M573 M574

S-BAND MAGNETRONS

Frequency variants of 7182

ABRIDGED DATA

Fixed frequency pulse magnetrons

Frequency range:		
M573	2850 to 2960	MHz
M574	2950 to 3060	MHz
Typical peak output power	2.5	MW
Magnet and launching section	separate electromagnet and launching section, see page 10	
Output	no. 10 waveguide (2.840 x 1.340 inches internal)	
Cooling	water and forced-air	

GENERAL

Electrical

Cathode	indirectly heated	
Heater voltage (see note 1)	12	V
Heater current	14	A
Heater starting current, peak value, not to be exceeded	40	A max
Cathode heating time (minimum) (see note 1)	3	min

Mechanical

Overall dimensions	15.32 x 3.26 x 3.26 inches max 390 x 82.9 x 82.9mm max
Net weight	9¾ pounds (4.5kg) approx
Mounting position	vertical only

Any lubricants used on the anode should be sulphur free.

Cooling water and forced-air (high pressure)

Water-cooling of the anode is incorporated with the electro-magnet, the window is cooled by air at high pressure in the waveguide, while low pressure air cooling may be used on the cathode terminal. The minimum window cooling air flow is $3ft^3$/min ($0.085m^3$/min) N.T.P., and the maximum air inlet temperature is 70°C.

The temperature rise across the water jacket should not exceed 15°C nor the water flow be less than 0.75 imp. gal/min (3.4 l./min). The design maximum temperature of the outlet water should be 70°C; under no conditions must 80°C be exceeded.

MAXIMUM AND MINIMUM RATINGS (Absolute values)

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

	Min	Max	
Magnetic field (see note 2):			
M573	1460	1580	gauss
M574	1520	1640	gauss
Heater voltage (see note 1)	11.4	15.0	V
Heater starting current (peak)	—	40	A
Anode voltage (peak):			
M573	35	41	kV
M574	38	44	kV
Anode current (peak):			
M573	115	170	A
M574	105	155	A
Input power (peak)	—	6.0	MW
Input power (mean) (see note 3)	—	8.3	kW
Duty cycle	—	0.0015	
Pulse length (see note 4)	0.5	5.0	μs
Pulse repetition rate	—	600	p.p.s.
Rate of rise of voltage pulse (see note 5)	100	150	kV/μs
Anode temperature (see note 2)	—	150	°C
Cathode terminal temperature (see note 2)	—	150	°C
V.S.W.R. at the output coupler (see note 6)	—	1.5:1	
Pressurising of waveguide (see note 7)	35	65	lb/in²
	2.46	4.57	kg/cm²

TYPICAL OPERATION

Operational Conditions

Heater voltage	0	V
Magnetic field:		
M573	1520	gauss
M574	1580	gauss
Anode current (peak):		
M573	144	A
M574	132	A
Pulse length	5.0	μs
Pulse repetition rate	300	p.p.s.

Typical Performance

Anode voltage (peak):		
M573	38	kV
M574	41	kV
Output power (peak)	2.5	MW
Output power (mean)	3.75	kW

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions (See Note 8)

	Oscillation 1	Oscillation 2	Oscillation 3	
Air flow			see note 9	
Magnetic field (see note 10):				
M573	1520	1520	1610	gauss
M574	1580	1580	1675	gauss
Heater voltage (for test)	0	0	0	V
Anode current (mean):				
M573	215	180	188	mA
M574	198	165	174	mA
Duty cycle	0.0015	0.001	0.0015	
Pulse length (see note 4)	2.5	5.0	5.0	μs
V.S.W.R. at the output coupler			see note 11	
Rate of rise of voltage pulse (see note 5)	72 to 90	150 to 180	113 to 137	kV/μs

Limits

	Min	Max	Min	Max	Min	Max	
Anode voltage (peak):							
M573	36	40	—	—	—	—	kV
M574	39	43	—	—	—	—	kV
Output power (mean)	3375	—	—	—	—	—	W
Frequency:							
M573	2850	2960	—	—	—	—	MHz
M574	2950	3060	—	—	—	—	MHz
R.F. bandwidth at ¼ power (see notes 12 and 13)	—	1.0	—	0.5	—	0.5	MHz
Frequency pulling (see note 12)	—	7.0	—	—	—	—	MHz
Frequency pushing (see note 14)	—	1.0	—	—	—	—	MHz
Stability (see notes 12, 13 and 15)	—	0.5	—	0.5	—	0.5	%
Heater current					see note 16		
Temperature coefficient of frequency					see note 17		

LIFE TEST

The quality of all production is monitored by the random selection of valves which are then life-tested under the Life Test conditions below. If the valve is to be operated under conditions other than those specified herein, English Electric Valve Company Ltd. should be consulted to verify that the life of the valve will not be impaired.

Life Test Conditions

Heater voltage	0	V
Magnetic field:		
M573	1520	gauss
M574	1580	gauss
Anode current (mean):		
M573	215	mA
M574	198	mA
Duty cycle	0.0015	
Pulse length	5.0	μs
V.S.W.R. at the output coupler	1.1:1	max
Rate of rise of voltage pulse	113 to 137	kV/μs

Switched off for 60 minutes every 24 hours.

End of Life Criteria (under Test Conditions Oscillation 1)

Output power (mean)	2700	W min
R.F. bandwidth at ¼ power (see notes 12 and 13)	1.0	MHz max
Frequency: must be within Test Limits above, Oscillation 1		
Stability (see notes 12, 13 and 15)	1.0	% max

NOTES

1. With no anode input power.

   Prior to the application of anode voltage, the cathode shall be heated to the required initial temperature by the application of 12 volts to the heater for at least four minutes or by the application of 15 volts for three minutes. The heater voltage must not exceed 12.6 volts for longer than five minutes. Immediately after the application of anode voltage, the heater voltage shall be reduced according to the formulae:

   V_h = 12.0–0.0010Pi for Pi less than 6000 watts

   V_h = 30.0–0.0040Pi for Pi greater than 6000 watts

   where Pi = mean input power in watts.

   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 further details see the preamble to this section.

The valve is normally tested with a heater supply frequency of 50Hz. English Electric Valve Company Ltd. should be consulted if the valve is to be operated with a heater supply of any other frequency.

2. Measured at the point specified on the electro-magnet and launching section (see page 10).

3. The various parameters are related by the formula:

$$P_i = i_{apk} \times v_{apk} \times Du$$

where P_i = mean input power in watts
i_{apk} = peak anode current in amperes
v_{apk} = peak anode voltage in volts
and Du = duty cycle.

4. Tolerance $\pm 10\%$.

5. The rate of rise of voltage is defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude.

6. A phase shifter should be incorporated into the waveguide immediately before the magnetron, and adjusted, if necessary, to give a satisfactory spectrum. The standing wave ratio between 3100 and 3200MHz for M573, and between 3200 and 3300MHz for M574, should not exceed 2.0:1.

7. At the maximum pressure of 65lb/in^2 (4.57kg/cm^2) the leakage will not exceed 0.03 litre (N.T.P.) per minute.

8. The modulator shall be such that the pulse energy delivered to the magnetron, followed by an arcing pulse, cannot greatly exceed the normal energy per pulse.

9. During this test the waveguide air pressure shall not exceed 35lb/in^2 (2.46kg/cm^2) absolute and the cooling air flow shall not exceed 3ft^3/min (0.085m^3/min) free air volume. There shall be no evidence of breakdown in the output waveguide during this test.

10. The value of the axial magnetic field should not vary by more than $\pm 4\%$ from the value at the specified point of the valve shown on page 10, over a distance of 2 inches (50.8mm) in either direction along the axis. The sense of the field shall be such that a north-seeking pole at the specified point is attracted towards the cathode terminal of the magnetron.

11. The load termination of the magnetron during this test shall be a waveguide with a v.s.w.r. of less than 1.1:1 at the oscillation frequency and less than 1.5:1 between frequencies 3100 and 3200MHz for M573, and between 3200 and 3300MHz for M574, unless otherwise specified.

12. •The valve shall be terminated by a mismatch giving a v.s.w.r. of at least 1.5:1 at the oscillating frequency. The mismatch shall be such that when the position of a voltage maximum is set to coincide with the launching section Reference Plane C (see page 12) the position of the voltage minimum at a frequency of 3150MHz for M573 and 3250MHz for M574 shall lie between ±10mm from the Reference Plane.

13. There shall be a range of at least $\lambda g/4$ where both the stability and bandwidth are less than the specified maxima, and they shall also be less than the maxima into a matched load.

14. The change in frequency when the mean input current is varied between the limits of 200 and 230mA for M573 and between the limits of 183 and 213mA for M574 shall be less than 1MHz. The current shall be varied continuously between the limits with a period not exceeding 5 seconds.

15. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal energy level in the rated frequency range of the magnetron. Missing pulses are expressed as a percentage of the number of input pulses applied during any 5 minute interval of a 10 minute test period.

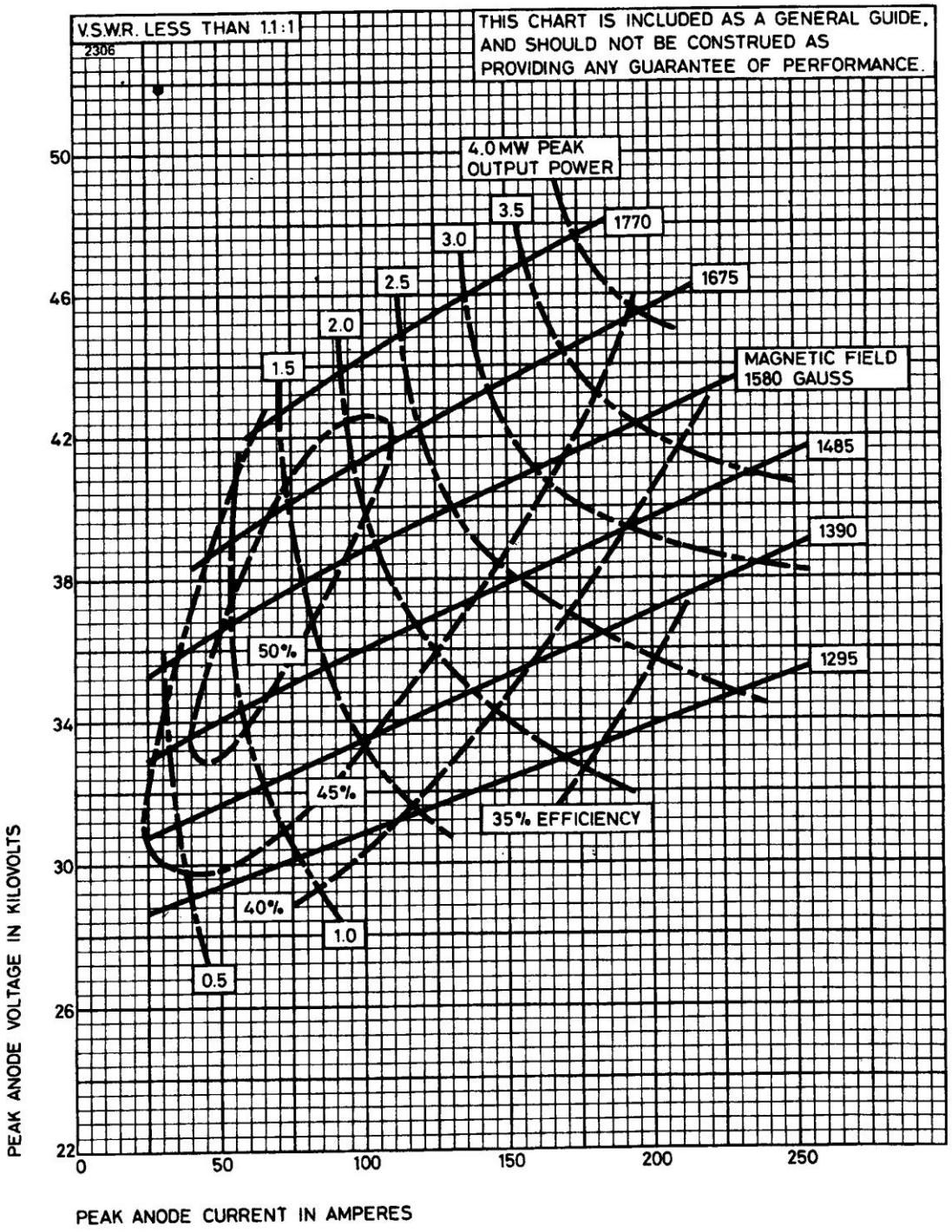
16. Measured with heater voltage of 12V and no anode input power, the heater current limits are 13A minimum, 15A maximum.

17. Design test only. The maximum frequency change with anode temperature change (after warming) is −0.05MHz/°C.

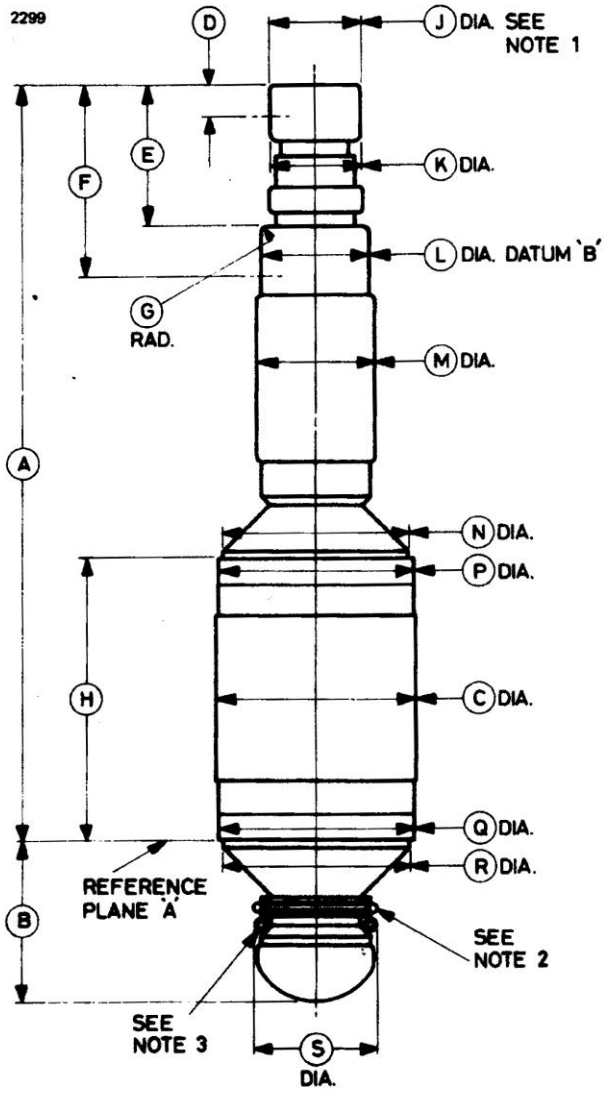
X-RAY WARNING

High voltage magnetrons emit a significant intensity of X-rays not only from the cathode sidearm but also from the output waveguide. These rays can constitute a health hazard unless adequate shielding for X-ray radiation is provided. This is a characteristic of all magnetrons and the X-rays emitted correspond to a voltage much higher than that of the anode.

PERFORMANCE CHART FOR M574



OUTLINE


2299
D
J DIA. SEE NOTE 1
E
F
K DIA.
L DIA. DATUM 'B'
G RAD.
M DIA.
A
N DIA.
P DIA.
H
C DIA.
Q DIA.
R DIA.
REFERENCE PLANE 'A'
B
SEE NOTE 2
SEE NOTE 3
S DIA.

OUTLINE DIMENSIONS

Ref	Inches	Millimetres
A	12.700 max	322.6 max
B	2.620 max	66.55 max
C	3.251 max	82.58 max
D	0.375 min	9.53 min
E	3.063 max	77.80 max
F	3.563 min	90.50 min
G	0.100 min	2.54 min
H	$4.625^{+0.015}_{-0.025}$	$117.48^{+0.38}_{-0.63}$
J	1.500 ± 0.010	38.10 ± 0.25
K	1.550 max	39.37 max
L	1.750 ± 0.010	44.45 ± 0.25
M	1.937 max	49.20 max
N	3.065 max	77.85 max
P	3.180 min	80.77 min
Q	3.180 min	80.77 min
R	3.065 max	77.85 max
S	1.980 min	50.29 min

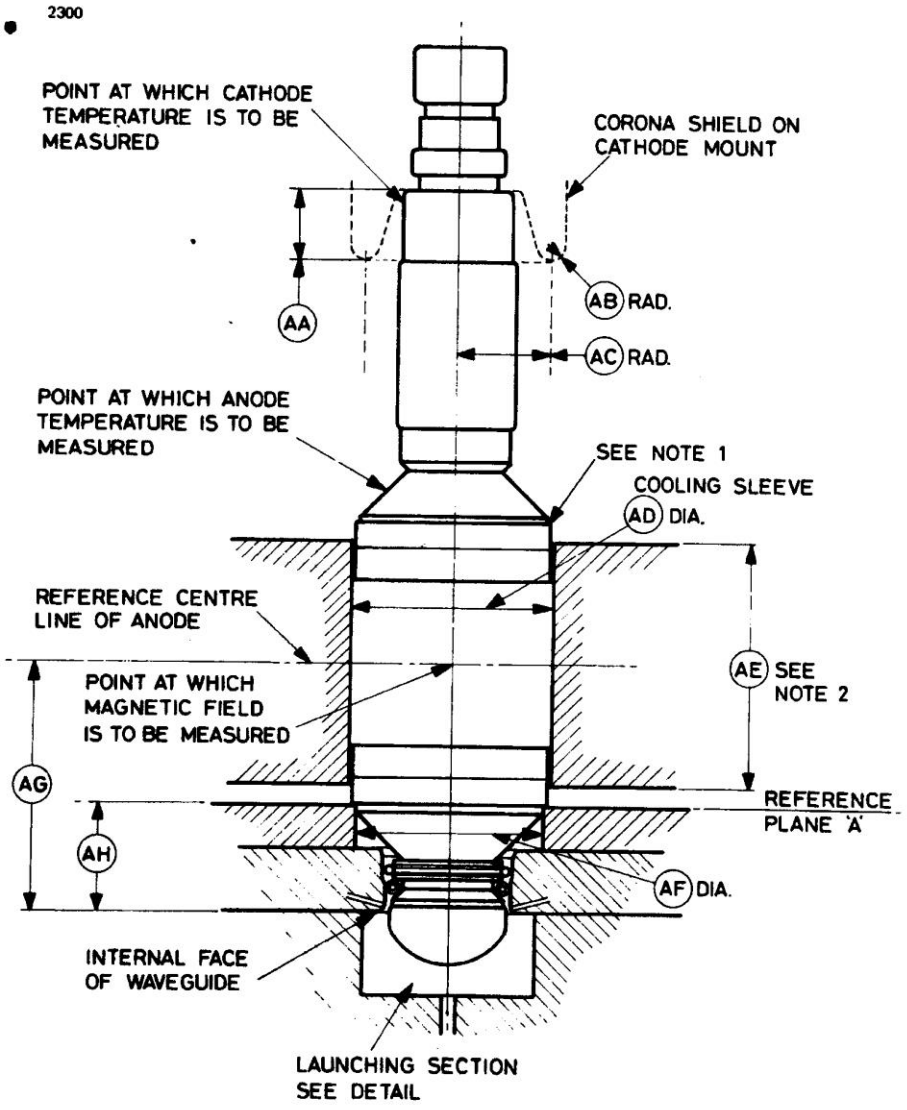
Millimetre dimensions have been derived from inches.

OUTLINE NOTES

1. Concentric tolerance 0.050 inch (1.27mm) diameter, Datum 'B' (B.S.308: 1953).
2. Silicone rubber 'O' ring, 50° Shore hardness. The dimensions and fit of this section to be tested on a pressure and leakage testing jig.
3. The contact spring dimensions to be measured when the part is not compressed.
4. All metal surfaces will be nickel or silver plated.

ELECTRO-MAGNET AND LAUNCHING SECTION

See page 12 for detail of launching section



DIMENSIONS FOR ELECTRO-MAGNET AND LAUNCHING SECTION

Ref	Inches	Millimetres	Ref	Inches	Millimetres
AA	1.375 min	34.93 min	AN	0.405 max	10.29 max
AB	0.250 min	6.35 min		0.400 min	10.16 min
AC	1.500 min	38.10 min	AP	0.187	4.75
AD	3.253 ± 0.001	82.626 ± 0.025	AQ	0.094	2.39
AE	4.000 min	101.6 min	AR	0.170	4.32
AF	3.068 ± 0.002	77.927 ± 0.051	AS	0.050 max	1.27 max
AG	4.080	103.6	AT	0.125 ± 0.015	3.18 ± 0.38
AH	1.767 ± 0.020	44.88 ± 0.51	AU	1.062	26.97
AJ	0.125	3.18	AV	1.340 ± 0.004	34.036 ± 0.102
AK	2.021 ± 0.001	51.333 ± 0.025	AW	0.125 ± 0.015	3.18 ± 0.38
AL	1.963 ± 0.001	49.860 ± 0.025	AX	1.181	30.00
AM	0.062	1.47	AY	2.840 ± 0.004	72.136 ± 0.102

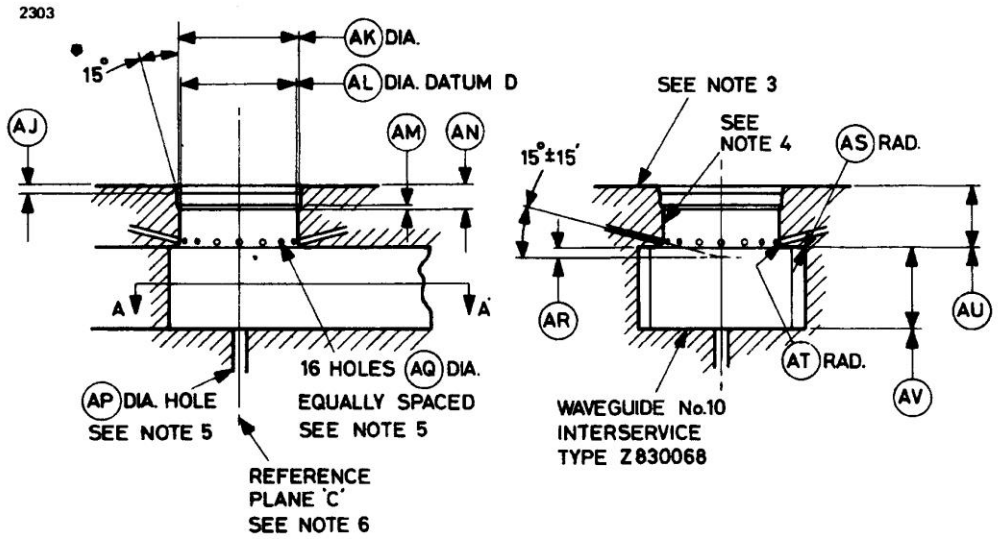
Millimetre dimensions have been derived from inches.

NOTES FOR ELECTRO-MAGNET AND LAUNCHING SECTION

1. An adjustable device shall be used to bear on this shoulder and to ensure that the magnetron locates on reference plane 'A'. It must be able to withstand the thrust on the magnetron due to a pressure of 65 lb/in^2 absolute in the waveguide.
2. The length of the water jacket centre line to be within 0.025 inch (0.64mm) of the reference centre line.
3. The flange to be central in the broad face of the waveguide to within ±0.005 inch (±0.13mm).
4. The internal surface of the flange to be silver plated 0.001 inch (0.025mm) thick, then rhodium plated 0.0001 inch (0.0025mm) thick.
5. Entry holes for window cooling air.
6. Reference plane 'C' is used for the definition of the phase of the standing wave in the waveguide.
7. Concentric tolerance 0.005 inch (0.13mm) Datum 'D' (B.S.308:1953).
8. The end plug profile to finish on a plane through the flange centre line and square to the waveguide internal profile to within ±0.005 inch (±0.13mm).

DETAIL OF LAUNCHING SECTION

See page 11 for dimensions and notes



Section A - A' showing shorting plug