

ML-7815/
 3CPN10A5
 ML-7815R



UHF Planar Triodes
 CW, Plate or Grid Pulsed
 Phormat Cathode
 Extended Grid-Anode Insulator
 3 GHz

DESCRIPTION

The ML-7815/3CPN10A5 and ML-7815R are ruggedized, high- μ 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-7815/3CPN10A5 is supplied without a radiator for conduction-convection cooling. The ML-7815R is supplied with a radiator for forced-air cooling. Except for plate-dissipation ratings, the characteristics of the two tubes are the same.

A special feature of these tubes as compared to other tubes fitting the same socket is an extended grid-anode insulator

in the tube envelope. The extended grid-anode insulator is an important feature in airborne equipment operating at high altitudes. Other features of these tubes include low inter-electrode capacitance, high transconductance, and great mechanical strength. 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	1.0 A
Cathode Heating Time, minimum	60 sec
Amplification Factor	100
Transconductance (I _b = 70mA, E _b = 600V)	25000 μ mhos
Interelectrode Capacitance, without Heater Voltage	
Grid-Plate	1.98 pf
Grid-Cathode	6.30 pf
Plate-Cathode, maximum035 pf

Mechanical

Mounting Position	Optional
Type of Cooling	
Without radiator (ML-7815/3CPN10A5)	Conduction & Convection
With radiator (ML-7815R)	Forced-Air
Maximum Envelope Temperature	250 °C
Net Weight	
Without radiator (ML-7815/3CPN10A5)	51 g
With radiator (ML-7815R)	63 g

**MAXIMUM RATINGS AND
TYPICAL OPERATING CONDITIONS**

**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
Peak Plate Current	3	a
Average Plate Dissipation		
Forced-air cooling (ML-7815R)	35	W
Conduction and convection (ML-7815)	10	W
Average Grid Dissipation	2	W
Pulse Duration	6	μs†
Duty Factor	.0033	†
Frequency	3	GHz

Typical Operation, Plate-Pulsed RF Oscillator

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	a
Average Plate Current	9	mA
Average Grid Current	3	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 Plate Voltage	2200	V
DC Grid 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	2.0	kw

Pulsed 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	150	v
DC Plate Current	100	mA
Pulse Cathode Current	4.8	a
Average Plate Dissipation		
Forced-air cooling (ML-7815R)	100	W
Conduction and convection (ML-7815)	10	W

Average Grid Dissipation	1.5	W
Pulse Duration	6	μs†
Duty Factor	.0033	†

**CW RF Power Amplifier and Oscillator
Class C Telegraphy**

Key-down conditions per tube without amplitude modulation‡

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 Cathode Current	125	mA
DC Grid Current	50	mA
Plate Dissipation		
Forced-air cooling (ML-7815R)	100	W
Conduction and convection (ML-7815)	10	W
Grid Dissipation	2	W
Frequency	2.5	GHz

Typical Operation, RF Power Amplifier, Grid Separation Circuit

Frequency	500	MHz
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, RF Oscillator

Frequency	2.5	GHz
DC Plate Voltage	900	V
DC Grid Voltage, approximate	-22	V
DC Plate Current	90	mA
DC Grid Current	10	mA
Useful Power Output	17	W

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

‡Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

**CHARACTERISTIC RANGE VALUES
FOR EQUIPMENT DESIGN**

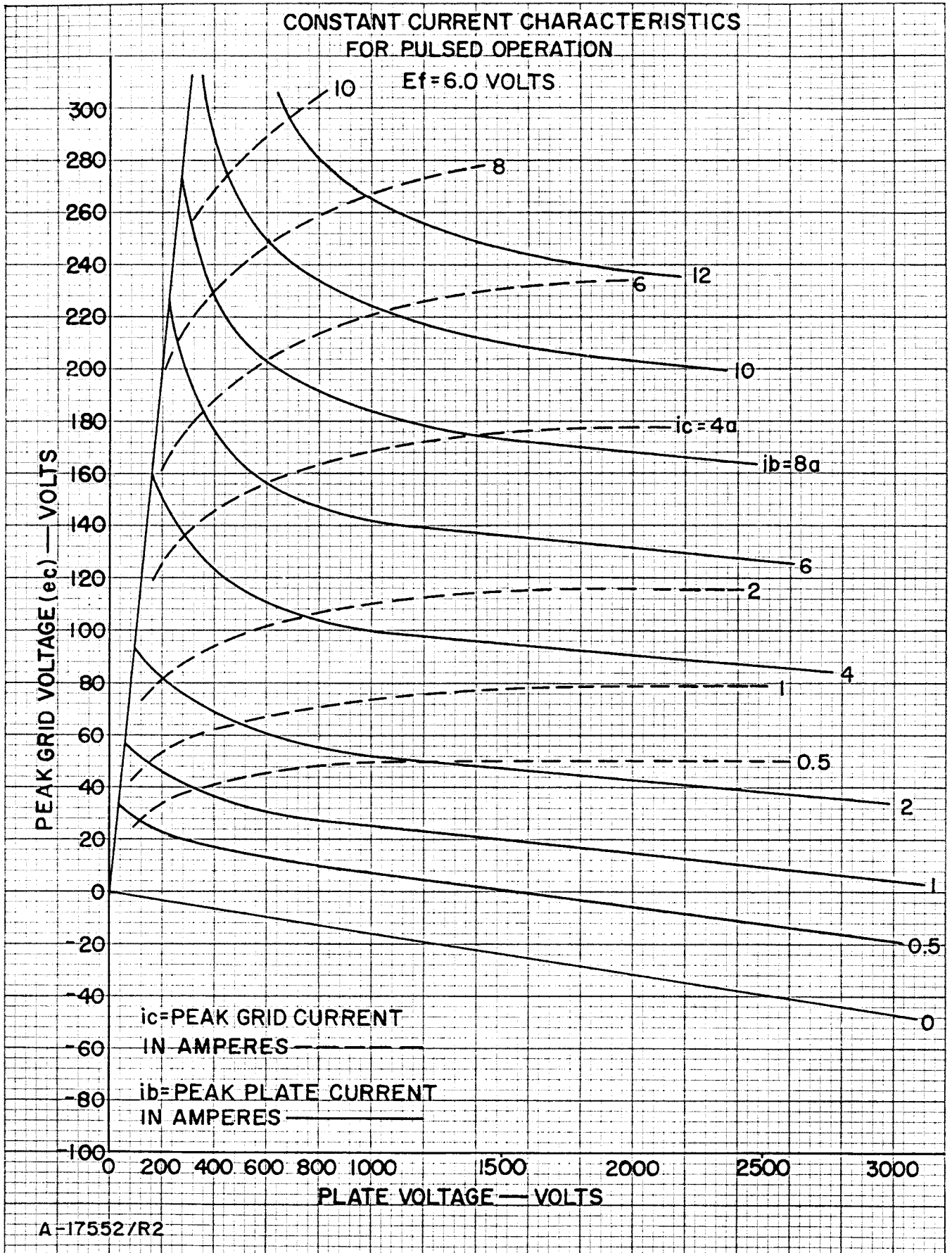
	Min.	Max.
Filament Current at 6.0 Volts	0.90	1.05 A
Cutoff Bias (Note 1)	—	-15 V
Grid-Plate Capacitance (Note 2)	1.85	2.10 pf
Grid-Cathode Capacitance (Note 2)	5.60	7.00 pf
Plate-Cathode Capacitance (Note 2)		.035 pf

Note 1 — Measured at 1 mA of plate current and a plate voltage of 600 volts.

Note 2 — Capacitance measurements are made with tube cold.

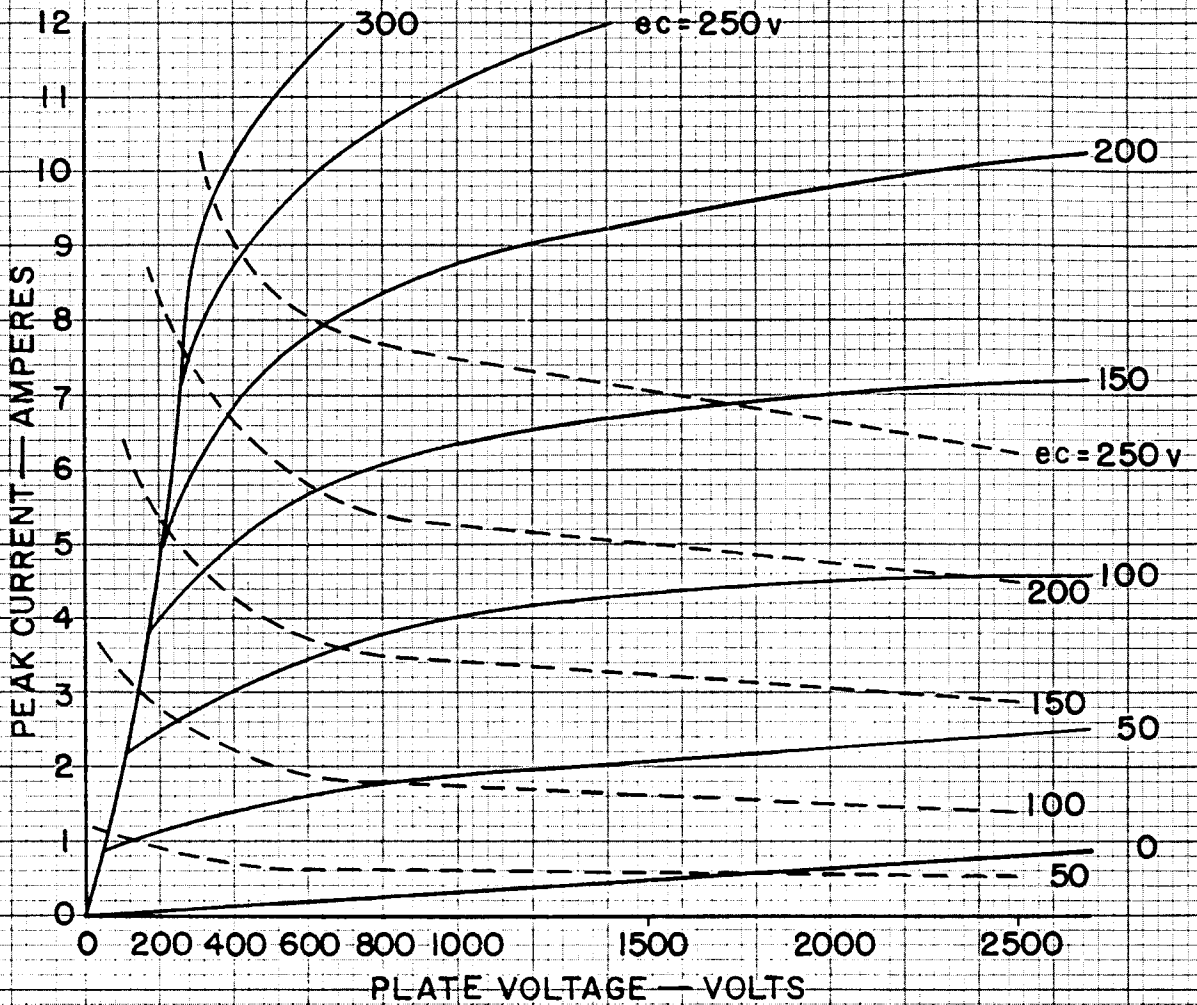
APPLICATION NOTES

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

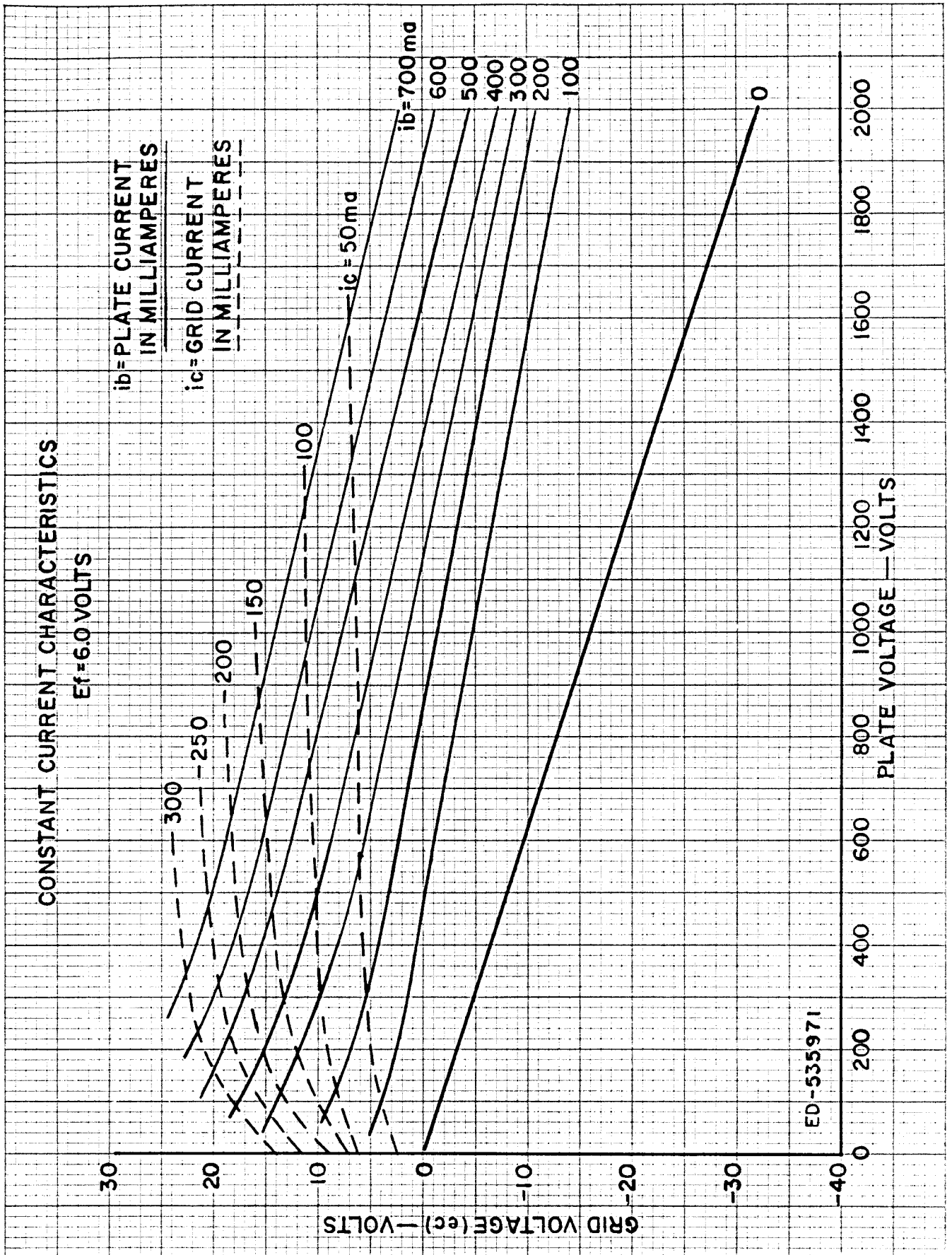


CONSTANT GRID-VOLTAGE CHARACTERISTICS
FOR PULSED OPERATION
 $E_f = 6.0$ VOLTS

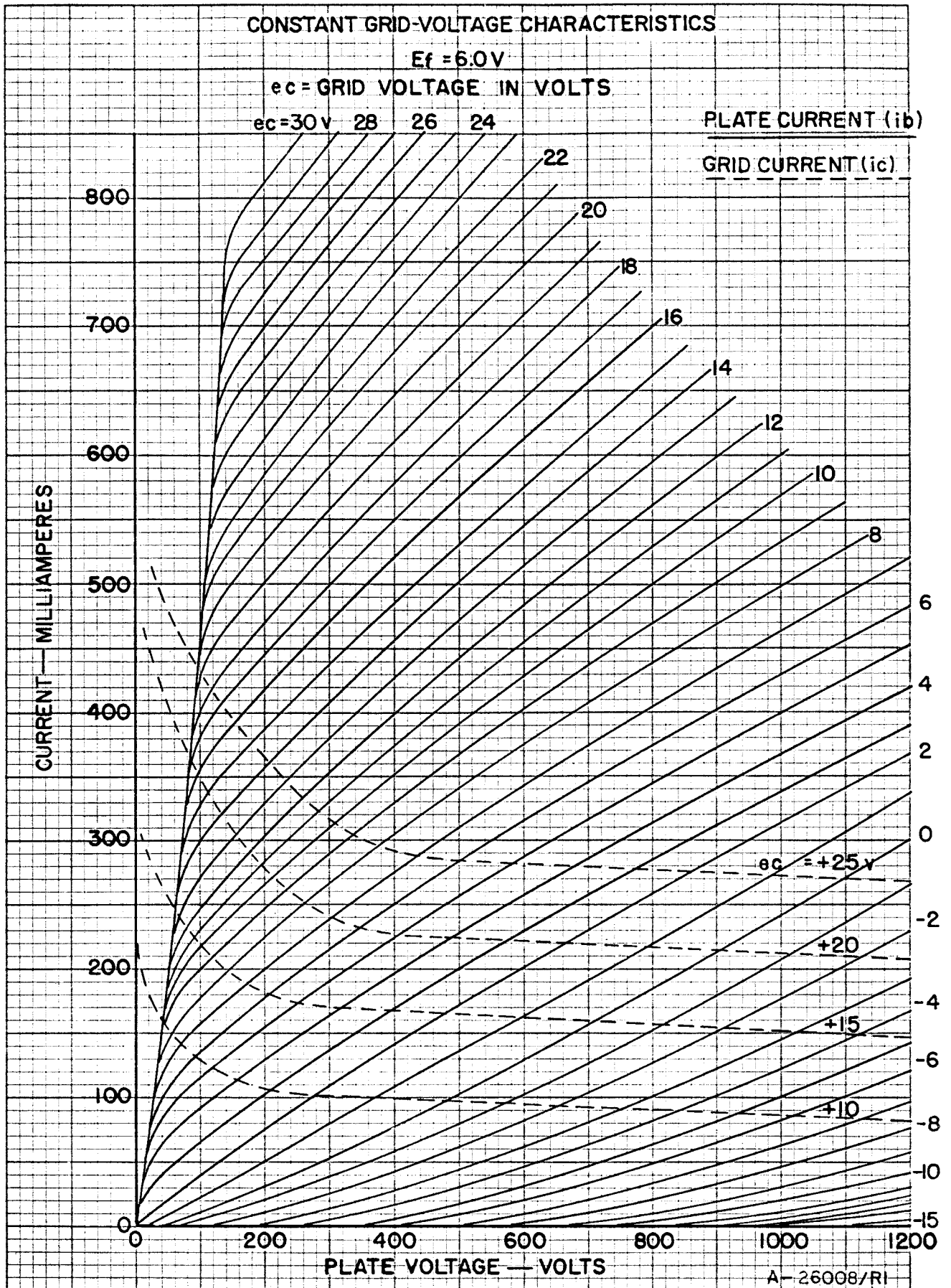
e_c = PEAK POSITIVE GRID
VOLTAGE IN VOLTS



PEAK PLATE CURRENT (i_b) ———
PEAK GRID CURRENT (i_c) - - - -



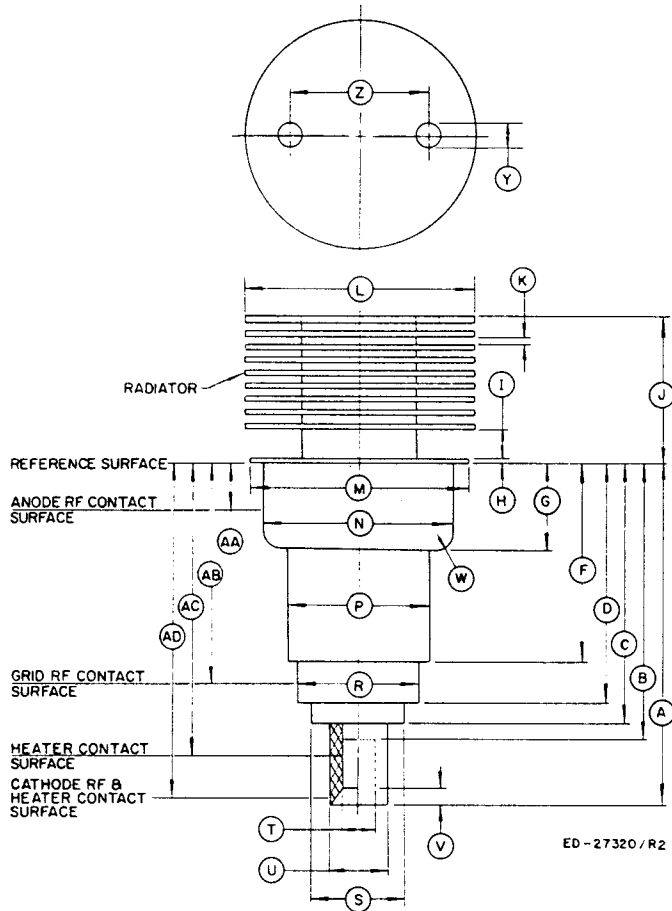
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DIMENSIONS FOR OUTLINE OF ML-7815R

The millimeter dimensions are derived from the original inch dimensions.

Ref.	Inches			Millimeters			Notes
	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum	
A	1.815		1.875	46.10		47.62	
AA	.035	.198	.361	.89	5.03	9.17	1, 5
AB	1.185	1.225	1.265	30.10	31.12	32.13	2, 5
AC	1.534	1.631	1.728	38.96	41.43	43.89	3, 6
AD	1.475	1.645	1.815	37.46	41.78	46.10	4, 5, 6
B			1.534			38.96	
C			1.475			37.46	
D	1.289		1.329	32.74		33.76	
F	.970		1.010	24.64		25.65	
G	.462		.477	11.73		12.12	
H			.040			1.02	
I	.125		.185	3.18		4.70	
J	.766		.826	19.46		20.98	
K	.025		.046	.64		1.17	
L	1.234		1.264	31.34		32.11	
M	1.180		1.195	29.97		30.35	
N	1.025		1.035	26.04		26.29	5
P	.752		.792	19.10		20.12	
R	.655		.665	16.64		16.89	5
S			.545			13.84	
T	.213		.223	5.41		5.66	6
U	.315		.325	8.00		8.26	5, 6
V			.086			2.18	
W			.100			2.54	
Y	.105		.145	2.67		3.68	
Z	.650		.850	16.51		21.59	



NOTES:

1. Anode rf contact surface and reference dimension for eccentricity measurements.
2. Grid rf contact surface and reference dimension for eccentricity measurements.
3. Heater contact surface and reference dimension for eccentricity measurements.
4. Heater and cathode rf contact surface and reference dimension for eccentricity measurements.
5. The total indicated runout of the anode and grid contact surface with respect to the cathode contact surface will not exceed .020 inch.
6. The total indicated runout of the cathode contact surface with respect to the heater contact surface will not exceed .012 inch.

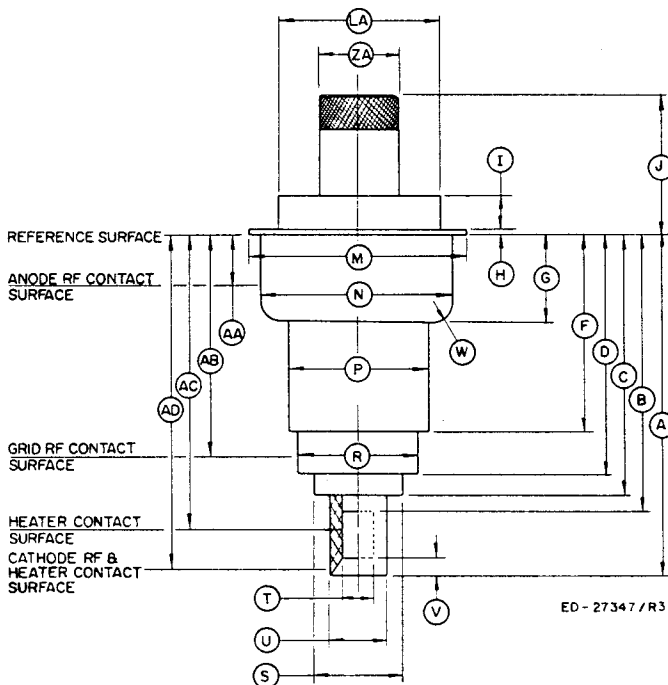
OUTLINE — ML-7815R

DIMENSIONS FOR OUTLINE OF ML-7815 /3CPN10A5

The millimeter dimensions are derived from the original inch dimensions.

Ref.	Inches			Millimeters			Notes
	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum	
A	1.815		1.875	46.10		47.62	
AA	.035		.361	.89	5.03	9.17	1, 5
AB	1.185	1.225	1.265	30.10	31.12	32.13	2, 5
AC	1.534	1.631	1.728	38.96	41.43	43.89	3, 6
AD	1.475	1.645	1.815	37.46	41.78	46.10	4, 5, 6
B			1.534			38.96	
C			1.475			37.46	
D	1.289		1.329	32.74		33.76	
F	.970		1.010	24.64		25.65	
G	.462		.477	11.73		12.12	
H			.040			1.02	
I			.185			4.70	
J	.766		.826	19.46		20.98	
LA	.840		.860	21.34		21.84	
M	1.180		1.195	29.97		30.35	
N	1.025		1.035	26.04		26.29	5
P	.752		.792	19.10		20.12	
R	.655		.665	16.64		16.89	5
S			.545			13.84	
T	.213		.223	5.41		5.66	6
U	.315		.325	8.00		8.26	5, 6
V			.086			2.18	
W			.100			2.54	
ZA	.427		.447	10.85		11.35	

OUTLINE—ML-7815/3CPN10A5



NOTES:

1. Anode rf contact surface and reference dimension for eccentricity measurements.
2. Grid rf contact surface and reference dimension for eccentricity measurements.
3. Heater contact surface and reference dimension for eccentricity measurements.
4. Heater and cathode rf contact surface and reference dimension for eccentricity measurements.
5. The total indicated runout of the anode and grid contact surface with respect to the cathode contact surface will not exceed .020 inch.
6. The total indicated runout of the cathode contact surface with respect to the heater contact surface will not exceed .012 inch.



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