

MACHLETT

ML-5658

ML-880

DESCRIPTION & RATINGS

## DESCRIPTION

The ML-5658 is a three-electrode tube designed specifically for radio-frequency heating service, replacing the type 880 in industrial applications without equipment modification. The anode is water cooled and is capable of dissipating 20 kilowatts. The cathode is a stress-free, pure-tungsten filament. The tube incorporates rigidly supported grid and filament assemblies, glass surfaces shielded against electron bombardment and filament radiation, and sturdy kovar anode, grid, and filament seals.

The ML-880 is a three-electrode tube designed specifically for use as a modulator, amplifier, or oscillator in radio transmitting service, featuring low lead inductances and low

interelectrode capacitances.

All of the structural improvements of the ML-5658 have been incorporated in the ML-880 so that these two types are now physically identical. With filament voltage at 12.6 volts, the ML-5658 is electrically identical to the ML-880 at the same filament voltage setting and will replace it directly.

Maximum ratings of 12.5 kVdc plate voltage and 60 kW plate input apply to the ML-5658 at frequencies up to 15 Mc; maximum ratings of 10.5 kVdc plate voltage and 60 kW plate input apply to both types at frequencies up to 25 Mc. Operation at higher frequencies is permissible with voltage and input reduced according to the table on p. 2.

## GENERAL CHARACTERISTICS

### Electrical

	ML-5658	ML-880
Filament Voltage .....	12.0	12.6 Volts
Filament Emission .....	28	35 Amps
Filament Current at Bogey Voltage .....	310	315 Amps
Filament Starting Current, maximum .....	450	450 Amps
Filament Cold Resistance .....	0.003	0.003 Ohms
Amplification Factor		
$I_b = 2.0 \text{ Adc}$ , $E_c = -100 \text{ Vdc}$ .....	20	20
Interelectrode Capacitances		
Grid-Plate .....	24	24 $\mu\mu\text{f}$
Grid-Filament .....	35	35 $\mu\mu\text{f}$
Plate-Filament .....	2	2 $\mu\mu\text{f}$

### Mechanical

Mounting Position .....	Vertical, Anode Down
Type of Cooling .....	Water and forced-air
Water flow on anode, minimum for 20 kW dissipation .....	10.4 gpm
Maximum outgoing water temperature .....	70 °C
Air flow on dish from 3" nozzle .....	50 cfm*
Maximum Glass Temperature .....	160 °C
Net Weight, approximate .....	7 lbs.

\*At frequencies above 10 Mc 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 radiating connectors for grid and filament posts are recommended when tube operation is at frequencies greater than 10 Mc.

**MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS**

VALUES APPLY TO BOTH TYPES UNLESS OTHERWISE SPECIFIED

**R-F C-W Oscillator (ML-5658)**

Maximum Ratings, Absolute Values

D-C Plate Voltage .....	12500	volts
D-C Grid Voltage .....	-1600	volts
D-C Plate Current .....	5.0	amps
D-C Grid Current .....	0.8	amp
Plate Input .....	60	kW
Plate Dissipation .....	20	kW
Frequency .....	15	Mc

Typical Operation

Filament Voltage .....	12.0	12.0	12.0	volts
D-C Plate Voltage .....	8000	10000	12000	volts
Filament Voltage .....	11.6	11.8	12.0	volts
D-C Grid Voltage .....	-800	-900	-1000	volts
Peak R-F Grid Voltage .....	1320	1510	1680	volts
D-C Plate Current .....	3.1	4.0	4.5	amps
D-C Grid Current, approx. ....	.40	.45	.50	amp
Power Output, approx. ....	17	27	38	kW

**A-F Power Amplifier and Modulator  
Class B**

Maximum Ratings, Absolute Values

D-C Plate Voltage .....	10500	volts
Signal D-C Plate Current* .....	5.0	amps
Signal Plate Input* .....	40	kW
Plate Dissipation* .....	15	kW

Typical Operation (Values are for 2 Tubes)

Filament Voltage .....	12.6	12.6	volts
D-C Plate Voltage .....	7500	10000	volts
Zero Signal D-C Plate Current .....	1.0	1.0	amp
Max. Signal D-C Plate Current .....	6.7	7.0	amps
D-C Grid Voltage .....	-340	-450	volts
Peak A-F Grid-to-Grid Voltage .....	1450	1680	volts
Effective Load (plate to plate) .....	2300	3100	ohms
Max. Signal Driving Power .....	490	540	watts
Max. Signal Power Output .....	31	46	kW

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

**R-F 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 .....	4.0	amps
Plate Input .....	32	kW
Plate Dissipation .....	20	kW

Typical Operation

Filament Voltage .....	12.6	12.6	volts
D-C Plate Voltage .....	7500	10000	volts
D-C Plate Current .....	3.3	2.75	amps
D-C Grid Voltage .....	-340	-460	volts
D-C Grid Current, approximate .....	0.013	0.009	amp
Peak R-F Grid Voltage .....	570	595	volts
Driving Power† .....	1250	900	watts
Power Output .....	8	9	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 .....	10500	volts
D-C Plate Current .....	3.6	amps
D-C Grid Current .....	0.8	amp
D-C Grid Voltage .....	-1200	volts
Plate Input .....	36	kW
Plate Dissipation .....	12	kW

Typical Operation

Filament Voltage .....	12.6	12.6	volts
D-C Plate Voltage .....	7500	10000	volts
D-C Plate Current .....	3.0	3.6	amps
D-C Grid Voltage .....	-1000	-1200	volts
Peak R-F Grid Voltage .....	1560	1840	volts
D-C Grid Current .....	0.57	0.64	amp
Driving Power .....	850	1100	watts
Power Output .....	16	27	kW

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

Key-down conditions per tube without modulation‡

Maximum Ratings, Absolute Values

D-C Plate Voltage .....	10500	volts
D-C Plate Current .....	6.0	amps
D-C Grid Current .....	0.8	amp
D-C Grid Voltage .....	-1200	volts
Plate Input .....	60	kW
Plate Dissipation .....	20	kW

Typical Operation

Filament Voltage .....	12.6	12.6	12.6	volts
D-C Plate Voltage .....	7500	10000	10000	volts
D-C Plate Current .....	4.8	4.5	6.0	amps
D-C Grid Voltage .....	-600	-800	-1000	volts
Peak R-F Grid Voltage .....	1250	1460	1830	volts
D-C Grid Current .....	0.79	0.78	0.8	amp
Driving Power .....	920	1000	1500	watts
Power Output .....	24	33	40	kW

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

**MAXIMUM FREQUENCY RATINGS**

Maximum ratings apply at frequencies up to 25 Mc. Both types may be operated at higher frequencies provided the maximum values of plate voltage and plate input are reduced according to the table below (other maximum ratings are the same as shown on page 2). For R-F C-W Oscillator operation, the ML-5658 may be operated up to 15 Mc with the plate voltage increased to 120 per cent of the maximum rating for 25 Mc. Special attention should be given to adequate ventilation of the dish and seals at the higher frequencies.

Percentage of Maximum Rated Plate Voltage and Input

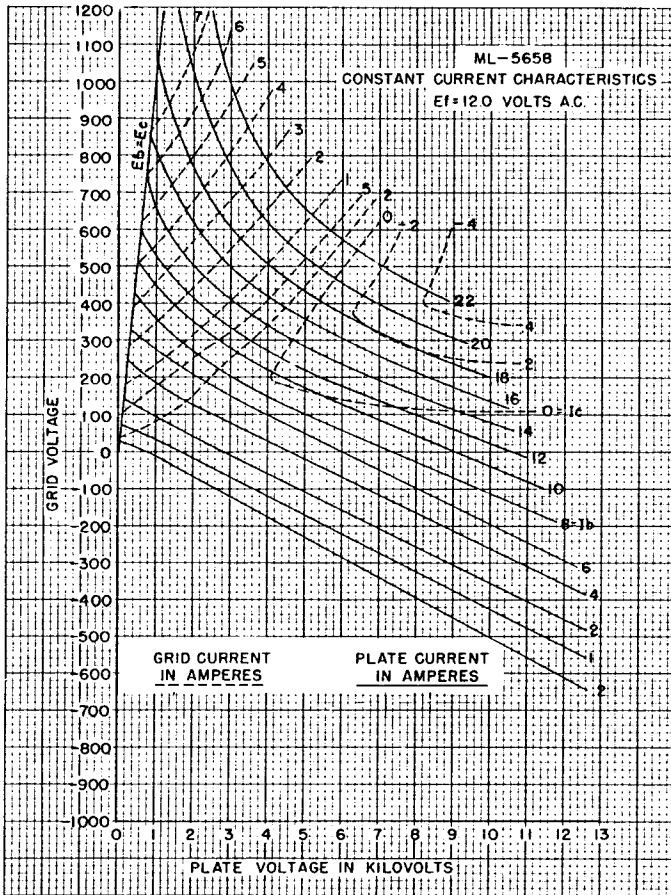
Mc	Class B		Class C Telephony	Class C Telegraphy
	Volts	Watts		
25	100	100	100	100
50	80	94	72	75
75	68	85	56	62
100	60	75	45	50

**CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN**

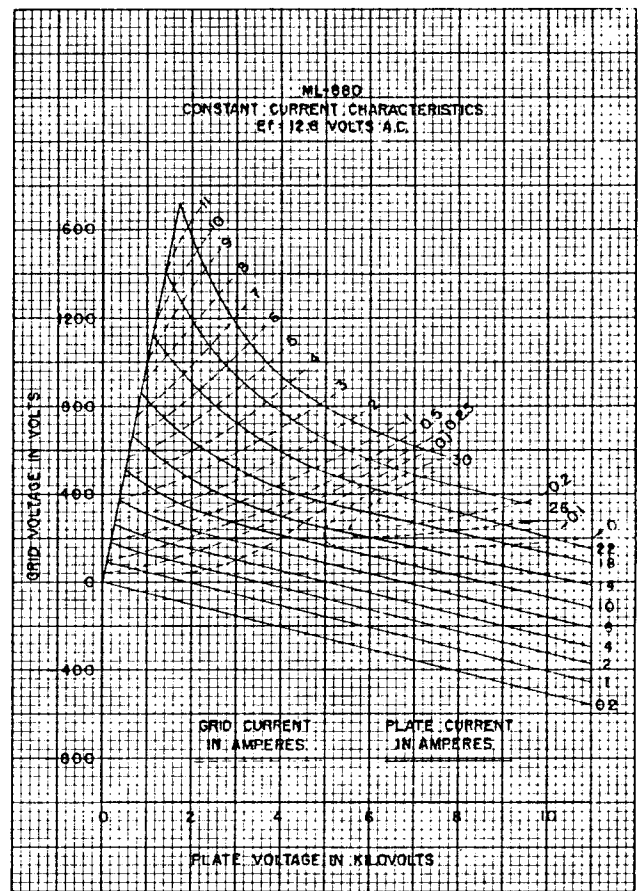
Characteristics	Conditions ( $E_f = 12.6$ Volts)	Limits		
		Minimum	Bogey	Maximum
Grid Voltage	$e_b = 2000$ volts; $i_b = 25$ amps	$e_c$ :	—	1300 Volts
Grid Current	$e_b = 2000$ volts; $i_b = 25$ amps	$i_c$ :	—	10.0 Amps
Plate Voltage	$E_c = 0$ Vdc; $I_b = 2.0$ Adc	$E_b$ :	2.8    3.2	3.6 kVdc
Plate Voltage	$E_c = -200$ Vdc; $I_b = 2.0$ Adc	$E_b$ :	6.5    7.3	8.1 kVdc
Grid Voltage	$E_b = 10.0$ kVc; $I_b = 0.02$ Adc	$E_c$ :	-460    -525	-690 Vdc
Peak Cathode Current	Note 1	$i_k$ :	35	— Amps
Power Output	$E_b = 10.0$ kVdc; $I_b = 4.5$ Adc	$P_o$ :	28	— kW
	$E_c = -1000$ Vdc; $I_c = 0.80$ Adc			

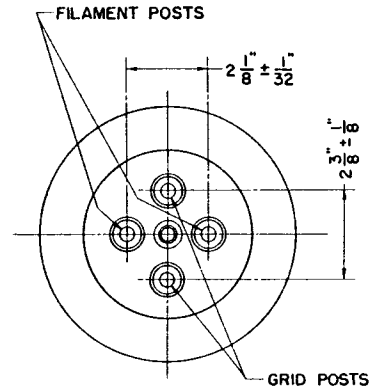
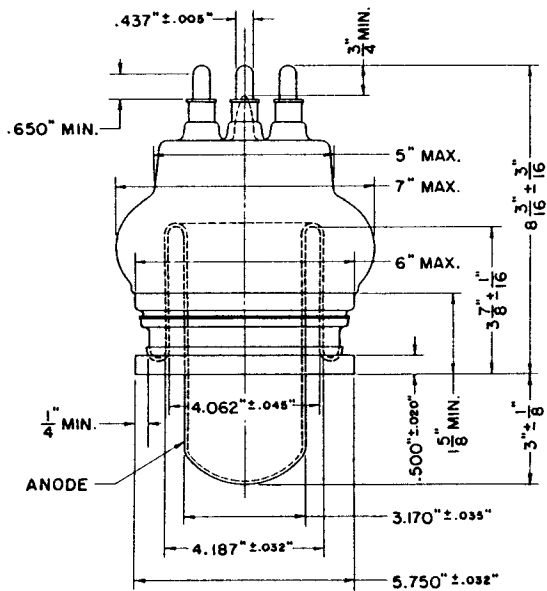
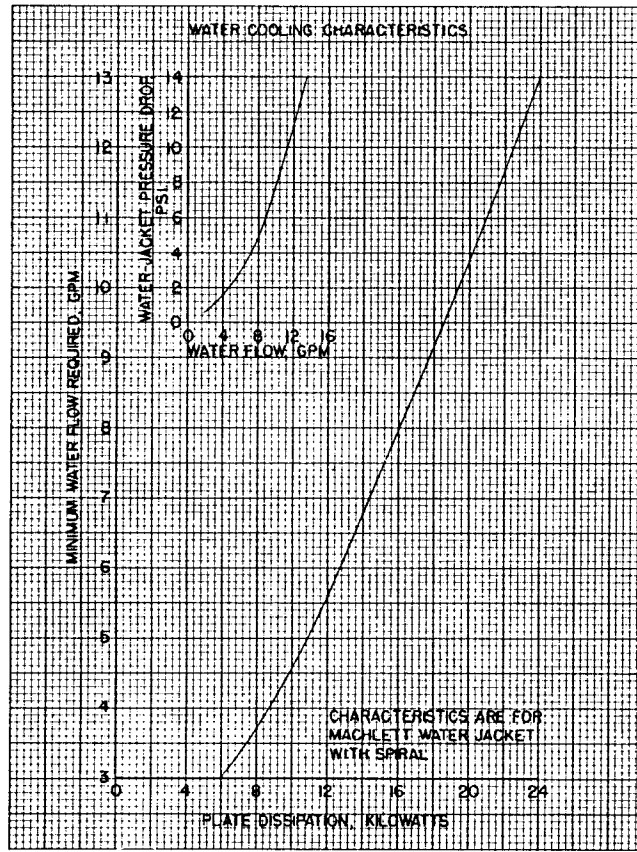
Note 1: Represents maximum plate current plus grid current for any condition of operation.

**ML-5658**



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