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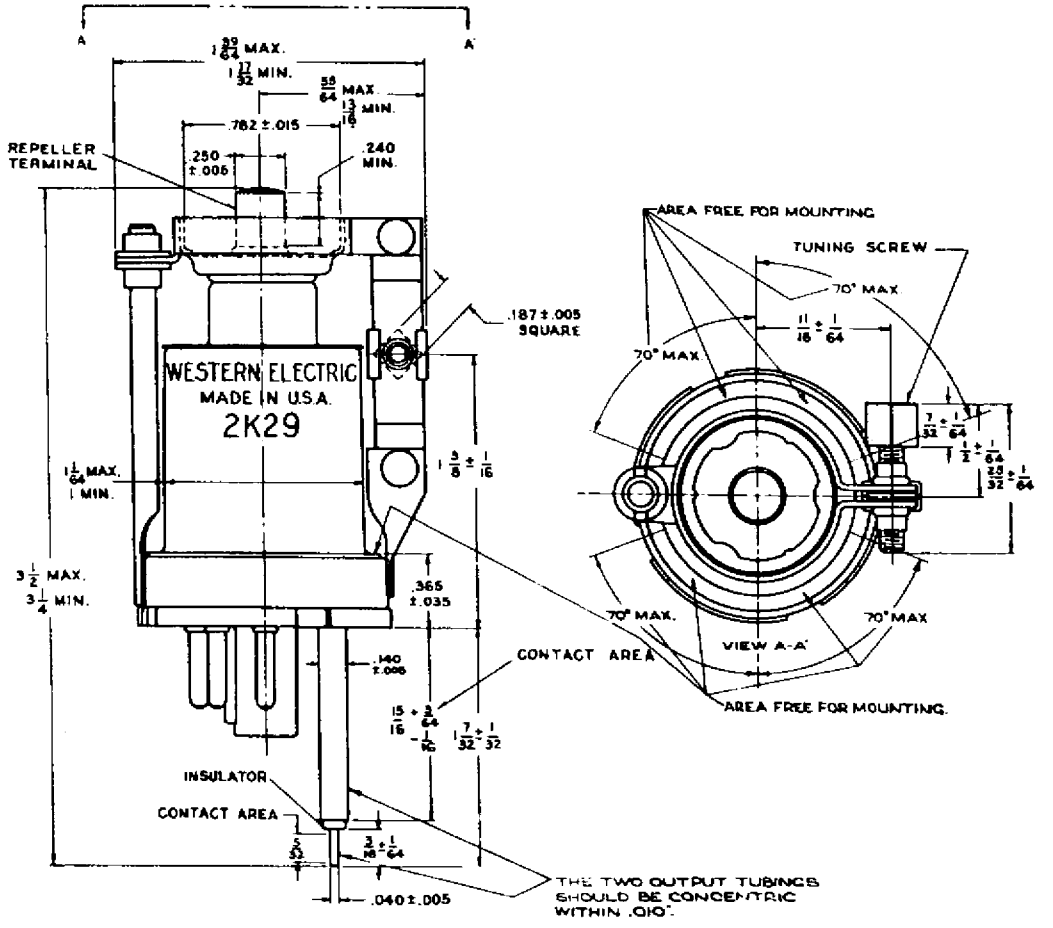
TECHNICAL INFORMATION

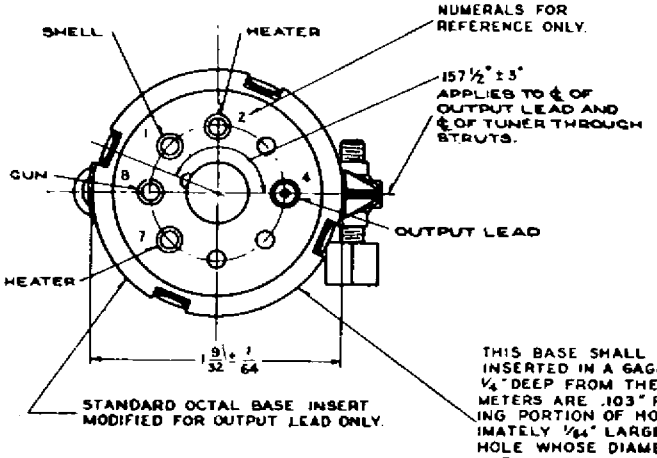
WESTERN ELECTRIC 2K29 VACUUM TUBE

Note:

The information contained herein is tentative.

It is recommended that proposed operating conditions for specific applications be discussed with Department 1400 of the Bell Telephone Laboratories.





NOTE: THIS SHEET DOES NOT IMPLY COMMERCIAL AVAILABILITY OF THE TUBE.

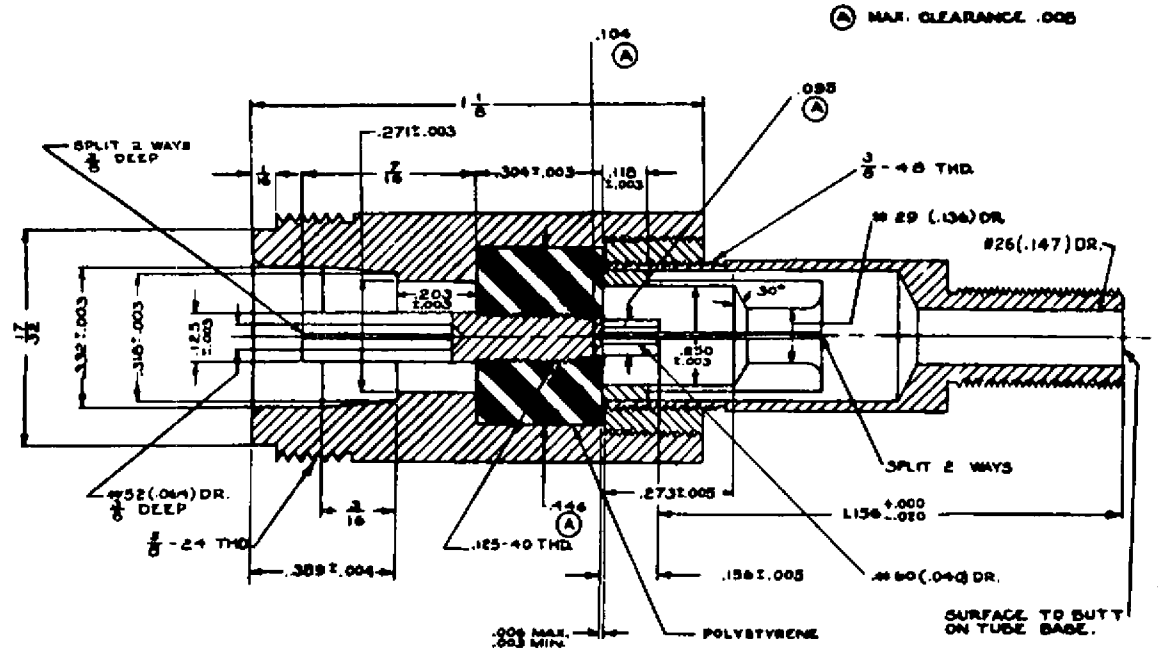


FIG. 1 ALL METAL PARTS BRASS SILVER PLATED 25 M.S.I.

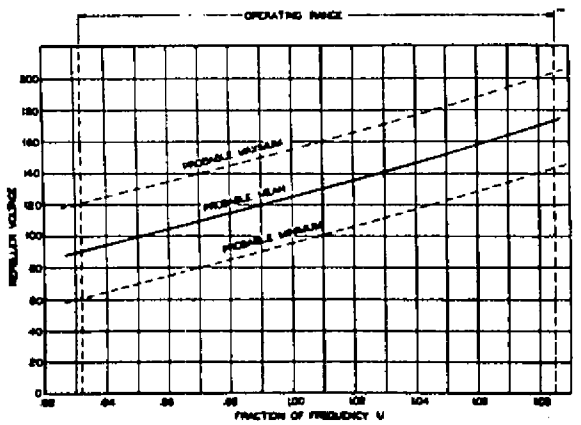


FIG. 2

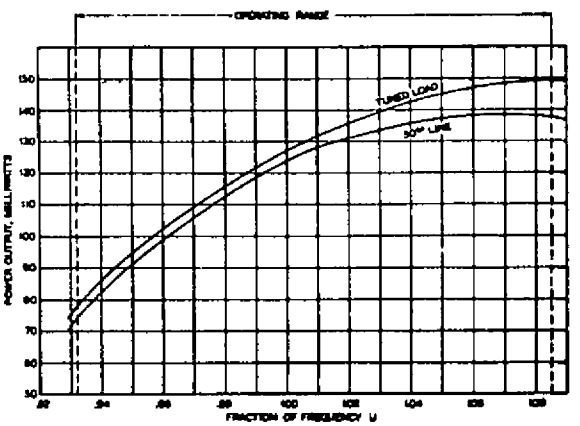


FIG. 3

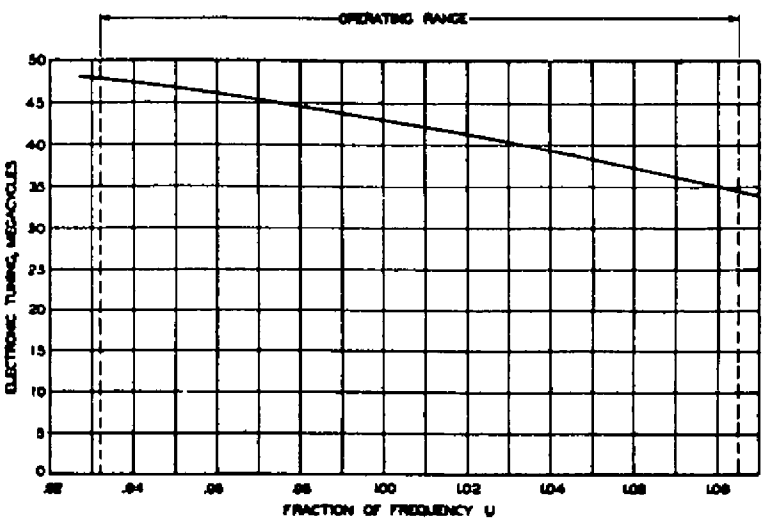


FIG. 4

CLASSIFICATION

The 2K29 vacuum tube is an ultra high frequency oscillator of the reflex type. The resonant circuit is contained within the tube. Means for mechanically tuning the resonant circuit are provided by the bow arrangement integral with each tube. Motion of the tuning bow produces motion of a diaphragm which forms one of the cavity walls. The tube has been developed for operation within a frequency range of 0.931 U to 1.085 U where U is the midpoint of the Sw Frequency band.

MOUNTING

This tube employs a modified intermediate octal wafer type base with the number four pin removed and the hole enlarged to allow the coaxial output line to pass through. The output line has been designed for direct mechanical connection to a suitable coaxial coupling. The polystyrene insulator should be kept clean to avoid power loss in a conducting surface film. The tube may be mounted in either a horizontal or vertical position. The number four pin of the socket must be enlarged to pass the coaxial output line. The coaxial coupling should not depend upon the tube coaxial output line for mechanical support. Care should be taken to insure that the coaxial coupling is in alignment with the tube coaxial output line. The tube should be fastened rigidly to the socket mounting by clamping at the base and adjacent platform only. The tube must not be clamped above the shoulder of the platform which is located .365" ± .035" above the bottom surface of the base.

OPERATING CONDITIONS AND CHARACTERISTICS FOR CONTINUOUS OPERATION

	Normal	Absolute Maximum
Heater voltage	6.3	6.3 ±8% volts
Heater current	0.44	amperes
Potential difference between heater and cathode	0	±45 volts
Resonator voltage	300	330 volts
Cathode current	22	35 milliamperes
Repeller voltage range	-20 to -300	-350 volts
Ambient temperature		110°C *

* This is the temperature surrounding the bulb proper. The temperature of the coaxial line below the base must not exceed 75°C.

The life of the 2K29 type tube will depend upon the operating conditions. Operation above the normal conditions will decrease the useful life.

The heater should be operated at as near as possible to the normal value of 6.3 volts.

The inner and outer conductors of the coaxial output line are at the same potential as the resonator. The resonator may be operated at a potential other than that of the coaxial line if suitable by-pass condensers are provided in the coupler.

MECHANICAL TUNING ADJUSTMENT

The mechanical tuning mechanism and flexible diaphragm has been designed to afford an occasional adjustment of frequency. It is not intended for use where continual or frequent adjustment is required.

When putting a tube into service, adjustment to the correct frequency is made by manipulation of the bow and repeller voltage. The bow should then be flexed a number of times to relax the strains in the system. By decreasing the flexing successively from a maximum of one full turn to zero in 8 or 10 flexes, the desired frequency will be found to be essentially stable.

REPELLER VOLTAGE RANGE

Oscillating conditions may be obtained in a given tube at a number of different repeller voltages. Only one mode is recommended. This mode will be found in the repeller voltage ranges shown between the broken lines of Fig. 2. A typical curve is given as a solid line.

POWER OUTPUT

Curves for power output as a function of frequency are given in Fig. 3. The upper curve gives the power output measured into an adjustable load. This curve is approximately average for pre-production tubes made to date. The curve immediately below this curve gives the power output into a fixed load. Here the tube coupled through a connector, details of which are shown in Fig. 1, is worked into a 50 ohm resistive load. The load consists of a section of 50 ohm lossy line operating into a load adjusted to 50 ohms at the frequency of measurement. The coupler is designed to couple to a (Neill) fitting D-163446 (Cd-49288).

The critical dimensions in the coupler of Fig. 1 are given therein. This coupler maintains an impedance of essentially 50 ohms throughout its length. The coupler may be made with or without by-pass condensers. These condensers are not illustrated in the unit shown. If desired, they should be designed to maintain the 50 ohm impedance.

The lowest curve shown in Fig. 3 is the probable minimum power which will be found in any tube using the coupler of Fig. 1.

ELECTRONIC TUNING

The frequency of oscillators of the 2K29 type may be varied over a restricted range by small variations in the repeller voltage. In order to make use of this characteristic, special design features have been incorporated to minimize a type of discontinuity in the electronic tuning characteristic which has been labeled electronic tuning hysteresis. In system uses where the electronic tuning feature, defined below, is used for frequency control a maximum of electronic tuning is desired. The 2K29 has been designed to provide an essentially uniform electronic tuning characteristic over the operating frequency range.

Electronic tuning characteristics for the 2K29 tube are given in Fig. 4. The results are obtained while working the tube into a tunable load adjusted for maximum power output. The electronic tuning range is here expressed in terms of the number of megacycles between two repeller voltages at which the power is 1/2 the maximum value for the given nominal wavelength. The results of measuring the electronic tuning range using the fixed load defined by the coupler of Fig. 1 and a 50 ohm line are coincident within 5% of the values given for the tunable load measurements.

There are two to three repeller-cathode voltages for which these tubes will oscillate when the resonator voltage is 300 volts. In order to minimize hysteresis from the electronic tuning characteristic it is necessary to restrict the operation to the mode for which data were given in Figs. 1 and 2. The amount of electronic tuning and its variation with the repeller-cathode voltage depend upon the type of load and strength of coupling to the load. It is important in operation of the tube in applications where the maximum electronic tuning range is required that the load should be essentially resistive. A highly reactive load will markedly decrease the available electronic tuning range. It is undesirable to adjust the r.f. output of the oscillator by changing the resonator voltage since the electronic tuning range decreases more rapidly than the power output as the resonator voltage is decreased and the electrical tuning performance is likely to suffer.

TEMPERATURE COEFFICIENT

The materials used in the mechanical tuning mechanism have been especially selected so that their thermal expansion and heat conduction coefficients will cooperate with those of the other parts of the tube to produce a desirable temperature coefficient. The coefficient for the 2K29 tube lies between +0.05 and -0.10 megacycles per degree centigrade.

The tube should be operated in either still air or in a uniform draft since varying drafts playing on the tube will produce fluctuations in the oscillating frequency.

PULSED OPERATION

This tube may be pulse operated for use in test equipment. Successful operation has been achieved by setting the resonator voltage at a value such that sustained oscillation does not occur. A square wave pulse is then applied which drives the cathode negative sufficiently to provide the oscillating condition. The repeller-cathode voltage is set to provide the optimum condition with the square wave applied. In pulsed operation a greater resonator potential is allowable than in steady operation, but the power input to the tube should not exceed that for the maximum rating.