M513A

X-BAND MAGNETRON

Service Type CV3528

The data should be read in conjunction with the Magnetron Preamble.

ABRIDGED DATA

Fixed frequency pulse magnetron

Frequency range	9345 to 9405	MHz
Typical peak output power	22	kW
Magnets		integral
Output		no. 16 waveguide (0.900 x 0.400 inch internal)
Coupler		UG-40B/U (5985-99-083-0051)
Cooling		natural or forced-air

GENERAL

Electrical

Cathode		indirectly heated
Heater voltage (see note 1)	6.3	V
Heater current at 6.3V	0.5	A
Heater starting current, peak value, not to be exceeded	3.0	A max
Cathode heating time (minimum) (see note 2)	2	min

Mechanical

Overall dimensions	5.375 x 5.031 x 4.468 inches max 136.5 x 127.8 x 113.5mm max
Net weight	5 pounds (2.3kg) approx
Mounting position	any

A minimum clearance of 2 inches (50mm) must be maintained between the magnet and any magnetic materials.

Cooling (see note 5) . . . . . natural or 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)	5.7	6.9	V
Heater starting current (peak)	—	3.0	A
Anode voltage (peak)	7.0	8.0	kV
Anode current (peak)	5.5	8.5	A
Input power (peak)	—	64	kW
Input power (mean) (see note 3)	—	80	W
Duty cycle	—	0.0025	
Pulse length	—	2.0	μs
Rate of rise of voltage pulse (see note 4)	—	100	kV/μs
Anode temperature (see note 5)	—	120	°C
V.S.W.R. at the output coupler	—	1.5:1	
Ambient pressure for satisfactory operation	500	—	mm Hg
Pressurising of waveguide (see note 6)	—	45	lb/in^2
	—	3.16	kg/cm^2

TYPICAL OPERATION

Operational Conditions

	Condition 1	Condition 2	
Heater voltage	6.3	6.3	V
Anode current (peak)	7.5	7.5	A
Pulse length	1.0	0.1	μs
Pulse repetition rate	500	1000	p.p.s.
Rate of rise of voltage pulse	100	100	kV/μs

Typical Performance

Anode voltage (peak)	7.6	7.6	kV
Output power (peak)	22	22	kW
Output power (mean)	11	2.2	W

TEST CONDITIONS AND LIMITS

The valve is tested to comply with the following electrical specification

Test Conditions

	Oscillation 1	Oscillation 2	
Heater voltage (for test)	6.3	6.3	V
Anode current (mean)	3.75	0.375	mA
Duty cycle	0.0005	0.00005	
Pulse length (see note 7)	1.0	0.05	μs
V.S.W.R. at the output coupler	1.15:1	1.15:1	
Rate of rise of voltage pulse (see note 4)	100	100	kV/μs

Limits

	Min	Max	Min	Max	
Anode voltage (peak)	7.0	8.0	7.0	8.0	kV
Output power (mean)	9.0	—	0.75	—	W
Frequency (see note 8)	9345	9405	—	—	MHz
R.F. bandwidth at ¼ power	—	2.5	—	50	MHz
Frequency pulling (v.s.w.r. not less than 1.5:1)	—	15	—	—	MHz
Stability (see note 9)	—	0.25	—	0.25	%
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 Typical Operation Condition 1. 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 Oscillations 1 and 2)

	Oscillation 1	Oscillation 2	
Anode voltage (peak)	7.0	7.0	kV min
Output power (mean)	8.0	—	W min
R.F. bandwidth at ¼ power	3.5	—	MHz max
Frequency	9345 to 9405	—	MHz
Stability (see note 9)	2.0	—	% max

NOTES

1. With no anode input power.
   For average pulse input powers greater than 25 watts the heater voltage must be reduced within 3 seconds after the application of h.t. according to the following schedule:

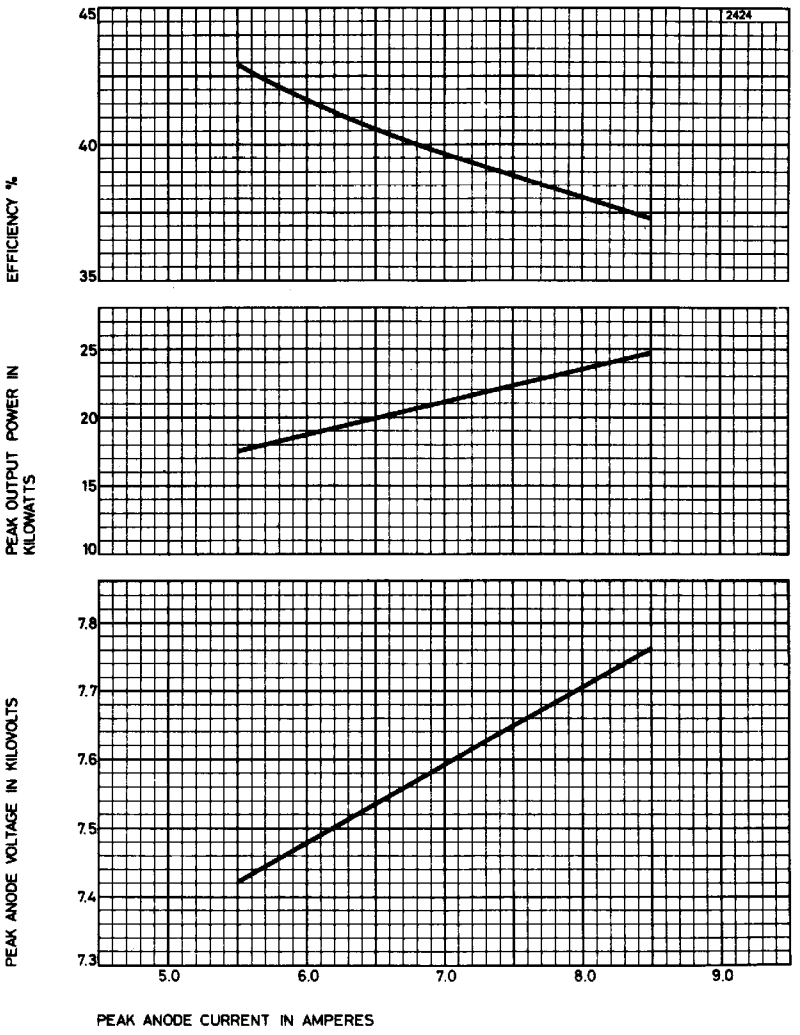
$$V_h = 6.3\left[1 - \frac{Pi}{180}\right] \text{ volts}$$

   where Pi = mean input power in watts.
   The valve heater must 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. 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:

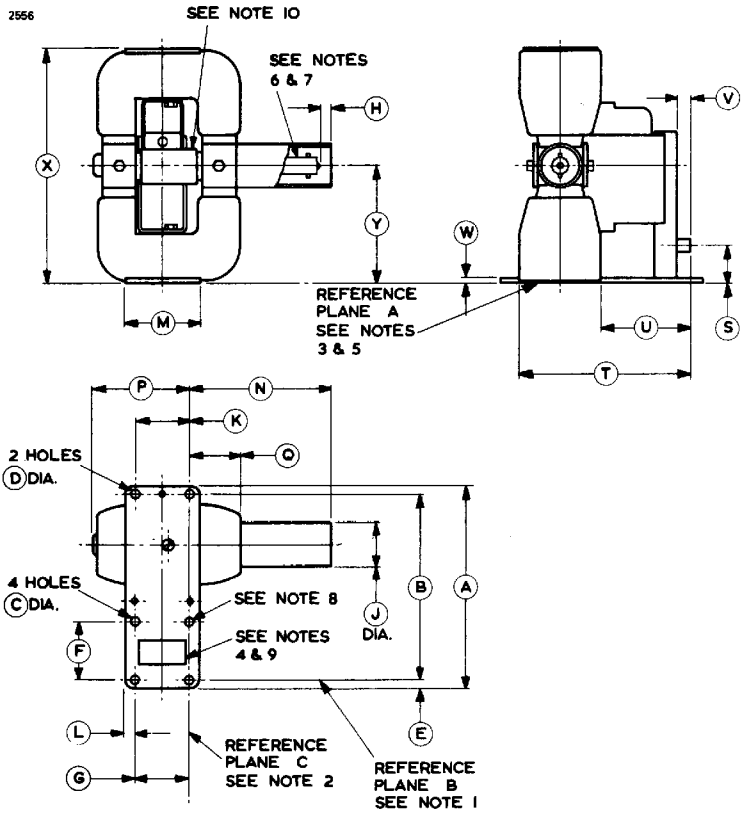
$$Pi = i_{apk} \times v_{apk} \times Du$$

   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. Defined as steepest tangent to leading edge of voltage pulse above 80% amplitude. Any capacitance in viewing system must not exceed 6.0pF.
5. The anode temperature measured at the point indicated on the outline drawing must be kept below the limit specified by means of a suitable flow of air over the anode body and waveguide attachment brackets which serve as cooling fins.
6. At the maximum pressure of 45 lb/in^2 (3.16kg/cm^2) absolute, the leakage will not exceed 0.5 litre (N.T.P.) per minute.
7. Tolerance ±10%.
8. Other frequency ranges can be supplied on request.
9. 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.
10. For the range 9345 to 9405MHz 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 6:1 with a minimum 16.5 to 22.5mm from the output flange towards the anode.
11. Measured with heater voltage of 6.3V and no anode input power, the heater current limits are 0.43A minimum, 0.60A maximum.
12. Design test only. The frequency change with anode temperature change after warm-up will not exceed −0.25MHz/°C.

TYPICAL PERFORMANCE CHART



OUTLINE



Bayonet Cap Connections

Contact	Element
End contact	Heater
Shell	Heater, Cathode

Outline Dimensions

Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	4.468 max	113.5 max	M	1.625 ± 0.016	41.28 ± 0.41
B	4.103 ± 0.004	104.216 ± 0.102	N	3.187 max	80.95 max
C	0.170 ± 0.003	4.318 ± 0.076	P	2.187 max	55.55 max
D	0.175 ± 0.003	4.445 ± 0.076	Q	1.187 max	30.15 max
E	0.172 ± 0.016	4.37 ± 0.41	S	0.875 ± 0.125	22.22 ± 3.18
F	1.280 ± 0.004	32.512 ± 0.102	T	4.000 max	101.6 max
G	1.220 ± 0.004	30.988 ± 0.102	U	1.938 max	49.23 max
H	0.250 max	6.35 max	V	0.375 max	9.53 max
J	1.000 max	25.40 max	W	0.125	3.18
K	1.220 ± 0.004	30.988 ± 0.102	X	5.031 max	127.8 max
L	0.203 ± 0.016	5.16 ± 0.41	Y	2.500 ± 0.050	63.50 ± 1.27

Millimetre dimensions have been derived from inches.

Outline Notes

1. Reference plane B passes through the centres of the two holes of the mounting plate as shown and is perpendicular to reference plane A.
2. Reference plane C intersects plane B at the centre of the mounting plate hole as shown and is mutually perpendicular to reference planes A and B.
3. With surface A resting on a flat surface plate, a feeler gauge 0.020 inch (0.51mm) thick and 0.125 inch (3.18mm) wide will not enter more than 0.125 inch (3.18mm) at any point.
4. The position of the waveguide hole is not specified on this drawing since tubes are tested and used with coupler UG-40B/U (5985-99-083-0051).
5. Surface A and interior surfaces of waveguide will be plated with 10mg/in^2 (1.55mg/cm^2) of gold or 30mg/in^2 (4.65mg/cm^2) of silver, but will not be plated if the parts are made of monel or equivalent corrosion resistant materials. All other metal surfaces will be painted with heat resistant paint or otherwise treated to prevent corrosion.

6. The axis of the heater lead protector will be within 5° of a normal to reference plane C.
7. The clearance between the inside surface of the protector and the 0.375 inch (9.53mm) diameter cylindrical surface of the standard single contact miniature bayonet lamp base (B.S.52-1952, type BA9s/14) will not be less than 0.125 inch (3.18mm).
8. The centre of this hole will lie within 0.004 inch (0.102mm) of reference plane C.
9. This area is gasketed for pressurising the waveguide output as with coupler UG-40B/U (5985-99-083-0051).
10. The anode temperature is measured at this point.