7214

Beam Power Tube

CERAMIC METAL SEALS — COAXIAL-ELECTRODE STRUCTURE
UNITIZED-ELECTRODE DESIGN — INTEGRAL RADIATOR
FORCED-AIR COOLED — 180 KW PEAK-PULSE POWER
MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

For Pulsed RF Amplifier Service with Full Ratings at Frequencies up to 1215 Mc

GENERAL DATA

Electrical:

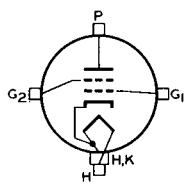
Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode:		
Voltage (AC or DC)[a]	5.5 typical 6 max.	volts volts
Current at heater volts = 5.5	17.3	amp
Minimum heating time at heater volts = 5.5.	5	minutes
Mu-Factor, Grid-No.2 to Grid No.1 for plate volts = 2500, grid-No.2 volts = 600, and plate ma. = 600.	19	
Direct Interelectrode Capacitances:		
Grid No.1 to plate[b]	0.17 max.	μμf
Grid No.1 to cathode & heater	42	μμf
Plate to cathode & heater[b,c]	0.017 max.	μμf
Grid No.1 to grid No.2.	55	μμf
Grid No.2 to plate.	16	μμf
Grid No.2 to cathode & heater[c]	1.4 max.	μμf

Mechanical:

Operating Position	Any
Overall Length	3.24" ± 0.10"
Greatest Diameter (See *Dimensional Outline*)	3.72" ± 0.03"
Weight (Approx.)	2 lbs
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

← Indicates a change.

Thermal:

Air Flow:

Through radiator—Adequate air flow to limit the plate seal temperature to 250° C should be delivered by a blower through the radiator before and during the application of heater, plate, grid-No.2, and grid-No.1 voltages. Typical values of air flow directed through the radiator versus percentage of maximum rated plate dissipation for each class of service are shown in accompanying *Typical Cooling-Requirements* curves. Plate power, grid-No.2 power, heater power, and air flow may be removed simultaneously.

To grid-No.2, grid-No.1, cathode, and heater seals—A sufficient quantity of air should be directed at the heater terminal and allowed to flow past each of these seals so that its temperature does not exceed the specified maximum value of 250° C. An air flow of 10 cfm is usually adequate.

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

GRID-PULSED RF AMPLIFIER

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

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

	Up to 1215 Mc	
DC PLATE VOLTAGE	5000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1200 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300 max.	volts
DC PLATE CURRENT DURING PULSE	18 max.	amp
DC PLATE CURRENT	0.2 max.	amp
GRID-No.2 INPUT (Average)	50 max.	watts
GRID-No.1 INPUT (Average)	30 max.	watts
PLATE DISSIPATION (Average)	1500 max.	watts

Typical Operation:

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

DC Plate Voltage	4500	volts
DC Grid-No.2 Voltage	1000	volts
DC Grid-No.1 Voltage	-80	volts
DC Plate Current during pulse	11	amp
DC Plate Current	0.11	amp
DC Grid-No.2 Current	0.005	amp
DC Grid-No.1 Current	0.01	amp
Driver Power Output at peak of pulse (Approx.)[g]	4.5	kw
Useful Power Output at peak of pulse (Approx.)	20	kw

PLATE- AND SCREEN-PULSED RF AMPLIFIER

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

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

	Up to 1215 Mc	
PEAK POSITIVE-PULSE PLATE VOLTAGE	10000 max.	volts
PEAK POSITIVE-PULSE GRID-No.2 (SCREEN-GRID) VOLTAGE	1200 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300 max.	volts
DC PLATE CURRENT DURING PULSE	18 max.	amp
DC PLATE CURRENT	0.2 max.	amp
GRID-No.2 INPUT (Average)	50 max.	watts
GRID-No.1 INPUT (Average)	30 max.	watts
PLATE DISSIPATION (Average)	1500 max.	watts

Typical Operation:

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

Peak Positive-Pulse Plate Voltage	9000	10000	volts
Peak Positive-Pulse Grid-No.2 Voltage	1000	1000	volts
DC Grid-No.1 Voltage	-80	-80	volts
DC Plate Current during pulse	16	18	amp
DC Plate Current	0.16	0.18	amp
DC Grid-No.2 Current	0.008	0.009	amp
DC Grid-No.1 Current	0.014	0.016	amp
Driver Power Output at peak of pulse (Approx.)[g]	10	11	kw
Useful Power Output at peak of pulse (Approx.)	50	65	kw

[a] Because the cathode is subjected to considerable back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should be reduced depending on operating conditions and frequency to prevent overheating the cathode and resultant short life.

[b] With external, flat, metal shield having diameter of 8", and center hole approximately 3" in diameter provided with spring fingers that connect the shield to grid-No.2 terminal. Shield is located in plane of grid-No.2 terminal perpendicular to the tube axis.

[c] With external, flat, metal shield having diameter of 8", and center hole approximately 2-3/8" in diameter provided with spring fingers that connect the shield to grid-No.1 terminal. Shield is located in plane of grid-No.1 termmnal perpendicular to the tube axis.

[d] Continuous Commercial Service.

[e] *"On" time* is defined as the sum of the durations of the individual pulses which occur during any 1000-microsecond interval.

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.

[f] *Duty factor* for the 7214 is defined as the "on" time in microseconds divided by 1000 microseconds.

[g] The driver stage is required to supply tube losses, rf-circuit losses, and in cathode-drive circuits, the rf power added to the plate input. The driver stage should be designed to provide an excess of power above the indicated value to take care of variations in line voltage, in components, in initial tube characteristics, and in tube characteristics during life.

SPECIAL TESTS & PERFORMANCE DATA

Design samples of the 7214 have been subjected to the following tests without adverse effects.

Variable-Frequency Vibration Performance:

This test was performed (per MIL-E-1D[h], paragraph 4.9.20.3) under the following conditions: Heater voltage of 5.5 volts, plate supply voltage of 450 volts, grid-No.2 voltage of 300 volts, grid-No.1 voltage varied to give a plate current of 10 milliamperes, and plate load resistor of 2000 ohms. The tubes were vibrated in each of 3 positions through frequency range from 10 to 50 cycles per second and back to 10 cycles per second. The vibrating frequency had a fixed amplitude of 0.040 inch (total excursion of 0.080 inch). During the test, the tubes did not show an rms output voltage across the plate load resistor in excess of 500 millivolts.

At the end of this test, the tubes did not show tap or permanent interelectrode shorts or defects that would cause the tubes to be inoperable. The tubes exhibited no pronounced mechanical resonance during this test.

Fatigue Test:

In this test (per MIL-E-1D, paragraph 4.9.20.6), the tubes were rigidly mounted and subjected to 2.5 g vibrational acceleration at 25 cycles per second for 32 hours in each of three positions with 5.5 volts applied to the heater. At the end of this test, the tubes did not show permanent or temporary shorts or open circuits, and passed all electrical tests.

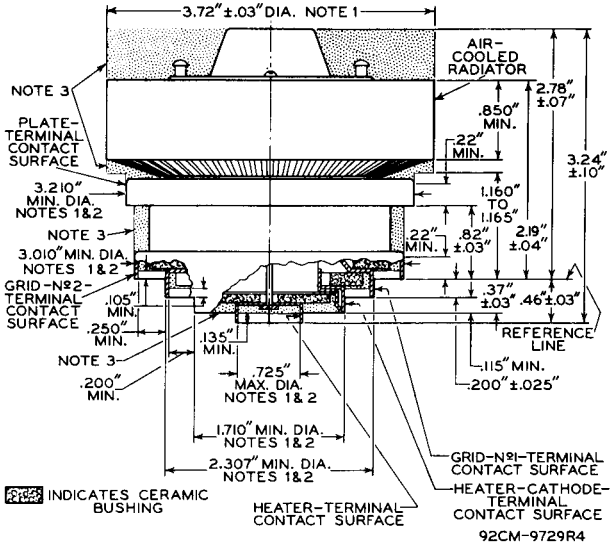
OPERATING CONSIDERATIONS

The *maximum seal temperature* of 250° C is a tube rating and is to be observed in the same manner as other ratings. The temperature may be measured with temperature-sensitive paint, such as Tempilaq. The latter is made by the Tempil Corporation, 132 W. 22nd Street, New York 11, New York in the form of liquid and stick.

The rated plate and grid-No.2 voltages of this tube are extremely dangerous to the user. 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.

[h] 31 March 1958, Military Specification, Electron Tubes and Crystal Rectifiers.

→ indicates a change.

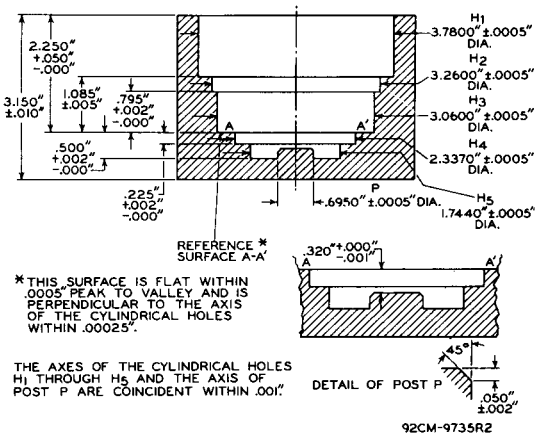


NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE RADIATOR BAND, PLATE TERMINAL, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, HEATER-CATHODE TERMINAL, AND HEATER TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. PROPER ENTRY OF THE TUBE IS OBTAINED WHEN THE GRID-No.2 TERMINAL IS SEATED ON THE SHOULDER A-A'. THE TUBE IS PROPERLY SEATED ON THE SHOULDER WHEN A 0.010"-THICKNESS GAUGE 1/8" WIDE WILL NOT ENTER MORE THAN 1/16" BETWEEN THE SHOULDER SURFACE AND THE GRID-No.2 TERMINAL. THE GAUGE IS PROVIDED WITH SLOTS TO PERMIT MAKING MEASUREMENT OF SEATING OF GRID-No.2 TERMINAL ON SHOULDER A-A'.

NOTE 2: THE DIAMETER OF EACH TERMINAL IS HELD TO INDICATED VALUES ONLY OVER THE INDICATED MINIMUM LENGTH OF ITS CONTACT SURFACE.

NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

GAUGE SKETCH G_1



*THIS SURFACE IS FLAT WITHIN .0005" PEAK TO VALLEY AND IS PERPENDICULAR TO THE AXIS OF THE CYLINDRICAL HOLES WITHIN .00025".

THE AXES OF THE CYLINDRICAL HOLES H_1 THROUGH H_5 AND THE AXIS OF POST P ARE COINCIDENT WITHIN .001".

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RCA

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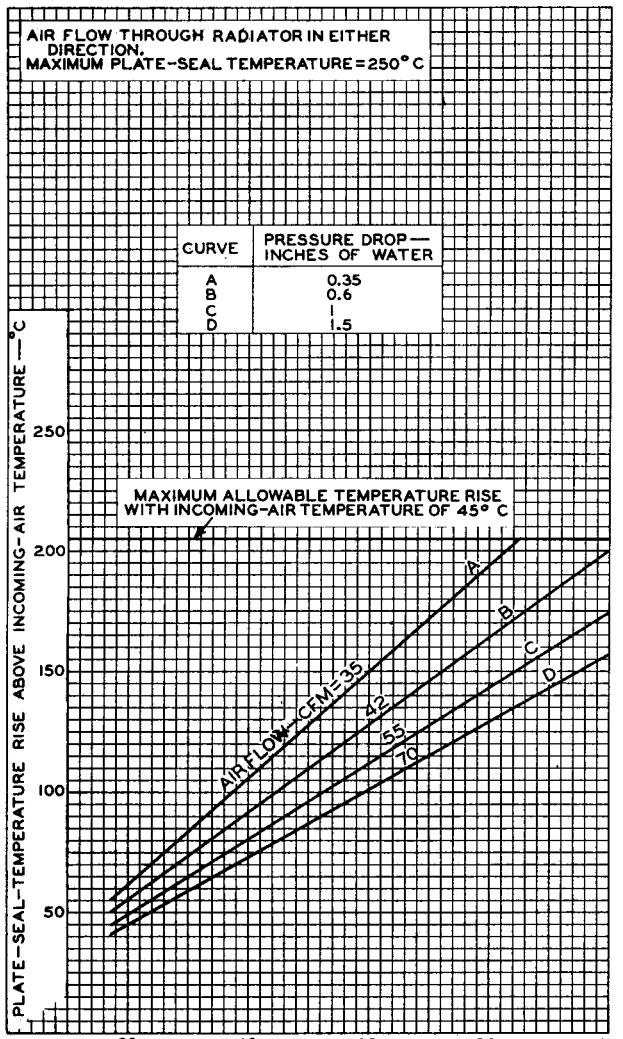
TYPICAL COOLING REQUIREMENTS



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92CM-9737

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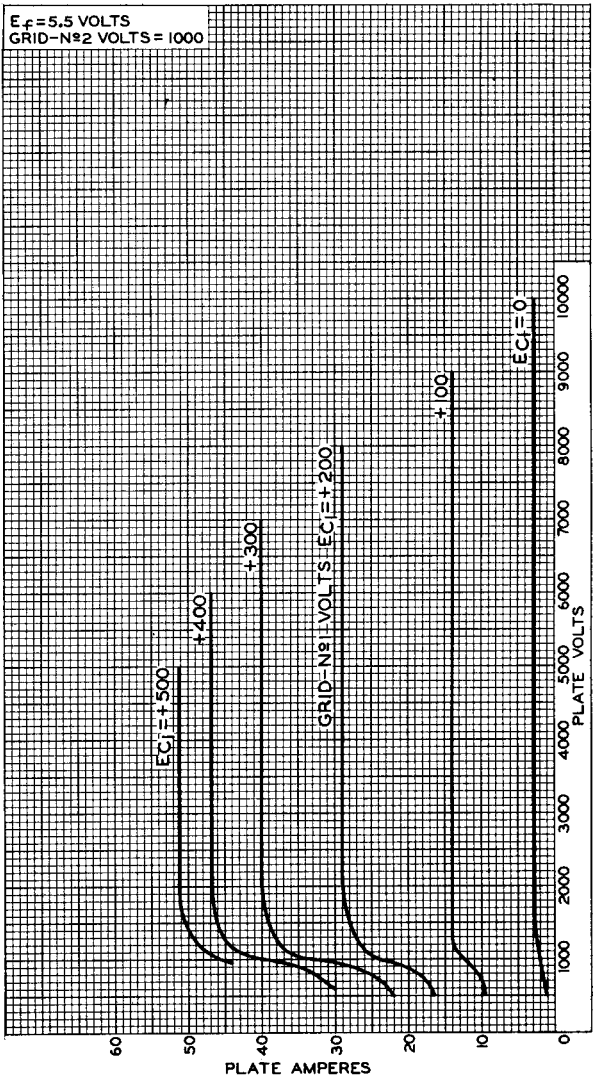
TYPICAL PLATE CHARACTERISTICS



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92CM-10186

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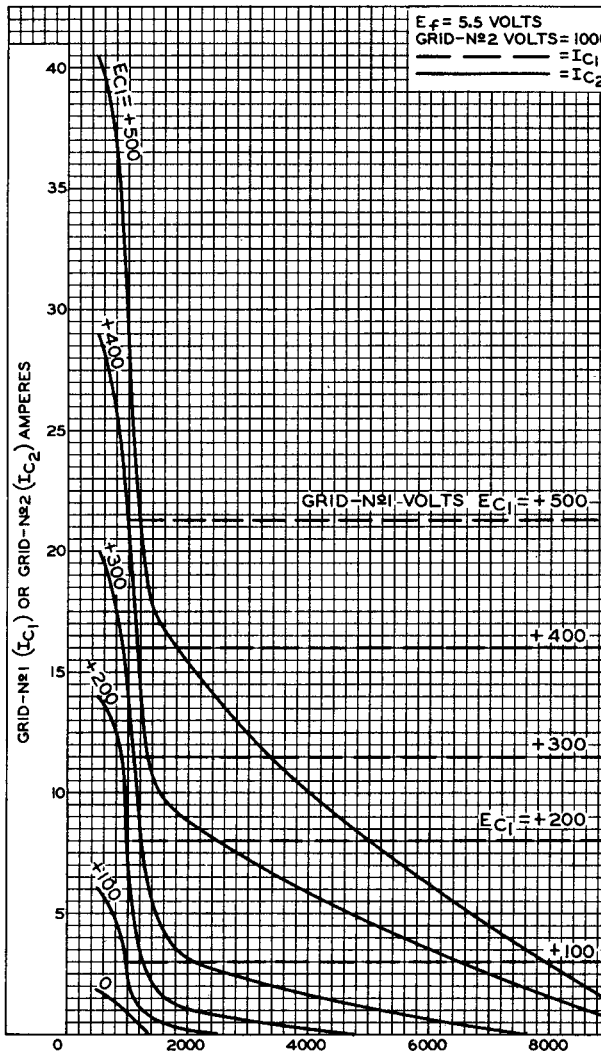
TYPICAL CHARACTERISTICS



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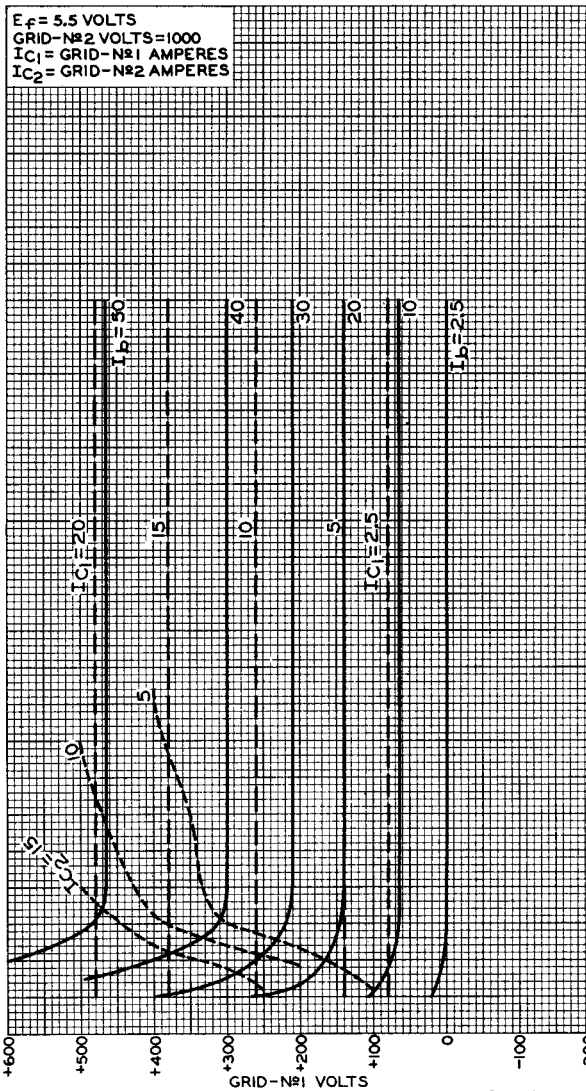
TYPICAL CONSTANT-CURRENT CHARACTERISTICS



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