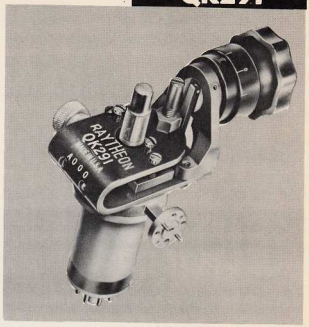
RAYTHEON

TECHNICAL INFORMATION

VELOCITY VARIATION OSCILLATOR

Excellence in Electronics

TYPE QK289 thru QK291



The types QK289 thru QK291 are mechanically tuned velocity variation oscillators having an oxide coated unipotential cathode and designed for operation in the 27,270 to 36,260 Mc. range.

GENERAL CHARACTERISTICS

ELECTRICAL

Heater

Heater Voltage	6.3 Volts A.C.-D.C.
Heater Current	.58 Amperes

Maximum Ratings

Heater Voltage	6.3±10% Volts A.C.-D.C.
Resonator Potential	2500 Volts D.C.
Cathode Current	15 Ma. D.C.
Reflector Potential	—50 to —450 Volts D.C.
Envelope Temperature	125° 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 Operation

Resonator Potential	2250 Volts D.C.
Focus Grid Potential	—20 to —250 Volts D.C.
Cathode Current	10 to 13.5 Ma.
Reflector Potential	—50 to —200 Volts D.C.
Power Output of QK-290 or QK-289	Average 20 Milliwatts
Power Output of QK-291	Average 18 Milliwatts
Frequency Range QK-289	27,270-30,000 Mc.
Frequency Range QK-290	29,700-33,520 Mc.
Frequency Range QK-291	33,520-36,250 Mc.

MECHANICAL

Base	Intermediate Octal.				
Pin No.	1	2	7	8	Small Top Cap.
Element	Focus	H	H	K	Reflector.
Bulb	Glass — Copper Disc Seal Construction.				
Mounting	Any position.				
Cooling	Freely Circulating or Forced Air (latter is preferable).				

Maximum Overall Dimensions	Height: Max. 4.625" Base to Top of Cap Excluding Pins.
	Diameter: Max. 4.375" Including Tuning Screw and Waveguide.
Waveguide: RG 96/W	To be used with .280" x .140 Waveguide with .040" Walls.

DETAILED ELECTRICAL INFORMATION

CATHODE

In most applications, the metal shell (resonator) of the QK289 thru QK291 types is operated at ground potential. The cathode is therefore negative with respect to ground by the amount of the resonator potential and must not be grounded. The cathode may be connected to one side of the heater or to the center tap of the heater transformer secondary. When cathode and heater are connected together, connections to the cathode should be made directly to the cathode on the tube socket and never to the heater lead. When cathode or heater are not connected together, the heater cathode voltage should not exceed ±50 volts. In all cases where the resonator is operated at ground potential the heater transformer must be insulated to withstand the maximum resonator voltage.

In applications where the metal envelope (resonator) of the QK289 thru QK291 is not at ground potential, it is essential that the tube be surrounded by a grounding shield to avoid injury to the operator. Adequate ventilation must be provided through this shield to keep the ambient temperature of the chamber below a maximum value.

The cathode current in these types must be adjusted to the proper value (between 10.0 and 13.5 mA) by adjusting the focus grid voltage. For optimum results, it is imperative that the cathode current be maintained at the value specified for each tube.

REFLECTOR

The reflector electrode is connected to the small cap on the top of the tube. The glass stem supporting the reflector electrode must be carefully protected against rough handling. If the glass stem comes in contact with other objects, damage may result which will cause the tube's characteristics to change.

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 −50 Vdc 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 voltage close to zero volts, or where extremely high reflector circuit impedances are required, a diode should be connected between cathode and reflector to prevent the reflector from going positive. Also, it is required that the application of reflector voltage precede the application of resonator voltage.

FREQUENCY STABILITY

To obtain the most stable operation from the QK289 thru QK291, the reflector and resonator voltage supplies should be very well regulated. It is also essential that those types be operated at a near constant ambient temperature.

The materials used in the tuning mechanism have been selected in such a way that their thermal expansion coefficient will produce a desirable ambient temperature vs. frequency coefficient.

After the back tuning stub has been adjusted for maximum power output, the lock nut on the plunger screw and Allen set screw should be tightened. Failure to observe this precaution may result in noisy and unstable operation.

MECHANICAL TUNING MECHANISM

The mechanical tuning mechanism of these types is designed to permit occasional frequency adjustments. Clockwise rotation of the tuning knob increases the frequency. Care should be taken not to exceed the maximum clockwise limit of the tuning knob, since further rotation may damage the tuning mechanism.

ELECTRONIC TUNING

With the mechanical 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 mechanical tuner setting, however, will be obtained at only one value of reflector voltage. If the mechanical 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.

MODES OF OPERATION

Oscillation may be obtained in a given tube with several combinations of resonator and reflector voltages at a given frequency. The regions where oscillation occurs within the reflector voltage range are referred to as voltage modes. Data cards are furnished with each tube showing various modes of operation. Operation in the higher voltage reflector modes usually results in more power output. Operation in the lower voltage reflector modes usually results in more electronic tuning.

DETAILED MECHANICAL INFORMATION

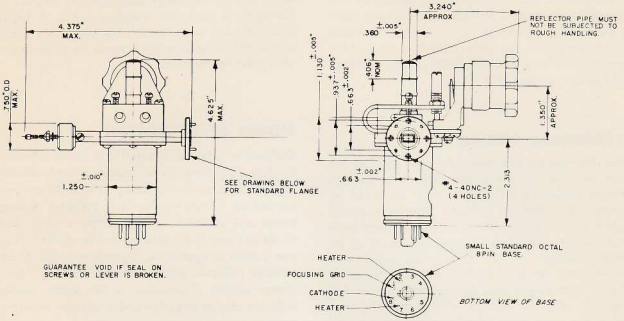
INSTALLATION

The types QK289 thru QK291 require a standard octal socket and may be mounted in any position. The output coupling flange should be rigidly clamped to a mating flange of the proper type. (See outline drawing)

Adequate cooling should be provided at all times due to relatively high input powers; forced air cooling is recommended.

SHIELDING

Where the types QK289 thru QK291 are to be operated in the presence of strong magnetic fields, shielding the resonator and reflector voltage leads is usually required in order to avoid undesirable modulation of the tube output. In extremely troublesome conditions, it may be advisable to place the tube in a metal chamber with polyiron chokes provided to bring the voltages into this chamber.



STANDARD FLANGE FOR MILLIMETER KLYSTRON (NEW TYPE)

TUBE TYPES	WAVEGUIDE	DIMENSION A	B	C	D	E	F	G	H
		+.005 -.000		±.001"		±.003"		±.003"	
QK 289	RG 96 U	.280"x.140"IDx.040" WALL	.363"	.225"	.182"	.112"	.468"	.1125"	.937"	.114"
QK 290										
QK 291