

ML-8536

ML-8537



**Miniature  
 UHF Planar Triodes**

CW, Plate or Grid Pulsed  
 Frequency Stable  
 Phormat Cathode  
 40W CW at 2.3 GHz

**DESCRIPTION**

The ML-8536 and ML-8537 are ruggedized, high-mu planar triodes of ceramic-and-metal construction, designed for use as grid-pulsed, plate-pulsed, or CW oscillators, frequency multipliers, or amplifiers in radio transmitting service from low frequency to 3 GHz. The ML-8536 is supplied without a radiator for conduction-convection or heat-sink cooling. The ML-8537 is supplied with a radiator for forced-air cooling. Except for plate dissipation ratings, the characteristics of the two tubes are the same.

A distinguishing characteristic of these tubes is their mini-

aturization. In addition to low interelectrode capacitance, high transconductance and high mu, these tubes also incorporate design features which help to assure frequency-stable operation even under conditions of adverse ambient temperature and varying plate dissipation. The tubes also employ a Phormat type cathode which consists of an indirectly heated disc with an oxide coating impregnated in a nickel matrix. This construction, in combination with proper plate series impedance, reduces to a minimum failures of the cathode due to voltage surges.

**GENERAL CHARACTERISTICS**

**Electrical**

Heater Voltage (AC or DC) .....	6.0 V
Heater Current at 6.0 Volts .....	1.00 A
Cathode Heating Time, minimum .....	60 sec
Amplification Factor .....	80
Transconductance ( $J_k=200\text{mA/cm}^2$ ) .....	30000 $\mu\text{mhos}$
Interelectrode Capacitance, without Heater Voltage	
Grid-Plate .....	1.65 pf
Grid-Cathode .....	7.50 pf
Plate-Cathode, maximum .....	.040 pf

**Mechanical**

Mounting Position .....	Optional
Type of Cooling	
With radiator (ML-8537) .....	Forced-air
Without radiator (ML-8536) .....	Conduction and convection
Maximum Anode Temperature .....	250 °C
Net Weight	
With radiator (ML-8537) .....	45 g
Without radiator (ML-8536) .....	20 g

**MAXIMUM RATINGS AND  
TYPICAL OPERATING CONDITIONS**  
**CW RF Power Oscillator and Amplifier  
Class C**

Maximum Ratings, Absolute Values	
DC Plate Voltage .....	2500 V
DC Grid Voltage .....	-150 V
Instantaneous Peak Grid-Cathode Voltage	
Grid negative to cathode .....	-400 v
Grid positive to cathode .....	30 v
DC Plate Current .....	150 mA
DC Grid Current .....	45 mA
Plate Dissipation	
Forced-air cooling (ML-8537) .....	150 W
Conduction and convection (ML-8536) .....	10 W†
Grid Dissipation .....	1.5 W
Frequency .....	2.5 GHz
Typical Operation, Power Amplifier	
Frequency .....	500 MHz
Filament Voltage .....	6.0 V
DC Plate Voltage .....	900 V
DC Grid Voltage .....	-40 V
DC Plate Current .....	90 mA
DC Grid Current, approximate .....	30 mA
Driving Power, approximate .....	6 W
Useful Power Output .....	40 W
Typical Operation, Power Amplifier	
Frequency .....	2.3 GHz
Filament Voltage .....	5.0 V
DC Plate Voltage .....	1000 V
DC Plate Current .....	150 mA
Useful Power Output .....	40 W
Gain .....	15 db

**Grid-Pulsed or Plate-Pulsed RF Oscillator  
or Amplifier — Class C**

Maximum Ratings, Absolute Values	
Plate Voltage	
Grid-pulsed, DC .....	2500 V
Plate-pulsed, peak pulse supply .....	3500 v
DC Grid Voltage .....	-150 V
Instantaneous Peak Grid-Cathode Voltage	
Grid negative to cathode .....	-750 v
Grid positive to cathode .....	250 v
Average Plate Current .....	10 mA
Average Grid Current .....	5 mA
Pulse Plate Current .....	3 a
Average Plate Dissipation	
Forced-air cooling (ML-8537) .....	35 W
Conduction and convection (ML-8536) .....	10 W†
Average Grid Dissipation .....	1.5 W
Pulse Duration .....	6 μs††
Duty Factor .....	.0033 ††
Frequency .....	3 GHz
Typical Operation, Plate-Pulsed RF Amplifier	
Frequency .....	2.5 GHz
Filament Voltage .....	5.8 V
Pulse Duration .....	5 μs
Duty Factor .....	.0030
Peak Plate Pulse Supply Voltage .....	3500 v
Peak Plate Current from Pulse Supply .....	3.0 a

Average Plate Current .....	9.0 mA
Average Grid Current .....	3.0 mA
Useful Peak Power Output, approximate .....	2.0 kw
Typical Operation, Grid-Pulsed RF Amplifier	
Frequency .....	1.1 GHz
Filament Voltage .....	6.0 V
Pulse Duration .....	3.5 μs
Duty Factor .....	.001
DC Grid Voltage .....	1700 V
DC Plate Voltage .....	-45 V
Peak Plate Current from DC Supply .....	1.9 a
Peak Grid Current from Pulse Supply .....	1.1 a
Driving Power During Pulse, approximate .....	400 W
Useful Peak Power Output, approximate .....	2 kw

**Pulse Modulator or Pulse Amplifier**

Maximum Ratings, Absolute Values	
DC Plate Voltage .....	2500 V
Peak Plate Voltage .....	3500 v
DC Grid Voltage .....	-150 V
Instantaneous Peak Grid-Cathode Voltage	
Grid negative to cathode .....	-750 v
Grid positive to cathode .....	100 v
DC Plate Current .....	100 mA
Pulse Cathode Current .....	5 a
Average Plate Dissipation	
Forced-air cooling (ML-8537) .....	150 W
Conduction and convection (ML-8536) .....	10 W†
Average Grid Dissipation .....	1.5 W
Pulse Duration .....	6 μs††
Duty Factor .....	.0033 ††

†Greater plate dissipation will be possible with the ML-8536 when the tube is used with an appropriately designed heat sink.

††For applications requiring longer pulse duration or higher duty factors, consult the Machlett Engineering Department.

**CHARACTERISTIC RANGE VALUES  
FOR EQUIPMENT DESIGN**

	Min.	Max.
Filament Current at 6.0V (Note 1) .....	.90	1.05 A
Cut-Off Bias (Note 2) .....	—	-25 Vdc
Grid-Plate Capacitance (Note 3) .....	1.50	1.80 pf
Grid-Cathode Capacitance (Note 3) .....	6.75	8.25 pf
Plate-Cathode Capacitance (Note 3) .....	—	.040 pf

Note 1 — For reduced filament voltage see "Heater Voltage" section in *Application Notes*.

Note 2 — Measured with 1 mA plate current and a plate voltage of 1000 Vdc.

Note 3 — Capacitance values are given for a cold tube. When the filament is heated to its proper temperature, the grid-cathode capacitance will increase by approximately 1 pf due to thermal expansion of the cathode.

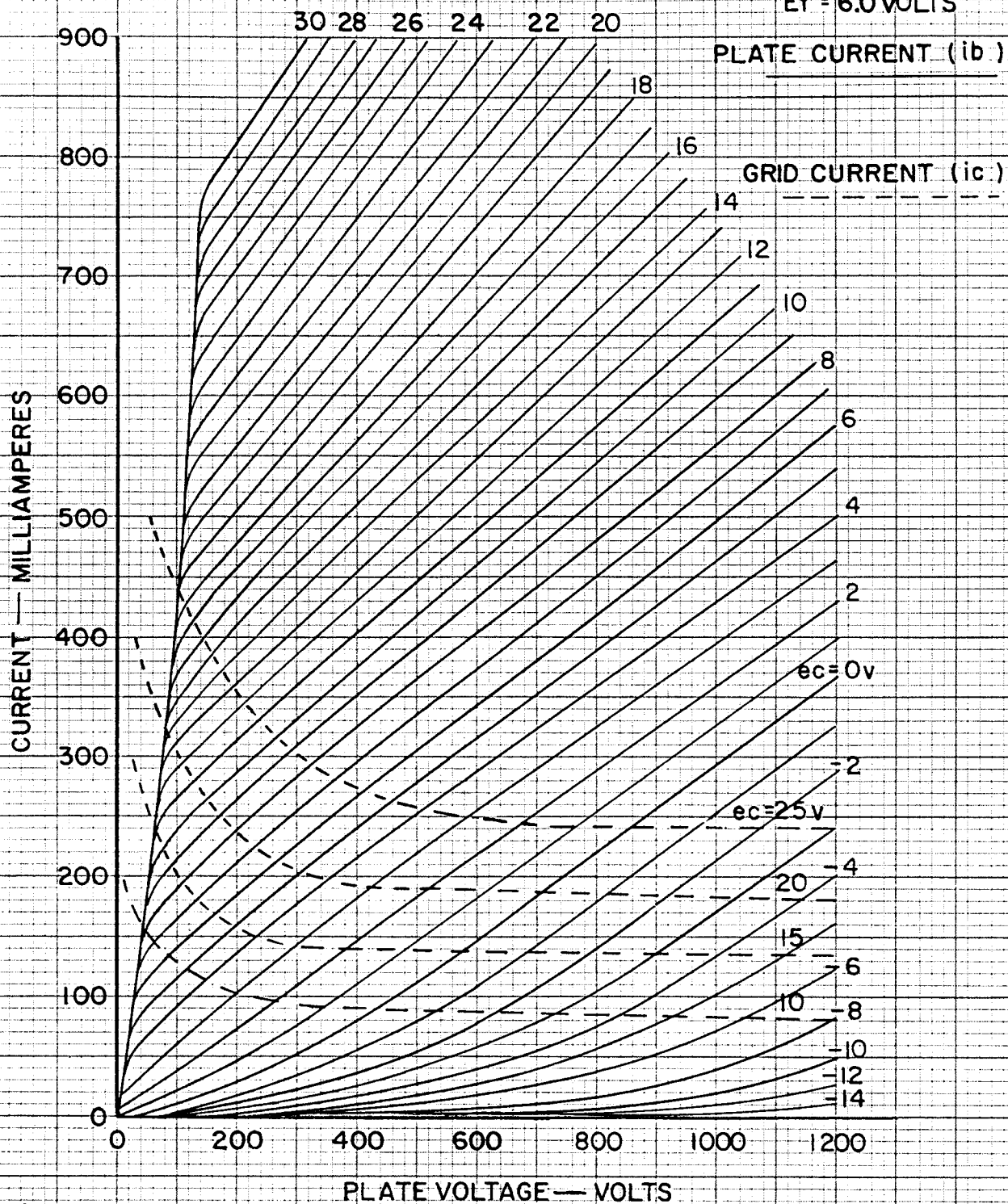
**APPLICATION NOTES**

Before designing equipment for use with these tubes and before installing them in equipment, refer to the general information given in the Machlett publication entitled *Application Notes, UHF Tubes* —General.

### CONSTANT GRID-VOLTAGE CHARACTERISTICS

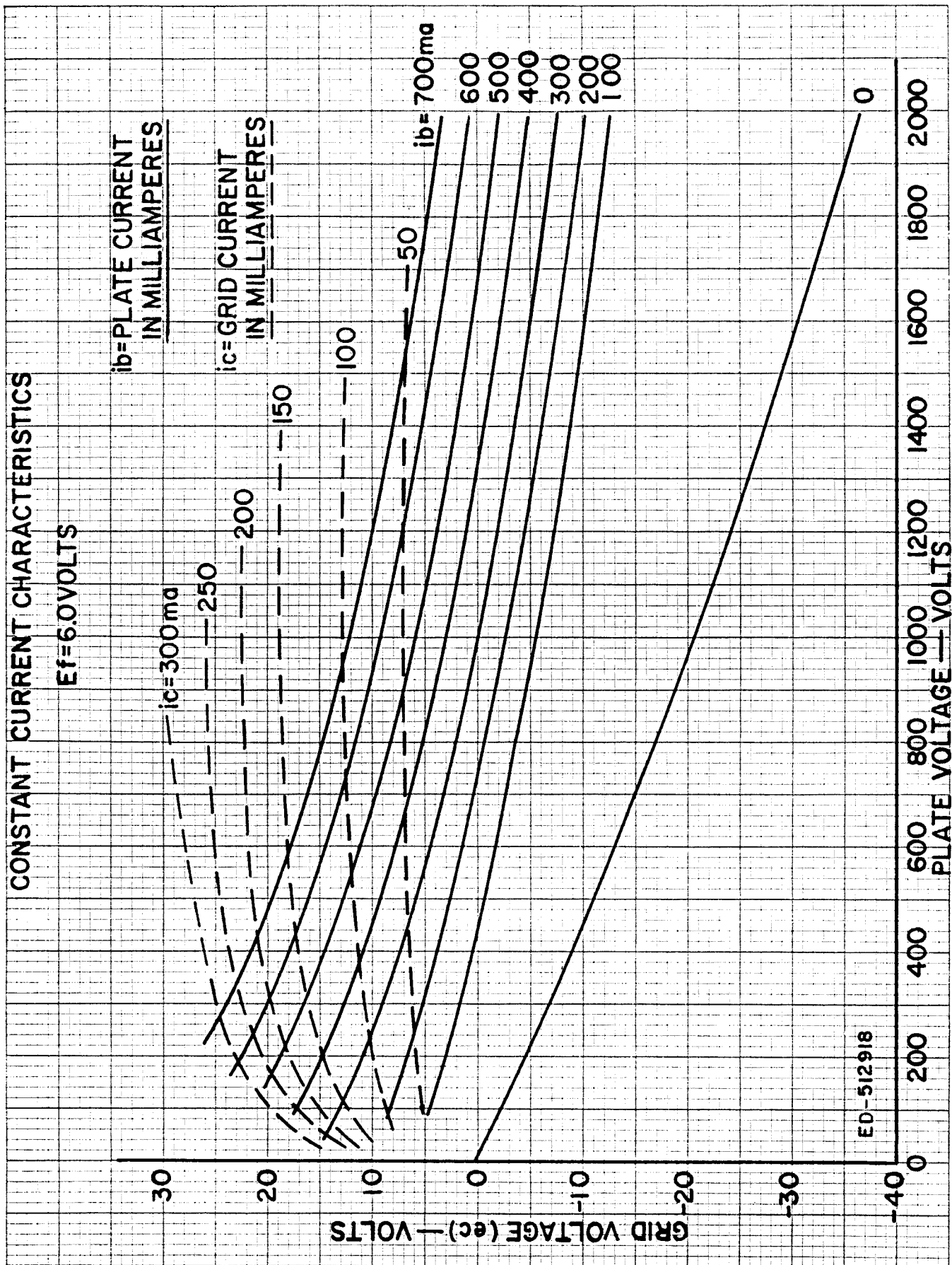
$e_c$  = GRID VOLTAGE IN VOLTS

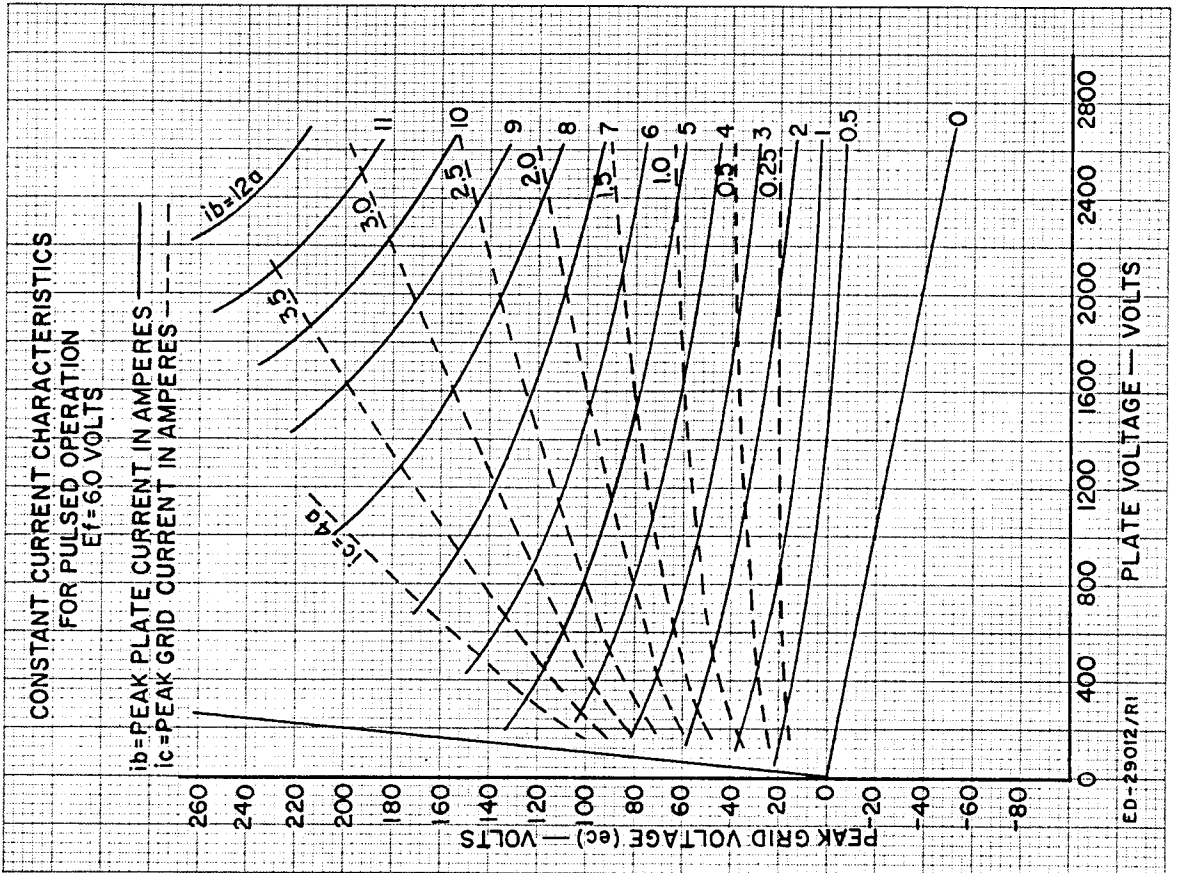
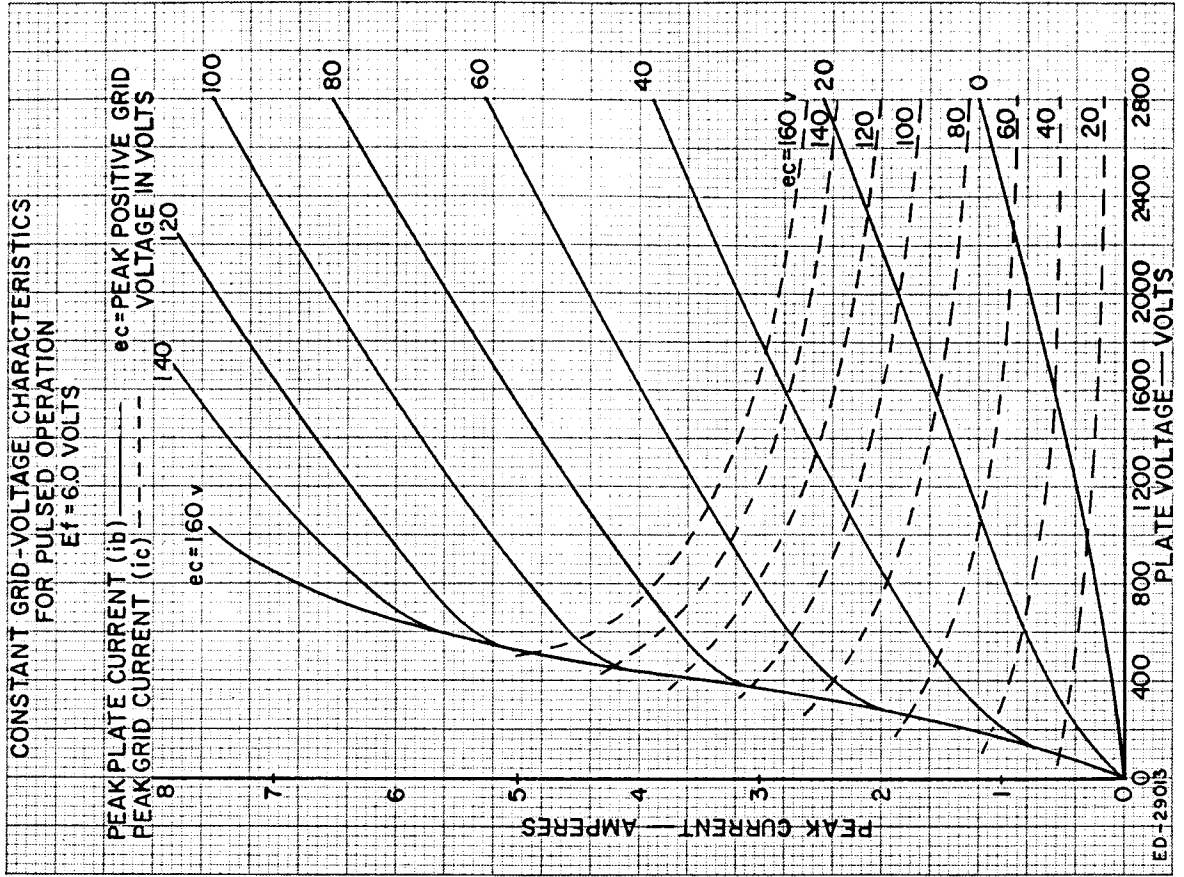
$E_f$  = 6.0 VOLTS



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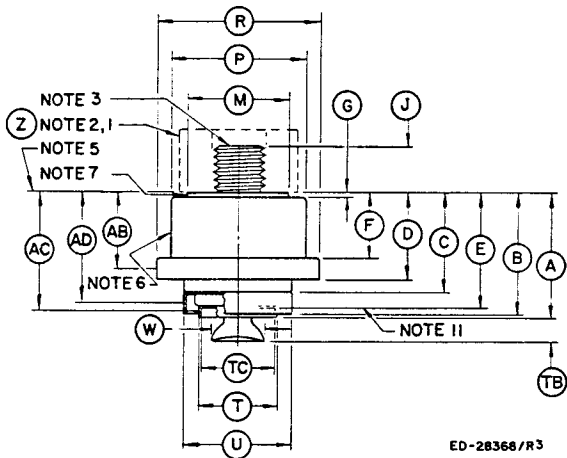
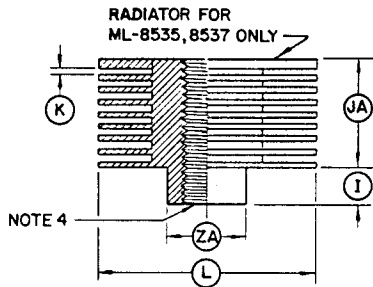
PLATE VOLTAGE — VOLTS





The millimeter dimensions are derived from the original inch dimensions.

Ref	Inches			Millimeters			Notes
	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum	
A	.714		.780	18.14		19.81	
AB	.437	.476	.515	11.10	12.09	13.08	1, 8
AC	.662	.682	.702	16.81	17.32	17.83	1, 10
AD	.605	.645	.685	15.37	16.38	17.40	1, 9
B	.691		.740	17.55		18.80	
C	.570		.607	14.48		15.42	
D	.520		.547	13.21		13.89	
E	.650		.705	16.51		17.91	
F	.400		.415	10.16		10.54	
G	.022		.040	.56		1.02	
I	.192		.208	4.88		5.28	
J	.240		.275	6.10		6.98	
JA	.585		.635	14.86		16.13	
K	.028		.045	.71		1.14	
L	1.235		1.265	31.37		32.13	
M	.565		.580	14.35		14.73	
P	.775		.785	19.68		19.94	
R	.935		.950	23.75		24.13	1, 8
T	.440		.460	11.18		11.68	1, 10
TB			.250			6.35	
TC	.410		.425	10.41		10.80	
U	.595		.607	15.11		15.42	1, 9
W			.313			7.95	
Z			.015			.38	1
ZA	.440		.460	11.18		11.68	



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**NOTES:**

1. The total indicated runout of the grid-contact surface (Note 8), the cathode-contact surface (Note 9) and the heater-contact surface (Note 10) will not exceed (Z). This measurement is made with the gage (Note 2) screwed on the anode thread (Note 3) so that the face of the gage makes full contact with the reference surface (Note 5). Runout is then measured with the gage chucked on the measurement reference axis.
2. See outline. Machlett gage No. S-L5. Details will be supplied upon request.
3. See outline. Anode,  $\frac{5}{16}$  — 24 UNF-2A thread.
4. See outline.  $\frac{5}{16}$  — 24 UNF-2B thread. Use  $\frac{5}{16}$ -24 bolt in this hole for tube extraction.
5. See outline. Reference surface. The tube shall be stopped only by this surface when screwed in the socket.
6. See outline. Insulating envelope. Do not clamp or locate on this surface.
7. See outline. Measure anode temperature on this surface.
8. Grid-contact surface and reference dimension for eccentricity measurement, defined by dimensions (R) and (AB).
9. Cathode- or heater-contact surface and reference dimension for eccentricity measurement, defined by dimensions (U) and (AD).
10. Heater-contact surface and reference dimension for eccentricity measurement, defined by dimensions (T) and (AC). See also Note 11.
11. See outline. Alternate heater-contact surface. Heater contact can be made to the bottom of the heater terminal-cup by means of a coil spring having a maximum coil OD of .390 inch and a minimum coil ID of .320 inch, or some similar device.



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