7649

Beam Power Tube

CERAMIC-METAL SEALS — **COAXIAL-ELECTRODE STRUCTURE**
"ONE-PIECE" ELECTRODE DESIGN — **INTEGRAL RADIATOR**
FORCED-AIR COOLED 9000-WATTS PEAK-PULSE INPUT UP TO 1215 Mc
MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

For Use at Frequencies up to 2000 Mc under Severe Shock and Vibration

GENERAL DATA

Electrical:

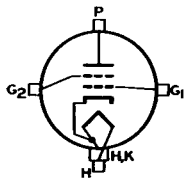
Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at heater volts = 6.3	3.2	amp
Minimum heating time	60	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 1000, grid-No.2 volts = 500, and plate ma. = 115	18	
Direct Interelectrode Capacitances:[a]		
Grid No.1 to plate	0.13 max.	μμf
Grid No.1 to cathode & heater	14	μμf
Plate to cathode & heater	0.019 max.	μμf
Grid No.1 to grid No.2	20	μμf
Grid No.2 to plate	6.5	μμf ←
Grid No.2 to cathode & heater	1.3 max.	μμf

Mechanical:

Operating Position	Any
Overall Length	1.885" + 0.070" - 0.080"
Greatest Diameter (See *Dimensional Outline*)	1.250" ± 0.015"
Weight (Approx.)	2 oz
Radiator	Integral part of tube
Socket:	
For frequencies up to about 400 Mc	[b]
For use at higher frequencies	See *Mounting Arrangement*

Terminal Connections (See *Dimensional Outline*):

G_1 – Grid-No.1–Terminal Contact Surface
G_2 – Grid-No.2–Terminal Contact Surface
H – Heater–Terminal Contact Surface



H,K – Heater- & Cathode–Terminal Contact Surface
P – Plate–Terminal Contact Surface

Air Flow:

Through radiator—Adequate air flow to limit the plate terminal temperature to 250° C should be delivered by a blower

← Indicates a change.

through the radiator before and during the application of plate, grid-No.2, and grid-No.1 voltages. Typical values of air flow directed through the radiator without cowling and with cowling versus plate dissipation are shown in accompanying *Typical-Cooling-Requirements* curves. Plate power, grid-No.2 power, and air flow may be removed simultaneously.

To Grid-No.2, Grid-No.1, Cathode, and Heater Terminals—A sufficient quantity of air should be delivered to these seals to prevent their temperature from exceeding the specified maximum value of 250° C.

During Standby Operation—Cooling air is not normally required when only heater voltage is applied to the tube.

Terminal Temperature (Plate, grid No.2, grid No.1, cathode, and heater)	250 max.	°C

GRID-AND-SCREEN-PULSED RF AMPLIFIER

Maximum CCS[c] Ratings, *Absolute-Maximum Values:*

For maximum "on" time[d] of 10 microseconds

	Up to 1215 Mc	
→DC PLATE VOLTAGE	2250 max.	volts
PEAK POSITIVE PULSE-GRID-No.2 VOLTAGE	750 max.	volts
DC GRID-No.1 VOLTAGE	-200 max.	volts
DC PLATE CURRENT DURING PULSE	3000 max.	ma
DC PLATE CURRENT	80 max.	ma
GRID-No.2 INPUT (Average)	4.5 max.	watts
GRID-No.1 INPUT (Average)	2 max.	watts
PLATE DISSIPATION (Average)	115 max.	watts

Typical Operation:

In class-AB_2 cathode-drive[e] circuit with rectangular-wave pulses at 1215 Mc and with duty factor[f] of 0.01

DC Plate Voltage	1350	1500	volts
Peak Positive-Pulse Grid-No.2 Voltage	700	700	volts
DC Grid-No.1 Voltage	0	0	volts
DC Plate Current during pulse	2700	3000	ma
DC Plate Current	47	53	ma
DC Grid-No.2 Current	1.6	2	ma
DC Grid-No.1 Current	5	5	ma
Driver Power Output at peak of pulse (Approx.)[g]	390	460	watts
Useful Power Output at peak of pulse (Approx.)	1600[h]	2300[h]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition	30000 max.	ohms

→Indicates a change.

PLATE-AND-SCREEN-PULSED RF AMPLIFIER

Maximum CCS[c] Ratings, *Absolute-Maximum Values:*

For maximum "on" time[d] of 10 microseconds

	Up to 1215 Mc	
PEAK POSITIVE-PULSE PLATE VOLTAGE	3000 max.	volts
PEAK POSITIVE-PULSE GRID-No.2 VOLTAGE	750 max.	volts
DC GRID-No.1 VOLTAGE	-200 max.	volts
DC PLATE CURRENT DURING PULSE	3000 max.	ma
DC PLATE CURRENT	50 max.	ma
GRID-No.2 INPUT (Average)	4.5 max.	watts
GRID-No.1 INPUT (Average)	2 max.	watts
PLATE DISSIPATION (Average)	115 max.	watts

Typical Operation:

In class AB_2 cathode-drive[e] circuit with rectangular-wave pulses at 1215 Mc and with duty factor[f] of 0.01

Peak Positive-Pulse Plate Voltage	2700	3000	volts
Peak Positive-Pulse Grid-No.2 Voltage	700	700	volts
DC Grid-No.1 Voltage	0	0	volts
DC Plate Current during pulse	2700	3000	ma
DC Plate Current	32	35	ma
DC Grid-No.2 Current	1	2	ma
DC Grid-No.1 Current	9	8	ma
Driver Power Output at peak of pulse (Approx.)[g]	350	450	watts
Useful Power Output at peak of pulse (Approx.)	3700[h]	4500[h]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition . . . . . 30000 max. ohms

[a] Measured with special shield adapter.

[b] For socket to be used with the 7649 consult manufacturers such as J-V-M Microwave Company, 4631 Lawndale Avenue, Lyons, Illinois; E. F. Johnson, Waseca, Minnesota; and Collins Radio Company, 855 35th Street North, Cedar Rapids, Iowa.

[c] Continous Commercial Service.

[d] *"On" time* is defined as the sum of the durations of all the individual pulses which occur during any 1000-microsecond interval. An increase in dc plate current during the pulse may be permissible at shorter "on" times, and a decrease is usually required at longer "on" times. *Pulse duration* is defined as the time interval between the two points on the pulse at which the instantaneous value is 70 per cent of the peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.

[e] Cathode is at dc ground potential.

[f] *Duty factor* is defined as the ratio of "on" time to total elapsed time in any 1000-microsecond interval.

[g] Driver power output includes circuit losses and feed-through power. It is actual power measured at input to the tube drive circuit. It will vary with frequency of operation and driver circuitry.

[h] This value of useful power is measured in load of output circuit.

→ CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

		Note	Min.	Max.	
1.	Heater Current.	1	2.90	4.00	amp
2.	Direct Interelectrode Capacitances:				
	Grid No.1 to plate.	2	–	0.13	μμf
	Grid No.1 to cathode & heater.	2	11.8	15.2	μμf
	Plate to cathode & heater . .	2	–	0.019	μμf
	Grid No.1 to grid No.2. . . .	2	17.3	21.9	μμf
	Grid No.2 to plate.	2	5.8	6.8	μμf
	Grid No.2 to cathode & heater.	2	–	1.3	μμf
3.	Grid-No.1 Voltage	1,3	-20	-50	volts
4.	Grid-No.1 Voltage	1,7	-6	-18	volts
5.	Reverse Grid-No.1 Current . . .	1,7	–	-20	μa
6.	Grid-No.2 Current	1,3	-5	11	ma
7.	Peak Emission Voltage	1,4	–	250	volts
8.	Interelectrode Leakage Resistance.	5	1	–	megohm
9.	Power Output.	1,6	4500	–	watts
10.	Grid-No.1 Cutoff Voltage. . . .	1,8	–	-104	volts

Note 1: With 6.3 volts ac or dc on heater.

Note 2: Measured with special shield adapter.

Note 3: With dc plate voltage of 1000 volts, dc grid-No.2 voltage of 700 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 115 ma.

Note 4: For conditions with 6.3 volts on heater; grid No.1, grid No.2, and plate tied together; and pulse-voltage source connected between plate and cathode. Pulse duration is 2 microseconds, pulse-repetition frequency is 60 pps, and duty factor is 0.00012. The voltage-pulse amplitude is adjusted until a peak cathode current of 13 amperes is obtained. After 1 minute at this value, the voltage-pulse amplitude will not exceed 200 volts (peak).

Note 5: Under conditions with tube at 20° to 30° C for at least 30 minutes without any voltages applied to the tube. The minimum resistance between any two electrodes as measured with a 200-volt Megger-type ohmmeter having an internal impedance of 1 megohm, will be 1 megohm.

Note 6: In a plate-and-screen-pulsed cathode-drive cavity at 1215 Mc and for conditions with 6.3 volts ac or dc on heater, peak plate voltage of 3000 volts, peak grid-No.2 voltage of 700 volts, driver power of 560 peak watts, and grid-No.1 voltage varied for peak plate current of 3 amperes. Pulse duration is 10 microseconds and duty factor is 0.01.

Note 7: With dc plate voltage of 1000 volts, dc grid-No.2 voltage of 300 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 115 ma.

Note 8: With dc plate voltage of 2250 volts, dc grid-No.2 voltage of 700 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 5 ma.

SPECIAL TESTS & PERFORMANCE DATA

Resonances in the tube mountings used in the following tests can cause the specified environmental conditions to produce greatly amplified effects. Extreme care must, therefore, be used in the design of the mountings to minimize resonance. Design details of mountings used by the RCA Electron Tube Division to perform these tests may be obtained from RCA Commercial Engineering, Harrison, New Jersey, on request.

→ Indicates a change.

50-g, 11-Millisecond Shock Test:

This test is performed on sample lots of tubes to determine the ability of the tube to withstand the specified long-duration impact acceleration. Tubes are held rigid in six different positions in a Medium-Impact Shock Machine and are subjected to three blows in each position. At the end of this test, tubes are required to meet the limits for items 1, 3, 5, 8, 9, and 10 under *Characteristics Range Values for Equipment Design.*

500-g, Nominal 3/4-Millisecond Shock Test:

This test is performed on sample lots of tubes to determine the ability of the tube to withstand the specified impact acceleration. Tubes are held rigid in four different positions in a High-Impact Shock Machine and are subjected to five blows in each position. At the end of this test, tubes are required to meet the limits for items 1, 3, 5, 8, 9, and 10 under *Characteristics Range Values for Equipment Design.*

5-to-2000 cps Vibration Test:

This test is performed on sample lots of tubes to determine the ability of the tube to withstand variable-frequency vibration. With heater voltage of 6.3 volts ac or dc, dc plate supply voltage of 300 volts, dc grid-No.2 voltage of 250 volts, grid-No.1 voltage adjusted to give dc plate current of 10 ma., and plate load resistor of 2000 ohms. The tube is vibrated along each of three mutually perpendicular axes over an 8-minute sweep consisting of:

a. 5-to-10 cps with fixed double amplitude of 0.08 inch ± 10%.

b. 10-to-15 cps at fixed acceleration of 0.41 g ± 10%.

c. 15-to-75 cps with fixed double amplitude of 0.036 inch ± 10%.

d. 75-to-2000 cps at fixed acceleration of 10 g ± 10%.

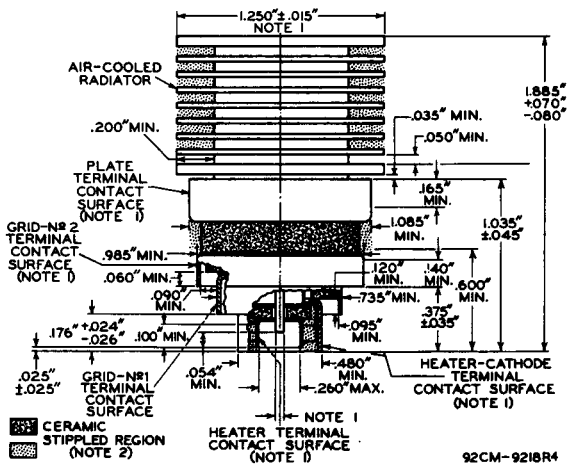
During the above vibration tests, tubes will not show an rms output voltage in excess of 15 volts across the plate load resistor in the 5-to-2000 cps range. At the end of this test, tubes are required to meet the limits for items 1, 3, 5, 8, 9, and 10 under *Characteristics Range Values for Equipment Design.*

OPERATING CONSIDERATIONS

A suggested *mounting arrangement* for the 7649 is shown in the accompanying drawing along with a layout of the associated contacts. Flexible connectors are required for the plate, grid-No.2, grid-No.1, cathode, and heater contact surfaces.

During standby periods in intermittent operation, it is recommended that the heater voltage be maintained at normal operating value when the period is less than 15 minutes, and that it be reduced to 80 per cent of normal when the period is between 15 minutes and 2 hours. For longer periods, the heater voltage should be turned off.

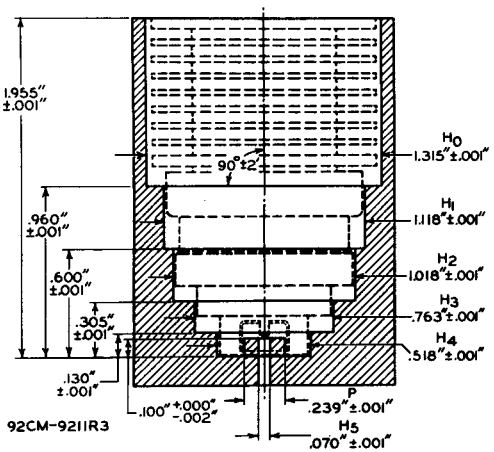
The maximum-rated plate and grid-No.2 voltages of this tube are extremely dangerous. Great care should be taken during the adjustment of circuits. The tube and its associated apparatus, especially all parts which may be at high potential above ground, should be housed in a protective enclosure. The protective housing should be designed with interlocks so that personnel can not possibly come in contact with any high-potential point in the electrical system. The interlock devices should function to break the primary circuit of the high-voltage supplies when any gate or door on the protective housing is opened, and should prevent the closing of the primary circuit until the door is again locked.



NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE PLATE TERMINAL, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, HEATER-CATHODE TERMINAL, AND HEATER TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. THE TUBE IS PROPERLY SEATED IN THE GAUGE WHEN A 0.010"-THICKNESS GAUGE 1/8" WIDE WILL NOT ENTER BETWEEN THE HEATER-CATHODE TERMINAL AND THE BOTTOM SURFACE OF H_4. THE GAUGE IS PROVIDED WITH A SLOT TO PERMIT MAKING MEASUREMENT OF SEATING OF HEATER-CATHODE TERMINAL ON BOTTOM OF HOLE H_4.

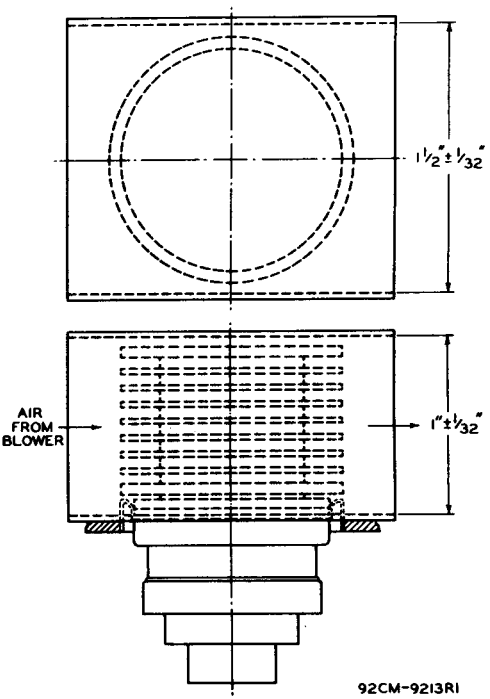
NOTE 2: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

SKETCH G_1

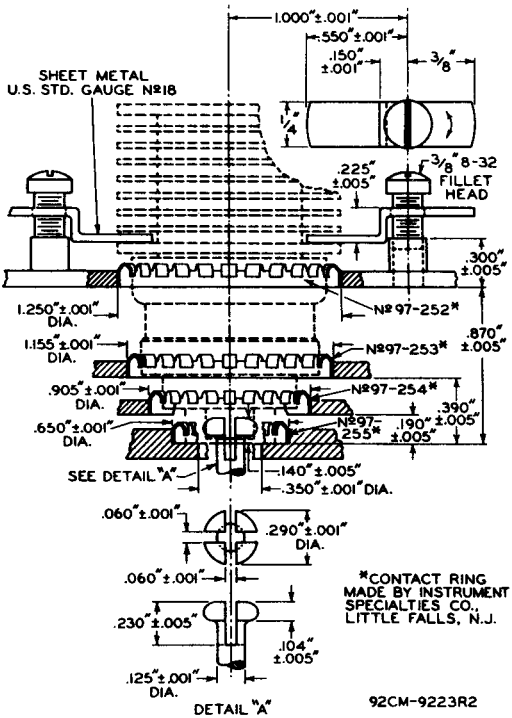


THE AXES OF THE CYLINDRICAL HOLES H_0 THROUGH H_5 AND THE AXES OF POST P ARE COINCIDENT WITHIN 0.001".

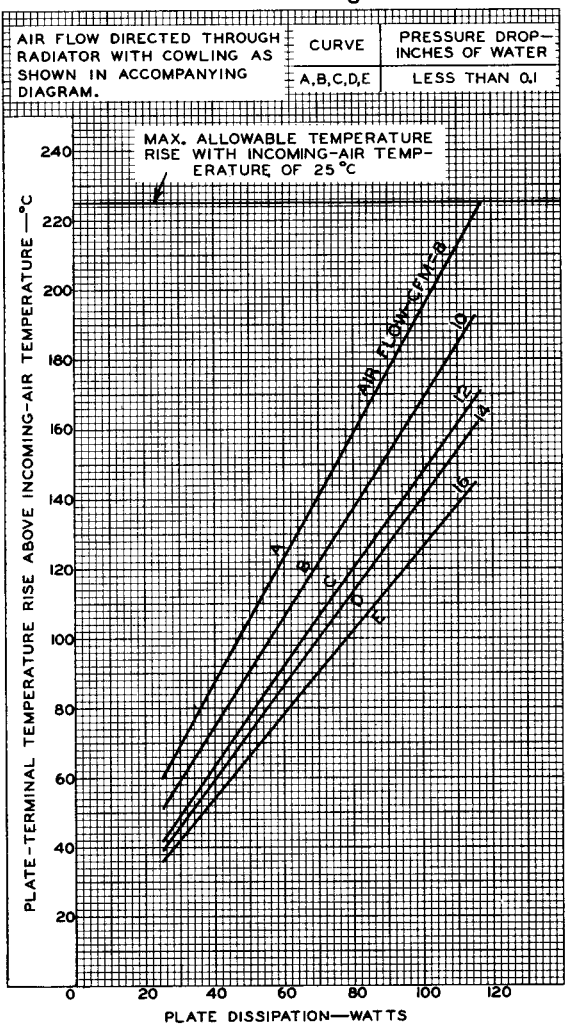
RECOMMENDED COWLING FOR DIRECTING AIR FLOW THROUGH RADIATOR



SUGGESTED MOUNTING ARRANGEMENT & LAYOUT OF ASSOCIATED CONTACTS

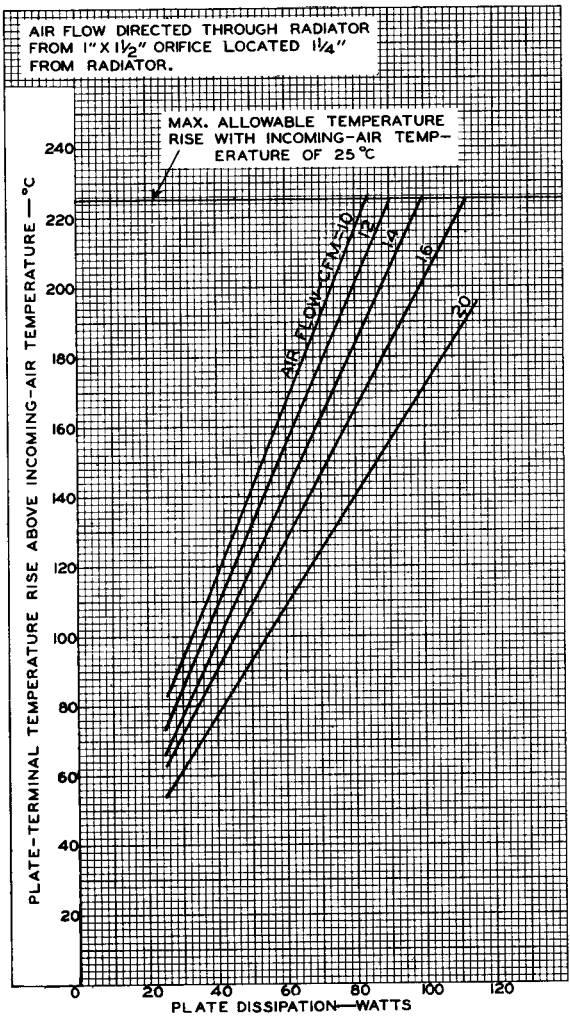


TYPICAL COOLING REQUIREMENTS
With Cowling



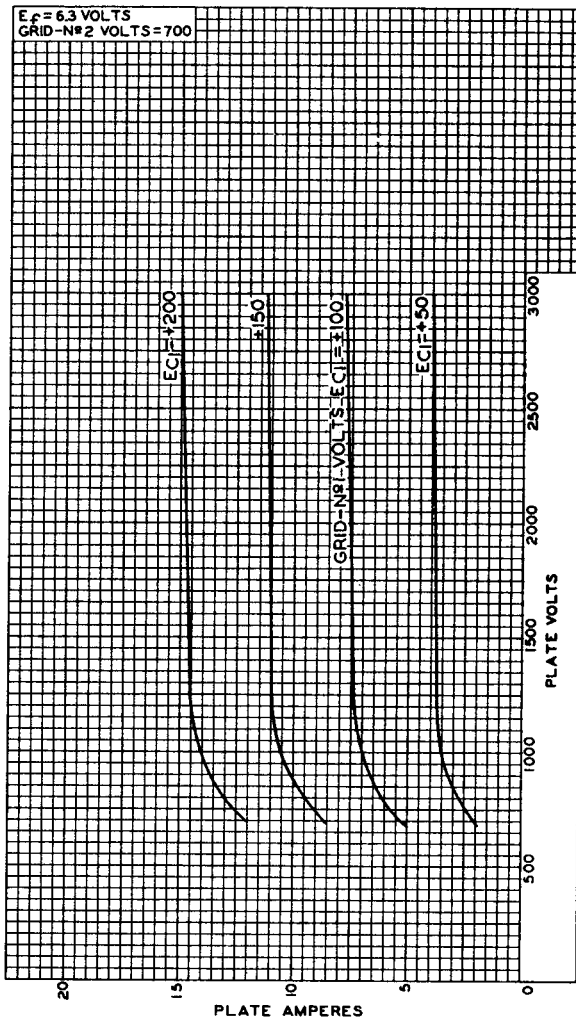
92CM-9219RI

TYPICAL COOLING REQUIREMENTS
Without Cowling



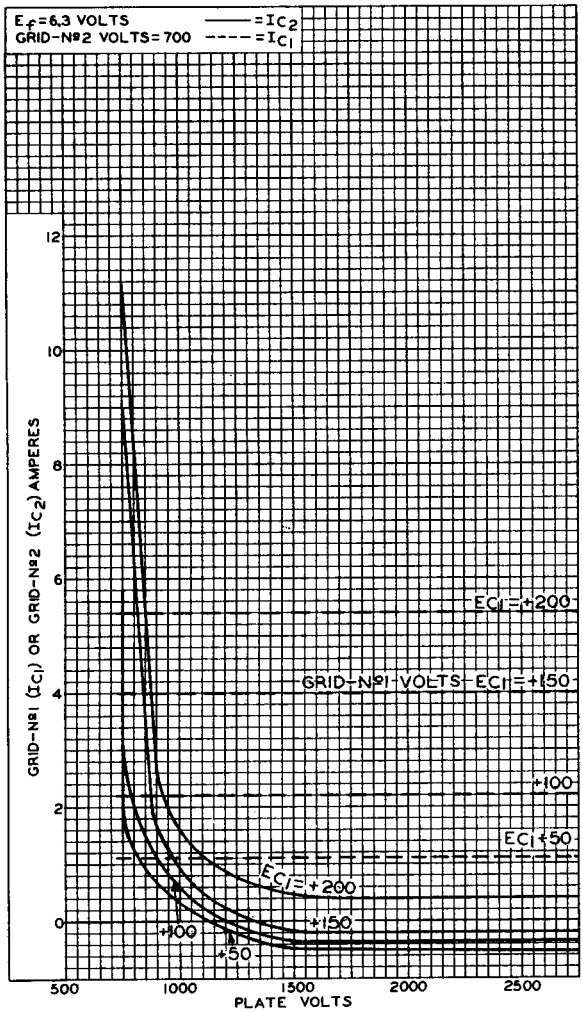
92CM-9220RI

TYPICAL PLATE CHARACTERISTICS



92CM-10649R1

TYPICAL CHARACTERISTICS



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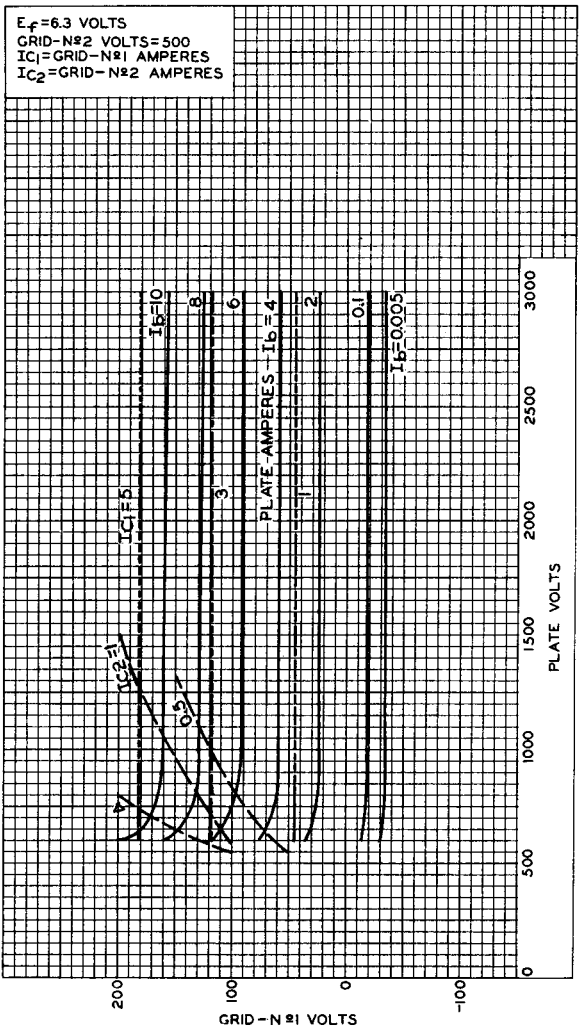
TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-10650

TYPICAL CONSTANT-CURRENT CHARACTERISTICS