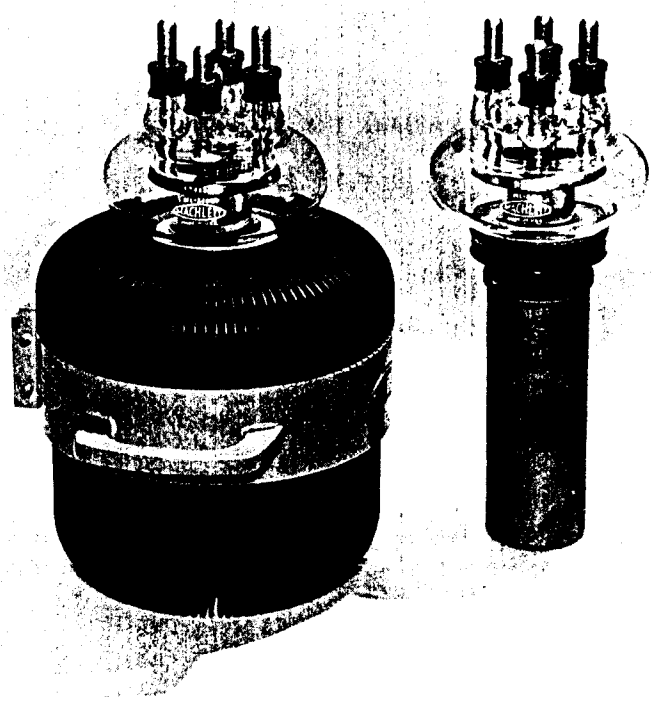


MACHLETT

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	ML-5604	ML-5619	
Grid-Plate	24.0	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		13.3	kW

Typical Operation			ML-5619	
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 Telegraphy

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

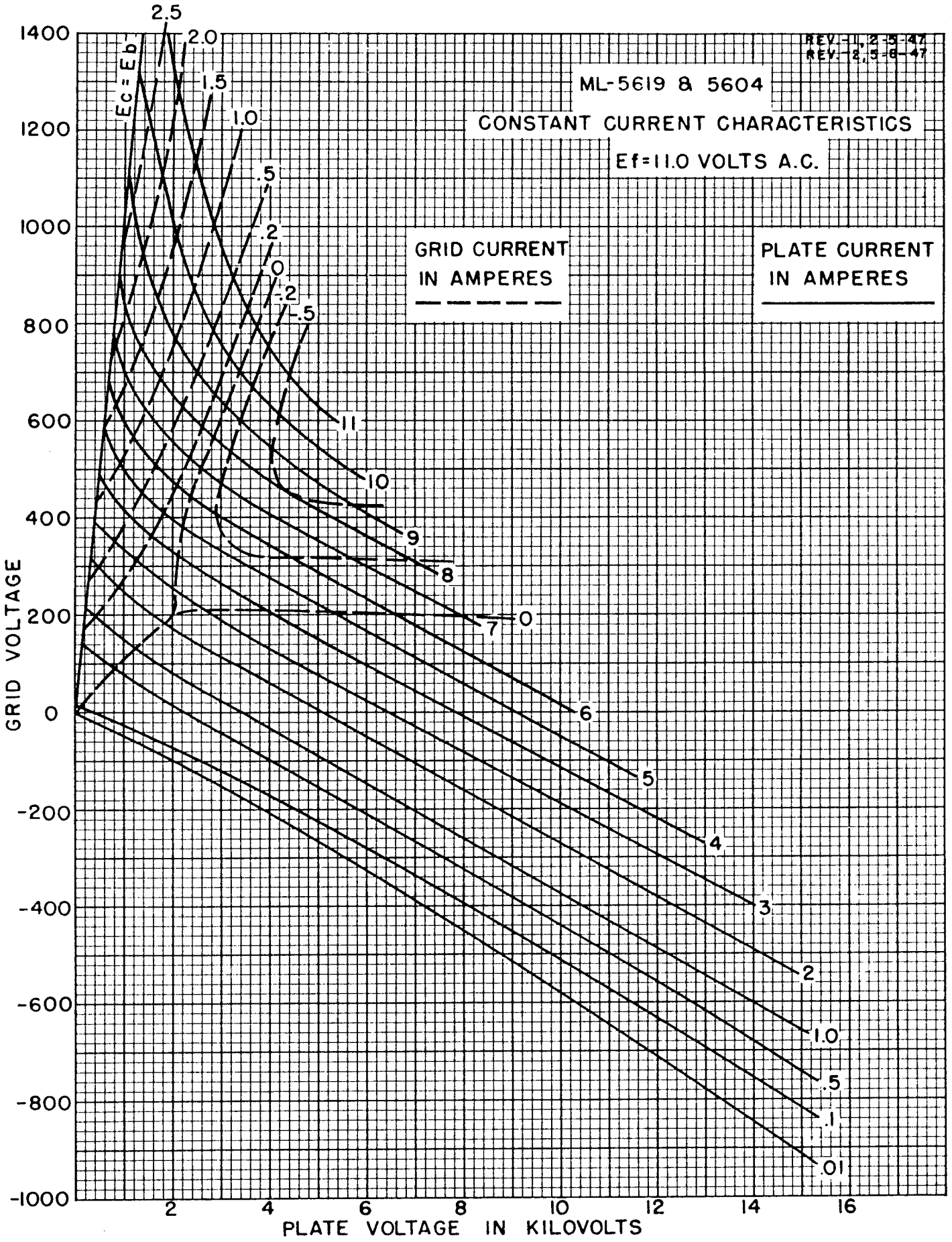
Maximum ratings apply at frequencies up to 25 Mc. These tubes may be operated at higher frequencies provided the maximum values of plate voltage and plate input are reduced according to the tabulation below (other maximum ratings are the same as shown above). Special attention should be given to adequate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

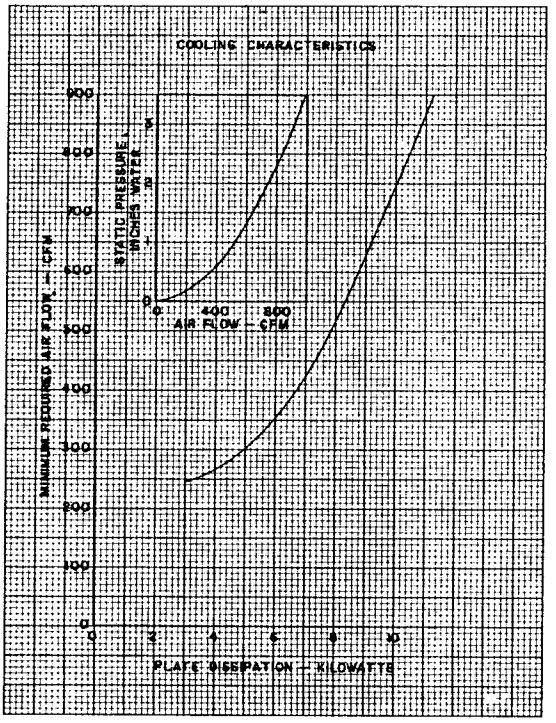
CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

Characteristic	Conditions		Limits Minimum	Limits Bogey	Limits 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_c = 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; I_c = 0.225 Adc; R_g = 6000 ohms	P_o:	22.5	——	——	kW

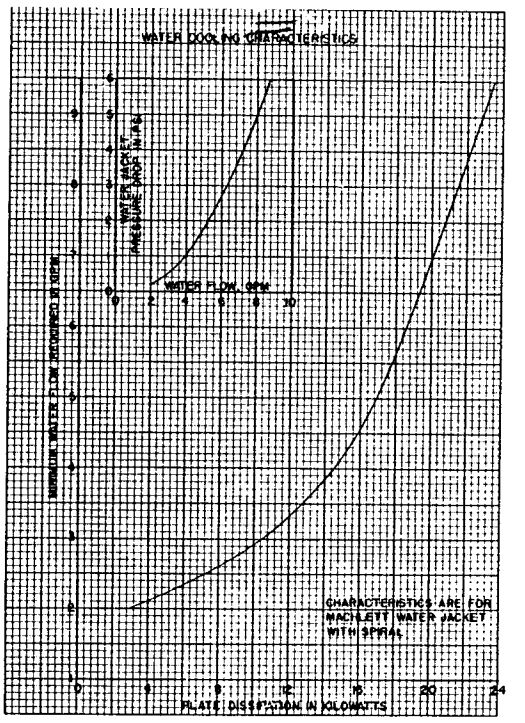
Note: Represents maximum useable plate current plus grid current for any condition of operation.

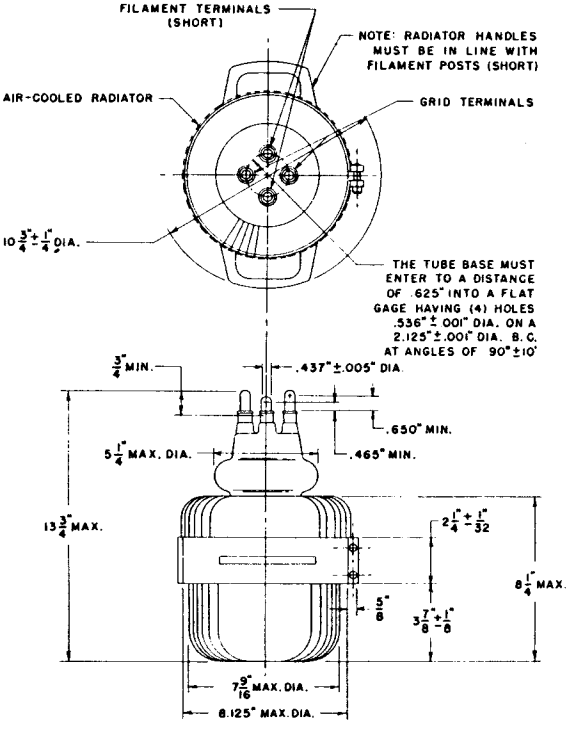

REV.-1, 2-5-47
REV.-2, 5-6-47
ML-5619 & 5604
CONSTANT CURRENT CHARACTERISTICS
Ef=11.0 VOLTS A.C.
GRID CURRENT IN AMPERES
PLATE CURRENT IN AMPERES
Ec=Eb
2.5
2.0
1.5
1.0
.5
.2
0
-.2
-.5
11
10
9
8
7
6
5
4
3
2
1.0
.5
.1
.01
1400
1200
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
GRID VOLTAGE
2
4
6
8
10
12
14
16
PLATE VOLTAGE IN KILOVOLTS

ML-5604

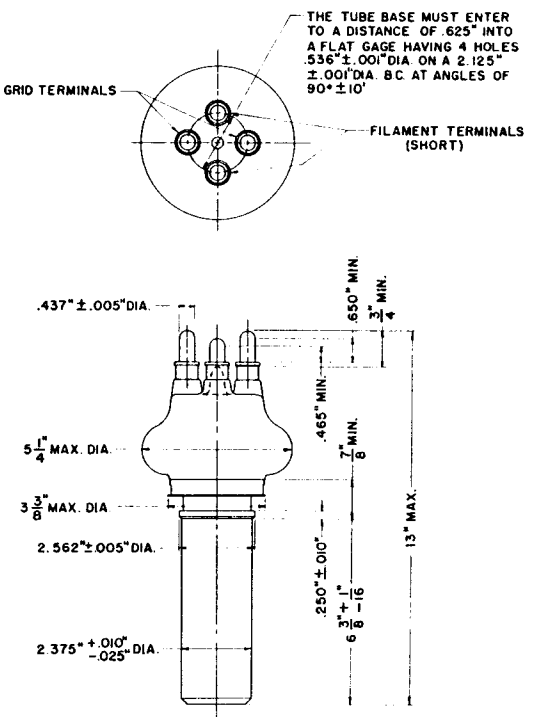


ML-5619





ML-5604



ML-5619

MACHLETT LABORATORIES, INC.

SPRINGDALE MACHLETT CONNECTICUT

U. S. A.