



# MAGNETRON

# M504

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## INTRODUCTION

The M504 is a forced-air cooled multi-resonator pulse operated Magnetron with a peak input power rating of 1.9MW and operates at a fixed frequency within the limits of 9325 and 9425Mc/s when used under the conditions specified below.

The valve is designed for use with a separate electro-magnet (not supplied).

The position of the magnet must be adjusted so that the axis of the field is in line with the axis of the anode. The diagram on page 9 shows a dummy pole piece assembly which can be used in conjunction with the electro-magnet to check that it is producing the correct magnetic field. The user is invited to consult the English Electric Valve Co. Ltd. on the choice of magnets.

The waveguide output flange is designed for coupling directly to waveguide No. 15 (1.122 inch  $\times$  0.497 inch internal dimensions) by means of coupler type UG-52A/U (Z830033).

The waveguide must be pressurised to a minimum pressure of 35 lb/sq.in. absolute to prevent waveguide breakdown and to provide cooling air across the valve output window.

## GENERAL DATA

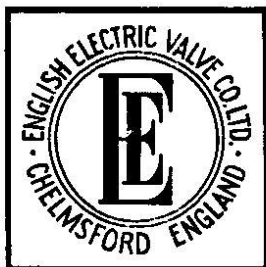
### Electrical

Cathode.. .. .	Indirectly Heated, Oxide Coated
Heater Voltage.. .. .	5.0 V
Heater Current ( <i>See Note 1</i> ) .. .. .	40 A
Heater Starting Current:	
Peak Value, not to be exceeded .. .. .	175 A
Cathode Heating Time (Minimum) .. .. .	5 minutes

### Mechanical

Overall Dimensions (excluding flexible leads)	14.16 $\times$ 8 $\times$ 8 inches	Max
	360 $\times$ 204 $\times$ 204 mm	Max
Net Weight .. .. .	5½ pounds (2.5 kg)	Approx
Mounting Position .. .. .		Any

Cooling .. .. .	Forced-air
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### MAXIMUM AND MINIMUM RATINGS

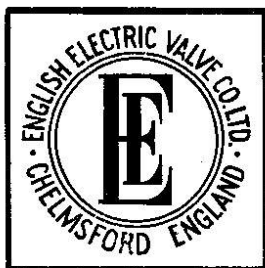
(Absolute Values)

These ratings cannot necessarily be used simultaneously, and no individual rating should be exceeded.

	<i>Min</i>	<i>Max</i>	
Heater Voltage at heater current 40A .. ..	4.3	5.2	V
Heater Current ( <i>See Note 1</i> ) .. .. .	—	40	A
Anode Voltage (Peak) .. .. .	32	38	kV
Anode Current (Peak) ( <i>See Note 2</i> ) .. ..	—	50	A
Input Power (Peak) .. .. .	—	1.9	MW
Input Power (Mean) ( <i>See Note 2</i> ) .. ..	—	1.2	kW
Duty Cycle ( <i>See Note 2</i> ) .. .. .	—	0.0006	
Pulse Length ( <i>See Note 4</i> ) .. .. .	—	1.0	$\mu$ sec
Rate of Rise of Voltage Pulse ( <i>See Note 3</i> ) ..	—	200	kV/ $\mu$ sec
Anode Temperature .. .. .	—	150	$^{\circ}$ C
Cathode Terminal Temperature .. .. .	—	165	$^{\circ}$ C
Frequency Change with Anode Temperature Change (after warming) .. .. .	—	—0.25Mc/s/ $^{\circ}$ C	
V.S.W.R. at the output coupler .. .. .	—	1.5:1	

### TYPICAL OPERATION

Heater Current .. .. .	30	A
Magnetic Field .. .. .	7000	Gauss
Anode Voltage (Peak) .. .. .	35	kV
Anode Current (Peak) .. .. .	50	A
Pulse Length .. .. .	0.6	$\mu$ sec
Pulse Repetition Rate .. .. .	1000	p.p.s.
Output Power (Peak) .. .. .	750	kW



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## TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

	Oscillation 1	Oscillation 2	
Magnetic Field .. .. .	7000	6500	Gauss
Heater Current (for test) .. .	30	30	A
Anode Current (Mean) .. .	30	30	mA
Duty Cycle (See Note 2) .. .	0.0006	0.0006	
Pulse Length (See Note 4) .. .	0.6	0.6	μsec
Voltage Standing Wave Ratio at the output coupler .. .	1.05:1	1.05:1	
Rate of Rise of Voltage Pulse (See Note 3)	150	150	kV/μsec

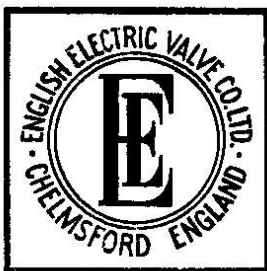
	Limits				
	Min	Max	Min	Max	
Anode Voltage (Peak) .. .	32	38			kV
Output Power (Mean) .. .	400				W
Frequency .. .	9325	9425			Mc/s
R.F. Bandwidth at ¼ Power (See Note 5) .. .		4.2		4.2	Mc/s
Frequency Pulling (V.S.W.R. not less than 1.5:1) .. .		15			Mc/s
Stability:					
Arc Count (See Note 6) .. .		1.0		1.0	%
Side Lobes (Ratio) .. .	6		6		db

## LIFE TEST

The quality of all production is monitored by the random selection of valves which are then life-tested under Oscillation 1 conditions. If the valve is to be run continuously under different conditions, the English Electric Valve Co. Ltd. should be consulted to verify that the life of the valve will not be impaired.

## END OF LIFE CRITERIA (under Test Conditions Oscillation 1)

Output Power (Mean) .. .	310	W Min
R.F. Bandwidth at ¼ Power .. .	5.0	Mc/s Max
Frequency: Must be within Test Limits above, Oscillation 1		
Stability:		
Arc Count (See Note 6) .. .	2.0	% Max
Side Lobes (Ratio) .. .	6	db Min



## NOTES

1. With no anode input power.

On stand-by the heater current shall not exceed 40 amperes. On the application of anode power the heater current should be lowered according to the following formula:

input powers up to 1050 watts,

$$I_h = 40 - 0.0095 P_i$$

where  $P_i$  = mean input power in watts.

For input powers above 1050 watts,

$$I_h = 80 - 0.0476 P_i$$

The valve heater shall be protected against arcing by the use of a minimum capacitance of 4000pF shunted across the heater directly at the input terminals; in some cases a capacitance as high as 2μF may be necessary depending on the equipment design. For full details see Notes on the Protection of Magnetrons, in the preamble to this section.

2. The various parameters are related by the following formula:

$$P_i = i_{apk} \times Du \times 35 \times 1000$$

where  $P_i$  = mean input power in watts

$i_{apk}$  = peak anode current and

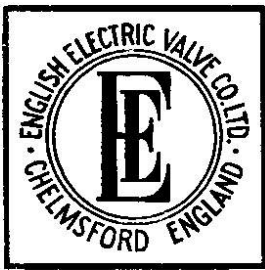
$Du$  = duty cycle.

3. The rate of rise of voltage is the slope of the steepest tangent to the leading edge of the voltage pulse above 80% amplitude. Any capacitance used in the viewing system must not exceed 6.0pF.

4. Tolerance  $\pm 0.1 \mu\text{sec}$ .

5. The R.F. Bandwidth in Mc/s is given by  $2.5/\text{pulse length in } \mu\text{secs}$ .

6. The valve shall be operated into a transmission line with a V.S.W.R. of 1.5 to 1 adjusted in phase to produce maximum instability. The valve shall be considered stable when it shows less than the maximum allowable percentage of arcs during the last five minute interval of a test period at fifteen minutes. The percentage of arcs is defined as the number of arcs in the five minute interval divided by the total number of magnetron pulses during that interval. Arcs shall be recorded by an electronic counter which is adjusted to respond to 10% above operating peak current.



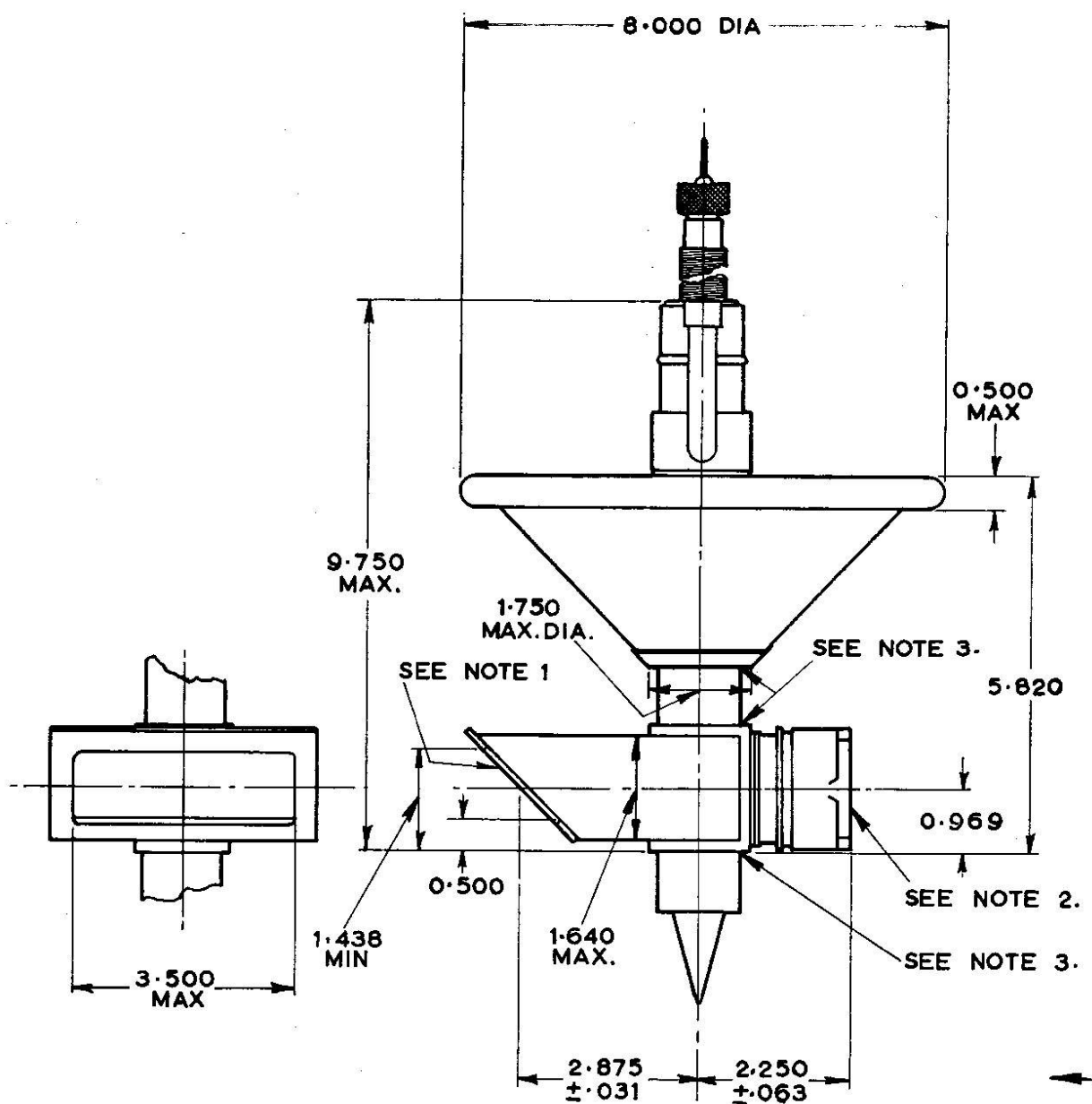
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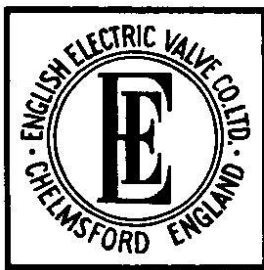
## OUTLINE

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ALL DIMENSIONS IN INCHES

INDICATES A CHANGE 



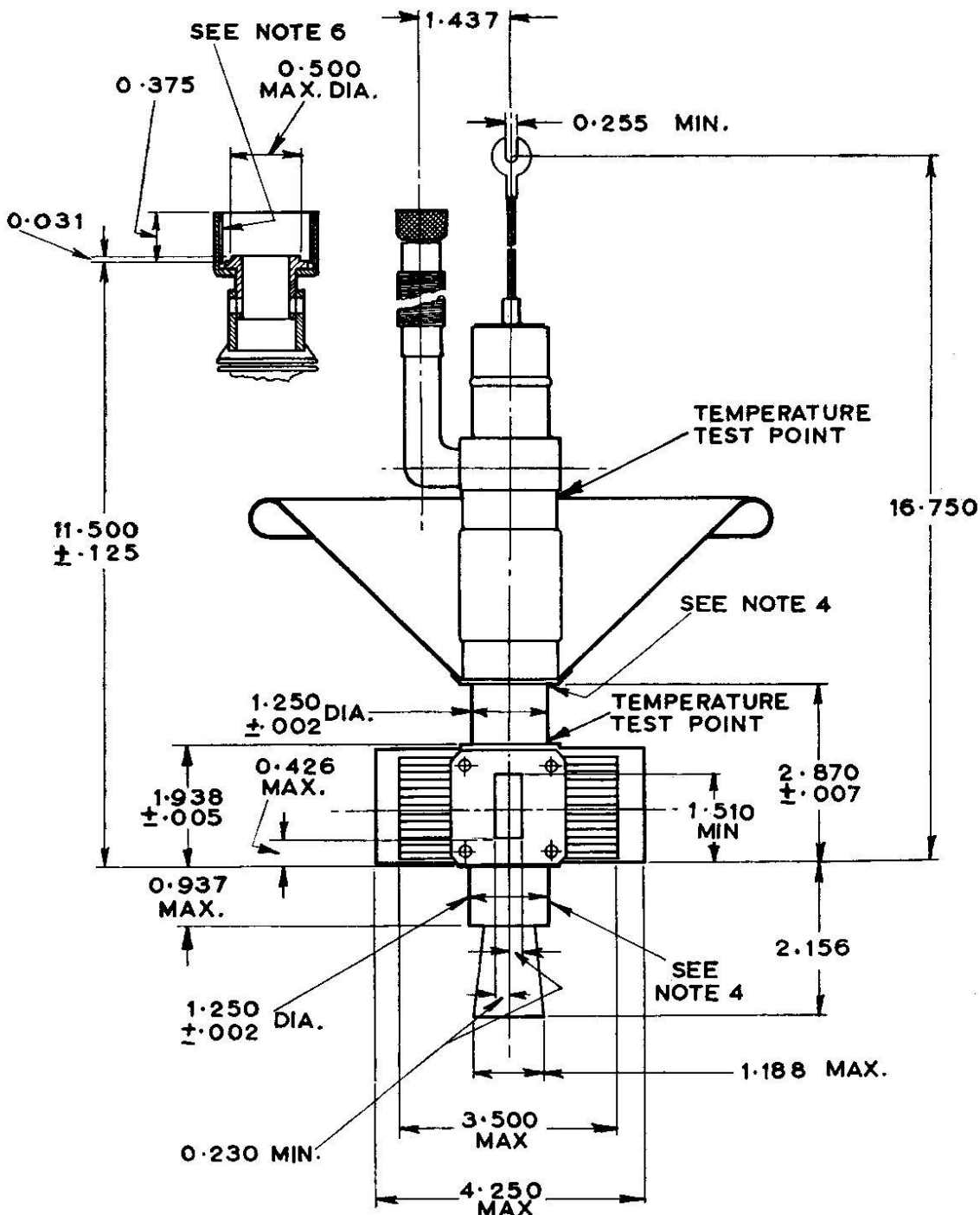
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## OUTLINE

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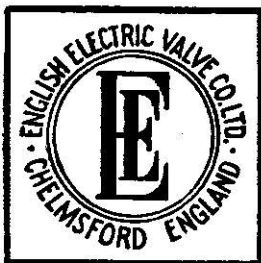


ALL DIMENSIONS IN INCHES

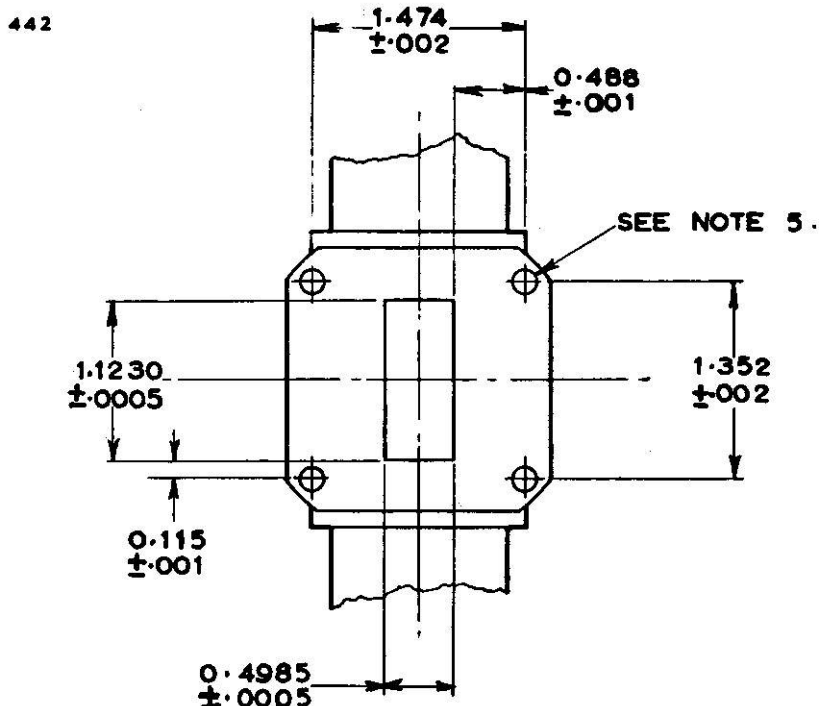
INDICATES A CHANGE  $\leftarrow$

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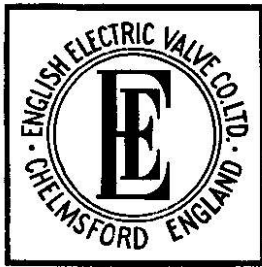
## OUTLINE DETAILS



## NOTES FOR OUTLINE

1. With the valve mounted in an approved gauge a feeler 0.045 thick and 0.125 wide will not enter at any point between this flange and a surface plate brought into contact with this flange.
2. With the valve mounted in an approved gauge a feeler 0.032 thick and 0.125 wide will not enter at any point between this flange and a surface brought into contact with this flange.
3. Maximum radius of solder 0.125.
4. The pole pieces will be concentric to within 0.005.
5. Four holes  $\begin{matrix} 0.167 \\ 0.166 \end{matrix}$  Dia.
6. Threaded 0.750 B.S.F. (Medium fit).

ALL DIMENSIONS IN INCHES



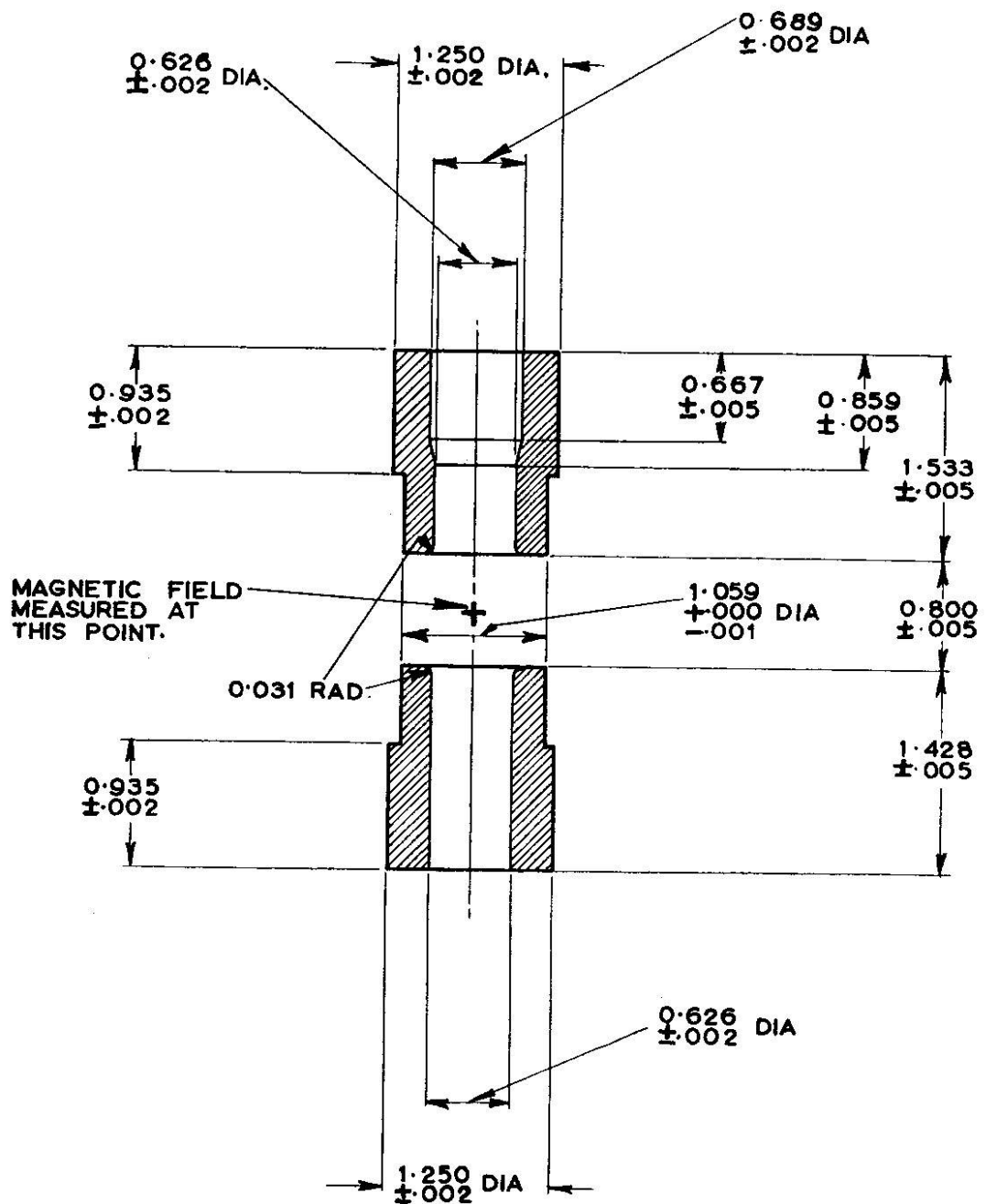
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## DUMMY POLE PIECE ASSEMBLY

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ALL DIMENSIONS IN INCHES

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