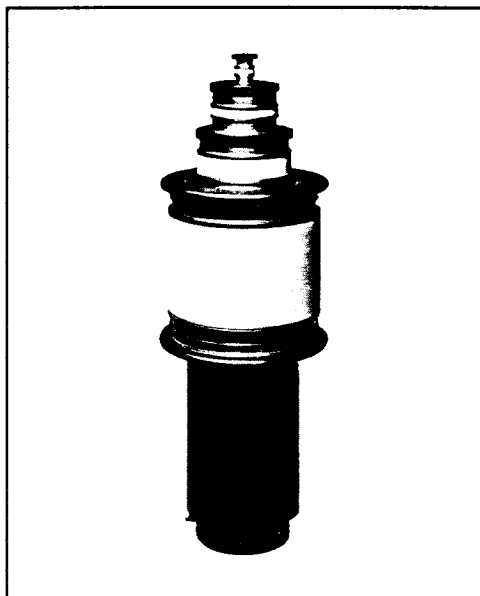


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ISSUED 1-70

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.

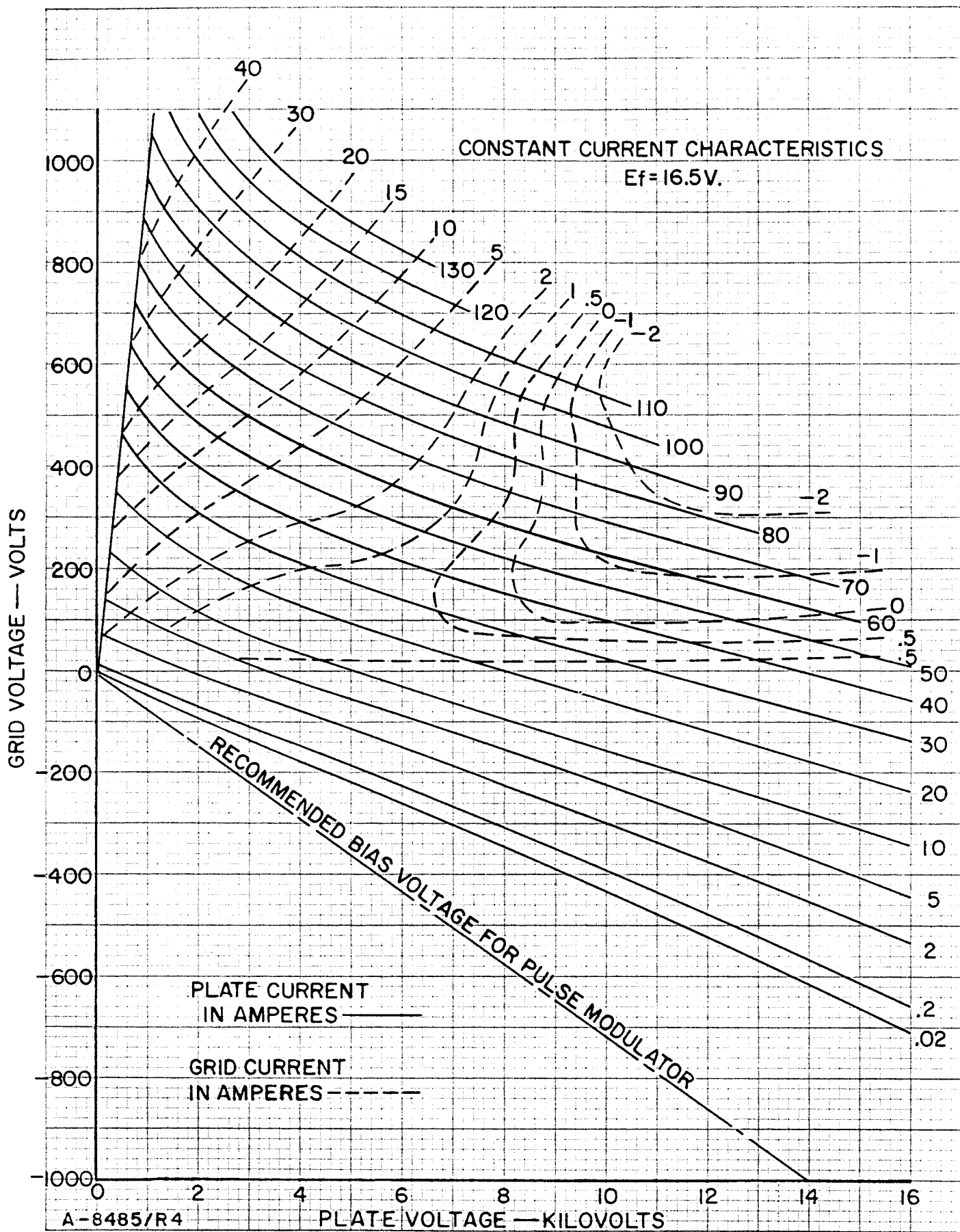
In addition to the normal circuit breakers and overload relays, it is necessary that a fast-acting electronic protective device (crowbar) or equivalent be used. This device will in most cases be a triggered gaseous device connected across the output of the plate supply filter, if used, to dissipate the 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.

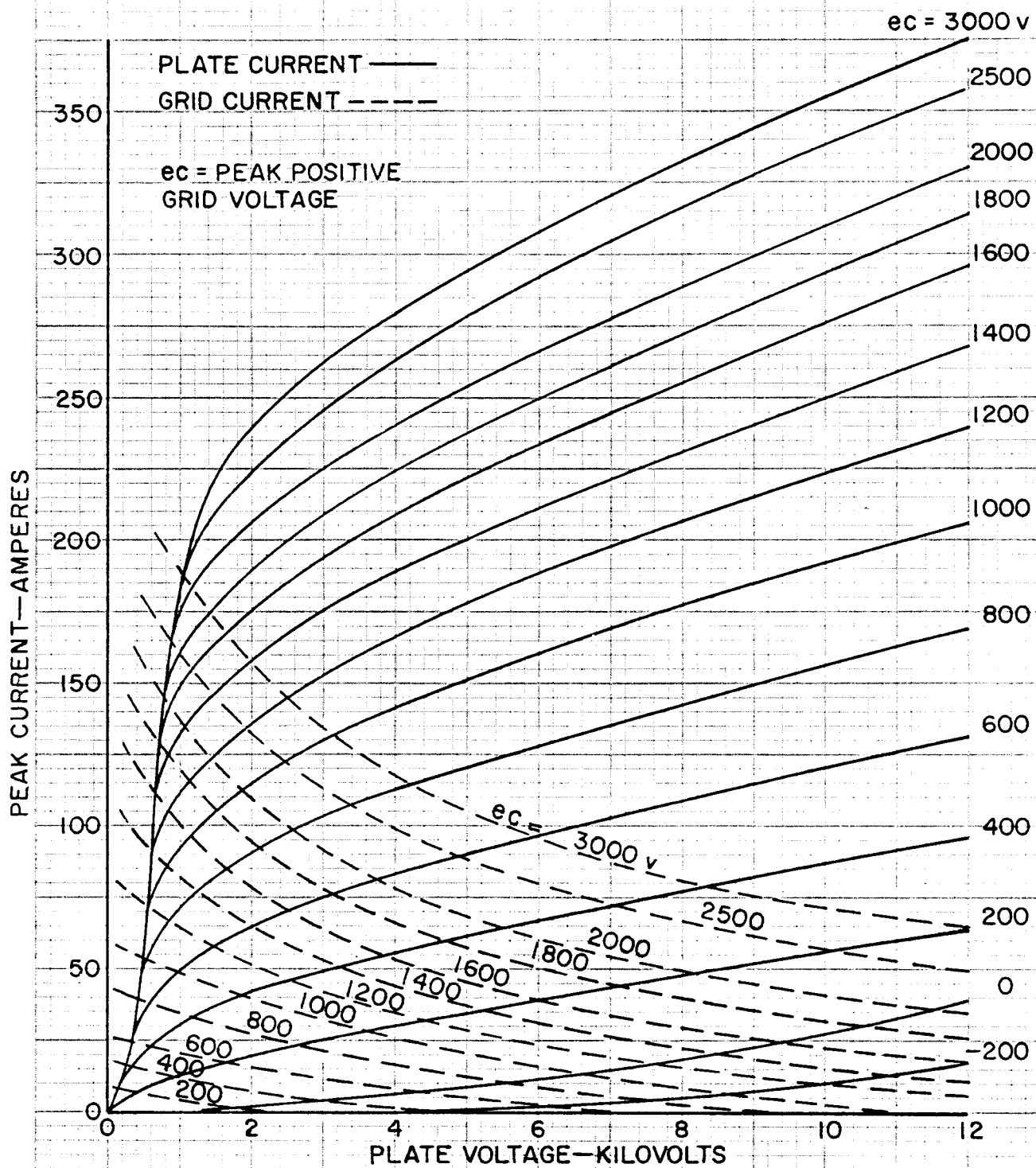
References:

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.

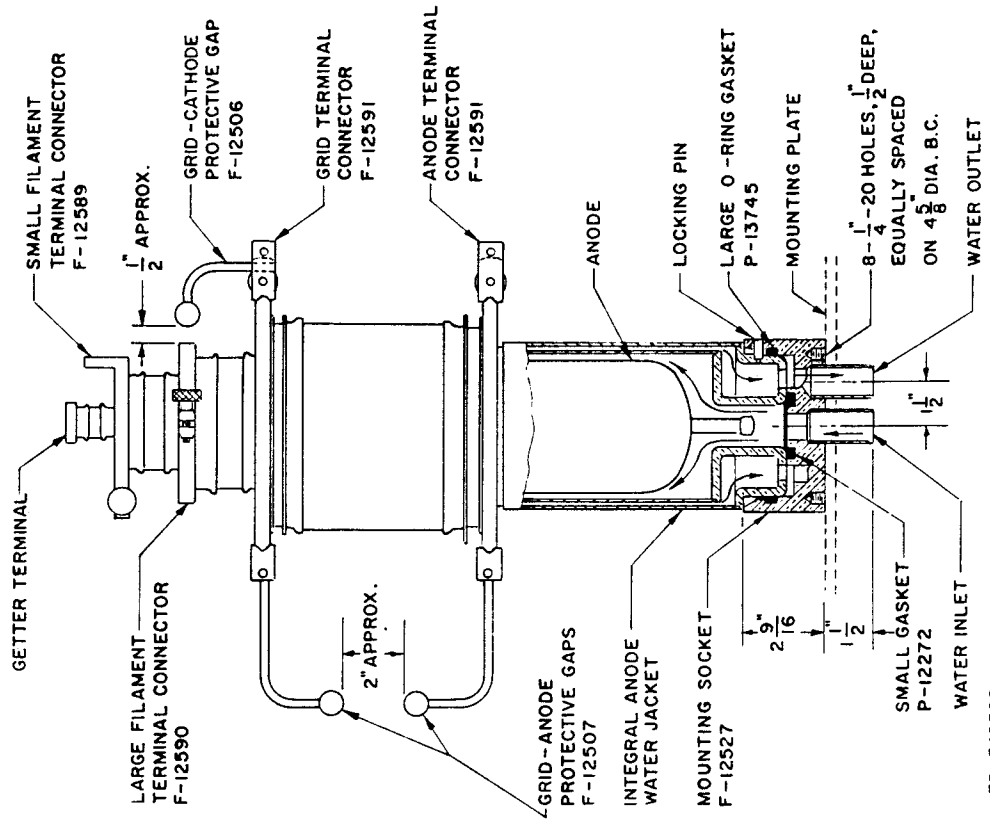


CONSTANT GRID-VOLTAGE CHARACTERISTICS

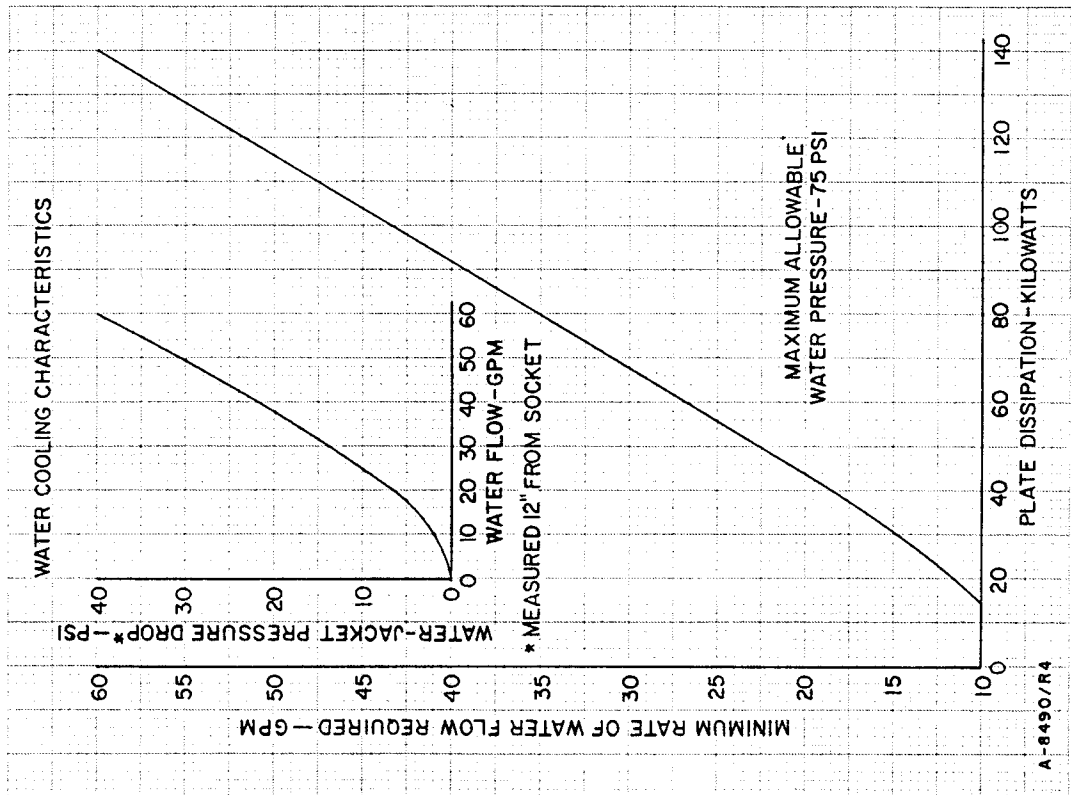
$E_f = 16.5$ VOLTS



COOLING SYSTEM & PROTECTIVE GAP ARRANGEMENT

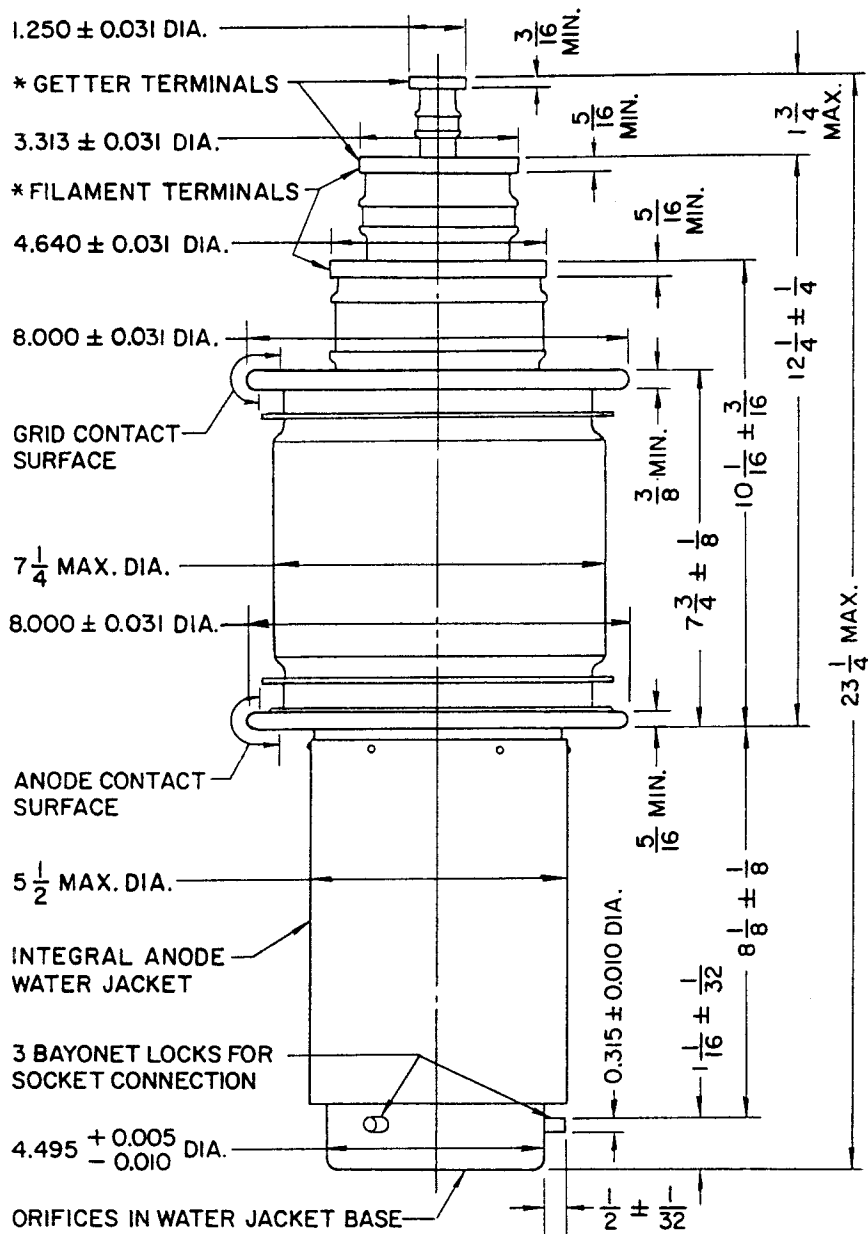


ED-540568



A-8490/R4

MAXIMUM ALLOWABLE
WATER PRESSURE - 75 PSI



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

ALL DIMENSIONS IN INCHES

ED-27386/R2

DIMENSIONS — ML-8846

RAYTHEON

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