6865-A
MAGNETRON

TUNABLE TYPE

FORCED-AIR COOLED — INTEGRAL MAGNET

For use as a pulsed oscillator at frequencies between 8750 and 9600 Mc

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage	13.75 ± 10%	ac or dc volts
Current at 13.75 volts	3.15	amp
Starting current	The maximum instantaneous starting current must never exceed 12 amperes, even momentarily	
Minimum Cathode Heating Time	2.5	minutes
Frequency	8750 to 9600	Mc
Maximum Frequency Pulling at VSWR of 1.5	13	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

Tuner . . . . . Calibrated, equipped with lock

Weight (Approx.) . . . . . 11-1/2 lbs

PULSED-OSCILLATOR SERVICE

Maximum and Minimum Ratings, *Absolute Values:*

For duty cycle up to 0.001 maximum

PEAK ANODE VOLTAGE	23 max.	kv
PEAK ANODE CURRENT	27.5 max.	amp
PEAK POWER INPUT●	630 max.	kw
AVERAGE POWER INPUT	0.63 max.	kw
PULSE DURATION	2.5 max.	μsec
RATE OF RISE OF VOLTAGE PULSE	180 max. 70 min.	kv/μsec kv/μsec
ANODE-BLOCK TEMPERATURE	150 max.	°C
HEATER-CATHODE-TERMINAL TEMPERATURE	165 max.	°C
LOAD-VOLTAGE STANDING-WAVE RATIO	1.5 max.	

●: See next page.

6865-A
MAGNETRON

Typical Operation▲ with Load-Voltage Standing-Wave Ratio Equal to or Less than 1.05, Except as Noted:

With duty cycle of 0.001

Heater Voltage	*See Operating Considerations*		
Peak Anode Voltage	22	22	kv
Peak Anode Current	27.5	27.5	amp
Pulse-Repetition Rate	400	2000	cps
Pulse Duration	2.5	0.5	μsec
RF Bandwidth with worst phasing of 1.5 VSWR	0.8	4	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° range of anode-block temperature between −55° and 150° C	0.2	0.2	Mc/°C
Peak Power Output	220	220	kw

● 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.

▲ 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	3.5	amp
Peak Anode Voltage	2	20	23	kv
Peak Power Output	3	190	–	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° 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 115° C approx., pulse duration of 1 microsecond, load-voltage standing-wave ratio of 1.5, and load-voltage standing-wave ratio phase adjusted to produce maximum instability. For heater voltage, *see Operating Considerations.*

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6865-A
MAGNETRON

DEFINITIONS

Smooth Peak Value. The maximum value of a smooth curve drawn through the average of the fluctuation over the top of a voltage or current pulse.

Pulse Width. The time interval between the two points of the current pulse at which the current is 50 per cent of the smooth peak value.

Rate of Rise of Voltage Pulse. The steepest slope of the voltage-pulse leading edge above 50 per cent of the smooth peak value. Measurement of the rate of rise of voltage should be made using a capacitance divider with an input capacitance not exceeding 6 $\mu\mu f$. An oscilloscope of sufficient bandpass, such as the Tektronix 517 or equivalent, should be used.

OPERATING CONSIDERATIONS

Mounting of the 6865-A should be accomplished by means of the mounting flange which may be positioned to operate the tube in any orientation. The flange is made so as to permit use of the 6865-A in applications requiring a pressure seal. Care should be taken by the equipment designer to insure that the tube is mounted on a surface having adequate flatness so as to avoid possible distortion of the mounting flange when it is bolted to the mounting surface.

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. It is recommended that the choke flange be sufficiently tight to avoid arcing and other contact effects. Before the choke flange is fastened to the waveguide output flange of the tube, the user should make certain that the waveguide window is entirely free of dust to prevent possible arcing with consequent damage to 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, from two 3/4"-diameter ducts placed 1/2" to 3/4" from the fins. Adequate flow should be provided to maintain the temperature of the anode block below 150° C under any condition of operation. Failure to provide adequate cooling will impair tube life. Cooling of the heater-cathode terminal may be required under some conditions to maintain the temperature of this terminal below 165° C.

The heater terminal and the *heater-cathode terminal require the use of a connector with flexible leads* such as the Ucinite* No. 115364 with built-in capacitor, or equivalent. Unless flexible leads are used, the heater and heater-cathode seals may be damaged.

A *heater starter* should be used to raise the voltage gradually and to limit the instantaneous starting current

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

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6865-A
MAGNETRON

through the heater when the circuit is first closed. The starter may be either a system of time-delay relays cutting resistance out of the circuit, a high-reactance heater transformer, or a simple rheostat. Regardless of the method of control, it is important that the maximum instantaneous starting current never exceed, even momentarily, a value of 12 amperes. Exceeding this value may damage the heater.

After the heater voltage is raised 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 6865-A begins to oscillate, the heater voltage (E_f) should be reduced in accordance with the following formulas, depending on the average power input (P_i) to the tube:

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

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

When the 6865-A is oscillating, the cathode is subjected to considerable electron bombardment which raises the temperature of the cathode. The magnitude of such heating is a function of the total dissipation and must be compensated by reduction of heater voltage in order to prevent overheating of the cathode. Failure to start the tube at rated heater voltage and to reduce the heater voltage as soon as oscillation starts may adversely affect tube life.

The heater should be protected against input-pulse power by placing a suitable capacitor in shunt with the heater leads as near the heater-cathode stem as possible in order to limit high transient voltages from developing across the heater. This capacitor may be incorporated in the design of the connector for the heater terminal and heater-cathode terminal.

Tuning is accomplished by turning the tuning knob until the setting of the micrometer-type indicator is reached which corresponds to the desired frequency, as determined from the calibration chart prepared for and affixed to each tube. Then lock the tuning knob by tightening the locking nut. For precise tuning adjustment, the final indicator setting should be approached using the same direction of rotation of the tuning knob. There is little frequency drift after changing tuner setting.

Our engineers are ready to assist you in circuit applications of the RCA-6865-A. For further information, write to Commercial Engineering, RCA, Harrison, New Jersey, giving complete details as to the proposed service.

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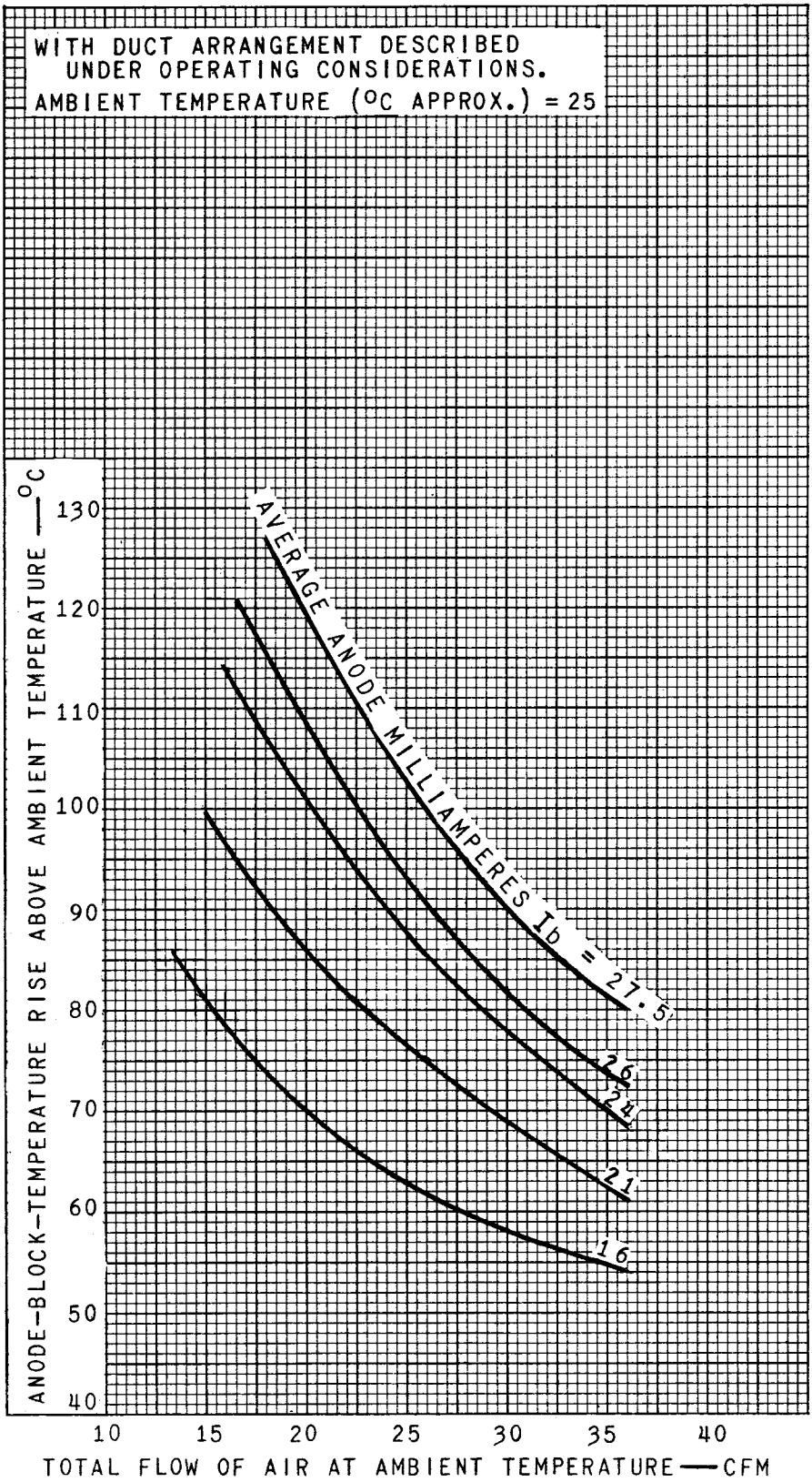
6865-A

TYPICAL COOLING REQUIREMENTS



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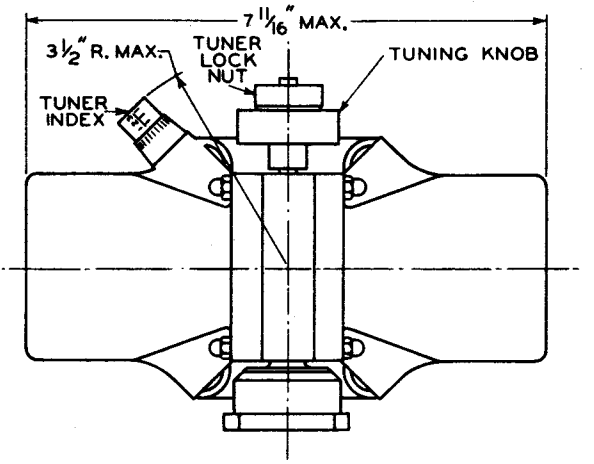
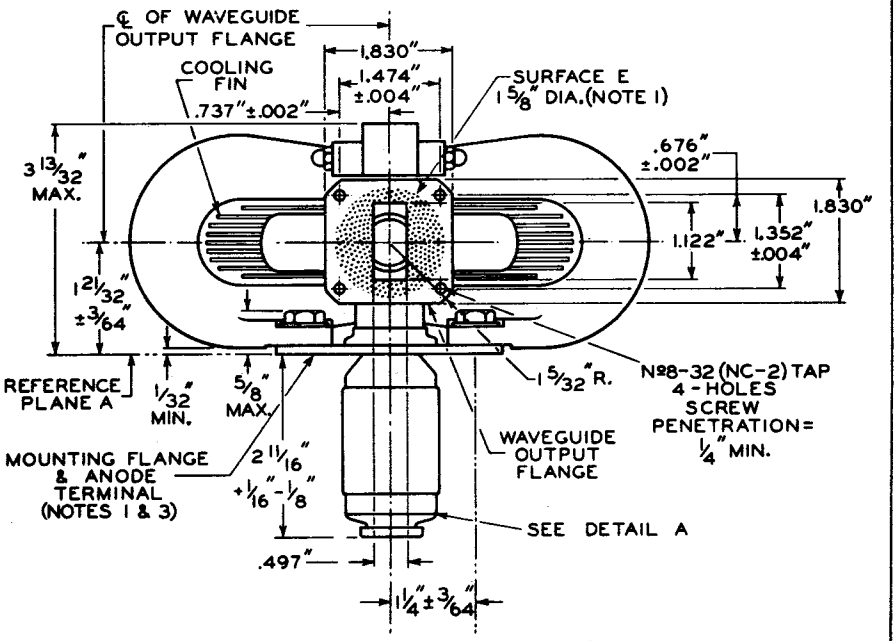
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CS-9284R1

6865-A
MAGNETRON





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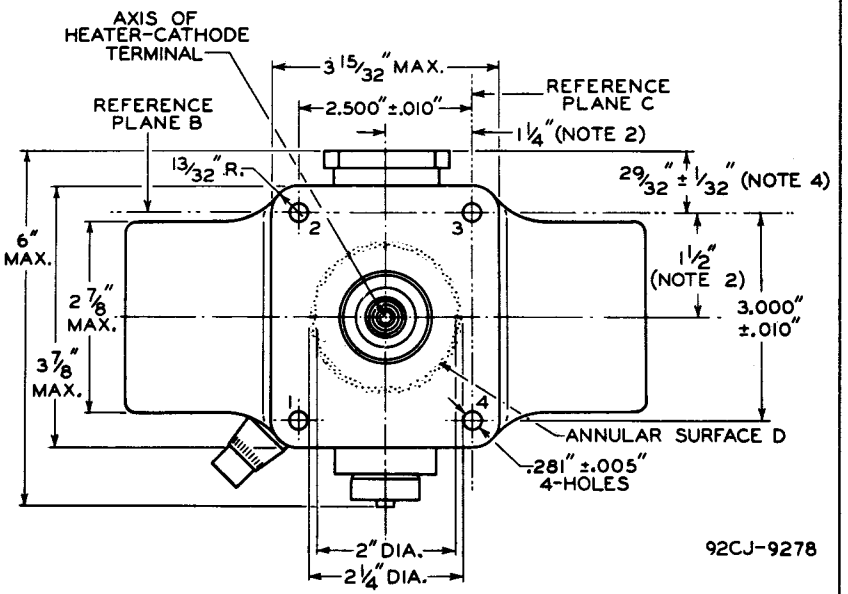
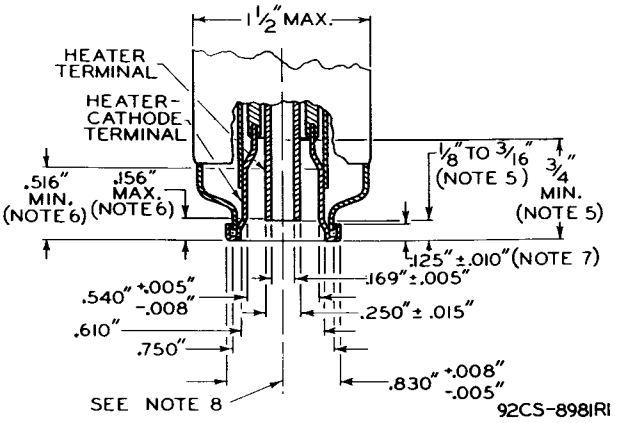
6865-A
MAGNETRON

BOTTOM VIEW



DETAIL A



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6865-A
MAGNETRON

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 No.2 & No.3.

REFERENCE PLANE C IS DEFINED AS THE PLANE WHICH IS PERPENDICULAR TO PLANE A & PLANE B AND PASSES THROUGH THE EXACT CENTER OF MOUNTING-FLANGE HOLES No.3 & No.4.

NOTE 1: SURFACE E OF THE WAVEGUIDE OUTPUT FLANGE, AND THE ENTIRE 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 3/64" AND WHOSE AXIS IS PERPENDICULAR TO REFERENCE PLANE A AT THE SPECIFIED LOCATION.

NOTE 3: ALL POINTS ON 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".

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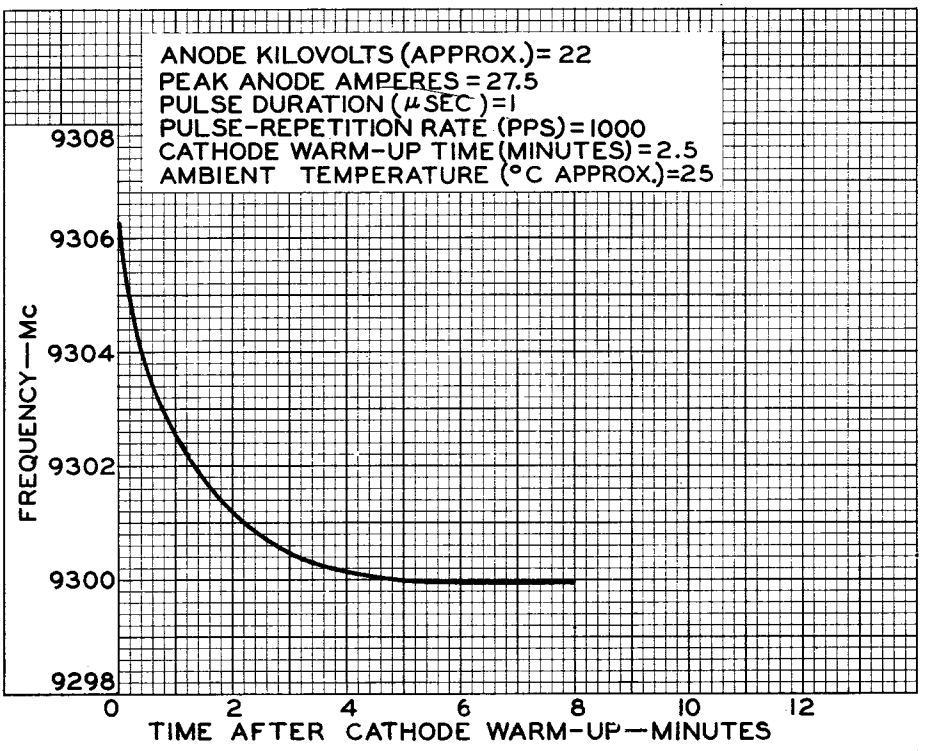
6865-A

TYPICAL STABILIZATION CHARACTERISTIC



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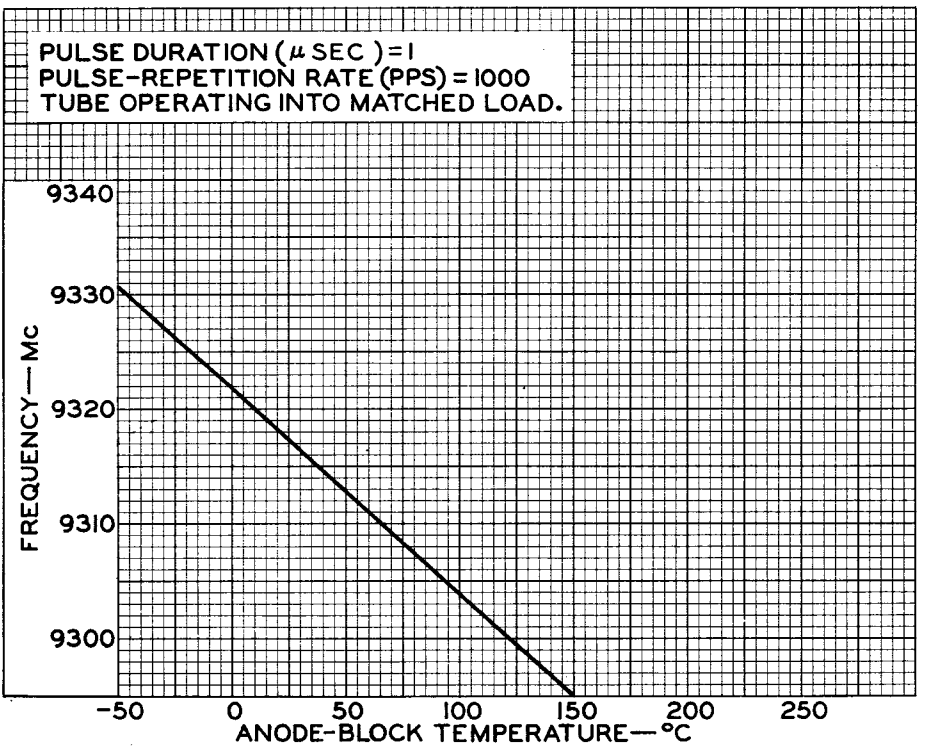
TYPICAL THERMAL-FACTOR CHARACTERISTIC



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6865-A

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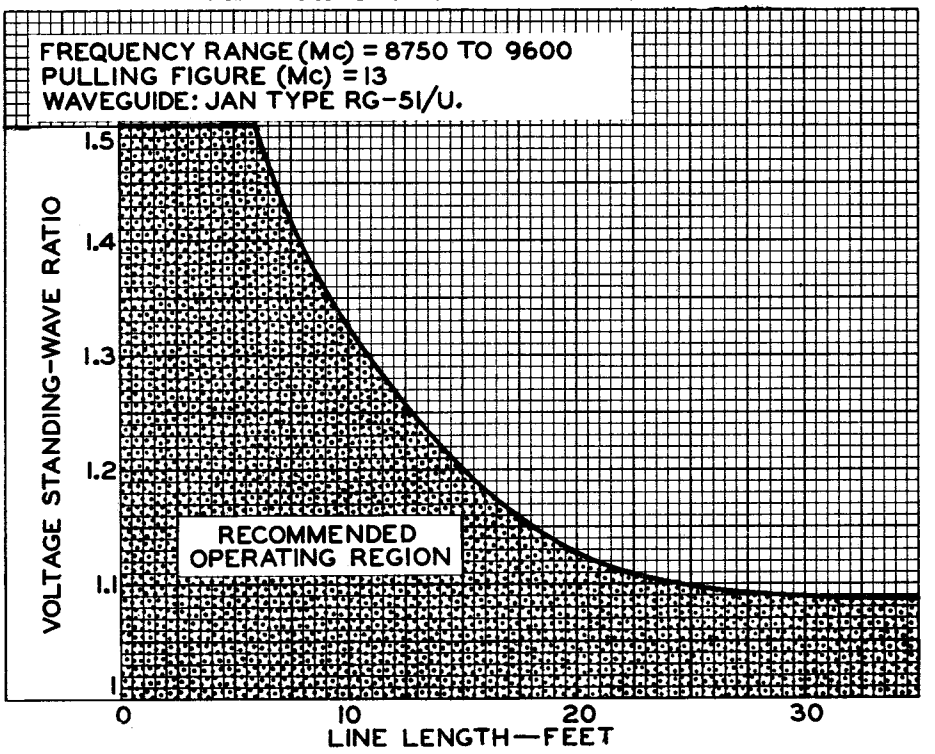
EFFECT OF LENGTH OF TRANSMISSION LINE BETWEEN OUTPUT FLANGE AND LOAD ON ALLOWABLE VOLTAGE STANDING-WAVE RATIO



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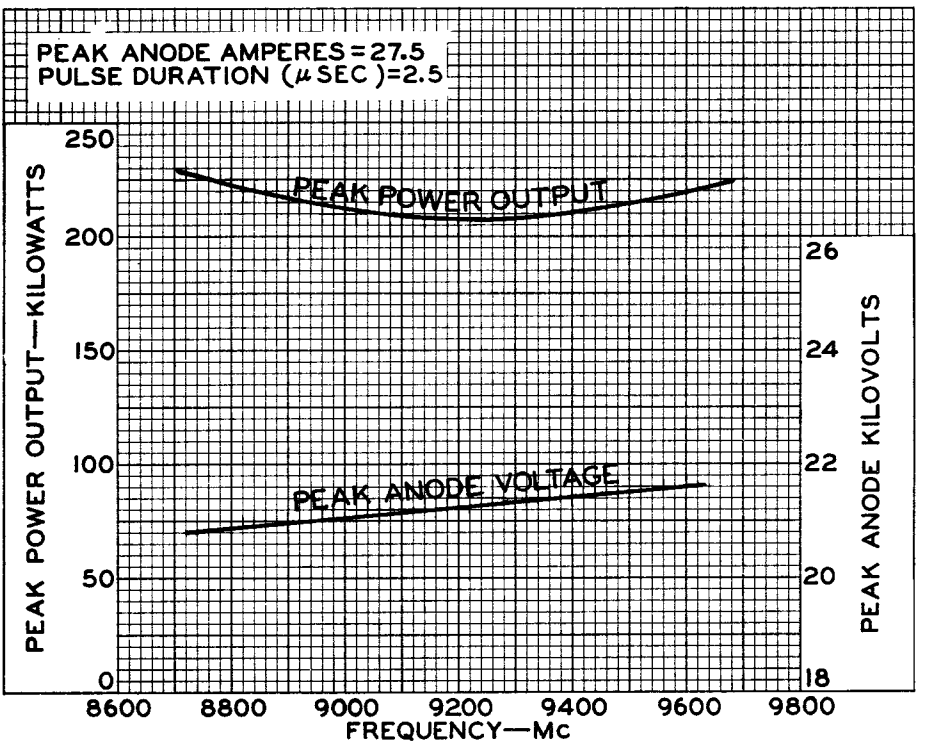
TYPICAL PERFORMANCE CURVES



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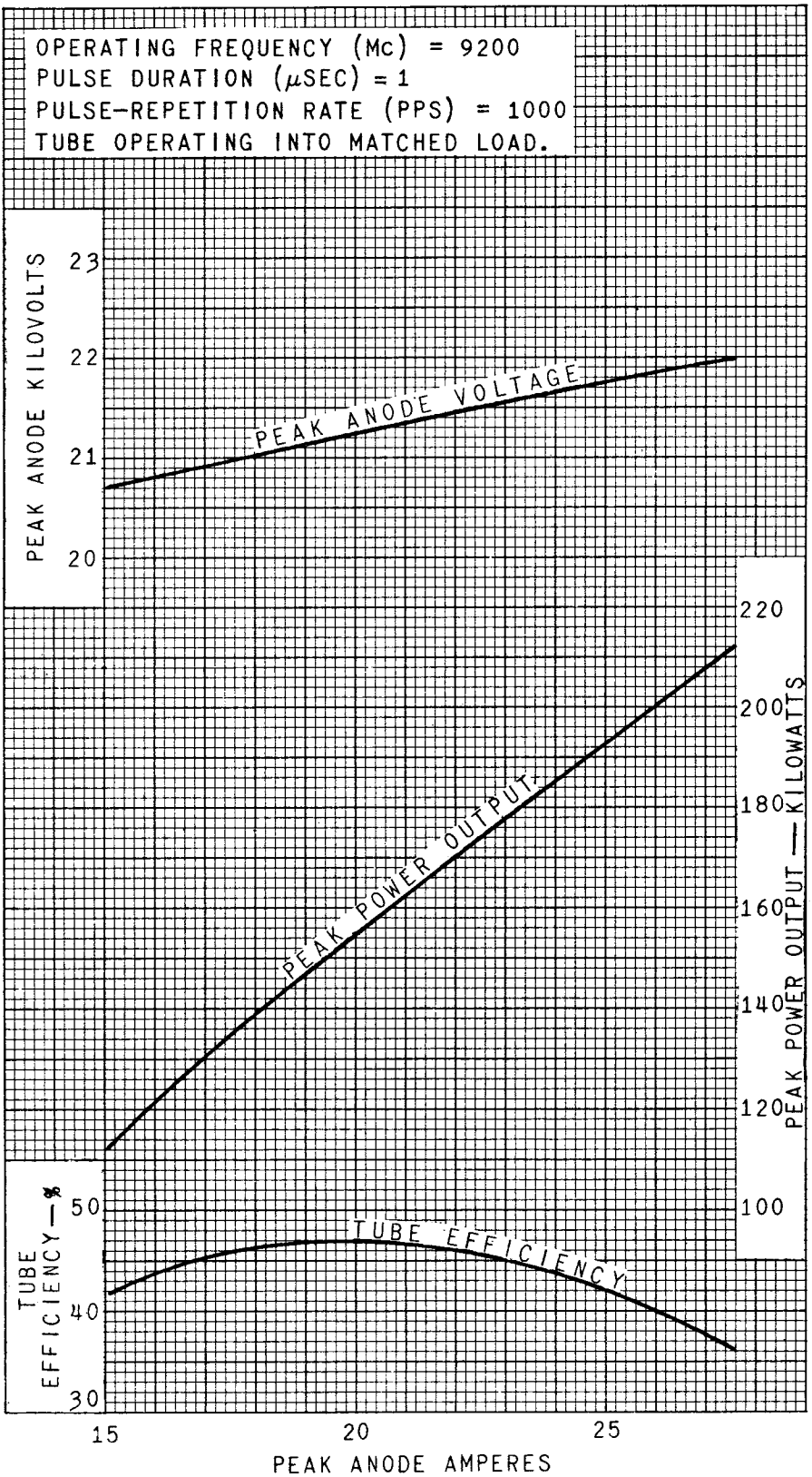
TYPICAL PERFORMANCE CURVES



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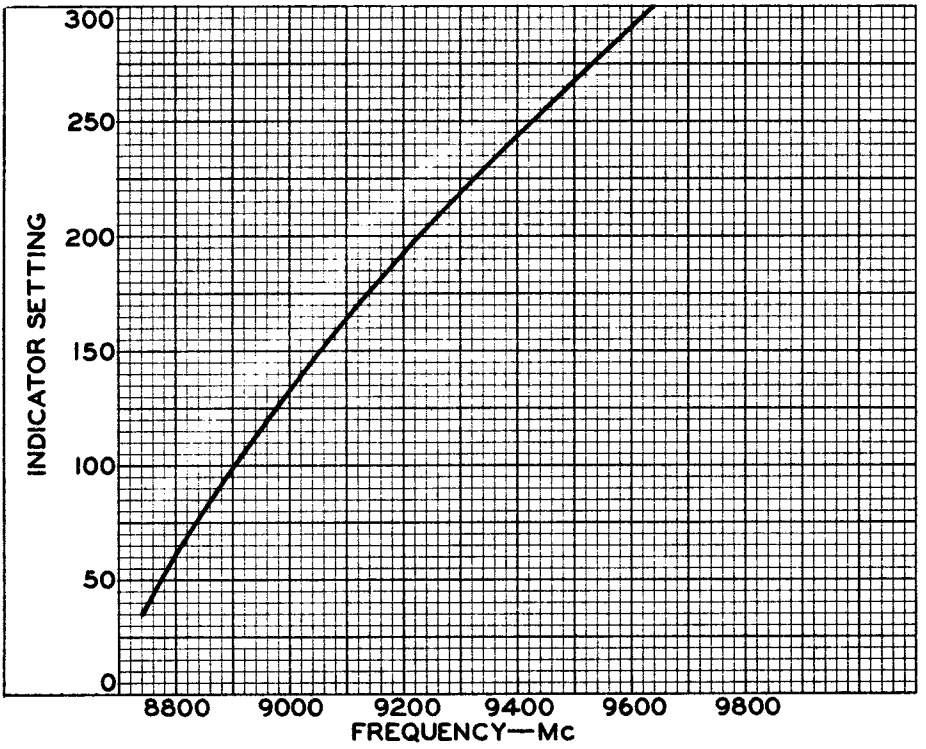
REPRESENTATIVE TUNING CHARACTERISTIC



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