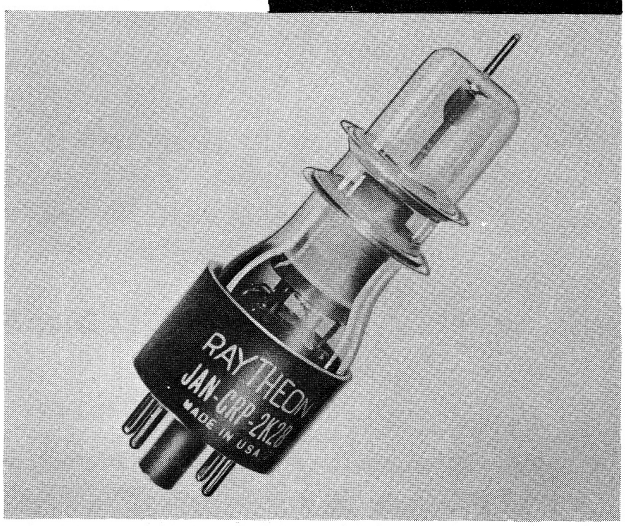
RAYTHEON

TECHNICAL INFORMATION

VELOCITY VARIATION OSCILLATOR

Excellence in Electronics

TYPE 2K28



The type 2K28 is a reflex velocity variation oscillator designed for use with an external cavity in CW operation over the 2650 to 3700 Mc range with a minimum power output of 80 milliwatts. Freely circulating or in some cases forced air is required for cooling of the grid ring cavity contacts. The wide frequency range of this tube makes it ideally suited for signal generator and special local oscillator applications. Special cavities and certain reflector modes can be used with the 2K28 to obtain an extended frequency coverage of 1800 to 4000 Mc.

GENERAL CHARACTERISTICS

ELECTRICAL

Heater Characteristics

Heater Voltage	6.3V ±5%
Heater Current	0.66 A

Ratings — Absolute Maximum Values

Grid #1 Voltage	330 Vdc
Grid #2 and #3 Voltage	330 Vdc
Cathode Current	45 mAdc
Reflector Voltage	
Positive Value	–25 Vdc
Negative Value	500 Vdc
Reflector Current	5 uAdc
Heater-Cathode Voltage	±50V
VSWR	1.20/1
Cavity Temperature	150°C
Thermal Frequency Drift (with brass cavity)	.15 Mc/°C

The values specified above are based on the absolute system and must not be exceeded under any service condition. Operation above these limiting values may affect tube life and serviceability adversely. It does not necessarily follow that combinations of absolute maximum ratings can be attained simultaneously.

Typical Operating Conditions

Frequency Range	3315-3680 Mc
Reflector Voltage Transit Mode	2¾
Grid #1 Voltage	300 Vdc
Grid #2 and #3 Voltage	300 Vdc
Cathode Current	30 mAdc
Reflector Voltage Range	—150 to —250 Vdc
Electronic Tuning Range Po/2	20 Mc
Average Power Output	125 mW

MECHANICAL

Mounting Position	Any
Overall Dimensions	See Outline Dwg.
Envelope	Glass
Vibration	10G (max.)
Altitude	10000′ (max.)
Base	Intermediate Octal, 4 Pin
Pin Connections	See Outline Dwg.

DETAILED ELECTRICAL INFORMATION

REFLECTOR

The power supply furnishing the reflector potential must be insulated to withstand the total resonator and reflector voltage. The reflector must never be allowed to become more positive than —25 volts with respect to the cathode. If this precaution is not observed, damage to the tube may result. Where high reflector circuit impedances are used, it is advisable to shunt the high impedance of the power supply with a small diode.

CATHODE

In most applications, the metal cavity used with the 2K28 is operated at ground potential and the cathode will be negative with respect to ground by the amount of the resonator potential. The cathode may be connected to one side of the heater or the center tap of the heater transformer secondary. When the cathode and heater are connected together, connections to the cathode should be made directly to the cathode contact 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 ±50V. In all cases where the resonator is operated at ground potential, the heater transformer must be insulated to withstand the maximum resonator voltage. To obtain maximum tube life, it is recommended that the heater be allowed to warm up for 30 seconds before other voltages are applied. Application of the beam potential must not precede the application of any of the other voltages.

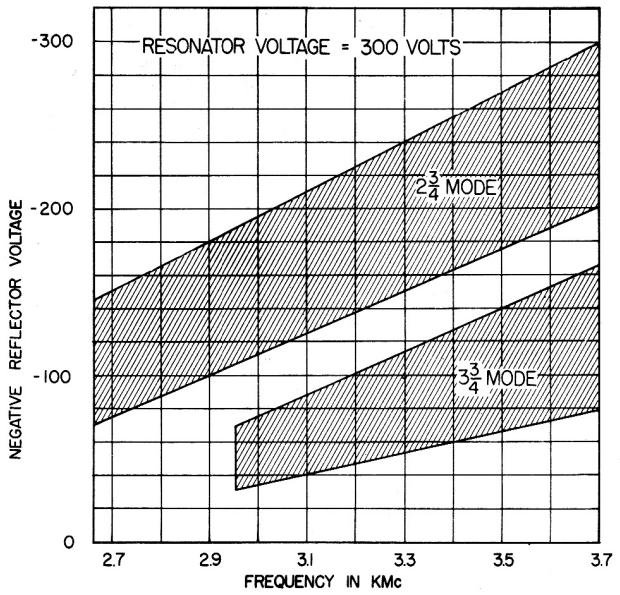
ELECTRONIC TUNING

Vernier adjustment of the frequency of the 2K28 is accomplished by varying the reflector voltage. If the mechanical tuning mechanism employed in the external cavity and the reflector voltage are mutually adjusted to yield a maximum power output at a given frequency, and if then the reflector voltage is varied above and below the value for maximum power such that the power output is reduced to one half, the frequency change between the half power values is defined as the electronic tuning range. The range of electronic tuning and the linearity of its variation with reflector voltage is a function of the type of load and coupling used. Maximum electronic tuning range will be achieved with operation into a resistive load. Operation into a highly reactive load may be attended by excessive hysteresis, and nonlinear variation of frequency with reflector voltage.

FREQUENCY STABILITY

The regulation of the voltages applied to the reflector and resonator will be reflected directly in the stability of the output frequency, hence the regulation of these supplies must be commensurate with the stability requirements of the application.

The thermal frequency drift experienced with the 2K28 will be mainly a function of the change in physical size of the resonant chamber with temperature. Careful consideration should therefore be given to the material from which the external cavity is constructed.

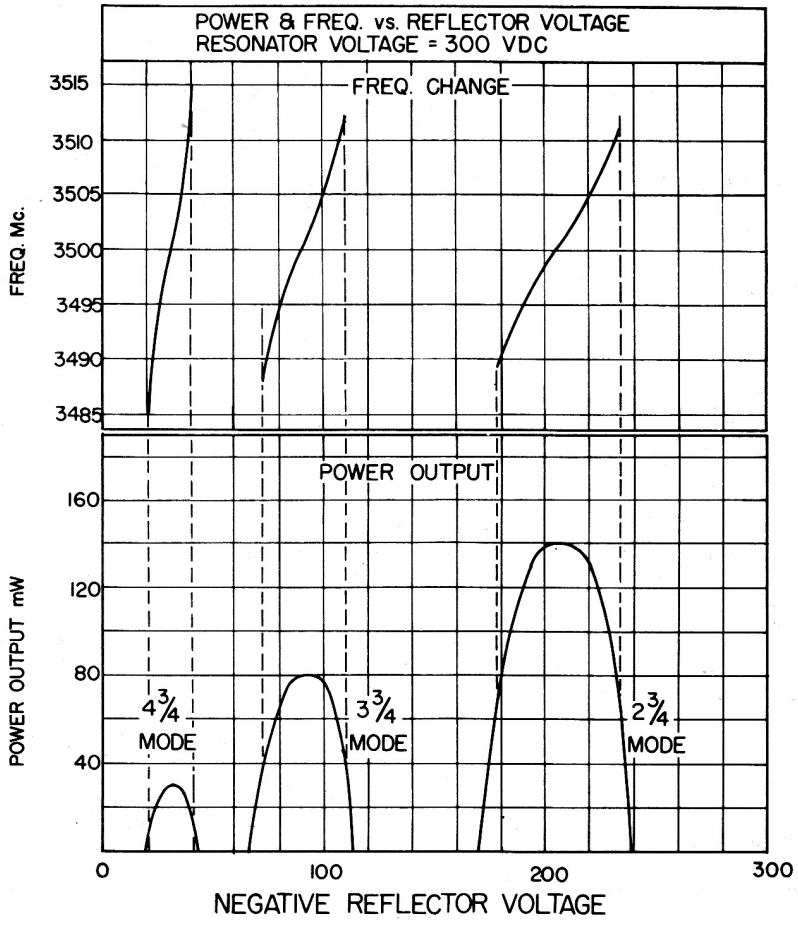


MODES OF OPERATION

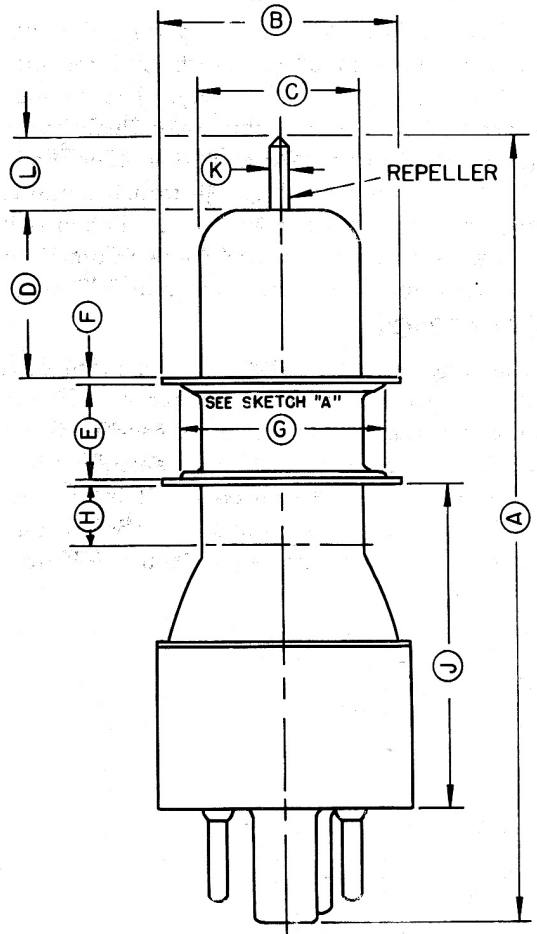
Oscillation can be obtained in a given tube with several combinations of resonator and reflector voltage at a particular frequency. The regions where oscillations occur, within the reflector voltage, are referred to as voltage modes. (See mode curves.) The 2¾ reflector voltage transit mode is the recommended mode of operation because it represents the best compromise between optimum power output and wide electronic tuning range.

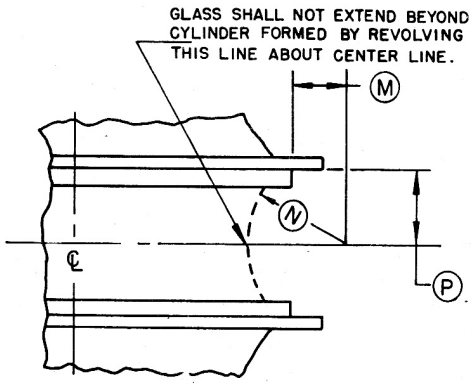
INSTALLATION

The tube mounts in any position and requires a standard octal socket. Positive contact of the resonator discs with the cavity is essential for satisfactory tube operation. Cavity design should be such that no undue strain be set up in the copper to glass seals at the junction of the disc and tube as a result of thermal expansion or contraction.



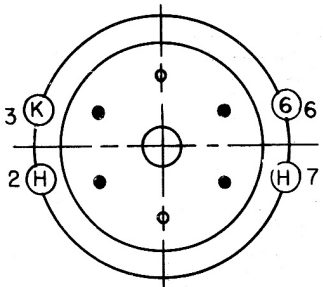
VELOCITY VARIATION OSCILLATOR





SKETCH "A"

REF.	DIMENSIONS
A	4.15 MAX.
B	1.115 MIN. 1.135 MAX.
C	.812 ± .031
D	.797 MIN. .891 MAX.
E	.405 ± .003
F	.010 APPROX.
G	1.005 MAX. NOTE 1.
H	.250 MIN.
J	1.531 MIN. 1.781 MAX.
K	.055 MIN. .062 MAX.
L	.313 MIN.
M	.188 MAX.
N	.250 MIN.
P	.201 MIN. .204 MAX.



BOTTOM VIEW OF STANDARD INTERMEDIATE OCTAL BASE.

NOTE 1:
DIMENSION APPLIES TO EACH DISC SEPARATELY.

NOTE 2:
DISCS SHALL BE CONCENTRIC WITH EACH OTHER WITHIN 0.015". THE DISCS SHALL BE CONCENTRIC WITHIN .094".

NOTE 3:
DISCS SHALL BE SMOOTH, FREE FROM TEARS & SHALL BE GOLD PLATED 20 MSI OR 10 MSI NICKEL PLUS 10 MSI SILVER.

NOTE 4:
THE CAVITY DIMENSIONS WHICH CORRESPOND TO THE 0.405 ± 0.003 DIMENSIONS ON THE TUBES SHALL BE 0.401" MAX. 0.396" MIN.

ALL DIMENSIONS IN INCHES.

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2K28
TUBE OUTLINE DRAWING