



Excellence in Electronics

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**TYPE
QKB691**

GENERAL DESCRIPTION

The QKB691 is a voltage-tunable backward wave oscillator designed for CW or pulsed operation over the 2000- to 4000-Mc range with a typical power output of 500 milliwatts at mid band. It is an integral magnet, coaxial output type tube requiring forced-air cooling and is designed for coupling to standard type "N" connector. A special control electrode, normally at cathode potential, facilitates low-voltage, pulsed or amplitude modulation.



**BACKWARD WAVE
OSCILLATOR**

GENERAL CHARACTERISTICS

ELECTRICAL

Heater Characteristics

Heater Voltage	6.3 V
Heater Current	1.3 A
Cathode Heating Time	1.0 minute min.

Maximum Ratings

Anode Voltage	250 Vdc
Anode Current	20 mAdc
Delay-Line Voltage	1600 Vdc Max. 100 Vdc Min.*
Delay-Line Current	45 mAdc
Delay-Line Dissipation	68 W
Control Electrode Voltage	
Positive Value	0 Vdc
Negative Value	100 Vdc

The values specified above must not be exceeded under any service condition. The ratings are limiting values above which the serviceability of any individual tube may be impaired. It does not necessarily follow that combinations of maximum ratings can be attained simultaneously.

* Minimum value may be exceeded provided care is taken that the attendant increased anode current will not result in excessive anode dissipation.

Typical Operation CW

Frequency Range	2000—4000 Mc
Delay-Line Voltage	150—1400 Vdc
Delay-Line Current	40 mAdc
Anode Voltage	130 Vdc
Anode Current	1-10 mAdc
Grid Voltage	0 Vdc
Power Output	0.1-1.0 W



VOLTAGE-TUNABLE BACKWARD WAVE OSCILLATOR

MECHANICAL

Over-all Dimensions	See outline drawing
Net Weight	8.5 lbs. approx.
Mounting Position	Any
Cooling	Forced air, 10 cu. ft/ min.
Output Coupling	Coaxial Type "N" Female
Base	Standard Intermediate Octal

DETAILED ELECTRICAL INFORMATION

CONTROL ELECTRODE

For CW operation at maximum power output, the control grid is tied to the cathode. In applica-

tions where pulsed or amplitude modulation is required, the circuit given in Figure 1 is recommended. The control grid must never be operated positive with respect to the cathode.

SIMPLIFIED MODULATION CIRCUIT

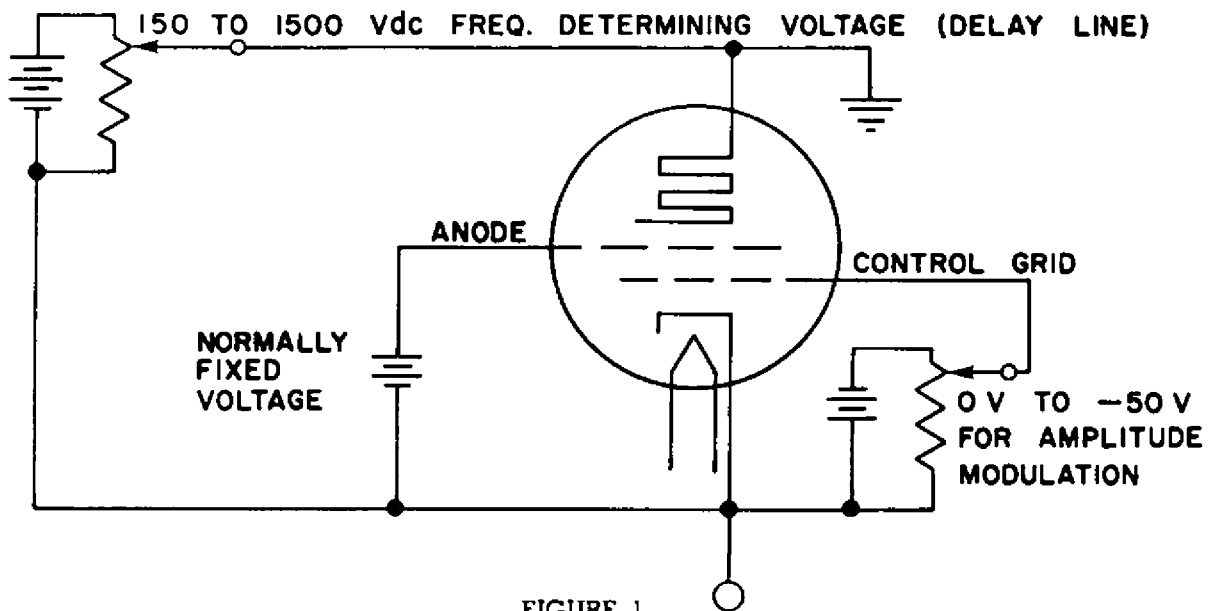


FIGURE 1

MICROWAVE AND POWER TUBE DIVISION

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FOUNDRY AVE., WALTHAM 54, MASS.

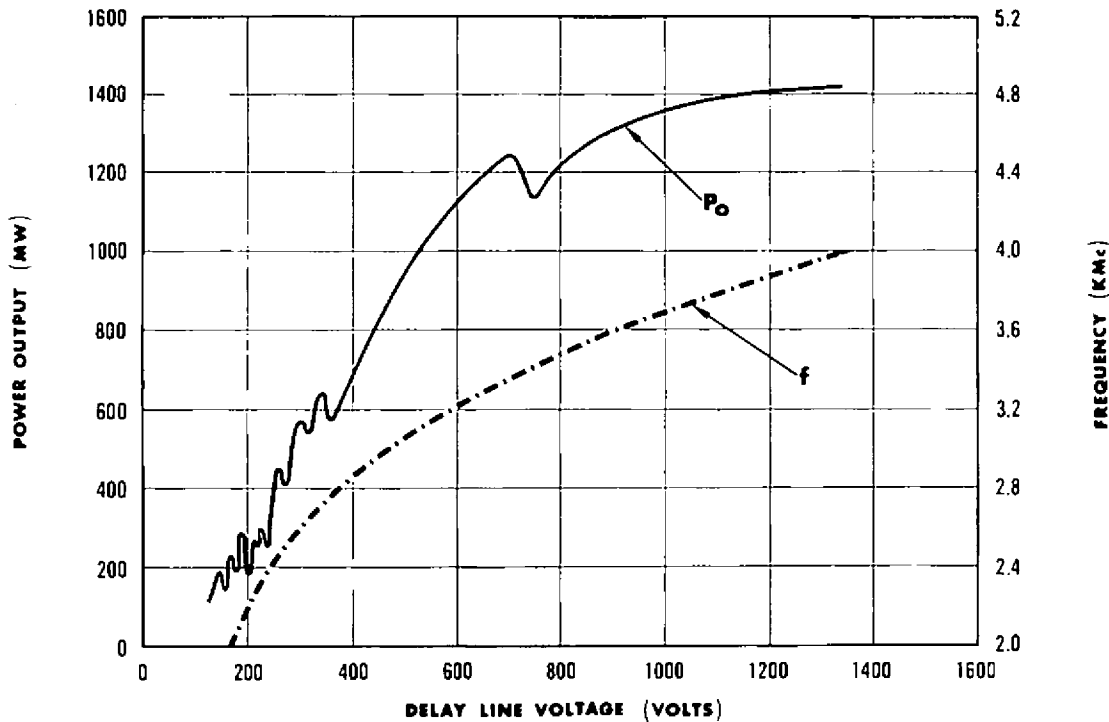
VOLTAGE-TUNABLE BACKWARD WAVE OSCILLATOR

FREQUENCY STABILITY

The regulation of the voltage supplied to the delay line and anode will be reflected directly in the stability of the output frequency.

The regulation of the control electrode bias supply will be reflected directly in the power output of the tube. Therefore, the regulation of these supplies must be commensurate with the power and frequency stability requirements of the application.

QKB691 POWER OUTPUT & FREQUENCY VS. DELAY LINE VOLTAGE



OPERATING PRECAUTIONS

In order to prevent damage to the tube, the anode voltage must not be applied without the minimum delay line voltage being applied before the anode voltage. Failure to observe this precaution will result in excessive anode current and possible burn out. Simultaneous application of all voltages after the preheat time is permissible. The grid must always be either zero or negative — never positive and can be applied or removed at any time with or without anode or delay line voltage except in the special case where the anode voltage is set high enough so that with operation without negative grid bias, the maximum cathode-delay line current would be exceeded. In this

case, the negative grid voltage must be applied before or simultaneously with but never after the anode. The grid and anode should not be allowed to float with respect to the cathode since these tubes contain a tetrode gun.

The cooling system capacity must be sufficient to maintain the delay-line temperature below 125° C and must be in operation before the application of the above voltages.

Adequate clearance must be maintained between the tube magnet and ferromagnetic materials or other magnets to avoid deterioration of the tube's gauss level. Generally a 4 inch clearance is sufficient.

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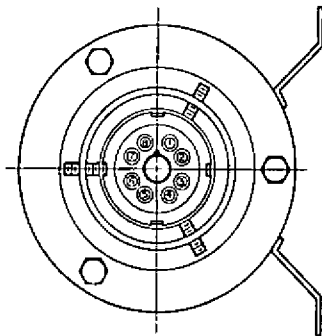
FOUNDRY AVE., WALTHAM 54, MASS.



VOLTAGE-TUNABLE BACKWARD WAVE OSCILLATOR

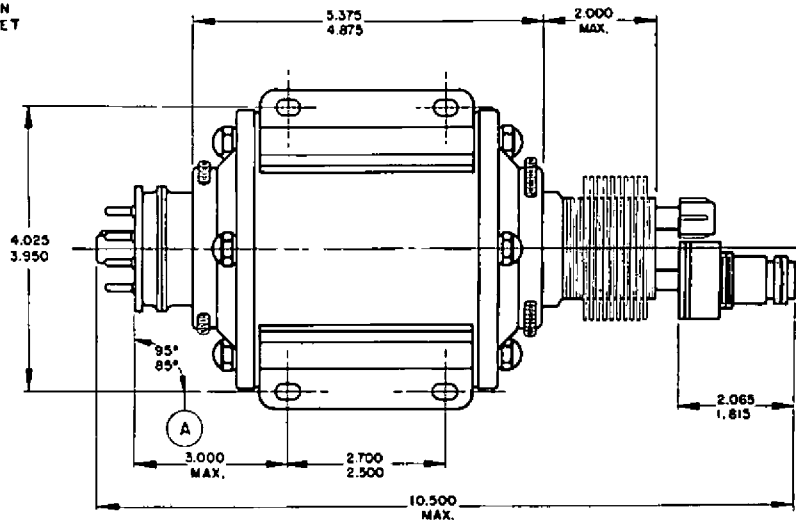
NOTE:

A. THESE TOLERANCES OCCASIONED BY THE NECESSITY FOR MANUFACTURERS ADJUSTMENT OF TUBE BODY WITHIN MAGNET ASSEMBLY. ADJUSTING SCREWS ARE PRE-SET BY MANUFACTURER.



PIN CONNECTIONS

- 1) SHELL & DELAY LINE
- 2) ANODE
- 3) N.C.
- 4) N.C.
- 5) GRID
- 6) N.C.
- 7) HEATER
- 8) H-CATHODE



QKB691 ELECTRON TUBE OUTLINE DRAWING

The tabulated data and accompanying graphs are representative of only a small sample and are presented as general information for the circuit designer. They should not be interpreted as completely defining the expected spread of the tube's

characteristics. Detailed information necessary for specific applications may be obtained by contacting the Applications Engineering Department, Microwave and Power Tube Operations.

REFERENCES

"New Oscillator Tubes With Wide-Band Electronic Tuning At Microwave Frequencies," P. Guénard, O. Doehler, B. Epsztein and R. Warnecke, *C. R. Acad. Sci. (Paris)* vol. 235, pp. 236-8 (July 21, 1952). In French.

"Understanding the Backward Wave Oscillator", D. A. Dunn, *Electronic Industries*, January, 1958.

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"The OType Carcinotron Tube", Palluel and Goldberger, *Proceedings of the I.R.E.*, March 1956, pp. 333-345.

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