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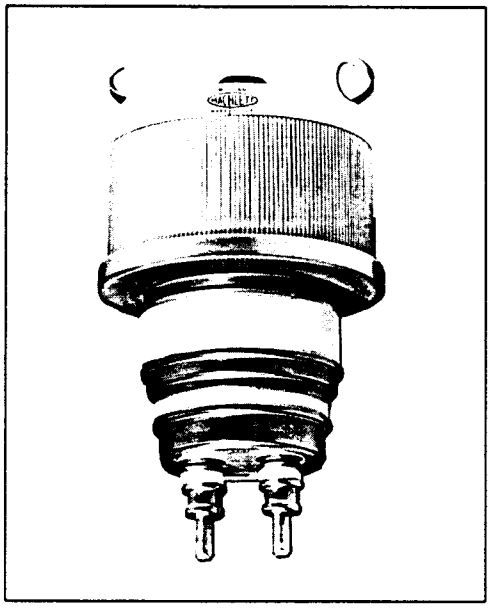


ISSUED 4-68

ML-7007

MACHLETT

High Power Tetrode
10 kW CW
800 kw Pulse Power

DESCRIPTION

The ML-7007 is a forced-air-cooled tetrode designed primarily for high-power vhf television service. It can also be used as a pulse modulator tube, and in this service is capable of switching up to 800 kW.

The envelope uses high-alumina ceramic insulation for mechanical strength and low electrical loss. Sturdy cylindrical supports for the two grids provide a smooth transition from the active tube elements to the external circuitry. With large-area coaxial terminals, they furthermore insure high heat dissipation capability. The anode is rated for 12 kW dissipation with an air flow of 550 cfm. The cathode is a sturdy, self-supporting, thoriated-tungsten filament. Maximum ratings apply at frequencies up to 220 MHz.

GENERAL CHARACTERISTICS

Electrical

Filament Voltage	5.0	Volts
Filament Current	180	Amps
Filament Cold Resistance	0.0036	Ohms
Amplification Factor, Grid No. 2 to Grid No. 1	10	
Direct Interelectrode Capacitances:		
Grid No. 1 - Plate*, maximum	0.6	pf
Grid No. 1 - Filament	43	pf
Plate - Filament*, maximum	0.08	pf
Grid No. 1 - Grid No. 2	60	pf
Grid No. 2 - Plate	21	pf
Strapped Resonant Frequency, approximate:		
Grid to Anode	510	MHz
Grid No. 1 to Grid No. 2	265	MHz
Grid No. 1 to Cathode	220	MHz

Mechanical

Mounting Position	Vertical, anode up or down	
Type of Cooling	Forced-air	
Air flow on anode, minimum for 10 kW dissipation	350 cfm at 3" water	
Air flow on seals, approximate	100	cfm†
Maximum incoming air temperature	50	°C
Maximum envelope temperature	180	°C
Net Weight, approximate	16	lbs.

*Measured with 12" square metal shield attached to Grid No. 2 terminal.

†Distributed among Grid No. 2, Grid No. 1 and Filament seals to maintain uniform temperature, not greater than 180°C, around the circumference of the seals.

WARNING: This electron tube when operating at peak voltages in excess of 15 kv may give off x rays, which can be harmful unless adequately shielded by the enclosure within which the tube is used. Instructions for protective installation are given in National Bureau of Standards Handbook 93, "Safety Standards for Non-Medical X-Ray and Sealed Gamma-Ray Sources".

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

(Continuous Commercial Service)

VOLTAGES ARE REFERRED TO CATHODE UNLESS OTHERWISE SPECIFIED

R-F Power Amplifier — Class B Television Service

Synchronizing-level conditions per tube unless otherwise specified.

Maximum Ratings, Absolute Values		
D-C Plate Voltage	7500	volts
D-C Grid No. 2 (Screen) Voltage	2000	volts
D-C Plate Current	4.0	amps
Plate Input	24	kW
Grid No. 2 (Screen) Input	400	watts
Plate Dissipation	12	kW
Grid No. 1 (Control Grid) Dissipation	300	watts
Typical Operation in Grid-Drive Circuit		
D-C Plate Voltage	5850	volts
D-C Grid No. 2 Voltage	1000	volts
D-C Grid No. 1 Voltage	−120	volts
Peak R-F Grid No. 1 Voltage		
Synchronizing Level	400	volts
Pedestal Level	300	volts
D-C Plate Current		
Synchronizing Level	3.2	amps
Pedestal Level	2.4	amps
D-C Grid No. 2 Current (Pedestal Level), approx.	0.110	amps
D-C Grid No. 1 Current, approx.		
Synchronizing Level	0.220	amps
Pedestal Level	0.090	amps
Driving Power, approx.		
Synchronizing Level	100	watts
Pedestal Level	30	watts
Power Output, approx.		
Synchronizing Level	12	kW
Pedestal Level	6.8	kW
Typical Operation in Cathode-Drive Circuit		
D-C Plate to Grid No. 1 Voltage	6000	volts
D-C Grid No. 2 to Grid No. 1 Voltage	700	volts
D-C Cathode to Grid No. 1 Voltage	45	volts
Peak R-F Cathode to Grid No. 1 Voltage		
Synchronizing Level	390	volts
Pedestal Level	290	volts
D-C Plate Current		
Synchronizing Level	3.8	amps
Pedestal Level	2.8	amps
D-C Grid No. 2 Current (Pedestal Level), approx.	0.140	amps
D-C Grid No. 1 Current, approx.		
Synchronizing Level	0.300	amps
Pedestal Level	0.140	amps
Driving Power, approx.		
Synchronizing Level	1200	watts
Pedestal Level	700	watts
Power Output, approx.*		
Synchronizing Level	12	kW
Pedestal Level	6.8	kW

*Includes power transferred from driver stage.

Linear RF Power Amplifier — Class AB Single-Sideband Suppressed-Carrier Service

Maximum Ratings, Absolute Values			
D-C Plate Voltage		7500	volts
D-C Grid No. 2 (Screen) Voltage		2000	volts
Maximum-Signal D-C Plate Current		2.8	amps
Maximum-Signal Plate Input		20	kW
Maximum-Signal Grid No. 2 (Screen) Input		400	watts
Plate Dissipation		12	kW
Typical Operation for Single-Tone Modulation			
D-C Plate Voltage	6500	7500	volts
D-C Grid No. 2 Voltage	1000	800	volts
D-C Grid No. 1 Voltage	−130	−100	volts
Zero Signal D-C Plate Current	0.200	0.200	amps
Zero Signal Grid No. 2 Current	0	0	amps
Maximum-Signal D-C Plate Current	2.7	2.3	amps
Maximum-Signal D-C Grid No. 2 Current, approx.	0.230	0.140	amps
Maximum-Signal D-C Grid No. 1 Current, approx.	0.140	0.160	amps
Maximum-Signal Peak RF Grid No. 1 Voltage	355	330	volts
Maximum-Signal Driving Power, approx.	40	50	watts
Maximum-Signal Plate Power Output, approx.	11	11	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	5000	volts
D-C Grid No. 2 (Screen) Voltage	2000	volts
D-C Grid No. 1 (Control Grid) Voltage	−1000	volts
D-C Plate Current	2.0	amps
D-C Grid No. 1 (Control Grid) Current	0.6	amps
Plate Input	10	kW
Plate Dissipation	8	kW
Typical Operation in Grid-Drive Circuit		
D-C Plate Voltage	4800	volts
D-C Grid No. 2 Voltage	800	volts
D-C Grid No. 1 Voltage	−300	volts
Peak R-F Grid Voltage	550	volts
D-C Plate Current	1.8	amps
D-C Grid No. 2 Current, approx.	0.160	amps
D-C Grid No. 1 Current, approx.	0.180	amps
Driving Power, approx.	100	watts
Power Output, approx.	6	kW

Pulse Modulator or Pulse Amplifier

Maximum Ratings, Absolute Values		
D-C Plate Voltage	25	kV
Peak Plate Voltage	30	kv
D-C Grid No. 2 (Screen) Voltage	4000	volts
D-C Grid No. 1 (Control Grid) Voltage	−1000	volts
Peak Negative Grid Voltage	−1500	volts
Pulse Cathode Current	50	amps
Grid No. 2 (Screen) Input	200	watts
Grid No. 1 (Control Grid) Dissipation	150	watts
Plate Dissipation	12	kW
Pulse Duration, approximate	1000	μsec
Duty Factor	0.01	
Typical Operation		
D-C Plate Voltage	24	kV
D-C Grid No. 2 (Screen) Voltage	3000	volts
D-C Grid No. 1 (Control Grid) Voltage	−400	volts
Pulse Positive Grid Voltage	1300	volts
Pulse Plate Current	40	amp
Pulse Grid No. 2 Current	6	amp
Pulse Grid No. 1 Current	4	amp
Pulse Driving Power	7	kw
Pulse Power Output	800	kw
Pulse Output Voltage	20	kv

R-F Power Amplifier Class C

Key-down conditions per tube without amplitude modulation

Maximum Ratings, Absolute Values		
D-C Plate Voltage	7500	volts
D-C Grid No. 2 (Screen) Voltage	2000	volts
D-C Grid No. 1 (Control Grid) Voltage	−1000	volts
D-C Plate Current	3.0	amps
D-C Grid No. 1 (Control Grid) Current	0.6	amps
Plate Input	20	kW
Grid No. 2 (Screen) Input	400	watts
Plate Dissipation	12	kW
Typical Operation in Grid-Drive Circuit		
D-C Plate Voltage	7000	volts
D-C Grid No. 2 Voltage	1000	volts
D-C Grid No. 1 Voltage	−300	volts
Peak R-F Grid No. 1 Voltage	570	volts
D-C Plate Current	2.6	amps
D-C Grid No. 2 Current, approx.	0.200	amps
D-C Grid No. 1 Current, approx.	0.150	amps
Driving Power, approx.‡†	80	watts
Power Output, approx.‡	12	kW

Typical Operation in Cathode-Drive Circuit			
D-C Plate to Grid No. 1 Voltage	7000	6000	volts
D-C Grid No. 2 to Grid No. 1 Voltage	700	700	volts
D-C Cathode to Grid No. 1 Voltage	200	140	volts
Peak R-F Cathode to Grid No. 1 Voltage	450	340	volts
D-C Plate Current	2.2	2.0	amps
D-C Grid No. 2 Current, approx.	0.150	0.125	amps
D-C Grid No. 1 Current, approx.	0.180	0.075	amps
Driving Power, approx.‡	1000	600	watts
Power Output, approx.‡*	12	6	kW

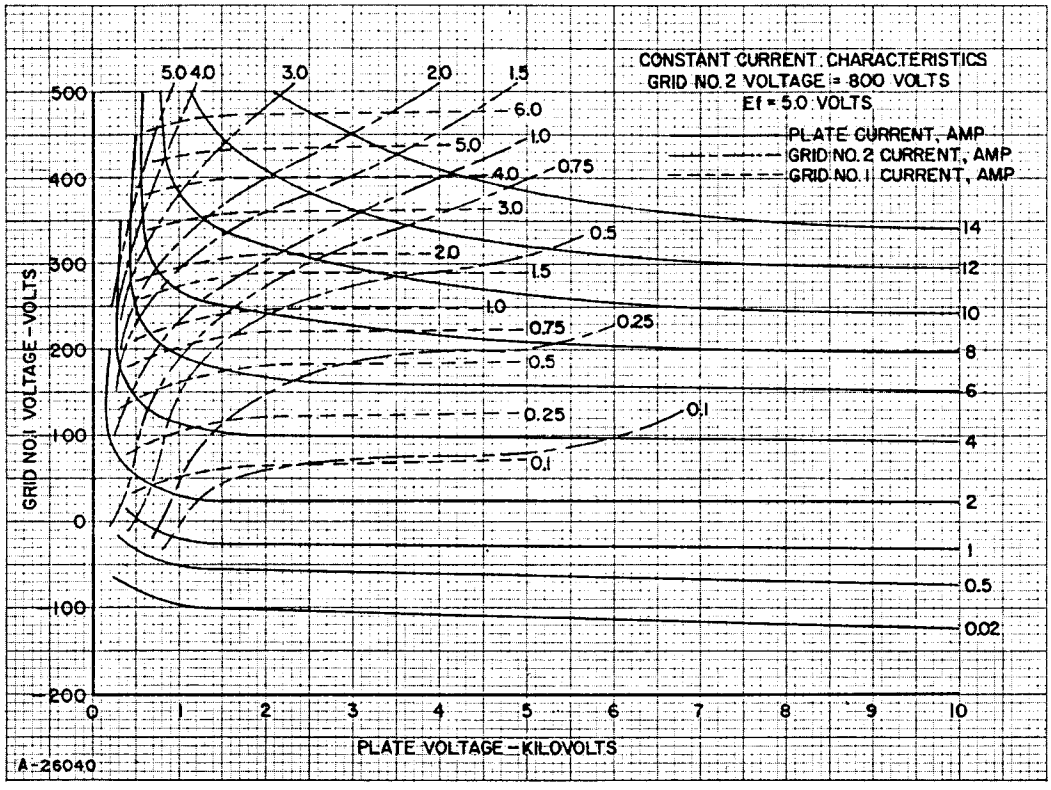
‡These calculations do not include circuit losses, since such losses are a function of frequency.

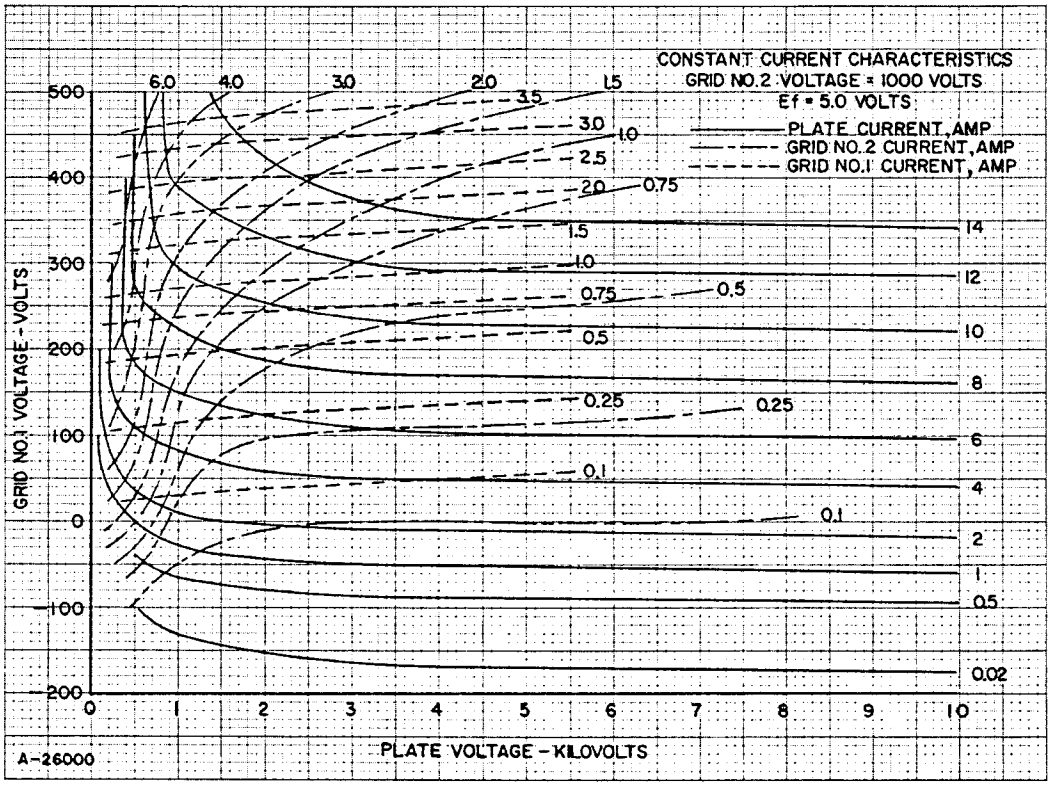
†At 220 MHz, the input losses may be as much as eight times the calculated drive power.

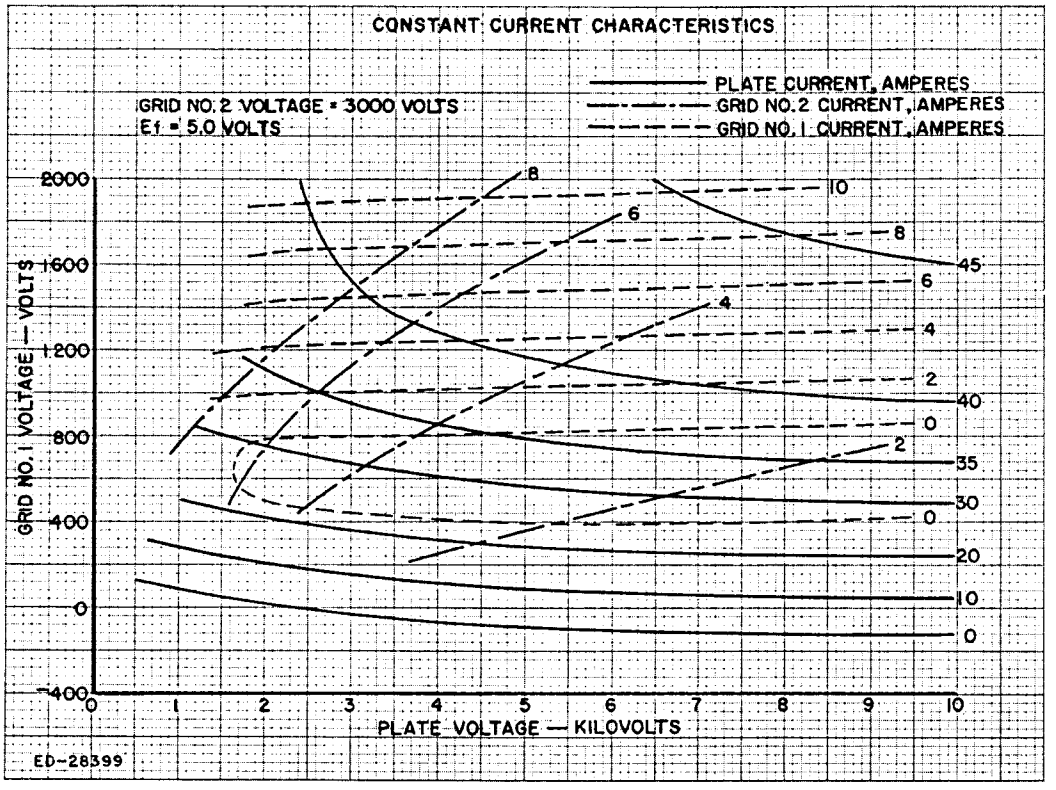
*Includes power transferred from driver stage.

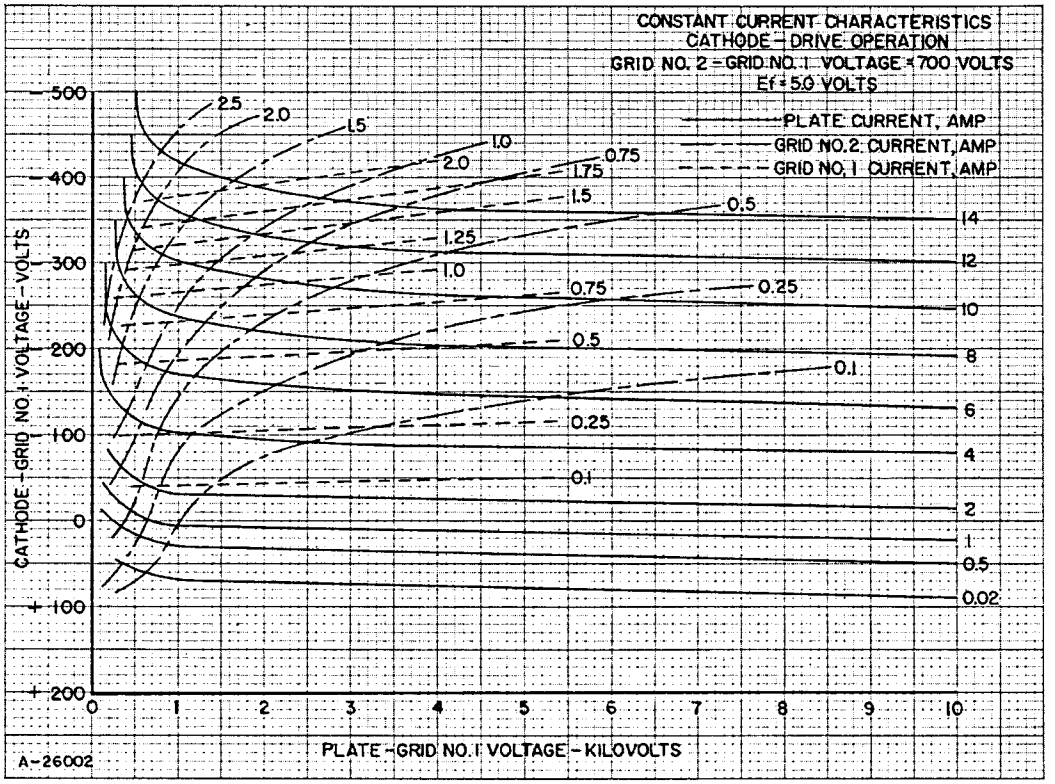
CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

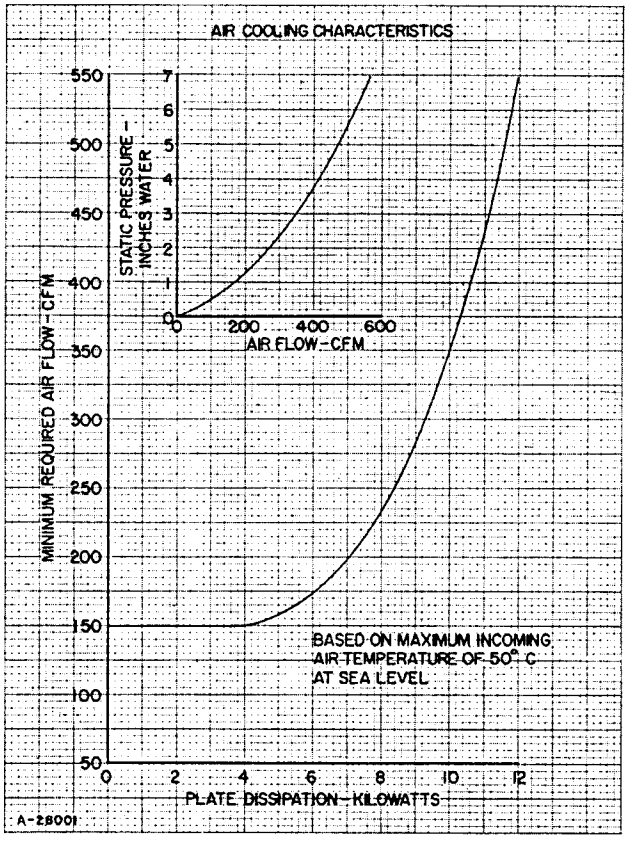
Characteristics	Conditions		Limits Minimum	Limits Bogey	Limits Maximum	
Grid No. 1 Voltage	E_b = 2000 Vdc; E_{c2} = 1000 Vdc; i_b = 8.5 amps	e_{c1}:	——	——	250	volts
Grid No. 2 Current	E_b = 2000 Vdc; E_{c2} = 1000 Vdc; i_b = 8.5 amps	i_{c2}:	——	——	0.75	amp
Grid No. 1 Current	E_b = 2000 Vdc; E_{c2} = 1000 Vdc; i_b = 8.5 amps	i_{c1}:	——	——	0.75	amp
Plate Voltage	$E_{c2} = E_b$; E_{c1} = 0 Vdc; I_b = 1.0 Adc	E_b:	0.40	0.65	0.90	kVdc
Plate Voltage	$E_{c2} = E_b$; E_{c1} = −200 Vdc; I_b = 1.0 Adc	E_b:	1.90	2.40	2.90	kVdc
Grid Voltage	E_b = 10.0 kVdc; E_{c2} = 1000 Vdc; I_b = 0.020 Adc	E_{c1}:	−110	−155	−200	Vdc


CONSTANT CURRENT CHARACTERISTICS
GRID NO.2 VOLTAGE = 800 VOLTS
Ef = 5.0 VOLTS
PLATE CURRENT, AMP
GRID NO.2 CURRENT, AMP
GRID NO.1 CURRENT, AMP
GRID NO.1 VOLTAGE - VOLTS
PLATE VOLTAGE - KILOVOLTS
A-26040

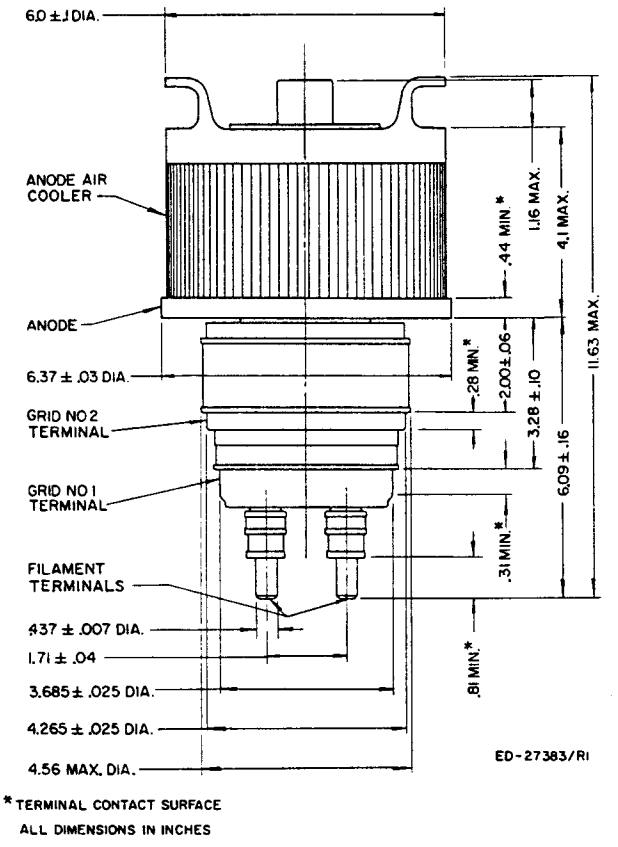

CONSTANT CURRENT CHARACTERISTICS
GRID NO.2 VOLTAGE = 1000 VOLTS
Ef = 5.0 VOLTS
PLATE CURRENT, AMP
GRID NO.2 CURRENT, AMP
GRID NO.1 CURRENT, AMP
GRID NO.1 VOLTAGE - VOLTS
PLATE VOLTAGE - KILOVOLTS
A-26000


CONSTANT CURRENT CHARACTERISTICS
GRID NO. 2 VOLTAGE = 3000 VOLTS
Ef = 5.0 VOLTS
PLATE CURRENT, AMPERES
GRID NO. 2 CURRENT, AMPERES
GRID NO. 1 CURRENT, AMPERES
GRID NO. 1 VOLTAGE — VOLTS
PLATE VOLTAGE — KILOVOLTS
ED-28399


CONSTANT CURRENT CHARACTERISTICS
CATHODE - DRIVE OPERATION
GRID NO. 2 - GRID NO. 1 VOLTAGE = 700 VOLTS
Ef = 5.0 VOLTS
PLATE CURRENT, AMP
GRID NO. 2 CURRENT, AMP
GRID NO. 1 CURRENT, AMP
CATHODE - GRID NO. 1 VOLTAGE - VOLTS
PLATE - GRID NO. 1 VOLTAGE - KILOVOLTS
A-26002



COOLING CHARACTERISTICS — ML-7007



DIMENSIONS — ML-7007

RAYTHEON
THE MACHLETT LABORATORIES, INC.
A SUBSIDIARY OF RAYTHEON COMPANY

Printed in U.S.A.

ST-1706 4.5M 4-68