7651

Beam Power Tube

CERAMIC-METAL SEALS — COAXIAL-ELECTRODE STRUCTURE
"ONE-PIECE" ELECTRODE DESIGN — INTEGRAL RADIATOR
FORCED-AIR COOLED — 27-KW PEAK-PULSE POWER INPUT UP TO 1215 Mc
MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

For Use under Severe Shock and Vibration

GENERAL DATA

Electrical:

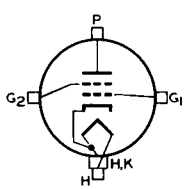
Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at heater volts = 6.3	7.5	amp
Minimum heating time	120	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 225, grid-No.2 volts = 225, and plate ma. = 100.	13	
Direct Interelectrode Capacitances:[a]		
Grid No.1 to plate	0.13 max.	μμf
Grid No.1 to cathode & heater	29	μμf
Plate to cathode & heater	0.01 max.	μμf
Grid No.1 to grid No.2	38	μμf
Grid No.2 to plate	6.5	μμf
Grid No.2 to cathode & heater	0.8 max.	μμf

Mechanical:

Operating Position	Any
Overall Length	2.34" ± 0.06"
Greatest Diameter (See *Dimensional Outline*)	2.06" ± 0.03"
Weight (Approx.)	3/4 lb
Radiator	Integral part of tube

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:

Air flow may be removed simultaneously with all voltages.

Through radiator—Adequate air flow to limit the plate-core temperature to 250° C should be delivered by a blower through the radiator during the application of heater, plate, grid-No.2, and grid-No.1 voltages. Typical values of air flow directed through the radiator to maintain the

plate core (See *Dimensional Outline*) at 250° C with an incoming air temperature of 25° C and with no restrictions at the plate-contact flange are:

Plate Dissipation (watts)	Air Flow (cubic ft/min)	Static Pressure (inches of water)
100	2	0.04
300	4	0.14
600	11	0.66

To Grid-No.2, Grid-No.1, Cathode, and Heater Terminals— A sufficient quantity of air should be directed at the heater terminal and allowed to flow past each of these terminals so that no terminal temperature exceeds the specified maximum value of 250° C. An air flow of 2.5 cfm is usually adequate. Forced-air cooling of heater and cathode terminals is usually required during standby (heater only) operation.

Plate-Core Temperature	250 max.	°C
Terminal Temperature (Plate, Grid No.2, Grid No.1, Cathode, and Heater)	250 max.	°C

GRID-PULSED RF AMPLIFIER and GRID-AND-SCREEN-PULSED RF AMPLIFIER

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

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

	Up to 1215 Mc	
→ DC PLATE VOLTAGE	5000 max.	volts
DC GRID-No.2 VOLTAGE	1200 max.	volts
DC GRID-No.1 VOLTAGE	−250 max.	volts
DC PLATE CURRENT DURING PULSE	9 max.	amp
DC PLATE CURRENT	0.5 max.	amp
GRID-No.2 INPUT (Average)	25 max.	watts
GRID-No.1 INPUT (Average)	10 max.	watts
PLATE DISSIPATION (Average)	600 max.	watts

Typical Operation:

In grid-pulsed cathode-drive[d] circuit with rectangular-wave pulse at 1215 Mc and with duty factor[e] of 0.01

DC Plate Voltage	3600	4000	volts
→ Peak-Positive Grid-No.2 Voltage	800	1000	volts
DC Grid-No.1 Voltage	−100	−120	volts
DC Plate Current during pulse	8	9	amp
DC Plate Current	0.19	0.2	amp
DC Grid-No.2 Current	0.005	0.006	amp
DC Grid-No.1 Current	0.02	0.02	amp
Output-Circuit Efficiency (Approx.)	80	80	%
Driver Power Output at peak of pulse (Approx.)[f]	5.2	6.3	kw
Useful Power Output at peak of pulse (Approx.)	15[g]	20[g]	kw

→ Indicates a change.

In grid-and-screen-pulsed cathode-drive[d] circuit with rectangular-wave pulses at 1215 Mc with duty factor[e] of 0.01

DC Plate Voltage	3600	4000	volts
Peak Positive-Pulse Grid-No.2 Voltage	800	1000	volts
DC Grid-No.1 Voltage	0	0	volts
DC Plate Current during pulse	8	9	amp
DC Plate Current	0.145	0.165	amp
DC Grid-No.2 Current	0.003	0.006	amp
DC Grid-No.1 Current	0.017	0.017	amp
Output-Circuit Efficiency (Approx.)	80	80	%
Driver Power Output at peak of pulse (Approx.)[f]	2.4	2.9	kw
Useful Power Output at peak of pulse (Approx.)	11[g]	15[g]	kw

PLATE-AND-SCREEN-PULSED RF AMPLIFIER

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

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

	Up to 1215 Mc	
PEAK POSITIVE-PULSE PLATE VOLTAGE	8000 max.	volts
PEAK POSITIVE-PULSE GRID-No.2 VOLTAGE	1200 max.	volts
DC GRID-No.1 VOLTAGE	-250 max.	volts
DC PLATE CURRENT DURING PULSE	9 max.	amp
DC PLATE CURRENT	0.12 max.	amp
GRID-No.2 INPUT (Average)	25 max.	watts
GRID-No.1 INPUT (Average)	10 max.	watts
PLATE DISSIPATION (Average)	600 max.	watts

Typical Operation:

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

Peak Positive-Pulse Plate Voltage	7200	8000	7200	8000	volts
Peak Positive-Pulse Grid-No.2 Voltage	800	1000	800	1000	volts
DC Grid-No.1 Voltage	0	0	-75	-80	volts
DC Plate Current during pulse	8	9	8	9	amp
DC Plate Current	0.09	0.1	0.09	0.1	amp
DC Grid-No.2 Current	0.003	0.008	0.003	0.004	amp
DC Grid-No.1 Current	0.015	0.016	0.019	0.02	amp
Output-Circuit Efficiency (Approx.)	80	80	80	80	%
Driver Power Output at peak of pulse (Approx.)[f]	1.8	2.2	4.5	5.3	kw
Useful Power Output at peak of pulse (Approx.)	22[g]	28[g]	30[g]	39[g]	kw

[a] Measured with special shield adapter.

[b] Continuous Commercial Service.

[c] *"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.

d Cathode is at dc ground potential.

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

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

g This value of useful power is measured in load of output circuit.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current.	1	6.9	8.3	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate.	2	–	0.13	μμf
Grid No.1 to cathode & heater . .	2	26	32	μμf
Plate to cathode & heater	2	–	0.01	μμf
Grid No.1 to grid No.2.	2	35	42	μμf
Grid No.2 to plate.	2	5.5	7.5	μμf
Grid No.2 to cathode & heater . .	2	–	0.8	μμf
Reverse Grid-No.1 Current	1,3	–	-50	μa
Peak Emission Voltage	1,4	–	850	volts
Interelectrode Leakage Resistance .	5	8	–	megohms
→ Grid-No.1 Cutoff Voltage.	1,6	–	-170	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 2500 volts, dc grid-No.2 voltage of 400 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 240 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 80 amperes is obtained. After 1 minute at this value, the voltage-pulse amplitude will not exceed 850 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 8 megohms.

Note 6: With dc plate voltage of 2500 volts, dc grid-No.2 voltage of 400 volts, and a 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 resonances. Design details of mountings used by the RCA Electron Tube Division to perform these tests may be obtained from RCA Commercial Engineering, Harrison, N. J., 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 will not show permanent or temporary shorts or open circuits.

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 will not show permanent or temporary shorts or open circuits.

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 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 cycle 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-105 cps with fixed double amplitude of 0.036 inch ± 10%.

d. 105-to-2000 cps at fixed acceleration of 20 g ± 10%.

At the end of this test, tubes will not show permanent or temporary shorts or open circuits.

OPERATING CONSIDERATIONS

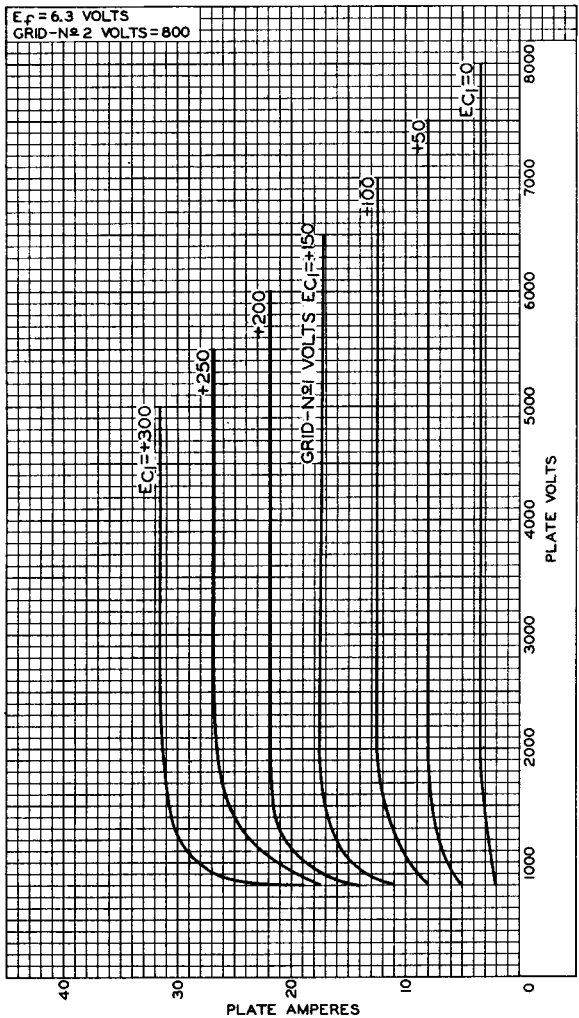
A suggested *mounting arrangement* for the 7651 is shown in the accompanying drawing along with a layout of the associated contacts. Flexible connectors are required for the plate, grid-No.2, grid-No.1, cathode, and heater contact surfaces.

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.

← Indicates a change.

DIMENSIONAL OUTLINE,
GAUGE DRAWING, and
SUGGESTED MOUNTING ARRANGEMENT
& LAYOUT OF ASSOCIATED CONTACTS
shown under Type 7650 also apply to the 7651

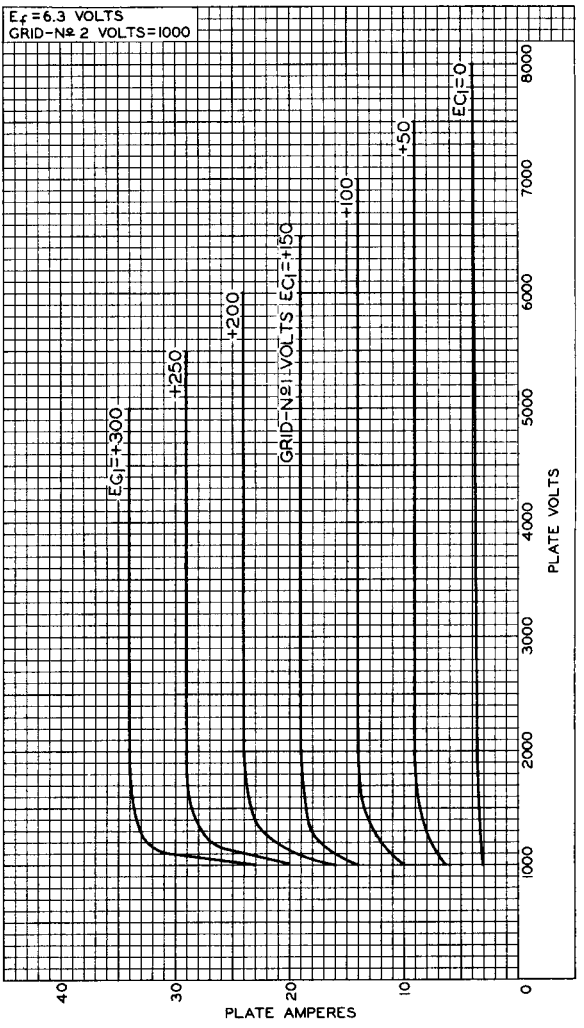
TYPICAL PLATE CHARACTERISTICS



92CM-10492

7651

TYPICAL PLATE CHARACTERISTICS



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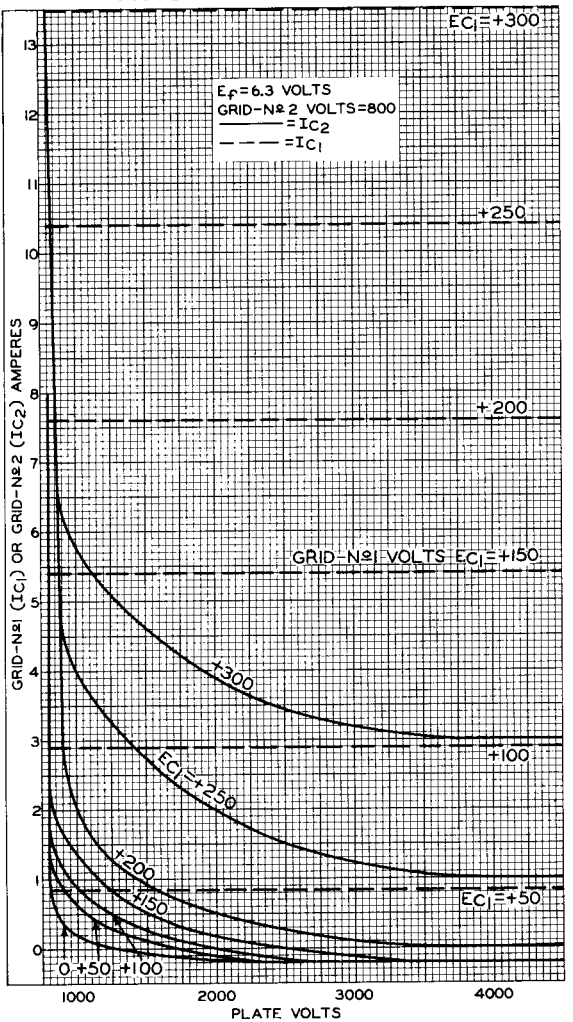
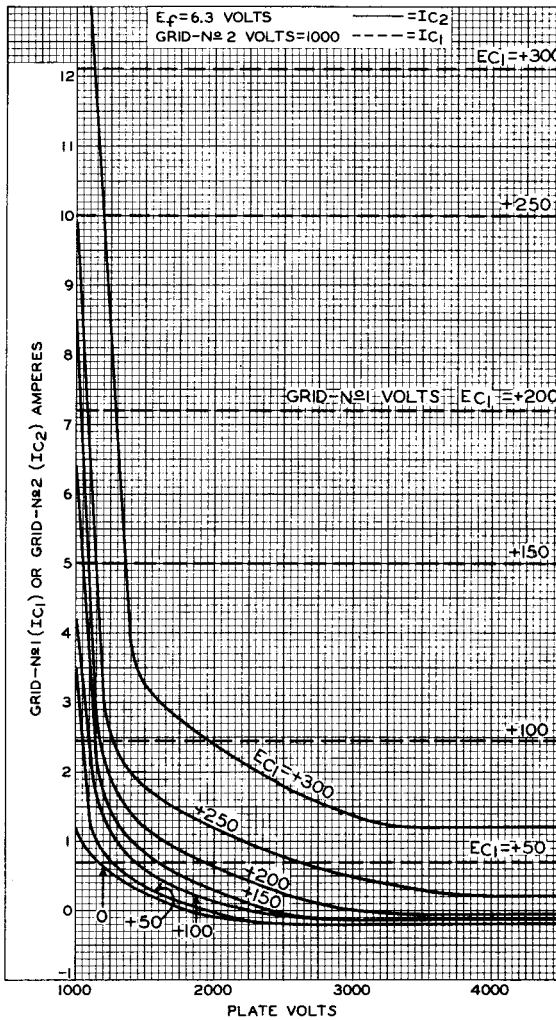
TYPICAL CHARACTERISTICS



92CM-10502

TYPICAL CHARACTERISTICS



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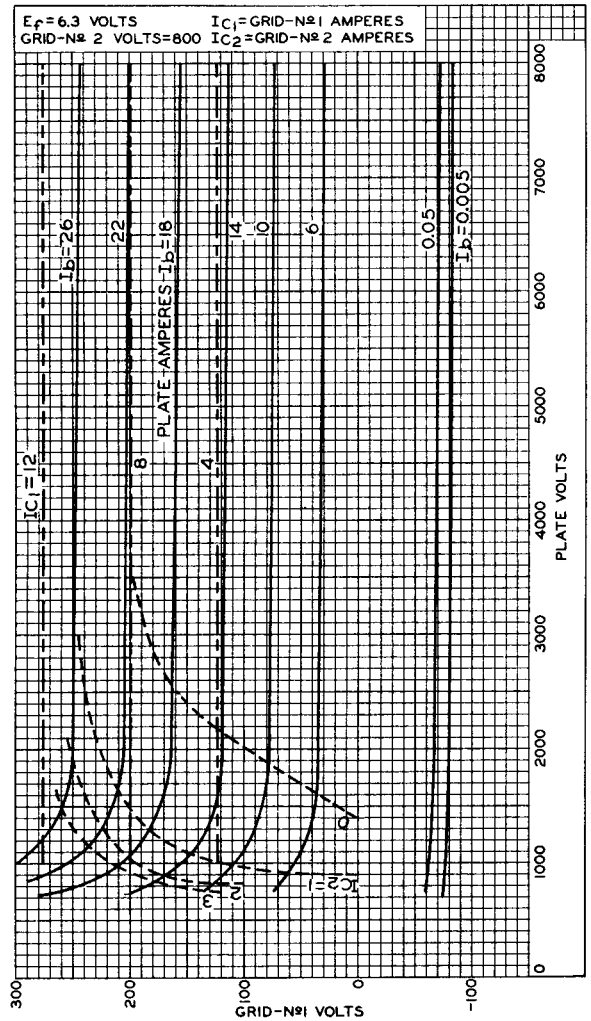
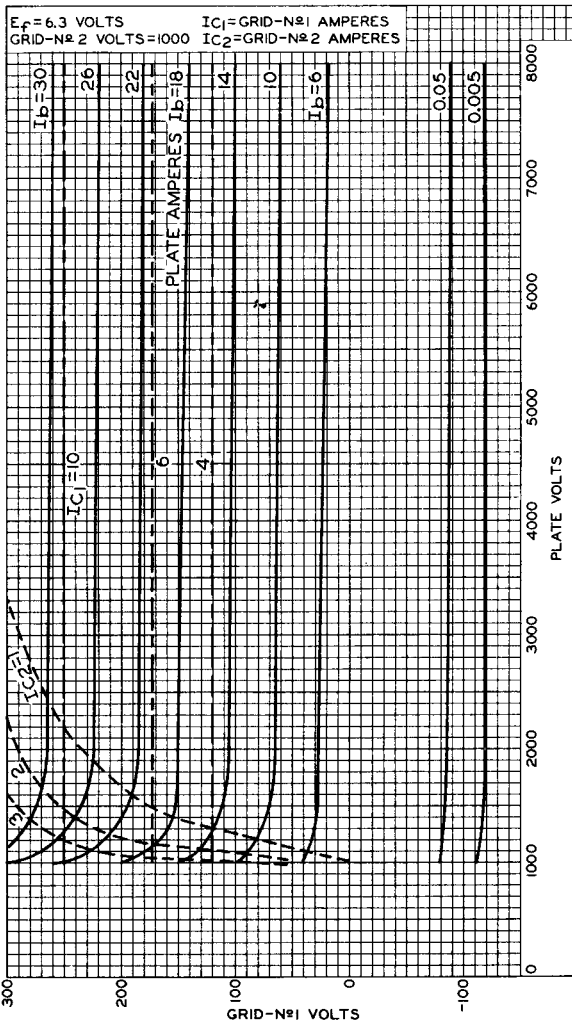
TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-10490R1

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



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