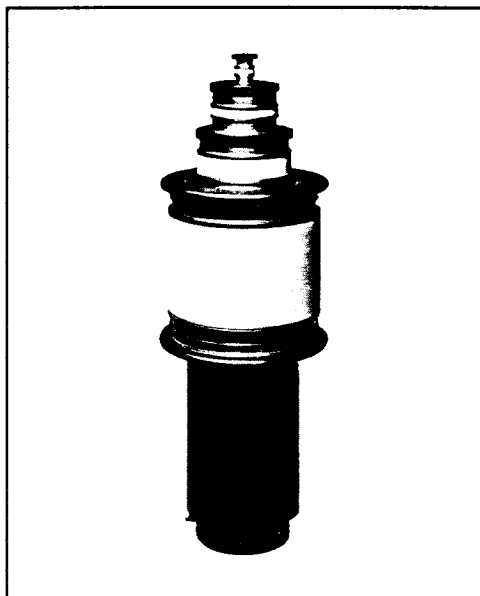


The Machlett Laboratories, Inc.  
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ISSUED 1-70

# ML-8846

**MACHLETT**

**General Purpose Triode**  
 215 kW CW  
 8 Mw Pulse Power

**DESCRIPTION**

The ML-8846 is a general-purpose high-power triode suitable for use in dielectric and induction heating, pulse modulation and similar applications. This tube features rugged, ceramic-and-metal, coaxial construction with high-dissipation, low-inductance rf terminals. The cathode consists of sturdy, stress-free, thoriated-rungsten filaments. This tube is suitable for cavity operation and its low plate impedance adapts it to broad-band service.

The ML-8846 is water-cooled and accepts a quick-change

water-jacket coupling. The heavy-wall anode will dissipate up to 140 kW with a water flow of 60 gpm. The maximum CW plate-voltage rating of 16 kV applies at frequencies up to 30 MHz. The tube may be operated up to 88 MHz with a reduction in ratings. In pulse service the tube is capable of switching up to 8 Mw with plate voltages up to 35 kV.

Except for minor dimensional differences, the ML-8846 can be used to replace the ML-5682.

**GENERAL CHARACTERISTICS**

**Electrical**

Filament Voltage .....	16.5	V
Filament Current at 16.5 volts .....	325	A
Filament Starting Current, maximum .....	800	A
Filament Cold Resistance .....	0.0052	ohm
Amplification Factor .....	30	
Direct Interelectrode Capacitances		
Grid-Plate .....	85	pf
Grid-Filament .....	110	pf
Plate-Filament .....	2.6	pf

**Mechanical**

Mounting Position .....	Vertical, anode down
Type of Cooling .....	Water and forced-air
Water Flow on Anode .....	See Water Cooling Characteristics
Maximum Water Pressure .....	75 psi
Maximum Outlet Water Temperature .....	70 °C
Air Flow on Envelope and Seals, approximate .....	250 cfm
Maximum Envelope Temperature .....	200 °C
Net Weight, approximate .....	50 lb.

**WARNING:** This electron tube when operating at peak voltages in excess of 15 kv may give off x-rays, which can be harmful unless adequately shielded by the enclosure within which the tube is used. Instructions for protective installation are given in National Bureau of Standards Handbook 93, "Safety Standards for Non-Medical X-Ray and Sealed Gamma-Ray Sources".

**ACCESSORIES**

Item	Part No.
Small Filament Connector .....	F-12589
Large Filament Connector .....	F-12590
Grid or Anode Connector .....	F-12591
Grid-Cathode Protective Gap .....	F-12506
Grid or Anode Protective Gap .....	F-12507
Mounting Socket .....	F-12527
Large Gasket for Mounting Socket .....	P-13745
Small Gasket for Mounting Socket .....	P-12272

NOTE: For additional information on accessories, refer to Accessory Data Sheet No. ST-1006.

**MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS**

**R F Power Amplifier and Oscillator  
Class C Telegraphy**

Key-down conditions per tube without amplitude modulation#

Maximum Ratings, Absolute Values

Frequency .....	88	30	MHz
D C Plate Voltage .....	9000	16000	V
D C Grid Voltage .....	-3200	-3200	V
D C Plate Current .....	20	20	A
D C Grid Current .....	2.5	4.0	A
Plate Input .....	170	300	kW
Plate Dissipation .....	140	140	kW

Typical Operation

Power Amplifier and Oscillator, Grid-Drive Circuit — 30 MHz				
D C Plate Voltage .....	8000	12000	15000	V
D C Grid Voltage .....	-750	-1100	-1400	V
Peak R F Grid Voltage .....	1210	1750	2200	v
Peak R F Plate Voltage .....	6600	10300	12800	v
D C Plate Current .....	9.7	14.3	18.4	A
D C Grid Current .....	2.1	2.9	3.0	A
R F Load Resistance .....	380	400	380	ohms
Driving Power, approximate ..	2.5	4.9	7.2	kW
Power Output, approximate ..	58	132	215	kW

# Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115% of the carrier conditions.

**Pulse Modulator or Pulse Amplifier**

Maximum Ratings

D C Plate Voltage .....	35	kV
Peak Plate Voltage .....	40	kv
Peak Negative Grid Voltage .....	-7000	v
Pulse Cathode Current .....	360	a
Grid Dissipation .....	2.5	kW
Plate Dissipation .....	140	kW
Pulse Duration, approximate ..	1000	μs‡
Duty Factor .....	.01	‡

Typical Operation

D C Plate Voltage .....	35	35	kV
D C Grid Voltage .....	-2000	-2000	V
Pulse Positive Grid Voltage .....	2000	2400	v
Pulse Plate Current .....	200	300	a
Pulse Grid Current .....	100	60	a
Pulse Driving Power .....	400	300	kW
Pulse Power Output .....	6.6	8.4	Mw
Plate Output Voltage .....	33	28	kv

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

**MAXIMUM FREQUENCY RATINGS**

Maximum ratings apply up to 30 MHz except as noted. These tubes may be operated at higher frequencies provided the maximum value of plate voltage and plate input are reduced according to the tabulation below (other maximum ratings are the same as shown above). Special attention should be given to adequate ventilation of the bulb at the higher frequencies.

Frequency in Megahertz .....	30	60	88
Percent Maximum Rated Plate Voltage and Plate Input	100	78	56

**TUBE PROTECTION**

The handling of very high power requires particular attention to the removal of power from tubes during fault conditions (initiated by tube or circuit instabilities) since the larger amount of energy involved can cause tube damage if not properly controlled. The tube must, therefore, be protected by limiting the time elapsed from inception of a fault condition to diverting the energy from the tube, as well as the amount of energy expended in the tube during this interval.

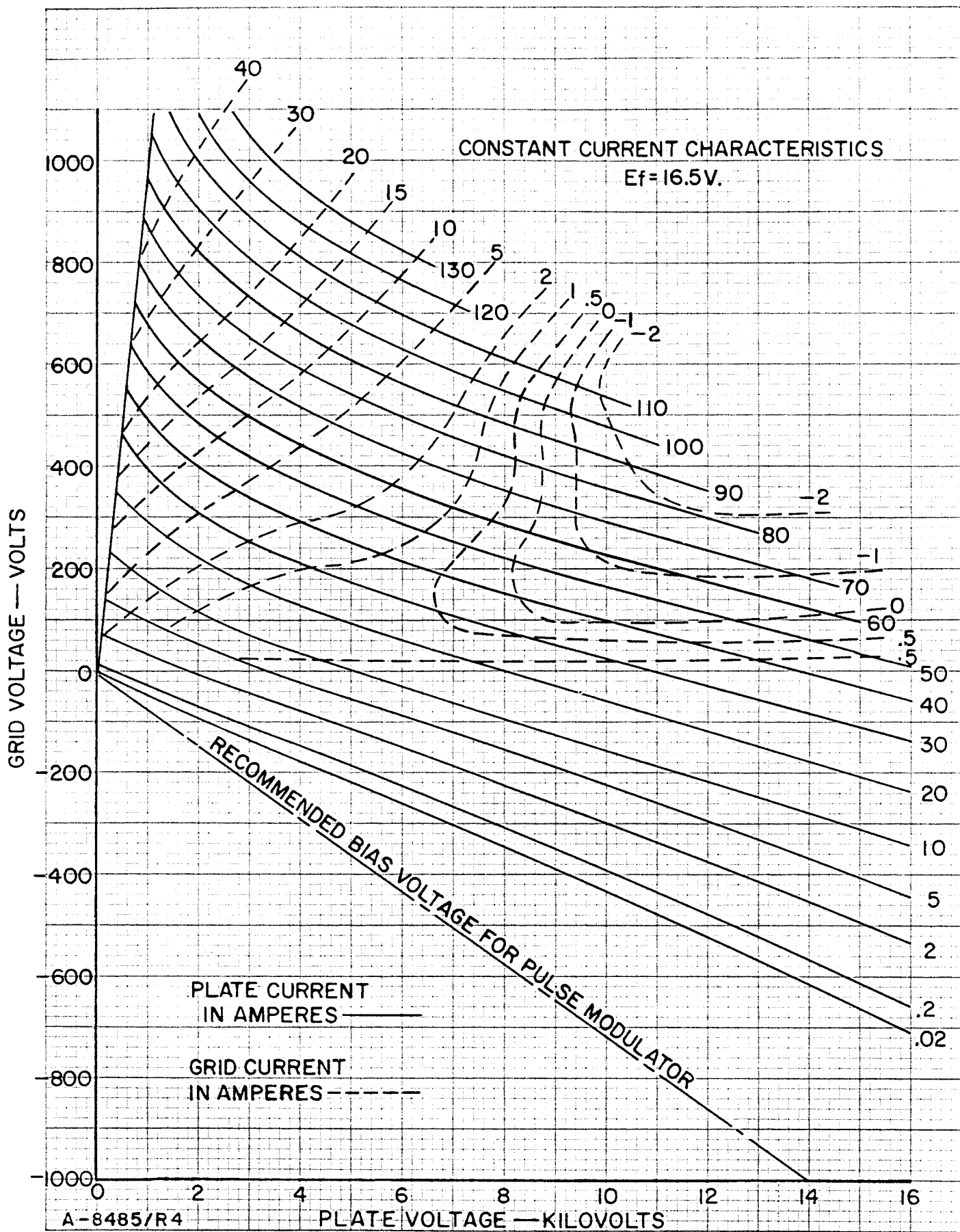
In addition to the normal circuit breakers and overload relays, it is necessary that a fast-acting electronic protective device (crowbar) or equivalent be used. This device will in most cases be a triggered gaseous device connected across the output of the plate supply filter, if used, to dissipate the filter-circuit energy as well as the rectifier output. The complete energy source must be shorted out as quickly as possible after the inception of a "fault", and in most cases the time interval should not be allowed to exceed approximately ten microseconds. For some basic electronic-crowbar fault-protection circuit considerations, as well as tests of the effectiveness of a protection device, refer to the references listed.

A nominal value of resistance must be placed in the plate lead of the tube being protected in order to be assured that the impedance of this tube under a flash arc condition is greater than that of the crowbar device when the latter is triggered. Critical damping is required for the crowbar discharge circuit. It is also recommended that a minimum of five to ten ohms resistance be connected in series with each rectifier tube in order to limit surge currents.

In circuits where high transient voltages may be developed due to a shorted load or other fault, special precautions are necessary to keep these excessive voltages from appearing at the tube electrodes.

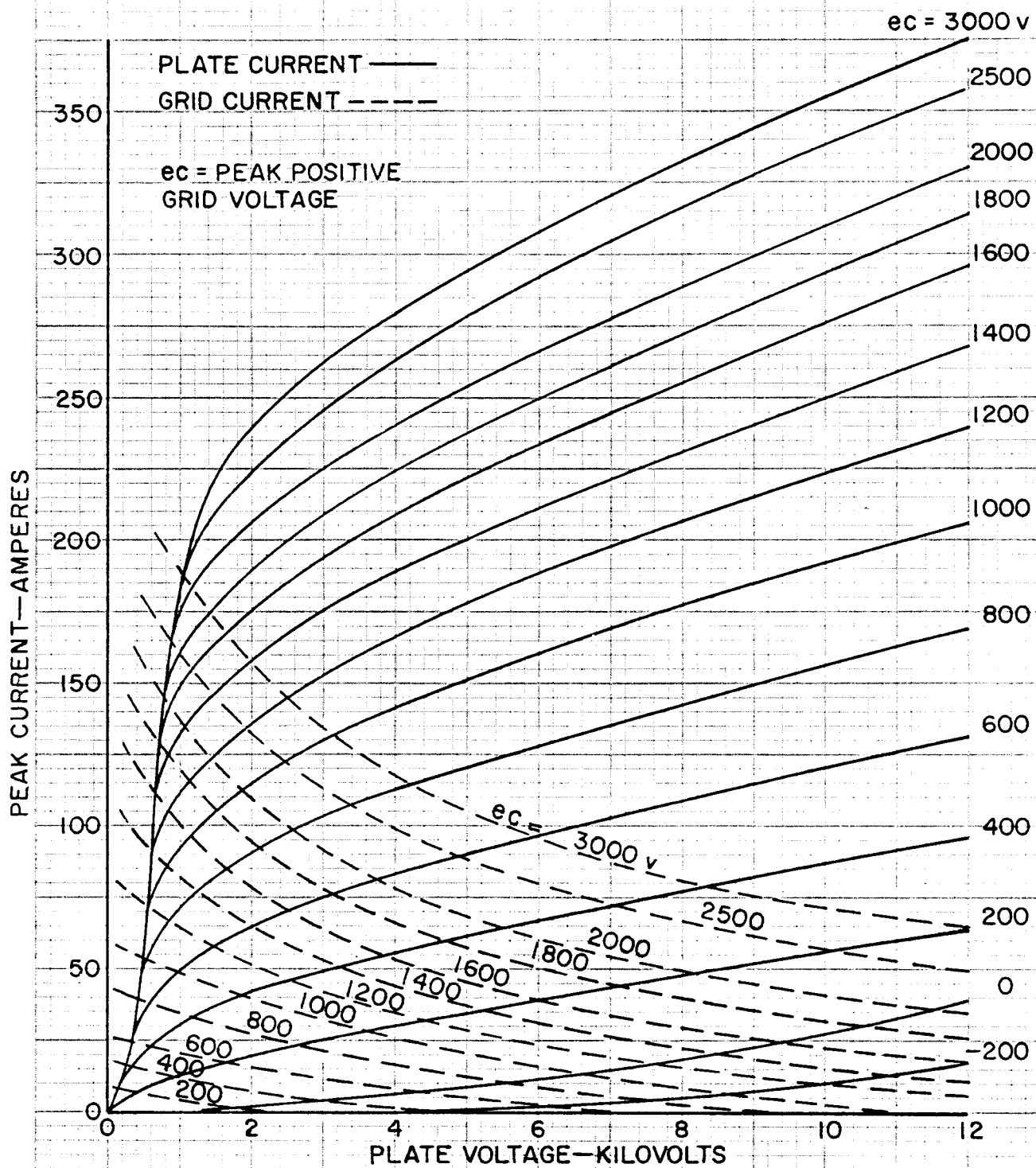
References:

1. W. N. Parker and M. V. Hoover, "Gas Tubes Protect High Power Transmitters", *Electronics*, 29, 144, January 1956.
2. H. D. Doolittle, "High Power Hydrogen Thyratrons", *Cathode Press*, 1, 6, 1954.

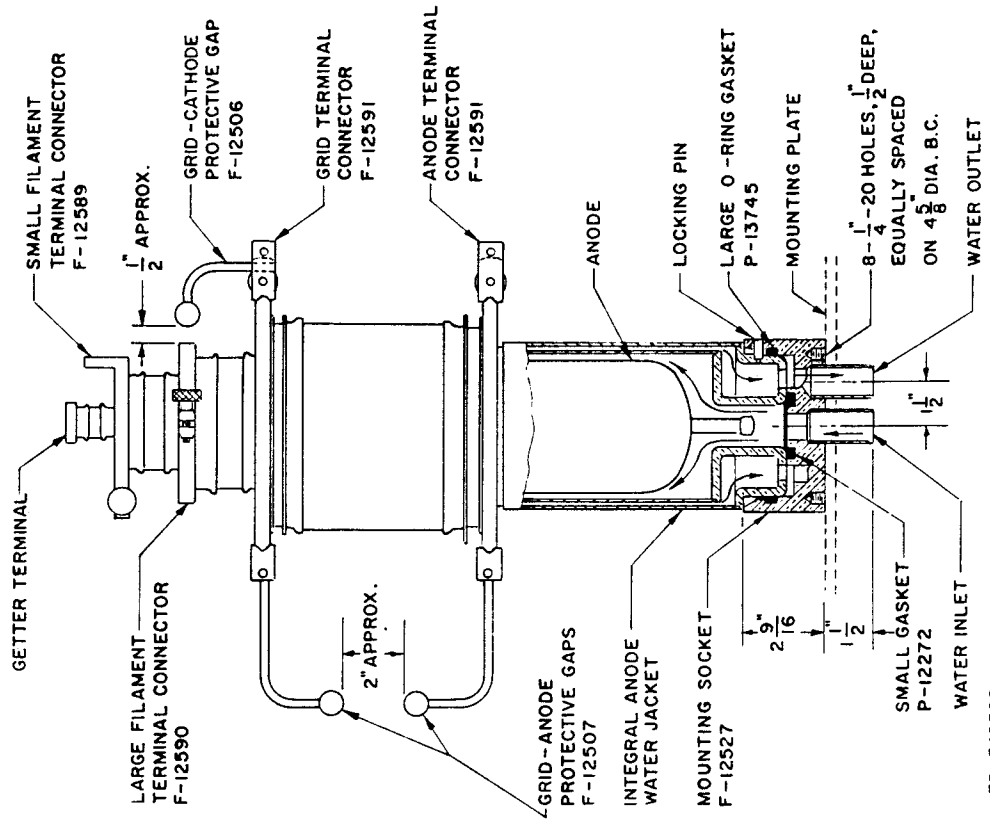


### CONSTANT GRID-VOLTAGE CHARACTERISTICS

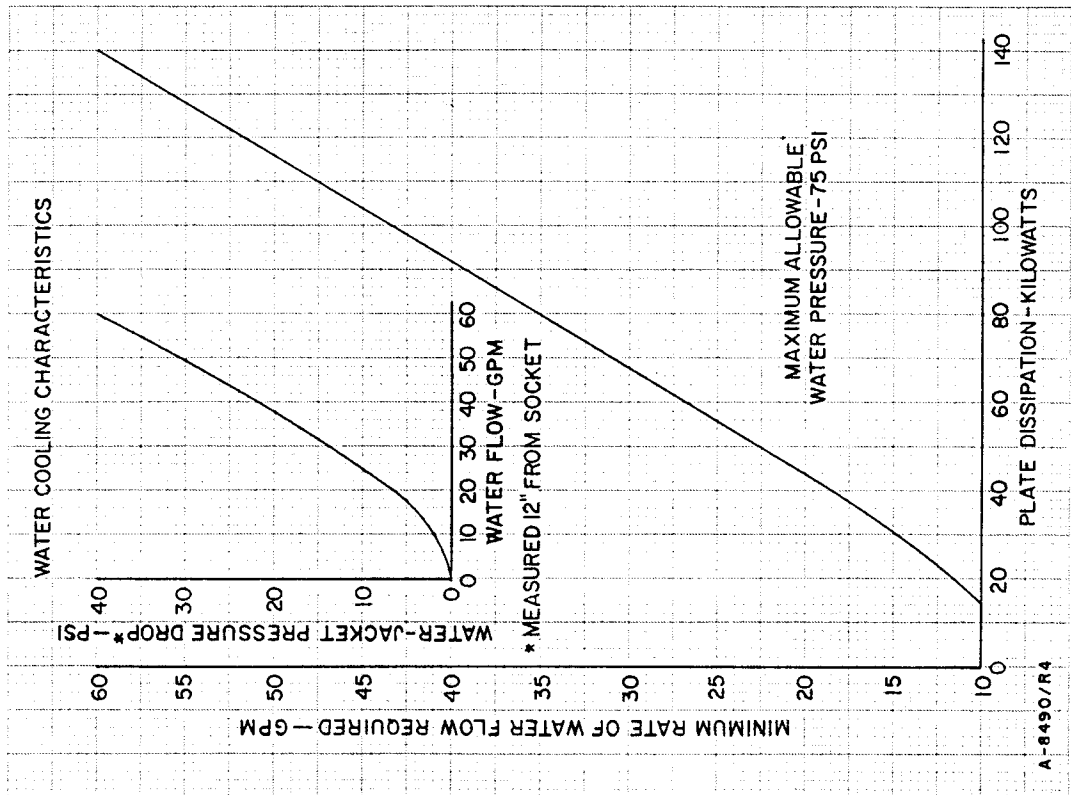
$E_f = 16.5$  VOLTS



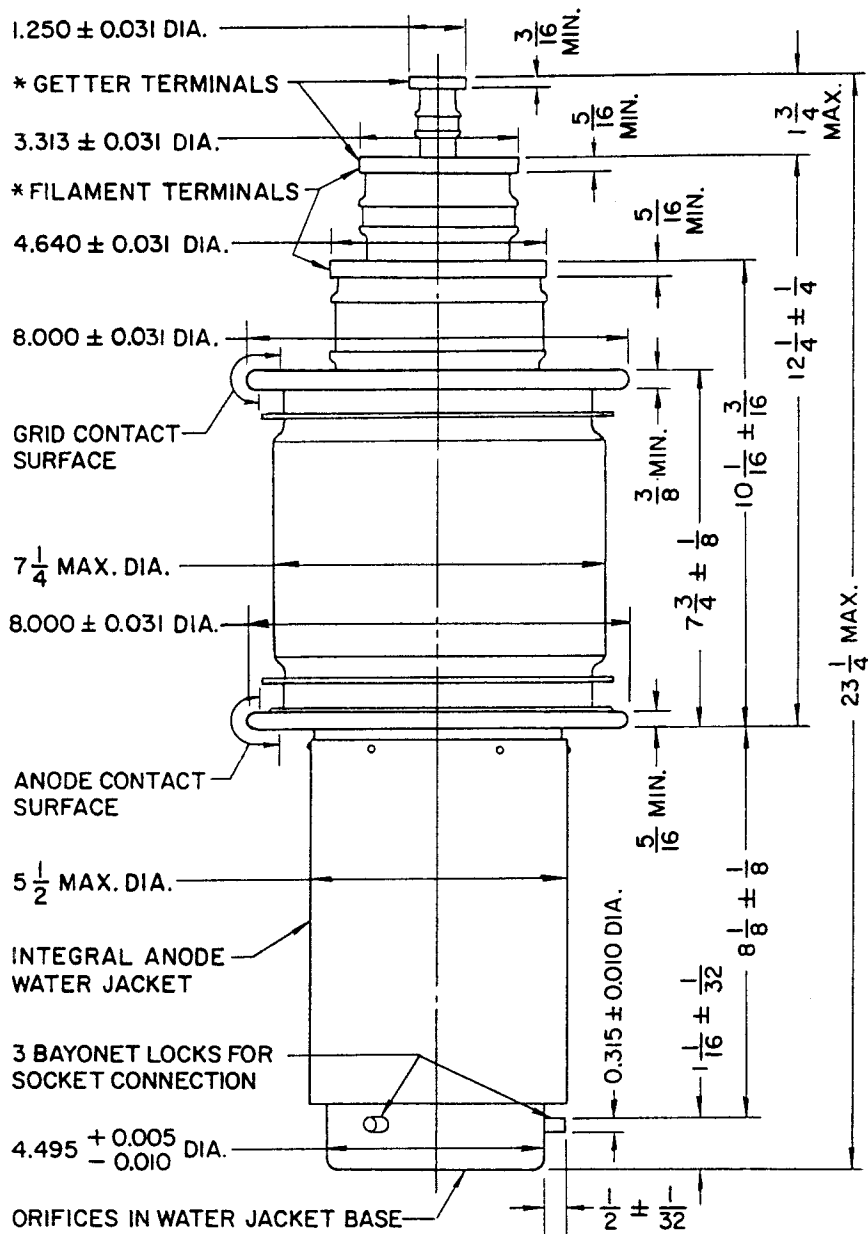
COOLING SYSTEM & PROTECTIVE GAP ARRANGEMENT



ED-540568



A-8490/R4



\* ELECTRICAL CONTACTS TO BE MADE ON THE PERIPHERY OF THESE TERMINALS.

ALL DIMENSIONS IN INCHES

ED-27386/R2

DIMENSIONS — ML-8846



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