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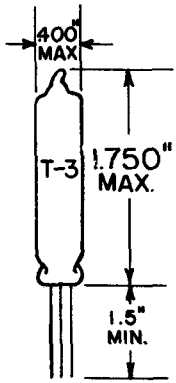
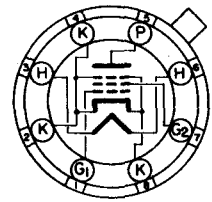


GLASS BULB

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 CONDI-TIONS (NOTE 7)	NORM. OPERA-TION (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.

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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	---	---	---	---	---	---	---	---

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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	---	$\Delta_t Sm(1)$:	---	---	---	---	15	---	PERCENT
GRID CURRENT (1):	---	Ic1	---	---	---	---	-3.0	---	μAdc
GLASS STRAIN (THERMAL SHOCK):	6.4	---	---	---	---	---	---	---	---

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

TEST ACCEPTANCE LIFE TESTS	ALLOWABLE DEF. PER CHARACTER. 1st SAMPLE	COMB. SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS
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	$\Delta_t Sm(1)$:	---	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	---	$\Delta_t Sm(1)$:	---	20	PERCENT
TRANSCONDUCTANCE (2) (NOTE 9)	1	3	---	$\Delta_{Ef} Sm$ (2):	---	20	PERCENT

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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	---	$\Delta_t Sm(1)$:	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	1	3	---	$\Delta_{Ef} Sm(2)$:	---	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	---	$\Delta_t Sm$:	---	25	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	1	3	---	$\Delta_{Ef} Sm(2)$:	---	20	PERCENT
HEATER-CATHODE LEAKAGE:							
Ehk=+100 Vdc	1	3	---	Ihk:	---	20	μAdc
Ehk=-100 Vdc			---	Ihk:	---	20	μAdc

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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= 6.3V TO THAT VALUE MEASURED AT Ef=5.7V.

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).

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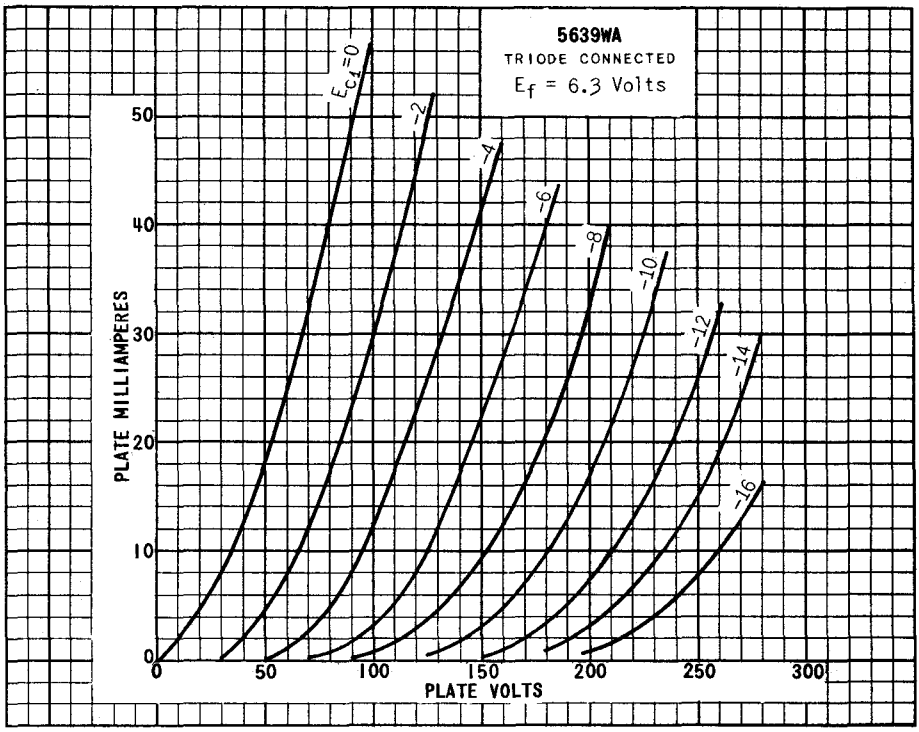

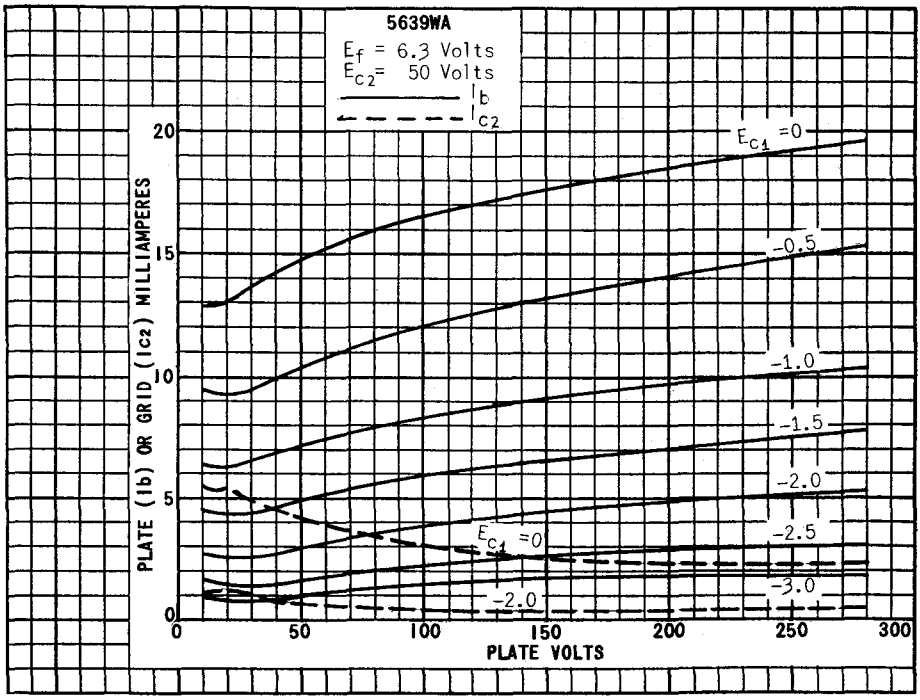

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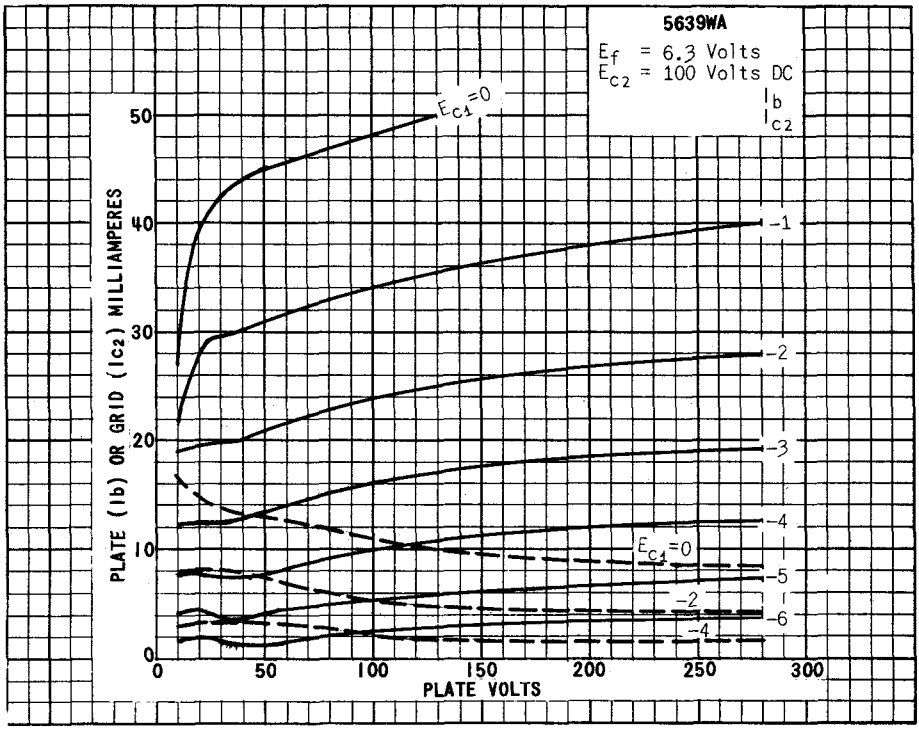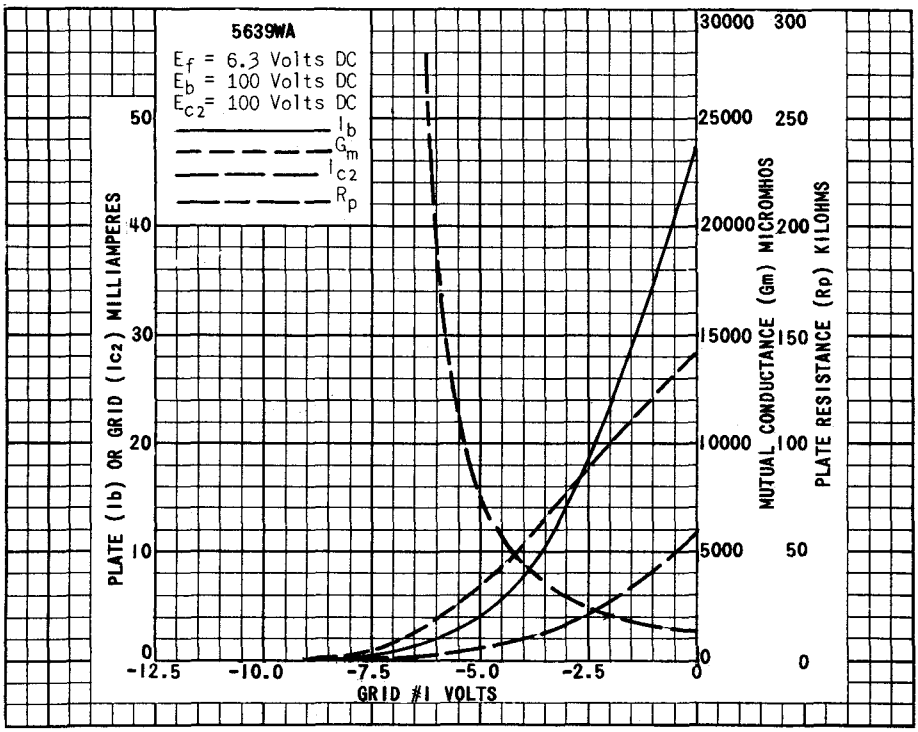
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