

**MACHLETT**

**ML-5531**

DESCRIPTION AND RATINGS

## DESCRIPTION

The ML-5531 is a three-electrode tube designed for industrial heating service and for AM broadcasting at frequencies up to 30 megacycles. The filament is oriented with respect to the grid structure to minimize the required r-f driving power. The cathode is a thoriated-tungsten filament, whose self-supporting structure employs no sliding contacts, insulators, or tension springs. A sturdy grid structure provides

great mechanical strength as well as low electrical loss. Circuit inductance has been kept at a minimum in the grid as well as in all other internal connections. Kovar is used for the glass-to-metal seals. The plate fin structure is designed to provide 10 kilowatts dissipation with a forced-air flow of 600 cfm. Maximum ratings of 10.5 kVdc plate voltage and 30 kW plate input apply at frequencies up to 30 Mc.

## GENERAL CHARACTERISTICS

### Electrical

Filament Voltage .....	6.3 Volts
Filament Current at 6.3 Volts .....	92 Amps
Filament Starting Current, Maximum .....	400 Amps
Filament Cold Resistance .....	.0085 Ohm
Amplification Factor .....	24
Grid-Plate Transconductance at $E_b = 4.0$ kV; $I_b = 3.0$ amps .....	22000 umhos
Interelectrode Capacitances	
Grid-Plate .....	26 uuf
Grid-Filament .....	23 uuf
Plate Filament .....	1.5 uuf

### Mechanical

Mounting Position .....	Vertical, anode down
Type of Cooling .....	Forced air
Maximum Incoming Air Temperature .....	45 °C
Required Air Flow on Anode .....	600 cfm
Static Pressure, Inches Water .....	0.8 inch
Maximum Bulb Temperature .....	160 °C
Net Weight, Approximate .....	30 pounds

**MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS**

(Continuous Commercial Service)

**Audio-Frequency Power Amplifier and Modulator  
Class B**

Maximum Ratings, Absolute Values

D-C Plate Voltage .....	10500 volts
Maximum Signal D-C Plate Current* .....	3.5 amps
Maximum Signal Plate Input* .....	30 kW
Plate Dissipation* .....	10 kW

Typical Operation (Values are for two tubes)

D-C Plate Voltage .....	9000 volts
D-C Grid Voltage .....	-350 volts
Peak A-F Grid-to-Grid Voltage .....	1620 volts
Peak A-F Plate-to-Plate Voltage .....	15400 volts
Zero Signal D-C Plate Current .....	1.0 amp
Maximum Signal D-C Plate Current .....	6.6 amps
Effective Load Resistance, plate-to-plate .....	2900 ohms
Maximum Signal Driving Power, approx. ....	490 watts
Maximum Signal Power Output, approx. ....	41 kW

**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 .....	10500 volts
D-C Plate Current .....	2.50 amps
Plate Input .....	20 kW
Plate Dissipation .....	10 kW

Typical Operation

D-C Plate Voltage .....	9000 volts
D-C Grid Voltage .....	-340 volts
Peak R-F Grid Voltage .....	430 volts
Peak R-F Plate Voltage .....	3800 volts
D-C Plate Current .....	1.8 amps
D-C Grid Current, approx. ....	0.030 amp
Driving Power, approx.** .....	330 watts
Power Output, approx. ....	5.5 kW

**High-Efficiency Grid-Modulated Amplifier**

Carrier conditions per tube, unless otherwise specified, for use with a maximum modulation factor of 1.0.

Maximum Ratings, Absolute Values

	Carrier Tube	Peak Tube
D-C Plate Voltage .....	10500	10500 volts
D-C Grid Voltage .....	-1500	-1500 volts
D-C Plate Current .....	3.0	2.0† amps
Plate Input .....	30	20† kW
Plate Dissipation .....	10	10 kW

Typical Operation

D-C Plate Voltage .....	10000	10000 volts
D-C Grid Voltage .....	-920	-920 volts
D-C Plate Current		
Carrier .....	1.5	0.2 amps
Modulated† .....	1.5	1.1 amps
Driving Power, approx. ....	450	— watts
Power Output, approx. ....	11.0	— kW

**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 .....	8000 volts
D-C Grid Voltage .....	-1500 volts
D-C Plate Current .....	3.1 amps
D-C Grid Current .....	0.60 amp
Plate Input .....	23 kW
Plate Dissipation .....	7.0 kW

Typical Operation

D-C Plate Voltage .....	7500 volts
D-C Grid Voltage .....	-1000 volts
Peak R-F Grid Voltage .....	1450 volts
Peak R-F Plate Voltage .....	6300 volts
D-C Plate Current .....	1.9 amps
D-C Grid Current .....	0.30 amp
Driving Power, approx. ....	415 watts
Power Output, approx. ....	11.3 kW

**Radio-Frequency Power Amplifier and Oscillator  
Class C**

Key-down conditions per tube without amplitude modulation.‡

Maximum Ratings, Absolute Values

D-C Plate Voltage .....	10500 volts
D-C Grid Voltage .....	-1500 volts
D-C Plate Current .....	3.75 amps
D-C Grid Current .....	0.60 amp
Plate Input .....	30 kW
Plate Dissipation .....	10 kW

Typical Operation	Amplifier		Oscillator	
	Grounded-Grid	Grounded-Filament		
D-C Plate Voltage .....	8500	8500	7500	9000 volts
D-C Grid Voltage .....	-1000	-1000	-800	-900 volts
Peak R-F Grid Voltage .....	1640	1640	1320	1460 volts
Peak R-F Plate Voltage .....	6700	6700	5700	6800 volts
D-C Plate Current .....	3.4	3.4	2.8	3.2 amps
D-C Grid Current, approx. ....	0.44	0.44	0.31	0.30 amp
Driving Power, approx. ....	5660	700	—	— watts
Power Output, approx. ....	25.3§	20.5	14	19 kW

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

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

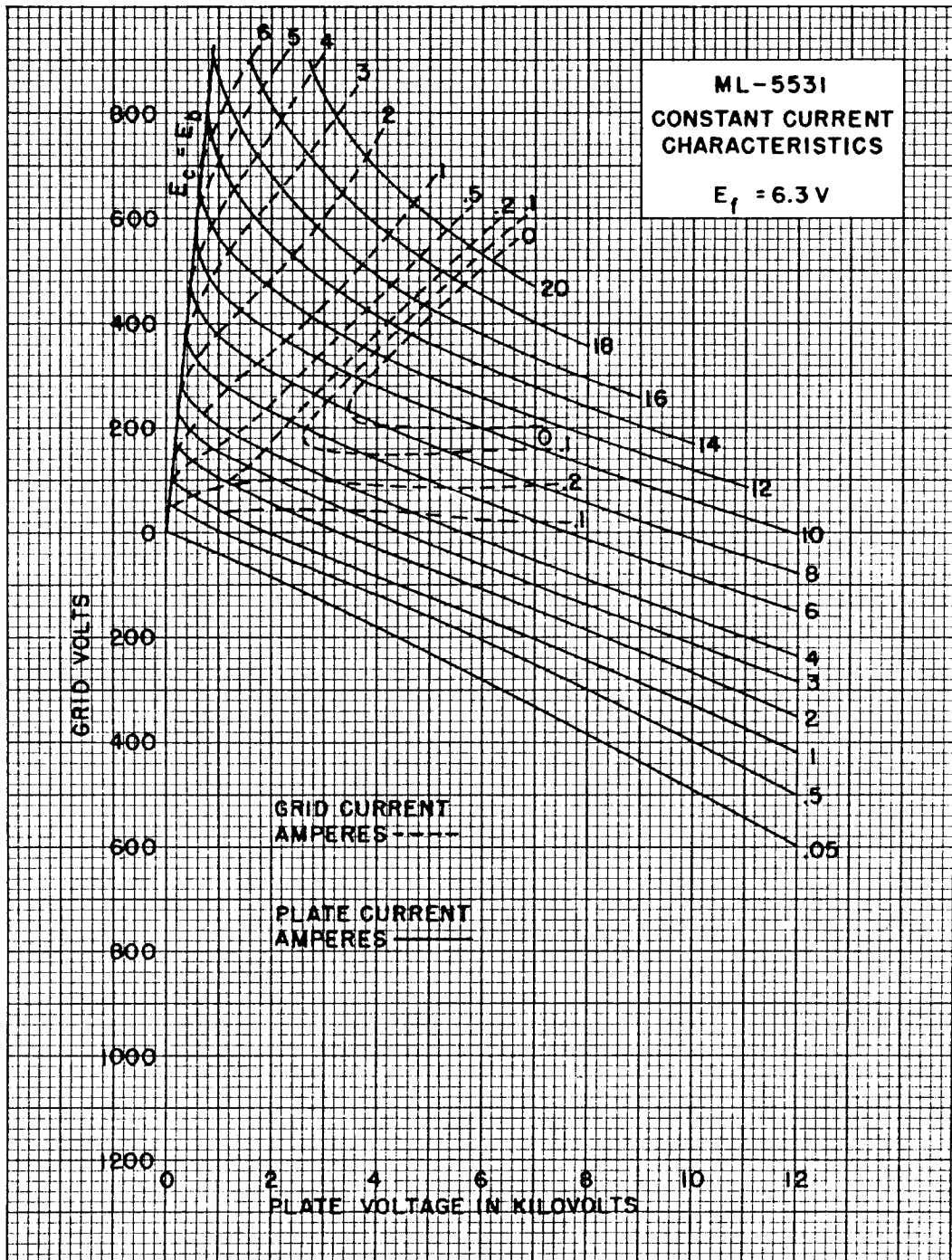
§ Includes power transferred from driver stage.

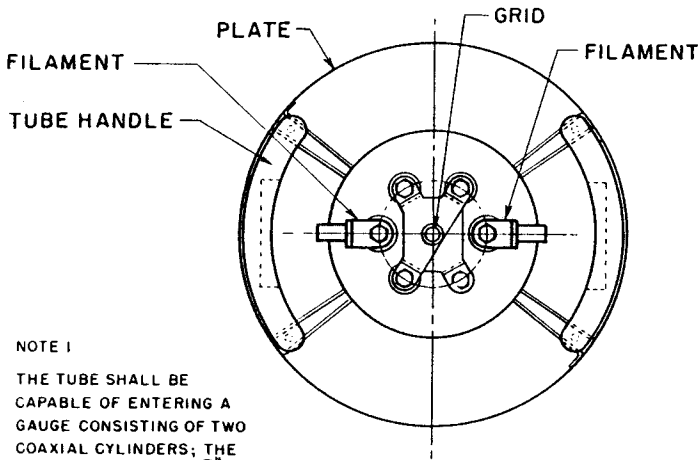
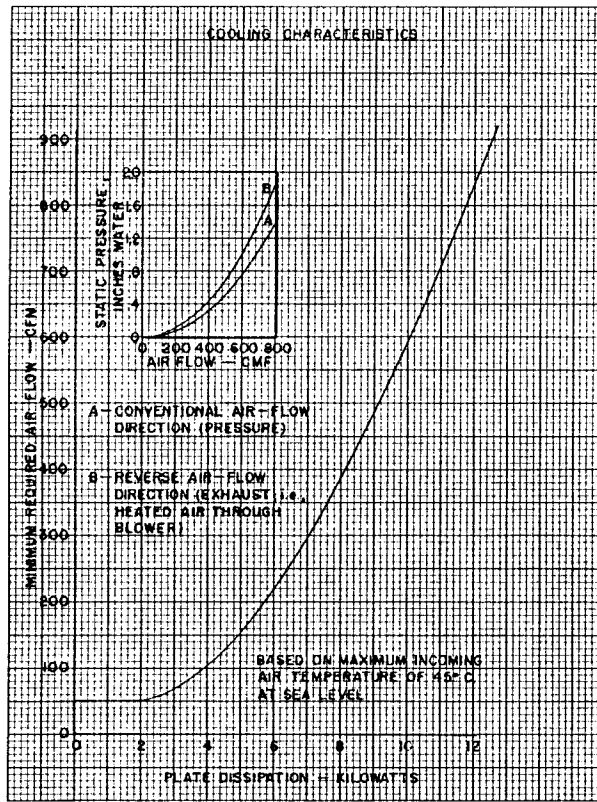
† Average value with modulation factor of 1.0.

‡ Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of its unmodulated value.

CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

Characteristics	Conditions		Min.	Limits Bogey	Max.
Grid Voltage	$e_b = 1100$ volts; $i_b = 14$ amps	$e_c$ :	—	—	850 volts
Grid Current	$e_b = 1100$ volts; $i_b = 14$ amps	$i_c$ :	—	—	7.0 amps
Plate Voltage	$E_c = 0$ ; $I_b = 1.0$ Adc	$E_b$ :	1.7	2.2	2.7 kVdc
Plate Voltage	$E_c = -100$ Vdc; $I_b = 1.0$ Adc	$E_b$ :	4.1	4.6	5.3 kVdc
Grid Voltage	$E_b = 10$ kVdc; $I_b = 0.02$ Adc	$E_c$ :	-400	-490	-580 Vdc
Plate Power Output	$E_b = 9.0$ kVdc; $E_c = -900$ Vdc; $I_b = 3.2$ Adc; $I_e = 0.30$ Adc	$P_o$ :	16	—	— kW



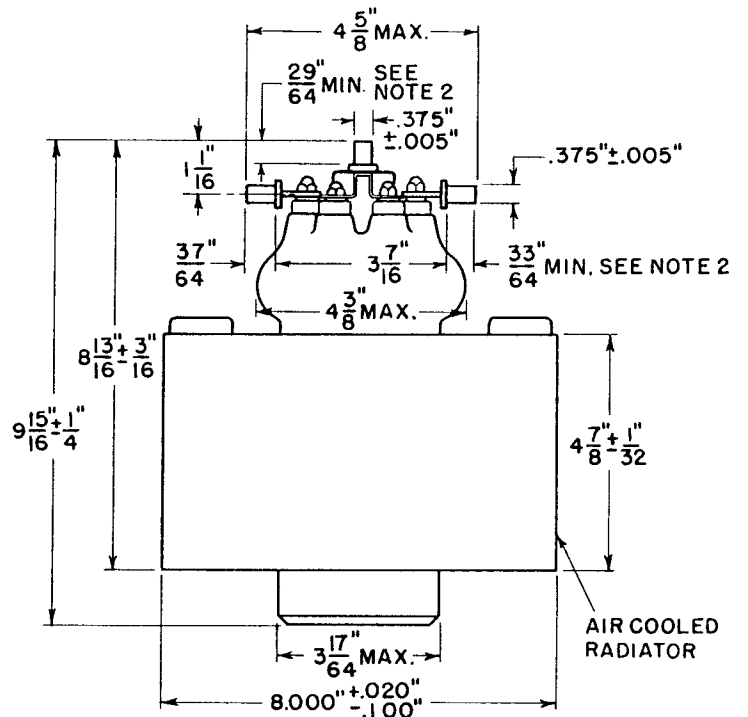


NOTE 1

THE TUBE SHALL BE CAPABLE OF ENTERING A GAUGE CONSISTING OF TWO COAXIAL CYLINDERS; THE FIRST 8.020" DIA. X 8 7/16" LONG AND THE SECOND .500" DIA. X 1/2" LONG.

NOTE 2

LENGTH OF CONTACT SURFACE.



**THE MACHLETT LABORATORIES, INC.**

Subsidiary of Raytheon Company

SPRINGDALE



CONNECTICUT

U. S. A.