

Magnetron

TUNABLE TYPE

FORCED-AIR COOLED INTEGRAL MAGNET

For Pulsed-Oscillator Applications at
Frequencies between 8500 and 9600 Mc

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	13.75 $\pm$ 10%	volts
Current at heater volts = 13.75	3.15	amp
Starting current	Must never exceed 12 amperes, even momentarily	
Minimum Cathode Heating Time	2.5	minutes
Frequency	8500 to 9600	Mc
Maximum Frequency Pulling at VSWR of 1.5	15	Mc

Mechanical:

Operating Position Any

Dimensions See *Dimensional Outline*

Air Flow:

To Fins--An air stream should be directed along the cooling fins toward the body of the tube. Adequate flow should be provided so that the temperature of the anode block does not exceed 150° C.

To Heater-Cathode Terminal--Adequate flow should be provided to maintain the temperature of the heater-cathode terminal below 165° C.

Waveguide Output Flange Mates with Modified JAN UG-52A/U Flange

Heater & Heater-Cathode Connector
with built-in capacitor Jettron No. 9000-C^a,
or Ucinite No. 115364^b

Tuning Shaft with Associated Calibrated Indicator:

Revolutions (Approx.) to cover full range of 8500 to 9600 Mc 8-1/2

Maximum torque (Absolute) at tuning-range stops 200 oz-in.

Typical torque between -55° and +150° C (Approx.) 50 oz-in.

Weight (Approx.) 12 lbs

PULSED OSCILLATOR

Maximum and Minimum Ratings, Absolute-Maximum Values:

For duty factor up to 0.0011 maximum

PEAK ANODE VOLTAGE	23 max.	kv
PEAK ANODE CURRENT	27.5 max.	amp
PEAK POWER INPUT ^c	630 max.	kw
AVERAGE POWER INPUT	0.63 max.	kw
PULSE DURATION	2.6 max.	μ sec



RATE OF RISE OF VOLTAGE PULSE	{ 200 max.	kv/ μ sec
	{ 70 min.	kv/ μ sec
ANODE-BLOCK TEMPERATURE	150 max.	$^{\circ}$ C
HEATER-CATHODE-TERMINAL TEMPERATURE . .	165 max.	$^{\circ}$ C
LOAD-VOLTAGE STANDING-WAVE RATIO. . . .	1.5 max.	

Typical Operation:^d

With load-voltage standing-wave ratio equal to or less than 1.05, except as noted, and with duty factor of 0.001

Heater Voltage.	See <i>Operating Considerations</i>		
Peak Anode Voltage.	22	22	kv
Peak Anode Current.	27.5	27.5	amp
Pulse-Repetition Rate	400	4000	pps
Pulse Duration.	2.5	0.25	μ sec
RF Bandwidth with worst phasing of 1.5 VSWR	0.5	5	Mc
Side Lobes with worst phasing of 1.5 VSWR	8	10	db
Pulling Figure at VSWR of 1.5 . .	10	10	Mc
Pushing Figure.	0.2	0.2	Mc/amp
Thermal Factor for any 30 $^{\circ}$ range of anode-block temperature between -55 $^{\circ}$ C and 150 $^{\circ}$ C . . .	0.2	0.2	Mc/ $^{\circ}$ C
Servo-Drive-Shaft Torque.	6	6	oz-in.
Frequency Deviation due to tuning backlash	8	8	Mc
Peak Power Output (Approx.) . . .	230	230	kw

^a Manufactured by Jettron Products, Hanover, New Jersey.

^b Manufactured by Ucinite Division of United-Carr Fastener Corporation, Newtonville 60, Massachusetts.

^c For atmospheric pressure greater than 600 millimeters of mercury in the vicinity of the heater-cathode stem. Operation at pressures lower than 600 millimeters of mercury may result in arc-over across the stem with consequent damage to the tube. The waveguide must always be pressurized to a minimum of 15 psi absolute to prevent arcing, especially when there is a mismatched load. Arcing in the waveguide due to lack of pressure can damage the tube.

^d It is essential that the input circuit be designed so that if arcing occurs the energy per pulse delivered to the tube cannot greatly exceed the normal energy per pulse. To satisfy this requirement, it is recommended that pulsers of the discharging-network type be used.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current.	1	2.9	3.3	amp
Peak Anode Voltage.	2	20	23	kv
Peak Power Output	3	200	—	kw
Pulses Missing from Total	4,5	—	0.25	%

Note 1: With 13.75 volts ac or dc on heater.

Note 2: With peak anode current of 27.5 amperes. For heater voltage, see *Operating Considerations*.

Note 3: With peak anode current of 27.5 amperes corresponding to a peak anode voltage in the order of 22 kv, anode-block temperature of 115 $^{\circ}$ C approx., pulse duration of 2.5 microseconds, and maximum load-voltage standing-wave ratio equal to or less than 1.05. For heater voltage, see *Operating Considerations*.

- Note 4: Pulses are considered to be missing if the energy level at the operating frequency is less than 70 per cent of the normal value.
- Note 5: With peak anode current of 27.5 amperes corresponding to a peak anode voltage in the order of 22 kv, anode-block temperature of 1150° C approx., pulse duration of 0.25 microsecond, and load-voltage standing-wave ratio of 1.5 adjusted in phase to produce maximum instability. For heater voltage, see *Operating Considerations*.

OPERATING CONSIDERATIONS

The high voltage at which the 7111 is operated is very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltage. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

Fastening the JAN RG-51/U waveguide to the waveguide output flange of the tube is accomplished in the following manner. A JAN UG-52A/U choke flange or equivalent should be modified by drilling out the screw threads from the four mounting holes in the choke flange using a No. 15 drill. This operation will permit four size 8-32 bolts inserted through the flange mounting holes to engage the threaded waveguide output flange of the tube.

Cooling of the anode block is accomplished by directing a separate stream of clean air through each set of cooling fins toward the anode block. The two streams are provided from two 3/4"-diameter ducts placed 1/2" to 3/4" from the fins.

After the *heater voltage* is raised gradually to its rated value of 13.75 volts, allow the cathode to warm up for at least 2-1/2 minutes to make sure that the cathode reaches operating temperature. When the cathode has reached full operating temperature, high-voltage pulses, negative with respect to anode (ground), can be applied to the heater-cathode terminal. As soon as the high-voltage pulses are applied, the heater voltage (E_f) should preferably be reduced in accordance with the following formula, depending on the average power input (P_i) to the tube:

$$P_i \text{ up to 450 watts: } E_f = 13.75 \left(1 - \frac{P_i}{450} \right) \text{ volts}$$

$$P_i \text{ greater than 450 watts: } E_f = 0 \text{ volts}$$

In those cases where this type is used as replacement for the fixed-frequency type 4J50, it is permissible to apply the following formula which is specified for reducing the heater voltage on the 4J50.

$$P_i \text{ up to 100 watts: } E_f = 13.75 \text{ volts}$$

$$P_i \text{ greater than 100 watts: } E_f = 14 \left(1 - \frac{P_i}{1120} \right) \text{ volts}$$



For *standby operation*, during which the high-voltage pulses are not applied to the tube, the heater voltage should be restored to 13.75 volts.

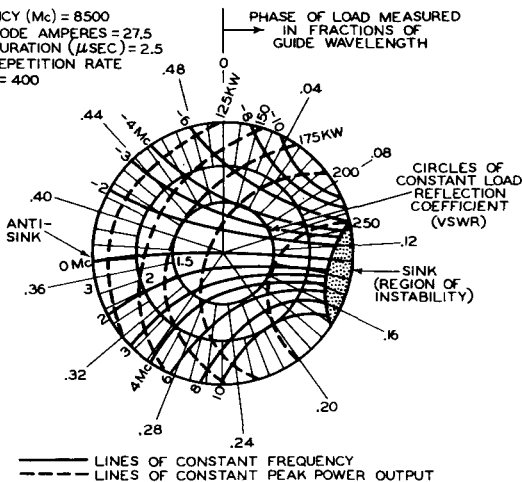
Tuning is accomplished by pushing in on the knurled tuning knob and turning it until the desired setting of the calibrated indicator is reached. Releasing the knob allows a spring to disengage it from the tuning mechanism. The design of the 7111 provides an essentially constant operating frequency without requiring a positive mechanical lock even though the tube is subjected to vibration.

For precise tuning adjustment, the final indicator setting should be approached using the same direction of rotation of the tuning shaft. There is little frequency drift after changing tuner setting.

Our engineers are ready to assist you in circuit applications of the RCA-7111. For further information, write to Commercial Engineering, RCA, Harrison, New Jersey, giving complete details as to the proposed service.

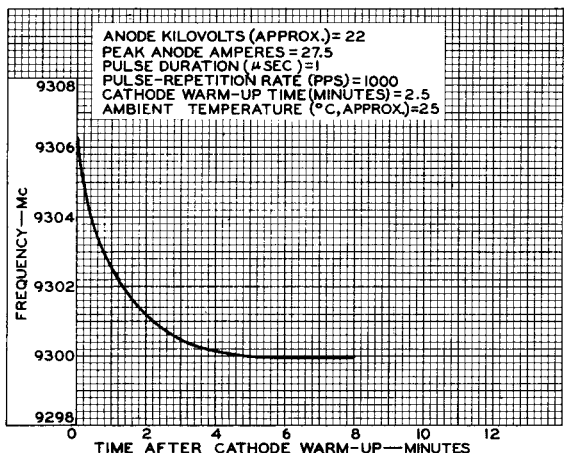
RIEKE DIAGRAM

FREQUENCY (Mc) = 8500
PEAK ANODE AMPERES = 27.5
PULSE DURATION (μ SEC) = 2.5
PULSE-REPETITION RATE
(PPS) = 400



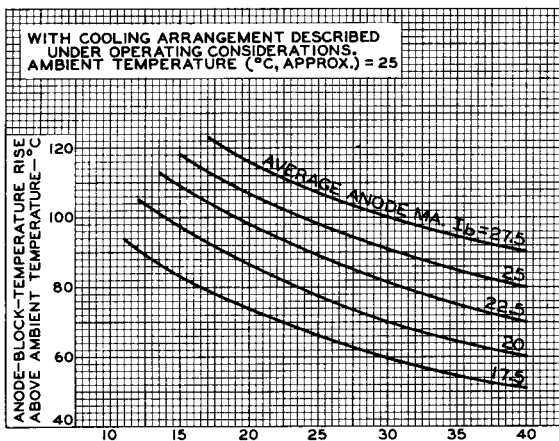
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TYPICAL STABILIZATION CHARACTERISTIC



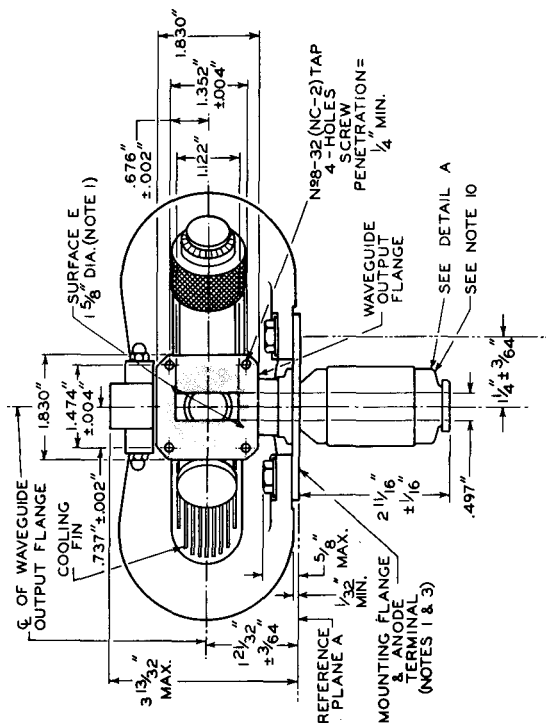
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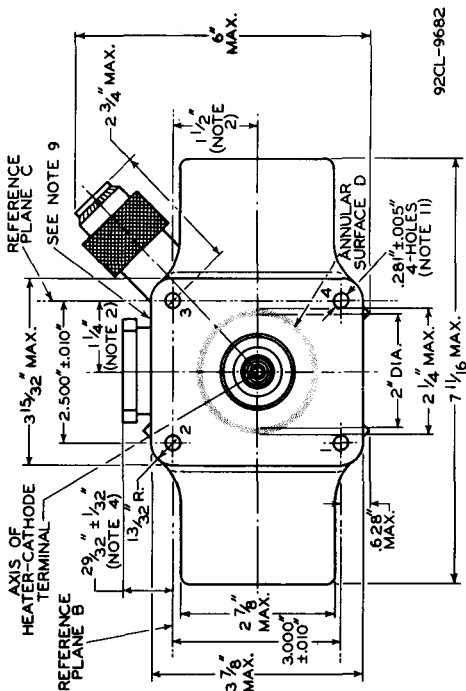
TYPICAL COOLING REQUIREMENTS



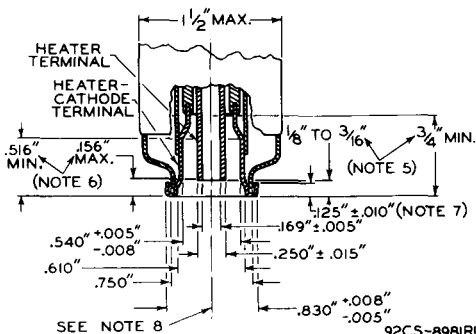
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DETAIL A



REFERENCE PLANE A IS DEFINED AS THE PLANE THROUGH THAT PORTION OF THE MOUNTING FLANGE DESIGNATED AS ANNULAR SURFACE D.

REFERENCE PLANE B IS DEFINED AS THE PLANE WHICH IS PERPENDICULAR TO PLANE A AND PASSES THROUGH THE EXACT CENTERS OF MOUNTING-FLANGE HOLES 2 AND 3.

REFERENCE PLANE C IS DEFINED AS THE PLANE WHICH IS PERPENDICULAR TO PLANE A AND PLANE B AND PASSES THROUGH THE EXACT CENTERS OF MOUNTING-FLANGE HOLES 3 AND 4.

NOTE 1: SURFACE E OF THE WAVEGUIDE OUTPUT FLANGE AND THE ENTIRE SURFACE OF THE MOUNTING FLANGE ARE MADE SO THAT THEY MAY BE USED TO PROVIDE A HERMETIC SEAL.

NOTE 2: THE AXIS OF THE HEATER-CATHODE TERMINAL WILL BE WITHIN THE CONFINES OF A CYLINDER WHOSE RADIUS IS $\frac{3}{64}"$ AND WHOSE AXIS IS PERPENDICULAR TO REFERENCE PLANE A AT THE SPECIFIED LOCATION.

NOTE 3: ALL POINTS ON THE MOUNTING FLANGE WILL LIE WITHIN $0.015"$ ABOVE OR BELOW REFERENCE PLANE A.

NOTE 4: THE LIMITS INCLUDE ANGULAR AS WELL AS LATERAL DEVIATIONS.

NOTE 5: THESE DIMENSIONS DEFINE EXTREMITIES OF THE $0.169"$ INTERNAL DIAMETER OF THE CYLINDRICAL HEATER TERMINAL.

NOTE 6: THESE DIMENSIONS DEFINE EXTREMITIES OF THE $0.540"$ INTERNAL DIAMETER OF THE CYLINDRICAL HEATER-CATHODE TERMINAL.

NOTE 7: NO PART OF THE CONNECTOR DEVICE FOR THE HEATER AND HEATER-CATHODE TERMINALS SHOULD BEAR AGAINST THE UNDERSIDE OF THIS LIP.

NOTE 8: THE HEATER TERMINAL AND THE HEATER-CATHODE TERMINAL ARE CONCENTRIC WITHIN $0.010"$.

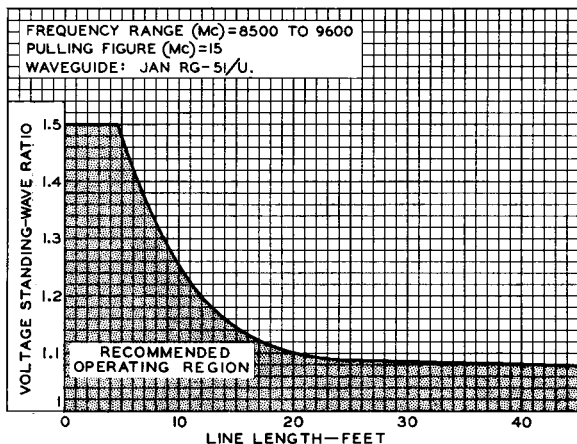
NOTE 9: ANODE TEMPERATURE MEASURED AT JUNCTION OF WAVEGUIDE AND ANODE BLOCK.

NOTE 10: CATHODE TEMPERATURE MEASURED HERE.

NOTE 11: THE ENDS OF THE MOUNTING STUDS MUST NOT PENETRATE THROUGH THE MOUNTING HOLES MORE THAN $1-3/32$ " FROM THE MOUNTING-FLANGE SURFACE.

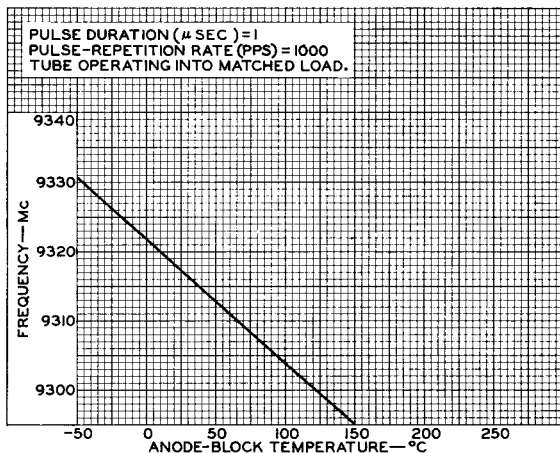


EFFECT OF LENGTH OF TRANSMISSION LINE BETWEEN OUTPUT FLANGE AND LOAD ON ALLOWABLE VOLTAGE STANDING-WAVE RATIO



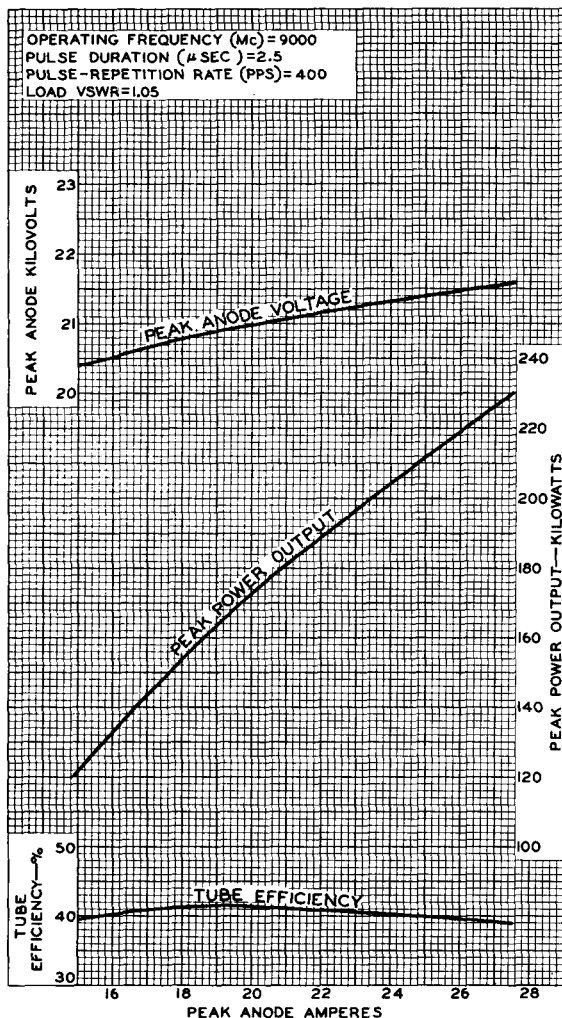
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TYPICAL THERMAL-FACTOR CHARACTERISTIC



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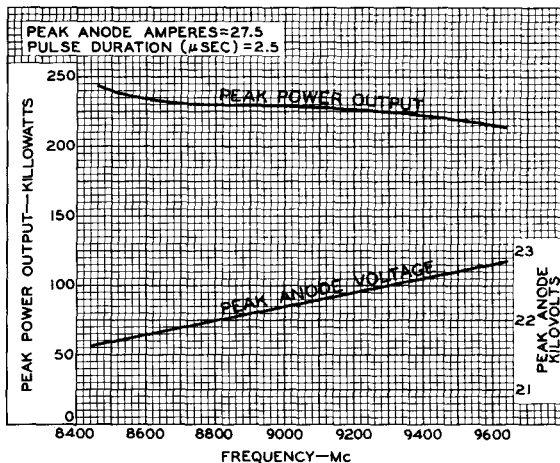
TYPICAL PERFORMANCE CHARACTERISTICS



92CM-9468RI

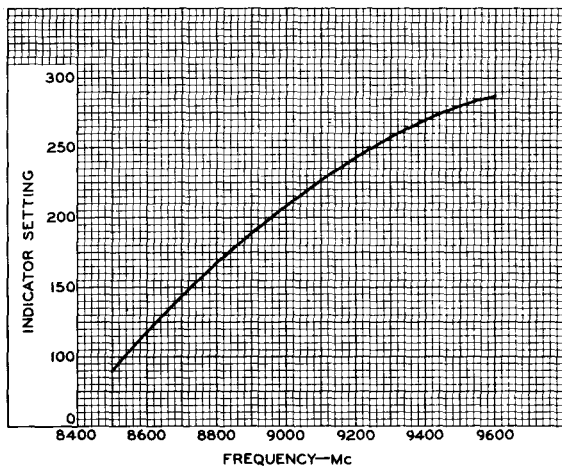


TYPICAL PERFORMANCE CHARACTERISTICS



92CS-9690

REPRESENTATIVE TUNING CHARACTERISTIC



92CS-9691