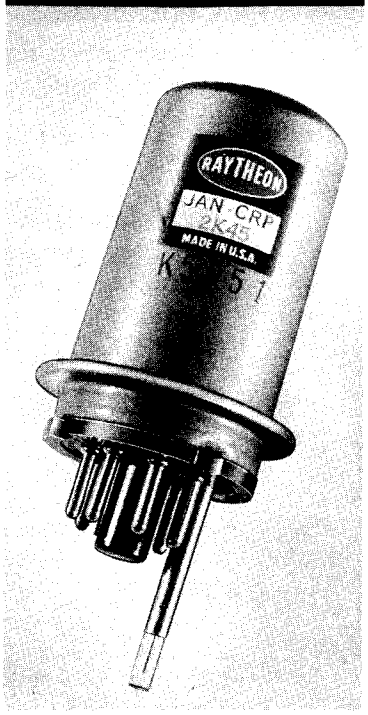
RAYTHEON

TECHNICAL INFORMATION

VELOCITY VARIATION OSCILLATOR

Excellence in Electronics

TYPE 2K45



The type 2K45 is a thermally tuned velocity variation oscillator of the single cavity (integral) reflex type designed for CW operation in the 8500 to 9660 Mc range with an average power output of 30 milliwatts. Sufficient cooling for this type is usually provided by freely circulating air. Output coupling is made by inserting the output probe directly into a standard 1" x ½" O. D. waveguide. The 2K45 is intended for local oscillator service in microwave receivers where remote frequency adjustment is desired.

GENERAL CHARACTERISTICS

Heater Characteristics:

Heater Voltage (ac or dc)	6.3 ± .5 volts
Heater Current at 6.3 volts (approx.)	.76 amperes

Maximum Ratings:

DC Resonator Voltage	350 volts
DC Resonator Current	30 ma. DC
Tuner Plate Power Dissipation	7.5 watts
DC Reflector Voltage-Positive	0 volts
DC Reflector Voltage-Negative	.350 volts
Heater Cathode Voltage	± 50 volts DC
DC Tuner Grid Voltage	.75 volts
Thermal Tuning Speed 8500-9660	9 seconds
Thermal Tuning Speed 9660-8500	9 seconds
Ambient Temperature of air around shell	110°C
Temperature of coaxial output line	70°C
VSWR Mismatch	1.5/1

Typical Operation: 8500-9660

DC Resonator Voltage	300 volts
DC Tuner Plate Voltage	300 volts
DC Resonator Current	25 ma. (average)
DC Reflector Voltage (max. Po) at 9660 Mc.	—95 to —145 volts
DC Reflector Voltage (max. Po) at 8500 Mc.	—66 to 110 volts
Power Output	26 to 34 mw.
Tuner Cathode Current	0 to 25 ma.
Tuner Grid Voltage	—35 to +15 v DC
Tuner Cathode bias resistor	750 ohms
Electronic Tuning (to halt power points)	85 to 70 mc.
Thermal Tuning Speed 8500 to 9660	6 seconds
Thermal Tuning Speed 9660 to 8500	6 seconds

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MICROWAVE AND POWER TUBE DIVISION
RAYTHEON COMPANY
FOUNDRY AVE., WALTHAM 54, MASS.

MECHANICAL:

Mounting Position	Any
Overall Dimensions	See outline drawing
Envelope	Metal
Base	Fits std. octal with #4, pin enlarged to 11/64"
Shock (maximum)	50 G
Vibration (maximum)	10 G
Altitude	50,000 feet
Humidity	100%
Tube Life	500 hours

DETAILED ELECTRICAL INFORMATION

CATHODE

In applications where the metal envelope (resonator) of the tube is operated at ground potential, the cathodes will be negative with respect to ground by the amount of resonator and tuner diode potentials respectively. The klystron cathode may be connected to one side of the heater or the center tap of the heater transformer secondary. When the klystron cathode and heater are connected together, connections to the cathode should be made directly to the cathode contacts on the tube socket and never to a heater lead. When the cathode and heater are not tied together, the heater-cathode voltage should not exceed ± 100 volts. In all cases where the resonator is operated at ground potential, the heater transformers must be insulated to withstand the maximum resonator and diode voltages respectively.

In applications where the metal envelope is operated above ground potential, the tube should be surrounded by a grounded enclosure or insulating device for the protection of the operator. Adequate ventilation must be provided through this enclosure or insulating device to keep the ambient below the maximum specified values.

REFLECTOR

The reflector is connected to the #8 pin on the base of the tube. The power supply furnishing the reflector potential must be insulated to withstand the total resonator and reflecor voltage. The reflector must never be allowed to become positive with respect to the cathode. If this precaution is not observed, damage to the reflector may result. In cases where modulating potentials bring the reflector close to zero volts, or where extremely high reflector circuit impedance is required, a diode should be connected between cathode and reflector to prevent the reflector from going positive.

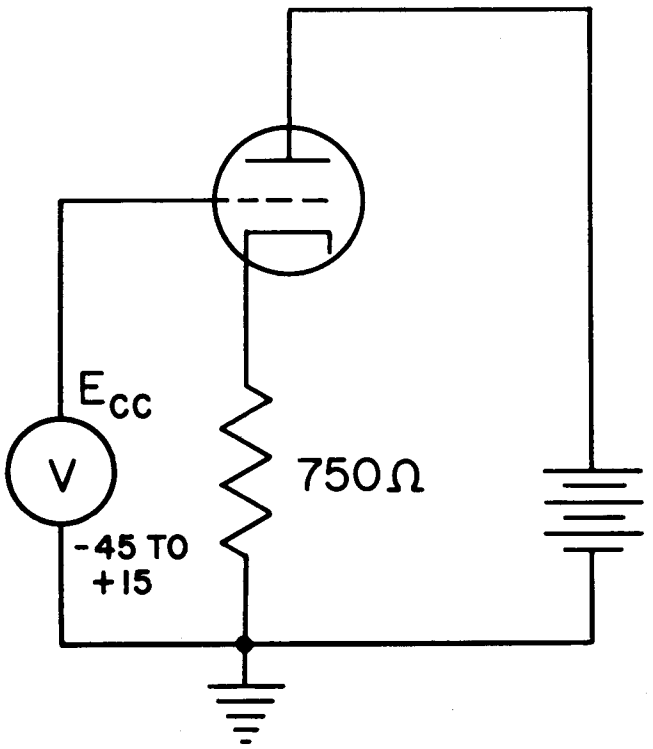
THERMAL TUNING

Thermal tuning has been accomplished in the 2K45 by coupling the thermal expansion characteristics of the plate of the integral triode to the top grid of the klystron cavity. Plate current changes in the triode (klystron tuning) are accomplished very smoothly by varying the control grid

voltage. Use of the tuner circuit in Figure 1 will avoid the possibility of drawing excessive tuner current and consequent damage to the tube.

ELECTRONIC TUNING

With the thermal tuner adjusted so that the tube is operating near the desired frequency, vernier frequency adjustment may be made by varying the reflector voltage. Maximum power output for a given thermal tuner setting, however, will be obtained at only one value of reflector voltage. If the thermal tuner and reflector voltage are mutually adjusted for maximum power output at a given frequency, and if then the reflector voltage is varied above and below the value for maximum power output, such that the power output is reduced by one half, the frequency change between the half power values is defined as the electronic tuning range. The electronic tuning range and linearity depend on the type of load and coupling used. A highly reactive load may shorten the electronic tuning range, and cause non-linear variation of frequency with reflector voltage.



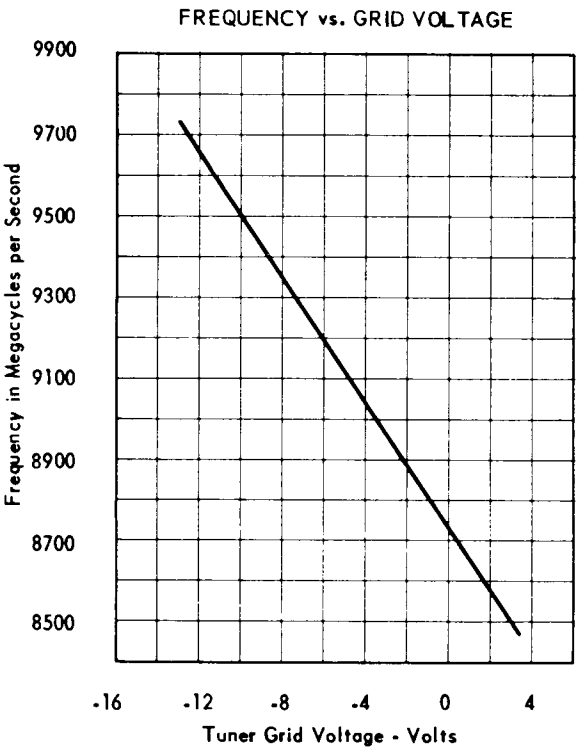


Figure 1

THE FOLLOWING DATA IS REPRESENTATIVE OF AVERAGE TUBES

TUBES DESIGNED FOR USE IN MODE A

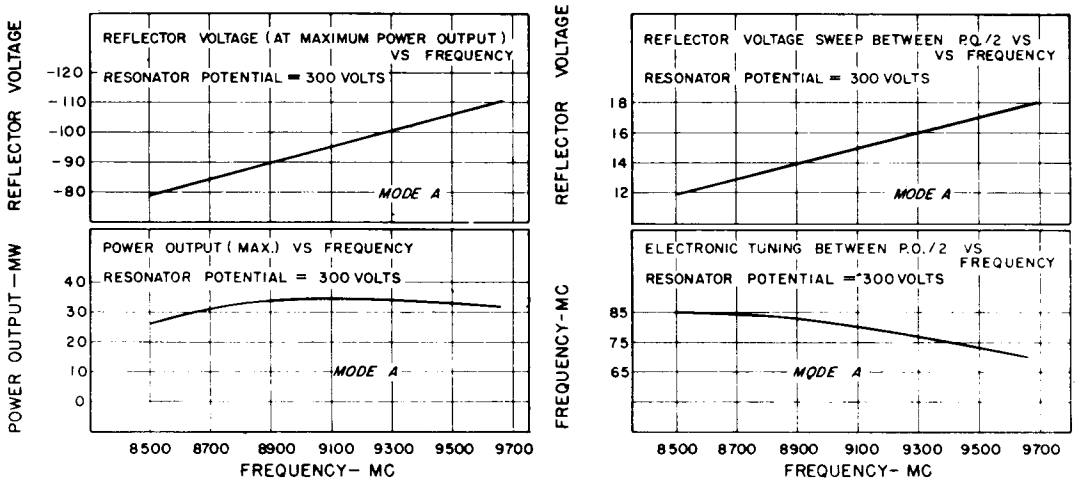


Figure 2a

MODES OF OPERATION

Oscillation may be obtained in a given tube with several combinations of resonator and reflector voltage at a particular frequency. The regions where oscillations occur, within the reflector voltage range, are referred to as voltage modes. The curves of Figure 2 show the characteristics of the 2K45 in the recommended mode. This mode has been chosen because it represents the best compromise between optimum power and wide electronic tuning range.

THE EXACT VALUE OF REFLECTOR VOLTAGE PRODUCING MAXIMUM OUTPUT AT A CERTAIN FREQUENCY, VARIES FROM TUBE TO TUBE. THE VOLTAGE FOR ALL TUBES, AT EACH MODE, WILL FALL WITHIN SHADED AREA INDICATED BELOW.

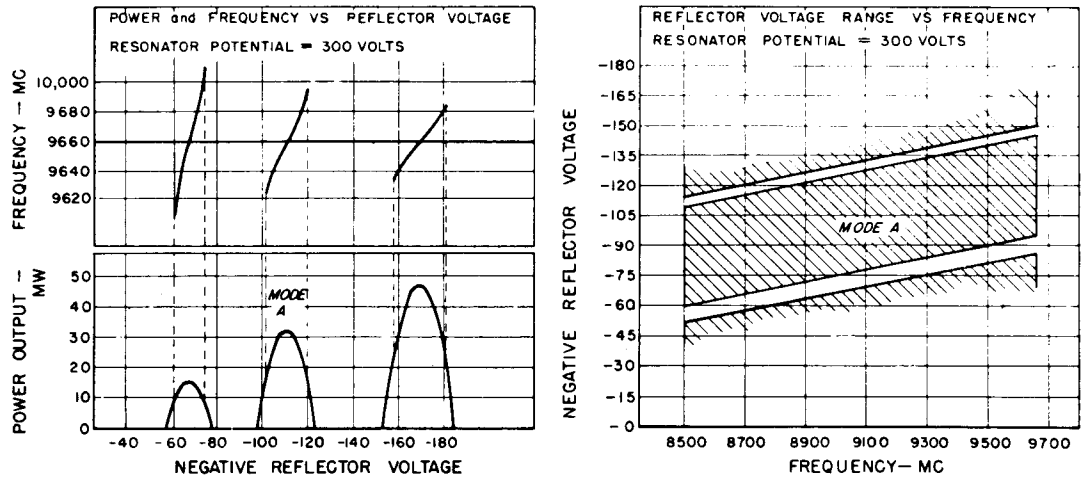


Figure 2b

DETAILED MECHANICAL INFORMATION

INSTALLATION

The 2K45 requires a modified standard octal socket with pin #4 enlarged. The tube may be mounted in any position, but should be rigidly clamped to insure the proper depth of the coaxial output line in the waveguide, and to guard against excessive strain in the coaxial output line. The tube must be clamped on or below the header skirt.

The coaxial output line is coupled into the waveguide (1" x ½") through a trap (see Figure 3 for socket details). All tabulated data in this sheet was obtained using this type of coupling. It is important that this tube coupling assembly, or its electrical equivalent, be used to insure its interchangeability. The voltage standing wave ratio at the coupling assembly should not exceed 1.1/1.

SHIELDING

Operation of the 2K45 in the presence of a strong magnetic field usually requires shielding of the resonator and reflector leads to avoid undesirable modulation of the tube output. In extremely troublesome magnetic environments, it may be necessary to place the 2K45 in a metal chamber with polyiron chokes provided to bring the voltages into the chamber.

OUTLINE DRAWING
ELECTRON TUBE 2K45

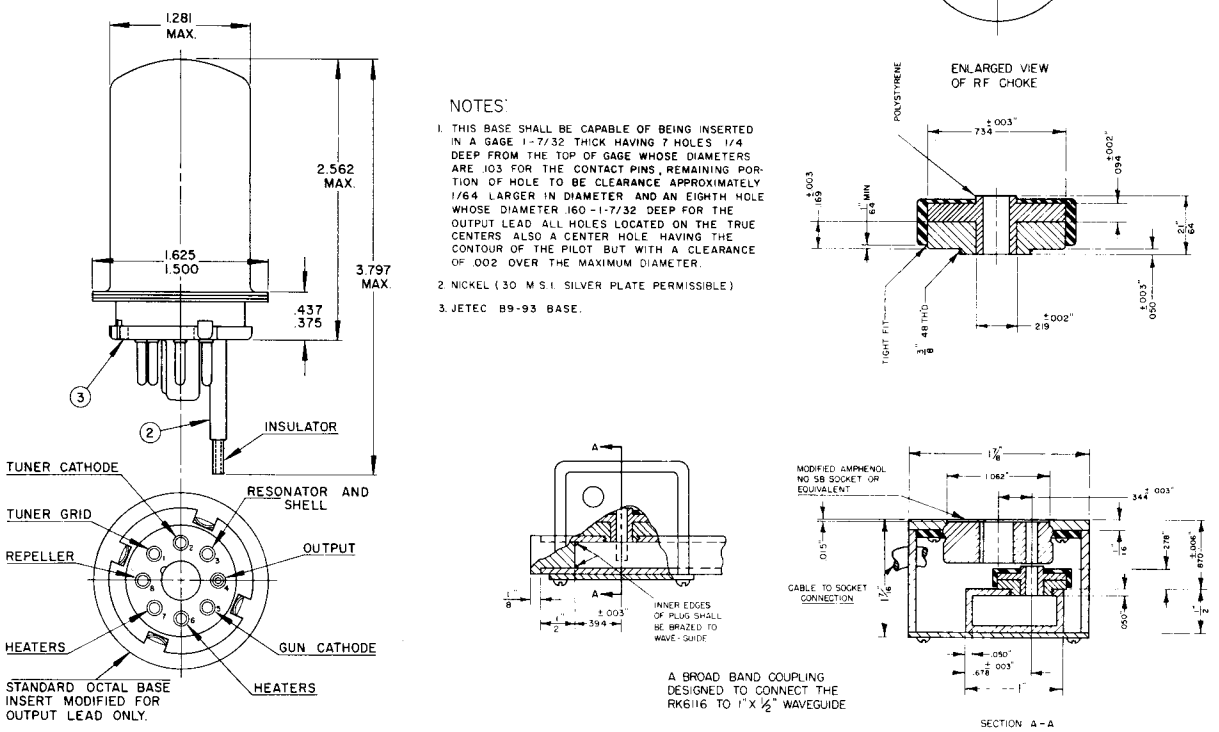


Figure 3