EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

TENTATIVE DATA

8350
4CW50,000C

RADIAL-BEAM POWER TETRODE

The Eimac 8350/4CW50,000C is a ceramic-metal, water cooled power tetrode intended for use at the 50 to 150 kilowatt output power level. It is recommended for use as a Class-C rf amplifier or oscillator, a Class-AB, rf linear amplifier or a Class-AB, push-pull af amplifier or modulator. The 8350/4CW50,000C is also useful as a plate and screen modulated Class-C rf amplifier.

The water cooled anode is rated at 50 kilowatts of plate dissipation with low water flow requirements.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament:	Thoriated Tungsten		
	Voltage	10	volts
	Current	300	amps
	Amplification Factor (Grid-Screen) (average)	4.5	

Direct Interelectrode Capacitances, Grounded Cathode:

Input	430	uuf
Output	45	uuf
Feedback	2.3	uuf

Frequency for Maximum Ratings:	30	Mc

MECHANICAL

Base	Special, graduated rings
Maximum Seal Temperature	250°C
Maximum Anode Core Temperature	250°C
Recommended Socket	Eimac, SK-1500
Operating Position	Vertical, base up or down
Maximum Dimensions:	
Height	16.5 inches
Diameter	8.02 inches
Cooling	Water and Forced air
Net Weight	60 pounds
Shipping Weight (approximately)	85 pounds

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions)

MAXIMUM RATINGS

DC PLATE VOLTAGE	20,000 MAX. VOLTS
DC SCREEN VOLTAGE	2500 MAX. VOLTS
DC PLATE CURRENT	15.0 MAX. AMPS
PLATE DISSIPATION	50,000 MAX. WATTS
SCREEN DISSIPATION	1750 MAX. WATTS
GRID DISSIPATION	500 MAX. WATTS

TYPICAL OPERATION

DC Plate Voltage	10	15	20 kV
DC Screen Voltage	750	750	750 volts
DC Grid Voltage	-420	-480	-540 volts
DC Plate Current	10.7	10.5	9.7 amps
DC Screen Current	2.25	2.1	1.65 amps
DC Grid Current	1.2	1.15	.89 amps
Peak RF Grid Voltage	680	740	790 volts
Driving Power	815	850	705 volts
Plate Dissipation	23	32	30 kW
Plate Output Power	84	124	165 kW

Note: Maximum plate voltage and plate current cannot be applied simultaneously without exceeding dissipation ratings.

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PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER

Class-C Telephony (Carrier conditions except where noted)

MAXIMUM RATINGS

DC PLATE VOLTAGE	15,000 MAX. VOLTS
DC SCREEN VOLTAGE	2000 MAX. VOLTS
DC PLATE CURRENT	15.0 MAX. AMPS
PLATE DISSIPATION*	33,000 MAX. WATTS
SCREEN DISSIPATION	1750 MAX. WATTS
GRID DISSIPATION	500 MAX. WATTS

*Corresponds to 50,000 watts at 100 percent sinewave modulation

TYPICAL OPERATION

DC Plate Voltage	10	12.5	15 kV
DC Screen Voltage	750	750	750 volts
Peak AF Screen Voltage (For 100% modulation)	705	675	745 volts
DC Grid Voltage	-490	-500	-510 volts
DC Plate Current	7.4	8.15	8.95 amps
DC Screen Current	1.2	1.4	1.55 amp
DC Grid Current	.470	.650	.790 amp
Peak RF Grid Voltage	670	710	730 volts
Grid Driving Power	315	460	570 watts
Plate Dissipation	14	18.5	24 kW
Plate Output Power	60	83.5	110 kW

AUDIO-FREQUENCY AMPLIFIER OR MODULATOR

Class-AB_1

MAXIMUM RATINGS (Per Tube)

DC PLATE VOLTAGE	20,000 MAX. VOLTS
DC SCREEN VOLTAGE	2500 MAX. VOLTS
DC PLATE CURRENT	15.0 MAX. AMPS
PLATE DISSIPATION	50,000 MAX. WATTS
SCREEN DISSIPATION	1750 MAX. WATTS
GRID DISSIPATION	500 MAX. WATTS

* Per Tube

**Approximate value

TYPICAL OPERATION (Two Tubes)

DC Plate Voltage	10	15	20 kV
DC Screen Voltage	1.5	1.5	1.5 kV
DC Grid Voltage	-280	-320	-360 volts
Max-Signal Plate Current	18.4	16.4	17.3 amps
Zero-Signal Plate Current	6.0	4.0	3.0 amps
Max-Signal Screen Current**	.780	.550	.500 amp
Zero-Signal Screen Current	0	0	0 amps
Peak AF Driving Voltage*	260	300	340 volts
Driving Power	0	0	0 watts
Load Resistance, Plate-to-Plate	1140	1980	2590 ohms
Max-Signal Plate Dissipation*	35	38	48 kW
Max-Signal Plate Output Power	114	170	250 kW

RADIO-FREQUENCY LINEAR AMPLIFIER

Class-AB_1

MAXIMUM RATINGS

DC PLATE VOLTAGE	20,000 MAX. VOLTS
DC SCREEN VOLTAGE	2500 MAX. VOLTS
DC PLATE CURRENT	15.0 MAX. AMPS
PLATE DISSIPATION	50,000 MAX. WATTS
SCREEN DISSIPATION	1750 MAX. WATTS
GRID DISSIPATION	500 MAX. WATTS

*Approximate value

TYPICAL OPERATION, Peak-Envelope or Modulation-Crest Conditions.

DC Plate Voltage	10	15	20 kV
DC Screen Voltage	1.5	1.5	1.5 kV
DC Grid Voltage	-280	-320	-360 volts
Max-Signal Plate Current	9.2	8.2	8.65 amps
Zero-Signal Plate Current	3.0	2.0	1.5 amp
Max-Signal Screen Current*	.390	.275	.250 amp
Peak RF Grid Voltage	260	300	340 volts
Driving Power	0	0	0 watts
Plate Dissipation	35	38	48 kW
Plate Output Power	57	85	125 kW
Resonant Load Impedance	570	990	1295 ohms

NOTE: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance is made for circuit losses of any kind. Adjustment of the RF grid drive to obtain the specified plate current at the specified grid bias, screen voltage, and plate voltage is assumed. If this procedure is followed, there will be little variation in output power when tubes are changed, even though there may be some variations in grid and screen currents. The grid and screen currents which result when the desired plate current is obtained are incidental and vary from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct RF driving voltage is applied.

APPLICATION

MECHANICAL

MOUNTING – The 4CW50,000C must be operated with its axis vertical. The base of the tube may be down or up at the convenience of the circuit designer.

SOCKET –The Eimac SK-1500 socket is recommended for use with the 4CW50,000C. Base cooling is accomplished by directing 50-100 CFM of air horizontally into the socket from the side. Temperature of the ceramic-metal seals must be limited to 250°C.

COOLING –Anode cooling is accomplished by circulating water through the integral anode-water jacket. A new more efficient design assures adequate cooling with low water flow rates. The table below lists minimum cooling water requirements at various dissipation levels.

Plate Dissipation* (kilowatts)	Water Flow GPM
20	7.2
30	10.2
40	12.9
50	15.2

*Since the power dissipated by the filament represents about 3000 watts and since grid-plus screen dissipation can, under some conditions, represent another 2250 watts, allowance has been made in preparing this tabulation for an additional 5250 watts dissipation.

The cooling table above assumes a water temperature rise of 20°C. Under no circumstances should the outlet water temperature exceed 70°C. Inlet water pressure should not exceed 75 psi. The pressure drop across the anode at full flow is less than 5 psi.

When the tube is mounted in the anode-up position, cooling water must enter the anode-water jacket through the outer connector; the outlet being the center connector; when the tube is mounted in an inverted position (base up) these connections are reversed, that is, the inlet connection is on the center water fitting and the water outlet is connected to the outer anode fitting.

Water flow must be started before applying any voltages to the tube. Water-flow and water temperature interlock switches are suggested for incorporation in any system to prevent tube damage due to inadequacy of flow. It is not necessary to continue water flow after the removal of all power.

ELECTRICAL

FILAMENT OPERATION –The rated filament voltage for the 4CW50,000C is 10.0 volts. Filament voltage, as measured at the socket, should be maintained at this value to obtain maximum tube life. In no case should it be allowed to deviate by more than plus or minus 5 percent from the rated value.

ELECTRODE DISSIPATION RATINGS –The maximum dissipation ratings for the 4CW50,000C must be respected to avoid damage to the tube. An exception is the plate dissipation, which may be permitted to rise above the rated maximum during brief periods, such as may occur during tuning.

PLATE DISSIPATION – The plate-dissipation rating for the 4CW50,000C is 50,000 watts for most applications, but for Class C plate modulated applications, the maximum allowable dissipation is 33,000 watts for carrier conditions.

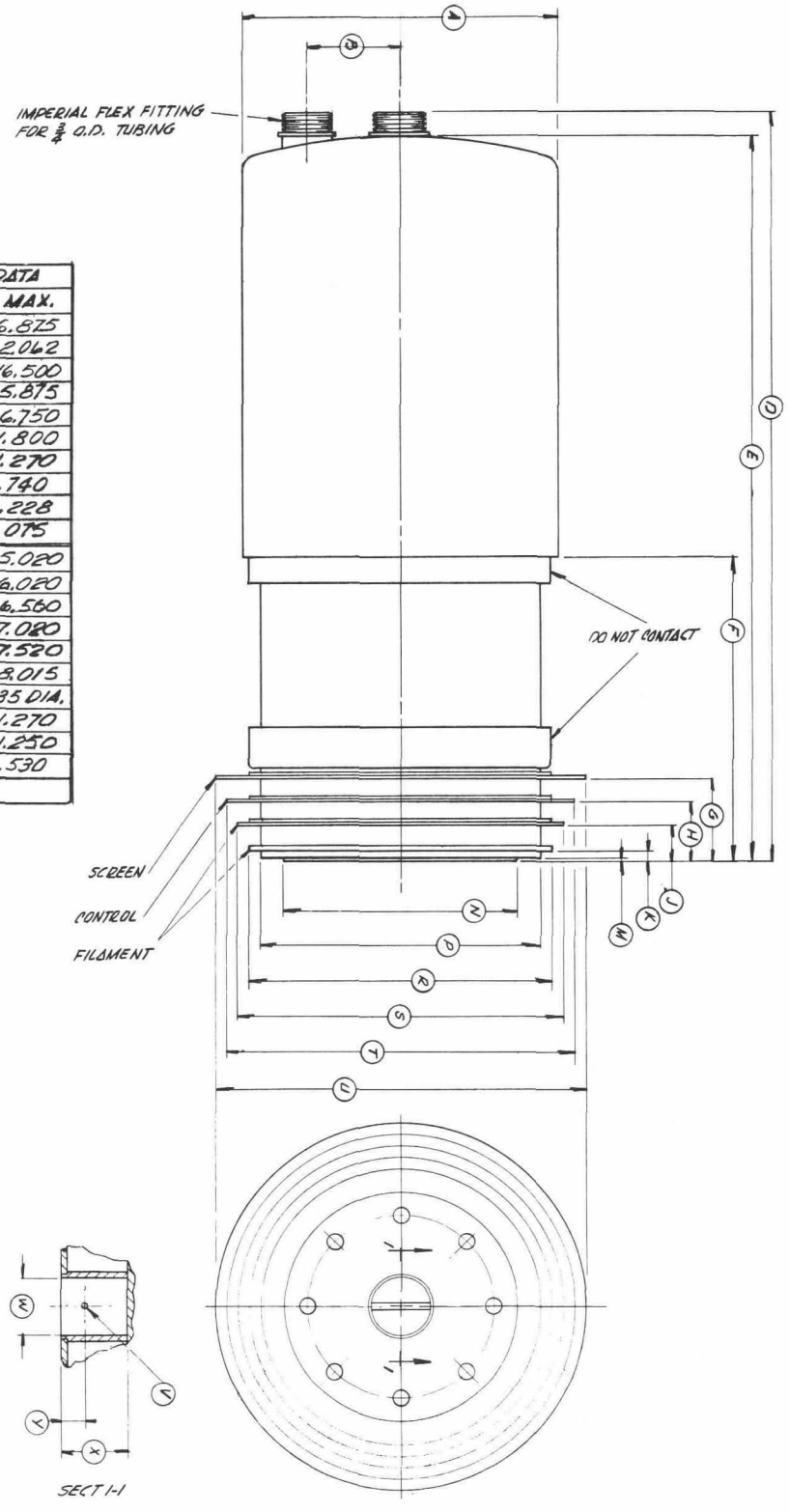
CONTROL-GRID OPERATION – The 4CW50,000C control grid has a maximum dissipation rating of 500 watts. Grid dissipation is the product of dc grid current and peak positive grid voltage. Precautions should be observed to avoid exceeding this rating. The grid bias and driving power should be kept near the values shown in the "Typical Operation" sections of the data sheet whenever possible. The maximum grid circuit resistance should not exceed 100,000 ohms per tube.

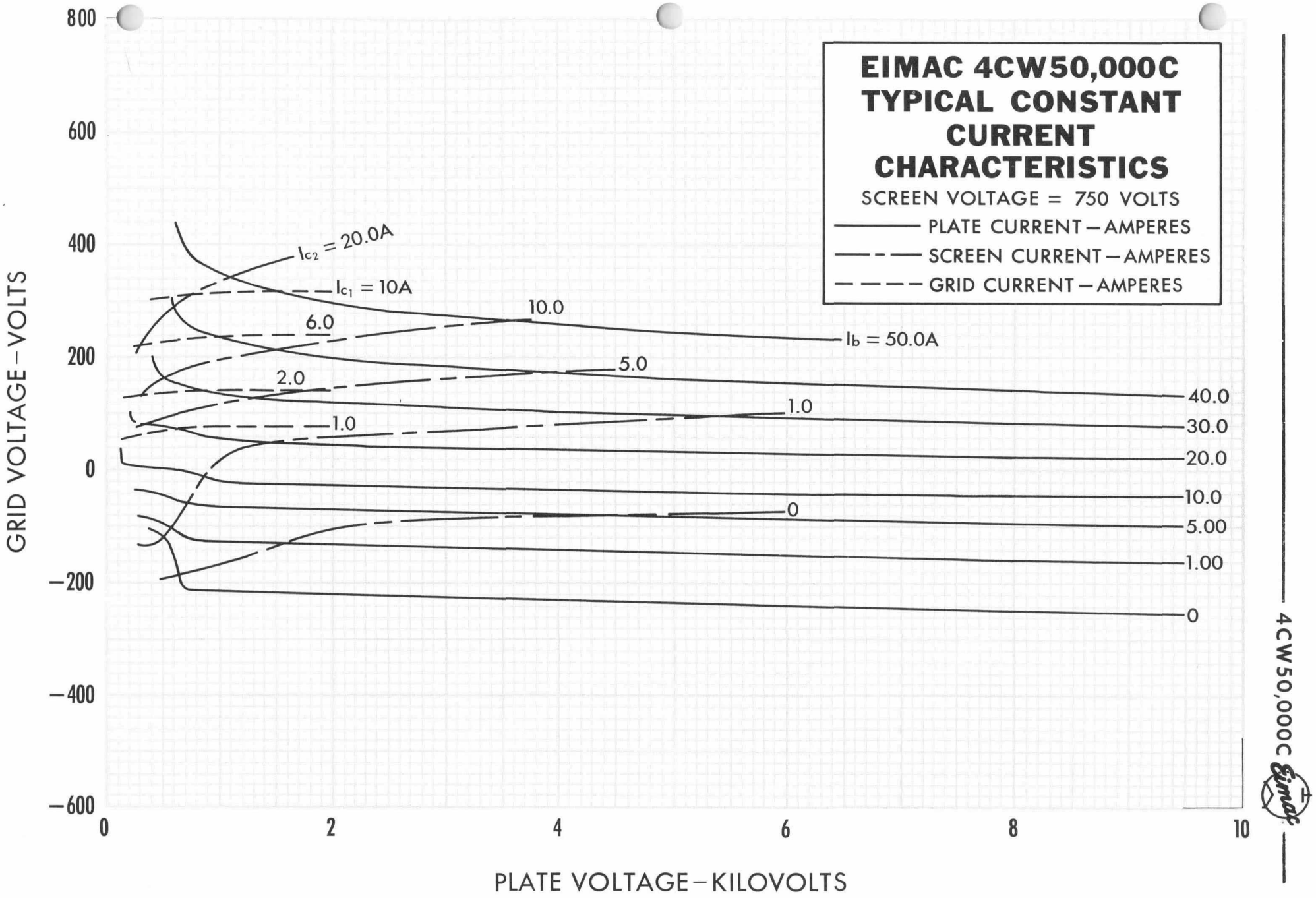
SCREEN-GRID OPERATION – The power dissipated by the screen of the 4CW50,000C must not exceed 1750 watts. Screen dissipation, in cases where there is no ac applied to the screen, is the simple product of the screen voltage and the screen current. If the screen voltage is modulated, the screen dissipation will depend upon loading, driving power, and carrier screen voltage.

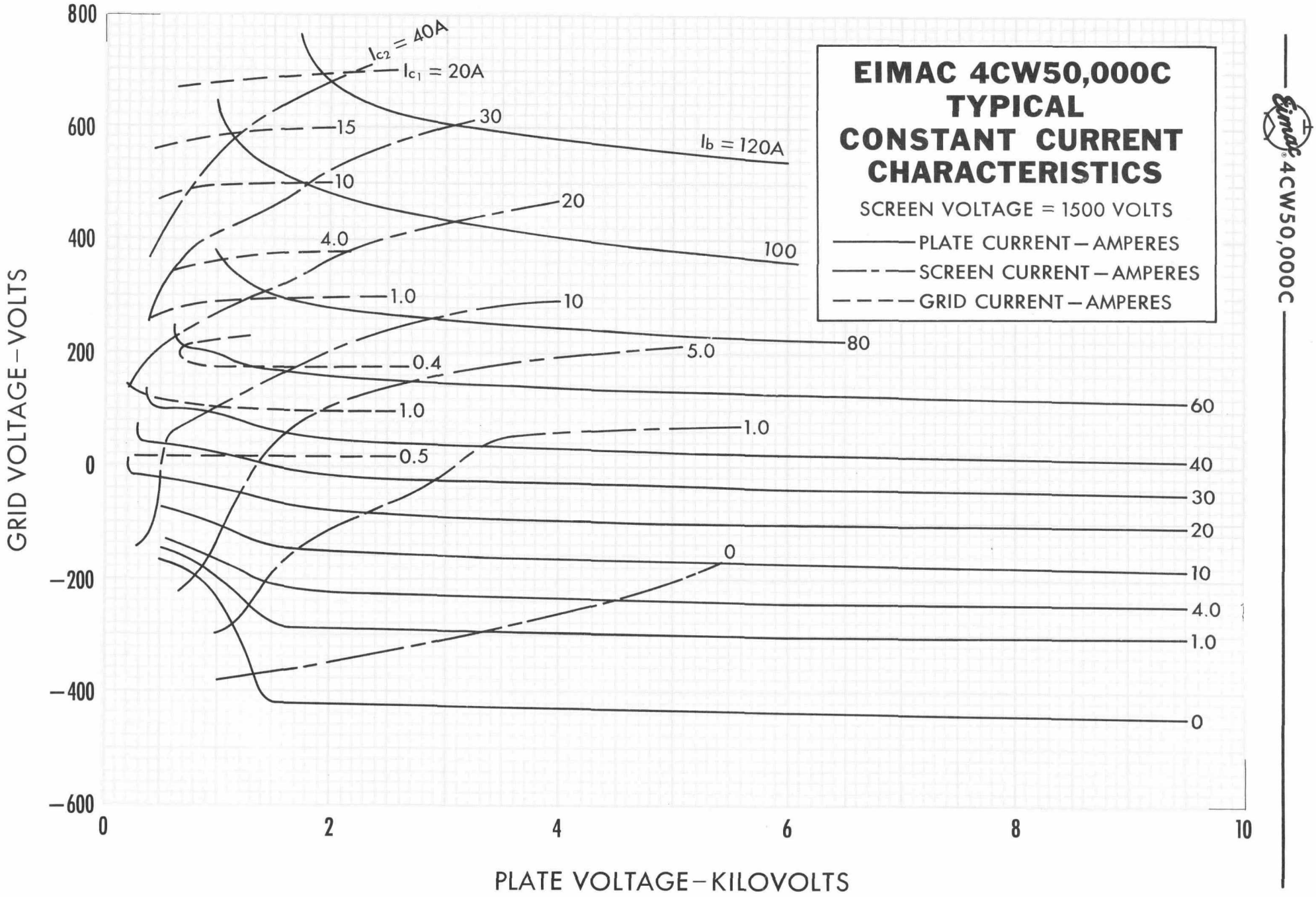
Screen Dissipation is likely to rise to excessive values when the plate voltage, bias voltage, or plate load are removed with filament and screen voltages applied. Suitable protective means must be provided to limit the screen dissipation to 1750 watts in the event of circuit failure.

SPECIAL APPLICATIONS – If it is desired to operate this tube under conditions widely different from those given here, write to the Power Grid Tube Marketing Department, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California for information and recommendations.

DIMENSION DATA		
REF	MIN.	MAX.
A	6.750	6.875
B	1.968	2.062
D	16.000	16.500
E	15.500	15.875
F	6.500	6.750
G	1.750	1.800
H	1.220	1.270
J	.690	.740
K	.188	.228
M	.045	.075
N	4.980	5.020
P	5.980	6.020
R	6.510	6.560
S	6.980	7.080
T	7.480	7.520
U	7.975	8.015
V		.135 DIA.
W	1.250	1.270
X		1.250
Y	.490	.530




EIMAC 4CW50,000C
TYPICAL CONSTANT
CURRENT
CHARACTERISTICS
SCREEN VOLTAGE = 750 VOLTS
PLATE CURRENT – AMPERES
SCREEN CURRENT – AMPERES
GRID CURRENT – AMPERES
800
600
400
200
0
−200
−400
−600
GRID VOLTAGE – VOLTS
0
2
4
6
8
10
PLATE VOLTAGE – KILOVOLTS
I_{c_2} = 20.0A
I_{c_1} = 10A
I_b = 50.0A
10.0
6.0
5.0
2.0
1.0
1.0
0
40.0
30.0
20.0
10.0
5.00
1.00
0
4CW50,000C
Eimac


EIMAC 4CW50,000C
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE = 1500 VOLTS
PLATE CURRENT – AMPERES
SCREEN CURRENT – AMPERES
GRID CURRENT – AMPERES
I_{c2} = 40A
I_{c1} = 20A
I_b = 120A
30
15
10
20
4.0
100
1.0
10
80
5.0
0.4
60
1.0
1.0
40
0.5
30
20
0
10
4.0
1.0
0
800
600
400
200
0
−200
−400
−600
0
2
4
6
8
10
GRID VOLTAGE – VOLTS
PLATE VOLTAGE – KILOVOLTS
Eimac 4CW50,000C