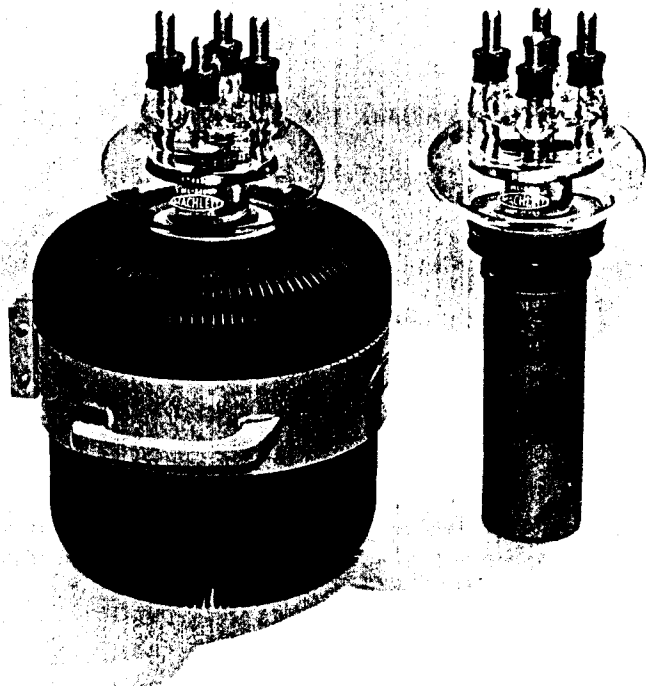




ML-5604 ML-5619

DESCRIPTION & RATINGS

DESCRIPTION

The ML-5604 and ML-5619 are general purpose three electrode tubes designed specifically to meet the severe conditions of industrial heating service. Their special design also contributes to better performance when used as modulators, amplifiers, or oscillators in communications equipment. The cathode of each type is a pure-tungsten filament designed to afford long filament life. Both tubes incorporate rigidly supported grid and filament assemblies, glass surfaces completely shielded against electron bombardment and filament radiation, and rugged kovar anode, grid, and filament

seals. The ML-5604 has a forced-air-cooled, heavy-wall anode capable of dissipating 10 kW with an air flow of approximately 750 cfm. The ML-5619 has a water-cooled, heavy-wall anode capable of dissipating 20 kW with a water flow of approximately 7 gpm. Maximum ratings of 12.5 kVdc plate voltage and 32.5 kW plate input apply at frequencies up to 25 Mc. These tubes are rated for service up to 50 Mc with plate voltage and plate input reduced according to the table on page 2.

GENERAL CHARACTERISTICS

Electrical

Filament Voltage	11.0	Volts
Filament Emission	12.4	Amps
Filament Current at Bogey Voltage	176	Amps
Filament Starting Current, maximum	270	Amps
Filament Cold Resistance	.0052	Ohms
Amplification Factor	20	
Interelectrode Capacitances		
Grid-Plate	ML-5604 24.0	ML-5619 23.0 $\mu\mu f$
Grid-Filament	27.0	27.0 $\mu\mu f$
Plate-Filament	1.25	1.00 $\mu\mu f$

Mechanical

Mounting Position	Vertical, anode down
Type of Cooling — ML-5604	Forced-air
Air flow on anode, minimum for 10 kW dissipation	750 cfm
Maximum incoming air temperature	45 °C
Type of Cooling — ML-5619	Water and forced-air
Water flow on anode, minimum for 20 kW dissipation	7 gpm
Maximum outgoing water temperature	70 °C
Maximum Glass Temperature	160 °C
Air flow on center of dish from 3" nozzle	50 cfm*
Net Weight, approximate	
ML-5604	45 lbs.
ML-5619	6 lbs.

* At frequencies above 15 Mc, more air flow may be necessary; special attention should be given to adequate ventilation of the dish and seals to keep the temperature at the hottest point below 160°C. Heat radiation connectors for grid and filament posts are recommended.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

(Continuous Commercial Service)

VALUES APPLY TO BOTH TYPES UNLESS OTHERWISE SPECIFIED

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

Maximum Ratings, Absolute Values	ML-5604	ML-5619	
D-C Plate Voltage	12500	12500	volts
Max.-Signal D-C Plate Current* ..	2.75	3.0	amps
Max.-Signal Plate Input*	32.5	32.5	kW
Plate Dissipation*	10	20	kW
Typical Operation (Values are for two tubes)			
D-C Plate Voltage	8000	10000	12000 volts
Filament Voltage	10.2	10.6	11.0 volts
D-C Grid Voltage	-370	-480	-600 volts
Peak A-F Grid-to-Grid Voltage	1620	2020	2380 volts
Zero-Signal D-C Plate Current	0.4	0.5	0.6 amp
Max.-Signal D-C Plate Current	2.6	3.7	4.5 amps
Effective Load Resistance, Plate-to-Plate	7200	6100	5900 ohms
Max.-Signal Driving Power, approximate	140	150	160 watts
Max.-Signal Power Output, approximate	14.5	25	36 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	ML-5604	ML-5619	
D-C Plate Voltage	12500	12500	volts
D-C Plate Current	1.4	1.5	amps
Plate Input	16	16	kW
Plate Dissipation	10	16	kW
Typical Operation			
D-C Plate Voltage	8000	10000	12000 volts
Filament Voltage	9.9	10.2	10.5 volts
D-C Grid Voltage	-400	-500	-610 volts
Peak R-F Grid Voltage	410	490	590 volts
D-C Plate Current	0.6	0.8	1.0 amp
D-C Grid Current	0.00	0.00	0.00 mA
Driving Power, approximate†	75	70	65 watts
Power Output, approximate	1.7	2.8	4.4 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	ML-5604	ML-5619	
D-C Plate Voltage	8000	10500	volts
D-C Grid Voltage	-2000	-2000	volts
D-C Plate Current	1.5	1.5	amps
D-C Grid Current	0.45	0.45	amp
Plate Input	12	15	kW
Plate Dissipation	C	13.3	kW
Typical Operation			
D-C Plate Voltage	6000	8000	10000 volts
Filament Voltage	10.4	10.7	11.0 volts
D-C Grid Voltage	-740	-1000	-1300 volts
Peak R-F Grid Voltage	1140	1540	1930 volts
D-C Plate Current	0.7	1.1	1.4 amps
D-C Grid Current	0.09	0.13	0.15 amp
Driving Power, approximate	100	200	280 watts
Power Output, approximate	3.4	7.1	11.9 kW

**R-F Power Amplifier and Oscillator
Class C Telephony**

Key-down conditions per tube without amplitude modulation†

Maximum Ratings, Absolute Values	ML-5604	ML-5619	
D-C Plate Voltage	12500	12500	volts
D-C Grid Voltage	-2000	-2000	volts
D-C Plate Current	3.0	3.0	amps
D-C Grid Current	0.45	0.45	amp
Plate Input	32.5	32.5	kW
Plate Dissipation	10	20	kW
Typical Operation			
D-C Plate Voltage	8000	10000	12000 volts
Filament Voltage	10.5	10.7	10.9 volts
D-C Grid Voltage	-680	-870	-1170 volts
Peak R-F Grid Voltage	1300	1620	2130 volts
D-C Plate Current	1.5	2.0	2.5 amps
D-C Grid Current	0.19	0.20	0.22 amp
Driving Power, approximate	250	320	470 watts
Power Output, approximate	9.2	15	22.5 kW

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

MAXIMUM FREQUENCY RATINGS

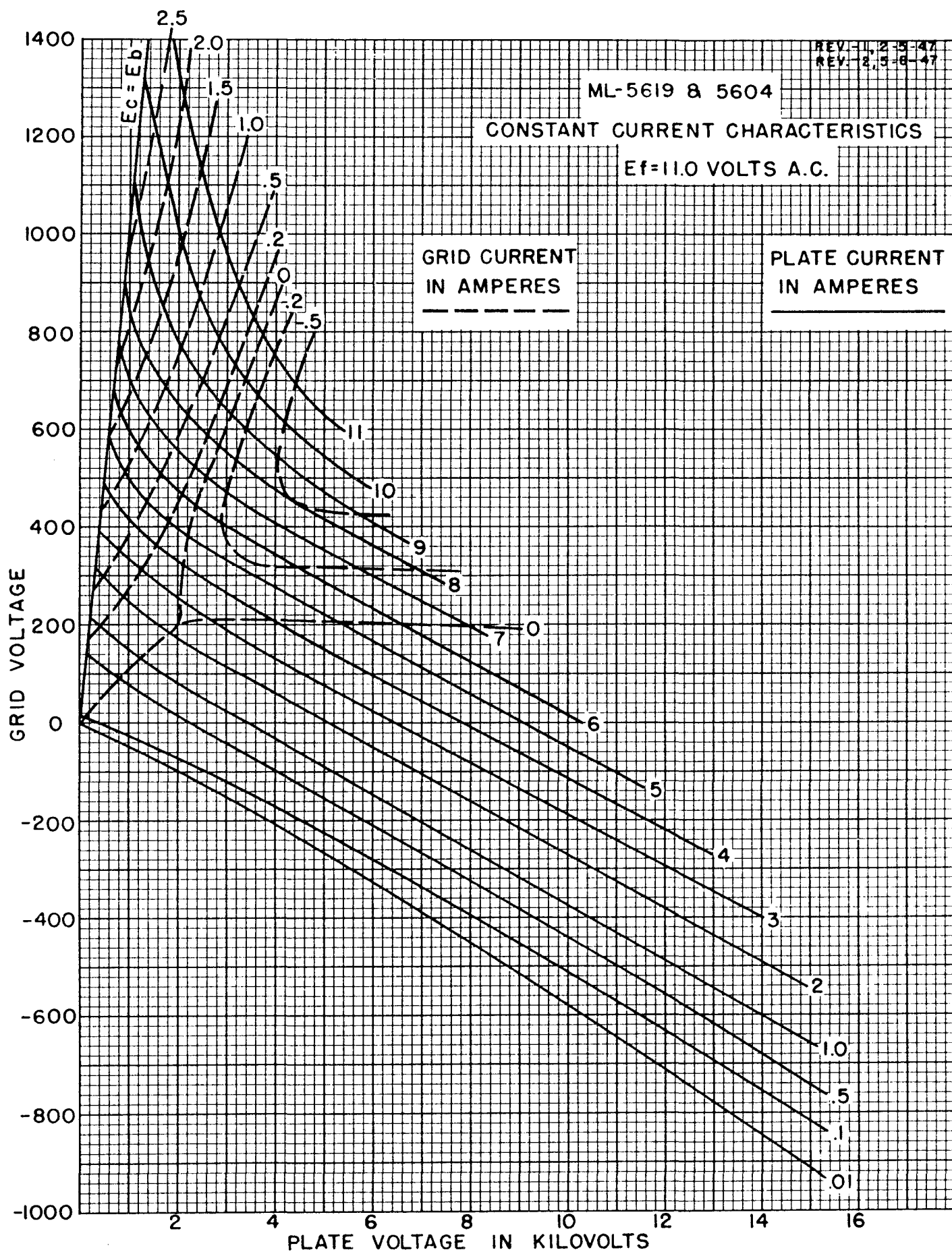
Maximum ratings apply at frequencies up to 25 Mc. These tubes may be operated at higher frequencies provided the maximum values of plate voltage and plate input are reduced according to the tabulation below (other maximum ratings are the same as shown above). Special attention should be given to adequate ventilation of the bulb at the higher frequencies.

Frequency	25	35	50 megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input			
Class B	100	85	70 per cent
Class C Plate Modulated	100	80	50 per cent
Class C Unmodulated	100	80	50 per cent

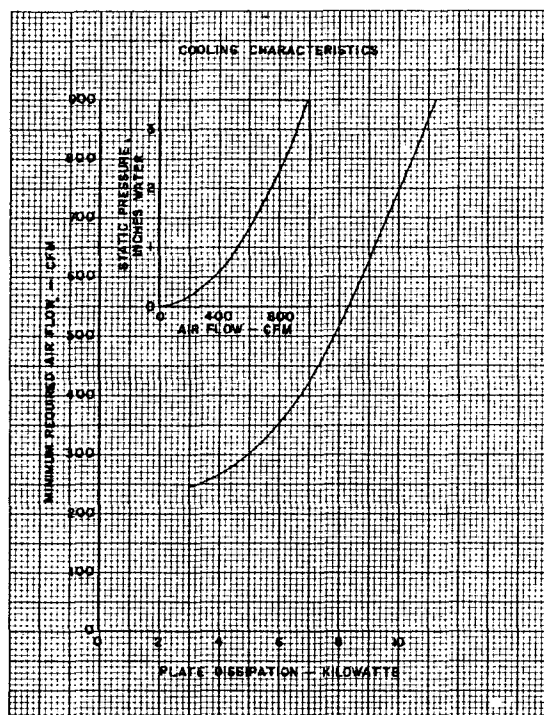
CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

Characteristic	Conditions	Minimum	Limits Bogey	Maximum	
Grid Voltage	$e_b = 1500$ volts; $i_b = 8.0$ amps	$e_c:$ —	—	830	volts
Grid Current	$e_b = 1500$ volts; $i_b = 8.0$ amps	$i_c:$ —	—	1.6	amps
Plate Voltage	$E_a = 0$ Vdc; $I_b = 1.25$ Adc	$E_b:$ 3.0	3.5	4.0	kVdc
Plate Voltage	$E_c = -200$ Vdc; $I_b = 1.25$ Adc	$E_b:$ 6.7	7.5	8.3	kVdc
Grid Voltage	$E_b = 10$ kVdc; $I_b = 0.020$ Adc	$E_c:$ -480	-520	-600	Vdc
Peak Cathode Current (See note)		$i_k:$ 11.5	—	—	amps
Power Output	$E_b = 12.5$ kVdc; $I_b = 2.6$ Adc	$P_o:$ 22.5	—	—	kW
	$I_c = 0.225$ Adc; $R_k = 6000$ ohms				

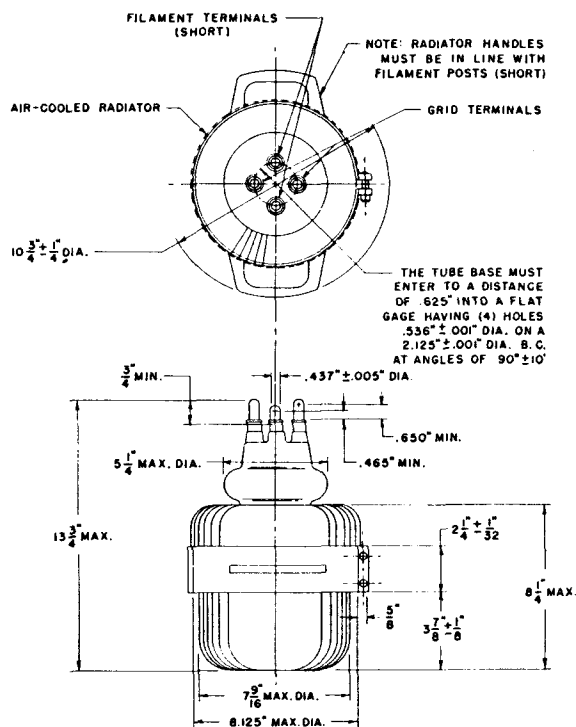
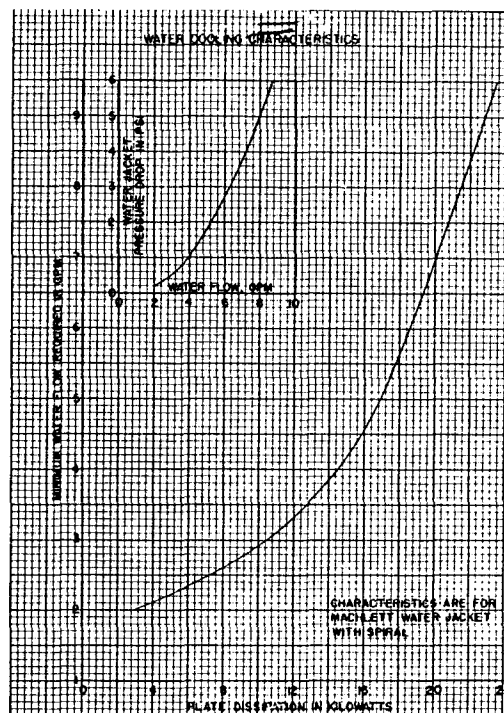
Note: Represents maximum useable plate current plus grid current for any condition of operation.



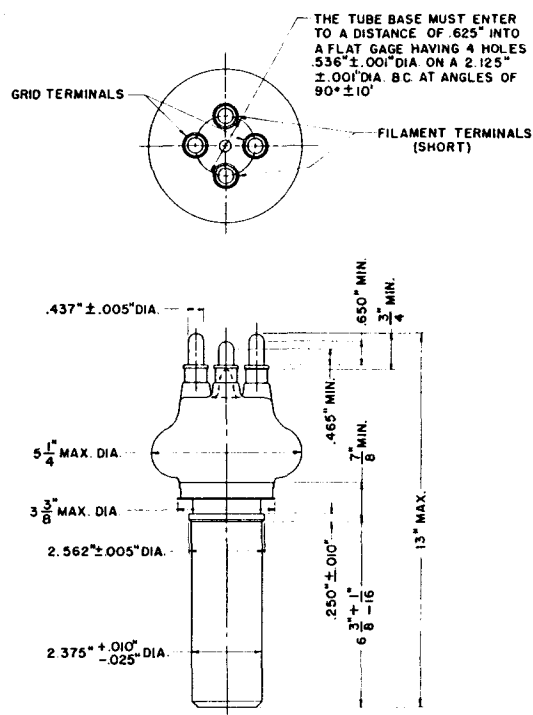
ML-5604



ML-5619



ML-5604



ML-5619

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