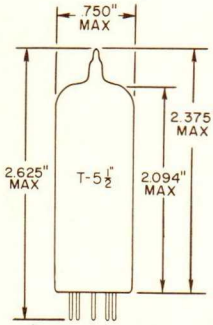


PRINTED IN U.S.A.

TUNG-SOL

PENTODE

MINIATURE TYPE

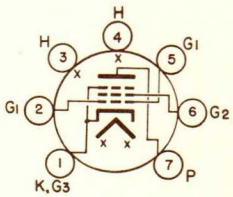


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

AUDIO POWER AMPLIFIER
FOR SERIES STRING OPERATION

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 40FR5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS AN AUDIO POWER AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.3	pf
INPUT: G1 TO (K+G3+G2+H)	12	pf
OUTPUT: P TO (K+G3+G2+H)	9.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	40 VOLTS	100	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		100±6	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSTIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME [A]		20	SECONDS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	150	VOLTS
GRID #2 VOLTAGE	130	VOLTS
PLATE DISSIPATION	5.2	WATTS
GRID #2 DISSIPATION	1.2	WATTS
GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CHARACTERISTICS

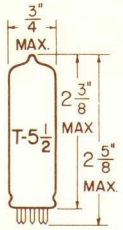
PLATE VOLTAGE	115	110	VOLTS
GRID #2 VOLTAGE	115	110	VOLTS
GRID #1 VOLTAGE	--	-7.5	VOLTS
CATHODE RESISTOR	180	---	OHMS
PEAK AF GRID #1 VOLTAGE	7.0	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	34	32	MA.
MAX.-SIGNAL PLATE CURRENT	31	35	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.2	3	MA.
MAX.-SIGNAL GRID #2 CURRENT	7.	7.5	MA.
TRANSCONDUCTANCE	---	6000	μMHOS
PLATE RESISTANCE, APPROX.	---	20,000	OHMS
LOAD RESISTANCE	3200	2800	OHMS
MAX.-SIGNAL POWER OUTPUT	1.3	1.5	WATTS
TOTAL HARMONIC DISTORTION	10	10	PERCENT

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.

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

50 VOLTS 150 MA.

AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7BZ

THE 50B5 IS A BEAM POWER AMPLIFIER IN THE MINIATURE CONSTRUCTION. BECAUSE OF ITS HIGH POWER SENSITIVITY AT LOW PLATE-SCREEN VOLTAGE, IT IS PARTICULARLY ADAPTABLE TO AC/DC RECEIVER APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES *

GRID TO PLATE: (G_1 TO P)	0.6	μμf
INPUT: G_1 TO ($H+K+G_2+G_3$)	13.0	μμf
OUTPUT: P TO ($H+K+G_2+G_3$)	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	50	VOLTS
MAXIMUM PLATE VOLTAGE	135	VOLTS
MAXIMUM GRID #2 VOLTAGE	117	VOLTS
MAXIMUM PLATE DISSIPATION	6.0 ←	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
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
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
CATHODE BIAS	0.5	MEGOHM
FIXED BIAS	0.1	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220 ←	°C

* INDICATES AN ADDITION.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

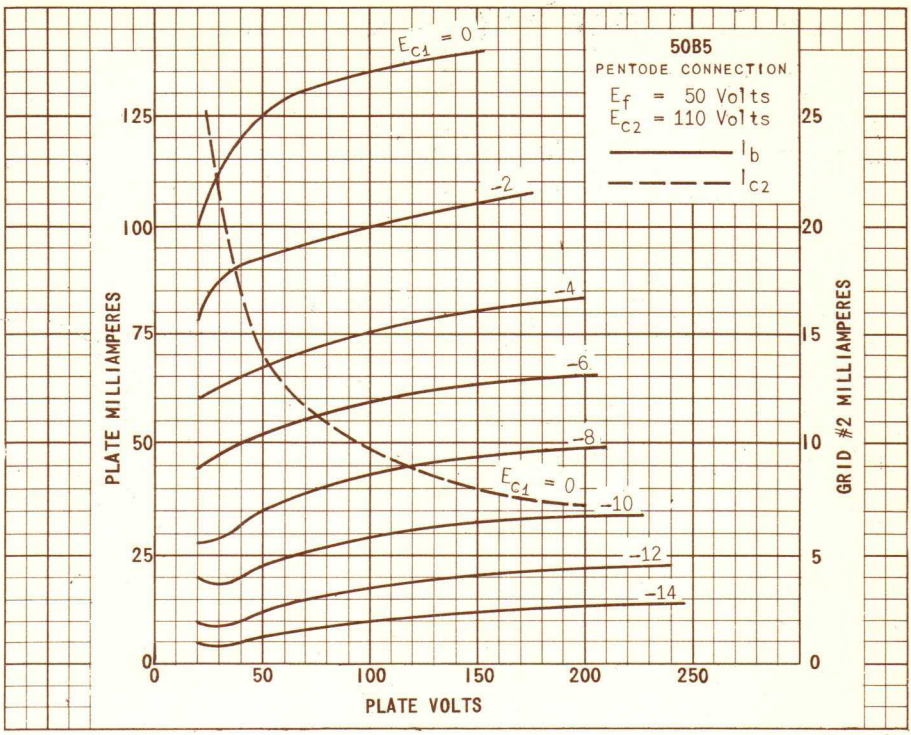
CONTINUED FROM PRECEDING PAGE

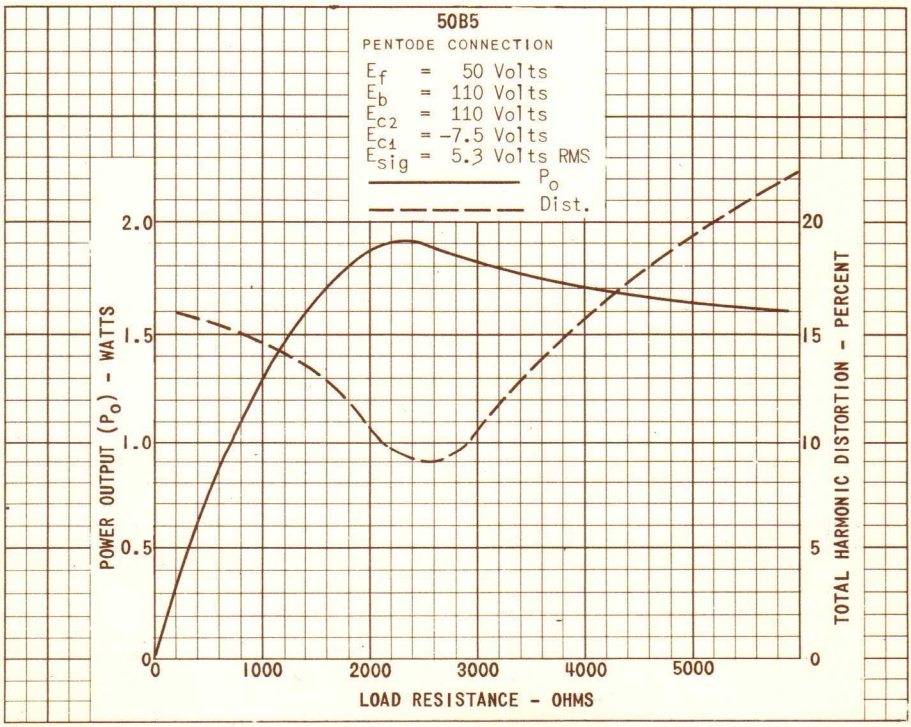
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	50	VOLTS
HEATER CURRENT	150	MA.
PLATE VOLTAGE	120 ←	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	−8 ←	VOLTS
PEAK AF GRID #1 VOLTAGE	8 ←	VOLTS
PLATE RESISTANCE (APPROX.)	10 000	OHMS
TRANSCONDUCTANCE	7 500	µMHOS
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.
LOAD RESISTANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	2.3	WATTS

ALL ELECTRICAL DATA EXCEPT HEATER CHARACTERISTICS FOR TYPE 50B5 ARE IDENTICAL WITH THOSE OF TYPES 12C5, 12CU5, 17C5, 25C5, AND 50C5.





PRINTED IN U.S.A.

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

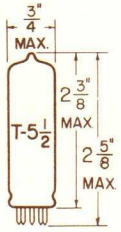
HEATER

50±10% VOLTS 0.15 AMP.

AC OR DC

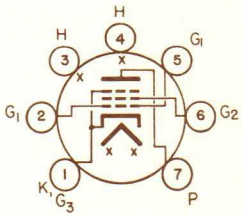
ANY MOUNTING POSITION

FOR SERIES STRING



GLASS BULB

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



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 50C5 IS A BEAM POWER AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. BECAUSE OF ITS HIGH POWER SENSITIVITY AT LOW PLATE-SCREEN VOLTAGE, IT IS PARTICULARLY ADAPTABLE TO AC/DC RECEIVER APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

GRID TO PLATE: G_1 TO P	0.6	μμf
INPUT: G_1 TO (H+K&G_3+G_2)	13.0	μμf
OUTPUT: P TO (H+K&G_3+G_2)	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	50±10%	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	7	WATTS
MAXIMUM GRID #2 DISSIPATION	1.4	WATTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
MAXIMUM BULB TEMPERATURE		
(AT HOTTEST POINT ON BULB SURFACE)	220	°C

ALL ELECTRICAL DATA EXCEPT HEATER CHARACTERISTICS FOR TYPE 50C5 ARE IDENTICAL WITH THOSE OF TYPES 12C5, 12CU5, 17C5, 25C5, AND 50B5.

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

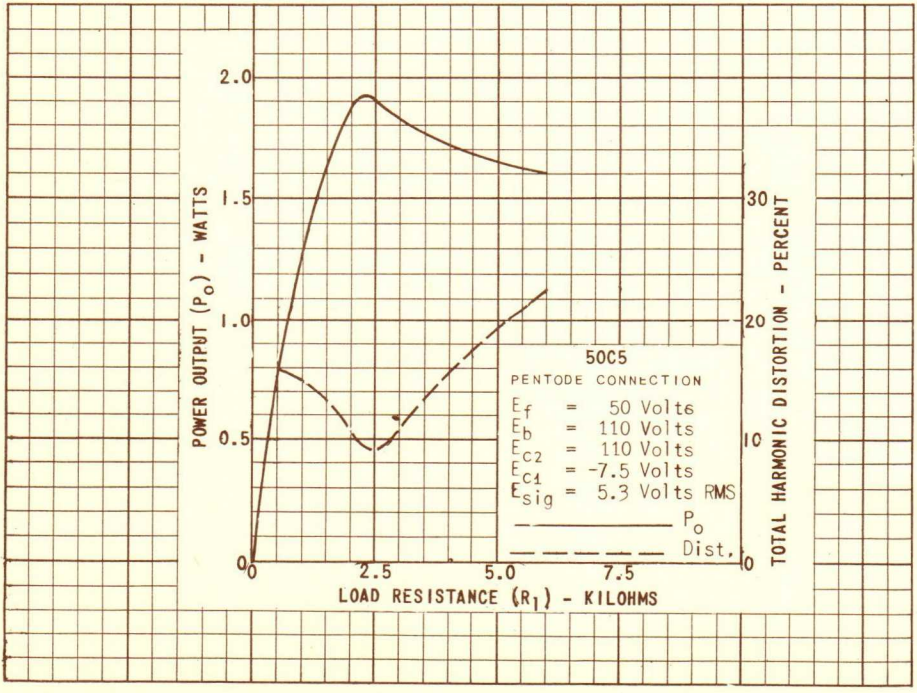
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

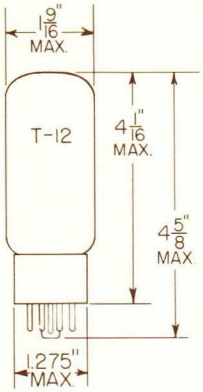
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	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.
ZERO-SIGNAL GRID #2 CURRENT	4	MA.
MAXIMUM SIGNAL PLATE CURRENT	50	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
MAXIMUM SIGNAL POWER OUTPUT	2.3	WATTS



TUNG-SOL

BEAM PENTODE

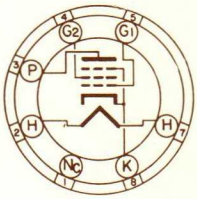


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
50 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM SHELL
7 PIN OCTAL
7S

THE 50C6GA IS A BEAM POWER AMPLIFIER HAVING HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT AT COMPARATIVELY LOW DC SUPPLY VOLTAGES. EXCEPT FOR ITS T-12 ENVELOPE THE 50C6GA IS IDENTICAL TO THE 50C6G.

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	50	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM PLATE DISSIPATION	12.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.75	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
SELF BIAS	0.5	MEGOHM

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

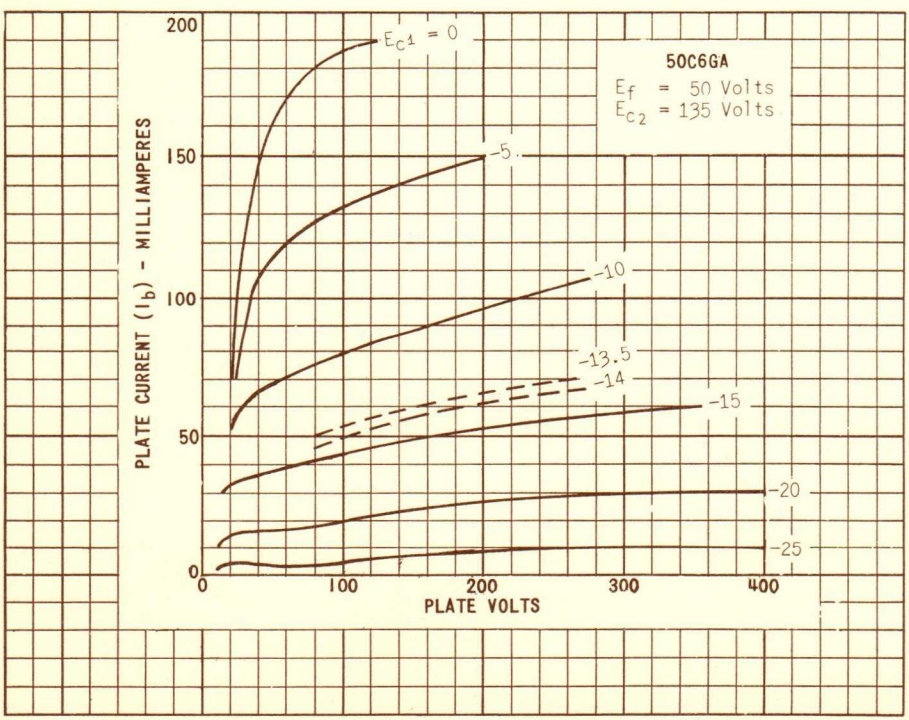
TUNG-SOL

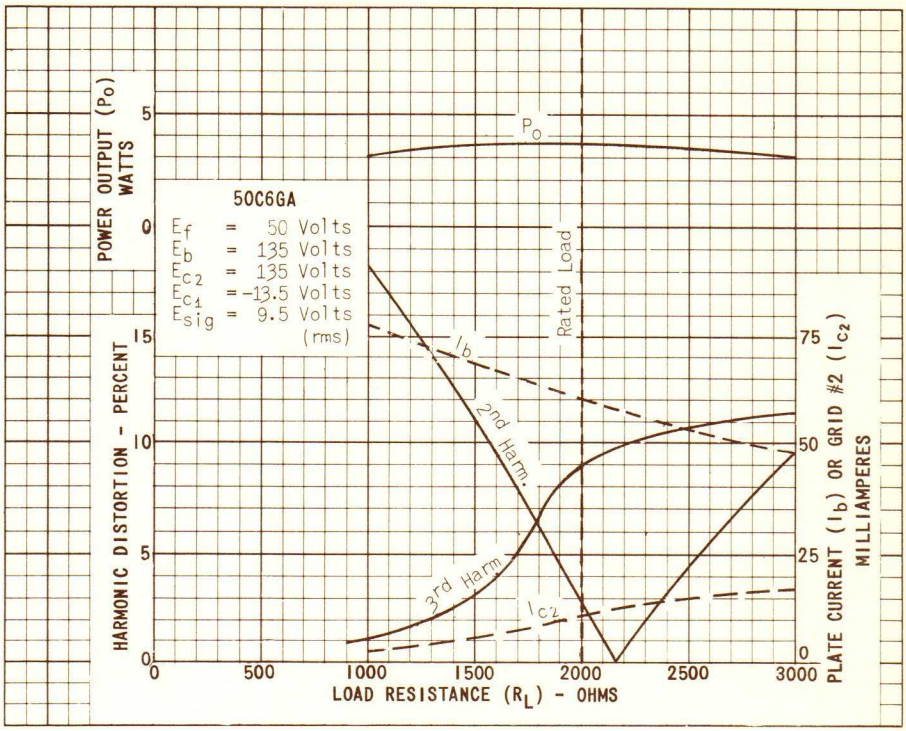
CONTINUED FROM PRECEDING PAGE

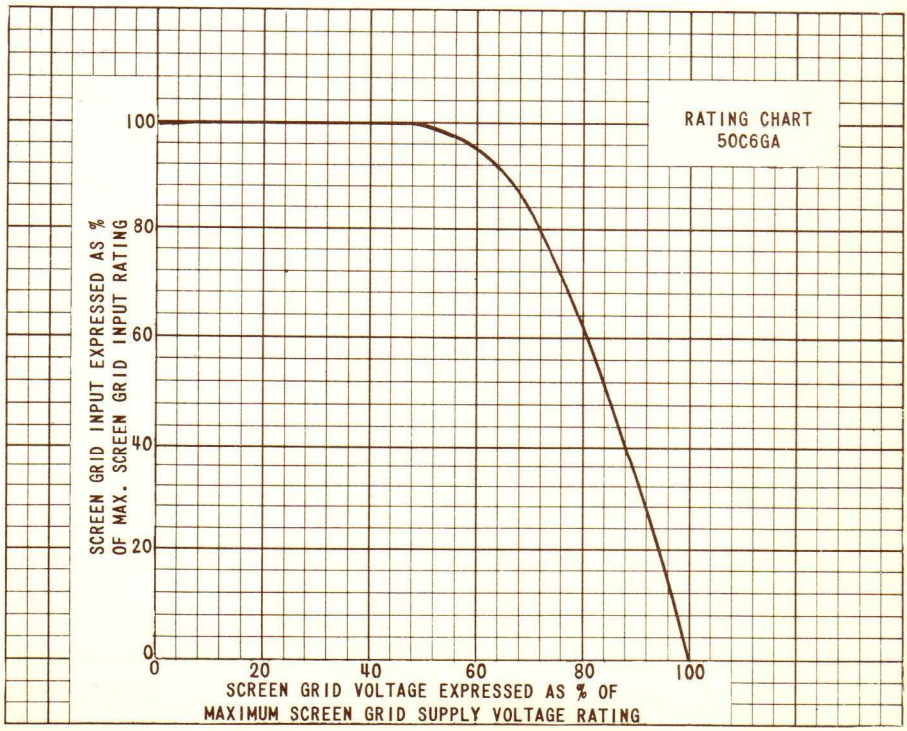
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	50		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	135	200	VOLTS
GRID #2 VOLTAGE	135	135	VOLTS
GRID #1 VOLTAGE	-13.5	-14	VOLTS
PEAK AF GRID #1 VOLTAGE	13.5	14	VOLTS
ZERO SIGNAL PLATE CURRENT	58	61	MA.
MAXIMUM SIGNAL PLATE CURRENT	60	66	MA.
ZERO SIGNAL GRID #2 CURRENT	3.5	2.2	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	11.5	9	MA.
TRANSCONDUCTANCE	7 000	7 100	μMHOS
PLATE RESISTANCE (APPROX.)	9 300	18 300	OHMS
LOAD RESISTANCE	2 000	2 600	OHMS
MAXIMUM SIGNAL POWER OUTPUT	3.6	6	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT







PRINTED IN U. S. A.

TUNG-SOL

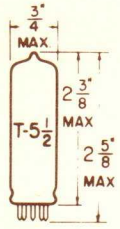
PENTODE

MINIATURE TYPE

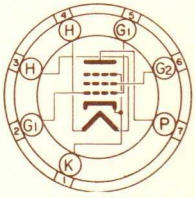
COATED UNIPOTENTIAL CATHODE

HEATER
50 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CV

THE 50CA5 IS A BEAM PENTODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE IN THE AUDIO FREQUENCY POWER OUTPUT STAGE OF TELEVISION AND RADIO RECEIVERS. IT FEATURES HIGH POWER SENSITIVITY AT RELATIVELY LOW PLATE AND SCREEN VOLTAGES. EXCEPT FOR HEATER RATINGS, IT IS IDENTICAL TO THE 6AC5.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	μμf
INPUT	15	μμf
OUTPUT	9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	50	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	130	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	5.0	WATTS
MAXIMUM GRID #2 DISSIPATION	1.4	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
BULB TEMPERATURE AT HOTTEST POINT	180	°C

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

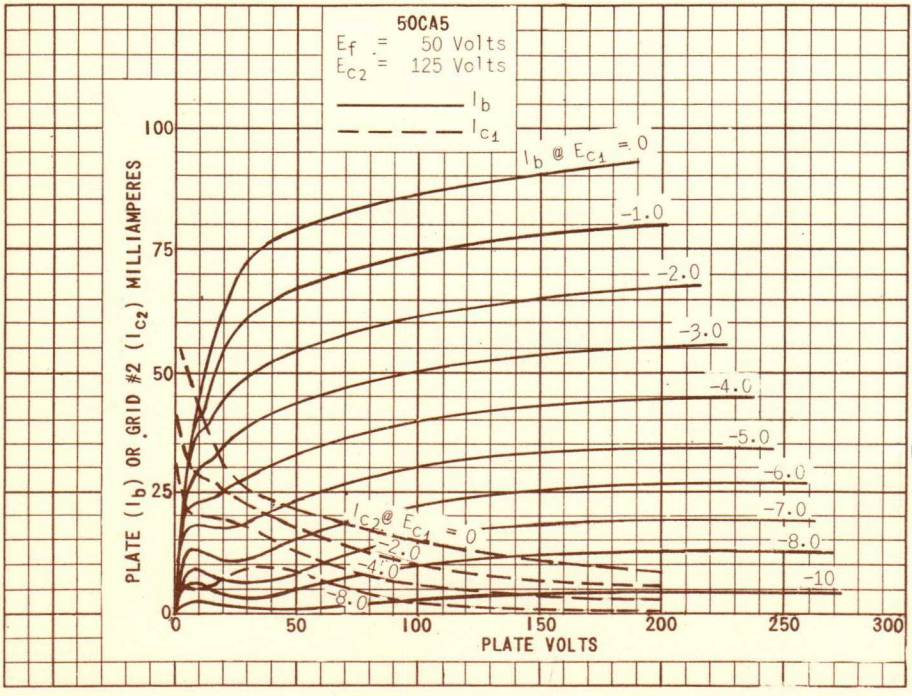
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

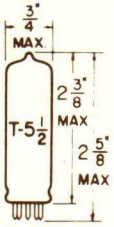
HEATER VOLTAGE	50		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	110	125	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-4.0	-4.5	VOLTS
PEAK AF GRID #1 VOLTAGE	4.0	4.5	VOLTS
PLATE RESISTANCE (APPROX.)	16 000	15 000	OHMS
TRANSCONDUCTANCE	8 100	9 200	μMHOS
ZERO-SIGNAL PLATE CURRENT	32	37	MA.
MAXIMUM SIGNAL PLATE CURRENT (APPROX.)	31	36	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.5	4.0	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (APPROX.)	7.5	11	MA.
LOAD RESISTANCE	3 500	4 500	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	5	6	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.1	1.5	WATTS



TUNG-SOL

DIODE

MINIATURE TYPE



GLASS BULB

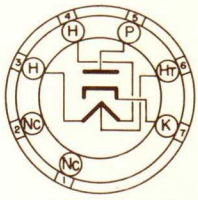
COATED UNIPOTENTIAL CATHODE

HEATER

50±10% VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
5BQ

THE 50DC4 IS A HALF-WAVE RECTIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN LINE-OPERATED EQUIPMENT HAVING SERIES-CONNECTED HEATERS AND THE HEATER IS TAPPED TO PERMIT OPERATION OF A PANEL LAMP.

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

RECTIFIER SERVICE

HEATER VOLTAGE	50±10%	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	330	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	720	MA.
MAXIMUM DC OUTPUT CURRENT		
WITHOUT PANEL LAMP	120	MA.
WITH PANEL LAMP AND SHUNTING RESISTOR	110	MA.
WITH PANEL LAMP AND NO SHUNTING RESISTOR	70	MA.
MAXIMUM HEATER-TAP VOLTAGE WHEN PANEL LAMP FAILS, RMS	16.5	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	330	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	330	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.

CONTINUED FROM PRECEDING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

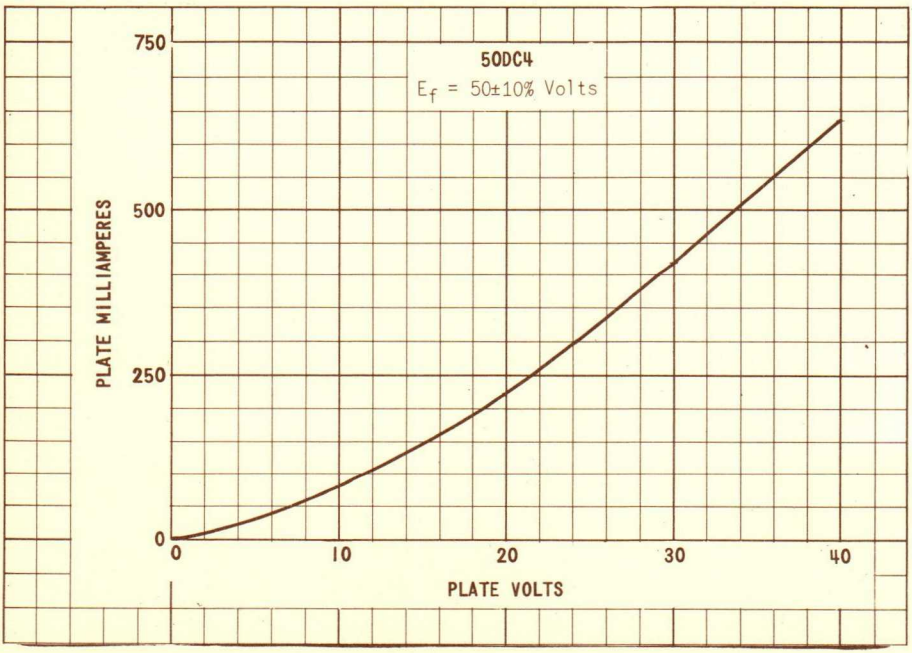
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER
WITH PANEL LAMP #40 OR #47

HEATER VOLTAGE (PIN 3 TO PIN 4)	45	45	45	45	VOLTS
HEATER-TAP VOLTAGE (PIN 4 TO PIN 6)	5.5	5.5	5.5	5.5	VOLTS
HEATER CURRENT (BETWEEN PINS 3 & 6)	150	150	150	150	MA.
AC PLATE-SUPPLY VOLTAGE, RMS	117	117	117	117	VOLTS
FILTER INPUT CAPACITOR	40	40	40	40	μf
TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE	15	15	15	15	OHMS
PANEL-LAMP SHUNTING RESISTOR	450	200	100	75	OHMS
DC OUTPUT CURRENT	70	80	90	100	MA.

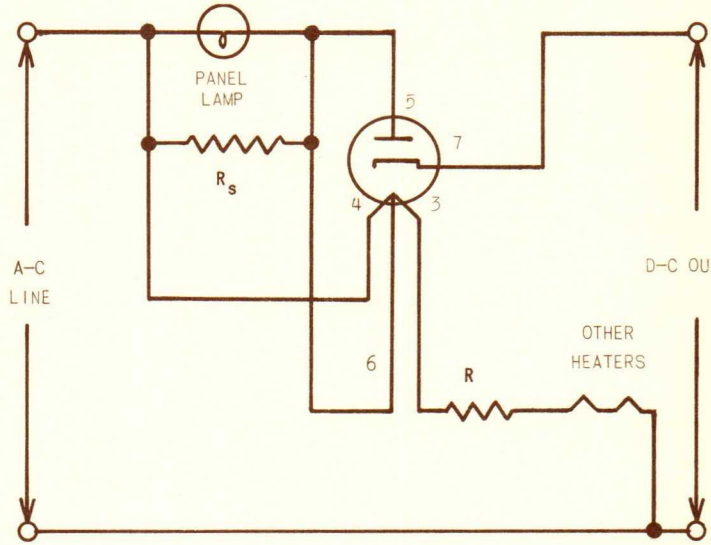
HALF-WAVE RECTIFIER
WITHOUT PANEL LAMP

HEATER VOLTAGE	50±10%	VOLTS
HEATER CURRENT	0.15	AMP.
HEATER VOLTAGE(PIN 3 TO PIN 4)	50	VOLTS
HEATER-TAP VOLTAGE (PIN 4 TO PIN 6)	7.5	VOLTS
HEATER CURRENT (BETWEEN PINS 3 & 4)	150	MA.
AC PLATE-SUPPLY VOLTAGE, RMS	117	VOLTS
FILTER INPUT CAPACITOR	40	μf
TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE	15	OHMS
DC OUTPUT CURRENT	110	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT (APPROX.)		
FOR DC OUTPUT CURRENT OF 55 MA.	130	VOLTS
FOR DC OUTPUT CURRENT OF 110 MA.	110	VOLTS
TUBE VOLTAGE DROP I_b= 240 MA. DC	21	VOLTS

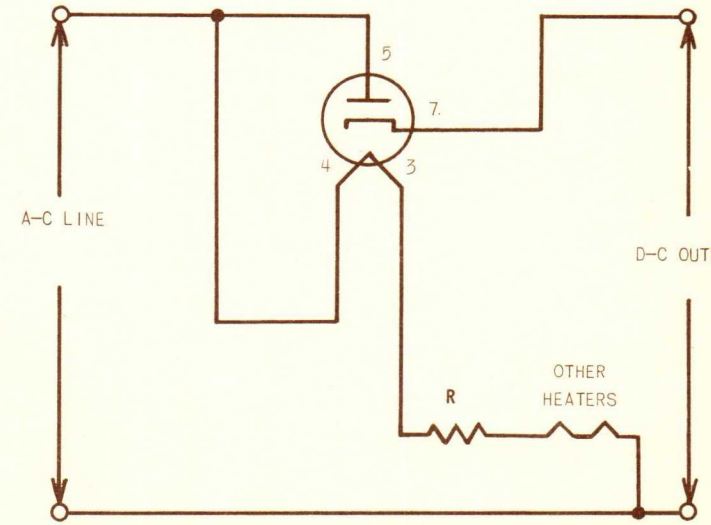


TUNG-SOL

TYPICAL CIRCUIT FOR OPERATION
WITH PANEL LAMP



R_S = PANEL-LAMP SHUNTING RESISTOR
DROP ACROSS R AT 0.15 AMPERE SHOULD EQUAL
DIFFERENCE BETWEEN LINE VOLTAGE AND TOTAL
OF ALL RATED HEATER VOLTAGES



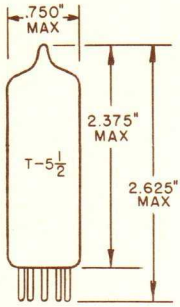
TYPICAL CIRCUIT FOR OPERATION
WITHOUT PANEL LAMP

PRINTED IN U. S. A.

TUNG-SOL

PENTODE

MINIATURE TYPE

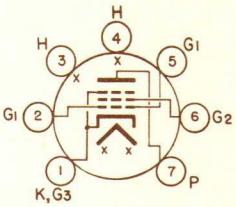


GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

FOR USE IN
AUDIO OUTPUT STAGES OF
RADIO AND TV RECEIVERS
AND PHONOGRAPHS

UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 50EH5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS BEEN SPECIFICALLY DESIGNED FOR USE IN THE AUDIO OUTPUT STAGE OF RADIO AND TELEVISION RECEIVERS AND PHONOGRAPHS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, IT IS IDENTICAL TO THE 6EH5, 12EH5 AND THE 25EH5.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	0.65	pf
GRID 1 TO CATHODE & GRID 3, HEATER & GRID 2	17	pf
PLATE TO CATHODE & GRID 3, HEATER & GRID 2	9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	50	VOLTS	150	MA.
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			150 ± 10	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			200 [B]	VOLTS

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

PRINTED IN U. S. A.

TUNG-SOL

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AMPLIFIER

PLATE VOLTAGE	→ 150	VOLTS
GRID 2 (SCREEN-GRID) VOLTAGE	→ 130	VOLTS
PLATE DISSIPATION	→ 5.5	WATTS
GRID 2 INPUT	→ 2	WATTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	220	°C
GRID 1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

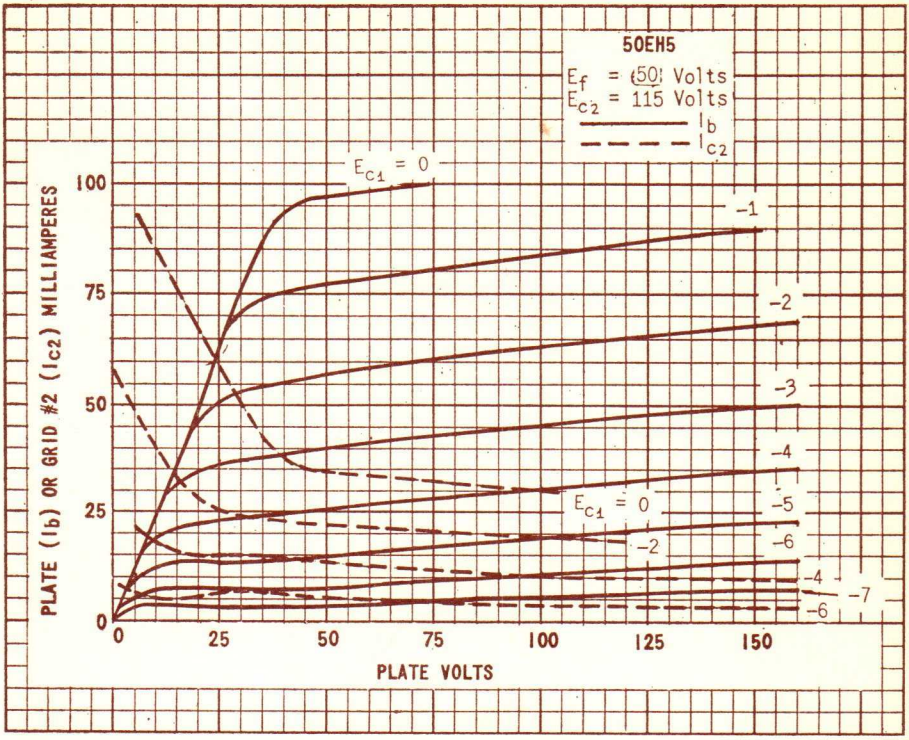
PLATE SUPPLY VOLTAGE	110	VOLTS
GRID 2 SUPPLY VOLTAGE	115	VOLTS
CATHODE RESISTOR	62	OHMS
PEAK AF GRID 1 VOLTAGE	3	VOLTS
ZERO-SIGNAL PLATE CURRENT	42	MA.
SIGNAL PLATE CURRENT (MAX.)	42	MA.
ZERO-SIGNAL GRID 2 CURRENT	11.5	MA.
SIGNAL GRID 2 CURRENT (MAX.)	14.5	MA.
TRANSCONDUCTANCE	14,600	μMHOS
PLATE RESISTANCE (APPROX.)	11,000	OHMS
LOAD RESISTANCE	3,000	OHMS
TOTAL HARMONIC DISTORTION	7	PERCENT
SIGNAL POWER OUTPUT (MAX.)	1.4	WATTS

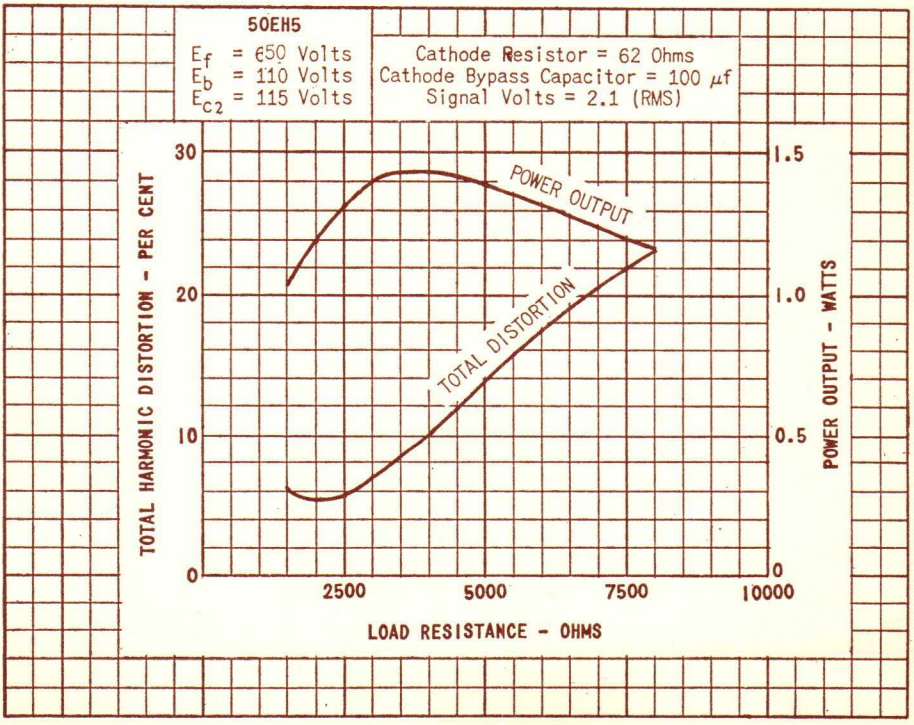
PUSH-PULL AF POWER AMPLIFIER - CLASS AB1

VALUES ARE FOR TWO TUBES

PLATE SUPPLY VOLTAGE	140	VOLTS
GRID 2 SUPPLY VOLTAGE	120	VOLTS
CATHODE RESISTOR	68	OHMS
PEAK AF GRID 1 TO GRID 1 VOLTAGE	9.4	VOLTS
ZERO-SIGNAL PLATE CURRENT	47	MA.
MAX. SIGNAL PLATE CURRENT	51	MA.
ZERO-SIGNAL GRID 2 CURRENT	11	MA.
MAX.-SIGNAL GRID 2 CURRENT	17.7	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	6000	OHMS
TOTAL HARMONIC DISTORTION	5	PERCENT
MAX.-SIGNAL POWER OUTPUT	3.8	WATTS.

→ INDICATES A CHANGE.



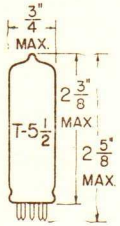


PRINTED IN U.S.A.

TUNG-SOL

POWER PENTODE

MINIATURE TYPE



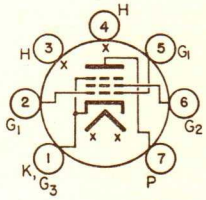
GLASS BULB

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

COATED UNIPOTENTIAL CATHODE

HIGH POWER SENSITIVITY

FOR SERIES STRING RECEIVERS



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CV

THE 50FA5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR LOW HEAT DISSIPATION THROUGH USE OF A LOW CURRENT HEATER. HEATER WARM-UP TIME (IN SERIES STRING APPLICATIONS) IS CONTROLLED FOR IMPROVED RELIABILITY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.28	pf
INPUT: G1 TO (K+G3+G2+H)	11	pf
OUTPUT: P TO (K+G3+G2+H)	8.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	50 VOLTS	100 [A]	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		100±6 [B]	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]		20	SECONDS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	150	VOLTS
GRID #2 VOLTAGE	130	VOLTS
PLATE DISSIPATION	5.2	WATTS
GRID #2 DISSIPATION	1.1	WATTS
GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CHARACTERISTICS

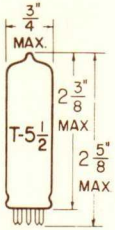
PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	40	MA.
MAX.-SIGNAL PLATE CURRENT	41	MA.
ZERO-SIGNAL GRID #2 CURRENT	3	MA.
MAX.-SIGNAL GRID #2 CURRENT	7	MA.
TRANSCONDUCTANCE	5800	μMHOS
PLATE RESISTANCE (APPROX.)	13,000	OHMS
LOAD RESISTANCE	2500	OHMS
MAX.-SIGNAL POWER OUTPUT	1.5	WATTS
TOTAL HARMONIC DISTORTION	10	PERCENT

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.

TUNG-SOL

POWER PENTODE

MINIATURE TYPE



SMALL-BUTTON MINIATURE

7 PIN BASE E7-1

OUTLINE DRAWING JEDEC 5-3

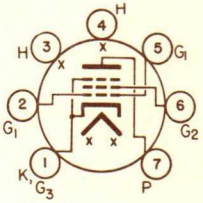
GLASS BULB

COATED UNIPOTENTIAL CATHODE

AUDIO OUTPUT AMPLIFIER

IN AC/DC RECEIVERS

ANY MOUNTING POSITION



BASING DIAGRAM

JEDEC 7CV

BOTTOM VIEW

THE 50FK5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN AC/DC RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.65	pf
GRID #1 TO CATHODE & GRID #3, HEATER & GRID #2	17	pf
PLATE TO CATHODE # GRID #3, HEATER & GRID #2	9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	50 VOLTS	100	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		100±6	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[A]	

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

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	CLASS A_1 AMPLIFIER	150	VOLTS
GRID #2 (SCREEN-GRID) VOLTAGE:		130	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE:			
POSITIVE BIAS VALUE		0	VOLTS
PLATE DISSIPATION		5	WATTS
GRID #2 INPUT		1.75	WATTS
BULB TEMPERATURE (AT HOTTEST POINT)		225	°C

MAXIMUM CIRCUIT VALUES

GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

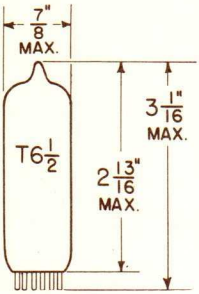
TYPICAL OPERATING CHARACTERISTICS

PLATE-SUPPLY VOLTAGE	110	VOLTS
GRID #2 SUPPLY VOLTAGE	115	VOLTS
CATHODE RESISTOR	62	OHMS
PEAK AF GRID #1 VOLTAGE	3	VOLTS
ZERO-SIGNAL PLATE CURRENT	32	MA.
MAX.-SIGNAL PLATE CURRENT	32	MA.
ZERO-SIGNAL GRID #2 CURRENT	8.5	MA.
MAX.-SIGNAL GRID #2 CURRENT	12	MA.
PLATE RESISTANCE (APPROX.)	14000	OHMS
TRANSCONDUCTANCE	12800	μMHOS
LOAD RESISTANCE	3000	OHMS
TOTAL HARMONIC DISTORTION	8	PERCENT
MAX.-SIGNAL POWER OUTPUT	1.2	WATTS

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE



GLASS BULB

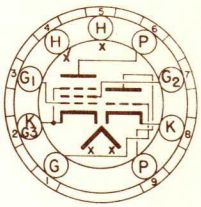
COATED UNIPOTENTIAL CATHODE

HEATER

50 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

9EX

THE 50FY8 IS A COMBINED TRIODE AND BEAM POWER PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE IN LOW-COST STEREO SYSTEMS.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	50		VOLTS
MAXIMUM PLATE VOLTAGE	150	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	150	VOLTS
MAXIMUM PLATE DISSIPATION	1	10	WATTS
MAXIMUM GRID #2 DISSIPATION	---	3	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	1.0	0.5	MEGOHM
CATHODE BIAS	3.0	1.0	MEGOHM
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE TO CATHODE	200		VOLTS
HEATER POSITIVE TO CATHODE[A]	200		VOLTS

[A] DC COMPONENT NOT TO EXCEED 100 VOLTS MAXIMUM.

TYPICAL OPERATION

FOR ONE CHANNEL STEREO AMPLIFIER

	EACH TRIODE	PUSH-PULL PENTODES	
HEATER VOLTAGE	50		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE SUPPLY VOLTAGE	125	125	VOLTS
GRID #2 SUPPLY	---	125	VOLTS
GRID #2 RESISTOR, EACH PENTODE	---	1000	OHMS
CATHODE BIAS RESISTOR	1800	62	OHMS
LOAD RESISTANCE	220,000	4000 (P TO P)	OHMS
REQUIRED EACH TRIODE INPUT AF VOLTAGE FOR 6.0 WATTS OUTPUT	0.3	---	VRMS
STEREO POWER OUTPUT	---	6.0	WATTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

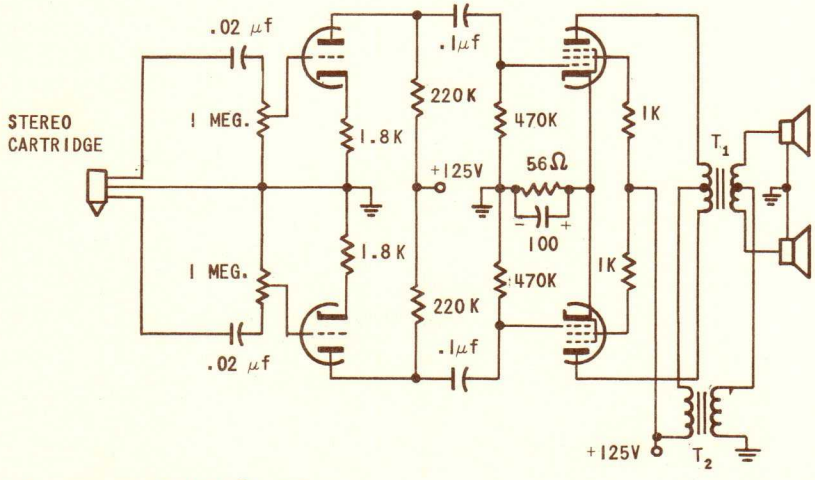
CONTINUED FROM PRECEDING PAGE

AVERAGE CHARACTERISTICS

CLASS A AMPLIFIER – EACH SECTION

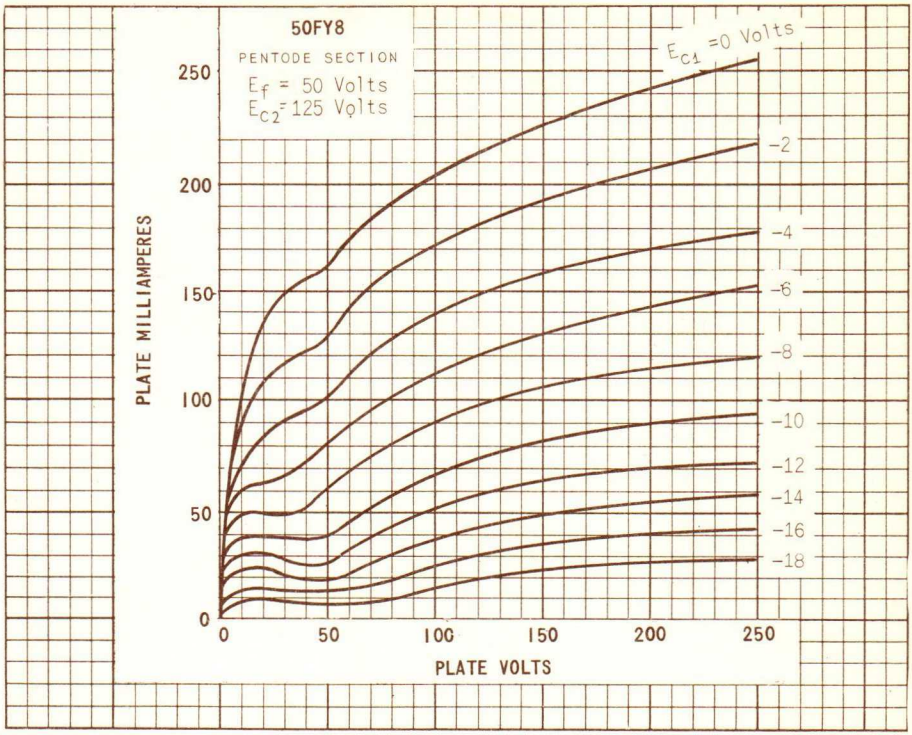
HEATER VOLTAGE	50		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE	---	125	VOLTS
GRID #1 VOLTAGE	-1.5	---	VOLTS
CATHODE BIAS RESISTOR	---	120	OHMS
PLATE RESISTANCE (APPROX.)	17000	5000	OHMS
TRANSCONDUCTANCE	2700	7500	μMHOS
PLATE CURRENT, ZERO SIGNAL	2.5	70	MA.
PLATE CURRENT, MAXIMUM SIGNAL	---	66	MA.
GRID #2 CURRENT, ZERO SIGNAL	---	10	MA.
GRID #2 CURRENT, MAXIMUM SIGNAL	---	19	MA.
LOAD RESISTANCE	---	2000	OHMS
POWER OUTPUT AT 10% DISTORTION	---	3	WATTS
AMPLIFICATION FACTOR	46	---	

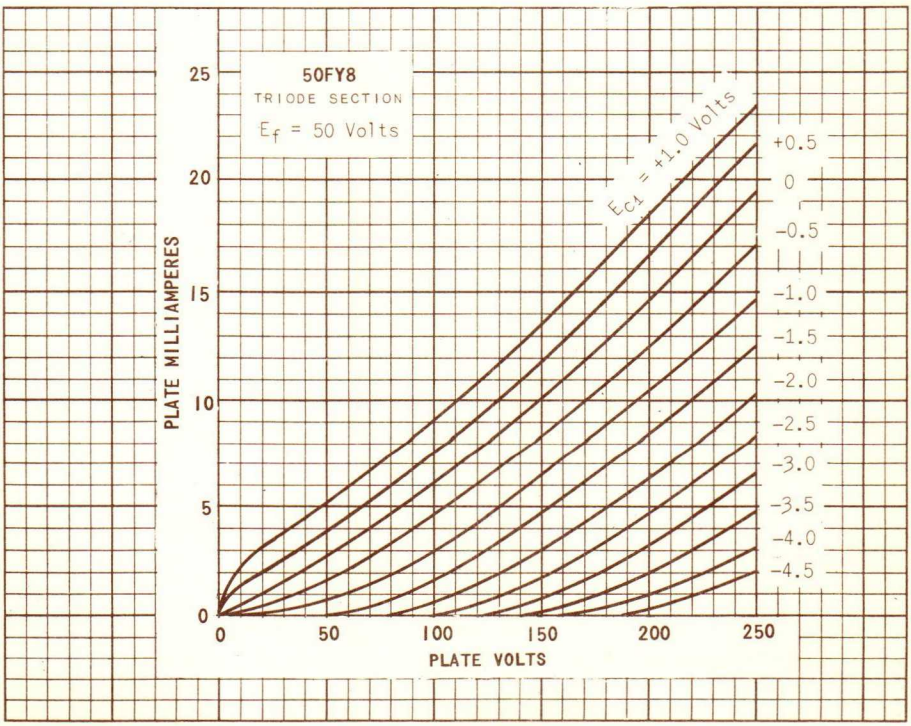
TWO TUBE 6 WATT STEREO AMPLIFIER



T_1 – Primary = 4000 Ω C.T.
– Secondary (One side to C.T.) = Voice Coil Impedance of One Speaker

T_2 – Primary = 1000 Ω
– Secondary = 1/2 Voice Coil Impedance of One Speaker



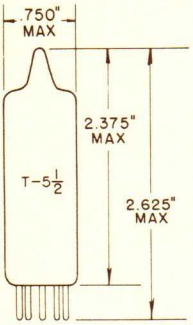


PRINTED IN U. S. A.

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE



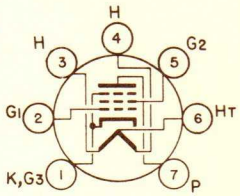
GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

FOR AF POWER

AMPLIFIER APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7FZ

THE 50HK6 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE IN THE AUDIO-FREQUENCY POWER OUTPUT STAGE OF RADIO RECEIVERS AND FOR PEAK CURRENT LIMITATION. FEATURES OF THE TUBE INCLUDE HIGH POWER SENSITIVITY AT LOW PLATE AND SCREEN VOLTAGES AND A HEATER TAP TO PERMIT OPERATION OF PANEL LAMP.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: (G1 TO P)	0.5	pf
INPUT: G1 TO (H+K+G2+G3)	14	pf
OUTPUT: P TO (H+K+G2+G3)	9.0	pf

HEATER RATINGS AND CHARACTERISTICS

DESIGN MAXIMUM VALUES- SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	50 VOLTS	150	MA.
HEATER TAP VOLTAGE[A]		7.0	VOLTS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		150±10	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

[A] WITHOUT PANEL LAMP.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HEATER TAP VOLTAGE WHEN PANEL LAMP FAILS, RMS	14	VOLTS
PLATE VOLTAGE	150	VOLTS
GRID #2 VOLTAGE	130	VOLTS
PLATE DISSIPATION	5.5	WATTS
GRID #2 DISSIPATION	1.1	WATTS
GRID #1 CIRCUIT RESISTANCE		
WITH FIXED BIAS	0.1	MEGOHMS
WITH CATHODE BIAS	0.5	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS
PLATE RESISTANCE, APPROX.	10 000	OHMS
TRANSCONDUCTANCE	7500	μMHOS
ZERO-SIGNAL PLATE CURRENT	49	MA.
MAX.-SIGNAL PLATE CURRENT	50	MA.
ZERO-SIGNAL GRID #2 CURRENT	4.0	MA.
MAX.-SIGNAL GRID #2 CURRENT	8.5	MA.
LOAD RESISTANCE	2500	OHMS
TOTAL HARMONIC DISTORTION, (APPROX.)	9	PERCENT
MAX.-SIGNAL POWER OUTPUT	1.9	WATTS

THE 50HK6 HAS A HEATER TAP, WHICH MAY BE USED FOR OPERATING A 6.3-VOLT, 150-MILLIAMPERE PANEL LAMP IN EQUIPMENT EMPLOYING SEMICONDUCTOR RECTIFIERS. THE TABLE BELOW GIVES THE REQUIRED VALUES OF PANEL-LAMP SHUNTING RESISTOR FOR VARIOUS RECTIFIER LOAD CURRENTS.

SHUNTING RESISTOR REQUIRED WITH PANEL LAMP NUMBER 40 OR NUMBER 47

SEE TYPICAL CIRCUIT

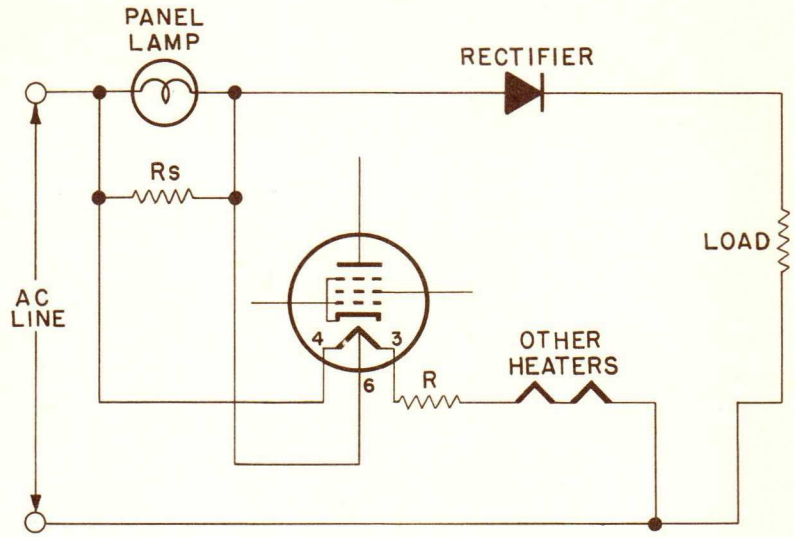
HEATER VOLTAGE (PIN 3 TO PIN 4)	45	45	45	45	45	45	45	VOLTS
HEATER-TAP VOLTAGE PIN 4 TO PIN 6)	5.0	5.4	5.5	5.5	5.5	5.5	5.5	VOLTS
HEATER CURRENT (BETWEEN PINS 3 & 6)	150	150	150	150	150	150	150	MA.
PANEL-LAMP SHUNTING RESISTOR	---	---	370	175	120	88	73	OHMS
RECTIFIER LOAD CURRENT[B]	60	70	80	90	100	110	120	MA.

[B] HIGHER LOAD CURRENTS WILL REQUIRE SMALLER VALUES OF PANEL-LAMP SHUNTING RESISTOR. FOR MAXIMUM PANEL-LAMP LIFE, THE SHUNTING RESISTOR SHOULD BE SELECTED TO ALLOW A PANEL-LAMP VOLTAGE OF 5.5 VOLTS WITH FULL RECTIFIER LOAD CURRENT.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

TYPICAL CIRCUIT FOR OPERATION WITH PANEL LAMP



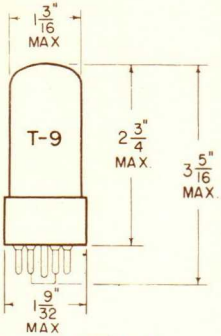
R_S = PANEL-LAMP SHUNTING RESISTOR

DROP ACROSS R AT 0.15 AMPERE SHOULD EQUAL DIFFERENCE BETWEEN LINE VOLTAGE AND TOTAL OF ALL RATED HEATER VOLTAGES

PRINTED IN U.S.A.

TUNG-SOL

BEAM PENTODE

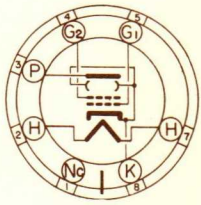


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
50 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE SHELL
7 PIN OCTAL
7AC

THE 50L6GT IS DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AC/DC RECEIVERS. IT DELIVERS A HIGH POWER OUTPUT WITH HIGH POWER SENSITIVITY FROM LOW SUPPLY VOLTAGES.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	50	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE: ←		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
DC AND PEAK	200	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

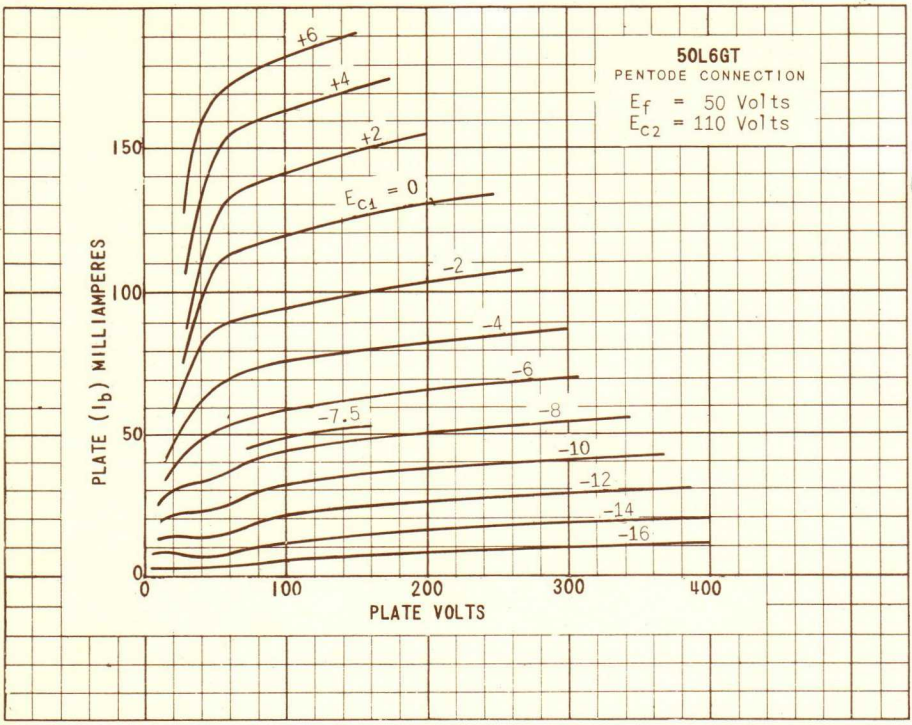
CLASS A_1 AMPLIFIER

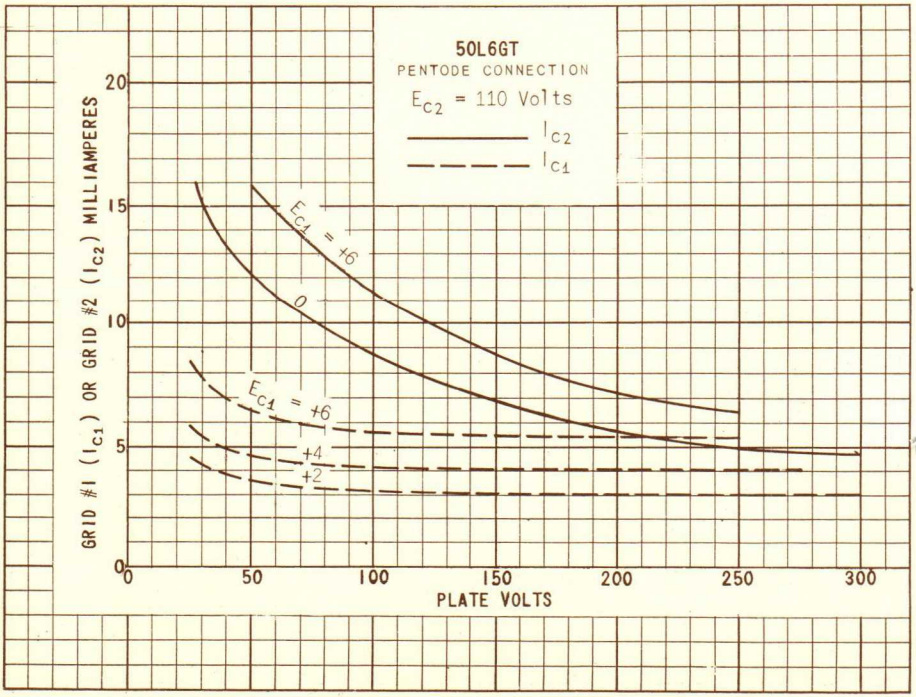
HEATER VOLTAGE	50	50	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
PLATE VOLTAGE	110	200	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-7.5	0	VOLTS
CATHODE BIAS RESISTOR	0	180	OHMS
PEAK AF GRID #1 VOLTAGE	7.5	8.5	VOLTS
PLATE RESISTANCE (APPROX.)	13 000	28 000	OHMS
TRANSCONDUCTANCE	8 000	8 000	µMHOS
ZERO-SIGNAL PLATE CURRENT	49	46	MA.
MAXIMUM-SIGNAL PLATE CURRENT	50	47	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	2.2	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	10	8.5	MA.
LOAD RESISTANCE	2 000	4 000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT
POWER OUTPUT	2.1	3.8	WATTS

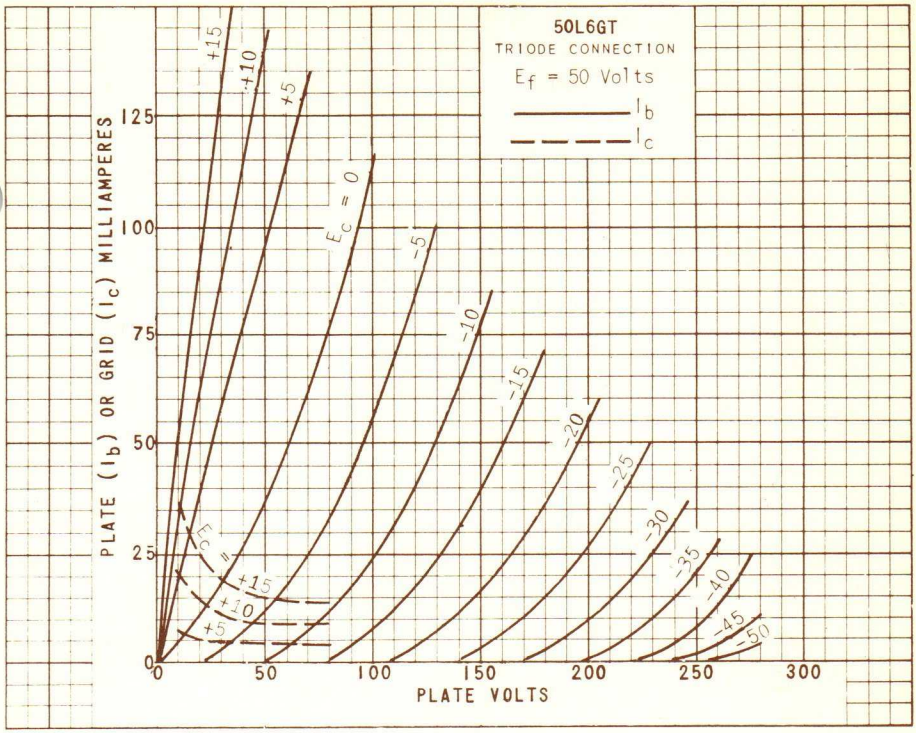
→ INDICATES A CHANGE.

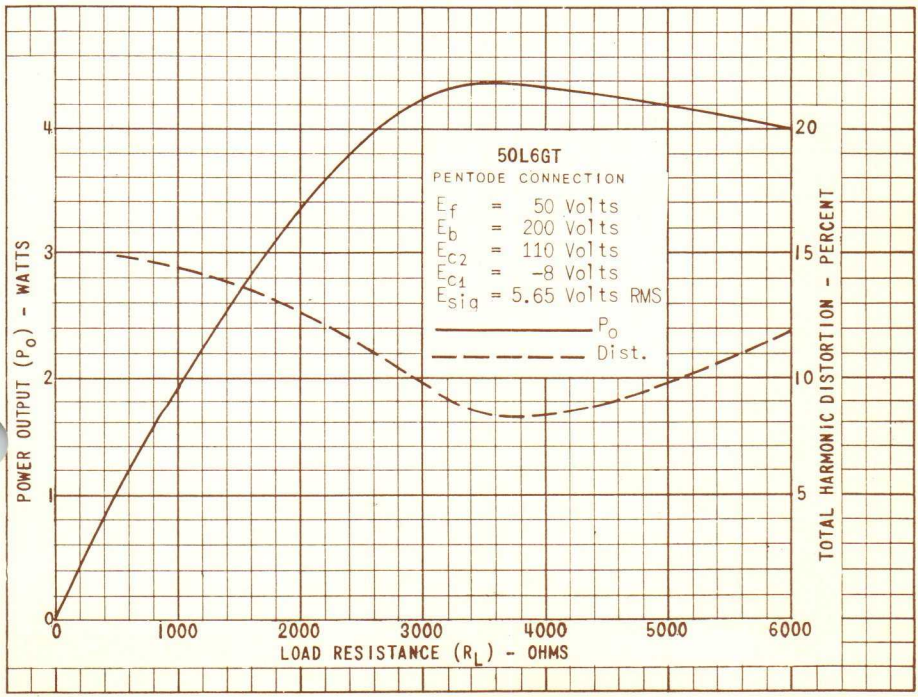
PRINTED IN U.S.A.

50L6GT


50L6GT
PENTODE CONNECTION
E_f = 50 Volts
E_{c2} = 110 Volts
PLATE (I_b) MILLIAMPERES
PLATE VOLTS
+6
+4
+2
E_{c1} = 0
-2
-4
-6
-7.5
-8
-10
-12
-14
-16
0
50
100
150
0
100
200
300
400


50L6GT
PENTODE CONNECTION
E_{c2} = 110 Volts
I_{c2}
I_{c1}
GRID #1 (I_{c1}) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
E_{c1} = +6
0
E_{c1} = +6
+4
+2
0
5
10
15
20
0
50
100
150
200
250
300





PRINTED IN U.S.A.

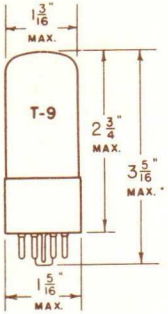
PLATE
2690
JUNE 1
1951

COPYRIGHT 1949 BY TUNG-SOL LAMP WORKS INC. ELECTRONIC TUBE DIVISION NEWARK, NEW JERSEY, U.S.A.

TUNG-SOL

TWIN DIODE HIGH VACUUM RECTIFIER

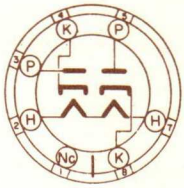
VOLTAGE DOUBLER



UNIPOTENTIAL CATHODE

HEATER
50 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB



G-7Qa

BOTTOM VIEW

INTERMEDIATE 7 PIN OCTAL BASE

THE TUNG-SOL 50Y6GT/G IS DESIGNED PRIMARILY FOR SERVICE AS A POWER RECTIFIER IN AC – DC RECEIVERS. TWO SEPARATE RECTIFIER SECTIONS PERMIT USING THE TUBE AS A VOLTAGE DOUBLER, FULL WAVE RECTIFIER OR HALF WAVE RECTIFIER. FOR HALF WAVE OPERATION THE TWO SECTIONS MAY BE OPERATED SEPARATELY, OR IN PARALLEL TO REDUCE TUBE DROP. ITS RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL TO THOSE OF THE 25Z5 AND THE 25Z6GT/G.

RATINGS

MAXIMUM AC PLATE VOLTAGE (RMS)	235	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	350	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	700	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	450	MA.
TUBE VOLTAGE DROP AT 150 MA. PER PLATE	22	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

VOLTAGE DOUBLER

	HALF WAVE	FULL WAVE	
AC VOLTAGE PER PLATE (RMS) MAX.	117	117	VOLTS
DC OUTPUT CURRENT MAX.	75	75	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.[A]	30	15	OHMS

[A] WHEN FILTER CONDENSERS LARGER THAN 40 UFDS ARE USED IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

PRINTED IN U.S.A.

PLATE 1063-2

JUNE 6 1941

COPYRIGHT 1941 BY TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION NEWARK, NEW JERSEY, U.S.A.

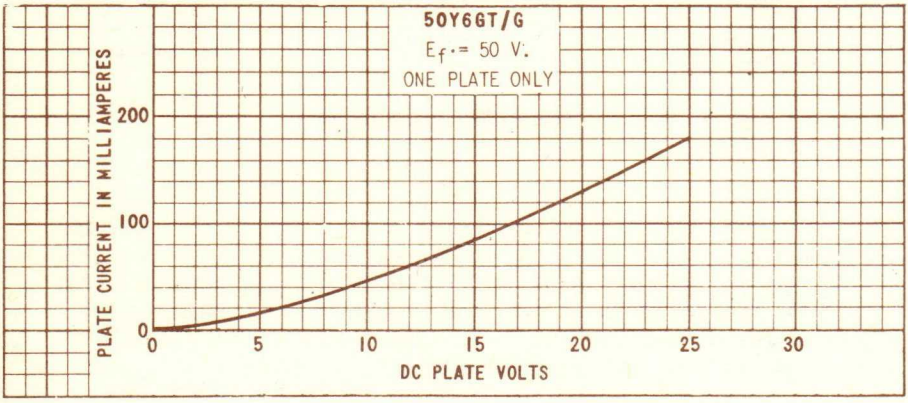
50Y6GT/G

TUNG-SOL

HALF WAVE RECTIFIER

AC PLATE VOLTAGE PER PLATE (RMS)	117	150	235 MAX.	VOLTS
DC OUTPUT CURRENT PER PLATE MAX.	75	75	75	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.A	15	40	100	OHMS

A WHEN FILTER CONDENSERS LARGER THAN 40 UFDS ARE USED IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.



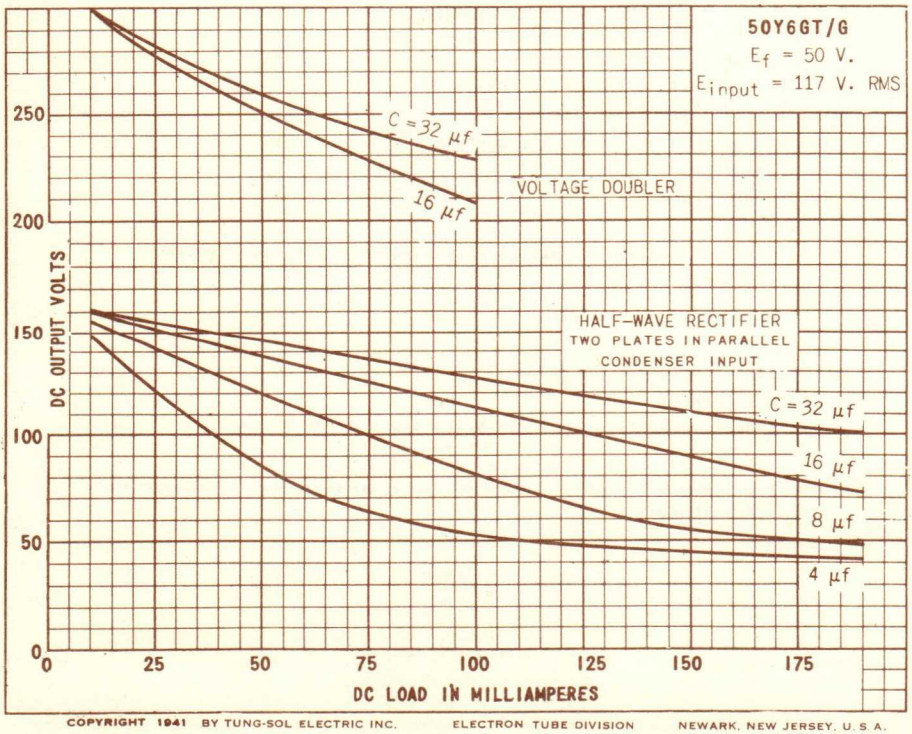


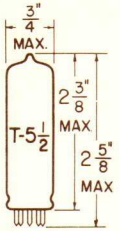
PLATE 1064-1

COPYRIGHT 1941 BY TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

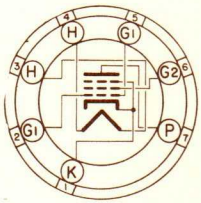
UNIPOTENTIAL CATHODE

HEATER

60±10% VOLTS 0.1 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON MINIATURE
7 PIN BASE
7CV

THE 6OFX5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN THE OUTPUT STAGES OF AUDIO AMPLIFIERS DESIGNED TO OPERATE FROM TRANSFORMERLESS AC OR AC/DC POWER SUPPLIES. THE 6OFX5 IS PARTICULARLY SUITABLE FOR USE IN TWO-TUBE SERIES-STRING STEREO-AMPLIFIER SYSTEMS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.65	μμf
GRID #1 TO CATHODE & GRID #3, GRID #2 & HEATER	17	μμf
PLATE TO CATHODE & GRID #3, GRID #2 & HEATER	9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	60±10%	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) VOLTAGE	130	VOLTS
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE-BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	5.5	WATTS
MAXIMUM GRID #2 INPUT	2	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	225	°C
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM

CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	60±10%	VOLTS
HEATER CURRENT	0.1	AMP.
PLATE-SUPPLY VOLTAGE	110	VOLTS
GRID #2 SUPPLY VOLTAGE	115	VOLTS
CATHODE RESISTOR	62	OHMS
PLATE RESISTANCE (APPROX.)	17 500	OHMS
TRANSCONDUCTANCE	13 500	μMHOS
PLATE CURRENT	36	MA.
GRID #2 CURRENT	10	MA.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

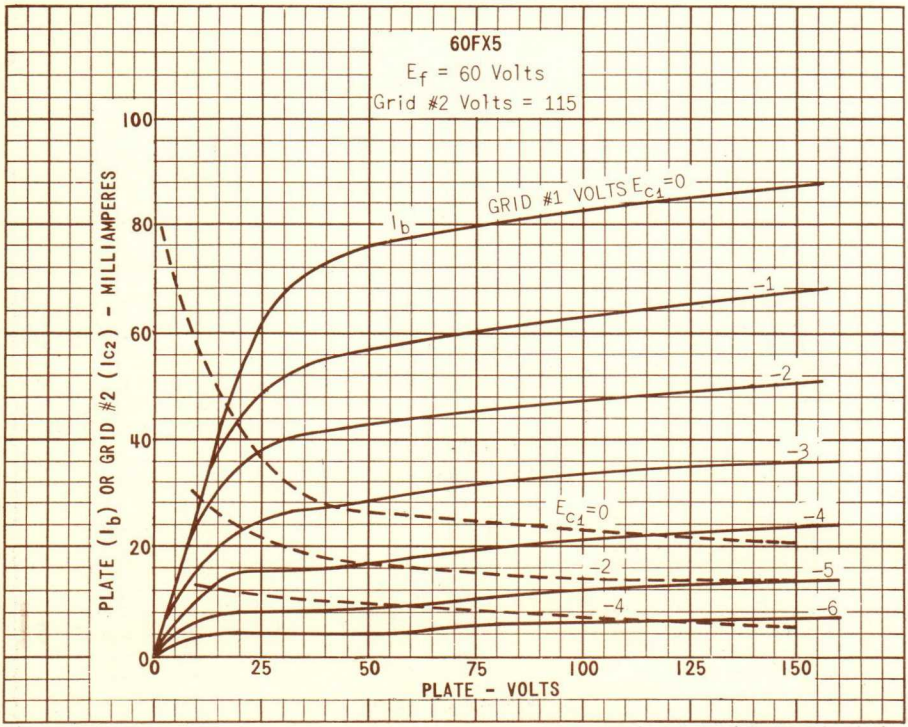
CONTINUED FROM PRECEDING PAGE

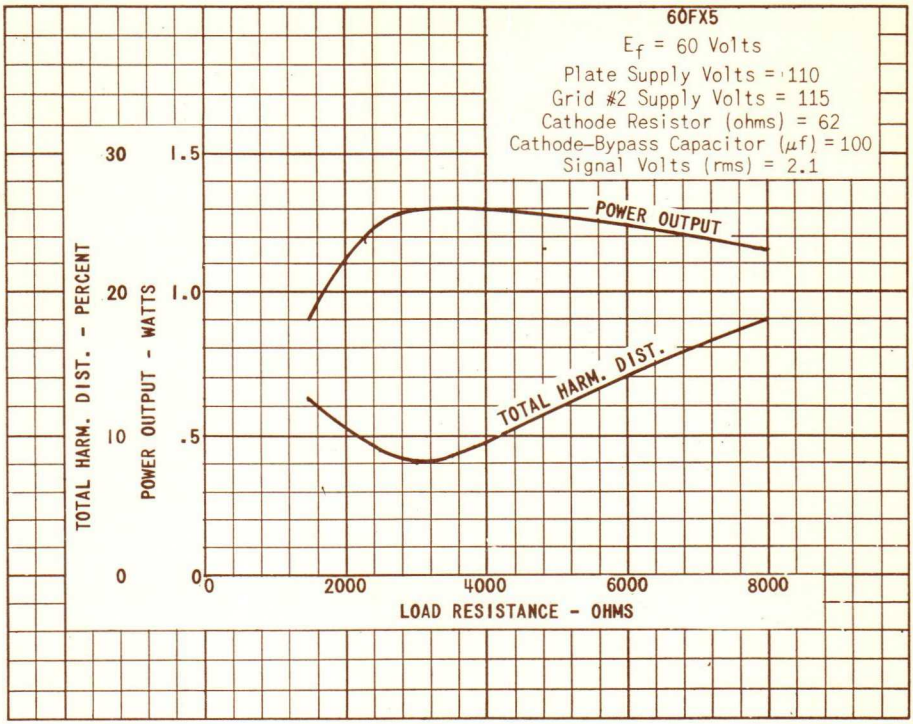
TYPICAL OPERATION

HEATER VOLTAGE	60±10%	VOLTS
HEATER CURRENT	0.1	AMP.
PLATE SUPPLY VOLTAGE	110	VOLTS
GRID #2 SUPPLY VOLTAGE	115	VOLTS
CATHODE RESISTOR	62	OHMS
PEAK AF GRID #1 VOLTAGE	3	VOLTS
ZERO-SIGNAL PLATE CURRENT	36	MA.
MAX.-SIGNAL PLATE CURRENT	35	MA.
ZERO-SIGNAL GRID #2 CURRENT	10	MA.
MAX.-SIGNAL GRID #2 CURRENT	12	MA.
LOAD RESISTANCE	3 000	OHMS
TOTAL HARMONIC DISTORTION	8	PERCENT
MAX.-SIGNAL POWER OUTPUT	1.3	WATTS

[A] THE DC COMPONENT MUST NOT EXCEED 100 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.

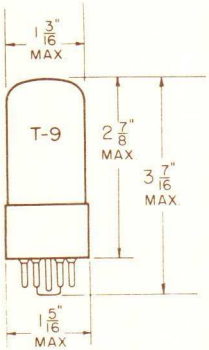




PRINTED IN U.S.A.

TUNG-SOL

COMBINED HALF WAVE RECTIFIER AND BEAM POWER AMPLIFIER

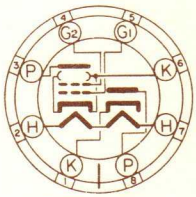


GLASS BULB

COATED UNIPOTENTIAL CATHODES

HEATER
70 VOLTS 0.15 AMPERE
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE SHELL
8-PIN OCTAL

THE 70L7GT IS A COMBINED RECTIFIER AND POWER OUTPUT BEAM TETRODE DESIGNED FOR SERVICE IN AC-DC RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE (AC OR DC)	70	VOLTS
HEATER CURRENT	0.15	AMP.

RECTIFIER UNIT

MAX. PEAK INVERSE PLATE VOLTAGE	350	VOLTS
MAX. PEAK PLATE CURRENT	420	MA.
MAX. DC HEATER-CATHODE POTENTIAL	175	VOLTS
WITH CONDENSER-INPUT FILTER:		
MAX. AC PLATE VOLTAGE (RMS)	117	VOLTS
MAX. DC OUTPUT CURRENT	70	MA.
MIN. TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE[A]	15	OHMS

AMPLIFIER UNIT

MAX. PLATE VOLTAGE	117	VOLTS
MAX. SCREEN VOLTAGE	117	VOLTS
MAX. PLATE DISSIPATION	5.0	WATTS
MAX. SCREEN DISSIPATION	1.0	WATT
HEATER-CATHODE VOLTAGE	AS LOW AS POSSIBLE[B]	

[A] WHEN A FILTER-INPUT CONDENSER EXCEEDING 40 μf IS USED, MORE PLATE SUPPLY IMPEDANCE MAY BE NECESSARY TO LIMIT THE PEAK PLATE CURRENT TO THE RATED VALUE.

[B] OBTAINED BY CONNECTING PIN #2 TO THE SIDE OF THE LINE OPPOSITE THAT TO WHICH PINS #7 AND #8 ARE CONNECTED.

PLATE 1633
NOV. 30 1945

CONTINUED ON FOLLOWING PAGE

COPYRIGHT 1945 BY TUNG-SOL LAMP WORKS INC. ELECTRONIC TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	110	VOLTS
SCREEN VOLTAGE	110	VOLTS
GRID VOLTAGE	7.5	VOLTS
PEAK AF GRID VOLTAGE	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	40	MA.
ZERO-SIGNAL SCREEN CURRENT (APPROX.)	3	MA.
MAX.-SIGNAL PLATE CURRENT	43	MA.
MAX.-SIGNAL SCREEN CURRENT (APPROX.)	6	MA.
GRID RESISTOR (MAX.)		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
PLATE RESISTANCE	15 000	OHMS
LOAD RESISTANCE	2000	OHMS
TRANSCONDUCTANCE	7500	µMHOS
MAX.-SIGNAL POWER OUTPUT	1.8	WATTS
TOTAL HARMONIC DISTORTION	10	PER CENT

SIMILAR TYPE REFERENCE: *Rectifier unit similar to types 117Z3 and 117Z4GT; amplifier unit somewhat similar to types 25L6G;35A5,35L6G.*

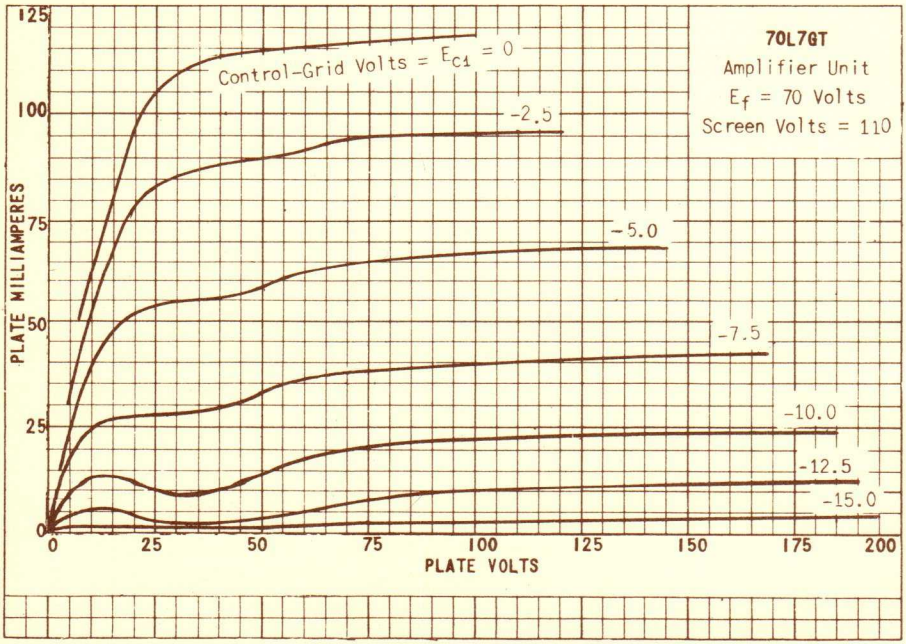
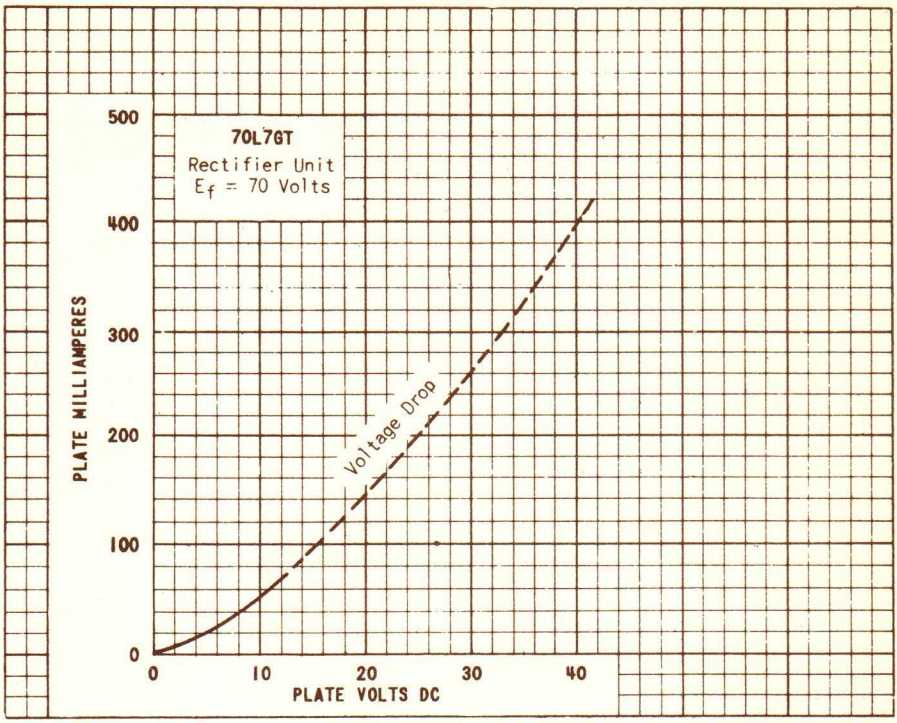
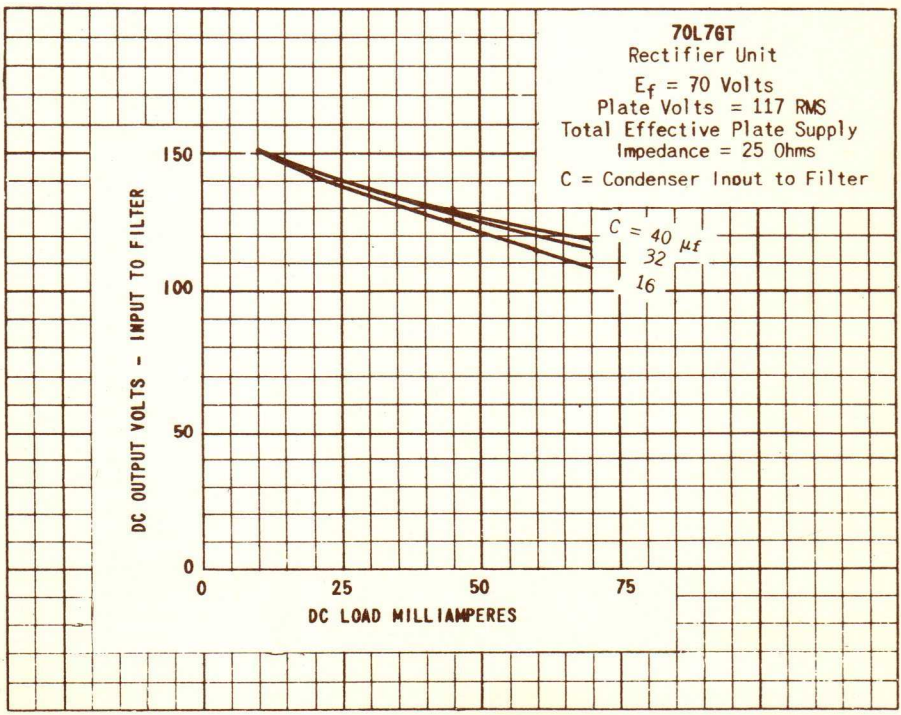


PLATE 1634
NOV. 30 1945

COPYRIGHT 1945 BY TUNG-SOL LAMP WORKS INC. ELECTRONIC TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.



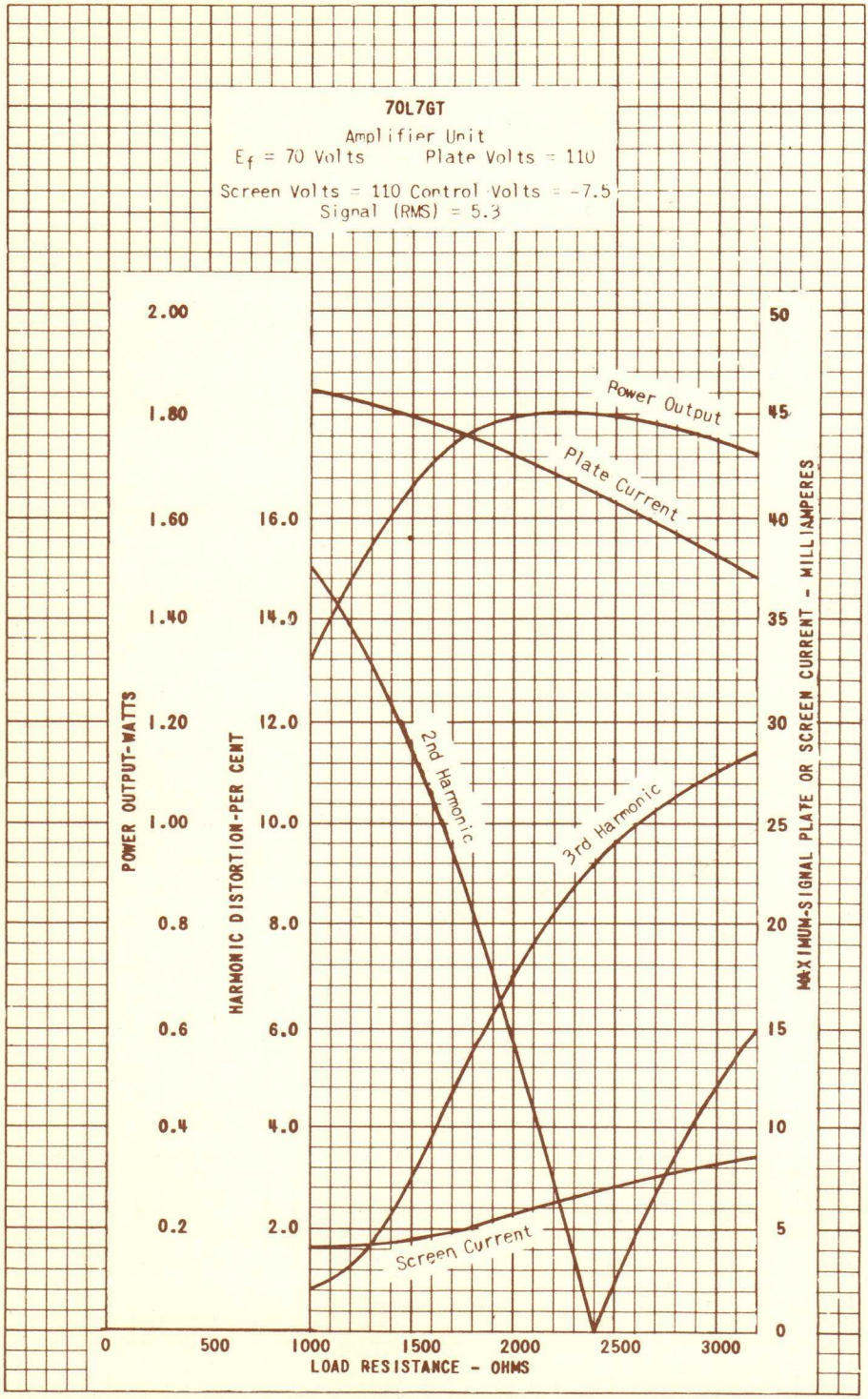


PRINTED IN U. S. A.

PLATE
1635
NOV. 30
1945

COPYRIGHT 1945 BY TUNG-SOL LAMP WORKS INC. ELECTRONIC TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

70L7GT

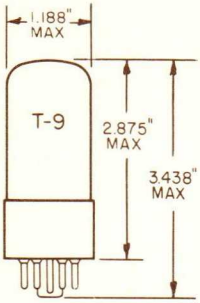


FLAT
1636
NOV. 30
1945

COPYRIGHT 1945 BY TUNG-SOL LAMP WORKS INC. ELECTRONIC TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

TUNG-SOL

DIODE-BEAM PENTODE



GLASS BULB
INTERMEDIATE SHELL
8 PIN OCTAL B8-6
OUTLINE DRAWING
JEDEC 9-15

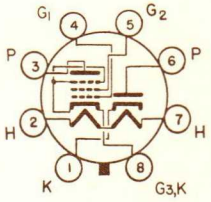
FOR

POWER RECTIFIER AND

AUDIO OUTPUT APPLICATIONS

COATED UNIPOTENTIAL CATHODES

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8A0

THE 117L7/M7GT COMBINES A HALF-WAVE RECTIFIER AND A BEAM POWER AMPLIFIER IN THE SAME ENVELOPE. IT IS DESIGNED FOR AC DC SERVICE FROM A 117 VOLT LINE IN THREE WAY PORTABLE RECEIVERS. IT HAS FOUND USE IN A NUMBER OF OTHER APPLICATIONS.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	117	VOLTS	90	MA.
LIMITS OF SUPPLIED VOLTAGE			117±12	VOLTS
MAXIMUM DC HEATER-CATHODE VOLTAGE			175	VOLTS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

DIODE UNIT

AC PLATE VOLTAGE, RMS	117	VOLTS
PEAK INVERSE VOLTAGE	350	VOLTS
STEADY-STATE PEAK PLATE CURRENT	450	MA.

PENTODE UNIT

PLATE VOLTAGE	117	VOLTS
GRID 2 VOLTAGE	117	VOLTS
PLATE DISSIPATION	6.0	WATTS
GRID 2 DISSIPATION	1.0	WATTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND OPERATING CONDITIONS

DIODE UNIT

TUBE VOLTAGE DROP:		
MEASURED WITH APPLIED DC AT 150 MA PLATE CURRENT	16	VOLTS

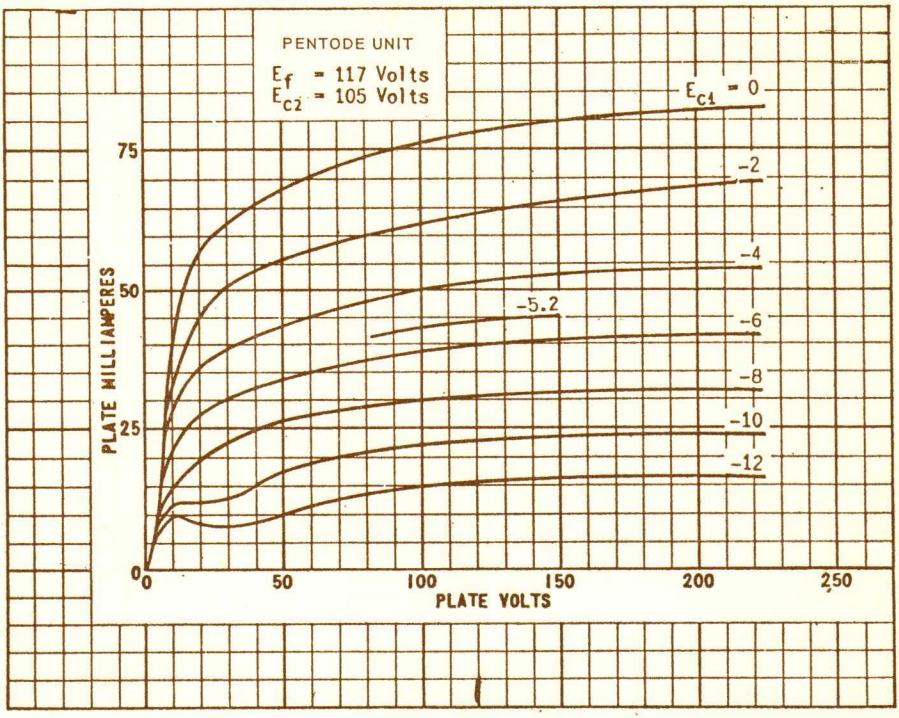
HALF-WAVE POWER RECTIFIER

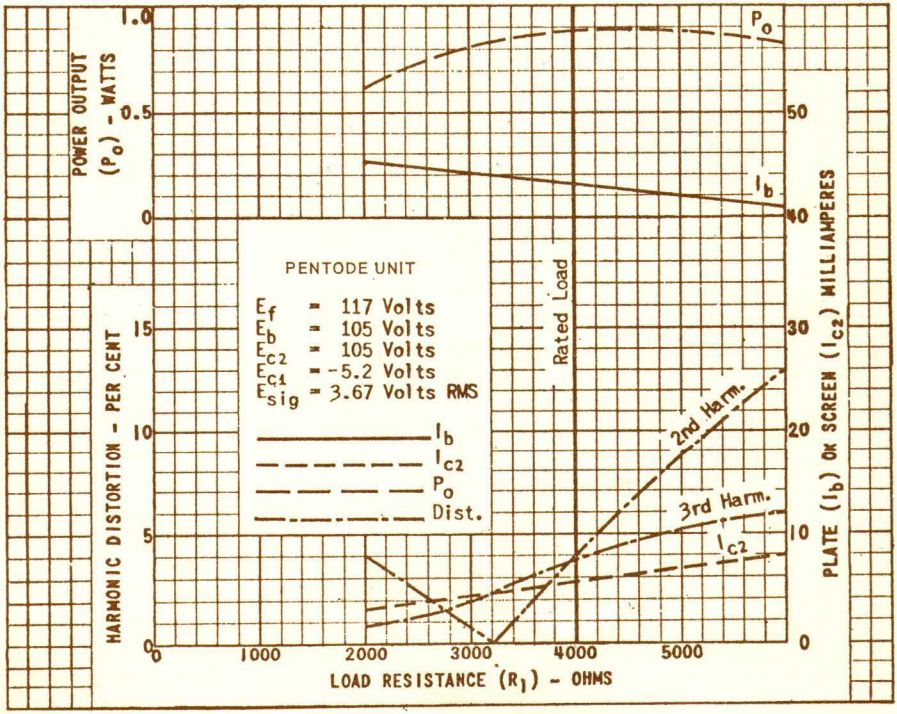
AC PLATE VOLTAGE, RMS	117	VOLTS
DC OUTPUT CURRENT	75	MA.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	15	OHMS

PENTODE UNIT

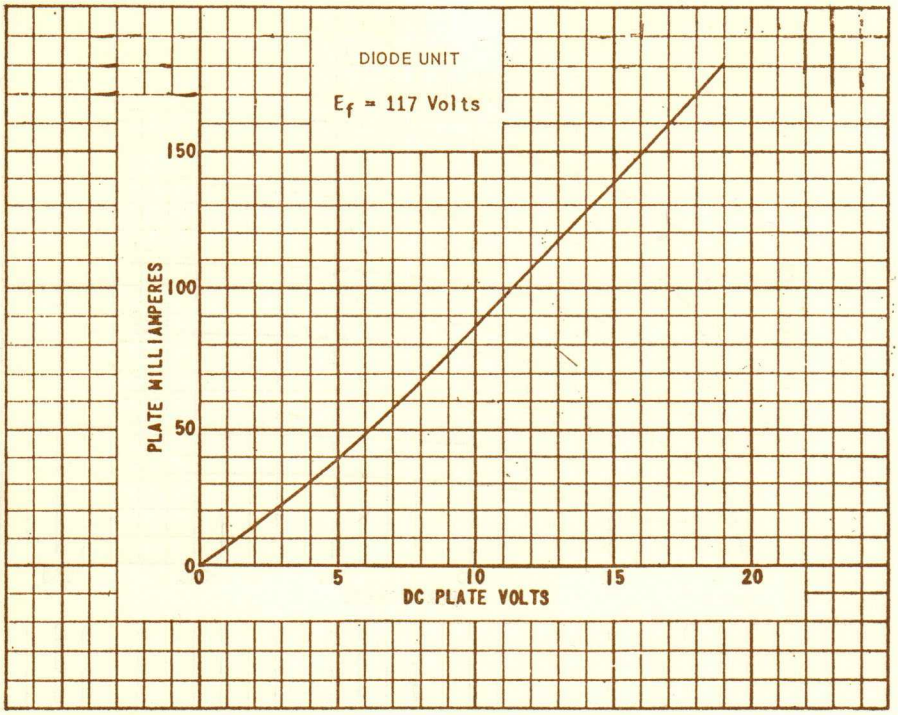
CLASS A1 AUDIO POWER AMPLIFIER

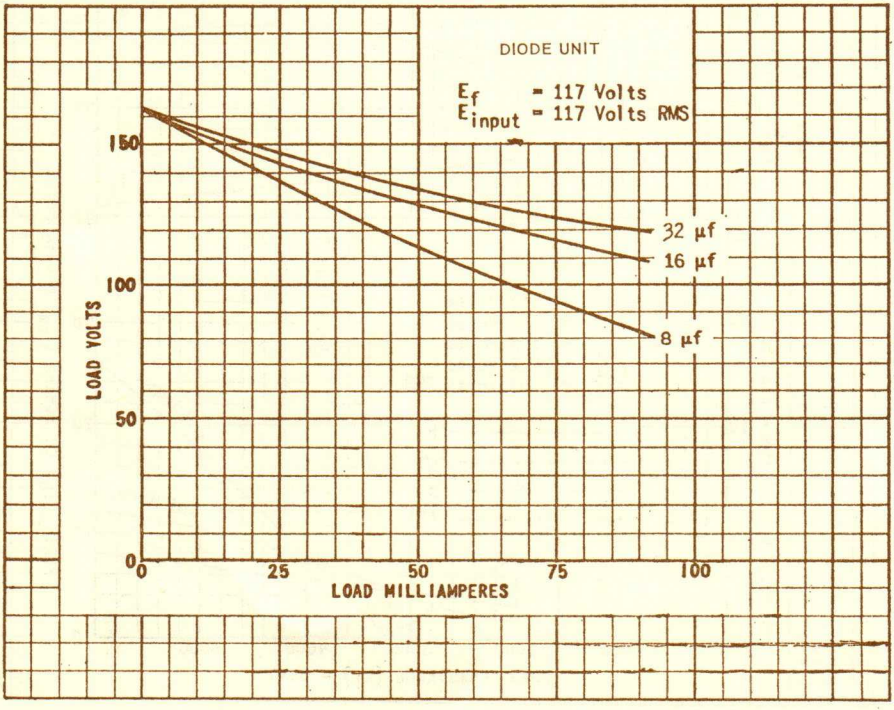
PLATE VOLTAGE	105	VOLTS
GRID 2 VOLTAGE	105	VOLTS
GRID VOLTAGE	-5.2	VOLTS
PEAK AF GRID VOLTAGE	5.2	VOLTS
ZERO-SIGNAL PLATE CURRENT	43	MA.
MAXIMUM-SIGNAL PLATE CURRENT	43	MA.
ZERO-SIGNAL GRID 2 CURRENT (NOMINAL)	4	MA.
MAXIMUM-SIGNAL GRID 2 CURRENT (NOMINAL)	5.5	MA.
PLATE RESISTANCE (APPROX.)	17,000	OHMS
TRANSCONDUCTANCE	5,300	μMHOS
LOAD RESISTANCE	4,000	OHMS
TOTAL HARMONIC DISTORTION	5.0	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	0.85	WATT





PRINTED IN U. S. A.


DIODE UNIT
E_f = 117 Volts
PLATE MILLIAMPERES
150
100
50
0
0
5
10
15
20
DC PLATE VOLTS


DIODE UNIT
E_f = 117 Volts
E_{input} = 117 Volts RMS
LOAD VOLTS
150
100
50
0
32 µf
16 µf
8 µf
0
25
50
75
100
LOAD MILLIAMPERES

TUNG-SOL

DIODE

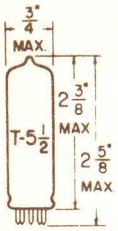
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
117 VOLTS 40 MA.
AC OR DC

ANY MOUNTING POSITION

NOTE: DO NOT USE PIN #1 ON SOCKET AS TIE POST.



GLASS BULB

BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 11Z3 IS A MINIATURE CATHODE-TYPE, CLOSE-SPACED HALF-WAVE RECTIFIER DESIGNED FOR SERVICE IN THREE-WAY PORTABLE RECEIVERS. THE 117 VOLT HEATER PERMITS DIRECT, ACROSS THE LINE, HEATER OPERATION WITHOUT NEED FOR A DROPPING RESISTOR.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	117	VOLTS
MAXIMUM DC HEATER-CATHODE VOLTAGE		
CATHODE POSITIVE	175	VOLTS
CATHODE NEGATIVE	100	VOLTS
MAXIMUM AC PLATE VOLTAGE (RMS)	117	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	330	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	540	MA.
MAXIMUM STEADY-STATE DC OUTPUT CURRENT	90	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT	2.5	AMP.
TUBE VOLTAGE DROP: MEASURED WITH TUBE CONDUCTING 180 MA. PLATE CURRENT	22.5	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER

HEATER VOLTAGE	117	VOLTS
HEATER CURRENT	40	MA.
AC PLATE SUPPLY VOLTAGE (RMS)	117	VOLTS
DC OUTPUT VOLTAGE	110	VOLTS
DC OUTPUT CURRENT	90	MA.
EFFECTIVE PLATE SUPPLY IMPEDANCE	20	OHMS
INPUT CONDENSER	30	µf

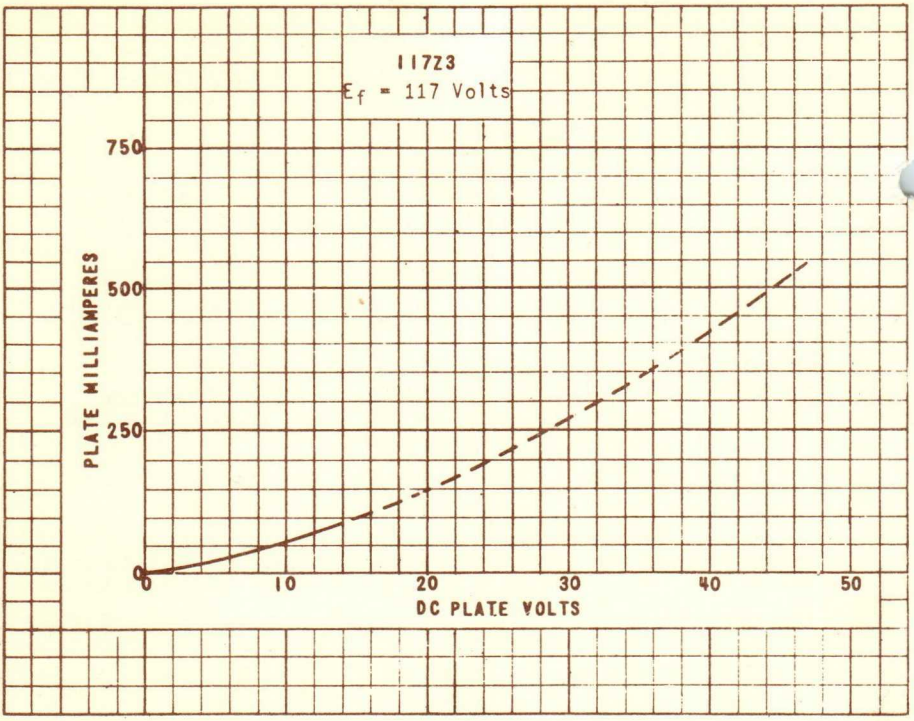
SIMILAR TYPE REFERENCE: *Same general characteristics as type 117Z4GT; somewhat similar to the rectifier unit of type 70L7GT.*

→ INDICATES A CHANGE OR ADDITION.

PRINTED IN U. S. A.

PLATE 2093
OCT. 1, 1948

COPYRIGHT 1948 BY TUNG-SOL LAMP WORKS INC. ELECTRONIC TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.



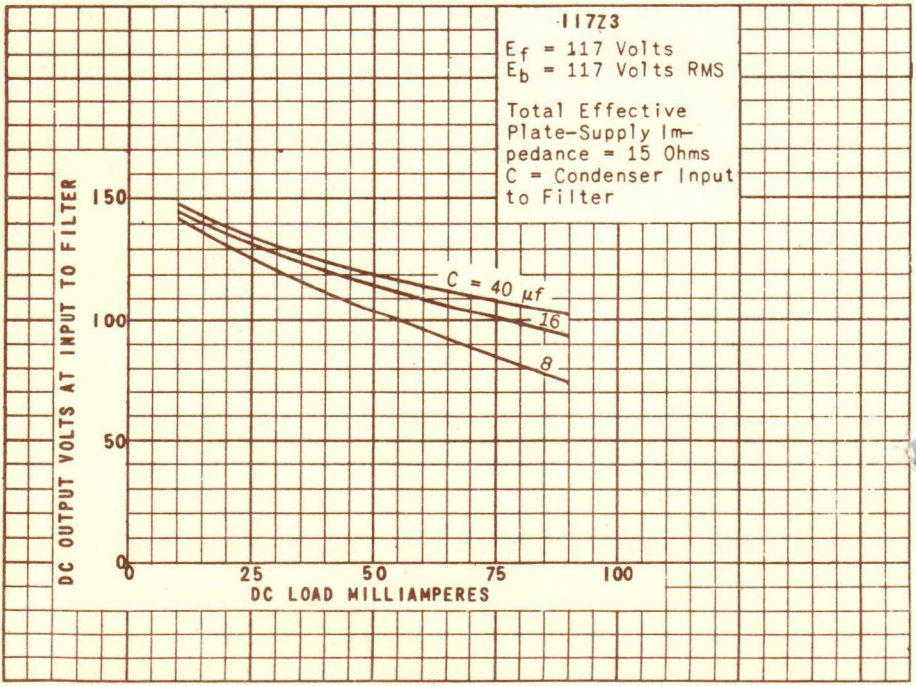


PLATE 2094
OCT. 1, 1948

COPYRIGHT 1948 BY TUNG-SOL LAMP WORKS INC ELECTRONIC TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

TUNG-SOL

MILITARY AND INDUSTRIAL TUBE TYPE SECTION

Page	Plate
Contents	6779
Contents	6780
Contents	6797
Standard Electron Tubes	5520
Military and Industrial Tube Type Preface	5214
Series Regulator Tubes	5493
0B2	5253
0B2	5254
0B2	5255
0C3W	5494
0C3W	5495
0C3W	5496
0D3W	5497
0D3W	5498
0D3W	5499
1A3	6711
1R5WA	5967
1R5WA	5968
1R5WA	5969
1S22	5500
1T4WA	5807
1T4WA	5808
1T4WA	5809
1U4WA	5810
1U4WA	5811
1U5WA	5970
1U5WA	5971
1U5WA	5972
1Z2	5234
1Z2	5235
2D21W	5371
2D21W	5372
2E26	6110
2E26	6058
2E26	6059
2E26	6060
2E26	6061
2E30	6749
2E30	6750
2E30	6202
2E30	6203
3B28	5236
3B28	5237
3C23	5812
3C23	5813
3C23	5814
3V4WA	6003
4B32	5238
4B32	5239
5AT4	6204
5R4WGA	5373
5R4WGA	5374
5R4WGB	5375
5R4WGB	5376
5R4WGB	5377
6AH6WA	6004
6AH6WA	6005
6AH6WA	6006
6AH6WA	6007
6AS7G	6112
6AS7G	5241
6AS7G	5242
6AU6WA	4461
6AU6WA	4846
6AU6WA	4463
6CA7	5722
6CA7	5723
6CA7	5724
6CA7	5725
6CA7	5726
6CA7	5727
6D4	5215
6D4	5216
6J6WA	6655
6J6WA	6656
6L6GC	5815
6L6GC	5816
6L6GC	5817
6L6GC	5818
6L6GC	5819
6L6GC	6419
6L6WGB	4464
6L6WGB	4847
6L6WGB	4466
6SL7WGT	6770
6SL7WGT	6771
6SN7WGTA	4848
6SN7WGTA	4849
6SN7WGTA	4850
6SN7WGTA	4851
6X4W	4852
6X4W	4853
6X4W	4854
6X4WA	6008
6X4WA	6009
6X4WA	6010
6X4WA	6011
6X4WA	6012
6X5WGT	6751
12AT7WA	4467
12AT7WA	4855
12AT7WA	4469
12AX7WA	6772
12AX7WA	6773
12SX7GT	6631
26A7GT	6616
26A7GT	6617
26E6WG	4856
26Z5W	4857
26Z5W	4858
323B	5821
323B	5822
323B	5823
393A	5824
393A	5825
393A	5826
395A	5256
395A	5827
395A	5258

CONTENTS

TUNG-SOL

MILITARY AND INDUSTRIAL TUBE TYPE SECTION

Page	Plate	Page	Plate
395A	5259	5687	6463
407A	5243	5687WA	5505
407A	5244	5687WA	4865
CH-1027	5728	5687WA	4485
CH-1027	5755	5691	6464
CH-1095	5521	5691	6465
CH-1096	5522	5693	6466
CH-1096	5523	5693	6467
CH-1097	5524	5693	6468
CH-1097	5525	5693	6469
VC-1257	5260	5696	5382
VC-1257	5261	5696	5383
VC-1257	5262	5702WA	6420
VC-1257	5263	5702WA	5623
1258	5501	5702WA	5624
1258	5502	5702WA	5625
1258	5518	5702WB	6421
2050	5620	5702WB	5627
2050	5504	5702WB	5628
2050W	5621	5702WB	5629
2050W	5265	5702WB	5630
5517	5378	5703 (5703WA, 5703WB)	6657
5636	4471	5703	6658
5636	4859	5718	5639
5636	4860	5718	5640
5636	4861	5718	5641
5639	4475	5718	5642
5639	4862	5719	5643
5639	4477	5719	5644
5639WA	5729	5719	5645
5639WA	5730	5719	5646
5639WA	5731	5725/6AS6W/6187	4486
5639WA	5732	5725/6AS6W/6187	4488
5639WA	5756	5725/6AS6W/6187	4866
5643	5266	5726	6470
5643	5828	5726/6AL5W/6097	4489
5643	5268	5726/6AL5W/6097	4867
5651	5247	5744	6471
5651	5248	5744WB	5647
5651WA	5379	5744WB	5648
5651WA	5380	5744WB	5649
5651WA	5381	5744WB	5650
5654	6450	5749	6472
5654	6451	5749	6473
5654/6AK5W/6096	4478	5749/6BA6W	4491
5654/6AK5W/6096	4863	5749/6BA6W	4868
5654/6AK5W/6096	4480	5749/6BA6W	4493
5670	6452	5751 (5751W1)	6659
5670	6453	5751	6660
5670WA	4481	5751WA	4494
5670WA	4864	5751WA	4869
5672	6454	5751WA	4496
5672	6455	5763	6013
5676	6456	5763	6014
5676	6457	5763	6015
5678	6458	5783	5651
5678	6459	5783WA	5217
5686	6460	5783WA	5218
5686	6461	5783WA	5219
5687	6462	5783WB	5652

TUNG-SOL

MILITARY AND INDUSTRIAL TUBE TYPE SECTION

Page	Plate
5783WB	5653
5783WB	5654
5784WA (5784WB)	6661
5784WA	6662
5814A (5814WB)	6663
5814A	6664
5814A	6665
5814WA	4497
5814WA	4870
5814WA	4499
5829WA	4871
5829WA	4872
5829WA	4873
5839	6477
5839	6478
5840	6554
5840	5830
5840	5831
5840	5832
5852	6674
5852	6480
5875	6481
5879	6781
5879	6782
5879	6783
5879	6784
5881	6482
5881	6483
5881	6484
5886	6712
5886	6713
5886	6714
5896	5655
5896	5656
5899	6116
5899	5658
5899	5659
5902	5660
5902	5661
5902	5662
5902	5663
5902WA	6752
5902WA	6753
5948	5526
5948	5527
5948	5528
5948	5529
5949	5530
5949	5531
5949	5532
5963	6303
5963	5665
5964	6304
5964	5667
5965	6035
5965	6036
5965	6037
5965	6038
5998	5220
5998	5221
5998	5222
5998A	6675
6000	6117
6005	6485
6005	6486
6012	6039
6012	5834
6021	4874
6021	4875
6021	6487
6021WA	5835
6021WA	5836
6021WA	5837
6021WA	5838
6021WA	5839
6026	6305
6026	6306
6080WA	6118
6080WA	5534
6080WA	5535
6088	6062
6088	5669
6098/6AR6WA	4503
6098/6AR6WA	4876
6110	6307
6111	6308
6111	5671
6111	5672
6111	5673
6111WA	6309
6111WA	5841
6111WA	5842
6111WA	5843
6111WA	5844
6112	5737
6112	5738
6112	5739
6112WA	5976
6112WA	5977
6112WA	5978
6112WA	5979
6112WA	5980
6136	6774
6136	6716
6186/6AG5WA	6040
6186/6AG5WA	6041
6186/6AG5WA	6042
6188	6119
6188/6SU7WGT	4877
6188/6SU7WGT	4878
6188/6SU7WGT	6085
6189/12AU7WA	4879
6189/12AU7WA	4880
6189/12AU7WA	4881
6201	6310
6201	6311
6201	6312
6201	6313
6202	6775
6202	6776

CONTENTS

TUNG-SOL

MILITARY AND INDUSTRIAL TUBE TYPE SECTION

Page	Plate
6205	6132
6205	5846
6205	5847
6205	5848
6206	6314
6216	6315
6216	6316
6216	6317
6245	5740
6245	5741
6245	5742
6245	5743
6263A	6785
6263A	6786
6263A	6787
6264A	6788
6264A	6789
6264A	6790
6286	6777
6286	6778
6327	6488
6327	6489
6336A	5223
6336A	5224
6336A	5225
6394A	5226
6394A	5227
6394A	5228
6418	6754
6418	5675
6419	6063
6419	6064
6485	6676
6485	6677
6520	5384
6520	5385
6528	5229
6528	5230
6528	5506
6528	5232
6533	5744
6533	5745
6533	5746
6542	5386
6542	5387
6542	5388
6550	6755
6550	6679
6550	6680
6550	6681
6562	6666
6562	6667
6627/0B2WA	5390
6627/0B2WA	5391
6627/0B2WA	5392
6660	6717
6660	6718
6660	6719
6661	6720
6661	6721
6661	6722
6662	6723
6662	6724
6662	6725
6663	6726
6663	6727
6664	6121
6664	6122
6669	6756
6669	6757
6676	6205
6676	6206
6676	6207
6679	6682
6679	6683
6680	6684
6680	6685
6680	6686
6681	6687
6681	6688
6688	5849
6688	5850
6832	6123
6832	6124
6872	6791
6872	6792
6887	6208
6943	5676
6943	5677
6977	6793
6977	6691
6977	6794
7025	6493
7025	6494
7044	6210
7044	5981
7099	5536
7099	5537
7099	5538
7105	5539
7105	5540
7105	5541
7189	6495
7189	6496
7190	5393
7190	5394
7190	5395
7191	5747
7191	5397
7191	5398
7192	5399
7192	5400
7192	5409
7236	6211
7240	5507
7240	5508
7240	5509
7241	5401
7241	5402
7241	5403

TUNG-SOL

MILITARY AND INDUSTRIAL TUBE TYPE SECTION

Page	Plate
7241	5404
7242	5405
7242	5406
7242	5407
7242	5408
7246	6318
7246	6319
7258	6795
7323	5748
7323	5511
7355	5851
7370	6497
7400	5749
7400	5750
7400	5751
7400	5542
7401	5752
7401	5753
7401	5754
7401	5543
7533	6671
7533	6672
7581	6555
7581	6213
7581	6214
7581	6215
7581	6216
7581	6422
7581A	6556
7581A	6557
7591	6125
7607	5853
7701	6320
7716	6218
7716	6219
7719	6017
7719	6018
7724	6220
7724	6221
7803	6321
7851	6126
7867	6127
8049	6222
8068	6796
8149	6634
8150	6635
8217	6423
8217	6424
8217	6425
8445	6758
8446	6759
8447	6760
8448	6761
8489	6762
9001	6498
9002	6499
9003	6500

TUNG-SOL

SUPPLEMENTAL CONTENTS
FOR
MILITARY AND INDUSTRIAL TUBE TYPE SECTION

PLEASE RETAIN IN YOUR BOOK THE MAIN CONTENTS PAGES DATED JANUARY 1, 1963, IN ADDITION TO THE MOST RECENT SUPPLEMENTAL CONTENTS PAGE DATED JULY-DEC., 1965.

PAGE	PLATE
Supplemental Contents	7079→
25Z6WGT	7080*
6AU6WB	6606
5675	6607
5675	6608
5876A	6609
5876A	6610
5933	6506
5933	6507
5977	6604
6028	7081*
6094	6509
6094	6600
6611	7082*
6611	7083*
6877	7084*
6900	6629
6900	6630
6943	6616
6943	6617
6944	6618
6944	6619
6945	6620
6945	6621
6946	6623
6946	6624
6947	6625
6947	6626
6948	6627
7757	6631
7757	6632
7757	6633
8150	6502
8150	6503
8517	6504
8522	6602
8569	6612
8569	6613
8569	6614

* INDICATES AN ADDITION.
→INDICATES A CHANGE.

PRINTED IN U.S.A.

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	OZ4A/1003 3B †3B28 4B26 †4B32 6C 16B 857B 869B 1005 5517	†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		KLYSTRONS	DIODES	TRIODES
	ATR	TR			
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).

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	80 200	45 30	20 52
6336A*, 6336	500 200	50 235	50 35	25 95
6528*	400 200	65 225	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	2.7	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

PRINTED IN U. S. A.

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.

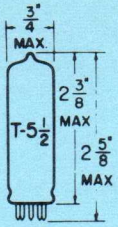
Much of the data on premium and military types has been taken from the MIL-E-1C specifications in effect at the time of publication. While all possible precautions have been taken to assure the accuracy of this material, *TUNG-SOL ELECTRIC INC.* assum no liability or responsibility with regard to its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

PRINTED IN U.S.A.

TUNG-SOL

VOLTAGE REGULATOR

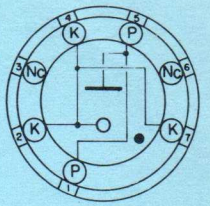
MINIATURE TYPE



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.)	0.3	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 MINUTRS AFTER PASSING THIS CURRENT TO STABILIZE THE TUBE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

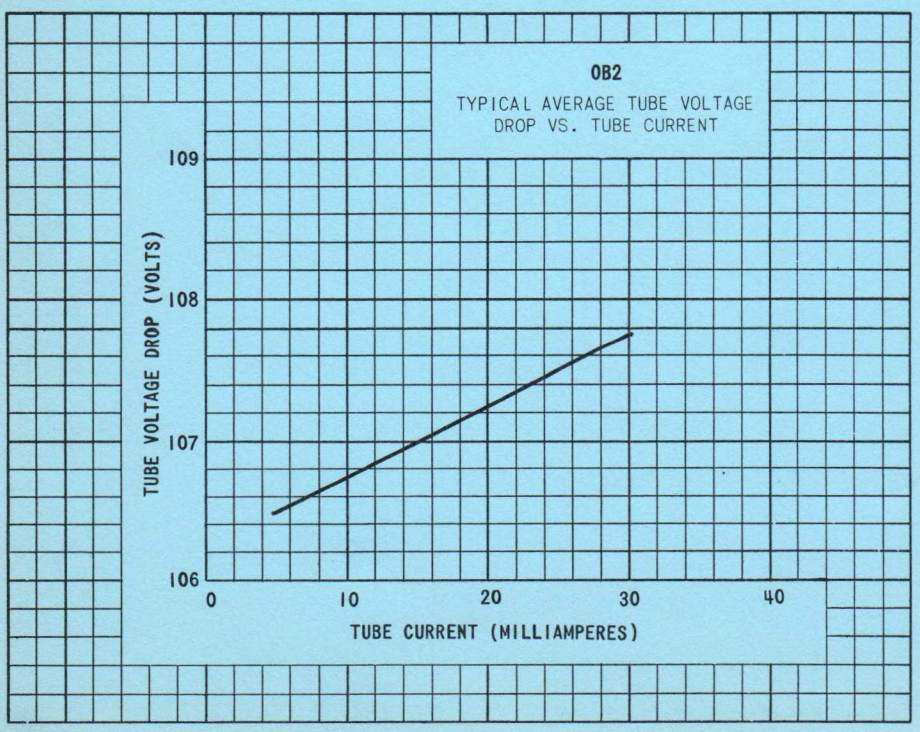
CIRCUIT VALUES

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

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

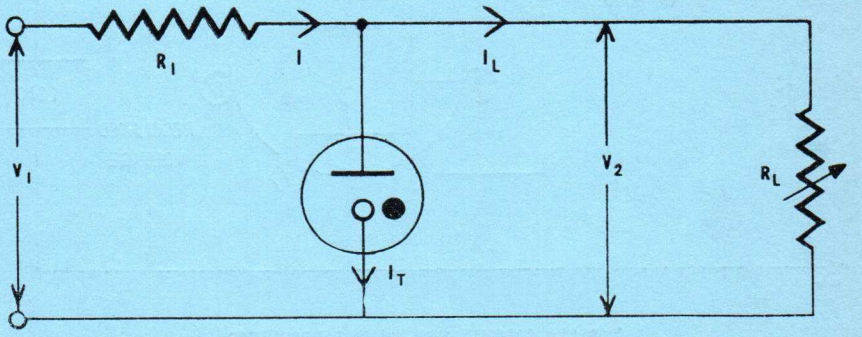
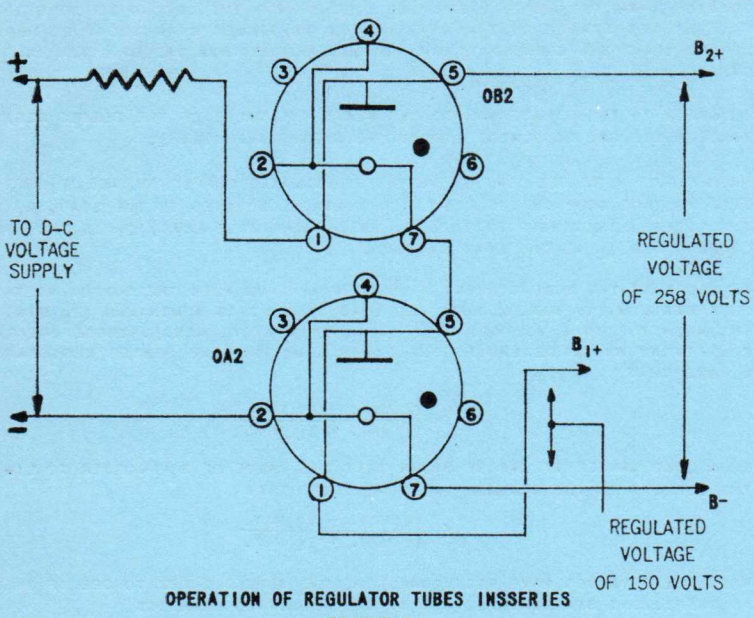


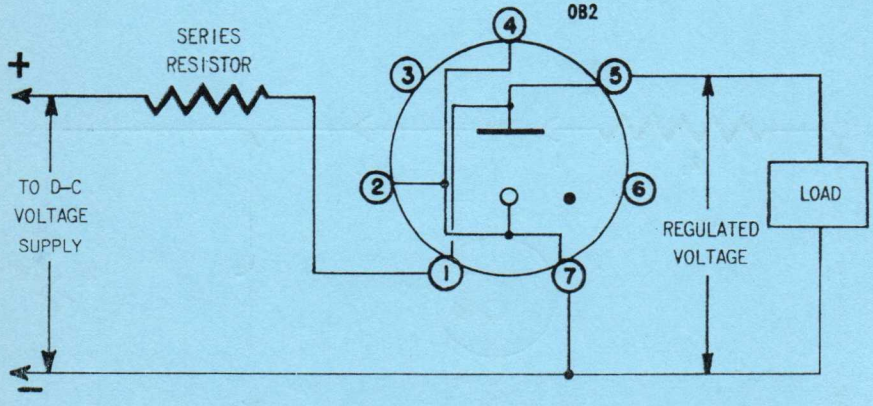
FIGURE 1

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE



OPERATION OF REGULATOR TUBES INSSERIES
FIGURE 2



TYPICAL CIRCUIT FOR VOLTAGE REGULATOR
FIGURE 3

CONTINUED ON FOLLOWING PAGE

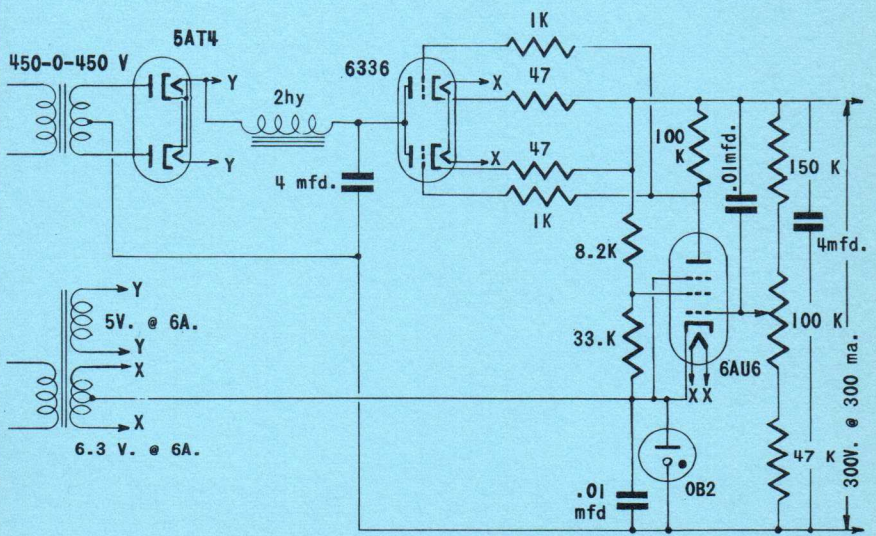
TUNG-SOL

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.

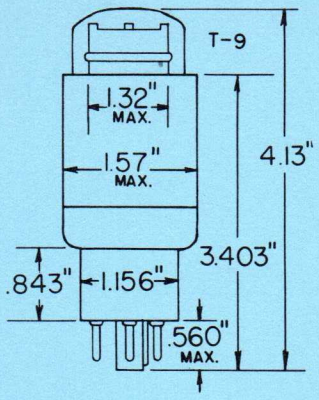


TYPICAL APPLICATION OF OB2
USED IN VOLTAGE REGULATED POWER SUPPLY
FIGURE 4

PRINTED IN U.S.A.

TUNG-SOL

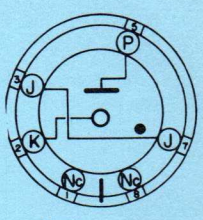
VOLTAGE REGULATOR



GLASS BULB

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

SPECIAL SKIRTED
SMALL SHELL OCTAL
6 PIN

LOW LOSS
PHENOLIC MATERIAL

THE OC3W 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 108 VOLTS OVER A CURRENT RANGE OF 5 TO 40 MILLIAMPERES.

THE OC3W 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 OC3W 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 (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.)	133	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

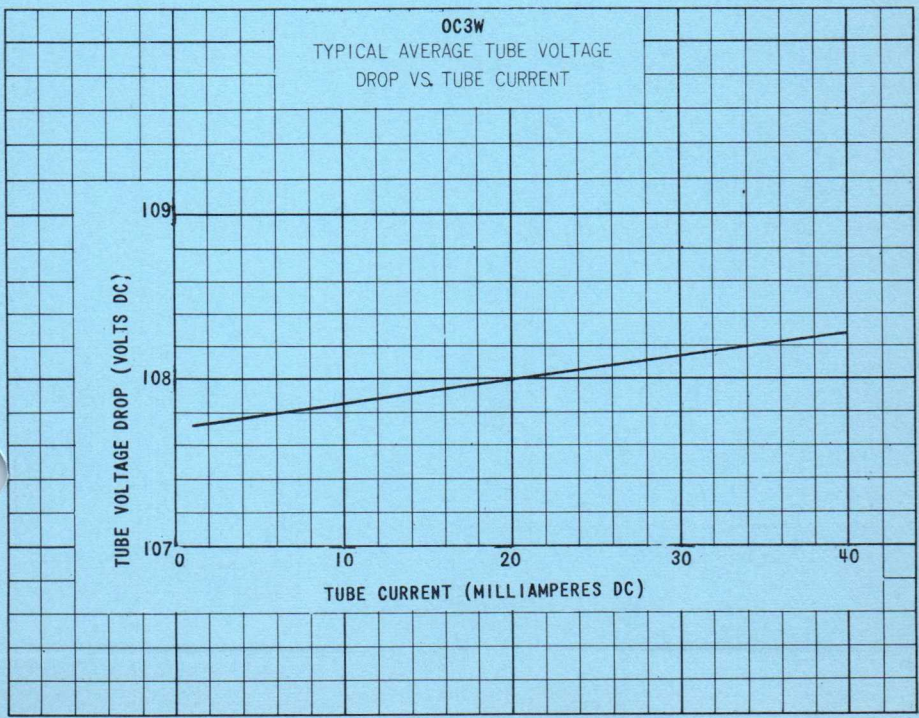
CONTINUED FROM PRECEDING PAGE

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	133[B]	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE	---	123	133	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.	103	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

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

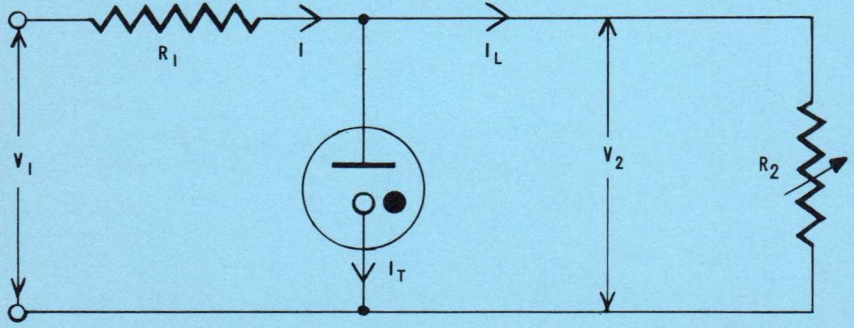


FIGURE 1

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

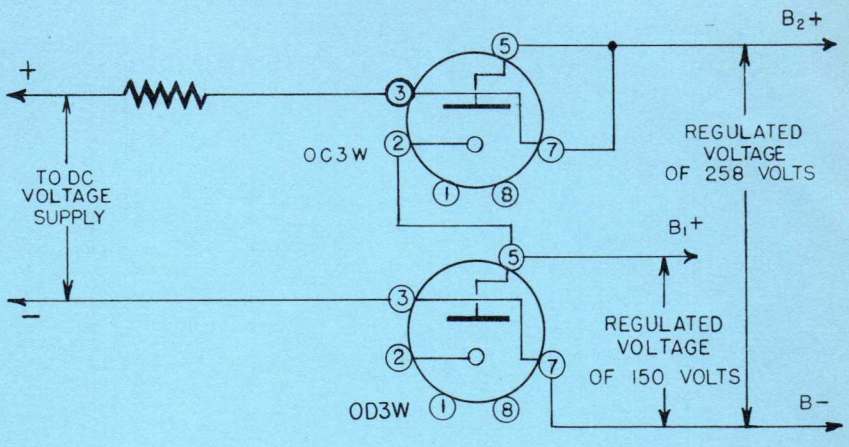


FIGURE 2 - OPERATION OF REGULATOR TUBES IN SERIES

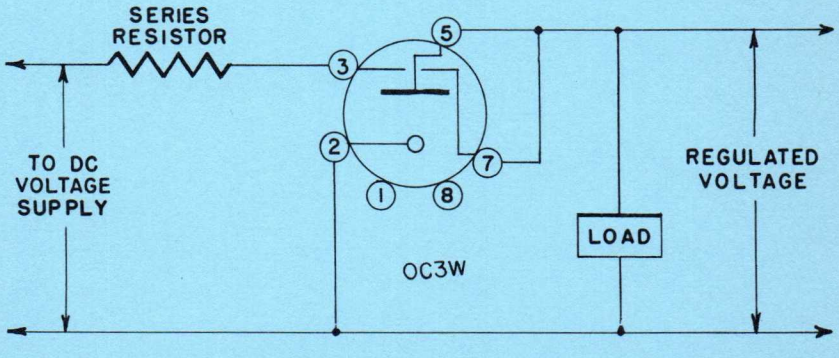


FIGURE 3 - TYPICAL CIRCUIT FOR VOLTAGE REGULATOR

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

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.

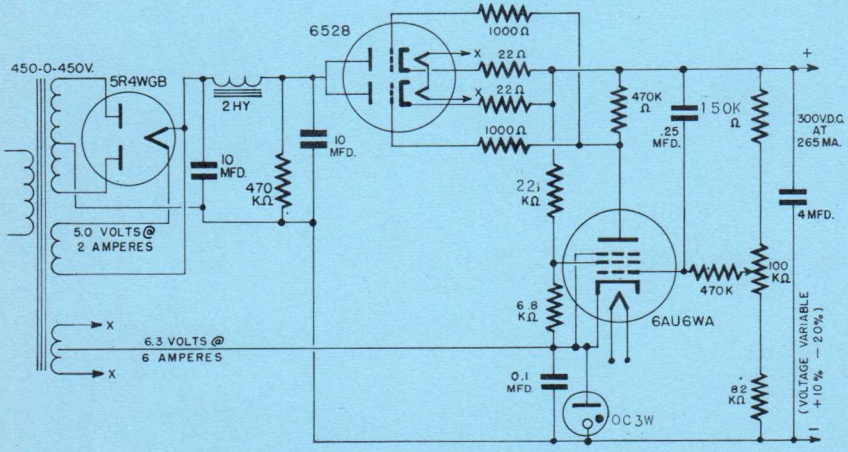
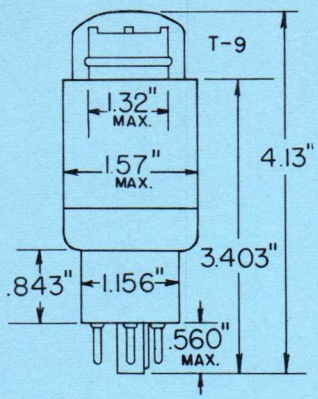


FIGURE 4

TYPICAL APPLICATION OF OC3W USED IN VOLTAGE REGULATED POWER SUPPLY

TUNG-SOL

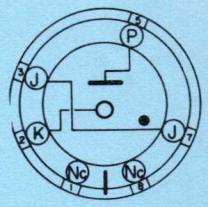
VOLTAGE REGULATOR



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 (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.)	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.)	4.5	VDC

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

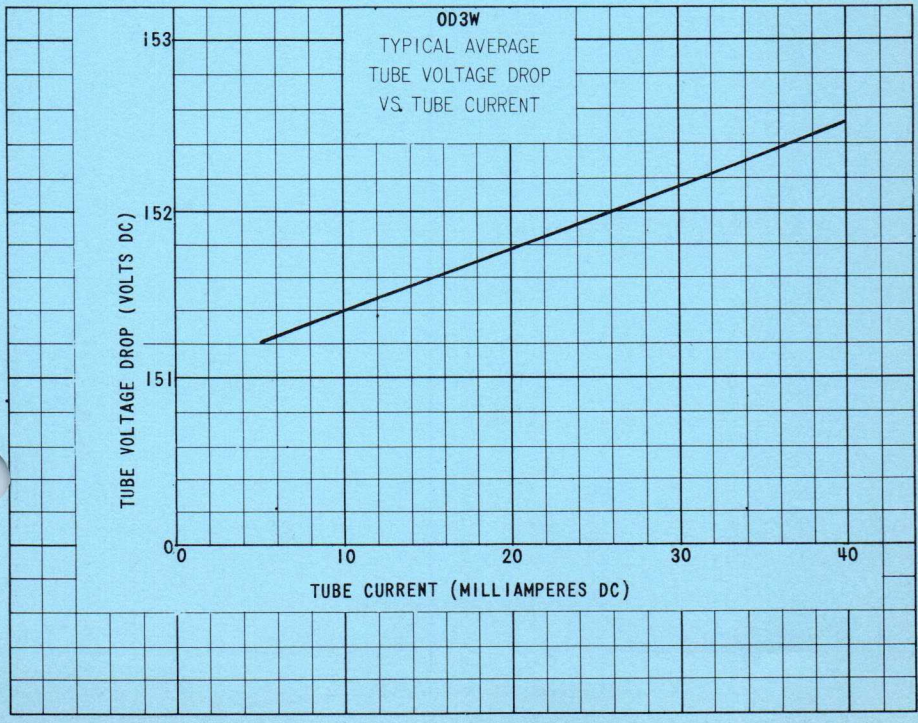
CONTINUED FROM PRECEDING PAGE

EQUIPMENT DESIGN AND RANGE VALUES

	MIN.	AVG.	MAX.	
D.C. ANODE SUPPLY VOLTAGE IN DARKNESS	225[B]	---	---	VOLTS
D.C. ANODE SUPPLY VOLTAGE IN LIGHT	185[B]	---	---	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	5.5	VOLTS
OSCILLATION (AURAL CHECK)	---	---	---	
NOISE	---	0	15	MVAC
LEAKAGE CURRENT (E_b=50V.DC; R_p= 100 KΩ)	---	0	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.



PRINTED IN U.S.A.

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

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

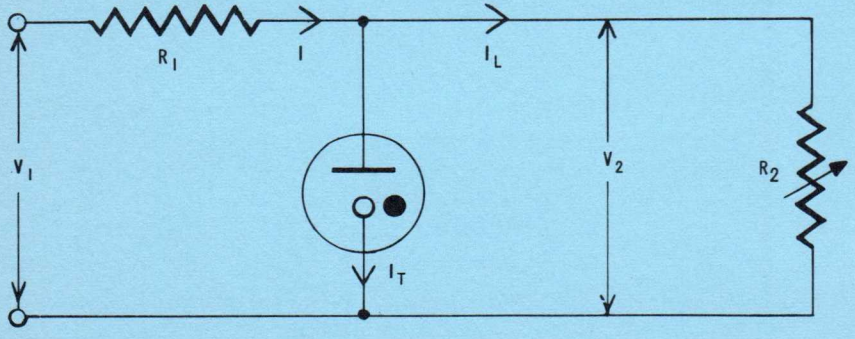


FIGURE 1

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

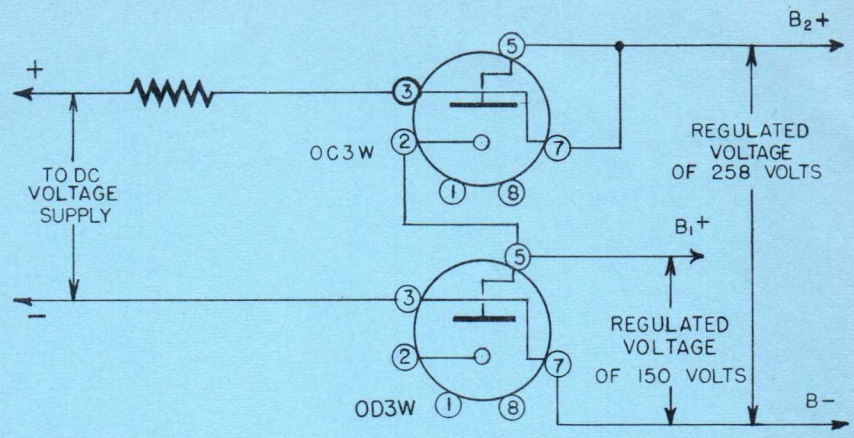


FIGURE 2 - OPERATION OF REGULATOR TUBES IN SERIES

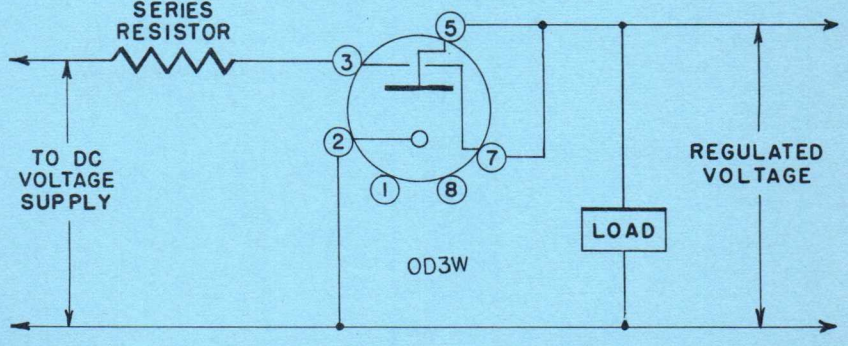


FIGURE 3 - TYPICAL CIRCUIT FOR VOLTAGE REGULATOR

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

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.

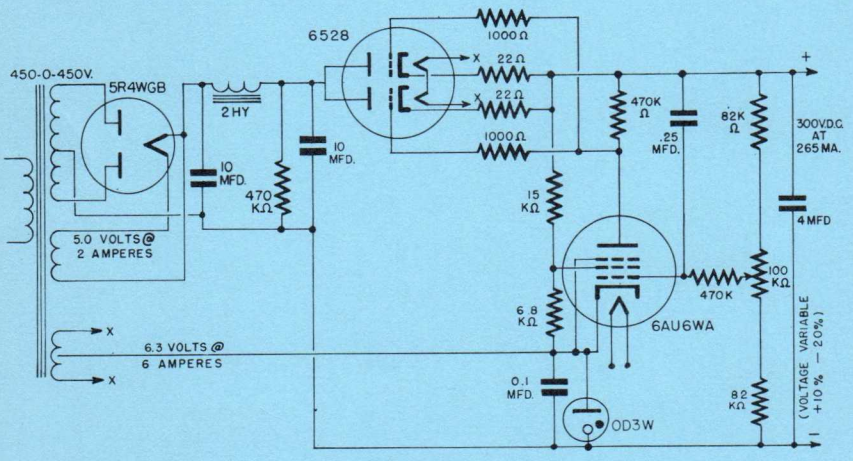


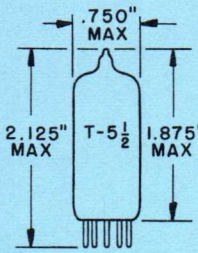
FIGURE 4

TYPICAL APPLICATION OF OD3W USED IN VOLTAGE REGULATED POWER SUPPLY

TUNG-SOL

DIODE

MINIATURE TYPE



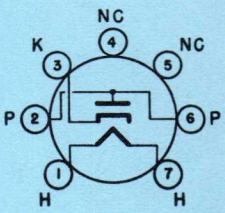
GLASS BULB

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

FOR
USE IN PORTABLE FM RECEIVERS
AND PORTABLE HF MEASURING
EQUIPMENT

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 5AP

THE 1A3 IS AN INDIRECTLY HEATED DIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS PARTICULARLY USEFUL AS A DISCRIMINATOR TUBE IN PORTABLE FM RECEIVERS, AND IN PORTABLE HF MEASURING EQUIPMENT. THE RESONANT FREQUENCY OF THE 1A3 IS APPROXIMATELY 1000 MC/S.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PLATE TO CATHODE (P TO K)	0.4	pf
PLATE TO HEATER (P TO H)	0.8	pf
HEATER TO CATHODE (H TO K)	0.6	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.4	VOLTS	150	MA.
LIMITS OF APPLIED VOLTAGE			1.4±0.2	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE, DC:			140	VOLTS

RATINGS - RECTIFIER SERVICE

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

MAXIMUM PEAK INVERSE PLATE VOLTAGE,	330	VOLTS
MAXIMUM PEAK PLATE CURRENT	5	MA.
MAXIMUM DC OUTPUT CURRENT	0.5	MA.

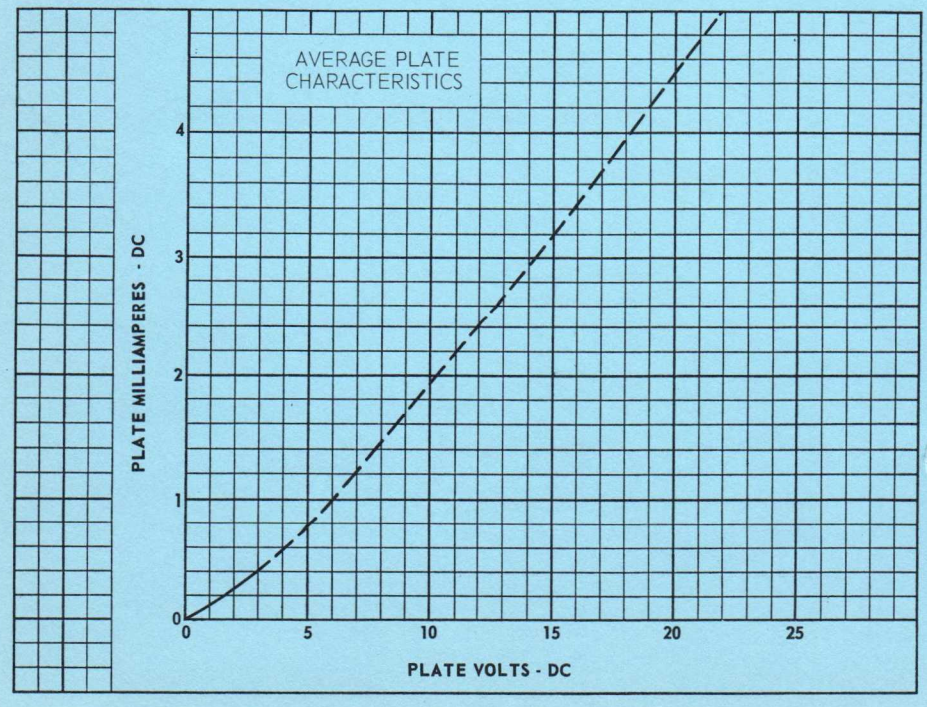
CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE –

TYPICAL OPERATION WITH CONDENSER-INPUT FILTER

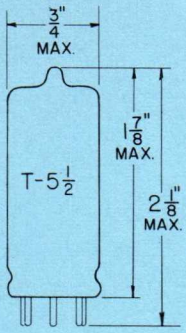
AC PLATE SUPPLY VOLTAGE (RMS)	117	VOLTS
FILTER INPUT CONDENSER	2	μf
MIN. TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE	0	OHMS



TUNG-SOL

HEPTODE CONVERTER

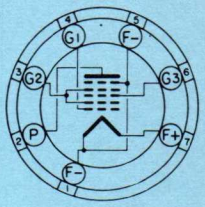
MINIATURE TYPE



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 CONDI-TIONS NOTE 5	NORM. OPER-ATION 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

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): 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 TRANS-CONDUCTANCE (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 TRANS-CONDUCTANCE (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

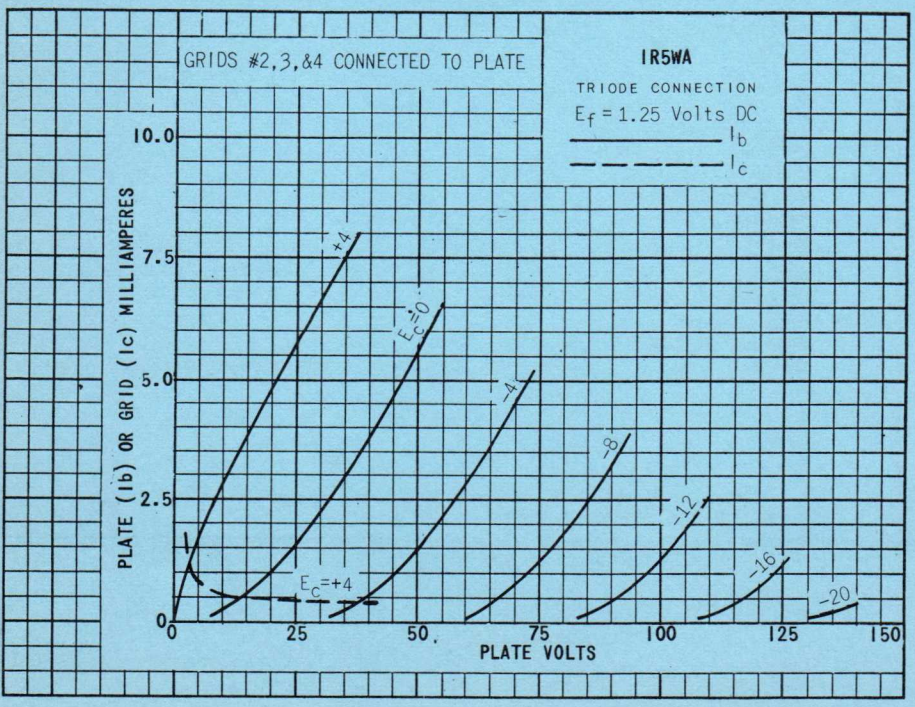
PRINTED IN U.S.A.

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 R_{gl}=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.



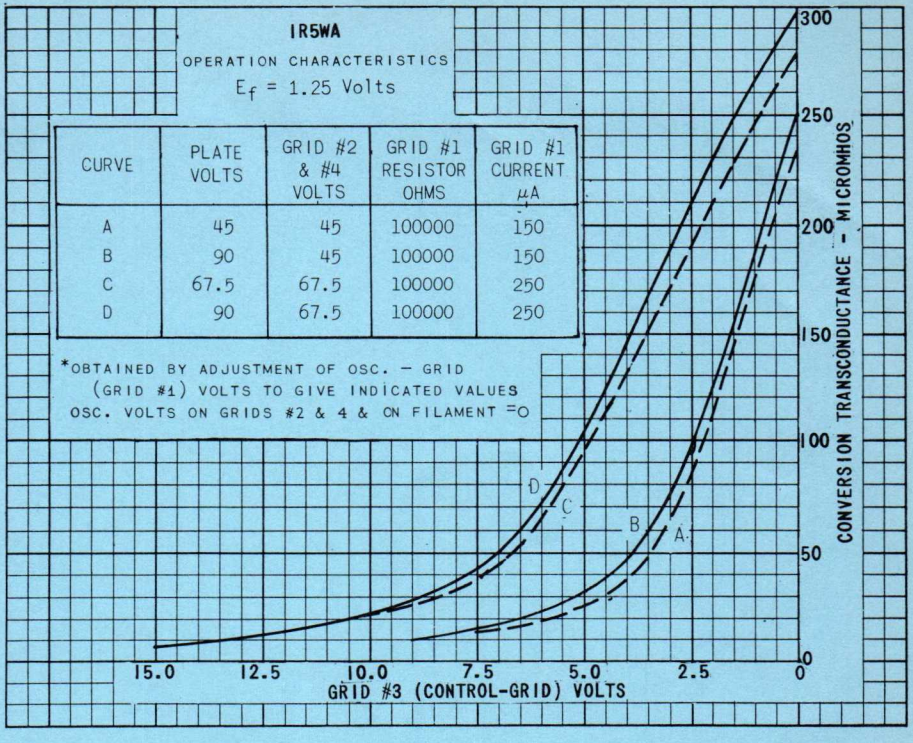
IR5WA

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

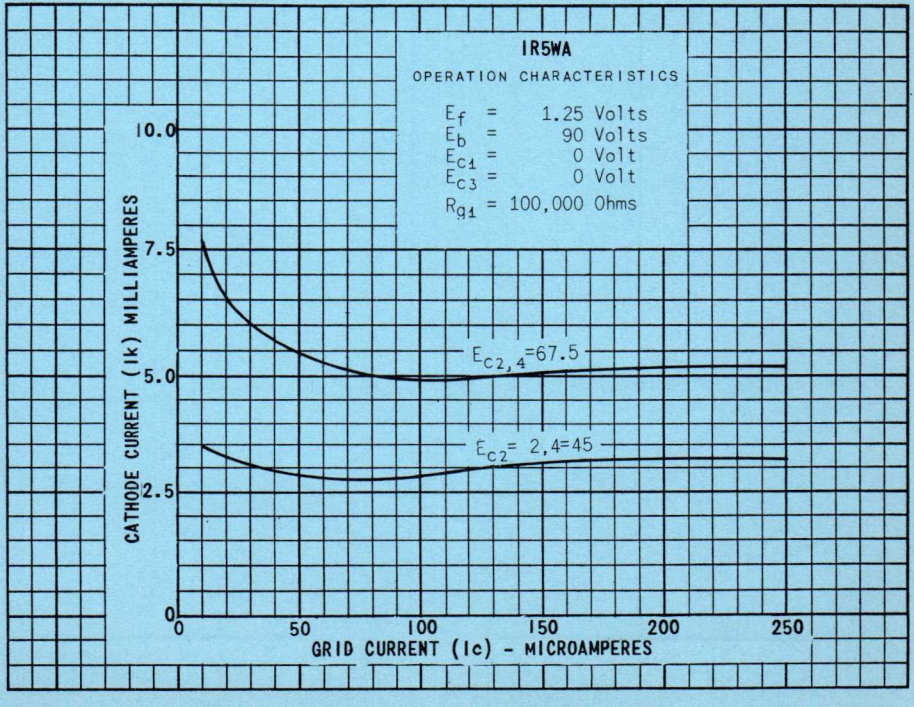
*OBTAINED BY ADJUSTMENT OF OSC. — GRID (GRID #1) VOLTS TO GIVE INDICATED VALUES OSC. VOLTS ON GRIDS #2 & 4 & ON FILAMENT =0



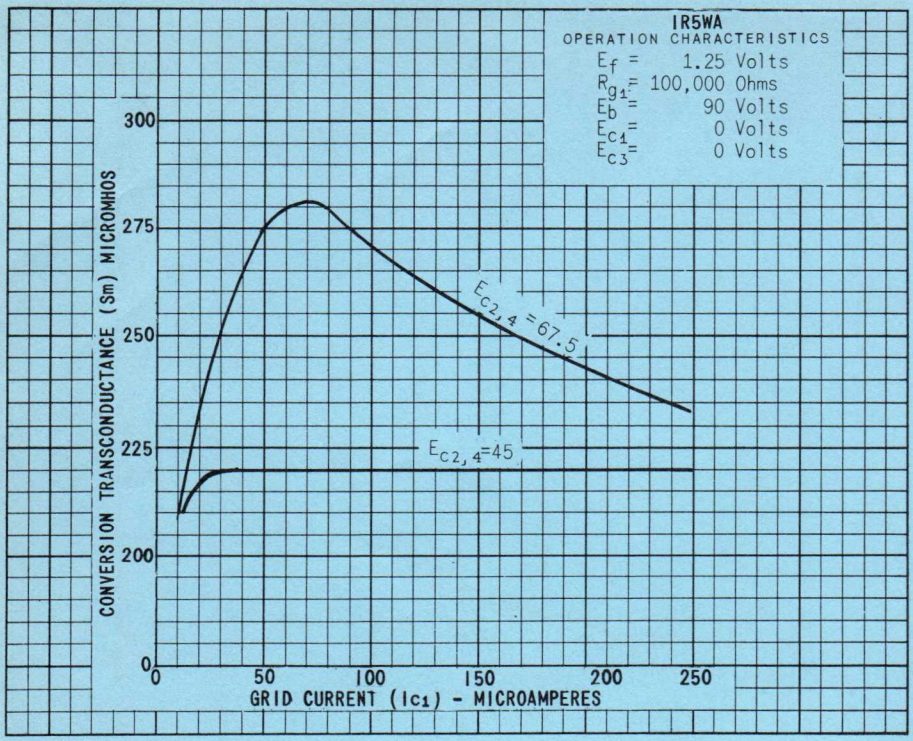
IR5WA

OPERATION CHARACTERISTICS

E_f = 1.25 Volts
E_b = 90 Volts
E_{c1} = 0 Volt
E_{c3} = 0 Volt
R_{g1} = 100,000 Ohms

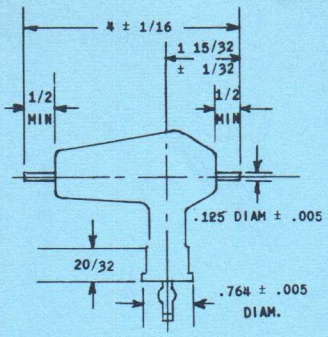


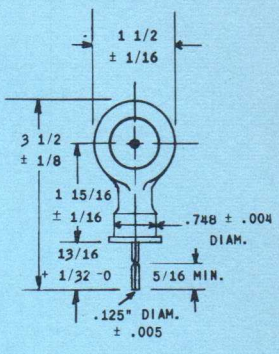
PRINTED IN U. S. A.


IR5WA
OPERATION CHARACTERISTICS
E_f = 1.25 Volts
R_{g_1} = 100,000 Ohms
E_b = 90 Volts
E_{c_1} = 0 Volts
E_{c_3} = 0 Volts
CONVERSION TRANSCONDUCTANCE (Sm) MICROMHOS
300
275
250
225
200
0
$E_{c_{2,4}}$ = 67.5
$E_{c_{2,4}}$ = 45
0
50
100
150
200
250
GRID CURRENT (I_{c_1}) - MICROAMPERES

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 SUCCESSFULL 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 5/8" 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

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

INTERRUPTING RATINGS
FOR INFORMATION ONLY

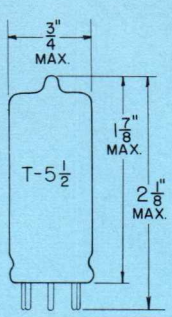
WITH RESISTIVE LOAD AT 10,000 V. RMS AT 60 CPS.

OPERATIONS	AMPERES
1000	10.0
1,000,000	3.0
500,000,000	0.1

TUNG-SOL

PENTODE

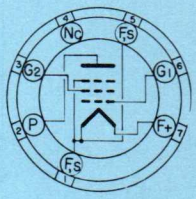
MINIATURE TYPE



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. OPER ATION 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

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS[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=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):	---	Ep:	---	---	---	---	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:	---	---		Ic(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

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES - cont'd.

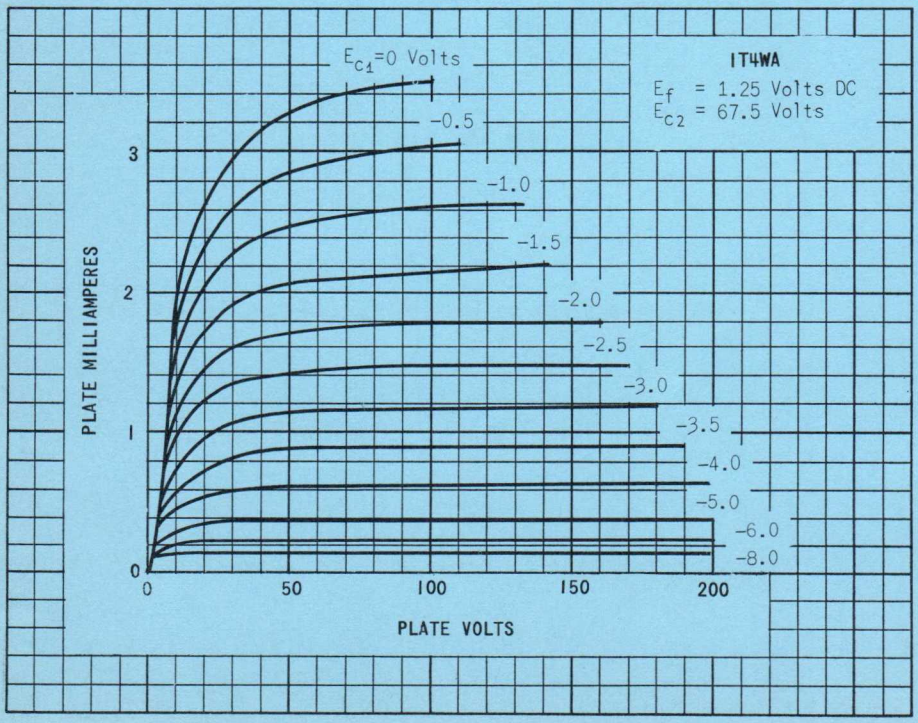
6. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

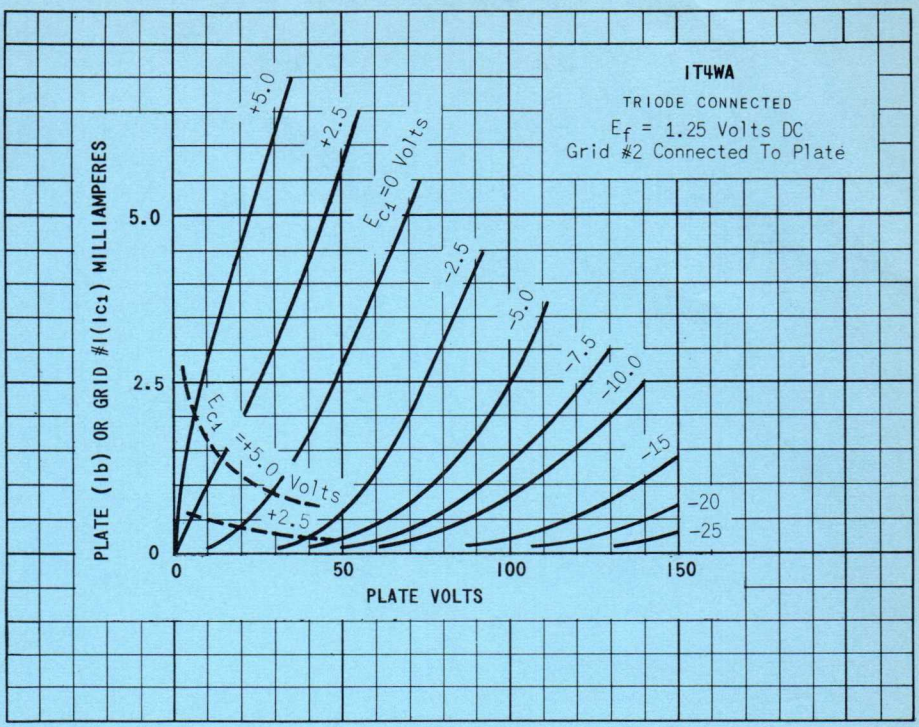
7. PLATE AND SCREEN SUPPLY VOLTAGES SHOULD NOT EXCEED THESE VALUES UNDER ANY CIRCUMSTANCES.

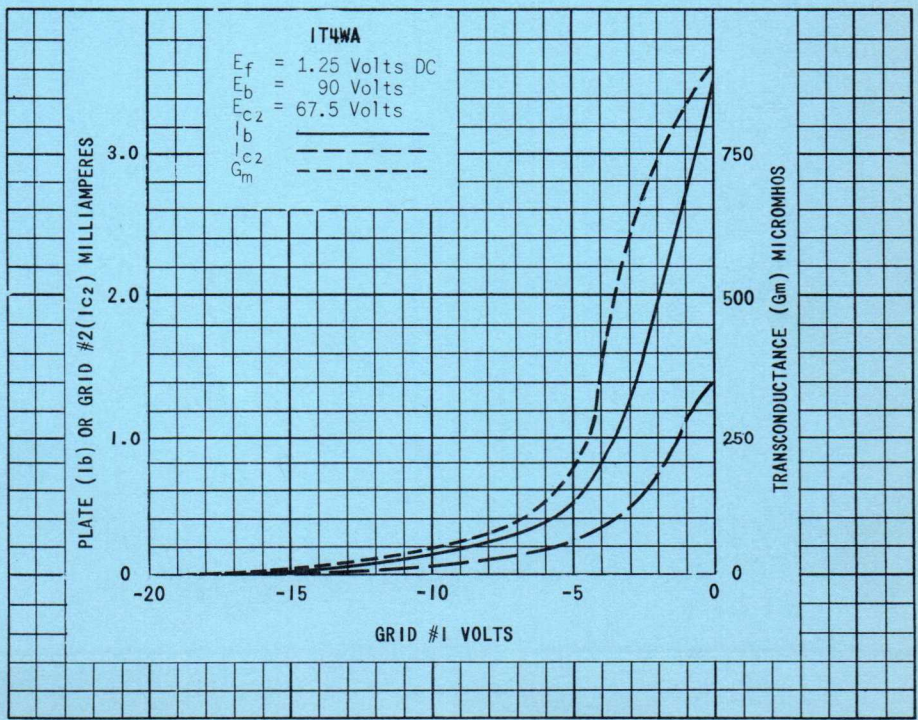
8. THE TUBE UNDER TEST SHALL BE RIGIDLY MOUNTED ON A VIBRATION TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TEST CONDITIONS OF PARAGRAPH 4.9.19.1 OF MIL-E-1 SHALL BE APPLIED AND E_p MONITORED WHILE THE FREQUENCY OF VIBRATION IS CONTINUOUSLY SWEPT FROM 50-3500 CPS AND THE PEAK ACCELERATION CONTROLLED 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.





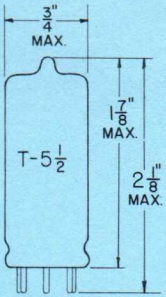


PRINTED IN U.S.A.

TUNG-SOL

PENTODE

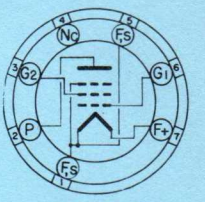
MINIATURE TYPE



GLASS BULB

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

6AR

THE 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 CONDI - TIONS NOTE 5	NORM. OPER- ATION 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.

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)		Cg1p:	---	---	---	---	0.02	---	μμf
CAPACITANCE (SHIELD #316)	6.5	Cin:	3.0	---	---	---	4.2	---	μμf
CAPACITANCE (SHIELD #316)		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	BOG.	UAL	MAX.	ALD	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS (CONT'D.)	COMBINED AQL=1.0% 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.	COMB. 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.

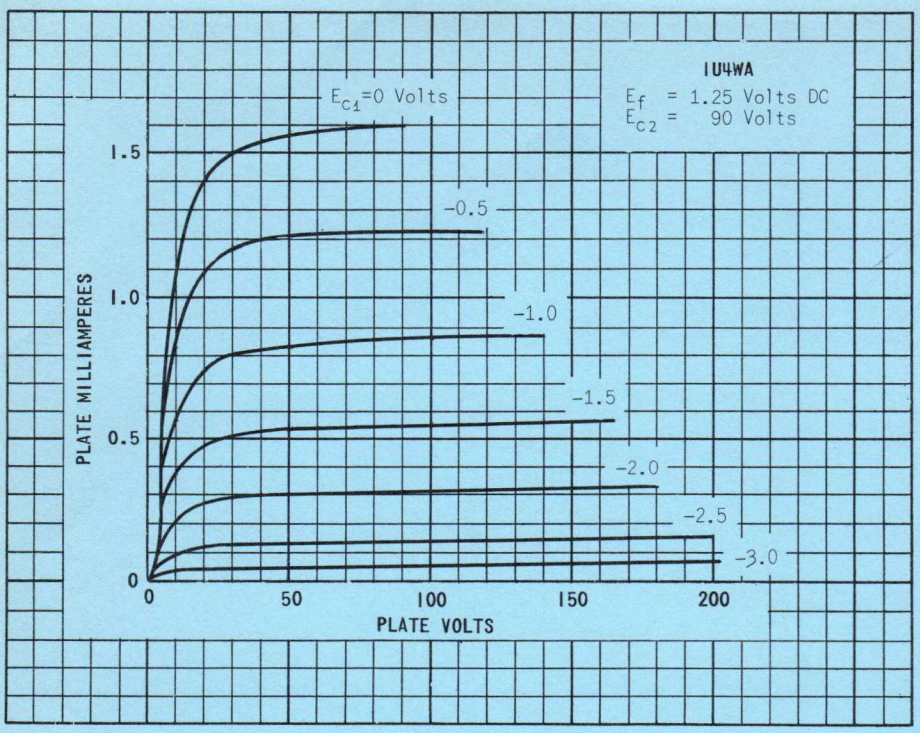
5. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTICS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

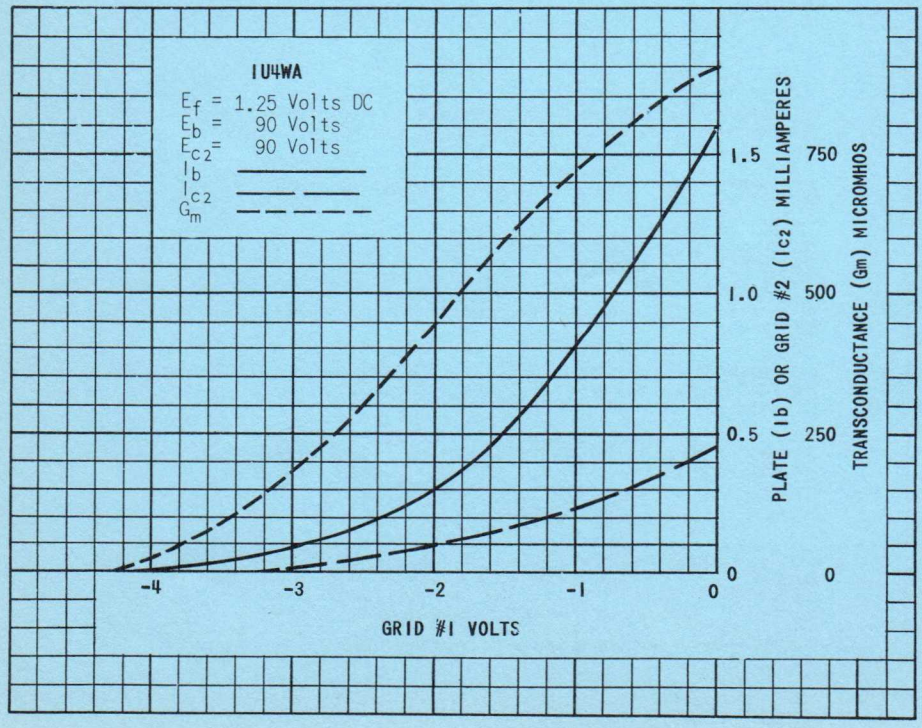
6. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AND IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

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.

PRINTED IN U.S.A.

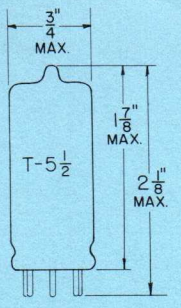

1U4WA
E_f = 1.25 Volts DC
E_{c2} = 90 Volts
E_{c1}=0 Volts
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
PLATE MILLIAMPERES
1.5
1.0
0.5
0
0
50
100
150
200
PLATE VOLTS


1U4WA
E_f = 1.25 Volts DC
E_b = 90 Volts
E_{c2} = 90 Volts
I_b
I_{c2}
G_m
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (Gm) MICROMHOS
1.5
1.0
0.5
0
750
500
250
0
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

DIODE PENTODE

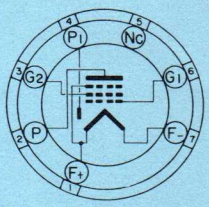
MINIATURE TYPE



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 CONDI-TIONS NOTE 5	NORM. OPER-ATION 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

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=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.; R_{g2}=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

PRINTED IN U. S. A.

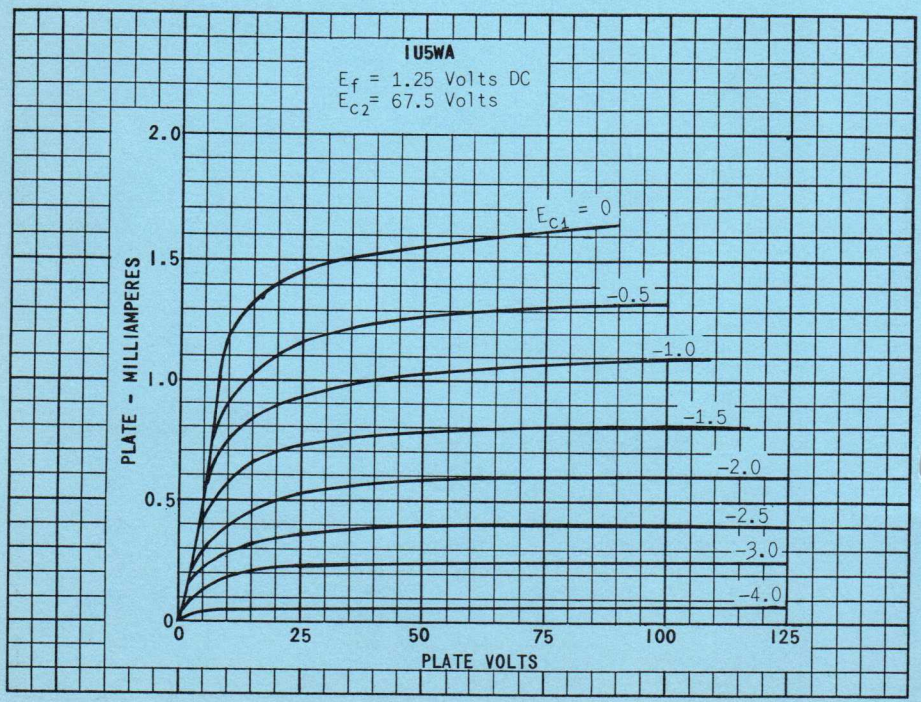
TUNG-SOL

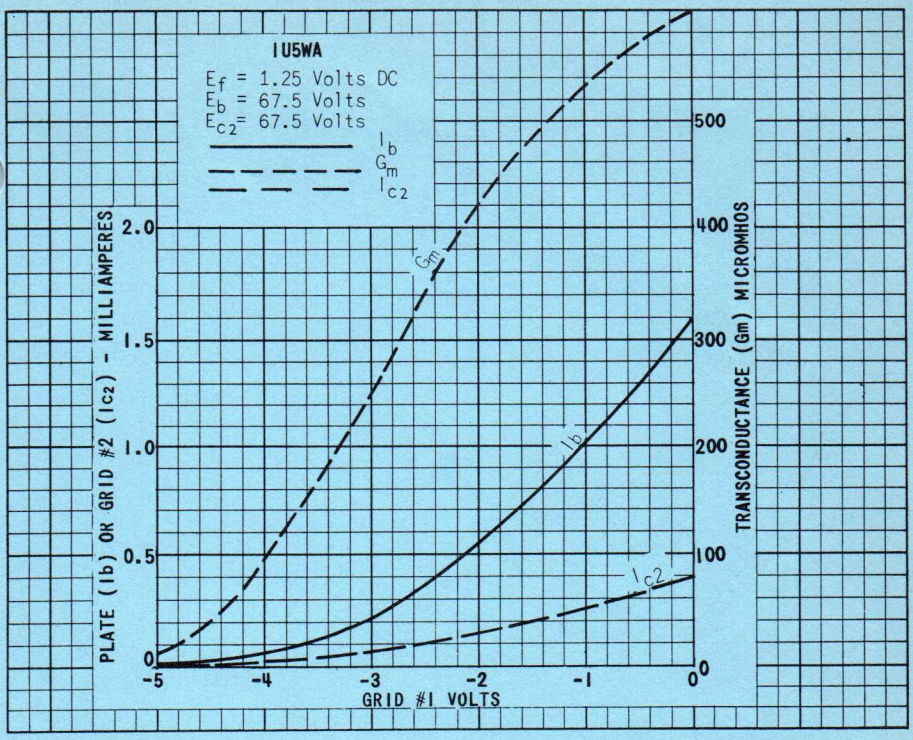
CONTINUED FROM PRECEDING PAGE

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.



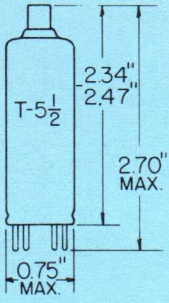


PRINTED IN U.S.A.

TUNG-SOL

DIODE

MINIATURE TYPE



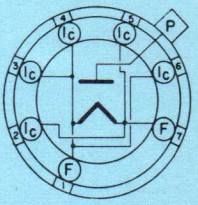
GLASS BULB

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 EXPECIALLY 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	200	KCYCLES
MAXIMUM ALTITUDE FOR FULL RATINGS	10 000	FEET
MINIMUM SUPPLY SOURCE IMPEDANCE (AT EPx =15 KV)	300 000	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

PRINTED IN U. S. A.

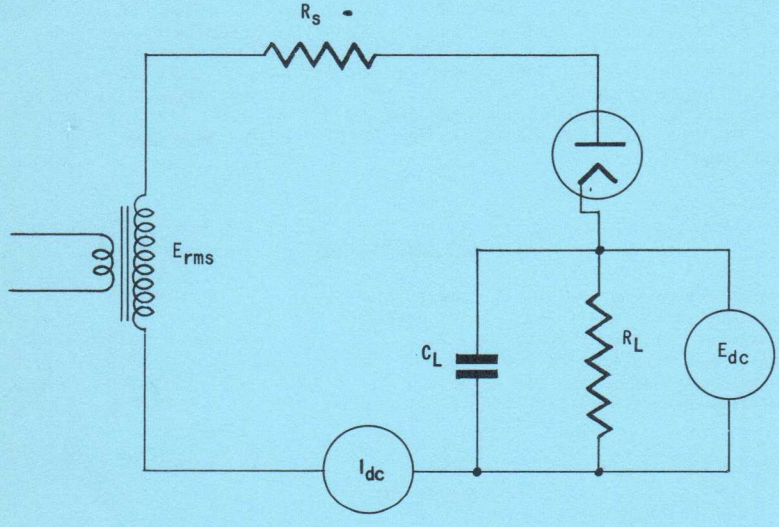
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

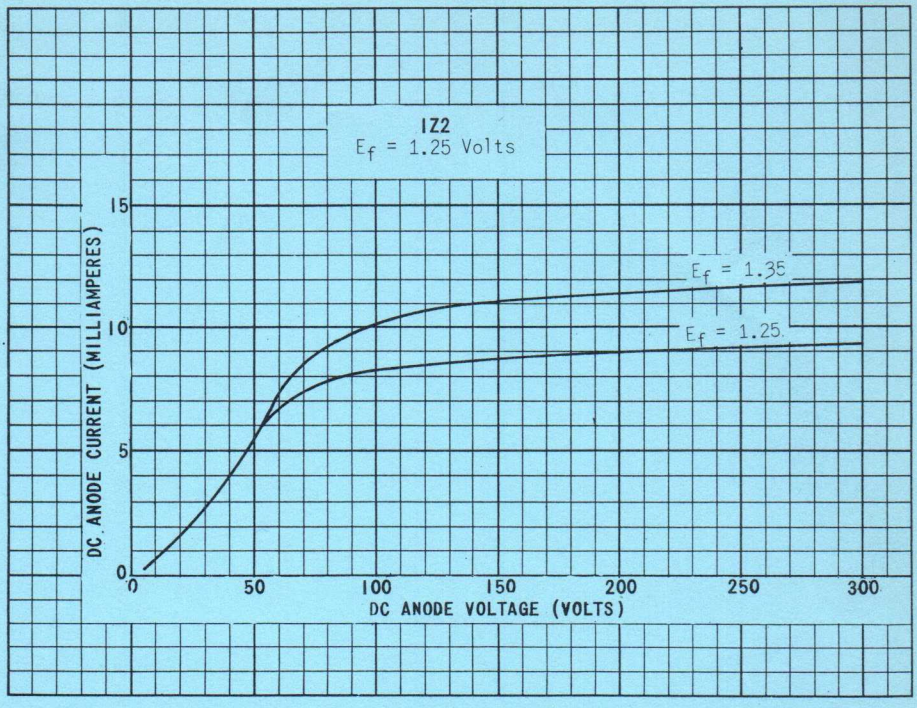
MECHANICAL DATA

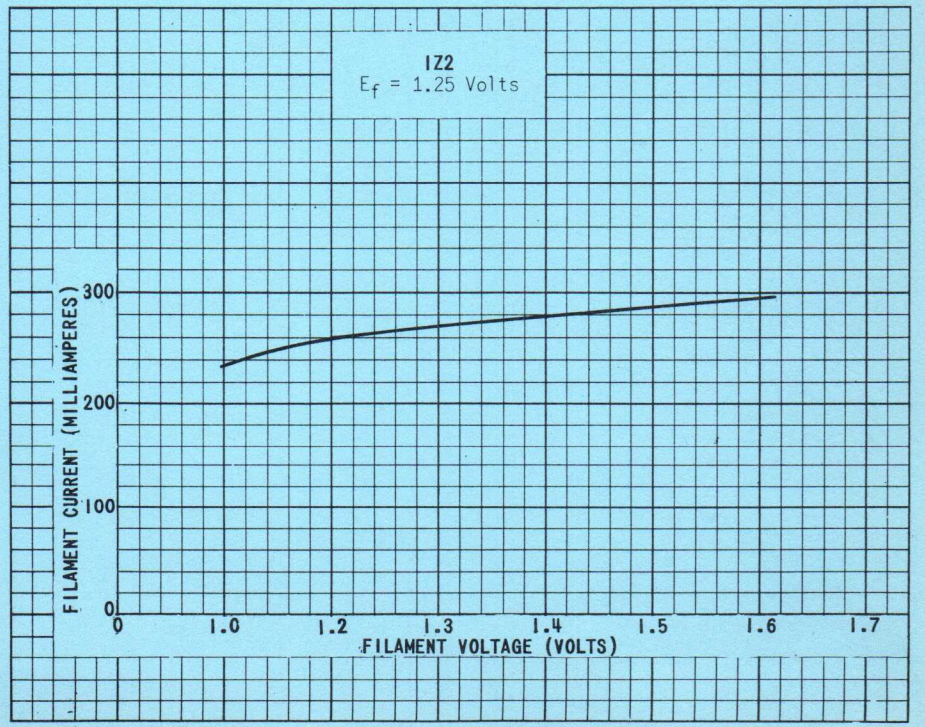
MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2.70	INCHES
SEATED LENGTH	2.34 TO 2.47	INCHES
MAXIMUM DIAMETER	0.75	INCHES
BULB	T-5 1/2	
CAP	SKIRTED MINIATURE	
BASE	MINIATURE BUTTON 7 PIN	
MAXIMUM WEIGHT (NET)	0.5	OUNCES

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	278.	.012	4.15	1.5
5.3	0.3	43.	.024	6.8	0.155

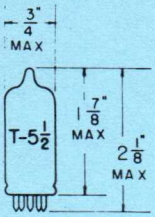




PRINTED IN U. S. A.

TUNG-SOL

THYRATRON



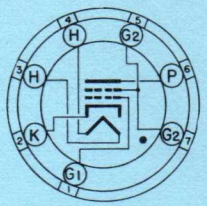
GLASS BULB

HEATER

6.3±10% VOLTS 0.600 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7-BN

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. =0.1AMPS.	35	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_{bb}=460V, RMS)	0.5	μAMPS.

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

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

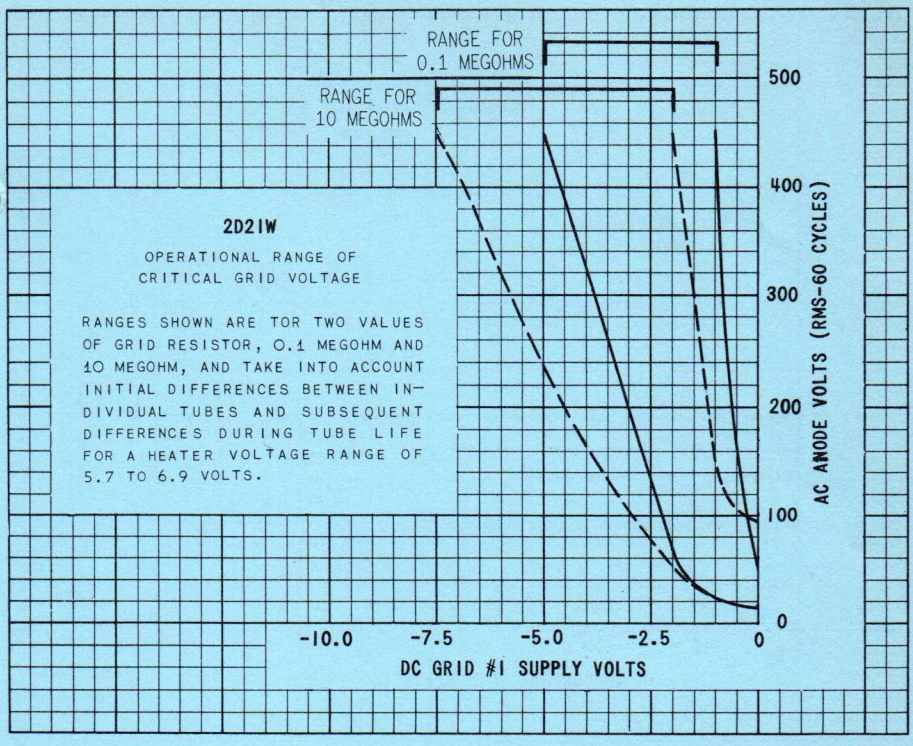
CONTINUED FROM PRECEDING PAGE

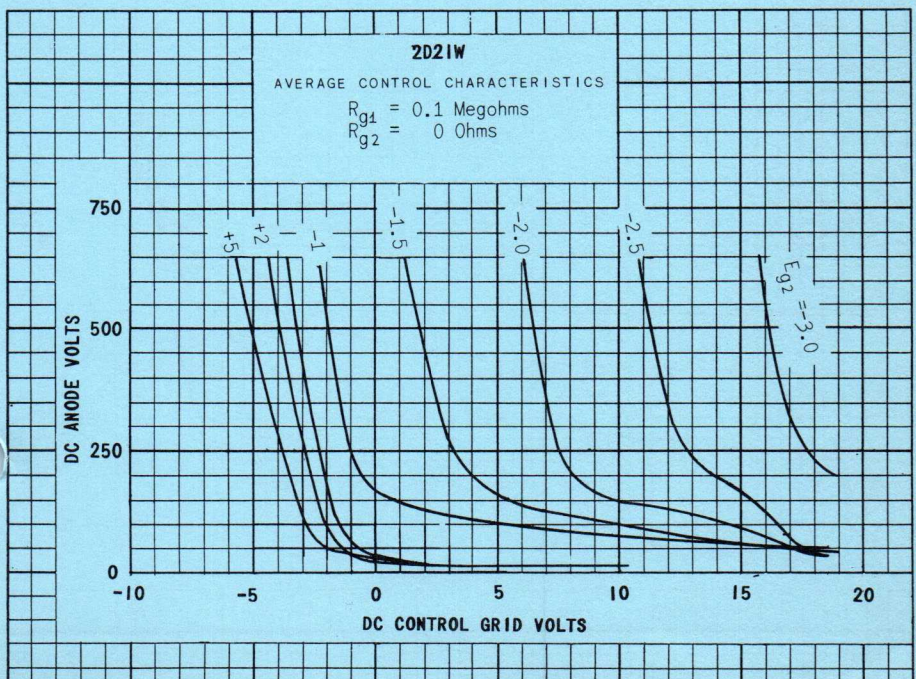
MECHANICAL DATA

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

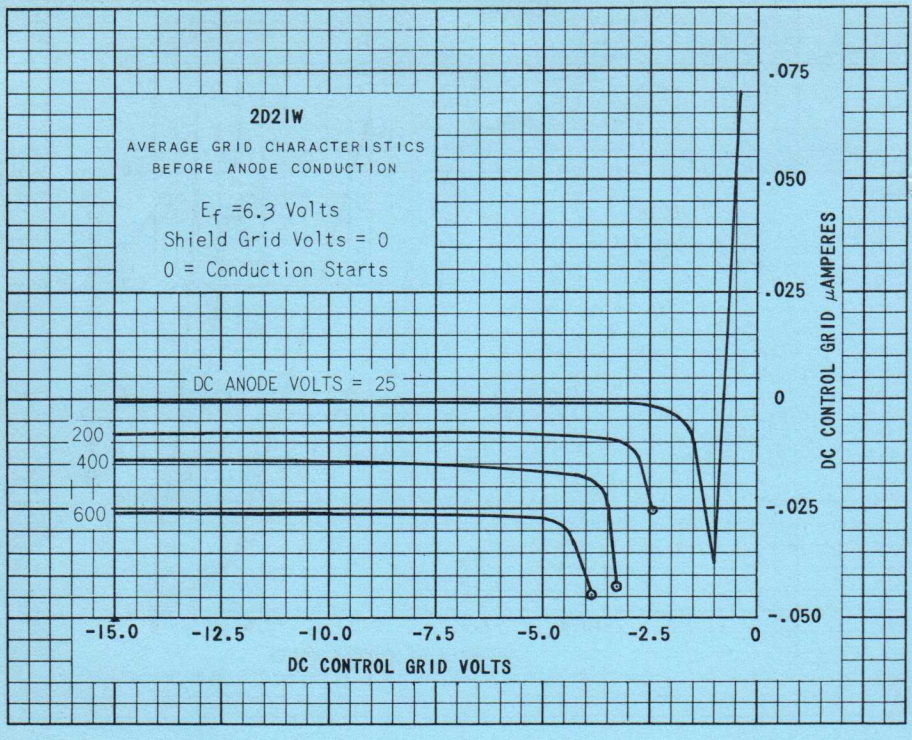
RATINGS
ABSOLUTE VALUES

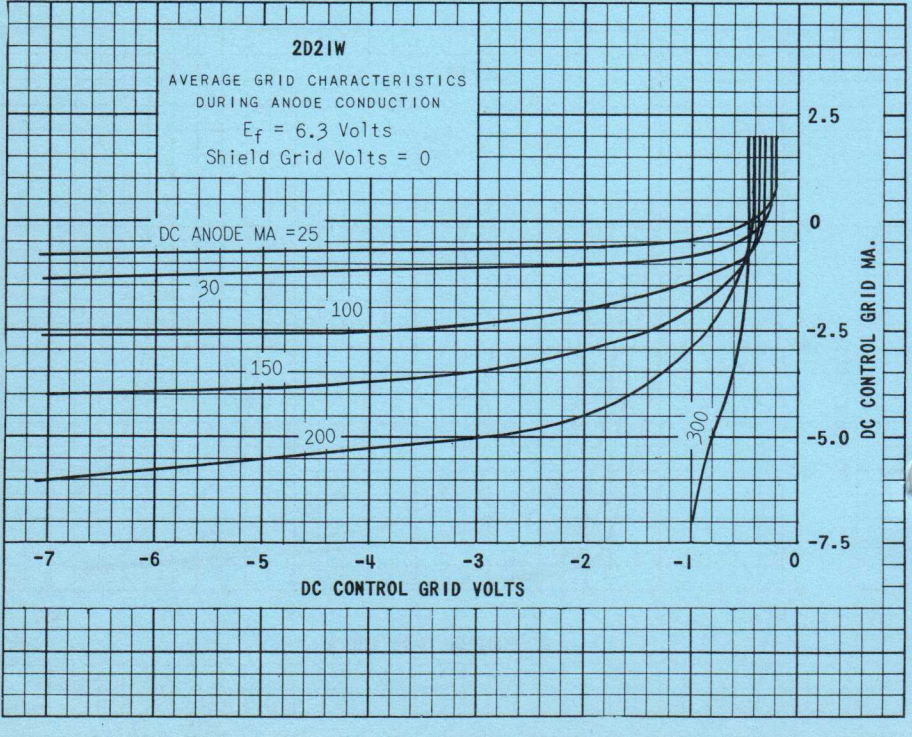
	RELAY & GRID CONTROLLED RECTIFIER SERVICE	PULSE MODULATOR SERVICE	
MAXIMUM PEAK ANODE VOLTAGE			
INVERSE	1300	100	VOLTS
FORWARD	650	500	VOLTS
MAXIMUM CATHODE CURRENT			
PEAK	0.5	10.	AMPS.
AVERAGE	100.	10.	MA.
SURGE (MAX.DURATION 0.1 SECONDS)	10.	---	AMPS.
MAXIMUM AVERAGE TIME	30.	---	SECONDS
MAXIMUM 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





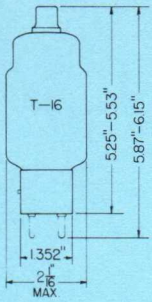
PRINTED IN U. S. A.


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

DIODE



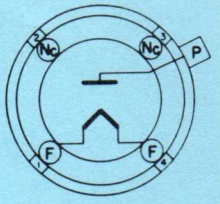
GLASS BULB

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
MAXIMIM PEAK CATHODE CURRENT	2.	1.	AMP.
MAXIMUM AVERAGE CATHODE CURRENT	0.5	0.25	AMP.
MAXIMUM SURGE CATHODE CURRENT (MAXIMUM DURATION TIME 0.1 SECONDS)	20.	20.	AMP.
MAXIMUM AVERAGING TIME	30.	30.	SECONDS
MAXIMUM SUPPLY FREQUENCY	500	150	CPS
AMBIENT TEMPERATURE LIMITS	-55 TO +75	-55TO+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

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MECHANICAL DATA

MOUNTING POSITION	ANY	
OVERALL LENGTH	5.87 TO 6.15	INCHES
SEATED LENGTH	5.25 TO 5.53	INCHES
MAXIMUM DIAMETER	2.07	INCHES
BULB	T- 16	NONEX
CAP	MEDIUM METAL, C1-5	
BASE	MEDIUM 4 PIN BAYONET, A4-10	
WEIGHT (NET) MAX.	4	OUNCES

MAXIMUM CIRCUIT VALUES

FIG.	CIRCUIT	TRANSFORMER	FILAMENT OPERATION	NO. OF TUBES	A.C. SECONDARY VOLTS E_{RMS}	DC OUTPUT (APPROX.) E_{DC} IN VOLTS	DC OUTPUT (APPROX.) I_{DC} IN AMPERES	RIPPLE VOLTS RMS	RIPPLE FREQ.
1	HALF WAVE SINGLE PHASE	SINGLE PHASE	IN PHASE	1	7000[A] 3500[B]	3200 1600	0.25 0.50	3500 1750	f
2	FULL WAVE SINGLE PHASE	SINGLE PHASE CENTER TAP	IN PHASE	2	3500[A] 1750[B]	3200 1600	0.50 1.00	1500 750	2f
3	BRIDGE CIRCUIT SINGLE PHASE	SINGLE PHASE	IN PHASE	4	7000[A] 3500[B]	6400 3200	0.50 1.00	3000 1500	2f
4	HALF WAVE THREE PHASE	DELTA-WYE	———	3	4000[A] 2000[B]	4800 2400	0.75 1.50	860 430	3f
5	FULL WAVE THREE PHASE	DELTA-WYE	QUADRATURE	6	4000[A] 2000[B]	9500 4750	0.75 1.50	400 200	6f
6	FULL WAVE THREE PHASE	DELTA-DELTA	QUADRATURE	6	7000[A] 3500[B]	9500 4750	0.75 1.50	400 200	6f
7	HALF WAVE SIX PHASE (THREE PHASE SUPPLY)	DELTA-STAR	QUADRATURE	6	3500[A] 1750[B]	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 10KV PEAK INVERSE VOLTAGE PER TUBE AND 150 CPS MAXIMUM SUPPLY FREQUENCY.

[B] VALUES FOR A MAXIMUM FO 5. KV PEAK INVERSE VOLTAGE PER TUBE AND 500 CPS MAXIMUM SUPPLY FREQUENCY.

TUNG-SOL

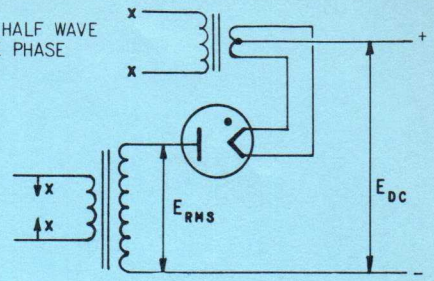


FIGURE 1 - HALF WAVE -SINGLE PHASE

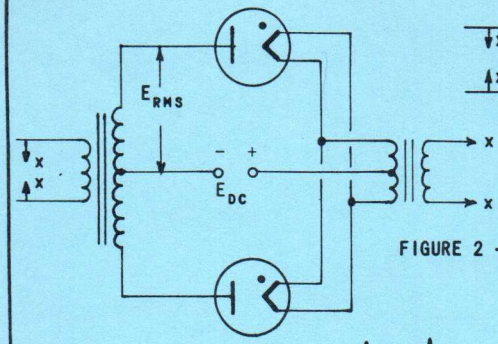


FIGURE 2 - FULL WAVE - SINGLE PHASE

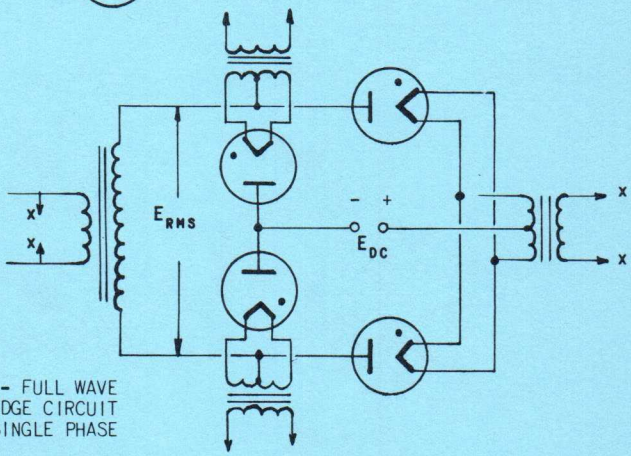


FIGURE 3 - FULL WAVE BRIDGE CIRCUIT -SINGLE PHASE

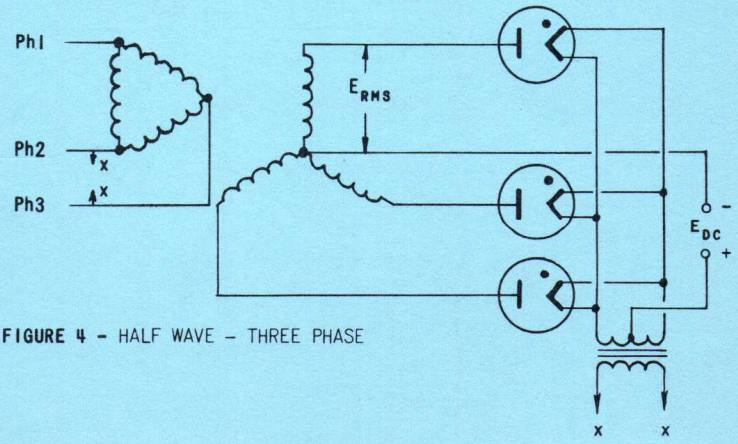


FIGURE 4 - HALF WAVE - THREE PHASE

PRINTED IN U. S. A.

FIGURE 5 - FULL WAVE–THREE PHASE

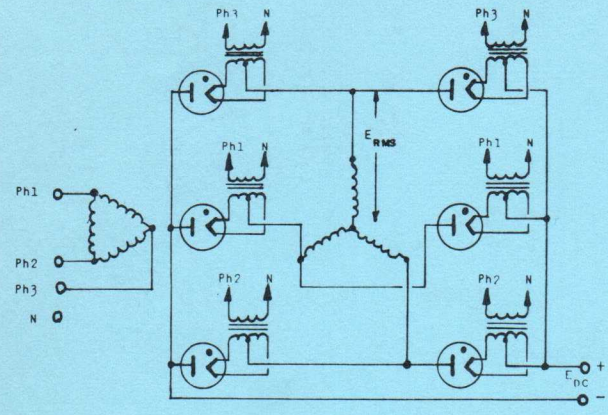


FIGURE 6 - FULL WAVE – THREE PHASE

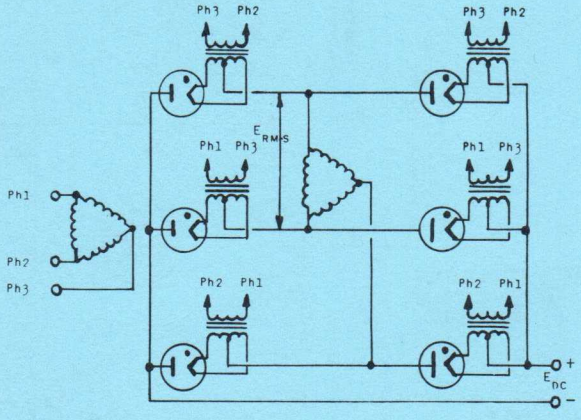
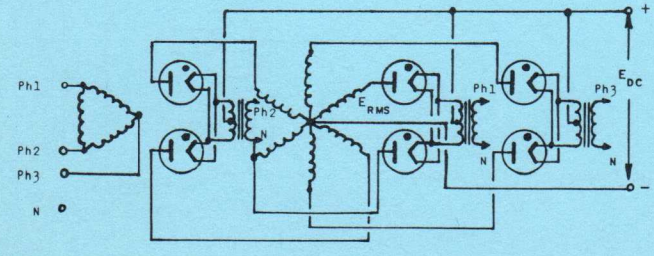


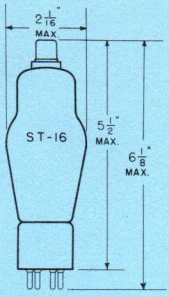
FIGURE 7 - HALF WAVE–SIX PHASE (3 PHASE SUPPLY)



TUNG-SOL

THYRATRON

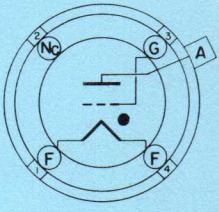
ARGON AND MERCURY - VAPOR



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

PRINTED IN U. S. A.

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

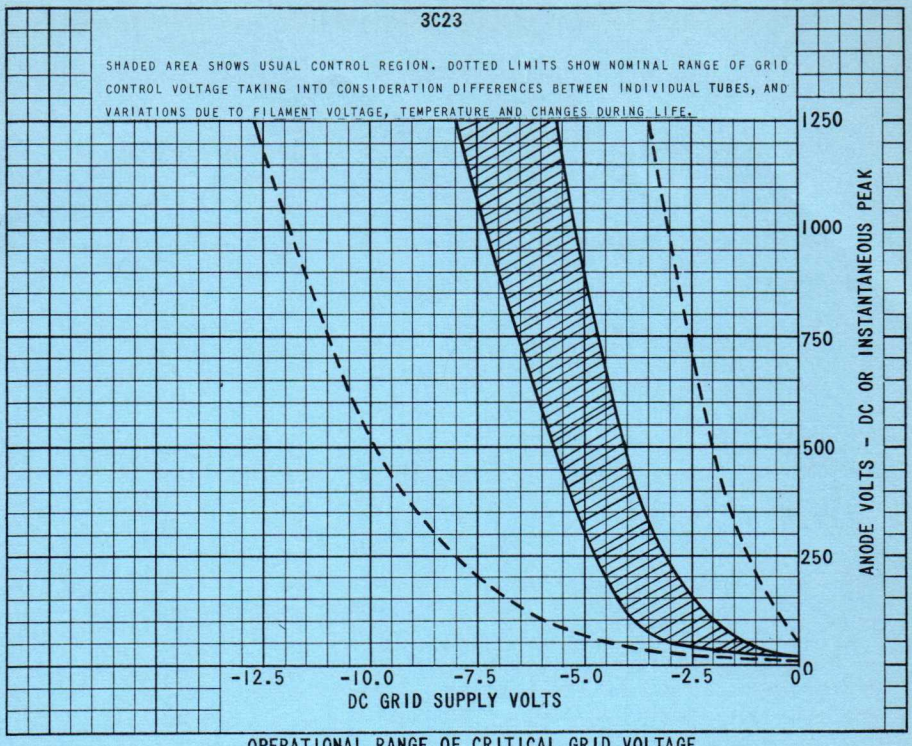
1. AVERAGED OVER ONE CONDUCTING PERIOD.

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.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

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.

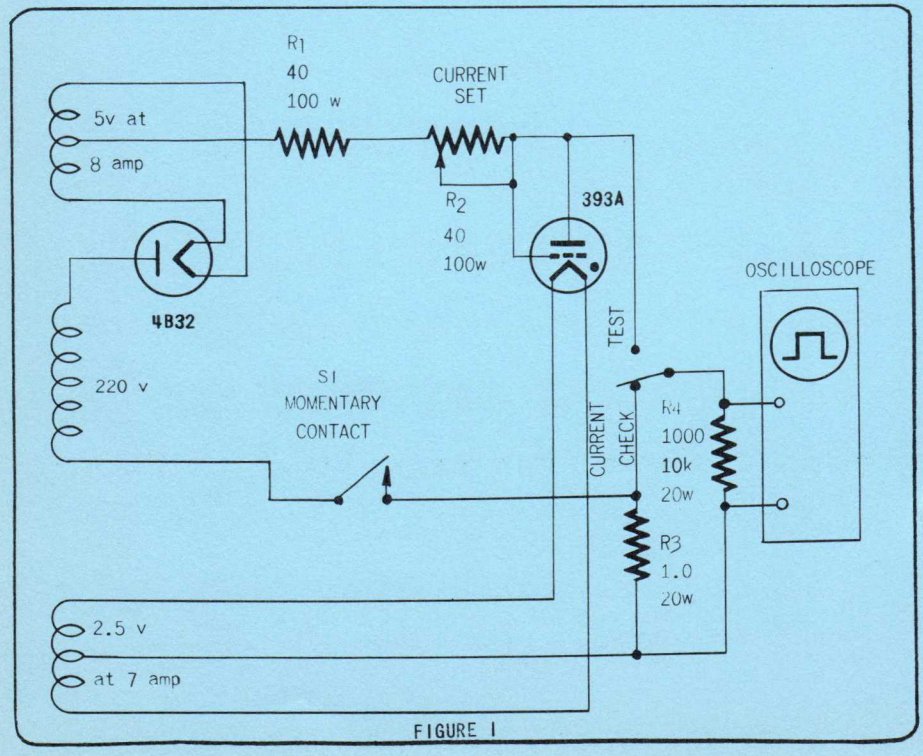


FIGURE 1

TUNG-SOL

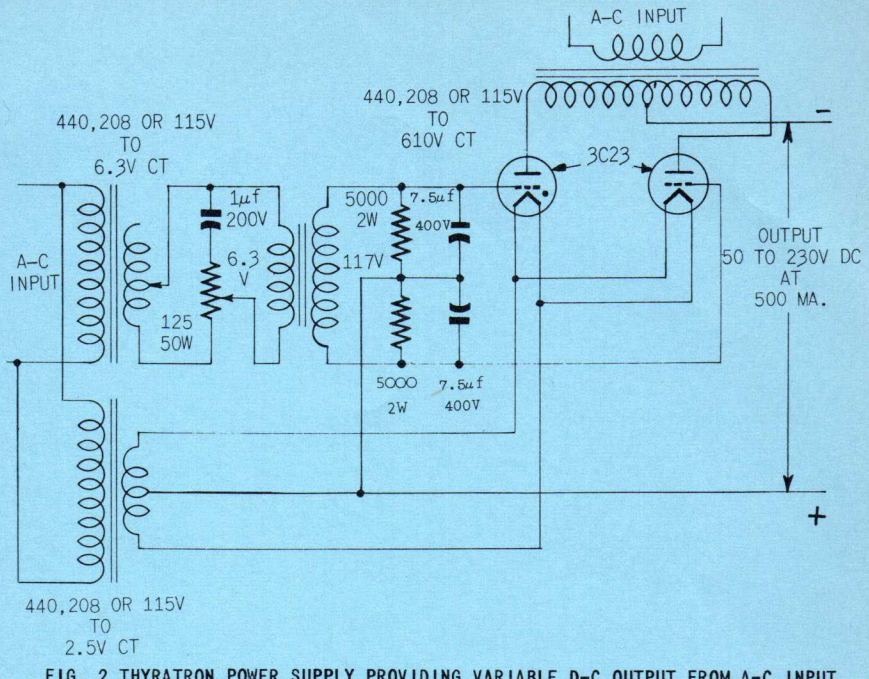


FIG. 2 THYRATRON POWER SUPPLY PROVIDING VARIABLE D-C OUTPUT FROM A-C INPUT

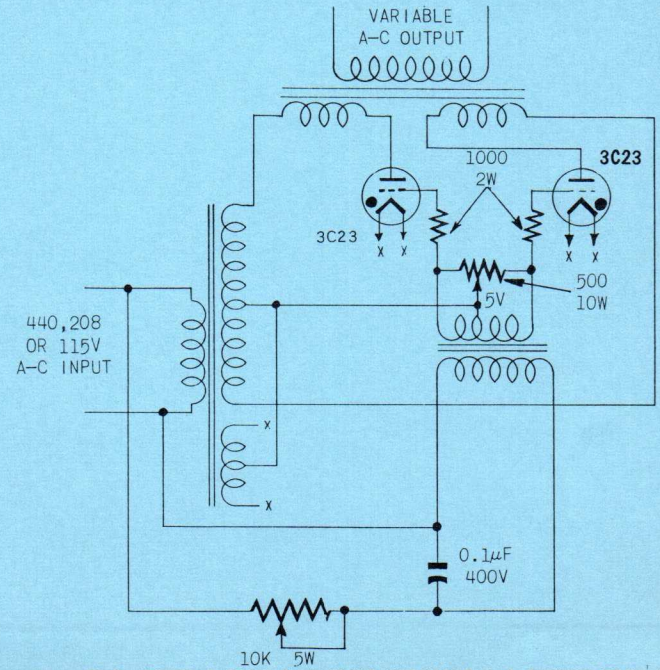


FIG. 3 THYRATRON POWER SUPPLY PROVIDING VARIABLE A-C OUTPUT FROM A-C INPUT

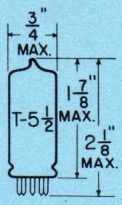
PRINTED IN U. S. A.

TUNG-SOL

POWER AMPLIFIER PENTODE

MINIATURE TYPE

COATED FILAMENT CATHODE



GLASS BULB

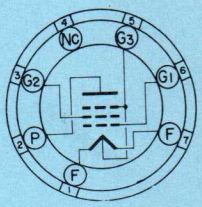
SERIES FILAMENT
E_f APPLIED BETWEEN PINS 1 & 7
E_{g1} REFERRED TO PIN 1

PARALLEL FILAMENT
E_f APPLIED BETWEEN PIN 5 AND PINS 1 & 7 TIED TOGETHER.
E_{g1} 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 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 3V4.



BOTTOM VIEW
MINIATURE BUTTON 7 PIN BASE

ANY MOUNTING POSITION

THE 3V4WA IS A POWER AMPLIFIER PENTODE UTILIZING THE 7PIN 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	---	13	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	1 975	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.

PRINTED IN U.S.A.

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 Ep 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 Ep 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 Ep FOR THE VIBRATION TEST SHALL READ "50 mVAC" AND (2) SYMBOL "Eb" AND THE MAX. VALUE "18 VU" FOR THE AF NOISE AND MICROPHONISM TEST SHALL BE DELETED.

(B) ON SHEET 2, (NOTE 1 SHALL BE CHANGED TO READ: "E_{bb}=E_{cc2}=135 VDC; E_{c1}= 0, R_{g1}= 3.3 MEG; R_p= 0.27 MEG; R_{g2}=2.0 MEG (BYPASSED WITH A 0.5 μf CAPACITOR TO −F). SET AMPLIFIER GAIN FOR 50MW OUTPUT WITH E_{sig}= 500 mVAC. THE REJECTION LEVEL SHALL BE SET AT THE VU METER READING OBTAINED DURING THE CALIBRATION.

GENERAL:

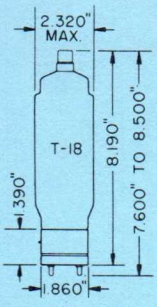
3V4WA SHALL MEET REQUIREMENTS OF MIL-E-1/343 DATED AUGUST 14, 1953 WITH FOLLOWING EXCEPTIONS.

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

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

TUNG-SOL

DIODE



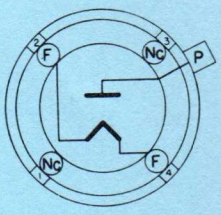
GLASS BULB

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

PRINTED IN U.S.A.

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	NONEX
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.)		RIPPLE	
						E_{DC} IN VOLTS	I_{DC} IN AMPERES	VOLTS RMS	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

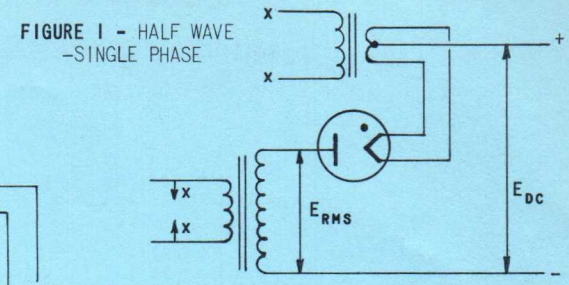


FIGURE 1 - HALF WAVE -SINGLE PHASE

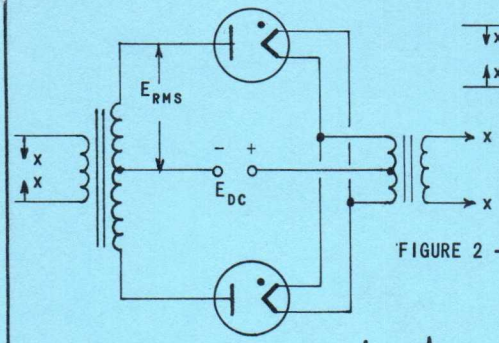


FIGURE 2 - FULL WAVE - SINGLE PHASE

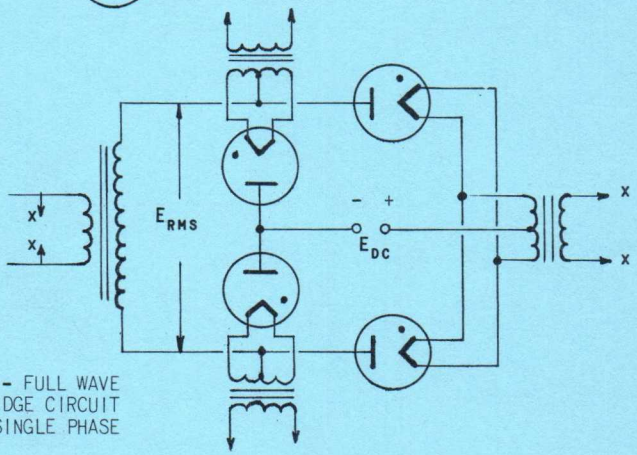


FIGURE 3 - FULL WAVE BRIDGE CIRCUIT -SINGLE PHASE

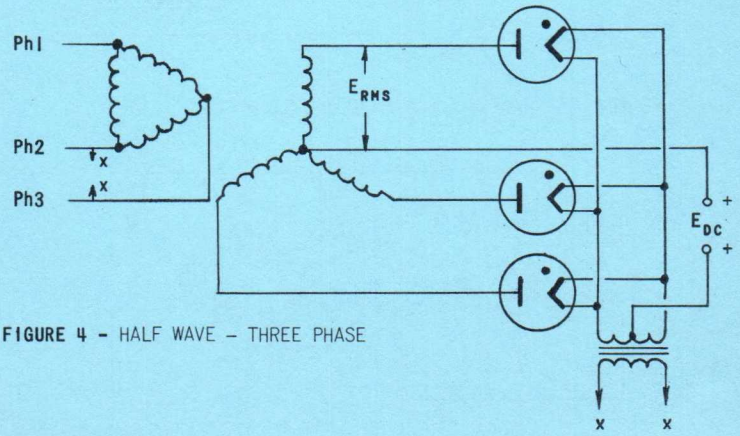


FIGURE 4 - HALF WAVE - THREE PHASE

PRINTED IN U. S. A.

FIGURE 5 - FULL WAVE–THREE PHASE

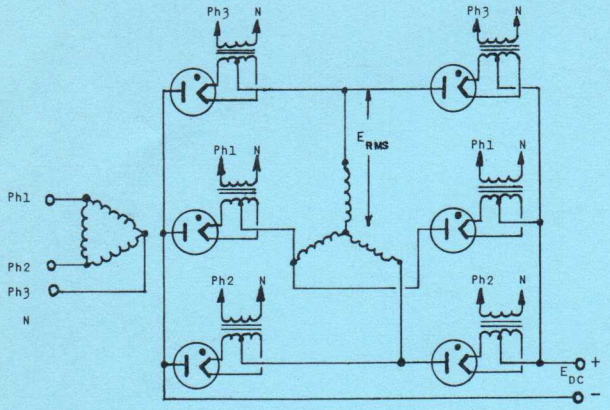


FIGURE 6 - FULL WAVE – THREE PHASE

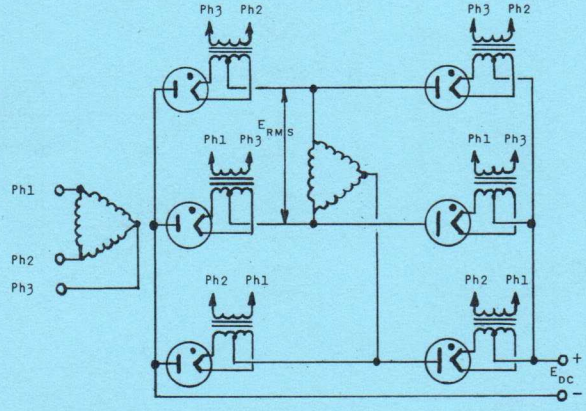
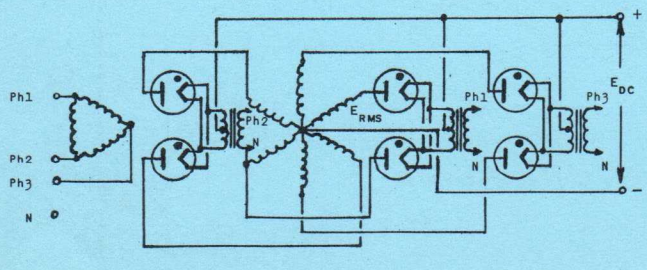
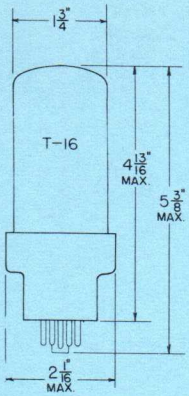


FIGURE 7 - HALF WAVE–SIX PHASE (3 PHASE SUPPLY)



TUNG-SOL

FULL WAVE RECTIFIER



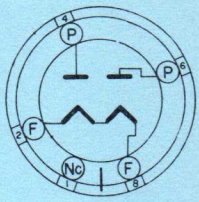
GLASS BULB
HARD GLASS

FILAMENT

5.0 VOLTS 2.0 AMP.

AC OR DC

VERTICAL MOUNTING POSITION
TUBE MAY BE OPERATED IN HORIZONTAL POSITION IF PINS #1 AND #4 ARE IN VERTICAL PLANE.



BOTTOM VIEW
SPECIAL SKIRTED
5 PIN. OCTAL
5T

THE 5R4WGA IS A HIGH VUCUUM FULL WAVE RECTIFIER CAPABLE OF SUPPLYING 950 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).

PRINTED IN U.S.A.

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

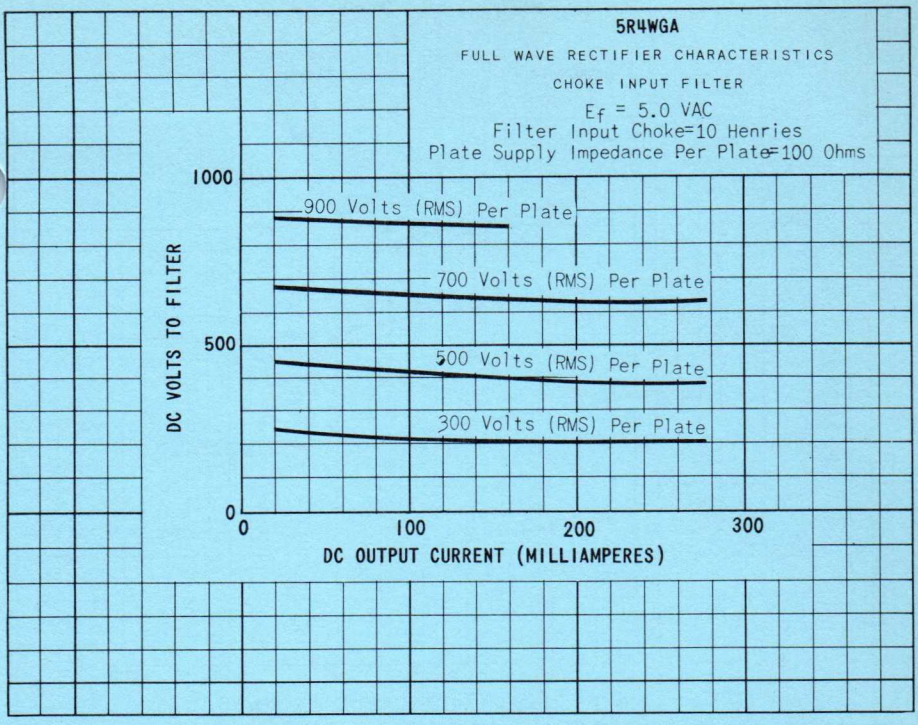
ALTITUDE	FILTER INPUT	PEAK INV. VOLTAGE	VOLTS RMS PER PLATE	MIN. SUPPLY IMPEDANCE PER PLATE
UP TO 30,000 FT.	4 μf	3050v⊕	1070v	575Ω⊕
UP TO 40,000 FT.	4 μf	2150⊕	760	---
	5 HENRIES	2300⊕	815	---
	4 μf	2800⊕	990	575⊕
UP TO 60,000 FT.	4 μf	1850⊕	655	---

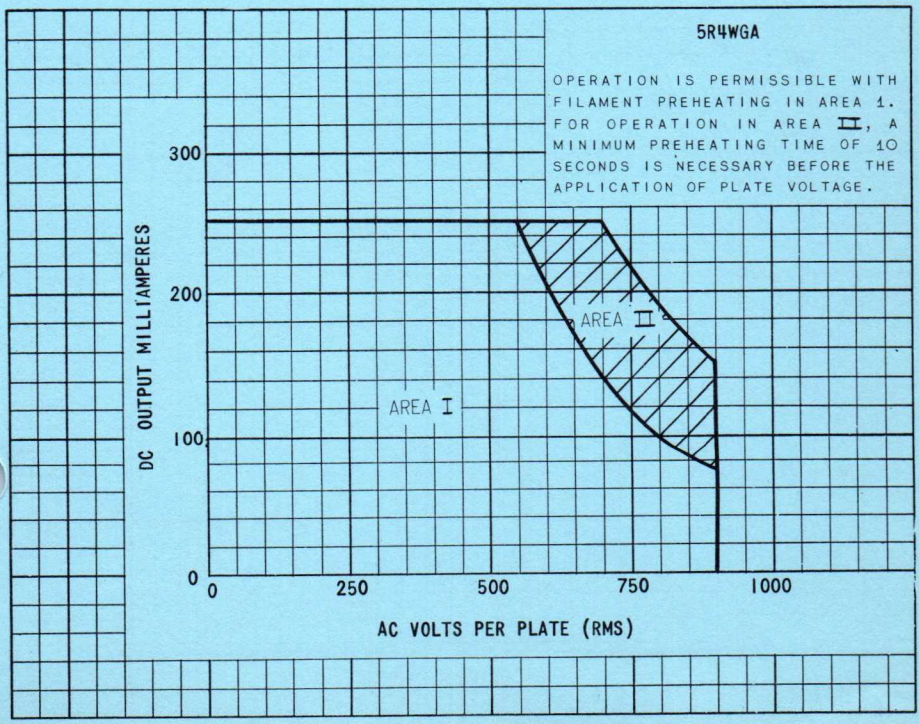
ALTITUDE	PEAK PLATE CURRENT	CURRENT	FULL LOAD VOLTAGE
UP TO 30,000 FT.	0 MA.⊕	0 MA.⊕	1525v
UP TO 40,000 FT.	700⊕	275⊕	770
	---	275⊕	650
	550	165⊕	1100
UP TO 60,000 FT.	700⊕	275⊕	620

⊕INDICATES MAXIMUM RATINGS; ALL OTHERS INDICATE APPROXIMATE VALUES.

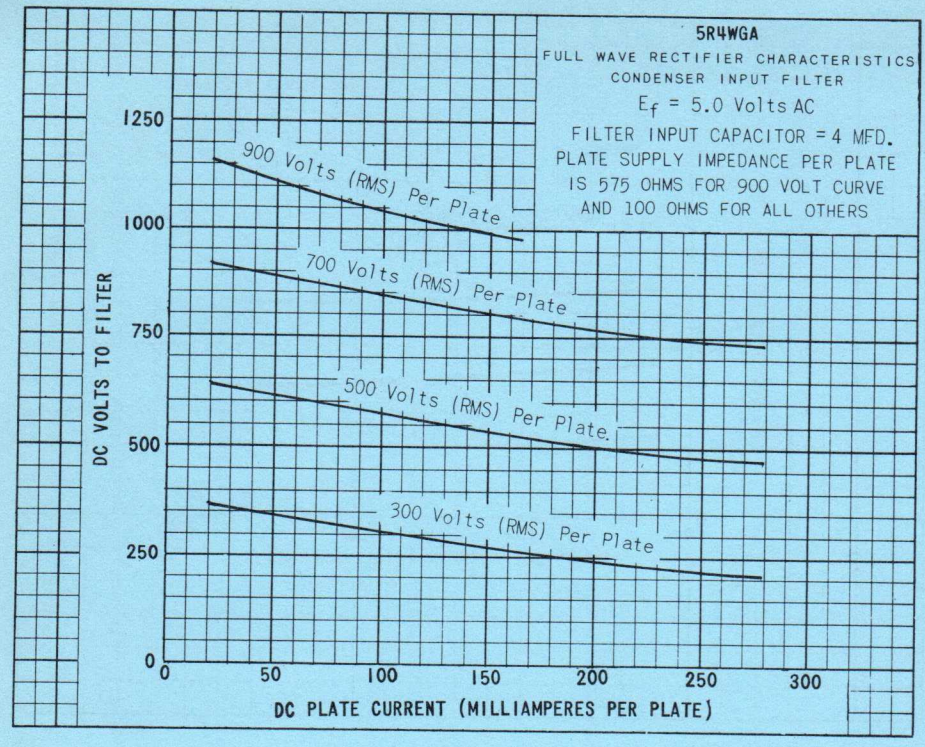
ALL VALUES ARE FOR E_f = 5.0 V. AND 10 SECONDS PREHEATING (NO PREHEATING IS NECESSARY FOR NO LOAD CONDTIONS). HIGHER VALUES OF FILTER CONDENSER CAPACITY MAY BE USED IF PLATE SUPPLY IMPEDANCE IS INCREASED TO KEEP PEAK PLATE CURRENT WITHIN RATINGS. FILTER VALUES ARE FOR 60 CYCLE OPERATION.

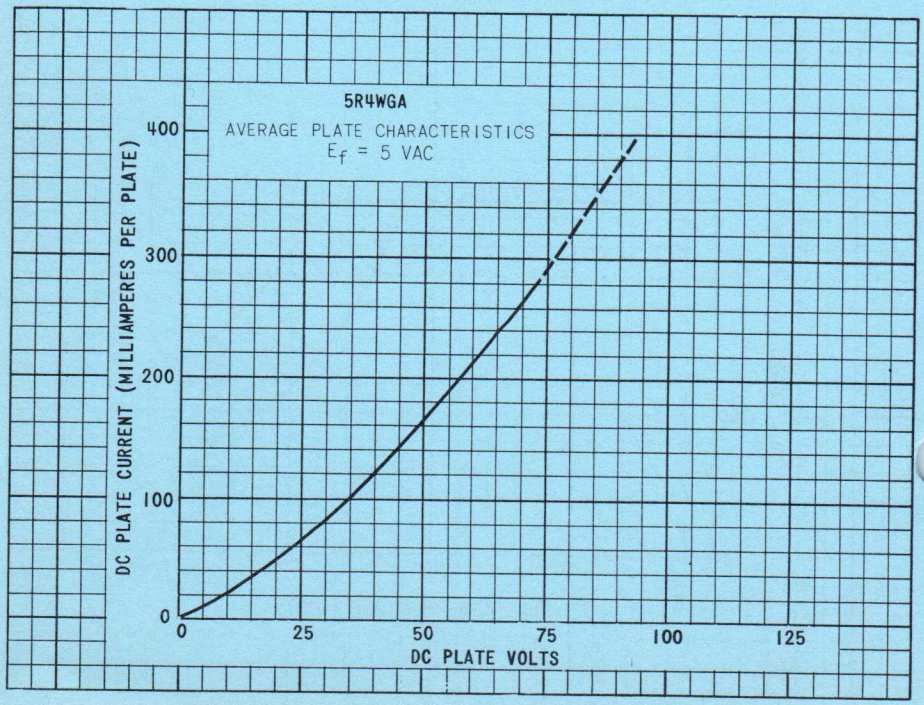
CONTINUED ON FOLLOWING PAGE





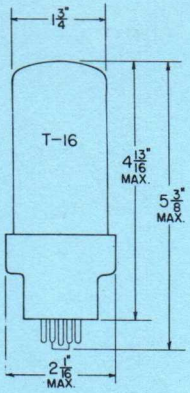
PRINTED IN U.S.A.


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
1250
1000
750
500
250
0
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)
400
300
200
100
0
0
25
50
75
100
125
DC PLATE VOLTS

TUNG-SOL

FULL WAVE RECTIFIER



GLASS BULB
HARD GLASS

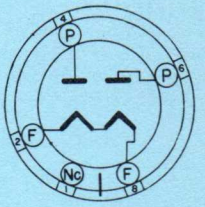
FILAMENT

5.0 VOLTS 2.0 AMP.

AC OR DC

VERTICAL MOUNTING POSITION

TUBE MAY BE OPERATED IN HORIZONTAL POSITION IF PINS #1 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).

PRINTED IN U.S.A.

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

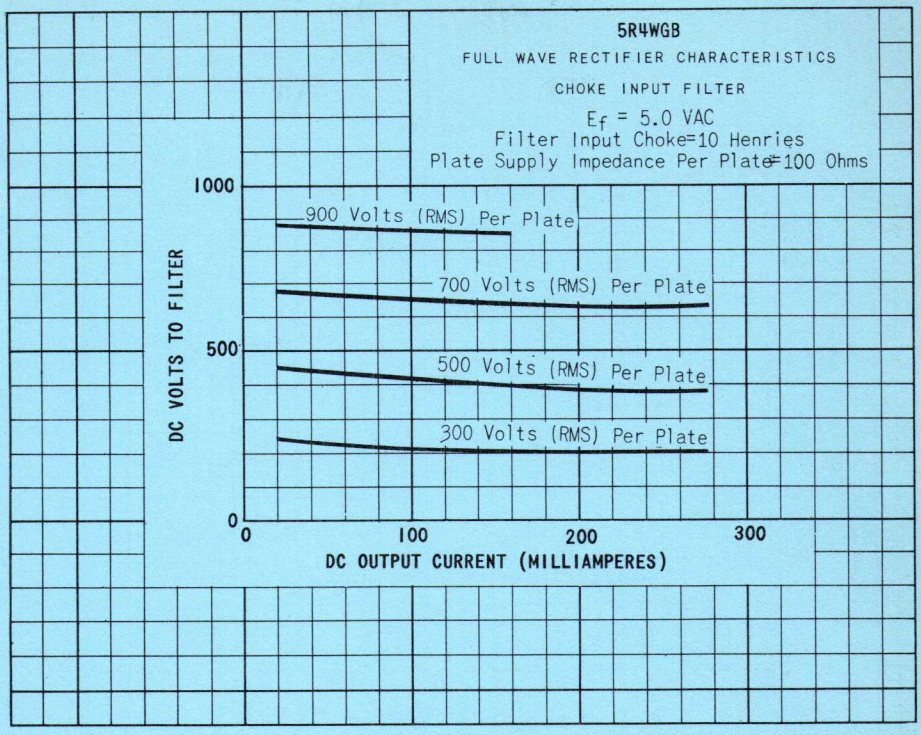
ALTITUDE	FILTER INPUT	PEAK INV. VOLTAGE	VOLTS RMS PER PLATE	MIN. SUPPLY IMPEDANCE PER PLATE
UP TO 30,000 FT.	4 μf	3050v⊕	1070v	575Ω⊕
UP TO 40,000 FT.	4 μf	2150⊕	760	---
	5 HENRIES	2300⊕	815	---
	4 μf	2800⊕	990	575⊕
UP TO 60,000 FT.	4 μf	1850⊕	655	---

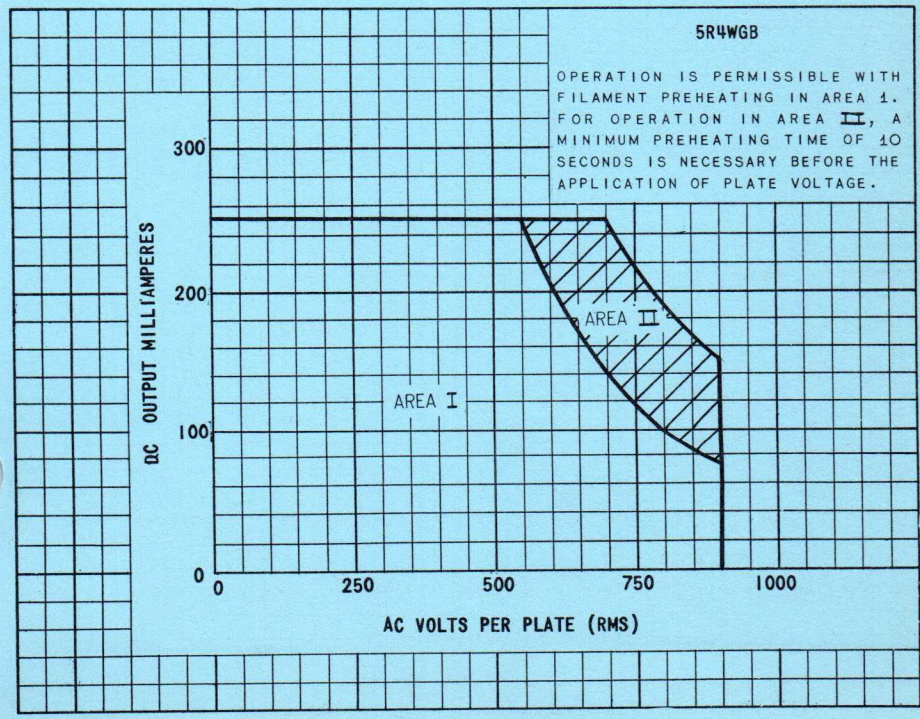
ALTITUDE	PEAK PLATE CURRENT	CURRENT	FULL LOAD VOLTAGE
UP TO 30,000 FT.	0 MA.⊕	0 MA.⊕	1525v
UP TO 40,000 FT.	700⊕	275⊕	770
	---	275⊕	650
	550	165⊕	1100
UP TO 60,000 FT.	700⊕	275⊕	620

⊕INDICATES MAXIMUM RATINGS; ALL OTHERS INDICATE APPROXIMATE VALUES.

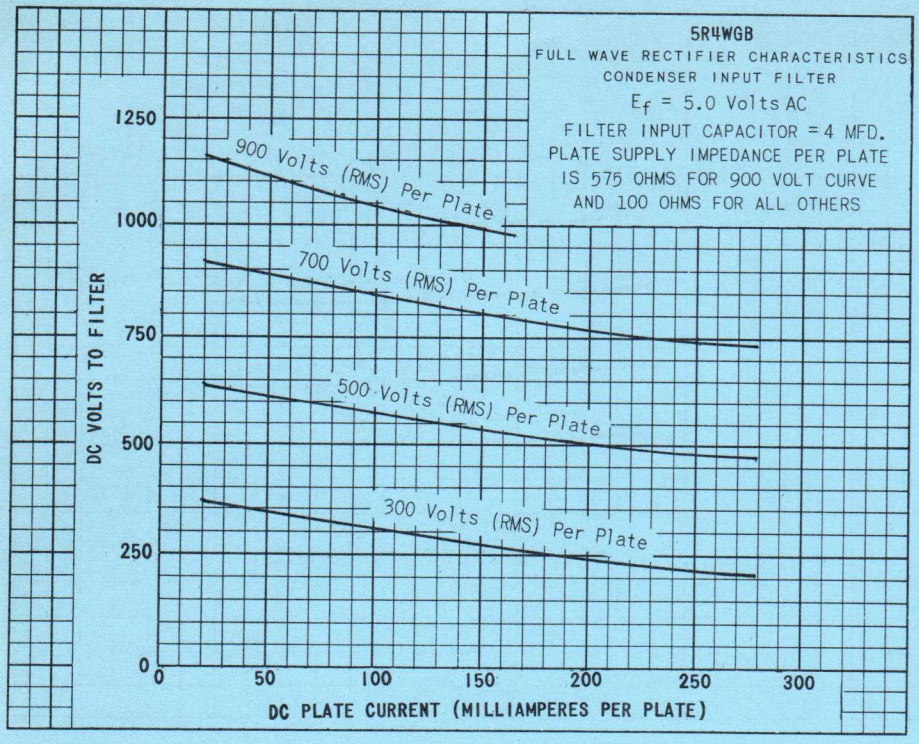
ALL VALUES ARE FOR E_f = 5.0 V. AND 10 SECONDS PREHEATING (NO PREHEATING IS NECESSARY FOR NO LOAD CONDTIONS). HIGHER VALUES OF FILTER CONDENSER CAPACITY MAY BE USED IF PLATE SUPPLY IMPEDANCE IS INCREASED TO KEEP PEAK PLATE CURRENT WITHIN RATINGS. FILTER VALUES ARE FOR 60 CYCLE OPERATION.

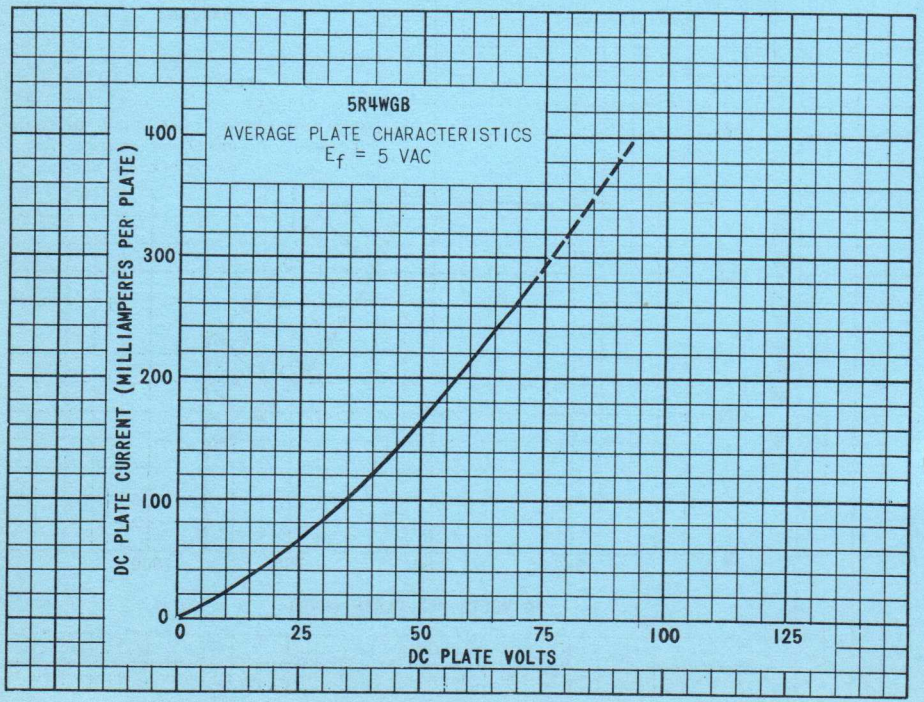
CONTINUED ON FOLLOWING PAGE





PRINTED IN U. S. A.


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): e_{px} = 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; I_o = 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). e_{px} = 1850 Vac; R_L/I_o = 275 mAdc; t_k = 10 SEC; C_L = 4 mfd; $Z_{ptotal/p}$ = 200Ω: FULL WAVE; PRESSURE = 55 mm (60000 ft.)

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

FATIGUE: 25 CPS, 0.80" 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

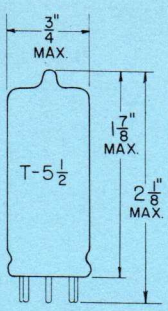
OPERATION (2)	100 HOURS	I_o > 245 mAdc.
OPERATION (2)	500 HOURS	I_o > 240 mAdc.
OPERATION (2)	1000 HOURS	I_o > 240 mAdc.

PRINTED IN U. S. A.

TUNG-SOL

PENTODE

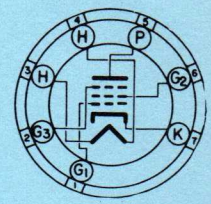
MINIATURE TYPE



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 CONDITIONS (NOTE 6)	NORMAL OPERATION (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:	---	---	2.5	---	mAdc
TRANSCONDUCTANCE (1)	Sm(1):	---	---	9000	---	μMHOS
PLATE RESISTANCE	rp:	---	---	0.5	---	MEG.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

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:	---	---	---	---	15	---	μAdc
Ehk=-100 Vdc		Ihk:	---	---	---	---	15	---	μAdc
GRID CURRENT:									
Rg1= 1.0 MEG.	0.65	Ic(1):	---	---	---	---	-2.0	---	μAdc
PLATE CURRENT (1):	0.65	Ib(1):	7.5	8.7	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 (6-2)									
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 8)	2.5	Δ_{Ef} Sm(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 MICRO-PHONICS:									
Ef=6.3 Vac; Ebb=Ecc2= 300 Vdc; Ec1=0; Rk= 200 OHMS; Ec3 to GROUND; Rp=10,000 OHMS; Rg2=60,000 OHMS; Cg2=2 μf; Ck= 1000 μf; Ecal=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	---	4.5	---	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:	---	---	---	---	30	---	μAdc
Ehk=-100 Vdc	---	Ihk:	---	---	---	---	30	---	μAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:	---	Δ_t Sm(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; 1min on, 4 min. off.	1.0	---	---	---	---	---	---	---	---

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

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:	---	30	μAdc
Ehk=-100 Vdc			---	Ihk:	---	30	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	$\Delta_t Sm(1)$:	---	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	3	---	---	---	---	---
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	---	$\Delta_t Sm(1)$:	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 8)	2	5	---	$\Delta_{Ef} Sm(2)$:	---	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	ALLOWABLE DEF. PER CHARACTER. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS - cont'd.							
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=O; 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

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES – CONT'D.

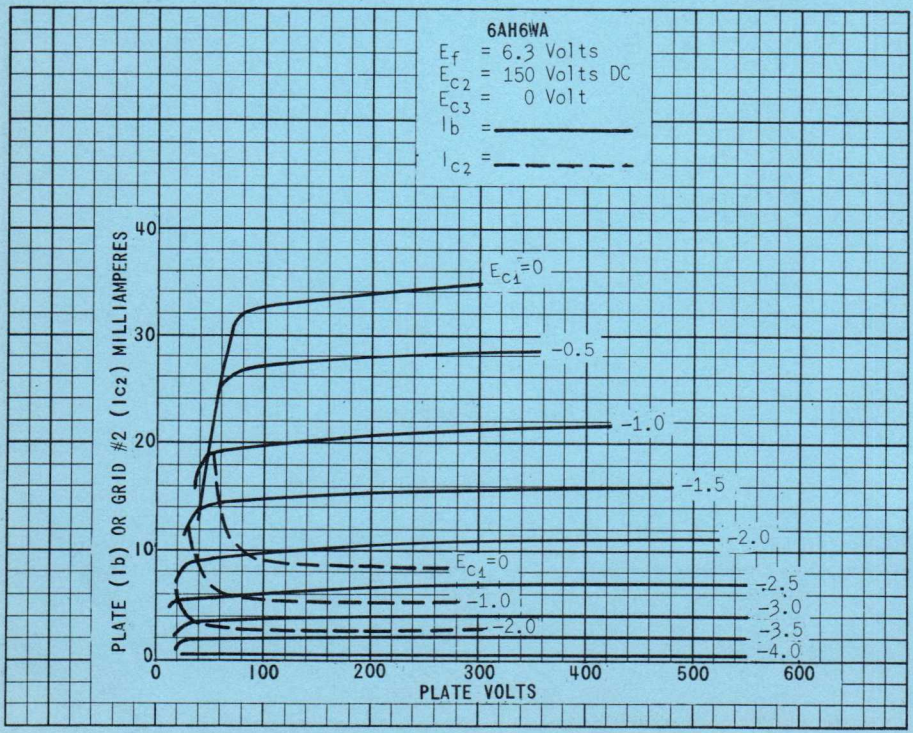
4. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

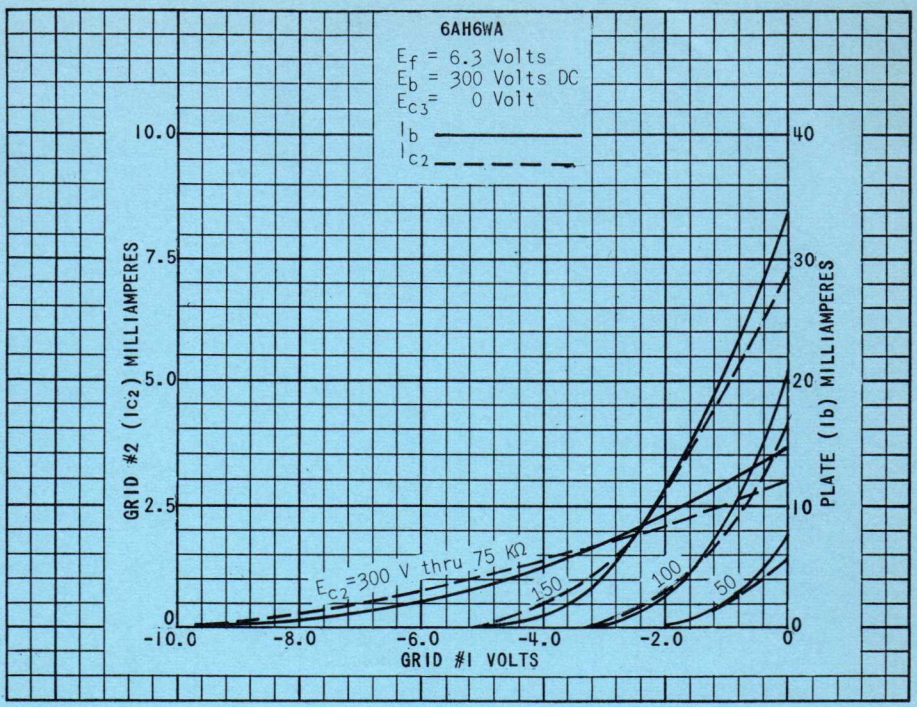
5. THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

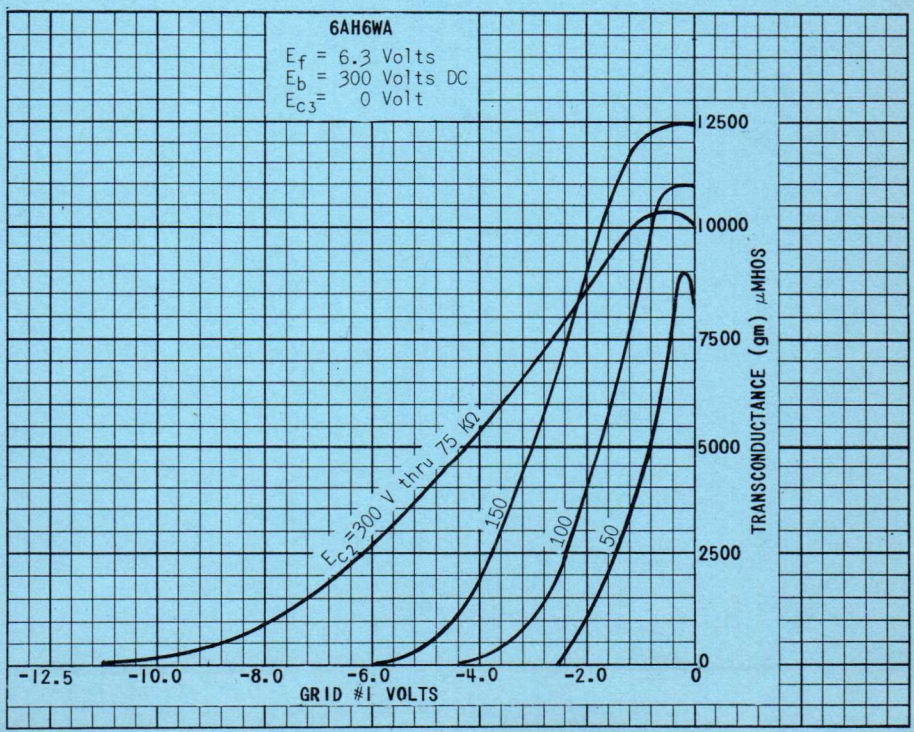
6. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHERWISE STATED UNDER INDIVIDUAL TEST ITEMS.

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 Ef=6.3 TO THAT VALUE MEASURED AT Ef=5.7 V.



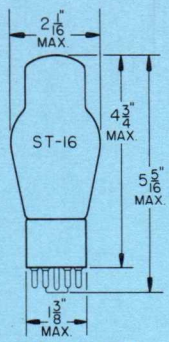




PRINTED IN U.S.A.

TUNG-SOL

TWIN TRIODE



GLASS BULB

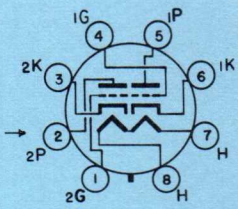
MEDIUM SHELL
8 PIN OCTAL B8-11

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 CAPACITIES 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 B8-11 PHENOLIC	
AVERAGE NET WEIGHT	2.5	OUNCES
MAXIMUM VIBRATION RATING (D=.08" @ 25 CPS)	2.5	G

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

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 Ω.
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 $(\frac{R}{\mu+1})$ 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 250 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.

PRINTED IN U. S. A.

TUNG-SOL

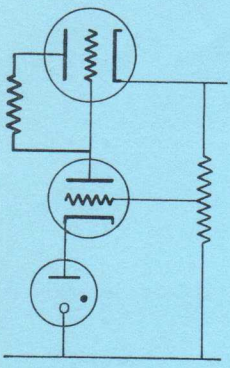


FIGURE 1

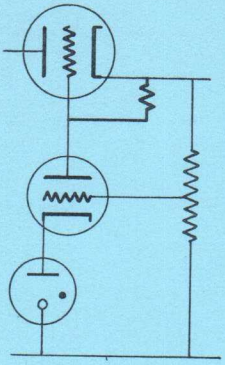


FIGURE 2

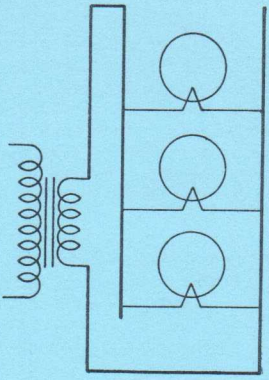
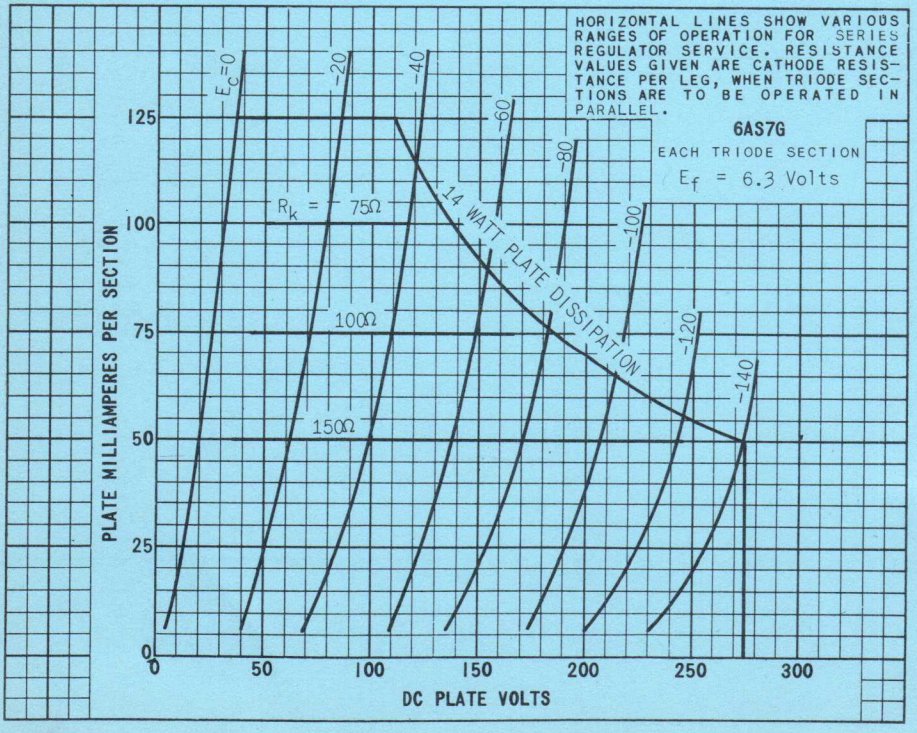
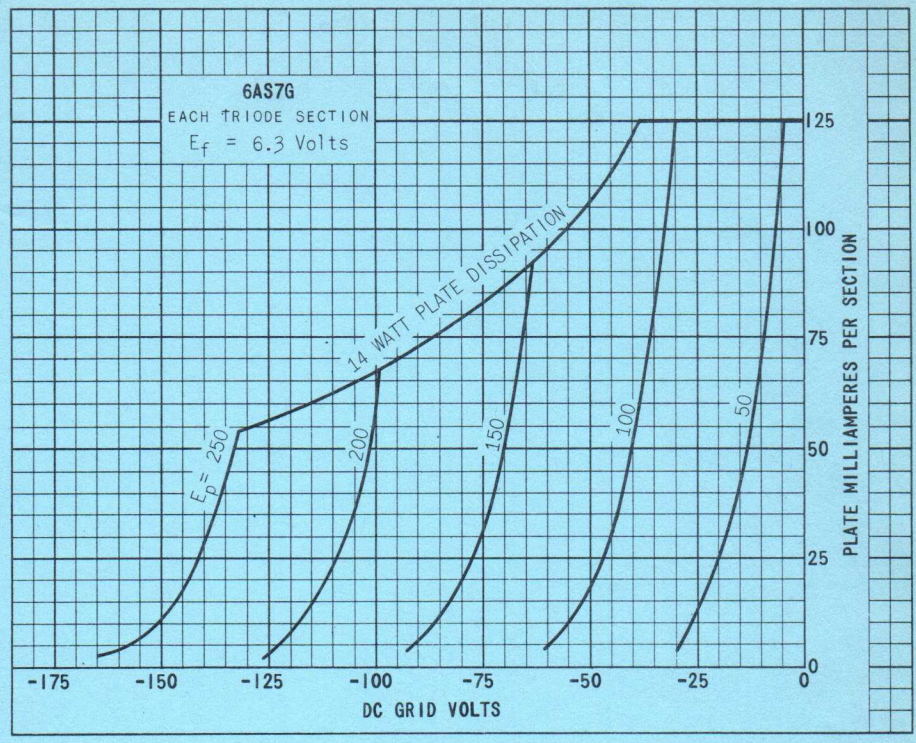
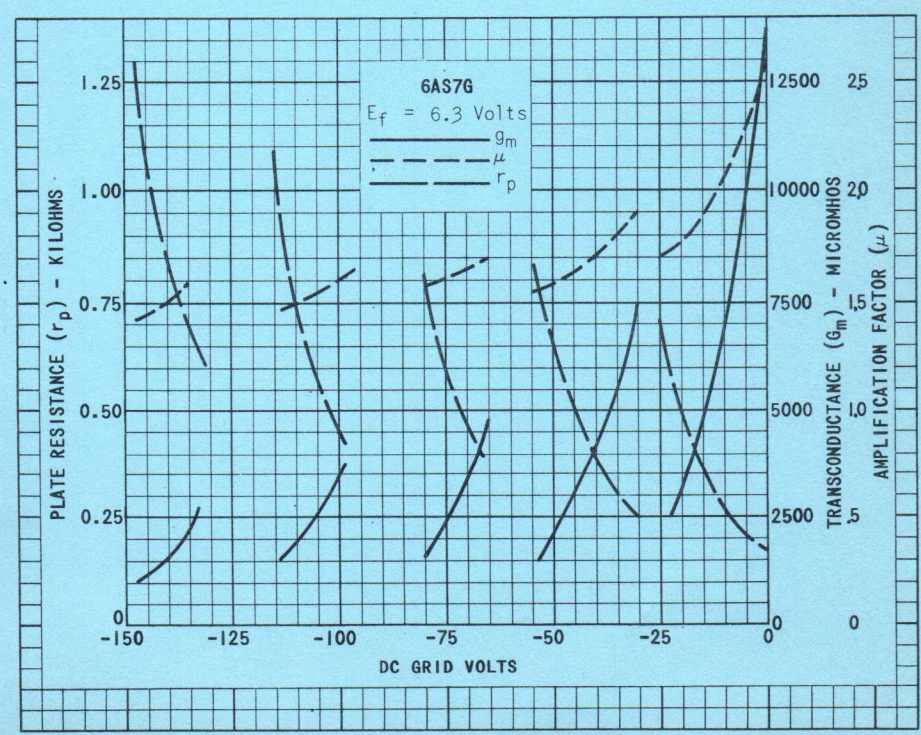


FIGURE 3







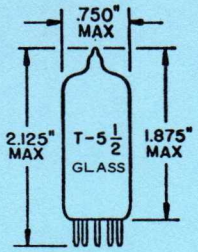
PRINTED IN U. S. A.

TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 5-2



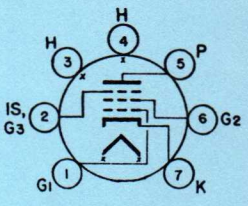
BASE 7 PIN MINIATURE BUTTON
JEDEC E7-1

FOR
INDUSTRIAL AND COMMERCIAL
APPLICATIONS WITH A HIGH
DEGREE OF RELIABILITY

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 7BK



BOTTOM VIEW

THE 6AU6WB IS A SHARP CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY LONG LIFE AND STABLE PERFORMANCE UNDER SEVERE CONDITIONS OF SHOCK, VIBRATION, HIGH TEMPERATURE AND HIGH ALTITUDE. THE TUBE MAY ALSO BE OPERATED UNDER STAND-BY CONDITIONS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	MAX.	0.0035	pf
INPUT		6.0	pf
OUTPUT		4.9	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES • SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	mA
LIMITS OF APPLIED VOLTAGE – AC OR DC		6.3 ± 0.6	VOLTS
HEATER-CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE		100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		100	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE - DC	330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
PLATE DISSIPATION	3.1	WATTS
GRID 2 DISSIPATION	0.7	WATT
GRID 3 VOLTAGE	0	VOLTS
GRID 1 VOLTAGE		
POSITIVE VALUE	0	VOLTS
NEGATIVE VALUE	50	VOLTS
GRID 1 CURRENT	1.0	mA
ENVELOPE TEMPERATURE	165	°C
ALTITUDE	60,000	FEET
GRID 1 CIRCUIT RESISTANCE	0.5	MEGOHMS

CHARACTERISTICS

PLATE VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	150	VOLTS
GRID 3 VOLTAGE - CONNECTED TO NEGATIVE END OF CATHODE RESISTOR	0	VOLTS
CATHODE RESISTOR	68	OHMS
PLATE CURRENT	10.6	mA
GRID 2 CURRENT	4.3	mA
TRANSCONDUCTANCE	5,200	μMHOS
PLATE RESISTANCE	1.0	MEGOHMS
GRID 1 VOLTAGE FOR $I_b = 35\ \mu A$ MAX.	-9.0	VOLTS

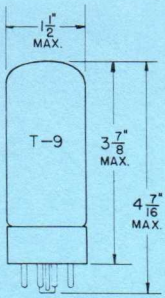
SPECIAL TESTS

LOW - FREQUENCY VIBRATION
VIBRATION FATIGUE
SHOCK TEST
HEATER - CYCLING LIFE TEST
INTERMITTENT LIFE TEST
INTERFACE LIFE TEST

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

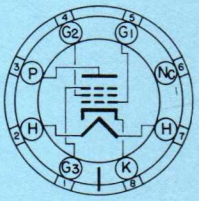
COATED UNIPOTENTIAL CATHODE

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

PRINTED IN U.S.A.

TUNG-SOL

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	11	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

TUNG-SOL

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

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

(CONT'D.)

IN TRIODE CONNECTION

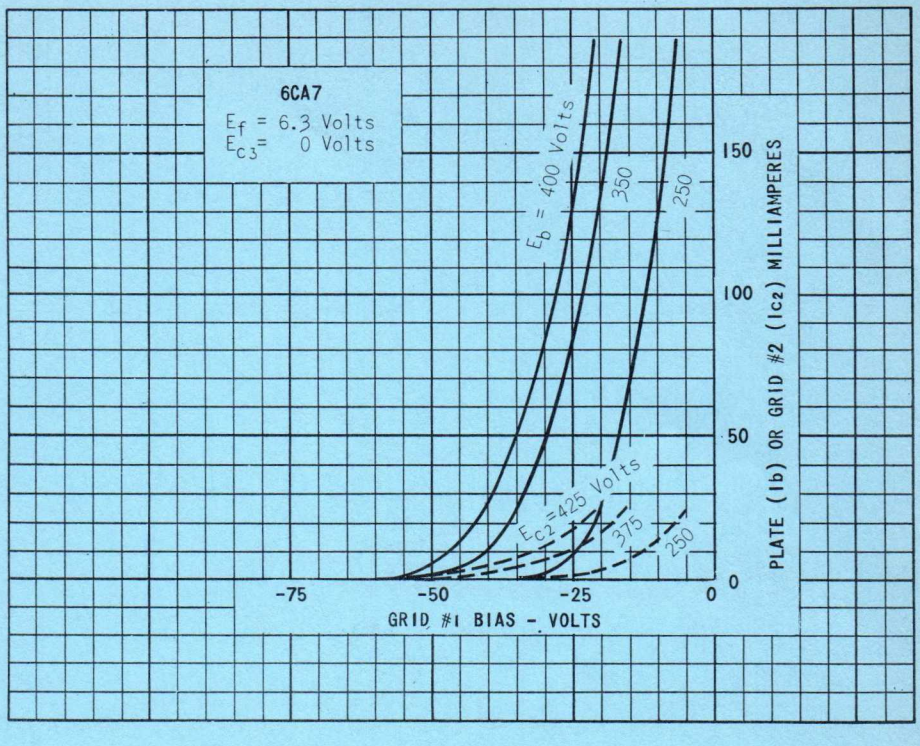
(GRID #2 CONNECTED TO PLATE)
CLASS A, ONE TUBE, SUPPLY VOLTAGE 375 VOLTS

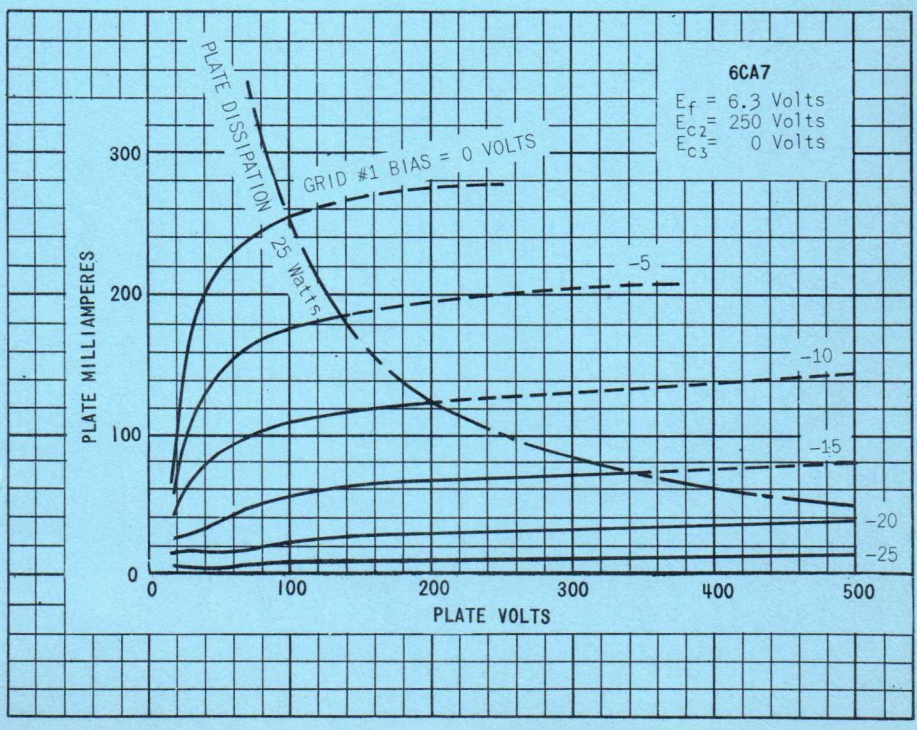
SUPPLY VOLTAGE	375	VOLTS
GRID #3 VOLTAGE	0	VOLT
CATHODE RESISTOR	370	OHMS
LOAD RESISTANCE	3000	OHMS
INPUT VOLTAGE (RMS)	18.9	VOLTS
PLATE CURRENT	70	MAMPS
MAX. SIGNAL POWER OUTPUT	6	WATTS
TOTAL HARMONIC DISTORTION	8	PERCENTS
INPUT VOLTAGE FOR POWER OUTPUT OF 50 MILLIWATTS (RMS)	1.7	VOLTS

IN TRIODE CONNECTION

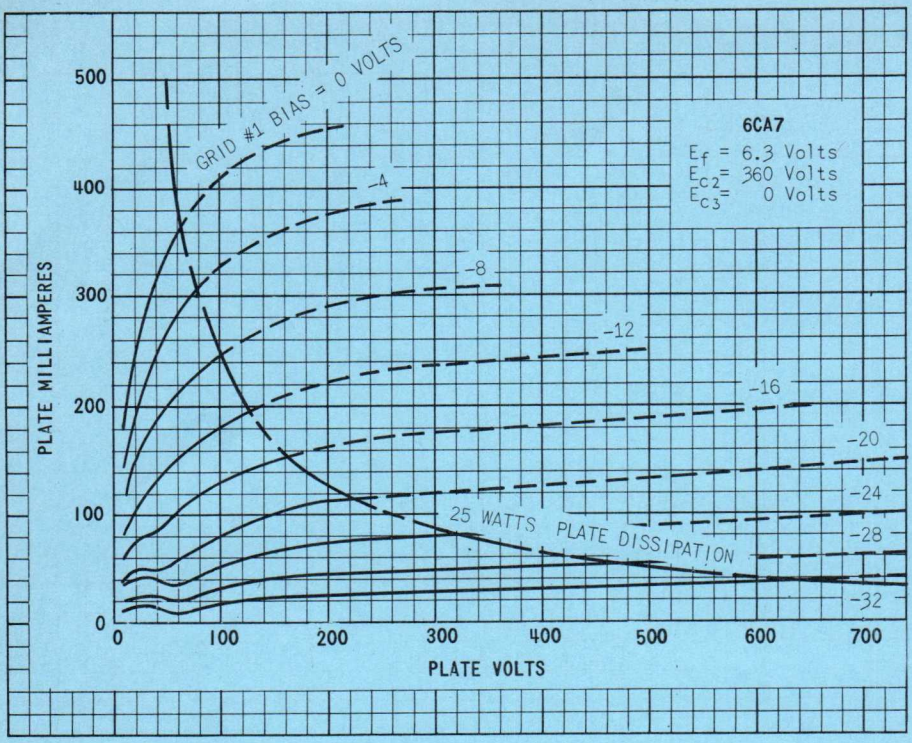
(GRID #2 CONNECTED TO PLATE)
CLASS AB, TWO TUBES, SUPPLY VOLTAGE 400 VOLTS

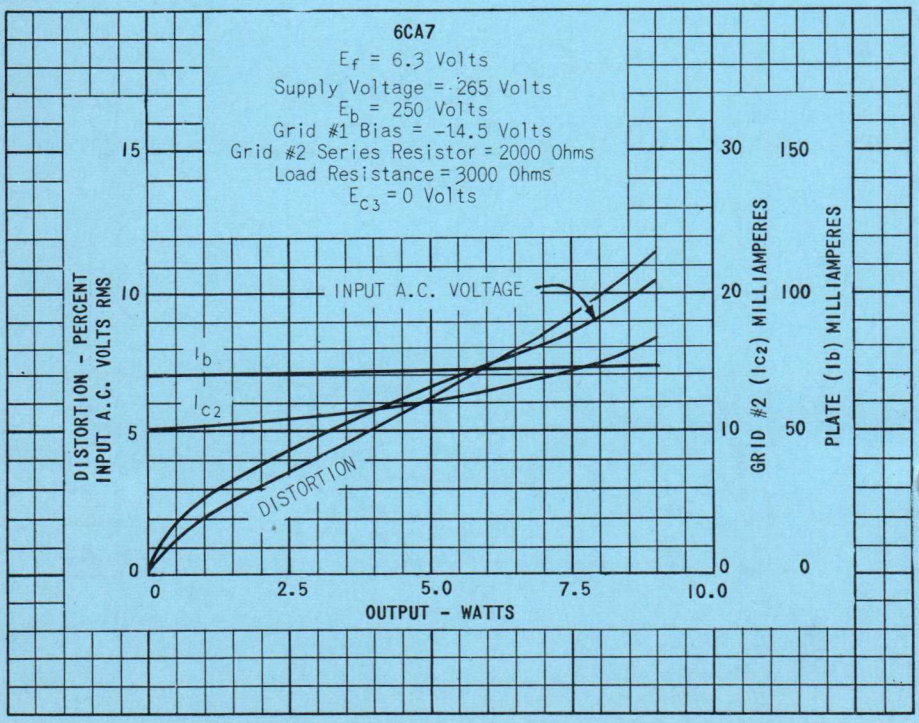
SUPPLY VOLTAGE	400		VOLTS
GRID #3 VOLTAGE	0		VOLT
CATHODE RESISTOR	220		OHMS
LOAD RESISTANCE, PLATE TO PLATE	5000		OHMS
INPUT VOLTAGE (RMS)	0	22	VOLTS
PLATE CURRENT	2X65	2X71	MAMPS
MAX. SIGNAL POWER OUTPUT	0	16.5	WATTS
TOTAL HARMONIC DISTORTION	–	3	PERCENTS

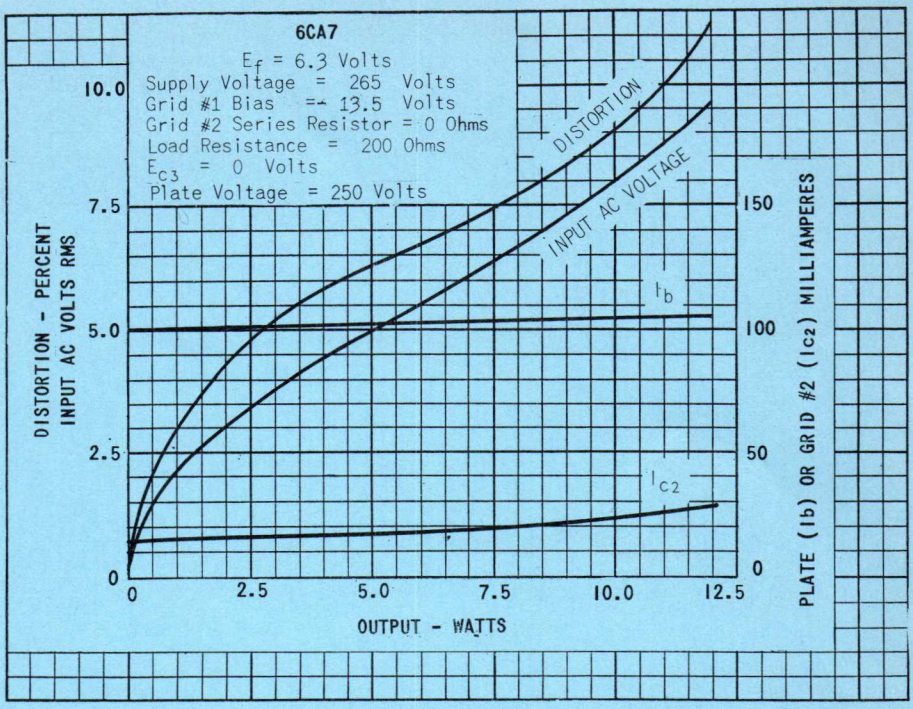


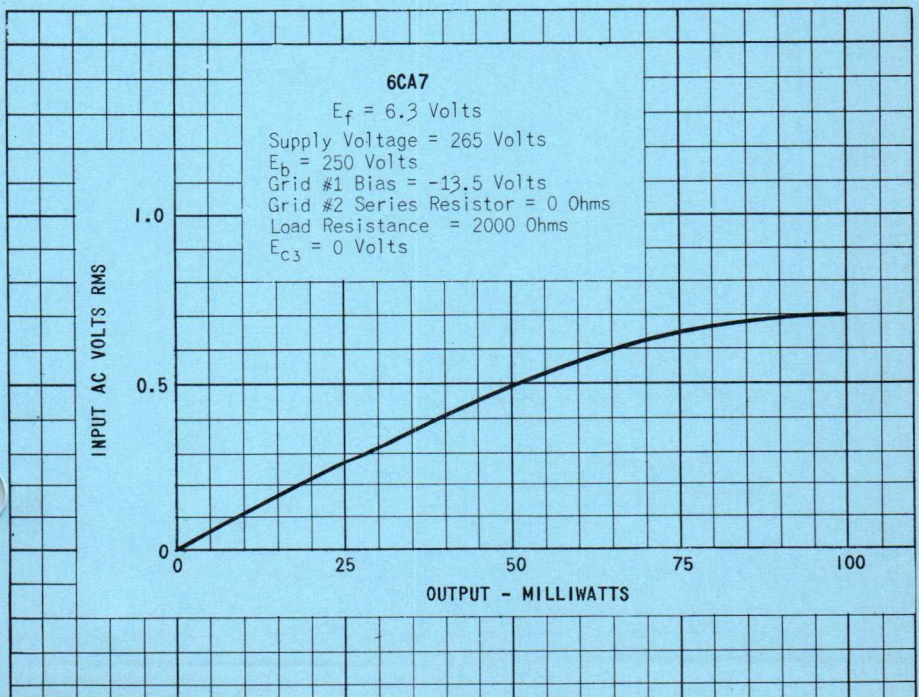


PRINTED IN U. S. A.


6CA7
E_f = 6.3 Volts
E_{c2} = 360 Volts
E_{c3} = 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

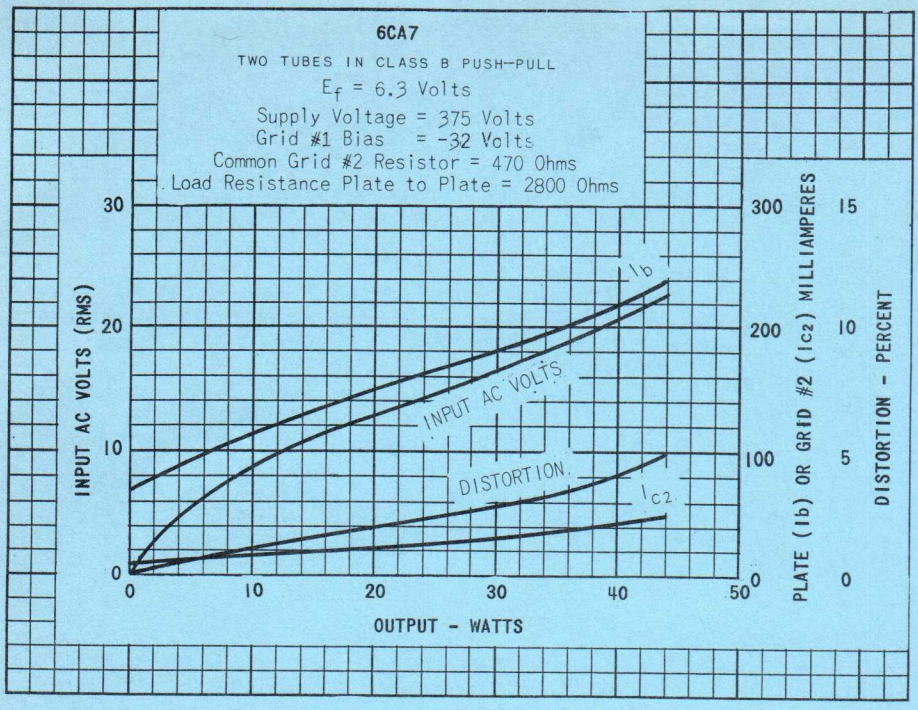

6CA7
E_f = 6.3 Volts
Supply Voltage = 265 Volts
E_b = 250 Volts
Grid #1 Bias = -14.5 Volts
Grid #2 Series Resistor = 2000 Ohms
Load Resistance = 3000 Ohms
E_{c3} = 0 Volts
INPUT A.C. VOLTAGE
I_b
I_{c2}
DISTORTION
DISTORTION - PERCENT INPUT A.C. VOLTS RMS
GRID #2 (I_{c2}) MILLIAMPERES
PLATE (I_b) MILLIAMPERES
OUTPUT - WATTS
0
2.5
5.0
7.5
10.0
15
10
5
30
20
10
150
100
50

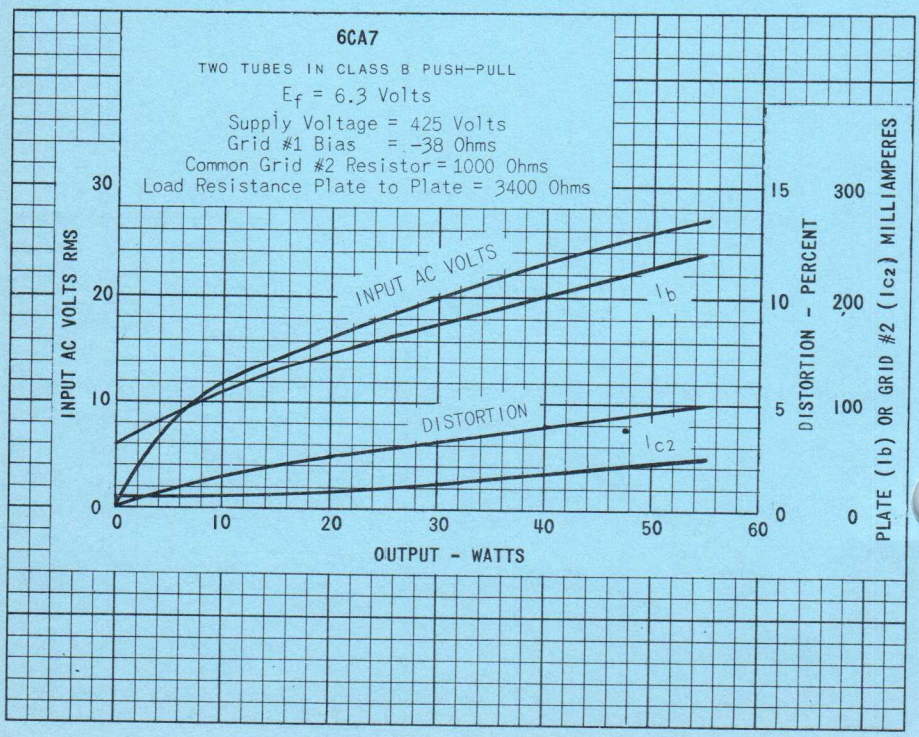


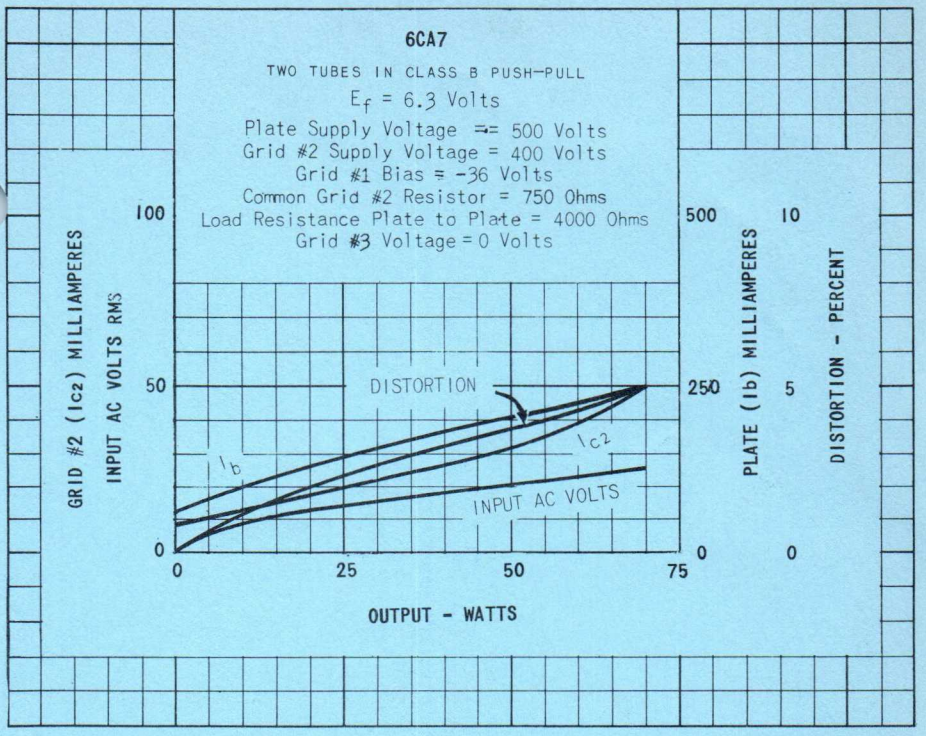


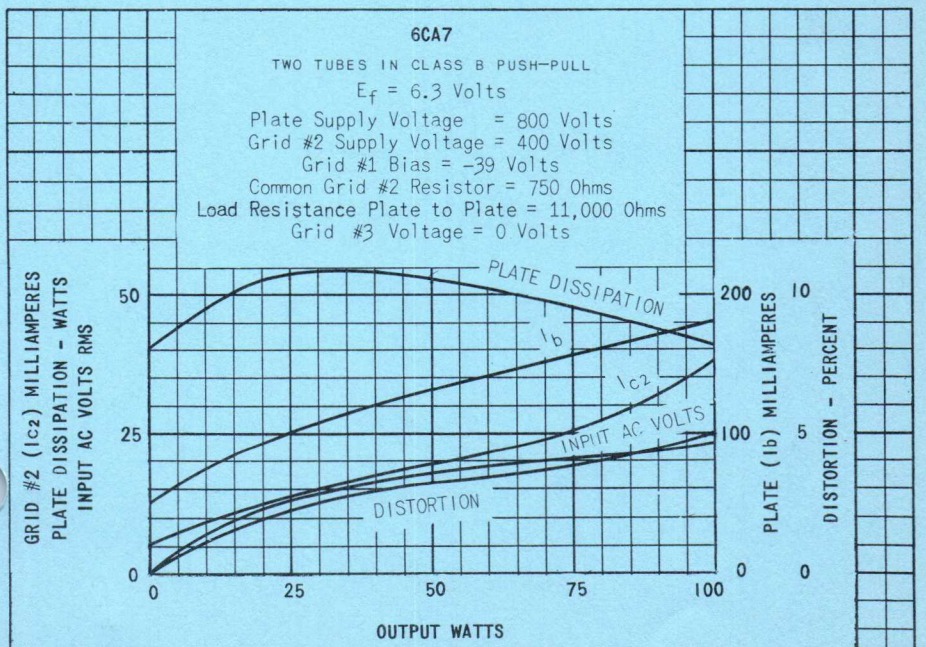
PRINTED IN U. S. A.

TENTATIVE DATA

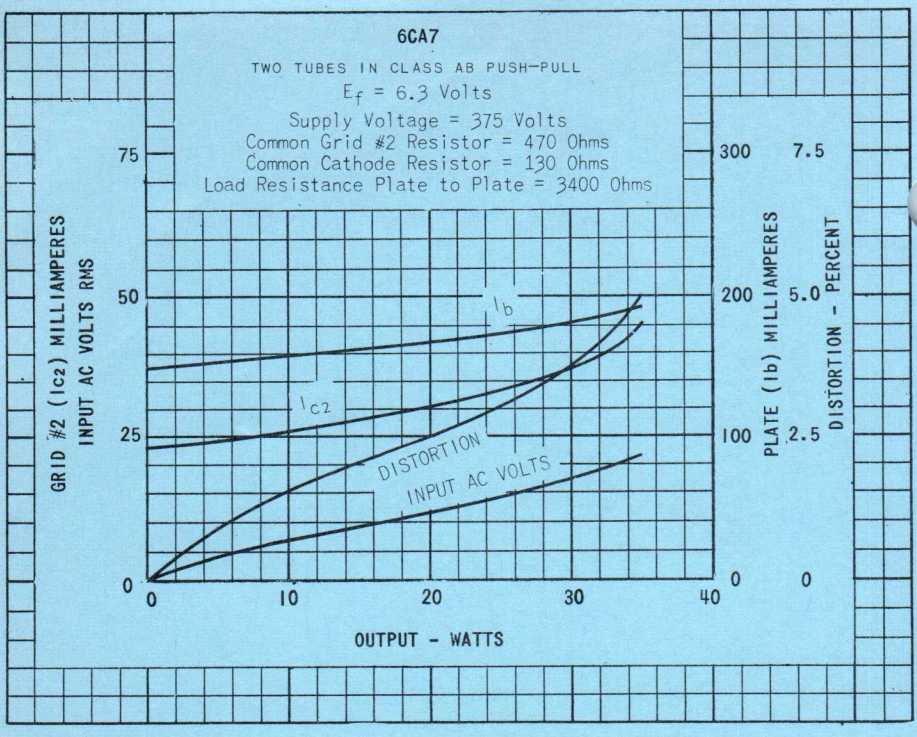


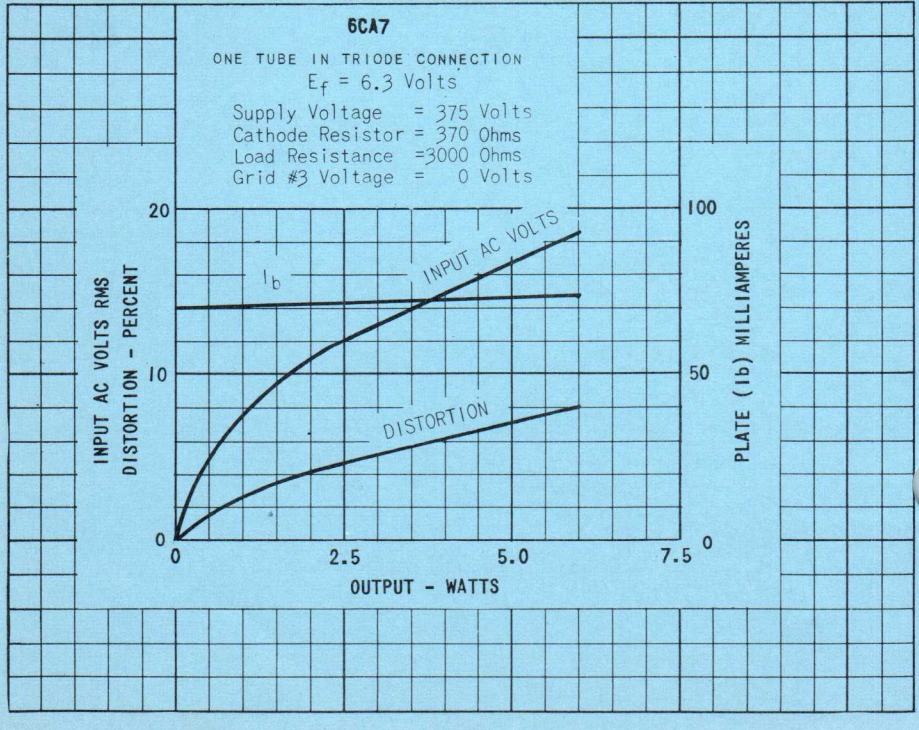


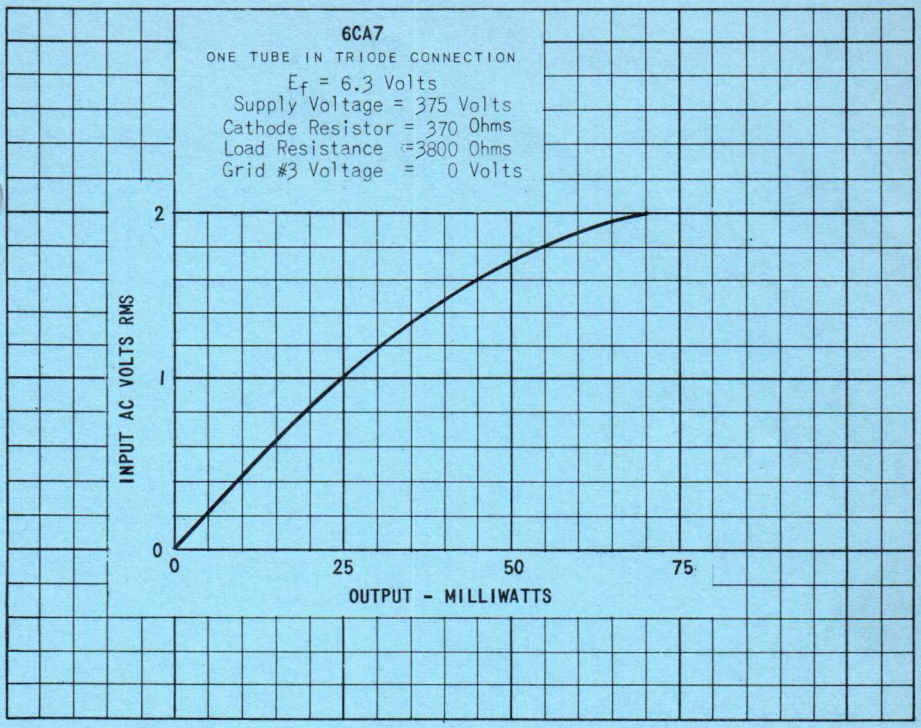




PRINTED IN U. S. A.


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
PLATE (Ib) MILLIAMPERES
DISTORTION - PERCENT
Ib
Ic2
DISTORTION
INPUT AC VOLTS
OUTPUT - WATTS
0
25
50
75
100
200
300
2.5
5.0
7.5
10
20
30
40


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
PLATE (Ib) MILLIAMPERES
Ib
INPUT AC VOLTS
DISTORTION
OUTPUT - WATTS
0
10
20
50
100
2.5
5.0
7.5

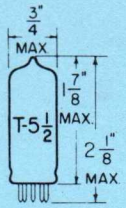


PRINTED IN U. S. A.

TUNG-SOL

ARGON THYRATRON

MINIATURE TYPE

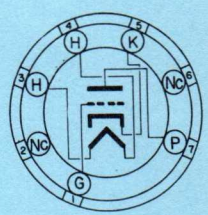


GLASS BULB

HEATER

6.3±10% VOLTS 0.25 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL MINIATURE BUTTON
7 PIN BASE

5AY

THE 6D4 IS AN ARGON FILLED TRIODE THYRATRON WITH NEGATIVE CONTROL GRID CHARACTERISTICS. ALTHOUGH THE 6D4 HAS FOUND USE AS A RELAY TUBE AND SAW TOOTH OSCILLATOR, ITS PRINCIPAL APPLICATION HAS BEEN AS AN RF NOISE GENERATOR. BECAUSE OF ITS SMALL SIZE, LIGHT WEIGHT, AND RELATIVE FREEDOM FROM TEMPERATURE RESTRICTIONS, THIS TUBE IS SUITED PARTICULARLY FOR USE IN COMPACT OR PORTABLE EQUIPMENT.

ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f = 6.3 VOLTS)	0.25	AMP.
MINIMUM CATHODE HEATING TIME	30	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	2.6	μμfd
CONTROL GRID TO CATHODE CAPACITANCE	1.2	μμfd
ANODE TO CATHODE CAPACITANCE	1.0	μμfd
HEATER TO CATHODE CAPACITANCE	2.9	μμfd
ANODE VOLTAGE DROP (AT 100 MA dc) (APPROX.)	12	VOLTS
NOISE OUTPUT (VIDEO BAND WIDTH 4 MC. FIG.2 CONDITIONS WITH E_{dc}=250V DC AND R=33,000 OHM) (P TO P)(MIN.)	9	VOLTS

MECHANICAL DATA

MOUNTING POSITION	ANY	
AVERAGE WEIGHT	0.3	OZ.
MAXIMUM VIBRATION RATING (D = .08", 25 CPS)	2.5	G.
BULB	T-5 1/2	
BASE	7 PIN MINIATURE BUTTON	

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

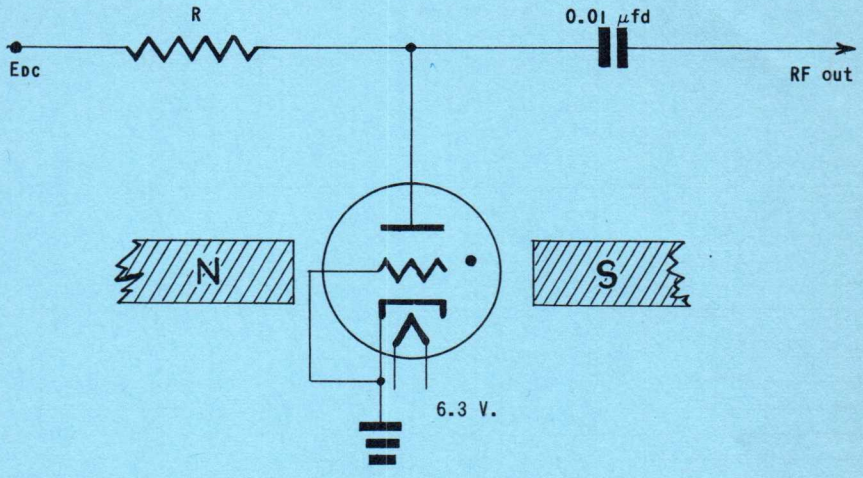
RATINGS
ABSOLUTE VALUES

	MINIMUM	MAXIMUM	
PEAK ANODE VOLTAGE			
FORWARD		350	VOLTS
INVERSE		350	VOLTS
DC PLATE SUPPLY VOLTAGE		250	VOLTS
CATHODE CURRENT			
PEAK		110	MA.
AVERAGE		25	MA.
AVERAGING TIME		30	SECONDS
NEGATIVE CONTROL GRID VOLTAGE	-150		
HEATER CATHODE VOLTAGE	-110	0	
AMBIENT TEMPERATURE	-55	90	°C
CONTROL GRID CIRCUIT RESISTANCE		0.5	MEGOHM

APPLICATION NOTES

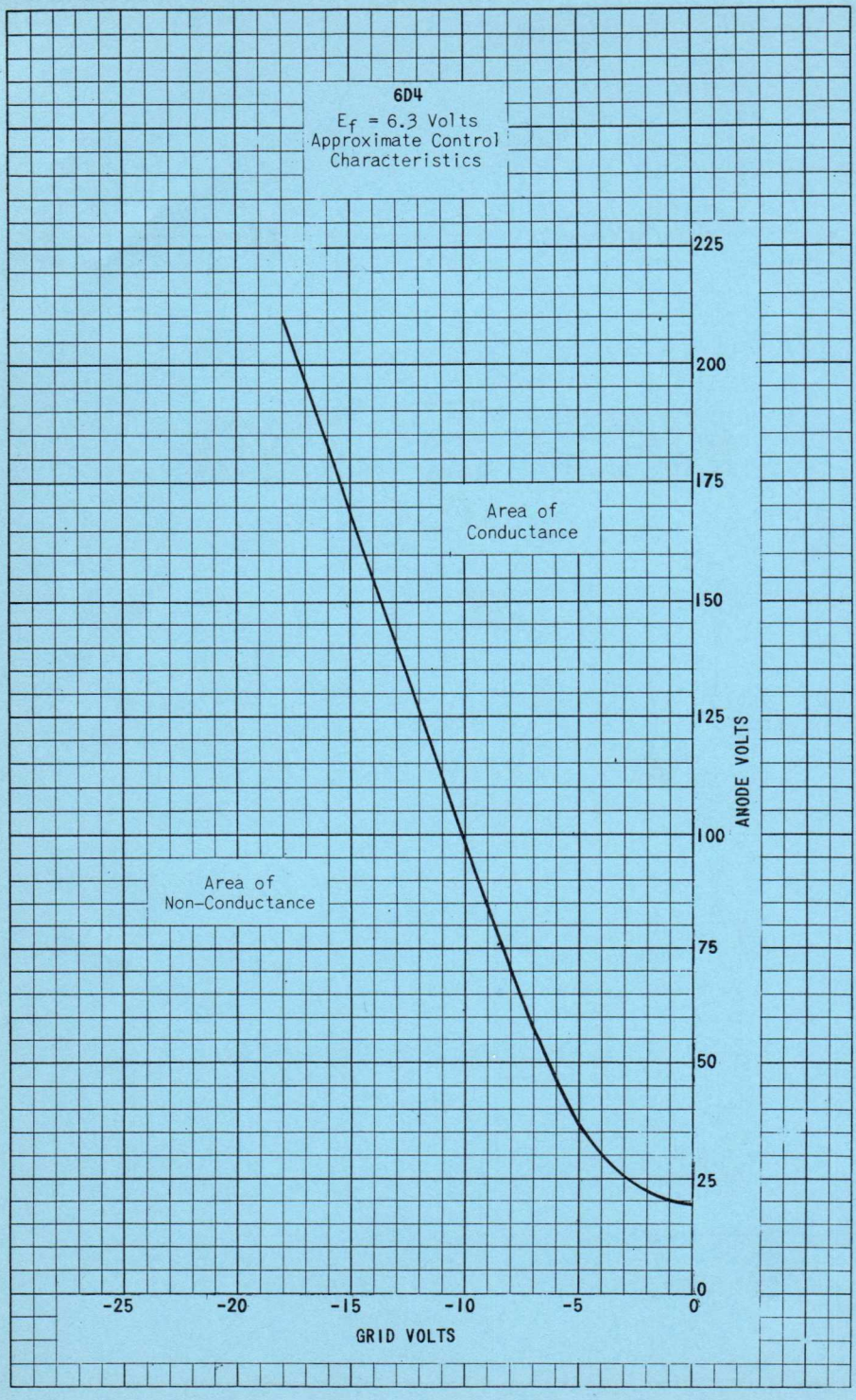
THE TUBE CAN BE USED IN CONJUNCTION WITH A 375 GAUSS MAGNET AS AN R.F. NOISE GENERATOR. THE MAGNETIC FIELD IS APPLIED PERPENDICULAR TO THE NORMAL ELECTRON PATH IN SUCH A WAY AS TO DEFLECT THE ELECTRONS UPWARD (NORTH POLE OF THE MAGNET AT PIN 7). MINIMUM OUTPUT FIGURES LISTED, ARE AS MEASURED THROUGH A TUNED FILTER, 1000 CPS BANDWIDTH AT 3 db POINTS, WITH R = 56,000 OHMS, E_{dc} = 300 V DC.

TUNG-SOL



FREQUENCY IN MEGACYCLES	MINIMUM NOISE VOLTAGE IN MICROVOLTS RMS
0.1	10,000
0.2	14,000
0.5	25,000
1.0	22,000
2.0	7,000
5.0	500.
10.0	70

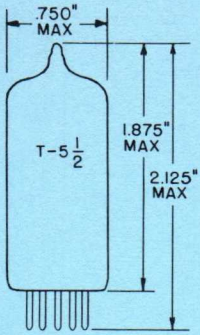
PRINTED IN U.S.A.


6D4
E_f = 6.3 Volts
Approximate Control
Characteristics
Area of
Conductance
Area of
Non-Conductance
225
200
175
150
125
100
75
50
25
0
ANODE VOLTS
-25
-20
-15
-10
-5
0
GRID VOLTS

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

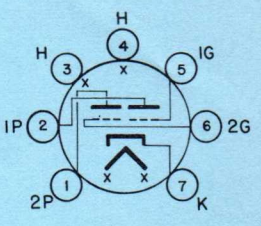


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

FOR MILITARY AND
INDUSTRIAL APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BF

THE 6J6WA IS A MEDIUM-MU TWIN TRIODE WITH A COMMON CATHODE IN THE 7 PIN MINIATURE CONSTRUCTION. THE TUBE IS PARTICULARLY ADAPTABLE FOR SERVICE AS A MIXER-OSCILLATOR AT FREQUENCIES UP TO 600 MEGACYCLES PER SECOND. IT INCORPORATES DISTINCTIVE MECHANICAL DESIGN FEATURES FOR HIGHLY RELIABLE OPERATION.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO CATHODE	1.3	pf
INPUT	2.1	pf
OUTPUT: (SECTION 1)	0.4	pf
OUTPUT: (SECTION 2)	0.45	pf
HEATER TO CATHODE	6.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	450	MA.
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			+180	VOLTS

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

EACH SECTION

PLATE VOLTAGE	300	VOLTS
PLATE DISSIPATION	1.1	WATTS
PLATE CURRENT	12.5	MA.
ENVELOPE TEMPERATURE	165	°C
ALTITUDE	60,000	FT.
GRID CURRENT RESISTANCE (CATHODE BIAS)	0.25	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

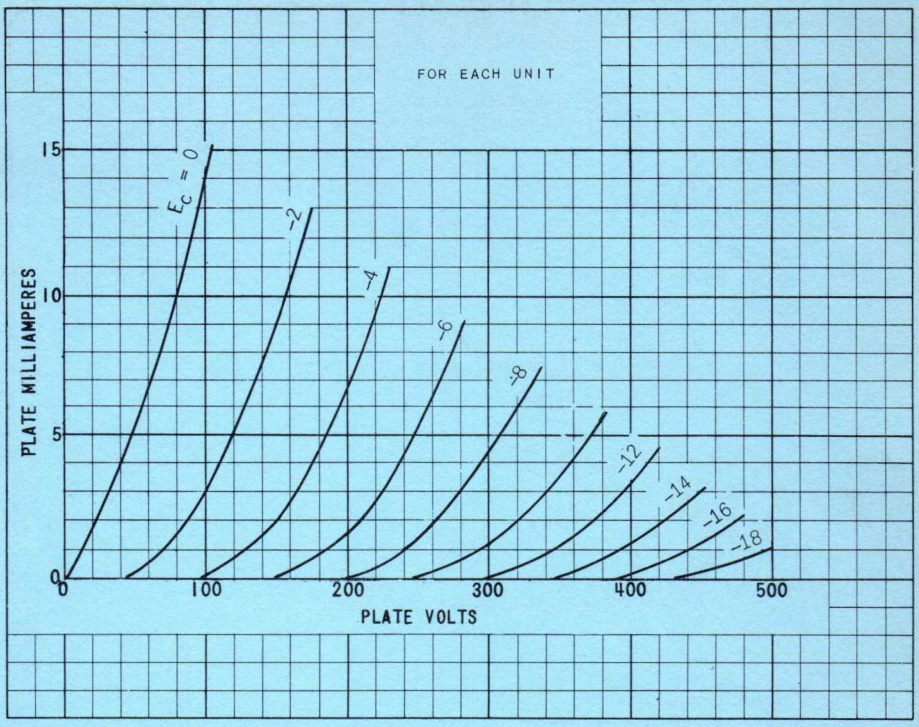
CLASS A1 AMPLIFIER - EACH SECTION

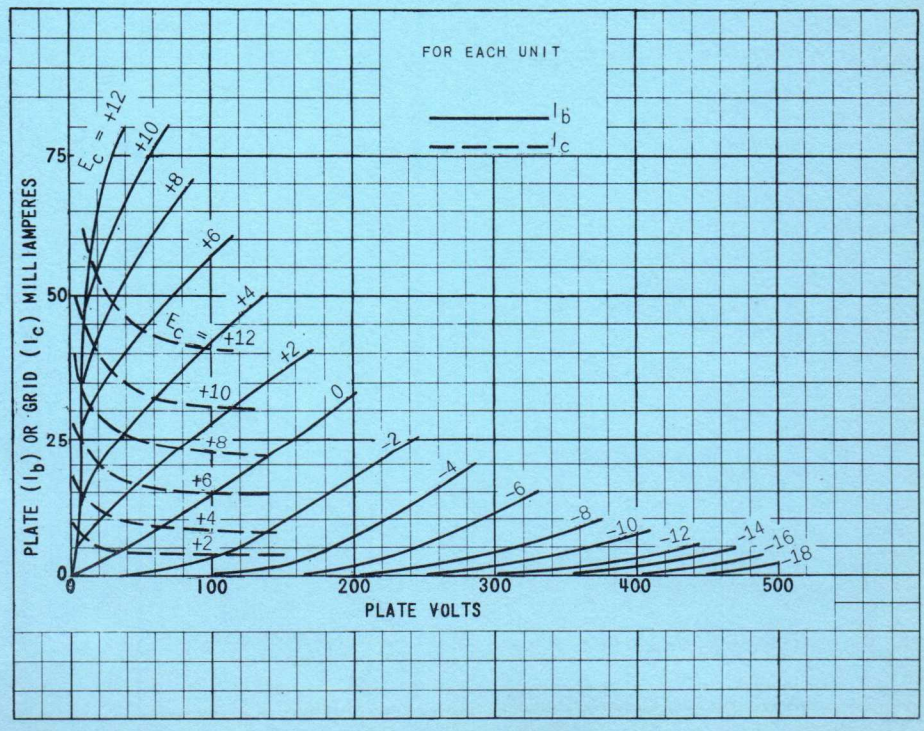
PLATE VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR (BOTH SECTIONS) [A]	50	OHMS
PLATE CURRENT	9.0	MA.
TRANSCONDUCTANCE	6,000	μMHOS
AMPLIFICATION FACTOR	38	
PLATE RESISTANCE	6,300	OHMS

SPECIAL TESTS AND CONTROLS

HEATER-CYCLING LIFE TEST
LOW PRESSURE VOLTAGE BREAKDOWN
SHOCK
FATIGUE

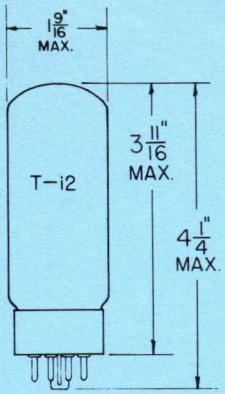
[A] OPERATION WITH FIXED BIAS IS NOT RECOMMENDED.


FOR EACH UNIT
PLATE MILLIAMPERES
PLATE VOLTS
0
5
10
15
100
200
300
400
500
E_c = 0
-2
-4
-6
-8
-12
-14
-16
-18


FOR EACH UNIT
I_b
I_c
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
200
300
400
500
E_c = +12
+10
+8
+6
+4
+2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18

TUNG-SOL

PENTODE



GLASS BULB

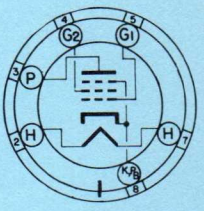
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.9 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SHORT MEDIUM SHELL
6 PIN OCTAL

SHORT MEDIUM SHELL
7 PIN OCTAL

MEDIUM SHELL
7 PIN OCTAL

7AC

THE 6L6GC IS A BEAM-POWER PENTODE PRIMARILY DESIGNED FOR USE IN AUDIO-FREQUENCY POWER AMPLIFIER APPLICATIONS. THE 6L6GC HAS THE SAME CHARACTERISTICS AS THE 6L6GB. HOWEVER, THE HIGHER POWER RATINGS OF THE 6L6GC ARE ADVANTAGEOUS WHERE GREATER POWER-HANDLING CAPABILITY IS REQUIRED.

DIRECT INTERELECTRODE CAPACITANCES -approx.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	μμf
INPUT	10	μμf
OUTPUT	6.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE[B] CONNECTION	PENTODE CONNECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	450	500	VOLTS
MAXIMUM SCREEN VOLTAGE		450[A]	
MAXIMUM PLATE DISSIPATION	30	30	WATTS
MAXIMUM SCREEN DISSIPATION		5.0	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS	0.1	0.1	MEG.
WITH CATHODE BIAS	0.5	0.5	MEG.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - TRIODE CONNECTION[B]

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.9	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	−20	VOLTS
PEAK AF GRID #1 VOLTAGE	20	VOLTS
AMPLIFICATION FACTOR	8	
PLATE RESISTANCE, APPROX.	1700	OHMS
TRANSCONDUCTANCE	4700	μMHOS
ZERO-SIGNAL PLATE CURRENT	40	MA.
MAXIMUM-SIGNAL PLATE CURRENT	44	MA.
LOAD RESISTANCE	5000	OHMS
TOTAL HARMONIC DISTORTION, APPROX.	5	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	1.4	WATTS

CLASS A_1 AMPLIFIER - PENTODE CONNECTION

PLATE VOLTAGE	250	300	350	VOLTS
SCREEN VOLTAGE	250	200	250	VOLTS
GRID #1 VOLTAGE	−14	−12.5	−18	VOLTS
PEAK AF GRID #1 VOLTAGE	14	12.5	18	VOLTS
PLATE RESISTANCE, APPROX.	22500	35000	33000	OHMS
TRANSCONDUCTANCE	6000	5300	5200	μMHOS
ZERO-SIGNAL PLATE CURRENT	72	48	54	MA.
MAXIMUM-SIGNAL PLATE CURRENT	79	55	66	MA.
ZERO-SIGNAL SCREEN CURRENT	5.0	2.5	2.5	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	7.3	4.7	7.0	MA.
LOAD RESISTANCE	2500	4500	4200	OHMS
TOTAL HARMONIC DISTORTION, APPROX.	10	11	15	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	6.5	6.5	10.8	WATTS

PUSH-PULL CLASS A_1 AMPLIFIER - VALUES FOR TWO TUBES

PLATE VOLTAGE	250	270	VOLTS
SCREEN VOLTAGE	250	270	VOLTS
GRID #1 VOLTAGE	−16	−17.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	32	35	VOLTS
ZERO-SIGNAL PLATE CURRENT	120	134	MA.
MAXIMUM SIGNAL PLATE CURRENT	140	155	MA.
ZERO-SIGNAL SCREEN CURRENT	10	11	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	16	17	MA.
EFFECTIVE LOAD RESISTANCE, PLATE-TO-PLATE	5000	5000	OHMS
TOTAL HARMONIC DISTORTION	2	2	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	14.5	17.5	WATTS

PUSH-PULL CLASS AB_1 AMPLIFIER -VALUES FOR TWO TUBES

PLATE VOLTAGE	360	360	450	VOLTS
SCREEN VOLTAGE	270	270	400	VOLTS
GRID #1 VOLTAGE	−22.5	−22.5	−37	VOLTS
PEAK AF GRID-TO-GRID VOLTAGE	45	45	70	VOLTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS -cont'd.

PUSH-PULL CLASS AB_1 AMPLIFIER -VALUES FOR TWO TUBES
CONTINUED

ZERO-SIGNAL PLATE CURRENT	88	88	116	MA.
MAXIMUM-SIGNAL PLATE CURRENT	132	140	210	MA.
ZERO-SIGNAL SCREEN CURRENT	5.0	5.0	5.6	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	15	11	22	MA.
EFFECTIVE LOAD RESISTANCE, PLATE-TO-PLATE	6600	3800	5600	OHMS
TOTAL HARMONIC DISTORTION	2	2	1.8	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	26.5	18	55	WATTS

PUSH-PULL CLASS AB_2 AMPLIFIER -VALUES FOR TWO TUBES

PLATE VOLTAGE	360	360	VOLTS
SCREEN VOLTAGE	225	270	VOLTS
GRID #1 VOLTAGE	-18	-22.5	VOLTS
PEAK AF GRID-TO-GRID VOLTAGE	52	72	VOLTS
ZERO-SIGNAL PLATE CURRENT	78	88	MA.
MAXIMUM-SIGNAL PLATE CURRENT	142	205	MA.
ZERO-SIGNAL SCREEN CURRENT	3.5	5.0	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	11	16	MA.
EFFECTIVE LOAD RESISTANCE, PLATE-TO-PLATE	6000	3800	OHMS
TOTAL HARMONIC DISTORTION	2	2	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	31	47	WATTS

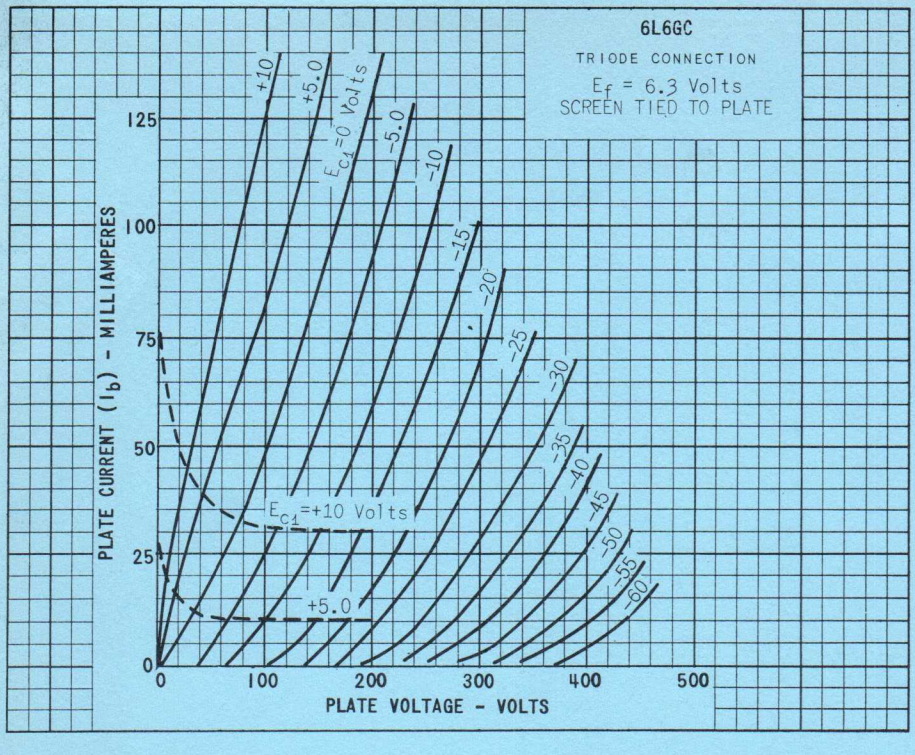
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY TUBE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE TUBE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE TUBE TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN TUBE 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 TUBE 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.

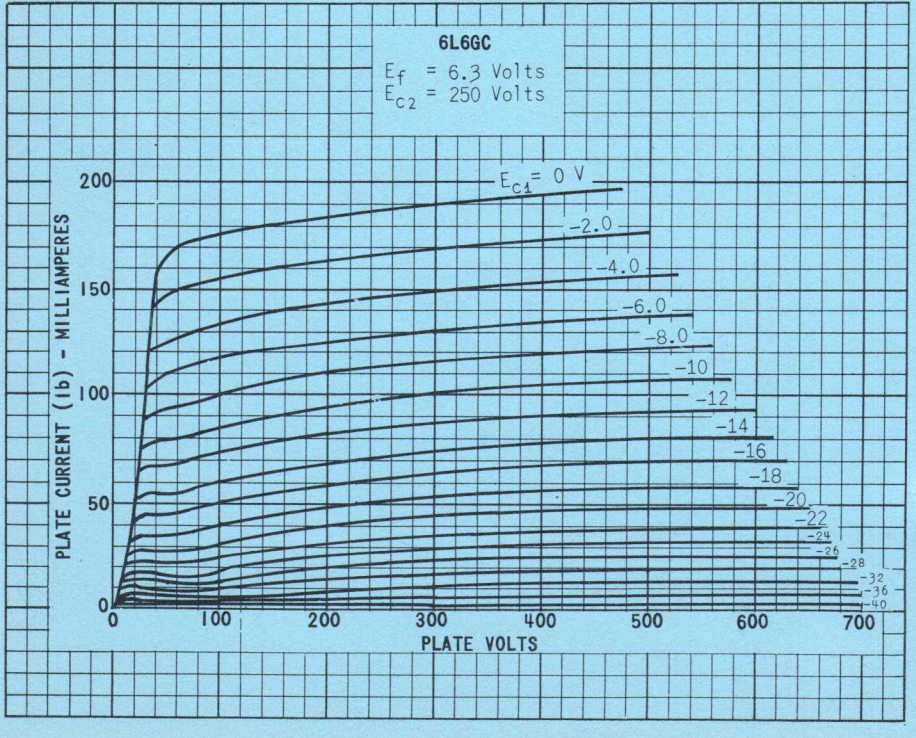
A. THE MAXIMUM SCREEN VOLTAGE RATING IS 500 VOLTS IN PUSH-PULL CIRCUITS WHERE THE SCREEN OF EACH TUBE IS CONNECTED TO A TAP ON THE PLATE WINDING OF THE OUTPUT TRANSFORMER.

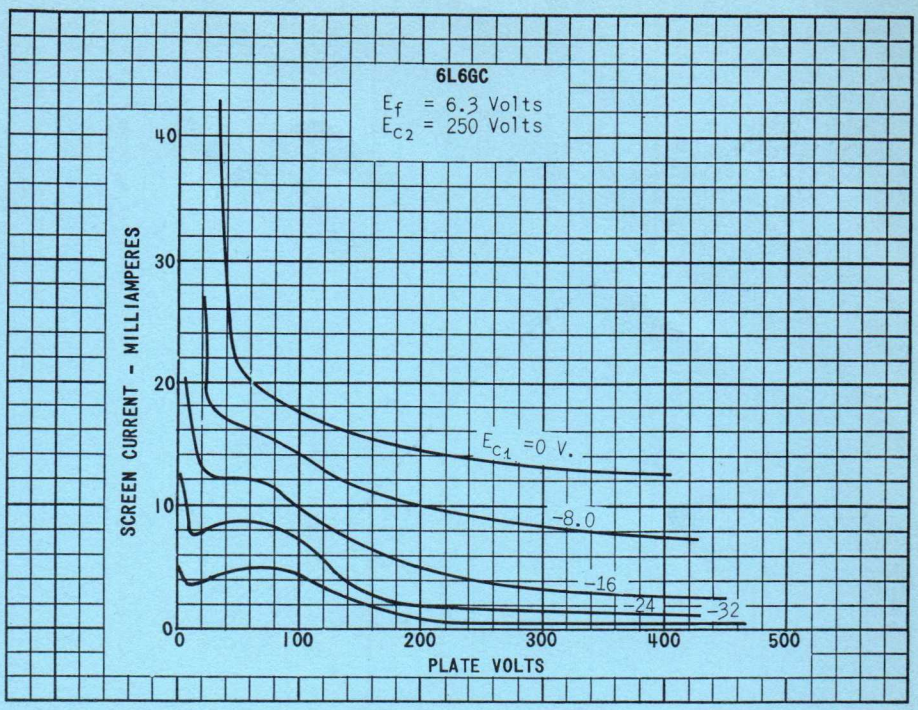
B. WITH SCREEN CONNECTED TO PLATE.

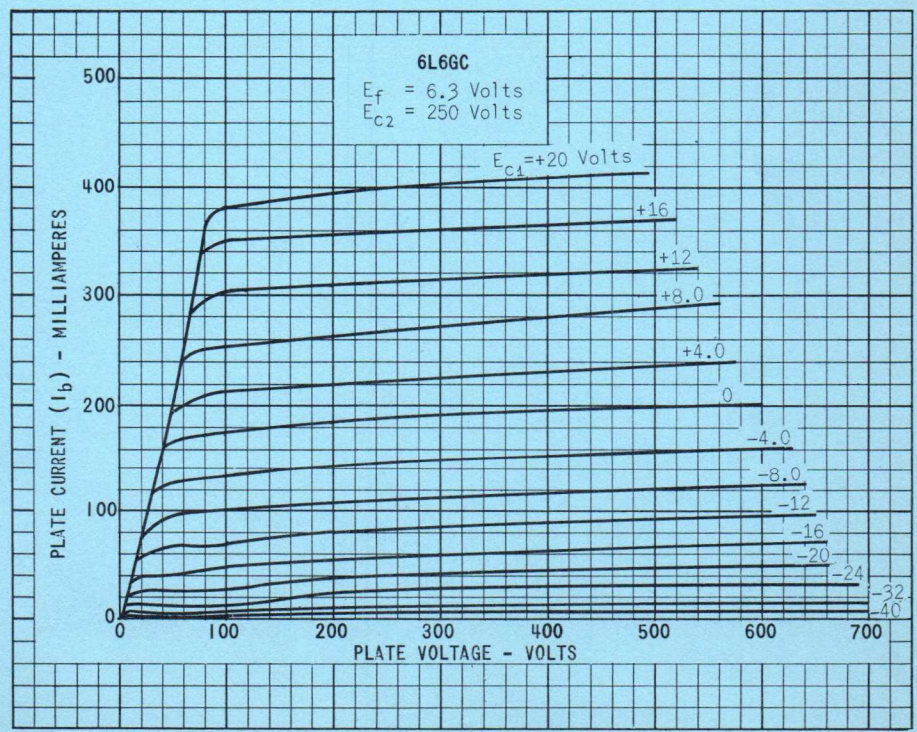
PRINTED IN U. S. A.

TENTATIVE DATA

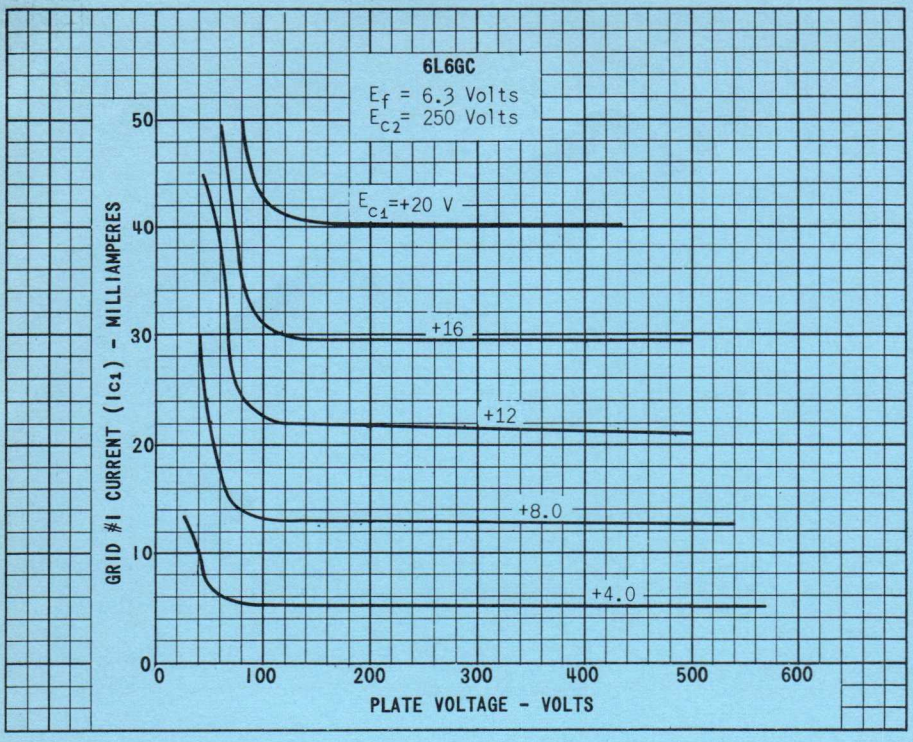


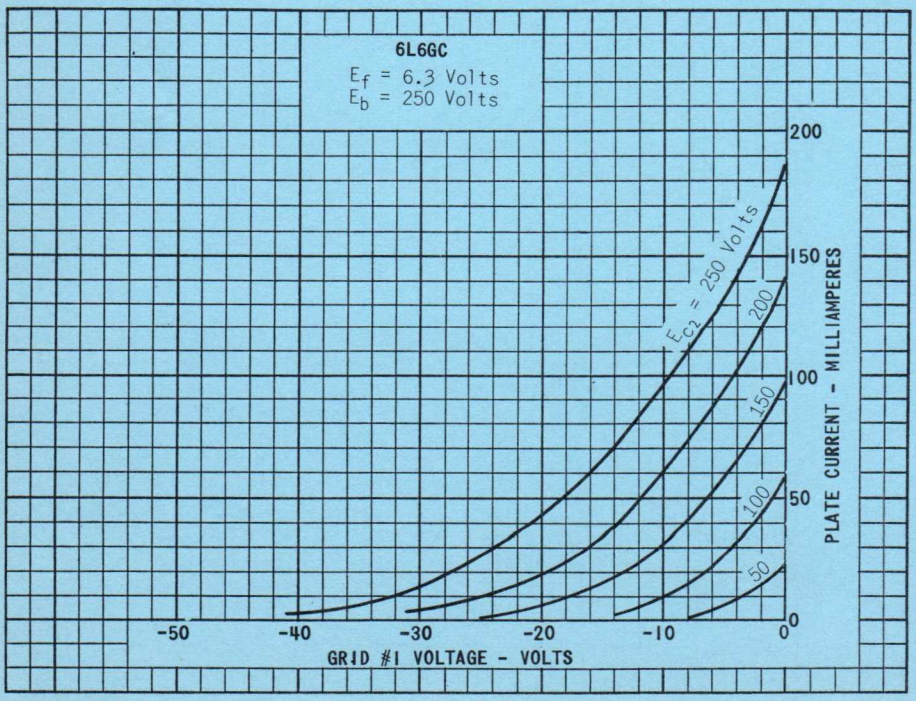


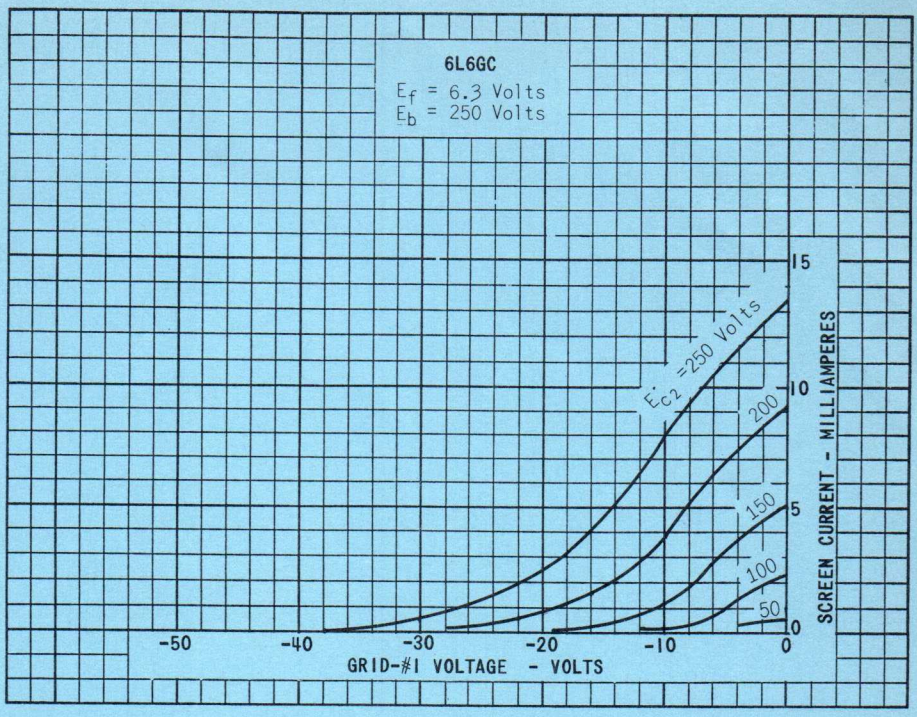


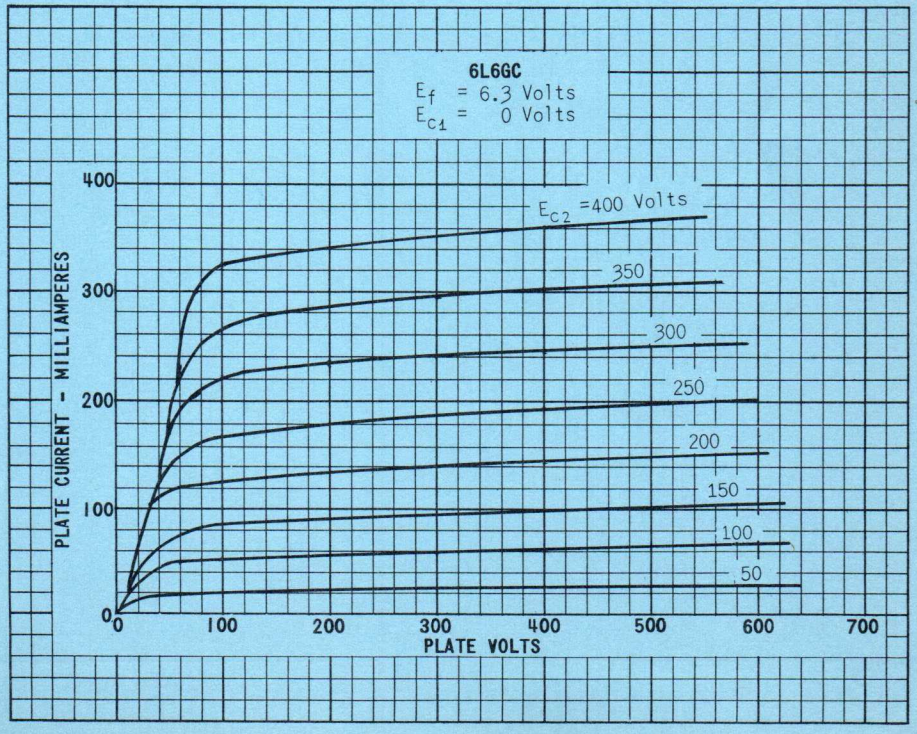


PRINTED IN U.S.A.

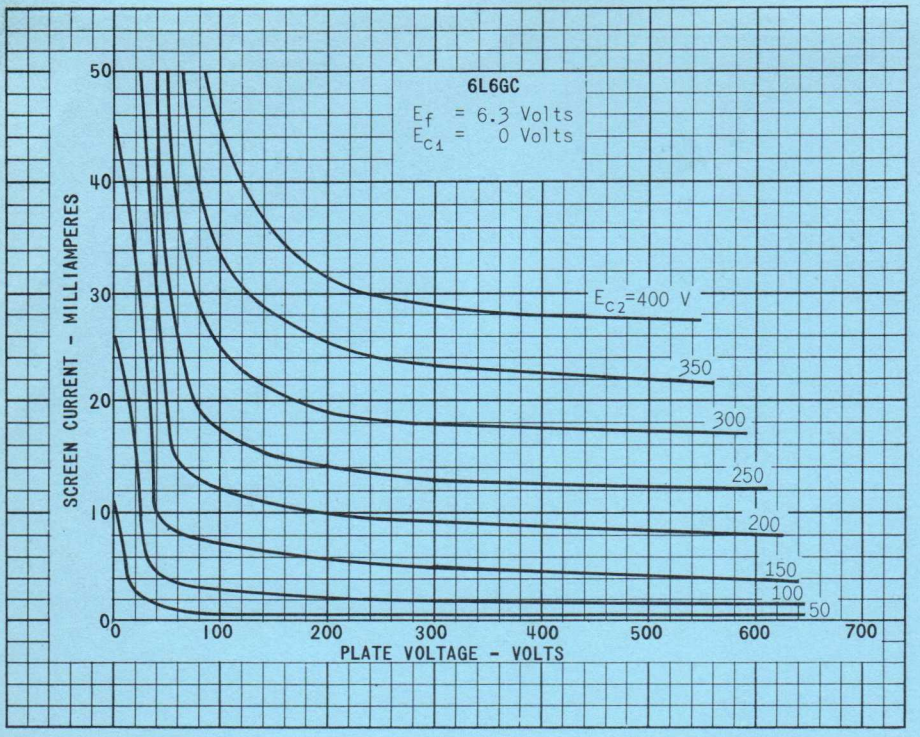

6L6GC
E_f = 6.3 Volts
E_{c2} = 250 Volts
E_{c1}=+20 V
+16
+12
+8.0
+4.0
GRID #1 CURRENT (I_{c1}) - MILLIAMPERES
0
10
20
30
40
50
0
100
200
300
400
500
600
PLATE VOLTAGE - VOLTS

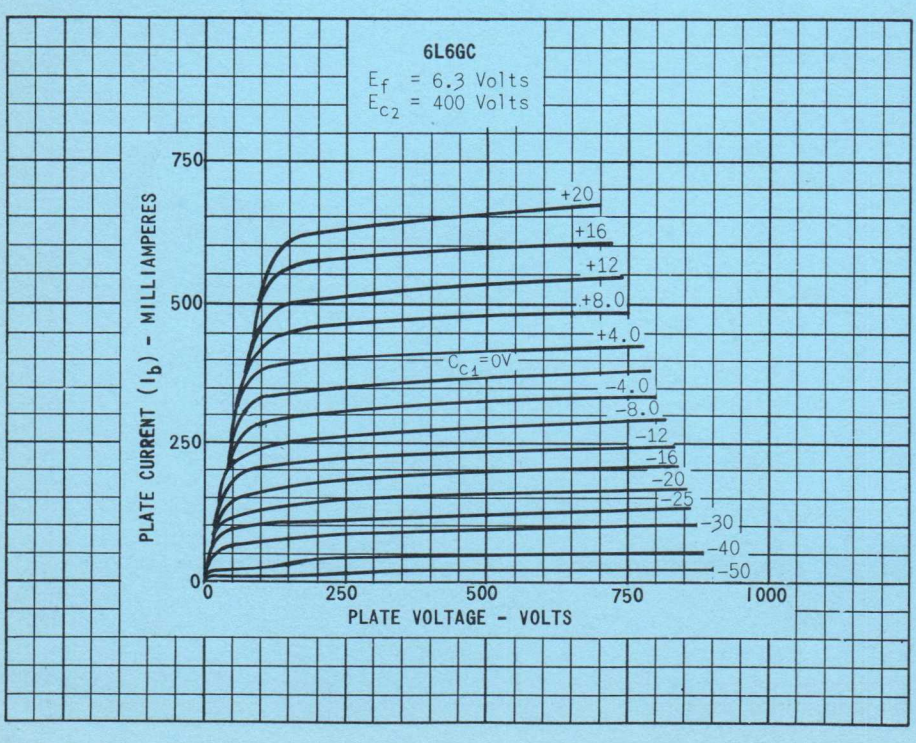

6L6GC
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
200
150
100
50
PLATE CURRENT - MILLIAMPERES
0
50
100
150
200
-50
-40
-30
-20
-10
0
GRID #1 VOLTAGE - VOLTS

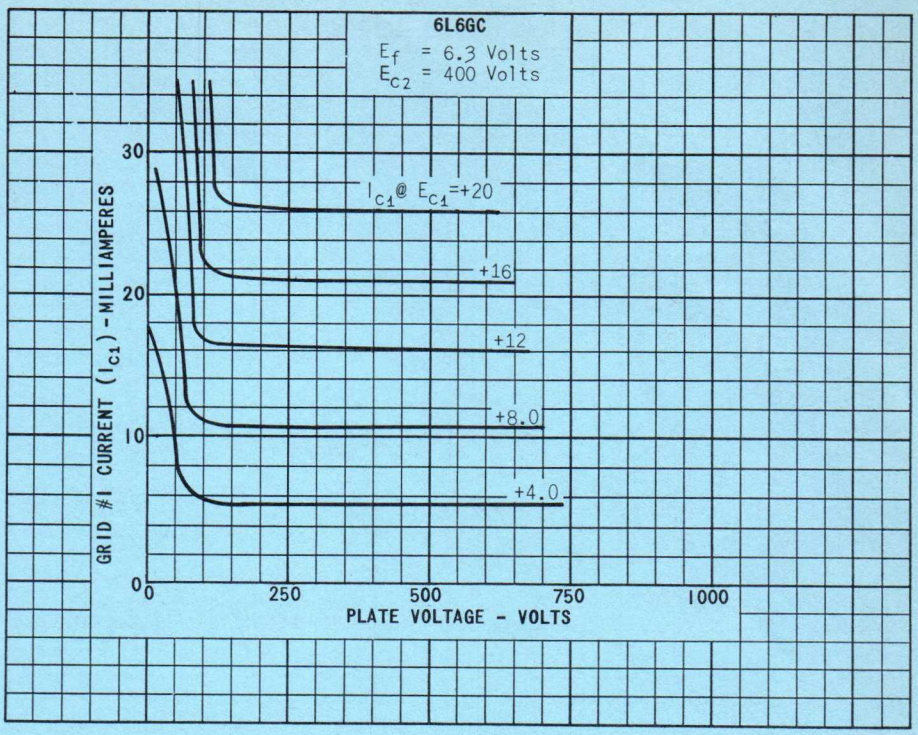


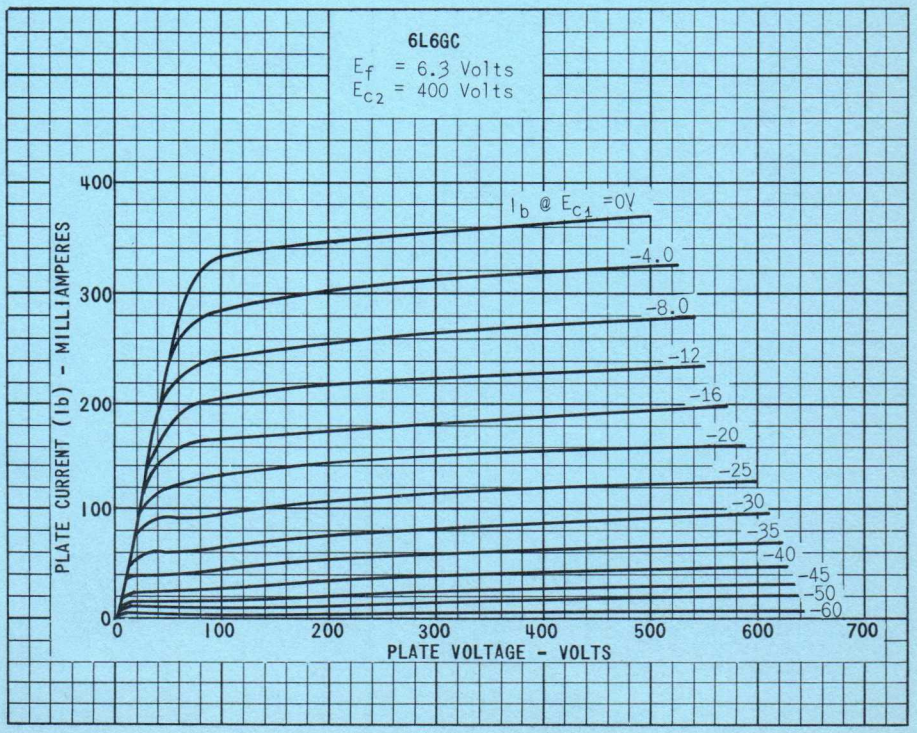


PRINTED IN U. S. A.

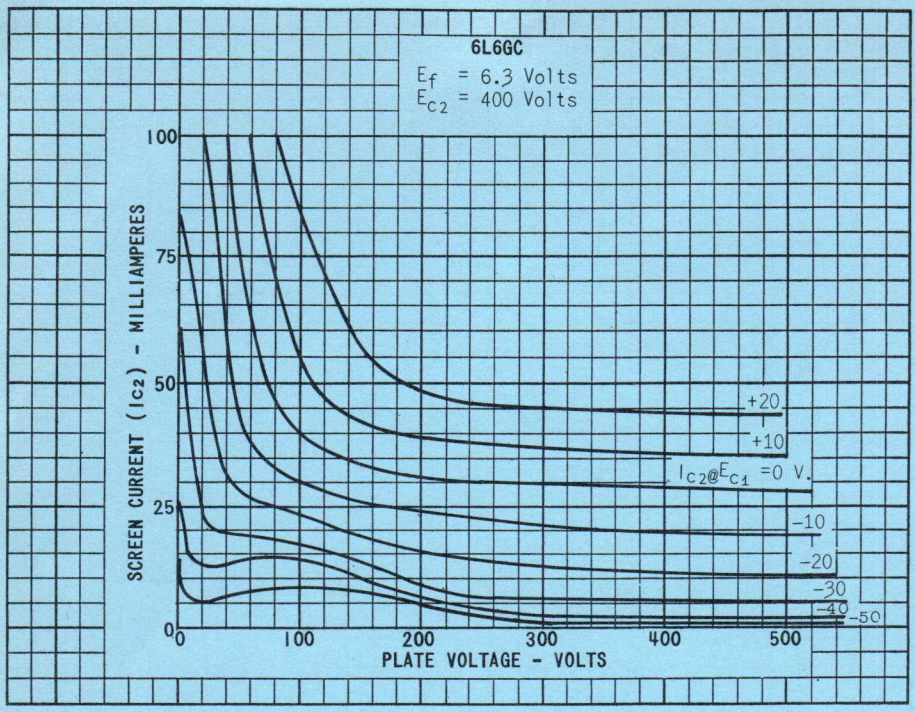

6L6GC
E_f = 6.3 Volts
E_{c_1} = 0 Volts
SCREEN CURRENT - MILLIAMPERES
PLATE VOLTAGE - VOLTS
E_{c_2}=400 V
350
300
250
200
150
100
50
0
10
20
30
40
50
0
100
200
300
400
500
600
700

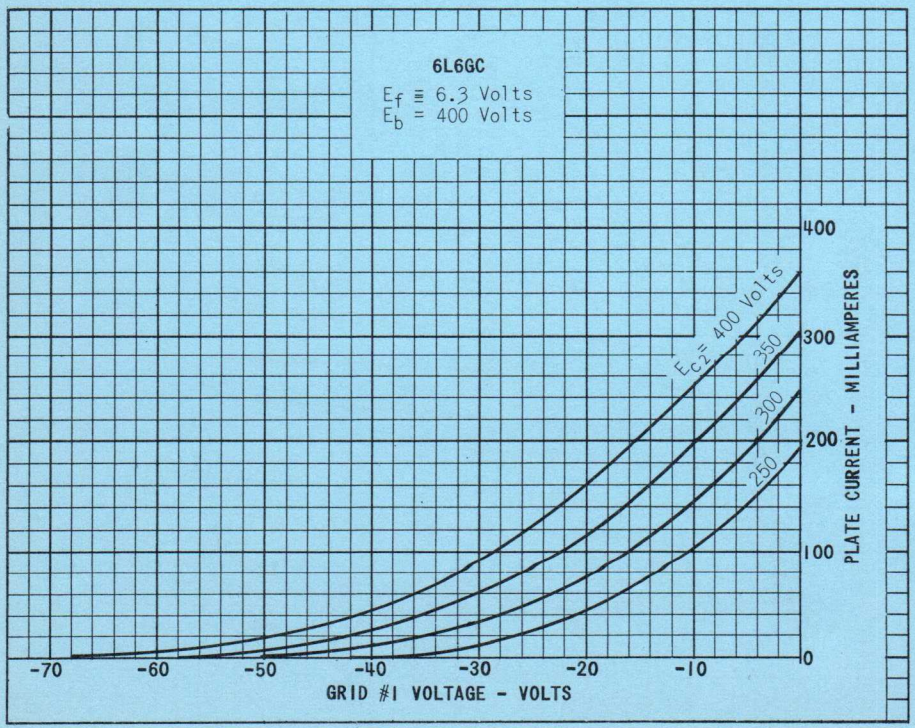

6L6GC
E_f = 6.3 Volts
E_{c_2} = 400 Volts
PLATE CURRENT (I_b) - MILLIAMPERES
PLATE VOLTAGE - VOLTS
+20
+16
+12
+8.0
+4.0
E_{c_1}=0V
-4.0
-8.0
-12
-16
-20
-25
-30
-40
-50
0
250
500
750
1000

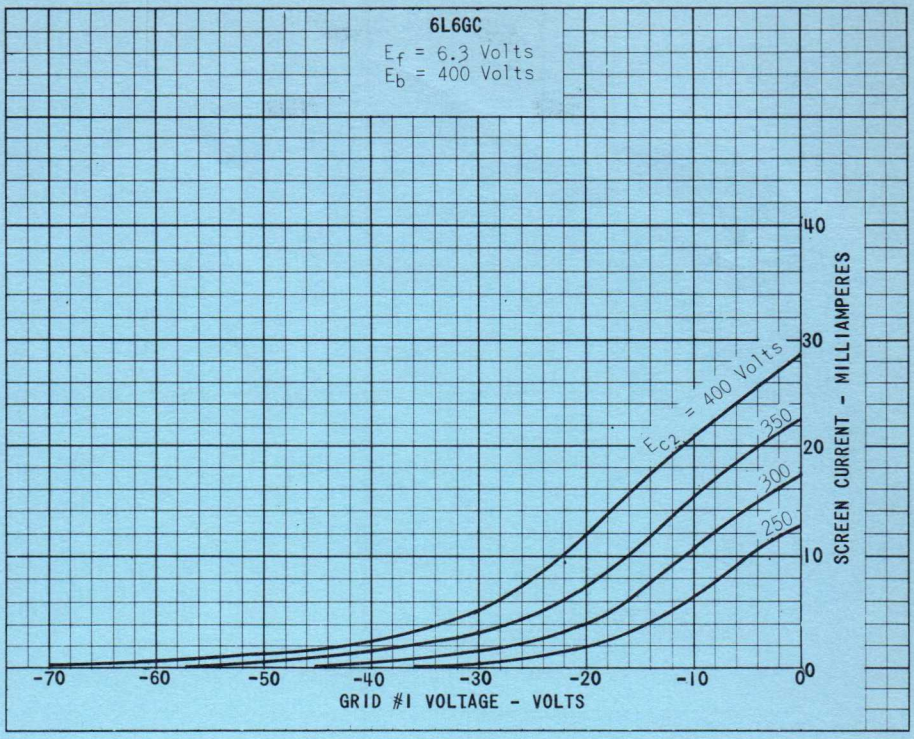


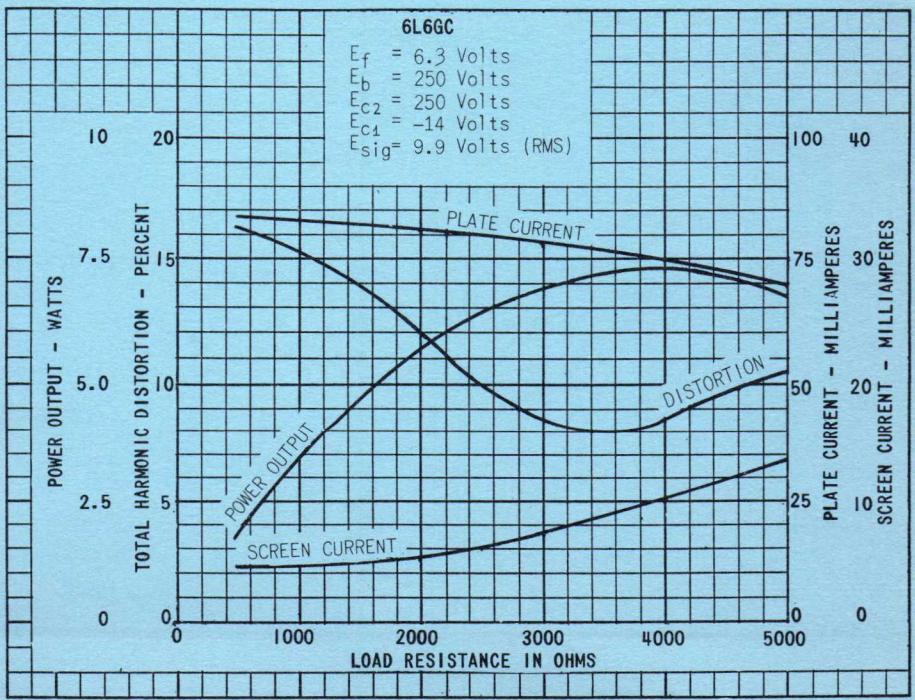


PRINTED IN U. S. A.


6L6GC
E_f = 6.3 Volts
E_{c_2} = 400 Volts
SCREEN CURRENT (I_{c_2}) - MILLIAMPERES
100
75
50
25
0
0
100
200
300
400
500
PLATE VOLTAGE - VOLTS
+20
+10
I_{c_2}@E_{c_1} =0 V.
-10
-20
-30
-40
-50

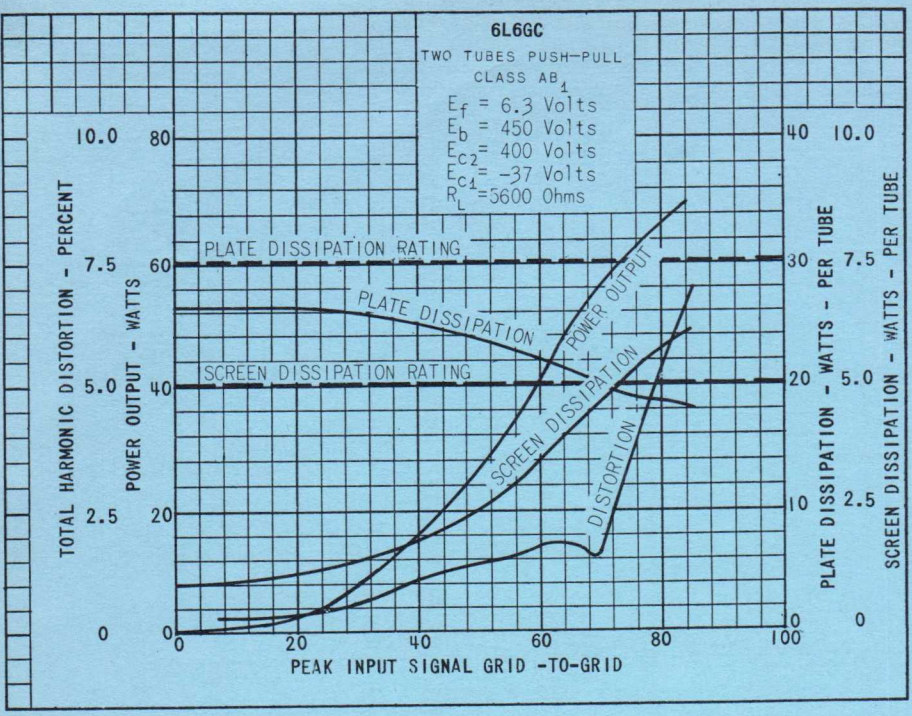

6L6GC
E_f = 6.3 Volts
E_b = 400 Volts
PLATE CURRENT - MILLIAMPERES
400
300
200
100
0
E_{c_2}= 400 Volts
350
300
250
-70
-60
-50
-40
-30
-20
-10
GRID #1 VOLTAGE - VOLTS





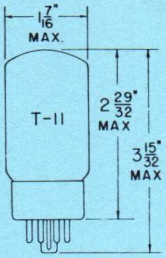
PRINTED IN U. S. A.

6L6GC


6L6GC
TWO TUBES PUSH-PULL
CLASS AB1
Ef = 6.3 Volts
Eb = 450 Volts
Ec2 = 400 Volts
Ec1 = -37 Volts
RL = 5600 Ohms
PLATE DISSIPATION RATING
SCREEN DISSIPATION RATING
PLATE DISSIPATION
POWER OUTPUT
SCREEN DISSIPATION
DISTORTION
TOTAL HARMONIC DISTORTION - PERCENT
POWER OUTPUT - WATTS
PLATE DISSIPATION - WATTS - PER TUBE
SCREEN DISSIPATION - WATTS - PER TUBE
PEAK INPUT SIGNAL GRID -TO-GRID
0
20
40
60
80
100
10.0
7.5
5.0
2.5

TUNG-SOL

PENTODE

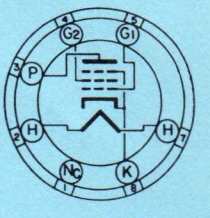


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.9 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL 7 PIN
LOW LOSS PHENOLIC
7S

THE 6L6WGB IS A RUGGEDIZED BEAM PENTODE OF THE SINGLE ENDED CONSTRUCTION USED PRIMARILY IN AUDIO POWER OUTPUT STAGES. IT IS ELECTRICALLY EQUIVALENT TO TYPES 6L6 AND 6L6G, EXCEPT THAT PLATE AND SCREEN DISSIPATIONS HAVE BEEN INCREASED APPROXIMATELY 20%. THE USE OF SPECIALLY COATED GRIDS AND ANODES GREATLY INCREASES ITS ABILITY TO WITHSTAND OVERLOAD CONDITIONS FOR SHORT PERIODS OF TIME AND PROVIDES IMPROVEMENT IN CONTINUITY OF SERVICE. THE 6L6WGB EMPLOYS A MICANOL BARRIER BASE WHICH ABSORBS LESS MOISTURE AND REDUCES THE CHANCE OF VOLTAGE BREAKDOWN BETWEEN ADJACENT PINS. SINCE THIS TUBE MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 6L6WGB IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION, SUCH AS AIRBORNE EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
GRID TO PLATE (RATED)	0.9	μμf
INPUT (RATED)	11.5	μμf
OUTPUT (RATED)	9.5	μμf

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	400	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	26	WATTS
MAXIMUM GRID #2 DISSIPATION	3.5	WATTS
MAXIMUM HEATER CATHODE VOLTAGE	±200	VOLTS
MAXIMUM ALTITUDE	10 000	FEET
MAXIMUM SHOCK	450	G

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

SINGLE TUBE

	TRIODE*		PENTODE		
HEATER VOLTAGE	6.3	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.9	0.9	0.9	0.9	AMP.
PLATE VOLTAGE	250	250	300	350	VOLTS
GRID #2 VOLTAGE	---	250	200	250	VOLTS
GRID #1 VOLTAGE	-20	-14	-12.5	-18	VOLTS
PEAK AF GRID #1 VOLTAGE	20	14	12.5	18	VOLTS
ZERO SIGNAL PLATE CURRENT	40	72	48	54	mA
ZERO SIGNAL GRID #2 CURRENT	---	5	2.5	2.5	mA
MAXIMUM SIGNAL GRID #2 CURRENT	---	7.3	4.7	7.0	mA
TRANSCONDUCTANCE	4700	6000	5300	5200	μMHOS
PLATE RESISTANCE	1700	22 500	35 500	33 000	OHMS
AMPLIFICATION FACTOR	8	---	---	---	OHMS
LOAD RESISTANCE	5000	2500	4500	4200	OHMS
MAXIMUM SIGNAL POWER OUTPUT	1.4	6.5	6.5	10.8	WATTS
TOTAL HARMONIC DISTORTION (APPROX)	5	10	11	15	PERCENT
MAXIMUM SIGNAL PLATE CURRENT	44	79	55	66	mA

PUSH-PULL AMPLIFIER

VALUES FOR TWO TUBES

	CLASS A1		CLASS AB1		CLASS AB2		
HEATER VOLTAGE	6.3	6.3	6.3	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.9	0.9	0.9	0.9	0.9	0.9	AMP.
PLATE VOLTAGE	250	270	360	360	360	360	VOLTS
GRID #2 VOLTAGE	250	270	270	270	225	270	VOLTS
GRID #1 VOLTAGE	-16	-17.5	-22.5	-22.5	-18	-22.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	32	35	45	45	52	72	VOLTS
ZERO SIGNAL PLATE CURRENT	120	134	88	88	78	88	mA
MAX. SIGNAL PLATE CURRENT	140	155	132	140	142	205	mA
ZERO SIGNAL GRID #2 CURRENT	10	11	5	5	3.5	5	mA
MAX. SIGNAL GRID #2 CURRENT	16	17	15	11	11	16	mA
TRANSCONDUCTANCE (EA. TUBE)	5500	5700	---	---	---	---	μMHOS
PLATE RESISTANCE (EA. TUBE)	24500	23500	---	---	---	---	OHMS
LOAD RESISTANCE	5000	5000	6600	3800	6000	3800	OHMS
POWER OUTPUT	14.5	17.5	26.5	18	31	47	WATTS
TOTAL HARMONIC DISTORTION	2	2	2	2	2	2	PERCENT

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V, E_b = 250Vdc, E_{c2} = 250Vdc, E_{c1} = -14Vdc

EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	840	960	---	---	---	---	mA
HEATER CATHODE LEAKAGE	0.	75	---	---	---	---	μAdc
GRID #1 CURRENT (E_b=400Vdc, E_{c2}=300Vdc E_{c1}=-19Vdc)	0	-3.0	---	---	---	---	μAdc
PLATE CURRENT (E_b=400Vdc, E_{c2}=300Vdc, E_{c1}=-22Vdc)	50	80	---	---	---	---	mAdc
SCREEN GRID CURRENT (E_b=400Vdc, E_{c2}=300Vdc E_{c1}=-22Vdc)	0	5.0	---	---	---	---	mAdc

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN – CONT'D.

E_f = 6.3V, E_b = 250Vdc, E_{c2} = 250Vdc, E_{c1} = −14Vdc
EXCEPT AS MODIFIED BELOW

TRANSCONDUCTANCE	5200	6800	---	---	---	---	μMHOS
POWER OUTPUT (E_{sig}=9.8 Vac, R_p= 2500 OHMS)	5.4	---	---	---	---	---	WATTS
GRID EMISSION (E_b=E_{c1}=E_{c2}=50Vdc)	275	---	---	---	---	---	mAdc

SPECIAL REQUIREMENTS

VARIABLE FREQUENCY VIBRATION[A] (R_p=2000 OHMS, E_{c1}=−27Vdc)	---	1000	mVac
LOW FREQUENCY VIBRATION[B] (R_p=2000 OHMS, E_{c1}=−27Vdc)	---	1000	mVac
SHOCK[C] (HAMMER ANGLE = 30°, E_f=−6.3V)	---	---	
VIBRATIONAL FATIGUE[D]	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	1000	Vac
HEATER CATHODE LEAKAGE	0	100	μAdc
TRANSCONDUCTANCE	4500	---	μMHOS
MECHANICAL RESONANCE[E]	---	---	
AF NOISE[F] (E_{sig} = 280mVac, R_p = 2000 OHMS)	---	17	VU
LIFE TEST END POINT			
POWER OUTPUT	4.0	---	WATTS
TRANSCONDUCTANCE	4500	---	μMHOS

NOTES

*GRID #2 CONNECTED TO PLATE

[A] SEE MIL-E-1C 4.9.20.3

[B] SEE MIL-E-1C 4.9.20.4

[C] SEE MIL-E-1C 4.9.20.5

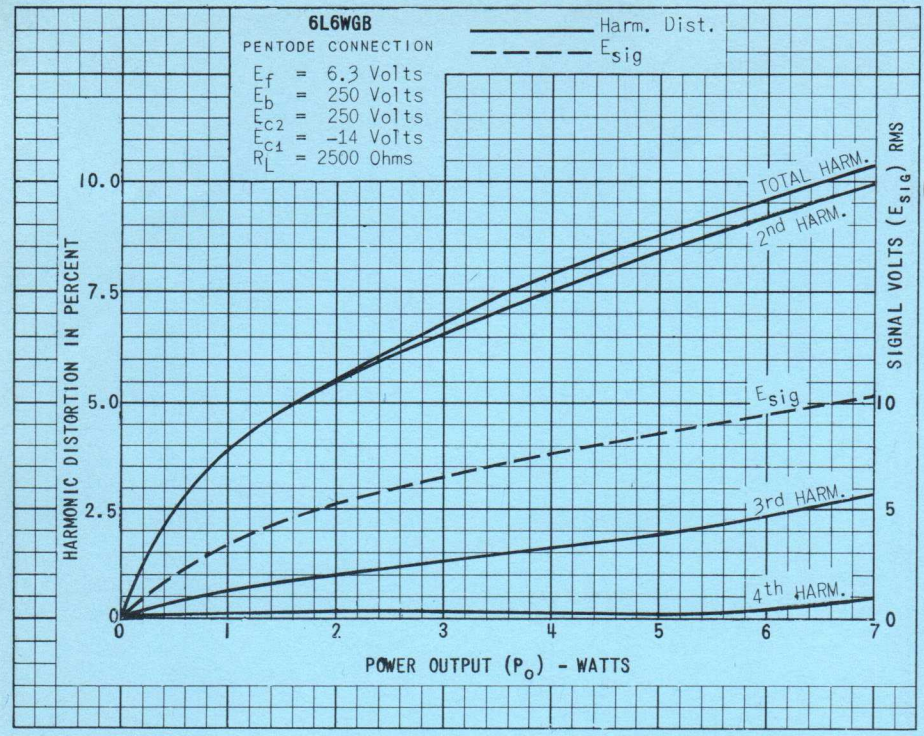
[D] SEE MIL-E-1C 4.9.20.6

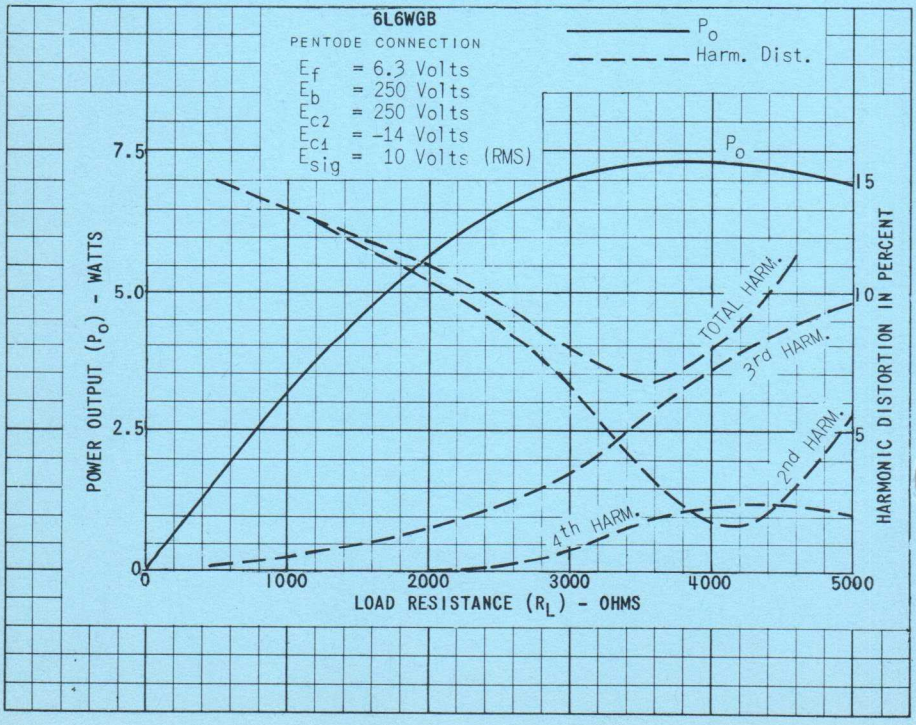
[E] THE MOUNT SHALL SHOW NO PRONOUNCED MECHANICAL RESONANCE BELOW 100 CPS.

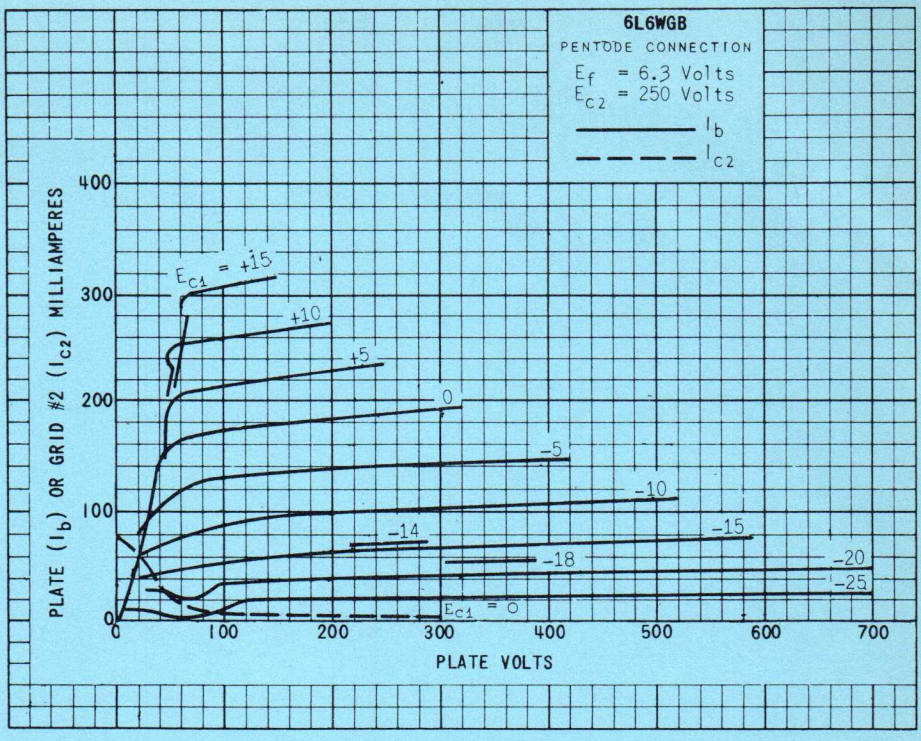
[F] SEE MIL-E-1C 4.10.3.2

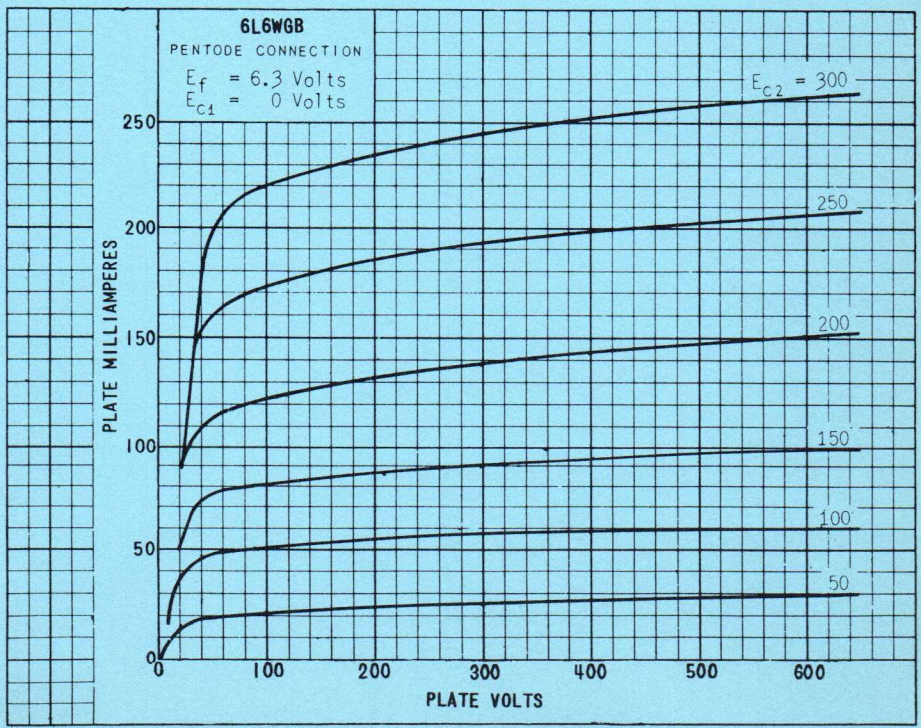
PRINTED IN U.S.A.

6L6WGB
PREMIUM TUBE



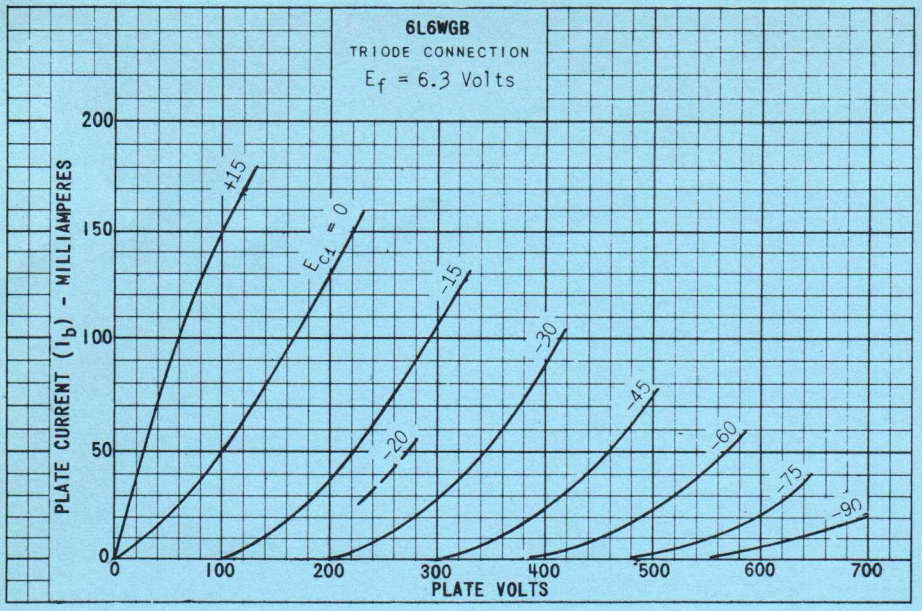






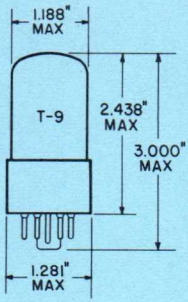
PRINTED IN U.S.A.

6L6WGB
PREMIUM TUBE



TUNG-SOL

TWIN TRIODE



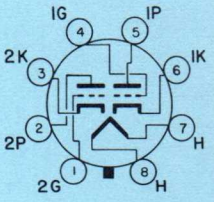
GLASS BULB
INTERMEDIATE SHELL
8 PIN OCTAL B8-6
LOW LOSS PHENOLIC
OUTLINE DRAWING
JEDEC 9-5

TWIN

HIGH MU TRIODES

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8BD

THE 6SL7WGT CONTAINS TWO INDEPENDENT HIGH MU TRIODES IN A T-9 ENVELOPE. IT IS DESIGNED PRIMARILY FOR USE AS RESISTANCE COUPLED AMPLIFIERS. THE TUBE IS INTENDED FOR APPLICATIONS WHERE SEVERE CONDITIONS OF VIBRATION AND MECHANICAL SHOCK ARE ENCOUNTERED.

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	300	MA.
LIMITS OF APPLIED VOLTAGE			6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			±100	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE, DC	275	VOLTS
PLATE DISSIPATION, EACH SECTION	1.1	WATTS

ADDITIONAL TESTS AND RATINGS [A]

IMPACT ACCELERATION TEST		
VIBRATIONAL ACCELERATION TEST		
ALTITUDE RATING	10,000	FEET

[A] LIMITATIONS BEYOND WHICH NORMAL TUBE PERFORMANCE AND TUBE LIFE MAY BE IMPAIRED.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CHARACTERISTICS

EACH SECTION

CONDITIONS:			
PLATE VOLTAGE, DC		250	VOLTS
GRID VOLTAGE, DC		-2	VOLTS
PLATE CURRENT		2.3	MA.
AMPLIFICATION FACTOR		70	
TRANSCONDUCTANCE		1,600	μMHOS
PLATE RESISTANCE		44,000	OHMS
GRID VOLTAGE FOR 10 μA PLATE CURRENT		-6.0	VOLTS
NOISE OUTPUT VOLTAGE[D]	MAX.	200	MV.

[D] ACROSS PLATE RESISTOR OF 2,000 OHMS, WITH APPLIED VIBRATIONAL ACCELERATION OF 2.5 g. SECTIONS TIED IN PARALLEL.

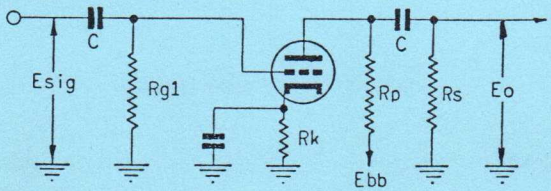
CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

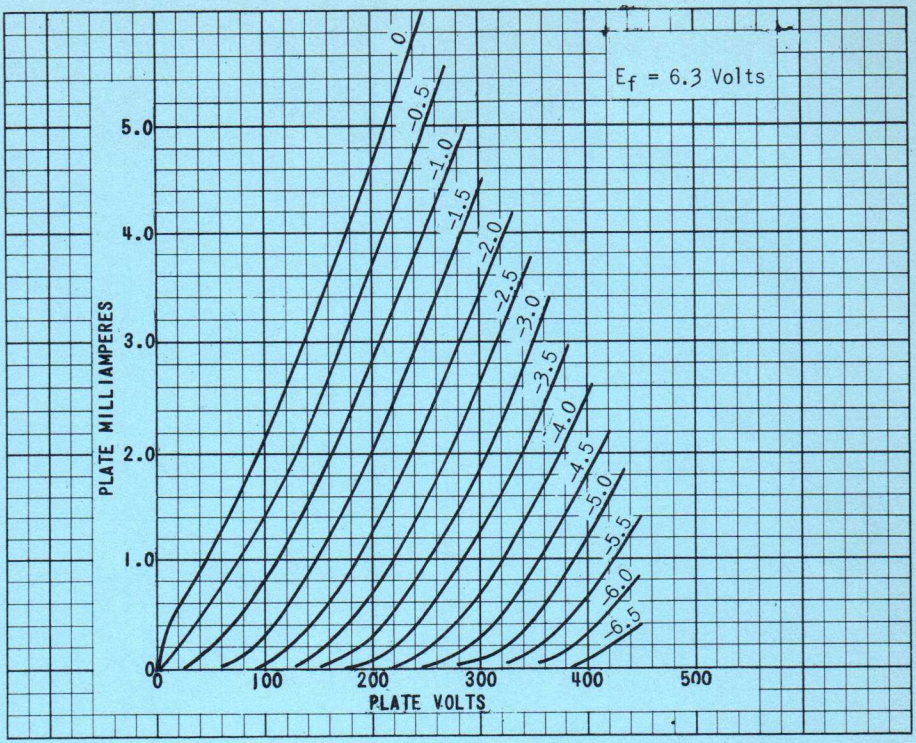
R_p	R_s	R_{g1}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
Meg.	Meg.	Meg.	Rk	Gain	Eo	Rk	Gain	Eo	Rk	Gain	Eo
0.10	0.10	0.10	1500	26	6.6	1200	30	19	1100	32	35
0.10	0.24	0.10	1700	31	9.5	1400	36	26	1300	37	47
0.24	0.24	0.10	3200	35	7.6	2200	40	24	2100	42	44
0.24	0.51	0.10	3800	39	10	2700	44	30	2500	46	54
0.51	0.51	0.10	7100	39	7.9	4400	45	23	3800	48	45
0.51	1.0	0.10	8000	41	9.9	5200	47	29	4700	50	53
0.24	0.24	10	0	34	6.0	0	42	21	0	45	42
0.24	0.51	10	0	38	8.3	0	46	28	0	48	52
0.51	0.51	10	0	38	6.8	0	47	22	0	50	43
0.51	1.0	10	0	41	8.7	0	50	27	0	53	52

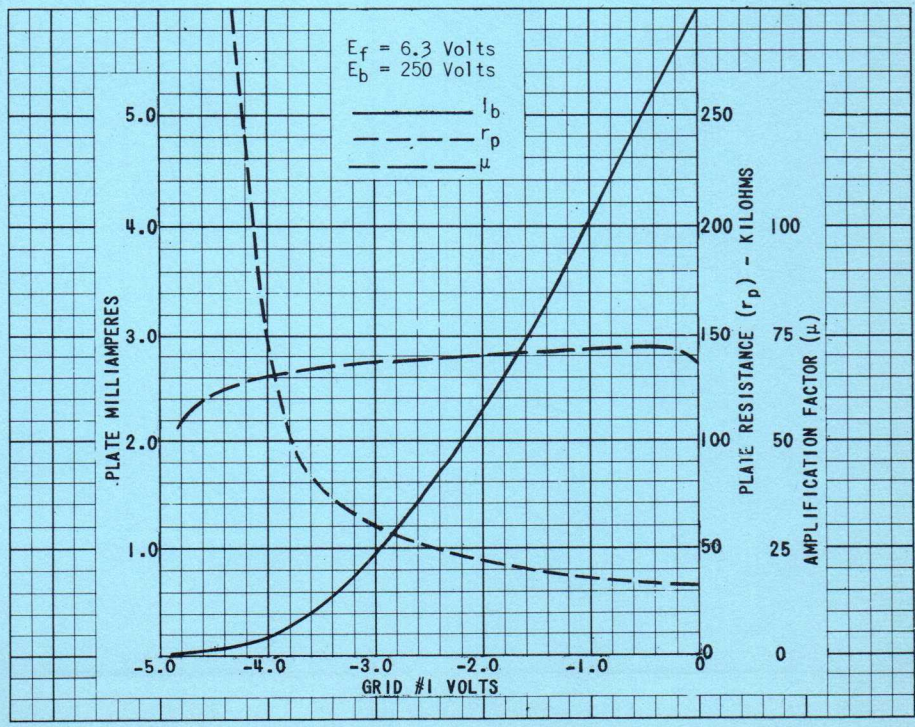
NOTES:

1. Eo MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT (5%) HARMONIC DISTORTION.
2. GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.
3. 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.

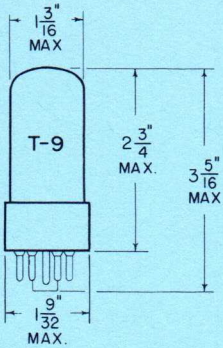




PRINTED IN U. S. A.

TUNG-SOL

TWIN TRIODE



GLASS BULB

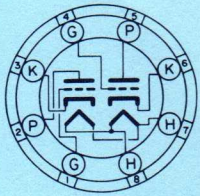
OATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE SHELL
8 PIN OCTAL

8BD

THE 6SN7WGTA IS A RUGGEDIZED, MEDIUM MU, TWIN TRIODE IN THE OCTAL BASE, BANTAM CONSTRUCTION. THE TWO TRIODE SECTIONS ARE ELECTRICALLY INDEPENDENT, ALLOWING SIMULTANEOUS USE OF THE TWO IN COMPLETELY DIFFERENT APPLICATIONS. THE TYPE IS SUITABLE FOR A WIDE RANGE OF GENERAL PURPOSE APPLICATIONS SUCH AS OSCILLATORS, MULTIVIBRATORS, RESISTANCE-COUPLED VOLTAGE AMPLIFIER, ETC. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 6SN7WGTA IS ESPECIALLY SUITED FOR USE IN MILITARY AND INDUSTRIAL AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

NO EXTERNAL SHIELD

	TRIODE #1	TRIODE #2	
GRID TO PLATE (RATED)	4.0	3.8	μμf
MAXIMUM	4.0	4.0	μμf
MINIMUM	3.0	3.0	μμf
INPUT (RATED)	2.2	2.6	μμf
MAXIMUM	2.7	2.7	μμf
MINIMUM	1.7	1.7	μμf
OUTPUT (RATED)	0.7	0.7	μμf
MAXIMUM	1.20	1.20	μμf
MINIMUM	0.60	0.60	μμf

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330	VOLTS
MAXIMUM PLATE DISSIPATION (PER PLATE)	3.44	WATTS
MAXIMUM GRID RESISTANCE	1.1	MEGOHMS
MAXIMUM HEATER–CATHODE VOLTAGE	2.5	VOLTS
MAXIMUM DC PLATE CURRENT (PER PLATE)	20.0	mAdc
MAXIMUM BULB TEMPERATURE	200	°C
MAXIMUM ALTITUDE	60 000	FEET

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

EACH UNIT

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	−8	VOLTS
PLATE CURRENT	10	9	mA.
AMPLIFICATION FACTOR	20	20	
PLATE RESISTANCE (APPROX.)	6 700	7 700	OHMS
TRANSCONDUCTANCE	3 000	2 600	μMHOS
PLATE CURRENT @ E_c =− 12,5 VOLTS	---	1.3	mA.
GRID VOLTAGE FOR Ib = 10 μA (APPROX.)	−7.0	−18	VOLTS

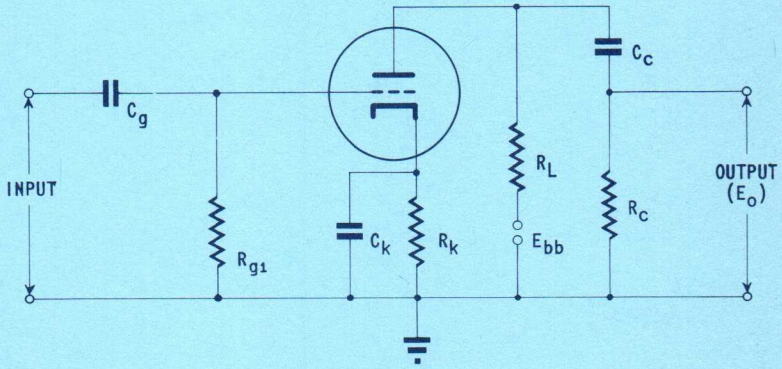
CONTINUED ON FOLLOWING PAGE

TUNG-SOL

RESISTANCE-COUPLED AMPLIFIER

R_L MEG.	R_{g1} MEG.	R_s 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	3300	14	13	2200	14	26	1800	14	40
0.10	A	0.24	3600	14	16	2700	15	33	2200	15	51
0.24	A	0.24	7500	14	16	5100	15	30	4300	15	44
0.24	A	0.51	9100	14	19	6800	15	39	5100	15	54
0.51	A	0.51	13000	14	16	9100	15	30	6800	16	40
0.51	A	1.0	15000	14	19	10000	16	32	7500	16	45
0.24	10	0.24	0	15	13	0	16	33	0	17	46
0.24	10	0.51	0	16	17	0	17	38	0	18	62
0.51	10	0.51	0	16	14	0	18	32	0	18	53
0.51	10	1.0	0	17	18	0	18	41	0	19	68

[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.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Ef=6.3V, Eb=250Vdc, Ec=-8Vdc, Ehk=0

EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	550	650	---	---	550	650	mA.
HEATER-CATHODE LEAKAGE (Ehk=±250 Vdc)	---	±25	---	---	---	±25	μAdc
INSULATION OF ELECTRODES[B] (Ef=6.3V.)							
E(g-ALL)	100	---	---	---	50	---	MEGOHMS
E(p-ALL)	100	---	---	---	50	---	MEGOHMS
GRID CURRENT[A]	0	-1.5	---	---	0	-1.5	μAdc
PLATE CURRENT (1)	5.5	12.5	---	---	---	---	mAdc
PLATE CURRENT (2) (Ec=-21Vdc)	---	50	---	---	---	---	μAdc
TRANSCONDUCTANCE (1)	2075	3125	2400	2800	---	---	μMHOS
CHANGE IN INDIVIUAL TUBES	---	---	---	---	---	15	PERCENT
AVERAGE CHANGE	---	---	---	---	---	15	PERCENT
ΔTRANSCONDUCTANCE (2) (Ef=5.7V)	---	15	---	---	---	15	PERCENT
GRID EMISSION[E] (Ef=7.5V, Ec=21Vdc, Rg/g=1.0 MEG.)	0	-1.5	---	---	---	---	μAdc
PLATE CURRENT (3) (Ec=-14 Vdc)	---	---	---	---	---	---	μAdc
AF NOISE[EA] (Esig=70mVac, Rp=0.01MEG.)	---	17	---	---	---	---	VU
TRANSCONDUCTANCE (3) (Eb=90 Vdc, Ec=0)	2400	3600	---	---	---	---	μMHOS
AMPLIFICATION FACTOR[F]	18	23	---	---	---	---	

SPECIAL REQUIREMENTS

	MIN.	MAX.	
CONTINUITY AND SHORTS[G] (INOPERATIVES)	---	---	
LOW PRESSURE VOLTAGE BREAKDOWN (PRESSURE =55±5mm HG; VOLTAGE =500Vac)	---	---	
LOW FREQUENCY VIBRATION[AHK] (Rp=2000 OHMS)	---	50	mVac
SHOCK[L] (HAMMER ANGLE =30°, Ehk=+100 Vdc)	---	---	
VIBRATIONAL FATIGUE[M] (G=2.5, FIXED FREQUENCY; F=25 MIN.,60 MAX.)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	75	mVac
HEATER CATHODE LEAKAGE (Ehk=±250 Vdc)	---	±75	μAdc
PLATE CURRENT (2)	---	150	μAdc
ΔTRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES	---	20	PERCENT
HEATER CYCLING LIFE TEST (Ef=7.5V, Eb=Ec=0, Ehk=+135 Vdc, 1 MIN. ON 4 MIN. OFF)	---	---	

CONTINUED ON FOLLOWING PAGE

SPECIAL REQUIREMENTS – CONT'D.

1 HOUR STABILITY LIFE TEST			
(Ehk=+250 Vdc, Rg/g=1.0 MEG, TA=ROOM)	---	---	
STABILITY LIFE TEST END POINTS			
ΔTRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES	---	10	PERCENT
100 HOUR SURVIVAL-RATE LIFE TEST			
(STABILITY LIFE TEST CONDITIONS OR EQUIVALENT, TA = ROOM)	---	---	
100 HOUR SURVIVAL-RATE TEST END POINTS			
CONTINUITY AND SHORTS (INOPERATIVES)	---	---	
TRANSCONDUCTANCE (1)	1850	---	μMHOS
INTERMITTENT LIFE TEST			
STABILITY LIFE TEST CONDITIONS TA=ROOM	---	---	

NOTES

A TIE 1K TO 2K, 1g TO 2g; AND 1p TO 2p.

B SEE MIL-E-1C 4.8.2

C SEE MIL-E-1C

D PRIOR TO THIS TEST, TUBES SHALL BE PREHEATED 5 MINUTES WITH BOTH SECTIONS OPERATING SEPARATELY AT CONDITIONS INDICATED BELOW. THE TUBES SHALL BE TESTED IMMEDIATELY AFTER PREHEATING. THE THREE MINUTE TEST IS NOT PERMITTED. GRID EMISSION SHALL BE THE LAST TEST PERFORMED ON THE SAMPLE SELECTED FOR THE GRID EMISSION TEST. Ef=7.5Vdc, Ec1=-8Vdc, Eb=250Vdc, Rg=1.0 MEG.

E SEE MIL-E-1C 4.10.3.2

F SEE MIL-E-1C 4.10.11.1

G SEE MIL-E-1C 4.7.5

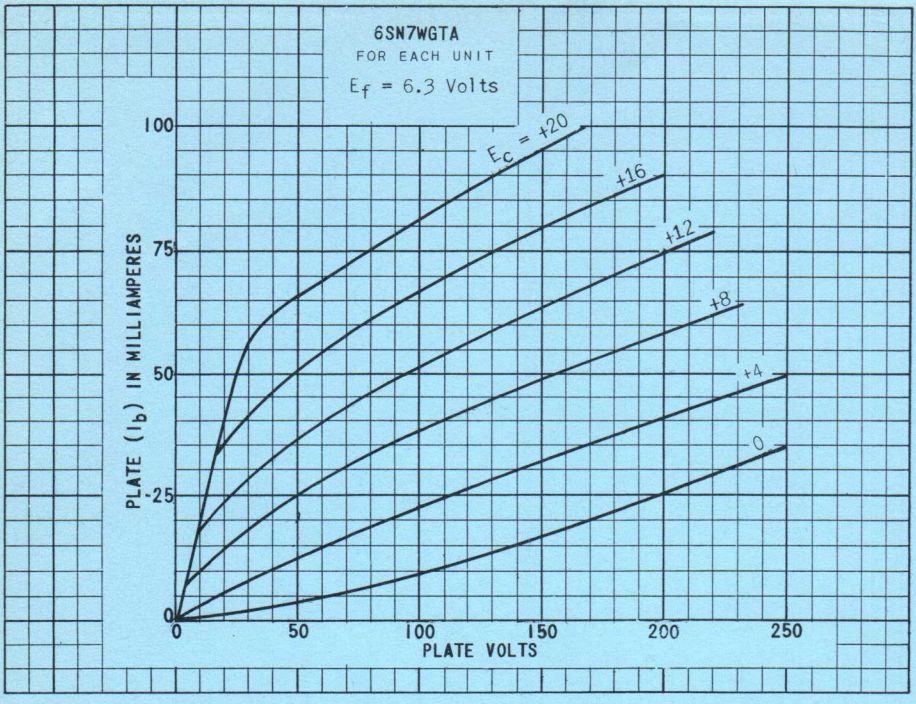
H SEE MIL-E-1C 4.19.9.1

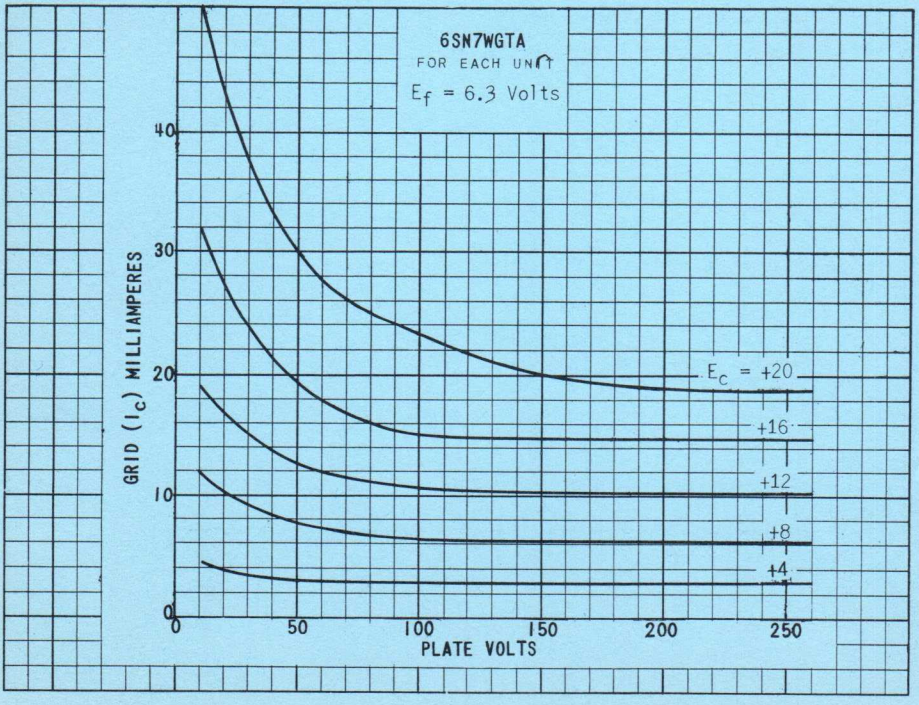
K THE IMPEDANCES OF THE PLATE VOLTAGE SUPPLIES SHALL NOT EXCEED THAT OF A 40μf CAPACITOR @ 10CPS.

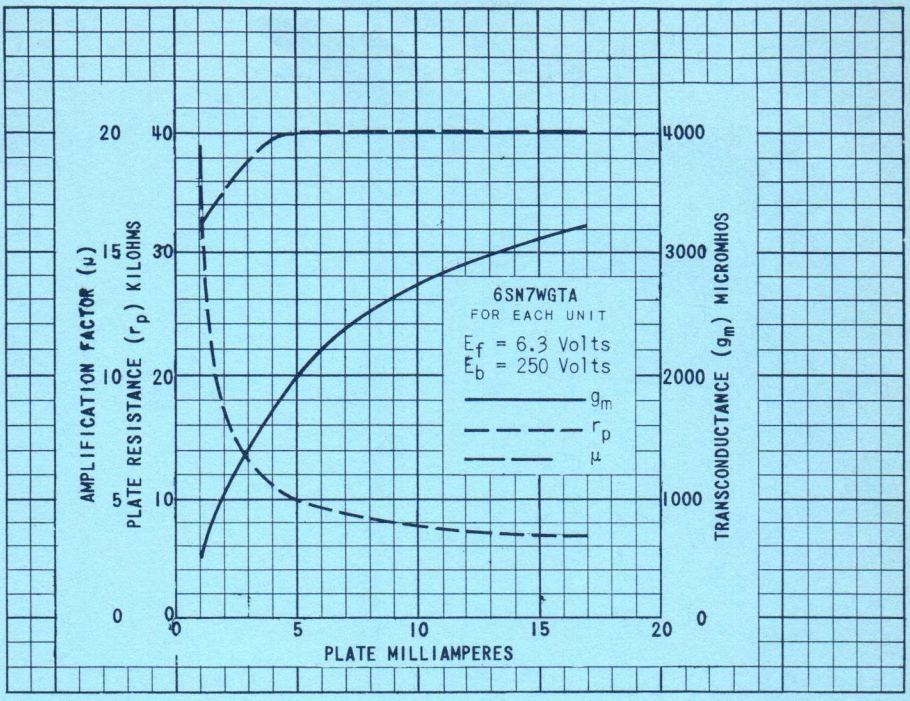
L SEE MIL-E-1C 4.9.20.5

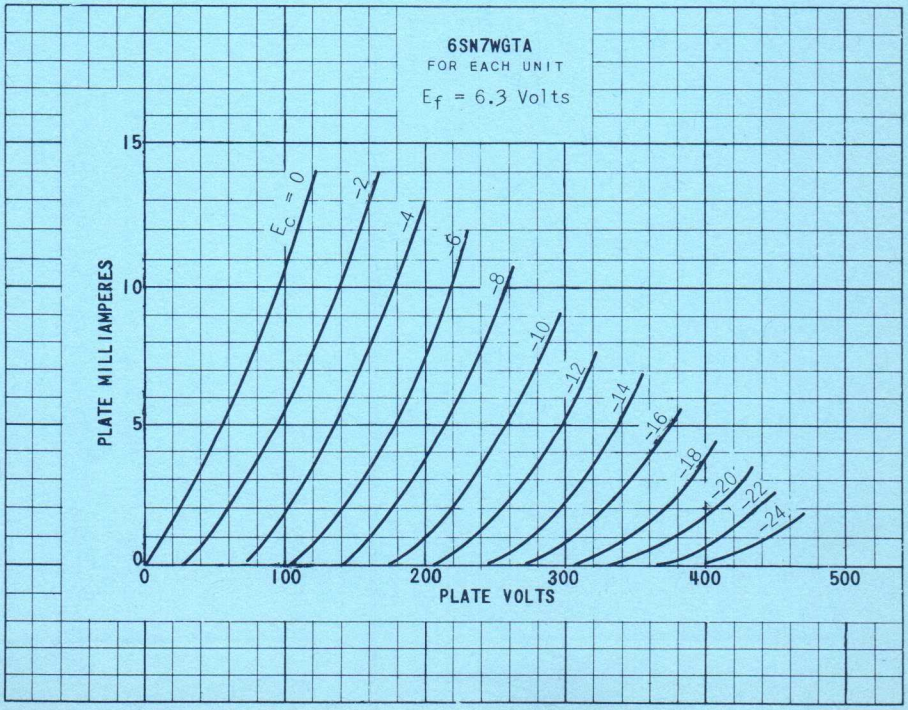
6SN7WGTA
PREMIUM TUBE-NAVY

TENTATIVE DATA







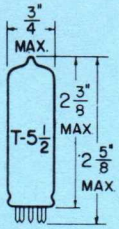


PRINTED IN U.S.A.

TUNG-SOL

DOUBLE DIODE

MINIATURE TYPE

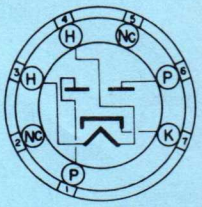


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
5BS

THE 6X4W IS A RUGGEDIZED HEATER-CATHODE TYPE DOUBLE DIODE USING THE SEVEN PIN MINIATURE CONSTRUCTION. IT IS SUITABLE FOR USE IN HALF OR FULL WAVE RECTIFIER APPLICATIONS, SUCH AS ENCOUNTERED WHEN USED IN CONJUNCTION WITH VIBRATOR-TYPE INVERTERS. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 6X4W IS ALSO SUITED FOR USE IN INDUSTRIAL AND MILITARY EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1375	VOLTS
MAXIMUM DC PLATE CURRENT	230	mA.
MAXIMUM DC OUTPUT CURRENT	75	mA.
MAXIMUM SURGE CURRENT	750	mA.
MAXIMUM HEATER-CATHODE VOLTAGE	450	VOLTS
MAXIMUM ALTITUDE	10 000	FEET
MAXIMUM SHOCK	700	G

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
FULL-WAVE RECTIFIER

	INPUT TO FILTER CAPACITOR	INPUT TO FILTER CHOKE	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE)	325	450	VOLTS
INPUT CONDENSER[A]	10	---	µfd
INPUT CHOKE	---	10	HENRYS
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE (EACH PLATE)	525	---	OHMS
DC OUTPUT CURRENT	70	70	mA.
DC OUTPUT VOLTAGE AT INPUT TO FILTER (APPROX.)			
AT HALF-LOAD CURRENT (35 mA)	365	395	VOLTS
AT FULL-LOAD CURRENT (70 mA)	310	385	VOLTS
DIFFERENCE (VOLTAGE REGULATION)	55	10	VOLTS
PERCENTAGE REGULATION	15	2.5	PERCENT

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Ef=6.3V, Epp/p=400Vac, RL=5700 Ohms, CL=8μf

EXCEPT AS MODIFIED BELOW

	INITIAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	540	660	mA.
HEATER–CATHODE LEAKAGE (Ehk=Eo)	0	150	μAdc
HEATER–CATHODE LEAKAGE[B]	−150	+150	μAdc
OPERATION[CD]			
GRID EMISSION (1)[E] (E_{2b}=O, E_{1b}=50Vdc)	140	---	mAdc
GRID EMISSION (2)[E] (E_{1b}=O, E_{2b}=50Vdc)	140	---	mAdc

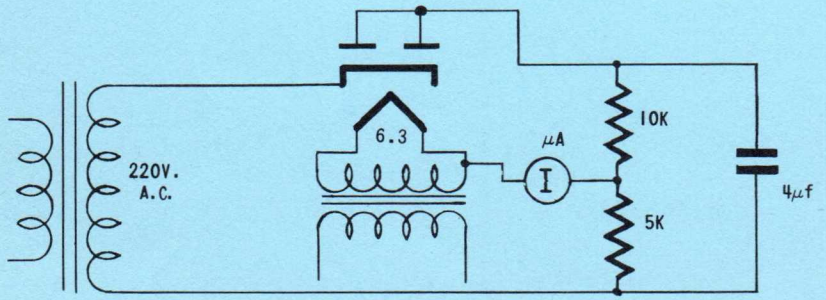
SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[F] (NO VOLTAGES)	---	---	
LOW FREQUENCY VIBRATION[G] (NO VOLTAGES)	---	---	
SHOCK[HJ] (HAMMER ANGLE = 48°)	---	---	
VIBRATIONAL FATIGUE[K]	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
OPERATION	65	---	mAdc
HEATER–CATHODE LEAKAGE	0	150	mAdc
MECHANICAL RESONANCE[L]	---	---	
LIFE TEST (1)[M]	500	---	HOURS
HEATER CYCLING LIFE TEST[N] (Ef=7.5Vac, Ehk=100V, Ep=O)	2000	---	CYCLES
LIFE TEST END POINT (1)[P] OPERATION	60	---	mAdc
LIFE TEST END POINT (2)[R]	---	---	

NOTES

[A] 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.

[B]



CONTINUED FROM PRECEDING PAGE

NOTES – CONT'D.

C SEE MIL-E-1C 4.10.13

D IN A FULL-WAVE CIRCUIT ADJUST Zp/p SUCH THAT A TUBE HAVING Etd=22 Vdc AT 70 mAdc PER PLATE GIVES Io=75 mAdc. THE TUBE MAY BE PREHEATED PRIOR TO THIS TEST PROVIDED TEST 4.11 IS CONDUCTED ACCORDING TO 4.11.5.

E SEE MIL-E-1C 4.10.1.1

F SEE MIL-E-1C 4.9.20.3

G SEE MIL-E-1C 4.9.20.4

H SEE MIL-E-1C 4.9.20.5

J AFTER SHOCK TESTS, THE TUBES SHALL MEET POST-SHOCK AND FATIGUE TEST END POINT REQUIREMENTS. IN ADDITION, THE TUBES SHALL NOT SHOW PERMANENT SHORTS OR OPEN CIRCUITS WHEN TESTED PER 4.7 (F-1e) AFTER SHOCK TESTS.

K SEE MIL-E-1C 4.9.20.6

L THE MOUNT SHALL EXHIBIT NO PRONOUNCED MECHANICAL RESONANCE BELOW 100 CPS.

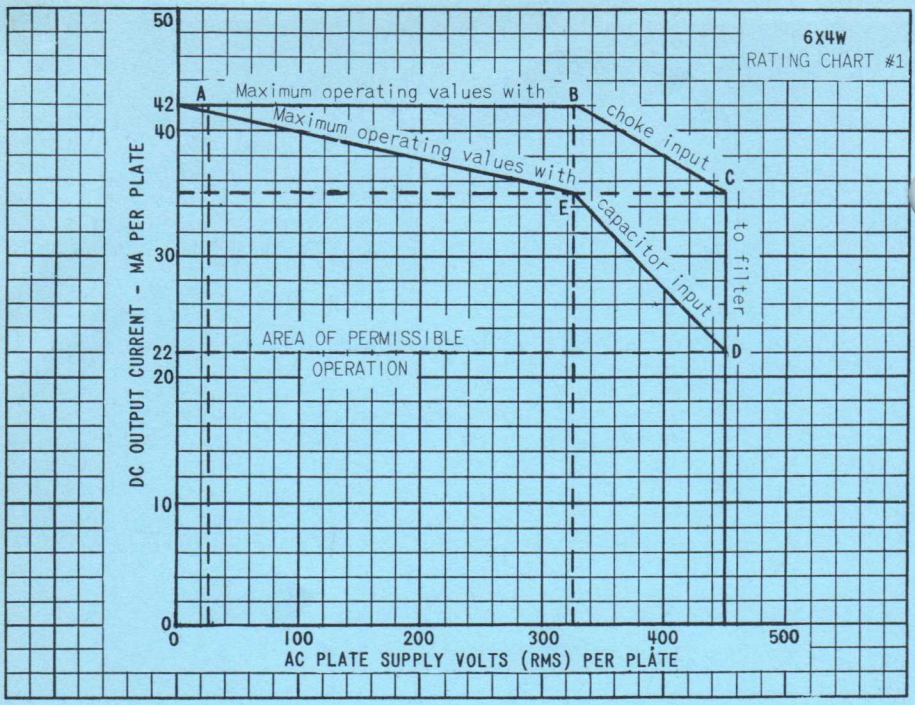
M IN LIFE TEST CONDITIONS THE VALUES OF RL AND CL GIVEN IN TEST CONDITIONS MAY BE CONSIDERED APPROXIMATE AND SHALL BE ADJUSTED INITIALLY TO GIVE Io = 75 mAdc WITH Ib GREATER THAN 205 mA; Ehk = Eo.

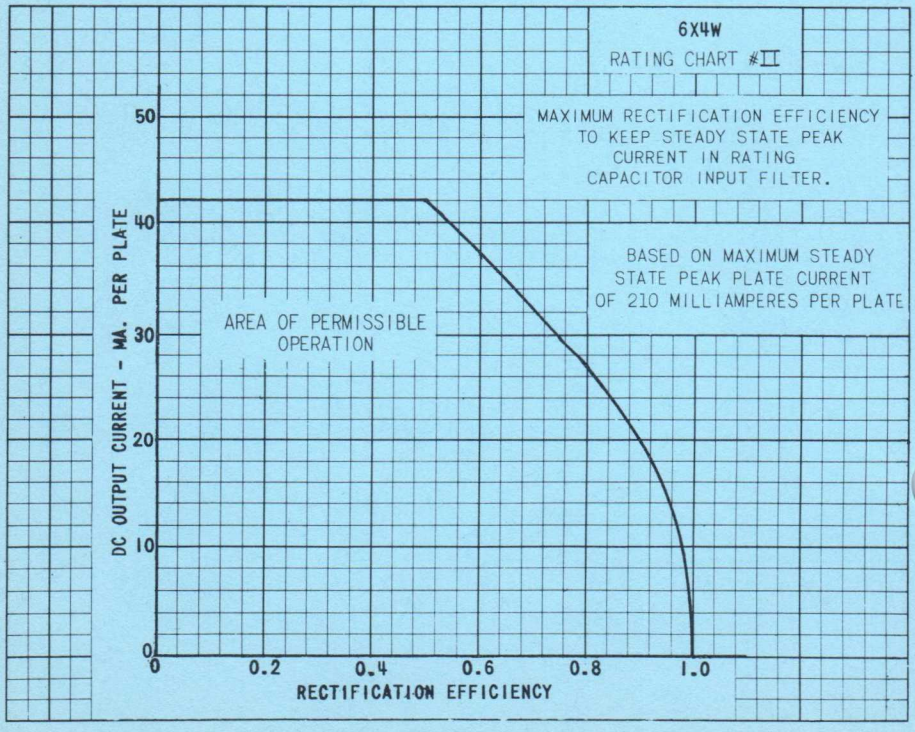
N SEE MIL-E-1C 4.11.7

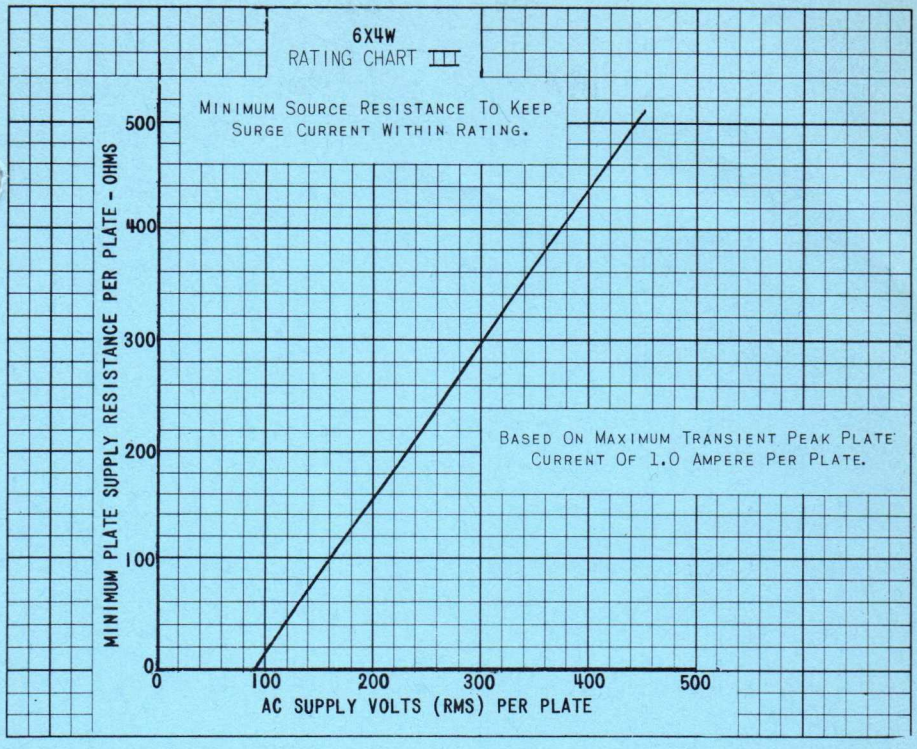
P SEE MIL-E-1C 4.11.4

R AN OPEN HEATER OR A HEATER-CATHODE SHORT CONSTITUTES A TUBE FAILURE. LOTS ARE ACCEPTABLE UNDER THIS TEST IF NO FAILURES OCCUR IN THE LIFE TEST SAMPLES, OR IF ONE TUBE FAILURE HAS OCCURED IN THE PREVIOUS TWENTY-FIVE (25) TUBES TESTED.

PRINTED IN U.S.A.


6X4W
RATING CHART #1
DC OUTPUT CURRENT - MA PER PLATE
AC PLATE SUPPLY VOLTS (RMS) PER PLATE
Maximum operating values with choke input
Maximum operating values with capacitor input
to filter
AREA OF PERMISSIBLE OPERATION
A
B
C
D
E
50
42
40
30
22
20
10
0
0
100
200
300
400
500


6X4W
RATING CHART #II
MAXIMUM RECTIFICATION EFFICIENCY TO KEEP STEADY STATE PEAK CURRENT IN RATING CAPACITOR INPUT FILTER.
BASED ON MAXIMUM STEADY STATE PEAK PLATE CURRENT OF 210 MILLIAMPERES PER PLATE
AREA OF PERMISSIBLE OPERATION
DC OUTPUT CURRENT - MA. PER PLATE
RECTIFICATION EFFICIENCY
50
40
30
20
10
0
0
0.2
0.4
0.6
0.8
1.0

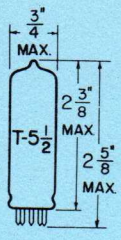


PRINTED IN U. S. A.

TUNG-SOL

FULL-WAVE RECTIFIER

MINIATURE TYPE



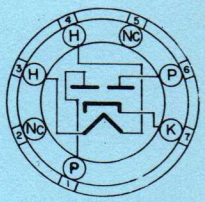
GLASS BULB
5-3

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.60 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
5BS

THE 6X4WA IS A FULL-WAVE RECTIFIER INTENDED FOR COMMERCIAL AND INDUSTRIAL APPLICATIONS WHERE A HIGH DEGREE OF RELIABILITY IS REQUIRED. IT IS CHARACTERIZED BY LONG LIFE AND STABLE PERFORMANCE UNDER CONDITIONS OF SEVERE VIBRATION, SHOCK, HIGH TEMPERATURE AND HIGH ALTITUDE.

DURABILITY CHARACTERISTICS

IMPACT ACCELERATION (1 MSEC DURATION) (MAX.)	450	G
FATIGUE (VIBRATIONAL ACCELERATION FOR EXTENDED PERIODS)(MAX.)	2.5	G

RATINGS[A]

ABSOLUTE MAXIMUM

HEATER VOLTAGE[B]	6.3±10%	VOLTS
AC PLATE SUPPLY VOLTAGE, RMS (EACH PLATE)	SEE RATING CHART 1	
STEADY STATE PEAK PLATE CURRENT, RATING CHART 2 (EACH PLATE)	220	MA.
TRANSIENT PEAK PLATE CURRENT, RATING CHART 3 (EACH PLATE)[D]	1.6	AMP.
DC OUTPUT CURRENT (EACH PLATE)	SEE RATING CHART 1	
HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK	450	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK	100	VOLTS
BULB TEMPERATURE	165	°C
ALTITUDE[C]	SEE RATING CHART 4	

CHARACTERISTICS[E]

FULL-WAVE RECTIFIER-CAPACITOR INPUT

AC PLATE SUPPLY VOLTAGE PER PLATE	400	VAC
FILTER INPUT CAPACITOR	8	μf
LOAD RESISTOR	8200	OHMS
DC OUTPUT CURRENT	55	MADC
DC OUTPUT VOLTAGE AT FILTER INPUT (APPROX.)	435	VDC
TUBE VOLTAGE DROP[E] I_b = 50 MA EACH PLATE	22	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES

[A] LIMITATIONS BEYOND WHICH NORMAL TUBE PERFORMANCE AND TUBE LIFE MAY BE IMPAIRED.

[B] IF ALTITUDE RATING IS EXCEEDED, REDUCTION OF INSTANTANEOUS VOLTAGES (Ef EXCLUDED) MAY BE REQUIRED.

[C] TUBE LIFE AND RELIABILITY OF PERFORMANCE ARE DIRECTLY RELATED TO THE DEGREE OF REGULATION OF THE HEATER VOLTAGE TO ITS CENTER-RATED VALUE.

[D] IF CAPACITOR INPUT CIRCUITS ARE TO BE USED, PROTECT THE CIRCUITS AGAINST THE POSSIBILITY OF HOT-SWITCHING AND DO NOT EXCEED A MAXIMUM PEAK CURRENT VALUE OF 1.6 AMPERE DURING THE INITIAL CYCLES OF THE HOT-SWITCHING TRANSIENT.

[E] TEST CONDITIONS ONLY.

INTERPRETATION OF RATING CHARTS

RATING CHARTS 1, 2 AND 3 REPRESENT BOUNDARY CONDITIONS BEYOND WHICH OPERATION IS NOT PERMITTED. WITH THE AID OF SIMPLE LABORATORY MEASUREMENTS AND THE USE OF THE THREE CHARTS, ANY APPLICATION MAY BE ANALYZED FOR PROPER RECTIFIER TYPE OPERATION.

THE BOUNDARIES OF RATING CHART 1 ARE BASED ON LIMITS OF SUPPLY VOLTAGE, PLATE DISSIPATION AND OUTPUT CURRENT. THESE BOUNDARIES DIFFER, DEPENDING UPON THE TYPE OF FILTER USED. WITH CAPACITOR INPUT, OPERATION IS CONFINED TO THE AREA BOUNDED BY FAEDG WHILE FOR CHOKE INPUT, THE ENTIRE AREA BOUNDED BY FABCG MAY BE USED.

THE BOUNDARY OF RATING CHART 2 DEFINES THE LIMIT OF STEADY-STATE PEAK CURRENT. OPERATION WITHIN THE BOUNDARY IS PERMITTED.

RATING CHART 3 DEFINES THE MINIMUM VALUE OF EFFECTIVE PLATE SUPPLY RESISTANCE, PER PLATE, FOR ANY GIVEN PLATE VOLTAGE SUPPLY WHICH WILL ASSURE THAT THE SURGE CURRENTS ARE WITHIN A SAFE VALUE.

$$Rs = N^2Rpri + Rsec + Ra$$

WHERE: N - VOLTAGE STEP UP RATIO OF PLATE TRANSFORMER:

$$N = \frac{N\ Secondary}{N\ Primary} \quad \text{for half-wave}$$

$$N = \frac{N\ Secondary}{2N\ Primary} \quad \text{for full-wave}$$

Rpri - DC RESISTANCE OF TRANSFORMER PRIMARY.

Rsec - AVERAGE DC RESISTANCE OF TRANSFORMER SECONDARY PER SECTION.

Ra - ADDED SERIES RESISTANCE.

FOR ANY APPLICATION, EACH CHART SHOULD BE CONSULTED. ON ALL CHARTS THE POINTS OF OPERATION SHOULD FALL WITHIN THE PROPER BOUNDARIES.

PLATE SUPPLY VOLTAGES ARE MEASURED WITH THE RECTIFIER TUBE NON-CONDUCTING, I.E., WITH THE TRANSFORMER UNLOADED. THIS UNLOADED VOLTAGE IS USED WITH CALCULATING RECTIFICATION EFFICIENCY.

THE RECTIFICATION EFFICIENCY IS DEFINED AS:

$$\frac{\text{DC OUTPUT VOLTAGE}}{\text{(UNLOADED RMS SUPPLY VOLTAGE PER PLATE)}}$$

THE DC OUTPUT VOLTAGE IS MEASURED AT THE INPUT TO THE FILTER

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

ACCEPTANCE CRITERIA

TEST CONDITIONS:

HEATER VOLTAGE	6.3	VOLTS
PLATE SUPPLY VOLTAGE PER PLATE	400	VAC
LOAD RESISTANCE	8200	OHMS
LOAD CAPACITANCE	8	μf

FOR THE PURPOSE OF INSPECTION, USE APPLICABLE RELIABLE PARAGRAPHS OF MIL-E-1 AND INSPECTION INSTRUCTIONS FOR ELECTRON TUBES.

MEASUREMENTS ACCEPTANCE TESTS:	MIL-E-1 REF.	AQL %	LIMITS MIN.	LIMITS BOG.	LIMITS MAX.	UNITS
HEATER CURRENT:	4.10.8	1.0	540	600	660	MA.
HEATER-CATHODE LEAKAGE:						
Ehk=-450 Vdc	4.10.15	0.65	---	---	75	μAdc
OPERATION: NOTE 5 Io						
Ehk=Eo+ 117 Vac	4.10.13	0.65	51	55	---	mAdc
EMISSION (1): NOTE 2, Is						
Eb = 50 Vdc	4.10.1.1	1.0	100	---	---	mAdc
CONTINUITY AND SHORTS:						
NOTE 7	----	0.4	---	---	---	
MECHANICAL: ENVELOPE (6-5)	4.9.1	---	---	---	---	
INSULATION OF ELECTRODES:	4.8	2.5	---	---	---	
NOTE 2 Ep-all=-500 Vdc,						
Rp-all		---	100	---	---	MEG.
EMISSION (2): Is						
Ef =5.5 V; Eb=50 Vdc	4.10.1.1	2.5	90	---	---	mAdc
LOW PRESSURE VOLTAGE BREAKDOWN:						
PRESSURE =140±5 mm Hg;						
VOLTAGE = 980 Vac	4.9.12.1	6.5	---	---	---	
VIBRATION (1):						
NO VOLTAGES; F=40 cps; g=10	4.9.19.1	6.5	---	---	---	
DEGRADATION RATE ACCEPTANCE TESTS - NOTE 3						
SHOCK:						
HAMMER ANGLE =30°(450 G,						
1 msec DURATION); Epp/p=						
0 V; Ef = 6.3 V	4.9.20.5	20	---	---	---	
FATIGUE:						
G= 2.5; FIXED FREQUENCY;						
F = 25 cps min.; 60 max.	4.9.20.6	6.5	96	---	---	HOURS
POST SHOCK AND FATIGUE TEST						
END POINTS:						
HEATER-CATHODE LEAKAGE,						
Ehk=-450 Vdc	----	---	---	---	150	μAdc
OPERATION, Io; NOTE 5		---	48	---	---	mAdc
GLASS STRAIN	----	---	---	---	---	

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

ACCEPTANCE CRITERIA

ACCEPTANCE LIFE TESTS, NOTE 3	MIL-E-1 REF.	AQL %	ALLOWABLE DEF. PER CHARACT. 1st SAMP.	ALLOWABLE DEF. PER CHARACT. COMB. SAMP.	LIMITS MIN.	LIMITS MAX.	UNITS
HEATER CYCLING LIFE TEST (2000 CYCLES MIN.) Ef =7.5V; 1 min. on, 1 min. off; Ehk=+100 Vdc; Epp/p = 0 V	4.11.7	---	---	---	---	---	
HEATER CYCLING LIFE TEST END POINTS							
HEATER-CATHODE LEAKAGE, Ehk =-450 Vdc	4.11.4	---	---	---	---	150	μAdc
SURVIVAL RATE LIFE TEST: NOTES 6 & 8							
Ef = 6.3 V; Epp/p=400 Vac; RL = 8200 OHMS; EL =8 μf; TA = Room	4.11.3.1	---	---	---	100	---	HOURS
SURVIVAL RATE LIFE TEST END POINTS:	4.11.4						
INOPERATIVE (NOTE 1)		0.65	---	---	---	---	
EMISSION (1):		1.0	---	---	51	---	mAdc
INTERMITTENT LIFE TEST: NOTES 4 & 6							
SURVIVAL RATE LIFE TEST CONDITIONS: T ENVELOPE =+185°C min.; 1000 HOUR REQUIREMENTS DO NOT APPLY	4.11.3.1	---	---	---	500	---	HOURS
INTERMITTENT LIFE TEST END POINTS: (500 HOURS)	4.11.4						
INOPERATIVE (NOTE 1)		---	1	3	---	---	
OPERATION - CHANGE OF INDIVIDUALS Δ Io		---	1	3	---	8.5	PERCENT
HEATER CURRENT		---	1	3	540	670	mA
HEATER-CATHODE LEAKAGE Ehk =-450 Vdc		---	1	3	---	---	
		---	---	---	---	90	μAdc
TOTAL DEFECTIVES		---	2	5	---	---	

ACCEPTANCE CRITERIA NOTES

1. AN INOPERATIVE IS DEFINED AS A TUBE HAVING ONE OR MORE OF THE FOLLOWING DEFECTS: DISCONTINUITY OR SHORT (REF. NOTE 7 EXCEPT TUBES SHALL NOT BE TAPPED:) AIR LEAKS (REF. MIL E-1, PAR. 4.7.6).

2. TEST EACH SECTION SEPARATELY.

3. TUBES SUBJECTED TO THE FOLLOWING DESTRUCTIVE TESTS ARE NOT TO BE ACCEPTED UNDER THIS SPECIFICATION.

4.9.20.5	SHOCK
4.9.20.6	FATIGUE
4.11.7	HEATER CYCLING LIFE TEST
4.11.3.1	INTERMITTENT LIFE TEST

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

ACCEPTANCE CRITERIA NOTES – cont'd.

4. ENVELOPE **TEMPERATURE** IS DEFINED AS THE HIGHEST TEMPERATURE INDICATED WHEN USING A THERMOCOUPLE OF #40 BS OR SMALLER DIAMETER ELEMENTS WELDED TO A RING OF 0.025 INCH DIAMETER PHOSPHOR BRONZE PLACED IN CONTACT WITH THE ENVELOPE. ENVELOPE TEMPERATURE REQUIREMENT WILL BE SATISFIED IF A TUBE, HAVING BOGEY Ib (±5%) UNDER NORMAL TEST CONDITIONS, IS DETERMINED TO OPERATE AT MAXIMUM SPECIFIED TEMPERATURE AT ANY POSITION ON THE LIFE TEST RACK.

5. IN A FULL-WAVE CIRCUIT, ADJUST Zp/p SO THAT A BOGEY TUBE GIVES Io = 55 mAdc. A BOGEY TUBE HAS A TUBE DROP Etd = 22 Vdc AT Is = 50 mAdc PER PLATE.

6. IN A FULL-WAVE TEST CIRCUIT, THE VALUES SPECIFIED FOR RL & CL MAY BE CONSIDERED APPROXIMATE AND SHALL BE ADJUSTED INITIALLY TO GIVE NOT LESS THAN Io =55 mAdc AND Ib =200 MA PER PLATE WITH A BOGEY TUBE. Ehk=Eo +117 Vac.

7. ALL TUBES SHALL BE TESTED FOR CONTINUITY OF ALL CIRCUITS, INCLUDING DUPLICATE PIN CONNECTIONS TO THE SAME ELECTRODE; FOR SHORTS BETWEEN ANY OF THE TUBE ELEMENTS OR BETWEEN THE ELEMENTS AND THE NO-CONNECTION BASE PINS; AND FOR AIR LEAKS.

   TESTS FOR SHORTS SHALL BE PERFORMED USING AN AUTOMATIC TAPPER DESIGNED AND ADJUSTED TO DELIVER AN IMPULSE OF APPROXIMATELY ONE-HALF SINE WAVE OF 300±50 μSEC DURATION (MEASURED 10% FROM THE BASE OF THE TUBE UNDER TEST) AND HAVING A PEAK ACCELERATION OF 85 G'S AS MEASURED WITH A GULTON A-305 ACCELEROMETER AND KA-1 KIT. THE SHORTS DETECTING EQUIPMENT SHALL BE A DC DEVICE CAPABLE OF DETECTING AS SHORTS INTERELEMENT RESISTANCES WHICH PERSIST FOR A PERIOD OF TIME IN EXCESS OF THAT DETERMINED BY A CURVE OF RESISTANCE VERSUS TIME DURATION PASSING THROUGH THE FOLLOWING POINTS: 600,000 OHMS - CONSTANT VALUE (PERMANENT SHORT); 500,000 OHMS - 500 μsec; 100,000 OHMS - 100 μsec; AND 1,000 OHMS - 60 μsec.

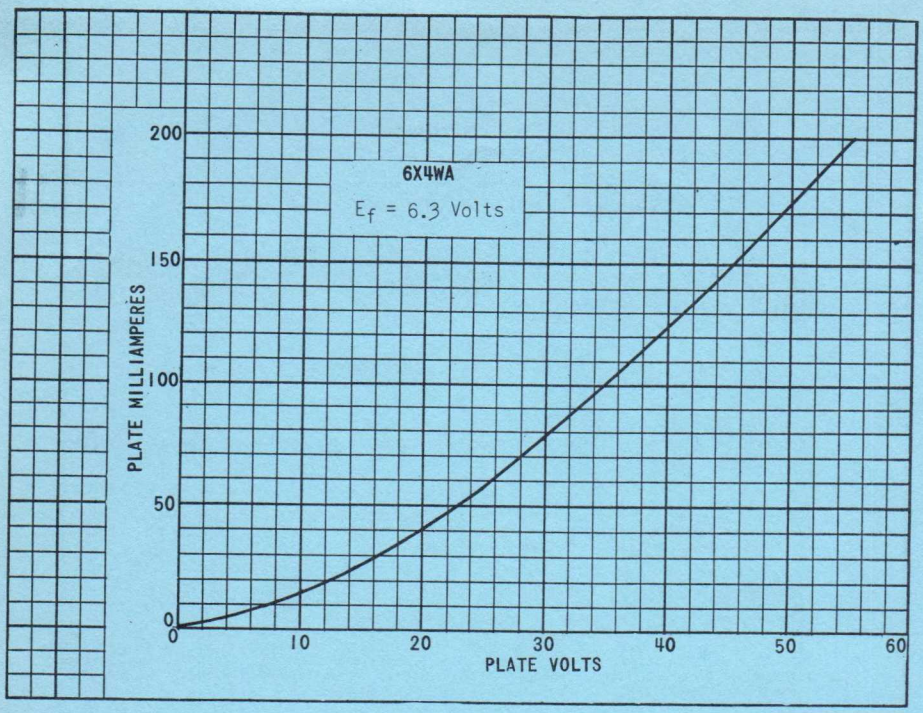
   THE TUBE UNDER TEST SHALL BE CONNECTED TO THE SHORTS TEST EQUIPMENT WITH ELEMENTS IN SEQUENCE FOR SINGLE SECTION TUBES BUT LIKE ELEMENTS IN THE SECTIONS OF A MULTISECTION TUBE MAY BE PARALLELED, PROVIDING THE MECHANICAL ASSEMBLY OF THE TUBE STRUCTURE IS SUCH THAT THE POSSIBILITY OF A SHORT DUE TO SECTION CROSS JUMPERS IS REMOTE.

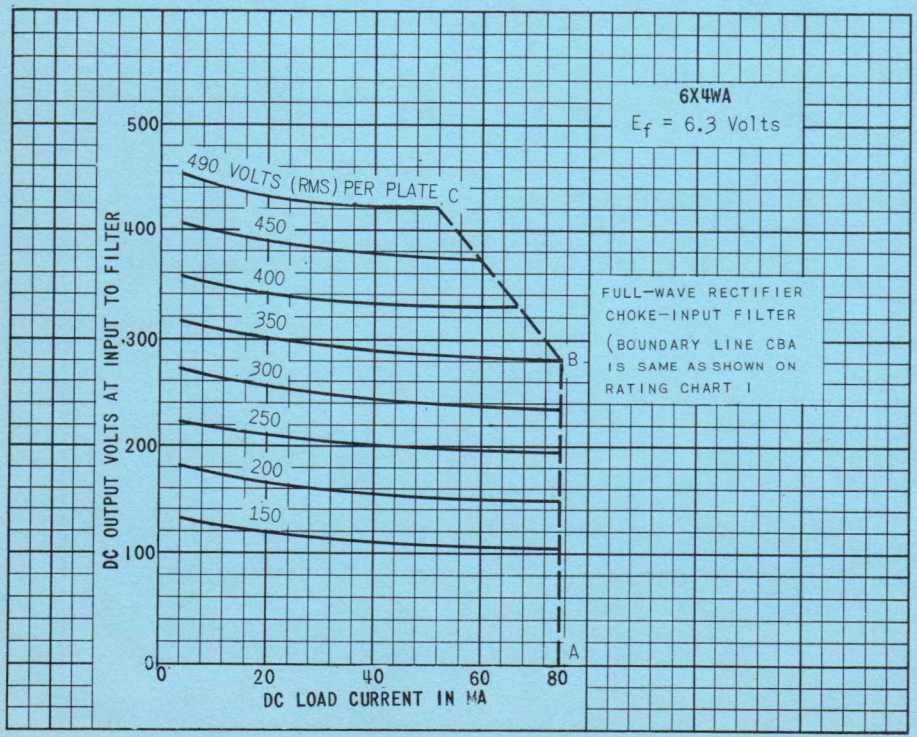
   TUBES HAVING PERMANENT SHORTS, OPENS AND AIR LEAKS SHALL BE REJECTED ON THE FIRST TEST. IF REJECTED FOR TAP-SHORT OR OPEN OCCURS ON FIRST SERIES OF TAPS REPEAT TAPPING CYCLE THREE TIMES. REJECT TUBE AS INOPERABLE IF REJECT OCCURS AT ANY TIME DURING THE THREE REPEAT TEST, OTHERWISE ACCEPT.

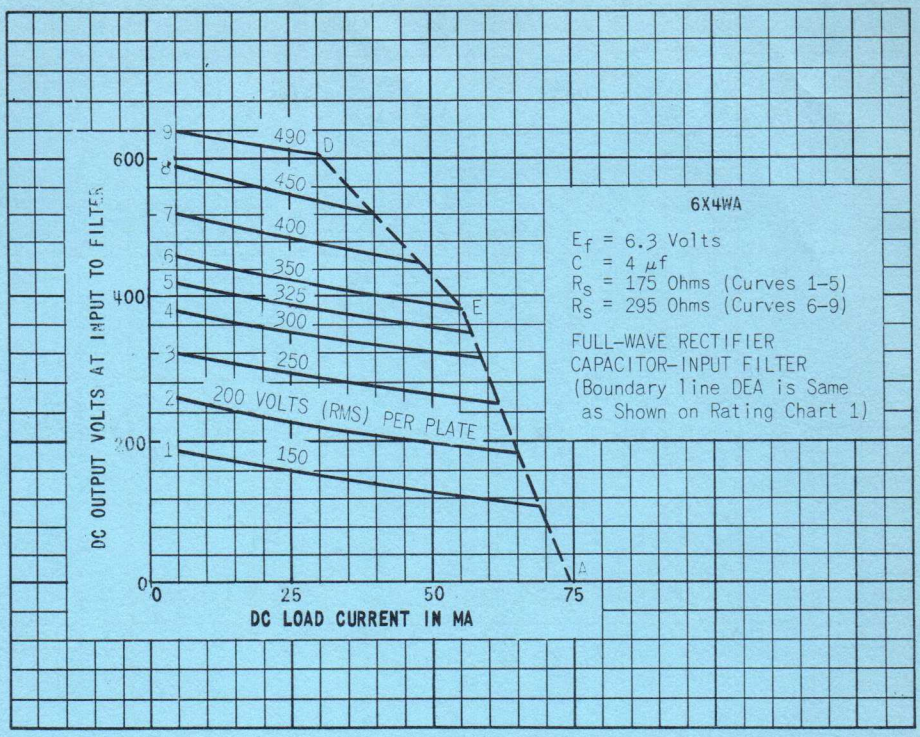
8. FOR SURVIVAL RATE LIFE TEST THE SAMPLING AND TESTING SHALL BE AS SPECIFIED IN 20.2.5.2 TO 20.2.5.4 INCLUSIVE OF APP. C. WITH THE FOLLOWING EXCEPTIONS: 20.2.5.3 - REPLACE THE LAST SENTENCE WITH "IF SUCH SELECTION RESULTS IN A SAMPLE CONTAINING ONE OR MORE TUBES WHICH ARE DEFECTIVE WHEN TESTED UNDER CONDITIONS OF INITIAL SHORT AND CONTINUITY TEST (REF. NOTE 7) SUCH TUBES SHALL BE REPLACED BY RANDOMLY SELECTED GOOD TUBES." 20.2.5.4(6): REPLACE WITH "UPON COMPLETION OF 100 HOURS, THE TUBES SHALL AGAIN BE SUBJECTED TO THE SHORT AND CONTINUITY TEST (REF. NOTE 7).

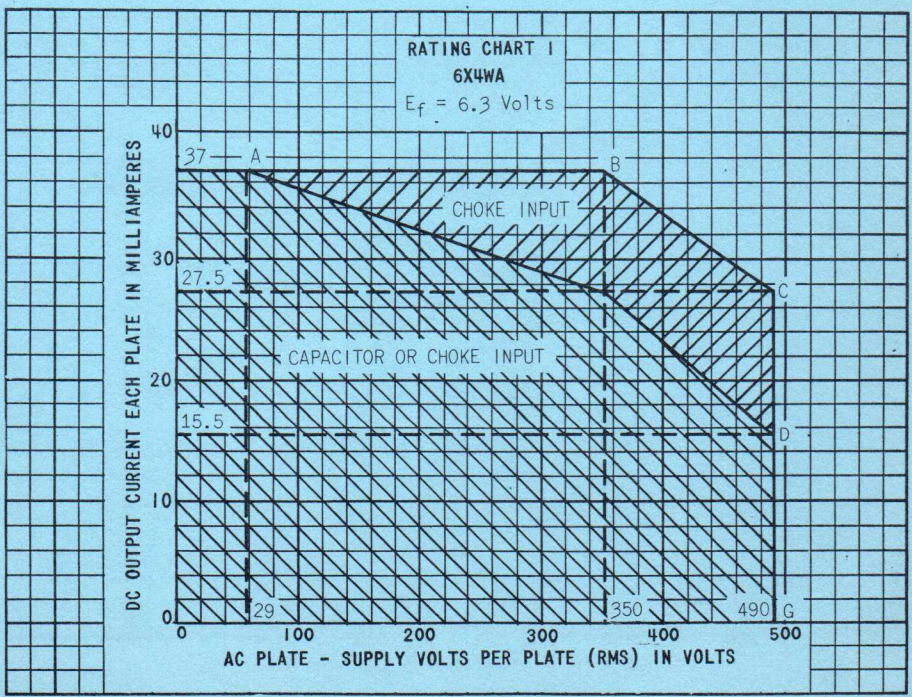
PRINTED IN U. S. A.

TENTATIVE DATA

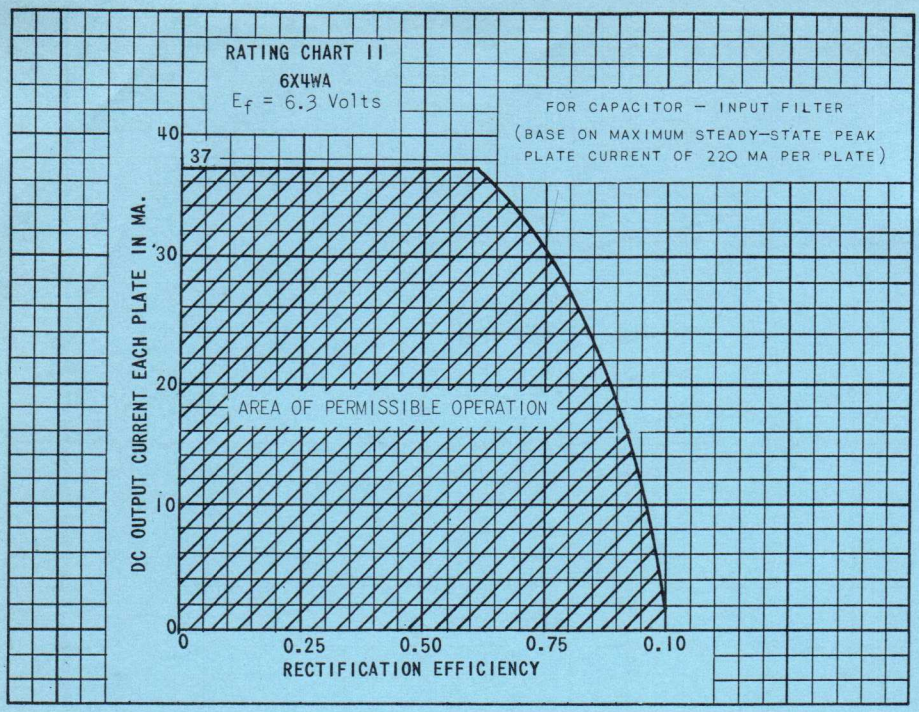


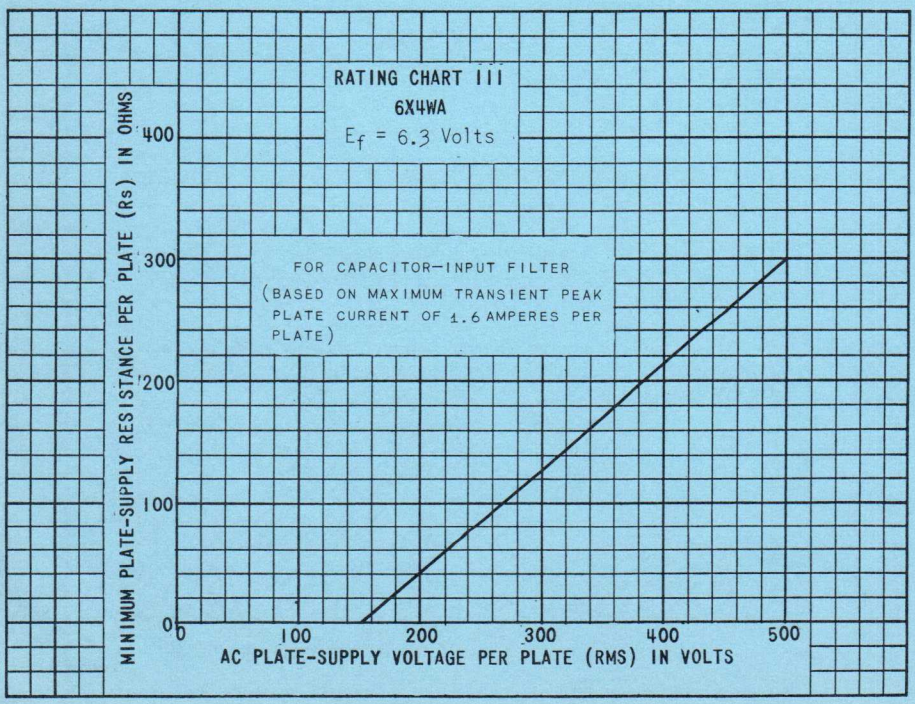


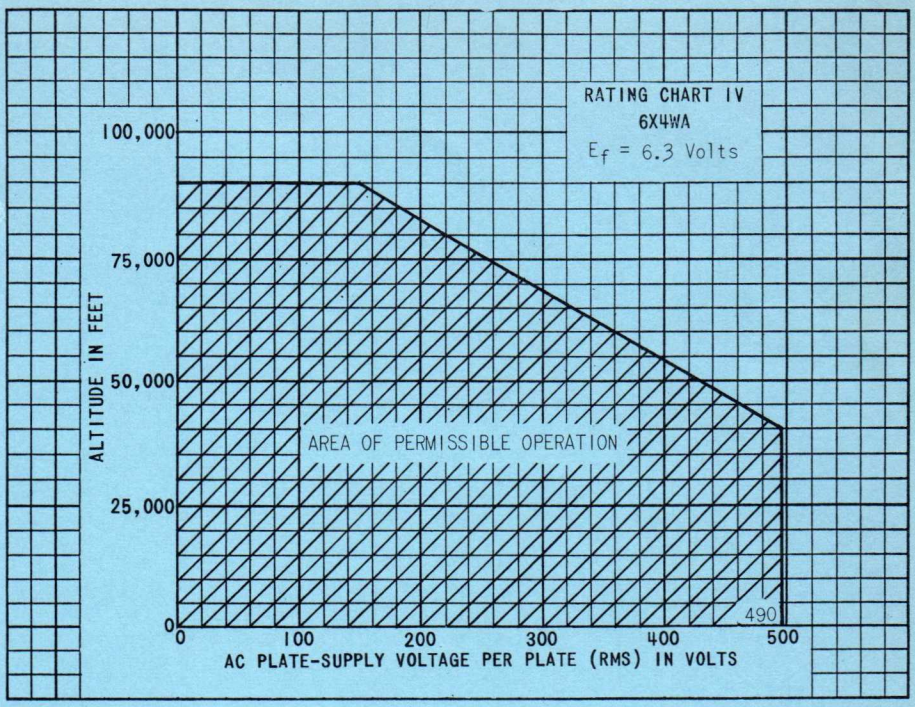




PRINTED IN U.S.A.


RATING CHART II
6X4WA
E_f = 6.3 Volts
FOR CAPACITOR – INPUT FILTER
(BASE ON MAXIMUM STEADY-STATE PEAK PLATE CURRENT OF 220 MA PER PLATE)
DC OUTPUT CURRENT EACH PLATE IN MA.
40
37
30
20
10
0
AREA OF PERMISSIBLE OPERATION
0
0.25
0.50
0.75
0.10
RECTIFICATION EFFICIENCY

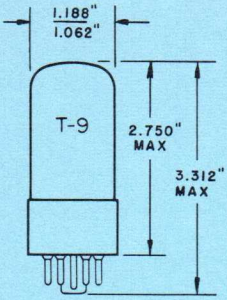

RATING CHART III
6X4WA
E_f = 6.3 Volts
FOR CAPACITOR–INPUT FILTER
(BASED ON MAXIMUM TRANSIENT PEAK PLATE CURRENT OF 1.6 AMPERES PER PLATE)
MINIMUM PLATE-SUPPLY RESISTANCE PER PLATE (Rs) IN OHMS
400
300
200
100
0
0
100
200
300
400
500
AC PLATE-SUPPLY VOLTAGE PER PLATE (RMS) IN VOLTS



PRINTED IN U.S.A.

TUNG-SOL

TWIN DIODE



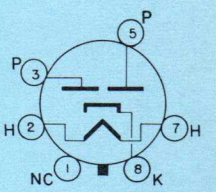
GLASS BULB

INTERMEDIATE SHELL
6 PIN OCTAL B6-8
LOW LOSS PHENOLIC
OUTLINE DRAWING
JEDEC 9-11

FULL - WAVE RECTIFIER

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6S

THE 6X5WGT IS A CATHODE TYPE FULL-WAVE RECTIFIER EMPLOYING A T-9 ENVELOPE WITH A LOW LOSS OCTAL BASE. IT IS DESIGNED FOR USE IN APPLICATIONS WHERE SEVERE CONDITIONS OF VIBRATION AND SHOCK ARE ENCOUNTERED.

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	600	MA.
LIMITS OF APPLIED CURRENT			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			±450	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PEAK INVERSE VOLTAGE	1,375	VOLTS
STEADY-STATE PEAK PLATE CURRENT (EACH PLATE)	230	MA.
TRANSIENT PEAK PLATE CURRENT (EACH PLATE)	750	MA.
OUTPUT CURRENT (DC) (TOTAL)	75	MA.

SPECIAL TESTS AND RATINGS

IMPACT ACCELERATION
VIBRATIONAL ACCELERATION FOR EXTENDED PERIODS
MECHANICAL RESONANCE
ALTITUDE RATING

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

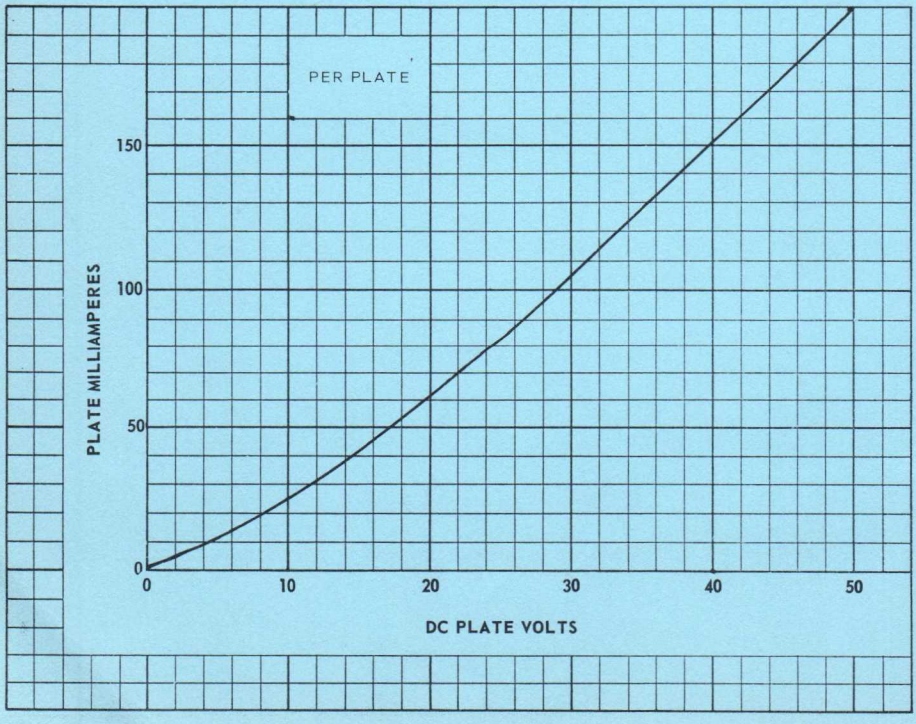
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE (AC) PER PLATE	325	450	VOLTS RMS
FILTER INPUT CAPACITOR	8	-----	μf
FILTER INPUT CHOKE (MIN.)	-----	10	HENRIES
EFFECTIVE PLATE SUPPLY IMPEDANCE [A] EACH PLATE	150	-----	OHMS
OUTPUT CURRENT (DC)	70	70	MA.
TUBE VOLTAGE DROP @ 70 mADC PER PLATE		22	VOLTS

[A] WHEN FILTER CONDENSERS LARGER THAN 40 μF ARE USED, IT MAY BE NECESSARY TO INCREASE THE SPECIFIED VALUE OF PLATE SUPPLY IMPEDANCE.



TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

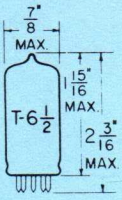
HEATER

6.3 VOLTS 0.3 AMP.
12.6 VOLTS 0.150 AMP.

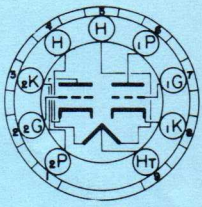
AC OR DC

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.



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9A

THE 12AT7WA IS A RUGGEDIZED TWIN TRIODE OF THE 9-PIN MINIATURE CONSTRUCTION. THE TWO HIGH TRANSCONDUCTANCE TRIODE SECTIONS ARE ELECTRICALLY INDEPENDENT, ALLOWING SIMULTANEOUS USE OF THE TWO IN COMPLETELY DIFFERENT APPLICATIONS. THE HIGH RATIO OF PLATE CURRENT TO TRANSCONDUCTANCE MAKES IT ADAPTABLE FOR USE AS A COMBINED HIGH FREQUENCY OSCILLATOR AND MIXER, OR AS A GROUNDED GRID RF AMPLIFIER. THE HEATER CENTER TAP PERMITS OPERATION FROM EITHER A 6.3 OR 12.6 VOLT SUPPLY. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS HEATER CURRENT, PLATE CURRENT, AND TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 12AT7WA IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

EACH SECTION

	WITH SHIELD #316	WITHOUT SHIELD	
GRID TO PLATE #1 (RATED)	1.5	1.5	µµf
MAXIMUM	---	1.90	µµf
MINIMUM	---	1.30	µµf
INPUT SECTION #1 (RATED)	2.2	2.2	µµf
MAXIMUM	---	3.00	µµf
MINIMUM	---	2.00	µµf
OUTPUT (SECTION#1) (RATED)	1.2	0.5	µµf
MAXIMUM	---	0.70	µµf
MINIMUM	---	0.20	µµf
OUTPUT (SECTION#2) (RATED)	1.5	0.4	µµf
MAXIMUM	---	0.60	µµf
MINIMUM	---	0.16	µµf
PLATE TO PLATE			
MAXIMUM	---	0.33	µµf
MINIMUM	---	0.15	µµf
HEATER TO CATHODE #1 (RATED)	2.4	2.4	µµf
MAXIMUM	---	3.50	µµf
MINIMUM	---	2.10	µµf
HEATER TO CATHODE #2 (RATED)	2.4	2.4	µµf
MAXIMUM	---	3.50	µµf
MINIMUM	---	2.10	µµf
GRID TO PLATE #2 (RATED)	1.5	1.5	µµf
MAXIMUM	---	1.90	µµf
MINIMUM	---	1.30	µµf
INPUT SECTION #2 (RATED)	2.2	2.2	µµf
MAXIMUM	---	3.00	µµf
MINIMUM	---	2.00	µµf

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS
ABSOLUTE MAXIMUM VALUES

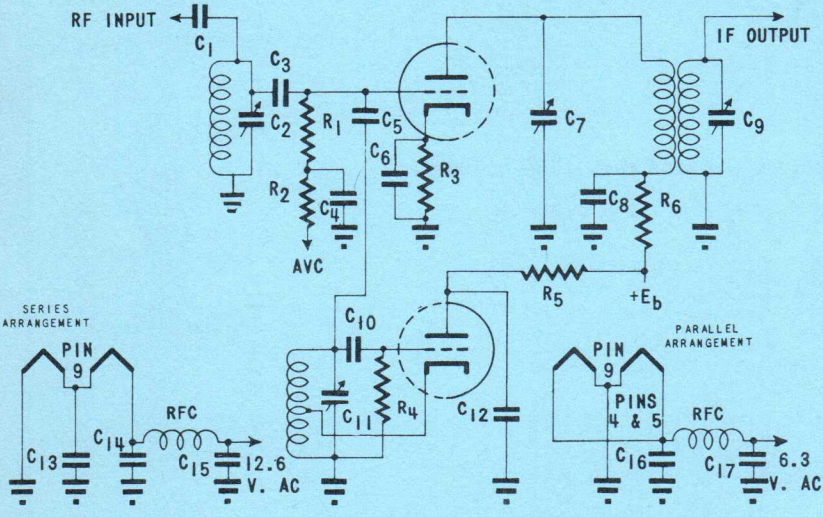
HEATER VOLTAGE	6.3±10%	12.6±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330		VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	−55		VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	2.8		WATTS
MAXIMUM HEATER CATHODE VOLTAGE	±100		VOLTS
MAXIMUM BULB TEMPERATURE	200		°C
MAXIMUM ALTITUDE	10 000		FEET
MAXIMUM SHOCK	600		G

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

HEATER VOLTAGE	12.6	6.3	12.6	6.3	VOLTS
HEATER CURRENT	150	300	150	300	mA
PLATE VOLTAGE	100		250		VOLTS
CATHODE BIAS 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

TYPICAL CIRCUIT FOR CONVERTER OPERATION AT 100 MEGACYCLES



C_1 = 100 μμF
C_2 = RF TUNING CAPACITOR
C_3 = 25 μμF
C_4 = 1000 μμF
C_5 = 1 μμF
C_6 = 1000 μμF
C_7 = 50 μμF (MAX.)
C_8 = 1000 μμF
C_9 = 50 μμF (MAX.)
C_{10} = 50 μμF
C_{11} = OSCILLATOR TUNING CAPACITOR
C_{12} = 1000 μμF
C_{13} = 1000 μμF
C_{14} = 1000 μμF
C_{15} = 1000 μμF
C_{16} = 1000 μμF
C_{17} = 1000 μμF
R_1 = 50000 OHMS
R_2 = 50000 OHMS
R_3 = 2000 OHMS
R_4 = 10000 OHMS
R_5 = 1000 OHMS
R_6 = 1000 OHMS
E_b = 100 OR 250V.

OSCILLATOR VOLTAGE APPLIED TO MIXER SHOULD BE JUST SUFFICIENT TO CAUSE GRID CURRENT TO FLOW IN THE MIXER SECTION.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

(Ef = 12.6V, Eb = 250Vdc, RK/K = 200 OHMS)
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	138	162	144	156	138	162	mA
HEATER-CATHODE LEAKAGE[A] (Ehk =±100Vdc)	---	±10	---	±2	---	±10	μAdc
GRID CURRENT[B] (Rg = 0.6 MEG.)	---	-0.7	---	-0.2	---	-0.7	μAdc
PLATE CURRENT (1)[B]	7.0	14.0	8.5	11.5	---	---	mAdc
TRANSCONDUCTANCE (1)	4500	6500	4880	6120	3800	6500	μMHOS
Δ AVERAGE TRANS-CONDUCTANCE (1)	---	---	---	---	---	20	PERCENT
INSULATION OF ELECTRODES[CB] (Ef=12.6 V, E(g-all)= +100Vdc, E(p-all)=-300Vdc)							
Rg-all	100	---	---	---	50	---	MEGOHM
Rp-all	100	---	---	---	50	---	MEGOHM
PLATE CURRENT (2)[DB] (Ec=-20Vdc, Rp=0.1MEG, Rk=0, Ck=0)	---	100	---	---	---	---	μAdc
PLATE CURRENT DIFFERENCE[B] BETWEEN SECTIONS	---	3.2	---	---	---	---	mAdc
TRANSCONDUCTANCE (2)[EB] (Ef = 11.0V)	4000	---	4400	---	---	---	μMHOS
AMPLIFICATION FACTOR[FB]	50	70	---	---	---	---	
GRID EMISSION[GB] (Ef=15.0V, Ec=20Vdc, Rg=0.5MEG, Rk=0, Ck=0)	---	-1.5	---	---	---	---	μAdc

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[HA] (Ec=-3Vdc, Rp=2000, Rk=0, Ck=0)	---	100	mVac
VIBRATIONAL FATIGUE[J]	---	---	
MINIATURE TUBE BASE STRAIN[K] (NO VOLTAGES)	---	---	
STABILIZATION[L] (INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT)	---	---	
SHOCK[M] (HAMMER ANGLE =42°, Ehk =100Vdc, Rg =0.1 MEG.)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	150	mVac
HEATER CATHODE LEAKAGE	---	30	μAdc
TRANSCONDUCTANCE (1)	3800	---	μMHOS
GRID CURRENT	---	-1.5	μAdc
SHORT AND CONTINUITY	---	---	
RF NOISE[NA] (Esig=15mVac, Rk=100, Ck=0.2 μf)	---	---	
NOISE AND MICROPHONICS[P] (Ef =12.6Vdc, Ebb=300Vdc, Ecal=100mVac, Rp=10,000)	---	100	mVac
LOW FREQUENCY VIBRATION[QA] (Ec =-3Vdc, Rp =2000, Rk =0, Ck=0)	---	100	mVac
INTERMITTENT LIFE TEST (Ehk = 135Vdc, Rg = 0.5 MEG., Ck= 0)	---	---	
HEATER CYCLING LIFE TEST (Ef = 7.5V HEATERS IN PARALLEL, Ehk = 135Vdc)	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 TEST WITH UNITS TIED TOGETHER.

B TEST EACH UNIT SEPARATELY WITH ELEMENTS OF OPPOSITE SECTION GROUNDED.

C SEE MIL-E-1C 4.8.2

D THE PLATE CURRENT DIFFERENCE BETWEEN SECTIONS SHALL BE WITHIN THE SPECIFIED LIMIT.

E PREHEAT ALL TUBES TO BE TESTED FOR TRANSCONDUCTANCE (2) UNDER THE FOLLOWING CONDITIONS FOR A PERIOD OF 5 MINUTES PRIOR TO TESTING. PREHEAT WITH TRIODE SECTIONS OPERATING SEPARATELY. E_f = 11.0V, E_b = 250Vdc, Rk = 200, R_g = 0.5MEG.

F SEE MIL-E-1C 4.10.11.1

G PREHEAT ALL TUBES TO BE TESTED FOR GRID EMISSION UNDER THE FOLLOWING CONDITIONS FOR A PERIOD OF 5 MINUTES PRIOR TO TESTING: E_f=15.0V, E_b=250Vdc, R_g=0.5MEG, R_k=200. PREHEAT WITH TRIODE SECTIONS OPERATING SEPARATELY. TWO SECONDS SHALL BE THE MAXIMUM TIME BETWEEN PREHEAT AND TEST.

H SEE MIL-E-1C 4.9.20.3

J SEE MIL-E-1C 4.9.20.6

K SEE MIL-E-1C 4.9.6.1

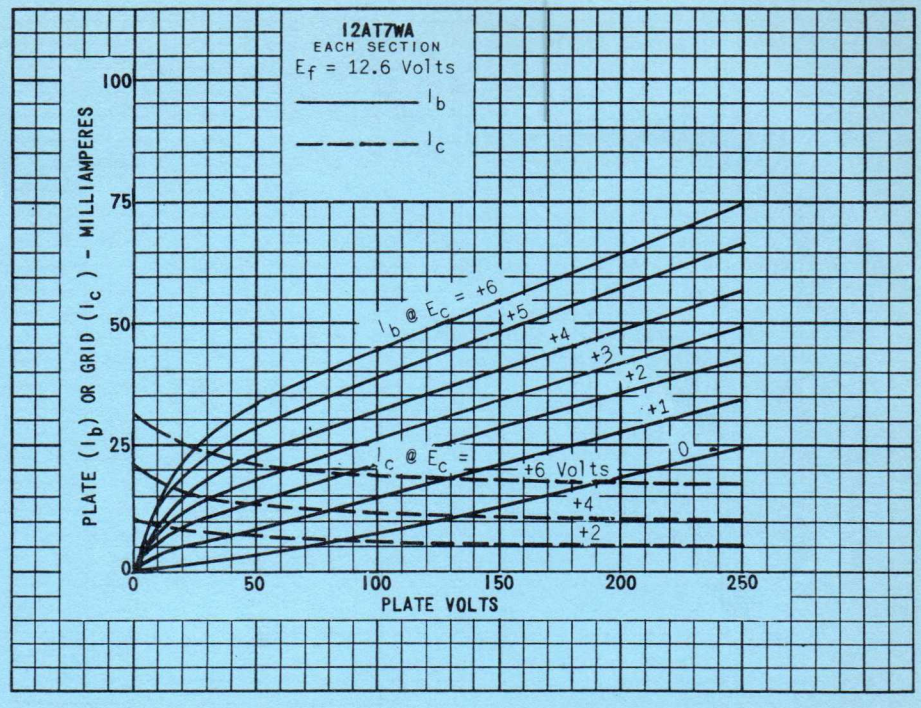
L SEE MIL-E-1C 4.6.2

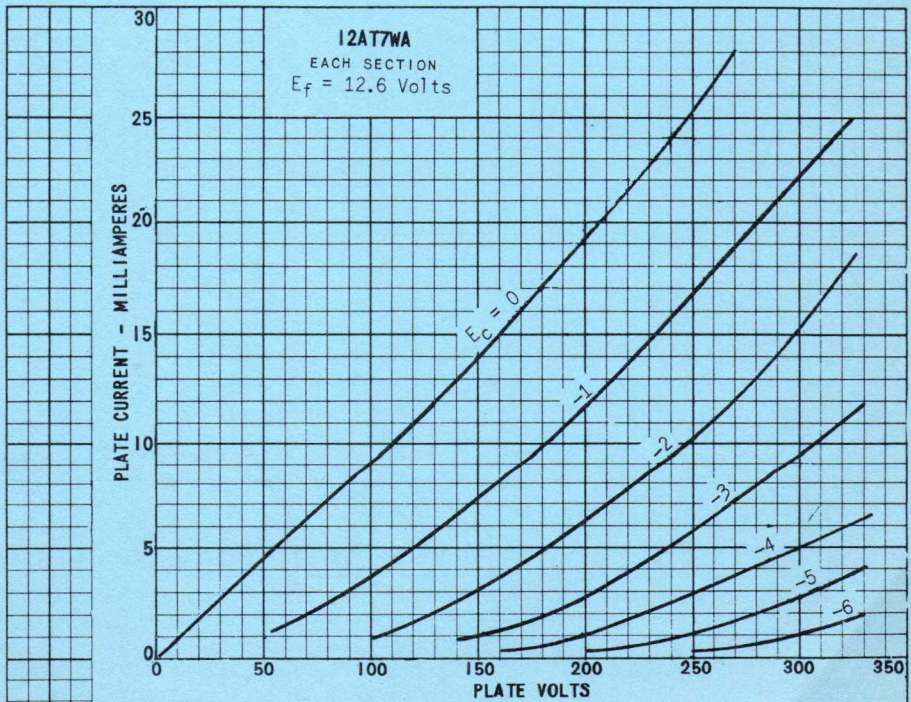
M SEE MIL-E-1C 4.9.20.5

N SEE MIL-E-1C 4.10.3.1

P TEST WITH TWO SECTIONS CONNECTED IN PARALLEL. TIE CATHODE TOGETHER AND GROUND THRU A 200 OHM RESISTOR. GRIDS ARE GROUNDED.

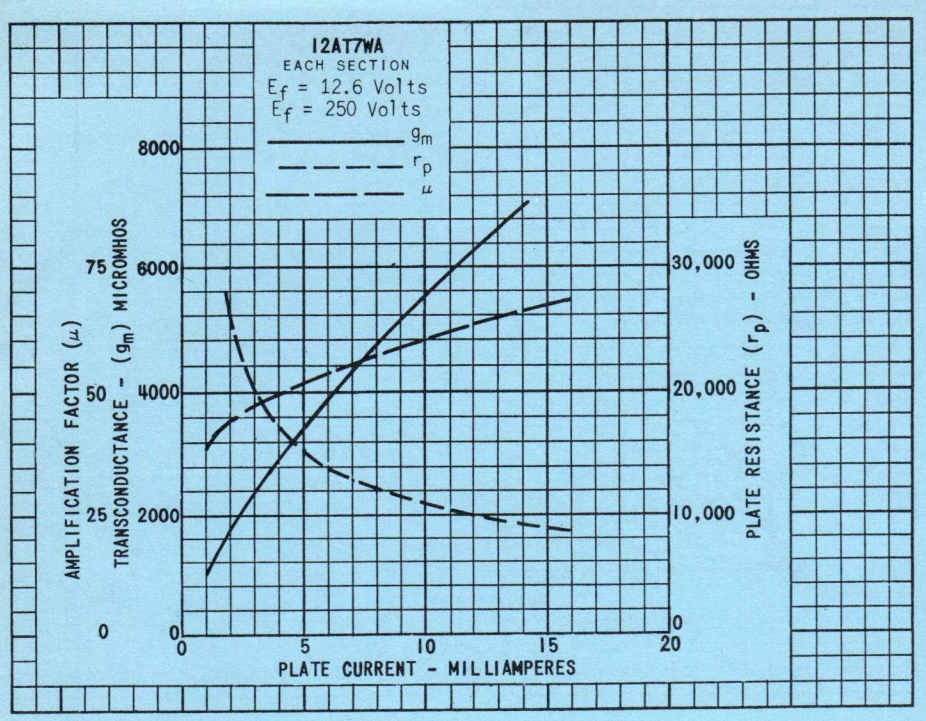
Q SEE MIL-E-1C 4.9.20.4

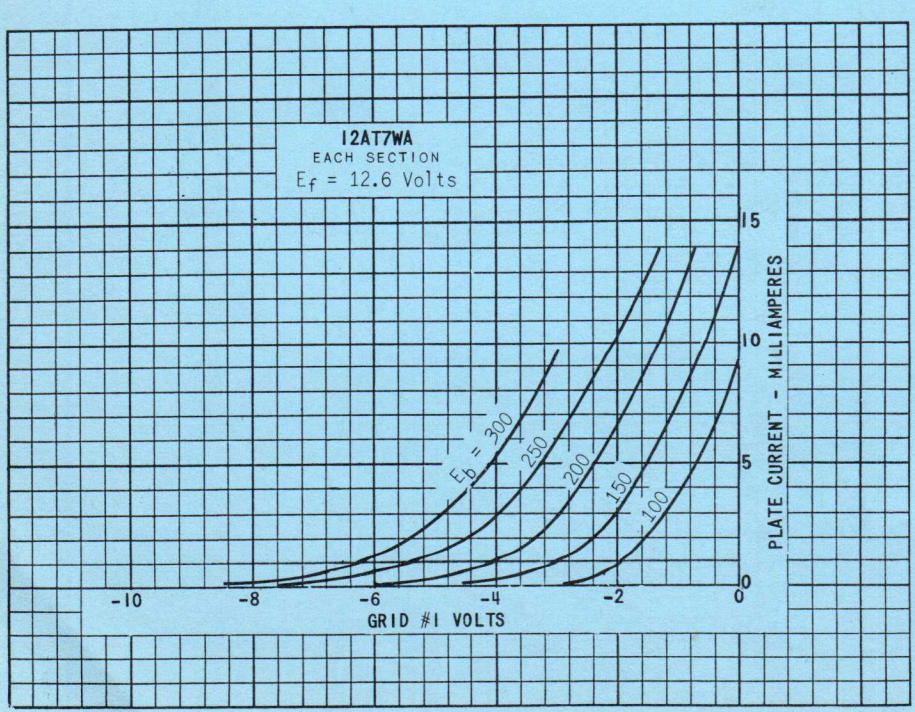




PRINTED IN U. S. A.

12AT7WA
PREMIUM TUBE





TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

HIGH-MU TRIODES

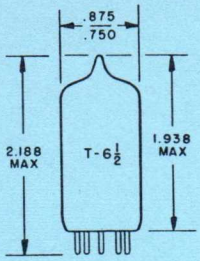
FOR

HIGH GAIN AUDIO AMPLIFIER SERVICE

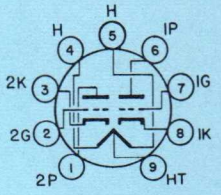
IN MILITARY APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON
9 PIN NOVAL E9-1
OUTLINE DRAWING
JEDEC 6-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9A

THE 12AX7WA CONTAINS TWO INDEPENDENT HIGH-MU TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS ADAPTABLE TO APPLICATIONS WHERE HIGH VOLTAGE GAIN AND LOW HEATER POWER ARE THE IMPORTANT CONSIDERATION, SUCH AS VOLTAGE AMPLIFIER, PHASE INVERTERS OR MULTIVIBRATORS. THE CENTER TAPPED HEATER CONNECTION PERMITS OPERATION FROM EITHER A 6.3 VOLT OR 12.6 VOLT SUPPLY AND IN 300 MA. OR 150 MA. SERIES HEATER SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: G TO P	1.7	pf
INPUT	1.8	pf
OUTPUT SECTION 1	0.46	pf
OUTPUT SECTION 2	0.34	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

SUPPLY CONNECTED TO PINS	4 AND 5	9 AND 4+5	
AVERAGE VALUES— VOLTAGE	12.6	6.3	VOLTS
— CURRENT	150	300	MA.
LIMITS OF APPLIED VOLTAGE	12.6 ± 1.2	6.3 ± 0.6	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

VALUES ARE FOR EACH UNIT

PLATE VOLTAGE	330	VOLTS
PLATE DISSIPATION	1.0	WATT
GRID VOLTAGE		
NEGATIVE BIAS VALUE	-50	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
BULB TEMPERATURE	+165	°C

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-2	VOLTS
PLATE CURRENT	1.2	MA.
AMPLIFICATION FACTOR	100	μ
TRANSCONDUCTANCE	1,650	μMHOS
PLATE RESISTANCE	62,500	OHMS

SPECIAL TESTS AND RATINGS

HEATER CYCLING RATING		
ALTITUDE	80,000	FEET
SHOCK		

RESISTANCE COUPLED AMPLIFIER

R_p MEG.	R_s MEG.	R_{g1} MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	0.10	0.1	1700	31	5.0	1000	40	15	760	43	30
0.10	0.24	0.1	2000	38	6.9	1100	46	20	900	50	40
0.24	0.24	0.1	3500	43	6.5	2000	54	18	1600	58	37
0.24	0.51	0.1	3900	49	8.6	2300	59	24	1800	64	47
0.51	0.51	0.1	7100	50	7.4	4300	62	19	3100	66	39
0.51	1.0	0.1	7800	53	9.1	4800	64	24	3600	69	46
0.24	0.24	10	0	37	3.9	0	53	15	0	62	32
0.24	0.51	10	0	44	5.4	0	60	19	0	67	41
0.51	0.51	10	0	44	5.0	0	61	17	0	69	35
0.51	1.0	10	0	49	6.4	0	66	21	0	71	41

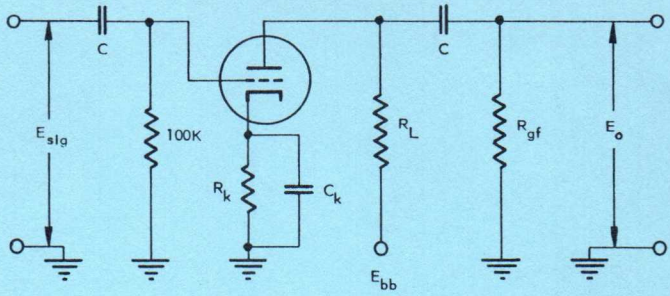
E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT TOTAL HARMONIC DISTORTION.

GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.

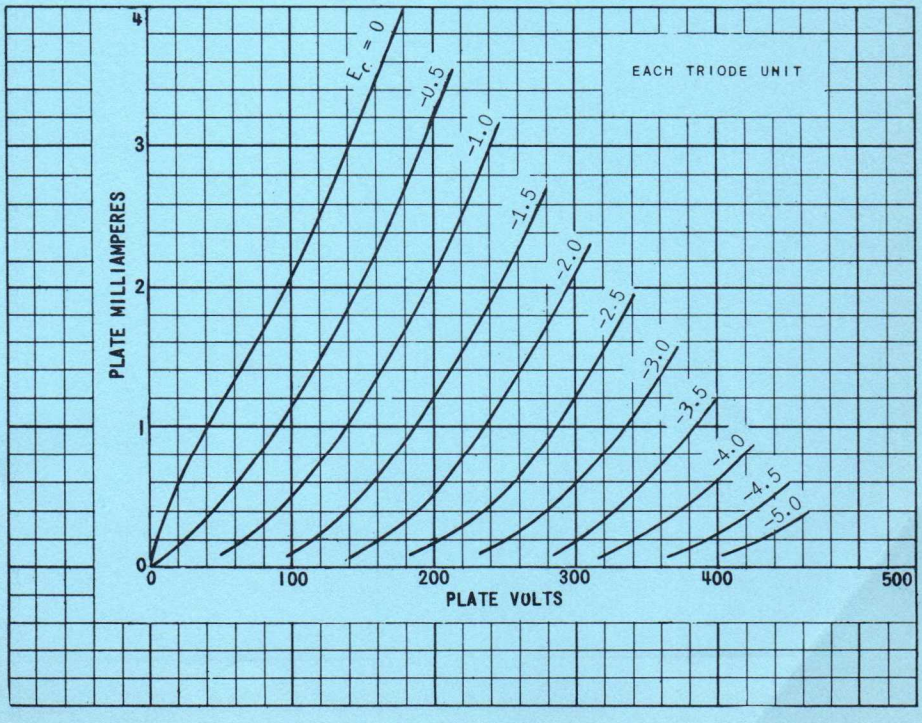
FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.

TUNG-SOL

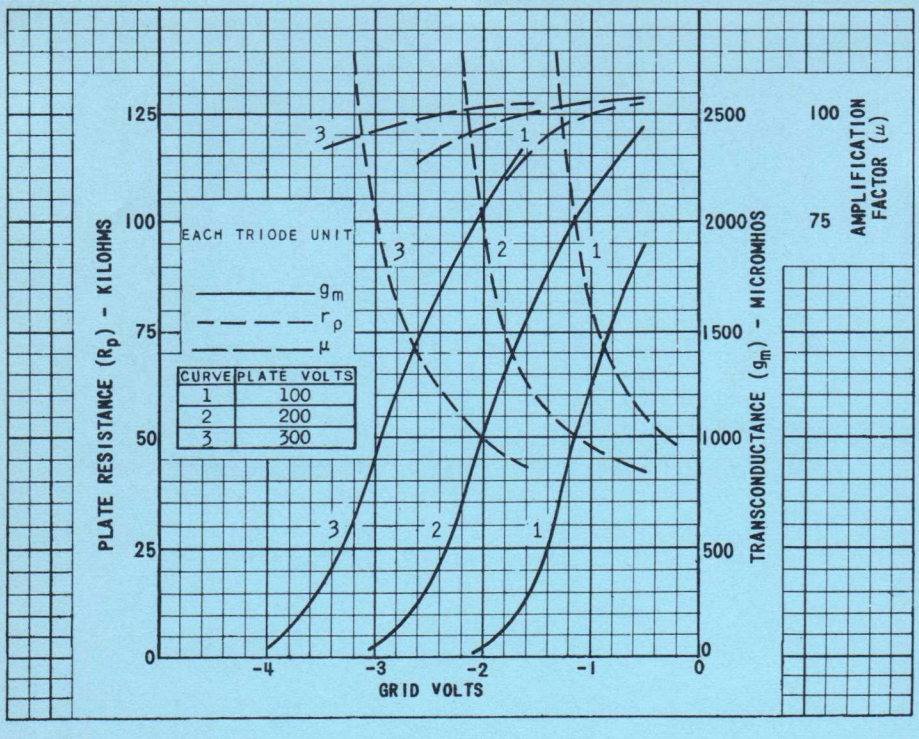
CONTINUED FROM PRECEDING PAGE



COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED.

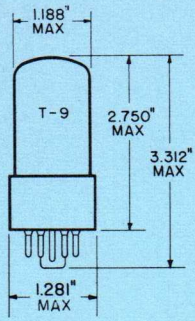


PRINTED IN U.S.A.


EACH TRIODE UNIT
g_m
r_p
μ
CURVE PLATE VOLTS
1 100
2 200
3 300
PLATE RESISTANCE (R_p) - KILOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
AMPLIFICATION FACTOR (μ)
GRID VOLTS
125
100
75
50
25
0
2500
2000
1500
1000
500
0
100
75
-4
-3
-2
-1
0

TUNG-SOL

TWIN TRIODE



GLASS BULB

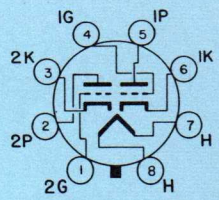
SHORT INTERMEDIATE SHELL
8 PIN OCTAL B8-58
OUTLINE DRAWING
JEDEC 9-41

COATED UNIPOTENTIAL CATHODE*

FOR USE AS AN
AUDIO AMPLIFIER, OSCILLATOR,
CONVERTER OR MULTI-VIBRATOR

LOW B VOLTAGE RATING

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8BD

THE 12SX7GT COMBINES TWO MEDIUM-MU TRIODES IN ONE ENVELOPE WHOSE SECTIONS ARE ELECTRICALLY INDEPENDENT EXCEPT FOR THE COMMON HEATER. IT IS DESIGNED FOR USE IN EQUIPMENT WHERE OPERATING VOLTAGES ARE OBTAINED FROM A 12 CELL STORAGE BATTERY. THE 12SX7GT IS RATED IN COMPLIANCE WITH MILITARY STANDARDS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	TRIODE #1	TRIODE #2	
GRID TO PLATE:G TO P	3.6	3.6	pf
INPUT: G TO (H+K)	3.0	2.8	pf
OUTPUT: P TO (H+K)	0.8	1.2	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		12.6±1.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		100	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID VOLTAGE:		
NEGATIVE BIAS VOLTAGE	50	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
CATHODE CURRENT	20	MA.
PLATE DISSIPATION	2.75	WATTS
GRID CIRCUIT RESISTANCE	1.0	MEGOHM
ALTITUDE	10,000	FT.

TYPICAL OPERATING CHARACTERISTICS

RESISTANCE COUPLED AMPLIFIER - EACH TRIODE

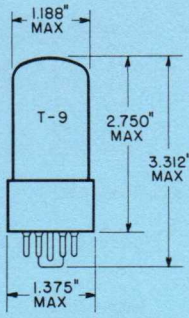
PLATE SUPPLY-VOLTAGE[A]	90	180	300	VOLTS
LOAD RESISTANCE	0.1	0.1	0.1	MEGOHM
GRID RESISTOR	0.25	0.25	0.25	MEGOHM
CATHODE RESISTOR	3,940	2,830	2,440	OHMS
CATHODE BY-PASS CONDENSER	1.29	1.35	1.42	μf
BLOCKING CONDENSER	0.012	0.012	0.0125	μf
PEAK VOLTAGE OUTPUT[B]	17	34	56	VOLTS
VOLTAGE GAIN (AT 5.0 VOLTS VOLTS RMS)	13	14	14	

A
VOLTAGE AT PLATE EQUALS PLATE-SUPPLY VOLTAGE MINUS VOLTAGE DROP IN LOAD RESISTANCE AND CATHODE RESISTOR.

B
VOLTAGE ACROSS GRID RESISTOR AT GRID CURRENT POINT.

TUNG-SOL

OUTLINE DRAWING



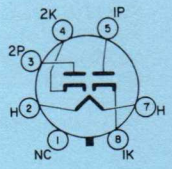
GLASS BULB
LOW LOSS MEDIUM SHELL 7 PIN OCTAL WITH RUBBER INSERT BASE B7-12

TWIN DIODE
FOR
USE IN THE
POWER SUPPLY OF AC
OR AC/DC RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM JEDEC 7Q



BOTTOM VIEW

THE 25Z6WGT IS A RUGGEDIZED HEATER-CATHODE TYPE FULL-WAVE HIGH-VACUUM RECTIFIER-DOUBLER IN THE OCTAL BASE T-9 CONSTRUCTION. IT IS DESIGNED FOR USE IN THE POWER SUPPLY OF AC OR AC/DC RECEIVERS.

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	25.0	VOLTS	300	mA
LIMITS OF APPLIED VOLTAGE			25.0±2.5	VOLTS
HEATER-CATHODE VOLTAGE			350	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

PEAK INVERSE PLATE VOLTAGE	730	VOLTS
PEAK PLATE CURRENT PER PLATE	500	mA
DC OUTPUT CURRENT PER PLATE	85	mA
ALTITUDE	10,000	FT.

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP AT I_b = 150mA	22	VOLTS

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATION

HALF-WAVE RECTIFIER (CAPACITOR INPUT FILTER)*

PLATE SUPPLY VOLTAGE, RMS, PER PLATE	117	235	VOLTS
PLATE SUPPLY RESISTANCE PER PLATE	15	100	OHMS
FILTER INPUT CAPACITOR	16	16	μF
DC OUTPUT CURRENT PER PLATE	75	75	mA
DC OUTPUT VOLTAGE AT FILTER INPUT	115	255	VOLTS

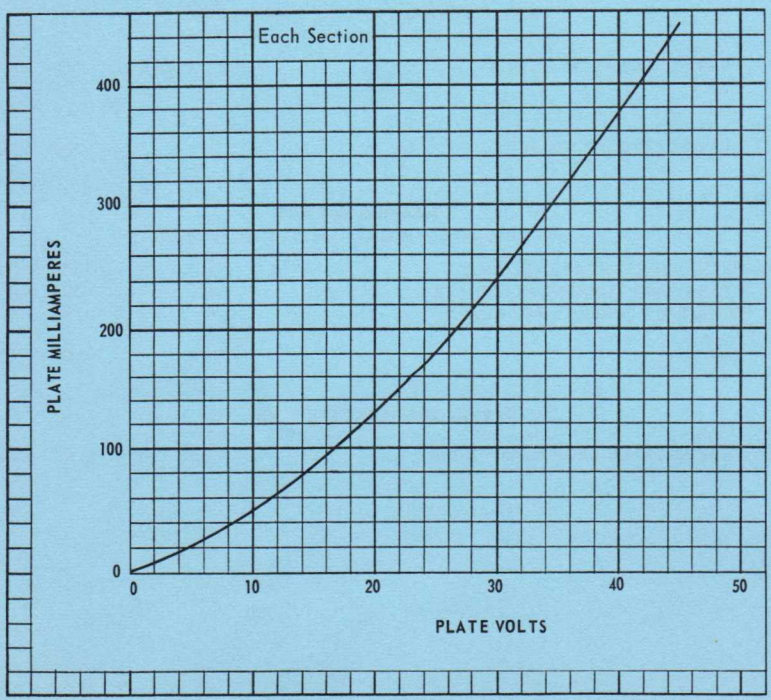
*AS A HALF-WAVE RECTIFIER, THE TWO SECTIONS MAY BE USED SEPARATELY OR IN PARALLEL.

TYPICAL OPERATION

VOLTAGE DOUBLER

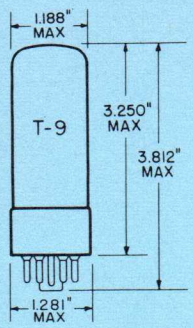
	HALF-WAVE	FULL-WAVE	
PLATE SUPPLY VOLTAGE, RMS, PER PLATE	117	117	VOLTS
FILTER INPUT CAPACITOR	16	16	μF
PLATE SUPPLY IMPEDANCE PER PLATE	30	15	OHMS
DC OUTPUT CURRENT	75	75	mA
DC OUTPUT VOLTAGE AT FILTER INPUT:			
AT HALF-LOAD CURRENT OF 37.5 mA	–	250	VOLTS
AT FULL-LOAD CURRENT OF 75 mA	–	205	VOLTS

NOTE: WHEN FILTER CAPACITORS LARGER THAN 40 μF ARE USED, IT MAY BE NECESSARY TO INCREASE PLATE SUPPLY RESISTANCE ABOVE VALUE GIVEN.



TUNG-SOL

DOUBLE BEAM PENTODE



GLASS BULB
INTERMEDIATE SHELL B8-6
OR
SHORT INTERMEDIATE
SHELL B8-58
8 PIN OCTAL
OUTLINE DRAWING
JEDEC 9-33 OR 9-44

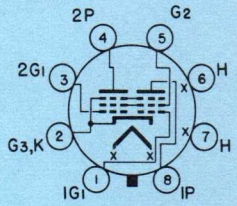
COATED UNIPOTENTIAL CATHODE

FOR

POWER OUTPUT TUBE IN

AIRCRAFT OR MOBILE SERVICE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8BU

THE 26A7GT IS A CATHODE TYPE TWIN BEAM POWER AMPLIFIER USING THE OCTAL BASE CONSTRUCTION. IT IS INTENDED FOR USE AS A PUSH-PULL OR PARALLEL CONNECTED POWER OUTPUT TUBE IN AIRCRAFT OR MOBILE SERVICE WHERE BOTH THE PLATE AND HEATER SUPPLY IS LIMITED TO 28 VOLTS.

DIRECT INTERELECTRODE CAPACITANCES

EACH UNIT

GRID TO PLATE: (G1 TO P)	1.2	pf
INPUT: G1 TO (H+K+G2+G3)	16	pf
OUTPUT: P TO (H+K+G2+G3)	13	pf

HEATER CHARACTERISTICS AND RATINGS

AVERAGE CHARACTERISTICS	26.5 VOLTS	600	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		90	VOLTS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

EACH UNIT

PLATE VOLTAGE	50	VOLTS
GRID 2 VOLTAGE	50	VOLTS
PLATE DISSIPATION	2	WATTS
GRID 2 DISSIPATION	0.5	WATTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

EACH UNIT

PLATE VOLTAGE	26.5	VOLTS
GRID 2 VOLTAGE	26.5	VOLTS
GRID 1 VOLTAGE [A]	-4.5	VOLTS
PEAK AF GRID 1 VOLTAGE	4.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	20	MA.
MAXIMUM-SIGNAL PLATE CURRENT	20.5	MA.
ZERO-SIGNAL GRID 2 CURRENT	1.9	MA.
MAXIMUM-SIGNAL GRID 2 CURRENT	5.5	MA.
TRANSCONDUCTANCE	5700	μMHOS
LOAD RESISTANCE	1500	OHMS
TOTAL HARMONIC DISTORTION	7	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	165	MW.

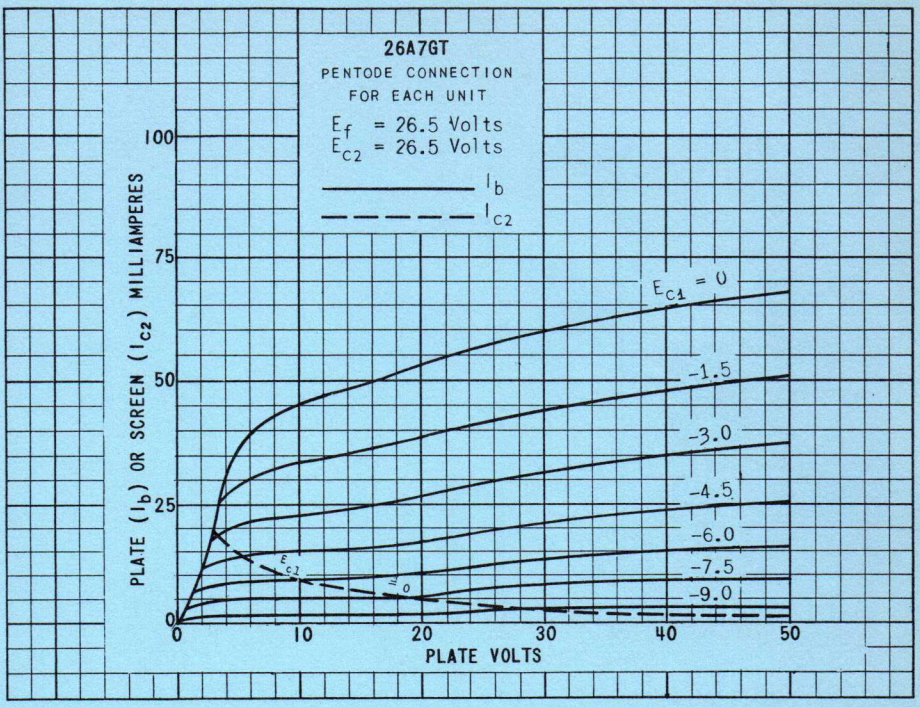
PUSH-PULL CLASS AB1 AMPLIFIER

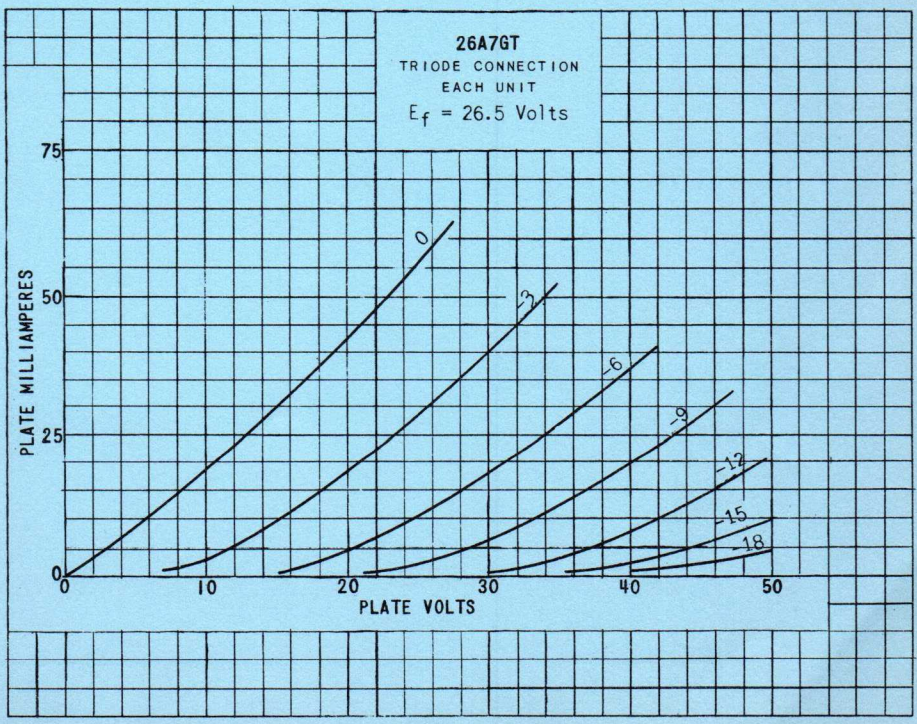
BOTH UNITS

PLATE VOLTAGE	26.5	VOLTS
GRID 2 VOLTAGE	26.5	VOLTS
GRID 1 VOLTAGE [A]	-7	VOLTS
PEAK AF GRID 1 TO GRID 1 VOLTAGE	14	VOLTS
ZERO-SIGNAL PLATE CURRENT	19	MA.
MAXIMUM-SIGNAL PLATE CURRENT	30	MA.
ZERO-SIGNAL GRID 2 CURRENT (APPROX.)	2	MA.
MAXIMUM-SIGNAL GRID 2 CURRENT (APPROX.)	8.5	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	2500	OHMS
TOTAL HARMONIC DISTORTION	5	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	500	MW.

A

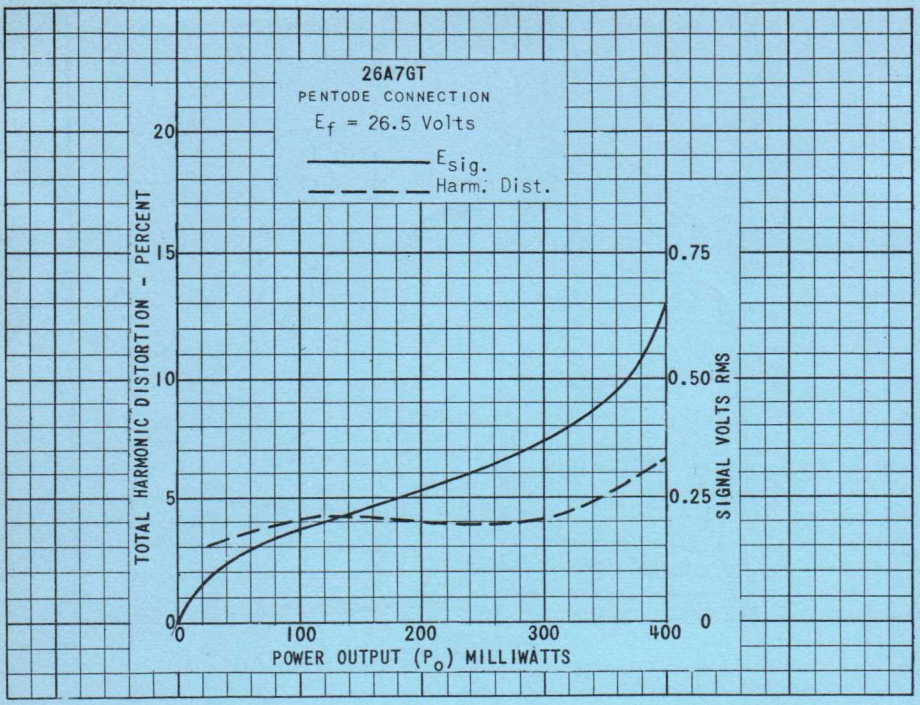
UNDER MAXIMUM RATED CONDITIONS, THE DC RESISTANCE IN EACH GRID CIRCUIT MAY BE AS HIGH AS 0.5 MEGOHM WITH CATHODE BIAS AND 0.1 MEGOHM WITH FIXED BIAS. WHEN THE PLATE VOLTAGE AND THE SCREEN VOLTAGE DO NOT EXCEED A MAXIMUM DESIGN VALUE OF 26.5 VOLTS, THE DC RESISTANCE IN THE GRID CIRCUIT MAY BE AS HIGH AS 0.5 MEGOHM WITH GRID-RESISTOR BIAS.





PRINTED IN U. S. A.

26A7GT


26A7GT
PENTODE CONNECTION
E_f = 26.5 Volts
$E_{sig.}$
Harm. Dist.
TOTAL HARMONIC DISTORTION - PERCENT
SIGNAL VOLTS RMS
POWER OUTPUT (P_o) MILLIWATTS
0
5
10
15
20
0.25
0.50
0.75
100
200
300
400

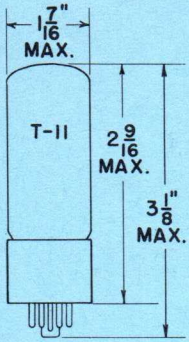
TUNG-SOL

PENTODE

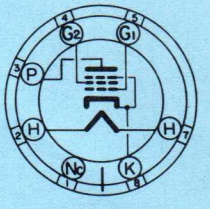
COATED UNIPOTENTIAL CATHODE

HEATER
26.5 VOLTS 0.30AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

SHORT INTERMEDIATE
SHELL 8 PIN OCTAL
LOW LOSS PHENOLIC

7S

THE 26E6WG IS A RUGGEDIZED, SINGLE-ENDED BEAM PENTODE USED IN AF POWER OUTPUT APPLICATIONS REQUIRING APPROXIMATELY FIVE WATTS. THE HEATER DESIGN MAKES THIS TYPE IDEAL FOR OPERATION IN AIRBORNE EQUIPMENT WHERE A 26 VOLT POWER SUPPLY IS NORMALLY AVAILABLE. ALSO THE RUGGEDIZED STRUCTURE IS CAPABLE OF WITHSTANDING SEVER SHOCK AND VIBRATION SUCH AS THAT ENCOUNTERED IN AIRCRAFT.

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	26.5±15%	VOLTS
MAXIMUM DC PLATE VOLTAGE	220	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	12.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.75	WATT
MAXIMUM HEATER CATHODE VOLTAGE	±300	VOLTS
MAXIMUM ALTITUDE	10 000	FEET

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	26.5	VOLTS
HEATER CURRENT	0.3	AMP.
DC PLATE VOLTAGE	200	VOLTS
DC GRID #1 VOLTAGE	-14	VOLTS
DC GRID #2 VOLTAGE	135	VOLTS
PEAK AF SIGNAL VOLTAGE	14	VOLTS
ZERO SIGNAL PLATE CURRENT	61	mA.
ZERO SIGNAL GRID #2 CURRENT	3.0	mA.
MAXIMUM SIGNAL PLATE CURRENT	66	mA.
MAXIMUM SIGNAL GRID #2 CURRENT	9	mA.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

CLASS A_1 AMPLIFIER

PLATE RESISTANCE	18 000	OHMS
TRANSCONDUCTANCE	7 100	μMHOS
EXTERNAL PLATE LOAD RESISTANCE	2 600	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
POWER OUTPUT	6	WATTS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 26.5V, E_b = 200Vdc, E_{c2} = 135Vdc, E_{c1} = -14Vdc

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	---	---	---	---	mA
HEATER-CATHODE LEAKAGE	0	75	---	---	---	---	μAdc
TOTAL GRID CURRENT	0	-3	---	---	---	---	μAdc
PLATE CURRENT (1)	43	79	---	---	--[A]	---	mAdc
POWER OUTPUT [B]	4.8	---	---	---	2.9	---	WATTS
PLATE CURRENT (2) (E_{c1} = 45 Vdc)	0	1	---	---	---	---	mAdc
SCREEN GRID CURRENT	0	6	---	---	---	---	mAdc
TRANSCONDUCTANCE	5800	8400	---	---	---	---	μMHOS
GRID EMISSION (E_b=E_{c1}=E_{c2}=30Vdc)	180	---	---	---	---	---	mAdc

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION [C] (R_p=2000, E_{c1}=-22Vdc)	---	750	mVac
LOW FREQUENCY VIBRATION [D] (R_p=2000, E_{c1}=-22 dc)	---	350	mVac
SHOCK [E] (HAMMER ANGLE =48°)	---	---	
VIBRATIONAL FATIGUE [F]			
POST SHOCK AND FATIGUE END POINTS			
LOW FREQUENCY VIBRATION	---	500	mVac
HEATER-CATHODE LEAKAGE	0	100	μAdc
PLATE CURRENT (2)	0	2	mAdc
POWER OUTPUT	4.15	---	WATTS
MECHANICAL RESONANCE [G]	---	---	
AF NOISE [H] (E_{sig}=200 mVac, R_p=2000)	---	17	VU
HEATER CYCLING LIFE TEST (E_f=32Vac, E_b=E_{c2}=E_{c1}=0)	---	---	

NOTES

[A] DURING THE FIRST 100 HOURS OF LIFE, PLATE CURRENT (1) SHALL NOT CHANGE BY MORE THAN 15% FROM ITS INITIAL VALUE.

[B] E_{sig}=9.9 Vac, R_p=2600

[C] SEE MIL-E-1C 4.9.20.3

[D] SEE MIL-E-1C 4.9.20.4

[E] SEE MIL-E-1C 4.9.20.5

[F] SEE MIL-E-1C 4.9.20.6

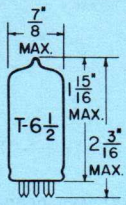
[G] THE MOUNT SHALL EXHIBIT NO PRONOUNCED MECHANICAL RESONANCE BELOW 100 CPS.

[H] SEE MIL-E-1C 4.10.3.2

TUNG-SOL

DOUBLE DIODE

MINIATURE TYPE

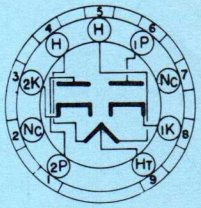


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
26.5 VOLTS 0.20 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9BS

THE 26Z5W IS A RUGGEDIZED HEATER-CATHODE TYPE DOUBLE DIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS SUITABLE FOR USE IN HALF OR FULL WAVE RECTIFIER APPLICATIONS OR AS A VOLTAGE DOUBLER. THE HEATER DESIGN MAKES THIS TYPE IDEAL FOR OPERATION IN AIRBORNE EQUIPMENT WHERE A 26 VOLT POWER SUPPLY IS NORMALLY AVAILABLE. ALSO THE RUGGEDIZED STRUCTURE IS CAPABLE OF WITHSTANDING SEVERE SHOCK AND VIBRATION SUCH AS THAT ENCOUNTERED IN AIRCRAFT.

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	26.5±15%	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1375	VOLTS
MAXIMUM DC PLATE CURRENT (EACH PLATE)	300	mA.
MAXIMUM DC OUTPUT CURRENT (PER PLATE)	55	mA.
MAXIMUM SURGE CURRENT	1	AMP.
MAXIMUM HEATER-CATHODE VOLTAGE	450	VOLTS
MAXIMUM ALTITUDE	10 000	FEET
MAXIMUM SHOCK	700	G

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
FULL-WAVE RECTIFIER

	INPUT TO FILTER CAPACITOR	INPUT TO FILTER CHOKE	
HEATER VOLTAGE	26.5	26.5	VOLTS
HEATER CURRENT	0.20	0.20	AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS	325	450	VOLTS
INPUT CONDENSER	10	---	μf
OUTPUT CHOKE	---	10	HENRYS
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE (EACH PLATE)	300	---	OHMS
DC OUTPUT CURRENT	100	100	mA.
DC OUTPUT VOLTAGE AT INPUT TO FILTER	325	380	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Ef = 26.5V, Epp/p = 400Vac, RL = 3650 Ohms, CL = 8μf
EXCEPT AS MODIFIED BELOW

	INITIAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	180	220	mAdc
OPERATION [AB]	100	---	mAdc
HEATER CATHODE LEAKAGE			
(EHK = Eo)[B]	0	±150	μAdc
GRID EMISSION (1)			
(E_{2B}=O; E_{1b}=40Vdc)	160	---	mAdc
GRID EMISSION (2)			
(E_{1B}=O; E_{2b}=40Vdc)	160	---	mAdc

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[C]			
(NO VOLTAGES)	---	---	
LOW FREQUENCY VIBRATION[D]			
(NO VOLTAGES)	---	---	
SHOCK[EF]			
(HAMMER ANGLE = 48°C)	---	---	
VIBRATIONAL FATIGUE[G]	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
HEATER-CATHODE LEAKAGE	---	250	Vdc
OPERATION	94	---	mAdc
LIFE TEST[H]	1500	---	HOURS
LIFE TEST END POINT[J]			
OPERATION	88	---	mAdc
HEATER CYCLING LIFE TEST[KL]	2000	---	CYCLES

NOTES

[A] SEE MIL-E-1C 4.10.13

[B] IN A FULL-WAVE CIRCUIT ADJUST Zp/p SUCH THAT A TUBE HAVING Etd=22 Vdc AT 100 mAdc PER PLATE GIVES I_o =110 mAdc.

[C] SEE MIL-E-1C 4.9.20.3

[D] SEE MIL-E-1C 4.9.20.4

[E] SEE MIL-E-1C 4.9.20.5

[F] AFTER SHOCK TESTS, THE TUBES SHALL MEET POST-SHOCK AND FATIGUE TEST END POINT REQUIREMENTS. IN ADDITION, THE TUBES SHALL NOT SHOW PERMANENT SHORTS OR OPEN CIRCUITS WHEN TESTED PER 4.7 (F-1e) AFTER SHOCK TESTS.

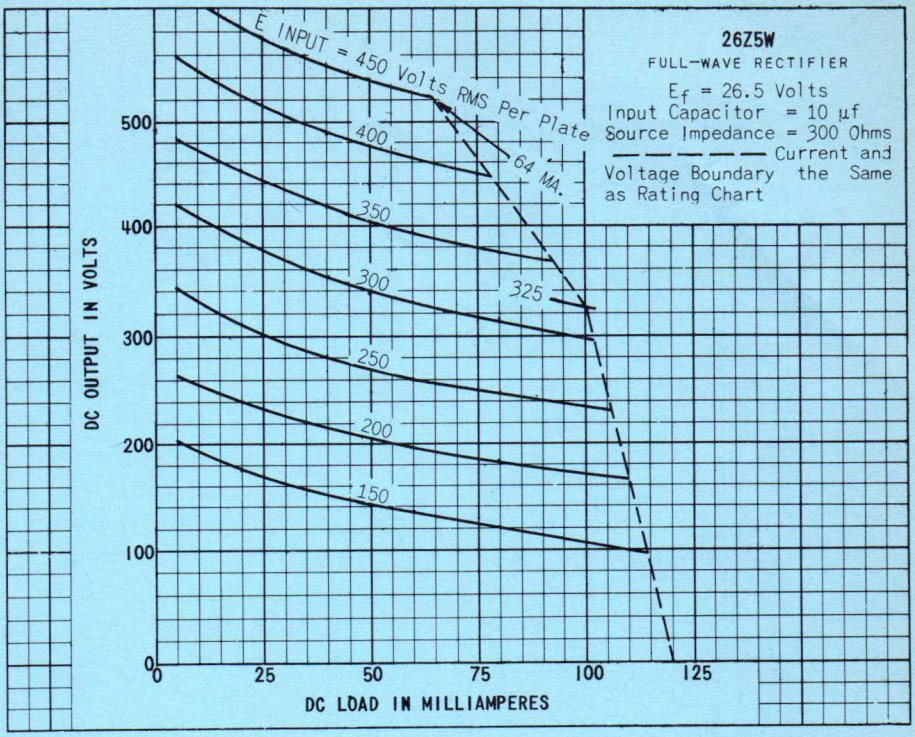
[G] SEE MIL-E-1C 4.9.20.6

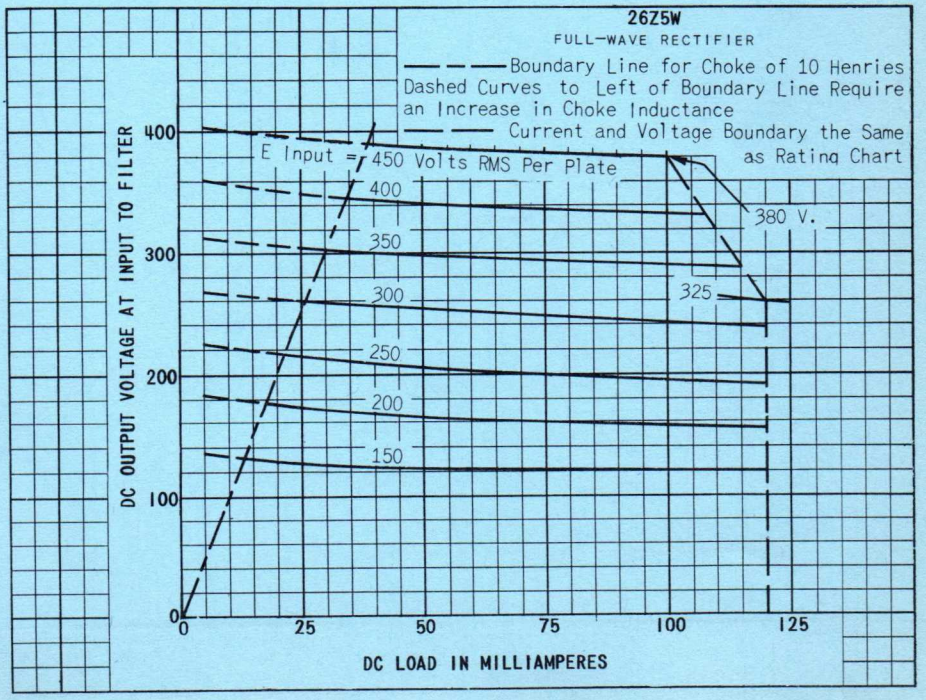
[H] IN LIFE TEST CONDITIONS THE VALUES OF RL AND CL GIVEN IN TEST CONDITIONS MAY BE CONSIDERED APPROXIMATE AND SHALL BE ADJUSTED INITIALLY TO GIVE I_o EQUAL TO OR GREATER THAN 110mAdc WITH Ib EQUAL TO OR GREATER THAN 300 mA. Ehk = Eo.

[J] SEE MIL-E-1C 4.11.4

[K] SEE MIL-E-1C 4.11.7

[L] EF=32vac, Ehk=-450V; Ep=Ec=O. TUBES TO PASS If, Ihk AND LIFE TEST END POINTS.



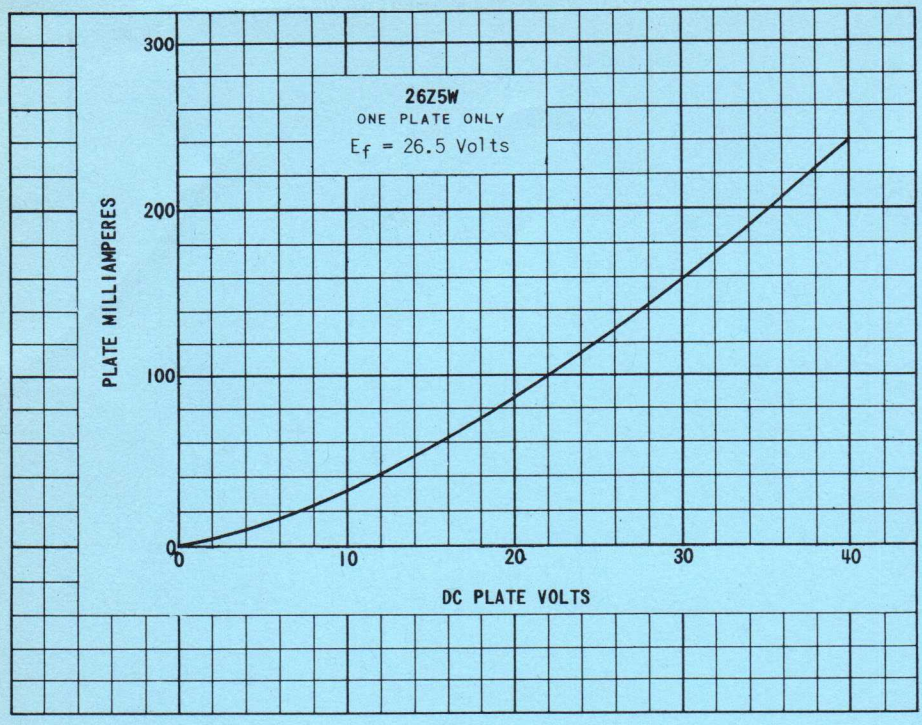


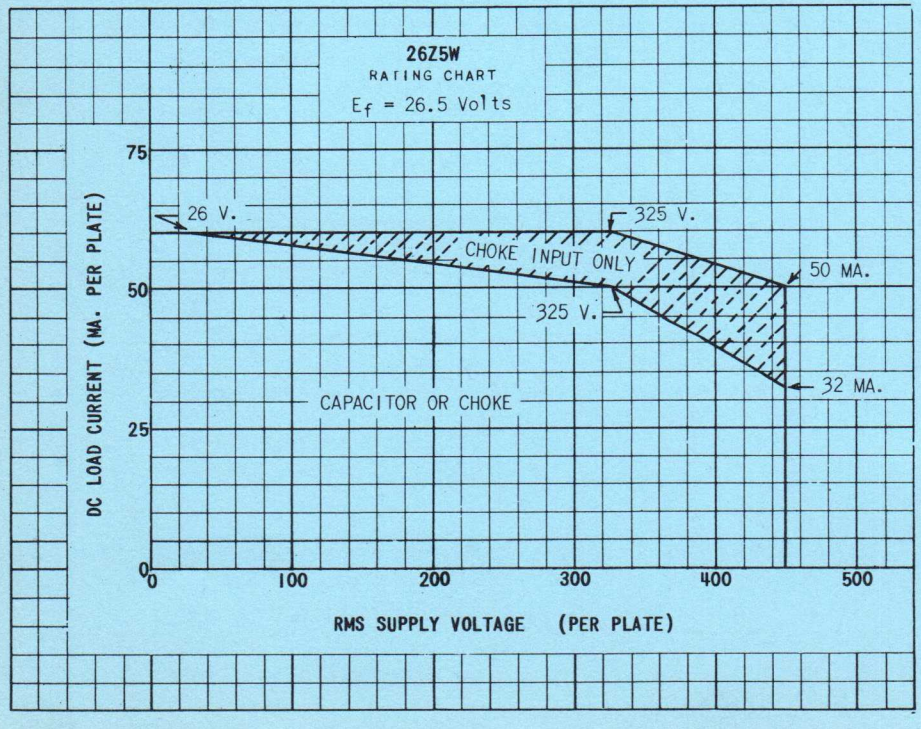
PRINTED IN U. S. A.

26Z5W

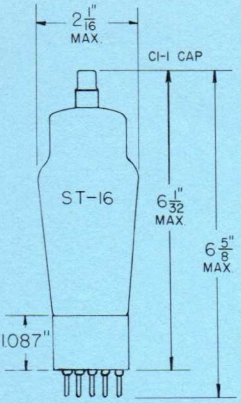
PREMIUM TUBE

TENTATIVE DATA





TUNG-SOL



GLASS BULB

THYRATRON

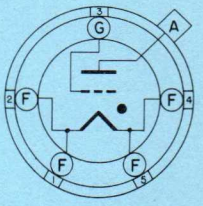
ARGON AND MERCURY-VAPOR

FILAMENT

2.5±0.125 VOLTS 7 AMP.

AC OR DC

VERTICAL MOUNTING POSITION
(BASE DOWN)



BOTTOM VIEW

THE 323B 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 323B EMPLOYS A MEDIUM, 5 PIN BASE.

ELECTRICAL DATA

FILAMENT VOLTAGE	2.5±0.125	VOLTS
FILAMENT CURRENT @ Ef = 2.5 VOLTS	7	AMP.
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 AMPERES		
GRID VOLTS =-20, GRID RESISTOR = 10,000 OHMS	360	μSECONDS
ANODE VOLTS =120, ANODE CURRENT = 1.5 AMPERES		
GRID VOLTS =- 500, GRID RESISTOR = 100,000 OHMS	60	μSECONDS
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	A5-11 MEDIUM
CAP	C1-1 SMALL
NET WEIGHT	3 OUNCES MAXIMUM
SOCKET	MEDIUM, 5-PIN

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

ABSOLUTE VALUES

		MIN.	MAX.	
PEAK ANODE VOLTAGE				
FORWARD		---	1250	VOLTS
REVERSE		---	1250	VOLTS
GRID VOLTAGE				
PEAKOR DC BEFORE TUBE CONDUCTION		---	-500	VOLTS
AVERAGE DURING TUBE CONDUCTION—NOTE 1		---	-10	VOLTS
ANODE CURRENT				
PEAK		---	6	AMP.
AVERAGE — NOTE 2		---	1.5	AMP.
FAULT— FOR DURATION OF 0.1 SECOND MAX. —NOTE 3		---	120	AMP.
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

NOTES

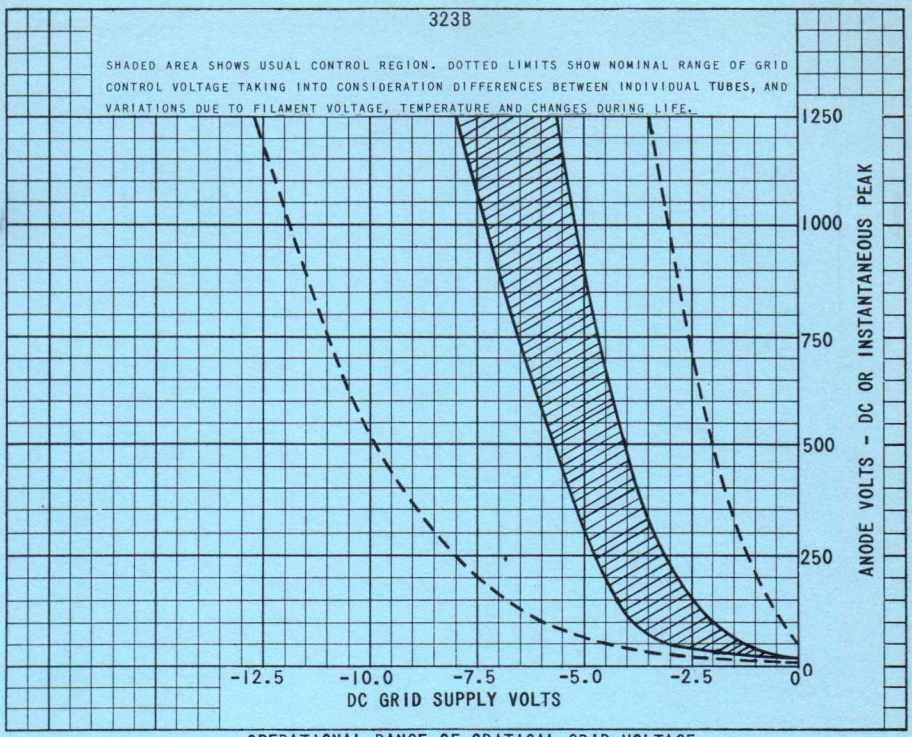
1. AVERAGED OVER ONE CONDUCTING PERIOD.

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.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

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.

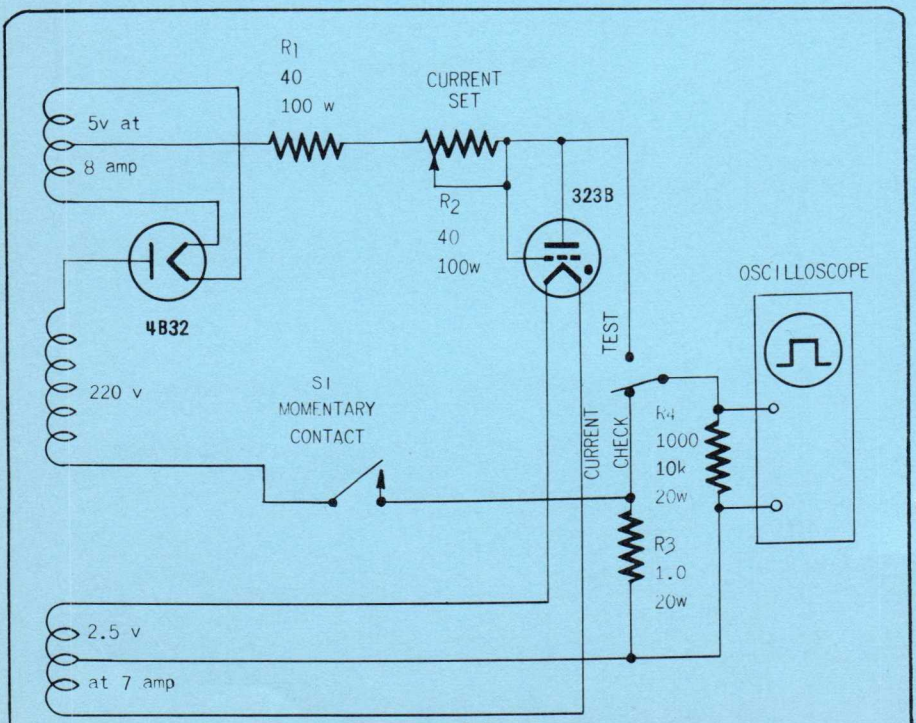


FIGURE 1

TUNG-SOL

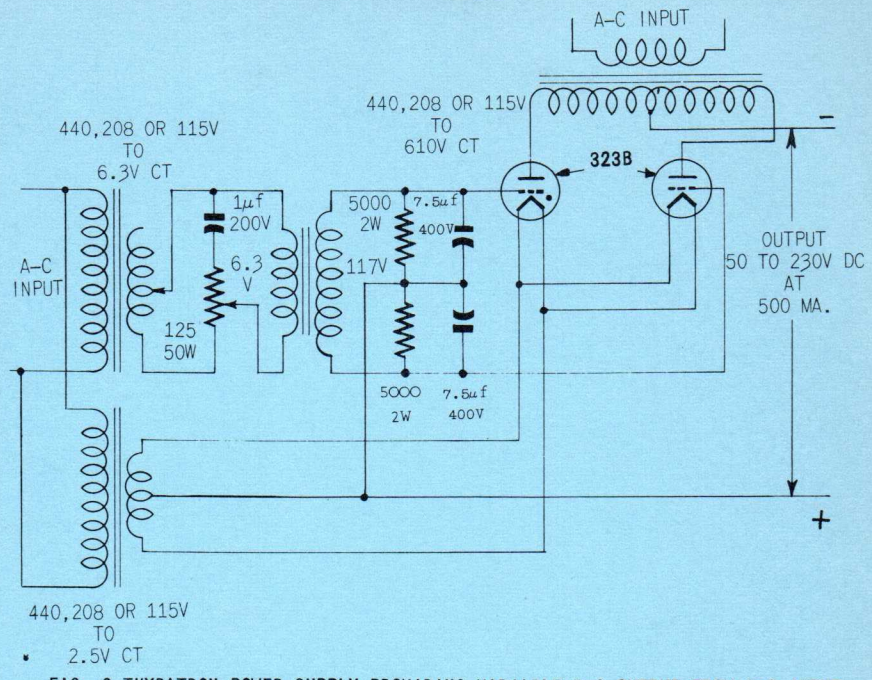


FIG. 2 THYRATRON POWER SUPPLY PROVIDING VARIABLE D-C OUTPUT FROM A-C INPUT

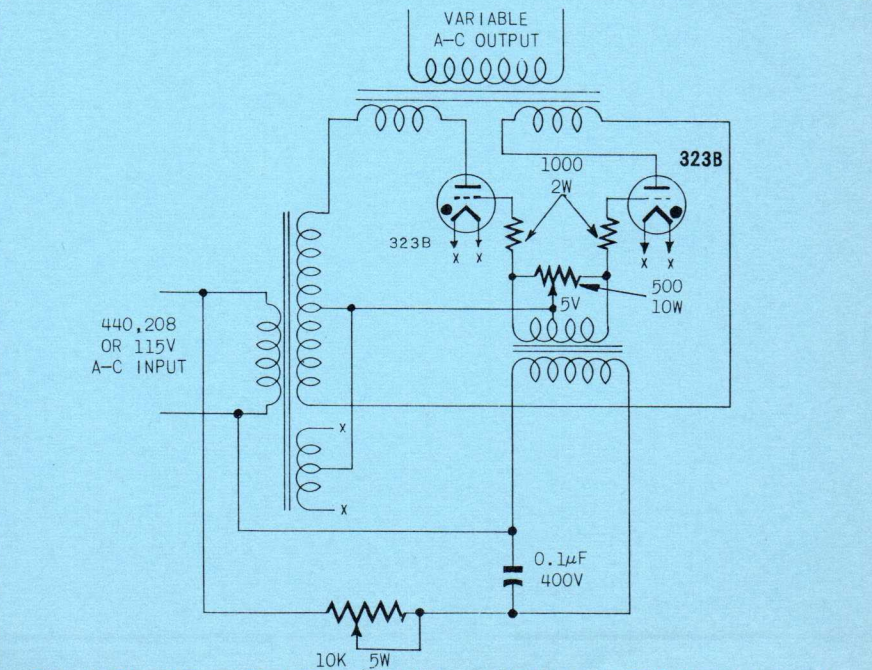


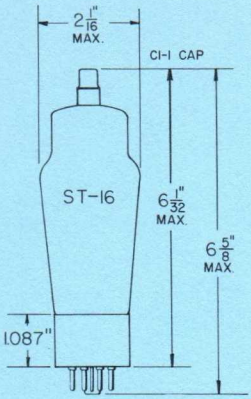
FIG. 3 THYRATRON POWER SUPPLY PROVIDING VARIABLE A-C OUTPUT FROM A-C INPUT

PRINTED IN U.S.A.

TUNG-SOL

THYRATRON

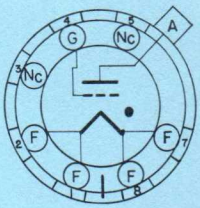
ARGON AND MERCURY VAPOR



FILAMENT

2.5±0.125 VOLTS 7 AMP.

MOUNTING POSITION
VERTICAL, BASE DOWN



BOTTOM VIEW
MEDIUM SHELL OCTAL
7 PIN BASE

GLASS BULB

THE 393A 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 393A EMPLOYS A 7 PIN OCTAL BASE.

ELECTRICAL DATA

FILAMENT VOLTAGE	2.5±0.125	VOLTS
FILAMENT CURRENT @ Ef =2.5 VOLTS	7	AMP.
CATHODE HEATING TIME -MINIMUM	15	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	1.8	$\mu\mu f$
DE-IONIZATION TIME -APPROXIMATE		
ANODE VOLTS = 120 ANODE CURRENT = 1.5 AMP.		
GRID VOLTS =- 20, GRID RESISTOR = 10,000 OHMS	360	μSEC.
ANODE VOLTS = 120, ANODE CURRENT =1.5 AMP.		
GRID VOLTS =-500, GRID RESISTOR = 100,000 OHMS	60	μSEC.
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	B7-12 MEDIUM SHELL OCTAL
CAP	C1-1 SMALL
NET WEIGHT	3 OUNCES MAXIMUM
SOCKET	OCTAL

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

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	AMP.
AVERAGE – NOTE 2		---	1.5	AMP.
FAULT–FOR DURATION OF 0.1 SEC. MAX. –NOTE 3		---	120	AMP.
GRID CURRENT				
AVERAGE – NOTE 4		---	+0.01	AMP.
OPERATING FREQUENCY	(PER SEC)	---	420	CYCLES
ALTITUDE		---	10,000	FEET
TEMPERATURE RANGE -- NOTE 5		40	80	°C
FILAMENT VOLTAGE		2.37	2.63	VOLTS

NOTES

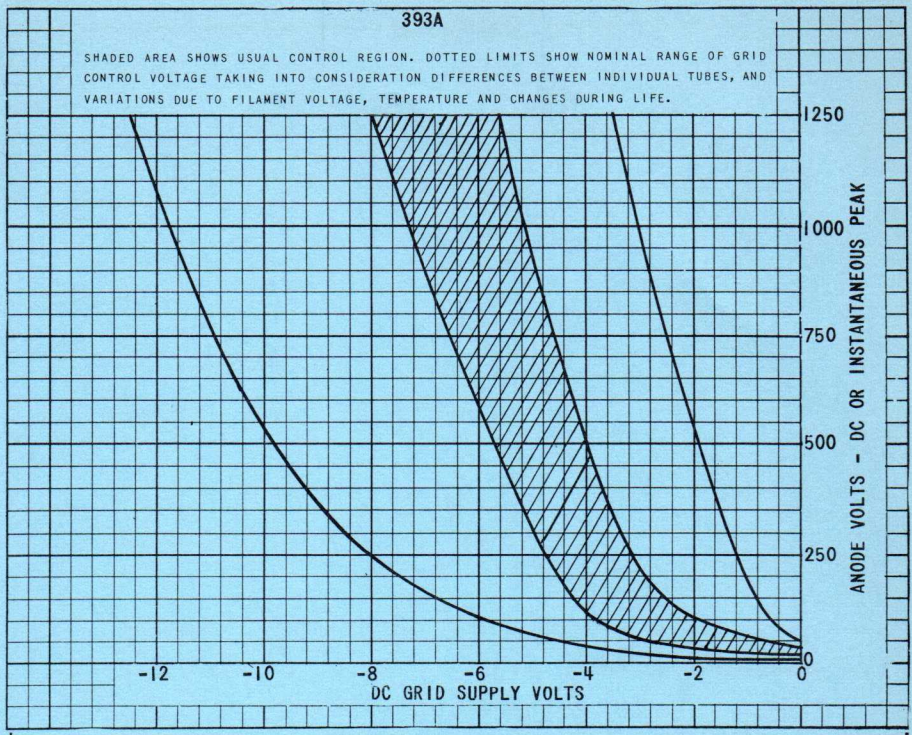
1. AVERAGED OVER ONE CONDUCTING PERIOD.

2. AVERAGED OVER ANY INTERVAL OF FIVE SECONDS.

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.



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.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

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.

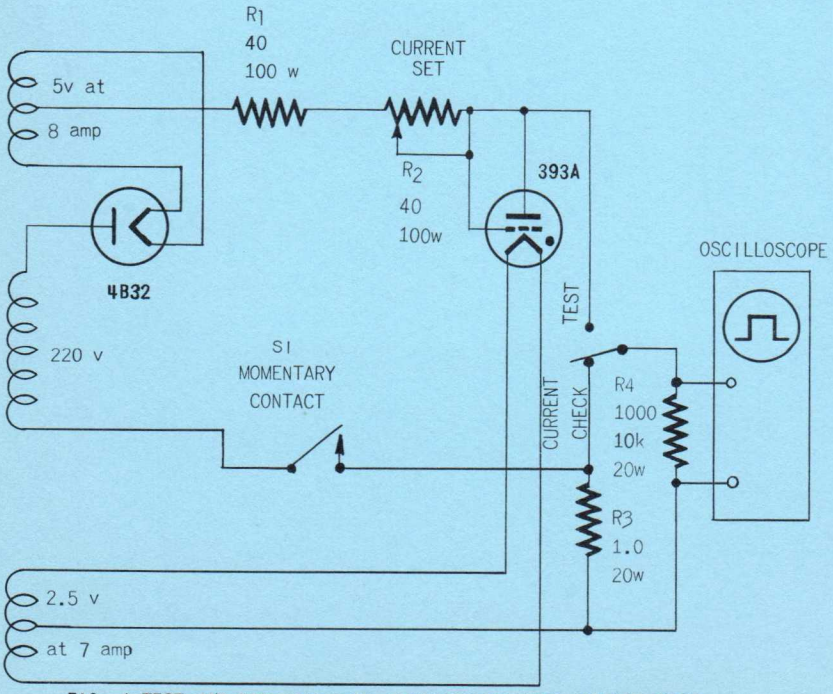


FIG. 1 TEST JIG FOR MEASURING EMISSION BY TUBE VOLTAGE DROP

TUNG-SOL

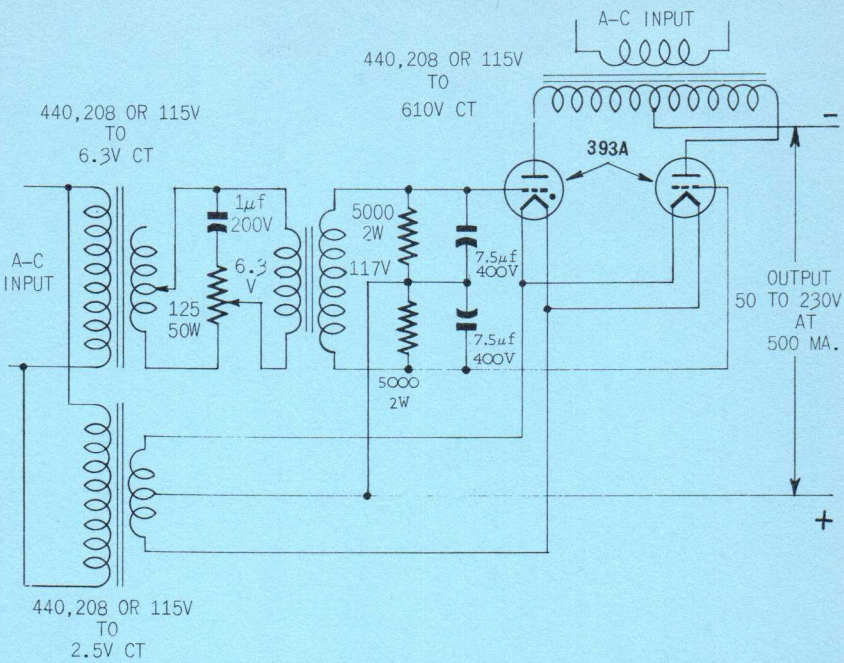


FIG. 2 THYRATRON POWER SUPPLY PROVIDING VARIABLE D-C OUTPUT FROM A-C INPUT

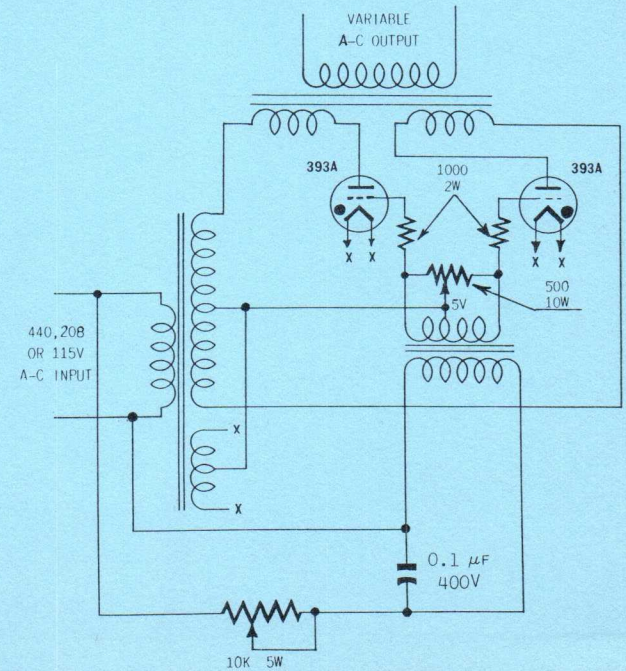


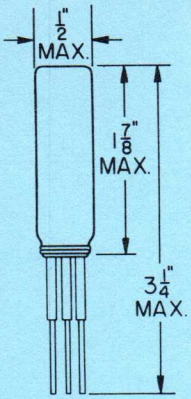
FIG. 3 THYRATRON POWER SUPPLY PROVIDING VARIABLE A-C OUTPUT FROM A-C INPUT

PRINTED IN U.S.A.

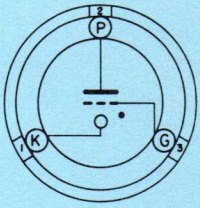
TUNG-SOL

THYRATRON

COLD CATHODE



GLASS BULB



BOTTOM VIEW

THE 395A IS A SMALL SIZE, LIGHT WEIGHT, COLD CATHODE THYRATRON USED PRIMARILY IN RELAY SERVICE. THE CHARACTERISTIC NEON GLOW DISPLAYED ON THE SURFACE OF THE CATHODE WHILE THE TUBE IS CONDUCTING, MAKES THE USE OF AUXILIARY VISUAL INDICATING DEVICES UNNECESSARY. THE MINUTE TRIGGERING CURRENT REQUIREMENTS AND THE LACK OF NECESSITY FOR FILAMENT POWER MAKE THIS TUBE EXTREMELY SUITABLE FOR USE IN TRANSISTORIZED EQUIPMENT OR IN BATTERY OPERATED EQUIPMENT. THE 395A WILL FIRE DIRECTLY FROM A SIGNAL SUPPLIED BY EITHER A VACUUM PHOTO TUBE OR A CADMIUM SULFHIDE PHOTO CELL.

THE 395A HAS ALSO FOUND USE AS A TRIGGER TUBE, AS A RELAXATION OSCILLATOR, AND AS A VOLTAGE REGULATOR.

MAXIMUM RATINGS FOR RELAY SERVICE

ABSOLUTE VALUES

POSITIVE ANODE VOLTAGE	140	VDC
NEGATIVE ANODE VOLTAGE (WITHOUT (WITHOUT DISCHARGE TO A POSITIVE GRID)	-60	VDC
POSITIVE GRID BIAS VOLTAGE (WITHOUT GRID IONIZATION)	70	VDC
TOTAL POSITIVE GRID VOLTAGE TO INSURE BREAKDOWN (WITH R_g = 0.1 MEGOHM MAX.) (MIN.)	87	VDC
NEGATIVE GRID VOLTAGE (WITHOUT DISCHARGE TO A POSITIVE ANODE)	-10	VDC
GRID TRANSFER CURRENT	5	μADC
CATHODE CURRENT PEAK, RECURRING (AVERAGED OVER 1 SECOND)	35	MA.
CATHODE CURRENT AVERAGE (SEE LIFE EXPECTANCY CURVE)	1	MA.
PEAK INVERSE ANODE CURRENT		

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

ELECTRICAL DATA
TYPICAL VALUES

CATHODE	COLD	
IONIZATION TIME (AT E_b=130V, Ec = 75V, e_c = 20V. PULSE, R_g=0.1 MEGOHMS)	23	μSEC
ANODE VOLTAGE DROP (AT I_b =10. MA.)	75	VDC
GRID VOLTAGE DROP (AT I_c =10. MA.)	65	VDC
ANODE IONIZATION VOLTAGE (AT E_g = 0)	170	VDC
GRID IONIZATION VOLTAGE	75	VDC
REQUIRED TRANSFER CURRENT FOR TRANSITION OF DISCHARGE TO ANODE AT 130 VOLTS DC	2.5	μAMP.

MECHANICAL DATA

TEMPERATURE	−40 TO +60	°C
ALTITUDE FOR FULL RATINGS	10 000	FEET
NORMAL ILLUMINATION (SEE APPLICATION NOTES)	5 TO 150	lm/SQ.FT.

TYPICAL OPERATING CONDITIONS

ANODE SUPPLY VOLTAGE	130	VDC
POSITIVE GRID BIAS	70	VDC
GRID TRIGGER VOLTAGE	20	VOLTS
ANODE CIRCUIT RESISTANCE	6800	OHMS
GRID CIRCUIT RESISTANCE	1	MEGOHM

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

APPLICATION NOTES

THE 395A THYRATRON CONTAINS A CATHODE, A TRIGGER GRID AND AN ANODE WITHIN A GASEOUS ATMOSPHERE. IF AN INCREASING POSITIVE VOLTAGE IS APPLIED TO THE GRID, A MINUTE PRE-IONIZATION CURRENT WILL FLOW UNTIL THE CRITICAL GRID CURRENT OF ABOUT TWO MICROAMPERES IS REACHED. AT THIS POINT THE REGION BETWEEN THE GRID AND CATHODE "BREAKS DOWN" OR IONIZES. IF THE APPLIED ANODE VOLTAGE IS EQUAL TO OR GREATER THAN THE GRID VOLTAGE, THE GLOW WILL THEN TRANSFER TO THE CATHODE-ANODE REGION. THUS, A VERY LOW ENERGY SIGNAL IN THE GRID CIRCUIT CAN CONTROL MUCH HIGHER ENERGY IN THE ANODE CIRCUIT. IF, IN THIS ILLUSTRATION AN ANODE CURRENT OF 10 MILLIAMPERES WERE TO FLOW, THE TUBE HAS PROVIDED CURRENT AMPLIFICATION OF 5,000.

AS WITH ANY GAS TUBE, ONCE THE TUBE CONDUCTS, THE TUBE VOLTAGE DROP REMAINS VIRTUALLY CONSTANT AND THE CURRENT THROUGH THE TUBE IS LIMITED BY THE CIRCUIT RESISTANCE. IN THE ANODE CIRCUIT THIS MAY BE THE RESISTANCE OF THE LOAD ITSELF, OR, THE LOAD PLUS ADDITIONAL LIMITING RESISTANCE. THE GRID CIRCUIT SHOULD CONTAIN A 5,000 OHM SERIES RESISTANCE IF THE SOURCE RESISTANCE IS LOWER THAN THIS FIGURE. IF THE GRID CIRCUIT RESISTANCE IS ABOVE 10 MEGOHMS, HOWEVER, IT MAY BE NECESSARY TO CONNECT A SMALL CAPACITANCES BETWEEN THE GRID AND CATHODE. THIS IS TO STORE ENOUGH ENERGY TO INSURE GRID IONIZATION.

IF THE 395A IS USED IN TOTALLY ENCLOSED EQUIPMENT THERE MAY BE A DELAY OF SEVERAL MILLISECONDS BEFORE FIRING. THIS CAN BE ALLEVIATED BY PROVIDING OVER-VOLTAGE ON THE GRID SIGNAL OR LOCATING THE TUBE WHERE IT WILL RECEIVE SOME ILLUMINATION FROM PILOT LIGHTS OR THE HEATERS OF VACUUM TUBES. THE 395A IS RADIOACTIVELY DOSED TO MINIMIZE THIS DELAY. THE MAGNITUDE OF ACTIVITY IS NOT GREAT ENOUGH TO INSTITUTE A PERSONAL HAZARD. HOWEVER, PERSONS ARE CAUTIONED NOT TO HANDLE BROKEN TUBES TO AVOID GETTING THE ACTIVE MATERIAL DIRECTLY INTO THE BLOODSTREAM THROUGH CUTS. IF A PERSON CUTS HIMSELF ON A BROKEN TUBE, THE CUT SHOULD BE CLEANSED IMMEDIATELY. AN OPEN CUT CAN BE CLEANSED BY HOLDING IT IN RUNNING WATER.

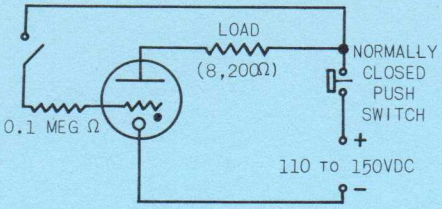
FOR "END ON" VISUAL INDICATION THE 395A CAN BE MOUNTED IN A RECESS IN A PANEL. FOR CURRENT LEVELS BELOW TWO MILLIAMPERES, THE ILLUMINATION CAN BE INCREASED BY USING FOR THE RECESS, TUBING WITH SHINY INNER WALLS. IF THE TUBE IS NOT USED IN A RECESS, THE BULB SIDES SHOULD BE SHIELDED (eg; NICKEL MESH) TO PREVENT HAND CAPACITY OR STRONG ELECTRIC FIELDS FROM ALTERING FIRING POTENTIALS.

TYPICAL CIRCUIT CONFIGURATIONS ARE ILLUSTRATED ABOVE. AS WITH ANY THYRATRON CIRCUIT, ONCE THE TUBE CONDUCTS, THE GRID WILL NOT REGAIN CONTROL UNTIL THE ANODE VOLTAGE FALLS LOW ENOUGH TO EXTINGUISH THE CATHODE-ANODE GLOW. THIS IS USUALLY ACCOMPLISHED BY BREAKING THE ANODE CIRCUIT. HOWEVER, IT CAN ALSO BE DONE UNDER D.C. OPERATION, BY CAUSING THE ANODE CURRENT TO FLOW IN SAW TOOTH STEPS. THE SAW TOOTH IS GENERATED BY RUNNING THE TUBE AS A RELAXATION OSCILLATOR BY INSERTING SUFFICIENT CAPACITY BETWEEN THE CATHODE AND ANODE. FIGURE 3 ILLUSTRATES AN APPLICATION OF THIS IDEA. THE 395A WILL ALSO REGAIN GRID CONTROL ON EACH CYCLE IF IT IS RUN FROM HALF WAVE RECTIFIER A.C. FIGURE 4 ILLUSTRATES AN APPLICATION OF THE TUBE ON A.C. OPERATION OF THE TUBE ON A.C. WITHOUT THE SERIES DIODE IS NOT RECOMMENDED.

THE FLAT ANODE VOLTAGE-CURRENT CHARACTERISTIC OF THE 395A HAS LED TO THE USE OF THE TUBE AS A VOLTAGE REGULATOR OR AS AN OVER VOLTAGE PROTECTIVE DEVICE. THE TUBE HAS ALSO FOUND USE AS A TRIGGER DEVICE CARRYING AMPERES OF CURRENT FOR SEVERAL SECONDS IN "ONE SHOT" APPLICATIONS.

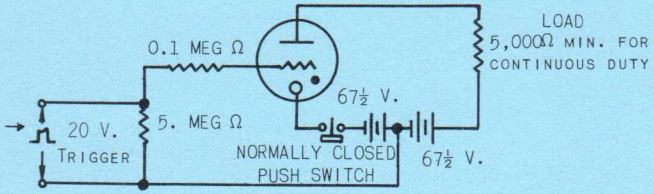
PRINTED IN U.S.A.

TUNG-SOL



7400 USED AS A MECHANICALLY OPERATED RELAY

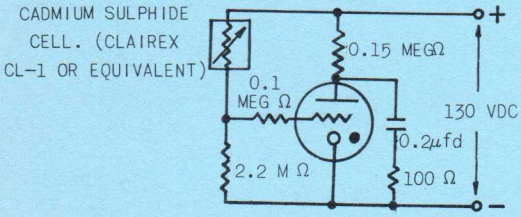
FIG. 1



395A OPERATED FROM DRY BATTERIES

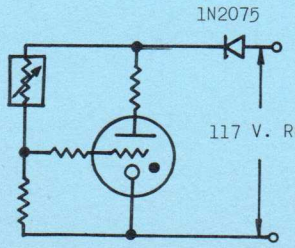
FIG. 2

→ INDICATES A CHANGE.



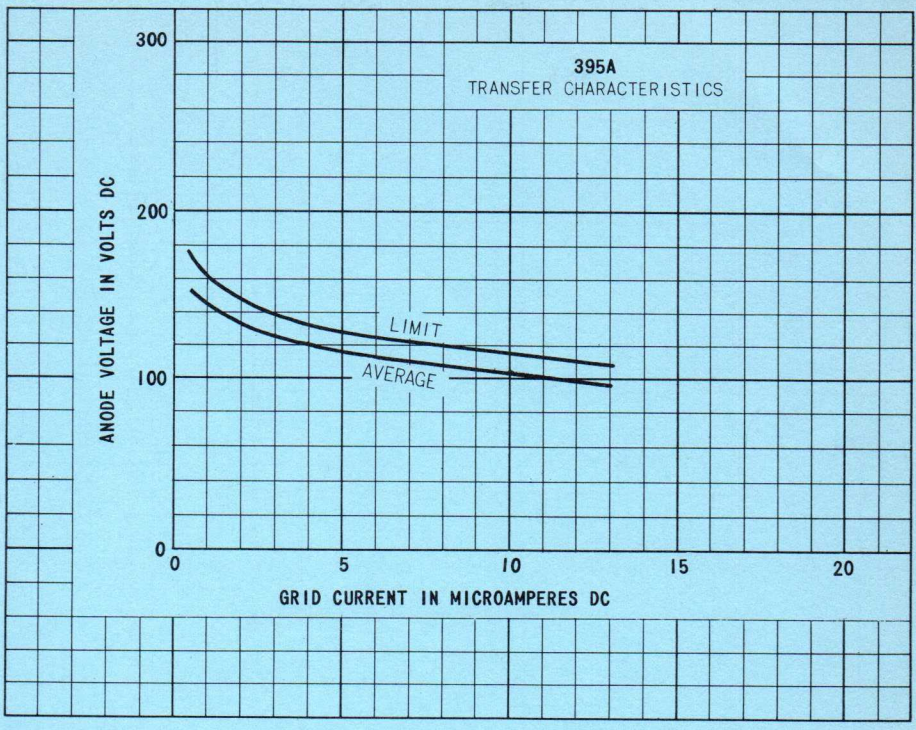
7400 ACTING AS A RELAY FOR A CADMIUM SULPHIDE PHOTO CELL

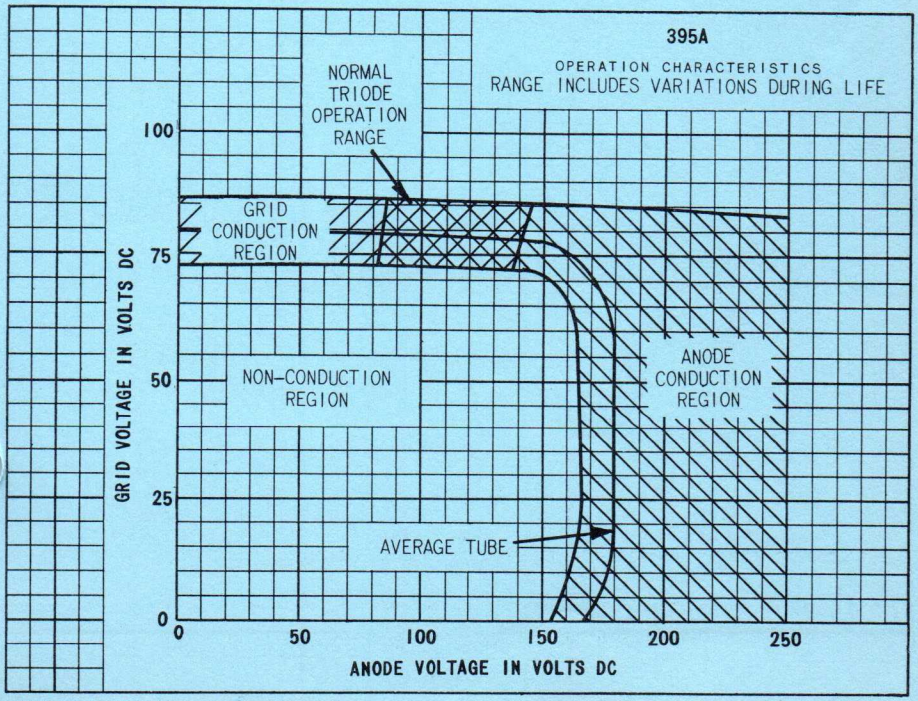
FIG. 3



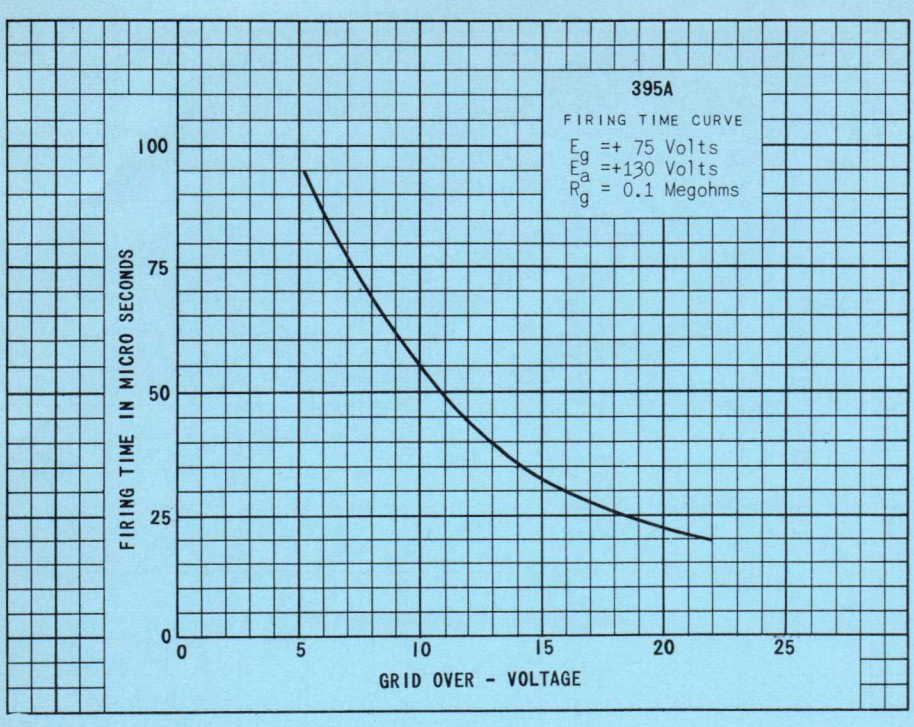
SAME AS FIGURE 3 BUT OPERATED FROM A.C. LINE

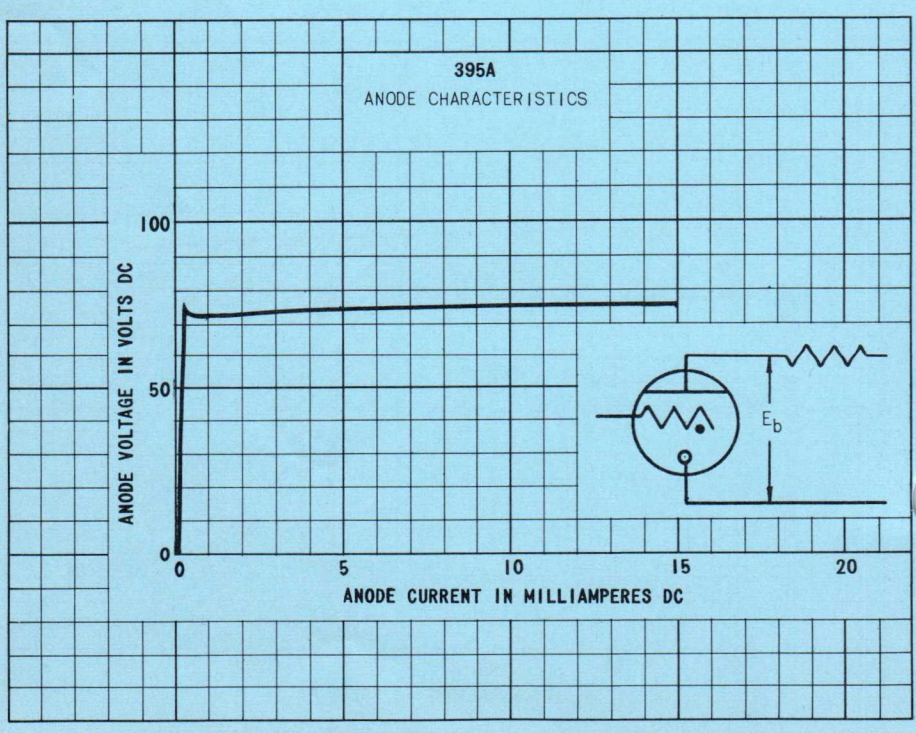
FIG. 4

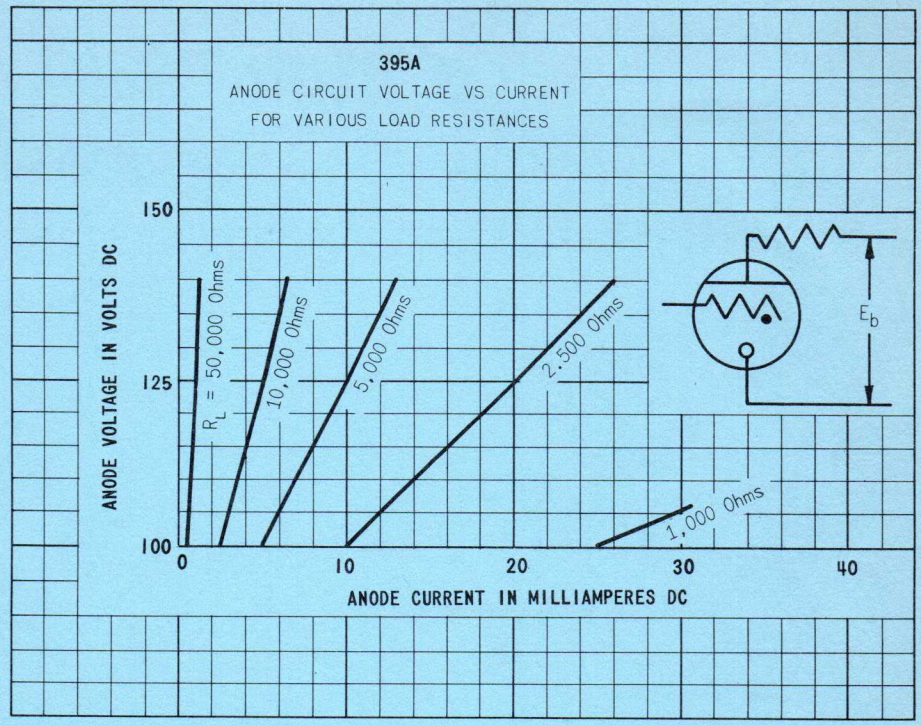


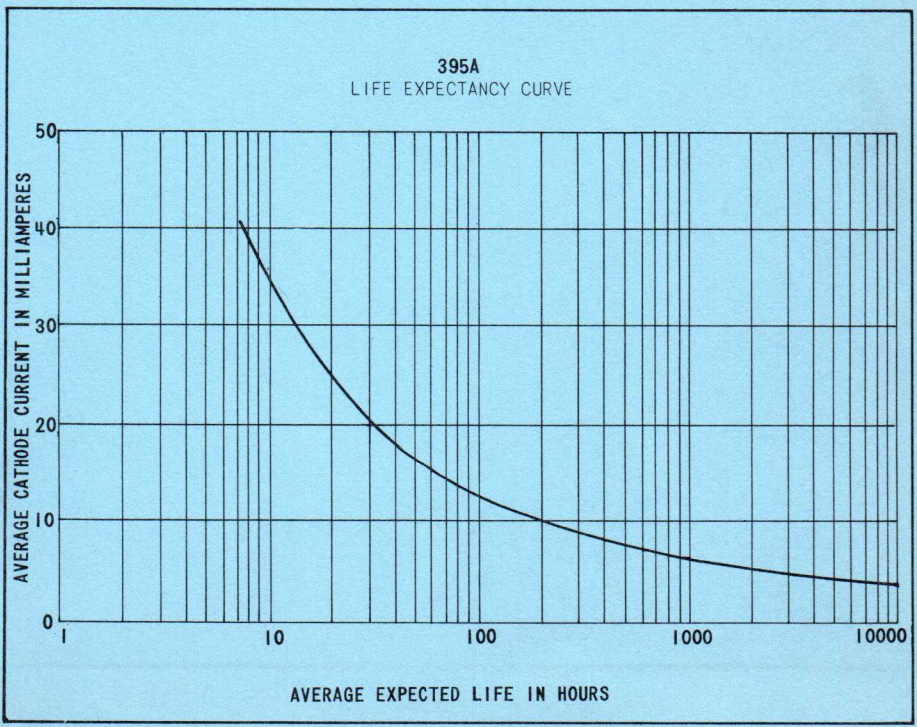


PRINTED IN U.S.A.


395A
FIRING TIME CURVE
E_g =+ 75 Volts
E_a =+130 Volts
R_g = 0.1 Megohms
FIRING TIME IN MICRO SECONDS
100
75
50
25
0
0
5
10
15
20
25
GRID OVER - VOLTAGE


395A
ANODE CHARACTERISTICS
ANODE VOLTAGE IN VOLTS DC
100
50
0
0
5
10
15
20
ANODE CURRENT IN MILLIAMPERES DC
E_b



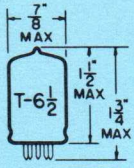


PRINTED IN U. S. A.

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

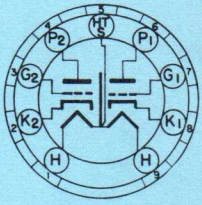


GLASS BULB

HEATER

SERIES	PARALLEL
40±5% VOLTS	20±5% VOLTS
.05 AMP.	0.1 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

THE TYPE 407A IS A NINE PIN MINIATURE, MEDIUM MU, TWIN TRIODE, FEATURING SEPARATE CATHODES. THE HEATER IS DESIGNED FOR PARALLEL OPERATION AT 20 VOLTS OR FOR SERIES OPERATION AT 40 VOLTS. OTHER CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 2C51 AND THE 5670. A SHIELD IS ATTACHED TO THE CENTER OF THE HEATER TO DECREASE POSSIBLE INTERACTION BETWEEN TRIODE SECTIONS. THE USEFUL FREQUENCY RANGE AS AN AMPLIFIER, MIXER, OSCILLATOR, OR MULTIVIBRATOR EXTENDS FROM LOW FREQUENCY TO VHF.

BECAUSE OF THE INHERENT LOW NOISE AND CHOICE OF EITHER 20 VOLT OR 40 VOLT HEATER OPERATION, THE 407A HAS FOUND WIDE USE IN CARRIER TELEPHONY CIRCUITS.

ELECTRICAL DATA

HEATER VOLTAGE SERIES CONNECTION (USE PINS 1 & 9)	40±5%	VOLTS
PARALLEL CONNECTION (TIE PIN 1 TO PIN 9: USE PIN 5, 1 & 9)	20±5%	VOLTS
HEATER CURRENT SERIES CONNECTION (USE PINS 1 & 9)	.05	AMP.
PARALLEL CONNECTION (TIE PIN 1 TO PIN 9: USE PIN 5, 1, & 9)	0.1	AMP.
CHARACTERISTICS PER SECTION UNDER CONDITIONS E_b = 150 Vdc, E_c = 0, Rk/k = 240 OHMS		
PLATE CURRENT	8.2	MADC
TRANSCONDUCTANCE	5 500	μMHOS
AMPLIFICATION FACTOR	35	
PLATE RESISTANCE (APPROX.)	6 400	OHMS
INTERELECTRODE CAPACITANCES (MEASURED WITH NO SHIELD AND WITH HEATER TIED TO CATHODE OF UNIT UNDER TEST. EACH SECTION TESTED SEPARATELY.)		
GRID TO PLATE	1.3	μμfd
GRID TO CATHODE	2.25	μμfd
PLATE TO CATHODE	1.0	μμfd
HEATER TO CATHODE	2.4	μμfd
INTERELECTRODE CAPACITIES BETWEEN TRIODE SECTIONS PLATE TO PLATE	0.1	μμfd
NOISE AND MICROPHONICS (USING WESTERN ELECTRIC 2B NOISE MEASURING TEST SET WITH WEIGHTING FILTER (#F1A)	8	db

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MECHANICAL DATA

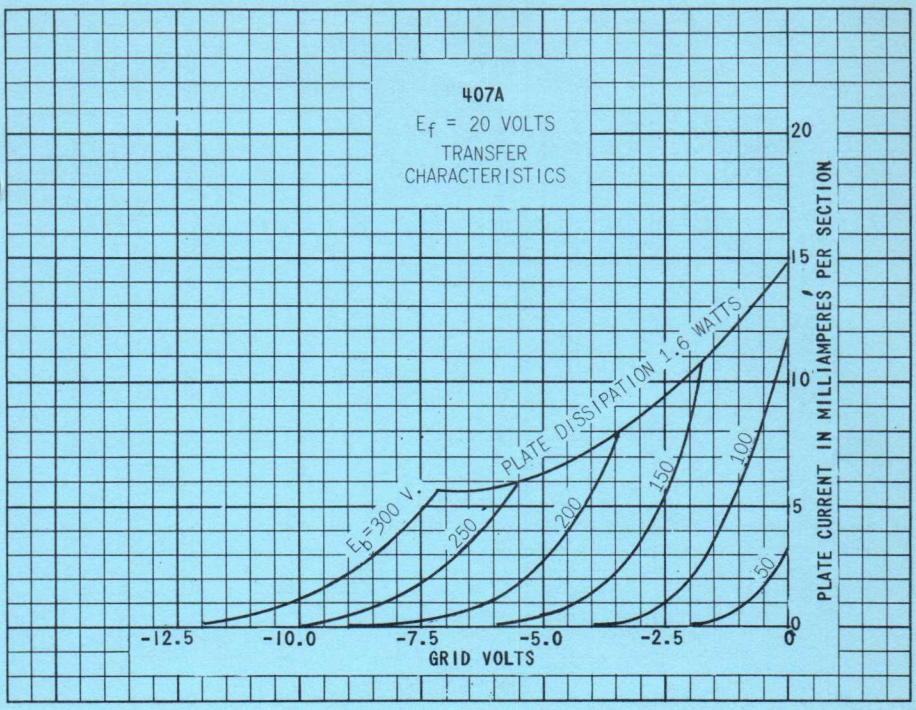
MOUNTING POSITION	ANY	
BULB	T-6 1/2	
BASE	MINIATURE BUTTON PIN	
NET WEIGHT, AVERAGE	0.3	OUNCES
MAXIMUM VIBRATION RATING (D=.08"@ 25 CPS)	2.5	G

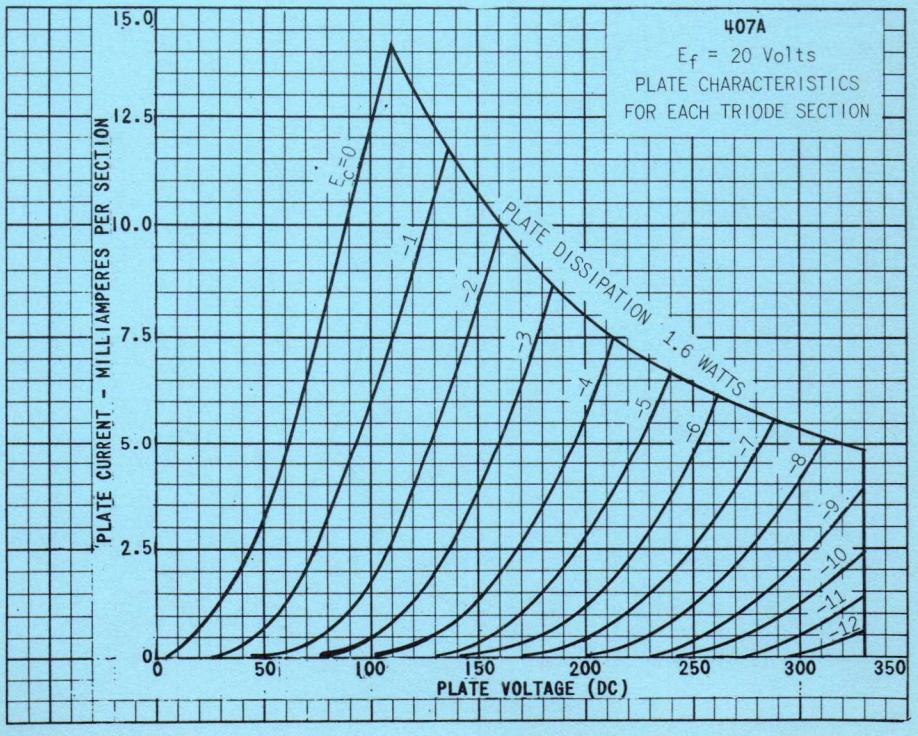
RATINGS
ABSOLUTE VALUES

	MINIMUM	MAXIMUM	
HEATER VOLTAGE (20VOLTS NOMINAL)	19	21	VOLTS
(40VOLTS NOMINAL)	38	42	VOLTS
PLATE VOLTAGE DC	---	330	VOLTS
GRID VOLTAGE DC	-55	0	VOLTS
HEATER-CATHODE VOLTAGE	-130	+130	VOLTS
GRID CURRENT PER GRID	---	3.0	MA.
PLATE CURRENT PER PLATE DC	---	18	MA.
POWER DISSIPATION PER PLATE	---	1.6	WATTS
ENVELOPE TEMPERATURE	---	165°	C
ALTITUDE FOR FULL RATINGS	---	60 000	FEET
CIRCUIT VALUES:			
GRID CIRCUIT RESISTANCE PER GRID	---	0.5	MEGOHM

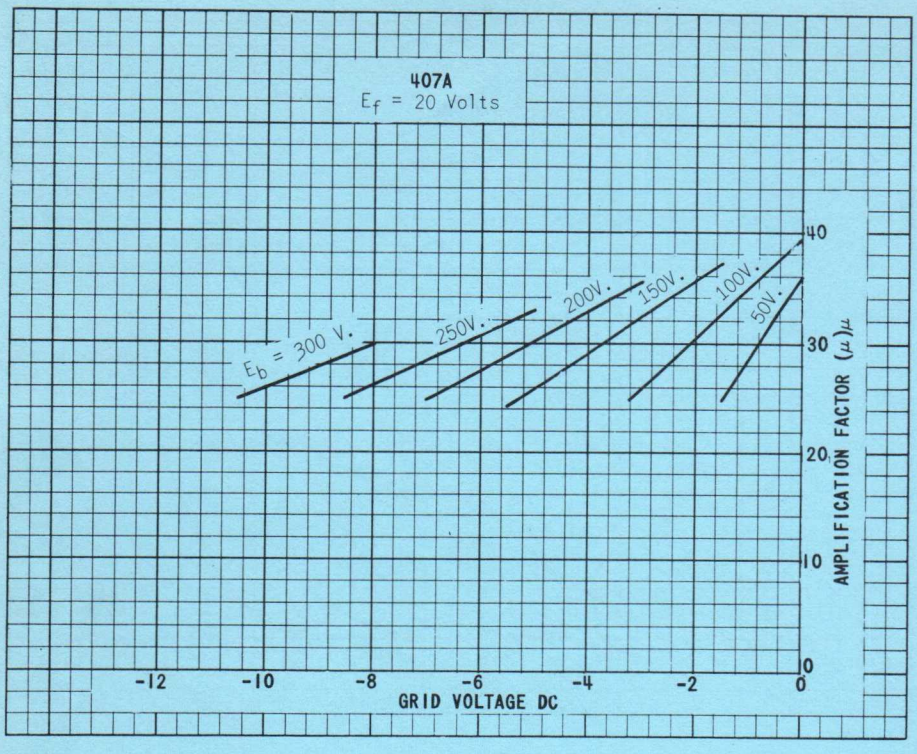
TYPICAL OPERATION
CLASS AB_1 AMPLIFIER

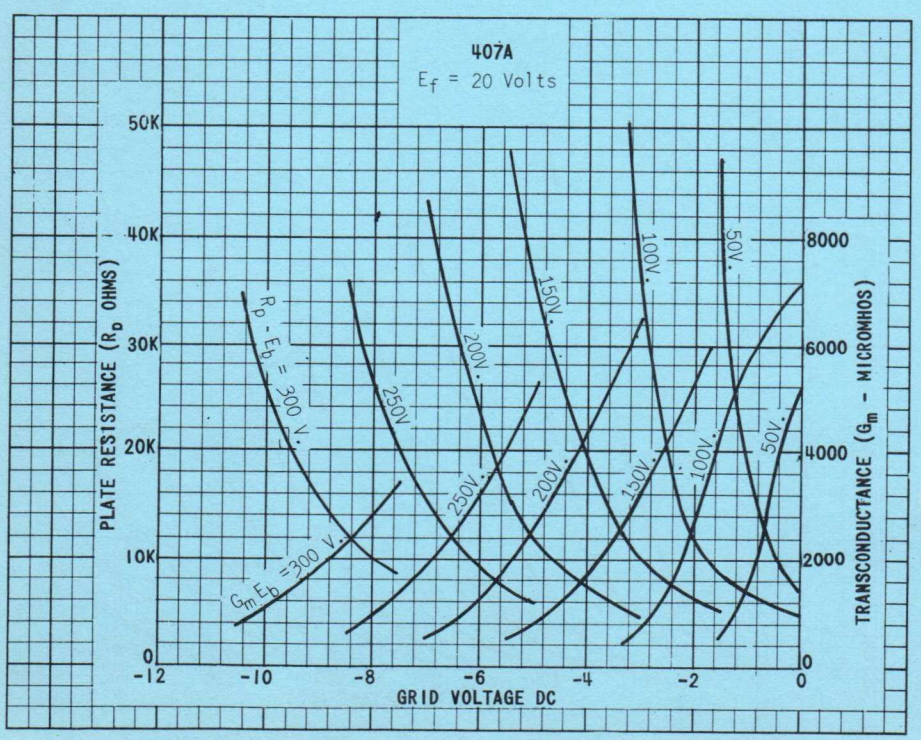
PLATE VOLTAGE	300	VOLTS
CATHODE RESISTOR	800	OHMS
AF GRID TO GRID VOLTAGE (RMS)	14	VOLTS
ZERO-SIGNAL PLATE CURRENT PER SECTION	4.9	MA.
MAXIMUM SIGNAL PLATE CURRENT PER SECTION	6.3	MA.
LOAD IMPEDANCE (PLATE TO PLATE)	27 000	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.0	WATT





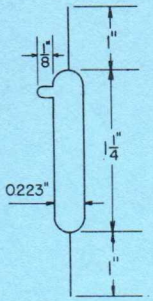
PRINTED IN U. S. A.


407A
E_f = 20 Volts
E_b = 300 V.
250V.
200V.
150V.
100V.
50V.
AMPLIFICATION FACTOR (μ)μ
0
10
20
30
40
-12
-10
-8
-6
-4
-2
0
GRID VOLTAGE DC


407A
E_f = 20 Volts
R_p - E_b = 300 V.
G_m E_b =300 V.
250V.
200V.
150V.
100V.
50V.
PLATE RESISTANCE (R_p OHMS)
0
10K
20K
30K
40K
50K
TRANSCONDUCTANCE (G_m - MICROMHOS)
0
2000
4000
6000
8000
-12
-10
-8
-6
-4
-2
0
GRID VOLTAGE DC

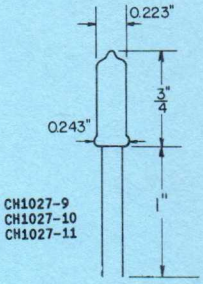
TUNG-SOL

CURPISTOR, MINUTE CURRENT REGULATOR



CH1027-12

ANY MOUNTING POSITION



CH1027-9
CH1027-10
CH1027-11

THE CH1027 FAMILY IS A SERIES OF SUBMINIATURE, TWO ELECTRODE, RADIOACTIVE, NITROGEN FILLED CONSTANT CURRENT TUBES. THEY ARE AVAILABLE IN CURRENT RATINGS FROM 10^{-12} TO 10^{-9} AMPERES. FOR THE TOLERANCES SHOWN BELOW, CURRENT PLATEAUS CAN EXTEND AS LOW AS 25 VOLTS AND AS HIGH AS 500 VOLTS.

BECAUSE OF THEIR CLOSE TOLERANCES AND EXTREMELY LONG LIFE, CURPISTORS PROVIDE A CIRCUIT FUNCTION NOT OBTAINABLE BY ANY OTHER SIMPLE COMPONENT.

CURRENT RATING

CH1027 - 9	10^{-9}	AMPS
CH1027- 10	10^{-10}	AMPS
CH1027- 11	10^{-11}	AMPS
CH1027- 12	10^{-12}	AMPS.

NET WEIGHT - approx.

CH1027 - 9, - 10, & -11	0.03	OUNCES
CH1027-12	0.06	OUNCES

BASE

CH1027 -9. -10, & -11 .....SUBMINIATURE FLAT PRESS WITH TWO FLYING LEADS

CH1027 -12 .....DOUBLE ENDED (SEE DIAGRAM)

MOUNTING POSITION.....ANY

LIFE.....UNLIMITED (HALF LIFE = 1620 YEARS)

AMBIENT TEMPERATURE RATING -70 TO +80 °C

ACTIVE MATERIAL.....RADIUM 226

MAXIMUM CURRENT VARIATION FROM CENTER VALUE

FOR PLATEAUS FROM 25 TO 500 VOLTS

CH1027-9 & CH1027-10	±1	PERCENT
CH1027-11 & CH1027-12	±2	PERCENT

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

ACTIVITY

CH1027-9	18.75	μCURIES
CH1027-10	1.875	μCURIES
CH1027-11	0.1875	μCURIES
CH1027-12	0.01875	μCURIES

LEAD MATERIAL..... (TINNED) COPPER

TYPICAL APPLICATIONS

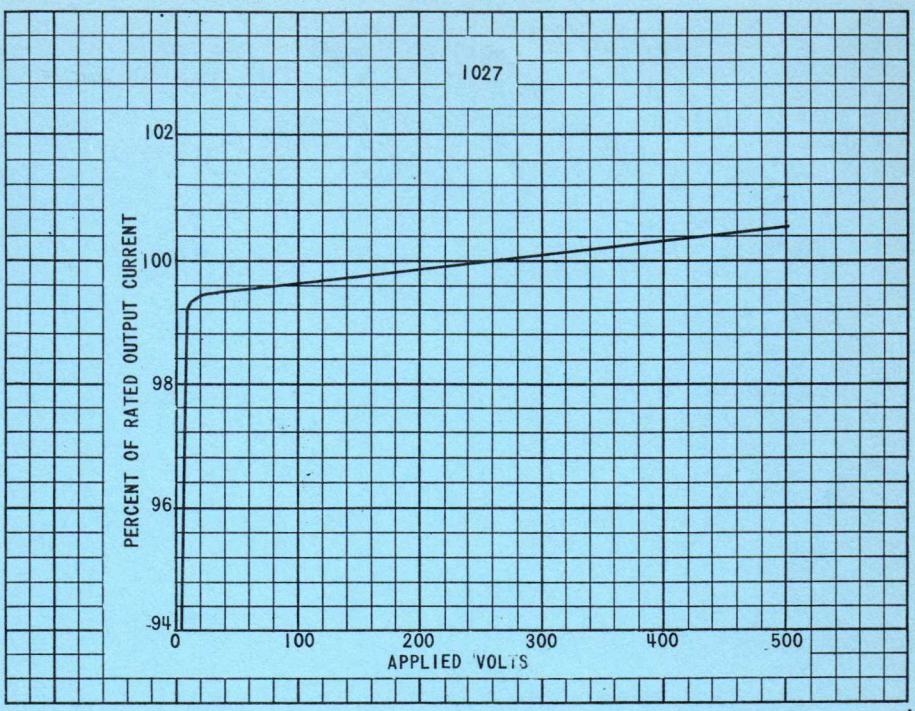
THE CURPISTOR IS SUITABLE AS A COMPONENT TO BE USED FOR:

CONSTANT CAPACITOR DRAIN OR CHARGE IN:
- MISSILE TIMING CIRCUITS
- ORDNANCE MINE TIMING CIRCUITS

INSTRUMENT BIAS

IONIZATION CHAMBER TESTING

CALIBRATION (AS A STANDARD)

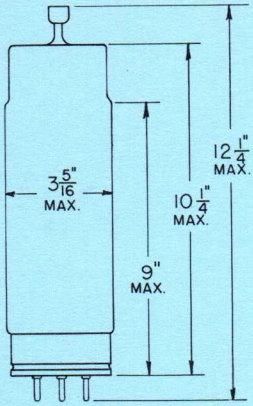


THE CURPISTOR SHOULD BE HANDLED IN ACCORDANCE WITH THE ATOMIC ENERGY COMMISSION'S REGULATIONS FOR THE ACTIVITY OF THE MAGNITUDE INDICATED FOR THE VARIOUS UNITS. THESE MAGNITUDES ARE NOT GREAT ENOUGH TO CONSTITUTE A HAZARD TO PERSONNEL IF PROPER PRECAUTIONS ARE TAKEN. PERSONNEL ARE CAUTIONED NOT TO HANDLE BROKEN TUBES SO AS TO AVOID THE ENTRANCE OF THE RADIOACTIVE MATERIAL DIRECTLY INTO THE BLOODSTREAM THROUGH CUTS. IF ONE IS CUT ON A BROKEN TUBE, THE CUT SHOULD BE CLEANED IMMEDIATELY. AN OPEN CUT CAN BE CLEANED BY HOLDING IT IN RUNNING WATER. IF A TUBE IS BROKEN, CARE SHOULD BE TAKEN THAT THE GAS IS NOT INHALED.

PRINTED IN U. S. A.

TUNG-SOL

THYRATRON



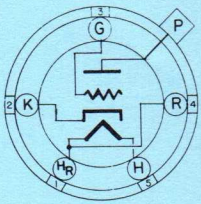
GLASS BULB

HEATER

6.3 VOLTS 23. AMP.

VERTICAL MOUNTING POSITION

(BASE DOWN)



BOTTOM VIEW

THE CH1095 IS A ZERO BIAS HYDROGEN THYRATRON DESIGNED TO PASS HIGH CURRENTS IN "CROWBAR" PROTECTIVE CIRCUITS. AS DESCRIBED IN THE APPLICATION NOTES, DESTRUCTIVE ARC CURRENTS ARE SHORT CIRCUITED BY THE CROWBAR TUBE BEFORE DAMAGE OCCURS TO OTHER TUBES OR CIRCUIT ELEMENTS.

THE INSTANTANEOUS RESPONSE, AND ABILITY TO REPEATEDLY CARRY EXTREMELY LARGE CURRENTS, MAKES THE HYDROGEN THYRATRON PRATICULARLY ATTRACTIVE FOR THIS APPLICATION. ONE TYPE CH1095 CAN HANDLE A PEAK CURRENT OF 800 AMPS AT 18 KILOVOLTS. THIS TUBE CONTAINS A HYDROGEN RESERVOIR WHICH PROMOTES LONG LIFE AND PERMITS OPTIMUM GAS PRESSURE ADJUSTMENT FOR VARIOUS CONDITIONS OF OPERATION.

ELECTRICAL DATA

	MIN.	BOGEY	MAX.	
CATHODE HEATER VOLTAGE	6.0	6.3	6.6	VOLTS
CATHODE HEATER CURRENT (E_f = 6.3 VOLTS)	15.	16.	22.	AMP.
CATHODE HEATING TIME	10.			MINUTES
RESERVOIR VOLTAGE	3.0	MARKED ON BASE	5.5	VOLTS
RESERVOIR CURRENT			6.5	AMP.
RESERVOIR HEATING TIME	10.			MINUTES

MECHANICAL DATA

TYPE OF COOLING	CONVECTION	
MAX. NET WEIGHT	2 1/4	LBS.
MOUNTING POSITION	ANY	
DIMENSIONS	SEE OUTLINE DRAWINGS	

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

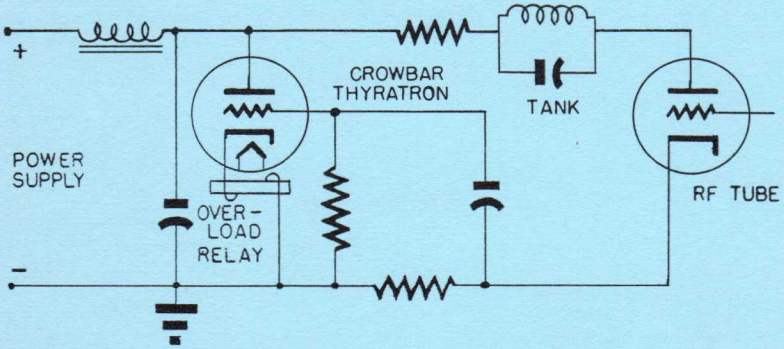
CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS
ABSOLUTE VALUES

	MIN.	MAX.	
D.C. ANODE VOLTAGE			
FORWARD	2	18	KVOLTS
INVERSE		5	KVOLTS
CATHODE CURRENT			
PEAK		800	AMP.
AVERAGE		1.	AMP.
CONDUCTION TIME PER FAULT		0.1	SECONDS
AVERAGING TIME		80	SECONDS
RECOVERY TIME		50	μSECONDS
GRID SIGNAL VOLTAGE	1000	2000	VOLTS
GRID IMPEDANCE	50	500	OHMS
GRID VOLTAGE RATE OF RISE	1800		V/μSEC.
ANODE DELAY TIME		0.6	μSECONDS
ANODE VOLTAGE DROP	50	200	VOLTS
AMBIENT TEMPERATURE RANGE	−50	+75	°C

APPLICATION NOTES

IN A TYPICAL APPLICATION, A CROWBAR THYRATRON IS CONNECTED IN SERIES WITH A SUITABLE IMPEDANCE ACROSS THE FILTER OF THE HIGH VOLTAGE POWER SUPPLY FOR A HIGH FREQUENCY TRIODE OSCILLATOR. WHENEVER AN ARC OCCURS IN THE OSCILLATOR TUBE, THE RISING CURRENT IS USED TO DELIVER A SUITABLE SIGNAL TO THE GRID OF THE THYRATRON. THE THYRATRON IMMEDIATELY CONDUCTS TO SHORT CIRCUIT THE POWER SUPPLY UNTIL THE PROTECTIVE CIRCUIT BREAKER OPENS 0.1 TO 0.5 SECOND LATER. WITH PROPER CIRCUITRY, THE THYRATRON CAN BE MADE TO RECOVER CONTROL BEFORE THE POWER SUPPLY BREAKER OPENS. IN THIS LATTER CASE, THE OSCILLATOR TUBE IS PROTECTED WITH A MINIMUM INTERRUPTION IN OPERATING TIME.



REFERENCES:

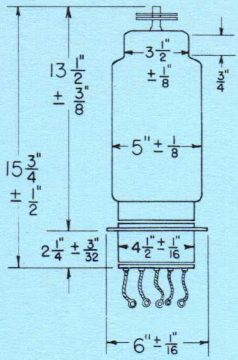
SMITH, BOB: THE FAULT DIVERTER - A PROTECTIVE DEVICE FOR HIGH-POWER ELECTRON TUBES. REPORT UCRL-3701 REV. UNIVERSITY OF CALIFORNIA, RADIATION LABORATORIES, BERKELEY, CALIF.

PARKER, W.N.
AND
HOOVER, M.V.: GAS TUBES PROTECT HIGH-POWER TRANSMITTERS. ELECTRONICS, JAN. 1956.

DOOLITTLE, [illegible]:
[illegible] POWERED HYDROGEN THYRATRONS. CATHODE PRESS, VI, PA, 1954.

TUNG-SOL

THYRATRON



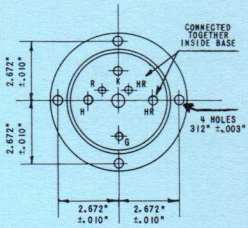
GLASS BULB

HEATER

6.3 VOLTS 23. AMP.

VERTICAL MOUNTING POSITION

(BASE DOWN)



BOTTOM VIEW

THE CH1096 IS A ZERO BIAS HYDROGEN THYRATRON DESIGNED TO PASS HIGH CURRENTS IN "CROWBAR" PROTECTIVE CIRCUITS. AS DESCRIBED IN THE APPLICATION NOTES, DESTRUCTIVE ARC CURRENTS ARE SHORT CIRCUITED BY THE CROWBAR TUBE BEFORE DAMAGE OCCURS TO OTHER TUBES OR CIRCUIT ELEMENTS.

THE INSTANTANEOUS RESPONSE, AND ABILITY TO REPEATEDLY CARRY EXTREMELY LARGE CURRENTS, MAKES THE HYDROGEN THYRATRON PRATICULARLY ATTRACTIVE FOR THIS APPLICATION. ONE TYPE CH1096 CAN HANDLE A PEAK CURRENT OF 1500 AMPS AT 18 KILOVOLTS. THIS TUBE CONTAINS A HYDROGEN RESERVOIR WHICH PROMOTES LONG LIFE AND PERMITS OPTIMUM GAS PRESSURE ADJUSTMENT FOR VARIOUS CONDITIONS OF OPERATION.

ELECTRICAL DATA

	MIN.	BOGEY	MAX.	
CATHODE HEATER VOLTAGE	6.0	6.3	6.6	VOLTS
CATHODE HEATER CURRENT (E_f = 6.3 VOLTS)	27.	30.	33.	AMP.
CATHODE HEATING TIME	15.			MINUTES
RESERVOIR VOLTAGE	2.5	MARKED ON BASE	5.5	VOLTS
RESERVOIR CURRENT			12.	AMP.
RESERVOIR HEATING TIME	15.			MINUTES

MECHANICAL DATA

TYPE OF COOLING	CONVECTION	
MAX. NET WEIGHT	4 5/8	LBS.
MOUNTING POSITION	VERTICAL, BASE DOWN	
DIMENSIONS	SEE OUTLINE DRAWINGS	

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

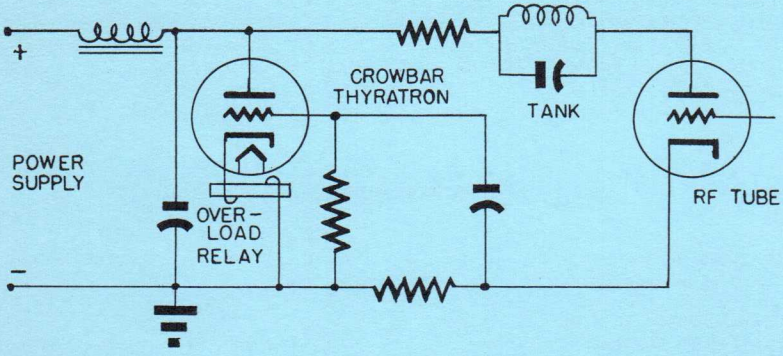
CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS
ABSOLUTE VALUES

	MIN.	MAX.	
D.C. ANODE VOLTAGE			
FORWARD	5	18	KVOLTS
INVERSE		5	KVOLTS
CATHODE CURRENT			
PEAK		1500	AMP.
AVERAGE		2	AMP.
CONDUCTION TIME PER FAULT		0.1	SECONDS
AVERAGING TIME		75	SECONDS
RECOVERY TIME		50	μSECONDS
GRID SIGNAL VOLTAGE	1000	2500	VOLTS
GRID IMPEDANCE	50	200	OHMS
GRID VOLTAGE RATE OF RISE	2200		V/μSEC.
ANODE DELAY TIME		0.6	μSECONDS
ANODE VOLTAGE DROP	50	300	VOLTS
AMBIENT TEMPERATURE RANGE	-50	+75	°C

APPLICATION NOTES

IN A TYPICAL APPLICATION, A CROWBAR THYRATRON IS CONNECTED IN SERIES WITH A SUITABLE IMPEDANCE ACROSS THE FILTER OF THE HIGH VOLTAGE POWER SUPPLY FOR A HIGH FREQUENCY TRIODE OSCILLATOR. WHENEVER AN ARC OCCURS IN THE OSCILLATOR TUBE, THE RISING CURRENT IS USED TO DELIVER A SUITABLE SIGNAL TO THE GRID OF THE THYRATRON. THE THYRATRON IMMEDIATELY CONDUCTS TO SHORT CIRCUIT THE POWER SUPPLY UNTIL THE PROTECTIVE CIRCUIT BREAKER OPENS 0.1 TO 0.5 SECOND LATER. WITH PROPER CIRCUITRY, THE THYRATRON CAN BE MADE TO RECOVER CONTROL BEFORE THE POWER SUPPLY BREAKER OPENS. IN THIS LATTER CASE, THE OSCILLATOR TUBE IS PROTECTED WITH A MINIMUM INTERRUPTION IN OPERATING TIME.



REFERENCES:

SMITH, BOB: THE FAULT DIVERTER - A PROTECTIVE DEVICE FOR HIGH-POWER ELECTRON TUBES. REPORT UCRL-3701 REV. UNIVERSITY OF CALIFORNIA, RADIATION LABORATORIES, BERKELEY, CALIF.

PARKER, W.N. AND HOOVER, M.V.: GAS TUBES PROTECT HIGH-POWER TRANSMITTERS. ELECTRONICS, JAN. 1956.

DOOLITTLE, H.D.: HIGH POWERED HYDROGEN THYRATRONS. CATHODE PRESS, V1, P6, 1954.

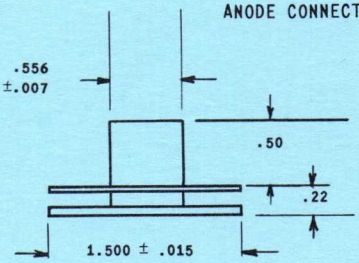
TUNG-SOL

LEAD CONNECTIONS

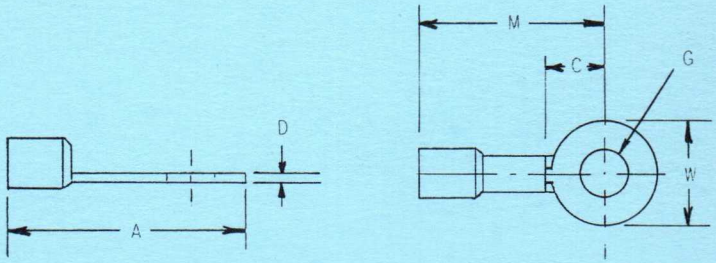
LEAD	FUNCTION	LEAD COLOR	LUG COLOR	LUG
1	GRID	GREEN	GREEN	S
2	CATHODE & HEATER C-T	BLACK	BLACK	L
3	HEATER	YELLOW	YELLOW	L
4	HEATER	YELLOW	BLACK	L
5	RESERVOIR	RED	YELLOW	S
6	RESERVOIR	RED	RED	S

LEADS ARE FLEXIBLE 5 1/2"±1/2" LONG FROM BOTTOM OF BASE TO CENTER OF LUG HOLE. COLOR CODING AS WELL AS BASE MARKING IDENTIFIES THE LEADS.

ANODE CONNECTOR



LUG DIMENSIONS

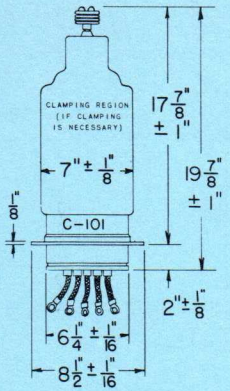


LUG	G STUD	A MAX.	W MAX.	C MIN.	D	M MAX.
L	1/4"	1.21"	.53"	.41"	.04"	.94"
S	#10	.90"	.31"	.30"	.03"	.74"

PRINTED IN U.S.A.

TUNG-SOL

THYRATRON



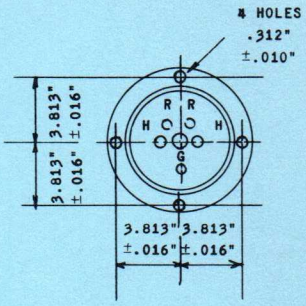
GLASS BULB

HEATER

6.3 VOLTS 23. AMP.

VERTICAL MOUNTING POSITION

(BASE DOWN)



BOTTOM VIEW

THE CH1097 IS A ZERO BIAS HYDROGEN THYRATRON DESIGNED TO PASS HIGH CURRENTS IN "CROWBAR" PROTECTIVE CIRCUITS. AS DESCRIBED IN THE APPLICATION NOTES, DESTRUCTIVE ARC CURRENTS ARE SHORT CIRCUITED BY THE CROWBAR TUBE BEFORE DAMAGE OCCURS TO OTHER TUBES OR CIRCUIT ELEMENTS.

THE INSTANTANEOUS RESPONSE, AND ABILITY TO REPEATEDLY CARRY EXTREMELY LARGE CURRENTS, MAKES THE HYDROGEN THYRATRON PRATICULARLY ATTRACTIVE FOR THIS APPLICATION. ONE TYPE CH1097 CAN HANDLE A PEAK CURRENT OF 2500 AMPS AT 25 KILOVOLTS. THIS TUBE CONTAINS A HYDROGEN RESERVOIR WHICH PROMOTES LONG LIFE AND PERMITS OPTIMUM GAS PRESSURE ADJUSTMENT FOR VARIOUS CONDITIONS OF OPERATION.

ELECTRICAL DATA

	MIN.	BOGEY	MAX.	
CATHODE HEATER VOLTAGE	6.0	6.3	6.6	VOLTS
CATHODE HEATER CURRENT (E_f = 6.3 VOLTS)	20.	23.	40.	AMP.
CATHODE HEATING TIME	15.			MINUTES
RESERVOIR VOLTAGE	3.5	MARKED ON BASE	6.0	VOLTS
RESERVOIR CURRENT			12	AMP.
RESERVOIR HEATING TIME	15.			MINUTES

MECHANICAL DATA

TYPE OF COOLING	CONVECTION	
MAX. NET WEIGHT	10	LBS.
MOUNTING POSITION	VERTICAL, BASE DOWN	
DIMENSIONS	SEE OUTLINE DRAWINGS	

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

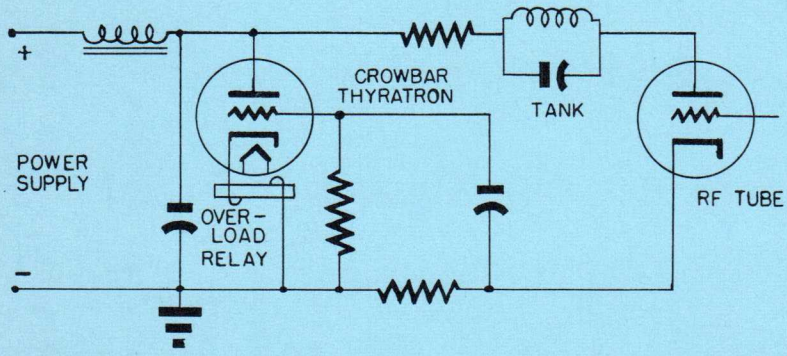
CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS
ABSOLUTE VALUES

	MIN.	MAX.	
D.C. ANODE VOLTAGE			
FORWARD	7	25	KVOLTS
INVERSE		5	KVOLTS
CATHODE CURRENT			
PEAK		2500	AMP.
AVERAGE		5	AMP.
CONDUCTION TIME PER FAULT		0.1	SECONDS
AVERAGING TIME		50	SECONDS
RECOVERY TIME		50	μSECONDS
GRID SIGNAL VOLTAGE	1400	2500	VOLTS
GRID IMPEDANCE	20	50	OHMS
GRID VOLTAGE RATE OF RISE	2500		V/μSEC.
ANODE DELAY TIME		0.6	μSECONDS
ANODE VOLTAGE DROP	50	300	VOLTS
AMBIENT TEMPERATURE RANGE	-55	+75	°C

APPLICATION NOTES

IN A TYPICAL APPLICATION, A CROWBAR THYRATRON IS CONNECTED IN SERIES WITH A SUITABLE IMPEDANCE ACROSS THE FILTER OF THE HIGH VOLTAGE POWER SUPPLY FOR A HIGH FREQUENCY TRIODE OSCILLATOR. WHENEVER AN ARC OCCURS IN THE OSCILLATOR TUBE, THE RISING CURRENT IS USED TO DELIVER A SUITABLE SIGNAL TO THE GRID OF THE THYRATRON. THE THYRATRON IMMEDIATELY CONDUCTS TO SHORT CIRCUIT THE POWER SUPPLY UNTIL THE PROTECTIVE CIRCUIT BREAKER OPENS 0.1 TO 0.5 SECOND LATER. WITH PROPER CIRCUITRY, THE THYRATRON CAN BE MADE TO RECOVER CONTROL BEFORE THE POWER SUPPLY BREAKER OPENS. IN THIS LATTER CASE, THE OSCILLATOR TUBE IS PROTECTED WITH A MINIMUM INTERRUPTION IN OPERATING TIME.



REFERENCES:

SMITH, BOB: THE FAULT DIVERTER - A PROTECTIVE DEVICE FOR HIGH-POWER ELECTRON TUBES. REPORT UCRL-3701 REV. UNIVERSITY OF CALIFORNIA, RADIATION LABORATORIES, BERKELEY, CALIF.

PARKER, W.N.
AND
HOOVER, M.V.:
GAS TUBES PROTECT HIGH-POWER TRANSMITTERS. ELECTRONICS, JAN. 1956.

DOOLITTLE, H.D.:
HIGH POWERED HYDROGEN THYRATRONS. CATHODE PRESS, V1, P6, 1954.

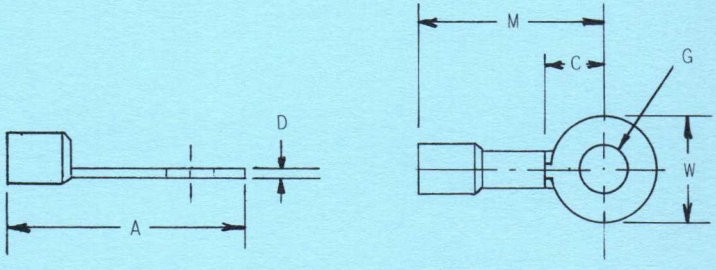
TUNG-SOL

LEAD CONNECTIONS

LEAD	FUNCTION	LEAD COLOR	LUG COLOR	LUG
1	GRID	GREEN	GREEN	S
2	HEATER	YELLOW	YELLOW	L
3	HEATER	YELLOW	YELLOW	L
4	RESERVOIR	RED	RED	S
5	RESERVOIR	RED	RED	S
6	CATHODE	TUBE BASE FLANGE		

LEADS ARE FLEXIBLE 8"±3/4" LONG FROM BOTTOM OF BASE TO CENTER OF LUG HOLE. COLOR CODING AS WELL AS BASE MARKING IDENTIFIES THE LEADS.

LUG DIMENSIONS

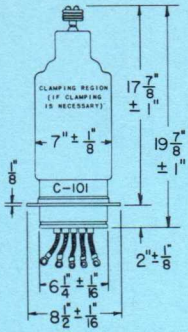


LUG	G STUD	A MAX.	W MAX.	C MIN.	D	M MAX.
L	1/4"	1.21"	.53"	.41"	.04"	.94"
S	#10	.90"	.31"	.30"	.03"	.74"

PRINTED IN U.S.A.

TUNG-SOL

THYRATRON

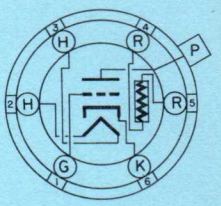


GLASS BULB

HEATER

AC OR DC

VERTICAL MOUNTING POSITION
(BASE DOWN)



BOTTOM VIEW

THE VC-1257 IS A THREE ELECTRODE, HYDROGEN FILLED, ZERO BIAS THYRATRON DESIGNED FOR THE GENERATION OF HIGH POWER PULSES. THE PRIMARY APPLICATION OF THE TUBE IS IN HIGH POWER, HIGH VOLTAGE RADAR MODULATORS. THE VC-1257 IS CAPABLE OF SUPPLYING 33 MEGAWATT PULSES IN THIS SERVICE. AN INTERNAL HYDROGEN RESERVOIR PROMOTES LONG LIFE AND PERMITS OPTIMUM PRESSURE ADJUSTMENT FOR VARIOUS CONDITIONS OF OPERATION. THE CATHODE IS UNIPOTENTIAL AND IS CONNECTED TO THE ELECTRICAL CENTER OF THE CATHODE HEATER CIRCUIT IN ORDER TO MINIMIZE TIME JITTER.

FIRM ELECTRICAL CONNECTIONS ARE MADE TO THE CATHODE HEATERS, GRID AND RESERVOIR BY MEANS OF FLEXIBLE CABLES FITTED WITH LUGS. THE TUBE IS RIGIDLY SUPPORTED BY A BASE WITH A FLANGE CONTAINING BOLT HOLES. THE CATHODE CONNECTION IS MADE THROUGH THE BASE FLANGE.

ELECTRICAL DATA

	SYMBOL	MIN.	BOGEY	MAX.	
HEATER VOLTAGE	Ef	6.0	6.3	6.6	VOLTS
HEATER CURRENT (WITH BOGIE HEATER AND RESERVOIR VOLTAGE)	If	20	23	40	AMPS.
CATHODE HEATING TIME	tk	15			MINUTES
RESERVOIR VOLTAGE (SEE APPLICATION NOTES)	Eres	3.5	MARKED ON BASE	6.0	VOLTS
RESERVOIR CURRENT	Ires			12	AMPS.
RESERVOIR HEATING TIME	tres	15			MINUTES
ANODE VOLTAGE DROP	etd	100	200	400	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MECHANICAL DATA

TYPE OF COOLING	CONVECTION	
(FORCED AIR COOLING ACROSS THE RADIATOR IS RECOMMENDED FOR MAXIMUM TUBE LIFE)		
MOUNTING POSITION	VERTICAL, BASE DOWN	
MAXIMUM NET WEIGHT	10	POUNDS
DIMENSIONS:	SEE OUTLINE DRAWING	

RATINGS

ABSOLUTE VALUES

	SYMBOL	MIN.	MAX.	
PEAK ANODE VOLTAGE				
INVERSE (NOTE 1)	epx	0.5	33	KVOLTS
FORWARD (SEE APPLICATION NOTES FOR STARTING PROCEDURE)	epy	7.	33	KVOLTS
CATHODE CURRENT				
PEAK	ib		2000	AMPS.
AVERAGE	ib		2.6	AMPS.
RMS (FOR SQUARE PULSE APPLICATIONS $I_p = \sqrt{I_b \times ib}$)	I_p		60	AMPS.
DC ANODE VOLTAGE	Ebb		3.5	KVOLTS
OPERATING FREQUENCY	prr		1500	CPS
(THIS IS NOT NECESSARILY THE UPPER OPERATING FREQUENCY LIMIT OF THE VC-1257 BUT REPRESENTS THE HIGHEST REPETITION RATE EXTENSIVELY LIFE TESTED TO DATE.)				
PEAK GRID VOLTAGE (NOTE 2)	egy	1100	2500	VOLTS
PEAK INVERSE GRID VOLTAGE	egx		650	VOLTS
GRID TIME OF RISE OF GRID PULSE (NOTE 5)	tr		0.35	μSEC.
GRID PULSE WIDTH AT 70.7% POINT		2.0		μSEC.
HEATING FACTOR (epy X ib X prr. SEE FIG. 3)	Pb		20×10^9	
CURRENT RATE OF RISE (NOTE 5)			10 000	AMP/μSEC.
ANODE DELAY TIME (NOTE 3)	tad		0.5	μSEC.
TIME JITTER (NOTE 4)	tj		0.01	μSEC.
AMBIENT TEMPERATURE	TA	-55	+75	°C

NOTES

1: IN PULSED OPERATION, THE PEAK INVERSE VOLTAGE, EXCLUSIVE OF A SPIKE OF 0.05μSEC. MAXIMUM DURATION, SHALL NOT EXCEED 5.0 KILOVOLTS DURING THE FIRST 25μSEC. FOLLOWING THE ANODE PULSE.

2: THE GRID DRIVE REQUIREMENTS OF A VC-1257 CHANGE CONSIDERABLY DURING THE FIRST FEW MINUTES OF TUBE OPERATION. IN ORDER TO RELIABLY TRIGGER A COLD TUBE, THE GRID PULSE VOLTAGE AND DURATION AND THE GRID CIRCUIT IMPEDANCE SHOULD BE CHOSEN ACCORDING TO THE LIMITING CURVES.

3: ANODE DELAY TIME IS DEFINED AS THE TIME INTERVAL BETWEEN THE POINT ON THE RISING PORTION OF THE GRID VOLTAGE PULSE WHICH IS 26 PERCENT OF THE MAXIMUM UNLOADED PULSE AMPLITUDE AND THE POINT WHERE ANODE CONDUCTION TAKES PLACE.

4: TIME JITTER IS MEASURED AT 50 PERCENT OF THE PULSE AMPLITUDE AFTER THE TUBE HAS BEEN OPERATING FOR AT LEAST 60 SECONDS. THE LIMIT OF 0.01 μSEC. SHOWN IS THE MAXIMUM ALLOWABLE UNDER SPECIFIED UNFAVORABLE OPERATING CONDITIONS. WITH SUFFICIENT GRID DRIVE AND WITH ANODE VOLTAGES OF 20 KV AND ABOVE, JITTER NOT EXCEEDING 0.005 μSEC. CAN BE EASILY ACHIEVED.

5: MEASUREMENT MADE BETWEEN 26% AND 70.7% POINTS.

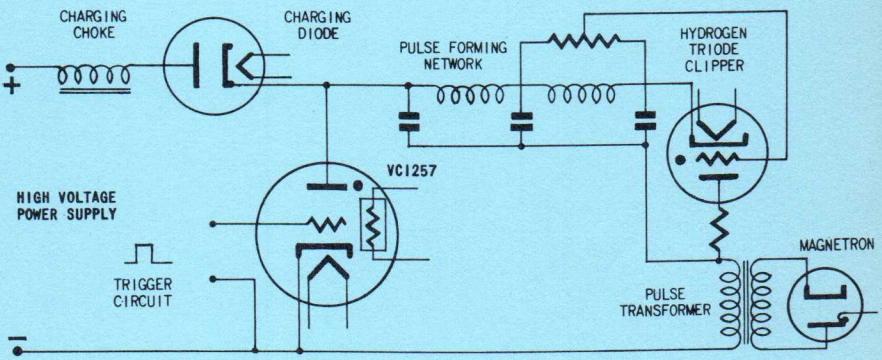
CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

APPLICATION NOTES

THE VC-1257 HYDROGEN THYRATRON IS DESIGNED PRIMARILY FOR USE IN HIGH POWER RADAR MODULATOR SERVICE. A BASIC CIRCUIT FOR SUCH SERVICE IS ILLUSTRATED BELOW. IN SUCH A CIRCUIT, THE HYDROGEN THYRATRON SERVES AS A SWITCH TO RELEASE INTO THE MAGNATRON OR OTHER RADIO FREQUENCY GENERATOR, THE ENERGY STORED IN THE PULSE FORMING NETWORK. THE VC-1257 IS ADMIRABLY SUITED FOR SUCH SERVICE BY ITS ABILITY TO HOLD OFF HIGH VOLTAGE, AND TO PASS HIGH PEAK CURRENTS WITH RELATIVELY LOW TUBE VOLTAGE DROP. THE TUBE WILL OPERATE OVER A WIDE RANGE OF PULSE REPETITION RATES, PULSE WIDTHS AND PEAK CURRENTS, THUS PROVIDING A VERY FLEXIBLE CIRCUIT ELEMENT. TRIGGERING REQUIREMENTS ARE SIMPLIFIED SINCE THE TUBE OPERATES WITH ZERO BIAS.



THE VC-1257 CONTAINS A HYDROGEN RESERVOIR THAT MAINTAINS THE GAS PRESSURE WITHIN THE TUBE IN ACCORDANCE WITH THE VOLTAGE IMPRESSED ACROSS IT. SINCE THE RESERVOIR CAN HOLD MANY TUBE VOLUMES OF GAS, LONG TUBE LIFE IS INSURED. IN ADDITION IT IS POSSIBLE TO SET THE GAS PRESSURE AT THE OPTIMUM VALUE FOR ANY PARTICULAR SET OF OPERATING CONDITIONS. THE RESERVOIR HEATER VOLTAGE STAMPED ON THE TUBE BASE HAS BEEN DETERMINED FOR A PARTICULAR SET OF CONDITIONS SOMEWHAT BEYOND THE MAXIMUM TUBE RATINGS AND WILL BE SATISFACTORY FOR MOST APPLICATIONS. IN GENERAL, IT IS DESIRABLE TO OPERATE AT AS HIGH A RESERVOIR VOLTAGE AS POSSIBLE WITHOUT OBTAINING SPURIOUS DISCHARGES IN THE GRID-ANODE REGION. WHEN THE VC-1257 IS OPERATED AT OR NEAR MAXIMUM RATINGS, THE RESERVOIR VOLTAGE REGULATION SHOULD NOT EXCEED ±2.5%. IF THE VC-1257 IS OPERATED AT REDUCED DUTY A WIDER RESERVOIR OPERATING RANGE CAN BE EXPECTED. HOWEVER, CARE SHOULD BE TAKEN WHEN DETERMINING THE RESERVOIR VOLTAGE TO INSURE SATISFACTORY OPERATION WITH THE ANTICIPATED RESERVOIR VOLTAGE REGULATION. UNDER NO CIRCUMSTANCES SHOULD THE RESERVOIR VOLTAGE BE REDUCED TO SUCH AN EXTENT THAT THE ANODE SHOWS COLOR.

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

APPLICATION NOTES —CONT'D.

THE INSTANTANEOUS APPLICATION OF ANODE VOLTAGE (INSTANTANEOUS STARTING OR "SLAT ON") IS NOT RECOMMENDED. WHEN IT IS ABSOLUTELY NECESSARY, THE MAXIMUM PERMISSIBLE EPY IS 22 KV AND THIS VALUE SHALL NOT BE ATTAINED IN LESS THAN 0.04 SEC. FOR INITIAL APPLICATION OF MAXIMUM RATED ANODE VOLTAGE, IT IS RECOMMENDED THAT ONE OF THE FOLLOWING STARTING METHODS BE USED:

A) *Step Starting.* APPLY NO MORE THAN 22 KV EPY INITIALLY. DO NOT INCREASE IN STEPS GREATER THAN 5 KV PER MINUTE.

B) *Reduced Reservoir Voltage.* THIS METHOD IS SUITABLE FOR AUTOMATIC CONTROL. DURING WARM-UP AND STANDBY PERIODS, THE RESERVOIR VOLTAGE IS HELD AT 92.5 PERCENT OF THE NOMINAL VALUE. AFTER INITIAL ANODE VOLTAGE APPLICATION OF NOT GREATER THAN 22KV, THE ANODE VOLTAGE MAY BE INCREASED AT A MAXIMUM RATE OF 1 KV PER SECOND, AFTER 7.5 MINUTES OF ANODE OPERATION AT MAXIMUM VOLTAGE, THE RESERVOIR VOLTAGE IS INCREASED TO ITS NOMINAL VALUE. OTHER STARTING METHODS CAN BE SUPPLIED TO MEET VARIOUS PARTICULAR APPLICATIONS.

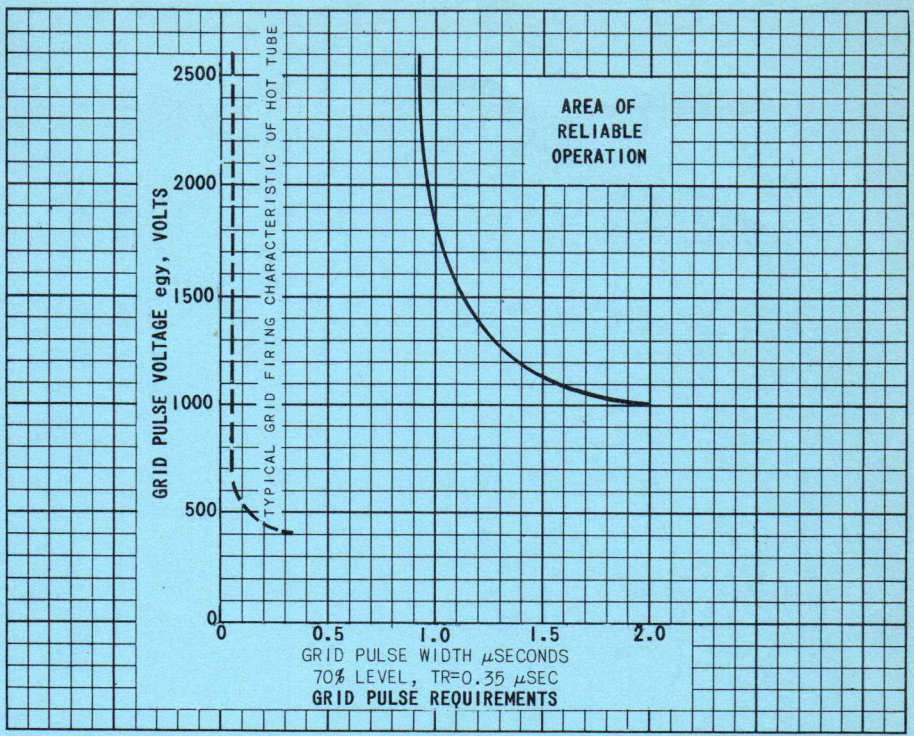
TYPICAL OPERATION

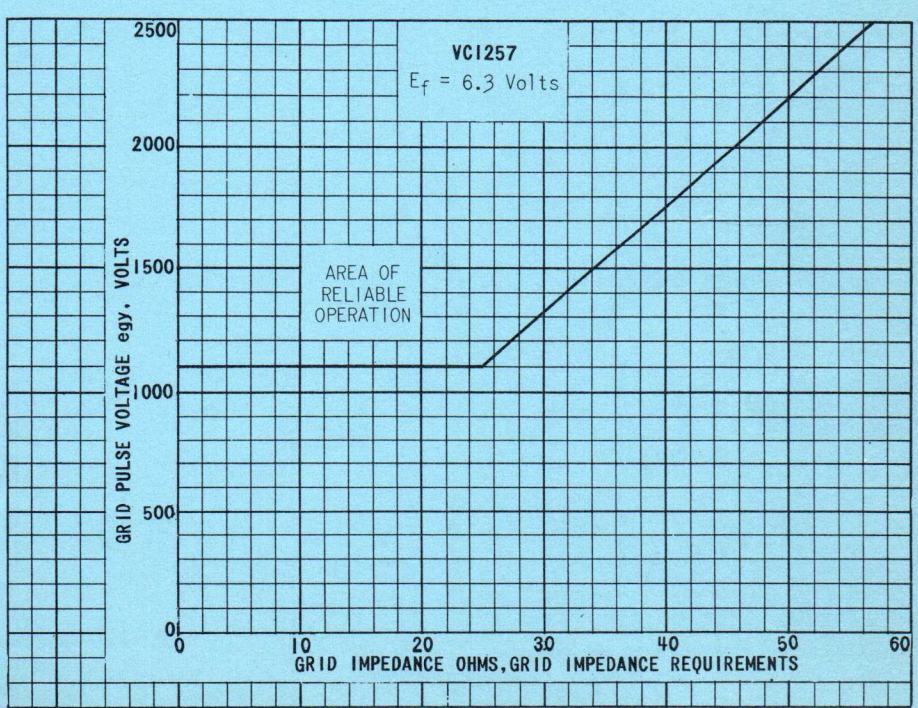
VARIATIONS IN THE OPERATING PARAMETERS AFFECT THE LIFE EXPECTANCY OF HYDROGEN THYRATRONS; THEREFORE, A SIMPLE METHOD OF RATING FOR ALL CONDITIONS IS DIFFICULT. UNTIL SUCH TIME AS SUFFICIENT INFORMATION IS AVAILABLE TO PREPARE COMPLETE OPERATION RATING CHARTS, WE LIST THE FOLLOWING TYPICAL CONDITIONS OF OPERATION UNDER WHICH CONSIDERABLE TUBE LIFE HAS BEEN OBTAINED. IF THE VC-1257 IS TO BE EMPLOYED IN AN OPERATION DIFFERING WIDELY FROM THESE CONDITIONS (UNLESS THE REQUIREMENTS ARE OBVIOUSLY LESS SEVERE) IT IS SUGGESTED THAT THE CUSTOMER REQUEST A RECOMMENDATION FOR THE SPECIFIC APPLICATION.

	PEAK ANODE VOLTAGE		PEAK	PULSE WIDTH	di/dt
Prr	FORWARD	INVERSE	CURRENT	70% POINT	AMPS/μS
pps	kv	kv	Amps	μS	
310	33	5.	2000	2.5	10000
500	30	1.7	1250	3.6	3400
900*	30	1.6	1250	1.0	4200
1500	20	5.	667	1.3	6670

* OPERATION MADE POSSIBLE BY USE OF HYDROGEN TRIODE CLIPPER.

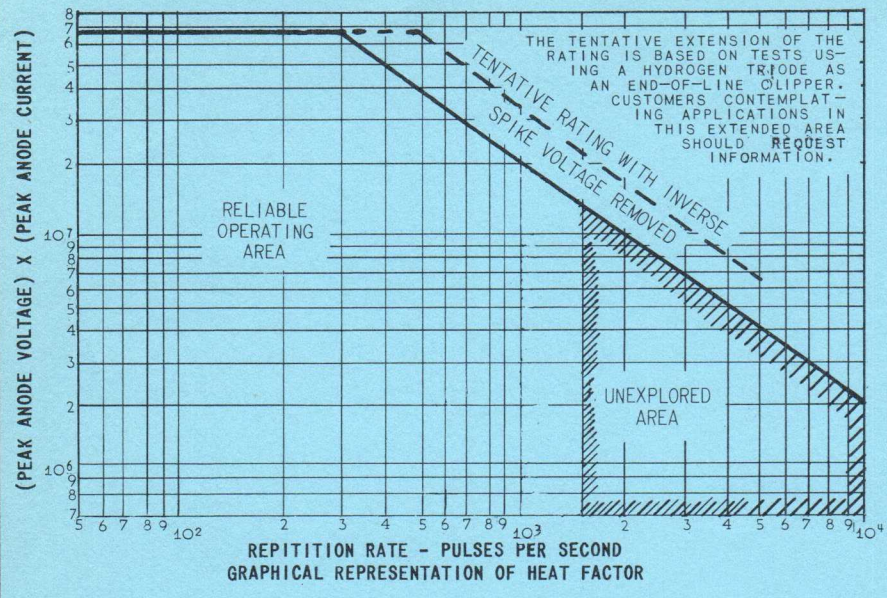
CONTINUED ON FOLLOWING PAGE





PRINTED IN U. S. A.

TUNG-SOL



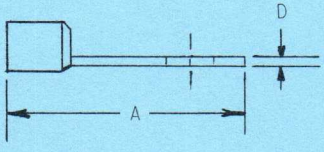
GRAPHICAL REPRESENTATION OF HEAT FACTOR

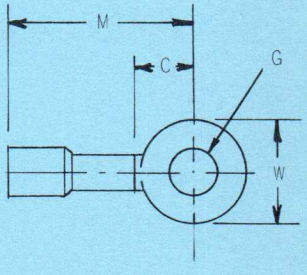
TUNG-SOL

LEAD CONNECTIONS

LEAD	FUNCTION	LEAD COLOR	LUG COLOR	LUG
1	GRID	GREEN	GREEN	S
2	HEATER	YELLOW	YELLOW	L
3	HEATER	YELLOW	YELLOW	L
4	RESERVOIR	RED	RED	S
5	RESERVOIR	RED	RED	S
6	CATHODE	TUBE BASE FLANGE		

LEADS ARE FLEXIBLE 8"±3/4" LONG FROM BOTTOM OF BASE TO CENTER OF LUG HOLE. COLOR CODING AS WELL AS BASE MARKING IDENTIFIES THE LEADS.





LUG DIMENSIONS

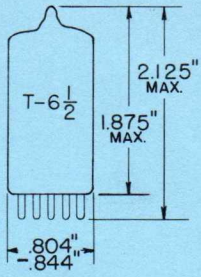
LUG	G STUD	A MAX.	W MAX.	C MIN.	D	M MAX.
L	1/4"	1.21"	.53"	.41"	.04"	.94"
S	#10	.90"	.31"	.30"	.03"	.74"

PRINTED IN U.S.A.

TUNG-SOL

THYRATRON

MINIATURE TYPE

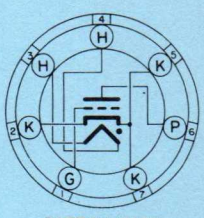


GLASS BULB
HARD

HEATER

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON MINIATURE
7 PIN BASE
7FJ

THE 1258 IS A ZERO BIAS MINIATURE HYDROGEN THYRATRON DESIGNED PRIMARILY FOR USE AS A PULSE MODULATOR TUBE FOR LOW POWER RADAR TRANSMITTERS. THIS TUBE CAN SUPPLY PEAK PULSE POWER OF 10 KILOWATTS AND THEREFORE WILL REPLACE PHYSICALLY LARGER TYPES IN MANY APPLICATIONS. BECAUSE OF ITS CLOSE ELECTRODE SPACING AND SMALL SIZE, MADE POSSIBLE BY HARD GLASS CONSTRUCTION, THE 1258 IS CAPABLE OF RELATIVELY HIGH PULSE REPETITION RATES.

THE 1258 HAS BECOME THE INDUSTRY STANDARD FOR A SMALL SIZE PULSE MODULATOR TUBE BECAUSE OF ITS LONG HISTORY OF SATISFACTORY SERVICE

ELECTRICAL DATA

	SYMBOL	MIN.	BOGEY	MAX.	
HEATER VOLTAGE (WHEN Ip IS LESS THAN 0.75 Aac, REFER TO RECOMMENDED HEATER VOLTAGE CURVE)	Ef	5.7	6.3	6.6	VOLTS
HEATER CURRENT (WITH BOGIE HEATER VOLTAGE)	If	1.6	1.8	2.0	AMP.
CATHODE HEATING TIME	tk	60			SECONDS
ANODE VOLTAGE DROP (AT RECOMMENDED Ef)	etd			175	VOLTS

MECHANICAL DATA

TYPE OF COOLING (HEAT DISSIPATING SHIELDS MAY BE USED. FORCED AIR COOLING IS NOT RECOMMENDED.)	CONVECTION
ALITITUDE	SEE APPLICATION NOTES
MOUNTING POSITION	ANY
MAXIMUM NET WEIGHT	0.5 OUNCES
DIMENSIONS	SEE OUTLINE DRAWINGS
MAXIMUM VIBRATION CONDITIONS	10-50 CPS @ 10G
MAXIMUM SHOCK CONDITIONS (48° HAMMER BLOW IN NAVY FLY WEIGHT, HIGH IMPACT SHOCK MACHINE)	720 G/1MSEC.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS
ABSOLUTE VALUES

	SYMBOL	MIN.	MAX.	
PEAK ANODE VOLTAGE				
INVERSE (NOTE 1)	epx	---	1000	VOLTS
FORWARD	epy	200	1000	VOLTS
CATHODE CURRENT				
PEAK	ib		20.0	AMP.
AVERAGE	Ib		50	MA.
RMS (FOR SQUARE PULSE APPLICATIONS $I_p = \sqrt{I_b \times ib}$)	I_p		1.0	AMP.
DC ANODE VOLTAGE	E_{bb}		300	VOLTS
HEATER-CATHODE VOLTAGE	Ehk	-100	+25	VOLTS
OPERATING FREQUENCY (THIS IS NOT NECESSARILY THE UPPER OPERATING FREQUENCY LIMIT BUT REPRESENTS THE HIGHEST REPETITION RATE EXTENSIVELY LIFE TESTED TO DATE.)	prr		5000	CPS
PEAK GRID VOLTAGE (SEE RECOMMENDED GRID PULSE CONDITIONS.)	egy	175	500	VOLTS
PEAK INVERSE GRID VOLTAGE	egx		150	VOLTS
HEATING FACTOR (epy x ib x prr.)	Pb		1×10^8	
CURRENT RATE OF RISE (NOTE 2)			400	AMP/μSEC.
ANODE DELAY TIME (NOTE 3)	tad		0.6	μSEC.
TIME JITTER (NOTE 4)	tj		0.01	μSEC.
AMBIENT TEMPERATURE	TA	-60	+125	°C

NOTES

[1] IN PULSED OPERATION, THE PEAK INVERSE VOLTAGE, EXCLUSIVE OF A SPIKE OF 0.05 μSEC. MAXIMUM DURATION, SHALL NOT EXCERD 500 VOLTS DURING THE FIRST 25 μSEC, FOLLOWING THE ANODE PULSE.

[2] MEASUREMENT MADE BETWEEN 26% AND 70.7% POINTS.

[3] ANODE DELAY TIME IS DEFINED AS THE TIME INTERVAL BETWEEN THE POINT ON THE RISING PORTION OF THE GRID VOLTAGE PULSE WHICH IS 26 PERCENT OF THE MAXIMUM UNLOADED PULSE AMPLITUDE AND THE POINT WHERE ANODE CONDUCTION TAKES PLACE.

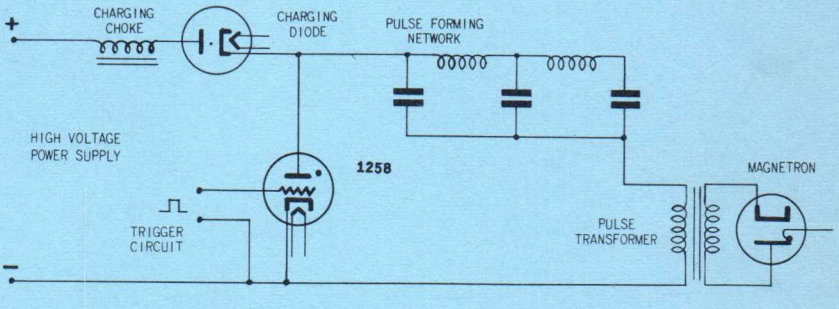
[4] TIME JITTER IS MEASURED AT 50 PERCENT OF THE PULSE AMPLITUDE AFTER THE TUBE HAS BEEN OPERATING FOR AT LEAST 60 SECONDS. THE LIMIT OF 0.01 μSEC. SHOWN IS THE MAXIMUM ALLOWABLE UNDER SPECIFIED UNFAVORABLE OPERATING CONDITIONS. WITH SUFFICIENT GRID DRIVE AND WITH ANODE VOLTAGES OF 600 VOLTS AND ABOVE, JITTER NOT EXCEEDING 0.005 μSEC. CAN BE EASILY ACHIEVED.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

APPLICATION NOTES

THIS MINIATURE HYDROGEN THYRATRON IS DESIGNED PRIMARILY FOR USE IN LINE TYPE RADAR MODULATORS. A BASIC CIRCUIT FOR SUCH SERVICE IS ILLUSTRATED BELOW. IN SUCH A CIRCUIT, THE HYDROGEN THYRATRON SERVES AS A SWITCH TO RELEASE INTO THE MAGNETRON OR OTHER RADIO FREQUENCY GENERATOR, THE ENERGY STORED IN THE PULSE FORMING NETWORK. THIS TUBE IS ADMIRABLY SUITED FOR SUCH SERVICE BY ITS ABILITY TO HOLD OFF RELATIVELY HIGH VOLTAGE, AND TO PASS HIGH PEAK CURRENT WITH RELATIVELY LOW TUBE VOLTAGE DROP. THE TUBE WILL OPERATE OVER A WIDE RANGE OF PULSE REPETITION RATES, PULSE WIDTHS AND PEAK CURRENTS, THUS PROVIDING A VERY FLEXIBLE CIRCUIT ELEMENT. TRIGGERING REQUIREMENTS ARE SIMPLIFIED SINCE THE TUBE OPERATES WITH ZERO BIAS.



THE 1258 FITS A STANDARD 7 PIN MINIATURE SOCKET. THE TUBE PINS, HOWEVER, ARE STIFF, AND CARE SHOULD BE TAKEN TO HAVE THE SOCKET CLIPS IN PERFECT ALIGNMENT BEFORE ATTEMPTING TO INSERT A TUBE. AS THE TUBE OPERATES AT HIGH TEMPERATURES, A CERAMIC TYPE SOCKET SHOULD BE EMPLOYED. CONNECTIONS TO THE SOCKET SHOULD BE MADE WITH FLEXIBLE LEADS TO PROVIDE FLOATING ACTION FOR THE SOCKET CLIPS. PIN STRAIGHTENERS SHOULD NEVER BE USED ON THIS TUBE TYPE, AS ANY ATTEMPT TO BEND THE PINS WILL RESULT IN CRACKED BUTTON BASES.

THE NOMINAL ALTITUDE RATING FOR THE 1258 IS 10,000 FEET. HOWEVER, IF PROVISION IS MADE TO PREVENT ARC-OVER BETWEEN PINS, THIS TYPE WILL OPERATE AT 80,000 FEET. ONE METHOD OF PREVENTING ARC-OVER BETWEEN PINS IS TO POT THE BASE END OF THE TUBE. IF THE ENTIRE ENVELOPE IS TO BE POTTED, HOWEVER, PRECAUTION MUST BE TAKEN TO KEEP BULB TEMPERATURE BELOW 225°C.

CATHODE TEMPERATURE IS DETERMINED BY RMS CATHODE CURRENT AS WELL AS BY HEATER POWER. THE BOGEY HEATER VOLTAGE OF 6.3 VOLTS THEREFORE IS APPLICABLE ONLY NEAR FULL OPERATING CONDITIONS. AT LIGHT LOADING IT IS RECOMMENDED TO OPERATE THE HEATER VOLTAGE HIGHER. RECOMMENDED FIGURES FOR VARIOUS OPERATING CONDITIONS ARE SHOWN ON THE CURVES.

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATION

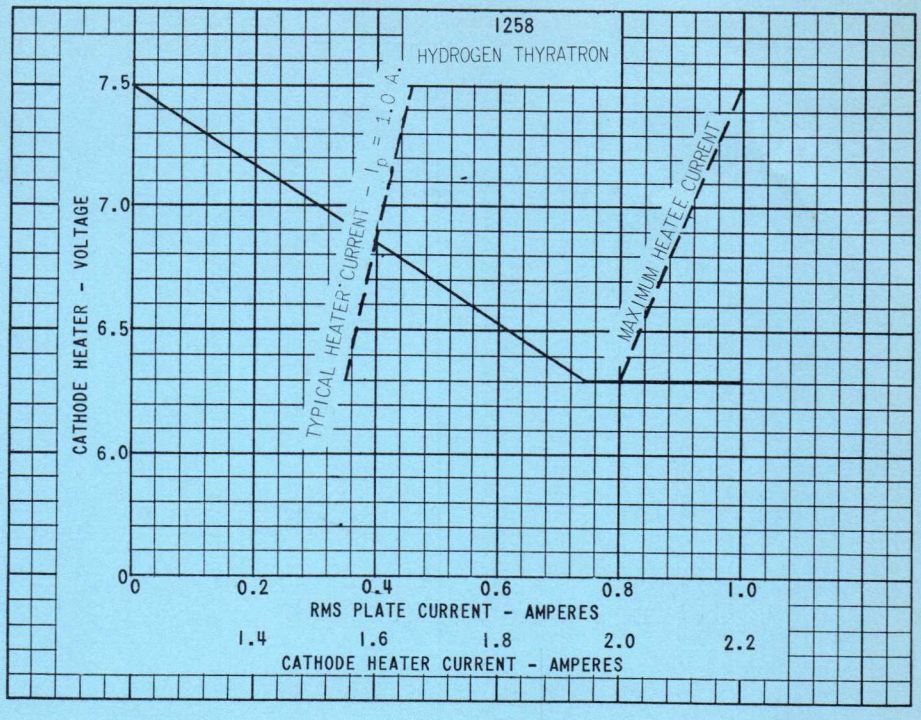
PRR	ANODE CURRENT			PEAK ANODE VOLTAGE	PULSE WIDTH	GRID DRIVE	
	PEAK	RMS	AVG.				
(pps)	(Amps)	Amps AC	mAd.c.	VOLTS	μ sec	μ sec	VOLTS
5000	20.0	1.0	50.	1000	0.5	1.0	175
10000	6.6	0.5	37.	316	0.56	2.0	175
33000*	3.5	0.46	60.	350	0.5	BLOCKING OSCILLATOR	200

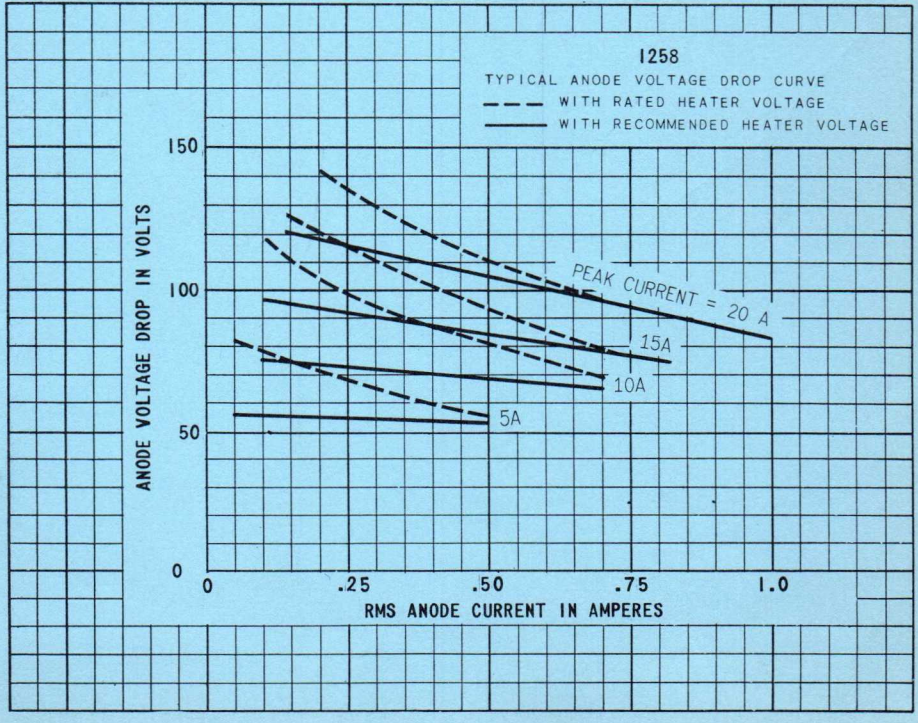
* LIMITED TEST INFORMATION.

RECOMMENDED GRID PULSE VALUES

	MIN.	MAX.	
PEAK VOLTAGE	200	500	VOLTS
DRIVER CIRCUIT IMPEDANCE	200	1000	OHMS
VOLTAGE RATE OF RISE PER μSEC.	350		VOLTS

THESE VALUES ARE AS MEASURED AT THE TUBE SOCKET WITH THE THYRATRON REMOVED. THE GRID PULSE WIDTH SHOULD NOT BE LONGER THAN THE ANODE PULSE EXCEPT IN CASES WHERE THE DRIVER CIRCUIT IMPEDANCE IS HIGH. THE MINIMUM PEAK TRIGGER VOLTAGE RECOMMENDED WILL INCREASE WITH DECREASING TRIGGER PULSE WIDTH. HOWEVER, THIS EFFECT IS IMPORTANT ONLY AT PULSE WIDTHS LESS THAN 0.5 MICROSECONDS.

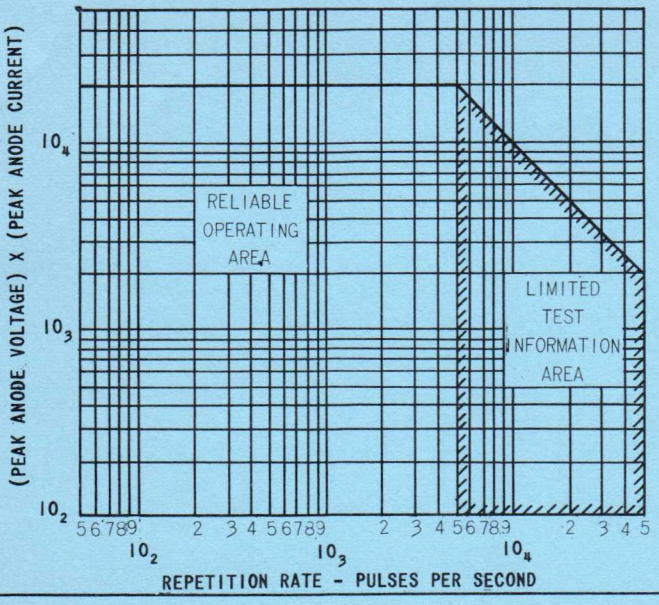




PRINTED IN U. S. A.

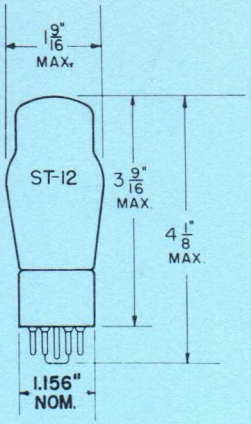
1258

GRAPHICAL REPRESENTATION OF HEAT FACTOR



TUNG-SOL

THYRATRON ←



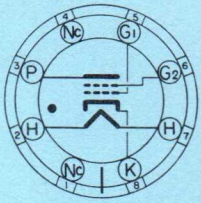
GLASS BULB

HEATER

6.3±10% VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SPECIAL SKIRTED
SMALL SHELL LOW-LOSS
OCTAL 8 PIN BASE

6BS

THE 2050 IS A XENON FILLED FOUR ELECTRODE THYRATRON WITH NEGATIVE CONTROL CHARACTERISTIC. THIS TUBE IS DESIGNED FOR RELAY APPLICATIONS FOR GRID CONTROLLED RECTIFIER SERVICE. WITH SHIELD GRID TYPE OF CONSTRUCTION A VERY LOW PRECONDUCTION GRID CURRENT FLOWS WHICH ALLOWS THE USE OF A HIGH RESISTANCE IN THE GRID CIRCUIT. THE GRID CONTROL CHARACTERISTIC, BECAUSE OF THE INERT GAS FILLING, IS INDEPENDENT OF AMBIENT TEMPERATURE OVER A WIDE RANGE.

THE EFFECTIVE ANODE TO CONTROL GRID CAPACITY MAY BE REDUCED BY CONNECTING PIN #4 TO #8 AND CONNECTING THE GRID RESISTOR DIRECTLY AT THE SOCKET TERMINAL.

ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f=6.3VOLTS)	0.60	AMP.
MINIMUM CATHODE HEATING TIME	10.	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	0.26	μμf
CONTROL GRID TO CATHODE (AND SHIELD GRID)CAPACITANCE	4.2	μμf
ANODE TO CATHODE (AND SHIELD GRID)CAPACITANCE	3.6	μμf
DE-IONIZATION TIME, APPROX. (SHIELD TIED TO CATHODE) WITH GRID VOLTS =-250, GRID RES.=1000Ω ANODE VOLTS =125, ANODE CURRENT =0.1 AMPS.	50	μSECONDS
WITH GRID VOLTS =-10, GRID RES.=1000 Ω, ANODE VOLTS =125, ANODE CURRENT =0.1 AMPS.	100	μSECONDS
IONIZATION TIME, APPROX.	0.5	μSECONDS
ANODE VOLTAGE DROP, APPROX.	8	VOLTS
MAXIMUM CRITICAL GRID CURRENT (AT E_{bb}=460V. RMS)	0.5	μAMPS.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

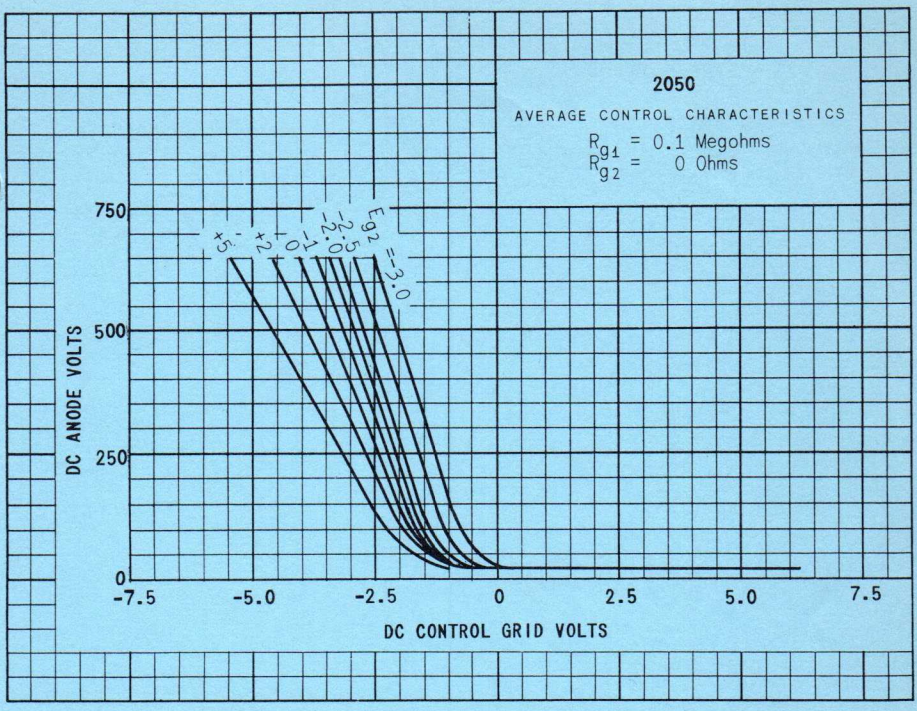
MECHANICAL DATA

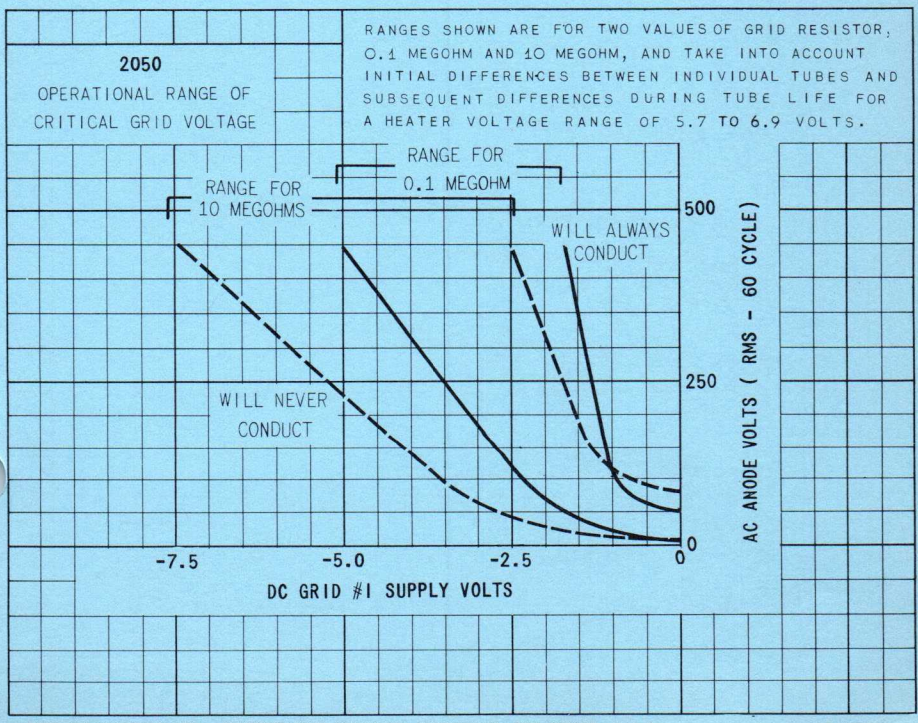
MOUNTING POSITION	ANY	
MAXIMUM OVERALL HEIGHT	4 1/8	INCHES
MAXIMUM SEATED LENGTH	3 9/16	INCHES
MAXIMUM DIAMETER	1 9/16	INCHES
BULB	ST-12	
BASE	SMALL SHELL OCTAL 8 PIN	
MAXIMUM NET WEIGHT	1.5	OUNCES

RATINGS
ABSOLUTE VALUES

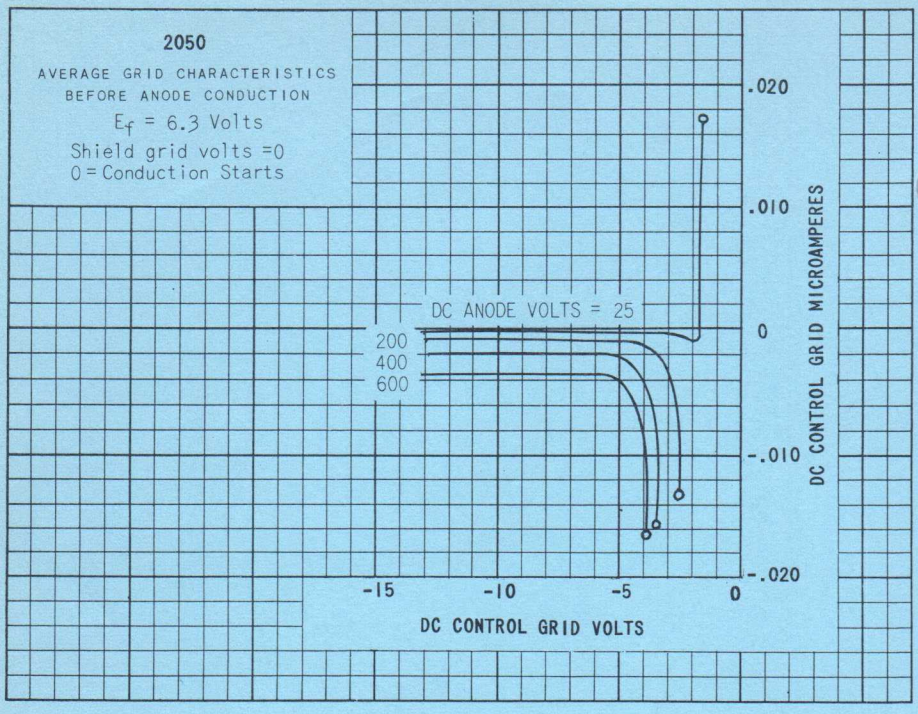
MAXIMUM PEAK ANODE VOLTAGE			
INVERSE	350	1300	VOLTS
FORWARD	180	650	VOLTS
MAXIMUM CATHODE CURRENT			
PEAK	1.0	1.0	AMPS.
AVERAGE	0.2	0.1	AMPS.
SURGE (MAX. DURATION 0.1 SECONDS)	10	10	AMPS.
MAXIMUM AVERAGING TIME	30	30	SECONDS
MAXIMUM NEGATIVE CONTROL GRID VOLTAGE			
BEFORE CONDUCTION	-250	-250	VOLTS
DURING CONDUCTION	-10	-10	VOLTS
MAXIMUM POSITIVE CONTROL GRID CURRENT, AVG. (AVERAGING TIME, 1 CYCLE)	0.01	0.01	AMPS.
MAXIMUM NEGATIVE SHIELD GRID VOLTAGE			
BEFORE CONDUCTION	-100	-100	VOLTS
DURING CONDUCTION	-10	-10	VOLTS
MAXIMUM POSITIVE SHIELD GRID CURRENT, AVG. (AVERAGING TIME, 1 CYCLE)	0.01	0.01	AMPS.
MAXIMUM CONTROL GRID CIRCUIT RESISTANCE	1.0	10	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE	-100	-100	VOLTS
HEATER POSITIVE	25	25	VOLTS
AMBIENT TEMPERATURE LIMITS	-75 TO +90		°C

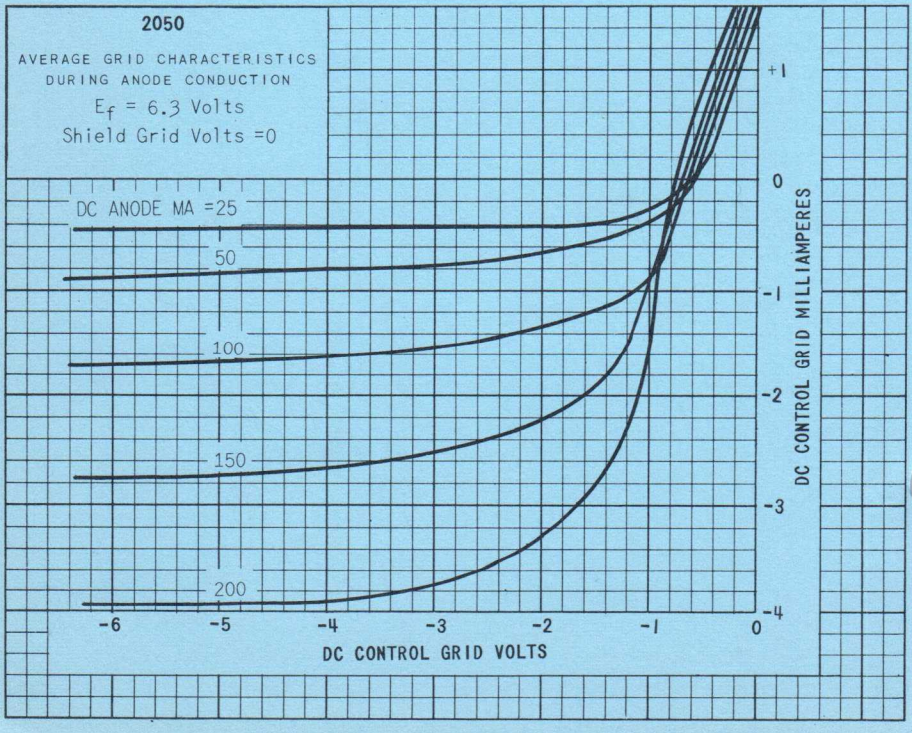
→ INDICATES A CHANGE.





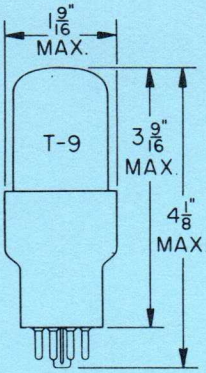
PRINTED IN U. S. A.


2050
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
.020
.010
0
-.010
-.020
DC CONTROL GRID MICROAMPERES
-15
-10
-5
0
DC CONTROL GRID VOLTS


2050
AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION
E_f = 6.3 Volts
Shield Grid Volts =0
DC ANODE MA =25
50
100
150
200
+1
0
-1
-2
-3
-4
DC CONTROL GRID MILLIAMPERES
-6
-5
-4
-3
-2
-1
0
DC CONTROL GRID VOLTS

TUNG-SOL

THYRATRON



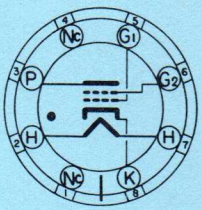
GLASS BULB

HEATER

6.3±10% VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SPECIAL SKIRTED
SMALL SHELL LOW-LOSS
OCTAL 8 PIN BASE

6BS

THE 2050W IS A RUGGEDIZED, XENON FILLED, FOUR ELECTRODE THYRATRON WITH WITH NEGATIVE CONTROL CHARACTERISTICS. THIS TUBE IS ELECTRICALLY EQUIVALENT TO THE POPULAR TYPE 2050, BUT HAS BEEN RUGGEDIZED TO PERMIT THE TUBE TO STAND HIGH IMPACT SHOCKS AND VIBRATION. THE DESIGN FEATURES STRONGER ELEMENTS AND A CUSHIONING SILASTIC RUBBER FILLING BETWEEN THE GLASS ENVELOPE AND THE SPECIAL SKIRTED LOW LOSS BASE. THIS TUBE IS DESIGNED FOR RELAY APPLICATIONS AND FOR GRID CONTROLLED RECTIFIER SERVICE. WITH THE SHIELD GRID TYPE OF CONSTRUCTION, A VERY LOW PRE-CONDUCTION GRID CURRENT FLOWS WHICH ALLOWS THE USE OF A HIGH RESISTANCE IN THE GRID CIRCUIT. THE GRID CONTROL CHARACTERISTIC, BECAUSE OF THE INERT GAS FILLING, IS INDEPENDENT OF AMBIENT TEMPERATURE OVER A WIDE RANGE.

THE EFFECTIVE ANODE TO CONTROL GRID CAPACITY MAY BE REDUCED BY CONNECTING PIN #4 TO #8 AND CONNECTING THE GRID RESISTOR DIRECTLY AT THE SOCKET TERMINAL.

ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f=6.3VOLTS)	0.60	AMP.
MINIMUM CATHODE HEATING TIME	10.	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	0.26	μμf
CONTROL GRID TO CATHODE (AND SHIELD GRID)CAPACITANCE	4.2	μμf
ANODE TO CATHODE (AND SHIELD GRID)CAPACITANCE	3.6	μμf
DE-IONIZATION TIME, APPROX. (SHIELD TIED TO CATHODE) WITH GRID VOLTS =-250, GRID RES.=1000Ω ANODE VOLTS =125, ANODE CURRENT =0.1 AMPS.	50	μSECONDS
WITH GRID VOLTS =-10, GRID RES.=1000 Ω, ANODE VOLTS =125, ANODE CURRENT =0.1 AMPS.	100	μSECONDS
IONIZATION TIME, APPROX.	0.5	μSECONDS
ANODE VOLTAGE DROP, APPROX.	8	VOLTS
MAXIMUMCCRITICAL GRID CURRENT (AT E_{bb}=460V. RMS)	0.5	μAMPS.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

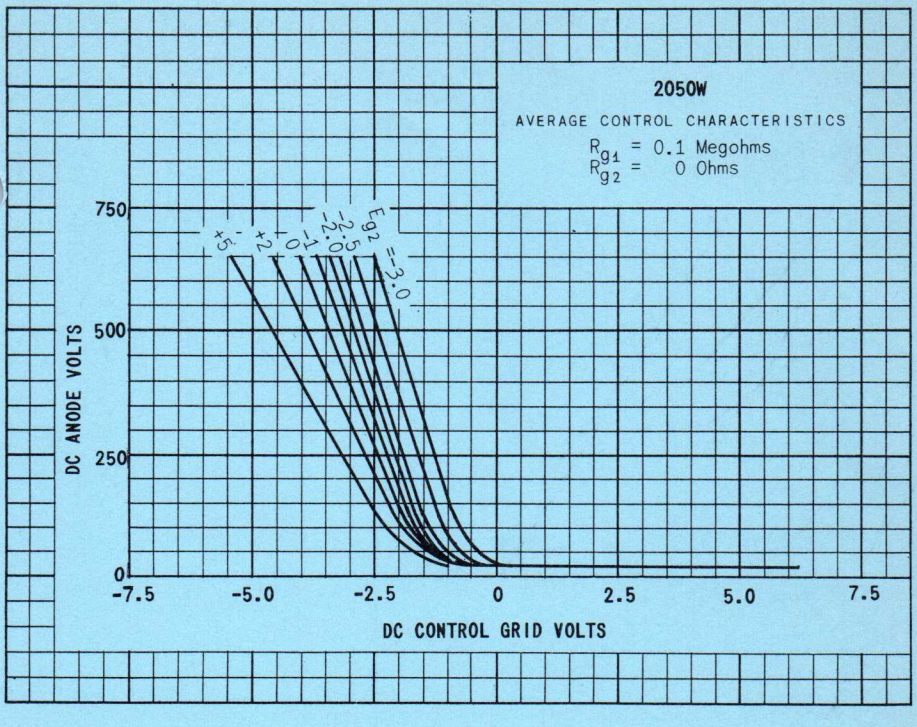
MECHANICAL DATA

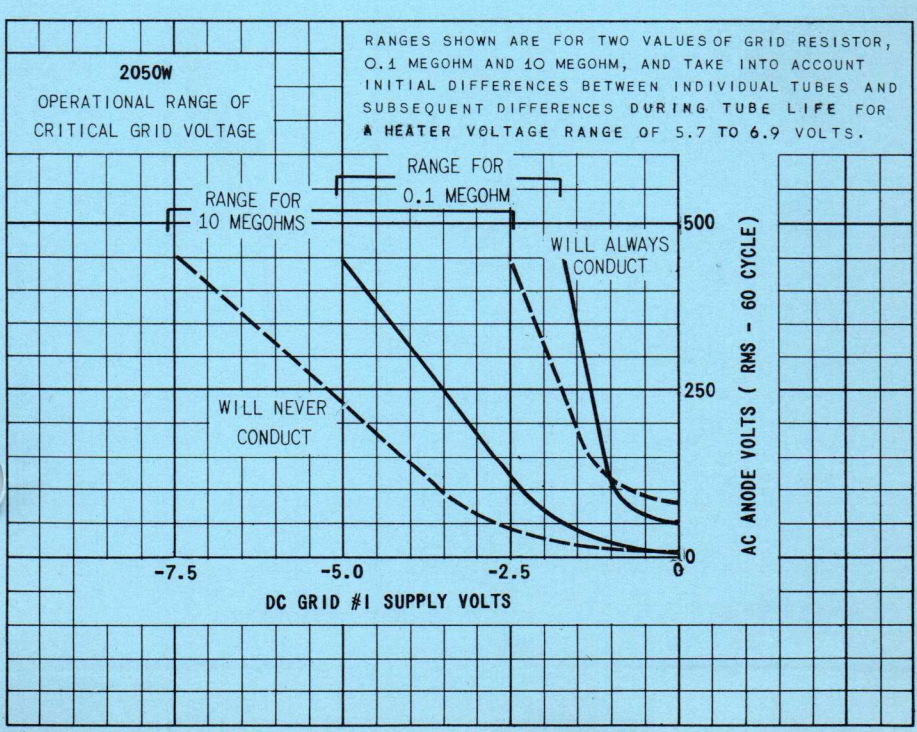
MAXIMUM SHOCK RATING	700	G
MOUNTING POSITION	ANY	
MAXIMUM OVERALL HEIGHT	4 1/8	INCHES
MAXIMUM SEATED LENGTH	3 9/16	INCHES
MAXIMUM DIAMETER	1 9/16	INCHES
BULB	T-9	
BASE	SMALL SHELL OCTAL 8 PIN	
MAXIMUM NET WEIGHT	2.5	OUNCES

RATINGS
ABSOLUTE VALUES

MAXIMUM PEAK ANODE VOLTAGE			
INVERSE	350	1300	VOLTS
FORWARD	180	650	VOLTS
MAXIMUM CATHODE CURRENT			
PEAK	1.0	1.0	AMPS.
AVERAGE	0.2	0.1	AMPS.
SURGE (MAX. DURATION 0.1 SECONDS)	10	10	AMPS.
MAXIMUM AVERAGING TIME	30	30	SECONDS
MAXIMUM NEGATIVE CONTROL GRID VOLTAGE			
BEFORE CONDUCTION	-250	-250	VOLTS
DURING CONDUCTION	-10	-10	VOLTS
MAXIMUM POSITIVE CONTROL GRID CURRENT, AVG. (AVERAGING TIME, 1 CYCLE)	0.01	0.01	AMPS.
MAXIMUM NEGATIVE SHIELD GRID VOLTAGE			
BEFORE CONDUCTION	-100	-100	VOLTS
DURING CONDUCTION	-10	-10	VOLTS
MAXIMUM POSITIVE SHIELD GRID CURRENT, AVG. (AVERAGING TIME, 1 CYCLE)	0.01	0.01	AMPS.
MAXIMUM CONTROL GRID CIRCUIT RESISTANCE	1.0	10	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE	-100	-100	VOLTS
HEATER POSITIVE	25	25	VOLTS
AMBIENT TEMPERATURE LIMITS	-75 TO +90		°C

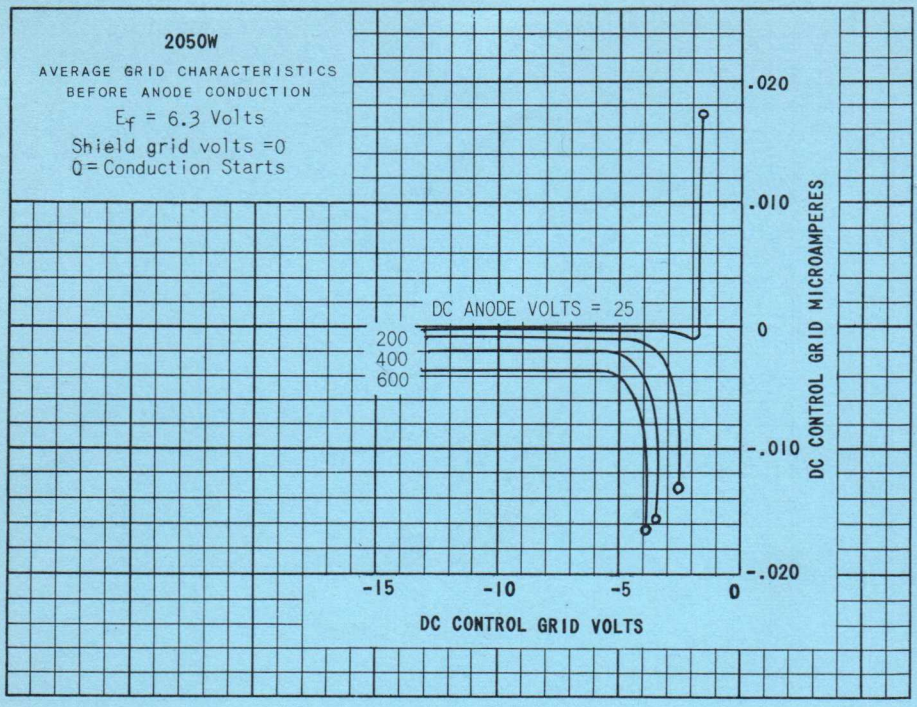
→ INDICATES A CHANGE.

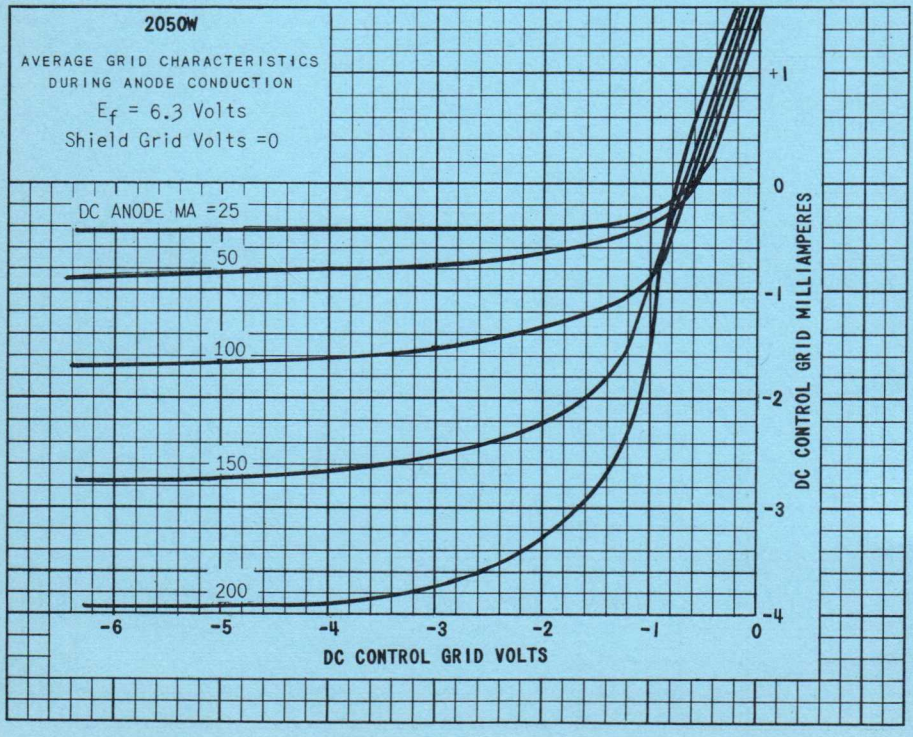




PRINTED IN U. S. A.

TENTATIVE DATA

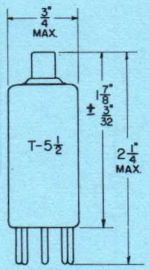




TUNG-SOL

HALF WAVE RECTIFIER

MINIATURE TYPE

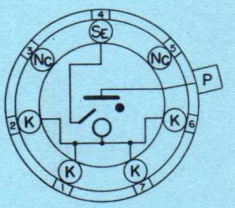


GLASS BULB

SKIRTED MINIATURE
C1-3

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

THE 5517 IS A GAS FILLED, COLD CATHODE, HALF WAVE RECTIFIER. THIS TUBE FEATURES SMALL SIZE, LIGHT WEIGHT AND INSTANT OPERATION. A STARTING ELECTRODE IS USED TO IGNITE THE TUBE AT RELATIVELY LOW VOLTAGE, PERMITTING IT TO OPERATE OVER A LARGE PORTION OF THE AC CYCLE. ONE TUBE IN A HALF WAVE CIRCUIT WILL SUPPLY 10 MADC AT MORE THAN 1,000 VDC. THIS TUBE IS USED EXTENSIVELY FOR PHOTOFLASH WORK AND FOR OTHER APPLICATIONS WHERE THE NECESSITY OF FILAMENT POWER DURING STANDBY WOULD BE A DISADVANTAGE.

MAXIMUM RATINGS

MAXIMUM PEAK INVERSE ANODE VOLTAGE	2800	VOLTS
MAXIMUM STARTING VOLTAGE (WITH STARTER ELECTRODE CONNECTED TO ANODE THROUGH 10 MEG.OHMS)RMS	400	VOLTS
MAXIMUM AVERAGE ANODE CURRENT	12	MA.
MAXIMUM PEAK ANODE CURRENT	100	MA.
MAXIMUM TUBE DROP (AT I_b =100 MA.)	125	VOLTS
MAXIMUM SURGE ANODE CURRENT	300	MA.
MINIMUM SOURCE IMPEDANCE[A]	5000	OHMS

[A] SOURCE IMPEDANCE MAY BE LESS THAN THAT SPECIFIED IF CIRCUIT CONSTANTS ARE SUCH THAT MAXIMUM PEAK ANODE CURRENT DOES NOT EXCEED 100MA AND THAT A SHORT CIRCUIT CURRENT IS LIMITED TO 300 MA.

ELECTRICAL DATA

AVERAGE TUBE DROP	100	VOLTS

MECHANICAL DATA

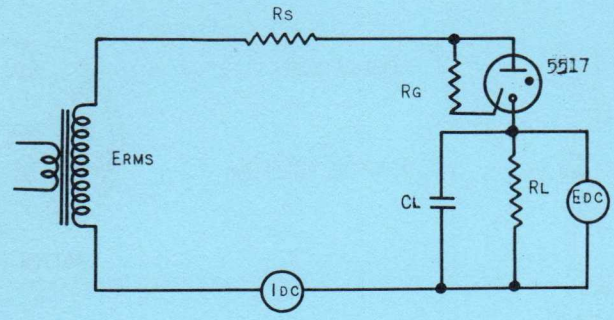
MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2 1/4	INCHES
SEATED LENGTH	1 7/8 ± 3/32	INCHES
MAXIMUM DIAMETER	0.75	INCHES
BULB	T-5 1/2	
CAP	SKIRTED MINIATURE, C1-3	
BASE	MINIATURE BUTTON 7 PIN	
AVERAGE WEIGHT	0.32	OUNCES

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

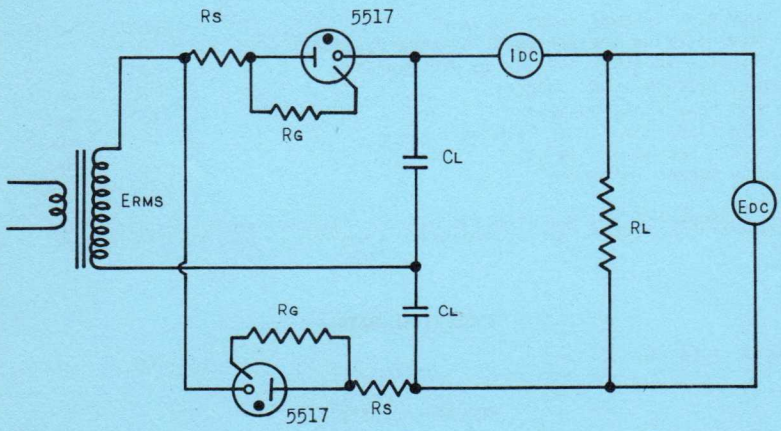
TUNG-SOL

Figure 1 - HALF WAVE RECTIFIER



ERMS VOLTS	Rs OHMS	RG MEGOHMS	RL OHMS	CL MFD	EDC VOLTS	IDC MILLIAMPS
1,000	6,000⊕	12●	100,000	2	1000	10

Figure 2 - VOLTAGE DOUBLER, FULL WAVE



ERMS VOLTS	Rs OHMS	RG MEGOHMS	RL OHMS	CL MFD	EDC VOLTS	IDC MILLIAMPS
1,200	6,000⊕	12●	255,000	4	2550	10

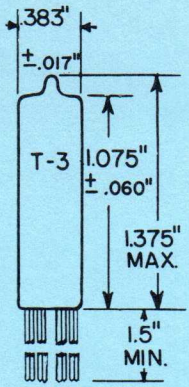
⊕INCLUDING TRANSFORMER IMPEDANCE.

●USE THREE 3.9 MEGOHM, 350V, 1/2 WATT RESISTORS IN SERIES.

TUNG-SOL

PENTODE

SUBMINIATURE TYPE

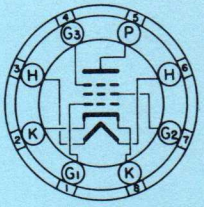


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE BUTTON
8 FLEXIBLE LEADS
8DC

THE 5636 IS A SUBMINIATURE DUAL-CONTROL PENTODE CAPABLE OF OPERATION OVER A RANGE OF FREQUENCIES FROM AF TO UHF. THE DUAL-CONTROL CHARACTERISTIC MAKES POSSIBLE ITS USE IN SUCH APPLICATIONS AS CONVERTER, MODULATOR, PHANTASTRON, AND GATING SERVICE, AS WELL AS SINGLE CONTROL USAGE SUCH AS AF, IF, AND RF AMPLIFIERS, MIXERS, ETC. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS HEATER CURRENT, PLATE CURRENT, AND TRANSCONDUCTANCE OFFER GREATER ASSURANCE TO THE EQUIPMENT DESIGNER THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL-CENTERED. AS THE TUBE MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET THE TEST SPECIFICATIONS, THE 5636 IS ESPECIALLY SUITABLE FOR USE IN MILITARY AND INDUSTRIAL EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION, SUCH AS AIRBORNE COMMUNICATIONS EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
MAXIMUM GRID #1 TO PLATE	0.020	0.030	μμf
MAXIMUM GRID #3 TO PLATE	1.10	1.10	μμf
MAXIMUM GRID #1 TO GRID #3	0.15	0.17	μμf
GRID #1 TO ALL OTHER ELECTRODES (RATED)	4.0	4.0	μμf
MINIMUM	3.5	---	μμf
MAXIMUM	4.5	---	μμf
GRID #3 TO ALL OTHER ELECTRODES (RATED)	4.0	3.8	μμf
MINIMUM	3.5	---	μμf
MAXIMUM	4.5	---	μμf
PLATE TO ALL OTHER ELECTRODES (RATED)	3.4	1.9	μμf
MINIMUM	2.9	---	μμf
MAXIMUM	3.9	---	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±200	VOLTS
MAXIMUM DC PLATE VOLTAGE	165	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	155	VOLTS
MAXIMUM POSITIVE GRID #3 VOLTAGE	30	VOLTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	0.55	WATT
MAXIMUM GRID #2 DISSIPATION	0.45	WATT
MAXIMUM PLATE CURRENT	11	mA
MAXIMUM GRID #2 CURRENT	7.0	mA
MAXIMUM BULB TEMPERATURE	220	°C
LIFE EXPECTANCY		
30°C AMBIENT TEMPERATURE	5 000	HOURS
175°C AMBIENT TEMPERATURE	1 000	HOURS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS [B]

DUAL CONTROL AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
DC PLATE VOLTAGE	100	100	VOLTS
DC GRID #1 VOLTAGE	0	0	VOLTS
DC GRID #2 VOLTAGE	100	100	VOLTS
DC GRID #3 VOLTAGE	−1	CATHODE POTENTIAL	
CATHODE RESISTOR	150	150	OHMS
PLATE CURRENT	4.0	5.3	mA
GRID #2 CURRENT	5.8	3.6	mA
GRID #1 TRANSCONDUCTANCE	1 950	3 200	μMHOS
GRID #3 TRANSCONDUCTANCE	950	500	μMHOS
PLATE RESISTANCE	0.05	0.11	MEGOHM
GRID #1 VOLTAGE FOR I_b = 10 μA.	---	−7.5	VOLTS
GRID #3 VOLTAGE FOR I_b = 10 μA.	−8.0	---	VOLTS
NOISE OUTPUT VOLTAGE (MAX.) [C]	---	60	mV

MIXER

HEATER VOLTAGE		6.3	VOLTS
HEATER CURRENT		0.15	AMP.
DC PLATE VOLTAGE		100	VOLTS
DC GRID #2 VOLTAGE		100	VOLTS
GRID #3 VOLTAGE:			
DC		0	VOLTS
AC		15	VOLTS
CATHODE RESISTOR		150	OHMS
PLATE CURRENT		3.5	mA.
GRID #2 CURRENT		5.7	mA
PLATE RESISTANCE		320 000	OHMS
CONVERSION TRANSCONDUCTANCE		1 280	μMHOS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V; E_b = 100Vdc; E_{c1} = 0Vdc; E_{c2} = 100Vdc; E_{c3} = 0Vdc; E_{hk} = 0V; R_k = 150 Ohms
(EXCEPT AS MODIFIED BELOW)

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVERAGE MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	140	160	144	156	138	164	mA.
HEATER CATHODE LEAKAGE (E_{hk}=±100V.)	---	±5.0	---	---	---	±10	μAdc
GRID #1 CURRENT (R_{g1} =1.0 MEGOHM)	0	−0.3	---	---	0	−0.9	μAdc
PLATE CURRENT	3.7	6.9	4.6	6.0	---	---	mA
GRID #1 TRANSCONDUCTANCE	2700	4000	2900	3500	---	20 [D]	PERCENT
					---	15 [E]	PERCENT
CUT-OFF PLATE CURRENT E_{c1} = −7.5; R_K = O	0	100	---	---	---	---	μAdc
INSULATION OF ELECTRODES [F]							
GRID #1 TO ALL	100	---	---	---	50	---	MEGOHMS
PLATE TO ALL	100	---	---	---	50	---	MEGOHMS
GRID #2 CURRENT	2.8	5.4	---	---	---	---	mA
GRID #1 EMISSION [G] (E_f = 7.5V; E_{c1} =−7.5V; R_K = O; R_{g1} = 1.0 MEG.) [G]	0	−0.5	---	---	---	---	μAdc
Δ GRID #1 TRANSCONDUCTANCE (E_f = 5.7V.)	---	15	---	---	---	15	PERCENT
GRID #3 TRANSCONDUCTANCE (E_{c3} = −1.0V.)	500	1800	---	---	---	---	μMHOS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

SPECIAL REQUIREMENTS

	MINIMUM	MAXIMUM	
AF NOISE[H] (E_{sig} = 70 mVac E_{c2} = 19V, R_p = 0.2 MEG.; R_{g1} = 9.1 MEG; R_{g2} = 1000 , C_k = 1000μf.	---	17	VU
LOW PRESSURE VOLTAGE BREAKDOWN[J] (PRESSURE = 55 +5mm Hg; VOLTAGE = 300VAC	---	---	
VARIABLE FREQUENCY VIBRATION[K] (F = 10CPS–4G TO F = 50CPS – 10G)	---	---	
LOW FREQUENCY VIBRATION[L] (F = 40 CPS; G = 15; R_p = 10K; C_K = 1,000μf)	---	60	mVac
SUBMINIATURE LEAD FATIGUE[M]	4	---	ARCS
SHOCK[N] (HAMMER ANGLE = 30°; E_{hk} = +100V; R_{g1} = 0.1MEG)	---	---	
VIBRATIONAL FATIGUE[P] (G = 2.5; FIXED FREQUENCY; F = 25 MIN–60 MAX.)	---	---	
POST SHOCK & VIBRATION FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	200	mVac
HEATER CATHODE LEAKAGE	---	±20	μA.
Δ TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES	---	20	PERCENT
1 HOUR STABILITY LIFE TEST (E_{hk} = + 200V; R_{g1} = 1.0 MEG.)	---	---	
STABILITY LIFE TEST END POINTS			
Δ GRID #1 TRANSCONDUCTANCE OF INDIVIDUAL TUBES	---	15	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST (STABILITY LIFE TEST CONDITION OR EQUIVALENT)	---	---	
SURVIVAL RATE LIFE TEST END POINTS (GRID #1 TRANSCONDUCTANCE	2350	---	μMHOS
HEATER CYCLING LIFE TEST (E_f = 7.0V; 1 MIN. ON – 4 MIN. OFF; E_{hk} = 140Vac; E_{c1} = E_{c2} = E_{c3} = E_b = 0)	2500		CYCLES

NOTES

[A] WITH SHIELD OF 0.405" INSIDE DIAMETER CONNECTED TO CATHODE.

[B] ALL VOLTAGES ARE REFERENCED TO THE NEGATIVE END OF THE CATHODE RESISTOR.

[C] ACROSS PLATE RESISTOR OF 10,000 OHMS, WITH APPLIED VIBRATIONAL ACCELERATION OF 15 G. AT NO CYCLES PER SECOND.

[D] SINGLE TUBE CHANGE IN TRANSCONDUCTANCE FROM INITIAL READING.

[E] AVERAGE CHANGE IN TRANSCONDUCTANCE.

[F] SEE MIL-E-1C 4.8.2

[G] PRIOR TO THIS TEST TUBES SHALL BE PREHEATED FOR A PERIOD OF 5 MINUTES UNDER CONDITIONS LISTED BELOW. TEST IMMEDIATELY AFTER PREHEATING. THREE MINUTE TEST IS NOT ALLOWED. GRID EMISSION SHALL BE THE LAST TEST ON THE SAMPLE SELECTED FOR THE GRID EMISSION TEST. E_f = 7.5 V, E_{c1} = 0 Vdc, E_{c2} = 100 Vdc, E_{c3} = 0 Vdc, E_b = 100 Vdc, R_k = 150 OHMS, R_{g1} = 1.0 MEG.

[H] SEE MIL-E-1C 4.10.3.2

[J] THERE SHALL BE NO EVIDENCE OF ARCING OR CORONA BETWEEN ANODE PINS AND ADJACENT PINS WITH NO OTHER VOLTAGES APPLIED.

[K] SEE MIL-E-1C 4.9.20.3 NO VOLTAGES –POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS APPLY.

[L] SEE MIL-E-1C 4.9.19.1

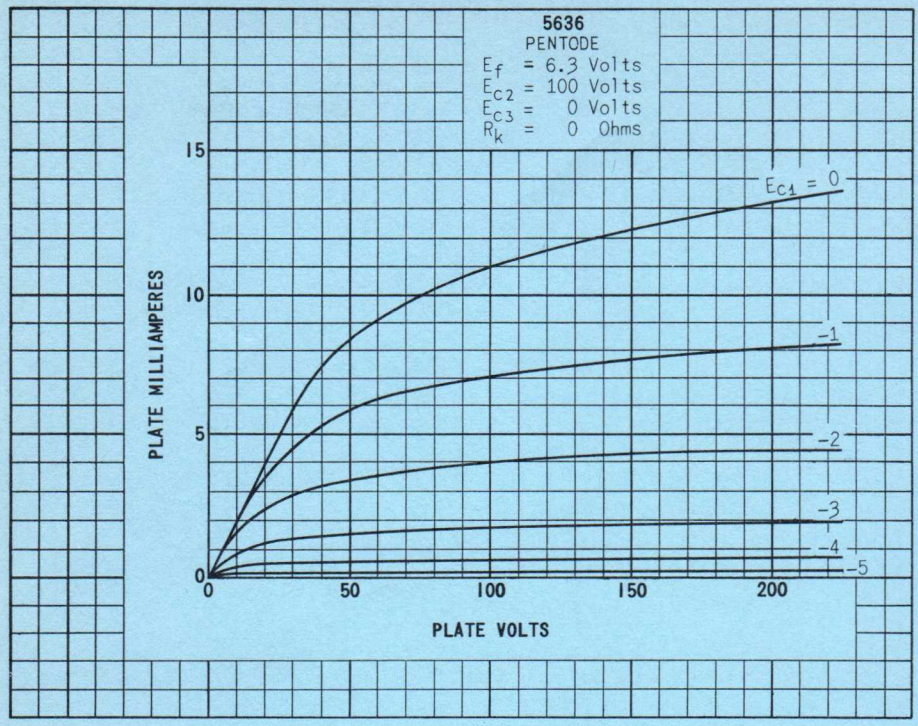
[M] SEE MIL-E-1C 4.9.5.3

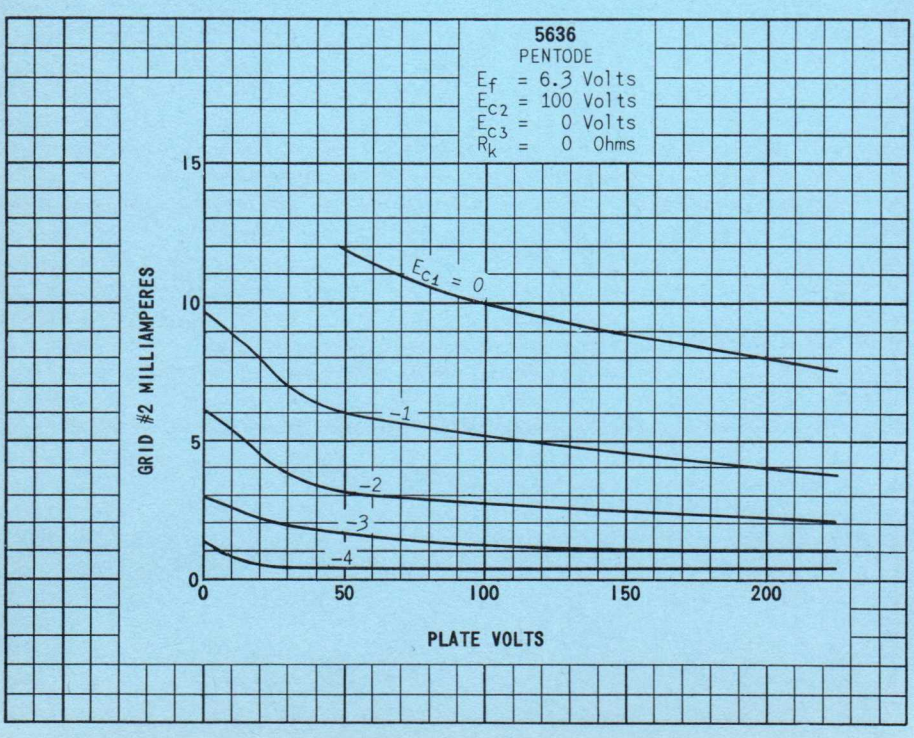
[N] SEE MIL-E-1C 4.9.20.5

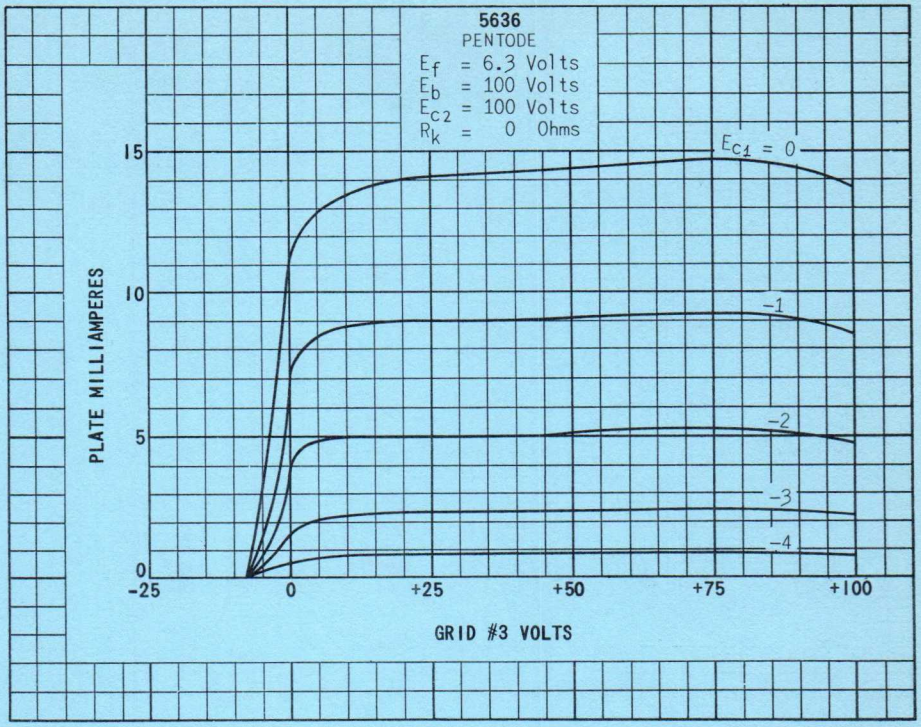
[P] SEE MIL-E-1C 4.9.20.6

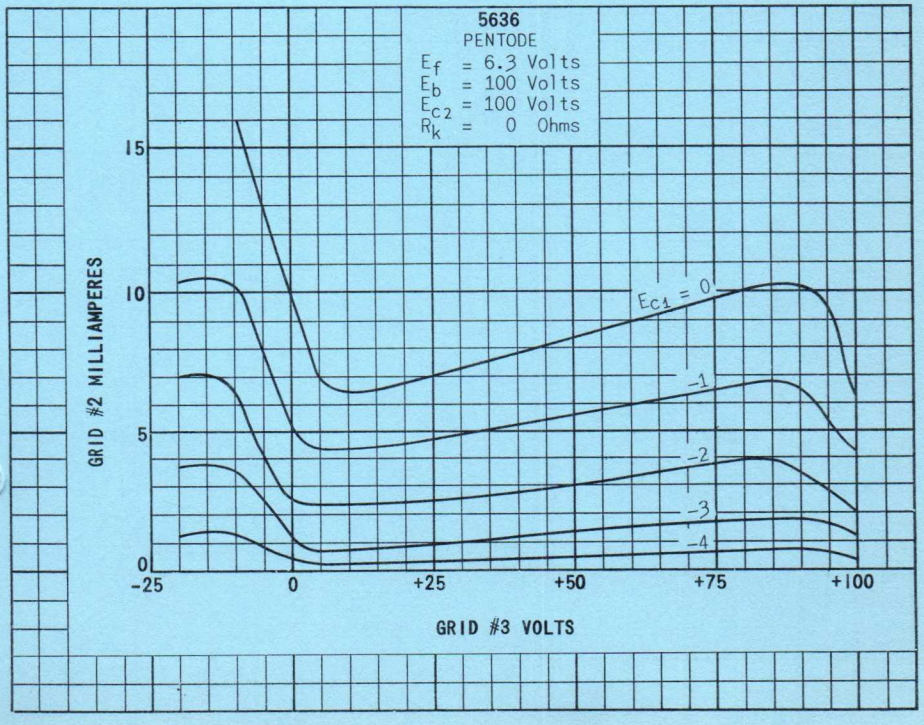
PRINTED IN U.S.A.

5636
PREMIUM TUBE



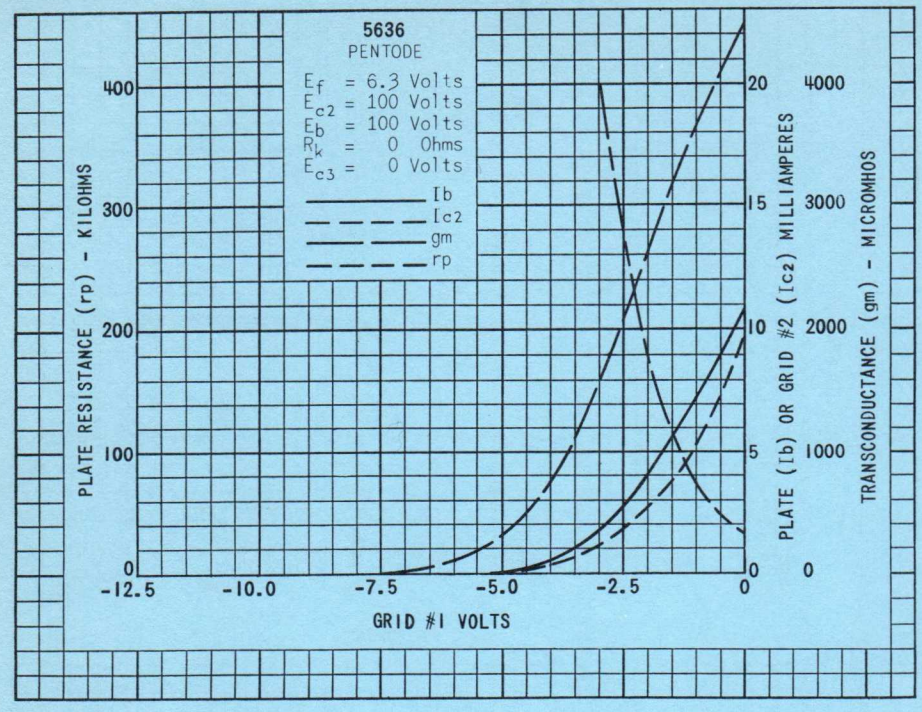


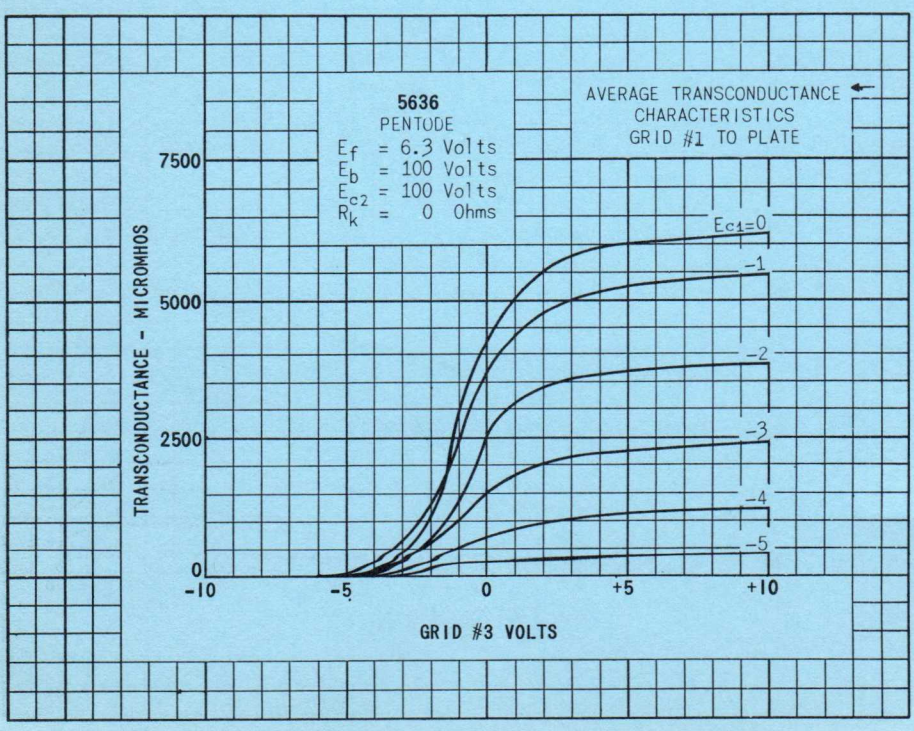


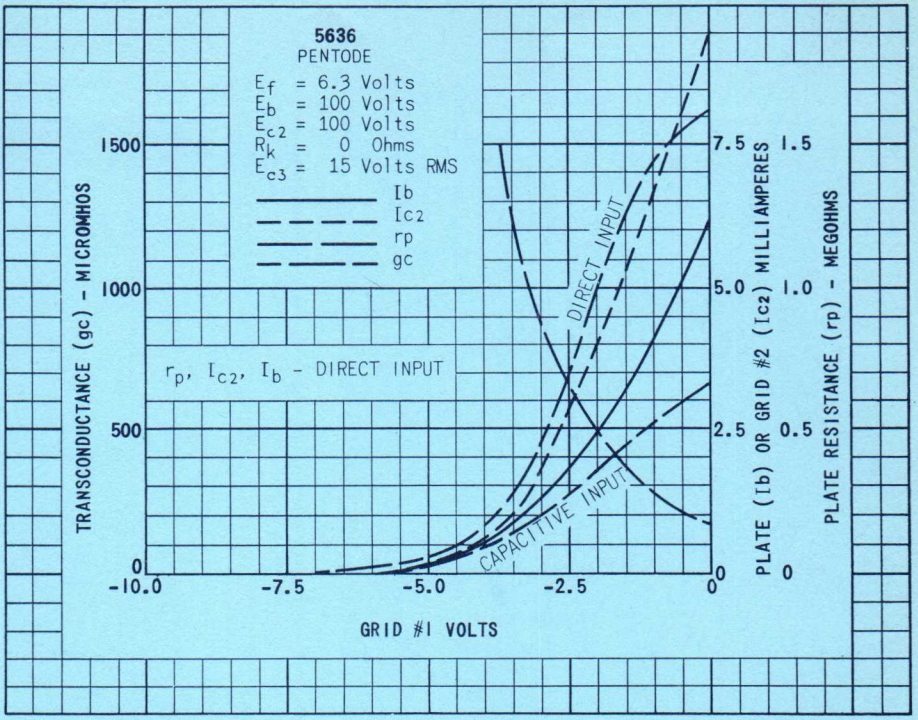


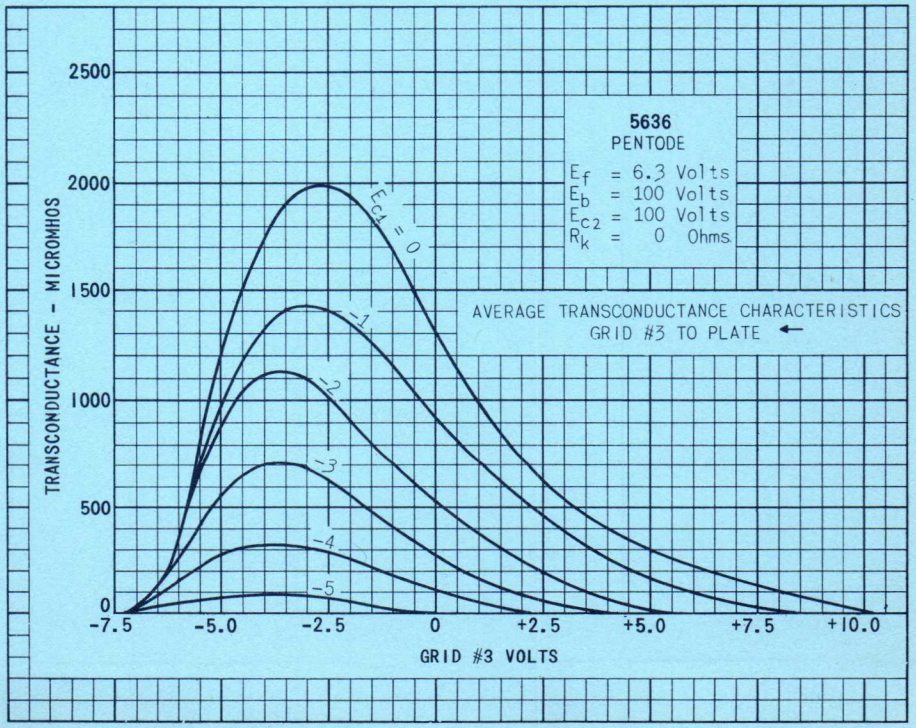
PRINTED IN U.S.A.

5636
PREMIUM TUBE



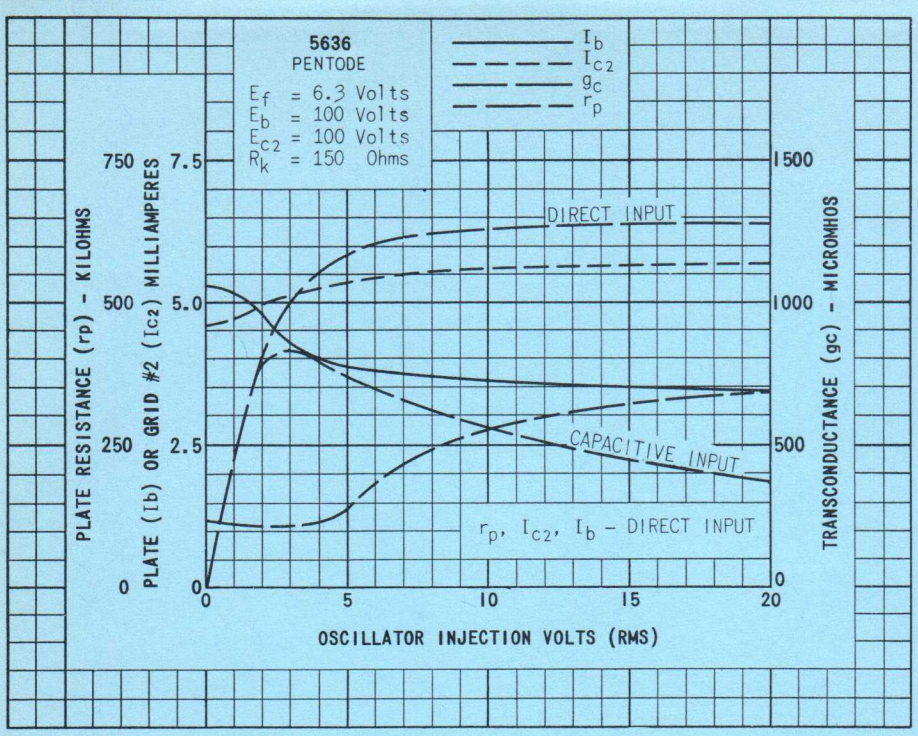






PRINTED IN U. S. A.

5636
PREMIUM TUBE



→ INDICATES A CHANGE.

TUNG-SOL

PENTODE

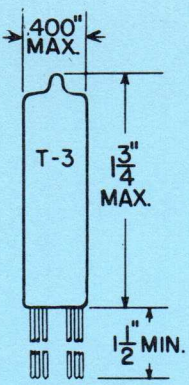
SUBMINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

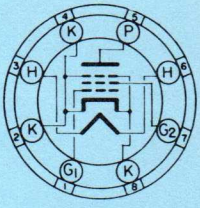
HEATER
6.3 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SUBMINIATURE BUTTON
8 FLEXIBLE LEADS
8DL

THE 5639 IS A RUGGEDIZED PENTODE IN THE 8 LEAD BUTTON SUBMINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN BROAD BAND AMPLIFIER APPLICATIONS SUCH AS IN RADAR AND VIDEO AMPLIFIER SERVICE. CONTROLS ON THE PRODUCT AVERAGE FOR HEATER CURRENT ASSURE THAT THIS CHARACTERISTIC WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5639 IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
MAXIMUM GRID #1 TO PLATE (RATED)	0.18	0.13	μμf
INPUT: (RATED)	9.0	9.0	μμf
MAXIMUM	---	10.0	μμf
MINIMUM	---	8.0	μμf
OUTPUT: (RATED)	4.6	8.0	μμf
MAXIMUM	---	9.0	μμf
MINIMUM	---	7.0	μμf

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM DC PLATE VOLTAGE	165	VOLTS
MAXIMUM DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	155	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±200	VOLTS
MAXIMUM GRID #1 RESISTANCE	0.5	MEG
MAXIMUM DC CATHODE CURRENT	40	mA
MAXIMUM PLATE DISSIPATION	3.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.0	WATT
MAXIMUM BULB TEMPERATURE	+220	°C
MAXIMUM ALTITUDE	60 000	FEET
LIFE EXPECTANCY (30°C AMBIENT TEMPERATURE)	5 000	HOURS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
DC PLATE VOLTAGE	150	VOLTS
DC GRID #2 VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR	100	OHMS
PLATE CURRENT	21	mA
GRID #2 CURRENT	4.0	mA
TRANSCONDUCTANCE	9 000	μMHOS
PLATE RESISTANCE	50 000	OHMS
GRID #1 VOLTAGE FOR 10μa PLATE CURRENT	-14	VOLTS
NOISE OUTPUT VOLTAGE (MAXIMUM)[B]	200	mV

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

R_k = 100 OHMS, E_f = 6.3V, E_b = 150Vdc, E_{c1} = 0Vdc, E_{c2} = 100Vdc, E_{hk} = 0V
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	420	480	432	468	414	492	mA
HEATER-CATHODE LEAKAGE (E_{hk} = ± 100Vdc)	---	15	---	---	---	60	μAdc
GRID #1 CURRENT (Rg1=1.0 MEG.)	0	-1.0	---	---	0	-2.0	μAdc
PLATE CURRENT (1)	14.0	28.0	---	---	---	---	mAdc
PLATE CURRENT (2) (Ec1=-14.0Vdc, Rk=0)	---	75	---	---	---	---	μAdc
TRANSCONDUCTANCE (1)	7500	10 500	---	---	μMHOS--	20[C]	PERCENT
ΔAVG. TRANSCONDUCTANCE (1)	---	---	---	---	---	15	PERCENT
INSULATION OF ELECTRODES[E]							
R(g1-all)	100	---	---	---	50	---	MEGOHMS
R(p-all)	100	---	---	---	50	---	MEGOHMS
POWER OUTPUT[F] (Esig=2.0Vac, Rp=9000)	0.75	---	---	---	---	---	WATT
SCREEN GRID CURRENT	2.0	6.0	---	---	---	---	mAdc
TRANSCONDUCTANCE (2) (Ef =5.7V)	---	10	---	---	---	15	PERCENT
GRID EMISSION[H] (Ef =7.5V, Ec1=14Vdc, Rg1=1.0 meg., Rk=0)	0	-2.0	---	---	---	---	μAdc
PLATE RESISTANCE	0.040	---	---	---	---	---	MEGOHM

SPECIAL REQUIREMENTS

	MIN.	MAX.	
CONTINUITY AND SHORTS[J]	---	---	
AF NOISE[K] (Esig = 200mVac, Ec2=100Vdc, Ec1=-2.5Vdc, Rg1=0.5 meg., Rg2=0.01 meg., Rp=2000, Rk=0, Cg2=4μf)	---	17	VU
LOW PRESSURE VOLTAGE BREAKDOWN (PRESSURE =55±5mm mercury, VOLTAGE =300Vac)	---	---	
VARIABLE FREQUENCY VIBRATION[M] (NO VOLTAGES: POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS APPLY)	---	---	
LOW FREQUENCY VIBRATION[NP] (Rp=2000, Ck=1000μf, G=15, F=40 cps)	---	100	mVac
SUBMINIATURE LEAD FATIGUE[Q]	4	---	ARCS
SHOCK[R] (HAMMER ANGLE=30°, Ehk= 100Vdc, Rg1=0.1 meg.)	---	---	
VIBRATIONAL FATIGUE[S] (G=2.5; FIXED FREQUENCY; F=25 min., 60 max.)	---	---	

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

SPECIAL REQUIREMENTS – CONT'D.

	MIN.	MAX.	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	350	mVac
HEATER CATHODE LEAKAGE (E_{hk}=±100Vdc)	---	±40	μAdc
Δ TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES	---	20	PERCENT
1 HOUR STABILITY LIFE TEST			
(E_{hk}= 200Vdc, R_{g1}=0.5 meg., TA=Room)	---	---	
STABILITY LIFE TEST END POINTS			
ΔTRANSCONDUCTANCE (1) INDIVIDUAL TUBES	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST			
STABILITY LIFE TEST CONDITIONS OR EQUIVALENT	---	---	
SURVIVAL RATE LIFE TEST END POINTS			
CONTINUITY AND SHORTS	---	---	
TRANSCONDUCTANCE (1)	6750	---	μMHOS
HEATER CYCLING LIFE TEST			
(E_f=7.0V, 1 min. on, 4 min. off, E_{hk}=140Vac, E_{c1}=E_{c2}=E_b=0)	---	---	
INTERMITTENT LIFE TEST			
STABILITY LIFE TEST CONDITIONS			
(T-BULB=+220°C min.)	---	---	

NOTES

A WITH SHIELD OF 0.405" INSIDE DIAMETER CONNECTED TO CATHODE.

B ACROSS A PLATE RESISTOR OF 2,000 OHMS WITH APPLIED VIBRATIONAL ACCELERATION OF 15g AT 40 CYCLES PER SECOND.

C CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES.

E SEE MIL-E-1C 4.8.2

F SEE MIL-E-1C 4.10.16.1

G TRANSCONDUCTANCE (2) IS THE PERCENT CHANGE IN TRANSCONDUCTANCE (1) OF AN INDIVIDUAL TUBE TYPE RESULTING FROM THE CHANGE IN Ef.

H PRIOR TO THIS TEST TUBES SHALL BE PREHEATED 5 MINUTES AT CONDITIONS INDICATED. TEST WITHIN 3 SECONDS AFTER PREHEATING. THREE MINUTE TEST IS NOT PERMITTED. GRID EMISSION SHALL BE THE LAST TEST PERFORMED ON THE SAMPLE SELECTED FOR THE GRID EMISSION TEST. CONDITIONS FOR TEST ARE AS FOLLOWS: Ef=7.5v, Ec1=0Vdc, Ec2=100Vdc, Ec3=0Vdc, Eb=150Vdc, Rk=100 OHMS, Rg1=0.5 MEG.

J SEE MIL-E-1C 4.7.5

K SEE MIL-E-1C 4.10.3.2

L THERE SHALL BE NO EVIDENCE OF ARCING OR CORONA BETWEEN ANODE PINS AND ADJACENT PINS WITH NO OTHER VOLTAGE APPLIED.

M SEE MIL-E-1C 4.9.20.3

N SEE MIL-E-1C 4.9.19.1

P FOR VIBRATION TESTS, THE IMPEDANCE OF THE PLATE VOLTAGE SUPPLY (AND SCREEN VOLTAGE SUPPLY IF ONE IS INDICATED) SHALL NOT EXCEED THAT OF A 40μf CAPACITOR AT 10 CPS.

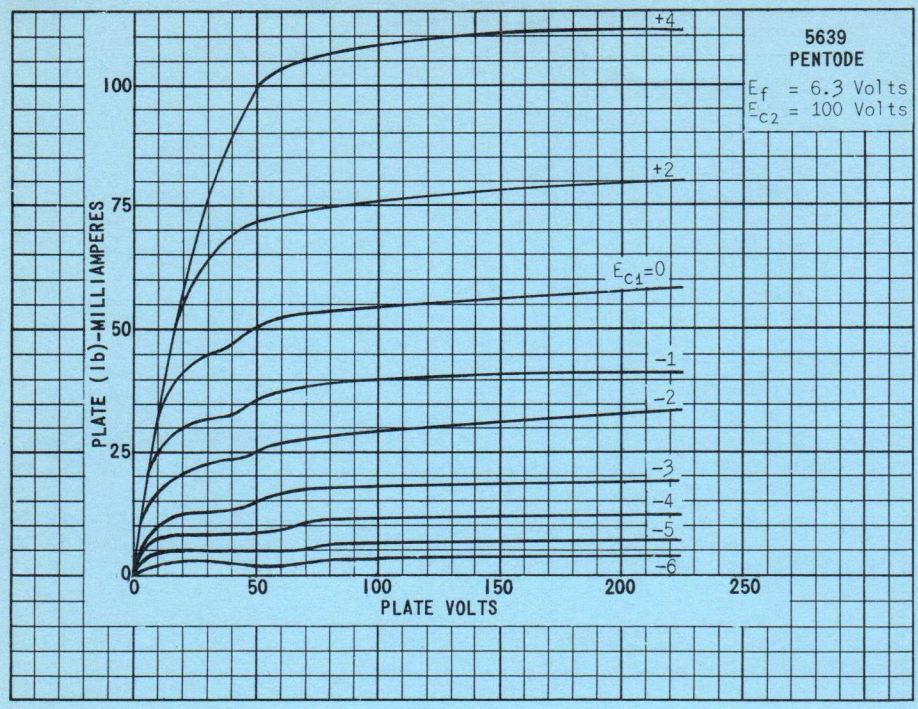
Q SEE MIL-E-1C 4.9.5.3

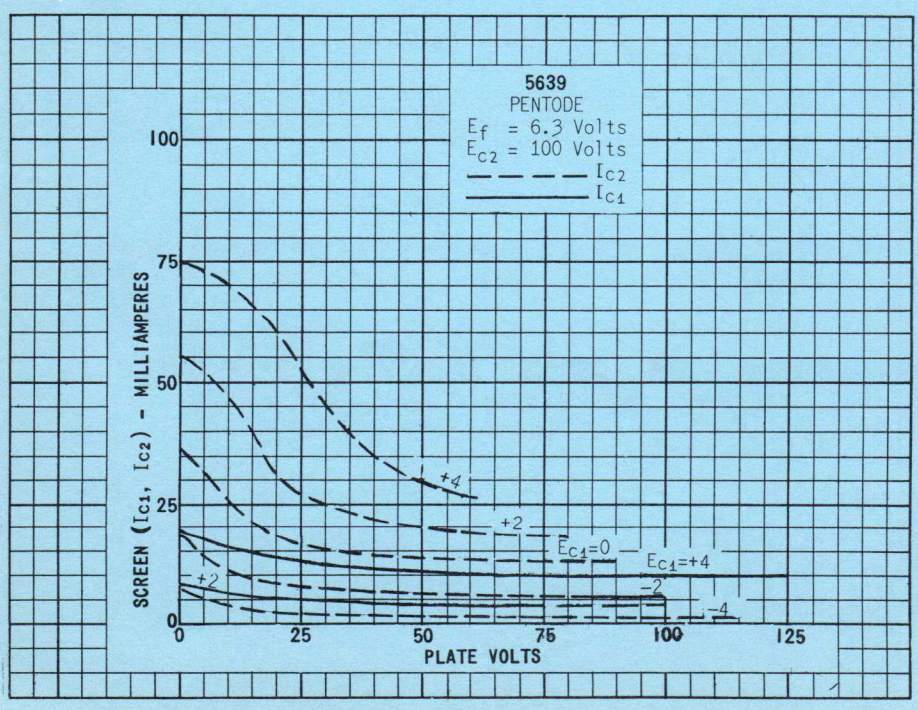
R SEE MIL-E-1C 4.9.20.5

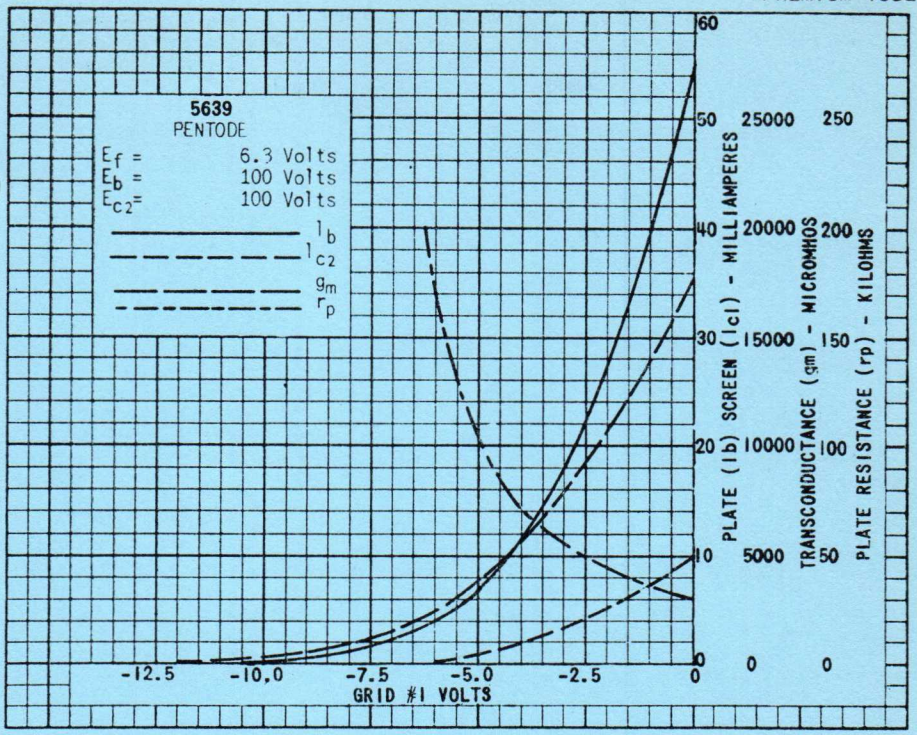
S SEE MIL-E-1C 4.9.20.6

PRINTED IN U.S.A.

5639
PREMIUM TUBE

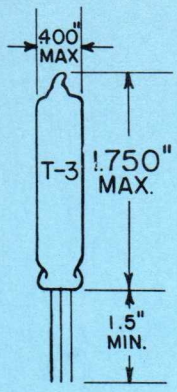






PRINTED IN U.S.A.

TUNG-SOL

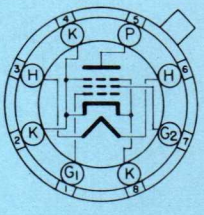


GLASS BULB

PENTODE
SUBMINIATURE TYPE

HEATER

AC OR DC



BOTTOM VIEW
SUBMINIATURE BUTTON
8 PIN BASE
0.017" TINNED FLEXIBLE LEADS
8DL

THE 5639WA IS A HEATER-CATHODE TYPE VIDEO AMPLIFIER PENTODE OF SUBMINIATURE CONSTRUCTION. IT IS DESIGNED FOR WIDE BAND, RF OR VIDEO POWER AMPLIFIER SERVICE IN EQUIPMENT WITH LOW PLATE SUPPLY VOLTAGES. IT IS SUITABLE FOR SERVICE WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. THE FLEXIBLE 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 A SUITABLE LENGTH.

RATINGS
MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST - NOTE 3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HOUR FATIGE TEST-NOTE 5)	2.5	G
MAXIMUM BULB TEMPERATURE	220	°C

RATINGS
AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MIN.	NORM. TEST CONDITIONS (NOTE 7)	NORM. OPERATION (NOTE 6)	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 8)	Ef:	6.0	6.3	6.3	6.6	V
PLATE VOLTAGE	Eb:	---	150	150	250	Vdc
PEAK PLATE VOLTAGE	eb:	---	---	---	360	v
GRID #1 VOLTAGE	Ec1:	-55	0	0	0	Vdc
GRID #2 VOLTAGE	Ec2:	---	100	100	155	Vdc
PLATE DISSIPATION	Pp:	---	---	3.15	3.5	W
GRID #2 DISSIPATION	Pg2:	---	---	0.4	1.0	W
GRID #1 CIRCUIT RESISTANCE	Rg1:	---	---	---	0.5	MEG.
HEATER-CATHODE VOLTAGE	Ehk:	-200	---	---	+200	Vdc
CATHODE CURRENT	Ik:	---	---	---	40	mAdc
CATHODE RESISTANCE	Rk:	---	100	100	---	OHMS
PLATE CURRENT (1)	Ib(1):	---	---	21.0	---	mAdc
GRID #2 CURRENT	Ic2:	---	---	4.0	---	mAdc
TRANSCONDUCTANCE (1)	Sm(1):	---	---	9000	---	μMHOS
PLATE RESISTANCE	rp:	---	---	0.05	---	MEG.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS[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						
HEATER CURRENT:	0.4	If:	427	---	---	---	473	---	mA
HEATER-CATHODE LEAKAGE:									
Ehk=+100 Vdc	0.4	Ihk:	---	---	---	---	10	---	μAdc
Ehk=-100 Vdc		Ihk:	---	---	---	---	10	---	μAdc
GRID CURRENT:									
Rg=1.0 MEG.	0.4	Ic(1):	---	---	---	---	-1.0	---	μAdc
PLATE CURRENT (1):	0.4	Ib(1):	14.0	---	21.0	---	28.0	---	mAdc
PLATE CURRENT (2):									
Ec1 =-14.0 Vdc	0.4	Ib(2):	---	---	---	---	50	---	μAdc
TRANSCONDUCTANCE (1):	0.4	Sm(1):	7500	---	9000	---	10500	---	μMHOS
CONTINUITY AND SHORTS (NOTE 11)									
INOPERATIVES:	0.4	---	---	---	---	---	---	---	---
MECHANICAL:									
ENVELOPE (8-4)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS PART 2									
INSULATION OF ELECTRODES:									
Ef=6.3 V									
Eg1-all=-100 Vdc	2.5	Rg1-all:	250	---	---	---	---	---	MEG.
Ep-all =-300 Vdc		Rp-all:	250	---	---	---	---	---	MEG.
POWER OUTPUT:									
Esig=2.0 Vac; Rp= 9000 OHMS	2.5	Po:	0.75	---	---	---	---	---	W
SCREEN CURRENT	2.5	Ic2:	2.0	---	4.0	---	6.0	---	mAdc
TRANSCONDUCTANCE (2):									
Ef=5.7 V (NOTE 9)	2.5	Δ_{Ef}Sm(2):	---	---	---	---	10	---	PERCENT
GRID EMISSION:									
Eb=250 Vdc; Rg=1.0 MEG: Rk=390 OHMS: Ec2=150 Vdc; Ef=7.5 V; PREHEAT 5MIN. AT Ec1= =0; TEST AT Ec1=-20 Vdc	6.5	Ic(2):	---	---	---	---	-2.0	---	μAdc
AF NOISE:									
Esig= 200mVac; Ecc2= 100 Vdc; Ec1=-2.5 Vdc; Rg1=0.5 MEG.; Rg2=0.01 MEG.; Rp=2000 OHMS; Rk= 0; Cg2=4μf	2.5	EB:	---	---	---	---	17	---	VU
PLATE RESISTANCE:	6.5	rp:	0.040	---	---	---	---	---	MEG.
CAPACITANCE:		Cgp:	---	---	---	---	0.13	---	μμf
CAPACITANCE (NOTE 2)	6.5	Cin:	8.0	---	9.0	---	10.0	---	μμf
CAPACITANCE:		Cout:	7.0	---	8.0	---	9.0	---	μμf
LOW PRESSURE VOLTAGE BREAKDOWN:									
PRESSURE=21±3mmHg: VOLTAGE =300 Vac	6.5	---	---	---	---	---	---	---	---

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 MECH. AND INOPERATIVES						
VIBRATION (2): F=40 Cps; G=15; Rp= 2000 OHMS	2.5	Ep:	---	---	---	---	40	---	mVac
VIBRATION (3): F=70-2000 cps; G=15; T= 3 MIN. Rp=2000 OHMS POSITIONS X1 AND X2 ONLY	6.5	ep:	---	---	---	---	250 PEAK TO PEAK	---	mv
OPERATION TIME: (NOTE 11)	4.0	t:	---	---	---	---	20	---	sec.
DEGRADATION RATE ACCEPTANCE TESTS									
SUBMINIATURE LEAD FATIGUE:	2.5	---	4.0	---	---	---	---	---	arcs
SHOCK (1); Ehk=+ 100 Vdc; Rg= 0.1 MEG: HAMMER ANGLE = 30° (NOTE 3)	20	---	---	---	---	---	---	---	---
FATIGUE (1): 96 HOURS; G=2.5: FIXED FREQUENCY: F =25 MIN., 60 MAX. (NOTE 5)	6.5	---	---	---	---	---	---	---	---
SHOCK (2): Ehk=+100 Vdc; Rg= 0.1 MEG.; HAMMER ANGLE= 120°+ RUBBER PAD:G = 75: t=10 MILLISECONDS (NOTE 13)	20	---	---	---	---	---	---	---	---
FATIGUE (2): 6 HOURS: G=10: F=130 - 2000-130 cps; (NOTE 12)	6.5	---	---	---	---	---	---	---	---
POST SHOCK (1) & (2) AND FATIGUE (1) & (2) TEST END POINTS: F=40 Cps; G=15; Rp= 2000 OHMS VIBRATION (2):	---	Ep:	---	---	---	---	80	---	mVac
HEATER-CATHODE LEAKAGE:									
Ehk=+100 Vdc	---	Ihk:	---	---	---	---	20		μAdc
Ehk=-100 Vdc	---	Ihk:	---	---	---	---	20	---	μAdc
CHANGE IN TRANSC. (1) OF INDIVIDUAL TUBES Ef=6.3 V	---	Δ_tSm(1):	---	---	---	---	15	---	PERCENT
GRID CURRENT (1):	---	Ic1	---	---	---	---	-3.0	---	μAdc
GLASS STRAIN (THERMAL SHOCK):	6.4	---	---	---	---	---	---	---	---

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

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

TEST	ALLOWABLE DEF. PER CHARACTER. 1st SAMPLE	ALLOWABLE DEF. PER CHARACTER. COMB. SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS							
HEATER CYCLING LIFE TEST: Ef=7.0 V; Eb=Ec1=Ec2= 0 V; 1 MIN. ON 4 MIN. OFF: Ehk=140 Vac	---	---	1.0	----	2000	---	CYCLE
HEATER CYCLING LIFE TEST END POINTS: HEATER CATHODE LEAKAGE:							
Ehk=+100 Vdc	---	---	---	Ihk:	---	20	μAdc
Ehk=-100 Vdc	---	---	---	Ihk:	---	20	μAdc
2 & 20 HOUR STABILITY LIFE TEST: Eb=250 Vdc ; Ec2= 150 Vdc; Rk = 390 OHMS: TA = ROOM: Rg= 0.47 MEG. Ehk=+200 Vdc	---	---	---	----	---	---	---
2 & 20 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 Eb =250 Vdc: Ec2 =150 Vdc: Rk =390 OHMS: TA = ROOM: Ehk =+200 Vdc; Rg = 0.47 MEG.	---	---	---	----	---	---	---
100 HOUR SURVIVAL RATE LIFE TEST: (TYPICAL SAMPLE SIZE = 200 TUBES)	---	---	---	----	---	---	---
INOPERATIVES:	---	---	0.65	----	---	---	---
TRANSCONDUCTANCE (1):	---	---	1.0	Sm(1):	6750	---	μMHOS
200 HOUR INTERMITTENT LIFE TEST (1): Eb =250 Vdc; Ec2 =150 Vdc: Rk =390 OHMS: TA = ROOM: Ehk =+200 Vdc: Rg=0.47 MEG.	---	---	---	----	---	---	---
200 HOUR INTERMITTENT LIFE TEST (1) END POINTS: (TYPICAL SAMPLE SIZE = 10 TUBES 1st SAMPLES, 40 TUBES 2nd SAMPLE)	---	---	---	----	---	---	---
INOPERATIVES:							
GRID CURRENT (1):	1	3	---	Ic(1):	0	-2.0	μAdc
HEATER CURRENT:	1	3	---	If:	414	492	mA
CHANGE IN TRANSC. (1) OF INDIVIDUAL TUBES:	1	3	---	Δ_tSm(1):	---	20	PERCENT
TRANSCONDUCTANCE (2) (NOTE 9)	1	3	---	Δ_{Ef}Sm (2):	---	20	PERCENT

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

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

TEST	ALLOWABLE DEF. PER CHARACTER. 1st SAMPLE	COMB. SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS (CONT'D.)							
HEATER-CATHODE LEAKAGE:							
Ehk=+100 Vdc	1	3	---	Ihk:	---	20	μAdc
Ehk=-100 Vdc			---	Ihk:	---	20	μAdc
ELECTRODE INSULATION:							
g1-all	1	3	---	Rg1-all:	50	---	MEG.
p-all			---	Rp-all:	50	---	MEG.
TOTAL DEFECTIVES:	3	6	---	----	---	---	---
INTERMITTENT HIGH TEMPERATURE LIFE TEST (2): T BULB = 220° C; Ehk=+200 Vdc; Rg= 0.5 MEG.	---	---	---	----	---	---	---
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST (2) END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE, 40 TUBES 2nd SAMPLE)	---	---	---	----	---	---	---
INOPERATIVES:	1	3	---	----	---	---	---
GRID CURRENT:	1	3	---	Ic1:	---	-2.0	μAdc
HEATER CURRENT:	1	3	---	If:	414	492	mA
CHANGE IN TRANSC. (1) OF INDIVIDUAL TUBES	1	3	---	Δ_tSm(1):	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	1	3	---	Δ_{Ef}Sm(2):	---	15	PERCENT
HEATER-CATHODE LEAKAGE:							
Ehk=+100 Vdc	1	3	---	Ihk:	---	20	μAdc
Ehk=-100 Vdc			---	Ihk:	---	20	μAdc
INSULATION OF ELECTRODES:							
g1-all	1	3	---	Rg1-all:	50	---	MEG.
p-all			---	Rp-all:	50	---	MEG.
TRANSC. (1) AVG. CHANGE:	---	---	---	Avg.Δ_t	---	15	PERCENT
TOTAL DEFECTIVES:	3	6	---	----	---	---	---
1000 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST (2) END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE: 40 TUBES 2nd SAMPLE)	---	---	---	----	---	---	---
INOPERATIVES:	1	3	---	----	---	---	---
GRID CURRENT (1):	1	3	---	Ic1:	---	-2.0	μAdc
HEATER CURRENT:	1	3	---	If:	414	496	mA
TRANSC. (1) CHANGE OF INDIVIDUAL TUBES	1	3	---	Δ_tSm:	---	25	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	1	3	---	Δ_{Ef}Sm(2):	---	20	PERCENT
HEATER-CATHODE LEAKAGE:							
Ehk=+100 Vdc	1	3	---	Ihk:	---	20	μAdc
Ehk=-100 Vdc			---	Ihk:	---	20	μAdc

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

TEST	ALLOWABLE DEF. PER CHARACTER. 1st SAMPLE	COMB. SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS (CONT'D.)							
ELECTRODE INSULATION:							
g1-all:	2	5	---	Rg1-all:	25	---	MEG.
p-all	4		---	Rp-all:	25	---	MEG.
TOTAL DEFECTIVES:	4	8	---	----	---	---	---

NOTES

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 A CYLINDRICAL SHIELD (0.405" I.D. 17/8" LONG) CONNECTED TO CATHODE LEAD.

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

4. CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

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

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

7. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

8. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±5% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

9. CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef= 6.3 V TO THAT VALUE MEASURED AT Ef=5.7 V.

10. OPERATION TIME IS THE TIME IN SECONDS REQUIRED FOR THE PLATE CURRENT TO ATTAIN A VALUE WITHIN ±15% OF THE THREE (3) MINUTE PLATE CURRENT (1) VALUE MEASURED AT PLATE CURRENT (1) TEST CONDITIONS. NO PREHEATING BEFORE THIS TEST IS ALLOWED. A COLD TUBE MUST BE USED.

11. DURING BOTH CONTINUITY AND SHORT TESTING, THE TUBE UNDER TEST SHALL BE TAPPED AT LEAST THREE TIMES IN EACH OF TWO PLANES 90° APART WITH A TAPPER WHICH SHALL BE ADJUSTED TO GIVE AN IMPULSE OF APPROXIMATELY ONE HALF SINE WAVE OF 300±50 MICRO SECONDS DURATION AND HAVING A MINIMUM AVERAGE AMPLITUDE OF 80 G's PEAK ACCELERATION AS MEASURED WITH A GULTON A-305 ACCELEROMETER AND KA-1 KIT. THE SHORTS DETECTING EQUIPMENT SHALL BE A DEVICE CAPABLE OF DETECTING AS SHORTS, THE FOLLOWING INTERELEMENT RESISTANCES OF THE GIVEN TIME DURATION.

DURATION	SENSITIVITY
PERMANENT SHORT	600,000 OHMS
500 μSEC.	500,000 OHMS
100 μSEC.	100,000 OHMS
60 μSEC.	1,000 OHMS

TUBES WHICH GIVE AN INDICATION OF ONE OR MORE OF THE FOLLOWING SHALL BE REJECTED AS INOPERABLE:

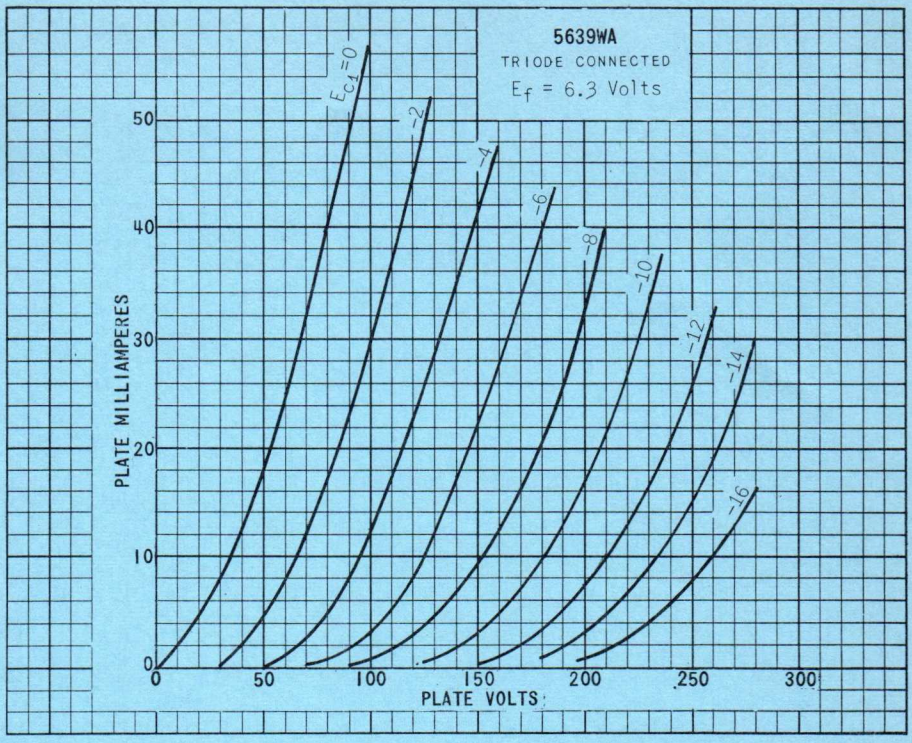
A. EITHER A PERMANENT OR TAP SHORT AT ANY TIME DURING THE TAPPING PROCEDURE.
B. ANY OPEN CIRCUIT.
C. ANY LEAKS.

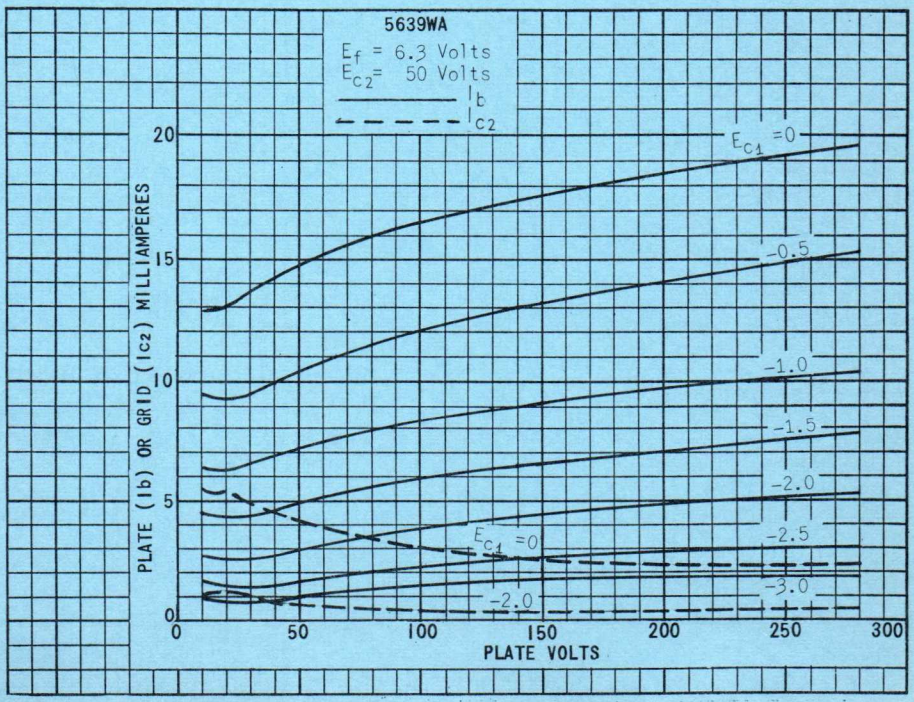
12. THE TUBES SHALL BE RIGIDLY MOUNTED ON A TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TUBES SHALL BE VIBRATED FOR A TOTAL OF 6 HOURS, 2 HOURS IN EACH OF THREE POSITIONS, X1, X2, AND Y1. ONLY RATED HEATER VOLTAGE SHALL BE APPLIED. TUBES WHICH SHOW ONE OR MORE OF THE FOLLOWING DEFECTS SHALL BE CONSIDERED FAILURES.

A. TUBES WHICH SHOW PERMANENT OR TAP SHORTS OR OPEN CIRCUITS FOLLOWING FATIGUE TEST, WHEN TESTED AS SPECIFIED IN 4.7.2 AND 4.7.3.
B. TUBES WHICH DO NOT COMPLY WITH PAST FATIGUE LIMITS, THIS IS A DESTRUCTIVE TEST.

13. THE PROVISIONS OF PARAGRAPH 4.9.20.5 OF SPECIFICATION MIL-E-1 SHALL APPLY, EXCEPT FOR TEST CONDITIONS LISTED FOR SHOCK TEST (2).

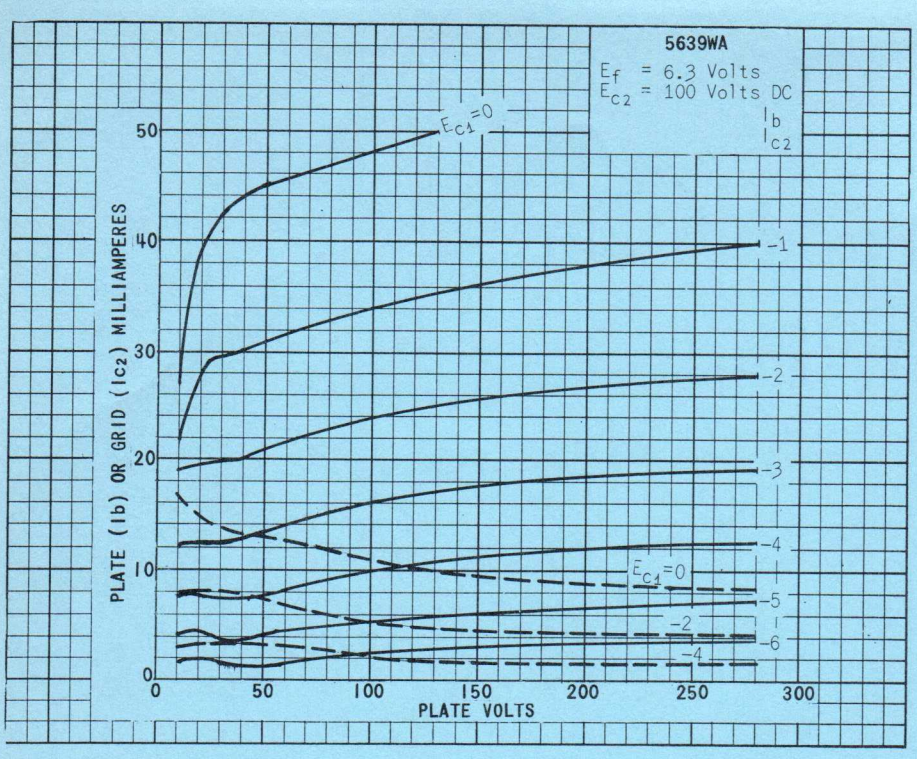
PRINTED IN U. S. A.

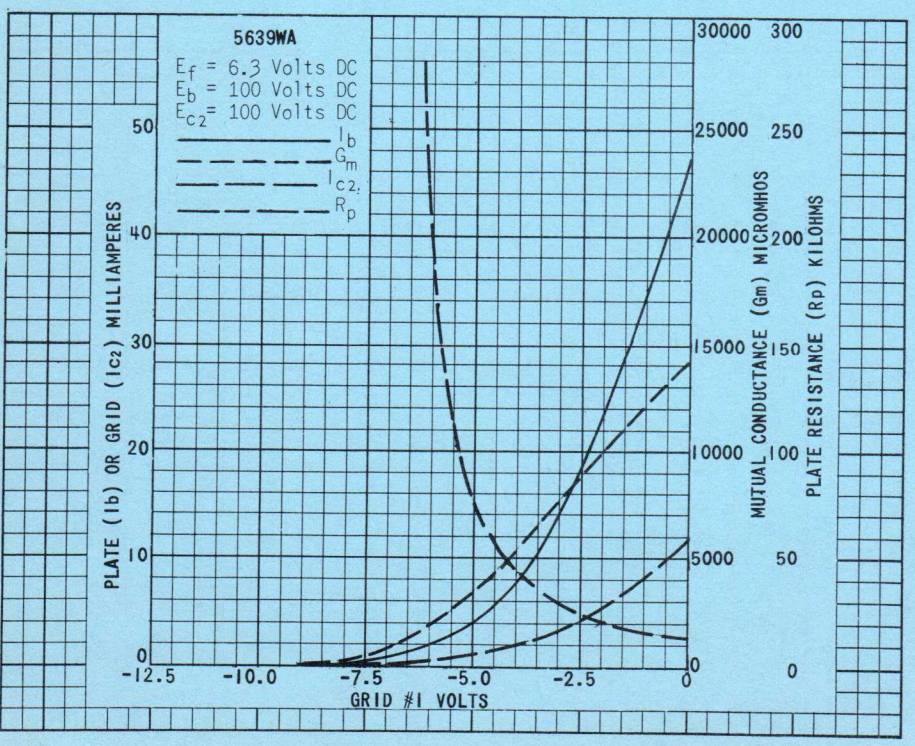




PRINTED IN U. S. A.

TENTATIVE DATA

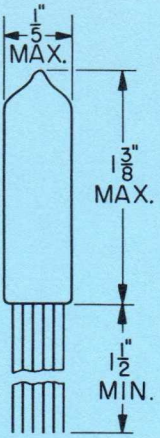




TUNG-SOL

SHIELD GRID THYRATRON

SUBMINIATURE TYPE



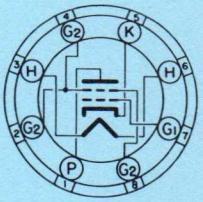
GLASS BULB

HEATER

6.3±5% VOLTS 0.150 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SUBMINIATURE BUTTON
8 FLEXIBLE LEADS
.017" TINNED

SUBMINIATURE TYPE 5643 IS A XENON FILLED, FOUR ELECTRODE THYRATRON WITH NEGATIVE CONTROL CHARACTERISTICS. IT IS SIMILAR IN CHARACTERISTICS TO THE MINIATURE TYPE 5696. THE 5643 IS SUITABLE FOR USE AS A SWITCHING TUBE, COUNTER, OR GRID CONTROLLED RECTIFIER. BECAUSE OF ITS SHIELD GRID CONSTRUCTION, THE INPUT WILL WORK DIRECTLY FROM A HIGH IMPEDANCE SOURCE SUCH AS A VACUUM PHOTOTUBE OR A CADMIUM SULPHIDE PHOTO CELL. THE EFFECTIVE DIODE TO CONTROL GRID CAPACITY MAY BE REDUCED BY CONNECTING LEADS 2, 4 AND 8 TO LEAD 5, AND CONNECTING THE GRID RESISTOR DIRECTLY TO THE SOCKET TERMINALS.

THIS TUBE IS PARTICULARLY SUITED FOR USE IN COMPACT AND PORTABLE EQUIPMENT, BECAUSE OF ITS SMALL SIZE AND LIGHT WEIGHT.

ELECTRICAL DATA

HEATER VOLTAGE	6.3±5%	VOLTS
HEATER CURRENT (E_f=6.3VOLTS)	0.150	AMP.
MINIMUM CATHODE HEATING TIME	10.	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	0.084	μμf
CONTROL GRID TO CATHODE (& SHIELD GRID) CAPACITANCE	1.33	μμf
ANODE TO CATHODE (& SHIELD GRID) CAPACITANCE	1.27	μμf
DE-IONIZATION TIME, APPROX. (SHIELD TIED TO CATHODE)		
WITH GRID VOLTS =-100, GRID RES.=1000 Ω ANODE VOLTS=500, ANODE CUR. =.016 AMPS	15	μSECONDS
WITH GRID VOLTS=- 10, GRID RES. =1000Ω, ANODE VOLTS =500, ANODE CUR.=.016 AMPS.	25	μSECONDS
ANODE VOLTAGE DROP, APPROX.	12.5	VOLTS
CRITICAL GRID CURRENT (AT E_{bb}=350V. RMS)	0.5	μAMPS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

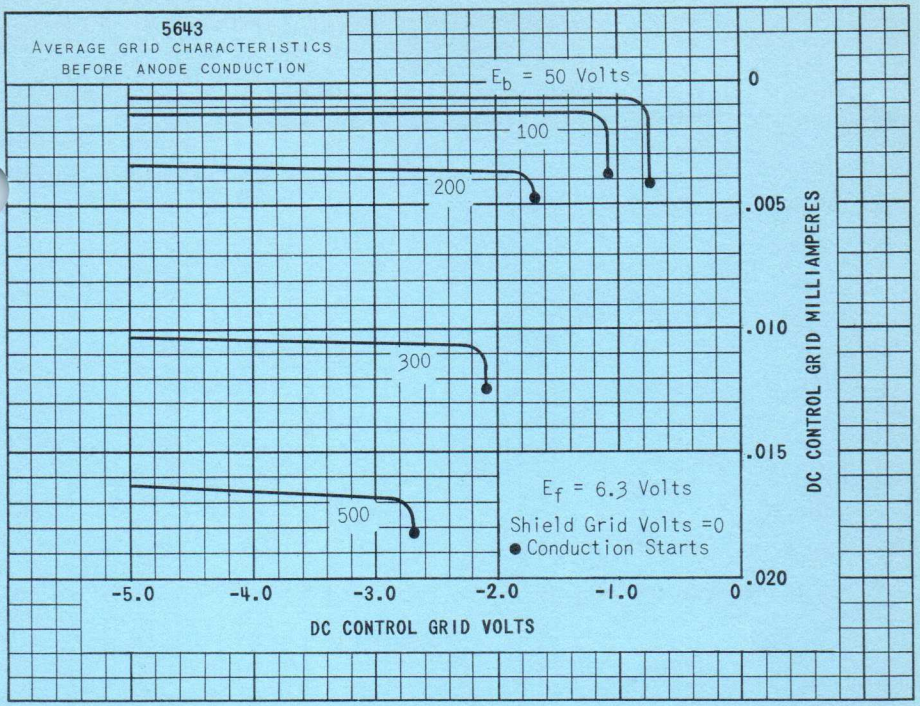
MECHANICAL DATA

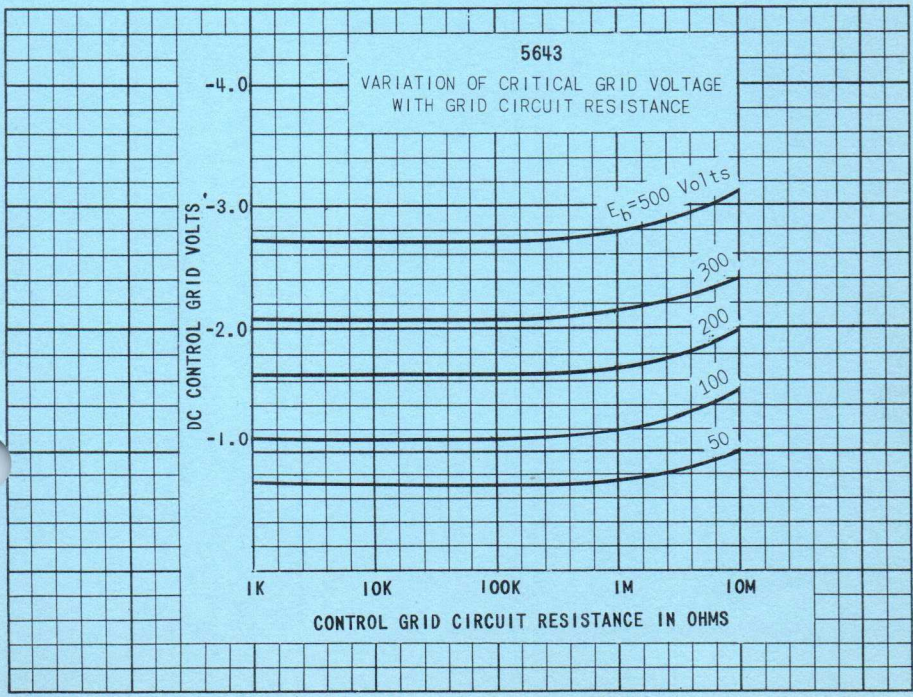
MAXIMUM SHOCK RATING	450	G
MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	SEE OUTLINE	
MAXIMUM SEATED LENGTH	1 3/8	INCHES
MAXIMUM DIAMETER	.40	INCHES
BULB	T-3	
BASE	SUBMINIATURE BUTTON 8 PIN LONG LEADS	
WEIGHT (APPROX.)	0.12	OUNCES

RATINGS

ABSOLUTE VALUES

MAXIMUM PEAK ANODE VOLTAGE		
INVERSE	500	VOLTS
FORWARD	500	VOLTS
MAXIMUM CATHODE CURRENT		
PEAK	100	MA.
AVERAGE	16	MA.
SURGE (MAX. DURATION 0.1 SECOND)	1.0	AMP.
MAXIMUM AVERAGE TIME	15	SECONDS
MAXIMUM NEGATIVE CONTROL GRID VOLTAGE		
BEFORE CONDUCTION	-200	VOLTS
DURING CONDUCTION	-10	VOLTS
MAXIMUM NEGATIVE SHIELD GRID VOLTAGE		
BEFORE CONDUCTION	-100	VOLTS
DURING CONDUCTION	-10	VOLTS
(THIS SHIELD GRID SHOULD NOT BE USED FOR CONTROL PURPOSES).		
MAXIMUM HEATER CATHODE VOLTAGE		
HEATER NEGATIVE	-100	VOLTS
HEATER POSITIVE	25	VOLTS
AMBIENT TEMPERATURE LIMITS	-55 TO +90	°C
MAXIMUM CONTROL GRID (G1) CIRCUIT RESISTANCE	10	MEGOHMS
ALTITUDE FOR FULL RATINGS	60 000	FEET

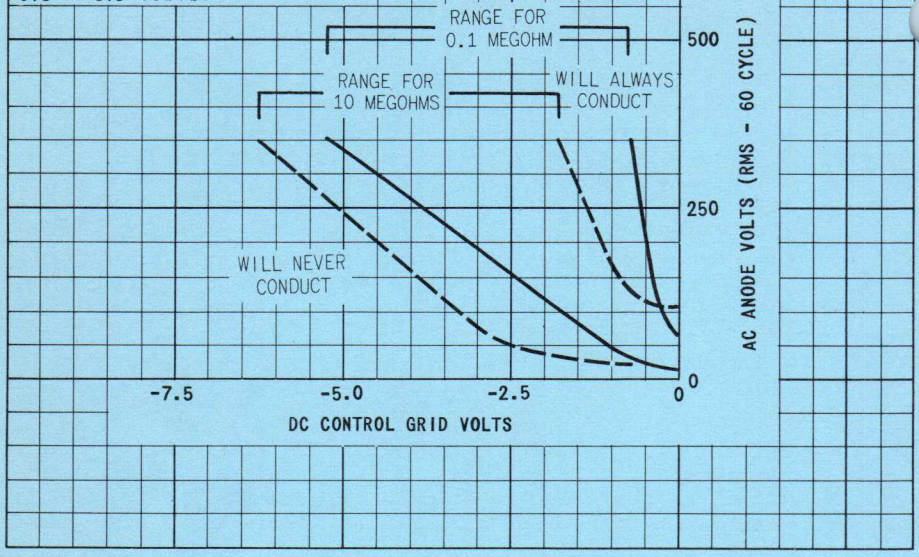




PRINTED IN U. S. A.

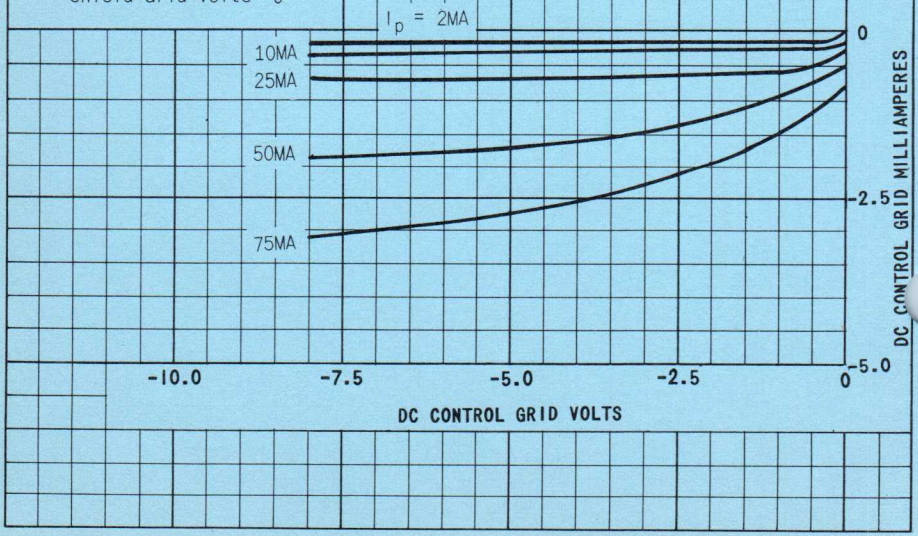
RANGES SHOWN ARE FOR TWO VALUES OF GRID RESISTOR, 0.1 MEGOHM AND 10 MEGOHM, AND TAKE INTO ACCOUNT INITIAL DIFFERENCES BETWEEN INDIVIDUAL TUBES AND SUBSEQUENT DIFFERENCES DURING TUBE LIFE FOR A HEATER VOLTAGE RANGE OF 6.0 TO 6.6 VOLTS.

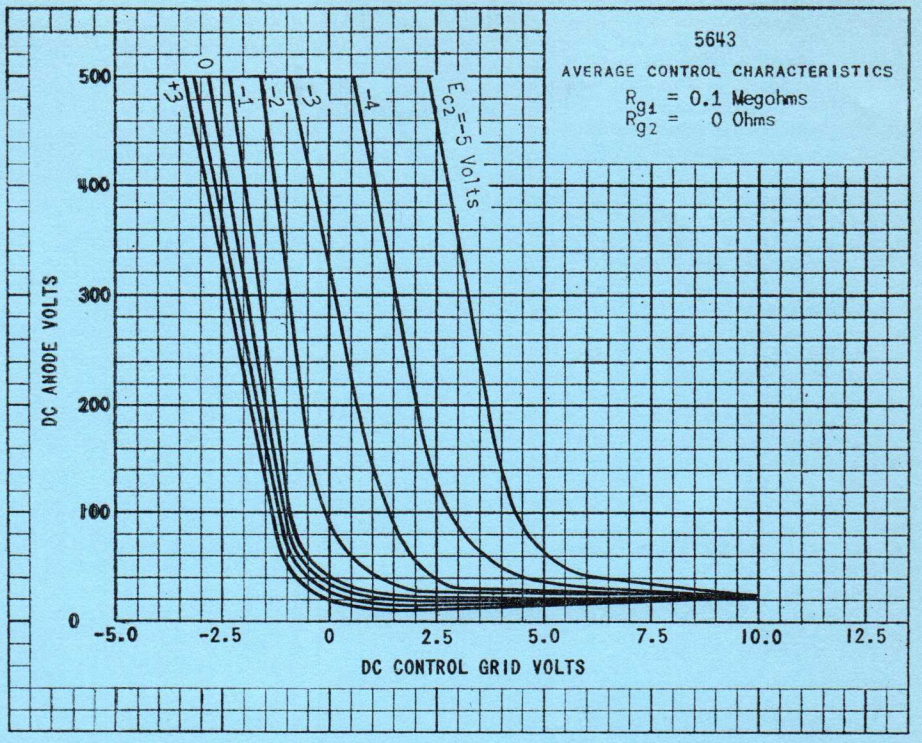
5643
OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



5643
AVERAGE GRID CHARACTERISTICS DURING ANODE CONDUCTION

R_g= 1000 Ohms
E_f= 6.3 Volts
Shield Grid Volts =0

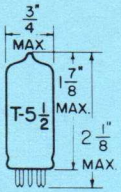



5643
AVERAGE CONTROL CHARACTERISTICS
R_{g1} = 0.1 Megohms
R_{g2} = 0 Ohms
E_{c2} = -5 Volts
+3
0
-1
-2
-3
-4
DC ANODE VOLTS
500
400
300
200
100
0
-5.0
-2.5
0
2.5
5.0
7.5
10.0
12.5
DC CONTROL GRID VOLTS

TUNG-SOL

DIODE

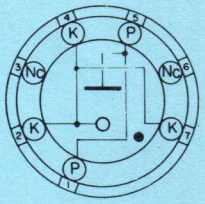
MINIATURE TYPE



GLASS BULB

COLD CATHODE – GLOW DISCHARGE

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL MINIATURE BUTTON
7 PIN BASE

THE 5651 IS A MINIATURE TWO ELECTRODE INERT-GAS-FILLED, COLD CATHODE, GLOW DISCHARGE DIODE FOR USE AS A VOLTAGE REFERENCE TUBE IN ELECTRONIC REGULATED SUPPLIES. IT HAS AN OPERATING VOLTAGE OF 86 VOLTS OVER A CURRENT RANGE OF 1.5 TO 3.5 MILLIAMPERES. THIS TUBE IS IDEALLY SUITED FOR APPLICATIONS IN WHICH SUDDEN FLUCTUATIONS MUST BE KEPT BELOW 0.1 VOLTS OVER THE ENTIRE RANGE AND WHICH REQUIRE VERY LOW OPERATING VOLTAGE DRIFT AND LONG LIFE.

ELECTRICAL DATA

CATHODE	COLD

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2 1/8	INCHES
MAXIMUM SEATED LENGTH	1 7/8	INCHES
MAXIMUM DIAMETER	3/4	INCHES
BULB	T-5 1/2	
BASE	SMALL BUTTON MINIATURE 7 PIN E7-1	

RATINGS

ABSOLUTE VALUES

MAXIMUM DC OPERATING CURRENT	3.5	MA.
MINIMUM DC OPERATING CURRENT	1.5	MA.
AMBIENT TEMPERATURE RANGE	-55 TO +90	°C

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CIRCUIT VALUES

MAXIMUM SHUNT CAPACITOR	.02	μf
SERIES RESISTOR	SEE NOTE BELOW	

NOTE:

A SERIES RESISTOR MUST ALWAYS BE USED WITH THE 5651 IN ORDER TO LIMIT THE CURRENT TO A MAXIMUM OF 3.5 MA AT THE HIGHEST ANODE SUPPLY VOLTAGE AND TO LIMIT THE CURRENT TO A MINIMUM OF 1.5 MA AT THE LOWEST ANODE SUPPLY VOLTAGE.

OPERATING NOTES

THE 5651 VOLTAGE REFERENCE TUBE HAS BEEN DESIGNED TO GIVE EXTREMELY STABLE TUBE VOLTAGE DROPS AT SPECIFIC CURRENTS WITHIN THE CURRENT RANGE VALUES. IT ALSO HAS BEEN DESIGNED TO ELIMINATE SUDDEN VOLTAGE JUMPS OR FLUCTUATIONS OVER ITS OPERATING CURRENT RANGE. THE VOLTAGE REGULATION CHARACTERISTIC OF A REFERENCE TUBE IS NOT INDEPENDENT OF THE TUBE CURRENT. THE CHANGE IN TUBE CURRENT THROUGH THE REFERENCE TUBE SHOULD BE LIMITED TO A PERCENTAGE LESS THAN THE ALLOWABLE PERCENTAGE VOLTAGE CHANGE. UNDER THESE CONDITIONS, CHANGES OF THE VOLTAGE DROP ACROSS THE TUBE WILL BE IN MANY CASES LESS THAN 0.2 PERCENT THROUGHOUT THE LIFE OF THE TUBE.

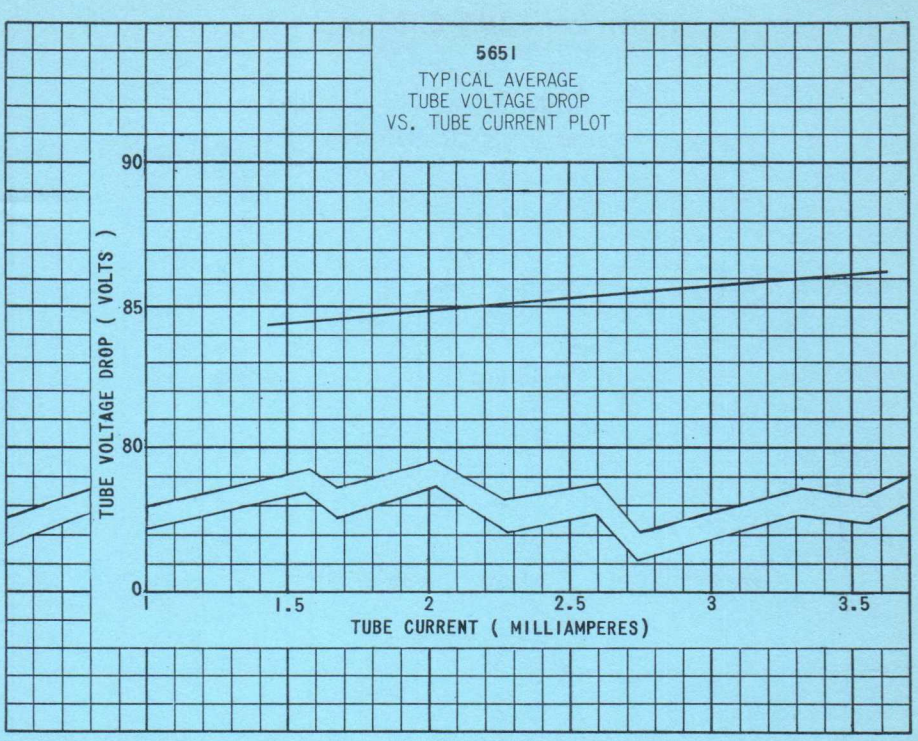
EQUIPMENT DESIGN AND RANGE VALUES

	MINIMUM VOLTS	AVERAGE VOLTS	MAXIMUM VOLTS
DC ANODE SUPPLY VOLTAGE IN DARKNESS	160[A]	---	---
DC ANODE SUPPLY VOLTAGE IN LIGHT	115[A]	---	---
ANODE BREAKDOWN VOLTAGE	---	106	115
TUBE VOLTAGE DROP (1) AT 1.5 MA.	82	84.5	---
TUBE VOLTAGE DROP (2) AT 3.5 MA.	---	86.0	92
REGULATION (1) (1.5 MA TO 3.5 MA.)	---	1.5	3
VOLTAGE JUMP[B]	---	0	0.1

[A] TO ASSURE STARTING THROUGHOUT TUBE LIFE, THE SUPPLY VOLTAGE SHOULD NOT BE LESS THAN THIS VALUE.

[B] DEFINED AS THE MAXIMUM VOLTAGE FLUCTUATION AT ANY CURRENT LEVEL WITHIN THE OPERATING CURRENT RANGE.

CONTINUED ON FOLLOWING PAGE



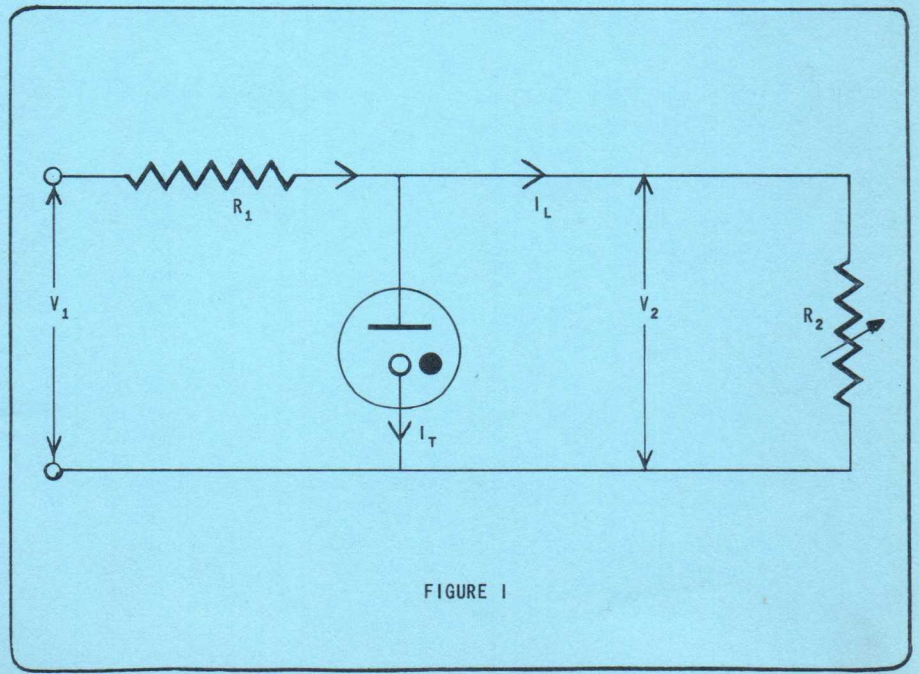
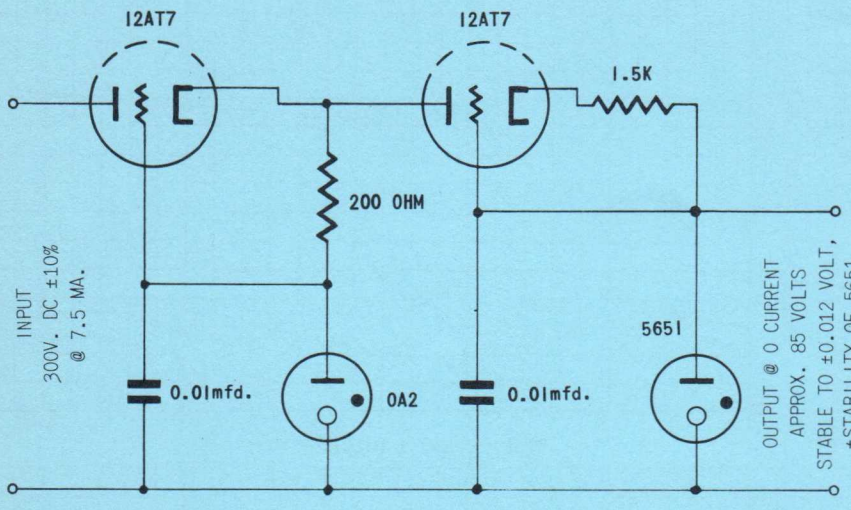


FIGURE 1

PRINTED IN U. S. A.

TUNG-SOL

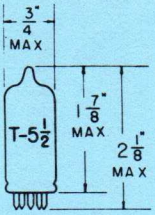
TYPICAL APPLICATION CIRCUIT



TUNG-SOL

DIODE

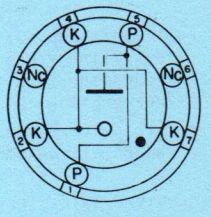
MINIATURE TYPE



GLASS BULB

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE
5B0

THE 5651WA IS A MINIATURE TWO ELECTRODE INERT-GAS-FILLED, COLD CATHODE, GLOW DISCHARGE DIODE FOR USE AS A VOLTAGE REFERENCE TUBE IN ELECTRONIC REGULATED SUPPLIES. IT HAS AN OPERATING VOLTAGE OF 86 VOLTS OVER A CURRENT RANGE OF 1.5 TO 3.5 MILLIAMPERES. THIS TUBE IS IDEALLY SUITED FOR APPLICATIONS IN WHICH SUDDEN FLUCTUATIONS MUST BE KEPT BELOW 5 MVOLTS OVER THE ENTIRE RANGE AND WHICH REQUIRE VERY LOW OPERATING VOLTAGE DRIFT AND LONG LIFE. THE 5651WA FEATURES HIGH SHOCK AND VIBRATION RATINGS AND WILL "STRIKE" AT LOW VOLTAGES IN THE ABSENCE OF LIGHT.

ELECTRICAL DATA

CATHODE	COLD

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2 1/8	INCHES
MAXIMUM SEATED LENGTH	1 7/8	INCHES
MAXIMUM DIAMETER	3/4	INCH
BULB	T-5 1/2	
BASE	7 PIN E7-1 SMALL-BUTTON MINIATURE	
NET WEIGHT (APPROX.)	0.3	OUNCES
MAXIMUM SHOCK RATING	450	G/1 MS
MAXIMUM VIBRATION RATING (D=.08" @ 50 CPS)	10	G

RATINGS
ABSOLUTE VALUES

MAXIMUM DC OPERATING CURRENT	3.5	MA.
MINIMUM DC OPERATING CURRENT	1.5	MA.
AMBIENT TEMPERATURE RANGE	-55 TO +150	°C
ALTITUDE	60 000	FEET

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

ADDITIONAL TESTS TO INSURE RELIABILITY

RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 30° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (450G/MSEC)

FATIGUE: 25 CPS, 0.08" TOTAL DISPLACEMENT FOR 32 HOURS IN EACH OF 3 MUTUALLY PERPENDICULAR PLANES (2.5 G)

POST SHOCK AND FATIGUE LIMITS:		
IONIZATION VOLTAGE (MAX.)	115	VDC
REGULATION (1.5 TO 3.5 MA)	82 TO 90	VDC
TUBE VOLTAGE DROP (1.5 AND 3.5 MA.) (MAX.)	3.0	VDC
STABILITY LIFE TEST (1 HOUR):		
END POINT: CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE @ I_b=2.5 mAdc (MAX.)	200	mVDC
SURVIVAL RATE LIFE TEST (100 HOURS):		
END POINT: CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE @ I_b=2.5 mAdc (MAX.)	500	mVDC
INTERMITTENT LIFE TEST: END POINTS (500 HOURS)		
CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE @ I_b = 2.5 mVdc (MAX.)	1.5	VDC
TUBE VOLTAGE DROP	82 - 90	VDC
REGULATION (MAX.)	3.0	VDC
IONIZATION VOLTAGE (MAX.)	115	VDC
END POINTS: (1000 HOURS):		
TUBE VOLTAGE DROP	82 - 90	VDC
REGULATION (MAX.)	3.2	VDC
IONIZATION VOLTAGE (MAX.)	115	VDC

EQUIPMENT DESIGN AND RANGE VALUES

	MIN.	AVG.	MAX.	
DC ANODE SUPPLY VOLTAGE IN DARKNESS	115[A]	---	---	VOLTS
DC ANODE SUPPLY VOLTAGE IN LIGHT	115[A]	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE	---	106	115	VOLTS
TUBE VOLTAGE DROP (1) AT 1.5 MA.	82	84.5	---	VOLTS
TUBE VOLTAGE DROP (2) AT 3.5 MA.	---	86.0.	88	VOLTS
REGULATION	---	0.8	1.0	VOLTS/MA.
VOLTAGE JUMP[B]	---	0	5.0	MVOLTS
VOLTAGE REPEATABILITY[C]	---	0.01	0.1	VOLTS
OSCILLATION (AURAL CHECK)	---	---	---	
NOISE	---	0	5.0	MVOLTS
LEAKAGE CURRENT (E_b =50V, R_p=3000Ω)	---	0	5.0	μAMPS.
GENERATED PLATE VOLTAGE (WHEN VIBRATED AT 40 CPS, 15G, R_p=10000Ω, I_b=2.5mAdc)	---	---	5.0	MVOLTS
MAXIMUM SHUNT CAPACITOR	---	---	0.02	μf
SERIES RESISTOR	D	---	---	
MAXIMUM CURRENT THROUGH INTERCONNECTED LEADS	---	---	1.0	AMP.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES

A TO ASSURE STARTING THROUGHOUT TUBE LIFE, THE SUPPLY VOLTAGE SHOULD NOT BE LESS THAN THIS VALUE.

B THE MAXIMUM VOLTAGE FLUCTUATION AT ANY CURRENT LEVEL WITHIN THE OPERATING CURRENT RANGE.

C TUBE IS CYCLED ONE MINUTE ON AND ONE MINUTE OFF FOR FIVE CYCLES. @ I_b = 2.5 mADC. READINGS ARE TAKEN INITIALLY AND AT THE END OF EACH "ON" PERIOD.

D SUFFICIENT SERIES RESISTANCE MUST BE USED TO LIMIT THE CURRENT TO A MAXIMUM OF 3.5 MA. AT THE HIGHEST ANODE SUPPLY VOLTAGE AND TO LIMIT THE CURRENT TO A MINIMUM OF 1.5 MA AT THE LOWEST ANODE SUPPLY VOLTAGE.

APPLICATION NOTES

VOLTAGE REFERENCE TUBES ARE OFTEN CONFUSED WITH VOLTAGE REGULATOR TUBES WHILE A REFERENCE TUBE IS A REGULATOR TUBE, IT IS A SPECIAL FORM OF REGULATOR TUBE, IN WHICH CURRENT RANGE AND REGULATION IS SACRIFICED TO PROVIDE VOLTAGE REPEATABILITY AND TEMPERATURE STABILITY AND TO MINIMIZE VOLTAGE JUMP AND LONG TERM DRIFT.

THE VOLTAGE REGULATION CHARACTERISTIC OF A REFERENCE TUBE IS NOT INDEPENDENT OF THE TUBE CURRENT. THEREFORE THE 5651WA **SHOULD BE RUN FROM A** CONSTANT SOURCE SUCH AS A VR TUBE, A PENTODE, OR A SIMPLE SERIES REGULATOR. PRACTICAL CIRCUITS ARE GIVEN IN FIGURES 1, 2, AND 3.

IF SO DESIRED, "INPUT AND OUTPUT" CONNECTIONS TO EITHER THE ANODE OR CATHODE CAN BE MADE TO DIFFERENT INTERNALLY CONNECTED PINS, SO THAT THE CIRCUIT WILL BE BROKEN UPON THE REMOVAL OF THE TUBE FROM ITS SOCKET. UNUSED PINS SHOULD NOT BE USED FOR CIRCUIT TIE POINTS AS VOLTAGE ON THESE PINS MAY CAUSE ERRATIC BEHAVIOR OF THE 5651WA OR EVEN FORM UNWANTED CIRCUIT CONNECTIONS THROUGH GAS BREAKDOWN. THE TUBE SHOULD BE SHIELDED IF IT IS TO BE USED IN STRONG RF OR MAGNETIC FIELDS.

MANY CIRCUITS UTILIZING THE 5651WA OR ITS PROTOTYPE, THE 5651, ARE TO BE FOUND IN THE HANDBOOK, PREFERRED CIRCUITS, Navy Aeronautical Electronic Equipment (NAVAER 16-1-519). THIS IS AVAILABLE FROM THE SUPERINTENDENT OF DOCUMENTS, US GOVT. PRINTING OFFICE, WASHINGTON 25, D.C. AT $1.75.

PRINTED IN U.S.A.

TUNG-SOL

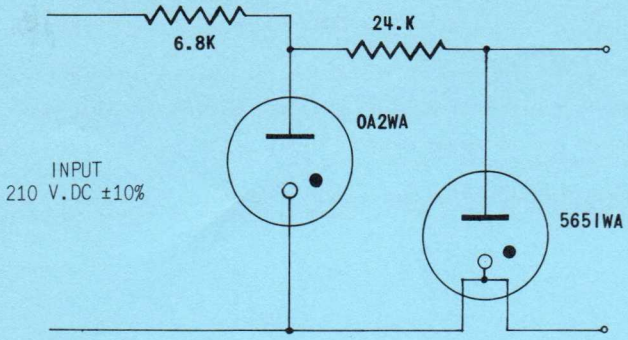


FIGURE 1

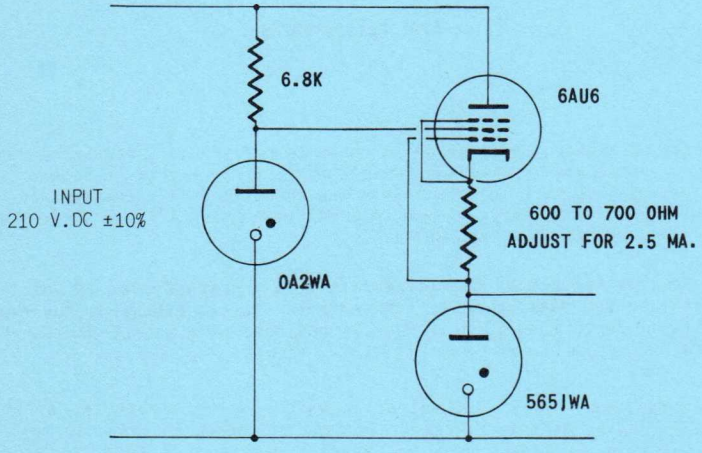


FIGURE 2

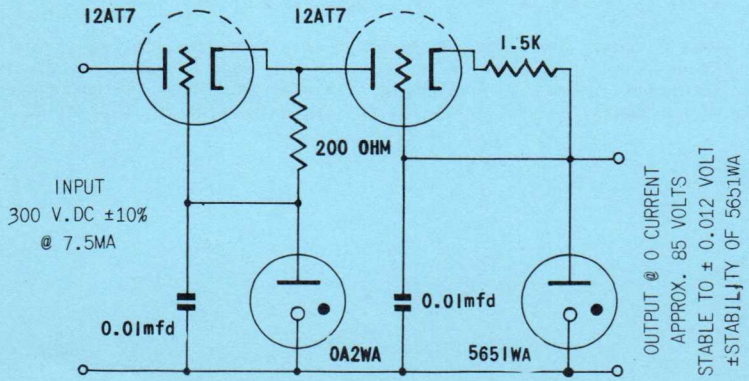


FIGURE 3

TUNG-SOL

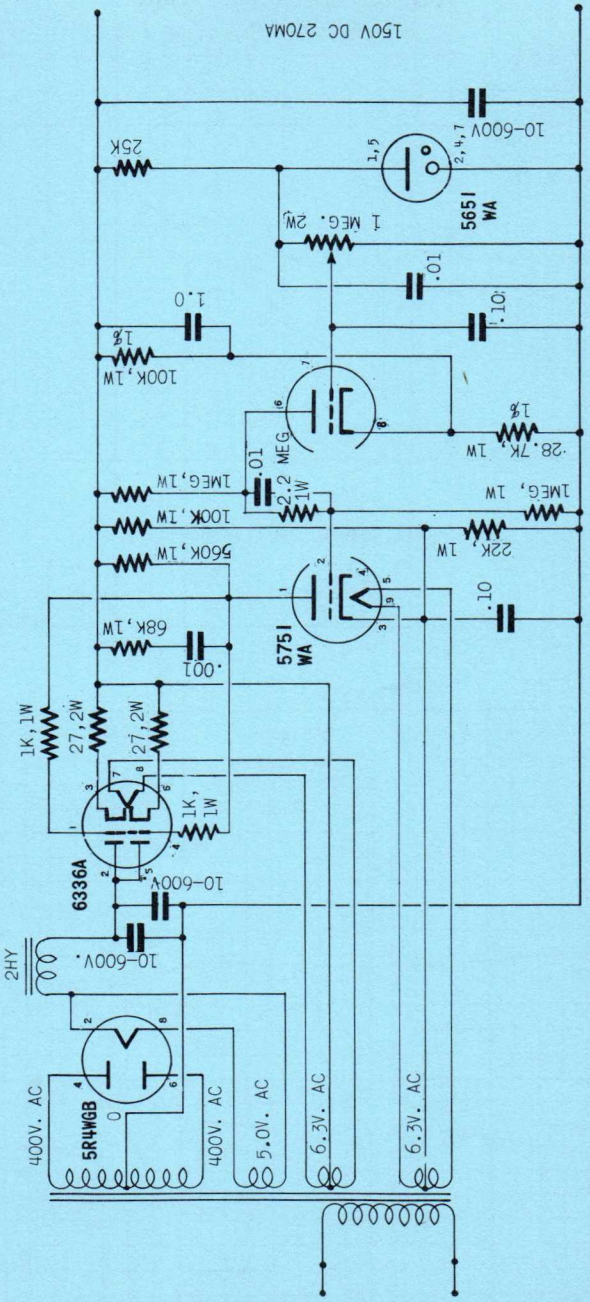
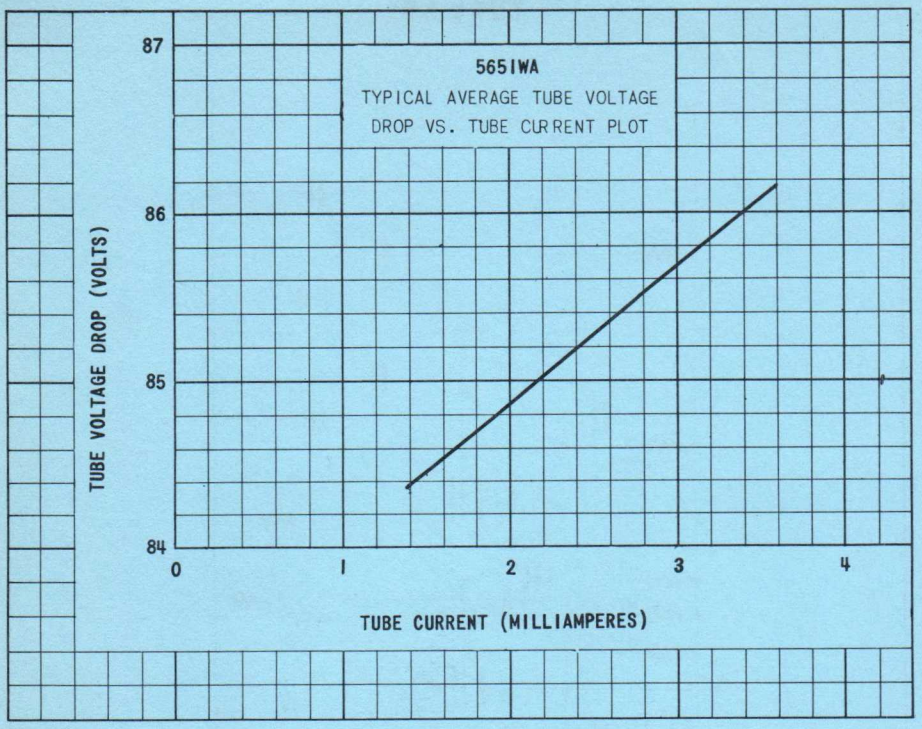
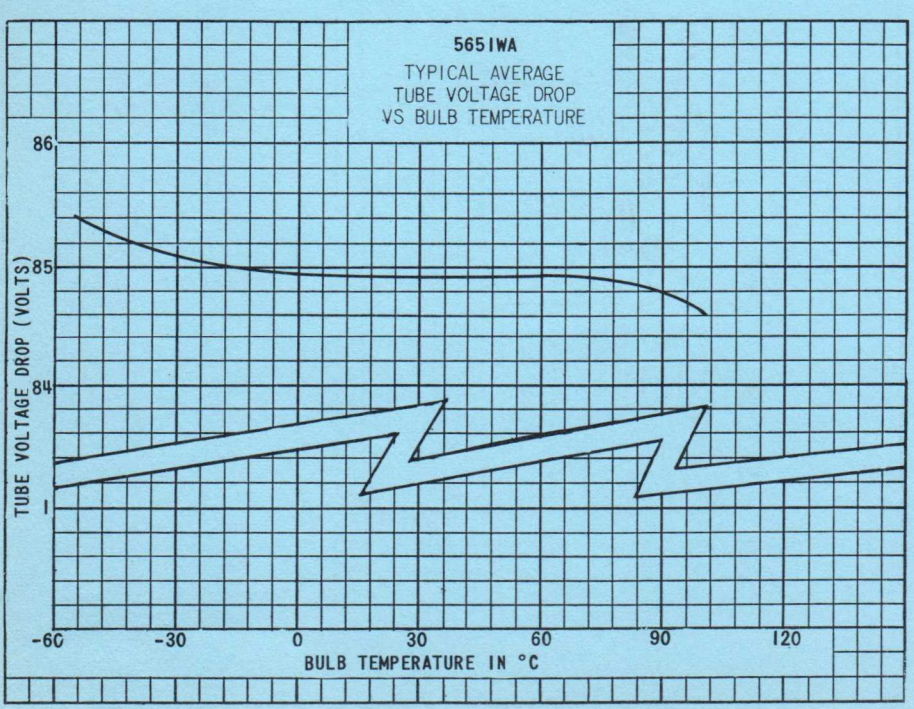


FIGURE 4

PRINTED IN U.S.A.

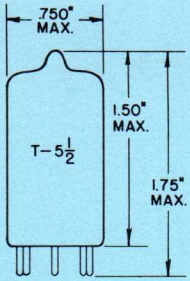

5651WA
TYPICAL AVERAGE TUBE VOLTAGE
DROP VS. TUBE CURRENT PLOT
TUBE VOLTAGE DROP (VOLTS)
87
86
85
84
0
1
2
3
4
TUBE CURRENT (MILLIAMPERES)


5651WA
TYPICAL AVERAGE
TUBE VOLTAGE DROP
VS BULB TEMPERATURE
TUBE VOLTAGE DROP (VOLTS)
86
85
84
1
-60
-30
0
30
60
90
120
BULB TEMPERATURE IN °C

TUNG-SOL

PENTODE

MINIATURE TYPE

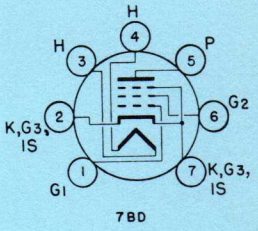


GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 175 MA.
AC OR DC

ANY MOUNTING POSITION



7BD

BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BD

THE 5654 IS A MINIATURE, SHARP-CUTOFF, RF PENTODE. IT IS DESIGNED FOR DEPENDABLE OPERATION UNDER CONDITIONS OF SHOCK AND VIBRATION USUALLY FOUND IN MOBILE AND AIRCRAFT APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD #316 CONNECTED TO PIN #7.

GRID #1 TO PLATE (MAX.)	0.02	pf
GRID #1 TO ALL OTHER ELECTRODES EXCEPT PLATE	4.0	pf
PLATE TO ALL OTHER ELECTRODES EXCEPT GRID #1	2.9	pf

RATINGS

DESIGN CENTER VALUES

MAXIMUM HEATER CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	140	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATTS
MAXIMUM DC CATHODE CURRENT	18	MA.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

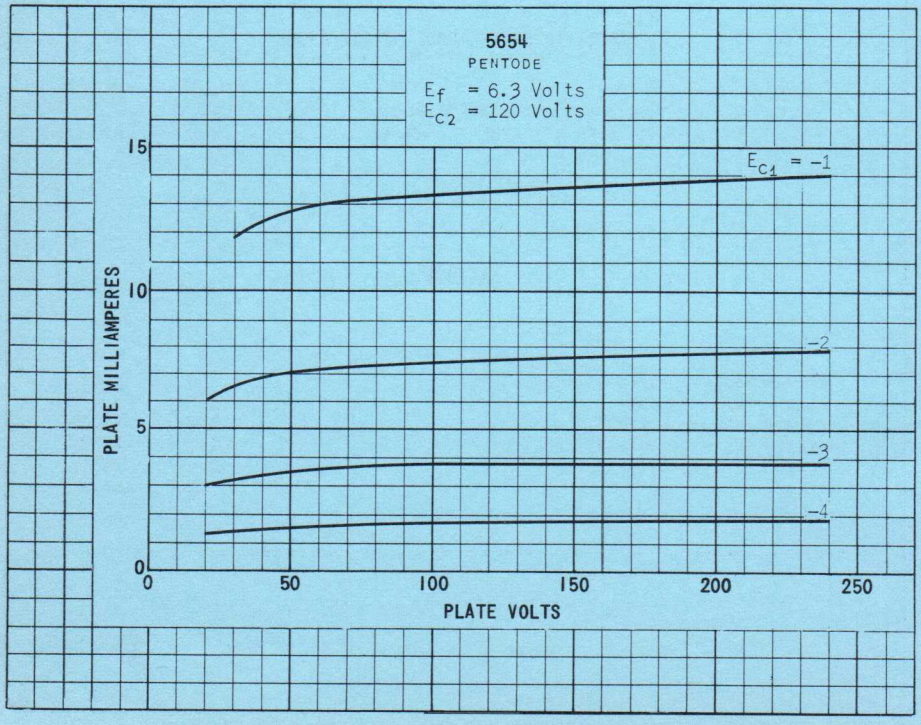
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

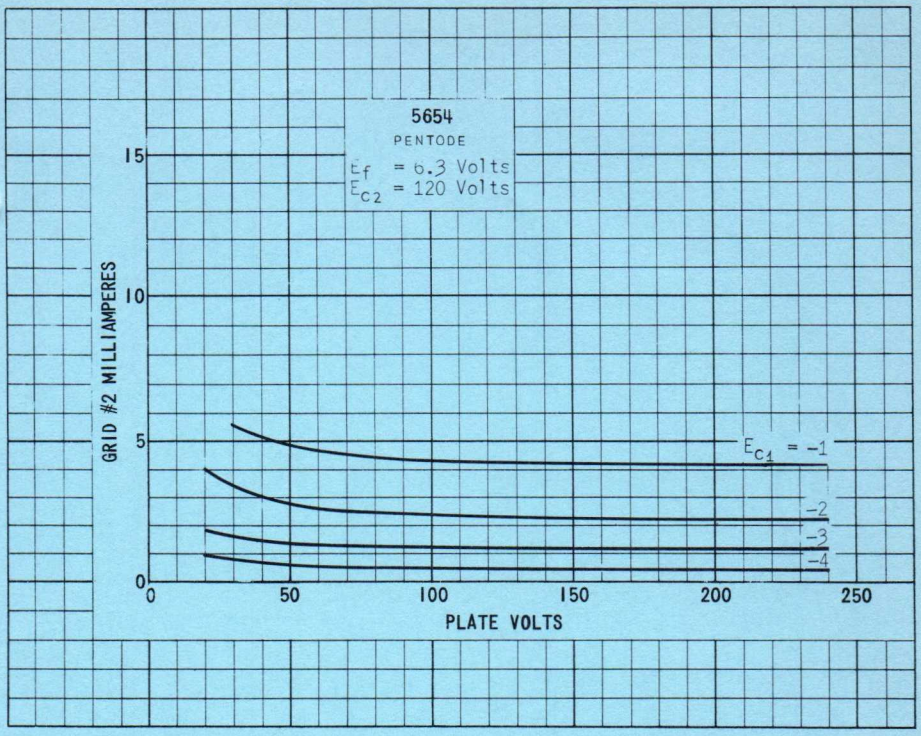
CLASS A_1 AMPLIFIER

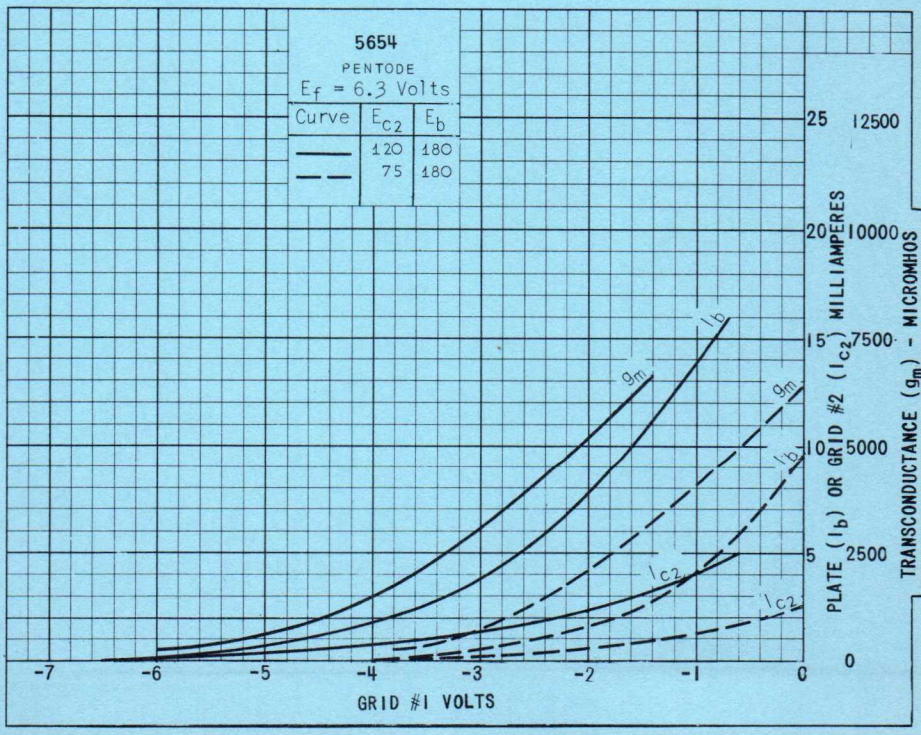
PLATE VOLTAGE	120	VOLTS
GRID #2 VOLTAGE	120	VOLTS
CATHODE RESISTOR	200	OHMS
PLATE RESISTANCE	0.34	MEGOHM
TRANSCONDUCTANCE	5 000	µMHOS
PLATE CURRENT	7.5	MA.
GRID #2 CURRENT	2.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µAMP.	−12	VOLTS
HEATER CYCLES OF INTERMITTENT OPERATION[A] (MIN.)	5 000	CYCLES

[A] THE TYPE 5654 HAS A HEATER WHICH IS DESIGNED TO WITHSTAND AT LEAST 3000 CYCLES OF INTERMITTENT OPERATION AT 7.5 VOLTS.

SIMILAR TYPE REFERENCE: Similar to the 6AK5.







PRINTED IN U.S.A.

TUNG-SOL

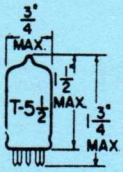
PENTODE

MINIATURE TYPE

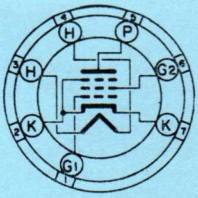
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.175 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7B0

THE 5654/6AK5W/6096 IS A RUGGEDIZED, SHARP CUT-OFF PENTODE OF THE SEVEN PIN MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY LOW HEATER POWER REQUIREMENTS, HIGH TRANSCONDUCTANCE AND INPUT IMPEDENCE AND LOW INTER-ELECTRODE CAPACITANCES AND LEAD INDUCTANCES. THESE FACTORS CONTRIBUTE GREATLY TO EXCELLENT PERFORMANCE IN HIGH FREQUENCY WIDE-BAND APPLICATIONS SUCH AS RADAR EQUIPMENT IF STAGES. THE 5654/6AK5W/6096 IS ELECTRICALLY EQUIVALENT TO THE 6AK5, BUT CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT, SCREEN GRID CURRENT AND TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5654/6AK5W/6096 IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE NAVIGATIONAL EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD #316	
MAXIMUM GRID #1 TO PLATE (RATED)	0.03	0.02	μμf
INPUT: (RATED)	4.0	4.0	μμf
MAXIMUM	---	4.6	μμf
MINIMUM	---	3.4	μμf
OUTPUT: (RATED)	2.1*	2.85	μμf
MAXIMUM	---	3.25	μμf
MINIMUM	---	2.45	μμf

*NOMINAL VALUE.

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	200	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	155	VOLTS
MAXIMUM PLATE DISSIPATION	1.65	WATTS
MAXIMUM HEATER CATHODE VOLTAGE	130	VOLTS
MAXIMUM DC CATHODE CURRENT [A]	20	mA
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM BULB TEMPERATURE	+165	°C

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.175	AMP.
PLATE VOLTAGE	120	VOLTS
GRID #2 VOLTAGE	120	VOLTS
CATHODE BIAS RESISTOR [B]	200	OHMS
PLATE RESISTANCE (APPROX.)	0.34	MEGOHM
TRANSCONDUCTANCE	5000	µMHOS
PLATE CURRENT	7.5	mA
GRID #2 CURRENT	2.5	mA
GRID #1 VOLTAGE (APPROX.) I_p=10 µa	-12	VOLTS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V, E_b = 120Vdc, E_{c1} = -2Vdc, E_{c2} = 120Vdc

EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	160	190	---	---	160	190	mA
HEATER-CATHODE LEAKAGE (E_{hk}=±100Vdc)	---	10	---	---	---	10	µAdc
GRID #1 CURRENT (R_g=0.1 MEG.)	0	-0.1	---	---	0	-0.1	µAdc
PLATE CURRENT (1)	5.0	11.0	6.5	8.5	4.5	11.0	mAdc
TRANSCONDUCTANCE (1)	4000	6250	4525	5475	3750	6250	µMHOS
INSULATION OF ELECTRODES [C] (E_f=6.3V, E(g1-ALL)= -100Vdc, E(p-all)= -300Vdc, E(g2-all)= -300Vdc,							
R(g1-all)	100	---	---	---	50	---	MEGOHMS
R(p-all)	100	---	---	---	50	---	MEGOHMS
R(g2-all)	100	---	---	---	50	---	MEGOHMS
SCREEN CURRENT	0.8	4.0	1.8	3.2	---	---	mAdc
Δ AVERAGE TRANSCONDUCTANCE (1)	---	---	---	---	---	15	PERCENT
PLATE CURRENT (2) (E_{c1}=-10Vdc)	---	200	---	---	---	---	µAdc
PLATE CURRENT (3) (E_{c1}=-5.5Vdc)	5.0	---	---	---	---	---	µAdc
Δ TRANSCONDUCTANCE (2) [D] (E_f=5.7V.)	---	---	---	---	---	15	PERCENT
GRID CURRENT (2) [E] (E_f=7.0 V, R_{g1}=0.1MEG)	0	-0.5	---	---	---	---	µAdc

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION [F] (R_p = 10,000)	---	150	mVac
VIBRATIONAL FATIGUE [G]	---	---	
SHOCK [H] (HAMMER ANGLE=30°, E_{hk}=100Vdc, HEATER POS., R_{g1} = 0.1 MEG.)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	450	mVac
HEATER-CATHODE LEAKAGE	---	±30	µAdc
TRANSCONDUCTANCE (1)	3500	---	µMHOS
GRID #1 CURRENT	0	-0.2	µAdc

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

SPECIAL REQUIREMENTS -CONT'D.

	MIN.	MAX.	
GLASS STRAIN [J]	---	---	
CONTINUITY AND SHORT [K]	---	---	
RF NOISE [L] (E_{c1}=0, E_{ca1}=15.0mVac, R_k=200, C_k=0.2 μf)	---	3.0	mW
NOISE AND MICROPHONICS [MN] (E_f=6.3Vac, E_{hk}=0, E_{bb}=E_{cc2}=200Vdc, E_{c1}=0, R_k=1000, R_p=0.1MEG, R_{g2}=0.5MEG., C_{g2}=2μf)	---	100	mVac
LOW FREQUENCY VIBRATION [P] (R_p=10,000)	---	150	mVac
LOW PRESSURE VOLTAGE BREAKDOWN [Q] (PRESSURE =±5mm mercury, TEMP=25±5°C, HUMIDITY=0, VOLTAGE =500Vac, 60 CYCLES, SINUSOIDAL WAVEFORM)	500	---	Vac
1 HOUR STABILITY LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS)	---	---	
STABILITY LIFE TEST END POINTS Δ TRANSCONDUCTANCE (1)	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT)	---	---	
HEATER CYCLING LIFE TEST (E_f=7.5V, E_{hk}=135Vdc, HEATER POS., E_b=E_{c1}=E_{c2}=0)	---	---	
HEATER CYCLING LIFE TEST END POINTS HEATER CATHODE LEAKAGE	---	±20	μAdc
INTERMITTENT LIFE TEST [R] (E_b=150Vdc, E_{c1}=0, E_{c2}=125Vdc, E_{hk}=135Vdc, HEATER POSITIVE, R_{g1}=0.1MEG., R_k=130, MIN. BULB TEMPERATURE =+165°C)	---	---	

NOTES

[A] DIFFICULTY MAYBE ENCOUNTERED IF THIS TUBE IS OPERATED FOR LONG PERIODS OF TIME WITH VERY SMALL VALUES OF CATHODE CURRENT.

[B] FIXED-BIAS OPERATION NOT RECOMMENDED.

[C] SEE MIL-E-1C 4.8.2

[D] THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED:

$$\frac{(\text{SM AT } 6.3)-(\text{SM AT } 5.7)}{(\text{SM AT } 6.3)} \times 100$$

[E] PRIOR TO THIS TEST TUBES TO BE PREHEATED 5 MINUTES AT CONDITIONS INDICATED BELOW. TEST IMMEDIATELY FOLLOWING PREHEATING. E_f=7.0Vac, E_{c1}=0Vdc, R_k=130OHMS, R_g=0.1MEG., E_v=150Vdc, E_{c2}=125 Vdc.

[F] SEE MIL-E-1C 4.9.20.3

[G] SEE MIL-E-1C 4.9.20.6

[H] SEE MIL-E-1C 4.9.20.5

[J] GLASS STRAIN TEST CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0°C±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST 2 LITERS PER FIFTEEN TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST. REJECT FOR EVIDENCE OF AIR LEAK.

[K] SEE MIL-E-1C 4.7.5

[L] SEE MIL-E-1C 4.10.3.1

[M] SEE MIL-E-1C 4.10.3.5

[N] THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS @ 60 CYCLES.

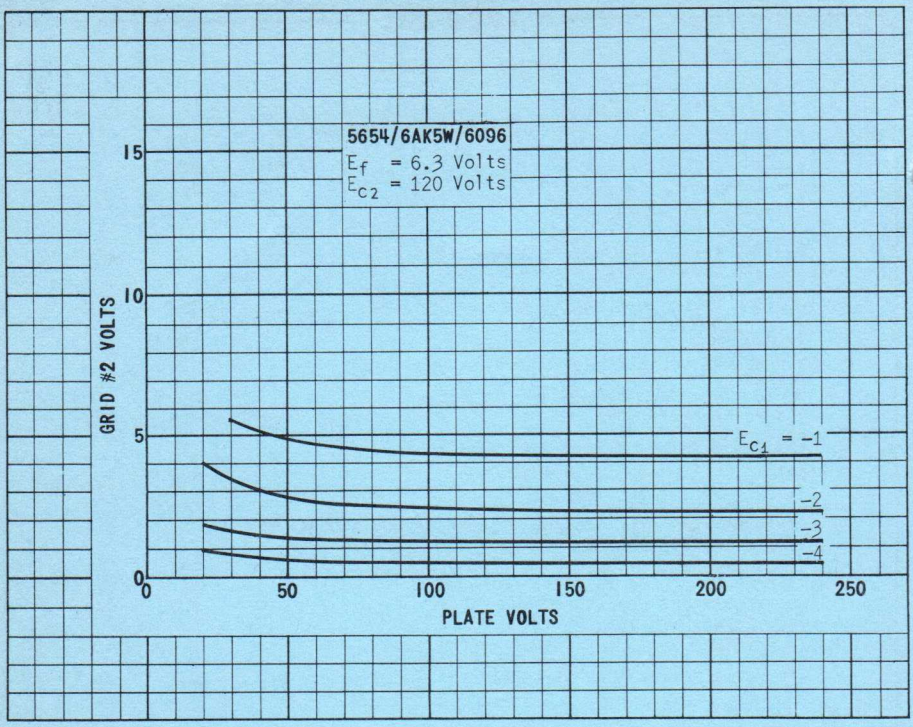
[P] SEE MIL-E-1C 4.9.20.4

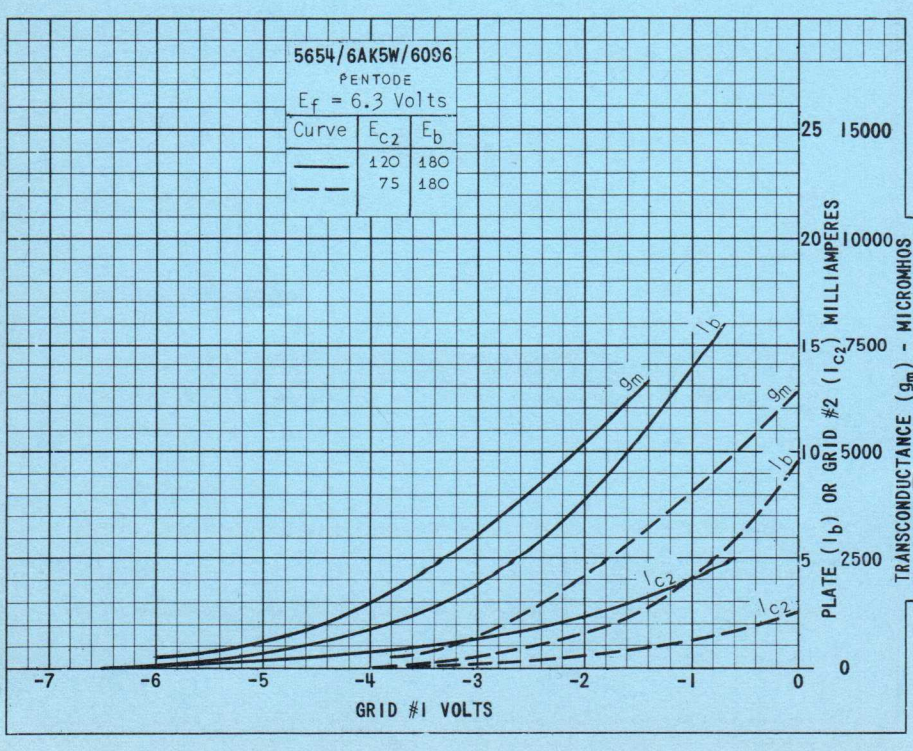
[Q] BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

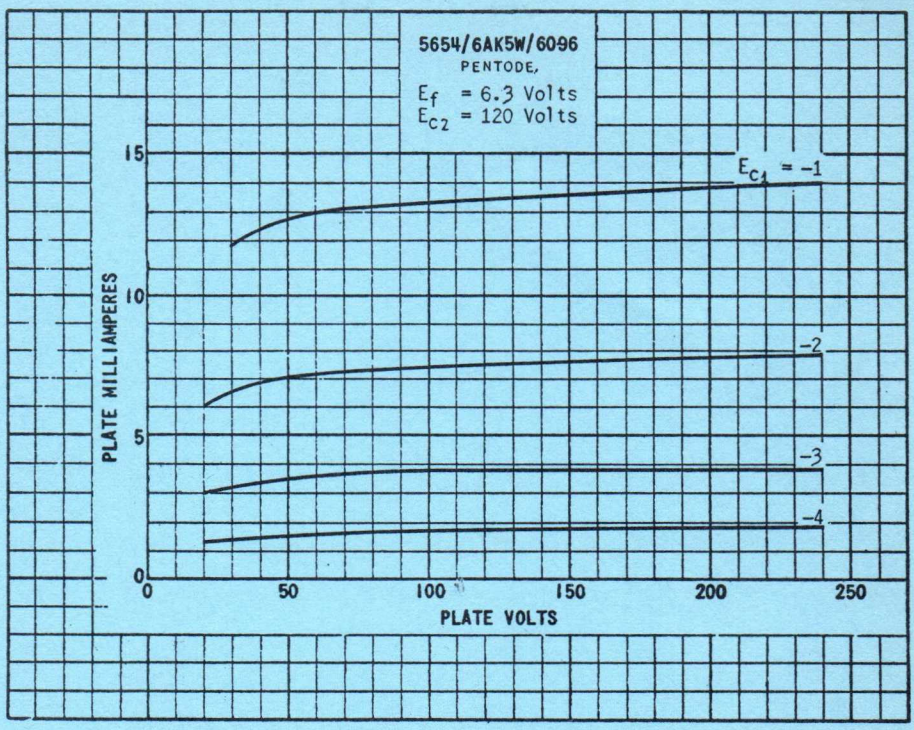
[R] SEE MIL-E-1C 4.11.5

PRINTED IN U.S.A.

5654/6AK5W/6096
PREMIUM TUBE



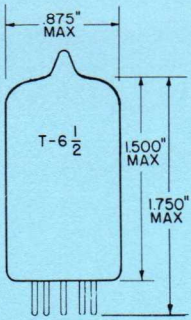



5654/6AK5W/6096
PENTODE,
E_f = 6.3 Volts
E_{c2} = 120 Volts
E_{c1} = -1
-2
-3
-4
PLATE MILLIAMPERES
0
5
10
15
0
50
100
150
200
250
PLATE VOLTS

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

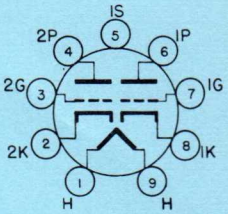


GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-1

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 350 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8CJ

THE 5670 IS A HIGH-FREQUENCY DOUBLE TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR RELIABLE LIFE UNDER CONDITIONS OF INTERMITTENT OPERATION.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

PLATE TO GRID (EACH SECTION)[A]	→	1.1	pf
PLATE TO CATHODE (EACH SECTION)[A]		1.0	pf
GRID TO CATHODE (EACH SECTION)[A]		2.2	pf
PLATE TO PLATE (NOMINAL)		0.05	pf
PLATE TO PLATE (MAXIMUM)		0.10	pf

[A] INTERNAL SHIELD AND HEATER CONNECTED TO CATHODE.

RATINGS

EACH TRIODE SECTION – DESIGN CENTER VALUES

MAXIMUM HEATER CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	1.5	WATTS
MAXIMUM DC CATHODE CURRENT	16.5 *	MA.
BULB TEMPERATURE AT HOTTEST POINT (ABSOLUTE MAXIMUM)	165 *	°C

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	150	VOLTS
CATHODE RESISTOR (EACH SECTION)	240	OHMS
PLATE CURRENT (EACH SECTION)	8.2	MA.
TRANSCONDUCTANCE (EACH SECTION)	5 500	µMHOS
AMPLIFICATION FACTOR	35	
GRID VOLTAGE (APPROX.) FOR I_b = 10 µA.	→ −8	VOLTS

CLASS AB_1 AMPLIFIER

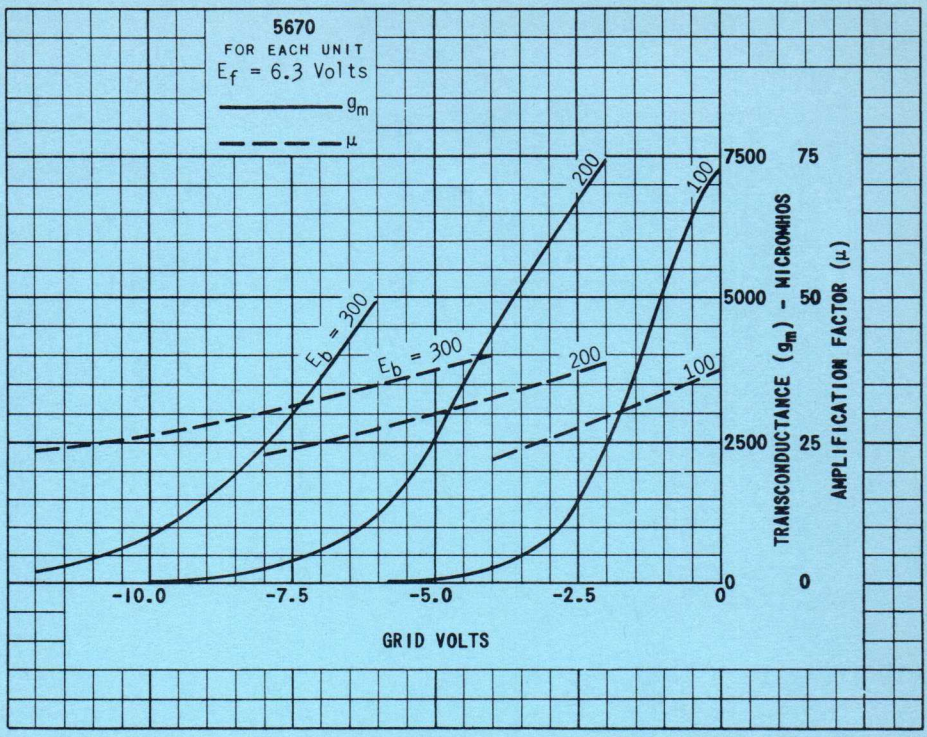
PLATE VOLTAGE	300	VOLTS
CATHODE RESISTOR	800	OHMS
AF GRID TO GRID VOLTAGE (RMS)	14	VOLTS
ZERO-SIGNAL PLATE CURRENT (EACH SECTION)	4.9	MA.
MAXIMUM SIGNAL PLATE CURRENT (EACH SECTION)	6.3	MA.
LOAD IMPEDANCE (PLATE-TO-PLATE)	27 000	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.0	WATT

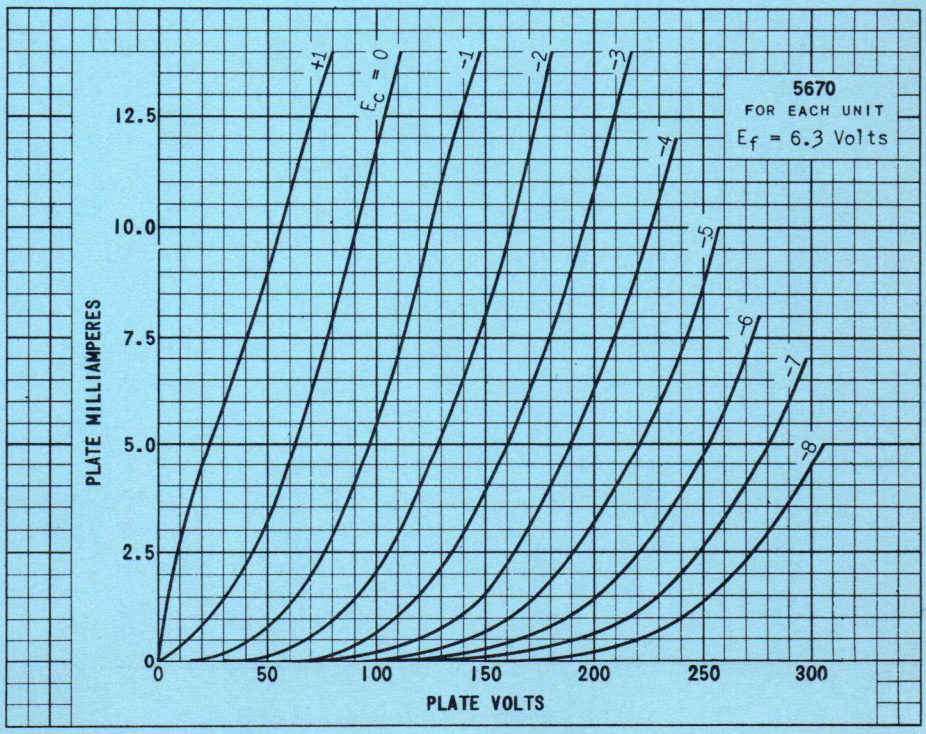
SPECIAL TESTS AND RATINGS *

HEATER-CYCLING RATINGS CYCLES OF INTERMITTENT OPERATION, MINIMUM Ef =7.5 VOLTS CYCLED FOR ONE MINUTE ON AND ONE MINUTE OFF. Eb=Ec=0 VOLTS. Ehk =135 VOLTS WITH HEATER POSITIVE WITH RESPECT TO CATHODE.	2 000	CYCLES
SHOCK RATING IMPACT ACCELERATION IN ANY DIRECTION FORCES AS APPLIED BY THE NAVY-TYPE, HIGH IMPACT (FLYWEIGHT) SHOCK MECHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT.	600	G
FATIGUE RATINGS VIBRATIONAL ACCELERATION IN ANY DIRECTION VIBRATIONAL FORCES FOR A PERIOD OF AT LEAST 100 HOURS AT A FREQUENCY OF 25 CYCLES PER SECOND	2.5	G

→ INDICATES A CHANGE.

*INDICATES AN ADDITION.





PRINTED IN U. S. A.

TUNG-SOL

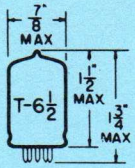
TWIN TRIODE

MINIATURE TYPE

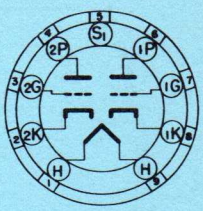
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.35 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
8CJ

THE 5670WA IS A RUGGEDIZED, MEDIUM MU, TWIN TRIODE OF THE NINE-PIN MINIATURE CONSTRUCTION. THE TWO TRIODE SECTIONS ARE ELECTRICALLY INDEPENDENT WITH A SHIELD BETWEEN SECTIONS BROUGHT OUT TO A SEPERATE BASE PIN. THE 5670WA MAY BE USED IN SUCH GENERAL PURPOSE APPLICATIONS AS AMPLIFIER, MIXER, OSCILLATOR AND MULTIVIBRATOR CIRCUITS OVER A FREQUENCY RANGE OF AF. THROUGH VHF. IT MAY ALSO BE OPERATED AS AN OSCILLATOR AT FREQUENCIES AS HIGH AS 800 MC IN AN OPEN-CIRCUITED RESONANT LINE OSCILLATOR WHEN THE TWO TRIODE SECTIONS ARE CONNECTED IN PARALLEL. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT, TRANSCONDUCTANCE AND AMPLIFICATION FACTOR ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5670WA IS ESPECIALLY SUITED FOR USE IN MILITARY AND INDUSTRIAL AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
PLATE TO GRID (EACH SECTION)[A] (RATED)	1.1	μμf
MAXIMUM	1.4	μμf
MINIMUM	0.8	μμf
OUTPUT (RATED)	1.0	μμf
MAXIMUM	1.3	μμf
MINIMUM	0.7	μμf
INPUT (RATED)	2.2	μμf
MAXIMUM	2.7	μμf
MINIMUM	1.7	μμf
MAXIMUM PLATE TO PLATE (RATED)	0.10	μμf

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330	VOLTS
MAXIMUM PLATE DISSIPATION, EACH SECTION	1.65	WATT
MAXIMUM HEATER-CATHODE VOLTAGE	±100	VOLTS
MAXIMUM DC CATHODE CURRENT, EACH SECTION[AA]	18	mAdc

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.35	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE RESISTOR (EACH SECTION)	240	OHMS
PLATE CURRENT (EACH SECTION)	8.2	mA
TRANSCONDUCTANCE (EACH SECTION)	5 500	μMHOS
AMPLIFICATION FACTOR	35	
GRID VOLTAGE (APPROX.) FOR Ib = 10 μa	-8	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D.

CLASS AB_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.35	AMP.
PLATE VOLTAGE	300	VOLTS
CATHODE RESISTOR	800	OHMS
AF GRID TO GRID VOLTAGE (RMS)	14	VOLTS
ZERO-SIGNAL PLATE CURRENT (EACH SECTION)	4.9	mA
MAXIMUM SIGNAL PLATE CURRENT (EACH SECTION)	6.3	mA
LOAD IMPEDANCE (PLATE-TO-PLATE)	27 000	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.0	WATT

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Ef = 6.3V, Eb = 150Vdc, Ec = 0Vdc, Rk/k = 240 OHMS
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	330	370	---	---	330	370	mA
HEATER-CATHODE LEAKAGE[B] (E_{hk} =±100Vdc)	---	±10	---	---	---	±10	μAdc
GRID CURRENT (1) (R_g =0.5 meg.)	0	-0.3	---	---	0	-0.3	μAdc
PLATE CURRENT (1)	5.9	10.5	7.3	9.1	---	---	mAdc
PLATE CURRENT (2) (E_c = 10Vdc, R_p=0.25 meg., R_k =0)	---	45	---	---	---	---	μAdc
TRANSCONDUCTANCE (1)	4500	6500	5125	5875	3850	6500	μMHOS
Δ AVG. TRANSCONDUCTANCE (1)	---	---	---	---	---	15	PERCENT
INSULATION OF ELECTRODES[C] (E_f=6.3V, E(g-all)= 100Vdc, g negative; E(p-all)= 300Vdc, p negative)							
R(g-all)	100	---	---	---	50	---	MEGOHM
R(p-all)	100	---	---	---	50	---	MEGOHM
PLATE CURRENT (1) DIFFERENCE BETWEEN SECTIONS	---	2.0	---	---	---	---	mAdc
TRANSCONDUCTANCE (2)[D] (E_f = 5.7V)	---	15	---	---	---	15	PERCENT
GRID CURRENT (2)[E] (E_f = 7.0V)	0	-0.5	---	---	---	---	μAdc
AMPLIFICATION FACTOR	26	44	30	40	---	---	

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[H] (R_p= 2000, R_k=0, E_{c1}=-3Vdc)	---	100	mVac
VIBRATIONAL FATIGUE[F]	---	---	
SHOCK[G] (HAMMER ANGLE =42°, E_{hk}=100Vdc, HEATER POSITIVE, R_g=0.1 meg.)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	300	mVac
HEATER-CATHODE LEAKAGE	---	±30	μAdc
TRANSCONDUCTANCE (1)	3850	---	μMHOS
GRID CURRENT (1)	0	-0.6	μAdc
GLASS STRAIN[J]	---	---	
CONTINUITY AND SHORT[K]	---	---	
RF NOISE [LBM] (E_p=250Vdc, E_{cal}=1.1 mVac, C_k=0.2 μf)	---	3.0	mW

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

SPECIAL REQUIREMENTS — CONT'D.

	MIN.	MAX.	
NOISE AND MICROPHONICS[NBMP] (Ef=6.3Vac, Ehk=0, Ebb=250Vdc, Ec1=0, Rp=10,000)	---	200	mVac
LOW FREQUENCY VIBRATION[QB] (Ec =-3Vdc, Rk=0, Rp=2000)	---	100	mVac
LOW PRESSURE VOLTAGE BREAKDOWN[R] (PRESSURE =55±5mm mercury, temp=25±5°C, HUMIDITY=0, VOLTAGE=500Vdc, 60 CYCLES, SINUSOIDAL WAVEFORM)	500	---	Vac
1 HOUR STABILITY LIFE TEST INTERMITTENT LIFE TEST CONDITIONS	---	---	
STABILITY LIFE TEST END POINTS Δ TRANSCONDUCTANCE (1)	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT	---	---	
HEATER CYCLING LIFE TEST (Ef=7.5V, Ehk=135Vdc, HEATER POSITIVE, Ec=Eb=0)	---	---	
HEATER CYCLING LIFE TEST END POINTS HEATER--CATHODE LEAKAGE	---	±20	μAdc
INTERMITTENT LIFE TEST (Ehk=135Vdc, HEATER POSITIVE, Rg=0.5 meg, min. BULB TEMPERATURE =+165°C)	---	---	

NOTES

[A] INTERNAL SHIELD AND HEATER CONNECTED TO CATHODE.

[AA] DIFFICULTY MAY BE ENCOUNTERED IF THIS TUBE IS OPERATED FOR LONG PERIODS OF TIME WITH VERY SMALL VALUES OF CATHODE CURRENT.

[B] TIE 1p TO 2p, 1g TO 2g, 1k TO 2k. (PARASITIC SUPPRESSORS OF 50 OHMS MAXIMUM PERMITTED.)

[C] SEE MIL-E-1C 4.8.2

[D] THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED:

$$\frac{(\text{SM AT } 6.3)-(\text{SM AT } 5.7)}{(\text{SM AT } 6.3)} \times 100$$

[E] PRIOR TO TEST TUBES TO BE PREHEATED FIVE (5) MINUTES AT FOLLOWING CONDITIONS. TEST IMMEDIATELY AFTER PREHEATING. Ef = 7.0V, Ec1 =0 Vdc, Rk = 240 OHMS, Eb = 150Vdc, Rg = 0.5 MEG.

[F] SEE MIL-E-1C 4.9.20.6

[G] SEE MIL-E-1C 4.9.20.5

[H] SEE MIL-E-1C 4.9.20.3

[J] GLASS STRAIN TEST CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST TWO (2) LITERS PER FIFTEEN TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST. REJECT FOR EVIDENCE OF AIR LEAK.

[K] SEE MIL-E-1C 4.7.5

[L] SEE MIL-E-1C 4.10.3.1

[M] TIE CATHODES TOGETHER AND GROUND THRU A 240 OHM RESISTOR. GRIDS ARE GROUNDED.

[N] SEE MIL-E-1C 4.10.3.5

[P] THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS @ 60 CYCLES.

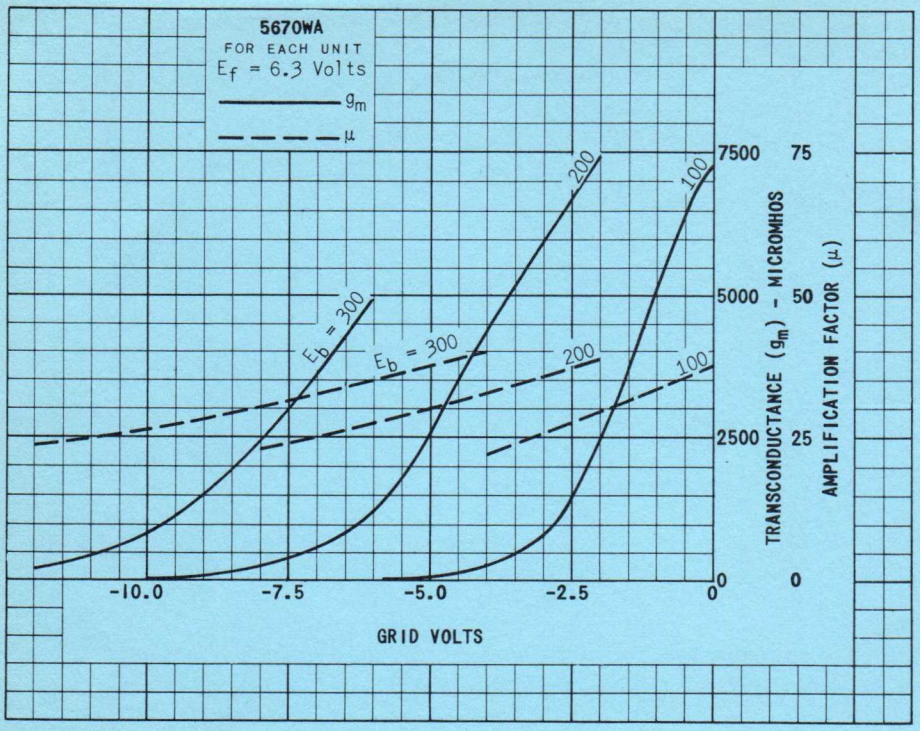
[Q] SEE MIL-E-1C 4.9.20.4

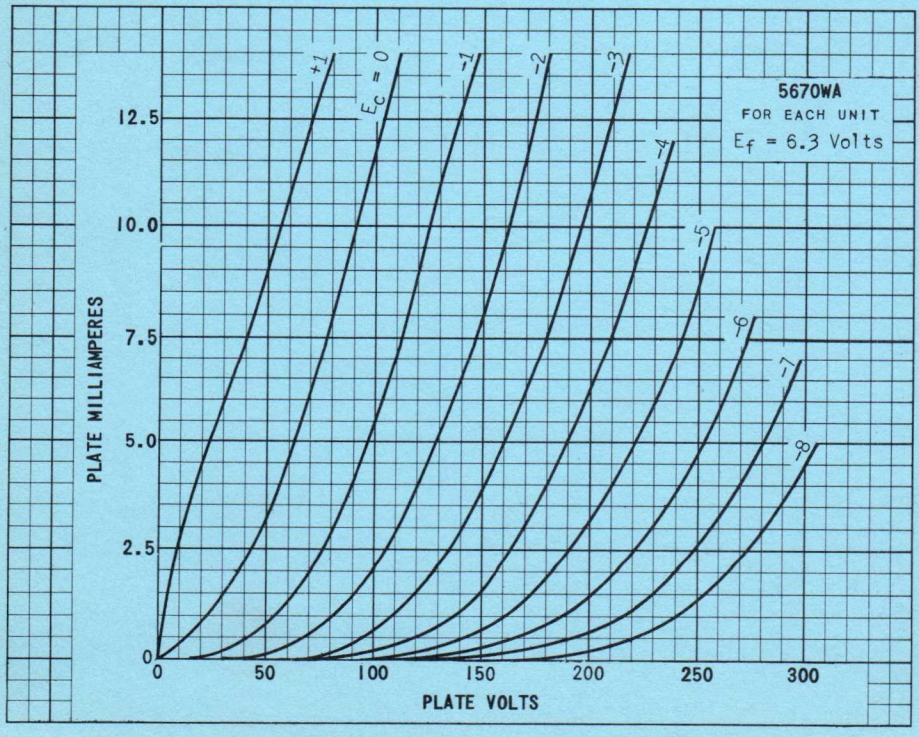
[R] BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

PRINTED IN U.S.A.

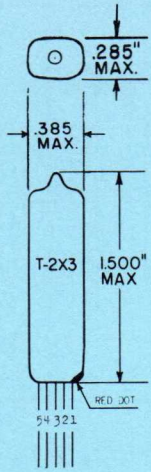
5670WA

PREMIUM TUBE





TUNG-SOL



GLASS BULB

RED DOT IS ADJACENT TO LEAD 1

PENTODE

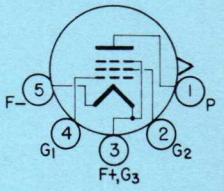
SUBMINIATURE TYPE

COATED FILAMENT

1.25 VOLTS 50 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS

0.048" SPACING CENTER-TO-CENTER

THE 5672 IS A FILAMENT TYPE PENTODE POWER AMPLIFIER OF SUBMINIATURE CONSTRUCTION DESIGNED FOR SERVICE IN WEARABLE AND PORTABLE EQUIPMENT. 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.

RATINGS

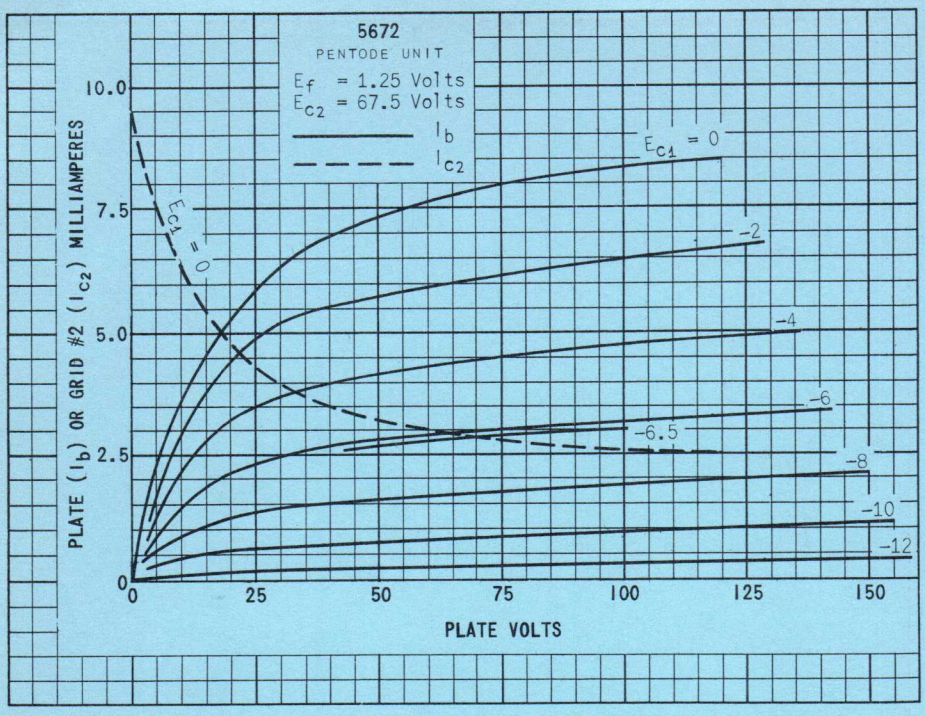
DESIGN CENTER VALUES

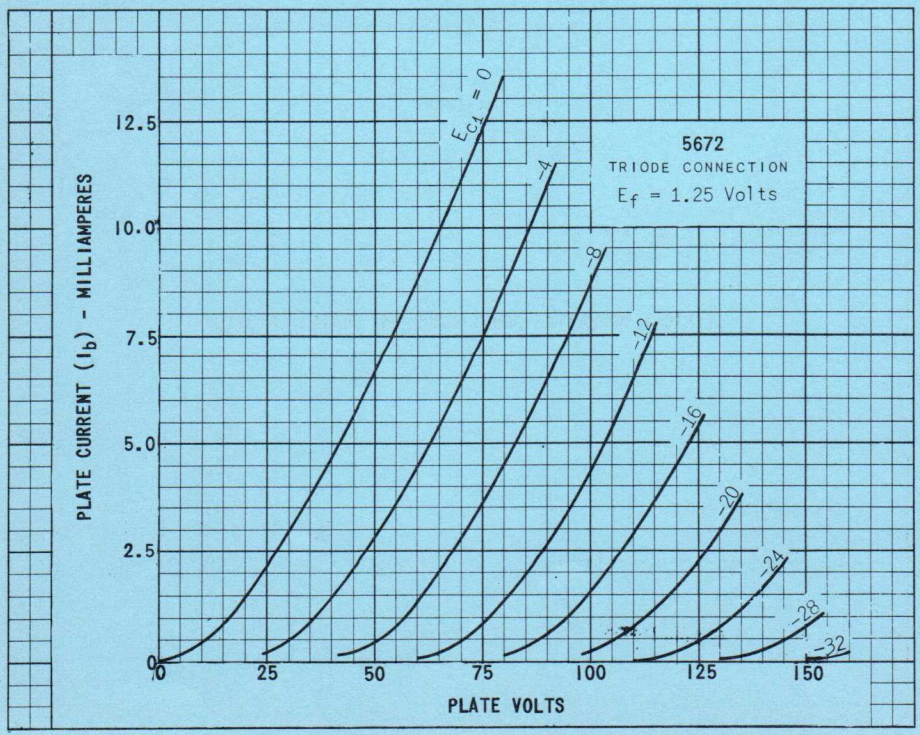
MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	5	MA.

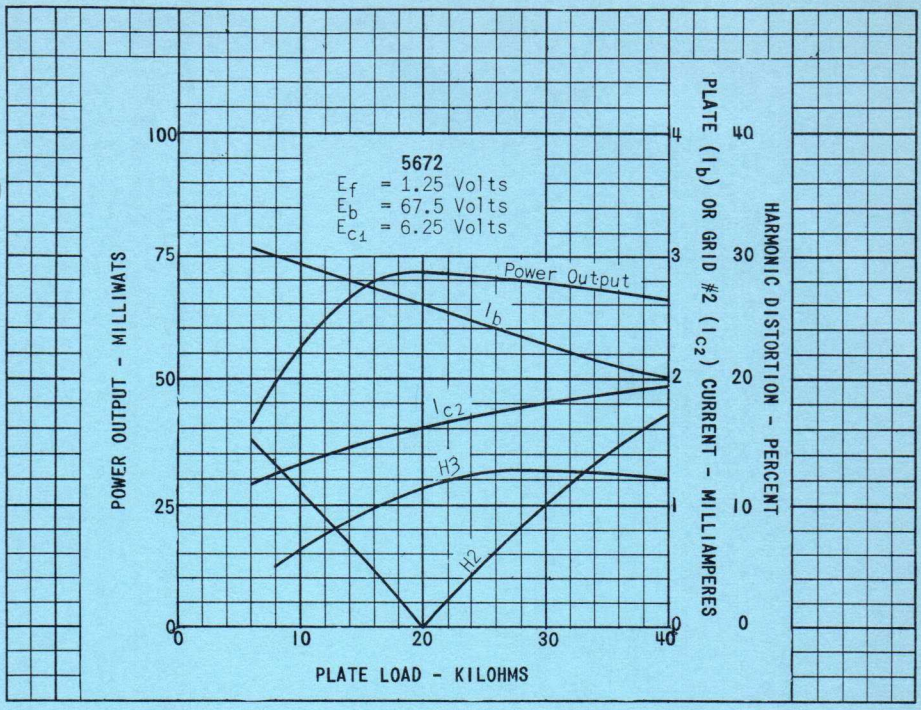
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

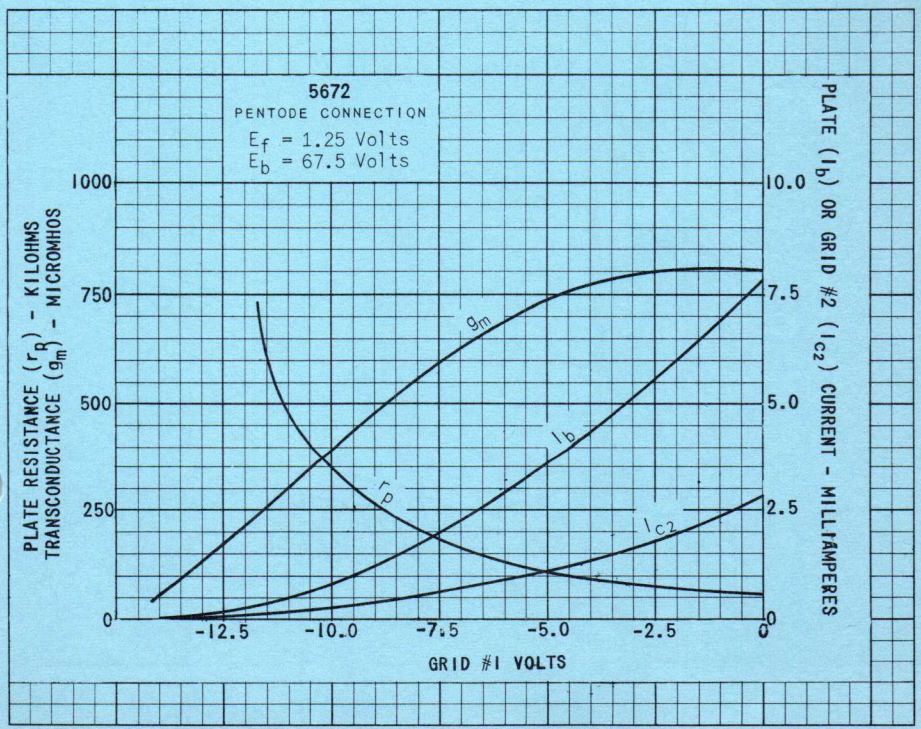
PLATE VOLTAGE	67.5	VOLTS
GRID #2 VOLTAGE	67.5	VOLTS
GRID #1 VOLTAGE	-6.5	VOLTS
PLATE CURRENT	3.25	MA.
GRID #2 CURRENT	1.1	MA.
TRANSCONDUCTANCE	650	µMHOS
LOAD RESISTANCE	20	KILOHMS
DISTORTION	10	PERCENT
POWER OUTPUT	65	MW.

PRINTED IN U. S. A.


5672
PENTODE UNIT
E_f = 1.25 Volts
E_{c_2} = 67.5 Volts
I_b
I_{c_2}
E_{c_1} = 0
-2
-4
-6
-6.5
-8
-10
-12
PLATE (I_b) OR GRID #2 (I_{c_2}) MILLIAMPERES
10.0
7.5
5.0
2.5
0
0
25
50
75
100
125
150
PLATE VOLTS


5672
TRIODE CONNECTION
E_f = 1.25 Volts
E_{c_1} = 0
-4
-8
-12
-16
-20
-24
-28
-32
PLATE CURRENT (I_b) - MILLIAMPERES
12.5
10.0
7.5
5.0
2.5
0
0
25
50
75
100
125
150
PLATE VOLTS





PRINTED IN U. S. A.

TUNG-SOL

UHF POWER TRIODE

PENCIL TYPE

FOR

RF POWER AMPLIFIER, OSCILLATOR

AND FREQUENCY MULTIPLIER APPLICATIONS

IN MOBILE AND AIRCRAFT EQUIPMENT

PHYSICAL DIMENSIONS SEE OUTLINE DRAWING

ELECTRODE TERMINATIONS SEE OUTLINE DRAWING

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

THE 5675 IS A COAXIAL METAL-GLASS PENCIL-TYPE MEDIUM MU TRIODE. ITS MAXIMUM PLATE DISSIPATION IS 5 WATTS CCS. THE TUBE MAY BE OPERATED WITH FULL RATINGS UP TO A FREQUENCY OF 1,700 MC/S, AND WITH REDUCED RATINGS UP TO 3,000 MC/S.

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE		1.4	pf
GRID TO CATHODE		2.4	pf
PLATE TO CATHODE	MAX.	0.09	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	135	mA
LIMITS OF APPLIED VOLTAGE – AC OR DC		6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		90	VOLTS
MINIMUM PREHEAT TIME		60	SEC.

AVERAGE STATIC CHARACTERISTICS

PLATE VOLTAGE	135	VOLTS
CATHODE RESISTOR	68	OHMS
PLATE CURRENT	24	mA
TRANSCONDUCTANCE	6,200	μMHOS
AMPLIFICATION FACTOR	20	

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

CLASS C TELEGRAPHY - RF POWER AMPLIFIER AND OSCILLATOR

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

CONTINUOUS COMMERCIAL SERVICE		
DC PLATE VOLTAGE	300	VOLTS
DC GRID VOLTAGE	-90	VOLTS
DC PLATE CURRENT	31	mA
DC GRID CURRENT	8	mA
PLATE INPUT	5	WATTS
PLATE DISSIPATION – SEE NOTE	5	WATTS
PLATE SEAL TEMPERATURE	175	° C
FREQUENCY FOR OPERATION AT FULL RATINGS	1,700	MC/S
ALTITUDE FOR OPERATION AT FULL RATINGS	60,000	FEET
GRID CIRCUIT RESISTANCE	0.1	MEGOHMS

NOTE: IF THE PLATE DISSIPATION EXCEEDS 2.5 WATTS, ADEQUATE COOLING MUST BE PROVIDED IN ORDER TO STAY WITHIN THE TEMPERATURE RATING.

TYPICAL OPERATION-OSCILLATOR IN CATHODE-DRIVE CIRCUIT

RF AMPLIFIER WITH CATHODE DRIVE

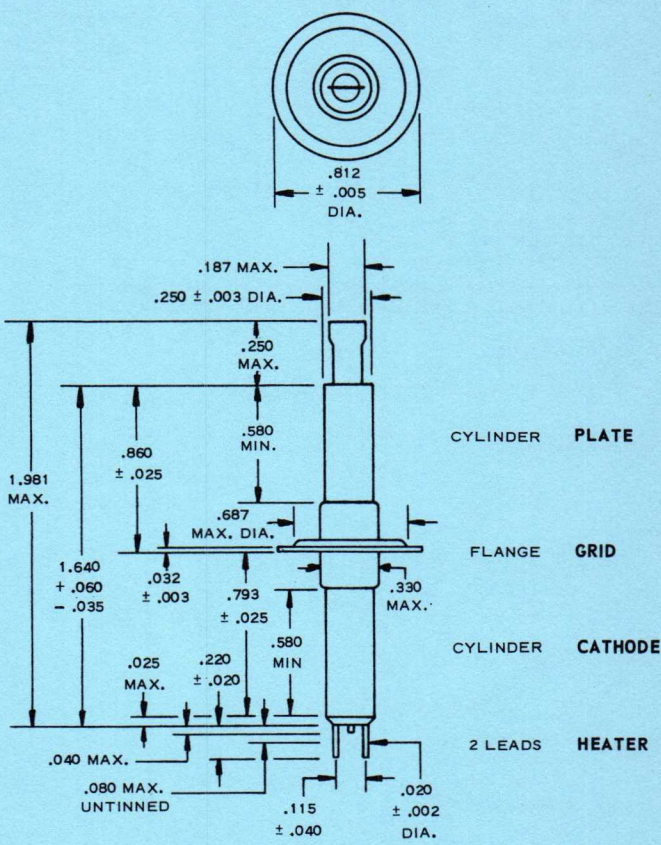
CONTINUOUS COMMERCIAL SERVICE			
FREQUENCY	1,700	3,000	MC/S
DC PLATE-TO-GRID VOLTAGE	128	151.5	VOLTS
DC CATHODE-TO-GRID VOLTAGE	8	1.5	VOLTS
FROM A GRID RESISTOR	2,000	5,000	OHMS
DC PLATE CURRENT	25	29	mA
DC GRID CURRENT - APPROX.	4	0.3	mA
USEFUL POWER OUTPUT - APPROX.	475	50	mW

SPECIAL TESTS AND PERFORMANCE DATA

CONTROLLED ON A SAMPLING BASIS

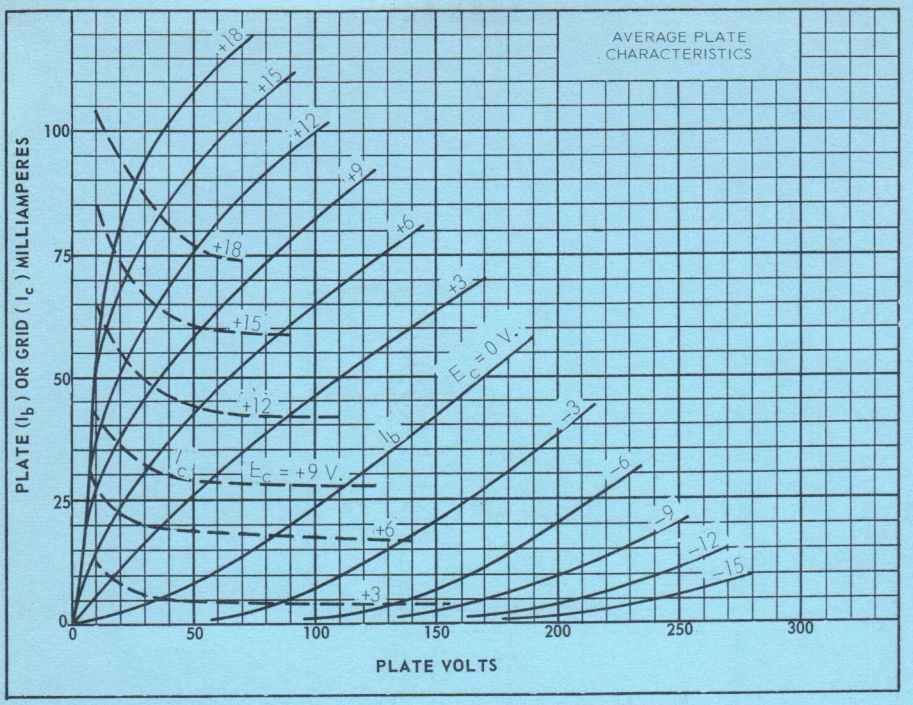
VIBRATION TEST
GLASS SEAL FRACTURE TESTS
500 HOUR LIFE TEST IN OSCILLATOR

OUTLINE DRAWING



ALL DIMENSIONS IN INCHES

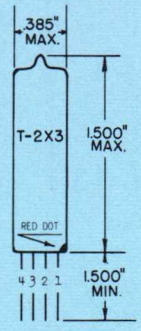
PRINTED IN U. S. A.


AVERAGE PLATE CHARACTERISTICS
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
0
50
100
150
200
250
300
+18
+15
+12
+9
+6
+3
E_c = 0 V.
I_b
-3
-6
-9
-12
-15
I_c
E_c = +9 V.
+18
+15
+12
+6
+3

TUNG-SOL

TRIODE

SUBMINIATURE TYPE



GLASS BULB

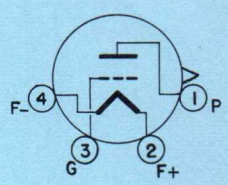
RED DOT IS ADJACENT TO LEAD 1

COATED FILAMENT

1.25 VOLTS 120 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS

0.048" SPACING CENTER-TO-CENTER

THE 5676 IS A SUBMINIATURE, FILAMENT TYPE, TRIODE. IT IS DESIGNED FOR SERVICE AS A HIGH FREQUENCY OSCILLATOR UP TO SEVERAL HUNDRED MEGACYCLES IN APPLICATIONS WHERE EXTREME COMPACTNESS MUST BE MAINTAINED. 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 LEAD #4

GRID TO PLATE	2.0	pf
GRID TO FILAMENT	1.3	pf
PLATE TO FILAMENT	4.0	pf

RATINGS

DESIGN CENTER VALUES

MAXIMUM PLATE VOLTAGE	135	VOLTS
MAXIMUM PLATE CURRENT	10	MA.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

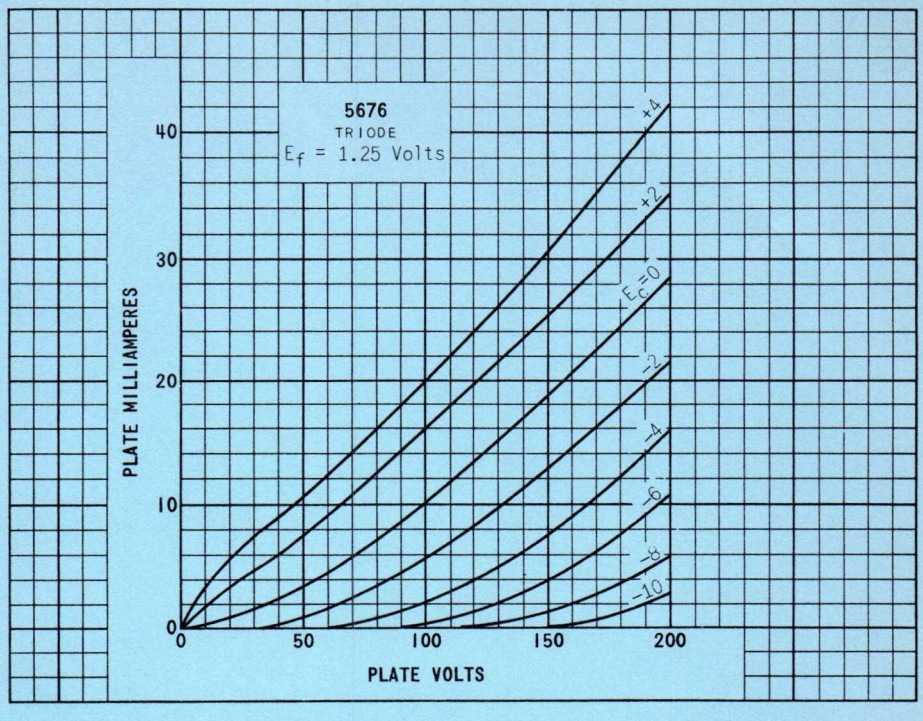
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	−5	VOLTS
TRANSCONDUCTANCE	1 600	µMHOS
AMPLIFICATION FACTOR	15	
PLATE CURRENT	4.0	MA.

VHF OSCILLATOR

PLATE VOLTAGE	135	VOLTS
GRID LEAK	10 000	OHMS
GRID CURRENT	150 TO 500	µA.
PLATE CURRENT	9	MA.
FREQUENCY	100 TO 350	MC.

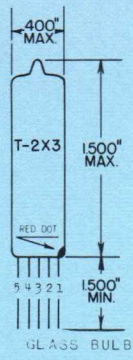


PRINTED IN U. S. A.

TUNG-SOL

PENTODE

SUBMINIATURE TYPE



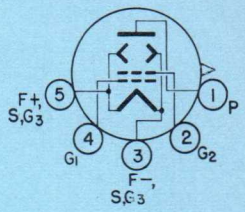
COLOR DOT IS ADJACENT TO LEAD 1

COATED FILAMENT

1.25 VOLTS 50 MA.

DC

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS

0.048" SPACING CENTER-TO-CENTER

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

THE 5678 IS A FILAMENT TYPE, SUBMINIATURE PENTODE DESIGNED FOR SERVICE IN RF APPLICATIONS REQUIRING ECONOMY OF SPACE, WEIGHT AND BATTERY DRAIN. A COATED METALLIC SHIELD IS USED AND CONNECTED TO LEAD #3. 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	pf
INPUT	3.3	pf
OUTPUT	3.8	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	67.5	VOLTS

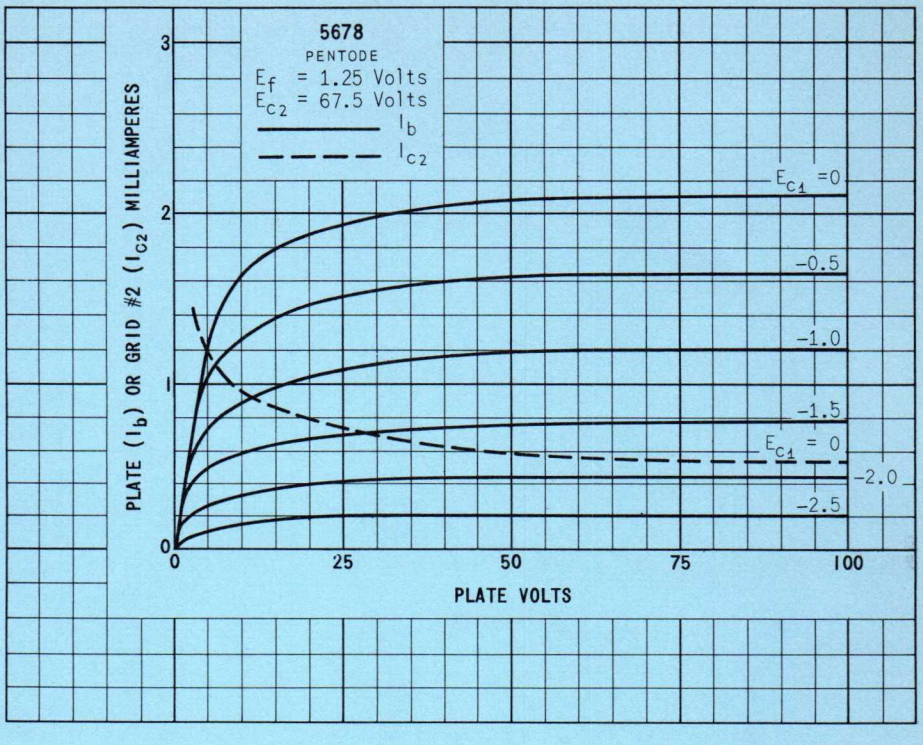
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

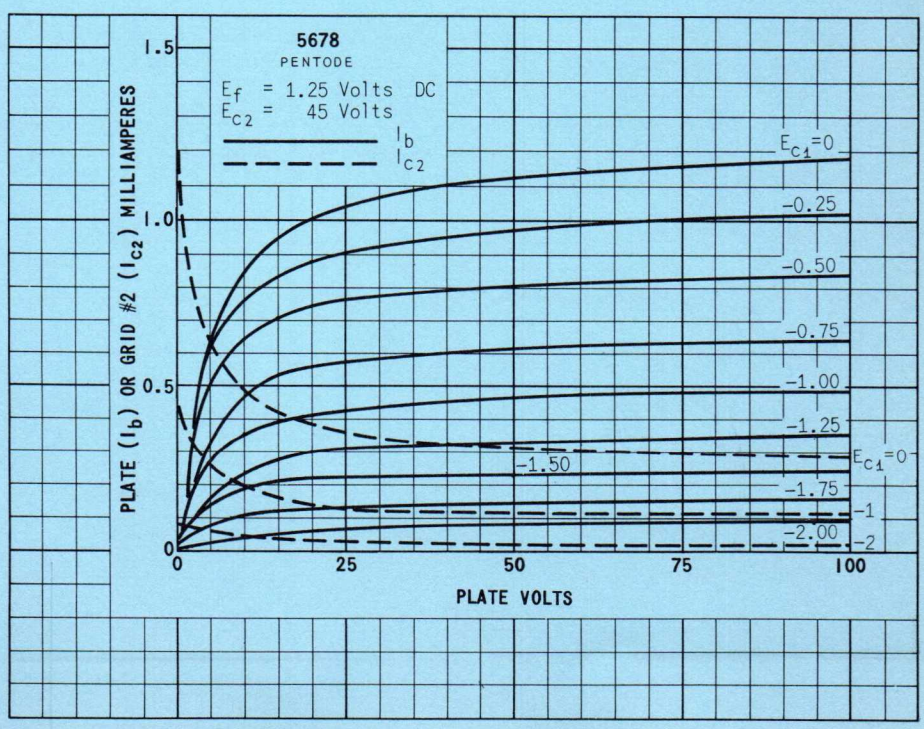
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	45	67.5	VOLTS
GRID #2 VOLTAGE	45	67.5	VOLTS
GRID #1 VOLTAGE[A]	0	0	VOLTS
PLATE RESISTANCE	1.2	1.0	MEGOHMS
TRANSCONDUCTANCE	820	1 100	μMHOS
PLATE CURRENT	0.8	1.8	MA.
GRID #2 CURRENT	0.22	0.48	MA.
GRID #1 VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE = 10 μMHOS	-3	-4	VOLTS

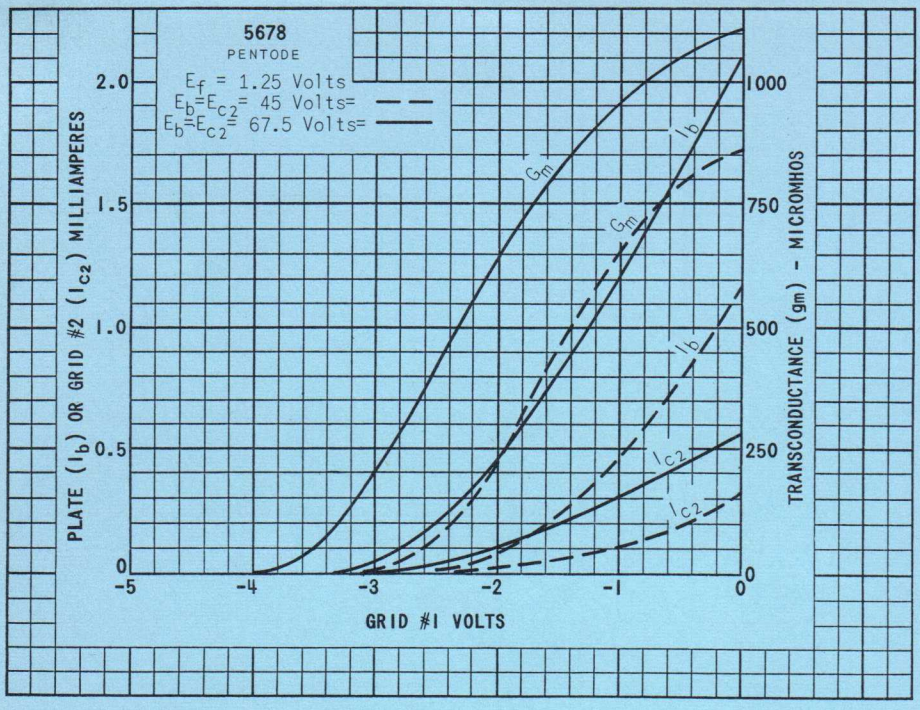
[A] GRID RESISTOR = 5 MEGOHMS.

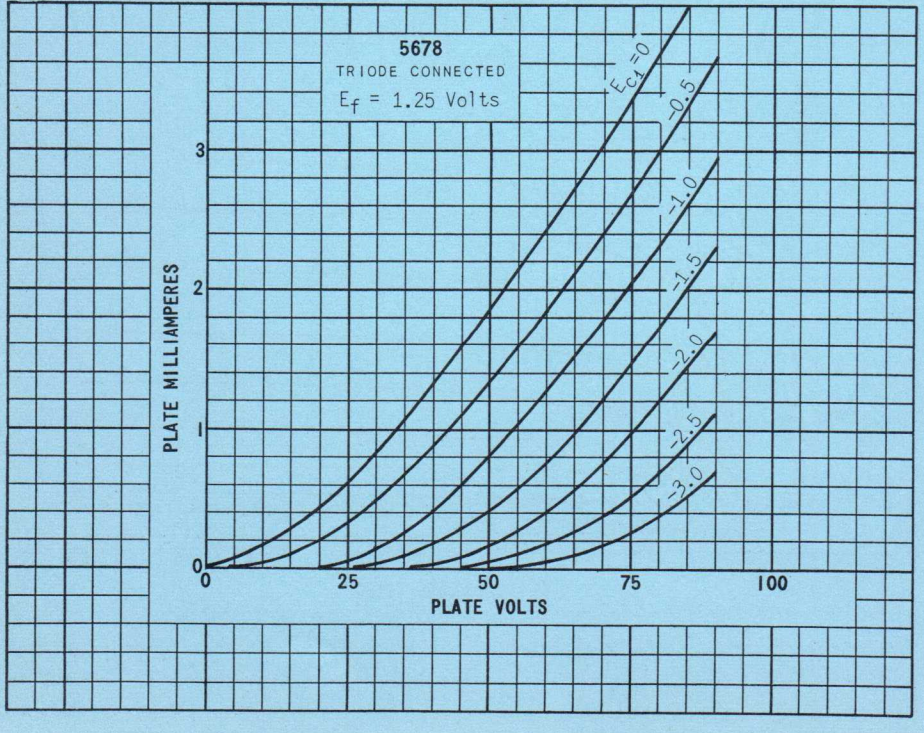
PRINTED IN U.S.A.



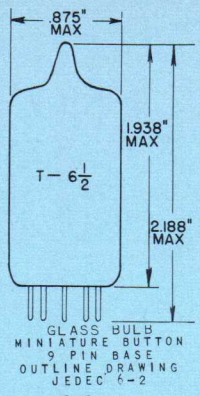


PRINTED IN U.S.A.


5678
PENTODE
E_f = 1.25 Volts
E_b=E_{c2}= 45 Volts=
E_b=E_{c2}= 67.5 Volts=
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (gm) - MICROMHOS
GRID #1 VOLTS
G_m
I_b
I_{c2}
2.0
1.5
1.0
0.5
0
1000
750
500
250
-5
-4
-3
-2
-1


5678
TRIODE CONNECTED
E_f = 1.25 Volts
E_{c1}=0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
PLATE MILLIAMPERES
PLATE VOLTS
3
2
1
0
25
50
75
100

TUNG-SOL



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

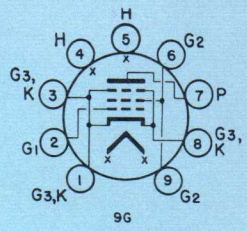
PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 350 MA.
AC OR DC

ANY MOUNTING POSITION



9G

BOTTOM VIEW
BASING DIAGRAM
JEDEC 9G

THE 5686 IS A HEATER–CATHODE TYPE PENTODE POWER AMPLIFIER PARTICULARLY DESIGNED FOR DEPENDABLE OPERATION UNDER CONDITIONS USUALLY FOUND IN MOBILE AND AIRCRAFT APPLICATIONS. IT IS SUITABLE FOR CLASS A AUDIO POWER AMPLIFIER SERVICE OR FOR CLASS C RF POWER AMPLIFIER SERVICE UP TO 160 MC. MULTIPLE LEADS ON THE CATHODE AND SCREEN GRID, FACILITATE RF BYPASSING AT HIGH FREQUENCIES.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

	WITH SHIELD	WITHOUT SHIELD	
GRID #1 TO PLATE (MAX.)	0.08	0.11	pf
INPUT	6.5	6.4	pf
OUTPUT	8.5	4.0	pf

RATINGS

CLASS A_1 AMPLIFIER — DESIGN CENTER VALUES

MAXIMUM PEAK HEATER CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	7.5	WATTS
MAXIMUM GRID #2 DISSIPATION	3.0	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHM

CLASS C RF AMPLIFIER — DESIGN CENTER VALUES

MAXIMUM PEAK HEATER CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	250	VOLTS
MAXIMUM GRID #1 VOLTAGE	-150	VOLTS
MAXIMUM PLATE DISSIPATION	7.5	WATTS
MAXIMUM GRID #2 DISSIPATION	3.0	WATTS
MAXIMUM PLATE INPUT POWER	10	WATTS
MAXIMUM PLATE CURRENT	40	MA.
MAXIMUM GRID #2 CURRENT	15	MA.
MAXIMUM GRID #1 CURRENT	3	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	50 000	OHMS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

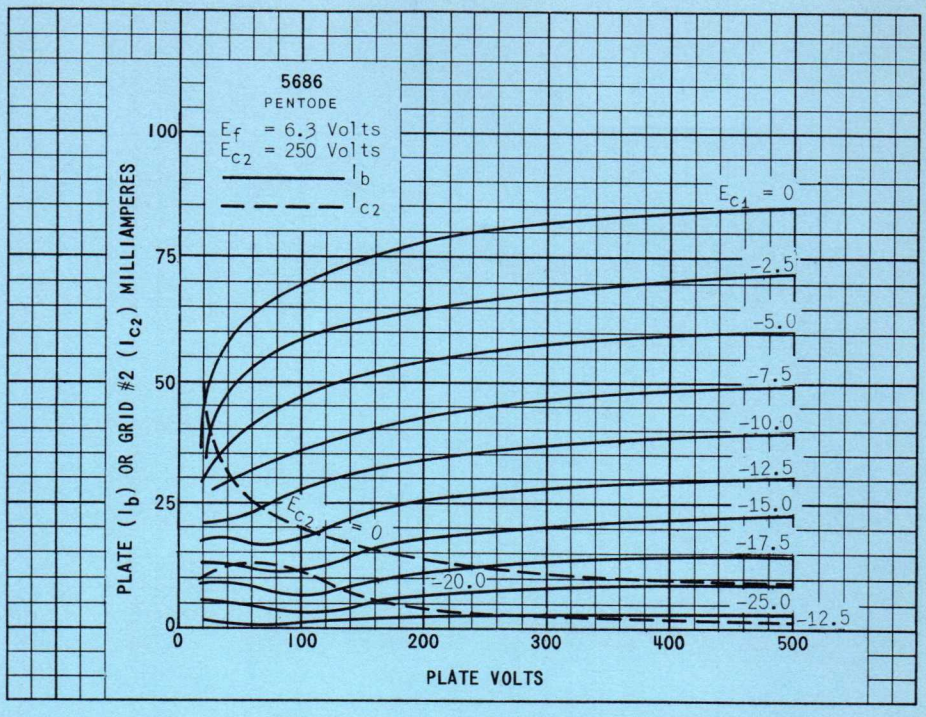
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

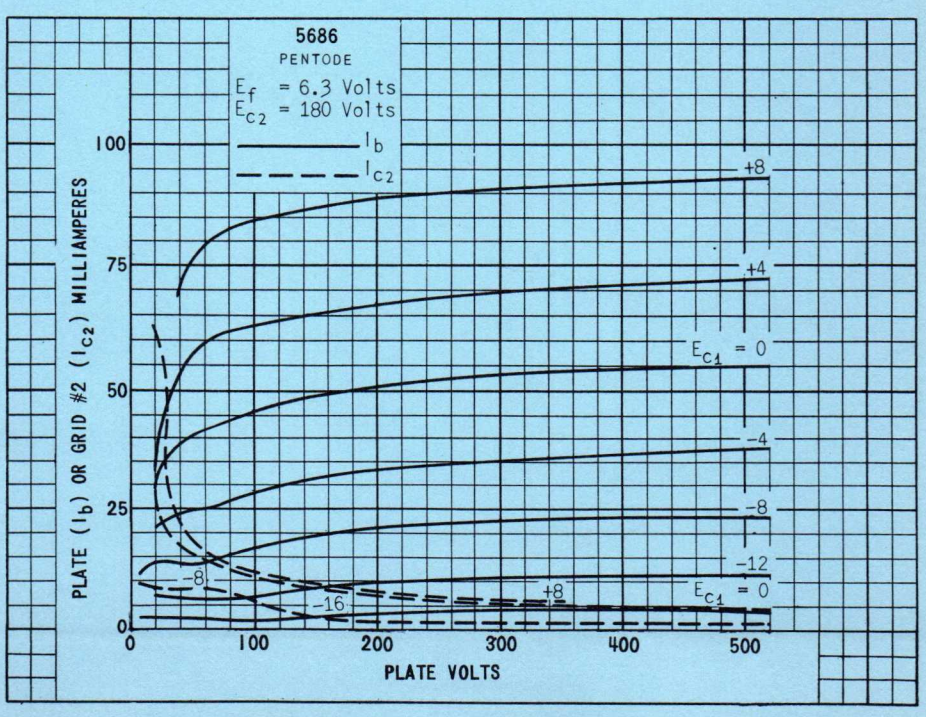
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	−12.5	VOLTS
TRANSCONDUCTANCE	3 100	µMHOS
ZERO-SIGNAL PLATE CURRENT	27	MA.
ZERO-SIGNAL GRID #2 CURRENT	5.0	MA.
LOAD RESISTANCE	9 000	OHMS
POWER OUTPUT	2.7	WATTS

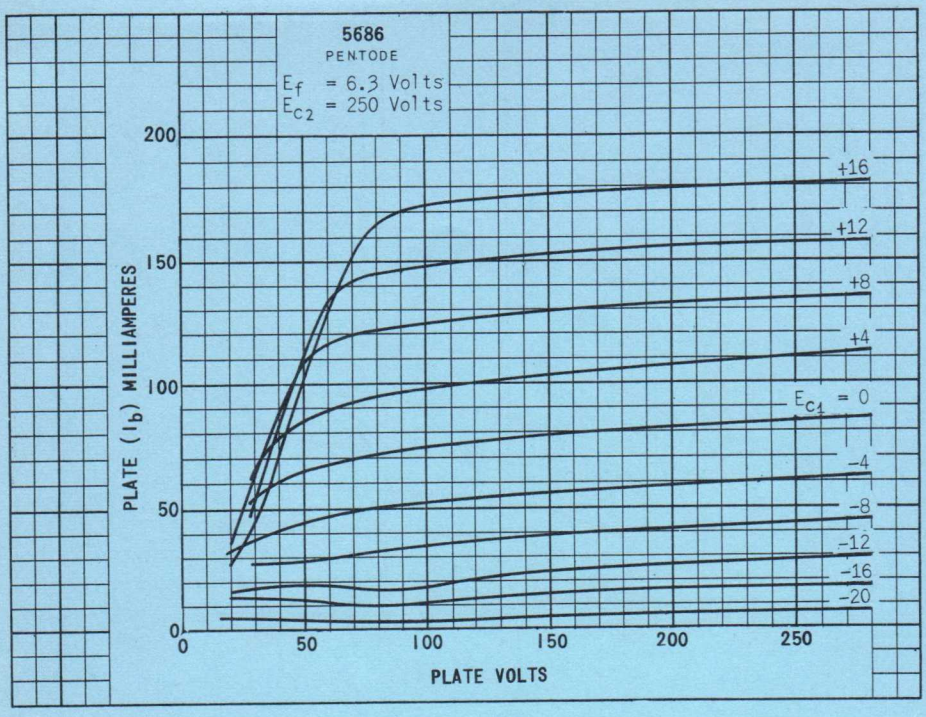
CLASS C RF AMPLIFIER UP TO 160 MC.

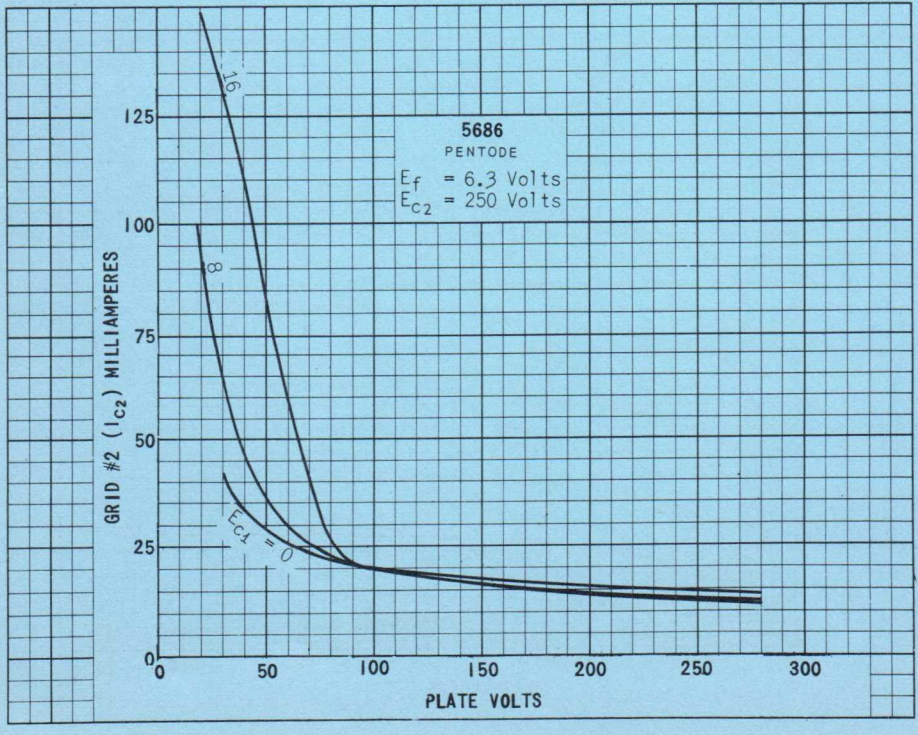
PLATE VOLTAGE	250	250	VOLTS
GRID #2 VOLTAGE	180	250	VOLTS
GRID #1 VOLTAGE	-30	−50	VOLTS
OR GRID #1 RESISTOR	15 000	25 000	OHMS
PEAK RF GRID #1 VOLTAGE	50	75	VOLTS
PLATE CURRENT	30	40	MA.
GRID #2 CURRENT (APPROX.)	6.5	10.5	MA.
GRID #1 CURRENT (APPROX.)	2.0	2.0	MA.
RF GRID DRIVING POWER (APPROX.)	5.0	6.5	MW.
USEFUL POWER OUTPUT AT 125 MC.	---	5.25	WATTS





PRINTED IN U. S. A.

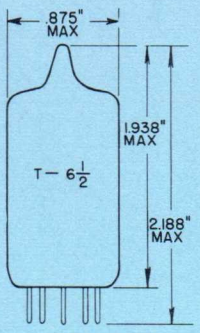

5686
PENTODE
E_f = 6.3 Volts
E_{c2} = 250 Volts
PLATE (I_b) MILLIAMPERES
PLATE VOLTS
0
50
100
150
200
250
+16
+12
+8
+4
E_{c1} = 0
-4
-8
-12
-16
-20


5686
PENTODE
E_f = 6.3 Volts
E_{c2} = 250 Volts
GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
125
0
50
100
150
200
250
300
16
8
E_{c1} = 0

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



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

COATED UNIPOTENTIAL CATHODE

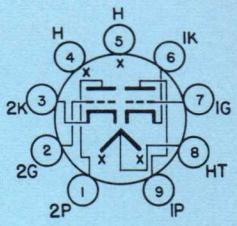
HEATER

SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
450 MA.	900 MA.

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 #8 AND PINS #4 AND #5 CONNECTED TOGETHER.



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9H

THE 5687 IS A GENERAL PURPOSE MEDIUM-MU DOUBLE TRIODE USING THE 9 PIN BUTTON ALL-GLASS CONSTRUCTION. EACH TRIODE IS ELECTRICALLY INDEPENDENT ALTHOUGH THE TWO HEATERS HAVE A COMMON CONNECTION. THE TUBE IS CHARACTERIZED BY HIGH PERVEANCE AND HIGH EMISSION CAPABILITIES.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

EACH TRIODE UNIT

GRID TO PLATE: (G TO P)	4.0	pf
GRID TO CATHODE: (G TO K+H)	4.0	pf
PLATE TO CATHODE: (P TO K+H)		
SECTION #1	0.6	pf
SECTION #2	0.5	pf
HEATER TO CATHODE: (H TO K)	7.0	pf
PLATE TO PLATE: (1P TO 2P) APPROX.	0.75	pf
GRID TO GRID: (1G TO 2G) APPROX.	0.025	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM INVERSE PLATE VOLTAGE	1000	VOLTS
MAXIMUM PLATE DISSIPATION (EACH UNIT)	4.2	WATTS
MAXIMUM TOTAL PLATE DISSIPATION (BOTH UNITS)	7.5	WATTS
MAXIMUM BULB TEMPERATURE (AT ANY PART OF ENVELOPE)	220	°C
MAXIMUM DC GRID CURRENT (EACH UNIT)	6	MA.
MAXIMUM EXTERNAL GRID CIRCUIT RESISTANCE (EACH UNIT)	1	MEGOHM

CONTINUED ON FOLLOWING PAGE

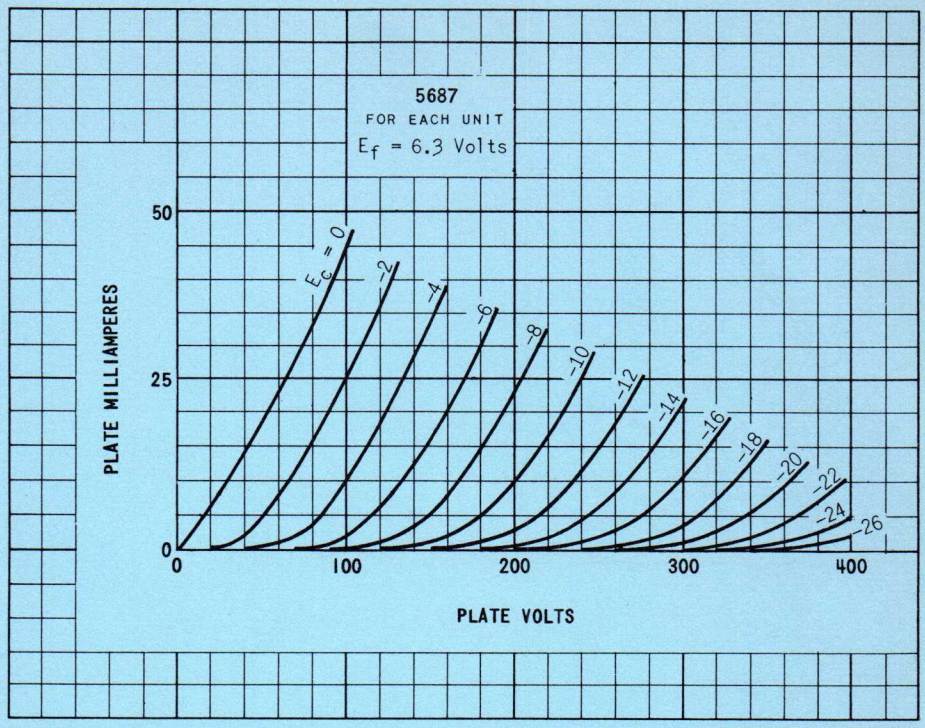
PRINTED IN U.S.A.

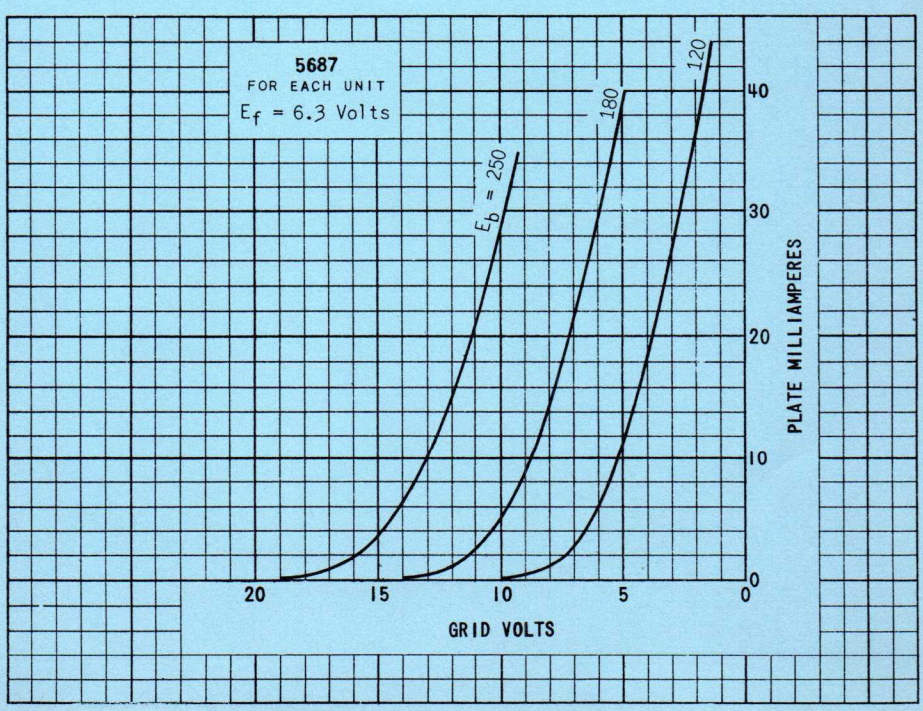
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

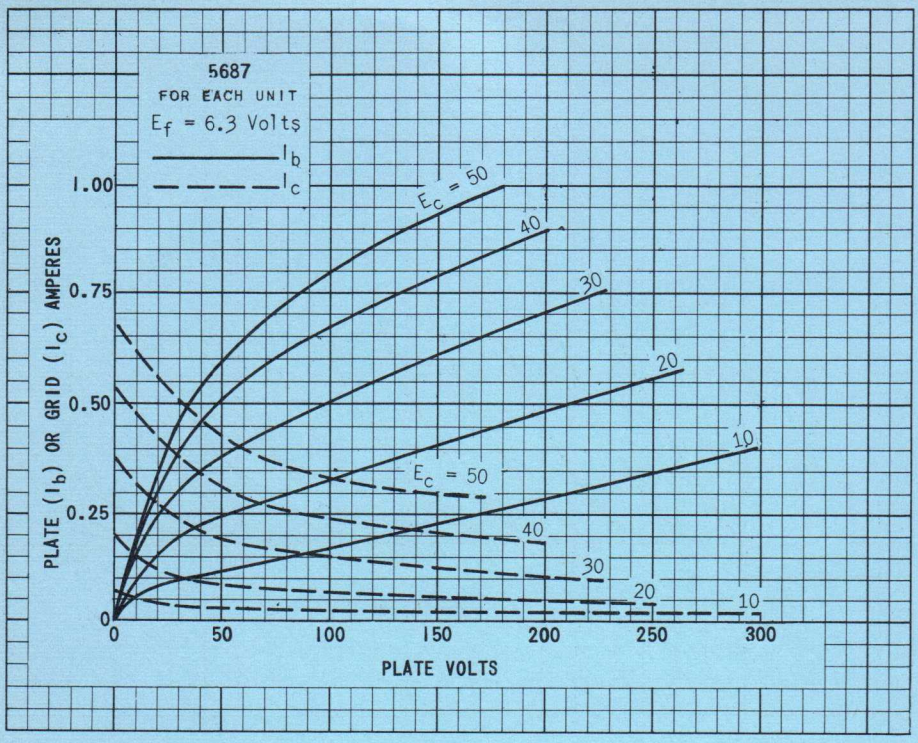
CLASS A_1 AMPLIFIER – EACH UNIT

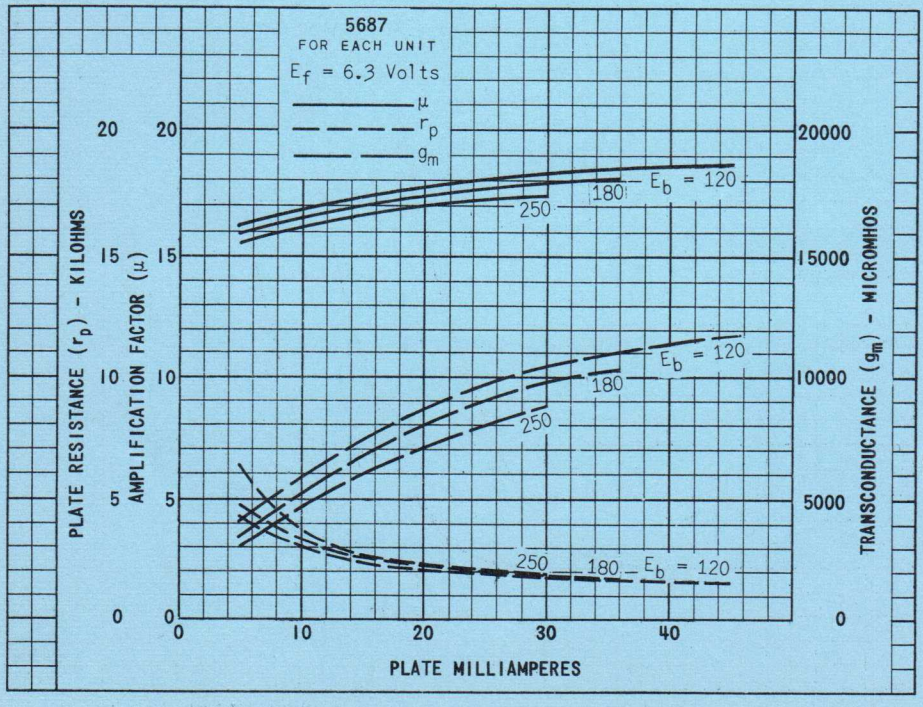
				VOLTS AMP.
PLATE VOLTAGE	120	180	250	VOLTS
GRID VOLTAGE	−2	−7	−12.5	VOLTS
PLATE CURRENT	36.0	23.0	12.0	MA.
PLATE RESISTANCE (APPROX.)	1 560	2 000	3 000	OHMS
TRANSCONDUCTANCE	11 500	8 500	5 400	μMHOS
AMPLIFICATION FACTOR	18.0	17.0	16.0	
GRID VOLTAGE FOR I_b = 100 μA. (APPROX.)	−9.0	−14.0	−19.0	VOLTS





PRINTED IN U. S. A.


5687
FOR EACH UNIT
E_f = 6.3 Volts
I_b
I_c
E_c = 50
40
30
20
10
PLATE (I_b) OR GRID (I_c) AMPERES
1.00
0.75
0.50
0.25
0
0
50
100
150
200
250
300
PLATE VOLTS


5687
FOR EACH UNIT
E_f = 6.3 Volts
μ
r_p
g_m
E_b = 120
180
250
PLATE RESISTANCE (r_p) - KILOHMS
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (g_m) - MICROMHOS
20
15
10
5
0
20000
15000
10000
5000
0
0
10
20
30
40
PLATE MILLIAMPERES

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

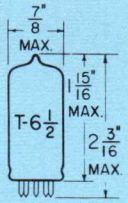
HEATER

6.3 VOLTS 0.9 AMP.
12.6 VOLTS 0.45 AMP.

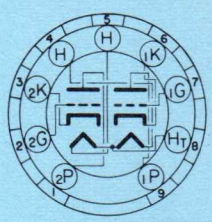
AC OR DC

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 #8 AND PINS #4 AND #5 TIED TOGETHER.



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9H

THE 5687WA IS A RUGGEDIZED, GENERAL PURPOSE MEDIUM-MU TWIN TRIODE OF THE MINIATURE BUTTON 9-PIN ALL GLASS CONSTRUCTION. EACH TRIODE SECTION IS ELECTRICALLY INDEPENDENT, ALTHOUGH THE TWO HEATERS HAVE A COMMON CONNECTION PERMITTING EITHER A 6.3 OR 12.6 VOLT OPERATION. THIS TYPE HAS HIGH PERVEANCE AND HIGH EMISSION CAPABILITIES WHICH ALLOW VERY HIGH PLATE CURRENT PULSES IF A SUITABLE SHORT DUTY CYCLE IS EMPLOYED. THE CATHODE MATERIAL IS CHOSEN TO MINIMIZE INTERFACE FORMATION, THUS MAKING THE 5687WA IDEAL FOR TRIGGERED APPLICATIONS INVOLVING LONG PERIODS OF STAND-BY CUT-OFF SERVICE. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5687WA IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

EACH TRIODE UNIT

	WITHOUT SHIELD	
GRID TO PLATE (RATED)	4.0	μμf
GRID TO CATHODE (RATED)	4.0	μμf
PLATE TO CATHODE (RATED)		
SECTION #1	0.6	μμf
SECTION #2	0.5	μμf
HEATER TO CATHODE (RATED)	7.0 ←	μμf
PLATE TO PLATE (APPROX.)	0.75	μμf
GRID TO GRID (APPROX.)	0.025	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	12.6±5%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330		VOLTS
MAXIMUM PLATE DISSIPATION, EACH PLATE[A]	4.2		WATTS
MAXIMUM DC HEATER-CATHODE VOLTAGE	±100		VOLTS
MAXIMUM DC CATHODE CURRENT, EACH SECTION[B]	65		mAdc
MAXIMUM BULB TEMPERATURE	+225		°C

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 12.6V, E_b = 120Vdc, E_c = −2Vdc
(EXCEPT AS MODIFIED BELOW)

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT (E_f = 6.3V)	0.82	0.94	---	---	0.80	0.96	AMP.
HEATER CATHODE LEAKAGE[C] (E_{hk}=±100Vdc)	---	±30	---	---	---	±50	μAdc
GRID CURRENT (1)[C] (R_g = 0.5MEG)	---	−1.5	---	---	---	−2.0	μAdc
PLATE CURRENT (1)	27	45	33	39	---	---	mAdc
INSULATION OF ELECTRODES (E_f=12.6V, E(g-all)= 300Vdc, E(g-neg., E(p-all)= 500 Vdc, P neg.)							
R(g-all)	100	---	---	---	50	---	MEGOHM
R(p-all)	100	---	---	---	50	---	MEGOHM
PLATE CURRENT (2) (E_b=300Vdc, E_c=−20Vdc)	---	6.0	---	---	---	---	mAdc
PLATE CURRENT (3) (E_b=300Vdc, E_c=−25Vdc)	---	1.0	---	---	---	---	mAdc
TRANSCONDUCTANCE (2)[D]	---	15	---	---	---	15	PERCENT
GRID CURRENT (2)[E] (E_f = 14.0V)	---	−5.0	---	---	---	---	μAdc
PLATE EMISSION[F] (E_b=195Vac, R_k/I_b= 10.5 mVdc, E_c = 0	---	25	---	---	---	---	μAdc
AMPLIFICATION FACTOR	16	21	---	---	---	---	
TRANSCONDUCTANCE (1)	---	---	10000	12000	6000	14000	μMHOS
Δ AVERAGE TRANS-CONDUCTANCE (1)	---	---	---	---	---	15	PERCENT

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[G] (R_p=2,000)	---	100	mVac
VIBRATIONAL FATIGUE[H]	---	---	
SHOCK[J] (HAMMER ANGLE =24°, SHORT INDICATOR EMPLOYED)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	150	mVac
HEATER-CATHODE LEAKAGE	---	±50	μAdc
TRANSCONDUCTANCE (1)	6 000	---	μMHOS
GRID CURRENT (1)	−3.0	---	μAdc
GLASS STRAIN[K]	---	---	
CONTINUITY AND SHORT[L]	---	---	
AF NOISE[MNPQ] (E_f=12.6Vdc, E_{bb}=300Vdc, E_c=0, E_{cal}=70mVac)	---	17	VU
LOW FREQUENCY VIBRATION[RC] (R_p=2000)	---	100	mVac
LOW PRESSURE VOLTAGE BREAKDOWN[S] (PRESSURE = 55±5 mm mercury, TEMP.=25±5°C) HUMIDITY=0, VOLTAGE = 500Vac, 60 CYCLES, SINUSOIDAL WAVE FORM)	500	---	Vac
1 HOUR STABILITY LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS)	---	---	
STABILITY LIFE TEST END POINTS TRANSCONDUCTANCE (1)	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT)	---	---	
SURVIVAL RATE LIFE TEST END POINTS PLATE CURRENT (1)	---	45	mAdc

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

SPECIAL REQUIREMENTS -CONT'D.

	MIN.	MAX.	
HEATER CYCLING LIFE TEST (E_f=7.5V, E_{hk}=135Vdc, HEATER POSITIVE, E_b=E_c=0)	---	---	
HEATER CYCLING LIFE TEST END POINTS [T] HEATER-CATHODE LEAKAGE	---	±30	μAdc
INTERMITTENT LIFE TEST [P] (E_{hk}=135Vdc, HEATER POSITIVE, R_g=1.0 MEG., E_c=0, MIN. BULB TEMP. =+225°C, R_k=68 OHMS)	---	---	

NOTES

[A] MAXIMUM TOTAL DISSIPATION FOR BOTH SECTIONS SHALL BE 7.5 WATTS.

[B] R_g MAX. 1.0 MEG WITH CATHODE BIAS; 0.1 MEGOHM WITH FIXED BIAS.

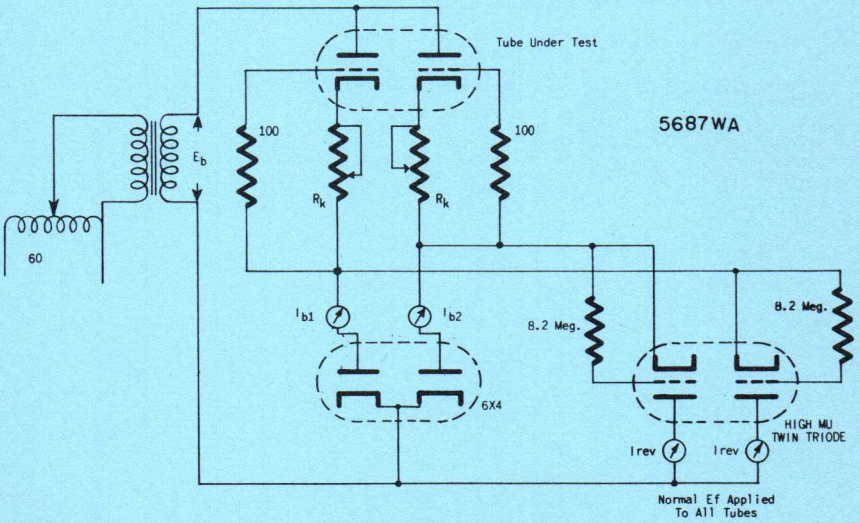
[C] TIE 1_p TO 2_p, 1_g TO 2_g, 1_k TO 2_k. (PARASITIC SUPPRESSORS OF 50 OHMS MAXIMUM PERMITTED.)

[D] THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED:

$$\frac{(\text{SM AT } 12.6)-(\text{SM AT } 11.4)}{(\text{SM AT } 12.6)} \times 100$$

[E] PRIOR TO THIS TEST TUBES SHALL BE PREHEATED AT FOLLOWING CONDITIONS AND TESTED IMMEDIATELY AFTER PREHEATING. E_f=14.0V, E_{c1}=-2Vdc, R_k=0 OHM, E_b=120Vdc, R_g=1.0 MEG.

[F] TIE GRIDS TO NEGATIVE END OF INDIVIDUAL Rk THRU INDIVIDUAL 100 OHM RESISTORS. ADJUST INDIVIDUAL Rk FOR SPECIFIED FORWARD PLATE CURRENT ±5% AS MEASURED ON THE FORWARD HALF CYCLE OF PLATE VOLTAGE. AFTER A MINIMUM OF 5 MINUTES OPERATION AS ABOVE, IMMEDIATELY MEASURE REVERSE PLATE CURRENT ON THE REVERSE HALF CYCLE OF PLATE VOLTAGE.



CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES -CONT'D.

G SEE MIL-E-1C 4.9.20.3

H SEE MIL-E-1C 4.9.20.6

J SEE MIL-E-1C 4.9.20.5

K GLASS STRAIN TEST SHALL CONSIST OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0°±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST 2 LITERS PER 15 TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST. TUBES SHALL BE REJECTED FOR EVIDENCE OF AIR LEAK.

L SEE MIL-E-1C 4.7.5

M SEE MIL-E-1C 4.10.3.2

N THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS @ 60 CYCLES.

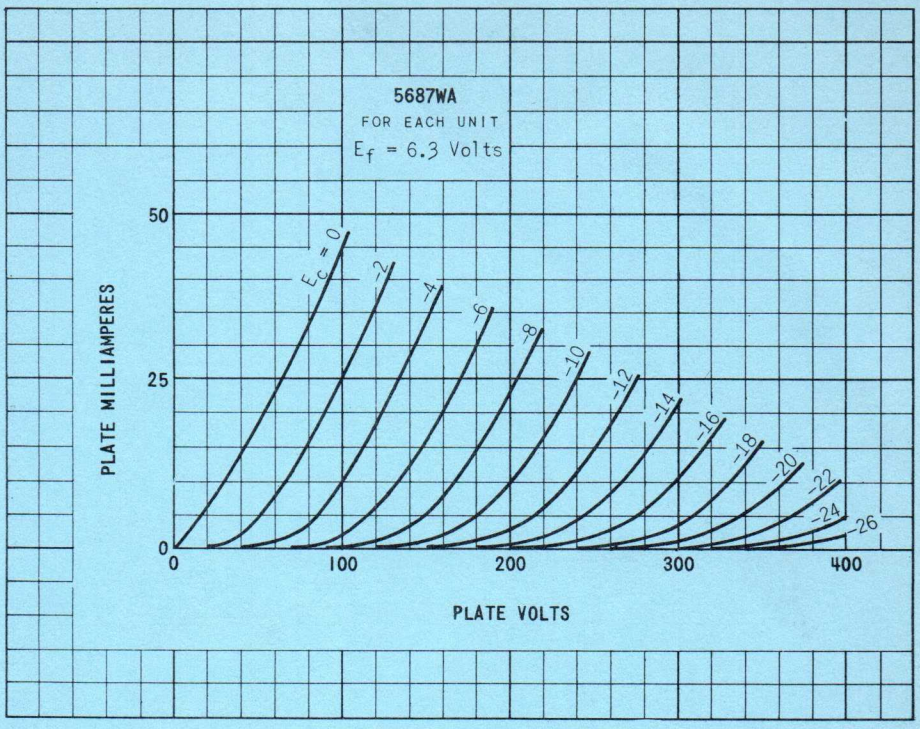
P R_p=2000 OHMS. E_{cal}=70mV FOR 17VU METER DEFLECTION INITIALLY. PARAGRAPH 4.10.3.2 OF MIL-E-1C IS AMMENDED AS FOLLOWS: THE FIFTH SENTENCE SHALL READ: THE GAIN OF THE POWER AMPLIFIER (SEE FIGURE 30) SHALL BE ADJUSTED BY REMOVING THE TUBE FROM THE SOCKET AND INTRODUCING THE SPECIFIED CALIBRATING VOLTAGE (SINE WAVE) THRU A CAPACITOR AND NOT MORE THAN 100 OHMS AT THE CALIBRATING FREQUENCY. THE POWER AMPLIFIER GAIN SHALL BE ADJUSTED FOR POWER OUTPUT LEVEL OF 17VU, (50MW).

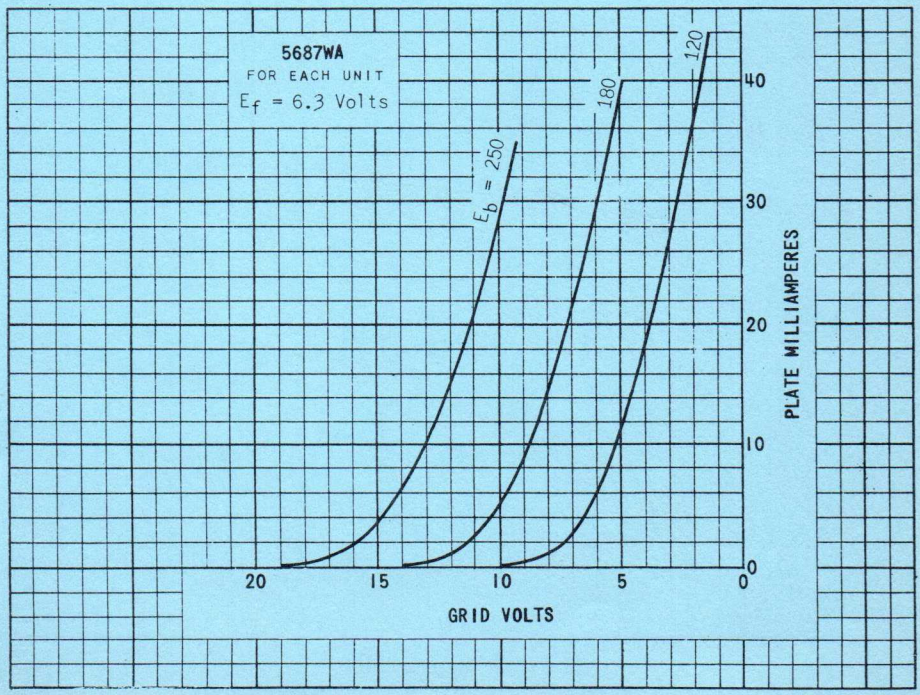
Q TIE PLATES TOGETHER. TIE GRIDS TOGETHER AND TO GROUND THRU A 1.0 MEG. RESISTOR. TIE CATHODES TOGETHER AND TO GROUND THRU A 680 OHM RESISTOR.

R SEE MIL-E-1C 4.9.20.4

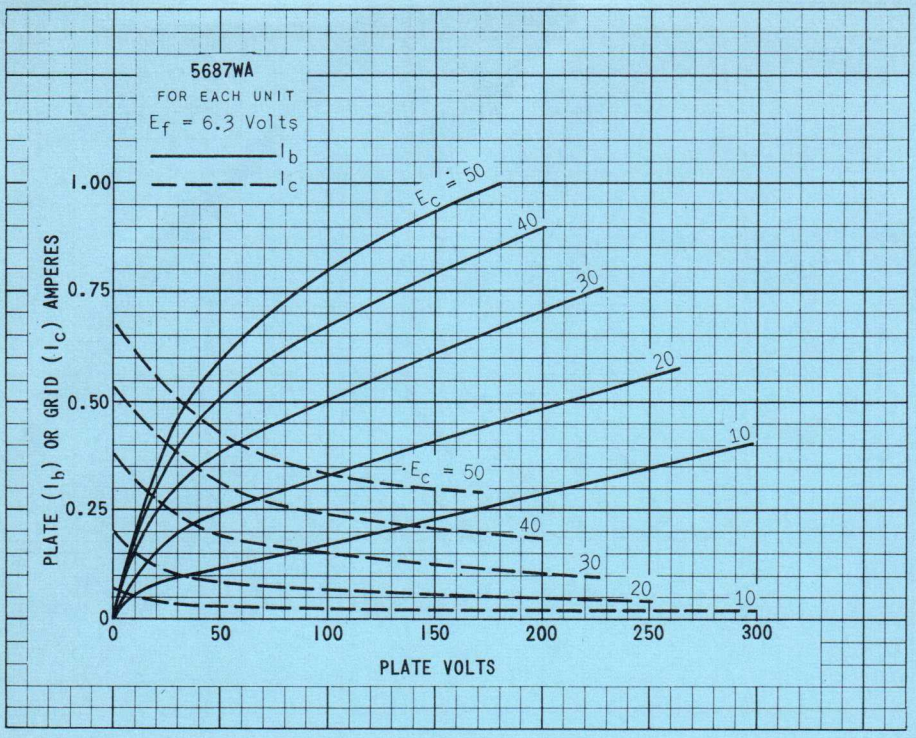
S BREAKDWON SHALL BE DEFINED AS THAT VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

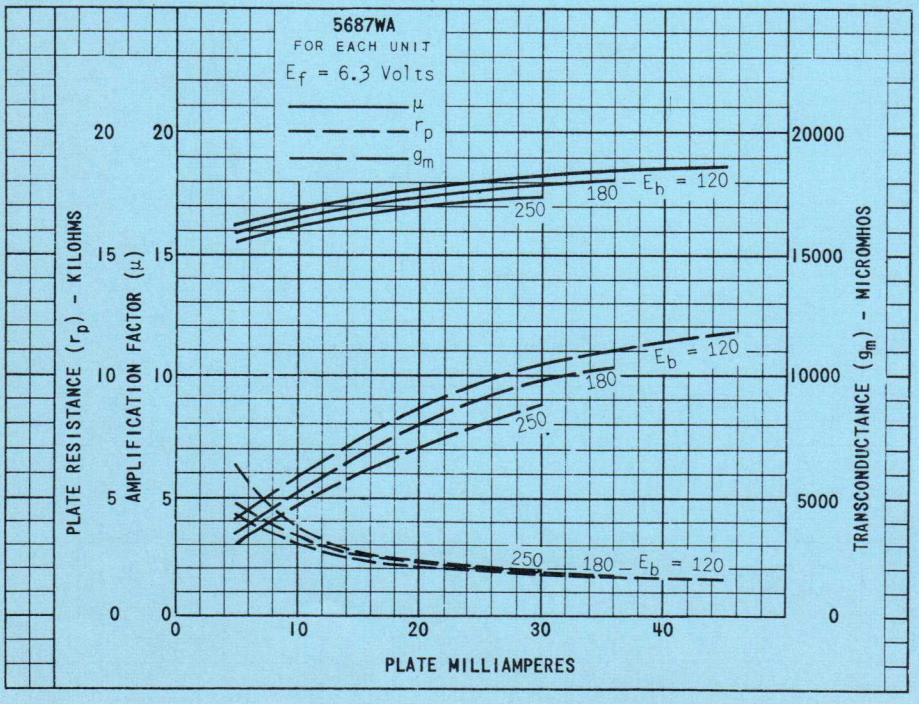
T AT THE CONCLUSION OF THE HEATER CYCLING LIFE TEST, A TEST SHALL BE MADE TO DETERMINE CATHODE CONTINUITY. A TUBE WHICH FAILS THE CATHODE CONTINUITY TEST SHALL BE CONSIDERED A DEFECTIVE TUBE FOR THE HEATER CYCLING LIFE TEST.


5687WA
FOR EACH UNIT
E_f = 6.3 Volts
PLATE MILLIAMPERES
50
25
0
E_c = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
0
100
200
300
400
PLATE VOLTS


5687WA
FOR EACH UNIT
E_f = 6.3 Volts
E_b = 250
180
120
40
30
20
10
0
PLATE MILLIAMPERES
20
15
10
5
0
GRID VOLTS

5687WA
PREMIUM TUBE

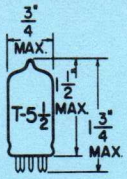




TUNG-SOL

THYRATRON

MINIATURE TYPE



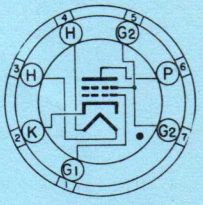
GLASS BULB

HEATER

6.3±10% VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BN

THE 5696 IS A XENON FILLED, FOUR ELECTRODE THYRATRON WITH NEGATIVE CONTROL CHARACTERISTICS. IT HAS FOUND WIDE USAGE AS A SWITCHING TUBE, AND IN GRID CONTROLLED RECTIFIER SERVICE. BECAUSE OF ITS SHIELD GRID CONSTRUCTION, THE INPUT OF THE 5696 WILL WORK DIRECTELY 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 5696 AND ITS RELATIVE FREEDOM FROM TEMPERATURE RESTRICTIONS MAKE THIS TUBE PARTICULARLY SUITED FOR USE IN COMPACT EQUIPMENT.

ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f = 6.3 VOLTS)	0.15	AMPS.
MINIMUM CATHODE HEATING TIME	10.	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	0.03	μμf
CONTROL GRID TO CATHODE (& SHIELD GRID) CAPACITANCE	1.8	μμf
DE-IONIZATION TIME, APPROX. (SHIELD TIED TO CATHODE)		
WITH GRID VOLTS =-100, GRID RES. =1000 Ω		
ANODE VOLTS =500 ANODE CUR. .025 AMPS	25	μSEC.
WITH GRID VOLTS =-15 GRID RES. = 1000 Ω		
ANODE VOLTS =500 ANODE CUR. .025 AMPS	40	μSEC.
IONIZATION TIME (APPROX.)	0.5	μSEC.
ANODE VOLTAGE DROP (APPROX.)	10	VOLTS
MAXIMUM CRITICAL GRID CURRENT (AT E_{bb} = 350 V.RMS)	0.5	μAMPS.

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	1.75	INCHES
MAXIMUM SEATED LENGTH	1.50	INCHES
MAXIMUM DIAMETER	0.75	INCHES
BULB	T-5 1/2	
BASE	MINIATURE BUTTON 7 PIN	
WEIGHT (NET)	0.3	OUNCES

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

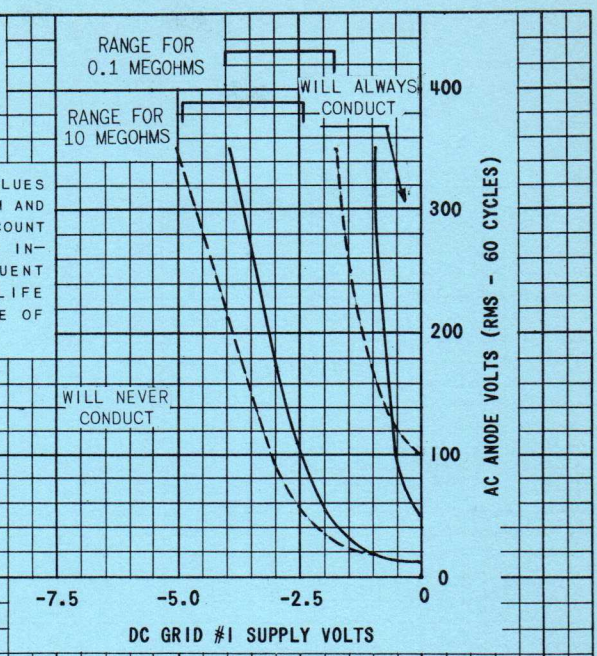
RATINGS
ABSOLUTE VALUES

MAXIMUM PEAK ANODE VOLTAGE		
INVERSE	500	VOLTS
FORWARD	500	VOLTS
MAXIMUM CATHODE CURRENT		
PEAK	100	MA.
AVERAGE	25	MA.
SURGE (MAX. DURATION 0.1 SECONDS)	2.0	AMP.
MAXIMUM AVERAGE TIME	30	SECONDS
MAXIMUM NEGATIVE CONTROL GRID VOLTAGE		
BEFORE CONDUCTION	−100	VOLTS
DURING CONDUCTION (AVERAGED OVER 30 SEC. MAX.)	−10	VOLTS
MAXIMUM POSITIVE CONTROL GRID CURRENT		
AVERAGE	5	MA.
MAXIMUM NEGATIVE SHIELD GRID VOLTAGE		
BEFORE CONDUCTION	−50	VOLTS
DURING CONDUCTION (AVERAGED OVER 30 SEC. MAX.)	−10	VOLTS
MAXIMUM POSITIVE SHIELD GRID CURRENT		
AVERAGE	5	MA.
MAXIMUM HEATER CATHODE VOLTAGE		
HEATER NEGATIVE	−100	VOLTS
HEATER POSITIVE	25	VOLTS
AMBIENT TEMPERATURE LIMITS	−75 TO 90	°C
MAXIMUM CONTROL GRID (G1) CIRCUIT RESISTANCE	10	MEGOHMS

5696

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

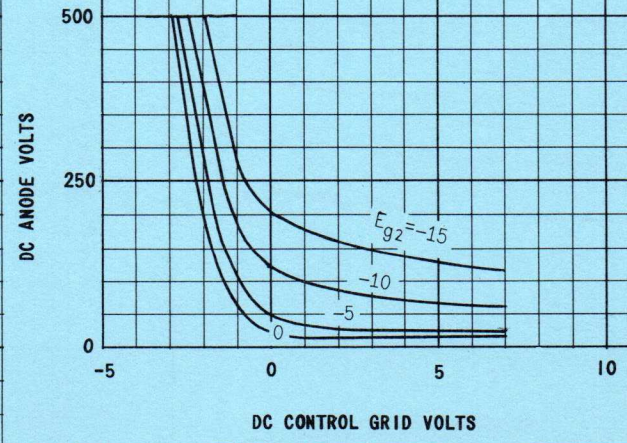
RANGES SHOWN ARE FOR TWO VALUES OF GRID RESISTOR, 0.1 MEGOHM AND 10 MEGOHM, AND TAKE INTO ACCOUNT INITIAL DIFFERENCES BETWEEN INDIVIDUAL TUBES AND SUBSEQUENT DIFFERENCES DURING TUBE LIFE FOR A HEATER VOLTAGE RANGE OF 5.7 TO 6.9 VOLTS.



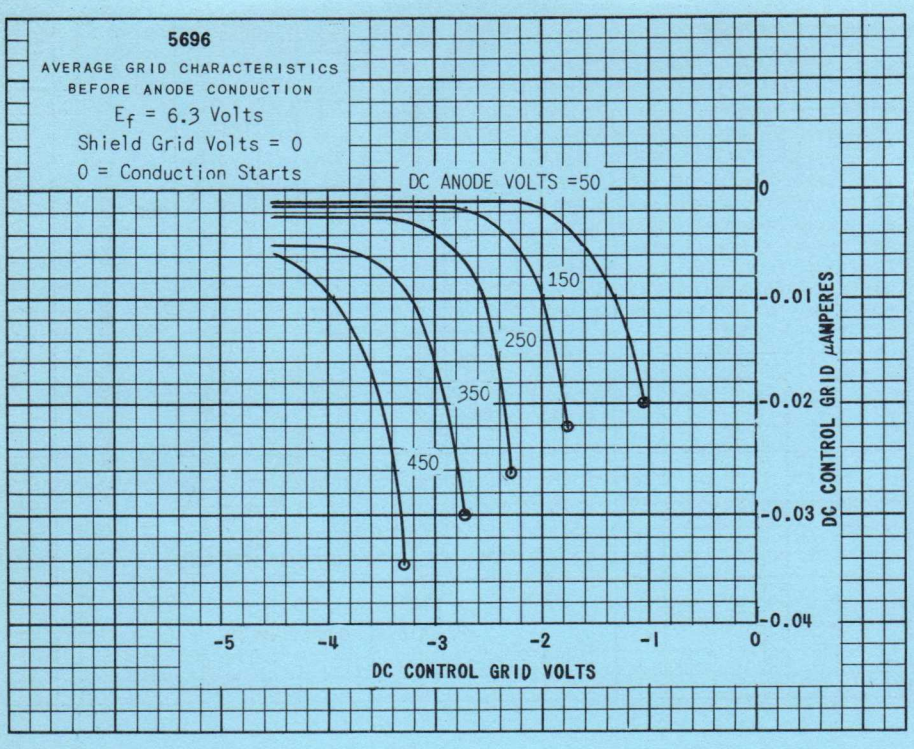
5696

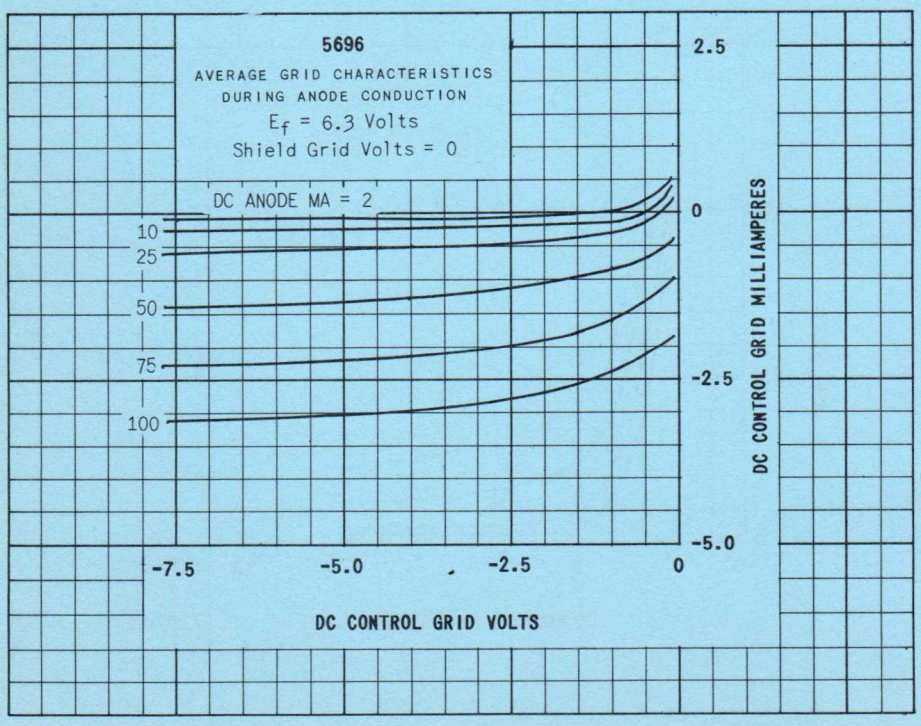
AVERAGE CONTROL CHARACTERISTICS

R_{g1} = 0.1 Megohms
R_{g2} = 0 Ohms



PRINTED IN U.S.A.

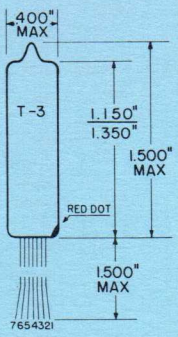

5696
AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION
E_f = 6.3 Volts
Shield Grid Volts = 0
0 = Conduction Starts
DC ANODE VOLTS =50
150
250
350
450
0
-0.01
-0.02
-0.03
-0.04
DC CONTROL GRID μAMPERES
-5
-4
-3
-2
-1
0
DC CONTROL GRID VOLTS


5696
AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION
E_f = 6.3 Volts
Shield Grid Volts = 0
DC ANODE MA = 2
10
25
50
75
100
2.5
0
-2.5
-5.0
DC CONTROL GRID MILLIAMPERES
-7.5
-5.0
-2.5
0
DC CONTROL GRID VOLTS

TUNG-SOL

PENTODE

SUBMINIATURE TYPE

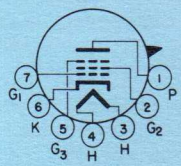


GLASS BULB

OUTLINE DRAWING
→ JEDEC 3-6

HEATER
6.3 VOLTS 0.20 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

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

THE 5702 WA IS A HEATER-CATHODE TYPE SHARP-CUTOFF PENTODE DESIGNED FOR SERVICE WHERE SEVERE CONDITIONS OF HIGH TEMPERATURE AND MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED, CAPABLE OF OPERATION IN THE VHF REGION. A SEPARATE TERMINAL CONNECTION IS PROVIDED FOR GRID #3, WHICH UNDER SELF-BIAS CONDITIONS CAN BE CONNECTED DIRECTLY TO GROUND, PERMITTING THE CATHODE BY-PASS CAPACITOR TO BE OMITTED FOR LOWER GRID LOADING. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD INLINE SUBMINATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST #3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST #4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE TEST #5)	2.5	G
MAXIMUM BULB TEMPERATURE	265	°C

RATINGS

AND NORMAL OPERATION

	MIL-E-1 SYMBOL	ABS. MIN.	NORMAL TEST COND. (NOTE 7)	NORMAL OPER. (NOTE 6)	ABS. MAX.	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE[8]	Ef:	5.7	6.3	6.3	6.9	---	V
PLATE VOLTAGE	Eb:	---	120	120	165	---	Vdc
GRID #1 VOLTAGE	Ec1:	-55	0	0	---	---	Vdc
GRID #2 VOLTAGE	Ec2:	---	120	120	155	---	Vdc
GRID #3 VOLTAGE	Ec3:	---	0	0	0	---	Vdc
PLATE DISSIPATION	Pp:	---	---	0.9	---	1.10	W
GRID #2 DISSIPATION	Pg2:	---	---	0.3	---	0.40	W
GRID #1 CIRCUIT RES.	Rg1	---	---	1.0	1.2	---	Meg
HEATER-CATHODE VOLT.	Ehk:	-200	---	100	+200	---	V
CATHODE CURRENT	Ik:	---	---	---	16.5	---	mAdc
CATHODE RESISTANCE	Rk:	---	200	200	---	---	OHMS
PLATE CURRENT (1)	Ib:	---	---	7.5	---	---	mAdc
GRID #2 CURRENT	Ic2:	---	---	2.6	---	---	mAdc
TRANSCONDUCTANCE (1):	Sm(1):	---	---	5000	---	---	μMHOS
PLATE RESISTANCE	rp:	---	---	0.34	---	---	Meg.

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOGIE	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1	COMBINED AQL=1.0% EXCLUDING MECH. & INOPERATIVES					
HEATER CURRENT:	0.65	If:	183	192	200	mA
HEATER-CATHODE LEAKAGE:						
Ehk=+100 VDC, Ehk=-100VDC	0.65	Ihk:	---	---	---	μAdc
GRID CURRENT (1):						
Rg1=1.0 MEG.	0.65	Ic1(1):	---	---	---	μAdc
PLATE CURRENT (1):	0.65	Ib(1):	5.5	6.7	7.5	mAdc
PLATE CURRENT (2):						
Ec1=-9.0 VDC, Rk=0	0.65	Ib(2):	---	---	---	μAdc
SCREEN CURRENT:	0.65	Ic2:	1.7	---	2.6	mAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	4200	4700	5000	μMHOS
CONTINUITY AND SHORTS (INOPERATIVES):	0.4	---	---	---	---	---

(CONT'D FROM ABOVE)	AQL %	MIL-E-1 SYMBOL	UAL	MAX.	ALD	MIL-E-1 UNITS
HEATER CURRENT:	0.65	If:	208	217	16	mA
HEATER-CATHODE LEAKAGE:						
Ehk=+100 VDC, Ehk=-100VDC	0.65	Ihk:	---	5	---	μAdc
GRID CURRENT (1):						
Rg1=1.0 MEG.	0.65	Ic1(1):	---	-0.1	---	μAdc
PLATE CURRENT (1):	0.65	Ib(1):	8.3	9.5	2.3	mAdc
PLATE CURRENT (2):						
Ec1=-9.0 VDC, Rk=0	0.65	Ib(2):	---	50	---	μAdc
SCREEN CURRENT:	0.65	Ic2:	---	3.5	---	mAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	5300	5800	900	μMHOS
CONTINUITY AND SHORTS (INOPERATIVES):	0.4	---	---	---	---	---
MECHANICAL:						
ENVELOPE (8-7)						

	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOGIE	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TEST PART 2	COMBINED AQL=1.0% EXCLUDING MECH. & INOPERATIVES					
INSULATION OF ELECTRODES:						
(Ef=6.3V, Eg-all=-100 Vdc	2.5	Rg1-all	100	---	---	MEG.
(Ep-all=-300 Vdc		Rp-all	100	---	---	MEG.
TRANSCONDUCTANCE (2):						
Ef=5.5 V (NOTE 9)	2.5	ΔEfSm(2):	---	---	---	PERCENT
GRID EMISSION:						
Ef=7.5 V; Rg1=1.0 MEG.;						
PREHEAT 5 MIN. AT						
Ec1=0; TEST AT Ec1=-10Vdc	6.5	Ic(2):	---	---	---	μAdc
AF NOISE: Esig= 70mVac; Ec2=25 Vdc;						
Rg1=0.1 MEG. ;Rg2=1000 OHMS;						
Rp=0.2 MEG.; Ck=1000 μf;						
Rk=4000 OHMS	2.5	EB:	---	---	---	VU

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOGIE	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TEST PART 2 (CONT'D)	COMBINED AQL= 1.0% EXCLUDING MECH. & INOPERATIVES					
PLATE RESISTANCE:	6.5	rp:	0.15	---	---	MEG.
CAPACITANCE:	6.5	Cgp:	---	---	---	μμf
CAPACITANCE: (NOTE 2)		Cin:	4.1	4.4	4.8	μμf
CAPACITANCE:		Cout:	2.9	3.1	3.5	μμf
LOW PRESSURE VOLT. BREAKDOWN PRESSURE =55±5mmHg; VOLTAGE = 300 Vac	6.5	---	---	---	---	---
VIBRATION (2): F=40cps; G=15; Rp=10,000 OHMS	2.5	Ep:	--	---	---	mVac

(CONT'D FROM ABOVE)	AQL %	MIL-E-1 SYMBOL	UAL	MAX.	ALD	MIL-E-1 UNITS
INSULATION OF ELECTRODES:						
Ef=6.3V; Eg-all=-100 Vdc;	2.5	Rg1-all:	---	---	---	MEG.
Ep-all=-300 Vdc		Rp-all	---	---	---	MEG.
TRANSCONDUCTANCE (2): Ef=5.5 V (NOTE 9)	2.5	ΔEfSm(2):	---	10	---	PERCENT
GRID EMISSION: Ef=7.5V; Rg1=1.0 MEG.; PREHEAT 5 MIN. AT Ec1=0; TEST AT Ec1=-10Vdc	6.5	Ic(2):	---	-0.5	---	μAdc
AF NOISE: Esig=70mVac: Ec2=25Vdc; Rg1=0.1 MEG;Rg2=1000 OHMS; Rp=0.2 MEG; Ck=1000 μf; Rk=4000 OHMS	2.5	EB:	---	17	---	VU
PLATE RESISTANCE:	6.5	rp:	---	---	---	MEG.
CAPACITANCE:	6.5	Cgp:	---	0.03	---	μμf
CAPACITANCE: (NOTE 2)		Cin:	5.2	5.5	0.83	μμf
CAPACITANCE:		Cout:	3.9	4.1	0.71	μμf
LOW PRESSURE VOLT. BREAKDOWN: PRESSURE=55±5mmHg: VOLTAGE=300 Vac	6.5	---	---	---	---	---
VIBRATION (2): F=40 cps; G=15; Rp=10,000 OHMS	2.5	Ep:	---	50	---	mVac

DEGRADATION RATE ACCEPTANCE TESTS	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG.	UAL	MAX	MIL-E-1 UNITS
SUBMINIATURE LEAD FATIGUE:	2.5	---	4.0	---	---	---	---	arcs
SHOCK (1): Ehk=+100 Vdc; Rg=0.1 MEG.; HAMMER ANGLE =30° (NOTE 3)	20	---	---	---	---	---	---	---
FATIGUE (1): 96 HOURS; G=2.5; FIXED FREQUENCY; F=25 MIN. 60 MAX. (NOTE 5)	6.5	---	---	---	---	---	---	---

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

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

TEST	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS (CONT'D.)					
POST SHOCK (1) AND FATIGUE TESTES (1) END POINTS: VIBRATION (2): F=40cps; G=15; Rp=10,000 OHMS	----	Ep:	---	100	mVac
HEATER-CATHODE LEAKAGE: Ehk=+100 Vdc , Ehk=-100 Vdc	---	Ihk:	---	20	μAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES: Ef=6.3 V.	---	Δ_tSm(1):	---	20	PERCENT
GLASS STRAIN (THERMAL SHOCK):	6.5	---	---	---	----
ACCEPTANCE LIFE TESTS					
HEATER CYCLE: Ef=7.0 V; Eb=Ec1=Ec2=Ec3=0V; Ehk=140 Vac; 1MIN. ON, 1MIN. OFF	1.0	---	2000	---	CYCLES
HEATER CYCLING LIFE TEST END POINTS: HEATER-CATHODE LEAKAGE: Ehk=±100 Vdc Ehk=-100 Vdc	---	Ihk:	---	20	μAdc
1HOUR STABILITY LIFE TEST: TA=ROOM; Ehk=+200;Vdc; Rg1=1.0 MEG.	---	---	---	---	----
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=+200 Vdc; Rg1=1.0 MEG.	---	---	---	---	----
100 HOUR SURVIVAL RATE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE 200 TUBES)	---	---	---	---	----
INOPERATIVES:	0.65	---	---	---	----
TRANSCONDUCTANCE (1):	1.0	Sm(1):	3800	---	μMHOS
INTERMITTENT HIGH TEMPERATURE LIFE TESTS: T BULB =265°C MIN; Ehk=+ 200 Vdc; Rg1=1.0 MEG.	---	---	---	---	----
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE=20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)	---	---	---	---	----
INOPERATIVES: [A]	---	---	---	---	----
GRID CURRENT (1): [B]	---	Ic(1):	---	-0.5	μAdc
HEATER CURRENT: [C]	---	If:	180	220	mA
CHANGE IN TRANSCONDUCTANCE [D] (1) OF INDIVIDUAL TUBES:	---	Δ_tSm(1):	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9) [F]	---	Δ_{Ef}Sm(2):	---	15	PERCENT
HEATER-CATHODE LEAKAGE: [E] Ehk=+ 100 Vdc Ehk=-100 Vdc	---	Ihk:	---	10	μAdc
INSULATION OF ELECTRODES: [G] g1-all	---	Rg1-all:	50	---	MEG.
p-all		Rp-all:	50	---	MEG.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS (cont'd.)					
TRANSCONDUCTANCE (1) AVG. CHANGE [H]	---	$Avg\Delta_t Sm(1)$:	---	15	PERCENT
TOTAL DEFECTIVES: [J]	---	---	---	---	----
1000 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: [K] (TYPICAL SAMPLE SIZE=20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)	---	---	---	---	----
INOPERATIVES: [L]	---	---	---	---	----
GRID CURRENT (1): [M]	---	Ic(1):	0	-1.0	μAdc
HEATER CURRENT: [N]	---	If:	177	223	mA
CHANGE IN TRANSCONDUCTANCE [P] (1) OF INDIVIDUAL TUBES:	---	$\Delta_t Sm(1)$:	---	30	PERCENT
HEATER - CATHODE LEAKAGE: [Q] Ehk=+ 100 Vdc Ehk=-100 Vdc	---	Ihk:	---	15	μAdc
TOTAL DEFECTIVES [R]	---	---	---	---	----

ALLOWABLE DEFECTS PER CHARACTERISTIC

NOTE:	1st SAMPLE	COMBINED SAMPLES
A	1	3
B	1	3
C	1	3
D	1	3
E	2	5
F	2	5
G	2	5
H	---	---
J	4	8
K	---	---
L	2	5
M	2	5
N	2	5
P	2	5
Q	2	5
R	5	10

PRINTED IN U. S. A.

TUNG-SOL

NOTES

NOTE 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.

NOTE 2 WITH A CYLINDRICAL SHIELD (0.405" I.D.–17/8" LONG) CONNECTED TO LEAD 6.

NOTE 3 TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATION.

NOTE 4 CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

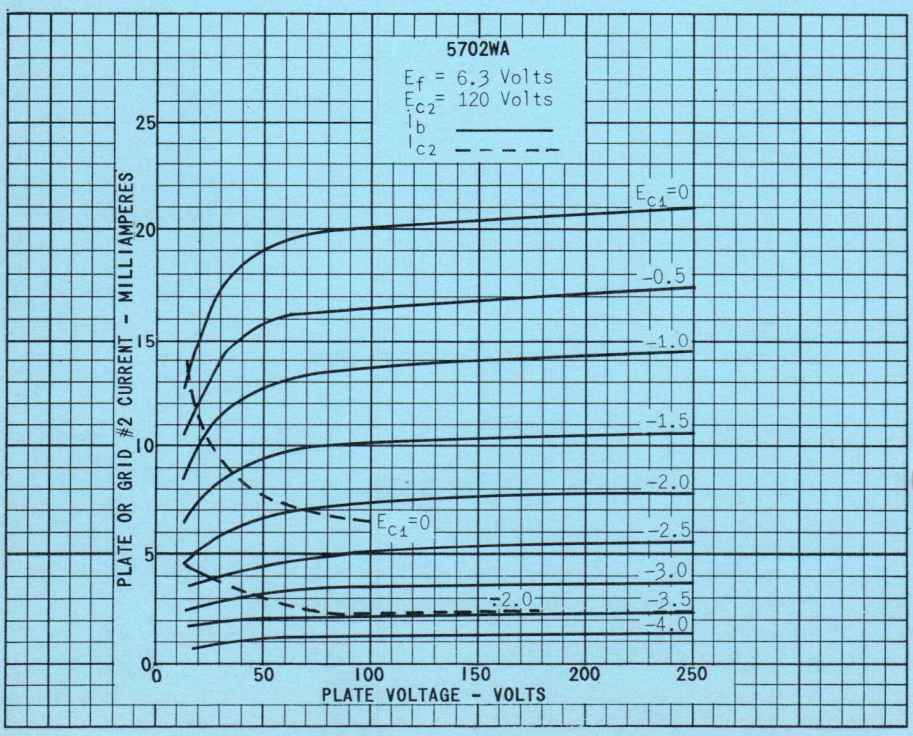
NOTE 5 TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

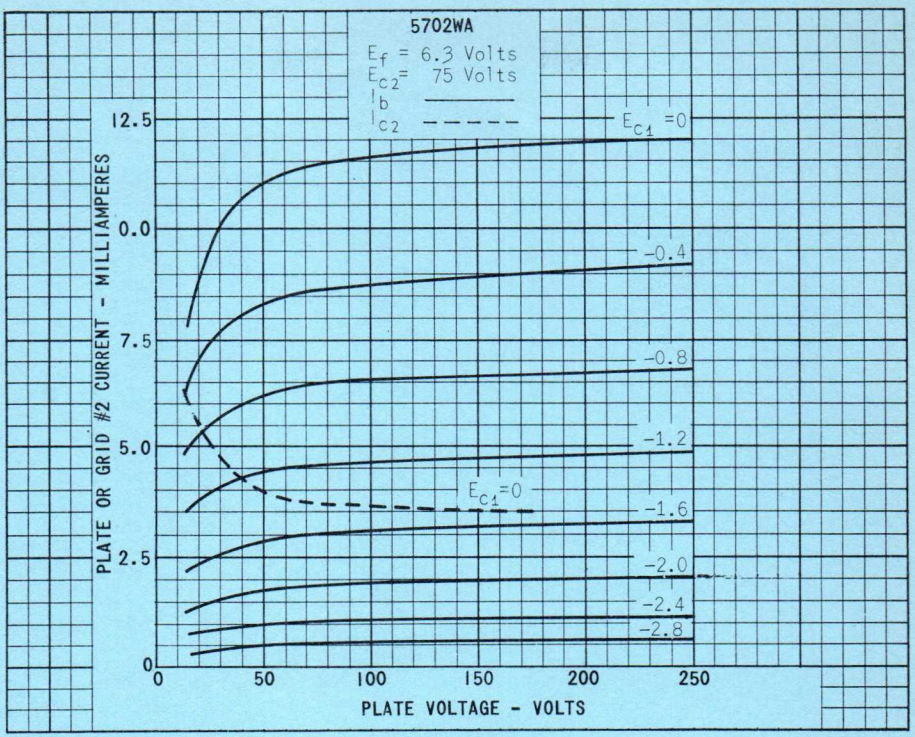
NOTE 6 THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

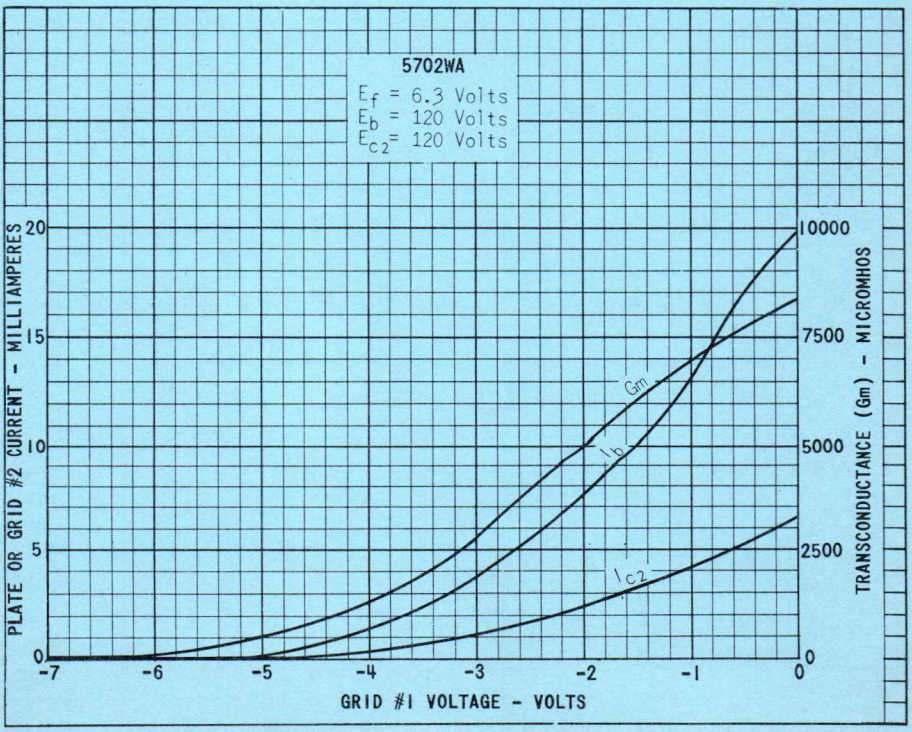
NOTE 7 THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

NOTE 8 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.

NOTE 9 CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef= 6.3V TO THAT VALUE MEASURED AT Ef=5.5V.

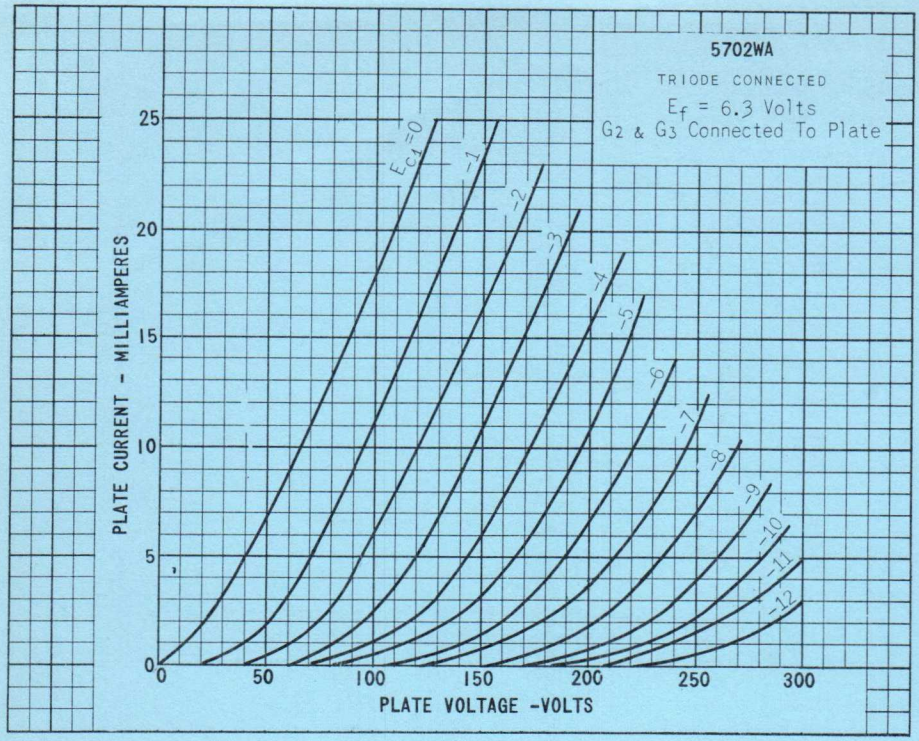


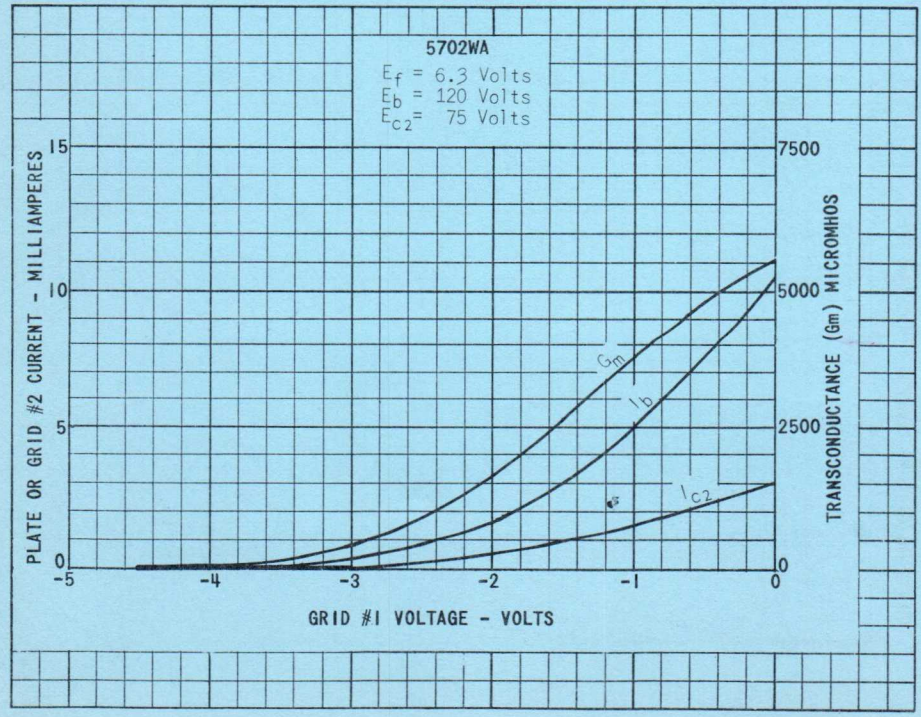




PRINTED IN U. S. A.

TENTATIVE DATA

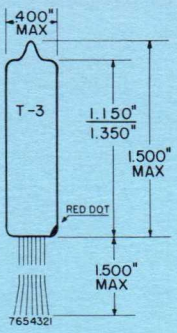




TUNG-SOL

PENTODE

SUBMINIATURE TYPE



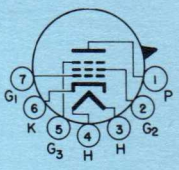
GLASS BULB

OUTLINE DRAWING
→ JEDEC 3-6

HEATER

6.3 VOLTS 0.20 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED
FLEXIBLE LEADS
0.048" CENTER-TO-CENTER
IN LINE

THE 5702 WB IS A HEATER-CATHODE TYPE SHARP-CUTOFF PENTODE OF SUBMINIATURE CONSTRUCTION CAPABLE OF OPERATION IN THE VHF REGION. IT IS DESIGNED FOR SERVICE WHERE SEVERE CONDITIONS OF HIGH TEMPERATURE AND MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. A SEPARATE TERMINAL CONNECTION IS PROVIDED FOR GRID #3 WHICH UNDER SELF-BIAS CONDITIONS CAN BE CONNECTED DIRECTLY TO GROUND, PERMITTING THE CATHODE BY-PASS CAPACITOR TO BE OMITTED FOR LOWER GRID LOADING. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE TEST-NOTE 5)	2.5	G
MAXIMUM BULB TEMPERATURE	220	°C

RATINGS

AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MAX	NORM. TEST CONDITIONS (NOTE 7)	NORM. OPERATION (NOTE 6)	DES. MAX	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 8)	Ef:	5.7	6.3	6.3	6.9	V
PLATE VOLTAGE	Eb:	---	120	120	165	Vdc
GRID #1 VOLTAGE	Ec1:	-55	0	0	---	Vdc
GRID #2 VOLTAGE	Ec2:	---	120	120	155	Vdc
GRID #3 VOLTAGE	Ec3:	---	0	0	0	Vdc
PLATE DISSIPATION	Pp:	---	---	0.9	1.10	W
GRID #2 DISSIPATION	Pg2:	---	---	0.3	0.40	W
GRID #1 CIRCUIT RES.	Rg1:	---	---	1.0	1.2	MEG.
HEATER-CATHODE VOLTAGE	Ehk:	-200	---	100	+200	v
CATHODE CURRENT	Ik:	---	---	---	16.5	mAdc
CATHODE RESISTANCE	Rk:	---	200	200	---	OHMS
PLATE CURRENT (1)	Ib(1):	---	---	7.5	---	mAdc
GRID #2 CURRENT	Ic2:	---	---	2.6	---	mAdc
TRANSCONDUCTANCE (1)	Sm(1):	---	---	5000	---	μMHOS
PLATE RESISTANCE	rp:	---	---	0.34	---	MEG.

PRINTED IN U.S.A.

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 1	COMBINED AQL=1.0% EXCLUDING MECHANICAL AND INOPERATIVES								
HEATER CURRENT:	0.65	If:	190	---	200	---	210	---	mA
HEATER-CATHODE LEAKAGE: Ehk=-100 Vdc									
Ehk=+100 Vdc	0.65	Ihk:	---	---	---	---	5	---	μAdc
GRID CURRENT (1):	0.65	Ic1(1):	---	---	---	---	-0.1	---	μAdc
PLATE CURRENT (1):	0.65	Ib(1):	5.5	6.9	7.5	8.1	9.5	2.3	mAdc
PLATE CURRENT (2):									
Ec1=-9.0 Vdc	0.65	Ib(2):	---	---	---	---	50	---	μAdc
SCREEN CURRENT:	0.65	Ic2:	1.7	---	2.6	---	3.5	---	mAdc
TRANSCONDUC-TANCE (1):	0.65	Sm(1):	4200	4775	5000	5225	5800	860	μMHOS
CONTINUITY AND SHORTS (INOPERATIVES):	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE (8-7)									
MEASUREMENTS ACCEPTANCE TEST PART 2									
INSULATION OF ELECTRODES:									
Ef=6.3 V									
Eg-all=-100 Vdc	2.5	Rg1-all:	250	---	---	---	---	---	MEG.
Ep-all =-300 Vdc	2.5	Rp-all:	250	---	---	---	---	---	MEG.
TRANSCONDUC-TANCE (2):									
Ef=5.7 V. (NOTE 9)	2.5	Δ_{Ef}Sm(2)	---	---	---	---	5	---	PERCENT
GRID EMISSION: Ef=7.5 V; PREHEAT 5 MINUTES AT Ec1=0; TEST AT Ec1=-10 Vdc	6.5	Ic(2):	---	---	---	---	-0.5	---	μAdc
AF NOISE: Esig=70 mVac; Ec2=25 Vdc; Rg1=0.1 MEG.; Rg2 =1000 OHMS; Rp=0.2 MEG; Ck =1000 μf; Rk=4000 OHMS.	2.5	EB:	---	---	---	---	17	---	VU.
PLATE RESISTANCE:	6.5	rp:	0.15	---	---	---	---	---	MEG.
CAPACITANCE:	6.5	Cgp:	---	---	---	---	0.03	---	μμf
CAPACITANCE: (NOT 2)		Cin:	4.1	---	---	---	5.5	---	μμf
CAPACITANCE:		Cout:	2.9	---	---	---	4.1	---	μμf
LOW PRESSURE VOLTAGE BREAKDOWN: PRESSURE=55±5mm Hg: VOLTAGE = 300 Vac	6.5	---	---	---	---	---	---	---	---
OPERATION TIME: (NOTE 10)	4.0	t:	---	---	---	---	20	---	sec.

→ INDICATES A CHANGE.

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 TEST PART 2 - cont'd.									
VIBRATION (2): F=40 cps;G=15; Rp= 10,000 OHMS	2.5	Ep:	---	---	---	---	50	---	mVac
VIBRATION (3): F=30-1000 cps;G=15; Rp =10,000 OHMS; t=3 MIN.; POSITIONS X_1 AND X_2 ONLY	4.0	Ep:	---	---	---	---	240 PEAK TO PEAK	---	mv
DEGRADATION RATE ACCEPTANCE TESTS									
SUBMINIATURE LEAD FATIGUE:	2.5	---	4.0	---	---	---	---	---	arcs
SHOCK (1): Ehk=+100 Vdc;Rg=0.1 MEG HAMMER ANGLE =30° (NOTE 3)	20	---	---	---	---	---	---	---	---
FATIGUE (1): 96 HRS; G=2.5; FIXED FREQUENCY; F=25 MIN. 60 MAX. (NOTE 5)	6.5	---	---	---	---	---	---	---	---
FATIGUE (2): 6 HOURS; G=10; FIXED FREQUENCY; F=25 MIN, 60 MAX. (NOTE 11)	---	---	---	---	---	---	---	---	---
POST SHOCK (1) AND FATIGUE TESTS (1) AND (2) END POINTS: VIBRATION (2): F=40 cps; G=15; Rp = 10,000 OHMS	---	Ep:	---	---	---	---	75	---	mVac
HEATER-CATHODE LEAKAGE: Ehk=+ 100 Vdc Ehk=-100 Vdc	---	Ihk:	---	---	---	---	10	---	μAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES: Ef = 6.3 V	---	Δ_tSm(1):	---	---	---	---	10	---	PERCENT
GRID CURRENT (1):	---	Ic(1):	---	---	---	---	-1.0	---	μAdc
SHOCK (2): Ehk=+100 Vdc; Rg=0.1 MEG.; G=75; (HAMMER ANGLE =120°+ RUBBER PAD); t =10 MILLISECONDS DURATION (NOTE 12)	---	---	---	---	---	---	---	---	---
POST SHOCK TEST (2) END POINTS: VIBRATION (2): F=40cps; G=15; Rp= 10,000 OHMS	---	Ep:	---	---	---	---	75	---	mVac

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS -CONT'D.					
HEATER-CATHODE LEAKAGE:					
Ehk =+100 Vdc Ehk=-100 Vdc	---	Ihk:	---	10	μAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:					
Ef = 6.3 V	---	Δ_tSm(1):	---	10	PERCENT
GRID CURRENT (1):	---	Ic(1):	---	-1.0	μAdc
GLASS STRAIN (THERMAL SHOCK):	6.5	---	---	---	---
ACCEPTANCE LIFE TESTS					
HEATER CYCLE: Ef =7.5 V; Eb=Ec1=Ec2=Ec3=0V; Ehk=140 Vac; 1 MIN. ON, 1 MIN. OFF.	1.0	---	2000	---	CYCLES
HEATER CYCLING LIFE TEST END POINTS: HEATER-CATHODE LEAKAGE: Ehk=+ 100 Vdc Ehk=-100 Vdc	---	Ihk:	---	20	μAdc
1 HOUR STABILITY LIFE TEST: TA = ROOM; Ehk=+200 Vdc; Rg1 = 1.0 MEG.	---	---	---	---	---
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=+200 Vdc; Rg1 =1.0 MEG.	---	---	---	---	---
100 HOUR SURVIVAL RATE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 200 TUBES)	---	---	---	---	---
INOPERATIVES:	0.65	---	---	---	---
TRANSCONDUCTANCE (1):	1.0	Sm(1):	3800	---	μMHOS
INTERMITTENT HIGH TEMPERATURE LIFE TESTS: T BULB = 220° C; Ehk =+200 Vdc; Rg1 = 1.0 MEG.	---	---	---	---	---

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

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

TEST	ALLOWABLE DEF. PER CHARACTER. 1st SAMPLE	COMB. SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TEST - cont'd.							
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE 40 TUBES 2nd SAMPLE)			---	---	---	---	---
INOPERATIVES:	1	3	---	---	---	---	---
GRID CURRENT (1):	1	3	---	Ic(1):	---	-0.5	μAdc
HEATER CURRENT:	1	3	---	If:	180	220	mA
CHANGE IN TRANSCONDUCTANCE (1) INDIVIDUAL TUBES:	1	3	---	$\Delta_t Sm(1)$:	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	2	5	---	$\Delta_{Ef} Sm(2)$:	---	15	PERCENT
HEATER-CATHODE LEAKAGE: Ehk=+ 100 Vdc Ehk=-100 Vdc	2	5	---	Ihk:	---	10	μAdc
INSULATION OF ELECTRODES: g1-all	2	5	---	Rg1-all:	50	---	MEG.
p-all	2	5	---	Rp-all:	50	---	MEG.
TRANSCONDUCTANCE (1): AVERAGE CHANGE:	---	---	---	Avg.$\Delta_t Sm(1)$:	---	15	PERCENT
TOTAL DEFECTIVES:	4	8	---	---	---	---	---
1000 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE 40 TUBES 2nd SAMPLE)	---	---	---	---	---	---	---
INOPERATIVES:	2	5	---	---	---	---	---
GRID CURRENT (1):	2	5	---	Ic(1):	---	-1.0	μAdc
HEATER CURRENT:	2	5	---	If:	177	223	mA
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:	2	5	---	$\Delta_t Sm(1)$:	---	30	PERCENT
HEATER-CATHODE LEAKAGE: Ehk=±100 Vdc	2	5	---	Ihk:	---	15	μAdc
TOTAL DEFECTIVES	5	10	---	---	---	---	---

NOTES

NOTE 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.

NOTE 2: WITH A CYLINDRICAL SHIELD (0.405" I.D.- 1 7/8" LONG) CONNECTED TO LEAD 6.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

NOTES - cont'd.

NOTE 3: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATION.

NOTE 4: CENTRIFUGE TEST WITH FORCES IN ANY DIRECTION.

NOTE 5: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATION.

NOTE 6: THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

NOTE 7: THESE NORMAL TEST CONDITIONS ARE MADE FOR ALL CHARACTERISTIC TESTS UNLESS OTHER WISE STATED UNDER THE INDIVIDUAL TEST ITEM.

NOTE 8: 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.

NOTE 9: CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef=6.3 V TO THAT VALUE MEASURED AT Ef=5.7V.

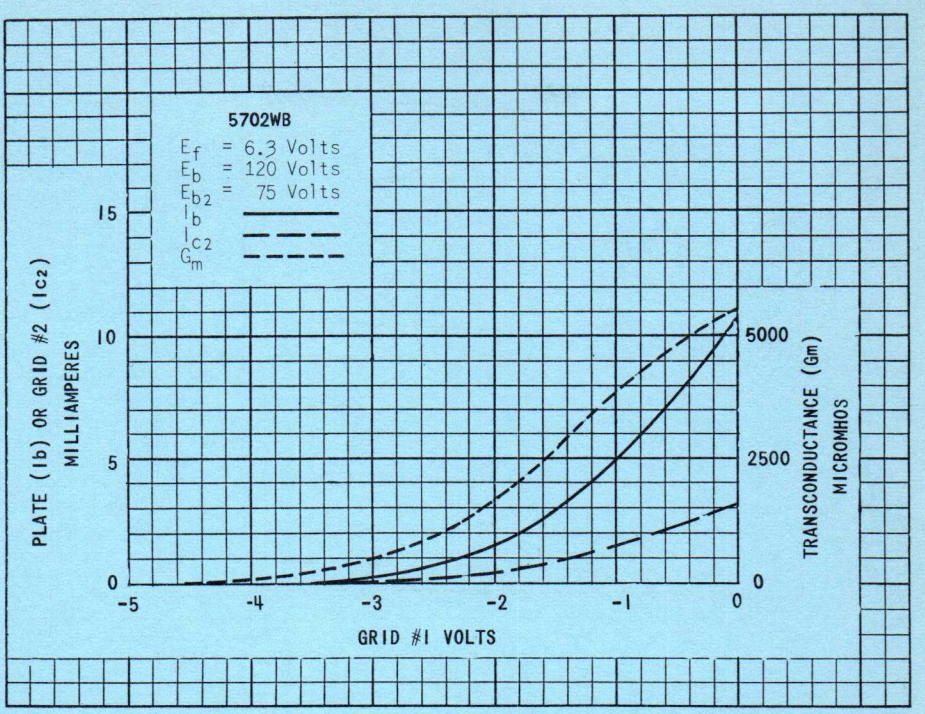
NOTE 10: OPERATION TIME IS THE TIME IN SECONDS REQUIRED FOR THE PLATE CURRENT TO ATTAIN A VALUE WITHIN PLUS OR MINUS 10 PERCENT OF THE THREE MINUTE PLATE CURRENT (1) VALUE USING A COLD TUBE. NO PREHEATING BEFORE THIS TEST WILL BE ALLOWED.

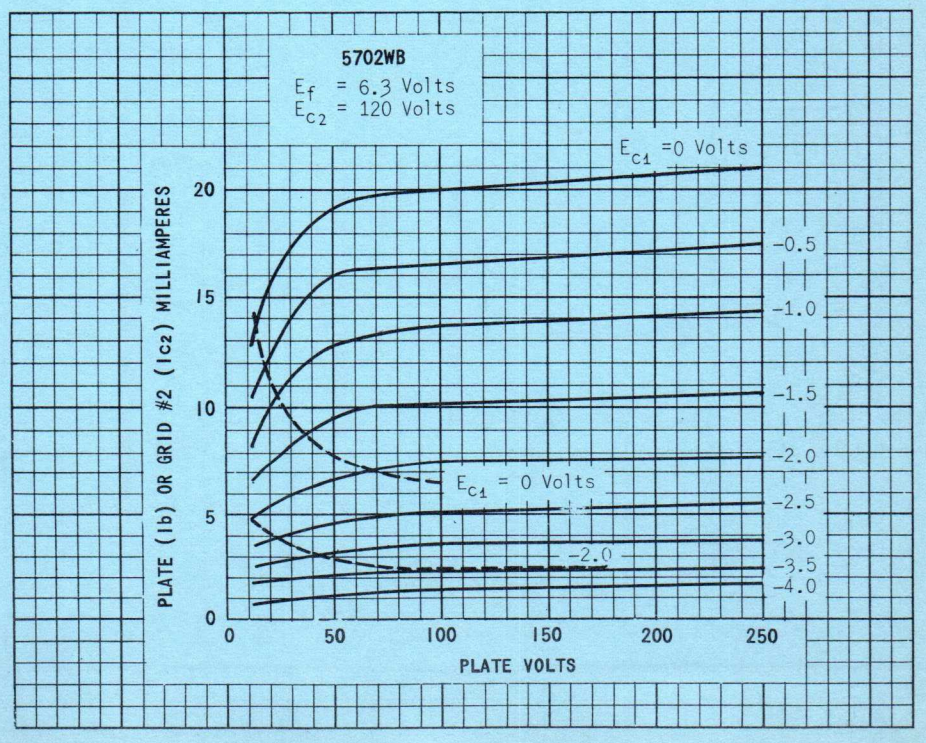
NOTE 11: THE TUBES SHALL BE RIGIDLY MOUNTED ON A TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TUBES SHALL BE VIBRATED FOR A TOTAL OF 6 HOURS, 2 HOURS IN EACH OF THREE POSITIONS, X1, X2, AND Y1. ONLY RATED HEATER VOLTAGE SHALL BE APPLIED. TUBES WHICH SHOW ONE OR MORE OF THE FOLLOWING DEFECTS SHALL BE CONSIDERED FAILURES.

(A) TUBES WHICH SHOW PERMANENT OR TAP SHORTS OR OPEN CIRCUITS FOLLOWING FATIGUE TEST, WHEN TESTED AS SPECIFIED IN 4.7.2 AND 4.7.3.

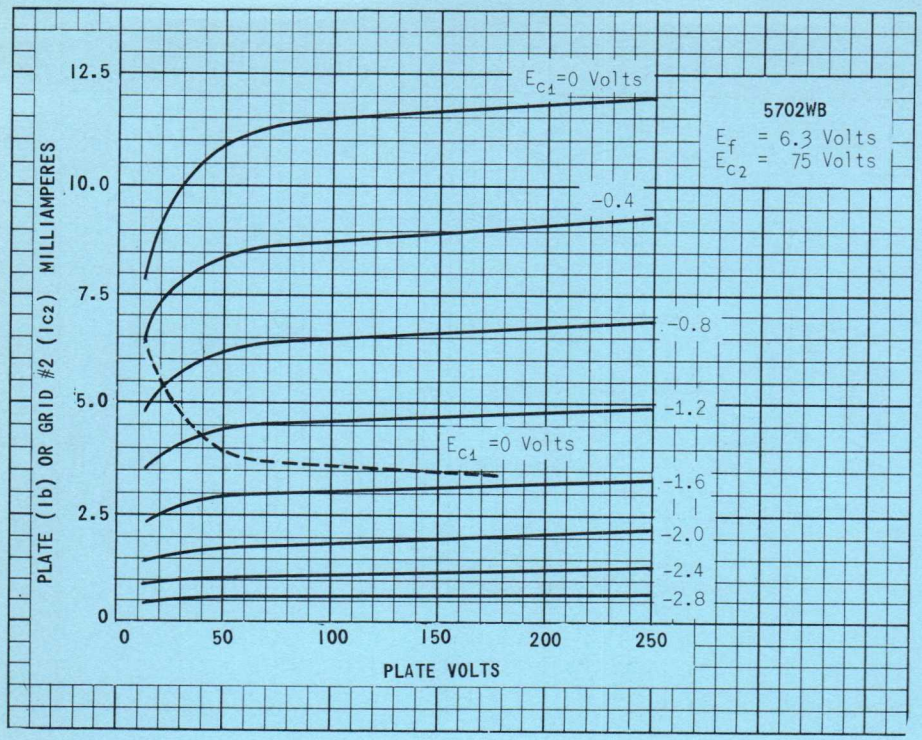
(B) TUBES WHICH DO NOT COMPLY WITH POST FATIGUE LIMITS. THIS IS A DESTRUCTIVE TEST.

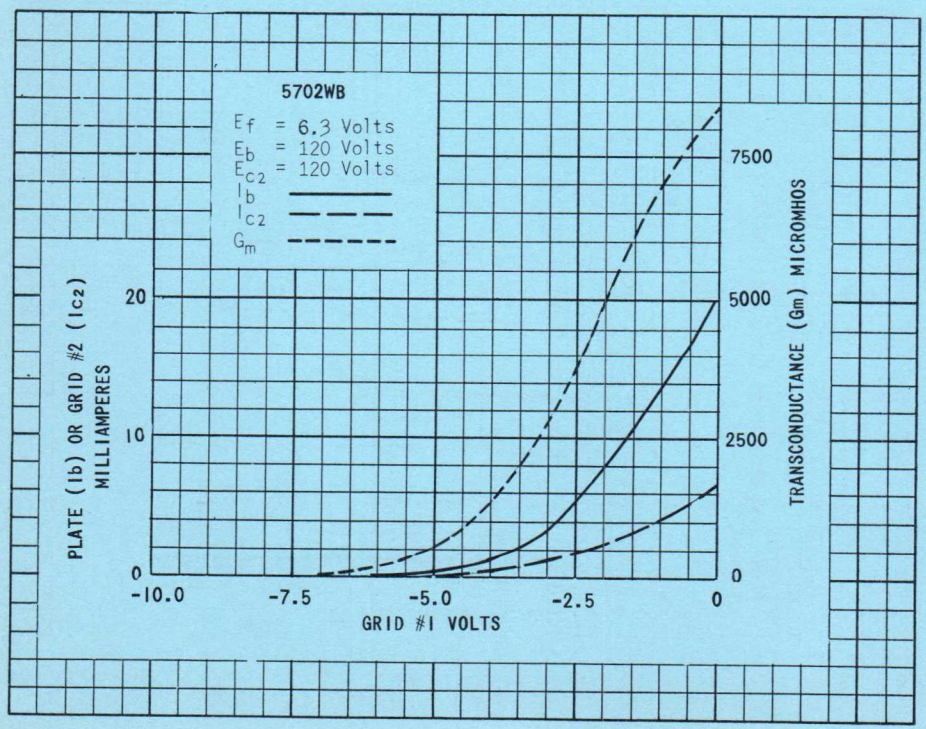
NOTE 12: THE PROVISIONS OF PARAGRAPH 4.9.20.5 OF SPECIFICATION MIL-E-1 SHALL APPLY, EXCEPT FOR TEST CONDITIONS LISTED FOR SHOCK TEST (2).

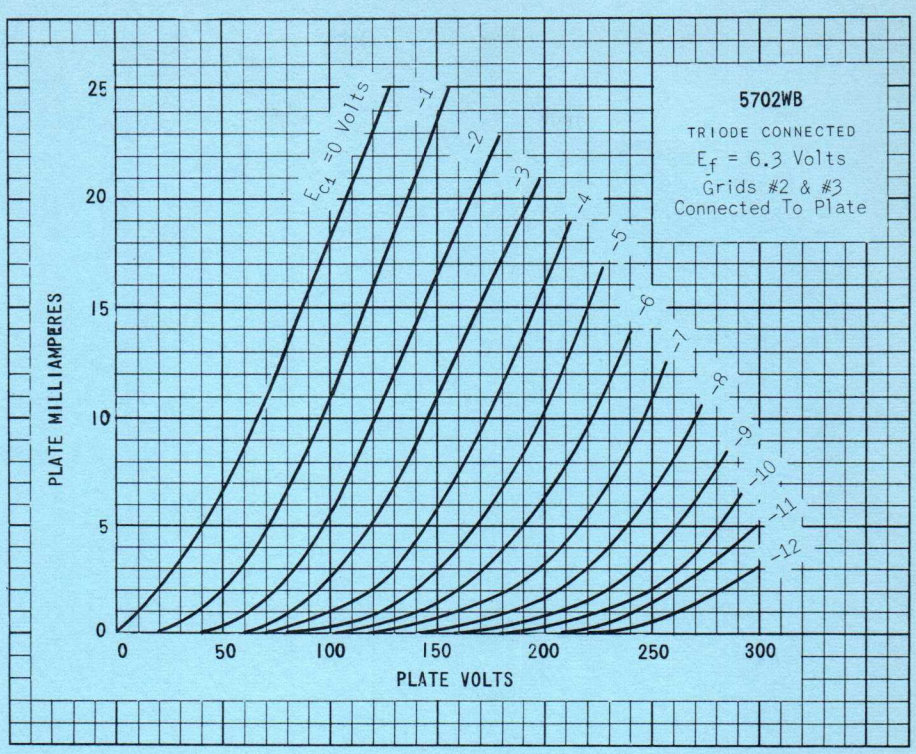




PRINTED IN U.S.A.


5702WB
E_f = 6.3 Volts
E_{c_2} = 75 Volts
E_{c_1}=0 Volts
-0.4
-0.8
-1.2
E_{c_1} =0 Volts
-1.6
-2.0
-2.4
-2.8
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
12.5
10.0
7.5
5.0
2.5
0
0
50
100
150
200
250
PLATE VOLTS


5702WB
E_f = 6.3 Volts
E_b = 120 Volts
E_{c_2} = 120 Volts
I_b
I_{c_2}
G_m
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
20
10
0
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS
7500
5000
2500
0
TRANSCONDUCTANCE (Gm) MICROMHOS

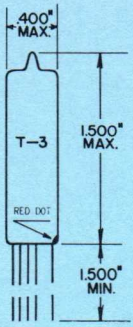


PRINTED IN U. S. A.

TUNG-SOL

THIS DATA SHEET ALSO APPLIES TO TWO OTHER MILITARY VERSIONS, DESIGNATED 5703WA AND 5703WB

TRIODE
SUBMINIATURE TYPE

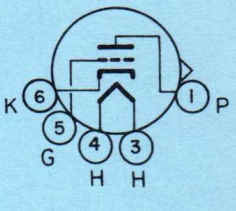


GLASS BULB

DOT IS ADJACENT TO LEAD 1..

FOR UHF OSCILLATOR APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED
FLEXIBLE LEADS
0.048" CENTER-TO-CENTER
EXCEPT LEADS 1-3 = 0.096"
CENTER-TO-CENTER
IN-LINE

THE 5703 IS A HEATER-CATHODE TYPE MEDIUM-MU SUBMINIATURE TRIODE CAPABLE OF OPERATION AS AN OSCILLATOR, CLASS C AMPLIFIER, OR FREQUENCY MULTIPLIER IN THE UHF REGION. 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 A SUITABLE LENGTH.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT SHIELD

GRID TO PLATE	1.2	pf
INPUT	2.6	pf
OUTPUT	0.7	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	200	MA.
HEATER SUPPLY LIMITS: VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE			±100	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	275	VOLTS
PLATE DISSIPATION	3.3	WATTS
PLATE CURRENT	22	MA.
GRID CURRENT	5.5	MA.
ALTITUDE	10,000	FEET
ENVELOPE TEMPERATURE	220	°C

PRINTED IN U. S. A.

TUNG-SOL

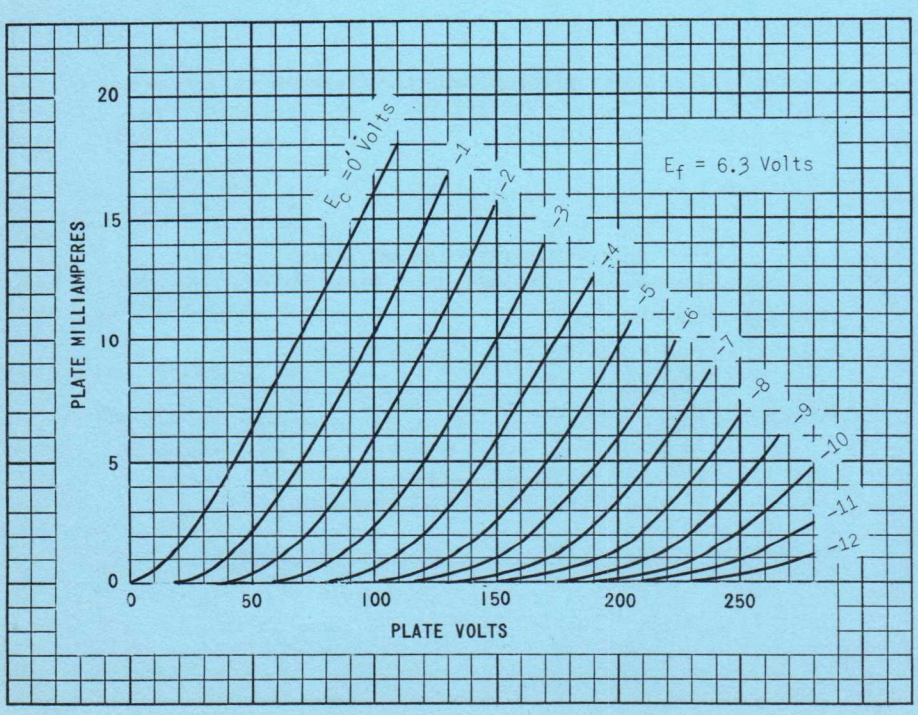
CONTINUED FROM PRECEDING PAGE

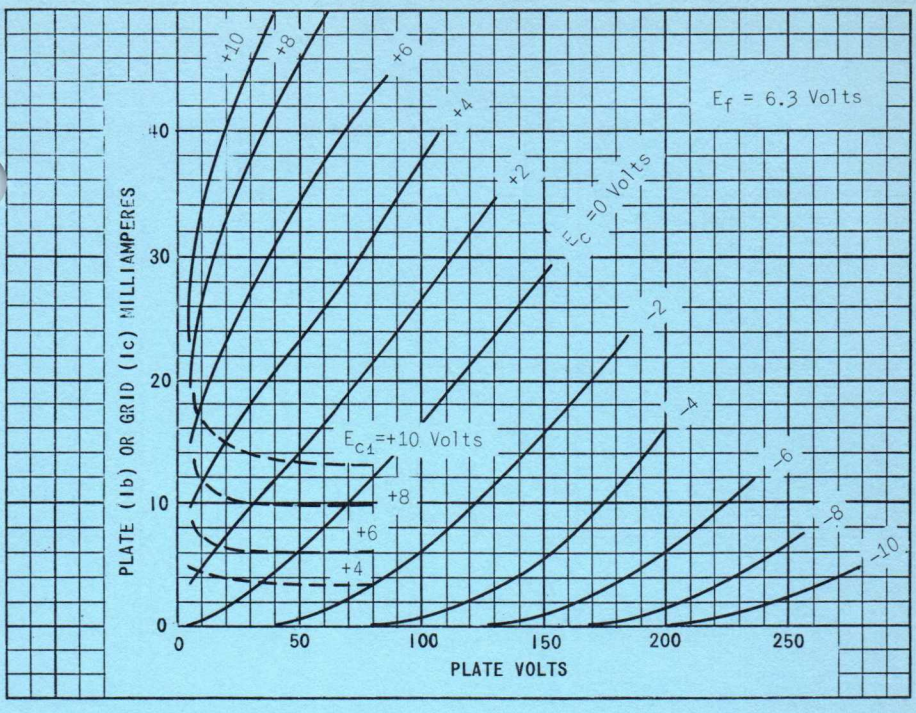
TYPICAL OPERATING CHARACTERISTICS

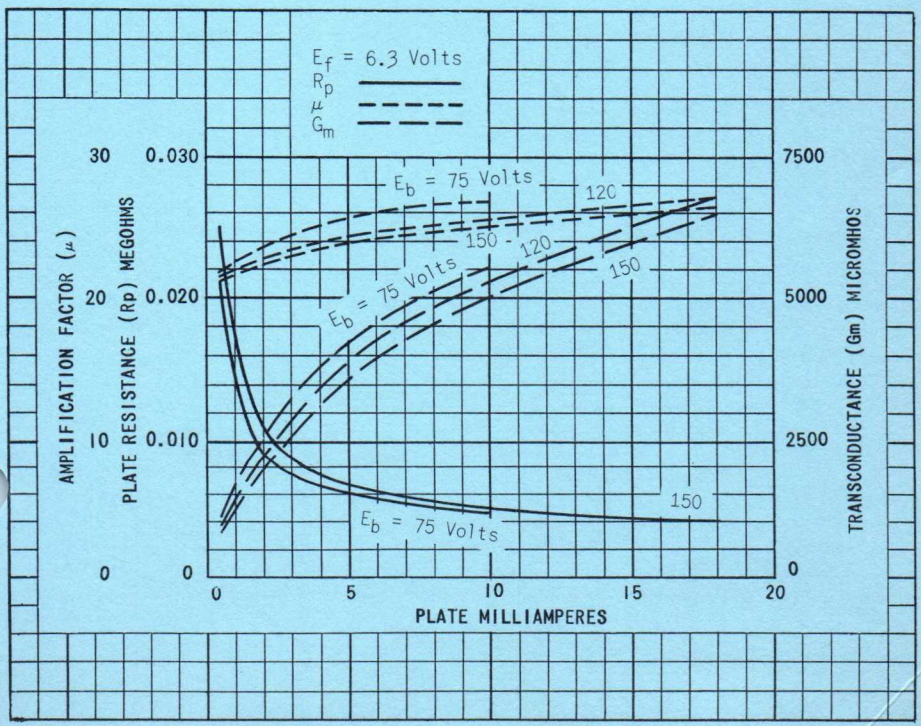
DC PLATE VOLTAGE	120	VOLTS
DC GRID VOLTAGE	0	VOLTS
CATHODE BIAS RESISTANCE	220	OHMS
PLATE CURRENT	9.6	MA.
TRANSCONDUCTANCE	5000	μMHOS
AMPLIFICATION FACTOR	25.5	

SPECIAL TESTS AND RATINGS

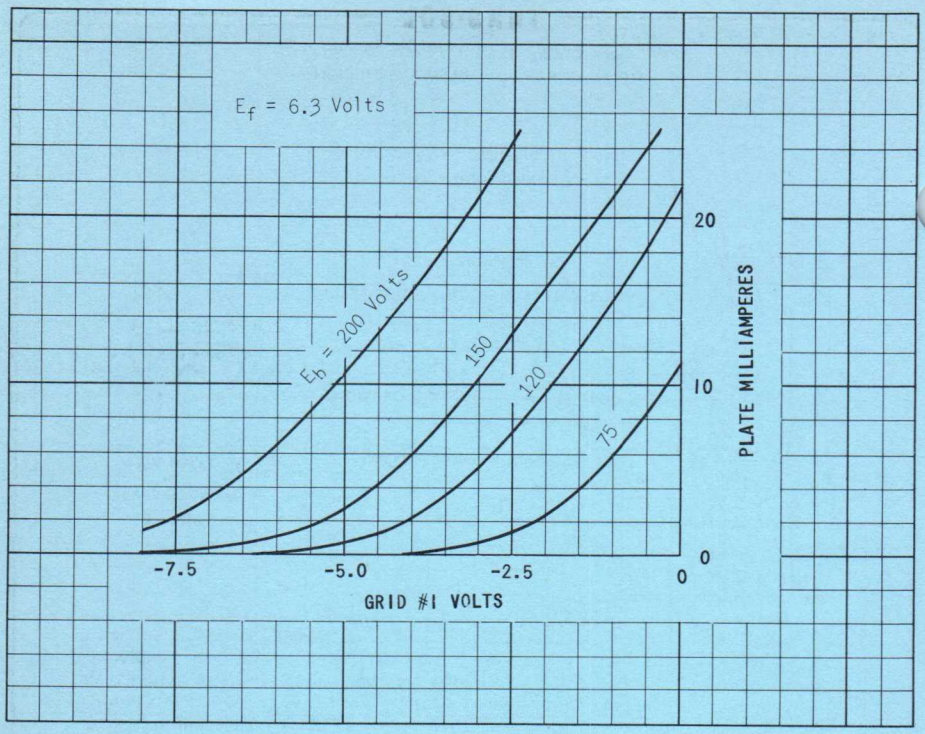
OPERATION PEAK OUTPUT (AC MIN.) Ebb = 105 Vdc; Ef = 5.2 Vac; Eg = 19.5 Vac; RL = 750; Rg = 2700; CIRCUIT DRAWING - SEE FIGURE 1	45	VOLTS
POWER OSCILLATION (MIN.) Ebb = 91 Vdc; Ef = 5.6 Vac; Tg = 2400; F = 400 Mc TEST PER 185 JAN DRAWING OR EQUIVALENT	180	MW







PRINTED IN U. S. A.


E_f = 6.3 Volts
E_b = 200 Volts
150
120
75
20
10
0
PLATE MILLIAMPERES
-7.5
-5.0
-2.5
0
GRID #1 VOLTS

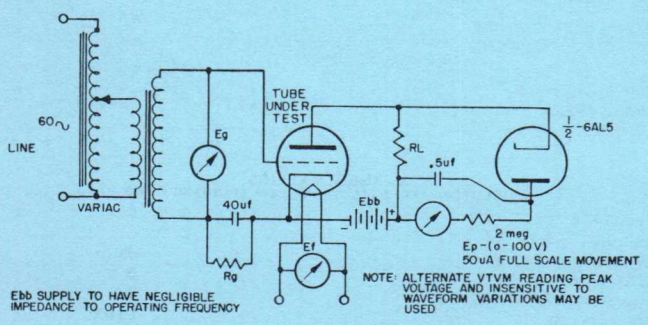
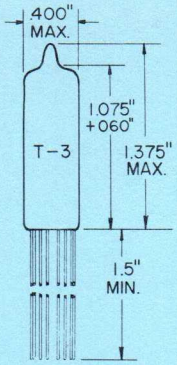

60~
LINE
VARIAC
Eg
TUBE UNDER TEST
40uf
Rg
Ef
RL
.5uf
Ebb
1/2-6AL5
2 meg
Ep-(o-100V)
50uA FULL SCALE MOVEMENT
Ebb SUPPLY TO HAVE NEGLIGIBLE IMPEDANCE TO OPERATING FREQUENCY
NOTE: ALTERNATE VTVM READING PEAK VOLTAGE AND INSENSITIVE TO WAVEFORM VARIATIONS MAY BE USED

FIG. 1

TUNG-SOL

TRIODE

SUBMINIATURE TYPE



GLASS BULB

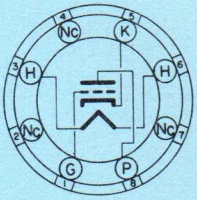
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±5% VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE BUTTON
8 LEAD BASE

8DK

THE 5718 IS A SUBMINIATURE MEDIUM-MU TRIODE DESIGNED FOR USE AS A HIGH FREQUENCY OSCILLATOR OR AS A GENERAL-PURPOSE AMPLIFIER. A POWER OUTPUT OF APPROXIMATELY 0.9 WATT CAN BE OBTAINED AT A FREQUENCY OF 500 MEGACYCLES

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
GRID TO PLATE	1.3	1.4	μμf
INPUT	2.4	2.2	μμf
OUTPUT	2.4	0.7	μμf

[A] WITH EXTERNAL SHIELD OF 0.405 INCH INSIDE DIAMETER CONNECTED TO CATHODE

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM PLATE VOLTAGE	165	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	0.9	WATTS
MAXIMUM DC PLATE CURRENT	22	MA.
MAXIMUM DC GRID CURRENT	5.5	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM BULB TEMPERATURE AT HOTTEST POINT	220	C

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±5%	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	150	OHMS
AMPLIFICATION FACTOR	27	
PLATE RESISTANCE (APPROX.)	4650	OHMS
TRANSCONDUCTANCE	5800	μMHOS
PLATE CURRENT	8.5	MA.
GRID VOLTAGE (APPROX.) Ib = 10 μAMPS.	−7	VOLTS

UHF OSCILLATOR

PLATE VOLTAGE	150	VOLTS
PLATE CURRENT	20	MA.
FREQUENCY	500	MEGACYC.
POWER OUTPUT (APPROX.)	0.9	WATTS

CLASS A RESISTANCE - COUPLED AMPLIFIER

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

R_L	R_{gf}	Ebb = 90 VOLTS			Ebb = 150 VOLTS			Ebb = 225 VOLTS		
		R_k	E_o	GAIN	R_k	E_o	GAIN	R_k	E_o	GAIN
0.10	0.10	2100	8.0	14	1800	13	16	1600	25	17
0.10	0.24	2700	11	15	2300	21	16	2100	33	17
0.24	0.24	5600	9.7	14	4700	19	16	4600	29	17
0.24	0.51	6800	12	15	6400	24	16	5800	37	17
0.51	0.51	12000	11	15	11000	20	16	10000	31	16
0.51	1.0	15000	14	15	13000	25	16	14000	40	16

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS

R_L	R_{gf}	Ebb = 90 VOLTS			Ebb = 150 VOLTS			Ebb = 225 VOLTS		
		R_k	E_o	GAIN	R_k	E_o	GAIN	R_k	E_o	GAIN
0.10	0.10	2700	10	14	2100	19	16	1800	30	17
0.10	0.24	3400	13	15	2700	25	16	2300	38	17
0.24	0.24	6900	12	14	5800	22	16	5000	34	17
0.24	0.51	8400	14	15	7000	27	16	6300	41	17
0.51	0.51	13000	13	15	12000	24	16	11000	37	16
0.51	1.0	17000	16	15	16000	29	16	15000	45	16

1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR APPROXIMATELY 5% TOTAL HARMONIC DISTORTION.

2. GAIN IS MEASURED FOR AN OUTPUT VOLTAGE OF TWO VOLTS RMS.

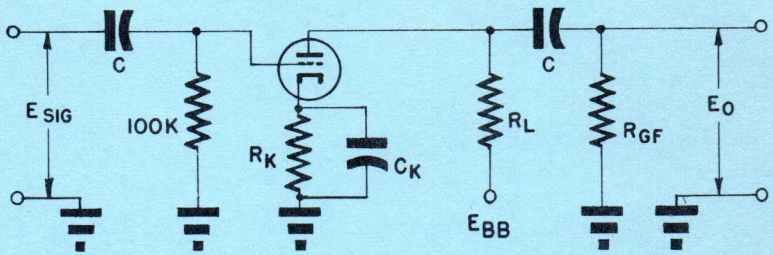
3. R_k IS IN OHMS; R_L AND R_{gf} ARE IN MEGOHMS.

4. COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE



CHARACTERISTICS LIMITS

		MIN	MAX	
HEATER CURRENT:				
Ef = 6.3 VOLTS	INITIAL	140	160	MA.
	500 HR.	138	164	MA.
PLATE CURRENT				
Ef =6.3 V., Eb =100 V., Rk =150 OHMS				
(BY-PASSED)	INITIAL	6.0	11	MA.
TRANSCONDUCTANCE CHANGE WITH HEATER VOLTAGE				
DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) AND TRANSCONDUCTANCE AT Ef = 5.7 VOLTS (OTHER CONDITIONS THE SAME) EXPRESSED AS A				
PERCENTAGE OF TRANSCONDUCTANCE (1)	INITIAL	---	10	PERCENT
	500 HR.	15	---	PERCENT
TRANSCONDUCTANCE (1)				
Ef = 6.3 V., Eb =100 V., Rk =150 OHMS				
(BY-PASSED)	INITIAL	4800	6800	μMHOS
TRANSCONDUCTANCE CHANGE WITH OPERATION				
DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) INITIALLY AND AFTER OPERATION EXPRESSED AS A PERCENTAGE OF				
INITIAL VALUE	500-HR.	---	20	PERCENT
AVERAGE TRANSCONDUCTANCE CHANGE WITH OPERATION:				
AVERAGE OF VALUES FOR 'TRANS-CONDUCTANCE CHANGE WITH OPERATION'	500-HR	---	15	PERCENT
AMPLIFICATION FACTOR:				
Ef =6.3 V., Eb =100 V., Rk =150 OHMS				
(BY-PASSED)	INITIAL	23	31	
PLATE CURRENT CUTOFF (1):				
Ef = 6.3 V., Eb =100 V., Ec =-7.0 VOLTS	INITIAL	---	100	μAMPS
PLATE CURRENT CUTOFF (2)				
Ef =6.3 V., Eb= 100 V., Ec=-4.0 VOLTS	INITIAL	20	---	μAMPS.
RF POWER OUTPUT:				
Ef =6.3 V., Eb =150 V., F =500 mc,				
Rg ADJUSTED FOR Ib =20 ma d-c	INITIAL	600	---	MW.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS LIMITS - cont'd.

INTERELECTRODE CAPACITANCES:				
GRID TO PLATE (G TO P)	INITIAL	1.1	1.8	μμf
INPUT(G TO K+H)	INITIAL	1.6	2.8	μμf
OUTPUT (P TO K+H)	INITIAL	0.5	0.9	μμf
(MEASURED WITHOUT EXTERNAL SHIELD)				
NEGATIVE GRID CURRENT:				
Ef =6.3 V., Eb =150 V., Rk =380 OHMS				
(BY-PASSED), Rg = 1.0 MEG.	INITIAL	---	0.4	μAMPS.
	500 HR.	---	0.6	μAMPS.
HEATER-CATHODE LEAKAGE CURRENT:				
Ef =6.3 V., Ehk =100 V.,				
HEATER POSITIVE WITH RESPECT				
TO CATHODE	INITIAL	---	5	μAMPS.
	500 HR.	---	10	μAMPS.
HEATER NEGATIVE WITH RESPECT				
TO CATHODE	INITIAL	---	5	μAMPS.
	500 HR.	---	10	μAMPS.
INTERELECTRODE LEAKAGE RESISTANCE:				
Ef =6.3 V POLARITY OF APPLIED DC				
INTERELECTRODE VOLTAGE IS SUCH				
THAT NO CATHODE EMISSION RESULTS:				
GRID TO ALL AT 100 VOLTS DC	INITIAL	100	---	MEGOHMS
	500 HR.	50	---	MEGOHMS
PLATE TO ALL AT 300 VOLTS DC	INITIAL	100	---	MEGOHMS
	500 HR.	50	---	MEGOHMS
VIBRATIONAL NOISE OUTPUT VOLTAGE, RMS				
Ef =6.3 V., Ebb =100 V., Rk =150 OHMS				
(BY-PASSED), R_L = 10,000 OHMS,				
VIBRATIONAL ACCELERATION =15 G AT 40cps	INITIAL	---	25	MILLIV
GRID EMISSION CURRENT:				
Ef =7.5 V., Eb=100 V., Ecc=-7.0 V., Rg=1.0 MEG.	INITIAL	---	0.4	μAMPS.

THE INDICATED 500-HOUR VALUES ARE LIFE-TEST END POINTS FOR THE FOLLOWING CONDITIONS OF OPERATION: Ef=6.3 VOLTS, Eb=100 VOLTS, Rk=150 OHMS, Rg=1.0 MEG, Ehk=200 VOLTS WITH HEATER POSITIVE WITH RESPECT TO CATHODE, AND BULB TEMPERATURE=220 C MINIMUM.

SPECIAL TESTS AND RATINGS

STABILITY LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HOUR TO EVALUATE AND CONTROL INITIAL VARIATIONS IN TRANSCONDUCTANCE.

SURVIVAL RATE LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HUNDRED HOURS TO EVALUATE AND CONTROL EARLY-LIFE ELECTRICAL AND MECHANICAL INOPERATIVES.

HEATER-CYCLING LIFE TEST
STATISTICAL SAMPLE OPERATED FOR 2000 CYCLES TO EVALUATE AND CONTROL HEATER-CATHODE DEFECTS. CONDITIONS OF TEST INCLUDE Ef=7.0 VOLTS CYCLED FOR ONE MINUTE ON AND FOUR MINUTES OFF, Eb=Ec=0 VOLTS, AND Ehk=140 VOLTS RMS.

SHOCK RATING--450 G
STATISTICAL SAMPLE SUBJECTED TO FIVE IMPACT ACCELERATIONS OF 450 G IN EACH OF FOUR DIFFERENT POSITIONS. THE ACCELERATING FORCES ARE APPLIED BY THE NAVY-TYPE, HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT.

TUNG-SOL

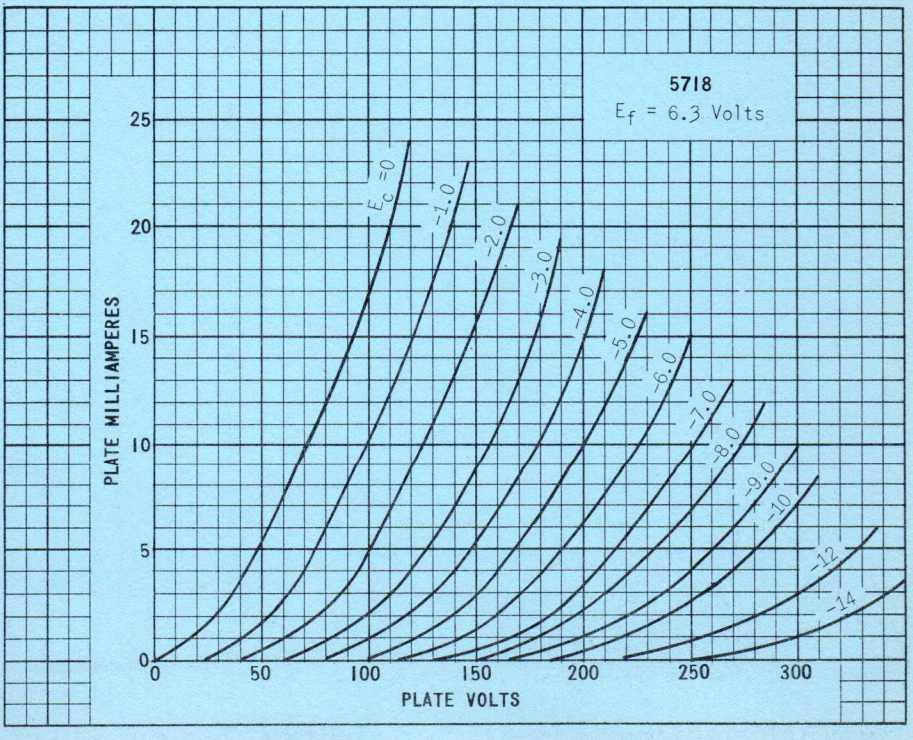
CONTINUED FROM PRECEDING PAGE

SECIAL TESTS AND RATINGS - cont'd.

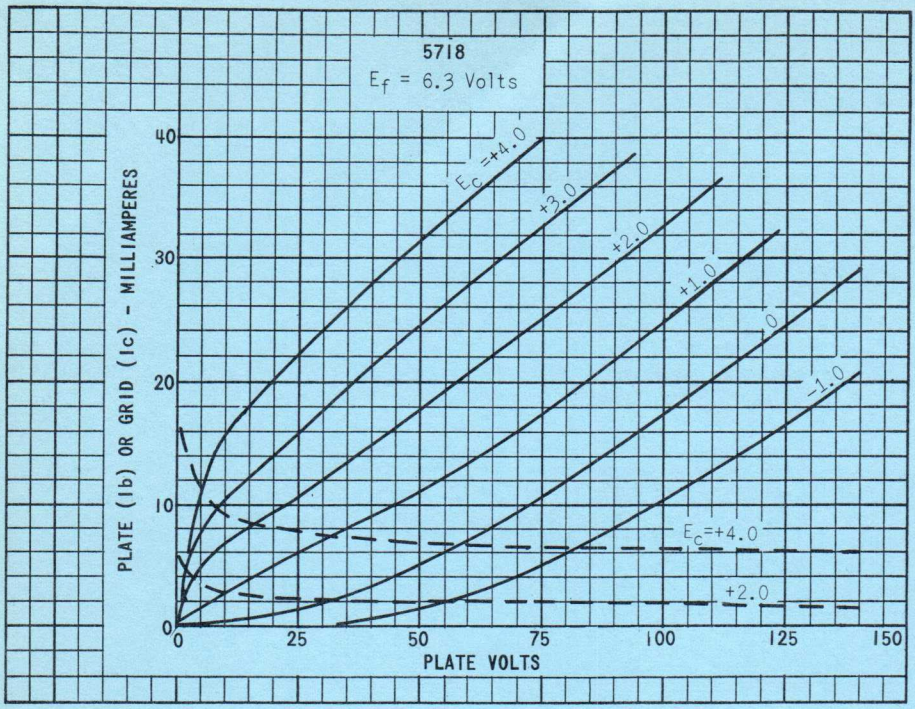
FATIGUE RATING--2.5 G
STATISTICAL SAMPLE SUBJECTED TO VIBRATIONAL ACCELERATION OF 2.5 G FOR 32 HOURS MINIMUM IN EACH OF THREE DIFFERENT POSITIONS. THE SINUSOIDAL VIBRATION IS APPLIED AT A FIXED FREQUENCY BETWEEN 25 AND 60 CYCLES PER SECOND.

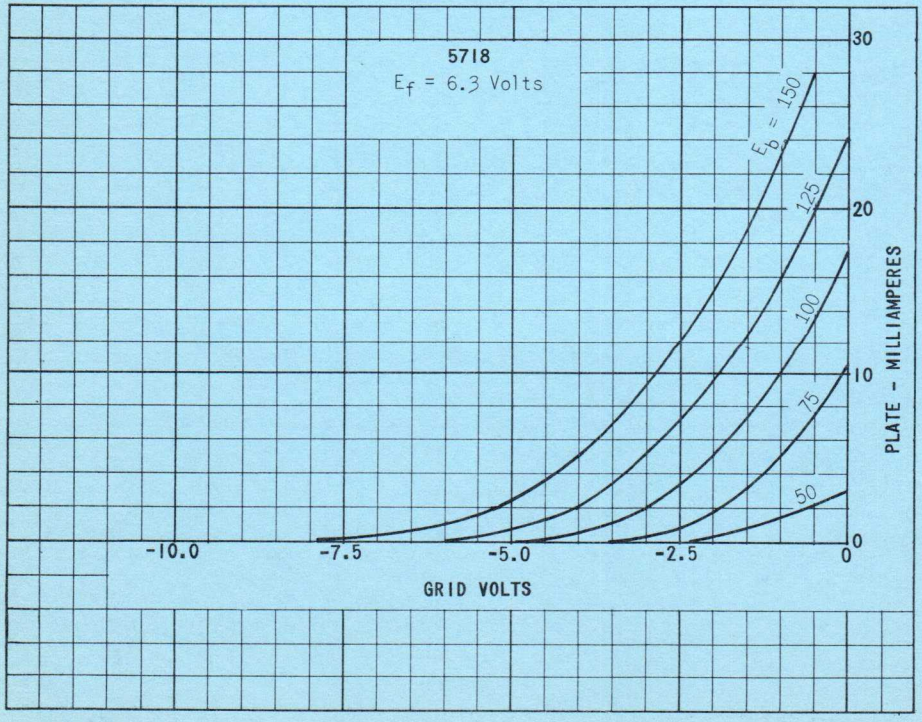
ALTITUDE RATING--60,000 FEET
STATISTICAL SAMPLE SUBJECTED TO PRESSURE OF 55 MILLIMETERS OF MERCURY TO EVALUATE AND CONTROL ARCING AND CORONA.

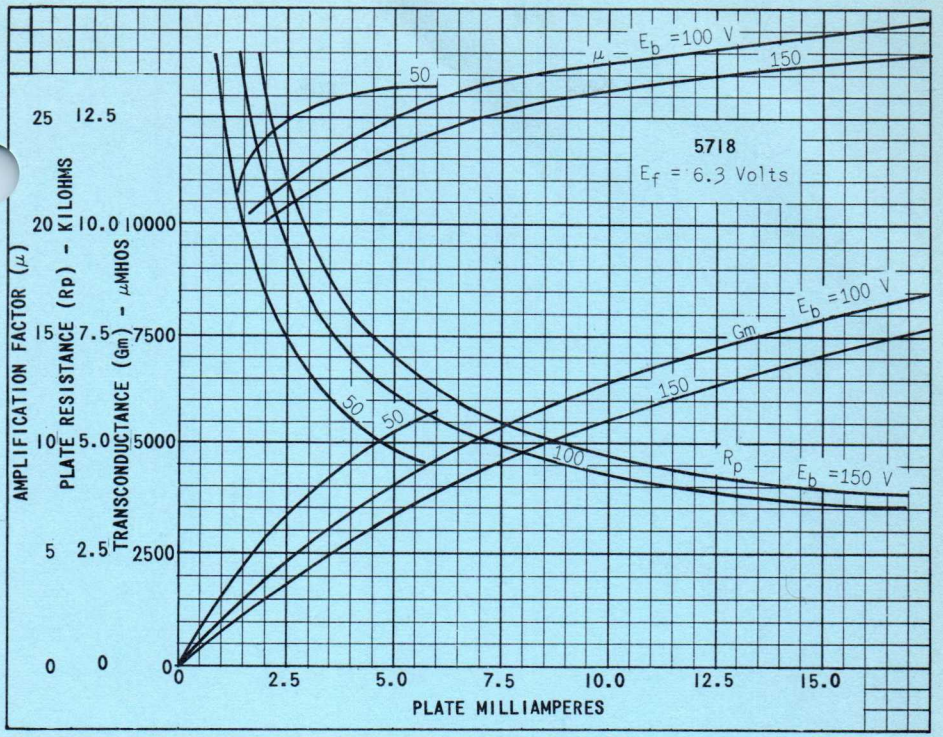
NOTE:
THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE DELIBERATELY BEEN SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS.
IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO THE APPROPRIATE MIL-E-1 SPECIFICATION.



PRINTED IN U.S.A.


5718
E_f = 6.3 Volts
PLATE (Ib) OR GRID (Ic) - MILLIAMPERES
PLATE VOLTS
E_c=+4.0
+3.0
+2.0
+1.0
0
-1.0
E_c=+4.0
+2.0
0
10
20
30
40
0
25
50
75
100
125
150


5718
E_f = 6.3 Volts
PLATE - MILLIAMPERES
GRID VOLTS
E_b = 150
125
100
75
50
0
10
20
30
-10.0
-7.5
-5.0
-2.5
0

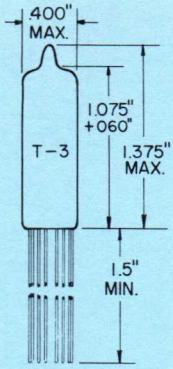


PRINTED IN U. S. A.

TUNG-SOL

TRIODE

SUBMINIATURE TYPE



GLASS BULB

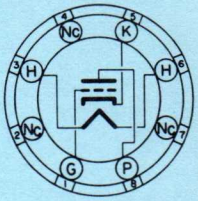
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±5% VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE BUTTON
8 LEAD BASE

8DK

THE 5719 IS A SUBMINIATURE HIGH-MU TRIODE DESIGNED FOR USE AS AN AUDIO-FREQUENCY VOLTAGE AMPLIFIER. BECAUSE OF ITS LOW MICROPHONIC CHARACTERISTICS, THE TUBE CAN BE EMPLOYED AT RELATIVELY LOW SIGNAL LEVELS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE	0.8	0.8	μμf
INPUT	1.9	1.7	μμf
OUTPUT	2.2	0.6	μμf

[A] WITH EXTERNAL SHIELD OF 0.405 INCH INSIDE DIAMETER CONNECTED TO CATHODE.

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM PLATE VOLTAGE	165	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	0.1	WATTS
MAXIMUM DC PLATE CURRENT	3.3	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1.2	MEGOHMS
MAXIMUM BULB TEMPERATURE AT HOTTEST POINT	220	C

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±5%	VOLTS
HEATER CURRENT	0.15	AMP
PLATE VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	1500	OHMS
AMPLIFICATION FACTOR	70	
PLATE RESISTANCE (APPROX.)	41,000	OHMS
TRANSCONDUCTANCE	1700	μMHOS
PLATE CURRENT	0.73	MA.
GRID VOLTAGE (APPROX.) Ib = 10 μAMPS.	-2.5	VOLTS

CLASS A RESISTANCE - COUPLED AMPLIFIER

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

R_L	R_{gf}	Ebb = 90 VOLTS			Ebb = 150 VOLTS			Ebb = 225 VOLTS		
		R_k	E_o	GAIN	R_k	E_o	GAIN	R_k	E_o	GAIN
0.10	0.10	2000	3.5	30	1200	11	38	1000	22	41
0.10	0.24	2300	5.3	35	1400	14	43	1100	27	46
0.24	0.24	4700	5.1	36	2900	12	44	2100	24	49
0.24	0.51	5100	6.6	39	3300	16	47	2500	30	51
0.51	0.51	9000	5.8	38	5800	13	46	4600	25	49
0.51	1.0	10000	7.6	42	6800	17	48	5600	31	51

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	Ebb = 90 VOLTS			E_{bb} = 150 VOLTS			Ebb = 225 VOLTS		
		R_k	E_b	GAIN	R_k	E_o	GAIN	R_k	E_o	GAIN
0.10	0.10	2700	6.7	29	1700	14	37	1300	25	40
0.10	0.24	3200	9.1	34	2000	18	41	1500	32	45
0.24	0.24	5600	8.7	34	3600	17	42	2700	29	47
0.24	0.51	6300	11	38	4200	22	45	3200	37	49
0.51	0.51	11000	9.5	37	7000	19	44	5300	32	49
0.51	1.0	12000	12	40	8000	24	47	6300	40	51

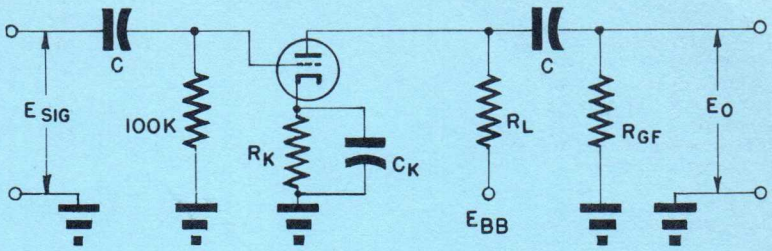
1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR APPROXIMATELY 5% TOTAL HARMONIC DISTORTION.

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



CHARACTERISTICS LIMITS

		MIN.	MAX.	
HEATER CURRENT	INITIAL	140	160	MA.
Ef = 6.3 V.	500 HR.	138	164	MA.
PLATE CURRENT				
Ef=6.3 V., Eb =100 V., Rk = 1500 OHMS				
(BY-PASSED)	INITIAL	0.5	0.9	MA.
TRANSCONDUCTANCE (1)				
Ef =6.3 V., Eb =100 V., Rk = 1500 OHMS				
(BY-PASSED)	INITIAL	1400	2000	μMHOS
TRANSCONDUCTANCE CHANGE WITH HEATER VOLTAGE:				
DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) AND TRANSCONDUCTANCE AT Ef =5.7 V., (OTHER CONDITIONS THE SAME) EXPRESSED AS A PERCENTAGE OF TRANSCONDUCTANCE (1)	INITIAL	---	10	PERCENT
	500HR.	---	15	PERCENT
TRANSCONDUCTANCE CHANGE WITH OPERATION:				
DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) INITIALLY AND AFTER OPERATION EXPRESSED AS A PERCENTAGE OF INITIAL VALUE	500 HR.	---	20	PERCENT
AVERAGE TRANSCONDUCTANCE CHANGE WITH OPERATION:				
AVG. OF VALUES FOR 'TRANSCONDUCTANCE CHANGE WITH OPERATION'	500 HR.	---	15	PERCENT
AMPLIFICATION FACTOR:				
Ef =6.3 V., Eb =100 V., Rk = 1500 OHMS				
(BY-PASSED)	INITIAL	60	80	
PLATE CURRENT CUTOFF (1)				
Ef = 6.3 V., Eb =100 V., Ec =-2.5 V.,	INITIAL	---	50	μAMPS.
PLATE CURRENT CUTOFF (2)				
Ef =6.3 V., Eb =100 V., Ec =-1.8 V.	INITIAL	5	---	μAMPS.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS LIMITS - cont'd.

		MIN.	MAX.	
AC AMPLIFICATION:				
(RMS OUTPUT VOLTAGE FROM FIXED INPUT SIGNAL)				
Ef =6.3 V., Ebb=100 V., Ecc=0 V				
Esig = 0.2 V., RMS	INITIAL	8.0	---	VOLTS
INTERELECTRODE CAPACITANCES:				
GRID TO PLATE (G TO P)	INITIAL	0.6	1.0	μμf
INPUT (G TO K+H)	INITIAL	1.2	2.2	μμf
OUTPUT (P TO K+H)	INITIAL	0.4	0.8	μμf
(MEASURED WITHOUT EXTERNAL SHIELD)				
NEGATIVE GRID CURRENT				
Ef =6.3 V., Eb =150 V., Rk= 2700 OHMS				
(BY-PASSED), Rg = 1.0 MEG.	INITIAL	---	0.3	μAMPS.
	500 HR.	---	0.6	μAMPS.
HEATER-CATHODE LEAKAGE CURRENT:				
Ef =6.3 V., Ehk =100 V.,				
HEATER POSITIVE WITH RESPECT TO CATHODE	INITIAL	---	5.0	μAMPS.
	500 HR.	---	10	μAMPS.
HEATER NEGATIVE WITH RESPECT TO CATHODE	INITIAL	---	5.0	μAMPS.
	500 HR.	---	10	μAMPS.
INTERELECTRODE LEAKAGE RESISTANCE:				
Ef =6.3 V., POLARITY OF APPLIED DC INTERELECTRODE VOLTAGE IS SUCH THAT NO CATHODE EMISSION RESULTS				
GRID TO ALL AT 100 VOLTS DC	INITIAL	100	---	MEGOHMS
	500 HR.	25	---	MEGOHMS
PLATE TO ALL AT 300 VOLTS DC	INITIAL	100	---	MEGOHMS
	500 HR.	25	---	MEGOHMS
VIBRATIONAL NOISE OUTPUT VOLTAGE, RMS:				
Ef =6.3 V., Ebb = 100 V., Rk = 1500 OHMS (BY-PASSED), R_L = 10,000 OHMS,				
VIBRATIONAL ACCELERATION =15 G AT 40cps	INITIAL	---	25	MV.
GRID EMISSION CURRENT:				
Ef = 7.5 V., Eb =100 V., Ecc =-2.5 V.,				
Rg =1.0 MEG.	INITIAL	---	0.3	μAMPS.

THE INDICATED 500-HOUR VALUES ARE LIFE-TEST END POINTS FOR THE FOLLOWING CONDITIONS OF OPERATION: Ef=6.3 VOLTS, Eb=150 VOLTS, Rk=680 OHMS, Rg=1.0 MEG, Ehk=200 VOLTS WITH HEATER POSITIVE WITH RESPECT TO CATHODE, AND BULB TEMPERATURE =220 C MINIMUM.

SPECIAL TESTS AND RATINGS

STABILITY LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HOUR TO EVALUATE AND CONTROL INITIAL VARIATIONS IN TRANSCONDUCTANCE.

SURVIVAL RATE LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HUNDRED HOURS TO EVALUATE AND CONTROL EARLY-LIFE ELECTRICAL AND MECHANICAL INOPERATIVES.

HEATER-CYCLING LIFE TEST
STATISTICAL SAMPLE OPERATED FOR 2000 CYCLES TO EVALUATE AND CONTROL HEATER-CATHODE DEFECTS. CONDITIONS OF TEST INCLUDE Ef=7.0 VOLTS CYCLED FOR ONE MINUTE ON AND FOUR MINUTES OFF, Eb=Ec=0 VOLTS, AND Ehk=140 VOLTS RMS.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

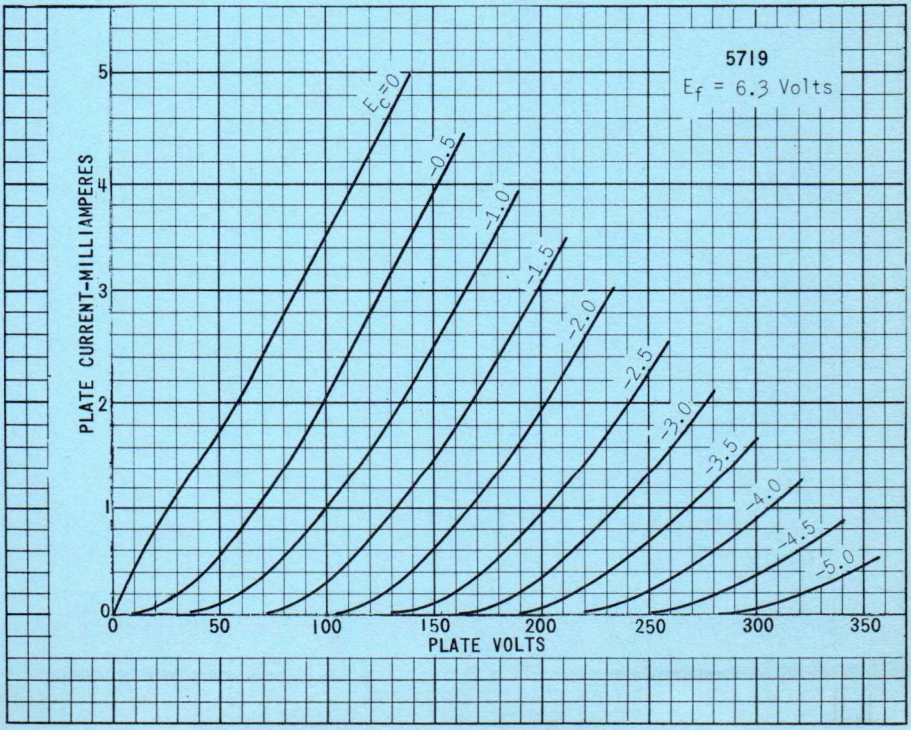
SPECIAL TESTS AND RATINGS - cont'd.

SHOCK RATING--450 G
STATISTICAL SAMPLE SUBJECTED TO FIVE IMPACT ACCELERATIONS OF 450 G IN EACH OF FOUR DIFFERENT POSITIONS. THE ACCELERATING FORCES ARE APPLIED BY THE NAVY-TYPE, HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT.

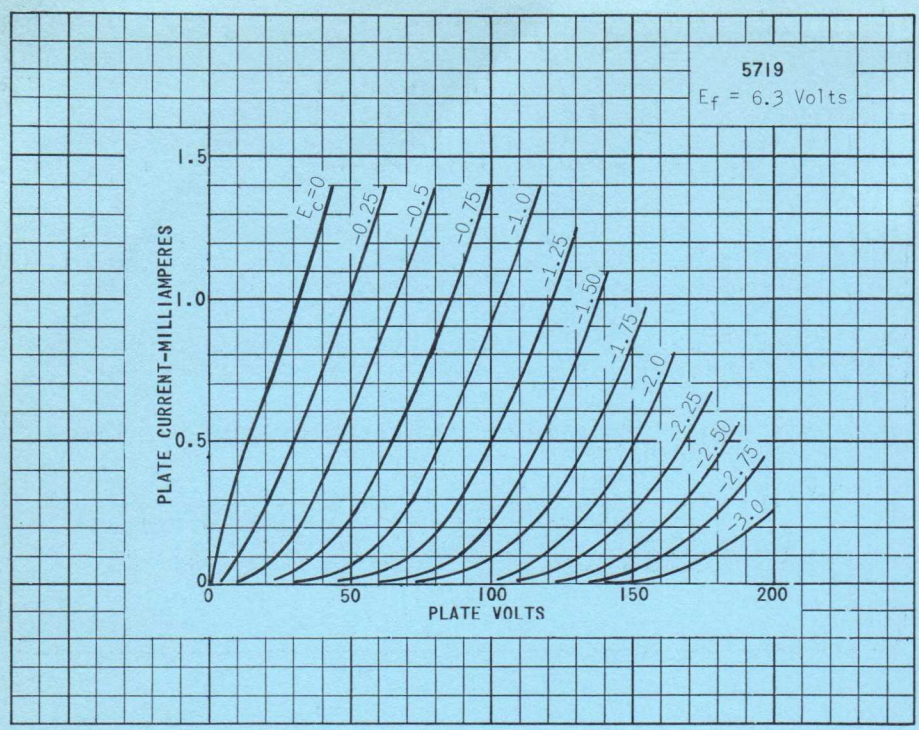
FATIGUE RATING--2.5 G
STATISTICAL SAMPLE SUBJECTED TO VIBRATIONAL ACCELERATION OF 2.5 G FOR 32 HOURS MINIMUM IN EACH OF THREE DIFFERENT POSITIONS. THE SINUSOIDAL VIBRATION IS APPLIED AT A FIXED FREQUENCY BETWEEN 25 AND 60 CYCLES PER SECOND.

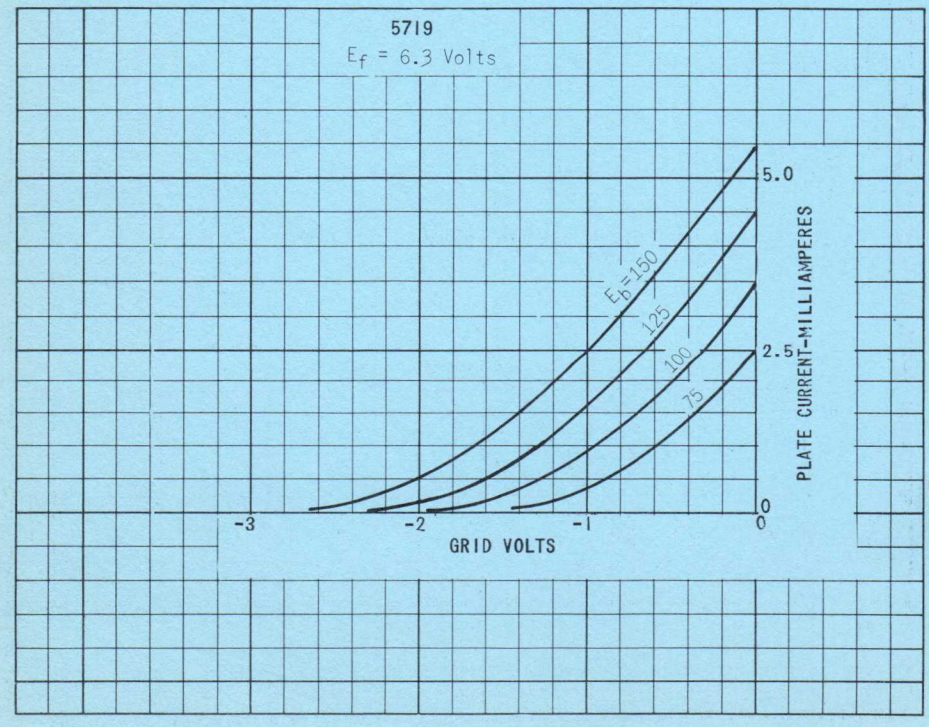
ALTITUDE RATING--60,000 FEET
STATISTICAL SAMPLE SUBJECTED TO PRESSURE OF 55 MILLIMETERS OF MERCURY TO EVALUATE AND CONTROL ARCING AND CORONA.

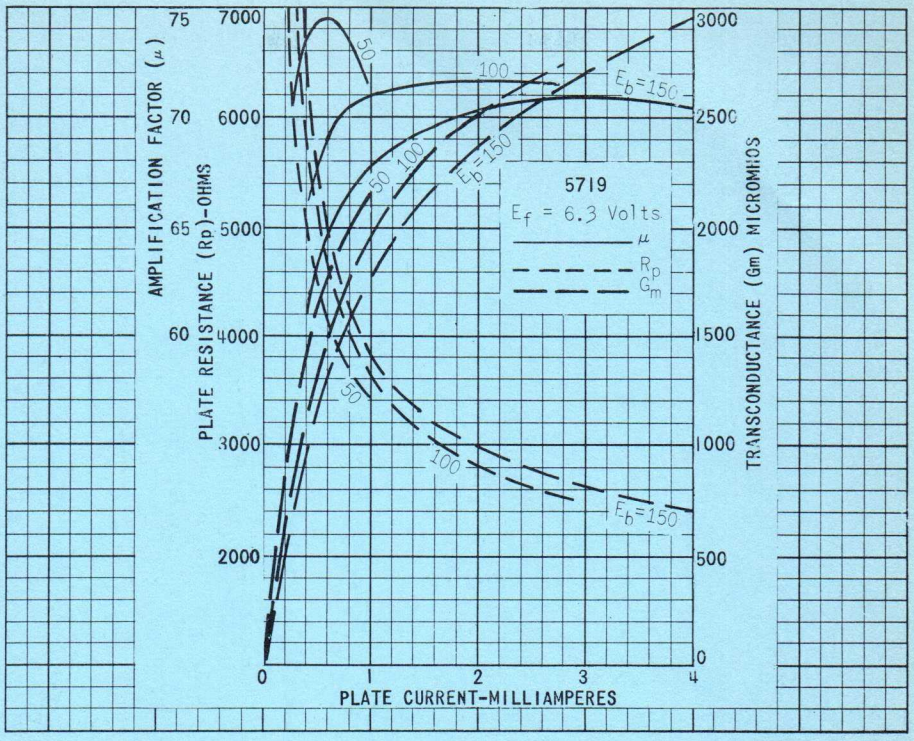
NOTE;
THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE DELIBERATELY BEEN SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS.
IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO THE APPROPRIATE MIL-E-1 SPECIFICATION.



PRINTED IN U. S. A.


5719
E_f = 6.3 Volts
PLATE CURRENT-MILLIAMPERES
1.5
1.0
0.5
0
0
50
100
150
200
PLATE VOLTS
E_c=0
-0.25
-0.5
-0.75
-1.0
-1.25
-1.50
-1.75
-2.0
-2.25
-2.50
-2.75
-3.0


5719
E_f = 6.3 Volts
PLATE CURRENT-MILLIAMPERES
5.0
2.5
0
-3
-2
-1
0
GRID VOLTS
E_b=150
125
100
75



PRINTED IN U. S. A.

TUNG-SOL

DUAL CONTROL PENTODE

MINIATURE TYPE

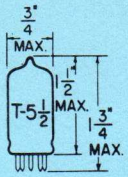
COATED UNIPOTENTIAL CATHODE

HEATER

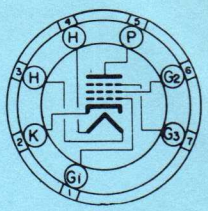
6.3 VOLTS 0.175 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 5725/6AS6W/6187 IS A RUGGEDIZED, SHARP CUT-OFF PENTODE VOLTAGE AMPLIFIER OF THE SEVEN PIN MINIATURE CONSTRUCTION. A SEPARATE SUPPRESSOR GRID BASE PIN CONNECTION MAKES DUAL CONTROL APPLICATIONS SUCH AS A CONVERTER, MODULATOR, PHANTASTRON AND GATING SERVICE POSSIBLE, AS WELL AS SINGLE CONTROL USAGE SUCH AS AF, IF, AND RF AMPLIFIERS, MIXERS, ETC. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT, SCREEN CURRENT AND TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE THIS TUBE MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5725/6AS6W/6187 IS ESPECIALLY SUITED FOR USE IN MILITARY AND INDUSTRIAL AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #316	WITHOUT SHIELD	
MAXIMUM GRID #1 TO PLATE (RATED)	0.02	0.025	μμf
INPUT (RATED)	4.0	3.9	μμf
MAXIMUM	4.5	---	μμf
MINIMUM	3.5	---	μμf
OUTPUT (RATED)	3.0	2.2	μμf
MAXUMUM	3.4	---	μμf
MINIMUM	2.6	---	μμf

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	200	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	155	VOLTS
MAXIMUM DC GRID #3 VOLTAGE	30	VOLTS
MAXIMUM PLATE DISSIPATION	1.65	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM HEATER CATHODE VOLTAGE	±100	VOLTS
MAXIMUM DC CATHODE CURRENT[A]	20	mA
MAXIMUM BULB TEMPERATURE	+165	°c

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.175	AMP.
PLATE VOLTAGE	120	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 VOLTAGE	120	VOLTS
GRID #1 VOLTAGE	-2	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

PLATE CURRENT	5.2	mA
GRID #2 CURRENT	3.5	mA
TRANSCONDUCTANCE		
GRID #1 TO PLATE	3200	μMHOS
GRID #3 TO PLATE	470	μMHOS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V, E_b = 120Vdc, E_{c1} = -2Vdc, E_{c2} = 120Vdc, E_{c3} = 0Vdc
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	160	190	---	---	160	190	mA
HEATER CATHODE LEAKAGE (E_{hk}=±100Vdc)	---	±10	---	---	---	±10	μAdc
GRID CURRENT (1) (R_{g1}=0.1 MEG.)	0	-0.1	---	---	0	-0.1	μAdc
PLATE CURRENT (1)	2.5	9.0	4.2	6.2	---	---	mAdc
TRANSCONDUCTANCE (1)	2500	4500	2925	3475	2200	4500	μMHOS
Δ AVERAGE TRANS-CONDUCTANCE (1)	---	---	---	---	---	15	PERCENT
INSULATION OF ELECTRODES[B] (E_f=6.3V, E(g_1 TO all)= 100Vdc, g_1 neg., E(g_2-all)= 300Vdc, g_2 neg., E(g_3-all)= 100Vdc, g_3 neg., E(p-all)= 300 Vdc, p neg.)							
R(g_1-all)	100	---	---	---	50	---	MEGOHM
R(g_2-all)	100	---	---	---	50	---	MEGOHM
R(g_3-all)	100	---	---	---	50	---	MEGOHM
R(p -all)	100	---	---	---	50	---	MEGOHM
PLATE CURRENT (2) (E_{c1}=-6Vdc)	5	---	---	---	---	---	μAdc
PLATE CURRENT (3) (E_{c1}=-10Vdc)	---	100	---	---	---	---	μAdc
PLATE CURRENT (4) (E_{c3}=-10Vdc, E_{c1}=-3Vdc)	---	200	---	---	---	---	μAdc
SCREEN CURRENT	1.5	5.5	2.6	4.4	---	---	mAdc
GRID CURRENT (2)[C] (E_f=7.0V)	0	-1.0	---	---	---	---	μAdc
Δ TRANSCONDUCTANCE (2)[D] (E_f=5.7V)	---	15	---	---	---	15	PERCENT
TRANSCONDUCTANCE (3) (E_{c3}=-3Vdc)	500	1300	660	960	---	---	μMHOS
TRANSCONDUCTANCE (4) (E_{c3}=-5Vdc)	900	1700	---	---	---	---	μMHOS
TRANSCONDUCTANCE (5) (E_{c3}=20Vdc)	---	25	---	---	---	---	μMHOS

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION (R_p= 10,000)	---	150	mVac
VIBRATIONAL FATIGUE[E]	---	---	
SHOCK[F] (HAMMER ANGLE = 30°, E_{hk}=100Vdc, HEATER POS, R_{g1}=0.1 MEG)	---	---	

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

SPECIAL REQUIREMENTS - CONT'D.

	MIN.	MAX.	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	450	mVac
HEATER—CATHODE LEAKAGE	---	±30	μAdc
GRID CURRENT (1)	0	-0.4	μAdc
TRANSCONDUCTANCE (1)	2200	---	μMHOS
GLASS STRAIN[G]	---	---	
CONTINUITY AND SHORT[H]			
RF NOISE [J] (E_{c1}=0, E_{ca1}=15.0 mVac, R_k=200, C_k=0.2μf)	---	3.0	mW
NOISE AND MICROPHONICS[KL] (E_f=6.3V, E_{hk}=0, E_{bb}=E_{cc2}=200Vdc, E_{c1}=0, R_p=0.1MEG., R_{g2}=0.5MEG, R_k=1000, C_{g2}=2.0μf)	---	100	mVac
LOW FREQUENCY VIBRATION[M] (R_p=10,000)	---	150	mVac
LOW PRESSURE VOLTAGE BREAKDOWN[N] (PRESSURE = 55±5 mm mercury, , TEMP.= 25±5°C, HUMIDITY =0, VOLTAGE = 500 Vac, 60 CYCLES, SINUSOIDAL WAVEFORM)	500	---	Vac
1 HOUR STABILITY LIFE TEST INTERMITTENT LIFE TEST CONDITIONS	---	---	
STABILITY LIFE TEST END POINTS Δ AVERAGE TRANSCONDUCTANCE (1)	---	10	PERCENT
HEATER CYCLING LIFE TEST (E_f=7.5V, E_{hk}=135Vdc, HEATER POSITIVE, E_{c1}=E_{c2}=E_b=0)	---	---	
HEATER CYCLING LIFE TEST END POINTS HEATER CATHODE VOLTAGE	---	±20	μAdc
INTERMITTENT LIFE TEST (E_b=180Vdc, E_{c1}=0, E_{c2}=125Vdc, E_{hk}=135Vdc, HEATER POSITIVE, R_{g1}=0.1MEG, R_k= 130, MIN. BULB TEMP =+165°C)	---	---	

NOTES

[A] DIFFICULTY MAY BE ENCOUNTERED IF THE TUBE IS OPERATED FOR LONG PERIODS OF TIME WITH VERY SMALL VALUES OF CATHODE CURRENT.

[B] SEE MIL-E-1C 4.8.2

[C] PRIOR TO THIS TEST TUBES TO BE PREHEATED 5 MINUTES AT CONDITIONS INDICATED BELOW. TEST IMMEDIATELY AFTER PREHEATING. E_f=7.0V, E_{c1}=0Vdc, R_k=130 OHMS, R_{g1}=0.1 MEG., E_b=180Vdc, E_{c2}= 125 Vdc.

[D] THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND I'S EXPRESSED:

$$\frac{(\text{SM AT } 6.3)-(\text{SM AT } 5.7)}{(\text{SM AT } 6.3)} \times 100$$

[E] SEE MIL-E-1C 4.9.20.6

[F] SEE MIL-E-1C 4.9.20.5

[G] TEST CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0°C±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST 2 LITERS PER FIFTEEN TUBES. TUBES FOR THIS TEST WILL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST. REJECT FOR EVIDENCE OF AIR LEAK.

[H] SEE MIL-E-1C 4.7.5

[J] SEE MIL-E-1C 4.10.3.1

[K] SEE MIL-E-1C 4.10.3.5

[L] THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS @ 60 CYCLES.

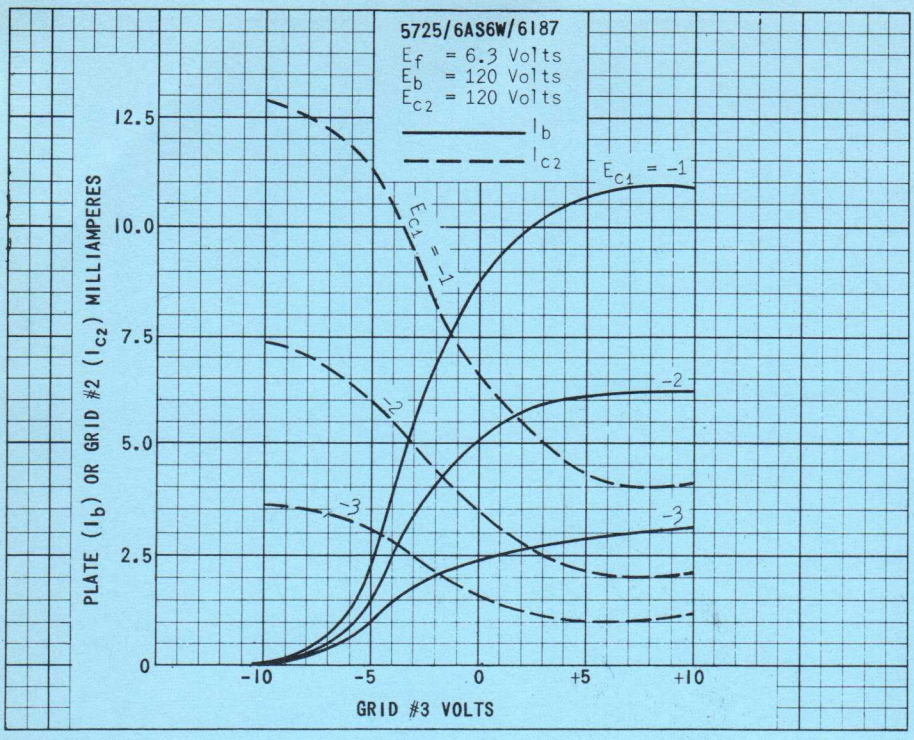
[M] SEE MIL-E-1C 4.9.20.4

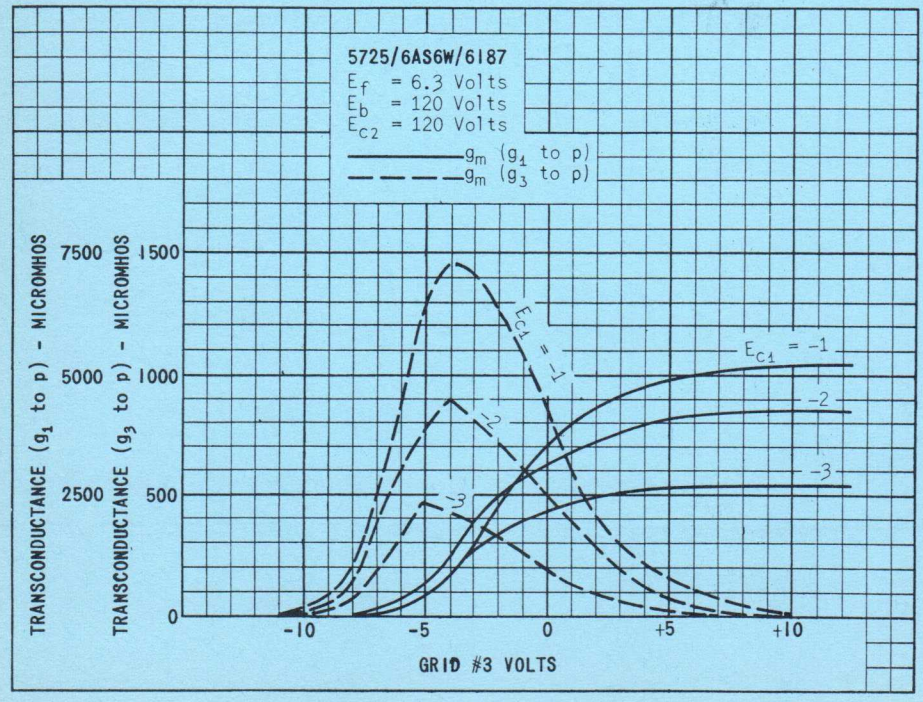
[N] BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

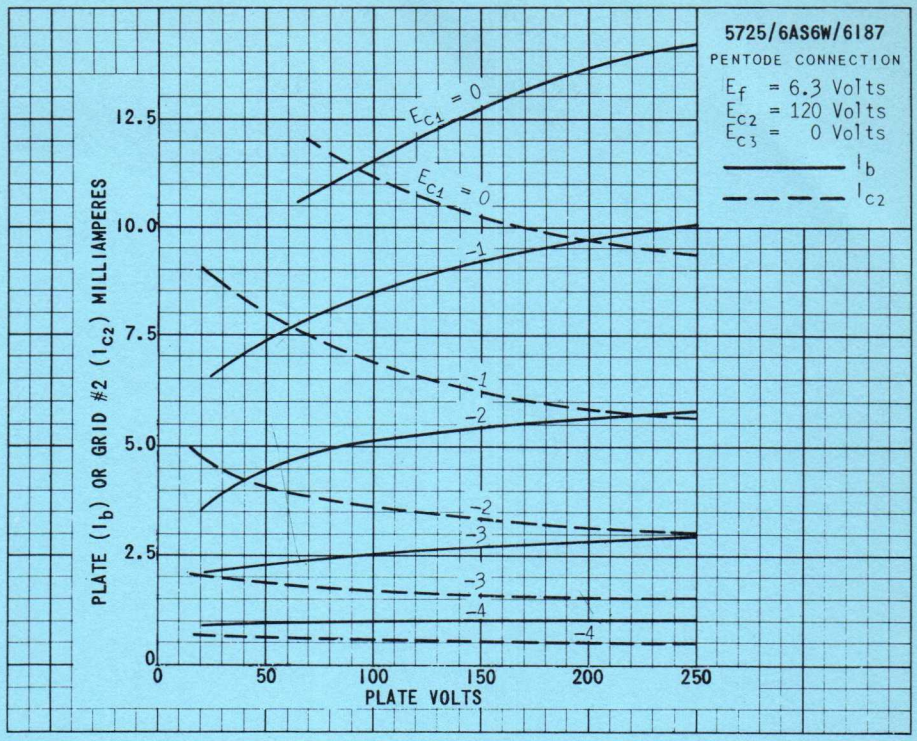
PRINTED IN U.S.A.

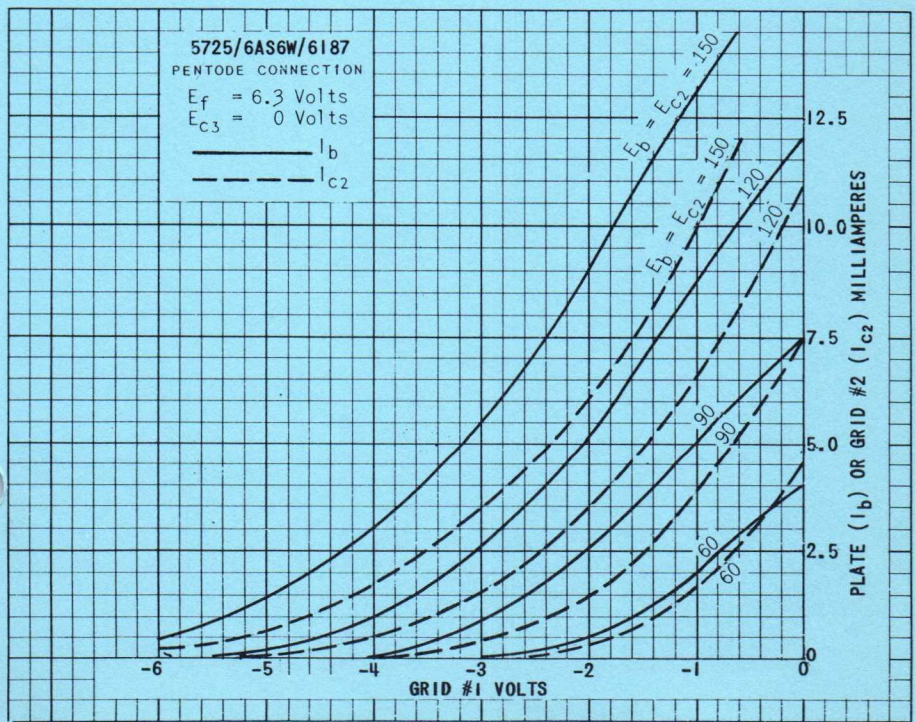
5725/6AS6W/6187

PREMIUM TUBE



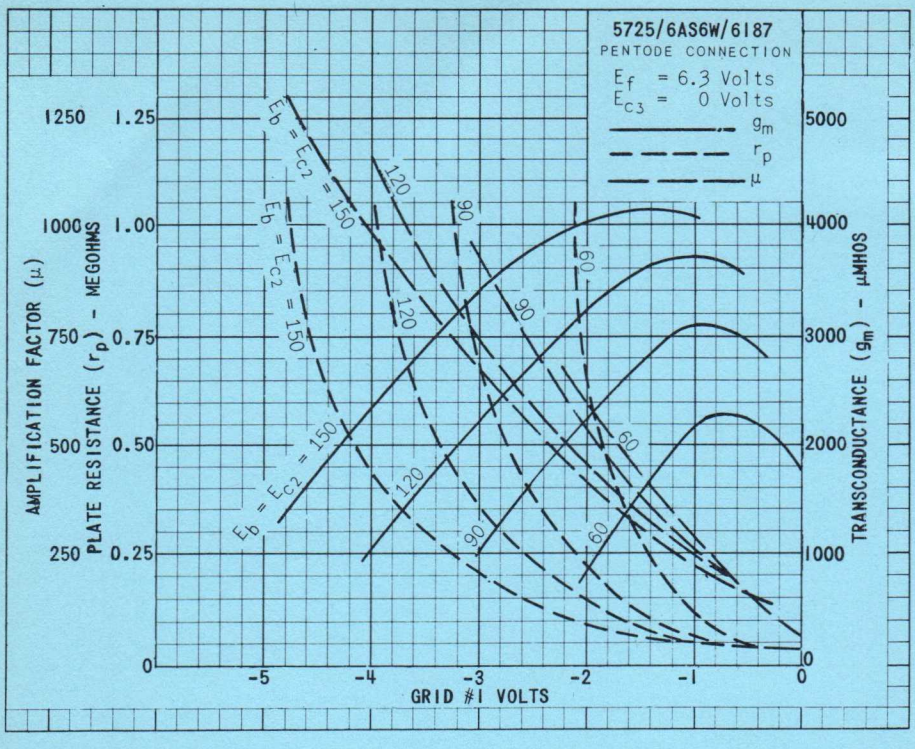


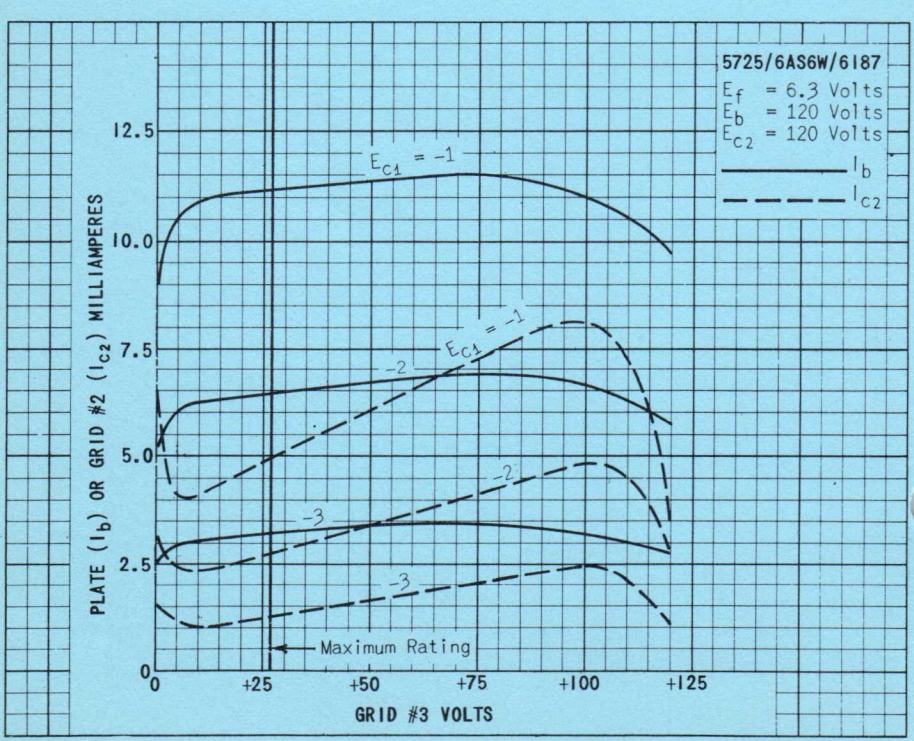




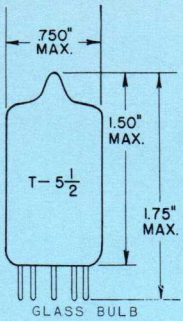
PRINTED IN U.S.A.

5725/6AS6W/6187
PREMIUM TUBE





TUNG-SOL



GLASS BULB

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

DOUBLE DIODE

MINIATURE TYPE

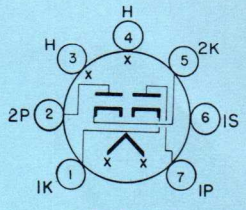
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 300 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 6BT

THE 5726 IS A MINIATURE DOUBLE DIODE PARTICULARLY DESIGNED FOR DEPENDABLE OPERATION UNDER CONDITIONS USUALLY FOUND IN MOBILE AND AIRCRAFT APPLICATIONS. THE HEATERS ARE DESIGNED TO MINIMIZE THE POSSIBILITY OF FAILURE UNDER SEVERE INTERMITTENT ON-OFF OPERATION. THE HEATERS FOR THE TWO DIODE UNITS ARE INTERNALLY CONNECTED IN SERIES SO THAT A HEATER FAILURE MAKES BOTH UNITS UNOPERATIVE. IT IS DESIGNED TO PASS THE SHOCK AND FATIGUE TEST REQUIREMENTS OF THE JAN TYPE 6AL5W.

DIRECT INTERELECTRODE CAPACITANCES

PLATE OF UNIT #1 TO CATHODE OF UNIT #1[A]	3.2	pf
PLATE OF UNIT #2 TO CATHODE OF UNIT #2[A]	3.2	pf
CATHODE OF UNIT #1 TO PLATE OF UNIT #1[B]	3.9	pf
CATHODE OF UNIT #2 TO PLATE OF UNIT #2[B]	3.9	pf
PLATE OF UNIT #1 TO PLATE OF UNIT #2 (MAX.)[C]	0.026	pf

[A] WITH JETEC SHIELD #313 CONNECTED TO HEATER, INTERNAL SHIELD AND CATHODE OF UNIT UNDER TEST.

[B] WITH JETEC SHIELD #313 CONNECTED TO HEATER, INTERNAL SHIELD AND PLATE OF UNIT UNDER TEST.

[C] WITH JETEC SHIELD #313 CONNECTED TO GROUND.

RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

MAXIMUM DC HEATER-CATHODE VOLTAGE	330	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	330	VOLTS
MAXIMUM PEAK PLATE CURRENT (PER PLATE)	54	MA.
MAXIMUM DC OUTPUT CURRENT (PER PLATE)	9	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

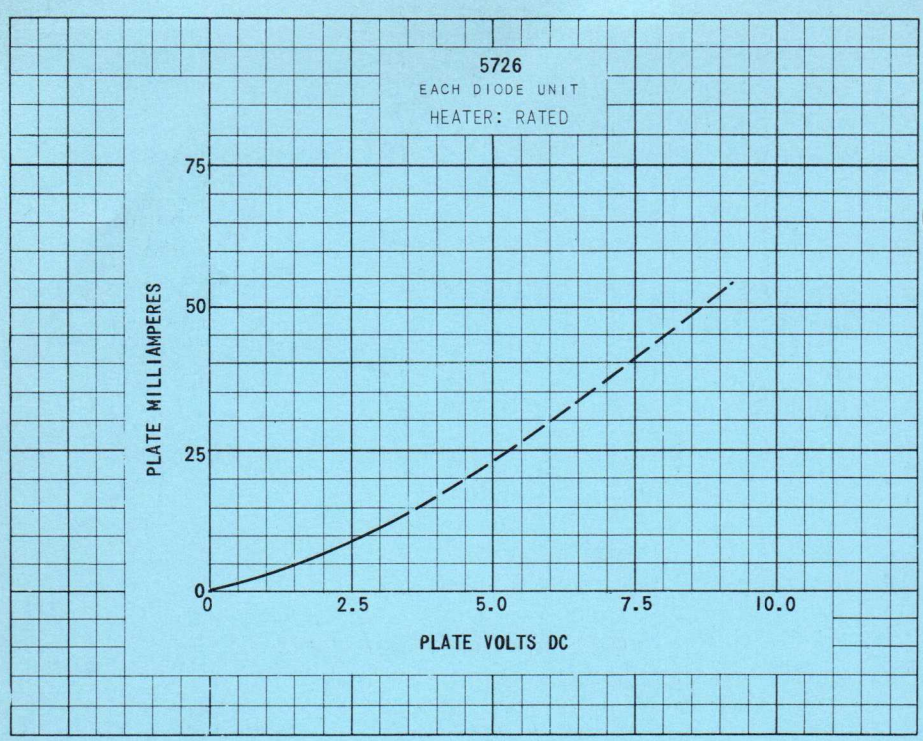
HALF-WAVE RECTIFIER

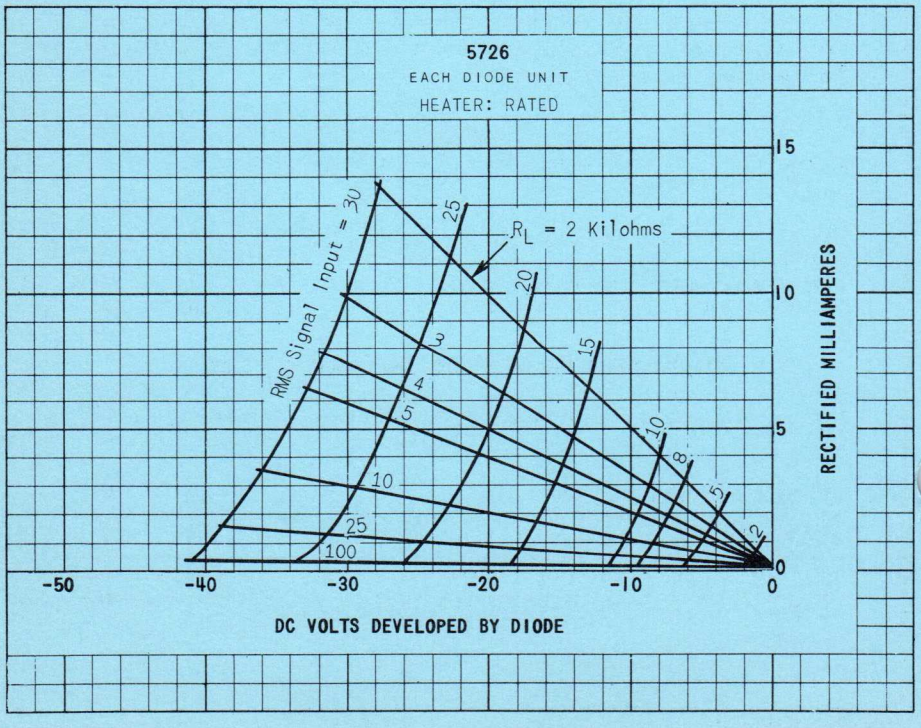
IN HALF-WAVE SERVICE THE TWO UNITS CAN BE USED SEPARATELY OR IN PARALLEL

AC PLATE VOLTAGE (PER PLATE) RMS	117	VOLTS
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE (PER PLATE)	300	OHMS
DC OUTPUT CURRENT (PER PLATE)	9	MA.
HEATER CYCLES OF INTERMITTENT OPERATION (MIN.)[C]	5 000	CYCLES

[C] THE 5726 HAS A HEATER WHICH IS DESIGNED TO WITHSTAND AT LEAST 3000 CYCLES OF INTERMITTENT OPERATION AT 7.5 VOLTS.

PRINTED IN U. S. A.


5726
EACH DIODE UNIT
HEATER: RATED
PLATE MILLIAMPERES
75
50
25
0
0
2.5
5.0
7.5
10.0
PLATE VOLTS DC


5726
EACH DIODE UNIT
HEATER: RATED
RECTIFIED MILLIAMPERES
15
10
5
0
RMS Signal Input = 30
25
20
15
10
8
5
2
R_L = 2 Kilohms
3
4
5
10
25
100
-50
-40
-30
-20
-10
0
DC VOLTS DEVELOPED BY DIODE

TUNG-SOL

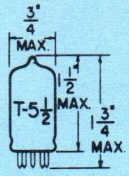
TWIN DIODE

MINIATURE TYPE

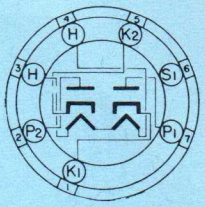
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.30 AMP
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6BT

THE 5726/6AL5W/6097 IS A RUGGEDIZED TWIN DIODE OF THE SEVEN PIN MINIATURE CONSTRUCTION. A SHIELD BETWEEN THE TWO DIODE SECTIONS IS BROUGHT OUT TO A SEPARATE BASE PIN, SO THAT ELECTRICALLY INDEPENDENT OPERATION WILL BE ASSURED. THIS IS USEFUL FOR GENERAL PURPOSE APPLICATIONS SUCH AS CLIPPER AND CLAMPER CIRCUITS, WHERE THE TWO SECTIONS MAY BE USED IN DIFFERENT PARTS OF THE OVERALL CIRCUITRY. ITS HIGH PERVEANCE PERMITS HIGH EFFICIENCY IN EITHER FM OR AM SERVICE, IN RATIO DETECTOR OR PHASE DISCRIMINATOR CIRCUITS. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5726/6AL5W/6097 IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD #316	
MAXIMUM PLATE #1 TO PLATE #2 (RATED)	.068	.026	μμf
PLATE TO (h+k+is+es) (RATED)	2.5	3.2	μμf
MAXIMUM	---	4.0	μμf
MINIMUM	---	2.4	μμf
CATHODE TO (h+p+is+es) (RATED)	3.9*	3.9	μμf
MAXIMUM	---	4.7	μμf
MINIMUM	---	3.1	μμf

* NOMINAL VALUE.

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	360	VOLTS
MAXIMUM PEAK DC PLATE CURRENT (EACH SECTION) [A]	60	mA
MAXIMUM DC OUTPUT CURRENT (EACH SECTION)	10	mA
MAXIMUM SURGE CURRENT (EACH SECTION)	350	mA
MAXIMUM HEATER CATHODE VOLTAGE	360	VOLTS
MAXIMUM BULB TEMPERATURE	165	°C

TYPICAL OPERATING CONDITIONS
HALF-WAVE RECTIFIER [B]

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.30	AMP.
AC PLATE VOLTAGE, PER PLATE (RMS)	117	VOLTS
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE, PER PLATE	300	OHMS
DC OUTPUT CURRENT, PER PLATE	9	mA
HEATER CYCLES OF INTERMITTENT OPERATION, MINIMUM	5000	CYCLES

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Ef = 6.3V, Epp/p = 165Vac, Rl = 11,000 OHMS, Cl = 8μf
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	---	---	275	325	mA
HEATER-CATHODE LEAKAGE (Ehk =± 100 Vdc)	---	±5	---	---	---	±10	μAdc
GRID EMISSION (1) (Eb = 10 Vdc)	40	---	---	---	35	---	mAdc
GRID EMISSION (2) [CD] (Eb = 7Vac)	---	15	---	---	---	15	PERCENT
OPERATION [EF]	16	---	---	---	---	---	mAdc
PLATE CURRENT (Ebb=0, Rp=40,000)	2	20	---	---	2	20	μAdc
PLATE CURRENT DIFFERENCE BETWEEN DIODES	---	5	---	---	---	---	μAdc
INSULATION OF ELECTRODES [G] (Ef=6.3V, E(p-all)=300Vdc, p NEGATIVE, E(sd-all)=300Vdc, sd NEGATIVE)							
R(p-all)	100	---	---	---	50	---	MEGOHMS
R(sd-all)	100	---	---	---	50	---	MEGOHMS

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION [H] (NO VOLTAGES)	---	---	
VIBRATIONAL FATIGUE [J]	---	---	
SHOCK [K] (HAMMER ANGLE = 48°, Epp/p=0)			
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
HEATER CATHODE LEAKAGE	---	±15	μAdc
OPERATION	14	---	mAdc
GLASS STRAIN [L]	---	---	
CONTINUITY AND SHORT [M]	---	---	
LOW PRESSURE VOLTAGE BREAKDOWN [N] (PRESSURE=55±5 mm MERCURY, TEMP. =25±5°C, HUMIDITY=0, VOLTAGE=500Vac, 60 CYCLES, SINUSOIDAL WAVEFORM)	500	---	Vac
HUM [P] (Ef = 7.0V)	---	10	mVac
1 HOUR STABILITY LIFE TEST INTERMITTENT LIFE TEST CONDITIONS	---	---	
STABILITY LIFE TEST END POINTS EMISSION [Q]	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT	---	---	
HEATER CYCLING LIFE TEST [R] (Ef=7.5V, Ehk=135Vdc, HEATER POSITIVE, Epp=0)	---	---	
HEATER CYCLING LIFE TEST END POINTS [S] HEATER-CATHODE LEAKAGE	---	±20	μAdc
INTERMITTENT LIFE TEST [TU] (MIN. BULB TEMP. =+165°C)	---	---	

NOTES

[A] DIFFICULTY MAY BE ENCOUNTERED IF THIS TUBE IS OPERATED FOR LONG PERIODS OF TIME WITH VERY SMALL VALUES OF CATHODE CURRENT.

[B] IN HALF-WAVE SERVICE THE TWO UNITS CAN BE USED SEPARATELY OR IN PARALLEL.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES -CONT'D.

C READINGS AT E_f=5.7V ARE MADE WITH E_b=7.0V.
THE VALUE OF EMISSION (2) SHALL APPLY TO INDIVIDUAL TUBES AS IS EXPRESSED:

MADE WITH E_b=7.0V. $\frac{(Is \text{ AT } 6.3)-(Is \text{ AT } 5.7)}{(Is \text{ AT } 6.3)} \times 100$

D SEE MIL-E-1C 4.10.1.1

E SEE MIL-E-1C 4.10.13

F IN A FULL-WAVE CIRCUIT, ADJUST Zp/p SO THAT A BOGIE TUBE GIVES I_o=18mAdc AND I_b NOT LESS THAN 50 MA PER PLATE. A BOGIE TUBE HAS A TUBE DROP OF E_{td}=10Vdc, AT I_s=60mAdc PER PLATE. $E_{hk}=E_o+117$ Vac.

G SEE MIL-E-1C 4.8.2

H SEE MIL-E-1C 4.9.20.3

J SEE MIL-E-1C 4.9.20.6

K SEE MIL-E-1C 4.9.20.5

L GLASS STRAIN CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0°C±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST 2 LITERS PER FIFTEEN TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THE TEST.

M SEE MIL-E-1C 4.7.5

N BREAKDOWN SHALL BE DEFINED AS THAT VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

P THE TEST CIRCUIT TO BE USED IS SHOWN SCHEMATICALLY IN FIGURE #1.

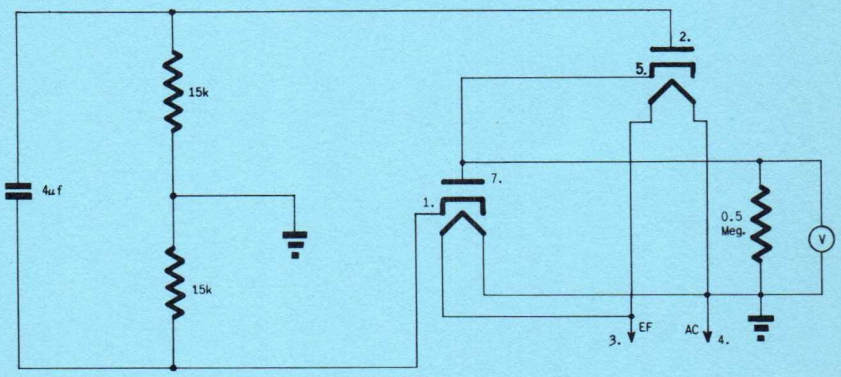


Figure 1.

Pin numbers for the element connections are indicated.

Q THE VALUE OF EMISSION SHALL BE MEASURED AT CONDITION E_b=7.0V FOR INITIAL AND TERMINAL READINGS.

R SEE MIL-E-1C 4.11.7

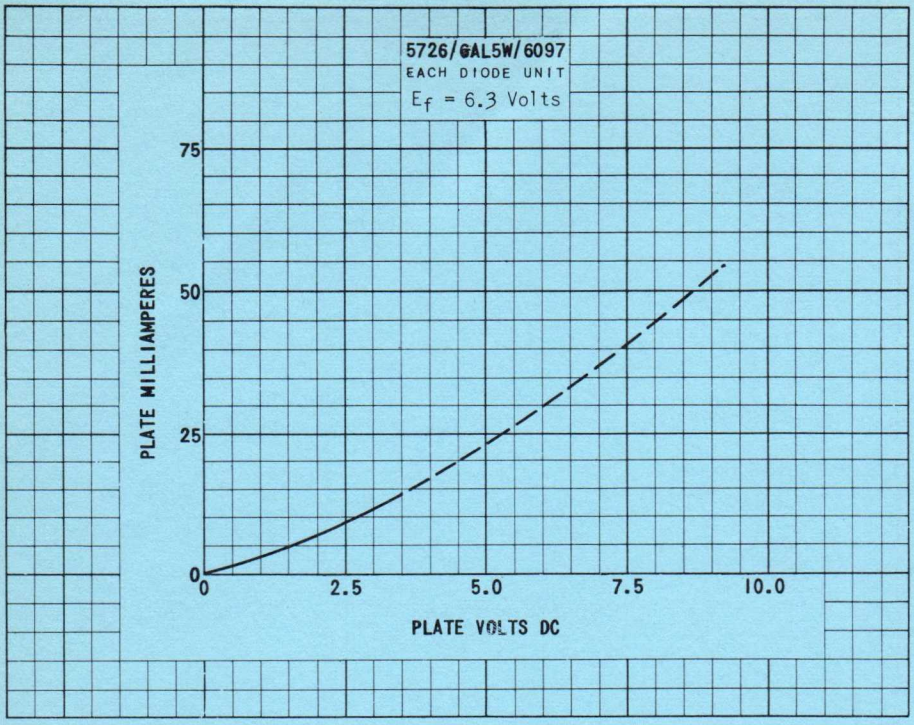
S SEE MIL-E-1C 4.11.4

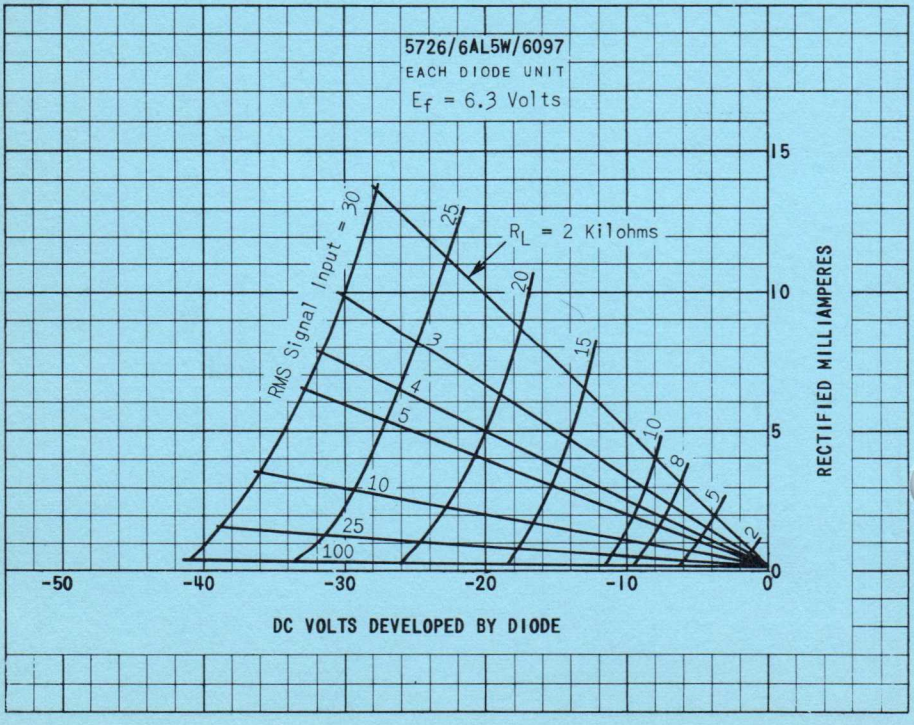
T SEE MIL-E-1C 4.11.5

U $E_{hk}=E_o+117$vac. IN A FULL-WAVE LIFE TEST CIRCUIT, THE VALUES SPECIFIED FOR RL AND CL MAY BE CONSIDERED AS APPROXIMATE AND SHALL BE ADJUSTED INITIALLY TO GIVE NOT LESS THAN I_O = 18 mAdc AND i_b = 50 MA WITH A BOGIE TUBE.

PRINTED IN U.S.A.

5726/6AL5W/6097
PREMIUM TUBE

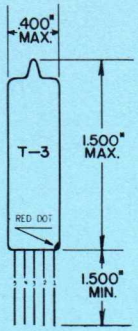




TUNG-SOL

TRIODE

SUBMINIATURE TYPE

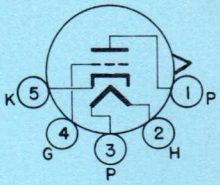


GLASS BULB
COLOR DOT IS ADJACENT TO LEAD 1
IN-LINE LEADS

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 200 MA.
AC OR DC

ANY MOUNTING POSITION



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

THE 5744 IS A HIGH-MU TRIODE, SUITABLE FOR SERVICE AS A HIGH FREQUENCY CONVERTER OR OSCILLATOR UP TO SEVERAL HUNDRED MEGACYCLES. IT IS ALSO USEFUL IN GENERAL PURPOSE AUDIO FREQUENCY VOLTAGE AMPLIFIER SERVICE. 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 SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE	0.80	0.83	pf
GRID TO CATHODE	2.7	2.6	pf
PLATE TO CATHODE	2.4	0.90	pf

[A] WITH A CYLINDRICAL SHIELD (0.40" I.D. - 1 7/8" LONG) CONNECTED TO LEAD 5.

RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

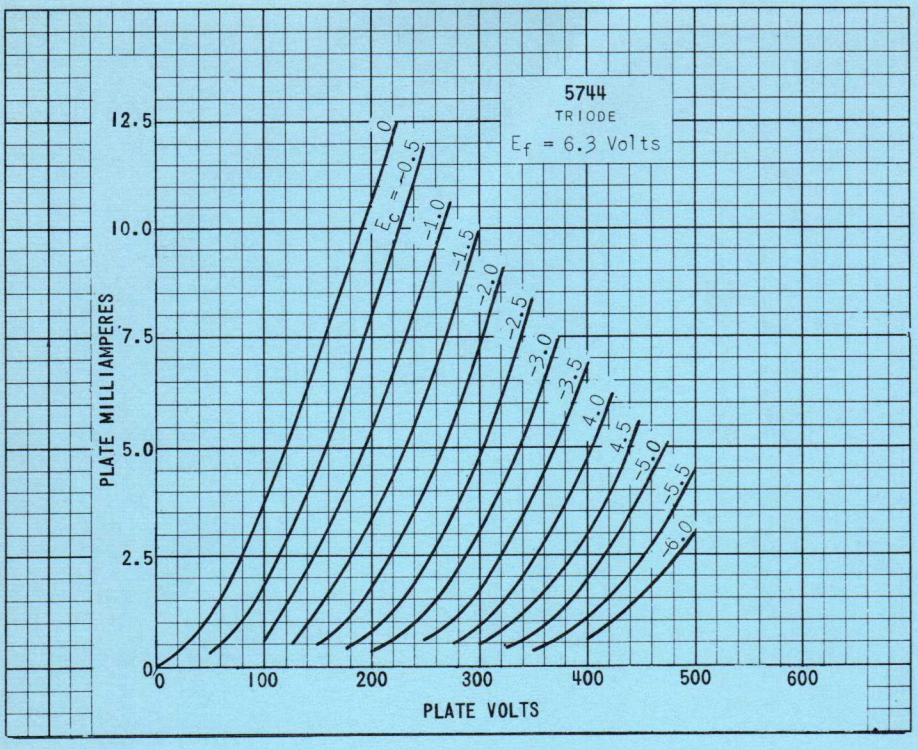
MAXIMUM PLATE VOLTAGE	250	VOLTS

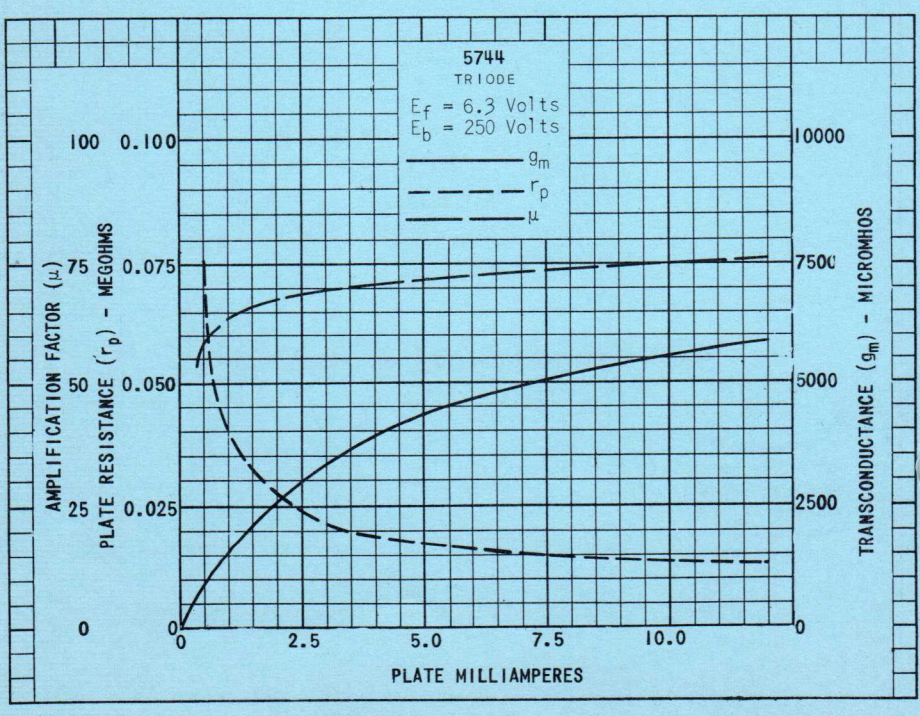
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
CATHODE BIAS RESISTANCE	500	OHMS
PLATE RESISTANCE	17500	OHMS
AMPLIFICATION FACTOR	70	
TRANSCONDUCTANCE	4 000	µMHOS
PLATE CURRENT	4	MA.

PRINTED IN U. S. A.

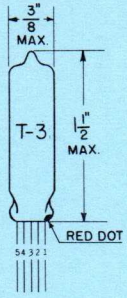

5744
TRIODE
E_f = 6.3 Volts
0
E_c = -0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-5.5
-6.0
PLATE MILLIAMPERES
12.5
10.0
7.5
5.0
2.5
0
0
100
200
300
400
500
600
PLATE VOLTS


5744
TRIODE
E_f = 6.3 Volts
E_b = 250 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
100
75
50
25
0
0.100
0.075
0.050
0.025
0
10000
7500
5000
2500
0
0
2.5
5.0
7.5
10.0
PLATE MILLIAMPERES

TUNG-SOL

TRIODE

SUBMINIATURE TYPE

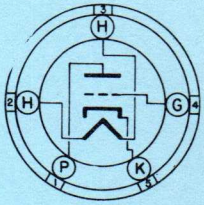


GLASS BULB

DOT IS ADJACENT TO LEAD 1

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS

0.048" CENTER-TO-CENTER

THE 5744WB IS A HEATER-CATHODE TYPE HIGH-MU TRIODE OF SUBMINIATURE CONSTRUCTION CAPABLE OF OPERATION AS A FREQUENCY CONVERTER OR OSCILLATOR IN THE UHF REGION. IT IS ALSO USEFUL IN GENERAL PURPOSE AUDIO FREQUENCY VOLTAGE AMPLIFIER SERVICE. IT IS DESIGNED FOR SERVICE WHERE SEVERE CONDITIONS OF HIGH TEMPERATURE AND MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD INLINE SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE-NOTE 5)	2.5	G
MAXIMUM BULB TEMPERATURE	220	°C

RATINGS AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MIN.	NORMAL TEST CONDITIONS NOTE 7	NORMAL OPERATION NOTE 6	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 8)	Ef:	5.7	6.3	6.3	6.9	VOLTS
PLATE VOLTAGE	Eb:	---	250	250	275	vdc
GRID #1 VOLTAGE	Ec1:	-55	0	0	---	vdc
PLATE DISSIPATION	Pp:	---	---	1.1	1.3	W
HEATER-CATHODE VOLTAGE	Ehk:	-200	---	100	+200	VOLTS
PLATE CURRENT	Ib:	---	---	4.2	6.5	mAdc
CATHODE RESISTANCE	Rk:	---	500	500	---	OHMS
GRID CIRCUIT RESISTANCE	Rg:	---	---	---	1.2	MEGOHMS
GRID CURRENT	Ic:	---	---	---	1.0	mAdc
TRANSCONDUCTANCE (1):	Sm(1):	---	---	4000	---	μMHOS
AMPLIFICATION FACTOR	Mu:	---	---	70	---	---

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS[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 MECHANICAL AND INOPERATIVES								
HEATER CURRENT:	0.65	If:	190	---	200	---	210	---	mA
HEATER-CATHODE LEAKAGE: Ehk=-100Vdc; Ehk =+100 Vdc	0.65	Ihk:	---	---	---	---	5	---	μAdc
GRID CURRENT	0.65	Ic(1):	---	---	---	---	-0.3	---	μAdc
PLATE CURRENT (1):	0.65	Ib(1):	3.2	3.7	4.2	4.7	5.2	1.2	mAdc
PLATE CURRENT (2): Ec1 =-6.5 Vdc	0.65	Ib(2):	---	---	---	---	50	---	μAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	3400	3700	4000	4300	4600	660	μMHOS
AC AMPLIFICATION: Esig=0.2 Vac; Ebb=100 Vdc; Ecc=0; Rg1=10 MEG; Rk=0; Rp =0.5 MEG.	0.65	Ep:	6.5	---	---	---	---	---	Vac
CONTINUITY AND SHORTS (INOPERATIVES:)	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE (8-7)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS PART 2									
INSULATION OF ELECTRODES: Ef=6.3V. Eg-all =-100 Vdc	2.5	R_{g1-all}:	100	---	---	---	---	---	MEG.
Ep-all=-300 Vdc PL	2.5	R_{p-all}:	100	---	---	---	---	---	MEG.
PLATE CURRENT (3) Ec1=-4.0 Vdc	2.5	Ib(3):	5	---	---	---	---	---	μAdc
TRANSCONDUCTANCE (2): Ef =5.7 V.	2.5	Δ_{Ef} Sm(2):	---	---	---	---	5	---	PERCENT
GRID EMISSION: Ef=7.5V;Rg=1.0MEG. PREHEAT 5 MINUTES AT Ec1=0; TEST AT Ec1=-10 Vdc	2.5	Ic(2):	---	---	---	---	-0.4	---	μAdc
AF NOISE: Esig=50 mVac;Rg=1.0 MEG; Rp=0.2MEG.	2.5	EB:	---	---	---	---	17	---	VU
AMPLIFICATION FACTOR	6.5	Mu:	60	65	70	75	80	7	---
CAPACITANCE:		Cgp:	0.65	---	0.8	---	0.95	---	μμf
CAPACITANCE:(NOTE 2)	6.5	Cin:	2.0	---	2.7	---	3.4	---	μμf
CAPACITANCE:		Cout:	1.6	---	2.3	---	3.0	---	μμf
LOW PRESSURE VOLTAGE BREAKDOWN: PRESSURE =55±5 mm Hg: VOLTAGE =300 Vac	6.5	---	---	---	---	---	---	---	---

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOGIE	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 2 - cont'd.									
		COMBINED AQL = 1.0% EXCLUDING MECHANICAL AND INOPERATIVES							
OPERATION TIME (NOTE 10)	4.0	t:	---	---	---	---	20	---	SEC.
VIBRATION (2): F = 40 cps; G = 15; Rp = 10,000 OHMS	2.5	Ep:	---	---	---	---	15	---	mVac.
VIBRATION (3): Rp = 10,000 OHMS; F = 30 -1000 cps; G = 15; POSITION X_1 AND X_2 ONLY.	4.0	ep:	---	---	---	---	75 PEAK TO PEAK	---	mv
DEGRADATION RATE ACCEPTANCE TESTS									
SUBMINIATURE LEAD FATIGUE:	2.5	---	4.0	---	---	---	---	---	arcs
SHOCK (1): HAMMER ANGLE = 30°; Ehk = +100 Vdc; Rg1 = 0.1 MEG.; (NOTE 3)	20	---	---	---	---	---	---	---	----
FATIGUE (1): 96 HOURS; G = 2.5; FIXED FREQUENCY; F = 25 MIN. 60 MAX. (NOTE 5)	6.5	---	---	---	---	---	---	---	----
FATIGUE (2): 6 HOURS; G = 10; FIXED FREQUENCY; F = 25 MIN. 60 MAX. (NOTE 11)	6.5	---	---	---	---	---	---	---	----

	ALLOWABLE DEFECTS PER CHARACTERISTIC 1st SAMPLE	ALLOWABLE DEFECTS PER CHARACTERISTIC COMBINED SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS
POST SHOCK (1) AND FATIGUE TESTS (1) AND (2) END POINTS; VIBRATION (2): F = 40 cps; G = 15; Rp = 10,000 OHMS			---	Ep:	---	25	mVac
HEATER-CATHODE LEAKAGE: Ehk = ± 100 Vdc			---	Ihk;	---	10	μAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES; Ef = 6.3 VOLTS			---	Δ_tSm(1):	---	10	PERCENT
GRID CURRENT (1):			---	Ic:	---	-1.0	μAdc

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

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

TEST	ALLOWABLE DEFECTS PER CHARACTERISTIC 1st SAMPLE	ALLOWABLE DEFECTS PER CHARACTERISTIC COMBINED SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS - cont'd.							
SHOCK (3): 75G; (HAMMER ANGLE= 120°+RUBBER PAD); t= 10 MILLISEC. (NOTE 12) Ehk =+100 Vdc; Rg1= 0.1 MEG.			20	---	---	---	-----
POST SHOCK TEST (2) END POINTS: VIBRATION (2): F=40 cps; G=15; Rp = 10,000 OHMS			---	Ep:	---	25	mVac
HEATER-CATHODE LEAKAGE: Ehk=±100 Vdc			---	Ihk:	---	10	μAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:: Ef =6.3 VOLTS			---	Δ_tSm(1):	---	10	PERCENT
GRID CURRENT			---	Ic:	---	-1.0	μAdc
GLASS STRAIN (THERMAL SHOCK)			6.5	---	---	---	---
ACCEPTANCE LIFE TESTS							
HEATER CYCLING LIFE TEST: Ef = 7.5 V; Eb = Ec1 =0V; Ehk =140 Vac; 1 MIN. ON, 1 MIN. OFF			1.0	---	2000	---	CYCLES
HEATER CYCLING LIFE TEST END POINTS; HEATER-CATHODE LEAKAGE: Ehk =±100 Vdc			---	Ihk:	---	20	μAdc
1 HOUR STABILITY LIFE TEST: TA = ROOM; Ehk=+200 Vdc; Rg1 = 1.0 MEG.			---	---	---	---	-----
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=+200 Vdc; Rg= 1.0 MEG.			---	---	---	---	-----

CONTINUED ON FOLLOWING PAGE

CONTINUED ON FOLLOWING PAGE

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

TEST	ALLOWABLE DEFECTS PER CHARACTERISTIC 1st SAMPLE	COMBINED SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TEST - cont'd.							
100 HOUR SURVIVAL RATE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 200 TUBES)			---	---	---	---	---
INOPERATIVES:			0.65	---	---	---	---
TRANSCONDUCTANCE (1):			1.0	Sm(1):	3800	---	μMHOS
INTERMITTENT HIGH TEMPERATURE LIFE TEST: T BULB = 220 °C; Ehk = +200 Vdc; Rg = 1.0 MEG.			---	---	---	---	---
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE, 40 TUBES 2nd SAMPLE)			---	---	---	---	---
INOPERATIVES:	1	3	---	---	---	---	---
GRID CURRENT (1):	1	3	---	Ic(1):	---	-0.6	μAdc
HEATER CURRENT:	1	3	---	If:	180	220	mA.
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:	1	3	---	Δ_tSm(1):	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	2	5	---	Δ_{Ef}Sm(2):	---	15	PERCENT
HEATER-CATHODE LEAKAGE: Ehk = ±100 Vdc	2	5	---	Ihk:	---	10	μAdc
INSULATION OF ELECTRODES:							
g1 - all	2	5	---	Rg1-all:	50	---	MEG.
p- all	2	5	---	Rp-all:	50	---	MEG.
TRANSCONDUCTANCE (1) AVERAGE CHANGE:	---	---	---	Avg.Δ_t Sm(1):	---	15	PERCENT
TOTAL DEFECTIVES:	4	8	---	---	---	---	---
1000 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE, 40 TUBES 2nd SAMPLE)	---	---	---	---	---	---	---
INOPERATIVES;	2	5	---	---	---	---	---
GRID CURRENT (1):	2	5	---	Ic(1):	---	-1.0	μAdc
HEATER CURRENT:	2	5	---	If:	177	223	mA
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:	2	5	---	Δ_tSm(1):	---	30	PERCENT
HEATER-CATHODE LEAKAGE: Ehk = ±100 Vdc	2	5	---	Ihk:	---	15	μAdc
TOTAL DEFECTIVES:	5	10	---	---	---	---	---

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

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 A CYLINDRICAL SHIELD (0.405" I.D.-1 7/8" LONG) CONNECTED TO LEAD 5.

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

4 CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

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

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

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

8 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.

9 CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef = 6.3 V TO THAT VALUE MEASURED AT Ef = 5.7 V.

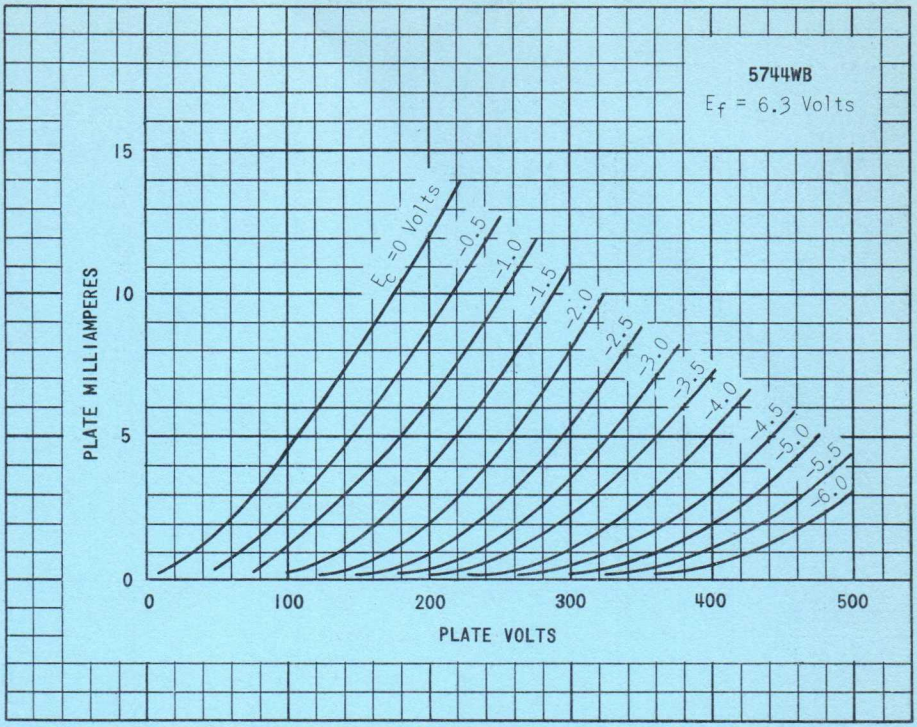
10 OPERATION TIME IS THE TIME IN SECONDS REQUIRED FOR THE PLATE CURRENT TO ATTAIN A VALUE WITHIN PLUS OR MINUS 10% OF THE THREE MINUTE PLATE CURRENT (1) VALUE. NO PREHEATING BEFORE THIS TEST WILL BE ALLOWED.

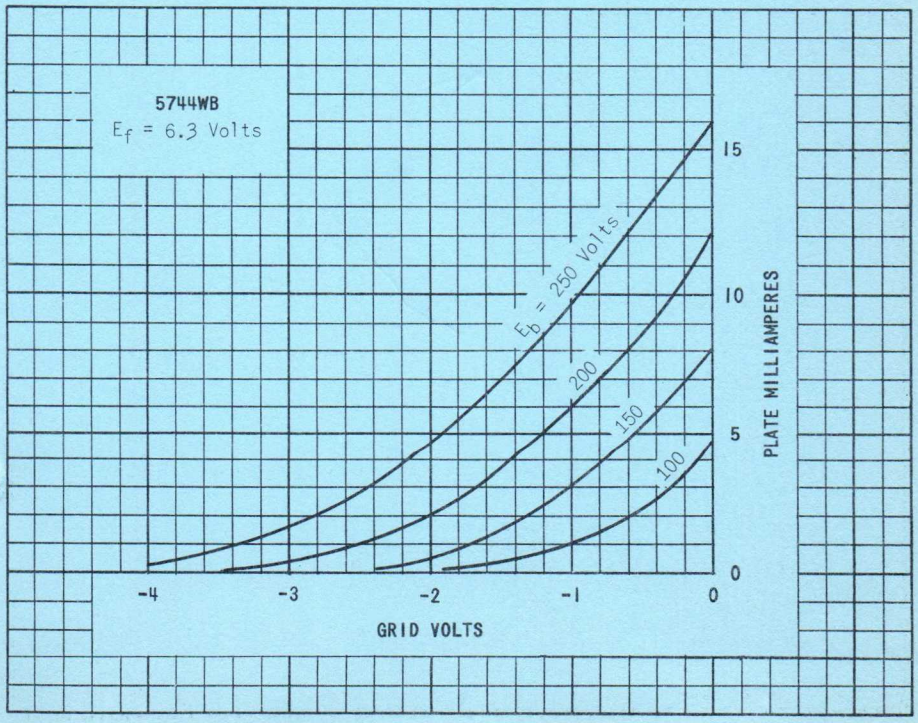
11 THE TUBES SHALL BE RIGIDLY MOUNTED ON A TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TUBES SHALL BE VIBRATED FOR A TOTAL OF 6 HRS, 2HRS IN EACH OF THREE POSITIONS, X1, X2, Y1. ONLY RATED HEATER VOLTAGE SHALL BE APPLIED. TUBES WHICH SHOW ONE OR MORE OF THE FOLLOWING DEFECTS SHALL BE CONSIDERED FAILURES:

(A) TUBES WHICH SHOW PERMANENT OR TAP SHORTS OR OPEN CIRCUITS FOLLOWING FATIGUE TEST, WHEN TESTED AS SPECIFIED IN PARAGRAPH 4.7.2 AND 4.7.3 OF SPECIFICATION MIL-E-1.

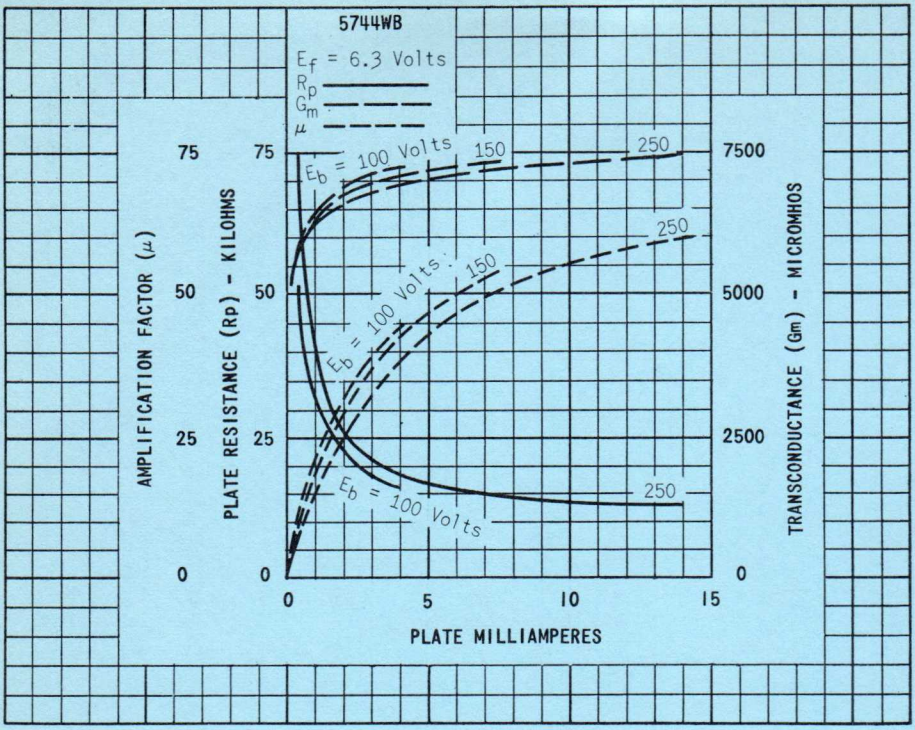
(B) TUBES WHICH DO NOT COMPLY WITH POST FATIGUE LIMITS. THIS IS DESTRUCTIVE TEST.

12 THE PROVISIONS OF PARAGRAPH 4.9.20.5 OF SPECIFICATION MIL-E-1 SHALL APPLY, EXCEPT FOR TEST CONDITIONS LISTED FOR SHOCK TEST (2).

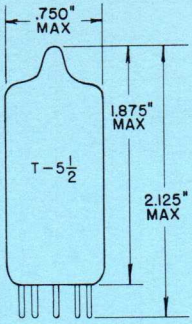




PRINTED IN U. S. A.


5744WB
E_f = 6.3 Volts
R_p
G_m
μ
E_b = 100 Volts
150
250
E_b = 100 Volts
150
250
E_b = 100 Volts
250
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (R_p) - KILOHMS
TRANSCONDUCTANCE (G_m) - MICROMHOS
PLATE MILLIAMPERES
0
25
50
75
0
5
10
15
2500
5000
7500

TUNG-SOL



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

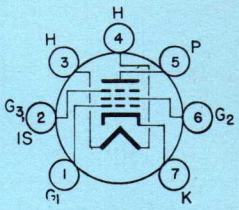
PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BK

THE 5749 IS A MINIATURE REMOTE CUT-OFF AMPLIFIER PENTODE INTENDED FOR USE AS A RADIO FREQUENCY OR INTERMEDIATE FREQUENCY AMPLIFIER. IT IS DESIGNED FOR RELIABLE LIFE UNDER CONDITIONS OF INTERMITTENT OPERATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE (MAX.)	0.0035	0.0035	pf
INPUT	5.5	5.5	pf
OUTPUT	5.5	5.0	pf

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

RATINGS

DESIGN CENTER VALUES

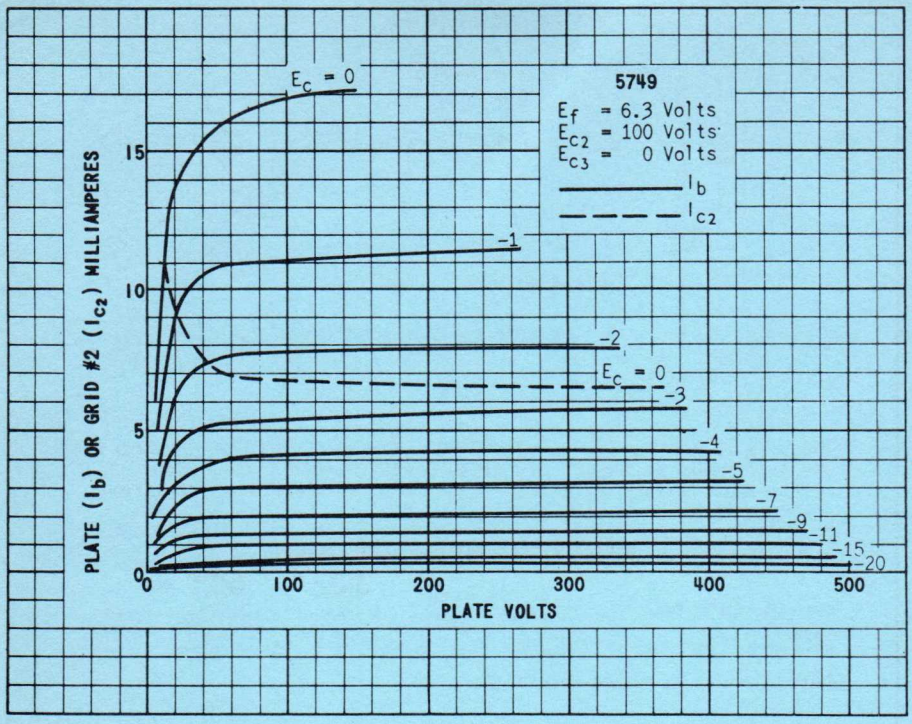
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM POSITIVE GRID #1 BIAS VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE GRID #1 BIAS VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATTS

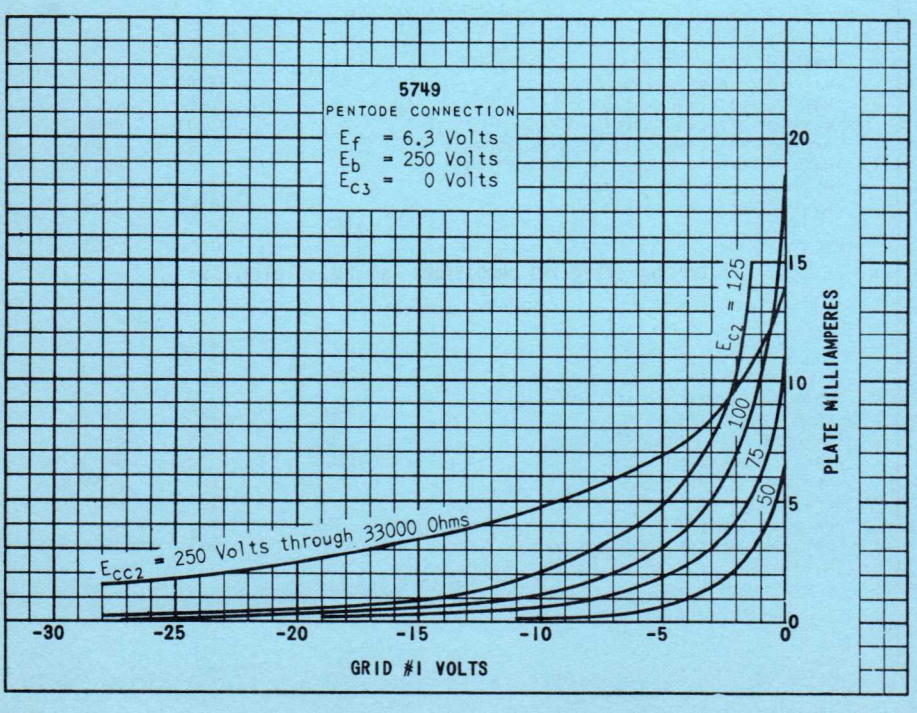
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

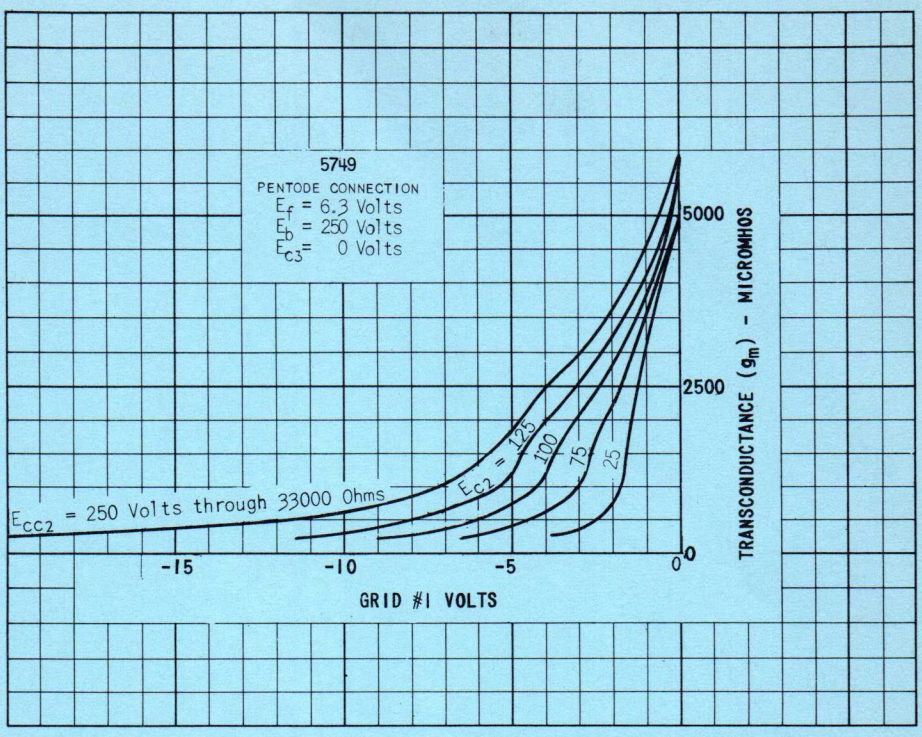
CLASS A_1 AMPLIFIER

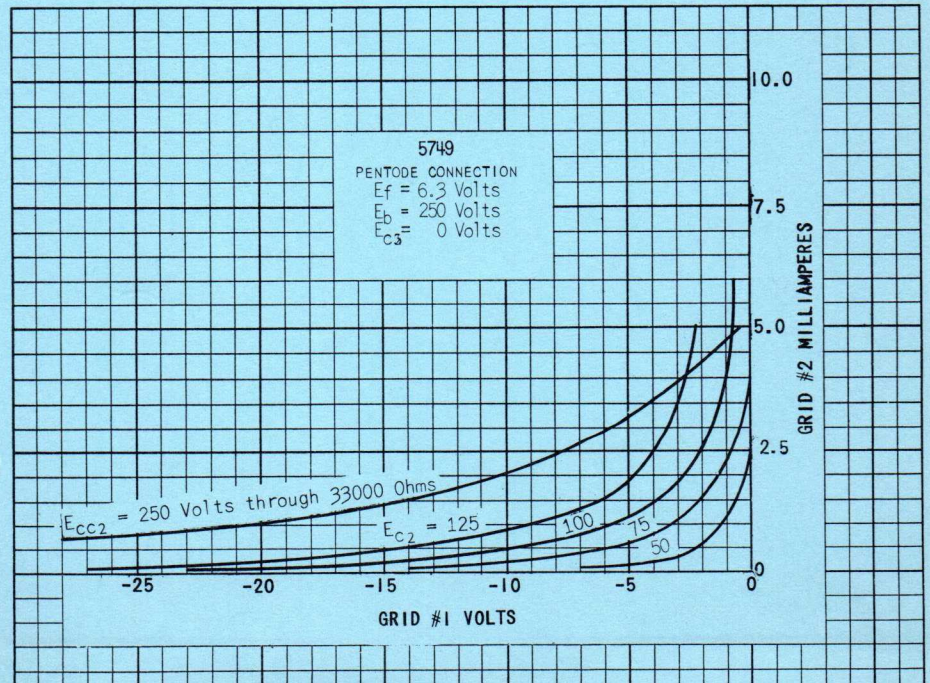
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE	100	100	VOLTS
CATHODE BIAS RESISTOR	68	68	OHMS
TRANSCONDUCTANCE	4,300	4 400	µMHOS
PLATE RESISTANCE (APPROX.)	0.25	1.0	MEGOHM
PLATE CURRENT	10.8	11.0	MA.
GRID #2 CURRENT	4.4	4.2	MA.
GRID #1 VOLTAGE FOR G_m = 40 µMHOS	-20	-20	VOLTS.

PRINTED IN U.S.A.


5749
E_f = 6.3 Volts
E_{c2} = 100 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_c = 0
-1
-2
E_c = 0
-3
-4
-5
-7
-9
-11
-15
-20
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
5
10
15
0
100
200
300
400
500


5749
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c3} = 0 Volts
E_{c2} = 125
100
75
50
E_{cc2} = 250 Volts through 33000 Ohms
PLATE MILLIAMPERES
GRID #1 VOLTS
0
5
10
15
20
-30
-25
-20
-15
-10
-5
0





PRINTED IN U.S.A.

TUNG-SOL

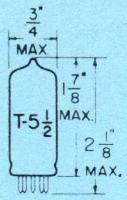
PENTODE

MINIATURE TYPE

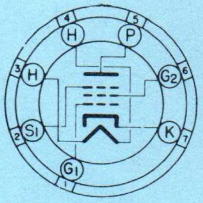
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BK

THE 5749/6BA6W IS A RUGGEDIZED, REMOTE CUT-OFF PENTODE VOLTAGE AMPLIFIER OF THE SEVEN PIN MINIATURE CONSTRUCTION. IT HAS EXTREMELY LOW GRID-PLATE CAPACITANCE AND HIGH TRANSCONDUCTANCE TO PERMIT EFFICIENT OPERATION IN SUCH APPLICATIONS AS RF AND IF AMPLIFIERS. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS HEATER CURRENT, PLATE CURRENT, SCREEN GRID CURRENT AND TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5749/6BA6W IS ESPECIALLY SUITED FOR USE IN MILITARY OR INDUSTRIAL AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315	WITHOUT SHIELD	
MAXIMUM GRID #1 TO PLATE (RATED)	.0035	.0035	µµf
INPUT (RATED)	5.5	5.5	µµf
MAXIMUM	---	6.6	µµf
MINIMUM	---	4.4	µµf
OUTPUT (RATED)	5.5	5.0	µµf
MAXIMUM	---	6.5	µµf
MINIMUM	---	3.5	µµf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	150	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

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE		6.3		VOLTS
HEATER CURRENT		0.3		AMP.
PLATE VOLTAGE	100		250	VOLTS
GRID #3 VOLTAGE	0		0	VOLTS
SCREEN GRID VOLTAGE	100		100	VOLTS

CONTINUED ON FILLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS — CONT'D.

CLASS A_1 AMPLIFIER

CATHODE BIAS RESISTOR	68	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	1.0	MEGOHM
TRANSCONDUCTANCE	4300	4400	μMHOS
PLATE CURRENT	10.8	11.0	mA
SCREEN CURRENT	4.4	4.2	mA
GRID #1 VOLTAGE, Gm = 40 μMHOS	−20	−20	VOLTS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V, E_b = 250Vdc, E_{c1} = 0Vdc, E_{c2} = 100Vdc, R_k[A] = 680OHMS, E_{c3}[B]

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	275	325	289	311	275	325	mA
HEATER CATHODE—LEAKAGE (E_{hk} = ±100 Vdc)	---	10	---	3	---	10	μAdc
GRID CURRENT (E_{c1}=−1.0Vdc, R_{g1}=0.25MEG)	---	−1.0	---	−0.2	---	−1.0	μAdc
PLATE CURRENT	8.5	13.5	9.4	12.6	---	---	mAdc
TRANSCONDUCTANCE (1)	3600	5200	3910	4890	3000	5200	μMHOS
INSULATION OF ELECTRODES[C] (E_f = 6.3V, E(g1−all)= −100Vdc, E(p−all)= −300Vdc)							
R(g1−all)	100	---	---	---	50	---	MEGOHMS
R(p −all)	100	---	---	---	50	---	MEGOHMS
SCREEN CURRENT	---	5.6	---	5.0	---	---	mAdc
TRANSCONDUCTANCE (2)[D] (E_f = 5.5V)	3100	---	3560	---	---	---	μMHOS
Δ AVERAGE TRANSCONDUCTANCE (1)	---	---	---	---	---	17	PERCENT
TRANSCONDUCTANCE (3) (E_{c1} =−20Vdc, R_k =0, C_k =0)	5	100	20	60	---	---	μMHOS
GRID EMISSION[E] (E_f =7.5V, E_{c1}=−25Vdc, R_{g1} =0.5 MEG, R_k =0, C_k = 0)	---	−1.0	---	---	---	---	μAdc

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[F] (R_p = 2000)	---	400	mVac
VIBRATIONAL FATIGUE[G]	---	---	
MINIATURE TUBE BASE STRAIN[H] (NO VOLTAGES)	---	---	
STABILIZATION[J] (INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT)	---	---	
SHOCK[K] (HAMMER ANGLE = 30°, E_{hk} = 100Vdc, R_{g1} =0.1 MEG., C_k =0)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
GRID CURRENT	---	−2.0	μAdc
HEATER−CATHODE LEAKAGE	---	30	μAdc
LOW FREQUENCY VIBRATION	---	450	mVac
TRANSCONDUCTANCE (1)	3000	---	μMHOS
SHORT AND CONTINUITY[L]	---	---	
RF NOISE[M] (E_{sig} = 15mVac, C_k= 0.2 μf)	---	---	

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

SPECIAL REQUIREMENTS - CONT'D.

	MIN.	MAX.	
NOISE AND MICROPHONICS[N] (E_f=6.3Vdc, E_{bb}=E_{cc2}=300Vdc, E_{ca1}=200mVac, R_p=10,000, R_k=200, R_{g2}=60,000, C_{g2}=2μf)	---	200	mVac
LOW FREQUENCY VIBRATION[O] (R_p = 2000)	---	300	mVac
INTERMITTENT LIFE TEST (E_b=300Vdc, E_{c2}=150Vdc, E_{hk}=135, R_{g1}=0.25MEG. R_k=230, C_k=0)	---	---	
HEATER CYCLING LIFE TEST (E_f=7.5V, E_b=E_{c1}=E_{c2}=E_{c3}=0, E_{hk}=135Vdc)	2000	---	CYCLES
HEATER CYCLING LIFE TEST END POINTS HEATER-CATHODE LEAKAGE	---	20	μAdc

NOTES

[A] THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS AT 60 CYCLES.

[B] TIE GRID #3 TO THE NEGATIVE TERMINAL OF THE CATHODE RESISTOR.

[C] SEE MIL-E-1C 4.8.2

[D] PREHEAT ALL TUBES TO BE TESTED FOR TRANSCONDUCTANCE (2) UNDER THE FOLLOWING CONDITIONS FOR A PERIOD OF 5 MINUTES PRIOR TO TESTING. E_f=5.5V, E_b=250Vdc, E_{c1}=E_{c3}=0, E_{c2}=100Vdc, R_k=68, R_{g1}=0.5MEG.

[E] PREHEAT ALL TUBES TO BE TESTED FOR GRID EMISSION UNDER THE FOLLOWING CONDITIONS FOR A PERIOD OF 5 MINUTES PRIOR TO TESTING. E_f=7.5V, E_b=250Vdc, E_{c1}=E_{c3}=0, E_{c2}=100Vdc, R_k=68, R_{g1}=0.5MEG. TWO SECONDS SHALL BE THE MAXIMUM TIME BETWEEN PREHEAT AND TEST.

[F] SEE MIL-E-1C 4.9.20.3

[G] SEE MIL-E-1C 4.9.20.6

[H] SEE MIL-E-1C 4.9.6.1

[J] SEE MIL-E-1C 4.7.5

[K] SEE MIL-E-1C 4.9.20.5

[L] SEE MIL-E-1C 4.7.5

[M] SEE MIL-E-1C 4.10.3.1

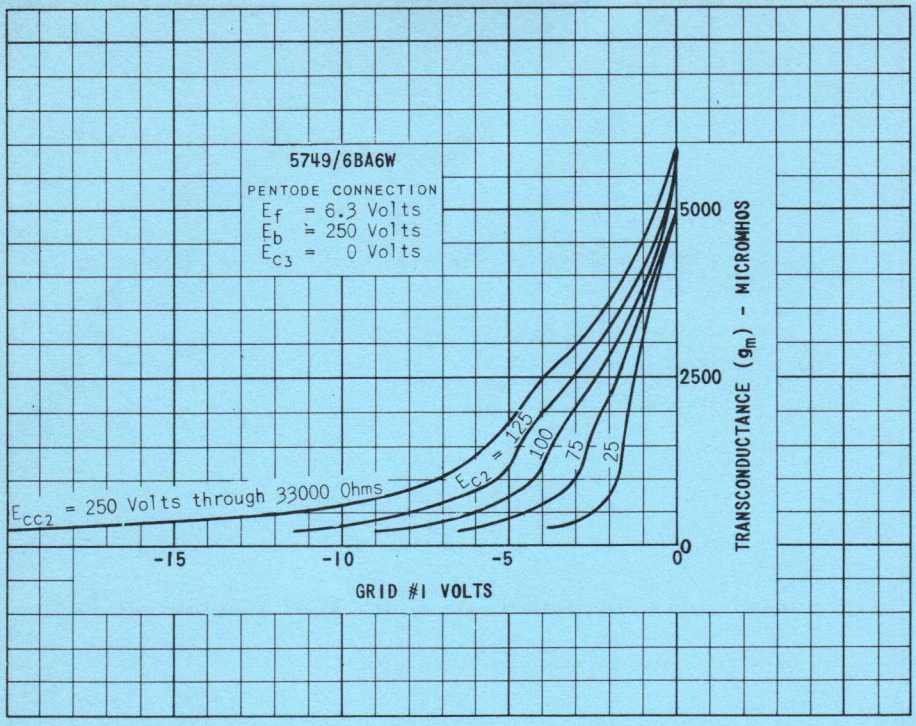
[N] SEE MIL-E-1C 4.10.3.5

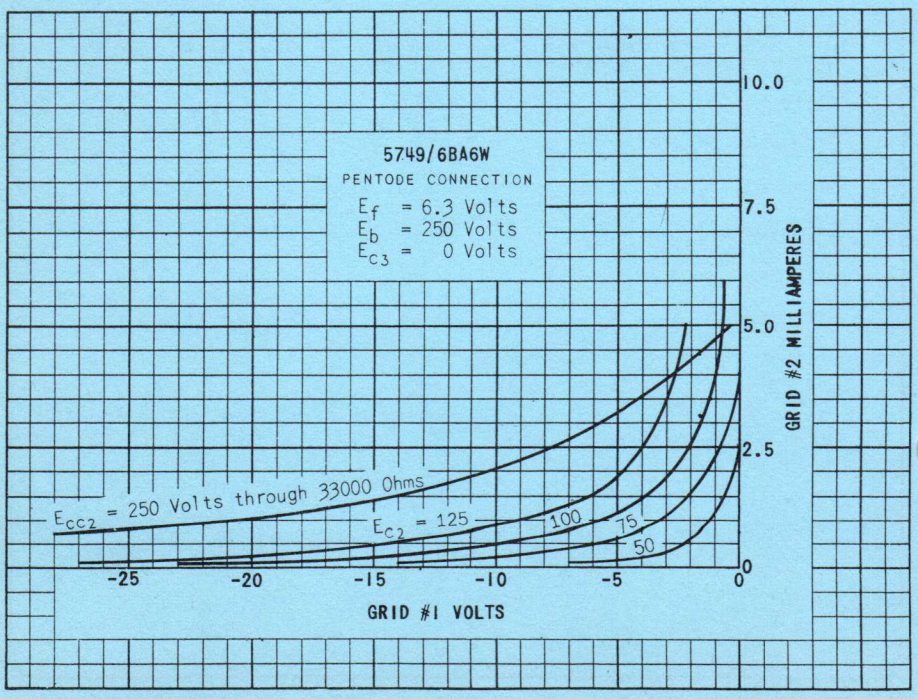
[O] SEE MIL-E-1C 4.9.20.4

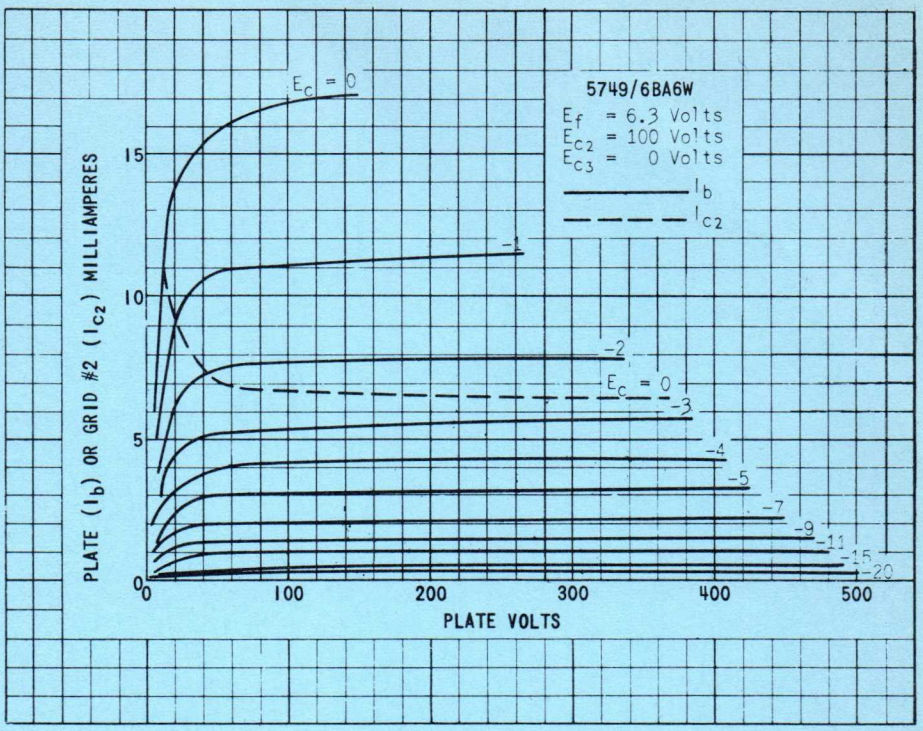
PRINTED IN U.S.A.

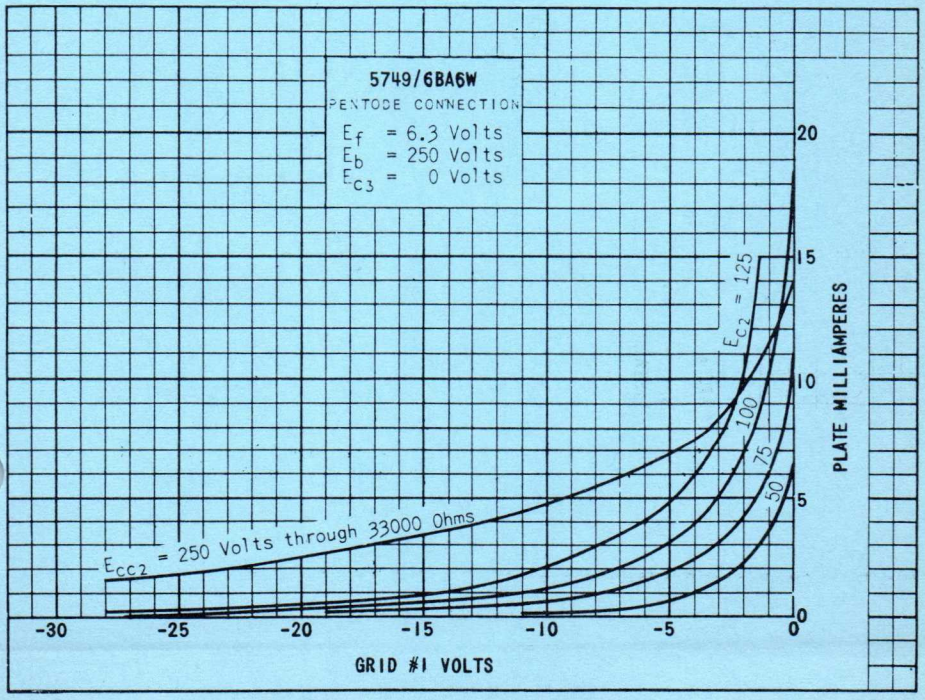
5749/6BA6W

PREMIUM TUBE





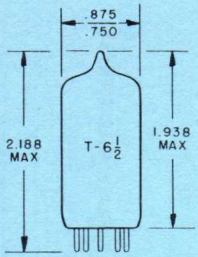

5749/6BA6W
Ef = 6.3 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
Ib
Ic2
Ec = 0
-1
-2
-3
-4
-5
-7
-9
-11
-15
-20
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
5
10
15
100
200
300
400
500


5749/6BA6W
PENTODE CONNECTION
Ef = 6.3 Volts
Eb = 250 Volts
Ec3 = 0 Volts
Ec2 = 125
100
75
50
Ecc2 = 250 Volts through 33000 Ohms
PLATE MILLIAMPERES
GRID #1 VOLTS
0
5
10
15
20
-30
-25
-20
-15
-10
-5
0

TUNG-SOL

THIS DATA SHEET ALSO APPLIES TO ANOTHER MILITARY VERSION, DESIGNATED 5751W1

DOUBLE TRIODE
MINIATURE TYPE



GLASS BULB

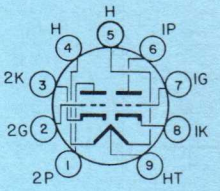
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

FOR GENERAL PURPOSE

VOLTAGE-AMPLIFIER APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9A

THE 5751 IS A 9-PIN MINIATURE, HIGH-MU TUBE WITH TWO TRIODE SECTIONS WITH INDIVIDUAL CATHODE CONNECTIONS. IT INCORPORATES DISTINCTIVE MECHANICAL DESIGN FEATURES, AND INCREASED HEATER CURRENT WHICH PROVIDES A SAFETY FACTOR IN CATHODE PERFORMANCE. THESE FEATURES COMBINE TO PRODUCE A STURDY SHOCK-RESISTANT TUBE AND ONE WHICH WILL GIVE LONG LIFE UNDER CONDITIONS OF INTERMITTENT OPERATION.
THE 5751W1 IS DESIGNED FOR HIGHLY RELIABLE APPLICATIONS BUT IS OTHERWISE IDENTICAL WITH TYPE 5751.

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

SUPPLY CONNECTED TO PINS	4 AND 5	9 AND 4 + 5	
AVERAGE VALUES - VOLTAGE	12.6	6.3	VOLTS
- CURRENT	175	350	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION	12.6±1.3	6.3±0.6	VOLTS

MAXIMUM RATINGS
ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID VOLTAGE:		
NEGATIVE BIAS VALUE	50	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
PLATE DISSIPATION (EACH SECTION)	0.8	WATTS
ALTITUDE FOR 5751	60,000	FT.
FOR 5751W1	80,000	FT.
ENVELOPE TEMPERATURE	165	°C
GRID RESISTANCE	0.5	MEGOHM

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CHARACTERISTICS

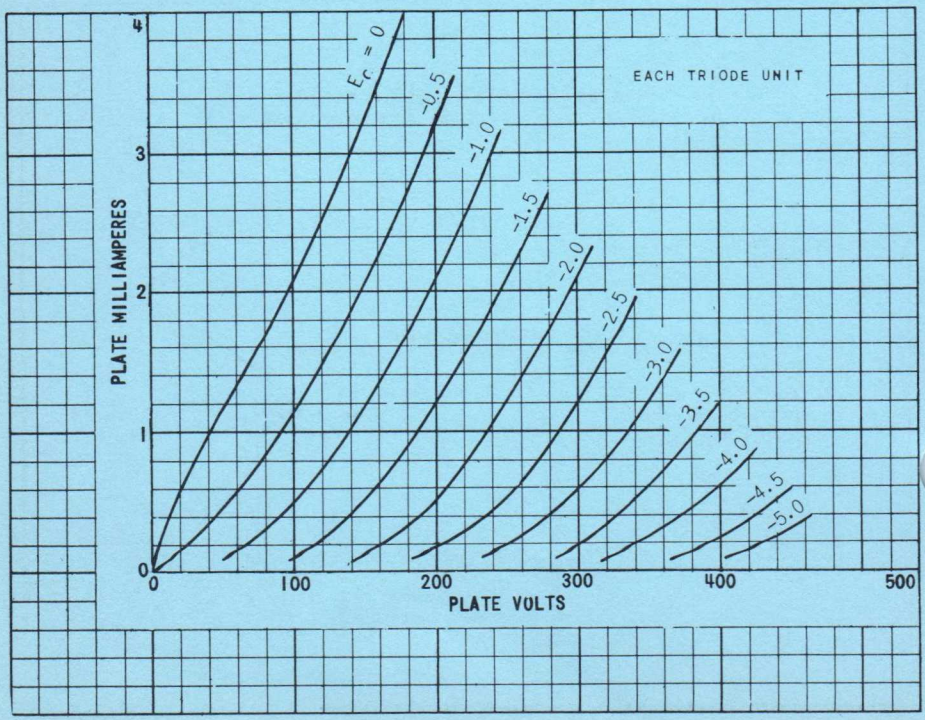
CLASS A1 AMPLIFIER - EACH TRIODE SECTION

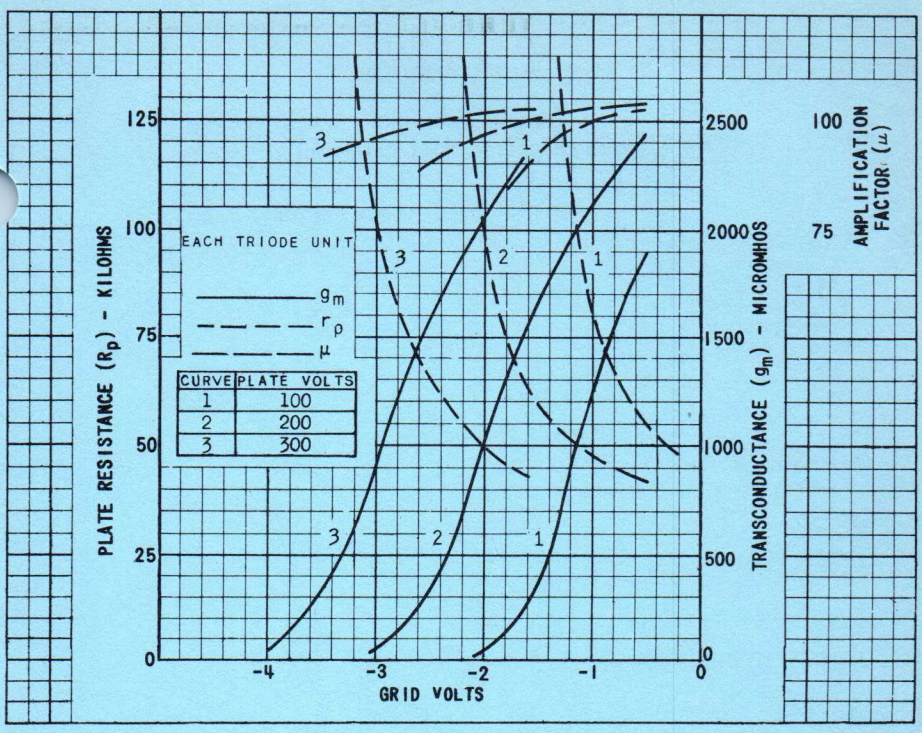
PLATE VOLTAGE	100	250	VOLTS
AMPLIFICATION FACTOR	70	70	
GRID BIAS VOLTAGE	−1	−3	VOLTS
PLATE RESISTANCE	58,000	58,000	OHMS
TRANSCONDUCTANCE	1,200	1,200	μMHOS
PLATE CURRENT	0.8	1.0	MA.

SPECIAL TESTS AND CONTROLS

HEATER-CYCLING LIFE TEST
LOW PRESSURE VOLTAGE BREAKDOWN
SHOCK
FATIGUE
SWEEP FREQUENCY VIBRATION (5751W1 ONLY)
OPERATION AT CUT-OFF 0 PLATE CURRENT (5751W1 ONLY)

SIMILAR TYPE REFERENCE: Similar to the 12AX7.



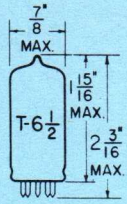


PRINTED IN U. S. A.

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE



GLASS BULB

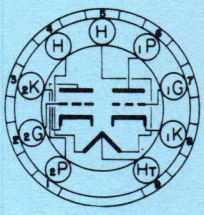
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.35 AMP.
12.6 VOLTS 0.175 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE

9A

THE 5751WA IS A RUGGEDIZED, HIGH MU TWIN TRIODE OF THE NINE-PIN MINIATURE CONSTRUCTION. THE TWO TRIODE SECTIONS ARE ELECTRICALLY INDEPENDENT, ALLOWING SIMULTANEOUS USE OF THE TWO IN COMPLETELY DIFFERENT APPLICATIONS. THE HEATER CENTER-TAP PERMITS OPERATION FROM EITHER A 6.3 OR 12.6 VOLT SUPPLY. THE 5751WA IS ADAPTABLE TO LOW LEVEL INPUT APPLICATIONS WHERE HIGH VOLTAGE GAIN AND LOW HEATER POWER ARE IMPORTANT CONSIDERATIONS. OTHER GENERAL APPLICATIONS INCLUDE VOLTAGE AMPLIFIERS, PHASE INVERTERS, AND MULTIVIBRATORS. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT, TRANSCONDUCTANCE AND AMPLIFICATION FACTOR ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5751WA IS ESPECIALLY SUITED FOR USE IN MILITARY OR INDUSTRIAL AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
GRID TO PLATE #1 (RATED)	1.4	μμf
MAXIMUM	1.70	μμf
MINIMUM	1.10	μμf
GRID TO PLATE #2 (RATED)	1.4	μμf
MAXIMUM	1.70	μμf
MINIMUM	1.10	μμf
INPUT (RATED)	1.4	μμf
MAXIMUM	1.70	μμf
MINIMUM	1.10	μμf
OUTPUT (SECTION #1) (RATED)	0.46	μμf
MAXIMUM	0.70	μμf
MINIMUM	0.22	μμf
OUTPUT (SECTION #2) (RATED)	0.36	μμf
MAXIMUM	0.54	μμf
MINIMUM	0.18	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	12.6±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330		VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	0.8		WATT
MAXIMUM HEATER-CATHODE VOLTAGE	±100		VOLTS
MAXIMUM DC CATHODE CURRENT (EACH SECTION)	22		mA
MAXIMUM BULB TEMPERATURE	±165		°C

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH TRIODE SECTION

HEATER VOLTAGE	6.3	12.6	6.3	12.6	VOLTS
HEATER CURRENT	0.35	0.175	0.35	0.175	AMP.
PLATE VOLTAGE	100		250		VOLTS
AMPLIFICATION FACTOR	70		70		
GRID BIAS VOLTAGE	-1		-3		VOLTS
PLATE RESISTANCE	58 000		58 000		OHMS
TRANSCONDUCTANCE	1 200		1 200		μMHOS
PLATE CURRENT	0.8		1.0		mA

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 12.6V, E_b = 250Vdc, E_c = -3Vdc
(EXCEPT AS MODIFIED BELOW)

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. AVG. MIN.	PROD. AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	160	190	---	---	160	190	mA
HEATER–CATHODE LEAKAGE[A] (E_{hk}=±100Vdc)	---	±10	---	---	---	±10	μAdc
GRID CURRENT (1) (R_g=1.0 MEG.)	0	-0.4	---	---	0	-0.4	μAdc
PLATE CURRENT (1)	0.4	1.8	0.7	1.3	---	---	mAdc
AC AMPLIFICATION[B] (E_{BB}=100Vdc, E_c=0, E_{sig}=0.2Vac, R_p=0.5 MEG, R_g=10 MEG.)	7.5	---	---	---	6.5	---	Vac
INSULATION OF ELECTRODES[C] (E_f=12.6V, E (g-all)= 100Vdc, g neg., E(p-all)= 300 Vdc, p neg.)							
R(g-all)	500	---	---	---	250	---	MEGOHMS
R(p-all)	500	---	---	---	250	---	MEGOHMS
PLATE CURRENT (2) (E_c =-10.6Vdc)	---	10	---	---	---	---	μAdc
PLATE CURRENT (1) DIFFERENCE BETWEEN SECTIONS	---	0.6	---	---	---	---	mAdc
TRANSCONDUCTANCE (1)	900	1600	1075	1325	---	---	μMHOS
Δ TRANSCONDUCTANCE (2)[D] E_f=11.4V)	---	15	---	---	---	---	PERCENT
GRID CURRENT (2)[E] (E_f=14V)	0	-1.5	---	---	---	---	μAdc
AMPLIFICATION FACTOR	55	85	62	78	---	---	

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[FA] (R_p=10,000)	---	100	mVac
VIBRATIONAL FATIGUE[G]	---	---	
SHOCK[H] (HAMMER ANGLE = 42°, E_{hk} =100 Vdc, HEATER POS., R_g = 0.1 MEG)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	150	mVac
HEATER–CATHODE LEAKAGE	---	±30	μAdc
AC AMPLIFICATION	6.5	---	Vac
GRID CURRENT (1)	0	-0.6	μAdc
GLASS STRAIN[J]	---	---	
CONTINUITY AND SHORT[K]	---	---	
NOISE AND MICROPHONICS[LAMN] (E_f = 12.6Vac, E_{hk} = 0, E_{bb} = 300Vdc, E_c = 0, R_p = 0.1 MEG.)	---	100	mVac

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

SPECIAL REQUIREMENTS - CONT'D.

	MIN.	MAX.	
LOW FREQUENCY VIBRATION[OA] (R_p = 2000)	---	100	mVac
LOW PRESSURE VOLTAGE BREAKDOWN[P] (PRESSURE = 55±5 mm mercury, TEMP. = 25±5°C, HUMIDITY = O, VOLTAGE = 500 Vac, 60 CYCLES, SINUSOIDAL WAVEFORM)	500	----	Vac
1 HOUR STABILITY LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS)	---	---	
STABILITY LIFE TEST END POINTS			
Δ TRANSCONDUCTANCE (1)	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT	---	---	
HEATER CYCLING LIFE TEST (E_f = 7.5V, E_{hk} = 135 Vdc, HEATER POSITIVE, E_{c1} = E_b = O)	---	---	
HEATER CYCLING LIFE TEST END POINTS HEATER CATHODE LEAKAGE	---	±20	μAdc
INTERMITTENT LIFE TEST (E_{hk} = 135 Vdc, HEATER POSITIVE, R_g = O.5 MEG., MIN. BULB TEMPERATURE = 165°C	---	---	

NOTES

A TIE 1_p TO 2_p, 1_g to 2_g, 1_k to 2_k. (PARASITIC SUPPRESSORS OF 50 OHMS MAXIMUM PERMITTED.

B SEE MIL-E-1C 4.10.11.2

C SEE MIL-E-1C 4.8.2

D THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED;

$$\frac{(\text{SM AT } 12.6)-(\text{SM AT } 11.4)}{(\text{SM AT } 12.6)} \times 100$$

E PRIOR TO THIS TEST, TUBES TO BE PREHEATED FIVE (5) MINUTES AT CONDITIONS INDICATED. TEST IMMEDIATELY AFTER PRE-HEATING. E_f=14.0V, E_{c1}=-3.0Vdc, R_k=0 OHMS, E_b=250Vdc, R_g/g=0.5 MEG.

F SEE MIL-E-1C 4.9.20.3

G SEE MIL-E-1C 4.9.20.6

H SEE MIL-E-1C 4.9.20.5

J GLASS STRAIN TEST CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0°C ±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST (2) LITERS PER 15 TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST. REJECT FOR EVIDENCE OF AIR LEAK.

K SEE MIL-E-1C 4.7.5

L SEE MIL-E-1C 4.10.3.5

M TIE CATHODES TOGETHER AND GROUND THRU A 1500 OHM RESISTOR. GRIDS ARE GROUNDED.

N THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS @ 60 CYCLES.

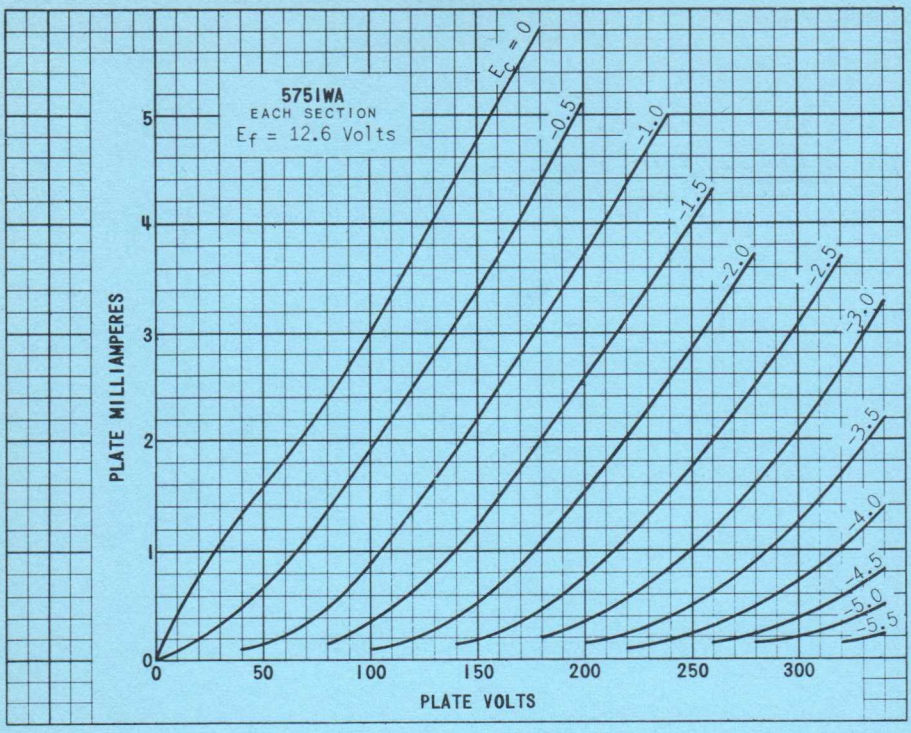
O SEE MIL-E-1C 4.9.20.4

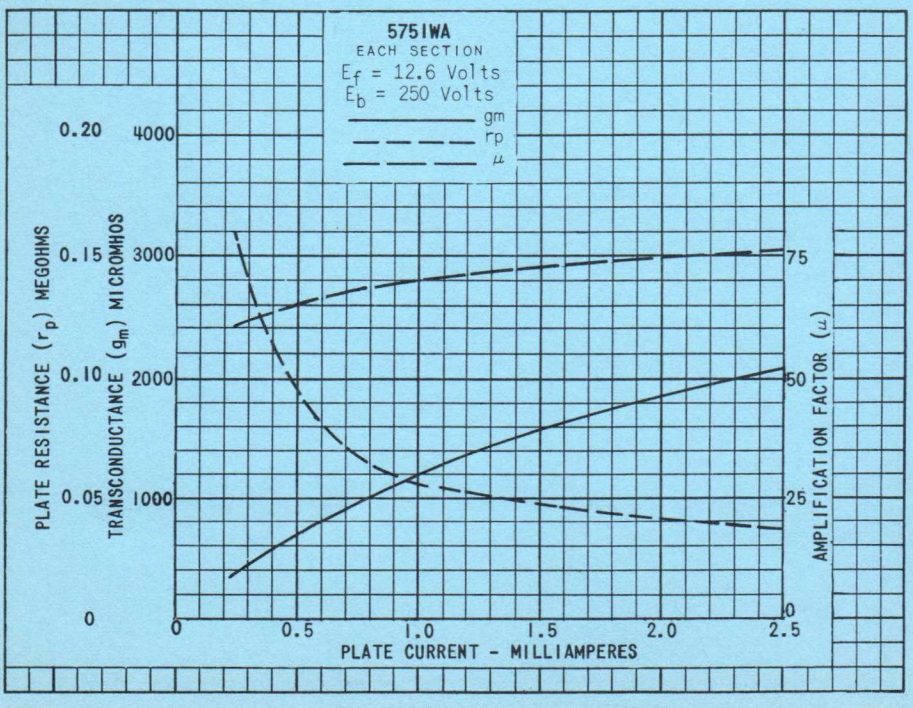
P BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

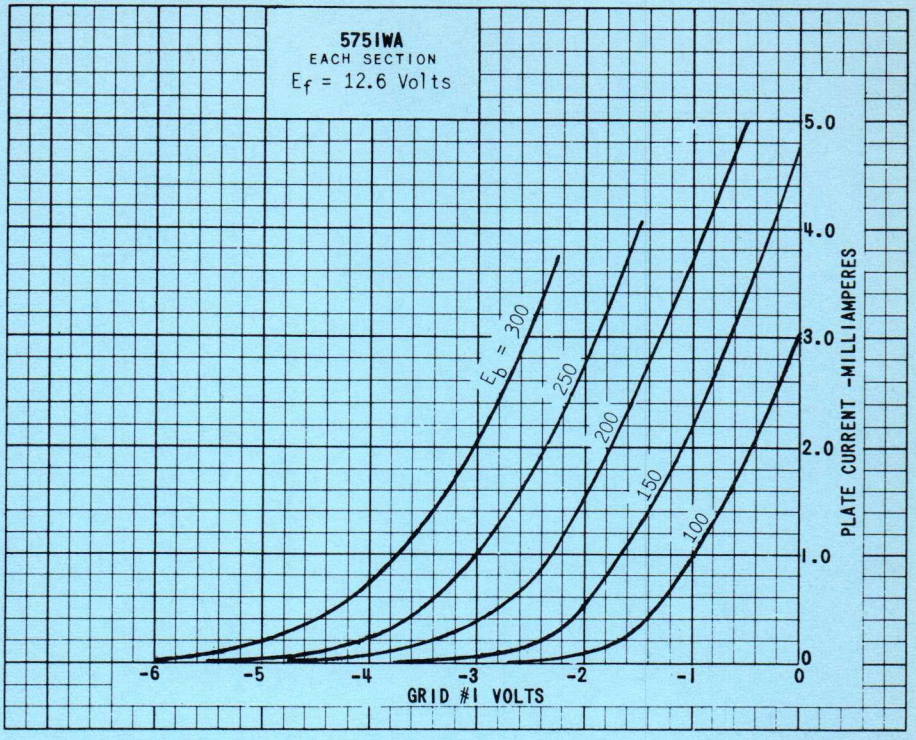
PRINTED IN U.S.A.

5751WA

PREMIUM TUBE



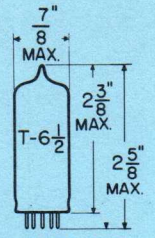



5751WA
EACH SECTION
E_f = 12.6 Volts
E_b = 300
250
200
150
100
5.0
4.0
3.0
2.0
1.0
0
PLATE CURRENT -MILLIAMPERES
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

AMPLIFIER

MINIATURE TYPE



GLASS BULB

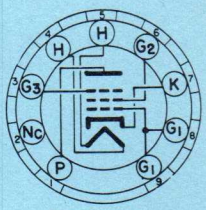
UNIPOTENTIAL CATHODE

HEATER

6.0±10% VOLTS 0.75 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON NOVAL
9 PIN BASE
9K

THE 5763 IS A HEATER-CATHODE TYPE TRANSMITTING BEAM POWER AMPLIFIER IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN COMPACT, LOW-POWER MOBILE TRANSMITTERS AND IN THE LOW-POWER STAGES OF LARGER FIXED STATION TRANSMITTERS. THE 5763 IS PARTICULARLY USEFUL IN THE DOUBLER AND TRIPLER STAGES OF TRANSMITTERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.3	pf
INPUT	9.5	pf
OUTPUT	4.5	pf

RATINGS

ABSOLUTE VALUES

PLATE-MODULATED RF POWER AMPLIFIER - CLASS C TELEPHONY

CARRIER CONDITIONS PER TUBE FOR USE WITH A MAX. MODULATION FACTOR OF 1.0

	CCS[A]	ICAS[B]	
MAXIMUM DC PLATE VOLTAGE	250	300	VOLTS
MAXIMUM DC GRID #3 (SUPPRESSOR) VOLTAGE	0	0	VOLTS
MAXIMUM DC GRID #2 (SCREEN) VOLTAGE	250	250	VOLTS
MAXIMUM DC GRID #1 (CONTROL-GRID) VOLTAGE	-125	-125	VOLTS
MAXIMUM DC PLATE CURRENT	40	50	MA.
MAXIMUM DC GRID #2 CURRENT	15	15	MA.
MAXIMUM DC GRID #1 CURRENT	5	5	MA.
MAXIMUM PLATE INPUT	10	15	WATTS
MAXIMUM GRID #2 INPUT	1.5	1.5	WATTS
MAXIMUM PLATE DISSIPATION	8	12	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 ON BULB SURFACE)	250	250	°C

[A] CONTINUOUS COMMERCIAL SERVICE.

[B] INTERMITTENT COMMERCIAL AND AMATEUR SERVICE

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED ON FOLLOWING PAGE

TYPICAL OPERATION UP TO 30 MC

DC PLATE VOLTAGE	250	300	
GRID #3	CONNECTED TO CATHODE AT SOCKET		
DC GRID #2 VOLTAGE[C]	250	250	VOLTS
DC GRID #1 VOLTAGE[D]	−39	−42.5	VOLTS
From a grid resistor of	39000	18000	OHMS
PEAK RF GRID #1 VOLTAGE	46.5	53.5	VOLTS
DC PLATE CURRENT	40	50	MA.
DC GRID #2 CURRENT	5.6	6	MA.
DC GRID #1 CURRENT (APPROX.)	1	2.4	MA.
DRIVING POWER (APPROX.)	0.05	0.15	WATT
USEFUL POWER OUTPUT (APPROX.)	6.4[E]	10[E]	WATTS

MAXIMUM CIRCUIT VALUES

CCS OR ICAS CONDITIONS

GRID #1 CIRCUIT RESISTANCE (MAX.)	0.1	MEGOHM

RATINGS

ABSOLUTE MAXIMUM VALUES

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

	CCS[A]	ICAS[B]	
DC PLATE VOLTAGE	300	350	VOLTS
DC GRID #3 (SUPPRESSOR) VOLTAGE	0	0	VOLTS
DC GRID #2 (SCREEN) VOLTAGE	250	250	VOLTS
DC GRID #1 (CONTROL-GRID) VOLTAGE	−125	−125	VOLTS
DC PLATE CURRENT	50	50	MA.
DC GRID #2 CURRENT	15	15	MA.
DC GRID #1 CURRENT	5	5	MA.
PLATE INPUT	15	17	WATTS
GRID #2 INPUT	2	2	WATTS
PLATE DISSIPATION	12	13.5	WATTS
PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	100	VOLTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	250	250	°C

TYPICAL OPERATION UP TP 30 MC

DC PLATE VOLTAGE	300	350	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET		
DC GRID #2 VOLTAGE	250	250	VOLTS
DC GRID #1 VOLTAGE[F]	−28.5	−28.5	VOLTS
From a grid resistor of	18000	18000	OHMS
PEAK RF GRID #1 VOLTAGE	37.5	37	VOLTS
DC PLATE CURRENT	50	48.5	MA.
DC GRID #2 CURRENT	6.6	6.2	MA.
DC GRID #1 CURRENT (APPROX.)	1.6	1.6	MA.
DRIVING POWER (APPROX.)	0.1	0.1	WATT
USEFUL POWER OUTPUT (APPROX.)	10.3[E]	12[E]	WATTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATION AT 50 MC

DC PLATE VOLTAGE	300	---	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET		
DC GRID #2 VOLTAGE	250	---	VOLTS
DC GRID #1 VOLTAGE[F]	-60	---	VOLTS
From a grid resistor of	22000	---	OHMS
PEAK RF GRID #1 VOLTAGE	80	---	VOLTS
DC PLATE CURRENT	50	---	MA.
DC GRID #2 CURRENT	5	---	MA.
DC GRID #1 CURRENT (APPROX.)	3	---	MA.
DRIVING POWER (APPROX.)	0.35	---	WATT
USEFUL POWER OUTPUT (APPROX.)	7[E]	---	WATTS

MAXIMUM CIRCUIT VALUES
CCS OR ICAS CONDITIONS

GRID #1 CIRCUIT RESISTANCE (MAX.)	0.1	MEGOHM

RATINGS
ABSOLUTE MAXIMUM VALUES

FREQUENCY MULTIPLIER

	CCS[A]	
DC PLATE VOLTAGE	300	VOLTS
DC GRID #3 (SUPPRESSOR) VOLTAGE	0	VOLTS
DC GRID #2 (SCREEN) VOLTAGE	250	VOLTS
DC GRID #1 (CONTROL-GRID) VOLTAGE	-125	VOLTS
DC PLATE CURRENT	50	MA.
DC GRID #2 CURRENT	15	MA.
DC GRID #1 CURRENT	5	MA.
PLATE INPUT	15	WATTS
GRID #2 INPUT	.2	WATTS
PLATE DISSIPATION	12	WATTS
PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	250	°C

TYPICAL OPERATION

	DOUBLER TO 175 MC	TRIPLER TO 175 MC	
DC PLATE VOLTAGE	300	300	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET		
DC GRID #2 VOLTAGE			
DC GRID #1 VOLTAGE[F]	-75	-100	VOLTS
From grid resistor of	75000	100000	OHMS
PEAK RF GRID #1 VOLTAGE	95	120	VOLTS
DC PLATE CURRENT	40	35	MA.
DC GRID #2 CURRENT	4	5	MA.
DC GRID #1 CURRENT (APPROX.)	1	1	MA.
DRIVING POWER APPROX.	0.6	0.6	WATT
USEFUL POWER OUTPUT (APPROX.)	2.1[E]	1.3[E]	WATTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM CIRCUIT VALUES
FOR MAXIMUM RATED CONDITIONS

GRID #1 CIRCUIT RESISTANCE(MAX.)	0.1	MEGOHM

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	NOTE	MIN.	MAX.	
HEATER CURRENT	1	0.69	0.81	AMP.
GRID #1 PLATE CAPACITANCE	2	---	0.3	pf
INPUT CAPACITANCE	2	8.0	11.0	pf
OUTPUT CAPACITANCE	2	3.8	5.2	pf
TRANSCONDUCTANCE	1,3	5100	8900	μMHOS
PLATE CURRENT	1,3	33	57	MA.
GRID #2 CURRENT	1,3	---	10	MA.
REVERSE GRID #1 CURRENT	1,4	---	2	μAMP.

NOTE 1: WITH 6 VOLTS AC OR DC ON HEATER.

NOTE 2: WITH NO EXTERNAL SHIELD

NOTE 3: WITH DC PLATE VOLTAGE OF 250 V., DC GRID #2 VOLTAGE OF 250 V, & DC GRID #1 VOLTAGE OF -7.5 VOLTS.

NOTE 4: WITH DC PLATE VOLTAGE OF 250 V, DC GRID #2 VOLTAGE OF 250 V, DC GRID #1 VOLTAGE OF -7.5 VOLTS, AND GRID #1 CIRCUIT RESISTANCE OF 0.1 MEGOHM.

A CONTINUOUS COMMERCIAL SERVICE

B INTERMITTENT COMMERCIAL AND AMATEUR SERVICE.

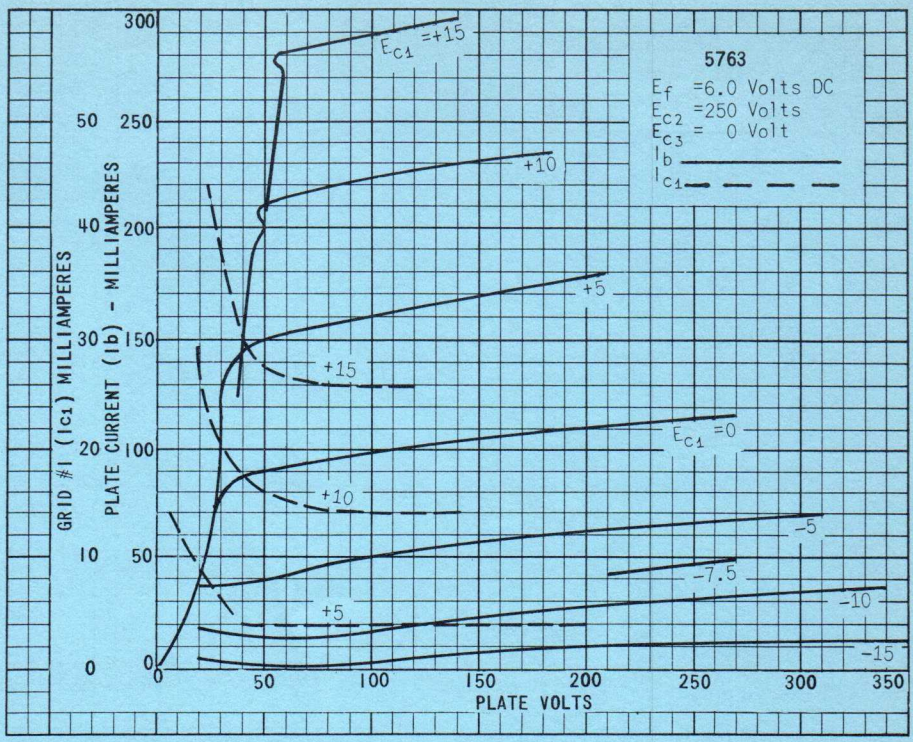
C OBTAINED PREFERABLY FROM A SEPARATE SOURCE MODULATED WITH THE PLATE SUPPLY, OR FROM THE MODULATED PLATE SUPPLY THROUGH A SERIES RESISTOR.

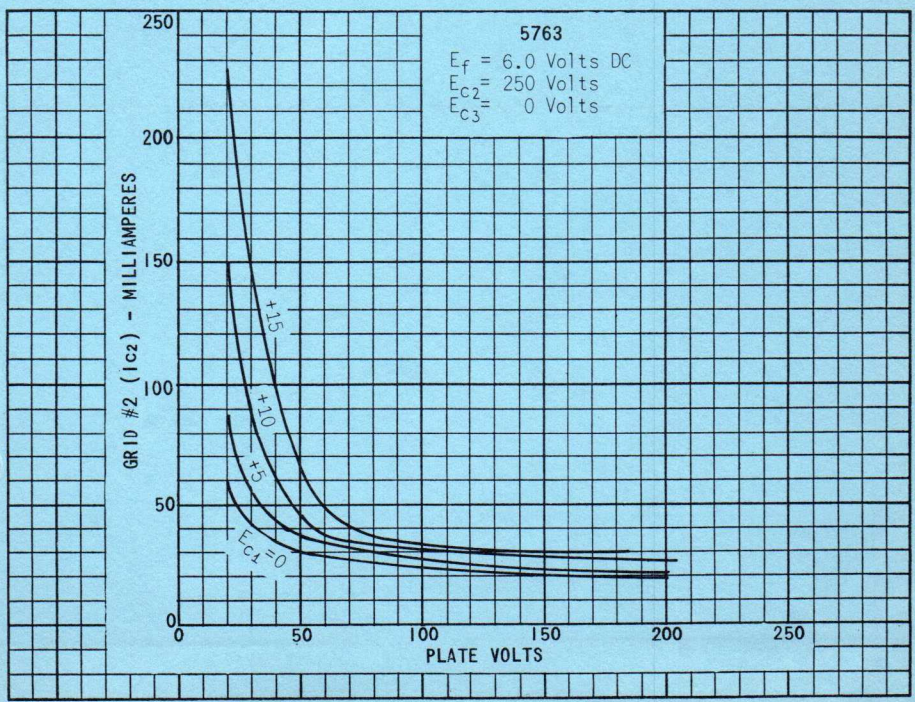
D OBTAINED FROM GRID #1 RESISTOR OR FROM A COMBINATION OF GRID #1 RESISTOR WITH EITHER FIXED SUPPLY OR CATHODE RESISTOR.

E THIS VALUE OF USEFUL POWER IS MEASURED AT LOAD OF OUTPUT CIRCUIT.

F OBTAINED FROM A FIXED SUPPLY, OR BY A GRID #1 RESISTOR OF VALUE SHOWN.

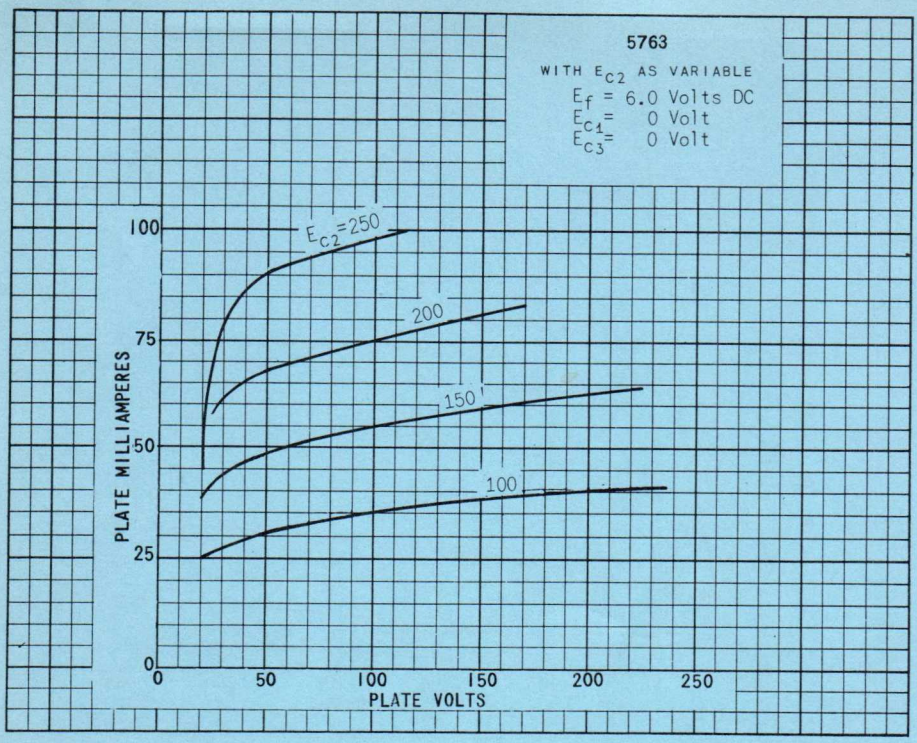
G KEY DOWN CONDITIONS PER TUBE WITHOUT AMPLITUDE MODULATION. MODULATION ESSENTIALLY NEGATIVE MY BE USED IF THE POSITIVE PEAK OF THE AUDIO-FREQUENCY ENVELOPE DOES NOT EXCEED 115% OF THE CARRIER CONDITIONS.





PRINTED IN U.S.A.

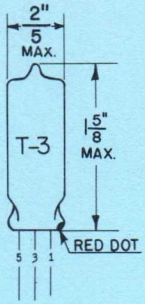
TENTATIVE DATA



TUNG-SOL

DIODE

SUBMINIATURE TYPE

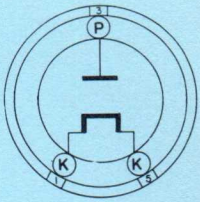


GLASS BULB

DOT IS ADJACENT TO LEAD 1

SUBMINIATURE GAS DIODE

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED
FLEXIBLE LEADS
0.10" CENTER-TO-CENTER

THE 5783 IS A COLD CATHODE, GLOW-DISCHARGE TUBE OF SUBMINIATURE CONSTRUCTION DESIGNED FOR SERVICE AS A VOLTAGE REFERENCE TUBE IN ELECTRONICALLY REGULATED DC POWER SUPPLIES. IT HAS AN OPERATING CURRENT RANGE OF 1.5 TO 3.5 MILLIAMPERERS OVER WHICH IT MAINTAINS A SUBSTANTIALLY CONSTANT OPERATING VOLTAGE OF 85 VOLTS. VOLTAGE FLUCTUATIONS ARE APPRECIABLY LESS THAN 0.1 VOLTS WITHIN THE RATED OPERATING CURRENT RANGE. TWO CATHODE LEADS ARE PROVIDED WHICH MAY BE USED TO DISCONNECT THE LOAD WHEN THE TUBE IS REMOVED FROM THE SOCKET. THE FLEXIBLE 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.

RATINGS

ABSOLUTE MAXIMUM VALUES

DC OPERATING CURRENT	1.5 TO 3.5	MA.
AMBIENT TEMPERATURE	-55 TO +90	°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

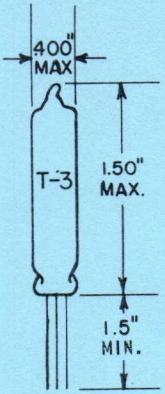
MINIMUM DC ANODE SUPPLY VOLTAGE	115	VOLTS
AVERAGE DC OPERATING VOLTAGE	85	VOLTS
DC OPERATING CURRENT RANGE	1.5 TO 3.5	MA
DC OPERATING VOLTAGE RANGE	80 TO 90	VOLTS
MAXIMUM REGULATION (1.5 TO 3.5 MA.)	3.0	VOLTS
STABILITY OF OPERATING VOLTAGE (VOLTAGE FLUCTUATION)	0.1	VOLTS
MAXIMUM SHUNT CAPACITANCE	0.02	μfd

PRINTED IN U. S. A.

TUNG-SOL

DIODE

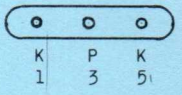
SUBMINIATURE TYPE



GLASS BULB

COLD-CATHODE GLOW DISCHARGE

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED
FLEXIBLE LEADS
0.1" CENTER TO CENTER

THE 5783WA IS A SUB-MINIATURE TWO ELECTRODE INERT-GAS-FILLED, COLD CATHODE GLOW DISCHARGE DIODE FOR USE AS A VOLTAGE REFERENCE TUBE IN ELECTRONIC REGULATED SUPPLIES. IT HAS AN OPERATING VOLTAGE OF APPROXIMATELY 86 VOLTS OVER A CURRENT RANGE OF 1.5 TO 3.5 MILLIAMPERES. THIS TUBE IS IDEALLY SUITED FOR APPLICATIONS IN WHICH SUDDEN FLUCTUATIONS MUST BE KEPT BELOW 5 MILLIVOLTS OVER THE ENTIRE RANGE AND WHICH REQUIRE VERY LOW OPERATING VOLTAGE DRIFT AND LONG LIFE.

THE 5783WA FEATURES HIGH SHOCK AND VIBRATION RATINGS. IT IS PARTICULARLY SUITABLE FOR APPLICATIONS REQUIRING SMALL SIZE AND LIGHT WEIGHT COMPONENTS.

ELECTRICAL DATA

CATHODE	COLD

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH EXCLUDING LEADS	1 1/2	INCHES
MAXIMUM DIAMETER	0.40	INCHES
BULB	T-3	
BASE	SUBMINIATURE FLAT PRESS WITH THREE FLYING LEADS	
NET WEIGHT (APPROX.)	0.1	OUNCES
MAXIMUM SHOCK RATING	450	G/1MS
MAXIMUM VIBRATION RATING D=.08"@50CPS	10	G

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS
ABSOLUTE VALUES

MAXIMUM DC OPERATING CURRENT	3.5	MA.
MINIMUM DC OPERATING CURRENT	1.5	MA.
MAXIMUM INVERSE VOLTAGE	−50	VOLTS
AMBIENT TEMPERATURE RANGE	−55 TO +155	°C
ALTITUDE	60 000	FEET

ADDITIONAL TESTS TO INSURE RELIABILITY
RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 30° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (450G/MSEC)

FATIGUE: 25° CPS, 0.08" TOTAL DISPLACEMENT, FOR 32 HOURS IN EACH OF 3 MUTUALLY PERPENDICULAR PLANES (2.5 G).

POST SHOCK AND FATIGUE LIMITS:		
IONIZATION VOLTAGE (MAX.)	120	VDC
TUBE VOLTAGE DROP (1.5 AND 3.5 MA)	81 TO 91	VDC
REGULATION (1.5 TO 3.5 MA) (MAX.)	4.0	VDC
STABILITY LIFE TEST (1 HOUR):		
END POINT: CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE (MAX.)	200	mVDC
SURVIVAL RATE LIFE TEST (100 HOURS):		
END POINT: CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE (MAX.)	1.0	VDC
INTERMITTENT LIFE TEST: END POINTS (500 HOURS):		
CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE (MAX)	4.0	VDC
TUBE VOLTAGE DROP	81 TO 91	VDC
REGULATION (MAX.)	4.0	VDC
IONIZATION VOLTAGE (MAX.)	120	VDC

EQUIPMENT DESIGN AND RANGE VALUES

	MIN.	AVERAGE	MAX.	
DC ANODE SUPPLY VOLTAGE IN DARKNESS	140[A]	---	---	VOLTS
DC ANODE SUPPLY VOLTAGE IN LIGHT	120[A]	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE	---	106	120	VOLTS
TUBE VOLTAGE DROP (1) AT 1.5 MA	81	84.5	---	VOLTS
TUBE VOLTAGE DROP (2) AT 3.5 MA	---	86.0	91	VOLTS
REGULATION	---	0.8	2.0	VOLTS/MA.
VOLTAGE JUMP[B]	---	0	5.0	MV
VOLTAGE REPEATABILITY[C]	---	0.01	0.1	VOLTS
OSCILLATION (AURAL CHECK)	---	---	---	
NOISE	---	0	20	MV.
LEAKAGE CURRENT (E_b=50V, R_p=3000Ω)	---	0	20	μAMPS
GENERATED PLATE VOLTAGE (WHEN VIBRATED AT 40 CPS, 15G, R_p=10,000Ω, I_b=2.5MADC)	---	---	50	MV.
MAXIMUM SHUNT CAPACITOR	---	---	0.02	μFARADS
SERIES RESISTOR	D	---	---	
MAXIMUM CURRENT THROUGH INTER-CONNECTED LEADS	---		0.2	AMP.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES

A TO ASSURE STARTING THROUGHOUT TUBE LIFE, THE SUPPLY VOLTAGE SHOULD NOT BE LESS THAN THIS VALUE.

B THE MAXIMUM VOLTAGE FLUCTUATION AT ANY CURRENT LEVEL WITHIN THE CURRENT OPERATING CURRENT RANGE.

C TUBE IS CYCLED ONE MINUTE ON AND ONE MINUTE OFF FOR FIVE CYCLES. READINGS ARE TAKEN INITIALLY AND AT THE END OF EACH "ON" PERIOD.

D SUFFICIENT SERIES RESISTANCE MUST BE USED TO LIMIT THE CURRENT TO A MAXIMUM OF 3.5 MA. AT THE HIGHEST ANODE SUPPLY VOLTAGE AND TO LIMIT THE CURRENT TO A MINIMUM OF 1.5 MA AT THE LOWEST ANODE SUPPLY VOLTAGE.

APPLICATION NOTES

VOLTAGE REFERENCE TUBES ARE OFTEN CONFUSED WITH VOLTAGE REGULATOR TUBES. WHILE A REFERENCE TUBE IS A REGULATOR TUBE, IT IS A SPECIAL FORM OF REGULATOR TUBE, IN WHICH CURRENT RANGE AND REGULATION IS SACRIFICED TO PROVIDE VOLTAGE REPEATABILITY AND TEMPERATURE STABILITY AND TO MINIMIZE VOLTAGE JUMP AND LONG TERM DRIFT.

THE VOLTAGE REGULATION CHARACTERISTIC OF A REFERENCE TUBE IS NOT INDEPENDENT OF THE TUBE CURRENT. THEREFORE THE 5783WA SHOULD BE RUN FROM A CONSTANT SOURCE SUCH AS A VR TUBE, A PENTODE, OR A SIMPLE SERIES REGULATOR. PRACTICAL CIRCUITS ARE GIVEN IN FIGURES 1, 2, AND 3.

IF SO DESIRED, "INPUT AND OUTPUT" CONNECTIONS TO THE CATHODE CAN BE MADE TO DIFFERENT INTERNALLY CONNECTED LEADS, SO THAT THE CIRCUIT WILL BE BROKEN UPON THE REMOVAL OF THE TUBE FROM ITS SOCKET. THE TUBE SHOULD BE SHIELDED IF IT IS TO BE USED IN STRONG RF OR MAGNETIC FIELDS.

THE PRINCIPAL USE OF THE 5783WA IS TO SUPPLY A REFERENCE VOLTAGE IN AN ELECTRONICALLY REGULATED POWER SUPPLY. THIS USE IS ILLUSTRATED IN FIGURE 4. THE 5783WA MAY ALSO BE SUBSTITUTED FOR THE MINIATURE TYPE 5651WA IN MANY CIRCUITS FOUND IN THE HANDBOOK, PREFERRED CIRCUITS, Navy Aeronautical Electronic Equipment (NAVAER 16-1-519). THIS IS AVAILABLE FROM THE SUPERINTENDENT OF DOCUMENTS, US GOVT. PRINTING OFFICE, WASHINGTON 25, D.C. AT $1.75.

PRINTED IN U.S.A.

TUNG-SOL

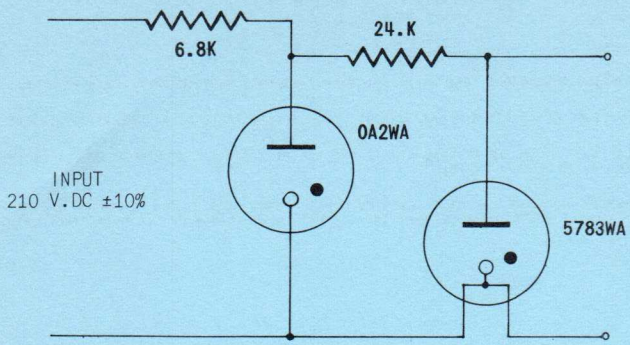


FIGURE 1

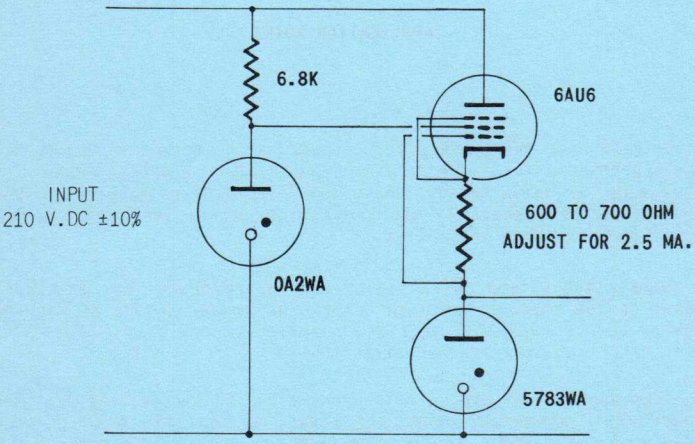


FIGURE 2

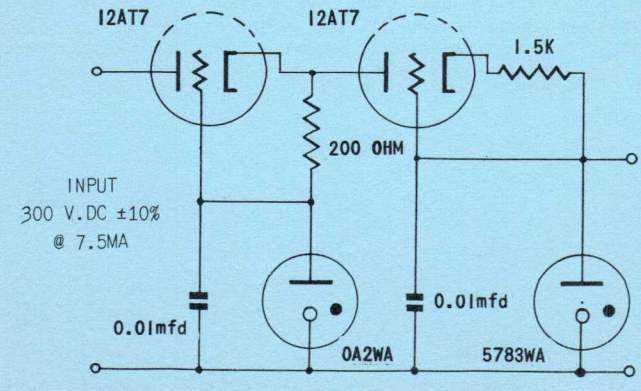


FIGURE 3

TUNG-SOL

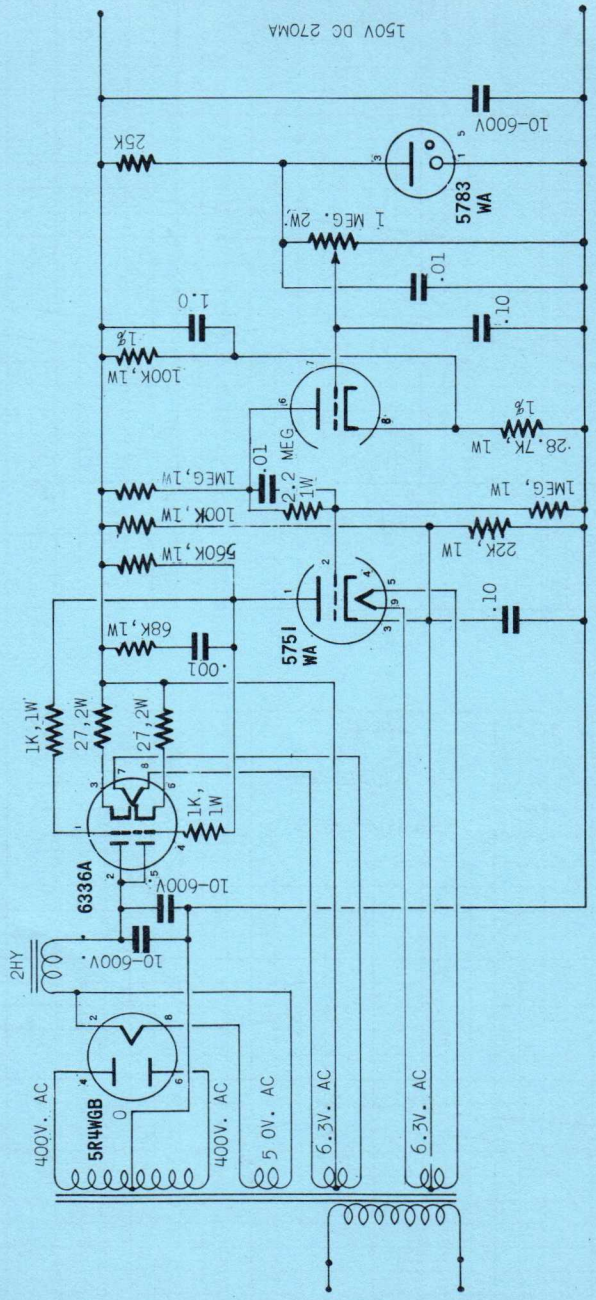
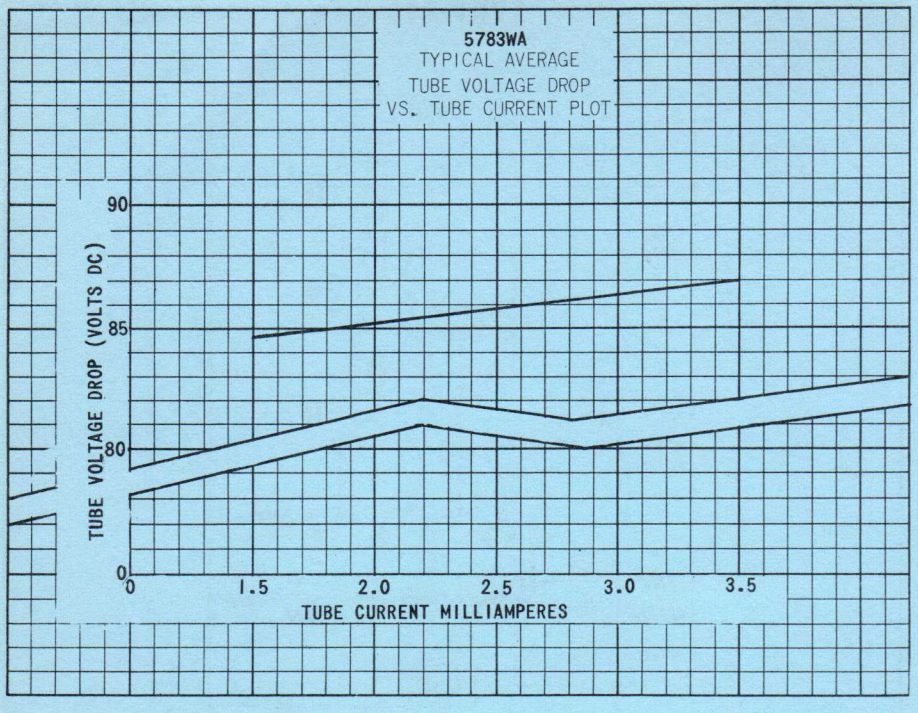
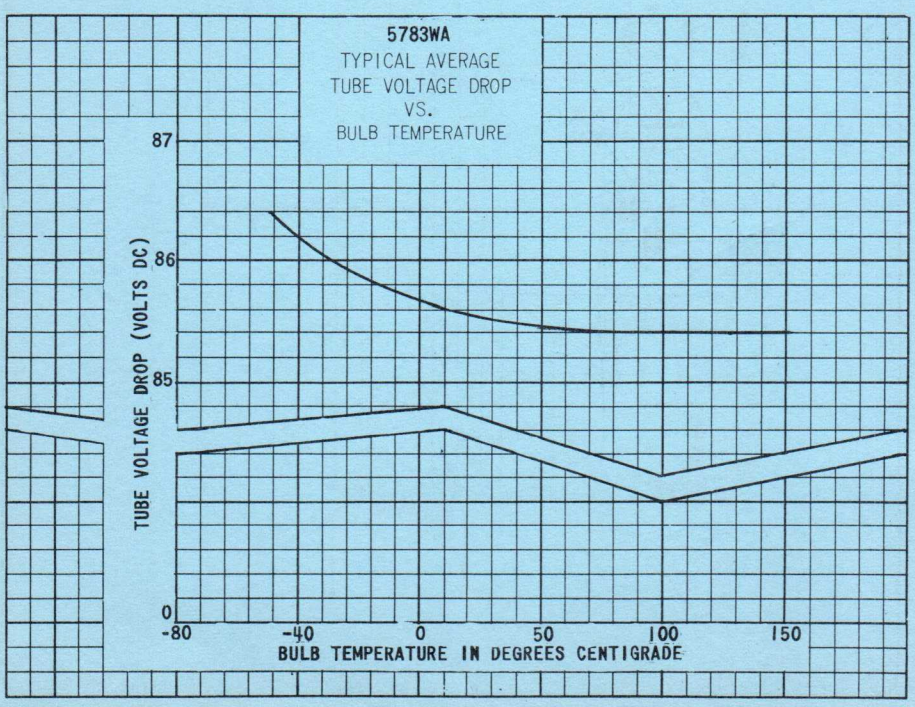


FIGURE 4

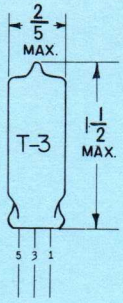

5783WA
TYPICAL AVERAGE
TUBE VOLTAGE DROP
VS. TUBE CURRENT PLOT
TUBE VOLTAGE DROP (VOLTS DC)
90
85
80
0
0
1.5
2.0
2.5
3.0
3.5
TUBE CURRENT MILLIAMPERES


5783WA
TYPICAL AVERAGE
TUBE VOLTAGE DROP
VS.
BULB TEMPERATURE
TUBE VOLTAGE DROP (VOLTS DC)
87
86
85
0
-80
-40
0
50
100
150
BULB TEMPERATURE IN DEGREES CENTIGRADE

TUNG-SOL

DIODE

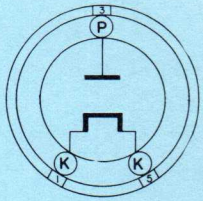
SUBMINIATURE TYPE



GLASS BULB

GAS DIODE

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS

0.096" CENTER-TO-CENTER

THE 5783WB IS A COLD-CATHODE, GAS FILLED, GLOW-DISCHARGE DIODE OF SUBMINIATURE CONSTRUCTION DESIGNED FOR USE AS A VOLTAGE REFERENCE TUBE IN ELECTRONICALLY REGULATED DC POWER SUPPLIES. IT HAS AN OPERATING CURRENT RANGE OF 1.5 TO 3.5 MILLIAMPERES OVER WHICH IT MAINTAINS A SUBSTANTIALLY CONSTANT OPERATING VOLTAGE OF 86 VOLTS. TWO CATHODE LEADS ARE PROVIDED FOR USE IN CIRCUITS WHICH SERVE TO DISCONNECT THE LOAD WHEN THE TUBE IS REMOVED FROM THE SOCKET. THIS TUBE IS DESIGNED FOR SERVICE WHERE SEVERE CONDITIONS OF HIGH TEMPERATURE AND MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. THE FLEXIBLE 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 A SUITABLE LENGTH.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST- NOTE 2)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (100 HR. FATIGUE TEST-NOTE 3)	2.5	G
MAXIMUM BULB TEMPERATURE	155	°C

RATINGS

	Ebb Vdc	TOTAL DARKNESS STARTING VOLTAGE Vdc	AMB. LIGHT STARTING VOLTAGE Vdc	OPERATING VOLTAGE RANGE Vdc	OPERATING CURRENT RANGE mAdc (NOTE 7)	AMBIENT TEMP. °C (NOTE 7)
ABSOLUTE:						
MAXIMUM:				91	3.5	+150
MINIMUM:	145	140	115	81	1.5	−55
TEST CONDITIONS:	150					25±5

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

TEST	AQL %	MIL-E-1B SYMBOL	MIN.	MAX.	MIL-E-1B UNITS
ACCEPTANCE TESTS-GROUP C					
CONTINUITY AND SHORTS	0.4				
ACCEPTANCE TESTS-GROUP D	COMBINED AQL= 1.0%				
IONIZATION VOLTAGE (1): Rp /Ib = 1.5-3.5 mAdc; AMBIENT LIGHT	0.65	(1)Ez:		115	Vdc
TUBE VOLTAGE DROP (1): Rp/Ib = 3.5 mAdc	0.65	(1)Etd:		89.0	Vdc
TUBE VOLTAGE DROP (2): Rp/Ib =1.5 mAdc	0.65	(2)Etd:	83.0		Vdc
REGULATION: (1) Etd -(2) Etd	0.65	Reg.		3.0	Vdc
VOLTAGE JUMP: (NOTE 8)	0.65	Jump:		5.0	mVdc
ACCEPTANCE TESTS-GROUP E					
NOISE: Rp/Ib =3.5 mAdc	1.0	Eb:		20	mVac
OSCILLATION: Esig =100 mVac; Rp/Ib = 1.5 - 3.5 mAdc	1.0				
ACCEPTANCE TESTS-GROUP F					
IONIZATION VOLTAGE (2) Rp/Ib =1 .5 -3.5 mAdc TOTAL DARKNESS	6.5	(2)Ez :		140	Vdc
LEAKAGE CURRENT: Eb = 50 Vdc; Rp =3000 OHMS	6.5	LIB:		20	μAdc
VIBRATION (2) F = 40 cps; G = 15; Rp = 10,000 OHMS; Ebb/I b =2.5 mAdc	6.5	Ep:		50	mVac
TUBE VOLTAGE DROP (3): Rp/Ib =2.5 mAdc	6.5	(3)Etd:	84	98	Vdc
ACCEPTANCE TESTS-GROUP G					
REPEATABILITY: Rp/Ib = 2.5 mAdc (NOTE 5)	6.5	Δ(3)Etd:		100	mVdc
ACCEPTANCE TESTS-GROUP A					
SHOCK: HAMMER ANGLE = 30° (NOTE 2)					
FATIGUE 96 HRS. (NOTE 3)	6.5				
POST SHOCK AND FATIGUE TEST END POINTS:					
IONIZATION VOLTAGE (1): Rp/Ib =1.5-3.5 mAdc		(1)Ez:		115	Vdc
TUBE VOLTAGE DROP (1): Rp/Ib =3.5 mAdc		(1)Etd:	81	91	Vdc
TUBE VOLTAGE DROP (2): Rp/Ib = 1.5 mAdc		(2)Etd:	81	91	Vdc
REGULATION: (1) Etd - (2) Etd		Reg:		4.0	Vdc

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

TEST	AQL %	MIL-E-1B SYMBOL	MIN.	MAX.	MIL-E-1B UNITS
ACCEPTANCE TESTS-GROUP B					
SUBMINIATURE: LEAD FATIGUE TEST	2.5		4		Arcs
GLASS STRAIN (THERMAL SHOCK):	6.5				
ACCEPTANCE LIFE TESTS					
1 HOUR STABILITY LIFE TEST: TA =Room; Rp/Ib = 2.5 mAdc					
1 HOUR STABILITY LIFE TEST END POINTS: Δ TUBE VOLTAGE DROP (3): (NOTE 6) (TYPICAL SAMPLE SIZE = 50 TUBES)	6.5	Δ(3)Etd:		200	mVdc
100 HOUR SURVIVAL RATE LIFE TEST: TA = Room; Rp/Ib = 2.5 mAdc					
100 HOUR SURVIVAL RATE LIFE TEST END POINTS: INOPERATIVES: (TYPICAL SAMPLE SIZE = 200 TUBES)	0.4				
ΔTUBE VOLTAGE DROP (3): (NOTE 6) (TYPICAL SAMPLE SIZE = 25 TUBES)	6.5	Δ(3)Etd:		1.0	Vdc
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST (1): TA = 150 °C; Rp/Ib =2.5 mAdc					

TEST	MAX. DEF. PER CHARACTERISTICS 1st SAMPLE	MAX. DEF. PER CHARACTERISTICS COMB. SAMPLE	MIL-E-1B SYMBOL	MIN.	MAX.	MIL-E-1B UNITS
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST (1) END POINTS: (TYPICAL SAMPLE SIZE= 20 TUBES, 1st SAMPLE; 40 TUBES 2nd SAMPLE)						
INOPERATIVES:	1	3				
REGULATION (1):	1	3	Reg:		4.0	Vdc
TUBE VOLTAGE DROP (1):	1	3	(1)Etd:	81	91	Vdc
TUBE VOLTAGE DROP (2):	1	3	(2)Etd:	81	91	Vdc
TUBE VOLTAGE DROP (3):	1	3	(3)Etd:	84	89	Vdc
IONIZATION VOLTAGE (1):	1	3	(1)Ez:		115	Vdc
ΔTUBE VOLTAGE DROP (3): (NOTE 6)	1	3	Δ(3)Etd:		4	Vdc
TOTAL DEFECTIVES	4	8				
5000 HOUR INTERMITTENT LIFE TEST (2): TA = Room; Rp/Ib =2.5 mAdc						
5000 HOUR INTERMITTENT LIFE TEST (2) END POINTS: READ FOR SAME CHARACTERISTICS AS INTERMITTENT LIFE TEST (1) ....LIMITS NOT ESTABLISHED						

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES

NOTE 1: CHARACTERISTICS, QUALITY CONTROL TEST PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1B, 'INSPECTION INSTRUCTIONS FOR ELECTRON TUBES' AND MIL-STD-105A.

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

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

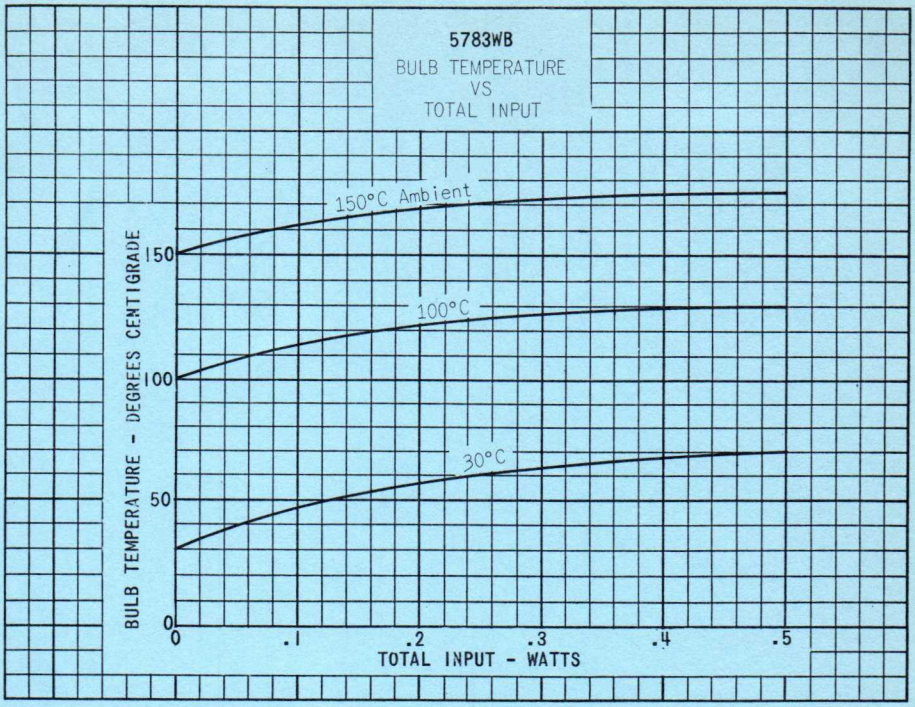
NOTE 4: CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

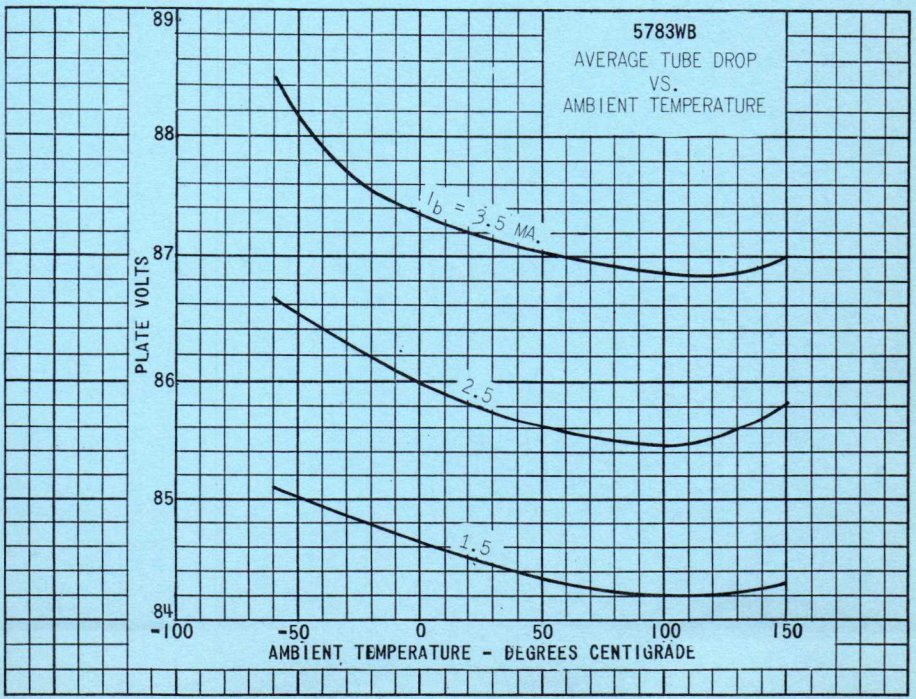
NOTE 5: REPEATABILITY IS THE MAXIMUM SHIFT IN THE TUBE VOLTAGE DROP BETWEEN SUCCESSIVE FIRINGS OF THE TUBE.

NOTE 6: ΔTUBE VOLTAGE DROP IS THE CHANGE IN INDIVIDUAL TUBES OF TUBE VOLTAGE DROP (3) FROM THE BEGINNING OF LIFE TO ITS VALUE AT THE SPECIFIED LIFE HOUR (S).

NOTE 7: LIMITS BEYOND WHICH NORMAL TUBE PERFORMANCE AND TUBE LIFE MAY BE IMPAIRED.

NOTE 8: SUDDEN VOLTAGE JUMPS AS MEASURED ON AN OSCILLOSCOPE CONNECTED ACROSS THE TUBE, WITH THE CURRENT THROUGH THE TUBE VARIED SLOWLY OVER ITS OPERATING RANGE, SHOULD BE LESS THAN 5 mVdc.





PRINTED IN U.S.A.

TUNG-SOL

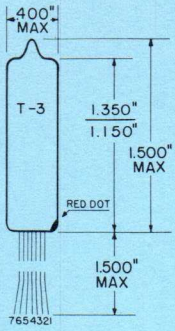
THIS DATA SHEET ALSO APPLIES TO ANOTHER MILITARY VERSION DESIGNATED 5784WB

PENTODE

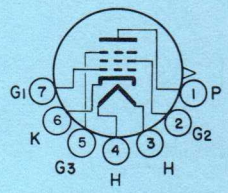
SUBMINIATURE TYPE

FOR MOBILE EQUIPMENT APPLICATIONS

ANY MOUNTING POSITION



GLASS BULB
IN-LINE LEADS
RED DOT IS ADJACENT TO LEAD 1



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

THE 5784WA IS A HEATER-CATHODE TYPE SUBMINIATURE DUAL-CONTROL PENTODE CAPABLE OF OPERATION IN THE VHF REGION. THE DUAL-CONTROL FEATURE MAKES USE OF THE CONTROL GRID AND SUPPRESSOR GRID AS INDEPENDENT CONTROL ELECTRODES FOR CIRCUITS SUCH AS GATED AMPLIFIERS, MIXERS, AND GAIN CONTROLLED AMPLIFIERS. THE TYPE WILL WITHSTAND SEVERE MECHANICAL SHOCK OR VIBRATION AND HIGH TEMPERATURE SERVICE. THE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF THE CIRCUIT COMPONENTS, OR MAY BE OUT TO A SUITABLE LENGTH FOR USE WITH STANDARD SUBMINIATURE SOCKETS.

THE 5784WB IS DESIGNED FOR HIGHLY RELIABLE APPLICATIONS HAVING CAPABILITIES BEYOND THE 5784WA. IT MAY BE USED AS A DIRECT REPLACEMENT HOWEVER IN EQUIPMENT NOW USING THE 5784WA.

DIRECT INTERELECTRODE CAPACITANCES

WITH 0.405" DIAMETER SHIELD [A]

GRID 1 TO PLATE (MAX)	0.030	pf
INPUT	4.5	pf
OUTPUT	3.6	pf

[A] EXTERNAL SHIELD 318 CONNECTED TO LEAD 6.

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	200	MA.
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			200	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	165	VOLTS
GRID 1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	55	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
GRID 2 VOLTAGE:	155	VOLTS
GRID 3 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	55	VOLTS
POSITIVE BIAS VOLTAGE	30	VOLTS
PLATE DISSIPATION (DESIGN MAX.)	0.79	WATTS
GRID 2 DISSIPATION (DESIGN MAX.)	0.6	WATTS
GRID 1 CIRCUIT RESISTANCE	1.2	MEGOHM
CATHODE CURRENT	16.5	MA DC
ENVELOPE TEMPERATURE	220	°C
ALTITUDE	60,000	FT.

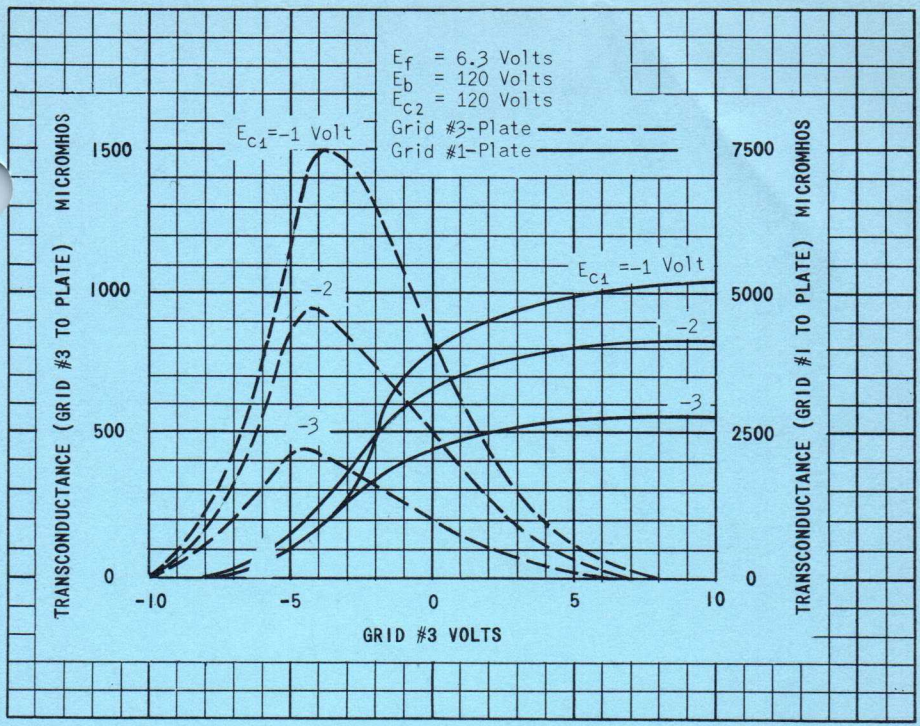
TYPICAL OPERATING CHARACTERISTICS

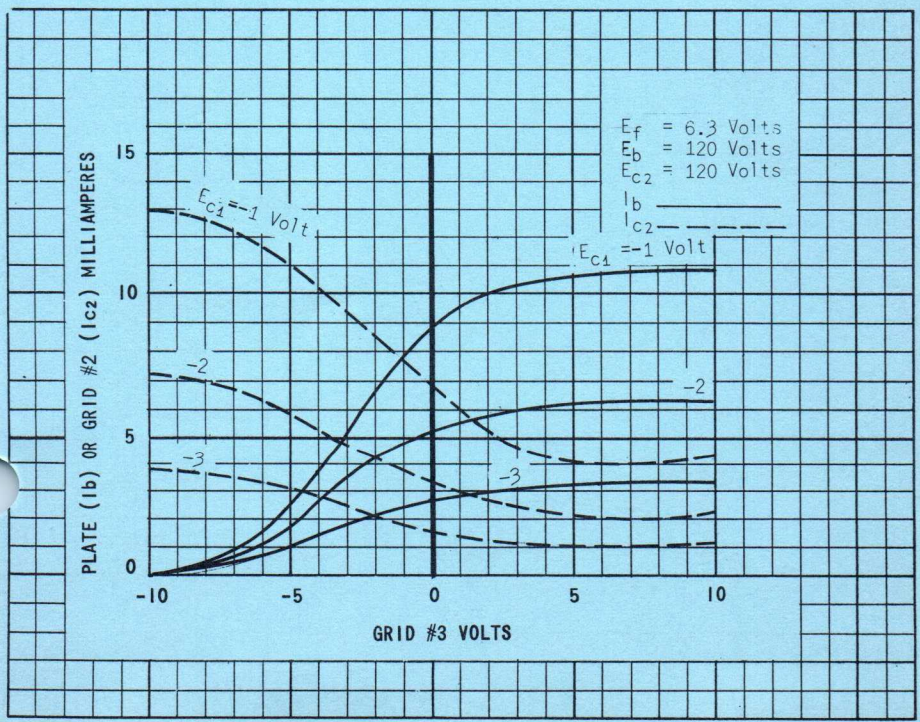
CLASS A1 AMPLIFIER

PLATE VOLTAGE	120	VOLTS
GRID 1 VOLTAGE	0	VOLTS
GRID 2 VOLTAGE	120	VOLTS
GRID 3 VOLTAGE	0	VOLTS
CATHODE BIAS RESISTOR	230	OHMS
PLATE CURRENT	5.5	MA.
TRANSCONDUCTANCE GRID 1 TO PLATE	3200	μMHOS
GRID 2 CURRENT	4.1	MA.

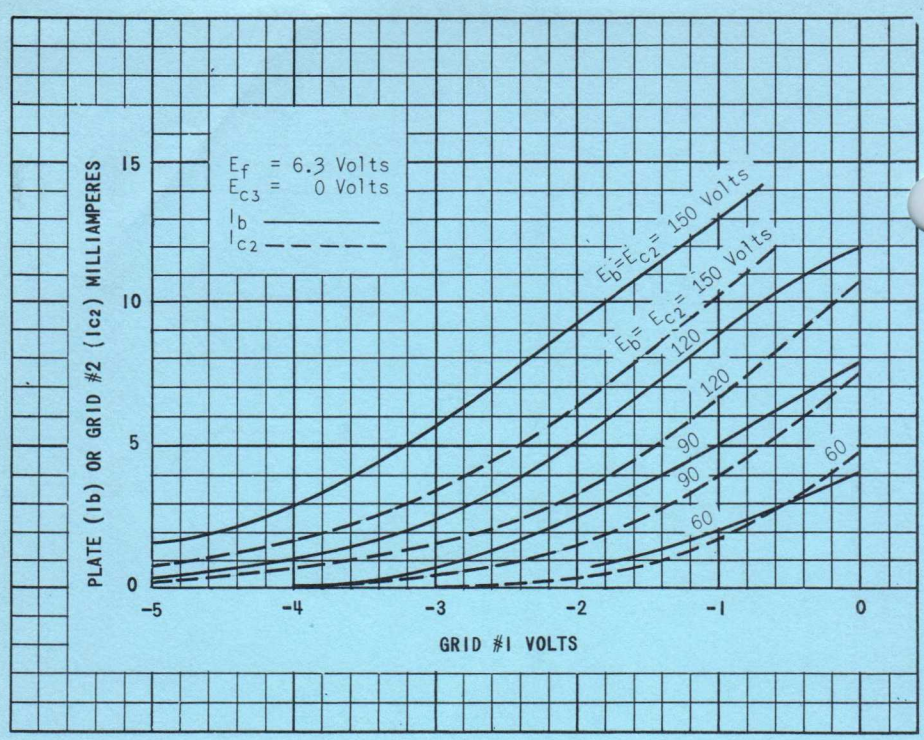
SPECIAL TESTS AND CONTROLS

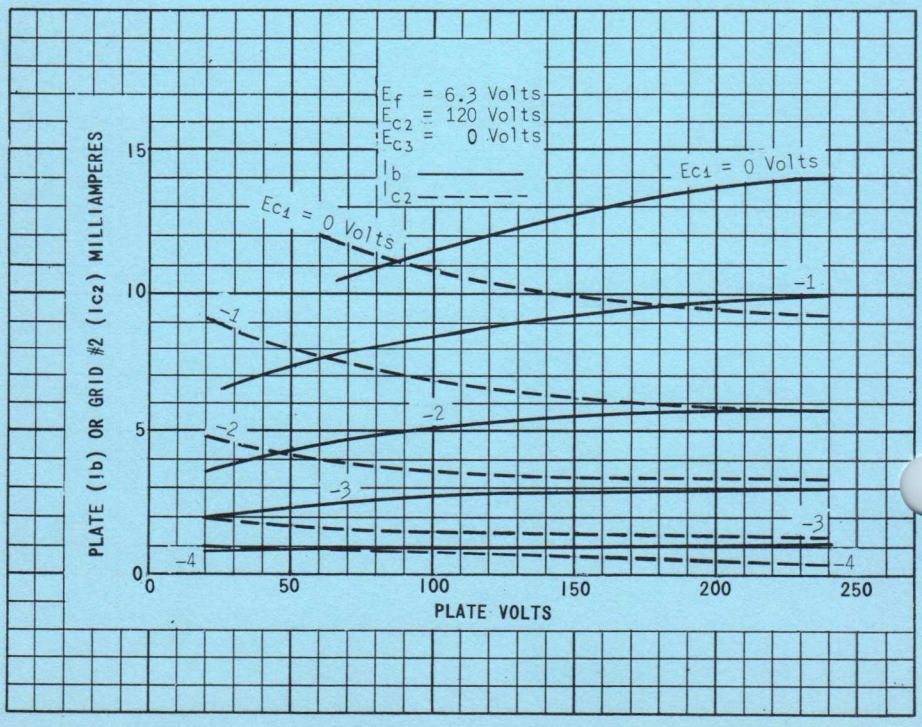
LOW-PRESSURE VOLTAGE BREAKDOWN
OPERATION TIME (5784WB ONLY)
SWEEP FREQUENCY VIBRATION (5784WB ONLY)
SHOCK (1)
SHOCK (2) (5784WB ONLY)
FATIGUE (1)
FATIGUE (2) (5784WB ONLY)





PRINTED IN U. S. A.

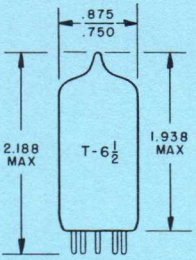

E_f = 6.3 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
$E_b = E_{c2}$ = 150 Volts
$E_b = E_{c2}$ = 150 Volts
120
120
90
90
60
60
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
15
10
5
0
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


E_f = 6.3 Volts
E_{c2} = 120 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c1} = 0 Volts
E_{c1} = 0 Volts
-1
-1
-2
-2
-3
-3
-4
-4
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
15
10
5
0
0
50
100
150
200
250
PLATE VOLTS

TUNG-SOL

THIS DATA SHEET ALSO APPLIES TO ANOTHER MILITARY VERSION, DESIGNATED 5814WB

TWIN TRIODE
MINIATURE TYPE

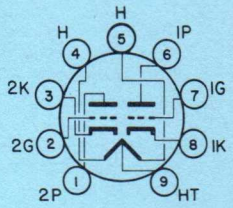


GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

FOR MILITARY AND INDUSTRIAL
GENERAL PURPOSE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9A

THE 5814A IS A 9 PIN MINIATURE MEDIUM-MU TWIN TRIODE, WITH INDIVIDUAL CATHODE CONNECTIONS. IT MAY BE USED FOR A WIDE VARIETY OF APPLICATIONS SUCH AS GENERAL PURPOSE AMPLIFIER, OSCILLATOR OR MULTI-VIBRATOR. THE 5814A IS A SPECIAL QUALITY TUBE WHICH IS RESISTANT TO SHOCK AND VIBRATION AND WILL TOLERATE LONG PERIODS OF OPERATIONS UNDER CUT-OFF CONDITIONS.
THIS TYPE IS SIMILAR TO THE ENTERTAINMENT TYPE 12AU7 EXCEPT FOR HEATER CURRENT.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID TO PLATE, EACH SECTION	1.5	pf
INPUT, EACH SECTION	1.6	pf
OUTPUT, SECTION 1	0.5	pf
OUTPUT, SECTION 2	0.4	pf

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

SUPPLY CONNECTED TO PINS	4 AND 5	9 AND 4 + 5	
AVERAGE VALUES - VOLTAGE	12.6	6.3	VOLTS
- CURRENT	0.175	0.35	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION	12.6±1.2	6.3±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE		100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		100	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

EACH SECTION

PLATE VOLTAGE	330	VOLTS
POSITIVE DC GRID VOLTAGE	0	VOLTS
NEGATIVE DC GRID VOLTAGE	55	VOLTS
PLATE DISSIPATION	3.0	WATTS
DC GRID CURRENT	5.0	MA.
DC CATHODE CURRENT	22	MA.
BULB TEMPERATURE AT HOTTEST POINT	165	°C
GRID CIRCUIT RESISTANCE		
WITH FIXED BIAS	0.5	MEGOHMS
WITH CATHODE BIAS	1.0	MEGOHMS

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH 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	3900	10	10	3600	20	11	3500	30	11
0.10	0.24	5000	14	11	4700	27	12	4400	41	12
0.24	0.24	9400	13	11	8700	25	11	8700	38	12
0.24	0.51	11000	17	11	11000	32	12	11000	48	12
0.51	0.51	19000	15	11	18000	29	12	18000	43	12
0.51	1.0	24000	19	11	23000	37	12	23000	54	12

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	2600	11	12	2000	22	13	1800	31	13
0.10	0.24	3400	16	12	2800	32	13	2600	44	14
0.24	0.24	7200	15	12	5800	29	13	5000	41	13
0.24	0.51	9400	19	12	8400	37	13	7000	52	13
0.51	0.51	17000	16	12	15000	33	13	13000	46	13
0.51	1.0	22000	20	12	20000	42	13	18000	58	13

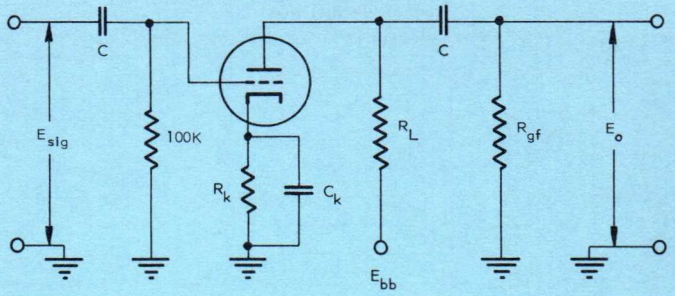
1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR APPROXIMATELY 5% TOTAL HARMONIC DISTORTION.

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.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE



COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED.

TYPICAL OPERATING CHARACTERISTICS

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	0	-8.5	VOLTS
PLATE CURRENT	11.8	10.5	MA.
TRANSCONDUCTANCE	3100	2200	μMHOS
AMPLIFICATION FACTOR	19.5	17	
PLATE RESISTANCE, APPROXIMATE	6250	7700	OHMS
GRID VOLTAGE, APPROXIMATE Ib = 10 μAMPS	------	-22	VOLTS

SPECIAL TESTS AND RATINGS

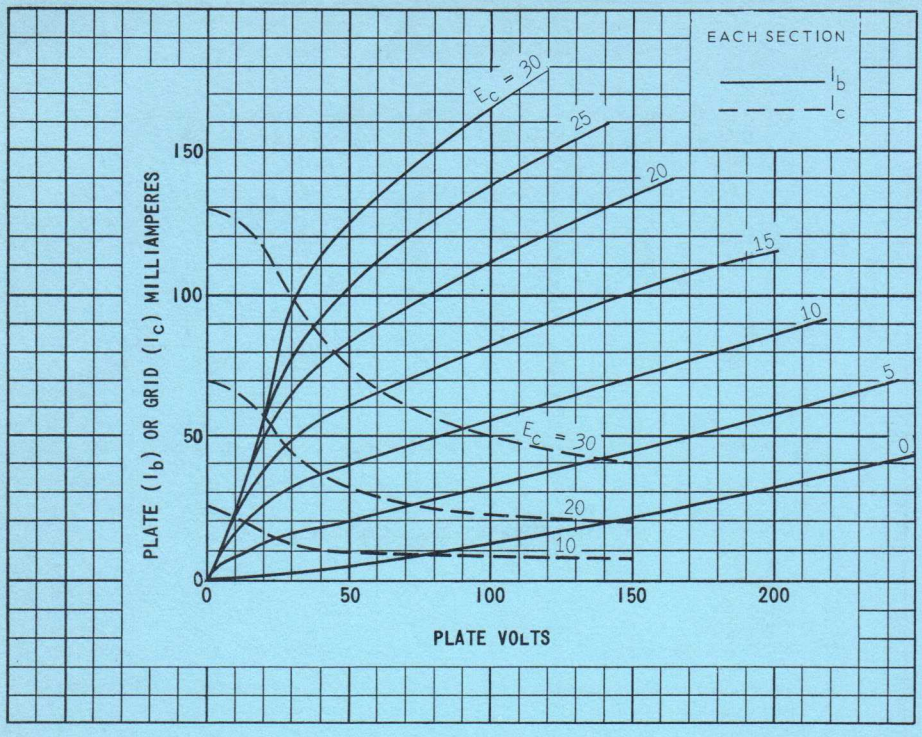
STABILITY LIFE TEST		
SURVIVAL RATE LIFE TEST		
PULSE EMISSION RATINGS		
HEATER-CYCLING LIFE TEST		
SHOCK RATING	40	G
FATIGUE RATING	2.5	G
ALTITUDE RATING	60,000	FEET

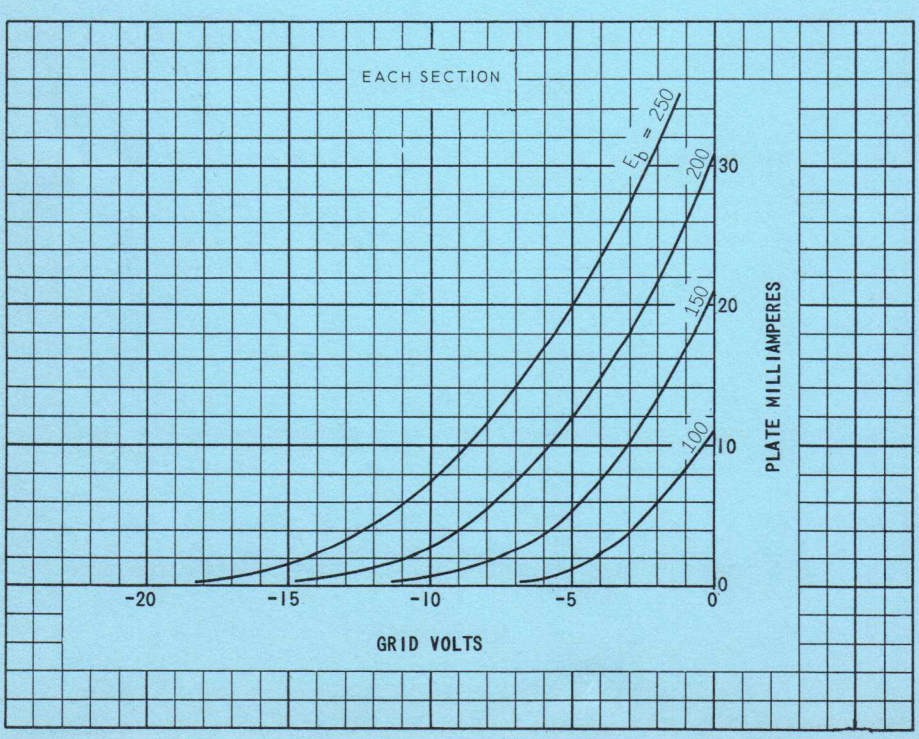
NOTE:

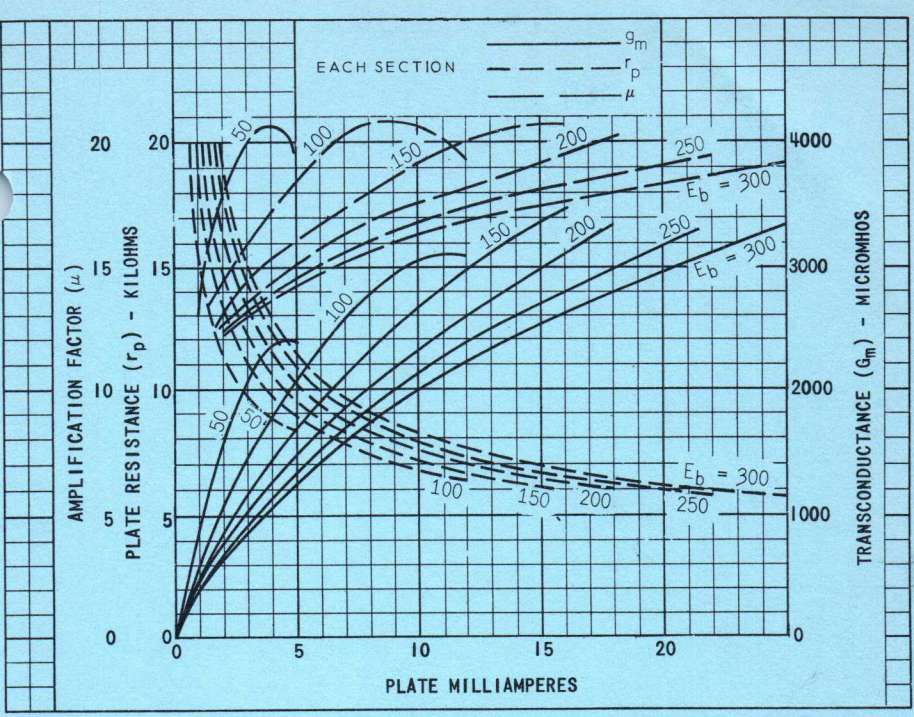
THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE DELIBERATELY BEEN SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS.

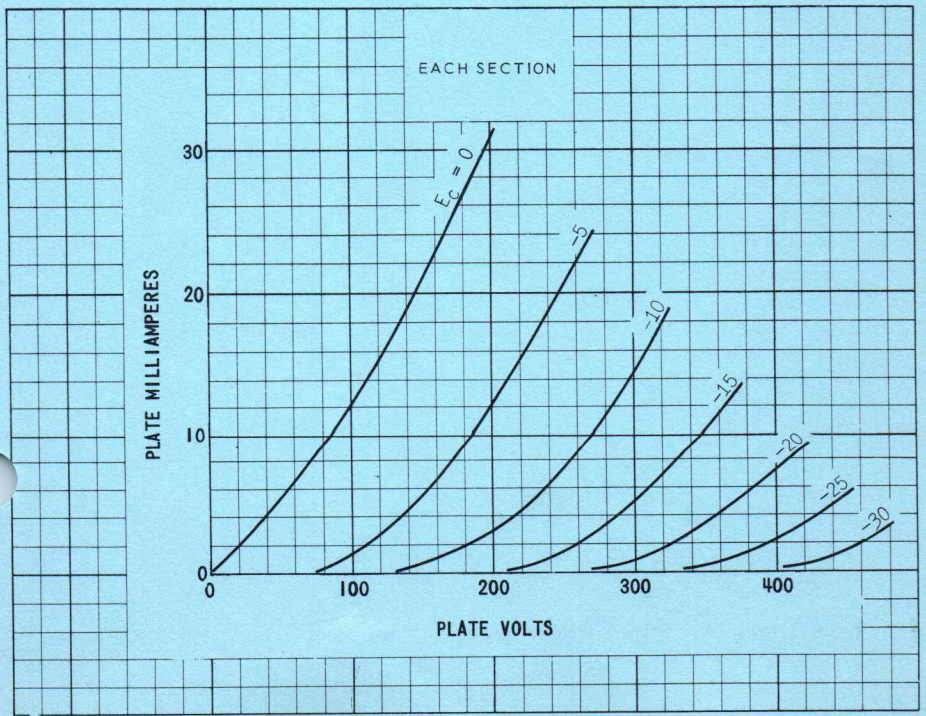
IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO THE LATEST ISSUE OF MIL-E-1.

PRINTED IN U. S. A.


EACH SECTION
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


EACH SECTION
$E_b = 250$
200
150
100
30
20
10
0
PLATE MILLIAMPERES
-20
-15
-10
-5
0
GRID VOLTS



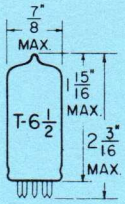


PRINTED IN U.S.A.

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE



GLASS BULB

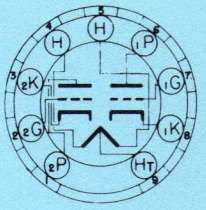
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.35 AMP.
12.6 VOLTS 0.175 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9A

THE 5814WA IS A RUGGEDIZED, MEDIUM MU, TWIN TRIODE OF THE NINE PIN MINIATURE CONSTRUCTION. THE TWO TRIODE SECTIONS ARE ELECTRICALLY INDEPENDENT, ALLOWING SIMULTANEOUS USE OF THE TWO IN COMPLETELY DIFFERENT APPLICATIONS. THE HEATER CENTER TAP PERMITS OPERATION FROM EITHER A 6.3 OR 12.6 VOLT SUPPLY. THE TUBE MAY BE ADAPTED TO SUCH APPLICATIONS AS VOLTAGE AMPLIFIER, OSCILLATOR-MIXER COMBINATION, MULTIVIBRATOR, OR PHASE INVERTER. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT, TRANSCONDUCTANCE, AND AMPLIFICATION FACTOR ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5814WA IS ESPECIALLY SUITED FOR USE IN MILITARY OR INDUSTRIAL AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD SECT. #1	WITHOUT SHIELD SECT. #2	
GRID TO PLATE (RATED)	1.5	1.5	μμf
INPUT (RATED)	1.6	1.6	μμf
OUTPUT (RATED)	0.50	0.35	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	12.6±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330		VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	3.0		WATTS
MAXIMUM DC HEATER-CATHODE VOLTAGE	±200		VOLTS
MAXIMUM DC CATHODE CURRENT[A]	22		mA
MAXIMUM BULB TEMPERATURE	+165		°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH TRIODE SECTION

HEATER VOLTAGE	6.3	12.6	6.3	12.6	VOLTS
HEATER CURRENT	0.35	0.175	0.35	0.175	AMP.
PLATE VOLTAGE	100		250		VOLTS
GRID VOLTAGE[B]	0		-8.5		VOLTS
AMPLIFICATION FACTOR	19.5		17		
PLATE RESISTANCE	6250		7700		OHMS
TRANSCONDUCTANCE	3100		2200		μMHOS
PLATE CURRENT	11.8		10.5		mA

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 12.6V, E_b = 250Vdc, E_c = -8.5Vdc
(EXCEPT AS MODIFIED BELOW)

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	160	190	---	---	160	190	mA
HEATER-CATHODE LEAKAGE[C] (E_{hk} = ±100Vdc)	---	±10	---	---	---	±10	μAdc
GRID CURRENT (1) (R_g = 0.5 MEG.)	0	-0.5	---	---	0	-0.5	μAdc
PLATE CURRENT (1)	6.5	14.5	9.0	12.0	---	---	mAdc
TRANSCONDUCTANCE (1)	1750	2650	2000	2400	1600	2650	μMHOS
Δ AVG. TRANSCONDUCTANCE (1)	---	---	---	---	---	15	PERCENT
INSULATION OF ELECTRODES[D] (E_f=12.6V, E(g-all)=100Vdc, g NEG., E(p-all)=300Vdc,p NEG.)							
$R_{(g-all)}$	500	---	---	---	250	---	MEGOHM
$R_{(p-all)}$	500	---	---	---	250	---	MEGOHM
PLATE CURRENT (2) (E_c=-25Vdc)	---	20	---	---	---	---	μAdc
Δ TRANSCONDUCTANCE (2)[S]	---	15	---	---	---	15	PERCENT
GRID CURRENT (2)[E] (E_f=14V)	0	-1.5	---	---	---	---	μAdc
PLATE CURRENT (1) DIFFERENCE BETWEEN SECTIONS	---	3.5	---	---	---	---	mAdc
TRANSCONDUCTANCE (3) (E_b=100Vdc, E_c=0)	2500	3700	2775	3425	---	---	μMHOS
AMPLIFICATION FACTOR	15.5	18.5	16.2	17.8	---	---	

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[CF] (R_p = 2000)	---	100	mVac
VIBRATIONAL FATIGUE[G]	---	---	
SHOCK[H] (HAMMER ANGLE=30°, E_{hk}=100Vdc, HEATER POSITIVE, R_g = 0.1 MEG.)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	150	mVac
HEATER CATHODE LEAKAGE	---	±30	μAdc
TRANSCONDUCTANCE (3)	2000	---	μMHOS
GRID CURRENT (1)	---	1.5	μAdc
CONTINUITY AND SHORT[J]			
GLASS STRAIN[K]			
RF NOISE[LC] (E_c =-9Vdc, E_{cal} =7.0mVac)	---	3.0	mW
NOISE AND MICROPHONICS[MCNP] (E_f=12.6Vac, E_{hk} =0, E_{bb} =300Vdc, E_c =0, R_p = 50,000)	---	50	mVac
LOW FREQUENCY VIBRATION[QC] (R_p = 2000)	---	100	mVac
LOW PRESSURE VOLTAGE BREAKDOWN[K] (PRESSURE=55±5 mm MERCURY, TEMP.=25±5°C, HUMIDITY=0, VOLTAGE =500Vac, 60 CYCLES SINUSOIDAL WAVEFORM)	500	---	Vac
1 HOUR STABILITY LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS)	---	---	
STABILITY LIFE TEST END POINTS Δ TRANSCONDUCTANCE (1)	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT)	---	---	

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

SPECIAL REQUIREMENTS - CONT'D.

	MIN.	MAX.	
HEATER CYCLING LIFE TEST (E_f =7.5V, E_{hk} =135 Vdc, HEATER POSITIVE, E_c =E_b=0)	---	---	
HEATER CYCLING LIFE TEST END POINTS HEATER-CATHODE LEAKAGE	---	±20	μAdc
INTERMITTENT LIFE TEST (E_{hk} =135 Vdc, HEATER POS., R_g=0.5 MEG, MIN. BULB TEMP =+165°C)	---	---	

NOTES

A DIFFICULTY MAY BE ENCOUNTERED IF THIS TUBE IS OPERATED FOR LONG PERIODS OF TIME WITH VERY SMALL VALUES OF CATHODE CURRENT.

B THE DC RESISTANCE IN THE GRID CIRCUIT UNDER RATED MAXIMUM CONDITIONS SHOULD NOT EXCEED 0.25.

C TIE 1_p TO 2_p, 1_g TO 2_g, 1_k TO 2_k. (PARASITIC SUPPRESSORS OF 50 OHMS MAXIMUM PERMITTED.

D SEE MIL-E-1C 4.8.2

E PRIOR TO THIS TEST TUBES TO BE PREHEATED 5 MINUTES AT CONDITIONS INDICATED BELOW. TEST IMMEDIATELY AFTER PREHEATING. E_f=14.0V, E_{c1}=-8.5V, R_k=0 OHM, E_b=250 Vdc, R_g=0.5 MEG.

F SEE MIL-E-1C 4.9.20.3

G SEE MIL-E-1C 4.9.20.6

H SEE MIL-E-1C 4.9.20.5

J SEE MIL-E-1C 4.7 5

K GLASS STRAIN TEST CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0°C ±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST (2) LITERS PER 15 TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST. REJECT FOR EVIDENCE OF AIR LEAK.

L SEE MIL-E-1C 4.10.3.1

M SEE MIL-E-1C 4.10.3.5

N THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHM @ 60 CYCLES.

P TIE CATHODES TOGETHER AND GROUND THRU A 1500 OHM RESISTOR. GRIDS ARE GROUNDED.

Q SEE MIL-E-1C 4.9.20.4

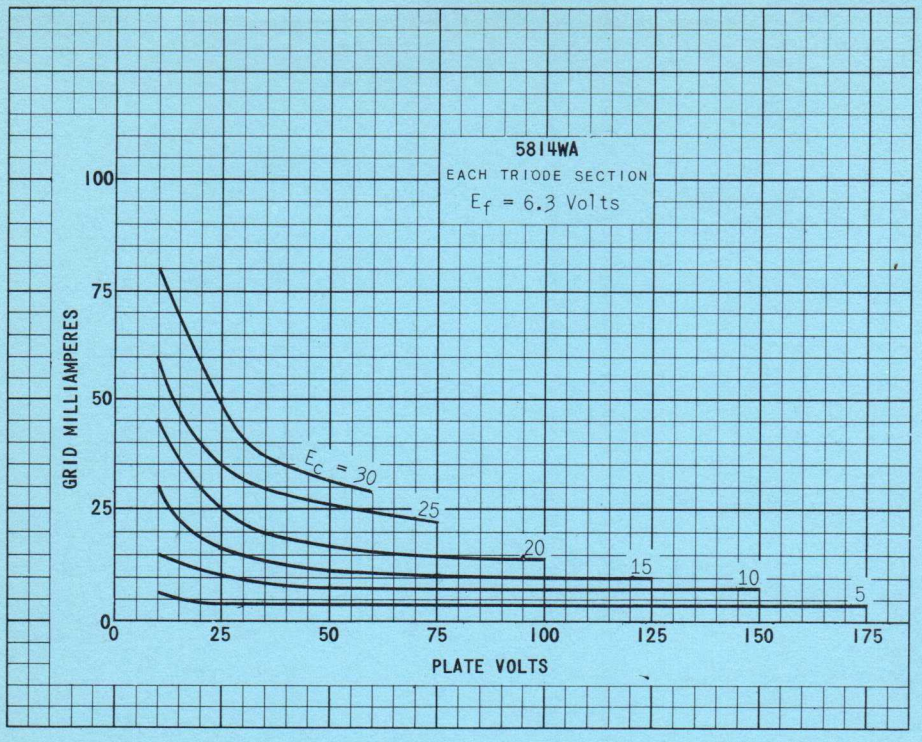
R BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

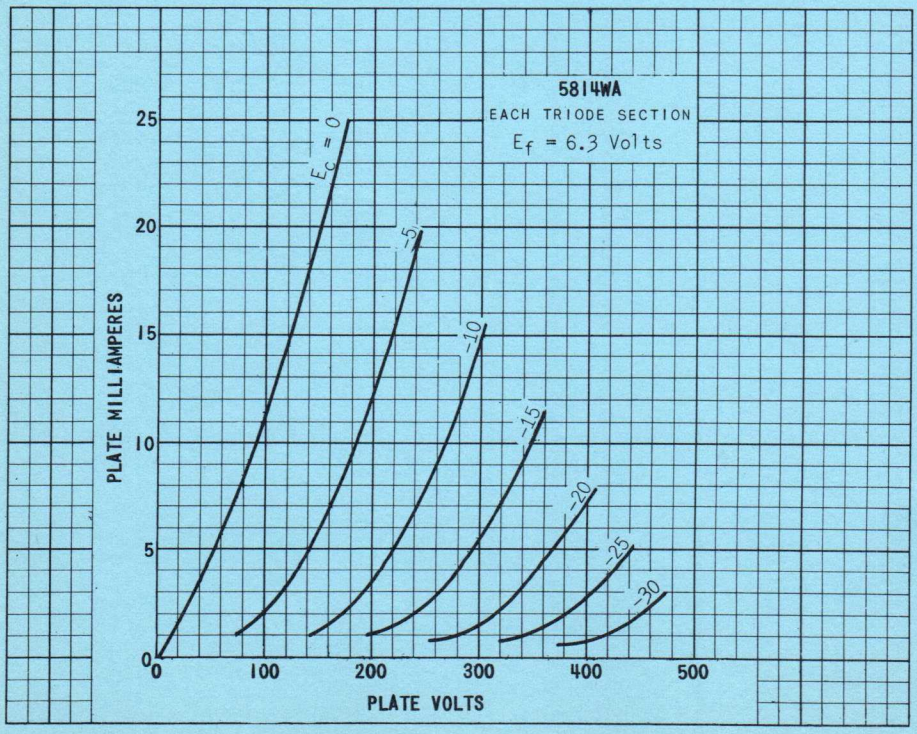
S THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED:

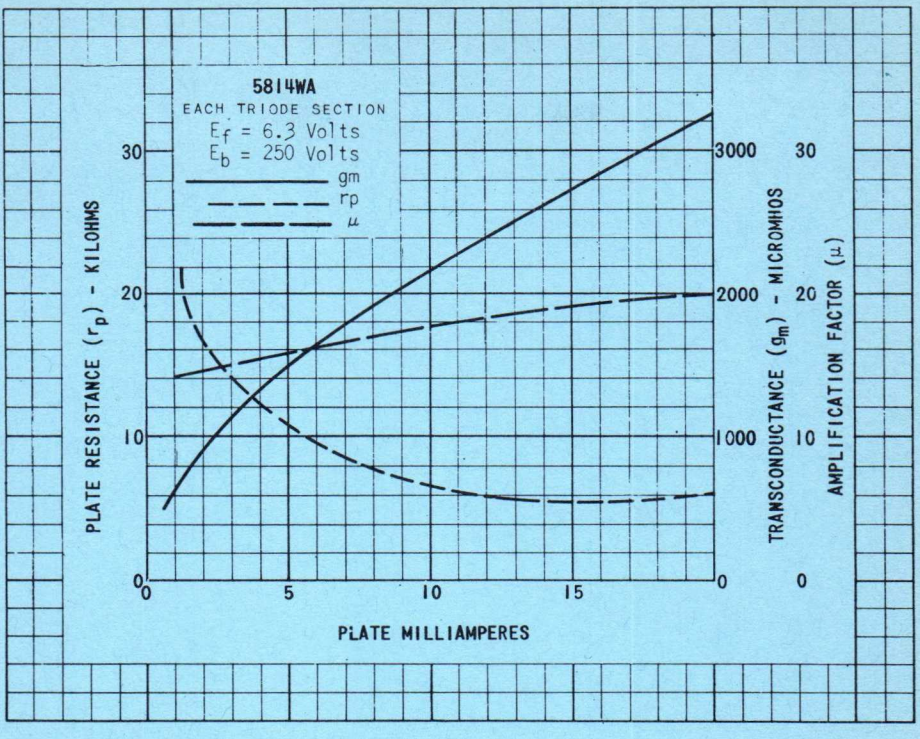
$$\frac{(\text{SM AT } 12.6)-(\text{SM AT } 11.4)}{(\text{SM AT } 12.6)} \times 100$$

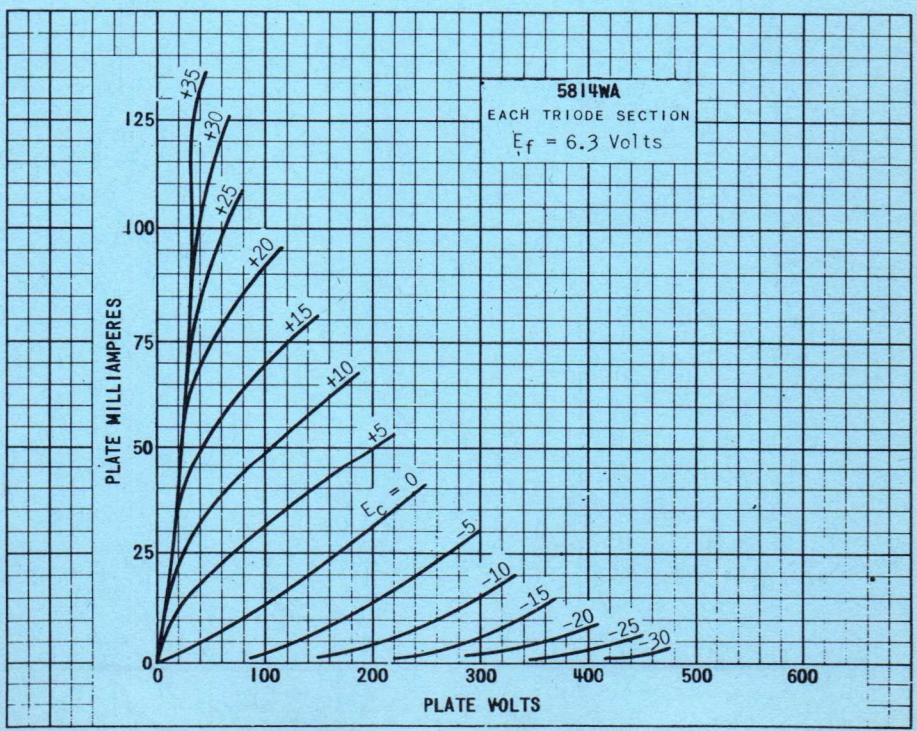
PRINTED IN U.S.A.

5814WA
PREMIUM TUBE





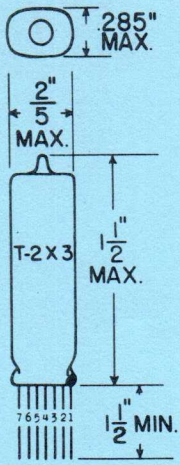

5814WA
EACH TRIODE SECTION
E_f = 6.3 Volts
E_b = 250 Volts
gm
rp
μ
PLATE RESISTANCE (r_p) - KILOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
AMPLIFICATION FACTOR (μ)
PLATE MILLIAMPERES
0
5
10
15
30
20
10
0
3000
2000
1000
30
20
10
0


5814WA
EACH TRIODE SECTION
E_f = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
+35
+30
+25
+20
+15
+10
+5
E_c = 0
-5
-10
-15
-20
-25
-30
125
100
75
50
25
0
100
200
300
400
500
600

TUNG-SOL

DOUBLE DIODE

SUBMINIATURE TYPE

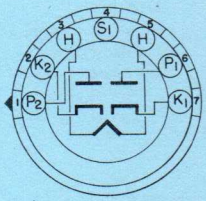


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE – 8 FLEXIBLE LEADS

THE 5829WA IS A CATHODE-TYPE DOUBLE DIODE IN THE SUBMINIATURE CONSTRUCTION, CAPABLE OF OPERATION UP TO ABOUT 400 MC. AN INTERNAL SHIELD IS CONSTRUCTED BETWEEN THE TWO DIODE SECTIONS AND BROUGHT OUT ON A SEPARATE LEAD SO THAT ELECTRICALLY INDEPENDENT OPERATION CAN BE ASSURED. PRODUCT AVERAGE CONTROLS ON SUCH CHARACTERISTICS AS EMISSION AND FULL WAVE OPERATIONAL LOAD CURRENT ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5829WA IS ESPECIALLY SUITABLE FOR USE IN MILITARY AND INDUSTRIAL EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION SUCH AS AIRBORNE COMMUNICATIONS EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
PLATE #1 TO ALL OTHER ELEMENTS (RATED)	2.6	μμf
MAXIMUM	3.5	μμf
MINIMUM	1.9	μμf
PLATE #2 TO ALL OTHER ELEMENTS (RATED)	2.3	μμf
MAXIMUM	3.3	μμf
MINIMUM	1.7	μμf
CATHODE #1 TO ALL OTHER ELEMENTS (RATED)	3.9	μμf
MAXIMUM	4.2	μμf
MINIMUM	2.4	μμf
CATHODE #2 TO ALL OTHER ELEMENTS (RATED)	3.9	μμf
MAXIMUM	4.6	μμf
MINIMUM	2.8	μμf
PLATE #1 TO PLATE #2 (RATED)	0.1	μμf
MAXIMUM	0.12	μμf
MINIMUM	0.06	μμf

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

DIRECT INTERELECTRODE CAPACITANCES – CONT'D.

	WITHOUT SHIELD	
CATHODE #1 TO HEATER (RATED)	2.0	μμf
MAXIMUM	2.2	μμf
MINIMUN	1.1	μμf
CATHODE #2 TO HEATER (RATED)	2.0	μμf
MAXIMUM	2.5	μμf
MINIMUM	1.3	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE (EACH SECTION)	130	VOLTS
MAXIMUM PEAK PLATE INVERSE VOLTAGE	360	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE	±360	VOLTS
MAXIMUM DC OUTPUT CURRENT (EACH SECTION)	5.5	mA.
MAXIMUM PEAK PLATE CURRENT (EACH SECTION)	33	mA.
MAXIMUM SURGE CURRENT (EACH SECTION)	175	mA.
MAXIMUM BULB TEMPERATURE	220	°C
MAXIMUM ALTITUDE	60 000	FEET

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.15	AMP.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE	400	OHMS
DC OUTPUT CURRENT PER PLATE	5	mA.
AVERAGE TUBE VOLTAGE DROP @ 15 mA PER PLATE	5	VOLTS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V, $E_{pp/p}$ = 117vdc, Ehk = 0V, R_L = 14000 Ohms, C_L = 8 μf

EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	138	162	---	---	135	165	mAdc
HEATER–CATHODE LEAKAGE (Ehk=±100 Vdc)	---	±10	---	---	---	±20	μAdc
INSULATION OF ELECTRODES (Ep TO ALL =- 300 Vdc)	100	---	---	---	50	---	MEGOHMS
PLATE CURRENT (Ebb =0, Rp =400)	2	20	---	---	---	---	μAdc
PLATE CURRENT DIFFERENCE BETWEEN SEC.	---	5.0	---	---	---	---	μAdc
GRID EMISSION (Eg=6.5 Vdc)	15	---	16.5	---	---	---	μAdc

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

SPECIAL REQUIREMENTS

	MIN.	MAX.	
LOW PRESSURE VOLTAGE BREAKDOWN			
(PRESSURE =55±5mm Hg, VOLTAGE=330 Vac)[A]	---	---	
VARIABLE FREQUENCY VIBRATION[B]			
(NO VOLTAGES, POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS APPLY)	---	---	
SUBMINIATURE LEAD FATIGUE[C]	4	---	ARCS
SHOCK[D]			
(HAMMER ANGLE = 30°)	---	---	
VIBRATIONAL FATIGUE[E]			
(G=2.5; FIXED FREQUENCY; F=25MIN, 60MAX)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
HEATER CATHODE LEAKAGE	---	±15	μAdc
OPERATION	7.0	---	mAdc
SHORT AND CONTINUITY[F]	---	---	
GLASS STRAIN[G]	---	---	
HEATER CYCLING LIFE TEST			
(Ef=7.5V, Ehk=140Vac, Eb=0, 1 MIN ON 4 MIN OFF)	---	---	
HEATER CYCLING LIFE TEST END POINTS			
HEATER CATHODE LEAKAGE	---	±20	μAdc
INTERMITTENT LIFE TEST			
(T ENVELOPE= 220°C) [H,J]	---	---	

NOTES

[A] TUBE SHALL BE TESTED IN A CHAMBER UNDER THE CONDITIONS OF PRESSURE SPECIFIED. THE SPECIFIED VOLTAGE SHALL BE APPLIED BETWEEN THE LEADS OF ELEMENTS CARRYING B+ VOLTAGE AND THE ADJACENT LEADS. VOLTAGE SHALL BE OF A SINUSOIDAL WAVE FORM WITH F=60 CYCLES. TUBE SHOWING EVIDENCE OF CORONA OR ARCING SHALL BE CONSIDERED DEFECTIVE.

[B] SEE MIL-E-1C 4.9.20.3

[C] SEE MIL-E-1C 4.9.5.3

[D] SEE MIL-E-1C 4.9.20.5

[F] SEE MIL-E-1C 4.7.5

[G] GLASS STRAIN TEST PROCEDURE: ALL TUBES SUBJECTED TO THIS TEST SHALL HAVE BEEN SEALED A MINIMUM OF 48 HOURS PRIOR THERETO. ALL TUBES SHALL BE AT ROOM TEMPERATURE IMMEDIATELY PRIOR TO THIS TEST. THE ENTIRE TUBE SHALL BE IMMERSED IN WATER OF NOT LESS THAN 85°C FOR 15 SECONDS AND IMMEDIATELY THEREAFTER IMMERSED IN WATER OF NOT MORE THAN 5°C FOR 5 SECONDS. THE VOLUME OF WATER SHALL BE LARGE ENOUGH THAT THE TEMPERATURE WILL NOT BE APPRECIABLY EFFECTED BY THE TEST. THE METHOD OF SUBMERSION SHALL BE IN ACCORDANCE WITH DRAWING #245-JAN, AND SUCH THAT A MINIMUM OF HEAT IS CONDUCTED AWAY BY THE HOLDER USED. THE TUBES SHALL BE PLACED IN WATER SO THAT NO CONTACT IS MADE WITH THE CONTAINING VESSEL, NOR SHALL THE TUBES CONTACT EACH OTHER. AFTER THE 5-SECOND SUBMERSION PERIOD, THE TUBES SHALL BE REMOVED AND ALLOWED TO DRY AT ROOM TEMPERATURE ON A WOODEN SURFACE. AFTER DRYING AT ROOM TEMPERATURE FOR 48 HOURS, THE TUBES SHALL BE INSPECTED FOR EVIDENCE OF AIR LEAKS. ELECTRICAL REJECTS, OTHER THAN INOPERATIVES, MAY BE USED IN THE PERFORMANCE TEST.

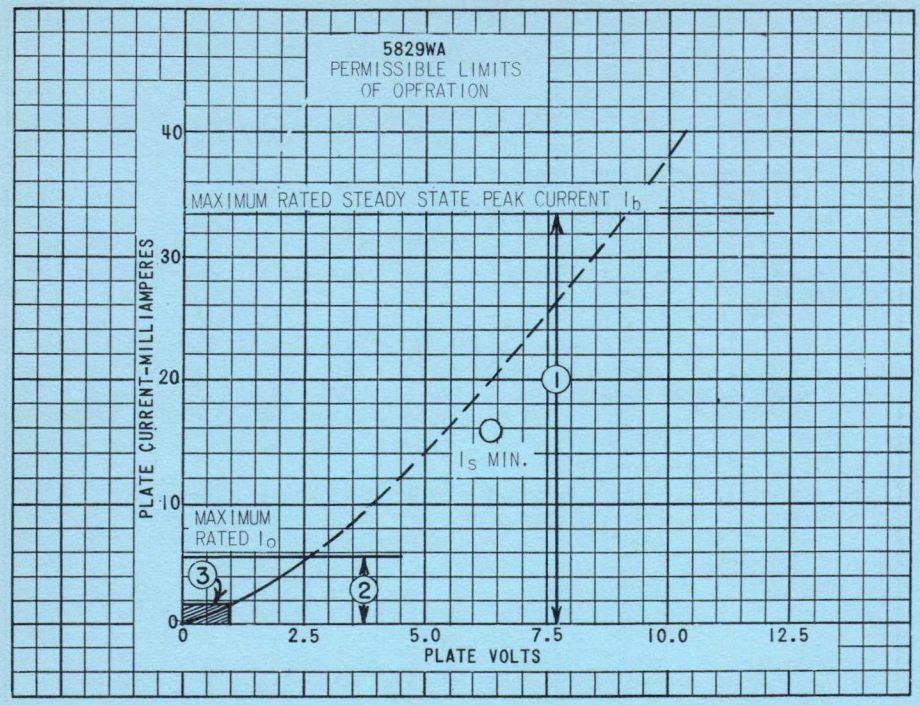
[H] ENVELOPE TEMPERATURE IS DEFINED AS THE HIGHEST TEMPERATURE INDICATED WHEN USING A THERMOCOUPLE OF #40BS OR SMALLER DIAMETER ELEMENTS WELDED TO A RING OF .025 INCH DIAMETER PHOSPHOR BRONZE PLACED IN CONTACT WITH THE ENVELOPE.

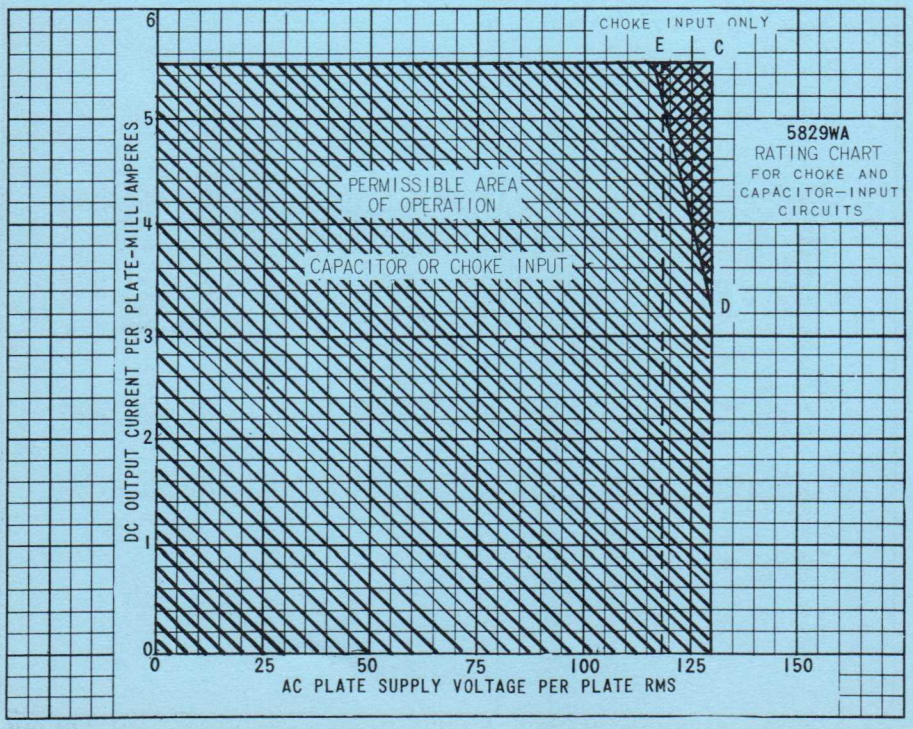
[J] IN FULL-WAVE LIFE TEST CIRCUIT, THE VALUES OF RL AND CL GIVEN IN THE TEST CONDITIONS SHALL BE CONSIDERED AS APPROXIMATE AND SHALL BE ADJUSTED INITIALLY TO GIVE Io EQUAL TO OR GREATER THAN 10 mAdc WITH Ib EQUAL TO OR GREATER THAN 25 mA. Ehk = 117 Vac.

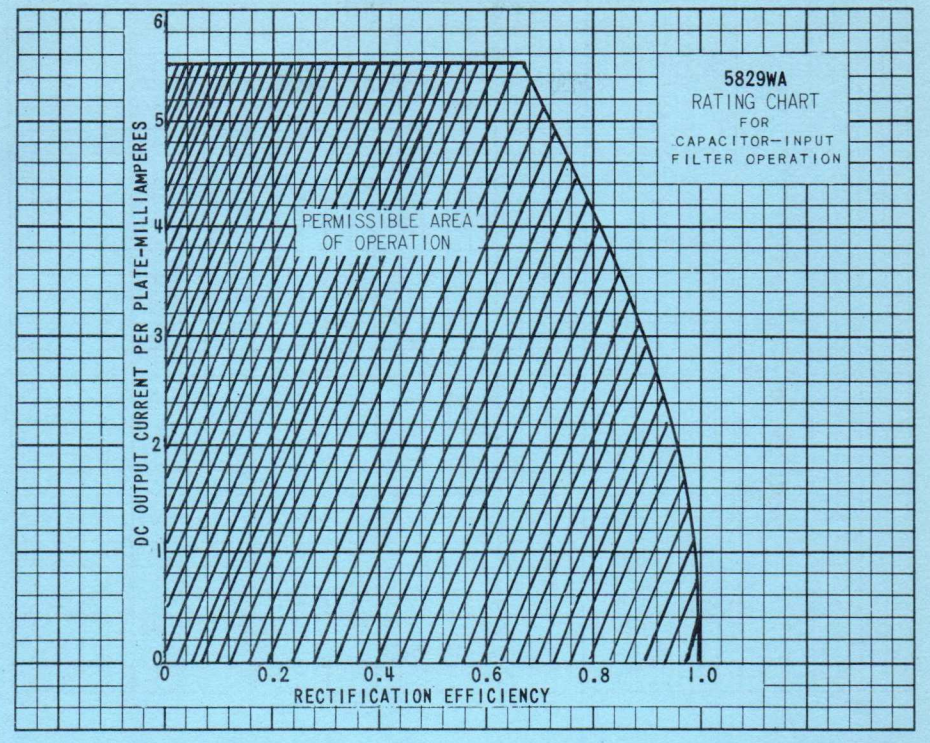
[E] SEE MIL-E-1C 4.9.20.6

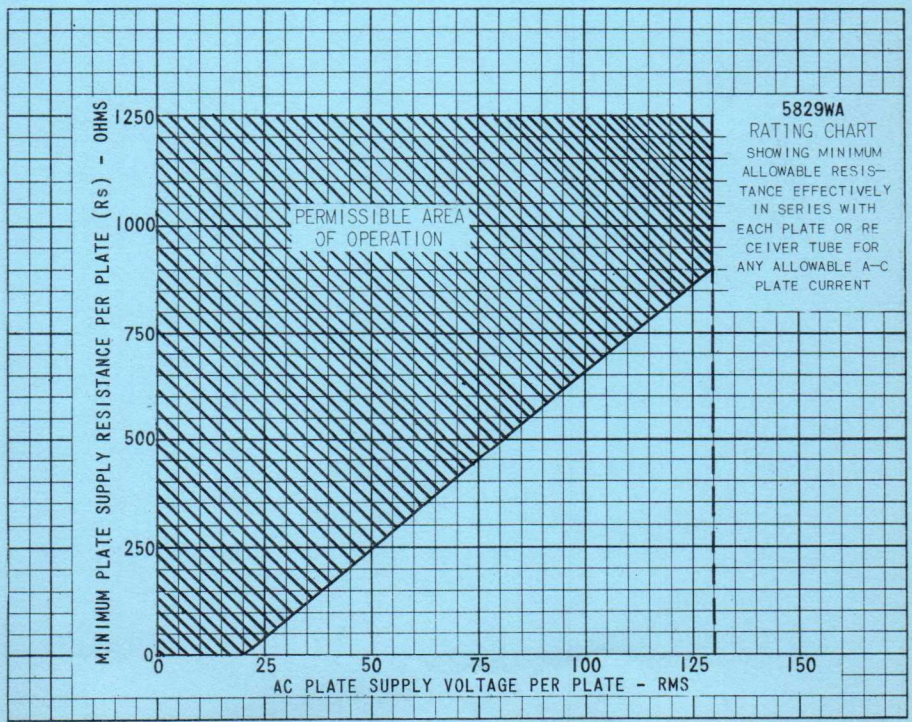
PRINTED IN U.S.A.

TENTATIVE DATA





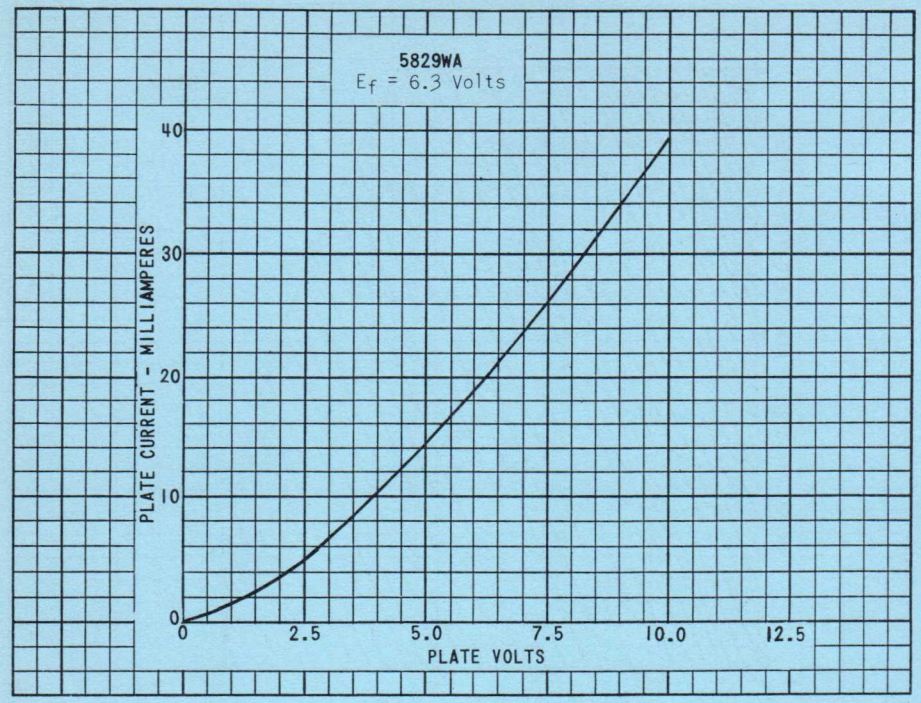




PRINTED IN U.S.A.

5829WA
PREMIUM TUBE

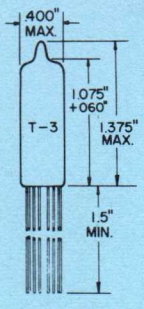
TENTATIVE DATA



TUNG-SOL

PENTODE

SUBMINIATURE TYPE



GLASS BULB

SUBMINIATURE BUTTON
8 PIN LEAD E8-10

OUTLINE DRAWING
JEDEC 3-1

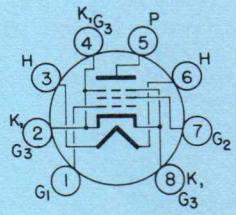
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±0.3 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8DL

THE 5840 IS A SHARP-CUTOFF PENTODE IN THE 8 PIN SUBMINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN HIGH FREQUENCY CIRCUITS. IN ON-OFF CONTROL APPLICATIONS, THE TUBE WILL MAINTAIN ITS EMISSION CAPABILITIES AFTER LONG PERIODS OF OPERATION UNDER CUTOFF CONDITIONS. EXCEPT FOR THE INCORPORATION OF AN INTERNAL CONNECTION FOR THE SUPPRESSOR GRID, THE 5840 IS IDENTICAL TO THE 6205.

DIRECT INTERELECTRODE CAPACITANCES

	[A] WITH SHIELD	WITHOUT SHIELD	
GRID #1 TO PLATE, MAXIMUM	0.015	0.03	pf
INPUT	4.2	4.0	pf
OUTPUT	3.4	1.9	pf

[A] WITH EXTERNAL SHIELD OF 0.405-INCH INSIDE DIAMETER CONNECTED TO CATHODE.

RATINGS

ABSOLUTE MAXIMUM VALUES

PLATE VOLTAGE	165	VOLTS
SCREEN VOLTAGE	155	VOLTS
NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
PLATE DISSIPATION	1.1	WATTS
SCREEN DISSIPATION	0.55	WATTS
DC CATHODE CURRENT	16.5	MA.
HEATER - CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLI FIER

HEATER VOLTAGE	6.3±5%	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	100	VOLTS
SCREEN VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	150	OHMS
PLATE RESISTANCE, APPROX.	0.26	MEGOHMS
TRANSCONDUCTANCE	5000	μMHOS
PLATE CURRENT	7.5	MA.
SCREEN CURRENT	2.4	MA.
GRID #1 VOLTAGE, APPROX. Ib= 10 μAMPS.	-9.0	VOLTS

CLASS A RESISTANCE;COUPLED AMPLIFIER

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

R_L	R_{gf}	Ebb = 90 Volts				Ebb = 150 Volts				Ebb = 225 Volts			
		R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain
0.10	0.10	1000	0.2	13	50	500	0.3	19	83	400	0.3	29	110
0.10	0.24	1000	0.2	16	73	500	0.3	25	120	400	0.3	38	160
0.24	0.24	1700	0.5	13	72	1500	0.6	20	100	700	0.8	29	160
0.24	0.51	2000	0.6	15	89	1500	0.7	24	140	700	0.9	35	210
0.51	0.51	2500	1.3	11	93	2000	1.5	18	140	1000	1.7	28	200
0.51	1.0	3000	1.5	13	110	2000	1.7	20	180	1000	2.0	31	260

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100 K OHMS)

R_L	R_{gf}	Ebb = 90 Volts				Ebb = 150 Volts				Ebb = 225 Volts			
		R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain
0.10	0.10	1200	0.2	13	48	700	0.2	18	77	500	0.3	28	110
0.10	0.24	1300	0.2	16	70	800	0.3	24	110	500	0.3	37	150
0.24	0.24	2800	0.4	12	68	1700	0.6	20	100	1200	0.8	29	150
0.24	0.51	3000	0.5	15	82	1800	0.7	24	140	1300	0.8	35	190
0.51	0.51	5500	1.0	11	76	3500	1.3	18	120	2400	1.6	26	180
0.51	1.0	6200	1.2	12	92	3800	1.6	19	160	2500	1.8	31	230

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.

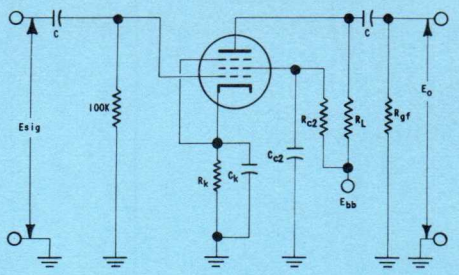
3. R_k IS IN OHMS; R_{c2}, R_L, AND R_{gf} ARE IN MEGOHMS.

4. COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k AND R_{c2} SHOULD BE ADEQUATELY BY-PASSED.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE



CHARACTERISTICS LIMITS

		MIN.	MAX.	
HEATER CURRENT				
Ef = 6.3 VOLTS	INITIAL	140	160	MA.
	500-HR.	138	164	MA.
PLATE CURRENT:				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=				
100 VOLTS, Rk=150 OHMS (BY-PASSED)	INITIAL	5.5	9.5	MA.
SCREEN CURRENT:				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=				
100 VOLTS, Rk=150 OHMS (BY-PASSED)	INITIAL	1.5	3.3	MA.
TRANSCONDUCTANCE (1):				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=				
100 VOLTS, Rk=150 OHMS (BY-PASSED)	INITIAL	4200	5800	μMHOS
TRANSCONDUCTANCE CHANGE WITH HEATER VOLTAGE:				
DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) AND TRANSCONDUCTANCE AT Ef= 5.7 VOLTS (OTHER CONDITIONS THE SAME) EXPRESSED AS A PERCENTAGE OF TRANSCONDUCTANCE (1)	INITIAL	---	10	PERCENT
	500-HR.	---	15	PERCENT
TRANSCONDUCTANCE CHANGE WITH OPERATION: DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) INITIALLY AND AFTER OPERATION EXPRESSED AS A PERCENTAGE OF INITIAL VALUE	500-HR.	---	20	PERCENT
AVERAGE TRANSCONDUCTANCE CHANGE WITH OPERATION: AVERAGE OF VALUES FOR 'TRANSCONDUCTANCE CHANGE WITH OPERATION'	500-HR.	---	15	PERCENT
PLATE RESISTANCE:				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=				
100 VOLTS, Rk=150 OHMS (BY-PASSED)	INITIAL	0.175	---	MEGOHMS
PLATE CURRENT CUTOFF:				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=				
100 VOLTS, Ec1=-9.0 VOLTS	INITIAL	---	50	μAMPS.
INTERELECTRODE CAPACITANCES:				
GRID #1 TO PLATE (G1 TO P)	INITIAL	---	0.015	μμf
INPUT (G1 TO H,K, G2 G3)	INITIAL	3.5	4.9	μμf
OUTPUT (P TO H, K, G2 G3)	INITIAL	2.9	3.9	μμf

(MEASURED WITH EXTERNAL SHIELD OF 0.405-INCH INSIDE DIAMETER CONNECTED TO CATHODE)

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS LIMITS - cont'd.

		MIN.	MAX.	
NEGATIVE GRID #1 CURRENT:				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=				
100 VOLTS, Rk=150 OHMS (BY-PASSED),				
Rg1=1.0 MEG.	INITIAL	---	0.3	μAMPS.
	500-HR.	---	0.8	μAMPS.
HEATER-CATHODE LEAKAGE CURRENT:				
Ef=6.3 VOLTS, Ehk=100 VOLTS,				
HEATER POSITIVE WITH RESPECT				
TO CATHODE	INITIAL	---	5.0	μAMPS.
	500-HR.	---	10	μAMPS.
HEATER NEGATIVE WITH RESPECT				
TO CATHODE	INITIAL	---	5.0	μAMPS.
	500-HR.	---	10	μAMPS.
INTERELECTRODE LEAKAGE RESISTANCE:				
Ef=6.3 VOLTS. POLARITY OF APPLIED DC				
INTERELECTRODE VOLTAGE IS SUCH				
THAT NO CATHODE EMISSION RESULTS				
GRID #1 TO ALL AT 100 VOLTS DC	INITIAL	100	---	MEG.
	500-HR.	50	---	MEG.
PLATE TO ALL AT 300 VOLTS DC	INITIAL	100	---	MEG.
	500-HR.	50	---	MEG.
VIBRATIONAL NOISE OUTPUT VOLTAGE RMS				
Ef=6.3 VOLTS, Ebb=100 VOLTS, Ec2=100				
VOLTS, Rk=150 OHMS (BY-PASSED), R_L=				
10,000 OHMS, VIBRATIONAL ACCELERATION=				
15 G AT 40 CPS	INITIAL	---	60	MV.
GRID #1 EMISSION CURRENT:				
Ef=7.5 VOLTS, Eb=100 VOLTS, Ec2=				
100 VOLTS, Ecc1=-9.0 VOLTS, Rg1=1.0 MEG.	INITIAL	---	0.5	μAMPS.

THE INDICATED 500-HOUR VALUES ARE LIFE-TEST END POINTS FOR THE FOLLOWING CONDITIONS OF OPERATION: Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=100 VOLTS, Rk=150 OHMS, Rg1=1.0 MEG, Ehk=200 VOLTS WITH HEATER POSITIVE WITH RESPECT TO CATHODE, AND BULB TEMPERATURE=220 C MINIMUM.

SPECIAL TESTS AND RATINGS

STABILITY LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HOUR TO EVALUATE AND CONTROL INITIAL VARIATIONS IN TRANSCONDUCTANCE.

SURVIVAL RATE LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HUNDRED HOURS TO EVALUATE AND CONTROL EARLY-LIFE ELECTRICAL AND MECHANICAL INOPERATIVES.

HEATER-CYCLING LIFE TEST
STATISTICAL SAMPLE OPERATED FOR 2000 CYCLES TO EVALUATE AND CONTROL HEATER-CATHODE DEFECTS. CONDITIONS OF TEST INCLUDE Ef=7.0 VOLTS CYCLED FOR ONE MINUTE ON AND FOUR MINUTES OFF, Eb=Ec2=Ec1=0 VOLTS, AND Ehk=140 VOLTS RMS.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

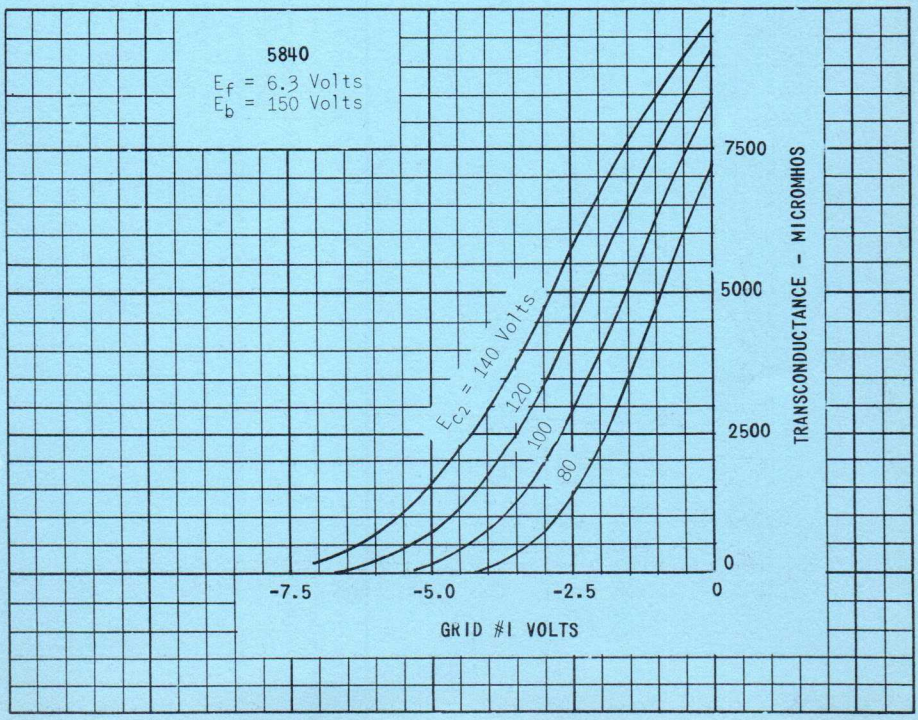
SPECIAL TESTS AND RATINGS - cont'd.

SHOCK RATING–450 G
STATISTICAL SAMPLE SUBJECTED TO FIVE IMPACT ACCELERATIONS OF 450 G IN EACH OF FOUR DIFFERENT POSITIONS. THE ACCELERATING FORCES ARE APPLIED BY THE NAVY-TYPE, HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT.

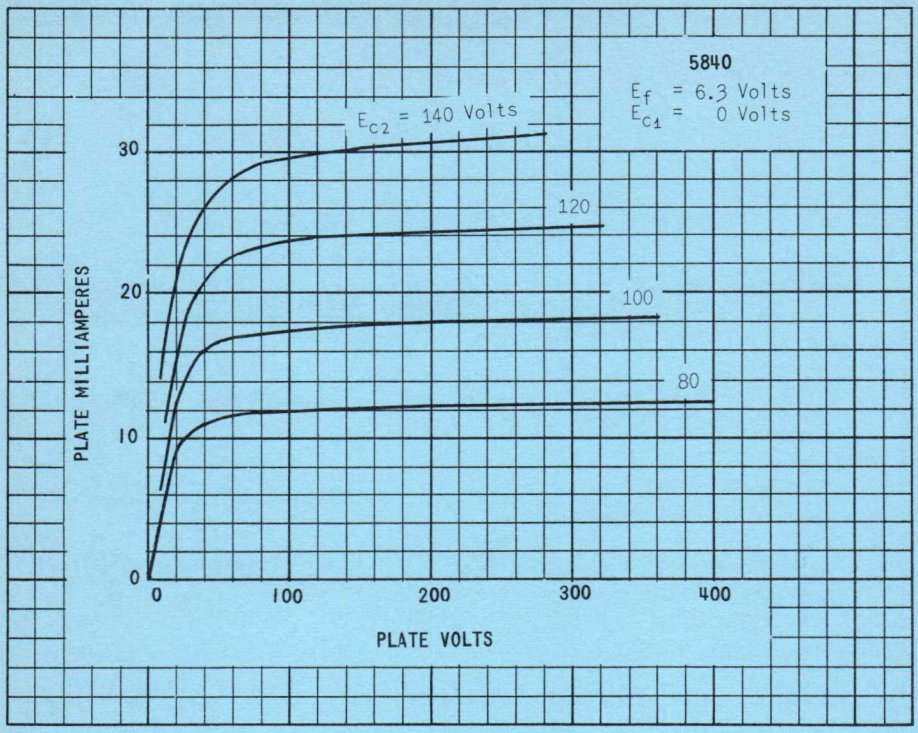
FATIGUE RATING–2.5 G
STATISTICAL SAMPLE SUBJECTED TO VIBRATIONAL ACCELERATION OF 2.5 G FOR 32 HOURS MINIMUM IN EACH OF THREE DIFFERENT POSITIONS. THE SINUSOIDAL VIBRATION IS APPLIED AT A FIXED FREQUENCY BETWEEN 25 AND 60 CYCLES PER SECOND.

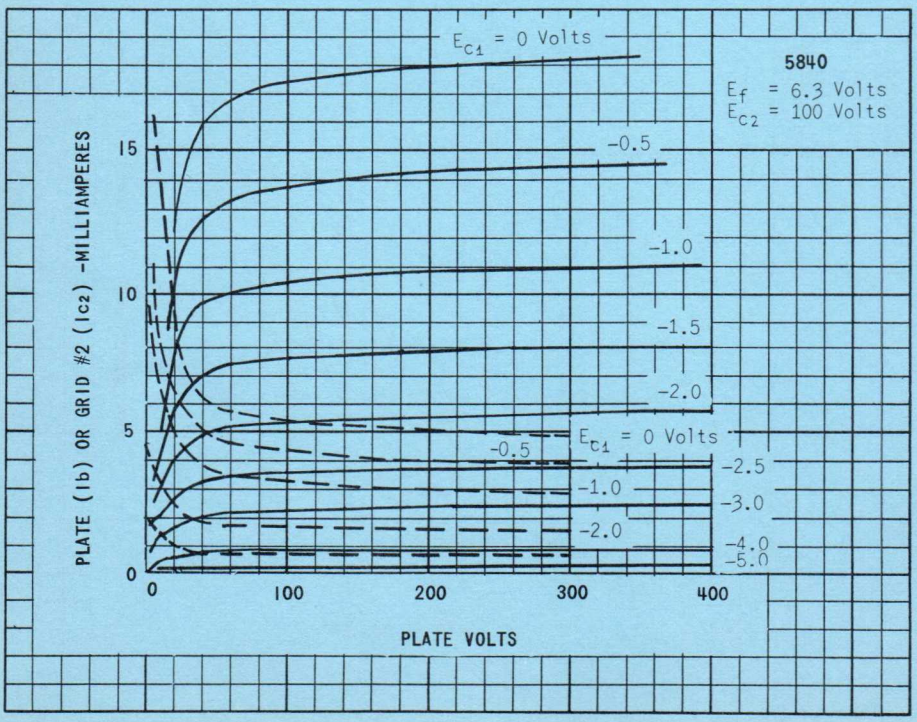
ALTITUDE RATING–60,000 FEET
STATISTICAL SAMPLE SUBJECTED TO PRESSURE OF 55 MILLIMETERS OF MERCURY TO EVALUATE AND CONTROL ARCING AND CORONA.

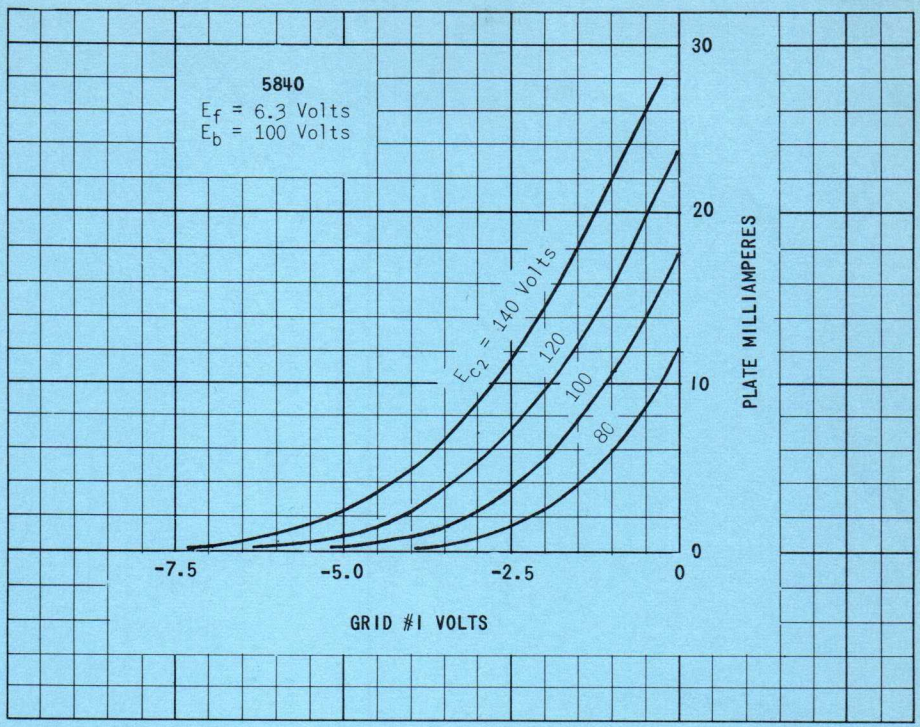
NOTE: THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE BEEN DELIBERATELY SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS. IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO THE APPROPRIATE MIL-E-1 SPECIFICATION.

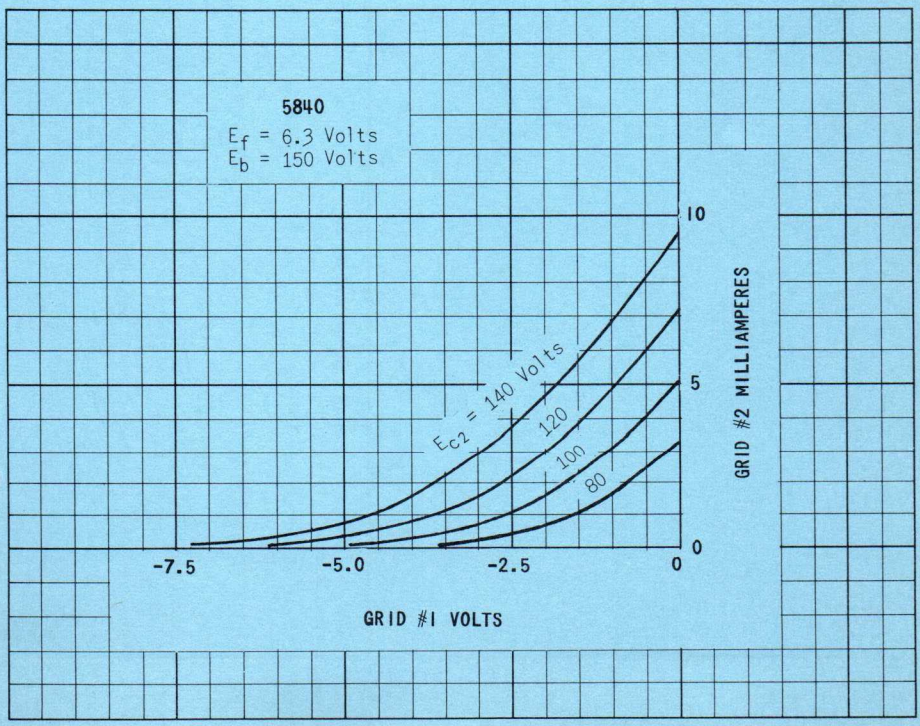


PRINTED IN U.S.A.


5840
E_f = 6.3 Volts
E_{c_1} = 0 Volts
E_{c_2} = 140 Volts
120
100
80
PLATE MILLIAMPERES
30
20
10
0
0
100
200
300
400
PLATE VOLTS


5840
E_f = 6.3 Volts
E_{c_2} = 100 Volts
E_{c_1} = 0 Volts
-0.5
-1.0
-1.5
-2.0
E_{c_1} = 0 Volts
-0.5
-1.0
-2.0
-2.5
-3.0
-4.0
-5.0
PLATE (Ib) OR GRID #2 (Ic2) -MILLIAMPERES
15
10
5
0
0
100
200
300
400
PLATE VOLTS



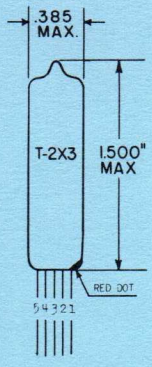


PRINTED IN U.S.A.

TUNG-SOL

PENTODE

SUBMINIATURE TYPE

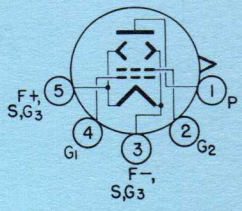


GLASS BULB
COLOR DOT IS ADJACENT
TO LEAD 1
IN-LINE LEADS

COATED FILAMENT

1.25 VOLTS 100 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED
FLEXIBLE LEADS

0.048" SPACING
CENTER—TO—CENTER

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

THE 5875 IS A FILAMENT TYPE, SHARP CUTOFF PENTODE OF SUBMINIATURE CONSTRUCTION, DESIGNED FOR RADIOSONDE APPLICATIONS. A COATED METALLIC 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.)	0.03	pf
INPUT	4.0	pf
OUTPUT	4.0	pf

RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	90	VOLTS
GRID #2 VOLTAGE	90	VOLTS
TOTAL CATHODE CURRENT	6.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	90	VOLTS
GRID #2 VOLTAGE	90	VOLTS
GRID #1 VOLTAGE	0	VOLTS
TRANSCONDUCTANCE	2 500	μMHOS
PLATE CURRENT	3.5	MA.
GRID #2 CURRENT	1.0	MA.
GRID #1 VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE = 10 μMHOS	-3.5	VOLTS

PRINTED IN U.S.A.

TUNG-SOL

UHF POWER TRIODE

PENCIL TYPE

FOR

RF POWER AMPLIFIER, OSCILLATOR

AND FREQUENCY MULTIPLIER APPLICATIONS

IN MOBILE AND AIRCRAFT EQUIPMENT

PHYSICAL DIMENSIONS SEE OUTLINE DRAWING

ELECTRODE TERMINATIONS SEE OUTLINE DRAWING

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

THE 5876A IS A COAXIAL METAL-GLASS PENCIL-TYPE MEDIUM MU TRIODE. ITS MAXIMUM PLATE DISSIPATION IS 6¼ WATTS CCS. THE TUBE MAY BE OPERATED WITH FULL RATINGS UP TO A FREQUENCY OF 1,700 MC/S, AND WITH REDUCED RATINGS UP TO 3,000 MC/S.

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE		1.4	pf
GRID TO CATHODE		2.4	pf
PLATE TO CATHODE	MAX.	0.035	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	135	mA
LIMITS OF APPLIED VOLTAGE - AC OR DC		6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		90	VOLTS
MINIMUM PREHEAT TIME		60	SEC.

AVERAGE STATIC CHARACTERISTICS

PLATE VOLTAGE	250	VOLTS
CATHODE RESISTOR	75	OHMS
PLATE CURRENT	18	mA
TRANSCONDUCTANCE	6,500	μMHOS
AMPLIFICATION FACTOR	56	

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

CLASS A_1 – RF AMPLIFIER

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

CONTINUOUS COMMERCIAL SERVICE

DC PLATE VOLTAGE	300	VOLTS
DC GRID VOLTAGE	-100	VOLTS
DC PLATE CURRENT	25	mA
PLATE DISSIPATION - SEE NOTE ON OUTLINE	6.25	WATTS
FREQUENCY FOR OPERATION AT FULL RATINGS	1,700	MC/S
ALTITUDE FOR OPERATION AT FULL RATINGS	60,000	FEET
GRID CIRCUIT RESISTANCE	0.5	MEGOHMS

CLASS C TELEGRAPHY - RF POWER AMPLIFIER AND OSCILLATOR

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

CONTINUOUS COMMERCIAL SERVICE

DC PLATE VOLTAGE	360	VOLTS
DC GRID VOLTAGE	-100	VOLTS
DC PLATE CURRENT	25	mA
DC GRID CURRENT	8	mA
PLATE INPUT	9	WATTS
PLATE DISSIPATION - SEE NOTE ON OUTLINE	6.25	WATTS
FREQUENCY FOR OPERATION AT FULL RATINGS	1,700	MC/S
ALTITUDE FOR OPERATION AT FULL RATINGS	60,000	FEET
GRID CIRCUIT RESISTANCE	0.1	MEGOHMS

TYPICAL OPERATION - OSCILLATOR IN CATHODE - DRIVE CIRCUIT

RF AMPLIFIER WITH CATHODE DRIVE

CONTINUOUS COMMERCIAL SERVICE

FREQUENCY	500	1,700	3,000	MC/S
DC PLATE -TO-GRID VOLTAGE	262	252	252	VOLTS
DC CATHODE-TO-GRID VOLTAGE OBTAINED FROM A GRID RESISTOR	12	2	2	VOLTS
DC PLATE CURRENT	23	23	25	mA
DC GRID CURRENT - APPROX.	6	3	4	mA
USEFUL POWER OUTPUT - APPROX.	3	0.75	0.1	mW

TYPICAL OPERATION - RF POWER AMPLIFIER IN CATHODE - DRIVE CIRCUIT

FREQUENCY	500	MC/S
DC PLATE - TO - GRID VOLTAGE	326	VOLTS
DC CATHODE - TO - GRID VOLTAGE OBTAINED FROM A GRID RESISTOR	51	VOLTS
DC PLATE CURRENT	23	mA
DC GRID CURRENT - APPROX.	7	mA
DRIVING POWER - APPROX.	2	WATTS
USEFUL POWER OUTPUT - APPROX.	5	WATTS

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

CLASS C TELEPHONY - PLATE - MODULATED RF POWER AMPLIFIER

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM

CONTINUOUS COMMERCIAL SERVICE		
DC PLATE VOLTAGE	275	VOLTS
DC GRID VOLTAGE	−100	VOLTS
DC PLATE CURRENT	22	mA
DC GRID CURRENT	8	mA
PLATE INPUT	6	WATTS
PLATE DISSIPATION - SEE NOTE ON OUTLINE	4.25	WATTS
FREQUENCY FOR OPERATION AT FULL RATINGS	1,700	MC/S
ALTITUDE FOR OPERATION AT FULL RATINGS	60,000	FEET
GRID CIRCUIT RESISTANCE	0.1	MEGOHMS

FREQUENCY MULTIPLIER

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM

CONTINUOUS COMMERCIAL SERVICE		
DC PLATE VOLTAGE	330	VOLTS
DC GRID VOLTAGE	−100	VOLTS
DC PLATE CURRENT	22	mA
DC GRID CURRENT	8	mA
PLATE INPUT	7.5	WATTS
PLATE DISSIPATION - SEE NOTE ON OUTLINE	6.25	WATTS
FREQUENCY FOR OPERATION AT FULL RATINGS	1,700	MC/S
ALTITUDE FOR OPERATION AT FULL RATINGS	60,000	FEET

TYPICAL OPERATION - CATHODE DRIVE CIRCUITS

CONTINUOUS COMMERCIAL SERVICE	TRIPLER TO 480 MC/S	DOUBLER TO 960 MC/S	
DC PLATE - TO - GRID VOLTAGE	390	370	VOLTS
DC CATHODE - TO - GRID VOLTAGE OBTAINED FROM A GRID RESISTOR	90	70	VOLTS
DC PLATE CURRENT	18	17.3	mA
DC GRID CURRENT - APPROX.	6	7	mA
DRIVING POWER - APPROX.	2.1	2	WATTS
USEFUL POWER OUTPUT - APPROX.	2.1	2	WATTS

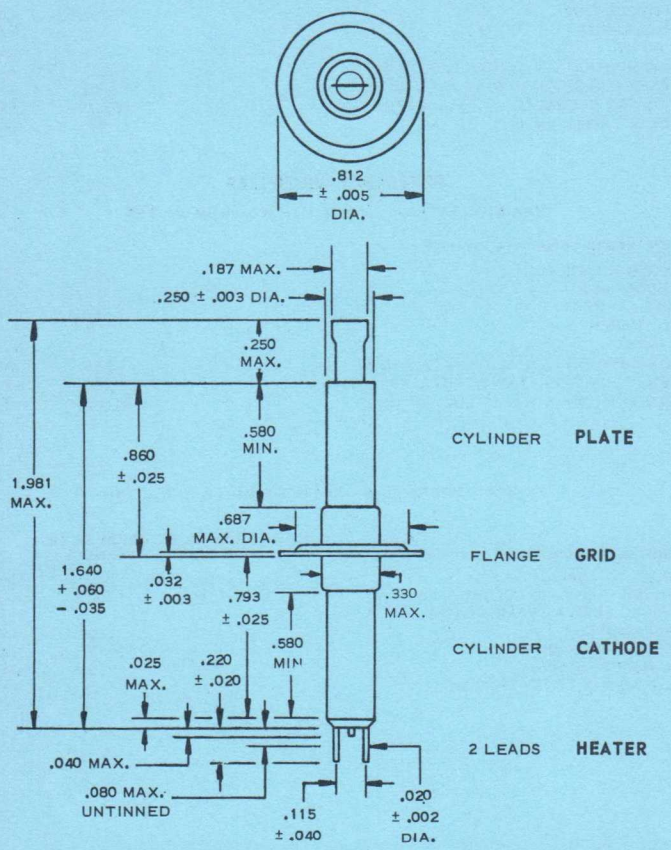
SPECIAL TESTS AND PERFORMANCE DATA

CONTROLLED ON A SAMPLING BASIS

VIBRATION TEST
GLASS SEAL FRACTURE TESTS
HEATER CYCLING LIFE TEST
500 HOUR LIFE TEST IN OSCILLATOR

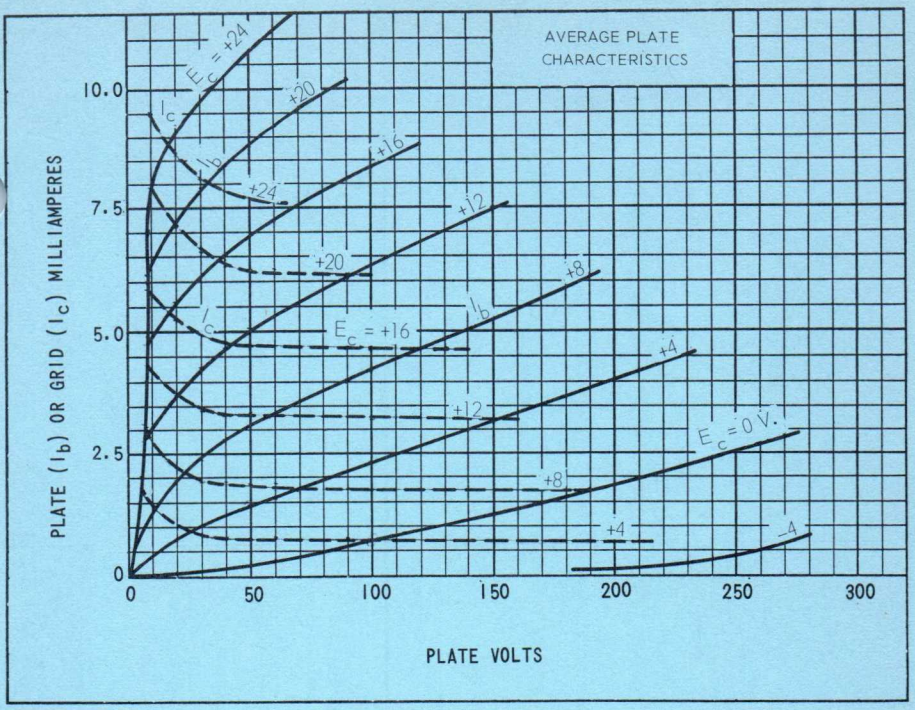
PRINTED IN U.S.A.

OUTLINE DRAWING



ALL DIMENSIONS IN INCHES

NOTE: COOLING MUST BE ADEQUATE SO AS TO ASSURE THAT TEMPERATURE OF THE PLATE SEAL WILL NOT EXCEED 175 °C.



PRINTED IN U. S. A.

TUNG-SOL

PENTODE

MINIATURE TYPE

SHARP-CUTOFF PENTODE

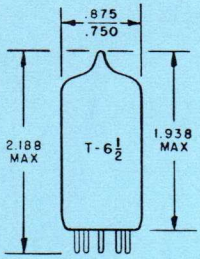
FOR

AUDIO PRE-AMPLIFIER

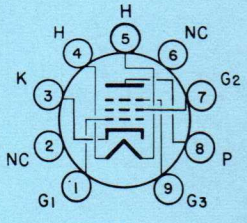
APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



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



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9AD

THE 5879 IS A SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN THE INPUT STAGE OF AUDIO AMPLIFIERS. IT COMBINES HIGH GAIN WITH VERY LOW LEVEL OF MICROPHONICS, HUM, AND OTHER AUDIO FREQUENCY NOISES.

DIRECT INTERELECTRODE CAPACITANCES

		PENTODE CONNECTION	TRIODE CONNECTION [A]	
GRID TO PLATE	MAX.	0.11	1.4	pf
INPUT		2.7	1.4	pf
OUTPUT		2.4	0.85	pf

[A] GRID 2 AND 3 CONNECTED TO PLATE.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	150	MA.
LIMITS OF APPLIED VOLTAGE : AC OR DC			6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			100	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE CONNECTION[A]	PENTODE CONNECTION	
PLATE VOLTAGE	275	330	VOLTS
GRID 3 VOLTAGE	-----	0	VOLTS
GRID 2 SUPPLY VOLTAGE		330	VOLTS
GRID 2 VOLTAGE		See Rating Chart	
PLATE DISSIPATION	1.7	1.25	WATTS
GRID 2 DISSIPATION UP TO 165 VOLTS	-----	0.25	
GRID 1 VOLTAGE:			
NEGATIVE BIAS VALUE	55	55	VOLTS
POSITIVE BIAS VALUE	0	0	VOLTS
GRID 1 CIRCUIT RESISTANCE	2.2	2.2	MEGOHMS

AVERAGE CHARACTERISTICS

		TRIODE CONNECTION[A]		PENTODE CONNECTION	
PLATE VOLTAGE		100	250	250	VOLTS
GRID 3 VOLTAGE		-----	-----	0	VOLTS
GRID 2 VOLTAGE		-----	-----	100	VOLTS
GRID 1 VOLTAGE		-3	-8	-3	VOLTS
PLATE CURRENT		2.2	5.5	1.8	MA.
GRID 2 CURRENT		-----	-----	0.4	MA.
TRANSCONDUCTANCE		1,240	1,530	1,000	μMHOS
AMPLIFICATION FACTOR		21	21		VOLTS
PLATE RESISTANCE	APPROX.	.017	.137	2	MEGOHMS
GRID 1 VOLTAGE FOR Ib = 10 μA				-8	VOLTS

[A] GRIDS 2 AND 3 CONNECTED TO PLATE.

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATION

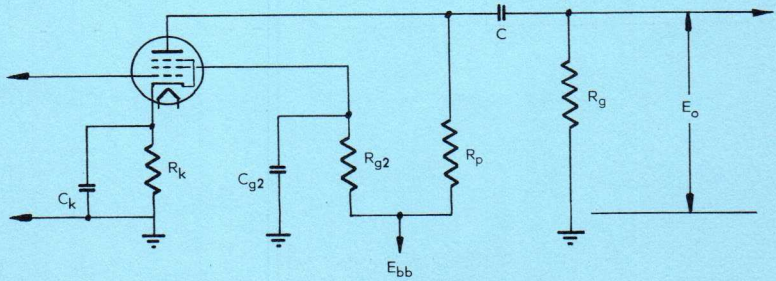
PENTODE CONNECTION

RESISTANCE-COUPLED AMPLIFIER

MAXIMUM VOLTAGE GAIN

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_k	C	E_o	V.G.*
90	0.1	0.1	0.35	1700	0.044	4.6	0.020	13	29
		0.22			0.046	4.5	0.012	17	39
		0.47			0.047	4.4	0.006	20	47
	0.22	0.22	0.80	3000	0.034	3.2	0.010	15	43
		0.47			0.035	3.1	0.005	21	59
		1.0			0.036	3.0	0.003	24	67
	0.47	0.47	1.9	7000	0.021	1.8	0.005	21	59
		1.0			0.022	1.7	0.003	25	75
		2.2			0.023	1.7	0.002	28	87
180	0.1	0.1	0.35	700	0.060	7.4	0.020	24	39
		0.22			0.062	7.3	0.012	28	56
		0.47			0.064	7.2	0.006	33	65
	0.22	0.22	0.80	1200	0.045	5.5	0.010	24	65
		0.47			0.046	5.3	0.005	31	87
		1.0			0.048	5.2	0.003	34	101
	0.47	0.47	1.9	2500	0.033	3.5	0.005	27	98
		1.0			0.034	3.4	0.003	32	122
		2.2			0.035	3.3	0.002	37	140
300	0.1	0.1	0.35	300	0.075	10.8	0.020	25	51
		0.22			0.077	10.6	0.012	32	68
		0.47			0.080	10.5	0.006	35	83
	0.22	0.22	0.80	600	0.056	7.9	0.010	28	81
		0.47			0.057	7.5	0.005	37	109
		1.0			0.058	7.4	0.003	41	123
	0.47	0.47	1.3	1200	0.044	5.3	0.005	35	125
		1.0			0.046	5.2	0.003	42	152
		2.2			0.047	5.1	0.002	48	174

*AT AN OUTPUT VOLTAGE OF 1 VOLT RMS AND GRID 1 BIAS OF 1 VOLT.



PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

RESISTANCE-COUPLED AMPLIFIER

MAXIMUM VOLTAGE OUTPUT

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_kC	E C	E_o	V.G.
90	0.1	0.1	0.12	2000	0.09	4.8	0.027	22	23
		0.22	0.15	2200	0.08	4.4	0.013	28	32
		0.47	0.17	2400	0.07	4.0	0.007	31	39
	0.22	0.22	0.35	3500	0.06	3.3	0.011	24	33
		0.47	0.40	3800	0.065	3.2	0.006	30	44
		1.0	0.44	4100	0.06	3.0	0.003	32	50
	0.47	0.47	0.90	6800	0.04	2.0	0.005	25	47
		1.0	1.0	7400	0.04	2.0	0.003	30	57
		2.2	1.1	8000	0.04	2.0	0.002	32	64
180	0.1	0.1	0.19	1300	0.08	6.0	0.021	48	33
		0.22	0.20	1400	0.08	5.85	0.013	59	46
		0.47	0.22	1500	0.07	5.45	0.007	68	57
	0.22	0.22	0.44	2000	0.09	4.85	0.011	48	41
		0.47	0.53	2300	0.07	4.45	0.006	62	62
		1.0	0.55	2400	0.065	4.25	0.004	68	72
	0.47	0.47	1.0	3500	0.07	3.5	0.005	51	54
		1.0	1.1	3700	0.07	3.5	0.003	59	66
		2.2	1.2	4000	0.07	3.3	0.002	66	81
300	0.1	0.1	0.18	1000	0.1	7.0	0.022	85	38
		0.22	0.2	1100	0.1	6.8	0.013	110	53
		0.47	0.23	1200	0.075	6.4	0.007	124	66
	0.22	0.22	0.47	1400	0.1	5.75	0.012	88	44
		0.47	0.52	1600	0.1	5.45	0.006	113	64
		1.0	0.58	1700	0.075	5.0	0.004	124	86
	0.47	0.47	1.1	2300	0.1	4.6	0.006	90	58
		1.0	1.2	2500	0.1	4.3	0.004	110	76
		2.2	1.3	2800	0.1	4.2	0.002	121	99

CONTINUED ON FOLLOWING PAGE

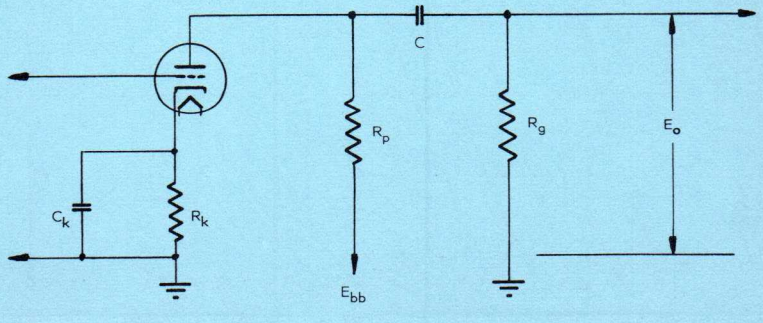
CONTINUED FROM PRECEDING PAGE

TRIODE
CONNECTION
RESISTANCE-COUPLED AMPLIFIER

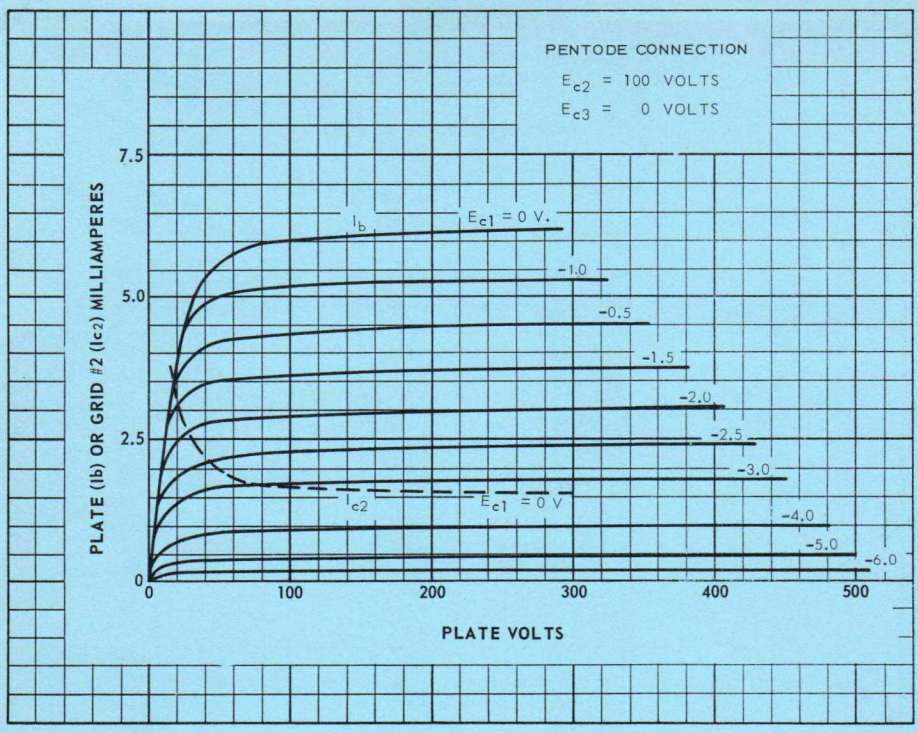
MAXIMUM VOLTAGE GAIN

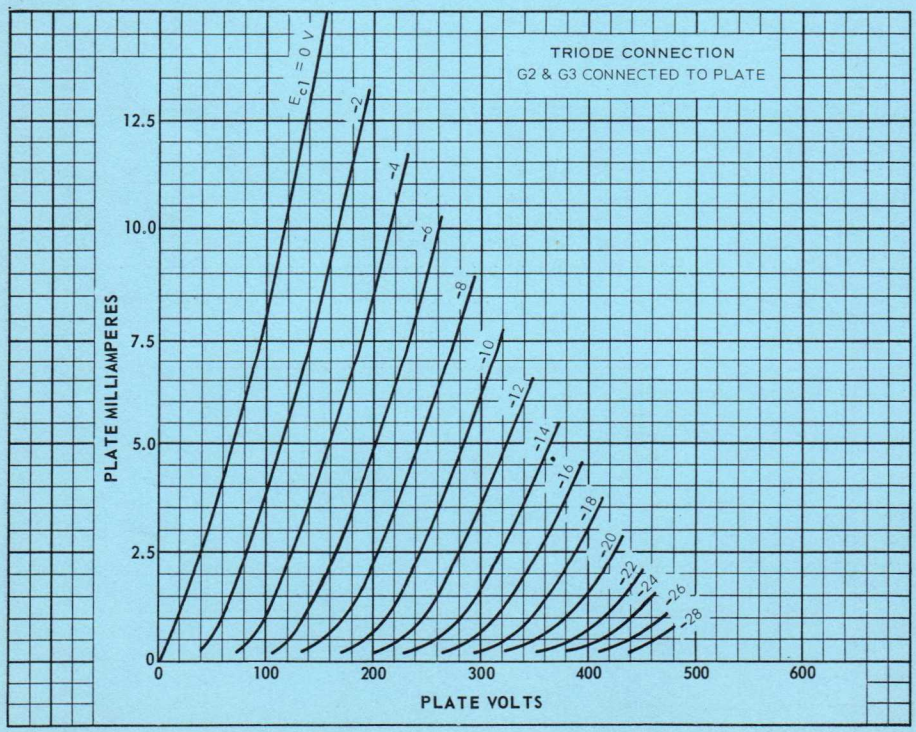
E_{bb}	R_p	R_g	R_k	C_k	C	E_o	V.G.
90	0.047	0.047	1800	2.9	0.060	9	10[A]
		0.1	2100	2.4	0.033	12	11[B]
		0.22	2200	2.3	0.016	14	12[C]
	0.1	0.1	3200	1.8	0.027	10	12[B]
		0.22	3900	1.3	0.015	13	13[C]
		0.47	4300	1.0	0.007	16	13
	0.22	0.22	6200	0.87	0.015	12	13[B]
		0.47	8100	0.53	0.006	16	13
		1.0	9000	0.49	0.003	19	14
180	0.047	0.047	1200	3.5	0.063	21	12
		0.1	1600	2.6	0.033	29	13
		0.22	1800	2.4	0.016	35	13
	0.1	0.1	2200	1.9	0.031	26	13
		0.22	2900	1.35	0.015	33	14
		0.47	3400	1.1	0.007	40	14
	0.22	0.22	4500	0.92	0.015	28	14
		0.47	6400	0.61	0.006	39	14
		1.0	8200	0.52	0.003	47	14
300	0.047	0.047	1100	3.9	0.063	42	13
		0.1	1500	2.8	0.033	65	13
		0.22	1700	2.5	0.016	71	14
	0.1	0.1	2000	2.1	0.032	45	15
		0.22	3400	1.4	0.015	74	15
		0.47	3700	1.1	0.007	83	15
	0.22	0.22	4300	0.97	0.015	50	15
		0.47	7200	0.63	0.007	88	15
		1.0	7400	0.63	0.003	94	15

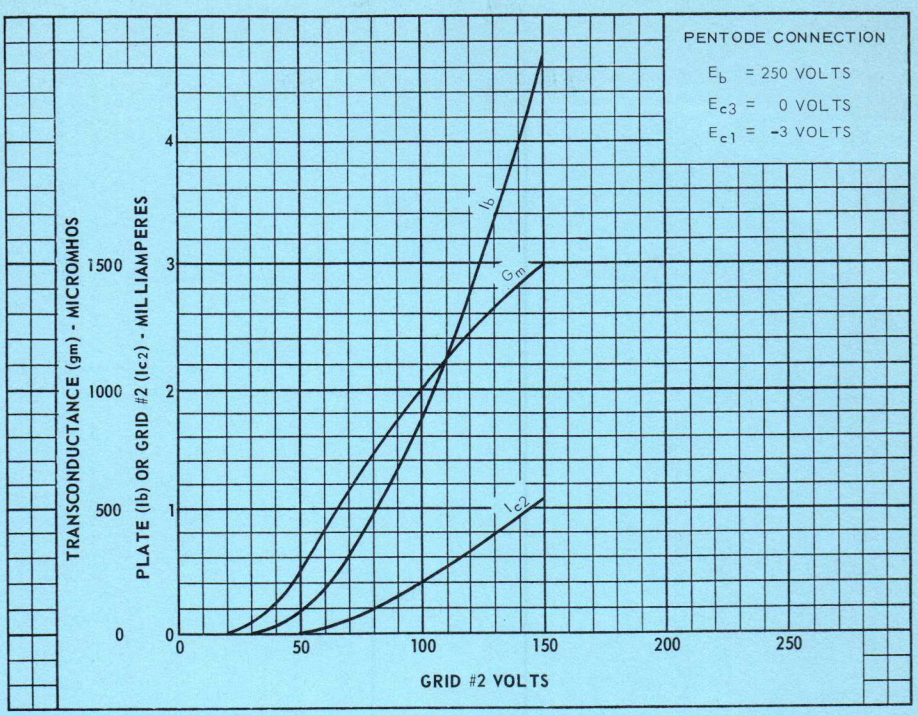
[A] AT 2 VOLTS (RMS) OUTPUT. [B] AT 3 VOLTS (RMS) OUTPUT. [C] AT 4 VOLTS (RMS) OUTPUT.

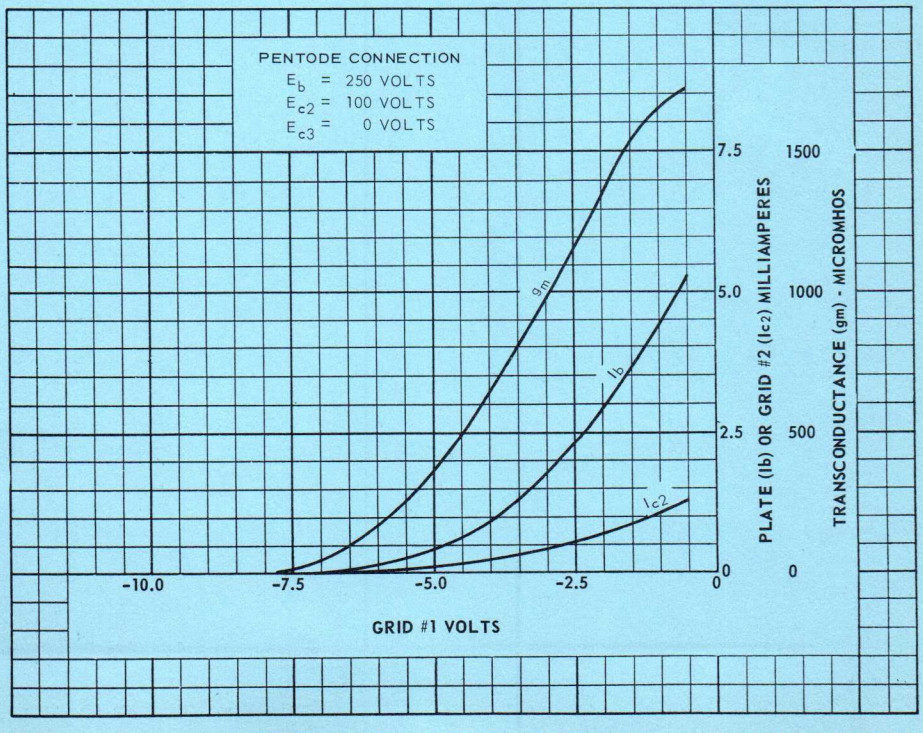


PRINTED IN U.S.A.


PENTODE CONNECTION
E_{c2} = 100 VOLTS
E_{c3} = 0 VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
7.5
5.0
2.5
0
I_b
E_{c1} = 0 V.
-1.0
-0.5
-1.5
-2.0
-2.5
-3.0
-4.0
-5.0
-6.0
I_{c2}
E_{c1} = 0 V
0
100
200
300
400
500
PLATE VOLTS


TRIODE CONNECTION
G2 & G3 CONNECTED TO PLATE
PLATE MILLIAMPERES
12.5
10.0
7.5
5.0
2.5
0
E_{c1} = 0 V
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
0
100
200
300
400
500
600
PLATE VOLTS

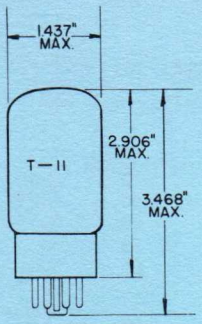




PRINTED IN U. S. A.

TUNG-SOL

BEAM PENTODE



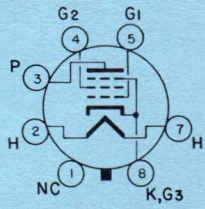
GLASS BULB

SHORT INTERMEDIATE SHELL
7 PIN OCTAL B7-47
OUTLINE 11-1

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 900 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7AC

THE 5881 IS THE ELECTRICAL EQUIVALENT TO TYPES 6L6 AND 6L6G EXCEPT THAT THE PLATE AND SCREEN DISSIPATION RATINGS HAVE BEEN INCREASED APPROXIMATELY 20 PERCENT. IT EMBODIES A COMPLETE MECHANICAL REDESIGN WHICH RESULTS IN GREATER RESISTANCE TO SHOCK AND VIBRATION. THE USE OF TREATED GRIDS AND ANODE GREATLY INCREASES ITS OVERLOAD CAPABILITIES AND THEREBY PROVIDES DESIRABLE IMPROVEMENT IN CONTINUITY OF SERVICE. THE ADDITION OF A LOW-LOSS BARRIER TYPE BASE WILL PROVIDE OBVIOUS ADVANTAGES IN CERTAIN APPLICATIONS.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM HEATER—CATHODE VOLTAGE	200	VOLTS
MAXIMUM PLATE VOLTAGE	400	VOLTS
MAXIMUM GRID #2 VOLTAGE	400	VOLTS
MAXIMUM PLATE VOLTAGE (TRIODE CONNECTION)	400	VOLTS
MAXIMUM PLATE DISSIPATION	23	WATTS
MAXIMUM GRID #2 DISSIPATION	3	WATTS
MAXIMUM PLATE DISSIPATION (TRIODE CONNECTION)	26	WATTS
MAXIMUM GRID RESISTANCE (FIXED BIAS)	0.1	MEGOHM
MAXIMUM GRID RESISTANCE (SELF BIAS)	0.5	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – SINGLE TUBE

PLATE VOLTAGE	250	300	350	VOLTS
GRID #2 VOLTAGE	250	200	250	VOLTS
GRID #1 VOLTAGE	-14	-12.5	-18	VOLTS
PEAK AF SIGNAL VOLTAGE	14	12.5	18	VOLTS
TRANSCONDUCTANCE	6 100	5 300	5 200	μMHOS
PLATE RESISTANCE	30 000	35 000	48 000	OHMS
ZERO-SIGNAL PLATE CURRENT	75	48	53	MA.
ZERO-SIGNAL GRID #2 CURRENT	4.3	2.5	2.5	MA.
MAXIMUM SIGNAL PLATE CURRENT	80	55	65	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	7.6	4.7	8.5	MA.
LOAD RESISTANCE	2 500	4 500	4 200	OHMS
POWER OUTPUT	6.7	6.5	11.3	WATTS
TOTAL HARMONIC DISTORTION	10	11	13	PERCENT

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

CLASS A_1 AMPLIFIER – SINGLE TUBE – TRIODE CONNECTION

GRID #2 CONNECTED TO PLATE

PLATE VOLTAGE	250	300	VOLTS
GRID VOLTAGE	-18	-20	VOLTS
PEAK AF SIGNAL VOLTAGE	18	20	VOLTS
ZERO-SIGNAL PLATE CURRENT	52	78	MA.
MAXIMUM SIGNAL PLATE CURRENT	58	85	MA.
AMPLIFICATION FACTOR	8	---	
TRANSCONDUCTANCE	5 250	---	µMHOS
LOAD RESISTANCE	4 000	4 000	OHMS
TOTAL HARMONIC DISTORTION	6	5.5	PERCENT
POWER OUTPUT	1.4	1.8	WATTS

CLASS A_1 PUSH-PULL AMPLIFIER

VALUES ARE FOR TWO TUBES

PLATE VOLTAGE	250	270	VOLTS
GRID #2 VOLTAGE	250	270	VOLTS
GRID #1 VOLTAGE	-16	-17.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	32	35	VOLTS
TRANSCONDUCTANCE (EACH TUBE)	5 500	5 700	µMHOS
PLATE RESISTANCE (EACH TUBE)	24 500	23 500	OHMS
ZERO-SIGNAL PLATE CURRENT	120	134	MA.
ZERO-SIGNAL GRID #2 CURRENT	10	11	MA.
MAXIMUM SIGNAL PLATE CURRENT	140	155	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	16	17	MA.
LOAD RESISTANCE	5 000	5 000	OHMS
POWER OUTPUT	14.5	17.5	WATTS
TOTAL HARMONIC DISTORTION	2	2	PERCENT

CLASS AB_1 PUSH-PULL AMPLIFIER

VALUES ARE FOR TWO TUBES

PLATE VOLTAGE	360	360	VOLTS
GRID #2 VOLTAGE	270	270	VOLTS
GRID #1 VOLTAGE	-22.5	-22.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	45	45	VOLTS
ZERO-SIGNAL PLATE CURRENT	88	88	MA.
ZERO-SIGNAL GRID #2 CURRENT	5	5	MA.
MAXIMUM SIGNAL PLATE CURRENT	132	140	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	15	11	MA.
LOAD RESISTANCE	6 600	3 800	OHMS
POWER OUTPUT	26.5	18	WATTS
TOTAL HARMONIC DISTORTION	2	2	PERCENT

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CLASS AB_1 PUSH-PULL AMPLIFIER – TRIODE CONNECTION

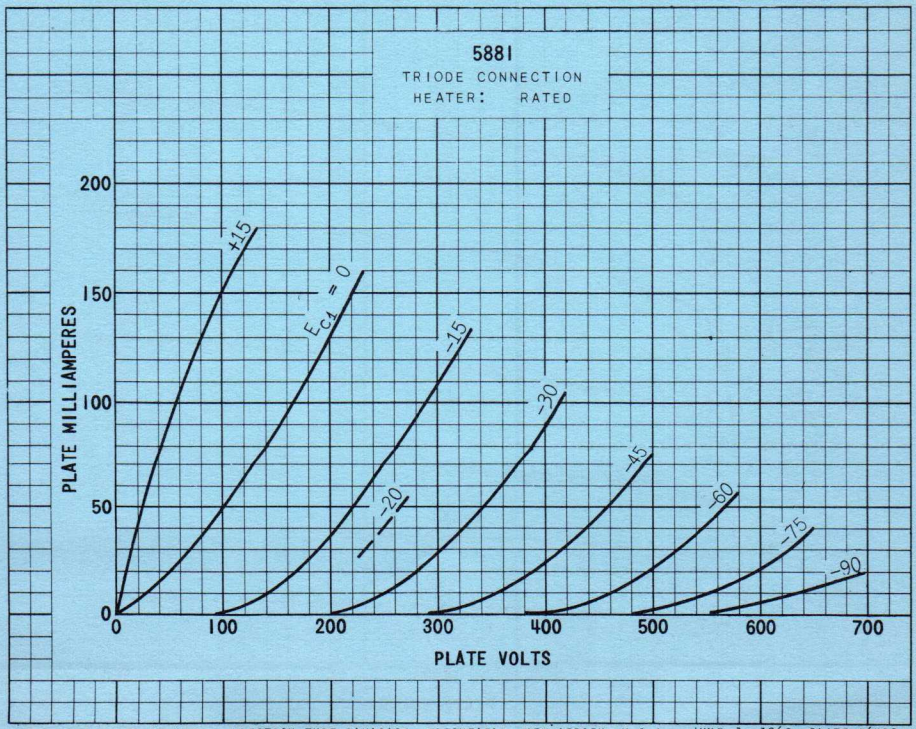
GRID #2 CONNECTED TO PLATE
VALUES ARE FOR TWO TUBES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.9	AMP.
PLATE VOLTAGE	400	VOLTS
GRID VOLTAGE	−45	VOLTS
PEAK AF GRID TO GRID VOLTAGE	90	VOLTS
ZERO-SIGNAL PLATE CURRENT	65	MA.
MAXIMUM SIGNAL PLATE CURRENT	130	MA.
LOAD RESISTANCE	4 000	OHMS
TOTAL HARMONIC DISTORTION	4.4	PERCENT
POWER OUTPUT	13.3	WATTS

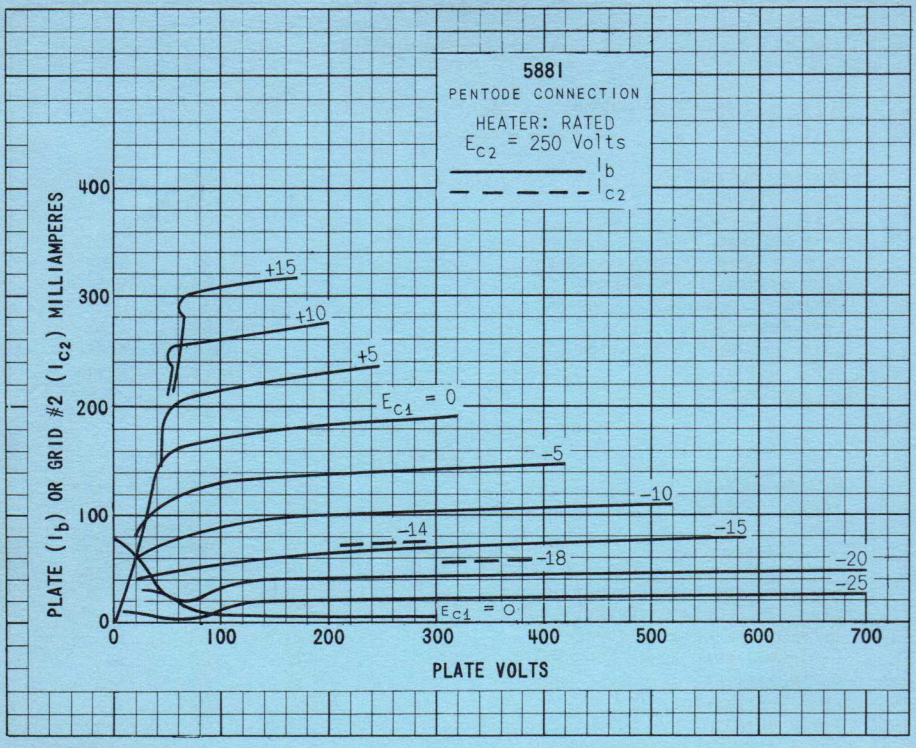
CLASS AB_2 PUSH-PULL AMPLIFIER

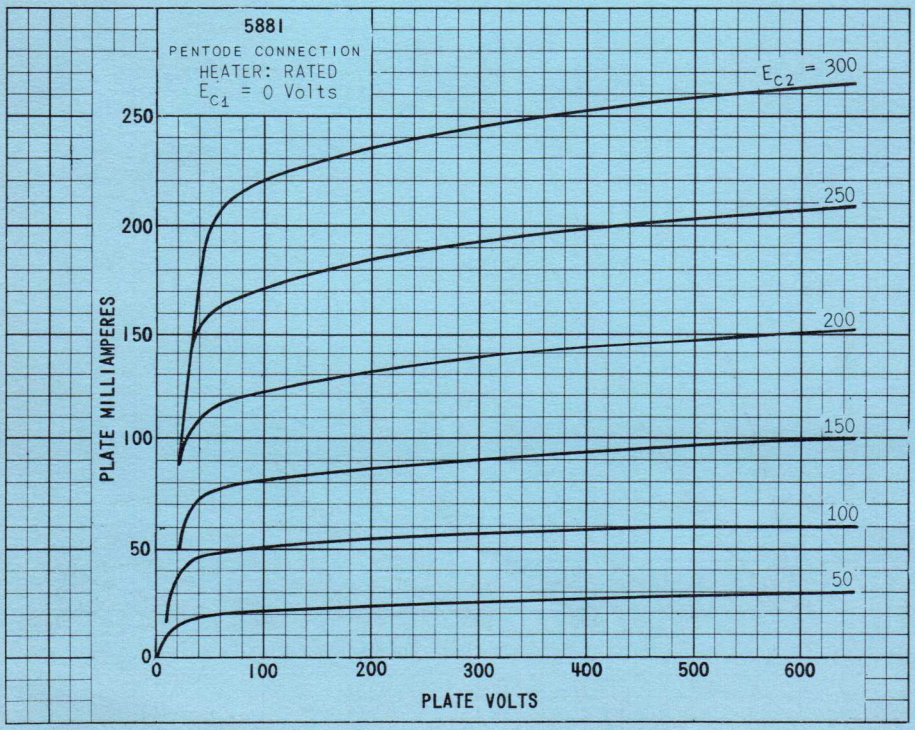
VALUES ARE FOR TWO TUBES

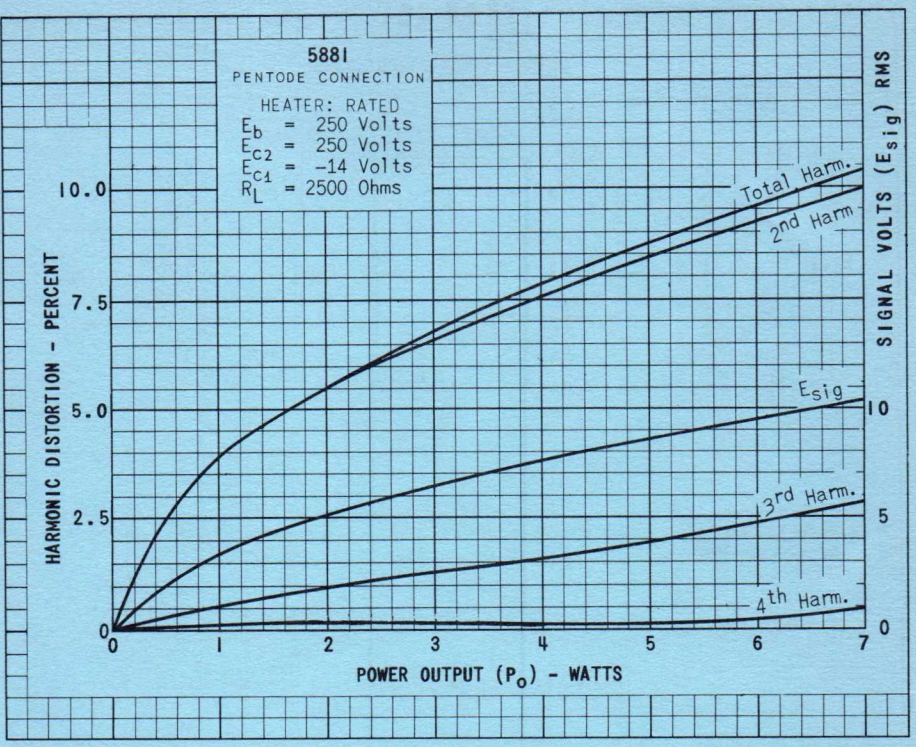
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.9	0.9	AMP.
PLATE VOLTAGE	360	360	VOLTS
GRID #2 VOLTAGE	225	270	VOLTS
GRID #1 VOLTAGE	−18	−22.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	52	72	VOLTS
ZERO-SIGNAL PLATE CURRENT	78	88	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.5	5	MA.
MAXIMUM SIGNAL PLATE CURRENT	142	205	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	11	16	MA.
LOAD RESISTANCE	6 000	3 800	OHMS
POWER OUTPUT	31	47	WATTS
TOTAL HARMONIC DISTORTION	2	2	PERCENT

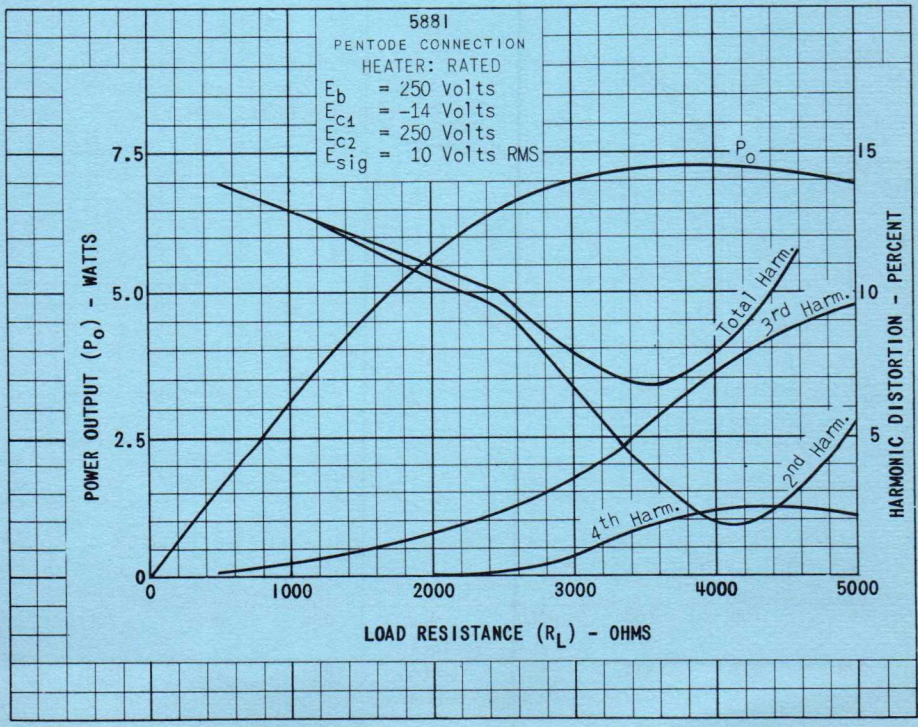


PRINTED IN U. S. A.


5881
PENTODE CONNECTION
HEATER: RATED
E_{c2} = 250 Volts
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
400
300
200
100
0
+15
+10
+5
E_{c1} = 0
-5
-10
-14
-15
-18
-20
-25
E_{c1} = 0
0
100
200
300
400
500
600
700
PLATE VOLTS


5881
PENTODE CONNECTION
HEATER: RATED
E_{c1} = 0 Volts
PLATE MILLIAMPERES
250
200
150
100
50
0
E_{c2} = 300
250
200
150
100
50
0
100
200
300
400
500
600
PLATE VOLTS

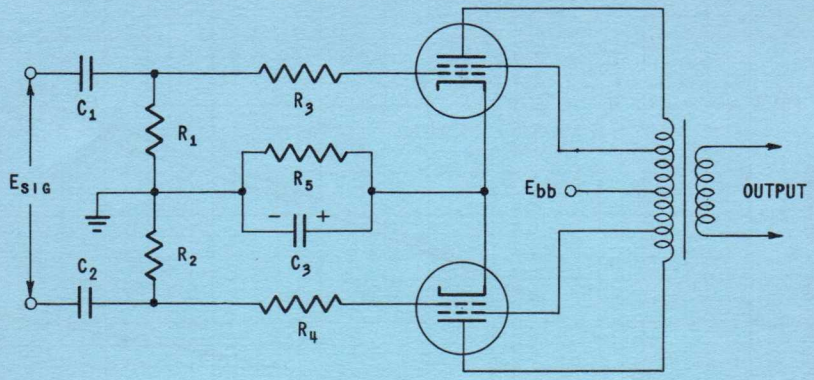




PRINTED IN U. S. A.

TUNG-SOL

ULTRA-LINEAR OUTPUT STAGE



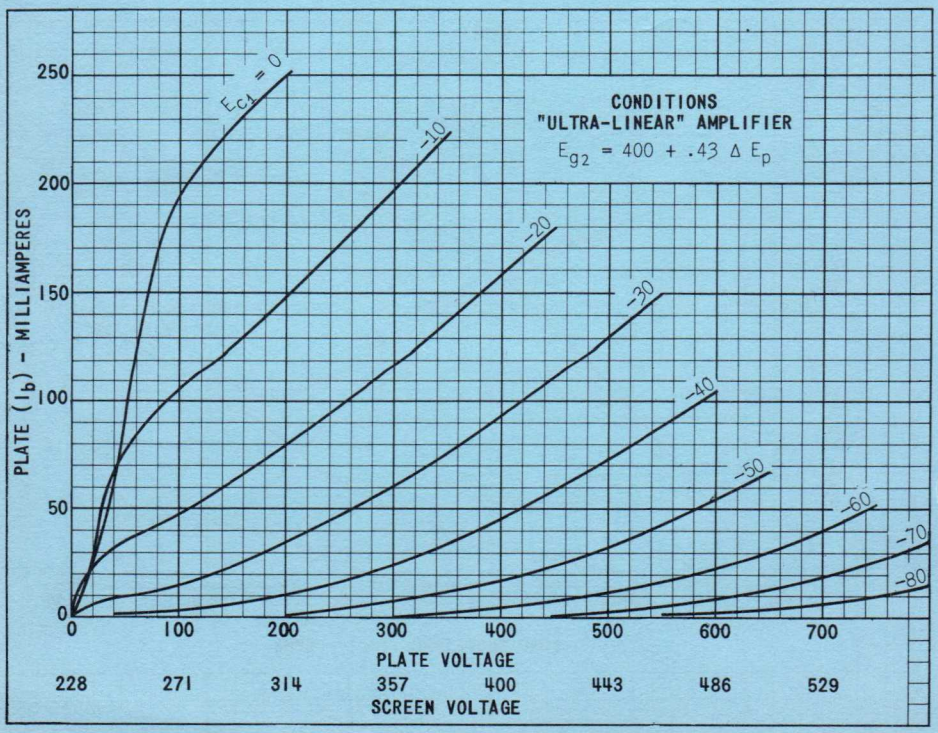
R_1, R_2 = 100 K. 1/2W
R_3, R_4 = 1 K. 1/2W
R_5 = 400 OHMS 10W

E_b = 450V.
E_{SIG} = 80V. PEAK TO PEAK
C_1, C_2 = 0.2 μf 600V
C_3 = 100 μf 50V

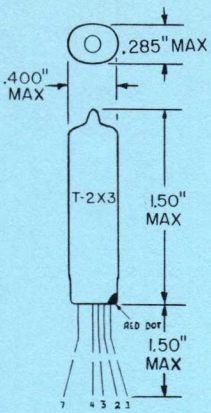
DIST. = 2.5%
P_o = 20W
R_l = 6K

IN THE ULTRA-LINEAR CIRCUIT THE SCREEN VOLTAGES ARE DERIVED FROM TAPS ON THE PLATE WINDINGS OF THE OUTPUT TRANSFORMER, THE TAPS ARE LOCATED SO AS TO APPLY 43% OF THE PLATE SIGNAL VOLTAGE TO THE SCREEN GRID.

THE PLATE FAMILY FOR THIS CONNECTION IS SHOWN BELOW. THESE CURVES WERE OBTAINED BY STATICALLY VARYING THE PLATE VOLTAGE IN INCREMENTS ABOUT THE QUIESCENT POINT (400 VOLTS PLATE AND SCREEN SUPPLY) AND SIMULTANEOUSLY CHANGING THE SCREEN VOLTAGE BY 43% OF THE INCREMENT. IN THE GRAPH BOTH PLATE AND SCREEN VOLTAGES HAVE BEEN PLOTTED ALONG THE ABSCISSA.



TUNG-SOL



GLASS BULB
DOT IS ADJACENT TO LEAD 1
OUTLINE DRAWING
JEDEC 2-5
IN-LINE LEADS

ELECTROMETER PENTODE

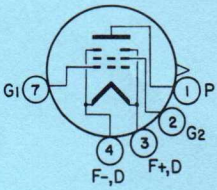
SUBMINIATURE TYPE

FOR

SINGLE STAGE AND MULTI-STAGE

CIRCUIT APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW
LEADS 5 & 6 ARE OMITTED

LEADS 0.048"
CENTER-TO-CENTER

THE 5886 IS A FILAMENTARY TYPE PENTODE IN THE 5 PIN SUBMINIATURE CONSTRUCTION. OPERATED AS A TRIODE, THE TUBE HAS AN UNUSUALLY HIGH RATIO OF TRANSCONDUCTANCE TO CONTROL GRID CURRENT FOR SINGLE STAGE CIRCUITS. AS A PENTODE, THE AMPLIFICATION FACTOR IS HIGH ENOUGH TO AFFORD CONSIDERABLE VOLTAGE GAIN IN THE ELECTROMETER STAGE OF A MULTI-STAGE CIRCUIT.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO ALL	2.2	pf
GRID 1 TO GRID 2 AND PLATE	2.0	pf

FILAMENT CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.25	VOLTS	10	MA.
LIMITS OF APPLIED VOLTAGE			1.25±0.25	VOLTS

FOR USE WITH BATTERIES HAVING AN INITIAL VOLTAGE OF 1.55 VOLTS MAX.

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

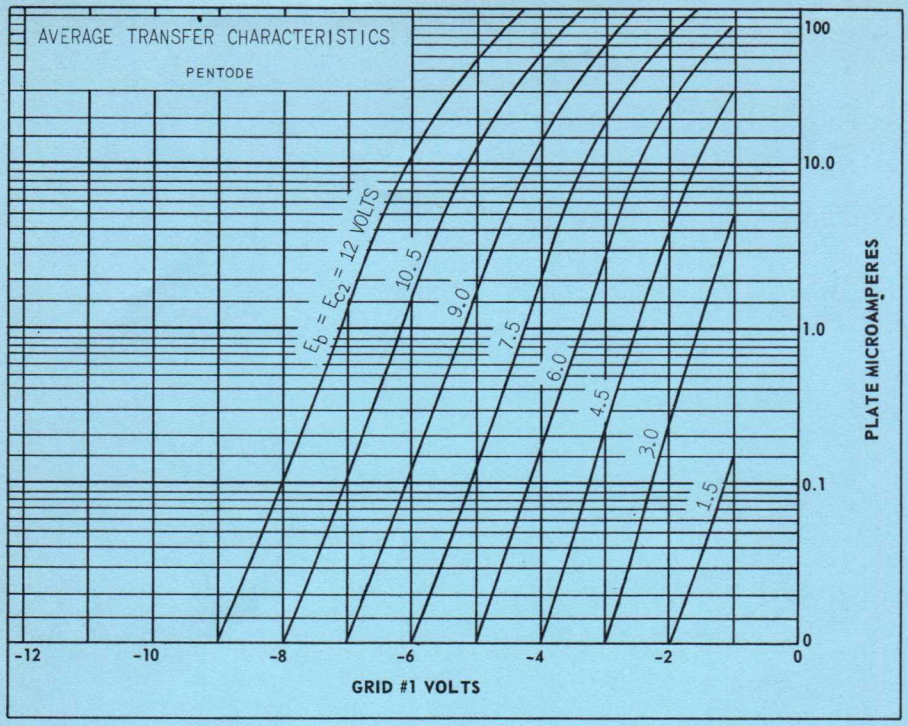
PLATE VOLTAGE	22.5	VOLTS
GRID 2 VOLTAGE	22.5	VOLTS
TOTAL CATHODE CURRENT	300	μA

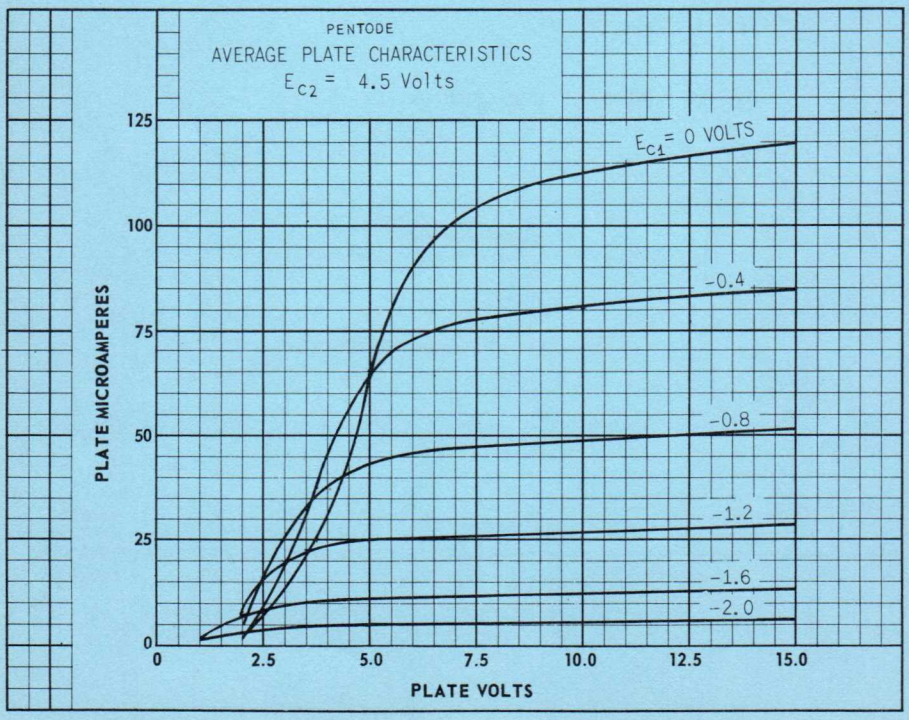
TYPICAL OPERATING CHARACTERISTICS

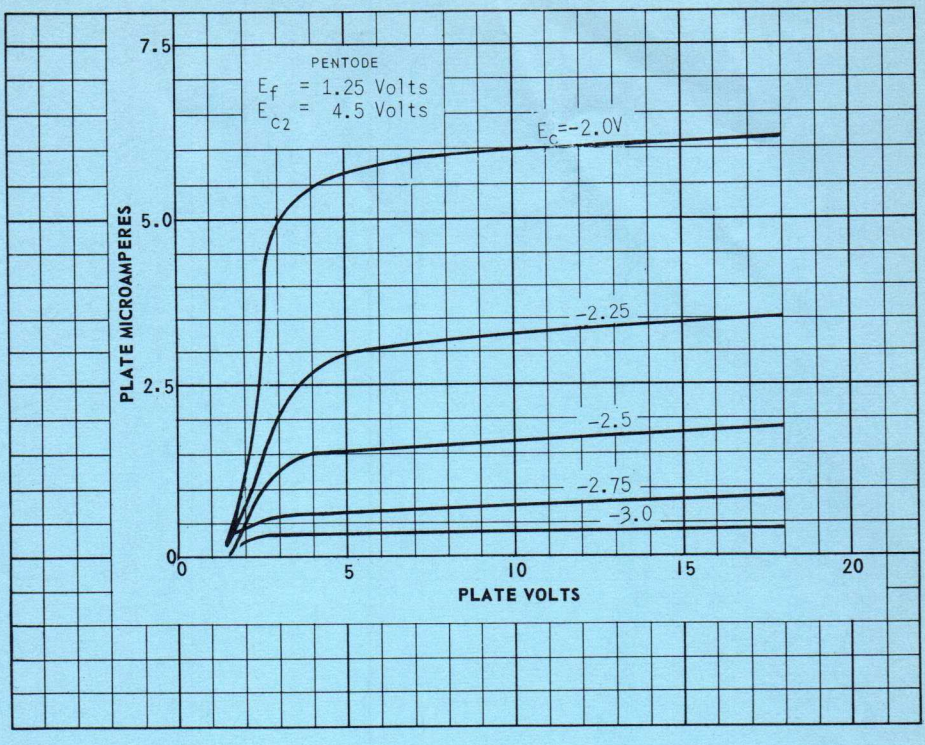
	TRIODE	PENTODE	
PLATE VOLTAGE	10.5	8.5	VOLTS
GRID 2 VOLTAGE	-----	4.5	VOLTS
GRID 1 VOLTAGE	-3	-2	VOLTS
PLATE CURRENT	200	6	μA
GRID 2 CURRENT	-----	3.6	μA
AMPLIFICATION FACTOR	1.8	-----	
TRANSCONDUCTANCE	175	14	μMHOS
PLATE RESISTANCE	-----	8	MΩ
MAX. GRID 1 CURRENT	2.5×10^{-13}	-----	AMP.
NOMINAL GRID 1 CURRENT		3×10^{-15}	AMP.

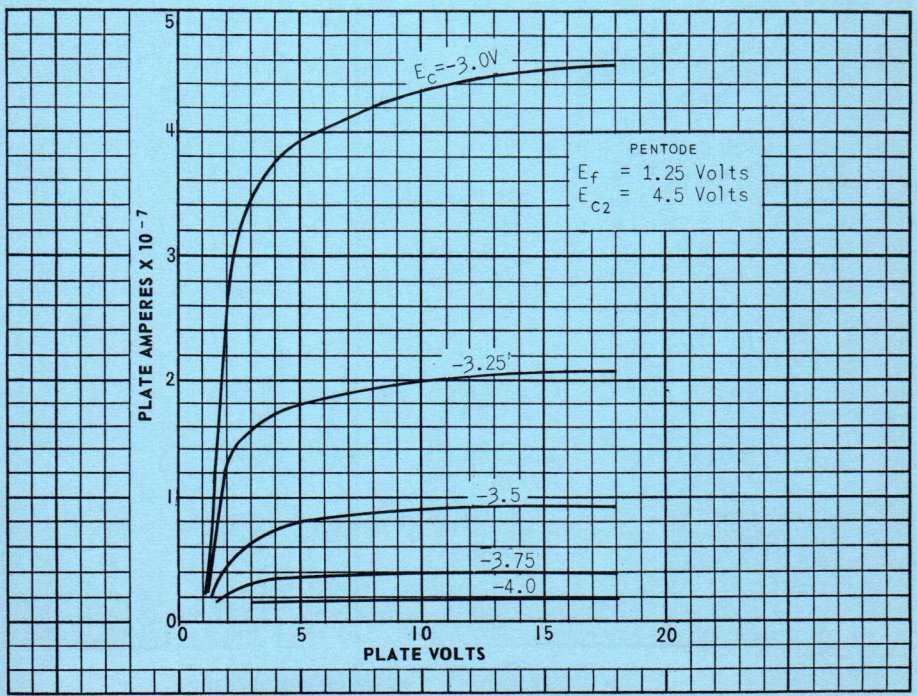
B GRID 2 CONNECTED TO PLATE

PRINTED IN U.S.A.

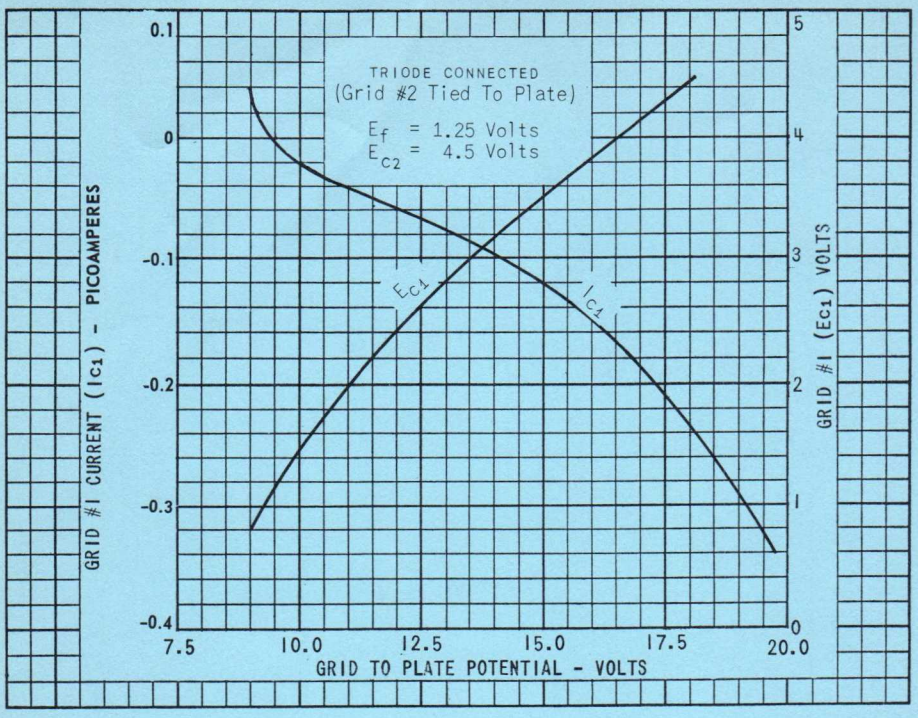

AVERAGE TRANSFER CHARACTERISTICS
PENTODE
$E_b = E_{c2}$ = 12 VOLTS
10.5
9.0
7.5
6.0
4.5
3.0
1.5
100
10.0
1.0
0.1
0
PLATE MICROAMPERES
-12
-10
-8
-6
-4
-2
0
GRID #1 VOLTS

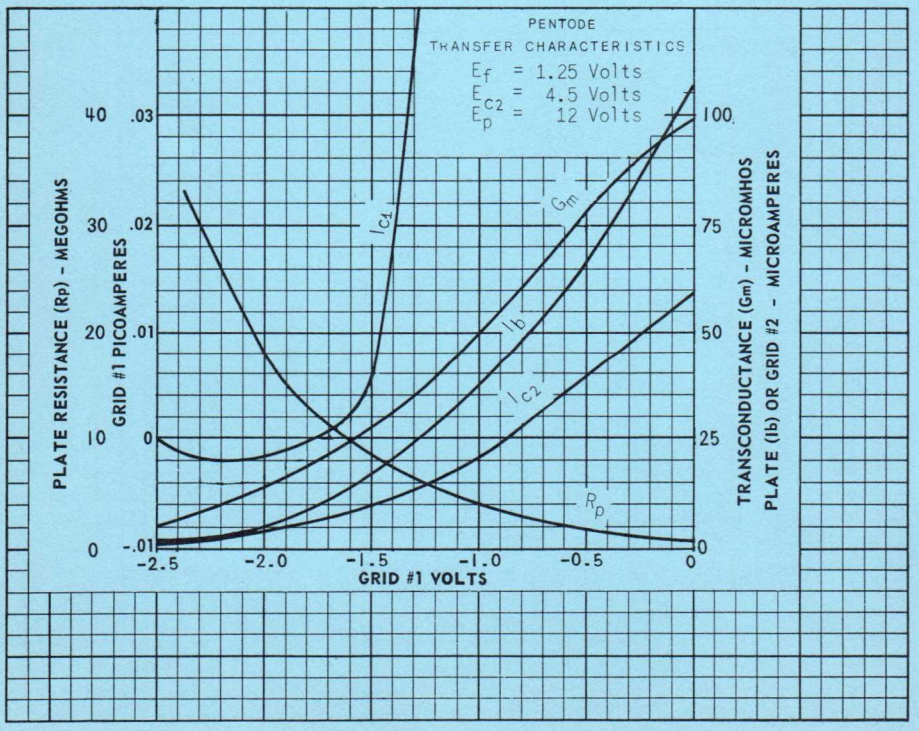

PENTODE
AVERAGE PLATE CHARACTERISTICS
E_{c2} = 4.5 Volts
E_{c1} = 0 VOLTS
-0.4
-0.8
-1.2
-1.6
-2.0
125
100
75
50
25
0
PLATE MICROAMPERES
0
2.5
5.0
7.5
10.0
12.5
15.0
PLATE VOLTS

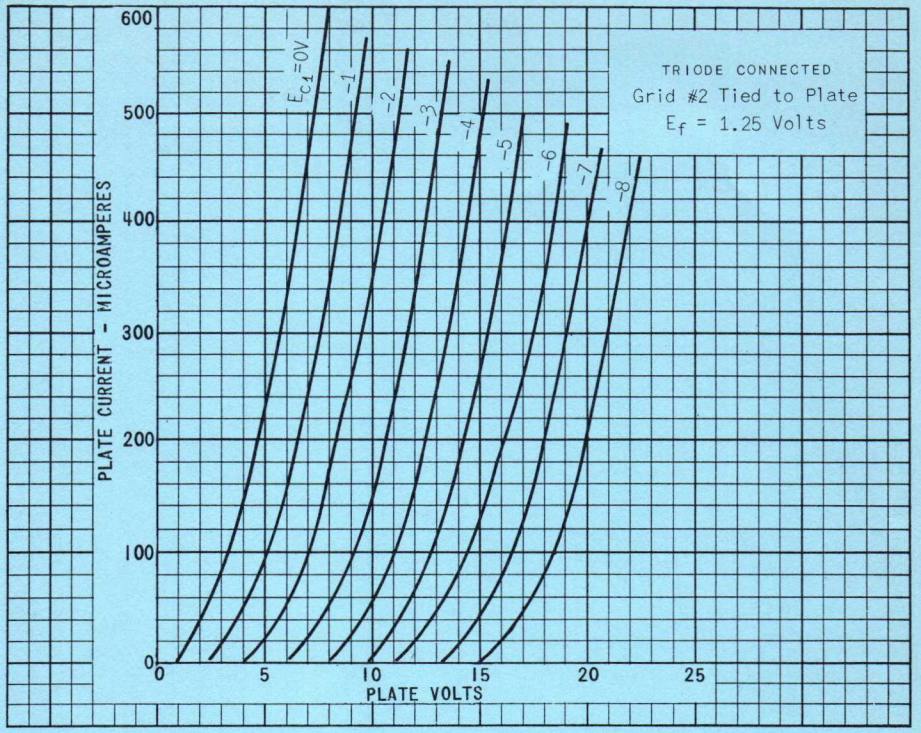


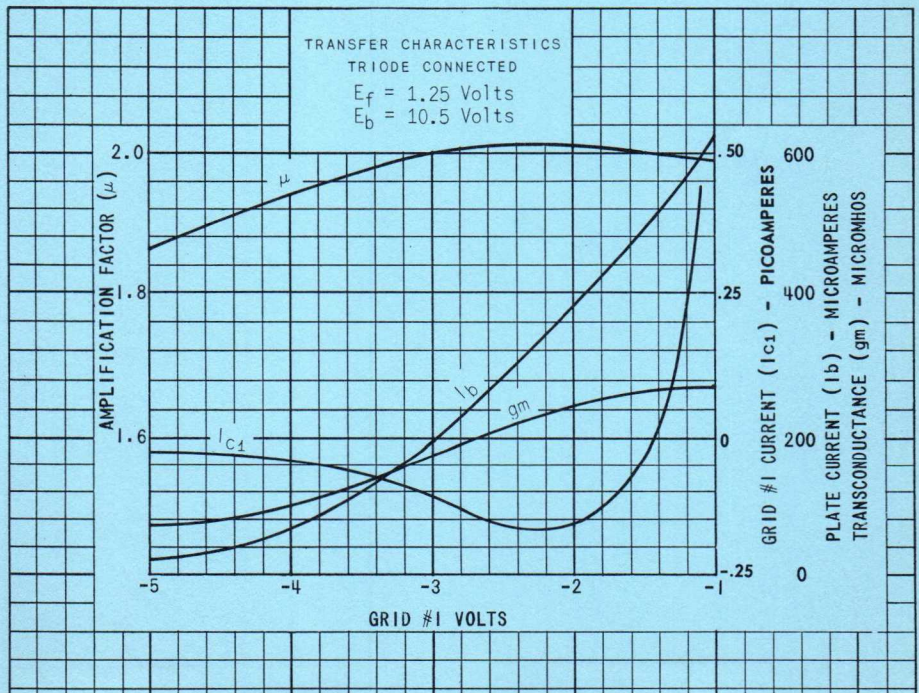


PRINTED IN U. S. A.

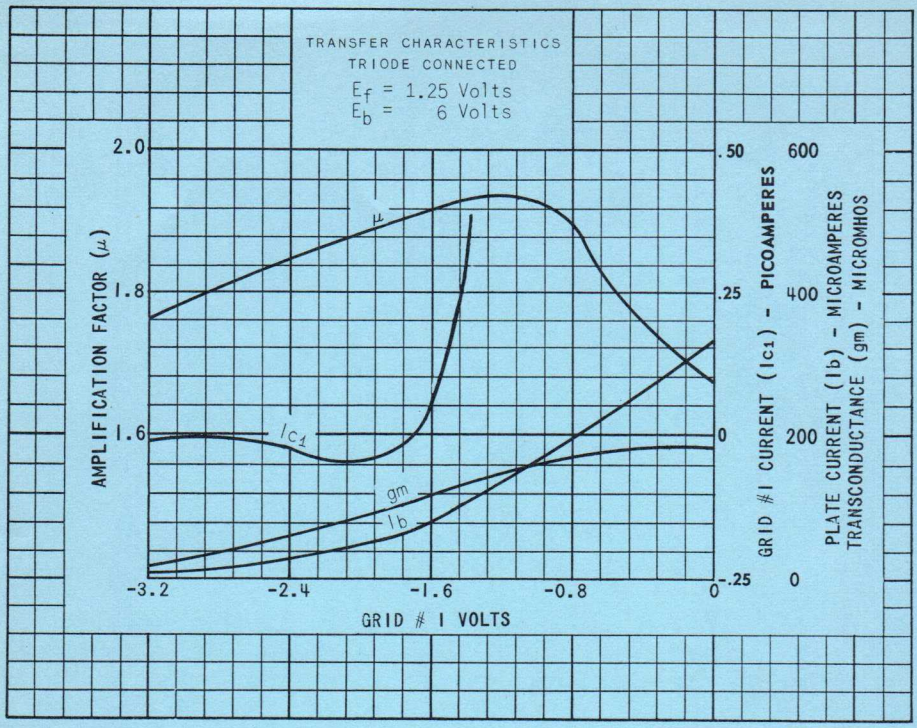

TRIODE CONNECTED
(Grid #2 Tied To Plate)
E_f = 1.25 Volts
E_{c2} = 4.5 Volts
E_{c1}
I_{c1}
GRID #1 CURRENT (I_{c1}) - PICOAMPERES
GRID #1 (E_{c1}) VOLTS
GRID TO PLATE POTENTIAL - VOLTS
0.1
0
-0.1
-0.2
-0.3
-0.4
5
4
3
2
1
0
7.5
10.0
12.5
15.0
17.5
20.0


PENTODE
TRANSFER CHARACTERISTICS
E_f = 1.25 Volts
E_{c2} = 4.5 Volts
E_p = 12 Volts
I_{c1}
G_m
I_b
I_{c2}
R_p
PLATE RESISTANCE (Rp) - MEGOHMS
GRID #1 PICOAMPERES
TRANSCONDUCTANCE (Gm) - MICROMHOS
PLATE (Ib) OR GRID #2 - MICROAMPERES
GRID #1 VOLTS
40
30
20
10
0
.03
.02
.01
0
-.01
100
75
50
25
0
-2.5
-2.0
-1.5
-1.0
-0.5
0





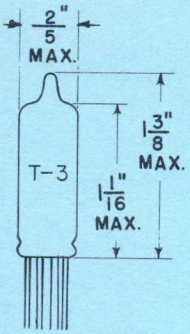
PRINTED IN U.S.A.


TRANSFER CHARACTERISTICS
TRIODE CONNECTED
E_f = 1.25 Volts
E_b = 6 Volts
AMPLIFICATION FACTOR (μ)
2.0
1.8
1.6
μ
I_{c_1}
gm
Ib
-3.2
-2.4
-1.6
-0.8
0
GRID # 1 VOLTS
.50
.25
0
-.25
GRID #1 CURRENT (Ic1) - PICOAMPERES
600
400
200
0
PLATE CURRENT (Ib) - MICROAMPERES
TRANSCONDUCTANCE (gm) - MICROMHOS

TUNG-SOL

TWIN DIODE

SUBMINIATURE TYPE



GLASS BULB

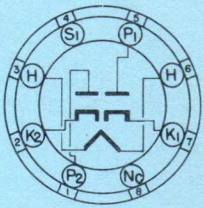
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±5% VOLTS 0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SUBMINIATURE BUTTON
8 LEAD BASE
8DJ

THE 5896 IS A SUBMINIATURE TWIN DIODE IN WHICH SEPARATE CATHODES ARE PROVIDED FOR THE TWO SECTIONS. EACH DIODE CAN BE USED INDEPENDENTLY OF THE OTHER OR COMBINED IN PARALLEL OR FULL-WAVE ARRANGEMENTS. IT IS SUITED FOR A WIDE VARIETY OF APPLICATIONS INCLUDING SERVICE AS A DETECTOR, AN AUTOMATIC-GAIN-CONTROL RECTIFIER, OR A LOW-CURRENT POWER RECTIFIER. THE RESONANT FREQUENCY OF EACH UNIT IS GREATER THAN 900 MEGACYCLES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PLATE #1 TO CATHODE #1, HEATER AND INTERNAL SHIELD	3.0	2.4	μμf
PLATE #2 TO CATHODE #2, HEATER, AND INTERNAL SHIELD	3.0	2.4	μμf
CATHODE #1 TO PLATE #1, HEATER AND INTERNAL SHIELD	4.2	4.0	μμf
CATHODE #2 TO PLATE #2, HEATER AND INTERNAL SHIELD	4.2	4.0	μμf
PLATE #1 TO PLATE #2, MAXIMUM	0.026	0.15	μμf

[A] WITH EXTERNAL SHIELD OF 0.405 INCH INSIDE DIAMETER CONNECTED TO LEAD 3.

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	460	VOLTS
MAXIMUM AC PLATE-SUPPLY VOLTAGE PER PLATE, RMS	165	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	60	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT PER PLATE, MAXIMUM DURATION 0.2 SECOND	350	MA.
MAXIMUM DC OUTPUT CURRENT PER PLATE	10	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	360	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	360	VOLTS
MAXIMUM BULB TEMPERATURE AT HOTTEST POINT	250	C

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

HEATER VOLTAGE	6.3±5%	VOLTS
HEATER CURRENT	0.3	AMPS.
AC PLATE-SUPPLY VOLTAGE PER PLATE, RMS	150	VOLTS
FILTER INPUT CAPACITOR	8	μFARADS
TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE PER PLATE	300	OHMS
LOAD RESISTANCE	11000	OHMS
DC OUTPUT CURRENT	18	MA.
TUBE VOLTAGE DROP		
Ib=18 MA. DC PER PLATE	4.5	VOLTS
RESONANT FREQUENCY (WITH SHORT AT TUBE BASE), MIN.	900	MEGACY.

CHARACTERISTICS LIMITS

		MIN	MAX	
HEATER CURRENT:				
Ef = 6.3 VOLTS	INITIAL	275	325	MA.
OPERATION CURRENT:				
(DC OUTPUT CURRENT FROM FW RECTIFIER)				
Ef = 6.3 VOLTS, Ebb PER PLATE = 165 VOLTS				
RMS, C_L = 8 μf., R_L = AND Rs PER PLATE ADJUSTED WITH A TUBE HAVING A 10-VOLT DROP AT				
50 ma. PER PLATE FOR Io = 18 ma. AND PEAK				
ib = 50 ma APPROXIMATELY	INITIAL	16	---	MA.
	500 HR.[A]	14	---	MA.
EMISSION CURRENT, EACH SECTION				
Ef =6.3 VOLTS Eb =10 VOLTS	INITIAL	30	---	MA.
PLATE CURRENT, EACH SECTION:				
Ef = 6.3 VOLTS, Ebb = 0 VOLTS				
R_L = 40000 OHMS (INCLUDING METER RESISTANCE)	INITIAL	5	25	μAMPS.
PLATE CURRENT DIFFERENCE BETWEEN SECTIONS:				
DIFFERENCE BETWEEN PLATE CURRENTS FOR EACH SECTION AT Ef =6.3 VOLTS, Ebb= 0 VOLTS, R_L= 40000 OHMS (INCLUDING METER RESISTANCE)	INITIAL	---	5	μAMPS.
INTERELECTRODE CAPACITANCES:				
PLATE INPUT (P TO K,H, I.S.) EA. SECTION	INITIAL	2.5	3.5	μμf
CATHODE INPUT (K TO P,H,I.S.) EA. SECT.	INITIAL	3.5	4.9	μμf
PLATE TO PLATE (P TO P)	INITIAL	---	0.026	μμf
(MEASURED WITH EXTERNAL SHIELD OF 0.405 INCH INSIDE DIAMETER CONNECTED TO LEAD 3.)				
HEATER-CATHODE LEAKAGE CURRENT, EA. SEC.				
Ef =6.3 VOLTS, Ehk= 360 VOLTS				
HEATER POSITIVE WITH RESPECT TO CATHODE	INITIAL	---	40	μAMPS.
	500 HR.[A]	---	120	μAMPS.
HEATER NEGATIVE WITH RESPECT TO CATHODE	INITIAL	---	40	μAMPS.
	500 HR.[A]	---	120	μAMPS.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS LIMITS - cont'd.

		MIN	MAX	
INTERELECTRODE LEAKAGE RESISTANCE: Ef = 6.3 VOLTS, POLARITY OF APPLIED DC INTERELECTRODE VOLTAGE IS SUCH THAT NO CATHODE EMISSION RESULTS. PLATE (EACH SECTION) TO ALL AT 300 VOLTS DC	INITIAL	100	---	MEGOHMS

A. CONDITIONS OF LIFE-TEST OPERATION AS A FULL-WAVE RECTIFIER ARE Ef = 6.3 VOLTS, Ebb PER PLATE = 165 VOLTS RMS, C_1 = 8 μf, R_1 AND Rs PER PLATE ADJUSTED WITH A TUBE HAVING A 10-VOLT DROP AT 50 MA PER PLATE FOR Io = 18 MA AND PEAK IB = 50 MA APPROXIMATELY, Ehk = Eo + 117 VOLTS RMS SO PHASED THAT THE 117 VOLTS AND Ef SUBTRACT, AND AMBIENT TEMPERATURE = 175°C.

SPECIAL TESTS AND RATINGS

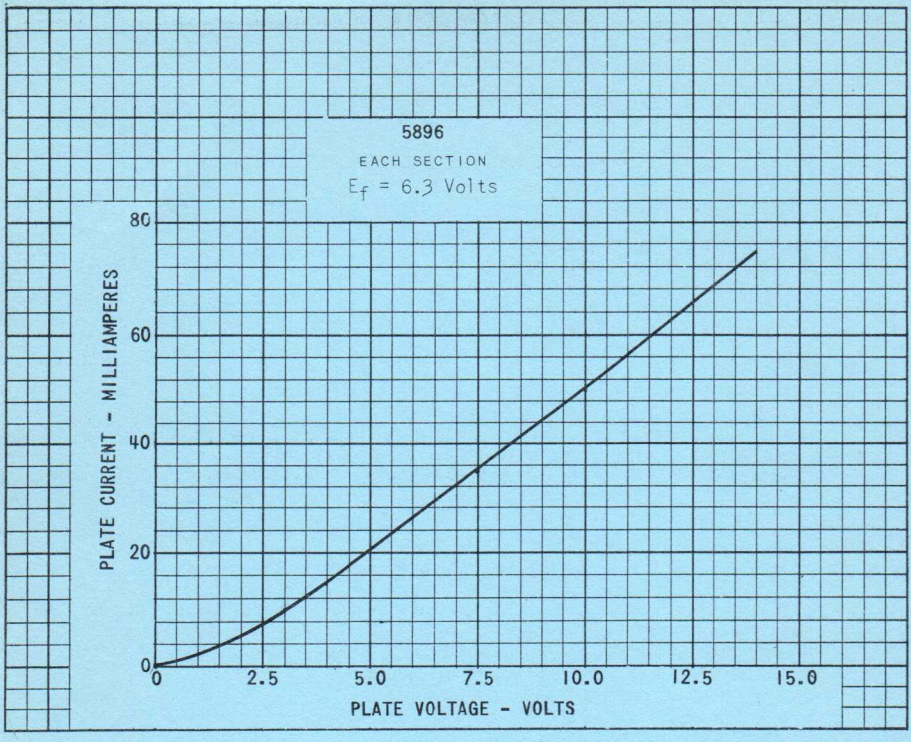
INOPERATIVES CONTROL: MINIMUM CONTINUOUS OPERATING TIME UNDER LIFE-TEST CONDITIONS OR EQUIVALENT FOR ALL TUBES PRIOR TO CHARACTERISTICS TESTING	46	HOURS
HEATER-CYCLING RATING: CYCLES OF INTERMITTENT OPERATION, MINIMUM Ef = 7.0 VOLTS CYCLED FOR ONE MINUTE ON AND FOUR MINUTES OFF. Eb = 0 VOLTS. Ehk = 140 VOLTS RMS.	2500	CYCLES
SHOCK RATING: IMPACT ACCELERATION IN ANY DIRECTION FORCES AS APPLIED BY THE NAVY-TYPE, HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT	450	G
FATIGUE RATING: VIBRATIONAL ACCELERATION IN ANY DIRECTION VIBRATIONAL FORCES FOR A PERIOD OF AT LEAST 100 HOURS AT A FREQUENCY OF 60 CYCLES PER SECOND.	2.5	G
UNIFORM ACCELERATION RATING UNIFORM ACCELERATION IN ANY DIRECTION FORCES APPLIED GRADUALLY AS IN A CENTRIFUGE	1000	G

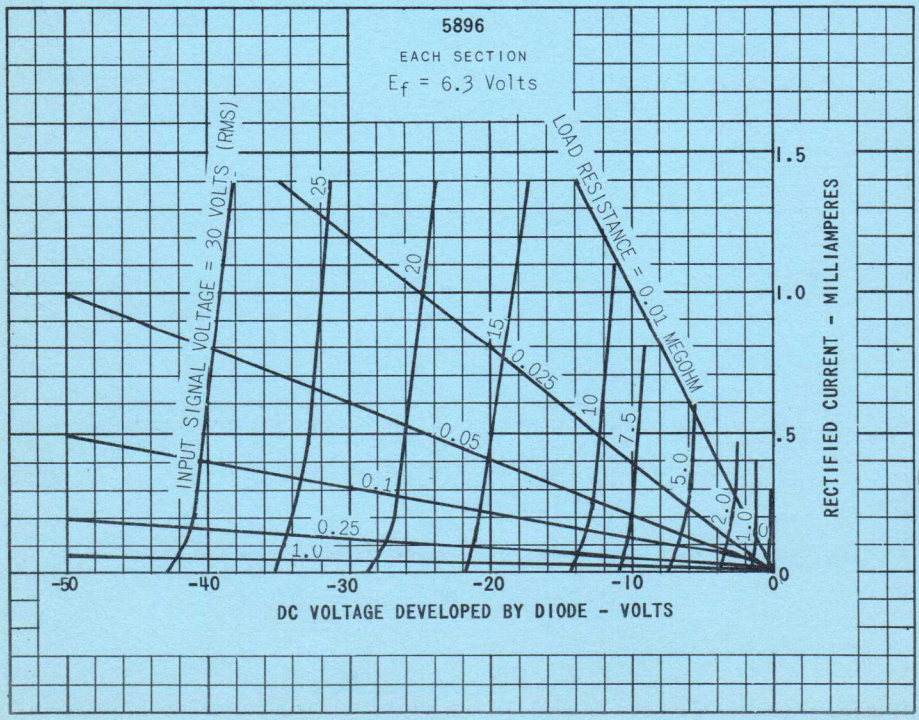
NOTE:

THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE DELIBERATELY BEEN SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS.

IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO APPROPRIATE MIL-E-1 SPECIFICATION.

PRINTED IN U.S.A.

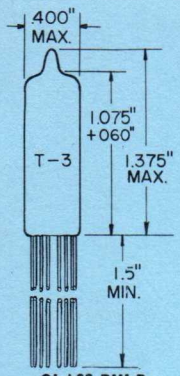

5896
EACH SECTION
E_f = 6.3 Volts
PLATE CURRENT - MILLIAMPERES
80
60
40
20
0
0
2.5
5.0
7.5
10.0
12.5
15.0
PLATE VOLTAGE - VOLTS


5896
EACH SECTION
E_f = 6.3 Volts
INPUT SIGNAL VOLTAGE = 30 VOLTS (RMS)
LOAD RESISTANCE = 0.01 MEGOHM
25
20
15
10
7.5
5.0
2.5
1.0
0.5
0.25
0.1
0.05
0.025
1.5
1.0
.5
0
-50
-40
-30
-20
-10
0
RECTIFIED CURRENT - MILLIAMPERES
DC VOLTAGE DEVELOPED BY DIODE - VOLTS

TUNG-SOL

PENTODE

SUBMINIATURE TYPE



GLASS BULB
SUBMINIATURE BUTTON
CIRCULAR 8 LEAD BASE E8-10
OUTLINE DRAWING
JEDEC 3-1

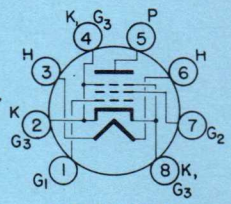
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 **VOLTS** 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM

JEDEC 8DL

THE 5899 IS A SUBMINIATURE, SEMI-REMOTE-CUTOFF PENTODE DESIGNED FOR USE AS A WIDE-BAND, HIGH FREQUENCY AMPLIFIER. ITS SEMI-REMOTE CHARACTERISTIC MAKES IT SUITABLE FOR USE IN CIRCUITS TO WHICH IT IS DESIGNED TO APPLY AUTOMATIC-GAIN-CONTROL.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID #1 TO PLATE (MAX.)	0.015	0.03	μμf
INPUT	4.2	4.0	μμf
OUTPUT	3.4	1.9	μμf

[A] WITH EXTERNAL SHIELD #317.

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	165	VOLTS
MAXIMUM SCREEN VOLTAGE	155	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	0.75	WATTS
MAXIMUM SCREEN DISSIPATION	0.35	WATTS
MAXIMUM DC CATHODE CURRENT	16.5	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM BULB TEMPERATURE AT HOTTEST POINT	220	C

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	VOLTS
SCREEN VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	120	OHMS
PLATE RESISTANCE (APPROX.)	0.26	MEGOHMS
TRANSCONDUCTANCE	4500	μMHOS
PLATE CURRENT	7.2	MA.
SCREEN CURRENT	2.0	MA.
GRID #1 VOLTAGE (APPROX.) Gm = 25 μMHOS	-14	VOLTS

CHARACTERISTICS LIMITS

		MIN	MAX	
HEATER CURRENT				
Ef = 6.3 VOLTS	INITIAL	140	160	MA.
	500-HR.	138	164	MA.
PLATE CURRENT:				
Ef =6.3 VOLTS, Eb =100 VOLTS Ec2 =100 VOLTS,				
Rk =120 OHMS (BY-PASSED)	INITIAL	5.2	9.2	MA.
SCREEN CURRENT:				
Ef =6.3 VOLTS, Eb =100 VOLTS Ec2 =100 VOLTS,				
Rk =120 OHMS (BY-PASSED)	INITIAL	1.0	3.0	MA.
TRANSCONDUCTANCE (1):				
Ef =6.3 VOLTS, Eb =100 VOLTS, Ec2=100 VOLTS,				
Rk =120 OHMS (BY-PASSED)	INITIAL	3800	5200	μMHOS
TRANSCONDUCTANCE CHANGE WITH HEATER VOLTAGE: DIFFERENCE BETWEEN TRANSCONDUCTANCE(1) AND TRANSCONDUCTANCE AT Ef =5.7 VOLTS (OTHER CONDITIONS THE SAME) EXPRESSED AS A PERCENTAGE OF TRANSCONDUCTANCE (1)	INITIAL	---	10	PERCENT
	500-HR.	---	15	PERCENT
TRANSCONDUCTANCE CHANGE WITH OPERATION: DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) INITIALLY AND AFTER OPERATION EXPRESSED AS A PERCENTAGE OF INITIAL VALUE	500-HR.	---	20	PERCENT
AVERAGE TRANSCONDUCTANCE CHANGE WITH OPERATION: AVERAGE OF VALUES FOR "TRANSCONDUCTANCE CHANGE WITH OPERATION"	500-HR.	---	15	PERCENT
PLATE RESISTANCE:				
Ef =6.3 VOLTS, Eb =100 VOLTS, Ec2 =100 VOLTS,				
Rk =120 OHMS (BY-PASSED)	INITIAL	0.175	---	MEGOHMS
TRANSCONDUCTANCE CUTOFF:				
Ef =6.3 VOLTS, Eb =100 VOLTS, Ec2 =100 VOLTS,				
Ec1 =-14 VOLTS	INITIAL	1.0	75	μMHOS
INTERELECTRODE CAPACITANCES:				
GRID #1 TO PLATE (G1 TO P)	INITIAL	---	0.015	μμf
INPUT (G1 TO H, K, G2, G3)	INITIAL	3.8	4.8	μμf
OUTPUT (P TO H, K, G2, G3)	INITIAL	2.9	3.9	μμf

(MEASURED WITH EXTERNAL SHIELD OF 0.405 INCH DIAMETER CONNECTED TO CATHODE)

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS LIMITS - cont'd.

NEGATIVE GRID #1 CURRENT: Ef =6.3 VOLTS, Eb =100 VOLTS Ec2 = 100 VOLTS, Rk =120 OHMS (BY-PASSED), Rg1 = 1.0 MEG.	INITIAL	---	0.3	μAMPS.
	500-HR.	---	0.8	μAMPS.
HEATER-CATHODE LEAKAGE CURRENT: Ef =6.3 VOLTS, Ehk=100 VOLTS HEATER POSITIVE WITH RESPECT TO CATHODE	INITIAL	---	5.0	μAMPS.
	500 - HR.	---	10	μAMPS.
HEATER NEGATIVE WITH RESPECT TO CATHODE	INITIAL	---	5.0	μAMPS.
	500-HR.	---	10	μAMPS.
INTERELECTRODE LEAKAGE RESISTANCE: Ef =6.3 VOLTS. POLARITY OF APPLIED DC INTERELECTRODE VOLTAGE IS SUCH THAT NO CATHODE EMISSION RESULTS. GRID #1 TO ALL AT 100 VOLTS DC	INITIAL	100	---	MEGOHMS
	500-HR.	50	---	MEGOHMS
PLATE TO ALL AT 300 VOLTS DC	INITIAL	100	---	MEGOHMS
	500-HR.	50	---	MEGOHMS
VIBRATIONAL NOISE OUTPUT VOLTAGE, RMS Ef =6.3 VOLTS, Ebb =100 VOLTS, Ec2 = 100 VOLTS, Rk =120 OHMS (BY-PASSED), R_L =10,000 OHMS, VIBRATIONAL ACCELERATION = 15 G AT 40 cps.	INITIAL	---	60	MV.
GRID #1 EMISSION CURRENT: Ef = 7.5 VOLTS, Eb =100 VOLTS, Ec2 = 100 VOLTS, Ecc1 =-14 VOLTS, Rg1 = 1.0 MEG.	INITIAL	---	0.5	μAMPS.

THE INDICATED 500 HOUR VALUES ARE LIFE-TEST END POINTS FOR THE FOLLOWING CONDITIONS OF OPERATION: Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=100 VOLTS, Rk=120 OHMS, Rg1=1.0 MEG, Ehk=200 VOLTS WITH HEATER POSITIVE WITH RESPECT TO CATHODE, AND BULB TEMPERATURE=220 C MINIMUM.

SPECIAL TESTS AND RATINGS

STABILITY LIFE TEST

STATISTICAL SAMPLE OPERATED FOR ONE HOUR TO EVALUATE AND CONTROL INITIAL VARIATIONS IN TRANSCONDUCTANCE.

SURVIVAL RATE LIFE TEST

STATISTICAL SAMPLE OPERATED FOR ONE HUNDRED HOURS TO EVALUATE AND CONTROL EARLY-LIFE ELECTRICAL AND MECHANICAL INOPERATIVES.

HEATER-CYCLING LIFE TEST

STATISTICAL SAMPLE OPERATED FOR 2000 CYCLES TO EVALUATE AND CONTROL HEATER-CATHODE DEFECTS. CONDITIONS OF TEST INCLUDE Ef=7.0 VOLTS CYCLED FOR ONE MINUTE ON AND FOUR MINUTES OFF, Eb=Ec2=Ec1=0 VOLTS, AND Ehk=140 VOLTS RMS.

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

SPECIAL TESTS AND RATINGS - cont'd.

SHOCK RATING--450 G

STATISTICAL SAMPLE SUBJECTED TO FIVE IMPACT ACCELERATIONS OF 450 G IN EACH OF FOUR DIFFERENT POSITIONS. THE ACCELERATING FORCES ARE APPLIED BY THE NAVY-TYPE, HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT.

FATIGUE RATING--2.5 G

STATISTICAL SAMPLE SUBJECTED TO VIBRATIONAL ACCELERATION OF 2.5 G FOR 32 HOURS MINIMUM IN EACH OF THREE DIFFERENT POSITIONS. THE SINUSOIDAL VIBRATION IS APPLIED AT A FIXED FREQUENCY BETWEEN 25 AND 60 CYCLES PER SECOND.

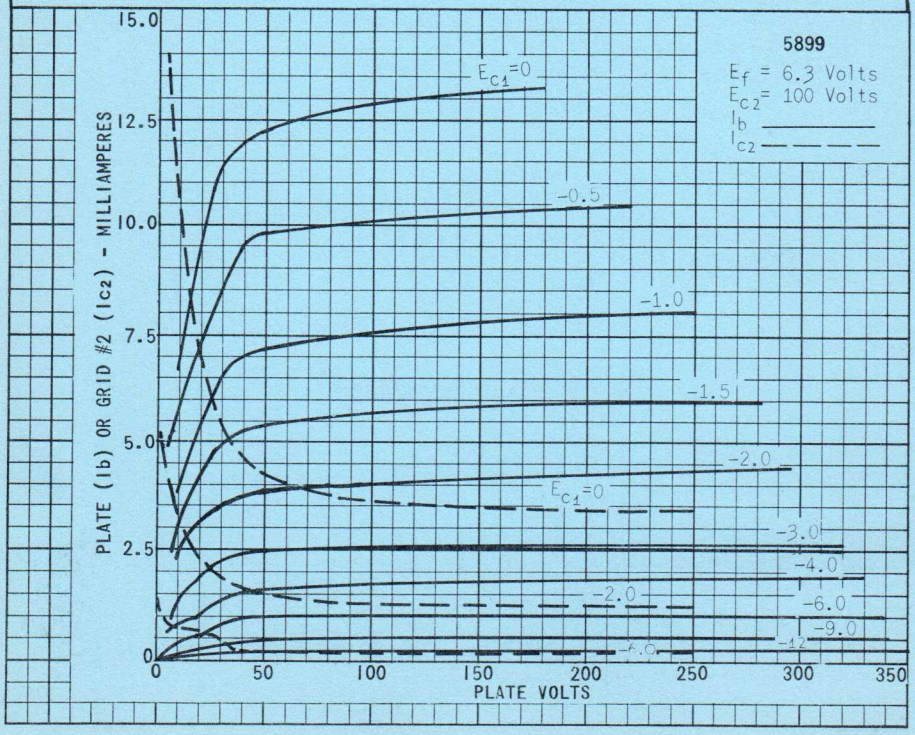
ALTITUDE RATING--60,000 FEET

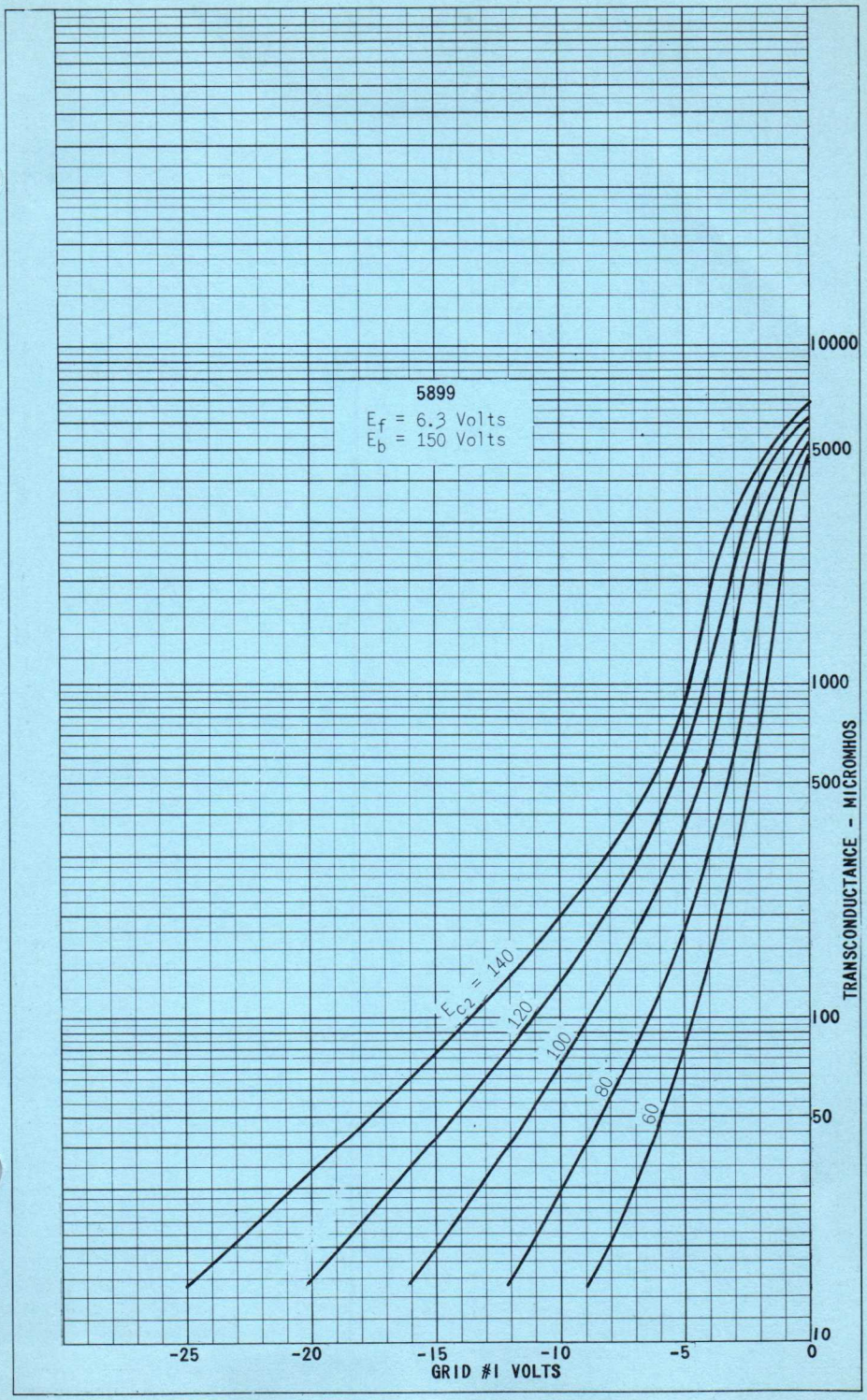
STATISTICAL SAMPLE SUBJECTED TO PRESSURE OF 55 MILLIMETERS OF MERCURY TO EVALUATE AND CONTROL ARCING AND CORONA.

NOTE:

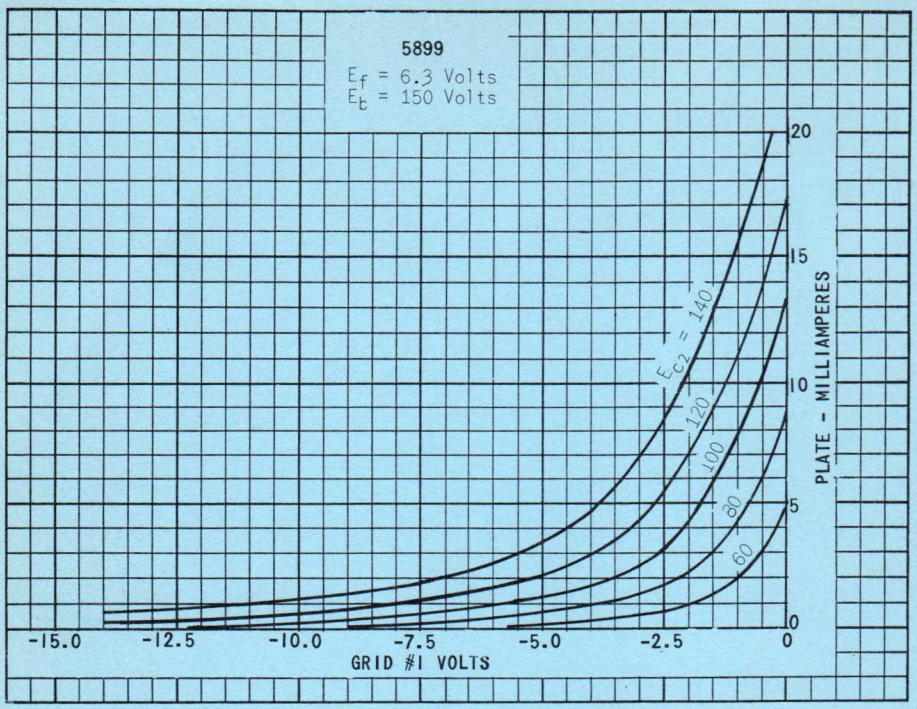
THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE DELIBERATELY BEEN SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS.

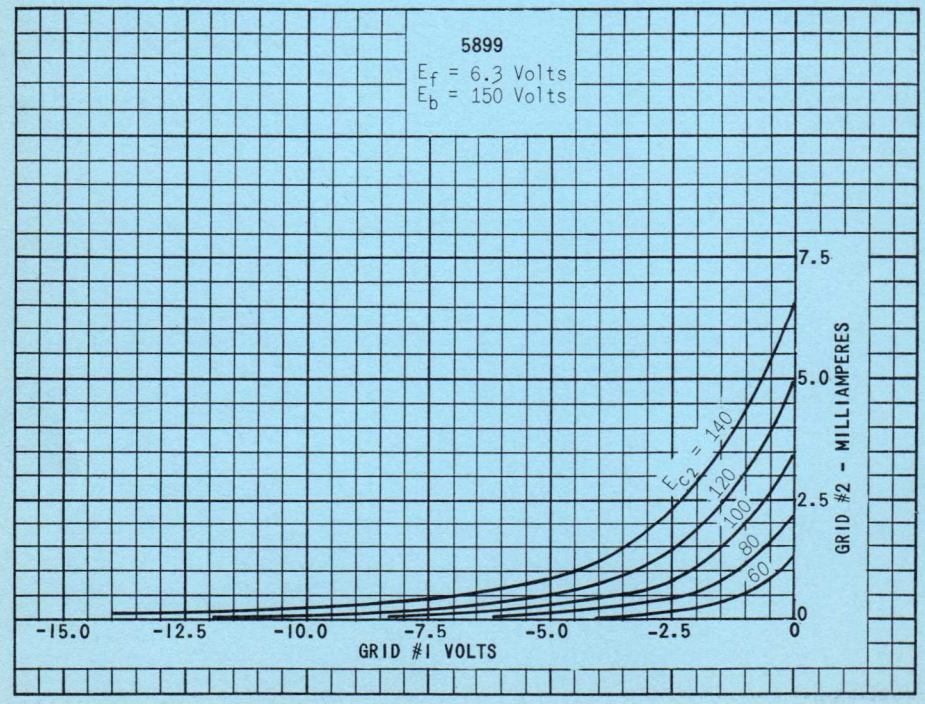
IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO THE APPROPRIATE MIL-E-1 SPECIFICATION.





PRINTED IN U. S. A.

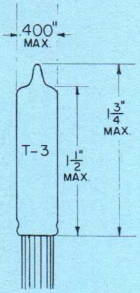

5899
E_f = 6.3 Volts
E_b = 150 Volts
E_{c2} = 140
120
100
80
60
20
15
10
5
0
PLATE - MILLIAMPERES
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS


5899
E_f = 6.3 Volts
E_b = 150 Volts
E_{c2} = 140
120
100
80
60
7.5
5.0
2.5
0
GRID #2 - MILLIAMPERES
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS

TUNG-SOL

PENTODE

SUBMINIATURE TYPE

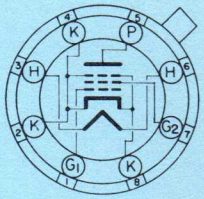


GLASS BULB

HEATER

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SUBMINIATURE BUTTON
0.017" TINNED FLEXIBLE LEADS
8 PIN BASE

8DL

THE 5902 IS A HEATER-CATHODE TYPE BEAM PENTODE OF SUBMINIATURE CONSTRUCTION SUITABLE FOR SERVICE WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. IT IS DESIGNED FOR AUDIO POWER AMPLIFIER SERVICE IN EQUIPMENTS WITH LOW PLATE SUPPLY VOLTAGES, AND IS CAPABLE OF APPROXIMATELY ONE WATT OUTPUT IN THE AUDIO RANGE. THE FLEXIBLE 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 A SUITABLE LENGTH.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE TEST-NOTE 5)	2.5	G
MAXIMUM BULB TEMPERATURE	220	°C

RATINGS

AND NORMAL OPERATION

	MIL-E-1 SYMBOL	ABS. MIN.	NORM. TEST CONDI-TIONS NOTE 7	NORMAL OPERA-TION NOTE 6	ABS. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 8)	Ef:	6.0	6.3	6.3	6.6	VOLTS
PLATE VOLTAGE	Eb:	---	110	110	165	Vdc
GRID #1 VOLTAGE	Ec1:	-55	0	0	0	Vdc
GRID #2 VOLTAGE	Ec2:	---	110	110	155	Vdc
PLATE DISSIPATION	Pp:	---	---	3.3	4.1	W
GRID #2 DISSIPATION	Pg2:	---	---	0.24	0.3	W
GRID #1 CIRCUIT RESISTANCE	Rg1:	---	---	---	0.55	MEG.
HEATER-CATHODE VOLTAGE	Ehk:	-200	---	---	+200	VOLTS
CATHODE CURRENT	Ik:	---	---	---	50	mAdc
CATHODE RESISTANCE	Rk:	---	270	270	---	OHMS
PLATE CURRENT (1):	Ib(1):	---	---	30	---	mAdc
GRID #2 CURRENT	Ic2:	---	---	2.2	---	mAdc
TRANSCONDUCTANCE (1)	Sm(1):	---	---	4200	---	μMHOS
PLATE RESISTANCE	rp:	---	---	0.015	---	MEG.

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS[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								
HEATER CURRENT:	0.65	If:	420	432	450	468	480	36	mA
HEATER-CATHODE LEAKAGE: Ehk=-100 Vdc Ehk=+100 Vdc	0.65	Ihk:	---	---	---	---	15	---	μAdc
GRID CURRENT: Rg1=1.0 MEG.	0.65	Ic(1):	---	---	---	---	-1.0	---	μAdc
PLATE CURRENT (1):	0.65	Ib(1):	23.0	27.0	30.0	33.0	37.0	8.0	mAdc
PLATE CURRENT (2): Ec1=-40 Vdc	0.65	Ib(2):	---	---	---	---	100	---	μAdc
POWER OUTPUT (1): Esig=6.4 Vac; Rp=3000 OHMS	0.65	Po(1):	0.75	---	---	---	---	---	W
CONTINUITY AND SHORTS: (INOPERATIVES):	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE (8-4)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS PART 2									
INSULATION OF ELECTRODES: Ef=6.3 V									
Eg1-all=-100 Vdc	2.5	Rg1-all:	50	---	---	---	---	---	MEG.
Ep-all=-300 Vdc	2.5	Rp-all:	50	---	---	---	---	---	MEG.
SCREEN CURRENT:	2.5	Ic2:	0	---	2.2	---	4.0	---	mAdc
TRANSCONDUCTANCE (1):	2.5	Sm(1):	3500	3850	4200	4550	4900	950	μMHOS
GRID EMISSION: Rg=0.47meg; Rk=220 OHMS; Ef=7.5 V; PREHEAT 5 MINUTES AT Ec1=0; TEST AT Ec1=-40 Vdc	2.5	Ic(2):	---	---	---	---	-2.0	---	μAdc
POWER OUTPUT (2): Ef=5.7 V; Esig=6.4 Vac; Rp=3000 OHMS.(NOTE 9)	2.5	ΔEf Po (2):	---	---	---	---	15	---	PERCENT
AF NOISE: Esig=150 mVac; Ec2= 110 Vdc; Ec1=-8.7 Vdc; Rg1=0.5 meg.; Rg2= 0.01 meg.; Rp=2000 OHMS; Rk=0; Cg2 =4 μf	2.5	EB:	---	---	---	---	17	---	VU
PLATE RESISTANCE:	6.5	rp:	0.01	---	---	---	---	---	MEG.
CAPACITANCE:		Cgp:	---	---	---	---	0.20	---	μμf
CAPACITANCE: (NOTE 2)	6.5	Cin:	5.5	---	6.5	---	7.5	---	μμf
CAPACITANCE:		Cout:	6.5	---	7.5	---	8.5	---	μμf
LOW PRESSURE VOLTAGE BREAKDOWN: PRESSURE =55±5 mm Hg; VOLTAGE = 300 Vac	6.5	---	---	---	---	---	---	---	---

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 MECH. AND INOPERATIVES									
VIBRATION (1) NO VOLTAGES: f VARIABLE FROM 10-50 cps; G max = 10; FIXED AMPLITUDE 0.040 INCH: POST SHOCK AND FATIGUE TEST END POINTS APPLY	---	---	---	---	---	---	---	---	---
VIBRATION (2): F =40cps; G=15; Rp= 2000 OHMS	2.5	Ep:	---	---	---	---	100	---	mVac
DEGRADATION RATE ACCEPTANCE TESTS									
SUBMINIATURE LEAK FATIGUE:	2.5	---	4.0	---	---	---	---	---	arcs
SHOCK: Ehk=+100 Vdc; Rg=0.1 MEG.; HAMMER ANGLE= 30° (NOTE 3)	20	---	---	---	---	---	---	---	---
FATIGUE: 96 HOURS; G= 2.5; FIXED FREQUENCY; F =25 min., 60 max. (NOTE 5)	6.5	---	---	---	---	---	---	---	---
POST SHOCK AND FATIGUE TEST END POINTS: VIBRATION (2): F = 40 cps; G =15; Rp= 2000 OHMS	---	Ep:	---	---	---	---	300	---	mVac
HEATER-CATHODE LEAKAGE: Ehk=-100 Vdc Ehk =± 100 Vdc	---	Ihk:	---	---	---	---	20	---	PERCENT
CHANGE IN POWER OUTPUT (1) OF INDIVIDUAL TUBES:	---	$\Delta_t Po(1)$:	---	---	---	---	40	---	μAdc
GLASS STRAIN (THERMAL SHOCK):	6.5	---	---	---	---	---	---	---	---
ACCEPTANCE LIFE TESTS									
HEATER CYCLING LIFE TEST: Ef =7.0 V; Eb=Ec1=Ec2= 0 V; 1 MIN ON, 4 MIN. OFF; Ehk = 140 Vac	2.5	---	2000	---	---	---	---	---	CYCLES
HEATER CYCLING LIFE TEST END POINTS: HEATER-CATHODE LEAKAGE: Ehk=-100 Vdc Ehk =±100 Vdc	---	Ihk:	---	---	---	---	40	---	μAdc

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

TEST	ALLOWABLE DEFECTS PER CHARACTERISTIC 1st SAMPLE	COMBINED SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN.	MAX	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS							
1 HOUR STABILITY LIFE TEST: TA = ROOM; Eb=Ec2= 100 Vdc; Ehk=+200 Vdc; 220 OHMS			---	---	---	---	---
1 HOUR STABILITY LIFE TEST END POINTS: CHANGE IN POWER OUTPUT (1) OF INDIVIDUAL TUBES: (TYPICAL SAMPLES SIZE = 50 TUBES)			1.0	Δ_t Po(1):	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST: TA= ROOM; Eb=Ec2= 100 Vdc;Ehk=+200 Vdc; Rg= 0.47 MEG. Rk =220 OHMS			---	---	---	---	---
100 HOUR SURVIVAL RATE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 200 TUBES)			---	---	---	---	---
INOPERATIVES:			0.65	---	---	---	---
POWER OUTPUT (1):			1.0	Po(1):	0.65	---	W
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST: T BULB =220° C; Eb =Ec2 = 100 Vdc; Ehk =+200 Vdc; Rg =0.47 MEG.; Rk = 220 OHMS			---	---	---	---	---
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE= 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)			---	---	---	---	---
INOPERATIVES:	1	3	---	---	---	---	---
HEATER CURRENT:	2	5	---	If:	414	492	mA
HEATER-CATHODE LEAKAGE: Ehk=-100 Vdc; Ehk=±100 Vdc	2	5	---	Ihk:	---	60	μAdc
GRID CURRENT (1):	1	3	---	Ic(1):	---	-2.0	μAdc
POWER OUTPUT (1) CHANGE OF INDIVIDUAL TUBES FROM INITIAL:	1	3	---	Δ_tPo(1):	---	20	PERCENT
POWER OUTPUT (1) AVERAGE CHANGE:	---	---	---	Ave.Δ_tPo(1):	---	15	PERCENT
INSULATION OF ELECTRODES:							
g-all	2	5	---	Rg1-all:	25	---	MEG.
p-all			---	Rp-all:	25	---	MEG.
POWER OUTPUT (2) (NOTE 9)	2	5	---	Δ_{Ef} Po(2):	---	15	PERCENT
TOTAL DEFECTIVES:	4	8	---	---	---	---	---

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

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

TEST	ALLOWABLE DEF. PER CHARACTERISTIC 1st SAMPLE	ALLOWABLE DEF. PER CHARACTERISTIC COMBINED SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS - cont'd.							
1000 HOUR HIGH TEMPERATURE INFORMATION LIFE TEST: T BULB=220°C; Eb= Ec2=100 Vdc; Ehk=+ 200 Vdc; Rg=0.47 MEG ; Rk =220 OHMS	---	---	---	---	---	---	---
1000 HOUR HIGH TEMPERATURE INFORMATION LIFE TEST END POINTS: READ FOR SAME CHARACTERISTICS AS FOR 500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST. LIMITS NOT ESTABLISHED.	---	---	---	---	---	---	---

NOTE 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.

NOTE 2: WITH A CYLINDRICAL SHIELD (0.405"I.D.–1 7/8" LONG) CONNECTED TO CATHODE LEADS.

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

NOTE 4: CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

NOTE 5: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

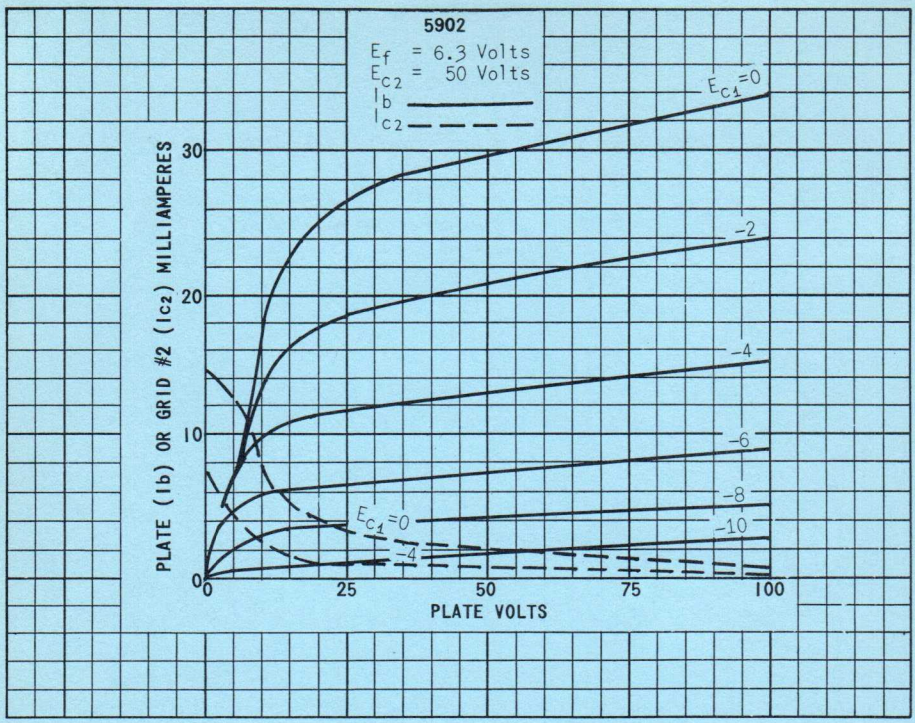
NOTE 6: THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

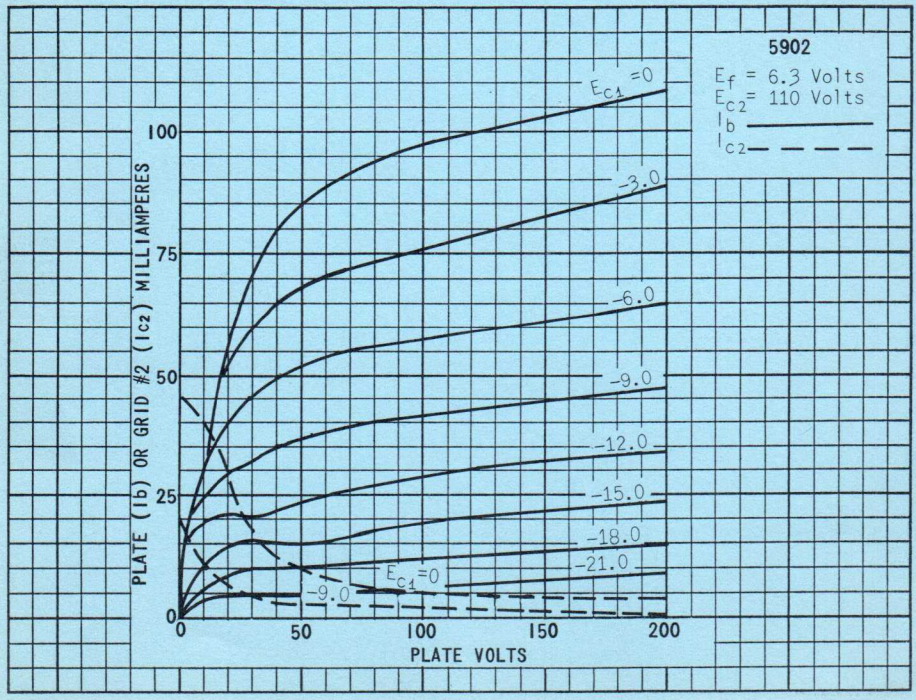
NOTE 7: THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

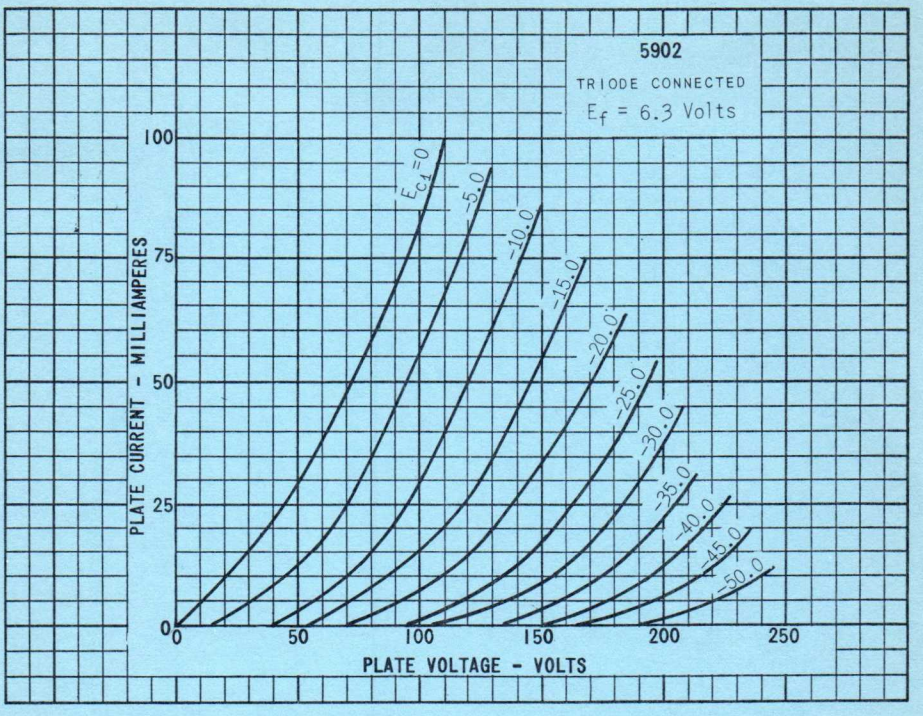
NOTE 8 FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±5% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

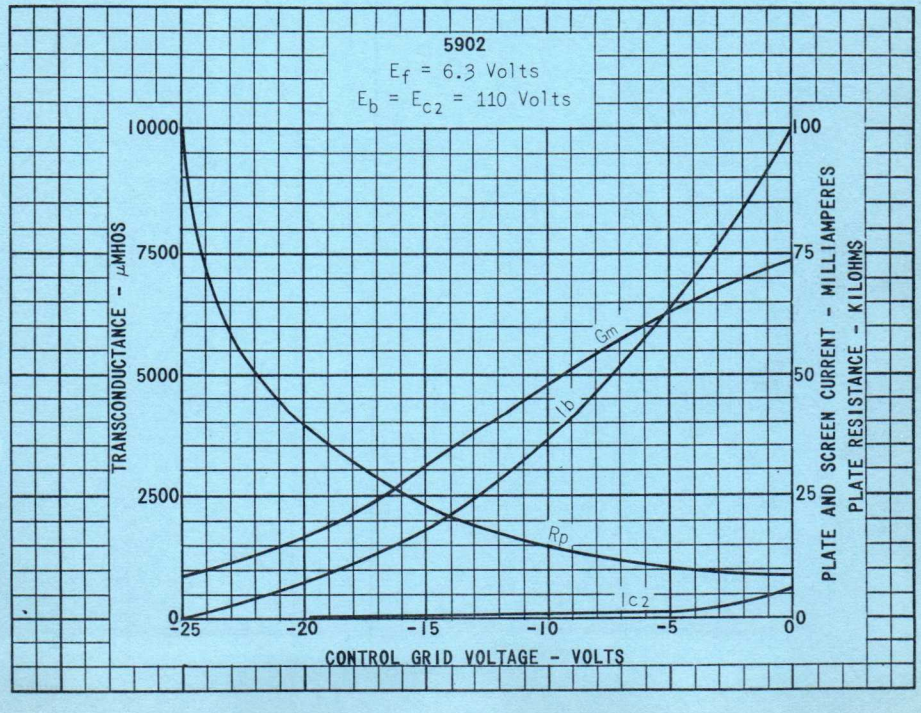
NOTE 9: CHANGE OF POWER OUTPUT FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef= 6.3 V TO THAT VALUE MEASURED AT Ef=5.7V.

PRINTED IN U. S. A.


5902
Ef = 6.3 Volts
Ec2 = 50 Volts
Ib
Ic2
Ec1=0
-2
-4
-6
-8
-10
-4
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0
10
20
30
0
25
50
75
100
PLATE VOLTS


5902
Ef = 6.3 Volts
Ec2= 110 Volts
Ib
Ic2
Ec1=0
-3.0
-6.0
-9.0
-12.0
-15.0
-18.0
-21.0
-9.0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0
25
50
75
100
0
50
100
150
200
PLATE VOLTS



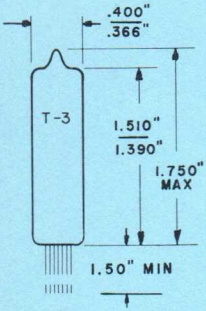


PRINTED IN U. S. A.

TUNG-SOL

PENTODE

SUBMINIATURE TYPE



GLASS BULB

SUBMINIATURE
8 PIN BASE E8-10
OUTLINE DRAWING
JEDEC 3-3

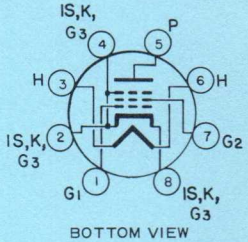
BEAM PENTODE

FOR

AUDIO POWER AMPLIFIER SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

8 FLEXIBLE LEADS
0.017" DIAMETER
BASING DIAGRAM
JEDEC 9DE

THE 5902WA IS A HEATER-CATHODE TYPE BEAM PENTODE OF SUBMINIATURE CONSTRUCTION SUITABLE FOR SERVICE WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. IT IS DESIGNED FOR AUDIO POWER AMPLIFIER SERVICE IN EQUIPMENTS WITH LOW PLATE SUPPLY VOLTAGES, AND IS CAPABLE OF APPROXIMATELY ONE WATT OUTPUT IN THE AUDIO RANGE.

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	450	MA.
LIMITS OF APPLIED VOLTAGE			6.0 TO 6.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			±200	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

DC PLATE VOLTAGE	250	VOLTS
PEAK PLATE VOLTAGE	360	VOLTS
NEGATIVE GRID 1 VOLTAGE	55	VOLTS
GRID 2 VOLTAGE	155	VOLTS
PLATE DISSIPATION	3.7	WATTS
GRID 2 DISSIPATION	0.4	WATTS
DC CATHODE CURRENT	50	MA
GRID 1 CIRCUIT RESISTANCE	155	MEGOHMS
ENVELOPE TEMPERATURE AT HOTTEST POINT	220°	C

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

CONTINUED FROM PRECEDING PAGE

SPECIAL TESTS AND RATINGS

INTERELECTRODE INSULATION		
VIBRATION		
SHOCK		
FATIGUE		
ALTITUDE RATING	80,000	FEET

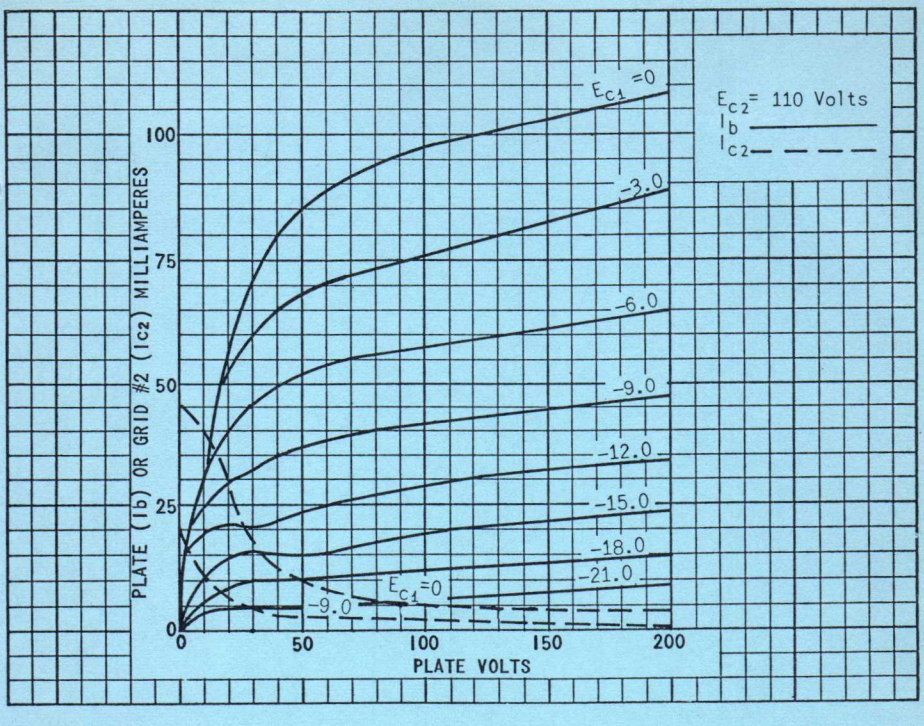
CHARACTERISTICS

PLATE VOLTAGE	110	VOLTS
GRID 2 VOLTAGE	110	VOLTS
CATHODE BIAS RESISTOR	270	OHMS
PLATE CURRENT	30	MA.
GRID 2 CURRENT	2.2	MA
TRANSCONDUCTANCE	4,200	μMHOS
PLATE RESISTANCE	15	K OHMS
GRID 1 VOLTAGE FOR Ib = 10 μA	-40	VOLTS

TYPICAL OPERATING CONDITIONS

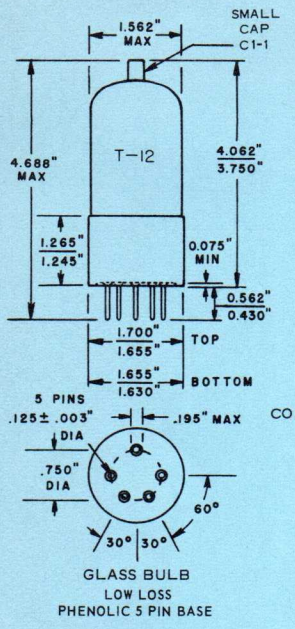
CLASS A1 POWER AMPLIFIER

PLATE SUPPLY VOLTAGE		110	VOLTS
GRID 2 VOLTAGE		110	VOLTS
CATHODE BIAS RESISTOR - BYPASSED		270	OHMS
GRID 1 SIGNAL VOLTAGE		6.4	VOLTS RMS
LOAD RESISTANCE		3,000	OHMS
PLATE CURRENT	APPROX.	29	MA.
GRID 2 CURRENT	APPROX.	5.5	MA.
TOTAL HARMONIC DISTORTION		10	PERCENT
SIGNAL POWER OUTPUT		1.0	WATT



PRINTED IN U. S. A.

TUNG-SOL



GLASS BULB
LOW LOSS
PHENOLIC 5 PIN BASE

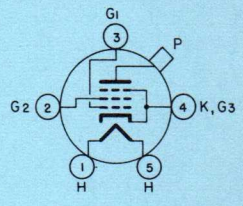
PENTODE

BEAM POWER

BEAM POWER PENTODE
FOR
AUDIO AND RF
AMPLIFIER APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5AW

THE 5933 IS A BEAM POWER PENTODE FOR AUDIO AND RF AMPLIFIER APPLICATIONS CONTAINED IN A T-12 ENVELOPE. IT IS INTENDED FOR APPLICATIONS WHERE CONDITIONS OF SEVERE SHOCK, VIBRATION, HIGH TEMPERATURE AND HIGH ALTITUDE PREVAIL.

DIRECT INTERELECTRODE CAPACITANCES

GRID 1 TO PLATE-SHIELD	MAX.	0.2	pf
INPUT-UNSHIELDED		11	pf
OUTPUT-UNSHIELDED		7	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	900	MA.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.3	VOLTS
HEATER CATHODE VOLTAGE		135	VOLTS

CONTINUED ON FOLLOWING PAGE

PRINTED IN U.S.A.

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES-SEE STANDARD RS-239

DC PLATE VOLTAGE (CLASS B, RF OR AF)	600	VOLTS
DC PLATE VOLTAGE (CLASS C, CONTINUOUS SERVICE)	600	VOLTS
DC PLATE VOLTAGE (CLASS C, AM TELEPHONY)	475	VOLTS
DC PLATE CURRENT (CLASS B, AF)	120	MA.
DC PLATE CURRENT (CLASS B, RF)	80	MA.
DC PLATE CURRENT (CLASS C, CONTINUOUS SERVICE)	100	MA.
DC PLATE CURRENT (CLASS C, AM TELEPHONY)	83	MA.
DC GRID 2 VOLTAGE	300	VOLTS
DC GRID 1 VOLTAGE (CLASS C)	−200	VOLTS
DC GRID 1 CURRENT (CLASS C CONTINUOUS SERVICE)	5	MA.
DC GRID 1 CURRENT (CLASS C, AM TELEPHONY)	5	MA.
PLATE DISSIPATION (CLASS B, RF OR AF)	25	WATTS
PLATE DISSIPATION (CLASS C, CONTINUOUS SERVICE)	25	WATTS
PLATE DISSIPATION (CLASS C, AM TELEPHONY)	16.5	WATTS
GRID 2 DISSIPATION (CLASS B, AF)	3.5	WATTS
GRID 2 DISSIPATION (CLASS B, RF)	2.5	WATTS
GRID 2 DISSIPATION (CLASS C, CONTINUOUS SERVICE)	3.5	WATTS
GRID 2 DISSIPATION (CLASS C, AM TELEPHONY)	2.5	WATTS
PLATE INPUT (CLASS B, AF)	60	WATTS
PLATE INPUT (CLASS B, RF)	37.5	WATTS
PLATE INPUT (CLASS C, CONTINUOUS SERVICE)	60	WATTS
PLATE INPUT (CLASS C, AM TELEPHONY)	40	WATTS
FREQUENCY FOR 100 % RATING	60	MC
FREQUENCY FOR 75% RATING (CLASS B, CLASS C GRID OR SUPPRESSOR MODULATED)	125	MC
FREQUENCY FOR 55% RATING (CLASS C, OR PLATE MODULATED)	125	MC
BULB TEMPERATURE	160	°C
ALTITUDE	80,000	FEET

IF ALTITUDE RATING IS EXCEEDED REDUCTION OF INSTANTANEOUS VOLTAGES (EF EXCLUDED) MAY BE REQUIRED.

CHARACTERISTICS AND LIMITS

PLATE VOLTAGE	600	VOLTS
GRID 2 VOLTAGE	300	VOLTS
GRID 1 VOLTAGE	−29	VOLTS
PLATE CURRENT	36	MA.
GRID 2 CURRENT (MAX.)	4	MA.
GRID VOLTAGE FOR I_b = 0.5 MA. MAX.	−100	VOLTS
MINIMUM POWER OUTPUT AT 15 MC		
E_{cc} = 200 VOLTS DC; I_b = 100 MA.		
I_c = 5-7 MA.; RL = .01 MEG	33	WATTS

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATION

AUDIO AMPLIFIER OR MODULATOR (CLASS AB_2) – TWO TUBES

	CCS			ICAS	
PLATE VOLTAGE	400	500	600	750	VOLTS
GRID 2 VOLTAGE	300	300	300	300	VOLTS
GRID 1 VOLTAGE	–25	–29	–30	–32	VOLTS
PEAK GRID TO GRID SIGNAL VOLTAGE	78	86	78	92	VOLTS
PLATE CURRENT (ZERO SIGNAL)	90	72	60	52	MA.
PLATE CURRENT (MAXIMUM SIGNAL)	240	240	200	240	MA.
GRID 2 CURRENT (ZERO SIGNAL)	5	5	5	5	MA.
GRID 2 CURRENT (MAXIMUM SIGNAL)	10	10	10	10	MA.
LOAD RESISTANCE (PLATE TO PLATE)	3200	4240	6400	6950	OHMS
DRIVING POWER (MAXIMUM SIGNAL) APPROX.	0.2	0.2	0.1	0.2	WATT
POWER OUTPUT APPROX.	55	75	80	120	WATTS

RF POWER AMPLIFIER (CLASS B TELEPHONY)
SINGLE TUBE – 100% MODULATION OF DRIVER STAGE

PLATE VOLTAGE	400	500	600	750	VOLTS
GRID 2 VOLTAGE	250	250	250	300	VOLTS
GRID 1 VOLTAGE	–25	–25	–25	–35	VOLTS
PEAK SIGNAL VOLTAGE	30	30	20	27	VOLTS
PLATE CURRENT	75	75	62.5	60	MA.
GRID 2 CURRENT	4	4	3	3	MA.
GRID 1 CURRENT APPROX.	0	0	0	0	MA.
DRIVING POWER APPROX.	0.25	0.25	0.2	0.12	WATT
POWER OUTPUT APPROX.	9	12.5	12.5	15	WATTS

RF POWER AMPLIFIER (CLASS C TELEPHONY)
SINGLE TUBE – 100% PLATE MODULATION

PLATE VOLTAGE	325	400	475	600	VOLTS
GRID 2 VOLTAGE	225	225	225	275	VOLTS
GRID 2 DROPPING RESISTOR	20000	30000	50000	50000	OHMS
GRID 1 VOLTAGE	–75	–80	–85	–90	VOLTS
GRID LEAK RESISTOR	25000	22800	21300	22500	OHMS
PEAK SIGNAL VOLTAGE	90	95	110	115	VOLTS
PLATE CURRENT	80	80	83	100	MA.
GRID 2 CURRENT	5	5.75	5	6.5	MA.
GRID CURRENT APPROX.	3	3.5	4	4	MA.
DRIVING POWER APPROX.	0.25	0.3	0.4	0.4	WATT
POWER OUTPUT APPROX.	17.5	22.5	27.5	42.5	WATTS

RF POWER AMPLIFIER OR OSCILLATOR (CLASS C TELEGRAPHY)
SINGLE TUBE KEY DOWN UNMODULATED CONDITION

PLATE VOLTAGE	400	500	600	750	VOLTS
GRID 2 VOLTAGE	250	250	250	250	VOLTS
GRID 2 DROPPING RESISTOR	20000	42000	50000	85000	OHMS
GRID 1 VOLTAGE	–45	–45	–45	–45	VOLTS
PEAK SIGNAL VOLTAGE	65	65	65	65	VOLTS
PLATE CURRENT	100	100	100	100	MA.
GRID 2 CURRENT	7.5	6.0	7.0	6.0	MA.
GRID CURRENT APPROX.	3.5	3.5	3.5	3.5	MA.
DRIVING POWER APPROX.	0.2	0.2	0.2	0.2	WATT
POWER OUTPUT APPROX.	25	30	40	50	WATTS

PRINTED IN U.S.A.