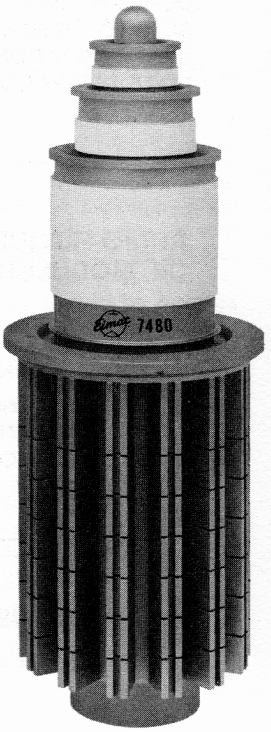
EIMAC
Division of Varian
SAN CARLOS
CALIFORNIA

7480

VAPOR COOLED MEDIUM-MU POWER TRIODE



The Eimac 7480 is a vapor cooled ceramic-metal triode designed for AM broadcast and communications amplifiers and for industrial heating service.

Low-loss ceramic and metal construction permits operation at full ratings at frequencies up to 40 MHz. Useful power output can be obtained at frequencies up to 80 MHz at reduced plate voltage.

The 7480 anode is capable of dissipating 80 kilowatts continuously, and higher power during intermittent operation or momentary overloads. A water cooled version of this tube, type 6696A, and a forced-air cooled version, type 6697A, are also available.

CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Filament: Thoriated-Tungsten				
Voltage		13		V
Current	190		220	A
Amplification Factor		20		
Direct Interelectrode Capacitances				
Grid-Plate	50		60	pF
Grid-Filament	65		85	pF
Plate-Filament	2.0		3.2	pF
Frequency for Maximum Ratings			40	MHz

MECHANICAL

Recommended Terminal Connectors Small Filament	Eimac SK-1610
Large Filament	Eimac SK-1611
Grid	Eimac SK-1612
Operating Position	Vertical, base up
Cooling	Vaporization of water
Maximum Seal Temperature	200° C
Recommended Boiler	Eimac BR-400 Series or equivalent
Maximum Height	20.1 in
Maximum Diameter	7.12 in
Net Weight	50 lbs

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions)

MAXIMUM RATINGS

DC PLATE VOLTAGE	16.0 KV
DC GRID VOLTAGE	—3200 VOLTS
DC PLATE CURRENT	11 AMPS
DC GRID CURRENT	2.0 AMPS
GRID DISSIPATION	1000 WATTS
PLATE DISSIPATION	80 KW

TYPICAL OPERATION

DC Plate Voltage	10	15 kV
DC Grid Voltage	—1200	—1600 volts
Peak RF Grid Voltage	1900	2100 volts
DC Plate Current	10.0	7.0 amps
DC Grid Current	810	300 mA
Resonant Load Impedance	440	970 ohms
Driving Power, approx.	1500	600 watts
Plate Output Power, approx.	72	80 kW

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PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER

Class-C Telephony (Carrier conditions)

MAXIMUM RATINGS

DC PLATE VOLTAGE	10.0 KV
DC GRID VOLTAGE	—3200 VOLTS
DC PLATE CURRENT	8.5 AMPS
DC GRID CURRENT	2.0 AMPS
GRID DISSIPATION	1000 WATTS
PLATE DISSIPATION	53 KW

TYPICAL OPERATION

DC Plate Voltage	9.5 kV
DC Grid Voltage	—1600 volts
Peak RF Grid Voltage	2300 volts
DC Plate Current	8.4 amps
DC Grid Current	900 mA
Resonant Load Impedance	510 ohms
Driving Power, approx.	2.0 kW
Plate Output Power, approx.	60 kW

AUDIO-FREQUENCY AMPLIFIER OR MODULATOR

Class-AB

MAXIMUM RATINGS (Per Tube)

DC PLATE VOLTAGE	16.0 KV
DC PLATE CURRENT	11.0 AMPS
PLATE DISSIPATION	80 KW

TYPICAL OPERATION (Two Tubes).

DC Plate Voltage	10	12 kV
DC Grid Voltage	—450	—600 volts
Peak AF Driving Voltage (per tube)	875	1060 volts
Zero-Sig DC Plate Current	3.0	2.0 amps
Max-Sig DC Plate Current	17.4	20.0 amps
Load Resistance, Plate-to-Plate	1170	1230 ohms
Max-Sig Driving Power, approx.	550	600 watts
Max-Sig Plate Output Power, approx.	110	152 kW

RADIO-FREQUENCY AM LINEAR AMPLIFIER

Class-AB (Carrier conditions)

MAXIMUM RATINGS

DC PLATE VOLTAGE	16.0 KV
DC PLATE CURRENT	9.0 AMPS
PLATE DISSIPATION	80 KW

TYPICAL OPERATION (AM Carrier conditions except where noted).

DC Plate Voltage	12	12 kV
DC Grid Voltage	—550	—550 volts
Peak RF Grid Voltage	510	640 volts
DC Plate Current	4.3	6.8 amps
DC Grid Current	0	0 amps
Resonant Load Impedance	780	500 ohms
Driving Power, approx.*	450	1500 watts
Plate Output Power, approx.	18	28 kW

*At modulation crest.

RADIO-FREQUENCY LINEAR AMPLIFIER

Class-AB, Single-Sideband Suppressed-Carrier Service

MAXIMUM RATINGS

DC PLATE VOLTAGE	16.0 KV
DC PLATE CURRENT	11.0 AMPS
PLATE DISSIPATION	80 KW

TYPICAL OPERATION (Peak-envelope or modulation-crest conditions in cathode-drive circuit).

DC Plate Voltage	12	12 kV
DC Cathode Voltage	600	600 volts
Peak RF Driving Voltage	830	1020 volts
DC Plate Current	5.2	9.8 amps
DC Grid Current, approx.	60	200 mA
Resonant Load Impedance	880	700 ohms
Driving Power, approx.	3.5	8.2 kW
Plate Power Output, approx.	43	83 kW

NOTE: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves. No allowance for circuit losses has been made.

APPLICATION

MECHANICAL

Mounting

The 7480 should be mounted vertically anode down in the boiler (Eimac type BR-400 or equivalent). Filament and grid connections are made through clamp rings or spring-finger contacts to the O.D. of the sturdy copper terminals of the tube. Satisfactory anode contact can be made to the boiler.

Anode Cooling

Efficient cooling is accomplished by vaporization of water in the boiler and transport of the vapor to a condenser at a temperature of about 100° C. The boiler, which is at anode potential, is isolated electrically from the rest of the system by sections of insulating pipe in the vapor and condensate return lines. The control box connected across the boiler on the ground side of the insulating tubes, displays the water level in the boiler, actuates warning or interlock circuits if the level is too low, and permits overflow if the level is too high. A reservoir is usually associated with the control box, either integral or remote, to replenish the system with distilled water as required.

Application information and typical system layout drawings are available from EIMAC. All accessory components and special hardware is available from Eimac except condensers, for which commercial sources exist.

Base Cooling

Forced-air cooling of the ceramic base and seals may be required, depending on ambient conditions and operating frequency. Air flow rate and direction should be determined to limit envelope temperatures to 200° C maximum and to maintain uniform temperature distribution around the seals. Spot temperatures are conveniently measured with Tempilaq (spray type) or equivalent. Often a flow of about 100 cfm, directed axially downward towards the tube, is sufficient.

ELECTRICAL

Filament Operation

The rated filament voltage, as measured at the tube terminals, should be maintained within ± 5% to assure long file and good performance within the rated power capability of the tube. To accommodate special requirements, the filament voltage may be centered near either of these extremes, e.g. at plus 5 percent for exceptionally high emission at a sacrifice of life, or at minus 5 percent for exceptionally long life where perhaps only half the full emission capability is required.

Grid Dissipation

Grid dissipation should be limited to 1,000 watts maximum. Grid dissipation may be calculated approximately as the product of peak positive grid voltage and dc grid current.

In many r-f amplifier applications where it is impractical to measure the positive grid voltage, the dc grid current rating serves as a satisfactory guide. The maximum dc grid current rating under normal full load conditions in 2 amperes. In most cases, however, high power output and good efficiency can be realized with grid current less than one ampere. By limiting the grid current in this manner there is obviously more latitude for grid current excursions resulting from changes in loading.

High Frequency Operation

The maximum ratings listed apply at frequencies up to 40 MHz. Useful output can be obtained at higher frequencies of the plate voltage and plate input power are reduced accordingly. For operation up to 60 MHz these parameters should be reduced to 75% of the listed dc plate voltage rating; for operation up to 80 MHz they should be reduced to 50%.

Aging

The manner of operating most high power tubes differs in at least some respects from conditions under which the tubes are tested, therefore, some aging is almost always required to condition a new tube to its new environment. In basic terms, the different operating conditions are manifest as different distributions of heat and voltage gradients. Satisfactory aging is most easily achieved by gradual application of voltages, e.g. first filament voltage, then partial plate voltage, and drive, working up to the final values. If continuous or stepped plate voltage control is not used, sufficient load should be connected before snapping on full voltage to limit transients to about 120% of the dc voltage.

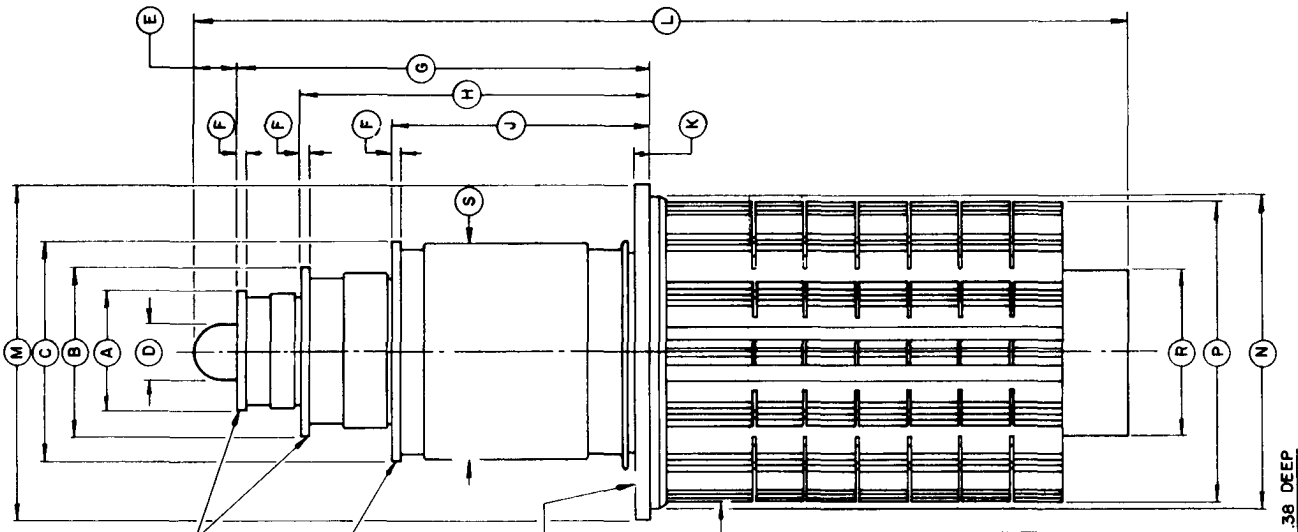
Tube Protection

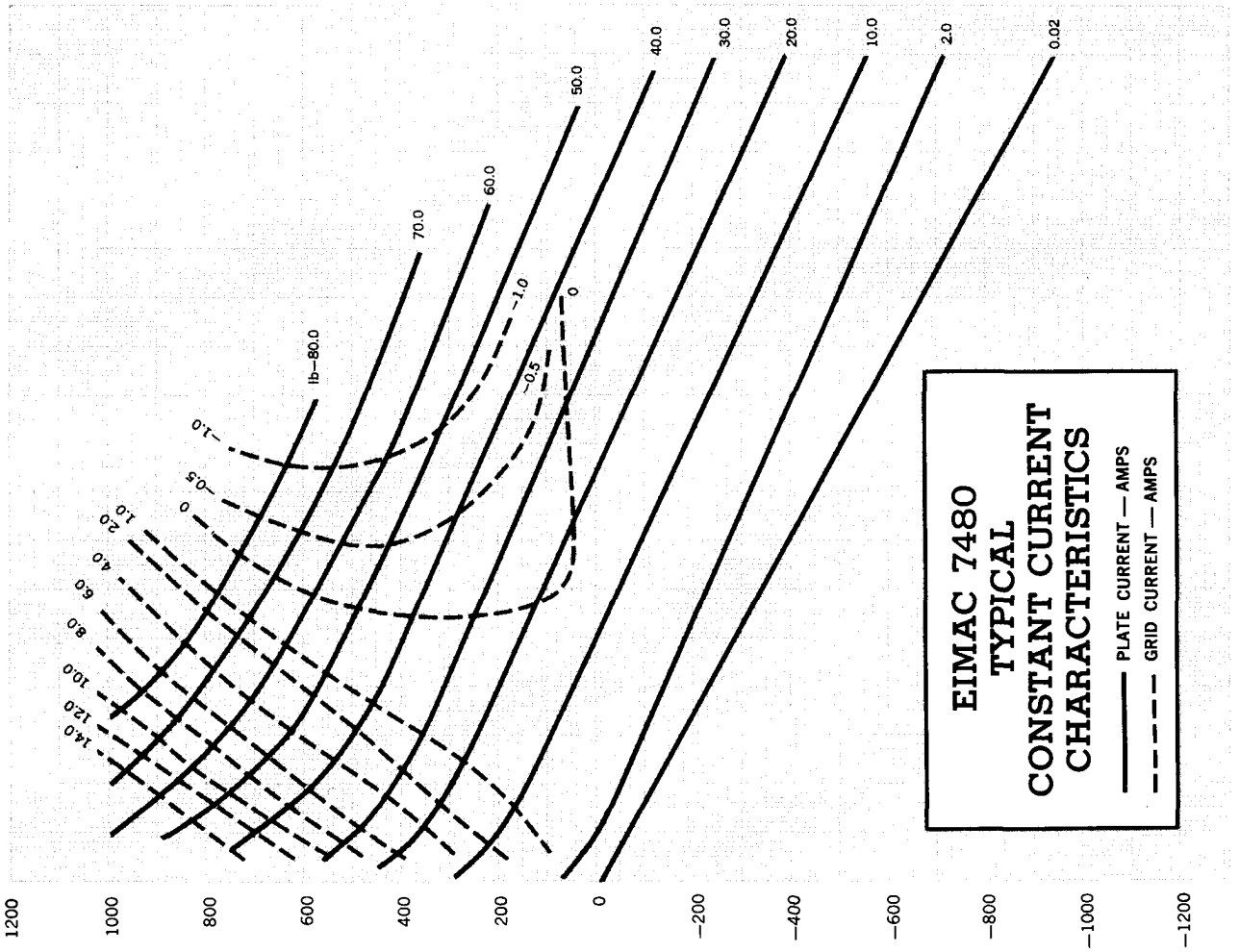
Since the possibility of fault overloads due to occasional tube or circuit instabilities is ever present, good engineering practice holds that suitable protective circuitry and devices be included in the equipment. In addition to the standard overcurrent relays, some series resistance should be placed in the output of the power supply to limit surge currents. In cases where no filter is used, the resistors may be placed in each rectifier lead to reduce the power loss during normal operation. In certain applications, furthermore, it is helpful to attach sphere gaps or rings to the tube terminals to divert any excessive transient voltages from the envelope and seals.

The use of an electronic fault diverter, or "crowbar" is probably the best way to insure high performance reliability and freedom from gassing or catastrophic failures. The crowbar system consists of circuitry to sense incipient fault currents and trigger the crowbar device, which is connected to short the power supply energy to ground, preferably within about 10 microseconds. The crowbar device, which is usually an ignitron, hydrogen thyratron, or spark gap, diverts most of the fault energy from the protected tube until the relay and circuit breakers open.

Special Applications

If it is desired to operate this tube under conditions widely different from those given herin, write to EIMAC, Division of Varian, 301 Industrial Way, San Carlos, California 94070.



DIMENSIONS IN INCHES			
DIMENSIONAL DATA			
REF	MIN	MAX	NOM
A	2.469	2.531	
B	3.469	3.531	
C	4.619	4.681	
D		1.187	
E		1.000	
F	.156		
G	8.120	8.500	
H	6.900	7.220	
J	5.250	5.370	
K	.250		
L		20.130	
M	7.000	7.120	
N	6.469	6.531	
P	6.120	6.380	
R		3.560	
S		4.720	

NOTE:
3 HOLES, 1/4-20 TAP, .38 DEEP
EQUALLY SPACED ON 5.740-5.760
POINT CIRCLE, FOR LIFTING.