

## REFLEX KLYSTRON

(THERMALLY TUNED)



### MAXIMUM RATINGS

(ABSOLUTE VALUES)

|                            |                         |
|----------------------------|-------------------------|
| Resonator Voltage .....    | 330 Vdc                 |
| Reflector Voltage .....    | —150 Vdc                |
| Tuner Grid Voltage.....    | —50 Vdc                 |
| Filament Voltage .....     | $6.3 \pm 8\% \text{ V}$ |
| Gun Cathode Current.....   | 28 mA <sub>dc</sub>     |
| Tuner Cathode Current..... | 10 mA <sub>dc</sub>     |
| Altitude .....             | 10,000 ft.              |

### PHYSICAL CHARACTERISTICS

- *Dimensions:* Refer to the outline drawing.
- *Base:* Small Octal 8-Pin, B8-21, Low Loss Phenolic Wafer.
- *Coupling to Wave Guide:* Direct, by means of an insulating fitting. (See Typical Adapter Assembly Drawing.)
- *Cooling:* Convection.
- *Mounting Position:* Any.
- *Cavity:* Silver Plated Steel.
- *Bulb:* Metal.
- *Output Window:* Low Loss glass.

### DESCRIPTION

The 2K50 Reflex Klystron (Bendix Red Bank Type TK-4) is a thermally tuned K band reflex oscillator. The tube is designed for use as a CW oscillator over the range of 23.5 kMc/sec. to 24.5 kMc/sec. The tube is thermally tuned over this frequency range by varying the grid bias voltage of a triode section incorporated in the metal envelope. The plate of this triode section is attached to the klystron structure and thermal expansion of the plate caused by variations of plate current is transmitted to the klystron section causing a change of gap spacing and a corresponding frequency change.

The wave guide coupling is accomplished by means of a tapered wave guide which couples to the cavity through a non-resonant iris. The guide tapers in the narrow dimension only, from the iris to a circular output window. External to the tube there is an insulating fitting which permits the tube to be coupled directly to the guide by means of a coupling (see Typical Adaptor Assembly drawing). This construction makes it possible to operate the shell of the tube at a different potential from that of the guide.

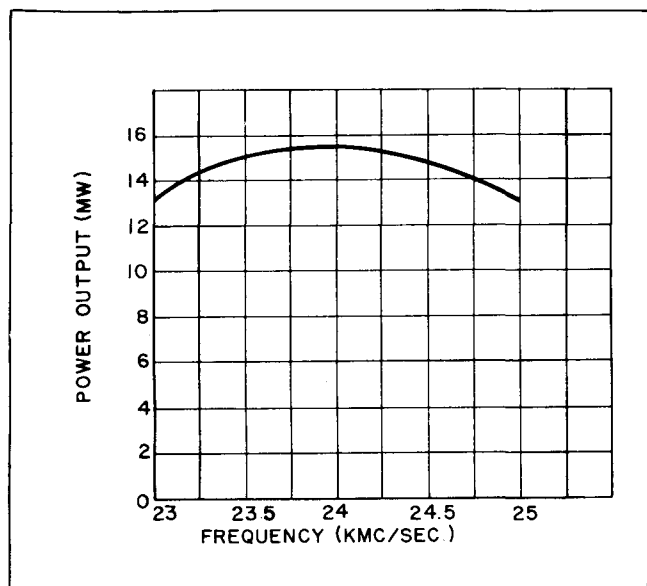
### APPLICATION NOTES

The 2K50 is unique in that its thermal tuning feature allows it to be tuned remotely by circuitry as in applications where direct mechanical tuning is impossible because of space limitations or inaccessibility. The type of thermal tuner employed in the 2K50 tends to be self compensating for ambient temperature changes, a factor which is highly desirable for most applications. In addition, the speed of the thermal tuner is remarkable. The tube will tune the prescribed frequency range from 23,500 Mc/sec. to 24,500 Mc/sec. in 1.2 to 2.6 seconds and, near the middle of the range, tuning speeds of 600 to 800 Mc/sec./sec. are obtained.

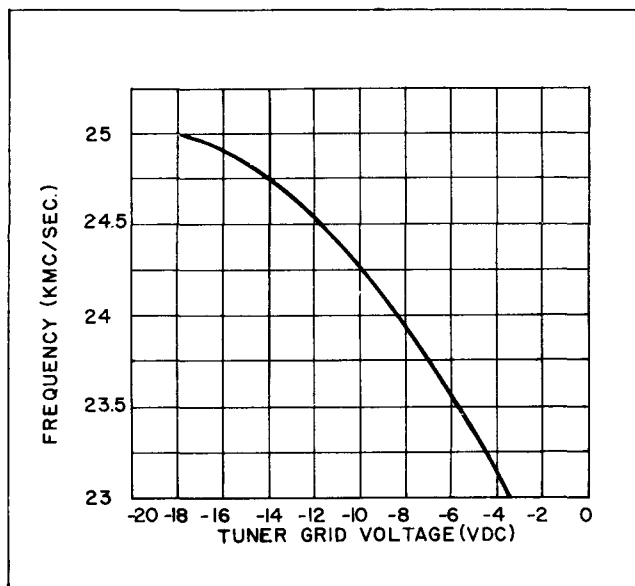
In addition to its application in radar circuitry, the 2K50 is finding wide application in microwave test gear and portable microwave spectroscopic equipment where ease and speed of tuning are desirable.

**THE *Bendix* CORPORATION**  
*Red Bank* DIVISION, EATONTOWN, NEW JERSEY

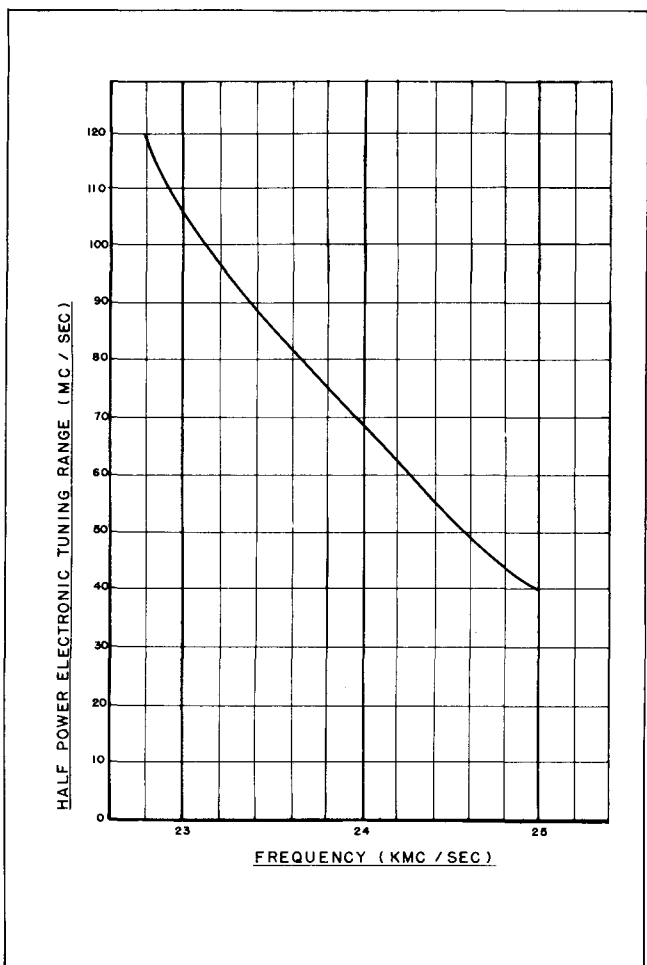
**AVERAGE CHARACTERISTICS**



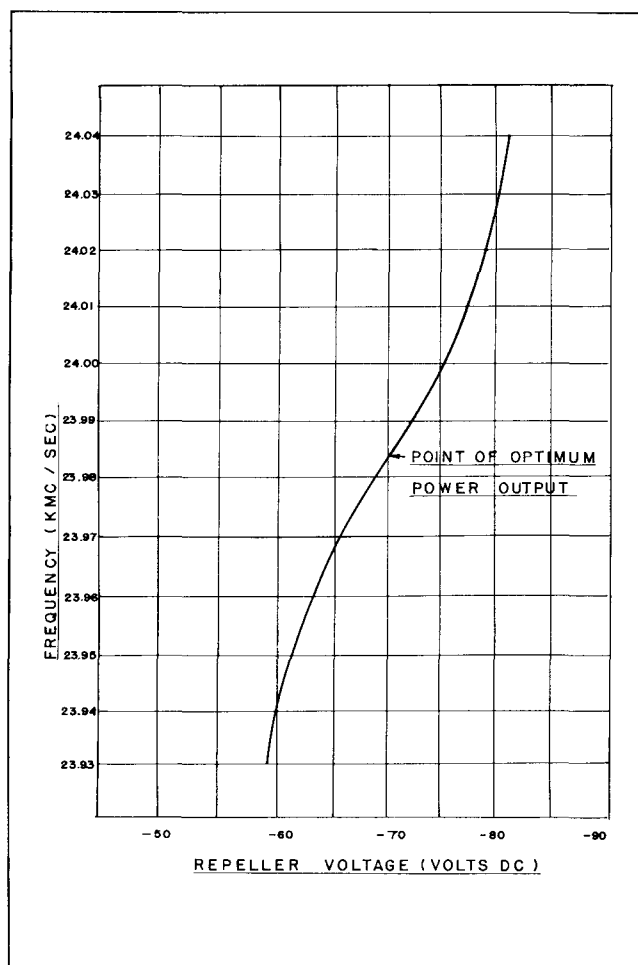
**POWER OUTPUT VS. FREQUENCY**  
(REPELLER VOLTAGE OPTIMIZED  
FOR EACH FREQUENCY)



**FREQUENCY VS. TUNER GRID  
VOLTAGE**



**VARIATION OF HALF POWER ELECTRONIC  
TUNING RANGE WITH FREQUENCY**



**VARIATION OF FREQUENCY  
WITH REPELLER VOLTAGE**

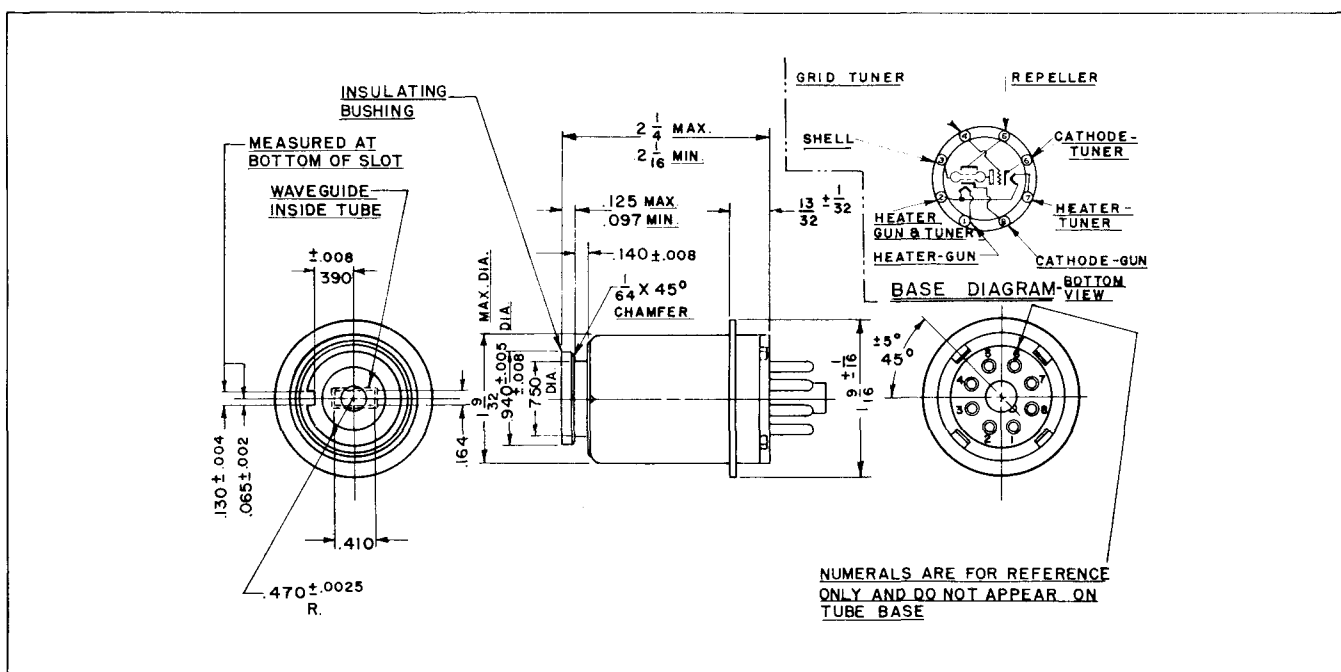
## ELECTRICAL CHARACTERISTICS & TEST CONDITIONS

### Test Conditions and Specification Limits

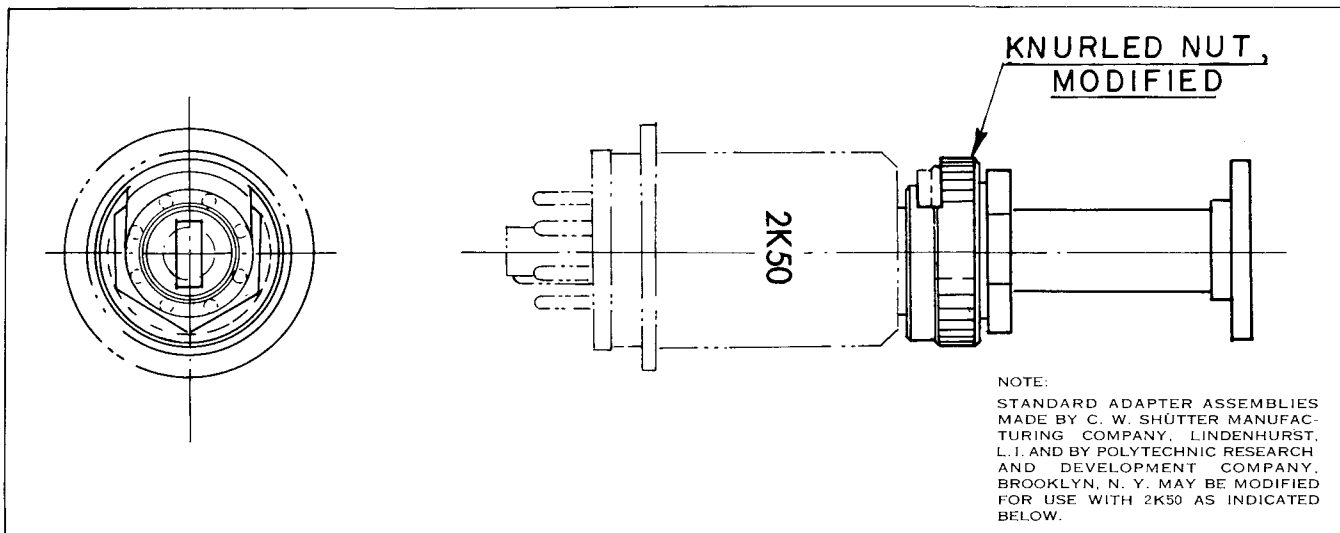
| TEST                      | CONDITIONS                                         | SYMBOL                   | LIMITS |       | UNITS     |    |
|---------------------------|----------------------------------------------------|--------------------------|--------|-------|-----------|----|
|                           |                                                    |                          | MIN.   | MAX.  |           |    |
| PRODUCTION TESTS          |                                                    |                          |        |       |           |    |
| Reflector Leakage Current | $E_r = -100$ Vdc                                   | $I_r$                    | —      | 5     | $\mu$ Adc |    |
| Reflector Gas Current     | $E_r = -100$ Vdc                                   | $I_r$                    | —      | 2     | $\mu$ Adc |    |
| Grid Current              | $E_c = -10$ Vdc                                    | $I_c$                    | —      | 2     | $\mu$ Adc |    |
| Gun Cathode Current       | $E_r = -50$ to $-100$ Vdc<br>Tube Non-Oscillating  | $I_{k_1}$                | —      | 22    | mAdc      |    |
| Tuner Cathode Current     | $E_c = 0$ Vdc                                      | $I_{k_2}$                | —      | 10    | mAdc      |    |
| Thermal Tuning Range (1)  | $E_r/\text{Max. Po}; E_c = 0$ Vdc                  | $F_1$                    | —      | 23216 | Mc        |    |
| Thermal Tuning Range (2)  | $E_r/\text{Max. Po}; E_c = -30$ Vdc                | $F_2$                    | 24751  | —     | Mc        |    |
| Bump                      | $E_r/\text{Max. Po}$                               | $\Delta P_o/P_o$         | —      | 10%   |           |    |
| Power Output              | $F = 23504$ Mc<br>$F = 23984$ Mc<br>$F = 24464$ Mc | VSWR = 1.2 max.          | $P_o$  | 8.5   | —         | mW |
|                           |                                                    |                          | $P_o$  | 10    | —         | mW |
|                           |                                                    |                          | $P_o$  | 8.5   | —         | mW |
| Tuner Grid Voltage        | $E_r/\text{Max. Po}$                               | $E_c$                    | —3     | —16   | Vdc       |    |
| Thermal Tuning            | $F = 23504$ to $24,464$ Mc                         | $\Delta E_c$             | —3     | —10   | Vdc       |    |
|                           | $E_r/\text{Max. Po}$                               |                          |        |       |           |    |
| Reflector Voltage         |                                                    | $E_r$                    | —40    | —110  | Vdc       |    |
| Emission Activity (Gun)   | $E_f = 5.8$ V                                      | $\Delta I_{k_1}/I_{k_1}$ | —      | 15%   |           |    |
| Emission Activity (Tuner) | $E_f = 5.8$ V                                      | $\Delta I_{k_2}/I_{k_2}$ | —      | 15%   |           |    |
| DESIGN TESTS              |                                                    |                          |        |       |           |    |
| Electrode Insulation      | 500 v; Tube Cold                                   | $R(k_1\text{-Res.})$     | 20     | —     | Meg.      |    |
|                           |                                                    | $R(k_2\text{-Res.})$     | 20     | —     | Meg.      |    |
|                           |                                                    | $R(f\text{-Res.})$       | 20     | —     | Meg.      |    |
| Heater Cathode Leakage    | $E_{hk_1} = \pm 45$ Vdc.                           | $I_{hk_1}$               | —      | 100   | $\mu$ Adc |    |
|                           | $E_{hk_2} = \pm 45$ Vdc                            | $I_{hk_2}$               | —      | 100   | $\mu$ Adc |    |
| Heater Current            |                                                    | $I_{f_1} + I_{f_2}$      | 705    | 805   | mA        |    |
| Thermal Tuning Time       |                                                    | $t$                      | 1.2    | 2.6   | sec.      |    |
| Electronic Tuning         | $E_r/50\%$ Max. $P_o$                              | $F$                      | 55     | 125   | Mc        |    |
| Hysteresis                |                                                    |                          | —      | 5%    |           |    |

### GENERAL TEST CONDITIONS:

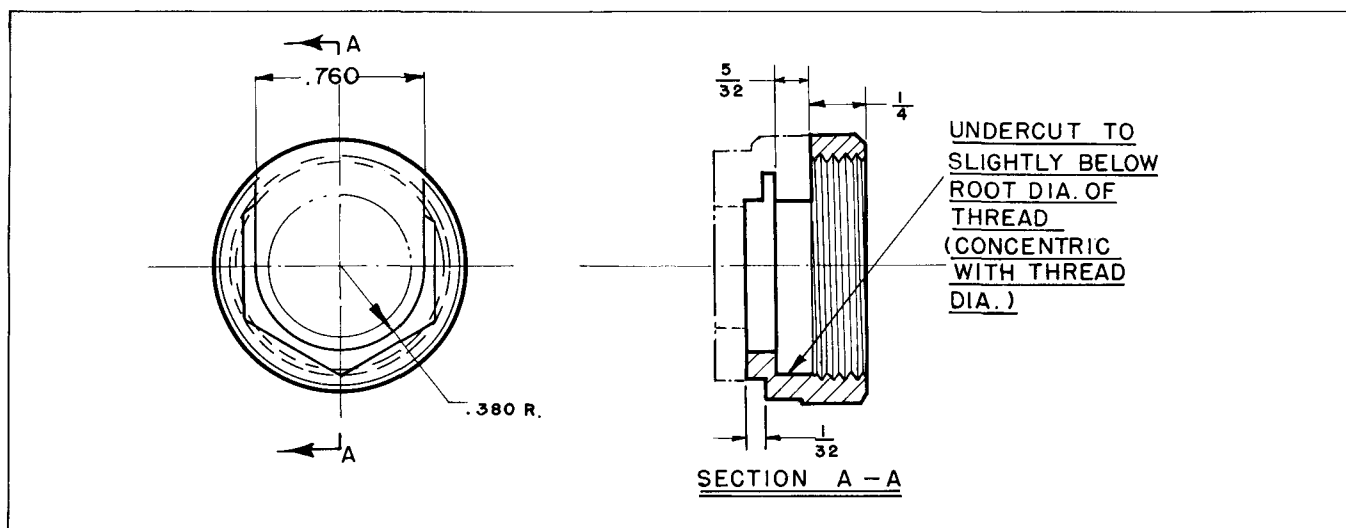
|                    |                        |                          |                       |                            |
|--------------------|------------------------|--------------------------|-----------------------|----------------------------|
| $E_f$<br>6.3 volts | $E_{res.}$<br>+300 Vdc | $E_r$<br>-20 to -130 Vdc | $E_c$<br>0 to -30 Vdc | $F$<br>$23984 \pm .3\%$ Mc |
|--------------------|------------------------|--------------------------|-----------------------|----------------------------|



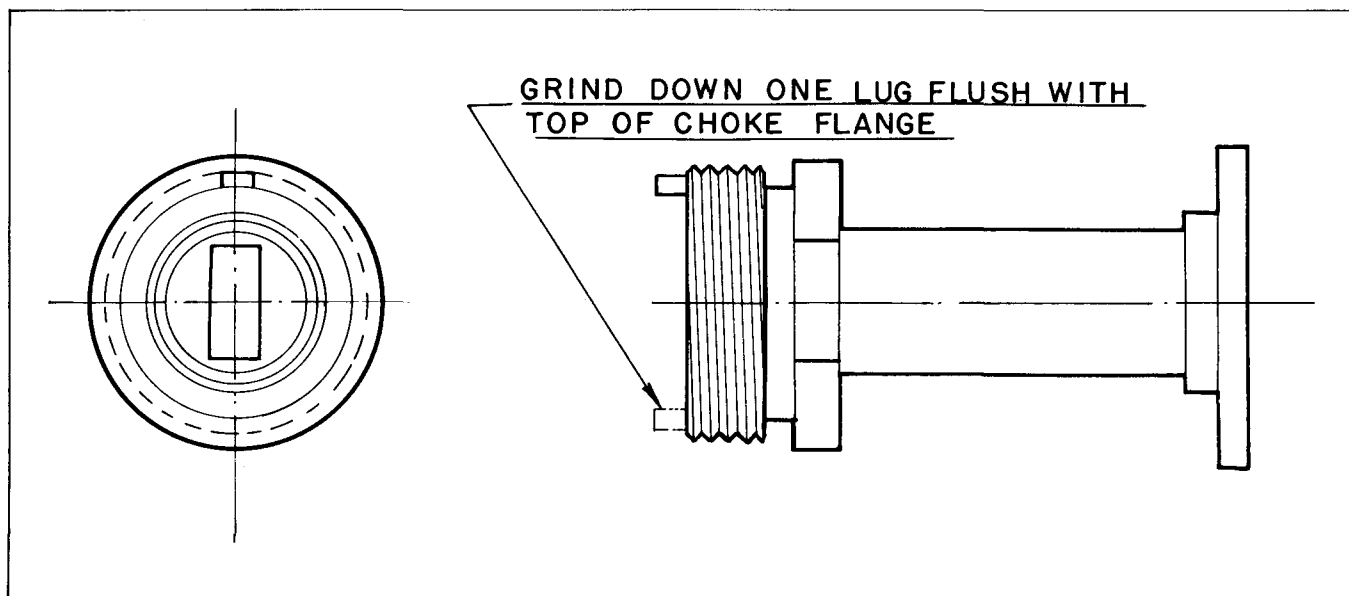
OUTLINE DRAWING



TYPICAL ADAPTER ASSEMBLY FOR COUPLING THE  
2K50 TO RG-53/U WAVEGUIDE



STANDARD KNURLED NUT — MODIFIED AS SHOWN



STANDARD WAVEGUIDE ADAPTER — MODIFIED AS SHOWN