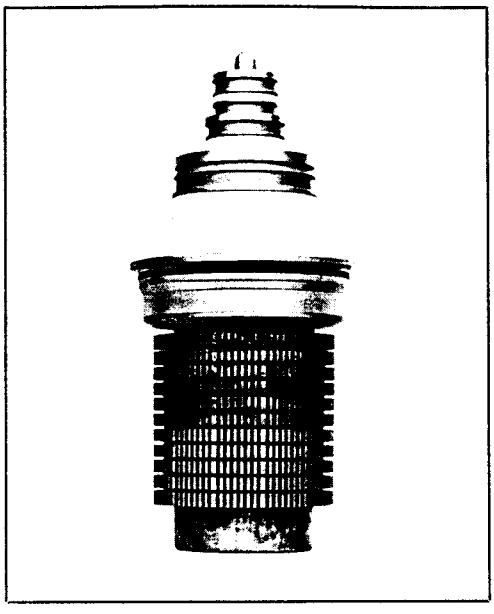


ISSUED 9-65

ML-7482

General Purpose Triode

440 kW CW

MACHLETT

ELECTRON TUBE SPECIALIST

DESRIPTION

The ML-7482 is a general-purpose vapor-cooled triode capable of 440 kilowatts continuous output as a Class C amplifier or oscillator at frequencies up to 30 Mc.

The anode is designed to dissipate 200 kilowatts, and substantially higher power during momentary overloads or intermittent operation. Efficient cooling is accomplished by vaporization of water in a boiler and transport of the vapor to a secondary cooling circuit at a temperature of about 100°C. Sturdy coaxial grid and cathode mounting structures provide low-inductance, high-dissipation rf terminals. The cathode consists of sturdy, self-supporting, stress-free, thoriated-tungsten filaments. Envelope insulation members are strong, low-loss, ceramic cylinders.

The maximum rating of 20 kVdc plate voltage applys at frequencies up to 30 Mc. Useful power output can be obtained at frequencies up to 110 Mc at reduced plate voltage.

GENERAL CHARACTERISTICS

Electrical

Filament Voltage	14.5	V*
Filament Current	450	A
Filament Starting Current, maximum	1200	A
Filament Cold Resistance	.0035	ohms
Amplification Factor	45	
Interelectrode Capacitances		
Grid-Plate	75	pf
Grid-Filament	200	pf
Plate-Filament	4	pf

Mechanical

Mounting Position	Vertical, Anode Down	
Type of Cooling, Anode	Vaporization of water	
Air Flow on Bulb and Seals, approximate	500	cfm**
Maximum Ceramic Temperature	165	°C
Net Weight, approximate	120	lb

*For older tubes with serial numbers lower than 476,000, the filament must be operated at 16.5 volts.

**At frequencies up to 15 Mc, air flow should be directed primarily on filament seals and the main ceramic bulb; at higher frequencies or high ambient temperatures, additional air flow may be required on the grid seals. Air flow should be distributed to maintain uniform temperature, not greater than 165°C, around the circumference of the seals.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Continuous Commercial Service

Audio-Frequency Power Amplifier and Modulator Class B

Maximum Ratings, Absolute Values			
DC Plate Voltage		20000	V
Maximum-Signal DC Plate Current*		30	A
Plate Dissipation*		200	kW
Typical Operation (Values are for two tubes)			
DC Plate Voltage	12000	15000	V
DC Grid Voltage	—250	—320	V
Peak AF Grid-to-Grid Voltage	960	1740	v
Peak AF Plate-to-Plate Voltage	20400	25200	v
Zero-Signal DC Plate Current	2	2	A
Maximum-Signal DC Plate Current	20	56	A
Effective Load Resistance, Plate-to-Plate	1300	570	ohms
Max.-Signal Driving Power, approximate	.8	5	kW
Max.-Signal Power Output, approximate	160	550	kW

*Averaged over any audio-frequency cycle of sine-wave form.

Linear RF Power Amplifier — Class AB Single-Sideband Suppressed-Carrier Service

Maximum Ratings, Absolute Values			
DC Plate Voltage		20000	V
Grid Dissipation		2500	W
Plate Dissipation		200	kW
Typical Operation, Cathode-Drive	2-tone	16-tone†	
DC Plate Voltage	20000	20000	V
DC Grid Voltage	—450	—450	V
Zero-Signal DC Plate Current	1	1	A
Maximum-Signal Peak Plate Current	54	135	a
Maximum-Signal Peak RF Grid Voltage	690	1100	v
Maximum-Signal Peak Driving Power	10	40	kw
Peak Envelope Power Output ‡	230	580	kw
Average Power Output, approximate	115	58	kW

†With peak-envelope to average power ratio of approximately 10.
‡Includes power transferred from driver stage.

Plate-Modulated RF Power Amplifier Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum Ratings, Absolute Values			
DC Plate Voltage		15000	V
DC Grid Voltage		—1500	V
DC Plate Current		20	A
DC Grid Current		4	A
Plate Dissipation		130	kW
Typical Operation	Cathode Drive		
DC Plate Voltage	12000	14000	V
DC Grid Voltage	—800	—1000	V
Peak RF Grid Voltage	1350	1630	v
Peak RF Plate Voltage	10600	11800	v
DC Plate Current	13.5	20.5	A
DC Grid Current	3.5	3.5	A
RF Load Impedance	490	320	ohms
Driving Power, approximate	20	5.7	kW
Power Output, approximate	145§	220	kW

§Includes power transferred from driver stage.

WARNING: Operation of this tube may produce x-rays. Adequate rayproof shielding must therefore be provided in the equipment.

RF Power Amplifier and Oscillator Class C Telegraphy

Key-down conditions per tube without amplitude modulation▲

Maximum Ratings, Absolute Values			
DC Plate Voltage		20000	V
DC Grid Voltage		—1500	V
DC Plate Current		35	A
DC Grid Current		4	A
Plate Dissipation		200	kW
Typical Operation			
DC Plate Voltage	14000	20000	V
DC Grid Voltage	—600	—1000	V
Peak RF Grid Voltage	1200	1600	v
Peak RF Plate Voltage	12000	17400	v
DC Plate Current	25	29	A
DC Grid Current	3.6	3.4	A
RF Load Impedance	250	330	ohms
Driving Power, approximate	4.5	6	kW
Power Output, approximate	260	440	kW

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

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.

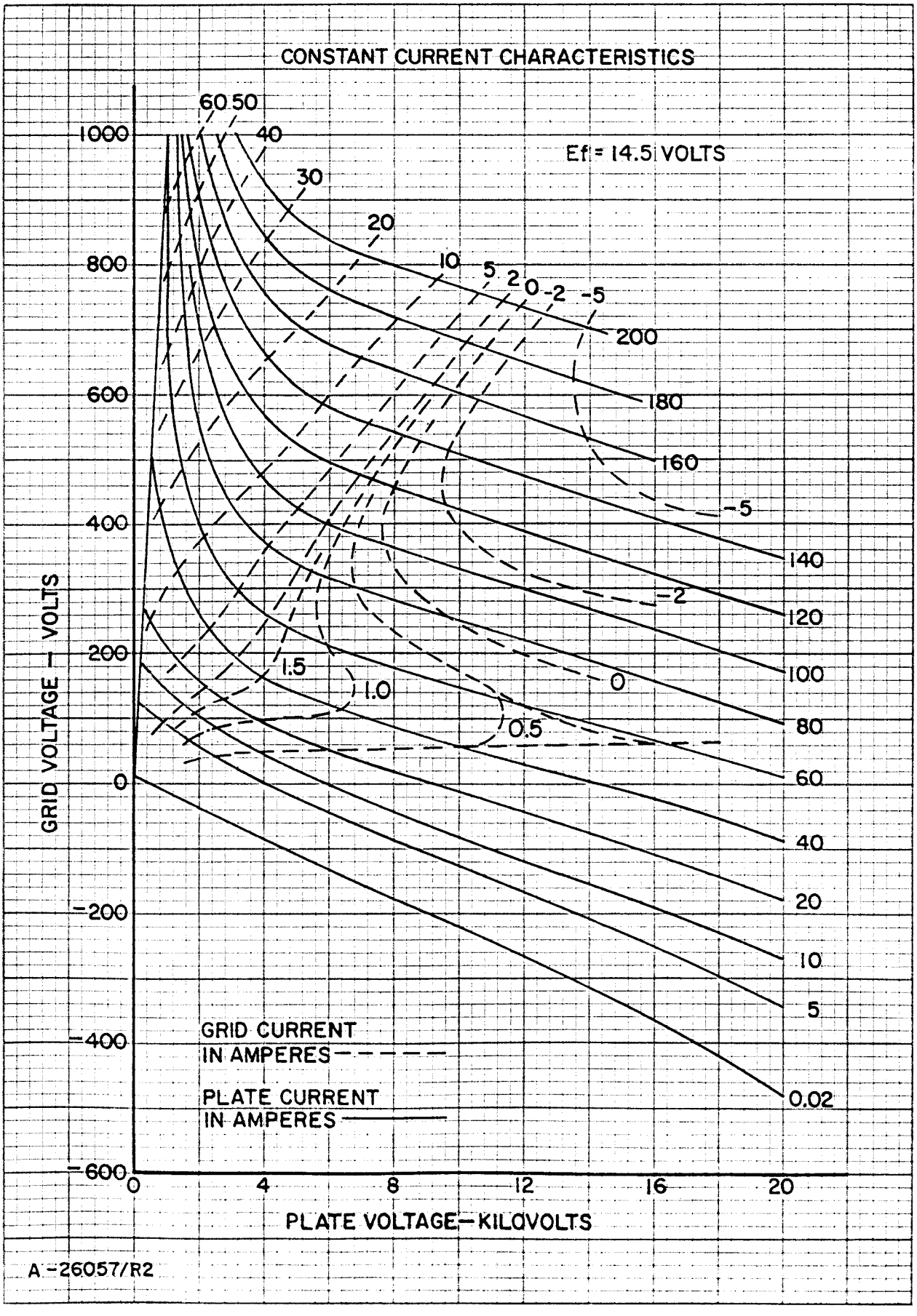
In addition to the normal circuit breakers and overload relays, it is necessary that a fast-acting electronic protective device (crowbar) or equivalent be used. This device will in most cases be a triggered gaseous device connected across the output of the plate supply filter, if used, to dissipate the 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 CURRENT CHARACTERISTICS
Ef = 14.5 VOLTS
GRID VOLTAGE — VOLTS
PLATE VOLTAGE—KILOVOLTS
GRID CURRENT IN AMPERES
PLATE CURRENT IN AMPERES
1000
800
600
400
200
0
-200
-400
-600
0
4
8
12
16
20
60
50
40
30
20
10
5
2
0
-2
-5
200
180
160
140
120
100
80
60
40
20
10
5
0.02
1.5
1.0
0.5
A-26057/R2

MAXIMUM FREQUENCY RATINGS

Maximum ratings apply up to 30 Mc except as noted. The tube may be operated at higher frequencies provided the maximum value of plate voltage is reduced according to the tabulation on the right. (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	30	70	110 Mc
Percent Maximum Rated Plate Voltage	100	80	60%

ACCESSORIES

Item	Part No.
Small Filament Connector	F-27218
Small Filament Connector (Alternate)	F-28090
Large Filament Connector	F-27219
Grid Connector	F-27220
Two-Tube Dolly	S-16096
One-Tube Dolly	S-16097

Item	Part No.
O Ring	P-25946
Jacket for Vapor-Up System, 150 kW	P-27899
Jacket for Vapor-Up System, 250 kW	P-27890
Jacket for Vapor-Down System, 150 kW	P-28903
Jacket for Vapor-Down System, 200 kW	P-28905
Condenser Jacket, 200 kW	P-27870

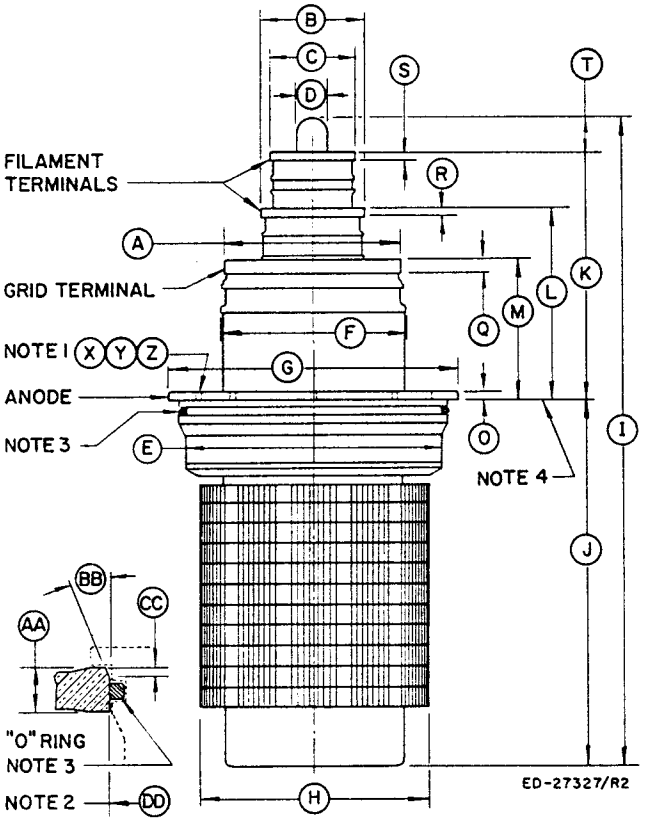
NOTE: Additional information on accessories will be supplied on request.

DIMENSIONS FOR OUTLINE OF ML-7482

Ref.	Inches			Notes
	Minimum	Nominal	Maximum	
A	6.907	6.938	6.969	
B	3.969	4.000	4.031	
C	3.282	3.313	3.344	
D	—	1.12	1.25	
E	—	10.00	10.13	
F	—	—	7.38	
G	11.25	11.31	11.37	
H	—	9.00	10.13	
I	—	—	26.3	
J	14.00	14.25	14.50	
K	9.45	9.75	10.05	
L	7.34	7.56	7.78	
M	5.37	5.56	5.75	
O	.344	.375	—	
Q	.500	.563	—	
R	.313	.375	—	
S	.313	.375	—	
T	—	—	1.75	
X	.44	.50	—	1
Y	9.60	9.63	9.66	1
Z	3.65	3.68	3.71	1
AA	—	.75	—	
BB	—	20°	—	degrees
CC	—	.19	—	
DD	10.498	10.503	10.508	2

NOTES:

1. Eight holes, ¼-20 tap, (X) deep, on circle diameter (Y), spaced at chordal distances (Z). For lifting tube.
2. Recommended diameter of opening for tube in cooling jacket.
3. O ring, Machlett Part No. P-25946, supplied with tube.
4. Tube to be supported in equipment only by this surface.



DETAIL OF RECOMMENDED OPENING IN COOLING JACKET

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