

# BEAM SWITCHING TUBE



## engineering data report

# 6704

## Magnetron Beam Switching Tube (MO-10R)

### HIGH SPEED, HIGH VACUUM, TEN OUTPUT

Type 6704 differs from Type 6700 in that it has 10 internally mounted spade load vacuum resistors to permit operation at higher frequencies and with reduced number of external stem leads.

#### ELECTRICAL

Heater, Voltage	6.3 ±10% V
	AC or DC
Current at 6.3V	0.3 A. ±10%

#### MECHANICAL, See Figure 1

Overall length (Including Dome Cap)	3.500" max.
Seated height (Including Dome Cap)	3.240" max.
Diameter, without protective caps	1.630" max.
Magnet, length, without protective caps	1.765" max.
Envelope connections	see figure 2
Socket, 20 pin (No. SK-105)	see figure 3
Weight, total	7.5 ozs.
Mounting Position	Any (Note 7)

#### INTERELECTRODE CAPACITANCES (typical)

Any spade to all other elements (including heater)	2 uuf
Any target to all other elements (including heater)	5 uuf
Odd grids (5) to all other elements (including heater)	10 uuf
Even grids (5) to all other elements (including heater)	10 uuf
Cathode to all other elements (including heater)	6 uuf

#### MAXIMUM RATINGS

Target voltage	300 V DC
Spade voltage	200 V DC
Grid voltage	200 V DC
Heater-cathode voltage	±90 V DC
Individual target dissipation	1 watt
Switching Speed	From static to above 10 Mc.

#### TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

See Notes 1 and 2

Target voltage ( $E_{TT}$ )	Spade Voltage
Target, individual output current ( $I_T$ )	4.7 - 6.3 MA
	see note 5
Target Load Resistor ( $R_T$ )	3-3 K ohms
Cathode current ( $I_K$ )	6.5 ma nom.
Spade voltage ( $E_{SS}$ )	100 ±10% V d.c.
	see note 2
Spade current ( $I_S$ )	1.0 ma nom.
Spade load resistor ( $R_S$ )	100 K ohms mounted internally
Grid voltage ( $E_{CC}$ )	+25 V DC
	see note 3
Grid input pulse amplitude ( $E_i$ )	-50 V see Note 6.
Cut-off voltage (all spades common)	+200 V see note 4

from JEDEC release #3295, May 29, 1961

BEAM SWITCHING TUBE  
TYPE 6704 (MO-10R)

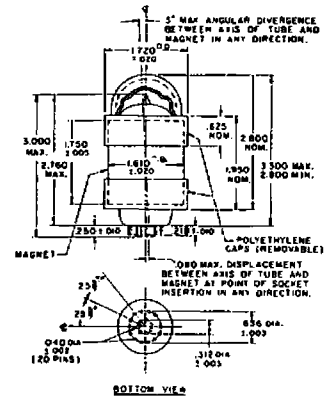


Figure 1  
Outline Drawing

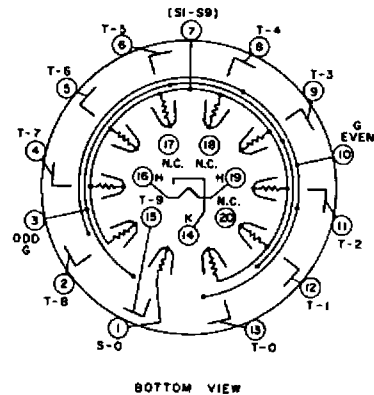


Figure 2  
Envelope Connection Diagram

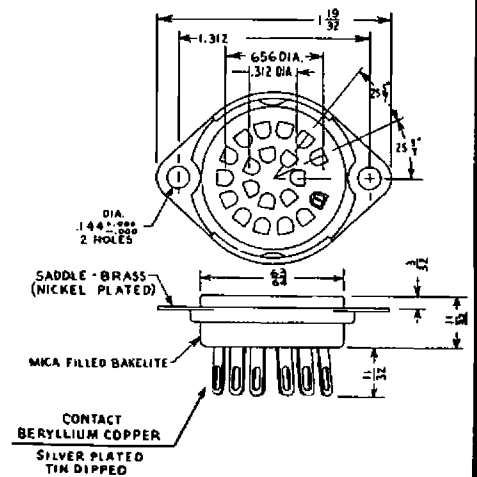


Figure 3  
Contact Socket Assembly

NOTES

1. The tube is tested at 10 KC but will operate in excess of ten megacycles under optimum operating conditions.
2. Under the specified test conditions in the test circuit, Figure 6, the tube will be clear and no output current will be produced, when all of the spades are at the spade source potential. As long as the spade source potential does not exceed the Firing Voltage (Note 4), a beam will not form spontaneously. Output current may be produced by forming a beam in the tube by lowering the potential of one spade to cathode potential. Once formed, the beam will not clear as long as the spade source voltage exceeds the specified minimum. With the potential of the switching grids at the specified grid bias voltage, the beam will not switch if the spade source voltage does not exceed the specified maximum.

3. Under the specified conditions, the beam will not switch if the potential of the switching grid at the position where the beam is formed exceeds the specified grid voltage.

4. Firing Voltage (DC Cut-Off Voltage): That voltage between cathode and spade bus above which spontaneous electron beam formation can occur. See Bulletin BX-535, page 5, for detailed explanation.

5. The tube is a constant current device having pentode type output characteristics. For a fixed value of spade voltage, output current at a given target is constant over a wide range of target voltage; however, because of normal manufacturing tolerances, the amount of target current can vary from target to target. With the tube operating in the test circuit, Figure 6, and with the spade and target supply voltages fixed at 100 volts, the target and cathode current measured with the beam at each of the ten targets must be within the specified limits.

6. (a) The beam is switched to the next position by applying a negative change in potential to the switching grid at the position where the beam is formed. Once the beam has switched from this position, the potential on the switching grid at this position no longer affects the beam. When the tube is operated in the test circuit as specified, the grid input pulse amplitude specified is the minimum change in potential from the specified grid voltage which will always switch the beam. The drive pulses to the switching grids must increase in amplitude as the frequency increases in order to overcome capacitive effects. With switching grid pulses of appropriate amplitude, the tube will operate at switching rates exceeding 10.0 MC.

(b) The switching grids are electrically connected inside the tube into even and odd sets. The switching voltages are alternately applied to the even grid and odd grid terminals.

7. In order to prevent changes in the electrical characteristics of this tube, do not strike the magnet and do not place the tube in close proximity (less than 2.0 inches) to ferro-magnetic materials or within strong magnetic fields. Do not operate tubes with spacing between tubes of less than 4.0 inches center to center. To secure tubes in equipment, mount them by clamping magnet to chassis. Allow socket to float so that magnetic alignment between the tube envelope and the magnet is not disturbed.

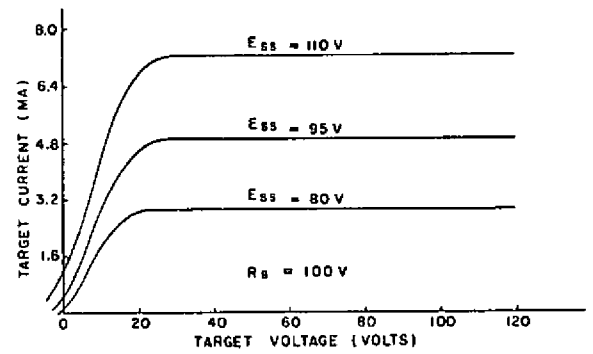


Figure 4  
Output characteristic

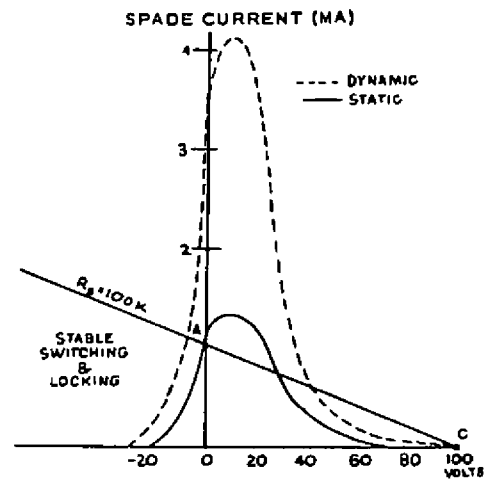


Figure 5  
Beam Forming & Locking Spade Characteristic

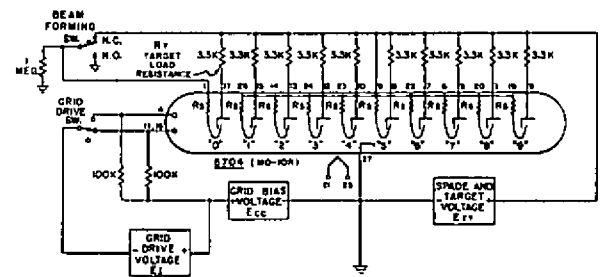


Figure 6  
Basic Circuit for 6704

NOTES:

1. Constants as shown will accept a 3 V. RMS, 5.0 Mc input signal which will drive an MO-10R at 10 Mc.
- The tuned circuit should utilize a high-L/C ratio for maximum output voltage. The output voltage should be 100 V or more peak to peak. The coil shown uses 36 turns of #22 Birmval center-tapped on a 3/4" dia. form. The dotted connection makes the circuit a Hartley Oscillator.