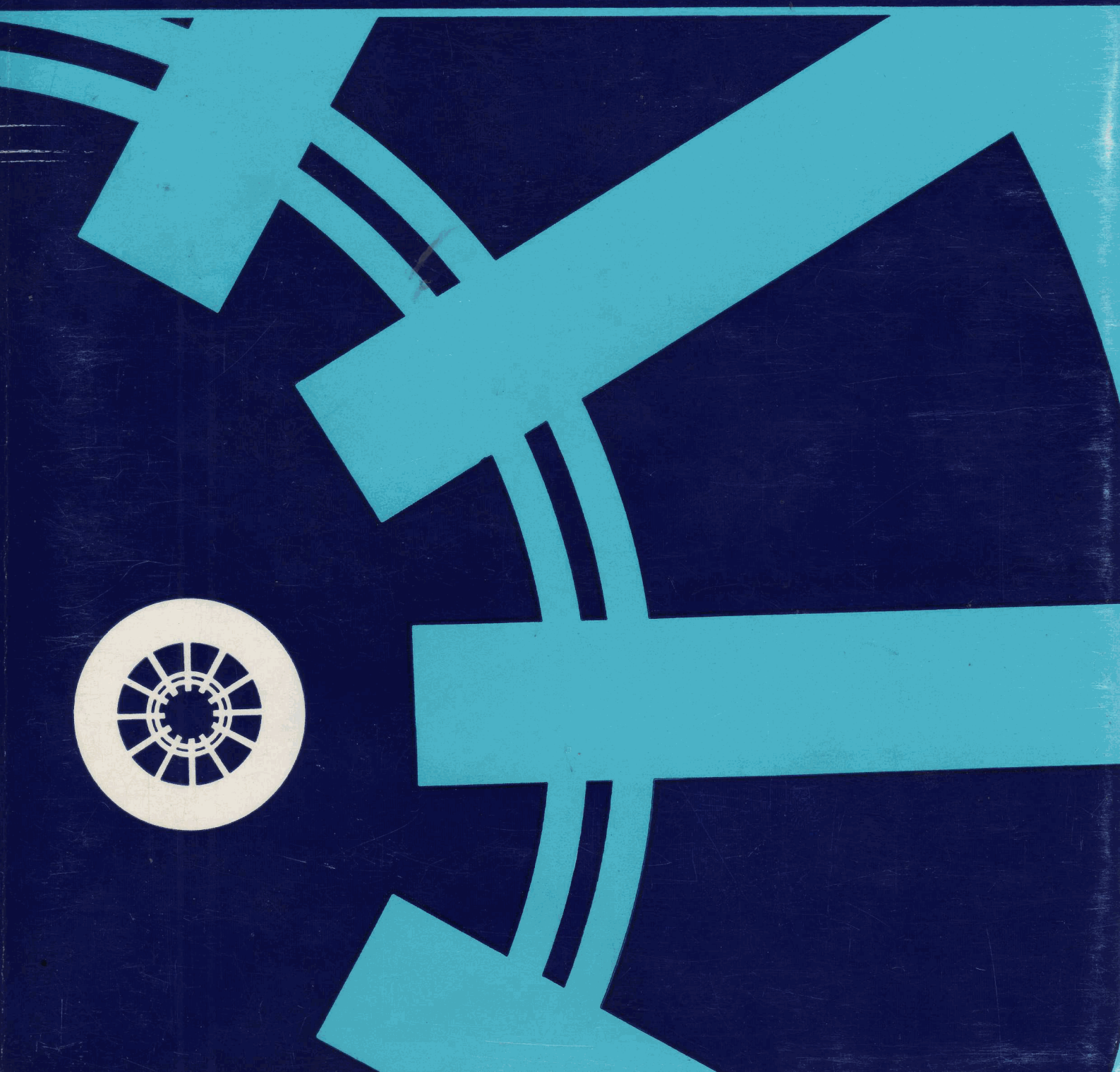
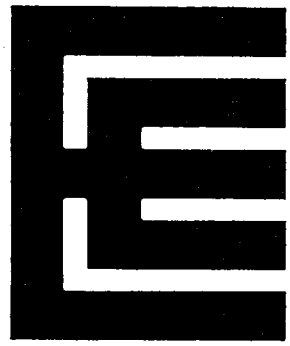
ENGLISH
ELECTRIC
VALVES

Magnetrons L, S, C Band and CW





Magnetrons L, S, C Band and CW

English Electric Valve Company Limited

Chelmsford, Essex, England
Telephone: Chelmsford (0245) 61777
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TABULATED DATA

MAGNETRONS

CW MAGNETRONS Fixed frequency types

Type	Frequency (MHz)	Typical operation: Output power (kW)	Typical operation: Anode voltage (kV)	Typical operation: Anode current (A)	Class (see page 6)
BM25LB	896 ± 10*	25	12.5	2.4	EWAZ
BM25LC	915 ± 10†				
BM25LD‡	896 ± 10*				

* For U.K., mandatory from August 1968

† For U.S.A.

‡ Identical with BM25LB apart from external fittings

PULSE MAGNETRONS Fixed frequency types
L -Band (1.0 to 2.5GHz)

Type	Frequency range (MHz)	Typical operation: Peak output power (MW)	Typical operation: Peak anode voltage (kV)	Typical operation: Peak anode current (A)	Class (see page 6)
M554**	1295–1365	2.6	39	150	SWGG
M565	1215–1365	5.0	48	240	EWAZ
M586**	1260–1300	2.6	39	150	SWGG

** Circular to rectangular waveguide transition section available

PULSE MAGNETRONS Fixed frequency types except where indicated
S-Band (2.5 to 4.1GHz)

Type	Frequency range (MHz)	Typical operation: Peak output power (kW)	Peak anode voltage (kV)	Peak anode current (A)	Class (see page 6)
2J30	2860–2900	300	20	30	SAC
2J31	2820–2860				
2J32	2780–2820				
2J33	2740–2780				
2J34	2700–2740				
4J31	2860–2900	1000	28	70	SAC
4J32	2820–2860				
4J33	2780–2820				
4J34	2740–2780				
4J35	2700–2740				
4J43	2992–3019	900	28	70	SAC
4J44	2965–2992				
4J53	2793–2813	1000	28	70	SAC
5586††	2700–2900	1000	30	70	SAC
5657††	2900–3100				
7182	2750–2860	2500	35	157	EWAX
BM1003	3034–3052	2000	43	90	SWGG
BM1004	2989–3007				
BM1005	2944–2962				
M525	2750–2855	1150	36	70	SWG
M561	3040–3060	80	13	15	SAC

Continued on page 3

†† Tunable

S-Band (2.5 to 4.1GHz) – continued

Type	•	Frequency range (MHz)	Typical operation: Peak output power (kW)	Peak anode voltage (kV)	Peak anode current (A)	Class (see page 6)
M566		2750–2860	2500	38.5	145	EWAZ
M569		2850–2960	2500	40	140	EWAZ
M570		2950–3060	2500	40	140	EWAZ
M573		2850–2960	2500	38	144	EWAX
M574		2950–3060	2500	41	132	EWAX
M577B **M578B**		3000–3040 3060–3100	900	28	70	SAC
M579		3050–3160	2500	38.5	145	EWAZ
M595B		2860–2900	1000	28	70	SAC
M5015††		2994–3002	2000	43	90	SWG
M5028††		2851–2861	5000	51	240	EWAZ
M5030†† **M5034**††		2900–3050 3050–3200	1000	33	70	PAG
M5058††		2994–3002	1300	36	70	SWGG

PULSE MAGNETRONS Fixed frequency types

C-Band (4.1 to 7.0GHz)

M5008	5250–5310	2250	34	60	EWAZ
M5009	5450–5510				
M5032	5250–5350				
M5033	5430–5530				

†† Tunable

PULSE MAGNETRONS Fixed frequency types except where indicated
X-Band (7.0 to 11.5GHz)

Type	Frequency range (MHz)	Typical operation: Peak output power (kW)	Peak anode voltage (kV)	Peak anode current (A)	Class (see page 6)
2J42	9345–9405	8.3	5.5	4.5	PANG
2J42H	9345–9405	8.3	5.5	4.5	PANG
2J55	9345–9405	50	12	12	PAG
2J56	9215–9275	45	12	12	PAG
4J50A	9345–9405	225	22	25	PAG
4J52A	9350–9400	80	15.5	15	PAG
6027	9345–9405	20	6.9	7.0	PAG
6027H	9345–9405	20	7.3	7.5	PAG
8356	9345–9405	20	7.2	7.5	PANG
8357	9345–9405	25	7.5	8.5	PANG
BM1026	9505–9540	60	14	11	SAG
BM1027	9540–9580				
BM1028	9580–9620				
BM1029	9620–9660				
BM1030	9660–9695				
BM1031	9420–9500	40	12	10	SAG
BM1032††	9440–9510	70	17	12	SAG
BM1033††	9800–9860				
BM1034††	9620–9680				
BM1035††	9520–9580				
BM1036††	9245–9305				
BM1037††	9145–9205				

Continued on page 5

†† Tunable

X-Band (7.0 to 11.5GHz) – continued

Type	Frequency range (MHz)	Typical operation: Peak output power (kW)	Typical operation: Peak anode voltage (kV)	Typical operation: Peak anode current (A)	Class (see page 6)
BM1040††	9040–9120	75	15	11	SAG
M502A	9325–9425	180	21	22.5	PAG
M503A	9345–9405	9.5	5.6	4.5	PANG
M504	9325–9425	750	35	50	EAG
M505	9360–9460	45	11.1	12	SAG
M506A	9360–9460	50	11.5	12	SAG
M508	9210–9270	8.0	5.5	4.5	PANG
M513A	9345–9405	22	7.5	7.5	PANG
M513B	9345–9405	22	7.5	7.5	PANG
M515	9380–9440	25	8.2	8.0	PANG
M521	9600–9700	45	11.1	12	SAG
M523	9580–9705	225	22	25	PAG
M529	8830–8995	225	22	25	PAG
M537A	8770–8830	9.0	5.5	4.5	PAG
M538A	9210–9270	225	22	25	PAG
M539	8665–8830	225	22	25	PAG
M546	9700–9850	225	22	25	PAG
M547	9850–10 000	225	22	25	PAG
M548	9003–9168	50	13.5	12	SAG
M549	8500–8665	225	22	25	PAG
M575	9345–9405	80	15	15	PAG

Continued on page 6

†† Tunable

X-Band (7.0 to 11.5GHz) – continued

Type	Frequency range (MHz)	Typical operation: Peak output power (kW)	Peak anode voltage (kV)	Peak anode current (A)	Class (see below)
M581	9415–9475	65	14	14	PAG
M591B	9415–9475	22	7.5	7.5	PANG
M596	9370–9430	80	14.8	15	PAG
M597	9380–9440	10.5	5.7	5.0	PANG
M598B	9380–9440	22	7.6	7.5	PANG
M599A **M599B**	9415–9475	3.0	3.5	3.0	PAG
M5005	9345–9405	50	13	12	PAG
M5019	9345–9405	8.0	5.4	4.5	PANG
M5022	9415–9475	30	8.3	9.0	PANG
M5023 **M5024** **M5025**	9345–9405 9415–9475 9380–9440	20	7.8	7.5	PANG

CLASS

Magnetic Field

E Electromagnet
P Packaged integral magnet
S Separate magnet (not supplied)

Cooling

A Forced-air
AN Forced-air or natural
W Water
WA Water and forced-air

Output

C Coaxial
G Waveguide
GG Waveguide output not sold with this valve
X Requires electromagnet with coaxial-to-waveguide launching section
Z Requires electromagnet with waveguide launching section

CW Magnetrons

English Electric Valve Company Limited
Chelmsford, Essex, England

Printed in England

BM25L

C.W. MAGNETRON

ABRIDGED DATA

Fixed frequency c.w. magnetron for r.f. heating applications.

Type	Frequency (MHz)	Outline
BM25LB	896 ± 10 (U.K.)	Page 14
BM25LC	915 ± 10 (U.S.A.)	Page 14
BM25LD*	896 ± 10	Page 12

Output power into matched load	30	kW
Electromagnet and launching section		M4122
Output	probe radiating into no. 4 waveguide (9.750 x 4.875 inches internal)	
Cooling	water and forced-air	

GENERAL

Electrical

Cathode	directly heated tungsten filament	
Filament voltage (single-phase a.c., r.m.s.) (for filament current of 112A)	11.5	V
Filament current (r.m.s.) (see note 1)	112	A
Maximum filament starting current (r.m.s.)	250	A
Filament cold resistance	0.01	Ω approx
Filament heating time	10	s
Electromagnet resistance at 18.5°C	12	Ω approx

Mechanical

BM25L Valve

Overall dimensions (excluding water pipes)	17 x 7 x 7 inches nom 43.2 x 17.8 x 17.8cm nom
Net weight	22 pounds (10kg) approx
Mounting position	axis vertical, filament terminals up or down

* The BM25LB and BM25LD are electrically identical.

Electromagnet and Launching Section M4122

Overall dimensions (including valve)	23.4 x 21.5 x 13.125 inches approx 59.43 x 54.61 x 33.34cm approx
Waveguide flange	see page 19
Net weight	143 pounds (65kg) approx

COOLING

The valve anode and electromagnet have integral water cooling jackets; the output window and filament seals are cooled by low-pressure air. All cooling supplies must be turned on before and during the application of any voltages and continued for at least 5 minutes after the removal of these voltages.

Valve

Anode cooling water flow rate	2.2 Imp.gal/min (10 l./min) min
Anode pressure drop	13lb/in^2 (0.9kg/cm^2) approx
Anode water outlet temperature	50°C max
Output window cooling air flow	20ft^3/min (0.57m^3/min)
Output window pressure drop	1.0 inch (25mm) water gauge
Filament terminals cooling air flow	5.0ft^3/min (0.14m^3/min)
Pressure drop	0.75 inch (19mm) water gauge
Filament terminal temperature	120°C max

Electromagnet

Cooling water flow rate	0.22 Imp.gal/min (1.0 l./min)

MAXIMUM RATINGS

Anode voltage	14.5	kV max
Anode current	3.0	A max
Input power	40	kW max
Anode dissipation	15	kW max
Filament starting current (r.m.s.)	250	A max
Anode water outlet temperature	50	°C max
Filament terminal temperature	120	°C max
Load v.s.w.r. (see note 2)	3:1	max
Inlet water pressure	100lb/in^2 (6.9kg/cm^2)	max

TYPICAL OPERATION

	Condition 1	Condition 2	
Operating Conditions			
Filament current	98	93	A
Electromagnet current (see note 3)	3.3	3.6	A
Anode current (see note 4)	2.1	2.4	A
Load v.s.w.r. (see note 5)	3:1	2.5:1	max
Waveguide coupling	see note 6	see note 6	
Typical Performance			
Filament voltage	10.4	10	V
Anode voltage	11.5	12.5	kV
Output power	20	25	kW
Frequency pushing (see note 7)	0.7	–0.4	MHz/A
Frequency modulation (see note 8)	0.2	0.2	MHz

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification.

	Oscillation 1		Oscillation 2		Oscillation 3		
Test Conditions							
Filament current	90		83		97		A
Electromagnet current	3.35		3.35		3.35		A
Anode current	2.5		2.5		2.5		A
V.S.W.R. at output coupler	1.1:1		3:1		3:1		
Limits							
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	
Anode voltage	12	13	–	–	–	–	kV
Output power	23	–	–	–	–	–	kW
Frequency:							
BM25LB	886	906	–	–	–	–	MHz
BM25LC	905	925	–	–	–	–	MHz
BM25LD	886	906	–	–	–	–	MHz
Frequency pulling (v.s.w.r. 1.5:1)	–	3.5	–	–	–	–	MHz
Stability	see note 9		see notes 9 and 10		see notes 9 and 11		
Filament current	–		see note 12		see note 12		

NOTES

1. With no anode input power.

   Prior to the application of anode voltage, the filament must be pre-heated by the application of 112A for at least ten seconds. On the application of anode voltage, the filament current must be reduced within 2 seconds in accordance with the graph on page 10. The upper and lower limits shown in this graph are absolute, and apply to the range of anode voltage and anode current shown in the performance chart on page 7.

   In applications where the r.f. load is approximately constant, reduction of heater voltage may be effected by manual or automatic switching to a fixed value, but where appreciable variations in load are likely an automatic variable control is preferable.

2. Over the frequency band of the magnetron and 5MHz above and below the band limits. The use of a reverse power detector is recommended to cut off the h.t. supply if the power reflected into the valve exceeds 5kW. For operating points in the 'sink' of the Rieke diagram the magnetron may stop oscillating, or oscillate in a different mode, if the v.s.w.r. exceeds this limit. In the event of oscillation in another mode the h.t. supply must be switched off and restarted; prolonged operation in other than the correct mode may damage the valve.

3. The output power may be controlled by direct adjustment of the anode current or the magnetic field. Stabilisation of supplies against input variations and drift is desirable. Automatic field control to keep the anode current or output power constant may be used. Alternatively the electromagnet can be operated in series with the anode supply (see page 5).

4. The valve is usually operated from a 3-phase bridge rectified supply, with or without a smoothing choke. The choice of supply and degree of smoothing are determined by the permissible power and frequency modulation of the r.f. output. The internal impedance of the h.t. supply should be such as to limit the peak anode current to 24A in the event of the magnetron arcing. A cut-out should be incorporated to switch off the h.t. supply in this case.

5. This is a maximum value for any phase of voltage reflection coefficient.

6. Load v.s.w.r. 1.5:1. The coupling between the magnetron and the waveguide is adjusted by a 2 inch diameter screw in the launching section. The nominal screw penetration is $11\frac{1}{2} \pm \frac{1}{8}$ turns from the fully anti-clockwise position, unless otherwise stated on the valve test sheet. The screw must not be used to adjust the frequency of oscillation.

7. This is an approximate steady-state value and includes the contribution due to thermal effects.

8. Typical peak to peak value with the h.t. supply from a 6-phase rectifier and a 5 Henry choke in series with the anode, giving an anode current ripple of 0.16A peak to peak. With no series choke, typical values are 0.56A peak to peak current ripple and 0.7MHz peak to peak modulation. These results are obtained with a matched load and a.c. filament supply.

9. The valve shall not stop oscillating during 20 minutes of a 30 minute test period.

10. The phase of the mismatch shall be adjusted to give minimum mean anode current.

11. The phase of the mismatch shall be adjusted to give maximum mean anode current.

12. The filament current shall not vary by more than 2A as the mismatch is varied through all phases.

ELECTROMAGNET OPERATION

The magnet may be energised by a separate supply, or may be connected in series with the valve h.t. supply. Series field operation considerably reduces the variation in r.f. power output with variation in mains supply voltage and the addition of a field bias current supply allows the power output to be controlled by varying the magnet current rather than the h.t. voltage. The characteristics shown on page 8 may be obtained with the circuit for series field operation shown on page 11.

With the magnet coil connected in series, instantaneous application of anode voltage would result in the full h.t. voltage appearing across the coil. The

recommended method of starting is to increase the bias current until the magnetic field is sufficient to prevent the valve drawing anode current at the no-load h.t. voltage, then switch on the h.t. supply and gradually reduce the bias current until the required operating point is reached.

INSTALLATION

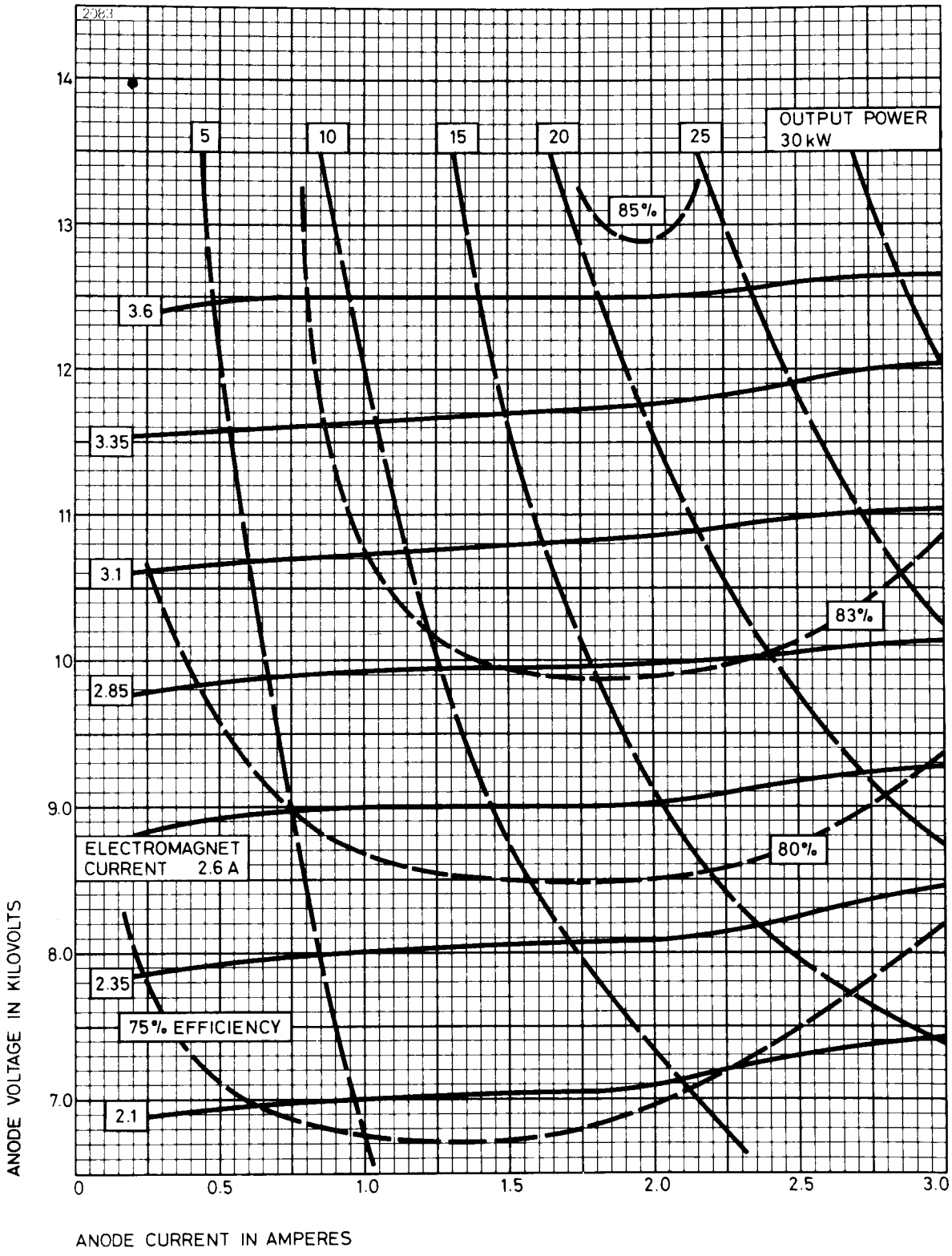
Care should be taken to protect the valve from excessive shocks during and after installation, with particular regard to the metal-ceramic seals.

R.F. connection between the valve and its launching section is by a copper washer. The valve must be seated squarely and the mounting screws uniformly tightened to ensure proper contact; a new washer should be fitted if the valve is removed and replaced for any reason.

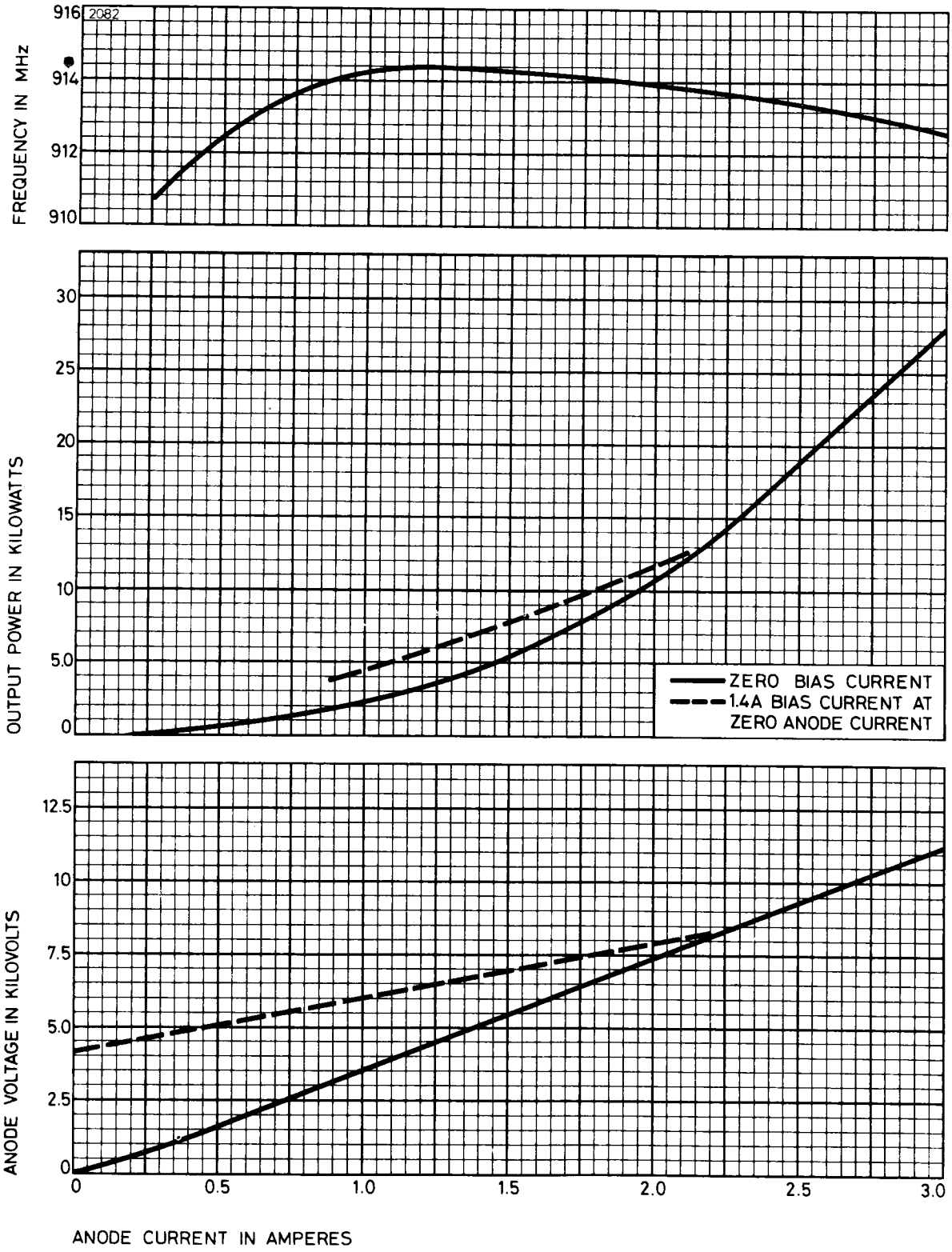
The domed output window is cooled by air ducted through an insulating cylinder, and it is necessary to ensure that the cylinder is concentric with the dome.

The filament terminals must be securely clamped to avoid overheating. They must be cooled by forced-air through a duct attached to the small filament terminal.

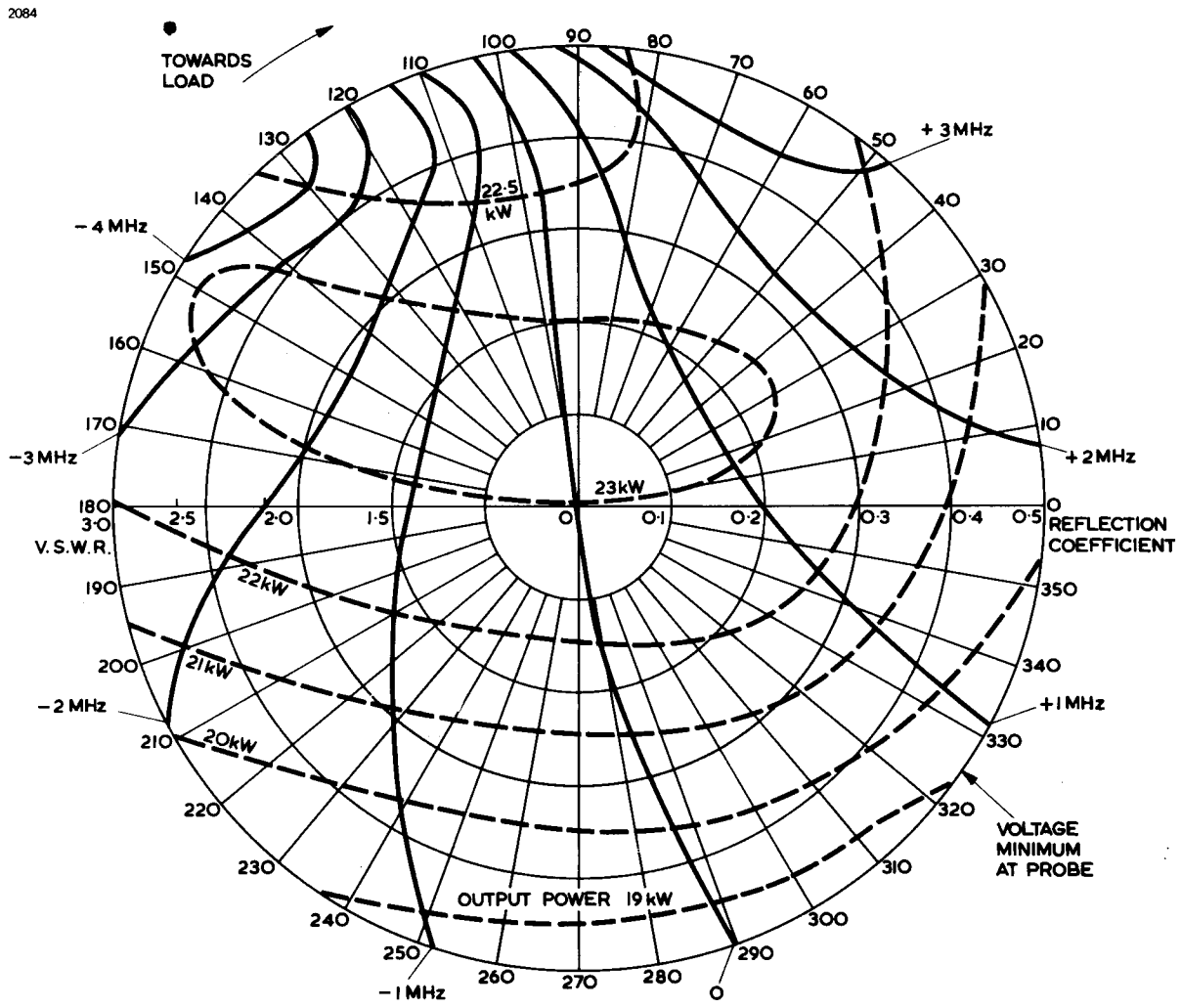
PERFORMANCE CHART



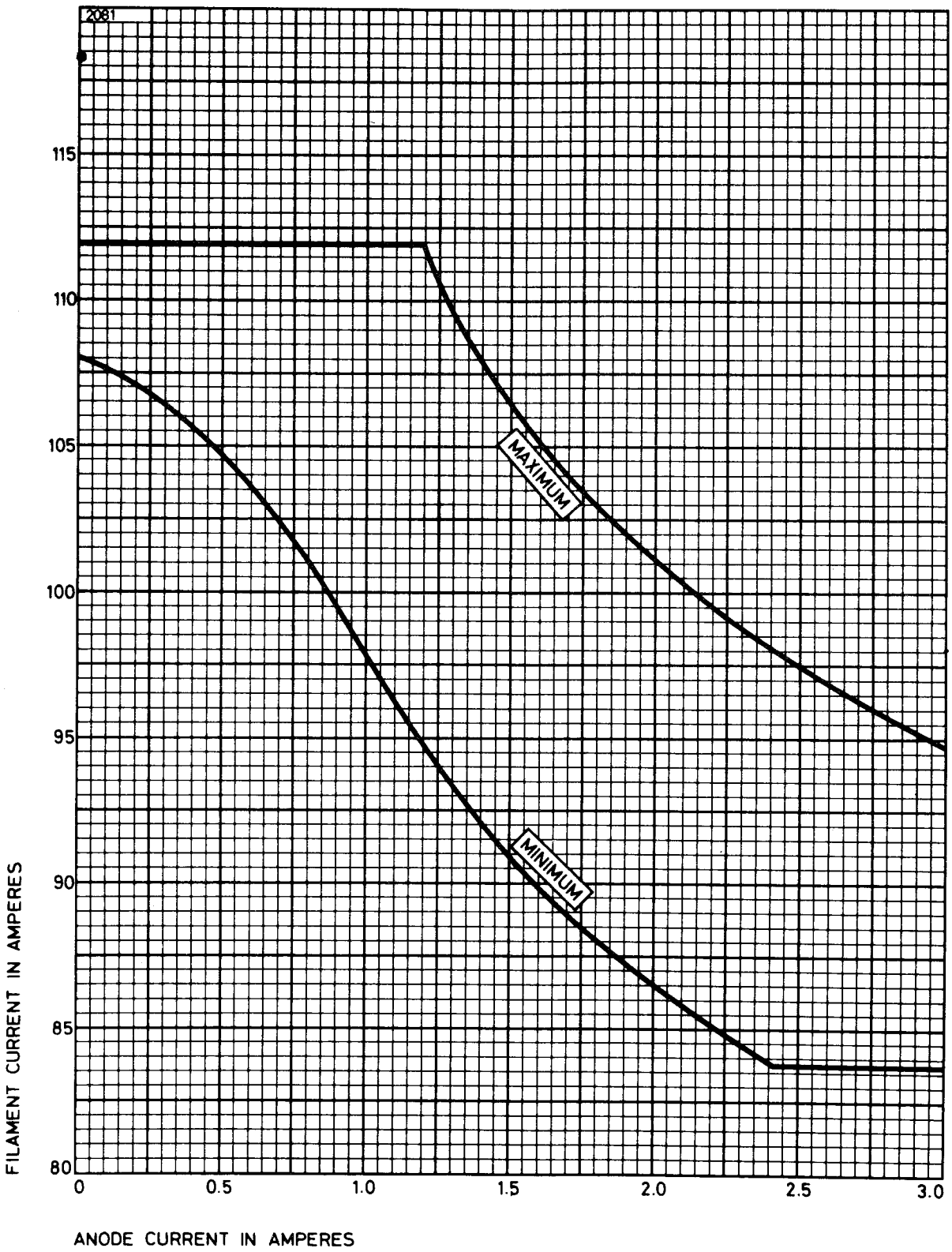
PERFORMANCE CHART WITH SERIES FIELD



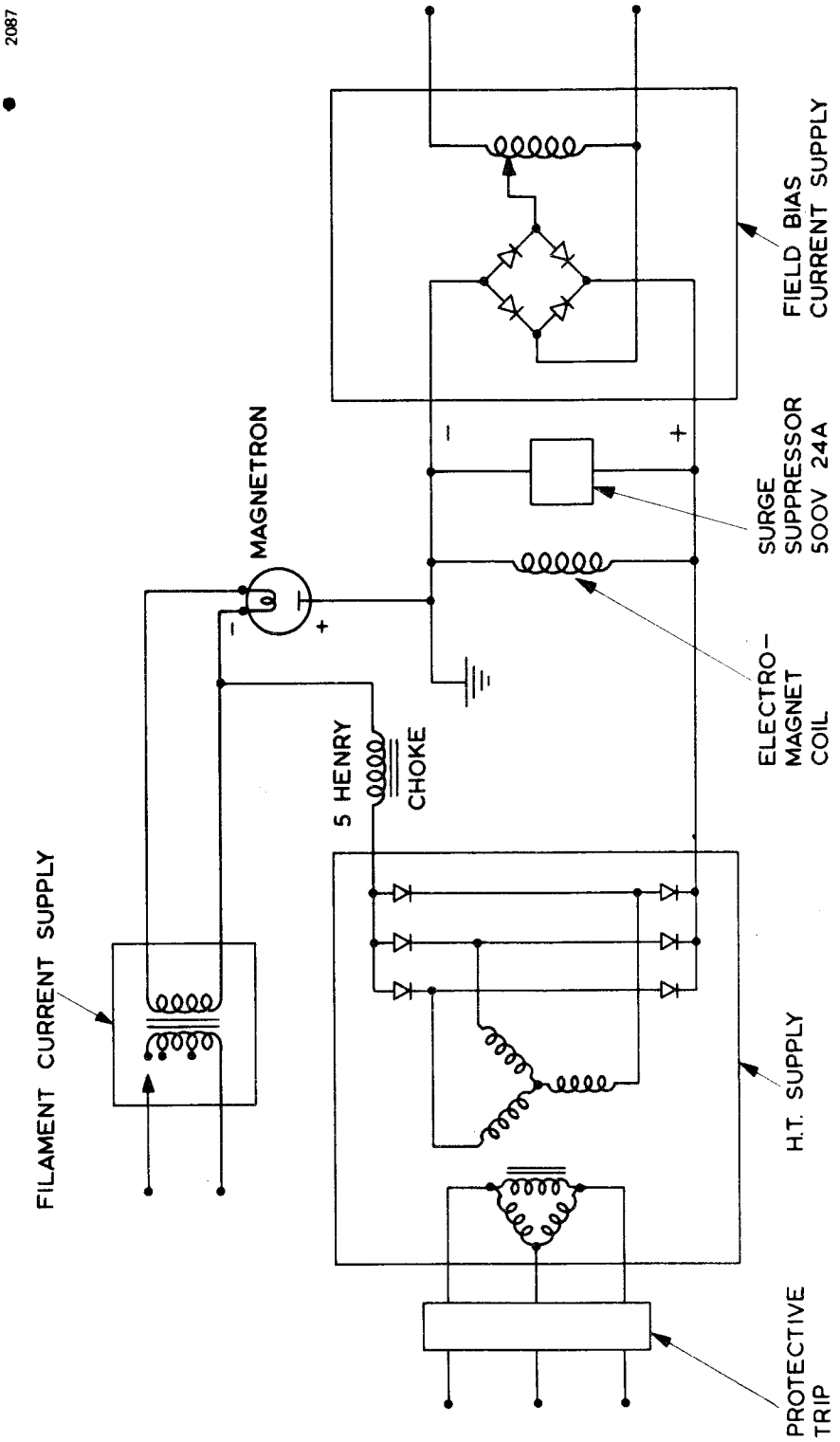
RIEKE DIAGRAM WITH SERIES FIELD



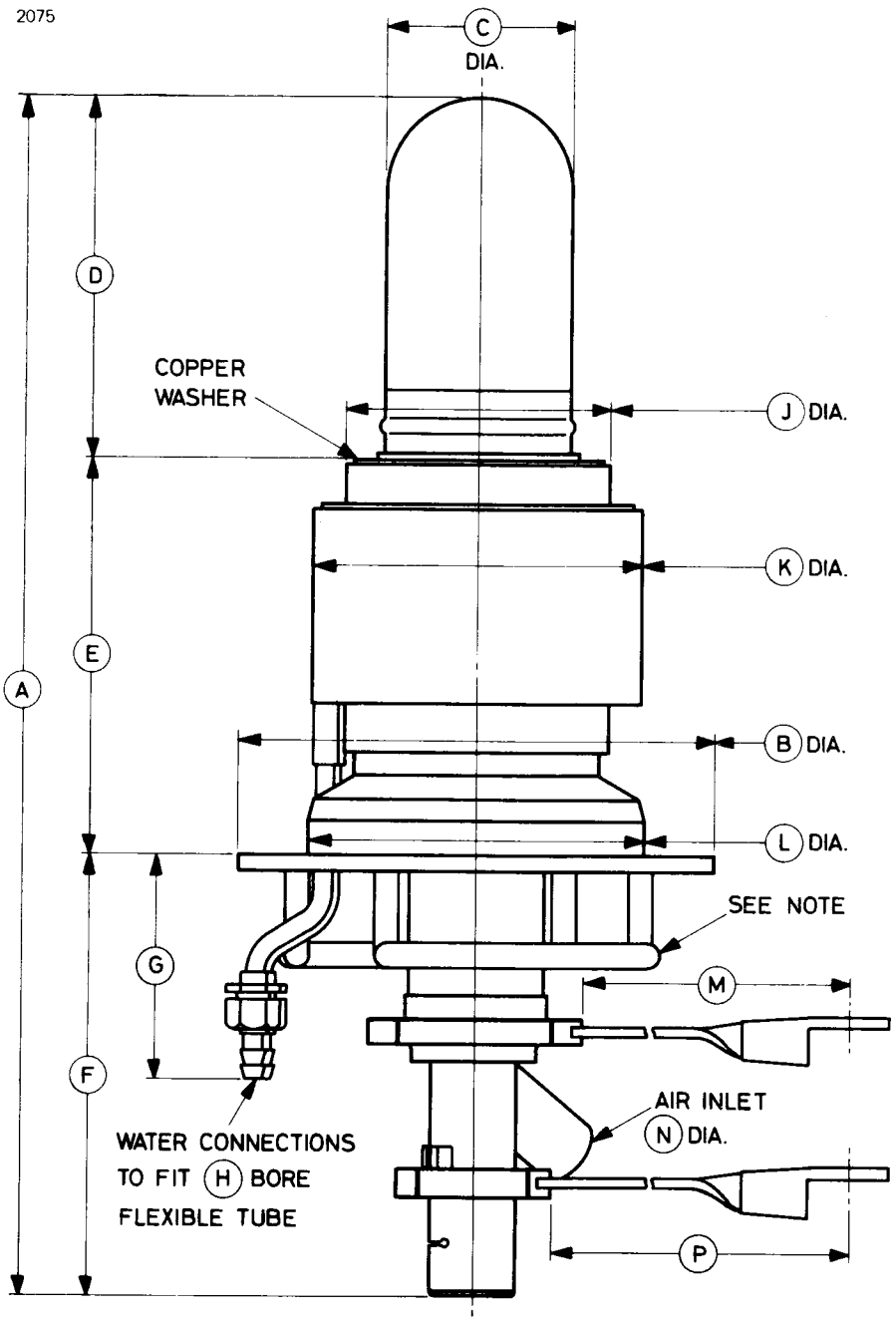
HEATER CURRENT LIMITS



TYPICAL CIRCUIT



OUTLINE OF BM25LD

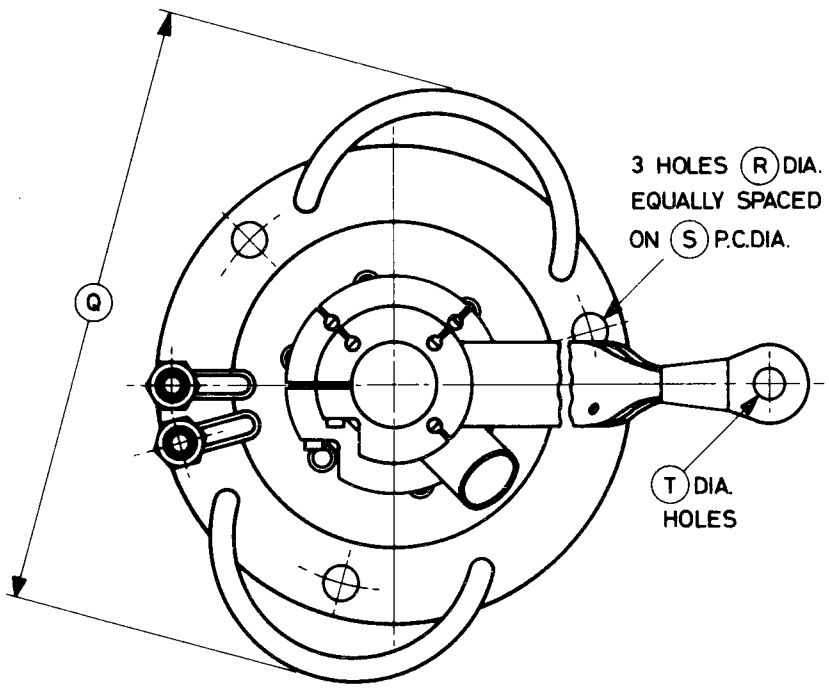


Note

Handles to facilitate handling and transit of magnetron, readily removable before installation if so required.

OUTLINE OF BM25LD

2076

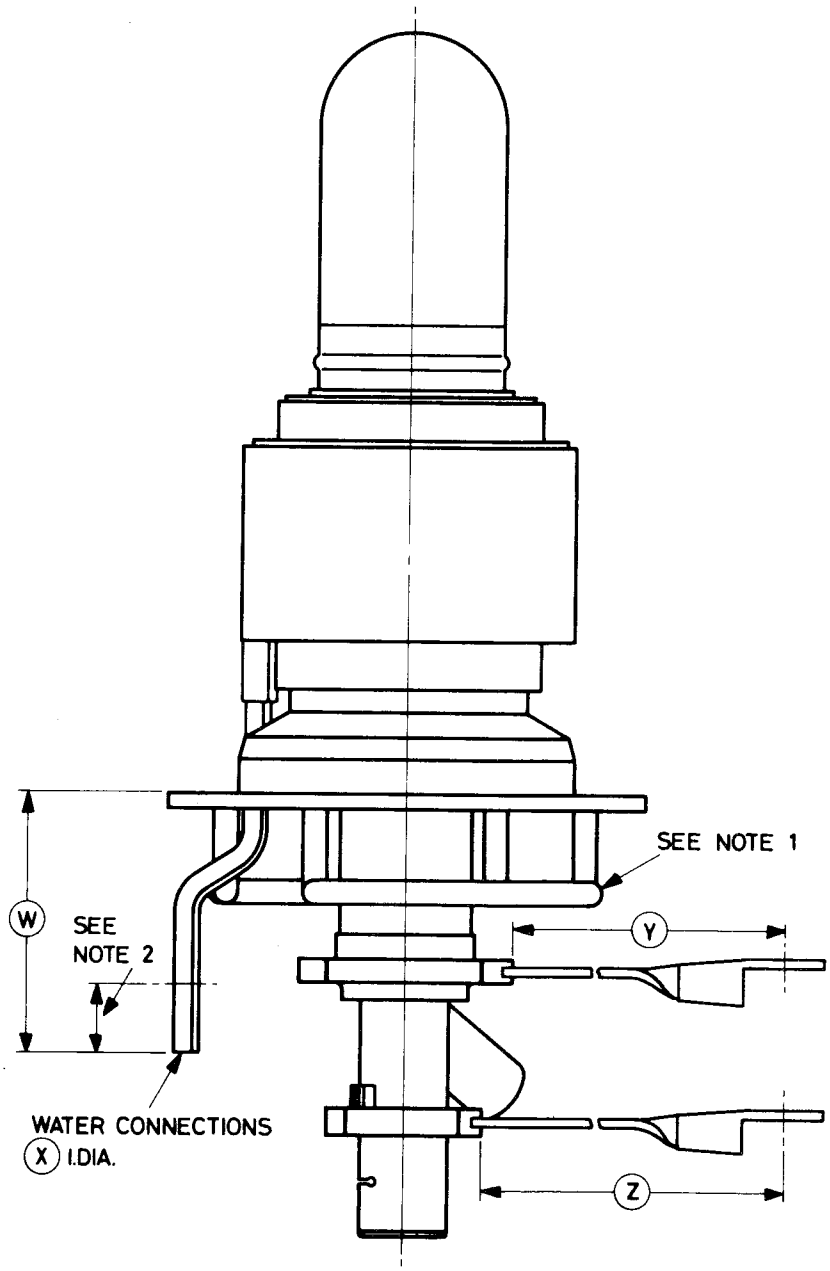


Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	17.500 max	444.5 max	K	4.900 max	124.5 max
B	7.000 ± 0.030	177.8 ± 0.76	L	4.960 max	126.0 max
C	2.750	69.85	M	20.000	508.0
D	5.000	127.0	N	1.000	25.40
E	5.745 min	145.9 min	P	24.000	609.6
F	6.500 max	165.1 max	Q	9.000 max	228.6 max
G	3.250	82.55	R	0.437	11.10
H	0.375	9.53	S	6.000 ± 0.010	152.4 ± 0.25
J	3.985 max	101.2 max	T	0.437	11.10

Millimetre dimensions have been derived from inches.

OUTLINE OF BM25LB AND BM25LC

2077

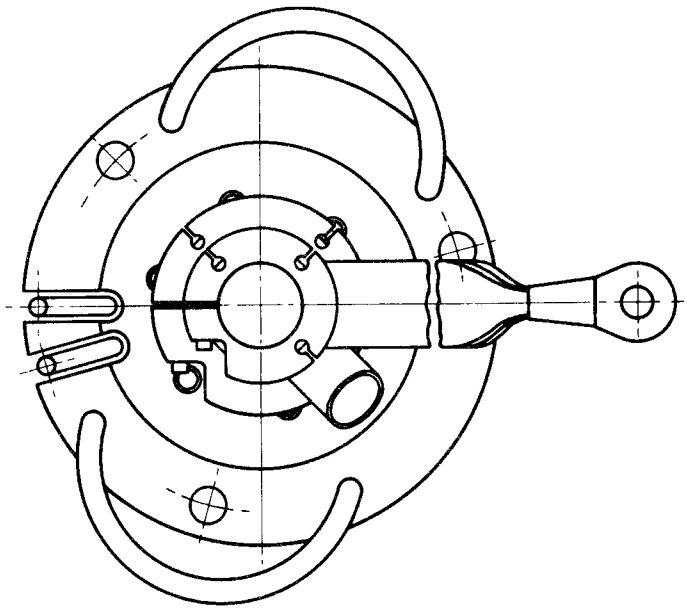


Notes

1. Handles to facilitate handling and transit of magnetron, readily removable before installation if so required.
2. First 1.000 inch (25.40mm) to be unpainted.

OUTLINE OF BM25LB AND BM25LC

2078

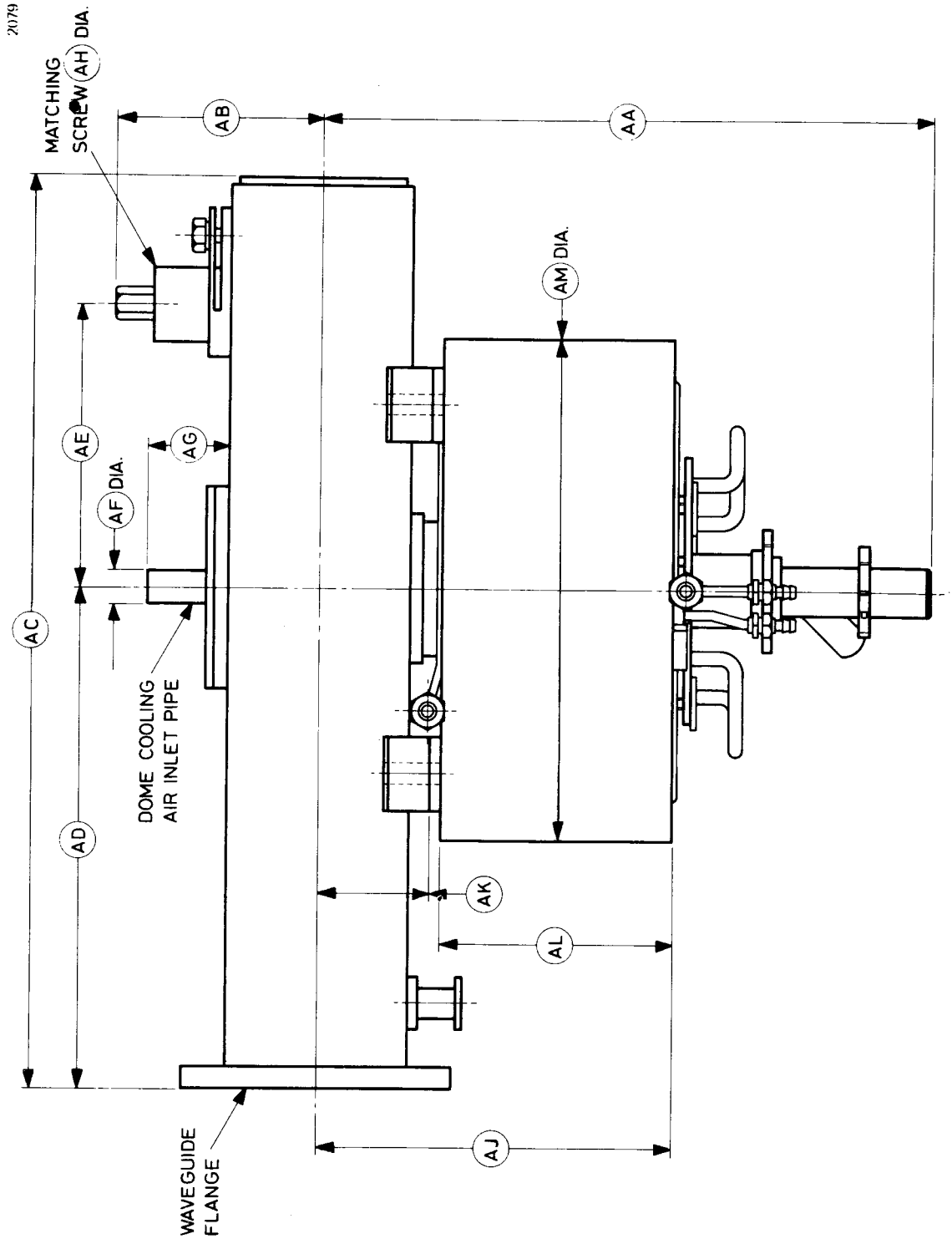


Ref	Inches	Millimetres
W	3.750	95.25
X	0.312	7.92
Y	10.500	266.7
Z	10.000	254.0

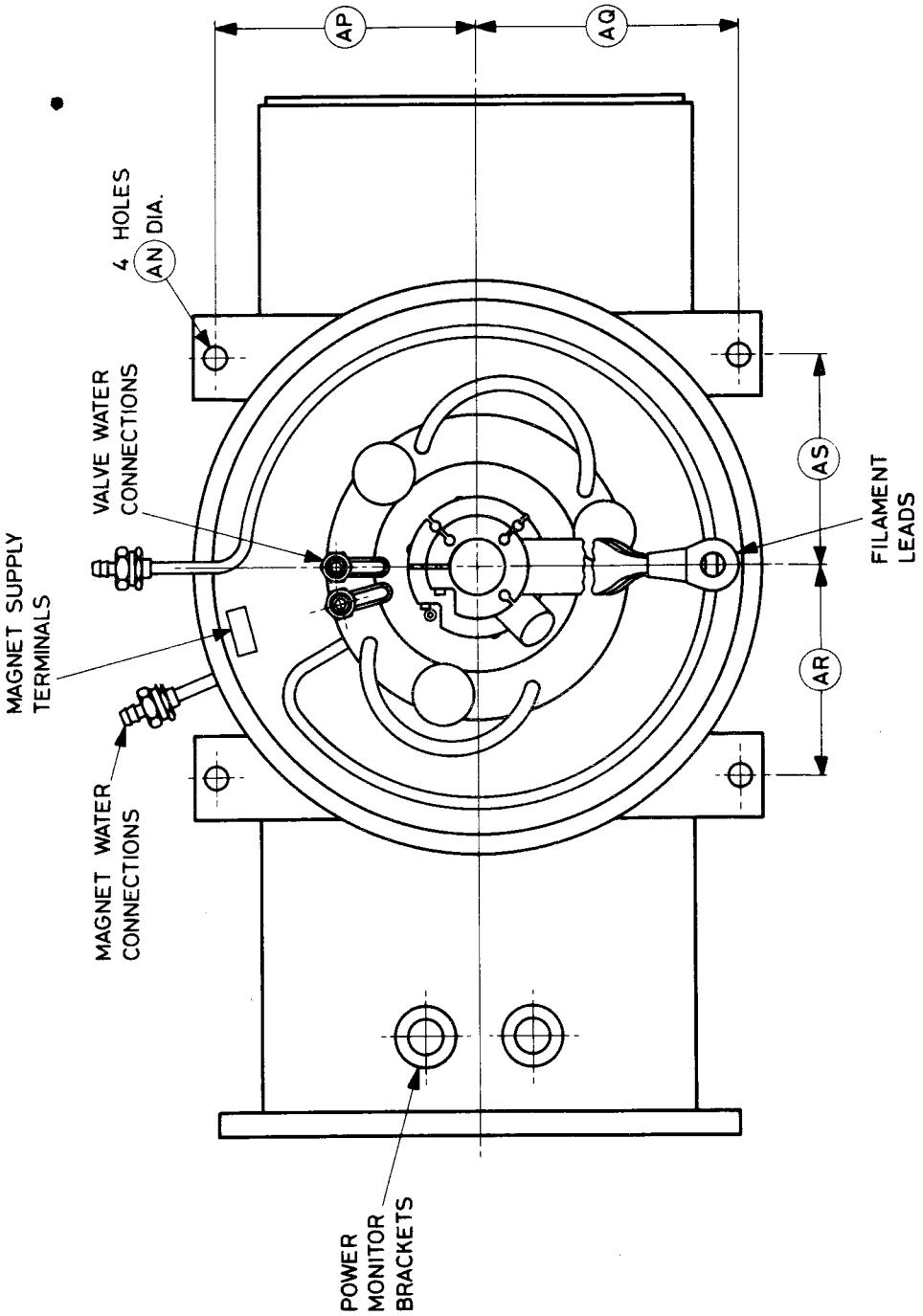
Millimetre dimensions have been derived from inches.

All other dimensions as for BM25LD.

OUTLINE OF M4122



OUTLINE OF M4122



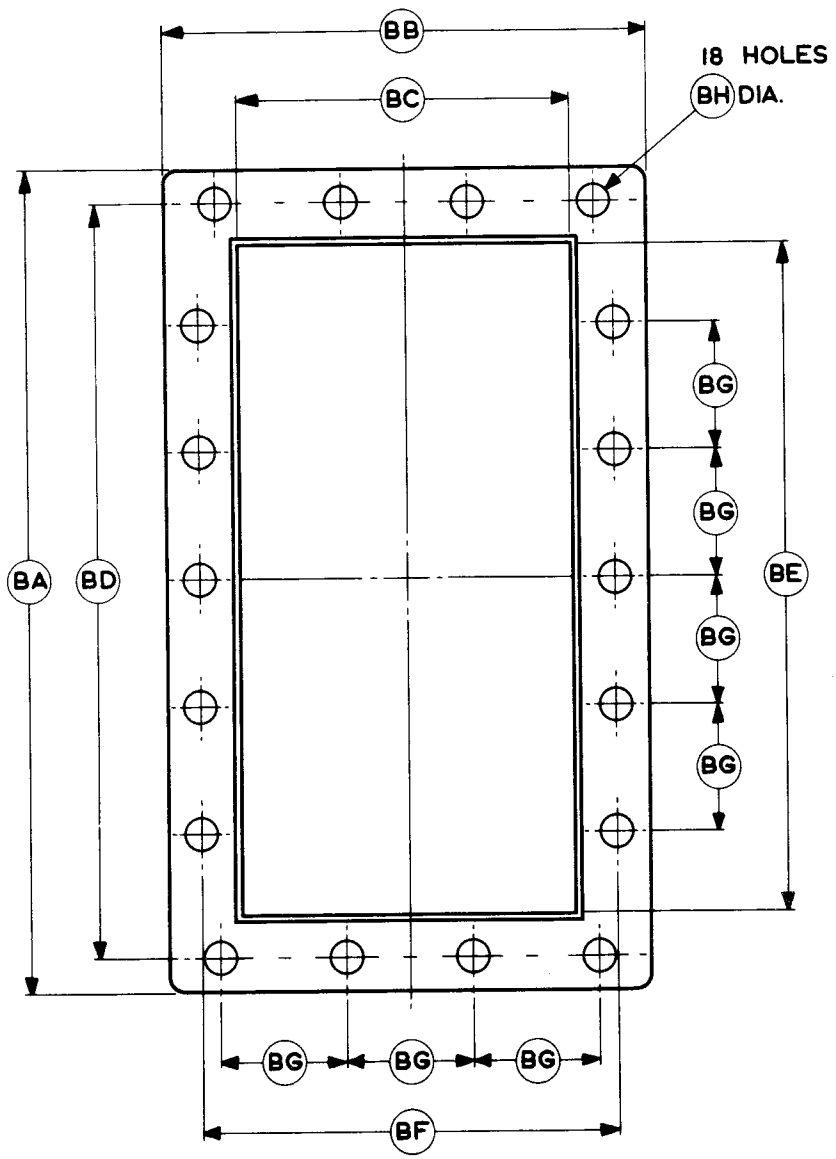
OUTLINE DIMENSIONS FOR M4122

Ref	Inches	Millimetres
AA	16.000	406.4
AB	5.500	139.7
AC	23.359	593.3
AD	13.000	330.2
AE	7.329	190.7
AF	1.000	25.40
AG	2.125	53.95
AH	2.000	50.80
AJ	9.250	235.0
AK	2.875	73.03
AL	6.125	155.6
AM	13.125	333.4
AN	0.563	14.30
AP	6.000	152.4
AQ	6.000	152.4
AR	4.875	123.8
AS	4.875	123.8

Millimetre dimensions have been derived from inches.

DETAIL OF WAVEGUIDE FLANGE

2091



Ref	Inches	Millimetres	Ref	Inches	Millimetres
BA	12.000	304.8	BE	9.750	247.7
BB	7.125	181.0	BF	6.125	155.6
BC	4.875	123.8	BG	1.844	46.84
BD	11.000	279.4	BH	0.437	11.10

Millimetre dimensions have been derived from inches.

L-Band Magnetrons

M554

L-BAND MAGNETRON

ABRIDGED DATA

Fixed frequency pulse magnetron		
Frequency range	1295 to 1365	MHz
Typical peak output power	2.6	MW
Magnet (see note 1)	separate magnet (not supplied)	
Transition section (see note 2 and page 11)	M4016, coupling to no. 6 waveguide (6.500 x 3.250 inches internal) via coupler UG417A/U	
Cooling	water	

GENERAL

Electrical

Cathode	indirectly heated	
Heater voltage (see note 3)	20	V
Heater current	13.5	A
Heater starting current, peak value, not to be exceeded	60	A max
Cathode heating time (minimum) (see note 3)	5	minutes

Mechanical

Overall dimensions (including transition section)	26.06 x 9.75 x 8.5 inches max 662 x 248 x 216mm max
Net weight:	
valve	22 pounds (10kg) approx
transition section	16 pounds (7.3kg) approx
Mounting position	vertical, cathode and heater terminals up

COOLING

The water cooling system is connected to the valve via ½-inch B.S.P. unions. The water flow must be greater than 20 imp. gal/hour (91 litres/hour) with a maximum outlet temperature of 80°C. A 5-foot (1.5 metre) head of water will be adequate to ensure a flow of 20 imp. gal/hour (91 litres/hour).

The purity of the water must be such that no measurable degree of furring occurs. It must not contain impurities corrosive to copper or brass.

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 4)	900	950	gauss
Heater voltage (see note 3)	18	22	V
Heater starting current (peak)	—	60	A
Anode voltage (peak)	35	42	kV
Anode current (peak)	—	150	A
Input power (peak)	—	6.0	MW
Input power (mean) (see note 5)	—	7.5	kW
Duty cycle	—	0.0015	
Pulse length (see note 6)	—	5.0	μs
Rate of rise of voltage pulse (see note 7)	50	70	kV/μs
Anode temperature (see note 8)	—	80	°C
Cathode terminal temperature	—	165	°C
V.S.W.R. at the output coupler (see note 9)	—	1.5:1	

TYPICAL OPERATION

Operational Conditions

Heater voltage	0	V
Magnetic field	925	gauss
Anode current (peak)	150	A
Pulse length	5.0	μs
Pulse repetition rate	250	p.p.s.

Typical Performance

Anode voltage (peak)	39	kV
Output power (peak)	2.6	MW
Output power (mean)	3.25	kW

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions

	Oscillation 1	Oscillation 2	
Magnetic field (see note 4)	950	950	gauss
Heater voltage (for test)	0	0	V
Anode current (mean)	190	190	mA
Duty cycle	0.00125	0.00125	
Pulse length (see note 6)	5.0	5.0	μs
V.S.W.R. at the output coupler	1.15:1	1.5:1	
Rate of rise of voltage pulse	70	70	kV/μs min

Limits

	Min	Max	Min	Max	
Anode voltage (peak)	38	42	—	—	kV
Output power (mean)	3150	—	—	—	W
Frequency	1295	1365	—	—	MHz
R.F. bandwidth at ¼ power	—	0.5	—	—	MHz
Frequency pulling	—	—	—	4.0	MHz
Frequency pushing (see note 10)	—	50	—	—	kHz/A
Stability (see note 11)	—	0.25	—	0.5	%
Heater current				see note 12	
Temperature coefficient of frequency				see note 13	

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 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.

End of Life Criteria (under Test Conditions Oscillation 1)

Output power (mean)	2500	W
R.F. bandwidth at ¼ power	0.5	MHz
Frequency must be within test limits above, Oscillation 1		

NOTES

1. The valve is designed for use with a separate magnet, not supplied by English Electric Valve Company Ltd. The user is invited to consult the Company on the choice of suitable magnets.

2. The valve must be used with the circular to rectangular waveguide transition section M4016 (see pages 11 and 12). The satisfactory performance of the valve is guaranteed only when it is used in conjunction with M4016.

   The magnetron flange and the transition section are bolted together directly with 6 OBA bolts (shank length 0.375 inch - 9.53mm) and the distance between the axis of the anode and the face of the rectangular waveguide coupling flange is 15.213 ± 0.187 inches (386.41 ± 4.75mm). It is essential for the valve to be located correctly with respect to M4016, as shown on the outline drawing on page 11.

3. 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 20 volts to the heater for at least 5 minutes.

   During high voltage operation it is essential to operate the heater according to the following schedule:

Mean Input Power (W)	**Heater Voltage (V)**
Less than 2000	20
2000 to 3000	15
3000 to 4000	10
4000 to 5000	5
More than 5000	0

   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 4μF may be necessary depending on the equipment design. For further details see the preamble to this section.

4. For normal operation the magnetic field should be 900 to 930 gauss measured at the centre of the gap. The variation of magnetic field

within a cylinder 3 inches (76.2mm) diameter and 2 inches (50.8mm) long situated centrally and co-axially between the poles must not exceed ± 50 gauss. The minimum gap between the pole pieces must be 3.750 inches (95.25mm).

The north pole of the magnet must be adjacent to the cathode terminal. The magnet position must be adjusted so that the axis of the field is within 0.062 inch (1.57mm) of the centre line of the anode (see outline drawing). It is necessary to provide for an axial adjustment to the magnet of ± 0.125 inch (± 3.18mm) relative to the M4016 waveguide flange.

5. The various parameters are related by the formula:

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

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

6. Tolerance ± 10%.

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

8. The temperature of the anode measured at the hottest point where contact is made with the water jacket. The rate of water flow must be such that the anode temperature is maintained below this maximum and in any case the flow must exceed 20 gallons per hour (91 litres per hour).

9. The v.s.w.r. of the output system shall be less than 1.5:1 over the frequency range 1295 to 1400MHz and less than 2.0:1 over the frequency range 1400 to 1600MHz, or an approved output system shall be used.

10. The change in frequency when the peak input current is varied between the limits of 100 and 150A shall be less than 50kHz/A. The frequency shall vary smoothly without discontinuity within the specified limit.

11. Missing pulses are counted at the phase of maximum instability of a mismatch of v.s.w.r. 1.5:1 and also at matched conditions at a peak anode current of 150A after a holding period of 672 hours. Pulses are

defined as missing when the r.f. energy level is less than 70% of the normal energy level in the frequency range 1295 to 1365MHz. Missing pulses are expressed as a percentage of the number of input pulses applied during the last minute of a test period not exceeding 5 minutes.

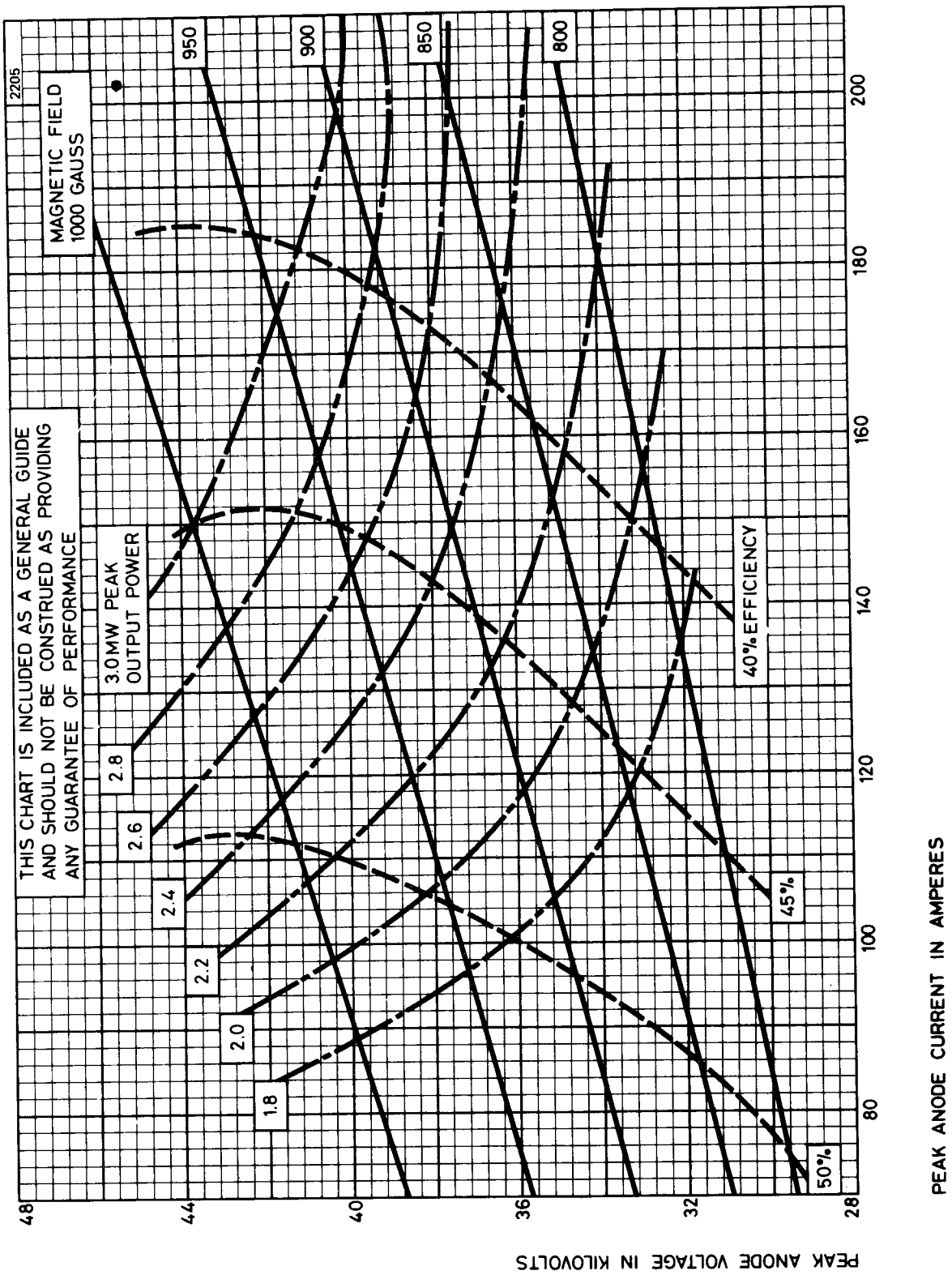
12. The heater current, measured with heater voltage of 20V and no anode input power, will be within the range 12 to 15A.

13. Design test only. The frequency change with anode temperature change after warm-up will not exceed −0.035MHz/°C.

X-RAY WARNING

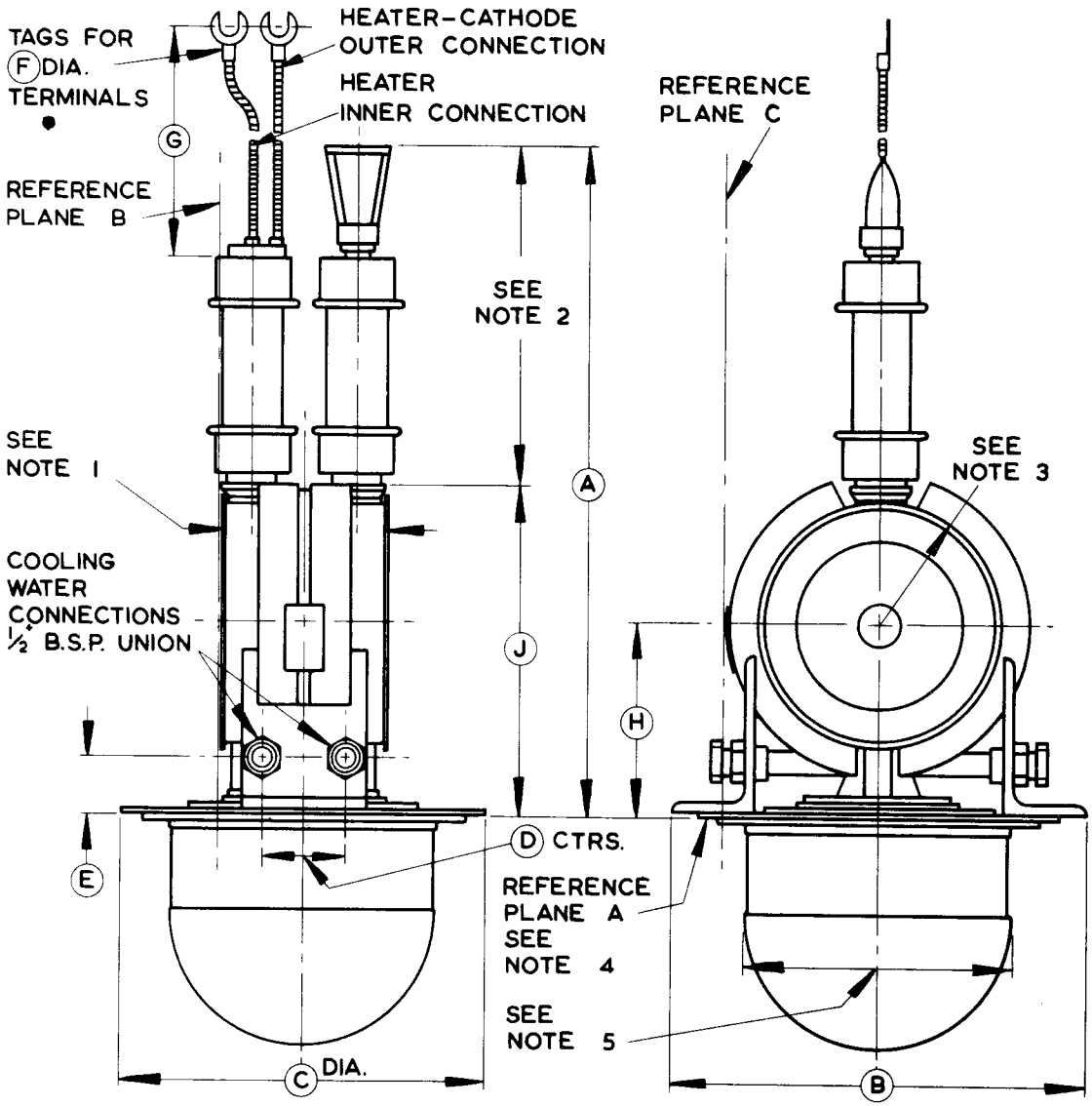
High voltage magnetrons emit a significant intensity of X-rays not only from the cathode sidearm but also from the output waveguide. These rays can constitute a health hazard unless the valve is adequately shielded for X-ray radiation. This is a characteristic of all magnetrons and the X-rays emitted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

PERFORMANCE CHART



OUTLINE

2214

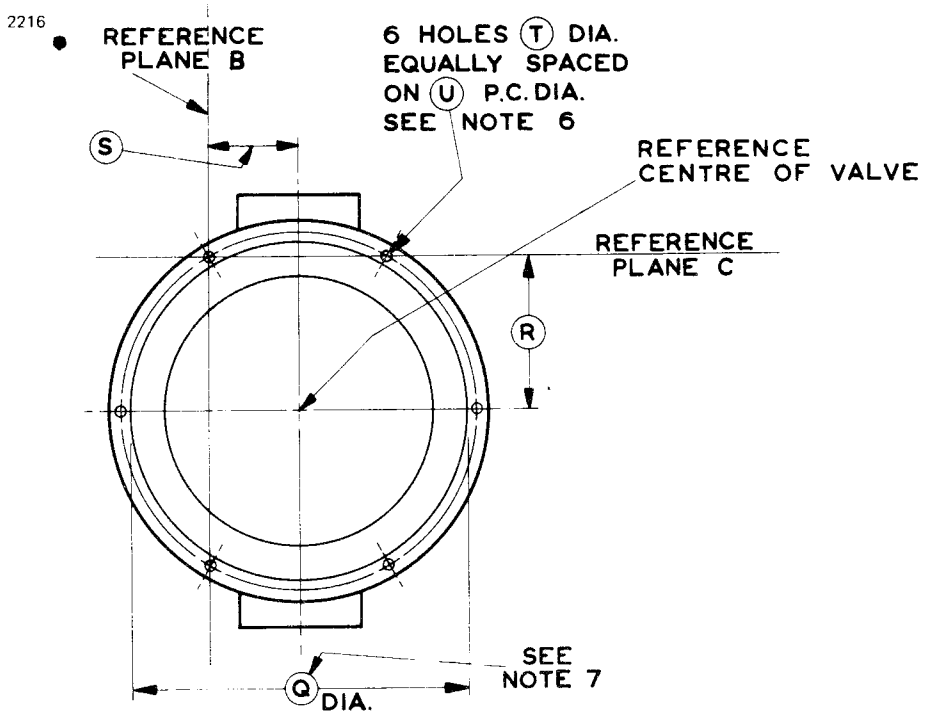


Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	15.000 max	381.0 max	F	0.312	7.92
B	9.750 max	247.7 max	G	8.000 min	203.2 min
C	8.500 max	215.9 max	H	4.213	107.0
D	1.812 ± 0.062	46.02 ± 1.57	J	7.750 max	196.8 max
E	1.187 ± 0.062	30.15 ± 1.57			

Millimetre dimensions have been derived from inches.

OUTLINE

View of Output End of Valve



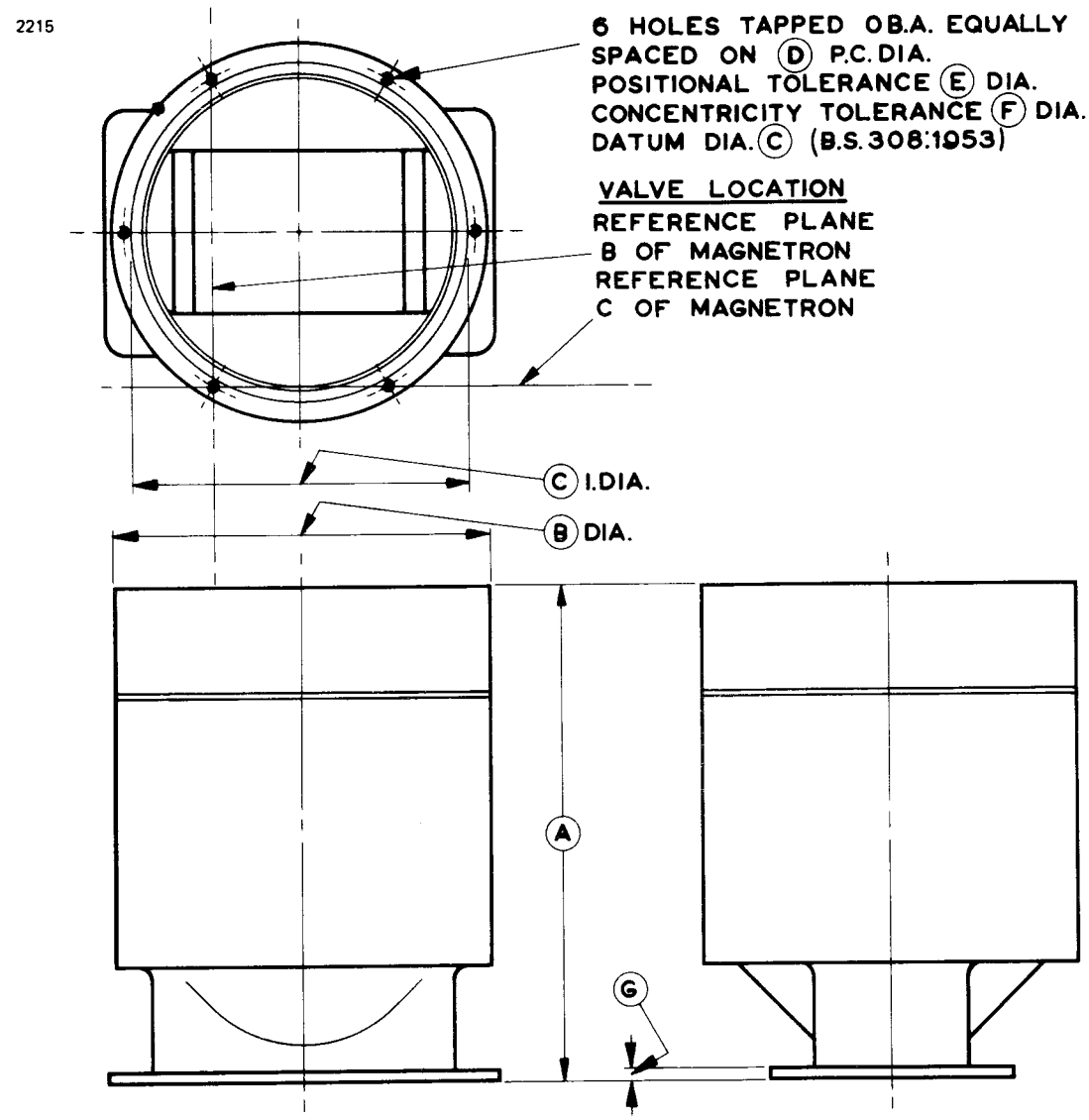
Ref	Inches	Millimetres
Q	See note 7	See note 7
R	3.383	85.93
S	1.953	49.61
T	$0.261^{+0.004}_{-0.000}$	$6.629^{+0.102}_{-0.000}$
U	7.813	198.5

Millimetre dimensions have been derived from inches.

OUTLINE NOTES

1. The overall width of the anode is such that it will pass between two planes 3.750 inches (95.25mm) apart equally spaced about the reference centre of the valve and parallel to reference plane B.
2. All parts of the valve within the limits shown will lie within a rectangular volume of sides 2.75 inches (69.8mm) perpendicular to reference plane C and 5.00 inches (127mm) perpendicular to reference plane B, centred on the reference centre of the valve.
3. The periphery of the anode will fall within a radius of 2.925 inches (74.30mm), positioned as shown.
4. The flatness of the mounting flange will be such that with reference plane A resting on a flat surface a feeler gauge 0.020 inches by 0.125 inches (0.51mm by 3.18mm) will not enter between plane A and the surface at any point.
5. Concentricity of the valve output will be such that diameter B will lie within a radius of 3.218 inches (81.74mm) from the reference centre of the valve.
6. Positional tolerance 0.005 inch (0.127mm) diameter (B.S.308:1953).
7. Diameter Q will lie within a radius of 3.718 inches (94.44mm) from the reference centre of the valve.

TRANSITION SECTION M4016



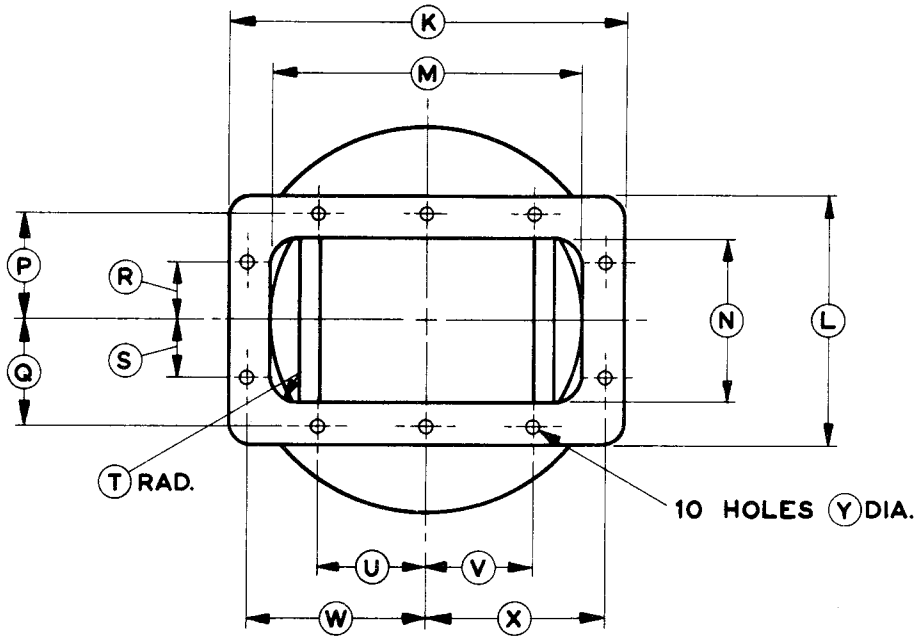
Ref	Inches	Millimetres
A	11.000 ± 0.062	279.40 ± 1.57
B	8.500 max	215.9 max
C	$7.443^{+0.010}_{-0.000}$	$189.05^{+0.25}_{-0.00}$
D	7.813	198.45
E	0.0075	0.19
F	0.005	0.127
G	0.312	7.92

Millimetre dimensions have been derived from inches.

DETAIL OF TRANSITION SECTION

View of Rectangular Output Flange

2217



Ref	Inches	Millimetres
K	8.680	220.5
L	5.440	138.2
M	6.500 ± 0.013	165.10 ± 0.33
N	3.250 ± 0.013	82.55 ± 0.33
P	2.311 ± 0.005	58.70 ± 0.13
Q	2.311 ± 0.005	58.70 ± 0.13
R	1.249 ± 0.005	31.72 ± 0.13
S	1.249 ± 0.005	31.72 ± 0.13
T	0.625	15.88
U	2.374 ± 0.005	60.30 ± 0.13
V	2.374 ± 0.005	60.30 ± 0.13
W	3.937 ± 0.005	100.00 ± 0.13
X	3.937 ± 0.005	100.00 ± 0.13
Y	0.330	8.38

Millimetre dimensions have been derived from inches.

M565

L-BAND MAGNETRON

ABRIDGED DATA

Fixed frequency pulse magnetron		
Frequency range	1215 to 1365	MHz
Typical peak output power	5.0	MW
Magnet	separate electromagnet	
Output	no. 6 waveguide (6.500 x 3.250 inches internal)	
Launching section	separate (see page 10)	
Cooling	water and forced-air	

GENERAL DATA

Electrical

Cathode	indirectly heated	
Heater voltage (see note 1)	48	V
Heater current	14	A
Heater starting current, peak value, not to be exceeded	40	A max
Cathode heating time (minimum) (see note 1)	10	minutes

Mechanical

Overall dimensions	27 x 13 x 13 inches max 686 x 330 x 330mm max
Net weight	72 pounds (32.8kg) approx
Mounting position	vertical only

Cooling

water and forced-air (high pressure)

The valve is water cooled and has an integral water jacket, 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 water flow should be at least 3 imp. gal/min (13.6 l./min), and the outlet temperature must not exceed 75°C. After all power has been removed from the magnetron, a water flow of at least 1.5 imp. gal/min (6.8 l./min) should

be maintained for at least 15 minutes to remove stored heat. The purity of the cooling water must be such that no deposition occurs when the water is heated.

The anode sealing ring should be lubricated with grease type MS4 (Midland Silicones Ltd.).

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)	750	800	Gauss
Heater voltage (see note 1)	45.6	50.4	V
Heater starting current (peak)	—	40	A
Anode voltage (peak)	45	52	kV
Anode current (peak)	200	250	A
Input power (peak)	—	12	MW
Input power (mean) (see note 3)	—	30	kW
Duty cycle	—	0.0025	
Pulse length	—	10	μs
Pulse repetition rate	—	600	p.p.s.
Rate of rise of voltage pulse (see note 4)	75	100	kV/μs
Anode temperature	—	150	°C
Cathode terminal temperature	—	150	°C
V.S.W.R. at the output coupler (see note 5)	—	1.3:1	
Pressurising of waveguide (see note 6)	25	35	lb/in^2
	1.76	2.46	kg/cm^2

TYPICAL OPERATION

Operational Conditions

Heater voltage	0	V
Magnetic field	800	Gauss
Anode current (peak)	240	A
Pulse length	10	μs
Pulse repetition rate	250	p.p.s.

Typical Performance

Anode voltage (peak)	48	kV
Output power (peak)	5.0	MW
Output power (mean)	12.5	kW

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions (See Note 7)

	Oscillation 1	Oscillation 2	
Air flow	see note 8		
Magnetic field (see note 9)	800	750	Gauss
Heater voltage (for test)	0	0	V
Anode current (mean) (see note 10)	500 to 585	see note 10	mA
Duty cycle	0.0025	0.0025	
Pulse length (see note 11)	10	10	μs
V.S.W.R. at the output coupler	<1.1:1	<1.1:1	
Rate of rise of voltage pulse (see note 4)	100 to 110	60 to 70	kV/μs

Limits

	Min	Max	Min	Max	
Anode voltage (peak)	45	51	—	—	kV
Output power (mean)	10.0	—	—	—	kW
Frequency	1215	1365	—	—	MHz
R.F. bandwidth at ¼ power (see note 10)	—	0.25	—	0.25	MHz
Frequency pulling (v.s.w.r. 1.3:1)	—	2.25	—	—	MHz
Stability (see notes 10 and 12)	—	0.5	—	0.5	%
Heater current				see note 13	
Temperature coefficient of frequency				see note 14	

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 48 volts to the heater for at least ten minutes. The heater voltage must not exceed 50.4 volts for longer than five minutes. Immediately after the application of anode voltage, the heater voltage shall be reduced according to the mean input power as specified in the following table.

Mean Input Power (kW)	Heater Voltage (V) Min	Max
0	45.6	50.4
0 to 5	43	48
5 to 10	38	43
10 to 15	32	38
15 to 20	25	32
20 to 24	15	25
24 to 30	0	15

The valve heater shall be protected against arcing by the use of a minimum capacitance of 8μF shunted across the heater directly at the input terminals. Suitable contacts for the shunt capacitor are provided on the valve and details of a capacitor connector are shown on page 8.

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.

3. The various parameters are related by the formula:

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

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

4. The rate of rise of voltage is defined as 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.

5. Where the load v.s.w.r. exceeds 1.3:1, a ferrite isolator or circulator should be incorporated in the output waveguide immediately before the magnetron.

6. At the maximum pressure of 35lb/in^2 (2.46kg/cm^2) the leakage will not exceed 0.06 litre (N.T.P.) per minute.

7. The modulator shall be such that the pulse energy delivered to the magnetron following an arcing pulse cannot greatly exceed the normal energy per pulse.

8. During this test the waveguide air pressure shall not exceed 25lb/in^2 (1.76kg/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.

9. The axial magnetic field shall be 800 gauss at the point specified on page 10 and shall decrease monotonically in the plane parallel to the axis of the electromagnet to points 4.000 ± 0.005 inches on each side of the specified point. At these two positions, the magnetic field shall be within the limits 700 to 720 gauss.

10. The anode current is adjusted to the value within the specified range giving optimum operation into all phases of a 1.3:1 mismatch; this value is marked on the valve. The spectrum bandwidth and stability will be within the required limits at all phases of a 1.3:1 mismatch at current levels ± 15mA about the marked value; the other tests are carried out at 15mA below the marked value.

11. Tolerance ± 10%.

12. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal energy level in the frequency range 1215 to 1365MHz. 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.

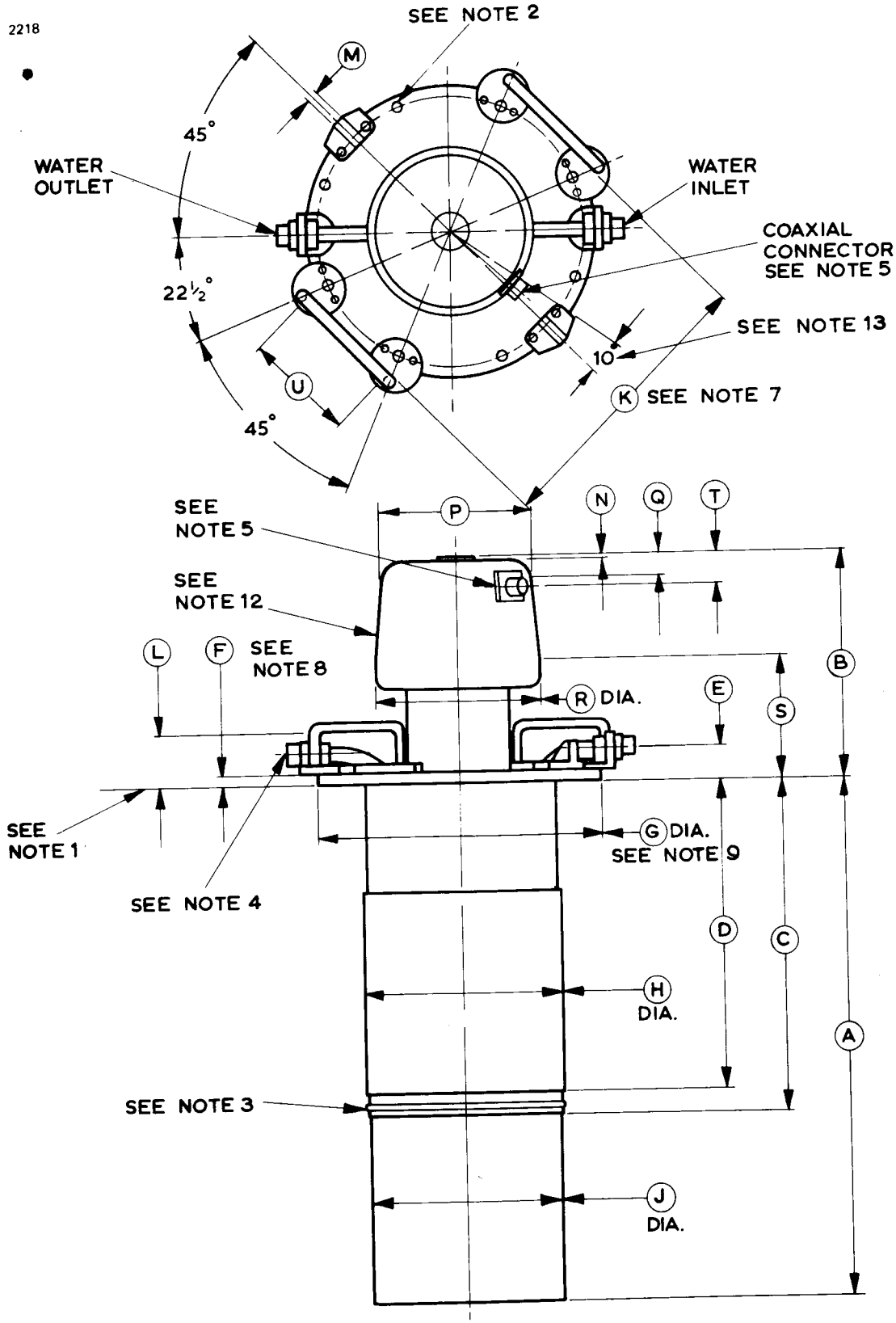
13. Measured with heater voltage of 48V and no anode input power the heater current limits are 13A minimum, 15A maximum after 10 minutes preheating.

14. Design test only. The maximum frequency change with anode temperature change (after warming) is −0.03MHz/°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.

OUTLINE (See page 9 for outline notes)



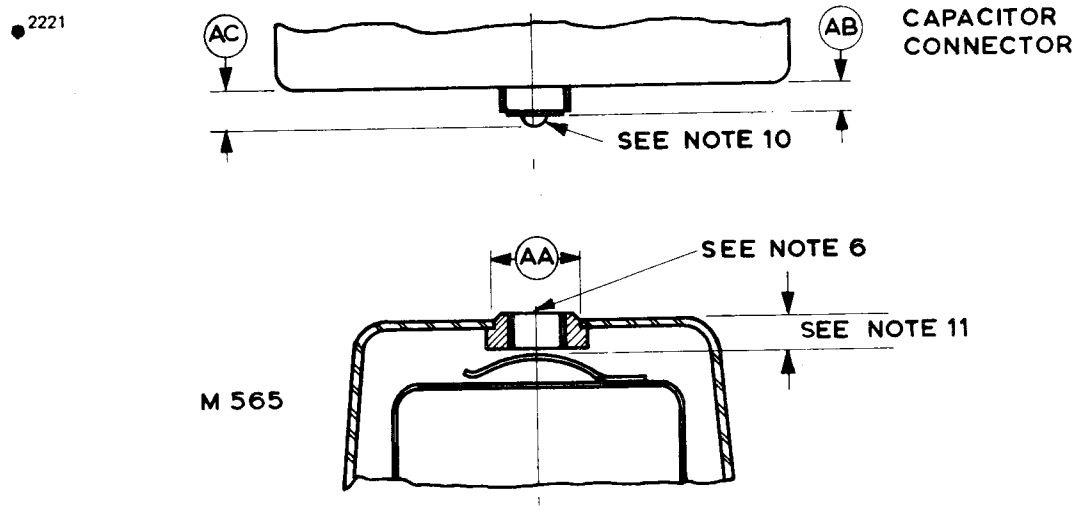
OUTLINE DIMENSIONS

Ref	Inches	Millimetres
A	18.594	472.3
B	8.250 max	209.6 max
C	11.900	302.3
D	11.125	282.6
E	1.125 ± 0.020	28.58 ± 0.51
F	0.437 ± 0.010	11.10 ± 0.25
G	10.250 ± 0.015	260.35 ± 0.38
H	7.240 max	183.9 max
J	$7.000 \begin{smallmatrix} +0.000 \\ -0.040 \end{smallmatrix}$	$177.80 \begin{smallmatrix} +0.00 \\ -1.02 \end{smallmatrix}$
K	10.250	260.4
L	1.937	49.20
M	$0.375 \begin{smallmatrix} +0.000 \\ -0.020 \end{smallmatrix}$	$9.53 \begin{smallmatrix} +0.00 \\ -0.51 \end{smallmatrix}$
N	0.093	2.36
P	5.500 max	139.7 max
Q	0.500 max	12.70 max
R	6.000 max	152.4 max
S	3.125	79.38
T	1.093	27.76
U	4.032	102.4

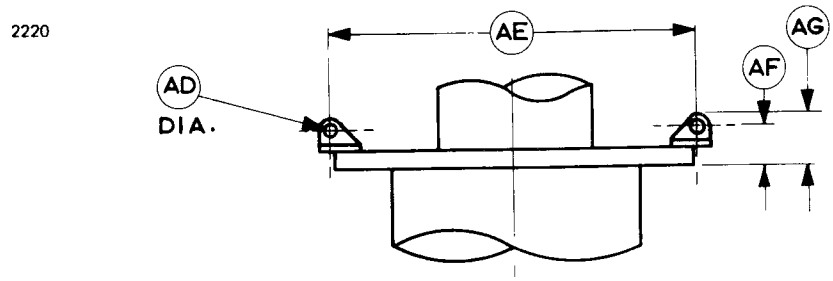
Millimetre dimensions have been derived from inches.

OUTLINE DETAILS

Capacitor Connector and Socket



Lifting Lugs on Mounting Flange



Outline Detail Dimensions

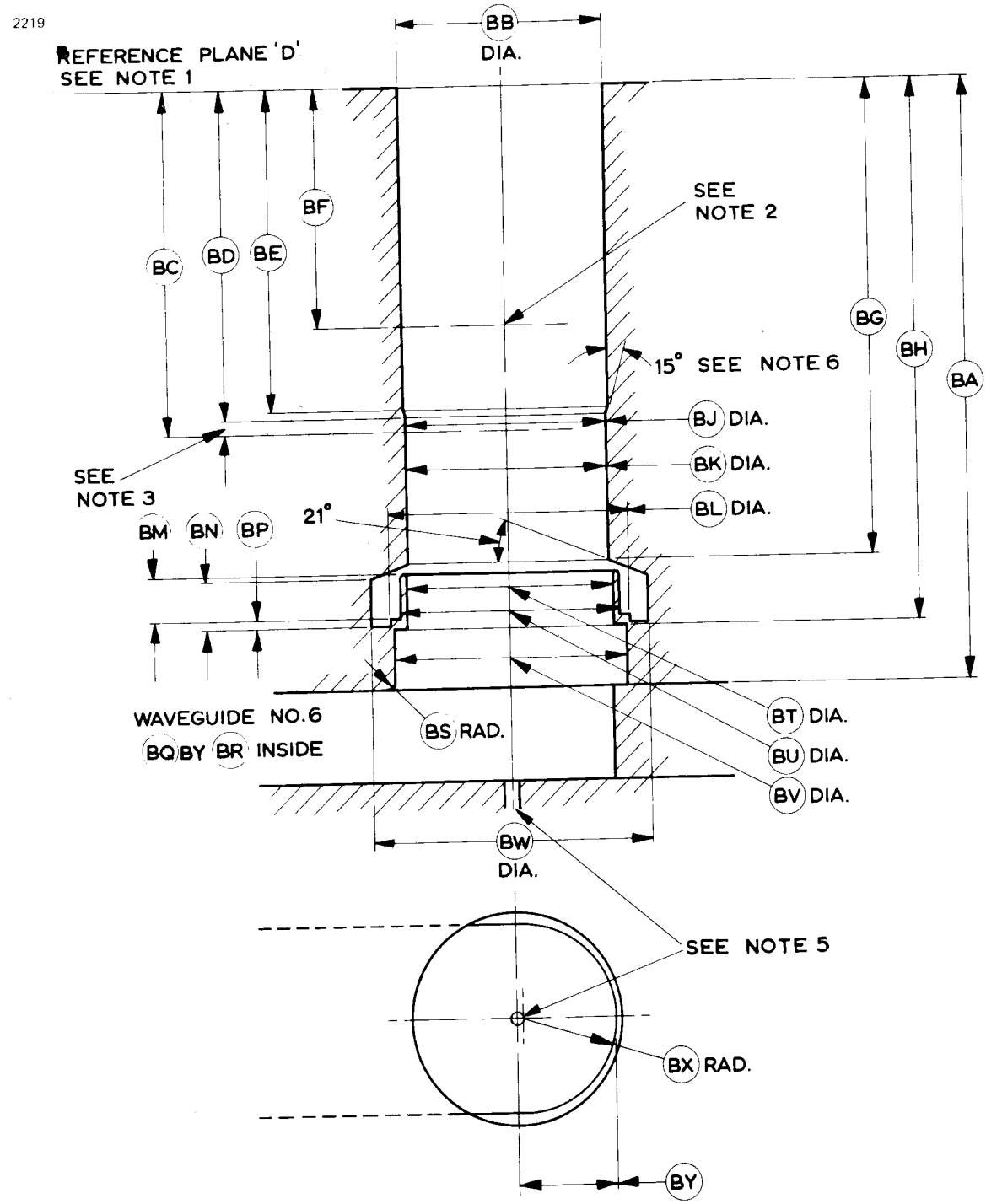
Ref	Inches	Millimetres	Ref	Inches	Millimetres
AA	1.247	31.67	AE	10.750 ± 0.125	273.05 ± 3.18
AB	0.452 ± 0.010	11.48 ± 0.25	AF	1.062 ± 0.062	26.97 ± 1.57
AC	0.577 ± 0.020	14.66 ± 0.51	AG	1.500 max	38.10 max
AD	$0.391^{+0.004}_{-0.000}$	$9.931^{+0.102}_{-0.000}$			

Millimetre dimensions have been derived from inches.

OUTLINE NOTES

1. Reference plane A. With this plane resting on a flat surface, a feeler gauge 0.010 inch (0.25mm) thick will not enter between them.
2. Holes 0.312 to 0.316 inch (7.925 to 8.027mm) diameter equally spaced on a pitch circle diameter to suit a gauge with 8 pins, 0.265 inch (6.73mm) diameter on 9.500 inch (241.3mm) pitch circle diameter.
3. 'O' Sealing Ring, 6.475 inch (164.5mm) internal diameter, 0.275 inch (6.99mm) section diameter, O.S.67 (B.S.1806:1951).
4. Water connections ½-inch B.S. screwed pipe to B.S.2051 part 2.
5. Heater-cathode connector, Joint Services Catalogue number 5935-99-932-5870; the number for the corresponding plug is 5935-99-940-1839.
6. Bush threaded 1-12 UNF-2B, silver plated brass.
7. Inside width of lifting handles.
8. This dimension will apply only within circles 0.625 inch (15.88mm) diameter centred on each of the 0.312 inch (7.925mm) diameter holes.
9. All parts mounted on the flange will lie within a 13.000 inch (330.2mm) diameter cylinder.
10. Domed contact, 0.187 inch (4.75mm) radius; silver plated brass.
11. The leaf spring will provide positive contact through the dimension range 0.540 to 0.600 inch (13.72 to 15.24mm).
12. Label reading 'DANGER X RADIATION HAZARD'.
13. Centre line through coaxial connector will lie within the arc shown.

LAUNCHING SECTION



LAUNCHING SECTION NOTES

1. The magnetron should be bolted down with Reference Plane 'A' of the magnetron in contact with Reference Plane 'D' of the launching section. At 20lb/in^2 (1.4kg/cm^2) excess pressure, the net upward thrust on the magnetron will be 700 pounds (318kg).
2. Magnetic field measured at this point.
3. All diameters concentric to 0.005 inch (0.13mm).
4. Radius on all inside corners.
5. Hole 0.375 inch (9.53mm) diameter for air cooling magnetron window.
6. The air sealing ring fitted on the magnetron seats on the 15° tapered portion.

LAUNCHING SECTION DIMENSIONS

Ref	Inches	Millimetres	Ref	Inches	Millimetres
BA	20.687 ± 0.015	525.45 ± 0.38	BM	1.570 ± 0.010	39.88 ± 0.25
BB	7.250 min	184.2 min	BN	1.670 ± 0.010	42.42 ± 0.25
BC	11.844 ± 0.005	300.84 ± 0.13	BP	0.250 ± 0.005	6.35 ± 0.13
BD	11.343 ± 0.005	288.11 ± 0.13	BQ	6.500 ± 0.005	165.10 ± 0.13
BE	11.155 ± 0.005	283.34 ± 0.13	BR	3.250 ± 0.005	82.55 ± 0.13
BF	8.250 ± 0.005	209.55 ± 0.13	BS	0.250 ± 0.015	6.35 ± 0.38
BG	16.379 ± 0.005	416.03 ± 0.13	BT	7.250 ± 0.005	184.15 ± 0.13
BH	18.562 ± 0.015	471.47 ± 0.38	BU	7.612 ± 0.005	193.34 ± 0.13
BJ	$7.000^{+0.004}_{-0.000}$	$177.80^{+0.102}_{-0.000}$	BV	8.000 ± 0.005	203.20 ± 0.13
			BW	9.700 ± 0.005	246.38 ± 0.13
BK	$7.005^{+0.010}_{-0.000}$	$177.93^{+0.25}_{-0.00}$	BX	3.250 ± 0.005	82.55 ± 0.13
			BY	3.500 ± 0.005	88.90 ± 0.13
BL	8.246 ± 0.005	209.45 ± 0.13			

Millimetre dimensions have been derived from inches.

M586

L-BAND MAGNETRON

Frequency variant of M554

ABRIDGED DATA

Fixed frequency pulse magnetron		
Frequency range	1260 to 1300	MHz
Typical peak output power	2.6	MW
Magnet (see note 1)	separate magnet (not supplied)	
Transition section (see note 2 and page 11)	M4016, coupling to no. 6 waveguide (6.500 x 3.250 inches internal) via coupler UG417A/U	
Cooling	water	

GENERAL

Electrical

Cathode	indirectly heated	
Heater voltage (see note 3)	20	V
Heater current	13.5	A
Heater starting current, peak value, not to be exceeded	60	A max
Cathode heating time (minimum) (see note 3)	5	minutes

Mechanical

Overall dimensions (including transition section)	26.06 x 9.75 x 8.5 inches max 662 x 248 x 216mm max
Net weight:	
valve	22 pounds (10kg) approx
transition section	16 pounds (7.3kg) approx
Mounting position	vertical, cathode and heater terminals up

COOLING

The water cooling system is connected to the valve via ½-inch B.S.P. unions. The water flow must be greater than 20 imp. gal/hour (91 litres/hour) with a maximum outlet temperature of 80°C. A 5-foot (1.5 metre) head of water will be adequate to ensure a flow of 20 imp. gal/hour (91 litres/hour).

The purity of the water must be such that no measurable degree of furring occurs. It must not contain impurities corrosive to copper or brass.

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 4)	900	950	gauss
Heater voltage (see note 3)	18	22	V
Heater starting current (peak)	—	60	A
Anode voltage (peak)	35	42	kV
Anode current (peak)	—	150	A
Input power (peak)	—	6.0	MW
Input power (mean) (see note 5)	—	7.5	kW
Duty cycle	—	0.0015	
Pulse length (see note 6)	—	5.0	μs
Rate of rise of voltage pulse (see note 7)	50	70	kV/μs
Anode temperature (see note 8)	—	80	°C
Cathode terminal temperature	—	165	°C
V.S.W.R. at the output coupler (see note 9)	—	1.5:1	

TYPICAL OPERATION

Operational Conditions

Heater voltage	0	V
Magnetic field	925	gauss
Anode current (peak)	150	A
Pulse length	5.0	μs
Pulse repetition rate	250	p.p.s.

Typical Performance

Anode voltage (peak)	39	kV
Output power (peak)	2.6	MW
Output power (mean)	3.25	kW

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions

	Oscillation 1	Oscillation 2	
Magnetic field (see note 4)	950	950	gauss
Heater voltage (for test)	0	0	V
Anode current (mean)	190	190	mA
Duty cycle	0.00125	0.00125	
Pulse length (see note 6)	5.0	5.0	μs
V.S.W.R. at the output coupler	1.15:1	1.5:1	
Rate of rise of voltage pulse	70	70	kV/μs min

Limits

	Min	Max	Min	Max	
Anode voltage (peak)	38	42	—	—	kV
Output power (mean)	3150	—	—	—	W
Frequency	1260	1300	—	—	MHz
R.F. bandwidth at ¼ power	—	0.5	—	—	MHz
Frequency pulling	—	—	—	4.0	MHz
Frequency pushing (see note 10)	—	50	—	—	kHz/A
Stability (see note 11)	—	0.25	—	0.5	%
Heater current				see note 12	
Temperature coefficient of frequency				see note 13	

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 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.

End of Life Criteria (under Test Conditions Oscillation 1)

Output power (mean)	2500	W
R.F. bandwidth at ¼ power	0.5	MHz
Frequency must be within test limits above, Oscillation 1		

NOTES

1. The valve is designed for use with a separate magnet, not supplied by English Electric Valve Company Ltd. The user is invited to consult the Company on the choice of suitable magnets.

2. The valve must be used with the circular to rectangular waveguide transition section M4016 (see pages 11 and 12). The satisfactory performance of the valve is guaranteed only when it is used in conjunction with M4016.

   The magnetron flange and the transition section are bolted together directly with 6 OBA bolts (shank length 0.375 inch - 9.53mm) and the distance between the axis of the anode and the face of the rectangular waveguide coupling flange is 15.213 $\pm$ 0.187 inches (386.41 $\pm$ 4.75mm). It is essential for the valve to be located correctly with respect to M4016, as shown on the outline drawing on page 11.

3. 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 20 volts to the heater for at least 5 minutes.

   During high voltage operation it is essential to operate the heater according to the following schedule:

Mean Input Power (W)	**Heater Voltage (V)**
Less than 2000	20
2000 to 3000	15
3000 to 4000	10
4000 to 5000	5
More than 5000	0

   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 4μF may be necessary depending on the equipment design. For further details see the preamble to this section.

4. For normal operation the magnetic field should be 900 to 930 gauss measured at the centre of the gap. The variation of magnetic field

within a cylinder 3 inches (76.2mm) diameter and 2 inches (50.8mm) long situated centrally and co-axially between the poles must not exceed ± 50 gauss. The minimum gap between the pole pieces must be 3.750 inches (95.25mm).

The north pole of the magnet must be adjacent to the cathode terminal. The magnet position must be adjusted so that the axis of the field is within 0.062 inch (1.57mm) of the centre line of the anode (see outline drawing). It is necessary to provide for an axial adjustment to the magnet of ± 0.125 inch (± 3.18mm) relative to the M4016 waveguide flange.

5. The various parameters are related by the formula:

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

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

6. Tolerance ± 10%.

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

8. The temperature of the anode measured at the hottest point where contact is made with the water jacket. The rate of water flow must be such that the anode temperature is maintained below this maximum and in any case the flow must exceed 20 gallons per hour (91 litres per hour).

9. The v.s.w.r. of the output system shall be less than 1.5:1 over the frequency range 1220 to 1350MHz and less than 2.0:1 over the frequency range 1350 to 1600MHz, or an approved output system shall be used.

10. The change in frequency when the peak input current is varied between the limits of 100 and 150A shall be less than 50kHz/A. The frequency shall vary smoothly without discontinuity within the specified limit.

11. Missing pulses are counted at the phase of maximum instability of a mismatch of v.s.w.r. 1.5:1 and also at matched conditions at a peak anode current of 150A after a holding period of 672 hours. Pulses are

defined as missing when the r.f. energy level is less than 70% of the normal energy level in the frequency range 1260 to 1300MHz. Missing pulses are expressed as a percentage of the number of input pulses applied during the last minute of a test period not exceeding 5 minutes.

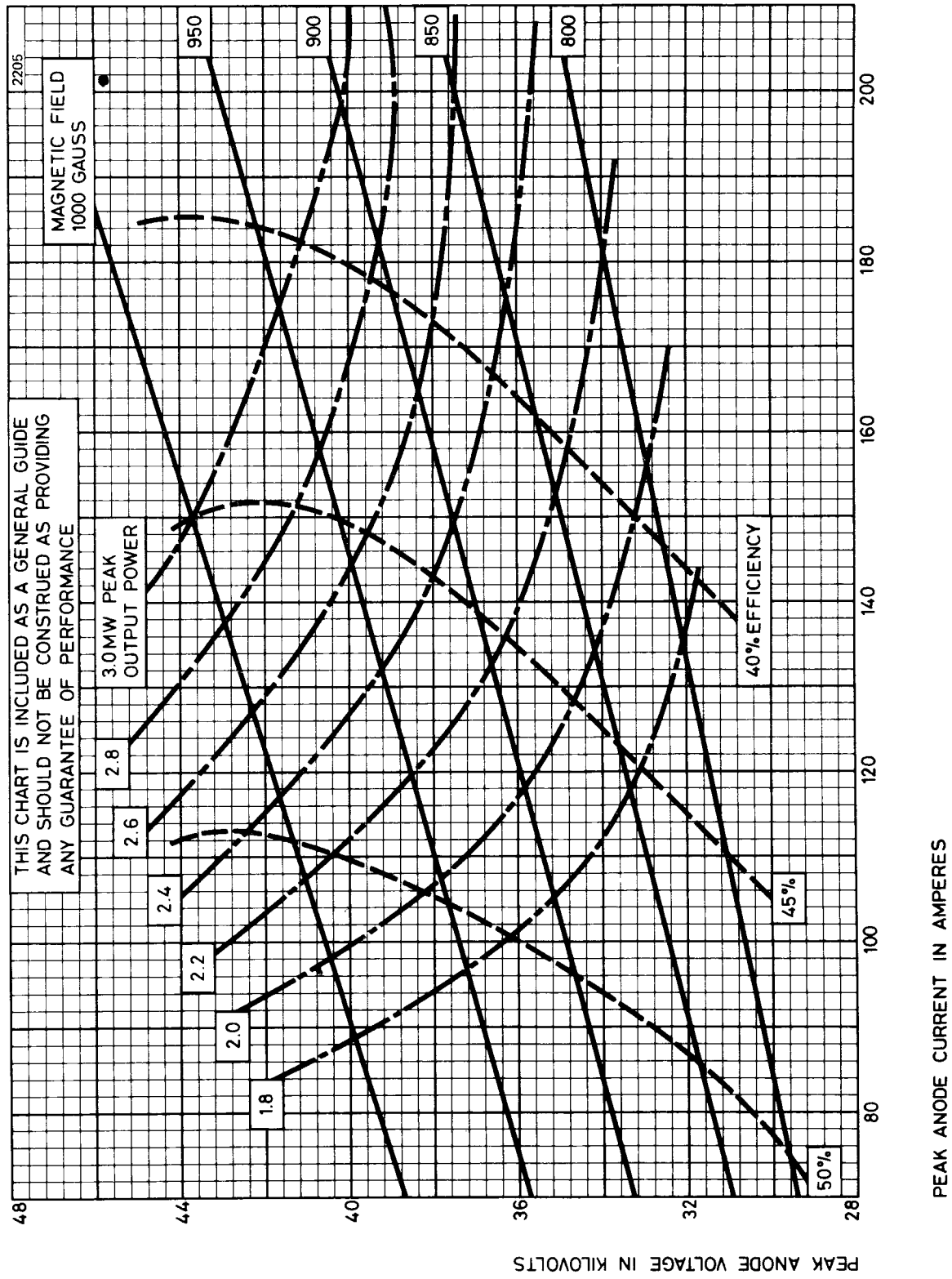
12. The heater current, measured with heater voltage of 20V and no anode input power, will be within the range 12 to 15A.

13. Design test only. The frequency change with anode temperature change after warm-up will not exceed -0.035MHz/°C.

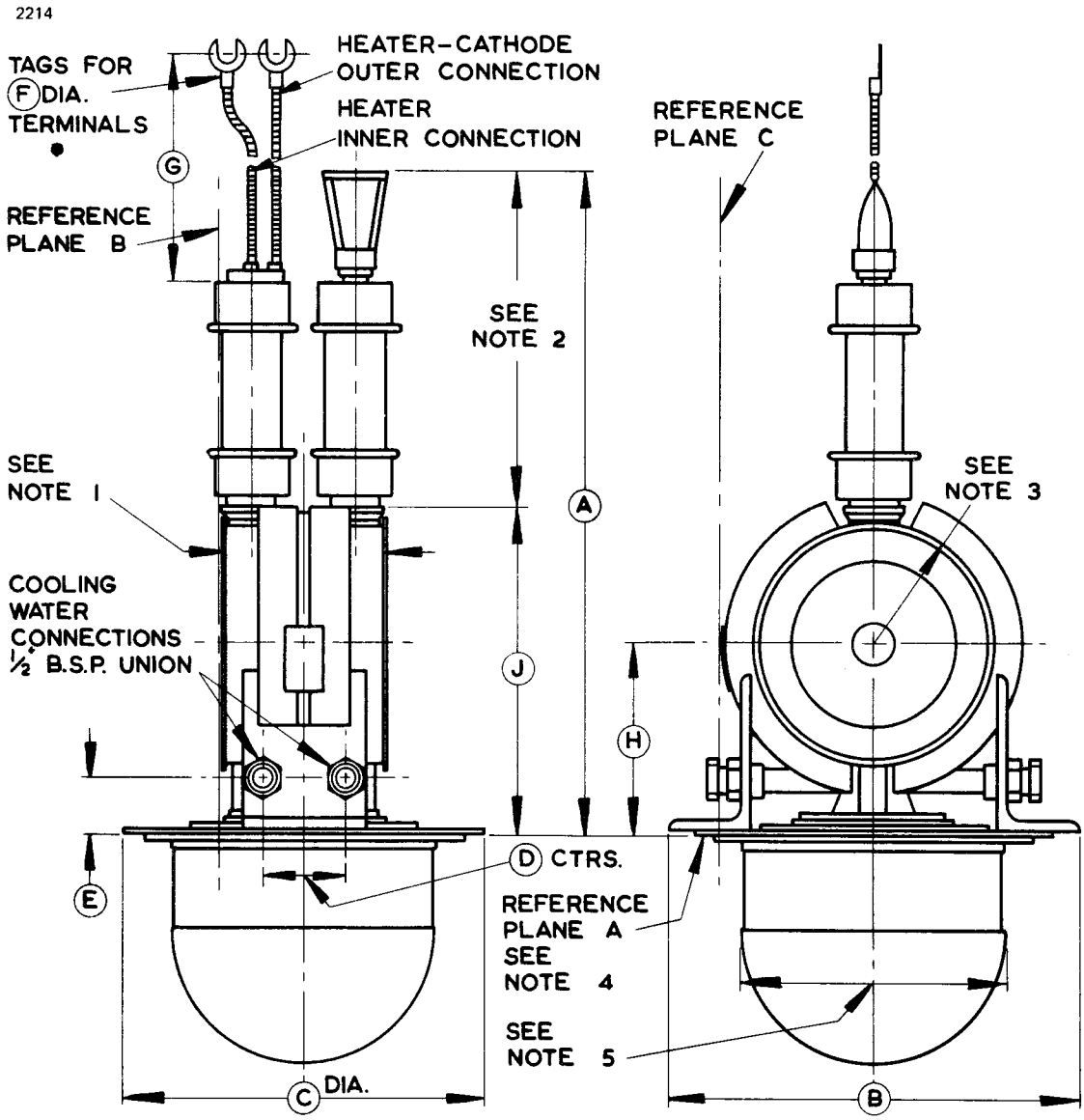
X-RAY WARNING

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 the valve is adequately shielded for X-ray radiation. 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



OUTLINE

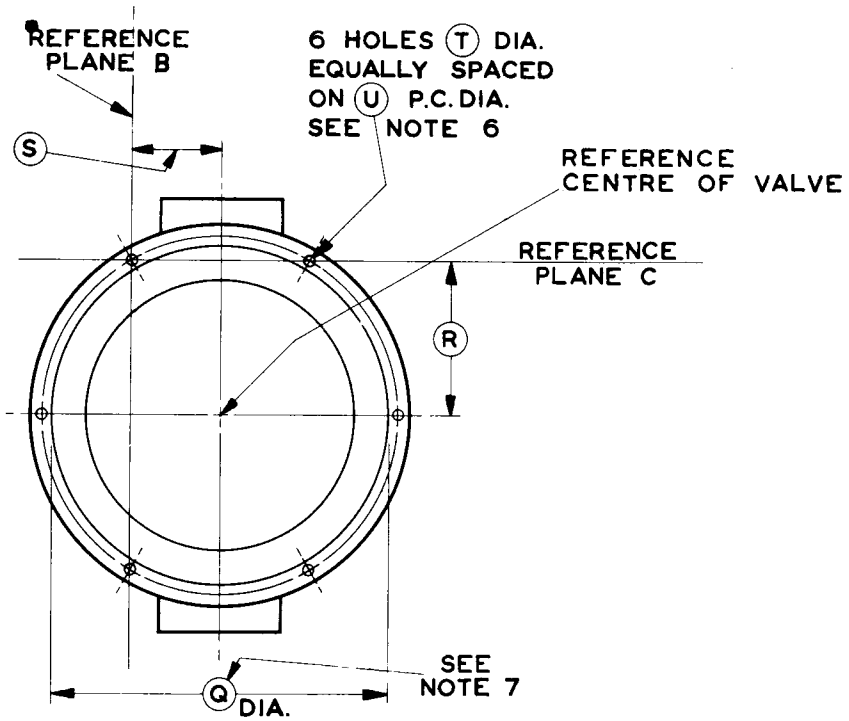


Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	15.000 max	381.0 max	F	0.312	7.92
B	9.750 max	247.7 max	G	8.000 min	203.2 min
C	8.500 max	215.9 max	H	4.213	107.0
D	1.812 ± 0.062	46.02 ± 1.57	J	7.750 max	196.8 max
E	1.187 ± 0.062	30.15 ± 1.57			

Millimetre dimensions have been derived from inches.

OUTLINE

View of Output End of Valve



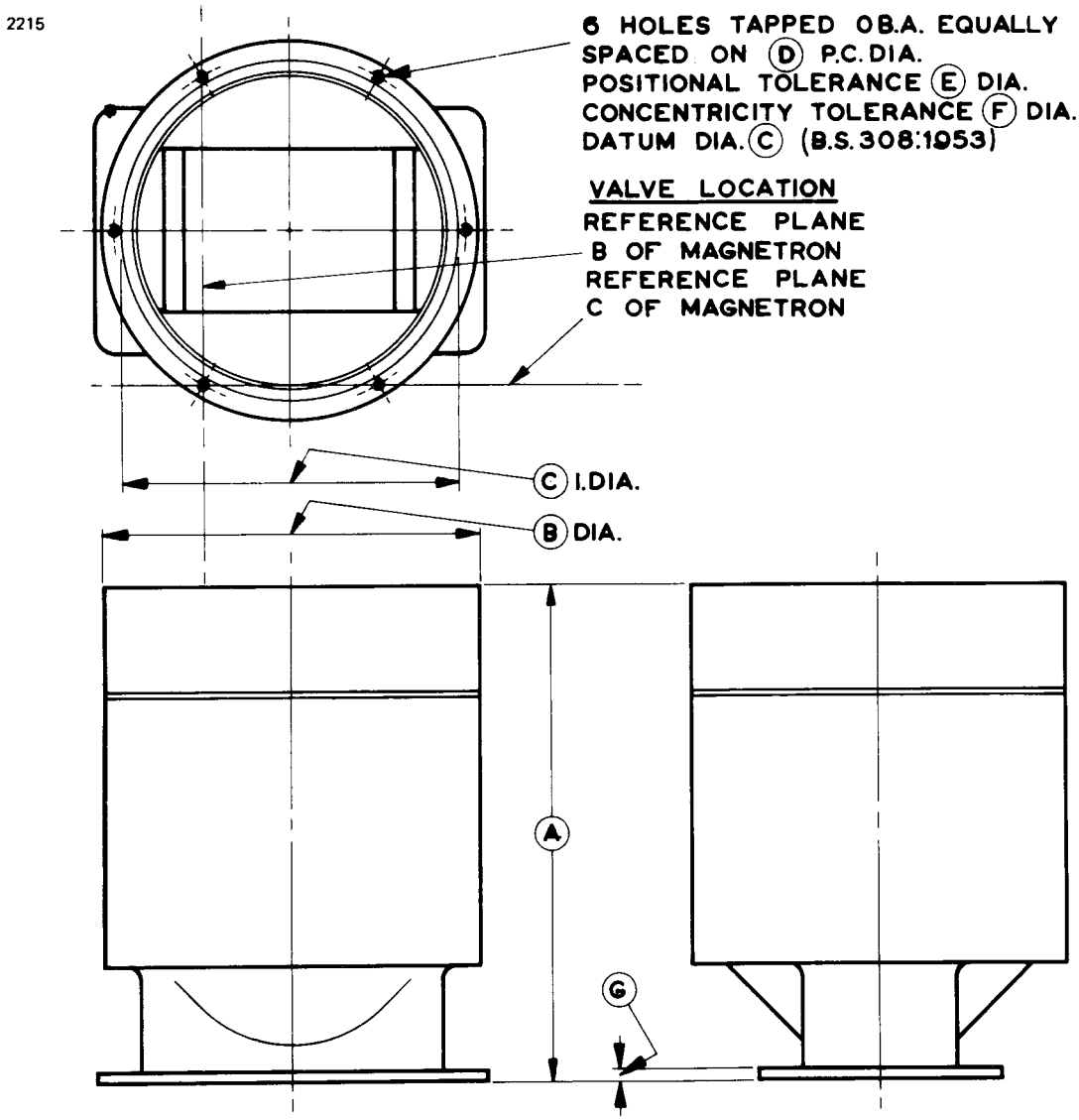
Ref	Inches	Millimetres
Q	See note 7	See note 7
R	3.383	85.93
S	1.953	49.61
T	$0.261^{+0.004}_{-0.000}$	$6.629^{+0.102}_{-0.000}$
U	7.813	198.5

Millimetre dimensions have been derived from inches.

OUTLINE NOTES

1. The overall width of the anode is such that it will pass between two planes 3.750 inches (95.25mm) apart equally spaced about the reference centre of the valve and parallel to reference plane B.
2. All parts of the valve within the limits shown will lie within a rectangular volume of sides 2.75 inches (69.8mm) perpendicular to reference plane C and 5.00 inches (127mm) perpendicular to reference plane B, centred on the reference centre of the valve.
3. The periphery of the anode will fall within a radius of 2.925 inches (74.30mm), positioned as shown.
4. The flatness of the mounting flange will be such that with reference plane A resting on a flat surface a feeler gauge 0.020 inches by 0.125 inches (0.51mm by 3.18mm) will not enter between plane A and the surface at any point.
5. Concentricity of the valve output will be such that diameter B will lie within a radius of 3.218 inches (81.74mm) from the reference centre of the valve.
6. Positional tolerance 0.005 inch (0.127mm) diameter (B.S.308:1953).
7. Diameter Q will lie within a radius of 3.718 inches (94.44mm) from the reference centre of the valve.

TRANSITION SECTION M4016

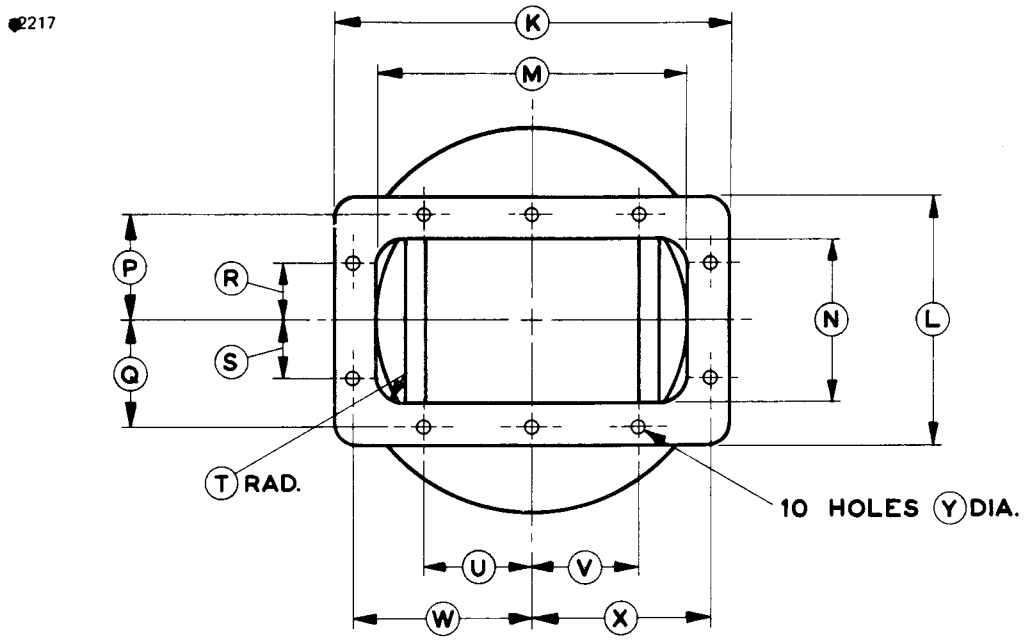


Ref	Inches	Millimetres
A	11.000 ± 0.062	279.40 ± 1.57
B	8.500 max	215.9 max
C	$7.443^{+0.010}_{-0.000}$	$189.05^{+0.25}_{-0.00}$
D	7.813	198.45
E	0.0075	0.19
F	0.005	0.127
G	0.312	7.92

Millimetre dimensions have been derived from inches.

DETAIL OF TRANSITION SECTION

View of Rectangular Output Flange



Ref	Inches	Millimetres
K	8.680	220.5
L	5.440	138.2
M	6.500 ± 0.013	165.10 ± 0.33
N	3.250 ± 0.013	82.55 ± 0.33
P	2.311 ± 0.005	58.70 ± 0.13
Q	2.311 ± 0.005	58.70 ± 0.13
R	1.249 ± 0.005	31.72 ± 0.13
S	1.249 ± 0.005	31.72 ± 0.13
T	0.625	15.88
U	2.374 ± 0.005	60.30 ± 0.13
V	2.374 ± 0.005	60.30 ± 0.13
W	3.937 ± 0.005	100.00 ± 0.13
X	3.937 ± 0.005	100.00 ± 0.13
Y	0.330	8.38

Millimetre dimensions have been derived from inches.

S-Band Magnetrons

2J30-2J34 inclusive

S-BAND MAGNETRONS

Service Types CV1807, CV1808 CV1809, CV1810

GENERAL DATA

The 2J30—2J34 series comprises five pulse operated, fixed frequency magnetrons. They are maintenance types and therefore only abridged data are given on this sheet. Full information is available on request.

Frequency range:

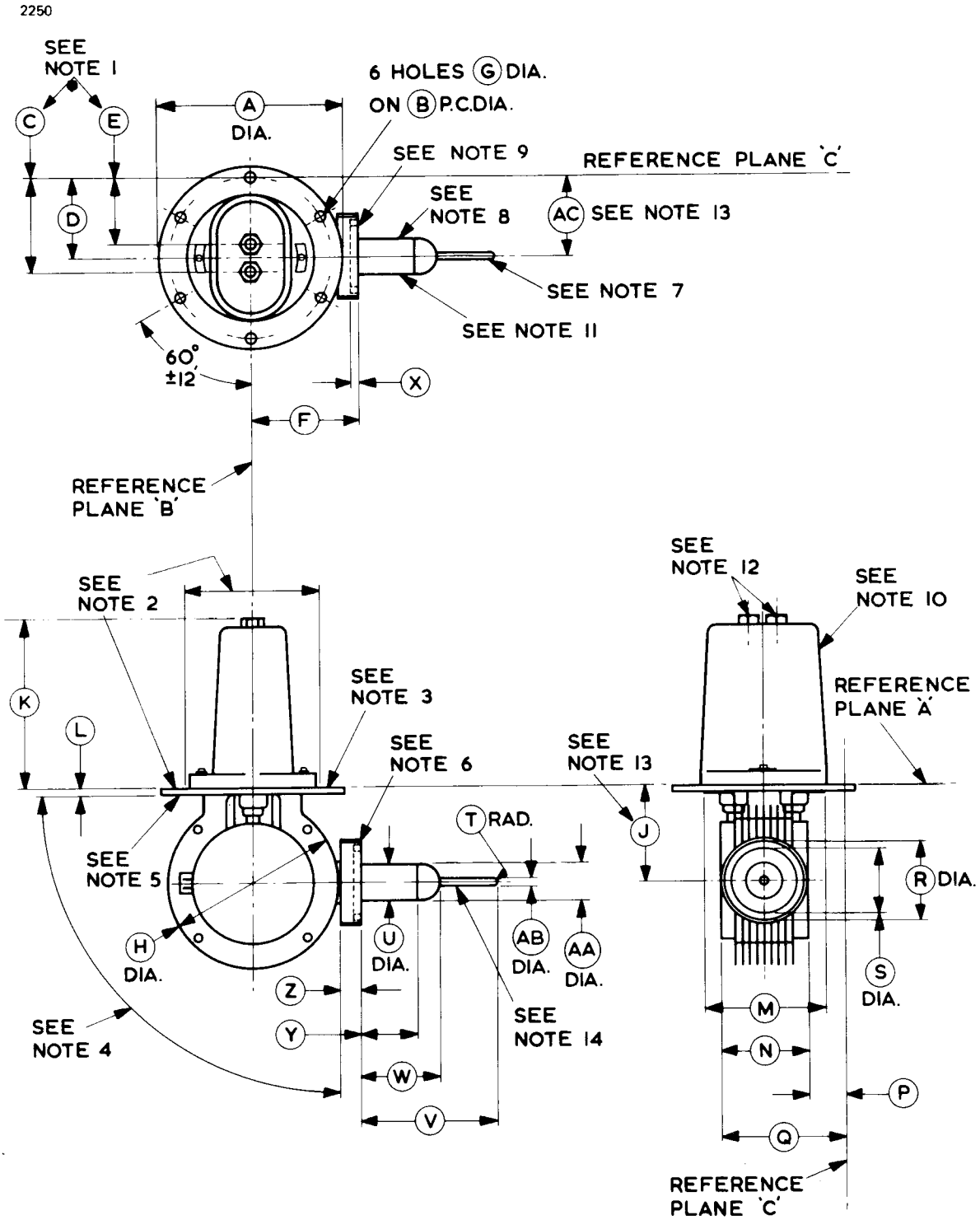
2J30	2860 to 2900	MHz
2J31 (CV1807)	2820 to 2860	MHz
2J32 (CV1808)	2780 to 2820	MHz
2J33 (CV1809)	2740 to 2780	MHz
2J34 (CV1810)	2700 to 2740	MHz

Typical Operation

Output power (peak)	300	kW
Anode voltage (peak)	20	kV
Anode current (peak)	30	A
Duty cycle	0.001	
Heater voltage	6.3	V
Heater current	1.5	A
Cathode heating time (minimum)	2.0	min
Magnetic field	1900	gauss
Magnet		separate
Output	Coaxial line. Internal diameter of outer conductor 0.812 inch, diameter of inner conductor 0.375 inch	
Cooling		forced-air

September 1968

OUTLINE (See page 4 for outline notes)



OUTLINE DIMENSIONS

Ref	Inches	Millimetres
A	3.250 ± 0.031	82.55 ± 0.79
B	2.875 ± 0.006	73.03 ± 0.15
C	1.687	42.85
D	1.437	36.50
E	1.187	30.15
F	1.875 ± 0.047	47.63 ± 1.19
G	0.193 ± 0.003	4.902 ± 0.076
H	3.000 ± 0.062	76.20 ± 1.57
J	1.687 ± 0.010	42.85 ± 0.25
K	2.984 ± 0.062	75.79 ± 1.57
L	0.125	3.18
M	2.480 max	62.99 max
N	1.490 max	37.85 max
P	0.677 min	17.20 min
Q	2.197 max	55.80 max
R	1.375 ± 0.010	34.93 ± 0.25
S	1.122 ± 0.005	28.50 ± 0.13
T	0.062	1.57
U	0.647 ± 0.022	16.43 ± 0.56
V	2.438 ± 0.062	61.93 ± 1.57
W	1.406 ± 0.031	35.71 ± 0.79
X	0.125 ± 0.010	3.18 ± 0.25
Y	1.000	25.40
Z	$0.365^{+0.010}_{-0.000}$	$9.27^{+0.25}_{-0.00}$
AA	0.670 max	17.02 max
AB	$0.125^{+0.002}_{-0.005}$	$3.175^{+0.051}_{-0.127}$
AC	1.457 ± 0.010	37.01 ± 0.25

Millimetre dimensions have been derived from inches.

OUTLINE NOTES

1. The jack holes will be within a radius of 0.023 inch (0.58mm) of the location specified, but will be spaced 0.500 ± 0.010 inch (12.70 ± 0.25mm) with respect to each other. The centre lines of the holes will be perpendicular to reference plane 'A' within 3°.
2. Any portion of the assembly extending above this surface will be within 1.110 inches (28.19mm) radius of the true centre of the plate.
3. With the flange resting on a plane surface, the flatness of the mounting plate 0.500 inch (12.70mm) from the outer edge will be such that a feeler gauge 0.010 inch (0.25mm) thick and 0.125 inch (3.18mm) wide will not enter for a distance of more than 0.250 inch (6.35mm).
4. Areas between these planes will be painted with a black heat resistant non-corrosive paint.
5. Soldered joints in the mounting flange and coupling adapter will be vacuum tight so that the mounting flange may be used to provide a hermetic seal.
6. U.S.F. 1.500 – 18 thread, class 2 fit.
7. The centre line of the lead measured at this end will be concentric with the centre line of the coupling adapter within 0.020 inch (0.51mm).
8. The centre line of the output cylinder will be concentric with the centre line of the coupling adapter within 0.010 inch (0.25mm).
9. This surface of the coupling adapter will be parallel to Reference Plane 'B' within 1°.
10. The common cathode connection is indicated by letter 'C' on this surface.
11. The output cylinder will be of non-corrosive material or will be painted black; minimum plating 20mg/in^2 silver, or 10mg/in^2 gold.
12. Hexagon head banana pin jacks 0.406 inch (10.31mm) long with holes 0.169 ± 0.005 inch (4.29 ± 0.13mm) diameter.
13. This dimension applies to the coupling adapter.
14. Polished, or gold plated.

4J31-4J35 inclusive

S-BAND MAGNETRONS

Service Types CV1914, CV1916, CV1897, CV1898, CV2744

ABRIDGED DATA

Fixed frequency pulse magnetrons

Frequency range:		
4J31 (CV1914)	2860 to 2900	MHz
4J32	2820 to 2860	MHz
4J33 (CV1916)	2780 to 2820	MHz
4J34 (CV1897)	2740 to 2780	MHz
CV2744 (selected 4J34)	2740 to 2765	MHz
4J35 (CV1898)	2700 to 2740	MHz
Typical peak output power	1.0	MW
Magnet	separate, see note 8 on page 5	
Output	coaxial line; internal diameter of outer conductor 1.527 inches, diameter of inner conductor 0.625 inch	
Coupler	see page 7	
Cooling	forced-air	

GENERAL

Electrical

Cathode	indirectly heated	
Heater voltage (see note 1)	16	V
Heater current	3.1	A
Heater starting current, peak value, not to be exceeded	15	A max
Cathode heating time (minimum) (see note 2)	2	min

Mechanical

Overall dimensions	10.523 x 7.233 x 4.624 inches max 267.3 x 183.7 x 117.5mm max
Net weight	6 pounds (2.8kg) approx
Mounting position	any
Cooling (see note 6)	forced-air

MAXIMUM AND MINIMUM RATINGS (Absolute values)

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

	Min	Max	
Heater voltage (see note 1)	14.4	17.6	V
Heater starting current (peak)	—	15	A
Anode voltage (peak)	—	30	kV
Anode current (peak)	—	70	A
Input power (peak)	—	2.0	MW
Input power (mean) (see note 3)	—	1.2	kW
Duty cycle	—	0.001	
Pulse length (see note 4)	—	2.5	μs
Rate of rise of voltage pulse (see note 5)	100	200	kV/μs
Anode temperature (see note 6)	—	100	°C
Cathode terminal temperature	—	100	°C
V.S.W.R. at the output coupler	—	1.5:1	
Ambient pressure for satisfactory operation	500	—	mm Hg
Pressurising (see note 7):			
input circuit	—	45	lb/in^2
output circuit	—	45	lb/in^2

TYPICAL OPERATION

Operational Conditions

Heater voltage	13	10.5	V
Magnetic field (see note 8)	2150	2700	gauss
Anode current (peak)	56	70	A
Pulse length	1.0	1.0	μs
Pulse repetition rate	500	500	p.p.s.

Typical Performance

Anode voltage (peak)	22	28	kV
Output power (peak)	600	1000	kW
Output power (mean)	300	500	W

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions

	Oscillation 1	Oscillation 2	
Magnetic field (see note 8)	2700	2700	gauss
Heater voltage (for test)	10	10	V
Anode current (mean)	35	45	mA
Duty cycle	0.0005	0.0006	
Pulse length (see note 4)	1.0	2.0	μs
V.S.W.R. at the output coupler	1.15:1	1.15:1	
Rate of rise of voltage pulse (see note 5)	200	200	kV/μs

Limits

	Min	Max	Min	Max	
Anode voltage (peak)	26	30	—	—	kV
Output power (mean)	400	—	—	—	W
Frequency:					
4J31 (CV1914)	2860	2900	—	—	MHz
4J32	2820	2860	—	—	MHz
4J33 (CV1916)	2780	2820	—	—	MHz
4J34 (CV1897)	2740	2780	—	—	MHz
CV2744*	2740	2765	—	—	MHz
4J35 (CV1898)	2700	2740	—	—	MHz
R.F. bandwidth at ¼ power	—	2.5	—	—	MHz
Frequency pulling (v.s.w.r. not less than 1.5:1)	—	15	—	—	MHz
Stability (see note 9)	—	0.5	—	0.5	%
Heater current				see note 10	
Temperature coefficient of frequency				see note 11	

* Selected 4J34 with limited frequency band.

LIFE TEST

The quality of all production is monitored by the random selection of valves which are then life-tested under Oscillation 1 conditions above. 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.

End of Life Criteria (under Test Conditions Oscillation 1)

Output power (mean)	320	W min
R.F. bandwidth at ¼ power	2.5	MHz max
Stability (see note 9)	1.0	% max

NOTES

1. (a) With no anode input power.

   During high voltage operation it is essential to operate the heater according to the following schedule:

Mean Input Power (W)	Heater Voltage (V)
1000–1200	8.0
800–1000	10.5
600–800	13
400–600	15
less than 400	16

   The above schedule is valid only for pulse repetition rates of 300p.p.s. or greater.

   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.

   (b) The 4J31–4J35 types have hum-free heaters and have been tested for satisfactory operation with sinusoidal heater supply voltages of frequency 50, 60 and 500Hz. English Electric Valve Company Ltd. should be consulted if other supply frequencies are to be used. Where complete freedom from frequency modulation is essential, the use of a d.c. heater supply is recommended.

2. For ambient temperatures above 0°C. For ambient temperatures between 0 and −55°C the cathode heating time is 3 minutes minimum.

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

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

   where Pi = 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 ±10%.

5. 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.

6. The anode temperature must be kept below the limit specified by means of a suitable flow of air over the cooling fins.

7. The mounting plate and the guard pipe are fitted to the valve in a manner to permit pressurising of the input circuit and the output circuit of the valve. At the maximum pressure of 45lb/in^2 absolute, the leakage will not exceed 0.5 litre (N.T.P.) per minute.

8. The valve is designed for use with a separate magnet which must conform with the specification given at the top of page 11. The axis of the magnetic field must be coincident with the axis of the anode, and the north pole of the magnet must be adjacent to the cathode terminal. A suitable magnet, type MA228, is available.

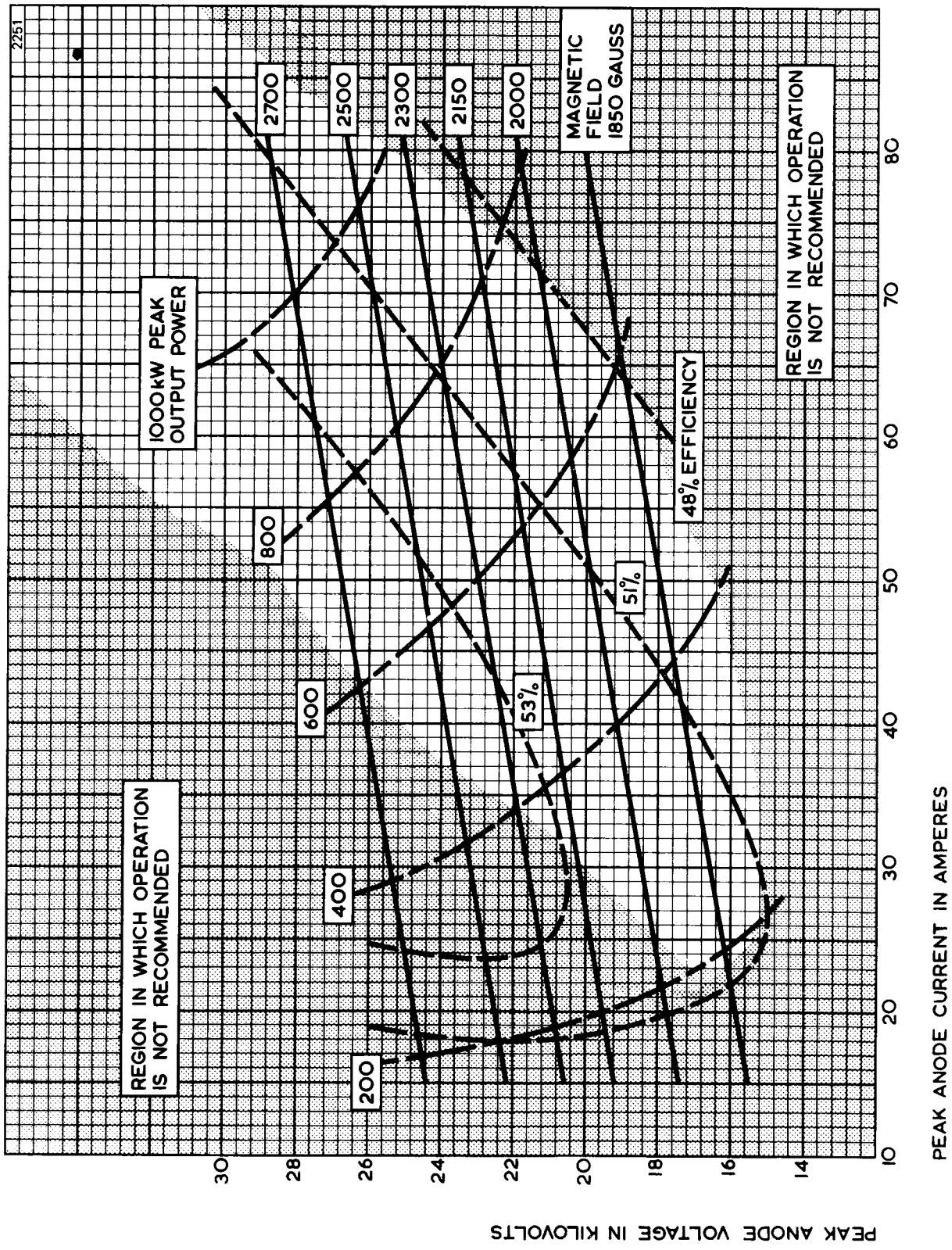
   If an electro-magnet is used, the pole tip dimensions should be as shown on page 11.

9. With the valve operating into a mismatch of v.s.w.r. 1.5:1, phased to give maximum instability. 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 valve. Missing pulses are expressed as a percentage of the number of input pulses applied during the last 30 seconds of a test interval not to exceed 5 minutes.

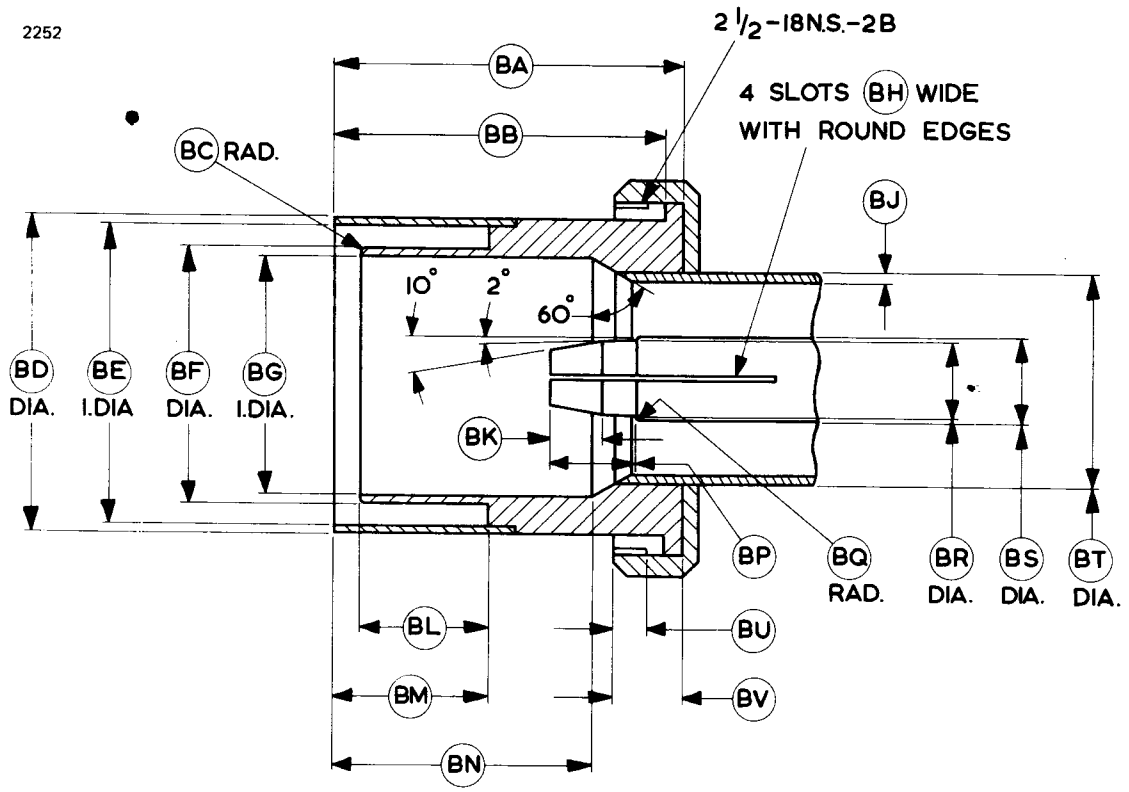
10. Measured with heater voltage of 16V and no anode input power, the heater current limits are 2.8A minimum, 3.4A maximum.

11. Design test only. The maximum frequency change with anode temperature change (after warming) is −0.07MHz/°C.

PERFORMANCE CHART



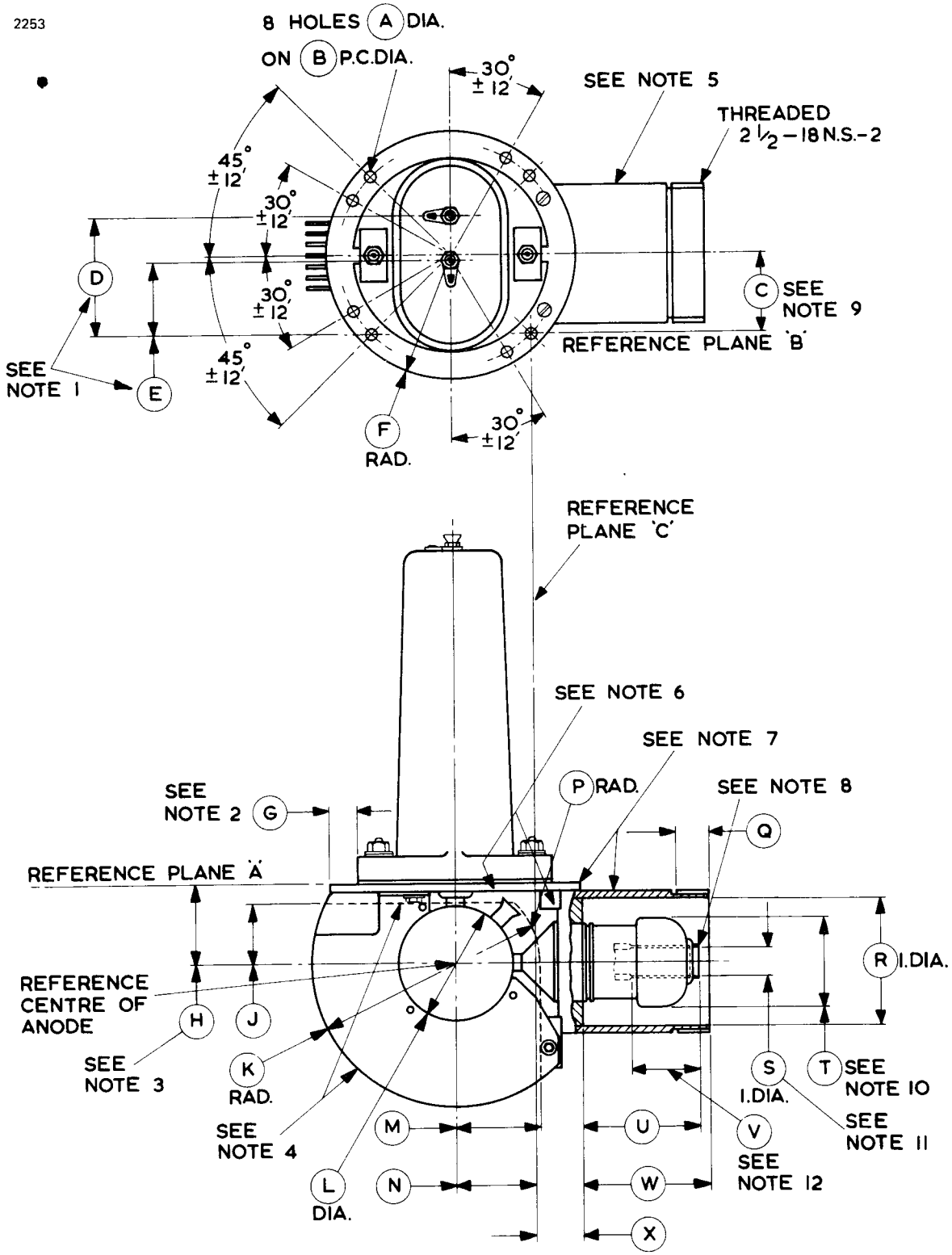
COUPLER



Ref	Inches	Millimetres	Ref	Inches	Millimetres
BA	2.531 ± 0.015	64.29 ± 0.38	BL	0.937 ± 0.003	23.800 ± 0.076
BB	2.402 ± 0.005	61.01 ± 0.13	BM	1.125 ± 0.003	28.575 ± 0.076
BC	0.031 ± 0.015	0.79 ± 0.38	BN	1.875 ± 0.005	47.63 ± 0.13
BD	2.310 ± 0.002	58.674 ± 0.051	BP	0.625 ± 0.015	15.88 ± 0.38
BE	2.185 ± 0.002	55.499 ± 0.051	BQ	0.016 ± 0.015	0.41 ± 0.38
BF	1.875 ± 0.002	47.625 ± 0.051	BR	0.576 ± 0.002	14.630 ± 0.051
BG	1.720 ± 0.002	43.688 ± 0.051	BS	0.625	15.88
BH	0.030	0.76	BT	1.625	41.28
BJ	0.049	1.24	BU	0.250 ± 0.015	6.35 ± 0.38
BK	0.375 ± 0.015	9.53 ± 0.38	BV	0.500 ± 0.015	12.70 ± 0.38

Millimetre dimensions have been derived from inches.

OUTLINE (See page 10 for outline notes)

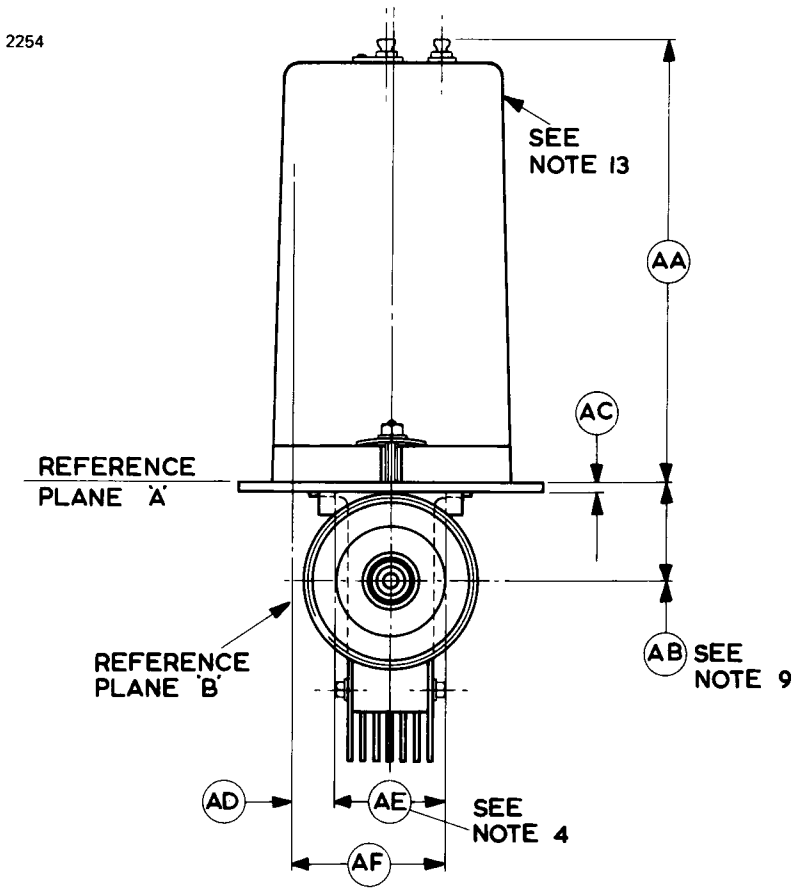


OUTLINE DIMENSIONS

Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	0.210 ± 0.005	5.33 ± 0.13	Q	0.593 min	15.06 min
B	2.032 ± 0.003	51.613 ± 0.076	R	2.321 ± 0.007	58.95 ± 0.18
C	1.437 ± 0.020	36.50 ± 0.51	S	0.555 ± 0.005	14.10 ± 0.13
D	2.156	54.76	T	1.620 max	41.15 max
E	1.359	34.52	U	2.085 ± 0.025	52.96 ± 0.64
F	2.281 ± 0.031	57.94 ± 0.79	V	1.125 min	28.58 min
G	0.500 min	12.70 min	W	2.297 ± 0.010	58.34 ± 0.25
H	1.440	36.58	X	0.818 ± 0.015	20.78 ± 0.38
J	1.063 min	27.00 min	AA	6.313 ± 0.094	160.35 ± 2.39
K	2.656 max	67.46 max	AB	1.440 ± 0.020	36.58 ± 0.51
L	2.062	52.37	AC	0.187	4.75
M	1.500 min	38.10 min	AD	0.677 min	17.20 min
N	1.437	36.50	AE	1.490 max	37.85 max
P	1.500 min	38.10 min	AF	2.197 max	55.80 max

Millimetre dimensions have been derived from inches.

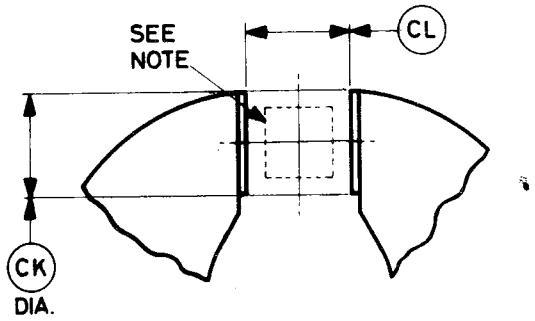
OUTLINE



OUTLINE NOTES

1. The centres of the jack holes will be within a radius of 0.100 inch (2.54mm) of the location specified, but spaced 0.797 ± 0.015 inch (20.24 ± 0.38mm) with respect to each other.
2. With the valve resting on a plane surface, the flatness of this annular area will be such that a feeler gauge 0.015 inch (0.38mm) thick and 0.125 inch (3.18mm) wide will not enter more than 0.250 inch (6.35mm) at any point.
3. The periphery of the anode will lie within a 2.160 inch (54.86mm) diameter circle located as specified.
4. The maximum width specified by dimension 'AE' applies to the area defined by the broken line and the circumference of the radiator.
5. The valve will be painted with black, heat resisting, non-corrosive paint, except for the following paint free areas: top surface of mounting plate, parts above mounting plate, screw threads on guard pipe and all surfaces inside the guard pipe.
6. All joints on the mounting plate and guard pipe will be soldered to provide hermetic seals.
7. The valve may be supported by the mounting plate or guard pipe.
8. There will be no sharp edges on the outside diameter at the end of the inner conductor.
9. Applies to the location of the centre line of the guard pipe.
10. The centre line of the glass portion will be concentric with the centre line of the guard pipe to within 0.040 inch (1.02mm).
11. Applies to the inner conductor insert only. The centre line of the inner conductor insert will be concentric with the centre line of the guard pipe to within 0.025 inch (0.64mm).
12. Applies to the straight portion of the inner conductor wall.
13. The common cathode connection is indicated by letter C.

PERMANENT MAGNET SPECIFICATION

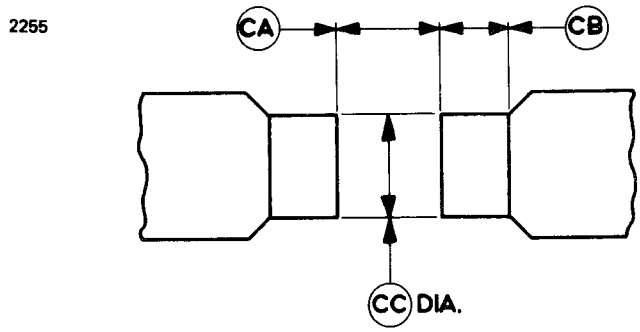


Ref	Inches	Millimetres
CK	1.500	38.10
CL	$1.500^{+0.010}_{-0.000}$	$38.10^{+0.25}_{-0.00}$

Millimetre dimensions have been derived from inches.

Note The variation of magnetic field within a cylinder 1.000 inch (25.4mm) long and 0.900 inch (22.86mm) diameter situated centrally and coaxially between the poles must not exceed ±140 gauss.

ELECTRO-MAGNET POLE PIECES



Ref	Inches	Millimetres
CA	$1.500^{+0.005}_{-0.000}$	$38.10^{+0.13}_{-0.00}$
CB	1.000 min	25.40 min
CC	1.500 ± 0.010	38.10 ± 0.25

Millimetre dimensions have been derived from inches.

4J43 4J44

S-BAND MAGNETRONS

ABRIDGED DATA

Fixed frequency pulse magnetrons

Frequency range:		
4J43	2992 to 3019	MHz
4J44	2965 to 2992	MHz
Typical peak output power	900	kW
Magnet	separate, see note 8 on page 5	
Output	coaxial line; internal diameter of outer conductor 1.527 inches, diameter of inner conductor 0.625 inch	
Coupler	see page 7	
Cooling	forced-air	

GENERAL

Electrical

Cathode	indirectly heated	
Heater voltage (see note 1)	16	V
Heater current	3.1	A
Heater starting current, peak value, not to be exceeded	15	A max
Cathode heating time (minimum) (see note 2)	2	min

Mechanical

Overall dimensions	10.523 x 7.233 x 4.624 inches max 267.3 x 183.7 x 117.5mm max
Net weight	6 pounds (2.8kg) approx
Mounting position	any
Cooling (see note 6)	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.

	Min	Max	
Heater voltage (see note 1)	14.4	17.6	V
Heater starting current (peak)	—	15	A
Anode voltage (peak)	—	30	kV
Anode current (peak)	—	70	A
Input power (peak)	—	2.0	MW
Input power (mean) (see note 3)	—	1.2	kW
Duty cycle	—	0.001	
Pulse length (see note 4)	—	2.5	μs
Rate of rise of voltage pulse (see note 5)	100	200	kV/μs
Anode temperature (see note 6)	—	100	°C
Cathode terminal temperature	—	100	°C
V.S.W.R. at the output coupler	—	1.5:1	
Ambient pressure for satisfactory operation	500	—	mm Hg
Pressurising (see note 7):			
input circuit	—	45	lb/in^2
output circuit	—	45	lb/in^2

TYPICAL OPERATION

Operational Conditions

Heater voltage	10.5	V
Magnetic field	2700	gauss
Anode current (peak)	70	A
Pulse length	1.0	μs
Pulse repetition rate	500	p.p.s.

Typical Performance

Anode voltage (peak)	28	kV
Output power (peak)	900	kW
Output power (mean)	450	W

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions

	Oscillation 1	Oscillation 2	
Magnetic field (see note 8)	2700	2700	gauss
Heater voltage (for test)	10	10	V
Anode current (mean)	35	45	mA
Duty cycle	0.0005	0.0006	
Pulse length (see note 4)	1.0	2.0	μs
V.S.W.R. at the output coupler	1.15:1	1.15:1	
Rate of rise of voltage pulse (see note 5)	200	200	kV/μs

Limits

	Min	Max	Min	Max	
Anode voltage (peak)	26	30	—	—	kV
Output power (mean)	400	—	—	—	W
Frequency:					
4J43	2992	3019	—	—	MHz
4J44	2965	2992	—	—	MHz
R.F. bandwidth at ¼ power	—	2.5	—	—	MHz
Frequency pulling (v.s.w.r. not less than 1.5:1)	—	15	—	—	MHz
Stability (see note 9)	—	0.5	—	0.5	%
Heater current				see note 10	
Temperature coefficient of frequency				see note 11	

LIFE TEST

The quality of all production is monitored by the random selection of valves which are then life-tested under Oscillation 1 conditions above. 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.

End of Life Criteria (under Test Conditions Oscillation 1)

Output power (mean)	320	W min
R.F. bandwidth at ¼ power	2.5	MHz max
Stability (see note 9)	1.0	% max

NOTES

1. (a) With no anode input power.

During high voltage operation it is essential to operate the heater according to the following schedule:

Mean Input Power (W)	Heater Voltage (V)
1000–1200	8.0
800–1000	10.5
600–800	13
400–600	15
less than 400	16

The above schedule is valid only for pulse repetition rates of 300p.p.s. or greater.

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.

(b) 4J43 and 4J44 have hum-free heaters and have been tested for satisfactory operation with sinusoidal heater supply voltages of frequency 50, 60 and 500Hz. English Electric Valve Company Ltd. should be consulted if other supply frequencies are to be used. Where complete freedom from frequency modulation is essential, the use of a d.c. heater supply is recommended.

2. For ambient temperatures above 0°C. For ambient temperatures between 0 and −55°C the cathode heating time is 3 minutes minimum.

3. The various parameters are related by the following 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 ±10%.

5. 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.

6. The anode temperature must be kept below the limit specified by means of a suitable flow of air over the cooling fins.

7. The mounting plate and the guard pipe are fitted to the valve in a manner to permit pressurising of the input circuit and the output circuit of the valve. At the maximum pressure of 45lb/in^2 absolute, the leakage will not exceed 0.5 litre (N.T.P.) per minute.

8. The valve is designed for use with a separate magnet which must conform with the specification given at the top of page 11. The axis of the magnetic field must be coincident with the axis of the anode, and the north pole of the magnet must be adjacent to the cathode terminal. A suitable magnet, type MA228, is available.

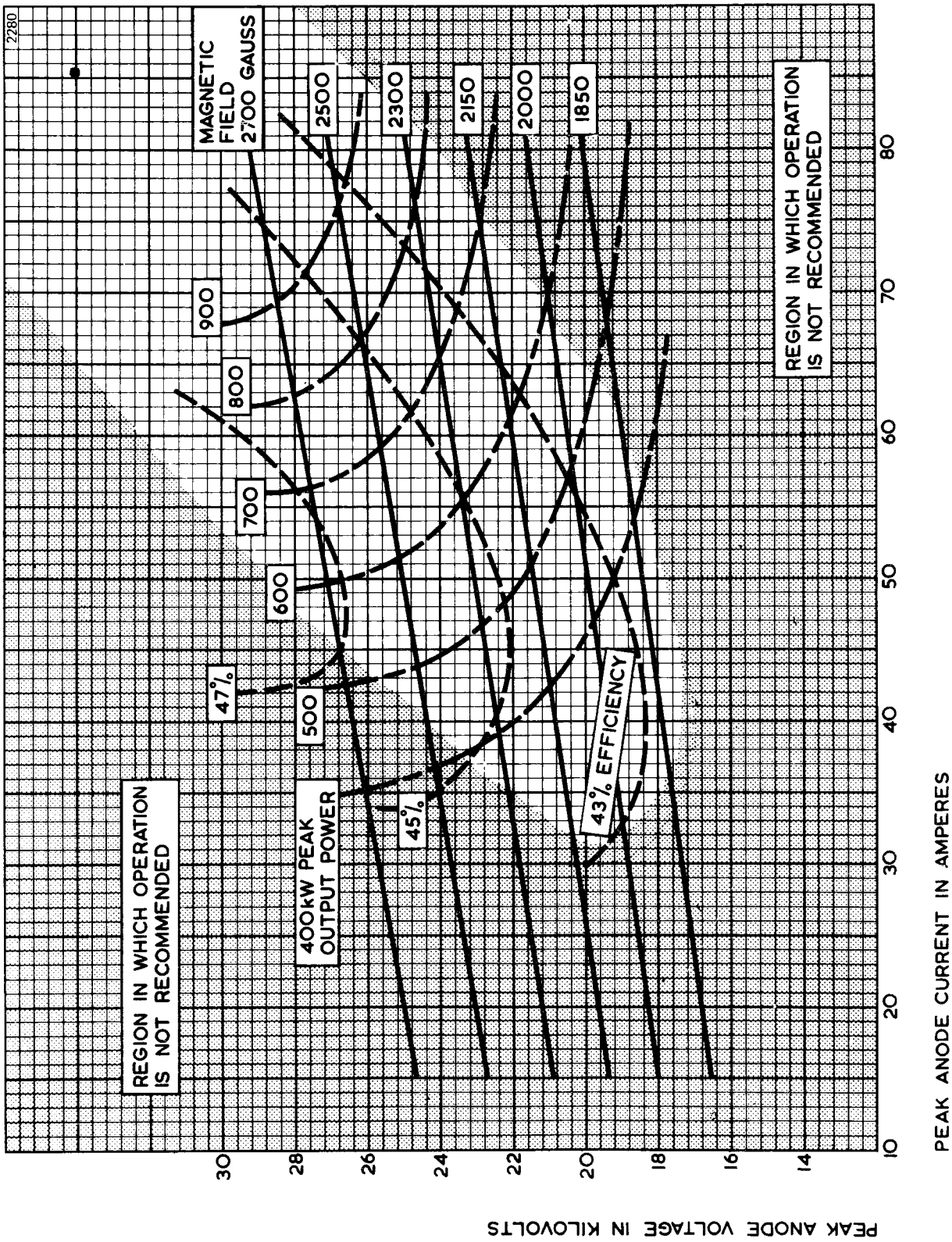
   If an electro-magnet is used, the pole tip dimensions should be as shown on page 11.

9. With the valve operating into a mismatch of v.s.w.r. 1.5:1, phased to give maximum instability. 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 valve. Missing pulses are expressed as a percentage of the number of input pulses applied during the last 30 seconds of a test interval not to exceed 5 minutes.

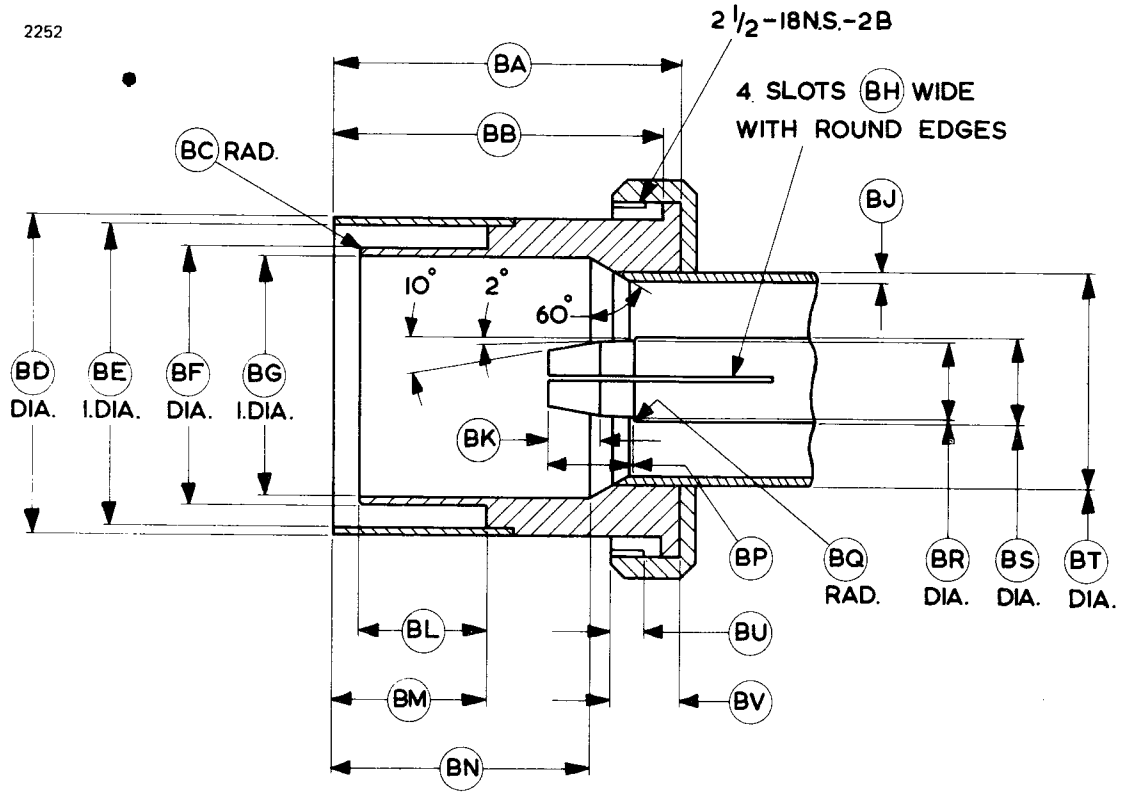
10. Measured with heater voltage of 16V and no anode input power, the heater current limits are 2.8A minimum, 3.4A maximum.

11. Design test only. The maximum frequency change with anode temperature change (after warming) is −0.07MHz/°C.

PERFORMANCE CHART



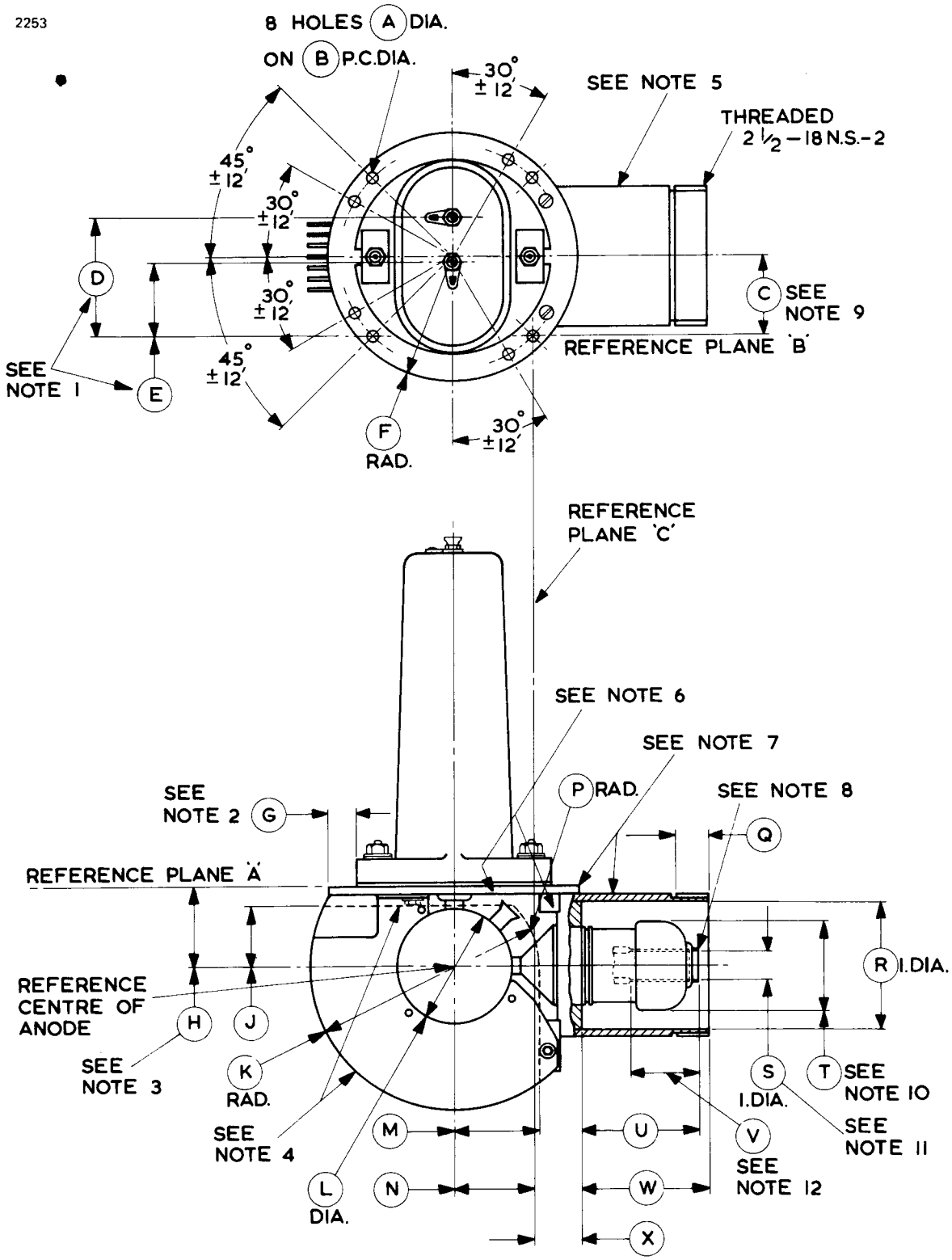
COUPLER



Ref	Inches	Millimetres	Ref	Inches	Millimetres
BA	2.531 ± 0.015	64.29 ± 0.38	BL	0.937 ± 0.003	23.800 ± 0.076
BB	2.402 ± 0.005	61.01 ± 0.13	BM	1.125 ± 0.003	28.575 ± 0.076
BC	0.031 ± 0.015	0.79 ± 0.38	BN	1.875 ± 0.005	47.63 ± 0.13
BD	2.310 ± 0.002	58.674 ± 0.051	BP	0.625 ± 0.015	15.88 ± 0.38
BE	2.185 ± 0.002	55.499 ± 0.051	BQ	0.016 ± 0.015	0.41 ± 0.38
BF	1.875 ± 0.002	47.625 ± 0.051	BR	0.576 ± 0.002	14.630 ± 0.051
BG	1.720 ± 0.002	43.688 ± 0.051	BS	0.625	15.88
BH	0.030	0.76	BT	1.625	41.28
BJ	0.049	1.24	BU	0.250 ± 0.015	6.35 ± 0.38
BK	0.375 ± 0.015	9.53 ± 0.38	BV	0.500 ± 0.015	12.70 ± 0.38

Millimetre dimensions have been derived from inches.

OUTLINE (See page 10 for outline notes)

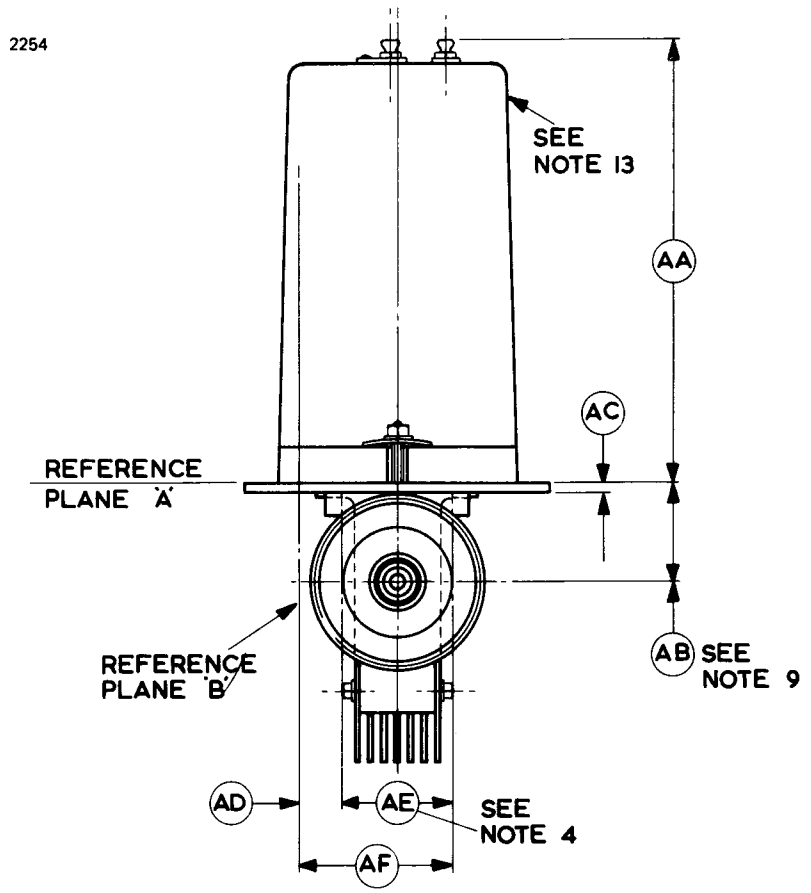


OUTLINE DIMENSIONS

Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	0.210 ± 0.005	5.33 ± 0.13	Q	0.593 min	15.06 min
B	2.032 ± 0.003	51.613 ± 0.076	R	2.321 ± 0.007	58.95 ± 0.18
C	1.437 ± 0.020	36.50 ± 0.51	S	0.555 ± 0.005	14.10 ± 0.13
D	2.156	54.76	T	1.620 max	41.15 max
E	1.359	34.52	U	2.085 ± 0.025	52.96 ± 0.64
F	2.281 ± 0.031	57.94 ± 0.79	V	1.125 min	28.58 min
G	0.500 min	12.70 min	W	2.297 ± 0.010	58.34 ± 0.25
H	1.440	36.58	X	0.818 ± 0.015	20.78 ± 0.38
J	1.063 min	27.00 min	AA	6.313 ± 0.094	160.35 ± 2.39
K	2.656 max	67.46 max	AB	1.440 ± 0.020	36.58 ± 0.51
L	2.062	52.37	AC	0.187	4.75
M	1.500 min	38.10 min	AD	0.677 min	17.20 min
N	1.437	36.50	AE	1.490 max	37.85 max
P	1.500 min	38.10 min	AF	2.197 max	55.80 max

Millimetre dimensions have been derived from inches.

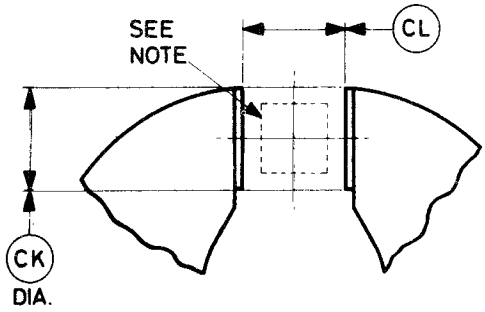
OUTLINE



OUTLINE NOTES

1. The centres of the jack holes will be within a radius of 0.100 inch (2.54mm) of the location specified, but spaced 0.797 ± 0.015 inch (20.24 ± 0.38mm) with respect to each other.
2. With the valve resting on a plane surface, the flatness of this annular area will be such that a feeler gauge 0.015 inch (0.38mm) thick and 0.125 inch (3.18mm) wide will not enter more than 0.250 inch (6.35mm) at any point.
3. The periphery of the anode will lie within a 2.160 inch (54.86mm) diameter circle located as specified.
4. The maximum width specified by dimension 'AE' applies to the area defined by the broken line and the circumference of the radiator.
5. The valve will be painted with black, heat resisting, non-corrosive paint, except for the following paint free areas: top surface of mounting plate, parts above mounting plate, screw threads on guard pipe and all surfaces inside the guard pipe.
6. All joints on the mounting plate and guard pipe will be soldered to provide hermetic seals.
7. The valve may be supported by the mounting plate or guard pipe.
8. There will be no sharp edges on the outside diameter at the end of the inner conductor.
9. Applies to the location of the centre line of the guard pipe.
10. The centre line of the glass portion will be concentric with the centre line of the guard pipe to within 0.040 inch (1.02mm).
11. Applies to the inner conductor insert only. The centre line of the inner conductor insert will be concentric with the centre line of the guard pipe to within 0.025 inch (0.64mm).
12. Applies to the straight portion of the inner conductor wall.
13. The common cathode connection is indicated by letter C.

PERMANENT MAGNET SPECIFICATION



Ref	Inches	Millimetres
CK	1.500	38.10
CL	$1.500^{+0.010}_{-0.000}$	$38.10^{+0.25}_{-0.00}$

Millimetre dimensions have been derived from inches.

Note The variation of magnetic field within a cylinder 1.000 inch (25.4mm) long and 0.900 inch (22.86mm) diameter situated centrally and coaxially between the poles must not exceed ±140 gauss.

ELECTRO-MAGNET POLE PIECES

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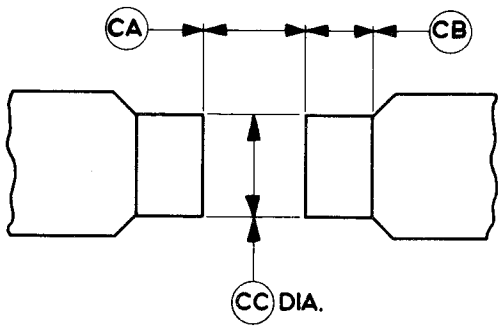


Ref	Inches	Millimetres
CA	$1.500^{+0.005}_{-0.000}$	$38.10^{+0.13}_{-0.00}$
CB	1.000 min	25.40 min
CC	1.500 ± 0.010	38.10 ± 0.25

Millimetre dimensions have been derived from inches.

4J53

S-BAND MAGNETRON

Service Type CV513

ABRIDGED DATA

Fixed frequency pulse magnetron, similar to type 4J33 but with closer frequency limits and controlled cold impedance.

Frequency range	2793 to 2813	MHz
Typical peak output power	1.0	MW
Magnet	separate, see note 8 on page 5	
Output	coaxial line; internal diameter of outer conductor 1.527 inches, diameter of inner conductor 0.625 inch	
Coupler	see page 7	
Cooling	forced-air	

GENERAL

Electrical

Cathode	indirectly heated	
Heater voltage (see note 1)	16	V
Heater current	3.1	A
Heater starting current, peak value, not to be exceeded	15	A max
Cathode heating time (minimum) (see note 2)	2	min

Mechanical

Overall dimensions	10.523 x 7.233 x 4.624 inches max 267.3 x 183.7 x 117.5mm max
Net weight	6 pounds (2.8kg) approx
Mounting position	any
Cooling (see note 6)	forced-air

September 1968

MAXIMUM AND MINIMUM RATINGS (Absolute values)

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

	Min	Max	
Heater voltage	14.4	17.6	V
Heater starting current (peak)	—	15	A
Anode voltage (peak)	—	30	kV
Anode current (peak)	—	70	A
Input power (peak)	—	2.0	MW
Input power (mean) (see note 3)	—	1.2	kW
Duty cycle	—	0.001	
Pulse length (see note 4)	—	2.5	μs
Rate of rise of voltage pulse (see note 5)	100	200	kV/μs
Anode temperature (see note 6)	—	100	°C
Cathode terminal temperature	—	100	°C
V.S.W.R. at the output coupler	—	1.5:1	
Ambient pressure for satisfactory operation	500	—	mm Hg
Pressurising (see note 7):			
input circuit	—	45	lb/in^2
output circuit	—	45	lb/in^2

TYPICAL OPERATION

Operational Conditions

Heater voltage	13	10.5	V
Magnetic field	2150	2700	gauss
Anode current (peak)	56	70	A
Pulse length	1.0	1.0	μs
Pulse repetition rate	500	500	p.p.s.

Typical Performance

Anode voltage (peak)	22	28	kV
Output power (peak)	600	1000	kW
Output power (mean)	300	500	W

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions

	Oscillation 1	Oscillation 2	
Magnetic field (see note 8)	2150	2700	gauss
Heater voltage (for test)	13	10	V
Anode current (mean)	28	35	mA
Duty cycle	0.0005	0.0005	
Pulse length (see note 4)	1.0	1.0	μs
V.S.W.R. at the output coupler	1.15:1	1.15:1	
Rate of rise of voltage pulse (see note 5)	200	200	kV/μs

Limits

	Min	Max	Min	Max	
Anode voltage (peak)	20	23	—	—	kV
Output power (mean)	250	—	400	—	W
Frequency	2793	2813	—	—	MHz
R.F. bandwidth at ¼ power	—	2.5	—	—	MHz
Frequency pulling (v.s.w.r. not less than 1.5:1)	—	15	—	—	MHz
Stability (see note 9)	—	0.5	—	0.5	%
Cold impedance				see note 10	
Heater current				see note 11	
Temperature coefficient of frequency				see note 12	

LIFE TEST

The quality of all production is monitored by the random selection of valves which are then life-tested under Oscillation 2 conditions above. 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.

End of Life Criteria (under Test Conditions Oscillation 2)

Output power (mean)	320	W min
R.F. bandwidth at ¼ power	2.5	MHz max
Stability (see note 9)	1	% max

NOTES

1. (a) With no anode input power.

During high voltage operation it is essential to operate the heater according to the following schedule:

Mean Input Power (W)	Heater Voltage (V)
1000—1200	8.0
800—1000	10.5
600—800	13
400—600	15
less than 400	16

The above schedule is valid only for pulse repetition rates of 300p.p.s. or greater.

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.

(b) 4J53 has a hum-free heater and has been tested for satisfactory operation with sinusoidal heater supply voltages of frequency 50, 60 and 500Hz. English Electric Valve Company Ltd. should be consulted if other supply frequencies are to be used. Where complete freedom from frequency modulation is essential, the use of a d.c. heater supply is recommended.

2. For ambient temperatures above 0°C. For ambient temperatures between 0 and −55°C the cathode heating time is 3 minutes minimum.

3. The various parameters are related by the following 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 ±10%

5. 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.

6. The anode temperature must be kept below the limit specified by means of a suitable flow of air over the cooling fins.

7. The mounting plate and the guard pipe are fitted to the valve in a manner to permit pressurising of the input circuit and the output circuit of the valve. At the maximum pressure of 45lb/in^2 absolute, the leakage will not exceed 0.5 litre (N.T.P.) per minute.

8. The valve is designed for use with a separate magnet which must conform with the specification given at the top of page 11. The axis of the magnetic field must be coincident with the axis of the anode, and the north pole of the magnet must be adjacent to the cathode terminal. A suitable magnet, type MA228, is available.

   If an electro-magnet is used, the pole tip dimensions should be as shown on page 11.

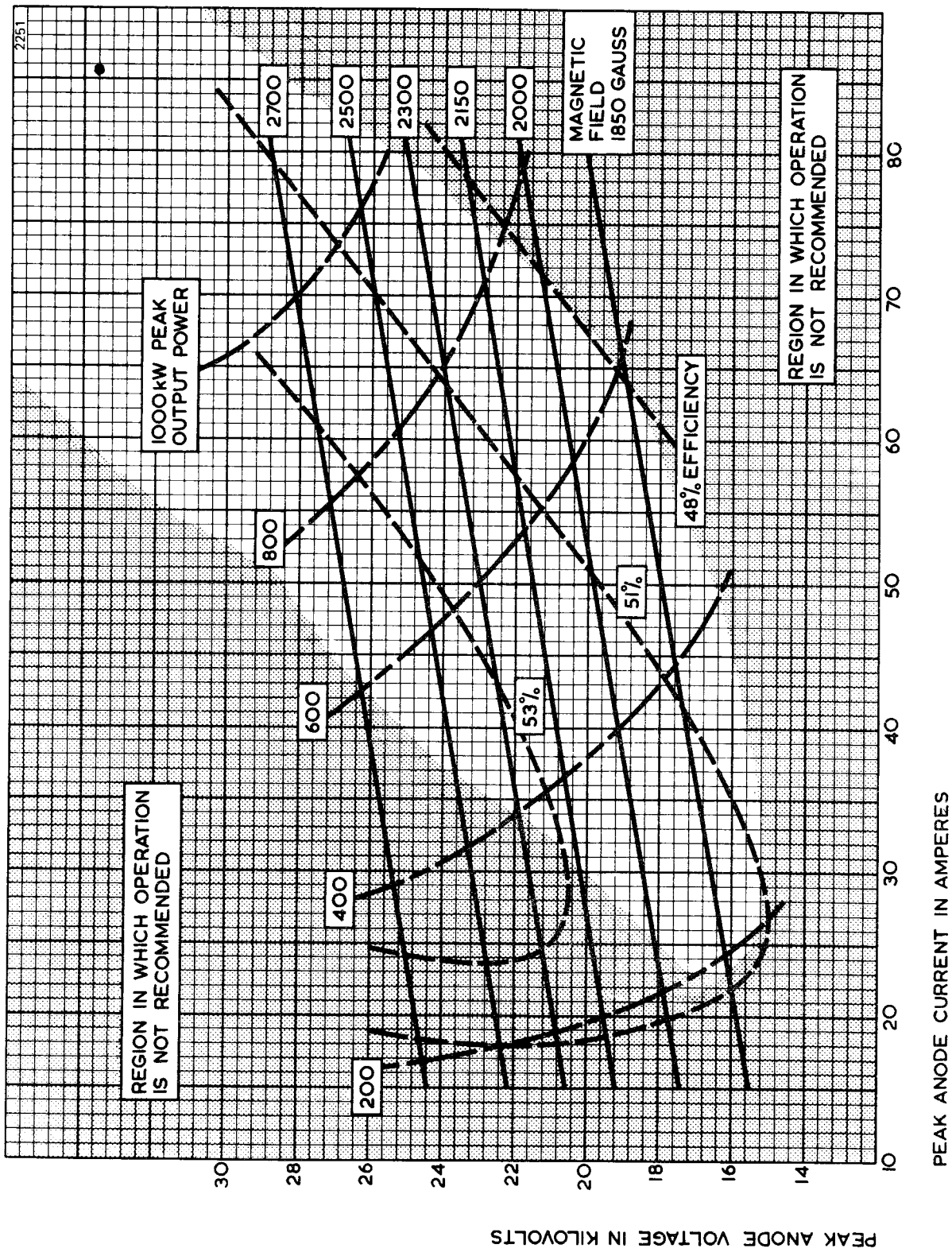
9. With the valve operating into a mismatch of v.s.w.r. 1.5:1, phased to give maximum instability. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal energy level in the rated frequency range of the valve. Missing pulses are expressed as a percentage of the number of input pulses applied during the last 30 seconds of a test interval not to exceed 5 minutes.

10. When a signal of the same frequency as the valve operating frequency is fed into the valve, a standing wave is produced in the feeder system. The v.s.w.r. is tested to be greater than 10:1. The position of the standing wave minimum nearest the valve is tested to be within the limits 9.7 to 11.9cm measured from Reference Plane C on the outline drawing. The test is carried out in a coaxial system coupled by means of the test coupling shown on page 7.

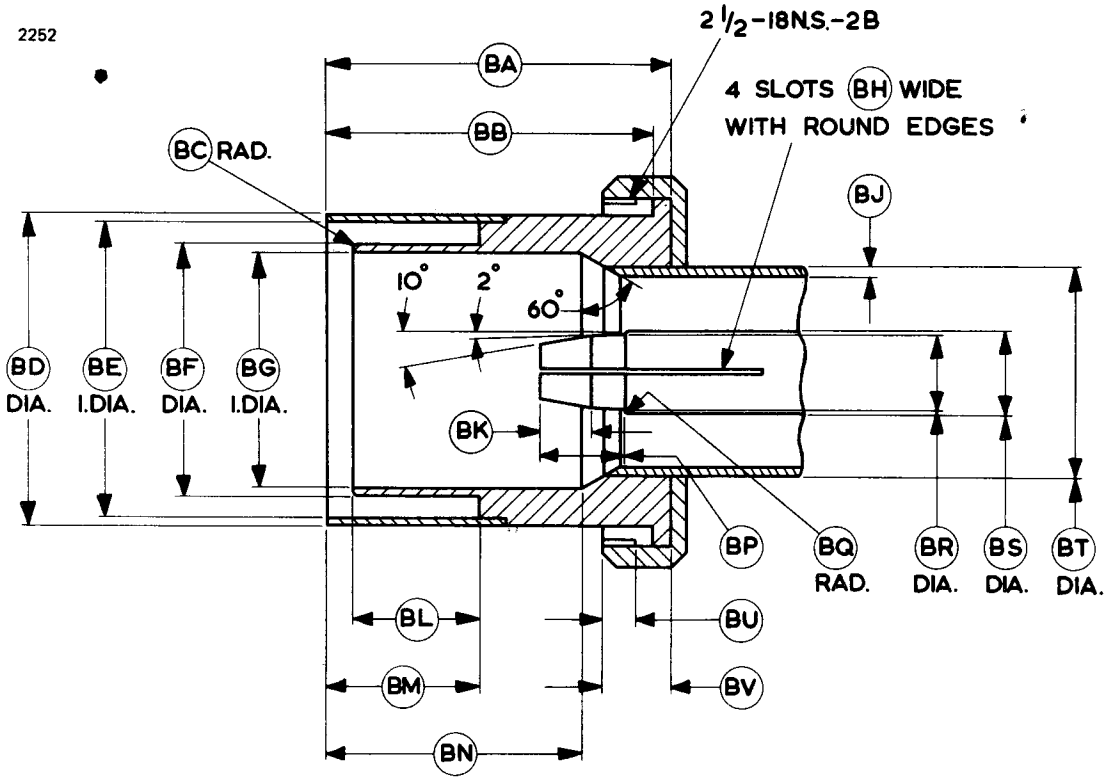
11. Measured with heater voltage of 16V and no anode input power, the heater current limits are 2.8A minimum, 3.4A maximum.

12. Design test only. The maximum frequency change with anode temperature change (after warming) is −0.07MHz/°C.

PERFORMANCE CHART



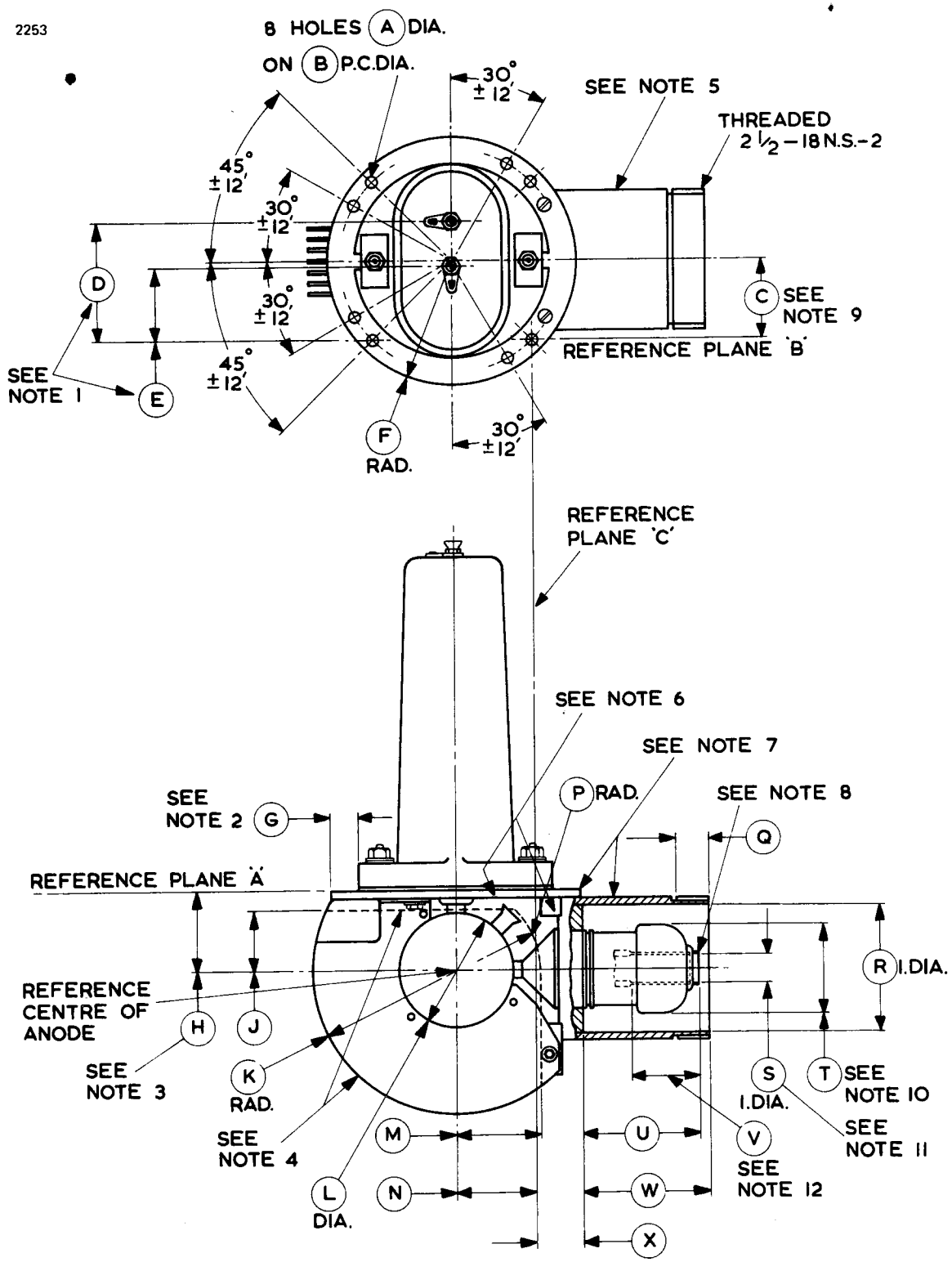
COUPLER



Ref	Inches	Millimetres	Ref	Inches	Millimetres
BA	2.531 ± 0.015	64.29 ± 0.38	BL	0.937 ± 0.003	23.800 ± 0.076
BB	2.402 ± 0.005	61.01 ± 0.13	BM	1.125 ± 0.003	28.575 ± 0.076
BC	0.031 ± 0.015	0.79 ± 0.38	BN	1.875 ± 0.005	47.63 ± 0.13
BD	2.310 ± 0.002	58.674 ± 0.051	BP	0.625 ± 0.015	15.88 ± 0.38
BE	2.185 ± 0.002	55.499 ± 0.051	BQ	0.016 ± 0.015	0.41 ± 0.38
BF	1.875 ± 0.002	47.625 ± 0.051	BR	0.576 ± 0.002	14.630 ± 0.051
BG	1.720 ± 0.002	43.688 ± 0.051	BS	0.625	15.88
BH	0.030	0.76	BT	1.625	41.28
BJ	0.049	1.24	BU	0.250 ± 0.015	6.35 ± 0.38
BK	0.375 ± 0.015	9.53 ± 0.38	BV	0.500 ± 0.015	12.70 ± 0.38

Millimetre dimensions have been derived from inches.

OUTLINE (See page 10 for outline notes)

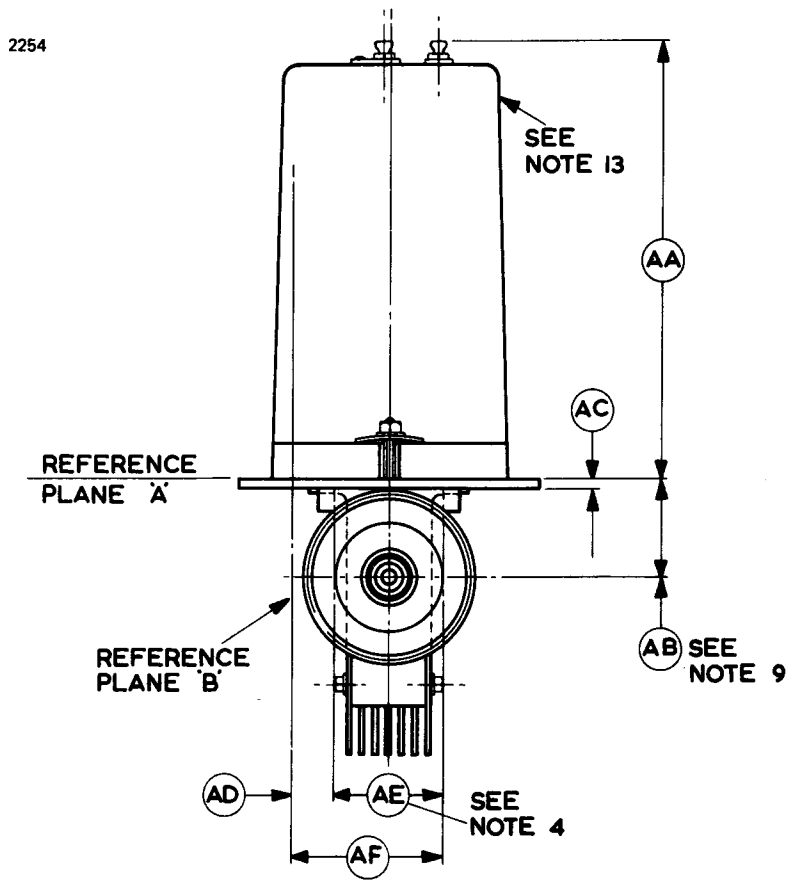


OUTLINE DIMENSIONS

Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	0.210 ± 0.005	5.33 ± 0.13	Q	0.593 min	15.06 min
B	2.032 ± 0.003	51.613 ± 0.076	R	2.321 ± 0.007	58.95 ± 0.18
C	1.437 ± 0.020	36.50 ± 0.51	S	0.555 ± 0.005	14.10 ± 0.13
D	2.156	54.76	T	1.620 max	41.15 max
E	1.359	34.52	U	2.085 ± 0.025	52.96 ± 0.64
F	2.281 ± 0.031	57.94 ± 0.79	V	1.125 min	28.58 min
G	0.500 min	12.70 min	W	2.297 ± 0.010	58.34 ± 0.25
H	1.440	36.58	X	0.818 ± 0.015	20.78 ± 0.38
J	1.063 min	27.00 min	AA	6.313 ± 0.094	160.35 ± 2.39
K	2.656 max	67.46 max	AB	1.440 ± 0.020	36.58 ± 0.51
L	2.062	52.37	AC	0.187	4.75
M	1.500 min	38.10 min	AD	0.677 min	17.20 min
N	1.437	36.50	AE	1.490 max	37.85 max
P	1.500 min	38.10 min	AF	2.197 max	55.80 max

Millimetre dimensions have been derived from inches.

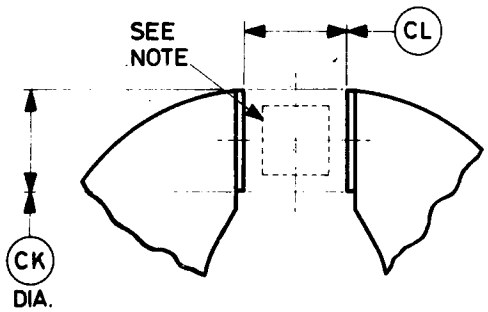
OUTLINE



OUTLINE NOTES

1. The centres of the jack holes will be within a radius of 0.100 inch (2.54mm) of the location specified, but spaced 0.797 ± 0.015 inch (20.24 ± 0.38mm) with respect to each other.
2. With the valve resting on a plane surface, the flatness of this annular area will be such that a feeler gauge 0.015 inch (0.38mm) thick and 0.125 inch (3.18mm) wide will not enter more than 0.250 inch (6.35mm) at any point.
3. The periphery of the anode will lie within a 2.160 inch (54.86mm) diameter circle located as specified.
4. The maximum width specified by dimension 'AE' applies to the area defined by the broken line and the circumference of the radiator.
5. The valve will be painted with black, heat resisting, non-corrosive paint, except for the following paint free areas: top surface of mounting plate, parts above mounting plate, screw threads on guard pipe and all surfaces inside the guard pipe.
6. All joints on the mounting plate and guard pipe will be soldered to provide hermetic seals.
7. The valve may be supported by the mounting plate or guard pipe.
8. There will be no sharp edges on the outside diameter at the end of the inner conductor.
9. Applies to the location of the centre line of the guard pipe.
10. The centre line of the glass portion will be concentric with the centre line of the guard pipe to within 0.040 inch (1.02mm).
11. Applies to the inner conductor insert only. The centre line of the inner conductor insert will be concentric with the centre line of the guard pipe to within 0.025 inch (0.64mm).
12. Applies to the straight portion of the inner conductor wall.
13. The common cathode connection is indicated by letter C.

PERMANENT MAGNET SPECIFICATION



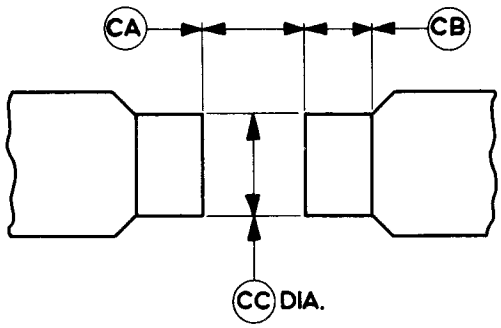
Ref	Inches	Millimetres
CK	1.500	38.10
CL	$1.500^{+0.010}_{-0.000}$	$38.10^{+0.25}_{-0.00}$

Millimetre dimensions have been derived from inches.

Note The variation of magnetic field within a cylinder 1.000 inch (25.4mm) long and 0.900 inch (22.86mm) diameter situated centrally and coaxially between the poles must not exceed ±140 gauss.

ELECTRO-MAGNET POLE PIECES

2255



Ref	Inches	Millimetres
CA	$1.500^{+0.005}_{-0.000}$	$38.10^{+0.13}_{-0.00}$
CB	1.000 min	25.40 min
CC	1.500 ± 0.010	38.10 ± 0.25

Millimetre dimensions have been derived from inches.

5586

TUNABLE S-BAND MAGNETRON

Service Type CV3611

ABRIDGED DATA

Mechanically tuned pulse magnetron, frequency variant of type 5657

Frequency range	2700 to 2900	MHz
Typical peak output power	1.0	MW
Magnet	separate, see note 9 on page 5	
Output	coaxial line; internal diameter of outer conductor 1.527 inches, diameter of inner conductor 0.625 inch	
Coupler	see page 7	
Cooling	forced-air	

GENERAL

Electrical

Cathode	indirectly heated	
Heater voltage (see note 1)	16	V
Heater current	3.1	A
Heater starting current, peak value, not to be exceeded	15	A max
Cathode heating time (minimum) (see note 2)	2	min

Mechanical

Overall dimensions	10.523 x 7.233 x 4.624 inches max 267.3 x 183.7 x 117.5mm max	
Net weight	5½ pounds (2.5kg) approx	
Mounting position	any	
Tuning (see note 3)	mechanical	
Tuner revolutions to cover frequency range	150	max
Cooling (see note 4)	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.

	Min	Max	
Heater voltage (see note 1)	14.4	17.6	V
Heater starting current (peak)	—	15	A
Anode voltage (peak)	—	32	kV
Anode current (peak)	—	70	A
Input power (peak)	—	2.0	MW
Input power (mean) (see note 5)	—	1.2	kW
Duty cycle	—	0.001	
Pulse length (see note 6)	—	2.5	μs
Rate of rise of voltage pulse (see note 7)	100	200	kV/μs
Anode temperature (see note 4)	—	100	°C
Cathode terminal temperature	—	100	°C
V.S.W.R. at the output coupler	—	1.5:1	
Ambient pressure for satisfactory operation	500	—	mm Hg
Pressurising (see note 8):			
input circuit	—	45	lb/in^2
output circuit	—	45	lb/in^2

TYPICAL OPERATION

Operational Conditions

Heater voltage	8.0	8.0	V
Magnetic field (see note 9)	2700	2700	gauss
Anode current (peak)	50	70	A
Pulse length	0.5	1.0	μs
Pulse repetition rate	1500	500	p.p.s.

Typical Performance

Anode voltage (peak)	30	30	kV
Output power (peak)	700	1000	kW
Output power (mean)	525	500	W

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions

	Oscillation 1	Oscillation 2	
Magnetic field (see note 9)	2700	2700	gauss
Heater voltage (for test)	10	10	V
Anode current (mean)	35	35	mA
Duty cycle	0.0005	0.0006	
Pulse length (see note 6)	1.0	2.0	μs
V.S.W.R. at the output coupler	1.15:1	1.15:1	
Rate of rise of voltage pulse (see note 7)	200	200	kV/μs

Limits

	Min	Max	Min	Max	
Anode voltage (peak) (see note 10)	27	32	—	—	kV
Output power (mean) (see note 10)	400	—	400	—	W
Frequency (see note 11)	2700	2900	—	—	MHz
R.F. bandwidth at ¼ power (see note 12)	—	2.5	—	—	MHz
Frequency pulling (v.s.w.r. not less than 1.5:1)	—	15	—	—	MHz
Stability (see notes 10 and 13)	—	0.5	—	—	%
Heater current					see note 14
Temperature coefficient of frequency					see note 15

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 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.

End of Life Criteria (under Test Conditions Oscillation 1)

Output power (mean)	320	W min
R.F. bandwidth at ¼ power	2.5	MHz max
Stability (see note 13)	1	% max

NOTES

1. With no anode input power.

   During high voltage operation it is essential to operate the heater according to the following schedule:

Mean Input Power (W)	Heater Voltage (V)
1000–1200	8.0
800–1000	10.5
600–800	13
400–600	15
less than 400	16

   The above schedule is valid only for pulse repetition rates of 300p.p.s. or greater.

   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.

2. It has been verified that the valve will operate at ambient temperatures as low as −55°C. At this temperature the minimum cathode heating time is 3 minutes.

3. Tuning is achieved by rotating a splined shaft which can be fitted to the valve in two positions as shown on the outline drawing. The splined shaft mates with S.S. White 2666X end fitting ($^{13}/_{32}$ inch diameter).

4. The anode temperature must be kept below the limit specified by means of a suitable flow of air over the cooling fins.

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

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

   where Pi = mean input power in watts

   i_{apk} = peak anode current in amperes

   v_{apk} = peak anode voltage in volts

   and Du = duty cycle.

6. Tolerance ±10%.

7. 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.

8. The mounting plate and the guard pipe are fitted to the valve in a manner to permit pressurising of the input and the output circuit of the valve. At the maximum pressure of 45lb/in^2 absolute, the leakage will not exceed 0.5 litre (N.T.P.) per minute.

9. The valve is designed for use with a separate magnet which must conform with the specification given at the top of page 12. The axis of the magnetic field must be coincident with the axis of the anode, and the north pole of the magnet must be adjacent to the cathode terminal. A suitable magnet, type MA244, is available.

   If an electro-magnet is used, the pole tip dimensions should be as shown on page 12.

10. These tests are carried out with the valve tuned to 2700, 2800 and 2900MHz.

11. The valve will tune over the indicated frequency range.

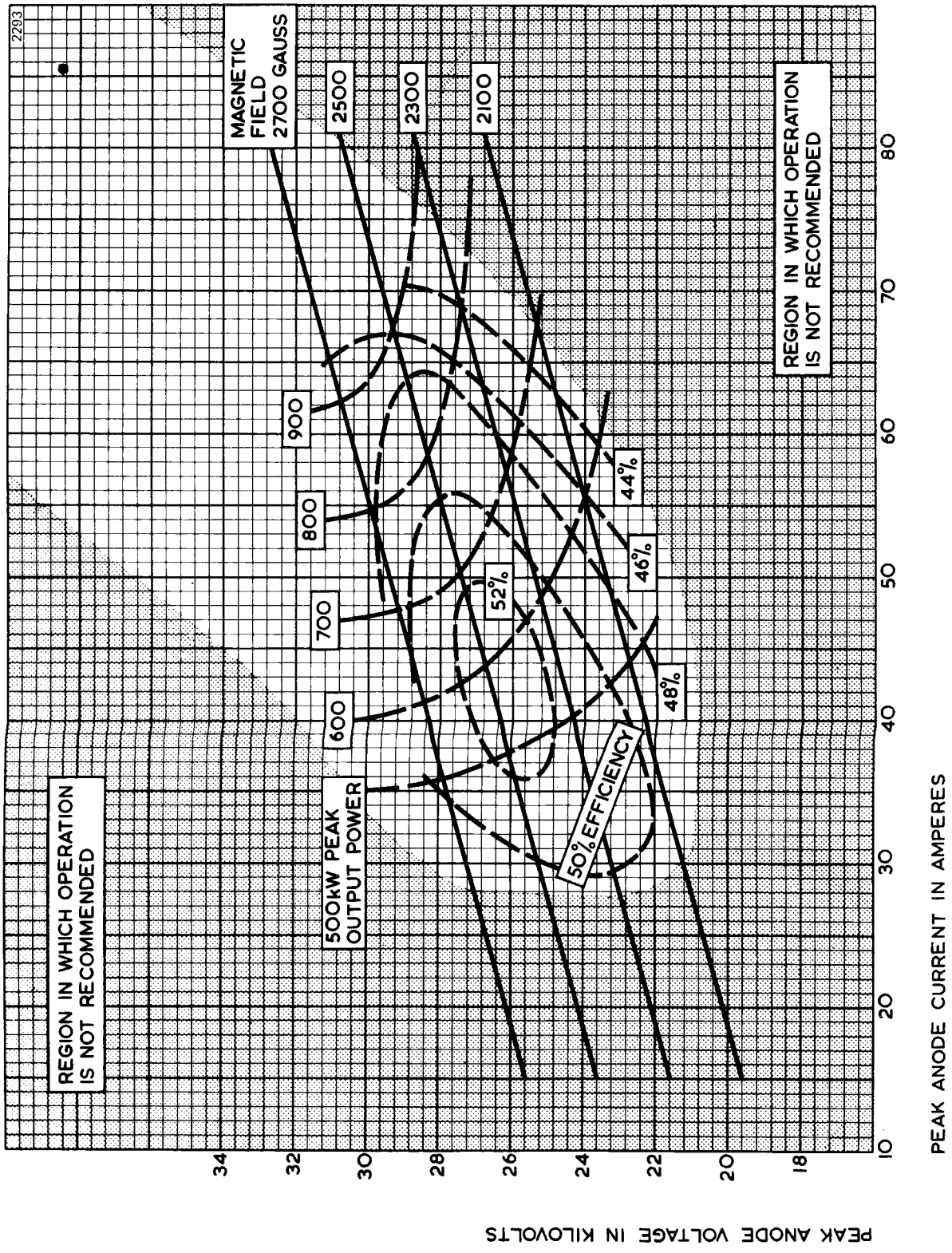
12. The specification limit for bandwidth applies over the whole tuning range.

13. With the valve operating into a v.s.w.r. of 1.5:1 phased to give maximum instability. 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 valve. Missing pulses are expressed as a percentage of the number of input pulses applied during the last 30 seconds of a test interval not to exceed 5 minutes.

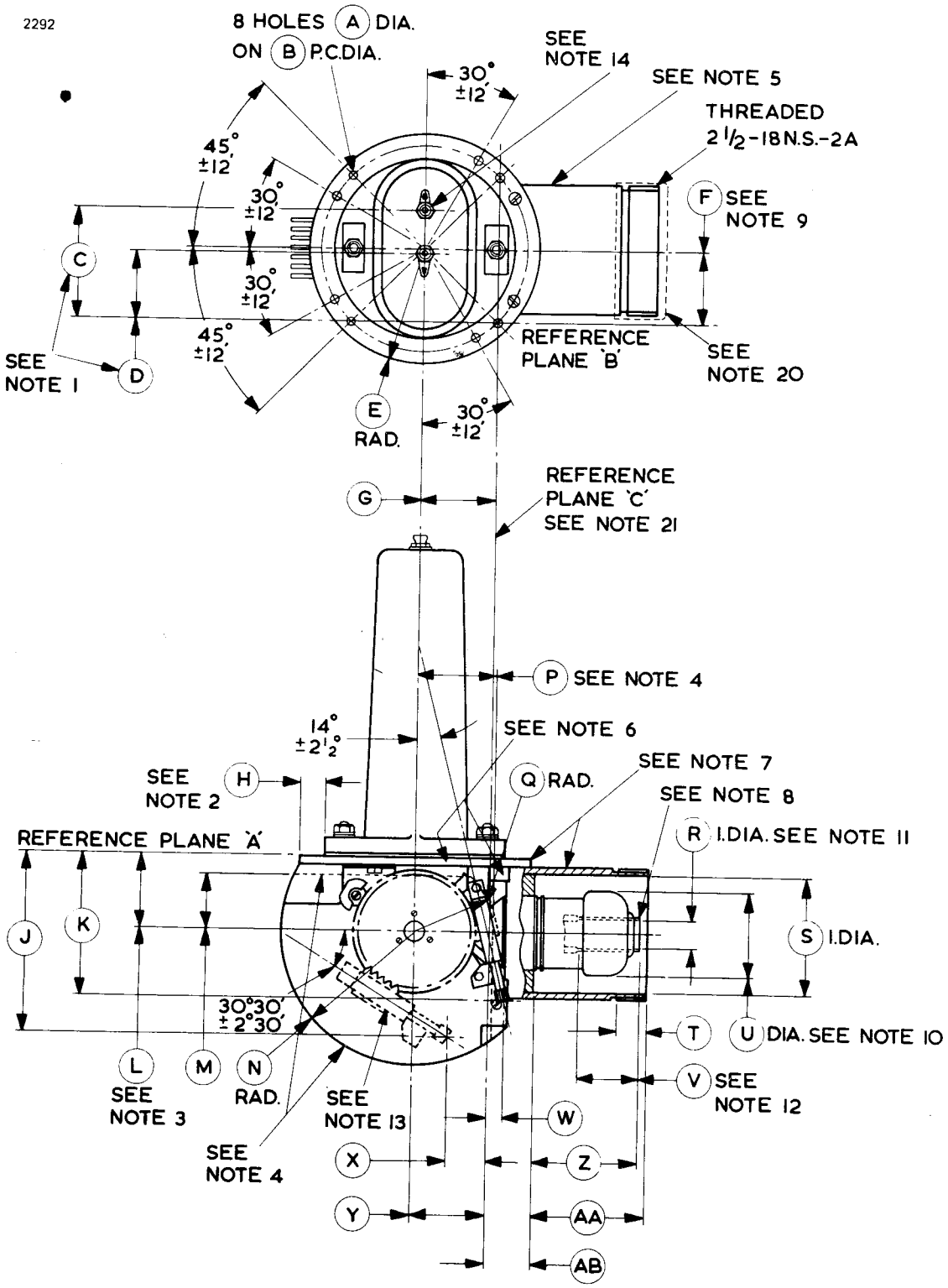
14. Measured with heater voltage of 16V and no anode input power, the heater current limits are 2.8A minimum, 3.4A maximum.

15. Design test only. The maximum frequency change with anode temperature change (after warming) is −0.07MHz/°C.

PERFORMANCE CHART



OUTLINE

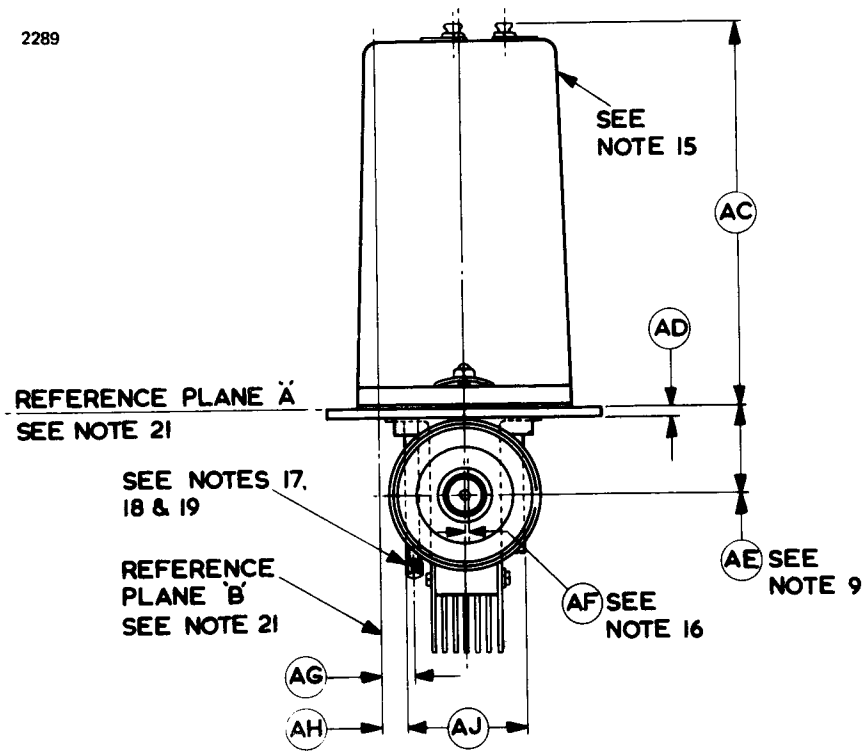

2292
8 HOLES (A) DIA.
ON (B) P.C.DIA.
SEE NOTE 14
SEE NOTE 5
THREADED 2 1/2-18N.S.-2A
30° ±12'
45° ±12'
30° ±12'
30° ±12'
45° ±12'
(F) SEE NOTE 9
(C)
SEE NOTE 1
(D)
REFERENCE PLANE 'B'
SEE NOTE 20
(E) RAD.
30° ±12'
(G)
REFERENCE PLANE 'C' SEE NOTE 21
(P) SEE NOTE 4
14° ±2 1/2°
SEE NOTE 6
SEE NOTE 7
SEE NOTE 8
SEE NOTE 2
(H)
(Q) RAD.
(R) I.DIA. SEE NOTE 11
REFERENCE PLANE 'A'
(J)
(K)
(S) I.DIA.
30°30' ±2°30'
(T)
(U) DIA. SEE NOTE 10
(L)
(M)
(N) RAD.
SEE NOTE 3
SEE NOTE 13
(V) SEE NOTE 12
SEE NOTE 4
(W)
(X)
(Z)
(Y)
(AA)
(AB)

OUTLINE DIMENSIONS

Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	0.210 ± 0.005	5.33 ± 0.13	T	0.593 min	15.06 min
B	4.064 ± 0.006	103.23 ± 0.15	U	1.620 max	41.15 max
C	2.156	54.76	V	1.125 min	28.58 min
D	1.359	34.52	W	0.313	7.95
E	2.281 ± 0.015	57.94 ± 0.38	X	0.756	19.20
F	1.437 ± 0.020	36.50 ± 0.51	Y	1.437	36.50
G	1.437	36.50	Z	2.085 ± 0.025	52.96 ± 0.64
H	0.500 min	12.70 min	AA	2.297 ± 0.010	58.34 ± 0.25
J	3.500	88.90	AB	0.818 ± 0.015	20.78 ± 0.38
K	2.812	71.42	AC	6.313 ± 0.094	160.4 ± 2.4
L	1.440	36.58	AD	0.187	4.75
M	1.063 min	27.00 min	AE	1.440 ± 0.020	36.58 ± 0.51
N	2.656 max	67.46 max	AF	0.025	0.64
P	1.500 min	38.10 min	AG	0.563 ± 0.125	14.30 ± 3.18
Q	1.500 min	38.10 min	AH	0.575 ± 0.050	14.61 ± 1.27
R	0.555 ± 0.005	14.10 ± 0.13	AJ	1.740 max	44.20 max
S	2.321 ± 0.007	58.95 ± 0.18			

Millimetre dimensions have been derived from inches.

OUTLINE



OUTLINE NOTES

1. The centres of the jack holes will be within a radius of 0.100 inch (2.54mm) of the location specified but spaced 0.797 ± 0.015 inch (20.24 ± 0.38mm) with respect to each other.
2. With the valve resting on a plane surface, the flatness of this annular area will be such that a feeler gauge 0.015 inch (0.38mm) thick and 0.125 inch (3.18mm) wide will not enter more than 0.250 inch (6.35mm) at any point.
3. The periphery of the anode will lie within a 2.160 inches (54.86mm) diameter circle located as specified for the non-tunable side of the anode.
4. The maximum width specified by dimension 'AJ' applies to the area defined by the broken line and the circumference of the radiator.
5. The valve will be painted with black, heat resisting non-corrosive paint, except for the following paint free areas: top surface of mounting plate, parts above mounting plate, screw threads on guard pipe, all surfaces inside guard pipe, tuning gear, stop, and worm shaft assembly.
6. All joints on the mounting plate and guard pipe will be soldered to provide hermetic seals.
7. The valve may be supported by the mounting plate or guard pipe.
8. There will be no sharp edges on the outside diameter at the end of the inner conductor.
9. Applies to the location of the centre line of the guard pipe only.
10. The centre line of the maximum diameter will be concentric with the centre line of the guard pipe to within 0.040 inch (1.02mm).
11. Applies to the inner conductor insert only. The centre line of the inner conductor insert will be concentric with the centre line of the guard pipe to within 0.025 inch (0.64mm).
12. Applies to the straight portion of the inner conductor wall.
13. Optional location of tuning spline. The valve will be supplied with the spline located as specified by the customer.

14. Hexagon locking head banana pin jack, hole 0.169 ± 0.005 inch (4.29 ± 0.13mm) diameter x 0.593 inch (15.06mm) long as per Mil-E-1, latest issue.

15. The common cathode connection is marked with letter C.

16. This dimension shows the relation between a plane passing through the lateral centre of the anode, and a plane passing through the centre of the guard pipe.

17. The tuning mechanism will provide the full range of tuning with a maximum of 5 complete revolutions of the large tuning gear.

18. The spline for adjusting the tuning mechanism is as follows: 12 teeth, 48 pitch, 0.250 inch (6.35mm) pitch diameter.

19. The clearance between the tuning spline and the guard pipe will be sufficient to allow the use of S.S. White No. 2666X end fitting ($^{13}/_{32}$ inch diameter).

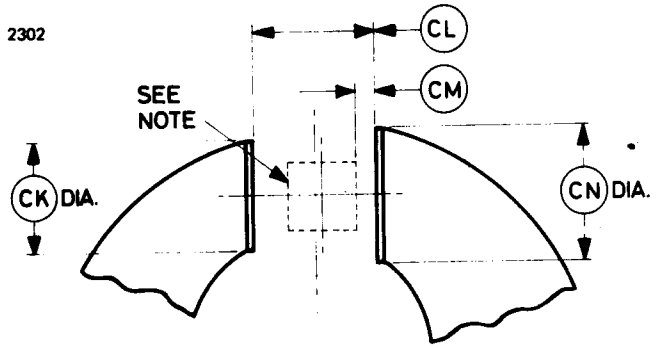
20. Protective guard for shipping purposes.

21. Reference plane 'A' is defined as a plane passing along the face of the mounting plate.

    Reference plane 'B' is defined as a plane perpendicular to plane 'A' and passing through the centre of the holes shown.

    Reference plane 'C' is defined as a plane mutually perpendicular to planes 'A' and 'B' and passing through the centre of the hole as shown.

PERMANENT MAGNET SPECIFICATION



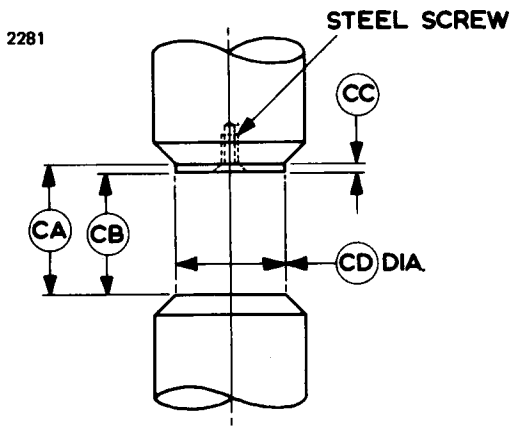
Ref	Inches	Millimetres	Ref	Inches	Millimetres
CK	1.625	41.28	CM	0.270	6.86
CL	1.800 ± 0.005	45.72 ± 0.13	CN	2.000	50.80

Millimetre dimensions have been derived from inches.

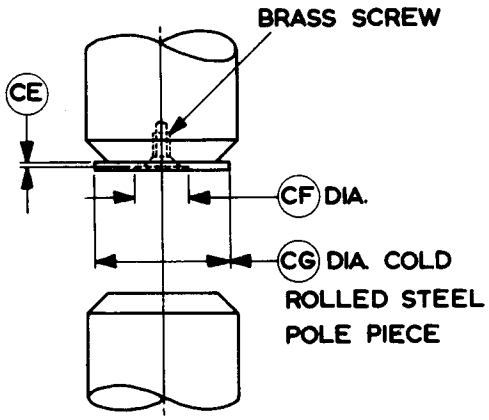
Note The variation of magnetic field within a cylinder 1.000 inch (25.4mm) long and 0.900 inch (22.86mm) diameter situated as shown and coaxially between the poles must not exceed ±140 gauss.

ELECTRO-MAGNET POLE PIECES

Magnet with Single Conventional Pole Piece



Magnet with Distortion Pole Piece



Ref	Inches	Millimetres	Ref	Inches	Millimetres
CA	1.925 ± 0.005	48.90 ± 0.13	CE	0.031 ± 0.015	0.79 ± 0.38
CB	1.800 ± 0.005	45.72 ± 0.13	CF	0.786 ± 0.005	19.96 ± 0.13
CC	0.125 ± 0.015	3.18 ± 0.38	CG	2.000 ± 0.015	50.80 ± 0.38
CD	1.625 ± 0.015	41.28 ± 0.38			

Millimetre dimensions have been derived from inches.

5657

TUNABLE S-BAND MAGNETRON

Service Type CV3958

ABRIDGED DATA

Mechanically tuned pulse magnetron, frequency variant of type 5586

Frequency range	2900 to 3100	MHz
Typical peak output power	1.0	MW
Magnet	separate, see note 9 on page 5	
Output	coaxial line; internal diameter of outer conductor 1.527 inches, diameter of inner conductor 0.625 inch	
Coupler	see page 10	
Cooling	forced-air	

GENERAL

Electrical

Cathode	indirectly heated	
Heater voltage (see note 1)	16	V
Heater current	3.1	A
Heater starting current, peak value, not to be exceeded	15	A max
Cathode heating time (minimum) (see note 2)	2	min

Mechanical

Overall dimensions	10.523 x 7.233 x 4.624 inches max 267.3 x 183.7 x 117.5mm max	
Net weight	5½ pounds (2.5kg) approx	
Mounting position	any	
Tuning (see note 3)	mechanical	
Tuner revolutions to cover frequency range	120	max
Cooling (see note 4)	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.

	Min	Max	
Heater voltage (see note 1)	14.4	17.6	V
Heater starting current (peak)	–	15	A
Anode voltage (peak)	–	32.5	kV
Anode current (peak)	–	70	A
Input power (peak)	–	2.2	MW
Input power (mean) (see note 5)	–	1.3	kW
Duty cycle	–	0.001	
Pulse length (see note 6)	–	2.5	μs
Rate of rise of voltage pulse (see note 7)	100	200	kV/μs
Anode temperature (see note 4)	–	100	°C
Cathode terminal temperature	–	100	°C
V.S.W.R. at the output coupler	–	1.5:1	
Ambient pressure for satisfactory operation	500	–	mm Hg
Pressurising (see note 8):			
input circuit	–	45	lb/in^2
output circuit	–	45	lb/in^2

TYPICAL OPERATION

Operational Conditions

Heater voltage	8.0	8.0	V
Magnetic field (see note 9)	2700	2700	gauss
Anode current (peak)	50	70	A
Pulse length	0.5	1.0	μs
Pulse repetition rate	1500	500	p.p.s.

Typical Performance

Anode voltage (peak)	30	30	kV
Output power (peak)	700	1000	kW
Output power (mean)	525	500	W

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions

	Oscillation 1	Oscillation 2	
Magnetic field (see note 9)	2700	2700	gauss
Heater voltage (for test)	10	10	V
Anode current (mean)	35	35	mA
Duty cycle	0.0005	0.0006	
Pulse length (see note 6)	1.0	2.0	μs
V.S.W.R. at the output coupler	1.15:1	1.15:1	
Rate of rise of voltage pulse (see note 7)	200	200	kV/μs

Limits

	Min	Max	Min	Max	
Anode voltage (peak) (see note 10)	27.5	32.5	—	—	kV
Output power (mean) (see note 10)	400	—	400	—	W
Frequency (see note 11)	2900	3100	—	—	MHz
R.F. bandwidth at ¼ power (see note 12)	—	2.5	—	—	MHz
Frequency pulling (v.s.w.r. not less than 1.5:1)	—	15	—	—	MHz
Stability (see notes 10 and 13)	—	0.5	—	—	%
Heater current					see note 14
Temperature coefficient of frequency					see note 15

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 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.

End of Life Criteria (under Test Conditions Oscillation 1)

Output power (mean)	320	W min
R.F. bandwidth at ¼ power	2.5	MHz max
Stability (see note 13)	1	% max

NOTES

1. With no anode input power.

   During high voltage operation it is essential to operate the heater according to the following schedule:

Mean Input Power (W)	Heater Voltage (V)
1000—1200	8.0
800—1000	10.5
600—800	13
400—600	15
less than 400	16

   The above schedule is valid only for pulse repetition rates of 300p.p.s. or greater.

   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.

2. It has been verified that the valve will operate at ambient temperatures as low as −55°C. At this temperature the minimum cathode heating time is 3 minutes.

3. Tuning is achieved by rotating a splined shaft which can be fitted to the valve in two positions as shown on the outline drawing. The splined shaft mates with S.S. White 2666X end fitting ($^{13}/_{32}$ inch diameter).

4. The anode temperature must be kept below the limit specified by means of a suitable flow of air over the cooling fins.

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

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

   where Pi = mean input power in watts

   i_{apk} = peak anode current in amperes

   v_{apk} = peak anode voltage in volts

   and Du = duty cycle.

6. Tolerance ±10%.

7. 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.

8. The mounting plate and the guard pipe are fitted to the valve in a manner to permit pressurising of the input and the output circuit of the valve. At the maximum pressure of 45lb/in^2 absolute, the leakage will not exceed 0.5 litre (N.T.P.) per minute.

9. The valve is designed for use with a separate magnet which must conform with the specification given at the top of page 11. The axis of the magnetic field must be coincident with the axis of the anode, and the north pole of the magnet must be adjacent to the cathode terminal. A suitable magnet, type MA244, is available.

   If an electro-magnet is used, the pole tip dimensions should be as shown on page 11.

10. These tests are carried out with the valve tuned to 2900, 3000 and 3100MHz.

11. The valve will tune over the indicated frequency range.

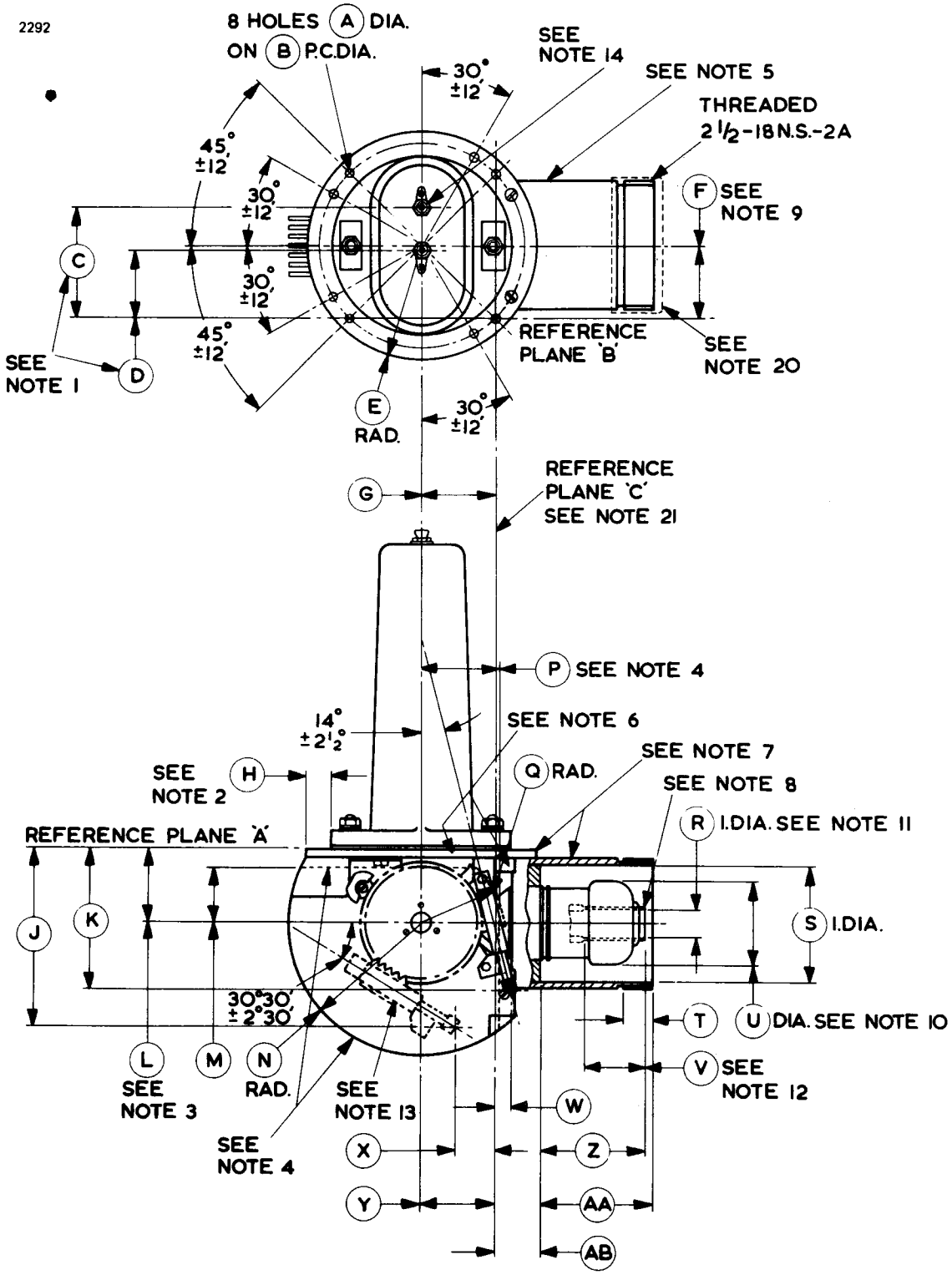
12. The specification limit for bandwidth applies over the whole tuning range.

13. With the valve operating into a v.s.w.r. of 1.5:1 phased to give maximum instability. 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 valve. Missing pulses are expressed as a percentage of the number of input pulses applied during the last 30 seconds of a test interval not to exceed 5 minutes.

14. Measured with heater voltage of 16V and no anode input power, the heater current limits are 2.8A minimum, 3.4A maximum.

15. Design test only. The maximum frequency change with anode temperature change (after warming) is −0.07MHz/°C.

OUTLINE

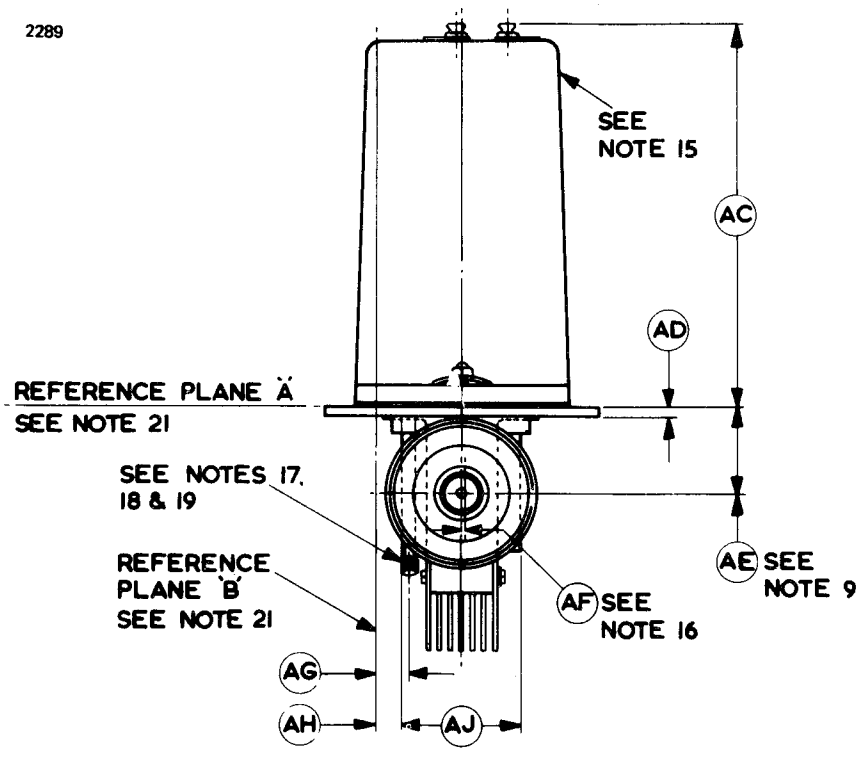

2292
8 HOLES (A) DIA.
ON (B) P.C.DIA.
SEE NOTE 14
SEE NOTE 5
THREADED
2 1/2-18N.S.-2A
30° ±12'
45° ±12'
30° ±12'
30° ±12'
45° ±12'
(F) SEE NOTE 9
(C)
SEE NOTE 1
(D)
REFERENCE PLANE 'B'
SEE NOTE 20
(E) RAD.
30° ±12'
(G)
REFERENCE PLANE 'C' SEE NOTE 21
(P) SEE NOTE 4
14° ±2 1/2°
SEE NOTE 6
SEE NOTE 7
SEE NOTE 8
SEE NOTE 2
(H)
(Q) RAD.
(R) I.DIA. SEE NOTE 11
REFERENCE PLANE 'A'
(J)
(K)
(S) I.DIA.
30°30' ±2°30'
(T)
(U) DIA. SEE NOTE 10
(L)
(M)
(N) RAD.
SEE NOTE 3
SEE NOTE 13
(V) SEE NOTE 12
(W)
SEE NOTE 4
(X)
(Z)
(Y)
(AA)
(AB)

OUTLINE DIMENSIONS

Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	0.210 ± 0.005	5.33 ± 0.13	T	0.593 min	15.06 min
B	4.064 ± 0.006	103.23 ± 0.15	U	1.620 max	41.15 max
C	2.156	54.76	V	1.125 min	28.58 min
D	1.359	34.52	W	0.313	7.95
E	2.281 ± 0.015	57.94 ± 0.38	X	0.756	19.20
F	1.437 ± 0.020	36.50 ± 0.51	Y	1.437	36.50
G	1.437	36.50	Z	2.085 ± 0.025	52.96 ± 0.64
H	0.500 min	12.70 min	AA	2.297 ± 0.010	58.34 ± 0.25
J	3.500	88.90	AB	0.818 ± 0.015	20.78 ± 0.38
K	2.812	71.42	AC	6.313 ± 0.094	160.4 ± 2.4
L	1.440	36.58	AD	0.187	4.75
M	1.063 min	27.00 min	AE	1.440 ± 0.020	36.58 ± 0.51
N	2.656 max	67.46 max	AF	0.025	0.64
P	1.500 min	38.10 min	AG	0.563 ± 0.125	14.30 ± 3.18
Q	1.500 min	38.10 min	AH	0.575 ± 0.050	14.61 ± 1.27
R	0.555 ± 0.005	14.10 ± 0.13	AJ	1.740 max	44.20 max
S	2.321 ± 0.007	58.95 ± 0.18			

Millimetre dimensions have been derived from inches.

OUTLINE



OUTLINE NOTES

1. The centres of the jack holes will be within a radius of 0.100 inch (2.54mm) of the location specified but spaced 0.797 ± 0.015 inch (20.24 ± 0.38mm) with respect to each other.

2. With the valve resting on a plane surface, the flatness of this annular area will be such that a feeler gauge 0.015 inch (0.38mm) thick and 0.125 inch (3.18mm) wide will not enter more than 0.250 inch (6.35mm) at any point.

3. The periphery of the anode will lie within a 2.160 inches (54.86mm) diameter circle located as specified for the non-tunable side of the anode.

4. The maximum width specified by dimension 'AJ' applies to the area defined by the broken line and the circumference of the radiator.

5. The valve will be painted with black, heat resisting non-corrosive paint, except for the following paint free areas: top surface of mounting plate, parts above mounting plate, screw threads on guard pipe, all surfaces inside guard pipe, tuning gear, stop, and worm shaft assembly.

6. All joints on the mounting plate and guard pipe will be soldered to provide hermetic seals.

7. The valve may be supported by the mounting plate or guard pipe.

8. There will be no sharp edges on the outside diameter at the end of the inner conductor.

9. Applies to the location of the centre line of the guard pipe only.

10. The centre line of the maximum diameter will be concentric with the centre line of the guard pipe to within 0.040 inch (1.02mm).

11. Applies to the inner conductor insert only. The centre line of the inner conductor insert will be concentric with the centre line of the guard pipe to within 0.025 inch (0.64mm).

12. Applies to the straight portion of the inner conductor wall.

13. Optional location of tuning spline. The valve will be supplied with the spline located as specified by the customer.

14. Hexagon locking head banana pin jack, hole 0.169 ± 0.005 inch (4.29 ± 0.13mm) diameter x 0.593 inch (15.06mm) long as per Mil-E-1, latest issue.

15. The common cathode connection is marked with letter C.

16. This dimension shows the relation between a plane passing through the lateral centre of the anode, and a plane passing through the centre of the guard pipe.

17. The tuning mechanism will provide the full range of tuning with a maximum of 4 complete revolutions of the large tuning gear.

18. The spline for adjusting the tuning mechanism is as follows: 12 teeth, 48 pitch, 0.250 inch (6.35mm) pitch diameter.

19. The clearance between the tuning spline and the guard pipe will be sufficient to allow the use of S.S. White No. 2666X end fitting ($^{13}/_{32}$ inch diameter.

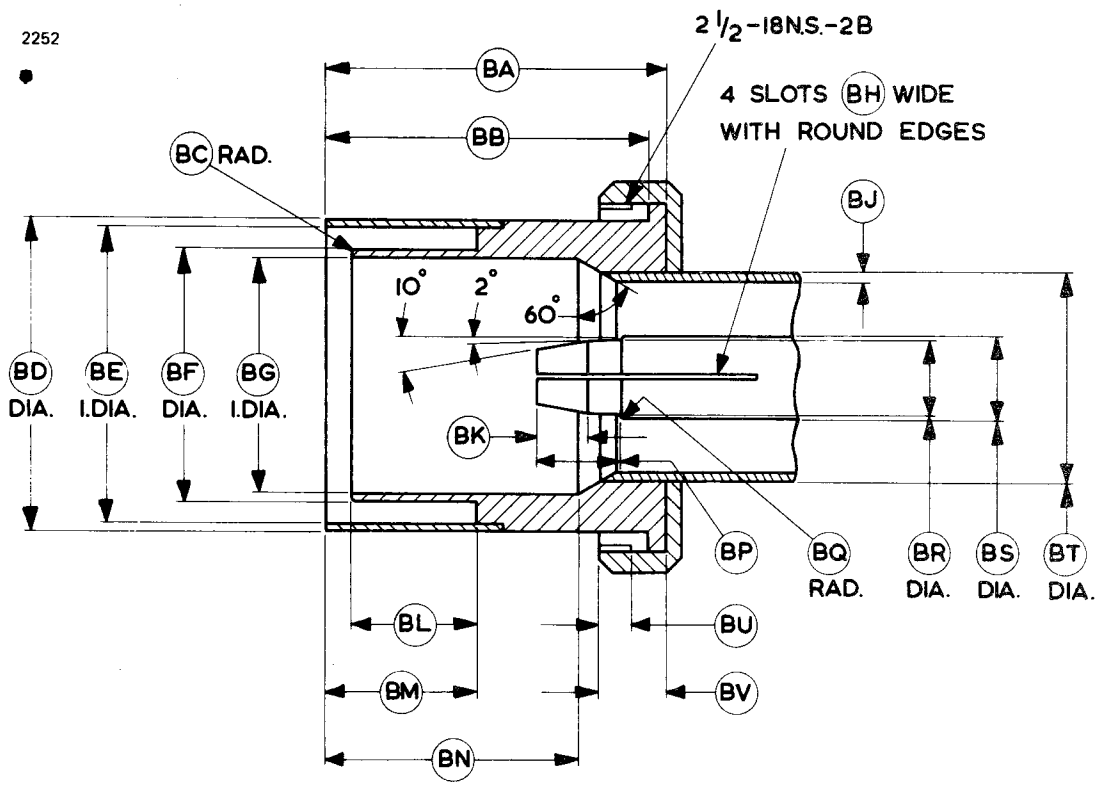
20. Protective guard for shipping purposes.

21. Reference plane 'A' is defined as a plane passing along the face of the mounting plate.

    Reference plane 'B' is defined as a plane perpendicular to plane 'A' and passing through the centre of the holes shown.

    Reference plane 'C' is defined as a plane mutually perpendicular to planes 'A' and 'B' and passing through the centre of the hole as shown.

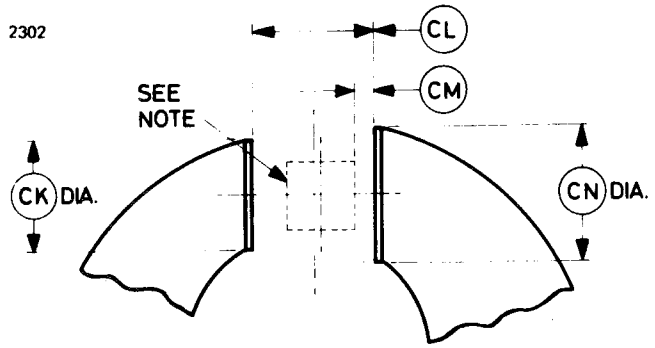
COUPLER



Ref	Inches	Millimetres	Ref	Inches	Millimetres
BA	2.531 ± 0.015	64.29 ± 0.38	BL	0.937 ± 0.003	23.800 ± 0.076
BB	2.402 ± 0.005	61.01 ± 0.13	BM	1.125 ± 0.003	28.575 ± 0.076
BC	0.031 ± 0.015	0.79 ± 0.38	BN	1.875 ± 0.005	47.63 ± 0.13
BD	2.310 ± 0.002	58.674 ± 0.051	BP	0.625 ± 0.015	15.88 ± 0.38
BE	2.185 ± 0.002	55.499 ± 0.051	BQ	0.016 ± 0.015	0.41 ± 0.38
BF	1.875 ± 0.002	47.625 ± 0.051	BR	0.576 ± 0.002	14.630 ± 0.051
BG	1.720 ± 0.002	43.688 ± 0.051	BS	0.625	15.88
BH	0.030	0.76	BT	1.625	41.28
BJ	0.049	1.24	BU	0.250 ± 0.015	6.35 ± 0.38
BK	0.375 ± 0.015	9.53 ± 0.38	BV	0.500 ± 0.015	12.70 ± 0.38

Millimetre dimensions have been derived from inches.

PERMANENT MAGNET SPECIFICATION



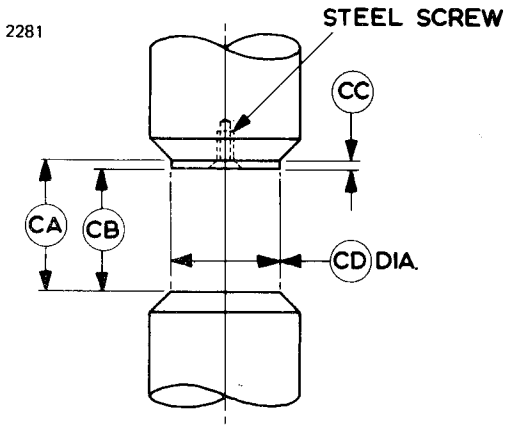
Ref	Inches	Millimetres	Ref	Inches	Millimetres
CK	1.625	41.28	CM	0.270	6.86
CL	1.800 ± 0.005	45.72 ± 0.13	CN	2.000	50.80

Millimetre dimensions have been derived from inches.

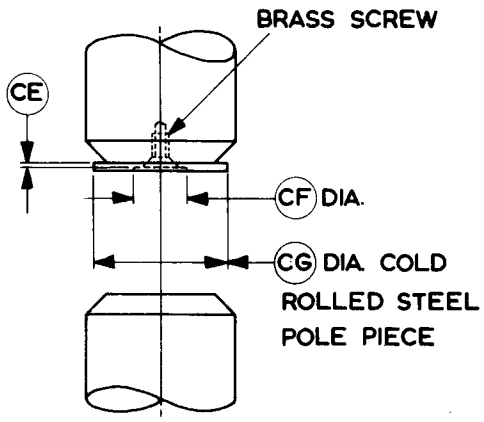
Note The variation of magnetic field within a cylinder 1.000 inch (25.4mm) long and 0.900 inch (22.86mm) diameter situated as shown and coaxially between the poles must not exceed ±140 gauss.

ELECTRO-MAGNET POLE PIECES

Magnet with Single Conventional Pole Piece



Magnet with Distortion Pole Piece



Ref	Inches	Millimetres	Ref	Inches	Millimetres
CA	1.925 ± 0.005	48.90 ± 0.13	CE	0.031 ± 0.015	0.79 ± 0.38
CB	1.800 ± 0.005	45.72 ± 0.13	CF	0.786 ± 0.005	19.96 ± 0.13
CC	0.125 ± 0.015	3.18 ± 0.38	CG	2.000 ± 0.015	50.80 ± 0.38
CD	1.625 ± 0.015	41.28 ± 0.38			

Millimetre dimensions have been derived from inches.

7182

S-BAND MAGNETRON

Frequency variant of M573, M574

ABRIDGED DATA

Fixed frequency pulse magnetron		
Frequency range	2750 to 2860	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)	1340	1460	gauss
Heater voltage (see note 1)	11.4	15.0	V
Heater starting current (peak)	—	40	A
Anode voltage (peak)	32	38	kV
Anode current (peak)	125	185	A
Input power (peak)	—	6.0	MW
Input power (mean) (see note 3)	—	8.5	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/in^2
	2.46	4.57	kg/cm^2

TYPICAL OPERATION

Operational Conditions

Heater voltage	0	V
Magnetic field	1400	gauss
Anode current (peak)	157	A
Pulse length	5.0	μs
Pulse repetition rate	300	p.p.s.

Typical Performance

Anode voltage (peak)	35	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)	1400	1400	1485	gauss
Heater voltage (for test)	0	0	0	V
Anode current (mean)	235	195	213	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)	33	37	—	—	—	—	kV
Output power (mean)	3375	—	—	—	—	—	W
Frequency	2750	2860	—	—	—	—	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	1400	gauss
Anode current (mean)	235	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 following 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:

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

where Pi = 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 3000 and 3100MHz 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 wave-

guide with a v.s.w.r. of less than 1.1:1 at the oscillation frequency and less than 1.5:1 between frequencies 3000 and 3100MHz, 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 3050MHz 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 220 and 250mA 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 frequency range 2750 to 2860MHz. 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.

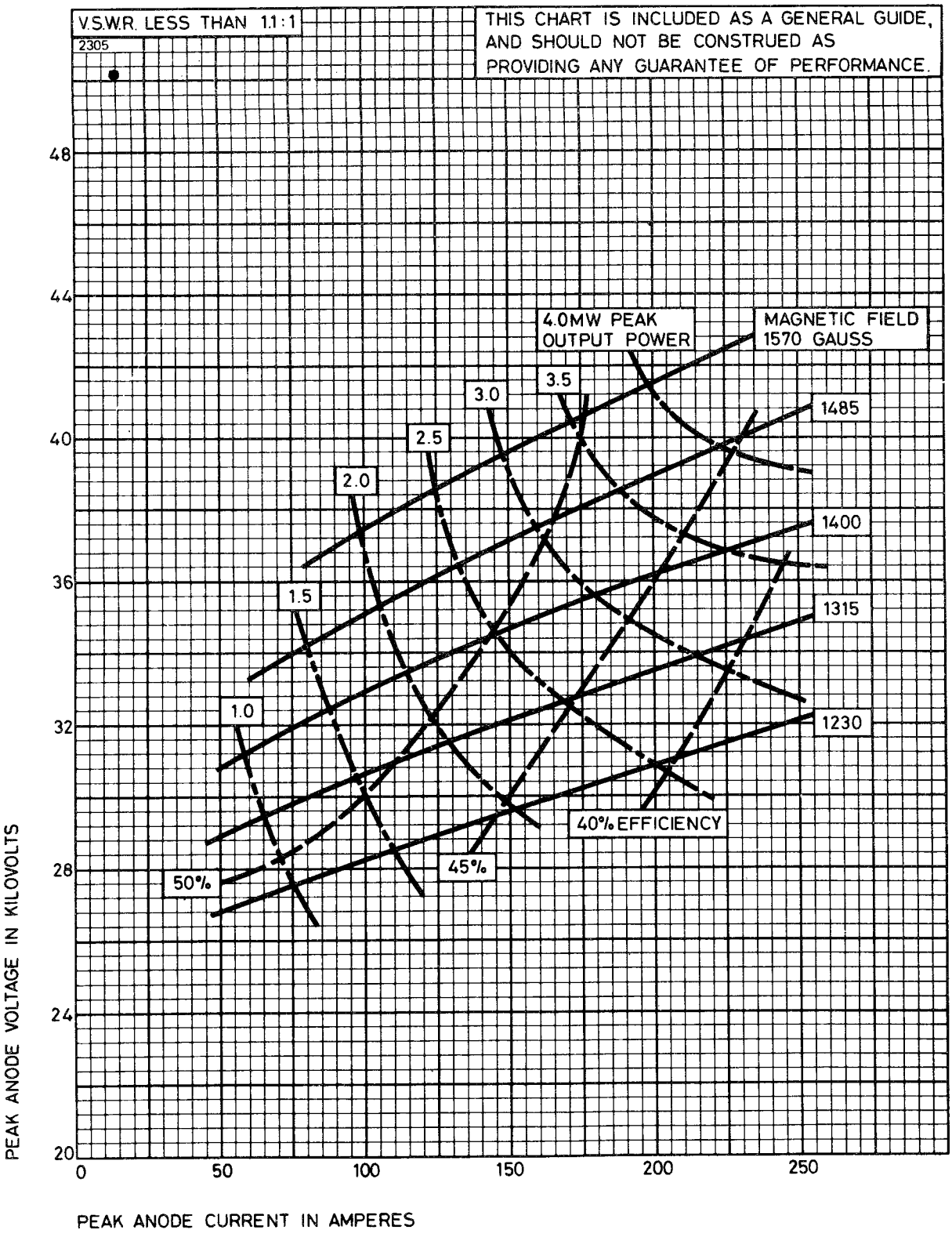
16. Measured with heater voltage of 12V and no anode input power, the heater current limits are 13A minimum, 15A maximum.

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

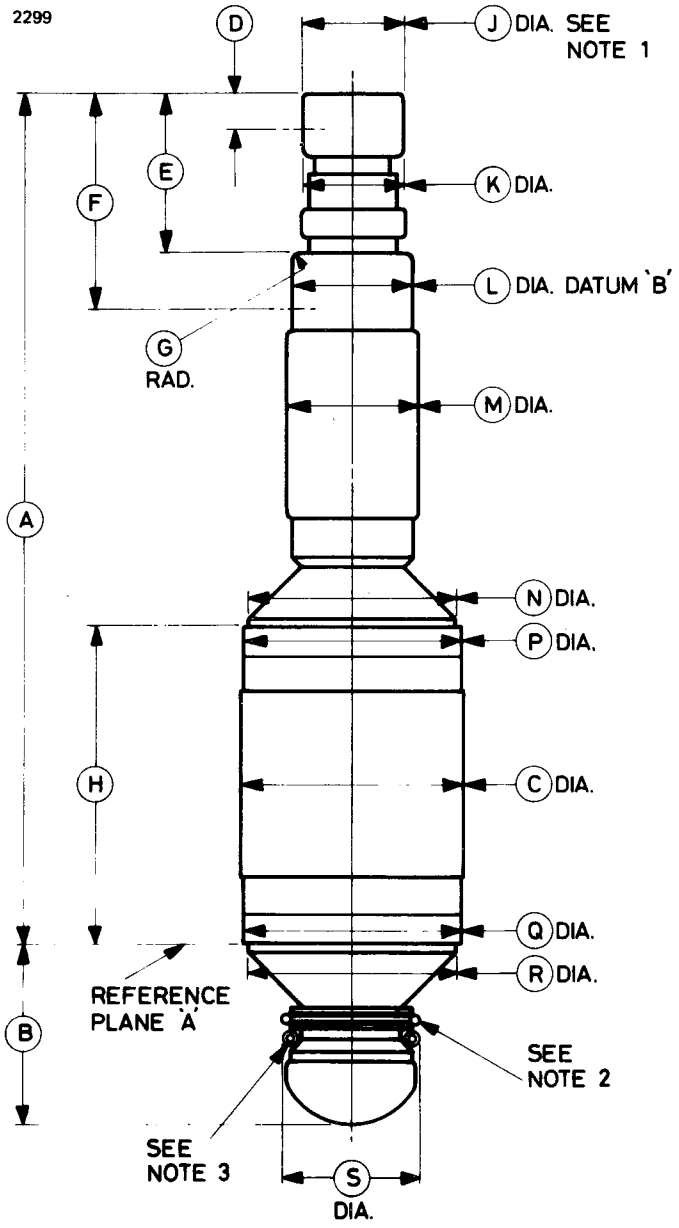
X-RAY WARNING

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



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

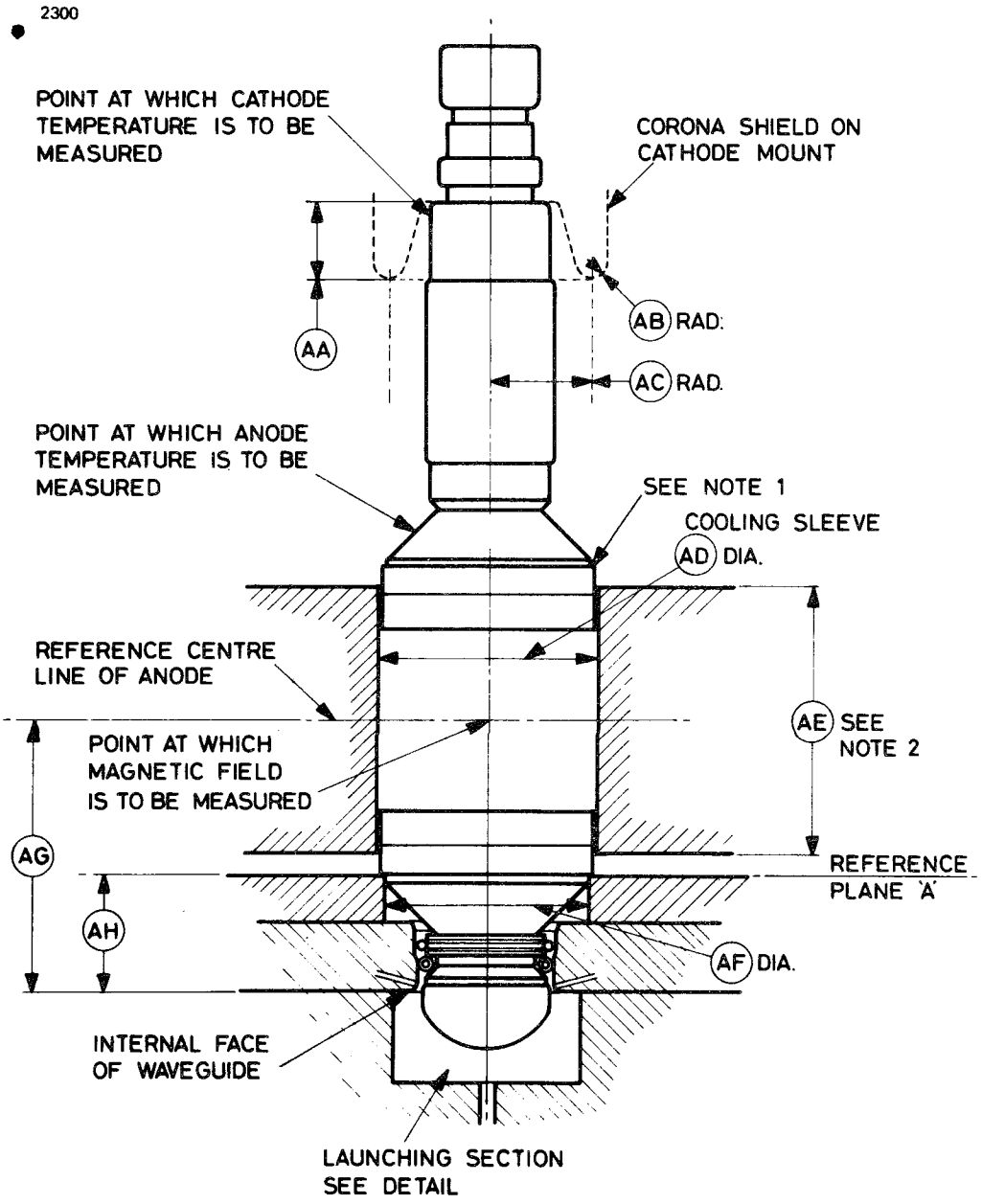
Millimetre dimensions have been derived from inches.

OUTLINE NOTES

1. Concentric tolerance 0.050 inch (1.27mm) diameter, Datum 'B' (B.S.308: 1953).
2. Silicon rubber 'O' ring, 50° Shore hardness. The dimensions and fit of this section to be tested on a pressure and leakage test 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	1.57	AY	2.840 ± 0.004	72.136 ± 0.102

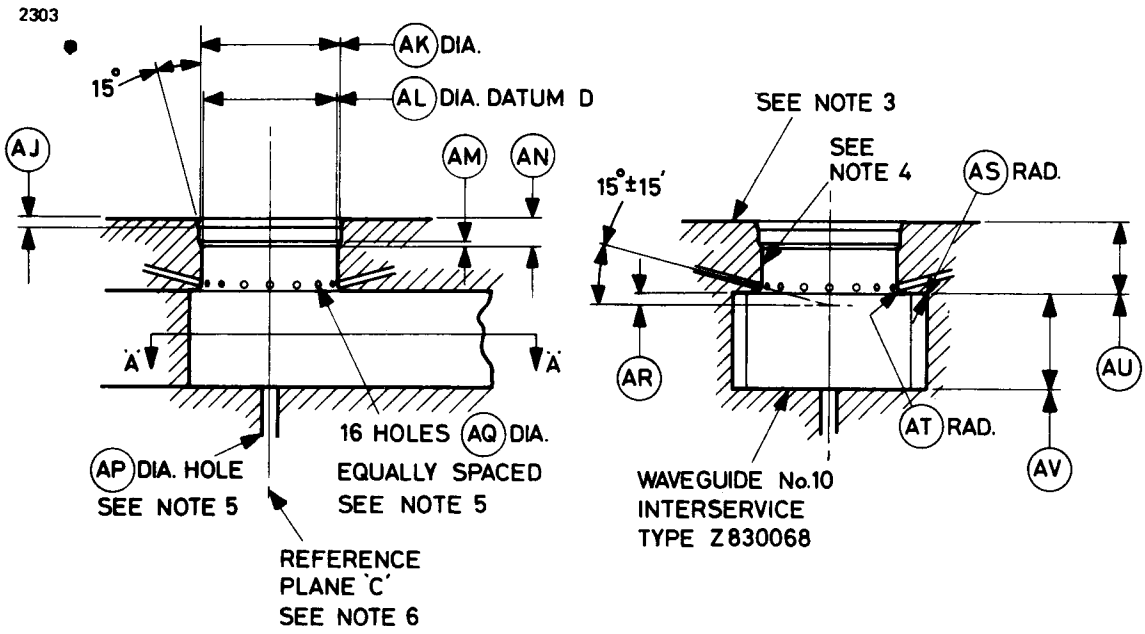
Millimetre dimensions have been derived from inches.

NOTES FOR ELECTRO-MAGNET AND LAUNCHING SECTION

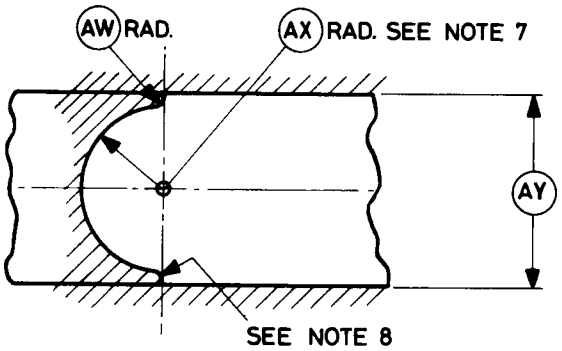
1. An adjustable device shall be used to bear on this shoulder and to ensure that the magnetron locates on reference plane 'A'. It must be able to withstand the thrust on the magnetron due to a pressure of 65 lb/in^2 absolute in the waveguide.
2. The length of the water jacket centre line to be within 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



BM1003 BM1004 BM1005

S-BAND MAGNETRONS

ABRIDGED DATA

Fixed frequency pulse magnetrons

Frequency range:		
BM1003	3034 to 3052	MHz
BM1004	2989 to 3007	MHz
BM1005	2944 to 2962	MHz
Typical peak output power	2.0	MW
Magnet		separate
Output		to no. 10 waveguide (2.840 x 1.340 inches internal) via the transition section M4117 shown on page 7
Cooling		water

GENERAL

Electrical

Cathode		indirectly heated
Heater voltage (see note 1)	8.5	V
Heater current	9.0	A
Heater starting current, peak value, not to be exceeded	20	A max
Cathode heating time (minimum)	3.0	min

Mechanical

Overall dimensions	14.375 x 6.000 x 6.000 inches max 365.1 x 152.4 x 152.4mm max
Net weight	18 pounds (8.2kg) approx
Mounting position	any

Cooling

The valve is water cooled and has an integral water jacket, the connections being made via ¼-inch B.S.P. unions. The water flow through the jacket must not be less than 1.2 litres per minute and the outlet water temperature must not exceed 50°C.

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)	1350	1600	gauss
Heater voltage (see note 1)	8.0	10	V
Heater starting current (peak)	—	20	A
Anode voltage (peak)	—	47	kV
Anode current (peak)	60	110	A
Input power (mean) (see note 3)	—	5.0	kW
Duty cycle	—	0.0015	
Pulse length (see note 4)	—	5.0	μs
Rate of rise of voltage pulse (see note 5)	—	120	kV/μs
Outlet water temperature	—	50	°C
V.S.W.R. at the output coupler	—	1.5:1	
Pressurising of waveguide	14	45	lb/in^2
	0.99	3.5	kg/cm^2

TYPICAL OPERATION

Operational Conditions

Magnetic field	1550 ± 25	gauss
Heater voltage	0	V
Anode current (peak)	90	A
Pulse length	2.0	μs
Pulse repetition rate	500	p.p.s.
Rate of rise of voltage pulse	110	kV/μs

Typical Performance

Anode voltage (peak)	43	kV
Output power (peak)	2.0	MW
Output power (mean)	2.0	kW

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification.

Test Conditions

Magnetic field	1550 ± 25	gauss
Heater voltage (for test)	0	V
Anode current (mean)	120	mA
Duty cycle	0.0015	
Pulse length (see note 4)	2.0	μs
V.S.W.R. at the output coupler	1.1:1	
Rate of rise of voltage pulse (see note 5)	110	kV/μs

Limits

	Min	Max	
Anode voltage (peak)	40	46	kV
Output power (mean)	2.1	–	kW
Frequency (see note 6):			
BM1003	3034	3052	MHz
BM1004	2989	3007	MHz
BM1005	2944	2962	MHz
R.F. bandwidth at ¼ power	–	1.5	MHz
Frequency pulling (v.s.w.r. not less than 1.5:1)	–	7.0	MHz
Stability (see note 7)	–	0.5	%
Heater current			see note 8
Temperature coefficient of frequency			see note 9

LIFE TEST

The quality of all production is monitored by the random selection of valves which are then life-tested under the Typical Conditions on page 2. 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.

End of Life Criteria (under Test Conditions above)

Anode voltage (peak)	38	kV min
Output power (mean)	1.8	kW min
R.F. bandwidth at ¼ power	2.0	MHz max

Frequency: must be within Test Limits above.

NOTES

1. With no anode input power.

   The heater voltage shall be reduced within 5 seconds after the application of h.t. according to the schedule shown on page 6.

   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.

2. The valve is designed for use with a separate magnet (not supplied); the north pole of the magnet must be adjacent to the cathode terminal, marked C. 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 user is invited to consult English Electric Valve Company Ltd. on the choice of magnets.

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

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

   where Pi = 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. Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude. Any capacitance in the viewing system must not exceed 6.0pF.

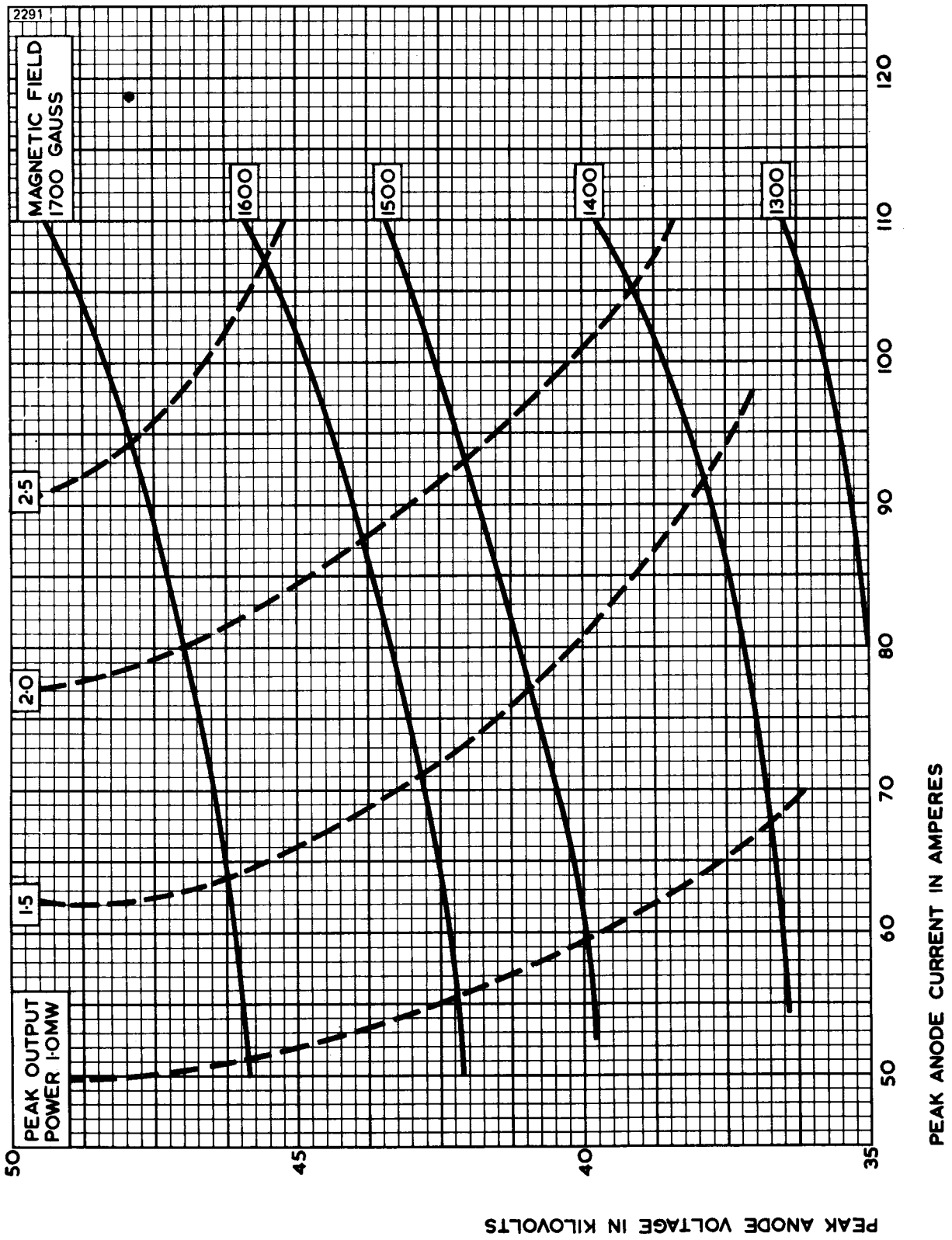
6. Other frequency ranges can be supplied on request.

7. With the valve operating into a v.s.w.r. of 1.15:1. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal energy level in a 0.5% frequency range. Missing pulses are expressed as a percentage of the number of input pulses applied during the period of observation after a period of 10 minutes operation.

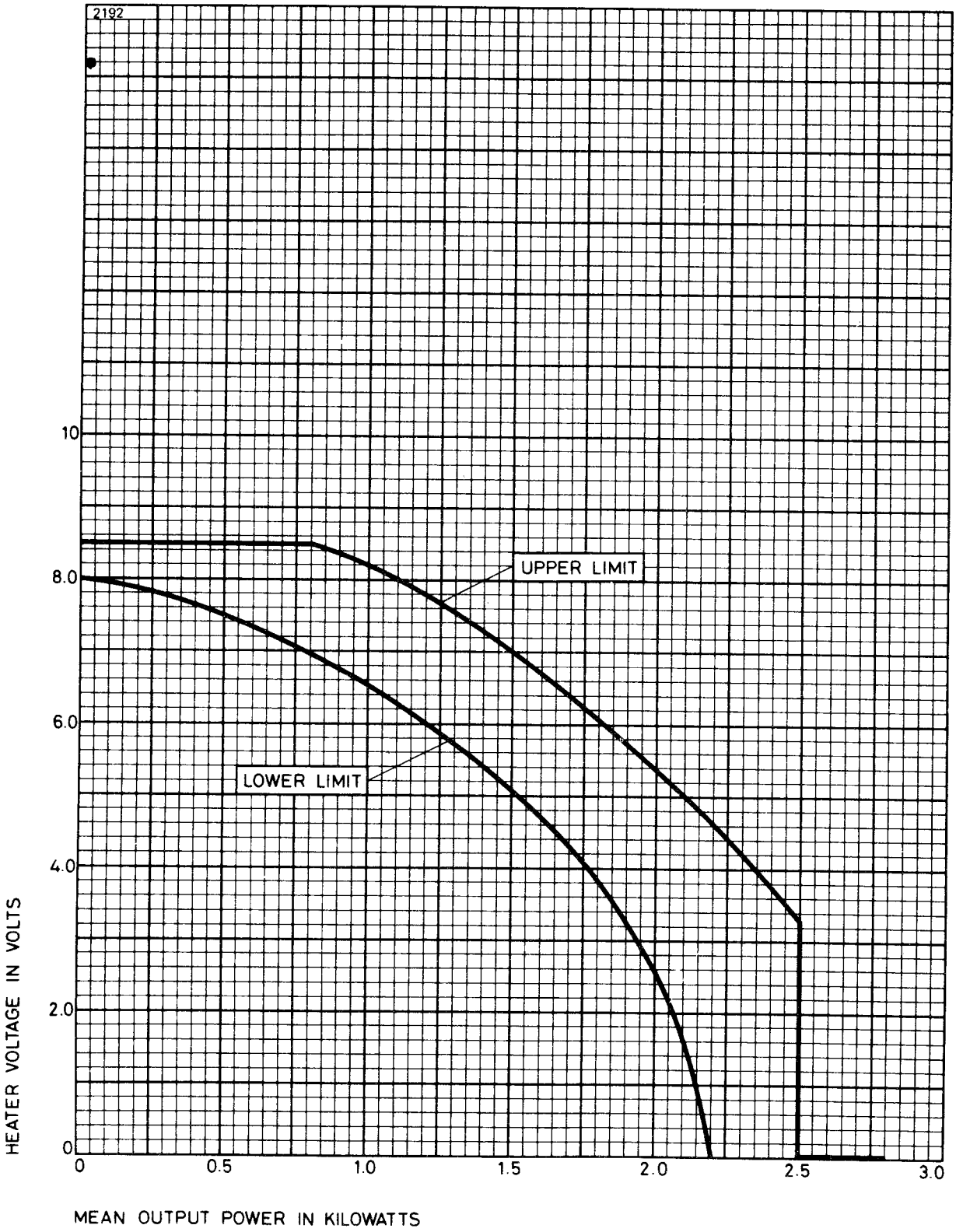
8. Measured with heater voltage of 8.5V and no anode input power, the heater current limits are 8.0A minimum, 10A maximum.

9. Design test only. The maximum frequency change with anode temperature change (after warming) is -0.25MHz/°C.

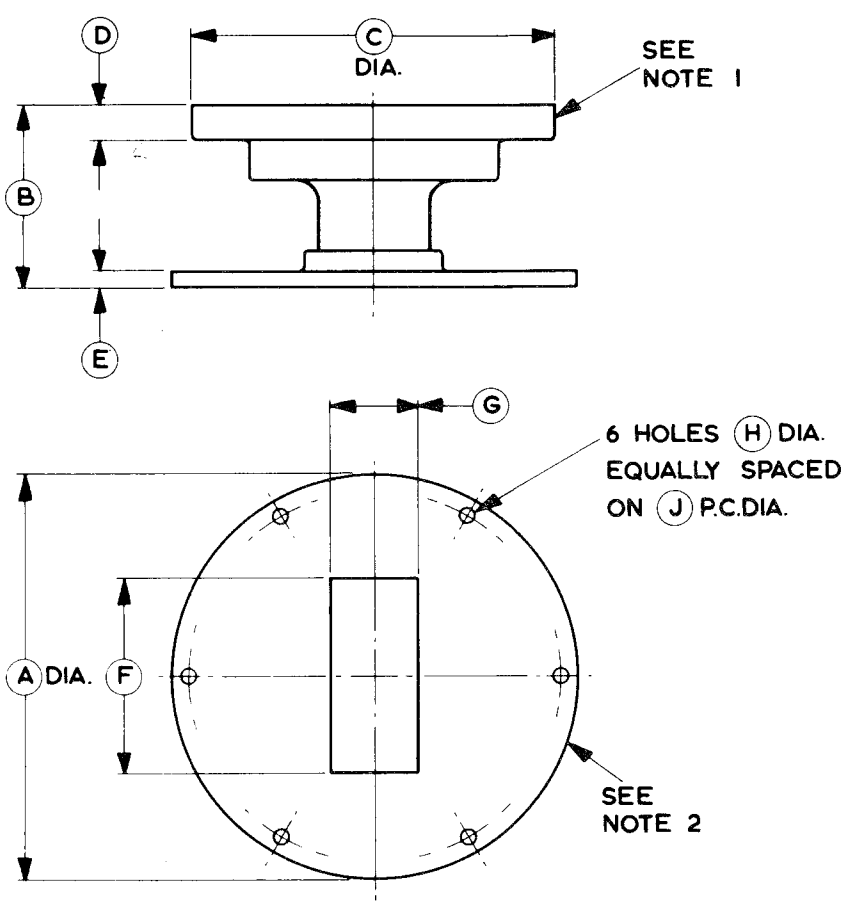
PERFORMANCE CHART



HEATER VOLTAGE ADJUSTMENT SCHEDULE



TRANSITION SECTION M4117



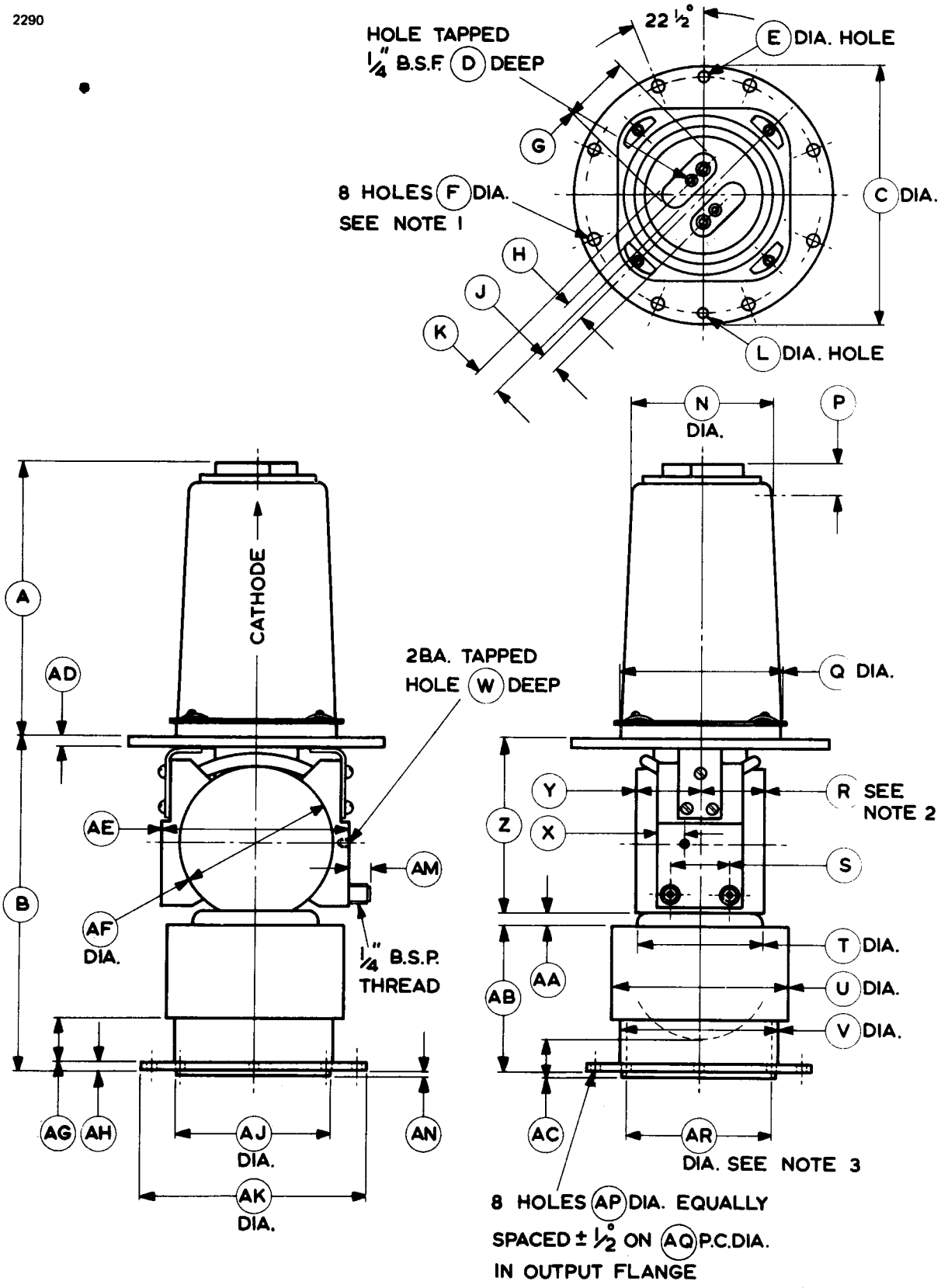
Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	5.875	149.2	F	2.840	72.14
B	2.643	67.13	G	1.340	34.04
C	5.250	133.4	H	0.257	6.53
D	0.500	12.70	J	5.375	136.5
E	0.250	6.35			

Millimetre dimensions have been derived from inches.

Notes for M4117

1. This flange mates with the output flange of the magnetron using 8—0.250 inch (6.35mm) diameter bolts, and an O-ring (supplied with M4117) 3.975 inches internal diameter and 0.210 inch diameter section. J.S.C. No. 5985-99-083-0011 or JAN MS 90064-17.
2. This flange is J.S.C. type No. 5985-99-083-1560.

OUTLINE (See page 10 for outline notes)



OUTLINE DIMENSIONS

Ref	Inches	Millimetres
A	6.375 ± 0.062	161.9 ± 1.57
B	7.780 ± 0.025	197.6 ± 0.64
C	6.000 $^{+0.000}_{-0.010}$	152.4 $^{+0.00}_{-0.25}$
D	0.250	6.35
E	0.312 $^{+0.005}_{-0.000}$	7.92 $^{+0.13}_{-0.00}$
F	0.312	7.92
G	1.625	41.28
H	0.437	11.10
J	0.437	11.10
K	0.625	15.88
L	0.250 $^{+0.005}_{-0.000}$	6.35 $^{+0.13}_{-0.00}$
N	3.250	82.55
P	0.750	19.05
Q	3.750	95.25
R	1.485 max (BM1003/4)	37.72 max (BM1003/4)
	1.530 max (BM1005)	38.86 max (BM1005)
S	1.375	34.93
T	2.937	74.60
U	4.125	104.8
V	3.687	93.65
W	0.250	6.35
X	0.625	15.88
Y	1.485 max (BM1003/4)	37.72 max (BM1003/4)
	1.530 max (BM1005)	38.86 max (BM1005)
Z	4.035 ± 0.030	102.5 ± 0.76
AA	0.312	7.92
AB	3.437	87.30
AC	0.875	22.23
AD	0.250 ± 0.005	6.35 ± 0.13
AE	4.375	111.1
AF	3.625	92.08
AG	1.218	30.94
AH	0.218	5.54
AJ	3.625 $^{+0.000}_{-0.006}$	92.08 $^{+0.00}_{-0.15}$
AK	5.250 ± 0.062	133.4 ± 1.57
AM	0.500	12.70
AN	0.125 ± 0.005	3.18 ± 0.13
AP	0.250 $^{+0.0005}_{-0.0000}$	6.350 $^{+0.013}_{-0.000}$
AQ	4.750 ± 0.005	120.7 ± 0.13
AR	3.375 $^{+0.005}_{-0.000}$	85.73 $^{+0.13}_{-0.00}$

Millimetre dimensions have been derived from inches.

OUTLINE NOTES

1. The 8 holes will clear studs 0.250 inch (6.35mm) diameter equally spaced on 5.500 inches (139.7mm) pitch circle diameter and within 0.005 inch (0.127mm) of their nominal positions, with the valve located by dowel pins 0.307 inch (7.80mm) diameter and 0.245 inch (6.22mm) diameter spaced 5.500 ± 0.002 inches (139.700 ± 0.051mm) apart.
2. The valve will fit between magnet poles 3.010 inches (76.45mm) diameter and 2.970 inches (75.44mm) apart, located symmetrically with respect to the dowel holes in the mounting flange and 2.500 inches (63.5mm) from the reference face.
3. This bore will accept a plug 3.335 inches (84.71mm) diameter.

M525

S-BAND MAGNETRON

Service Types CV2362 to CV2368

ABRIDGED DATA

Fixed frequency pulse magnetron		
Frequency range (in seven bands)	2750 to 2855	MHz
Typical peak output power	1.15	MW
Magnet		separate
Output		no. 10 waveguide (2.840 x 1.340 inches internal)
Coupler		see pages 7 and 8
Cooling		water

GENERAL

Electrical

Cathode		indirectly heated
Heater voltage (see note 1)	8.5	V
Heater current	9.0	A
Heater starting current, peak value, not to be exceeded	50	A max
Cathode heating time (minimum)	3	minutes

Mechanical

Overall dimensions	17.32 x 6.00 x 6.00 inches max 441 x 153 x 153mm max
Net weight	13 pounds (6kg) approx
Mounting position	any

Cooling

water

The water cooling system is connected to the valve via ¼-inch B.S.P. unions. The water flow must exceed 1 litre/minute with a maximum outlet temperature of 90°C. A 5-foot head of water will be adequate to ensure the flow.

MAXIMUM AND MINIMUM RATINGS (Absolute values)

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

	Min	Max	
Heater voltage (see note 1)	7.65	9.35	V
Heater starting current (peak)	—	50	A
Anode voltage (peak)	—	40	kV
Anode current (peak)	—	80	A
Input power (peak)	—	3.0	MW
Input power (mean) (see note 2)	—	4.5	kW
Duty cycle	—	0.00125	
Pulse length (see note 3)	—	1.25	μs
Rate of rise of voltage pulse (see note 4)	100	200	kV/μs
Anode temperature	—	90	°C
Cathode terminal temperature	—	150	°C
V.S.W.R. at the output coupler	—	1.5:1	

TYPICAL OPERATION

Operational Conditions

Heater voltage	6.0	V
Magnetic field (see note 5)	1800	gauss
Anode current (peak)	70	A
Pulse length	1.0	μs
Pulse repetition rate	1000	p.p.s.

Typical Performance

Anode voltage (peak)	36	kV
Output power (peak)	1.15	MW
Output power (mean)	1.15	kW

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions

	Oscillation 1	Oscillation 2	
Magnetic field (see note 5)	1800	1800	gauss
Heater voltage (for test)	6.0	6.0	V
Anode current (peak)	70	70	A
Duty cycle	0.00125	0.00125	
Pulse length (see note 3)	1.25	1.25	μs
V.S.W.R. at the output coupler	1.1:1	1.5:1	
Rate of rise of voltage pulse	150	150	kV/μs

Limits

	Min	Max	Min	Max	
Anode voltage (peak)	34	38	—	—	kV
Efficiency	40	—	—	—	%
Frequency:					
CV2362	2750	2765	—	—	MHz
CV2363	2765	2780	—	—	MHz
CV2364	2780	2795	—	—	MHz
CV2365	2795	2810	—	—	MHz
CV2366	2810	2825	—	—	MHz
CV2367	2825	2840	—	—	MHz
CV2368	2840	2855	—	—	MHz
R.F. bandwidth at ¼ power	—	—	—	2.5	MHz
Frequency pulling	—	—	—	7.0	MHz
Stability (see note 6)	—	—	—	0.5	%
Heater current					see note 7
Temperature coefficient of frequency					see note 8

LIFE TEST

The quality of all production is monitored by the random selection of valves which are then life-tested under Oscillation 1 conditions above. 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.

End of Life Criteria (under Test Conditions Oscillation 1)

Efficiency	35	% min
R.F. bandwidth at ¼ power	2.5	MHz max
Stability (see note 6)	1.0	% max

NOTES

1. With no anode input power.

   During high voltage operation it is essential to operate the heater in accordance with the following schedule.

• Mean Input Power (kW)	Heater Voltage (V)
less than 1.0	8.5
1.0 to 2.5	7.0
2.5 to 3.5	6.0
3.5 to 4.5	4.0

   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 of the valve data book.

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

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

   where Pi = mean input power in watts

   i_{apk} = peak anode current in amperes

   v_{apk} = peak anode voltage in volts

   and Du = duty cycle.

3. Tolerance $\pm$ 10%.

4. 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.

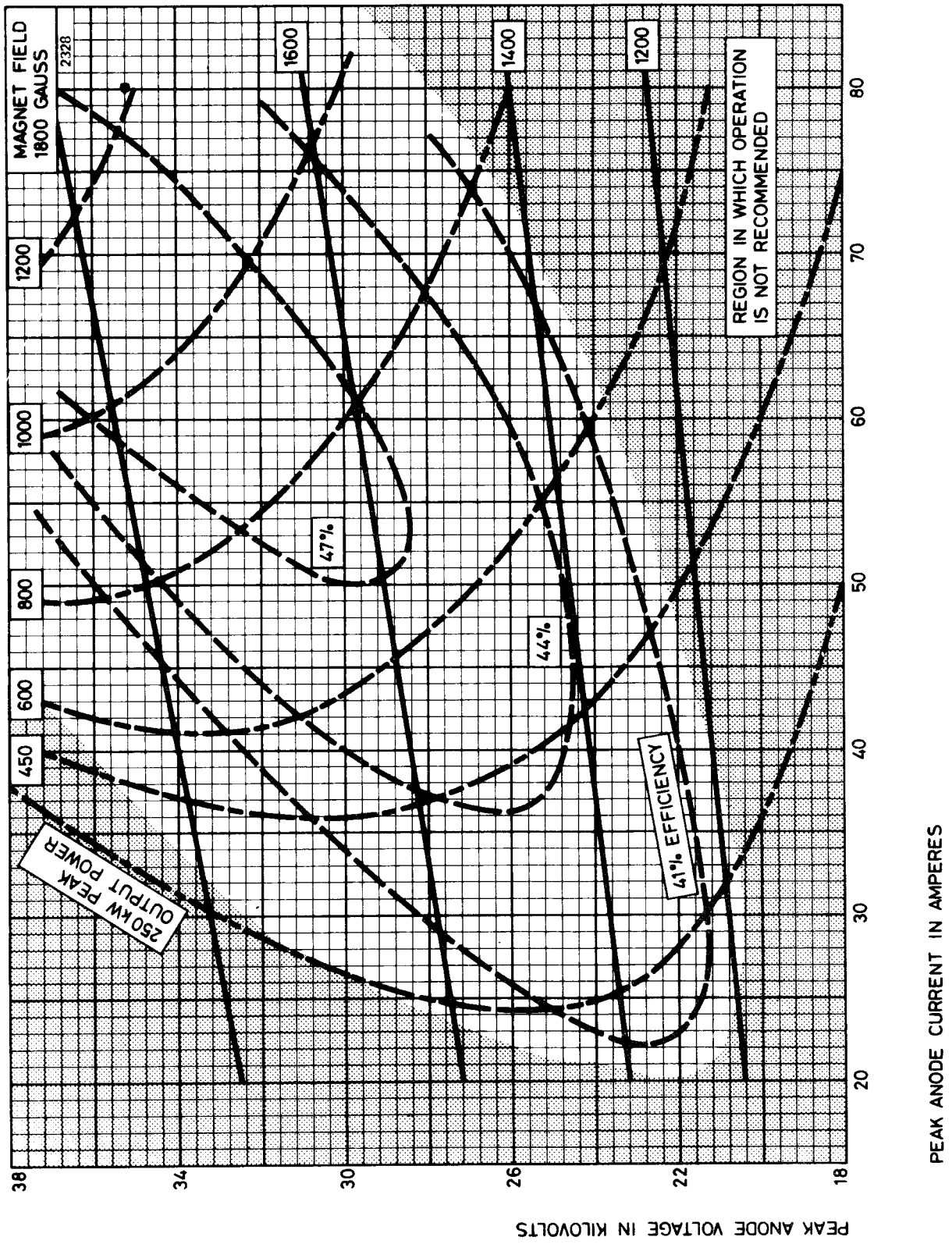
5. The variation of magnetic field within a cylinder 1½ inches (38.10mm) diameter and 1.125 inch (28.58mm) long, situated centrally and co-axially between the poles of the magnet should not exceed 10% overall. The position of the magnet must be adjusted so that the axis of the field is in line with the axis of the anode. The north pole of the magnet must be adjacent to the cathode terminal. The user is invited to consult English Electric Valve Company Ltd. on the choice of magnets.

6. With the valve operating into a mismatch of v.s.w.r. 1.5:1, phased to give maximum instability. 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 valve. Missing pulses are expressed as a percentage of the number of input pulses over an interval of 60 seconds.

7. Measured with heater voltage of 8.5V and no anode input power, the heater current limits are 8.0A minimum, 10A maximum.

8. Design test only. The maximum frequency change with anode temperature change (after warm-up) is –0.07MHz/°C.

PERFORMANCE CHART

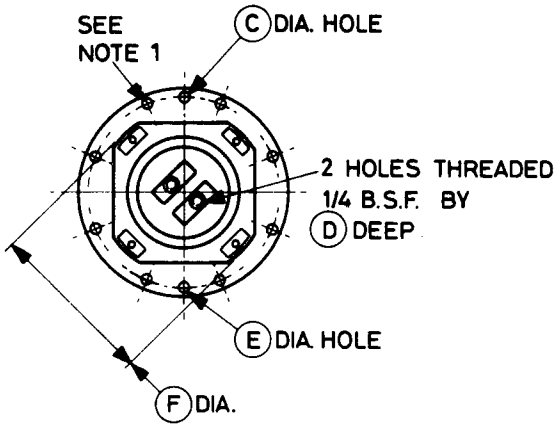


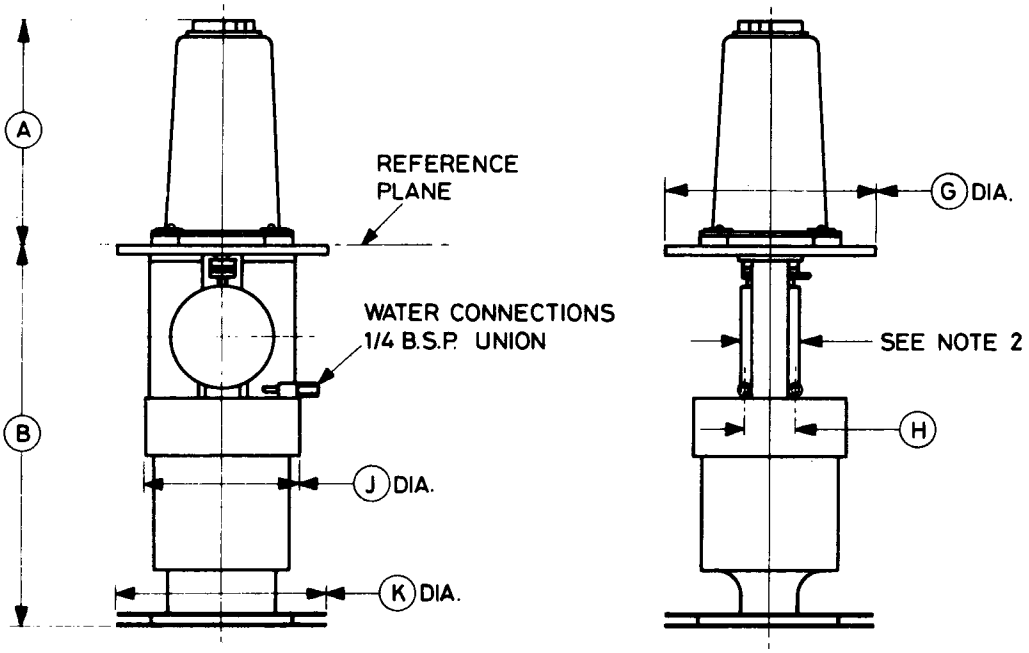
OUTLINE

Ref	Inches	Millimetres
A	6.375 ± 0.035	161.93 ± 0.89
B	10.875 ± 0.032	276.23 ± 0.81
C	0.312 $^{+0.003}_{-0.000}$	7.925 $^{+0.076}_{-0.000}$
D	0.250	6.35
E	0.250 $^{+0.003}_{-0.000}$	6.350 $^{+0.076}_{-0.000}$
F	4.750 max	120.7 max
G	6.000 $^{+0.000}_{-0.010}$	152.4 $^{+0.00}_{-0.25}$
H	1.375 $^{+0.005}_{-0.025}$	34.93 $^{+0.13}_{-0.64}$
J	4.406 ± 0.015	111.9 ± 0.38
K	5.875 ± 0.015	149.23 ± 0.38

Millimetre dimensions have been derived from inches.

2326

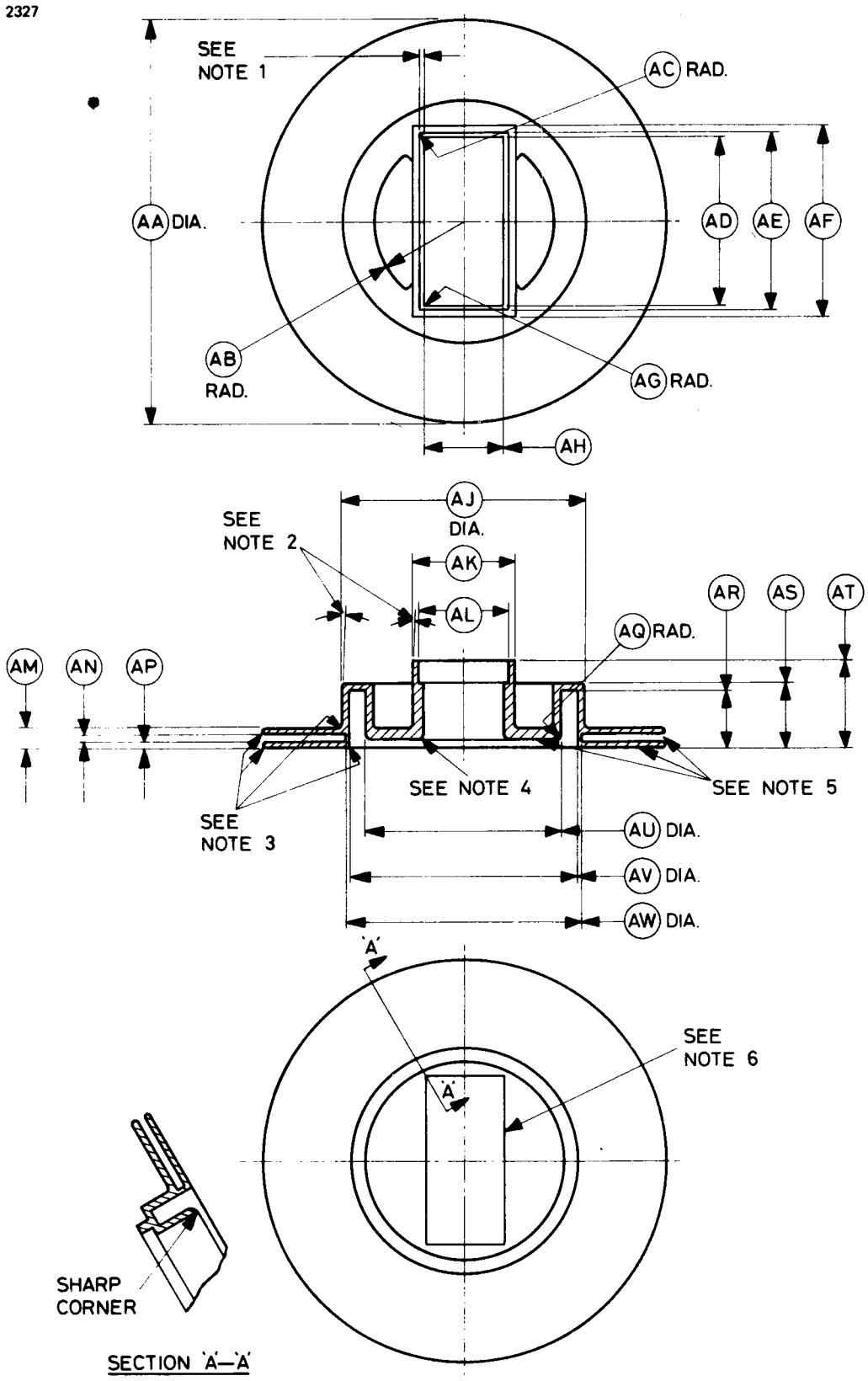




Outline Notes

1. Holes to clear 8 studs 0.250 inch (6.35mm) diameter equally spaced on 5.500 inch (139.7mm) P.C.D. and within 0.005 inch (0.13mm) of nominal position with the valve located by dowel pins 0.307 inch (7.80mm) diameter and 0.245 inch (6.22mm) diameter spaced 5.500 ± 0.002 inch (139.700 ± 0.051mm) apart.
2. The valve is to fit between magnet poles 3.010 inch (76.45mm) diameter and 2.125 inch (53.98mm) apart, located symmetrically with respect to dowel holes in the mounting flange and 2.500 inch (63.5mm) from the reference plane.

COUPLER



See page 8 for dimensions and notes.

Dimensions for Coupler

Ref	Inches	Millimetres	Ref	Inches	Millimetres
AA•	5.875	149.2	AM	0.375	9.53
AB	1.500	38.10	AN	0.125	3.18
AC	0.050 max	1.27 max	AP	0.125	3.18
AD	2.840 ± 0.003	72.136 ± 0.076	AQ	0.090	2.29
AE	$3.005^{+0.005}_{-0.000}$	$76.327^{+0.127}_{-0.000}$	AR	0.980 ± 0.005	24.89 ± 0.13
			AS	1.125	28.58
AF	3.250	82.55	AT	1.500	38.10
AG	0.025 max	0.64 max	AU	3.320 ± 0.005	84.33 ± 0.13
AH	1.340 ± 0.003	34.036 ± 0.076	AV	3.880 ± 0.005	98.55 ± 0.13
AJ	4.125	104.8	AW	4.000	101.6
AK	1.750	44.45			
AL	$1.505^{+0.005}_{-0.000}$	$38.227^{+0.127}_{-0.000}$			

Millimetre dimensions have been derived from inches.

Notes for Coupler

1. These faces parallel to within 25'.
2. Maximum draft angle 2°.
3. Radius on these corners 0.031 inch (0.79mm).
4. On all four sides 0.125 inch (3.2mm) radius at centre fairs to give a sharp corner as shown in section A - A; length of fairing not to exceed 0.125 inch (3.2mm).
5. These faces to be flat, smooth, free from machining marks and square with rectangular bore.
6. Rectangular bore to be within 0.003 inch (0.076mm) of nominal position.

M561

S-BAND MAGNETRON

ABRIDGED DATA

Fixed frequency pulse magnetron		
Frequency range	3040 to 3060	MHz
Typical peak output power	80	kW
Magnet	separate, see note 7 on page 4	
Output	coaxial line; internal diameter of outer conductor 1.527 inches, diameter of inner conductor 0.625 inch	
Coupler	see page 9	
Cooling	forced-air	

GENERAL

Electrical

Cathode	indirectly heated	
Heater voltage (see note 1)	10	V
Heater current	1.1	A
Heater starting current, peak value, not to be exceeded	5.0	A max
Cathode heating time (minimum) (see note 2)	2	min

Mechanical

Overall dimensions	6.28 x 6.22 x 3.28 inches max 159.5 x 158.0 x 83.3mm max
Net weight	3¼ pounds (1.5kg) approx
Mounting position	any

Cooling

forced-air

MAXIMUM AND MINIMUM RATINGS (Absolute values)

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

	Min	Max	
Heater voltage (see note 1)	9.0	11	V
Heater starting current (peak)	—	5.0	A
Anode voltage (peak)	11	18	kV
Anode current (peak)	10	25	A
Input power (peak)	—	400	kW
Input power (mean) (see note 3)	—	500	W
Duty cycle	—	0.002	
Pulse length (see note 4)	—	2.0	μs
Rate of rise of voltage pulse (see note 5)	100	180	kV/μs
Anode temperature (see note 6)	—	140	°C
V.S.W.R. at the output coupler	—	1.5:1	

TYPICAL OPERATION

Operational Conditions

	Condition 1	Condition 2	
Heater voltage	10	7.5	V
Magnetic field (see note 7)	1800	1800	gauss
Anode current (peak)	15	15	A
Pulse length (see note 4)	0.1	1.0	μs
Pulse repetition rate	1000	1000	p.p.s.
Rate of rise of voltage pulse	150	150	kV/μs

Typical Performance

Anode voltage (peak)	13	13	kV
Output power (peak)	80	80	kW
Output power (mean)	8	80	W

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification.

Test Conditions

	Oscillation 1	Oscillation 2	
Magnetic field (see note 7)	1800	1800	gauss
Heater voltage (for test)	7.5	10	V
Anode current (mean)	15	1.5	mA
Duty cycle	0.001	0.0001	
Pulse length (see note 4)	1.0	0.1	μs
V.S.W.R. at the output coupler	1.15:1	1.15:1	
Rate of rise of voltage pulse (minimum) (see note 5)	180	180	kV/μs

Limits

	Min	Max	Min	Max	
Anode voltage (peak)	12	14	—	—	kV
Output power (mean)	65	—	—	—	W
Frequency	3040	3060	—	—	MHz
R.F. bandwidth at ¼ power	—	2.5	—	25	MHz
Frequency pulling (v.s.w.r. not less than 1.5:1)	—	6.0	—	—	MHz
Frequency pushing (see note 8)	—	0.2	—	—	MHz/A
Stability (see note 9)	—	0.5			%
Stability (see note 10)			—	0.5	%
Cold impedance				see note 11	
Heater current				see note 12	
Temperature coefficient of frequency				see note 13	

LIFE TEST

The quality of all production is monitored by the random selection of valves which are then life-tested under Oscillation 1 conditions above. 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.

NOTES

1. With no anode input power.

   For average values of pulse input power greater than 50 watts the heater voltage shall be reduced within 3 seconds after the application of h.t. according to the following schedule:

   $$V_h = 10.0 \left[1 - \frac{Pi}{900}\right] \text{ volts}$$

   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. For further details see the preamble to this section.

2. For ambient temperatures above 0°C. For ambient temperatures between 0 and −55°C the cathode heating time is 3 minutes minimum.

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

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

   where Pi = 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 ±10% for pulse length 1.0μs and ±50% for pulse length 0.1μs.

5. 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.

6. The anode temperature must be kept below the limit specified by means of a suitable flow of air over the anode fins.

7. The valve is designed for use with a separate magnet which must conform with the specification given at the top of page 10. The axis of the magnetic field must be coincident with the axis of the anode, and the north pole of the magnet must be adjacent to the cathode terminal.

   A suitable magnet, type MA290, is available. If an electro-magnet is used, the pole tip dimensions should be as shown on page 10.

8. The frequency pushing is the difference between the maximum and minimum frequencies as the peak anode current is varied rapidly between 10 and 18A.

9. With the valve operating into a v.s.w.r. of 1.1:1. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal energy level in the frequency range 3040 to 3060MHz. Missing pulses are expressed as a percentage of the number of input pulses applied during the period of observation after a period of 5 minutes.

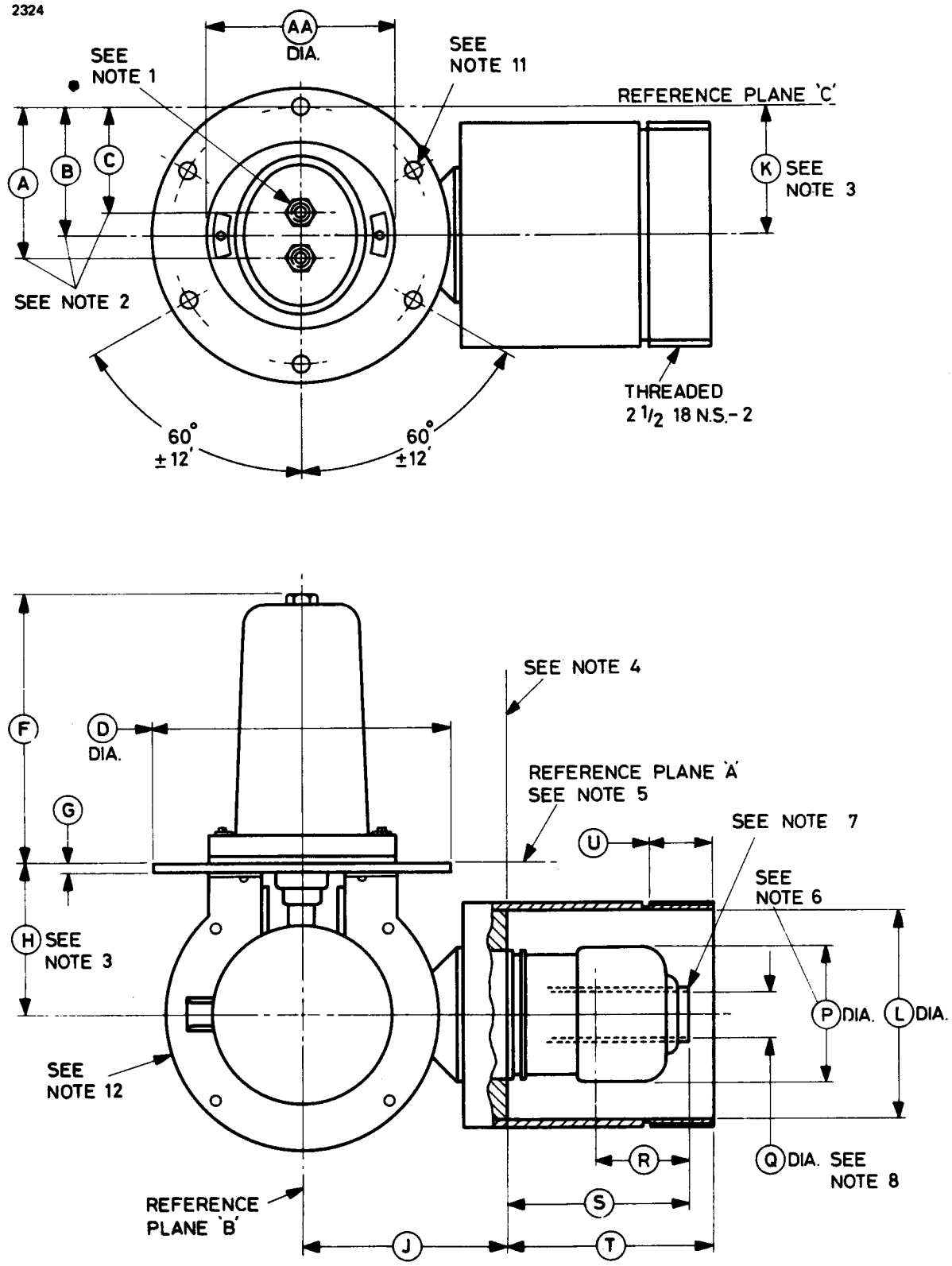
10. There shall be no evidence of mode change as the mean anode current is varied over the range 1.0 to 2.5mA.

11. For the range 3040 to 3060MHz the impedance of the valve measured at the operating frequency when not oscillating will be such as to give a v.s.w.r. of at least 10:1 with a minimum 77 to 87mm from the reference plane shown on the outline drawing.

12. Measured with heater voltage of 10V and no anode input power, the heater current limits are 0.9A minimum, 1.3A maximum.

13. Design test only. The maximum frequency change with anode temperature change (after warm-up) is -0.07MHz/°C.

OUTLINE

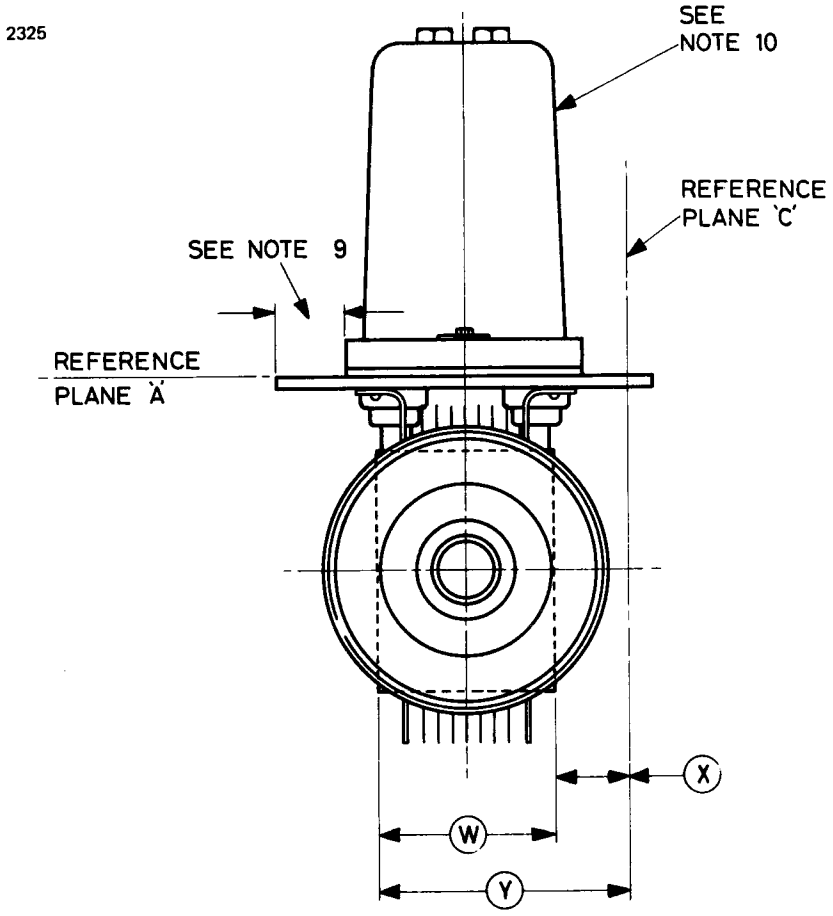

2324
AA DIA.
SEE NOTE 1
SEE NOTE 11
REFERENCE PLANE 'C'
A
B
C
K SEE NOTE 3
SEE NOTE 2
THREADED 2 1/2 18 N.S.-2
60° ±12'
60° ±12'
SEE NOTE 4
F
D DIA.
REFERENCE PLANE 'A' SEE NOTE 5
G
SEE NOTE 7
U
SEE NOTE 6
H SEE NOTE 3
P DIA.
L DIA.
SEE NOTE 12
R
Q DIA. SEE NOTE 8
S
REFERENCE PLANE 'B'
J
T

OUTLINE DIMENSIONS

Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	1.687	42.85	P	1.620 max	41.15 max
B	1.437	36.50	Q	0.555 ± 0.005	14.10 ± 0.13
C	1.187	30.15	R	1.125 min	28.58 min
D	3.250 ± 0.031	82.55 ± 0.79	S	2.085 ± 0.025	52.96 ± 0.64
F	2.984 ± 0.062	75.79 ± 1.57	T	2.297 ± 0.010	58.34 ± 0.25
G	0.125	3.18	U	0.583 min	14.81 min
H	1.687 ± 0.010	42.85 ± 0.25	W	1.490 max	37.85 max
J	2.255 ± 0.015	57.28 ± 0.38	X	0.677 min	17.20 min
K	1.437 ± 0.010	36.50 ± 0.25	Y	2.197 max	55.80 max
L	2.321 ± 0.007	58.95 ± 0.18	AA	2.218 max	56.34 max

Millimetre dimensions have been derived from inches.

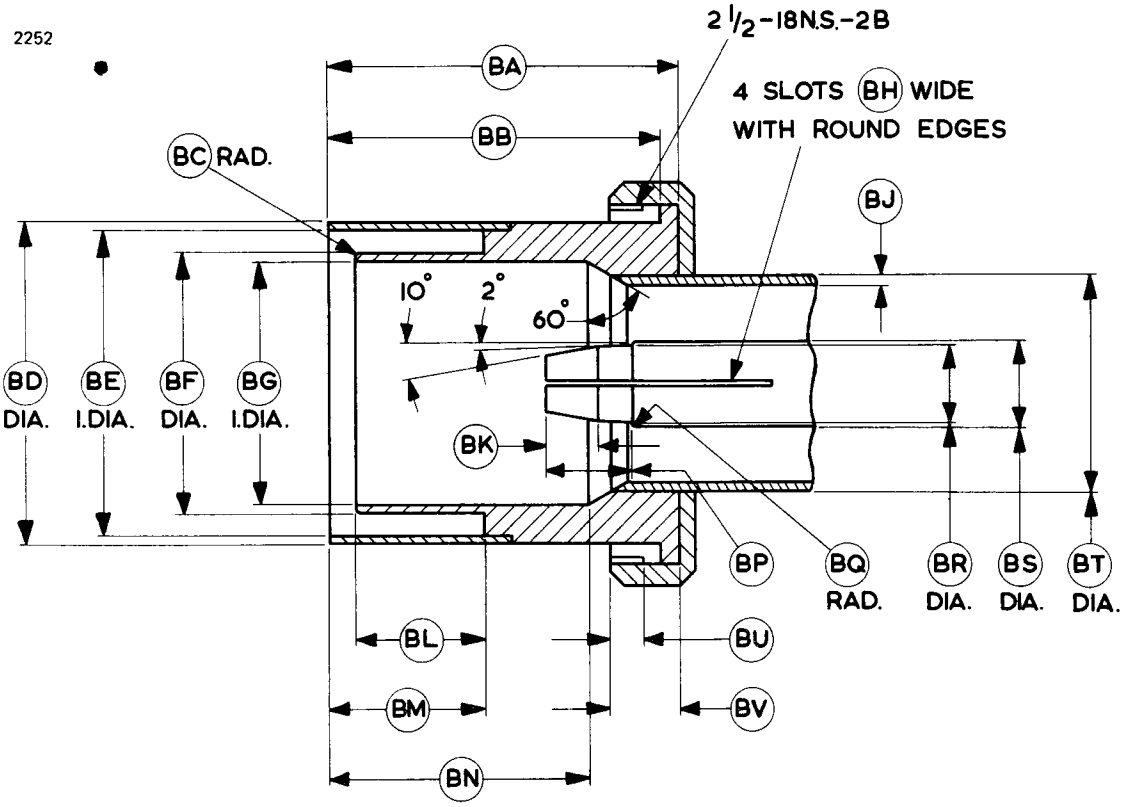
OUTLINE



OUTLINE NOTES

1. Hole 0.169 ± 0.004 inch (4.293 ± 0.102mm) diameter in both pin jacks.
2. The pin jack holes will be within a radius of ± 0.023 inch (0.58mm) of the location specified and will be spaced 0.500 ± 0.010 inch (12.70 ± 0.25mm) between centres with respect to each other. The centre lines of these holes will be perpendicular to reference plane A to within 3 degrees.
3. Measured to centre line of guard pipe.
4. Reference plane for electrical cold impedance tests.
5. Any part of the assembly extending above reference plane A will be within a radius of 1.109 inch (28.17mm) of the true centre of the mounting plate, measured with respect to the mounting holes.
6. The centre line of the glass portion will be concentric with the centre line of the guard pipe to within 0.040 inch (1.02mm).
7. There will be no sharp edges on the outside diameter at the end of the inner conductor.
8. This dimension applies to the inner conductor insert only. The centre line of the insert will be concentric with the centre line of the guard pipe to within 0.025 inch (0.64mm).
9. With the flange resting on a plane surface the flatness of the mounting plate 0.500 inch (12.70mm) from the edge will be such that a 0.010 inch (0.254mm) thickness gauge 0.125 inch (3.18mm) wide will not enter for a distance of more than 0.250 inch (6.35mm).
10. Common cathode connection indicated by 'C' embossed on this surface.
11. Six holes 0.193 ± 0.003 inch (4.902 ± 0.076mm) diameter, equally spaced on 2.875 ± 0.006 inch (73.03 ± 0.15mm) pitch circle diameter.
12. Radiator diameter 3.000 ± 0.062 inch (76.20 ± 1.57mm).

COUPLER

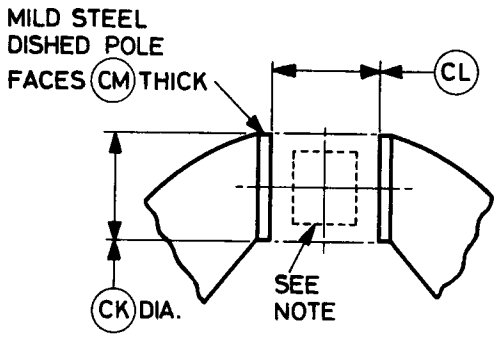


Ref	Inches	Millimetres	Ref	Inches	Millimetres
BA	2.531 ± 0.015	64.29 ± 0.38	BL	0.937 ± 0.003	23.800 ± 0.076
BB	2.402 ± 0.005	61.01 ± 0.13	BM	1.125 ± 0.003	28.575 ± 0.076
BC	0.031 ± 0.015	0.79 ± 0.38	BN	1.875 ± 0.005	47.63 ± 0.13
BD	2.310 ± 0.002	58.674 ± 0.051	BP	0.625 ± 0.015	15.88 ± 0.38
BE	2.185 ± 0.002	55.499 ± 0.051	BQ	0.016 ± 0.015	0.41 ± 0.38
BF	1.875 ± 0.002	47.625 ± 0.051	BR	0.576 ± 0.002	14.630 ± 0.051
BG	1.720 ± 0.002	43.688 ± 0.051	BS	0.625	15.88
BH	0.030	0.76	BT	1.625	41.28
BJ	0.049	1.24	BU	0.250 ± 0.015	6.35 ± 0.38
BK	0.375 ± 0.015	9.53 ± 0.38	BV	0.500 ± 0.015	12.70 ± 0.38

Millimetre dimensions have been derived from inches.

PERMANENT MAGNET SPECIFICATION

2331



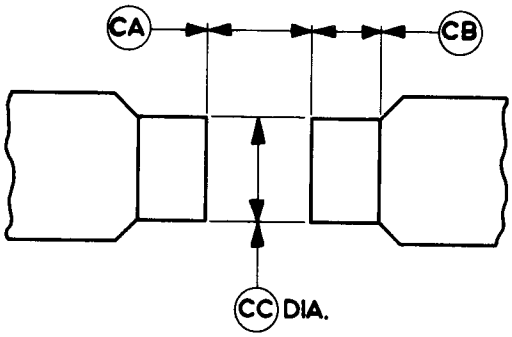
Ref	Inches	Millimetres
CK	1.500 ± 0.005	38.10 ± 0.13
CL	$1.500^{+0.010}_{-0.000}$	$38.10^{+0.25}_{-0.00}$
CM	0.187	4.75

Millimetre dimensions have been derived from inches.

Note The variation of magnetic field within a cylinder 1.000 inch (25.4mm) long and 0.900 inch (22.86mm) diameter, situated centrally and coaxially between the poles must not exceed $\pm$ 90 gauss.

ELECTRO-MAGNET POLE PIECES

2255



Ref	Inches	Millimetres
CA	$1.500^{+0.005}_{-0.000}$	$38.10^{+0.13}_{-0.00}$
CB	1.000 min	25.40 min
CC	1.500 ± 0.010	38.10 ± 0.25

Millimetre dimensions have been derived from inches.

M566 M569 M570

S-BAND MAGNETRONS

Frequency variants of M579

ABRIDGED DATA

Fixed frequency pulse magnetrons

Frequency range:		
M566	2750 to 2860	MHz
M569	2850 to 2960	MHz
M570	2950 to 3060	MHz
Typical peak output power	2.5	MW
Magnet and launching section	separate electromagnet and launching section assembly M4011 (see page 12 also)	
Isolator	use of an isolator is recommended (see note 8, page 6)	
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	15.00 x 4.00 x 4.00 inches max 381 x 102 x 102mm max
Net weight	9¾ pounds (4.5kg) approx
Mounting position	vertical only

Any lubricants used on the anode should be sulphur free.

Electro-magnet and Launching Section

The complete electro-magnet and launching section is designated M4011 (see page 14); the launching section can be supplied as a separate item if required and is designated M4017 (see page 16).

	Min	Max	
D.C. current for 1580 gauss field (see note 2 and page 9)	27	30	A
Resistance of field windings:			
at 20°C	0.9	1.15	Ω
during operation	—	1.65	Ω
Overall dimensions (see page 14)	15.437 x 12.625 x 12.250 inches approx 392 x 320 x 310mm approx		
Net weight	110 pounds (50kg) approx		
Output flange	UG-53/U		

Cooling

The electro-magnet is water cooled and provides cooling for the magnetron anode by conduction through the inner liner of the magnet assembly into which the magnetron fits. The liner is machined to very fine limits and it is essential that the inner surface is carefully cleaned before the magnetron is fitted. Precautions must be taken to ensure that power to the magnetron and the electro-magnet is removed in the event of a cooling water supply failure. A flow of 1.5 imp. gal/min (6.8 l./min) is usually adequate, although this will depend on the method employed for mounting the assembly. The water pressure required for a flow of 1.5 imp. gal/min (6.8 l./min) is 4 lb/in^2 (0.28kg/cm^2) maximum.

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.

The magnetron output window is cooled by air at high pressure in the waveguide; 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 cathode terminal may be cooled by low pressure air.

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 3)	1520	1675	gauss
Heater voltage (see note 1)	11.4	15.0	V
Heater starting current (peak)	—	40	A
Anode voltage (peak):			
M566	34.5	41.5	kV
M569, M570	36	43	kV
Anode current (peak):			
M566	119	176	A
M569, M570	115	170	A
Input power (peak)	—	6	MW
Input power (mean) (see note 4)	—	8.5	kW
Duty cycle	—	0.0015	
Pulse length (see note 5)	0.5	5.0	μs
Pulse repetition rate	—	600	p.p.s.
Rate of rise of voltage pulse (see note 6)	100	150	kV/μs
Anode temperature (see note 7)	—	150	°C
Cathode terminal temperature (see note 7)	—	150	°C
V.S.W.R. at the output coupler (see note 8)	—	1.5:1	
Pressurising of waveguide (see note 9)	35	65	lb/in^2
	2.46	4.57	kg/cm^2

TYPICAL OPERATION

	M566	M569, M570	
Operational Conditions			
Heater voltage	0	0	V
Magnetic field	1580	1580	gauss
Anode current (peak)	145	140	A
Pulse length	5.0	5.0	μs
Pulse repetition rate	300	300	p.p.s.
Typical Performance			
Anode voltage (peak)	38.5	40	kV
Output power (peak)	2.5	2.5	MW
Output power (mean)	3.75	3.75	kW

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions (See Note 10)

	Oscillation 1	Oscillation 2	Oscillation 3	
Air flow			see note 11	
Magnetic field (see note 12)	1580	1580	1675	gauss
Heater voltage (for test)	0	0	0	V
Anode current (mean):				
M566	218	186	183	mA
M569, M570	210	180	177	mA
Duty cycle	0.0015	0.001	0.0015	
Pulse length (see note 5)	2.5	5.0	5.0	μs
V.S.W.R. at the output coupler			see note 13	
Rate of rise of voltage pulse (see note 6)	72 to 90	150 to 180	113 to 137	kV/μs

Limits

	Min	Max	Min	Max	Min	Max	
Anode voltage (peak):							
M566	36.5	40.5	—	—	—	—	kV
M569, M570	38	42	—	—	—	—	kV
Output power (mean)	3375	—	—	—	—	—	W
Frequency:							
M566	2750	2860	—	—	—	—	MHz
M569	2850	2960	—	—	—	—	MHz
M570	2950	3060	—	—	—	—	MHz
R.F. bandwidth at ¼ power (see notes 14 and 15)	—	1.0	—	0.5	—	0.5	MHz
Frequency pulling (see note 14)	—	7.0	—	—	—	—	MHz
Frequency pushing (see note 16)	—	1.0	—	—	—	—	MHz
Stability (see notes 14, 15 and 17)	—	0.5	—	0.5	—	0.5	%
Heater current					see note 18		
Temperature coefficient of frequency					see note 19		

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	1580	gauss
Anode current (mean):		
M566	218	mA
M569, M570	210	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 14 and 15)	1.0	MHz max
Frequency: must be within Test Limits above, Oscillation 1		
Stability (see notes 14, 15 and 17)	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 following 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. The current required to give a field of 1580 gauss is marked on each M4017 electro-magnet assembly. Arrangements should be made for the magnetron input pulse to be switched off if the electro-magnet current varies by more than ±5% from this value.

   The ripple on the electro-magnet current should not exceed 1.5% overall. A three phase full wave rectifier output is normally suitable.

3. Measured at the point specified on the electro-magnet and launching section (page 12).

4. 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.

5. Tolerance ±10%.

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

7. Measured at the point indicated on the outline drawing.

8. In order to prevent malfunction, e.g. spectrum degradation, it is necessary to control the load v.s.w.r. in certain frequency bands other than the operating band; it is also necessary to avoid high Q resonances at frequencies adjacent to these band edges. The use of an isolator of approved design will facilitate the realization of these conditions.

Type	Frequency band (MHz)	Maximum V.S.W.R.
M566	3000 to 3100	2.0:1
	3450 to 3560	1.5:1
M569	3100 to 3200	2.0:1
	3450 to 3560	1.5:1
M570	3200 to 3300	2.0:1
	3510 to 3660	1.5:1

9. 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.

10. 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.

11. 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.

12. The value of the axial magnetic field shall fall to between 87.5% and 92% of the value at the specified point at points distant ±2 inches along

the magnetron axis from the specified point. 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.

13. 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 the following frequencies unless otherwise specified.

M566	**M569**	**M570**
3000 to 3100MHz	3100 to 3200MHz	3200 to 3300MHz

14. 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-C' (see page 12) the position of the voltage minimum at a frequency of 3050MHz for M566, 3150MHz for M569, and 3250MHz for M570, shall lie between ±10mm from the Reference Plane.

15. 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.

16. The change in frequency when the mean input current is varied between the limits of 202 and 233mA for M566, and between the limits of 195 and 225mA for M569 and M570, shall be less than 1MHz. The current shall be varied continuously between the limits with a period not exceeding 5 seconds.

17. 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.

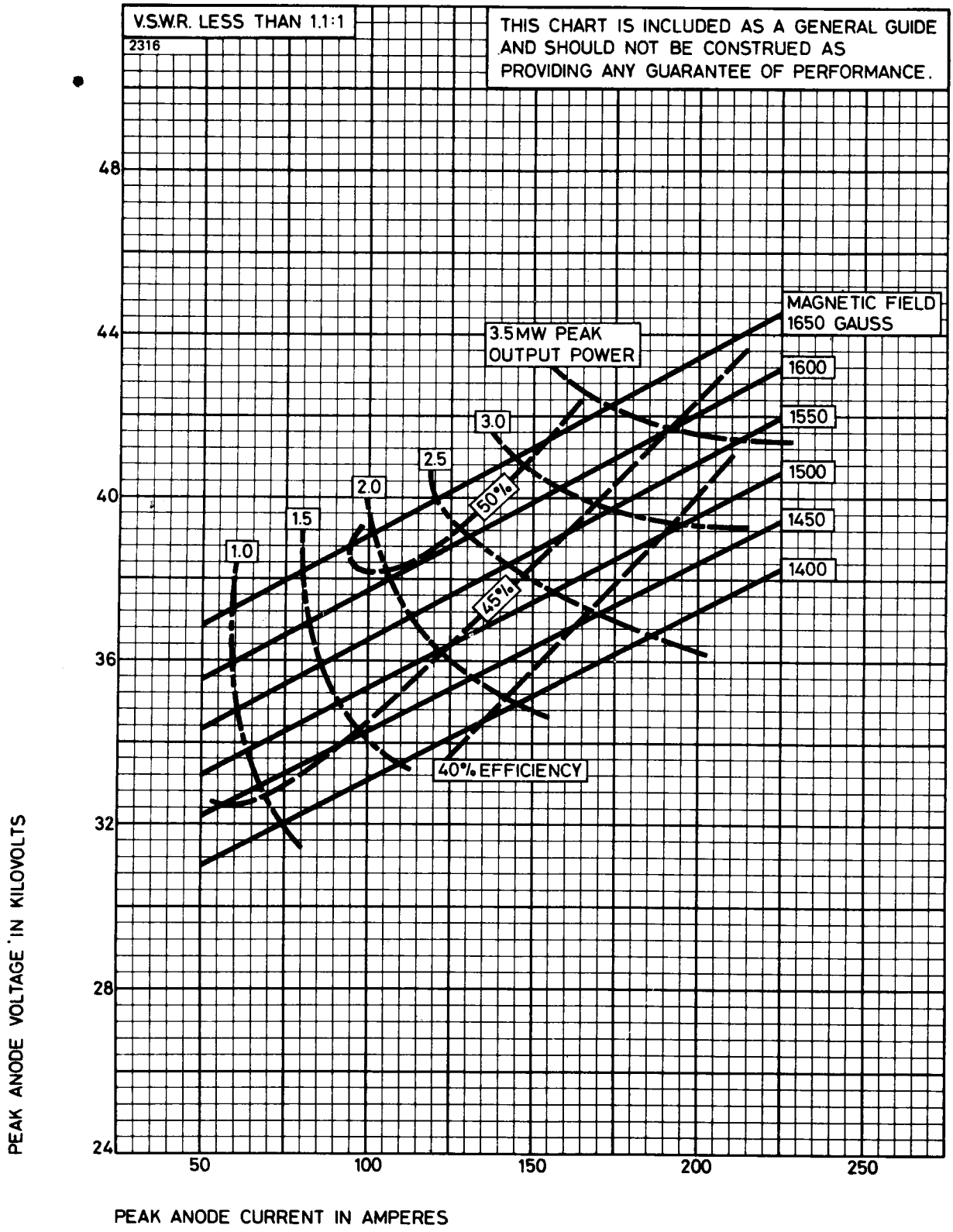
18. Measured with heater voltage of 12V and no anode input power, the heater current limits are 13A minimum, 15A maximum.

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

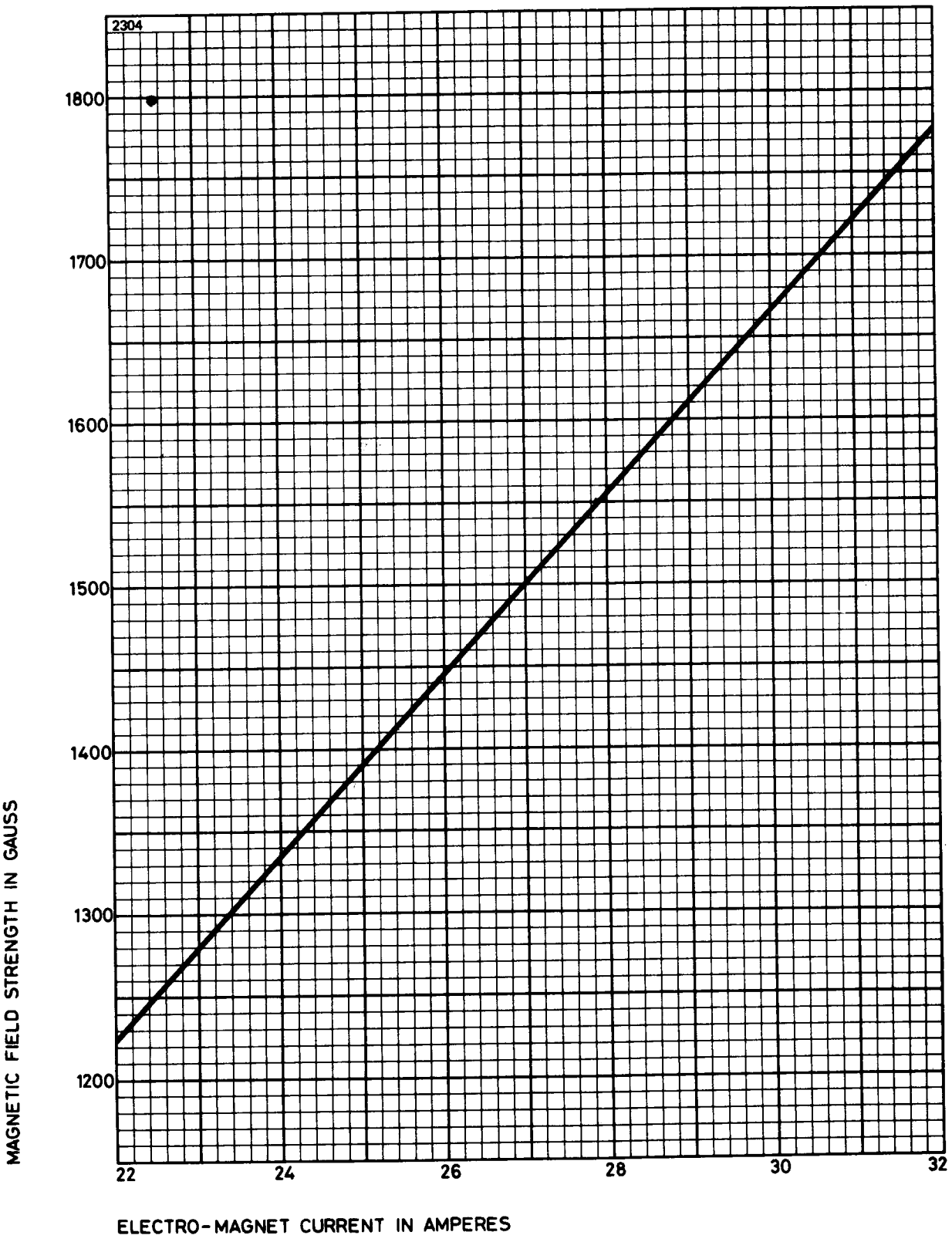
X-RAY WARNING

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 M569

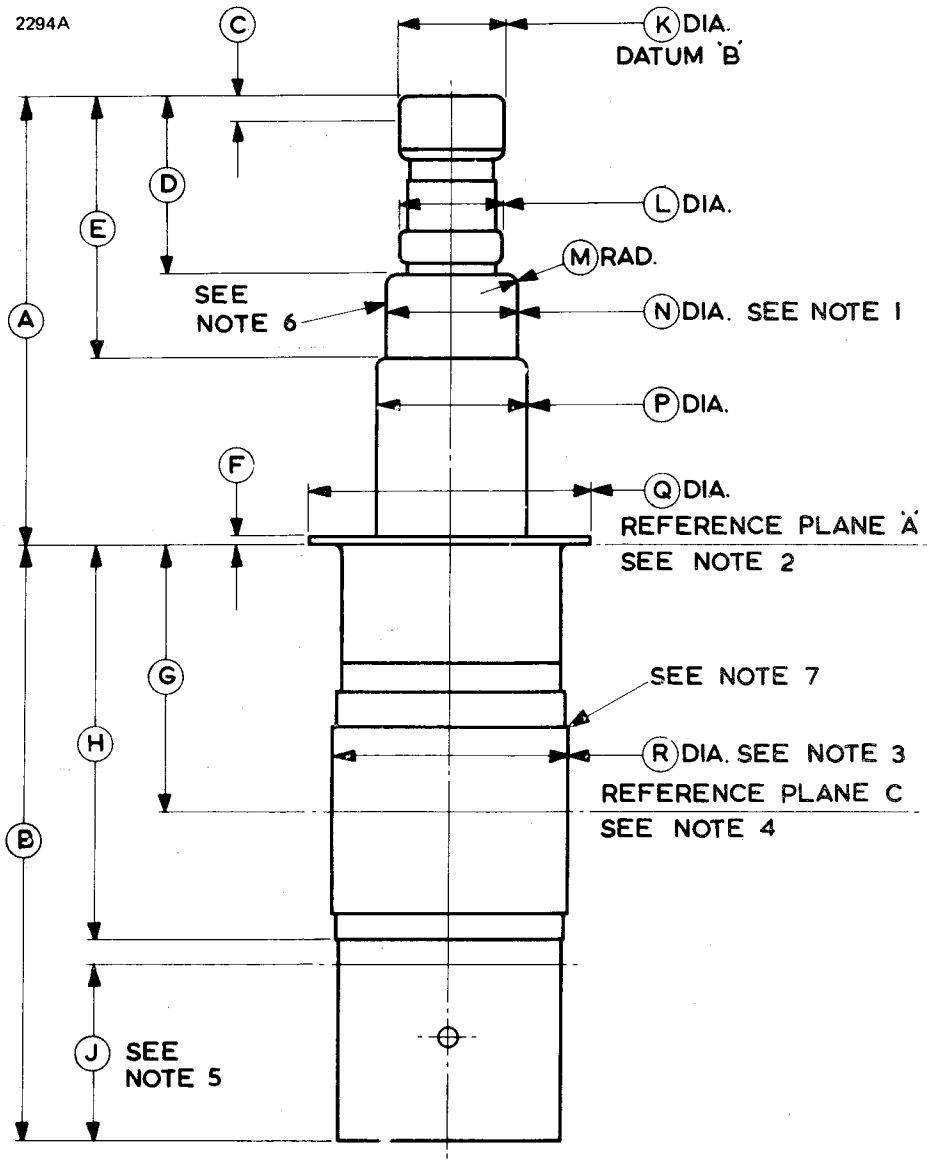


TYPICAL CURRENT CHARACTERISTIC FOR M4017



An individual calibration curve is supplied with each M4017 (see note 2 on page 6 also). Other types of electro-magnet will require calibration.

OUTLINE


2294A
C
K DIA.
DATUM 'B'
D
L DIA.
E
M RAD.
SEE
NOTE 6
A
N DIA. SEE NOTE 1
P DIA.
F
Q DIA.
REFERENCE PLANE 'A'
SEE NOTE 2
G
SEE NOTE 7
H
R DIA. SEE NOTE 3
REFERENCE PLANE C
SEE NOTE 4
B
J SEE
NOTE 5

OUTLINE DIMENSIONS

Ref	Inches	Millimetres
A	6.427 max	163.2 max
B	8.514	216.3
C	0.375 min	9.53 min
D	3.063 max	77.80 max
E	3.563 min	90.50 min
F	0.125 ± 0.005	3.18 ± 0.13
G	3.939	100.1
H	5.689	144.5
J	2.500 min	63.50 min
K	1.500 ± 0.010	38.10 ± 0.25
L	1.550 max	39.37 max
M	0.100 min	2.54 min
N	1.750 ± 0.010	44.45 ± 0.25
P	1.937 max	49.20 max
Q	3.995 ± 0.005	101.5 ± 0.13
R	3.251 max	82.58 max

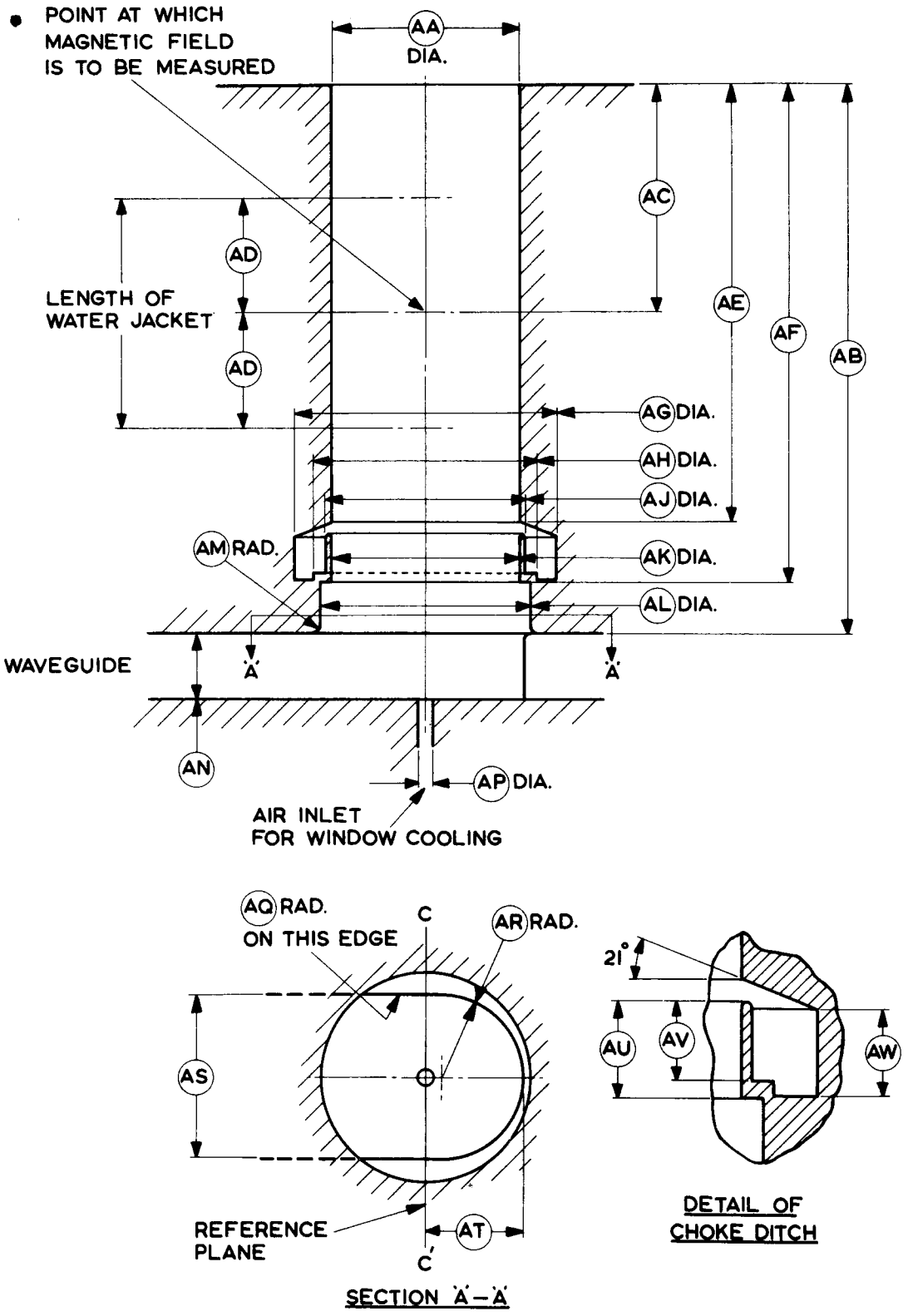
Millimetre dimensions have been derived from inches.

OUTLINE NOTES

1. Concentric tolerance 0.050 inch (1.27mm) diameter, Datum 'B' B.S.308-1953.
2. This plane will be square to the axis of diameter 'R' to within 10'.
3. This surface will be silver or nickel plated.
4. Reference plane 'C' is the plane at which the magnetic field is measured. The magnetic field must be within the specified limits for an axial distance of ±2.000 inches (50.80mm) from plane 'C' and the valve must be fitted into a water jacket 3.253 ± 0.001 inches (82.626 ± 0.025mm) diameter which extends for ±2.000 inches (50.80mm) from plane 'C'.
5. The diameter over dimension 'J' will be 3.200 ± 0.010 inches (81.28 ± 0.25mm).
6. Cathode terminal temperature measured here.
7. Anode temperature measured here.
8. All metal surfaces will be silver or nickel plated or black finish.

CROSS SECTION OF SUITABLE ELECTRO-MAGNET AND LAUNCHING SECTION

2295

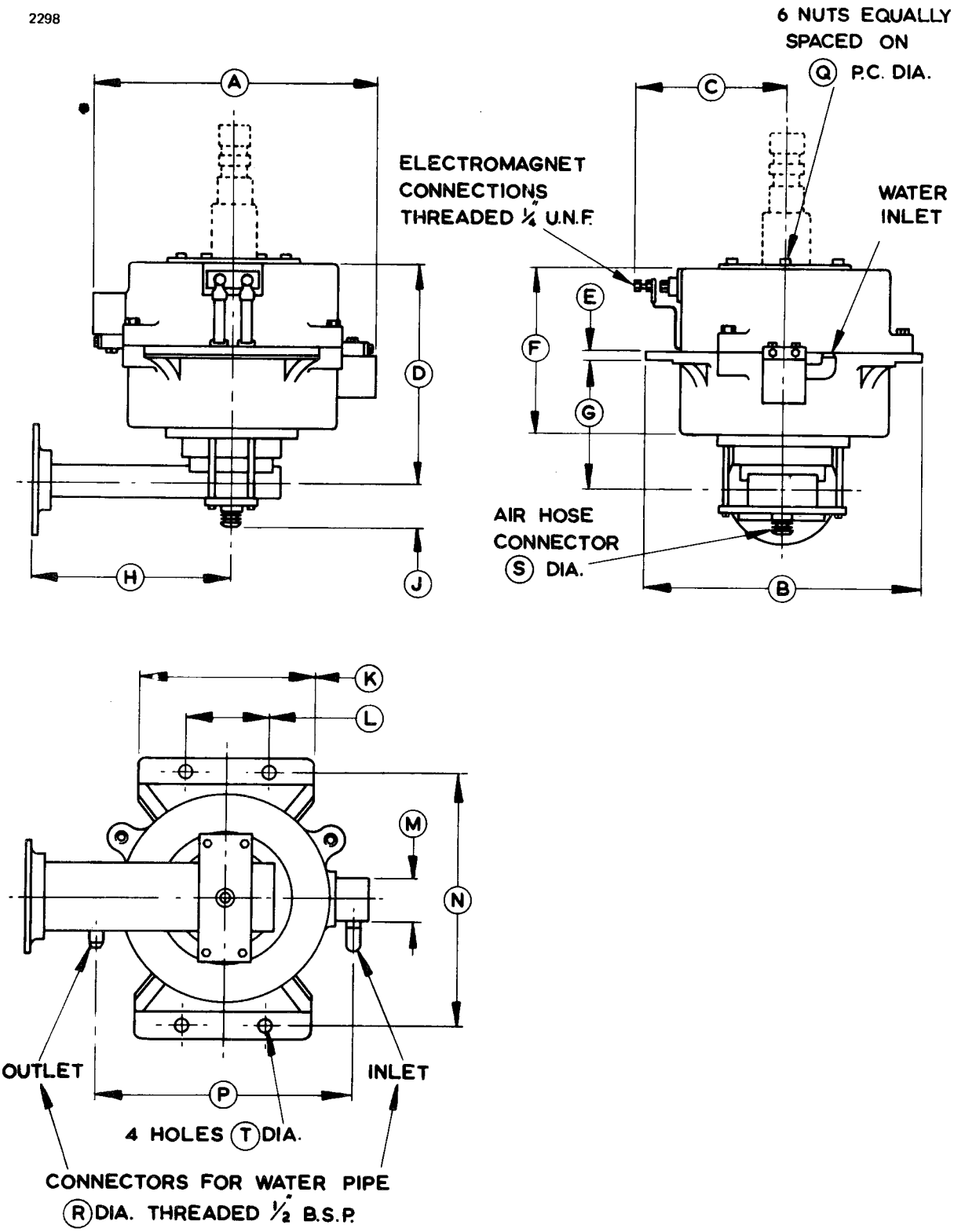


DIMENSIONS FOR ELECTRO-MAGNET AND LAUNCHING SECTION

Ref	Inches	Millimetres
AA	3.253 ± 0.001	82.626 ± 0.025
AB	9.551	242.6
AC	3.939	100.1
AD	2.000 min	50.80 min
AE	7.637	194.0
AF	8.601	218.5
AG	4.340 ± 0.005	110.2 ± 0.13
AH	3.713 ± 0.003	94.310 ± 0.076
AJ	3.410 ± 0.005	86.61 ± 0.13
AK	3.250 ± 0.005	82.55 ± 0.13
AL	3.625 ± 0.003	92.075 ± 0.076
AM	0.125	3.18
AN	1.340	34.04
AP	0.250	6.35
AQ	0.125	3.18
AR	1.417 ± 0.005	35.99 ± 0.13
AS	2.840	72.14
AT	1.667 ± 0.010	42.34 ± 0.25
AU	0.813 ± 0.010	20.65 ± 0.25
AV	0.688 ± 0.010	17.48 ± 0.25
AW	0.750 ± 0.010	19.05 ± 0.25

Millimetre dimensions have been derived from inches.

OUTLINE FOR M4011

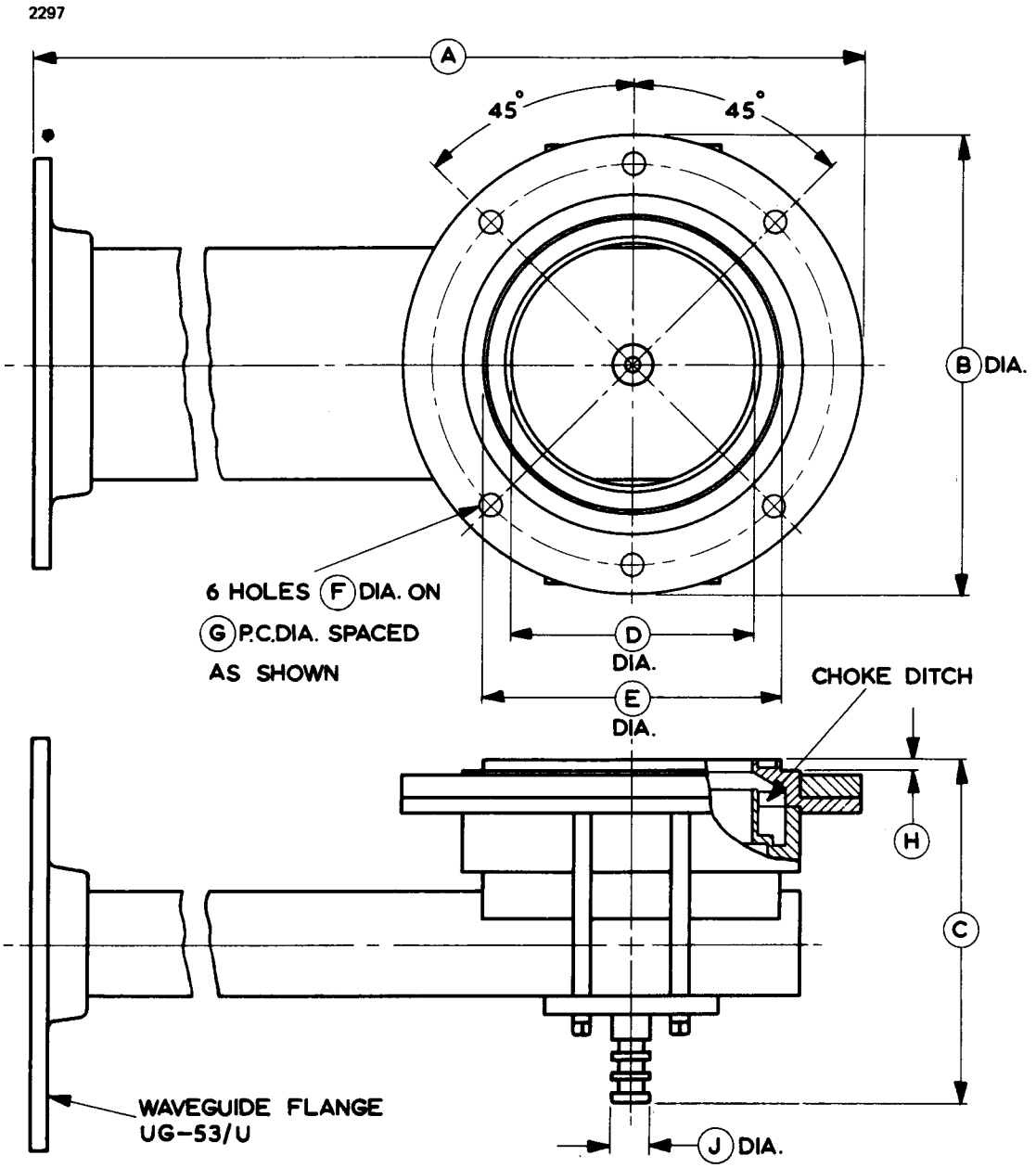


OUTLINE DIMENSIONS FOR M4011

Ref	Inches	Millimetres
A	12.875	327.0
B	12.625	320.7
C	7.000 max	177.8 max
D	10.031	254.8
E	0.375	9.53
F	7.500	190.5
G	5.906	150.0
H	9.000	228.6
J	2.000 max	50.80 max
K	8.000	203.2
L	3.750	95.25
M	2.000	50.80
N	11.625	295.3
P	11.375	288.9
Q	5.250	133.4
R	0.500	12.70
S	0.500	12.70
T	0.406	10.31

Millimetre dimensions have been derived from inches.

OUTLINE FOR M4017



Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	11.969	304.0	F	0.265	6.73
B	5.938	150.8	G	5.250	133.4
C	4.406	111.9	H	$0.140^{+0.005}_{-0.000}$	$3.56^{+0.13}_{-0.00}$
D	3.255	82.68			
E	3.865 ± 0.002	98.17 ± 0.25	J	0.500	12.70

Millimetre dimensions have been derived from inches.

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/in^2
	2.46	4.57	kg/cm^2

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:

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

where Pi = 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.

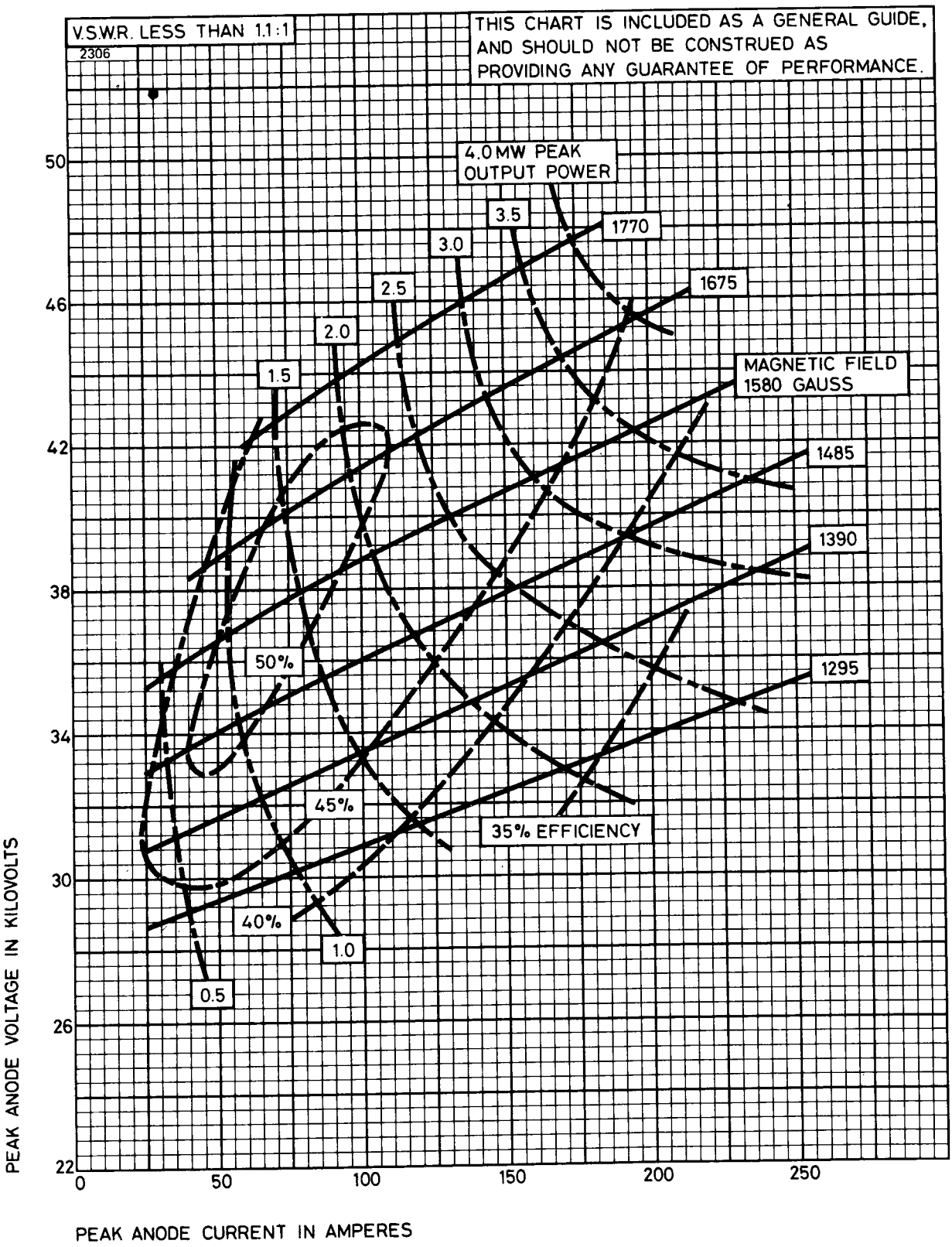
16. Measured with heater voltage of 12V and no anode input power, the heater current limits are 13A minimum, 15A maximum.

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

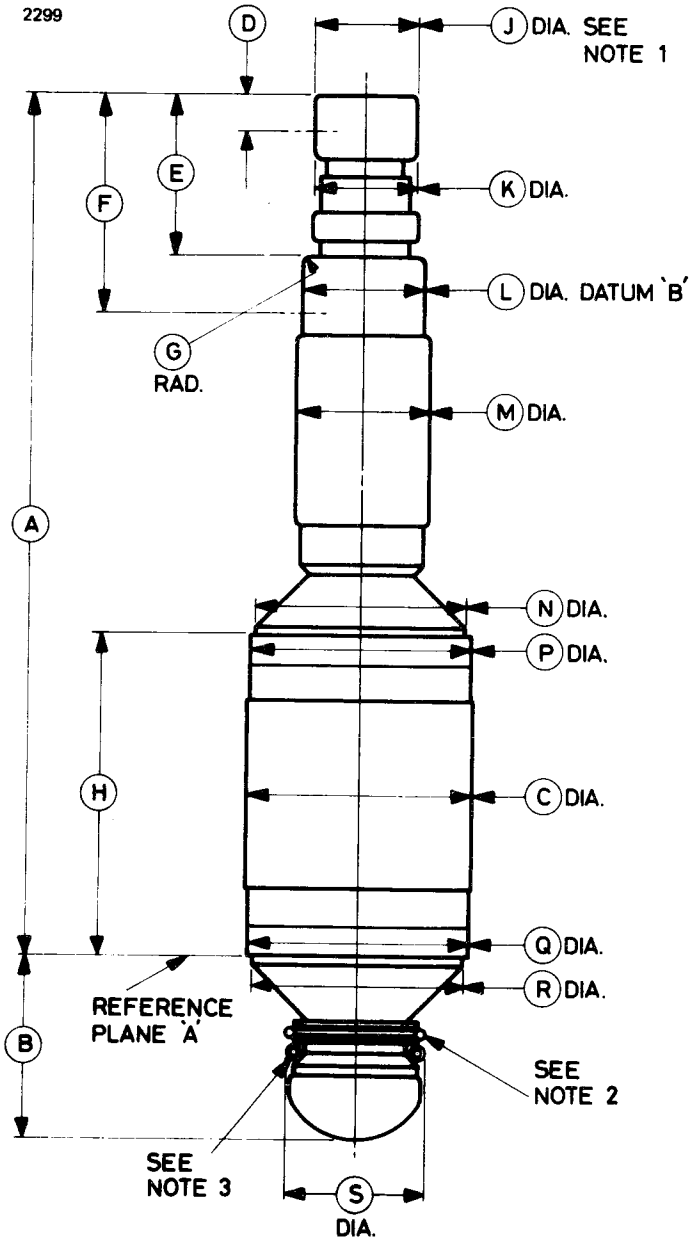
X-RAY WARNING

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

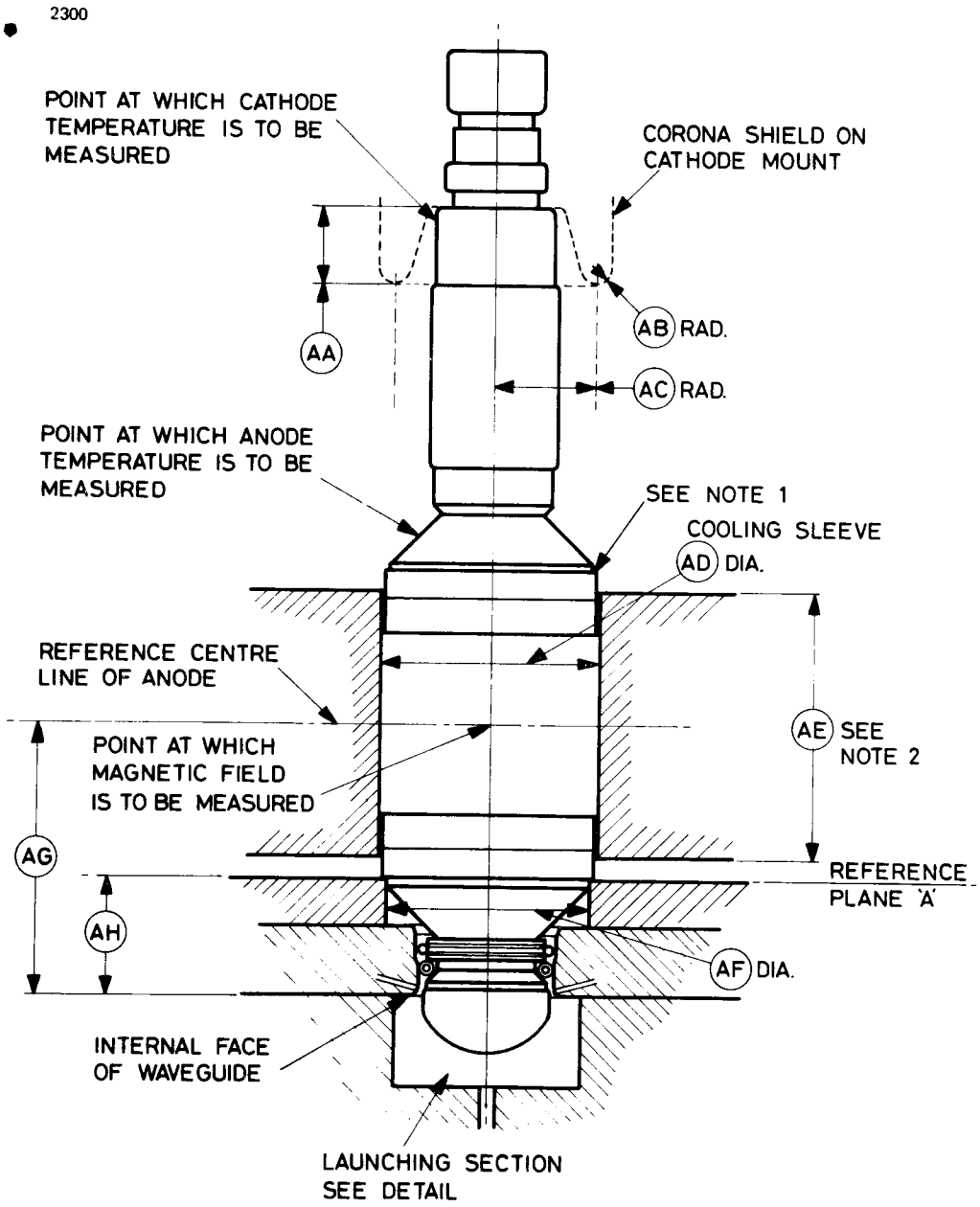
Millimetre dimensions have been derived from inches.

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

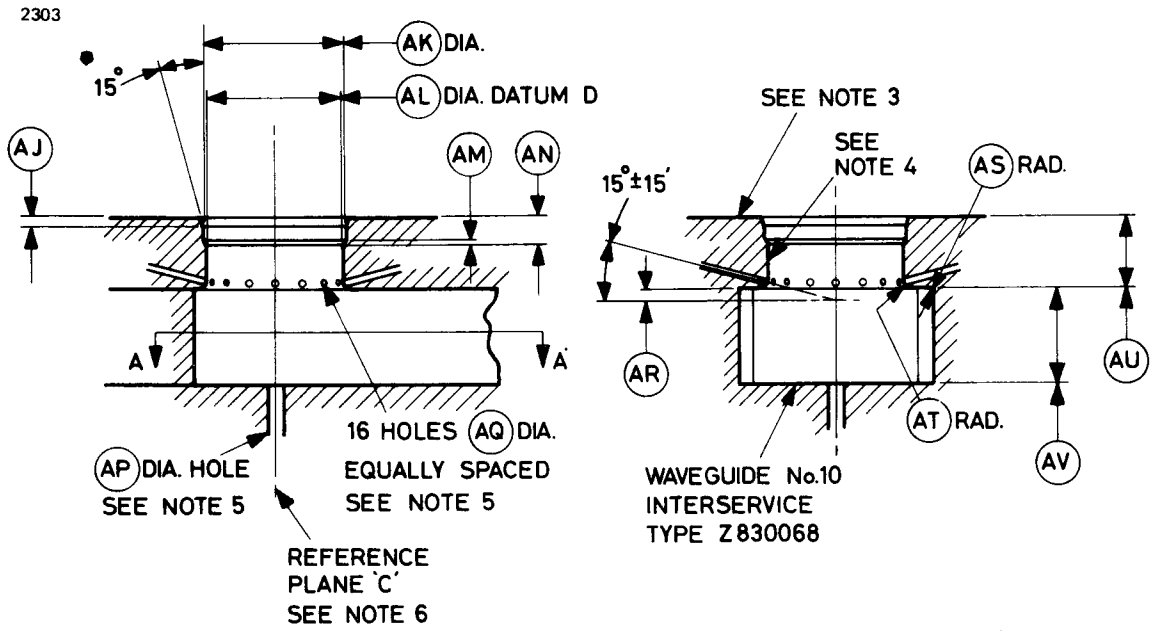
Millimetre dimensions have been derived from inches.

NOTES FOR ELECTRO-MAGNET AND LAUNCHING SECTION

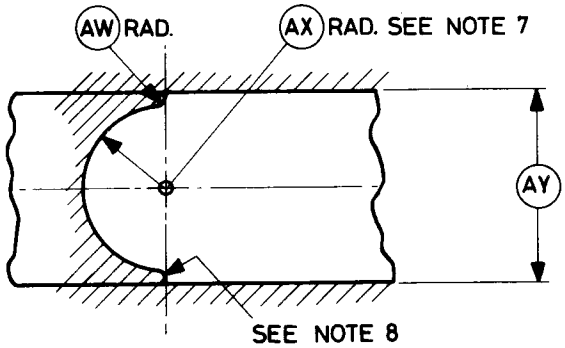
1. An adjustable device shall be used to bear on this shoulder and to ensure that the magnetron locates on reference plane 'A'. It must be able to withstand the thrust on the magnetron due to a pressure of 65 lb/in^2 absolute in the waveguide.
2. The length of the water jacket centre line to be within 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



M577B M578B

S-BAND MAGNETRONS

Service Type CV10210 (M577B)

ABRIDGED DATA

Fixed frequency pulse magnetrons, replacing types M577, M577A and M578, M578A. Frequency variants of 4J43 and 4J44.

Frequency range:		
M577B	3000 to 3040	MHz
M578B	3060 to 3100	MHz
Typical peak output power	900	kW
Magnet	separate, see note 8 on page 5	
Output	coaxial line; internal diameter of outer conductor 1.527 inches, diameter of inner conductor 0.625 inch	
Coupler	see page 7	
Cooling	forced-air	

GENERAL

Electrical

Cathode	indirectly heated	
Heater voltage (see note 1)	16	V
Heater current	3.1	A
Heater starting current, peak value, not to be exceeded	15	A max
Cathode heating time (minimum) (see note 2)	2	min

Mechanical

Overall dimensions	10.523 x 7.233 x 4.624 inches max 267.3 x 183.7 x 117.5mm max
Net weight	6 pounds (2.8kg) approx
Mounting position	any

Cooling

forced-air

MAXIMUM AND MINIMUM RATINGS (Absolute values)

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

	Min	Max	
Heater voltage (see note 1)	14.4	17.6	V
Heater starting current (peak)	—	15	A
Anode voltage (peak)	—	30	kV
Anode current (peak)	—	70	A
Input power (peak)	—	2.0	MW
Input power (mean) (see note 3)	—	1.2	kW
Duty cycle	—	0.001	
Pulse length (see note 4)	—	2.5	μs
Rate of rise of voltage pulse (see note 5)	100	200	kV/μs
Anode temperature (see note 6)	—	100	°C
Cathode terminal temperature	—	100	°C
V.S.W.R. at the output coupler	—	1.5:1	
Ambient pressure for satisfactory operation	500	—	mm Hg
Pressurising (see note 7):			
input circuit	—	45	lb/in^2
output circuit	—	45	lb/in^2

TYPICAL OPERATION

Operational Conditions

Heater voltage	10.5	V
Magnetic field (see note 8)	2700	gauss
Anode current (peak)	70	A
Pulse length	1.0	μs
Pulse repetition rate	500	p.p.s.

Typical Performance

Anode voltage (peak)	28	kV
Output power (peak)	900	kW
Output power (mean)	450	W

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions

	Oscillation 1	Oscillation 2	
Magnetic field (see note 8)	2700	2700	gauss
Heater voltage (for test)	10	10	V
Anode current (mean)	35	45	mA
Duty cycle	0.0005	0.0006	
Pulse length (see note 4)	1.0	2.0	μs
V.S.W.R. at the output coupler	1.15:1	1.15:1	
Rate of rise of voltage pulse (see note 5)	200	200	kV/μs

Limits

	Min	Max	Min	Max	
Anode voltage (peak)	26	30	—	—	kV
Output power (mean)	400	—	—	—	W
Frequency:					
M577B	3000	3040	—	—	MHz
M578B	3060	3100	—	—	MHz
R.F. bandwidth at ¼ power	—	2.5	—	—	MHz
Frequency pulling (v.s.w.r. not less than 1.5:1)	—	15	—	—	MHz
Stability (see note 9)	—	0.5	—	0.5	%
Heater current				see note 10	
Temperature coefficient of frequency				see note 11	

LIFE TEST

The quality of all production is monitored by the random selection of valves which are then life-tested under Oscillation 1 conditions above. 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.

End of Life Criteria (under Test Conditions Oscillation 1)

Output power (mean)	320	W min
R.F. bandwidth at ¼ power	2.5	MHz max
Stability (see note 9)	1.0	% max

NOTES

1. (a) With no anode input power.

During high voltage operation it is essential to operate the heater according to the following schedule:

Mean Input Power (W)	Heater Voltage (V)
1000–1200	8.0
800–1000	10.5
600–800	13.0
400–600	15.0
less than 400	16.0

The above schedule is valid only for pulse repetition rates of 300p.p.s. or higher.

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.

(b) M577B and M578B have hum-free heaters and have been tested for satisfactory operation with sinusoidal heater supply voltages of frequency 50, 60 and 500Hz. English Electric Valve Company Ltd. should be consulted if other supply frequencies are to be used. Where complete freedom from frequency modulation is essential, the use of a d.c. heater supply is recommended.

2. For ambient temperatures above 0°C. For ambient temperatures between 0 and −55°C the cathode heating time is 3 minutes minimum.

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

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

where Pi = 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 ±10%.

5. 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.

6. The anode temperature must be kept below the limit specified by means of a suitable flow of air over the cooling fins.

7. The mounting plate and the guard pipe are fitted to the valve in a manner to permit pressurising of the input circuit and the output circuit of the valve. At the maximum pressure of 45lb/in^2 absolute, the leakage will not exceed 0.5 litre (N.T.P.) per minute.

8. The valve is designed for use with a separate magnet which must conform with the specification given at the top of page 11. The axis of the magnetic field must be coincident with the axis of the anode, and the north pole of the magnet must be adjacent to the cathode terminal. A suitable magnet, type MA228, is available.

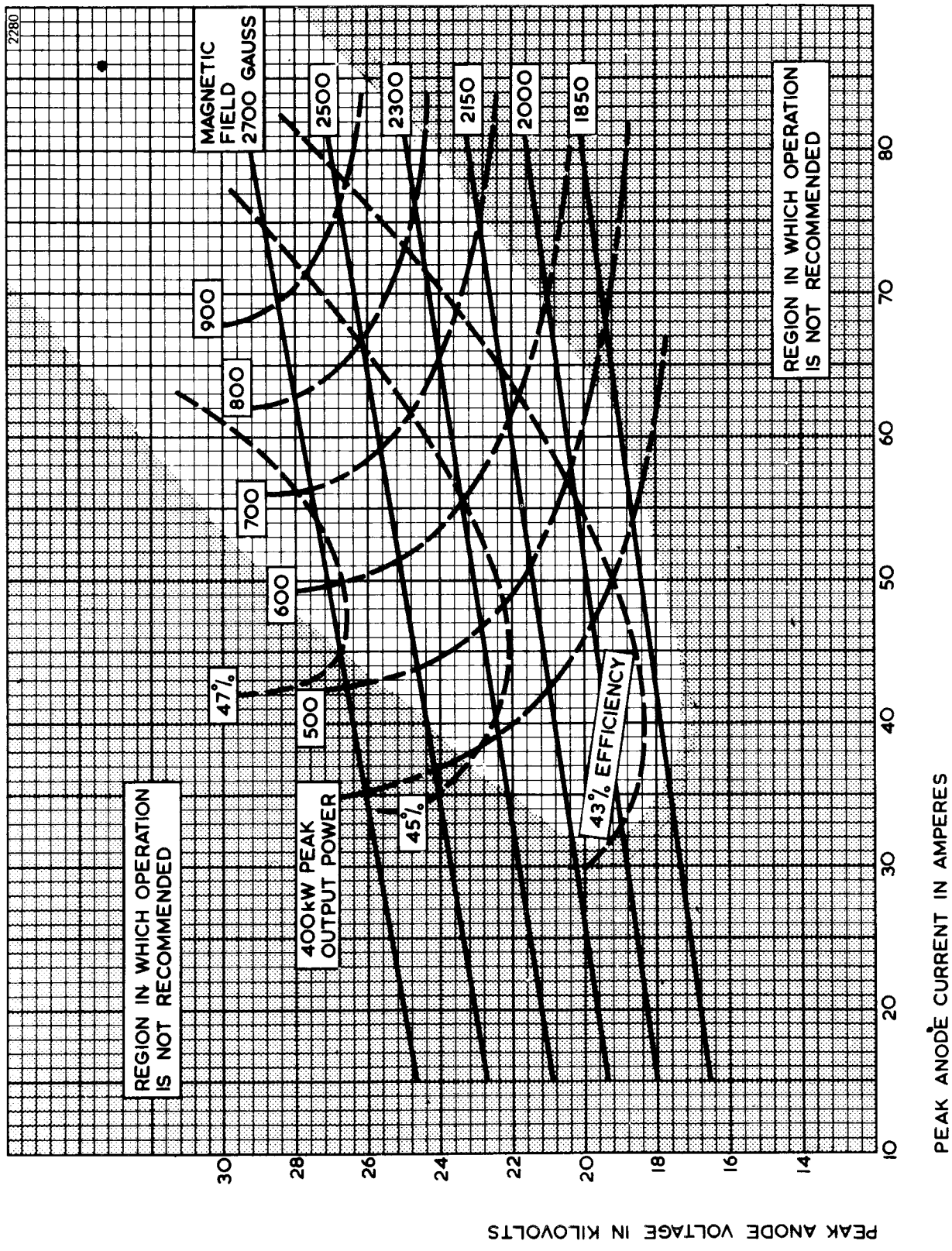
   If an electro-magnet is used, the pole tip dimensions should be as shown on page 11.

9. With the valve operating into a mismatch of v.s.w.r. 1.5:1, phased to give maximum instability. 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 valve. Missing pulses are expressed as a percentage of the number of input pulses applied during the last 30 seconds of a test interval not to exceed 5 minutes.

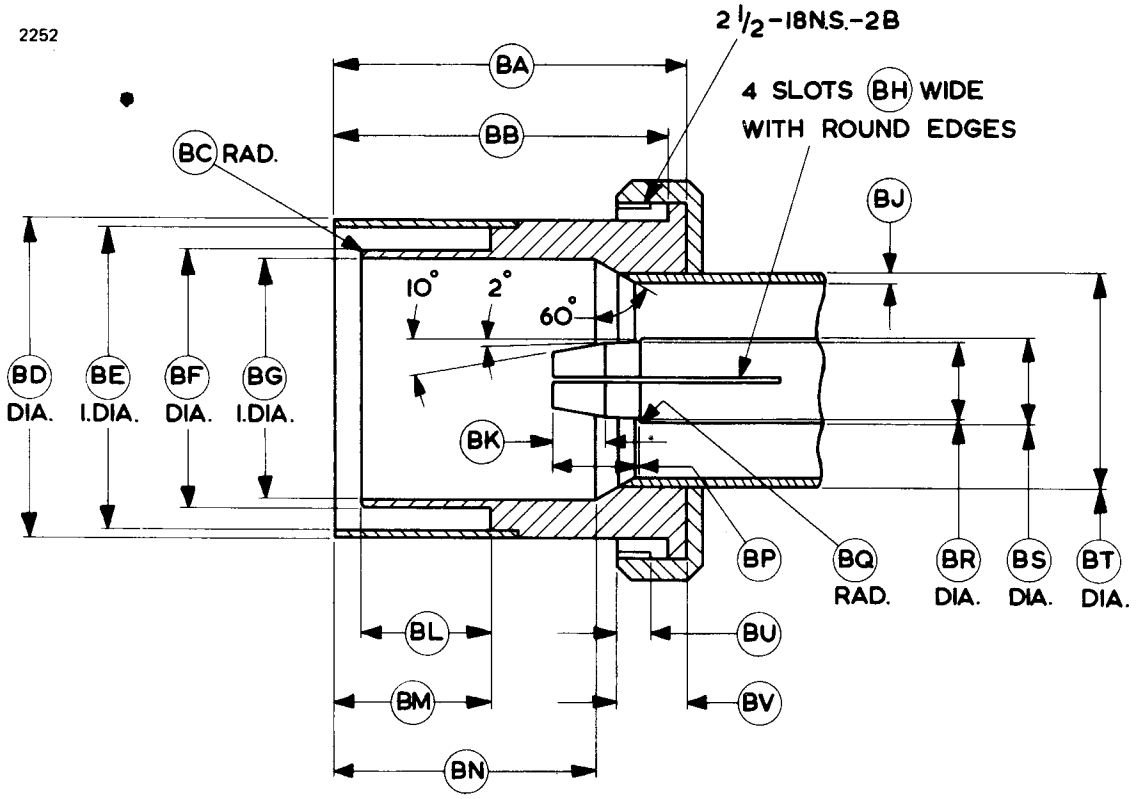
10. Measured with heater voltage of 16V and no anode input power, the heater current limits are 2.8A minimum, 3.4A maximum.

11. Design test only. The maximum frequency change with anode temperature change (after warming) is -0.07MHz/°C.

PERFORMANCE CHART



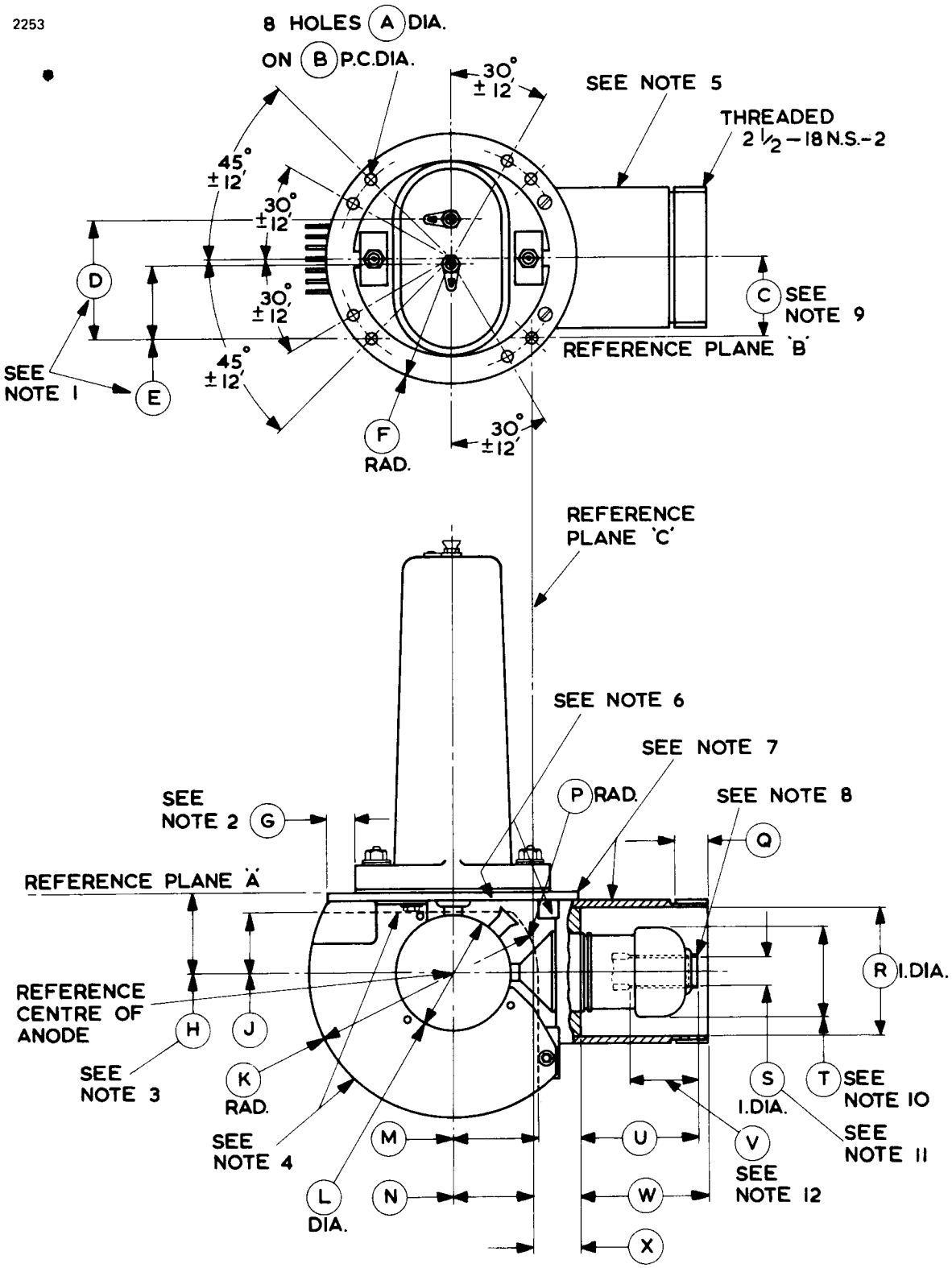
COUPLER



Ref	Inches	Millimetres	Ref	Inches	Millimetres
BA	2.531 ± 0.015	64.29 ± 0.38	BL	0.937 ± 0.003	23.800 ± 0.076
BB	2.402 ± 0.005	61.01 ± 0.13	BM	1.125 ± 0.003	28.575 ± 0.076
BC	0.031 ± 0.015	0.79 ± 0.38	BN	1.875 ± 0.005	47.63 ± 0.13
BD	2.310 ± 0.002	58.674 ± 0.051	BP	0.625 ± 0.015	15.88 ± 0.38
BE	2.185 ± 0.002	55.499 ± 0.051	BQ	0.016 ± 0.015	0.41 ± 0.38
BF	1.875 ± 0.002	47.625 ± 0.051	BR	0.576 ± 0.002	14.630 ± 0.051
BG	1.720 ± 0.002	43.688 ± 0.051	BS	0.625	15.88
BH	0.030	0.76	BT	1.625	41.28
BJ	0.049	1.24	BU	0.250 ± 0.015	6.35 ± 0.38
BK	0.375 ± 0.015	9.53 ± 0.38	BV	0.500 ± 0.015	12.70 ± 0.38

Millimetre dimensions have been derived from inches

OUTLINE (See page 10 for outline notes)

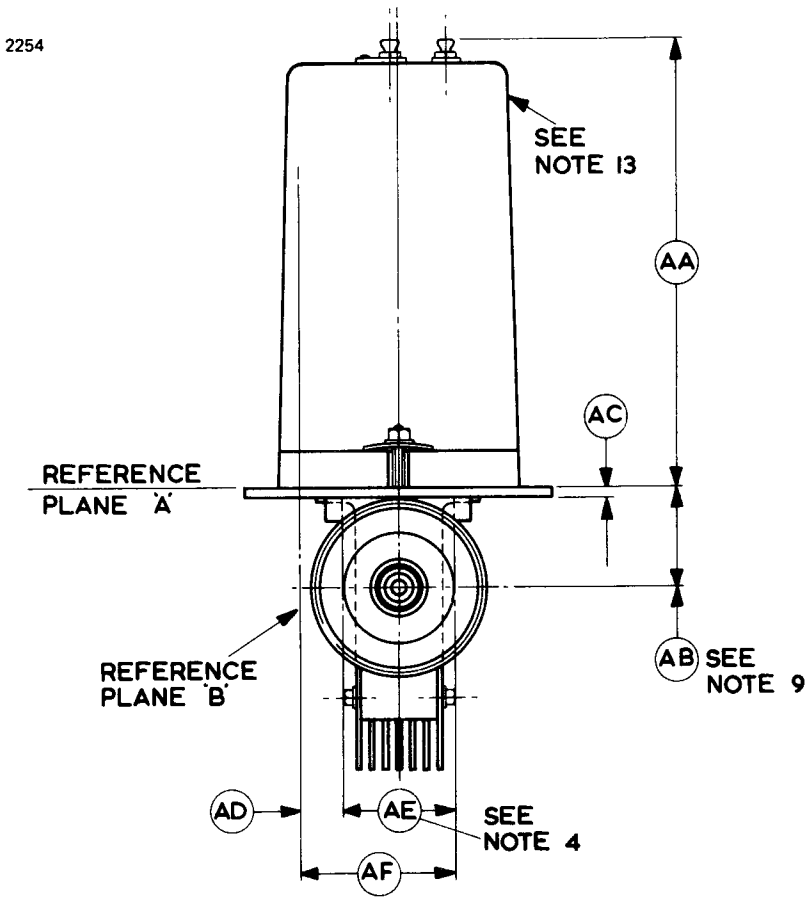


OUTLINE DIMENSIONS

Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	0.210 ± 0.005	5.33 ± 0.13	Q	0.593 min	15.06 min
B	2.032 ± 0.003	51.613 ± 0.076	R	2.321 ± 0.007	58.95 ± 0.18
C	1.437 ± 0.020	36.50 ± 0.51	S	0.555 ± 0.005	14.10 ± 0.13
D	2.156	54.76	T	1.620 max	41.15 max
E	1.359	34.52	U	2.085 ± 0.025	52.96 ± 0.64
F	2.281 ± 0.031	57.94 ± 0.79	V	1.125 min	28.58 min
G	0.500 min	12.70 min	W	2.297 ± 0.010	58.34 ± 0.25
H	1.440	36.58	X	0.818 ± 0.015	20.78 ± 0.38
J	1.063 min	27.00 min	AA	6.313 ± 0.094	160.35 ± 2.39
K	2.656 max	67.46 max	AB	1.440 ± 0.020	36.58 ± 0.51
L	2.062	52.37	AC	0.187	4.75
M	1.500 min	38.10 min	AD	0.677 min	17.20 min
N	1.437	36.50	AE	1.490 max	37.85 max
P	1.500 min	38.10 min	AF	2.197 max	55.80 max

Millimetre dimensions have been derived from inches.

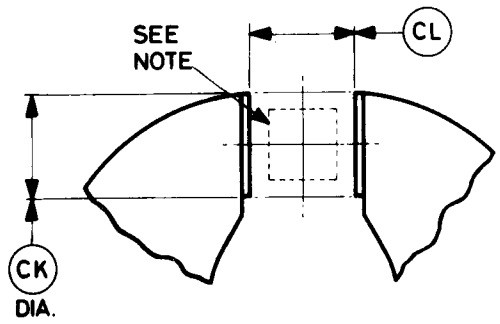
OUTLINE



OUTLINE NOTES

1. The centres of the jack holes will be within a radius of 0.100 inch (2.54mm) of the location specified, but spaced 0.797 ± 0.015 inch (20.24 ± 0.38mm) with respect to each other.
2. With the valve resting on a plane surface, the flatness of this annular area will be such that a feeler gauge 0.015 inch (0.38mm) thick and 0.125 inch (3.18mm) wide will not enter more than 0.250 inch (6.35mm) at any point.
3. The periphery of the anode will lie within a 2.160 inch (54.86mm) diameter circle located as specified.
4. The maximum width specified by dimension 'AE' applies to the area defined by the broken line and the circumference of the radiator.
5. The valve will be painted with black, heat resisting, non-corrosive paint, except for the following paint free areas: top surface of mounting plate, parts above mounting plate, screw threads on guard pipe and all surfaces inside the guard pipe.
6. All joints on the mounting plate and guard pipe will be soldered to provide hermetic seals.
7. The valve may be supported by the mounting plate or guard pipe.
8. There will be no sharp edges on the outside diameter at the end of the inner conductor.
9. Applies to the location of the centre line of the guard pipe.
10. The centre line of the glass portion will be concentric with the centre line of the guard pipe to within 0.040 inch (1.02mm).
11. Applies to the inner conductor insert only. The centre line of the inner conductor insert will be concentric with the centre line of the guard pipe to within 0.025 inch (0.64mm).
12. Applies to the straight portion of the inner conductor wall.
13. The common cathode connection is indicated by letter C.

PERMANENT MAGNET SPECIFICATION



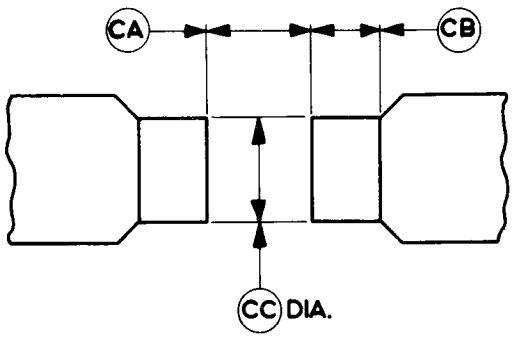
Ref	Inches	Millimetres
CK	1.500	38.10
CL	$1.500^{+0.010}_{-0.000}$	$38.10^{+0.25}_{-0.00}$

Millimetre dimensions have been derived from inches.

Note The variation of magnetic field within a cylinder 1.000 inch (25.4mm) long and 0.900 inch (22.86mm) diameter situated centrally and coaxially between the poles must not exceed ±140 gauss.

ELECTRO-MAGNET POLE PIECES

2255



Ref	Inches	Millimetres
CA	$1.500^{+0.005}_{-0.000}$	$38.10^{+0.13}_{-0.00}$
CB	1.000 min	25.40 min
CC	1.500 ± 0.010	38.10 ± 0.25

Millimetre dimensions have been derived from inches.

M579

S-BAND MAGNETRON

Frequency variant of M566, M569, M570

ABRIDGED DATA

Fixed frequency pulse magnetron		
Frequency range	3050 to 3160	MHz
Typical peak output power	2.5	MW
Magnet and launching section	separate electromagnet and launching section assembly M4011 (see page 12 also)	
Isolator	use of an isolator is recommended (see note 8, page 6)	
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	15.00 x 4.00 x 4.00 inches max 381 x 102 x 102mm max
Net weight	9¾ pounds (4.5kg) approx
Mounting position	vertical only

Any lubricants used on the anode should be sulphur free.

Electro-magnet and Launching Section

The complete electro-magnet and launching section is designated M4011 (see page 14); the launching section can be supplied as a separate item if required and is designated M4017 (see page 16).

	Min	Max	
D.C. current for 1580 gauss field (see note 2 and page 9)	27	30	A
Resistance of field windings:			
at 20°C	0.9	1.15	Ω
during operation	—	1.65	Ω
Overall dimensions (see page 14)	15.437 x 12.625 x 12.250 inches approx 392 x 320 x 310mm approx		
Net weight	110 pounds (50kg) approx		
Output flange	UG-53/U		

Cooling

The electro-magnet is water cooled and provides cooling for the magnetron anode by conduction through the inner liner of the magnet assembly into which the magnetron fits. The liner is machined to very fine limits and it is essential that the inner surface is carefully cleaned before the magnetron is fitted. Precautions must be taken to ensure that power to the magnetron and the electro-magnet is removed in the event of a cooling water supply failure. A flow of 1.5 imp. gal/min (6.8 l./min) is usually adequate, although this will depend on the method employed for mounting the assembly. The water pressure required for a flow of 1.5 imp. gal/min (6.8 l./min) is 4 lb/in^2 (0.28kg/cm^2) maximum.

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.

The magnetron output window is cooled by air at high pressure in the wave-guide; 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 cathode terminal may be cooled by low pressure air.

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 3)	1200	1675	gauss
Heater voltage (see note 1)	11.4	15.0	V
Heater starting current (peak)	—	40	A
Anode voltage (peak)	27	41.5	kV
Anode current (peak)	70	176	A
Input power (peak)	—	6	MW
Input power (mean) (see note 4)	—	8.5	kW
Duty cycle	—	0.0015	
Pulse length (see note 5)	0.5	5.0	μs
Pulse repetition rate	—	600	p.p.s.
Rate of rise of voltage pulse (see note 6)	100	150	kV/μs
Anode temperature (see note 7)	—	150	°C
Cathode terminal temperature (see note 7)	—	150	°C
V.S.W.R. at the output coupler (see note 8)	—	1.5:1	
Pressurising of waveguide (see note 9)	35	65	lb/in^2
	2.46	4.57	kg/cm^2

TYPICAL OPERATION

Operational Conditions

Heater voltage	0	V
Magnetic field	1580	gauss
Anode current (peak)	145	A
Pulse length	5.0	μs
Pulse repetition rate	300	p.p.s.

Typical Performance

Anode voltage (peak)	38.5	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 10)

	Oscillation 1	Oscillation 2	Oscillation 3	
Air flow			see note 11	
Magnetic field (see note 12)	1580	1580	1675	gauss
Heater voltage (for test)	0	0	0	V
Anode current (mean)	210	180	187	mA
Duty cycle	0.0015	0.001	0.0015	
Pulse length (see note 5)	2.5	5.0	5.0	μs
V.S.W.R. at the output coupler			see note 13	
Rate of rise of voltage pulse (see note 6)	72 to 90	150 to 180	113 to 137	kV/μs

Limits

	Min	Max	Min	Max	Min	Max	
Anode voltage (peak)	38.0	41.5	—	—	—	—	kV
Output power (mean)	3375	—	—	—	—	—	W
Frequency	3050	3160	—	—	—	—	MHz
R.F. bandwidth at ¼ power (see note 14)	—	1.0	—	0.5	—	0.5	MHz
Frequency pulling	—	7	—	—	—	—	MHz
Frequency pushing (see note 15)	—	1.0	—	—	—	—	MHz
Stability (see notes 14 and 16)	—	0.5	—	0.5	—	0.5	%
Heater current					see note 17		
Temperature coefficient of frequency					see note 18		

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 run continuously 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	1580	gauss
Anode current (mean)	218	mA
Duty cycle	0.0015	
Pulse length	5	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 note 14)	1.0	MHz max
Frequency: must be within Test Limits above, Oscillation 1		
Stability (see notes 14 and 16)	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 following 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. The current required to give a field of 1580 gauss is marked on each M4017 electro-magnet assembly. Arrangements should be made for the magnetron input pulse to be switched off if the electro-magnet current varies by more than ±5% from this value.

   The ripple on the electro-magnet current should not exceed 1.5% overall. A three phase full wave rectifier output is normally suitable.

3. Measured at the point specified on the electro-magnet and launching section (page 12).

4. 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.

5. Tolerance ±10%.

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

7. Measured at the point indicated on the outline drawing.

8. In order to prevent malfunction, e.g. spectrum degradation, it is necessary to control the load v.s.w.r. in certain frequency bands other than the operating band; it is also necessary to avoid high Q resonances at frequencies adjacent to these band edges. The use of an isolator of approved design will facilitate the realization of these conditions.

Frequency Band (MHz)	**Maximum V.S.W.R.**
3300 to 3400	2.0:1
3620 to 3730	1.5:1

9. 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.

10. 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.

11. 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.

12. The value of the axial magnetic field shall fall to between 87.5% and 92% of the value at the specified point at points distant ±2 inches along the magnetron axis from the specified point. 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.

13. 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 3300 and 3400MHz, and between 3620 and 3730MHz, unless otherwise specified.

14. 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.

15. The change in frequency when the mean input current is varied between the limits of 202 and 233mA shall be less than 1MHz. The current shall be varied continuously between the limits with a period not exceeding 5 seconds.

16. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal energy level in the frequency range 3050 to 3160MHz. 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.

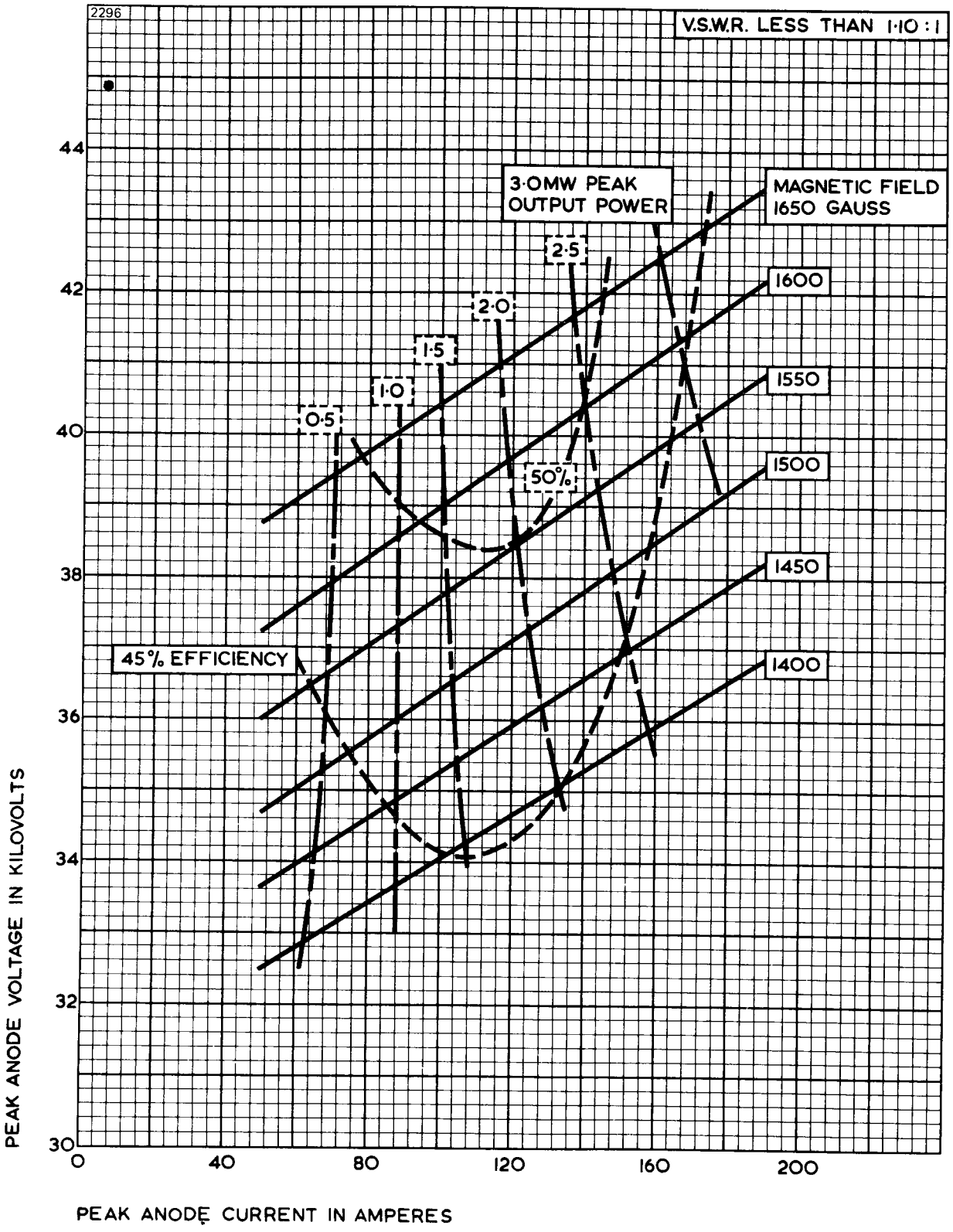
17. Measured with heater voltage of 12V and no anode input power, the heater current limits are 13A minimum, 15A maximum.

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

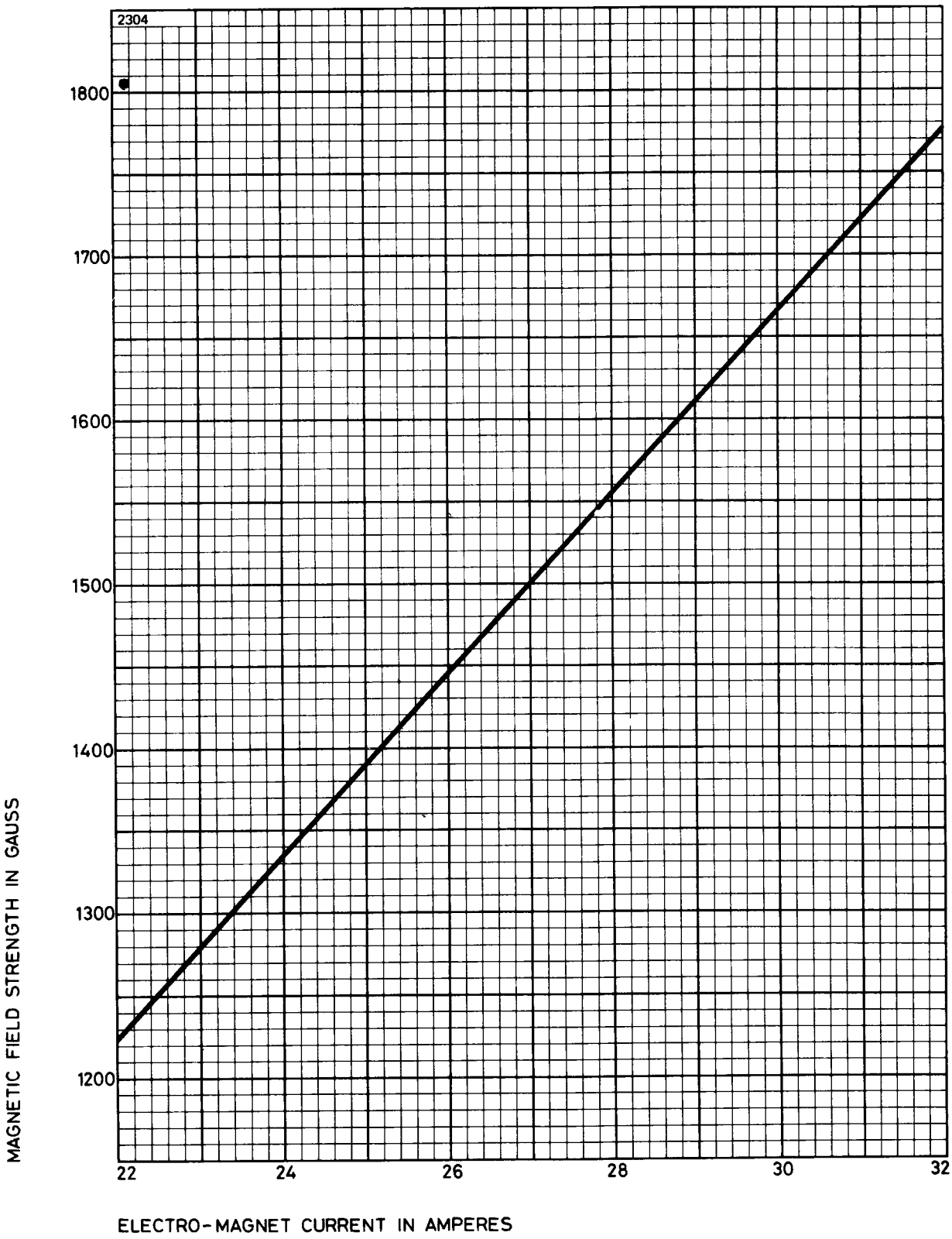
X-RAY WARNING

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

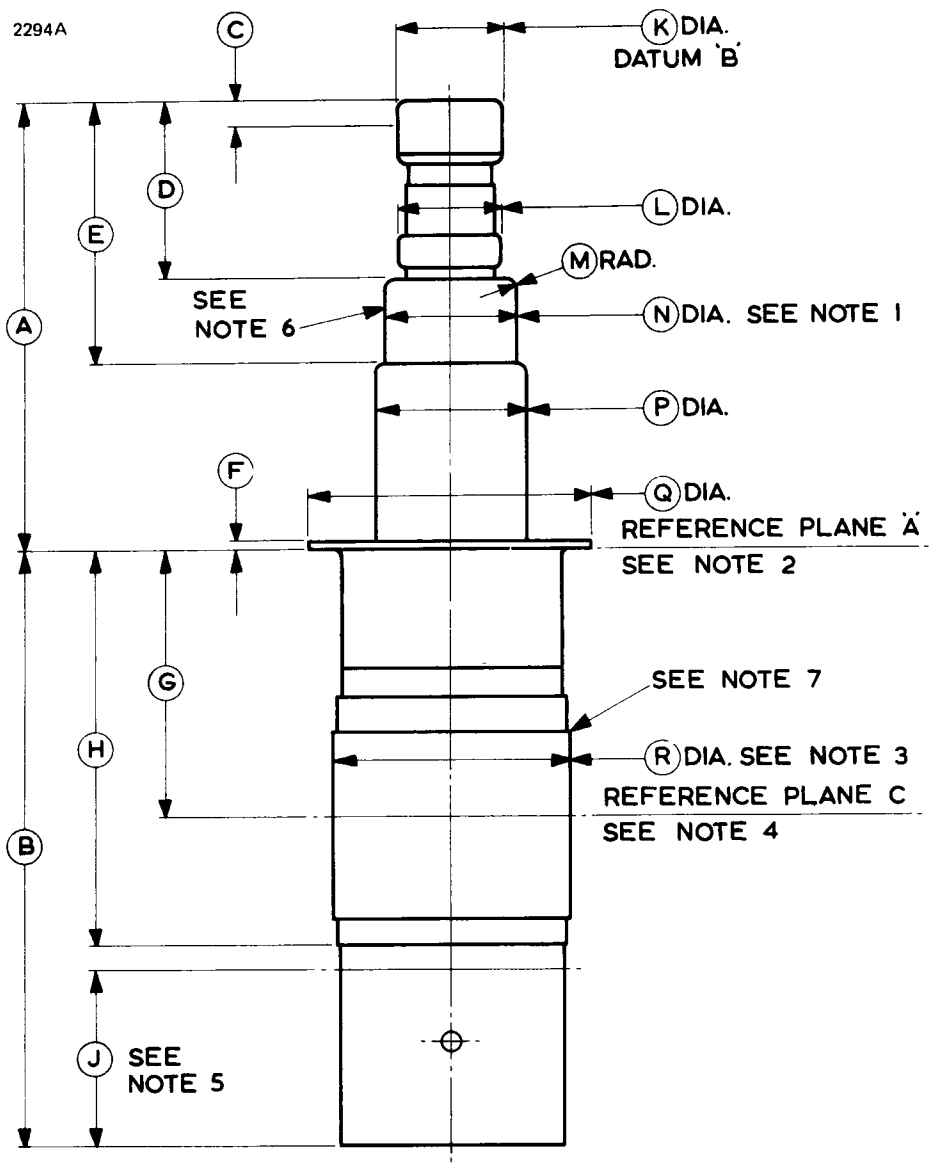


TYPICAL CURRENT CHARACTERISTIC FOR M4017



An individual calibration curve is supplied with each M4017 (see note 2 on page 6 also). Other types of electro-magnet will require calibration.

OUTLINE


2294A
C
K DIA.
DATUM 'B'
D
L DIA.
E
M RAD.
SEE
NOTE 6
A
N DIA. SEE NOTE 1
P DIA.
F
Q DIA.
REFERENCE PLANE 'A'
SEE NOTE 2
G
SEE NOTE 7
H
R DIA. SEE NOTE 3
REFERENCE PLANE C
SEE NOTE 4
B
J SEE
NOTE 5

OUTLINE DIMENSIONS

Ref	Inches	Millimetres
A	6.427 max	163.2 max
B	8.514	216.3
C	0.375 min	9.53 min
D	3.063 max	77.80 max
E	3.563 min	90.50 min
F	0.125 ± 0.005	3.18 ± 0.13
G	3.939	100.1
H	5.689	144.5
J	2.500 min	63.50 min
K	1.500 ± 0.010	38.10 ± 0.25
L	1.550 max	39.37 max
M	0.100 min	2.54 min
N	1.750 ± 0.010	44.45 ± 0.25
P	1.937 max	49.20 max
Q	3.995 ± 0.005	101.5 ± 0.13
R	3.251 max	82.58 max

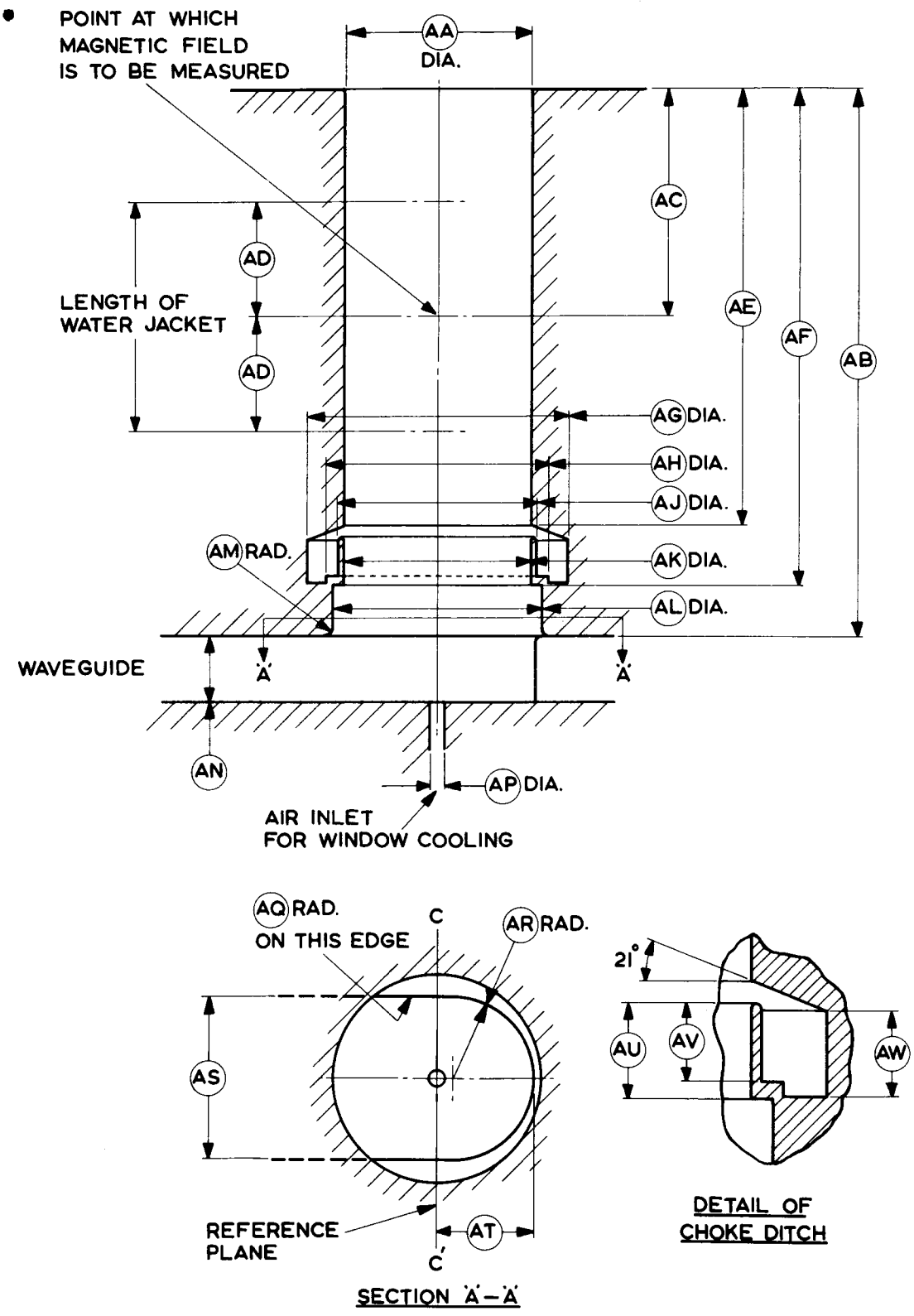
Millimetre dimensions have been derived from inches.

OUTLINE NOTES

1. Concentric tolerance 0.050 inch (1.27mm) diameter, Datum 'B' B.S.308-1953.
2. This plane will be square to the axis of diameter 'R' to within 10'.
3. This surface will be silver or nickel plated.
4. Reference plane 'C' is the plane at which the magnetic field is measured. The magnetic field must be within the specified limits for an axial distance of ±2.000 inches (50.80mm) from plane 'C' and the valve must be fitted into a water jacket 3.253 ± 0.001 inches (82.626 ± 0.025mm) diameter which extends for ±2.000 inches (50.80mm) from plane 'C'.
5. The diameter over dimension 'J' will be 3.200 ± 0.010 inches (81.28 ± 0.25mm).
6. Cathode terminal temperature measured here.
7. Anode temperature measured here.
8. All metal surfaces will be silver or nickel plated or black finish.

CROSS SECTION OF SUITABLE ELECTRO-MAGNET AND LAUNCHING SECTION

2295

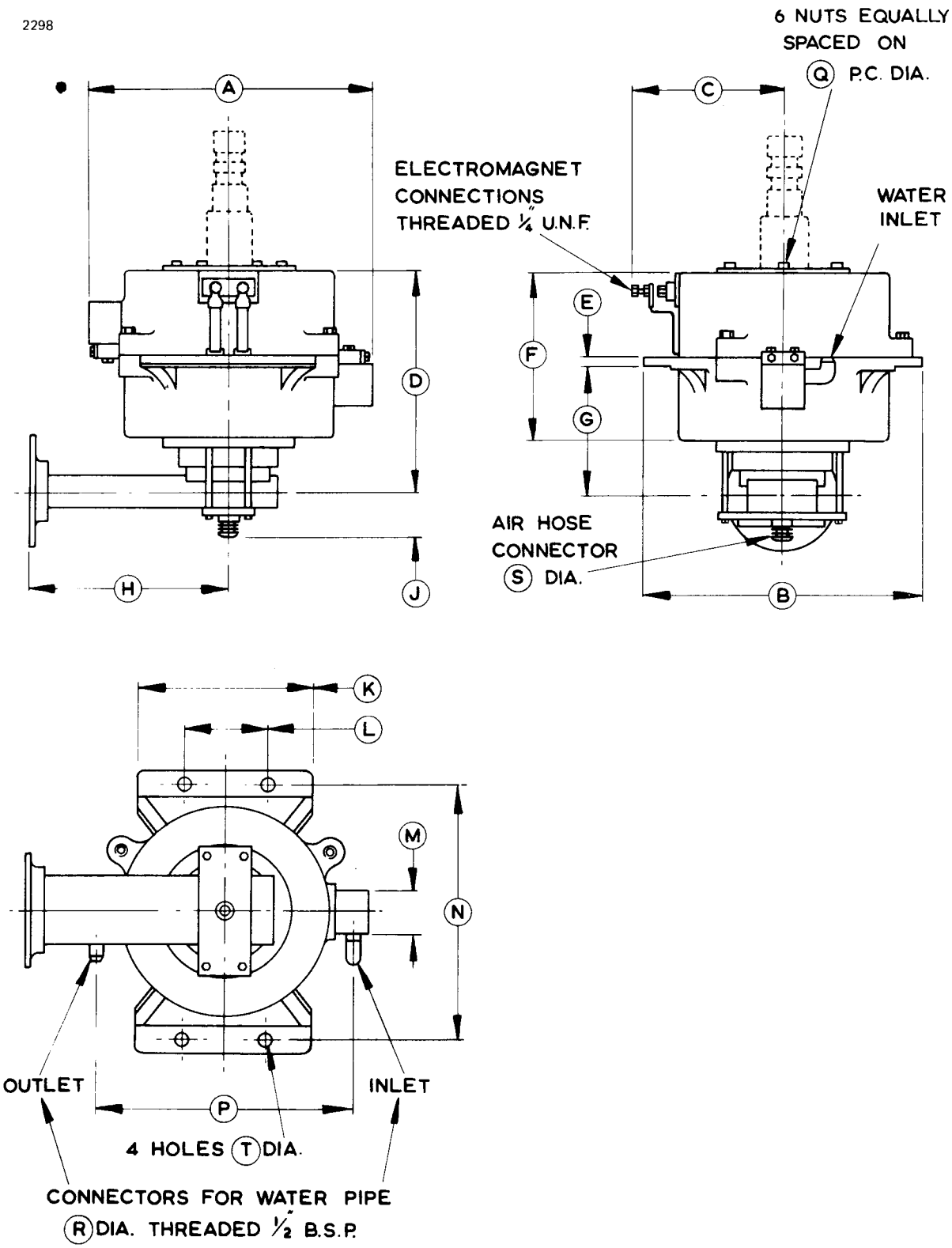


DIMENSIONS FOR ELECTRO-MAGNET AND LAUNCHING SECTION

Ref	Inches	Millimetres
AA	3.253 ± 0.001	82.626 ± 0.025
AB	9.551	242.6
AC	3.939	100.1
AD	2.000 min	50.80 min
AE	7.637	194.0
AF	8.601	218.5
AG	4.340 ± 0.005	110.2 ± 0.13
AH	3.713 ± 0.003	94.310 ± 0.076
AJ	3.410 ± 0.005	86.61 ± 0.13
AK	3.250 ± 0.005	82.55 ± 0.13
AL	3.625 ± 0.003	92.075 ± 0.076
AM	0.125	3.18
AN	1.340	34.04
AP	0.250	6.35
AQ	0.125	3.18
AR	1.417 ± 0.005	35.99 ± 0.13
AS	2.840	72.14
AT	1.667 ± 0.010	42.34 ± 0.25
AU	0.813 ± 0.010	20.65 ± 0.25
AV	0.688 ± 0.010	17.48 ± 0.25
AW	0.750 ± 0.010	19.05 ± 0.25

Millimetre dimensions have been derived from inches.

OUTLINE FOR M4011

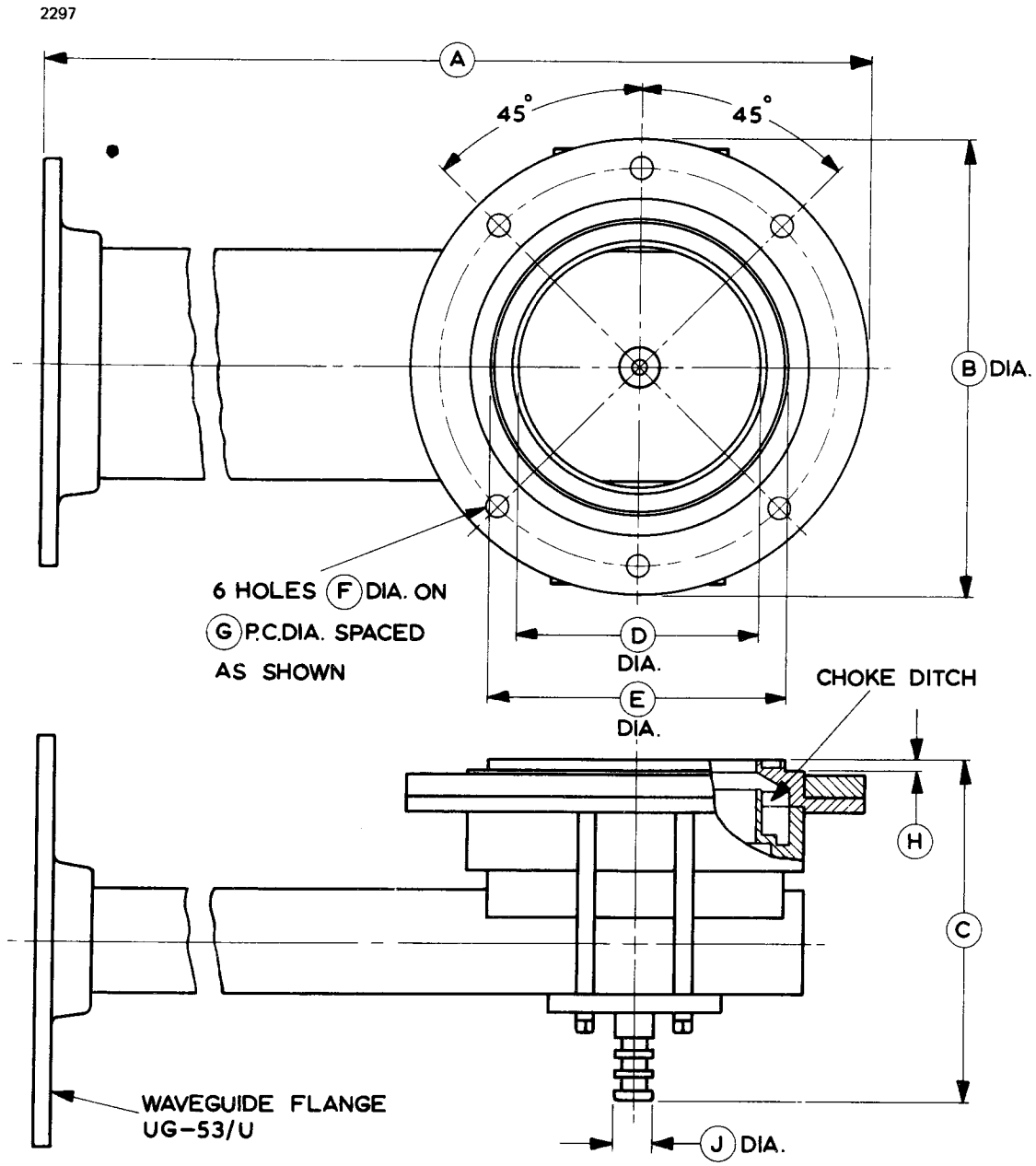


OUTLINE DIMENSIONS FOR M4011

Ref	Inches	Millimetres
A	12.875	327.0
B	12.625	320.7
C	7.000 max	177.8 max
D	10.031	254.8
E	0.375	9.53
F	7.500	190.5
G	5.906	150.0
H	9.000	228.6
J	2.000 max	50.80 max
K	8.000	203.2
L	3.750	95.25
M	2.000	50.80
N	11.625	295.3
P	11.375	288.9
Q	5.250	133.4
R	0.500	12.70
S	0.500	12.70
T	0.406	10.31

Millimetre dimensions have been derived from inches.

OUTLINE FOR M4017



Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	11.969	304.0	F	0.265	6.73
B	5.938	150.8	G	5.250	133.4
C	4.406	111.9	H	$0.140^{+0.005}_{-0.000}$	$3.56^{+0.13}_{-0.00}$
D	3.255	82.68			
E	3.865 ± 0.002	98.17 ± 0.25	J	0.500	12.70

Millimetre dimensions have been derived from inches.

M595B

S-BAND MAGNETRON

Service Type CV8905

ABRIDGED DATA

Fixed frequency pulse magnetron		
Frequency range	2860 to 2900	MHz
Typical peak output power	1.0	MW
Magnet	separate, see note 8 on page 5	
Output	coaxial line; internal diameter of outer conductor 1.527 inches, diameter of inner conductor 0.625 inch	
Coupler	see page 7	
Cooling	forced-air	

GENERAL

Electrical

Cathode	indirectly heated	
Heater voltage (see note 1)	16	V
Heater current	3.1	A
Heater starting current, peak value, not to be exceeded	15	A max
Cathode heating time (minimum) (see note 2)	2	min

Mechanical

Overall dimensions	10.523 x 7.233 x 4.624 inches max 267.3 x 183.7 x 117.5mm max
Net weight	6 pounds (2.8kg) approx
Mounting position	any

Cooling

forced-air

MAXIMUM AND MINIMUM RATINGS (Absolute values)

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

	Min	Max	
Heater voltage (see note 1)	14.4	17.6	V
Heater starting current (peak)	—	15	A
Anode voltage (peak)	—	30	kV
Anode current (peak)	—	70	A
Input power (peak)	—	2.0	MW
Input power (mean) (see note 3)	—	1.2	kW
Duty cycle	—	0.001	
Pulse length (see note 4)	—	2.5	μs
Rate of rise of voltage pulse (see note 5)	100	200	kV/μs
Anode temperature (see note 6)	—	100	°C
Cathode terminal temperature	—	100	°C
V.S.W.R. at the output coupler	—	1.5:1	
Ambient pressure for satisfactory operation	500	—	mm Hg
Pressurising (see note 7):			
input circuit	—	45	lb/in^2
output circuit	—	45	lb/in^2

TYPICAL OPERATION

Operational Conditions

Heater voltage	13	10.5	V
Magnetic field (see note 8)	2150	2700	gauss
Anode current (peak)	56	70	A
Pulse length	1.0	1.0	μs
Pulse repetition rate	500	500	p.p.s.

Typical Performance

Anode voltage (peak)	22	28	kV
Output power (peak)	600	1000	kW
Output power (mean)	300	500	W

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions

	Oscillation 1	Oscillation 2	
Magnetic field (see note 8)	2700	2700	gauss
Heater voltage (for test)	10	10	V
Anode current (mean)	35	45	mA
Duty cycle	0.0005	0.0006	
Pulse length (see note 4)	1.0	2.0	μs
V.S.W.R. at the output coupler	1.15:1	1.15:1	
Rate of rise of voltage pulse (see note 5)	200	200	kV/μs

Limits

	Min	Max	Min	Max	
Anode voltage (peak)	26	30	—	—	kV
Output power (mean)	400	—	—	—	W
Frequency	2860	2900	—	—	MHz
R.F. bandwidth at ¼ power	—	2.5	—	—	MHz
Frequency pulling (v.s.w.r. not less than 1.5:1)	—	15	—	—	MHz
Stability (see note 9)	—	0.5	—	0.5	%
Heater current					see note 10
Temperature coefficient of frequency					see note 11

LIFE TEST

The quality of all production is monitored by the random selection of valves which are then life-tested under Oscillation 1 conditions above. 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.

End of Life Criteria (under Test Conditions Oscillation 1)

Output power (mean)	320	W min
R.F. bandwidth at ¼ power	2.5	MHz max
Stability (see note 9)	1.0	% max

NOTES

1. (a) With no anode input power.

During high voltage operation it is essential to operate the heater according to the following schedule:

Mean Input Power (W)	Heater Voltage (V)
1000–1200	8.0
800–1000	10.5
600–800	13.0
400–600	15.0
less than 400	16.0

The above schedule is valid only for pulse repetition rates of 300p.p.s. or greater.

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.

(b) The M595B has a hum-free heater and has been tested for satisfactory operation with sinusoidal heater supply voltages of frequency 50, 60 and 500Hz. English Electric Valve Company Ltd. should be consulted if other supply frequencies are to be used. Where complete freedom from frequency modulation is essential, the use of a d.c. heater supply is recommended.

2. For ambient temperatures above 0°C. For ambient temperatures between 0 and −55°C the cathode heating time is 3 minutes minimum.

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

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

where Pi = 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 ±10%.

5. 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.

6. The anode temperature must be kept below the limit specified by means of a suitable flow of air over the cooling fins.

7. The mounting plate and the guard pipe are fitted to the valve in a manner to permit pressurising of the input circuit and the output circuit of the valve. At the maximum pressure of 45lb/in^2 absolute, the leakage will not exceed 0.5 litre (N.T.P.) per minute.

8. The valve is designed for use with a separate magnet which must conform with the specification given at the top of page 11. The axis of the magnetic field must be coincident with the axis of the anode, and the north pole of the magnet must be adjacent to the cathode terminal. A suitable magnet, type MA228, is available.

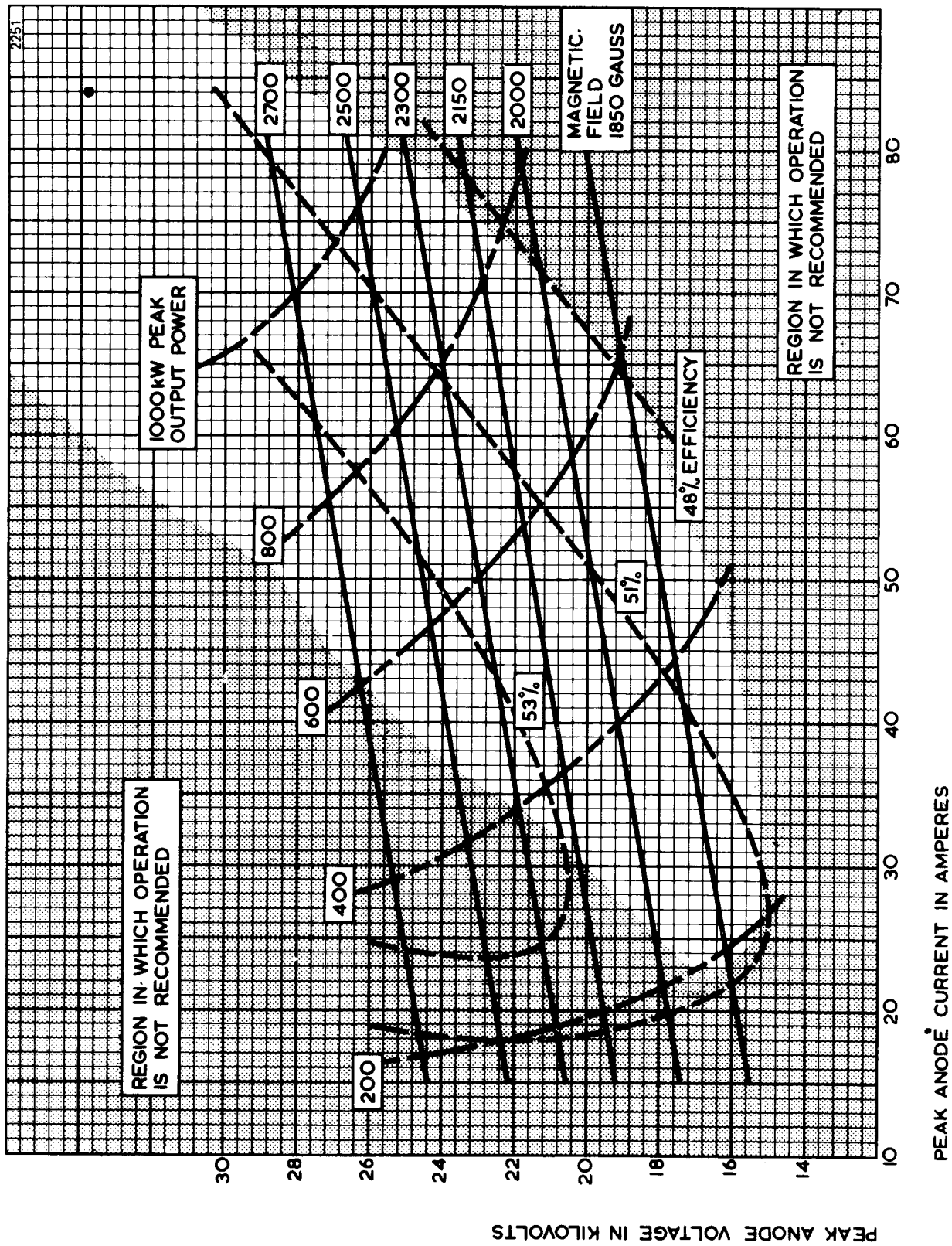
   If an electro-magnet is used, the pole tip dimensions should be as shown on page 11.

9. With the valve operating into a mismatch of v.s.w.r. 1.5:1, phased to give maximum instability. 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 valve. Missing pulses are expressed as a percentage of the number of input pulses applied during the last 30 seconds of a test interval not to exceed 5 minutes.

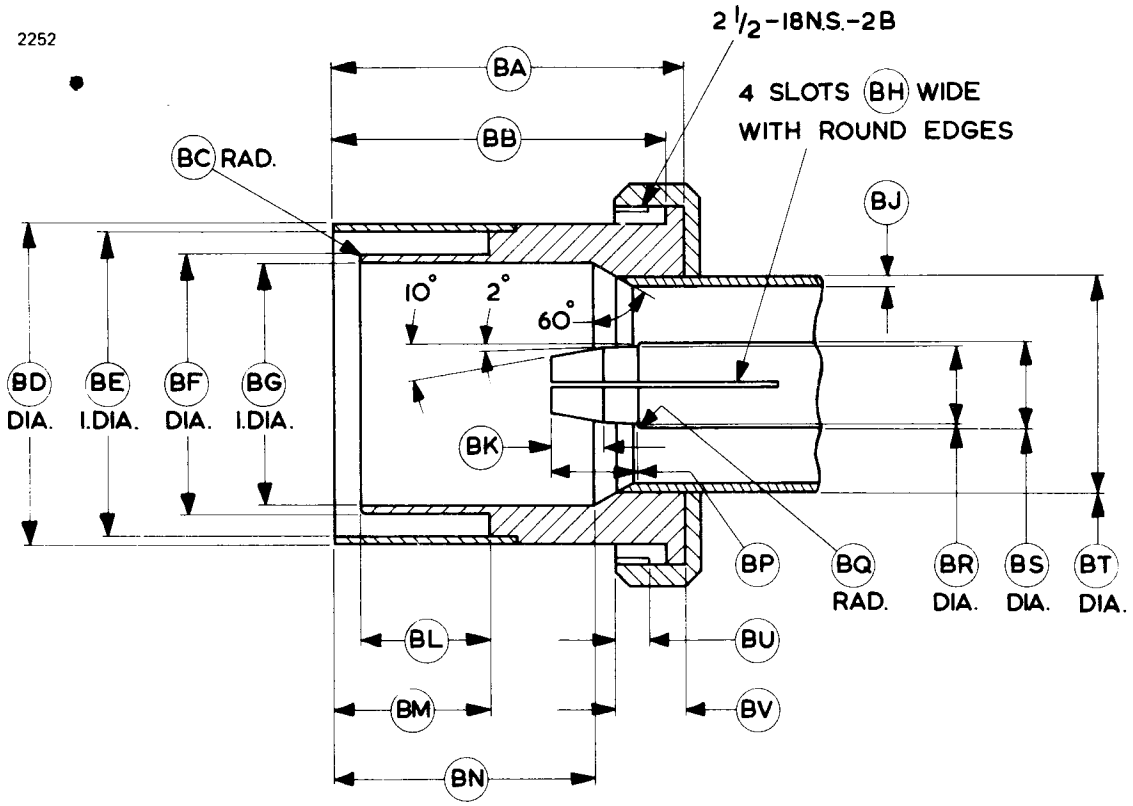
10. Measured with heater voltage of 16V and no anode input power, the heater current limits are 2.8A minimum, 3.4A maximum.

11. Design test only. The maximum frequency change with anode temperature change (after warming) is −0.07MHz/°C.

PERFORMANCE CHART



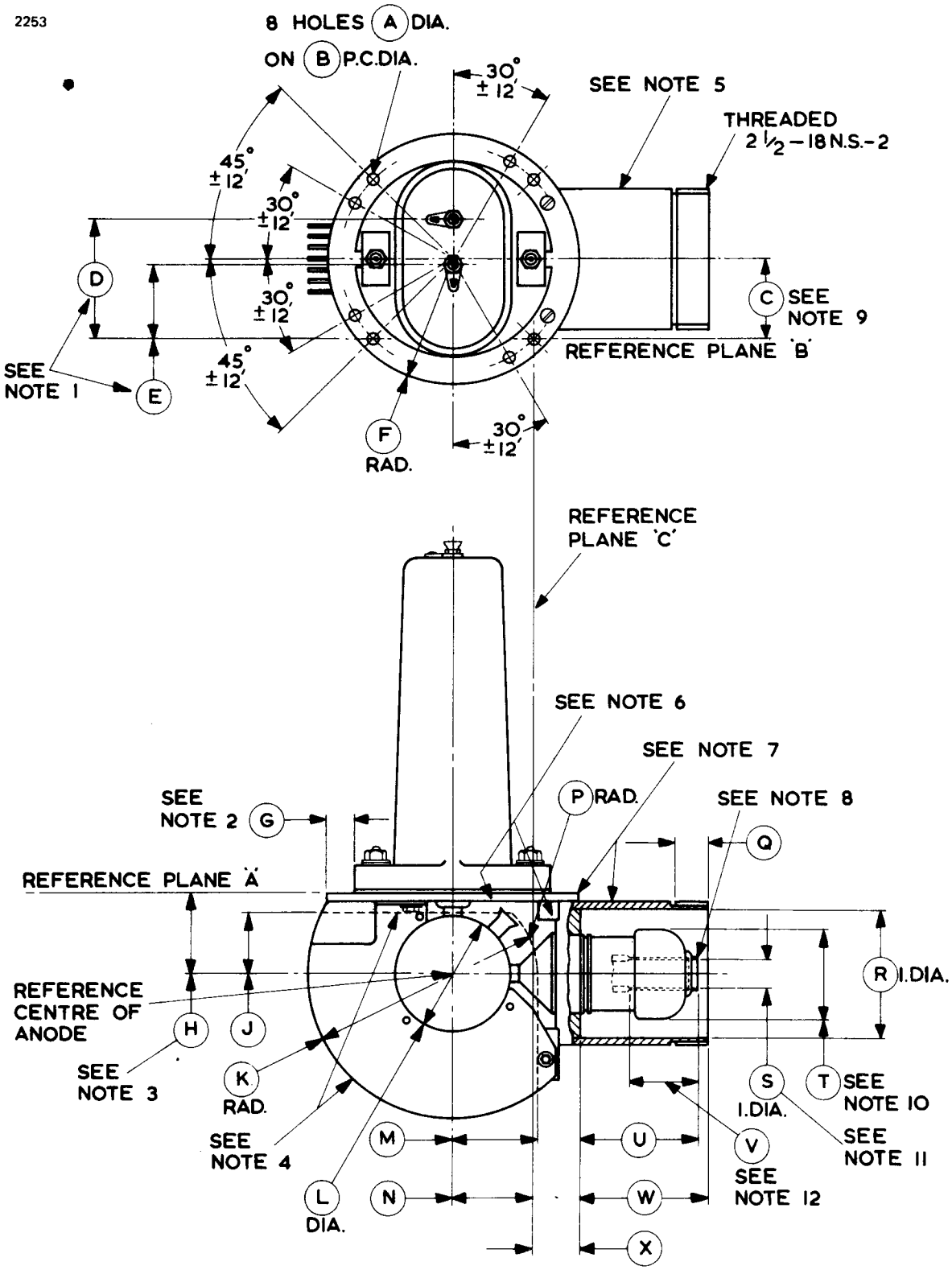
COUPLER



Ref	Inches	Millimetres	Ref	Inches	Millimetres
BA	2.531 ± 0.015	64.29 ± 0.38	BL	0.937 ± 0.003	23.800 ± 0.076
BB	2.402 ± 0.005	61.01 ± 0.13	BM	1.125 ± 0.003	28.575 ± 0.076
BC	0.031 ± 0.015	0.79 ± 0.38	BN	1.875 ± 0.005	47.63 ± 0.13
BD	2.310 ± 0.002	58.674 ± 0.051	BP	0.625 ± 0.015	15.88 ± 0.38
BE	2.185 ± 0.002	55.499 ± 0.051	BQ	0.016 ± 0.015	0.41 ± 0.38
BF	1.875 ± 0.002	47.625 ± 0.051	BR	0.576 ± 0.002	14.630 ± 0.051
BG	1.720 ± 0.002	43.688 ± 0.051	BS	0.625	15.88
BH	0.030	0.76	BT	1.625	41.28
BJ	0.049	1.24	BU	0.250 ± 0.015	6.35 ± 0.38
BK	0.375 ± 0.015	9.53 ± 0.38	BV	0.500 ± 0.015	12.70 ± 0.38

Millimetre dimensions have been derived from inches.

OUTLINE (see page 10 for outline notes)

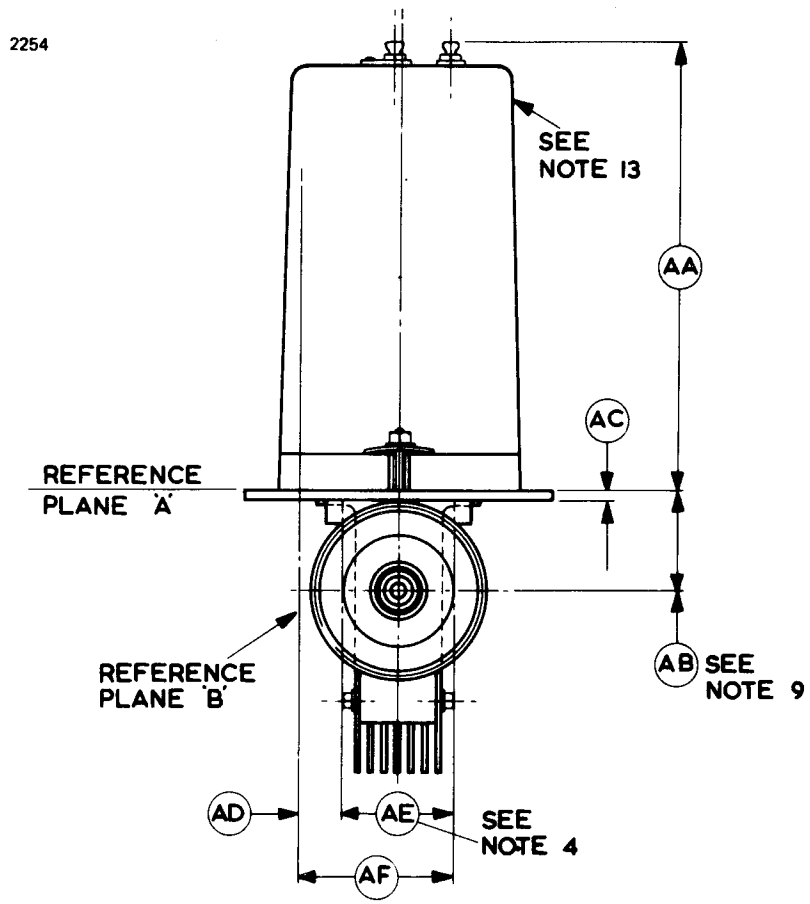


OUTLINE DIMENSIONS

Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	0.210 ± 0.005	5.33 ± 0.13	Q	0.593 min	15.06 min
B	2.032 ± 0.003	51.613 ± 0.076	R	2.321 ± 0.007	58.95 ± 0.18
C	1.437 ± 0.020	36.50 ± 0.51	S	0.555 ± 0.005	14.10 ± 0.13
D	2.156	54.76	T	1.620 max	41.15 max
E	1.359	34.52	U	2.085 ± 0.025	52.96 ± 0.64
F	2.281 ± 0.031	57.94 ± 0.79	V	1.125 min	28.58 min
G	0.500 min	12.70 min	W	2.297 ± 0.010	58.34 ± 0.25
H	1.440	36.58	X	0.818 ± 0.015	20.78 ± 0.38
J	1.063 min	27.00 min	AA	6.313 ± 0.094	160.35 ± 2.39
K	2.656 max	67.46 max	AB	1.440 ± 0.020	36.58 ± 0.51
L	2.062	52.37	AC	0.187	4.75
M	1.500 min	38.10 min	AD	0.677 min	17.20 min
N	1.437	36.50	AE	1.490 max	37.85 max
P	1.500 min	38.10 min	AF	2.197 max	55.80 max

Millimetre dimensions have been derived from inches.

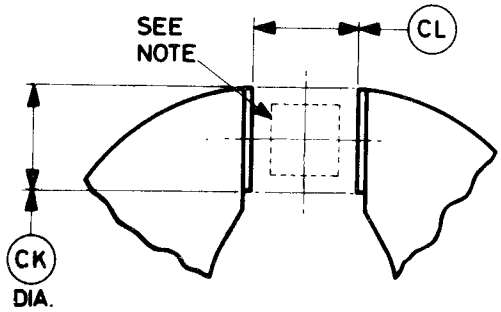
OUTLINE



OUTLINE NOTES

1. The centres of the jack holes will be within a radius of 0.100 inch (2.54mm) of the location specified, but spaced 0.797 ± 0.015 inch (20.24 ± 0.38mm) with respect to each other.
2. With the valve resting on a plane surface, the flatness of this annular area will be such that a feeler gauge 0.015 inch (0.38mm) thick and 0.125 inch (3.18mm) wide will not enter more than 0.250 inch (6.35mm) at any point.
3. The periphery of the anode will lie within a 2.160 inch (54.86mm) diameter circle located as specified.
4. The maximum width specified by dimension 'AE' applies to the area defined by the broken line and the circumference of the radiator.
5. The valve will be painted with black, heat resisting, non-corrosive paint, except for the following paint free areas: top surface of mounting plate, parts above mounting plate, screw threads on guard pipe and all surfaces inside the guard pipe.
6. All joints on the mounting plate and guard pipe will be soldered to provide hermetic seals.
7. The valve may be supported by the mounting plate or guard pipe.
8. There will be no sharp edges on the outside diameter at the end of the inner conductor.
9. Applies to the location of the centre line of the guard pipe.
10. The centre line of the glass portion will be concentric with the centre line of the guard pipe to within 0.040 inch (1.02mm).
11. Applies to the inner conductor insert only. The centre line of the inner conductor insert will be concentric with the centre line of the guard pipe to within 0.025 inch (0.64mm).
12. Applies to the straight portion of the inner conductor wall.
13. The common cathode connection is indicated by letter C.

PERMANENT MAGNET SPECIFICATION



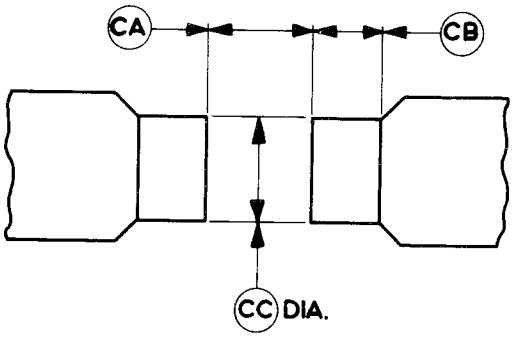
Ref	Inches	Millimetres
CK	1.500	38.10
CL	$1.500^{+0.010}_{-0.000}$	$38.10^{+0.25}_{-0.00}$

Millimetre dimensions have been derived from inches.

Note The variation of magnetic field within a cylinder 1.000 inch (25.4mm) long and 0.900 inch (22.86mm) diameter situated centrally and coaxially between the poles must not exceed ±140 gauss.

ELECTRO-MAGNET POLE PIECES

2255



Ref	Inches	Millimetres
CA	$1.500^{+0.005}_{-0.000}$	$38.10^{+0.13}_{-0.00}$
CB	1.000 min	25.40 min
CC	1.500 ± 0.010	38.10 ± 0.25

Millimetre dimensions have been derived from inches.

M5015

TUNABLE S-BAND MAGNETRON

ABRIDGED DATA

Mechanically tuned pulse magnetron intended primarily for linear accelerators.

Frequency range	2994 to 3002	MHz
Peak output power	2.0	MW
Magnet		separate
Output	to No. 10 waveguide (2.840 x 1.340 inches internal) via the transition sections M4117 or M4119 shown on pages 11 and 12	
Isolator	the use of an isolator is recommended, see note 8 on page 4	
Cooling		water

GENERAL

Electrical

Cathode		indirectly heated
Heater voltage (see note 1)	8.5	V
Heater current	9.0	A
Heater starting current, peak value, not to be exceeded	20	A max
Cathode heating time (minimum)	3.0	min

Mechanical

Overall dimensions	14.750 x 7.250 x 6.000 inches max 374.7 x 184.2 x 152.4mm max	
Net weight	16 pounds (7.3kg) approx	
Tuner revolutions to cover frequency range (see note 2)	4	approx
Method of mounting		see note 3
Mounting position (see note 4)		any

Continued on page 2

Cooling

The valve is water cooled and has an integral water jacket, the connections being made via ¼-inch B.S.P. unions. The recommended water flow is 5 litres per minute or more; a pressure of approximately 1.25kg/cm^2 will be necessary to give this rate of flow. The outlet water temperature must not exceed 50°C.

MAXIMUM AND MINIMUM RATINGS (Absolute values)

No individual rating should be exceeded.

	Min	Max	
Magnetic field (see note 5)	1350	1600	gauss
Heater voltage (see note 1)	8.0	10	V
Heater starting current (peak)	—	20	A
Anode voltage (peak)	—	47	kV
Anode current (peak)	60	100	A
Input power (mean)	—	6.0	kW
Duty cycle	—	0.0015	
Pulse length (see note 6)	—	2.2	μs
Rate of rise of voltage pulse (see note 7)	—	120	kV/μs
Outlet water temperature	—	50	°C
V.S.W.R. at the output coupler (see note 8)	—	1.5:1	
Pressurising of waveguide (see note 9)	14	45	lb/in^2 abs.
	0.99	3.5	kg/cm^2 abs.

TYPICAL OPERATION

Operational Conditions

Magnetic field	1550 ± 25	gauss
Heater voltage	0	V
Anode current (peak)	90	A
Pulse length	2.0	μs
Pulse repetition rate	750	p.p.s.
Rate of rise of voltage pulse	110	kV/μs

Typical Performance

Anode voltage (peak)	43	kV
Output power (peak)	2.0	MW
Frequency drift		see note 10

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification.

Test Conditions (see note 11)

Magnetic field	1550 ± 25	gauss
Heater voltage (for test)	0	V
Output power (peak) (see note 12)	2.0	MW
Duty cycle	0.0015	
Pulse length (see note 6)	2.0	μs
V.S.W.R. at the output coupler	1.1:1	
Rate of rise of voltage pulse (see note 7)	110	kV/μs

Limits

	Min	Max	
Anode voltage (peak)	40	46	kV
Anode current (peak) (see note 12)	85	100	A
Frequency (see note 13):			
lower end of tuning range	–	2994	MHz
upper end of tuning range	3002	–	MHz
R.F. bandwidth at ¼ power	–	1.5	MHz
Frequency pulling (v.s.w.r. not less than 1.5:1)	–	7.0	MHz
Stability (see note 14)	–	0.5	%
Heater current			see note 15

LIFE TEST

The quality of all production is monitored by the random selection of valves which are then life-tested under Typical Operation Conditions. 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.

End of Life Criteria

(Under the test conditions specified above but with anode current adjusted to give maximum output power)

Anode voltage (peak)	38	kV min
Output power (peak)	1.8	MW min
R.F. bandwidth at ¼ power	2.0	MHz max

Frequency: must be within the limits given above.

NOTES

1. With no anode input power.

   The heater voltage shall be reduced within 5 seconds after the application of h.t. according to the schedule shown on page 7.

   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.

2. The tuner mechanism is driven by means of three tapped holes in the tuner knob (see outline drawing) via a flexible drive. The torque required is 0.5kg-cm minimum.

3. It is recommended that the magnetron should be mounted by means of the output flange (shown as Flange A on the outline drawing). Should a mounting arrangement employing Flange B be envisaged, care must be taken to avoid mechanical stress on the magnetron between the two flanges. Users are invited to submit details of their mounting arrangements to English Electric Valve Company Ltd. for approval.

4. To minimise frequency deviation when the magnetron is rotated about a horizontal axis, this axis should be parallel to the axis of the tuner.

5. The valve is designed for use with a separate magnet which can be supplied if requested. The north pole of the magnet must be adjacent to the cathode terminal, marked C. The position of the magnet must be adjusted so that the axis of the field is in line with the axis of the anode and is at right angles to the H plane of the system waveguide. The user is invited to consult English Electric Valve Company Ltd. on the choice of alternative magnets.

6. The use of magnetron M5058, a variant of M5015, is recommended for applications requiring pulse lengths up to 5.0μs where a reduction in peak output power can be tolerated.

7. Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude. Any capacitance in the viewing system must not exceed 6.0pF.

8. It is recommended that the magnetron should be isolated from the load by means of an isolator of approved design. Information on the characteristics of a suitable isolator may be obtained from English Electric Valve Company Ltd.

9. At the maximum pressure of 45lb/in^2 (3.5kg/cm^2) absolute the maximum leakage will be such that with an enclosed volume of 1 litre the pressure will not drop by more than 10 pounds in 7 days.

10. The frequency of the valve will vary during the first 30 seconds after the application of anode voltage. Typically the frequency will be 0.4MHz high 5 seconds after switching on h.t. and 0.1MHz high 20 seconds after switching on.

11. These tests are carried out at 2998MHz except where otherwise specified.

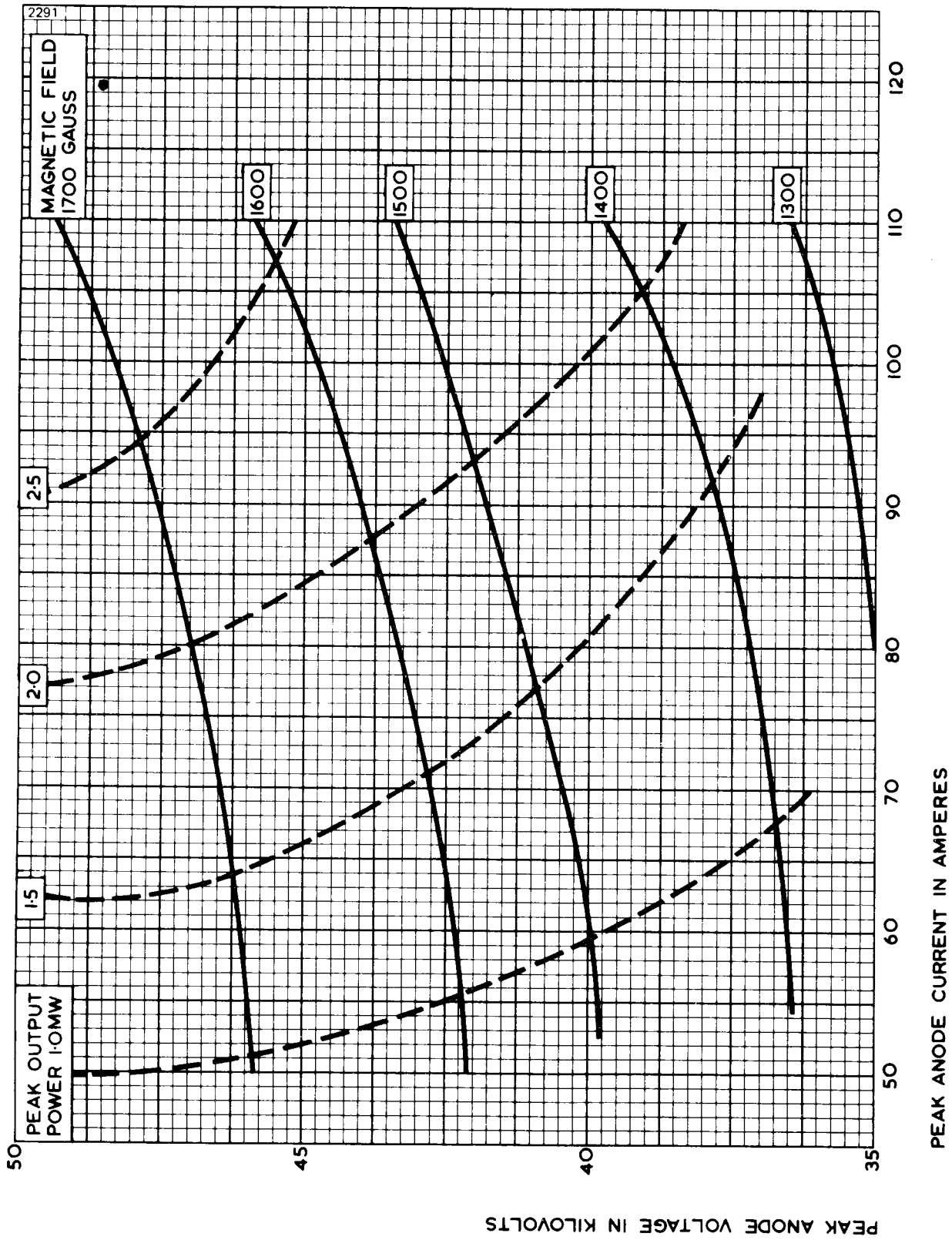
12. The M5015 is designed to give 2.0MW peak output power. At this figure the peak anode current will be between 85 and 100A, depending on the efficiency of the magnetron. The magnetron should not be operated at a peak current greater than that necessary to achieve 2.2MW peak output power.

13. With ambient temperature 20°C, inlet water temperature 20°C and water flow rate 5.0 litres per minute. Other frequency ranges can be supplied on request.

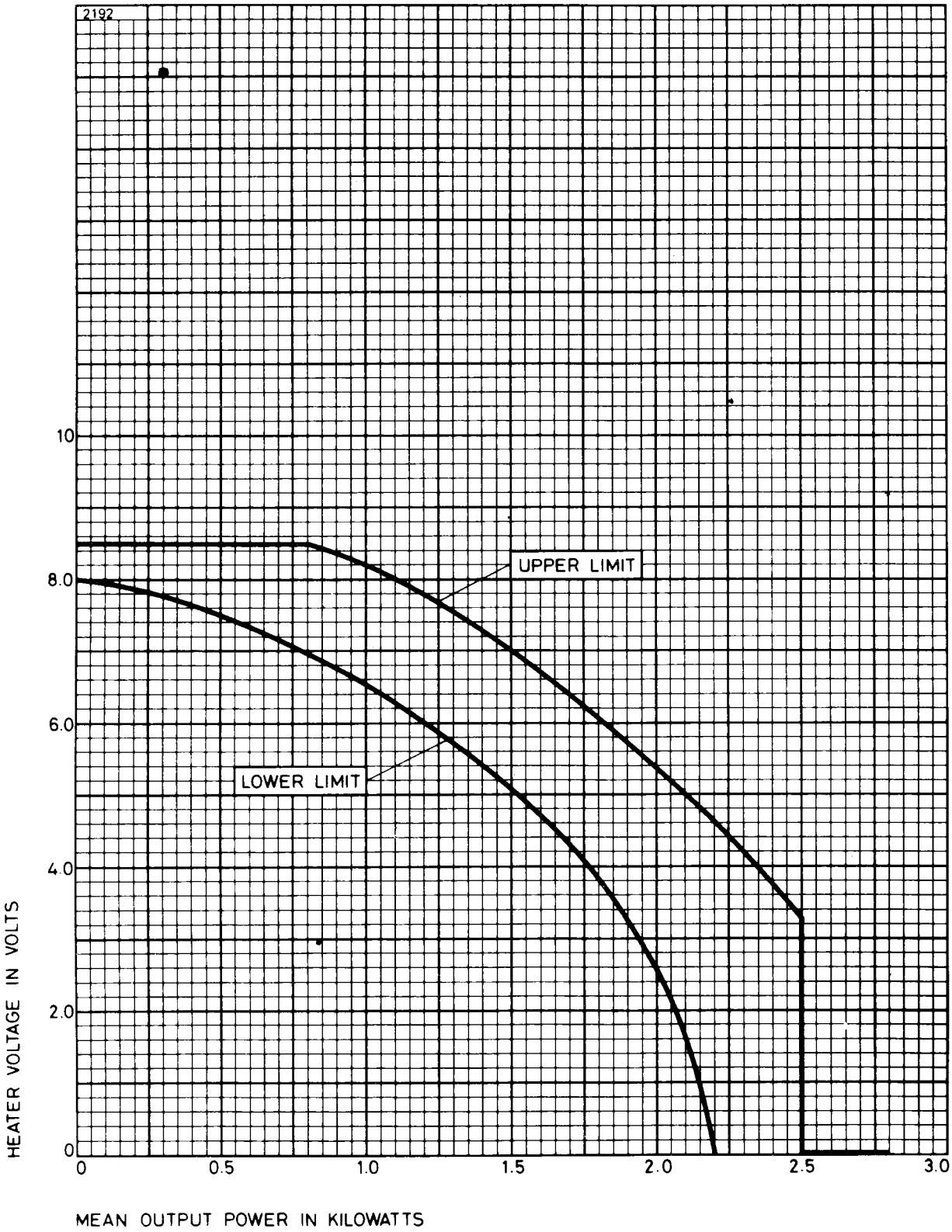
14. With the valve operating into a v.s.w.r. of 1.15:1. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal energy level in a 0.5% frequency range. Missing pulses are expressed as a percentage of the number of input pulses applied during the period of observation after a period of 10 minutes operation.

15. Measured with heater voltage of 8.5V and no anode input power, the heater current limits are 8.0A minimum, 10.0A maximum.

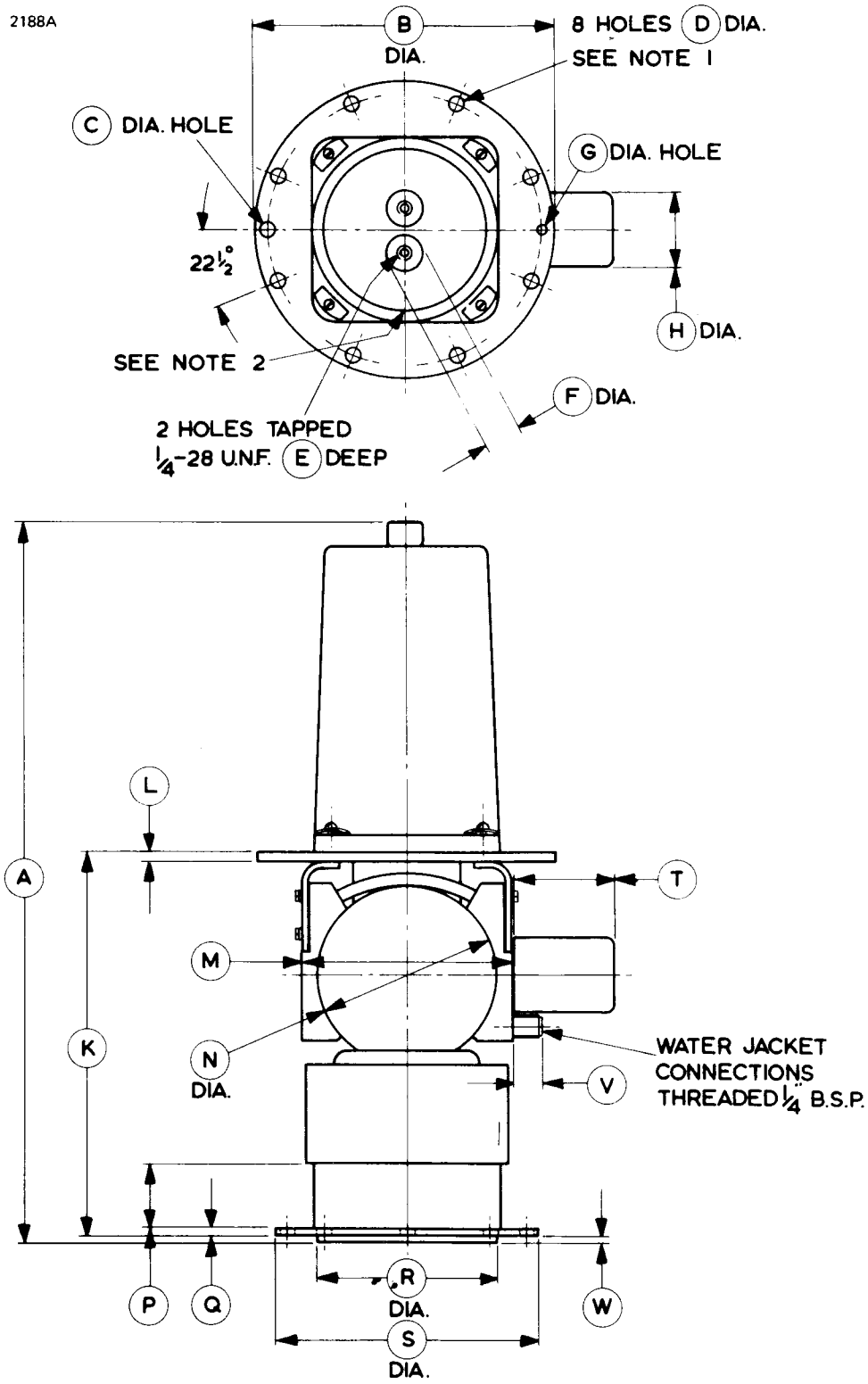
PERFORMANCE CHART



HEATER VOLTAGE REDUCTION SCHEDULE



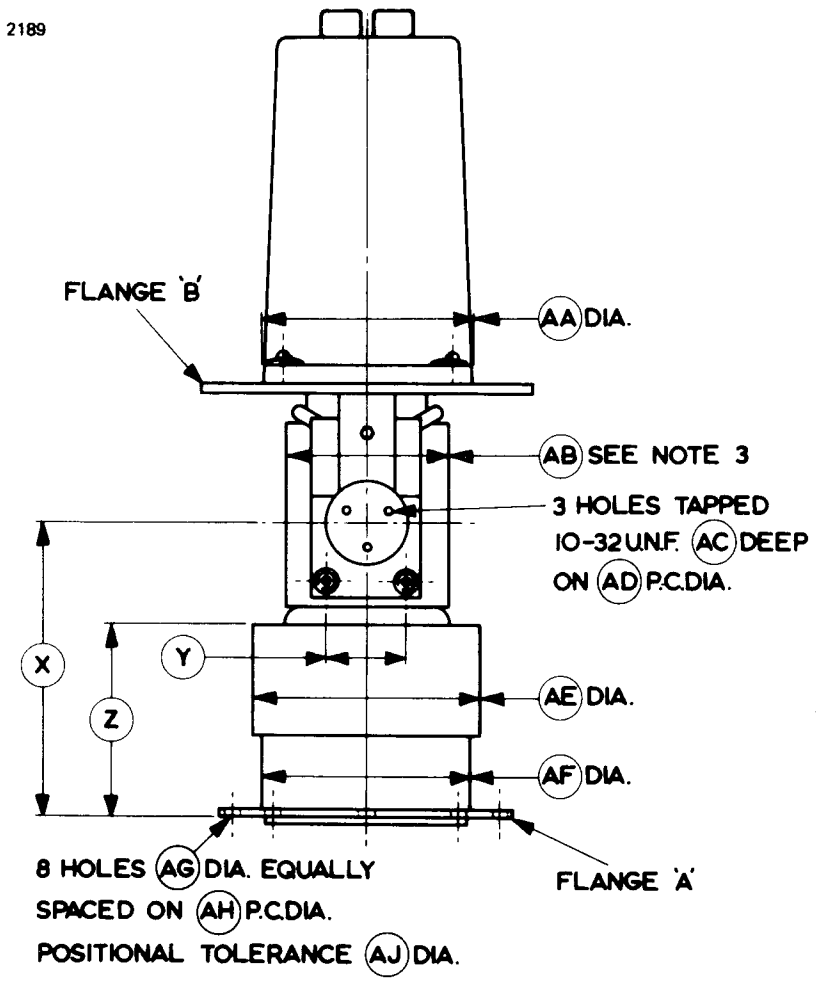
OUTLINE (See page 10 for dimensions)



OUTLINE NOTES

1. The 8 holes will clear studs 0.250 inch (6.35mm) diameter equally spaced on 5.500 inches (139.7mm) pitch circle diameter and within 0.005 inch (0.127mm) of their nominal positions, with the valve located by dowel pins 0.307 inch (7.80mm) diameter and 0.245 inch (6.22mm) diameter spaced 5.500 ± 0.002 inches (139.700 ± 0.051mm) apart.
2. This surface is marked with the letter 'C' to indicate the cathode terminal.
3. The valve will fit between magnet poles 3.010 inch (76.45mm) diameter and 2.970 inches (75.44mm) apart.

OUTLINE

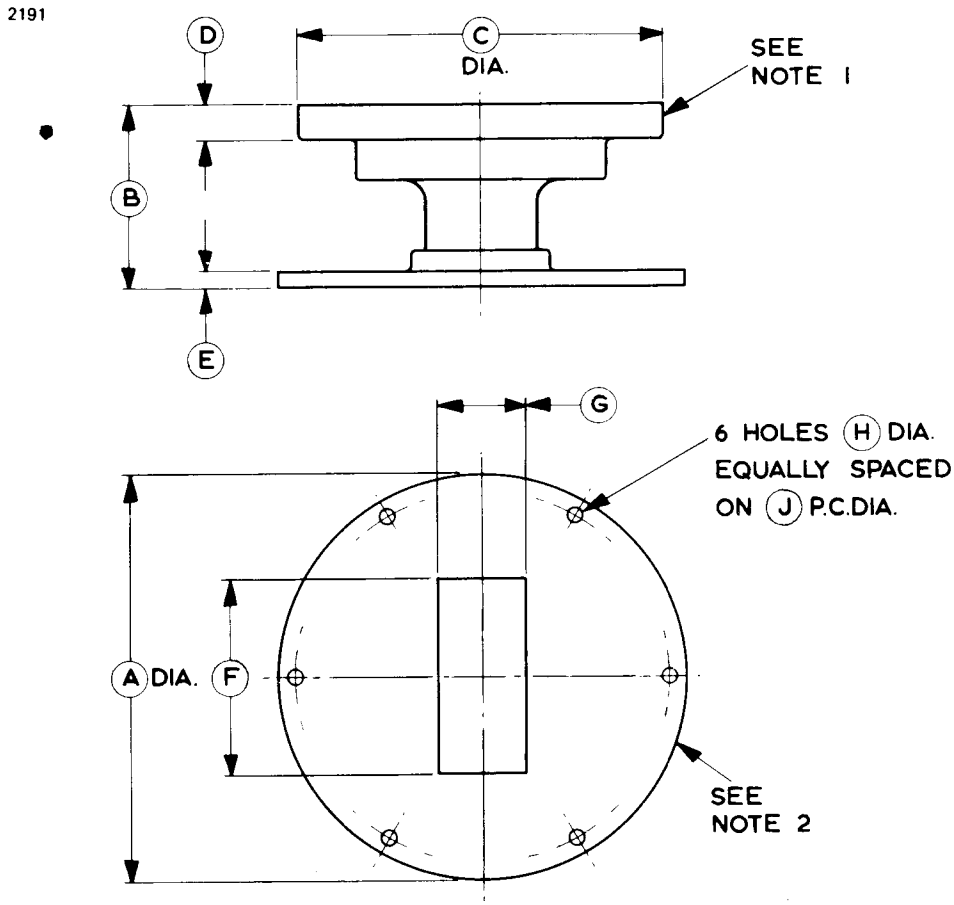


OUTLINE DIMENSIONS

Ref	Inches	Millimetres
A	14.750 max	374.7 max
B	$6.000^{+0.000}_{-0.010}$	$152.4^{+0.00}_{-0.25}$
C	$0.312^{+0.005}_{-0.000}$	$7.92^{+0.13}_{-0.00}$
D	0.312	7.92
E	0.250	6.35
F	0.750	19.05
G	$0.250^{+0.005}_{-0.000}$	$6.35^{+0.13}_{-0.00}$
H	1.500	38.10
K	7.780 ± 0.025	197.6 ± 0.64
L	0.250 ± 0.005	6.35 ± 0.13
M	4.375	111.1
N	3.625	92.08
P	1.218	30.94
Q	0.218	5.54
R	$3.625^{+0.000}_{-0.006}$	$92.08^{+0.00}_{-0.15}$
S	5.250 ± 0.062	133.4 ± 1.57
T	2.000 max	50.80 max
V	0.500	12.70
W	0.125 ± 0.005	3.18 ± 0.13
X	5.291 ± 0.015	134.4 ± 0.38
Y	1.375	34.93
Z	3.500 ± 0.125	88.90 ± 3.18
AA	3.750	95.25
AB	2.970 max	75.44 max
AC	0.187	4.75
AD	0.750	19.05
AE	4.125	104.8
AF	3.687	93.65
AG	0.250	6.35
AH	4.750 ± 0.005	120.7 ± 0.13
AJ	0.006	0.15

Millimetre dimensions have been derived from inches.

TRANSITION SECTION M4117



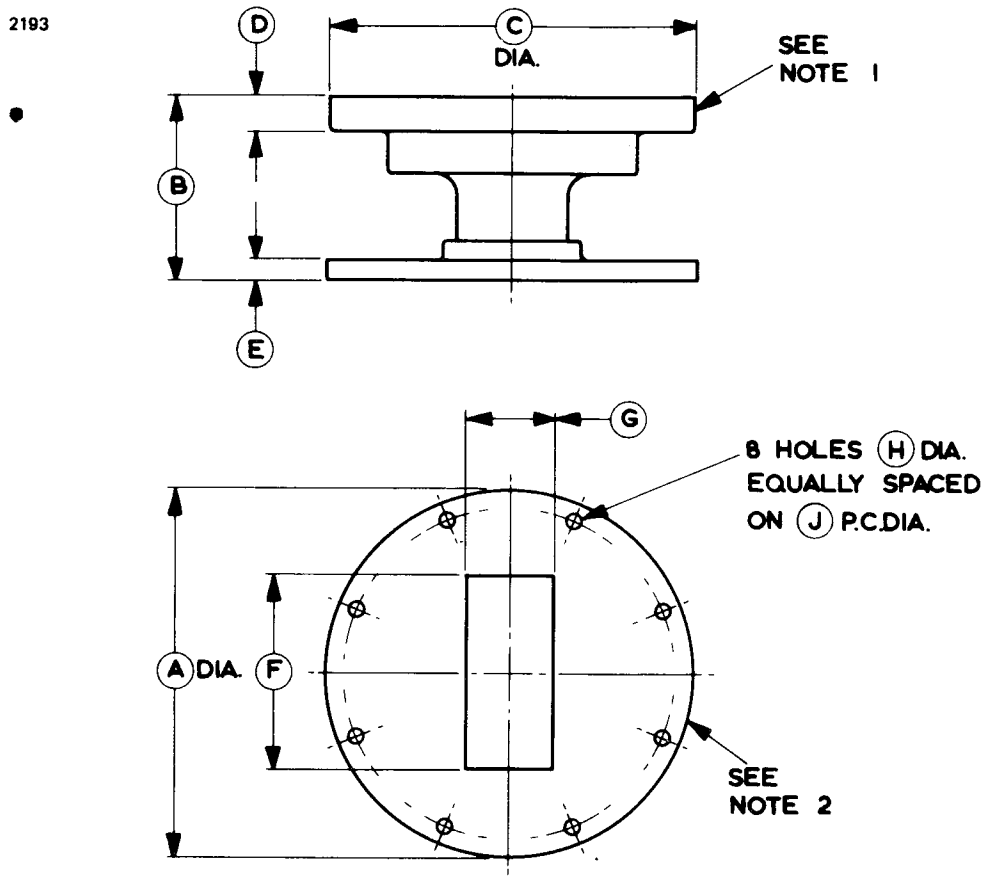
Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	5.875	149.2	F	2.840	72.14
B	2.643	67.13	G	1.340	34.04
C	5.250	133.4	H	0.257	6.53
D	0.500	12.70	J	5.375	136.5
E	0.250	6.35			

Millimetre dimensions have been derived from inches.

Notes for M4117

1. This flange mates with flange 'A' of the magnetron using 8–0.250 inch (6.35mm) diameter bolts, and an O-ring (supplied with M4117) 3.975 inches internal diameter and 0.210 inch diameter section. J.S.C. No. 5985-99-083-0011 or JAN MS 90064-17.
2. This flange is J.S.C. type No. 5985-99-083-1560.

TRANSITION SECTION M4119



Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	5.312	134.9	F	2.840	72.14
B	2.643	67.13	G	1.340	34.04
C	5.250	133.4	H	0.257	6.53
D	0.500	12.70	J	4.750	120.7
E	0.312	7.93			

Millimetre dimensions have been derived from inches.

Notes for M4119

1. This flange mates with flange 'A' of the magnetron using 8–0.250 inch (6.35mm) diameter bolts, and an O-ring (supplied with M4119) 3.975 inches internal diameter and 0.210 inch diameter section. J.S.C. No. 5985-99-083-0011 or JAN MS 90064-17.
2. This flange is equivalent to J.S.C. Type No. 5985-99-083-0010 or JAN UG-53/U.

M5028

PRECISION TUNED MAGNETRON

ABRIDGED DATA

Precision tuned pulse magnetron for linear accelerators. The tuning drive will mechanically tune the valve to within 50kHz of any point in the frequency range and has been designed to be driven remotely by an electric motor.

Frequency range (see note 1)	2851–2861	MHz
Peak output power (nominal)	5.0	MW
Magnet and launching section	separate electro-magnet and launching section assembly M4121	
Isolator	use of an isolator is recommended (see note 2)	
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 3)	12	V
Heater current	14	A
Heater starting current, peak value, not to be exceeded	40	A max
Cathode heating time (minimum)	4.0	min

Mechanical

Overall dimensions	18 x 7.5 x 6.5 inches nom 457 x 190 x 165mm nom	
Net weight	18 pounds (8kg) approx	
Mounting position	any	
Tuning drive	splined shaft, to mate with S.S. White EX977 remote control flexible shaft	
Tuner turns between stops	350	

Electro-magnet and Launching Section M4121

Overall dimensions	see outline drawing, page 12
Power consumption	1.5kW approx
Net weight	110 pounds (50kg) approx
R.F. output	no. 10 waveguide
Waveguide pressurising	see note 4

Cooling

The valve anode and the electro-magnet have integral water jackets. The valve requires a water flow of 4 to 6 imp.gal/min (18 to 27 l./min); the pressure drop across the water jacket is 15 lb/in^2 (1.05kg/cm^2) maximum. The electro-magnet requires a water flow of 1.0 imp.gal/min (4.5 l./min) at a pressure drop of 2.0 lb/in^2 (0.14kg/cm^2).

The valve output window is cooled by high pressure air; a flow of not less than 3ft^3/min (0.085m^3/min) (N.T.P.) into the air inlet at the base of the launching section is required. Low pressure air cooling may be required for the cathode terminal.

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 5)	1300	1640	gauss
Heater voltage (see note 3)	11.4	12.3	V
Anode voltage (peak)	34	53	kV
Anode current (peak):			
at 5.0MW, 2.0μs, 1580 gauss	—	265	A
at 2.5MW, 4.0μs, 1530 gauss	—	160	A
at 1.0MW, 5.0μs, 1350 gauss	—	100	A
Input power (peak) (see note 6)	—	12	MW
Input power (mean) (see note 7)	—	7.0	kW
Duty cycle	—	0.003	
Pulse length:			
at 5.0MW peak	—	2.5	μs
at 2.5MW peak	—	4.5	μs
at 1.0MW peak	—	5.5	μs
Rate of rise of voltage pulse (see note 8)	100	150	kV/μs
V.S.W.R. at the output coupler (see note 2)	—	1.3:1	
Anode water outlet temperature	—	70	°C
Tuner torque	—	30	oz-in
Pressurising of waveguide (see note 4)	—	65	lb/in^2
	—	4.6	kg/cm^2

TYPICAL OPERATION

Operating Conditions

Heater voltage	0	0	0	V
Magnetic field	1350	1530	1580	gauss
Anode current (peak)	60	130	240	A
Pulse length	5.0	4.0	2.3	μs
Duty cycle	0.003	0.0012	0.0006	
Rate of rise of voltage	125	125	125	kV/μs

Typical Performance

Anode voltage	36.5	46	51	kV
Output power (peak)	1.0	2.5	5.0	MW
Output power (mean)	3.0	3.0	3.0	kW

TEST CONDITIONS AND LIMITS

The valve is tested in electro-magnet and launching section type M4121 to comply with the following electrical specification. For each oscillation condition, the performance is checked at each end of the specified frequency range.

Test Conditions

	Oscillation 1	**Oscillation 2**	**Oscillation 3**	
Heater voltage (for test)	0	0	0	V
Output window cooling air flow (max)	3.0	3.0	3.0	ft^3/min
Waveguide air pressure (max)	25	35	45	lb/in^2 abs.
Magnetic field	1350	1530	1580	gauss
Anode current (mean)	180	148	133	mA
Duty cycle	0.003	0.001	0.0006	
Pulse length (see note 9)	5.0	5.0	2.5	μs
V.S.W.R. at the output coupler	see note 10	see note 10	see note 10	
Rate of rise of voltage pulse (see note 8)	60–70	120–130	140–150	kV/μs

Test Limits

	Min	Max	Min	Max	Min	Max	
Anode voltage (peak)	34.5	38.5	44	48	48	53	kV
Output power (mean)	2800	—	2800	—	2800	—	W
Frequency (see note 11)	2851	2861	2851	2861	2851	2861	MHz
R.F. bandwidth at 6db	—	0.5	—	0.5	—	1.0	MHz
Stability (see notes 12 and 13)	—	0.5	—	0.5	—	0.5	%
Frequency pulling (see note 12)	—	—	—	4.5	—	—	MHz
Heater current						see note 14	
Temperature coefficient of frequency						see note 15	

END OF LIFE CRITERIA (Under Test Conditions oscillation 3)

Output power (mean)	2500	W min
R.F. bandwidth at 6db	2.0	MHz max
Frequency (see note 11)	2851–2861	MHz
Stability (see notes 12 and 13)	1.0	% max

WARNING

X-rays High voltage magnetrons emit a significant intensity of X-rays not only from the region of the cathode insulator 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.

R.F. Leakage There is a certain amount of r.f. radiation from the cathode insulator and it may be necessary to shield adjacent electrical circuits. If extensive shielding is fitted extra ventilation may be needed to ensure that the cathode seal temperature does not exceed 150°C. The temperature may be checked by temperature sensitive paint.

NOTES

1. The frequency range 2851 to 2861MHz is only achieved at the full mean input power rating of 7kW. For lower powers the frequency at any tuner setting will increase by 630kHz per kW reduction in mean input power.
2. The magnetron must be protected from the load by an isolator or circulator. The maximum v.s.w.r. at 2856MHz is 1.3:1 and must not exceed 2:1 over the range 2800–3500MHz.

3. 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. Within 30 seconds after the application of anode voltage the heater voltage shall be reduced as follows:

Mean input power (kW)	**Heater voltage ($V_{r.m.s.}$)**
0–2.3	10.5
2.3–4.6	8.5
4.6–7.0	6.0
7.0 (maximum)	zero

The heater voltage shall be maintained within ±5% of the specified value. A rectified supply is recommended to reduce frequency modulation due to heater current when operating at less than 7kW input power. The valve is assumed to be operated with a heater supply frequency of 50 or 60Hz. English Electric Valve Company Ltd. should be consulted if the valve is to be operated with a heater supply of any other frequency.

A coaxial lead shall be used to connect the magnetron to the filament transformer or pulse transformer, the outer being the cathode pulse connection. Capacitors shall be used to prevent pulse voltages being applied to the heater, either from unbalance of a bifilar pulse transformer or by induction from the pulse current; this protection must be effective both for normal operation and in the event of the magnetron sparking. Capacitors up to 10μF may be required, shunted by small high frequency capacitors.

4. The minimum air pressure in the output waveguide can vary with the peak power level at which the magnetron is operated. It should not be less than 25 lb/in^2 at 1MW, 35 lb/in^2 at 3MW and 45 lb/in^2 at 5MW. At the maximum pressure of 65 lb/in^2 (4.57kg/cm^2) the leakage will not exceed 0.03 litre (N.T.P.) per minute.

5. Measured at the point indicated on the outline drawing; the axial distribution must be that produced by the M4121 electro-magnet or authorized equivalent (see page 10).

6. The modulator must have an efficient overswing damping system, such that the pulse energy delivered to the magnetron following an arcing pulse does not appreciably exceed the normal pulse energy. An interlock relay shall be used to trip the modulator in the event of excessive magnetron arcing, preferably operated by the overswing diode current. The trip should operate if the magnetron arcs for 25 consecutive pulses.

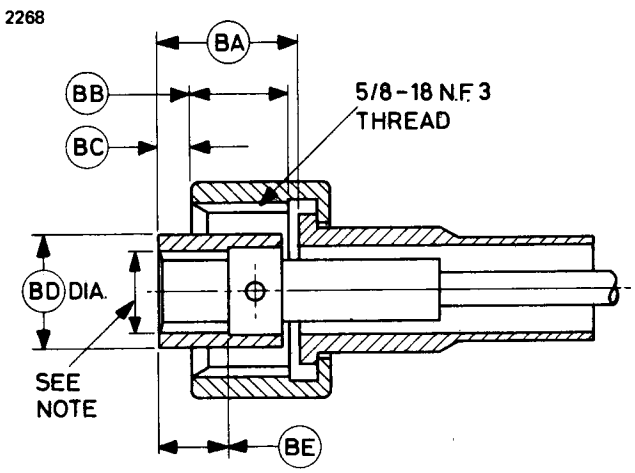
7. The various parameters are related by the formula:

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

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.

8. The rate of rise of voltage is defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude.
9. Tolerance ±10%.
10. 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 3200 and 3500MHz.
11. The valve tuning range shall include the two limits given.
12. Measured with a v.s.w.r. of 1.3:1 at the frequency of oscillation, varied through all phases.
13. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal energy level in the frequency range 2851 to 2861MHz. 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.
14. Measured with a heater voltage of 12 volts and no anode input power, the heater current limits are 13A minimum, 15A maximum.
15. Design test only. The maximum frequency change with anode temperature change (after warming) is −0.05MHz/°C.

DETAIL OF FLEXIBLE DRIVE CONNECTOR

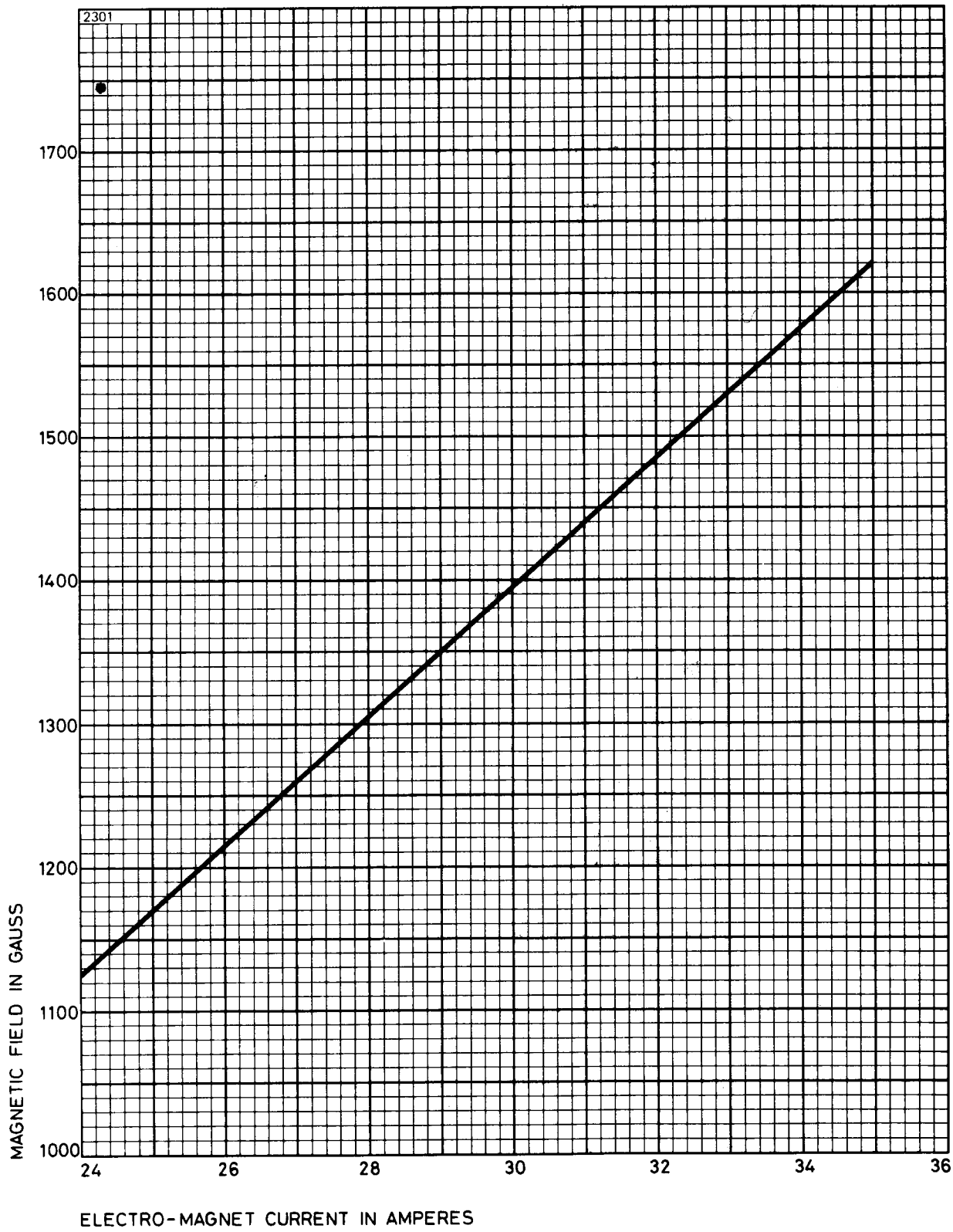


Ref	Inches	Millimetres
BA	0.500	12.70
BB	0.360	9.14
BC	0.112	2.84
BD	0.406	10.31
BE	0.250	6.35

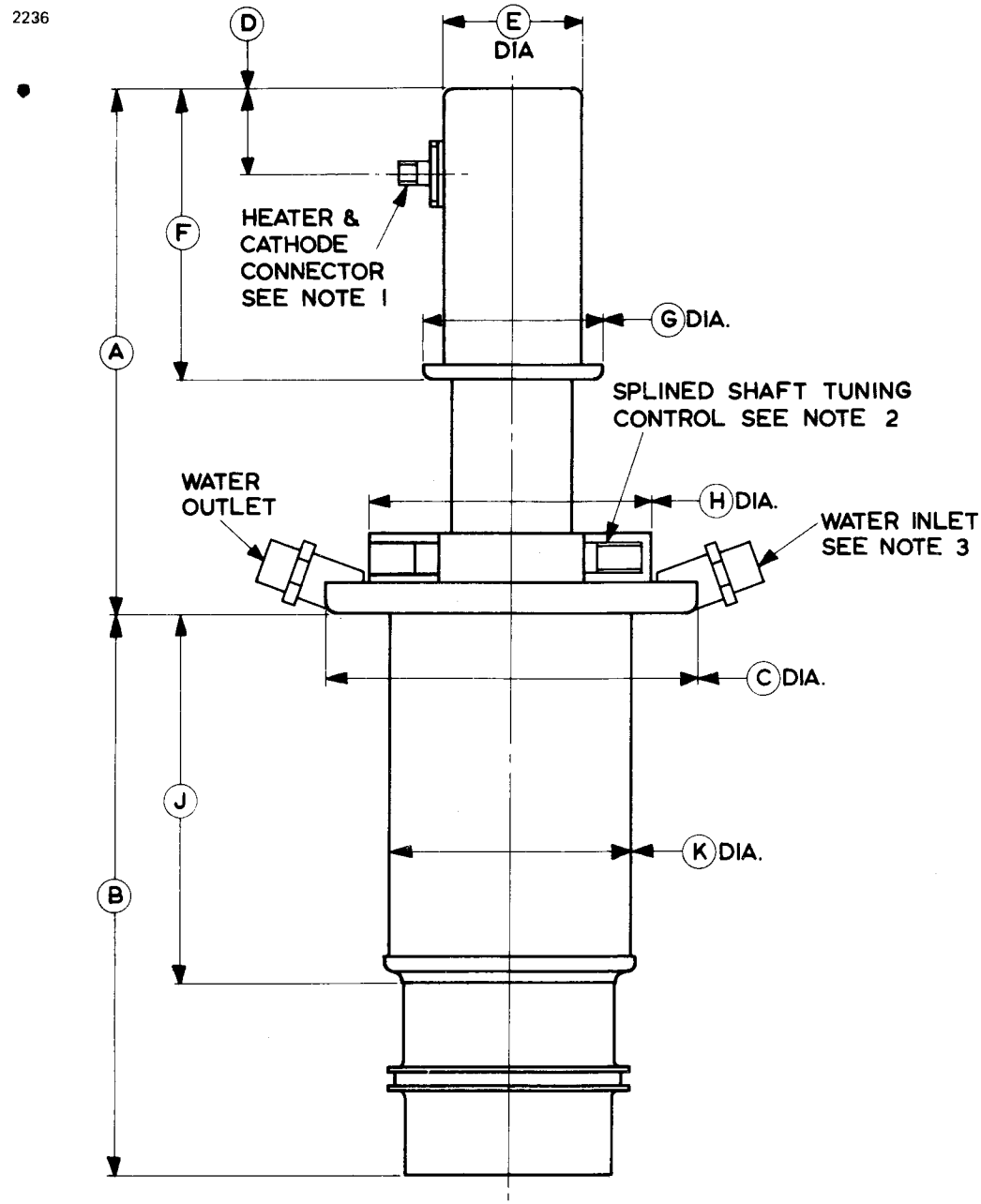
Millimetre dimensions have been derived from inches.

Note Internal spline, 12 tooth 48 DP, 14½° pressure angle, involute form.

CURRENT-FIELD STRENGTH CHARACTERISTIC FOR M4121

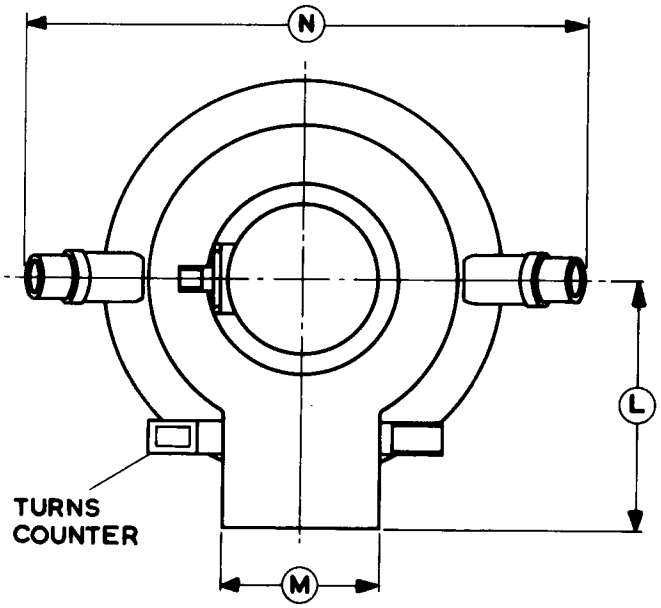


OUTLINE OF M5028



OUTLINE OF M5028

2237



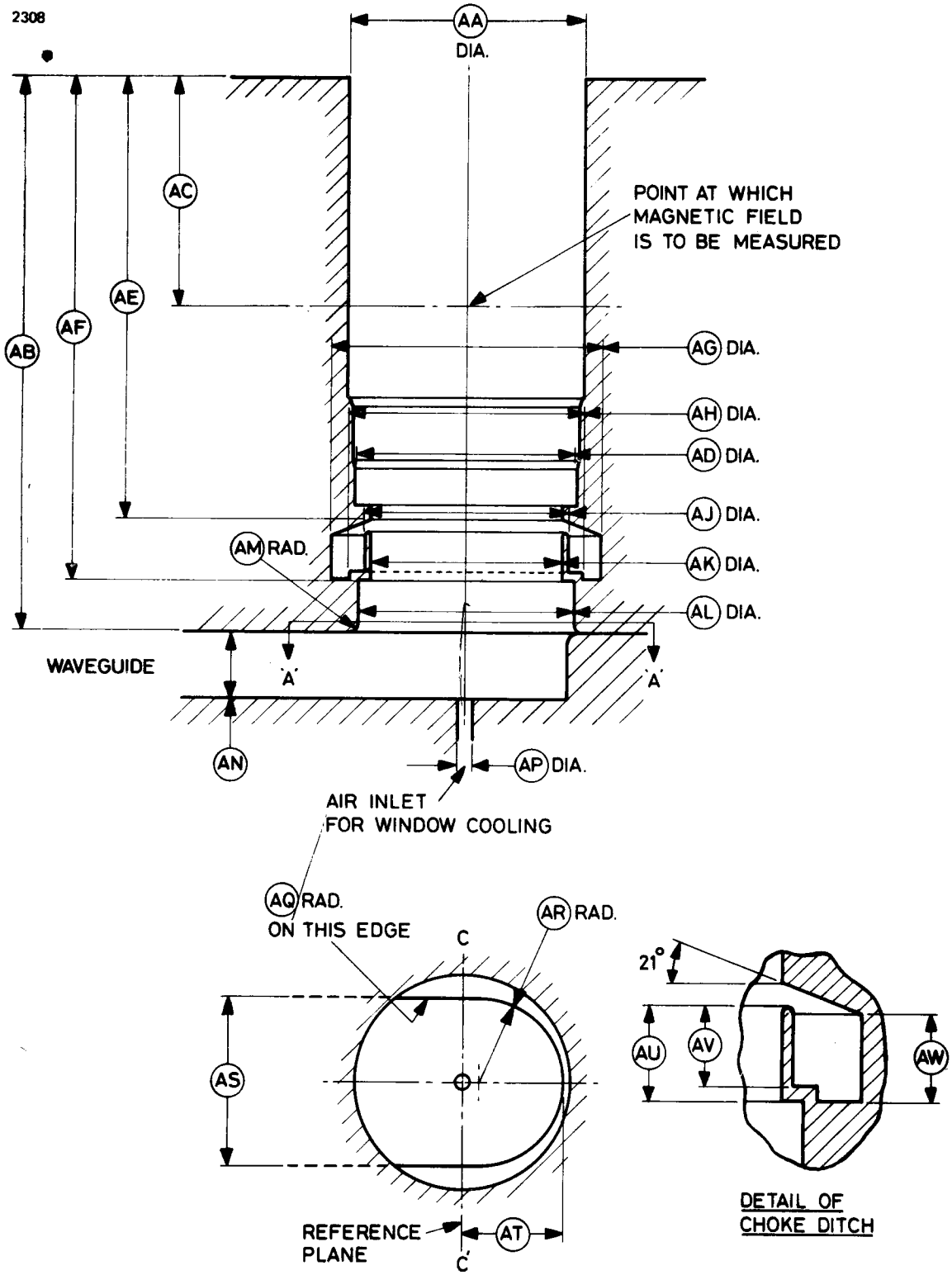
Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	9.500	241.3	H	4.375	111.1
B	8.514	216.3	J	5.689	144.5
C	5.775 max	146.7 max	K	4.000 max	101.6 max
D	1.300	33.02	L	3.563	90.50
E	2.250 max	57.15 max	M	2.250	57.15
F	4.400	111.8	N	7.500	190.5
G	3.000 max	76.20 max			

Millimetre dimensions have been derived from inches.

NOTES

1. Heater-cathode connector, Joint Services Catalogue number 5935-99-932-5870; the number for the corresponding plug is 5935-99-940-1839.
2. Splined shaft, to mate with S.S. White EX977 remote control flexible shaft (see page 6).
3. Water connections ½ inch B.S. screwed pipe to B.S.2051 part 2.

CROSS-SECTION OF SUITABLE ELECTRO-MAGNET AND LAUNCHING SECTION



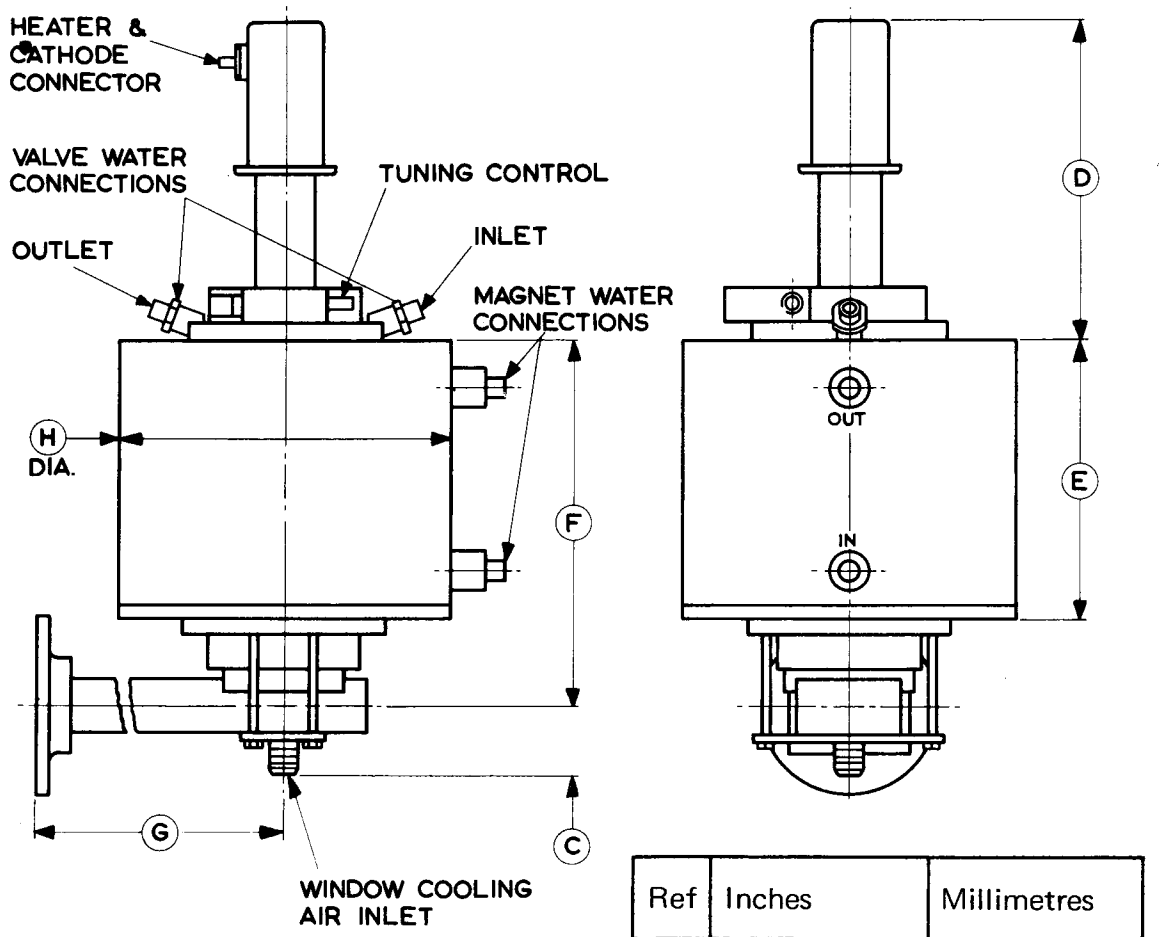
DIMENSIONS FOR ELECTRO-MAGNET AND LAUNCHING SECTION

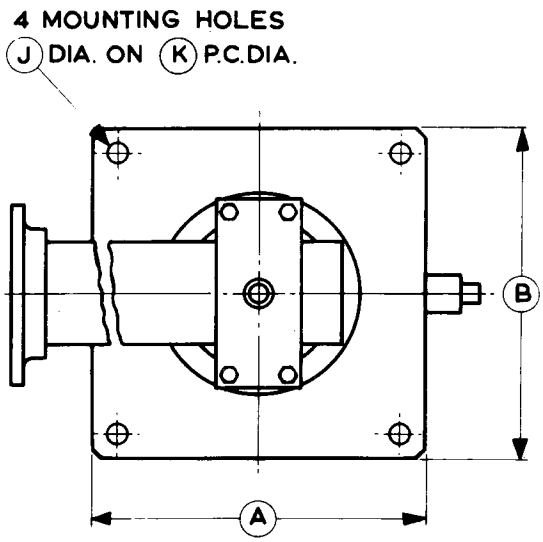
Ref	Inches	Millimetres
AA	$4.000^{+0.003}_{-0.000}$	$101.600^{+0.076}_{-0.000}$
AB	9.551	242.6
AC	3.939	100.1
AD	$3.750^{+0.002}_{-0.000}$	$95.250^{+0.051}_{-0.000}$
AE	7.637	194.0
AF	8.601	218.5
AG	4.340 ± 0.005	110.2 ± 0.13
AH	3.713 ± 0.003	94.310 ± 0.076
AJ	3.410 ± 0.005	86.61 ± 0.13
AK	3.250 ± 0.005	82.55 ± 0.13
AL	3.625 ± 0.003	92.075 ± 0.076
AM	0.125	3.18
AN	1.340	34.04
AP	0.250	6.35
AQ	0.125	3.18
AR	1.417 ± 0.005	35.99 ± 0.13
AS	2.840	72.14
AT	1.667 ± 0.010	42.34 ± 0.25
AU	0.813 ± 0.010	20.65 ± 0.25
AV	0.688 ± 0.010	17.48 ± 0.25
AW	0.750 ± 0.010	19.05 ± 0.25

Millimetre dimensions have been derived from inches.

OUTLINE OF M4121

2235





Ref	Inches	Millimetres
A	9.250	235.0
B	9.250	235.0
C	2.000	50.80
D	9.500	241.3
E	8.000	203.2
F	10.530	267.5
G	9.000	228.6
H	9.250	235.0
J	0.219	5.56
K	11.000	279.4

Millimetre dimensions have been derived from inches.

M5030 M5034

TUNABLE S-BAND MAGNETRONS

ABRIDGED DATA

Mechanically tuned pulse magnetrons for m.t.i. operation

Frequency range:		
M5030	2900 to 3050	MHz
M5034	3050 to 3200	MHz
Typical peak output power	1.0	MW
Magnet		integral
Output (see note 1)		no. 10 waveguide - RG 48/U (2.840 x 1.340 inches internal)
Coupler		special
Cooling		forced air
Isolator		the use of an isolator is recommended

GENERAL

Electrical

Cathode		indirectly heated
Heater voltage (see note 2)	8.5	V
Heater current (at 8.5V)	9.0	A
Heater starting current, peak value, not to be exceeded	40	A
Cathode heating time (minimum)	6	min

Mechanical

Overall dimensions	18.500 x 13.750 x 7.272 inches max 469.9 x 349.3 x 184.7mm max
Net weight	67 pounds (30kg) approx
Mounting position	cathode connector vertically downwards
Tuning (see note 3)	mechanical
Tuner turns to cover frequency range (see notes 4 and 5)	220 max
Cooling (see note 6)	forced air
Minimum rate of air flow (at 35°C)	200ft^3/min (5.7m^3/min)
Maximum pressure drop	2.5 inches (63.5mm) w.g.

MAXIMUM AND MINIMUM RATINGS

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

	Min	Max	
Heater voltage (see note 2)	8.1	8.9	V
Heater starting current (peak)	—	40	A
Anode voltage (peak)	—	36	kV
Anode current (peak)	—	80	A
Input power (peak)	—	2.3	MW
Input power (mean) (see note 7)	—	4.6	kW
Duty cycle	—	0.002	
Pulse length (see note 8)	0.5	5.0	μs
Rate of rise of voltage pulse (see note 9)	—	100	kV/μs
Anode temperature	—	140	°C
Cathode terminal temperature	—	160	°C
V.S.W.R. at the output coupler	—	1.3:1	
Rate of air flow into magnetron waveguide	5.0	—	ft^3/min

The modulator shall be such that the pulse energy delivered to the magnetron following an arcing pulse cannot exceed the normal pulse energy.

TYPICAL OPERATION

Operating Conditions

Heater voltage	0	V
Anode current (peak)	70	A
Pulse length	2.0	μs
Pulse repetition rate	1000	p.p.s.

Typical Performance

Anode voltage (peak)	33	kV
Output power (peak)	1.0	MW
Output power (mean)	2.0	kW
Frequency pushing (at 70A)	40	kHz/A

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following specification.

Electrical Test Conditions

Heater voltage (for test)	0	V
Anode current (mean)	150	mA
V.S.W.R. at the output coupler	1.15:1	max
Pulse length (see note 8)	5.0	μs
Duty cycle	0.002	
Rate of rise of voltage pulse (see note 9)	100	kV/μs min

Limits

	Min	Max	
Anode voltage (peak) (see note 10)	30	36	kV
Output power (mean) (see note 10)	2.0	—	kW
Frequency:			
M5030	2900	3050	MHz
M5034	3050	3200	MHz
R.F. bandwidth at ¼ power	—	0.4	MHz
Performance continuity	The spectrum shall be observed continuously over the specified frequency range.		
Frequency pulling (v.s.w.r. not less than 1.5:1)	—	7.0	MHz
Stability (see notes 10 and 11)	—	0.25	%
Heater current			see note 12
Temperature coefficient of frequency			see note 13

Mechanical Test Conditions

1. Valve at room temperature, no voltages applied.
2. Valve operating under electrical test conditions.

Limits

	Min	Max	
Tuning shaft turns to cover specified frequency range (condition 2)	150	220	turns
Tuning shaft torque (conditions 1 and 2) (see note 10)	—	35	oz-in
Backlash in tuning shaft	—	60	degrees rotation

END OF LIFE CRITERIA (Under Test Conditions)

Output power (mean)	1.7	kW min
R.F. bandwidth at ¼ power	0.4	MHz max
Stability	0.5	% max
Backlash in tuning shaft	90	degrees max

NOTES

1. The magnetron must be protected from mechanical strain by the use of a section of flexible waveguide between the magnetron and the waveguide system.

2. With no anode input power. On the application of anode voltage the heater voltage must be reduced as follows:

Mean input power (kW)	Heater voltage ($V_{r.m.s.}$)
0 to 1	8.5
1 to 2	6.5
2 to 3	5.0
3 to 4	3.0
over 4	zero

The valve heater shall be protected against arcing by the use of a minimum capacitance of 1.0μF shunted across the heater directly at the input terminals. A specially designed capacitor with coaxial connectors for mating with the valve input socket is available; details may be obtained from English Electric Valve Company Ltd.

3. Tuning is achieved by rotating a splined shaft which mates with S.S. White flexible drive assembly EX 977 (see page 5).

4. The tuning shaft shall not be rotated at a rate greater than 300rev/min.

5. Under no circumstances should a torque greater than 50oz-in be applied to the tuner shaft. The drive to the tuner should be transmitted through a torque limiting clutch to protect the valve from the inertia of the drive mechanism.

6. The anode temperature must be kept below 140°C by means of a suitable flow of air over the cooling fins.

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

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

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

8. Tolerance $\pm$10%.

9. 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.

10. These tests are carried out at the following frequencies:

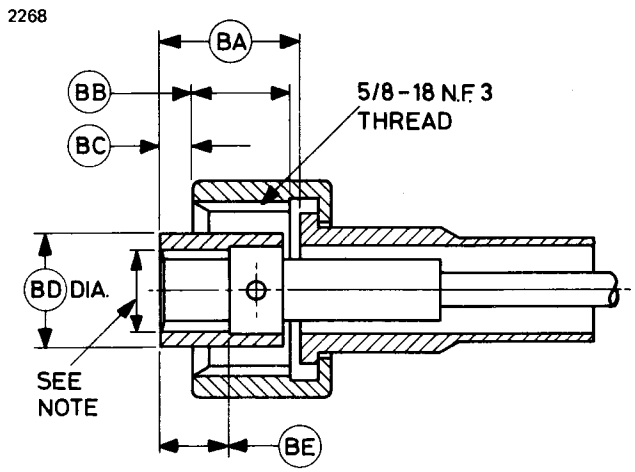
M5030	M5034
2900MHz	3050MHz
2950MHz	3100MHz
3000MHz	3150MHz
3050MHz	3200MHz

11. 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 valve. Missing pulses are expressed as a percentage of the number of input pulses during the last 30 seconds of a test interval not to exceed 5 minutes.

12. Measured with heater voltage of 8.5V and no anode input power, the heater current limits are 8.0A minimum, 12A maximum.

13. Design test only. The maximum frequency change with anode temperature change (after warm-up) is −0.07MHz/°C.

DETAIL OF FLEXIBLE DRIVE CONNECTOR

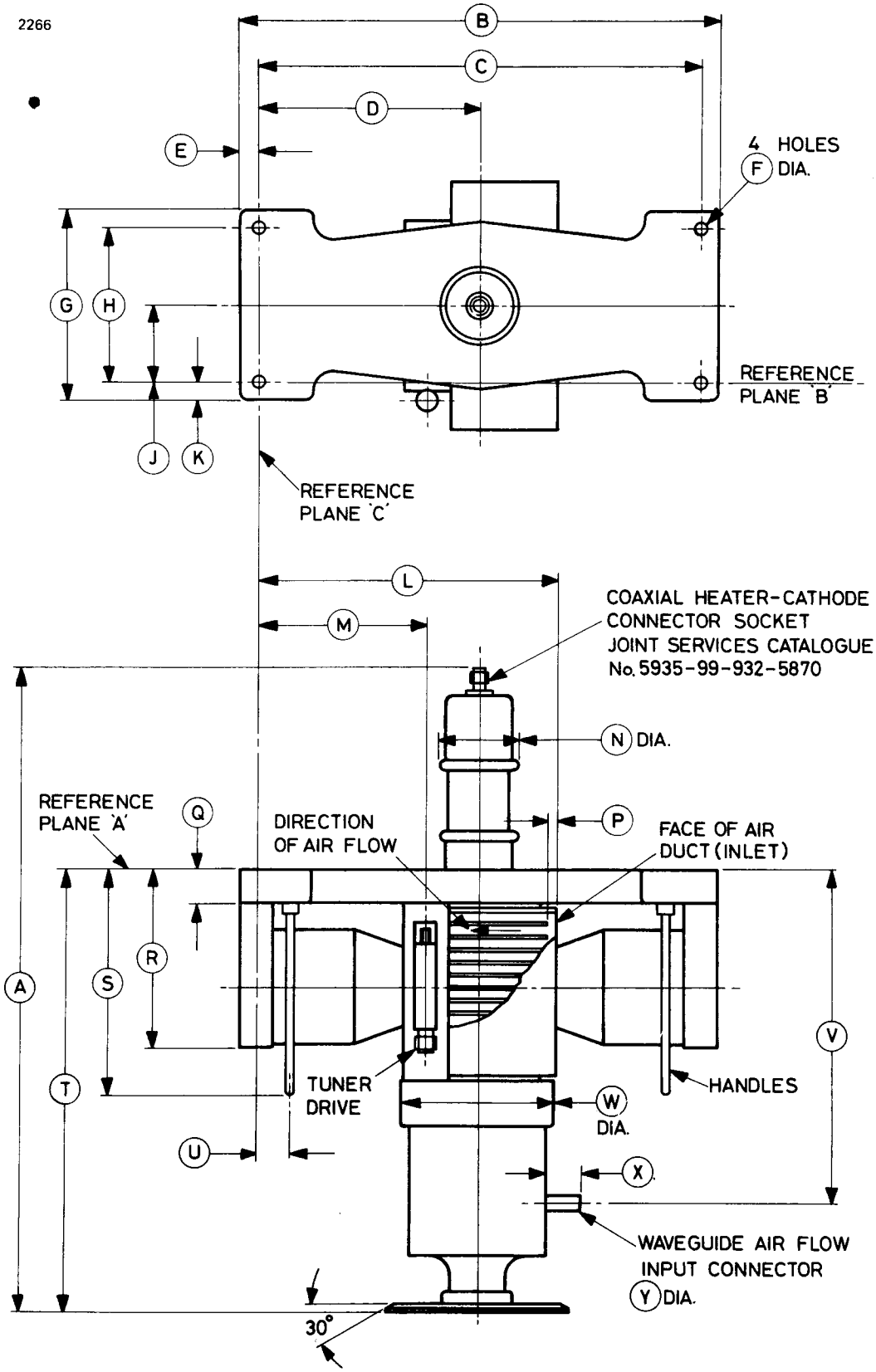


Ref	Inches	Millimetres
BA	0.500	12.70
BB	0.360	9.14
BC	0.112	2.84
BD	0.406	10.31
BE	0.250	6.35

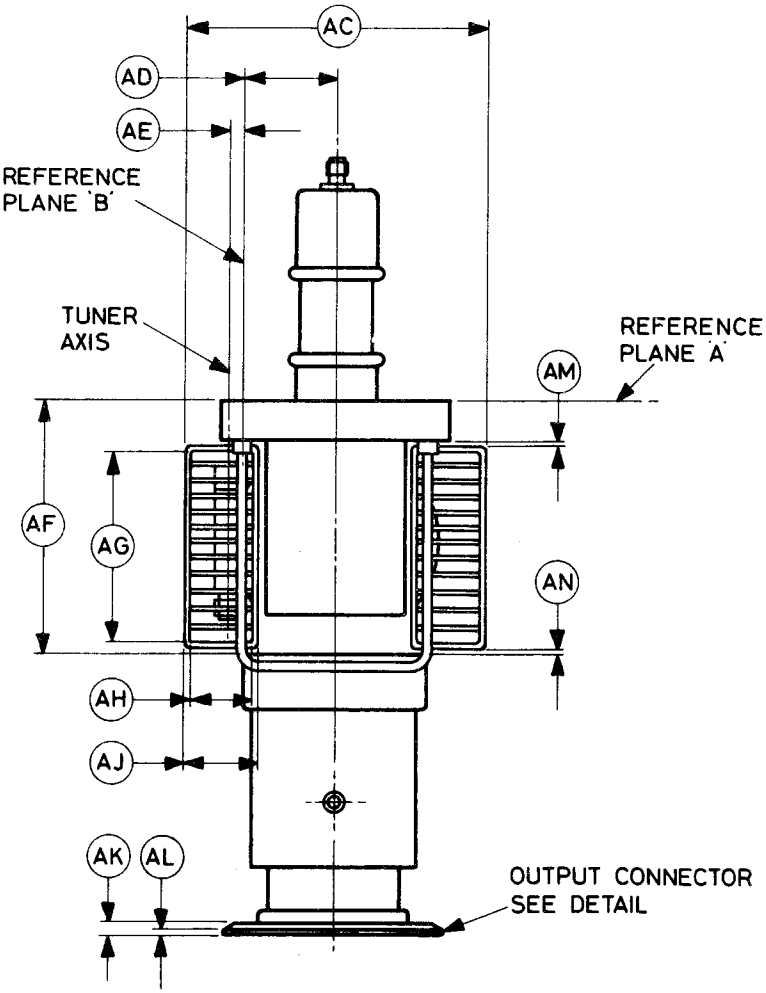
Millimetre dimensions have been derived from inches.

Note Internal spline, 12 tooth 48 DP, 14½° pressure angle, involute form.

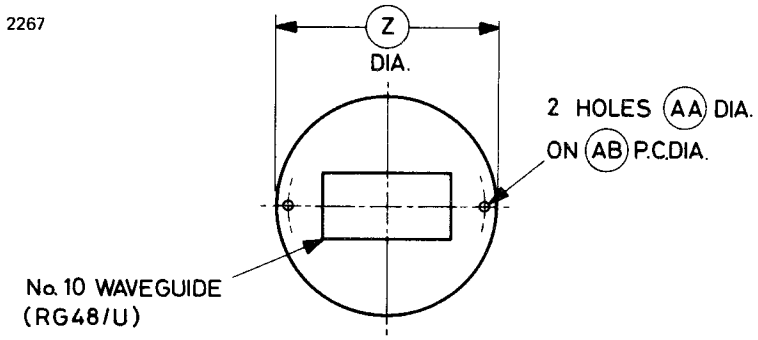
OUTLINE


2266
B
C
D
E
4 HOLES
F DIA.
G
H
J
K
REFERENCE PLANE 'B'
REFERENCE PLANE 'C'
L
M
COAXIAL HEATER-CATHODE CONNECTOR SOCKET JOINT SERVICES CATALOGUE No. 5935-99-932-5870
N DIA.
REFERENCE PLANE 'A'
Q
DIRECTION OF AIR FLOW
P
FACE OF AIR DUCT (INLET)
A
S
R
T
TUNER DRIVE
HANDLES
V
W DIA.
U
X
WAVEGUIDE AIR FLOW INPUT CONNECTOR
Y DIA.
30°

OUTLINE



Detail of Output Connector



OUTLINE DIMENSIONS

Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	18.500 max	469.9 max	V	9.560 ± 0.050	242.8 ± 1.3
B	13.750 max	349.3 max	W	4.425 max	112.4 max
C	12.720 ± 0.030	323.09 ± 0.76	X	1.000 ± 0.060	25.4 ± 1.5
D	6.360 ± 0.020	161.54 ± 0.51	Y	0.500 ± 0.020	12.70 ± 0.51
E	0.500 ± 0.030	12.70 ± 0.76	Z	5.272 ± 0.030	133.91 ± 0.76
F	0.375 ± 0.015	9.53 ± 0.38	AA	0.207 ± 0.005	5.26 ± 0.13
G	5.530 max	140.5 max	AB	4.764 ± 0.004	121.006 ± 0.102
H	4.500 ± 0.015	114.30 ± 0.38	AC	7.252 ± 0.020	184.20 ± 0.51
J	2.250 ± 0.020	57.15 ± 0.51	AD	2.250 ± 0.020	57.15 ± 0.51
K	0.500 ± 0.030	12.70 ± 0.76	AE	0.326 ± 0.040	8.28 ± 1.02
L	8.623 ± 0.060	219.0 ± 1.5	AF	6.060 ± 0.030	153.92 ± 0.76
M	4.865 ± 0.040	123.6 ± 1.0	AG	4.862 ± 0.015	123.49 ± 0.38
N	2.280 max	57.91 max	AH	1.752 ± 0.010	44.50 ± 0.25
P	0.250 ± 0.030	6.35 ± 0.76	AJ	1.832 ± 0.015	46.53 ± 0.38
Q	1.000 ± 0.020	25.40 ± 0.51	AK	0.275 ± 0.007	6.99 ± 0.18
R	5.180 max	131.6 max	AL	0.137 ± 0.015	3.48 ± 0.38
S	6.500 ± 0.125	165.1 ± 3.2	AM	0.060 ± 0.020	1.52 ± 0.51
T	12.650 ± 0.040	321.3 ± 1.0	AN	0.060 ± 0.020	1.52 ± 0.51
U	0.985 ± 0.030	25.02 ± 0.76			

Millimetre dimensions have been derived from inches.

M5058

TUNABLE S-BAND MAGNETRON

ABRIDGED DATA

Mechanically tuned pulse magnetron intended primarily for linear accelerators.

Frequency range	2994 to 3002	MHz
Peak output power	1.3	MW
Magnet		separate
Output		to no. 10 waveguide (2.840 x 1.340 inches internal) via the transition sections M4117 or M4119 shown on pages 11 and 12
Isolator		the use of an isolator is recommended, see note 8 on page 4
Cooling		water

GENERAL

Electrical

Cathode		indirectly heated
Heater voltage (see note 1)	8.5	V
Heater current	9.0	A
Heater starting current, peak value, not to be exceeded	20	A max
Cathode heating time (minimum)	3.0	min

Mechanical

Overall dimensions		14.750 x 7.250 x 6.000 inches max 374.7 x 184.2 x 152.4mm max
Net weight		16 pounds (7.3kg) approx
Tuner revolutions to cover frequency range (see note 2)	4	approx
Method of mounting		see note 3
Mounting position (see note 4)		any

Continued on page 2

Cooling

The valve is water cooled and has an integral water jacket, the connections being made via ¼-inch B.S.P. unions. The recommended water flow is 5 litres per minute or more; a pressure of approximately 1.25kg/cm^2 will be necessary to give this rate of flow. The outlet water temperature must not exceed 50°C.

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 5)	1350	1400	gauss
Heater voltage (see note 1)	8.0	10	V
Heater starting current (peak)	—	20	A
Anode voltage (peak)	—	40	kV
Anode current (peak)	60	80	A
Input power (mean)	—	5.0	kW
Duty cycle	—	0.0015	
Pulse length (see note 6)	—	5.0	μs
Rate of rise of voltage pulse (see note 7)	—	120	kV/μs
Outlet water temperature	—	50	°C
V.S.W.R. at the output coupler (see note 8)	—	1.5:1	
Pressurising of waveguide (see note 9)	14	45	lb/in^2 abs.
	0.99	3.5	kg/cm^2 abs.

TYPICAL OPERATION

Operational Conditions

Magnetic field	1375 ± 25	gauss
Heater voltage	4.0	V
Anode current (peak)	70	A
Pulse length	5.0	μs
Pulse repetition rate	300	p.p.s.
Rate of rise of voltage pulse	110	kV/μs

Typical Performance

Anode voltage (peak)	36	kV
Output power (peak)	1.3	MW
Output power (mean)	1.9	kW
Frequency drift		see note 10

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification (see note 11).

Test Conditions

Magnetic field	1375 ± 25	gauss
Heater voltage (for test)	4.0	V
Anode current (peak)	70	A
Duty cycle	0.0015	
Pulse length (see note 6)	5.0	μs
V.S.W.R. at the output coupler	1.1:1	
Rate of rise of voltage pulse (see note 7)	90	kV/μs

Limits

	Min	Max	
Anode voltage (peak)	34	38	kV
Output power (peak)	1.25	–	MW
Frequency (see note 12):			
lower end of tuning range	–	2994	MHz
upper end of tuning range	3002	–	MHz
R.F. bandwidth at ¼ power	–	1.5	MHz
Frequency pulling (v.s.w.r. not less than 1.5:1)	–	7.0	MHz
Stability (see note 13)	–	0.5	%
Heater current			see note 14
Temperature coefficient of frequency			see note 15

NOTES

1. With no anode input power.

   The heater voltage shall be reduced within 5 seconds after the application of h.t. according to the schedule shown on page 7.

   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.

2. The tuner mechanism is driven by means of three tapped holes in the tuner knob (see outline drawing) via a flexible drive. The torque required is 0.5kg-cm minimum.

3. It is recommended that the magnetron should be mounted by means of the output flange (shown as Flange A on the outline drawing). Should a mounting arrangement employing Flange B be envisaged, care must be taken to avoid mechanical stress on the magnetron between the two flanges. Users are invited to submit details of their mounting arrangements to English Electric Valve Company Ltd. for approval.

4. To minimise frequency deviation when the magnetron is rotated about a horizontal axis, this axis should be parallel to the axis of the tuner.

5. The valve is designed for use with a separate magnet which can be supplied if requested. The position of the magnet must be adjusted so that the axis of the field is in line with the axis of the anode and is at right angles to the H plane of the system waveguide. The user is invited to consult English Electric Valve Company Ltd. on the choice of alternative magnets.

6. The use of magnetron M5015 is recommended for applications requiring a peak output power of 2.0MW at a pulse length of 2.0μs.

7. Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude. Any capacitance in the viewing system must not exceed 6.0pF.

8. It is recommended that the magnetron should be isolated from the load by means of an isolator of approved design. Information on the characteristics of a suitable isolator may be obtained from English Electric Valve Company Ltd.

9. At the maximum pressure of 45lb/in^2 (3.5kg/cm^2) absolute the maximum leakage will be such that with an enclosed volume of 1 litre the pressure will not drop by more than 10 pounds in 7 days.

10. The frequency of the valve will vary during the first 30 seconds after the application of anode voltage. Typically the frequency will be 0.4MHz high 5 seconds after switching on h.t. and 0.1MHz high 20 seconds after switching on.

11. These tests are carried out at 2998MHz except where otherwise specified.

12. With ambient temperature 20°C, inlet water temperature 20°C and water flow rate 5.0 l./s. Other frequency ranges can be supplied on request.

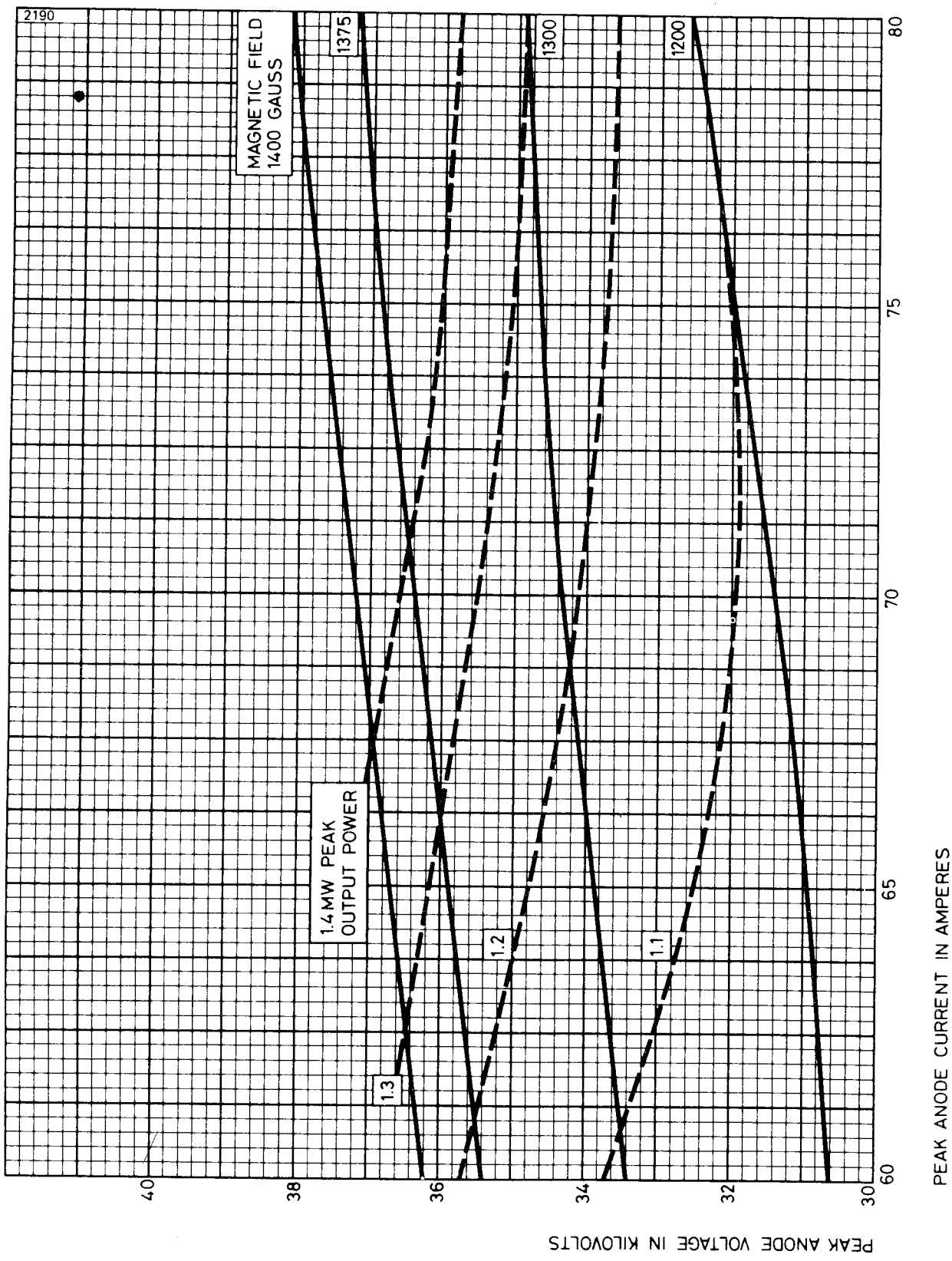
13. With the valve operating into a v.s.w.r. of 1.15:1. Pulses are defined as

missing when the r.f. energy level is less than 70% of the normal energy level in a 0.5% frequency range. Missing pulses are expressed as a percentage of the number of input pulses applied during the period of observation after a period of 10 minutes operation.

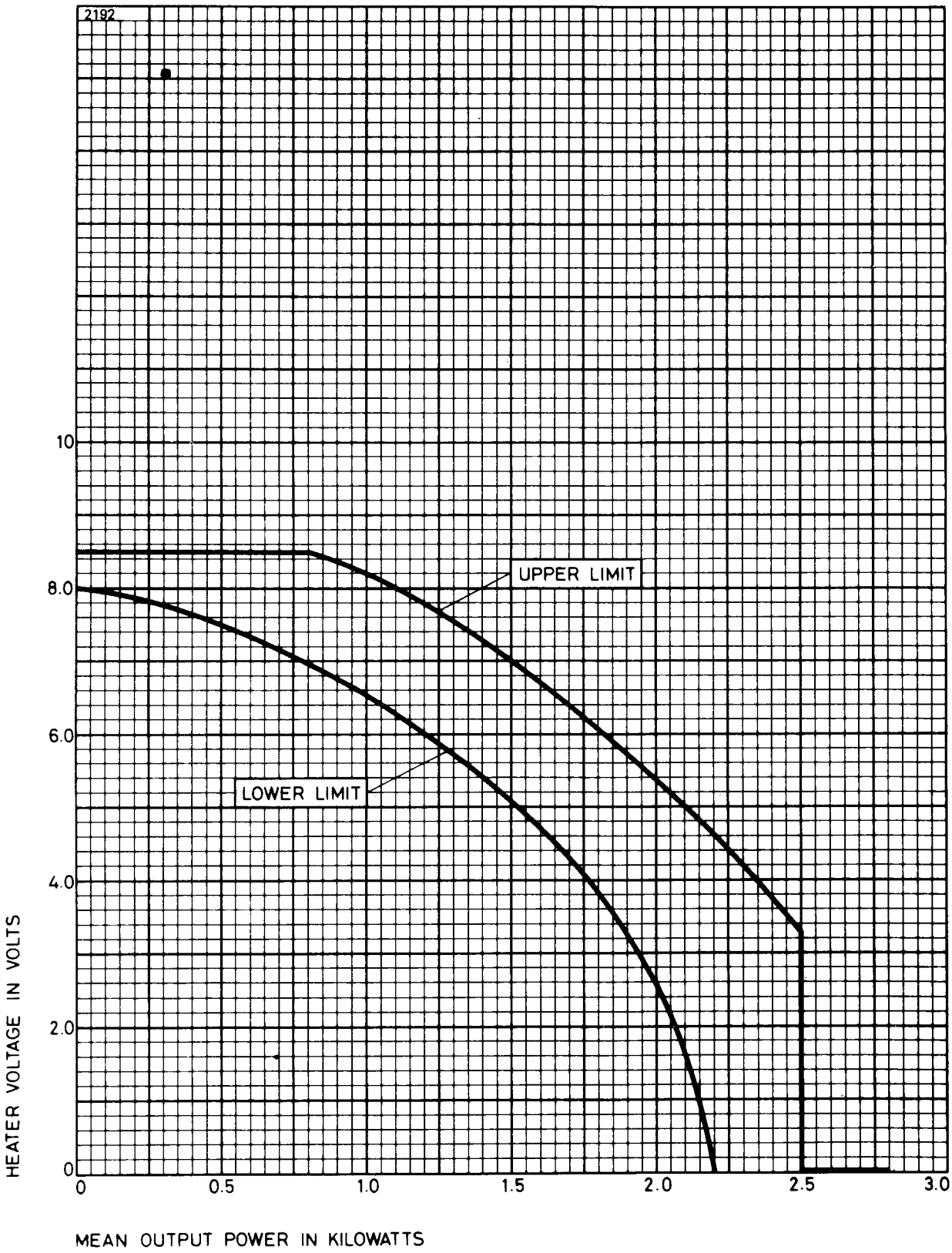
14. Measured with heater voltage of 8.5V and no anode input power, the heater current limits are 8.0A minimum, 10.0A maximum.

15. Design test only. The maximum frequency change with anode temperature change (after warming) is -0.25MHz/°C.

PERFORMANCE CHART

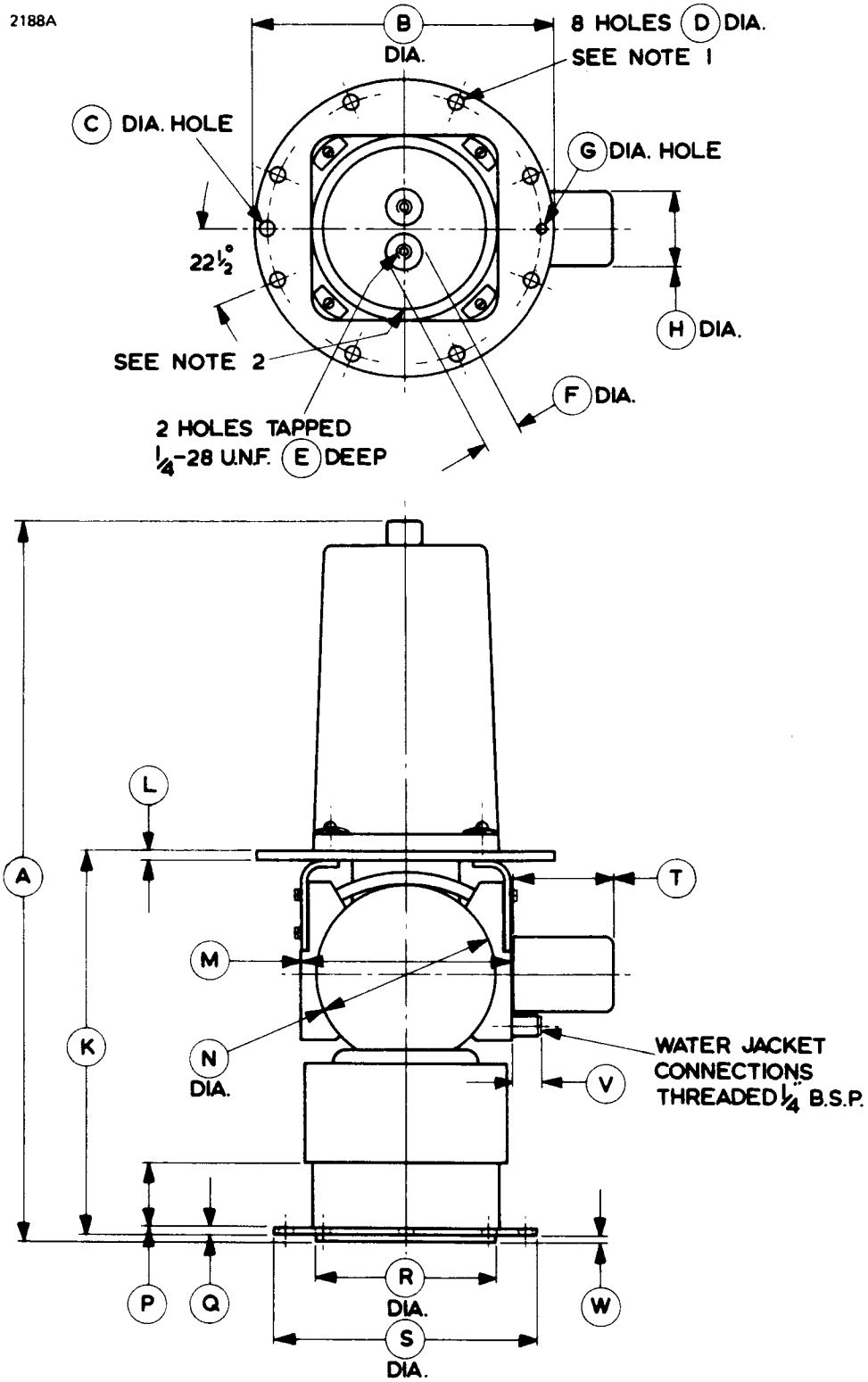


HEATER VOLTAGE ADJUSTMENT SCHEDULE



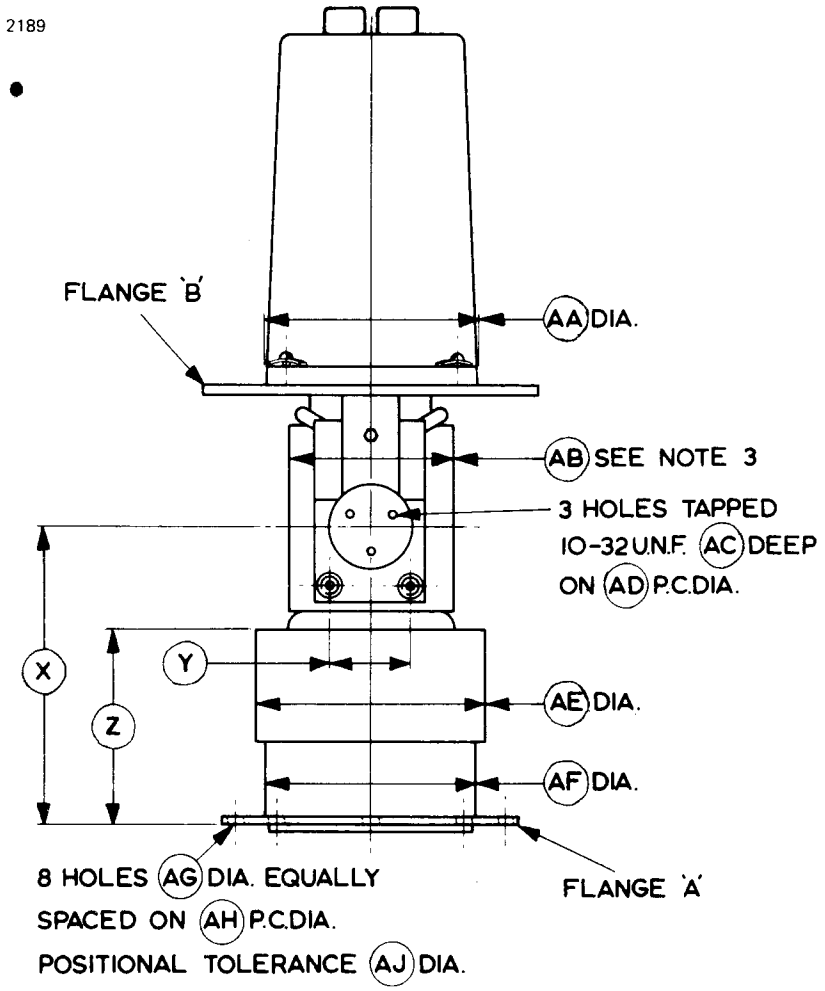
OUTLINE

See page 10 for outline dimensions



OUTLINE

See page 10 for outline dimensions



OUTLINE NOTES

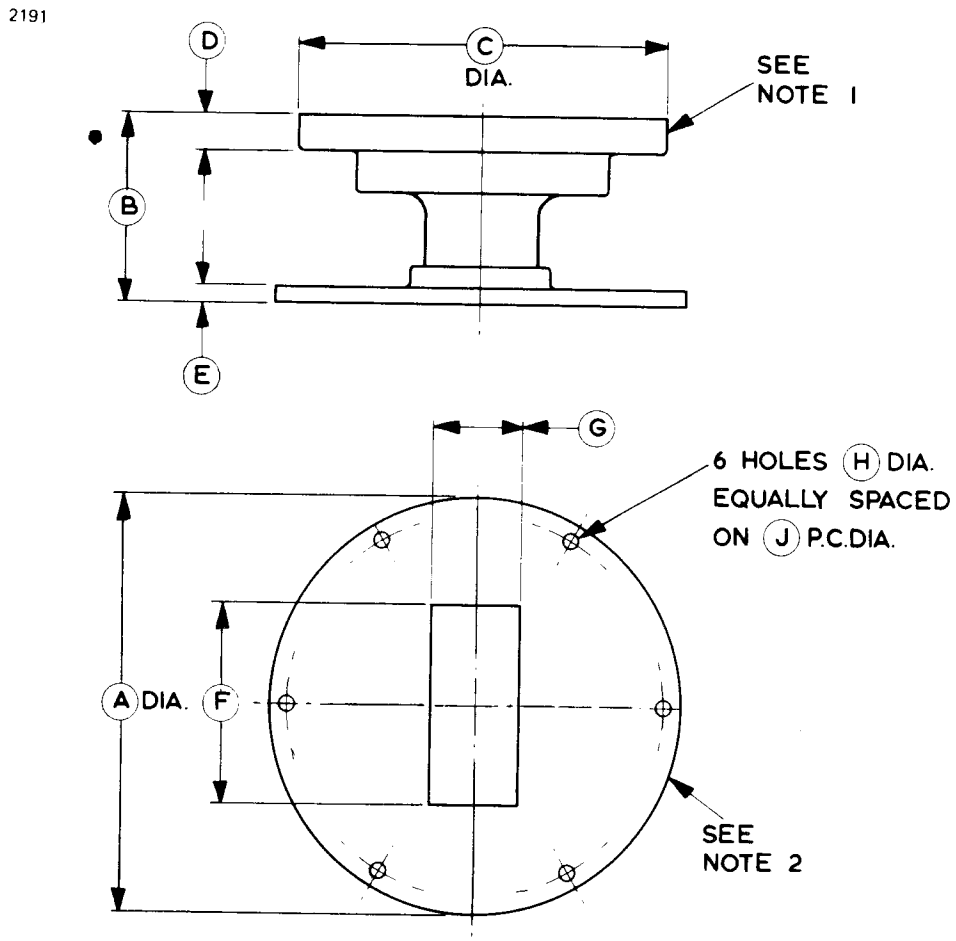
1. The 8 holes will clear studs 0.250 inch (6.35mm) diameter equally spaced on 5.500 inches (139.7mm) pitch circle diameter and within 0.005 inch (0.127mm) of their nominal positions, with the valve located by dowel pins 0.307 inch (7.80mm) diameter and 0.245 inch (6.22mm) diameter spaced 5.500 ± 0.002 inches (139.700 ± 0.051mm) apart.
2. This surface is marked with the letter 'C' to indicate the cathode terminal.
3. The valve will fit between magnet poles 3.010 inch (76.45mm) diameter and 2.970 inches (75.44mm) apart.

OUTLINE DIMENSIONS

Ref	Inches	Millimetres
A	14.750 max	374.7 max
B	$6.000^{+0.000}_{-0.010}$	$152.4^{+0.00}_{-0.25}$
C	$0.312^{+0.005}_{-0.000}$	$7.92^{+0.13}_{-0.00}$
D	0.312	7.92
E	0.250	6.35
F	0.750	19.05
G	$0.250^{+0.005}_{-0.000}$	$6.35^{+0.13}_{-0.00}$
H	1.500	38.10
K	7.780 ± 0.025	197.6 ± 0.64
L	0.250 ± 0.005	6.35 ± 0.13
M	4.375	111.1
N	3.625	92.08
P	1.218	30.94
Q	0.218	5.54
R	$3.625^{+0.000}_{-0.006}$	$92.08^{+0.00}_{-0.15}$
S	5.250 ± 0.062	133.4 ± 1.57
T	2.000 max	50.80 max
V	0.500	12.70
W	0.125 ± 0.005	3.18 ± 0.13
X	5.291 ± 0.015	134.4 ± 0.38
Y	1.375	34.93
Z	3.500 ± 0.125	88.90 ± 3.18
AA	3.750	95.25
AB	2.970 max	75.44 max
AC	0.187	4.75
AD	0.750	19.05
AE	4.125	104.8
AF	3.687	93.65
AG	0.250	6.35
AH	4.750 ± 0.005	120.7 ± 0.13
AJ	0.006	0.15

Millimetre dimensions have been derived from inches.

TRANSITION SECTION M4117



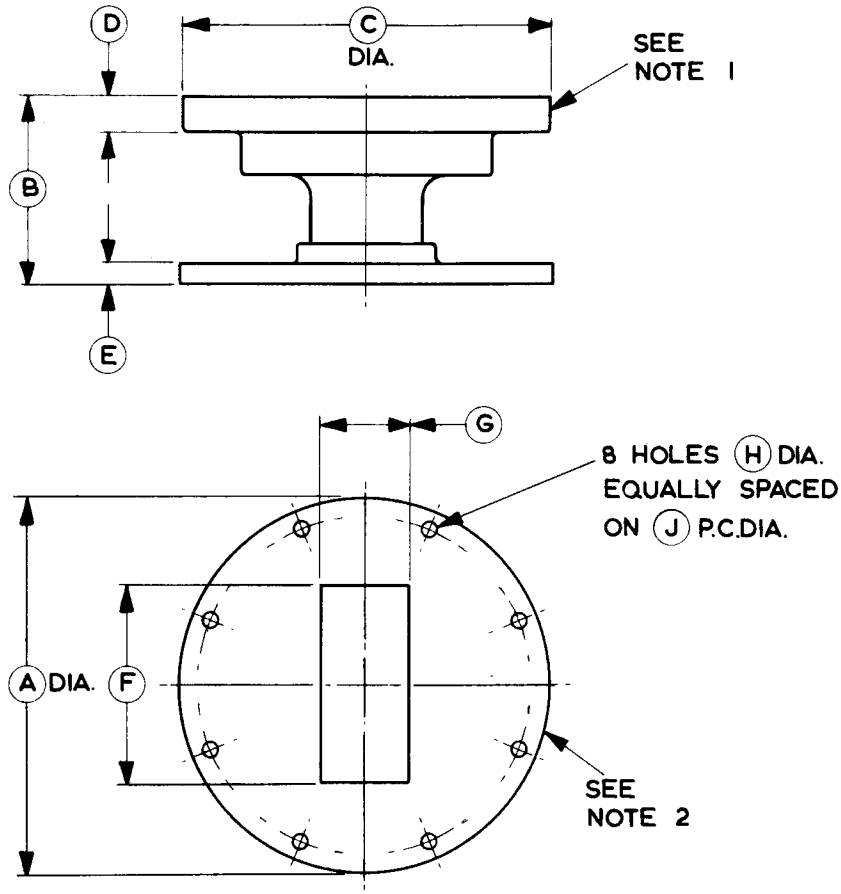
Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	5.875	149.2	F	2.840	72.14
B	2.643	67.13	G	1.340	34.04
C	5.250	133.4	H	0.257	6.53
D	0.500	12.70	J	5.375	136.5
E	0.250	6.35			

Millimetre dimensions have been derived from inches.

NOTES

1. This flange mates with flange 'A' of the Magnetron using 8–0.250 inch (6.35mm) diameter bolts, and an O-ring (supplied with M4117) 3.975 inches internal diameter and 0.210 inch diameter section. J.S. No. 5985-99-083-0011 or JAN MS 90064–17.
2. This flange is J.S. type No. 5985-99-083-1560.

TRANSITION SECTION M4119



Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	5.312	134.9	F	2.840	72.14
B	2.643	67.13	G	1.340	34.04
C	5.250	133.4	H	0.257	6.53
D	0.500	12.70	J	4.750	120.7
E	0.312	7.93			

Millimetre dimensions have been derived from inches.

NOTES

1. This flange mates with flange 'A' of the Magnetron using 8–0.250 inch (6.35mm) diameter bolts, and an O-ring (supplied with M4119) 3.975 inches internal diameter and 0.210 inch diameter section. J.S. No. 5985-99-083-0011 or JAN MS 90064–17.
2. This flange is equivalent to J.S. Type No. 5985-99-083-0010 or JAN UG-53/U.

C-Band Magnetrons

M5008 M5009

C-BAND MAGNETRONS

ABRIDGED DATA

Fixed frequency pulse magnetrons

Frequency range:		
M5008	5250 to 5310	MHz
M5009	5450 to 5510	MHz
Typical peak output power	0.84	MW
Magnet and launching section	separate electro-magnet and launching section (see page 7 for dimensions)	
Isolator	use of an isolator is recommended (see note 7 on page 4)	
Output	no. 12 waveguide (1.872 x 0.872 inches internal)	
Cooling	water and forced-air	

GENERAL

Electrical

Cathode	indirectly heated	
Heater voltage (see note 1)	6.3	V
Heater current	13	A
Heater starting current, peak value, not to be exceeded	40	A max
Cathode heating time (minimum)	3.0	min

Mechanical

Overall dimensions	10.557 x 3.000 x 3.000 inches max 268.1 x 76.20 x 76.20mm max	
Net weight	3.8 pounds (1.73kg) approx	
Mounting position	any	

Cooling

water and forced-air

Water cooling of the anode is incorporated in the electro-magnet; the minimum rate of flow of cooling water is 1 imp. gal/min (4.54 l./min) with a maximum inlet temperature of 60°C.

The output window is cooled by high pressure air in the waveguide; the minimum window cooling air flow is 55g/min (42.5 l./min) with a maximum inlet temperature of 60°C.

Any lubricants used on the anode should be sulphur free.

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)	2900	3100	gauss
Heater voltage (see note 1)	5.85	6.75	V
Heater starting current (peak)	–	40	A
Cathode heating time (see note 1)	180	–	s
Anode current (peak)	55	65	A
Input power (mean) (see note 3)	–	3.0	kW
Duty cycle	–	0.0015	
Pulse length (see note 4)	–	3.0	μs
Rate of rise of voltage pulse (see note 5)	170	210	kV/μs
Anode temperature (see note 6)	–	150	°C
Cathode terminal temperature (see note 6)	–	150	°C
V.S.W.R. at the output coupler (see note 7)	–	1.3:1	
Pressurising of waveguide	45	65	lb/in^2
	3.16	4.57	kg/cm^2

TYPICAL OPERATION

Operational Conditions

Heater voltage	0	V
Magnetic field	3000	gauss
Anode current (peak)	60	A
Pulse length	2.5	μs
Pulse repetition rate	600	p.p.s.

Typical Performance

Anode voltage (peak)	34	kV
Output power (peak)	0.84	MW
Output power (mean)	1.25	kW

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification.

Test Conditions (see note 8)

Air flow		see note 9
Magnetic field (see note 10)	3000	gauss
Heater voltage (for test)	0	V
Anode current (mean)	90	mA
Duty cycle	0.0015	
Pulse length (see note 4)	2.5	μs
V.S.W.R. at the output coupler		see note 11
Rate of rise of voltage pulse (see note 5)	210	kV/μs min

Limits

	Min	Max	
Anode voltage (peak)	32	36	kV
Output power (mean)	1100	—	W
Frequency:			
M5008	5250	5310	MHz
M5009	5450	5510	MHz
R.F. bandwidth at ¼ power (see note 12)	—	1.0	MHz
Frequency pulling (see note 13)	—	10	MHz
Stability (see note 14)	—	0.25	%
Heater current			see note 15

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.

Heater voltage	0	V
Magnetic field	3000	gauss
Anode current (mean)	90	mA
Duty cycle	0.0015	
Pulse length	2.5	μs
V.S.W.R. at the output coupler		see note 11
Rate of rise of voltage pulse	210	kV/μs min

End of Life Criteria (under Test Conditions above)

Output power (mean)	1.0	kW min
Bandwidth	1.25	MHz max
Stability	0.5	% max

NOTES

1. With no input power.

   Prior to the application of anode voltage, the cathode must be heated for at least 3 minutes by the application of 6.3 volts (±7½%) to the heater. Immediately after the application of anode voltage, the heater voltage must be reduced according to the mean input power as follows:

Mean Input Power (kW)	Heater Voltage ($V_{r.m.s.}$)
0 to 1	6.3 ± 0.45
1 to 2	4.0 ± 0.45
2 to 3	Zero

   The valve heater must be protected against arcing by the use of a minimum capacitance of 1.0μF shunted across the heater directly at the input terminals. A specially designed capacitor with coaxial connectors for mating with the valve input socket is available; details may be obtained from English Electric Valve Company Ltd. 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 electromagnet (see page 7).

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

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

   where Pi = 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 ±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. Any capacitance used in the viewing system must not exceed 6.0pF.

6. Measured at the point specified on the valve outline (see page 6).

7. The magnetron will operate satisfactorily into a load with a v.s.w.r. of 1.3:1, at all phases of the mismatch. It will also operate into a load of v.s.w.r. 1.5:1, at all phases of the mismatch, but the valve characteristics may deteriorate and life may be impaired if such operation is for more than nominally short periods.

   It is recommended that the magnetron should be isolated from the load by means of an isolator of approved design. Information on the characteristics of a suitable isolator may be obtained from English Electric Valve Company Ltd.

8. The modulator must be such that the pulse energy delivered to the magnetron following an arcing pulse cannot greatly exceed the normal pulse energy.

9. During this test the waveguide air pressure must not exceed 45lb/in^2 (3.16kg/cm^2) absolute and the cooling air flow shall not exceed 55g/min. For the purposes of this specification the following conversions and equivalents are to be used:

   1 litre of dry air (normal temperature and pressure) weighs 1.293 gramme.

   1 cubic foot = 28.3 litres

   453.6 grammes = 1 pound

10. The value of the magnetic field must fall monotonically to between 87.5 and 92% of the value at the specified point at ± 1.100 inches (±27.94mm) along the magnetron axis from the specified point. The sense of the field must be such that a north seeking pole at the specified point will move towards the magnetron cathode terminal.

11. The v.s.w.r. of the specified load is that measured at the output flange of the launching section. The load v.s.w.r. for this test will be less than 1.05:1.

12. The v.s.w.r. of the load for this test will be at least 1.3:1 and the phase adjusted for maximum deterioration of spectrum shape.

13. The v.s.w.r. of the load for this test will be at least 1.3:1, varied through all phases of the mismatch.

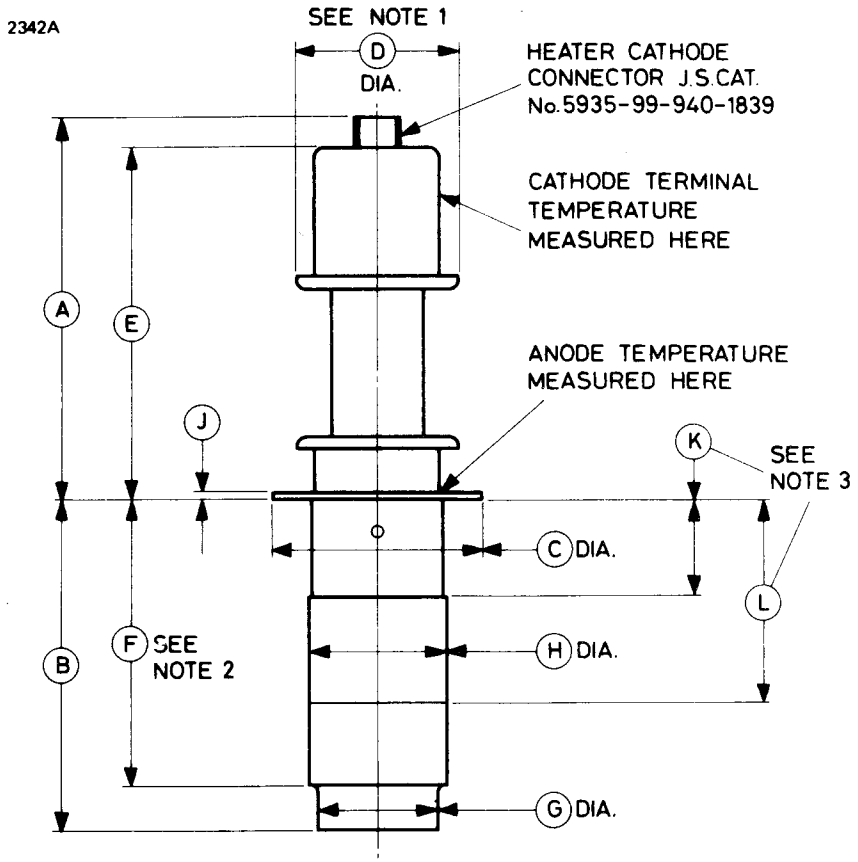
14. Stability is the ratio of missing pulses to the total number of input pulses. A pulse is considered to be missing when its energy is less than 70% of the normal energy level within the frequency band accommodating all the frequency bands plus an extension at each end of twice the pulling figure.

15. Measured with heater voltage of 6.3V and no anode input power, the heater current limits are 12A minimum, 14A maximum.

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.

OUTLINE



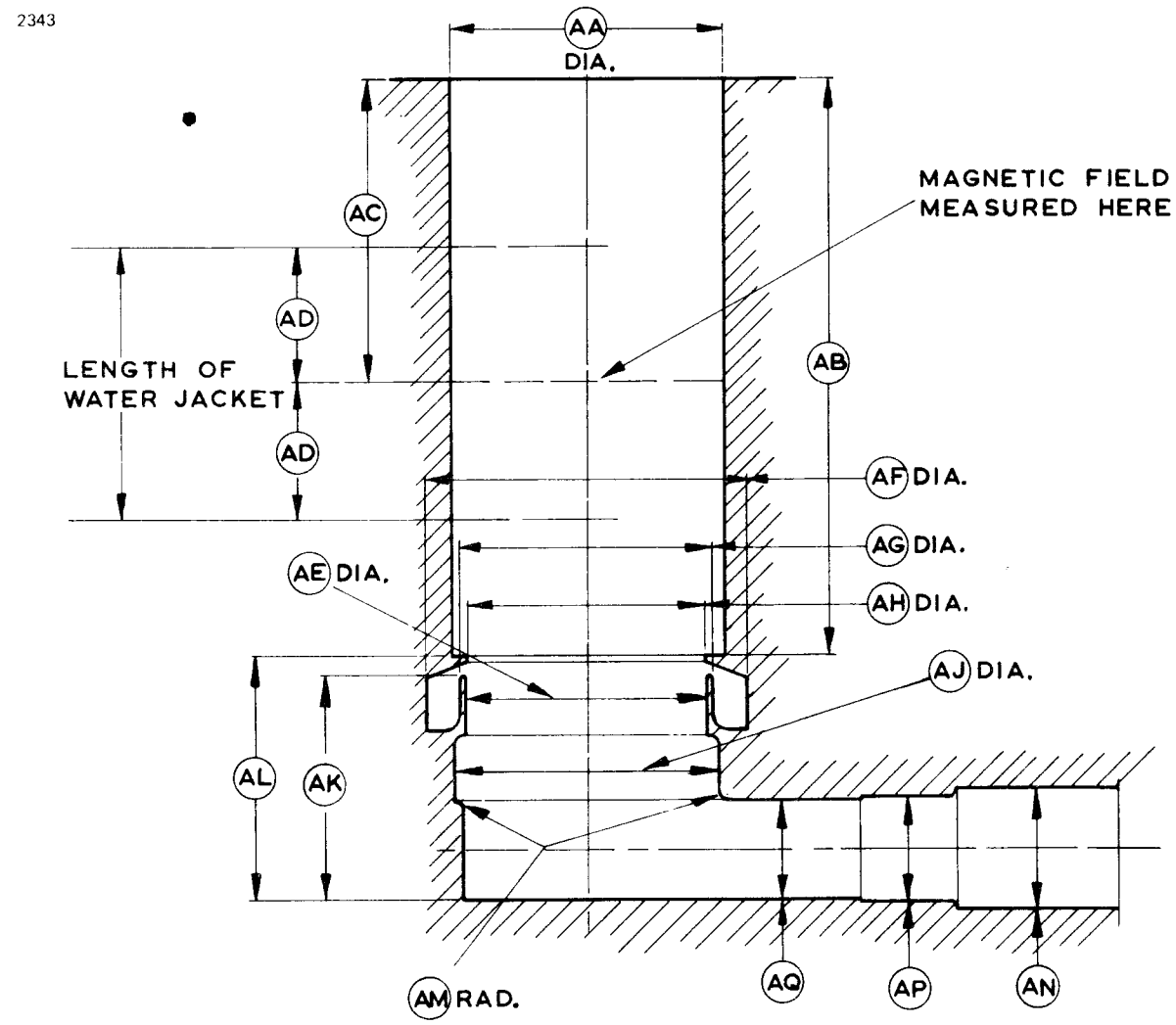
Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	5.800 max	147.3 max	G	1.721 ± 0.010	43.71 ± 0.25
B	4.725 ± 0.032	120.02 ± 0.81	H	2.000 ± 0.001	50.800 ± 0.025
C	2.995 ± 0.005	76.07 ± 0.13	J	0.125 ± 0.005	3.18 ± 0.13
D	2.500 max	63.50 max	K	1.441 max	36.60 max
E	5.225 max	132.7 max	L	2.936 min	74.57 min
F	4.100 ± 0.022	104.14 ± 0.56			

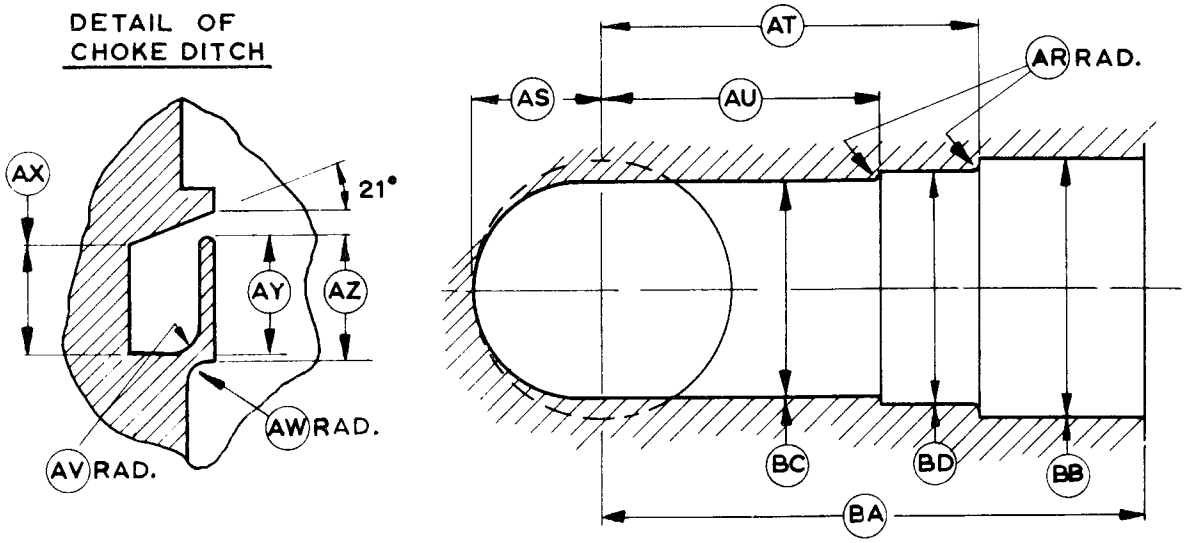
Millimetre dimensions have been derived from inches.

Outline Notes

1. All cathode terminal features will lie within a cylinder of diameter D, concentric with datum diameter H.
2. All features over this length will lie within a cylinder of diameter 2.001 inches (50.825mm), concentric with datum diameter H.
3. Diameter H will be maintained between these dimensions.

ELECTRO-MAGNET AND LAUNCHING SECTION





DIMENSIONS FOR ELECTRO-MAGNET AND LAUNCHING SECTION

Ref	Inches	Millimetres
AA	$2.002^{+0.002}_{-0.000}$	$50.851^{+0.051}_{-0.000}$
AB	4.145 ± 0.010	105.3 ± 0.25
AC	2.200	55.88
AD	1.000 min	25.40 min
AE	1.757	44.63
AF	2.346 ± 0.003	59.588 ± 0.076
AG	1.844	46.84
AH	1.757 ± 0.003	44.627 ± 0.076
AJ	1.959 ± 0.003	49.758 ± 0.076
AK	1.672	42.47
AL	1.812	46.02
AM	0.062	1.57
AN	0.870	22.10
AP	0.772	19.61
AQ	0.725	18.42
AR	0.020	0.51
AS	0.901	22.89
AT	2.687 ± 0.016	68.25 ± 0.41
AU	1.969 ± 0.016	50.01 ± 0.41
AV	0.100	2.54
AW	0.062	1.57
AX	0.392	9.96
AY	0.4215 ± 0.0025	10.706 ± 0.064
AZ	0.4415 ± 0.0025	11.214 ± 0.064
BA	3.875 ± 0.016	98.43 ± 0.41
BB	1.872	47.55
BC	1.536	39.01
BD	1.652	41.96

Millimetre dimensions have been derived from inches.

M5032 M5033

C-BAND MAGNETRONS

ABRIDGED DATA

Fixed frequency pulse magnetrons

Frequency range:		
M5032	5250 to 5350	MHz
M5033	5430 to 5530	MHz
Typical peak output power	0.84	MW
Magnet and launching section	separate electro-magnet and launching section (see page 7 for dimensions)	
Isolator	use of an isolator is recommended (see note 7 on page 4)	
Output	no. 12 waveguide (1.872 x 0.872 inches internal)	
Cooling	water and forced-air	

GENERAL

Electrical

Cathode	indirectly heated	
Heater voltage (see note 1)	6.3	V
Heater current	13	A
Heater starting current, peak value, not to be exceeded	40	A max
Cathode heating time (minimum)	3.0	min

Mechanical

Overall dimensions	10.557 x 3.000 x 3.000 inches max 268.1 x 76.20 x 76.20mm max
Net weight	3.8 pounds (1.73kg) approx
Mounting position	any

Cooling

water and forced-air

Water cooling of the anode is incorporated in the electro-magnet; the minimum rate of flow of cooling water is 1 imp. gal/min (4.54 l./min) with a maximum inlet temperature of 60°C.

The output window is cooled by high pressure air in the waveguide; the minimum window cooling air flow is 55g/min (42.5 l./min) with a maximum inlet temperature of 60°C.

Any lubricants used on the anode should be sulphur free.

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)	2900	3100	gauss
Heater voltage (see note 1)	5.85	6.75	V
Heater starting current (peak)	—	40	A
Cathode heating time (see note 1)	180	—	s
Anode current (peak)	55	65	A
Input power (mean) (see note 3)	—	3.0	kW
Duty cycle	—	0.0015	
Pulse length (see note 4)	—	5.5	μs
Rate of rise of voltage pulse (see note 5)	170	210	kV/μs
Anode temperature (see note 6)	—	150	°C
Cathode terminal temperature (see note 6)	—	150	°C
V.S.W.R. at the output coupler (see note 7)	—	1.3:1	
Pressurising of waveguide	45	65	lb/in^2
	3.16	4.57	kg/cm^2

TYPICAL OPERATION

Operational Conditions

Heater voltage	0	V
Magnetic field	3000	gauss
Anode current (peak)	60	A
Pulse length	5.0	μs
Pulse repetition rate	300	p.p.s.

Typical Performance

Anode voltage (peak)	34	kV
Output power (peak)	0.84	MW
Output power (mean)	1.25	kW

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification.

Test Conditions (see note 8)

Air flow		see note 9
Magnetic field (see note 10)	3000	gauss
Heater voltage (for test)	0	V
Anode current (mean)	90	mA
Duty cycle	0.0015	
Pulse length (see note 4)	5.0	μs
V.S.W.R. at the output coupler		see note 11
Rate of rise of voltage pulse (see note 5)	210	kV/μs min

Limits

	Min	Max	
Anode voltage (peak)	32	36	kV
Output power (mean)	1100	—	W
Frequency:			
M5032	5250	5350	MHz
M5033	5430	5530	MHz
R.F. bandwidth at ¼ power (see note 12)	—	0.5	MHz
Frequency pulling (see note 13)	—	10	MHz
Stability (see note 14)	—	0.25	%
Heater current			see note 15

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.

Heater voltage	0	V
Magnetic field	3000	gauss
Anode current (mean)	90	mA
Duty cycle	0.0015	
Pulse length	5.0	μs
V.S.W.R. at the output coupler		see note 11
Rate of rise of voltage pulse	210	kV/μs min

End of Life Criteria (under Test Conditions above)

Output power (mean)	1.0	kW min
Bandwidth	1.25	MHz max
Stability	0.5	% max

NOTES

1. With no input power.

   Prior to the application of anode voltage, the cathode must be heated for at least 3 minutes by the application of 6.3 volts (±7½%) to the heater. Immediately after the application of anode voltage, the heater voltage must be reduced according to the mean input power as follows:

Mean Input Power (kW)	Heater Voltage ($V_{r.m.s.}$)
0 to 1	6.3 ± 0.45
1 to 2	4.0 ± 0.45
2 to 3	Zero

   The valve heater must be protected against arcing by the use of a minimum capacitance of 1.0μF shunted across the heater directly at the input terminals. A specially designed capacitor with coaxial connectors for mating with the valve input socket is available; details may be obtained from English Electric Valve Company Ltd. 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 electromagnet (see page 7).

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

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

   where Pi = 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 ±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. Any capacitance used in the viewing system must not exceed 6.0pF.

6. Measured at the point specified on the valve outline (see page 6).

7. The magnetron will operate satisfactorily into a load with a v.s.w.r. of 1.3:1, at all phases of the mismatch. It will also operate into a load of v.s.w.r. 1.5:1, at all phases of the mismatch, but the valve characteristics may deteriorate and life may be impaired if such operation is for more than nominally short periods.

   It is recommended that the magnetron should be isolated from the load by means of an isolator of approved design. Information on the characteristics of a suitable isolator may be obtained from English Electric Valve Company Ltd.

8. The modulator must be such that the pulse energy delivered to the magnetron following an arcing pulse cannot greatly exceed the normal pulse energy.

9. During this test the waveguide air pressure must not exceed 45lb/in^2 (3.16kg/cm^2) absolute and the cooling air flow shall not exceed 55g/min. For the purposes of this specification the following conversions and equivalents are to be used:

   1 litre of dry air (normal temperature and pressure) weighs 1.293 gramme.

   1 cubic foot = 28.3 litres

   453.6 grammes = 1 pound

10. The value of the magnetic field must fall monotonically to between 87.5 and 92% of the value at the specified point at ± 1.100 inches (±27.94mm) along the magnetron axis from the specified point. The sense of the field must be such that a north seeking pole at the specified point will move towards the magnetron cathode terminal.

11. The v.s.w.r. of the specified load is that measured at the output flange of the launching section. The load v.s.w.r. for this test will be less than 1.05:1.

12. The v.s.w.r. of the load for this test will be at least 1.3:1 and the phase adjusted for maximum deterioration of spectrum shape.

13. The v.s.w.r. of the load for this test will be at least 1.3:1, varied through all phases of the mismatch.

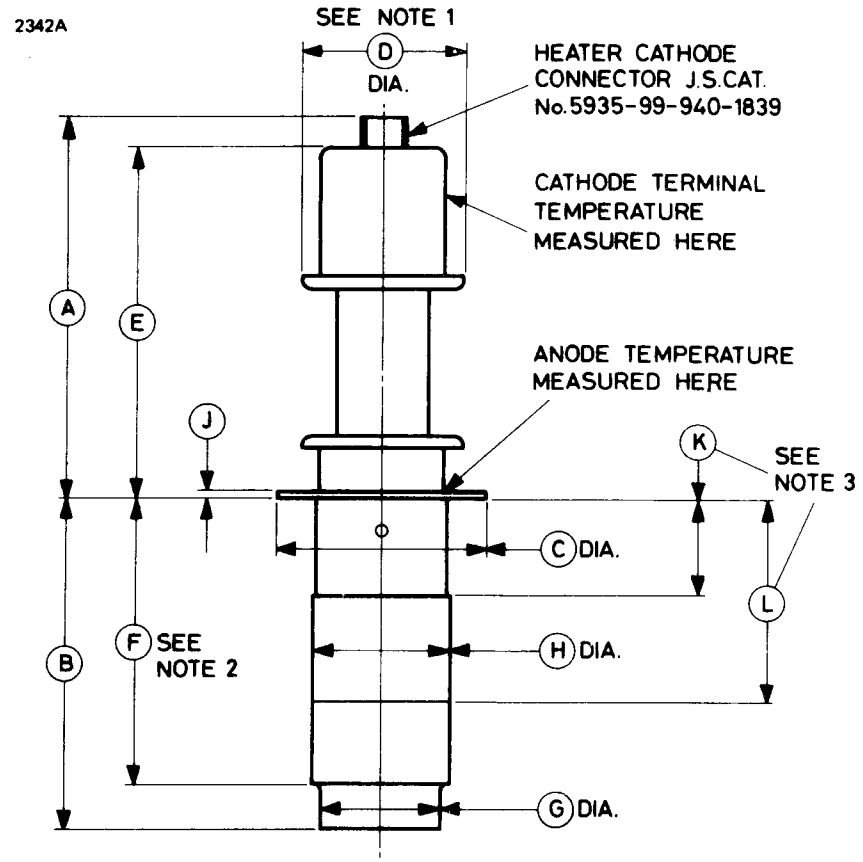
14. Stability is the ratio of missing pulses to the total number of input pulses. A pulse is considered to be missing when its energy is less than 70% of the normal energy level within the frequency band accommodating all the frequency bands plus an extension at each end of twice the pulling figure.

15. Measured with heater voltage of 6.3V and no anode input power, the heater current limits are 12A minimum, 14A maximum.

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.

OUTLINE



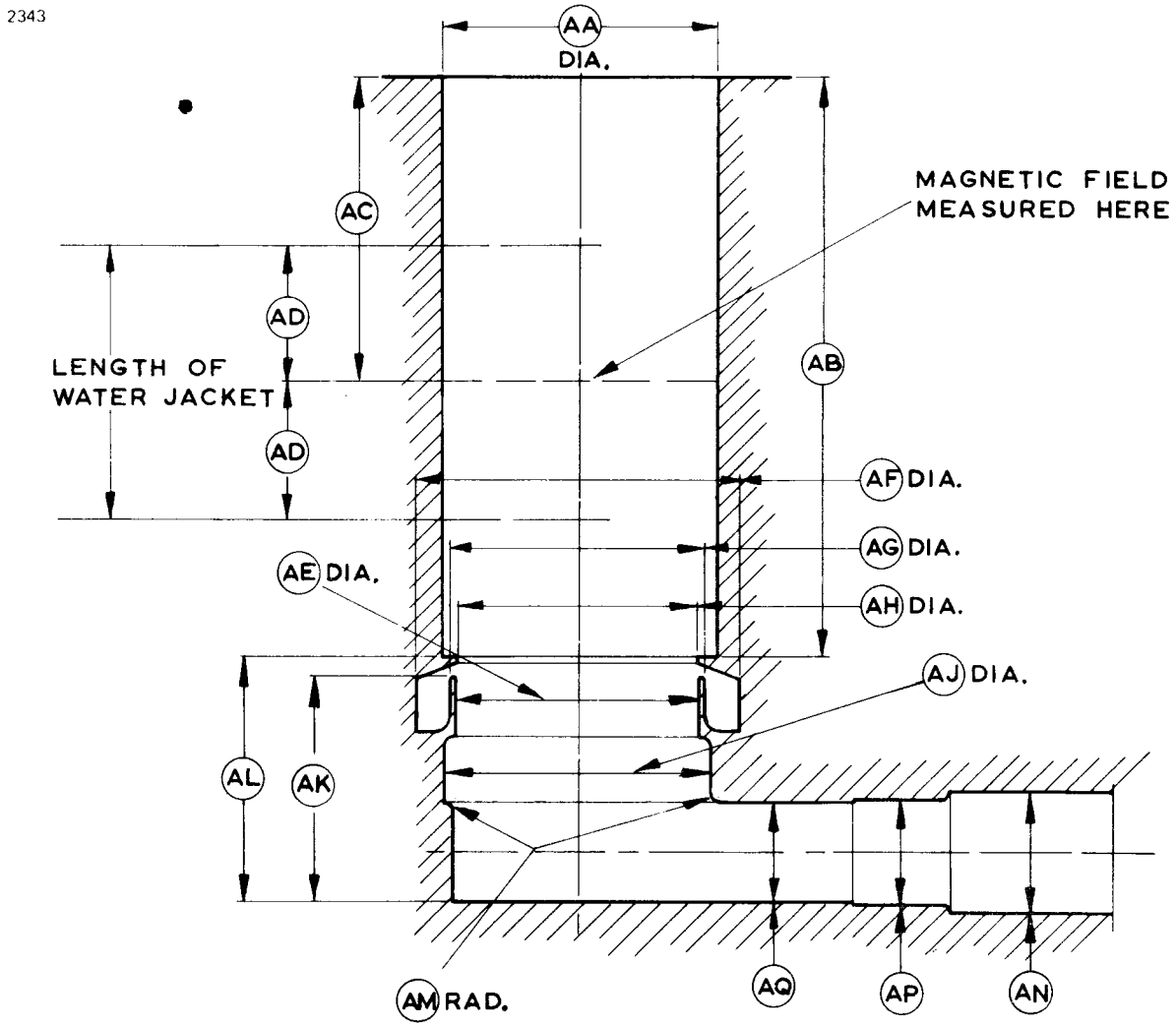
Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	5.800 max	147.3 max	G	1.721 ± 0.010	43.71 ± 0.25
B	4.725 ± 0.032	120.02 ± 0.81	H	2.000 ± 0.001	50.800 ± 0.025
C	2.995 ± 0.005	76.07 ± 0.13	J	0.125 ± 0.005	3.18 ± 0.13
D	2.500 max	63.50 max	K	1.441 max	36.60 max
E	5.225 max	132.7 max	L	2.936 min	74.57 min
F	4.100 ± 0.022	104.14 ± 0.56			

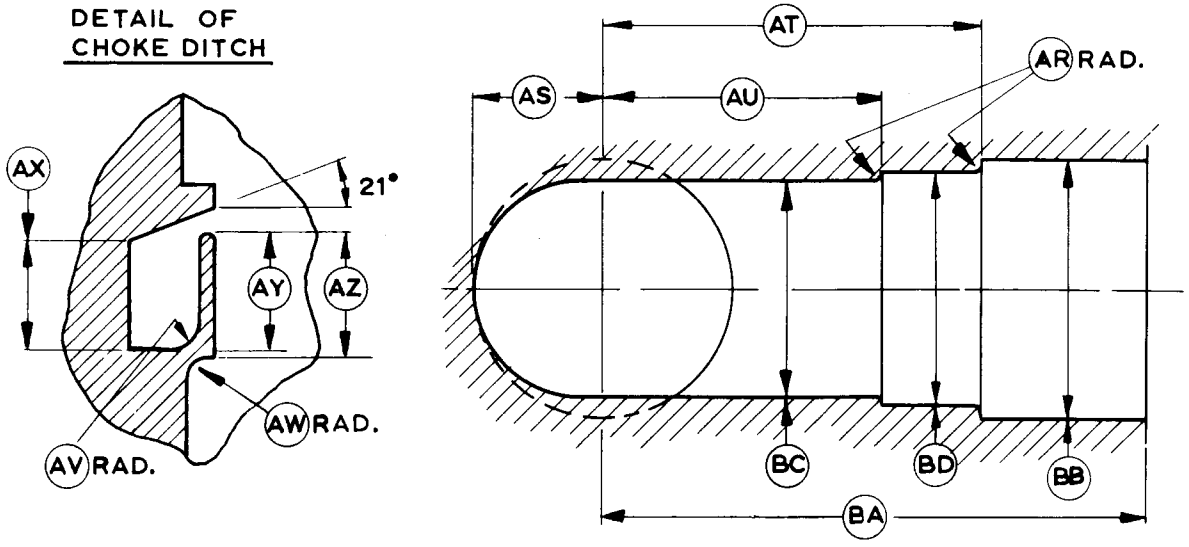
Millimetre dimensions have been derived from inches.

Outline Notes

1. All cathode terminal features will lie within a cylinder of diameter D, concentric with datum diameter H.
2. All features over this length will lie within a cylinder of diameter 2.001 inches (50.825mm), concentric with datum diameter H.
3. Diameter H will be maintained between these dimensions.

ELECTRO-MAGNET AND LAUNCHING SECTION





DIMENSIONS FOR ELECTRO-MAGNET AND LAUNCHING SECTION

Ref	Inches	Millimetres
AA	$2.002^{+0.002}_{-0.000}$	$50.851^{+0.051}_{-0.000}$
AB	4.145 ± 0.010	105.3 ± 0.25
AC	2.200	55.88
AD	1.000 min	25.40 min
AE	1.757	44.63
AF	2.346 ± 0.003	59.588 ± 0.076
AG	1.844	46.84
AH	1.757 ± 0.003	44.627 ± 0.076
AJ	1.959 ± 0.003	49.758 ± 0.076
AK	1.672	42.47
AL	1.812	46.02
AM	0.062	1.57
AN	0.870	22.10
AP	0.772	19.61
AQ	0.725	18.42
AR	0.020	0.51
AS	0.901	22.89
AT	2.687 ± 0.016	68.25 ± 0.41
AU	1.969 ± 0.016	50.01 ± 0.41
AV	0.100	2.54
AW	0.062	1.57
AX	0.392	9.96
AY	0.4215 ± 0.0025	10.706 ± 0.064
AZ	0.4415 ± 0.0025	11.214 ± 0.064
BA	3.875 ± 0.016	98.43 ± 0.41
BB	1.872	47.55
BC	1.536	39.01
BD	1.652	41.96

Millimetre dimensions have been derived from inches.

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Printed in England by Wightman & Co. Ltd.