DESCRIPTION

The ML-7479 is a general-purpose vapor-cooled triode conservatively designed for 40-50 kW industrial heating and AM broadcast service.

The anode is designed to dissipate 50 kilowatts, and substantially higher power during momentary overloads or intermittent operation. It features greater mass than usual, with thick external ribs or protrusions. 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 r-f terminals. The cathode itself is a sturdy, self-supporting, stress-free, thoriated-tungsten filament. Envelope insulation members are strong, low-loss, ceramic cylinders.

Maximum ratings of 12.5 kVdc plate voltage and 90 kW plate input apply at frequencies up to 50 Mc. Useful power output can be obtained at frequencies up to 70 Mc at reduced plate voltage and plate input.

GENERAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Electrical</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Filament Voltage</td>
<td>8.0</td>
</tr>
<tr>
<td>Filament Current</td>
<td>200</td>
</tr>
<tr>
<td>Filament Starting Current, maximum</td>
<td>800</td>
</tr>
<tr>
<td>Filament Cold Resistance</td>
<td>0.0051</td>
</tr>
<tr>
<td>Amplification Factor</td>
<td>20</td>
</tr>
<tr>
<td>Inter-electrode Capacitances:</td>
<td></td>
</tr>
<tr>
<td>Grid-Plate</td>
<td>38 pf</td>
</tr>
<tr>
<td>Grid-Filament</td>
<td>58 pf</td>
</tr>
<tr>
<td>Plate-Filament</td>
<td>1.8 pf</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mechanical</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting Position</td>
<td>Vertical, Anode Down</td>
</tr>
<tr>
<td>Type of Cooling, Anode</td>
<td>Vaporization of water</td>
</tr>
<tr>
<td>Air Flow on Bulb and Seals, approximate</td>
<td>100 cfm</td>
</tr>
<tr>
<td>Maximum Ceramic Temperature</td>
<td>165 °C</td>
</tr>
<tr>
<td>Net Weight, approximate</td>
<td>38 lb.</td>
</tr>
</tbody>
</table>

* For information on boiler and application details, consult the Machlett Laboratories Engineering Department.
** 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.

from JEDEC release #3954, Oct. 29, 1962
MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio-Frequency Power Amplifier and Modulator
Class B

Maximum Ratings, Absolute Values

D-C Plate Voltage .................................. 12500 volts
Max-Signal D-C Plate Current* .................. 7.0 amps
Max-Signal Plate Input* .......................... 90 kW
Plate Dissipation* .................................. 50 kW

Typical Operation (Values are for two tubes)

D-C Grid Voltage .................................. 8500 10000 12000 volts
D-C Plate Voltage ................................. −400 −500 −550 volts
Peak A-F Grid-to-Grid Voltage .............. 1600 1940 2120 volts
Peak A-F Plate-to-Plate Voltage .............. 14000 16000 19000 volts
Zero-Signal D-C Plate Current .............. 1.3 1.2 2.4 amps
Max-Signal D-C Plate Current .............. 7.8 10.0 12.4 amps
Effective Load Resistance, Plate-to-c .... 2300 2000 1950 ohms
Max-Signal Driving Power, approximate ...... 200 200 170 watts
Max-Signal Plate Power Output, approximate .... 42 63 93 kW

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

Radio-Frequency Power Amplifier
Class B

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

Maximum Ratings, Absolute Values

D-C Plate Voltage .................................. 12500 volts
D-C Plate Current .................................. 6.0 amps
Plate Input ........................................ 75 kW
Plate Dissipation .................................. 50 kW

Typical Operation

D-C Plate Voltage .................................. 12000 10000 12000 volts
D-C Grid Voltage .................................. −550 −450 −550 volts
Peak R-F Grid Voltage .............................. 550 580 600 volts
Peak R-F Plate Voltage ............................. 5400 4200 5300 volts
D-C Plate Current .................................. 2.6 3.6 3.2 amps
D-C Grid Current .................................. 0 0 0 mA
R-F Load Resistance ................................ 1330 730 1040 ohms
Driving Power, approximate* .................. 350 550 480 watts
Power Output, approximate ....................... 11 12 13.5 kW

* At crest of audio-frequency cycle with modulation factor of 1.0.

Plate-Modulated R-F Power Amplifier
Class C Telephony

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

Maximum Ratings, Absolute Values

D-C Plate Voltage .................................. 9000 volts
D-C Grid Voltage .................................. −2000 volts
D-C Plate Current .................................. 6.0 amps
D-C Grid Current .................................. 1.0 amp
Plate Input ........................................ 60 kW
Plate Dissipation .................................. 32 kW

Typical Operation

D-C Plate Voltage .................................. 8500 volts
D-C Grid Voltage .................................. −1400 volts
Peak R-F Grid Voltage .............................. 2140 volts
Peak R-F Plate Voltage ............................. 7000 volts
D-C Plate Current .................................. 4.8 amps
D-C Grid Current .................................. 0.50 amp
R-F Load Resistance ................................ 800 ohms
Driving Power, approximate ..................... 1.1 kW
Power Output, approximate ....................... 30.7 kW

R-F Power Amplifier and Oscillator
Class C Telegraphy

Key-down conditions per tube without amplitude modulation†

Maximum Ratings, Absolute Values

D-C Plate Voltage .................................. 7500 12500 volts
D-C Grid Voltage .................................. −1200 −2000 volts
D-C Plate Current .................................. 8.0 8.0 amps
D-C Grid Current .................................. 0.8 1.0 amp
Plate Input ........................................ 54 90 kW
Plate Dissipation .................................. 50 50 kW
Frequency .......................................... 70 30 Mc

Typical Operation

D-C Plate Voltage .................................. 7500 10000 12000 12000 volts
D-C Grid Voltage .................................. −850 −1100 −1200 −1200 volts
Peak R-F Grid Voltage .............................. 1500 1880 1880 1940 volts
Peak R-F Plate Voltage ............................. 5600 8000 10000 9800 volts
D-C Plate Current .................................. 5.3 6.5 5.4 6.4 amps
D-C Grid Current .................................. 0.35 0.48 0.30 0.35 amp
R-F Load Resistance ................................ 750 700 550 870 ohms
Driving Power, approx. ......................... 7500 900 550 670 watts
Power Output, approx. ......................... 335 46.4 48.5 55.4 kW

† Modulation essentially negative may be used if the positive peak of the envelope does not exceed 113% of the carrier conditions.
†† Includes power transferred from driver stage.

CHARACTERISTIC RANGEVALUES FOR EQUIPMENT DESIGN

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Conditions</th>
<th>Minimum</th>
<th>Limits</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid Voltage</td>
<td>es = 1500 volts, i0 = 28 amps</td>
<td>1500</td>
<td>8500</td>
<td>1000 volts</td>
</tr>
<tr>
<td>Grid Current</td>
<td>i0 = 1500 volts, es = 28 amps</td>
<td>28</td>
<td>8.5</td>
<td>amps</td>
</tr>
<tr>
<td>Plate Voltage</td>
<td>EP = 0 Vdc, i0 = 3.0 Adc</td>
<td>3.3</td>
<td>3.8</td>
<td>4.3 kVdc</td>
</tr>
<tr>
<td>Plate Voltage</td>
<td>EP = −200 Vdc, i0 = 3.0 Adc</td>
<td>7.2</td>
<td>7.8</td>
<td>8.4 kVdc</td>
</tr>
<tr>
<td>Grid Voltage</td>
<td>EP = 10.0 kVdc, i0 = 0.02 Adc</td>
<td>−480</td>
<td>−500</td>
<td>−640 Vdc</td>
</tr>
<tr>
<td>Plate Power Output</td>
<td>EP = 12.0 Adc, EP = −1200 Vdc, i0 = 0.30 Adc</td>
<td>40</td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>
MAXIMUM FREQUENCY RATINGS

Maximum ratings apply at frequencies up to 30 Mc except as noted. The tube may be operated at higher frequencies provided the maximum values 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.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>30</th>
<th>50</th>
<th>70 Mc</th>
</tr>
</thead>
</table>

Percent Maximum Rated Plate Voltage and Plate Input

Class B: 100 90 70
Class C: 100 75 60

APPLICATION NOTES

The handling of high power requires particular attention to the removal of power under fault conditions, since the large amount of energy involved can severely damage the electron tube if not properly controlled. Therefore the ground leads of the plate and grid circuits should be equipped with individual quick-acting overload relays which will remove power from these circuits within 1/10 second.

Additional protection is recommended and may be obtained by connecting a resistor in series with the plate lead of each tube for protection of the tube during the time required for the plate overload relay to act. The criterion is the total energy to which the tube can be subjected. The minimum value of resistance which will give adequate protection with reasonably low power loss is as follows:

Maximum Power Output

- Of Rectifier: 80 160 320 640 kW
- Series Resistor: 15 25 40 60 ohms
3.500 ± .031 DIA.
2.500 ± .031 DIA.
FILAMENT
4.650 ± .031 DIA.
GRID
4.72 MAX. DIA.
7.06 ± .06 DIA.
NOTE*
6.500 ± .031 DIA.
WATER LEVEL
ANODE
ALL DIMENSIONS IN INCHES
* NOTE: THREE HOLES,
\( \frac{1}{4} \) - 20 TAP, 0.38 DEEP,
EQUALLY SPACED ON
5.750 ± .010 B.C., FOR LIFTING

DIMENSIONS — ML-7479