Mullard **VOLUME 3A**

Microwave Devices and Components

communications magnetrons
industrial magnetrons
klystrons
travelling wave tubes
disc seal triodes
microwave components

Issued by
TECHNICAL INFORMATION DEPARTMENT
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GENERAL OPERATIONAL RECOMMENDATIONS

1. GENERAL

Failure to observe these General Operational Recommendations may seriously reduce the life of a valve and in some instances could result in catastrophic failure.

Any enquiries should be addressed to the Government and Industrial Valve Division, Mullard Limited.

2. CHARACTERISTICS

The published characteristics are based upon averages of readings taken on a representative number of valves.

3. LIMITING VALUES

The limiting values whether maximum or minimum are absolute and the following definition of the absolute system has been based on that agreed by the International Electrotechnical Commission.

3.1. Absolute-maximum rating system

Absolute-maximum ratings are limiting values of operating and environmental conditions applicable to any valve of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the valve manufacturer to provide acceptable serviceability of the valve, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the valve under consideration and all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any valve under the worst probable operating conditions with respect to supply voltage variations, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the valve under consideration and of all other devices in the equipment.

In some instances, such as with very short pulse durations or complex wave trains, it may be permitted to exceed the absolute values, but the desired operating conditions must be agreed with Mullard Limited.

4. TYPICAL OPERATING CONDITIONS

Typical operating conditions are given, some of which may incorporate one or more of the absolute ratings; in such cases the designer should take precautionary steps to ensure that these ratings are never exceeded.

Where several typical operating conditions are given, interpolation for intermediate conditions is generally permitted. There are exceptions to this rule and the operating conditions should be agreed with Mullard Limited.

5. INSTALLATION

Ferrous tools must not be used on permanent magnet valves, as this may cause deterioration in the performance of the valve. Any glass or ceramic insulation supporting the cathode terminal should be carefully cleaned when necessary since pulse current leakage could cause irregular transmission and damage through local heating. In addition the outlet flange must be clean in order to discourage arcing.

6. PRESENTATION OF VALVE DATA

The symbols, component and base references incorporated in the data are in accordance with the following British Standards:—

1409: 1950	Letter symbols for electronic valves.
1991: Part I: 1954	Letter symbols, signs and abbreviations.
530: 1948 (with supplements)	Graphical symbols for telecommunications.
448: 1953	Electronic-valve bases, caps and holders.
204: 1960	Glossary of terms used in telecommunications (including radio) and electronics.

COMMUNICATIONS
MAGNETRONS

GENERAL OPERATIONAL RECOMMENDATIONS

The following recommendations should be interpreted in conjunction with British Standard Code of Practice No. CP1005: 'The Use of Electronic Valves', Part 9, upon which these notes have, in part, been based.

1. HEATER

1.1. General

A cathode temperature either too high or low may lead to unsatisfactory operation such as moding and arcing, involving short life and loss of efficiency.

During operation the cathode temperature is increased by electron bombardment ('back heating'). The data sheets for magnetrons, therefore, usually contain information relating the heater voltage to the average anode input power so that the cathode temperature can be maintained at the desired level.

The heater voltage should be at the stated nominal when the h.t. is first applied, and be subsequently reduced as recommended in the data. In the case of magnetrons having cathodes of small thermal capacity, it may be necessary to reduce the heater voltage immediately the anode voltage is applied.

With some valves it may be required to limit the filament or heater current when switching on the supply. Information on this will generally be included on individual data sheets.

1.2. Indirectly heated oxide-coated cathodes

To obtain maximum life the heater voltage must be within ±5% of the value recommended for a particular operation.

1.3. Directly heated cathodes

Reference should be made to the individual data sheets.

2. INPUT AND OUTPUT CONNECTIONS

2.1. Input connection

The negative input voltage should be applied to the common heater-cathode terminal to avoid the flow of anode current through the heater which might be damaged.

In applications where a bifilar pulse transformer is used a non-inductive capacitor should be connected between the heater-cathode and heater terminals to suppress any high transient voltages.

2.2. Output connection

It is important that the type of output connection should be as specified in the data. Use of flat coupling instead of choke coupling or vice versa may upset the matching and possibly cause breakdown of the output system. Connections to the output must be designed to be sufficiently tight to avoid arcing and other faults. It is also important to avoid undue stressing of the output section which would either deform the metal or break the glass or ceramic vacuum seals. It is, therefore, necessary that any mechanical pressure be applied uniformly.

3. H.T. SUPPLY AND MODULATORS

3.1. General

The dynamic impedance of magnetrons is in general low; thus small variations in the applied voltage can cause appreciable changes in operating current. In the equipment design it is necessary to ensure that such variations in operating current do not lead to operation outside the published limits.

Current changes result in variation of power frequency and frequency spectrum quality and consequent deterioration of equipment performance. This factor should determine the maximum current change inherent in the equipment design under the worst operating conditions.

3.2. C.W. types

For c.w. types the amount of smoothing required in the h.t. supply depends on the amount of modulation, resulting from operating current variation, which can be tolerated.

Under certain operational conditions a c.w. magnetron can develop a negative resistance characteristic and a minimum value of series resistance which should be adjacent to the magnetron is given in individual data sheets.

3.3. Pulse types

To ensure a constant operating condition with a pulsed valve the modulator design must provide a pulse, the amplitude of which does not vary to any significant extent from pulse to pulse. The necessary design precautions depend on the type of modulator employed, and cannot be generalised.

The performance of a magnetron is often a sensitive function of the shape of the pulse that it receives and it is necessary to control four distinct aspects: rate of rise, spike, flat and rate of fall. In this connection it is important that any observation of the shape of the pulse, either of voltage or of current, supplied by the modulator should be made with a magnetron load and not with a dummy load, because a magnetron acts as a non-linear impedance. Furthermore, a magnetron is likely to be more sensitive to a mismatched load.

3.3.1. Rate of rise

Both maximum and minimum rates of rise of voltage (and sometimes current) may be specified. The most critical value is that just before and during the initiation of oscillation. Too high or low a rate of rise may accentuate the tendency to moding.

Too high a rate of rise may cause operation in the wrong mode or even failure to oscillate, and either of these conditions may lead to arcing due to overheating or to excessive voltages.

Operation at too low a rate of rise may also cause oscillation in the wrong mode or oscillation in the normal mode for an appreciable period at less than full current and this will cause frequency pushing leading to a broad frequency spectrum.

The rate of rise of voltage should be measured above the 80% point of the peak voltage corresponding to the onset of oscillation. For accuracy it is advisable to measure the rate of rise by means of a differentiating circuit whose total capacitance does not exceed 5% of the total stray capacitance of the modulator output circuit. Direct observation on an oscilloscope can be misleading due to the limitation of the oscilloscope and sampling device.

3.3.2. Spike

It is important that the voltage pulse should not have a high spike on the leading edge. Such a spike may cause the valve to start in an undesired mode. Although this operation may not be sustained, the transient condition may lead to destructive arcing. Measures taken to reduce the spike must not also reduce the rate of rise below the specified minimum.

3.3.3. Flat

The top of the voltage pulse should be free from ripple or droop since small changes in voltage cause large current variations resulting in frequency pushing. This leads to frequency modulation of the r.f. pulse and consequent broadening of the spectrum or instability.

3.3.4. Rate of fall

The fall of voltage must be rapid at least to the point where oscillation ceases, to avoid appreciable periods of operation below full current, with the attendant frequency pushing. This point is normally reached when the voltage has fallen to about 80% of the peak value.

Beyond this point a lower rate of fall is generally permissible, but a significant amount of noise will be generated, which may be detrimental to radar systems with a very short minimum range. To prevent coherent noise being generated especially in short range radars the voltage tail must decay to zero before the radar receiver recovers.

A fast rate of fall is also important where valves are operated at a high pulse recurrence frequency since any diode current which occurs after oscillations have ceased will add appreciably to the mean current and dissipation of the valve.

In certain applications it is desirable to return the valve cathode to a positive d.c. bias in order to speed up the rate of fall and to prevent diode current being passed during the inter-pulse period.

4. LOADING

The anode current range shown in individual data sheets is related to a maximum standing wave ratio seen by the magnetron of 1.5 to 1. Incorrect loading beyond this may reduce the current range for stable operation and can cause arcing or moding.

5. GENERATOR LOAD CHART (Rieke diagram)

A chart showing typical output power and frequency change plotted on a modified impedance circle diagram against magnitude (v.s.w.r.) and phase of the load seen by the magnetron, provides information on the behaviour of the magnetron to different load conditions.

Such a chart is often referred to as a Rieke diagram.

6. PHASE OF SINK

From the generator load chart it is seen that with a load of bad mismatch and at a particular phase, there is a region on the chart which is characterised by high power output and convergence of the frequency contours. This region is known as 'the sink' and the phase of the load at which the magnetron behaves in this manner is known as 'the phase of sink'. Operation of the magnetron under this load condition will lead to instability and may cause failure of the magnetron. By matching the r.f. system such that the maximum permitted load v.s.w.r. is not exceeded, the sink will be avoided.

7. OPERATION IN DUPLEXER SYSTEMS

7.1. Position of t.r. cell

Where the r.f. systems incorporates a t.r. cell a bad load mismatch, which is unavoidable, is seen by the magnetron momentarily until the cell has been ionised. If the phase of this mismatch is such that it is in the phase of sink the build up of oscillation of the magnetron may be prevented. It is therefore essential that the t.r. cell is so positioned that its phase of mismatch as seen by the magnetron is remote from the sink region.

7.2. Position of minimum

In the non-oscillating condition the magnetron presents at its frequency of oscillation a bad mismatch of considerable magnitude to the r.f. system. This property is utilised in certain duplexer systems. In the design of such a system it is necessary to know the phase of the above load mismatch and this is designated at a position of minimum of the voltage standing wave in relation to a reference plane on the magnetron output system.

8. COOLING

8.1. General

The maximum temperature of the anode block, cathode terminal assembly and waveguide windows, where applicable, should on no account be exceeded. It may be necessary to provide additional cooling to prevent these temperature limits being exceeded. Where air or water cooling is necessary, interlock switches should be provided to prevent operation in the event of failure or reduction of cooling medium. In the development stage of an equipment the various temperatures should be measured with due regard to the ultimate environmental conditions. Special paints and lacquers are available for this purpose but any other suitable means may be used.

8.2. Air cooling

For the cooling of components such as input waveguide windows and output domes it is important that the air should not contain dust, moisture or grease.

8.3. Water cooling

The circulating cooling water should be as free as possible from all solid matter and the dissolved oxygen content should be low. Whenever possible a closed water system using distilled or demineralised water should be employed.

9. PRESSURISATION

The limiting values and operating conditions quoted in the data are given for a pressure of 650mm of mercury unless otherwise stated. In the case of high power magnetrons it may be necessary to pressurise the output waveguide in order to prevent electrical breakdown. Advice is given in the individual valve data sheets. Precautionary steps should be taken to prevent operation in the event of the failure of the pressurisation. In order to avoid dielectric breakdown, clean and dry air or gas must be used.

10. STORAGE

Valves should be stored in their original packing because this has been designed to protect the valve against reasonable vibration, and knocks. It also ensures that the spacing between permanent-magnet valves and other magnets or ferrous objects is adequate to avoid reduction of magnetisation. Despite this controlled spacing, magnetically-sensitive instruments such as compasses, electrical meters and watches should not be brought close to a bank of packaged magnetrons.

When a valve is protected by a moisture-proof container this fact is clearly stated on the outside. Unnecessary opening of the seal should be avoided so that the dessicant is not exhausted rapidly. When a magnetron is temporarily taken out of service it should be placed immediately in its proper container. This is a good practice which obviates the risk of damage to the magnet or to the glass or ceramic parts and prevents the entry of foreign matter into the output aperture.

Unpacked permanent-magnet valves should **NEVER** be placed on steel benches or shelves.

11. CONDITIONING

It is recommended that after transit or a long period of storage the anode voltage should be increased gradually or in several steps until normal operation is achieved. This treatment will clean up any traces of gases which could cause arcing or instability and this procedure is particularly important in high power magnetrons.

12. RADIATION HAZARDS

In general the shorter the wavelength of an r.f. radiation the greater the absorption by body tissues and hence for comparable power, the greater the hazard. With magnetrons the power may be sufficient to cause danger, particularly to the eyes.

If it is necessary to look directly into a magnetron output, this should be performed through an attenuating tube or through a small hole set in the wall of the waveguide at a bend. Alternatively r.f. screening such as copper gauze of mesh small compared with the wavelength must be provided.

With high power magnetrons precautions may also be necessary to reduce the stray r.f. radiation emitted through the cathode stem and other apertures, especially when the magnetron is functioning incorrectly.

High voltage magnetrons (as well as the high voltage rectifier and pulse modulator valves) can emit a significant intensity of X-rays and protection of the operator may be necessary. When magnetron behaviour is viewed through an aperture X-rays may be present. Protection of the eye is afforded by viewing through lead glass.

TUNABLE MAGNETRON

JNT1-500

Frequency: *'L' band, mechanically tunable.*
Power output: *600kW, pulsed.*
Construction: *Unpackaged, forced-air cooled.*

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook.

CHARACTERISTICS

	Min.	*Max.*	
Frequency			
Tunable over the range	1.22 to 1.35		Gc/s
Pulse voltage			
(I_{pulse} = 46A, H = 1.4kG)	26.5	31.5	kV
R.F. pulse power output			
(I_{pulse} = 46A, H = 1.4kG)	400	—	kW
Frequency pulling factor			
(v.s.w.r. = 1.5)	—	5.0	Mc/s
Frequency pushing factor	—	60	kc/s per A
Frequency temperature coefficient	—	–30	kc/s per °C

CATHODE

Indirectly heated

V_h	23.5	V
I_h	2.2	A
$I_{h(surge)}$ max.	4.0	A

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 3 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 5 minutes.
It is necessary to reduce the heater voltage immediately after the application of h.t. and if operation substantially different from that shown under typical operation is envisaged Mullard Ltd. should be consulted.

TYPICAL OPERATION

f	1.285	Gc/s
Heater voltage (running)	15.5	V
Pulse duration	1.0	µs
Pulse repetition frequency	1000	p/s
Duty cycle	0.001	
Pulse current	46	A
Pulse voltage	27.2	kV
Pulse input power	1.25	MW
R.F. pulse output power	610	kW
Mean input current	46	mA
Mean input power	1.25	kW
Mean r.f. output power	610	W
Frequency pulling (v.s.w.r. = 1.5)	4.0	Mc/s
Rate of rise of pulse voltage	60	kV/µs
Magnetic field strength	1.4	kG

OPERATING NOTES

1. The magnetron is designed to feed into a 50Ω, $1\frac{5}{8}$ inch coaxial transmission line.
2. The maximum torque to be applied to the driving gear wheel for tuning the magnetron should not exceed 8lb. in (9.2kg.cm).
3. The coaxial outlet should be protected by a dust cover when the magnetron is not in use.

JNT1-500 TUNABLE MAGNETRON

COOLING

It is necessary to direct a flow of cooling air between the radiator fins, and on the cathode and heater seals, in order to keep the temperature below the permitted maximum.

LIMITING VALUES (absolute ratings)

	Min.	*Max.*	
Pulse current	25	60	A
Pulse voltage	24	34	kV
Pulse duration	1.0	6.0	μs
Duty cycle	—	0.002	
Mean input power	—	1.8	kW
Rate of rise of voltage pulse			
$t_p \leqslant 1.0\mu s$	—	70	kV/μs
$t_p > 1.0 \leqslant 5.0\mu s$	—	30	kV/μs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	125	°C

MOUNTING POSITION

Any

PRESSURISING

The output system may be pressurised up to a pressure of 1550torr.

PHYSICAL DATA

Weight of magnetron	19lb 13oz	9 kg
Weight of magnetron in carton	37lb 8oz	17 kg

ACCESSORY

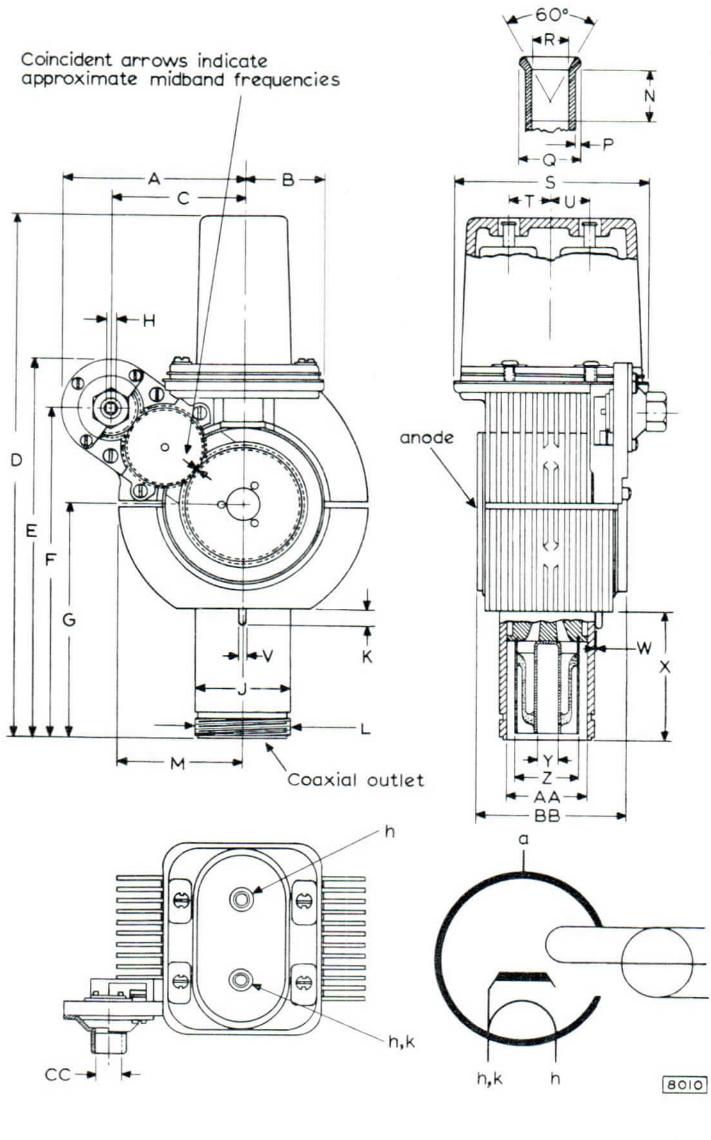
Permanent magnet 55302

DIMENSIONS

	Inches	Millimetres			Inches	Millimetres	
A	4.496	114.2	max.	P	0.012	0.31	min.
B	2.000	50.8	max.	Q	0.281±0.003	7.135±0.075	
C	3.374	85.7	max.	R	0.169±0.005	4.30±0.13	
D	12.500	317.5	max.	S	4.750	120.65	max.
E	9.185	233.3	max.	T	1.036	26.31	
F	8.000±0.185	203.2±4.7		U	0.904	22.96	
G	5.469±0.061	138.90±1.55		V	0.125±0.003	3.175±0.075	
H	0.250±0.002	6.35±0.05 (square hole)		W	0.010	0.25	max.
				X	3.055±0.007	77.585±0.185	
J	2.310±0.003	58.6625±0.0625		Y	0.564±0.010	14.325±0.255	
K	0.376±0.014	9.55±0.35		Z	1.577±0.010	40.05±0.25	
*L	2.312	58.7		AA	1.931±0.004	49.05±0.10	
M	3.000	76.2	max.	BB	3.505±0.055	89.025±1.395	
N	0.592±0.002	15.04±0.04	max.	CC	0.375±0.002	9.525±0.055	

*Thread specification—5 full threads minimum

Maximum major diameter = 58.75mm, 2.313in.
Minimum major diameter = 58.37mm, 2.298in.
Maximum pitch diameter = 57.69mm, 2.271in.
Minimum pitch diameter = 57.48mm, 2.263in.
Minimum minor diameter = 56.78mm, 2.235in.


Coincident arrows indicate approximate midband frequencies
A
B
C
D
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F
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Coaxial outlet
60°
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N
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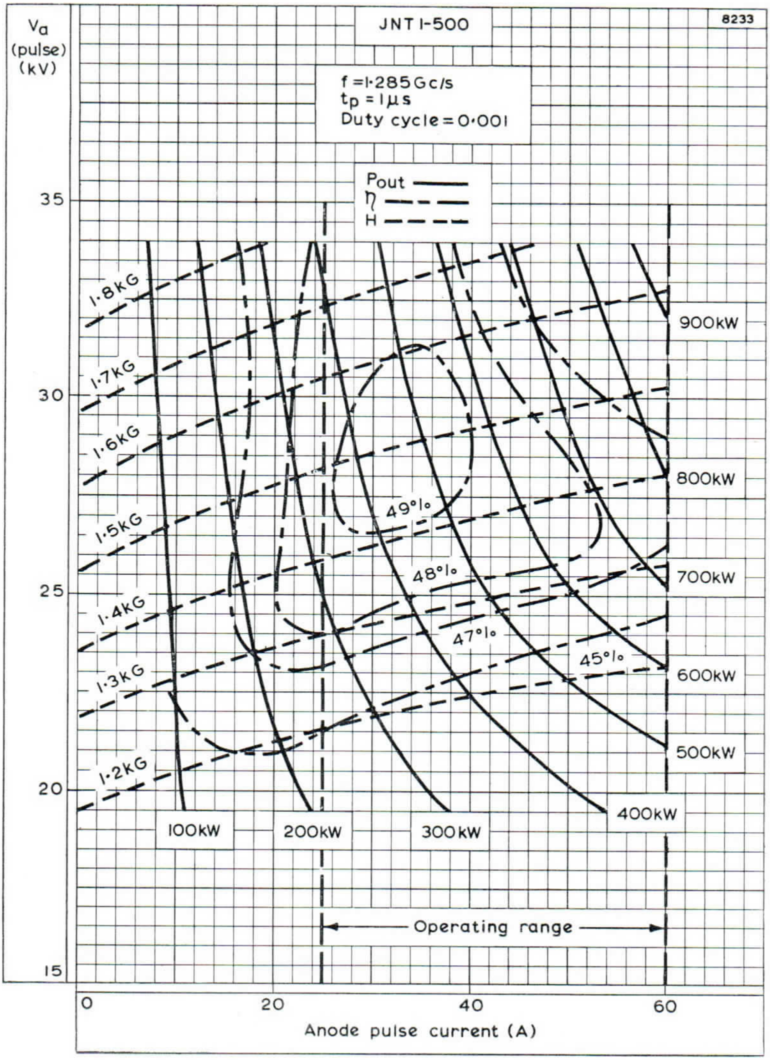
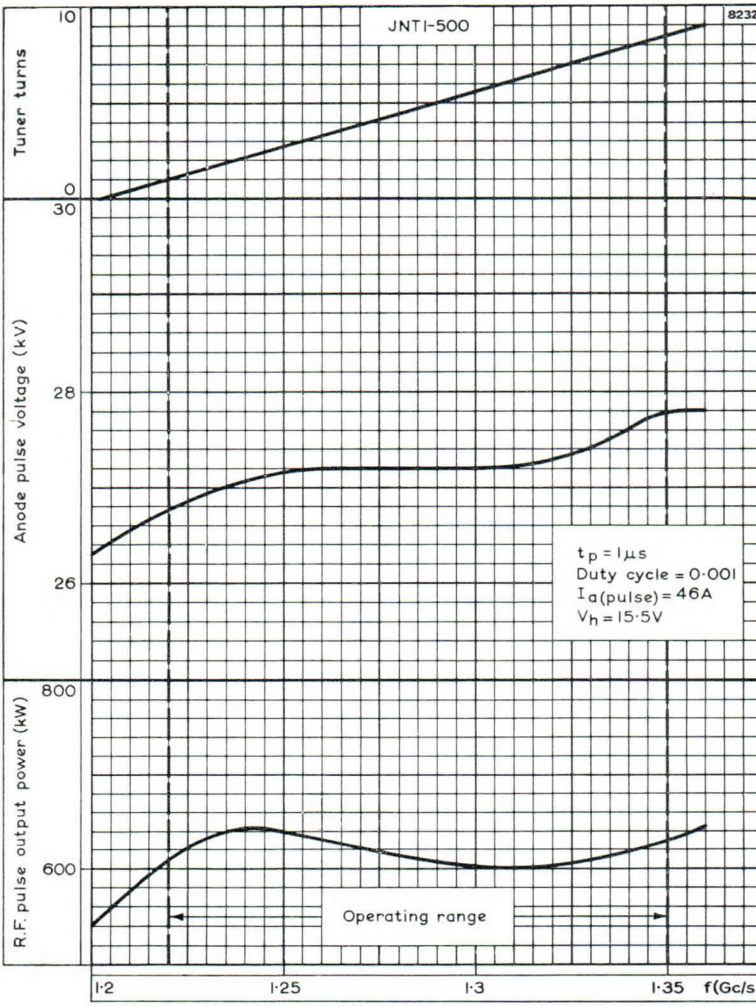


ANODE PULSE VOLTAGE PLOTTED AGAINST ANODE PULSE CURRENT WITH R.F. PULSE POWER OUTPUT, MAGNETIC FIELD STRENGTH AND EFFICIENCY AS PARAMETERS



TUNER TURNS, ANODE PULSE VOLTAGE AND R.F. PULSE OUTPUT POWER PLOTTED AGAINST FREQUENCY

MAGNETRON

JP5-04 JP5-04B JP5-04C

Frequency: 'C' band, fixed.
Power output: 70W, pulsed.
Construction: Packaged, natural cooling.

PRELIMINARY DATA

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook.

CHARACTERISTICS

	Min.		Max.	
Frequency				
Fixed within the band				
JP5-04	5.43	to	5.47	G/cs
JP5-04B	5.63	to	5.67	Gc/s
JP5-04C	5.83	to	5.87	Gc/s
Pulse voltage ($I_{pulse} = 200$mA)	0.95		1.15	kV
R.F. pulse power output ($I_{pulse} = 200$mA)	40		—	W
Frequency pulling factor (v.s.w.r. = 1.5)			15	Mc/s
Frequency pushing factor			0.1	Mc/s per mA
Frequency temperature coefficient			–0.2	Mc/s per °C
Input capacitance			9.0	pF

CATHODE

Indirectly heated

V_h	6.3	V
I_h	1.2	A

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 2 minutes before the application of h.t.

TYPICAL OPERATION

Heater voltage (running)	6.3	V
Pulse duration	1.0	µs
Pulse repetition frequency	1000	p/s
Duty cycle	0.001	
Pulse current	200	mA
Pulse voltage	1.05	kV
R.F. pulse output power	70	W
Mean input current	0.2	mA
Mean input power	210	mW
Mean r.f. output power	70	mW
Frequency pulling (v.s.w.r. = 1.5)	11	Mc/s
Rate of rise of pulse voltage	5.0	kV/µs

JP5-04
JP5-04B
JP5-04C

MAGNETRON

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
Pulse current	175	225	mA
Pulse voltage	0.9	1.2	kV
Pulse duration		2.0	μs
Duty cycle		0.01	
Mean input power		3.0	W
Rate of rise of voltage pulse		6.0	kV/μs
Load mismatch (v.s.w.r.)		1.5	
Temperature of anode block		140	°C

MOUNTING POSITION

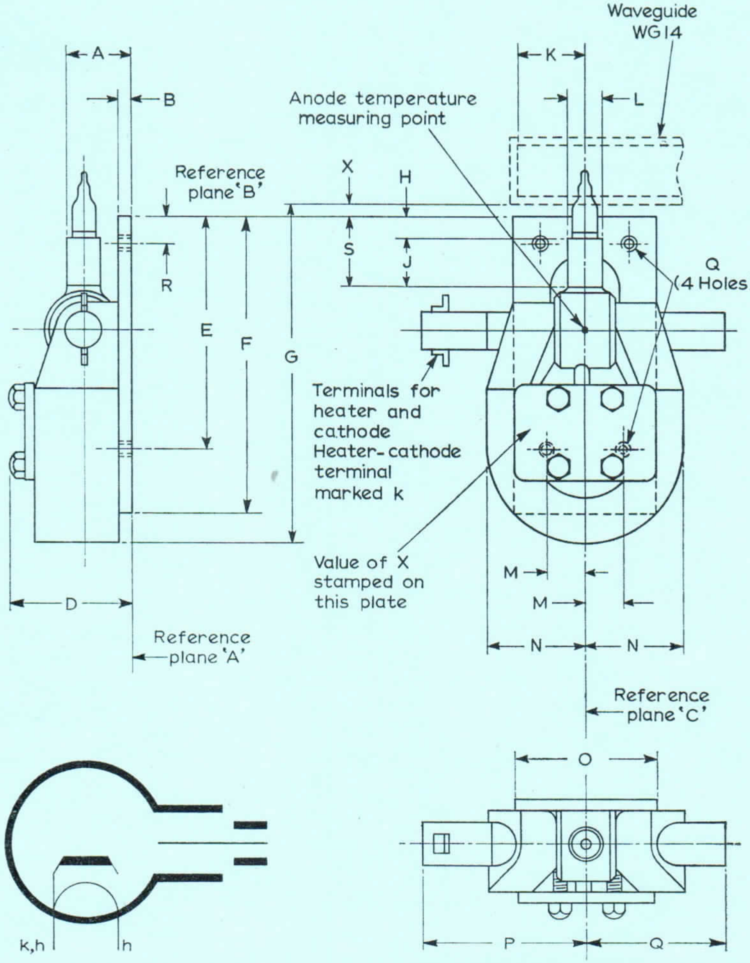
Any

PHYSICAL DATA

Weight of magnetron	1.2 560	lb g
Weight of magnetron in carton	2.4 1.1	lb kg
Dimensions of storage carton	5.0 × 7.25 × 7.25 127 × 184 × 184	in mm

DIMENSIONS

	Inches	Millimetres	
A	0.75 ± 0.01	19.1 ± 0.3	
B	0.175 ± 0.005	4.45 ± 0.13	
D	1.5	38	max.
E	2.625	66.58	
F	3.4 ± 0.1	86 ± 3.0	
G	3.897	98.98	max.
H	0.25	6.35	max.
J	0.57 ± 0.02	14.5 ± 0.5	
K	0.669	17	
L	0.3935 ± 0.0005	9.995 ± 0.013	
M	0.375	9.53	
N	1.2	30	max.
O	1.65 ± 0.05	41.9 ± 1.3	
P	2.0	51	max.
Q	1.65 ± 0.05	41.9 ± 1.3	
R	0.380	9.65	
S	0.81 ± 0.06	20.6 ± 1.5	
X	1.67 ± 0.30	4.25 ± 0.75	



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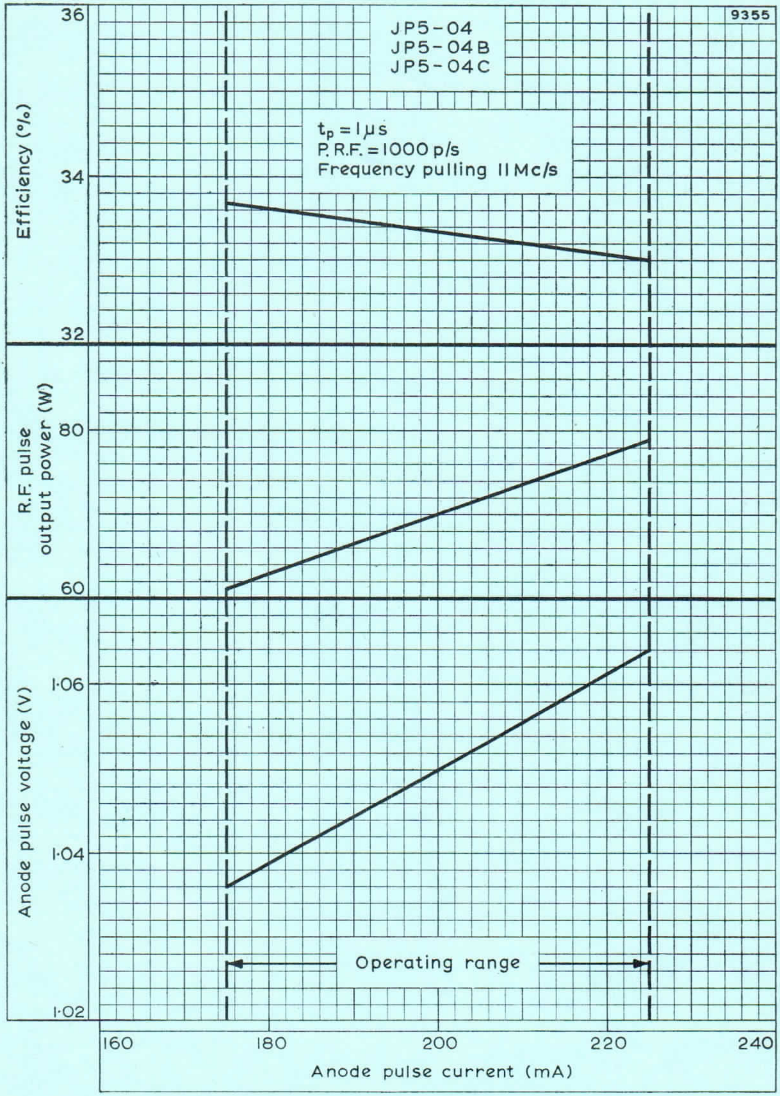
ANODE CONNECTION TERMINATED AT THE BASE PLATE



ANODE PULSE VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT

MAGNETRON

JP8-02B

PRELIMINARY DATA

QUICK REFERENCE DATA

Forced-air cooled fixed frequency 'X' band pulsed magnetron. with high duty ratio. Suitable for airborne doppler navigation equipment.

Frequency	8.80	Gc/s
Power output (pulsed)	25	W
Construction		Packaged

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook.

CHARACTERISTICS

	Min.		*Max.*	
Frequency				
Fixed within the band	8.77	to	8.83	Gc/s
Pulse voltage (I_{pulse} = 150mA)	750		850	V
R.F. pulse power output (I_{pulse} = 150mA)	17		—	W
Frequency pulling factor (v.s.w.r. = 1.5)	—		15	Mc/s
Frequency pushing factor	—		0.125	Mc/s per mA
Frequency temperature coefficient	—		–0.25	Mc/s per °C
Input capacitance	—		9.0	pF

CATHODE

Indirectly heated

V_h	6.3	V
I_h	1.2	A

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

TYPICAL OPERATION

Heater voltage (running)	5.5	4.5	V
Pulse duration	4.0	4.0	µs
Pulse repetition frequency	100,000	100,000	p/s
Duty cycle	0.2	0.4	
Pulse current	150	150	mA
Pulse voltage	800	800	V
R.F. pulse output power	25	25	W
Mean input current	60	60	mA
Mean input power	48	48	W
Mean r.f. output power	10	10	W
Frequency pulling factor (v.s.w.r. = 1.5)	12	12	Mc/s
Rate of rise of pulse voltage	4.0	4.0	kV/µs

JP8-02B

MAGNETRON

COOLING

It is necessary to direct a flow of cooling air between the radiator fins, in order to keep the temperature below the permitted maximum.

ABSOLUTE MAXIMUM RATINGS

	Min.	*Max.*	
Pulse current	110	180	mA
Pulse duration	—	5.0	μs
Duty cycle	—	0.5	
Mean input power	—	60	W
Rate of rise of voltage pulse	—	5.0	kV/μs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	140	°C

END OF LIFE PERFORMANCE

	Min.	*Max.*	
R.F. pulse power output ($I_{pulse} = 150mA$)		15	W
Frequency Within the band	8.77	to 8.83	Gc/s
Pulse voltage ($I_{pulse} = 150mA$)	750	850	V

MOUNTING POSITION

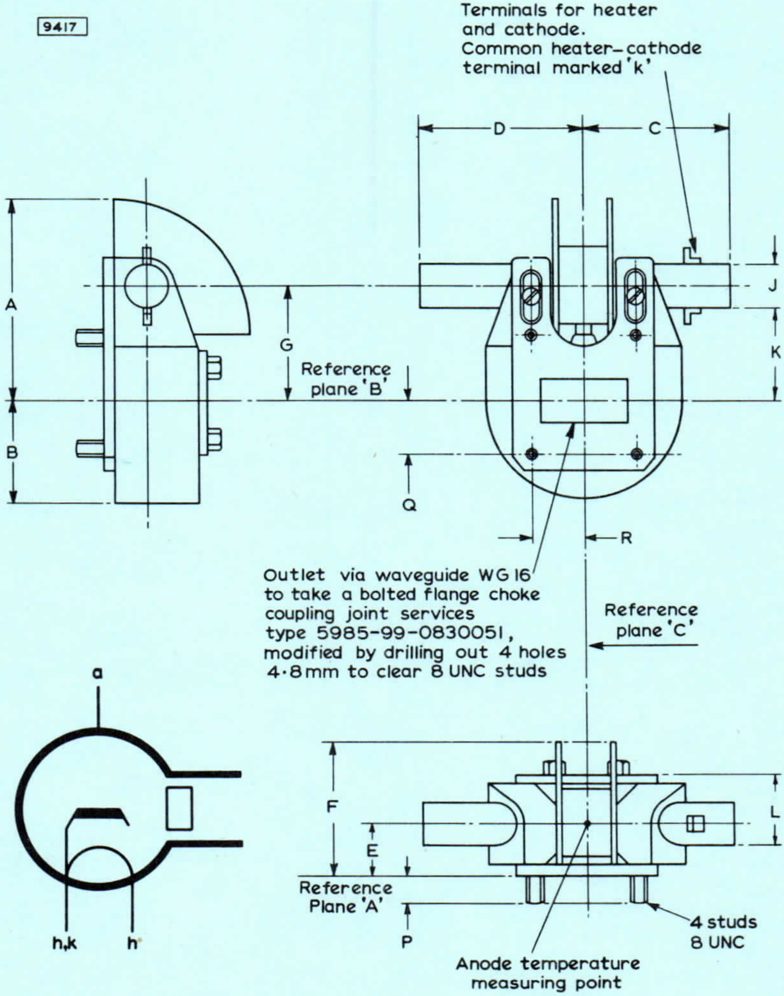
Any

PHYSICAL DATA

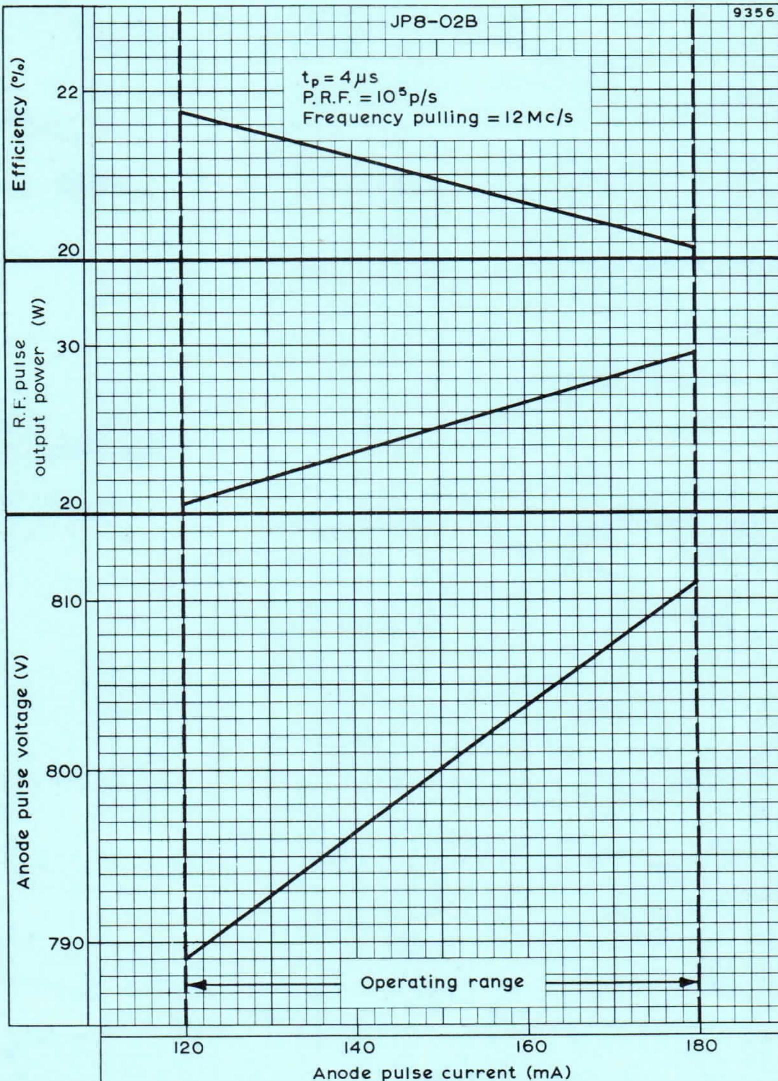
Weight of magnetron	1.0 454	lb g
Weight of magnetron in carton	2 lb 1.02	4 oz kg
Dimensions of storage carton	5.0 × 7.25 × 7.25 127 × 184 × 184	in mm

DIMENSIONS

	Inches	Millimetres	
A	2.36	60	max
B	1.26	32	max
C	1.73	44	max
D	1.73	44	max
E	1.53 ± 0.02	13.5 ± 0.5	
F	1.77	45	max
G	1.22 ± 0.08	31 ± 2	
J	0.51	13	max
K	1.14	29	max
L	0.79	20	max
P	0.32 ± 0.04	8 ± 1	
Q	0.64	16.2	
R	0.61	15.5	



ANODE CONNECTION IS TERMINATED AT THE BASE PLATE



ANODE PULSE VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT

JP8-02C

PRELIMINARY DATA

QUICK REFERENCE DATA

Forced-air cooled fixed frequency 'X' band pulsed magnetron, with high duty ratio. Suitable for airborne doppler navigation equipment.

Frequency	8.80 Gc/s
Power output (pulsed)	25 W
Construction	Packaged

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook.

CHARACTERISTICS

	Min.		*Max.*	
Frequency				
Fixed within the band	8.77	to	8.83	Gc/s
Pulse voltage ($I_{pulse} = 150$mA)	750		850	V
R.F. pulse output power ($I_{pulse} = 150$mA)	17		—	W
Frequency pulling factor (v.s.w.r. = 1.5)	—		15	Mc/s
Frequency pushing factor	—		0.125	Mc/s per mA
Frequency temperature coefficient	—		–0.25	Mc/s per °C
Input capacitance	—		9.0	pF

CATHODE

Indirectly heated

V_h	6.3	V
I_h	1.2	A

Heating Time. At ambient temperatures above 0°C the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

TYPICAL OPERATION

Heater voltage (running)	5.5	V
Pulse duration	4.0	µs
Pulse repetition frequency	50,000	p/s
Duty cycle	0.2	
Pulse current	150	mA
Pulse voltage	800	V
R.F. pulse output power	25	W
Mean input current	30	mA
Mean input power	24	W
Mean r.f. output power	5	W
Frequency pulling (v.s.w.r. = 1.5)	12	Mc/s
Rate of rise of pulse voltage	3.0	kV/µs

JP8-02C

MAGNETRON

COOLING

It is necessary to direct a flow of cooling air between the radiator fins, in order to keep the temperature below the permitted maximum.

ABSOLUTE MAXIMUM RATINGS

	Min.	*Max.*	
Pulse current	120	180	mA
Pulse duration	—	5.0	μs
Duty cycle	—	0.25	
Mean input power	—	30	W
Rate of rise of voltage pulse	—	4.0	kV/μs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	140	°C

END OF LIFE PERFORMANCE

	Min.	*Max.*	
R.F. pulse power output (I_{pulse} = 150mA)		15	W
Frequency			
Within the band	8.77 to	8.83	Gc/s
Pulse voltage (I_{pulse} = 150mA)	750	850	V

MOUNTING POSITION

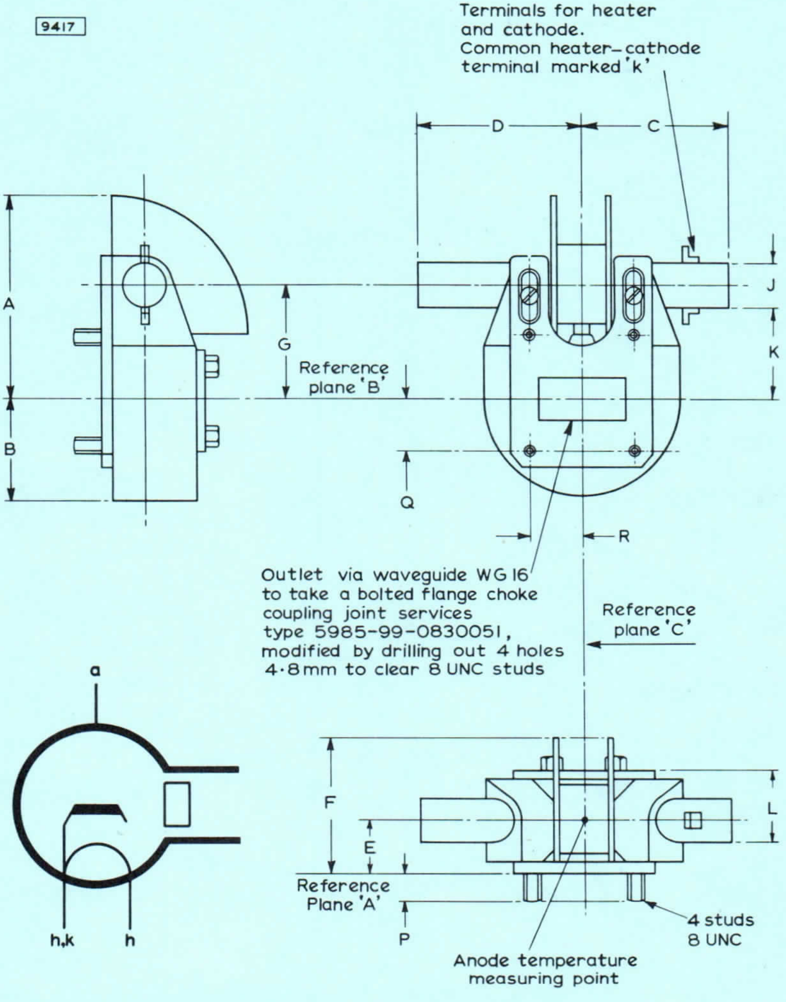
Any

PHYSICAL DATA

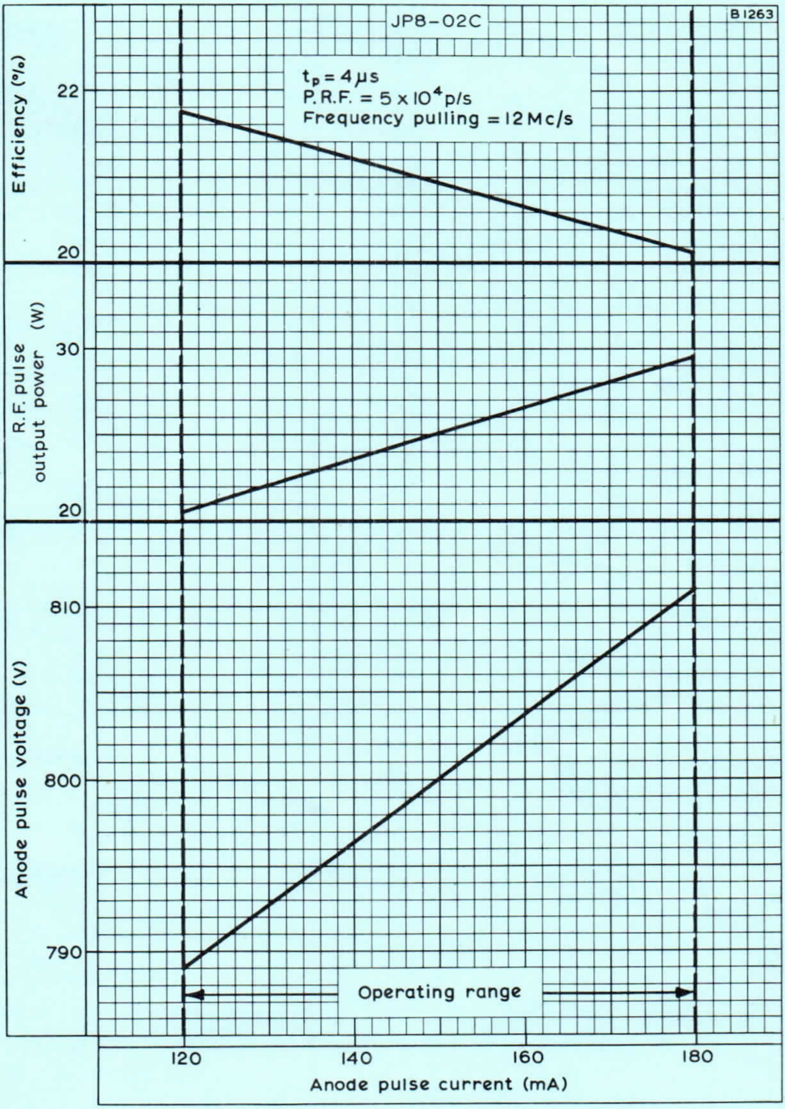
Weight of magnetron	1.0	lb
	454	g
Weight of magnetron in carton	2 lb	4 oz
	1.02	kg
Dimensions of storage carton	5.0 × 7.25 × 7.25	in
	127 × 184 × 184	mm

DIMENSIONS

	Inches	*Millimetres*	
A	2.36	60	max.
B	1.26	32	max.
C	1.73	44	max.
D	1.73	44	max.
E	0.53±0.02	13.5±0.5	
F	1.77	45	max.
G	1.22±0.08	31±2	
J	0.51	13	max.
K	1.14	29	max.
L	0.79	20	max.
P	0.32±0.04	8±1	
Q	0.64	16.2	
R	0.61	15.5	



ANODE CONNECTION IS TERMINATED AT THE BASE PLATE



ANODE PULSE VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT

QUICK REFERENCE DATA		
Fixed frequency 'X' band c.w. magnetron		
Frequency	9.375	Gc/s
Power output (c.w.)	10	W

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

MAINTENANCE TYPE

CHARACTERISTICS

	Min.		Max.	
Frequency				
Fixed within the band	9.345	to	9.405	Gc/s
Operating voltage (I = 50mA)	0.9		1.1	kV
R.F. power output (I = 50mA)	8.0		-	W
Frequency pulling (v.s.w.r. = 1.5)	-		15	Mc/s
Frequency temperature coefficient	-		-0.25	Mc/s per deg C
Frequency pushing	-		0.5	Mc/s per mA

OPERATING CONDITIONS at f = 9.375 Gc/s

R.F. power output	10	W
Heater voltage (running)	6.3	V
Operating current	50	mA
Operating voltage	930	V
Input power	46	W
Frequency pulling (v.s.w.r. = 1.5)	13	Mc/s

CATHODE

Indirectly heated

V_h	6.3	V
I_h	1.2	A

Heating time

At ambient temperatures above $0^{\circ}C$ the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Operating current (unmodulated c.w.)	20	60	mA
Peak operating current (modulated c.w.)	-	100	mA
Mean input power	-	60	W
Load mismatch (v.s.w.r.)	-	1.5	
Temperature of anode block	-	140	^{o}C

OPERATING NOTE

A limiting resistor of 1kΩ should be inserted in series with the magnetron.

END OF LIFE PERFORMANCE

The valve is deemed to have reached end of life when it fails to satisfy the following:-

	Min.		Max.	
R.F. power output (I = 50mA)			6.0	W
Frequency				
Within the band	9.345	to	9.405	Gc/s
Operating voltage (I = 50mA)	0.9	to	1.1	kV

MOUNTING POSITION

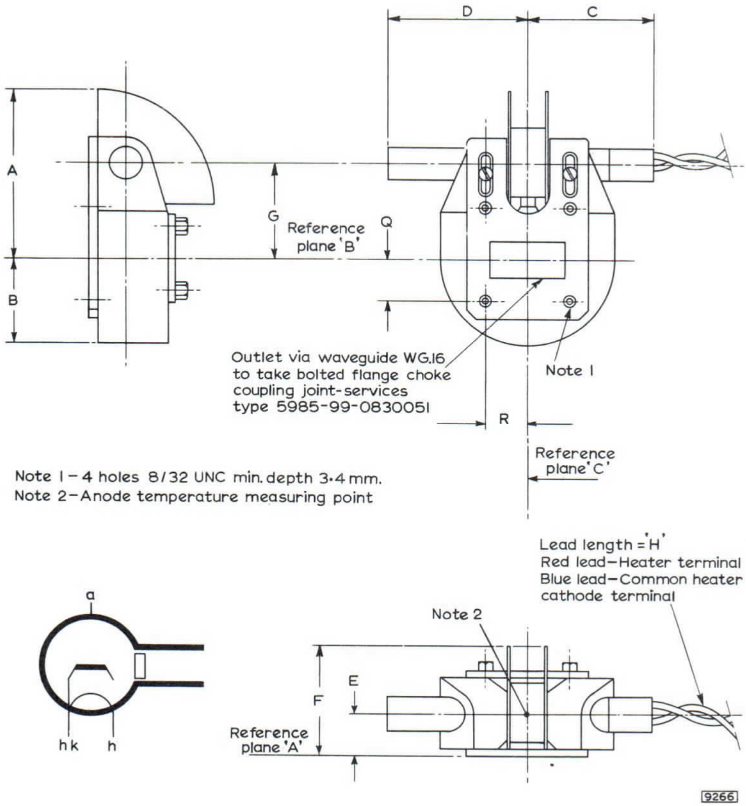
Any

PHYSICAL DATA

	lb	kg
Weight of magnetron	1.0	0.45
Weight of magnetron in carton	2.25	1.02
	in	cm
Dimensions of storage carton	5.0 × 7.25 × 7.25	12.7 × 18.4 × 18.4

COOLING

It is necessary to direct a flow of cooling air between the radiator fins in order to keep the anode block temperature below the permitted maximum.

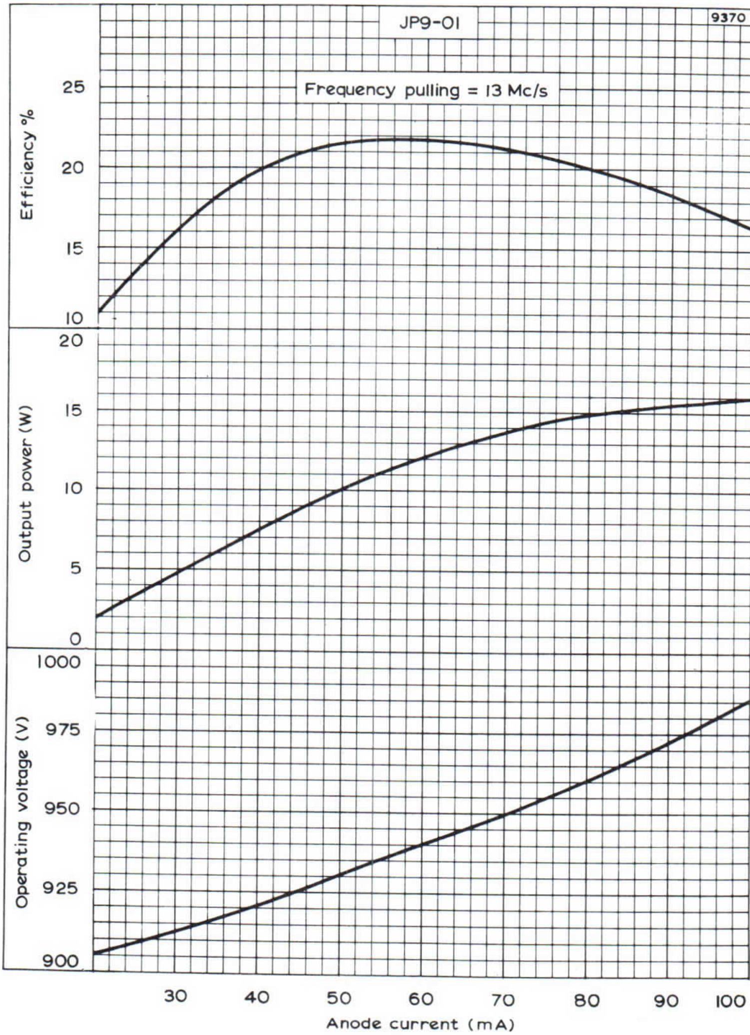


ANODE CONNECTION TERMINATED AT THE BASE PLATE

DIMENSIONS

	Inches	Millimetres		Inches	Millimetres
A	2.36	60 max.	F	1.77	45 max.
B	1.25	32 max.	G	1.220 ± 0.079	31 ± 2
C	1.96	50 max.	H	5.12 ± 0.20	130 ± 5
D	1.73	44 max.	Q	0.638	16.2
E	0.531 ± 0.020	13.5 ± 0.5	R	0.610	15.5

Inch dimensions derived from original millimetre dimensions



OPERATING VOLTAGE, R.F. POWER OUTPUT AND EFFICIENCY PLOTTED AGAINST ANODE CURRENT

MAGNETRON

JP9-2.5
JP9-2.5B
JP9-2.5C

QUICK REFERENCE DATA

Fixed frequency 'X' band magnetron with natural cooling.

Frequency JP9-2.5	9.410	Gc/s
JP9-2.5B	9.255	Gc/s
JP9-2.5C	9.550	Gc/s
Power output (pulsed)	3.0	kW
Construction	Packaged	

Unless otherwise shown data is applicable to all types.

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook.

CHARACTERISTICS

		Min.		Max.	
Frequency					
Fixed within the band	JP9-2.5	9.345	to	9.475	Gc/s
	JP9-2.5B	9.190	to	9.320	Gc/s
	JP9-2.5C	9.520	to	9.580	Gc/s
Pulse voltage ($I_{pulse} = 3.0A$)		3.20		3.80	kV
R.F. pulse power output ($I_{pulse} = 3.0A$)		2.5		—	kW
Frequency pulling factor (v.s.w.r. = 1.5)		—		18	Mc/s
Frequency pushing factor		—		2.5	Mc/s per A
Frequency temperature coefficient		—		0.25	Mc/s per °C
Distance of v.s.w. minimum from face of mounting plate into valve	JP9-2.5	0		6	mm
	JP9-2.5B	0		6	mm
	JP9-2.5C	3		9	mm
Input capacitance		—		9.0	pF

TYPICAL OPERATION

Duty cycle	0.0002	
Heater voltage (running)	6.3	V
Pulse duration	0.1	µs
Pulse repetition frequency	2000	p/s
Pulse current	3.0	A
Pulse voltage	3.4	kV
Pulse input power	10	kW
R.F. pulse output power	3.0	kW
Mean input current	600	µA
Mean input power	2.0	W
Mean r.f. output power	600	mW
Frequency pulling (v.s.w.r. = 1.5)	15	Mc/s
Rate of rise of pulse voltage	50	kV/µs

JP9-2.5
JP9-2.5B
JP9-2.5C

MAGNETRON

CATHODE

Indirectly heated

V_h	6.3	V
I_h	500	mA

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

ABSOLUTE MAXIMUM RATINGS

	Min.	*Max.*	
Pulse current	2.5	3.5	A ←
Pulse duration	0.02	1.0	μs
Duty cycle	—	0.001	
Mean input power	—	13	W
Rate of rise of voltage pulse	—	60	kV/μs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	120	°C

END OF LIFE PERFORMANCE ←

R.F. pulse power output (I_{pulse} = 3.0A)			2.0	kW
		Min.	*Max.*	
Frequency				
Within the band	JP9-2.5	9.345 to	9.475	Gc/s
	JP9-2.5B	9.190 to	9.320	Gc/s
	JP9-2.5C	9.520 to	9.580	Gc/s
Pulse voltage (I_{pulse} = 3.0A)		3.2	3.8	kV

MOUNTING POSITION

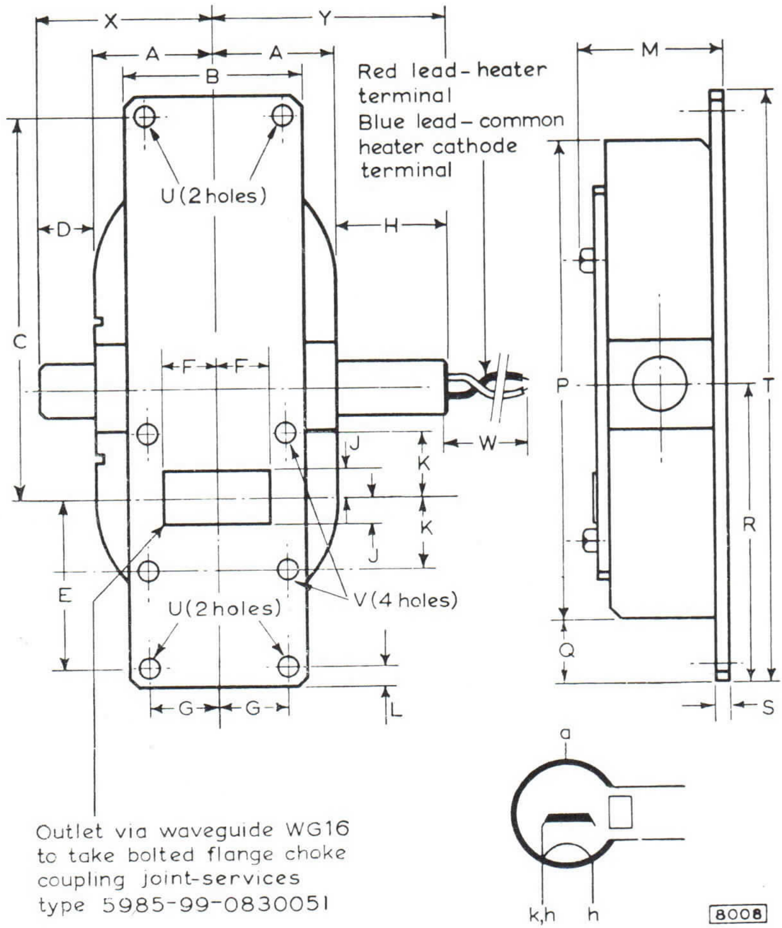
Any

PHYSICAL DATA

Weight of magnetron	2 lb 4 oz	
	1.02	kg
Weight of magnetron in carton	4 lb 0 oz	
	1.82	kg
Dimensions of storage carton	7.5 × 7.5 × 11	in
	190 × 190 × 280	mm

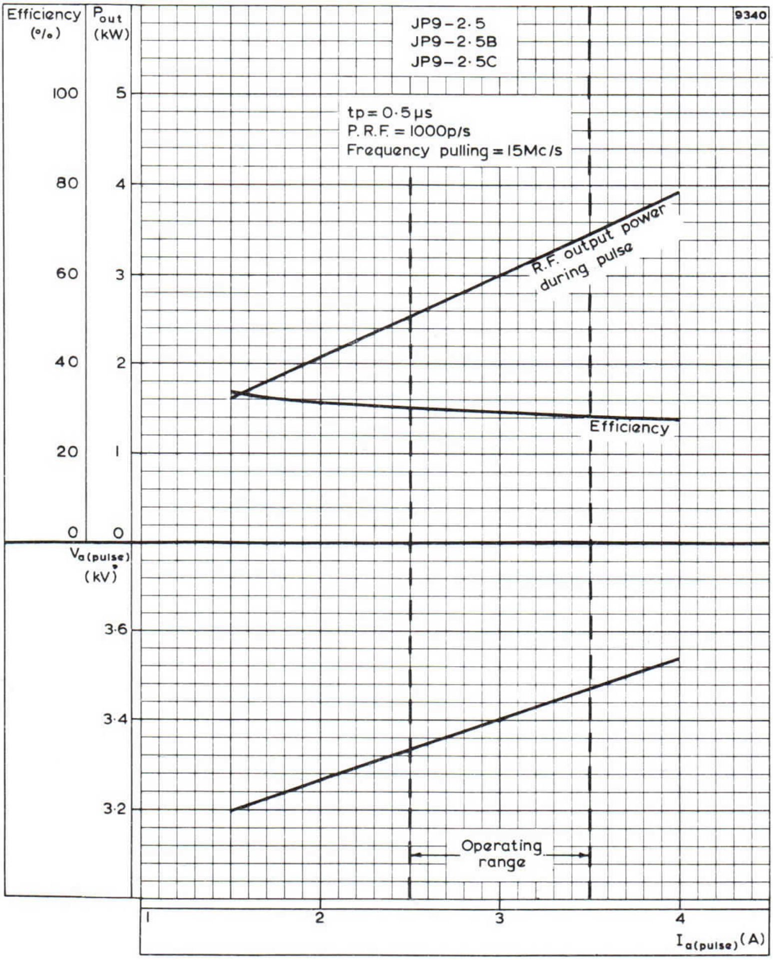
DIMENSIONS

	Inches	*Millimetres*	
A	1.181	30	max.
B	1.625 ± 0.015	41.28 ± 0.38	
C	3.463 ± 0.001	87.960 ± 0.025	
D	0.591	15	max.
E	1.521 ± 0.001	38.633 ± 0.025	
F	0.450 ± 0.001	11.400 ± 0.025	
G	0.610 ± 0.001	15.500 ± 0.025	
H	0.984	25	max.
J	0.200 ± 0.001	5.100 ± 0.025	
K	0.640 ± 0.001	16.255 ± 0.025	
L	0.175 ± 0.003	4.44 ± 0.08	
M	1.457	37	max.
P	4.528	115	max.
Q	0.428 ± 0.167	12.25 ± 4.25	
R	2.717 ± 0.156	69 ± 4	
S	0.157	4.0	min.
T	5.335 ± 0.007	135.50 ± 0.17	
U	0.175 ± 0.003	4.445 ± 0.076	dia.
V	0.170 ± 0.001	4.318 ± 0.025	dia.
W	8.000 ± 0.500	203.20 ± 12.70	
X	1.772	45	max.
Y	2.165	55	max.

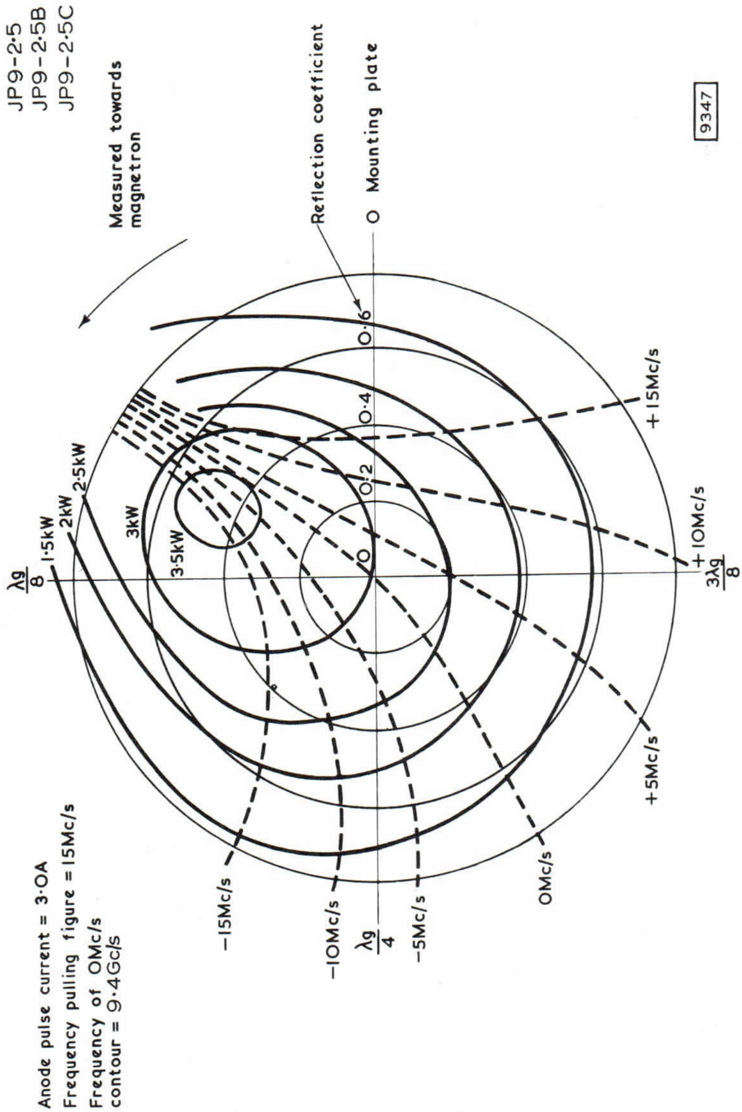


Outlet via waveguide WG16 to take bolted flange choke coupling joint-services type 5985-99-0830051

THE ANODE IS TERMINATED AT THE BASE PLATE



ANODE PULSE VOLTAGE, R.F. OUTPUT POWER DURING PULSE AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT



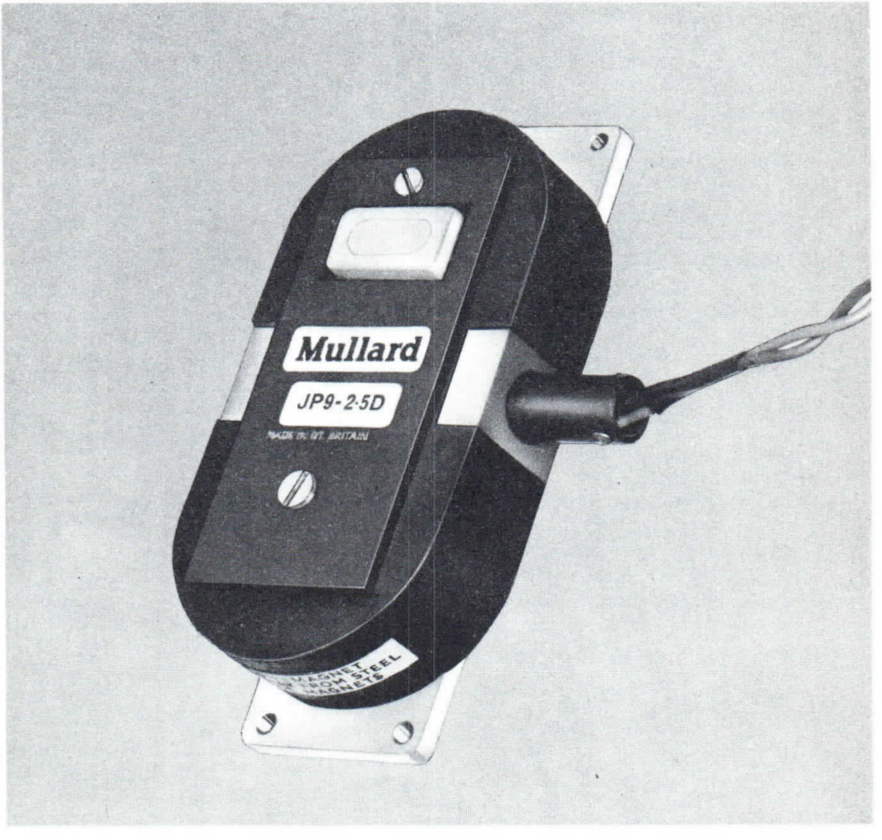
RIEKE DIAGRAM

QUICK REFERENCE DATA		
X-Band, fixed frequency, pulsed magnetron		
Frequency (fixed within the band)	9.415 to 9.475	GHz
Power output (peak)	4.0	kW
Output connection	Waveguide 16 flange	

Service type No. for JP9-2.5E is CV10758

Unless otherwise shown, data is applicable to all types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES



TYPICAL OPERATION

Operating conditions

	Condition 1	Condition 2	
Heater voltage	6.3	6.3	V
Anode current (peak)	3.0	3.0	A
Pulse duration (t_p)	0.1	0.5	μs
Pulse repetition rate	2000	1000	pulse/s
Rate of rise of voltage pulse	60	60	kV/μs

Typical performance

Anode voltage (peak)	3.6	3.6	kV
Power output (peak)	4.0	4.0	kW
Power output (mean)	0.8	2.0	W

CATHODE

Indirectly heated

Heater voltage	6.3	V
Heater current	0.5	A
Heating time (min.) (see note 1)	2.0	minutes

TEST CONDITIONS AND LIMITS

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

Test conditions

Heater voltage	6.3	V
Anode current (mean)	3.0	mA
Duty factor	0.001	
Pulse duration (t_p) (see note 2)	1.0	μs
v.s.w.r. at output coupler	<1.05:1	
Rate of rise of voltage pulse (see note 3)	70	kV/μs

Limits and characteristics

	Min.	Max.	
Anode voltage (peak)	3.2	3.8	kV
Power output (mean)	3.0	-	W
Frequency (see note 11)	9.415	9.475	GHz
R.F. Bandwidth at 1/4 power (see note 2)	-	$\frac{2.5}{t_p}$	MHz
Frequency pulling (v.s.w.r. ≮1.5:1)	-	18	MHz
Minor lobe level (v.s.w.r. ≮1.5:1)	6.0	-	dB
Stability (see note 4)	-	0.25	%
Frequency pushing	-	2.5	MHz/A
Cold impedance (see notes 5 and 12)			
Heater current (see note 6)			
Frequency temperature coefficient (see note 7)			
Input capacitance (see note 8)			

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

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

	Min.	Max.	
Heater voltage (see notes 1 and 9)	5.7	6.9	V
Anode current (peak)	2.5	3.5	A
Power input (peak)	-	13.5	kW
Power input (mean)	-	13.5	W
Duty factor	-	0.001	
Pulse duration (t_p) (see note 3)	0.02	1.0	μs
Rate of rise of anode voltage (see note 4)	-	70	kV/μs
Anode temperature	-	120	°C
v.s.w.r. at output coupler	-	1.5:1	

END OF LIFE PERFORMANCE

The quality of all production is monitored by the random selection of magnetrons which are then life tested under the stated test conditions. If the magnetron is to be operated under different conditions from those specified above, Mullard Ltd., should be consulted to verify that the life will not be affected. The magnetron is considered to have reached the end of life when it fails to meet the following limits when operated as specified on page 2.

	Min.	Max.	
Anode voltage (peak)	3.2	3.8	kV
Power output (mean)	2.5	-	W
Frequency	9.415	9.445	GHz
R.F. Bandwidth at 1/4 power	-	$\frac{3.5}{t_p}$	MHz
Stability	-	0.5	%

MOUNTING POSITION (See note 10) Any

COOLING Natural

PHYSICAL DATA

	kg	lb
Weight of magnetron	1.02	2.25
Weight of magnetron in storage carton	1.82	4.0
	mm	in
Dimensions of storage carton	190×190×280	7.5×7.5×11

VIBRATION

The magnetron is vibration tested to ensure that it will withstand normal conditions of service.

NOTES

1. For ambient temperatures above $0^{\circ}C$ the cathode must be heated for at least 2 minutes before the application of h.t. For ambient temperatures between $0^{\circ}C$ and $-55^{\circ}C$ the cathode heating time is three minutes.
2. The tolerance of current pulse duration (t_p) measured at 50% amplitude is ±10%.

NOTES (contd.)

3. Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude.

4. With the magnetron operating into a v.s.w.r. of 1.5:1 varied through all phases over an anode current range of 2.5 to 3.5mA mean. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal level in the frequency range 9.415 to 9.475GHz. Missing pulses are expressed as a percentage of the number of input pulses applied during the period of observation after a period of ten minutes operation.

5. The cold impedance of the magnetron is measured at the operating frequency and will give a v.s.w.r. of >6:1. The position of voltage minimum from the face of the output flange into the magnetron is 3 to 9mm for the JP9-2.5D and JP9-2.5F and 0 to 6mm for the JP9-2.5E.

6. Measured with heater voltage of 6.3 volts and no anode input power, the heater current limits are 0.5 to 0.6Amps.

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

8. Design test only. The maximum input capacitance is 9pF.

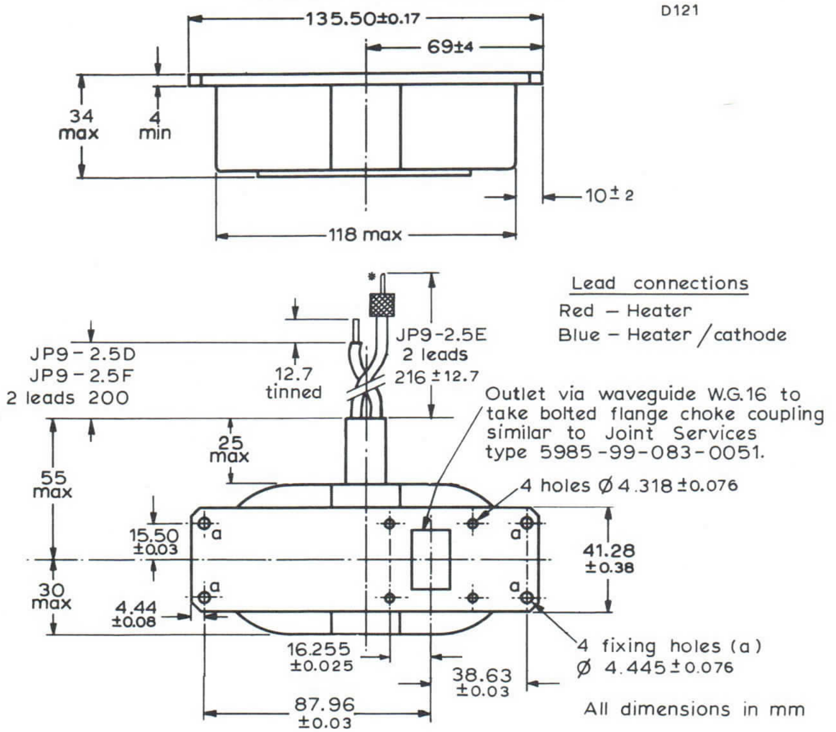
9. The magnetron is normally tested with a heater supply of 50Hz and is suitable for operation at 1kHz and 1.1kHz. Mullard Ltd., should be consulted if the magnetron is to be operated with a heater supply of any other frequency.

10. It is necessary to keep all magnetic material as far as possible, at least 50mm (2in), from the magnet and mounting plate. The inner polystyrene pack of the magnetron carton provides adequate separation between magnetrons, and it is recommended that magnetrons not in use be kept in these packs.

11. Magnetrons with other frequency ranges can be supplied to order.

12. The JP9-2.5D and JP9-2.5F are electrically and mechanically identical.

OUTLINE DRAWING OF JP9-2.5



*JP9-2.5E wander plugs:-

Belling Lee { 4mm single pin 378/4/Red – Red lead
3mm single pin 378A/3/Black – Blue lead

CONVERSION TABLE
(Rounded outwards)

Millimetres	Inches	Millimetres	Inches
4 min.	0.15 min.	34 max.	1.34 max.
Ø 4.318 ±0.076	Ø 0.170 ±0.003	38.63 ± 0.03	1.5209 ± 0.0012
4.44 ±0.08	0.1748 ±0.0032	41.28 ±0.38	1.625 ±0.015
Ø 4.445 ±0.076	Ø 0.175 ±0.003	55 max.	2.17 max.
10 ±2	0.393 ±0.079	69 ± 4	2.72 ±0.16
12.7	0.50	87.96 ±0.03	3.4630 ±0.0012
15.50 ±0.03	0.6102 ±0.0012	118 max.	4.65 max.
16.255 ±0.025	0.640 ±0.001	135.50 ±0.17	5.3347 ± 0.0067
25 max.	0.99 max.	200	7.87
30 max.	1.19 max.	216 ± 12.7	8.50 ±0.50

MAGNETRON

JP9-7
JP9-7A
JP9-7B

Frequency: *'X' band, fixed.*
Power output: *7.5kW, pulsed.*
Construction: *Packaged, forced-air cooled.*

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook.

CHARACTERISTICS

		Min.		*Max.*	
Frequency (measured with the anode block at 45°C) Fixed within the band	JP9–7	9.345	to	9.405	Gc/s
	JP9–7A	9.210	to	9.270	Gc/s
	JP9–7B	9.525	to	9.585	Gc/s
Pulse voltage (I_{pulse} = 4.5A)		5.3		5.7	kV←
R.F. pulse power output (I_{pulse} = 4.5A)		7.0			kW
Frequency pulling factor (v.s.w.r. = 1.5)				15	Mc/s
Frequency temperature coefficient				−0.25	Mc/s per °C
Distance of v.s.w. minimum from face of mounting plate into valve		16.5		22.5	mm←
Input capacitance				8.0	pF

CATHODE

Indirectly heated

V_h	6.3	V
I_h	600	mA

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

For mean input powers greater than 25 watts, it is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power-heating voltage rating chart on page C2.

TYPICAL OPERATION

Heater voltage (running)	6.3	V
Pulse duration	1.0	μs
Pulse repetition frequency	1000	p/s
Duty cycle	0.001	
Pulse current	4.5	A
Pulse voltage	5.5	kV
R.F. pulse output power	7.5	kW←
Mean input current	4.5	mA
Mean input power	24.7	W
Mean r.f. output power	7.5	W←
Frequency pulling (v.s.w.r. = 1.5)	14	Mc/s←
Rate of rise of pulse voltage	50	kV/μs←

COOLING

In normal circumstances natural cooling is adequate, but where the ambient temperature is abnormally high a flow of cooling air between the radiator fins may be necessary to keep the block temperature below the permitted maximum.

JP9-7
JP9-7A
JP9-7B

MAGNETRON

ABSOLUTE MAXIMUM RATINGS

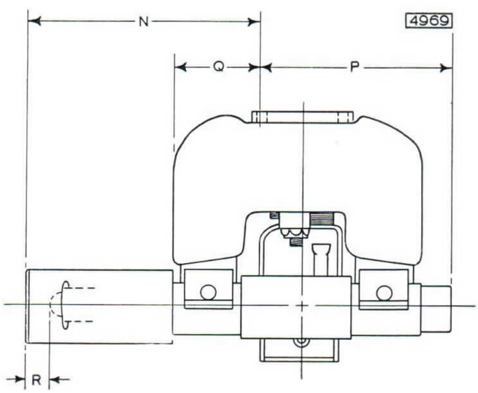
	Min.	*Max.*	
Pulse current	3.5	5.5	A
Pulse voltage	5.0	6.0	kV
Pulse duration		2.5	μs
Duty cycle		0.0025	
Mean input power		82.5	W
Rate of rise of voltage pulse		60	kV/μs
Load mismatch (v.s.w.r.)		1.5	
Temperature of anode block		120	°C

MOUNTING POSITION

Any

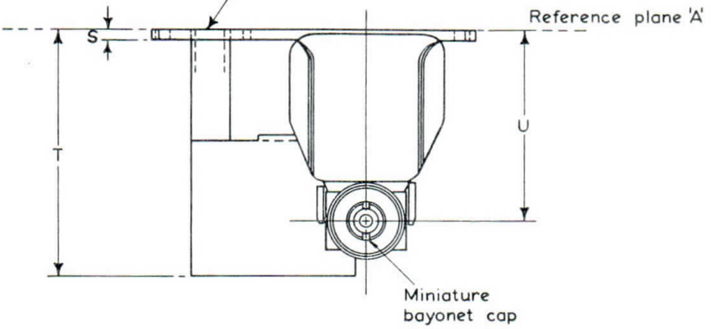
PHYSICAL DATA

Weight of magnetron	3.0	lb
	1.4	kg
Weight of magnetron in carton	5.7	lb
	2.5	kg
Dimensions of storage carton	7.75 × 8.0 × 9.75	in
	200 × 210 × 250	mm

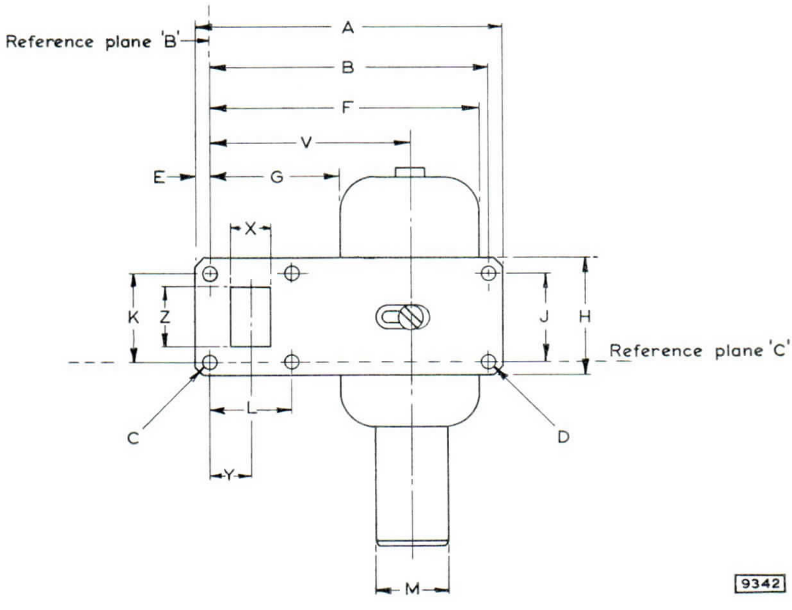


DIMENSIONS

	inches	mm	
A	4.47	113.5	max.
B	4.103±0.004	104.2±0.1	
C	0.17±0.003	4.32±0.08	
D	0.175±0.003	4.45±0.08	
E	0.19	4.8	max.
F	4.0	102	max.
G	1.93	49	min.
H	1 64	41.7	max.
J	1.22±0.003	30.99±0.08	
K	1.22±0.004	30.99±0.1	
L	1.28±0.004	32.51±0.1	
M	1.0	25.4	max.
N	3.19	81.0	max.
P	2.19	55.6	max.
Q	1.19	30.2	max.
R	0.25	6.4	max.
S	0.125±0.01	3.18±0.25	
T	3.25	82.6	max.
U	2.52±0.13	64±3	
V	3.0±0.13	76±3	
X	0.400±0.003	10.16±0.08	
Y	0.640±0.004	16.25±0.10	
Z	0.900±0.003	22.86±0.10	

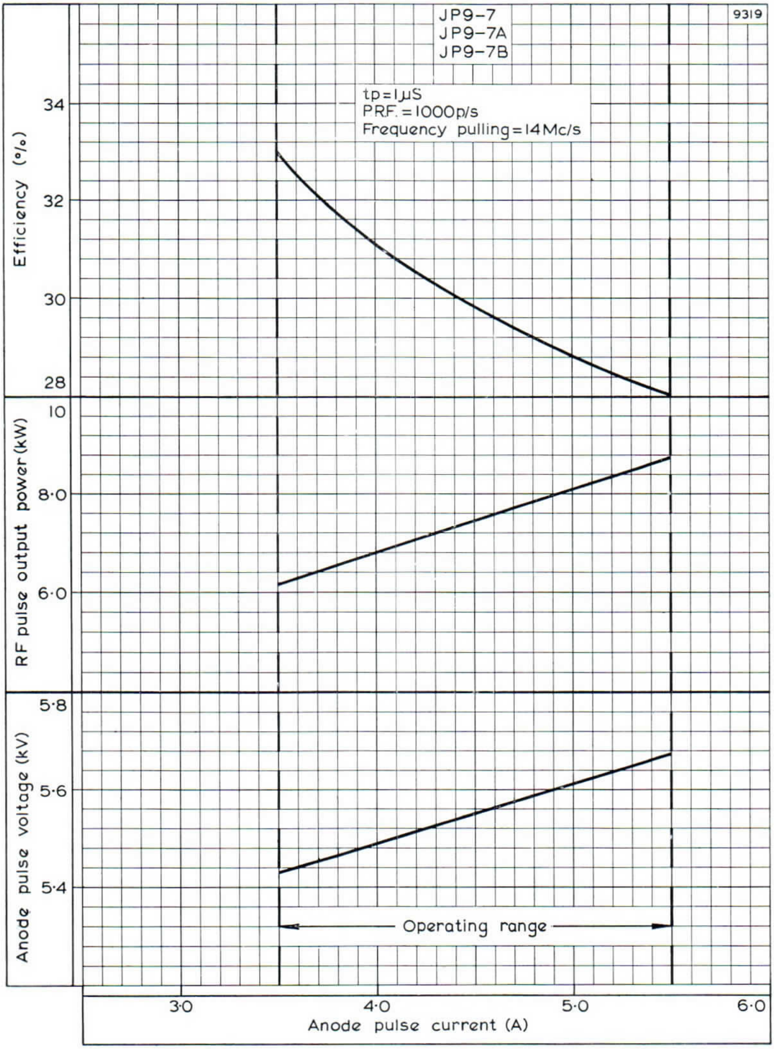


OUTLET VIA WAVEGUIDE WG16
TO TAKE BOLTED FLANGE CHOKE
COUPLING JOINT-SERVICES TYPE 5985-99-0830051
Reference plane 'A'
S
T
U
Miniature
bayonet cap

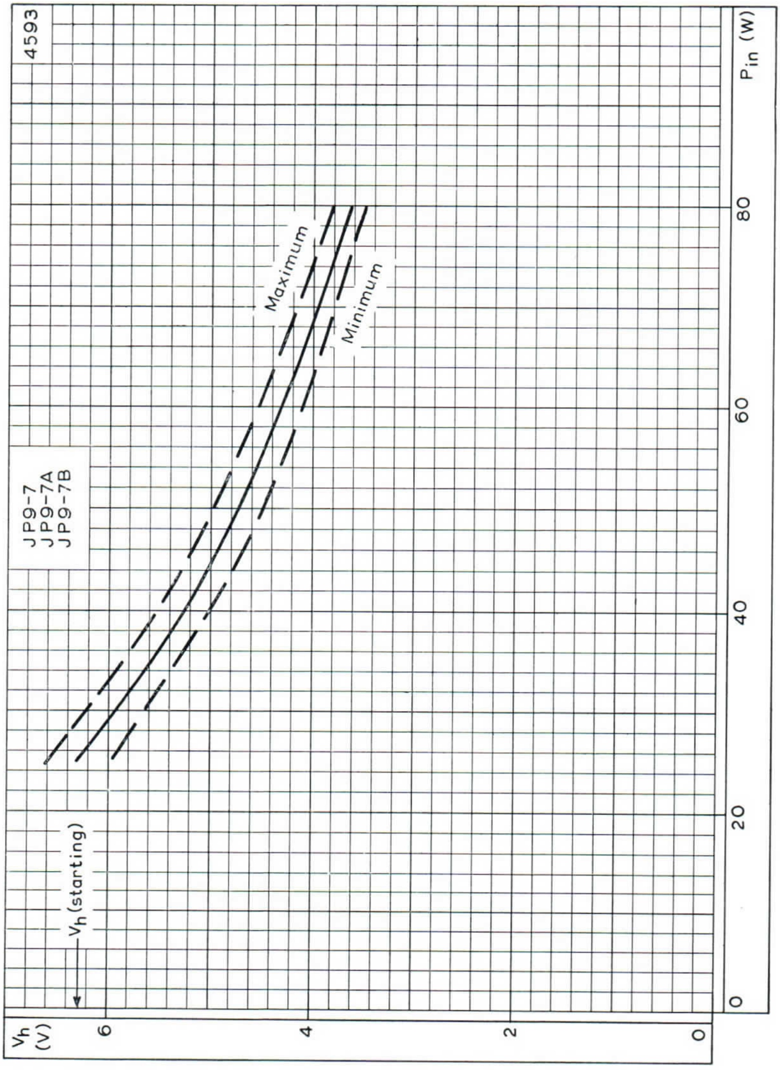


Reference plane 'B'
A
B
F
V
E
G
X
K
Z
J
H
Reference plane 'C'
L
C
D
Y
M

9342



ANODE PULSE VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT



HEATER VOLTAGE PLOTTED AGAINST MEAN INPUT POWER

MAGNETRON

JP9-7D

QUICK REFERENCE DATA

Forced-air cooled fixed frequency 'X' band magnetron.

Frequency	9.375	Gc/s
Power output (pulsed)	10	kW
Construction	Packaged	

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook.

TYPICAL OPERATION

Heater voltage (running)	6.3	6.3	5.8	V
Pulse duration	0.05	0.1	1.0	μs
Pulse repetition frequency	4000	1000	1000	p/s
Duty cycle	0.0002	0.0001	0.001	
Pulse current	7.0	6.0	5.5	A
Pulse voltage	5.9	5.7	5.6	kV
Pulse input power	41.3	34.2	30.8	kW
R.F. pulse output power	10.5	9.5	9.0	kW
Mean input current	1.4	0.6	5.5	mA
Mean input power	8.3	3.4	31	W
Mean r.f. output power	2.1	0.95	9.0	W
Frequency pulling factor (v.s.w.r. = 1.5)	14	14	14	Mc/s
Rate of rise of pulse voltage	110	110	80	kV/μs

ABSOLUTE MAXIMUM RATINGS

	Min.	*Max.*	
Pulse current			
$t_p < 1.0\mu s$	4.5	6.0	A
$t_p < 0.1\mu s$	4.5	7.0	A
Pulse duration	0.05	1.0	μs
Duty cycle	—	0.002	
Mean input power	—	83	W
Rate of rise of voltage pulse	—	120	kV/μs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	100	°C

JP9-7D

MAGNETRON

CATHODE

Indirectly heated

V_h	6.3	V
I_h	600	mA

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes. For mean input powers greater than 25 watts it is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power/heater rating chart on page C2.

CHARACTERISTICS

	Min.		*Max.*	
Frequency (measured with the anode block at 45°C) Fixed within the band	9.345	to	9.405	Gc/s
Pulse voltage (I_{pulse} = 5.5A)	5.4		5.9	kV
R.F. pulse output power (I_{pulse} = 5.5A)	8.0		—	kW
Frequency pulling factor (v.s.w.r. = 1.5)	—		15	Mc/s
Distance of v.s.w. minimum from mounting plate into valve	16.5		22.5	mm ←
Input capacitance	—		8	pF

END OF LIFE PERFORMANCE

	Min.		*Max.*	
R.F. pulse output power (I_{pulse} = 5.5A)			7.0	kW ←
Frequency (measured with anode block at 45°C) Fixed within the band	9.345	to	9.405	Gc/s
Pulse voltage (I_{pulse} = 5.5A)	5.4		5.9	kV

COOLING

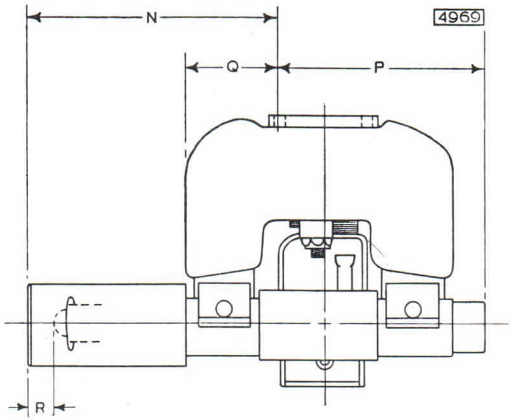
In normal circumstances natural cooling is adequate, but where the ambient temperature is abnormally high a flow of cooling air between the radiator pins may be necessary to keep the anode block temperature below the permitted maximum.

MOUNTING POSITION

Any

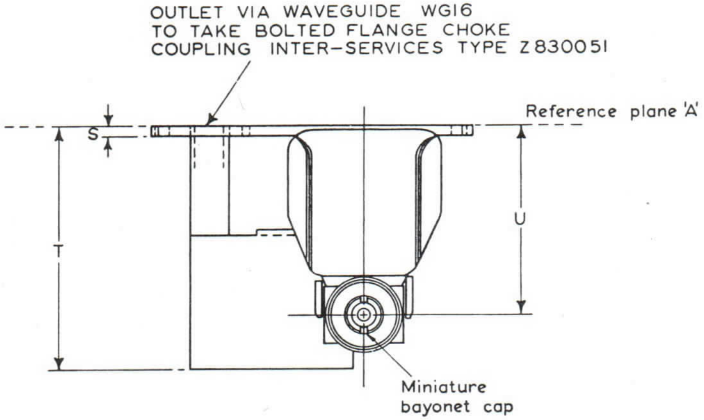
PHYSICAL DATA

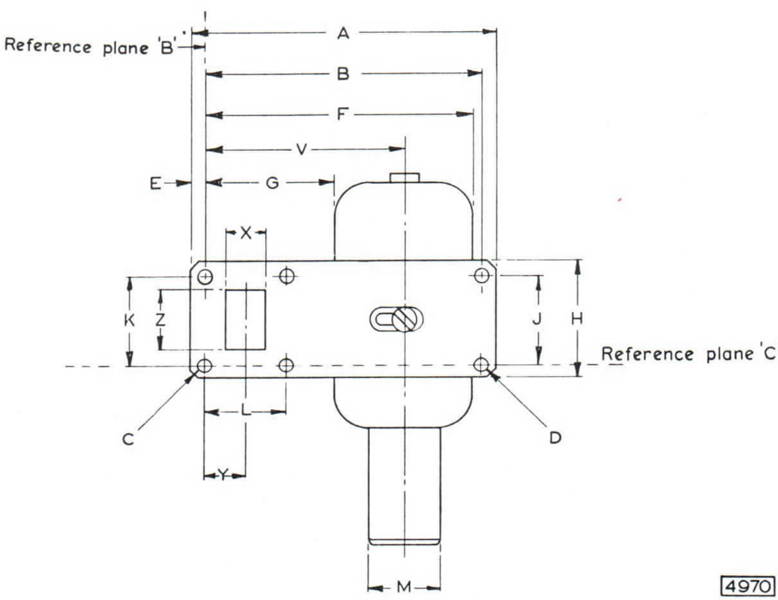
Weight of magnetron	3 lb 0 oz 1.4	 kg
Weight of magnetron in carton	5 lb 11 oz 2.5	 kg
Dimensions of storage carton	7.75 × 8.0 × 9.75 200 × 210 × 250	in mm

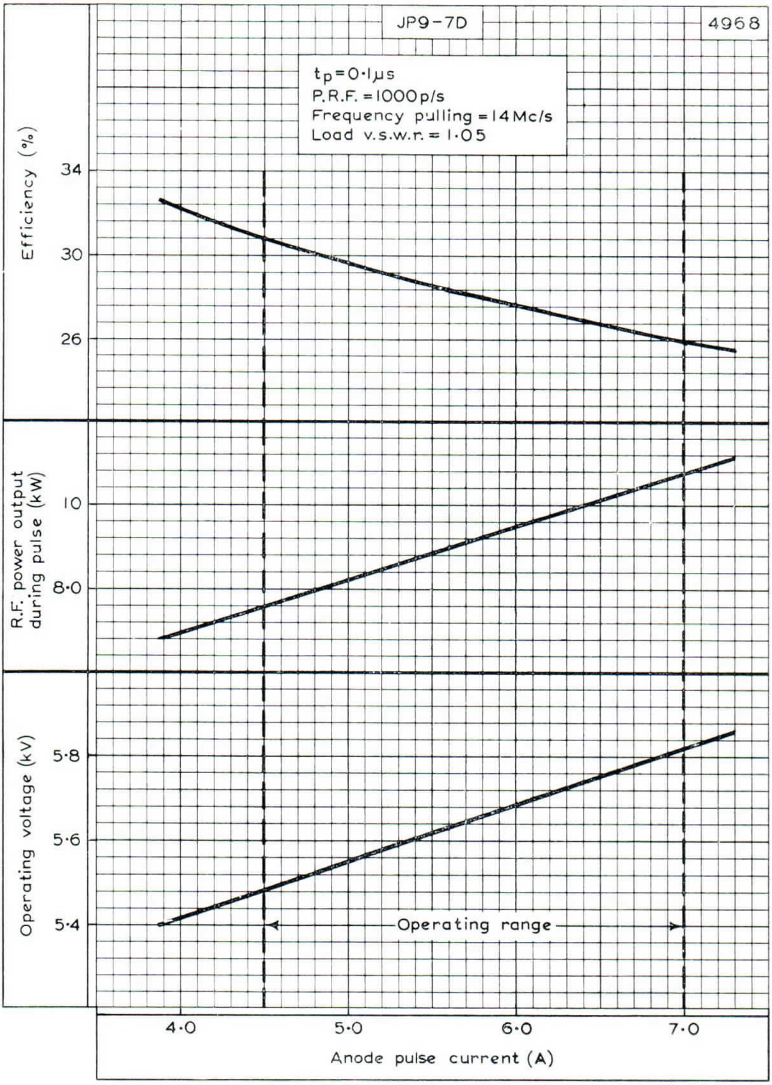


DIMENSIONS

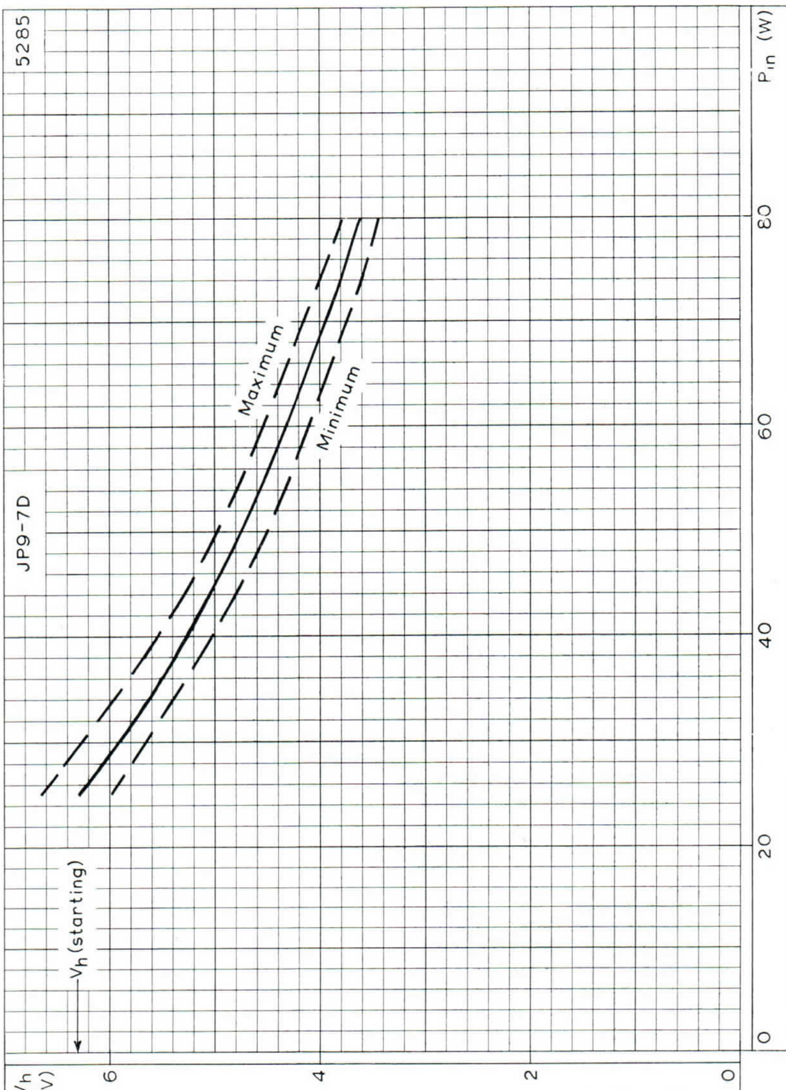
	Inches	Millimetres	
A	4.453 ± 0.015	113.11 ± 0.38	
B	4.103 ± 0.004	104.2 ± 0.10	
C	0.170 ± 0.003	4.32 ± 0.08	
D	0.175 ± 0.003	4.45 ± 0.08	
E	0.172 ± 0.016	4.37 ± 0.41	
F	4.0	102	max.
G	1.938	49	min.
H	1.625 ± 0.016	41.28 ± 0.41	
J	1.22 ± 0.003	30.99 ± 0.08	
K	1.22 ± 0.004	30.99 ± 0.10	
L	1.28 ± 0.004	32.51 ± 0.10	
M	1.0	25.4	max.
N	2.938 ± 0.25	74.61 ± 6.35	
P	2.188	55.6	max.
Q	1.188	30.2	max.
R	0.25	6.4	max.
S	0.125 ± 0.01	3.18 ± 0.25	
T	3.25	82.6	max.
U	2.52 ± 0.13	64 ± 3	
V	3.0 ± 0.13	76 ± 3	
X	0.400 ± 0.003	10.16 ± 0.08	
Y	0.640 ± 0.004	16.25 ± 0.10	
Z	0.900 ± 0.003	22.86 ± 0.10	


OUTLET VIA WAVEGUIDE WG16
TO TAKE BOLTED FLANGE CHOKE
COUPLING INTER-SERVICES TYPE Z830051
Reference plane 'A'
S
T
U
Miniature
bayonet cap

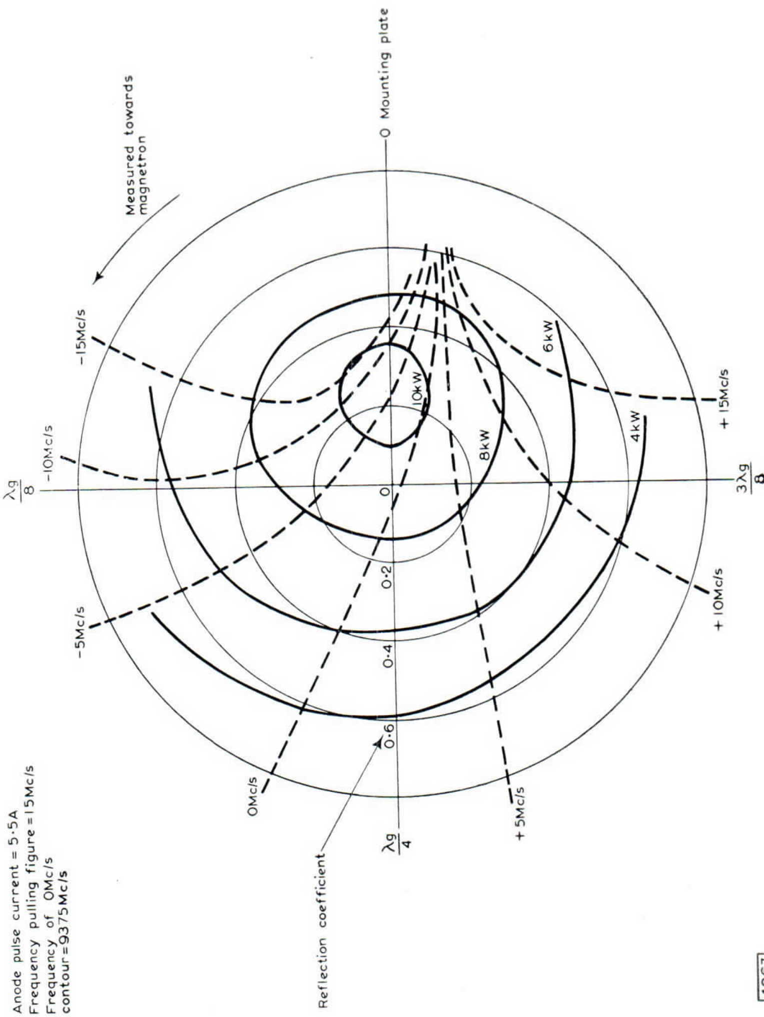

Reference plane 'B'
A
B
F
V
E
G
X
K
Z
J
H
Reference plane 'C'
L
C
D
Y
M
4970



OPERATING VOLTAGE, R.F. POWER OUTPUT DURING PULSE AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT



HEATER VOLTAGE PLOTTED AGAINST INPUT POWER



REIKE DIAGRAM

JP9-15
JP9-15B

QUICK REFERENCE DATA

Fixed frequency 'X' band magnetron with natural or forced-air cooling.

Frequency JP9-15	9.375	Gc/s
JP9-15B	9.445	Gc/s
Power output (pulsed)	18	kW
Construction	Packaged	

Unless otherwise shown data is applicable to both types.

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES which precede this section of the handbook.

TYPICAL OPERATION

Pulse duration	0.05	0.1	1.0	μs
Pulse repetition frequency	2500	2000	500	p/s
Duty cycle	0.000125	0.0002	0.0005	
Pulse current	8.0	7.5	7.0	A
Pulse voltage	7.7	7.6	7.5	kV
Pulse input power	62	57	53	kW
R.F. pulse output power	22	21	20	kW
*Mean input current	1.2	1.6	3.5	mA
Mean input power	7.75	11.4	26.5	W
Mean R.F. output power	2.75	4.2	10.0	W
Heater voltage running	6.3	6.3	6.3	V
Frequency pulling factor (v.s.w.r. = 1.5)	17	17	17	Mc/s
Rate of rise of pulse voltage	95	90	80	kV/μs

*Includes pre-oscillation current

ABSOLUTE MAXIMUM RATINGS

	Min.	*Max.*	
Pulse current			
($t_p \leqslant 1.0\mu s$)	6.0	9.0	A
($t_p > 1.0$ to $2.5\mu s$)	6.0	7.5	A
Pulse duration		2.5	μs
Duty cycle	—	0.0015	
Mean input power	—	83	W
Rate of rise of voltage pulse	—	100	kV/μs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	120	°C

JP9-15
JP9-15B

MAGNETRON

CATHODE

Indirectly heated

V_h	6.3	V
I_h	550	mA

Heating time. At ambient temperatures above 0°C, the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.
In many applications involving short pulse lengths and high pulse repetition frequencies the mean current which would be calculated from the duty cycle is increased by a pre-oscillation current.
For mean input powers greater than 25 watts, it is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power heater voltage rating chart on page C3.

CHARACTERISTICS

		Min.		*Max.*	
Frequency					
Fixed within the band	JP9-15	9.345	to	9.405	Gc/s
	JP9-15B	9.415	to	9.475	Gc/s
Pulse voltage ($I_{pulse} = 7.5A$)		7.0		8.2	kV
R.F. pulse power output ($I_{pulse} = 7.5A$)		17		—	kW
Frequency pulling factor (v.s.w.r. = 1.5)		—		18	Mc/s
Frequency pushing factor		—		1.5	Mc/s per A
Frequency temperature coefficient		—		–250	kc/s per °C
Distance of v.s.w. minimum from face of mounting plate into valve		16.5		22.5	mm
Input capacitance		—		8.0	pF

END OF LIFE PERFORMANCE

		Min.		*Max.*	
R.F. pulse power output ($I_{pulse} = 7.5A$)				15	kW
Frequency					
Within the band	JP9-15	9.345	to	9.405	Gc/s
	JP9-15B	9.415	to	9.475	Gc/s
Pulse voltage ($I_{pulse} = 7.5A$)		7.0		8.2	kV

COOLING

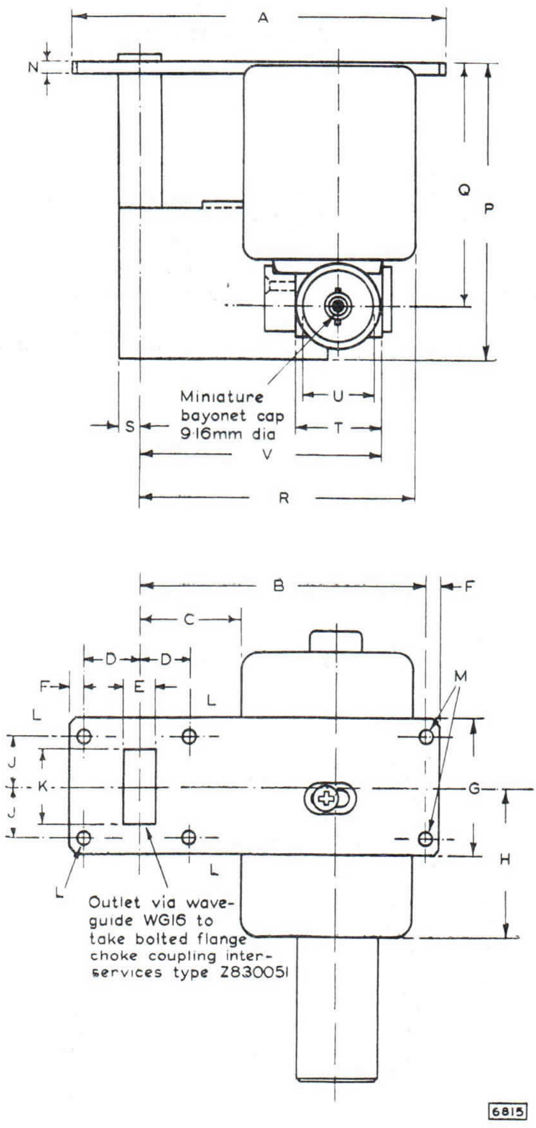
In normal circumstances natural cooling is adequate, but where the ambient temperature is abnormally high, a flow of cooling air between the radiator fins may be necessary to keep the block temperature below the permitted maximum.

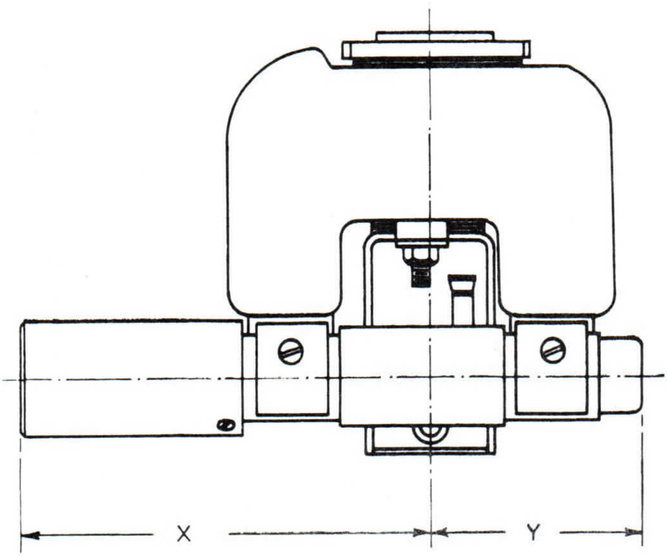
MOUNTING POSITION

Any

PHYSICAL DATA

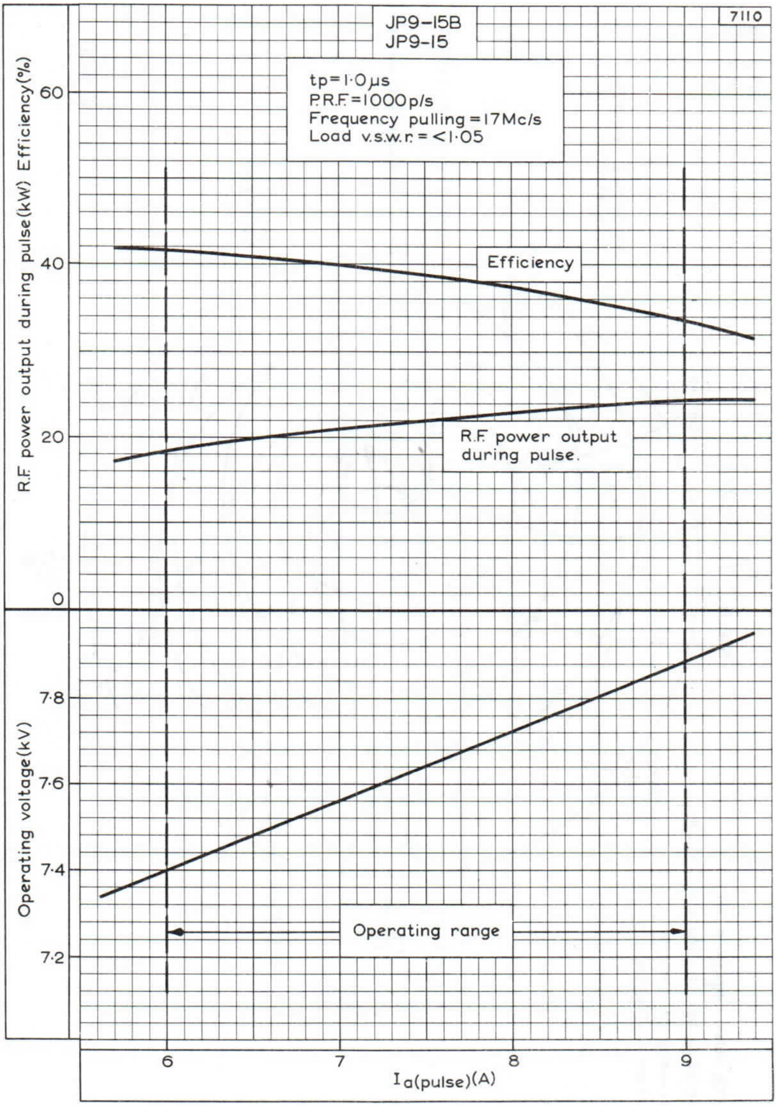
Weight of magnetron	3 lb 11 oz	1.7 kg
Weight of magnetron in carton	6 lb 6 oz	2.9 kg
Dimensions of storage carton	7.8 × 8.0 × 9.8 in	197 × 204 × 248 mm


A
N
Q
P
Miniature
bayonet cap
9·16mm dia
U
S
T
V
R
B
F
C
D
D
F
E
M
L
L
J
K
G
J
L
H
L
Outlet via wave-
guide WG16 to
take bolted flange
choke coupling inter-
services type Z830051
6815

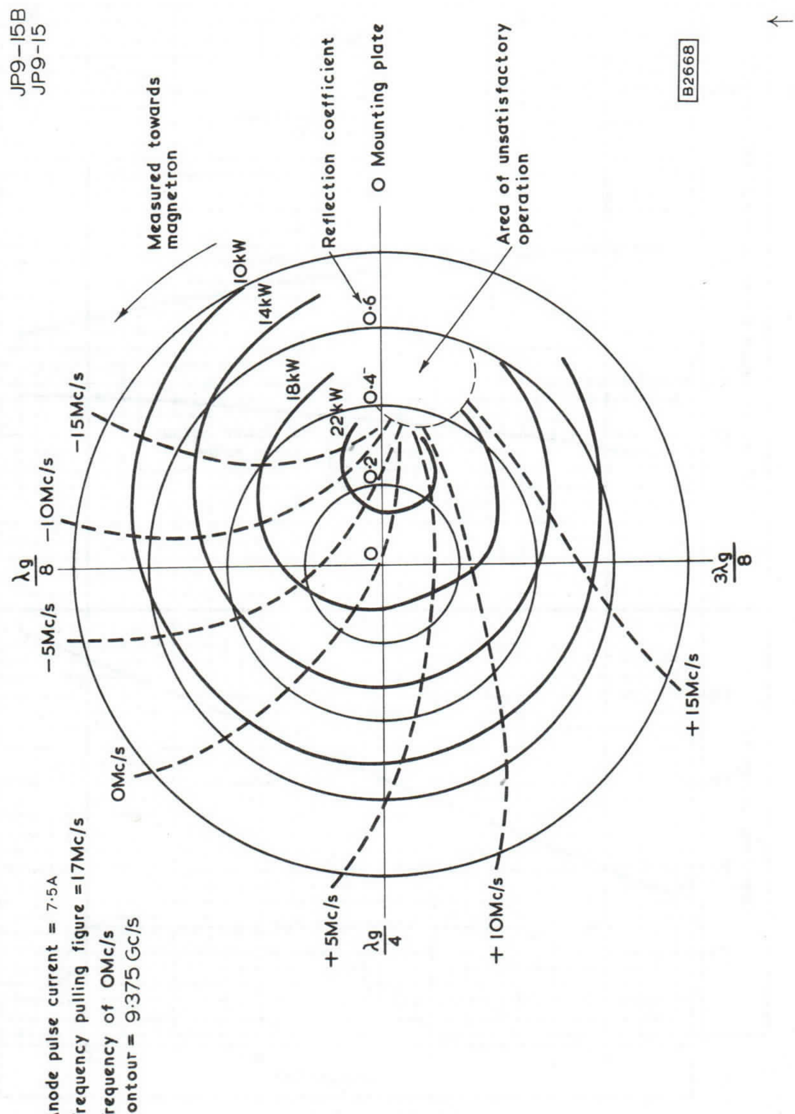


6816

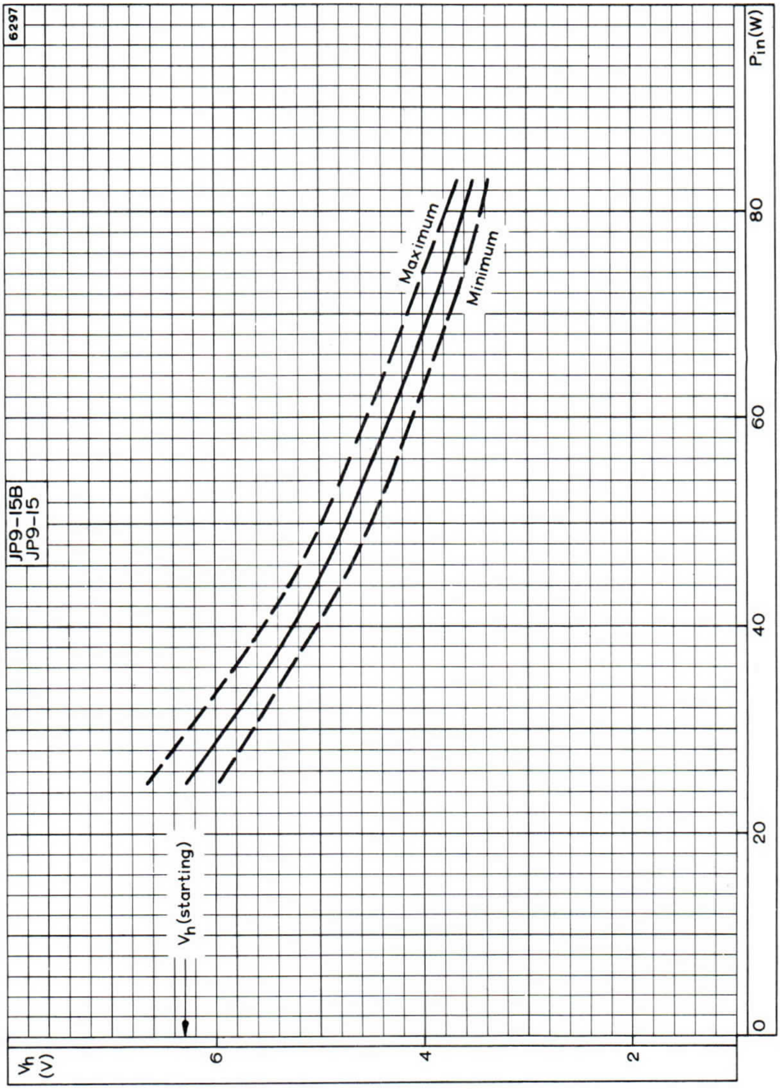
	Inches	Millimetres	
A	4.468	113.5	max.
B	3.465 ± 0.004	88.0 ± 0.1	
C	1.169	29.7	min.
D	0.640 ± 0.004	16.25 ± 0.10	
E	0.400 ± 0.003	10.16 ± 0.08	
F	0.185	4.7	max.
G	1.641	41.7	max.
H	1.800	45.7	max.
J	0.610 ± 0.004	15.5 ± 0.1	
K	0.900 ± 0.004	22.86 ± 0.10	
L	0.170 ± 0.003	4.32 ± 0.08	
M	0.175 ± 0.003	4.45 ± 0.08	
N	0.138	3.5	max.
P	3.500	88.9	max.
Q	2.824	71.74	max.
R	3.358	85.3	max.
S	0.252	6.4	max.
T	1.000	25.4	max.
U	0.591	15	min.
V	2.760	70.1	max.
X	3.799	96.5	max.
Y	1.575	40	max.



R.F. POWER OUTPUT DURING PULSE, OPERATING VOLTAGE AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT



RIEKE DIAGRAM



HEATER VOLTAGE PLOTTED AGAINST INPUT POWER

MAGNETRON

JP9-18

QUICK REFERENCE DATA		
Fixed frequency 'X' band magnetron with natural cooling		
Frequency	9.41	GHz
Power output (pulsed)	21	kW
Construction	Packaged	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS

R.F. pulse power output	21	21	kW
Duty factor	0.0002	0.0005	
Pulse duration	0.1	1.0	μs
Pulse repetition frequency	2000	500	p.p.s.
Heater voltage (running)	6.3	6.3	V
Pulse current	8.6	8.6	A
Pulse voltage	7.2	7.2	kV
Pulse input power	62	62	kW
Rate of rise of voltage pulse	90	90	kV/μs
*Mean input current	1.8	4.3	mA
Mean input power	13	31	W
Mean r.f. output power	4.2	10.5	W
Frequency pulling (v.s.w.r. = 1.5)	16	16	MHz

*Includes pre-oscillation current

CHARACTERISTICS

	Min.	Max.	
Frequency fixed within the band	9.38	9.44	GHz
Pulse voltage (I_{pulse} = 8.6A)	7.0	7.5	kV
R.F. pulse power output (I_{pulse} = 8.6A)	19	-	kW
Frequency pulling (v.s.w.r. = 1.5)	-	18	MHz
Frequency temperature coefficient	-	-0.25	MHz per degC
Distance for v.s.w. minimum from face of mounting plate into valve	16.5	22.5	mm
Input capacitance	-	8.0	pF
Frequency pushing	-	1.5	MHz per A

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Pulse current	7.0	10	A
Pulse duration	-	2.5	μs
Duty factor	-	0.0015	
Mean input power	-	83	W
Rate of rise of voltage pulse	-	100	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	

CATHODE

Indirectly heated

V_h	6.3	V
I_h	0.55	A
$I_{h\ (surge)}$ max.	5.0	A
r_h (cold)	1.75	Ω

Heating time

At ambient temperatures above $0^{o}C$ the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

In many applications involving short pulse lengths and high pulse repetition frequencies the mean current which would be calculated from the duty cycle is increased by a pre-oscillation current.

For mean input powers greater than 25watts, it is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power-heater voltage rating chart on page C1.

END OF LIFE PERFORMANCE

The valve is deemed to have reached end of life when it fails to satisfy the following:

R.F. pulse power output (I_{pulse} = 8.6A)			17	kW
	Min.		Max.	
Frequency within the band	9.38	to	9.44	GHz
Pulse voltage (I_{pulse} = 8.6A)	7.0	to	7.5	kV

MOUNTING POSITION

Any

PHYSICAL DATA

	kg	lb
Weight of magnetron	1.7	3.7
Weight of magnetron in carton	2.9	6.4
	cm	in
Dimensions of storage carton	19.7 × 20.4 × 24.8	7.8 × 8.0 × 9.8

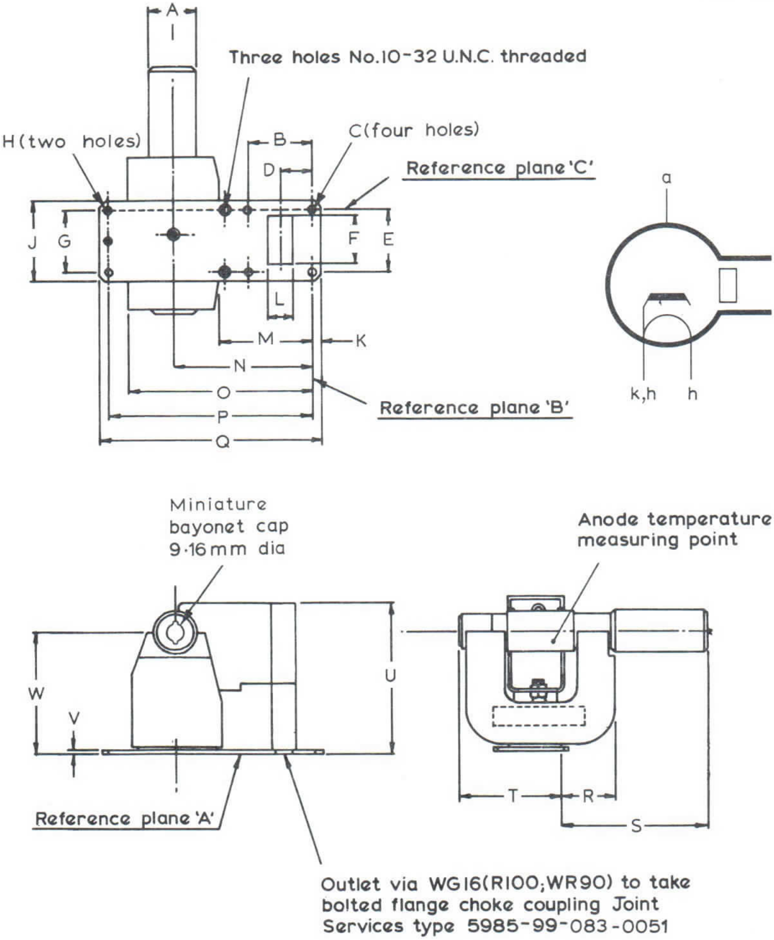
COOLING

In normal circumstances natural cooling is adequate, but where the ambient temperature is abnormally high, a flow of cooling air between the radiator fins may be necessary to keep the anode block temperature below the permitted maximum.

Temperature

Anode block max.	120	°C

B7357

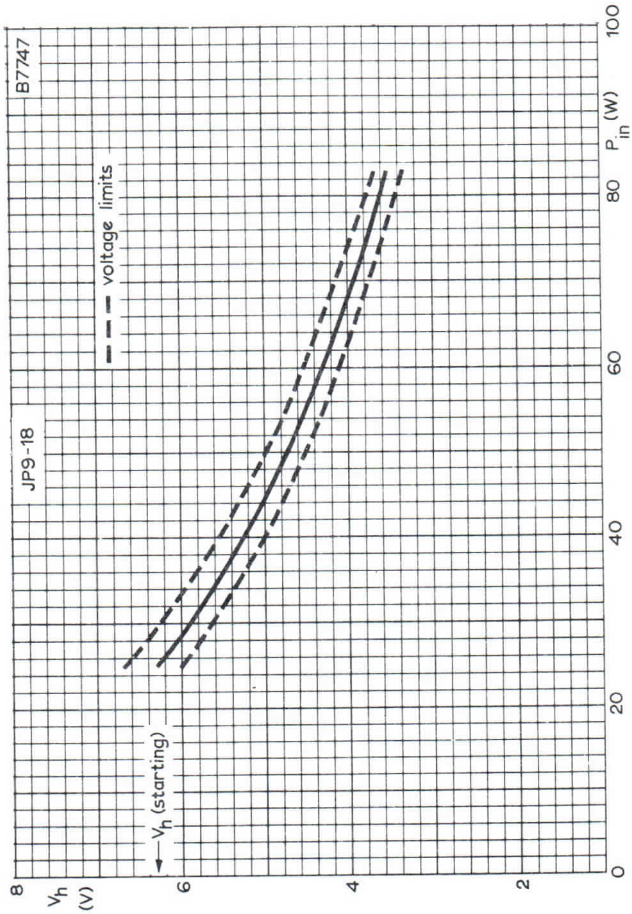


Three holes No.10-32 U.N.C. threaded
H(two holes)
C(four holes)
Reference plane 'C'
A
B
D
J
G
F
E
L
M
K
N
O
P
Q
Reference plane 'B'
a
k,h
h
Miniature
bayonet cap
9·16mm dia
Anode temperature
measuring point
W
V
U
T
R
S
Reference plane 'A'
Outlet via WG16(R100;WR90) to take
bolted flange choke coupling Joint
Services type 5985-99-083-0051

DIMENSIONS

	Millimetres	Inches	
A	25.40	1.000	dia.max.
B	32.51 ± 0.10	1.280 ± 0.004	
C	4.32 ± 0.08	0.170 ± 0.003	dia.
D	16.25 ± 0.10	0.640 ± 0.004	
E	30.99 ± 0.08	1.220 ± 0.003	
F	22.86 ± 0.10	0.900 ± 0.004	
G	30.99 ± 0.08	1.220 ± 0.003	
H	4.445 ± 0.075	0.175 ± 0.003	dia.
J	41.70	1.641	max.
K	4.80	0.189	max.
L	10.16 ± 0.08	0.400 ± 0.003	
M	47.00	1.850	min.
N	76 ± 3.0	3.0 ± 0.12	
O	102	4.015	max.
P	104.2 ± 0.10	4.10 ± 0.004	
Q	113.5	4.468	max.
R	28.00	1.10	max.
S	78.00	3.07	max.
T	55.00	2.165	max.
U	84.00	3.307	max.
V	3.18 ± 0.25	0.125 ± 0.0098	
W	65 ± 3.0	2.56 ± 0.12	

Inch dimensions derived from original millimetre dimensions



HEATER DERATING CHART

MAGNETRON

JP9-50 JP9-50A

Frequency: *'X' Band, fixed.*
Power Output: *50kW, pulsed.*
Construction: *Packaged, forced-air cooled.*

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook

CHARACTERISTICS

	Min.	Max.	
Frequency			
Fixed within the band JP9–50	9.215 to 9.275		G/cs
JP9–50A	9.345 to 9.405		Gc/s
Pulse voltage ($I_{pulse} = 12A$)	—	13.5	kV
R.F. pulse power output ($I_{pulse} = 12A$)	40	—	kW
Frequency pulling factor (v.s.w.r. = 1.5)	—	15	Mc/s
Frequency temperature coefficient	—	–0.25	Mc/s per °C
Input capacitance	—	9.5	pF

CATHODE

Indirectly heated

V_h	6.3	V
I_h	1.0	A
$I_{h(surge)}$ max.	6.0	A
r_h (cold)	0.8	Ω

Heating time. The cathode must be heated for at least 2 minutes before the application of h.t.

It is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power-heater voltage rating chart on page C2.

TYPICAL OPERATION

Heater voltage (running)	5.0	0	V
Pulse duration	0.1	1.0	µs
Pulse repetition frequency	3300	1000	p/s
Duty cycle	0.00033	0.001	
Pulse current	12	12	A
Pulse voltage	12.7	12.7	kV
Pulse input power	152	152	kW
R.F. pulse output power	50	50	kW
Mean input current	4.0	12	mA
Mean input power	50	152	W
Mean r.f. output power	16.5	50	W
Frequency pulling (v.s.w.r. = 1.5)	12	12	Mc/s
Voltage pulse rise time	0.08	0.08	µs

COOLING

It is necessary to direct a flow of cooling air between the radiator fins, and on the cathode and heater seals, in order to keep the temperature below the permitted maximum

JP9-50
JP9-50A

MAGNETRON

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
Pulse current	6.0	15	A
Pulse duration	—	2.5	μs
Duty cycle	—	0.001	
Mean input power	—	180	W
Voltage pulse rise time	0.05	0.25	μs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	100	°C
Pressurisation of waveguide output	520	—	torr
	10	—	lb/in²
Pressurisation of circular mounting flange	—	2224	torr
	—	43	lb/in²

MOUNTING POSITION

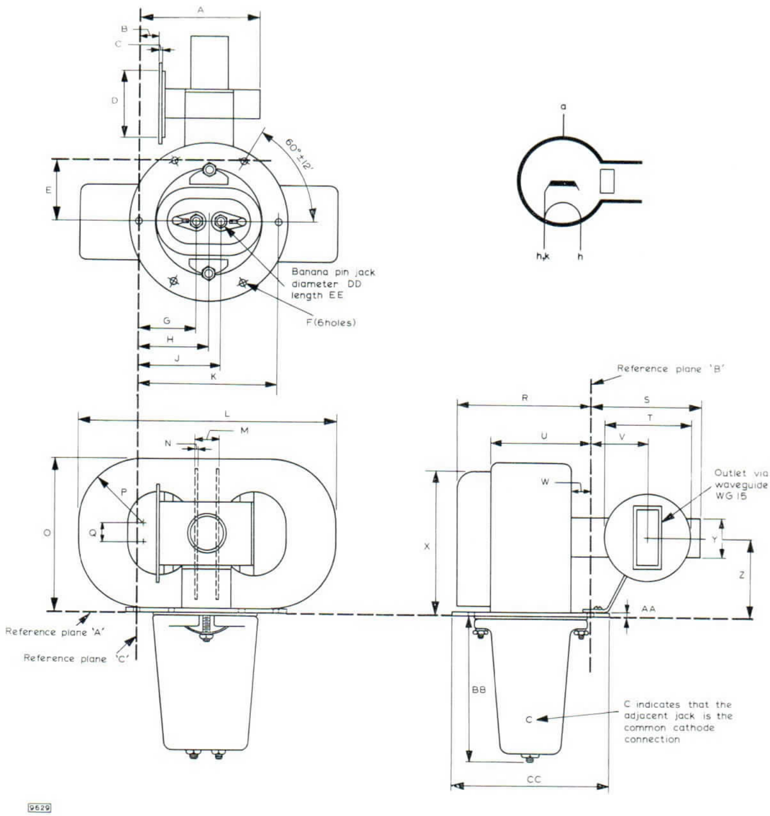
Any

PHYSICAL DATA

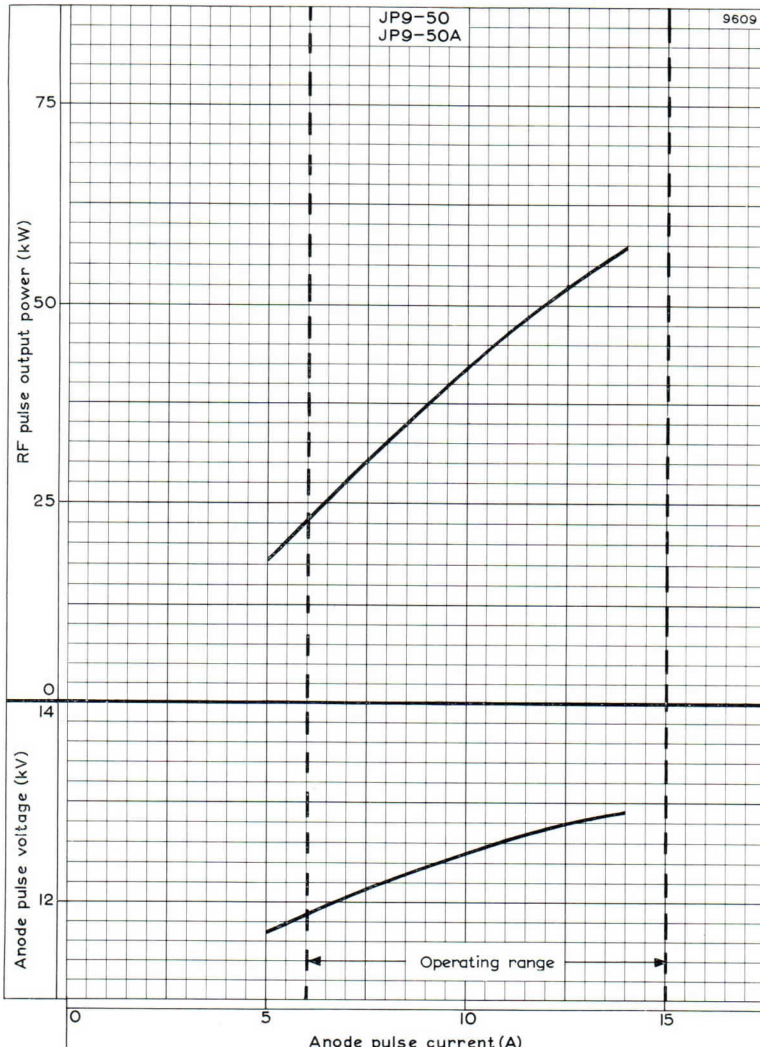
Weight of magnetron	3.7	lb
	1.7	kg
Weight of magnetron in carton	9.9	lb
	4.5	kg

DIMENSIONS

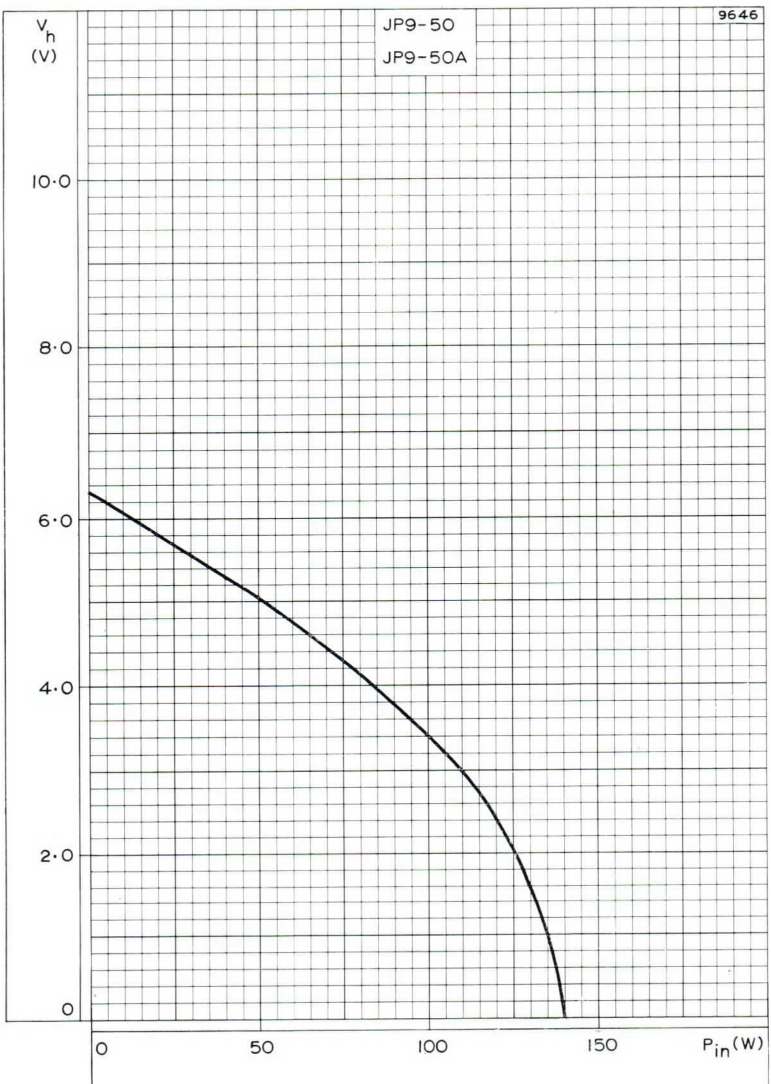
	Inches	Millimetres	
A	2.50	63.5	max.
B	0.437 ± 0.020	11.1 ± 0.5	
C	0.0850 ± 0.0051	2.16 ± 0.13	
D	1.42	36	max.
E	1.24	31.6	
F	0.1929 ± 0.0028	4.90 ± 0.07	dia.
G	1.187	30.15	
H	1.437 ± 0.028	36.5 ± 0.7	
J	1.687	42.85	
K	2.8740 ± 0.0051	73.0 ± 0.13	
L	5.373	136.5	max.
M	0.5	12.7	max.
N	0.063	1.6	
O	3.12	79.3	max.
P	1.34	34	rad.
Q	0.37	9.5	
R	2.74	69.7	max.
S	2.66	67.6	max.
T	1.7500 ± 0.0071	44.45 ± 0.18	
U	2.06	52.2	max.
V	1.192 ± 0.020	30.3 ± 0.5	
W	0.43	11	min.
X	2.97	75.4	max.
Y	0.75	19	
Z	1.563 ± 0.020	39.7 ± 0.5	
AA	0.1254 ± 0.0051	3.18 ± 0.13	
BB	2.984 ± 0.063	75.8 ± 1.6	
CC	3.248 ± 0.028	82.5 ± 0.7	



ANODE CONNECTION TERMINATED AT THE BASE PLATE



ANODE PULSE VOLTAGE AND R.F. PULSE OUTPUT POWER PLOTTED AGAINST ANODE PULSE CURRENT



HEATER VOLTAGE PLOTTED AGAINST MEAN INPUT POWER

MAGNETRON

JP9-75
JP9-75B

QUICK REFERENCE DATA

Forced-air cooled fixed frequency 'X' band pulsed magnetron

Frequency JP9-75	9.375 Gc/s
JP9-75B	9.445 Gc/s
Power output (pulsed)	80 kW
Construction	Packaged

Unless otherwise shown, data are applicable to both types.

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES which precede this section of the handbook.

CHARACTERISTICS

	Min.		Max.	
Frequency				
Fixed within the band JP9-75	9.345	to	9.405	Gc/s
JP9-75B	9.415		9.475	Gc/s
Pulse voltage ($I_{pulse} = 15A$)	14		16	kV
R.F. pulse output power ($I_{pulse} = 15A$)	65		—	kW
Frequency pulling factor (v.s.w.r. = 1.5)	—		15	Mc/s
Frequence pushing factor	—		750	kc/s per A
Frequency temperature coefficient	—		–250	kc/s per °C
Distance of v.s.w. minimum from face of mounting plate into valve	10.8	to	17.8	mm
Input capacitance	—		12	pF

TYPICAL OPERATION

Duty cycle	0.0002	0.001	0.001	
Heater voltage (running)	10	7.5	7.5	V
Pulse duration	0.1	1.0	5.0	μs
Pulse repetition frequency	2000	1000	200	p/s
Pulse current	15	15	15	A
Pulse voltage	15	15	15	kV
Pulse input power	225	225	225	kW
R.F. pulse output power	80	80	80	kW
*Mean input current	3.5	15	15	mA
Mean input power	45	225	225	W
Mean r.f. output power	16	80	80	W
Frequency pulling (v.s.w.r. = 1.5)	10	10	10	Mc/s
Rate of rise of pulse voltage	140	70	60	kV/μs

*Includes pre-oscillation current

JP9-75
JP9-75B

MAGNETRON

CATHODE

Indirectly heated

V_h	10	V
I_h	2.85	A
$I_{h(surge)}$ max.	11.5	A
r_h (cold)	0.4	Ω

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 3 minutes before the application of h.t.

In many applications involving short pulse lengths and high pulse repetition frequencies the mean current which would be calculated from the duty cycle is increased by the pre-oscillation current.

For mean input powers greater than 50 watts, it is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power-heater voltage rating chart on page C2.

ABSOLUTE MAXIMUM RATINGS

	Min.	*Max.*	
Pulse current	11	17	A←
Pulse duration	—	5.5	μs
Duty cycle	—	0.002	
Mean input power	—	400	W
Rate of rise of voltage pulse			
($t_p \leqq 1\mu s$)	—	150	kV/μs
($t_p > 1\mu s$)	—	80	kV/μs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	175	°C
Temperature of cathode and heater seals	—	150	°C

END OF LIFE PERFORMANCE

The valve is deemed to have reached end of life when it fails to satisfy the following:—

R.F. pulse power output (I_{pulse} = 15A)			60	kW
Frequency	Min		Max	
JP9-75	9.345	to	9.405	Gc/s
Within the band JP9-75B	9.415	to	9.475	Gc/s
Pulse voltage (I_{pulse} = 15A)	14	to	16	kV

MOUNTING POSITION

Any

PRESSURISING

The valve must not be operated at a pressure lower than 600mm of mercury. The waveguide output system can be pressurised up to a pressure of 2370mm of mercury.

PHYSICAL DATA ←

	lb	kg
Weight of magnetron	4.7	2.2
Weight of magnetron in carton	13	5.9

	in	cm
Dimensions of storage carton	13.25 x 12 x 9.375	33.7 x 30.5 x 23.8

COOLING

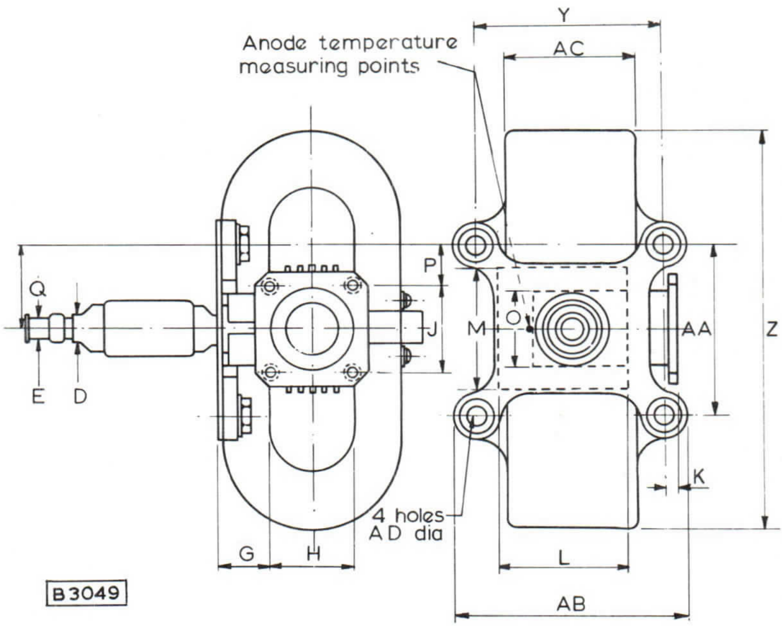
It is necessary to direct a flow of cooling air between the radiator fins, and on the cathode and heater seals, in order to keep the temperature below the permitted maximum.

→ DIMENSIONS

	Inches	Millimetres	
A	0.157	4.0	min.
B	0.276	7.0	min.
C	0.932 ± 0.014	23.65 ± 0.35	
D	0.470 ± 0.010	11.95 ± 0.25	
E	0.323 ± 0.008	8.2 ± 0.2	
F	3.150	80	max.
G	0.787 ± 0.024	20 ± 0.6	
H	1.220 ± 0.004	31 ± 0.1	
J	1.280 ± 0.004	32.5 ± 0.1	
K	0.197 ± 0.118	5.0 ± 3.0	
L	1.969 ± 0.079	50 ± 2.0	
M	1.870 ± 0.098	47.5 ± 2.5	
N	0.787 ± 0.079	20 ± 2.0	
O	1.412	29	max.
P	0.626 ± 0.024	15.9 ± 0.6	
Q	1.260 ± 0.039	32 ± 1.0	
R	3.189	81	max.
S	2.874	73	max.
T	0.630 ± 0.079	16 ± 2.0	
X	0.551	14	max.
Y	2.783 ± 0.012	70.7 ± 0.3	
Z	5.945	151	max.
AA	2.531 ± 0.010	64.29 ± 0.25	
AB	3.622	92	max.
AC	1.969	50	max.
AD	0.281 ± 0.005	7.14 ± 0.12	

Inch dimensions derived from original millimetre dimensions.

←


Anode temperature measuring points
Y
AC
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M
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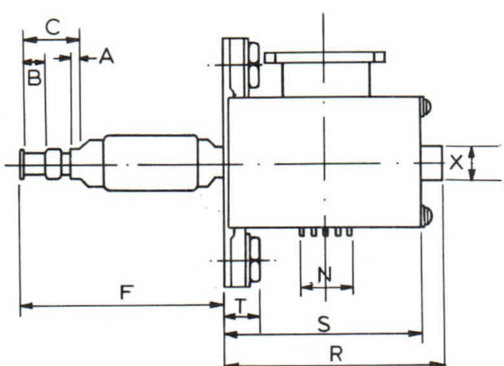
C
A
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X
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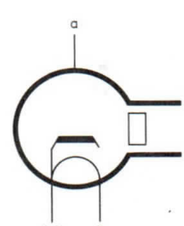
R


a
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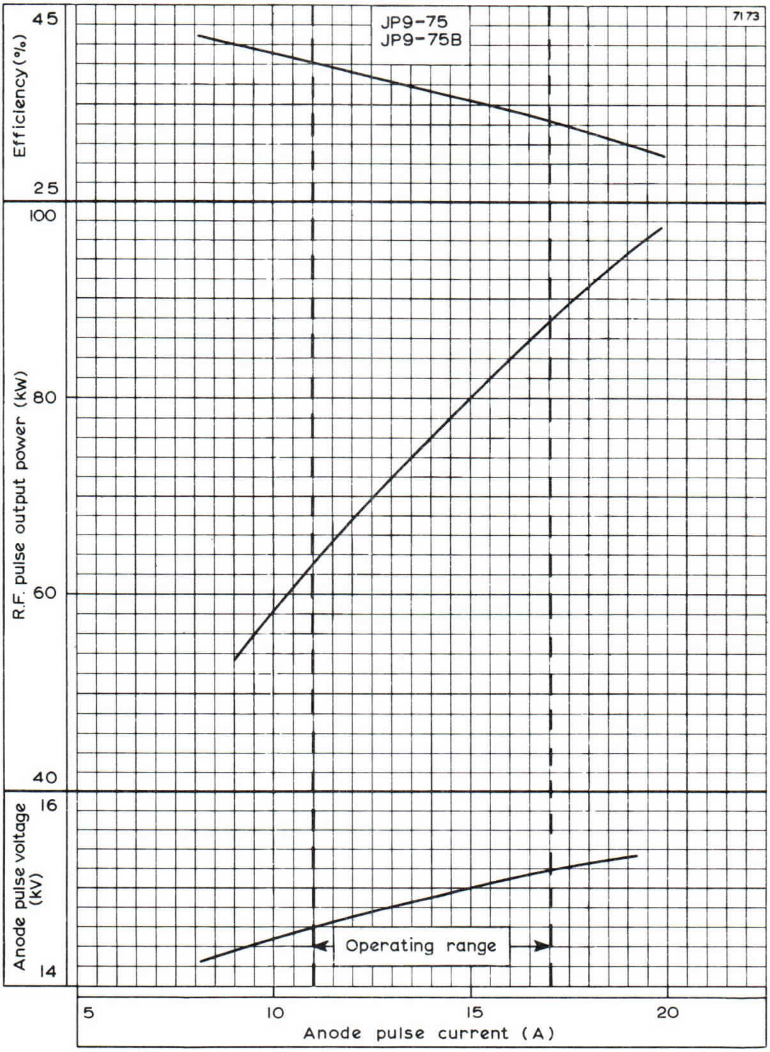
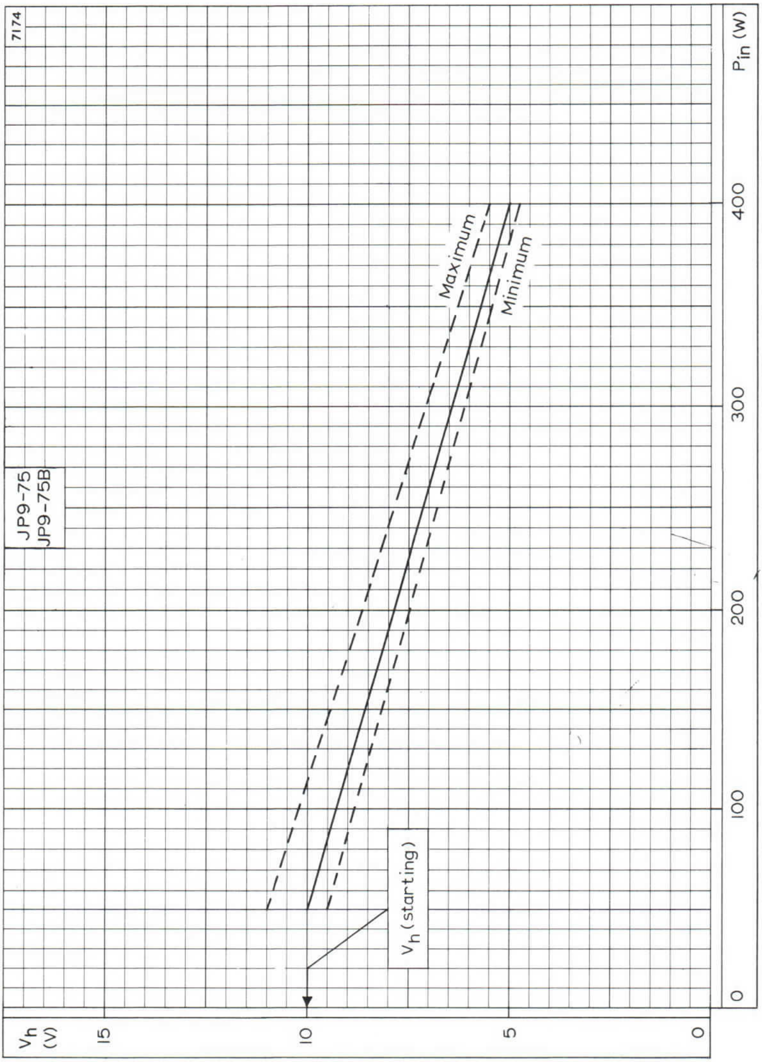
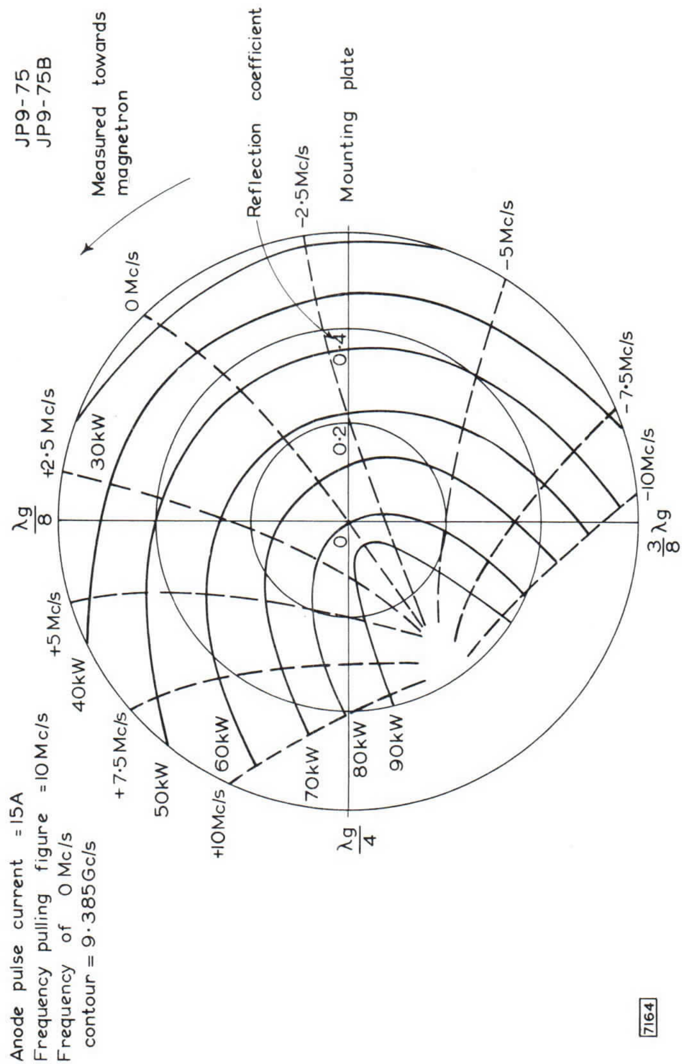
h



ANODE PULSE VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT



REDUCTION OF HEATER VOLTAGE PLOTTED AGAINST MEAN INPUT POWER



RIEKE DIAGRAM

QUICK REFERENCE DATA

Forced-air cooled fixed frequency 'X' band pulsed magnetron.

Frequency	JP9-80	9.375	Gc/s
	JP9-80A	9.240	Gc/s
Power output (pulsed)		80	kW

To be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES.

Unless otherwise shown, data are applicable to both types.

CHARACTERISTICS

	Min.		Max.	
Frequency Fixed within the band JP9-80	9.345	to	9.405	Gc/s
Frequency Fixed within the band JP9-80A	9.210	to	9.270	Gc/s
Pulse voltage (I pulse = 15 A)	14		16	kV
R.F. pulse power output (I pulse = 15A)	70		-	kW
Frequency pulling (v.s.w.r. = 1.5)	-		13	Mc/s
Frequency temperature coefficient	-		-0.25	Mc/s per °C
Position of phase of sink from face of mounting plate towards load	0.26	to	0.40	λg
Input capacitance	-		14	pF
Frequency pushing (12A to 15A)	-		0.5	Mc/s per A

TYPICAL OPERATION

R.F. pulse power output	80	80	80	kW
Duty factor	0.0008	0.001	0.001	
Pulse duration	0.4	1.0	5.0	μs
Pulse repetition frequency	2000	1000	200	p.p.s.
Heater voltage (running)	8.5	7.8	7.8	V
Pulse current	15	15	15	A
Pulse voltage	15	15	15	kV
Pulse input power	225	225	225	kW
Rate of rise of voltage pulse	140	125	85	kV/μs
Mean input current	12	15	15	mA
Mean input power	180	225	225	W
Mean r.f. output power	64	80	80	W
Frequency pulling (v.s.w.r. = 1.5)	12	12	12	Mc/s

CATHODE

Indirectly heated

Vh	12.6	V
Ih	2.2	A
rh (cold)	0.65	Ω
Ih (surge) max.	10	A
Minimum warm up time	90	s

It is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power - heater voltage rating chart on page C2.

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
Pulse current	12	15	A
Pulse duration	-	5.0	μs
Duty factor	-	0.001	
Mean input power	-	240	W
Rate of rise of voltage pulse			
t_p 0.4μs	120	160	kV/μs
t_p 1.0μs	100	150	kV/μs
t_p 4.5μs	70	100	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	
Temperature of anode block	-	150	$^{\circ}$C
Temperature of cathode and heater seals	-	175	$^{\circ}$C

END OF LIFE PERFORMANCE

The valve is deemed to have reached end of life when it fails to satisfy the following :-

R.F. pulse power output (I pulse = 15A) 60 kW

		Min.		Max.	
Frequency					
Within the band	JP9-80	9.345	to	9.405	Gc/s
	JP9-80A	9.210	to	9.270	Gc/s
Pulse voltage (I pulse = 15A)		14	to	16	kV

MOUNTING POSITION

Any

PRESSURISING

The valve can be operated in the pressure range 500 to 2,050mm of mercury.

PHYSICAL DATA

	lb	kg
Weight of magnetron	5.875	2.7
Weight of magnetron in carton	14.625	6.7
	in	cm
Dimensions of storage carton	7.5 x 8.7 x 10	19.1 x 22.3 x 25.4

COOLING

It is necessary to direct a flow of cooling air between the radiator fins, and on the cathode and heater seals, in order to keep the temperature below the permitted maximum.

DIMENSIONS

	Inches	Millimetres	
A	3.437	87.3	max
B	2.531±0.010	64.29±0.25	
C	0.281±0.005	7.14±0.12	
D	1.016±0.024	25.8±0.6	
E	3.622	92	max
F	1.937	49.2	max
G	2.781±0.010	70.64±0.25	
H	1.874	47.6	min
J	5.937	150.8	max
K	1.831	46.5	
L	1.474±0.004	37.44±0.1	
M	3.154	80.1	max
N	2.843	72.2	max
P	1.406±0.020	35.71±0.5	
Q	0.497	12.62	
R	1.122	28.5	
S	1.352±0.004	34.34±0.1	
T	1.831	46.5	
U	2.156±0.061	54.75±1.55	
V	1.126	28.6	
W	0.520	13.2	min
X	0.125	3.17	
Y	0.752	19.1	min
Z	0.156±0.030	3.95±0.75	
AA	0.169±0.005	4.29±0.12	
BB	0.126±0.008	3.2±0.2	
CC	0.201	5.1	max
DD	0.250±0.014	6.35±0.35	
EE	0.539±0.006	13.68±0.16	
FF	0.610	15.5	
GG	0.748	19	
HH	0.831±0.006	21.12±0.16	

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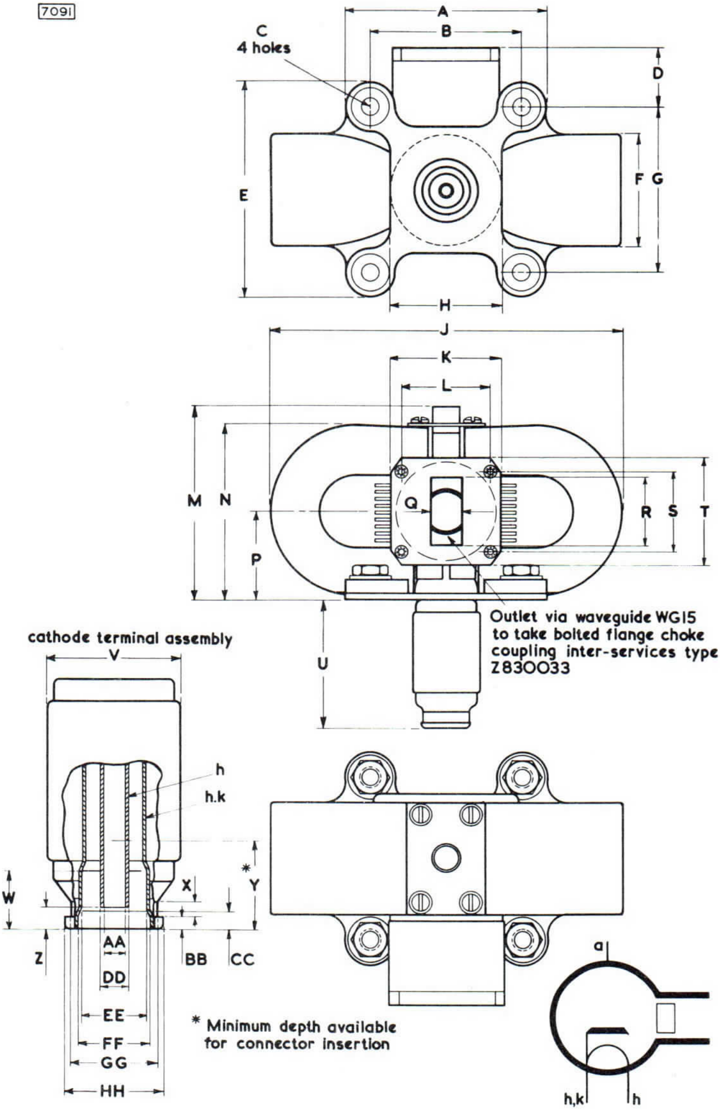
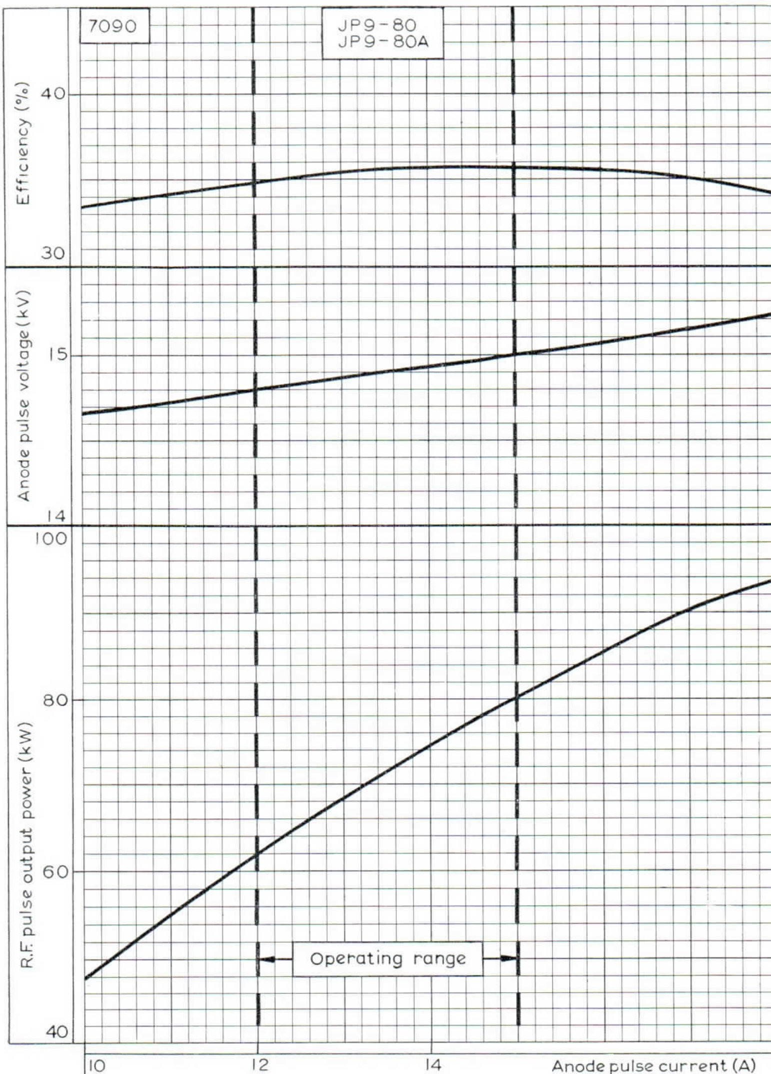
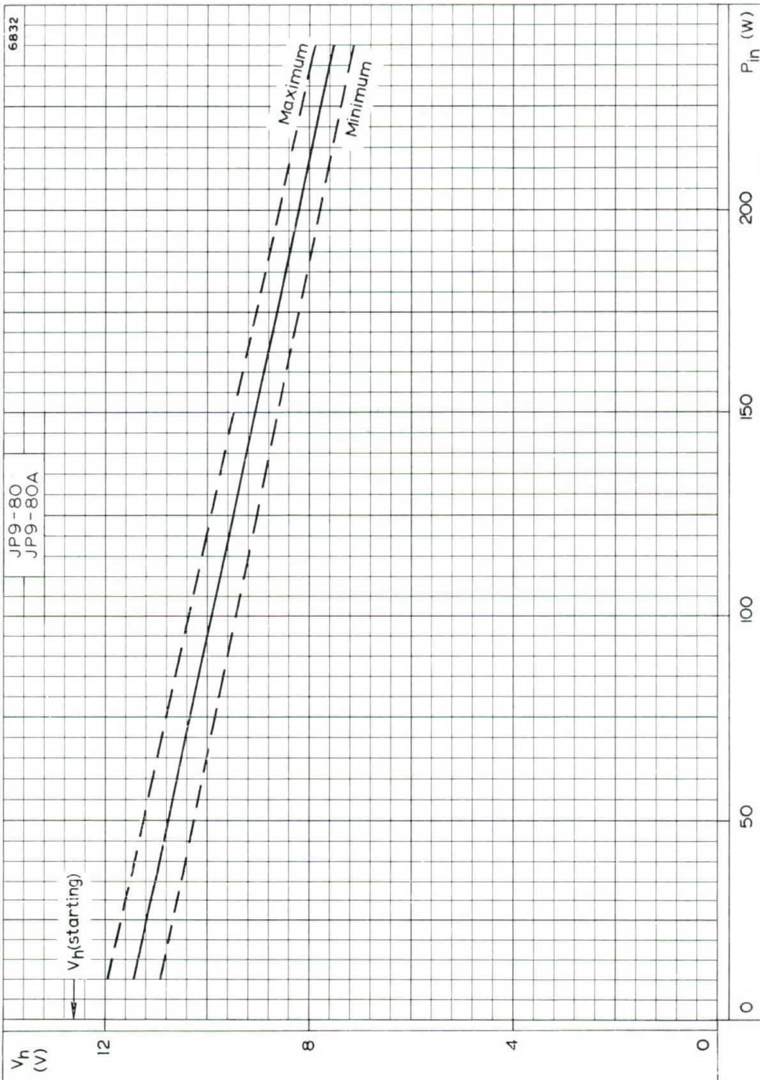


THE ANODE IS TERMINATED AT THE BASE PLATE.



R.F. PULSE OUTPUT POWER, ANODE PULSE VOLTAGE AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT



REDUCTION OF HEATER VOLTAGE PLOTTED AGAINST INPUT POWER

MAGNETRON

Frequency: *'X' band.*
Output power: *180kW, pulsed.*
Construction: *Packaged, forced-air cooled.*

JP9-180

PRELIMINARY DATA

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES which precede this section of the handbook.

CHARACTERISTICS

	Min.		*Max.*	
Frequency				
Fixed within the band	9.325	to	9.425	Gc/s
Pulse voltage ($I_{pulse} = 22.5A$)	18		23	kV
R.F. pulse output power ($I_{pulse} = 22.5A$)	150		—	kW
Frequency pulling factor (v.s.w.r. = 1.5)	—		15	Mc/s
Frequency temperature coefficient	—		–250	kc/s per °C

CATHODE

Indirectly heated

V_h	12.6	V
I_h	2.25	A
$I_{h(surge)}$ max.	7.5	A
$r_{h(cold)}$	0.67	Ω

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 3 minutes before the application of full h.t. Below this temperature the heating time must be increased to at least 4 minutes.

It is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power-heater voltage rating chart on page C2.

TYPICAL OPERATION

Duty cycle	0.0004	
Heater voltage (running)	8.0	V
Pulse duration	1.0	μs
Pulse repetition frequency	400	p/s
Pulse current	22.5	A
Pulse voltage	20.5	kV
Pulse input power	460	kW
R.F. pulse output power	180	kW
Mean input current	9.0	mA
Mean input power	184	W
Mean r.f. output power	72	W
Frequency pulling (v.s.w.r. = 1.5)	13	Mc/s
Rate of rise of pulse voltage	100	kV/μs

COOLING

It is necessary to direct a flow of cooling air between the radiator fins, and on the cathode and heater seals, in order to keep the temperature below the permitted maximum.

JP9-180

MAGNETRON

LIMITING VALUES (absolute ratings)

	Min.	Max.	
Pulse current	16	25	A
Pulse voltage	17	24	kV
Pulse duration	—	2.0	μs
Duty cycle	—	0.0005	
Mean input power	—	250	W
Rate of rise of voltage pulse	—	110	kV/μs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	140	°C
Temperature of cathode and heater seals	—	200	°C

MOUNTING POSITION

Any

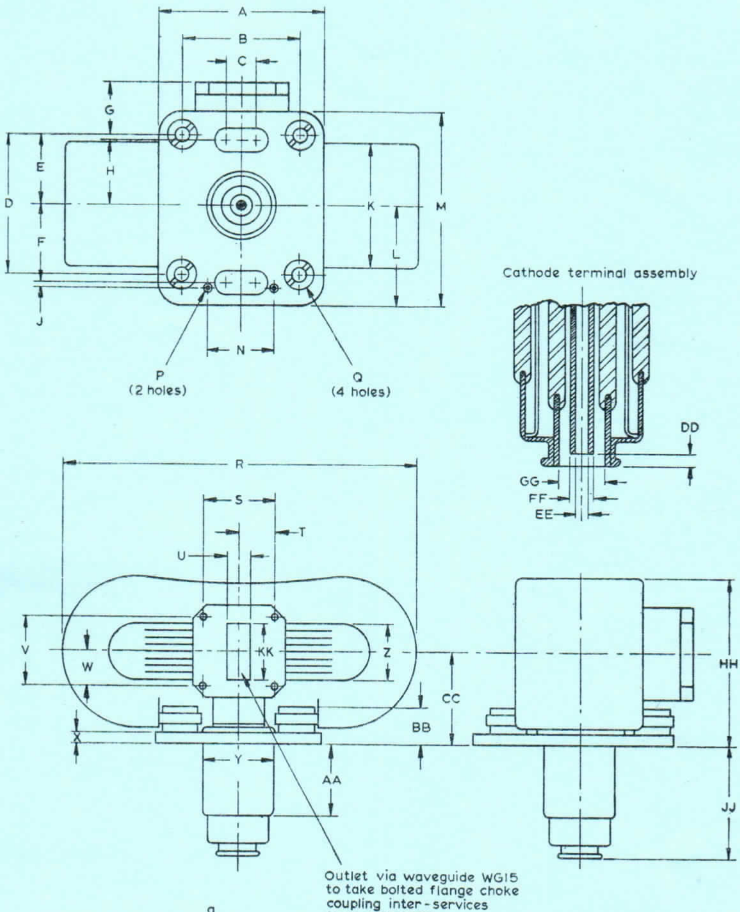
PRESSURISING

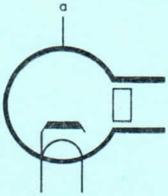
The valve can be operated in the pressure range 600 to 2370mm of mercury.

DIMENSIONS

	Inches	Millimetres	
A	3.500	88.9	
B	2.500 ± 0.010	63.5 ± 0.25	
C	0.625 ± 0.015	15.9 ± 0.4	
D	3.000 ± 0.010	76.2 ± 0.25	
E	1.500	38.1	
F	1.750	44.5	
G	0.907 ± 0.025	23.0 ± 0.6	
H	1.437	36.5	
J	0.125	3.18	
K	2.875	73.0	max.
L	2.187 ± 0.015	55.5 ± 0.4	
M	4.125	104.8	
N	1.500 ± 0.015	38.1 ± 0.4	
P	0.125	3.18	
Q	0.281	7.14	
R	7.687	195.3	max.
S	1.474 ± 0.004	37.5 ± 0.1	
T	0.737	18.7	

	Inches	Millimetres	
U	0.4985 ± 0.0005	12.7 ± 0.01	
V	1.352 ± 0.004	34.3 ± 0.1	
W	0.676	17.2	
X	0.125	3.18	
Y	1.375	34.9	max.
Z	1.200	30.5	min.
AA	1.500	38.1	
BB	0.625	15.9	
CC	1.792 ± 0.020	45.5 ± 0.5	
DD	0.156 ± 0.031	3.97 ± 0.8	
EE	0.169 ± 0.005	4.30 ± 0.1	
FF	0.250 ± 0.015	6.35 ± 0.4	
GG	$0.540^{+0.005}_{-0.008}$	$13.7^{+0.1}_{-0.2}$	
HH	3.545	90.0	max.
JJ	2.548 ± 0.062	64.7 ± 1.6	
KK	1.122 ± 0.003	28.5 ± 0.1	





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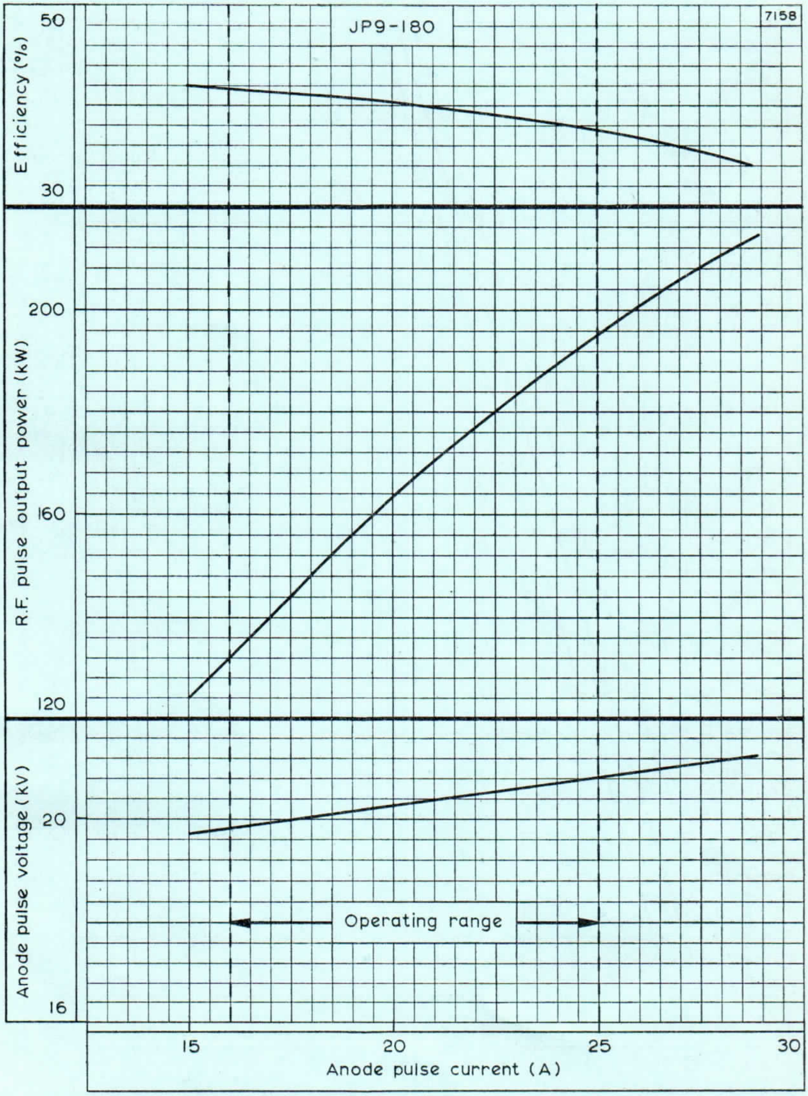
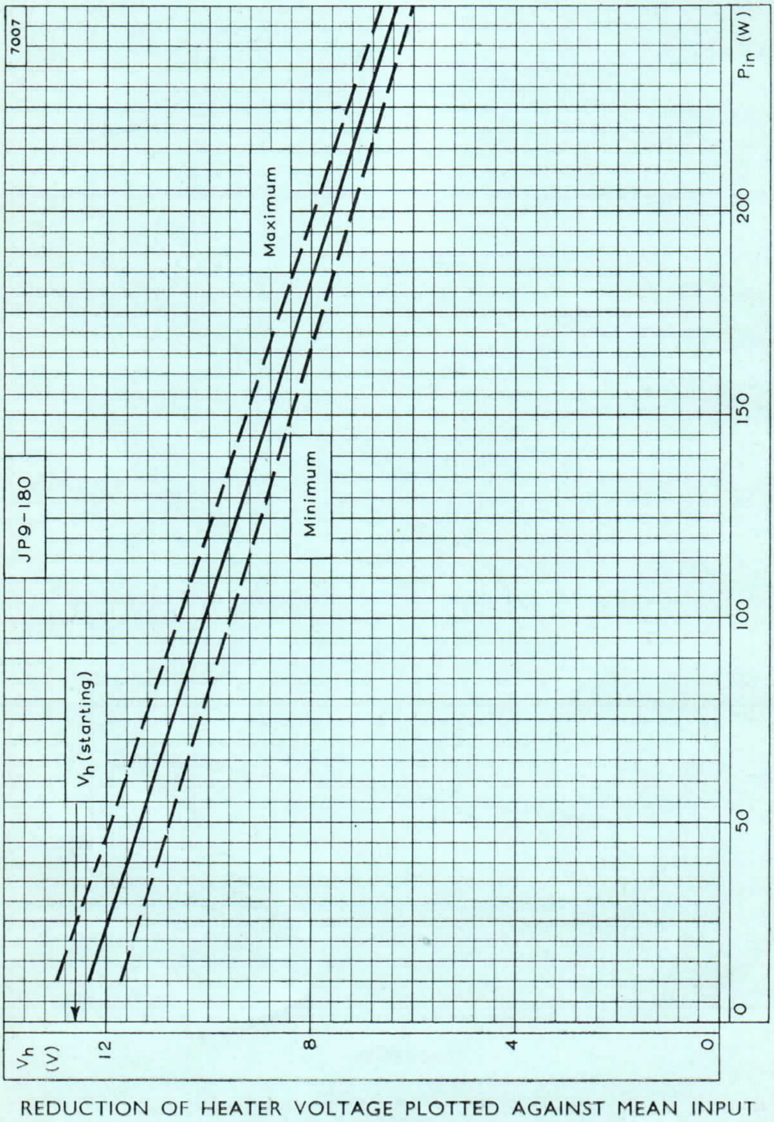
The anode is terminated at the base plate.



ANODE PULSE VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT



REDUCTION OF HEATER VOLTAGE PLOTTED AGAINST MEAN INPUT POWER

MAGNETRON

JP9-250 Series

Frequency: 'X' band.
Power output: 250kW pulsed.
Construction: Packaged, forced-air cooled.

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES which precede this section of the handbook.

CHARACTERISTICS

	Min.		Max.	
Frequency:				
Fixed within band				
JP9-250	9.345	to	9.405	Gc/s
JP9-250A	9.003	to	9.168	Gc/s
JP9-250B	8.830	to	8.995	Gc/s
JP9-250C	8.865	to	8.995	Gc/s
JP9-250D	8.665	to	8.830	Gc/s
JP9-250E	8.500	to	8.665	Gc/s
Pulse voltage ($I_{pulse} = 27.5A$)	20		23	kV
R.F. pulse power output ($I_{pulse} = 27.5A$)	225		—	kW
Frequency pulling factor (v.s.w.r. = 1.5)	—		15	Mc/s
Frequency temperature coefficient	—		−250	kc/s per °C
Position of phase of sink from face of mounting plate towards load	0.25	to	0.4	λg

CATHODE

Indirectly heated

V_h	13.75	V
I_h	3.25	A
$I_{h\ (surge)}$	15	A
$r_{h\ (cold)}$	0.58	Ω

Heating time. The cathode must be heated for at least 3 minutes before the application of h.t.

It is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power-heater voltage rating chart on page C2.

TYPICAL OPERATION

Duty cycle	0.001	0.001	0.001	
Heater voltage (running)	6.6	7.4	9.3	V
Pulse duration	0.5	2.0	5.0	μs
Pulse repetition frequency	2000	500	200	p/s
Pulse current	27.5	25	18	A
Pulse voltage	21.5	21.3	20.7	kV
Pulse input power	590	532	373	kW
R.F. pulse output power	250	225	155	kW
Mean input current	27.5	25	18	mA
Mean input power	590	532	373	W
Mean r.f. output power	250	225	155	W
Frequency pulling (v.s.w.r. = 1.5)	14	14	14	Mc/s
Rate of rise of pulse voltage	140	110	90	kV/μs

COOLING

It is necessary to direct a flow of cooling air between the radiator fins, and on the cathode and heater seals, in order to keep the temperature below the permitted maximum.

JP9-250 Series

MAGNETRON

LIMITING VALUES (absolute ratings)

	Min.	Max.	
Pulse current $\leq 1.2\mu s$	15	27.5	A
$= 6.0\mu s$	15	18	A
Pulse voltage	18.5	23	kV
Pulse duration	—	6.0	μs
Duty cycle	—	0.001	
Mean input power	—	750	W
Rate of rise of voltage pulse	70	160	kV/μs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	150	°C
Temperature of cathode and heater seals	—	165	°C

MOUNTING POSITION

Any

PRESSURISING

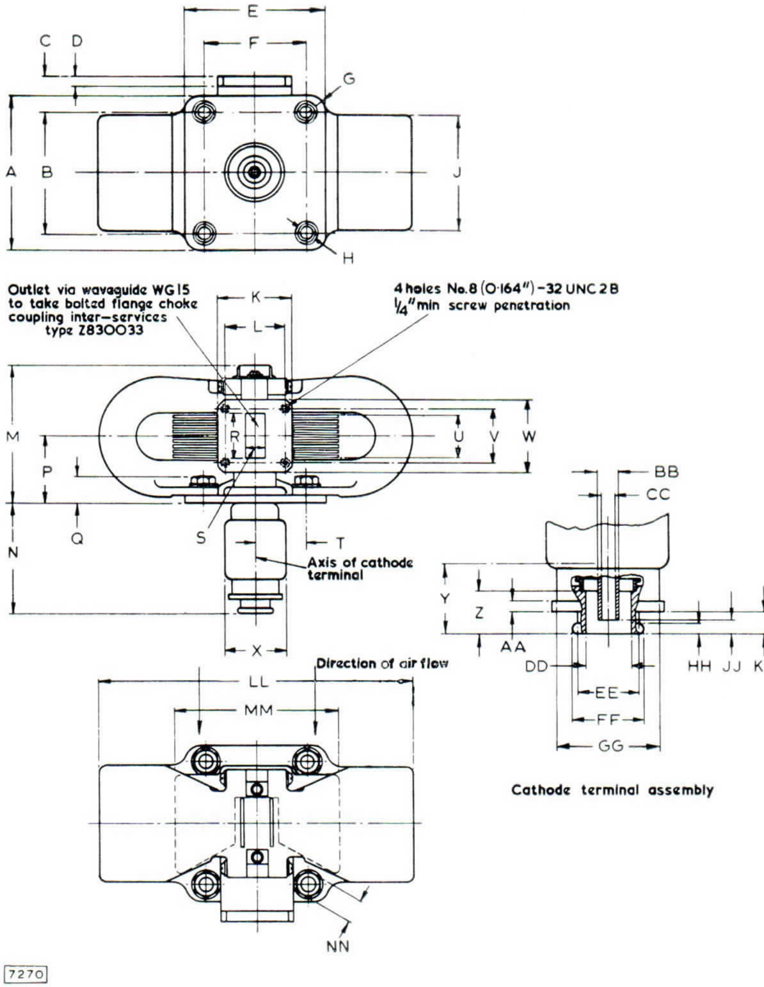
The valve can be operated in the pressure range 600 to 2050mm of mercury.

PHYSICAL DATA

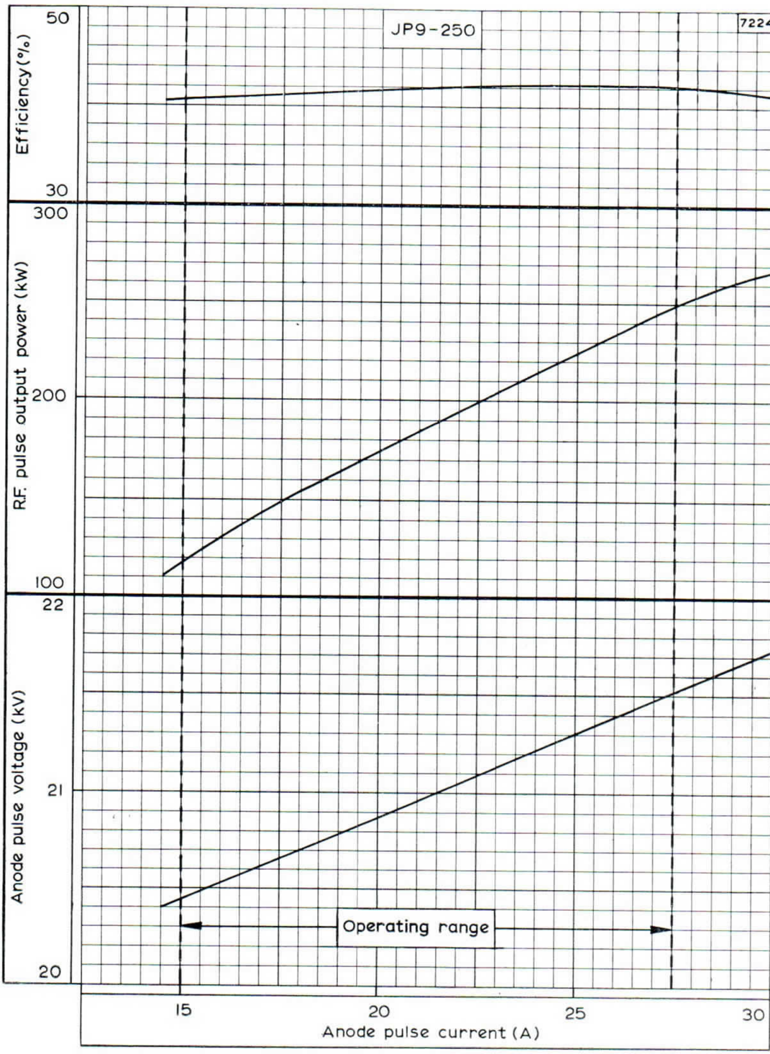
Weight of magnetron	10	lb
	4.5	kg
Weight of magnetron in carton	13	lb
	6.0	kg
Dimensions of storage carton	7.0 × 9.6 × 11.2	in
	178 × 244 × 284.5	mm

DIMENSIONS

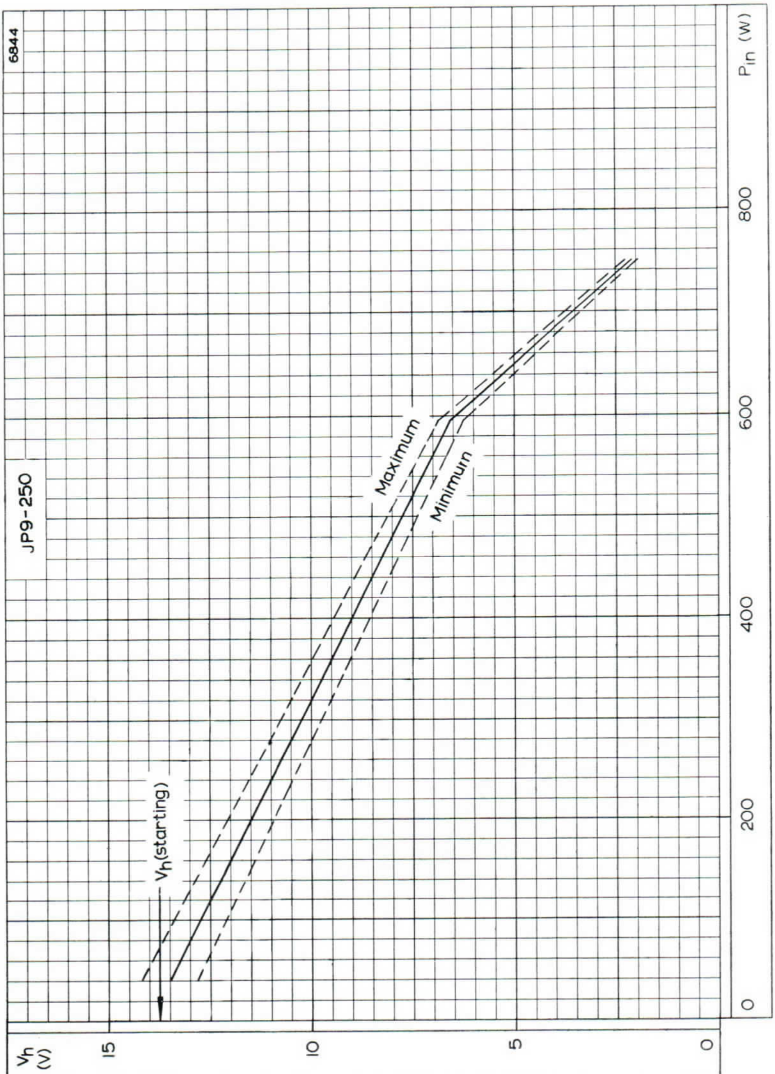
	Inches	Millimetres			Inches	Millimetres	
A	3.874	98.4	max.	W	1.830 ± 0.01	46.48 ± 0.25	
B	3.000 ± 0.01	76.20 ± 0.25		X	1.500	38.1	max.
C	0.906 ± 0.02	23.0 ± 0.5		Y	0.750	19.05	min.
D	0.250	6.35		Z	0.516	13.1	min.
E	3.469	88.1	max.	AA	0.115	3.175	
F	2.500 ± 0.01	63.50 ± 0.25		BB	0.250 ± 0.02	6.35 ± 0.40	
G	0.512	10.3R		CC	0.169 ± 0.004	4.3 ± 0.1	
H	0.281	7.14		DD	$0.539^{+0.004}_{-0.008}$	$13.7^{+0.1}_{-0.2}$	
J	2.874	73	max.	EE	0.750	19.05	
K	1.830	46.48		FF	$0.830^{+0.008}_{-0.004}$	$21.08^{+0.20}_{-0.10}$	
L	1.474 ± 0.004	37.44 ± 0.10		GG	1.252	31.8	
M	3.603	91.52	max.	HH	0.125 ± 0.01	3.175 ± 0.250	
N	2.680 ± 0.06	68.25 ± 1.50		JJ	0.125	3.175	min.
P	1.653 ± 0.02	41.99 ± 0.50			0.187	4.75	max.
Q	0.625 ± 0.03	15.88 ± 0.80		KK	0.250	6.35	
R	1.122	28.50		LL	7.687	195.25	max.
S	0.497	12.62		MM	4.000	101.6	
T	1.250	31.75		NN	0.500	12.7	
U	1.000 ± 0.04	25.4 ± 1.0					
V	1.352 ± 0.004	34.34 ± 0.10					



The common heater cathode terminal is the sleeve of the cap, the other heater terminal is the centre contact. The anode connection is terminated at the base plate.



ANODE PULSE VOLTAGE R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT



HEATER VOLTAGE PLOTTED AGAINST MEAN INPUT POWER

JP35-30

QUICK REFERENCE DATA

Air-cooled magnetron designed for very short pulse operation

Frequency	34.86	Gc/s
Power output (pulsed)	40	kW
Construction		Packaged

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—MICROWAVE DEVICES : INTRODUCTION and RADAR AND COMMUNICATIONS MAGNETRONS which precede this section of the handbook.

TYPICAL OPERATION

Heater voltage (running)	4.0	4.0	5.0	V
Pulse duration	0.3	0.1	0.02	μs
Pulse repetition frequency	670	2000	5000	p/s
Duty cycle	0.0002	0.0002	0.0001	
Pulse current	12.5	12.5	7.5	A
Pulse voltage	11.7	11.7	11.1	kV
Pulse input power	146	146	83	kW
R.F. pulse output power	40	40	30	kW
*Mean input current	2.5	2.5	1.55	mA
Mean input power	35	35	20	W
Mean r.f. output power	8.0	8.0	3.0	W
Frequency pulling factor (v.s.w.r. = 1.5)	35	35	35	Mc/s
Rate of rise of pulse voltage	250	250	600	kV/μs

*Includes pre-oscillation current.

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
Pulse current	6.0	16	A
Pulse voltage	12.5	15.5	kV
Pulse duration	—	0.4	μs
Duty cycle	—	0.0003	
Mean input power	—	60	W
*Rate of rise of voltage pulse (hard valve modulator)			
pulse duration > 0.05μs	200	300	kV/μs
pulse duration = 0.02μs (at duty cycle = 1.0×10^{-4})	—	600	kV/μs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	150	°C
Temperature of cathode and heater seals	—	150	°C
Pressurisation of waveguide output system	—	45	lb/in²
	—	2280	torr
Pressurisation of input system	8.7	—	lb/in²
	450	—	torr

*For pulse lengths between 0.05μs and 0.02μs rates of rise between 300kV/μs and 600kV/μs can be tolerated, depending on the operating conditions. Prior reference should be made to Mullard Ltd. in such instances.

JP35-30

MAGNETRON

CATHODE

Indirectly heated, dispenser type

V_h	5.0	V
I_h (at 5.0V)	3.9	A
$I_{h\ (surge)}$ max.	8.0	A
r_h (cold)	0.16	Ω

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 3 minutes before the application of h.t.
For mean input powers greater than 20 watts, it is necessary to reduce the heater voltage immediately after the application of h.t.

In many applications involving short pulse lengths and high pulse repetition frequencies the mean current which would be calculated from the duty cycle is increased by the pre-oscillation current.

In determining the heater reduction is it necessary to obtain the mean input power from the measured mean input current × 12,500. The correct value of nominal heater voltage is given by the curve on page C2.

CHARACTERISTICS

	Min.		*Max.*	
Frequency				
Fixed within the band	34.51		35.21	Gc/s
Pulse voltage (I pulse = 12.5A)	11.5		13.5	kV
R.F. pulse output power (I pulse = 12.5A)	30		—	kW
Frequency pulling factor (v.s.w.r. = 1.5)	—		50	Mc/s
Frequency pushing factor	—		4.0	Mc/s per A
Frequency temperature coefficient	—		−1.0	Mc/s per °C
Position of phase of sink from face of mounting plate out of valve	0.25		0.4	λg
Input capacitance		6.0		pF

COOLING

For normal operating conditions, a low velocity air-flow is sufficient to keep within the maximum temperature limits.

MOUNTING POSITION

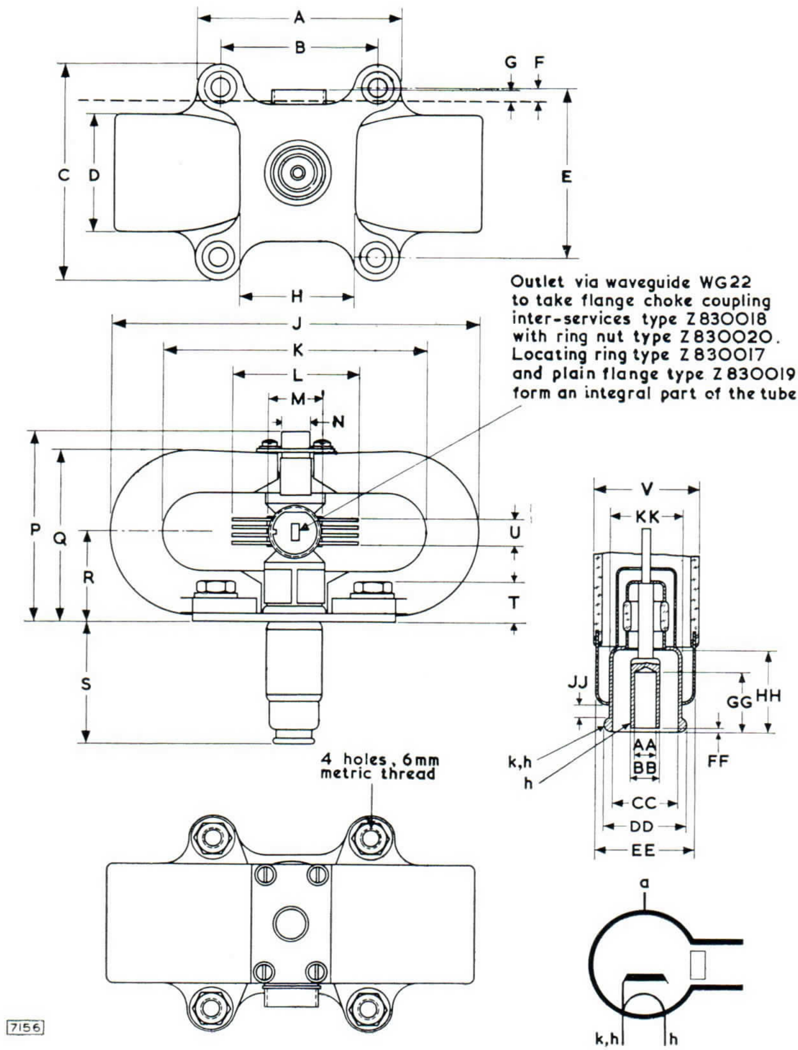
Any

PHYSICAL DATA

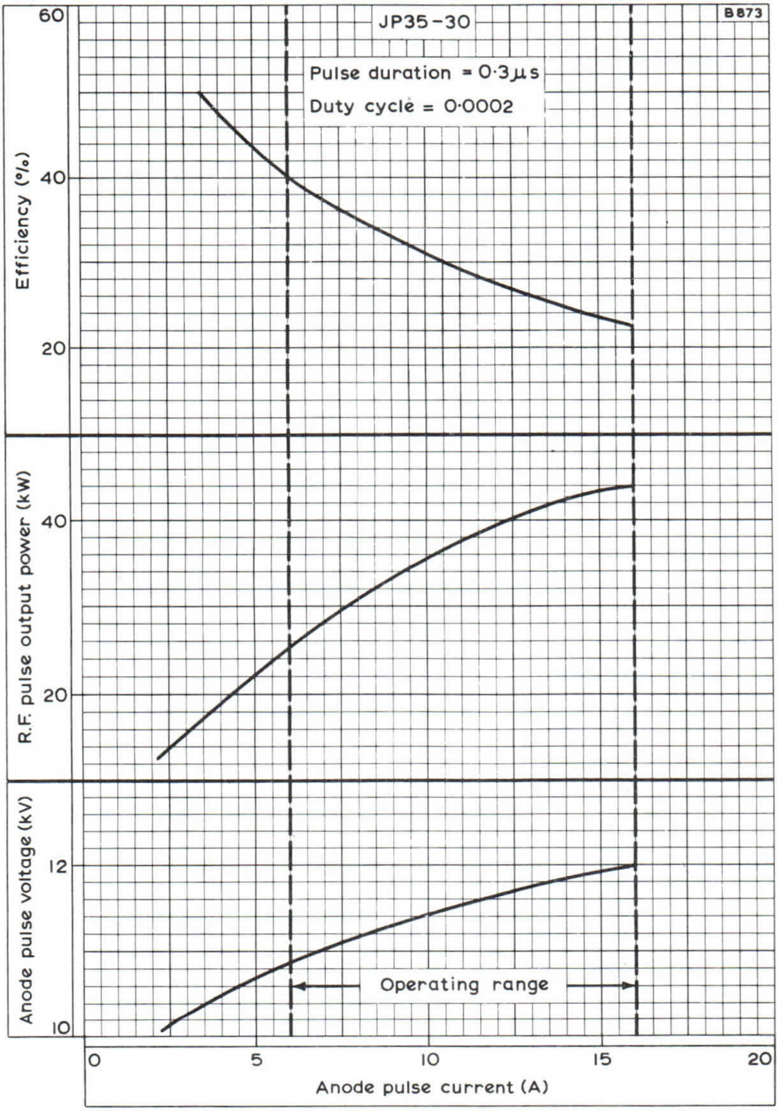
Weight of magnetron	4lb	3oz
	1.9	kg
Weight of magnetron in carton	12lb	13oz
	5.8	kg
Dimensions of storage carton	7.0 × 9.6 × 11.2	in
	178 × 244 × 284.5	mm

DIMENSIONS

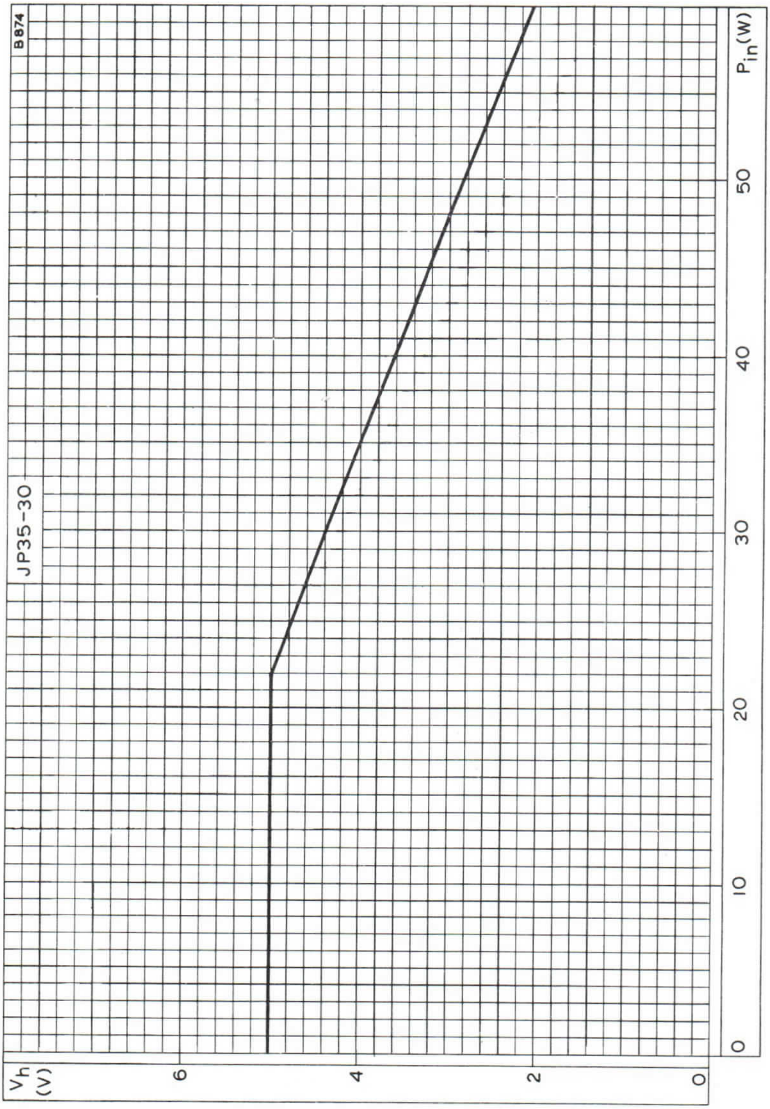
	Inches	Millimetres	
A	3.437	87.3	max.
B	2.531 ± 0.010	64.29 ± 0.25	
C	3.622	92	max.
D	1.937	49.2	max.
E	2.781 ± 0.010	70.64 ± 0.25	
F	0.217 ± 0.039	5.5 ± 1.0	
G	0.189	4.8	max.
H	1.874	47.6	min.
J	5.933	150.7	max.
K	3.819	97	min.
L	2.087	53	max.
M	0.906	23	max.
N	0.512	13	max.
P	3.189	81	max.
Q	2.842	72.2	max.
R	1.402 ± 0.039	35.6 ± 1.0	
S	1.968	50	max.
T	0.650 ± 0.059	16.5 ± 1.5	
U	0.433	11	max.
V	0.906	23	max.
AA	0.169 ± 0.006	4.30 ± 0.15	
BB	0.236 ± 0.004	6.0 ± 0.1	
CC	0.524 ± 0.008	13.3 ± 0.2	
DD	0.665 ± 0.008	16.9 ± 0.2	
EE	0.807	20.5	max.
FF	0.022 ± 0.018	0.55 ± 0.45	
GG	0.492	12.5	min.
HH	0.591	15	min.
JJ	0.079	2.0	min.
KK	0.591 ± 0.008	15.0 ± 0.2	



A
B
G F
C D
E
H
Outlet via waveguide WG22 to take flange choke coupling inter-services type Z830018 with ring nut type Z830020. Locating ring type Z830017 and plain flange type Z830019 form an integral part of the tube
J
K
L
M
N
P Q
R
U
T
S
V
KK
JJ
GG HH
k,h
h
AA
BB
FF
CC
DD
EE
4 holes, 6mm metric thread
a
k,h
h
7156



ANODE PULSE VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT



HEATER VOLTAGE PLOTTED AGAINST MEAN INPUT POWER
MEAN INPUT POWER = MEAN INPUT CURRENT × 12,500

TUNABLE MAGNETRON

JPG8-01 JPG8-01B JPT8-01 JPT8-01B

Frequency: 'X' band, mechanically tunable.
Power output: 12W, c.w.
Construction: Packaged, forced-air cooled.

The only difference between the JPG8–01 and the JPT8–01 is in the mechanical tuning arrangement (see appropriate outline drawing). The suffix 'B' indicates a frequency variant of the basic type.

PRELIMINARY DATA

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook.

CHARACTERISTICS

	Min.		Max.	
Frequency				
Tunable over the range				
JPG8–01 JPT8–01	8.6	to	9.15	Gc/s
JPG8–01B JPT8–01B	8.0	to	8.6	Gc/s
Operating voltage (I = 50mA)	0.9		1.1	kV
R.F. power output (I = 50mA)	5.0		—	W
Frequency pulling factor	—		20	Mc/s
Frequency pushing factor	—		1.0	Mc/s per mA
Frequency temperature coefficient	—		–0.5	Mc/s per °C

CATHODE

Indirectly heated

V_h	6.3	V
I_h	1.2	A←

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

For mean input powers greater than 20 watts it is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power-heater voltage rating chart on page C1.

TYPICAL OPERATION

	JPG8–01B JPT8–01B	JPG8–01 JPT8–01	
Frequency	8.3	8.9	Gc/s
Heater voltage (running)	4.5	4.5	V
Operating voltage	0.96	0.96	kV←
Operating current	50	50	mA
Input power	48	48	W←
R.F. power output	11.8	11.8	W←
Frequency pulling (v.s.w.r. = 1.5)	15	15	Mc/s

JPG8-01 JPG8-01B
JPT8-01 JPT8-01B

TUNABLE MAGNETRON

OPERATING NOTE

A limiting resistor of 1kΩ should be inserted in series with the magnetron.

COOLING

It is necessary to direct a flow of cooling air between the radiator fins in order to keep the temperature below the permitted maximum.

ABSOLUTE MAXIMUM RATINGS

	Min.	*Max.*	
Operating current (unmodulated c.w.)	20	60	mA
Peak operating current (modulated c.w.)	—	100	mA
Operating voltage	0.85	1.15	kV
Mean input power	—	60	W
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	140	°C

MOUNTING POSITION

Any

MECHANICAL CHARACTERISTICS ←

	Min.	*Max.*	
Number of turns to cover the tuning range	4	8	
Tuning torque			
JPG8–01, JPG8–01B		16	oz in
JPT8–01, JPT8–01B		32	oz in
Tuning backlash		5	Mc/s

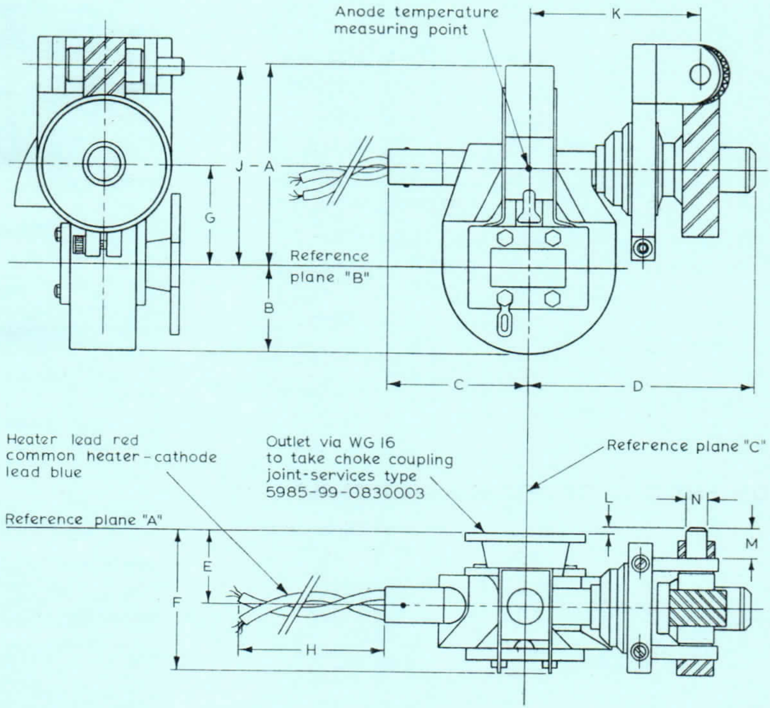
There is no limit to the number of tuning sweeps which may be carried out within the stated frequency range.

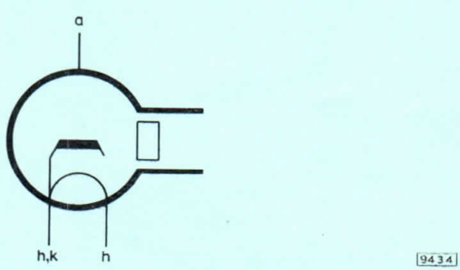
The JPG8–01 and JPG8–01B are intended for motor tuning.

PHYSICAL DATA

Weight of magnetron	1 lb 8 oz	680 g
Weight of magnetron in carton	2 lb 8 oz	1.13 kg
Dimensions of storage carton	5.0 × 7.0 × 7.5 in	127 × 178 × 190 mm

OUTLINE DRAWING OF JPG8-01 AND JPG8-01B





ANODE CONNECTION TERMINATED AT THE BASE PLATE

JPG8-01 JPG8-01B
JPT8-01 JPT8-01B

TUNABLE MAGNETRON

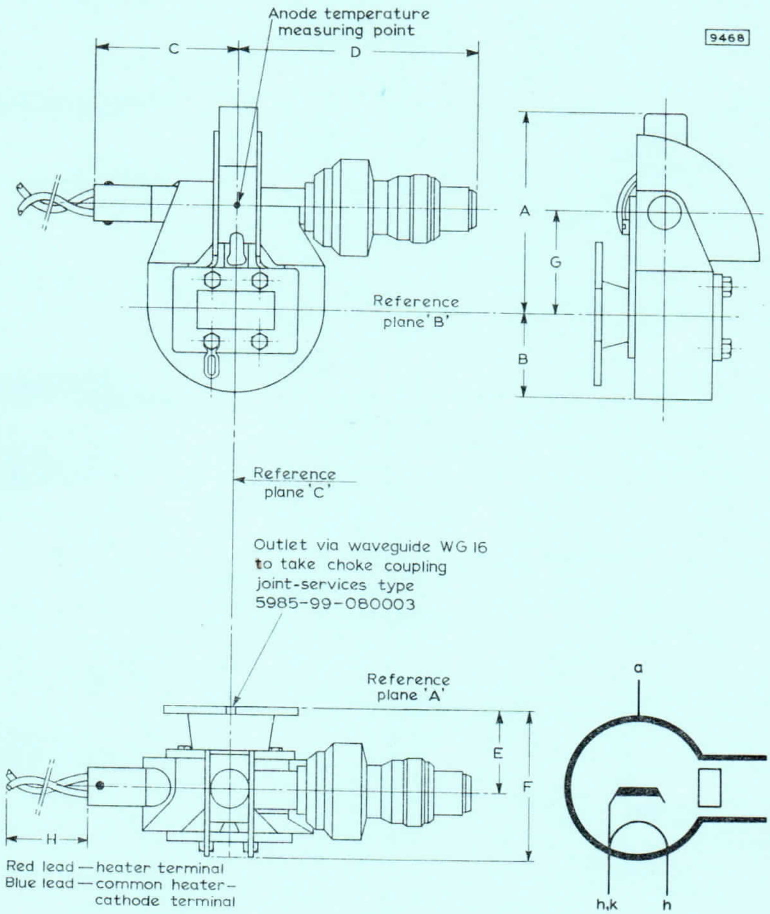
DIMENSIONS OF JPG8–01 AND JPG8–01B ←

	Inches	*Millimetres*	
A	2.56	65	max.
B	1.26	32	max.
C	1.97	50	max.
D	2.39	86	max.
E	0.965 ± 0.040	24.5 ± 1.0	
F	2.24	57	max.
G	1.223 ± 0.075	31 ± 2	
H	5.12 ± 0.20	130 ± 5	
J	2.463 ± 0.071	62.5 ± 2.0	
K	2.38 ± 0.10	60.5 ± 2.5	
L	0.098 ± 0.039	2.5 ± 1.0	
M	0.374 ± 0.020	9.5 ± 0.5	
N	0.247 ± 0.001	6.275 ± 0.025	

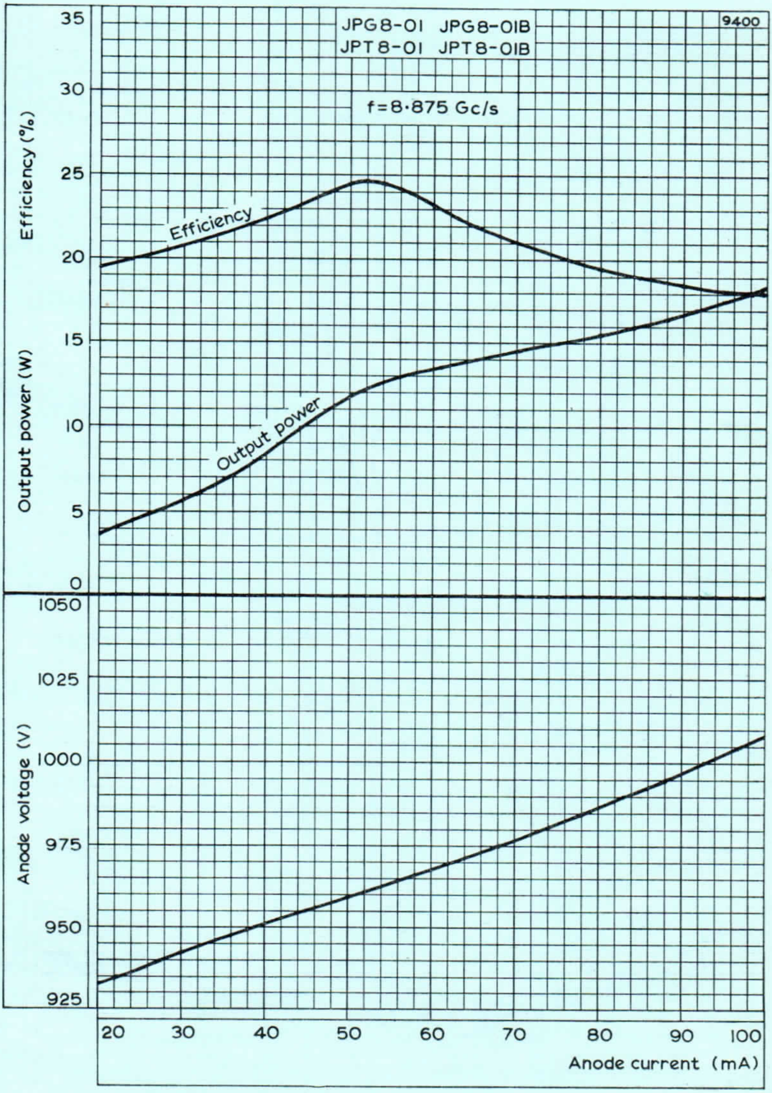
DIMENSIONS OF JPT8–01 AND JPT8–01B ←

	Inches	*Millimetres*	
A	2.56	65	max.
B	1.26	32	max.
C	1.97	50	max.
D	2.39	86	max.
E	0.965 ± 0.040	24.5 ± 1.0	
F	2.24	57	max.
G	1.223 ± 0.075	31 ± 2	
H	5.12 ± 0.20	130 ± 5	

OUTLINE DRAWING OF JPT8-01 AND JPT8-01B



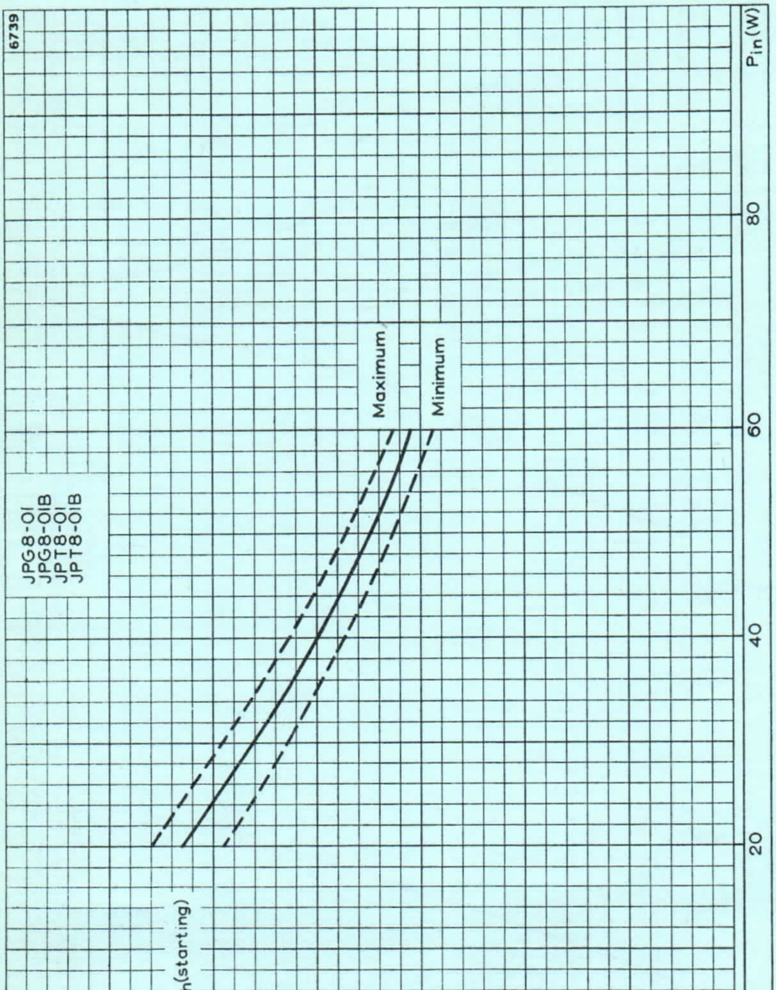
ANODE CONNECTION TERMINATED AT THE BASE PLATE



ANODE VOLTAGE, OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE CURRENT

JPG8-01 JPG8-01B
JPT8-01 JPT8-01B

TUNABLE MAGNETRON



HEATER VOLTAGE PLOTTED AGAINST INPUT POWER

JPG8-01E
JPG9-01B

PRELIMINARY DATA

QUICK REFERENCE DATA

Mechanically and electronically tunable c.w. magnetrons

Frequency	JPG8–01E	8.62	Gc/s
	JPG9–01B	9.3	Gc/s
Power output		18	W
Construction		Packaged	

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook.

CHARACTERISTICS

	Min.		*Max.*	
Frequency				
Mechanically tunable over the range				
JPG8-01E	8.49	to	8.76	Gc/s
JPG9-01B	9.04	to	9.51	Gc/s
Operating voltage (I = 60mA)	910		1090	V
R.F. power output (I = 60mA)	11		—	W
R.F. power output (I = 30mA)	5.0		—	W
Electronic tuning rate (over current range 30mA–90mA)	0.25		1.5	Mc/s per mA
Electronic tuning (over current range 30mA–90mA)	25		—	Mc/s
Frequency temperature coefficient	—		−1.0	Mc/s per °C
Input capacitance	—		12	pF

CATHODE Indirectly heated

V_h	6.3	V
I_h	1.2	A

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

TYPICAL OPERATION

Frequency	Midband	
Heater voltage	6.3	V
Mean operating current	60	mA
Operating voltage	1.05	kV
Mean input power	63	W
Mean R.F. power output	18	W
Electronic tuning (over current range 30mA to 90mA)	32	Mc/s

JPG8-01E
JPG9-01B

MAGNETRON

ABSOLUTE MAXIMUM RATINGS

	Min.	*Max.*	
Mean operating current	30	60	mA
Modulated current excursion	30	95	mA
Mean input power	—	66	W
Load mismatch (v.s.w.r.)	—	1.2	
Temperature of anode block	—	140	°C

MECHANICAL CHARACTERISTICS

Tuning torque	16	oz in
Tuning backlash	5.0	Mc/s

The valve may be used with a pressurised system. At 30lb/in^2 the leakage rate will not exceed 0.0004lb/hr.

MOUNTING POSITION

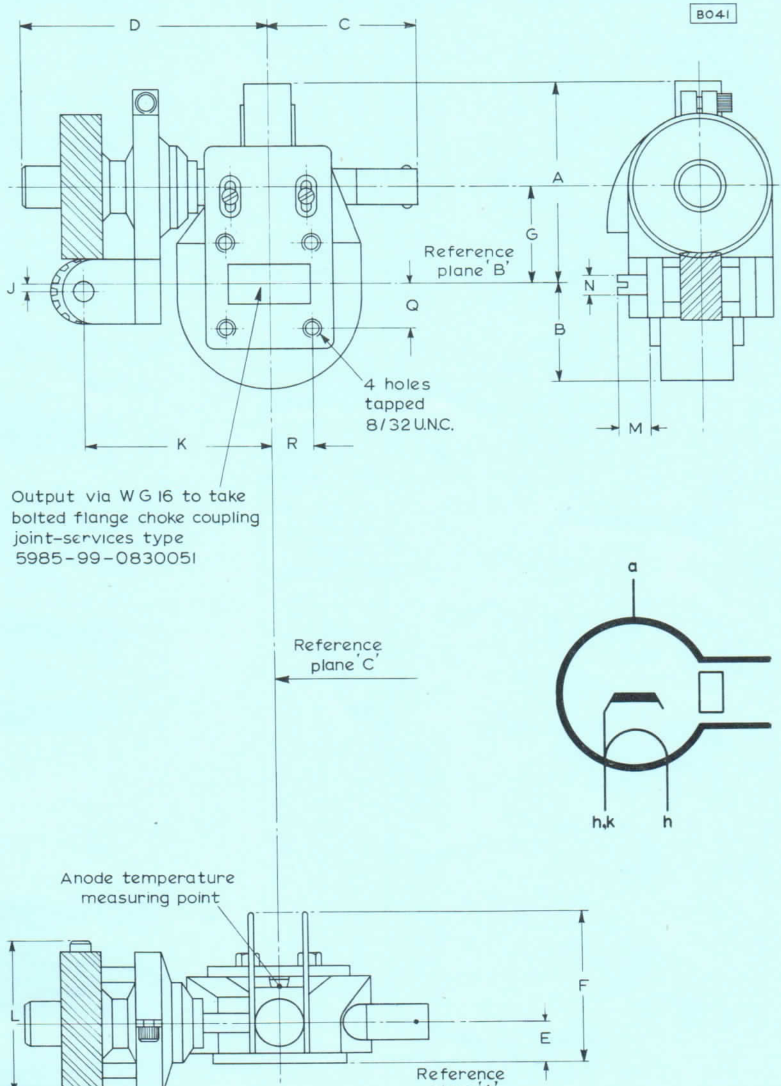
Any

PHYSICAL DATA

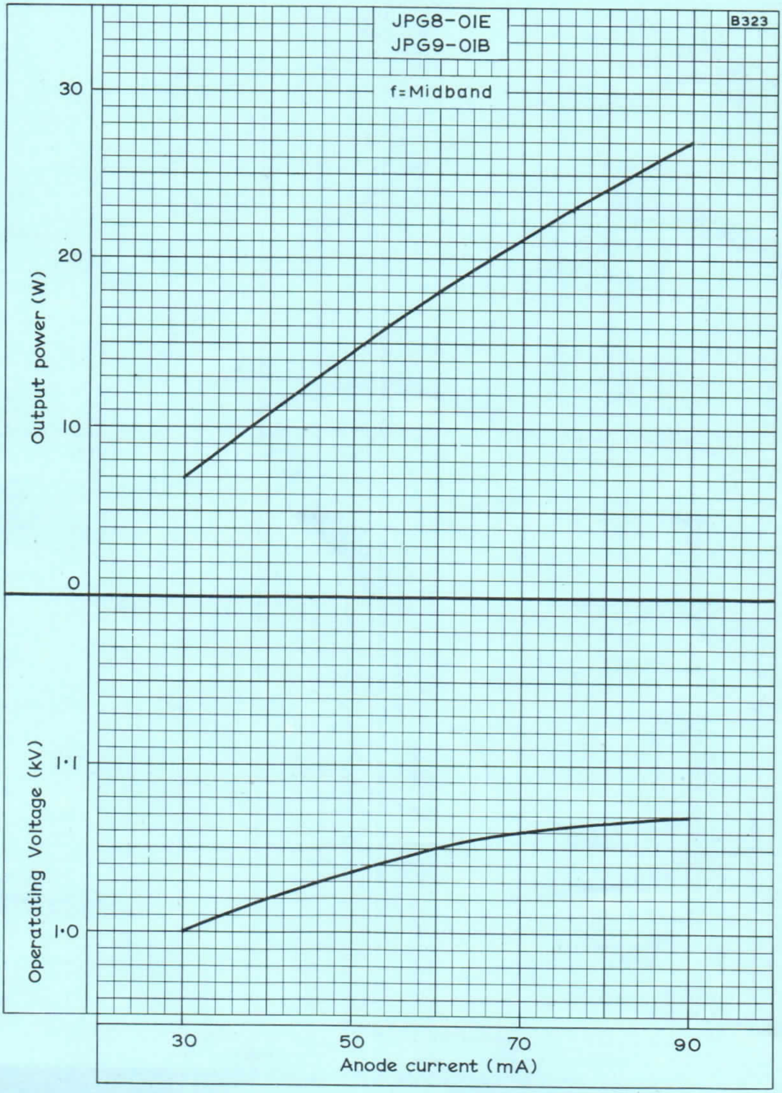
Weight of magnetron	1 lb	10 oz
	730	g
Weight of magnetron in carton	2 lb	10 oz
	1.19	kg
Dimensions of storage carton	5.0 × 7.0 × 7.5	in
	127 × 178 × 190	mm

DIMENSIONS

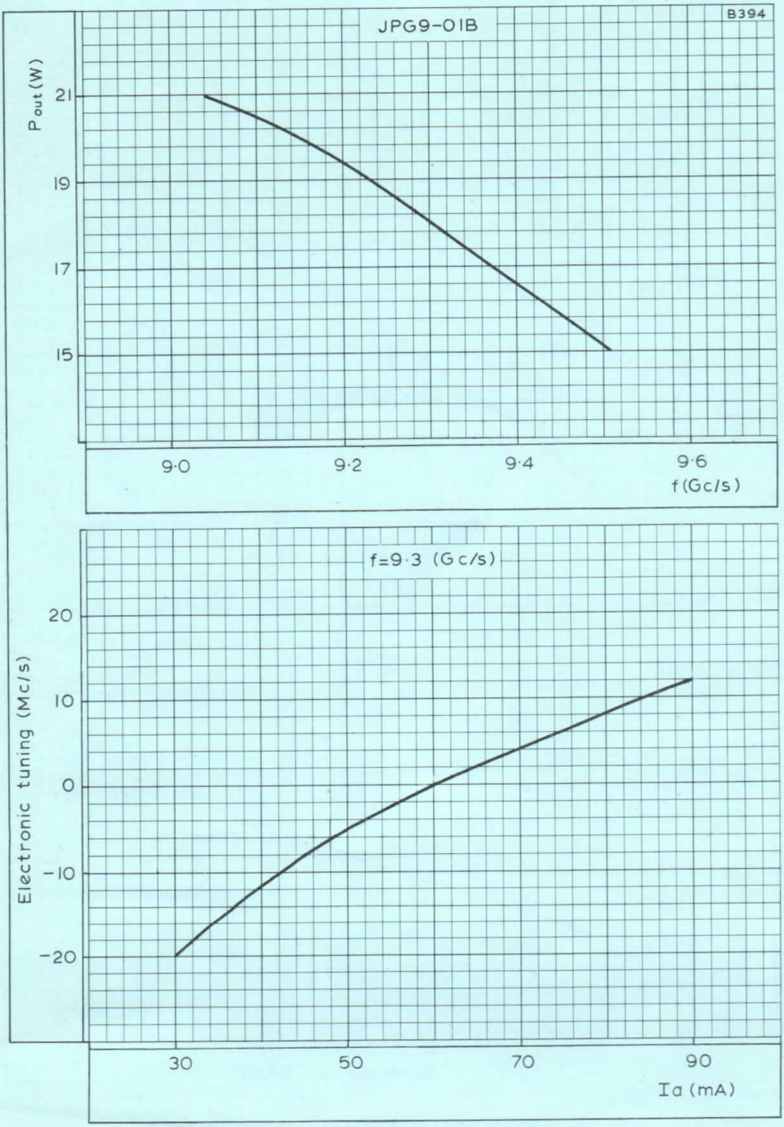
	Inches	*Millimetres*	
A	2.56	65	max.
B	1.26	32	max.
C	1.97	50	max.
D	2.39	86	max.
E	0.531 ± 0.020	13.5 ± 0.5	
F	1.77	45	max.
G	1.220 ± 0.079	31 ± 2.0	
J	0 ± 0.079	0 ± 2.0	
K	2.382 ± 0.098	60.5 ± 2.5	
L	1.555 ± 0.020	39.5 ± 0.5	
M	0.374 ± 0.020	9.5 ± 0.5	
N	0.247 ± 0.001	6.275 ± 0.025	
Q	0.640	16.26	
R	0.610	15.49	



ANODE CONNECTION TERMINATED AT THE BASE PLATE



OPERATING VOLTAGE AND OUTPUT POWER PLOTTED AGAINST ANODE CURRENT



OUTPUT POWER PLOTTED AGAINST FREQUENCY AND ELECTRONIC TUNING PLOTTED AGAINST ANODE CURRENT

JPG8-02B
JPG9-02B

PRELIMINARY DATA

QUICK REFERENCE DATA

Tunable pulsed magnetrons intended for motor-driven tuning assemblies.

Frequency	JPG8-02B	8.75	Gc/s
	JPG9-02B	9.24	Gc/s
Power output		30	W
Construction		Packaged	

Unless otherwise shown data is applicable to both types

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook.

CHARACTERISTICS

	Min.	Max.	
Frequency			
Tunable over the range JPG8-02B	8.51 to	9.00	Gc/s
JPG9-02B	9.00 to	9.48	Gc/s
Pulse voltage (I_{pulse} = 150mA)	0.96	1.15	kV
R.F. pulse power output (I_{pulse} = 150mA)	25	—	W
Frequency pulling (v.s.w.r. = 1.5)	—	25	Mc/s
Frequency pushing factor (I_{pulse} = 150mA)	—	0.2	Mc/s per mA
Frequency temperature coefficient	—	−1.0	Mc/s per °C
Input capacitance	—	12	pF

CATHODE

Indirectly heated

V_h	6.3	V
I_h	1.2	A

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

TYPICAL OPERATION

Frequency	mid band	
Heater voltage (running)	6.3	V
Pulse duration	0.5	µs
Pulse repetition frequency	1000	p/s
Duty cycle	0.0005	
Pulse current	150	mA
Pulse voltage	1.05	kV
Pulse input power	158	W
R.F. pulse output power	30	W
Mean input current	75	µA
Mean input power	79	mW
Mean r.f. output power	15	mW
Frequency pulling (v.s.w.r. = 1.5)	18	Mc/s
Rate of rise of pulse voltage	5.0	kV/µs

JPG8-02B
JPG9-02B

MAGNETRON

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
Pulse current	120	160	mA
Pulse duration	—	5.0	μs
Duty cycle	—	0.05	
Mean input power	—	6.0	W
Rate of rise of voltage pulse	—	6.0	kV/μs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	140	°C

MECHANICAL CHARACTERISTICS

	Min.	Max.	
Tuning torque		32	oz in
Tuning backlash		5.0	Mc/s

There is no limit to the number of tuning sweeps which may be carried out within the stated frequency range.

The valve may be used with pressurised systems. At 30lb/in^2 the leakage rate will not exceed 0.0004lb/hr.

MOUNTING POSITION

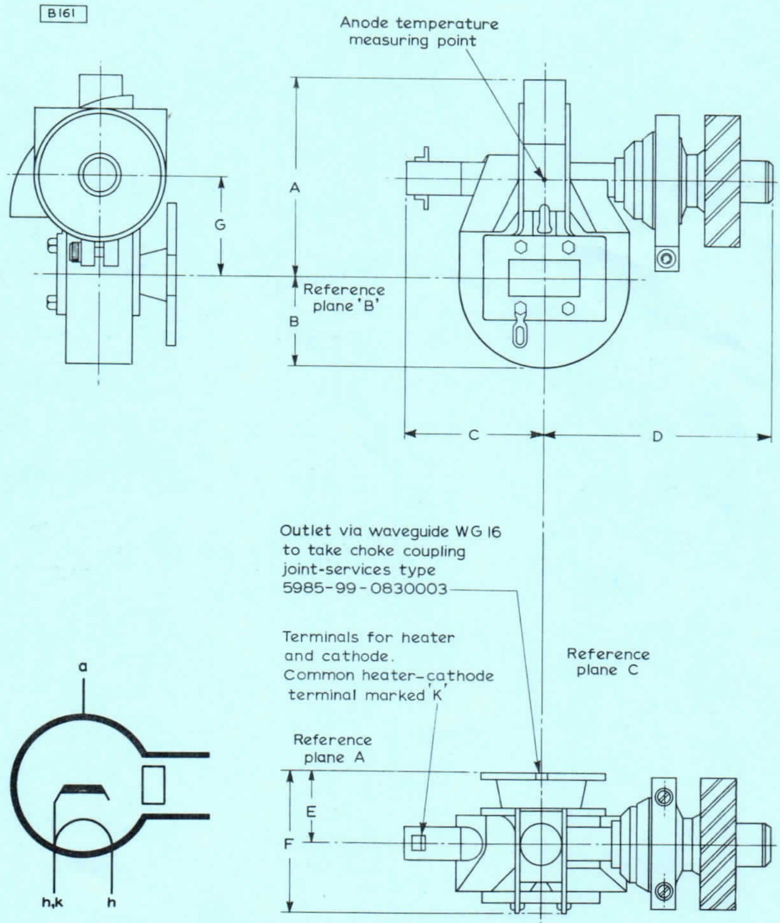
Any

PHYSICAL DATA

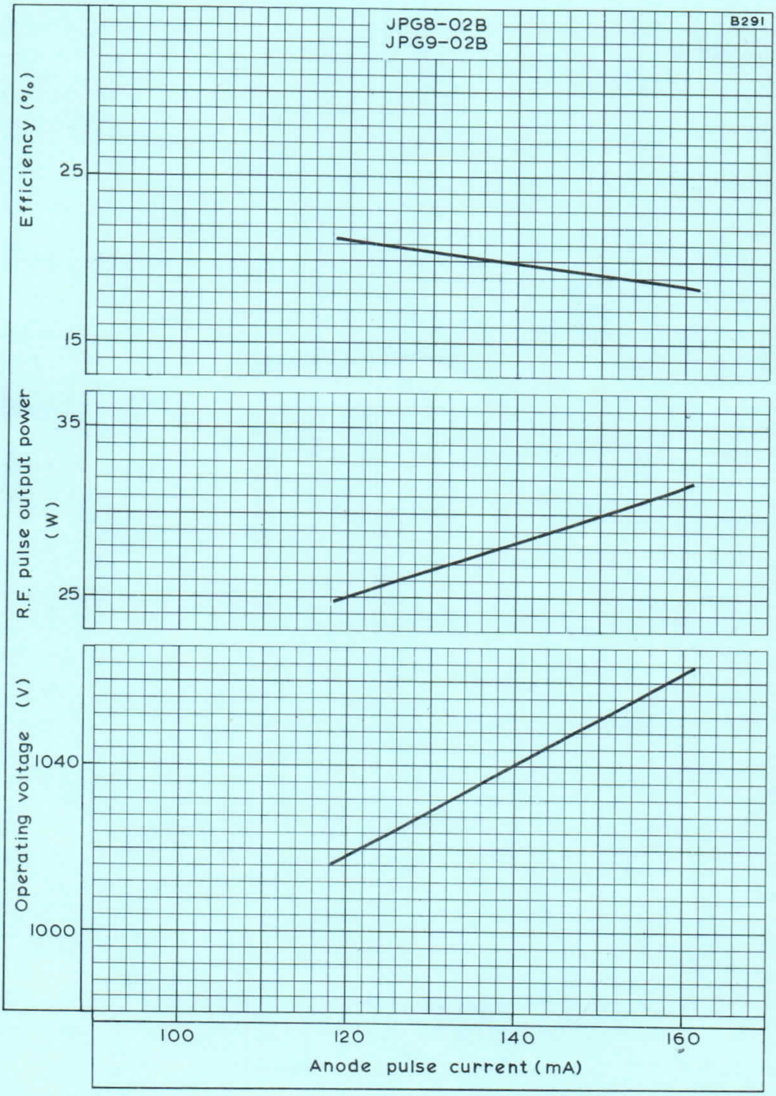
Weight of magnetron	1lb	10oz
	730	g
Weight of magnetron in carton	2lb	10oz
	1.19	kg
Dimensions of storage carton	5.0 × 7.0 × 7.5	in
	127 × 178 × 190	mm

DIMENSIONS

	Inches	Millimetres	
A	2.56	65	max.
B	1.26	32	max.
C	1.97	50	max.
D	2.39	86	max.
E	0.964 ± 0.012	24.5 ± 0.3	
F	2.24	57	max.
G	1.240 ± 0.059	31.5 ± 1.5	



ANODE CONNECTION TERMINATED AT THE BASE PLATE



OPERATING VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT

TUNABLE MAGNETRON

JPG9-01
JPT9-01

Frequency: *'X' band, mechanically tunable.*
Power output: *10W, c.w.*
Construction: *Packaged, forced-air cooled.*

The only difference between the JPG9–01 and the JPT9–01 is in the mechanical tuning arrangement (see appropriate outline drawing)

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook.

CHARACTERISTICS

	Min.		Max.	
Frequency				
Tunable over the range	9.15	to	9.6	Gc/s
Operating voltage (I = 50mA)	0.9	to	1.1	kV
R.F. power output (I = 50mA)	5.0		—	W
Frequency pulling factor (v.s.w.r. = 1.5)	—		20	Mc/s
Frequency pushing factor	—		1.0	Mc/s per mA
Frequency temperature coefficient	—		–0.5	Mc/s per °C

CATHODE

Indirectly heated

V_h	6.3	V
I_h	1.2	A←

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes. For mean input powers greater than 20 watts it is necessary to reduce the heater voltage immediately after application of h.t. in accordance with the input power-heater voltage rating chart on page C3.

TYPICAL OPERATION

Frequency	9.2	9.4	9.55	Gc/s
Heater voltage (running)	4.5	4.5	4.5	V
Operating voltage	920	930	930	V
Operating current	50	50	50	mA
Input power	46	46	46	W
R.F. power output	10.5	10.5	9.8	W
Frequency pulling (v.s.w.r. = 1.5)	19	16	14	Mc/s

OPERATING NOTE

A limiting resistor of 1kΩ should be inserted in series with the magnetron.

COOLING

It is necessary to direct a flow of cooling air of at least 5 cu. ft. per minute between the radiator fins in order to keep the temperature below the permitted maximum.

JPG9-01
JPT9-01

TUNABLE MAGNETRON

ABSOLUTE MAXIMUM RATINGS

	Min.	*Max.*	
Operating current (unmodulated c.w.)	20	60	mA
Peak operating current (modulated c.w.)	—	100	mA
Operating voltage (modulated c.w.)	0.85	1.15	kV
Mean input power	—	60	W
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	140	°C

MECHANICAL CHARACTERISTICS ←

	Min.	*Max.*	
Number of turns to cover the tuning range	4	8	
Tuning torque			
JPG9–01	—	16	oz in
JPT9–01	—	32	oz in
Tuning backlash	—	5	Mc/s

There is no limit to the number of tuning sweeps which may be carried out within the stated frequency range.

The JPG9–01 is intended for motor tuning.

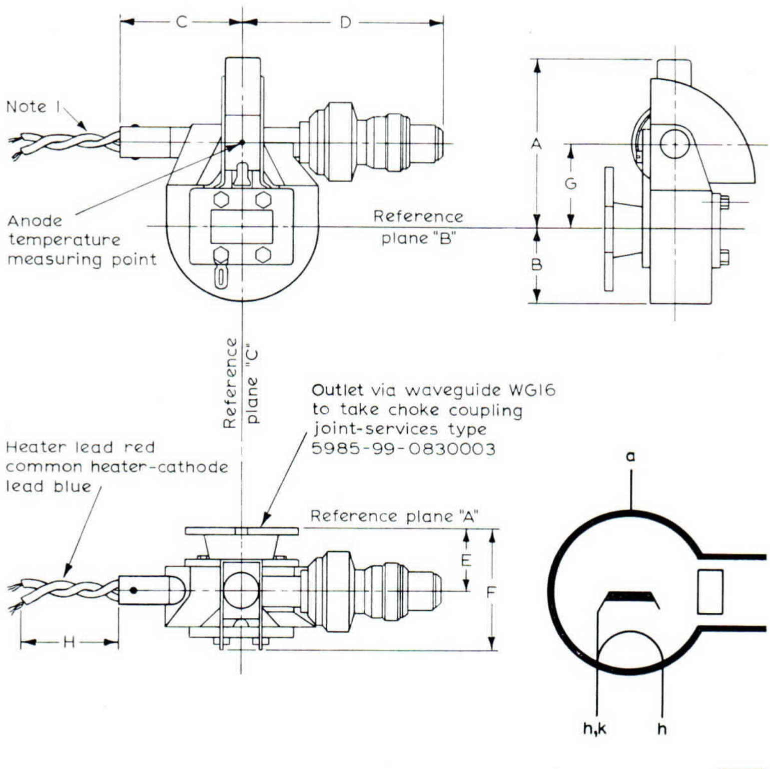
PHYSICAL DATA

Weight of magnetron	1 lb 8 oz	680 g
Weight of magnetron in carton	2 lb 8 oz	1.13 kg
Dimensions of storage carton	$5.0 \times 7.0 \times 7.5$ in	$127 \times 178 \times 190$ mm

DIMENSIONS OF JPT9–01 ←

	Inches	*Millimetres*	
A	2.56	65	max.
B	1.26	32	max.
C	1.97	50	max.
D	2.39	86	max.
E	0.965 ± 0.040	24.5 ± 1.0	
F	2.24	57	max.
G	1.223 ± 0.075	31 ± 2	
H	5.12 ± 0.20	130 ± 5	

OUTLINE DRAWING OF JPT9-01



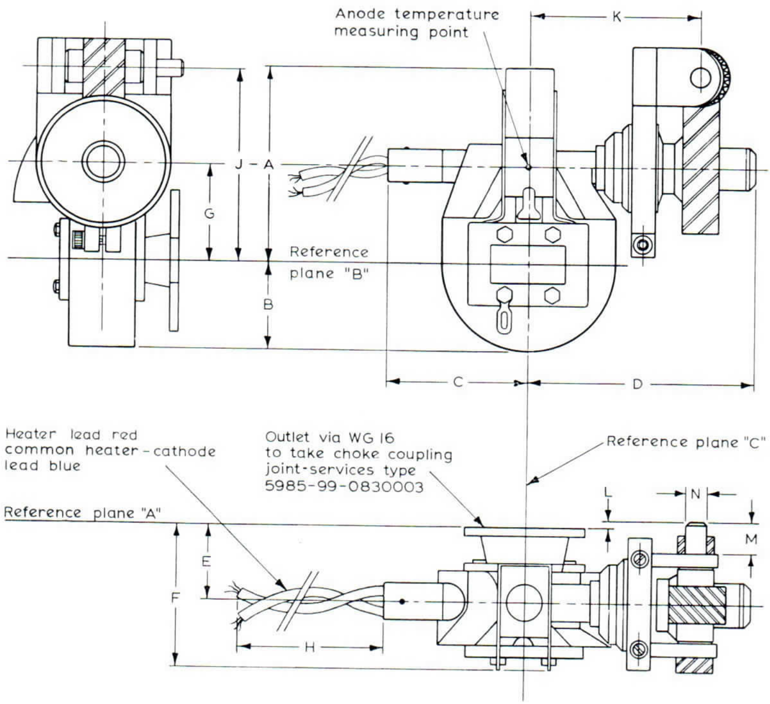
ANODE CONNECTION TERMINATED AT THE BASE PLATE

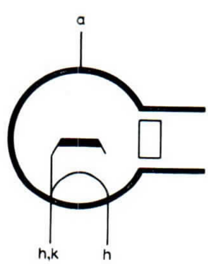
DIMENSIONS OF JPG9–01

←

	Inches	*Millimetres*
A	2.56	65
B	1.26	32
C	1.97	50
D	2.39	86
E	0.965 ± 0.040	24.5 ± 1.0
F	2.24	57
G	1.223 ± 0.075	31 ± 2
H	5.12 ± 0.20	130 ± 5
J	2.463 ± 0.071	62.5 ± 2.0
K	2.38 ± 0.10	60.5 ± 2.5
L	0.098 ± 0.039	2.5 ± 1.0
M	0.374 ± 0.020	9.5 ± 0.5
N	0.247 ± 0.001	6.275 ± 0.025

OUTLINE DRAWING OF JPG9–01





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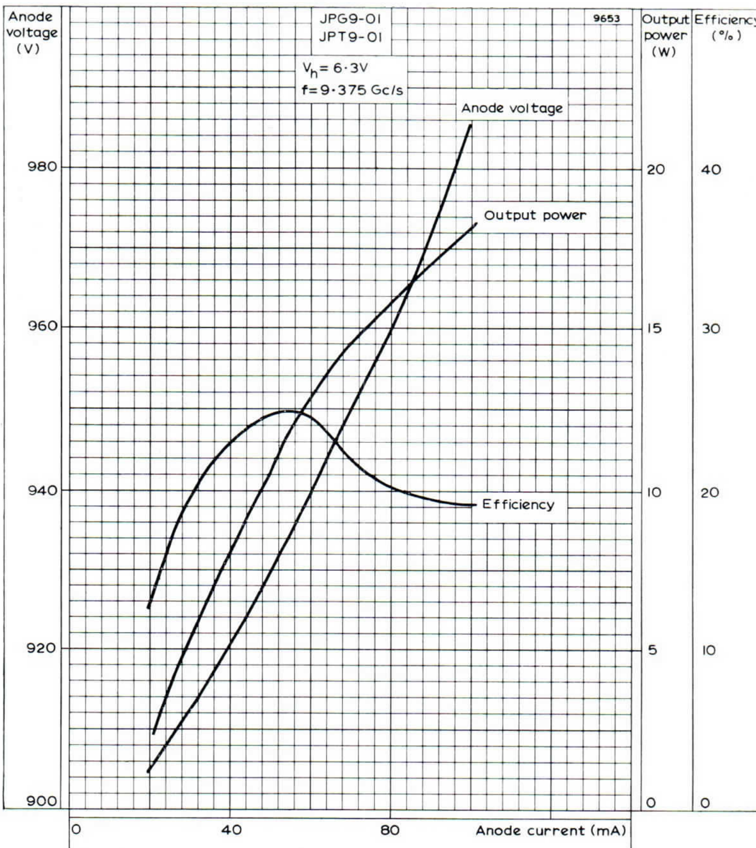
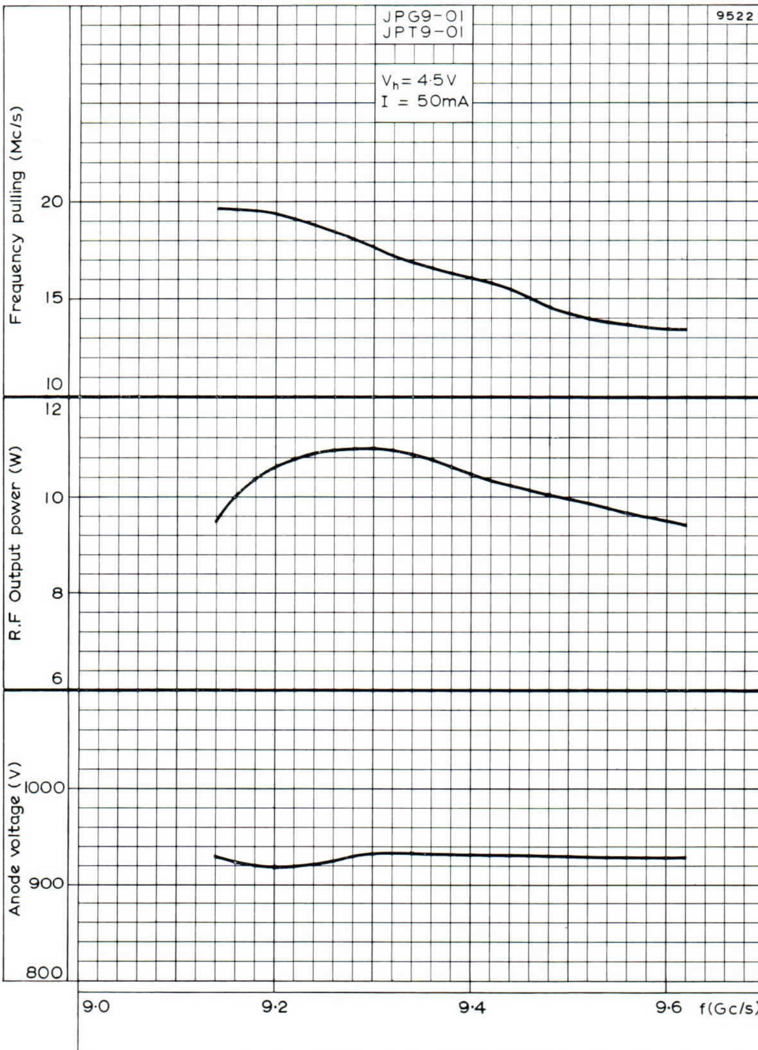
ANODE CONNECTION TERMINATED AT THE BASE PLATE



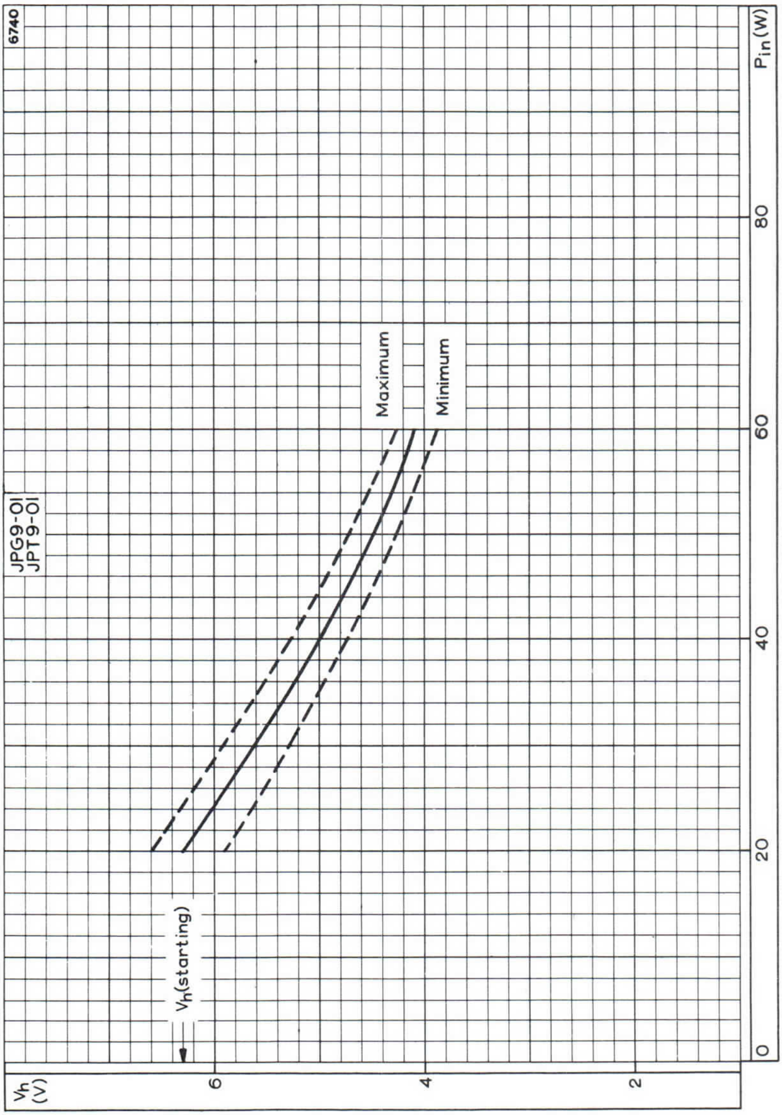
ANODE VOLTAGE, OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE CURRENT

JPG9-01
JPT9-01

TUNABLE MAGNETRON



ANODE VOLTAGE, R.F. OUTPUT POWER AND FREQUENCY PULLING PLOTTED AGAINST FREQUENCY



HEATER VOLTAGE PLOTTED AGAINST INPUT POWER

TUNABLE MAGNETRON

JPG9-02
JPT9-02

Frequency: *'X' band, mechanically tunable.*
Power output: *25W, pulsed.*
Construction: *Packaged.*

The only difference between the JPG9-02 and the JPT9-02 is in the mechanical tuning arrangement (see appropriate outline drawing)

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook.

CHARACTERISTICS

	Min.		*Max.*	
Frequency				
Tunable over the range	9.15	to	9.6	Gc/s
Pulse voltage (I_{pulse} = 120mA)	0.95		1.15	kV
R.F. pulse power output (I_{pulse} = 120mA)	18		—	W
Frequency pulling factor (v.s.w.r. = 1.5)	—		20	Mc/s
Frequency pushing factor (I_{pulse} = 140mA)	—		0.2	Mc/s per mA←
Frequency temperature coefficient	—		−0.5	Mc/s per °C
Input capacitance	—		12	pF

CATHODE

Indirectly heated

V_h	6.3	V
I_h	1.2	A←

Heating time At ambient temperatures above 0°C the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

TYPICAL OPERATION

Frequency	9.2	9.4	9.55	Gc/s
Heater voltage (running)	6.3	6.3	6.3	V
Pulse duration	0.5	0.5	0.5	µs
Pulse repetition frequency	1000	1000	1000	p/s
Duty cycle	0.0005	0.0005	0.0005	
Pulse current	120	120	120	mA
Pulse voltage	0.97	1.0	1.0	kV←
Pulse input power	120	120	120	W
R.F. pulse output power	22	25	24	W
Mean input current	60	60	60	µA
Mean input power	60	60	60	mW
Mean r.f. output power	11	12.5	12	mW
Frequency pulling (v.s.w.r. = 1.5)	19	16	14	Mc/s
Rate of rise of pulse voltage	5.0	5.0	5.0	kV/µs←

JPG9-02
JPT9-02

TUNABLE MAGNETRON

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
Pulse current	50	150	mA ←
Pulse voltage	0.9	1.15	kV
Pulse duration	—	5.0	μs
Duty cycle	—	0.05	
Mean input power	—	6.0	W
Rate of rise of voltage pulse	—	6.0	kV/μs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	140	°C

MECHANICAL CHARACTERISTICS ←

	Min.	Max.	
Number of turns to cover the tuning range	4	8	
Tuning torque JPG9–02	—	16	oz in
Tuning torque JPT9–02	—	32	oz in
Tuning backlash	—	5.0	Mc/s

There is no limit to the number of tuning sweeps which may be carried out within the stated frequency range .

The JPG9–02 is intended for motor tuning.

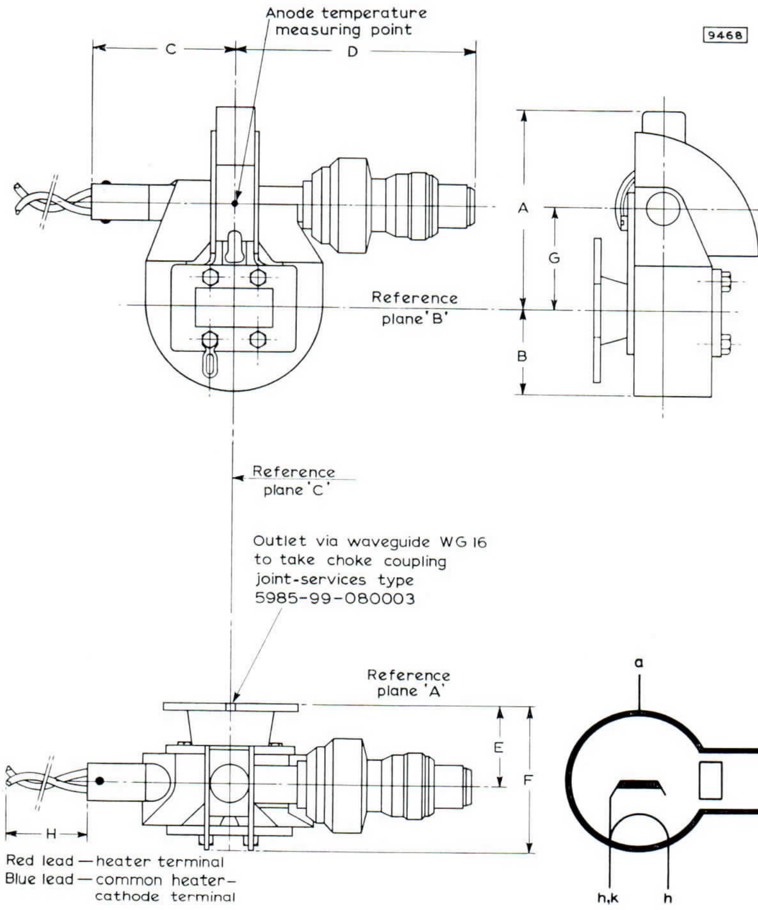
PHYSICAL DATA

Weight of magnetron	1 lb 8 oz	680 g
Weight of magnetron in carton	2 lb 8 oz	1.13 kg
Dimensions of storage carton	$5.0 \times 7.0 \times 7.5$ in	$127 \times 178 \times 190$ mm

DIMENSIONS OF JPT9–02 ←

	Inches	Millimetres	
A	2.56	65	max.
B	1.26	32	max.
C	1.97	50	max.
D	2.39	86	max.
E	0.965 ± 0.040	24.5 ± 1.0	
F	2.24	57	max.
G	1.223 ± 0.075	31 ± 2	
H	5.12 ± 0.20	130 ± 5	

OUTLINE DRAWING OF JPT9-02

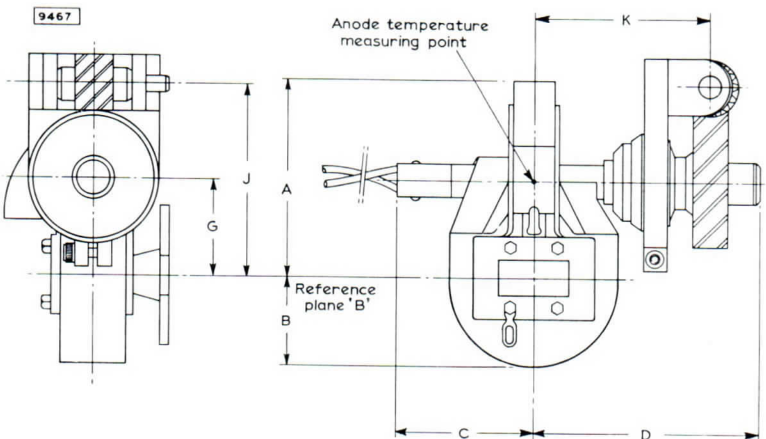


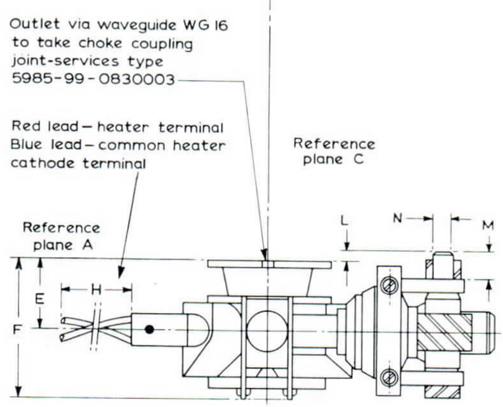
ANODE CONNECTION TERMINATED AT THE BASE PLATE

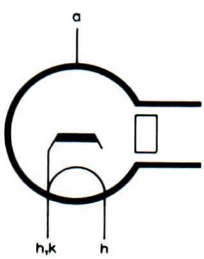
DIMENSIONS OF JPG9–02

	Inches	*Millimetres*	
A	2.56	65	max.
B	1.26	32	max.
C	1.97	50	max.
D	2.39	86	max.
E	0.965 ± 0.040	24.5 ± 1.0	
F	2.24	57	max.
G	1.223 ± 0.075	31 ± 2	
H	5.12 ± 0.20	130 ± 5	
J	2.463 ± 0.071	62.5 ± 2	
K	2.38 ± 0.10	60.5 ± 2.5	
L	0.098 ± 0.039	2.5 ± 1.0	
M	0.374 ± 0.020	9.5 ± 0.5	
N	0.247 ± 0.001	6.275 ± 0.025	

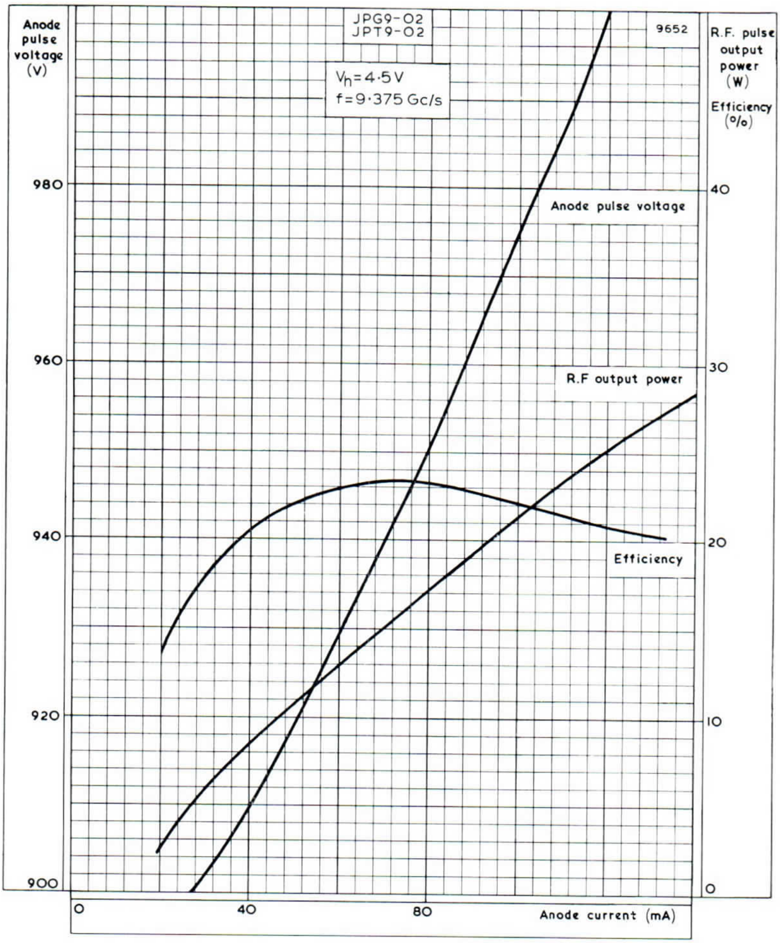
OUTLINE DRAWING OF JPG9-02



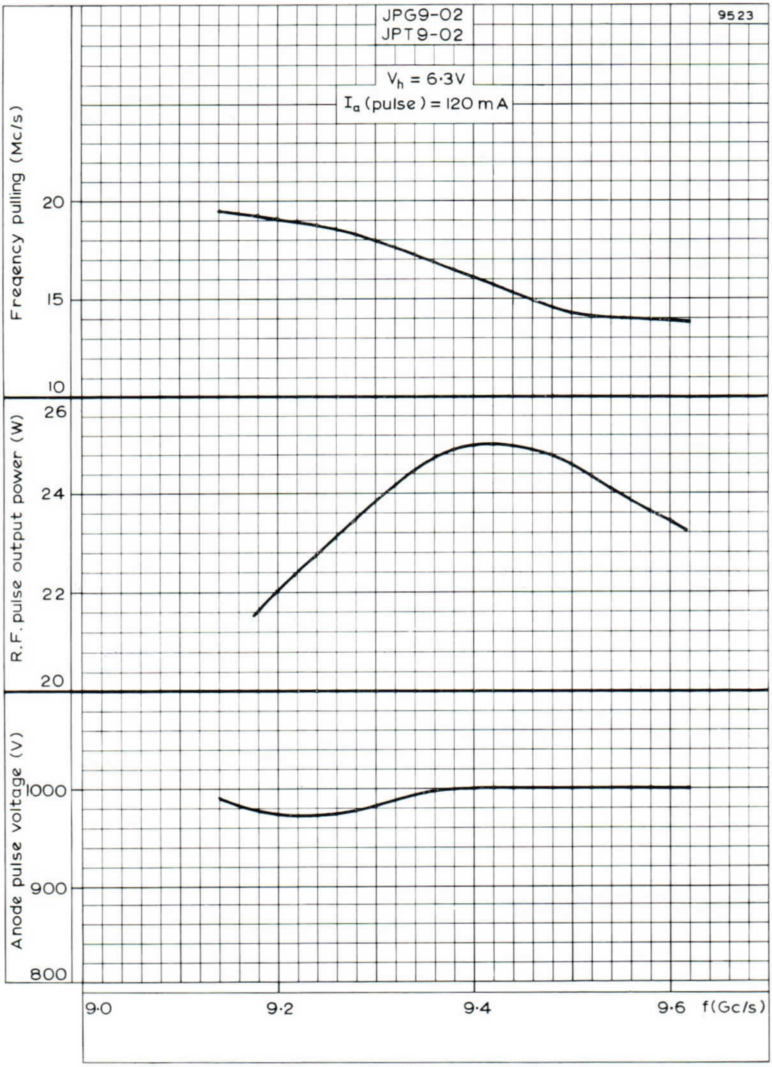




ANODE CONNECTION TERMINATED AT THE BASE PLATE



ANODE PULSE VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE CURRENT



ANODE PULSE VOLTAGE, R.F. PULSE OUTPUT POWER AND FREQUENCY PULLING PLOTTED AGAINST FREQUENCY

JPG9-02C

PRELIMINARY DATA

QUICK REFERENCE DATA

Mechanically tunable pulsed magnetron

Frequency	9.4	Gc/s
Pulsed power output	25	W
Construction	Packaged, low stray radiation, suitable for motor tuning.	

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook.

CHARACTERISTICS

	Min.		*Max.*	
Frequency Tunable over the range	9.15	to	9.55	Gc/s
Pulse voltage ($I_{pulse} = 140$mA)	0.95		1.15	kV
R.F. pulse power output ($I_{pulse} = 140$mA)	18		—	W
Frequency pulling factor (v.s.w.r. = 1.5)	—		20	Mc/s
Frequency pushing factor ($I_{pulse} = 140$mA)	—		0.2	Mc/s per mA
Frequency temperature coefficient	—		–1.0	Mc/s per °C
Input capacitance	—		12	pF
Peak r.f. leakage power	—		2.5	μW

CATHODE

Indirectly heated

V_h	6.3	V
I_h	1.2	A

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

JPG9-02C

MAGNETRON

TYPICAL OPERATION

f	9.4	Gc/s
Heater voltage	6.3	V
Pulse duration	0.5	µs
Pulse repetition frequency	1000	p/s
Duty cycle	0.0005	
Pulse current	140	mA
Pulse voltage	1.02	kV
Pulse input power	143	W
R.F. pulse output power	25	W
Mean input current	70	µA
Mean input power	71	mW
Mean r.f. output power	12.5	mW
Frequency pulling (v.s.w.r. = 1.5)	16	Mc/s
Rate of rise of pulse voltage	5.0	kV/µs

ABSOLUTE MAXIMUM RATINGS

	Min.	*Max*	
Pulse current	100	150	mA
Pulse duration	—	5.0	µs
Duty cycle	—	0.05	
Mean input power	—	6.0	W
Rate of rise of voltage pulse	—	6.0	kV/µs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	—	140	°C

MECHANICAL CHARACTERISTICS

	Min.	*Max.*	
Number of turns of drive shaft to cover the tuning range	10	20	
Tuning torque	—	16	oz in
Tuning backlash	—	5.0	Mc/s

There is no limit to the number of tuning sweeps which may be carried out within the stated frequency range.

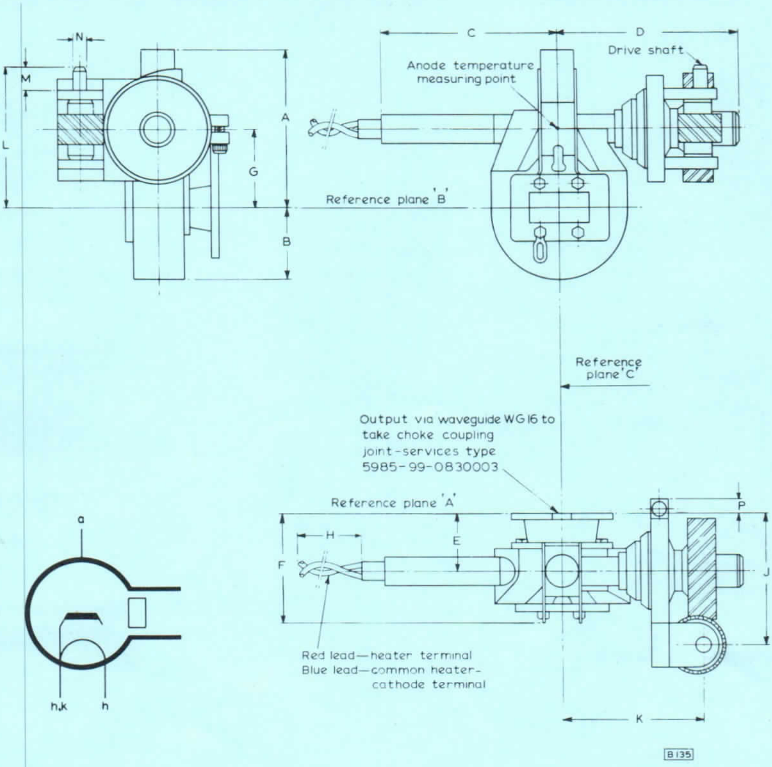
MOUNTING POSITION

Any

PHYSICAL DATA

Weight of magnetron	1 lb	10 oz
	730	g
Weight of magnetron in carton	2 lb	10 oz
	1.19	kg
Dimensions of storage carton	5.0 × 7.0 × 7.5	in
	127 × 178 × 190	mm

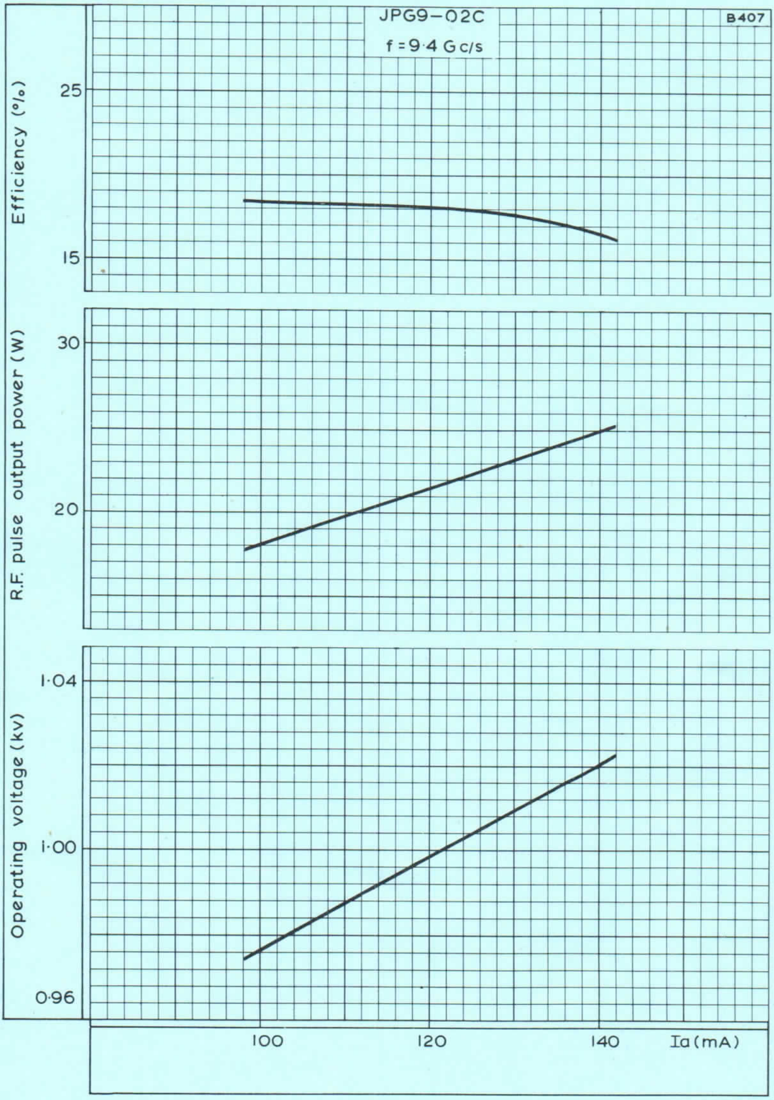
JPG9-02C



ANODE CONNECTION TERMINATED AT THE BASE PLATE

DIMENSIONS

	Inches	*Millimetres*	
A	2.56	65	max.
B	1.26	32	max.
C	5.51 ± 0.16	104 ± 4.0	
D	2.39	86	max.
E	0.96 ± 0.04	24.5 ± 1.0	
F	2.24	57	max.
G	1.220 ± 0.079	31 ± 2.0	
H	5.12 ± 0.20	130 ± 5.0	
J	2.20 ± 0.04	56 ± 1.0	
K	2.382 ± 0.098	60.5 ± 2.5	
L	2.283 ± 0.079	58 ± 2.0	
M	0.374 ± 0.02	9.5 ± 0.5	
N	0.247 ± 0.001	6.275 ± 0.025	
P	0.315	8.0	max.



OPERATING VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE CURRENT

QUICK REFERENCE DATA		
Packaged magnetron with push-rod tuning mechanism for rapid frequency sweeping.		
Frequency	9.32 to 9.5	GHz
Power output (pulsed)	15	W

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS

R.F. pulse power output	15	W
Duty factor	0.11	
Pulse duration	45	µs
Pulse repetition frequency	2500	p.p.s.
Heater voltage (running)	6.3	V
Pulse current	100	mA
Pulse voltage	1.0	kV
Pulse input power	100	W
Rate of rise of voltage pulse	5.0	kV/µs
Mean r.f. output power	1.65	W
Frequency pulling (v.s.w.r.=1.5)	16	MHz
Swept over the range	9.32 to 9.50	GHz

CATHODE

Indirectly heated

V_h	6.3	V
I_h	1.2	A

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

CHARACTERISTICS

	Min.	Typ.	Max.	
Frequency tunable over the range	9.32	-	9.50	GHz
Pulse voltage (I_{pulse} = 100mA)	0.9	-	1.1	kV
R.F. pulse power output (I_{pulse} = 100mA)	12	-	-	W
Frequency pulling (v.s.w.r. = 1.5)	-	-	20	MHz
Frequency temperature coefficient	-	-	-0.5	MHz per degC
Input capacitance	-	-	12	pF
Frequency pushing (I_{pulse} = 100mA)	-	0.3	-	MHz per A

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Pulse current	60	140	mA
Pulse duration	-	50	µs
Duty factor	-	0.25	
Mean input power	-	60	W
Rate of rise of voltage pulse	-	10	kV/µs
Load mismatch (v.s.w.r.)	-	1.5	
Temperature of anode block	-	120	^{o}C

MECHANICAL CHARACTERISTICS

	Min.	Max.	
Movement of push rod to cover tuning range	0.127	0.254	mm
	0.005	0.01	in

The tuning mechanism is designed for cam operation and may require 6.35kg (14lb) thrust for operation.

There is no limit to the number of tuning sweeps which may be carried out within the stated frequency range,

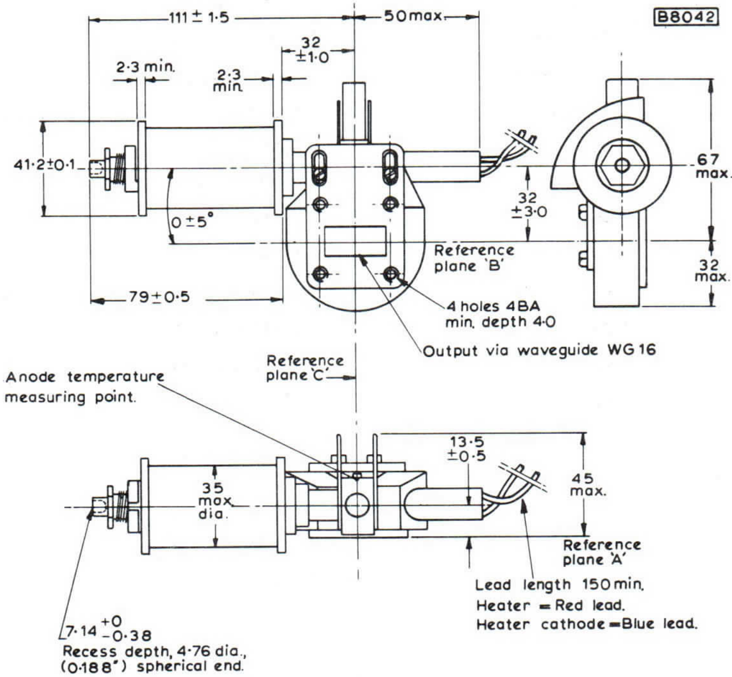
MOUNTING POSITION

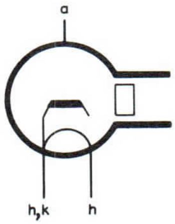
Any

PHYSICAL DATA

	kg	lb
Weight of magnetron	0.74	1.63
Weight of magnetron in carton	1.19	2.63
	mm	in
Dimensions of storage carton	127 × 178 × 190	5.0×7.0×7.5

OUTLINE DRAWING





All dimensions in mm.
Conversion table overleaf.

DIMENSION CONVERSION TABLE

Millimetres		Inches	
2.3		0.090	min
7.14	$^{+0}_{-0.38}$	0.281 $^{+0}_{-0.015}$	
13.5	±0.5	0.531 ± 0.019	
32	±3.0	1.259 ± 0.118	
32	±1.0	1.259 ± 0.039	
32		1.259	max
35		1.377	max
41.2	±0.1	1.622 ± 0.003	
45		1.771	max
50		1.968	max
67		2.637	max
79	± 0.5	3.110 ± 0.019	
111	±1.5	4.370 ± 0.059	
150		5.9	min

MAGNETRON

JPT9-60

Frequency: 'X' *band, tunable.*
Power output: 60kW, pulsed.
Construction: Packaged, forced-air cooled.

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES: INTRODUCTION and RADAR AND COMMUNICATION MAGNETRONS which precede this section of the handbook.

CHARACTERISTICS

	Min.		*Max.*	
Frequency: Tunable over the range	8.5	to	9.6	Gc/s
Pulse voltage (I_{pulse} = 14A)	13		15.5	kV
R.F. pulse power output (I_{pulse} = 14A)	50		—	kW
Frequency pulling factor (v.s.w.r. = 1.5)	—		18	Mc/s
Frequency temperature coefficient	—		−0.25	Mc/s per °C
Input capacitance	—		6.0	pF

CATHODE

Indirectly heated

V_h	6.3	V
I_h	1.0	A

Heating time. The cathode must be heated for at least 2 minutes before the application of h.t. The heater voltage must be reduced immediately after the application of h.t. in accordance with the input-power/heater-voltage rating chart on page C4.

TYPICAL OPERATION

Frequency	9.0	9.0	9.0	Gc/s
Heater voltage (running)	4.8	0	0	V
Pulse duration	0.1	1.0	3.4	µs
Pulse repetition frequency	3333	1000	324	p/s
Duty cycle	0.00033	0.001	0.0011	
Pulse current	14	14	14	A
Pulse voltage	13.5	13.5	13.5	kV
Pulse input power	190	190	190	kW
R.F. pulse output power	60	60	60	kW
Mean input current	4.7	14	15.4	mA
Mean input power	63	190	210	W
Mean r.f. output power	20	60	65	W
Frequency pulling (v.s.w.r. = 1.5)	10	10	10	Mc/s

OPERATING NOTES

The valve is provided with four magnetic shunts. (See outline drawings, pages D3 and D4.) From examination of the performance charts the number required for a particular application may be determined. To remove shunts which are not required, grip the tabs firmly with suitable pliers and pull away from the valve.

COOLING

A flow of cooling air must be directed between the radiator fins, and on to cathode and heater seals, in order to keep the temperature below the permitted maximum.

ABSOLUTE MAXIMUM RATINGS

	Min.	*Max.*	
Pulse current	—	15.5	A
Pulse voltage	—	16.0	kV
Pulse duration	—	3.6	μs
Duty cycle	—	0.0012	
Mean input power	—	230	W
Voltage pulse rise time			
$0.1\mu s \leqslant t_p \leqslant 1.0\mu s$	—	0.08	μs
$t_p = 3.6\mu s$	—	0.12	μs
Load mismatch (v.s.w.r.)	—	1.5	
Temperature of anode block	−60	150	°C
Pressurisation of waveguide output system	—	43	lb/in^2
	—	2200	torr
Pressurisation of input system	11	—	lb/in^2
	550	—	torr

MOUNTING POSITION

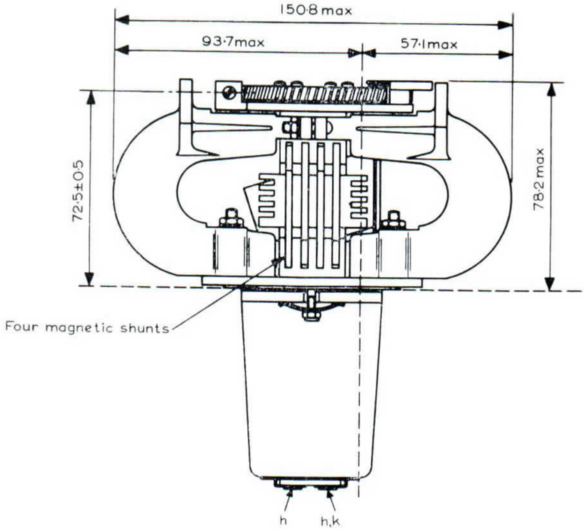
Any

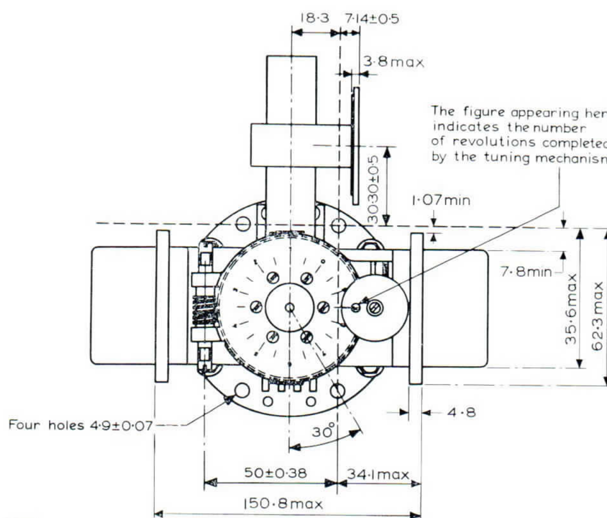
MECHANICAL CHARACTERISTICS

	Min.	*Max.*	
Number of turns of worm shaft to cover the tuning range	—	110	
Tuning torque	10	40	oz/in

PHYSICAL DATA

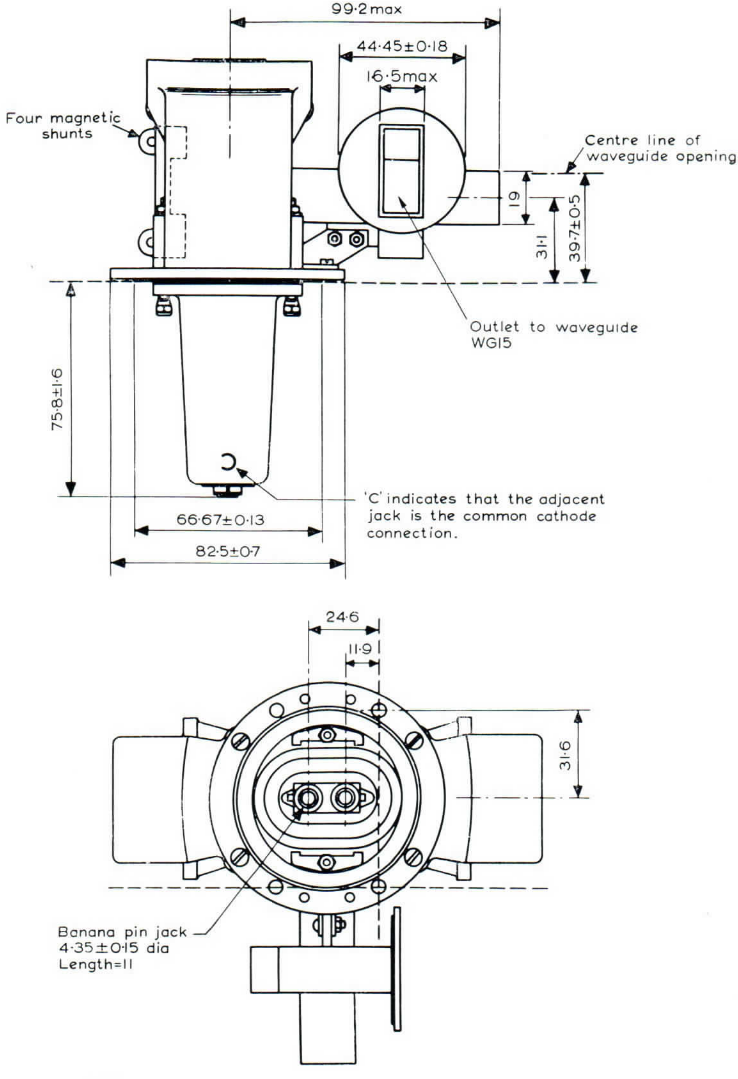
Weight of magnetron	4.8	lb
	2.2	kg
Weight of magnetron in carton	13.9	lb
	6.3	kg
Dimensions of storage carton	12.5 × 13 × 13	in
	318 × 330 × 330	mm





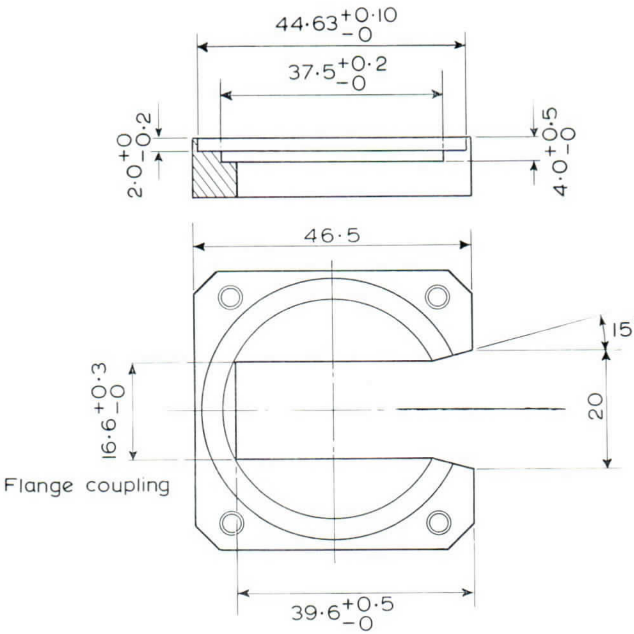
9663

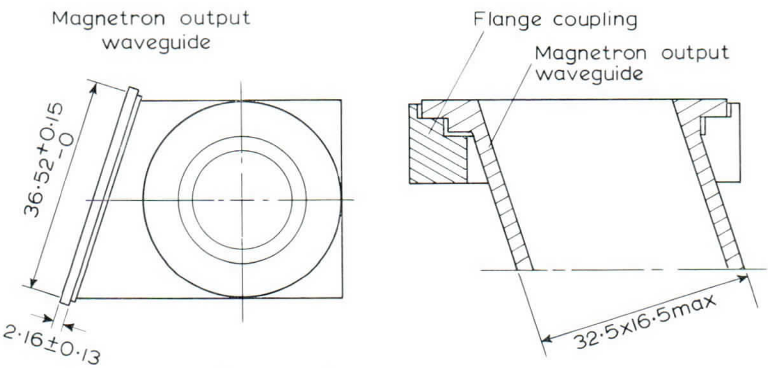
All dimensions in mm



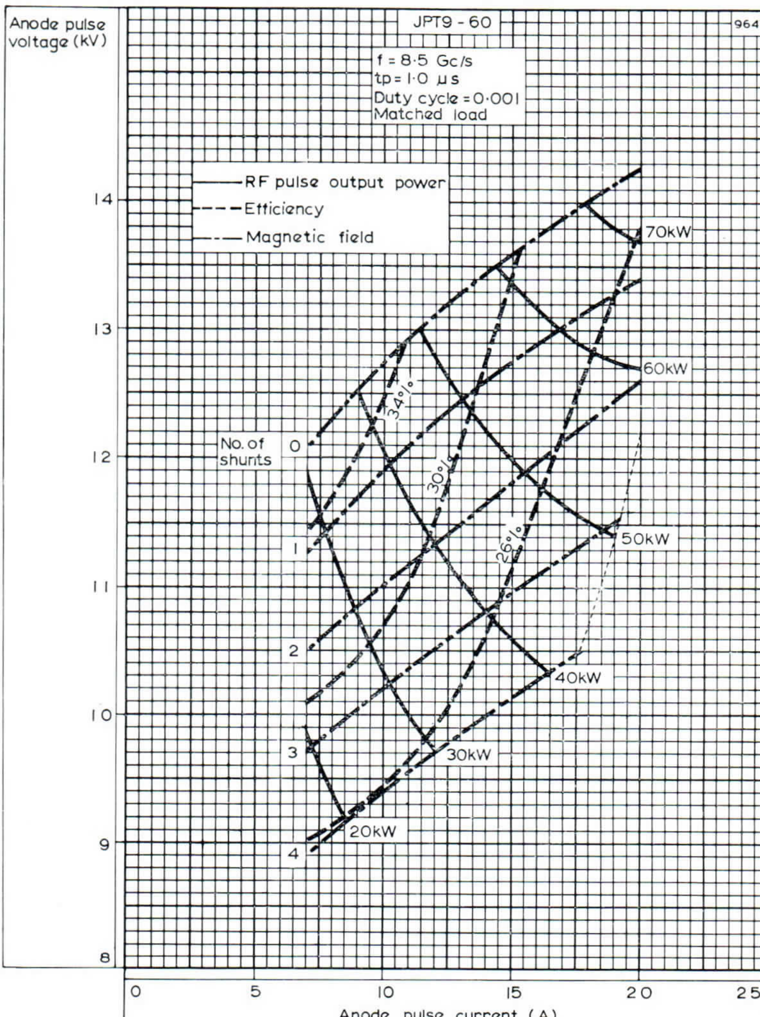
All dimensions in mm

9608

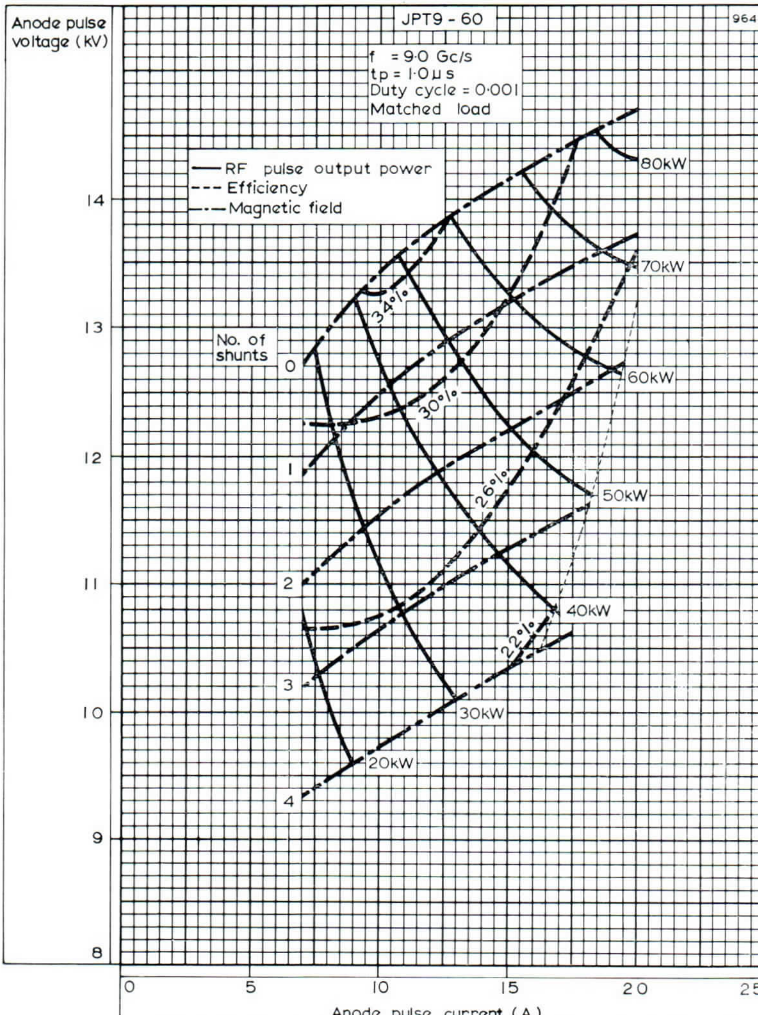




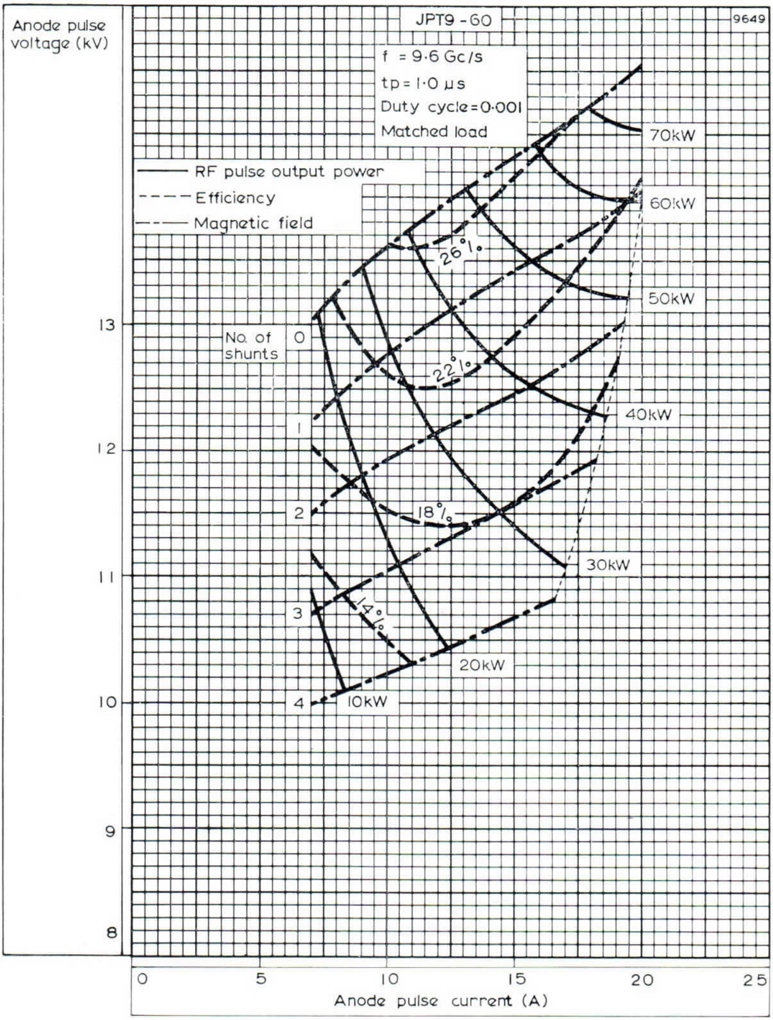
All dimensions in mm



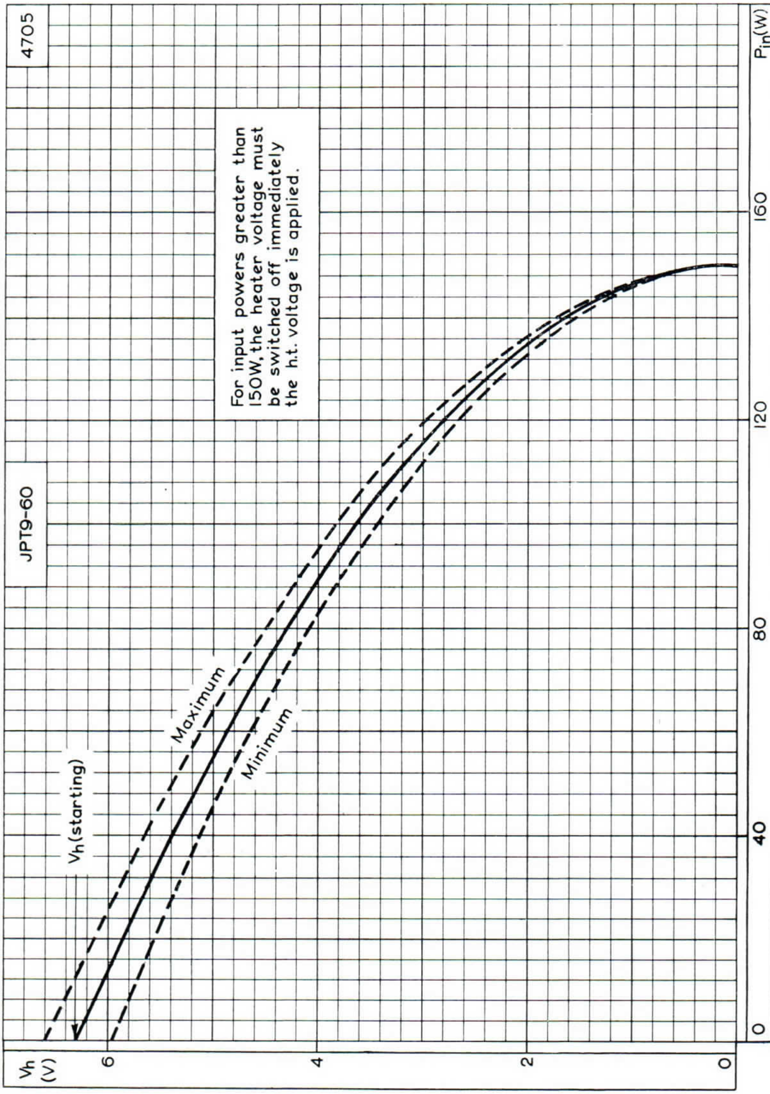
PERFORMANCE CHART (f = 8.5Gc/s)



PERFORMANCE CHART (f = 9.0Gc/s)



PERFORMANCE CHART (f = 9.6Gc/s)



HEATER VOLTAGE PLOTTED AGAINST MEAN INPUT POWER

MAGNETRON

YJ1010

QUICK REFERENCE DATA

Servo-tunable 'X' band pulsed magnetron, suitable for use in navigational search and fine control radar systems, in either ground based or airborne installations.

Frequency	8.5 to 9.6	GHz
Power output (pulsed)	225	kW
Construction	packaged	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS

R.F. pulse power output	200	200	225	225	kW
Duty factor	0.00026	0.0007	0.001	0.001	
Pulse duration	0.13	0.34	0.6	1.0	μs
Pulse repetition frequency	2000	2080	1670	1000	p.p.s.
Heater voltage (running)	9.7	3.0	0	0	V
Pulse current	24	24	27.5	27.5	A
Pulse voltage	21	21	21.5	21.5	kV
Pulse input power	500	500	590	590	kW
Rate of rise of voltage pulse	200	200	200	200	kV/μs
Mean input current	6.2	16.8	27.5	27.5	mA
Mean input power	130	350	590	590	W
Mean r.f. output power	52	140	225	225	W
Frequency pulling (v.s.w.r. = 1.5)	11	11	10	10	MHz

CHARACTERISTICS

	Min.		Max.	
Frequency. Tunable over the range	8.5	to	9.6	GHz
Pulse voltage (I_{pulse} = 27.5A)	20		23	kV
R.F. pulse power output (I_{pulse} = 27.5A)	200		-	kW
Frequency pulling (v.s.w.r. = 1.5)	-		13.5	MHz
Input capacitance	9.0		13	pF

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Pulse current	15	30	A
Pulse duration	-	2.75	μs
Duty factor	-	0.0011	
Mean input power	-	630	W
Rate of rise of voltage pulse ($t_p \leq 1.5\mu s$)	70	225	kV/μs
($t_p > 1.5\mu s$)	70	200	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	

CATHODE

Indirectly heated

V_h	13.75 ± 10%	V
I_h	3.1 ± 0.2	A
I_h (surge)max.	12	A
r_h (cold)	0.53	Ω
Minimum warm up time	2.5	min

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 2.5 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 4 minutes.
For mean input powers greater than 0 watts, it is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power - heater voltage rating chart on page C1.

MOUNTING POSITION			Any

PRESSURISING

See operating notes

PHYSICAL DATA

Weight of magnetron		5.9kg	13lb

COOLING

Temperatures

Anode block	max.	150	^{o}C
Cathode and heater seals	max.	165	^{o}C

An adequate air flow should be forced through the cooling ducts on the magnetron to keep the anode block temperature below 150°C under any condition of operation. The heater-cathode terminal should also be sufficiently cooled to keep its temperature below 165°C.

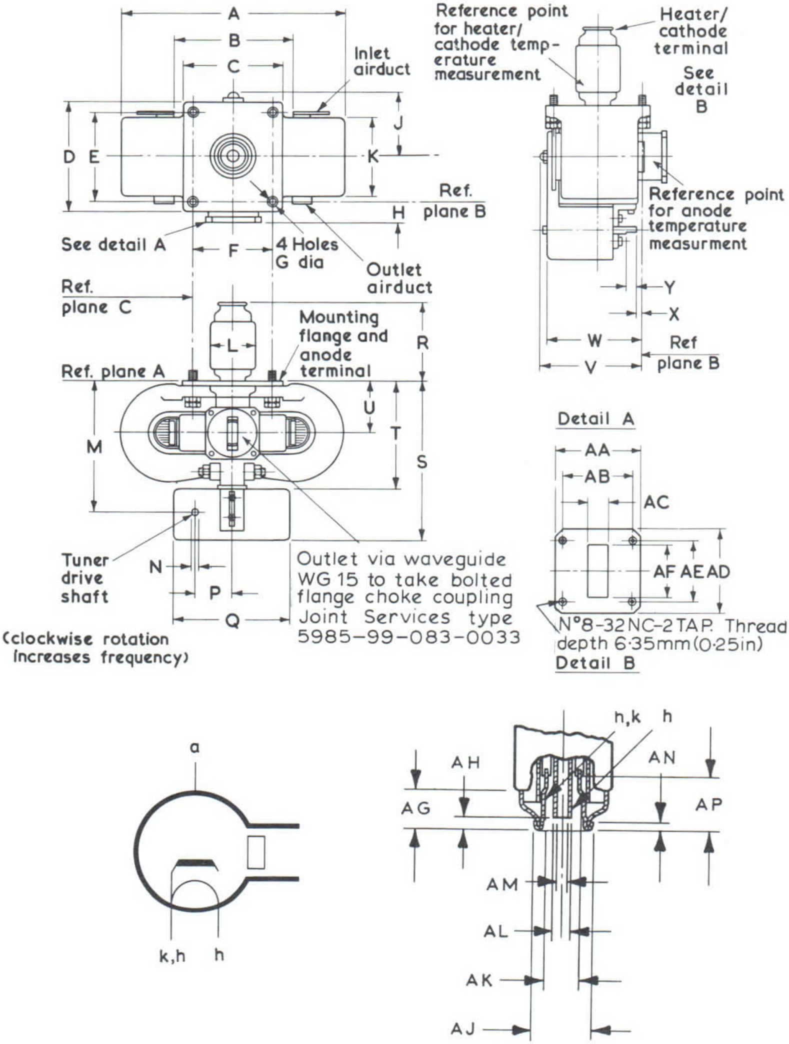
OPERATING NOTES

Input pressurization min. 0.82kg/cm^2 (11.6lb/in^2) absolute.
Output pressurization max. 3.2kg/cm^2 (45lb/in^2) absolute
The output assembly must always be pressurized. When the magnetron is not working into a matched load, the pressure on the window must be higher than 1.0kg/cm^2 (14.2lb/in^2) absolute.

TUNING MECHANISM

The frequency of the magnetron decreases with clockwise rotation of the tuner drive shaft, as viewed directly towards the waveguide flange. (See page D4.)
A digital indicator provides a visual indication of the magnetron frequency. A number of frequencies and the corresponding indicator settings are indicated on the wall of the tuner box.
Axial stress on the tuner mechanism should be avoided. The tuner shaft should therefore be driven by a flexible coupling. The torque on the shaft must never exceed 13.8kg cm (1.0ft lb). Adjustment of the tuning mechanism beyond the stated frequency limits must not be attempted. The starting torque required to operate the tuner shaft is max. 1.5kg cm (0.108ft lb). The tuner drive should be capable of supplying 2.3kg cm (0.166ft lb).

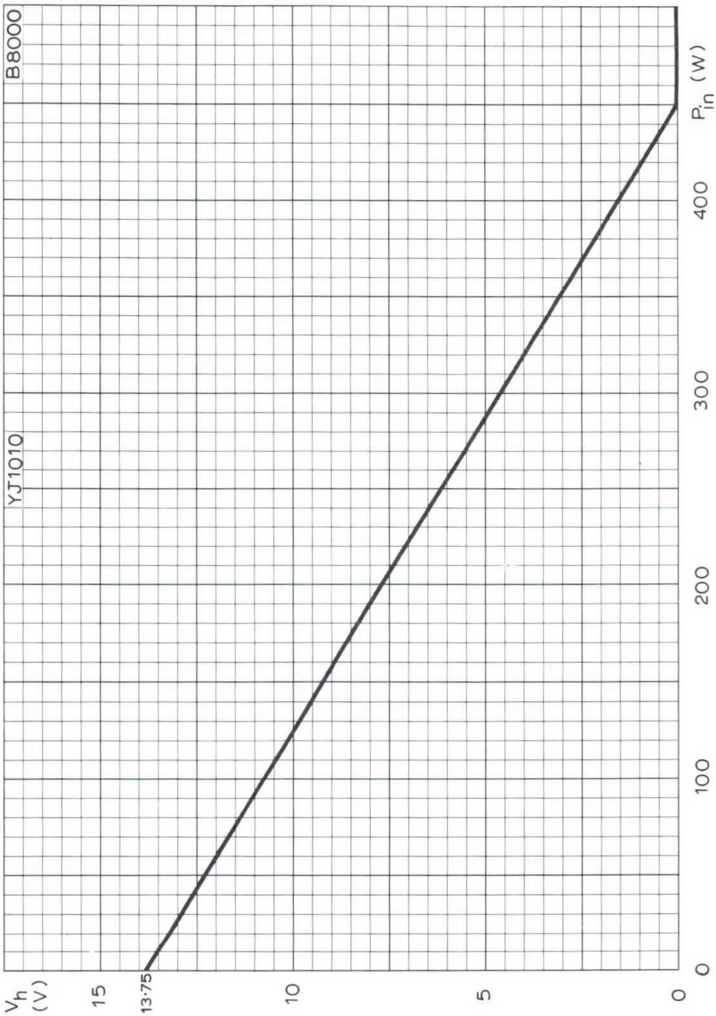
OUTLINE DRAWING OF YJ1010



DIMENSIONS

	mm	Inches	
A	195.25	7.687	max.
B	95.94 ± 1.19	3.777 ± 0.047	
C	88.09	3.468	max.
D	98.42	3.875	max.
E	76.20 ± 0.25	3.000 ± 0.010	
F	63.5 ± 0.25	2.500 ± 0.010	
G	7.14 ± 0.12	0.281 ± 0.005	dia.
H	23.01 ± 0.79	0.906 ± 0.031	
J	58.40	2.300	max.
K	73.02	2.875	max.
L	38.10	1.500	max.
M	109.52 ± 2.39	4.312 ± 0.094	
N	4.77 ± 0.025	0.188 ± 0.001	
P	31.75 ± 1.57	1.250 ± 0.062	
Q	101.6	4.000	max.
R	68.5 ±1.57	2.687 ± 0.062	
S	139.7	5.500	max.
T	86.50	3.406	max.
U	42.06 ± 1.19	1.656 ± 0.047	
V	96.52	3.800	max.
W	83.82	3.300	max.
X	7.92 ± 1.57	0.312 ± 0.062	
Y	15.88 ± 0.79	0.625 ± 0.031	
AA	46.48	1.830	
AB	37.44 ± 0.10	1.474 ± 0.004	
AC	12.62	0.497	
AD	46.48	1.830	
AE	34.34 ± 0.10	1.352 ± 0.004	
AF	28.50	1.122	
AG	13.11	0.516	min.
AH	3.96	0.156	max.
AJ	$21.08^{+0.20}_{-0.12}$	$0.830^{+0.008}_{-0.005}$	
AK	$13.72^{+0.12}_{-0.20}$	$0.540^{+0.005}_{-0.008}$	
AL	6.35 ± 0.38	0.250 ± 0.015	
AM	4.29 ± 0.12	0.169 ± 0.005	
AN	3.17 ± 0.25	0.125 ± 0.010	
AP	19.05	0.750	min.

Millimetre dimensions derived from original inch dimensions



HEATER VOLTAGE PLOTTED AGAINST INPUT POWER

DEVELOPMENT SAMPLE DATA

QUICK REFERENCE DATA

Air-cooled magnetron designed for the marine navigational radar band.

Frequency	32.6	Gc/s
Power output (pulsed)	40	kW

To be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES.

CHARACTERISTICS

	Min.		Max.	
Frequency				
Fixed within the band	31.8		33.4	Gc/s
Pulse voltage (I pulse = 12.5 A)	11.5		13.5	kV
R.F. pulse power output (I pulse = 12.5A)	30		-	kW
Frequency pulling (v.s.w.r. = 1.5)	-		50	Mc/s
Frequency temperature coefficient	-		-1.0	Mc/s per °C
Position of phase of sink from face of mou ting plate out of valve	0.25		0.4	λg
Input capacitance		6.0		pF
Frequency pushing	-		4.0	Mc/s per A

TYPICAL OPERATION

R.F. pulse power output	40	40	30	kW
Duty factor	0.0002	0.0002	0.0001	
Pulse duration	0.3	0.1	0.02	µs
Pulse repetition frequency	670	2000	5000	p.p.s.
Heater voltage (running)	4.0	4.0	5.0	V
Pulse current	12.5	12.5	7.5	A
Pulse voltage	11.7	11.7	11.1	kV
Pulse input power	146	146	83	kW
Rate of rise of voltage pulse	250	250	600	kV/µs
* Mean input current	2.5	2.5	1.55	mA
Mean input power	35	35	20	W
Mean r.f. output power	8.0	8.0	3.0	W
Frequency pulling (v.s.w.r. = 1.5)	35	35	35	Mc/s

* Includes pre-oscillation current.

CATHODE

Indirectly heated, dispenser type

Vh	5.0	V
Ih (at 5.0 V)	3.9	A
rh (cold)	0.16	Ω
Ih (surge) max.	8.0	A

Heating time. At ambient temperatures above 0 °C the cathode must be heated for at least 3 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 5 minutes.

For mean input powers greater than 20 watts, it is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power-heater voltage rating chart on page C2.

* In many applications involving short pulse lengths and high pulse repetition frequencies the mean current which would be calculated from the duty factor is increased by the pre-oscillation current.
In determining the heater reduction is it necessary to obtain the mean input power from the measured mean input current ×12,500. The correct value of nominal heater voltage is given by the curve on page C2.

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
Pulse current	6.0	16	A
Pulse duration	-	0.4	µs
Duty factor	-	0.0003	
Mean input power	-	60	W
** Rate of rise of voltage pulse			kV/µs
Load mismatch (v.s.w.r.)	-	1.5	
Temperature of anode block	-	150	°C
Temperature of cathode and heater seals	-	150	°C

** See operating notes.

END OF LIFE PERFORMANCE

The valve is deemed to have reached end of life when it fails to satisfy the following :-

	Min.		Max.	
R.F. pulse power output (I pulse = 12.5 A)			24	kW
Frequency				
Within the band	31.8	to	33.4	Gc/s
Pulse voltage (I pulse = 12.5A)	11.5	to	13.5	kV

MOUNTING POSITION

Any

PRESSURISING

	Min.	Max.	
Waveguide output system	-	45	lb/in^2
		2280	torr.
Input system	8.7		lb/in^2
	450		torr.

PHYSICAL DATA

	lb		kg
Weight of magnetron	4.19		1.90
Weight of magnetron in carton	12.81		5.80

	in	cm
Dimensions of storage carton	7.0 x 9.6 x 11.2	17.8 x 24.4 x 28.45

COOLING

For normal operating conditions, a low velocity air-flow, is sufficient to keep within the maximum temperature limits.

OPERATING NOTES

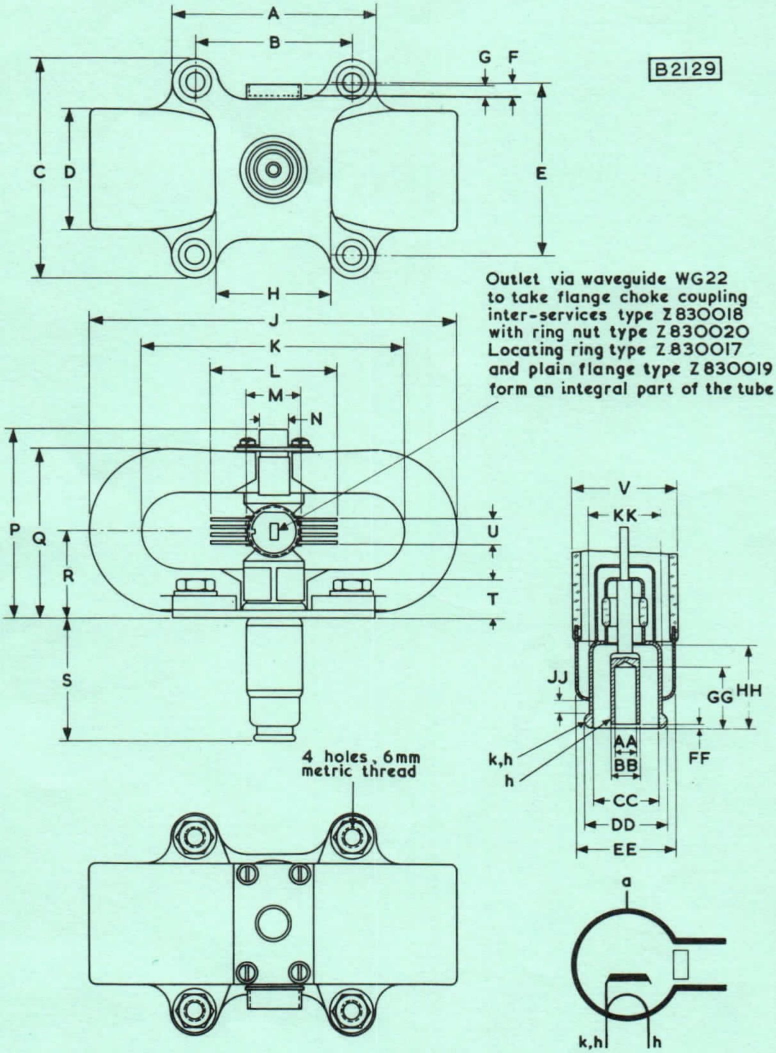
	Min.	Max.	
** Rate of rise of voltage pulse (hard valve modulator) pulse duration > 0.05 μs	200	300	kV/μs
pulse duration = 0.02 μs (at duty factor = 1.0×10^{-4})	-	600	kV/μs

For pulse lengths between 0.05μs and 0.02μs rates of rise between 300 kV/μs and 600 kV/μs can be tolerated, depending on the operating conditions. Prior reference should be made to Mullard Ltd in such instances.

DIMENSIONS

	Inches	Millimetres	
A	3.437	87.3	max.
B	2.531 ± 0.010	64.29 ± 0.25	
C	3.622	92	max.
D	1.937	49.2	max.
E	2.781 ± 0.010	70.64 ± 0.25	
F	0.217 ± 0.039	5.5 ± 1.0	
G	0.189	4.8	max.
H	1.874	47.6	min.
J	5.933	150.7	max.
K	3.819	97	min.
L	2.087	53	max.
M	0.906	23	max.
N	0.512	13	max.
P	3.189	81	max.
Q	2.842	72.2	max.
R	1.402 ± 0.039	35.6 ± 1.0	
S	1.968	50	max.
T	0.650 ± 0.059	16.5 ± 1.5	
U	0.433	11	max.
V	0.906	23	max.
AA	0.169 ± 0.006	4.30 ± 0.15	
BB	0.236 ± 0.004	6.0 ± 0.1	
CC	0.524 ± 0.008	13.3 ± 0.2	
DD	0.665 ± 0.008	16.9 ± 0.2	
EE	0.807	20.5	max.
FF	0.022 ± 0.018	0.55 ± 0.45	
GG	0.492	12.5	min.
HH	0.591	15	min.
JJ	0.079	2.0	min.
KK	0.591 ± 0.008	15.0 ± 0.2	

Inch dimensions derived from original millimetre dimensions.



B2129
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KK
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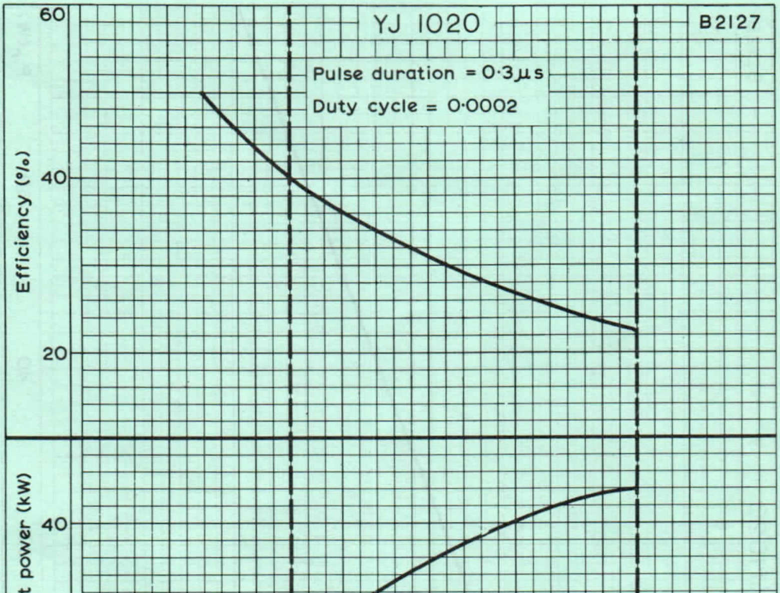
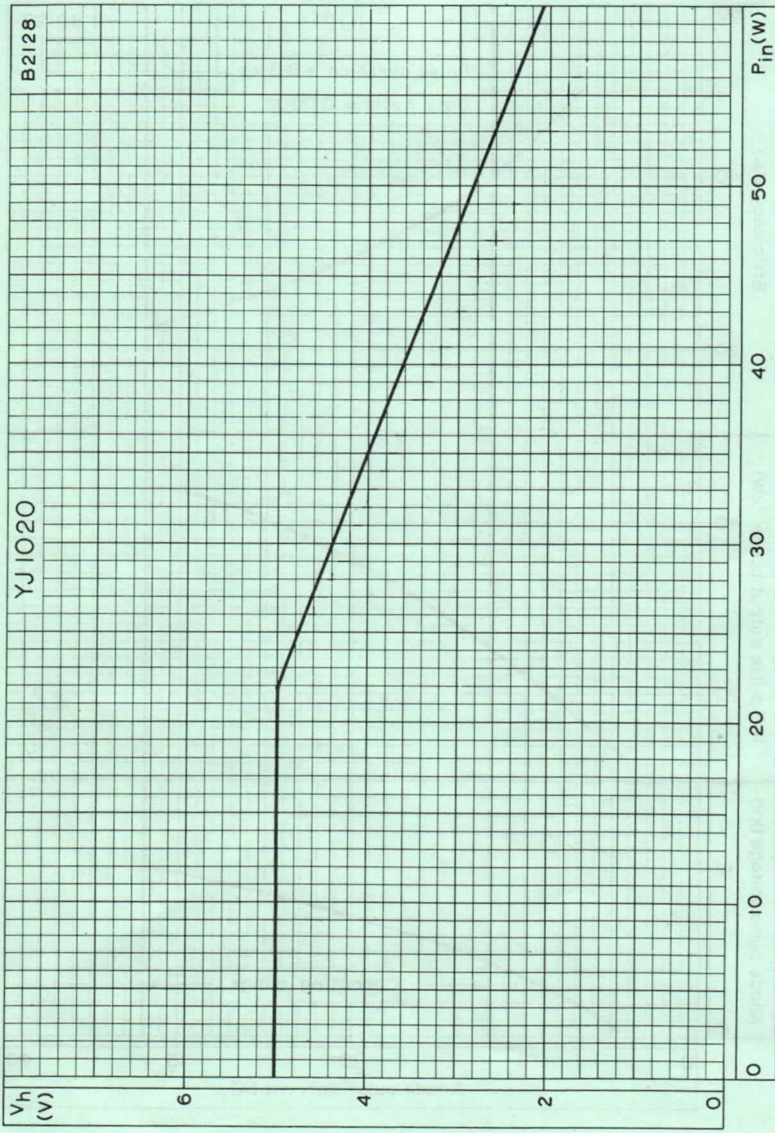
a
Outlet via waveguide WG22 to take flange choke coupling inter-services type Z830018 with ring nut type Z830020 Locating ring type Z830017 and plain flange type Z830019 form an integral part of the tube
4 holes, 6mm metric thread



ANODE PULSE VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT.



HEATER VOLTAGE PLOTTED AGAINST MEAN INPUT POWER.
MEAN INPUT POWER = MEAN INPUT CURRENT x 12,500.

MAGNETRON

YJ1021

QUICK REFERENCE DATA		
Fixed frequency magnetron suitable for use in high-definition short-range radar systems.		
Frequency	33	GHz
Power output (pulsed)	30	kW
Construction	Packaged	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS

R.F. pulse power output	25	30	30	kW
Duty factor	0.0001	0.0002	0.0002	
Pulse duration	0.04	0.1	0.3	μs
Pulse repetition frequency	2500	2000	670	pulse/s
Heater voltage (running)	4.0	3.8	3.8	V
Pulse current	10.5	12.5	12.5	A
Pulse voltage	12.5	12.5	12.5	kV
Pulse input power	131	156	156	kW
Rate of rise of voltage pulse	300	250	250	kV/μs
Mean input current	1.6	2.5	2.5	mA
Mean input power	20	31.3	31.3	W
Mean r.f. output power	2.5	6.0	6.0	W
Frequency pulling (v.s.w.r. = 1.5)	40	40	40	MHz

CATHODE

Indirectly heated

V_h	3.8 to 4.4	V
I_h (at V_h = 4.0V)	2.7 to 4.1	A
I_h (surge) max.	8.0	A
r_h (cold) min.	0.16	Ω
t_{h-k} min.	180	s

For mean input powers greater than 22 watts, it is necessary to reduce the heater voltage immediately after application of h.t. in accordance with the input power-heater voltage rating chart on page 3.

CHARACTERISTICS

	Min.	Max.	
Frequency (fixed within the band)	32.7	33.4	GHz
Pulse voltage (I_{pulse} =12.5A)	11.5	13.5	kV
R.F. pulse power output (I_{pulse} =12.5A)	27.5	-	kW
Frequency pulling (v.s.w.r. =1.5)	-	50	MHz
Frequency temperature coefficient	-	1.0	MHz/degC
Distance of v.s.w. minimum from face of mounting plate into valve	0.58	3.15	mm
Frequency pushing	-	4.0	MHz/A

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Pulse current	6.0	16	A
Pulse duration	-	0.5	μs
Duty factor	-	0.0003	
Mean input power	-	60	W
Rate of rise of voltage pulse <0.1μs	200	400	kV/μs
Rate of rise of voltage pulse ≥0.1μs	-	300	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	

MOUNTING POSITION

Any

PRESSURISING

To prevent arcing the pressure must exceed 450 torr.

PHYSICAL DATA

	kg	lb
Weight of magnetron	1.9	4.2
Weight of magnetron in carton	5.8	12.8
	mm	in
Dimensions of storage carton	178 x 244 x 285	7.0 x 9.6 x 11.2

COOLING

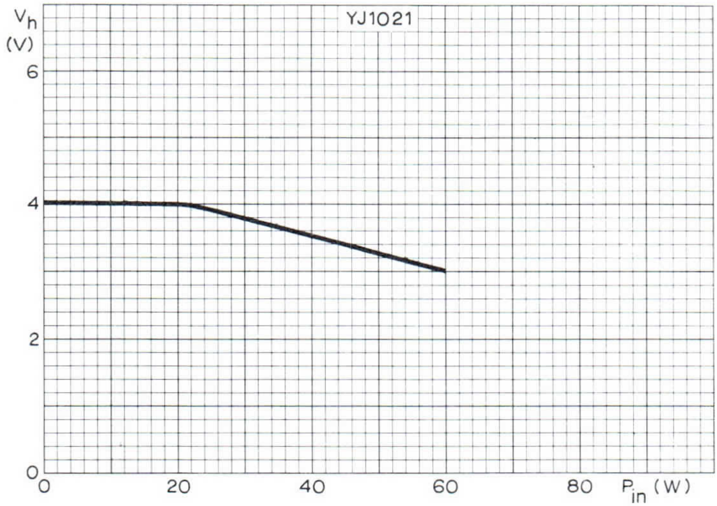
For normal operating conditions no additional cooling of the magnetron will be required to keep the temperature of the anode block and heater seals below the stated maximum ratings.

Temperatures

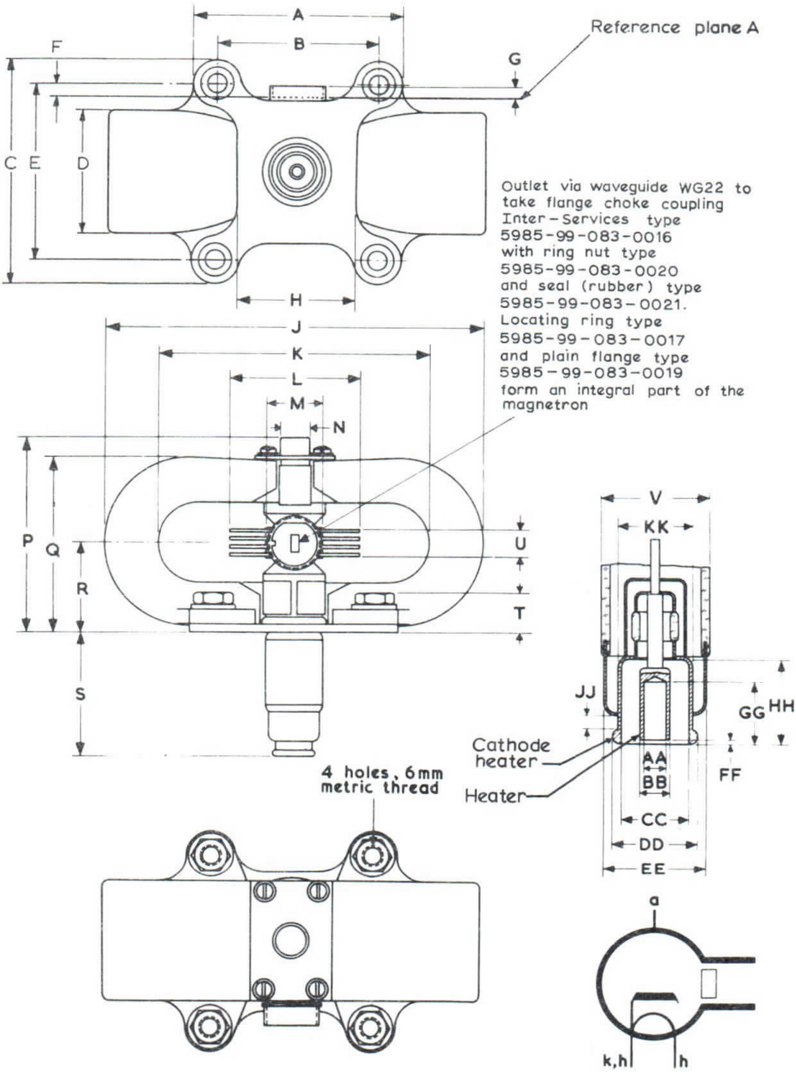
Anode block max. (between 2nd and 3rd fins)	150	°C
Cathode and heater seals max.	150	°C

ACCESSORY

Cathode connector 55356



HEATER VOLTAGE PLOTTED AGAINST MEAN INPUT POWER
MEAN INPUT POWER = MEAN INPUT CURRENT x 12 500 x DUTY FACTOR


Reference plane A
A
B
C
D
E
F
G
H
Outlet via waveguide WG22 to take flange choke coupling Inter-Services type 5985-99-083-0016 with ring nut type 5985-99-083-0020 and seal (rubber) type 5985-99-083-0021. Locating ring type 5985-99-083-0017 and plain flange type 5985-99-083-0019 form an integral part of the magnetron
J
K
L
M
N
P
Q
R
S
T
U
V
KK
JJ
GG
HH
FF
AA
BB
CC
DD
EE
Cathode heater
Heater
4 holes, 6mm metric thread
a
k,h
h

DIMENSIONS

	Millimetres	Inches	
A	87.3	3.437	max.
B	64.29 ± 0.25	2.531 ± 0.010	
C	92	3.622	max.
D	49.2	1.937	max.
E	70.64 ± 0.25	2.781 ± 0.010	
F	5.5 ± 1.0	0.217 ± 0.039	
G	4.8	0.189	max.
H	47.6	1.874	min.
J	150.7	5.933	max.
K	97	3.819	min.
L	53	2.087	max.
M	23	0.906	max.
N	13	0.512	max.
P	81	3.189	max.
Q	72.2	2.842	max.
R	35.6 ± 1.0	1.402 ± 0.039	
S	50	1.968	max.
T	16.5 ± 1.5	0.650 ± 0.059	
U	11	0.433	max.
V	23	0.906	max.
AA	4.30 ± 0.15	0.169 ± 0.006	
BB	6.0 ± 0.1	0.236 ± 0.004	
CC	13.3 ± 0.2	0.524 ± 0.008	
DD	16.9 ± 0.2	0.665 ± 0.008	
EE	20.5	0.807	max.
FF	0.55 ± 0.45	0.022 ± 0.018	
GG	12.5	0.492	min.
HH	15	0.591	min.
JJ	2.0	0.079	min.
KK	15.0 ± 0.2	0.591 ± 0.008	

Inch dimensions derived from original millimetre dimensions.

MAGNETRON

YJ 1021
ON T&I

YJ1030

QUICK REFERENCE DATA

Rugged magnetron with low frequency temperature coefficient, suitable for high altitude operation.

Frequency (Mechanically tunable)	5.65	Gc/s
Power output (pulsed)	120	W
Construction	Packaged, coaxial output	

To be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES.

CHARACTERISTICS

	Min.	Max.	
Frequency			
Tunable over the range	5.4	5.9	Gc/s
Pulse voltage (I pulse = 0.8 A)	1.00	1.35	kV
R.F. pulse power output (I pulse = 0.8 A)	70	-	W
Frequency pulling (v.s.w.r. = 1.5)	-	12	Mc/s
Frequency temperature coefficient	-	-0.1	Mc/s per ^{o}C
Frequency modulation under vibration of 12g (50-2000c/s)	-	2.0	Mc/s
Input capacitance	-	6.0	pF
Frequency pushing	-	15	Mc/s per A

TYPICAL OPERATION

R.F. pulse power output	160	W
Duty factor	0.002	
Pulse duration	1.0	μs
Pulse repetition frequency	2000	p.p.s.
Heater voltage (running)	5.0	V
Pulse current	0.8	A
Pulse voltage	1.2	kV
Pulse input power	944	W
Rate of rise of voltage pulse	6.0	kV/μs
Mean input current	1.6	mA
Mean input power	1.9	W
Mean r.f. output power	320	mW
Frequency pulling (v.s.w.r. = 1.5)	10	Mc/s

CATHODE

Indirectly heated

Vh	5.0	V
Ih	0.5	A

Heating time. At ambient temperatures above 0 °C the cathode must be heated for at least 0.5 minutes before the application of h.t.

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
Pulse current	0.6	1.0	A
Pulse duration	-	3.0	µs
Duty factor	-	0.002	
Mean input power	-	2.5	W
Rate of rise of voltage pulse	-	8.0	kV/µs
Load mismatch (v.s.w.r.)	-	1.5	
Temperature of anode block	-	100	°C

MOUNTING POSITION Any

PHYSICAL DATA

	lb	kg
Weight of magnetron	0.45	0.2
Weight of magnetron in carton	9.0	4.1
	in	cm
Dimensions of storage carton	12.5 x 11.5 x 11.0	318 x 292 x 279

COOLING

In normal circumstances natural cooling is adequate but where the ambient temperature is abnormally high, or where convection cooling is restricted, provision for conduction cooling may be made by a clamp, of non-magnetic material, around the body.

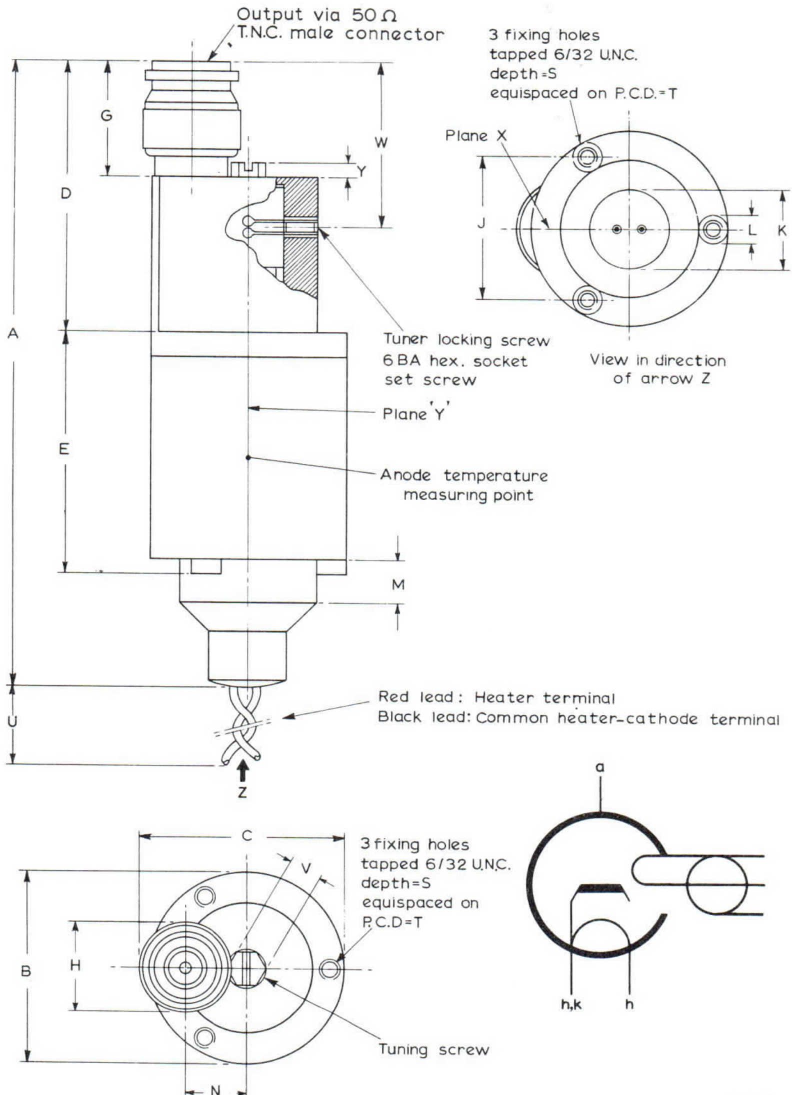
OUTPUT CONNECTION

Output via 50Ω T.N.C. Male Connector

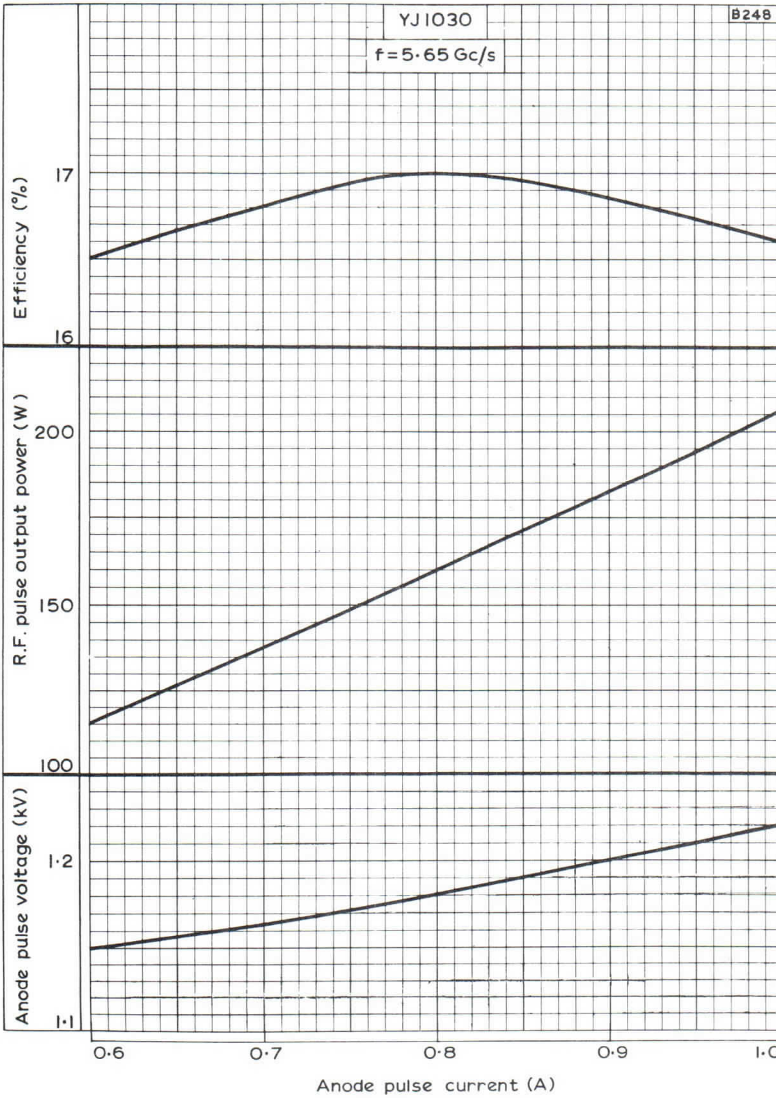
DIMENSIONS

	Inches	Millimetres	
A	4.006 ± 0.069	101.75 ± 1.75	
B	1.270 ± 0.010	32.25 ± 0.25	
C	1.348 ± 0.010	34.25 ± 0.25	
D	1.742 ± 0.030	44.25 ± 0.75	
E	1.545 ± 0.030	39.25 ± 0.75	
G	0.709 ± 0.008	18.0 ± 0.2	
H	0.640	16.25	max.
J	0.876 ± 0.010	22.25 ± 0.25	
K	0.502 ± 0.010	12.75 ± 0.25	
L	0.177 ± 0.004	4.5 ± 0.1	
M	0.295 ± 0.020	7.5 ± 0.5	
N	0.394 ± 0.010	10.00 ± 0.25	
S	0.167 ± 0.010	4.25 ± 0.25	
T	1.06	27.0	
U	8.0	203	min.
V	0.192 ± 0.001	4.875 ± 0.025	
W	1.024 ± 0.016	26.0 ± 0.4	
Y	0.077 ± 0.022	1.95 ± 0.55	

Inch dimensions derived from original millimetre dimensions.



Output via 50 Ω
T.N.C. male connector
3 fixing holes
tapped 6/32 U.N.C.
depth = S
equispaced on P.C.D. = T
Plane X
G
W
Y
D
J
L
K
A
Tuner locking screw
6 BA hex. socket
set screw
View in direction
of arrow Z
Plane 'Y'
E
Anode temperature
measuring point
M
U
Red lead: Heater terminal
Black lead: Common heater-cathode terminal
Z
a
C
V
3 fixing holes
tapped 6/32 U.N.C.
depth = S
equispaced on
P.C.D = T
B
H
h,k
h
Tuning screw
N
9957



ANODE PULSE VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT

TENTATIVE DATA

QUICK REFERENCE DATA

Fixed frequency 'X' band pulsed magnetron.
Suitable for high altitude operation.

Frequency	9.375	Gc/s
Power output (pulsed)	14	kW

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

CHARACTERISTICS

	Min.	Max.	
Frequency			
Fixed within the band	9.345	9.405	Gc/s
Pulse voltage (I_{pulse} = 5.75A)	5.9	6.3	kV
R.F. pulse power output (I_{pulse} = 5.75A)	12.5	-	kW
Frequency pulling (v.s.w.r. = 1.2)	-	15	Mc/s
Frequency temperature coefficient	-	-0.25	Mc/s per deg C
Input capacitance	-	8.0	pF

TYPICAL OPERATION

R.F. pulse power output	14	kW
Duty factor	0.001	
Pulse duration	2.5	μs
Pulse repetition frequency	400	p.p.s.
Heater voltage (running)	6.3	V
Pulse current	5.75	A
Pulse voltage	6.1	kV
Pulse input power	35	kW
Rate of rise of voltage pulse	70	kV/μs
Mean input current	5.75	mA
Mean input power	5.6	W
Mean R.F. output power	2.24	W
Frequency pulling (v.s.w.r. = 1.2)	12	Mc/s

CATHODE

Indirectly heated

V_h	6.3	V
I_h	0.5 to 0.6	A
f_h	400	c/s

Heating time. At ambient temperatures above $0^{\circ}C$ the cathode must be heated for at least 1.5 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 2.0 minutes.

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
Pulse current	5.0	6.5	A
Pulse duration	-	2.5	μs
Duty factor		0.0015	
Mean input power		60	W
Rate of rise of voltage pulse		80	kV/μs
Load mismatch (v.s.w.r.)		1.2	
Temperature of anode block		120	°C

END OF LIFE PERFORMANCE

The valve is deemed to have reached end of life when it falls to satisfy the following:-

R.F. pulse power output (I_{pulse} =5.75A)	10	kW

	Min.	Max.	
Frequency			
Within the band	9.345	9.405	Gc/s
Pulse voltage (I_{pulse} = 5.75A)	5.9	6.5	kV

MOUNTING POSITION

Any

PRESSURISING

The valve is fitted with flying leads and the output waveguide is sealed with a vacuum tight window to allow operation at high altitude without pressurising.

Operation to 60 000 ft can be achieved.

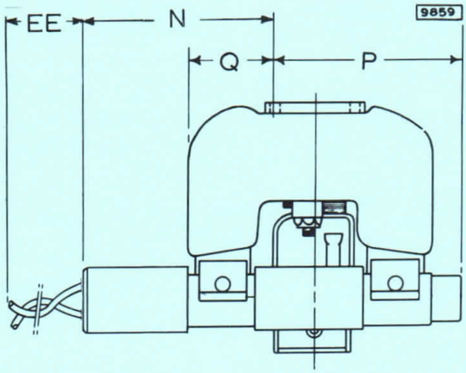
The output window must not be pressurised.

PHYSICAL DATA

	lb	kg
Weight of magnetron	3.75	1.7

COOLING

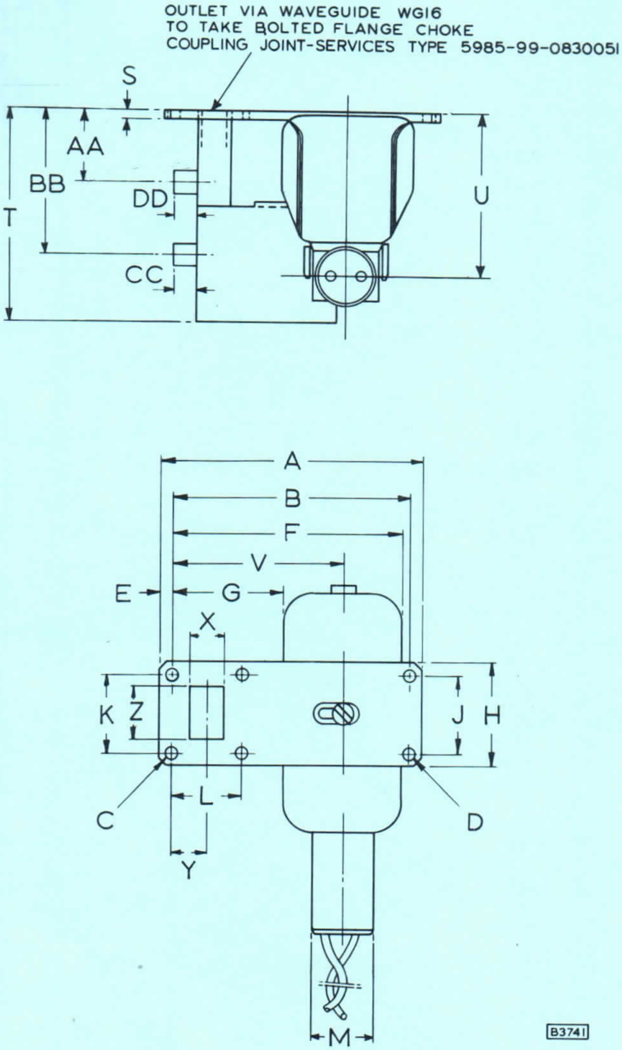
In normal circumstances natural cooling is adequate but where the ambient temperature is abnormally high, or convection cooling is restricted, artificial cooling may be necessary to keep the block temperature below the permitted maximum.



DIMENSIONS

	Inches	Millimetres	
N	3.19	81	max.
P	2.19	55.6	max.
Q	1.19	30.2	max.
EE	6.0	152	min.

Inch dimensions derived from original millimetre dimensions, except dimension "EE".



DIMENSIONS

	Inches	Millimetres	
A	4.47	113.5	
B	4.10 ± 0.004	104.2 ± 0.10	
C	0.17 ± 0.003	4.32 ± 0.08	
D	0.175 ± 0.003	4.45 ± 0.08	
E	0.19	4.8	max.
F	4.0	102	max.
G	1.9	49	min.
H	1.64	41.7	max.
J	1.219 ± 0.003	30.99 ± 0.08	
K	1.219 ± 0.004	30.99 ± 0.10	
L	1.269 ± 0.004	32.51 ± 0.10	
M	1.00	25.4	max.
R	0.25	6.4	max.
S	0.125 ± 0.010	3.18 ± 0.25	
T	3.23	82.6	max.
U	2.4 ± 0.12	64 ± 3.0	
V	3.0 ± 0.12	76 ± 3.0	
X	0.457 ± 0.003	10.16 ± 0.08	
Y	0.640 ± 0.004	16.25 ± 0.10	
Z	0.910 ± 0.004	22.68 ± 0.10	
AA	0.9 ± 0.12	22 ± 3.0	
BB	1.8 ± 0.20	45 ± 5.0	
CC	0.4	10	max.
DD	0.36	9.5	max.

Inch dimensions derived from original millimetre dimensions

MAGNETRON YJ1050

QUICK REFERENCE DATA		
Fixed frequency 'X' band pulsed magnetron. Suitable for high altitude operation.		
Frequency	9.24	GHz
Power output (pulsed)	22	kW
Construction	Packaged, flying leads	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS

R.F. pulse power output	22	kW
Duty factor	0.0004	
Pulse duration	0.5	µs
Pulse repetition frequency	800	p.p.s.
Heater voltage (running)	6.3	V
Pulse current	7.5	A
Pulse voltage	7.5	kV
Pulse input power	56.25	kW
Rate of rise of voltage pulse	60	kV/µs
Mean input current	3.0	mA
Mean input power	22.5	W
Mean r.f. output power	8.8	W
Frequency pulling (v.s.w.r. = 1.2)	12	MHz

CATHODE

Indirectly heated

V_h	6.3	V
I_h	550	mA
Frequency of heater supply	400	Hz

Heating time. At ambient temperatures above 0^{o}C the cathode must be heated for at least 45 seconds before the application of h.t. Below this temperature the heating time must be increased to at least 1.0 minute.

CHARACTERISTICS

	Min.		Max.	
Frequency fixed within the band	9.21	to	9.27	GHz
Pulse voltage (I_{pulse} = 7.5A)	7.0		7.7	kV
R.F. pulse power output (I_{pulse} = 7.5A)	20		-	kW
Frequency pulling (v.s.w.r. = 1.2)	-		15	MHz
Frequency temperature coefficient	-		-0.25	MHz per degC
Frequency pushing	-		1.5	MHz per A

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Pulse current	6.0	9.0	A
Pulse duration	-	1.0	μs
Duty factor	-	0.0015	
Mean input power	-	85	W
Rate of rise of voltage pulse	-	100	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	

END OF LIFE PERFORMANCE

The valve is deemed to have reached end of life when it fails to satisfy the following:-

	Min.		Max.	
R.F. pulse power output (I_{pulse} = 7.5A)			16	kW
Frequency fixed within the band	9.21	to	9.27	GHz
Pulse voltage (I_{pulse} = 7.5A)	7.0	to	7.9	kV

MOUNTING POSITION

Any

PRESSURISING

To meet the reduced atmospheric pressure during high altitude operation the output waveguide is sealed with a vacuum tight window. Operation up to 60 000ft is offered provided a choke coupling is used but on no account is pressurisation of the output window permitted. A protective cover for the window is supplied.

PHYSICAL DATA

Weight of magnetron	1.2	kg
Weight of magnetron in carton	2.3	kg
Dimensions of storage carton	19.7×20.3×24.8	cm

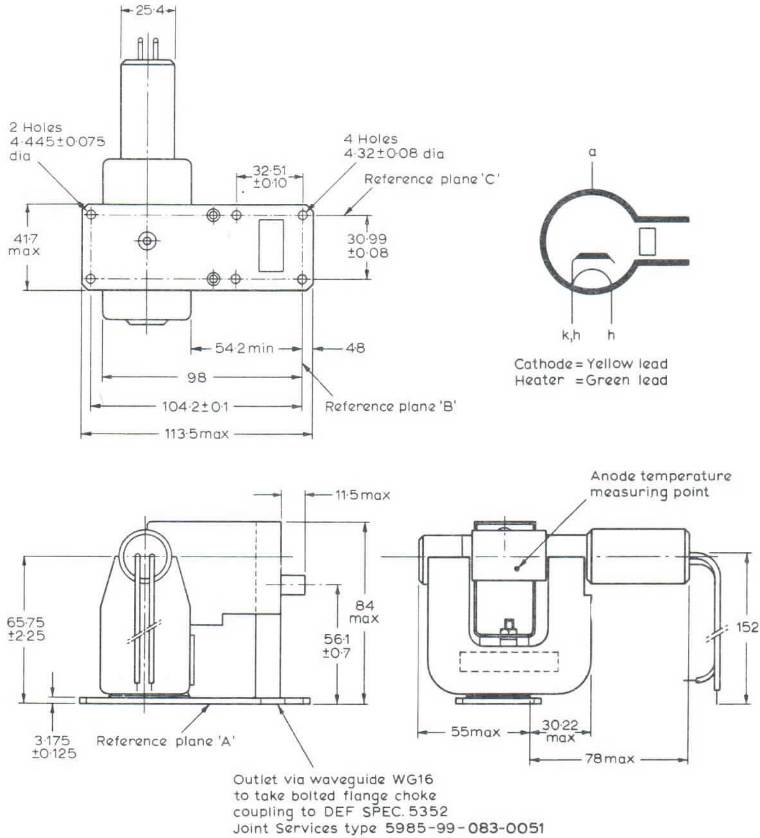
COOLING

In normal circumstances natural cooling is adequate, but where the ambient temperature is abnormally high, or convection cooling is restricted, artifical cooling may be necessary to keep the block temperature below the permitted maximum.

Temperature

Anode block max.	120	^{o}C

OUTLINE DRAWING OF YJ1050

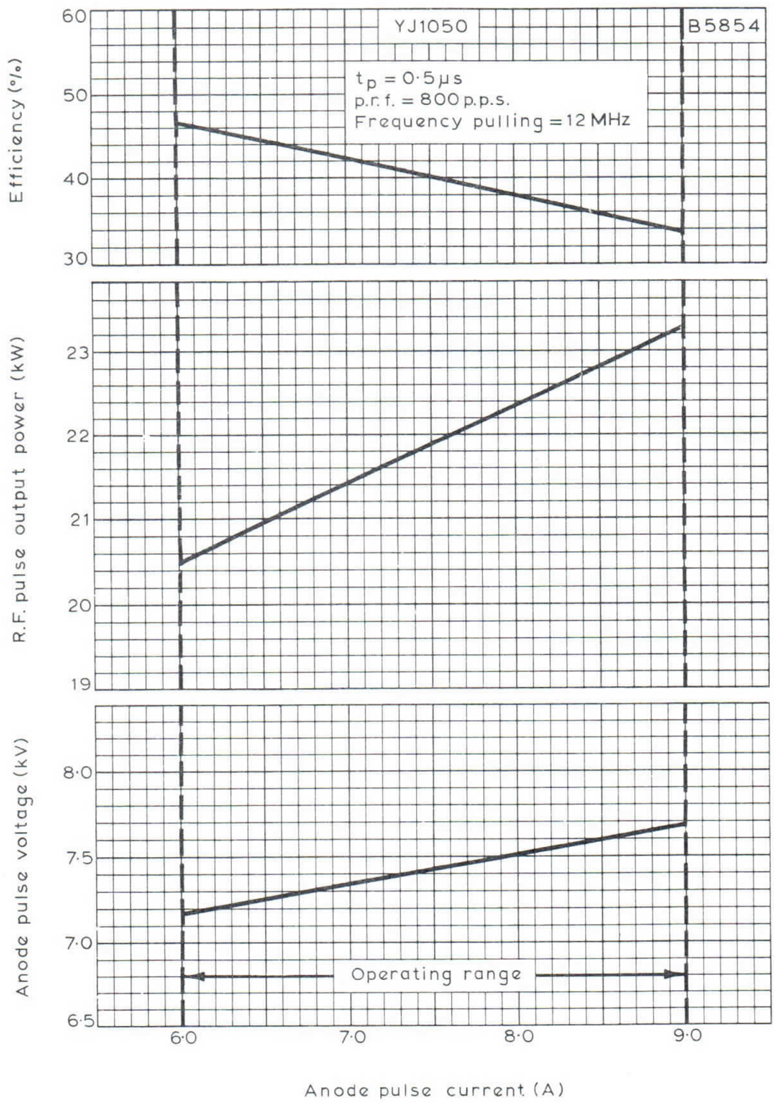


All dimensions in mm

B5851

DIMENSIONS

Millimetres	Inches		Millimetres	Inches	
152	5.98		41.7	1.641	max.
113.5	4.468	max.	32.51 ±0.10	1.280±0.004	
104.2 ±0.1	4.102±0.004		30.99 ±0.08	1.220±0.003	
98	3.86		30.22	1.189	max.
84	3.30	max.	25.4	1.000	
78	3.07		11.5	0.452	max.
65.75±2.25	2.588±0.088		4.8	0.189	
56.1 ±0.7	2.209±0.027		4.445±0.075	0.175±0.003	dia.
55	2.16	max.	4.32 ±0.08	0.170±0.003	dia.
54.2	2.134	min.	3.175±0.125	0.125±0.005	



ANODE PULSE VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT

MAGNETRON

YJ1060

PRELIMINARY DATA

QUICK REFERENCE DATA

Fixed frequency 'X' band pulsed magnetron. Suitable for high altitude operation.

Frequency	9.375	Gc/s
Power output (pulsed)	20	kW

To be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES.

CHARACTERISTICS

	Min.	Max.	
Frequency			
Fixed within the band	9.345	9.405	Gc/s
Pulse voltage (I pulse = 7.5 A)	6.4	7.4	kV
R.F. pulse power output (I pulse = 7.5 A)	18	-	kW
Frequency pulling (v.s.w.r. = 1.5)	-	15	Mc/s
Frequency temperature coefficient	-	-0.25	Mc/s per °C
Input capacitance	-	8.0	pF

TYPICAL OPERATION

R.F. pulse power output	20	20	kW
Duty factor	0.0007	0.001	
Pulse duration	1.8	2.5	µs
Pulse repetition frequency	400	400	p.p.s.
Heater voltage (running)	5.4	4.6	V
Pulse current	7.5	7.5	A
Pulse voltage	7.2	7.2	kV
Pulse input power	54	54	kW
Rate of rise of voltage pulse	50	50	kV/µs
Mean input current	5.3	7.5	mA
Mean input power	38	54	W
Mean r.f. output power	14	20	W
Frequency pulling (v.s.w.r. = 1.5)	14	14	Mc/s

CATHODE

Indirectly heated

Vh	6.3	V
Ih	0.55	A

Heating time. At ambient temperatures above 0 °C the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

For mean input powers greater than 25 watts, it is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power-heater voltage rating chart on page C1.

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
Pulse current	5.0	8.0	A
Pulse duration	-	2.5	μs
Duty factor	-	0.002	
Mean input power	-	80	W
Rate of rise of voltage pulse	-	60	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	
Temperature of anode block	-	120	°C

MOUNTING POSITION

Any

PRESSURISING

The valve is fitted with flying leads and the output waveguide is sealed with a vacuum tight window to allow operation at high altitude without pressurising. Operation to 60,000 ft can be achieved.

PHYSICAL DATA

	lb	kg
Weight of magnetron	3.25	1.5
Weight of magnetron in carton	5.5	2.5

	in	mm
Dimensions of storage carton	7.75 x 8.0 x 9.75	197 x 203 x 248

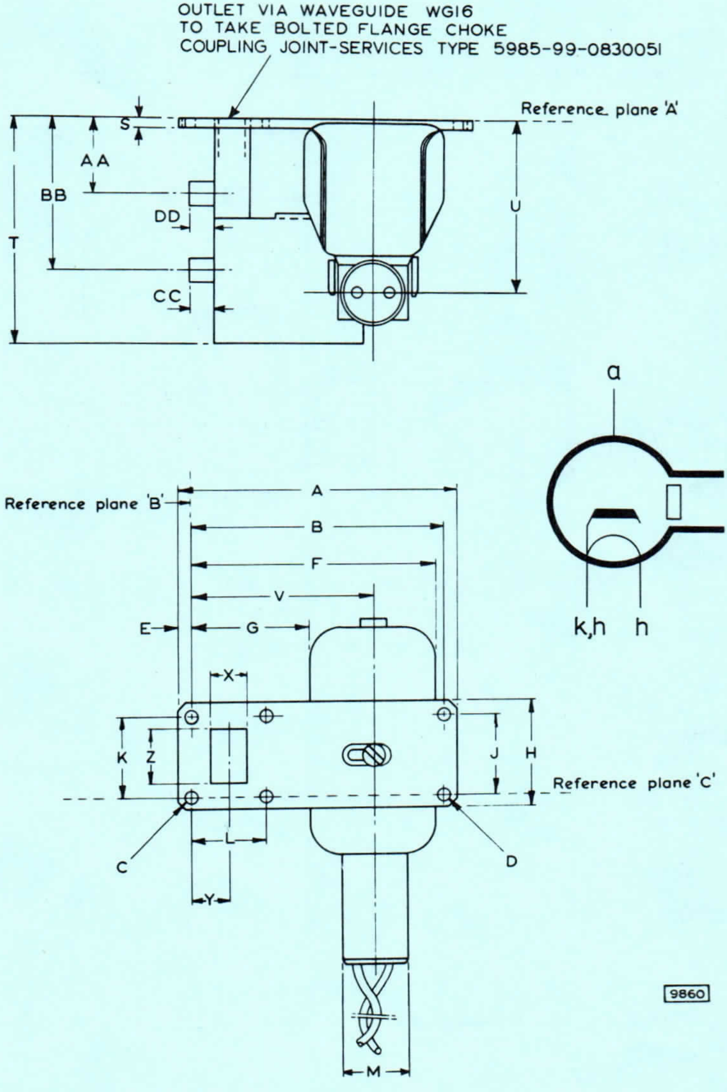
COOLING

In normal circumstances natural cooling is adequate, but where the ambient temperature is abnormally high, or convection cooling is restricted artificial cooling may be necessary to keep the block temperature below the permitted maximum

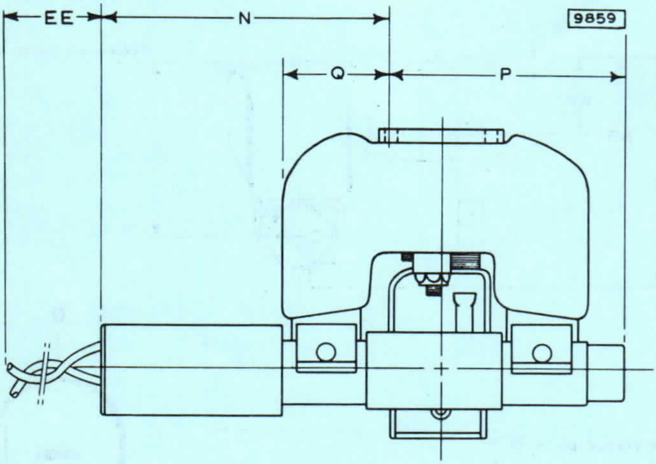
DIMENSIONS

	Inches	Millimetres	
A	4.47	113.5	max
B	4.103 ± 0.004	104.2 ± 0.1	
C	0.17 ± 0.003	4.32 ± 0.08	
D	0.175 ± 0.003	4.45 ± 0.08	
E	0.19	4.8	max
F	4.0	102	max
G	1.93	49	min
H	1.64	41.7	max
J	1.22 ± 0.003	30.99 ± 0.08	
K	1.22 ± 0.004	30.99 ± 0.1	
L	1.28 ± 0.004	32.51 ± 0.1	
M	1.0	25.4	max.
S	0.125 ± 0.01	3.18 ± 0.25	
T	3.25	82.6	max
U	2.52 ± 0.118	64 ± 3	
V	3.0 ± 0.118	76 ± 3	
X	0.400 ± 0.003	10.16 ± 0.08	
Y	0.640 ± 0.004	16.25 ± 0.10	
Z	0.900 ± 0.004	22.86 ± 0.10	
AA	0.88 ± 0.118	22 ± 3	
BB	1.8 ± 0.197	53 ± 5	
CC	0.39	10	max
DD	0.38	9.5	max

Inch dimensions are derived from the original millimetre dimensions



ANODE CONNECTION TERMINATED AT THE BASE PLATE

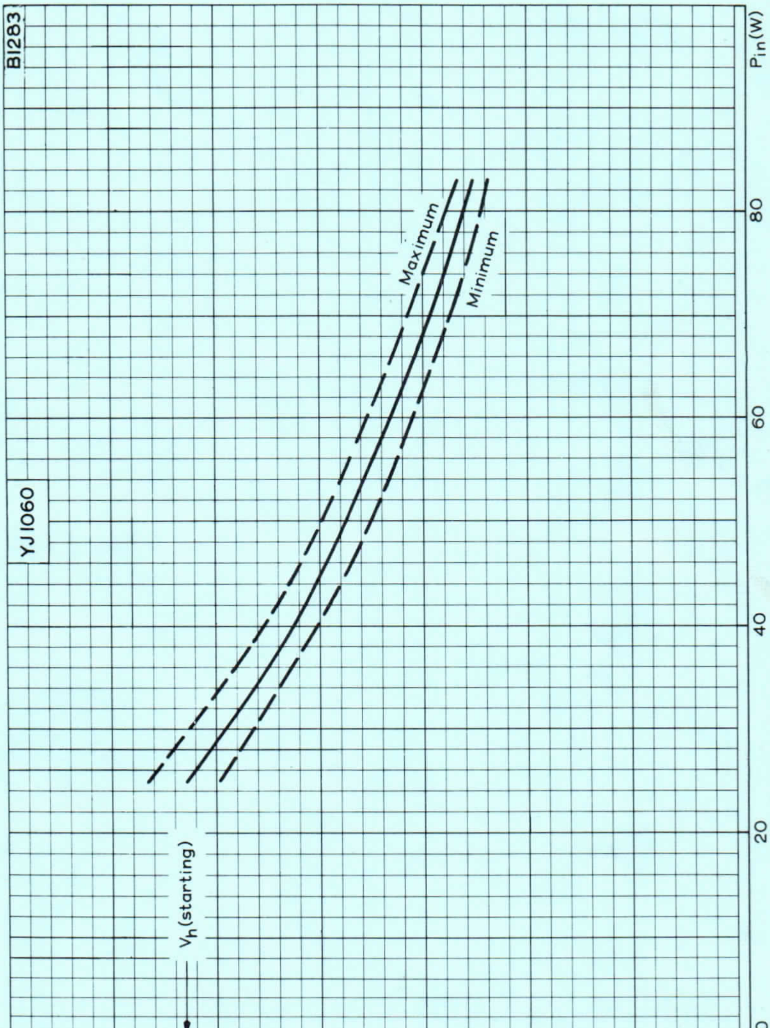


COMMON HEATER/CATHODE LEAD IDENTIFIED BY A SLEEVE

DIMENSIONS

	Inches	Millimetres	
N	3.19	81	max
P	2.19	55.6	max
Q	1.19	30.2	max
EE	6.0	152	

Inch dimensions are derived from the original millimetre dimensions



HEATER VOLTAGE PLOTTED AGAINST INPUT POWER

QUICK REFERENCE DATA		
Fixed frequency 'X' band magnetron		
Frequency	9.41	Gc/s
Power output (pulsed)	10.5	kW
Construction	Packaged, flying leads	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

CHARACTERISTICS

	Min.	Max.	
Frequency fixed within the band	9.38	9.44	Gc/s
Pulse voltage (I_{pulse} = 6.0A)	5.5	5.9	kV
R.F. pulse power output (I_{pulse} = 6.0A)	9.0	-	kW
Frequency pulling (v.s.w.r. = 1.5)	-	15	Mc/s
Frequency temperature coefficient	-	-0.25	Mc/s per degC
Distance of v.s.w. minimum from face of mounting plate into valve	16.5	22.5	mm
Frequency pushing	-	2.0	Mc/s per A

OPERATING CONDITIONS

	Min.	Max.	
R.F. pulse power output	10.5	10.5	kW
Duty factor	0.0001	0.0005	
Pulse duration	0.1	0.5	μs
Pulse repetition frequency	1000	1000	p.p.s.
Heater voltage (running)	6.3	6.3	V
Pulse current	6.0	6.0	A
Pulse voltage	5.7	5.7	kV
Pulse input power	34.8	34.8	kW
Rate of rise of voltage pulse	110	100	kV/μs
Mean input current	0.65*	3.0	mA
Mean input power	3.48	17.4	W
Mean r.f. output power	1.1	5.5	W
Frequency pulling (v.s.w.r. = 1.5)	14	14	Mc/s

*This includes pre-oscillation current.

CATHODE

Indirectly heated

V_h	6.3	V
I_h	0.55	A

Heating time

At ambient temperatures above $0^{\circ}C$ the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.
For mean input powers greater than 25 watts, it is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power-heater voltage rating chart on page C2.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Pulse current	4.5	7.0	A
Pulse duration	-	1.0	μs
Duty factor	-	0.002	
Mean input power	-	85	W
Rate of rise of voltage pulse	-	120	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	
Temperature of anode block	-	120	$^{\circ}C$

END OF LIFE PERFORMANCE

The valve is deemed to have reached end of life when it fails to satisfy the following:

	Min.		Max.	
R.F. pulse power output (I_{pulse} = 6.0A)	7.0			kW
Frequency fixed within the band	9.38	to	9.44	Gc/s
Pulse voltage (I_{pulse} = 6.0A)	5.5	to	6.0	kV

MOUNTING POSITION

Any

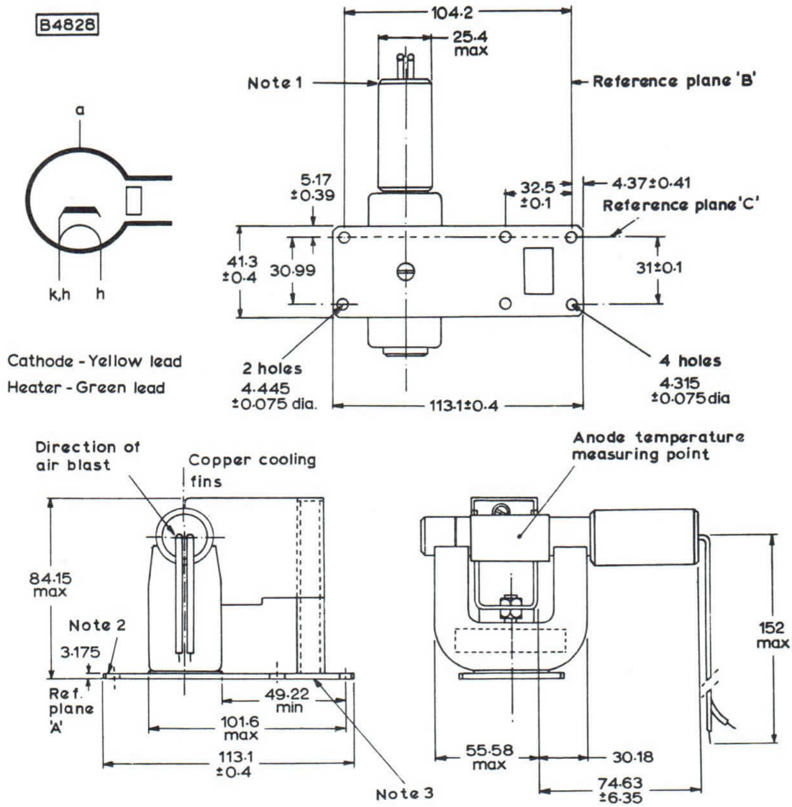
PHYSICAL DATA

	lb	kg
Weight of magnetron	3.0	1.4
Weight of magnetron in carton	5.7	2.5

	in	cm
Dimensions of storage carton	7.75 × 8.0 × 9.75	20 × 21 × 25

COOLING

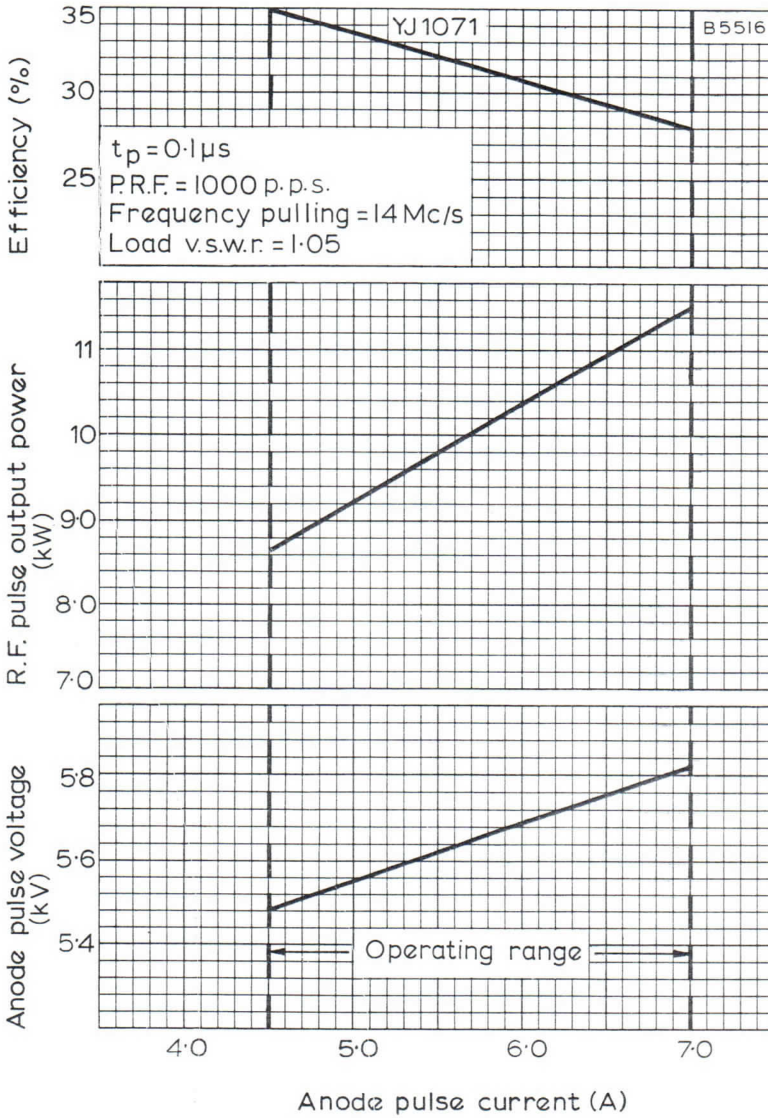
In normal circumstances natural cooling is adequate, but when the ambient temperature is abnormally high a flow of cooling air between the cooling fins may be necessary to keep the anode block temperature below the permitted maximum.



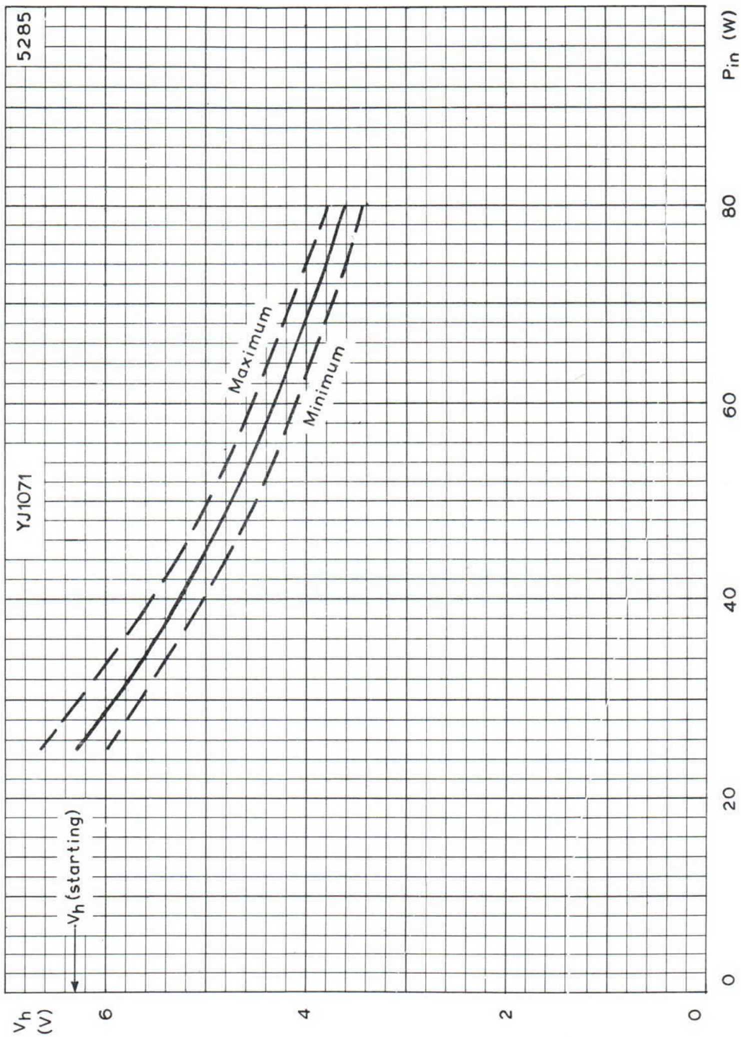
All dimensions in mm

NOTES

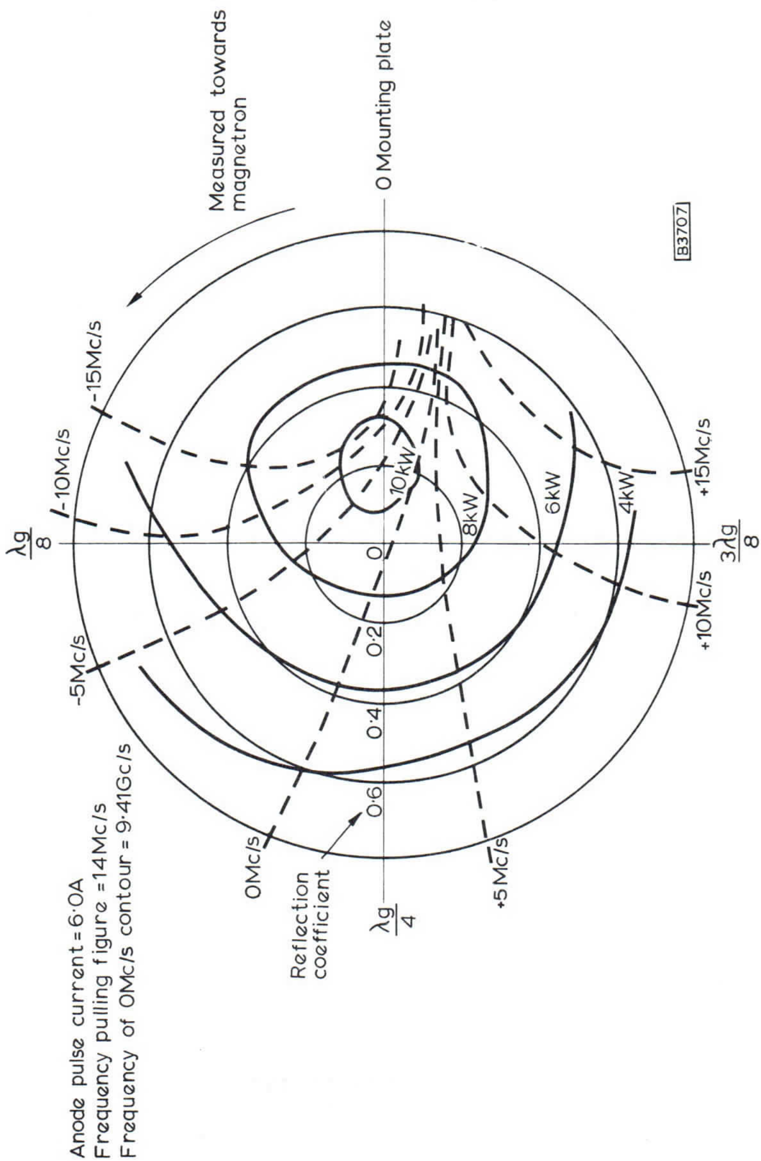
1. The protector sleeve shall be within 5^{0} of a normal to reference plane C.
2. A cylinder 0.33in (8.38mm) diameter centred in the holes shown shall clear the side of the magnet.
3. The outlet via the waveguide WG16 is to take a bolted flange choke coupling, Joint Services type 5985-99-0830051.



ANODE PULSE VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT



HEATER VOLTAGE PLOTTED AGAINST INPUT POWER



RIEKE DIAGRAM

DEVELOPMENT SAMPLE DATA

QUICK REFERENCE DATA

Quick heating magnetrons for microwave heating applications
The YJ1080 is water cooled.
The YJ1082 is forced-air cooled.

Frequency	2.45	Gc/s
Power output (c.w.)	2.5	kW
Minimum delay before applying H.T.	10	s
Construction	Packaged, Ceramic and Metal	

Unless otherwise shown, data is applicable to both types

To be read in conjunction with

GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

CHARACTERISTICS

Measured at I_a = 800mA with v.s.w.r. = 2.5 in "phase of sync."*

	Min.		Max.	
Frequency fixed within the band	2.425	to	2.475	Gc/s
Operating voltage range (d.c.) within the range	4.7	to	5.2	kV

*"phase of sync" is at the following distance from the reference plane (see drawings)

YJ1080	0.345λ
YJ1082	0.255λ

OPERATION FROM SINGLE-PHASE FULL-WAVE RECTIFIER WITHOUT SMOOTHING FILTER

Operating conditions

The dynamic impedance of the power supply must be such that the given i_a (pk) max. is not exceeded.

Filament current (running)	25	A
Mean anode current	800	mA
Peak anode current	2.0	A
Load mismatch (v.s.w.r.)	2.5	
P_{out} (v.s.w.r. 2.5 in phase of sync.)	2.5	kW

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

		Min.	Max.	
Filament current		-	60	A
Mean anode current		300	850	mA
Peak anode current		-	2.1	A
Load mismatch (v.s.w.r.)				
in the region ±0.1λ about phase of sync		-	3.0	
instantaneous value*		-	10	
in the remaining region		-	2.5	
Temperature of the ceramic-metal seals		-	250	°C
Temperature of the anode block	YJ1080	-	150	°C
	YJ1082	-	180	°C

*max. duration 20ms, max. duty ratio 0.2. Moding must be avoided by the use of an appropriate coupling system.

CATHODE

Directly heated thoriated tungsten mesh

*I_f (starting)		54	A
V_f (starting)	approx.	3.5	V
I_f (surge) max.		140	A
r_f (cold)		0.008	Ω
Minimum delay before applying H.T.		10	s

*Temporary fluctuations not exceeding +3 and -6% of the nominal value of the heater current are permissible.

OUTPUT CONNECTION

50Ω. 1 5/8 in. coaxial transmission line.

COOLING (YJ1080)

Water cooled (see curve on page C1)

A plate is provided for mounting a thermal switch to protect the valve in the event of water failure. This switch must operate at a temperature not higher than 150°C.

COOLING (YJ1082)

Forced-air cooled		
Maximum air inlet temperature	40	°C
Minimum air flow 1.8m^3/min (64ft^3/min) at a pressure of 30mm (1.2in.) water		

A plate is provided for mounting a thermal switch to protect the valve in the event of failure of the cooling air. This switch must operate at a temperature not higher than 180°C.

MOUNTING POSITION Any

In equipment, the following minimum distances should be maintained between the magnet and magnetic materials.

(see outline drawing).

directions a and d	40	mm
directions b and c	110	mm

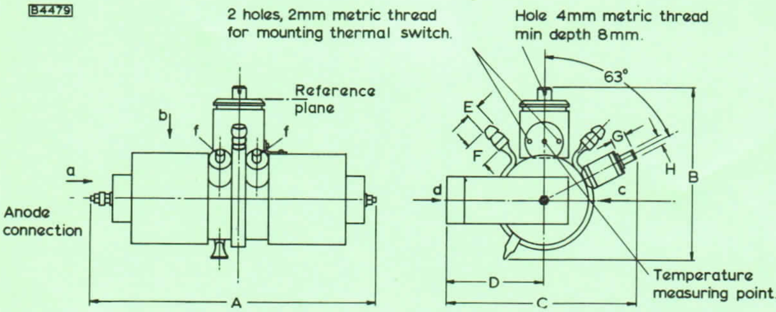
PHYSICAL DATA

	lb	kg
Weight of magnetron YJ1080	11.0	5.0
YJ1082	15.4	7.0

ACCESSORIES

Cap nut	55312
Spring ring	55313
Filament terminal cooling clip	40634

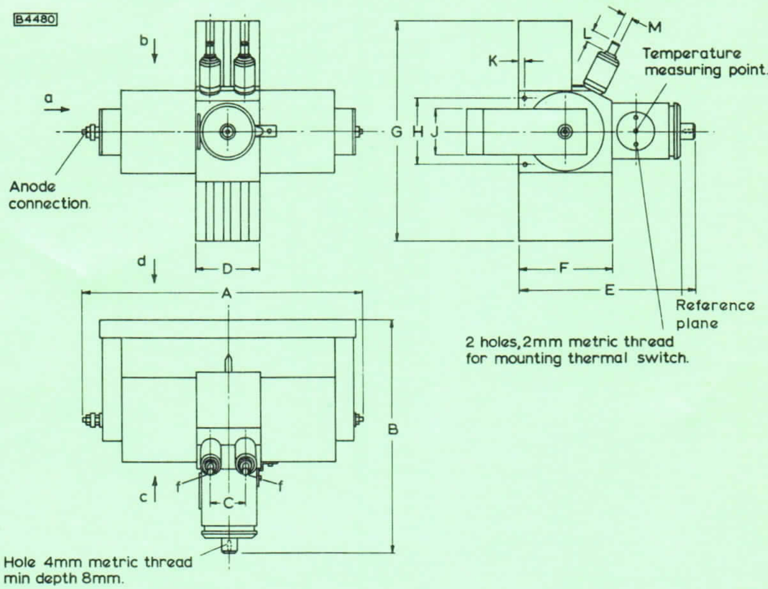
OUTLINE AND DIMENSIONS YJ1080



	Inches	Millimetres	
A	9.37	238	max.
B	5.91	150	
C	6.57	167	max.
D	3.25	82.5	
E	0.49	12.5	
F	0.79	20	
G	0.51	13	
H	0.35	9.0	

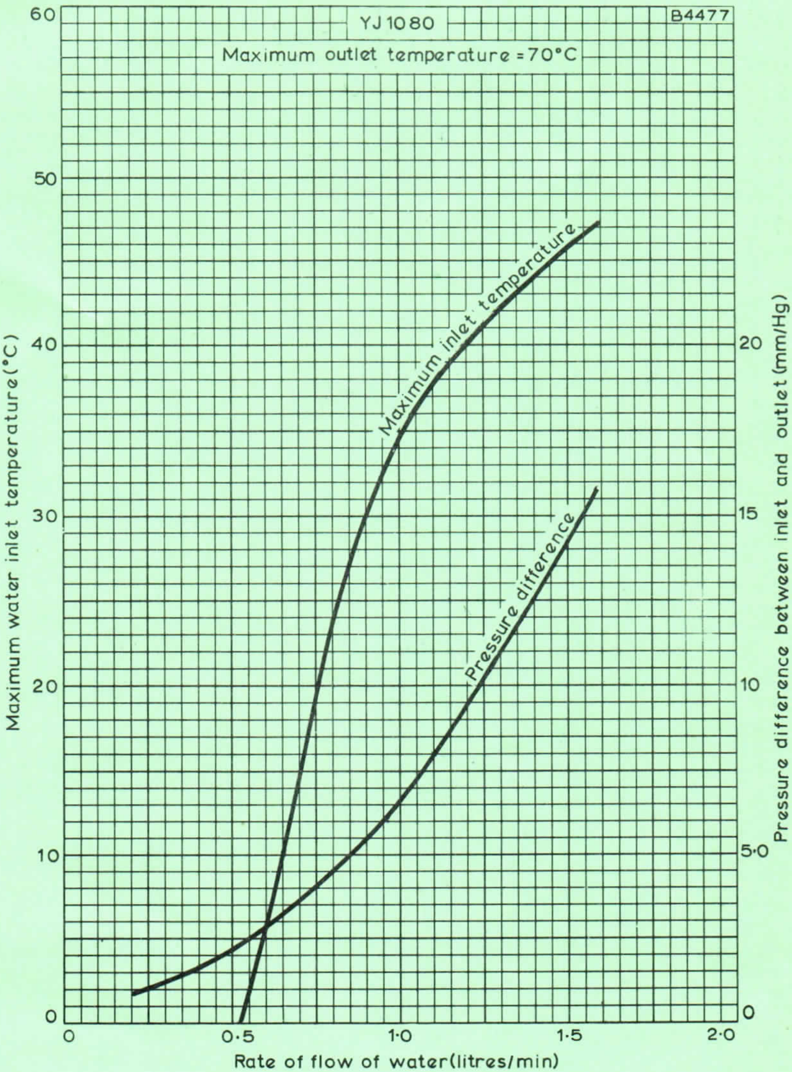
Inch dimensions derived from original millimetre dimensions

OUTLINE AND DIMENSIONS YJ1082

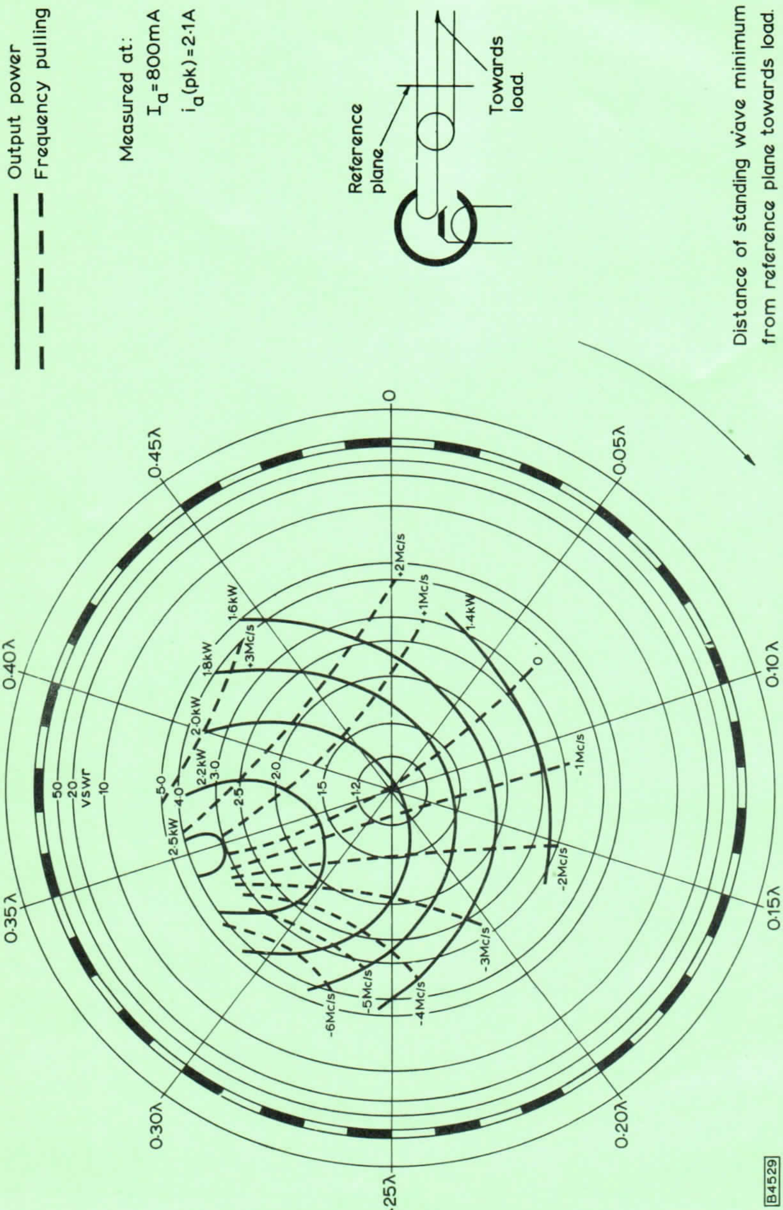


	Inches	Millimetres	
A	9.44	240	max.
B	7.87	200	max.
C	1.18	30	
D	2.20	56	max.
E	5.98	152	max.
F	3.22	82	max.
G	7.55	192	max.
H	5.51	40	
J	2.36	60	
K	0.20	5	
L	0.52	13.2	
M	0.35	9	

Inch dimensions derived from original millimetre dimensions



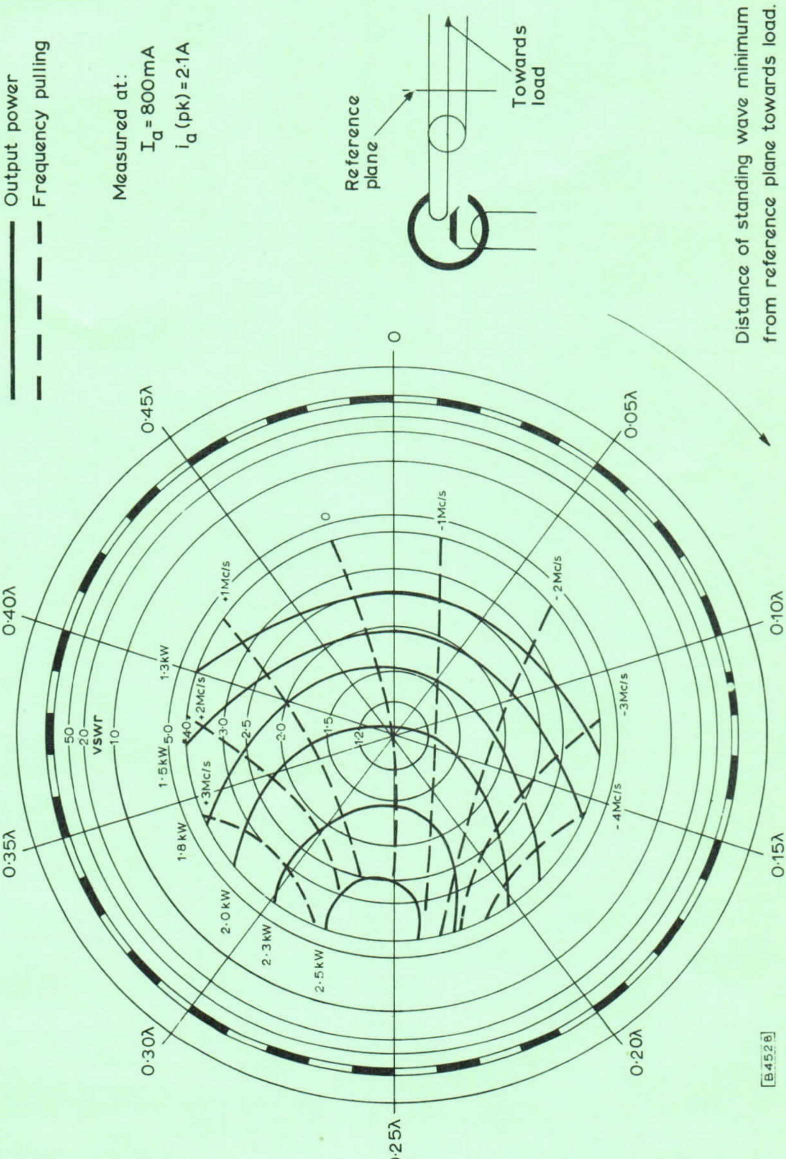
COOLING CURVES FOR YJ1080



RIEKE DIAGRAM - YJ1080

QUICK HEATING MAGNETRONS

YJ1080
YJ1082



RIEKE DIAGRAM - YJ1082

MAGNETRON

YJ1090
YJ1091

TENTATIVE DATA

QUICK REFERENCE DATA

Mechanically tunable rugged magnetron with low frequency temperature coefficient and pulling figure. Suitable for high altitude operation.

Frequency	YJ1090	9.0 to 9.5	Gc/s
	YJ1091	8.5 to 9.0	Gc/s
Power output (pulsed)		50	W

To be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS-MICROWAVE DEVICES.

Unless otherwise shown data is applicable to both types.

CHARACTERISTICS

		Min.	Max.	
Frequency	YJ1090	9.0	9.5	Gc/s
Tunable over the range	YJ1091	8.5	9.0	Gc/s
Pulse voltage (I pulse = 0.9 A)		1.025	1.350	kV
R.F. pulse power output (I pulse = 0.9 A)		30	-	W
Frequency pulling (v.s.w.r. = 1.5)		-	3.0	Mc/s
Frequency temperature coefficient over the range T anode 60 to 100°C		-	0.1	Mc/s per $^{\circ}$C
Frequency modulation under vibration of 12g (50-2000c/s)			3.0	Mc/s
Input capacitance		-	6.0	pF
Frequency pushing (I pulse = 0.9 A)		-	25	kc/s per mA

TYPICAL OPERATION at f = 9.25Gc/s (YJ1090) and f = 8.75Gc/s (YJ1091)

R.F. pulse power output	50	W
Duty factor	0.002	
Pulse duration	1.0	μs
Pulse repetition frequency	2000	p.p.s.
Heater voltage (running)	5.0	V
Pulse current	0.9	A
Pulse voltage	1.18	kV
Pulse input power	1.06	kW
Rate of rise of voltage pulse	8.0	kV/μs
Mean input current	1.8	mA
Mean input power	2.12	W
Mean r.f. output power	100	mW
Frequency pulling (v.s.w.r. = 1.5)	1.9	Mc/s
Frequency pushing	10	kc/s per mA

CATHODE

Indirectly heated

Vh	5.0	V
Ih	0.5	A

Heating time. At ambient temperatures above $0^{o}C$ the cathode must be heated for at least 0.5 minute before the application of h.t.

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
Pulse current	0.7	1.1	A
Pulse duration	-	2.0	μs
Duty factor	-	0.004	
Mean input power	-	6.0	W
Rate of rise of voltage pulse	-	10.0	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	
Temperature of anode block	-	100	^{o}C

END OF LIFE PERFORMANCE

The valve is deemed to have reached end of life when it fails to satisfy the following:-

R.F. pulse power output (I pulse = 0.9 A) 20 W

		Min.		Max.	
Over the frequency band	YJ1090	9.0	to	9.5	Gc/s
	YJ1091	8.5	to	9.0	Gc/s
Pulse voltage (I pulse = 0.9 A)		1.025	to	1.350	kV

MOUNTING POSITION

Any

COOLING

In normal circumstances natural cooling is adequate but where the ambient temperature is abnormally high, or where convection cooling is restricted, provision for conduction cooling may be made by a clamp, of non magnetic material, around the body.

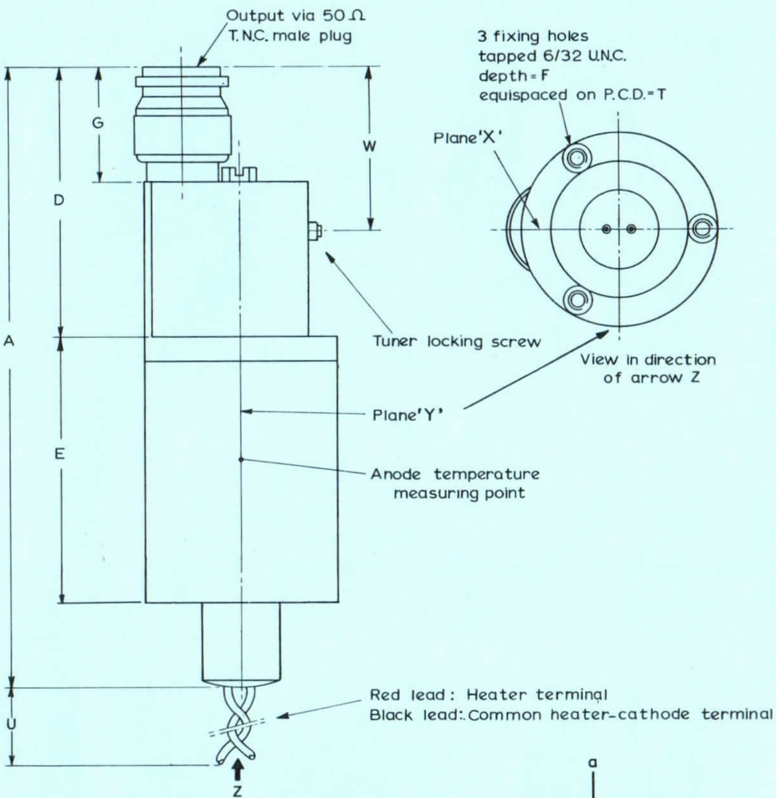
OPERATING NOTE

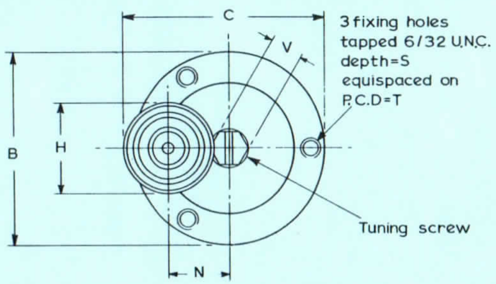
Adjustment of the tuning mechanism beyond the stated frequency limits must not be attempted.

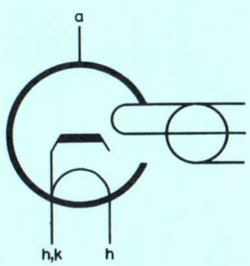
PHYSICAL DATA

	lb	kg
Weight of magnetron	0.5	0.23

YJ1090
YJ1091







B2165

DIMENSIONS

	Inches	Millimetres
A	4.006 ± 0.069	101.75 ± 1.75
B	1.270 ± 0.010	32.25 ± 0.25
C	1.348 ± 0.010	34.25 ± 0.25
D	1.742 ± 0.030	44.25 ± 0.75
E	1.644 ± 0.014	41.75 ± 0.35
F	0.207 ± 0.010	5.25 ± 0.25
G	0.709 ± 0.008	18 ± 0.2
H	0.640	16.25 max.
N	0.394 ± 0.010	10.0 ± 0.25
S	0.167 ± 0.010	4.25 ± 0.25
T	1.063	27.0
U	8.0	203 min.
V	0.192 ± 0.001	4.875 ± 0.025
W	1.024 ± 0.016	26 ± 0.4

Inch dimensions derived from original millimetre dimensions.

TENTATIVE DATA

QUICK REFERENCE DATA

Mechanically tunable rugged magnetron with low frequency temperature coefficient, suitable for high altitude operation.

Frequency	YJ1100	9.0 to 9.5	Gc/s
	YJ1101	8.5 to 9.0	Gc/s
Power output (pulsed)		180	W

To be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS-MICROWAVE DEVICES.
Unless otherwise shown data is applicable to both types.

CHARACTERISTICS

	Min.	Max.	
Frequency YJ1100	9.0	9.5	Gc/s
Tunable over the range YJ1101	8.5	9.0	Gc/s
Pulse voltage (I pulse = 0.9 A)	1.025	1.350	kV
R.F. pulse power output (I pulse = 0.9 A)	150	-	W
Frequency pulling (v.s.w.r. = 1.5)	-	15	Mc/s
Frequency temperature coefficient over the range T anode 60 to 100 °C	-	0.1	Mc/s per °C
Frequency modulation under vibration of 12g (50-2000c/s)	-	3.0	Mc/s
Input capacitance		6.0	pF
Frequency pushing (I_{pulse} = 0.9 A)	-	25	kc/s per mA

TYPICAL OPERATION at f = 9.25Gc/s (YJ1100) and f = 8.75Gc/s (YJ1101)

R.F. pulse power output	180	W
Duty factor	0.002	
Pulse duration	1.0	µs
Pulse repetition frequency	2000	p.p.s.
Heater voltage (running)	5.0	V
Pulse current	0.9	A
Pulse voltage	1.18	kV
Pulse input power	1.06	kW
Rate of rise of voltage pulse	10	kV/µs
Mean input current	1.8	mA
Mean input power	2.12	W
Mean r.f. output power	0.36	W
Frequency pulling (v.s.w.r. = 1.5)	10	Mc/s
Frequency pushing	10	kc/s per mA

CATHODE

Indirectly heated

Vh	5.0	V
Ih	0.5	A

Heating time. At ambient temperatures above $0^{o}C$ the cathode must be heated for at least 30 seconds before the application of h.t.

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
Pulse current	0.7	1.1	A
Pulse duration	-	2.0	μs
Duty factor	-	0.004	
Mean input power	-	6.0	W
Rate of rise of voltage pulse	-	12	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	
Temperature of anode block	-	100	^{o}C

END OF LIFE PERFORMANCE

The valve is deemed to have reached end of life when it fails to satisfy the following:-

R.F. pulse power output (I pulse = 0.9 A)	120	W

Pulse voltage (I pulse = 0.9A)	1.025	to	1.350	kV

MOUNTING POSITION

Any

PHYSICAL DATA

	lb	kg
Weight of magnetron	0.5	0.23

COOLING

In normal circumstances natural cooling is adequate but where the ambient temperature is abnormally high, or where convection cooling is restricted, provision for conduction cooling may be made by a clamp, of non-magnetic material, around the body.

OPERATING NOTE

Adjustment of the tuning mechanism beyond the stated frequency limits must not be attempted.

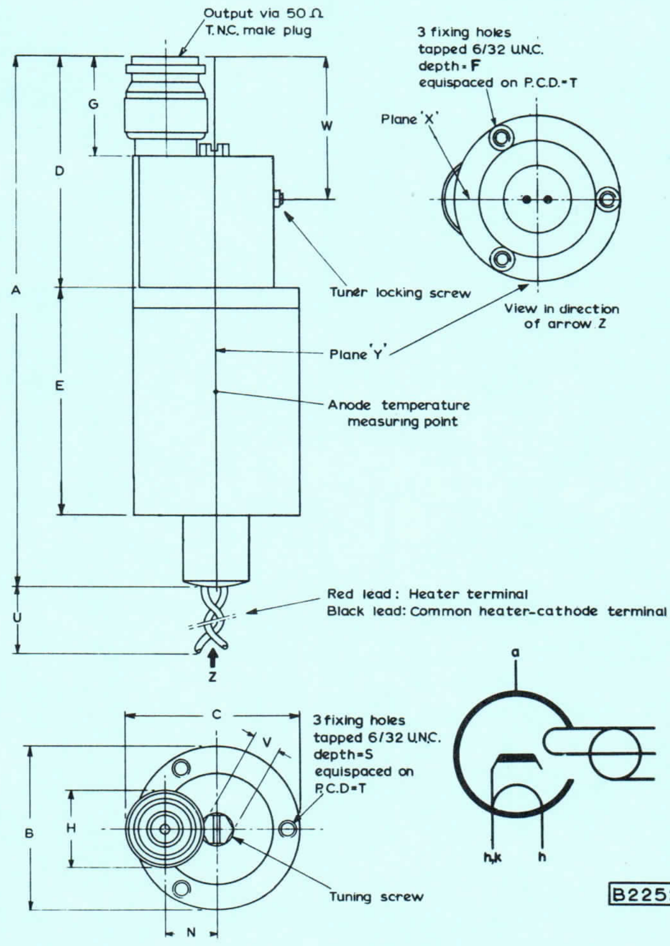
DIMENSIONS

	Inches	Millimetres	
A	4.006 ±0.069	101.75 ±1.75	
B	1.270 ±0.010	32.25 ±0.25	
C	1.348 ± 0.010	34.25 ±0.25	
D	1.742 ±0.030	44.25 ±0.75	
E	1.644 ±0.014	41.75 ±0.35	
F	0.207 ±0.010	5.25 ±0.25	
G	0.709 ±0.008	18 ±0.2	
H	0.640	16.25	max.
N	0.394 ±0.010	10.0 ±0.25	
S	0.167 ±0.010	4.25 ±0.25	
T	1.063	27.0	
U	8.0	203	min.
V	0.192 ±0.001	4.875 ±0.025	
W	1.024 ±0.016	26 ±0.4	

Inch dimensions derived from original millimetre dimensions.

MAGNETRON

YJ1100
YJ1101



QUICK REFERENCE DATA		
Fixed frequency 'X' band magnetron		
Frequency YJ1110	9.345 to 9.405	Gc/s
YJ1111	9.415 to 9.475	Gc/s
Power output	20	kW
Construction	Packaged	

Unless otherwise shown, data is applicable to both types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

CHARACTERISTICS

	Min.		Max.	
Frequency YJ1110	9.345	to	9.405	Gc/s
YJ1111	9.415	to	9.475	Gc/s
Pulse voltage (I_{pulse} = 7.5A)	7.0		8.2	kV
R.F. pulse power output (I_{pulse} = 7.5A)	17		-	kW
Frequency pulling (v.s.w.r. = 1.5)	-		18	Mc/s
Frequency temperature coefficient	-		-0.25	Mc/s per degC
Distance of v.s.w. minimum from face of mounting plate into valve	16.5		22.5	mm
Input capacitance	-		8.0	pF
Frequency pushing	-		1.5	Mc/s per A

OPERATING CONDITIONS

R.F. pulse power output	20	20	20	kW
Duty factor	0.0005	0.0001	0.0005	
Pulse duration	0.5	0.1	0.05	μs
Pulse repetition frequency	1000	1000	1000	p.p.s.
Heater voltage (running)	6.3	6.3	6.3	V
Pulse current	7.5	7.5	7.5	A
Pulse voltage	7.8	7.8	7.8	kV
Pulse input power	58.5	58.5	58.5	kW
Rate of rise of voltage pulse	80	100	100	kV/μs
*Mean input current	3.75	0.8	0.425	mA
Mean input power	29	6.2	3.3	W
Mean r.f. output power	10	2.0	1.0	W
Frequency pulling (v.s.w.r. = 1.5)	16	16	16	Mc/s

*Includes pre-oscillation current.

CATHODE

Indirectly heated

V_h	6.3	V
I_h	0.55	A
r_h (cold)	1.75	Ω
$I_{h(surge)}$ max.	5.0	A

Heating time. At ambient temperatures above $0^{\circ}C$ the cathode must be heated for at least 2.0 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3.0 minutes.
For mean input powers greater than 25 watts, it is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power/heater voltage rating chart on page C3.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Pulse current ($t_p \leq 1.0\mu s$)	6.0	9.0	A
($t_p > 1.0\mu s$)	6.0	7.5	A
Pulse duration	0.05	2.5	μs
Duty factor	-	0.0015	
Mean input power	-	85	W
Rate of rise of voltage pulse	-	120	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	
Temperature of anode block	-	120	^{o}C

END OF LIFE PERFORMANCE

The valve is deemed to have reached end of life when it fails to satisfy the following:-

	Min.		Max.	
R.F. pulse power output ($I_{pulse} = 7.5A$)			14	kW
Frequency YJ1110	9.345	to	9.405	Gc/s
YJ1111	9.415	to	9.475	Gc/s
Pulse voltage ($I_{pulse} = 7.5A$)	7.0	to	8.4	kV

MOUNTING POSITION

Any

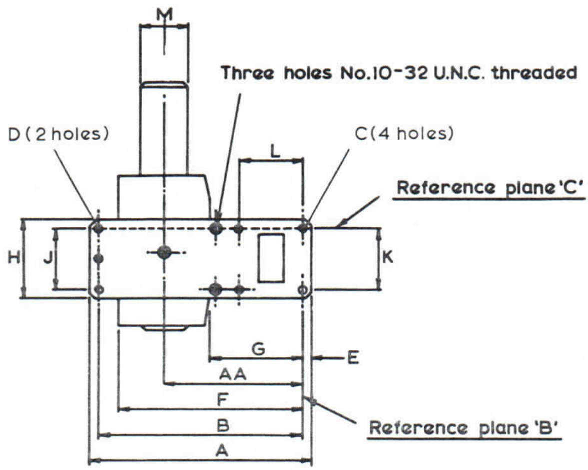
PHYSICAL DATA

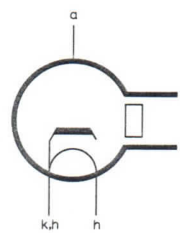
	lb	kg
Weight of magnetron	3.3	1.5
Weight of magnetron in carton	6.4	2.9
	in	cm
Dimensions of storage carton	7.8×8.0×9.8	19.7×20.4×24.8

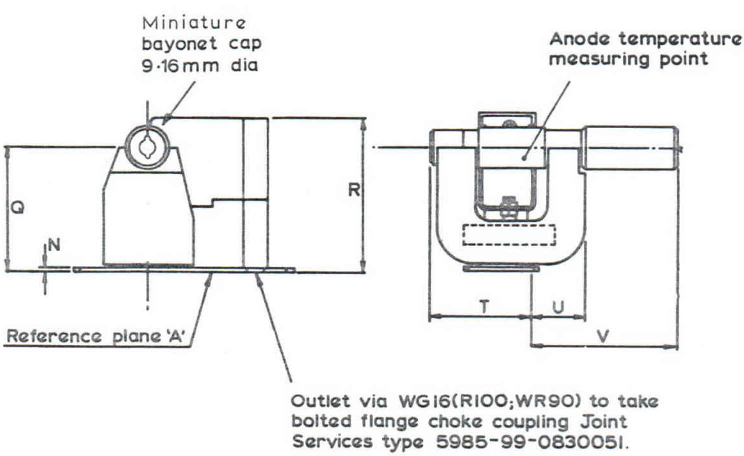
COOLING

In normal circumstances natural cooling is adequate, but where the ambient temperature is abnormally high, a flow of cooling air between the radiator fins may be necessary to keep the block temperature below the permitted maximum.

B5631


M
Three holes No.10-32 U.N.C. threaded
D (2 holes)
C(4 holes)
L
Reference plane 'C'
H
J
K
G
E
AA
F
B
A
Reference plane 'B'

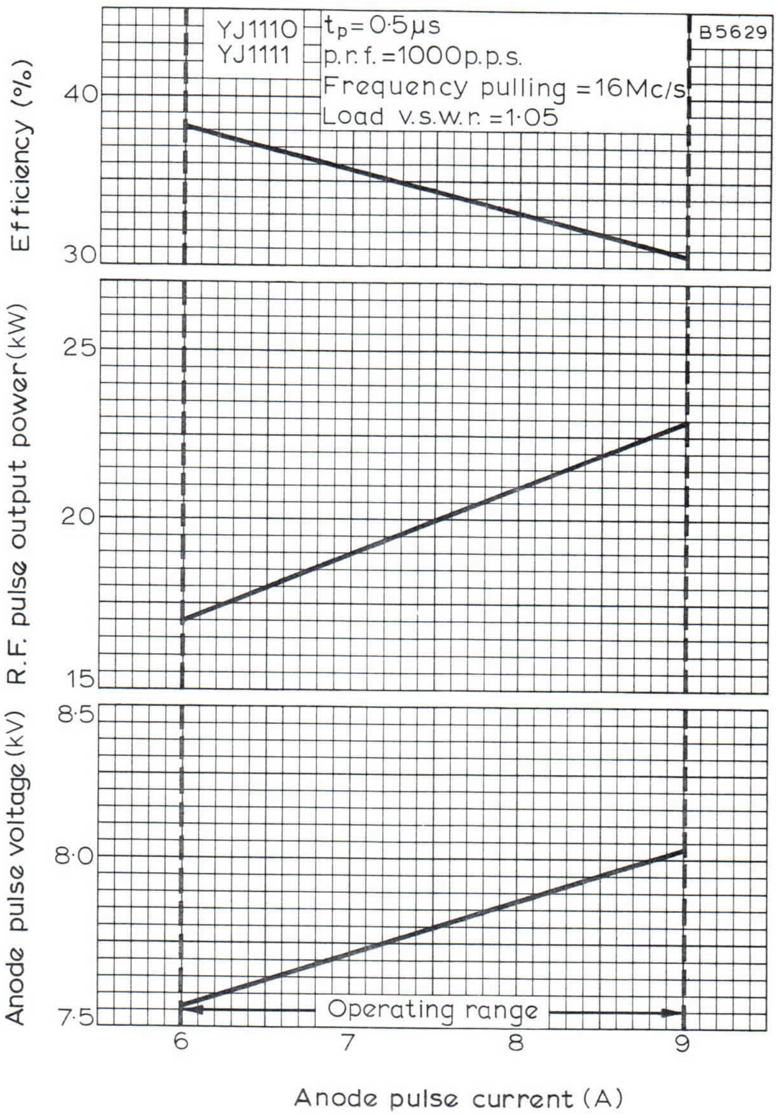

a
k,h
h


Miniature
bayonet cap
9·16 mm dia
Anode temperature
measuring point
Q
N
R
T
U
V
Reference plane 'A'
Outlet via WG16(R100;WR90) to take
bolted flange choke coupling Joint
Services type 5985-99-0830051.

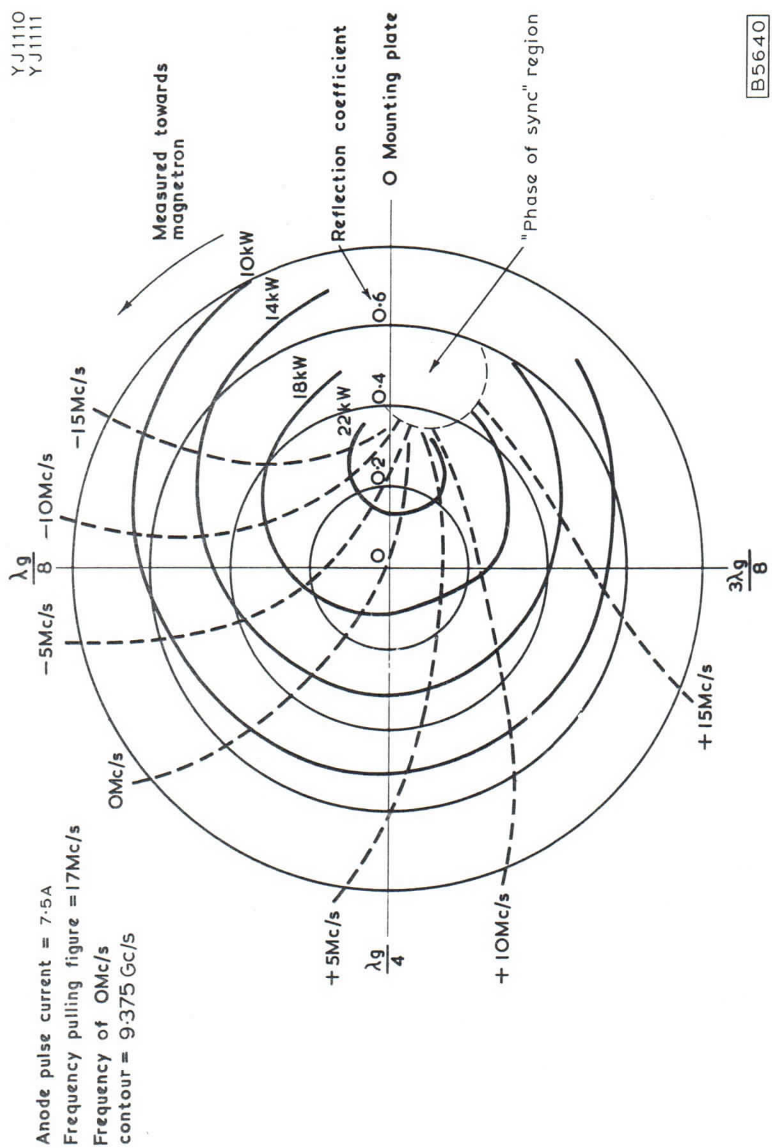
DIMENSIONS

	Inches	Millimetres	
A	4.468	113.5	max.
B	4.102 ± 0.004	104.2 ± 0.10	
C	0.170 ± 0.003	4.32 ± 0.08	dia.
D	0.175 ± 0.003	4.45 ± 0.08	dia.
E	0.188	4.80	max.
F	4.01	102	max.
G	1.851	47.00	min.
H	1.641	41.70	max.
J	1.220 ± 0.003	30.99 ± 0.08	
K	1.220 ± 0.003	30.99 ± 0.08	
L	1.280 ± 0.004	32.51 ± 0.10	
M	1.000	25.40	max. dia.
N	0.125 ± 0.009	3.18 ± 0.25	
Q	2.56 ± 0.12	65 ± 3.0	
R	3.307	84.00	max.
T	2.165	55.00	max.
U	1.102	28.00	max.
V	3.070	78.00	max.
AA	2.99 ± 0.12	76 ± 3.0	

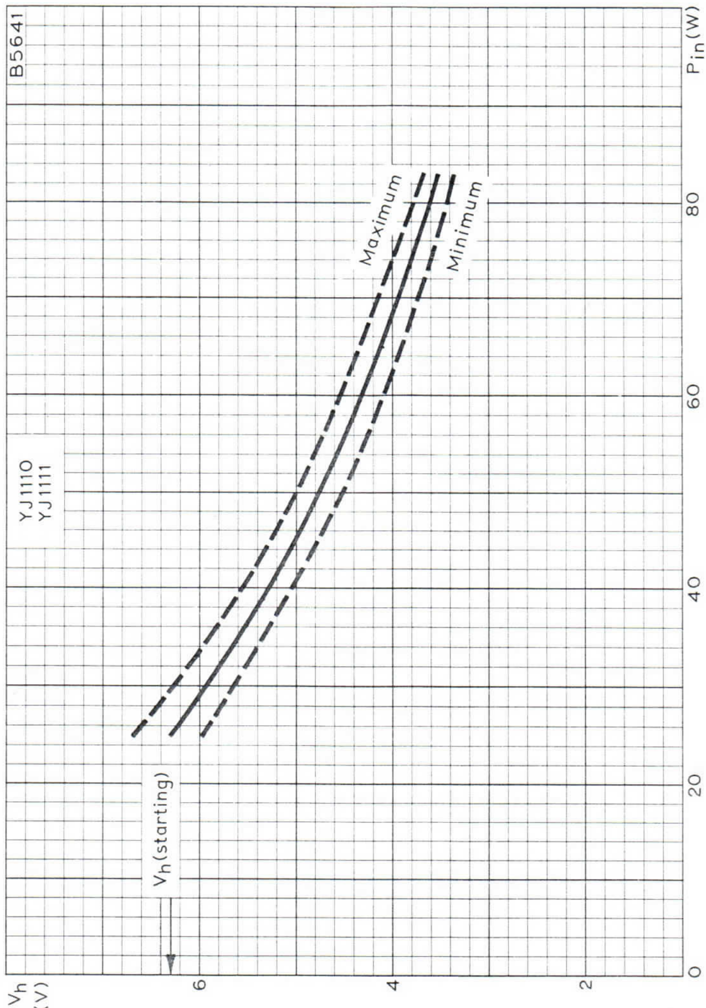
Inch dimensions derived from original millimetre dimensions



ANODE PULSE VOLTAGE, R.F. PULSE OUTPUT POWER AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT



RIEKE DIAGRAM



HEATER VOLTAGE PLOTTED AGAINST MEAN INPUT POWER

TENTATIVE DATA

QUICK REFERENCE DATA

Fixed frequency 'X' Band Magnetron

Frequency	9.415 to 9.475	Gc/s
Power output	26	kW
Construction	Packaged, flying leads	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

CHARACTERISTICS

	Min.	Max.	
Frequency	9.415	9.475	Gc/s
Pulse voltage (I_{pulse} = 9.0A)	7.5	8.5	kV
R.F. pulse power output (I_{pulse} = 9.0A)	22	-	kW
Frequency pulling (v.s.w.r. =1.5)	-	18	Mc/s
Frequency temperature coefficient	-	-0.25	Mc/s per degC
Distance of v.s.w. minimum from face of mounting plate into valve	16.5	22.5	mm
Input capacitance	-	8.0	pF
Frequency pushing	-	1.5	Mc/s per A

OPERATING CONDITIONS

R.F. pulse power output	26	26	26	26	kW
Duty factor	0.0001	0.00015	0.0005	0.0006	
Pulse duration	0.05	0.15	0.5	1.2	µs
Pulse repetition frequency	2000	1000	1000	500	p.p.s.
Heater voltage (running)	6.3	6.3	6.3	6.3	V
Pulse current	9.0	9.0	9.0	9.0	A
Pulse voltage	8.3	8.3	8.3	8.3	kV
Pulse input power	75	75	75	75	kW
Rate of rise of voltage pulse	120	120	100	100	kV/µs
Mean input current	*0.95	*1.4	4.5	5.4	mA
Mean input power	7.9	11.7	35.5	45	W
Mean r.f. output power	2.6	3.9	13.0	15.6	W
Frequency pulling (v.s.w.r. =1.5)	16	16	16	16	Mc/s

*Includes pre-oscillation current.

CATHODE

Indirectly heated

V_h	6.3	V
I_h	0.6	A
r_h(cold)	1.75	Ω
I_h(surge) max.	5.0	A

Heating time

At ambient temperatures above $0^{\circ}C$ the cathode must be heated for at least 2.0 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3.0 minutes.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Pulse current	6.0	10	A
Pulse duration	-	1.5	μs
Duty factor	-	0.0015	
Mean input power	-	85	W
Rate of rise of voltage pulse	-	120	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	
Temperature of anode block	-	120	°C
Temperature of cathode and heater seals	-	120	°C

END OF LIFE PERFORMANCE

The valve is deemed to have reached end of life when it fails to satisfy the following:-

R.F. pulse power output (I_{pulse} = 9.0A)			18	kW
	Min.		Max.	
Frequency				
Within the band	9.415	to	9.475	Gc/s
Pulse voltage (I_{pulse} = 9.0A)	7.5	to	8.5	kV

MOUNTING POSITION Any

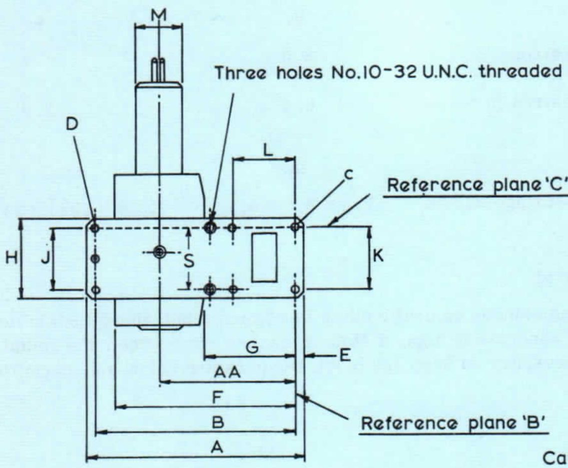
PHYSICAL DATA

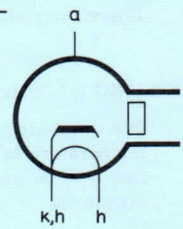
	lb	kg
Weight of magnetron	3.0	1.4
Weight of magnetron in carton	6.4	2.9
	in	cm
Dimensions of storage carton	7.8 × 8.0 × 9.8	19.8 × 20.3 × 24.9

COOLING Natural

In normal circumstances natural cooling is adequate, but where the ambient temperature is abnormally high, a flow of cooling air between the radiator fins may be necessary to keep the block temperature below the permitted maximum.

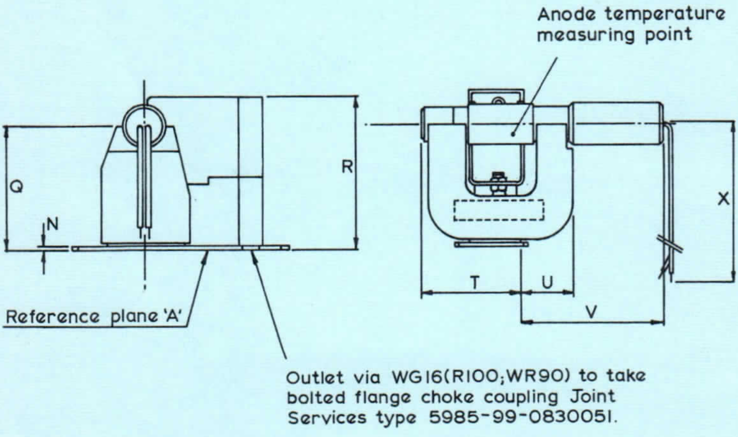
B5479





Cathode = Yellow lead

Heater = Green lead



DIMENSIONS

	Inches	Millimetres	
A	4.467	113.5	max.
B	4.102 ± 0.004	104.2 ± 0.10	
C	0.170 ± 0.003	4.32 ± 0.08	dia.
D	0.175 ± 0.003	4.445 ± 0.075	dia.
E	0.189	4.80	max.
F	4.01	102	max.
G	1.850	47.00	min.
H	1.641	41.70	max.
J	1.250	31.75	nom.
K	1.220 ± 0.003	30.99 ± 0.08	
L	1.280 ± 0.004	32.51 ± 0.10	
M	1.000	25.40	max.dia.
N	0.125 ± 0.010	3.18 ± 0.25	
Q	2.559 ± 0.118	65 ± 3.0	
R	3.307	84.00	max.
S	1.250	31.75	nom.
T	2.165	55.00	max.
U	1.102	28.00	max.
V	3.070	78.00	max.
X	5.98	152	nom.
AA	2.992 ± 0.118	76 ± 3.0	

Inch dimensions derived from original millimetre dimensions

DEVELOPMENT SAMPLE DATA

QUICK REFERENCE DATA

Fixed frequency, forced-air cooled magnetron

Frequency	16.35 to 16.65	Gc/s
Power output	45	kW
Construction	Packaged	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

CHARACTERISTICS

	Min.	Max.	
Frequency	16.35	16.65	Gc/s
Pulse voltage (I_{pulse} = 15A)	11	13	kV
Peak anode current	8.0	17	A
R.F. pulse power output (I_{pulse} = 15A)	40	-	kW
Frequency pulling (v.s.w.r. = 1.5)	-	25	Mc/s
Frequency temperature coefficient	-	-0.5	Mc/s per degC
Input capacitance	-	14	pF
Frequency pushing	-	4.0	Mc/s per A

This Development Sample Data is derived from Development Samples provided for initial circuit work, it does not form part of the Mullard Technical Handbook Service and does not necessarily imply that the device will go into production

OPERATING CONDITIONS

R.F. pulse power output	45	kW
Duty factor	0.0004	
Pulse duration	0.5	μs
Pulse repetition frequency	800	p.p.s.
Heater voltage (running)	10	V
Pulse current	15	A
Pulse voltage	11 to 13	kV
Rate of rise of voltage pulse	100 to 160	kV/μs
Mean input current	6.0	mA
Mean r.f. output power	18	W
Frequency pulling (v.s.w.r. = 1.5)	20	Mc/s

CATHODE

Indirectly heated, dispenser type

$^*V_h$	12.6	V
I_h (approx.)	3.0	A
$I_{h(surge)}$ max.	12	A

*Temporary fluctuations not exceeding +10% and -5% of the nominal value of the heater voltage are permissible.

Heating time

At ambient temperatures above $0^{\circ}C$ the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

Heater voltage (starting)	14	V
Heater surge current	12	A
Pulse current	17	A
Pulse duration	1.0	μs
Duty factor	0.001	
Mean input power	220	W
Rate of rise of voltage pulse	160	kV/μs
Load mismatch (v.s.w.r.)	1.5	
Temperature of anode block	150	$^{\circ}C$
Temperature of cathode and heater seals	165	$^{\circ}C$

MOUNTING POSITION Any

PRESSURISING

Minimum operating pressure	45	cm Hg

The mounting flange and also the waveguide output system of the valve are made so that the magnetron can be used in applications requiring a pressure seal. They can be maintained at a maximum pressure of $3.1 kg/cm^2$ ($45 lb/in^2$).

PHYSICAL DATA

	lb	kg
Weight of magnetron	6.0	2.7

COOLING

An adequate flow of cooling air should be directed along the cooling fins towards the body of the valve to keep the temperature of the anode block below 150°C under any condition of operation. If necessary, the heater-cathode terminal should also be cooled to keep the temperature below 165°C.

OUTPUT CONNECTION

The waveguide output is designed for coupling to rectangular waveguide WG18 with outside dimensions 17.83 × 9.93mm (0.702 × 0.391in).

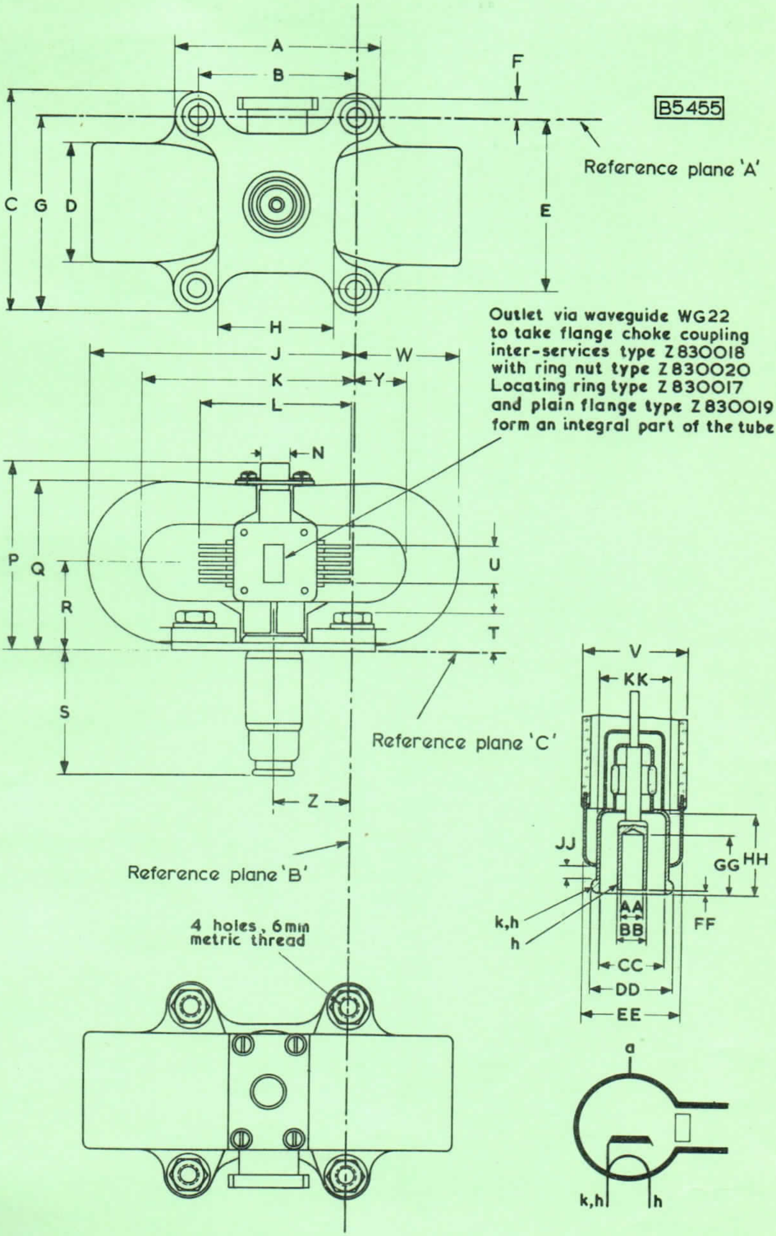
ACCESSORIES

Cathode connector	55356

DIMENSIONS

	Inches	Millimetres	
A	3.437	87.3	max.
B	2.531 ± 0.010	64.29 ± 0.25	
C	3.62	92	max.
D	1.937	49.2	max.
E	2.781 ± 0.010	70.64 ± 0.25	
F	0.250	6.35	nom.
G	3.208	81.5	max.
H	1.874	47.6	min.
J	4.259	108.2	max.
K	3.130	79.5	min.
L	2.36	60	max.
N	0.511	13	max.
P	3.188	81	max.
Q	2.842	72.2	max.
R	1.402 ± 0.039	35.6 ± 1.0	
S	1.968	50	max.
T	0.650 ± 0.059	16.5 ± 1.5	
U	0.728	18.5	max.
V	0.905	23	max.
W	1.673	42.5	max.
Y	0.689	17.5	min.
Z	1.265 ± 0.004	32.15 ± 0.10	
AA	0.169 ± 0.006	4.30 ± 0.15	
BB	0.236 ± 0.004	6.0 ± 0.1	
CC	0.524 ± 0.008	13.3 ± 0.2	
DD	0.665 ± 0.008	16.9 ± 0.2	
EE	0.807	20.5	max.
FF	0.022 ± 0.018	0.55 ± 0.45	
GG	0.493	12.5	min.
HH	0.591	15	min.
JJ	0.079	2.0	min.
KK	0.591 ± 0.008	15.0 ± 0.2	

Inch dimensions derived from original millimetre dimensions


B5455
A
B
C
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F
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W
Y
Z
Reference plane 'A'
Reference plane 'B'
Reference plane 'C'
Outlet via waveguide WG22 to take flange choke coupling inter-services type Z830018 with ring nut type Z830020 Locating ring type Z830017 and plain flange type Z830019 form an integral part of the tube
4 holes, 6mm metric thread
KK
JJ
GG
HH
FF
AA
BB
CC
DD
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a
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QUICK REFERENCE DATA		
Pulsed magnetron tunable by means of an integral servo-motor over 450MHz sweep in 500μs.		
Frequency	8.7 to 9.5	GHz
Power output	205	kW

Unless otherwise shown, data is applicable to all types

To be read in conjunction with

GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS (at f = 9.075GHz centre ± 250MHz range)

R.F. pulse power output	205	205	kW
Duty factor	0.0007	0.001	
Pulse duration	0.2	1.0	μs
Pulse repetition frequency	3500	1000	p.p.s.
Heater voltage (running)	7.7	5.0	V
Pulse current	27.5	27.5	A
Pulse voltage	22.5	22.5	kV
Pulse input power	619	619	kW
Rate of rise of voltage pulse	200	180	kV/μs
Mean input current (I_{mean})	19.25	27.5	mA
Mean input power	433	619	W
Mean r.f. output power	143	205	W
Frequency pulling (v.s.w.r. = 1.5)	12	12	MHz

CATHODE

Indirectly heated

V_h	13.75 ± 10%	V
I_h	3.15 ± 10%	A
I_h (surge) max.	12	A

The valve heater shall be protected against arcing by the use of a connector that places a minimum capacitance of 4000pF across the heater directly at the input terminals.

Heating time. At ambient temperatures above 0°C the cathode must be heated for at least 2.5 minutes before the application of h.t.

It is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the formula:

$$V_h = 13.75\,(1 - \frac{I_{mean}}{43})$$

CHARACTERISTICS

	Min.	Max.	
Frequency	8.7	9.5	GHz
*Frequency sweep	400	-	MHz
Pulse voltage (I_{pulse} = 27.5A)	21	24	kV
R.F. pulse power output (I_{pulse} =27.5A)	180	-	kW
Frequency pulling (v.s.w.r.=1.5)	-	15	MHz
Frequency temperature coefficient	-	-0.5	MHz/degC
Frequency pushing	-	0.5	MHz per A
Hot to cold frequency difference	9.0	16	MHz

*An alternative version (YJ1181) is available with an optional frequency lock. This allows the tube to be frequency locked to within 20MHz of any predetermined frequency. The external dimensions remain unchanged.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Pulse current	-	27.5	A
Pulse duration	0.15	1.5	μs
Duty factor	-	0.0011	
Mean input power	-	660	W
Rate of rise of voltage pulse			
Short pulse operation - up to 1.0μs	-	200	kV/μs
Long pulse operation - up to 2.0μs	-	180	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	

TUNING

Tuning programme	16 full cycles per shaft revolution. One cycle consists of a quasi-sinusoidal scan through the entire tuning range and return.
Integral servo-motor	Navy Bu. Ord. Size 18 servo-motor N.A.T.O. number 6105-99-972-6555
Drive input	115V, 400Hz, fixed phase 115V, 400Hz, centre tapped control phase 9.2W/phase
Minimum drive speed	4000 r.p.m.

MAGNETRONS

(JPS9-200) YJ1180 YJ1181

MOUNTING POSITION Any

PRESSURISING

To prevent arcing the air pressure in the waveguide should not be less than 740 torr.

PHYSICAL DATA

	kg	lb
Weight of magnetron	6.8	15

COOLING

Forced-air cooling is required in order to keep the anode block temperature below the permitted maximum.
An air flow of approximately 0.85m^3/min. (30ft^3/min.) should be directed on the cooling fins.

Temperature

Anode block max.	120	^{o}C

OUTPUT CONNECTION

Suitable for connection to waveguide RG51/U (WG15, R84)

OPERATING NOTES

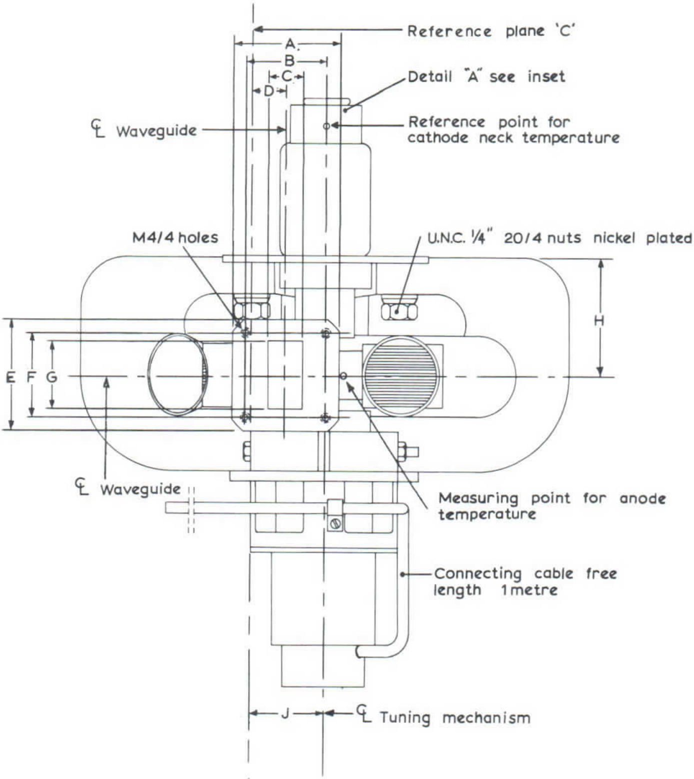
Tunable version with optional fixed frequency lock, YJ1181.

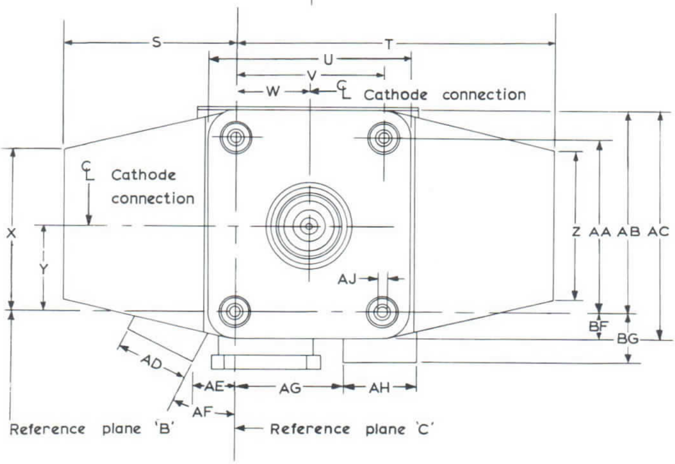
The lock consists of a small mechanical device mounted with the electrical connections to the two-phase, 400Hz drive motor.

It does not add to the volume or external dimensions of the magnetron as it is completely contained in the present housing for the motor cable connections. The only protruding part is the frequency adjustment screw, similar to those of conventional tunable magnetrons. The frequency trimming is made by means of a screw-driver or a flexible shaft to a knob for manual adjustment, or to a servo motor for remote monitoring. In the latter case the magnetron frequency may be kept as close as desired to a predetermined frequency by comparison with a resonant cavity in a closed servo loop.

The lock is actuated simply by reversing the phase order of the motor, thus letting the stalled torque work against a stop. The actuated lock keeps the tuner in a precisely defined angular position, corresponding to a predetermined frequency.

For a fixed operating point in steady state conditions the frequency can be locked to within 20MHz from any predetermined frequency within the tuning band without any adjustments, either manual or automatic. With the operating point varying within the specification, the frequency can still be kept within 35MHz. Under all conditions (transient or steady state) the locking frequency is kept within 60MHz from the predetermined frequency. See page D4.


Reference plane 'C'
A
B
C
D
Detail "A" see inset
Reference point for cathode neck temperature
℄ Waveguide
M4/4 holes
U.N.C. 1/4" 20/4 nuts nickel plated
E F G
H
℄ Waveguide
Measuring point for anode temperature
Connecting cable free length 1 metre
J
℄ Tuning mechanism


S
T
U
V
W
℄ Cathode connection
℄ Cathode connection
X
Y
Z AA AB AC
AJ
BF
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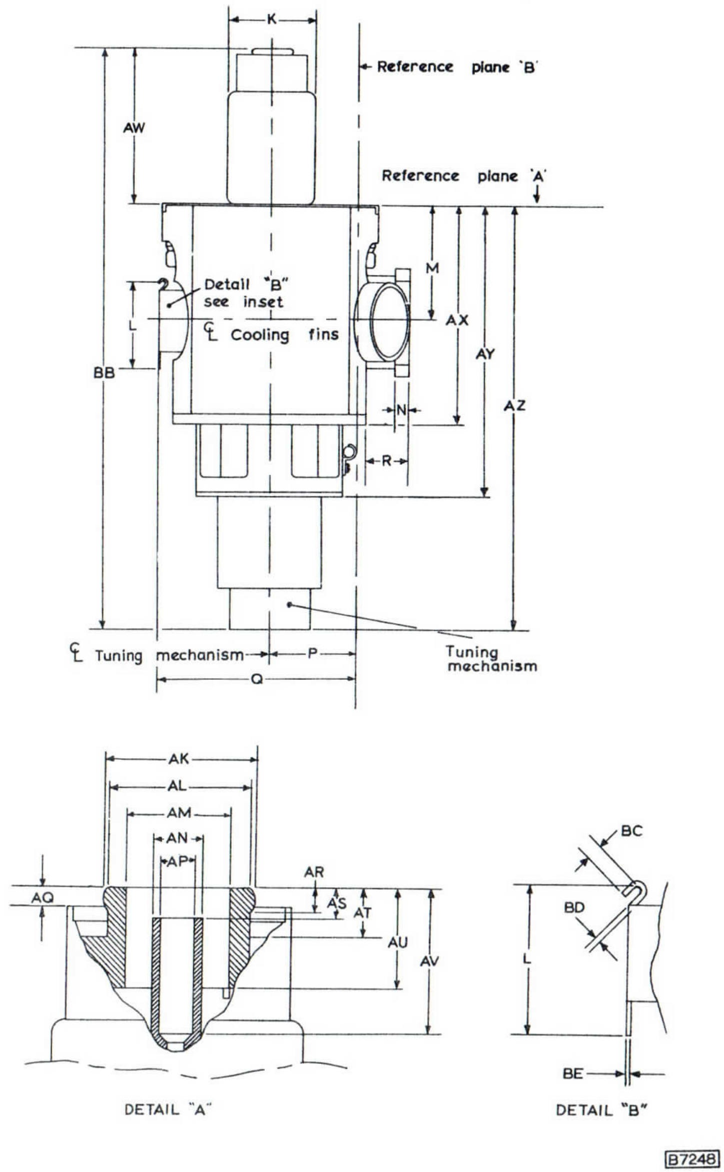
AH
AF
Reference plane 'B'
Reference plane 'C'

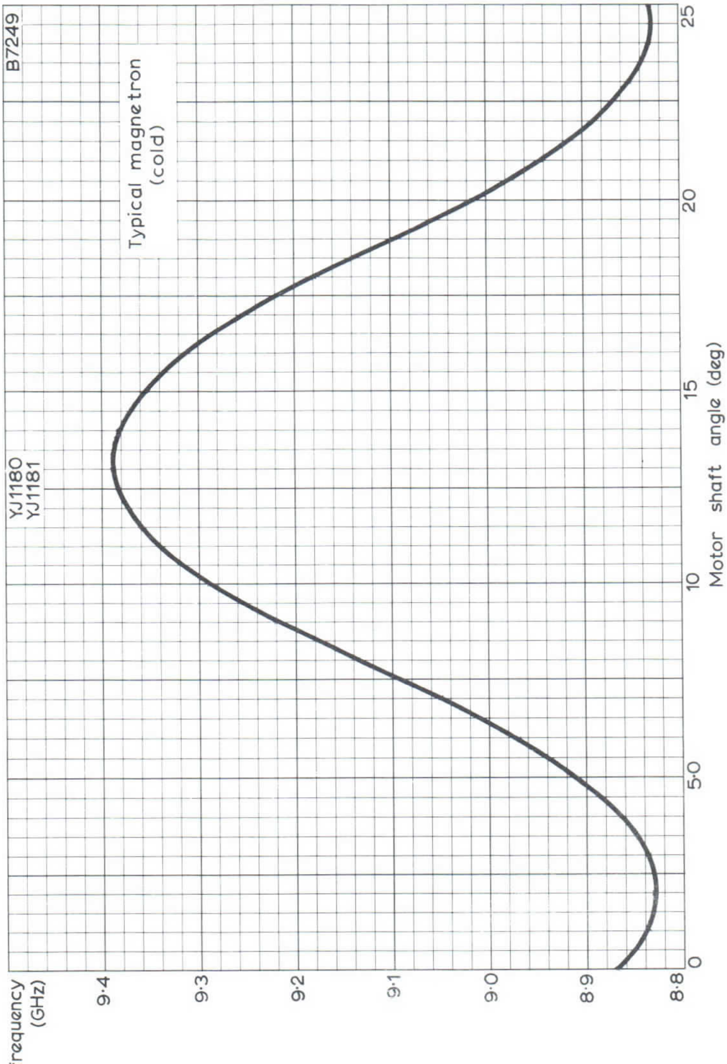
OUTLINE AND DIMENSIONS OF YJ1180 AND YJ1181



DIMENSIONS OF YJ1180 AND YJ1181

	Millimetres	Inches		Millimetres	Inches
A	46.5	1.83	AD	32 dia.	1.26 dia.
B	37.4 ± 0.1	1.47 ± 0.004	AE	18.5	0.73
C	12.6	0.49	AF	27^{o}	27^{o}
D	14.75 ± 1.2	0.58 ± 0.05	AG	47.5	1.87
E	46.5	1.83	AH	32 dia.	1.26 dia.
F	34.3 ± 0.1	1.35 ± 0.004	AJ	7.15 dia.	0.28 dia.
G	28.5	1.12	AK	21.1 ± 0.15 dia.	0.83 ± 0.006 dia.
H	47.1 ± 1.2	1.85 ± 0.05	AL	19 dia.	0.75 dia.
J	31.75 ± 2.0	1.25 ± 0.08	AM	13.7 ± 0.15 dia.	0.54 ± 0.006 dia.
K	38.1 dia.	1.50 dia.	AN	6.35 ± 0.4 dia.	0.25 ± 0.02 dia.
L	38	1.50	AP	4.3 ± 0.12 dia.	0.17 ± 0.005 dia.
M	47.1 ± 3.0	1.85 ± 0.12	AQ	0 min.	0 min.
N	6.5	0.26	AR	3.2 ± 0.25	0.13 ± 0.01
P	38.1 ± 2.0	1.50 ± 0.08	AS	3.95 ± 0.8	0.16 ± 0.03
Q	85.5 ± 3.0	3.37 ± 0.12	AT	6.35	0.25
R	23 ± 0.8	0.91 ± 0.03	AU	13.1 min.	0.51 min.
S	75 max.	2.95 max.	AV	19 min.	0.75 min.
T	138.5 max.	5.45 max.	AW	67.5 ± 2.4	2.66 ± 0.09
U	88.1 max.	3.47 max.	AX	96 max.	3.78 max.
V	63.5 ± 0.25	2.50 ± 0.01	AY	127 max.	5.00 max.
W	31.75 ± 1.2	1.25 ± 0.05	AZ	185 max.	7.28 max.
X	75 max.	2.95 max.	BB	255 max.	10.0 max.
Y	38.1 ± 1.2	1.50 ± 0.05	BC	4.0	0.16
Z	73 max.	2.87 max.	BD	1.6	0.06
AA	76.2 ± 0.25	3.00 ± 0.01	BE	1.0	0.04
AB	86.9 max.	3.42 max.	BF	10.7 max.	0.42 max.
AC	98.4 max.	3.87 max.	BG	22.5	0.89

Inch dimensions derived from original millimetre dimensions



PASSIVE RESONANCE FREQUENCY AS A FUNCTION OF
THE MOTOR SHAFT ANGLE

MAGNETRON

YJ1200
YJ1201

TENTATIVE DATA

QUICK REFERENCE DATA		
High altitude magnetrons for X-band operation. Output coupling to type YJ1200 is WG16, and to type YJ1201 is WG15.		
Frequency	9.375	GHz
Power output	50	kW
Construction	Packaged with flying leads	

Unless otherwise shown, data is applicable to both types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS

R.F. pulse power output	50	kW
Duty factor	0.0016	
Pulse duration	4.0	μs
Pulse repetition frequency	400	p.p.s.
Heater voltage (running)	7.7	V
Pulse current	12	A
Pulse voltage	12	kV
Pulse input power	144	kW
Rate of rise of voltage pulse	60	kV/μs
Mean input current	19.2	mA
Mean input power	230	W
Mean r.f. output power	80	W
Frequency pulling (v.s.w.r. = 1.3)	10	MHz

CATHODE

Indirectly heated

V_h	12.4	V
I_h	2.2±0.2	A
$I_{h(surge)}$ max. starting	10	A

The cathode must be heated for at least 90 seconds before the application of h.t.

CHARACTERISTICS

	Min.	Max.	
Frequency fixed within the band	9.345	9.405	GHz
Pulse voltage ($I_{pulse} = 12A$)	11	12.5	kV
R.F. pulse power output ($I_{pulse} = 12A$)	40	-	kW
Frequency pulling (v.s.w.r. = 1.3)	-	15	MHz
Frequency temperature coefficient	-	-0.25	MHz/degC
Frequency pushing	-	0.5	MHz/A

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Pulse current	8.0	14	A
Pulse duration	-	5.0	μs
Duty factor	-	0.0025	
Mean input power	-	350	W
Rate of rise of voltage pulse	-	80	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	

END OF LIFE PERFORMANCE

The magnetron is deemed to have reached end of life when it fails to satisfy the following:-

	Min.	Max.	
R.F. pulse power output ($I_{pulse} = 12A$)		35	kW
Frequency fixed within the band	9.345	9.405	GHz
Pulse voltage ($I_{pulse} = 12A$)	11	13.5	kV

MOUNTING POSITION Any

COOLING

Temperatures

Anode block max.	120	^{o}C
Cathode and heater seals max.	150	^{o}C

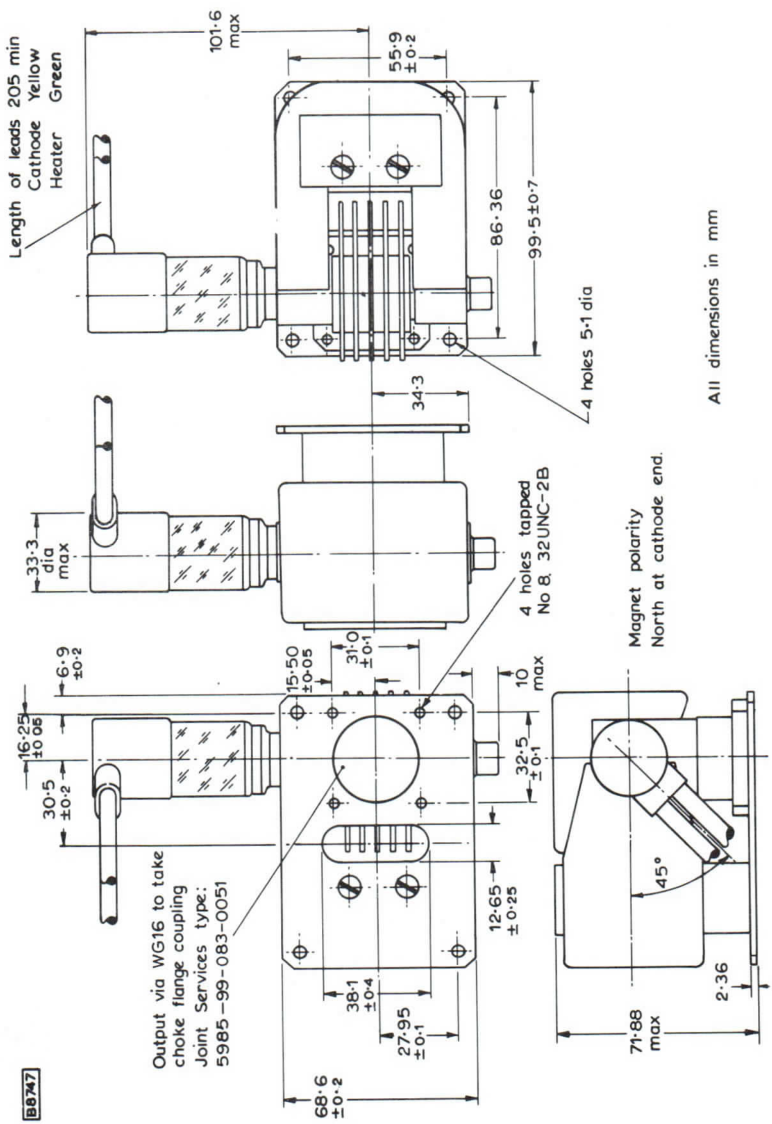
PRESSURISING

The magnetron is capable of unpressurised operation at altitudes up to 30 000ft for the YJ1200 and 40 000ft for the YJ1201.

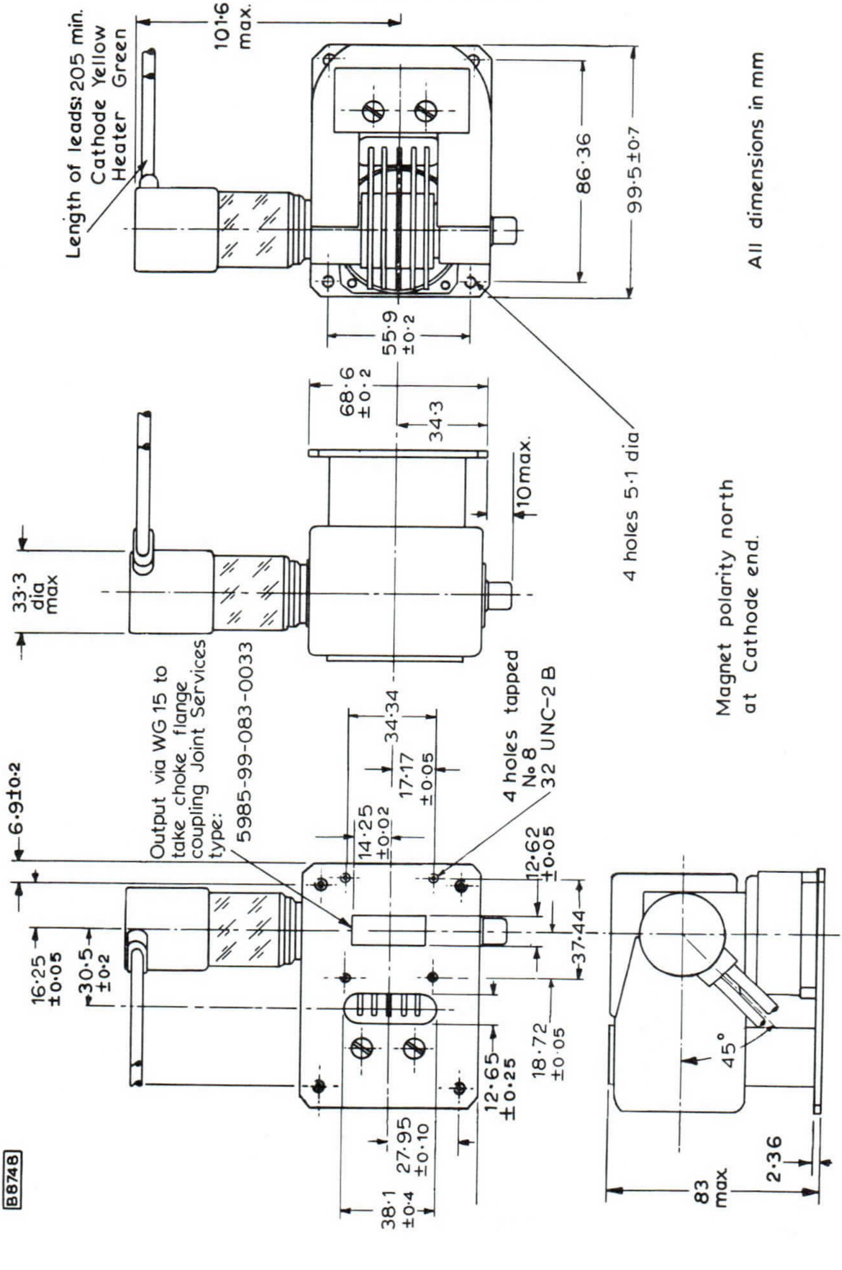
PHYSICAL DATA

Weight of magnetron	1.9	kg

OUTLINE DRAWING OF YJ1200



OUTLINE DRAWING OF YJ1201



MAGNETRON YJ1220

TENTATIVE DATA

QUICK REFERENCE DATA		
X-Band fixed frequency rugged magnetron with quick warm-up cathode. Suitable for airborne and missile requirements. Magnetrons can be supplied to any spot frequency ±50MHz in X-Band.		
f (nom)	9.375	GHz
P_{out}	150	W
Construction	Packaged, flying leads	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS

R.F. Pulse power output	150	W
Duty factor	0.01	
Pulse duration	0.2	μs
Pulse repetition frequency	50	kHz
Heater voltage	5.0	V
Pulse current	1.0	A
Pulse voltage	850	V
Rate of rise of voltage pulse	30	kV/μs
Frequency pulling (v.s.w.r. = 1.5)	15	MHz

CATHODE

Indirectly heated

V_h	5.0	V
I_h	0.7	A
*t_{h-k} typ	2.5	s

*Heater and h.t. voltage applied simultaneously

PHYSICAL DATA

Weight of magnetron	170	g

CHARACTERISTICS

	Min.	Max.	
Frequency (nom)		9.375	MHz
Pulse voltage (I_{pulse} = 1.0A)	800	900	V
R.F. Pulse power output (I_{pulse} = 1.0A)	120	-	W
Frequency pulling (v.s.w.r. = 1.5)	-	18	MHz
Frequency temperature coefficient	-	-0.25	MHz per degC

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Pulse current	0.5	2.0	A
Pulse duration	0.03	1.0	μs
Duty factor	-	0.02	
Mean input power	-	25	W
Rate of rise of voltage pulse	-	50	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	

END OF LIFE PERFORMANCE

The magnetron is deemed to have reached end of life when it fails to satisfy the following:-

R.F. Pulse power output (I_{pulse} = 1.0A) 90 W

	Min.	Max.	
Pulse voltage (I_{pulse} = 1.0A)	750	900	V

MOUNTING POSITION

Any

COOLING

Temperature

Anode block max 140 °C

OUTLINE DRAWING OF YJ1220

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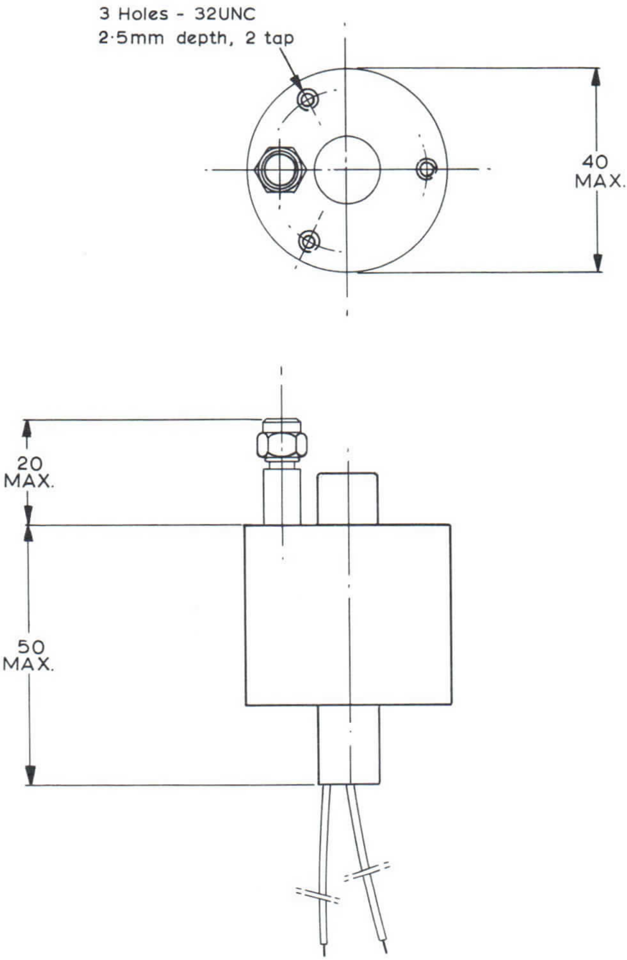


All dimensions in mm.

MAGNETRON

YJ1240

DEVELOPMENT SAMPLE DATA

QUICK REFERENCE DATA

Fixed frequency pulse magnetron with coaxial output

Frequency	9.345 to 9.405	GHz
Power output (pk)	900	W
Construction	Packaged with flying leads	

To be read in conjunction with

GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS

R.F. Pulse power output	900	900	W
Duty factor	0.0005	0.001	
Pulse duration	0.05	0.5	μs
Pulse repetition frequency	10 000	2000	p.p.s.
Heater voltage (running)	5.0	5.0	V
Pulse current	2.0	2.0	A
Pulse voltage	2.0	2.0	kV
Pulse input power	4.0	4.0	kW
Rate of rise of voltage pulse	100	100	kV/μs
Mean input current	1.0	2.0	mA
Mean input power	2.0	4.0	W
Mean r.f. output power	450	900	mW
Frequency pulling (v.s.w.r. = 1.5)	20	20	MHz

CATHODE

Indirectly heated

V_h	5.0	V
I_h (at V_h = 5.0V)	0.7	A

Heating time. At ambient temperatures above $0^{o}C$ the cathode must be heated for at least 30 seconds before the application of h.t.

This Development Sample Data is derived from Development Samples provided for initial circuit work, it does not form part of the Mullard Technical Handbook Service and does not necessarily imply that the device will go into production

CHARACTERISTICS

	Min.	Max.	
Frequency fixed within the band	9.345	9.405	GHz
Pulse voltage (I_{pulse} = 2.0A)	1.8	2.2	kV
R.F. Pulse power output (I_{pulse} = 2.0A)	800	-	W
Frequency pulling (v.s.w.r. = 1.5)	-	20	MHz
Frequency temperature coefficient	-	0.25	MHz per degC
Input capacitance	-	10	pF

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Pulse current	1.5	2.5	A
Pulse duration	0.03	1.0	µs
Duty factor	-	0.001	
Mean input power	-	6.0	W
*Rate of rise of voltage pulse	-	100	kV/µs
Load mismatch (v.s.w.r.)	-	1.5	

*Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude.

END OF LIFE PERFORMANCE

The magnetron is deemed to have reached end of life when it fails to satisfy the following:-

	Min.	Max.	
R.F. Pulse power output (I_{pulse} = 2.0A)		600	W
Frequency fixed within the band	9.345	9.405	GHz
Pulse voltage (I_{pulse} = 2.0A)	1.7	2.3	kV

MOUNTING POSITION

Any

COOLING

Temperature

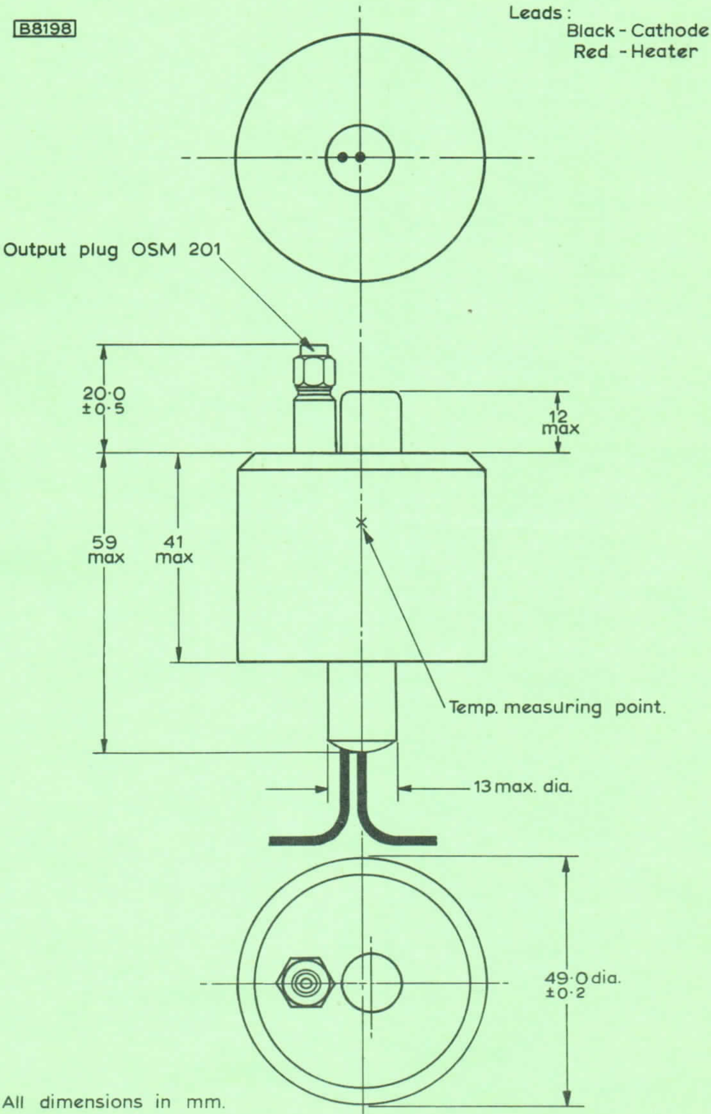
Anode block max. 120 ^{o}C

The anode temperature measured at the point indicated on the outline drawing must be kept below the limit specified.

PHYSICAL DATA

Weight of magnetron 456 g

OUTLINE DRAWING OF YJ1240



All dimensions in mm.

TENTATIVE DATA

QUICK REFERENCE DATA		
X-Band fixed frequency rugged magnetron		
Frequency	9.345	GHz
Power output (pk)	90	kW
Construction	Lightweight, packaged with flying leads	

To be read in conjunction with

GENERAL OPERATIONAL RECOMMENDATIONS-MICROWAVE DEVICES

OPERATING CONDITIONS

R.F. Pulse power output	90	kW
Duty factor	0.0012	
Pulse duration	6.0	μs
Pulse repetition frequency	200	p.p.s.
Heater voltage (running)	7.7	V
Pulse current	17.5	A
Pulse voltage	15.2	kV
Pulse input power	265	kW
Rate of rise of voltage pulse	50	kV/μs
Mean input current	21	mA
Mean input power	320	W
Mean r.f. output power	108	W
Frequency pulling (v.s.w.r. = 1.3)	10	MHz

CATHODE

Indirectly heated

V_h	12.6	V
I_h	2.0 to 2.4	A
$I_{h(surge)}$ max.	10	A
r_h (cold)	0.65	Ω

The cathode must be heated for at least 90 seconds before the application of h.t.

CHARACTERISTICS

	Min.	Max.	
Frequency fixed within the band	9.315	9.375	GHz
Pulse voltage (I_{pulse} = 17.5A)	14	16	kV
R.F. Pulse power output (I_{pulse} = 17.5A)	85	120	kW
Frequency pulling (v.s.w.r. = 1.3)	-	15	MHz
Frequency temperature coefficient	-	−0.25	MHz per degC
Input capacitance	-	14	pF
Frequency pushing	-	0.5	MHz per A

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Pulse current	15	20	A
Pulse duration	-	7.0	μs
Duty factor	-	0.0015	
Mean input power	-	400	W
Rate of rise of voltage pulse	-	90	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	

END OF LIFE PERFORMANCE

The magnetron is deemed to have reached end of life when it fails to satisfy the following:-

	Min.	Max.	
R.F. Pulse power output (I_{pulse} = 17.5A)		75	kW
Frequency fixed within the band	9.315	9.375	GHz
Pulse voltage (I_{pulse} = 17.5A)	14	17	kV

MOUNTING POSITION

Any

PHYSICAL DATA

Weight of magnetron	1.9	kg

COOLING

Temperatures

Anode block max.	120	°C
Cathode and heater seals max.	150	°C

PRESSURISING

The cathode stem bushing will not arc over at a reduced atmospheric pressure equivalent to an altitude of 35 000ft. The output system will operate satisfactorily at a reduced atmospheric pressure equivalent to an altitude of 25 000ft with a load v.s.w.r. of 1.5:1 varied through all phases.

VIBRATION

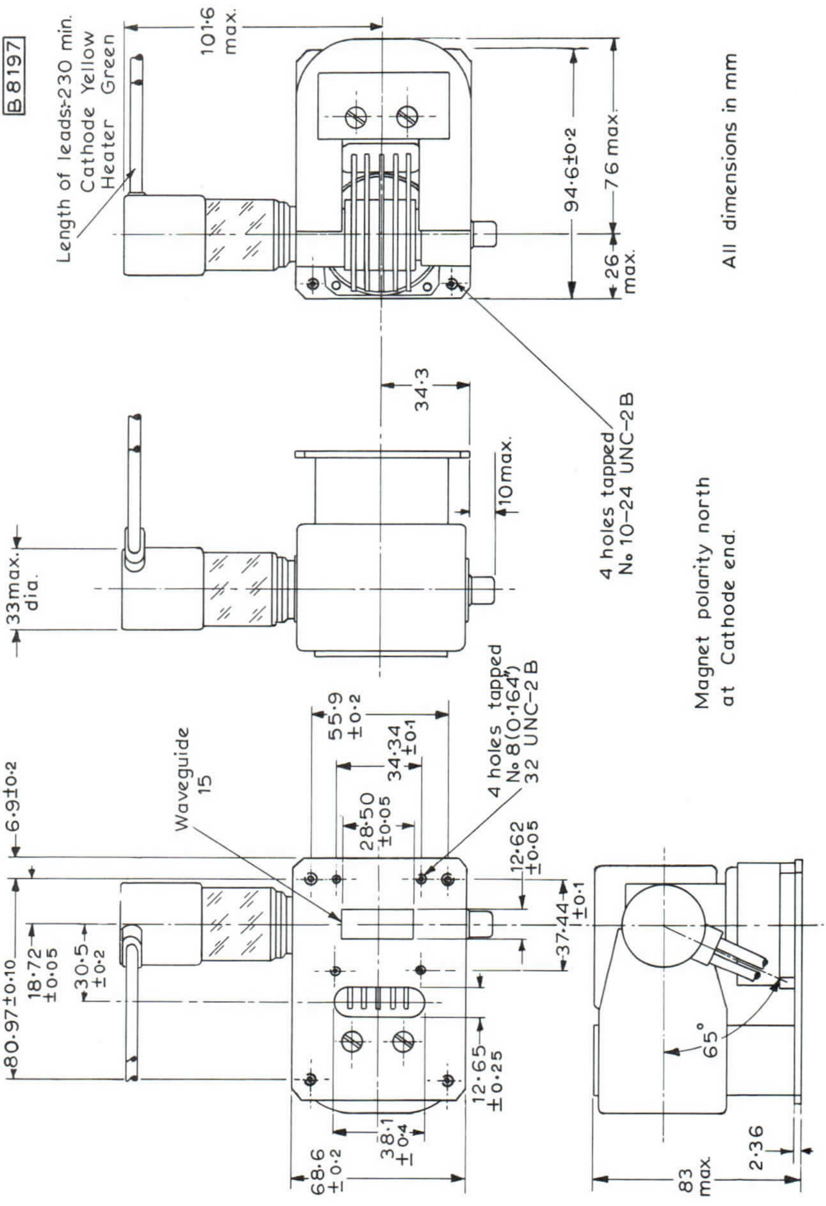
The magnetron will operate normally when subjected to sinusoidal vibrations of amplitude ±0.5mm or 1.5g which ever is the smaller in the frequency range 5 to 150Hz in any plane and the total frequency deviation shall not exceed 100kHz.

ACCELERATION

The magnetron will function normally when subjected to an acceleration of 5.5g in any plane. No part of the valve will break loose when subjected to an acceleration of 10g in any plane.

CLIMATIC

The magnetron will meet the requirements of the Joint Services Spec. K1001 issue 6 clauses 10.1, 10.3 and 10.8.


B 8197
Length of leads:-230 min.
Cathode Yellow
Heater Green
101·6 max.
94·6±0·2
76 max.
26 max.
34·3
10 max.
33 max. dia.
4 holes tapped No 10-24 UNC-2B
All dimensions in mm
Magnet polarity north at Cathode end.
6·9±0·2
Waveguide 15
55·9 ±0·2
34·34 ±0·1
28·50 ±0·05
4 holes tapped No 8(0·164") 32 UNC-2B
12·62 ±0·05
37·44 ±0·1
80·97±0·10
18·72 ±0·05
30·5 ±0·2
12·65 ±0·25
38·1 ±0·4
68·6 ±0·2
65°
83 max
2·36

MAGNETRON

YJ1290

TENTATIVE DATA

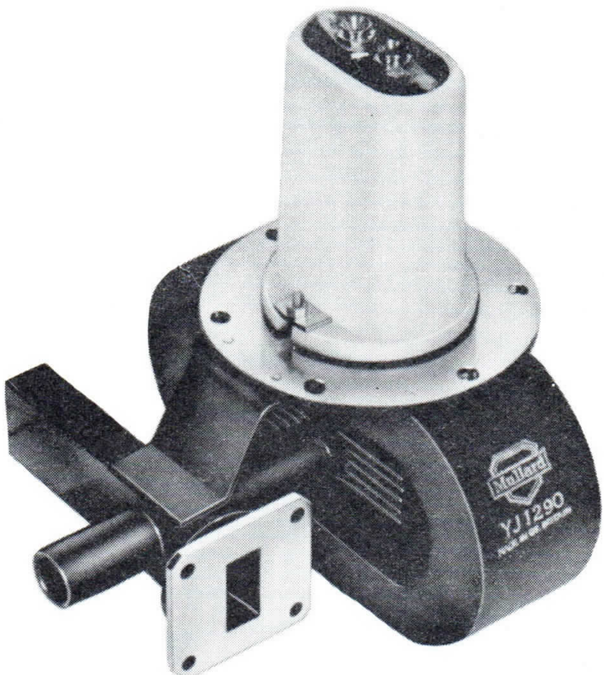
QUICK REFERENCE DATA

X-band, fixed frequency, pulsed magnetron

Frequency (fixed within the band)	9.415 to 9.475	GHz
Power output (peak)	65	kW
Construction		Packaged
Output connection		Waveguide 16 flange

To be read in conjunction with

GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES



TYPICAL OPERATION

Operating conditions

Heater voltage	1.0	V
Anode current (peak)	14	A
Pulse duration (t_p)	0.5	µs
Pulse repetition rate	1250	pulse/s
Rate of rise of voltage pulse	145	kV/µs

Typical performance

Anode voltage	14	kV
Power output (peak)	65	kW
Power output (mean)	40.5	W

CATHODE

Indirectly heated		
Heater voltage (see notes 1 and 9)	6.3	V
Heater current	1.0	A
Heater current (surge) max.	5.0	A
Heating time min. (see note 2)	2.0	minutes

TEST CONDITIONS AND LIMITS

The magnetron is tested to comply with the following electrical specification:-

Test conditions

Heater voltage (for test)	0	V
Anode current (mean)	8.8	mA
Duty factor	0.00062	
Pulse duration (t_p) see note 3	0.5	µs
v.s.w.r. at output connection	$\ngtr$1.05:1	
Rate of rise of voltage pulse (see note 4)	$\nless$150	kV/µs

Limits and characteristics	Min.	Max.	
Anode voltage (peak)	12.5	15	kV
Power output (mean)	34	-	W
Frequency	9.415	9.475	GHz
R.F. Bandwidth at 1/4 power (see note 3)	-	$\frac{2.5}{tp}$	
Frequency pulling (v.s.w.r. =1.5:1)	-	15	MHz
Minor lobe level (v.s.w.r. =1.5:1)	6.0	-	dB
Stability (see note 5)	-	0.25	%
Heater current (see note 6)			
Frequency temperature coefficient (see note 7)			

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

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

	Min.	Max.	
Heater voltage	5.7	7.0	V
Anode voltage (peak)	-	16	kV
Anode current (peak)	12	16	A
Power input (mean)	-	160	W
Duty factor	-	0.001	
Pulse duration (t_p) (see note 3)	-	1.0	μs
Rate of rise of voltage pulse (see note 4)	100	150	kV/μs
Anode temperature (see note 8)	-	120	^oC
v.s.w.r. at output connection	-	1.5:1	

END OF LIFE PERFORMANCE

The quality of all production is monitored by random selection of magnetrons which are then life tested under the stated test conditions. If the magnetron is to be operated under different conditions from those specified above, Mullard Ltd. should be consulted to verify that the life will not be affected. The magnetron is considered to have reached the end of life when it fails to meet the following limits when tested as specified on page 2.

	Min.	Max.	
Power output (peak)	50	-	kW
Frequency	9.415	9.475	GHz
R.F. bandwidth at 1/4 power	-	$\frac{3.5}{t_p}$	MHz
Stability	-	0.5	%

MOUNTING POSITION (see note 10) Any

COOLING

Adequate cooling is provided at maximum mean input power by an airflow of 0.43m^3/min (15ft^3/min) at T_{amb} = 55°C and standard pressure from an orifice of 31.75mm (1.250in) diameter located at 6.35mm (0.250in) from the cooling fins.

PHYSICAL DATA

	kg	lb	
Weight of magnetron	2.1	4.6	
Weight of magnetron in storage carton	2.75	6.0	
Dimensions of storage carton	215.9 × 247.65 × 266.7		mm
	8.5 × 9.75 × 10.5		in.

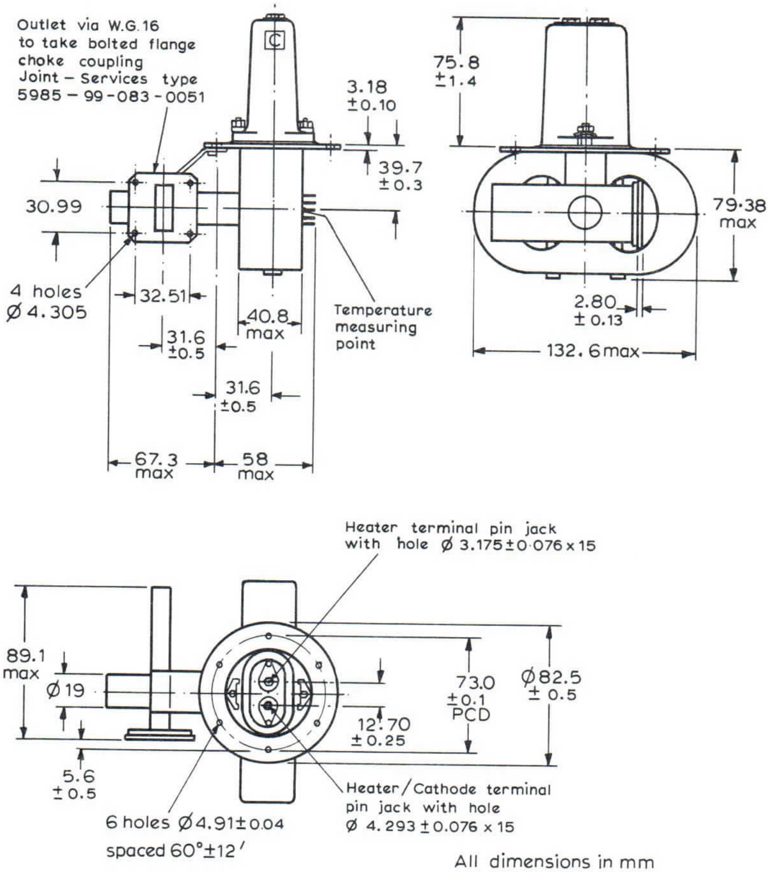
VIBRATION

The magnetron is vibration tested to ensure that it will withstand normal conditions of service.

NOTES

1. With no anode input power. The heater voltage during operation is very dependant on the application and should be agreed with Mullard Ltd.
2. For ambient temperatures above $-15^{o}C$ the cathode must be heated for at least 2 minutes before the application of H.T. For ambient temperatures between $-15^{o}C$ and $-55^{o}C$ the cathode heating time is 3 minutes minimum.
3. The tolerance of pulse current duration (t_p) measured at 50% amplitude is ±10%.
4. Defined as the steepest tangent to the leading edge of the anode voltage pulse above 80% amplitude.
5. With the magnetron operating into a v.s.w.r. of 1.5:1 varied through all phases over the anode current range of 12A to 16A peak. Pulses are defined as missing when the r.f. energy level is < 70% of the normal level in the frequency range 9.415GHz to 9.475GHz. Missing pulses are expressed as a percentage of the number of input pulses applied during the period of observation after a period of 3 minutes of operation.
6. Measured with a heater voltage of 6.3V and no anode input power, the heater current limits are 0.9 and 1.1A.
7. Design test only. The maximum frequency change with anode temperature change, after warming, is -0.25MHz/degC.
8. The anode temperature measured at the point indicated on the outline drawing must be kept below the limit specified.
9. The magnetron is normally tested with a heater supply of 50Hz and is suitable for operation at 1.1kHz. Mullard Ltd. should be consulted if the magnetron is to be operated with a heater supply of any other frequency.
10. It is necessary to keep all magnetic material as far as possible, at least 50mm (2in.) away from the magnet. The inner polystyrene pack of the magnetron carton provides adequate separation between magnetrons, and it is recommended that magnetrons not in use be kept in these packs.

OUTLINE DRAWING



Millimetre to inch conversion table overleaf

Millimetre to inch conversion table (rounded outwards).

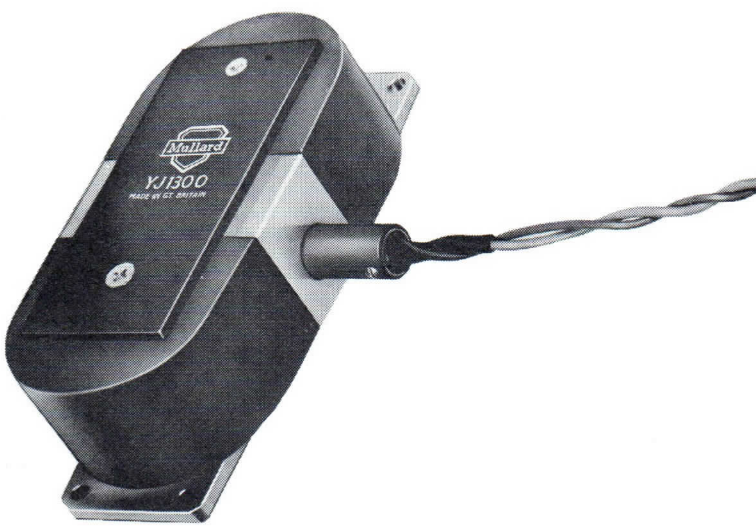
Millimetres	Inches
2.80 ± 0.13	0.110 ± 0.005
Ø 3.175 ± 0.076 × 15	Ø 0.125 ± 0.003 × 0.591
3.18 ± 0.10	0.1252 ± 0.0040
Ø 4.293 ± 0.076 × 15	Ø 0.169 ± 0.003 × 0.591
Ø 4.305	Ø 0.1695
Ø 4.91 ± 0.04	Ø 0.1932 ± 0.0015
5.6 ± 0.5	0.220 ± 0.020
12.70 ± 0.25	0.500 ± 0.010
Ø 19	Ø 0.75
30.99	1.220
31.6 ± 0.5	1.244 ± 0.020
32.51	1.280
39.7 ± 0.3	1.563 ± 0.012
40.8 max	1.606 max
58 max	2.28 max
67.3 max	2.650 max
73.0 ± 0.1	2.874 ± 0.004
75.8 ± 1.4	2.984 ± 0.055
79.38 max	3.125 max
82.5 ± 0.5	3.248 ± 0.020
89.1 max	3.51 max
132.6 max.	5.22 max

MAGNETRON

YJ1300

QUICK REFERENCE DATA		
X-Band, fixed frequency, pulsed magnetron.		
Frequency (fixed within the band)	9.380 to 9.440	GHz
Power output (peak)	7.0	kW
Construction	Packaged	
Output connection	Waveguide 16 flange	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES



TYPICAL OPERATION

Operating conditions

	Condition 1	Condition 2	
Heater voltage	6.3	6.3	V
Anode current (peak)	5.0	5.0	A
Pulse duration (tp)	0.1	1.0	µs
Pulse repetition rate	2000	1000	pulse/s
Rate of rise of voltage pulse	60	60	kV/µs

Typical performance

Anode voltage (peak)	4.25	4.25	kV
Power output (peak)	7.0	7.0	kW
Power output (mean)	1.4	7.0	W

CATHODE

Indirectly heated

Heater voltage	6.3	V
Heater current	0.5	A
Heater current (surge) maximum	3.0	A
Heating time (minimum) (see note 1)	30	s

TEST CONDITIONS AND LIMITS

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

Test conditions

Heater voltage	6.3	V
Anode current (mean)	5.0	mA
Duty factor	0.001	
Pulse duration (tp) (see note 2)	1.0	µs
v.s.w.r. at output connection	1.05:1	
Rate of rise of voltage pulse (see note 3)	75	kV/µs

TEST CONDITIONS AND LIMITS (contd.)

Limits and characteristics

	Min.	Max.	
Anode voltage (peak)	4.0	4.5	kV
Power output (mean)	6.0	-	W
Frequency (see note 4)	9.380	9.440	GHz
R.F. Bandwidth at 1/4 power (see note 2)	-	$\frac{2.5}{tp}$	MHz
Frequency pulling (v.s.w.r.=1.5:1)	-	18	MHz
Stability (see note 5)	-	0.25	%
Minor lobe level	6.0	-	dB
Cold impedance (see note 6)			
Heater current (see note 7)			
Frequency temperature coefficient (see note 8)			
Input capacitance (see note 9)			

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

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

	Min.	Max.	
Heater voltage (see note 10)	5.7	6.9	V
Anode voltage (peak)	4.0	4.6	kV
Anode current (peak)	4.0	6.0	A
Power input (peak)	-	20	kW
Power input (mean)	-	20	W
Duty factor	-	0.001	
Pulse duration (tp)	-	1.0	μs
Rate of rise of voltage pulse (see note 3)	-	75	kV/μs
Anode temperature	-	120	°C
v.s.w.r. at output connection	-	1.5:1	

END OF LIFE PERFORMANCE

The quality of all production is monitored by the random selection of magnetrons which are then life tested under the stated test conditions. If the magnetron is to be operated under different conditions from those specified above, Mullard Ltd., should be consulted to verify that the life will not be affected. The magnetron is considered to have reached the end of life when it fails to meet the following limits when operated under the conditions specified on page 2.

	Min.	Max.	
Anode voltage (peak)	4.0	4.5	kV
Power output (mean)	5.0	-	kW
Frequency	9.380	9.440	GHz

MOUNTING POSITION (see note 11) — Any

COOLING — Natural

PHYSICAL DATA

	kg	lb
Weight of magnetron	1.25	2.75
Weight of magnetron in storage carton	1.82	4.0
	mm	in
Dimensions of storage carton	190 × 190 × 280	7.5 × 7.5 × 11

VIBRATION

The magnetron is vibration tested to ensure that it will withstand normal conditions of service.

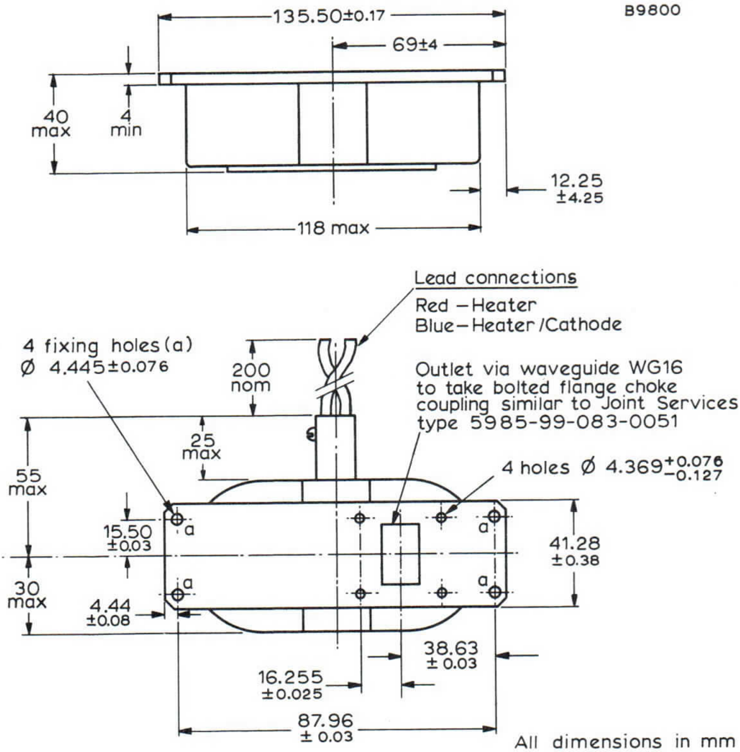
NOTES

1. For ambient temperatures above $0^{o}C$ the cathode must be heated for at least 30 seconds before the application of h.t. For ambient temperatures between $0^{o}C$ and $-55^{o}C$ the cathode heating time is 45 seconds minimum.
2. The tolerance of pulse current duration (tp) is ±10%.
3. Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude.
4. Magnetrons with other frequency ranges can be supplied to order.
5. With the magnetron operating into a v.s.w.r. of 1.5:1 varied through all phases over an anode current range of 4.0mA to 6.0mA. Pulses are defined as missing when the energy level is less than 70% of the normal level in the frequency range 9.380 to 9.440GHz. 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.
6. The cold impedance is measured at the operating frequency and will give a v.s.w.r. of >6:1. The position of voltage minimum from the face of the output flange into the magnetron shall be 3.0 to 9.0mm.

NOTES (contd.)

7. Measured with heater voltage of 6.3 volts and no anode input power, the heater current limits are 0.5 to 0.6A.
8. Design test only. The maximum frequency change with anode temperature change (after warming) is -0.25MHz/degC.
9. Design test only. The maximum input capacitance is 9.0pF.
10. The magnetron is normally tested with a heater supply of 50Hz and is suitable for operation at 1kHz. Mullard Ltd. should be consulted if the magnetron is to be operated with a heater supply of any other frequency.
11. It is necessary to keep all magnetic material as far as possible, at least 50mm (2in) from the magnet. The inner polystyrene pack of the magnetron carton provides adequate separation between magnetrons and it is recommended that magnetrons not in use be kept in these packs.

OUTLINE DRAWING OF YJ1300



CONVERSION TABLE
(Rounded outwards)

Millimetres	Inches	Millimetres	Inches
4 min.	0.15 min.	38.63 ±0.03	1.5209 ±0.0012
Ø 4.369 $^{+0.076}_{-0.127}$	Ø 0.172 $^{+0.003}_{-0.005}$	40 max.	1.58 max.
4.44 ±0.08	0.1748 ±0.0032	41.28 ±0.38	1.625 ±0.015
Ø 4.445 ±0.076	Ø 0.175 ±0.003	55 max.	2.17 max.
12.25 ±4.25	0.48 ±0.17	69 ±4	2.72 ±0.16
15.50 ±0.03	0.6102 ±0.0012	87.96 ±0.03	3.4630 ±0.0012
16.255 ±0.025	0.640 ±0.001	118 max.	4.65 max.
25 max.	0.99 max.	135.50 ±0.17	5.3347 ±0.0067
30 max.	1.19 max.	200 nom.	7.87 nom.

MAGNETRON

2J42
(MIL-E-1/667E)

QUICK REFERENCE DATA

Fixed frequency 'X' band magnetron with natural or forced-air cooling.

Frequency	9.345 to 9.405	Gc/s
Power output (pulsed)	7.5	kW

To be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES.

CHARACTERISTICS

	Min.	Max.	
Frequency			
Fixed within the band	9.345	9.405	Gc/s
Pulse voltage (I_{pulse} = 4.5A)	5.3	5.7	kV
R.F. pulse power output (I_{pulse} = 4.5A)	7.0	-	kW
Frequency pulling (v.s.w.r. = 1.5)	-	15	Mc/s
Frequency temperature coefficient	-	0.25	Mc/s per ^{o}C
Distance of v.s.w. minimum from face of mounting plate into valve	13.5	22.5	mm
Input capacitance	-	8.0	pF

TYPICAL OPERATION

R.F. pulse power output	7.5	kW
Duty factor	0.001	
Pulse duration	1.0	µs
Pulse repetition frequency	1000	p.p.s.
Heater voltage (running)	6.3	V
Pulse current	4.5	A
Pulse voltage	5.5	kV
Pulse input power	24.7	kW
Rate of rise of voltage pulse	50	kV/µs
Mean input current	4.5	mA
Mean input power	24.7	W
Mean r.f. output power	7.5	W
Frequency pulling (v.s.w.r. = 1.5)	14	Mc/s

CATHODE

Indirectly heated

Vh	6.3	V
Ih	600	mA

Heating time. At ambient temperatures above $0\,^{\circ}C$ the cathode must be heated for at least 2 minutes before the application of h.t. Below this temperature the heating time must be increased to at least 3 minutes.

For mean input powers greater than 25 watts, it is necessary to reduce the heater voltage within 3 seconds of applying h.t. in accordance with the formula:

$$V_h = 6.3\left(1 - \frac{P_{in}}{180}\right)\text{Volts}$$

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
Pulse current	3.5	5.5	A
Pulse duration		2.5	μs
Duty factor		0.0025	
Mean input power		82.5	W
Rate of rise of voltage pulse		75	kV/μs
Load mismatch (v.s.w.r.)		1.5	
Temperature of anode block		120	$^{\circ}$C

MOUNTING POSITION Any

PHYSICAL DATA

	lb	kg
Weight of magnetron	3.0	1.4
Weight of magnetron in carton	5.7	2.5
	in	mm
Dimensions of storage carton	7.75 x 8.0 x 9.75	200 x 210 x 250

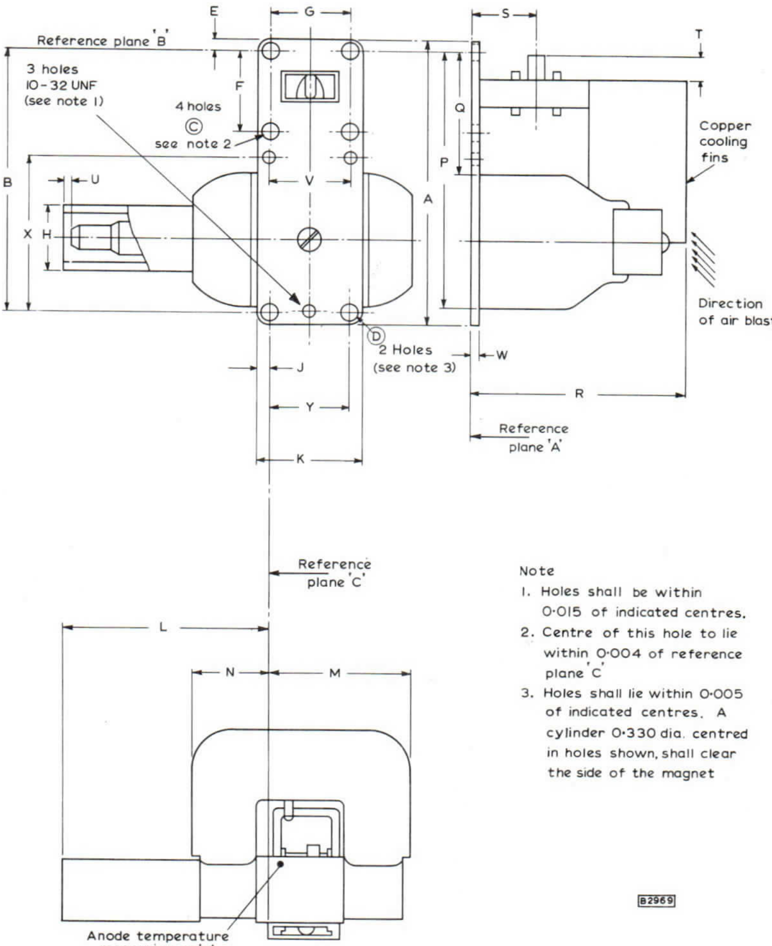
COOLING

In normal circumstances natural cooling is adequate, but where the ambient temperature is abnormally high, a flow of cooling air between the radiator fins may be necessary to keep the block temperature below the permitted maximum.

DIMENSIONS

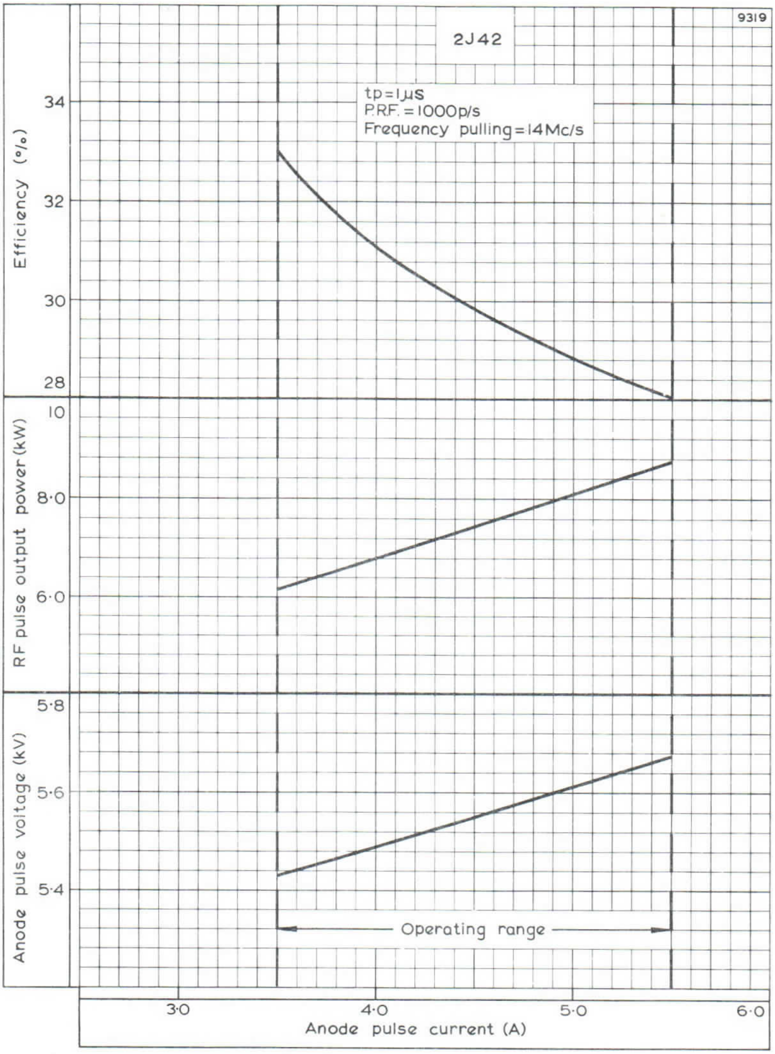
	Inches			Millimetres		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	4.438	-	4.469	112.7	-	113.5
B	-	4.103	-	-	104.2	-
C	0.167	-	0.173	4.24	-	4.39 dia.
D	0.172	-	0.178	4.37	-	4.52 dia.
E	0.156	-	0.188	3.96	-	4.78
F	1.276	-	1.284	32.4	-	32.5
G	1.216	-	1.224	30.9	-	31.1
H	-	-	1.0	-	-	25.4
J	0.188	-	0.219	4.78	-	5.56
K	1.609	-	1.641	40.9	-	41.7
L	2.688	-	3.188	68.28	-	80.98
M	-	-	2.188	-	-	55.58
N	-	-	1.188	-	-	30.18
P	-	-	4.0	-	-	101.6
Q	1.938	-	-	49.22	-	-
R	-	-	3.313	-	-	84.15
S	0.750	-	1.0	19.05	-	25.40
T	-	-	0.375	-	-	9.52
U	-	-	0.250	-	-	6.35
V	-	1.250	-	-	31.75	-
W	-	0.125	-	-	3.175	-
X	-	2.393	-	-	60.78	-
Y	-	1.220	-	-	30.99	-

Millimetre dimensions derived from original inch dimensions.



Note

1. Holes shall be within 0·015 of indicated centres.
2. Centre of this hole to lie within 0·004 of reference plane 'C'
3. Holes shall lie within 0·005 of indicated centres. A cylinder 0·330 dia. centred in holes shown, shall clear the side of the magnet



ANODE PULSE VOLTAGE. R.F. PULSE POWER OUTPUT AND EFFICIENCY PLOTTED AGAINST ANODE PULSE CURRENT

MAGNETRON 2J55

QUICK REFERENCE DATA		
Fixed frequency 'X' band forced air cooled magnetron.		
Frequency	9.375	GHz
Power output (pulsed)	50	kW
Construction		Packaged

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS

R.F. pulse power output	50	50	kW
Duty factor	0.00067	0.001	
Pulse duration	2.0	1.0	μs
Pulse repetition frequency	325	1000	p.p.s.
Heater voltage (running)	2.5	0	V
Pulse current	12	12	A
Pulse voltage	12	12	kV
Pulse input power	144	144	kW
Rate of rise of voltage pulse	50	50	kV/μs
Mean input current	8.0	12	mA
Mean input power	96	144	W
Mean r.f. output power	32.5	50	W
Frequency pulling (v.s.w.r. = 1.5)	12	12	MHz

CATHODE

Indirectly heated

V_h	6.3 ± 10%	V
I_h	1.0	A
I_h (surge) max.	6.0	A
t_{h-k} (min.)	120	s

It is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power-heater voltage rating chart on page C1.

CHARACTERISTICS

	Min.	Max.	
Frequency (fixed within the band)	9.345	9.405	GHz
Pulse voltage (I_{pulse} = 12A)	4.0	13.0	kV
R.F. pulse power output (I_{pulse} = 12A)	40	-	kW
Frequency pulling (v.s.w.r.=1.5)	-	15.0	MHz
Frequency temperature coefficient	-	0.25	MHz per degC

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Max.	
Pulse current	16	A
Pulse duration	2.5	μs
Duty factor	0.001	
Mean input power	180	W
Rate of rise of voltage pulse	60	kV/μs
Load mismatch (v.s.w.r.)	1.5	

END OF LIFE PERFORMANCE

The valve is deemed to have reached end of life when it fails to satisfy the following:

R.F. pulse power output (I_{pulse} = 12A) 30 kW

	Min.		Max.	
Frequency				
Within the band	9.345	to	9.405	GHz

BANDWIDTH

$\frac{3.0}{tp}$ MHz

Where tp = Pulse duration in μs

MOUNTING POSITION

Any

PRESSURISING

The magnetron need not be pressurized at heights up to 10,000ft.

The circular mounting flange and the waveguide output system of the valve are made to enable the magnetron to be used in applications requiring a pressure seal.

They can be maintained at a pressure of 3.17kg/cm^2 (45lb/in^2) absolute.

PHYSICAL DATA

	kg	lb
Weight of magnetron	1.7	3.7
Weight of magnetron in carton	4.5	9.9

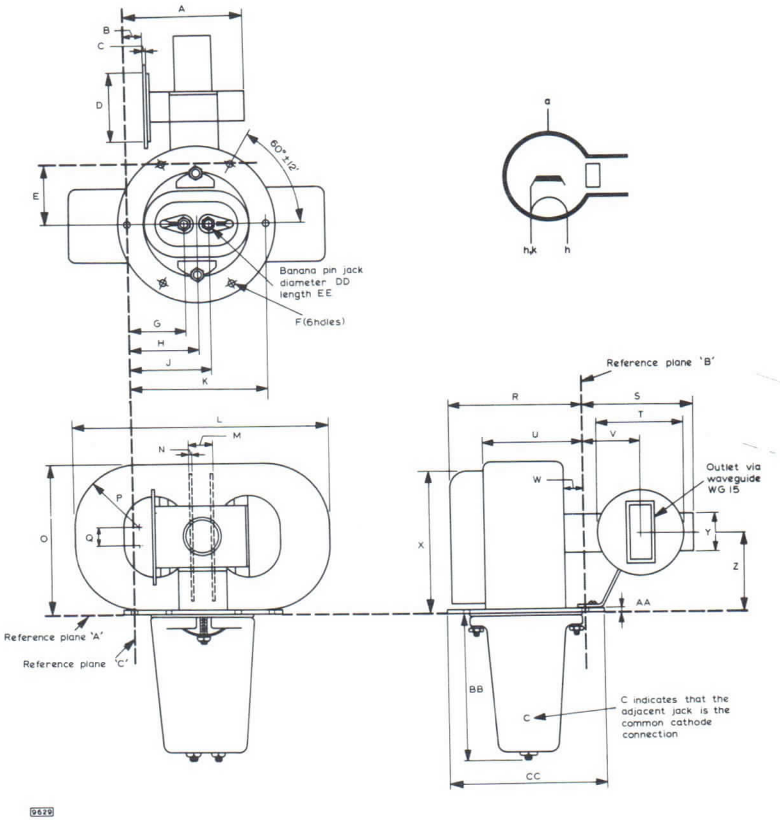
COOLING

A flow of cooling air may be necessary to keep the anode block temperature below the permitted maximum.

Temperature

Anode block max.	100	°C

OUTLINE DRAWING



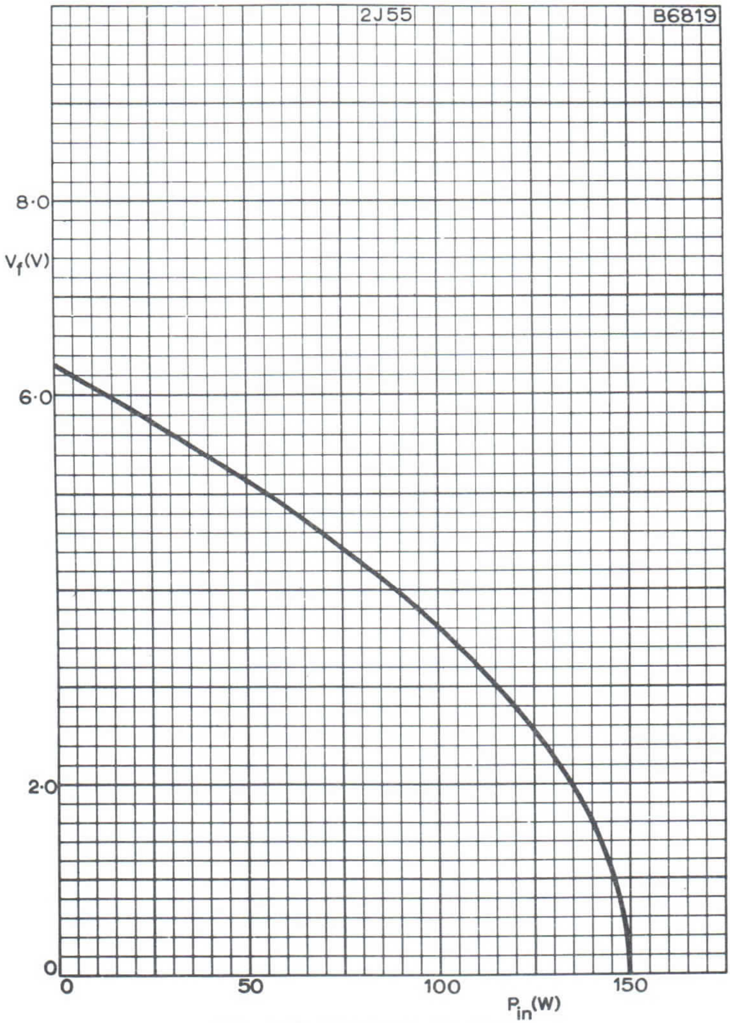
ANODE CONNECTION TERMINATED AT THE BASE PLATE

Dimensions overleaf

DIMENSIONS

	Millimetres	Inches	
A	63.5	2.50	max.
B	11.1 ±0.5	0.437 ±0.020	
C	2.16±0.13	0.085 ±0.0051	
D	36	1.42	max.
E	31.6	1.24	
F	4.90±0.07	0.193 ±0.0028	dia.
G	30.15	1.187	
H	36.5 ±0.7	1.437 ±0.028	
J	42.85	1.687	
K	73.0 ±0.13	2.874 ±0.0051	
L	136.47	5.373	max.
M	12.7	0.5	max.
N	1.6	0.063	
O	79.3	3.12	max.
P	34	1.34	rad
Q	9.5	0.37	
R	69.7	2.74	max.
S	67.6	2.66	max.
T	44.45±0.18	1.750 ±0.0071	
U	52.3	2.06	max.
V	30.3 ±0.5	1.192 ±0.020	
W	11	0.43	min.
X	75.4	2.97	max.
Y	19	0.75	
Z	39.7 ±0.5	1.563 ±0.020	
AA	3.18±0.13	0.125 ±0.0051	
BB	75.8 ±1.6	2.984 ±0.063	
CC	82.5 ±0.7	3.248 ±0.028	

Millimetre dimensions derived from original inch dimensions



HEATER DERATING CHART

MAGNETRON 2J56

QUICK REFERENCE DATA		
Frequency	9.245	GHz
Power output (pulsed)	50	kW
Construction		Packaged

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS

R.F. pulse power output	50	50	kW
Duty factor	0.00033	0.001	-
Pulse duration	0.1	1.0	μs
Pulse repetition frequency	3300	1000	p.p.s.
Heater voltage (running)	5.0	0	V
Pulse current	12	12	A
Pulse voltage	12.7	12.7	kV
Pulse input power	152	152	kW
Rate of rise of voltage pulse	100	100	kV/μs
Mean input current	4.0	12	mA
Mean input power	50	152	W
Mean r.f. output power	16.5	50	W
Frequency pulling (v.s.w.r. = 1.5)	12	12	MHz

CATHODE

Indirectly heated

V_h	$6.3 \pm 10\%$	V
I_h	1.0	A
I_h (surge) max.	6.0	A
r_h (cold)	0.8	Ω
t_{h-k} (min.)	120	s

It is necessary to reduce the heater voltage immediately after the application of h.t. in accordance with the input power-heater voltage rating chart on page C1.

CHARACTERISTICS

	Min.	Max.	
Frequency (fixed within the band)	9.215	9.275	GHz
Pulse voltage (I_{pulse} = 12A)	11	13	kV
R.F. pulse power output (I_{pulse} =12A)	40	-	kW
Frequency pulling (v.s.w.r. = 1.5)	-	15	MHz
Frequency temperature coefficient	-	0.25	MHz per degC
Input capacitance	-	9.5	pF

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Pulse current	11	13	A
Pulse duration	-	2.5	μs
Duty factor	-	0.001	
Mean input power	-	180	W
Rate of rise of voltage pulse	-	150	kV/μs
Load mismatch (v.s.w.r.)	-	1.5	

END OF LIFE PERFORMANCE

The valve is deemed to have reached end of life when it fails to satisfy the following:

	Min.		Max.	
R.F. pulse power output (I_{pulse} = 12A)			30	kW
Frequency				
Within the band	9.21	to	9.28	GHz
Pulse voltage (I_{pulse} = 12A)	11	to	13.5	kV

MOUNTING POSITION

Any

PHYSICAL DATA

	kg	lb
Weight of magnetron	1.7	3.7
Weight of magnetron in carton	4.5	9.9

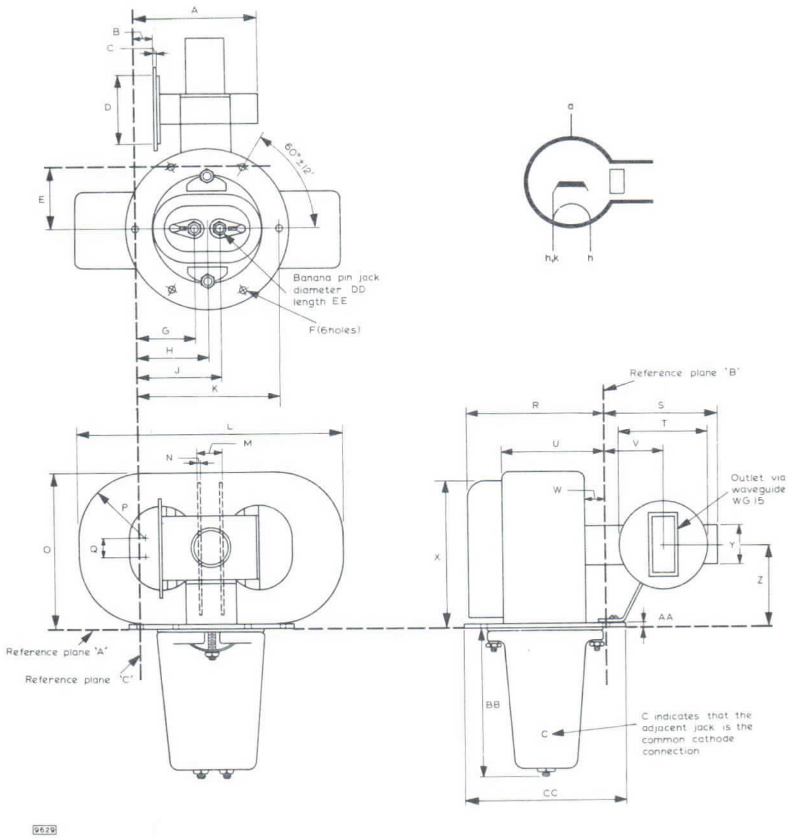
COOLING

A flow of cooling air may be necessary to keep the anode block temperature below the permitted maximum.

Temperature

Anode block max. 100 ^{o}C

OUTLINE DRAWING OF 2J56



ANODE CONNECTION TERMINATED AT THE BASE PLATE

Dimensions overleaf

DIMENSIONS

	Millimetres	Inches	
A	63.5	2.50	max.
B	11.1 ±0.5	0.437 ±0.020	
C	2.16 ±0.13	0.085 ±0.0051	
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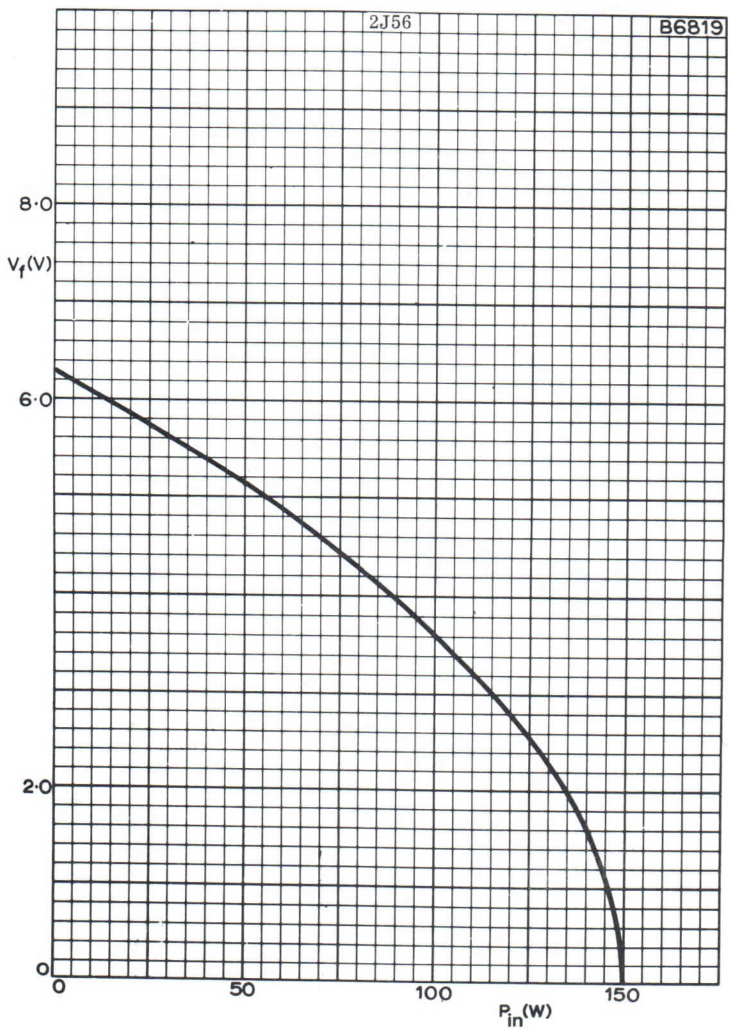
F	4.90 ±0.07	0.193 ±0.0028	dia.
G	30.15	1.187	
H	36.5 ±0.7	1.437 ±0.028	
J	42.85	1.687	
K	73.0 ±0.13	2.874 ±0.0051	
L	136.47	5.373	max.
M	12.7	0.5	max.
N	1.6	0.063	
O	79.3	3.12	max.
P	34	1.34	rad.
Q	9.5	0.37	
R	69.7	2.74	max.
S	67.6	2.66	max.
T	44.45 ±0.18	1.750 ±0.0071	
U	52.3	2.06	max.
V	30.3 ±0.5	1.192 ±0.020	
W	11	0.43	min.
X	75.4	2.97	max.
Y	19	0.75	
Z	39.7 ±0.5	1.563 ±0.020	
AA	3.18 ±0.13	0.125 ±0.0051	
BB	75.8 ±1.6	2.984 ±0.063	
CC	82.5 ±0.7	3.248 ±0.028	

Millimetre dimensions derived from original inch dimensions



HEATER DERATING CHART

INDUSTRIAL MAGNETRONS

1. HEATER

1.1 GENERAL

Incorrect setting of the heater voltage and, in consequence, a cathode temperature too high or too low, may lead to unsatisfactory operation and cause the valve life to be shortened.

1.2 SURGE CURRENT

With some valves it may be required to limit the heater current when switching on the heater supply. Individual data sheets give information on this together with the cold heater resistance to assist in the design of a suitable surge current limiting circuit.

1.3 STARTING VOLTAGE

With indirectly heated cathodes the heater starting voltage should be set within ± 2.5 % at nominal supply input voltage.

In the case of directly heated cathodes reference should be made to the individual data sheets.

1.4 PRE-HEATING TIME

Before the application of the h.t. supply the heater starting voltage should be applied for a time not less than that stated in the individual data sheets. This ensures adequate electron density to start oscillation in the required mode.

1.5 RUNNING VOLTAGE

During operation the cathode temperature is increased by electron back bombardment ("back heating"). The individual data sheets, therefore, contain information relating the heater running voltage to the average anode current so that the cathode temperature can be maintained at the desired level. The heater voltage must be reduced to the appropriate value immediately the h.t. voltage is applied.

1.6 TEMPORARY FLUCTUATIONS

Unless otherwise stated in the individual data sheets, the cathode will accept temporary fluctuations of heater voltage within the range +5% to -10% of the nominal values

2. INPUT AND OUTPUT CONNECTIONS

2.1 INPUT CONNECTION

To prevent anode current flowing through the heater the negative h.t. voltage line should be connected to the common heater-cathode terminal.

2.2 OUTPUT CONNECTION

It is important that the type of output connection should be as specified in the data. Connections to the output must be designed to prevent misaligned surfaces which introduce reflecting discontinuities and must be sufficiently tight to avoid arcing. It is also important to avoid undue stressing of the output section which would either deform the metal or break the glass or ceramic vacuum seals. It is necessary therefore that any mechanical pressure be applied uniformly, when a uniform mechanical pressure is not certain a flexible mounting must be provided, e.g. rubber bushes for fixing screws.

3. H. T. SUPPLY

3.1 GENERAL

Usually the dynamic impedance of a magnetron is low, therefore small variations in the applied voltage can cause appreciable changes in operating current. In the equipment design it is necessary to ensure that such resultant variations in operating current do not lead to operation outside the published limits.

Changes in current cause changes in power and frequency and, consequently, change the equipment performance. Their effects should determine the maximum permissible change of current inherent in the equipment design under the worst operating conditions. Where these changes in performance are not acceptable, either manual control or automatic stabilisation of the average operating current must be incorporated in the power supply design.

3.2 MINIMUM OPERATING CURRENT

At a low operating current, above the threshold of oscillation, magnetrons can develop a negative resistance characteristic. When operated with an unregulated power supply, additional series resistance is necessary to prevent instability. With a regulated power supply the range of control should be limited to avoid hunting. For this reason a minimum operating current is given in the data sheets.

3.3 PEAK CURRENT LIMITATION

In certain applications an unfiltered power supply is used. In these circumstances care should be taken to ensure that the peak current rating cannot be exceeded. A resistance or inductance is usually needed in series with the power supply to augment the inherent regulation of the supply.

4. LOADING

4.1 GENERATOR LOAD CHART (RIEKE DIAGRAM)

A chart showing typical output power and frequency change plotted on a modified impedance circle diagram against magnitude (v.s.w.r.) and phase of the load seen by the magnetron provides information on the behaviour of the magnetron under various load conditions.

Such a chart is often referred to as a Rieke diagram.

With a load of bad mismatch and at a particular phase there is a region on the chart which is characterised by high power output and convergence of the frequency contours. This region is known as the "sink" and the phase of the load at which the magnetron behaves in this manner is known as "the phase of sink". Operation of the magnetron under this load condition will lead to instability and may cause failure.

The region opposite the sink indicates a low power output. A low power output leads to excessive anode dissipation and increased "back heating" of the cathode. These effects can be detrimental to the life of the magnetron and should be avoided.

4.2 MAXIMUM VOLTAGE STANDING WAVE RATIO OF LOAD

Information on the maximum standing wave ratio that can be withstood under continuous operation is given in individual data sheets. Incorrect loading (exceeding this value of v.s.w.r.) may cause unstable operation in the form of moding or arcing.

4.3 COLD LOAD MEASUREMENT

Before the h.t. is applied it must be established that the load condition is such that the v.s.w.r. presented to the magnetron at its output connection dies not exceed the limiting value. For this purpose low power measurements using a standing wave detector or reflectometer technique are necessary over an appropriate frequency range about the actual magnetron frequency. The frequency range must be adequate to cover operational frequency drift due to, current pushing, load pulling and magnetron temperature change.

When magnetrons are likely to be replaced in equipment without further measurement or adjustment of the coupling system, the low power measurements must cover a frequency range which embraces the whole frequency band of the magnetron together with an extension to cover operational frequency drift outside the band.

It should be noted that the value of v.s.w.r. will be vastly different when the load is removed from the applicator or heating chamber and that h.t. should never be applied under this condition. As a protection against this risk a suitable preload should be incorporated in the microwave circuit.

4.4 ON-LOAD MEASUREMENTS

It is possible to monitor the power reflected from the load to the magnetron by means of a reflectometer technique. If it is possible for the reflected power to become excessive so that the v.s.w.r. limit is approached, the magnetron should be safeguarded by means of an automatic h.t. switch-off.

4.5 INSTANTANEOUS LOAD CONDITION

Some equipments include a device which provides a varying field pattern, to produce a more uniform energy distribution. This device introduces a varying instantaneous load condition. Some relaxation of the maximum v.s.w.r. rating under continuous operation can be allowed for instantaneous load conditions outside the "sink"region provided that the average reflected power does not exceed that implied by the continuous v.s.w.r. rating. Any relaxation should be agreed with Mullard Limited. No relaxation can be permitted in the sink region.

5. COOLING

5.1 GENERAL

The cooling requirements given in the data sheets refer to magnetrons operated under open bench conditions. In order to keep within the limiting temperatures for anode block, cathode terminal assembly and output seal, where appropriate, it may be necessary in the practical equipment to provide additional coolant on account of high environmental temperatures due to restrictions imposed by the cabinet and to associated components within the cabinet, and to high ambient temperatures at the equipment location.

The residual heat of the cathode on switch-off may raise the seal temperature above its permitted maximum. This danger can be avoided either by continuing the airflow after removal of cathode heater power or by using sufficient air during operation to keep the temperature of the cathode so low that the rise in seal temperature on switch-off can be accommodated.

Having regard to the limiting temperatures, measurements should be made in the development stage of an equipment using special paints, lacquers, thermopapers or other suitable means.

Thermal cut out switches should be used to prevent operation with excessive anode block temperature in the event of reduction or failure of the cooling medium.

5.2 AIR COOLING

It is important that the air should not contain dust, moisture or oil. If an air filter is incorporated in the system, allowance must be made for the pressure drop across the filter when choosing an adequate blower.

5.3 WATER COOLING

Circulating cooling water should be as free as possible from all solid matter and its dissolved oxygen content should be low. A closed water system using demineralised or distilled water should be used whenever possible.

6. INSTALLATION

The magnetron should never be held by the cathode radiator.

Because the magnet produces a strong field, only non-magnetic tools may be used for installing the magnetron or adjacent components, this reduces the risk of collision between the tools and the glass parts of the magnetron.

7. MOUNTING

The minimum distance from other magnetic materials given on the data sheet must be maintained to prevent deterioration of the magnetron performance. Other devices which produce stray magnetic fields (Blower or stirrer motor) should be placed so that they do not influcence the operation of the magnetron.

The magnetron should be mounted by means of the mounting holes provided. It should NEVER be supported by the coupling to the magnetron output system.

8. STORAGE

Magnetrons should be stored in their original packing because this has been designed to protect them against reasonable vibration and knocks. It also ensures that the spacing between permanent magnet valves and other magnets and ferrous objects is adequate to avoid demagnetisation.

Magnetically sensitive instruments such as compasses, electric meters and watches should not be brought close to a bank of packaged magnetrons.

When a magnetron is temporarily taken out of service it should be placed immediately in its proper container. This is good practice and obviates the risk of damage to the magnets or the glass and ceramic parts and prevents the entry of foreign matter into the output aperture.

Unpacked permanent magnet valves should NEVER be placed on steel benches or shelves.

9. CONDITIONING

After transit or a long period of storage, the h.t. voltage should be increased gradually or in several steps until normal operation is achieved. This treatment will remove any traces of gases which could cause instability, it is particularly important in high power magnetrons.

10. STRAY MICROWAVE RADIATION

The document* entitled "Safety Precautions Relating To Intense Radio-Frequency Radiation" implies that a stray radiation field is a human hazard if the power density exceeds $10mW/cm^2$. The power output of industrial magnetrons is such that, with improperly sealded or defective closures and connections in the transmission system, this power density can easily be exceeded. Serious attention should be given to this point in the manufacture of equipment with due regard to probable deterioration through its life.

* Published by H.M.S.O. 1960 S.O. Code No. 43-182.

QUICK REFERENCE DATA		
Magnetron for use in microwave diathermy or as a laboratory source for gas ionisation.		
Frequency	2.45	GHz
Power output (c.w.)	200	W
Construction	Packaged	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

CHARACTERISTICS (measured at I_a = 200mA d.c., v.s.w.r. <1.05)

Frequency fixed within the band	2.425 to 2.475	GHz
Operating voltage range (d.c.)	1.55 to 1.7	kV

OPERATION FROM SINGLE-PHASE SUPPLY WITHOUT RECTIFIER

OPERATING CONDITIONS (using h.t. supply with $Z > 250\Omega$)

*Heater voltage (running)	4.5	V
Mean anode current	200	mA
Peak anode current	1.3	A
Load mismatch (v.s.w.r.)	1.5	
Power output (matched load)	200	W

*For different values of anode current, the heater voltage should be adjusted in accordance with either curve 'a' or 'b' on page C3.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Heater voltage (starting)	4.8	5.6	V
Heater surge current	-	8.5	A
Mean anode current	-	230	mA
Peak anode current	-	1.4	A
Load mismatch (v.s.w.r.)	-	2.0	
Envelope temperature	-	125	$^{\circ}C$

OPERATION FROM SINGLE-PHASE FULL-WAVE RECTIFIER WITHOUT SMOOTHING FILTER

OPERATING CONDITIONS (using h.t. supply with $Z > 500\Omega$)

*Heater voltage (running)	4.6	V
Mean anode current	200	mA
Peak anode current	700	mA
Load mismatch (v.s.w.r.)	1.5	
Power output (matched load)	200	W

*For different values of anode current, the heater voltage should be adjusted in accordance with either curve 'a' or 'b' on page C3.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Heater voltage (starting)	4.8	5.6	V
Heater surge current	-	8.5	A
Mean anode current	-	230	mA
Peak anode current	-	800	mA
Load mismatch (v.s.w.r.)	-	2.0	
Envelope temperature	-	125	^{o}C

OPERATION FROM D.C. SUPPLY

To obtain optimum power output, it is necessary to insert between the magnetron and the load, a fixed reflection element (see page D8) giving a mismatch with v.s.w.r. of 2.0 in "phase of sink".

OPERATING CONDITIONS

*Heater voltage (running)	4.0	4.8	V
Mean anode current	150	100	mA
Peak anode current	220	150	mA
†Load mismatch (v.s.w.r.)	2.0	2.0	
†Power output (matched load)	150	100	W

*For different values of anode current, the heater voltage should be adjusted in accordance with curve 'c' on page C3.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Heater voltage (starting)	4.4	5.0	V
Heater surge current	-	8.5	A
Mean anode current	-	200	mA
Peak anode current	-	400	mA
†Load mismatch (v.s.w.r.)	-	3.0	
Envelope temperature	-	125	^{o}C

†Excluding fixed reflection element

CATHODE

Indirectly heated

Anode supply	A.C. or rectified A.C.	D.C.	
**V_h (starting)	5.3	4.8	V
I_h	3.5	3.3	A
r_h (cold)	0.2	0.2	Ω
Preheat delay before applying h.t.	3.0	4.0	min.

**Temporary fluctuations not exceeding +5% and -10% of the nominal heater voltage are permissible.

The heater voltage must be reduced immediately after the application of h.t. in accordance with the curves on page C3.

OUTPUT CONNECTION

50Ω coaxial with 4.8mm inner conductor and 11mm outer conductor.

COOLING

Natural cooling is sufficient provided that the magnetron is effectively mounted on a heat conducting non-magnetic heatsink. It is desirable to mount the heatsink vertically.

MOUNTING POSITION — Any (but see COOLING)

PHYSICAL DATA

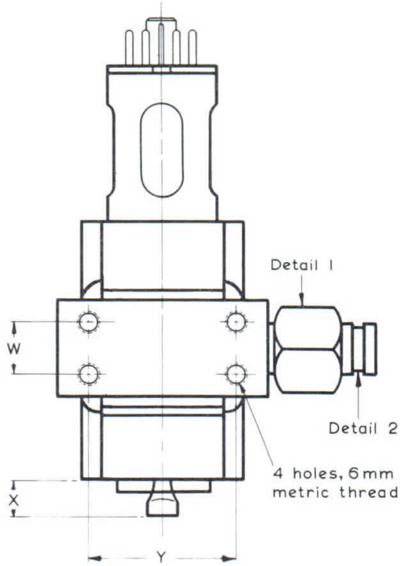
	kg	lb
Weight of magnetron	2.4	5.3
Weight of magnetron in carton	3.5	7.7

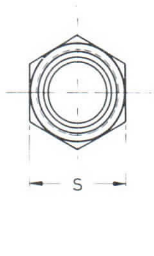
DIMENSIONS

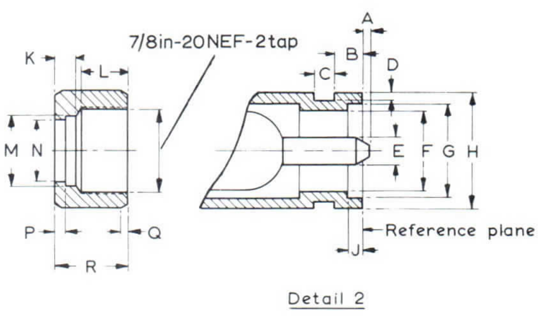
	Millimetres	Inches	
A	1.5	0.059	
B	4.0 ±0.2	0.157 ±0.008	
C	2.8 ±0.2	0.110 ±0.008	
D	1.5	0.059	
E	3.8 ±0.05	0.150 ±0.002	dia.
F	11.1 ±0.15	0.437 ±0.006	dia.
G	12.8 ±0.15	0.504 ±0.006	dia.
H	16	0.63	dia.
J	2.0 ±0.15	0.079 ±0.006	
K	6.0	0.236	
L	13	0.51	
M	19	0.75	dia.
N	16.5	0.650	dia.
P	3.0	0.118	
Q	2.0	0.079	
R	21	0.83	
S	27	1.06	
W	16	0.63	
X	20	0.78	max
Y	45	1.77	

Inch dimensions derived from original millimetre dimensions.

OUTLINE DRAWING





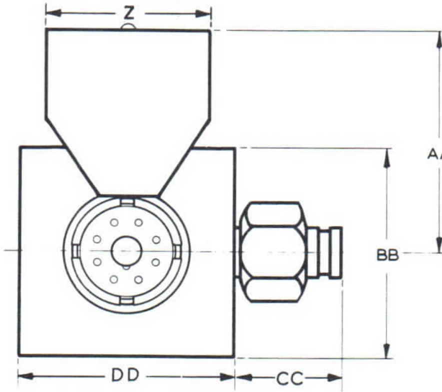


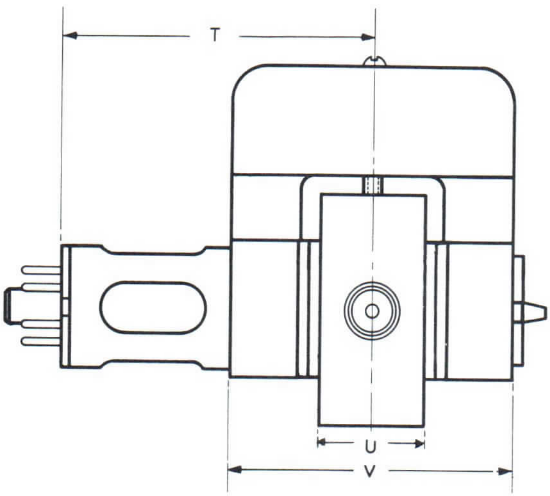
Note:
The inner conductor (E above) will always lie within a circle of diameter 5·5mm.

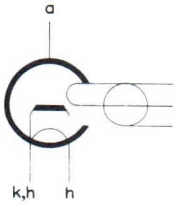
DIMENSIONS

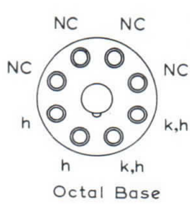
	Millimetres	Inches
T	90	3.54
U	30	1.18
V	80	3.15
Z	50	1.97
AA	71	2.80
BB	64	2.52
CC	33	1.30
DD	64	2.52

Inch dimensions derived from original millimetre dimensions.







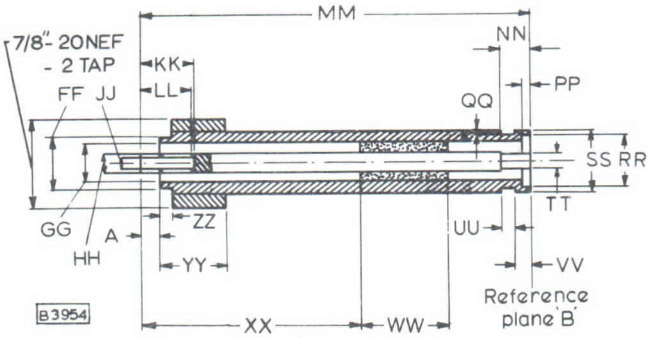


The anode is terminated in the base plate.

8147

FIXED REFLECTION ELEMENT

TEFLON $\varepsilon_r = 2.0$ DRIVING FIT

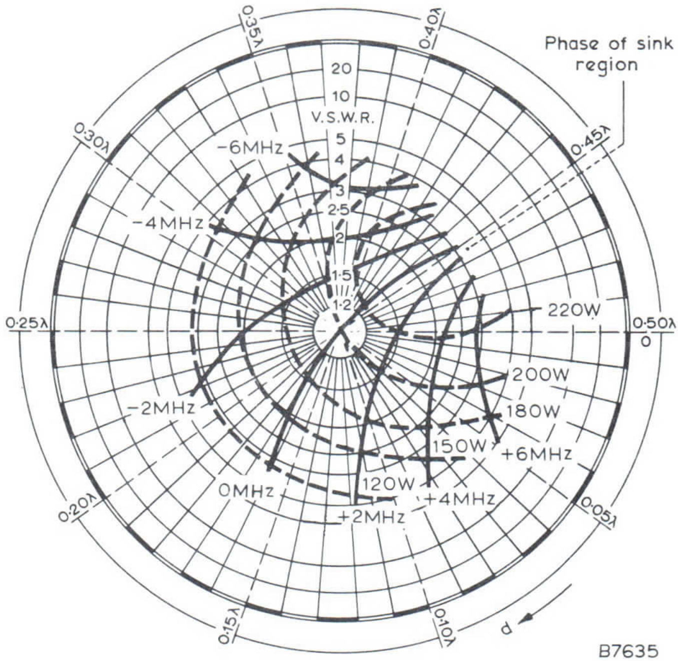


DIMENSIONS

	Millimetres	Inches	
FF	12.6 ± 0.05	0.496 ± 0.002	dia.
GG	11.1 ± 0.15	0.437 ± 0.006	dia.
HH	4.8 ± 0.05	0.189 ± 0.002	dia.
JJ	3.85 + 0.05	0.152 + 0.002	dia.
KK	14	0.55	
LL	13	0.51	
MM	105	4.13	
NN	7.2 + 0.1	0.283 + 0.004	
PP	2.0 ± 0.15	0.079 ± 0.006	
QQ	1.5	0.059	
RR	12.8 ± 0.15	0.504 ± 0.006	dia.
SS	15 ± 0.2	0.591 ± 0.008	dia.
TT	3.8 ± 0.05	0.150 ± 0.002	dia.
UU	2.8 ± 0.2	0.110 ± 0.008	
VV	4.0 ± 0.2	0.157 ± 0.008	
WW	22 ± 0.1	0.866 ± 0.004	
XX	57.5 ± 0.2	2.264 ± 0.008	
YY	16	0.63	
ZZ	3.0	0.118	
A	5.0 0.1	0.197 – 0.004	

Inch dimensions derived from original millimetre dimensions.

RIEKE DIAGRAM ←

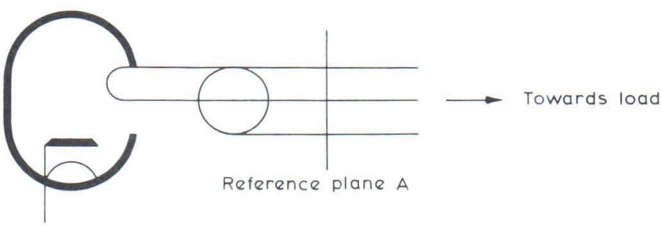


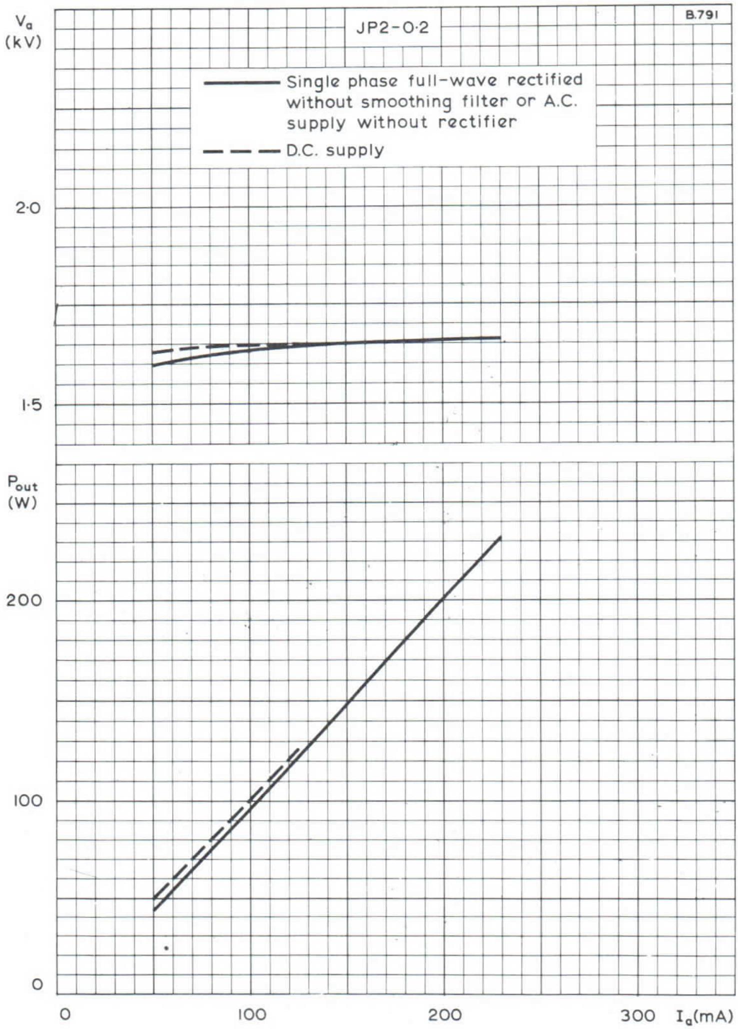
Measured with a.c. supply I_a = 0.2A

- - - = Output power

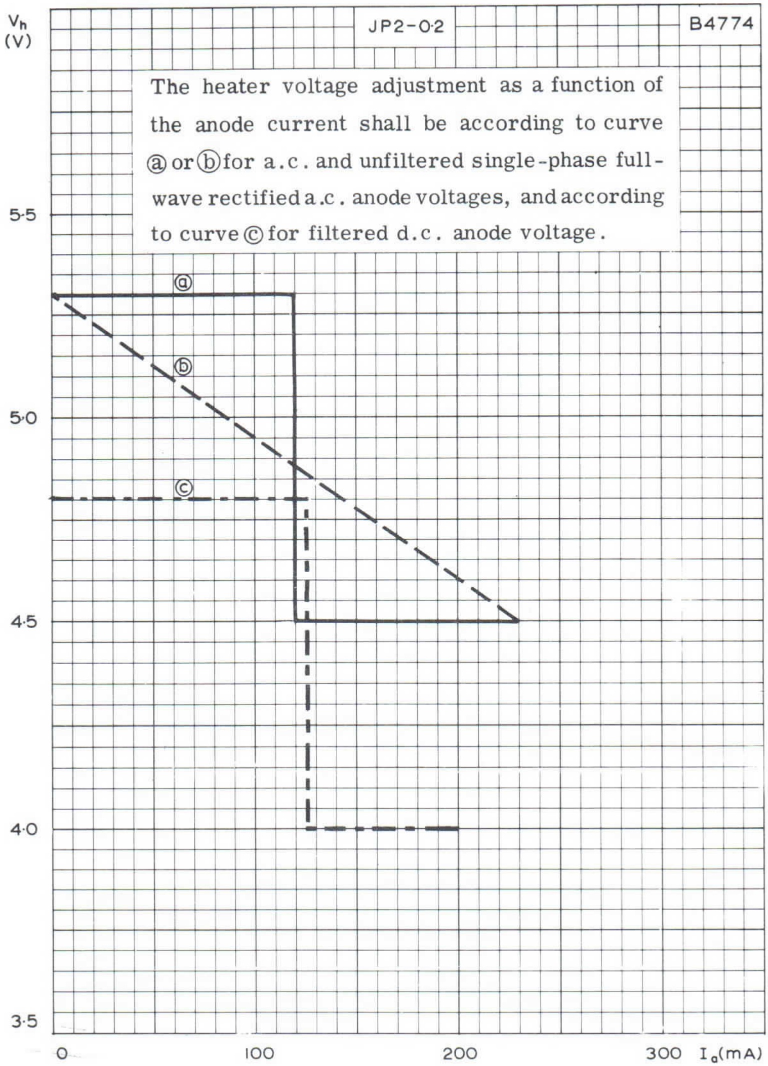
—— = Frequency pulling

d = distance of standing wave minimum from reference plane 'A' towards load.





OUTPUT POWER AND ANODE VOLTAGE PLOTTED AGAINST MEAN ANODE CURRENT



HEATER VOLTAGE PLOTTED AGAINST MEAN ANODE CURRENT

DEVELOPMENT SAMPLE DATA

QUICK REFERENCE DATA

Magnetron for microwave heating applications	
Frequency	2.45 Gc/s
Power output (c.w.)	1.0 kW
Construction	Packaged, Ceramic and Metal

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

CHARACTERISTICS (measured at I_a =380mA d.c. at v.s.w.r. <1.1)

	Min.		Max.	
Frequency fixed within the band	2.425	to	2.475	Gc/s
Operating voltage range (d.c.) within the range	5.4	to	5.8	kV

OPERATION FROM SINGLE-PHASE FULL-WAVE OR TWO-PHASE HALF-WAVE RECTIFIER WITHOUT SMOOTHING FILTER

Typical operation

The dynamic impedance of the power supply must be such that the given $i_{a\,(pk)}$ max. is not exceeded.

Filament voltage	4.0	V
Mean anode current	380	mA
Peak anode current	1.1	A
Load mismatch (v.s.w.r.)	3.0	
P_{out} (v.s.w.r. <1.1)	1.0	kW

	Min.	Max.	
Filament voltage	-	4.2	V
Mean anode current	-	410	mA
Peak anode current	0.8	1.3	A
V_{a-k}		±10	kV
Load mismatch (v.s.w.r.)		4.0	

CATHODE

Directly heated

*V_f (starting)	4.0	V
*V_f (running)	4.0	V
I_f	30	A
I_f (surge) max. peak value	70	A
r_f (cold)	0.018	Ω
Minimum delay before applying H.T.	7.0	s

*Temporary fluctuations not exceeding +5 and -10% of the nominal value of the heater voltage are permissible.

OUTPUT CONNECTION

Integral probe, suitable for coupling to a waveguide, a coaxial line or directly into a cavity.

MOUNTING POSITION Axis of cathode stem vertical

The weight of the magnetron should be supported by the flat surfaces of the magnet system, the valve being secured to its mount by means of the 1/4 in. studs provided. The mounting should be sufficiently flexible and adjustable such that no stress is placed on the output system when the mounting nuts are tightened.

To ensure a good r.f. contact between the output system of the magnetron and the circuit to which it is connected, the use of gasket S330109 is recommended as shown on the MAGNETRON ACCESSORIES sheet.

COOLING

Forced air

Maximum temperatures

Anode block	180	°C
Filament input terminal	200	°C
Any other point	200	°C

The anode heat radiator must be cooled by a ducted air stream of at least 100ft^3/min. (3.0m^3/min.), static pressure relative to the magnetron to be reckoned as 1.0in. w.g.

The filament terminals must be cooled by use of the thermal flow connectors S32995 and S32996 and by directing some of the cooling air to them.

PHYSICAL DATA

	lb	kg
Weight of magnetron	9.25	4.2
Weight of magnetron and carton	12.5	5.7

ACCESSORIES (see separate sheets for outline drawings)

Coupling adaptor (for cold measurement)	S32990
Cathode connector	S32995
Filament connector	S32996
Thermoswitch	S32997
R.F. Gasket	S330109

CIRCUIT ADJUSTMENT

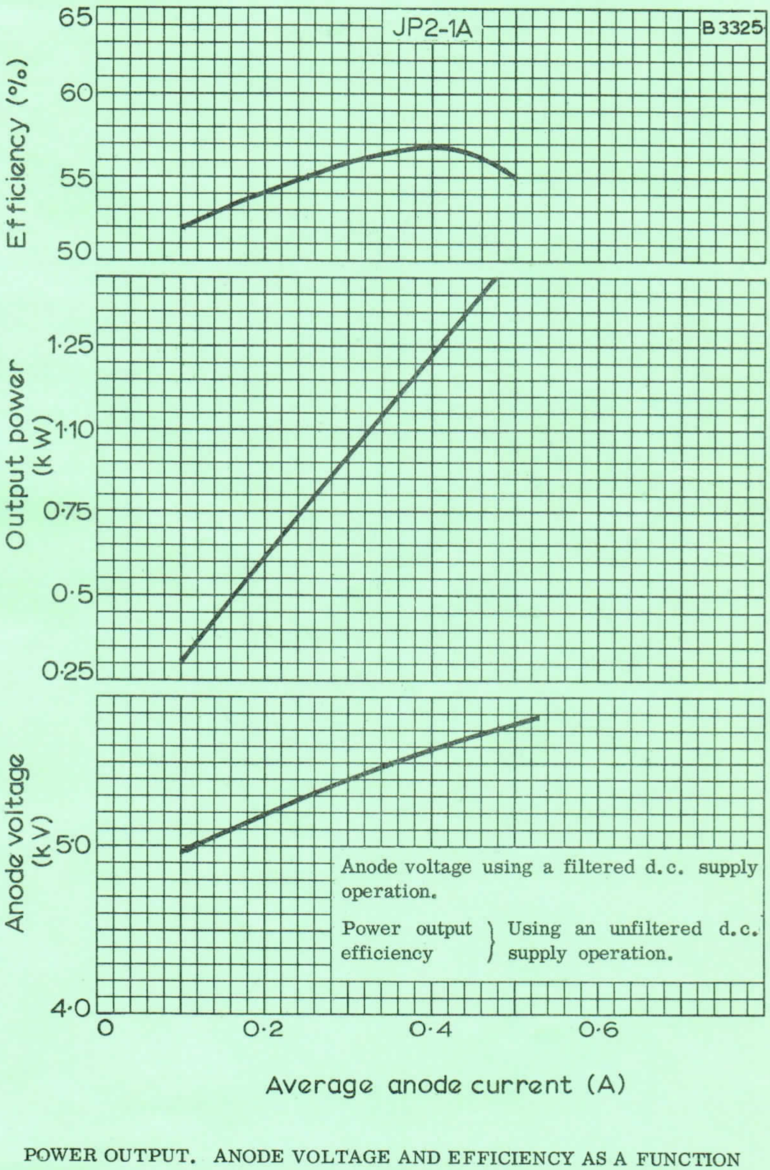
For load impedance measurements relative to the RIEKE DIAGRAM the reference plane is as given on the outline drawing (see page D5).

Prior to installation of the magnetron,coupling adaptor S32990 is used in place of the magnetron and together with appropriate measuring apparatus the cold load impedance relative to the reference plane can be determined. By adjustment of the load coupling circuit the required load condition for the magnetron can be established.

DIMENSIONS

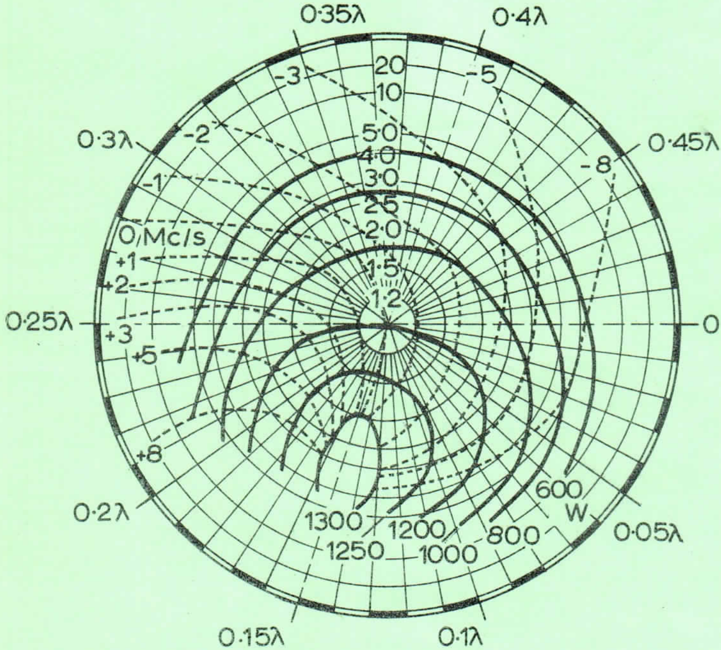
	Inches	Millimetres	
A	6.31	160.3	
B	4.50	114.3	
C	0.46	11.7	
D	1.50	38.1	dia.
E	1.78	45.2	
F	3.91	99.3	
G	0.250 ± 0.002	6.350 ± 0.050	
H	$0.625^{+0.000}_{-0.003}$	$15.875^{+0.000}_{-0.076}$	dia.
J	4.91	124.7	
K	4.50	114.3	
L	1.44	36.6	dia.
M	1.20	30.5	dia.
N	$0.421^{+0.005}_{-0.000}$	$10.694^{+0.126}_{-0.000}$	dia.
P	0.25	6.4	
Q	1.287	32.69	
R	0.14	3.6	min.
S	4.75	120.6	dia.
T	1.63	41.4	
U	0.81	20.6	
V	2.52	64.0	

Millimetre dimensions derived from original inch dimensions



POWER OUTPUT. ANODE VOLTAGE AND EFFICIENCY AS A FUNCTION OF AVERAGE ANODE CURRENT

RIEKE DIAGRAM



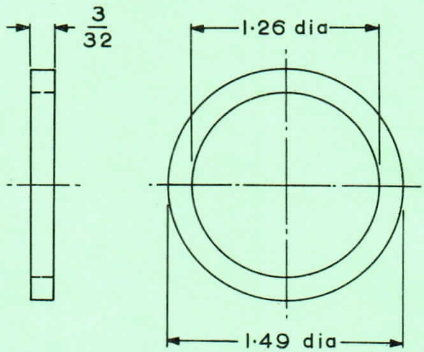
Distance of standing wave minimum from reference plane toward load

B3330

F = 2.45Gc/s
AVERAGE ANODE CURRENT = 0.38A
PEAK ANODE CURRENT = 1.1A
UNFILTERED RECTIFIED ANODE SUPPLY

R.F. - GASKET

S-330109

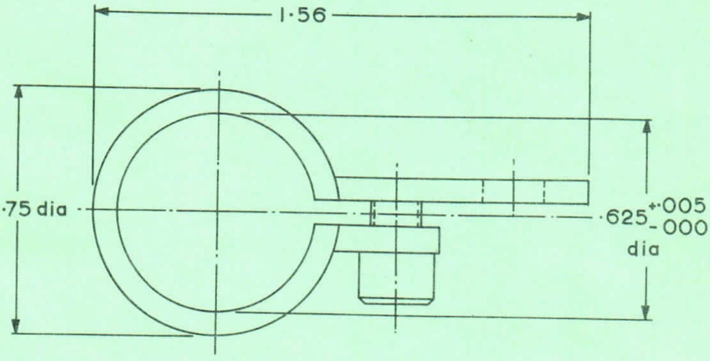


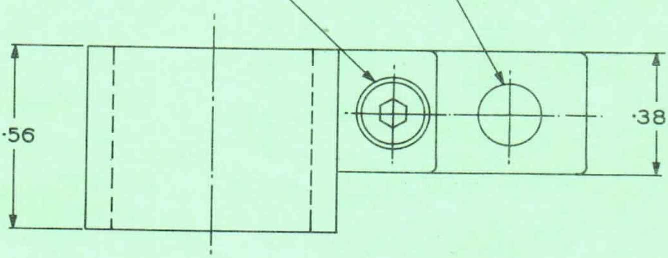
All dimensions in inches

B3679

CATHODE CONNECTOR

S-32995



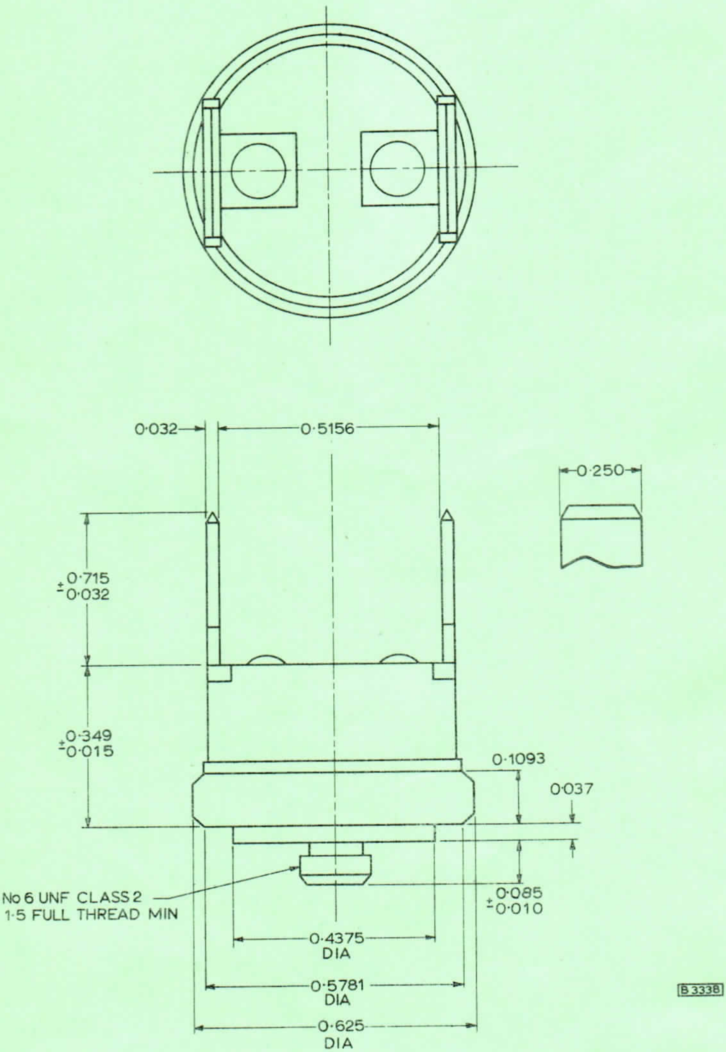


All dimensions in inches

B3677

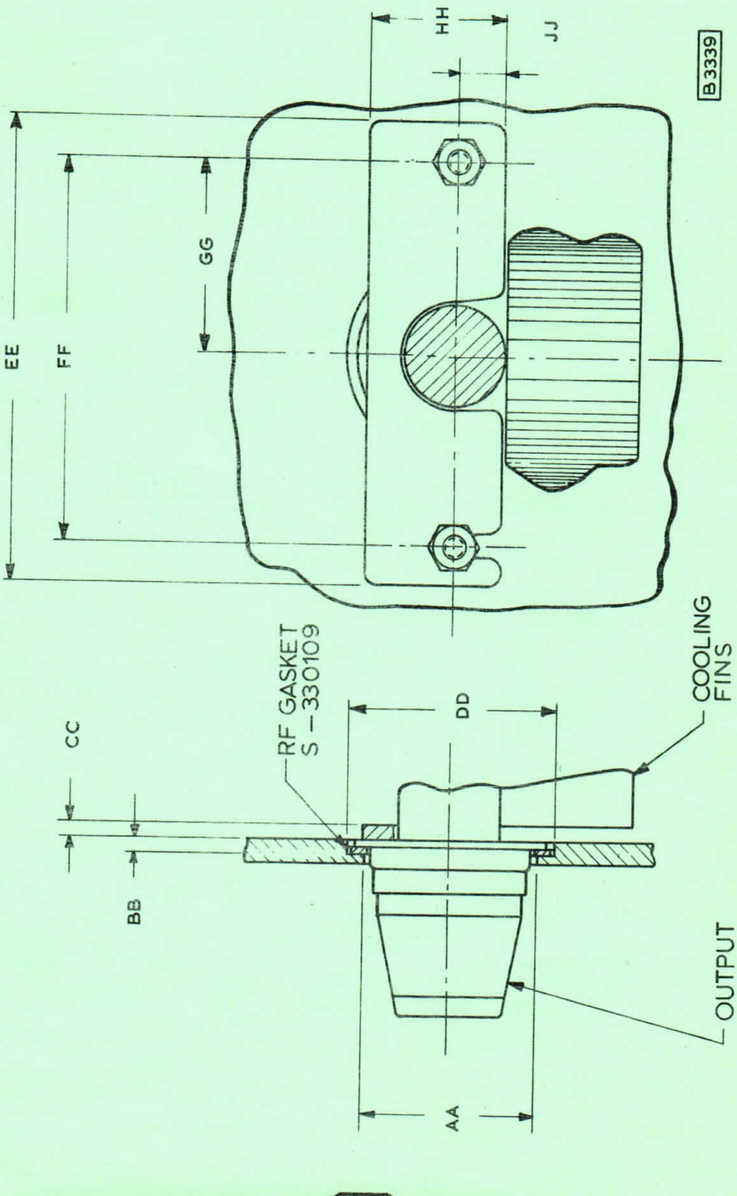
THERMOSWITCH

S-32997



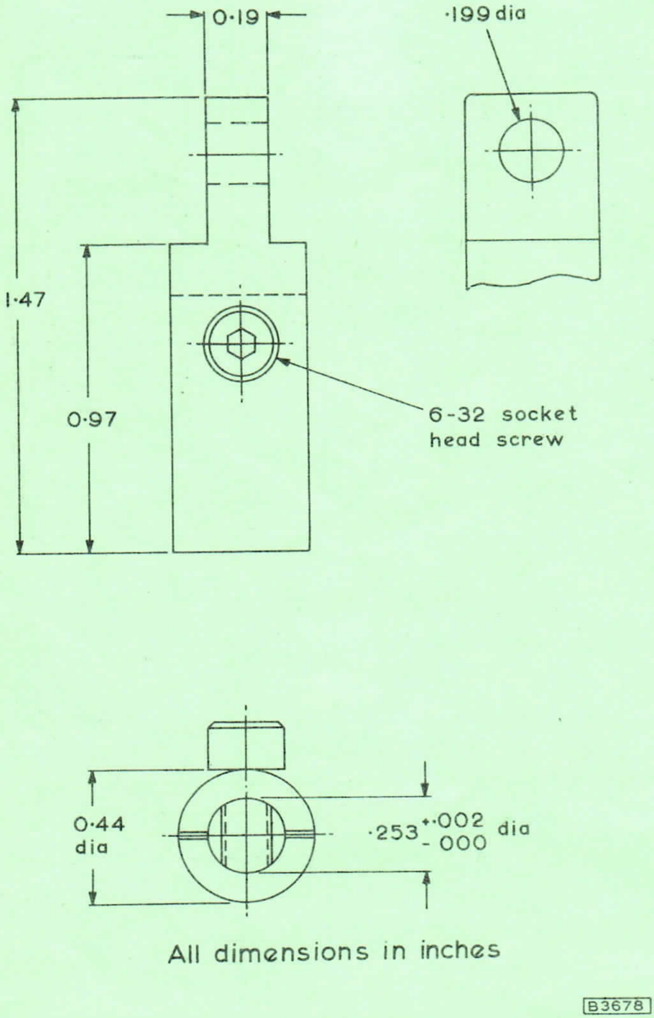
All dimensions in inches.

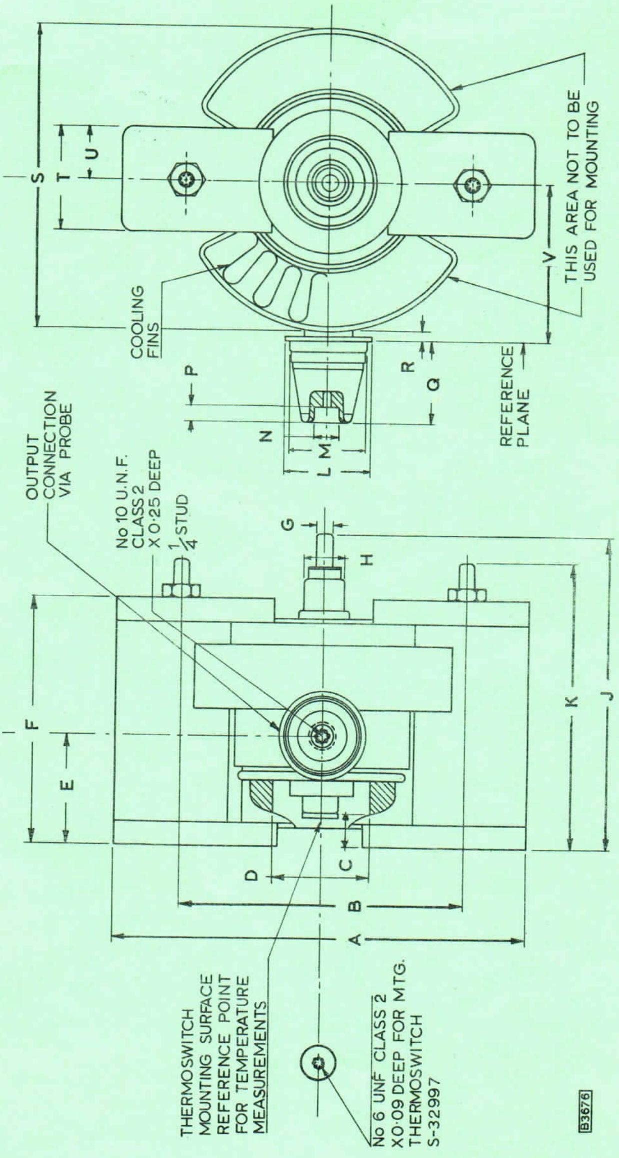
METHOD FOR COUPLING TO R.F. CIRCUITRY



HEATER CONNECTOR

S-32996




THIS AREA NOT TO BE USED FOR MOUNTING
COOLING FINS
REFERENCE PLANE
OUTPUT CONNECTION VIA PROBE
No 10 U.N.F. CLASS 2 X 0·25 DEEP
1/4 STUD
THERMOSWITCH MOUNTING SURFACE REFERENCE POINT FOR TEMPERATURE MEASUREMENTS
No 6 UNF CLASS 2 X0·09 DEEP FOR MTG. THERMOSWITCH S-32997
S
T
U
V
P
R
Q
N
L
M
G
H
F
E
D
C
B
A
K
J
B3676

DIMENSIONS of coupling drawing.

	Inches	Millimetres	
AA	1.25	31.8	dia.
BB	0.09	2.3	
CC	0.125	3.18	
DD	1.562	39.67	dia.
EE	3.375	85.73	
FF	2.875	73.03	
GG	1.438	36.53	
HH	1.000	25.40	
JJ	0.3437	8.73	

Millimetre dimensions derived from original inch dimensions

JP2-2.5A (YJ1162) JP2-2.5W (YJ1160)

QUICK REFERENCE DATA		
Magnetrons for microwave heating applications JP2-2.5A (YJ1162) is forced-air cooled JP2-2.5W (YJ1160) is water cooled		
Frequency	2.45	Gc/s
Power output	2.5	kW
Construction	Packaged, high stability ticonal magnet	

Unless otherwise shown data is applicable to both types

To be read in conjunction with

GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

CHARACTERISTICS

	Min.		Max.	
Frequency fixed within the band	2.425		2.475	Gc/s
Operating voltage range (d.c.), within the range (at I_a = 750mA d.c., v.s.w.r. < 1.05)	4.4		4.8	kV
Operating voltage range (d.c.), within the range (at I_a = 800mA d.c., v.s.w.r. = 3.0 in "phase of sync")	4.6		5.0	kV
"Phase of sync" from the reference plane (see drawings) towards load (nominal)		0.40		λ

OPERATION IN MICROWAVE OVEN WITH FIELD STIRRER, WITH SINGLE-PHASE FULL-WAVE RECTIFIER WITHOUT SMOOTHING FILTER

OPERATING CONDITIONS

For this condition the centre of the locus of the load impedance seen by the magnetron to be at v.s.w.r. = 3.0 in "phase of sync".
The impedance of the h.t. supply should be greater than 500Ω. In addition, a limiting resistor of 300Ω should be inserted in series with the magnetron.

Heater voltage (running)	1.7	V
Mean anode current	800	mA
Peak anode current	2.0	A
Load mismatch (v.s.w.r.)		
in the region of ±0.1λ		
about "phase of sync"	3.0	
instantaneous value*	5.0	
in the remaining region	2.5	
Power output (v.s.w.r. = 3.0 in "phase of sync")	2.5	kW

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Heater voltage (starting)	4.5	5.2	V
Mean anode current	100	850	mA
Peak anode current	-	2.1	A
Load mismatch (v.s.w.r.)			
in the region of ±0.1λ			
about "phase of sync"	-	4.0	
instantaneous value*	-	10	
in the remaining region	-	4.0	

*Maximum duration 20ms, maximum duty ratio 0.2. Moding must be avoided by the use of an appropriate coupling system.

OPERATION IN MICROWAVE OVEN WITHOUT FIELD STIRRER OR INDUSTRIAL APPLICATION WITH SINGLE-PHASE FULL-WAVE RECTIFIER WITHOUT SMOOTHING FILTER

OPERATING CONDITIONS

The impedance of the h.t. supply should be greater than 500Ω. In addition, a limiting resistor of 300Ω should be inserted in series with the magnetron.

Heater voltage (running)	2.0	V
Mean anode current	750	mA
Peak anode current	2.0	A
Load mismatch (v.s.w.r.)	3.0	
*Power output (matched load)	2.0	kW

*For the output power under conditions of mismatch, see the Rieke diagram on page C5.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Heater voltage (starting)	4.5	5.2	V
Mean anode current	100	800	mA
Peak anode current	-	2.1	A
Load mismatch (v.s.w.r.)			
in the region of ±0.03λ about "phase of sync"	-	4.0	
in the remaining region	-	5.0	

OPERATION IN MICROWAVE OVEN WITHOUT FIELD STIRRER FROM SINGLE-PHASE SUPPLY WITHOUT RECTIFIER

OPERATING CONDITIONS

A limiting inductance of 2.25H must be inserted in series with the magnetron.

Heater voltage (running)	3.4	V
Mean anode current	400	mA
Peak anode current	2.0	A
Load mismatch (v.s.w.r.)	2.0	
*Power output (matched load)	1.0	kW

*For the output power under conditions of mismatch, see the Rieke diagram on page C5.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Heater voltage (starting)	4.8	5.2	V
Mean anode current	-	500	mA
Peak anode current	-	2.1	A
Load mismatch (v.s.w.r.)			
in the region of $\pm 0.03\lambda$ about "phase of sync"	-	4.0	
in the remaining region	-	5.0	

OPERATION IN INDUSTRIAL APPLICATION WITH FIXED REFLECTION ELEMENT AND THREE-PHASE HALF-WAVE RECTIFIER WITHOUT SMOOTHING FILTER

To obtain optimum power output, it is necessary to insert between the magnetron and the load, a fixed reflection element (see page D9) giving a mismatch with v.s.w.r. of 1.5 in "phase of sync".

OPERATING CONDITIONS

The impedance of the h.t. supply should be greater than 350Ω.

Heater voltage (running)	1.5	V
Mean anode current	850	mA
Peak anode current	2.0	A
*Load mismatch (v.s.w.r.)	1.5	
*†Power output (matched load)	2.5	kW

†For the output power under conditions of mismatch, see the Rieke diagram on page C4.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Heater voltage (starting)	4.5	5.2	V
Mean anode current	100	900	mA
Peak anode current	-	2.1	A
*Load mismatch (v.s.w.r.)			
in the region of ±0.03λ			
in "phase of sync"	-	2.5	
in the remaining region	-	4.0	

*Excludes fixed reflection element

CATHODE

Indirectly heated, dispenser type

**V_h (starting)	5.0	V
I_h (at V_h = 5.0V)	35	A
r_h (cold)	0.02	Ω
$I_{h\ (surge)}$ max.	140	A

For a heater starting voltage in the range 5.0 to 5.2V the cathode must be heated for at least 2 minutes before the application of h.t. At a heater starting voltage of 4.5V the heating time must be increased to at least 3 minutes. For a heater starting voltage in the range 4.5 to 5.0V the minimum heating time can be determined by linear interpolation.
It is necessary to reduce the heater voltage immediately after the application of anode power to compensate for additional heating of the cathode by back bombardment. The correct value of the nominal heater voltage is given by the curve (full line) on page C6.

Where it is required to design a heating generator for several fixed output power levels, the heater voltage may be reduced in one or two steps depending on the anode current range. The appropriate nominal value of heater voltage is that which falls within the limit curves (dotted lines) for the appropriate operating currents. The deviation from the nominal should be kept to a minimum.

**Temporary fluctuations not exceeding +5% and -10% of the nominal heater voltage are permissible.

COOLING

Maximum temperatures

Anode block reference point (see page D9)	125	^{o}C
Cathode radiator	180	^{o}C

Cathode

Cooling clips 40634 and 40649 should be attached to the heater and cathode terminals respectively.

A flow of air should be directed at the cathode radiator in order to keep it below the stated maximum. This should not be allowed to cool the supporting glassware.

Due to the thermal capacity of the cathode if heater and air flow are switched off simultaneously the maximum temperature of the cathode radiator will be exceeded unless the cathode radiator is kept at approximately 100°C during operation. This requires a minimum air flow of 8.0ft^3/min. (0.22m^3/min). If after blowing is provided the minimum air flow may be reduced to 2.0ft^3/min. (0.06m^3/min.).

JP2-2.5A (YJ1162)

Forced-air cooled (see curve on page C2)

Example:-

Under open bench conditions with a matched load, for operation from three-phase or single-phase supplies with rectifier T_{in} = 25°C, the minimum air flow is 60ft^3/min. (1.7m^3/min.) at pressure of 15mm water.

When operating in a confined enclosure causing an increased ambient temperature around the magnetron and with conditions of load mismatch causing reduced efficiency the amount of forced-air cooling will need to be increased.

A plate is provided on the anode block for the mounting of a thermal switch to protect the valve in the event of failure of the cooling air. This switch should come into operation at a temperature not higher than 105°C.

JP2-2.5W (YJ1160)

Water cooled (see curve on page C3)

A plate is provided on the anode block for the mounting of a thermal switch to protect the valve in the event of water failure. This switch should come into operation at a temperature not higher than 120°C.

MOUNTING POSITION

In equipment, the following minimum distances should be maintained between the magnet and magnetic materials (see outline drawings).

direction a	60	mm
direction b	100	mm
direction c	110	mm

OUTPUT CONNECTION

50Ω coaxial transmission line with 16mm inner conductor and 39mm outer conductor.

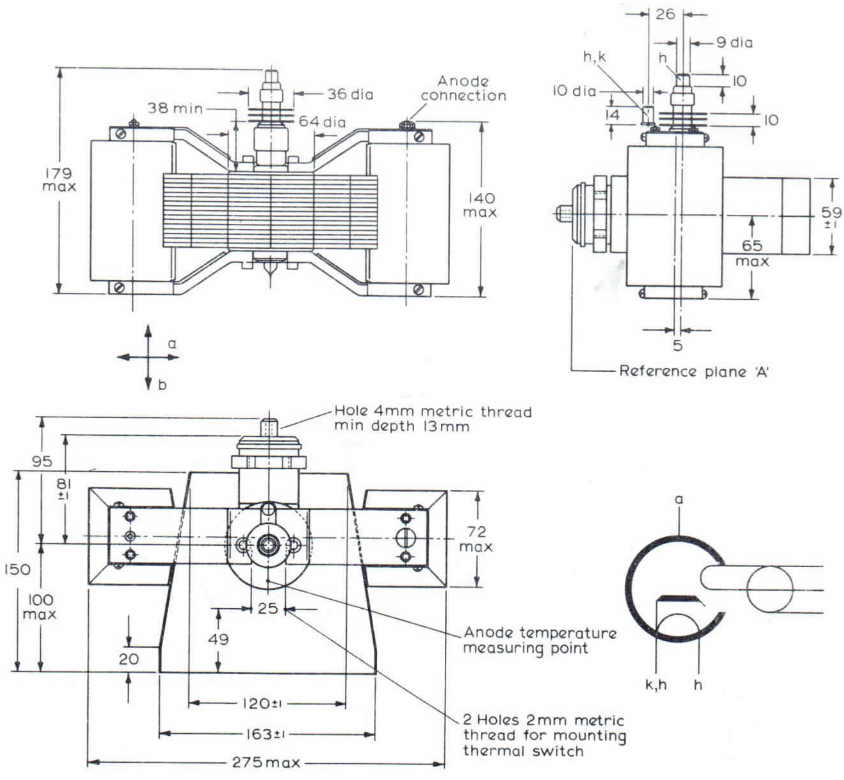
PHYSICAL DATA

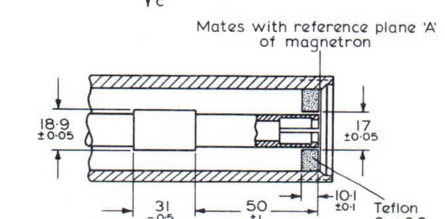
	JP2-2.5A (YJ1162)	JP2-2.5W (YJ1160)	
Net weight of magnetron	17.4	11.2	lb
	7.9	5.1	kg

ACCESSORIES

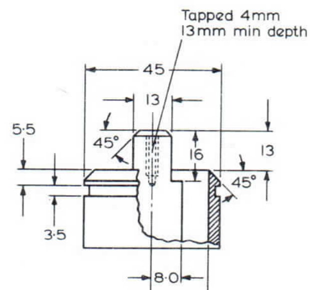
Cap nut	55312
Split spring ring	55313
Heater terminal cooling clip	40634
Cathode terminal cooling clip	40649

OUTLINE DRAWING OF JP2-2.5A (YJ1162)





Fixed reflection element

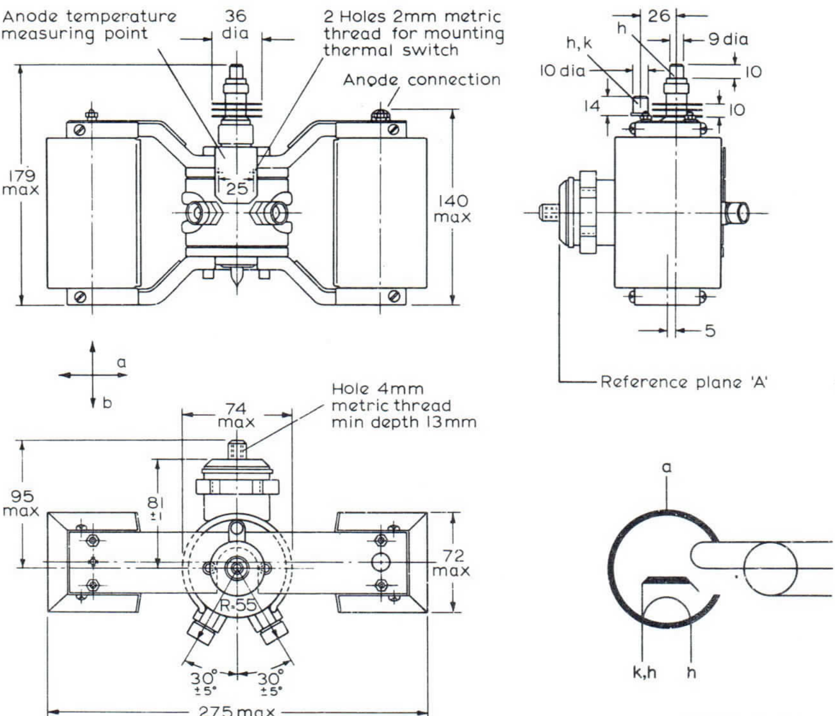


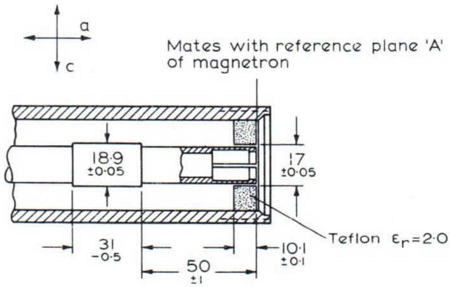
Output terminal

All dimensions in mm

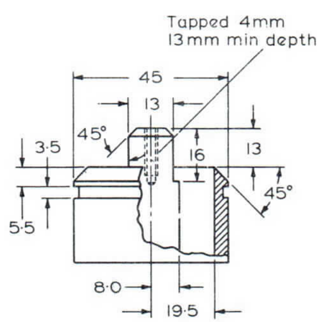
B5020

OUTLINE DRAWING OF JP2-2.5W (YJ1160)





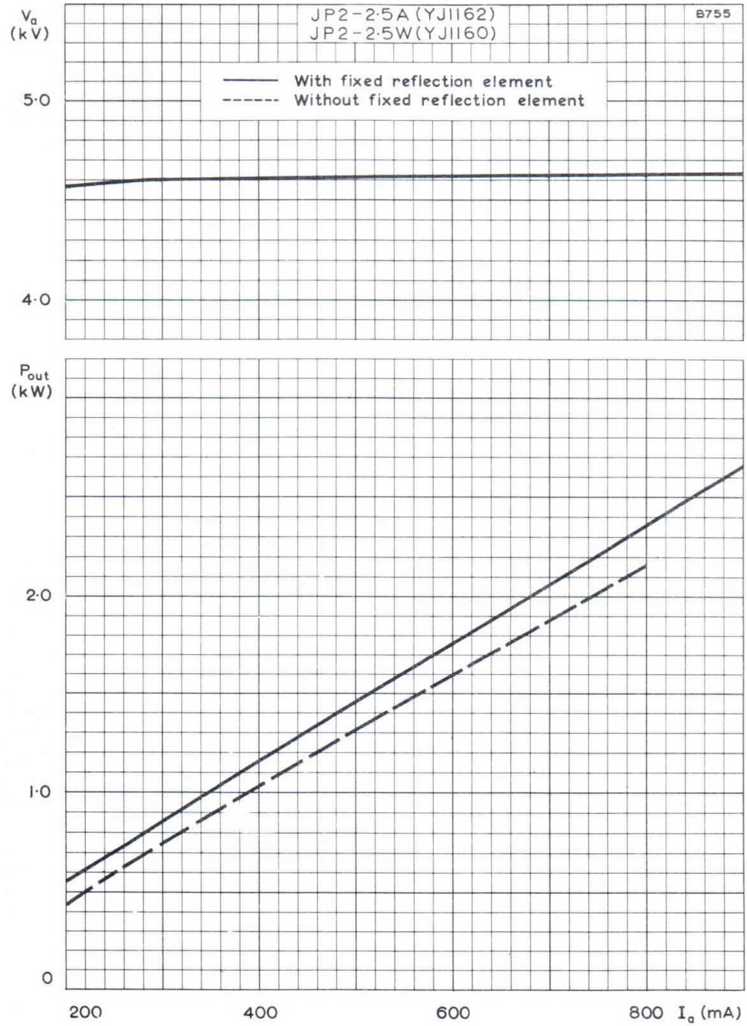
Fixed reflection element



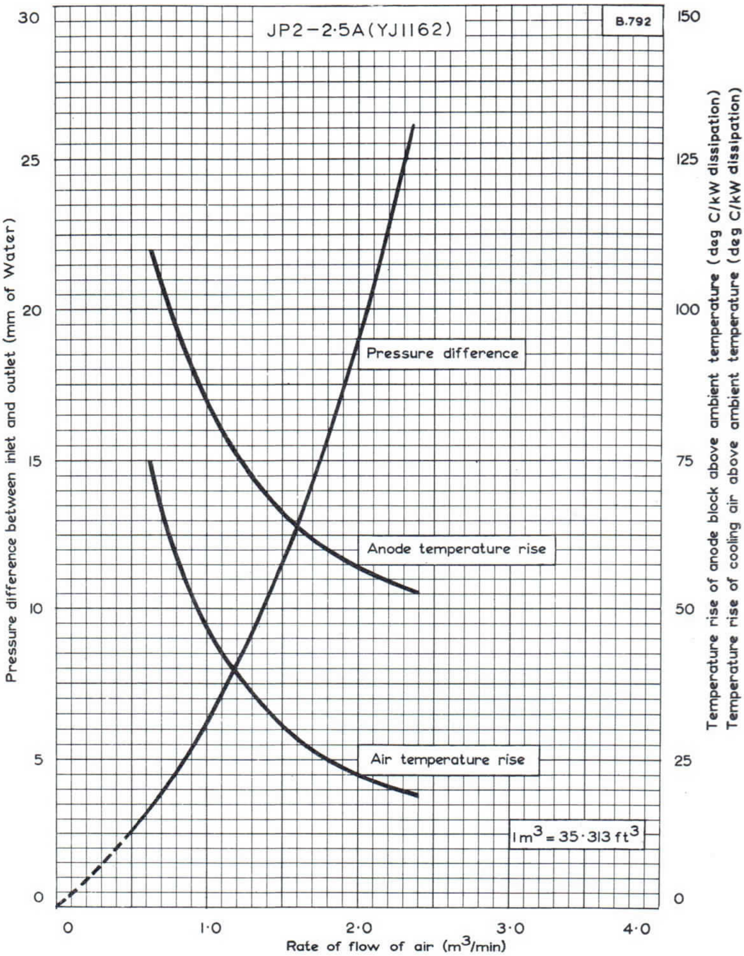
Output terminal

All dimensions in mm

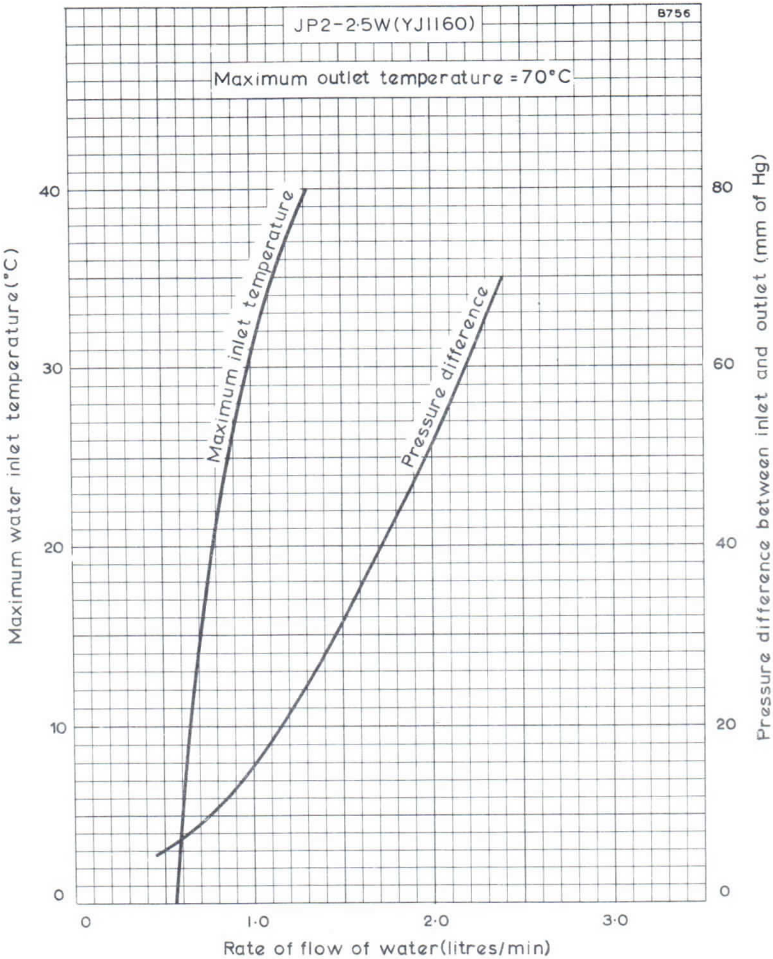
B5059



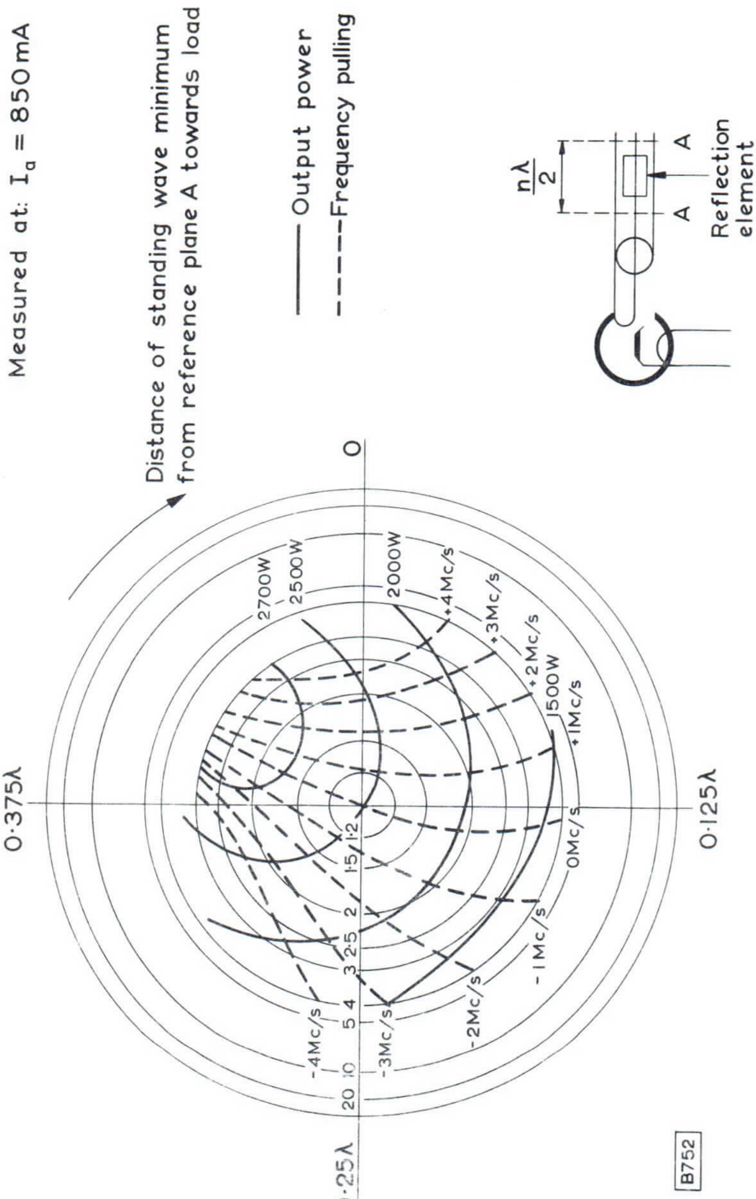
OUTPUT POWER AND ANODE VOLTAGE PLOTTED AGAINST MEAN ANODE CURRENT



COOLING CURVES FOR JP2-2.5A (YJ1162)



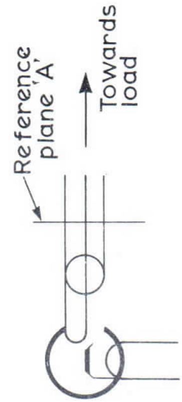
COOLING CURVES FOR JP2-2.5W (YJ1160)

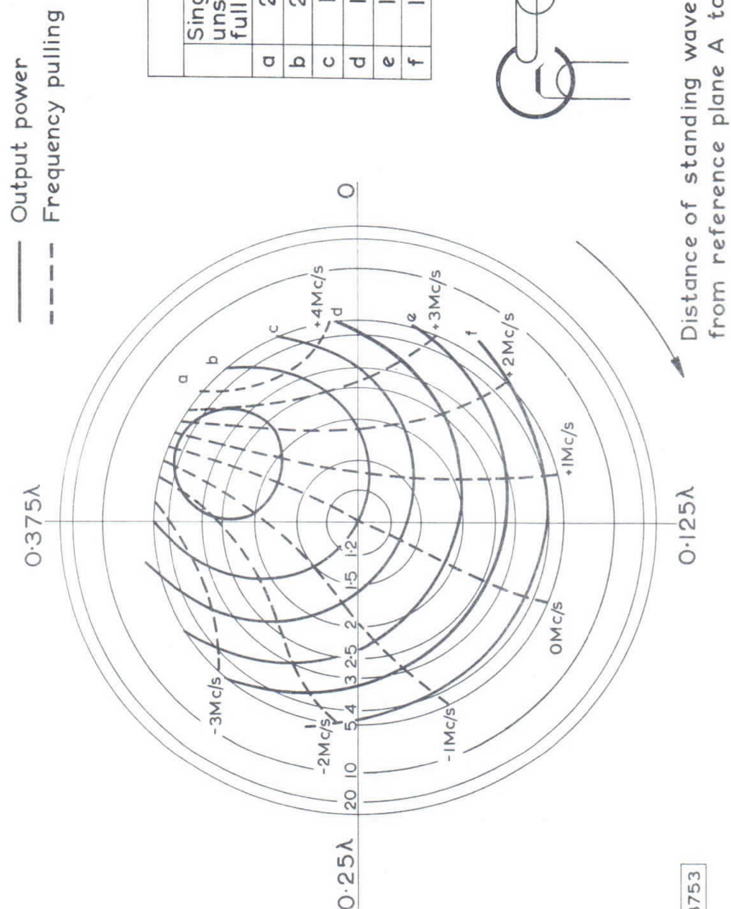


RIEKE DIAGRAM (WITH REFLECTION ELEMENT)

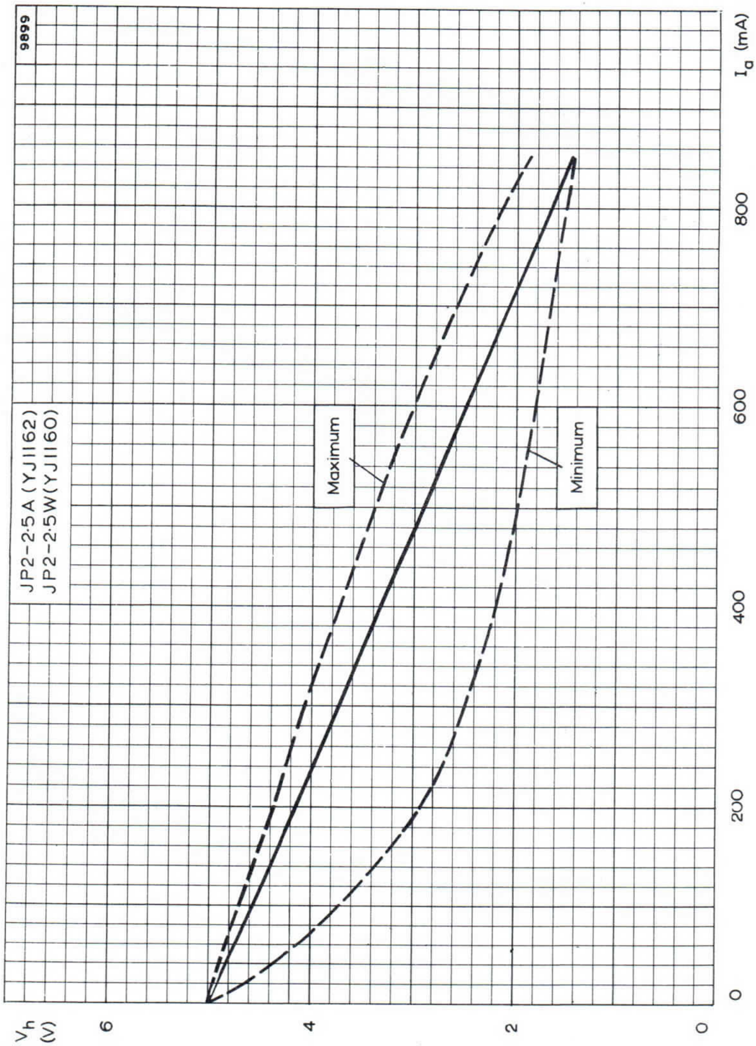
Measured at:
$I_a = 750\,mA$
$i_{a(pk)} = 2{\cdot}0\,A$

	Pout (kW)	
	Single phase unsmoothed full-wave	Self rectified a.c.
a	2·25	1·125
b	2·00	1·000
c	1·75	0·875
d	1·50	0·750
e	1·25	0·625
f	1·00	0·500





RIEKE DIAGRAM (WITHOUT REFLECTION ELEMENT)



HEATER VOLTAGE PLOTTED AGAINST MEAN ANODE CURRENT

TENTATIVE DATA

QUICK REFERENCE DATA		
Continuous wave air and water-cooled magnetron intended for microwave heating applications.		
Frequency (fixed within the band)	2.425 to 2.475	GHz
Power output	5.0	kW
Construction	Packaged, ceramic and metal	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS

Typical operation from d.c. or low peak current (L-C stabilised) supply.

Frequency (see note 1)	2.45	GHz
Power output	5.0	kW
Anode voltage	7.1	kV
Mean anode current (see note 2)	1.25	A
Peak anode current	1.5	A
Filament voltage (running)	1.0	V
Load v.s.w.r.	≤1.05	

CATHODE

Directly heated a.c. 50 or 60Hz or d.c. Thoriated tungsten.

V_f (starting and standby)		5.5 ± 10%	V
I_f (at V_f = 5.5V and V_a = 0)	nominal	46	A
	max	50	A
I_f (surge) max		120	A
r_f (cold)		0.015	Ω
Minimum waiting time before applying h.t.		30	s

The positive potential must be applied to the filament connector when the filament supply is d.c.

CHARACTERISTICS

	Min.	Max.	
Frequency (fixed within the band) (see note 1)	2.425	2.475	GHz
Anode voltage (at $I_a = 1.25A$) (see notes 1, 2, 3)	6.8	7.2	kV
Distance of voltage standing wave minimum (see note 4)	0.36	0.42	λguide
Power output (at $I_a = 1.25A$)	4.65	-	kW
Load v.s.w.r.	-	1.05	

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Anode voltage (see note 5)	-	±12	kV
Peak anode current	-	2.6	A
Mean anode current (see note 2)	0.3	1.3	A
Mean anode input power	-	9.6	kW
v.s.w.r. (from 0.3λ to 0.5λ)	-	2.5	
v.s.w.r. (remaining region)	-	1.5	

OPERATING NOTES

1. Measured with a matched load (v.s.w.r. ≤ 1.05)
2. Measured with a moving coil instrument.
3. The anode voltage should be measured with the magnetron operating on a filtered anode voltage obtained by three-phase full-wave rectification.
4. The distance is measured in the direction of the load, starting at the reference plane for electrical measurements using standard cold measurement techniques and a 16/39 coaxial line.
5. An 8mm spark gap near the input terminals is recommended to ensure that the maximum anode voltage is not exceeded.

COOLING

Anode block Water

For required quantity of water and pressure drop see page 14.

Filament and filament/cathode connectors Forced-air

A low-velocity air flow perpendicular to the cathode axis is required.

R.F. output system

A minimum air flow of $0.1m^3$/min is required at room temperature (typical 18^oC).

Maximum temperatures

Anode block (see page 9 for reference point)	90	^oC
Cooling water outlet temperature	70	^oC
Filament and filament/cathode terminals and any other point	200	^oC

At standby with filament voltage = 5.5V water and forced-air cooling is required to prevent overheating.

A thermoswitch should be mounted at the point indicated on the outline drawing (see page 9). The switch should operate at a mounting disc temperature of 85 to 90^oC.

PHYSICAL DATA

Weight of magnetron (approx.)	6.0	kg
	13.2	lb

MOUNTING POSITION Axis of cathode vertical

OUTPUT CONNECTION

The coaxial output system of the magnetron may be coupled by suitable means to a coaxial line or to a waveguide.

ACCESSORIES

Filament connector	55323
Filament/cathode connector	55324
Cap nut (for output coupling)	55312
Snap ring	55313
Mounting plate	55327
Washer	55328
Cap nut (for cooling system)	TE1051b
Hose nipple (for 9mm hose)	TE1051c

GENERAL

Whenever it is considered to operate the magnetron at conditions substantially different from those indicated, the magnetron manufacturer should be consulted.
Equipment design should be orientated around the magnetron specifications given in this data and not around one particular magnetron, since due to normal production variations, the design parameters (V_a, r_f(cold), f, P_{out}, etc.) will vary around the nominal values.

Anode supply

The magnetron can be operated from an unfiltered three-phase full-wave supply unit. The design of the unit should be such that the limiting values for the mean and peak anode currents are not exceeded.

Filament supply

The secondary of the filament transformer must be well insulated from the primary, since in normal magnetron operation the cathode will be at high negative potential and the anode will be earthed.
The transformer should be designed so that the filament voltage and surge current limits are not exceeded.
Immediately after applying the anode voltage the filament voltage must be reduced as a function of the anode current according to the diagram on page 14. The life of the magnetron will be greatest if the filament voltage is reduced to a value given by the fully drawn line 'a'. The filament voltage should be adjusted within 10% as given by the dashed lines which border the hatched area.
If it is intended to design the equipment for a predetermined number of steps in output power level, the reduced filament voltage for each step must be set to a value within the area bordered by the lines 'b' and 'c', and preferably within or close to the hatched area.
The filament voltage should be maintained within the limits given by the lines 'b' and 'c'.

Filament connections

It is important to ensure that the filament connections make good electrical and mechanical contact due to the high filament current. This will prevent the temperature of the filament connections rising due to the high contact resistance. Bad electrical contacts cause voltage drop and thus lower the filament voltage which may result in reduced efficiency of operation. The filament connectors (see page 10) have been designed to ensure effective electrical and mechanical contact. A high temperature resistant silicone grease is recommended to prevent oxidation of the filament contacts.
The electrical conductors to the cathode and filament connectors should be flexible in order to prevent undue stress on the terminals.

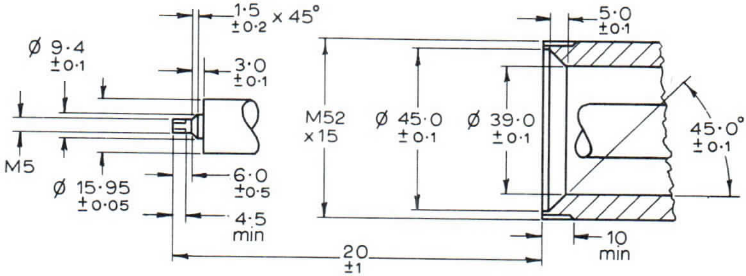
Load impedance

Optimum output power and life will be obtained when the magnetron is loaded with an impedance giving a v.s.w.r. of approximately 1.5 in the phase of sink region. This phase condition is reached when the position of the voltage standing wave minimum is at a distance of about 0.39λguide from the reference plane for electrical measurements (see outline drawing page 8) in the direction of the load.

GENERAL (cont'd)

Antenna

When an antenna is used, the coaxial coupling should be according to the figure below:-



All dimensions in mm

A soft copper washer of 0.5mm thickness is required between the antenna and the magnetron to ensure reliable r.f. contact. The maximum torque applied when screwing the antenna coupling into the magnetron is 15kg cm (13lb in).

Cooling

The r.f. output system of the magnetron is provided with air inlet and outlet holes for the application of at least 0.1m^3/min of cooling air to the ceramic part inside. All air inlet holes must be used to obtain the required uniform cooling. The cooling air must be filtered to be free from dust, water and oil. For an example of a cooling device around the output system see the drawing on page 12.

To prevent the magnetron from overheating if the anode cooling fails, provision is made for mounting a thermoswitch which should operate within a mounting disc temperature of 85 to 90°C (see page 8)

A stream of cooling air should also be directed at the input connectors and should be perpendicular to the cathode axis.

The type TE1051c hose nipple is suitable for connecting a flexible hose or soldering to a metal water pipe.

Shielding

Where required, r.f. radiation from the filament terminals may be reduced by external filtering and/or shielding. A filter box of non-magnetic material may be mounted on the aluminium top cover plate of the magnetron. For drilling and tapping the cover plate must be removed. The filter box mounting screws **must not** penetrate through the top cover plate (thickness 6mm). When removing and re-mounting the cover plate, non-magnetic tools should be used.

Magnetron cleanliness

The ceramic insulation between the terminals of the magnetron must be kept clean. A protective cover of suitable material should be placed over the output terminal if the magnetron is inserted directly into a cavity. The cooling air should be filtered and ducted to prevent deposits forming on the insulation during operation.

HANDLING, STORAGE, MOUNTING AND OPERATIONAL CHECKS

Handling and storage

The original packing should be used for transporting and storing the magnetron.
Shipment of the magnetron mounted in equipment is not permitted unless specifically authorised by the magnetron manufacturer.
When the magnetrons have to be unpacked, e.g. at an assembly line or for measurement purposes, care should be taken to ensure that a minimum distance of 150mm (6in) is maintained between magnets. As the tungsten heaters are sensitive to shocks and vibrations, care should be taken when handling and storing unpackaged magnetrons that such shocks and vibrations are avoided. High intensity magnetic fields associated with transformers and other magnetic equipment can demagnetise the magnets. Such fields must not be present when the magnetrons are stored, handled or serviced.
The user should be aware of the strong magnetic fields around the magnetron. When handling and mounting the magnetron, non-magnetic tools must be used and extreme care taken to avoid damage to watches and other precision instruments nearby.

Mounting

When magnetic materials are present in two or more planes, the minimum distance from the magnets is 130mm (5in) in all directions. Mounting holes may be drilled and tapped in the bottom cover plate when removed from the magnetron. The mounting screws **must not** penetrate through the bottom cover plate (thickness 6mm). A special mounting plate (type 55327) with 4 mounting holes as indicated in the drawing (see page 8), can be screwed to the bottom cover plate of the magnetron by removing the two existing M4 screws and replacing them by screws 15mm (0.6in) long.
For removing and re-mounting these plates non-magnetic tools should be used. When mounting the magnetron, all tools used close to or in contact with the magnetron must be made of non-magnetic material to avoid possible mechanical damage to ceramic parts as well as short-circuiting the magnetic flux by magnetic attraction.
The anode power supply lead should be connected to the terminal shown in the outline drawing (see page 8) or to one of the mounting screws.

HANDLING, STORAGE, MOUNTING AND OPERATIONAL CHECKS(cont'd)

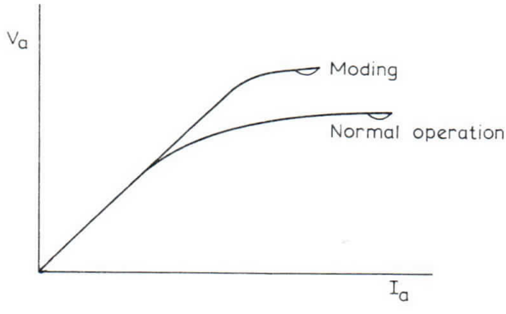
Operational checks

Excessive v.s.w.r. and/or current values may lead to moding of the magnetron which can be detected by displaying the V_a/I_a characteristic of the magnetron on an oscilloscope. This should be done for various load conditions and should be part of production line inspection and of field inspection before and after magnetron replacement.

For x-y display on a service oscilloscope the anode voltage can be sampled from a voltage divider chain connected between earth and the cathode connector, and the anode current from a sampling resistor of a few ohms which may be permanently connected to the earth terminal of the high voltage supply unit.

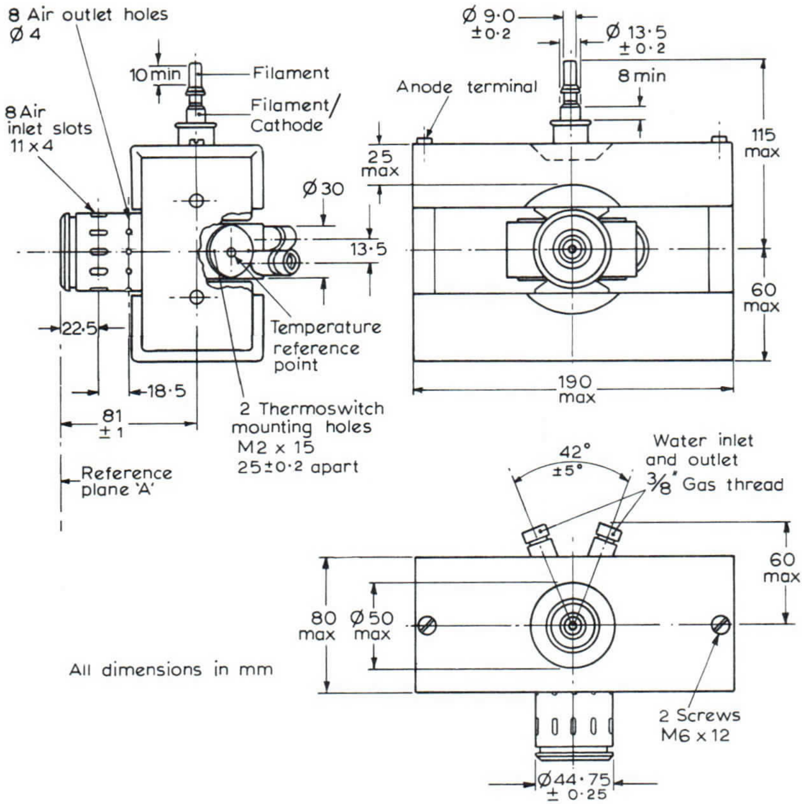
The normal characteristic should be a fairly straight loop. The appearance of a second loop or parts thereof showing distinctly above the first loop indicates undesired modes of oscillation that can rapidly lead to failure of the magnetron.

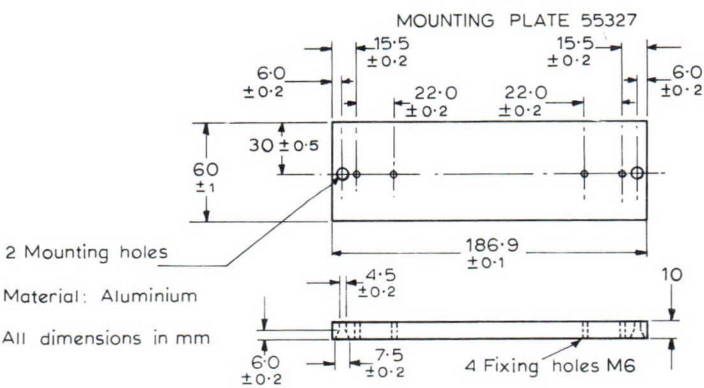
Operating conditions including v.s.w.r. must be checked at once and the magnetron replaced if under the correct conditions moding still occurs. The mean anode current may be measured directly across the sampling resistor.



X-Y Display of magnetron characteristic

OUTLINE DRAWING





MILLIMETRE TO INCH CONVERSION TABLE FOR OUTLINE DRAWING

Rounded outwards

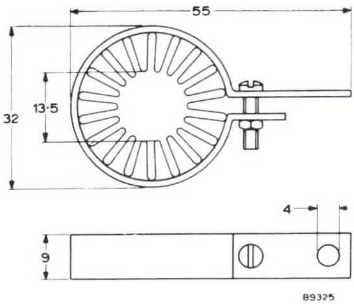
Millimetres	Inches	
8.0	0.314	min
9.0 ± 0.2	0.3543 ± 0.0079	Ø
10	0.393	min
13.5	0.532	
13.5 ± 0.2	0.5315 ± 0.0079	Ø
18.5	0.728	
22.5	0.886	
25	0.99	max
25 ± 0.2	0.9842 ± 0.0079	
30	1.18	Ø
44.75 ± 0.25	1.762 ± 0.010	Ø
50	1.97	max
60	2.37	max
80	3.15	max
81 ± 1	3.189 ± 0.040	
115	4.528	max
190	7.49	max

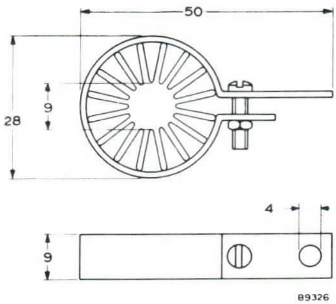
Mounting plate 55327

Millimetres	Inches	
4.5 ± 0.2	0.1772 ± 0.0079	Ø
6.0 ± 0.2	0.2362 ± 0.0079	
7.5 ± 0.2	0.2953 ± 0.0079	Ø
10	0.39	
15.5 ± 0.2	0.6102 ± 0.0079	
22 ± 0.2	0.8661 ± 0.0079	
30 ± 0.5	1.181 ± 0.020	
60 ± 1.0	2.362 ± 0.040	
186.9 ± 0.1	7.3582 ± 0.0040	

ACCESSORIES

Inch dimensions given in conversion tables below are derived from original millimetre dimensions



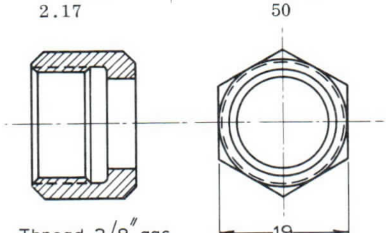


Filament/cathode connector
55324

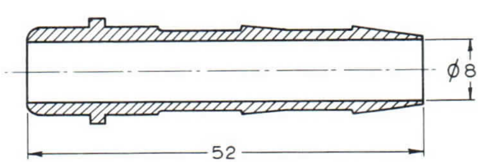
Millimetres	Inches
4 dia	0.16 dia
9	0.35
13.5 dia	0.532 dia
32 dia	1.26 dia
55	2.17

Filament connector
55323

Millimetres	Inches
4 dia	0.16 dia
9	0.35
9 dia	0.35 dia
28 dia	1.10 dia
50	1.97

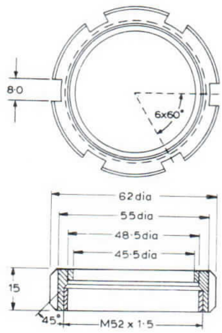


Cap nut
TE1051b



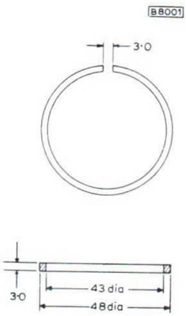
Connection for 9mm hose
TE1051c

Millimetres	Inches
8 dia	0.31 dia
19	0.75
52	2.05



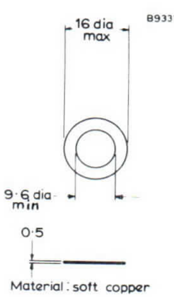
Cap nut
55312

Millimetres	Inches
8.0	0.315
15	0.59
45.5 dia	1.791 dia
48.5 dia	1.909 dia
55 dia	2.165 dia
62 dia	2.441 dia



Snap ring
55313

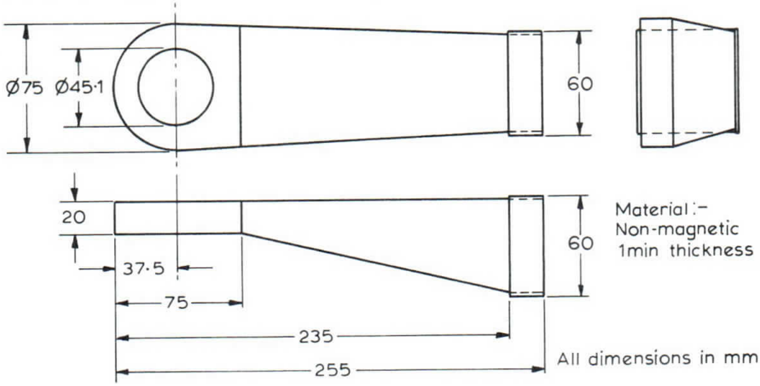
Millimetres	Inches
3.0	0.118
43 dia	1.69 dia
48 dia	1.89 dia



Washer
55328

Millimetres	Inches
0.5	0.020
9.6 dia min	0.377 dia min
16 dia max	0.63 dia max

Example of a cooling device for output system

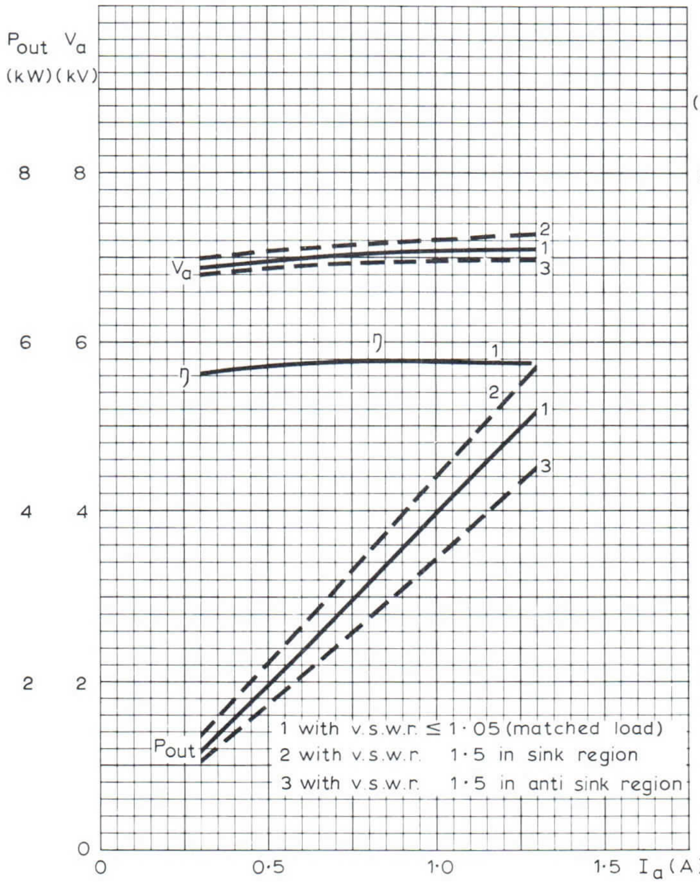


Pressure loss at $0.1m^3/min$:

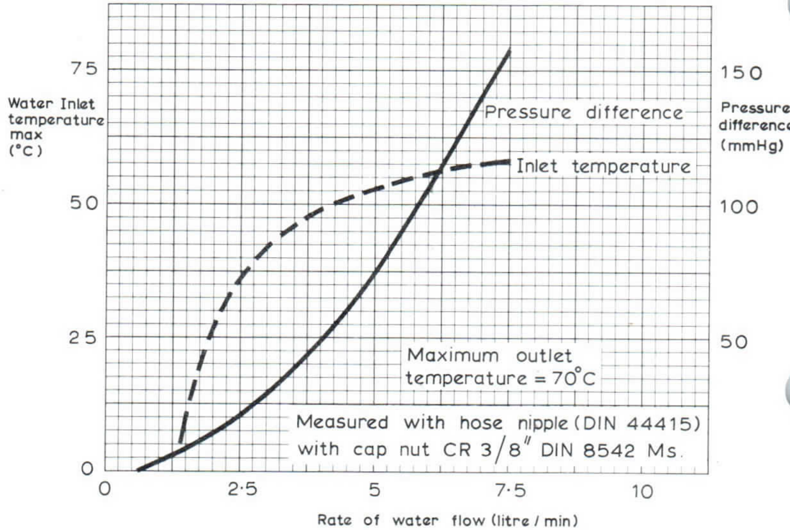
About 60mm water with air outlet only via outlet holes.

About 30mm water if air can also escape towards the load through the waveguide or coaxial line.

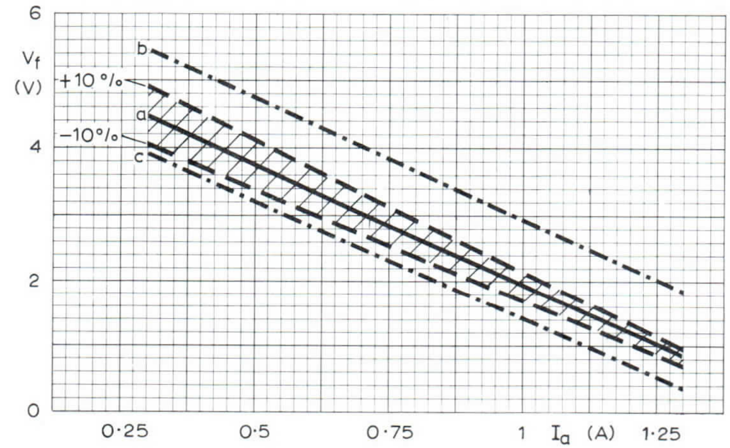
Millimetres	Inches
20	0.79
37.5	1.476
45.1 dia	1.776 dia
60	2.36
75	2.95
75 dia	2.95 dia
235	9.25
255	10.04



OUTPUT POWER, ANODE VOLTAGE AND EFFICIENCY
PLOTTED AGAINST ANODE CURRENT



COOLING CHARACTERISTICS



HEATER DERATING CHART

TENTATIVE DATA

QUICK REFERENCE DATA

Air-cooled c.w. magnetron for microwave heating applications.

Frequency (fixed within the band)	2.425 to 2.475	GHz
Power output (c.w.)	1.25	kW
Construction	Packaged, ceramic and metal	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS

Typical operation from d.c. or low peak current (L-C stabilised) supply

Frequency (see note 1)	2.45	GHz
Power output	1.25	kW
Anode voltage	5.7	kV
Mean anode current (see note 2)	380	mA
Filament voltage (running)	3.5	V
Load v.s.w.r.	≤1.05	

CATHODE

Directly heated a.c. 50 or 60Hz or d.c. Thoriated tungsten.

V_f (starting and standby)		5.0±10%	V
V_f (running) at $I_{a(mean)}$ = 380mA		3.5±10%	V
I_f (at V_f = 5.0V and V_a = 0)	nominal	28	A
	max.	32	A
$I_{f(surge)}$ max.		70	A
r_f (cold)		0.02	Ω
Minimum waiting time before applying h.t.		10	s

The positive potential must be applied to the filament connector when the filament supply is d.c.

CHARACTERISTICS

	Min.	Max.	
Frequency fixed within the band (see note 1)	2.425	2.475	GHz
Anode voltage (at $I_a = 380mA$) (see notes 1, 2 and 3)	5.4	5.8	kV
Distance of voltage standing wave minimum (see note 4)	0.03	0.09	λg
Power output (at $I_a = 380mA$)	1.15	-	kW
Load v.s.w.r.	-	1.05	

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Anode voltage (see note 5)	-	±10	kV
Peak anode current (see note 5)	380	800	mA
Mean anode current (see note 2)	100	450	mA
Mean anode input power	-	2.7	kW
v.s.w.r. (continuous) (see note 6)	-	4.0	
v.s.w.r. (during max. 0.02s or 20% of the time whichever is the smaller. See notes 6 and 7)	-	10	

OPERATING NOTES

1. Measured with a matched load (v.s.w.r. ≤1.05)
2. Measured with a moving coil instrument.
3. The anode voltage should be measured with the magnetron operating on a filtered anode voltage obtained by single-phase or three-phase full-wave rectification, the peak anode current should not exceed 480mA, with 380mA as the mean value.
4. The distance is measured outside the magnetron, starting at the reference plane for electrical measurements (see page 8), a standard cold measuring technique is used with a matched load.
5. An 8mm spark gap near the input terminals is recommended to ensure that the maximum anode voltage is not exceeded.
6. Determined with adaptor 55336.
7. Any interval at which the v.s.w.r. is between 4 and 10 must be followed by an interval four times as long, during which the v.s.w.r. is ≤4. When operating under these conditions the magnetron should not be permitted to mode.

COOLING

Anode block		Forced-air
Filament terminals		Forced-air
Maximum temperatures		
Anode block (see page 8 for reference point)	180	^{o}C
*Filament and filament/cathode terminal	250	^{o}C
Any other point	200	^{o}C
Inlet air, typical		
Temperature	35	^{o}C
Rate of air flow	1.2	m^3/min
Pressure drop	10	mm water

At standby, with filament voltage = 5.0V forced-air cooling is required to keep the temperature of the filament terminal and filament/cathode terminal below the stated maximum limit.
A thermoswitch should be mounted at the point indicated on the outline drawing (see pages 8 and 11).
*For maximum valve life it is recommended that the operating temperature be less than 200^{o}C.

PHYSICAL DATA

Weight of magnetron (approx.)	2.3	kg
	5.1	lb

OUTPUT CONNECTION

Probe output suitable for coupling to waveguide, coaxial line or directly to a cavity.

MOUNTING POSITION

Axis of cathode vertical

ACCESSORIES

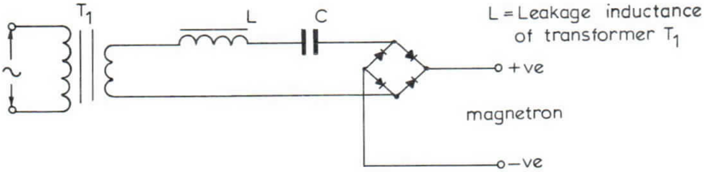
Filament/cathode connector		55324
Filament connector		55323
R.F. gasket (1 supplied)		S-330109
Thermoswitch	4.5A max.	S-32997
	25A max.	S-330923
Washer		55328
Coupling adaptor for measurement purposes only		55336
Air inlet duct		

GENERAL

Whenever it is considered to operate the magnetron at conditions substantially different from those indicated, the magnetron manufacturer should be consulted.
Equipment design should be orientated around the magnetron specifications given in this data and not around one particular magnetron, since, due to normal production variations, the design parameters (V_a, r_f(cold), f, P_{out} etc.) will vary around the nominal values.

Anode supply

The magnetron should be operated from an L-C stabilised anode supply unit. The design of the unit should be such that the limiting values for the mean and peak anode currents are not exceeded.



Basic series resonant circuit of an L-C power supply

Filament supply

The secondary of the filament transformer must be well insulated from the primary since in normal magnetron operation the cathode will be at high negative potential and the anode will be earthed.
The transformer should be designed so that the filament voltage and surge current limits are not exceeded.

Filament connections

It is important to ensure that the filament connections make good electrical and mechanical contact due to the high filament current. This will prevent the temperature of the filament connections rising due to high contact resistance. Bad electrical contacts cause voltage drop and thus lower the filament voltage which may result in reduced efficiency of operation. The filament connectors shown in the drawing (page 10), have been designed to ensure effective electrical and mechanical contact. A high temperature resistant silicone grease is recommended to prevent oxidation of the filament contacts.
The electrical conductors to the cathode and filament connectors should be flexible in order to prevent undue stress on the terminals.

Load impedance measured with coupling adaptor

Using type 55336 coupling adaptor enables the designer of microwave heating equipment to determine the value of the load impedance (v.s.w.r. and phase of reflection as seen by the magnetron) using standard cold measuring techniques, and to arrive at the correct coupling for the magnetron. The adaptor simulates the r.f. output system of the magnetron; it may be coupled either to a waveguide or directly into a cavity in place of the magnetron, in both cases the type S-330109 gasket should be used.

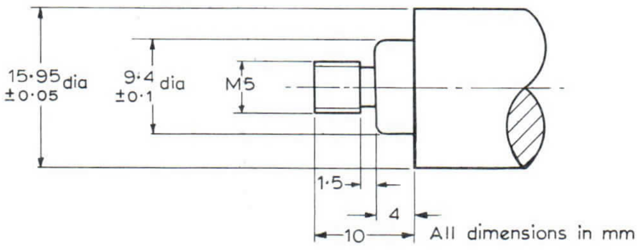
GENERAL (cont'd)

Load impedance measured with coupling adaptor (cont'd)

In order to obtain efficient operation, the magnetron should be loaded in the phase of sink.
The average mismatch of the cavity should not be higher than a v.s.w.r. of approximately 3 with the position of the voltage standing wave minimum about 0.33λ from the reference plane in the direction of the load. (See adaptor outline drawing page 11).

Antenna

When an antenna is used, the part of the antenna screwed into the magnetron should be according to the figure below:-



Inch dimensions derived from original millimetre dimensions

Millimetres	Inches	Millimetres	Inches
1.5	0.06	10	0.39
4	0.16	15.95±0.05 dia	0.628±0.002 dia
9.4±0.1 dia	0.370±0.004 dia		

A soft copper washer of 0.5mm thickness is required between the antenna and the magnetron to ensure reliable r.f. contact. The maximum torque applied when screwing the antenna into the magnetron is 15kg cm (13lb in).

Standby operation

Without anode voltage, the filament voltage during any standby period should be kept at $V_f = 5.0V$. Forced-air cooling will be required to prevent overheating.
Full anode voltage may be applied immediately after an initial waiting time of 10 seconds minimum or after a standby period with $V_f = 5.0V$. Microwave energy is then normally available in less than one second.

Shielding

Where required r.f. radiation from the filament terminals may be reduced by external filtering and/or shielding.

Magnetron cleanliness

The ceramic insulation between the terminals of the magnetron must be kept clean. A protective cover of suitable material should be placed over the output terminal if the magnetron is inserted directly into a cavity.
The cooling air should be filtered and ducted to prevent deposits forming on the insulation during operation.

HANDLING, STORAGE, MOUNTING AND OPERATIONAL CHECKS

Handling and storage

The original packing should be used for transporting and storing the magnetron.
Shipment of the magnetron mounted in equipment is not permitted unless specifically authorised by the magnetron manufacturer.
When the magnetrons have to be unpacked, e.g. at an assembly line or for measurement purposes, care should be taken to ensure that a minimum distance of 150mm (6in) is maintained between magnets. As the tungsten heaters are sensitive to shocks and vibrations, care should be taken when handling and storing unpackaged magnetrons that such shocks and vibrations are avoided. High intensity magnetic fields associated with transformers and other magnetic equipment can demagnetise the magnets. Such fields must not be present when the magnetrons are stored, handled or serviced.
The user should be aware of the strong magnetic fields around the magnetron. When handling and mounting the magnetron, non-magnetic tools must be used and extreme care taken to avoid damage to watches and other precision instruments nearby.

Mounting

When magnetic materials are present in two or more planes, the minimum distance from the magnets is 130mm (5in) in all directions. In order to ensure a good r.f. contact between the output of the magnetron and the circuit in which it is connected, the use of gasket S-330109 is essential. The output coupling of the magnetron should not be used as the only means of mounting. The magnetron should be mounted and secured by the two mounting holes provided. (See outline drawing page 8).
The power supply lead to the anode should be connected via one of the mounting holes.

HANDLING, STORAGE, MOUNTING AND OPERATIONAL CHECKS (cont'd)

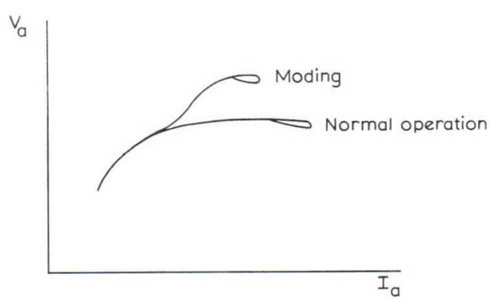
Operational checks

Excessive v.s.w.r. and/or current values may lead to moding of the magnetron which can be detected by displaying the $V_a/i_{a(pk)}$ characteristic of the magnetron on an oscilloscope. This should be done for various load conditions and should be part of production line inspection and of field inspection before and after magnetron replacement.

For x-y display on a service oscilloscope the anode voltage can be sampled from a voltage divider chain connected between earth and the cathode connector, and the anode current from a sampling resistor of a few ohms which may be permanently connected to the earth terminal of the high voltage supply unit.

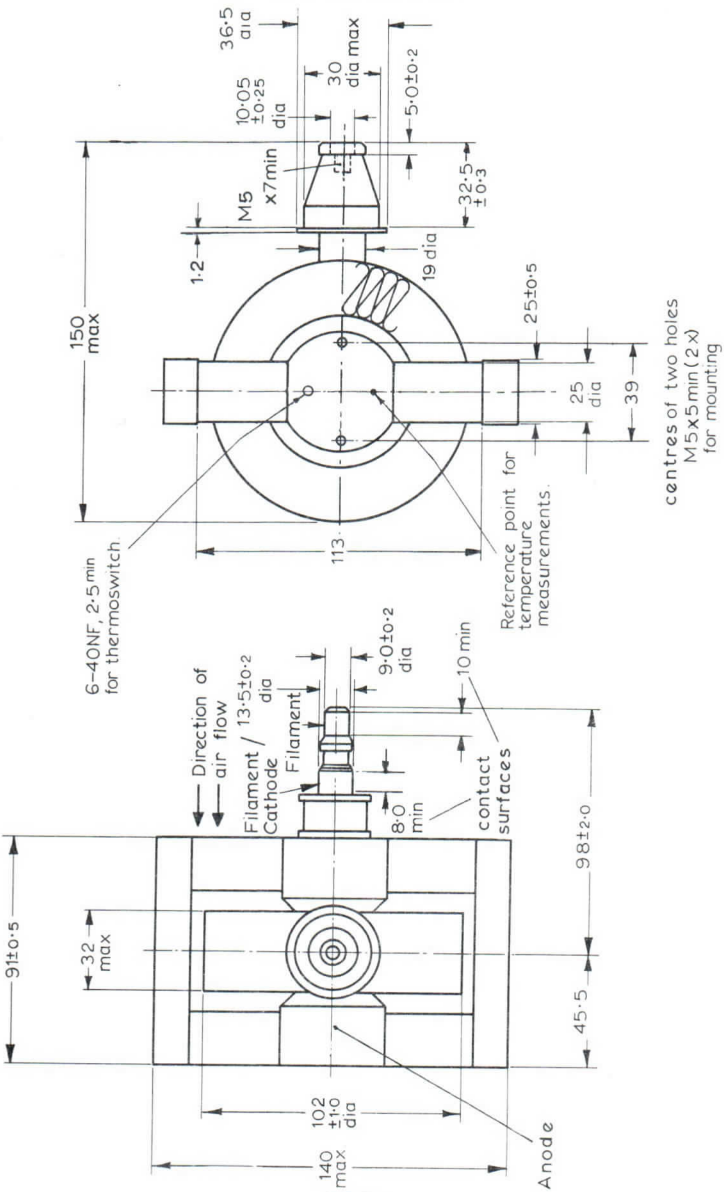
The normal characteristic should be a fairly straight loop. The appearance of a second loop or parts thereof showing distinctly above the first loop indicates undesired modes of oscillation that can rapidly lead to failure of the magnetron.

Operating conditions including v.s.w.r. must be checked at once and the magnetron replaced if under the correct conditions moding still occurs. The mean anode current may be measured directly across the sampling resistor.



X-Y Display of magnetron characteristic

OUTLINE DRAWING

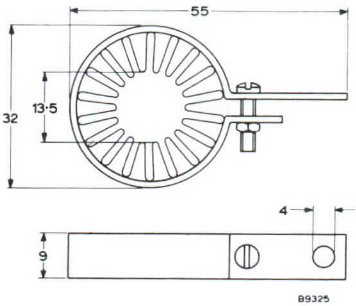


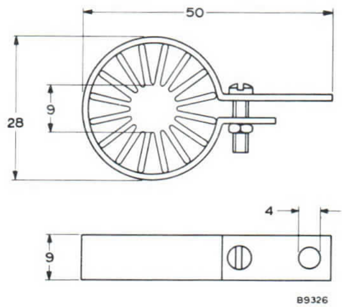
MILLIMETRE TO INCH CONVERSION TABLE FOR OUTLINE DRAWING

Millimetres	Inches	
1.2	0.047	
5.0 ± 0.2	0.197 ± 0.007	
8.0	0.315	min
9.0 ± 0.2	0.354 ± 0.007	dia
10	0.394	min
10.05 ± 0.25	0.396 ± 0.009	
13.5 ± 0.2	0.531 ± 0.007	dia
19	0.748	dia
25	0.98	dia
25 ± 0.5	0.984 ± 0.19	
30	1.18	max
32	1.26	max
32.5 ± 0.3	1.280 ± 0.01	
36.5	1.43	
39	1.53	
45.5	1.79	
62.2 ± 0.6	2.450 ± 0.023	
91 ± 0.5	3.583 ± 0.19	
98 ± 2.0	3.858 ± 0.07	
102 ± 1.0	4.016 ± 0.03	dia
113	4.45	
140	5.511	max
150	5.905	max

ACCESSORIES

Inch dimensions given in conversion tables below are derived from original millimetre dimensions



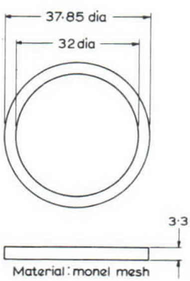


Filament/cathode connector
55324

Millimetres	Inches
4 dia	0.16 dia
9	0.35
13.5 dia	0.53 dia
32 dia	1.26 dia
55	2.16

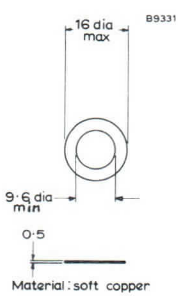
Filament connector
55323

Millimetres	Inches
4 dia	0.16 dia
9	0.35
9 dia	0.35 dia
28 dia	1.10 dia
50	1.97



R.F. gasket
S-330109

Millimetres	Inches
3.3	0.13
32 dia	1.26 dia
37.85 dia	1.5 dia

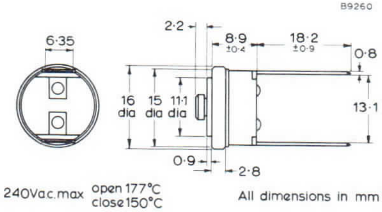


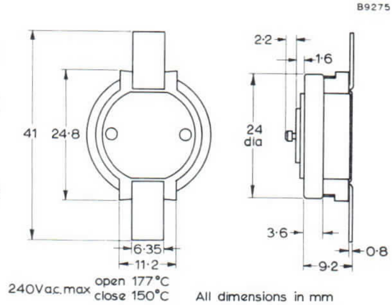
Washer
55328

Millimetres	Inches
0.5	0.02
9.6 dia min	0.38 dia min
16 dia max	0.63 dia max

ACCESSORIES (cont'd)

Inch dimensions given in conversion tables below are derived from original millimetre dimensions



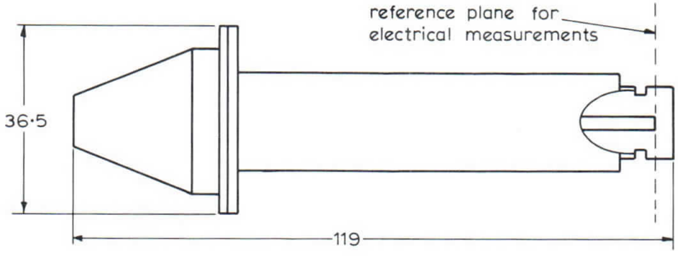


Thermoswitch 4.5A max
S-32997

Millimetres	Inches
0.8	0.031
0.9	0.035
2.2	0.086
2.8	0.110
6.35	0.25
8.9 ± 0.4	0.350 ± 0.015
11.1 dia	0.437 dia
13.1	0.515
15 dia	0.59 dia
16 dia	0.63 dia
18.2 ± 0.9	0.716 ± 0.035

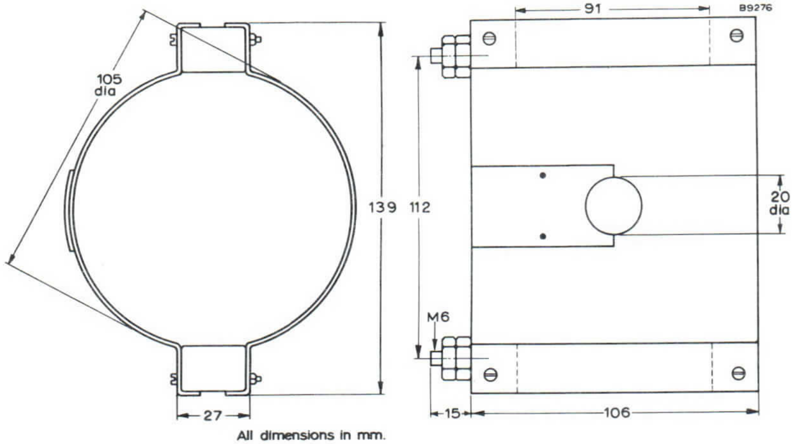
Thermoswitch 25A max
S-330923

Millimetres	Inches
0.8	0.031
1.6	0.063
2.2	0.086
3.6	0.142
6.35	0.25
9.2	0.362
11.2	0.441
24 dia	0.94 dia
24.8	0.976
41	1.61



Coupling adaptor
55336

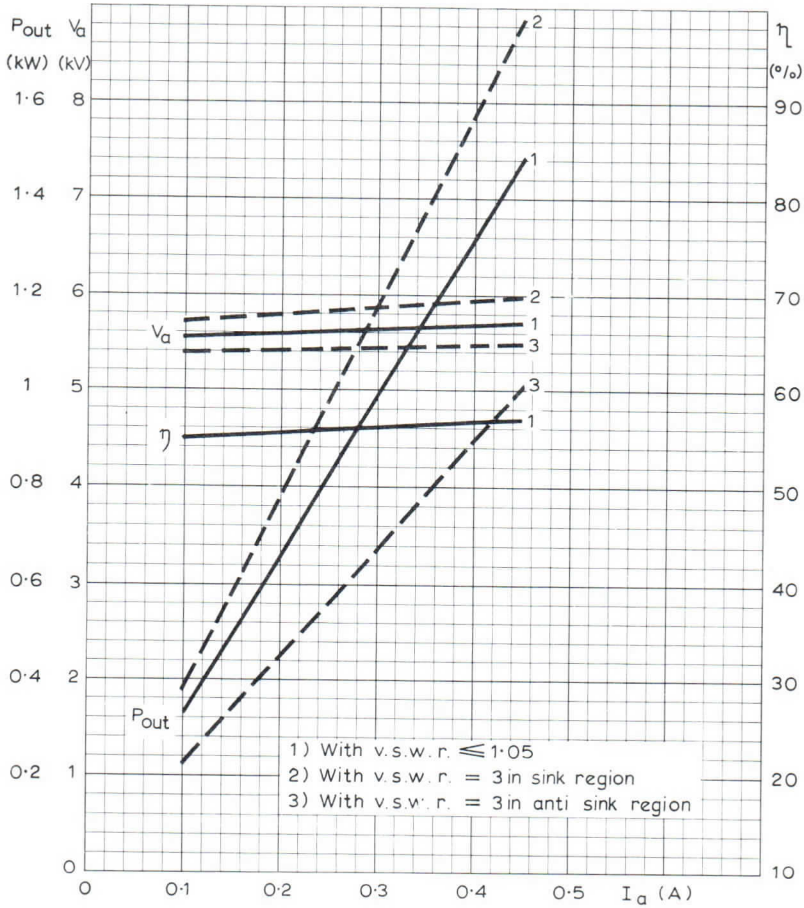
Millimetres	Inches
36.5	1.43
119	4.68



Air inlet duct

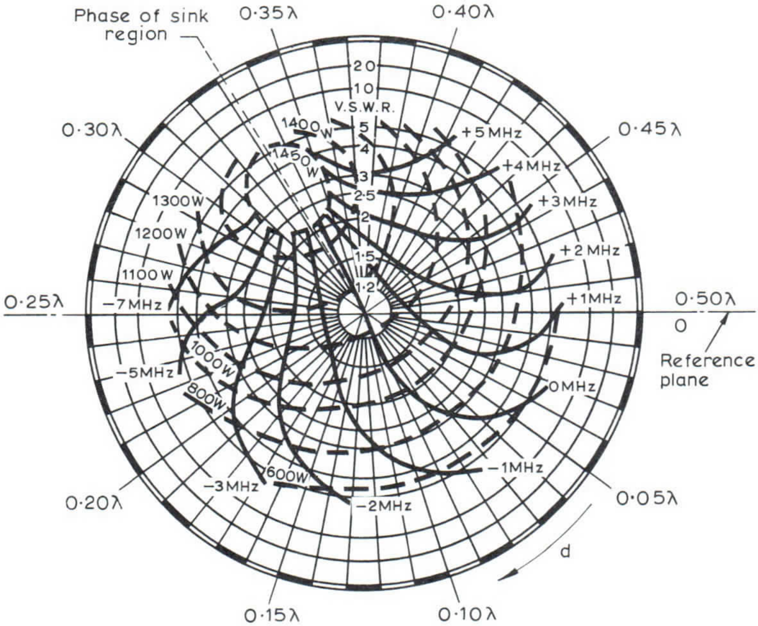
Inch dimensions given in conversion table below are derived from original millimetre dimensions

Millimetres	Inches
15	0.59
20 dia	0.79 dia
27	1.06
91	3.58
105 dia	4.13 dia
106	4.17
112	4.41
139	5.47



OUTPUT POWER, ANODE VOLTAGE AND EFFICIENCY
PLOTTED AGAINST ANODE CURRENT

RIEKE DIAGRAM



Mean anode current I_a = 380mA

Frequency f_o = 2.45GHz

— — — — = Output power

———— = Frequency pulling

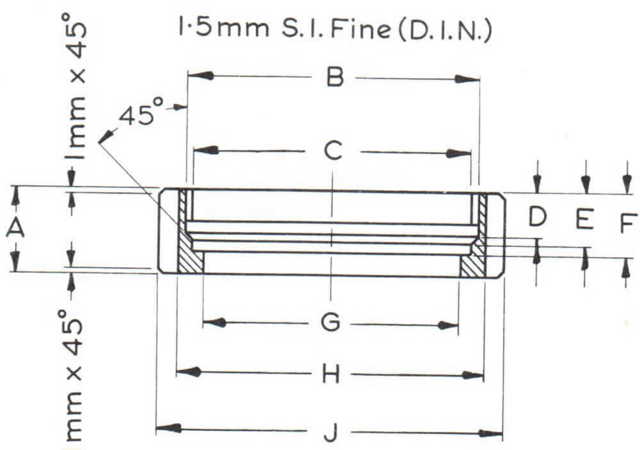
d = distance of voltage standing wave minimum from reference plane for electrical measurement (using coupling adaptor 55336) towards load.

Constant air cooling

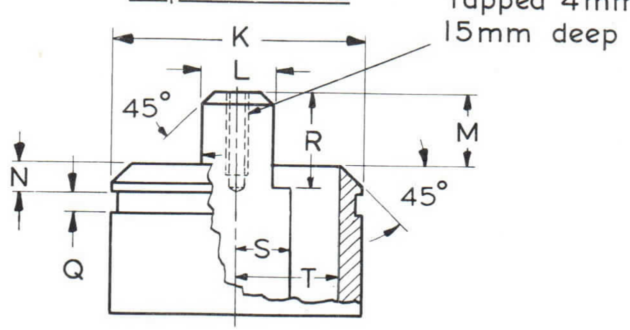
OUTLINE AND DIMENSIONS OF CAP NUT AND COAXIAL OUTPUT

	Inches	Millimetres
A	0.5905 ± 0.0078	15.0 ± 0.2
B	2.05	52
C	1.9528 ± 0.0020	49.6 ± 0.05
D	0.3149 ± 0.0039	8.0 ± 0.1
E	0.3740 ± 0.0039	9.5 ± 0.1
F	0.4330 ± 0.0039	11.0 ± 0.1
G	1.7913 ± 0.0020	45.5 ± 0.05
H	2.1653 ± 0.0078	55.0 ± 0.2
J	2.4409 ± 0.0078	62.0 ± 0.2

	Inches	Millimetres
K	1.77	45
L	0.51	13
M	0.51	13
N	0.217	5.5
Q	0.138	3.5
R	0.63	16
S	0.315	8.0
T	0.768	19.5



Cap Nut 55312



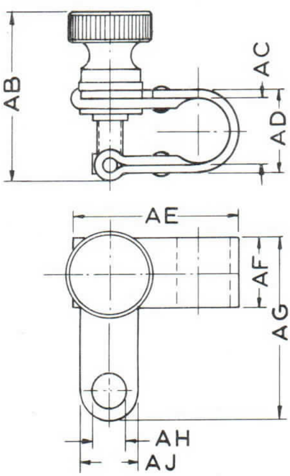
Output Terminal

9379

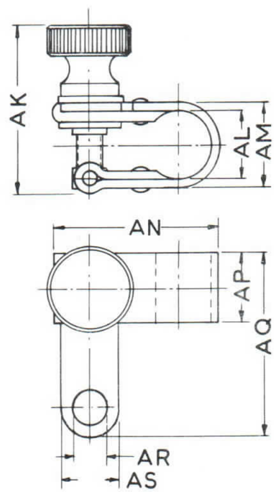
MAGNETRON ACCESSORIES
JP2-2.5A, 2.5W, 5W

OUTLINE AND DIMENSIONS OF COOLING CLIPS

	Inches	*Millimetres*		*Inches*	*Millimetres*
AB	1.06	27	AK	1.02	26
AC	0.41	10.5	AL	0.35	9
AD	0.51	13	AM	0.47	12
AE	1.10	28	AN	1.10	28
AF	0.47	12	AP	0.47	12
AG	1.18	30	AQ	1.18	30
AH	0.26	6.5	AR	0.26	6.5
AJ	0.47	12	AS	0.47	12



Cathode terminal
cooling clip 40649



heater terminal
cooling clip 40634

9177

KLYSTRONS

1. HEATER

The heater voltage unless otherwise specified in individual data sheets must be set within ±7% of the nominal value and temporary fluctuations must be within ±10%. Where freedom from undesirable modulation is important a d.c. stabilised heater supply should be used.

2. CONTROL GRID

This electrode when incorporated is used to control the resonator current and the nominal voltage is specified in the data for individual types.

The control grid must never be allowed to become positive with respect to the cathode.

3. RESONATOR

This electrode is usually connected to the body of the valve and is normally operated at earth potential.

4. REFLECTOR

To avoid damage to the valve the reflector potential must never become positive with respect to the cathode and for this reason it is essential that the reflector connection be made at all times during operation.

If a high impedance reflector voltage supply is used, the time constant should be such that the resonator voltage is not applied before the reflector has become negative with respect to the cathode.

5. MODES OF OSCILLATION

A reflex klystron may be operated in several modes which are determined by transit time effects and are dependent upon the reflector voltage. The mode of operation is chosen for optimum power output and for the maximum electronic tuning range.

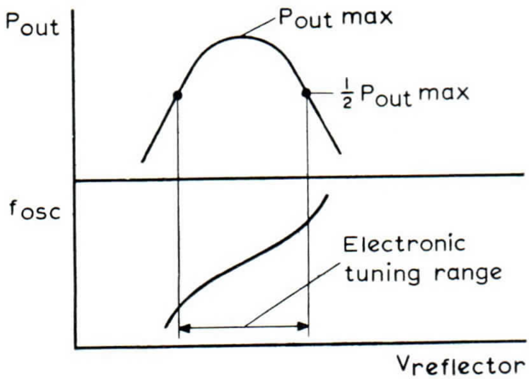
6. TUNING

6.1. Electronic tuning

The frequency of oscillation within a mode may be varied by adjusting the reflector voltage. The frequency change between the frequencies at which the power output has fallen to half the maximum value is defined as the electronic tuning range.

6.2. Mechanical tuning

Generally klystrons can be mechanically tuned over a wide frequency range but it is necessary to optimise the reflector voltage for maximum power output at the required frequency.



7664

7. MODULATION

7.1. Frequency modulation

Frequency modulation may be achieved by applying a modulating voltage to the reflector electrode. To minimise distortion, the amplitude of the modulation signal should be small compared with the voltage required to achieve the electronic tuning range. The most linear frequency modulation characteristic is normally obtained with the reflector voltage optimised for maximum power output at the required carrier frequency.

7.2. Pulse modulation

The output of a reflex klystron may be pulsed by modulating the reflector or control electrode voltage. To minimise frequency modulation effects the modulating signal should be as near rectangular as possible.

The reflector voltage is adjusted so that the valve is not oscillating and the amplitude of the modulating signal should be the difference between this voltage and the reflector voltage required to give optimum power output at the required frequency. The amplitude of the modulating voltage must not cause the valve to oscillate in more than one mode and the static reflector voltage should be chosen accordingly.

8. FREQUENCY STABILITY

The frequency of oscillation is primarily dependent upon the applied voltage between the reflector and resonator and the valve should be operated from a well regulated power supply.

Variations of the ambient temperature, load, atmospheric pressure, and heater voltage have a secondary effect.

9. LOAD MISMATCH

Care must be taken to minimise load reflections, as a change of phase of the mismatch will cause frequency pulling and variation in the power output. A severe mismatch may cause the valve to cease oscillating over portions of the tuning range.

10. TUNING MECHANISM

Information on the number of turns of the tuning mechanism required to cover the prescribed tuning range is given in the individual data sheets.

Adjustment of the tuning mechanism beyond the stated frequency limits must not be attempted. Where the mechanical tuning is achieved by adjustment of a cavity within the evacuated envelope by means of a flexible diaphragm the number of tuning cycles may be limited to avoid damage to the diaphragm.

11. SHIELDING

The resonator and reflector leads should be screened to shield the valve from induced modulation.

12. COOLING

Adequate cooling to prevent the maximum temperature limits being exceeded is required particularly when the valve is enclosed in a protective shield.

13. MOUNT

The performance quoted in the individual data sheets for those valves which have a coaxial lead output is dependent upon the use of the specified coaxial to waveguide transition unit.

KLYSTRON

KS7-85

Frequency: *7Gc/s. band. Mechanical tuning.*
Power output: *50mW minimum.*
Construction: *All metal, coaxial output probe.*
Application: *Local oscillator, signal generator.*

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—MICROWAVE DEVICES: INTRODUCTION and REFLEX KLYSTRONS which precede this section of the handbook.

CHARACTERISTICS

	Min.	Max.	
Mechanical tuning range	6.5	7.5	Gc/s
Electronic tuning range, between half power points at any frequency in the mechanical tuning range	25	—	Mc/s
Power output at 7Gc/s ± 20Mc/s (principal mode)	85	—	mW
Power output at any other frequency in the band	50	—	mW
Reflector voltage for maximum power output at 7Gc/s ± 20Mc/s	–100	–175	V
Reflector voltage range, inclusive of electronic tuning range	–60	–215	V
Frequency change with temperature	—	500	kc/s per °C

CATHODE

Indirectly heated

V_h	6.3	V
I_h	500	mA

OPERATING CONDITIONS IN SPECIFIED MOUNT

f	7.0	Gc/s
$V_{resonator}$	300	V
$I_{resonator}$	24	mA
$V_{reflector}$	–140	V
$I_{reflector}$	1.0	µA
Electronic tuning range between half power points	38	Mc/s
P_{out}	100	mW

COOLING

Natural

ABSOLUTE RATINGS

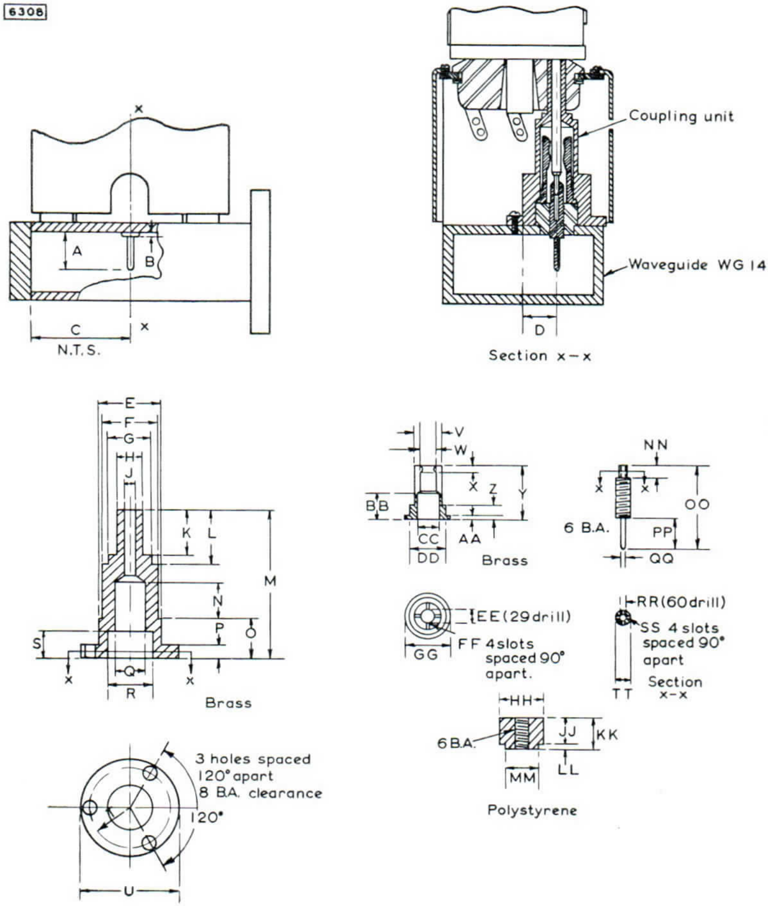
$V_{resonator}$ max.	350	V
$I_{resonator}$ max.	37	mA
$V_{reflector}$ max.	–1.0 to –400	V
V_{h-k} max.	–150	V
$T_{amb\ (shell)}$ max.	110	°C
$T_{coaxial\ line}$ max.	90	°C

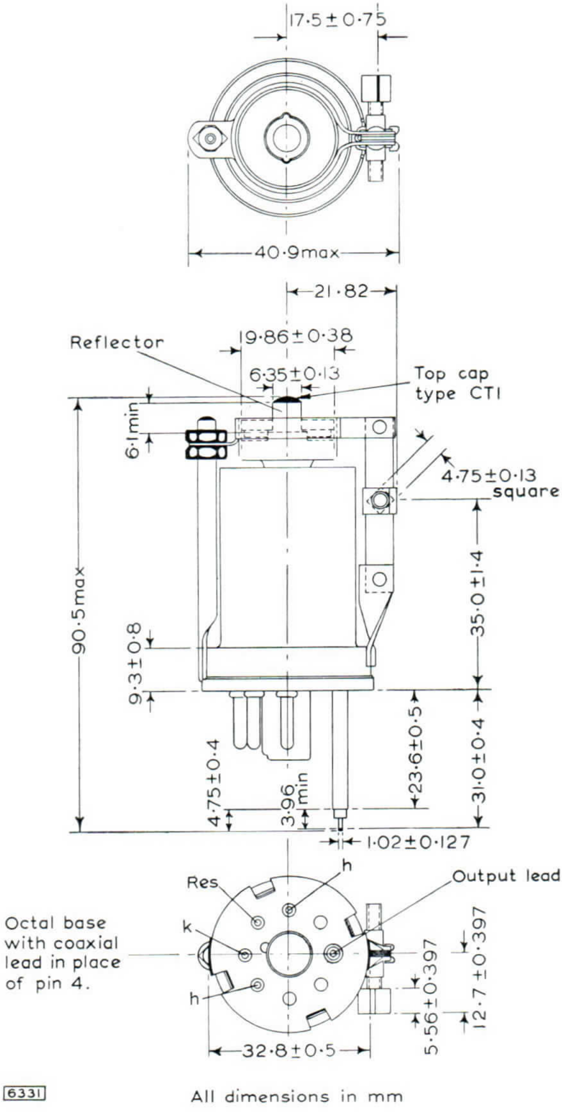
OPERATING NOTE

The prescribed tuning range is covered by five turns of the mechanical tuning screw.

	Inches	*Millimetres*
A	0.370 ± 0.005	9.398 ± 0.127
B	0.045	1.143
C	0.315	8.001
D	0.333	8.458
E	0.5625	14.287
F	0.5	12.7
G	0.390	9.90
H	0.25	6.350
J	0.145	3.683
K	0.475	12.065
L	0.568	14.427
M	1.5	38.1
N	0.5	12.7
O	0.375	9.525
P	0.125	3.175
Q	0.314	7.976
R	0.468	11.887
S	0.250	6.350
T	0.375	9.525
U	1.000	25.4
V	0.281	7.137
W	0.15	3.81
X	0.1	2.54
Y	0.53	13.462
Z	0.125	3.175
AA	0.020	0.508
BB	0.250	6.350
CC	0.250	6.350
DD	0.312	7.925
EE	0.136	3.454
FF	0.015 × 0.313	0.381 × 7.950
GG	0.438	11.131
HH	0.468	11.887
JJ	0.230	5.842
KK	0.292	7.417
LL	0.062	1.575
MM	0.375	9.525
NN	0.088	2.235
OO	0.750	19.05
PP	0.325	8.255
QQ	0.040	1.016
RR	0.040 × 0.186	1.016 × 4.724
SS	0.010 × 0.180	0.254 × 4.572
TT	0.095	2.413

6308


A
B
C
N.T.S.
x
Coupling unit
Waveguide WG 14
D
Section x – x
E
F
G
H
J
K
L
M
N
P
O
S
Q
R
Brass
3 holes spaced 120° apart 8 B.A. clearance
120°
U
V
W
X
Y
Z
BB
CC
DD
AA
Brass
NN
OO
6 B.A.
PP
QQ
EE (29 drill)
FF 4 slots spaced 90° apart.
GG
RR (60 drill)
SS 4 slots spaced 90° apart
TT
Section x – x
HH
6 B.A.
JJ
KK
LL
MM
Polystyrene



All dimensions in mm

LOCAL OSCILLATOR KLYSTRON

KS9-20

(723A/B)

Mechanically-tuned klystron of all-metal construction designed for use as a local oscillator over the frequency range 8702 to 9548 Mc/s.

PRELIMINARY DATA

HEATER

Indirectly Heated

V_h	6.3	V
I_h	0.6	A

MOUNTING POSITION

Any

CHARACTERISTICS

Minimum electronic tuning range at 9370 ±0.3% Mc/s and between half power tuning points	35	Mc/s
Minimum power output at 9370 Mc/s. Mode A	20	mW
Minimum power output at all other frequencies	10	m
Maximum change of frequency with temperature	0.25 Mc/s per °C	

TYPICAL OPERATION AT 9370 Mc/s—Mode A

With Waveguide size W16

D.C. resonator voltage	300	V
D.C. reflector voltage range	−130 to −185	V
D.C. resonator current	22	mA
D.C. reflector current	3.0	μA
Electronic tuning range between half power tuning points	40	Mc/s
Power output	25	mW

LIMITING VALUES

Maximum resonator voltage (absolute)	330	V
Maximum resonator current (absolute)	32	mA
*Maximum reflector voltage (absolute)	−400	V
Mechanical tuning range limits	8702 to 9548	Mc/s
Maximum heater to cathode voltage	±50	V
Maximum ambient temperature of shell	110	°C
Maximum temperature of coaxial line	90	°C

*Reflector voltage for maximum power output in principle mode −85 to −200V.

OPERATING NOTES

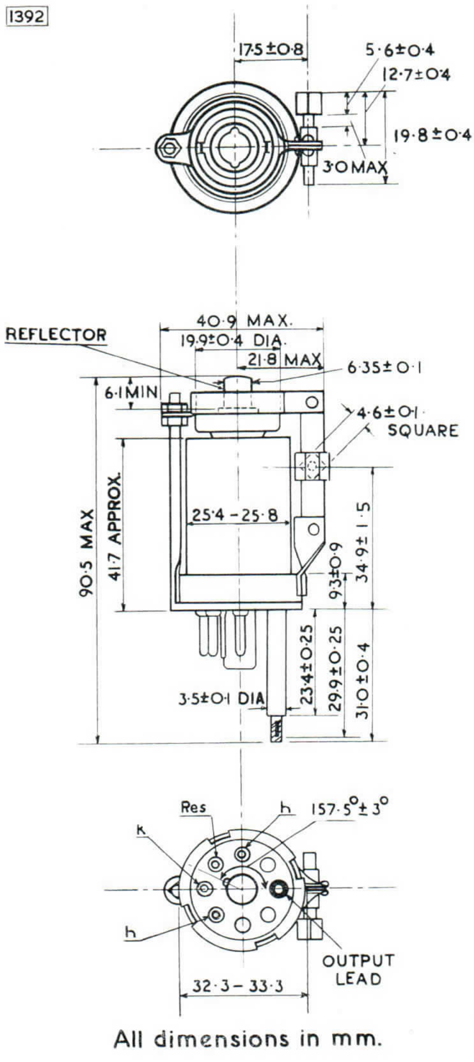
1. The above performance depends upon the use of the specified mount. (See pages 3 and 4.)
2. When the valve is enclosed in a protective shield, adequate ventilation must be provided. For the best frequency stability the KS9-20 should be operated at nearly constant ambient temperature and with a well-regulated power supply.
3. The resonator and reflector leads should be screened to shield the valve from induced modulation. To avoid damage to the valve the reflector potential must never become positive with respect to the cathode. For this reason it is essential that the reflector connection be made at all times during operation.
4. The prescribed tuning range is covered by three turns of the mechanical-tuning screw. Adjustment beyond the stated frequency limits must not be attempted.

KS9-20

(723A/B)

LOCAL OSCILLATOR KLYSTRON

Mechanically-tuned klystron of all-metal construction designed for use as a local oscillator over the frequency range 8702 to 9548 Mc/s.



All dimensions in mm.

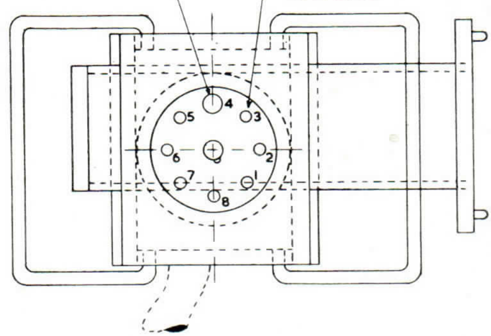
LOCAL OSCILLATOR KLYSTRON

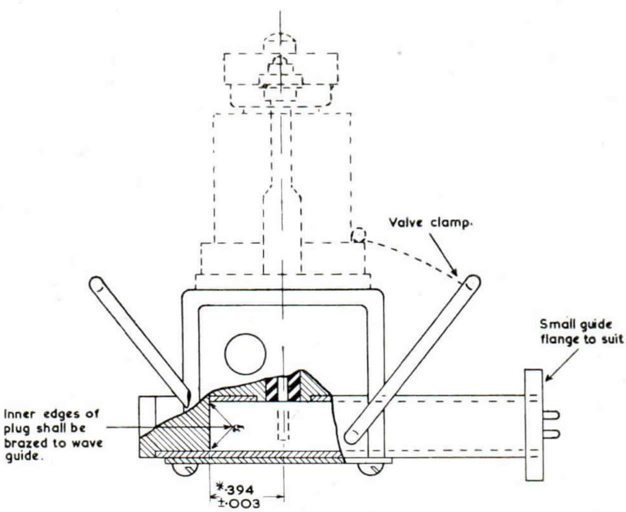
KS9-20

(723A/B)

Mechanically-tuned klystron of all-metal construction designed for use as a local oscillator over the frequency range 8702 to 9548 Mc/s.

1451





Dimensions indicated by * determine the broad band characteristics of the coupler and should be held to tolerances shown

All high frequency surfaces to be silver or gold plated.

All dimensions in inches

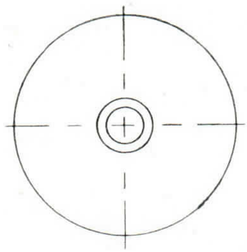
KS9-20

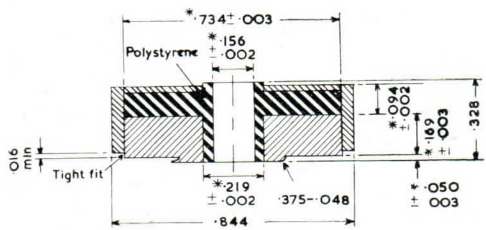
(723A/B)

LOCAL OSCILLATOR KLYSTRON

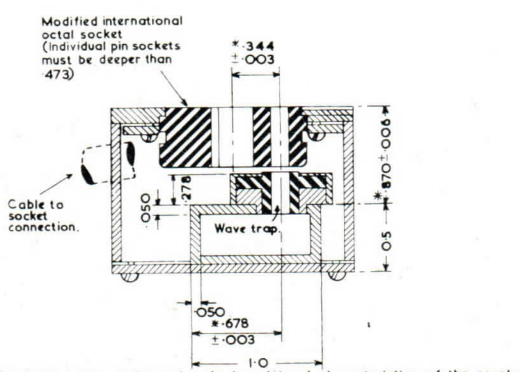
Mechanically-tuned klystron of all-metal construction designed for use as a local oscillator over the frequency range 8702 to 9548 Mc/s.

1452





Wave trap



Dimensions indicated by * determine the broad band characteristics of the coupler and should be held to tolerances shown.

All high frequency surfaces to be silver or gold plated.

All dimensions in inches

QUICK REFERENCE DATA

Mechanically tuned klystron for local oscillator applications.

Frequency	8.50 to 9.66	Gc/s
Power output	30	mW

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES: INTRODUCTION and REFLEX KLYSTRONS which precede this section of the handbook.

TYPICAL OPERATION IN RECOMMENDED MOUNT - PRINCIPAL MODE

f	9.37	Gc/s
Vresonator	300	V
Iresonator	22	mA
Vreflector	-130 to -190	V
Electronic tuning range between half-power points	40	Mc/s
Pout	50	mW

ABSOLUTE MAXIMUM RATINGS

Vresonator max.	330	V
Iresonator max.	37	mA
Vreflector max.	-400	V
Vh-k max.	± 50	V
Tshell max.	110	°C
v.s.w.r.	2.5	

CATHODE

Indirectly heated

Vh	6.3	V
Ih	450	mA

CHARACTERISTICS

	Min.	Max.	
Mechanical tuning range	8.50	9.66	Gc/s
Electronic tuning range between half-power points			
(a) at 9.37 Gc/s	35	-	Mc/s
(b) at all other frequencies	28	-	Mc/s
Reflector voltage for maximum power output at 9.37 Gc/s in principal mode (Vresonator = 300V)	-130	-190	V
Frequency temperature coefficient	-	0.2	Mc/s per $^{\circ}$C

END OF LIFE PERFORMANCE

Electronic tuning range at 9.37 Gc/s between half-power points (Vresonator = 300V)	32	Mc/s
Power output at any frequency in the mechanical tuning range with reflector voltage optimised (Vresonator = 300V)	16	mW

COOLING

Natural

MOUNTING POSITION

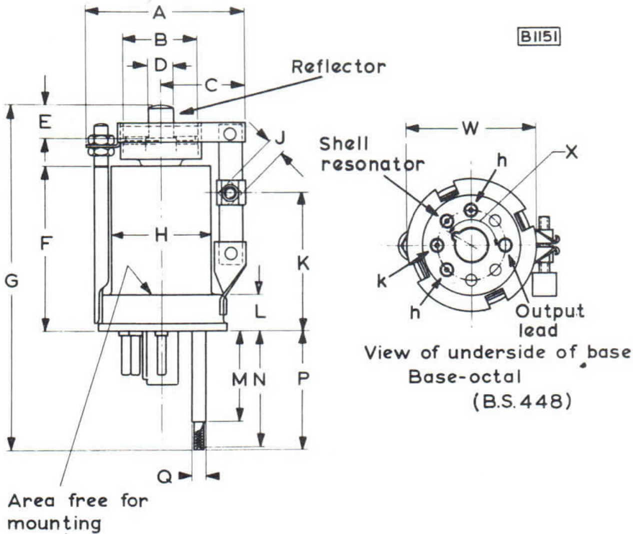
Any

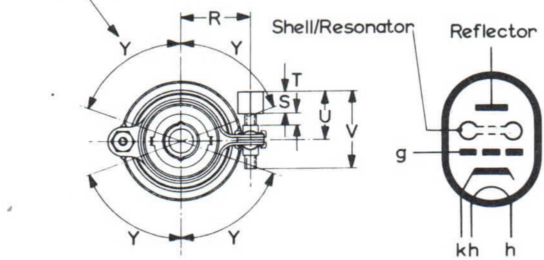
OPERATING NOTES

1. The impedance of the reflector supply should not exceed 100kΩ.
2. Adjustment beyond the stated frequency limits must not be attempted.

PHYSICAL DATA

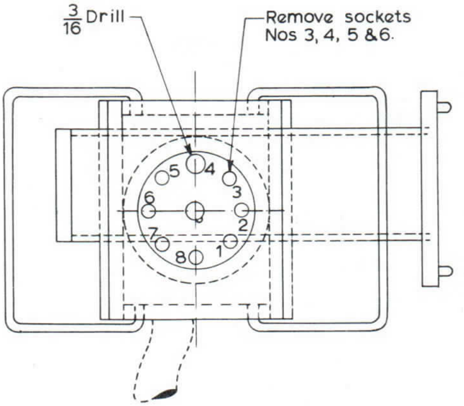
Weight of klystron	2.29	oz
	65	g
Weight of klystron plus carton	4.59	oz
	130	g
Dimensions of storage carton	3.75 x 2 x 2	in
	95 x 51 x 51	mm



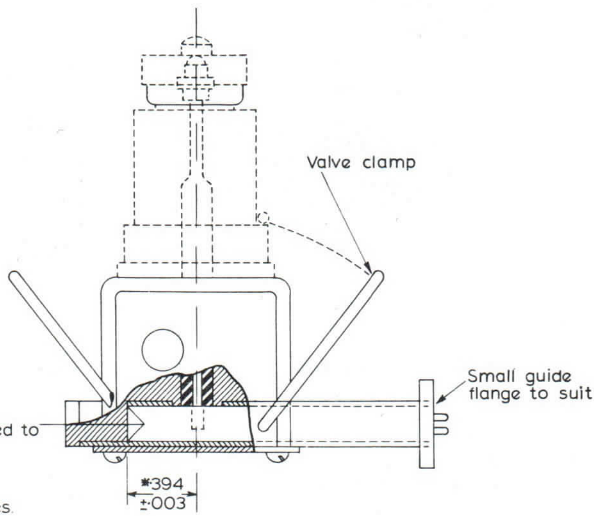


DIMENSIONS

	Inches	Millimetres			Inches	Millimetres	
A	1.610	40.9	max	N	1.177 ± 0.010	29.90 ± 0.25	
B	0.783 ± 0.016	19.9 ± 0.4		P	1.221 ± 0.016	31 ± 0.4	
C	0.860	21.8	max	Q	0.122 ± 0.004	3.1 ± 0.1	dia
D	0.252 ± 0.004	6.35 ± 0.1		R	0.302 ± 0.032	7.5 ± 0.8	
E	0.240	6.1	min	S	0.224 ± 0.016	5.6 ± 0.4	
F	1.642	41.7	nominal	T	0.118	3.0	max
G	3.563	90.5	max	U	0.500 ± 0.016	12.7 ± 0.4	
H	1.008 ± 0.008	25.6 ± 0.2	dia	V	0.780 ± 0.016	19.8 ± 0.4	
J	0.180 ± 0.001	4.55 ± 0.05		W	1.292 ± 0.020	32.8 ± 0.5	
K	1.374 ± 0.059	34.9 ± 1.5		X	157.5° ± 3°		
L	0.366 ± 0.035	9.3 ± 0.9		Y	70°		max
M	0.917 ± 0.010	23.40 ± 0.25					



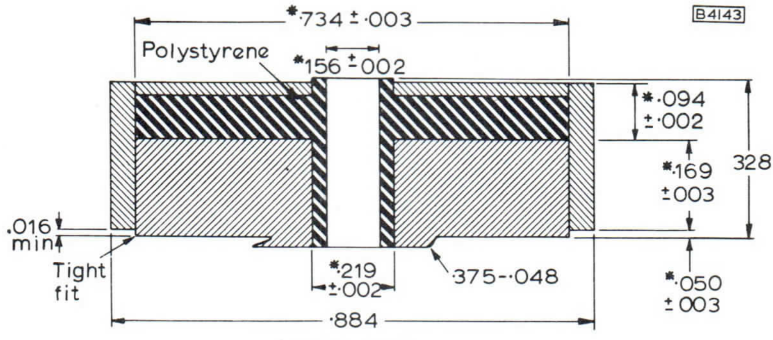
B3806



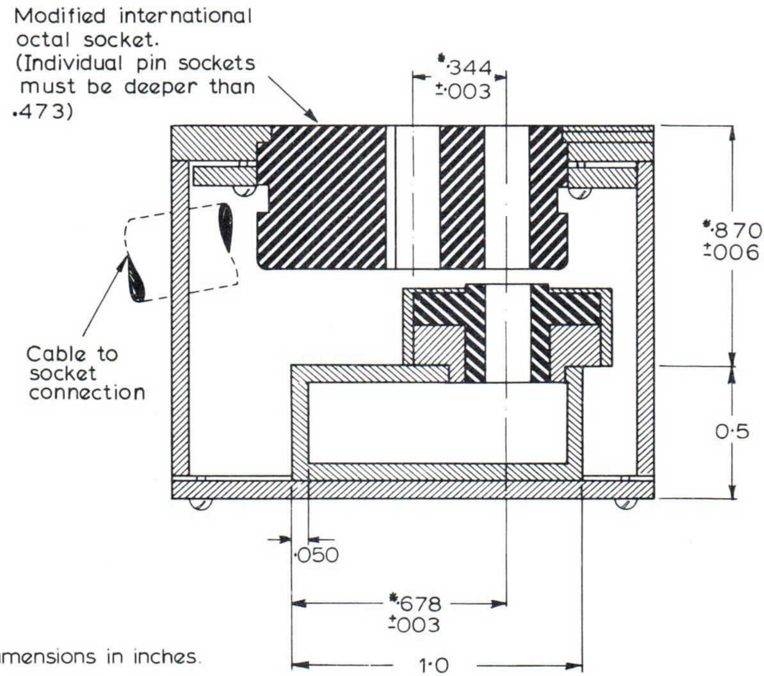
Dimensions in inches.

Dimensions indicated by * determine the broad band characteristics of the coupler and should be held to tolerances shown.

All high frequency surfaces to be silver or gold plated.



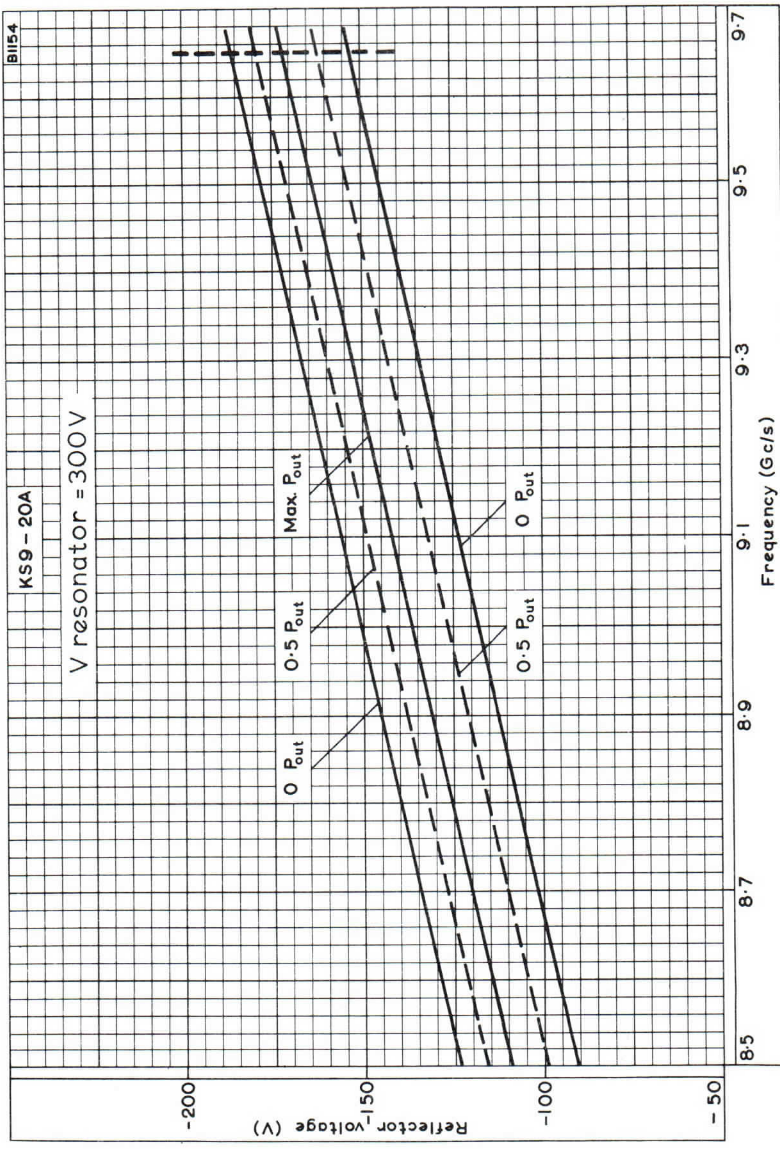
Wave trap



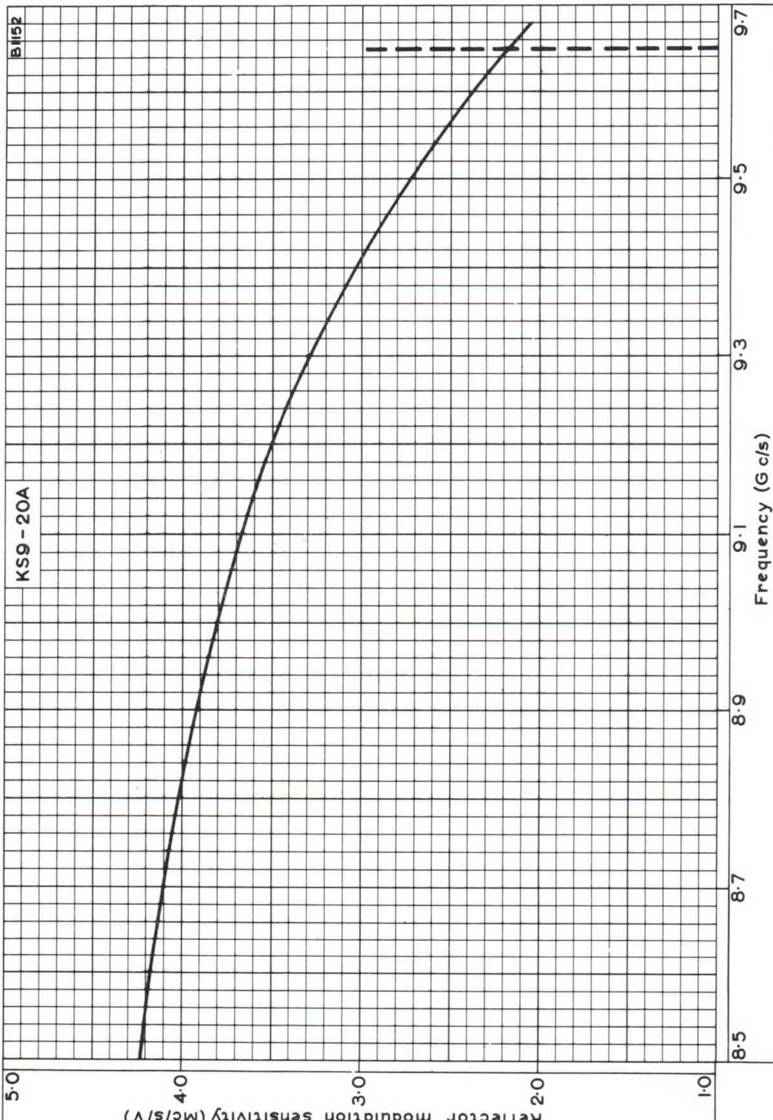
Dimensions in inches.

Dimensions indicated by * determine the broad band characteristics of the coupler and should be held to tolerances shown.

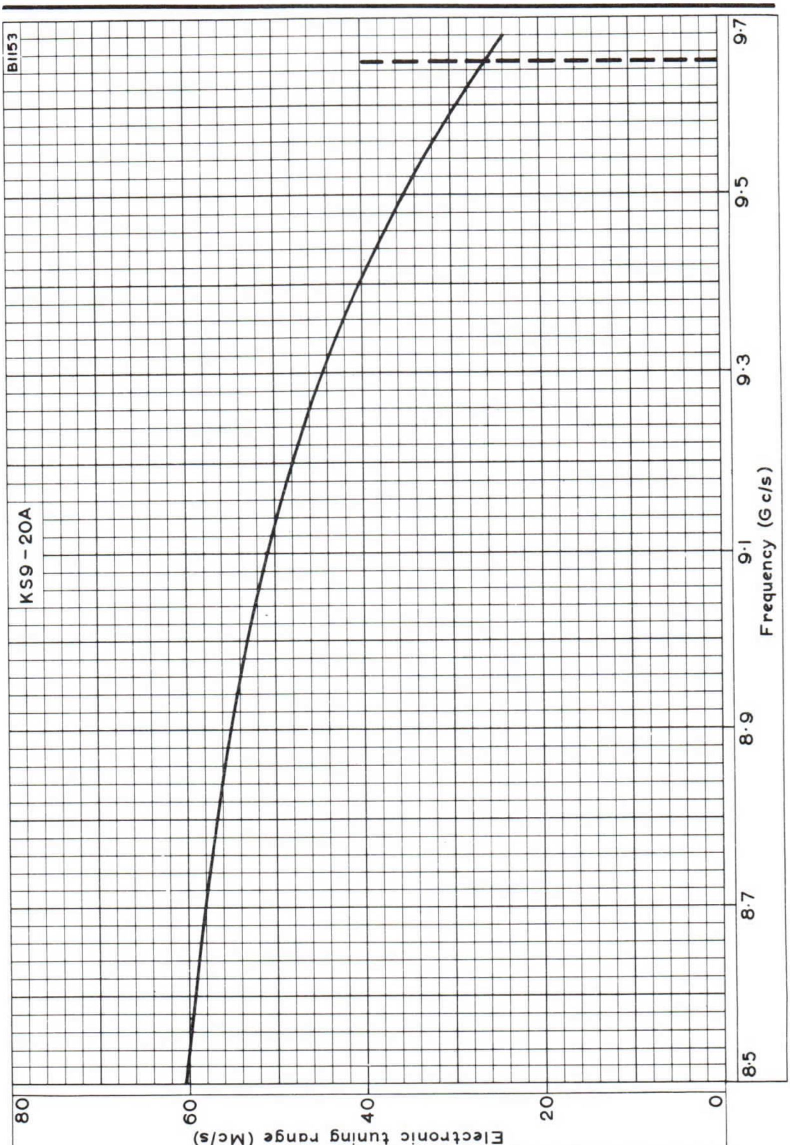
All high frequency surfaces to be silver or gold plated.



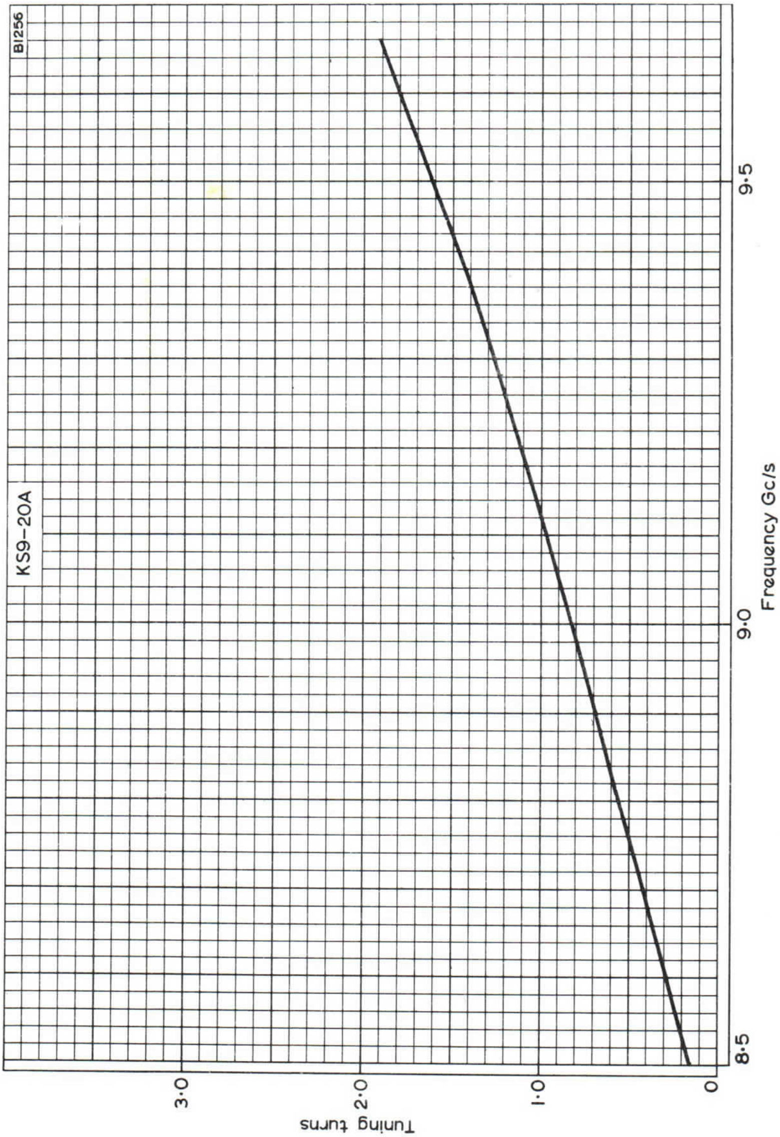
REFLECTOR VOLTAGE PLOTTED AGAINST FREQUENCY



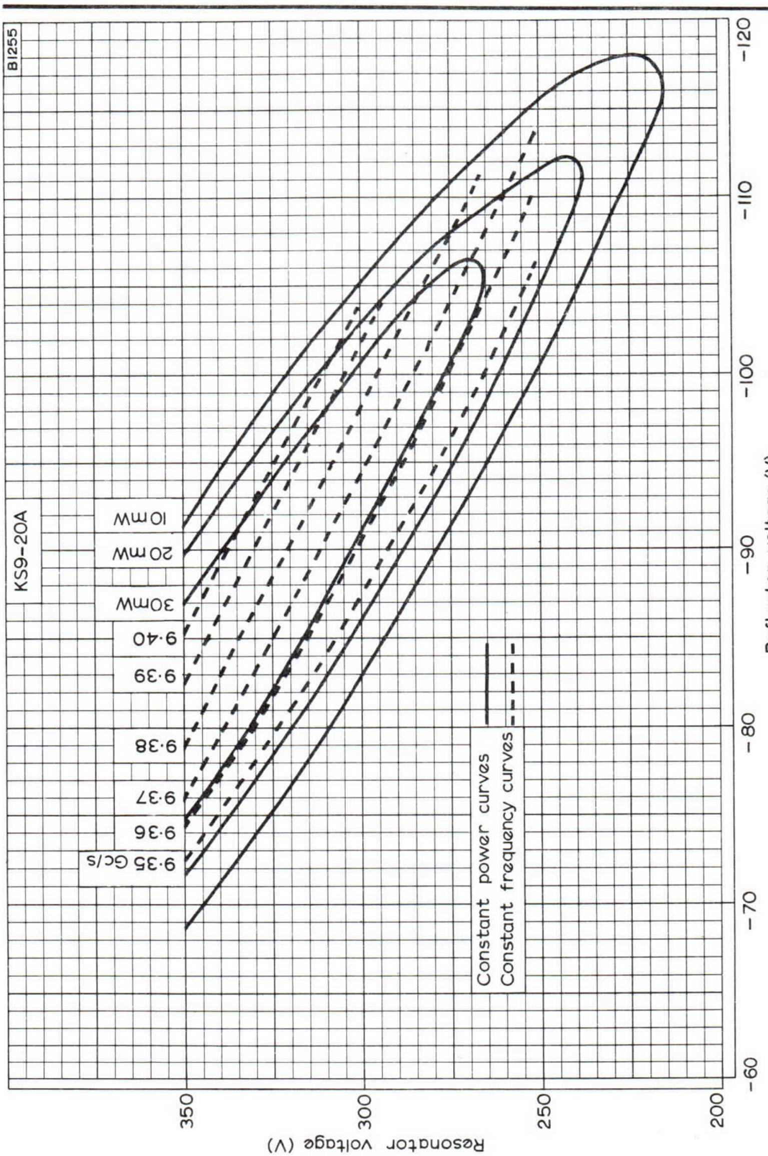
REFLECTION MODULATION SENSITIVITY PLOTTED AGAINST FREQUENCY



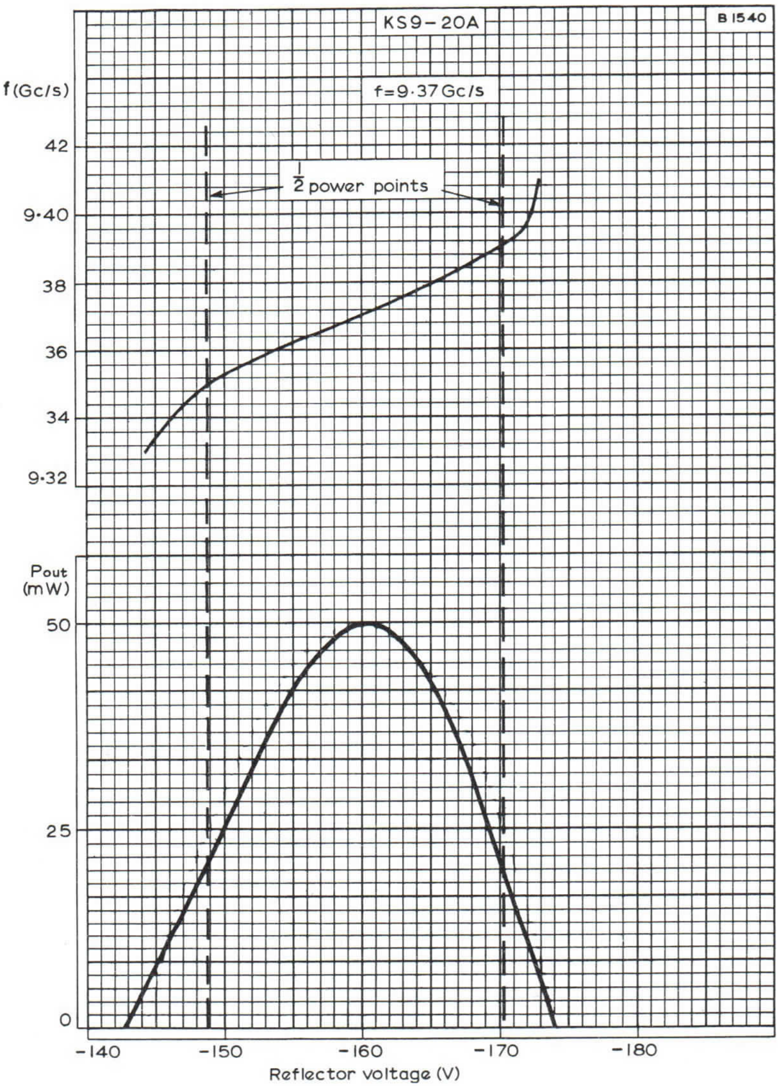
ELECTRONIC TUNING RANGE PLOTTED AGAINST FREQUENCY.



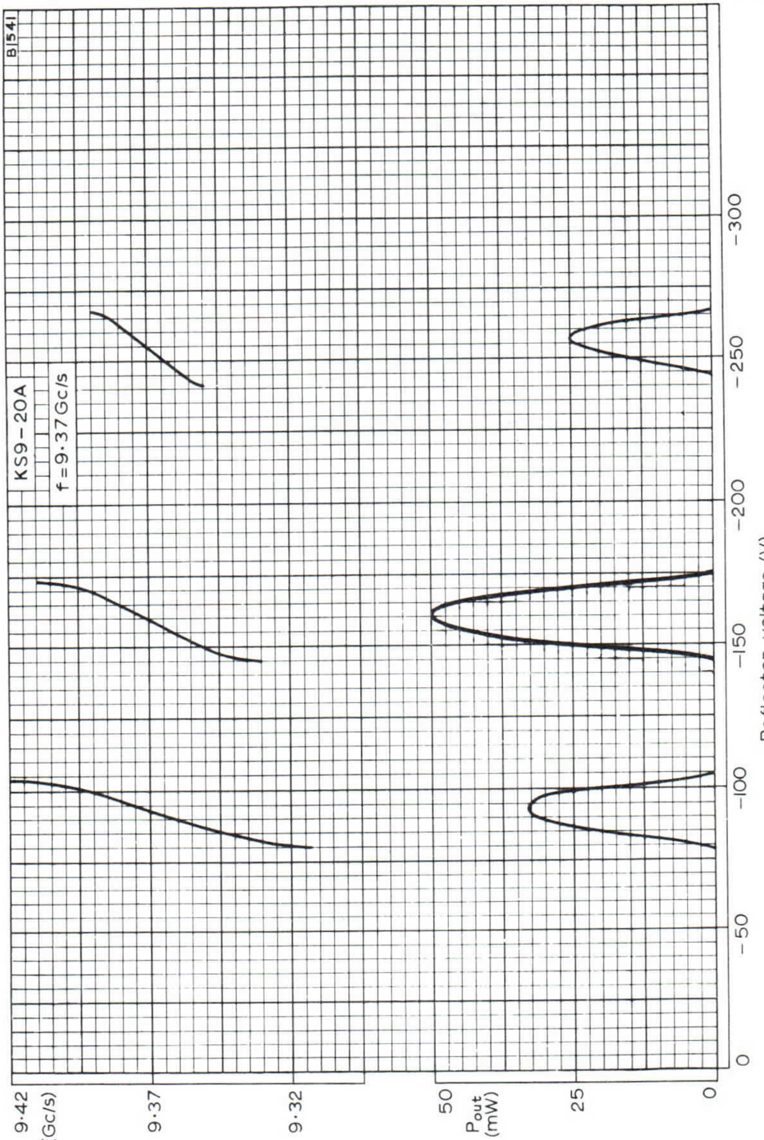
TUNING TURNS PLOTTED AGAINST FREQUENCY



RESONATOR VOLTAGE PLOTTED AGAINST REFLECTOR VOLTAGE.



FREQUENCY AND OUTPUT POWER PLOTTED AGAINST REFLECTOR VOLTAGE



FREQUENCY AND OUTPUT POWER PLOTTED AGAINST REFLECTOR VOLTAGE

REFLEX KLYSTRON

KS9-30
(6975)

QUICK REFERENCE DATA

Mechanically tunable 'X' band reflex klystron with integral external cavity.

Frequency	8.5 to 9.6	GHz
Power output	35	mW
Construction	Waveguide output with coupled cavity	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS ($6\,^3/_4$ Mode) ←

f	8.5	9.6	GHz
V_{res}	300	300	V
I_{res}	30	30	mA
V_{refl}	-95	-145	V←
$^*I_{refl}$	1.0	1.0	μA
Electronic tuning range between half power points	50	45	MHz
P_{out}	35	30	mW
Electronic tuning rate	2.0	1.5	MHz per V←

*The internal resistance of the reflector power supply should not exceed 1MΩ.

CATHODE

Indirectly heated

V_h	6.3	V
I_h max. (at V_h = 6.3V)	500	mA

COOLING

Natural

Shell temperature max.	200	°C

MOUNTING POSITION Any

PHYSICAL DATA

	g	oz
Weight of klystron	140	5.0

CHARACTERISTICS

	Min.	Max.	
Mechanical tuning range	8.5	9.6	GHz
Mechanical tuning rate	190	275	MHz per turn
Electronic tuning range, between half-power points at any frequency in the mechanical tuning range	30	-	MHz
Output power at any frequency in the mechanical tuning range with reflector voltage optimised (V_{res} =300V)	20	-	mW
Reflector voltage for maximum power output (V_{res} =300V)	-85	-150	V←
Frequency change with temperature	-	-200	kHz per degC rise
Frequency modulation under vibration of 10g applied to flange (50Hz to 1.0kHz)	-	1.0	MHz←
Electronic tuning rate	1.0	2.0	MHz per volt ←

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
V_{res} max.	-	350	V
I_{res} max.	-	52	mA
V_{refl}	-20	-500	V←

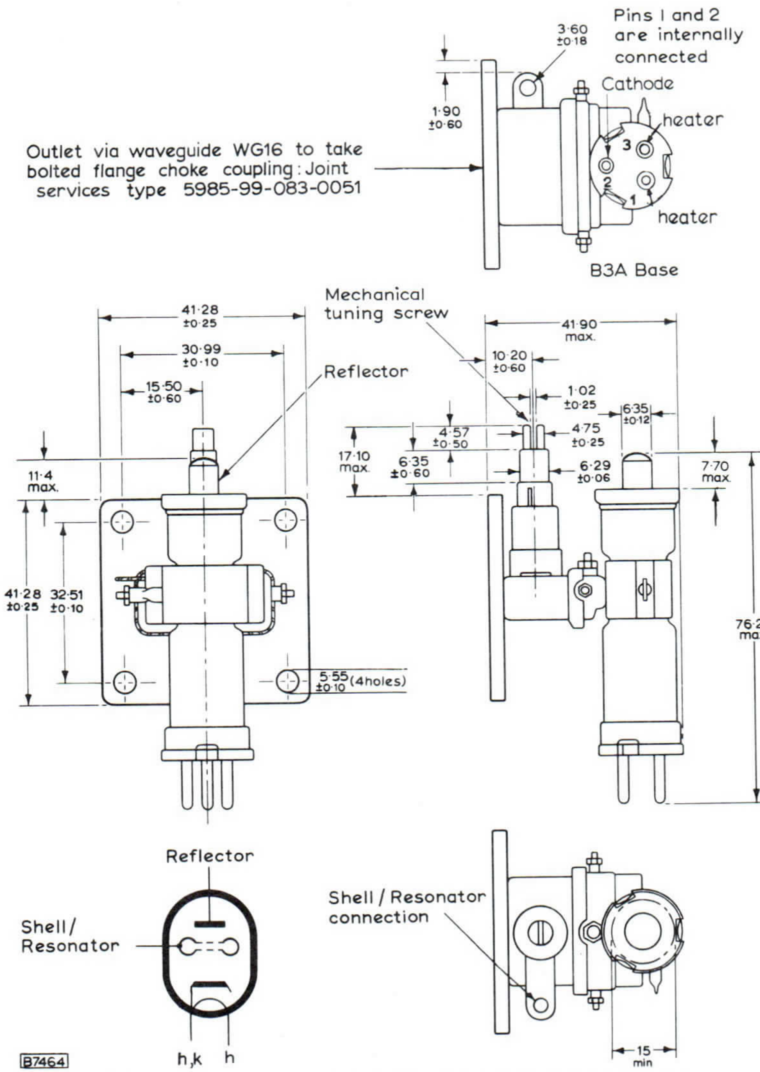
OPERATING NOTES

1. The mechanical tuning range is covered by 4 to $5^3/_4$ turns of the tuning screw.
2. To avoid damage to the klystron the reflector potential must never become positive with respect to the cathode. The resonator voltage should be applied only after the reflector connection has been made.

ACCESSORIES

Socket	E2 555 37
Connector for reflector	55316

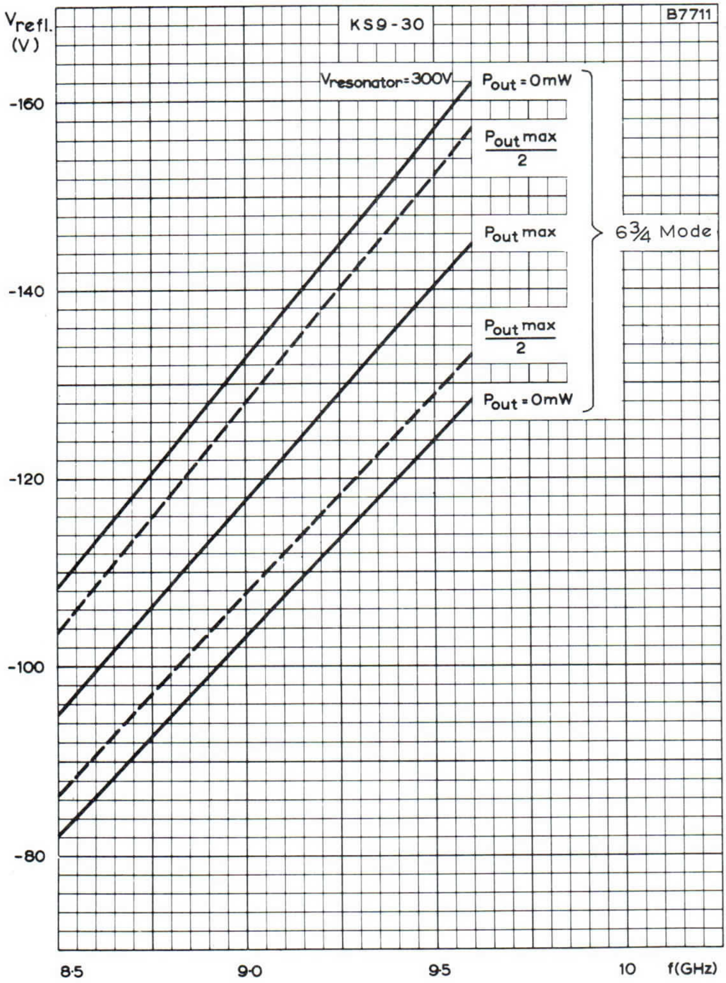
OUTLINE DRAWING



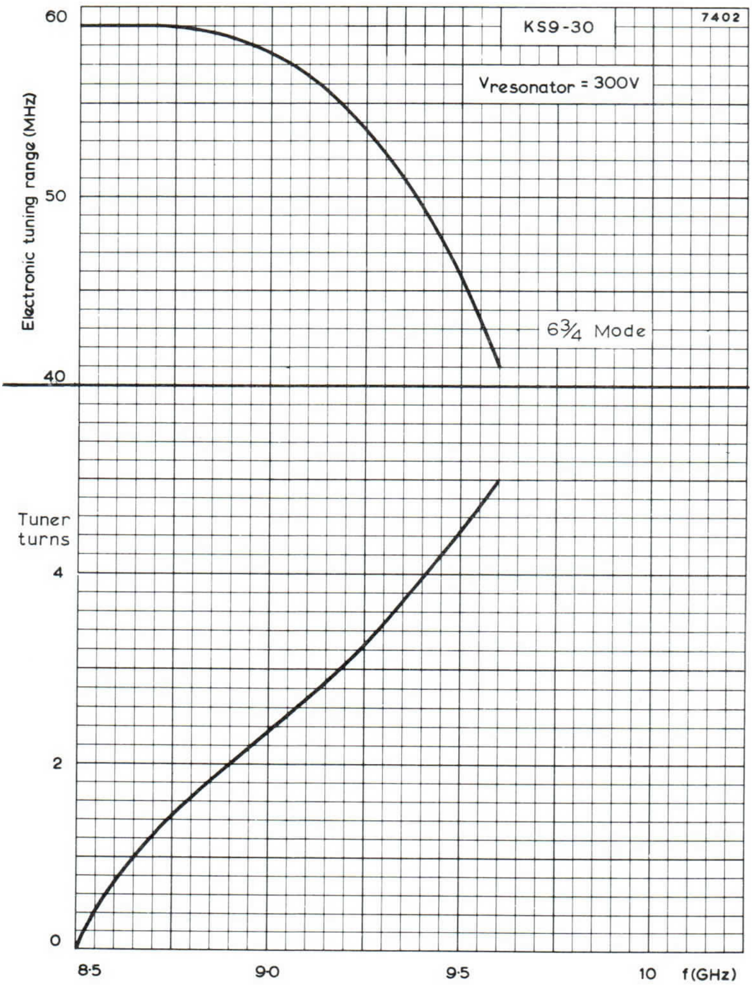
Millimetre dimensions derived from original inch dimensions
(conversions overleaf)

DIMENSION CONVERSION TABLE

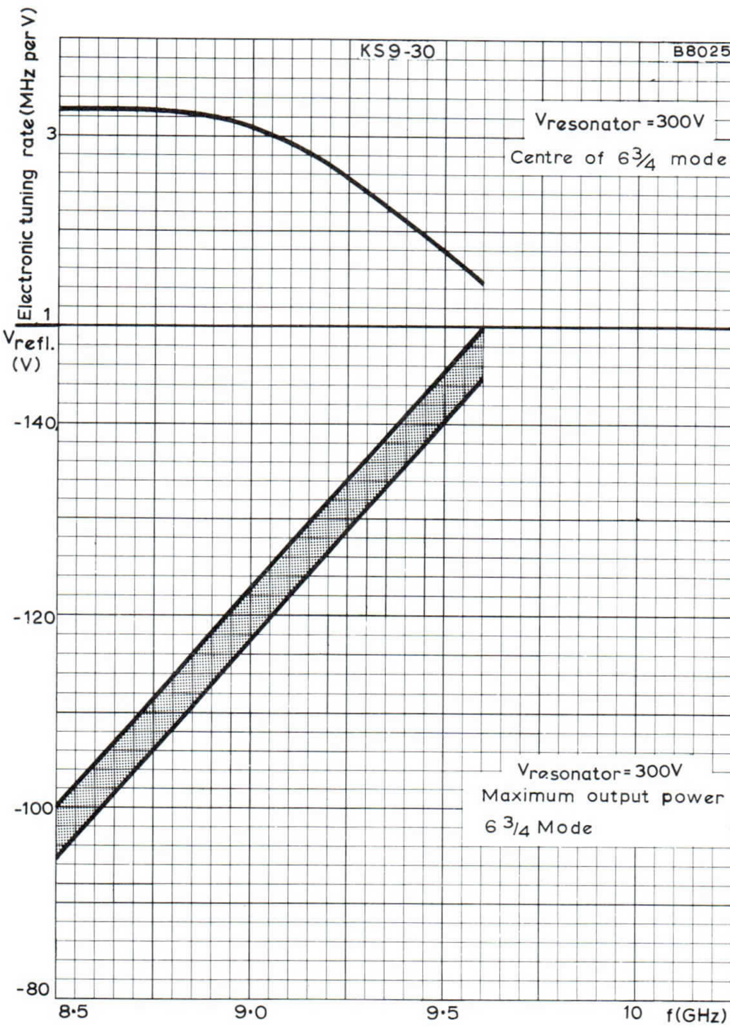
Millimetres	Inches	
1.02 ±0.25	0.040 ±0.010	
1.90 ±0.60	0.075 ±0.024	
3.60 ±0.18	0.142 ±0.007	
4.57 ±0.50	0.180 ±0.020	
4.75 ±0.25	0.187 ±0.010	
5.55 ±0.10	0.219 ±0.004	
6.29 ±0.06	0.248 ±0.002	
6.35 ±0.12	0.250 ±0.005	
6.35 ±0.60	0.250 ±0.024	
7.70	0.303	max.
10.20 ±0.60	0.402 ±0.024	
11.40	0.449	max.
15.00	0.591	min.
15.50 ±0.60	0.610 ±0.024	
17.10	0.673	max.
30.99 ±0.10	1.220 ±0.004	
32.51 ±0.10	1.280 ±0.004	
41.28 ±0.25	1.625 ±0.010	
41.90	1.650	max.
76.20	3.000	max.



REFLECTOR VOLTAGE PLOTTED AGAINST FREQUENCY



ELECTRONIC TUNING RANGE AND TUNER TURNS
PLOTTED AGAINST FREQUENCY



ELECTRONIC TUNING RATE AND REFLECTOR VOLTAGE RANGE FOR MAXIMUM OUTPUT POWER PLOTTED AGAINST FREQUENCY.

KS9-40

QUICK REFERENCE DATA

Light-weight mechanically tunable klystron for local oscillator applications.

Frequency	9.3 to 9.5 Gc/s
Power output	40 mW
Construction	Waveguide output with coupled cavity

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—MICROWAVE DEVICES: INTRODUCTION and REFLEX KLYSTRONS which precede this section of the handbook.

TYPICAL OPERATION

f	9.4	Gc/s
$V_{resonator}$	300	V
$I_{resonator}$	33	mA
$V_{reflector}$	−85	V
P_{out}	40	mW
Electronic tuning range between half-power points	45	Mc/s

ABSOLUTE MAXIMUM RATINGS

	Min.	*Max.*	
$V_{resonator}$	—	350	V
$I_{resonator}$	—	45	mA
$V_{reflector}$	−10	−400	V
$Z_{reflector}$		100	kΩ
V_{h-k}	—	±50	V
T_{shell}	—	150	°C
v.s.w.r.	—	1.5	

CATHODE

Indirectly heated

V_h	6.3	V
I_h max.	700	mA
t_{h-k}	60	s

KS9-40

KLYSTRON

CHARACTERISTICS

	Min.	Max.	
Mechanical tuning range	9.3	9.5	Gc/s
Mechanical tuning rate (average over range)	—	150	Mc/s per turn
Electronic tuning range, between half-power points at any frequency in the mechanical tuning range ($V_{resonator} = 300V$)	28	—	Mc/s
Reflector modulation sensitivity at mode centre	2.0	3.0	Mc/s per volt
Power output at any frequency in the mechanical tuning range with reflector voltage optimised ($V_{resonator} = 300V$)	25	—	mW
Reflector voltage for maximum power output at 9.4Gc/s in principal mode ($V_{resonator} = 300V$)	–70	–110	V
Reflector voltage range over mechanical tuning range for optimum power output ($V_{resonator} = 300V$)	–65	–115	V
Frequency drift after first 5 minutes of operation	—	3.0	Mc/s
Temperature coefficient ($T_{ambient} = -50°C$ to $+70°C$)	—	–0.2	Mc/s per °C
Frequency change with atmospheric pressure change equivalent to operation 0 to 30,000 ft altitude	—	1.0	Mc/s
Frequency modulation under vibration of 10g applied to flange (30 to 1,000c/s)	—	2.0	Mc/s

END OF LIFE PERFORMANCE

Electronic tuning range, between half-power points at any frequency in the mechanical tuning range ($V_{resonator} = 300V$)	25	Mc/s
Power output at any frequency in the mechanical tuning range with reflector voltage optimised ($V_{resonator} = 300V$)	20	mW

COOLING

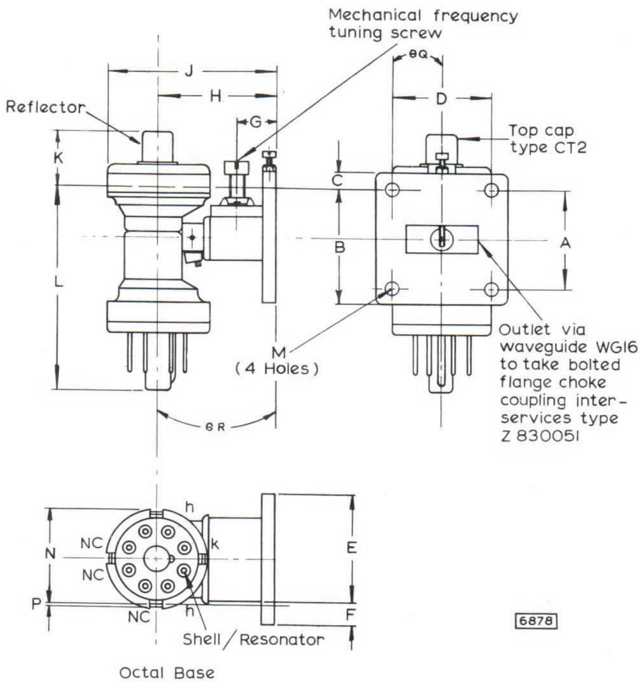
Natural

MOUNTING POSITION

Any

PHYSICAL DATA

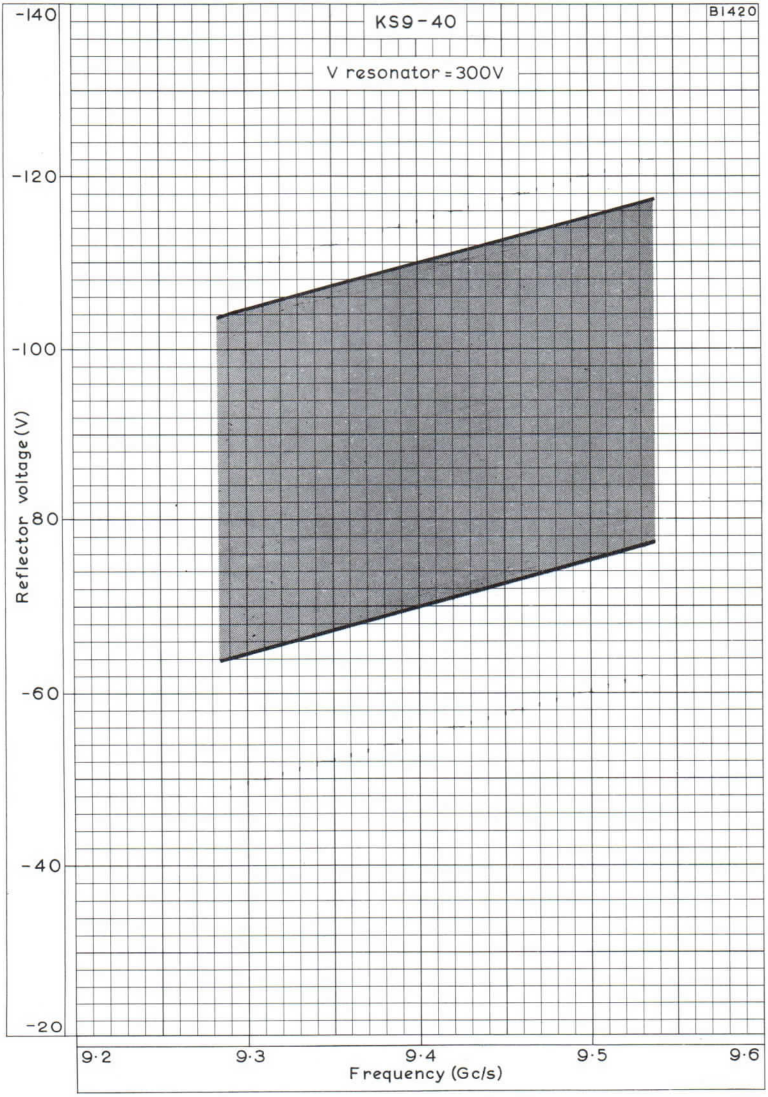
Weight of klystron	5.6 / 150	oz / g
Weight of klystron carton	9 / 255	oz / g
Dimensions of storage carton	5.5 × 4.48 × 4.84 / 140 × 114 × 123	in / mm



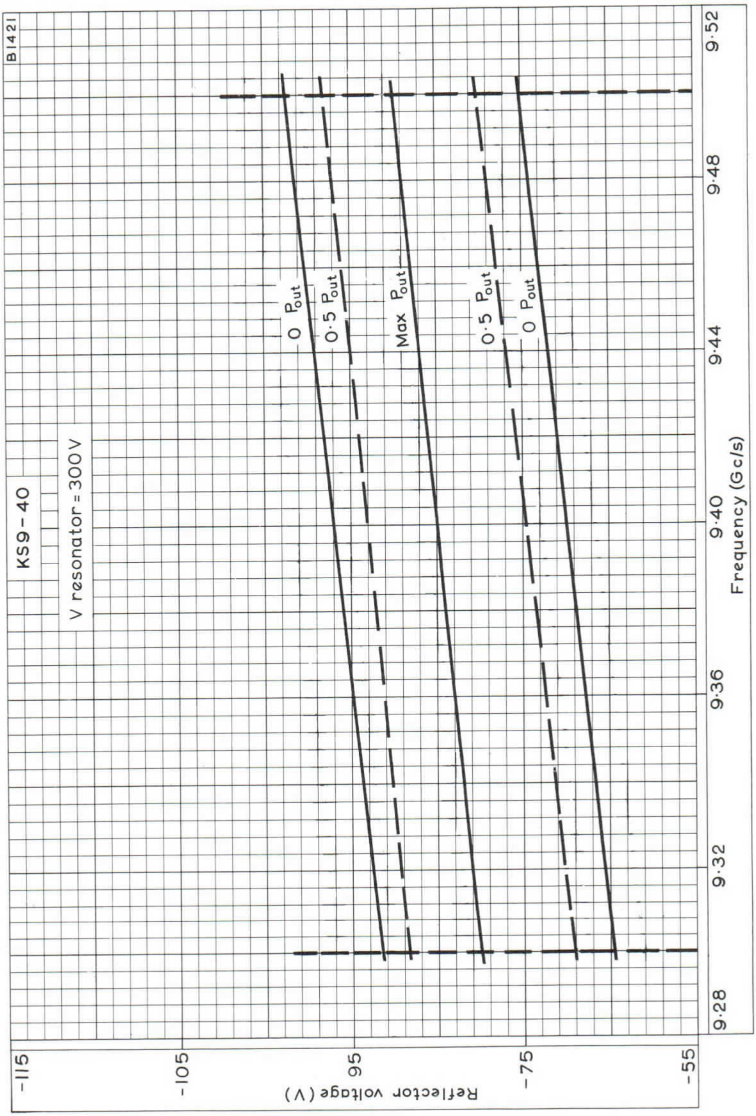
Octal Base

DIMENSIONS

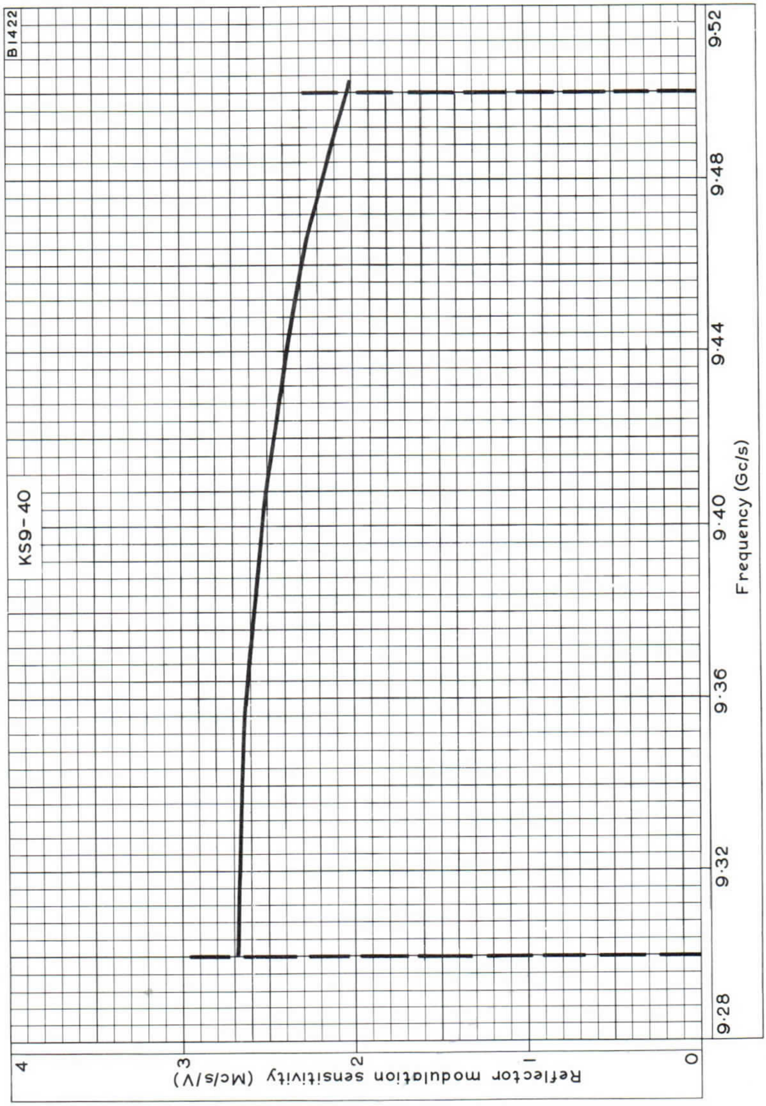
	Inches	*Millimetres*	
A	1.282 ± 0.004	32.54 ± 0.1	
B	1.461	37.10	max.
C	0.177	4.50	max.
D	1.220 ± 0.004	30.97 ± 0.1	
E	1.429	36.30	max.
F	0.209	5.30	max.
G	0.354 ± 0.039	9 ± 1	
H	1.437 ± 0.099	36.5 ± 2.5	
J	2.126	54	max.
K	0.866	22	max.
L	2.520	64	max.
M	0.168 ± 0.003	4.275 ± 0.075	
N	1.280	32.5	max.
P	0.059	1.5	max.
θQ	1°		max.
θR	1°		max.



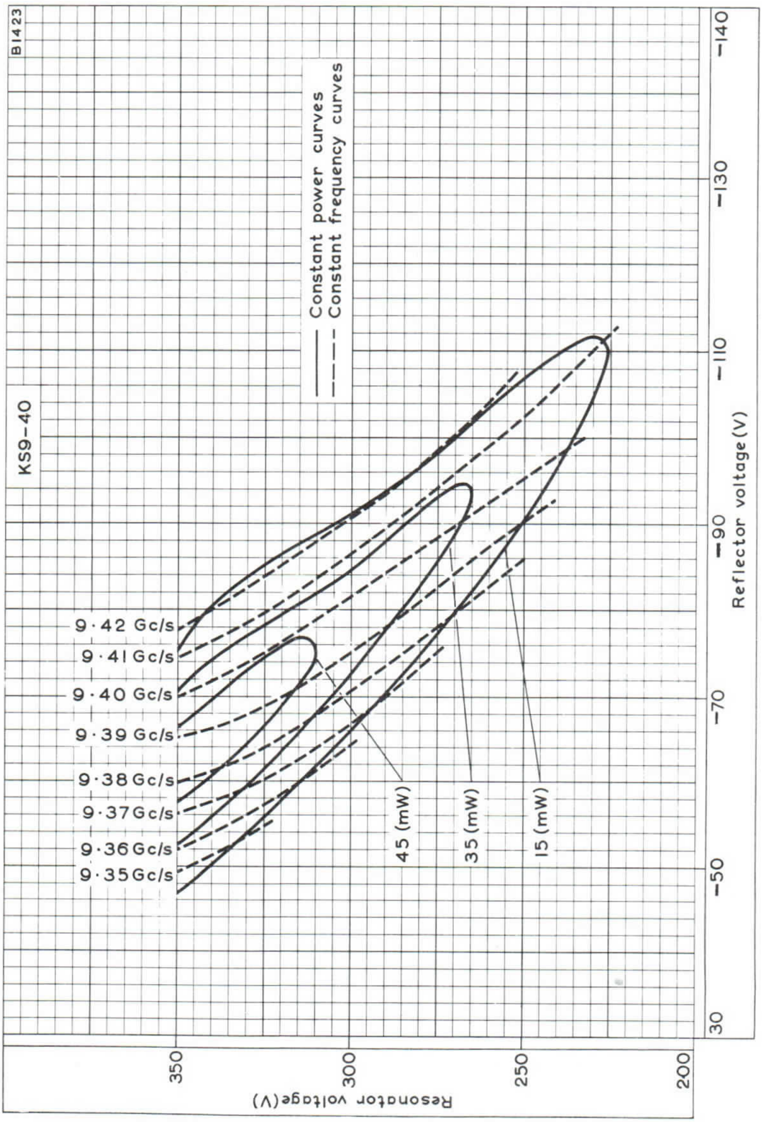
REFLECTOR VOLTAGE RANGE PLOTTED AGAINST FREQUENCY



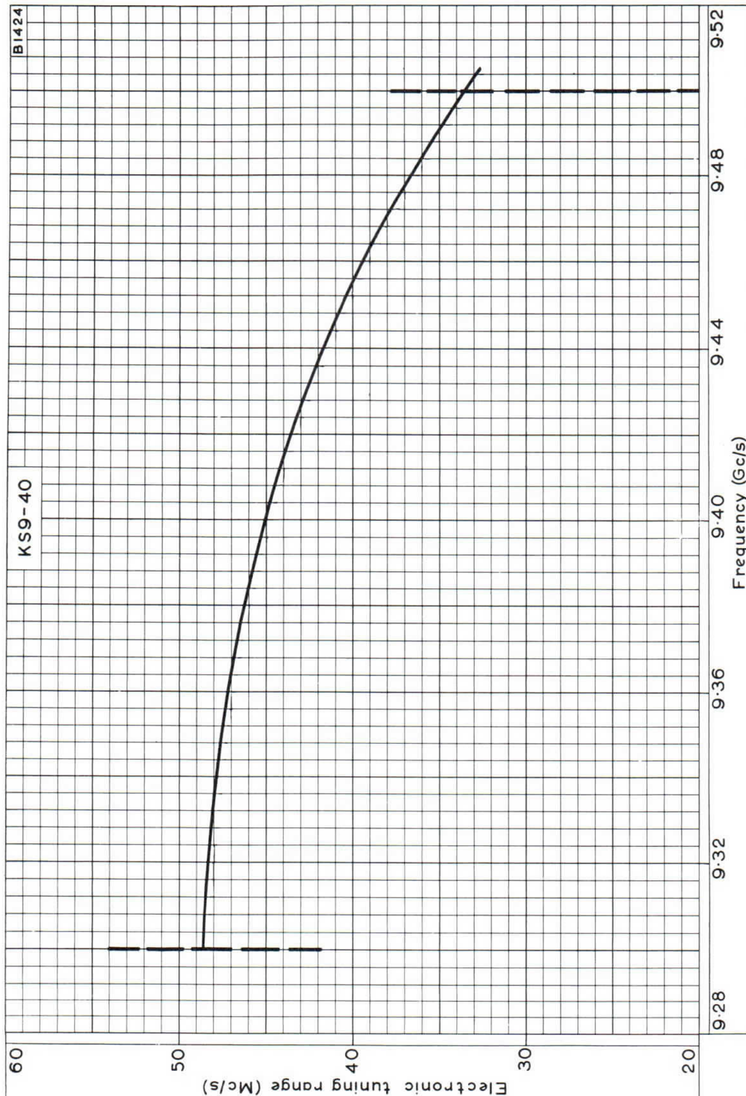
REFLECTOR VOLTAGE PLOTTED AGAINST FREQUENCY



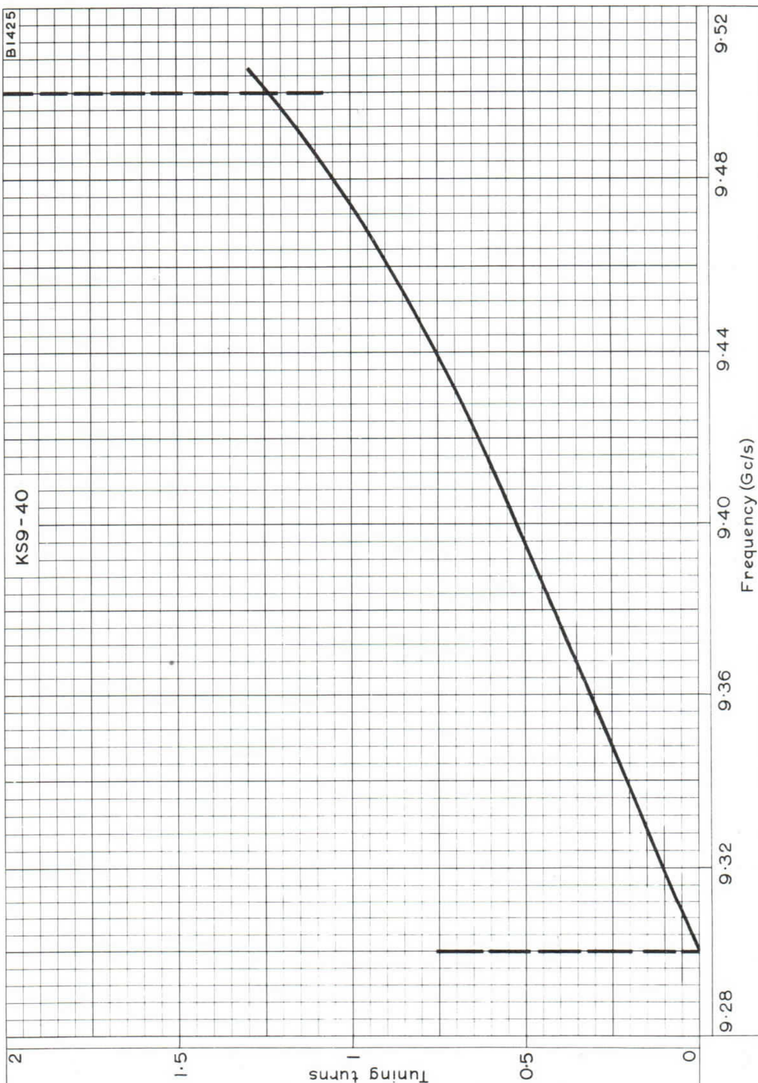
REFLECTION MODULATION SENSITIVITY PLOTTED AGAINST FREQUENCY



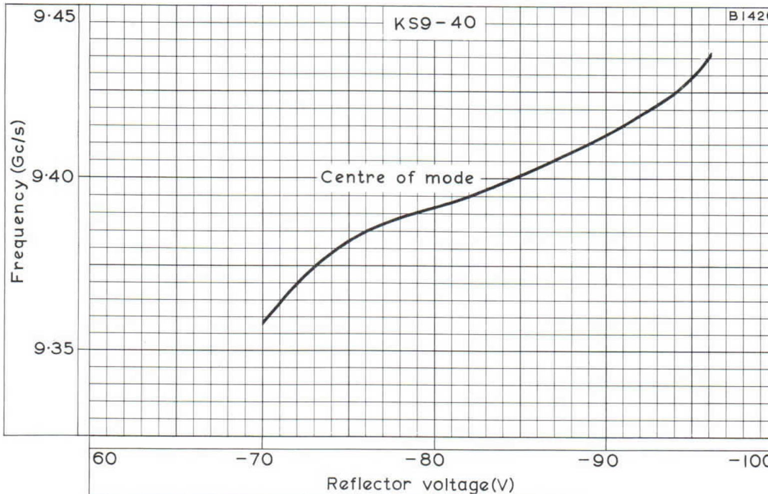
RESONATOR VOLTAGE PLOTTED AGAINST REFLECTOR VOLTAGE

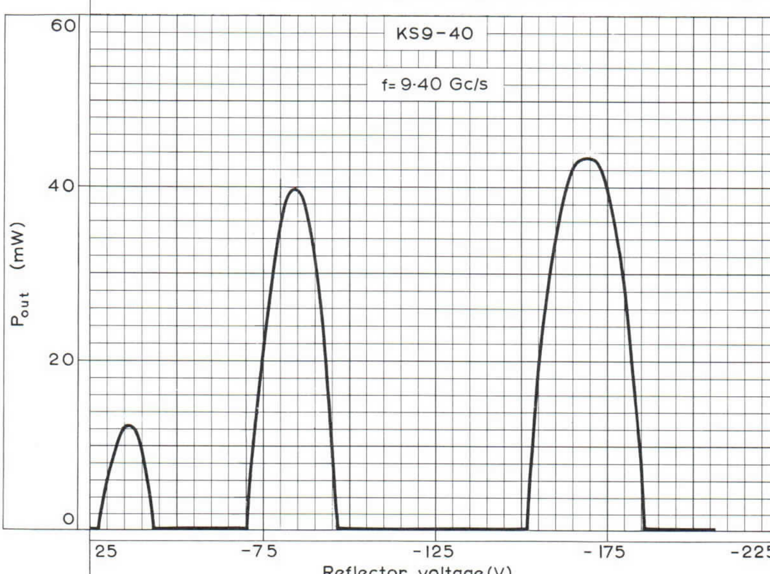


ELECTRONIC TUNING RANGE PLOTTED AGAINST FREQUENCY



TUNING TURNS PLOTTED AGAINST FREQUENCY





FREQUENCY AND OUTPUT POWER PLOTTED AGAINST NEGATIVE REFLECTOR VOLTAGE

TENTATIVE DATA

QUICK REFERENCE DATA		
Lightweight, mechanically tunable klystron for local oscillator applications.		
Frequency	9.35 to 9.55	GHz
Power output	40	mW
Construction	Waveguide output, flying lead connections	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS (Typical at 9.45GHz)

Resonator voltage	300	V
Resonator current	22	mA
Reflector voltage	-90	V
Load v.s.w.r.	1.1	
Electronic tuning range (see note 1)	35	MHz
Power output	40	mW

CHARACTERISTICS

Conditions

Heater voltage	6.3	V
Resonator voltage	300	V
Reflector voltage	Adjust	
v.s.w.r.	<1.1	

Limits

	Min.	Max.	
Frequency range	9.35	9.55	GHz
Mechanical tuning rate (see note 3)	-	150	MHz/turn
Electronic tuning range (see note 1)	20	50	MHz
Electronic tuning rate at mode centre	2.0	3.0	MHz/V
Power output (see note 4)	30	-	mW
Reflector voltage (see note 4)	-60	-115	V
Warm-up frequency drift (see note 5)	-	3.0	MHz
Frequency change with temperature (see note 6)	-	-0.2	MHz/degC
Frequency change with atmospheric pressure change equivalent to operation from 0 to 30 000ft altitude	-	1.0	MHz
Peak frequency deviation under vibration of 10g applied to the flange (30 to 1000Hz)	-	2.0	MHz
Resonator current	-	25	mA

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Resonator voltage	-	350	V
Resonator current	-	35	mA
Reflector voltage	-10	-400	V
Heater to cathode voltage	-	±50	V
v.s.w.r.	-	1.5	
Reflector impedance (see note 2)	-	-	

END OF LIFE PERFORMANCE

	Min.	Max.	
Electronic tuning range (see note 4)	-	25	MHz
Power output	20	-	mW

CATHODE

Indirectly heated

	Min.	Typ.	Max.	
Heater voltage	-	6.3	-	V
Heater current	410	460	550	mA

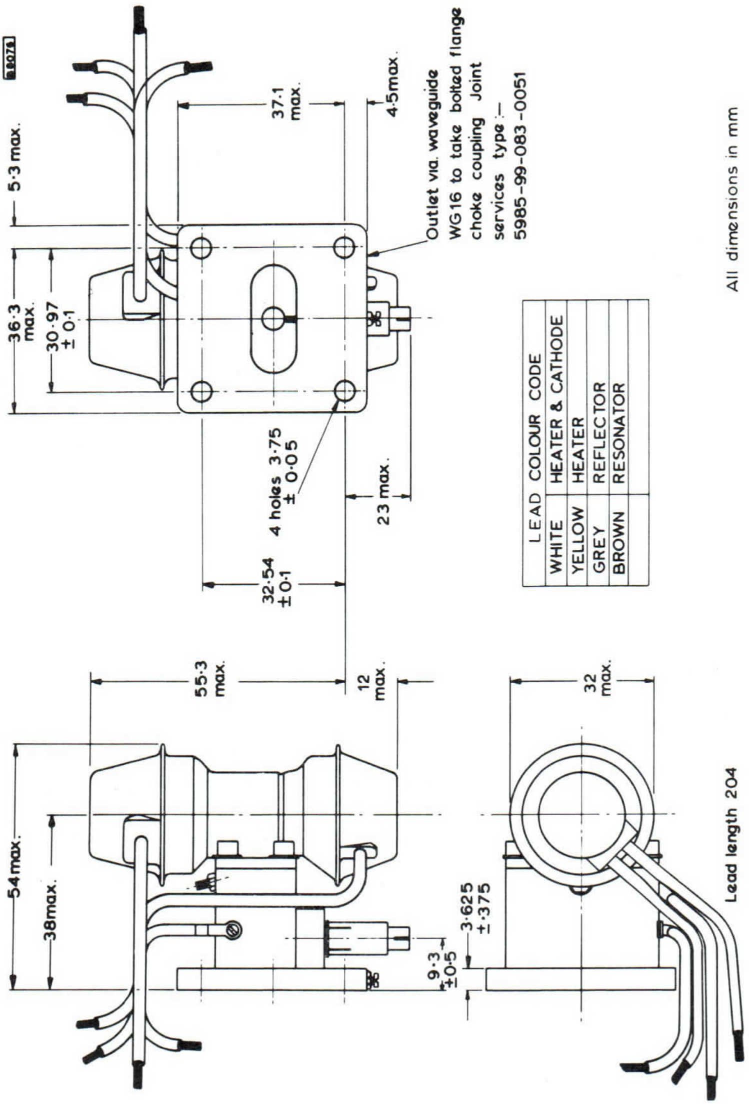
COOLING	Convection and conduction	
Shell temperature max.	150	^{o}C
MOUNTING POSITION		Any

PHYSICAL DATA

Weight of klystron	188	g

OPERATING NOTES

1. Measured at half-power points
2. The time constant should be such that the resonator voltage is not applied before the reflector has become negative with respect to the cathode.
3. Average over the frequency range.
4. Reflector voltage adjusted for maximum power output.
5. Measured after the first five minutes of operation.
6. Over the ambient temperature range of -50 to +70^{o}C.



LEAD	COLOUR CODE
WHITE	HEATER & CATHODE
YELLOW	HEATER
GREY	REFLECTOR
BROWN	RESONATOR

KS9-40D

PRELIMINARY DATA

QUICK REFERENCE DATA

Light-weight mechanically tunable klystron for local oscillator applications.

Frequency	9.38 to 9.51 Gc/s
Power output	35 mW
Construction	Waveguide output with coupled cavity

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES: INTRODUCTION and REFLEX KLYSTRONS which precede this section of the handbook.

TYPICAL OPERATION

f	9.45	Gc/s
$V_{resonator}$	300	V
$I_{resonator}$	33	mA
$V_{reflector}$	–88	V
P_{out}	35	mW
Electronic tuning range between half-power points	40	Mc/s

ABSOLUTE MAXIMUM RATINGS

	Min.	*Max.*	
$V_{resonator}$	—	350	V
$I_{resonator}$	—	45	mA
$V_{reflector}$	–10	–400	V
$Z_{reflector\ supply}$	—	100	kΩ
V_{h-k}	—	±50	V
T_{shell}	—	150	°C
v.s.w.r.		1.5	

CATHODE

Indirectly heated

V_h	6.3	V
I_h max.	700	mA
t_{h-k}	60	s

KS9-40D

KLYSTRON

CHARACTERISTICS

	Min.	Max.	
Mechanical tuning range	9.38	9.51	Gc/s
Mechanical tuning rate (average over range)	—	150	Mc/s per turn
Electronic tuning range, between half-power points at any frequency in the mechanical tuning range ($V_{resonator} = 300V$)	30	—	Mc/s
Electronic tuning rate at mode centre	2.0	3.0	Mc/s per volt
Power output at any frequency in the mechanical tuning range with reflector voltage optimised ($V_{resonator} = 300V$)	25	45	mW
Reflector voltage for maximum power output at 9.45Gc/s in principal mode ($V_{resonator} = 300V$)	–70	–115	V
Reflector voltage range over mechanical tuning range for optimum power output ($V_{resonator} = 300V$)	–60	–120	V
Frequency drift after first 5 minutes of operation	—	3.0	Mc/s
Temperature coefficient ($T_{ambient} = -50°C$ to $+70°C$)	—	–0.2	Mc/s per °C
Frequency change with atmospheric pressure change equivalent to operation 0 to 30,000ft altitude	—	1.0	Mc/s
Frequency modulation under vibration of 10g applied to flange (30 to 1,000c/s)	—	2.0	Mc/s
Resonator current ($V_{resonator} = 300V$)	—	40	mA

Signal-to-noise ratio $>$160dB per cycle of i.f. bandwidth. A.M. noise on a typical sample with reflector voltage optimised for maximum power at frequency of measurement and with receiver intermediate frequency $>$25Mc/s.

END OF LIFE PERFORMANCE

Electronic tuning range, between half-power points at any frequency in the mechanical tuning range ($V_{resonator} = 300V$)	25	Mc/s
Power output at any frequency in the mechanical tuning range with reflector voltage optimised ($V_{resonator} = 300V$)	20	mW

COOLING

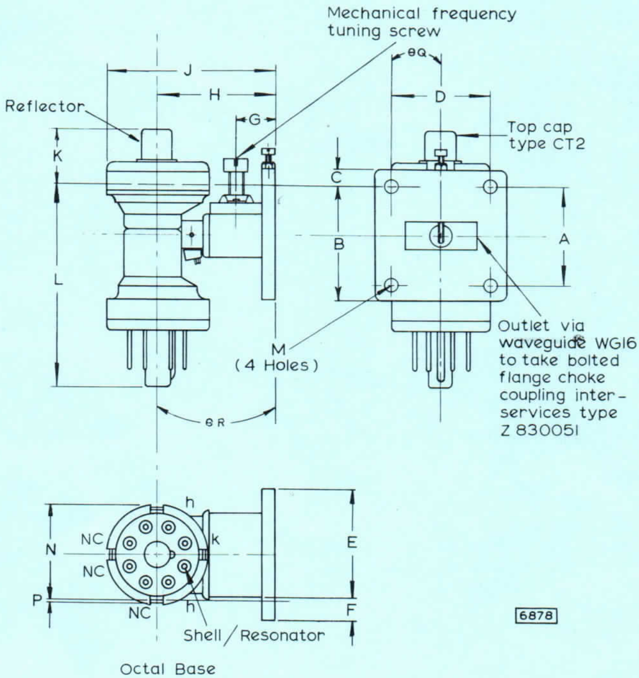
Natural

MOUNTING POSITION

Any

PHYSICAL DATA

Weight of klystron	5.6 / 150	oz / g
Weight of klystron carton	9 / 255	oz / g
Dimensions of storage carton	5.5 × 4.48 × 4.84 / 140 × 114 × 123	in / mm



DIMENSIONS

	Inches	*Millimetres*	
A	1.282 ± 0.004	32.54 ± 0.1	
B	1.461	37.10	max.
C	0.177	4.50	max.
D	1.220 ± 0.004	30.97 ± 0.1	
E	1.429	36.30	max.
F	0.209	5.30	max.
G	0.354 ± 0.039	9 ± 1	
H	1.437 ± 0.099	36.5 ± 2.5	
J	2.126	54	max.
K	0.866	22	max.
L	2.520	64	max.
M	0.168 ± 0.003	4.275 ± 0.075	
N	1.280	32.5	max.
P	0.059	1.5	max.
θQ		1°	max.
θR		1°	max.

POWER KLYSTRON

YK1001
YK1002

PRELIMINARY DATA

QUICK REFERENCE DATA

The YK1001 is a forced-air cooled power klystron for vision and sound transmitters at bands IV and V. The YK1002 is electrically identical but has a water-cooled collector.

f	470 to 790	Mc/s
P_{out}	10	kW

Construction: Permanent magnet focusing, unpackaged

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES which precede this section of the handbook.

Unless otherwise shown, data are applicable to both types.

TYPICAL OPERATION

Linear amplifier for television service (negative modulation)

	Normal collector voltage	*Depressed collector voltage*	
Collector voltage	18	13	kV
Collector current	1.85	1.85	A
Drift tube No. 5 voltage	18	18	kV
Drift tube current (total)	25	40	mA
Focusing electrode voltage	–300	–300	V
Drive power (sync)	10		W
Output power (sync)	11		kW
Gain	30		dB

Tuning of resonant cavities for C.C.I.R. system

Cavity 1	+2.0	Mc/s
Cavity 2	–0.5	Mc/s
Cavity 3	+4.5	Mc/s
Cavity 4	±0	Mc/s

Cavity damping at black level ($P_{out\ (sync)} = 11$kW)

Cavity 1	2.0	W
Cavity 2	50	W
Cavity 3	80	W

YK1001
YK1002

POWER KLYSTRON

ABSOLUTE MAXIMUM RATINGS

Peak collector voltage ($I_{beam} = 0A$)	21	kV
Collector voltage max.	18.5	kV
Peak drift tube No. 5 voltage ($I_{beam} = 0A$)	21	kV
Drift tube No. 5 voltage max.	18.5	kV
Focusing electrode voltage max. (negative)	500	V
Collector current max.	2.0	A
Drift tube current max. (total)		
depressed collector operation ($V_{coll} < V_{cavity\ 5}$)	150	mA
normal collector operation ($V_{coll} = V_{cavity\ 5}$)	100	mA
Collector dissipation max.	35	kW
Cathode seal temperature max.	125	°C
First anode temperature max.	125	°C
Drift tubes Nos. 1, 2 and 3 temperature max.	80	°C
Drift tubes Nos. 4 and 5 temperature max.	150	°C
Output cavity temperature max.	125	°C
Collector temperature max.	260	°C
Ion pump voltage max.	4.0	kV
Ion pump current max.	10	mA

CATHODE

Indirectly heated, dispenser type

V_h	7.5±3%	V
I_h	32	A
$I_{h\ surge}$ max.	80	A
$r_{h\ cold}$	28	mΩ
t_{h-k} min.	3.0	min

GETTER

Ion pump

Ion pump voltage	3.0	kV
Ion pump current	See curve on page C4	

COOLING

A low velocity airflow should be directed at the cathode and accelerating anode. A flow of air of 1m³/min (35.3ft³/min) directed at cavities Nos. 1, 2 and 3 and 2m³/min (70.6ft³/min) at cavity No. 4 is sufficient to keep the temperature below the permitted maximum.

Cavity No. 5 and output cavity should be cooled by a flow of air of 2m³/min (70.6ft³/min) at a pressure of 90mm H_2O.

The collector of YK1001 is forced-air cooled, see curve on page C1.

The collector of YK1002 is water cooled, see curve on page C2.

MOUNTING POSITION

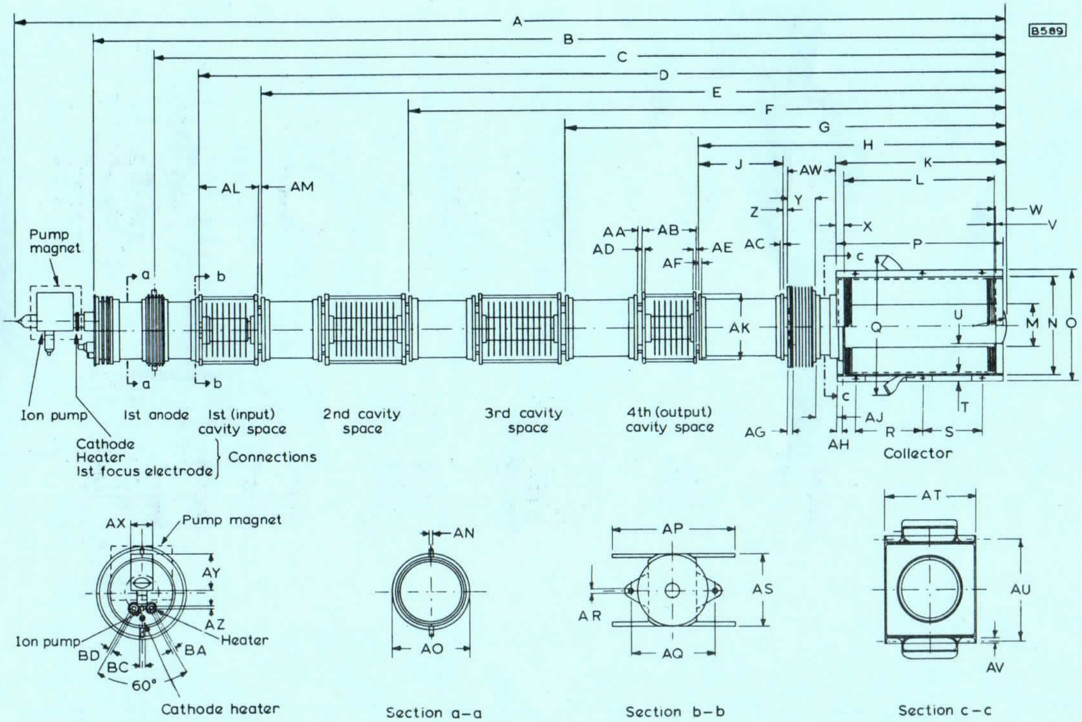
Vertical, cathode uppermost

OPERATING NOTE

For optimum performance, the electron beam should be focused for minimum cavity current.

YK1001
YK1002

OUTLINE DRAWING OF YK1001



DIMENSIONS OF YK1001

The inch dimensions are derived from the original millimetre dimensions.

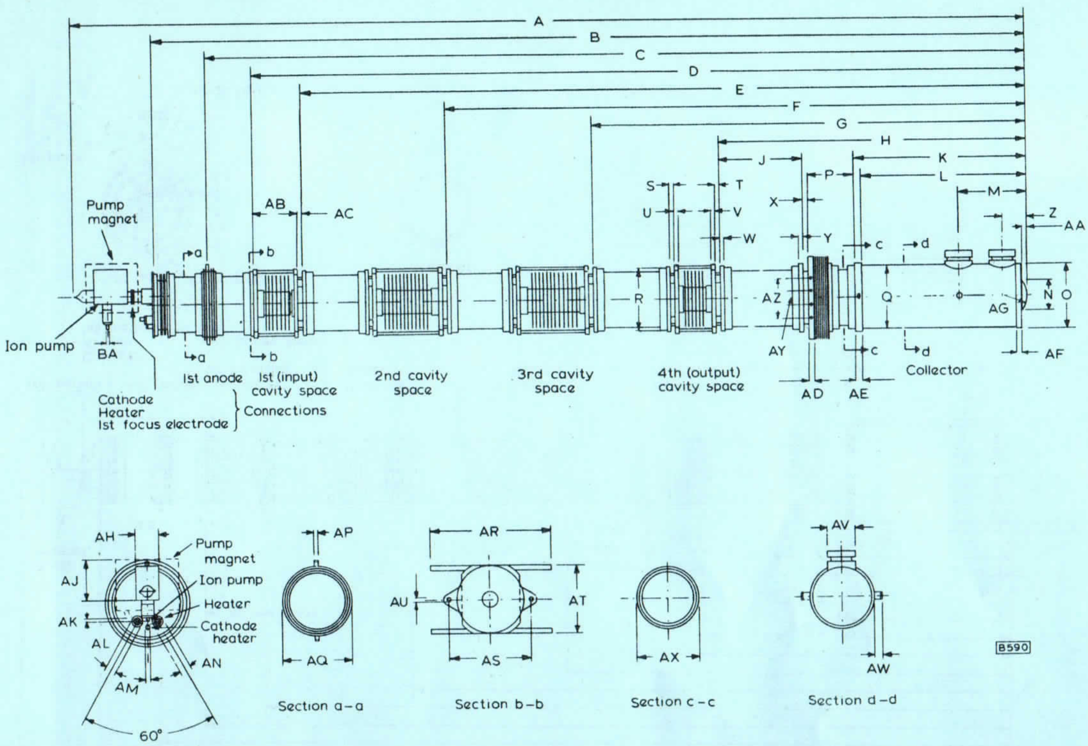
	Millimetres	Inches			Millimetres	Inches			Millimetres	Inches	
A	1642	64.6		T	12	0.47		AL	80	3.15	
B	1499	59		U	60	2.36	dia.	AM	7.0	0.28	
C	1393	54.8		V	1.5	0.06		AN	9.0	0.35	dia.
D	1306	51.4		W	17	0.67		AO	130	5.12	
E	1219	48		X	12	0.47		AP	200	7.9	
F	963	37.9		Y	40.5	1.6		AQ	150	5.9	
G	707	27.8		Z	7.0 ± 0.5	0.28 ± 0.02		AR	8.5	0.33	
H	496	19.53		AA	7.0	0.28		AS	120	4.7	
J	117 ± 0.5	4.60 ± 0.02		AB	80	3.15		AT	161	6.34	
K	295	11.6		AC	6.3 ± 0.2	0.248 ± 0.008		AU	174	6.85	
L	265	10.4		AD	8.0	0.315		AV	10	0.39	
M	69	2.72	dia.	AE	8.0	0.315		AW	77.5	3.05	
N	161	6.34		AF	6.3 ± 0.2	0.248 ± 0.008		AX	38	1.5	
O	184	7.2		AG	8.0	0.315		AY	75	2.95	
P	288	11.34		AH	10	0.39		AZ	6.0	0.24	
Q	250	9.84		AJ	39	1.54		BA	10.5	0.59	
R	114	4.5		AK	117 + 0.1 −0.2	4.606 + 0.004 −0.008	dia.	BC	10.5	0.59	
S	114	4.5						BD	9.0	0.35	

DIMENSIONS OF YK1002

The inch dimensions are derived from the original millimetre dimensions.

	Millimetres	Inches			Millimetres	Inches			Millimetres	Inches
A	1642	64.6		R	117 +0.1 −0.2	4.606 +0.004 −0.008	dia.	AH	38	1.5
B	1499	59						AJ	75	2.95
C	1393	54.8		S	7.0	0.28		AK	6.0	0.24
D	1306	51.4		T	7.0 ± 0.5	0.28 ± 0.02		AL	9.0	0.35
E	1219	48		U	8.0	0.315		AM	10.5	0.59
F	963	37.9		V	8.0	0.315		AN	10.5	0.59
G	707	27.8		W	6.3 ± 0.2	0.248 ± 0.008		AP	9.0	0.35
H	496	19.53		X	7.0 ± 0.5	0.28 ± 0.02		AQ	130	5.12
J	117 ± 0.5	4.60 ± 0.02		Y	6.3 ± 0.2	0.248 ± 0.008		AR	200	7.9
K	295	11.6		Z	40	1.58		AS	150	5.9
L	285	11.2		AA	10	0.39		AT	120	4.72
M	122	4.8		AB	80	3.15		AU	8.5	0.33
N	60	2.36	dia.	AC	7.0	0.28		AV	38.1	1.5
O	117.5	4.6	dia.	AD	8.0	0.315		AW	15	0.6
P	77.5	3.05		AE	10	0.39		AX	117	4.6
Q	115	4.53	dia.	AF	5.0	0.2		AY	20	0.79
				AG	55	2.17	rad.	AZ	60	2.36

OUTLINE DRAWING OF YK1002

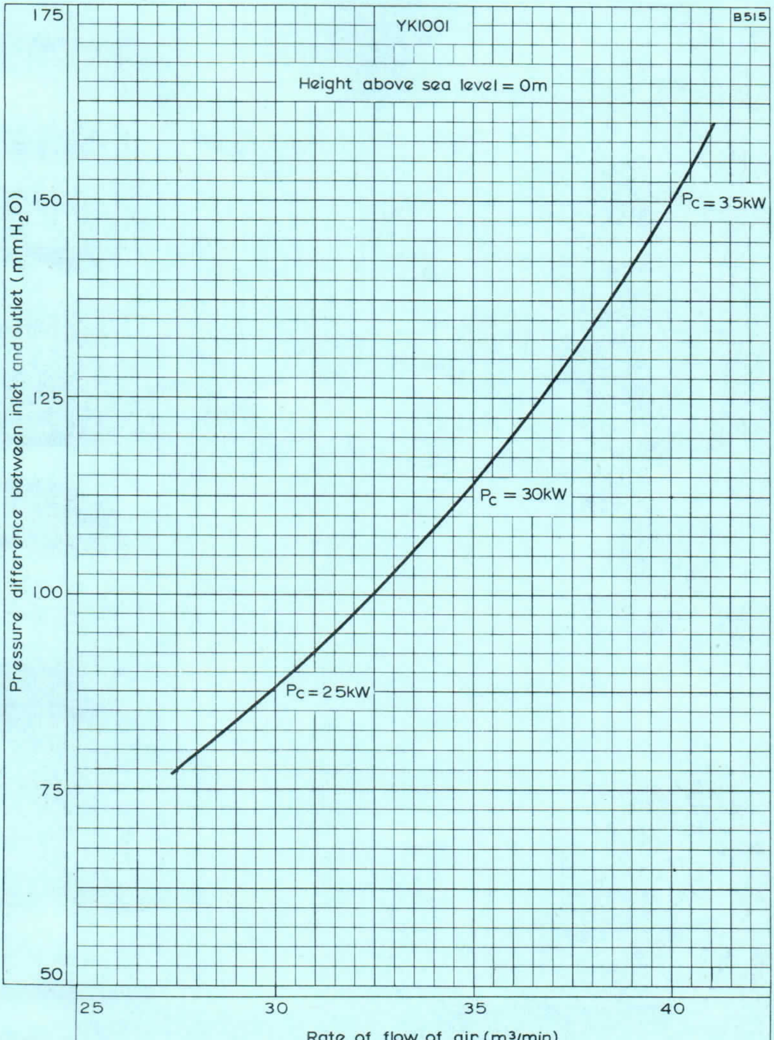


PHYSICAL DATA

Weight of klystron	YK1001	126	lb
		57	kg
	YK1002	126	lb
		57	kg
Weight of accessories		265	lb
		120	kg

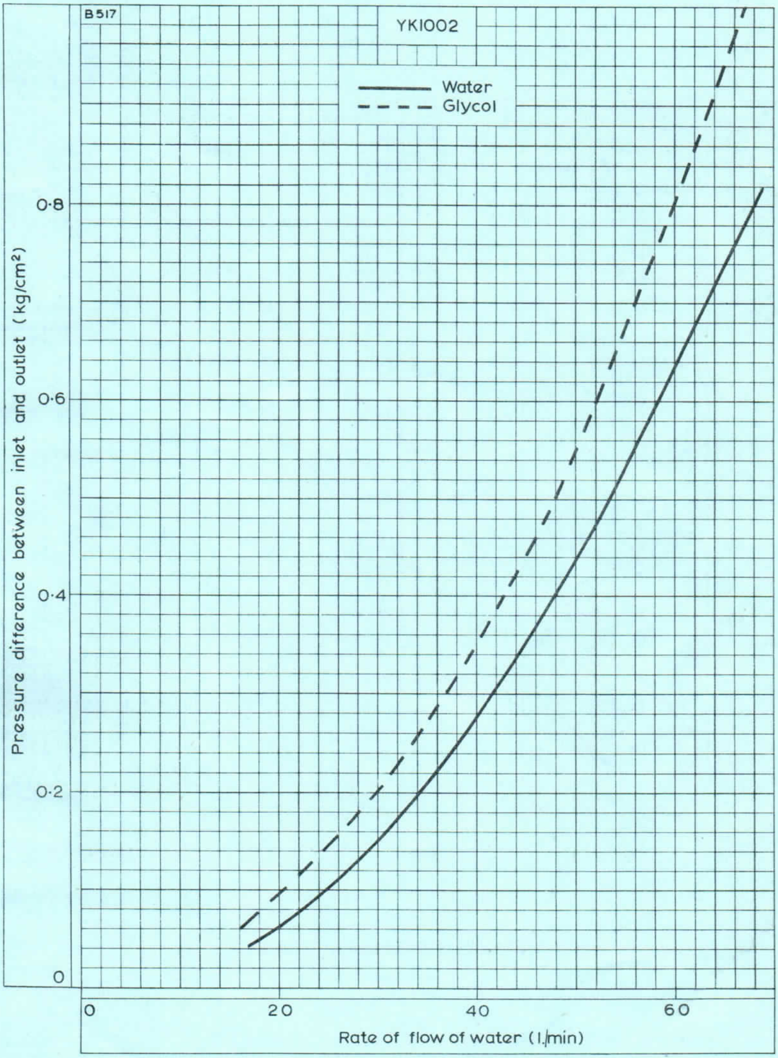
ACCESSORIES

Heater connector	40649
Cathode connector	40649
Focusing electrode connector	40634
First anode connector	40634
Collector connector	40634
Ion pump connector	55351
Ion pump magnet	TE1053
5 focusing magnets	TE1065
4 resonant cavities	TE1066

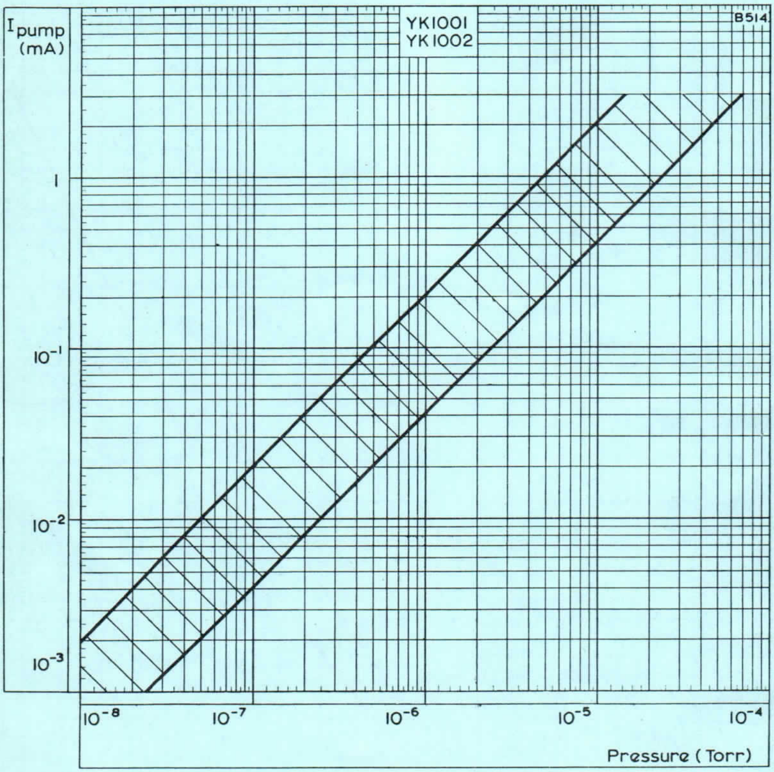


COOLING CURVE FOR YK1001

COOLING CURVE FOR YK1002



COOLING CURVE FOR YK1002



ION PUMP CHARACTERISTICS

POWER KLYSTRON YK1005

TENTATIVE DATA

QUICK REFERENCE DATA		
Permanent magnet focused power amplifier klystron, suitable for depressed collector operation. Intended for use as vision and sound amplifier for bands IV and V.		
Frequency	470 to 860	MHz
Power output	11	kW
Construction	Ceramic-metal, unpackaged	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS

Typical vision amplifier operation with depressed collector voltage C.C.I.R. system with negative modulation. Bandwidth (-1dB) = 6MHz.

Frequency	470	790	MHz
Cathode to collector voltage (see note 1)	-13.5	-16	kV
Collector to drift tube voltage	-4.0	-4.0	kV
Accelerator to drift tube voltage (see note 2)	0	0	V
Focus electrode to cathode voltage	-240	-600	V
Drift tube current			
static (focused for minimum)	30	30	mA
black level (see note 3)	80	60	mA
Cathode current	2.0	1.85	A
Output power	11	11	kW
Drive power (see curve page 8 and note 4)	2.0	1.0	W
Power gain	38	40	dB
Linearity (without compensation, see note 5)	80	80	%
Max. sync compression (see note 6)	45/25	45/25	
Max. sideband suppression (see note 7)	-20	-20	dB
Max. noise (referred to black level, see note 8)	-46	-46	dB
Differential phase (without compensation)	5.0	5.0	deg

OPERATING CONDITIONS (cont'd)

Typical operation as sound amplifier (with depressed collector)

Frequency	470	790	MHz
Cathode to collector voltage (see note 1)	-13.5	-13.5	kV
Collector to drift tube voltage	-5.0	-5.0	kV
Accelerator to drift tube voltage (see note 2)	-7.5	-5.5	kV
Focus electrode to cathode voltage	-400	-400	V
Drift tube current	50	70	mA
Cathode current	0.7	1.0	A
Output power	2.2	4.4	kW
Max. drive power	0.5	0.5	W

Tuning of cavities with respect to carrier frequency (approx.)

Cavity 1	+3.0	MHz
Cavity 2	-0.5	MHz
Cavity 3	-4.5	MHz
Cavity 4	0	MHz

Max. cavity damping at black level for P_{out} sync = 11kW

Cavity 1	5.0	W
Cavity 2	100	W
Cavity 3	200	W

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

Max. drift tube to cathode voltage	22	kV
Max. drift tube to cathode voltage at zero current	25	kV
Max. drift tube to collector voltage	7.0	kV
Max. cathode to focus electrode voltage (see note 9)	700	V
Min. cathode to focus electrode voltage	100	V
Max. drift tube to accelerator voltage	25	kV
Max. accelerator voltage source resistance	20	kΩ
Min. accelerator voltage source resistance	10	kΩ
Max. drift tube current	150	mA
Max. cathode current	2.2	A
Max. collector dissipation	40	kW
Max. voltage standing wave ratio	1.5	

NOTES

1. In operation, a cathode voltage fluctuation of ±3% will not damage the tube, but should not exceed ±1% for good transmission quality.

2. If the accelerator electrode voltage is obtained by means of a potential divider from the cathode supply voltage, then the divider must pass a quiescent current of at least 3mA.

3. To be focused for minimum drift tube current at black level. A maximum deviation of 10% from the minimum current is permitted, if necessary, to obtain the required signal transfer quality but the limiting value must not be exceeded.

4. A circulator must be used between driver stage and input cavity. The drive power is measured between the circulator and first cavity at a 50Ω resistance and represents the sum of the forward and the reflected power in the first cavity. A pre-correction is required in the preamplifier for the level dependency of the band pass curve caused by non linearity of the klystron.

5. Measured with a sawtooth voltage of amplitude between 17 and 75% of the peak sync value, on which is superimposed a 4.43MHz sine wave with a 10% peak to peak value.

6. A picture/sync ratio of 75/25 for the outgoing signal of the klystron requires a ratio of 55/45 for the incoming signal.

7. Measured with a 10 to 75% modulation without compensation and a vestigial sideband filter between driver and klystron.

8. Produced by the klystron itself, without hum from power supplies.

9. The focus voltage power supply should be pre-loaded by a minimum current of 10mA at 700 volts.

Supply failure

In the case of a failure, all electrode voltages for the klystron except the pump and heater voltages should be switched off and reduced to less than 5% of the nominal value within 250ms after the failure has occured.

CATHODE

Indirectly heated, dispenser type

$^{*}V_h$	7.5 to 8.0	V
V_h (absolute max.)	9.0	V
I_h at 7.5V (approx.)	32	A
I_h max.	36	A
I_h surge max. (a.c. supply)	80	A
I_h surge max. (d.c. supply)	65	A
r_h cold	28	mΩ
t_{h-k} min.	180	s

*Maximum heater voltage fluctuation ±3% except during the first 300 hours of life when the heater voltage should be 8.5V.

GETTER ION PUMP

Ion pump supply voltage (unloaded)	4.0	kV
Supply internal resistance	300	kΩ
Max. ion pump voltage	4.0	kV
Max. ion pump current	15	mA

COOLING

Maximum air inlet temperature = $40^{\circ}C$

Minimum air flow requirements:-

Cathode base and accelerator electrode	0.5	m^3/min
Drift tubes 1, 2 and 3	1.0	m^3/min
Drift tube 4	1.5	m^3/min
Drift tube 5 (pressure difference = 90mm water) forced air	1.5	m^3/min
Output resonator (pressure difference = 90mm water) forced air	2.0	m^3/min
Collector forced air	See graphs on pages 9 and 10	

COOLING (cont'd)

Maximum temperatures

Cathode base	125	°C
Accelerator electrode	125	°C
Drift tubes 1, 2 and 3	80	°C
Drift tubes 4 and 5	150	°C
Collector seal	200	°C
*Collector body	300	°C
Output resonator	125	°C

*To safeguard this temperature limit it is recommended to measure the air outlet temperature at least at two places, one at 50mm and the other at 150mm from the upper collector plate and at a distance of 50mm from the cooling fins.

PRESSURISING

Altitude max.	3000	m

MOUNTING POSITION — Vertical, cathode uppermost

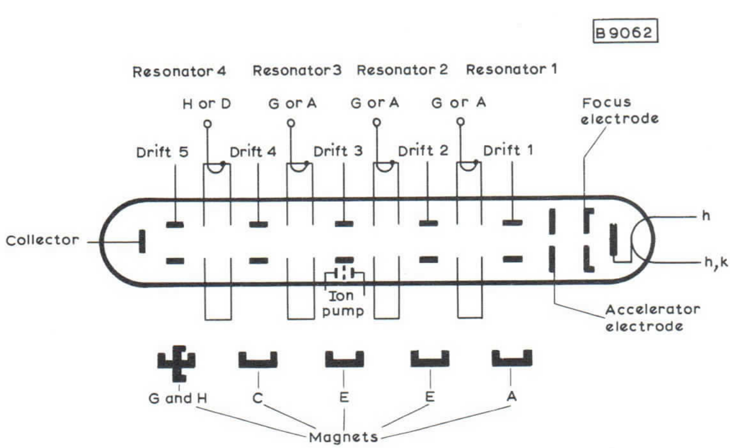
In order to prevent distortion of the magnetic focusing field ferromagnetic material should not be placed within a radius of 350mm from the tube axis. All connections should be free from strain.

PHYSICAL DATA

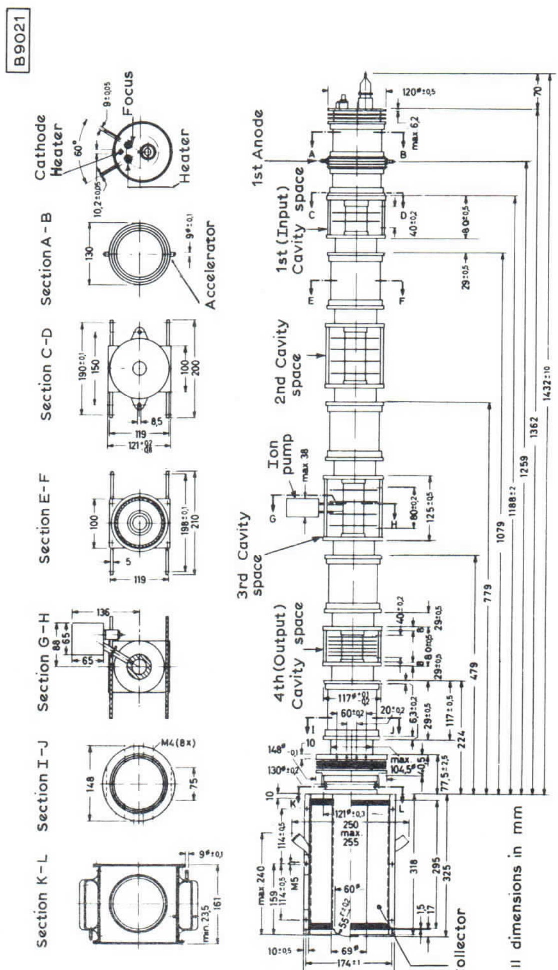
Weight of klystron (approx.)	60	kg
Weight of accessories (approx.)	130	kg

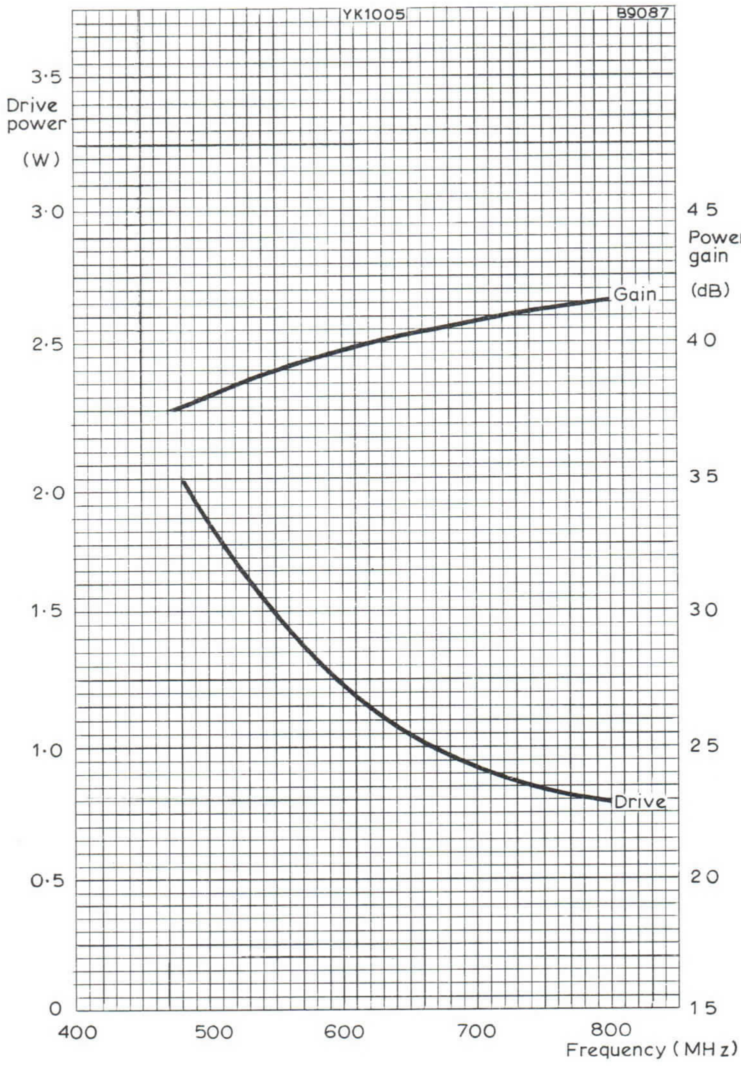
ACCESSORIES

Heater connector	40649
Heater/cathode connector	40649
Focusing electrode connector	40634
Accelerating electrode connector	40634
Collector connector	40634
Ion pump connector	55351
Resonators for 470 to 615MHz	3 × TE1056G 1 × TE1056H
Resonators for 615 to 860MHz	3 × TE1067A 1 × TE1067D
Permanent magnet assemblies	2 × TE1065A 2 × TE1065C 4 × TE1065E 2 × TE1065G 2 × TE1065H
Air duct	TE1071
Magnetic screen	TE1075
Circulators (temperature compensated)	
for 470 to 600MHz	4322 020 50090
for 590 to 720MHz	4322 020 50110
for 710 to 860MHz	4322 020 50120
for 608 to 790MHz	4322 020 50150

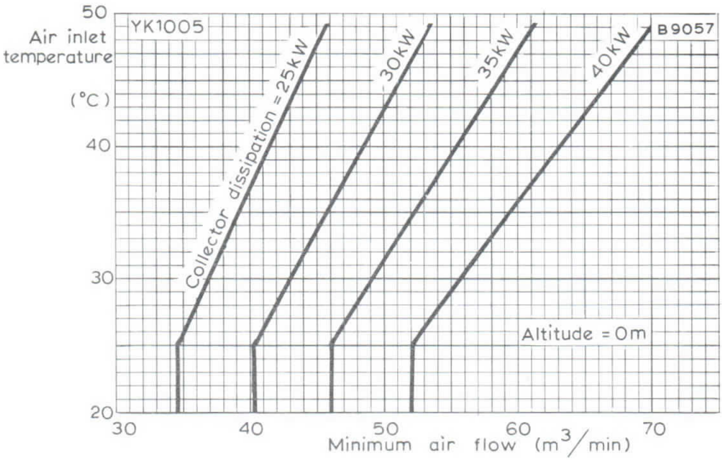


OUTLINE DRAWING

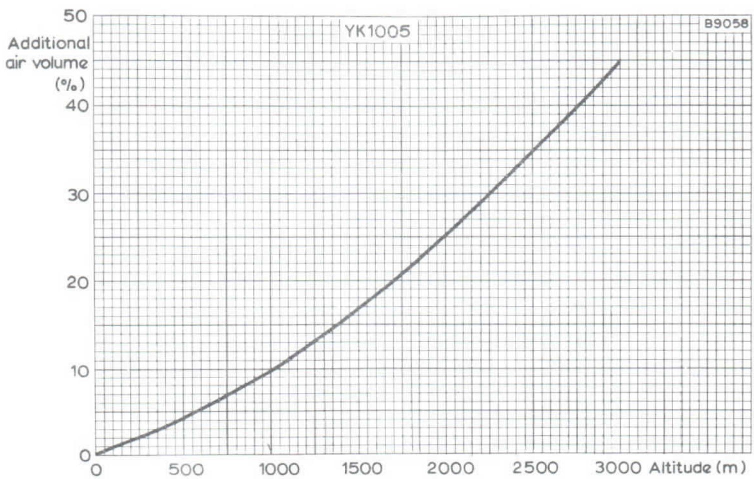




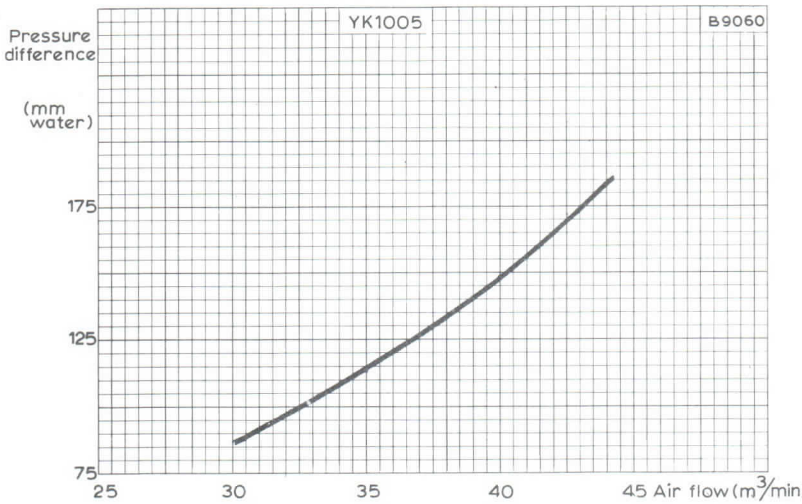
DRIVE POWER AND POWER GAIN PLOTTED AGAINST OPERATING FREQUENCY



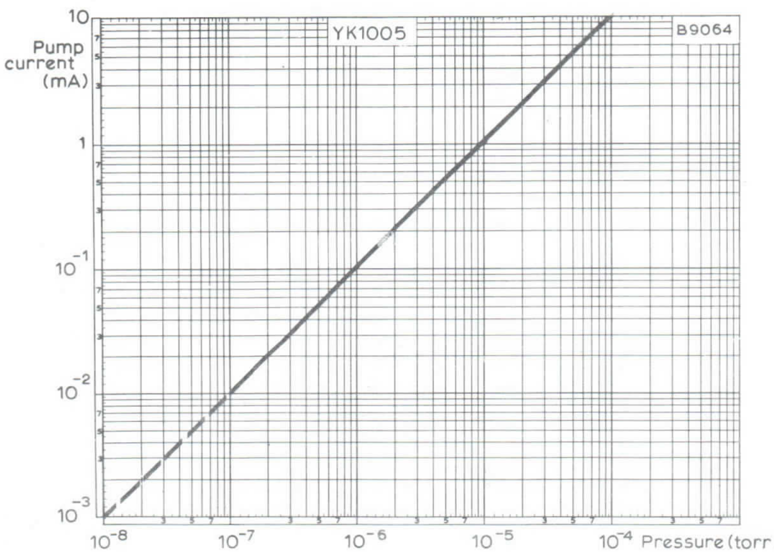
AIR INLET TEMPERATURE PLOTTED AGAINST MINIMUM AIR FLOW WITH COLLECTOR DISSIPATION AS PARAMETER



ADDITIONAL AIR VOLUME REQUIRED FOR INCREASED ALTITUDE



AIR FLOW CHARACTERISTICS



PUMP CURRENT AS A FUNCTION OF PRESSURE

KLYSTRON

YK1010

DEVELOPMENT SAMPLE DATA

QUICK REFERENCE DATA

Mechanically tunable reflex klystron for local oscillator applications.

Frequency	67 to 74	Gc/s
Power output	130	mW
Construction	Metal, micrometer tuning, waveguide output	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

TYPICAL OPERATION

f	70	Gc/s
V_{res}	2.5	kV
I_{res}	18	mA
$-V_{refl}$	330	V
$-V_g$	50	V
Electronic tuning range between half-power points	100	Mc/s
P_{out}	130	mW

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
V_{res}	-	2.6	kV
I_{res}	-	20	mA
p_{res}	-	45	W
$-V_{refl}$	20	500	V
$-V_g$	0	200	V
T resonator block	-	80	°C

DESIGN RANGES FOR POWER SUPPLY

	Min.	Max.	
$-V_{refl}$	20	500	V
$-V_g$	0	200	V
Internal resistance of reflector supply	-	75	kΩ
Internal resistance of grid supply	-	10	kΩ

CATHODE

Indirectly heated, dispenser type

V_h	3.5	V
$*I_h$	1.75	A
$I_{h(surge)}$ max.	4.0	A
r_f cold	0.3	Ω
Preheat delay before applying H.T.	15	min

*The absolute variation of the heater current should be maintained within 0.02A of this value.

CHARACTERISTICS

	Min.	Typ.	Max.	
Mechanical tuning range	67		74	Gc/s
Mechanical tuning rate	-	3.5	-	Gc/s per turn

COOLING

Forced-air in direction as shown in the outline drawing through a nozzle of 30mm (1.2in) dia of 200 l/min (7.0ft^3/min) minimum.

MOUNTING POSITION Any

PHYSICAL DATA

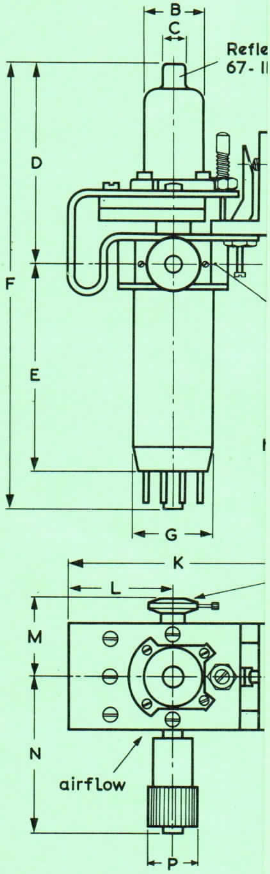
	lb	kg
Weight of klystron	2.2	1.0

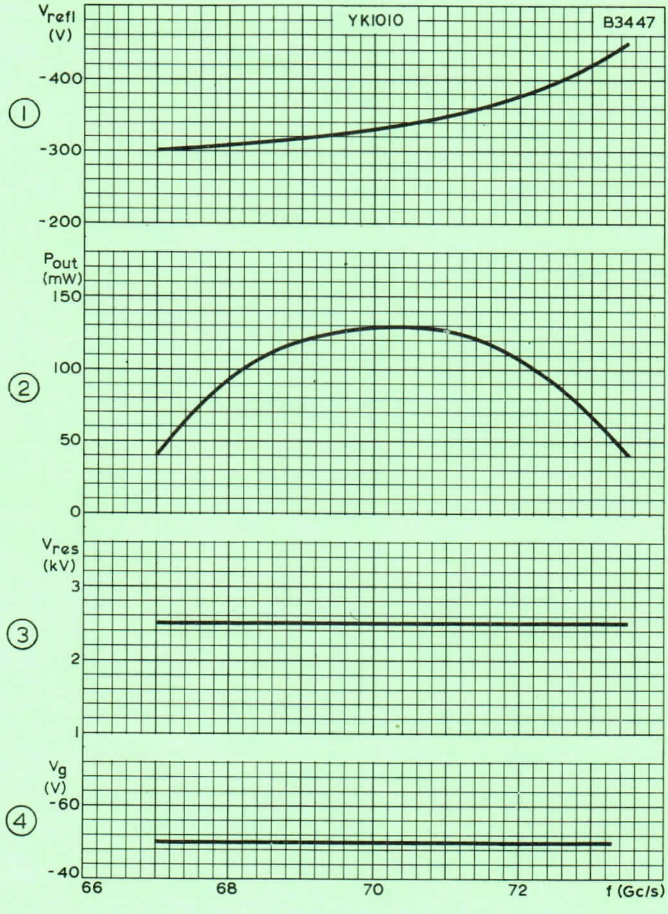
OUTPUT CONNECTION

Waveguide IEC-R740 (WG26, WR12) with claw flange and clamping ring is supplied. An extra claw flange for coupling to other output systems can be supplied.

KLYSTRON

OUTLINE DR



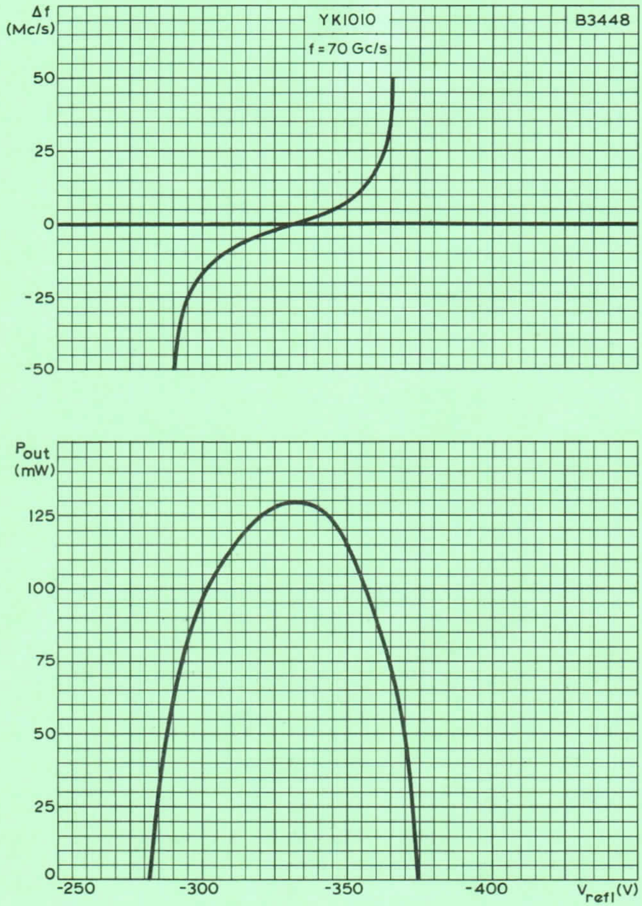


1 REFLECTOR VOLTAGE PLOTTED AGAINST FREQUENCY

2 OUTPUT POWER PLOTTED AGAINST FREQUENCY

3 RESONATOR VOLTAGE PLOTTED AGAINST FREQUENCY

4 GRID VOLTAGE PLOTTED AGAINST FREQUENCY



CHANGE OF FREQUENCY AND OUTPUT POWER PLOTTED AGAINST REFLECTOR VOLTAGE. f = 70Gc/s

KLYSTRON

YK1041 YK1043
YK1042 YK1044

ADVANCE DATA FOR USE WITH DEVELOPMENT SAMPLES

QUICK REFERENCE DATA

Mechanically tunable light-weight reflex klystron suitable for use in parametric amplifiers and instrument applications.

Frequency	YK1041	8.6 to 9.4	Gc/s
	YK1042	8.1 to 8.9	Gc/s
	YK1043	9.3 to 10.1	Gc/s
	YK1044	10.1 to 10.6	Gc/s
Power output		60	mW
Construction		Flying leads	

Unless otherwise stated data applies to all types.

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES.

TYPICAL OPERATION at
f = 9.0Gc/s (YK1041)
f = 8.5Gc/s (YK1042)
f = 9.7Gc/s (YK1043)
f = 10.35Gc/s (YK1044)

V_{res}	350	V
I_{res}	40	mA
V_{refl}	-100	V
Electronic tuning range between half power-points	40	Mc/s
P_{out}	60	mW

ABSOLUTE MAXIMUM RATINGS

	Min	Max	
V_{res}	-	400	V
I_{res}	-	60	mA
V_{refl}	-10	-400	V
V_{h-k}	-	±50	V
T_{shell}	-	150	^{o}C
v.s.w.r.	-	1.5	

CATHODE

Indirectly heated

V_h	6.3	V
I_h	600	mA
t_{h-k}	30	s

CHARACTERISTICS

		Min	Typ	Max	
Mechanical tuning range	YK1041	8.6	to	9.4	Gc/s
	YK1042	8.1	to	8.9	Gc/s
	YK1043	9.3	to	10.1	Gc/s
	YK1044	10.1	to	10.6	Gc/s
Mechanical tuning rate		-	-	75	Mc/s per turn
Electronic tuning range between half-power points at any frequency in the mechanical tuning range (V_{res} = 350V)		30	-	-	Mc/s
Power output at any frequency in the mechanical tuning range with reflector voltage optimised (V_{res} = 350V)		35	-	-	mW
Reflector voltage for maximum power output at centre frequency in principal mode (V_{res} = 350V)		-70	-	-130	V
Reflector voltage range for maximum power output over the mechanical tuning range (V_{res} = 350V)		-40	-	-160	V
Frequency drift after first 5 min of operation		-	-	3.0	Mc/s
Frequency change with temperature (T_{amb} = -50^{o}C to $+70^{o}$C)		-	-	-0.1	Mc/s per ^{o}C
Peak frequency deviation under vibration of 10g applied to the flange (30 to 2,000 c/s in all three planes)		-	1.0	-	Mc/s

COOLING	Natural	
MOUNTING POSITION	Any	
PHYSICAL DATA		
Weight of klystron	5.0	oz
	142	g

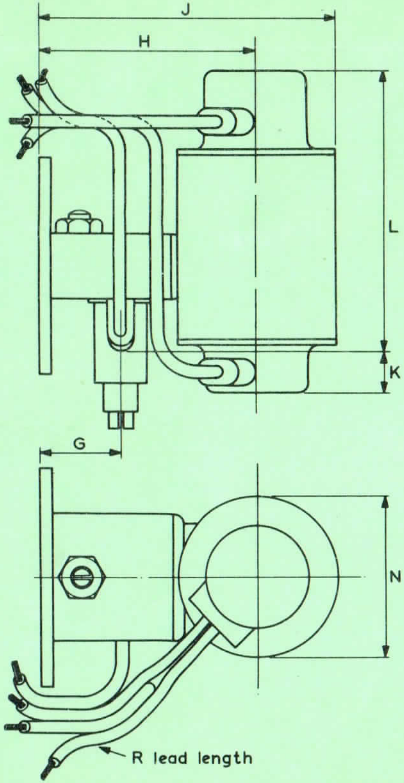
OPERATING NOTE

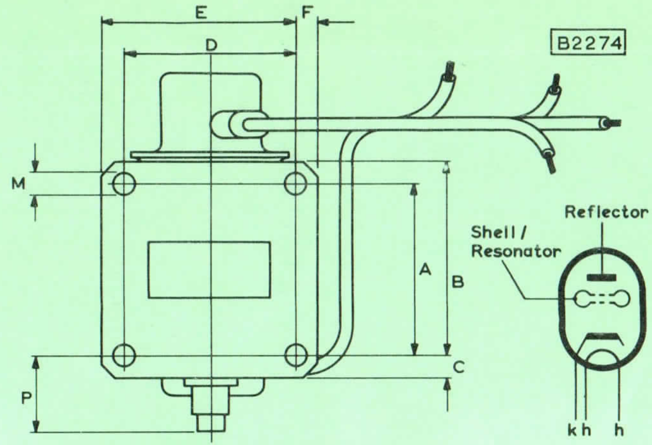
The impedance of the reflector supply should not exceed 100kΩ.

CONNECTIONS

Wire colour code (see page D4)

WHITE	heater and cathode
YELLOW	heater
GREY	reflector
BROWN	resonator





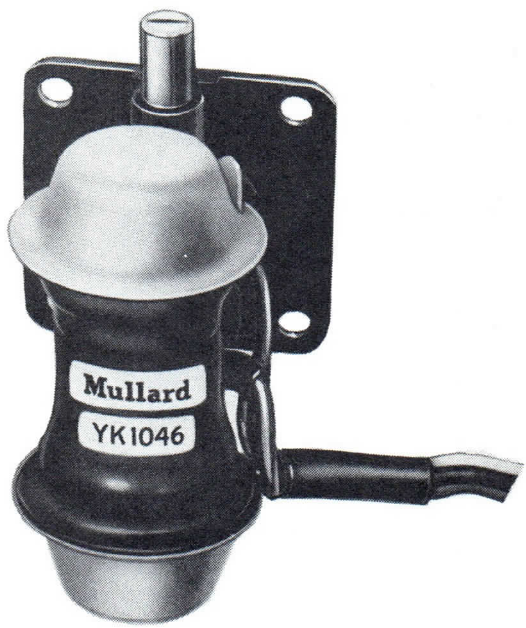
	Inches	Millimetres		Inches	Millimetres
A	1·282 ± 0·004	32·54 ± 0·1	J	2·430	64·5 max
B	1·461	37·1 max	K	0·422	10·7 max
C	0·178	4·5 max	L	2·177	55·3 max
D	1·219 ± 0·004	30·97 ± 0·1	M	0·169 ± 0·003	4·275 ± 0·075
E	1·429	36·3 max	N	1·500	38·1 max
F	0·209	5·3 max	P	0·984	25 max
G	0·729 ± 0·008	18·50 ± 0·2	R	5·906	150 max
H	1·063	27 max			

TENTATIVE DATA

QUICK REFERENCE DATA		
X-band, lightweight reflex klystron, with integral tuning cavity for local oscillator applications.		
Frequency range	9.16 to 9.34	GHz
Power output	35	mW
Construction	Aluminium body with flying leads	
Output connection	Waveguide 16 flange	

Services type: CV6195

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES



TYPICAL OPERATION (at 9.25GHz)

Operating Conditions (see note 1)

Heater voltage	6.3	V
Resonator voltage	275	V
Reflector voltage	-85	V
Load v.s.w.r.	≤1.1:1	

Typical Performance

Resonator current	22	mA
Power output	35	mW
Electronic tuning range to 1/2 power points	30	MHz

CATHODE

Indirectly heated

Heater voltage	6.3	V
Heater current	0.45	A

TEST CONDITIONS AND LIMITS

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

Test Conditions (see note 1)

Heater voltage	6.3	V
Resonator voltage	275	V
Reflector voltage	Adjust	
Load v.s.w.r.	≤1.1:1	

Limits and Characteristics

	Frequency (GHz)	Min.	Max.	
Heater current	-	0.4	0.5	A
Resonator current	-	-	40	mA
Reflector voltage (see note 2)	9.16	-75	-100	V
	9.25	-75	-100	V
	9.34	-75	-100	V
Power output (see note 2)	9.16	25	60	mW
	9.25	25	60	mW
	9.34	25	60	mW
Electronic tuning range to 1/2 power points	9.16	25	-	MHz
	9.25	25	-	MHz
	9.34	25	-	MHz

Mullard

Limits and Characteristics (cont'd)

	Frequency (GHz)	Min.	Max.	
Reflector modulator sensitivity (see note 3)	-	0.5	1.5	MHz
Frequency pulling (see note 4)	-	-	6.0	MHz
Mechanical tuning rate	9.16 to 9.34	150	250	MHz/turn
Mechanical tuning torque	-	0.07	0.22	Nm
	-	0.7	2.2	(kg cm)
Mechanical tuning range	-	9.16	9.34	GHz
Frequency temperature coefficient (see note 5)	9.25	-50	-200	kHz/degC
Frequency modulation under vibration, peak acceleration = 10g at 30Hz to 1kHz	9.25	-	200	kHz peak
Mode separation (see note 6)	9.16 to 9.34	-50	-125	V

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

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

	Min.	Max.	
Heater voltage	5.7	6.9	V
Resonator voltage	-	350	V
Resonator current	-	45	mA
Reflector voltage (see note 2)	-20	-500	V
Body temperature (see note 7)	-	150	^{o}C
Storage temperature	-55	+75	^{o}C
v.s.w.r.	-	1.5:1	
Impedance of reflector/cathode circuit	-	500	kΩ

END OF LIFE PERFORMANCE

The quality of all production is monitored by the random selection of klystrons which are then life tested under the stated test conditions. If the klystron is to be operated under different conditions from those specified, Mullard Ltd. should be consulted to verify that the life will not be affected. The klystron is considered to have reached the end of life when it fails to meet the following limits when operated as specified on pages 2 and 3.

	Min.	Max.	
Power output (at 9.25GHz)	15	-	mW
Electronic tuning range	20	-	MHz

MOUNTING POSITION — Any

COOLING — Natural

PHYSICAL DATA

	g	oz	
Weight of klystron	92	3.25	
Dimensions of storage carton	120 × 120 × 145		mm

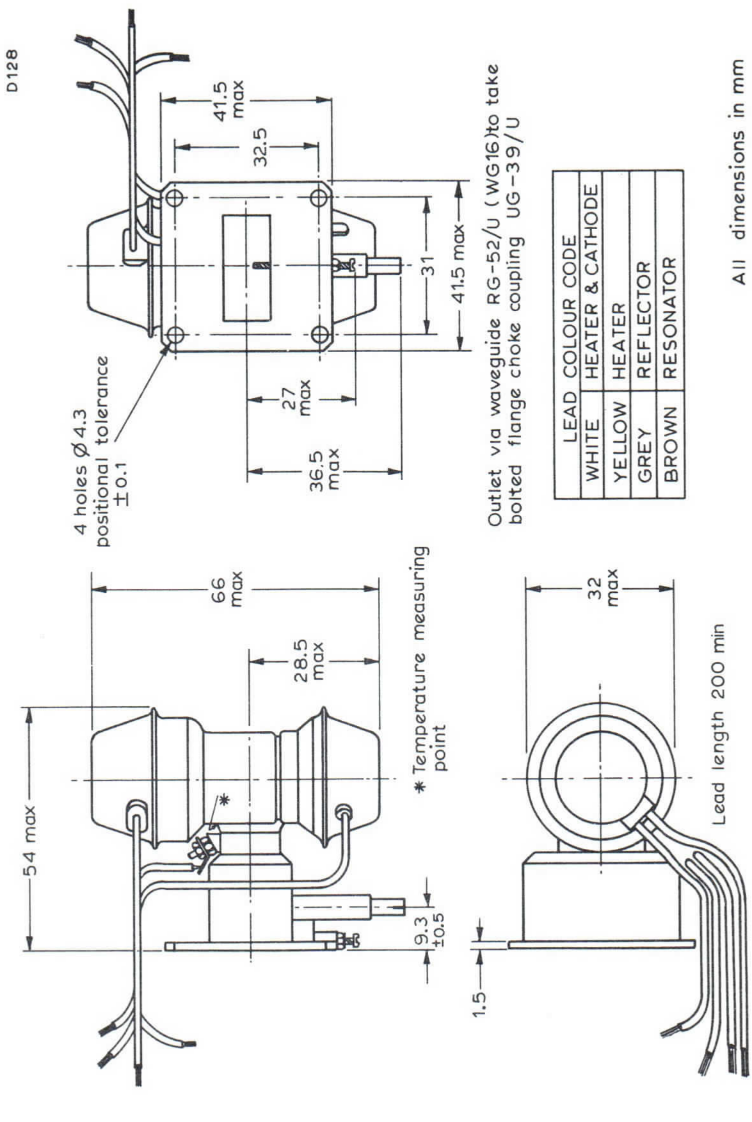
NOTES

1. Tests are made with the klystron rigidly connected to and in good thermal contact with a UG-39/U flange on an RG-52/U (WG16) waveguide.
2. Reflector voltage adjusted for the maximum power point of the mode. The reflector voltage must never be allowed to fall below the minimum value specified in the ratings.
3. Measured at mode optimum, 1 volt peak to peak deviation.
4. Measured with a v.s.w.r. of 1.5:1 varied through all phases. The power output must not be less than 10mW and the frequency versus reflector voltage must be continuous between the half power points.
5. Measured over the ambient temperature range -50 to +70°C.
6. No mode or part of a mode other than the required mode will exist within the specified reflector voltage range as the valve is mechanically tuned over the complete frequency range.
7. Measured at the point indicated on the outline drawing. For maximum valve life the klystron should be operated at temperatures below the specified maximum.

Dimensions
(Rounded outwards)

mm	in	mm	in
1.5	0.059	32.5	1.279
Ø 4.3	Ø 0.169	36.5 max.	1.437 max.
9.3 ± 0.5	0.366 ± 0.020	41.5 max.	1.634 max.
27 max.	1.06 max.	54 max.	2.13 max.
28.5 max.	1.122 max.	66 max.	2.60 max.
31	1.22	200 min.	7.87 min.
32 max.	1.26 max.		

OUTLINE DRAWING



LEAD COLOUR CODE	
WHITE	HEATER & CATHODE
YELLOW	HEATER
GREY	REFLECTOR
BROWN	RESONATOR

QUICK REFERENCE DATA		
Mechanically tunable reflex klystron intended for transmitter service in microwave relay systems. Contact cooled version of the YK1140 Series.		
Frequency range	5.925 to 8.1	GHz
Power output	1.2	W
Construction	Metal, waveguide output	

Unless otherwise shown, data is applicable to all types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS (Typical at 7.0GHz)

Resonator voltage	750	V
Resonator current	70	mA
Reflector voltage	-350	V
Power output	1.2	W
Electronic tuning range	35	MHz
Modulation sensitivity	300	kHz/V

MECHANICAL TUNING RANGE

	Min.	Max.	
YK1070	7.750	8.1	GHz
YK1071	7.425	7.750	GHz
YK1072	7.125	7.425	GHz
YK1073	6.875	7.125	GHz
YK1074	6.575	6.875	GHz
YK1075	6.425	6.575	GHz
YK1076	6.125	6.425	GHz
YK1077	5.925	6.225	GHz

CHARACTERISTICS (load v.s.w.r. 1.1:1)

		Min.	Max.	
Reflector voltage		-250	-400	V
Resonator current		55	80	mA
Electronic tuning range between half-power points	YK1070	21	-	MHz
	YK1071	25	-	MHz
	YK1072 to YK1077	28	-	MHz
Reflector modulation sensitivity		225	525	kHz/V
Frequency change with temperature	YK1070	-125	+100	kHz/degC
	YK1071 to YK1077	-100	+100	kHz/degC
Power output	YK1070	0.5	-	W
	YK1071 to YK1077	0.7	-	W

TUNING

External cavity, single screw

Tuner turns (average) 3.0

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Resonator voltage	-	775	V
Resonator current	-	80	mA
*Reflector voltage	-50	-1000	V

*Care should be taken in the design of the power supply to ensure that the reflector potential never becomes positive with respect to the cathode, as destruction of the klystron could result.

CATHODE

Oxide coated, unipotential

	Min.	Nom.	Max.	
Heater voltage	5.7	6.3	7.0	V
Heater current (at $V_h = 6.3V$)	-	800	-	mA
Heater to cathode voltage (pk)	-	-	±45	V

COOLING

For power inputs exceeding 10W it is recommended that a radiator of at least 930cm^2 (1 ft^2) total area be screwed to the heatsink. For maximum valve life the operating temperature should be less than the maximum operating temperature.

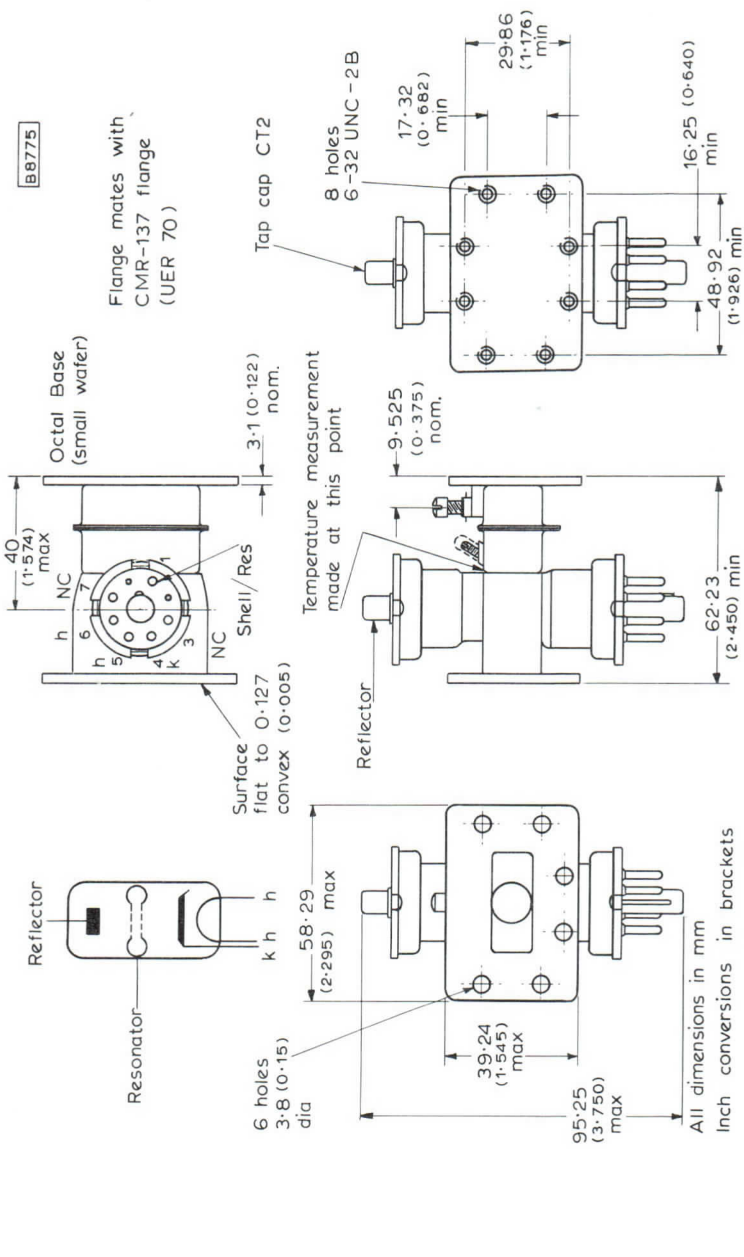
Temperatures

Body temperature max. (see page 4)	150	^{o}C
Operating temperature max.	100	^{o}C

MOUNTING POSITION Any

PHYSICAL DATA

	gm	oz
Weight	330	11.7


B8775
Flange mates with
CMR-137 flange
(UER 70)
Tap cap CT2
8 holes
6-32 UNC-2B
17·32
(0·682)
min
29·86
(1·176)
min
16·25 (0·640)
min
48·92
(1·926) min
Octal Base
(small wafer)
3·1 (0·122)
nom.
40
(1·574)
max
NC
7
1
h
6
Shell/Res
h 5
4 k
3
NC
Temperature measurement
made at this point
9·525
(0·375)
nom.
62·23
(2·450) min
Reflector
Surface
flat to 0·127
convex (0·005)
Reflector
Resonator
k h
h
58·29
(2·295) max
6 holes
3·8 (0·15)
dia
39·24
(1·545)
max
95·25
(3·750)
max
All dimensions in mm
Inch conversions in brackets

TENTATIVE DATA

QUICK REFERENCE DATA

Lightweight mechanically tunable reflex klystron. Suitable for high altitude operation. The YK1090 is a rugged version of the YK1091.

Frequency	10.5 to 12.2	Gc/s
Power output	400	mW
Construction	Integral cavity, waveguide output	
YK1090	Flying leads	
YK1091	Three pin base	

Unless otherwise stated data applies to both types.

To be read in conjunction with

GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

TYPICAL OPERATION

f	10.5	11.5	12.2	Gc/s
V_{res}	400	400	400	V
I_{res}	65	65	65	mA
$-V_{refl}$	190	260	315	V
Electronic tuning range between half power points	58	52	47	Mc/s
Reflector modulation sensitivity	1.0	1.0	1.0	Mc/s per V
P_{out} (matched load)	150	270	370	mW
P_{out} (optimised load)	320	400	420	mW

f	10.5	11.5	12.2	Gc/s
V_{res}	200	200	200	V
I_{res}	23	23	23	mA
$-V_{refl}$	60	90	110	V
Electronic tuning range between half power points	60	50	38	Mc/s
P_{out} (matched load)	10	22	27	mW
P_{out} (optimised load)	25	30	27	mW

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
V_{res}	-	450	V
I_{res}	-	70	mA
$-V_{refl}$	20	1000	V
T_{Body}	-	200	°C

CATHODE

Indirectly heated, oxide coated

V_h	6.3	V
I_h	1.2	A
t_{hk} min.	15	s

CHARACTERISTICS

	Min.	Typ.	Max.	
Electronic tuning range between half-power points at any frequency in the mechanical tuning range (V_{res} = 400V)	30		-	Mc/s
Reflector modulation sensitivity over complete frequency range	0.8		2.0	Mc/s per V
Power output at any frequency in the mechanical tuning range with reflector voltage optimised (V_{res} = 400V)	50		-	mW
Reflector negative voltage for maximum power output at centre frequency in principal mode (V_{res} = 400V)	-		260	V
Reflector negative voltage range for maximum power output over the mechanical tuning range (V_{res} = 400V)	100		400	V
Frequency drift after first 5 minutes of operation	-		0.5	Mc/s
Frequency change with temperature (T_{amb} = -10 to + 40°C)	-		0.25	Mc/s per deg C

	Min.	Typ.	Max.	
*Frequency change with atmospheric pressure change equivalent to operation 0 to 66 000ft		1.0	3.0	Mc/s
0 to 98 000ft		2.0	10	Mc/s
*Peak frequency deviation under vibration of 5g applied to the flange (50 to 5000c/s in all three planes)		-	4.0	Mc/s

*YK1090 only

COOLING

Natural and forced-air

Forced-air cooling is necessary for resonator input powers greater than 10W in order to maintain the body temperature below 200°C. For maximum life it is recommended that the temperature of the body should not exceed 100°C.

MOUNTING POSITION — Any

PHYSICAL DATA

	oz	g
Weight of klystron	7.0	200

CONNECTIONS — YK1090 Wire colour code

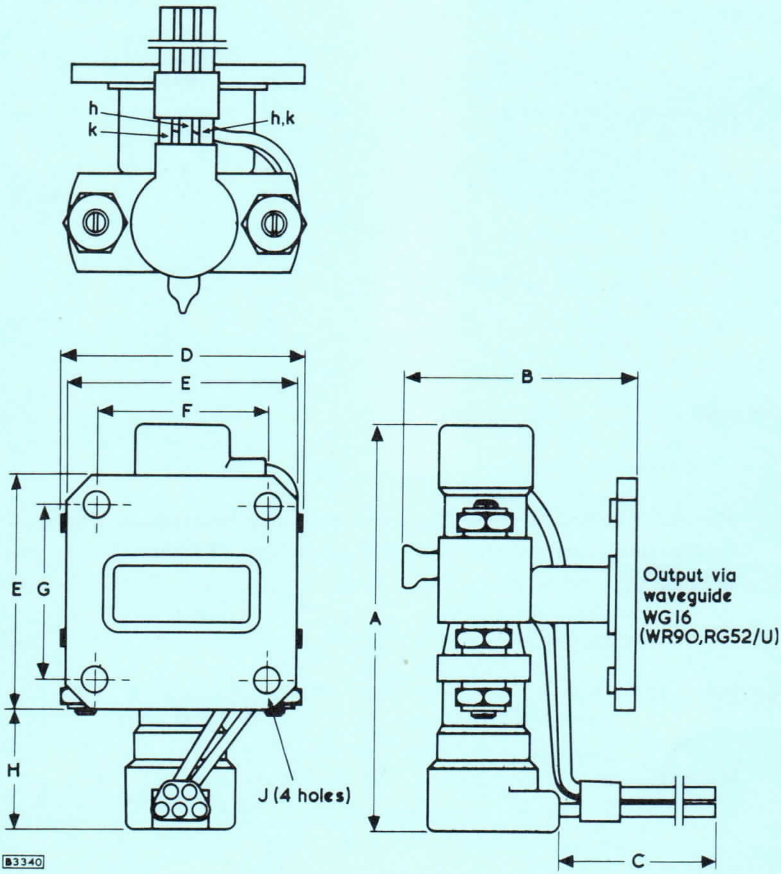
Colour	Coding
White	Heater and cathode
Yellow	Heater
Green	Cathode
Grey	Reflector
Red	Resonator

YK1091 Pin connections

See outline drawing on page D5.

The heater voltage must never be applied to the green (cathode) lead on the YK1090 or the cathode pin on the YK1091.

OUTLINE DRAWING OF YK1090

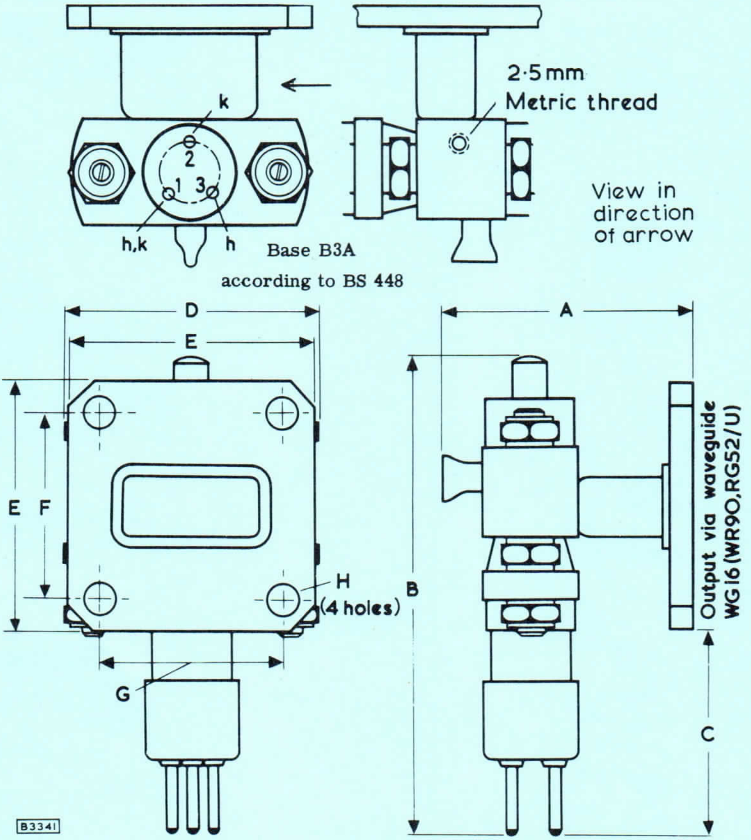


DIMENSIONS

	Inches	Millimetres	
A	2.992	76	max.
B	1.811	46	max.
C	15.748	400	min.
D	1.717 ± 0.094	43.6 ± 2.4	
E	1.657 ± 0.012	42.1 ± 0.3	
F	1.220 ± 0.004	31 ± 0.1	
G	1.280 ± 0.004	32.5 ± 0.1	
H	1.000	25.4	max.
J	0.185 ± 0.008	4.7 ± 0.2	dia.

Inch dimensions derived from original millimetre dimensions.

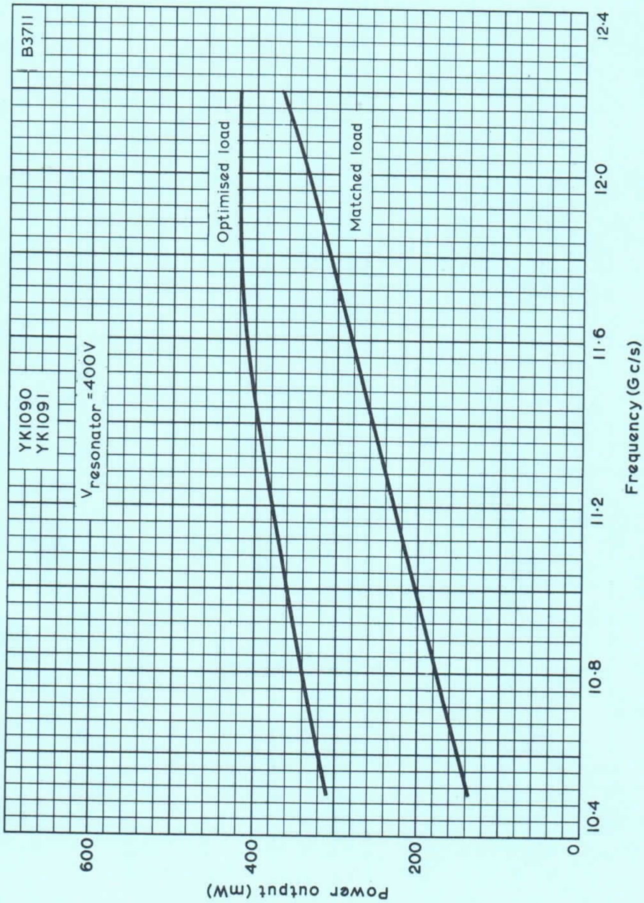
OUTLINE DRAWING OF YK1091



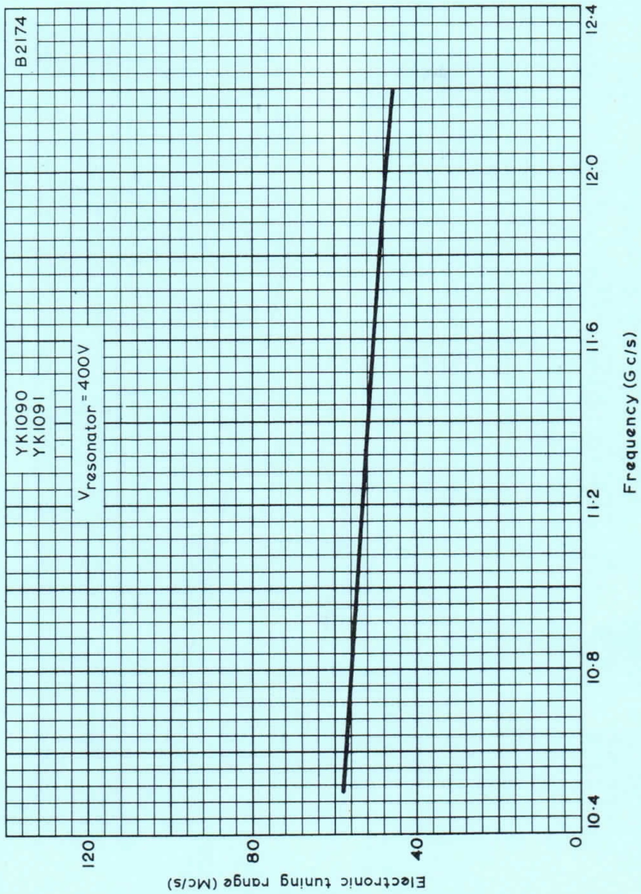
DIMENSIONS

	Inches	Millimetres	
A	1.811	46	max.
B	3.150	80	max.
C	1.378	35	max.
D	1.717 ± 0.094	43.6 ± 2.4	
E	1.651 ± 0.012	42.1 ± 0.3	
F	1.280 ± 0.004	32.5 ± 0.1	
G	1.220 ± 0.004	31 ± 0.1	
H	0.217 ± 0.004	5.5 ± 0.1	

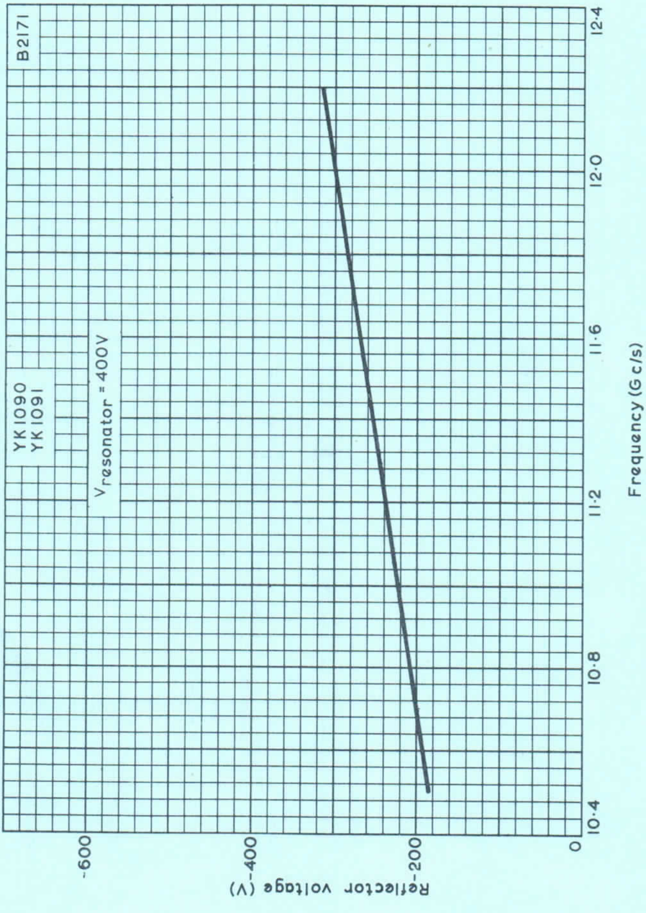
Inch dimensions derived from original millimetre dimensions.



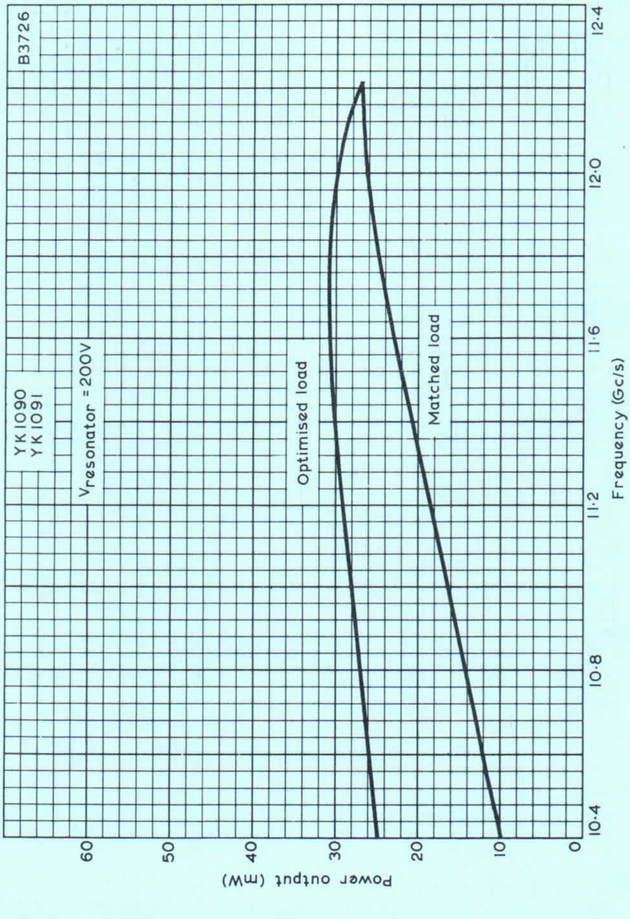
TYPICAL POWER OUTPUT FOR OPTIMISED AND MATCHED LOAD PLOTTED AGAINST FREQUENCY. $V_{resonator} = 400V$



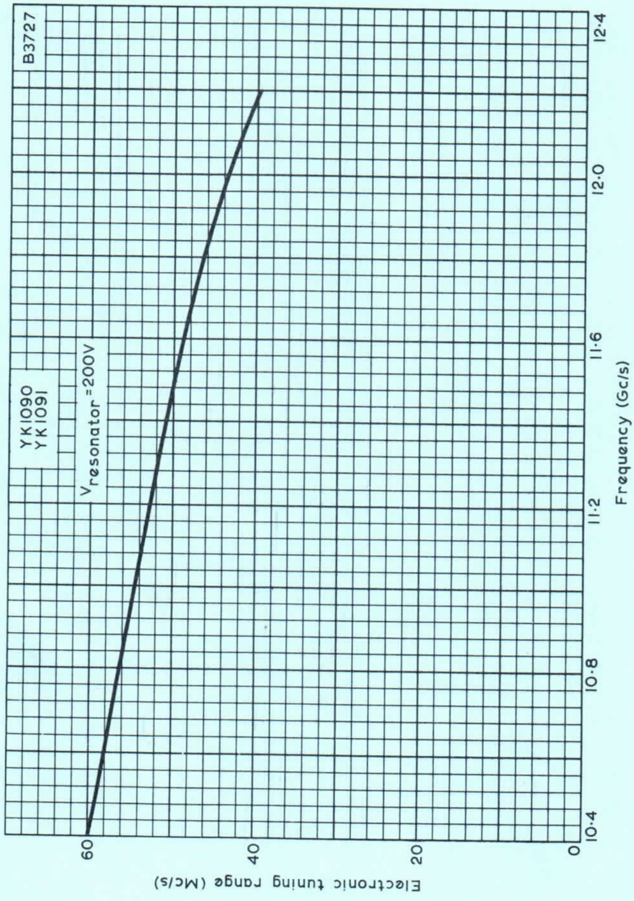
TYPICAL ELECTRONIC TUNING RANGE PLOTTED AGAINST FREQUENCY.
Vresonator = 400V.



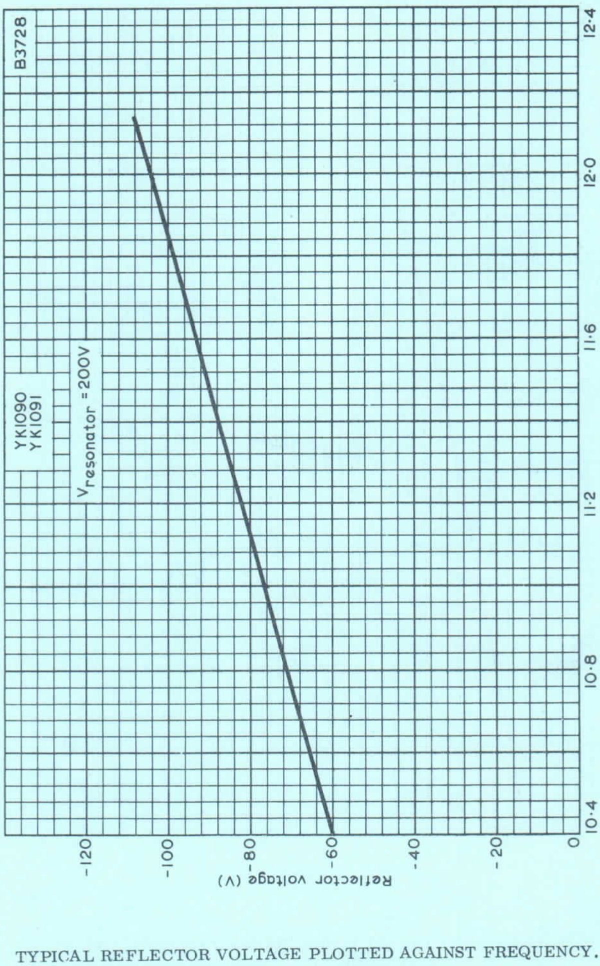
TYPICAL REFLECTOR VOLTAGE PLOTTED AGAINST FREQUENCY.
Vresonator = 400V.



TYPICAL POWER OUTPUT FOR OPTIMISED AND MATCHED LOAD
PLOTTED AGAINST FREQUENCY. $V_{resonator}$ =200V



TYPICAL ELECTRONIC TUNING RANGE PLOTTED AGAINST FREQUENCY. $V_{resonator} = 200V$



TYPICAL REFLECTOR VOLTAGE PLOTTED AGAINST FREQUENCY.
$V_{resonator} = 200V$

KLYSTRON

YK1140 Series
KS6-1000 Series
KS7-1000 Series

QUICK REFERENCE DATA		
Mechanically tunable reflex klystron intended for transmitter service in microwave relay systems. Forced-air cooled version of the YK1070 Series.		
Frequency range	5.925 to 8.1	GHz
Power output	1.2	W
Construction	Metal, waveguide output	

Unless otherwise shown, data is applicable to all types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS (Typical at 7.0GHz)

Resonator voltage	750	V
Resonator current	70	mA
Reflector voltage	-350	V
Power output	1.2	W
Electronic tuning range	35	MHz
Modulation sensitivity	300	kHz/V

MECHANICAL TUNING RANGE

		Min.	Max.	
YK1140	(KS7-1000Z)	7.750	8.1	GHz
YK1141	(KS7-1000A)	7.425	7.750	GHz
YK1142	(KS7-1000B)	7.125	7.425	GHz
YK1143	(KS7-1000C)	6.875	7.125	GHz
YK1144	(KS6-1000D)	6.575	6.875	GHz
YK1145	(KS6-1000G)	6.425	6.575	GHz
YK1146	(KS6-1000E)	6.125	6.425	GHz
YK1147	(KS6-1000F)	5.925	6.225	GHz

CHARACTERISTICS (Load v.s.w.r. 1.1:1)

		Min.	Max.	
Reflector voltage		-250	-400	V
Resonator current		55	80	mA
Electronic tuning range between half-power points	YK1140	21	-	MHz
	YK1141	25	-	MHz
	YK1142 to YK1147	28	-	MHz
Reflector modulation sensitivity		225	525	kHz/V
Frequency change with temperature	YK1140	-125	+100	kHz/degC
	YK1141 to YK1147	-100	+100	kHz/degC
Power output	YK1140	0.5	-	W
	YK1141 to YK1147	0.7	-	W

TUNING

External cavity, single screw

Tuner turns (average) 3.0

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
Resonator voltage	-	775	V
Resonator current	-	80	mA
*Reflector voltage	-50	-1000	V

*Care should be taken in the design of the power supply to ensure that the reflector potential never becomes positive with respect to the cathode, as destruction of the klystron could result.

CATHODE

Oxide coated, unipotential

	Min.	Nom.	Max.	
Heater voltage	5.7	6.3	7.0	V
Heater current (at $V_h = 6.3V$)	-	800	-	mA
Heater to cathode voltage (pk)	-	-	±45	V

COOLING

For the YK1140 Series with inputs exceeding 10W, an air flow of $0.85m^3$/min ($30ft^3$/min) should be directed on the cooling fins to keep the body temperature below the stated operating maximum. For maximum valve life the operating temperature should be less than the maximum operating temperature.

Temperatures

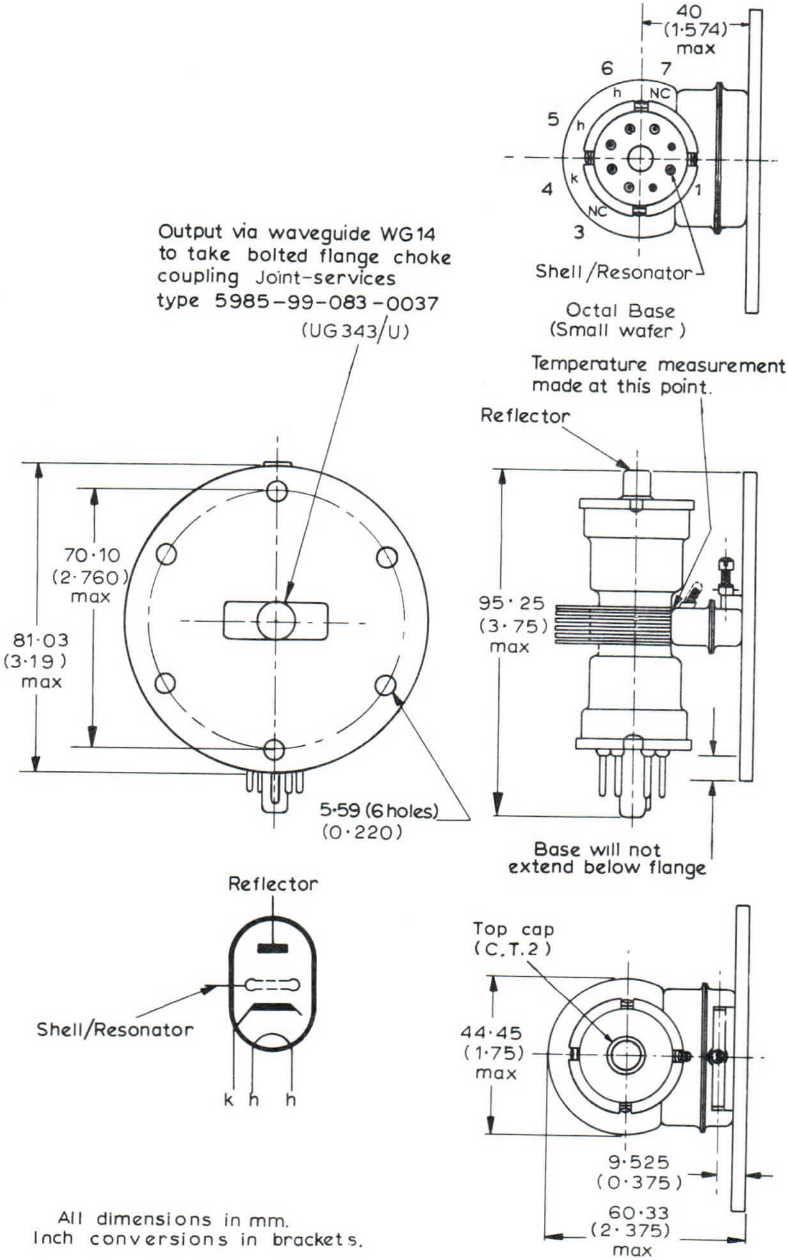
Body temperature max. (see page 4)	150	^oC
Operating temperature max.	100	^oC

MOUNTING POSITION — Any

PHYSICAL DATA

	gm	oz
Weight	230	8.1

OUTLINE DRAWING OF YK1140 SERIES



All dimensions in mm.
Inch conversions in brackets.

TRAVELLING WAVE TUBES

1. HEATER

1.1. Low noise values

To obtain the minimum noise figure the heater voltage must be within ±2.5% of the specified value and temporary fluctuations must be within ±5%.

1.2. Intermediate and power values

To obtain the maximum life the heater voltage must be within ±2.5% of the nominal value and temporary fluctuations must be within ±10%.

2. COOLING

It may be necessary to provide additional cooling to prevent the valve and focusing system temperature limits being exceeded.

Forced cooling of the collector terminal may be required and recommendations will be given in the individual valve data.

Normally cooling of electromagnetic focusing systems will be required.

3. FOCUSING MOUNTS

A suitable magnetic field is provided by the mounts available from Mullard Limited.

Designers who do not propose to use one of these mounts should consult the valve manufacturer as an unsuitable mount can impair the performance of the valve. In many instances, the focusing mount incorporates the radio frequency input and output connections with suitable matching devices.

Focus alignment screws are provided on the approved mounts and a presetting procedure for these has been established (see appropriate data sheets). This procedure will reduce the risk of damage to the valve due to excessive helix dissipation during the focusing operations.

4. SHIELDING

Any disturbance of the focusing field may impair the performance of the valve, and the valve must be protected from the effects of nearby ferrous material and stray magnetic fields.

The degree of susceptibility to such interference varies for different focusing systems and specific information will be given in the individual data sheets. Unless magnetic shielding or component orientation is adopted ferrous objects should be kept more than 9 inches away and other magnetic objects should be positioned 18 inches away from the valve.

5. POWER SUPPLIES

5.1. Protective devices

Protective devices are desirable to prevent damage to the valve if the power supply or cooling arrangements fail.

5.2. Regulation

The regulation requirements can be determined with reference to the typical curves of gain, phase shift and electrode voltages.

The change in gain with electrode voltage is usually greatest for the current controlling electrode (normally the first grid) and the helix.

Any ripple voltage on the helix will give rise to phase modulation of the signal.

With an electromagnetic focusing system the solenoid current must be stabilised.

6. INSTALLATION SEQUENCE

When putting a valve into operation the initial adjustments should be made in the following order:

Ensure that the control electrode voltage is set at zero and then apply simultaneously the remaining electrode voltages and adjust in accordance with recommended values. Increase the control electrode voltage until cathode current is drawn, ensuring that the maximum helix current limit is not exceeded. Adjust the focus alignment screws so that the helix current is a minimum and the collector current is a maximum. Repeat this procedure until the required collector current is achieved and the helix current is a minimum. A typical helix current is given in the valve data under operating conditions.

Inject a low level radio frequency signal at the desired operating frequency ensuring that the value is not saturated and observe the output level. Adjust the helix voltage until a maximum output level is achieved. Recheck for optimum focusing and lock focus alignment screws.

7. OPERATING SEQUENCE

The following sequence should be followed:

a. Apply the heater voltage and allow the specified heater warm up time.

b. Switch on the power supply of the electromagnetic focusing system.

c. The electrode voltages may be applied simultaneously but it is preferable that the control electrode voltage be delayed with respect to the other electrode voltages.

8. SWITCHING OFF

All the electrode voltages may be removed simultaneously but it is preferable for the control electrode voltage to decrease more rapidly than the other electrode voltages.

Where an electromagnetic focusing arrangement is used the valve electrode voltages must be removed before switching off the solenoid power supply.

9. STORAGE

The valve should be stored in its original packing, which is designed to give reasonable protection against vibration and knocks. This also ensures that the spacing between permanent magnet valves and other ferrous objects is adequate to avoid reduction of magnetisation.

Unpacked permanent magnet valves should **NEVER** be placed on steel benches or shelves.

LB6-12

QUICK REFERENCE DATA

Forward wave amplifier suitable for use in the power output stages of wideband multi-channel microwave links.

Frequency	6	Gc/s band
Saturation power output	12	W
Gain	37	dB
Construction		Unpackaged

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – MICROWAVE DEVICES: INTRODUCTION and FORWARD WAVE AMPLIFIERS which precede this section of the handbook.

CHARACTERISTICS

Tube in mount – type P6L–3

		Min.	*Max.*	
Frequency band		5.900	7.125	Gc/s
Gain (over frequency band)				
$P_{out} = 100$mW		37	—	dB
$P_{out} = 5.0$W		33	—	dB
Noise factor ($P_{out} = 5.0$W)		—	30	dB
Saturation power output		10	—	W
Attenuation (at $I_k = 0$mA)		65	—	dB
Hot input match	v.s.w.r.			
Over any 50Mc/s in band with matching device adjusted		—	1.2	
Over 5.9 to 6.4Gc/s without use of matching device		—	1.7	
Hot output match	v.s.w.r.			
Over any 50Mc/s in band with matching device adjusted		—	1.3	
Over 5.9 to 6.4Gc/s without use of matching device		—	2.0	

CATHODE

Indirectly heated

V_h	6.3	V
I_h	0.9	A
t_{h-k} min.	2.0	min

The absolute maximum variation of the heater voltage should be less than $\pm 4\%$.

LB6-12 FORWARD WAVE AMPLIFIER

DESIGN RANGES FOR POWER SUPPLY

	Min.	Max.	
For adjustment of focus			
(a) Variable V_{g1}			
V_{g1}	0	–200	V
V_{g2}	1.6	2.3	kV
(b) Variable V_{g2}			
V_{g1}	0	–20	V
V_{g2}	0.3	2.3	kV
For normal operation			
$V_{collector}$	1.6	1.8	kV
V_{helix}	2.5	2.9	kV
V_{g1}	0	–20	V
V_{g2}	1.6	2.3	kV

TYPICAL OPERATION

As a power amplifier with the collector earthed and using a mount type P6L-3

f		6.5	Gc/s
$V_{collector}$		1.7	kV
V_{helix}		2.65	kV
V_{g2}		1.9	kV
V_{g1}		–8.0	V
$I_{collector}$		40	mA
I_{helix}		0.25	mA
Gain		37	dB
Power output		5.0	W
Typical noise factor (inclusive of any gas noise)		25	dB
Hot input match with matching device adjusted	v.s.w.r.		
At 6.5Gc/s		1.02	
At ±25Mc/s about 6.5Gc/s		1.08	
Hot output match with matching device adjusted	v.s.w.r.		
At 6.5Gc/s		1.02	
At ±25Mc/s about 6.5Gc/s		1.15	

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
$V_{collector}$	1.5	1.8	kV
$I_{collector}$	—	45	mA
$P_{collector}$	—	80	W
V_{helix}	—	3.0	kV
I_{helix}			
during focusing	—	2.5	mA
during operation	—	1.5	mA
V_{g2}	—	3.0	kV
I_{g2}	—	1.0	mA
$-V_{g1}$	—	250	V
P_{in} (signal)	—	1.0	W
V_{h-k}	—	50	V

MOUNTING POSITION

Any

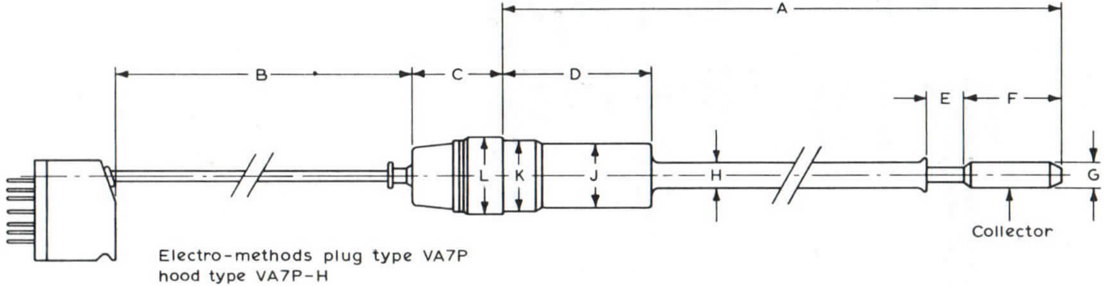
COOLING

Tube installed in mount type P6L-3

Horizontally mounted	Natural	
Vertically mounted	Natural assisted by convection duct or low velocity air flow	
$T_{collector\ seal}$ max.	200	°C
Ambient temperature range for operation to full specification	−10 to +65	°C
Ambient temperature range for operation to reduced specification	−25 to +65	°C
Storage temperature at 95% humidity	−60 to +85	°C

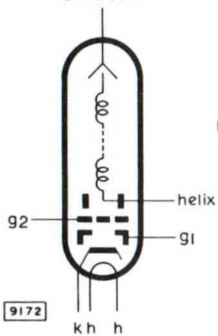
PHYSICAL DATA

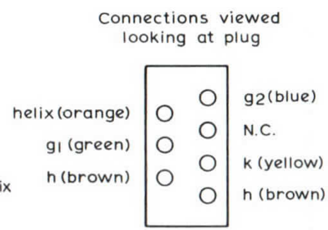
Weight of LB6-12	7.5	oz
	212.6	g
Weight of LB6-12 in carton	9lb	4oz
	4.2	kg
Dimensions of storage carton	17 × 17 × 29	in
	432 × 432 × 736.6	mm
Weight of P6L-3 mount	11lb	8 oz
	5.2	kg
Weight of P6L-3 mount in carton	40lb	10 oz
	18.4	kg
Dimensions of storage carton	25 × 16 × 19.5	in
	635 × 407 × 496	mm



DIMENSIONS OF LB6-12

	Inches	*Millimetres*	
A	12.48 ± 0.80	317 ± 2.0	
B	3.62 ± 0.12	92 ± 3.0	
C	1.033 ± 0.034	26.25 ± 0.85	
D	2.1	53.3	max.
E	0.632 ± 0.060	16.5 ± 1.5	
F	1.772 ± 0.002	45 ± 0.6	
G	0.294 ± 0.001	7.475 ± 0.025	
H	0.295	7.5	max.
J	1.06	27.5	max.
K	1.238 ± 0.001	31.47 ± 0.02	
L	1.32	33.5	max.



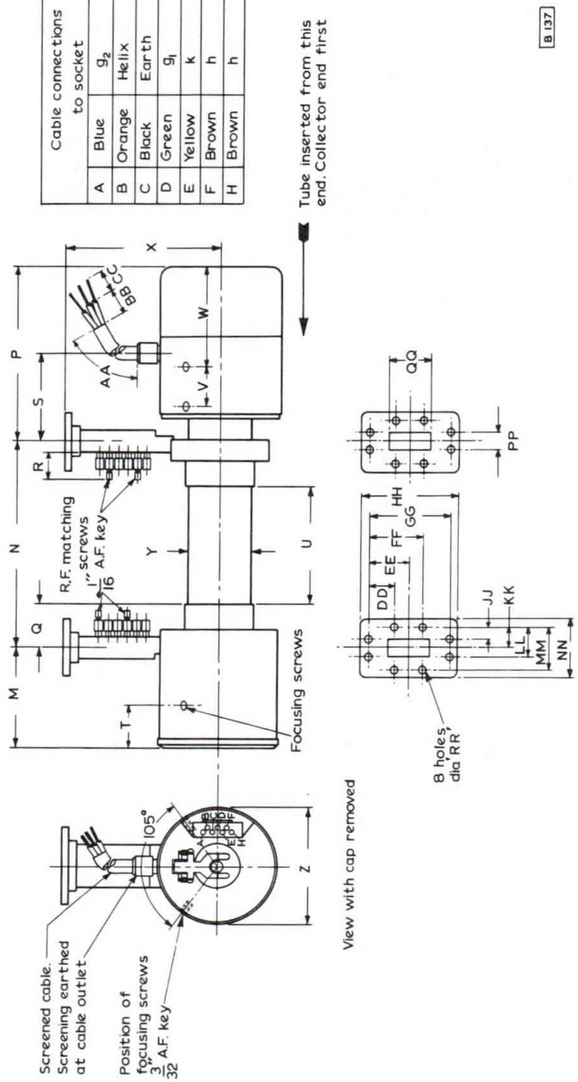


OUTLINE LB6–12

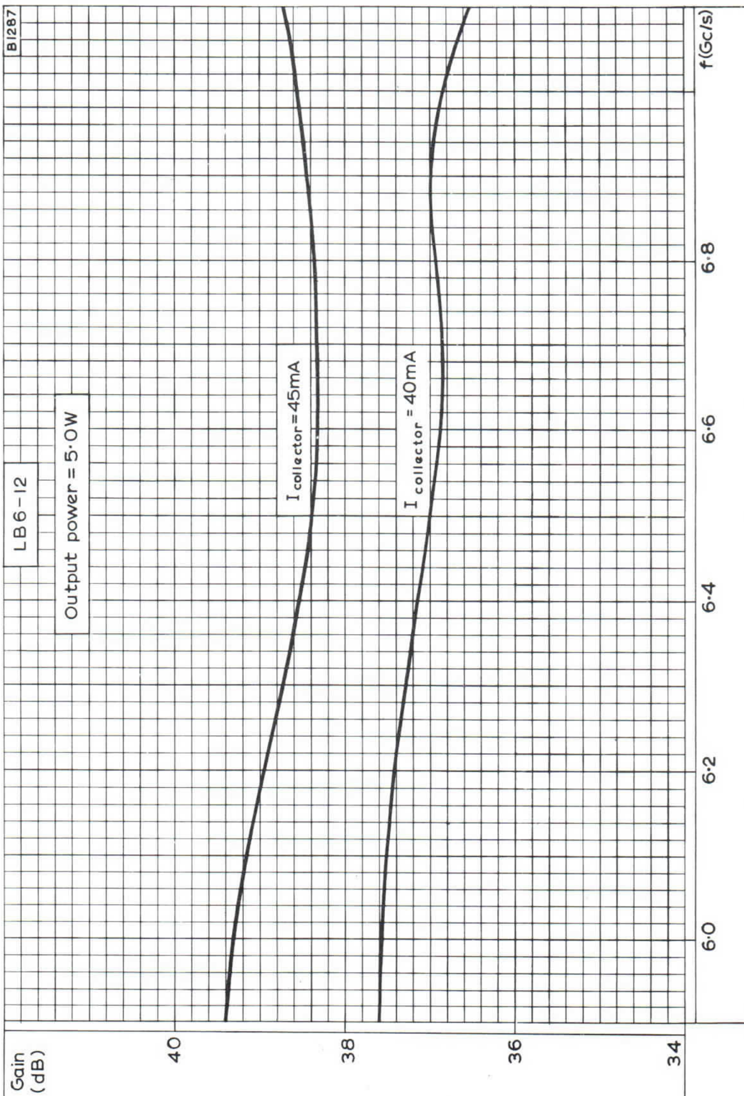
DIMENSIONS OF P6L–3 MOUNT

	Inches	Millimetres	
M	3.46 ± 0.02	88 ± 0.5	
N	6.84 ± 0.02	173.8 ± 0.5	
P	5.91 ± 0.02	150 ± 0.5	
Q	1.45 ± 0.02	36.9 ± 0.5	
R	1.18 ± 0.02	30 ± 0.5	
S	2.83 ± 0.02	72 ± 0.5	
T	1.34 ± 0.02	34 ± 0.5	
U	3.94 ± 0.02	100 ± 0.5	
V	1.34 ± 0.02	34 ± 0.5	
W	3.5 ± 0.02	89 ± 0.5	
X	5.12 ± 0.02	130 ± 0.5	
Y	2.17 ± 0.02	55 ± 0.5	dia.
Z	4.02 ± 0.02	102 ± 0.5	dia.
AA	24 ± 0.02	609.6 ± 0.5	
BB	2.00 ± 0.02	50.8 ± 0.5	
CC	0.50 ± 0.02	12.7 ± 0.5	
DD	0.655 ± 0.001	16.66 ± 0.025	
EE	1.094 ± 0.001	27.78 ± 0.025	
FF	1.531 ± 0.001	38.88 ± 0.025	
GG	2.188 ± 0.001	55.57 ± 0.025	
HH	2.69 ± 0.02	68.32 ± 0.5	
JJ	0.406 ± 0.001	10.31 ± 0.025	
KK	0.719 ± 0.001	18.26 ± 0.025	
LL	1.030 ± 0.001	26.18 ± 0.025	
MM	1.438 ± 0.001	36.52 ± 0.025	
NN	1.94 ± 0.02	49.27 ± 0.5	
PP	0.622 ± 0.001	15.8 ± 0.025	
QQ	1.372 ± 0.001	34.85 ± 0.025	
RR	1.980 ± 0.001	5.03 ± 0.025	dia.

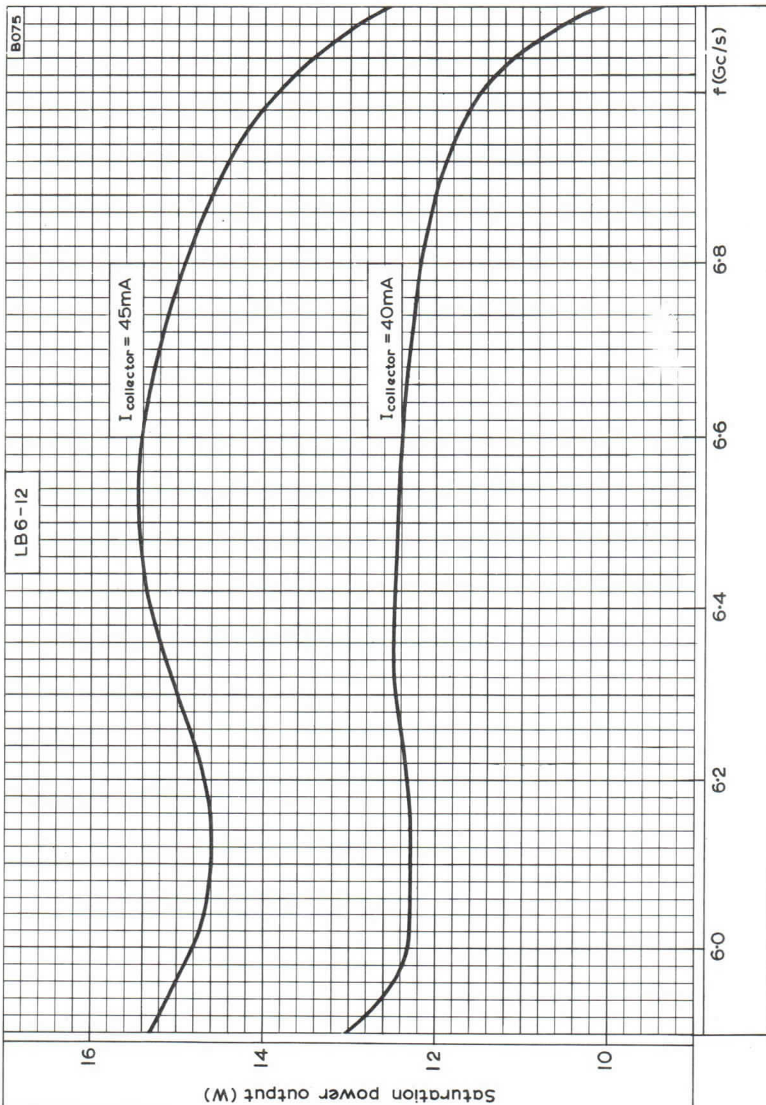
Cable connections to socket		
A	Blue	g_2
B	Orange	Helix
C	Black	Earth
D	Green	g_1
E	Yellow	k
F	Brown	h
H	Brown	h



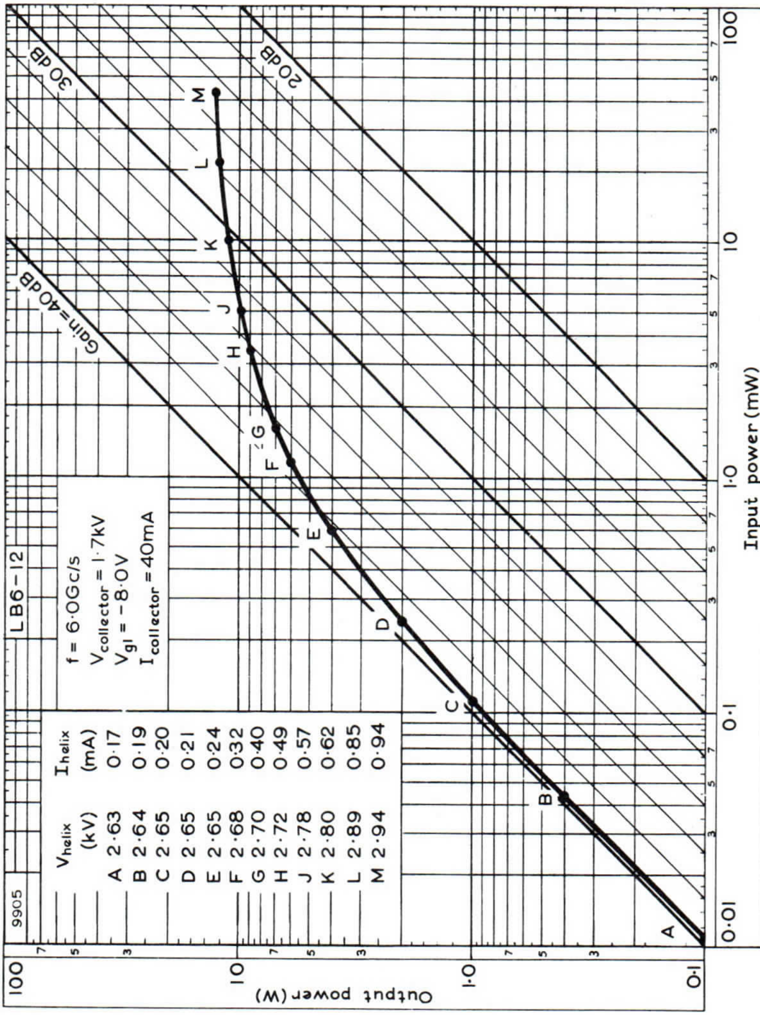
OUTLINE P6L–3 MOUNT



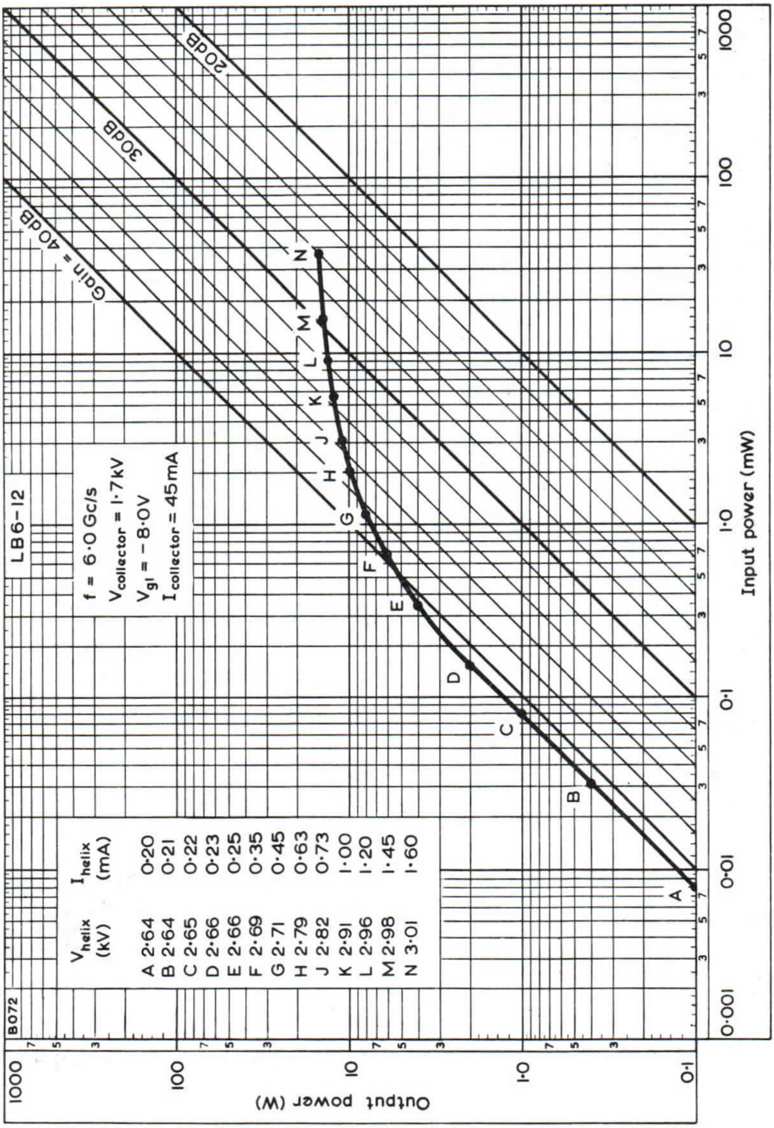
TYPICAL GAIN PLOTTED AGAINST FREQUENCY



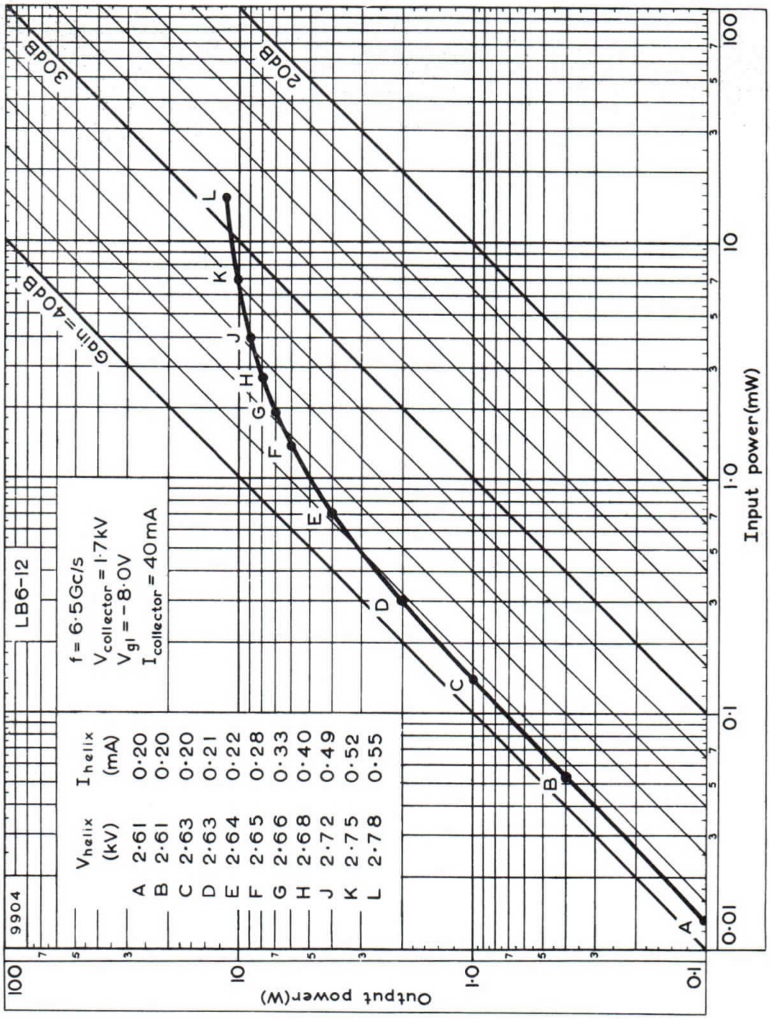
SATURATION POWER OUTPUT PLOTTED AGAINST FREQUENCY



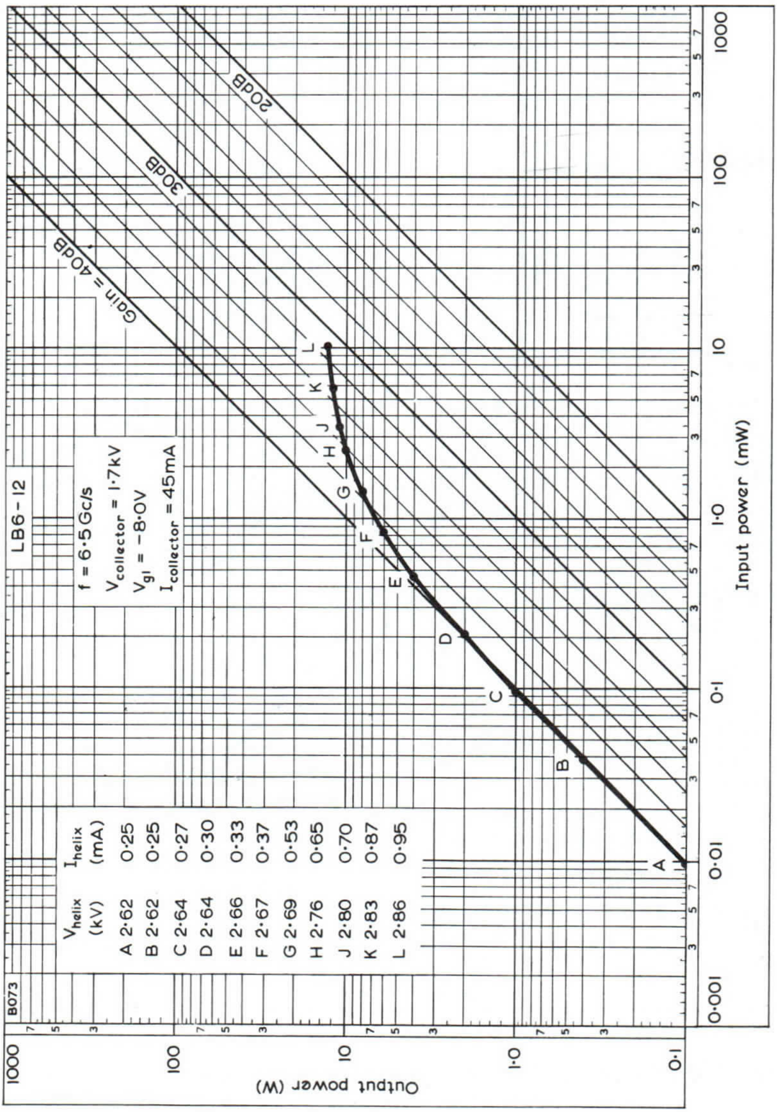
OUTPUT POWER PLOTTED AGAINST INPUT POWER AT 6.0Gc/s WITH A COLLECTOR CURRENT OF 40mA



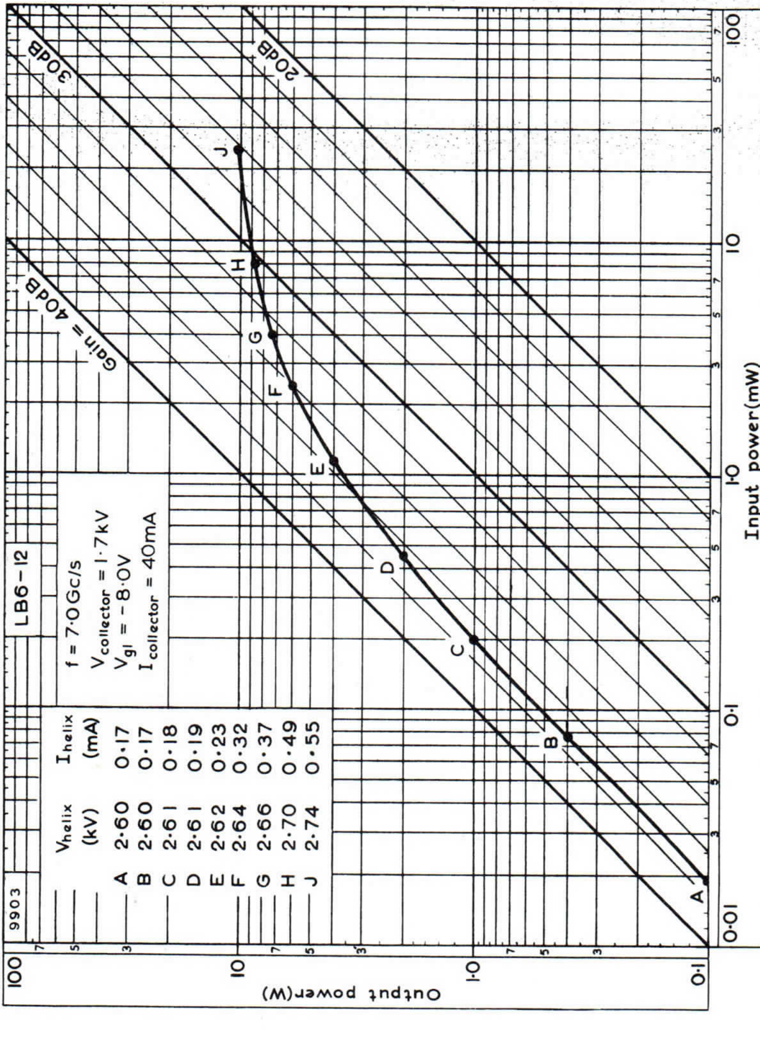
OUTPUT POWER PLOTTED AGAINST INPUT POWER AT 6.0Gc/s WITH A COLLECTOR CURRENT OF 45mA



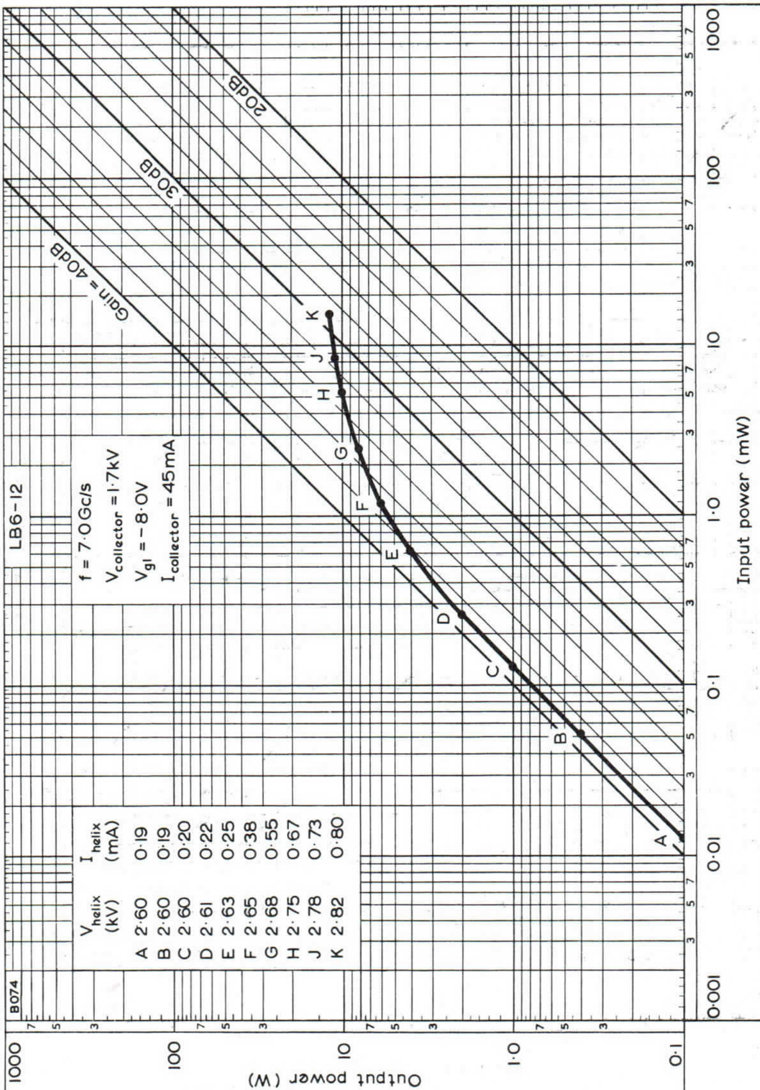
OUTPUT POWER PLOTTED AGAINST INPUT POWER AT 6.5Gc/s WITH A COLLECTOR CURRENT OF 40mA



OUTPUT POWER PLOTTED AGAINST INPUT POWER AT 6.5Gc/s WITH A COLLECTOR CURRENT OF 45mA



OUTPUT POWER PLOTTED AGAINST INPUT POWER AT 7.0Gc/s WITH A COLLECTOR CURRENT OF 40mA



OUTPUT POWER PLOTTED AGAINST INPUT POWER AT 7.0Gc/s WITH A COLLECTOR CURRENT OF 45mA

FORWARD WAVE AMPLIFIER LB6-25

QUICK REFERENCE DATA		
Forward wave amplifier for use in power output stages of wideband multi-channel microwave links.		
Frequency	5.9 to 6.5	GHz
Saturation power output	25	W
Gain	38	dB
Construction	Unpackaged	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

OPERATING CONDITIONS

As a power amplifier with the collector earthed and tube focused in a mount type P6L11. (Electrode potentials with respect to cathode).

f	6.0	GHz
$V_{collector}$	2.0	kV
$I_{collector}$	45	mA
V_{helix}	3.4	kV
I_{helix}	0.4	mA
V_{g1}	-15	V
I_{g1}	1.0	μA
V_{g2}	2.2	kV
I_{g2}	5.0	μA
Gain	38	dB ←
Power output	15	W
Noise factor (including gas noise)	28	dB
Hot input match (v.s.w.r.)	1.2	
Hot output match (v.s.w.r.)	1.4	

CHARACTERISTICS

	Min.	Max.	
Tube in mount P6L11			
Frequency band	5.925	6.425	GHz
Gain (P_{out} = 15Watts)	37	40	dB
Noise factor (P_{out} = 15Watts)	-	30	dB
Saturation power output	23	-	W
Attenuation at I_k = 0mA	60	-	dB
Hot input match (v.s.w.r.)	-	1.8	
Hot output match (v.s.w.r.)	-	2.0	

CATHODE

Indirectly heated, dispenser cathode

* V_h d.c. or r.m.s.	6.3	V
I_h	0.85 to 1.05	A
t_{h-k} min.	2.0	min

* The absolute variation of the heater voltage should be less than ±2%. When operated on d.c. the heater must be positive with respect to the cathode.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
$V_{collector}$	1.8	2.2	kV
$I_{collector}$	-	50	mA
$P_{collector}$	-	100	W
V_{helix}	-	4.0	kV
I_{helix} during focusing (transient)	-	2.0	mA
I_{helix} during operation	-	1.5	mA
V_{g1}	-250	0	V
I_{g1}	-	1.0	mA
V_{g2}	-	3.0	kV
I_{g2}	-	1.0	mA
P_{in} signal	-	0.25	W
V_{h-k}	-	50	V

DESIGN RANGES FOR POWER SUPPLY

(Electrode potentials with respect to cathode)

	Min.	Max.	
For normal operation			
*$V_{collector}$	1.8	2.2	kV
V_{helix}	3.2	3.8	kV
**V_{g1}	-20	0	V
***V_{g2}	1.9	2.8	kV
$I_{collector}$	40	50	mA
I_{helix}	-	2.0	mA
I_{g1}	-	100	μA
I_{g2}	-250	+250	μA
V_h	6.15	6.45	V

*Normally 2.0kV

**Normally -15V

***For adjustment of focus it is necessary for V_{g2} to be made adjustable over the range 0 to 2.8kV.

MOUNTING POSITION

Any (but see cooling)

COOLING

Tube installed in mount P6L11 (convection cooled)

Horizontally mounted	Natural
Vertically mounted	Assisted by convection duct or low velocity air flow

A conduction cooled mount is available.

Temperatures

Collector seal max.	200°C
Reference point max.	140°C

AMBIENT TEMPERATURE RANGES FOR MOUNT

Operation to full specification	-10 to +65	°C
Operation without damage to tube	-20 to +65	°C
Storage	-60 to +85	°C

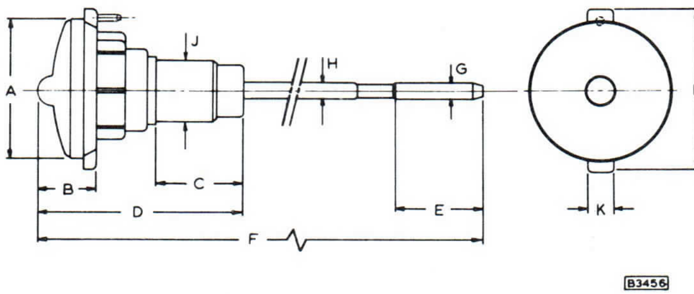
PHYSICAL DATA

	kg	lb
Weight of LB6-25	0.2	0.4
Weight of LB6-25 and transit carton (2 valves per carton)	4.0	9.0
Weight of mount P6L11	5.5	12
Weight of P6L11 mount and transit carton	20.5	45

	cm	in
Dimensions of LB6-25 storage carton	40 × 10 × 10	16 × 4 × 4
Dimensions of P6L11 storage carton	50 × 27 × 14	20 × 11 × 6

←

OUTLINE DRAWING OF LB6-25

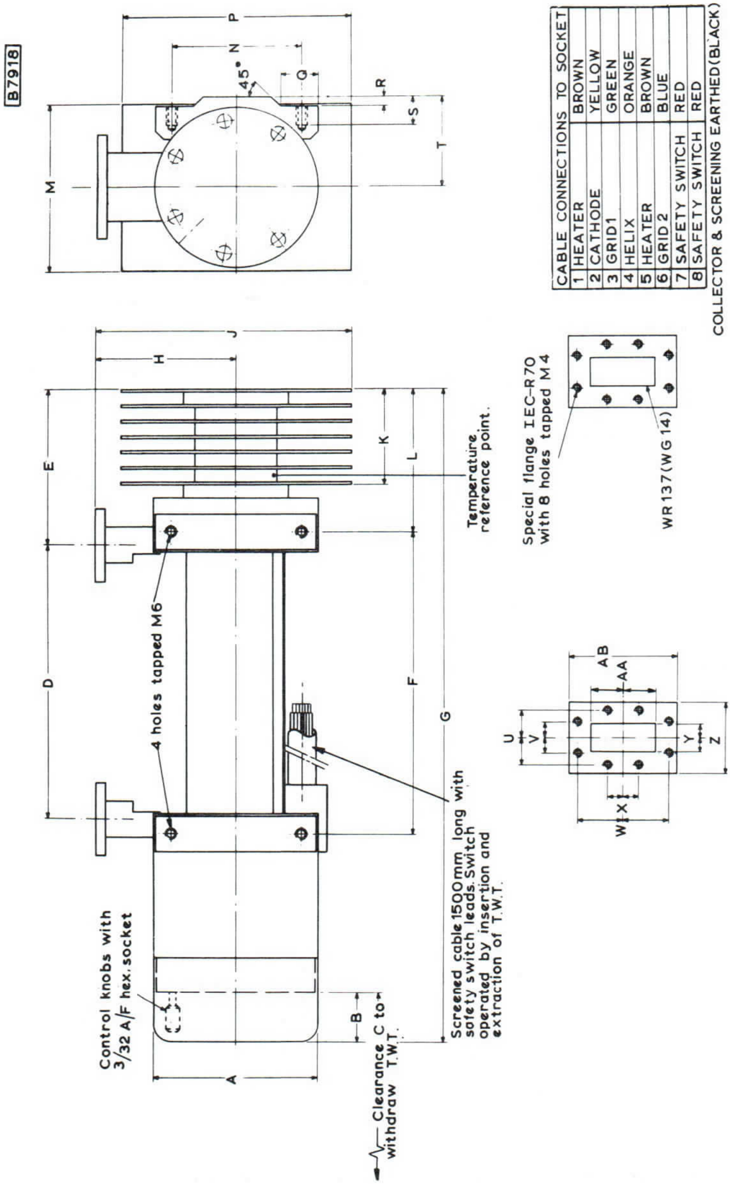


DIMENSIONS OF LB6-25

	Millimetres	Inches	
A	61	2.40	dia.
B	27	1.06	
C	29	1.14	max.
D	82 ± 1.0	3.228 ± 0.039	
E	45	1.77	
F	348	13.70	max.
G	$7.5\ ^{+0}_{-0.02}$	$0.2953\ ^{+0}_{-0.0008}$	dia.
H	7.5	0.295	dia. max.
J	31.5 ± 0.01	1.2402 ± 0.0004	dia.
K	12	0.47	
L	71	2.80	

Inch dimensions are derived from original millimetre dimensions

OUTLINE DRAWING OF P6L11 MOUNT



CABLE CONNECTIONS TO SOCKET		
1	HEATER	BROWN
2	CATHODE	YELLOW
3	GRID1	GREEN
4	HELIX	ORANGE
5	HEATER	BROWN
6	GRID 2	BLUE
7	SAFETY SWITCH	RED
8	SAFETY SWITCH	RED

COLLECTOR & SCREENING EARTHED (BLACK)

DIMENSIONS OF P6L11 MOUNT

	Millimetres	Inches	
A	89	3.50	dia.
B	28	1.10	
C	338	13.31	
D	149.2 ± 0.1	5.874 ± 0.004	
E	85	3.35	
F	163.0 ± 0.2	6.417 ± 0.008	
G	356	14.02	
H	76	2.99	
J	139	5.47	
K	52.5	2.067	
L	78	3.07	
M	92	3.62	
N	70.0 ± 0.2	2.756 ± 0.008	
P	125	4.92	
Q	20.0 ± 0.5	0.787 ± 0.020	
R	5.5 ± 0.2	0.217 ± 0.008	
S	16	0.63	
T	50	1.97	
U	14.99 ± 0.05	0.590 ± 0.002	
V	8.71 ± 0.05	0.343 ± 0.002	
W	17.42 ± 0.05	0.686 ± 0.002	
X	8.18 ± 0.05	0.322 ± 0.002	
Y	7.90 ± 0.05	0.311 ± 0.002	
Z	39.0 ± 0.3	1.535 ± 0.011	
AA	24.51 ± 0.05	0.965 ± 0.002	
AB	58.0 ± 0.3	2.283 ± 0.011	

Inch dimensions derived from original millimetre dimensions

FORWARD WAVE AMPLIFIER LB6-25A

QUICK REFERENCE DATA		
Forward wave amplifier for use in power output stages of wideband multi-channel microwave links.		
Frequency	6.4 to 7.2	GHz
Saturation power output	20	W
Gain	38	dB
Construction	Unpackaged	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS-MICROWAVE DEVICES

OPERATING CONDITIONS

As a power amplifier with the collector earthed and tube focused in a mount type P6L11A (Electrode potentials with respect to cathode).

f	6.8	GHz
$V_{collector}$	2.0	kV
$I_{collector}$	45	mA
V_{helix}	3.5	kV
I_{helix}	0.4	mA
V_{g1}	-15	V
I_{g1}	1.0	μA
V_{g2}	2.2	kV
I_{g2}	5.0	μA
Gain	38	dB
Power output	10	W
Noise factor (including gas noise)	28	dB
Hot input match (v.s.w.r.)	1.2	
Hot output match (v.s.w.r.)	1.4	

CHARACTERISTICS

	Min.	Max.	
Tube in mount type P6L11A			
Frequency band	6.425	7.125	GHz
Gain (P_{out} = 10 watts)	37	40	dB
Noise factor (P_{out}=10 watts)	-	30	dB
Saturation power output	20	-	W
Attenuation at I_k = 0mA	60	-	dB
Hot input match (v.s.w.r.)		1.8	
Hot output match (v.s.w.r.)		2.0	

CATHODE

Indirectly heated, dispenser cathode

	Min.	Max.	
*V_h d.c. or r.m.s.	6.3		V
I_h	0.8	1.1	A
t_{h-k} min.		2.0	min

*The absolute variation of heater voltage should be less than ±2%.

When operated on d.c. the heater must be positive with respect to the cathode.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Min.	Max.	
$V_{collector}$	1.8	2.2	kV
$I_{collector}$	-	50	mA
$P_{collector}$	-	100	W
V_{helix}	-	4.0	kV
I_{helix} during focusing (transient)	-	2.0	mA
I_{helix} during operation	-	1.5	mA
V_{g1}	-250	0	V
I_{g1}	-	1.0	mA
V_{g2}	-	3.0	kV
I_{g2}	-	1.0	mA
P_{in} signal	-	0.25	W
V_{h-k}	-	50	V

DESIGN RANGES FOR POWER SUPPLY

(Electrode potentials with respect to the cathode)

	Min.	Max.	
For normal operation			
$V_{collector}$ (fixed in range)	1.8	2.5	kV
V_{helix}	3.2	3.8	kV
V_{g1}	-20	0	V
*V_{g2}	1.9	2.8	kV
$I_{collector}$	40	50	mA
I_{helix}	-	2.0	mA
I_{g1}	-	100	μA
I_{g2}	-	500	μA
V_h	6.15	6.45	V

*For adjustment of focus it is necessary for V_{g2} to be made adjustable over the range:- 0 to 2.8kV.

MOUNTING POSITION

Any (but see cooling)

COOLING

Tube installed in mount P6L11A (convection cooled)

Horizontally mounted	Natural
Vertically mounted	Assisted by convection duct or low velocity air flow

A conduction cooled mount is available

Temperatures

Collector seal max.	200	^{o}C
Reference point max.	140	^{o}C

AMBIENT TEMPERATURE RANGES FOR MOUNT

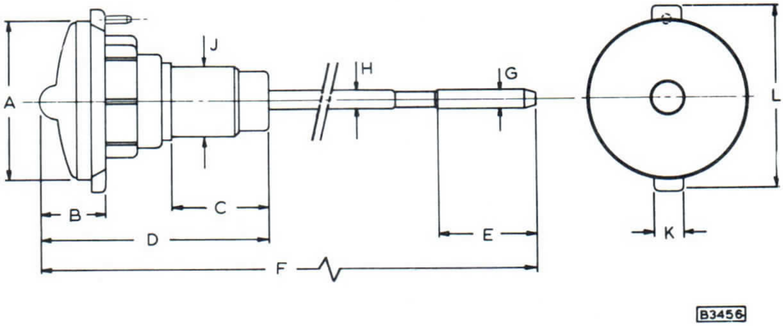
Operation to full specification	-10 to +65	^{o}C
Operation without damage to tube	-20 to +65	^{o}C
Storage	-60 to +85	^{o}C

PHYSICAL DATA

	kg	lb
Weight of LB6-25A	0.2	0.4
Weight of LB6-25A and transit carton (2 valves per carton)	4.0	9.0
Weight of mount P6L11A	5.5	12
Weight of P6L11A mount and transit carton	20.5	45

	cm	in
Dimensions of LB6-25A storage carton	40 × 10 × 10	16 × 4 × 4
Dimensions of P6L11A storage carton	50 × 27 × 14	20 × 11 × 6

OUTLINE DRAWING OF LB6-25A

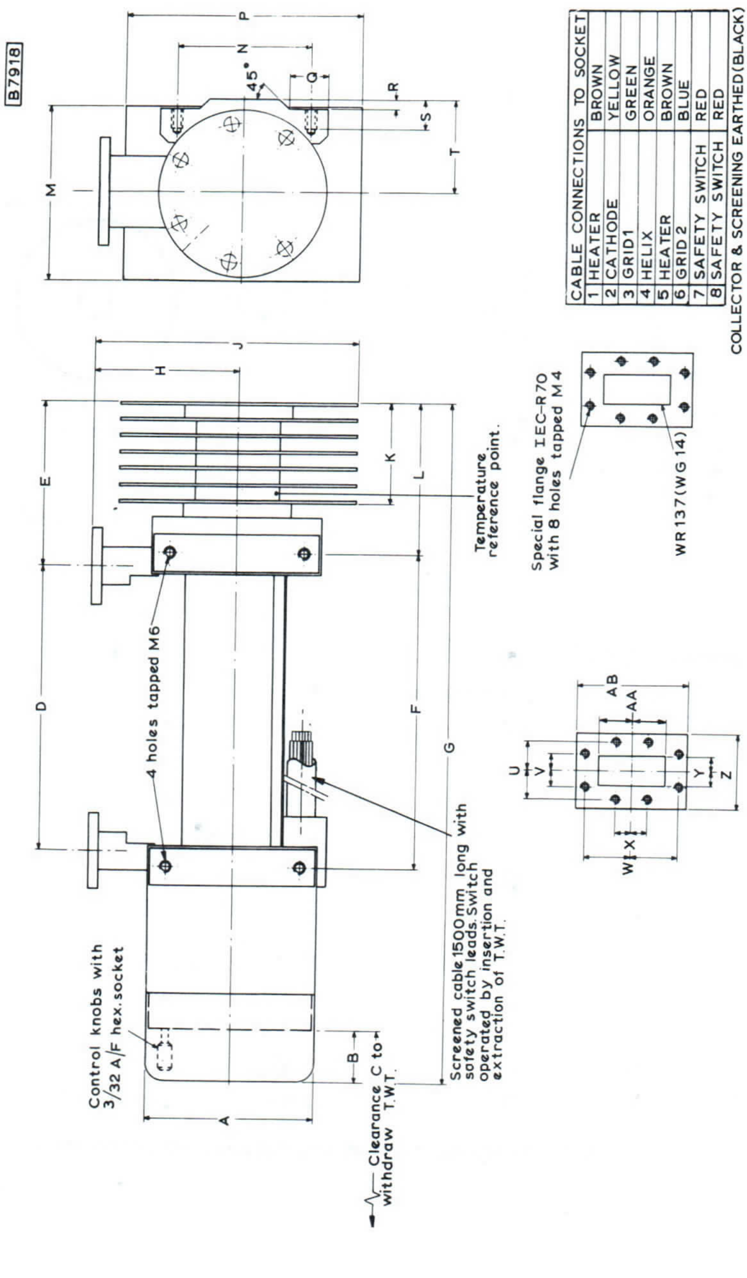


DIMENSIONS OF LB6-25A

	Millimetres	Inches	
A	61	2.40	dia.
B	27	1.06	
C	29	1.14	max.
D	82 ± 1.0	3.228 ± 0.039	
E	45	1.77	
F	348	13.70	max.
G	$7.5^{+0}_{-0.02}$	$0.2953^{+0}_{-0.0008}$	dia.
H	7.5	0.295	dia. max.
J	31.5 ± 0.01	1.2402 ± 0.0004	dia.
K	12	0.47	
L	71	2.80	

Inch dimensions are derived from original millimetre dimensions

OUTLINE DRAWING OF P6L-11A MOUNT



CABLE CONNECTIONS TO SOCKET		
1	HEATER	BROWN
2	CATHODE	YELLOW
3	GRID1	GREEN
4	HELIX	ORANGE
5	HEATER	BROWN
6	GRID 2	BLUE
7	SAFETY SWITCH	RED
8	SAFETY SWITCH	RED

COLLECTOR & SCREENING EARTHED (BLACK)

DIMENSIONS OF P6L11A MOUNT

	Millimetres	Inches	
A	89	3.50	dia.
B	28	1.10	
C	338	13.31	
D	149.2±0.1	5.874±0.004	
E	85	3.35	
F	163.0±0.2	6.417±0.008	
G	356	14.02	
H	76	2.99	
J	139	5.47	
K	52.5	2.067	
L	78	3.07	
M	92	3.62	
N	70.0±0.2	2.756±0.008	
P	125	4.92	
Q	20.0±0.5	0.787±0.020	
R	5.5±0.2	0.217±0.008	
S	16	0.63	
T	50	1.97	
U	14.99±0.05	0.590±0.002	
V	8.71±0.05	0.343±0.002	
W	17.42±0.05	0.686±0.002	
X	8.18±0.05	0.322±0.002	
Y	7.90±0.05	0.311±0.002	
Z	39.0±0.3	1.535±0.011	
AA	24.51±0.05	0.965±0.002	
AB	58.0±0.3	2.283±0.011	

Inch dimensions derived from original millimetre dimensions

TRAVELLING-WAVE TUBE

YH1030

TENTATIVE DATA

QUICK REFERENCE DATA

Convection and radiation cooled forward wave amplifier suitable for use in the power output stages of wideband multi-channel microwave links.

Frequency	6	Gc/s band
Saturation Power Output	25	W
Gain	40	dB
Construction		Unpackaged

To be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

TYPICAL OPERATION

As a power amplifier with the helix earthed and using a mount type 55320.

f	5.9-6.5	6.5-7.2	Gc/s
$V_{collector}$	1.5	1.5	kV
*V_{helix}	2.3-2.25	2.25	kV
V_{gl}	1.95	1.95	kV
$I_{collector}$	65	65	mA
I_{helix}	2.0	2.0	mA
I_{gl}	< 0.1	< 0.1	mA
Gain	36-38	36	dB
Power output	15-10	10	W

*Adjusted for maximum gain

ABSOLUTE MAXIMUM RATINGS

$V_{collector}$ max.	2.0	kV
V_{helix} max.	3.0	kV
I_{helix} max.	4.0	mA
$I_{cathode}$ max.	70	mA
V_{gl} max.	2.5	kV
I_{gl} max.	0.3	mA
$P_{in\ (signal)}$ max.	100	mW

CATHODE

Indirectly heated, dispenser type

V_h (d.c. or r.m.s.)	6.3	V
I_h	800	mA
t_{h-k}	5.0	min

CHARACTERISTICS

	Min.	Typ	Max.	
Frequency band	5.9		7.2	Gc/s
**Low level gain	-		40	dB
Noise factor	-		30	dB
***Saturation power output	-		25	W
Attenuation (at I_k = 0mA)	60		-	dB
Cold input match v.s.w.r.	-		1.5	
Magnetic field strength at axis of mount 55320		600		Gs

**Measured at f = 6.5Gc/s, $I_{collector}$ = 65mA and V_{helix} optimised at 2.2kV.

***Measured at f = 6.5Gc/s, $I_{collector}$ = 65mA and V_{helix} optimised at 2.5kV.

COOLING

Horizontally mounted	Natural by convection and radiation	
Vertically mounted	Natural assisted by low velocity air flow	
$T_{collector\ seal}$ max.	200	^{o}C

MOUNTING POSITION — Any

PHYSICAL DATA

	lb	kg
Weight of YH1030	1.76	0.8
Weight of 55320 mount	55	25

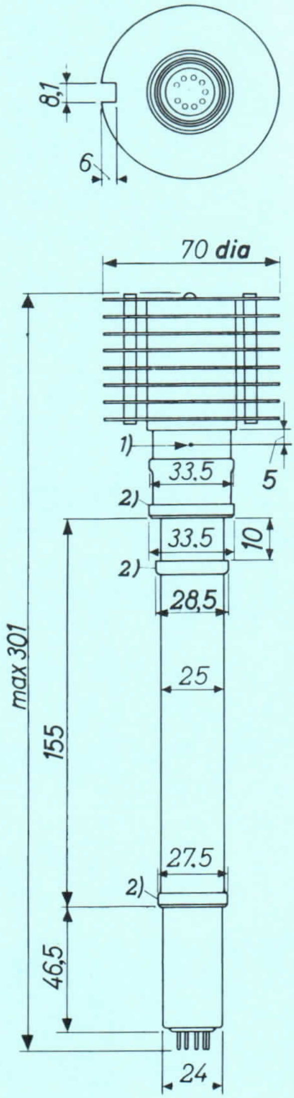
ACCESSORY

Mount	Permanent magnet	55320

DETAILS OF MOUNT 55320 (see page D5)

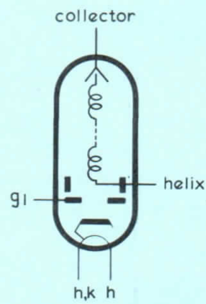
Input and output waveguides	IEC-R70 (RG-50/U, WR137, WG14)
Waveguide flanges	IEC-VER70
Connections of the plug of the mount	1) mount, helix 2) free) interconnected 3) free) 4) collector 5) g_1 6) heater 7) heater, cathode
Mounting position	Any

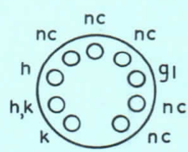
Note If any part of the shielding box is removed or if ferromagnetic materials are introduced into the mount, the magnetic properties of the mount may be disturbed irreversibly. Voltages should never be applied to the tube when the door is open.



B2166

All dimensions in millimetres

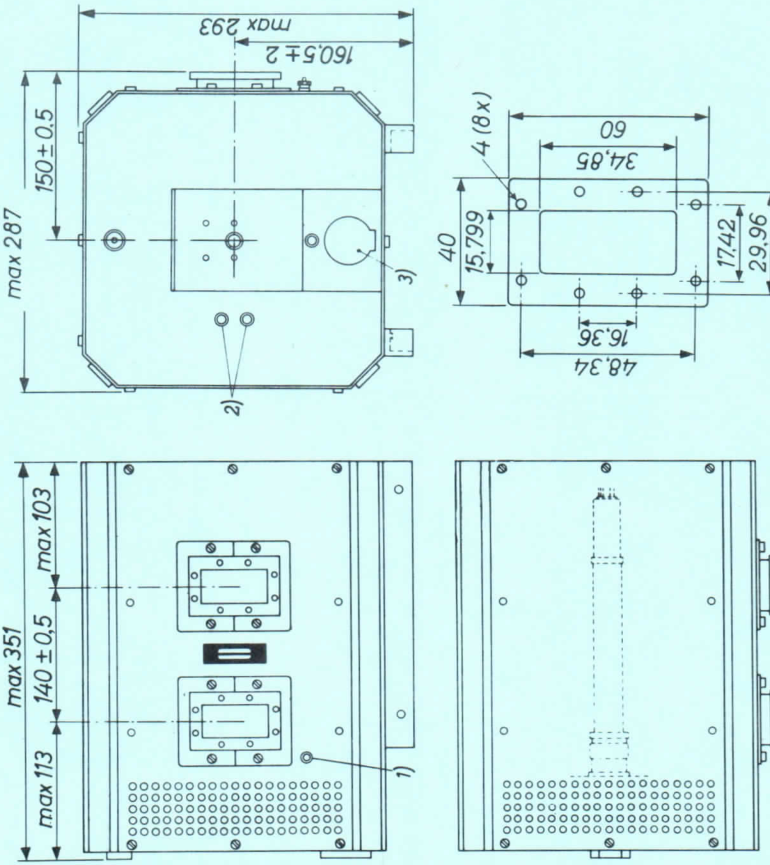




Base: B9A Noval

1) Reference point for collector temperature measurements

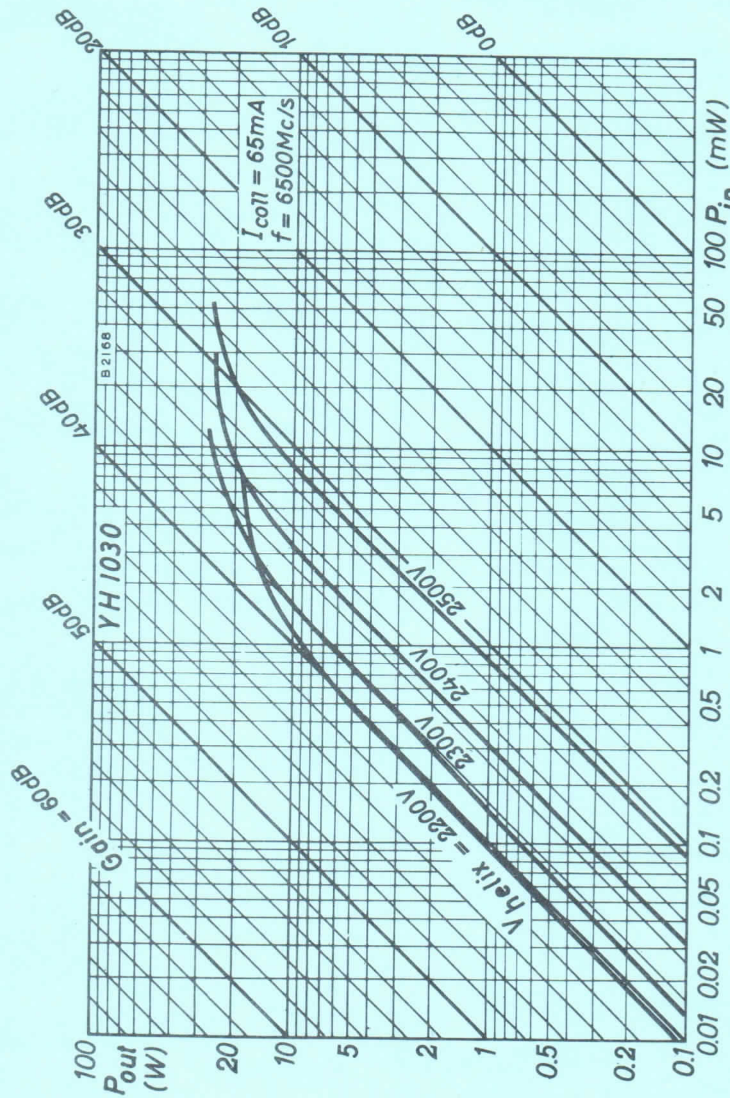
2) Contact rings



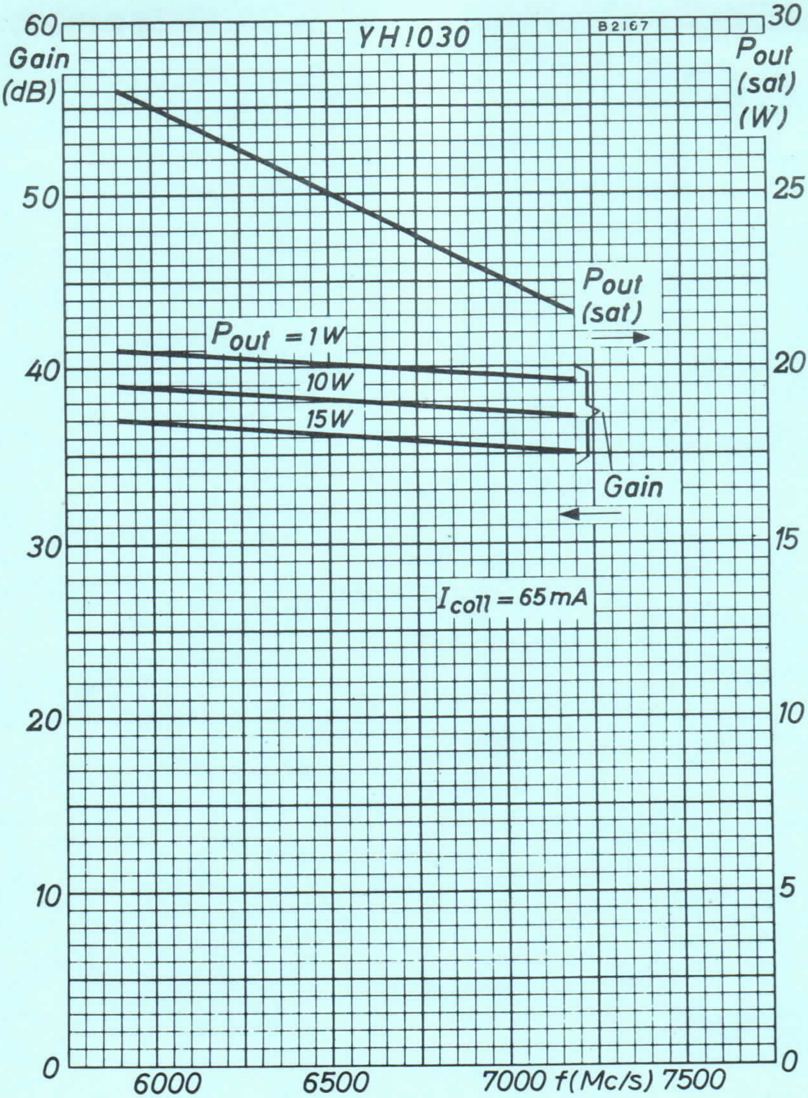
1) Earth connection
2) Focus alignment screws
3) Connector to power supply

Mount 55320

All dimensions in millimetres



OUTPUT POWER PLOTTED AGAINST INPUT POWER
WITH HELIX VOLTAGE AS PARAMETER.
$I_{collector}$ = 65mA at f = 6.5Gc/s.



SATURATION OUTPUT POWER PLOTTED
AGAINST FREQUENCY
HELIX-TO-CATHODE VOLTAGE ADJUSTED
FOR MAXIMUM OUTPUT

GAIN PLOTTED AGAINST FREQUENCY.
HELIX-TO-CATHODE VOLTAGE ADJUSTED
FOR MAXIMUM GAIN

BACKWARD-WAVE OSCILLATOR

YH1100

DEVELOPMENT SAMPLE DATA

QUICK REFERENCE DATA

Backward-wave oscillator, suitable for use in a swept signal generator or as an electronically tuned local oscillator.

f	8.0 to 12.4	Gc/s
Power output	50	mW
Construction	Permanent magnet packaged	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

TYPICAL OPERATION

f	8.0	10	12.4	Gc/s
P_{out}	50	150	120	mW
$V_{slow\ wave\ structure}$	490	910	1980	V
V_{g2}	120	120	120	V
$-V_{g1}$	0	0	0	V
$I_{slow\ wave\ structure}$	20	21	22	mA
I_{g2}	3.0	2.0	2.0	mA

CHARACTERISTICS

	Min.	Max.	
Frequency electronically tunable over range	8.0	12.4	Gc/s
Slow wave structure voltage			
f=8.0Gc/s	460	520	V
f=12.4Gc/s	1800	2100	V
Sensitivity over frequency range	1.3	8.0	Mc/s per V
Power output over frequency range	25	-	mW
Grid voltage - maximum output	-	0	V
- zero output	-	-100	V
Grid cathode resistance	1.0	-	MΩ

CATHODE

Indirectly heated, dispenser type

V_h (d.c. or r.m.s.)	6.3±3%	V
I_h nom.	1.7	A
t_{hk} min.	2.0	min

CAPACITANCES

c_{hk-all}
c_{g-all}
c_{a-all}
$c_{slow\ wave\ structure\ -\ all}$

dependent on connector plug fitting

ABSOLUTE MAXIMUM RATINGS

	Min.	Max.	
$V_{slow\ wave\ structure}$	*	2200	V
V_{g2}	-	350	V
$-V_{g1}$	0	150	V
I_k	-	35	mA
I_{g2}	-	10	mA
$P_{slow\ wave\ structure}$	-	60	W

*This must always be greater than V_{g2}.

DESIGN RANGES FOR POWER SUPPLY

	Min.	Max.	
$V_{slow\ wave\ structure}$ (for full frequency range)	460	2100	V
$I_{slow\ wave\ structure}$	-	35	mA
V_{g2}	30	300	V
$-V_{g1}$ - normally connected to cathode			
- for power control	0	30	V
- for cut-off	100	-	V
I_{g2}	-	10	mA

MOUNTING POSITION

Any

BACKWARD-WAVE OSCILLATOR

YH1100

COOLING

Conduction cooled mount

$T_{reference\ point}$	150°C max.

AMBIENT TEMPERATURE

Operation to full specification	-10 to +65	°C
Storage	-60 to +85	°C.

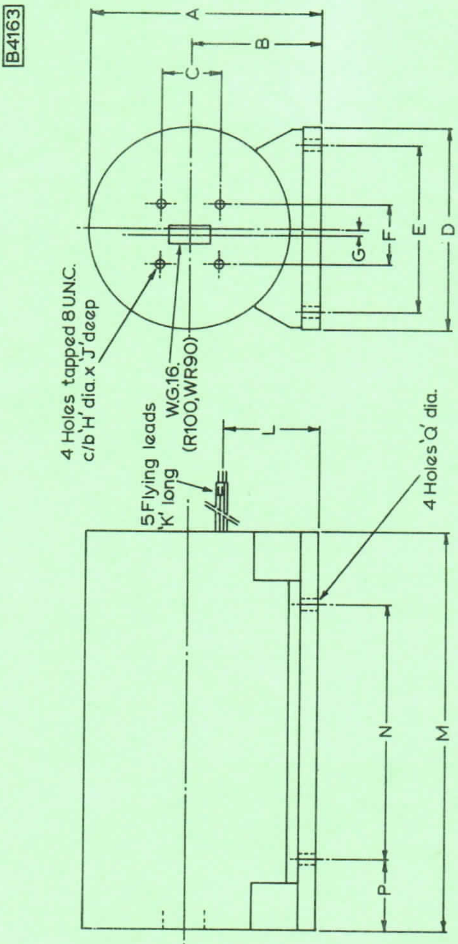
OUTPUT CONNECTION

Rectangular waveguide WG16 (R100, WR90) with bolted rectangular flange

Joint Services type 5985-99-0830052

PHYSICAL DATA

	lb	kg
Weight of YH1100	15	6.75

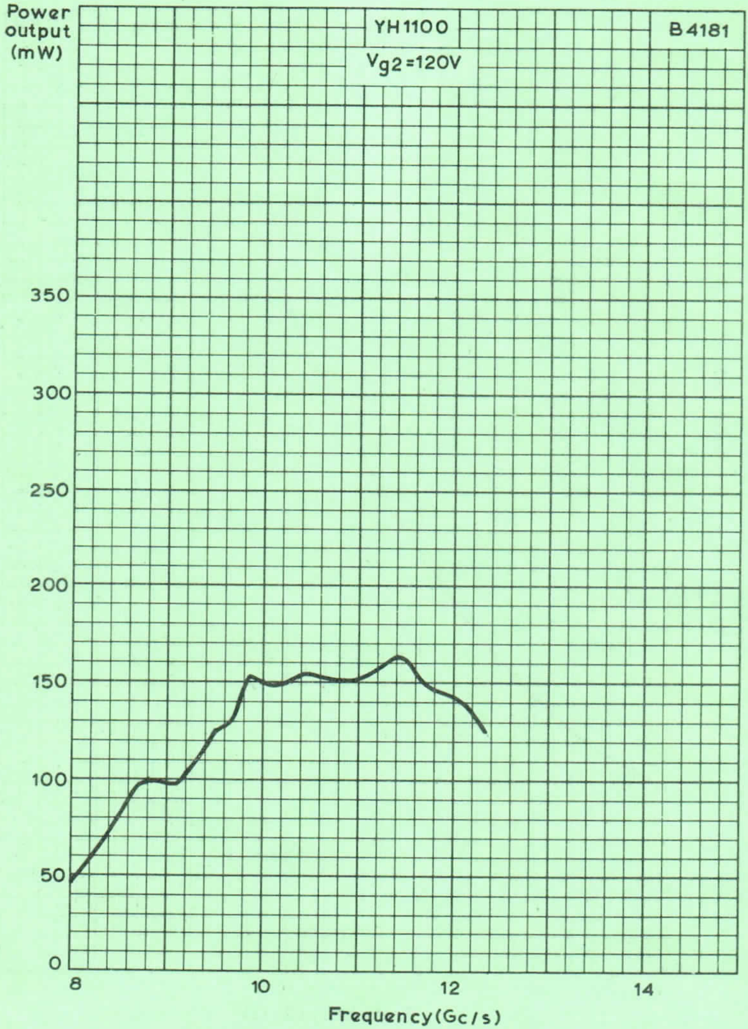

B4163
A
B
C
D
E
F
G
4 Holes tapped 8 U.N.C.
c/b 'H' dia. x 'J' deep
W.G.16.
(R100,WR90)
5 Flying leads
'K' long
L
4 Holes 'Q' dia.
M
N
P

DIMENSIONS

	Inches	Millimetres	
A	4.862	123.5	
B	2.736	69.5	
C	1.220 ± 0.004	30.99 ± 0.1	
D	4.252	108.0	
E	3.465 ± 0.008	88.0 ± 0.2	
F	1.280 ± 0.004	32.51 ± 0.1	
G	0.138 ± 0.004	3.5 ± 0.1	
H	0.169	4.3	dia.
J	0.157	4.0	dia.
K	12.0	305	
L	2.067	52.5	
M	8.5	216	
N	5.512 ± 0.008	140 ± 0.2	
P	1.496	38.0	
Q	0.256	6.5	dia.

Inch dimensions derived from original millimetre dimensions

TYPICAL SLOW WAVE STRUCTURE VOLTAGE PLOTTED AGAINST FREQUENCY



TYPICAL POWER OUTPUT PLOTTED AGAINST FREQUENCY

DISC SEAL TRIODES

DISC SEAL TRIODE

EC157

QUICK REFERENCE DATA

Disc seal triode, intended as a broadband low power amplifier or frequency multiplier.

f	4.0	Gc/s
P_{load}	1.8	W
f max.	4.0	Gc/s
V_a max.	300	V
p_a max.	12.5	W

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

HEATER

$*V_h$	6.3	V
I_h	750	mA

*The absolute variation of heater voltage should be less than ±2%.

MOUNTING POSITION Any

CAPACITANCES (measured with V_h = 6.3V, I_k = 0mA)

c_{a-g}	1.4	pF
c_{a-k}	35	mpF
c_{g-k}	3.0	pF

CHARACTERISTICS

measured at V_a = 180V, I_a = 60mA

	Min.	Av.	Max.	
V_g	0	-1.25	-2.5	V
g_m	15	21	-	mA/V
μ	33	43	52	

measured at V_a = 180V, I_a = 30mA

	Av.	
V_g	-2.8	V
g_m	18	mA/V

COOLING

In order to keep within the seal temperatures, a low velocity air flow may be required.

Maximum temperatures

Anode seal	150	°C
Grid seal	75	°C
Cathode seal	75	°C

ABSOLUTE MAXIMUM RATINGS

$V_{a(b)}$ max.	500	V
V_a max.	300	V
p_a max.	12.5	W
$+V_g$ max.	0	V
$-V_g$ max.	50	V
I_g max.	10	mA
p_g max.	200	mW
I_k max.	70	mA
*$P_{load\ (driver)}$ max.	1.0	W
†R_{g-k} max. (fixed bias)	3.0	kΩ
V_{h-k} max.	50	V
R_{h-k} max.	20	kΩ

*Grounded grid connection(f = 4.0Gc/s).

†This value can be multiplied by the d.c. inverse feedback factor to a maximum of 25kΩ.

RECOMMENDED OPERATION

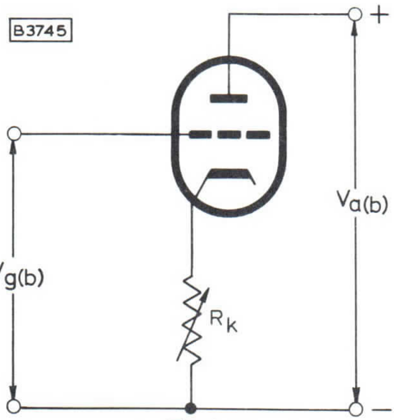


Fig.1

f	4.0	4.0	Gc/s
$V_{a(b)}$	200	200	V
$V_{g(b)}$	+20	+20	V
$^*R_k$	1.0	0.5	kΩ
I_a	30	60	mA
Bandwidth (-0.1dB)	50	50	Mc/s
P_{load} (at V_h = 6.3V)			
Gain = 8dB	-	1.8 (min.1.5)	W
Gain = 6dB	0.5 (min.0.35)	-	W
Gain ($P_{load\ (driver)}$ = 1mW)	13 (min.10)	13 (min. 10)	dB

$^*R_k$ should consist of a variable resistor and be adjusted to give the required anode current (see Fig.1).

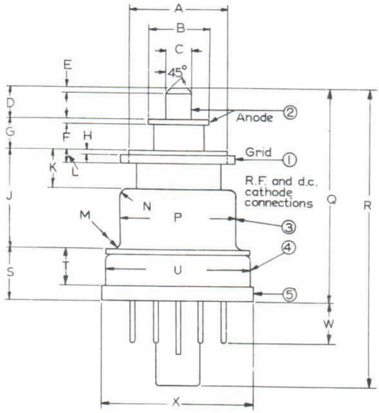
MOUNTING POSITION

In order to screw the valve into a cavity a key with a slip torque of 15kgcm max. is recommended. This should be a key with studs which fit into the notches in the tube base. It is inadvisable to use a device which utilises the pins of the valve base.

DIMENSIONS

	Inches	Millimetres	
A	0.831 ± 0.004	21.1 ± 0.1	
B	0.563 ± 0.001	14.3 ± 0.03	
C	0.250 ± 0.002	6.35 ± 0.05	
D	0.248 ± 0.001	6.3 ± 0.02	
E	0.039	1.0	max.
F	0.031 ± 0.004	0.8 ± 0.1	
G	0.187 ± 0.006	4.75 ± 0.15	
H	0.024 ± 0.004	0.6 ± 0.1	
J	0.878 ± 0.020	22.3 ± 0.5	
K	0.374 ± 0.006	9.5 ± 0.15	
L	0.138 ± 0.008	3.5 ± 0.2	
M	0.059	1.5	max.
N	0.098	2.5	max.
P	1.028 ± 0.008	26.1 ± 0.2	
Q	1.791	45.5	max.
R	2.362	60	max.
S	0.433 ± 0.020	11 ± 0.5	
T	0.339 ± 0.020	8.6 ± 0.5	
U	1.252 ± 0.008	31.8 ± 0.2	
W	0.472	12	max.
X	1.292	32.8	max.
Y	0.039	1.0	max.
Z	0.709 ± 0.008	18 ± 0.2	
AA	0.138	3.5	min.
BB	0.875	22.225	

Inch dimensions derived from original millimetre dimensions



① The eccentricities are given with respect to the axis of the threaded hole shown in Fig.1, the grid disc of the tube being screwed firmly against the flange (with inner diameter of 18mm.)

② Maximum eccentricity of the anode 0·15mm.

③ Maximum eccentricity of the cathode connection 0·20mm.

④ The tolerance of the eccentricity of the base is such that this base fits into a hole with a diameter of 32·5mm, providing this hole is correctly centred with respect to axis of the hole specified in Fig.1.

⑤ The tolerance of the eccentricity of the base flange is such that this base flange fits into a hole with a diameter of 33·5mm, providing this hole is correctly centred with respect to the axis of the hole specified in Fig. 1.

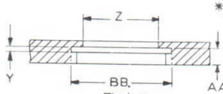
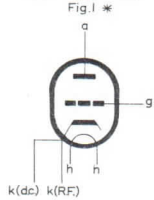
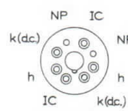


Fig. 1 *

*Data of screw thread of grid disc and of recommended mount. 32 threads per inch; 60° thread angle;

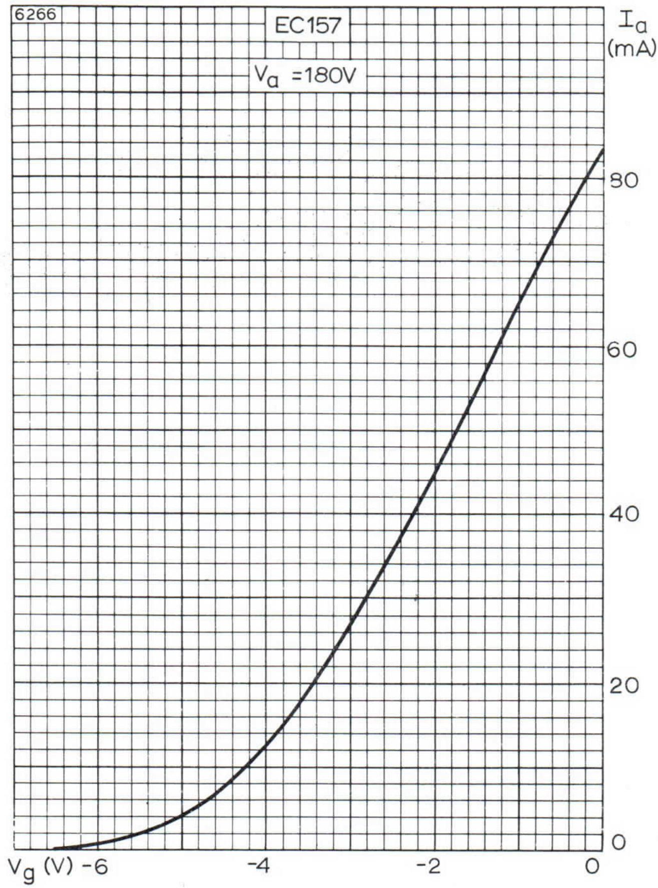
	Minor diameter	Major diameter	Effective diameter
AA Grid	$21{\cdot}22^{+0}_{-0{\cdot}15}$	$22{\cdot}2^{+0}_{-0{\cdot}15}$	$21{\cdot}68^{+0}_{-0{\cdot}09}$
Fig. 1	$21{\cdot}51^{+0}_{-0{\cdot}15}$	22·23 min.	$21{\cdot}83^{+0}_{-0{\cdot}12}$



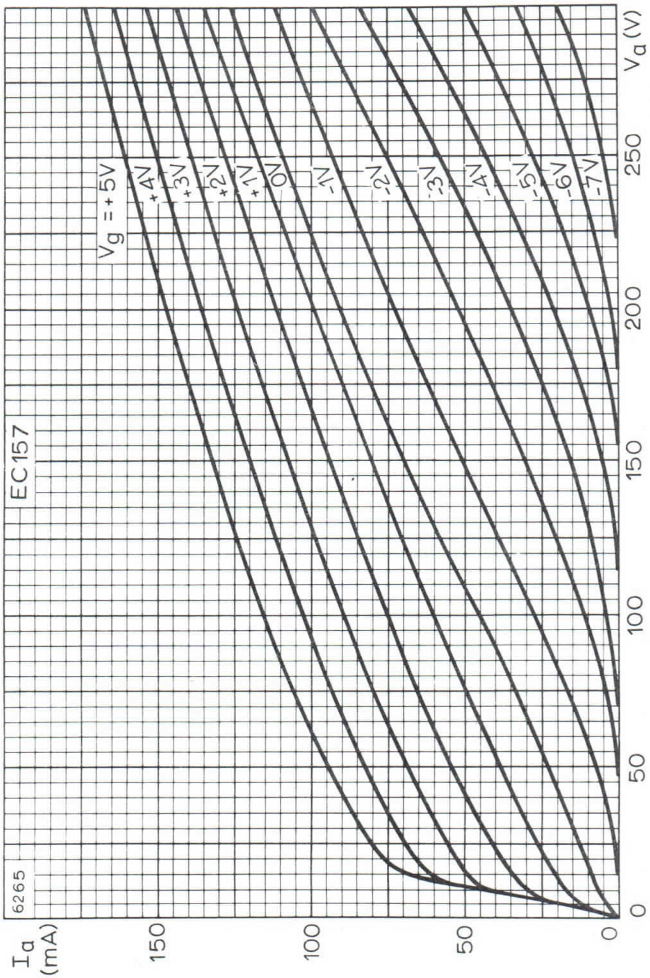


Octal Base

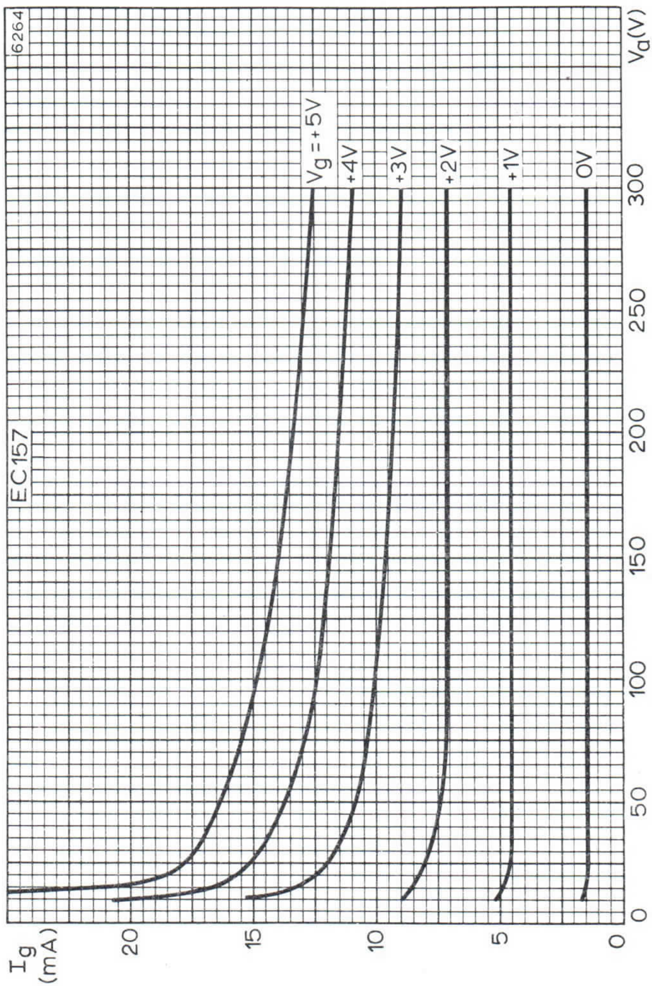
Pins 3 and 8 are connected internally to the cathode disc terminal



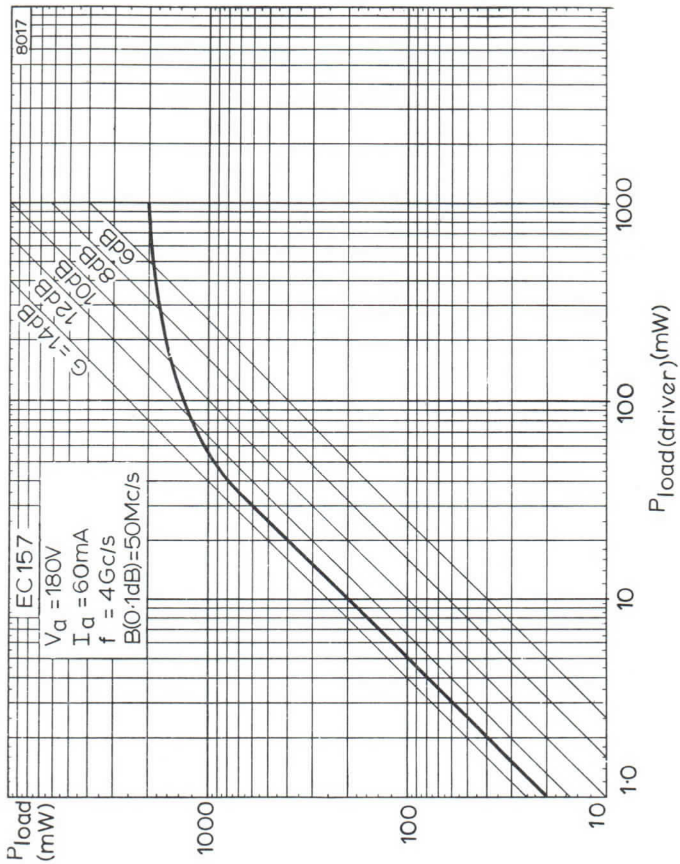
ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER



GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH GRID VOLTAGE AS PARAMETER



POWER GAIN AT 4.0Gc/s

DISC SEAL TRIODE EC158

QUICK REFERENCE DATA

Disc seal triode, intended as broadband low power amplifier or frequency multiplier.

f	4.2	Gc/s
P_{load}	5.3	W
f max.	4.2	Gc/s
V_a max.	300	V
p_a max.	30	W

To be read in conjunction with

GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

HEATER

$^*V_h$	6.3	V
I_h	900	mA

*The absolute variation of heater voltage should be less than ±2%.

MOUNTING POSITION

Any

CAPACITANCES (measured at V_h = 6.3V, I_k = 0mA)

c_{a-g}	1.7	pF
c_{a-k}	36	mpF
c_{g-k}	3.5	pF

CHARACTERISTICS

measured at V_a = 180V, I_a = 60mA

	Min.	Av.	Max.	
V_g	-5.5	-3.5	-1.5	V
g_m	17	22	27	mA/V
μ	20	30	40	

COOLING

In order to keep within the seal temperatures, a low velocity air flow may be required.

Maximum temperatures		
Anode seal	150	°C
Grid seal	75	°C
Cathode seal	75	°C

ABSOLUTE MAXIMUM RATINGS

$V_{a(b)}$ max.	500	V
V_a max.	300	V
p_a max.	30	W
$+V_g$ max.	10	V
$+v_{g(pk)}$ max.	30	V
$-V_g$ max.	50	V
$-v_{g(pk)}$ max.	100	V
I_g max.	25	mA
p_g max.	350	mW
I_k max.	170	mA
*$P_{load\ (driver)}$ max.	2.0	W
†R_{g-k} max. (fixed bias)	3.0	kΩ
V_{h-k} max.	50	V
R_{h-k} max.	20	kΩ

*Grounded grid connection (f = 4.2Gc/s)

†This value can be multiplied by the d.c. inverse feedback factor to a maximum of 25kΩ.

RECOMMENDED OPERATION

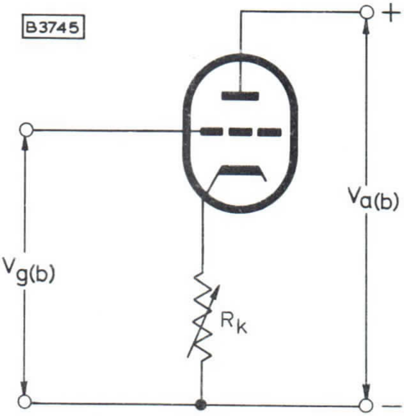


Fig.1

f	4.2	Gc/s
$V_{a(b)}$	200	V
$V_{g(b)}$	+20	V
$^*R_k$	200	Ω
I_a	140	mA
Bandwidth (-0.1dB)	50	Mc/s
P_{load} Gain = 6dB	5.3	W
Gain ($P_{load\ (driver)}$ = 10mW)	11.5	dB

$^*R_k$ should consist of a variable resistor and be adjusted to give the required anode current (see Fig.1).

MOUNTING NOTE

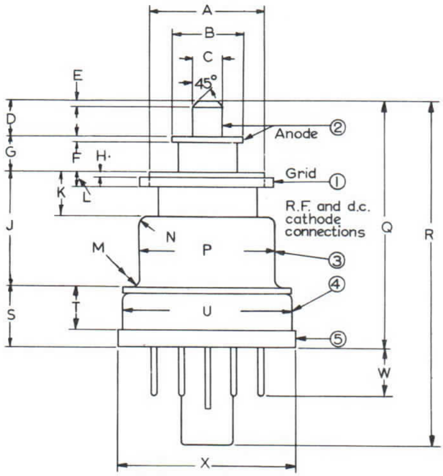
In order to screw the valve into a cavity a key with a slip torque of 15kgcm max. is recommended. This should be a key with studs which fit into the notches in the tube base. It is inadvisable to use a device which utilises the pins of the valve base.

DIMENSIONS

	Inches	Millimetres	
A	0.831 ± 0.004	21.1 ± 0.1	
B	0.563 ± 0.001	14.3 ± 0.03	
C	0.250 ± 0.002	6.35 ± 0.05	
D	0.248 ± 0.001	6.3 ± 0.02	
E	0.039	1.0	max.
F	0.031 ± 0.004	0.8 ± 0.1	
G	0.187 ± 0.006	4.75 ± 0.15	
H	0.024 ± 0.004	0.6 ± 0.1	
J	0.878 ± 0.020	22.3 ± 0.5	
K	0.374 ± 0.006	9.5 ± 0.15	
L	0.138 ± 0.008	3.5 ± 0.2	
M	0.059	1.5	max.
N	0.098	2.5	max.
P	1.028 ± 0.008	26.1 ± 0.2	
Q	1.791	45.5	max.
R	2.362	60	
S	0.433 ± 0.020	11 ± 0.5	
T	0.339 ± 0.020	8.6 ± 0.5	
U	1.252 ± 0.008	31.8 ± 0.2	
W	0.472	12	max.
X	1.291	32.8	max.
Y	0.039	1.0	max.
Z	0.709 ± 0.008	18 ± 0.2	
AA	0.138	3.5	min.
BB	0.875	22.225	

Inch dimensions derived from original millimetre dimensions

B3692



① The eccentricities are given with respect to the axis of the threaded hole shown in Fig.1, the grid disc of the tube being screwed firmly against the flange (with inner diameter of 18mm.)

② Maximum eccentricity of the anode 0·15mm.

③ Maximum eccentricity of the cathode connection 0·20mm.

④ The tolerance of the eccentricity of the base is such that this base fits into a hole with a diameter of 32·5mm, providing this hole is correctly centred with respect to axis of the hole specified in Fig.1.

⑤ The tolerance of the eccentricity of the base flange is such that this base flange fits into a hole with a diameter of 33·5mm, providing this hole is correctly centred with respect to the axis of the hole specified in Fig.1.

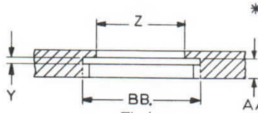
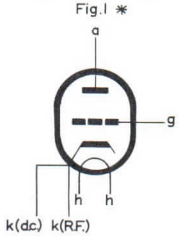
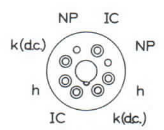


Fig.1 *

*Data of screw thread of grid disc and of recommended mount. 32 threads per inch; 60° thread angle;

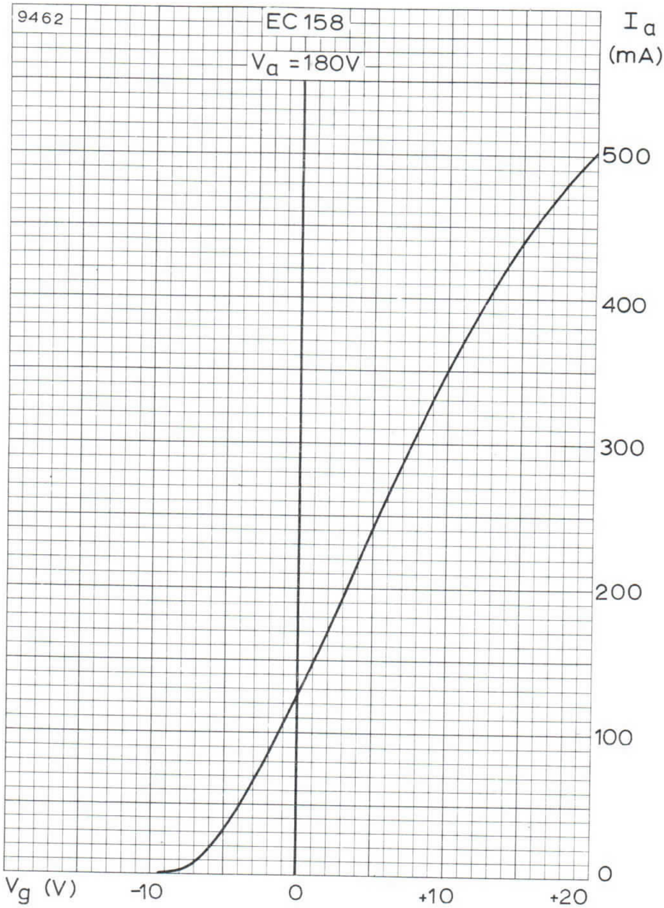
	Minor diameter	Major diameter	Effective diameter
Grid	$21{\cdot}22^{+0}_{-0{\cdot}15}$	$22{\cdot}2^{+0}_{-0{\cdot}15}$	$21{\cdot}68^{+0}_{-0{\cdot}09}$
Fig. I	$21{\cdot}51^{+0}_{-0{\cdot}15}$	22·23 min.	$21{\cdot}83^{+0}_{-0{\cdot}12}$



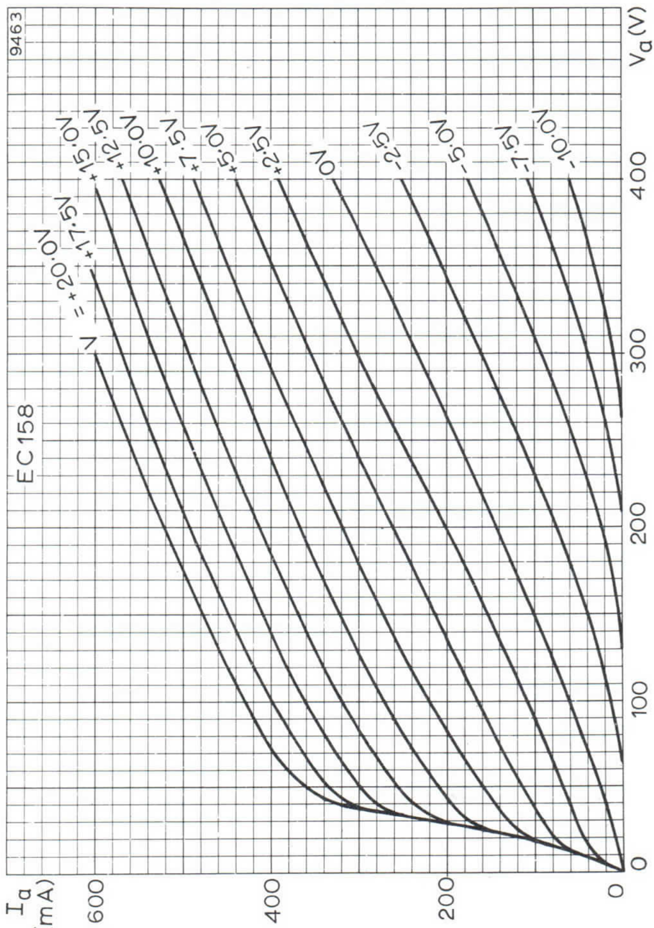


Octal Base

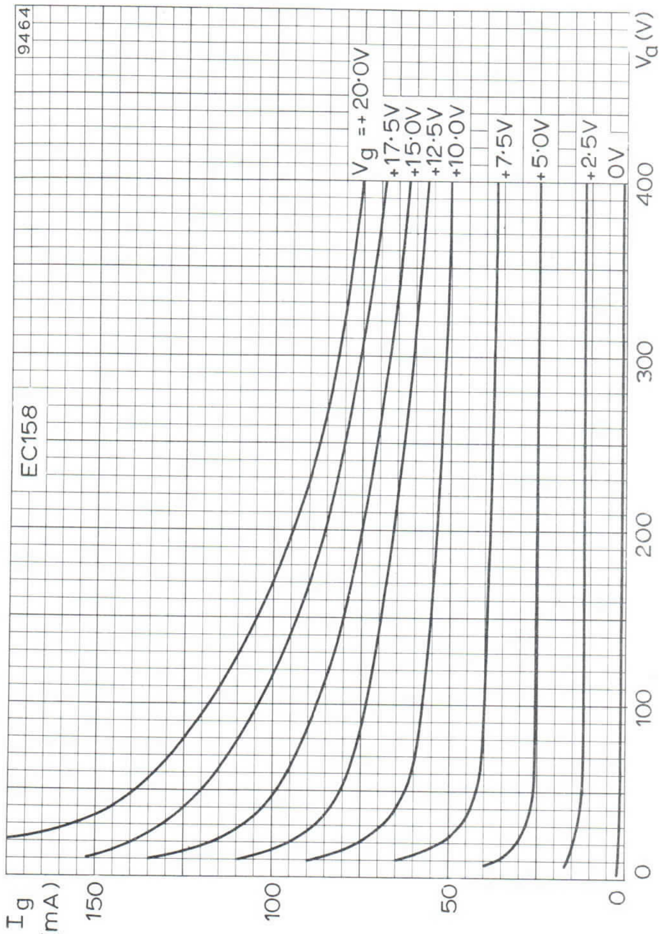
Pins 3 and 8 are connected internally to the cathode disc terminal



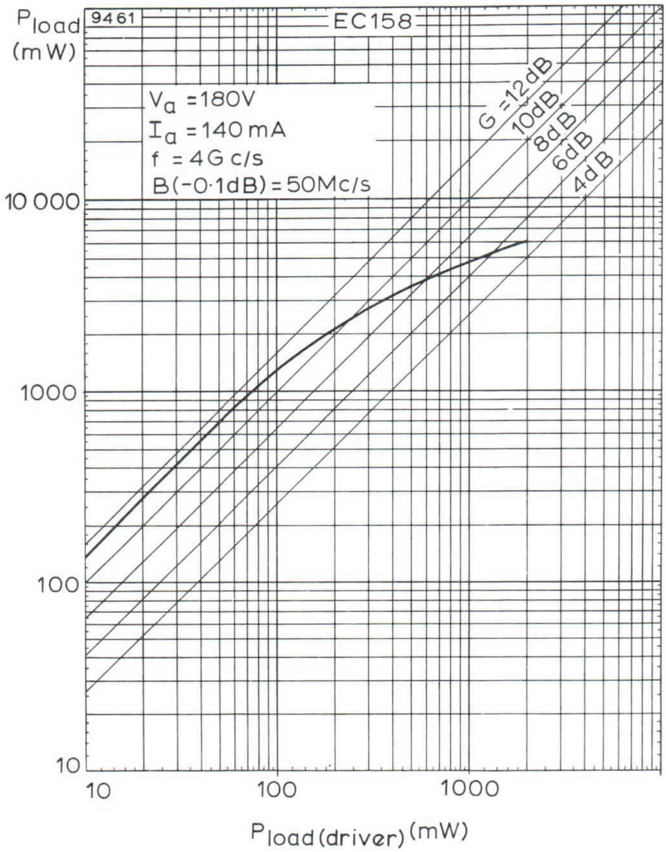
ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE, WITH GRID VOLTAGE AS PARAMETER



GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE, WITH GRID VOLTAGE AS PARAMETER



POWER GAIN AT 4.0Gc/s

DISC SEAL TRIODE

TD03-5

Application: *R.F. amplifier*
Frequency: 2.0*Gc/s*
Construction: *Disc seal, natural cooling*

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—TRANSMITTING VALVES included in this section of the handbook.

HEATER

V_h	6.3	V
I_h	400	mA

MOUNTING POSITION

Any

CAPACITANCES

c_{a-g}	1.0	pF
c_{a-k}	10	mpF
c_{g-k}	2.0	pF

CHARACTERISTICS

V_a	250	V
I_a	10	mA
μ	70	
g_m	6.5	mA/V

OPERATING CONDITIONS

V_a	250	V
V_g	−2.0	V
I_a	10	mA
Noise factor		
at 1.0Gc/s with 15dB power gain	9.5	dB
at 1.5Gc/s with 13.5dB power gain	12	dB
at 2.0Gc/s with 11.5dB power gain	14.5	dB

LIMITING VALUES

V_a max.	350	V
I_k max.	25	mA
p_a max.	5.0	W
$T_{anode\ seal}$ max.	140	°C

In order to limit the anode seal temperature and also to limit the rate of change of temperature it is necessary that the mass of metal in close thermal contact with the anode disc shall not be less than 45g ($1\frac{1}{2}$ oz) of brass or its thermal equivalent.

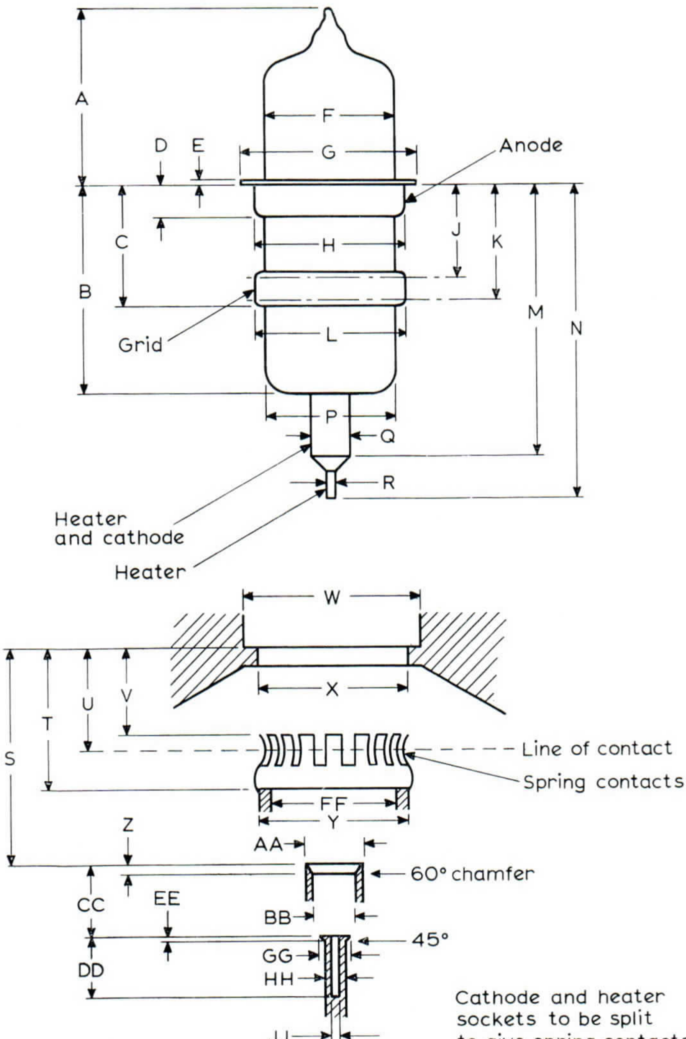
DIMENSIONS

	Inches	*Millimetres*	
A	0.876	22.25	max.
B	1.053	26.75	max.
C	0.621 ± 0.039	15.75 ± 1.00	
D	0.165 ± 0.004	4.2 ± 0.1	
E	0.012	0.3	
F	*	*	
G	0.876 ± 0.004	22.25 ± 0.10	
H	0.748 ± 0.006	19.00 ± 0.15	
J	0.484	12.3	max.
K	0.539	13.7	min.
L	$0.748^{+0.000}_{-0.010}$	$19.00^{+0.00}_{-0.25}$	
M	1.366 ± 0.039	34.7 ± 1.0	
N	1.575 ± 0.020	40.0 ± 0.5	
P	†	†	
Q	0.187 ± 0.004	4.75 ± 0.10	
R	0.044 ± 0.001	1.120 ± 0.025	
S	1.073 ± 0.010	27.25 ± 0.25	
T	0.709	18	min.
U	0.512	13	
V	0.433 ± 0.010	11.00 ± 0.25	
W	0.898 ± 0.005	22.80 ± 0.12	
X	0.776 ± 0.005	19.70 ± 0.12	
Y	0.748	19	
Z	$0.039^{+0.000}_{-0.006}$	$1.00^{+0.00}_{-0.15}$	
AA	0.248	6.3	
BB	0.187	4.76	
CC	0.364 ± 0.010	9.25 ± 0.25	
DD	0.315	8.0	min.
EE	$0.020^{+0.000}_{-0.003}$	$0.500^{+0.000}_{-0.075}$	
FF	0.677	17.2	max.
GG	0.125	3.17	
HH	0.094	2.38	
JJ	0.046	1.18 (No. 56 drill)	

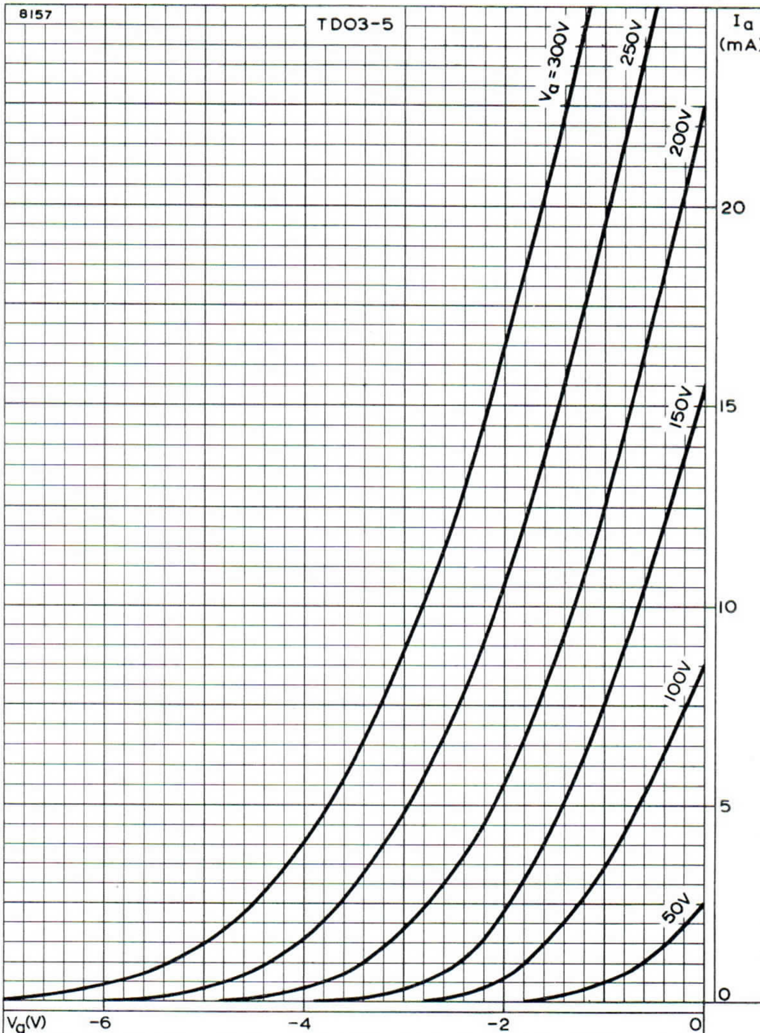
*To fit inside a cylinder of 17.5mm (0.689in) diameter co-axial with the anode disc. This diameter may be continued to maximum length.

†Grid disc to fit co-axially inside a cylinder of 17.2mm (0.677in) diameter.

Note—The eccentricity of the grid, cathode and heater contacts shall not exceed 0.375mm (0.015in).


A
B
C
D
E
F
G
H
J
K
L
M
N
P
Q
R
Anode
Grid
Heater
and cathode
Heater
W
X
S
T
U
V
Line of contact
Spring contacts
FF
Y
Z
AA
60° chamfer
CC
EE
BB
45°
GG
HH
DD
JJ
Cathode and heater
sockets to be split
to give spring contacts

8128



ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER

DISC SEAL TRIODE TD03-10

QUICK REFERENCE DATA

Disc seal triode, intended for use in a common grid, earthed anode, concentric line oscillator or power amplifier.

f	1.0	Gc/s
Pout	2.8	W
f max.	3.75	Gc/s
Va max.	350	V
pa max.	10	W

To be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES.

HEATER

Indirectly heated

Vh	6.3	V
Ih (approx.)	0.4	A

CAPACITIES

ca-g	1.1	pF
ca-k	20	mpF
cg-k	2.2	pF

CHARACTERISTICS

Measured at Va = 250V, Vg = -3.5V, Ia = 20mA

gm	6.0	mA/V
μ	30	

LIMITING VALUES

Va max.	350	V
pa max.	10	W
Ia max.	50	mA
ia(pk) max.	150	mA
pg max.	0.5	W
Tanode-seal max.	140	^{o}C
Tgrid-seal max.	140	^{o}C

In order to limit the rate of change of anode seal temperature, it is necessary that the mass of metal in close thermal contact with the anode disc shall not be less than 2oz (60g) of brass or its thermal equivalent.

OPERATING NOTES

A typical circuit arrangement is shown where the anode-to-grid and grid-to-cathode circuits are both coaxial lines, the grid line being common to both circuits.

Tuning is effected in both circuits by means of movable bridges which should ideally be a quarter of a wavelength in length to ensure that the actual contact occurs at a current node. Over the wavelength range 10 to 60cm a good compromise is obtained with a bridge of 2.5cm in length.

It is essential that perfect contact is maintained between the lines and the bridges.

The heater-to-cathode circuit may be tuned by means of a capacity bridge. For the longer wavelengths tuning is not essential but must be employed for wavelengths around 10cm. A bridge positioned 7.2cm from the valve end of the cathode line will give satisfactory operation over the range 8 to 12cm.

Feedback is obtained by means of an adjustable capacitive probe (6BA threaded rod) which makes contact with the anode line and passes through a 1/4-in hole in the grid line. For wavelengths longer than 30cm it is advisable to terminate the probe by a small circular disc. Below 30cm this is unnecessary, and at approximately 10cm the increased capacitance prohibits its use.

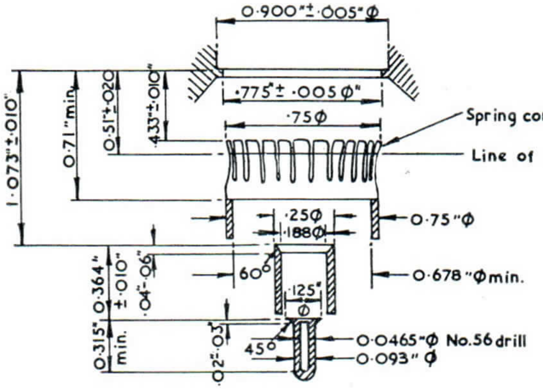
It is impossible to use a single probe position over each oscillator range and three positions A, B and C are given below for a typical circuit together with the range of wavelengths covered.

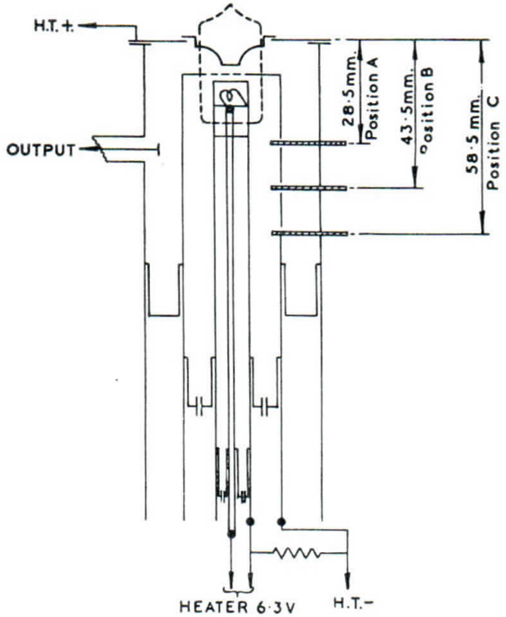
Probe position	Distance from anode plane (mm)	Range of λ with anode line $3/4\ \lambda$ mode (cm)	Min. λ with anode line on $1/4\ \lambda$ mode (cm)
A	28.5	9 to 14	24
B	43.5	11 to 19	29
C	58.5	12 to 24	35

DISC SEAL TRIODE

TD03-10

Indirectly-heated disc seal triode, without internal feedback, primarily intended for use as a common grid, earthed anode, concentric line oscillator. It may also be used as a power amplifier.





TYPICAL CIRCUIT ARRANGEMENT FOR OSCILLATOR

TD03-10

DISC SEAL TRIODE

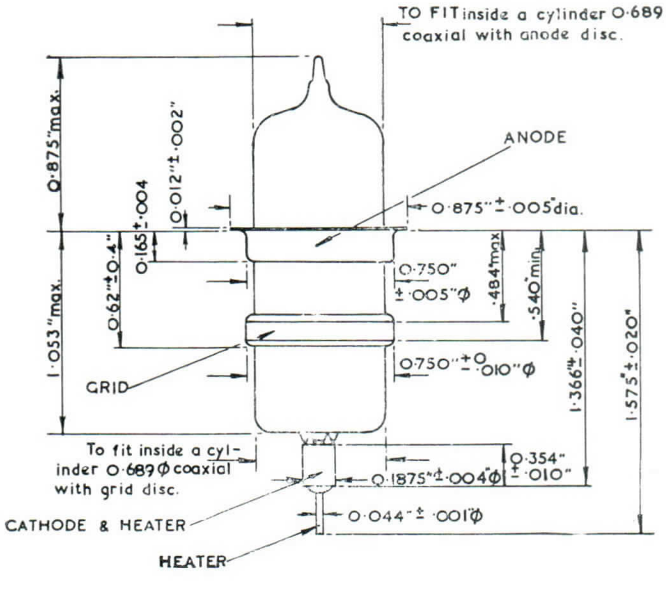
Indirectly-heated disc seal triode, without internal feedback, primarily intended for use as a common grid, earthed anode, concentric line oscillator. It may also be used as a power amplifier.

In order that bias may be used, a capacitor is incorporated in the grid-cathode bridge. The optimum value of bias varies with frequency and the following table gives the approximate values of cathode resistor for various wavelengths.

Operating Wavelength (cm)	Cathode Bias Resistor (Ω)
30	300 to 350
15	100
<12	0

Zero bias at a wavelength of 30 cm may cause a reduction in efficiency of 50%.

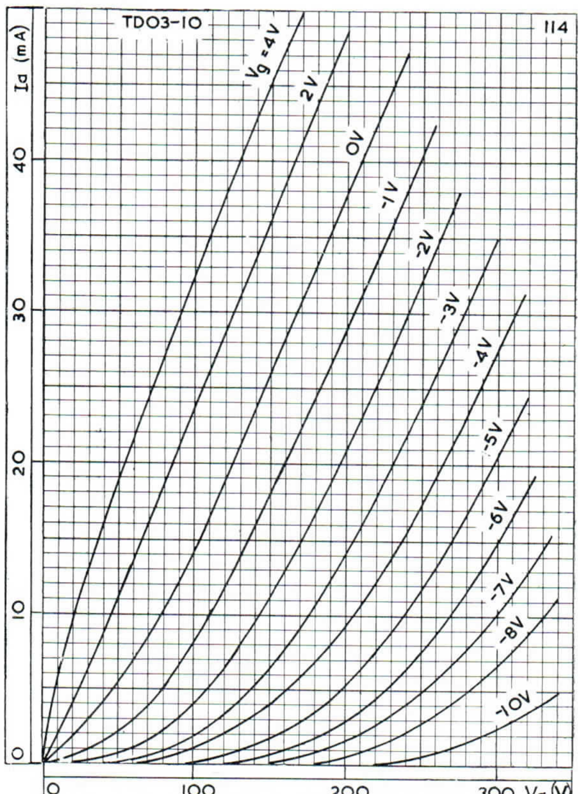
The output may be coupled into a 75 Ω line by means of a capacitive probe and this can be adjusted for optimum coupling by sliding the probe along the line, or by varying the depth of penetration towards the grid line.



DISC SEAL TRIODE

TD03-10

Indirectly-heated disc seal triode, without internal feedback, primarily intended for use as a common grid, earthed anode, concentric line oscillator. It may also be used as a power amplifier.

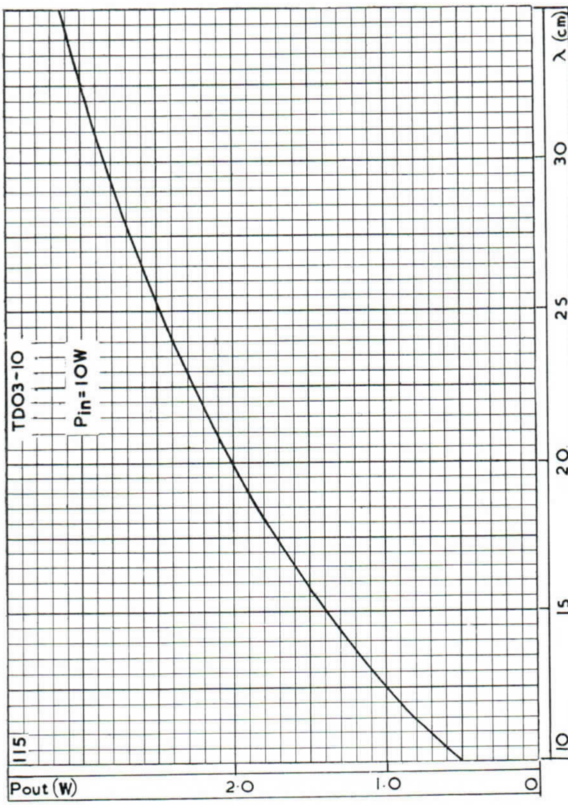


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER

TD03-10

DISC SEAL TRIODE

Indirectly-heated disc seal triode, without internal feedback, primarily intended for use as a common grid, earthed anode, concentric line oscillator. It may also be used as a power amplifier.



OUTPUT POWER PLOTTED AGAINST WAVELENGTH

DISC SEAL TRIODE

TD03-10F

Indirectly heated disc seal triode, with internal feedback, primarily intended for use as a common grid earthed, anode, concentric line oscillator.

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS — TRANSMITTING VALVES included in this volume of the handbook.

HEATER

V_h	6.3	V
I_h (approx.)	400	mA

MOUNTING POSITION

Any

CAPACITANCES

c_{a-g}	1.4	pF
c_{a-k}	0.045	pF
c_{g-k}	1.7	pF

CHARACTERISTICS (measured at $V_a = 250V$, $I_a = 20mA$, $V_g = -3.5V$)

g_m	6.0	mA/V
μ	30	

COOLING

$T_{anode\ seal}$ max.	140	°C

In order to limit the anode seal temperature and also to limit the rate of change of anode seal temperature, it is necessary that the mass of metal in close thermal contact with the anode disc shall not be less than 60g (2oz) of brass or its thermal equivalent.

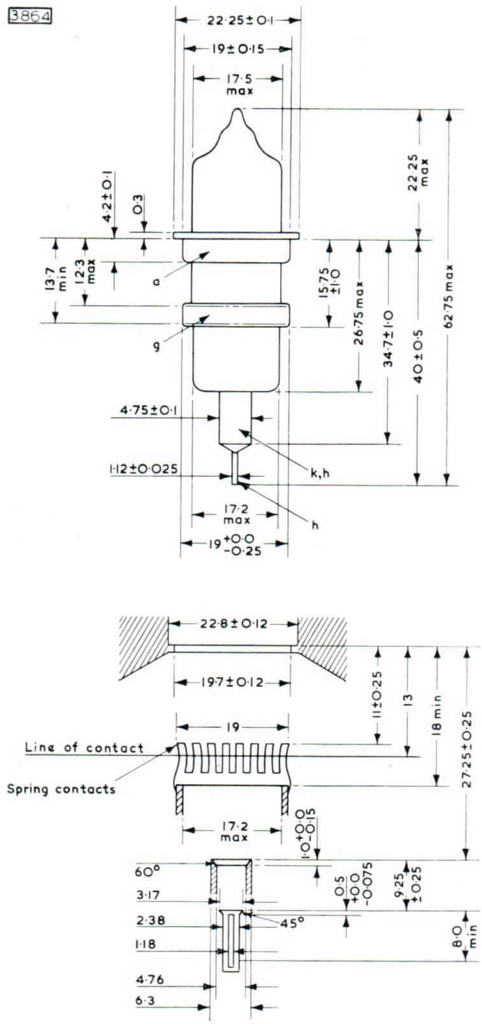
LIMITING VALUES

V_a max.	350	V
p_a max.	10	W
I_a max.	50	mA
$i_{a(pk)}$ max.	150	mA
p_g max.	500	mW

TD03-10F

DISC SEAL TRIODE

Indirectly heated disc seal triode, with internal feedback, primarily intended for use as a common grid, earthed anode, concentric line oscillator.



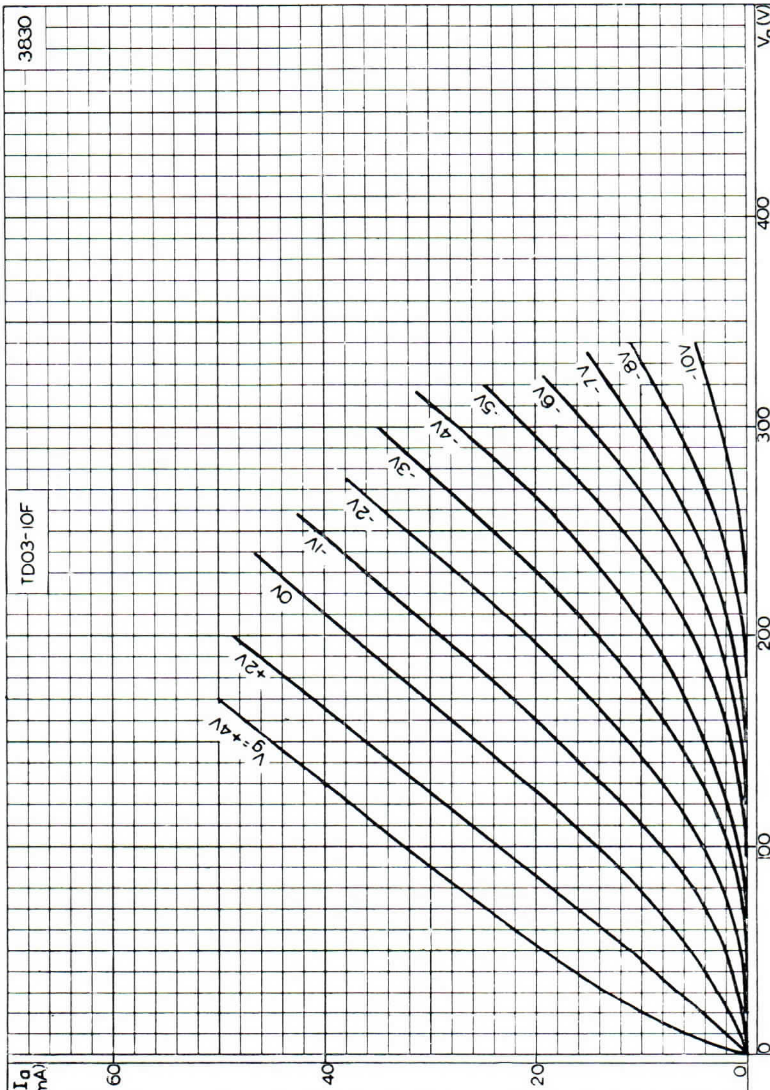
Note:
Eccentricity of grid, cathode and heater contacts shall not exceed 0·375

All dimensions in mm

DISC SEAL TRIODE

TD03-10F

Indirectly heated disc seal triode, with internal feedback, primarily intended for use as a common grid, earthed anode, concentric line oscillator.

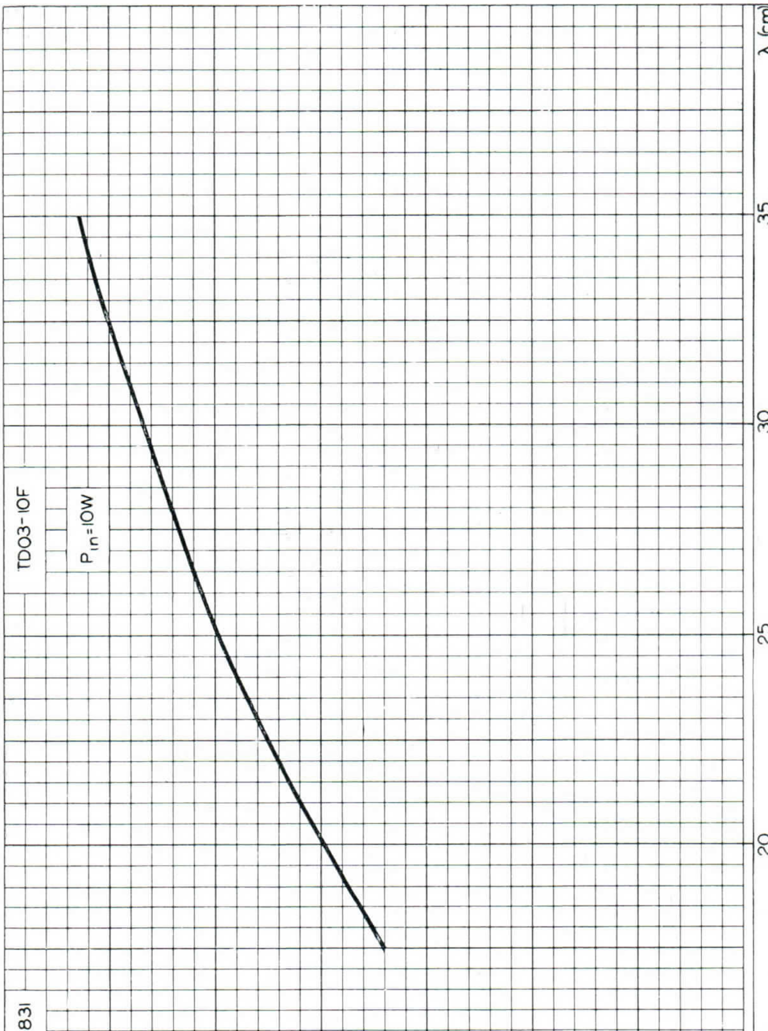


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

TD03-10F

DISC SEAL TRIODE

Indirectly heated disc seal triode, with internal feedback, primarily intended for use as a common grid, earthed anode concentric line oscillator.



POWER OUTPUT PLOTTED AGAINST WAVELENGTH

DISC SEAL TRIODE

TD04-20

Application: *R.F. amplifier or oscillator.*
Power output: *13.5W at $f = 1.0$Gc/s.*
Construction: *Disc seal, natural cooling.*

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – TRANSMITTING VALVES included in this volume of the handbook.

CATHODE

Indirectly heated

V_h	6.3	V
I_h	1.0	A

MOUNTING POSITION

Any

CAPACITANCES

c_{a-g}	2.3	pF
c_{a-k}	50	mpF
c_{g-k}	5.0	pF

CHARACTERISTICS

V_a	400	V
I_a	50	mA
g_m	10	mA/V
μ	28	

LIMITING VALUES

V_a max.	400	V
p_a max.	20	W
I_k max.	150	mA
$i_{k(pk)}$ max.	600	mA
p_g max.	1.0	W
$T_{anode\ seal}$ max.	140	°C

In order to limit the anode seal temperature and also to limit the rate of change of temperature it is necessary that the mass of metal in close thermal contact with the anode disc should not be less than 120g (approx. 4 oz) of brass or its thermal equivalent.

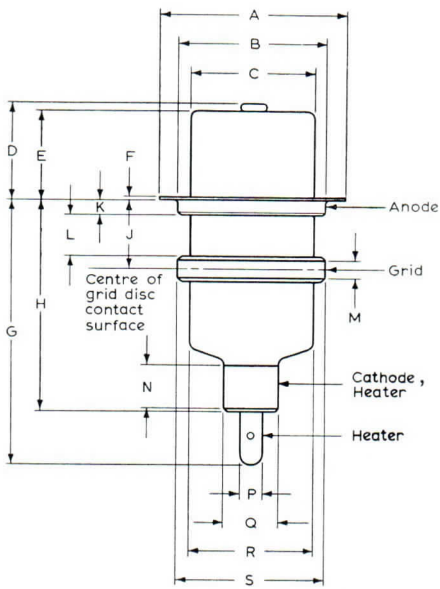
TD04-20

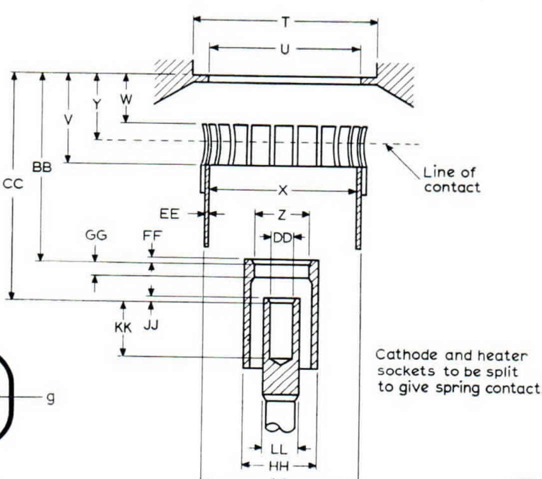
DISC SEAL TRIODE

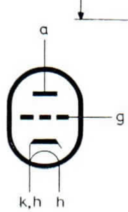
DIMENSIONS

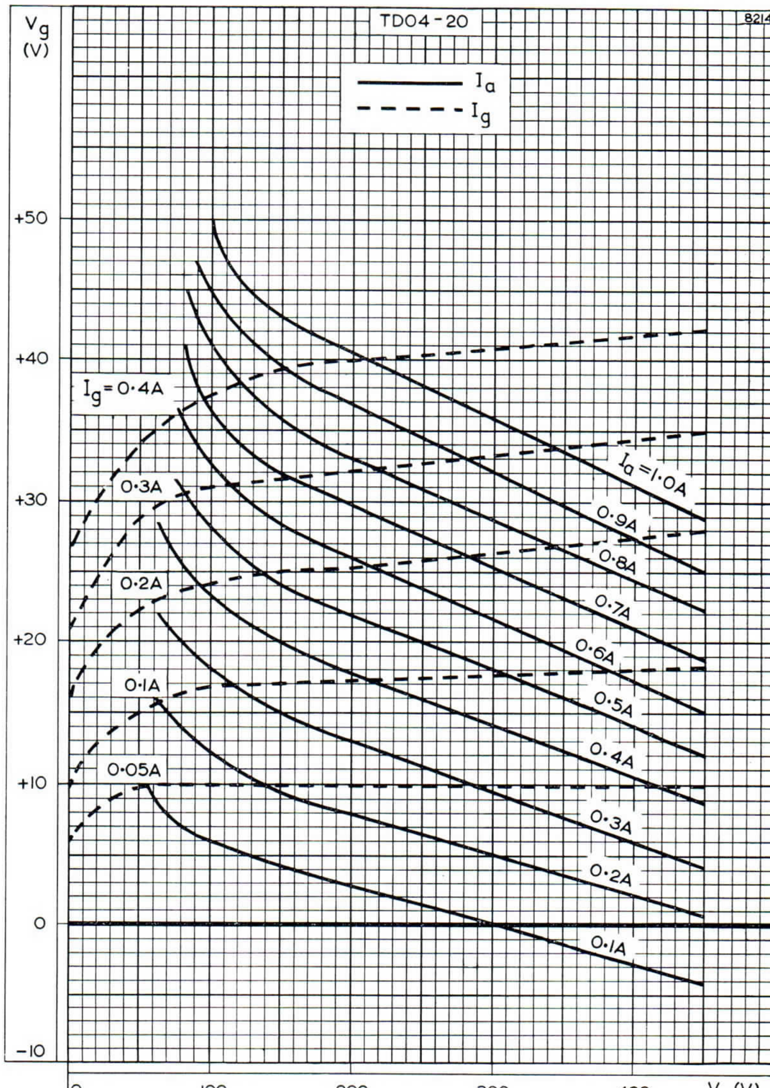
	Inches	Millimetres	
A	1.252 ± 0.020	31.8 ± 0.5	
B	1.000 ± 0.010	25.4 ± 0.25	
C	*	*	
D	1.000	25.4	max.
E	0.902	22.9	max.
F	0.012 ± 0.002	0.3 ± 0.05	
G	1.772 ± 0.059	45.0 ± 1.5	
H	1.417 ± 0.039	36 ± 1	
J	0.465 ± 0.030	11.8 ± 0.75	
K	0.106	2.7	
L	0.280 ± 0.020	7.1 ± 0.5	
M	0.098	2.5	min.
N	0.299 ± 0.059	7.6 ± 1.5	
P	0.156 ± 0.004	3.96 ± 0.1	
Q	$0.375 {}^{+0.015}_{-0.000}$	$9.53 {}^{+0.38}_{-0.00}$	
R	*	*	
S	1.000 ± 0.010	25.4 ± 0.25	
T	1.275	32.39	min.
U	1.063 ± 0.005	27.00 ± 0.13	
V	0.630 ± 0.010	16.00 ± 0.25	
W	0.354 ± 0.010	8.99 ± 0.25	
X	1.000	25.40	
Y	0.453 ± 0.010	11.51 ± 0.25	
Z	0.375	9.53	
AA	1.063	27.00	
BB	1.260 ± 0.010	32.00 ± 0.25	
CC	1.535 ± 0.010	38.99 ± 0.25	
DD	0.156	3.96	
EE	0.031	0.79	
FF	0.031	0.79	
GG	0.094	2.39	
HH	0.500	12.70	
JJ	0.031	0.79	
KK	0.406	10.31	min.
LL	0.250	6.35	

*To fit inside a cylinder 24.13mm (0.950 in) diameter, co-axial with the anode disc.

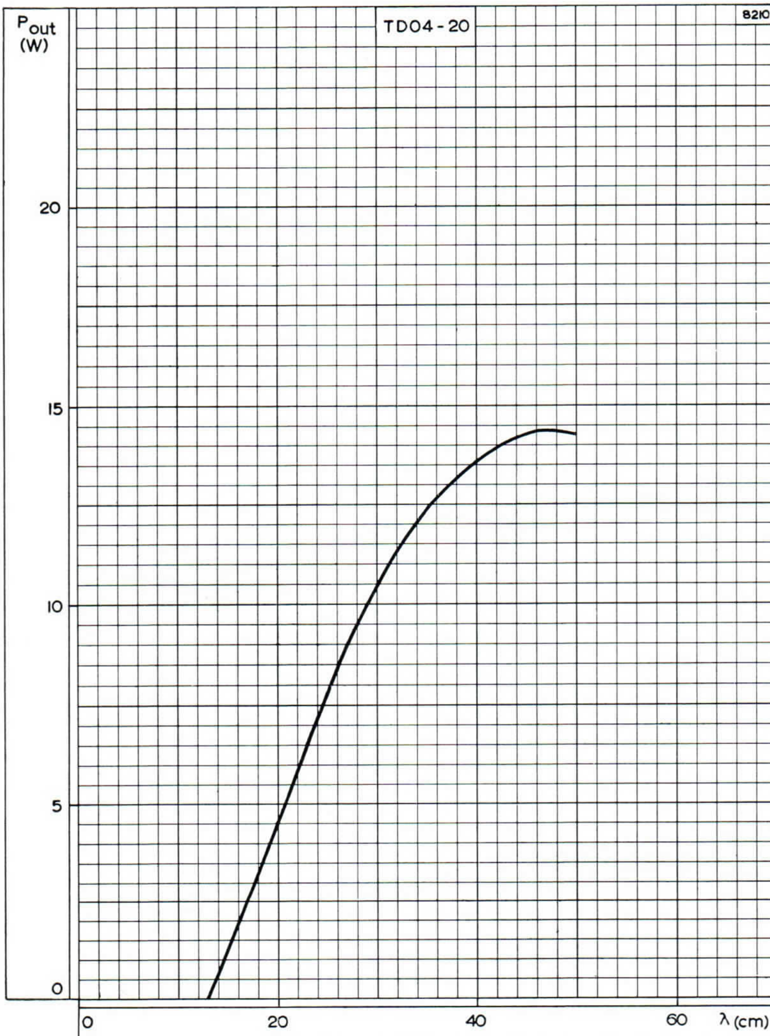

A
B
C
D
E
F
K
L
J
Anode
Grid
M
Centre of grid disc contact surface
H
G
N
Cathode, Heater
Heater
P
Q
R
S


T
U
W
Y
V
BB
CC
Line of contact
X
EE
Z
GG
FF
DD
KK
JJ
Cathode and heater sockets to be split to give spring contacts
LL
HH
AA
8158

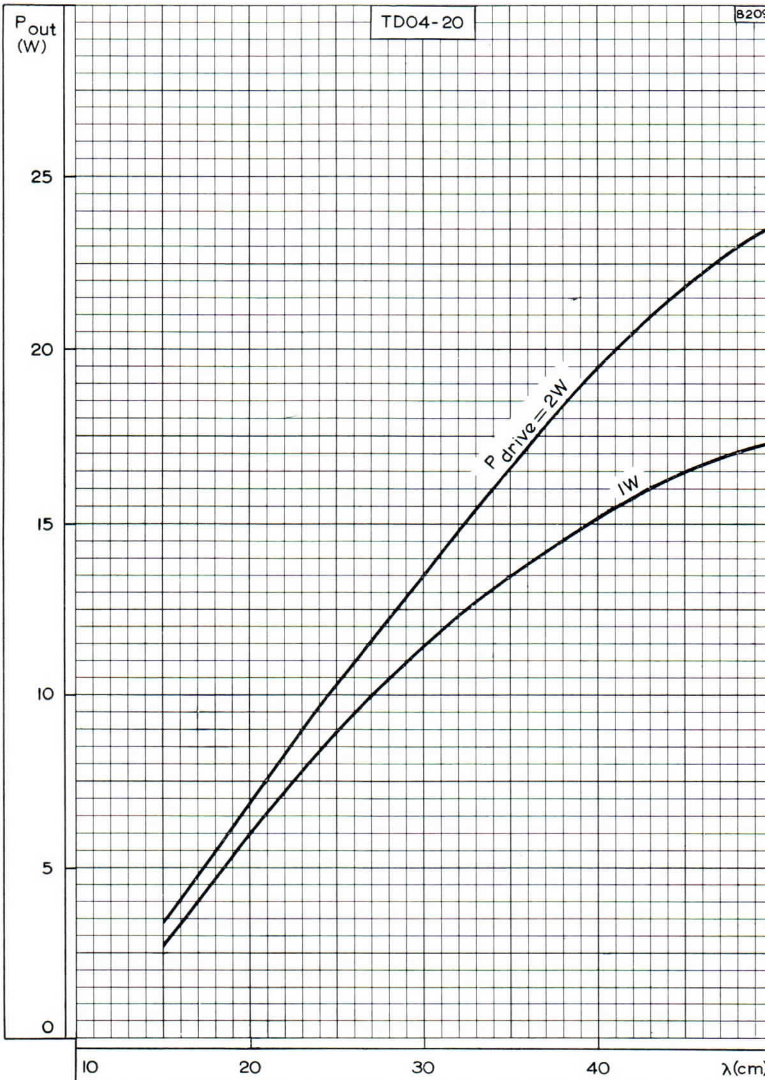

a
g
k,h
h



CONSTANT CURRENT CURVES



OUTPUT POWER PLOTTED AGAINST WAVELENGTH AS A COMMON GRID OSCILLATOR



OUTPUT POWER PLOTTED AGAINST WAVELENGTH AS A COMMON GRID AMPLIFIER

DISC SEAL TRIODE

TD1-100C
(2C39BA)

QUICK REFERENCE DATA

Triode, ceramic construction, for use as an amplifier and frequency multiplier up to 3.5GHz.

	Telegraphy or F.M. Telephony Class 'C'	Frequency Doubler	
f	2.5	1.0 to 2.0	GHz
P_{out}	24	5.2	W
f max.	3.0	3.5	GHz
V_a max.	1.0	1.0	kV
p_a max.	100	100	W

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

TELEGRAPHY OR F.M. TELEPHONY, CLASS 'C'

OPERATING CONDITIONS (Oscillator)

f	2.5	2.5	GHz
P_{out}	16	24	W
P_{load}	10	16	W
V_a	600	800	V
I_a	100	100	mA
$-V_g$	18	20	V
I_g	22	20	mA
R_{g-h}	0.820	1.0	kΩ
p_a	44	56	W
η_a	27	30	%

FREQUENCY DOUBLER

OPERATING CONDITIONS

f	1.0 to 2.0	GHz
P_{out}	5.2	W
P_{load}	4.0	W
V_a	400	V
I_a	55	mA
$-V_g$	15	V
I_g	18	mA
P_{load} (driver)	1.5	W
p_a	17	W
η_a	24	%

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

f max.	3.5	GHz
V_a max.	1.0	kV
$-V_g$ max.	150	V
I_k max.	125	mA
p_a max.	100	W
p_g max.	2.0	W
I_g max.	50	mA
R_{g-h} max.	10	kΩ

CATHODE

Indirectly heated

V_h	*6.0	V
I_h	0.9 to 1.05	A
t_{h-k} min.	60	s

*The heater voltage must be adjusted to compensate for back heating of the cathode, which occurs at higher frequencies. Reduction values of heater voltage should be taken from the curves on page C5.
Maximum heater voltage fluctuation should not exceed ±5%.

DISC SEAL TRIODE

TD1-100C (2C39BA)

CAPACITANCES

c_{a-g}	2.05	pF
c_{a-k}	<0.035	pF
c_{g-k}	6.3	pF
c_{a-k} (V_h=6.0V, I_k=0)	<0.045	pF
c_{g-k} (V_h=6.0V, I_k=0)	7.5	pF

CHARACTERISTICS (measured at V_a=600V, I_a=75mA)

g_m	25	mA/V
μ	100	

MOUNTING POSITION Any

COOLING

Anode - forced-air cooled. See page C5.

Ceramic to metal seals - low velocity air flow

Temperatures

Anode max.	250	^{o}C
Seals max.	250	^{o}C

ACCESSORIES

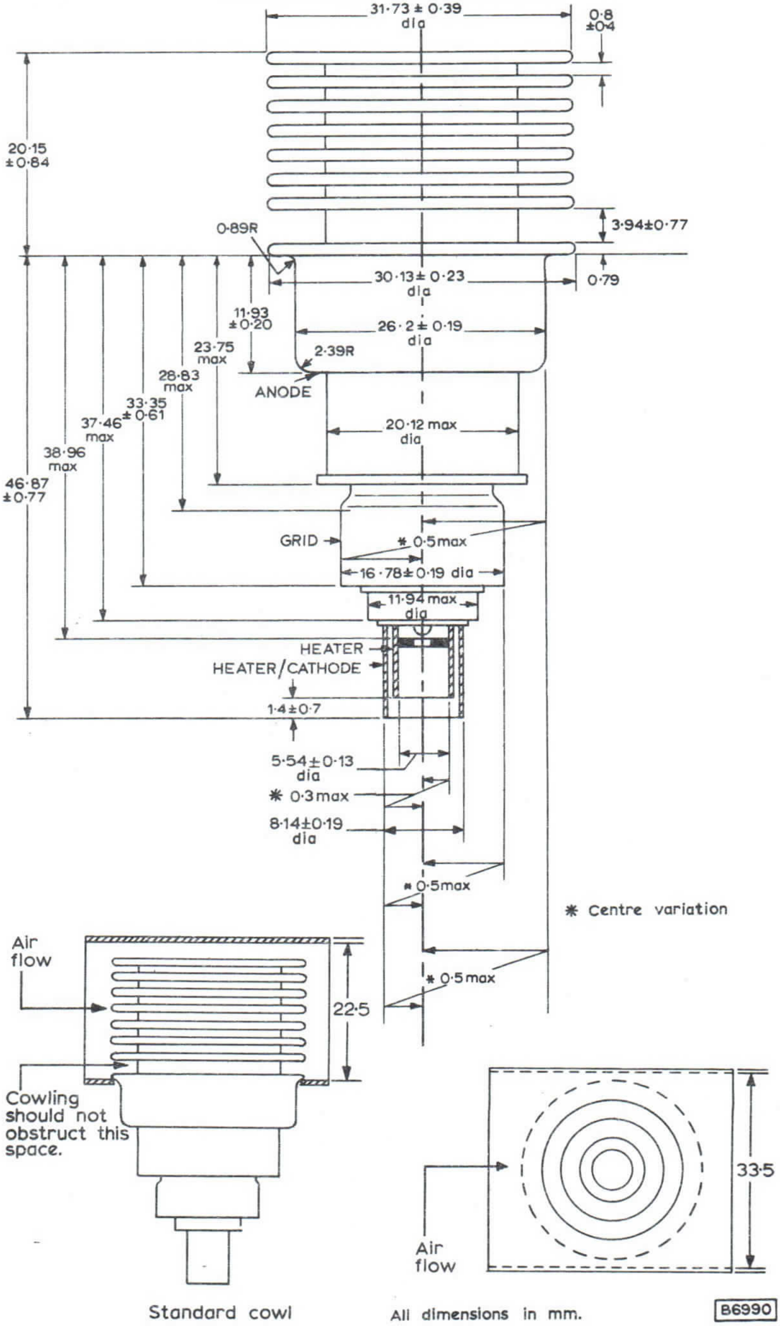
The construction and design of a suitable cowling depends upon the type of equipment in use. The dimensions of a suitable design are given on page D4.

When mounting in co-axial resonators use of resilient spring contacts is recommended.

PHYSICAL DATA

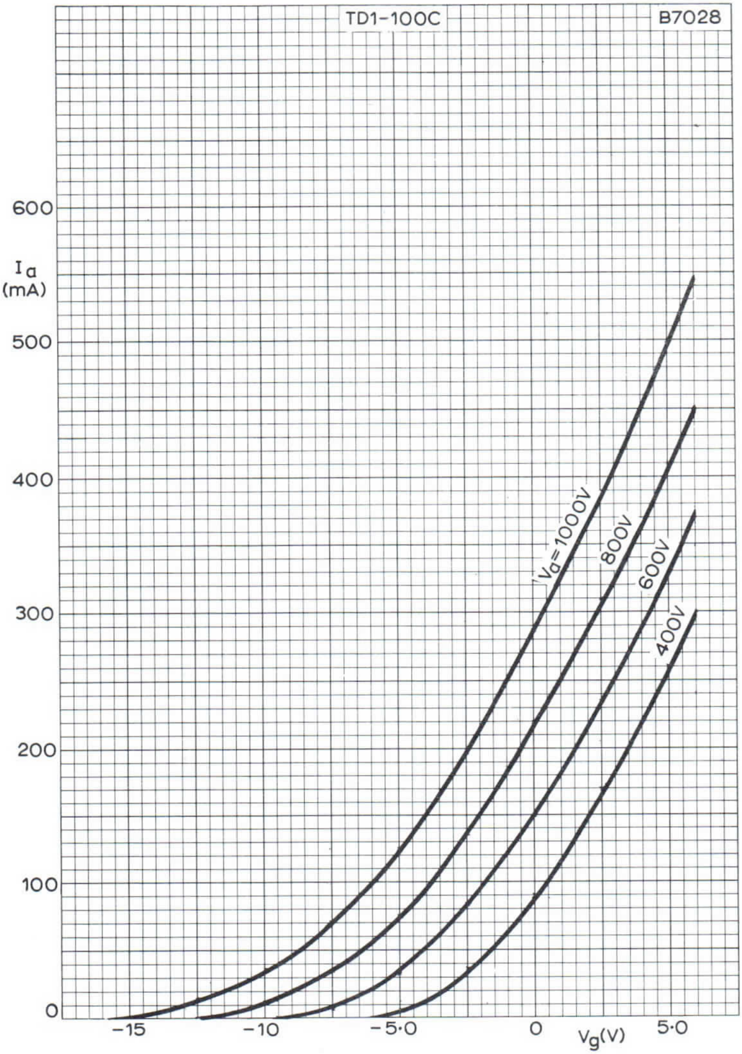
Weight of valve	70	g
	2.5	oz

OUTLINE DRAWING OF TD1-100C

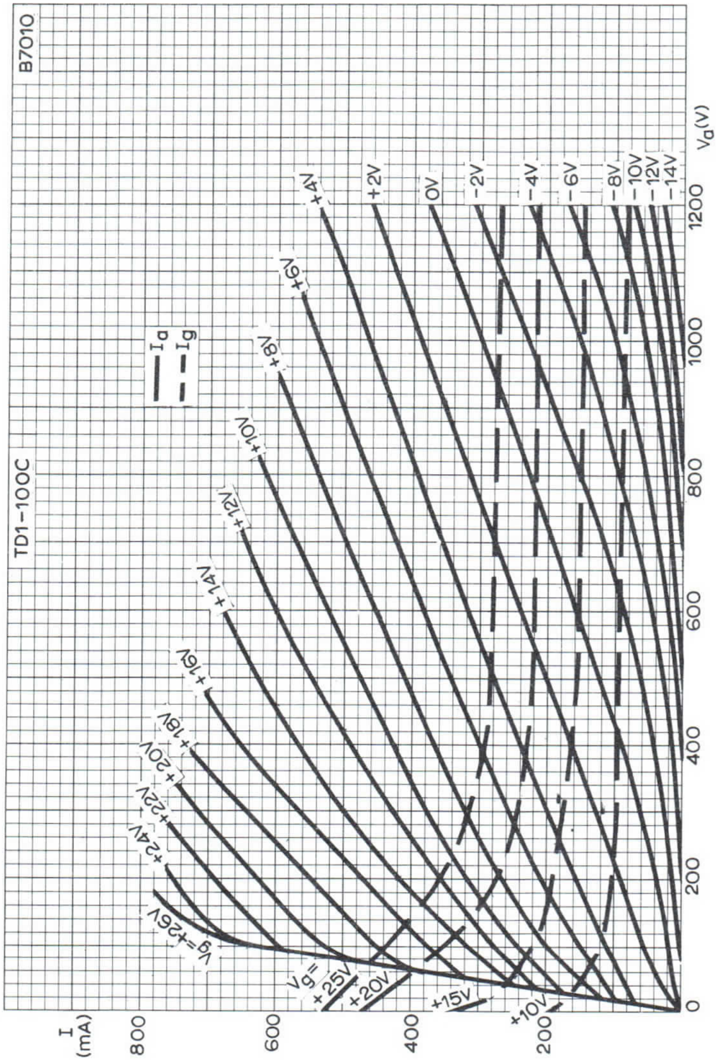


DISC SEAL TRIODE

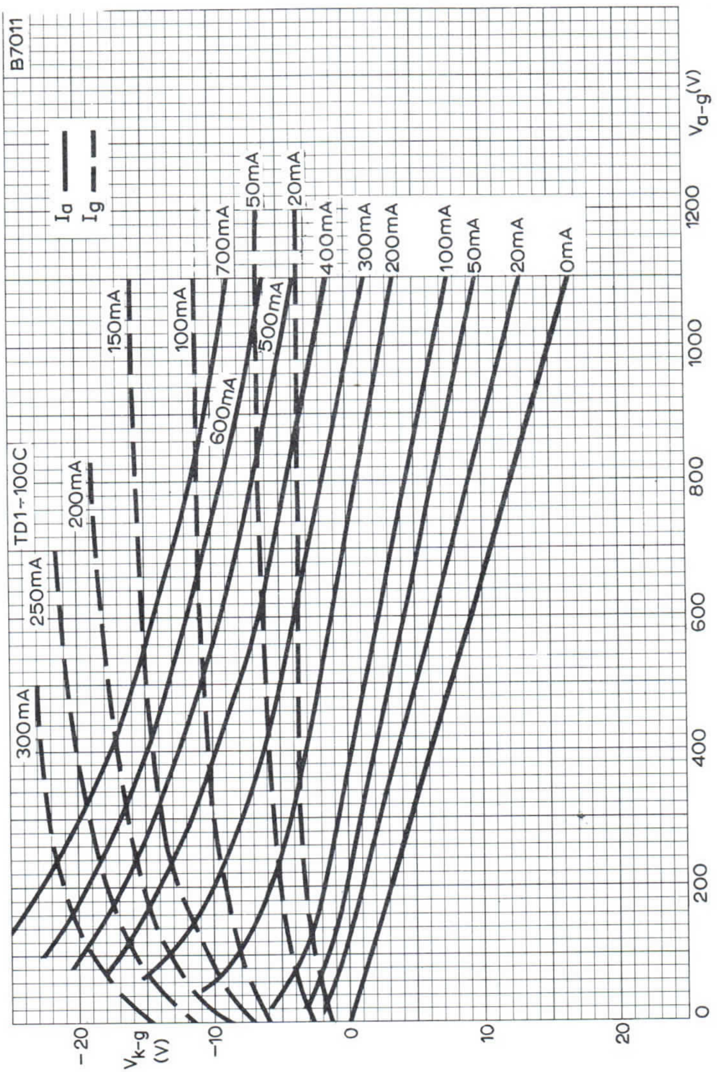
TD1-100C
(2C39BA)



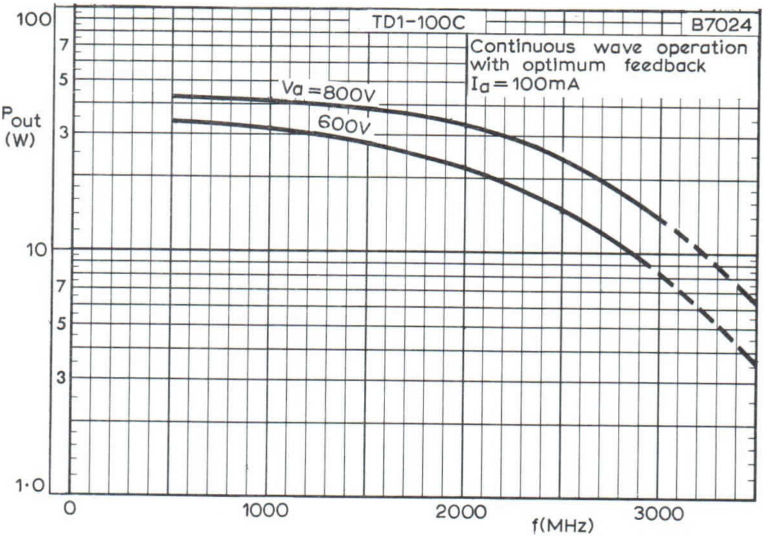
ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER



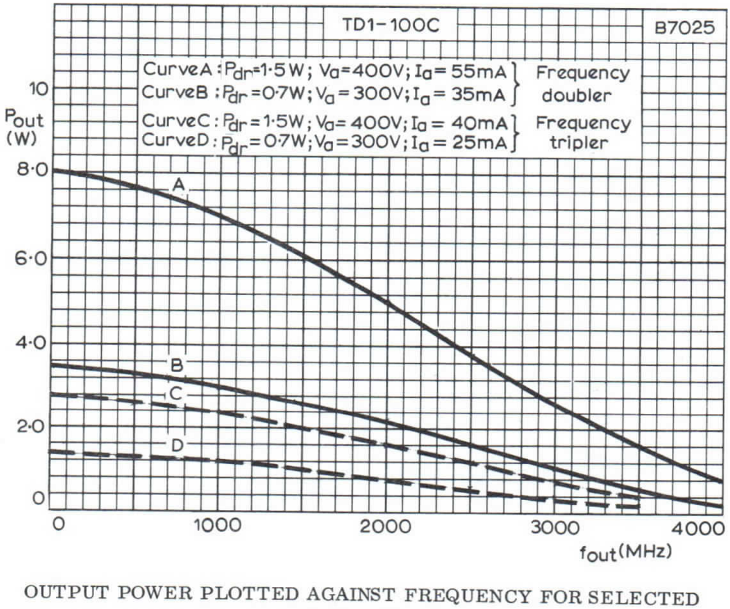
CONSTANT VOLTAGE CHARACTERISTICS



CONSTANT CURRENT CHARACTERISTICS



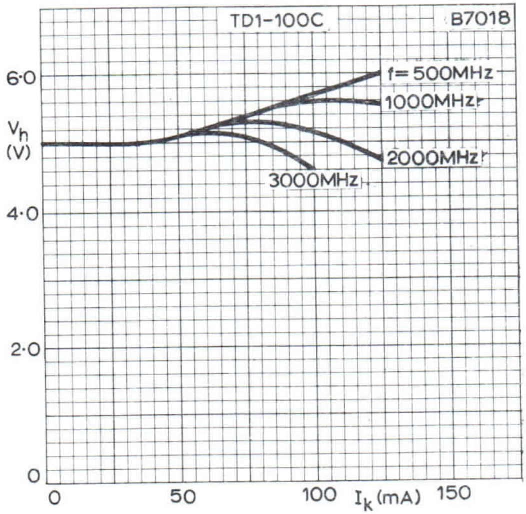
OUTPUT POWER PLOTTED AGAINST FREQUENCY FOR SELECTED ANODE VOLTAGES. CONTINUOUS WAVE OPERATION



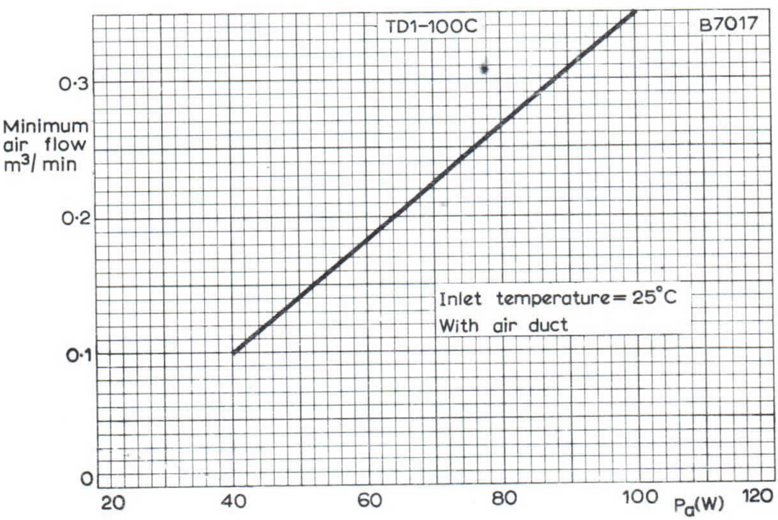
OUTPUT POWER PLOTTED AGAINST FREQUENCY FOR SELECTED DRIVE POWERS

DISC SEAL TRIODE

TD1-100C
(2C39BA)



HEATER DERATING CHARACTERISTICS



MINIMUM AIR FLOW PLOTTED AGAINST ANODE DISSIPATION

DISC SEAL TRIODE

TD2-400A

Application:	*R.F. oscillator, amplifier or frequency multiplier.*
Power output:	*600W at f=470Mc/s.*
Frequency:	*470Mc/s at full ratings, 900Mc/s at reduced ratings.*
Construction:	*Disc seal, ceramic envelope, forced-air cooled.*

This data should be used in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—TRANSMITTING VALVES included in this volume of the handbook.

FILAMENT

Thoriated tungsten

V_f (f < 600Mc/s)	3.4	V
I_f	19	A

The TD2–400A operates at frequencies where transit time effects cause back bombardment heating of the cathode. At frequencies higher than 600Mc/s the filament voltage must be reduced immediately after operation commences, in accordance with the following table:—

f (Mc/s)	V_f (V)
<600	3.4
600 to 750	3.3
750 to 900	3.2

MOUNTING POSITION

Vertical, anode up or down

CAPACITANCES

c_{a-g}	6.5	pF
c_{g-f}	11.5	pF
c_{a-f}	120	mpF

CHARACTERISTICS

V_a	2.0	kV
I_a	200	mA
V_g	−40	V
g_m	10	mA/V
μ	33	

COOLING

Forced air

$T_{anode\ seal}$ max.	250	°C
$T_{grid\ seal}$ max.	250	°C
$T_{filament\ seal}$ max.	200	°C

At all values of anode dissipation and frequencies forced-air cooling of the seals is necessary to ensure that the maximum seal temperatures are not exceeded. Typical values of inlet temperature, rate of flow of air, and pressure difference between the inlet and outlet of the housing are given in the following table:—

Anode dissipation P_a (W)	Height above sea level h (km)	(ft)	Max. inlet temperature T_{in} (°C)	Min. rate of flow of air per minute (m^3)	(ft^3)	Pressure difference between inlet and outlet (mm of water)	(in. of water)
400	0	0	45	0.65	23	12	0.47
400	1500	4920	35	0.65	23	12	0.47
400	3000	9840	25	0.65	23	12	0.47

TD2-400A

DISC SEAL TRIODE

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

Limiting values (absolute ratings)

f max.	470	600	900	Mc/s
V_a max.	2.2	2.1	2.1	kV
p_a max.		400		W
I_k max.		520		mA
$i_{k(pk)}$ max.		2.7		A
$-V_g$ max.		300		V
I_g max.		120		mA
R_{g-f} max.		10		kΩ

Typical operation (grounded grid)

f	470	640	730	810	Mc/s
V_a	2.0	1.8	1.8	1.8	kV
I_a	400	400	400	400	mA
V_g	−140	−120	−120	−120	V
I_g	120	100	100	100	mA
$P_{load(driver)}$	120	105	105	105	W
p_a	290	310	340	392	W
η_a	63.5	57	53	45.5	%
$^*P_{out}$	510+85	410+80	380+80	328+80	W
P_{load} ($\eta_{transfer}$ = 80%)	476	392	368	330	

*Includes power transferred from driver stage.

CLASS 'C' OSCILLATOR FOR R.F. INDUSTRIAL HEATING

Anode supply from transformer without intermediate rectifier

Limiting values (absolute ratings)

f max.	470	Mc/s
$V_{tr(r.m.s.)}$ max.	2.0	kV
p_a max.	170	W
I_k max.	295	mA
$i_{k(pk)}$ max.	2.3	A
$-V_g$ max.	300	V
I_g max.	85	mA
R_{g-f} max.	5.0	kΩ

Typical operation (grounded grid)

f	470	Mc/s
$V_{tr(r.m.s.)}$	1.8	kV
I_a	190	mA
I_g	70	mA
R_{g-f}	400	Ω
p_a	150	W
η_a	60	%
P_{out}	230	W
P_{load} $(0.85\ P_{out}-P_{drive})$	160	W

CLASS 'C' OSCILLATOR FOR R.F. INDUSTRIAL HEATING

With d.c. anode supply

Limiting values (absolute ratings)

f max.	470	900	Mc/s
V_a max.	2.2	2.0	kV
p_a max.		400	W
I_k max.		520	mA
$i_{k(pk)}$ max.		2.7	A
$-V_g$ max.		300	V
I_g max.		120	mA
R_{g-f} max.		10	kΩ

Typical operation

f	470	810	Mc/s
V_a	2.0	1.8	kV
I_a	380	380	mA
*I_g	110	110	mA
R_{g-f}	1.0	1.0	kΩ
p_a	280	400	W
η_a	63	41	%
P_{out}	480	284	W
P_{load} $(0.85\ P_{out}-P_{drive})$	340	200	W

*Using a current stabilising device as the grid resistance.

TD2-400A

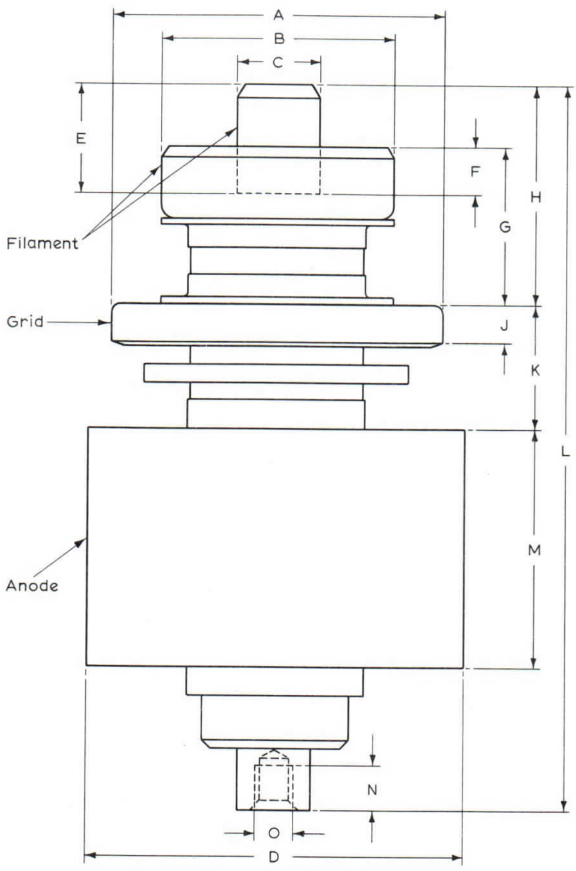
DISC SEAL TRIODE

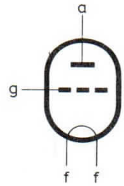
WEIGHT

Valve only	5.5 157	oz g
Shipping weight	9.0 250	oz g

DIMENSIONS

	Inches	*Millimetres*		
A	1.433±0.008	36.4±0.2		
B	1.0±0.008	25.4±0.2		
C	0.354±0.008	9.0±0.2		
D	1.626±0.008	41.3±0.2		
E	0.472	12		
F	0.236	6.0		
G	0.669±0.020	17±0.5		
H	0.925±0.039	23.5±1.0		
J	0.158	4.0		
K	0.551±0.020	14±0.5		
L	3.268	83	max.	←
M	1.024	26		
N	0.158	4.0		←
O	4 millimetre metric thread			←





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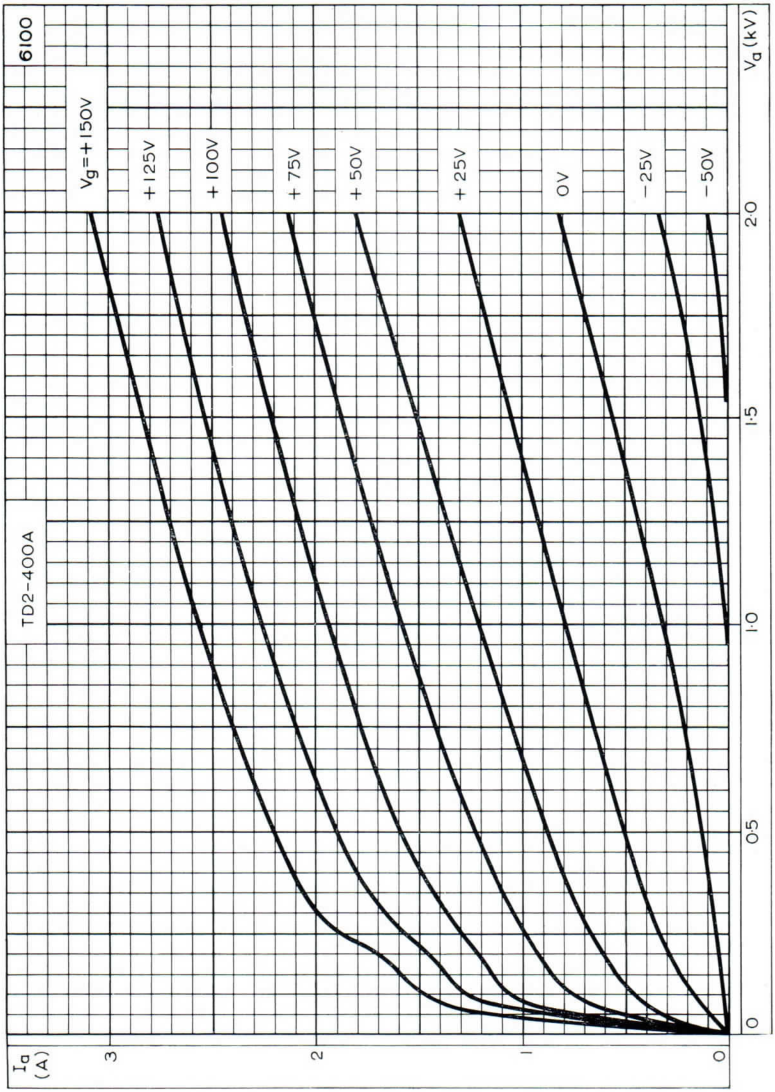
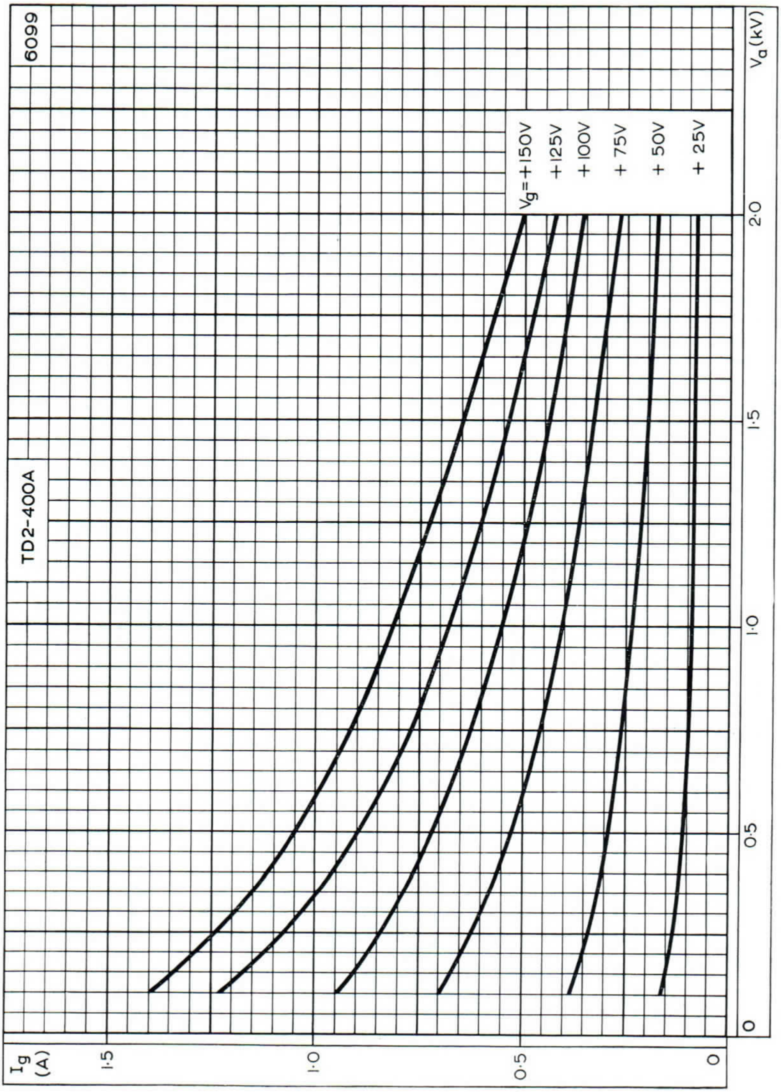
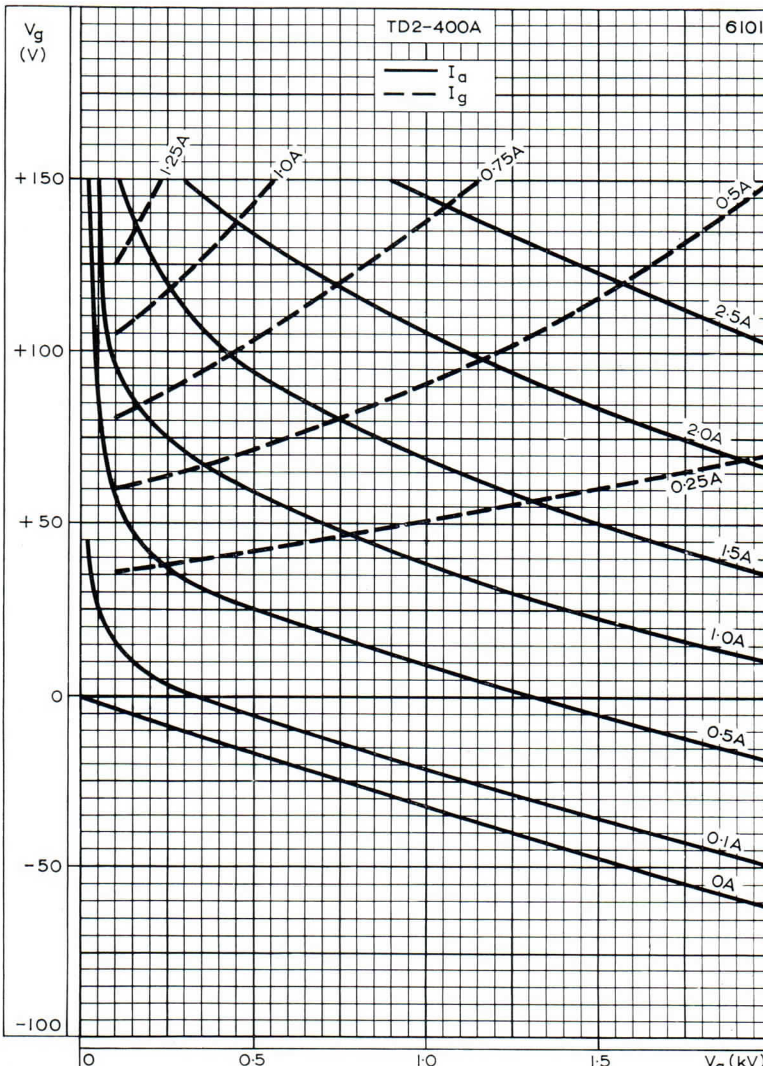


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER



GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER



CONSTANT CURRENT CURVES

DISC SEAL TRIODE TD2-500A

QUICK REFERENCE DATA

Disc seal triode with ceramic envelope intended for use as a power amplifier, oscillator or frequency multiplier.

f		400	625	Mc/s
P_{out}		670	580	W
f max.	400	625	940	Mc/s
V_a max.	2.7	2.5	2.0	kV
p_a max.	500	500	500	W

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

Maximum operating conditions for valve in common grid circuit amplifier

f	400	625	Mc/s
*P_{out}	620+50	533+47	W
P_{load}	470	405	W
η_a	64	64	%
V_a	2.5	2.5	kV
I_a	380	380	mA
V_g	70	60	V
I_g	160	170	mA
P_{load} (driver)	70	65	W
p_a	330	302	W

*Includes power transferred from driver stage.

ABSOLUTE MAXIMUM RATINGS

f max.	400	625	940	Mc/s
V_a max.	2.7	2.5	2.0	kV
V_g max.	300	300	300	V
I_k max.	575	575	560	mA
p_a max.	500	500	500	W

CATHODE

Directly heated, thoriated tungsten.

At frequencies higher than 600Mc/s, transit time causes back bombardment heating of the cathode. The filament voltage must be reduced immediately after operation commences in accordance with the following table:-

f (Mc/s)	V_f (V)
<600	3.4
600 to 750	3.2

I_f (at V_f=3.4V)	19	A

CAPACITANCES

c_{a-f}	50	mpF
c_{g-f}	11	pF
c_{a-g}	3.8	pF

CHARACTERISTICS (measured at V_a = 2.0kV, I_a = 240mA)

g_m	14	mA/V
μ	70	

MOUNTING POSITION

Vertical with anode up or down.

COOLING

Forced air

Maximum temperature

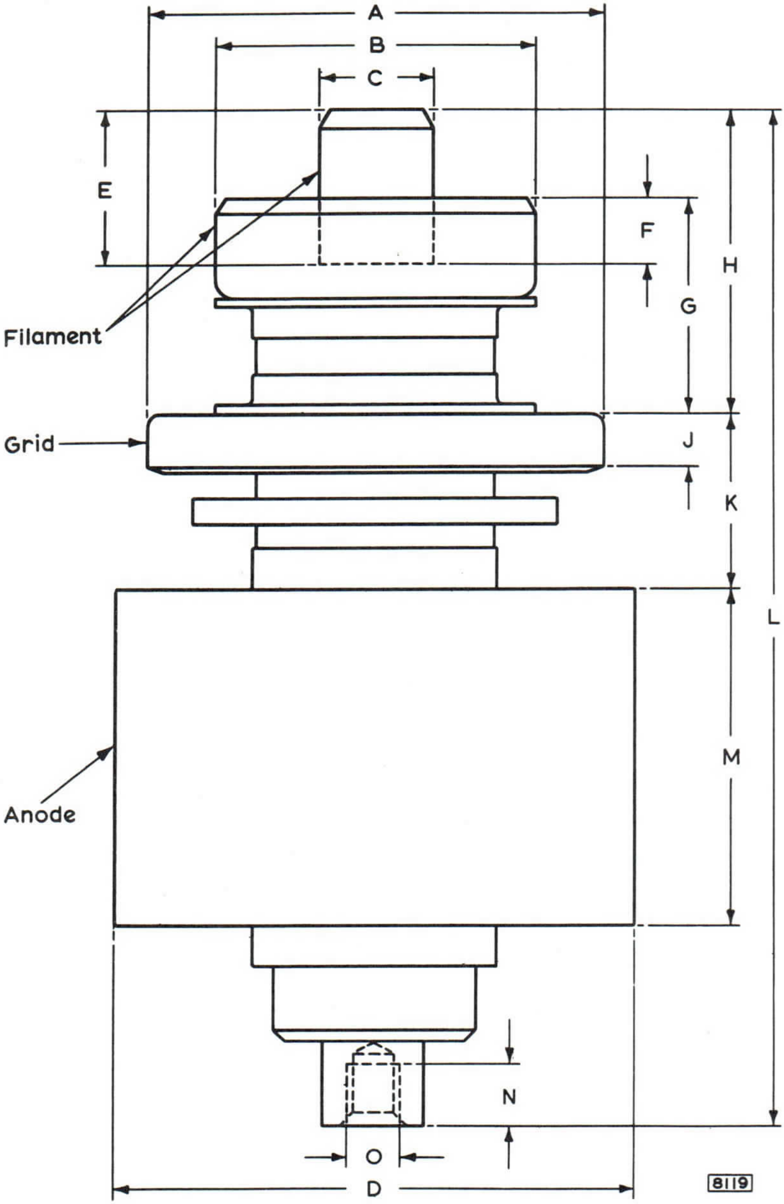
Seals 200 °C

The amount of forced-air cooling required for this valve depends upon the anode dissipation and the height above sea level. Typical values of inlet temperature, rate of flow of air and pressure difference between the inlet and outlet of the housing are given in the following table:-

Anode dissipation	Height above sea level		Max. inlet temperature	Min. rate of flow of air per minute		Pressure difference between inlet and outlet	
p_a (W)	h (km)	(ft)	T_{in} (^{o}C)	(m^3)	(ft^3)	(mm of water)	(inches of water)
500	0	0	45	0.9	32	24	0.94
500	1.5	4 920	35	0.9	32	20	0.79
500	3.0	9 840	25	1.0	35	21	0.83

PHYSICAL DATA

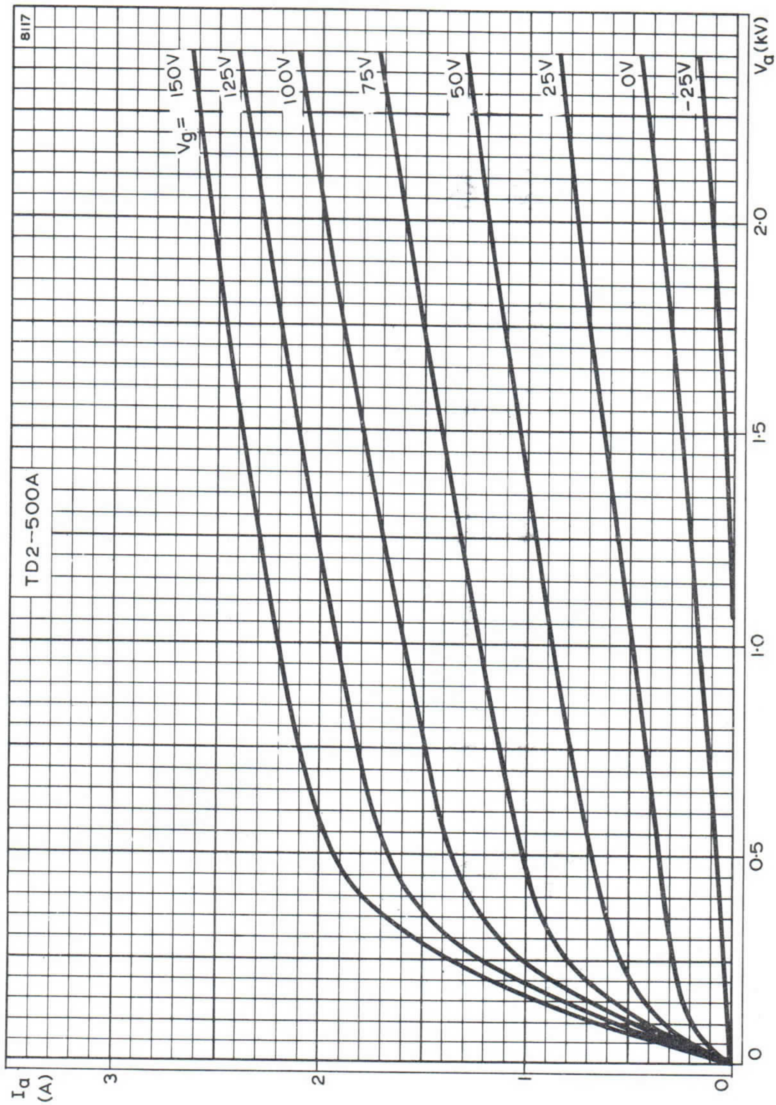
	oz	g
Weight of valve	6.0	170
Weight of valve plus carton	9.0	255


A
B
C
E
F
G
H
Filament
Grid
J
K
L
M
Anode
N
O
D
8119

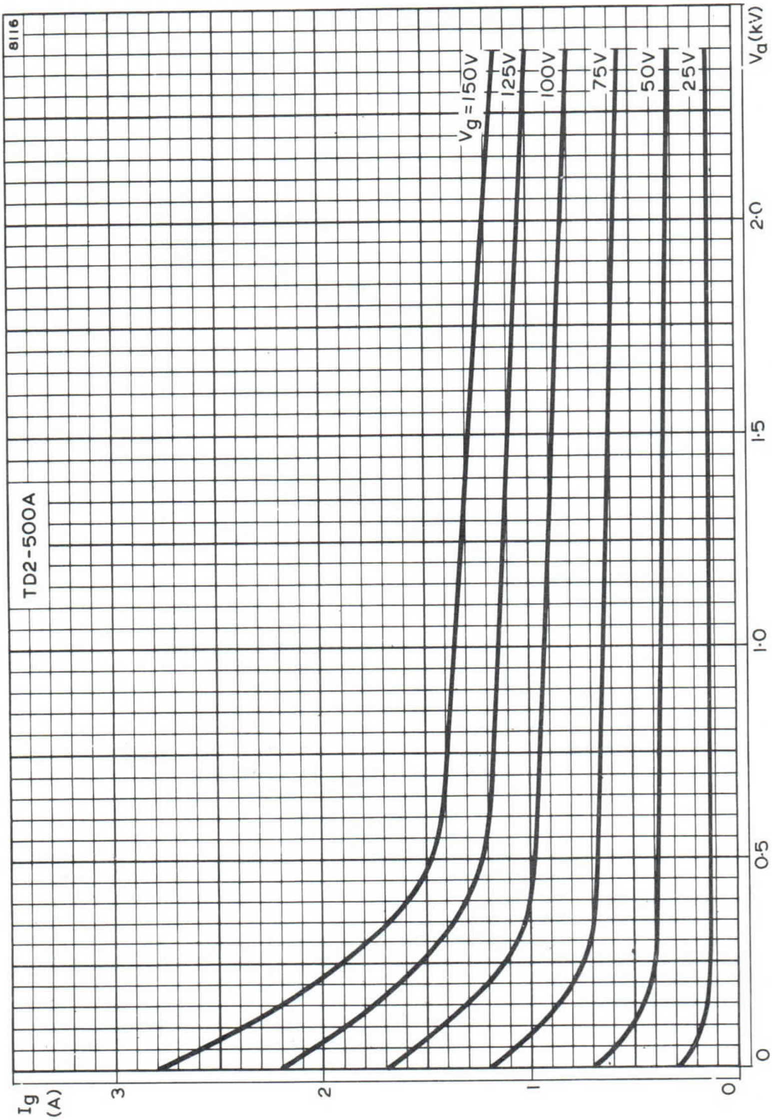
DIMENSIONS

	Inches	Millimetres	
A	1.433 ± 0.008	36.4 ± 0.2	
B	1.0 ± 0.008	25.4 ± 0.2	
C	0.354 ± 0.008	9.0 ± 0.2	
D	1.626 ± 0.008	41.3 ± 0.2	
E	0.48	12	min.
F	0.236	6.0	
G	0.669 ± 0.020	17 ± 0.5	
H	0.925 ± 0.039	23.5 ± 1.0	
J	0.158 ± 0.020	4.0 ± 0.5	
K	0.551 ± 0.020	14 ± 0.5	
L	3.26	83	max.
M	1.02	26	
N	0.158	4.0	
O	4 millimetre metric thread		

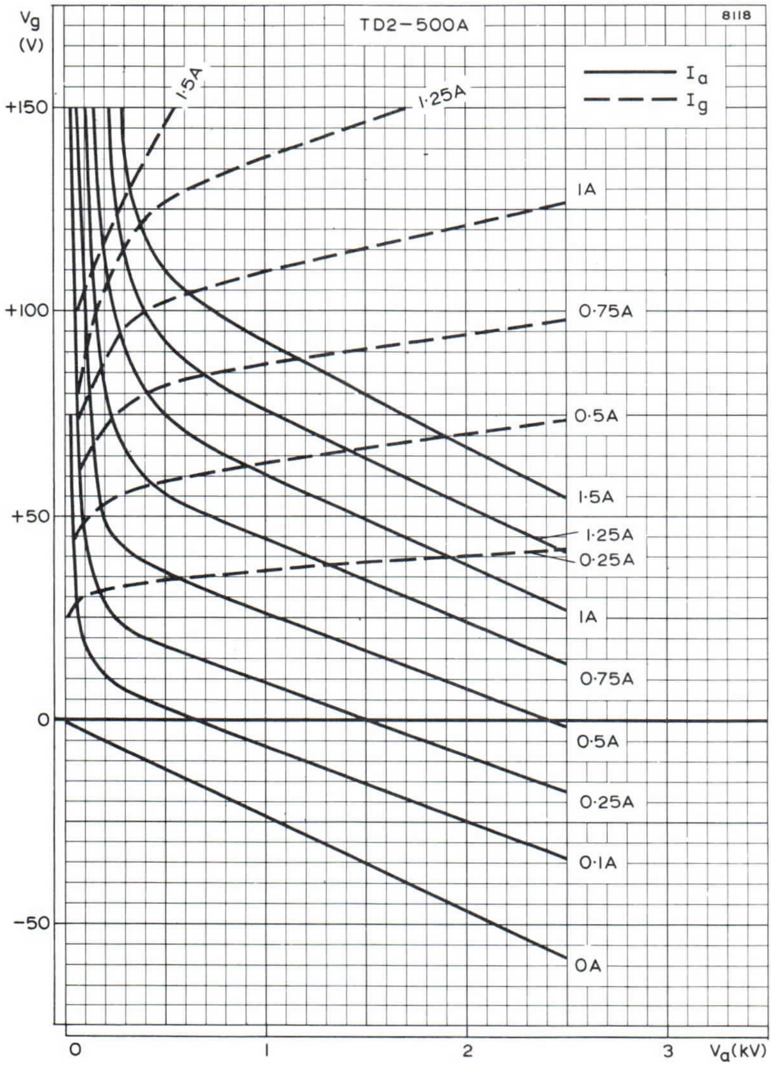
Inch dimensions derived from original millimetre dimensions



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER



GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER



CONSTANT CURRENT CHARACTERISTICS

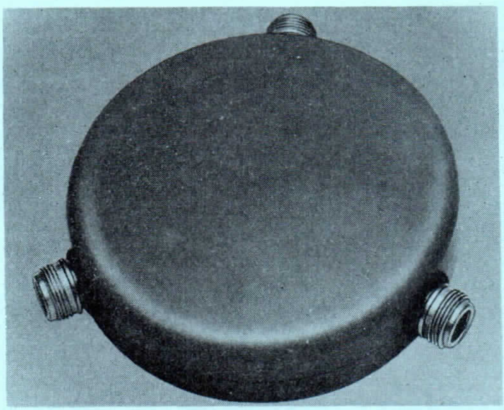
MICROWAVE COMPONENTS

CL 5001

PRELIMINARY DATA

QUICK REFERENCE DATA

Type	Coaxial 3 port
Frequency	1.9 to 2.3 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	all ports	1.9 to 2.3 Gc/s
Isolation	all ports	$>$ 20 dB (typically 30 dB)
Insertion loss	all ports	$<$ 0.75 dB (typically 0.5 dB)
Input v.s.w.r.	all ports	$<$ 1.15

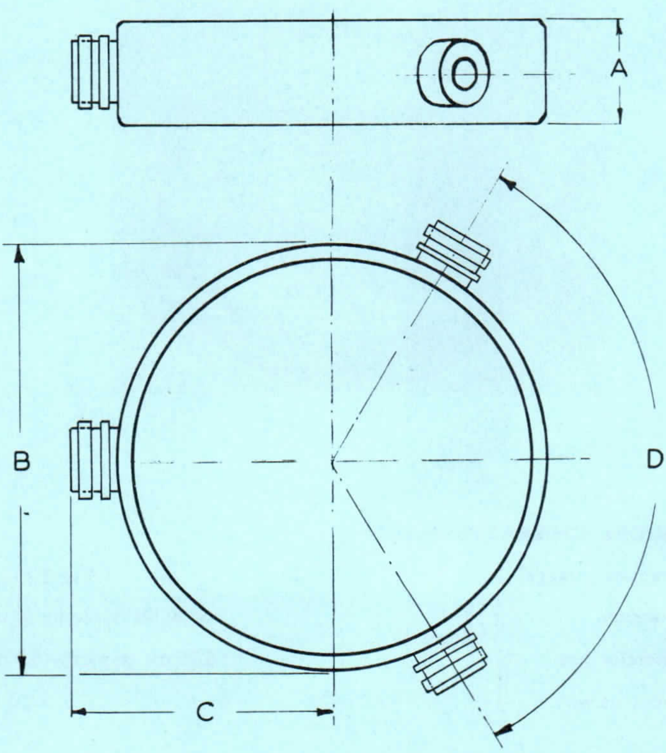
MECHANICAL DATA

Construction	Strip line coaxial 3 port
Terminations	50Ω Type N—Female
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

	Inches	*Millimetres*
A	1.154 ± 0.007	29.3 ± 0.2
B	4.342 ± 0.012	110.3 ± 0.3
C	2.654 ± 0.006	67.4 ± 0.15
D	$3 \times 120^{\circ}$	



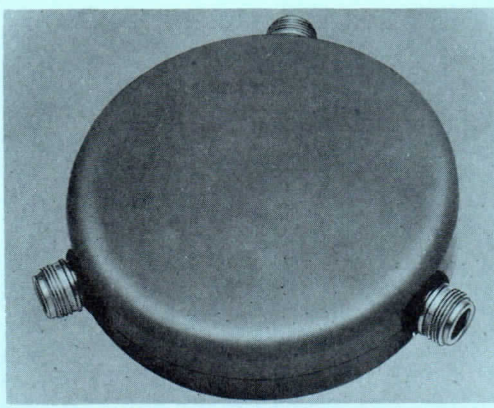
CIRCULATOR

CL 5002

PRELIMINARY DATA

QUICK REFERENCE DATA

Type	Coaxial 3 port
Frequency	1.9 to 2.3 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	all ports	1.9 to 2.1	2.1 to 2.3 Gc/s
Isolation	all ports	> 20	> 20 dB (typically 25-35 dB)
Insertion loss	all ports	< 0.75	< 0.75 dB (typically 0.5 dB)
Input v.s.w.r.	all ports	< 1.1	< 1.2

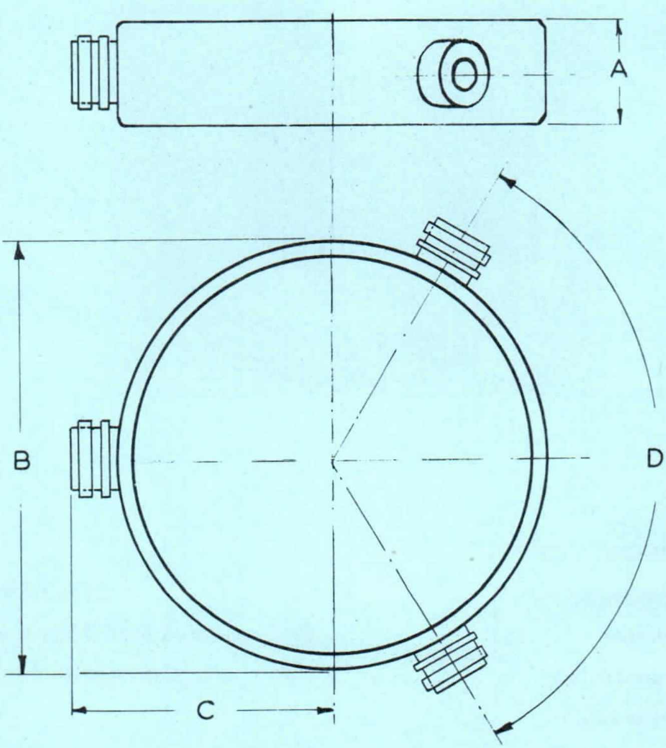
MECHANICAL DATA

Construction	Strip line coaxial 3 port
Terminations	50Ω Type N—Female
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

	Inches	*Millimetres*
A	1.154 ± 0.007	29.3 ± 0.2
B	4.342 ± 0.012	110.3 ± 0.3
C	2.654 ± 0.006	67.4 ± 0.15
D	$3 \times 120°$	



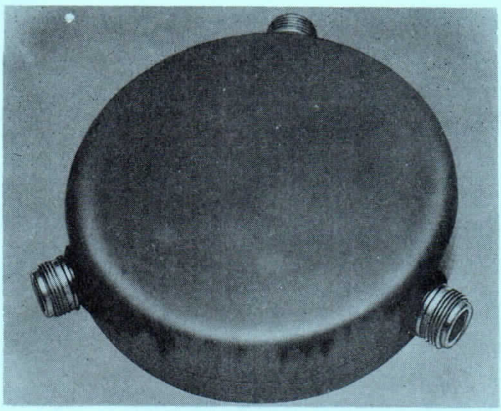
CIRCULATOR

CL 5003

PRELIMINARY DATA

QUICK REFERENCE DATA

Type	Coaxial 3 port
Frequency	1.9 to 2.3 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	all ports	2.1 to 2.3	1.9 to 2.1 Gc/s
Isolation	all ports	> 20	> 20 dB (typically 25-35 dB)
Insertion loss	all ports	< 0.75	< 0.75 dB (typically 0.5 dB)
Input v.s.w.r.	all ports	< 1.1	< 1.2

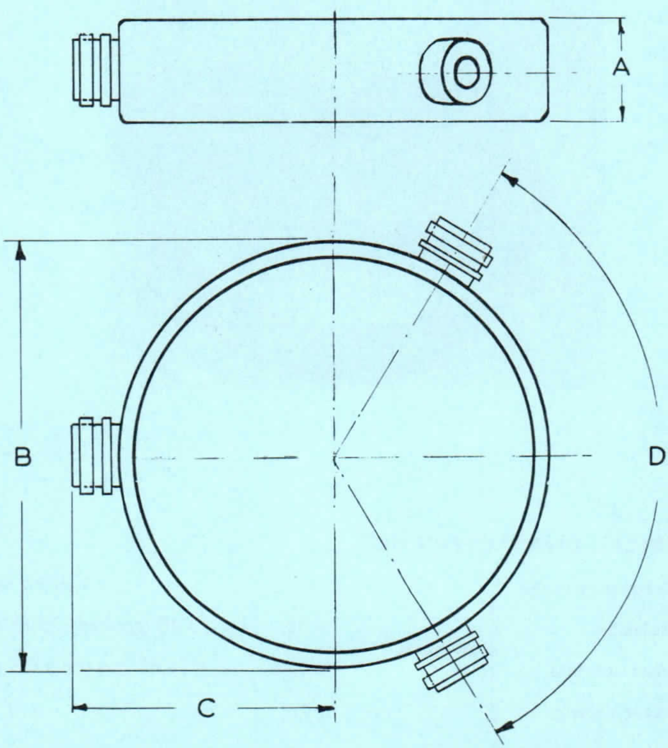
MECHANICAL DATA

Construction	Strip line coaxial 3 port
Terminations	50Ω Type N—Female
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

	Inches	*Millimetres*
A	1.154 ± 0.007	29.3 ± 0.2
B	4.342 ± 0.012	110.3 ± 0.3
C	2.654 ± 0.006	67.4 ± 0.15
D	3 × 120°	

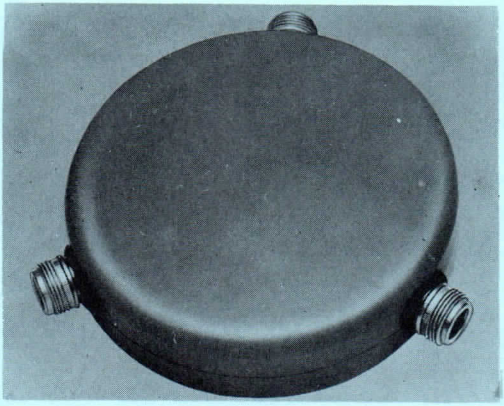


CL 5004

PRELIMINARY DATA

QUICK REFERENCE DATA

Type	Coaxial 3 port
Frequency	2.5 to 2.9 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	all ports	2.5 to 2.9 Gc/s
Isolation	all ports	> 20 dB
Insertion loss	all ports	< 0.6 dB (typically 0.4 dB)
Input v.s.w.r.	all ports	< 1.1

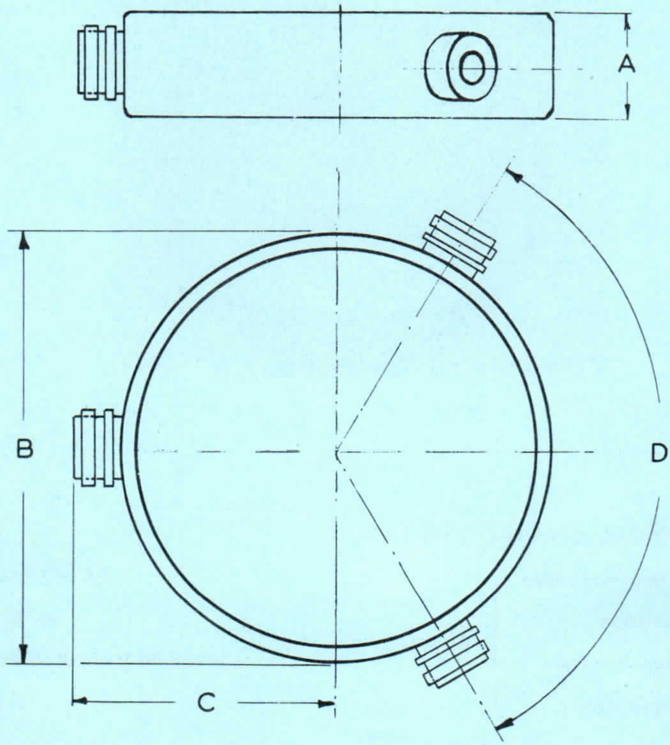
MECHANICAL DATA

Construction	Strip line coaxial 3 port
Terminations	50Ω Type N—Female
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

	Inches	*Millimetres*
A	1.154 ± 0.007	29.3 ± 0.2
B	4.342 ± 0.012	110.3 ± 0.3
C	2.654 ± 0.006	67.4 ± 0.15
D	3 × 120°	

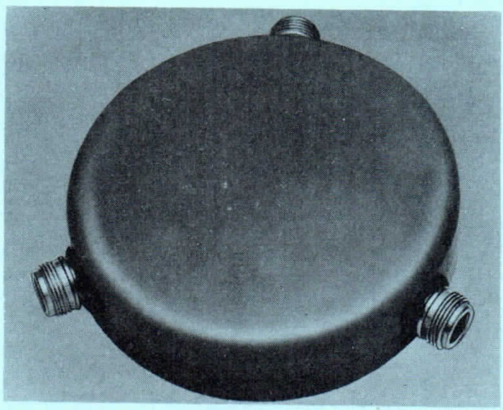


CIRCULATOR CL 5005

PRELIMINARY DATA

QUICK REFERENCE DATA

Type	Coaxial 3 port
Frequency	2.2 to 3.0 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	all ports	2.2 to 3.0 Gc/s
Isolation	all ports	> 20 dB
Insertion loss	all ports	< 0.6 dB (typically 0.4 dB)
Input v.s.w.r.	all ports	< 1.2

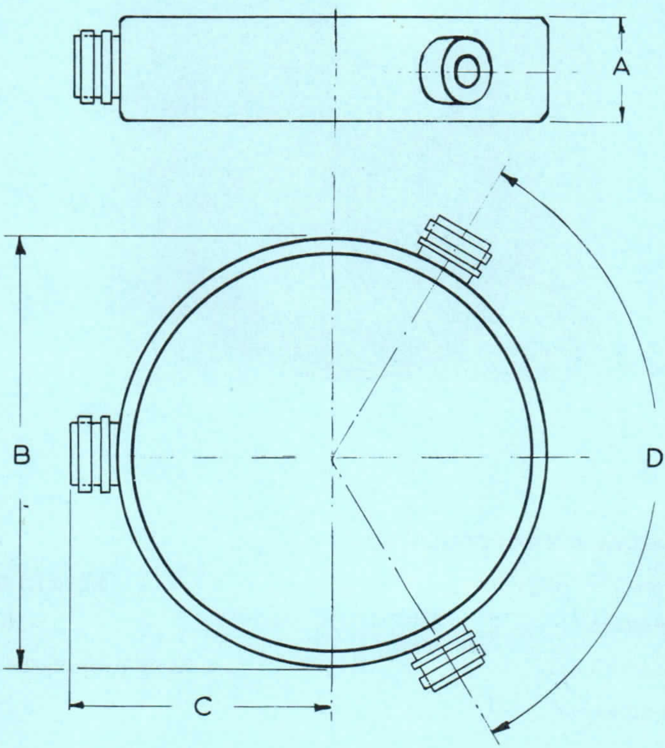
MECHANICAL DATA

Construction	Strip line coaxial 3 port
Terminations	50Ω Type N—Female
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

	Inches	*Millimetres*
A	1.154 ± 0.007	29.3 ± 0.2
B	4.342 ± 0.012	110.3 ± 0.3
C	2.654 ± 0.006	67.4 ± 0.15
D	3 × 120°	

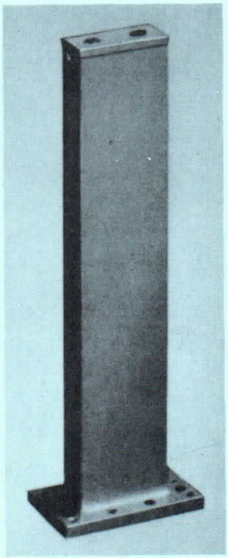


TENTATIVE DATA

QUICK REFERENCE DATA

*Type	Waveguide 14 ←
Frequency	5.4 to 8.2 Gc/s
Power	Low power for Telecommunications

*Available to this specification in other waveguide sizes.



ELECTRICAL CHARACTERISTICS

		Typical	
Frequency range	5.4 to 8.2	**5.4 to 6.4	Gc/s
V.s.w.r.	<1.03	<1.01 ←	

**Or other selected portions of band.

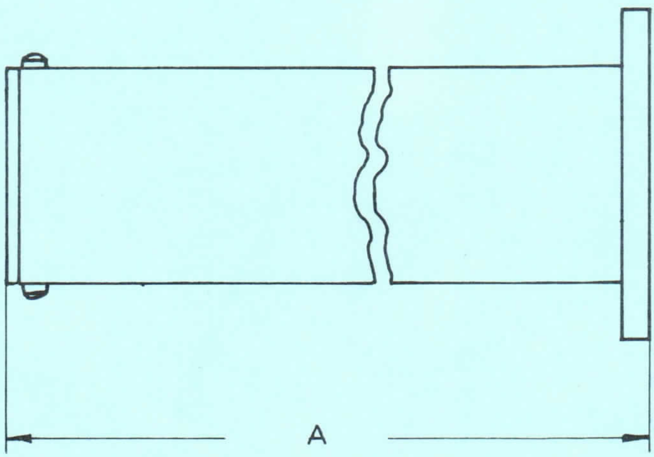
MECHANICAL DATA

Construction	Waveguide 14
Terminations	Waveguide I.E.C. UER70
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

←

OUTLINE DRAWING

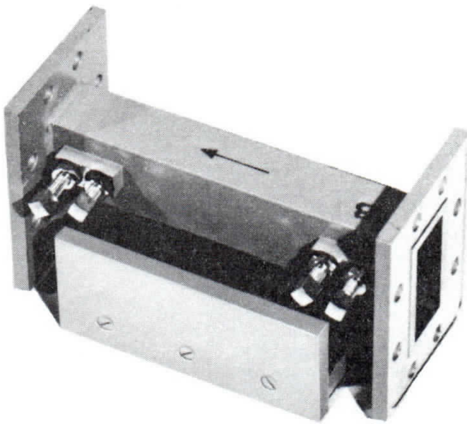
Dimension	*Inches*	*Millimetres*
A	7.165 ± 0.016	182 ± 0.4



CL 6200

QUICK REFERENCE DATA

Type	Field Displacement
Frequency	3.4 to 3.8 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	3.4 to 3.8 Gc/s
'solation	> 30 dB (typically 35 dB)
Insertion loss	< 0.8 dB (typically 0.5 dB)
Input v.s.w.r. over band	< 1.05 (typically < 1.02)

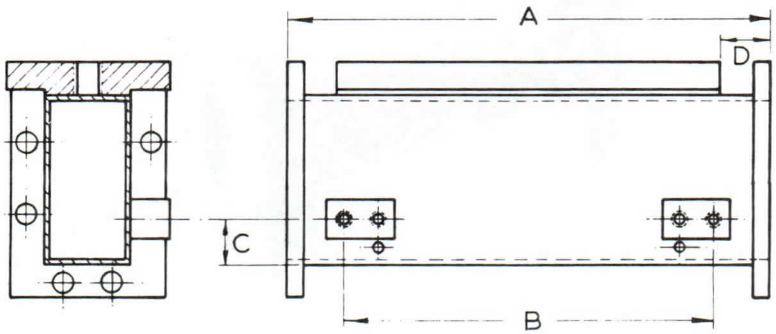
MECHANICAL DATA

Construction	Waveguide WG11A (WR229, R40)
Terminations	Input / Output: I.E.C. plain flanges, other flanges to order
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

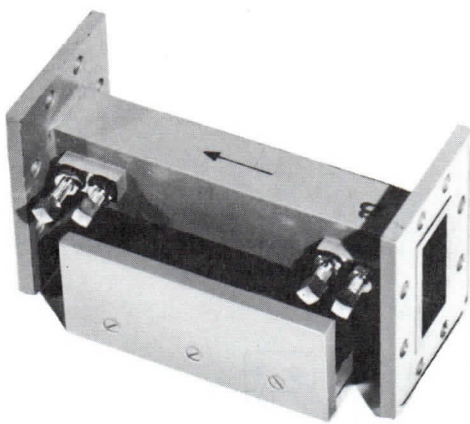
	Inches	*Millimetres*
A	7.087	180
B	5.197	132
C	0.657	16.7
D	0.945	24



CL 6201

QUICK REFERENCE DATA

Type	Field Displacement
Frequency	3.8 to 4.2 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	3.8 to 4.2 Gc/s
Isolation	> 30 dB (typically 35 dB)
Insertion loss	< 0.8 dB (typically 0.5 dB)
Input v.s.w.r. over band	<1.08 (typically < 1.02) ←

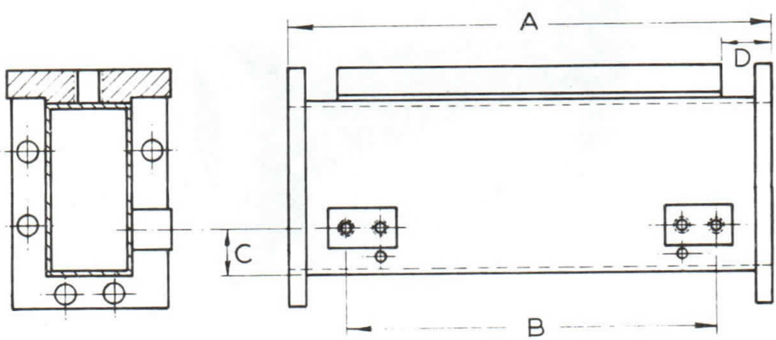
MECHANICAL DATA

Construction	Waveguide WG12 (WR187, R48)
Terminations	Input } I.E.C. plain flanges, Output } other flanges to order
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

	Inches	*Millimetres*
A	5.512	140
B	4.685	119
C	0.528	13.4
D	0.413	10·5

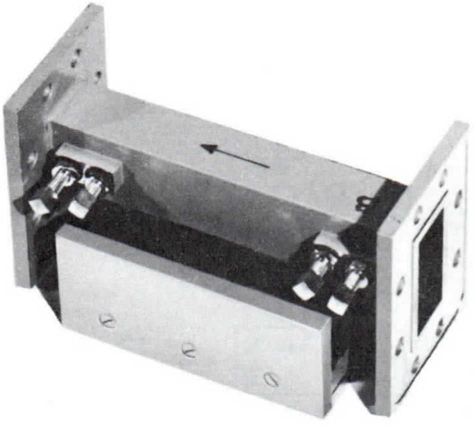


ISOLATOR

CL 6202

QUICK REFERENCE DATA

Type	Field Displacement
Frequency	4.2 to 4.6 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	4.2 to 4.6 Gc/s
Isolation	$>$ 30 dB (typically 35 dB)
Insertion loss	$<$ 0.8 dB (typically 0.5 dB)
Input v.s.w.r. over band	$<$ 1.05 (typically $<$ 1.02)

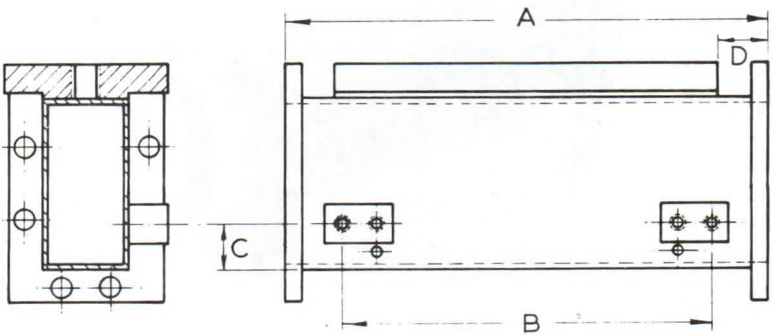
MECHANICAL DATA

Construction	Waveguide WG12 (WR187, R48)
Terminations	Input, Output } I.E.C. plain flanges, other flanges to order
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

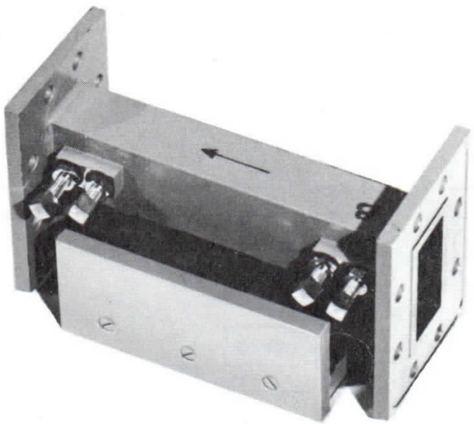
	Inches	*Millimetres*
A	5.512	140
B	5.197	132
C	0.528	13.4
D	0.551	14



CL 6203

QUICK REFERENCE DATA

Type	Field Displacement
Frequency	4.6 to 5.0 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	4.6 to 5.0 Gc/s
Isolation	$>$ 30 dB (typically 35 dB)
Insertion loss	$<$ 0.5 dB (typically 0.3 dB) ←
Input v.s.w.r. over band	$<$ 1.05 (typically $<$ 1.02)

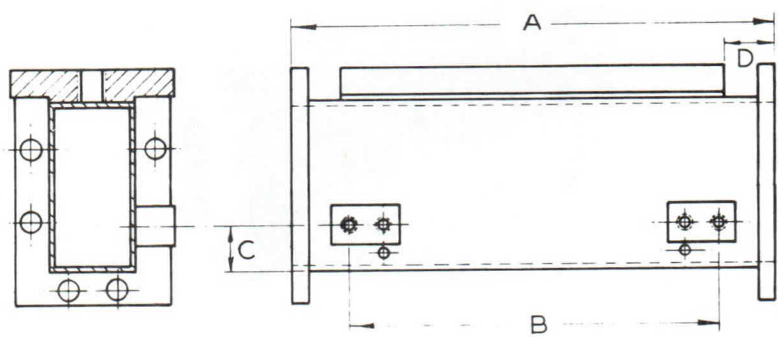
MECHANICAL DATA

Construction	Waveguide WG14 (WR137, R70)
Terminations	Input } I.E.C. plain flanges, Output } other flanges to order
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

	Inches	*Millimetres*
A	5.512	140
B	4.252	108
C	0.528	13.4
D	0.630	16

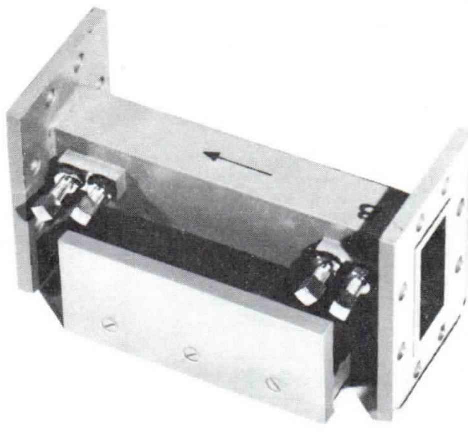


ISOLATOR

CL 6206

QUICK REFERENCE DATA

Type	Field Displacement
Frequency	5.925 to 6.425 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	5.925 to 6.425 Gc/s
Isolation	$>$ 30 dB (typically 35 dB)
Insertion loss	$<$ 0.5 dB (typically 0.3 dB) ←
Input v.s.w.r. over band	$<$ 1.05 (typically $<$ 1.02)

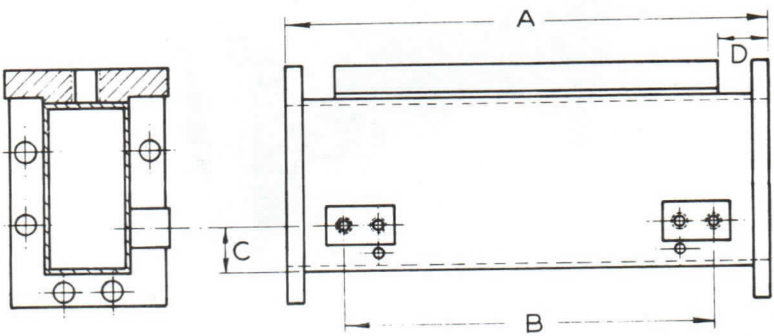
MECHANICAL DATA

Construction	Waveguide WG14 (WR137, R70)
Terminations	Input / Output } I.E.C. plain flanges, other flanges to order
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

	Inches	*Millimetres*
A	4.528	115
B	4.134	105
C	0.433	11
D	0.670	17



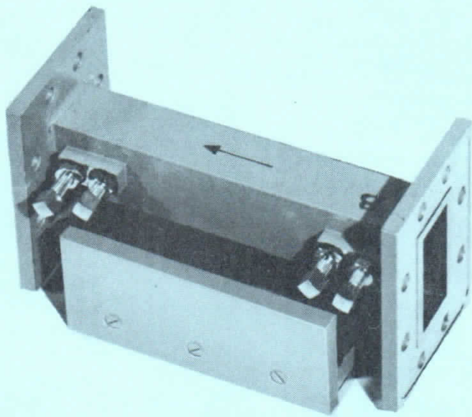
ISOLATOR

CL 6207

PRELIMINARY DATA

QUICK REFERENCE DATA

Type	Field Displacement
Frequency	6.6 to 6.95 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	6.6 to 6.95 Gc/s
Isolation	> 30 dB (typically 35 dB)
Insertion loss	< 0.8 dB (typically 0.5 dB)
Input v.s.w.r. over band	< 1.05 (typically < 1.02)

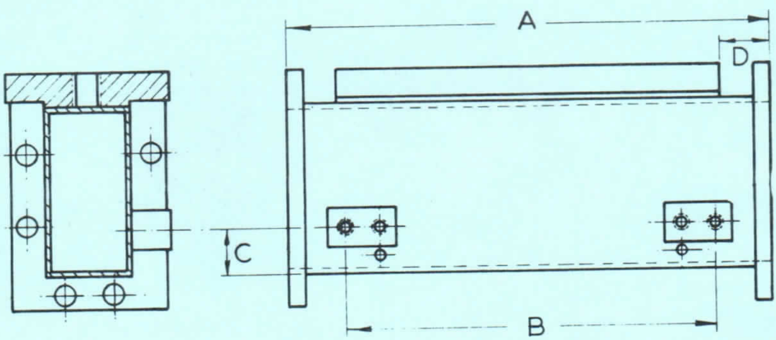
MECHANICAL DATA

Construction	Waveguide WG14 (WR137, R70)
Terminations	Input } I.E.C. plain flanges, Output } other flanges to order
External finish	Whole unit silver plated and gold flashed. Top and bottom plates are enamelled grey

OUTLINE DRAWING

Dimensions

	Inches	*Millimetres*
A	4.528	115
B	4.134	105
C	0.433	11
D	0.670	17

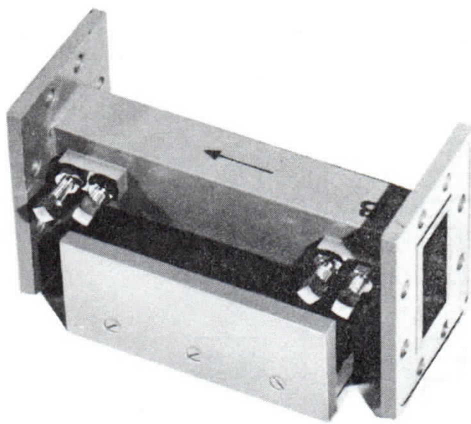


ISOLATOR

CL 6208

QUICK REFERENCE DATA

Type	Field Displacement
Frequency	6.825 to 7.125 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	6.825 to 7.125 Gc/s
Isolation	$>$ 30 dB (typically 35 dB)
Insertion loss	$<$ 0.5 dB (typically 0.3 dB) ←
Input v.s.w.r. over band	$<$ 1.05 (typically $<$ 1.02)

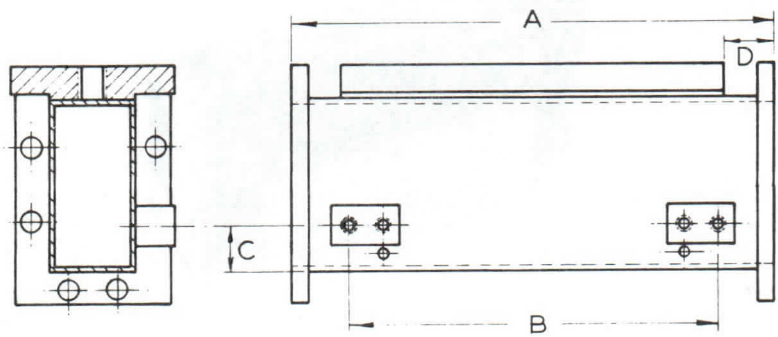
MECHANICAL DATA

Construction	Waveguide WG14 (WR137, R70)
Terminations	Input } I.E.C. plain flanges, Output } other flanges to order
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

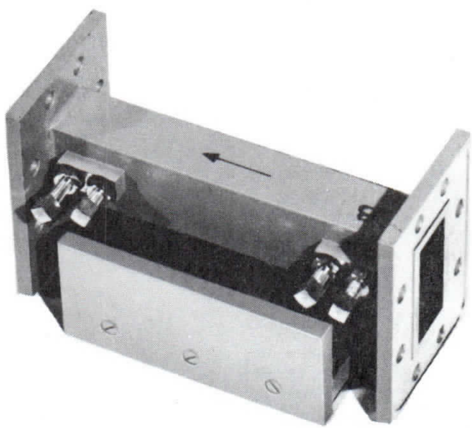
	Inches	*Millimetres*
A	4.528	115
B	3.465	88
C	0.433	11
D	0.670	17



CL 6209

QUICK REFERENCE DATA

Type	Field Displacement
Frequency	7.125 to 7.425 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	7.125 to 7.425 Gc/s
Isolation	$>$ 30 dB (typically 35 dB)
Insertion loss	$<$ 0.5 dB (typically 0.3 dB) ←
Input v.s.w.r. over band	$<$ 1.05 (typically $<$ 1.02)

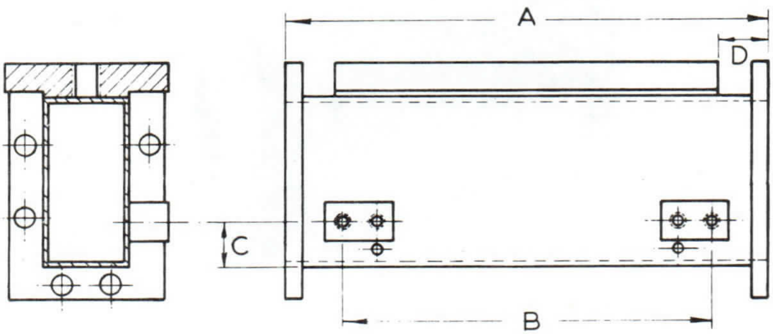
MECHANICAL DATA

Construction	Waveguide WG14 (WR137, R70)
Terminations	Input } I.E.C. plain flanges, Output } other flanges to order
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

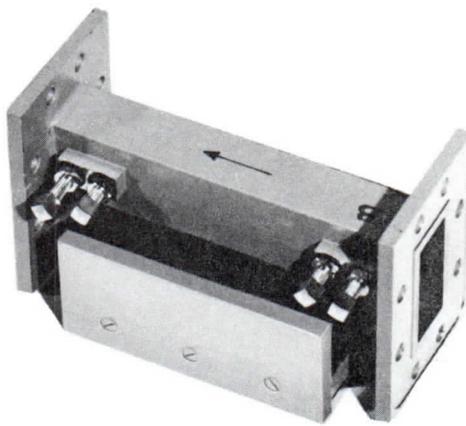
	Inches	*Millimetres*
A	4.528	115
B	3.465	88
C	0·433	11
D	0.670	17



CL 6210

QUICK REFERENCE DATA

Type	Field Displacement
Frequency	7.425 to 8.025 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	7.425 to 8.025 Gc/s
Isolation	$>$ 30 dB (typically 35 dB)
Insertion loss	$<$ 0.5 dB (typically 0.3 dB)
Input v.s.w.r. over band	$<$ 1.05 (typically $<$ 1.02)

MECHANICAL DATA

→ Construction — Waveguide WG14 (WR137, R70)

Terminations — Input } I.E.C. plain flanges, Output } other flanges to order

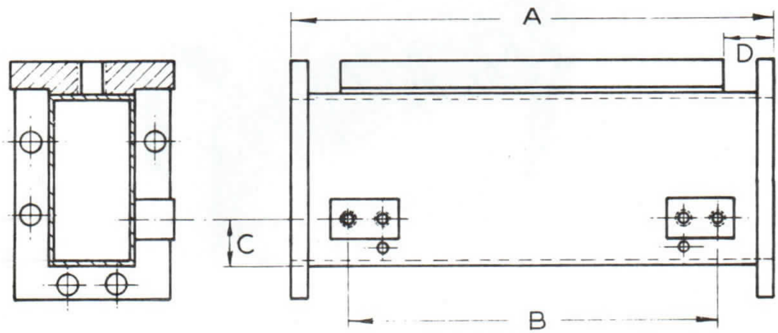
External finish — Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

	Inches	Millimetres
A	4.528	115
B	*	*
C	*	*
D	0.670	17

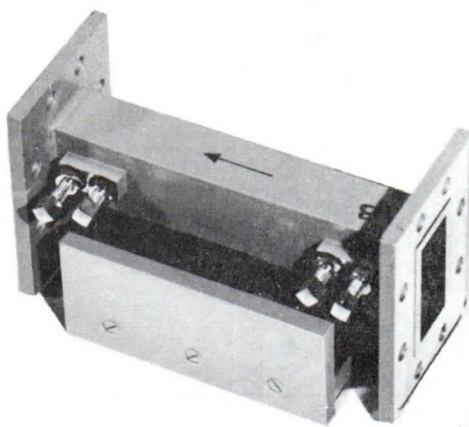
*Matching screws not necessary



CL 6215

QUICK REFERENCE DATA

Type	Field Displacement
Frequency	10.7 to 11.7 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	10.7 to 11.7 Gc/s
Isolation	$>$ 30 dB (typically 35 dB)
Insertion loss	$<$ 0.8 dB (typically 0.5 dB)
Input v.s.w.r. over band	$<$ 1.05 (typically $<$ 1.02)

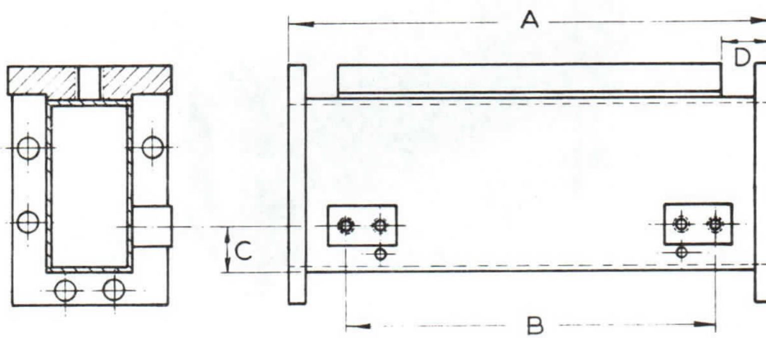
MECHANICAL DATA

Construction	Waveguide WG16 (WR90, R100)
Terminations	Input } I.E.C. plain flanges, Output } other flanges to order
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

	Inches	*Millimetres*
A	3.150	80
B	2.402	61
C	0.276	7
D	0.583	14.8

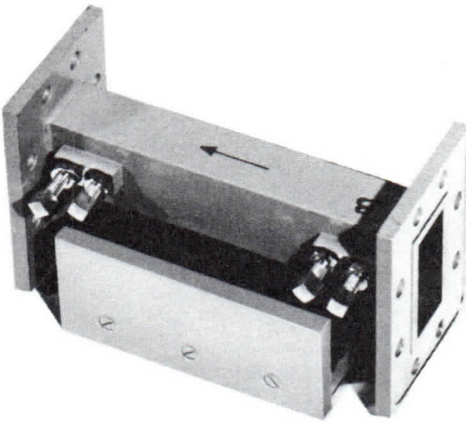


ISOLATOR

CL 6217

QUICK REFERENCE DATA

Type	Field Displacement
Frequency	12.5 to 13.5 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	12.5 to 13.5 Gc/s
Isolation	> 30 dB (typically 35 dB)
Insertion loss	< 0.5 dB (typically 0.3 dB) ←
Input v.s.w.r. over band	< 1.05 (typically < 1.02)

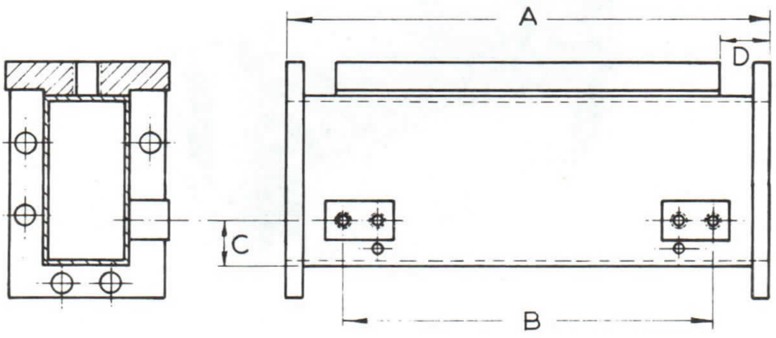
MECHANICAL DATA

Construction	Waveguide WG18 (WR62, R140)
Terminations	Input } I.E.C. plain flanges, Output } other flanges to order
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

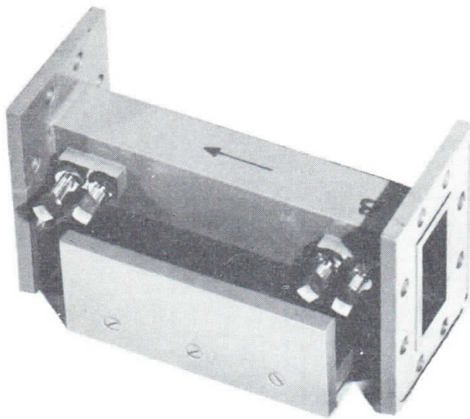
	Inches	*Millimetres*
A	2.362	60
B	1.772	45
C	0.157	4
D	0.406	10.3



CL 6236

QUICK REFERENCE DATA

Type	Field Displacement ←
Frequency	3.8 to 4.2 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	3.8 to 4.2 Gc/s
Isolation	> 30 dB (typically 35 dB)
Insertion loss	< 1.0 dB (typically 0.5 dB)
Input v.s.w.r. over band	< 1.10 (typically < 1.02)

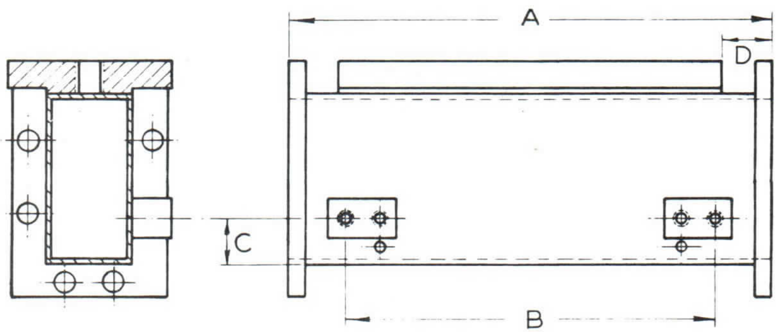
MECHANICAL DATA

Construction	Waveguide WG12 (WR187, R48)
Terminations	Input } I.E.C. plain flanges, Output } other flanges to order
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

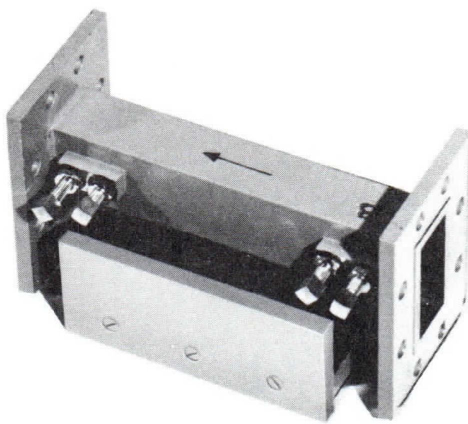
	Inches	*Millimetres*
A	4.016	102
B	2.756	70
C	0.709	18
D	0.571	14.5



CL 6240

QUICK REFERENCE DATA

Type	Field Displacement
Frequency	3.8 to 4.2 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	3.8 to 4.2 Gc/s
Isolation	$>$ 30 dB (typically 35 dB)
Insertion loss	$<$ 0.8 dB (typically 0.5 dB)
Input v.s.w.r. over band	$<$ 1.08 (typically $<$ 1.02) ←

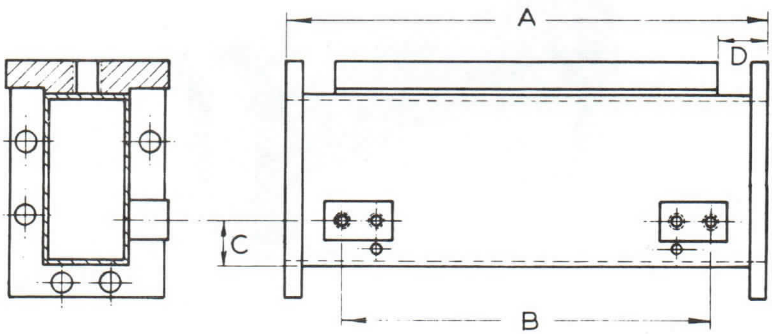
MECHANICAL DATA

Construction	Waveguide WG11A (WR229, R40)
Terminations	Input } I.E.C. plain flanges, Output } other flanges to order
External finish	Whole unit silver plated and gold flashed with some surfaces also enamelled grey

OUTLINE DRAWING

Dimensions

	Inches	*Millimetres*
A	7.087	180
B	5.748	146
C	0.657	16.7
D	0.665	16.9

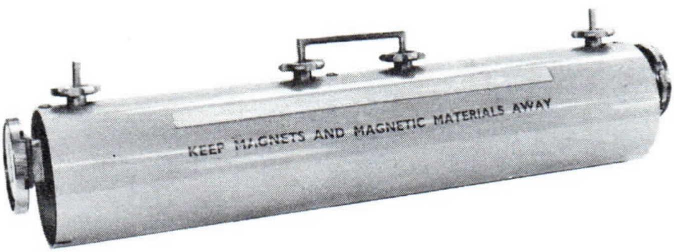


HIGH POWER ISOLATOR

CL 6241

QUICK REFERENCE DATA

Type	Resonance
Frequency	8.5 to 9.9 Gc/s
Power	High power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	8.5 to 9.9 Gc/s
Isolation	$>$ 10 dB over the range 8.7–9.7 Gc/s $>$ 9.5 dB over the range 8.5–9.9 Gc/s
Insertion loss	$<$ 0.8 dB
Input v.s.w.r.	$>$ 0.9

C.W. POWER RATING

When working into a load with a v.s.w.r. of 0.5 or greater the input power to the isolator must not exceed 2kW. Under no circumstances should the reflected power into the isolator exceed 250W.

MECHANICAL DATA

Construction	Waveguide WG16 (I.E.C.100, WR90, RG52/U)
Terminations	Input port—Z830004 plain flange. Output port—Z830003 choke flange with gasket groove.
External finish	Waveguide flange—silver plated. Protective cover—grey.
Weight	14 lb 2 oz. (6.4 kg.)

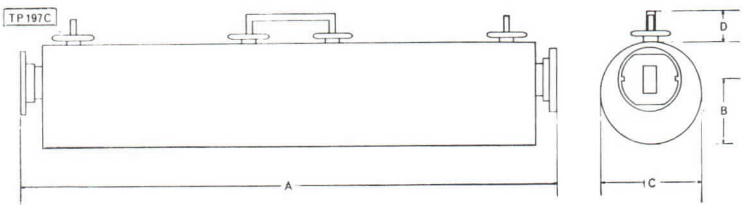
COOLING

The rate of flow of cooling water should not be less than 0.15 l/min (0.33gal/min). Inlet water temperature $\leqslant$ 20°C.

OUTLINE DRAWING

Dimensions

	Inches	*Millimetres*
A	$17\frac{1}{4}$	438
B	$2\frac{1}{16}$	52
C	$3\frac{1}{4}$	82
D	$1\frac{1}{8}$	28

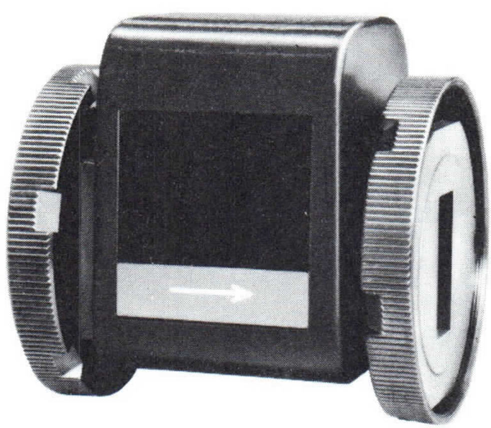


LOW POWER ISOLATOR

CL 6250

QUICK REFERENCE DATA

Type	Resonance
Frequency	8.925 to 9.825 Gc/s
Power	Low power for Telecommunications



ELECTRICAL CHARACTERISTICS

Frequency range	8.925 to 9.825 Gc/s
Isolation	> 15dB (over the band) > 20db (at band centre)
Insertion loss	< 1.0dB
Input v.s.w.r.	> 0.85

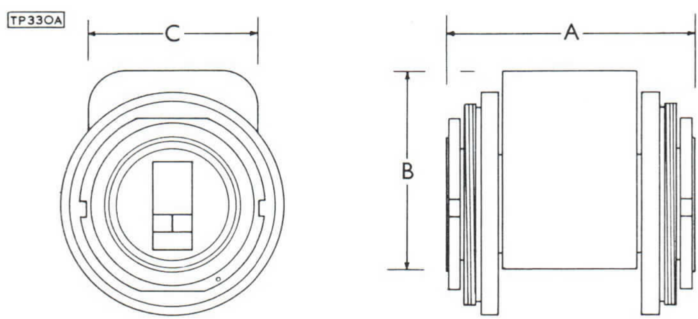
MECHANICAL DATA

Construction	Waveguide WG16 (I.E.C.100, WR90, RG52/U)
Terminations	Input Port—Z830003 choke flange Output port—Z830004 plain flange Coupling rings—male or female as required
External finish	Waveguide flanges—nickel plated
	Body—grey paint
Weight	1 lb 3 oz. (540 g)

OUTLINE DRAWING

Dimensions

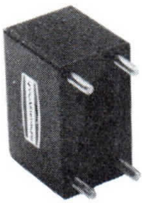
	Inches	*Millimetres*
A	$2\frac{1}{2}$	64
B	2	51
C	$1\frac{3}{4}$	44



MIXER ACCESSORIES

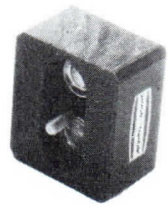
Crystal contacts and retaining covers for coaxial balanced mixers

CL 7050
CL 7051
CL 7052



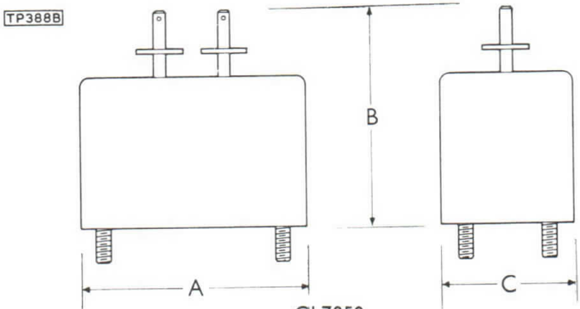
CL7050
For CL7300
Series

CL7051
For CL7311
Series

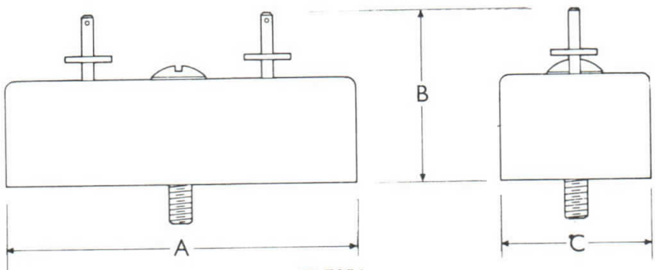


CL7052
For CL7411
Series

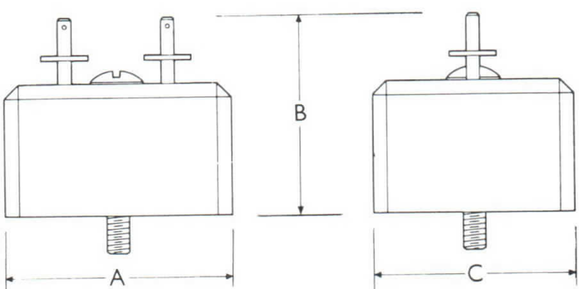
The covers are machined from solid blocks of Paxolin and their spring-loaded contacts are silver plated to DTD 919B. The CL7050 and CL7051 covers, fitted to their respective mixers, are shown below.



CL7050



CL7051



CL7052

DIMENSIONS AND WEIGHTS

	CL7050		CL7051		CL7052	
	Inches	*Millimetres*	*Inches*	*Millimetres*	*Inches*	*Millimetres*
A	$1\frac{1}{2}$	38	$2\frac{5}{16}$	58	$1\frac{1}{2}$	38
*B	$1\frac{7}{16}$	37	$1\frac{1}{8}$	28	$1\frac{5}{16}$	33
C	$\frac{7}{8}$	22	1	25	$1\frac{1}{3}$	32
Weight	1 oz (28g)		1 oz (28g)		1 oz (28g)	

*With crystals fitted in mixer.

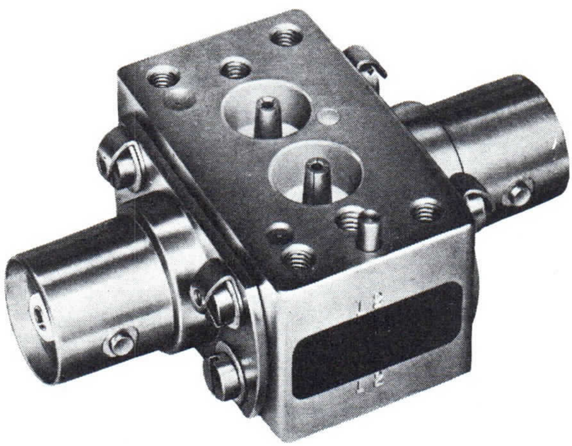
X-BAND COAXIAL BALANCED MIXER

CL 7300
CL 7301

QUICK REFERENCE DATA

Unless otherwise shown data is applicable to both types

Type	Coaxial balanced mixer
Frequency	7.0 to 11.5 Gc/s



ELECTRICAL CHARACTERISTICS

Frequency range	7.0 to 11.5 Gc/s
Isolation	>10 dB
Out of balance	<1.5 dB
Input v.s.w.r.	>0.2
Total output capacitance	14pF $\pm$ 1.5 pF

MECHANICAL DATA

Construction	Coaxial Balanced Mixer
Terminations	Input } CL7300 – Type C, 50Ω Output } CL7301 – Type N, 50Ω
External finish	Silver plated to DTD919B and Rhodium flashed
Weight	$5\frac{1}{2}$ oz (156g)

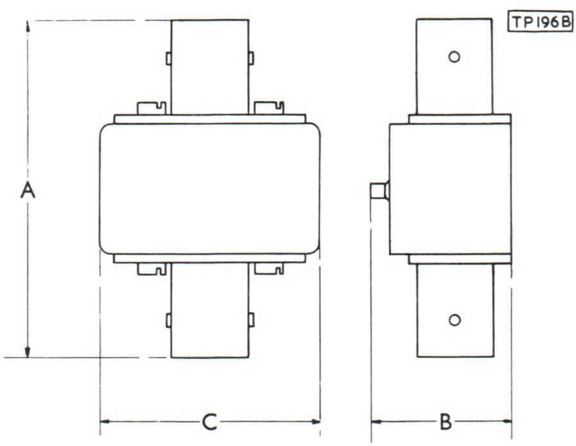
OUTLINE DRAWING

Dimensions

	CL7300		CL7301	
	Inches	*Millimetres*	*Inches*	*Millimetres*
A	$2\frac{5}{16}$	59	$2\frac{3}{4}$	70
B	$1\frac{5}{16}$	34	$1\frac{5}{16}$	34
C	$1\frac{1}{2}$	38	$1\frac{1}{2}$	38

ACCESSORIES

Crystal contacts and retaining cover CL7050



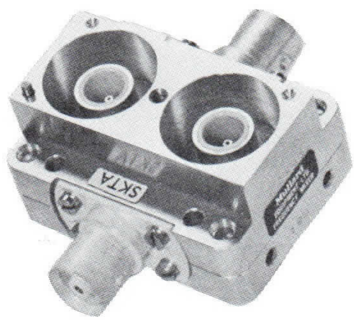
S-BAND COAXIAL BALANCED MIXER

CL 7311
CL 7312

QUICK REFERENCE DATA

Unless otherwise shown data is applicable to both types

Type	Coaxial balanced mixer
Frequency	2.5 to 4.1 Gc/s



ELECTRICAL CHARACTERISTICS

Frequency range	2.5 to 4.1	Gc/s
Isolation	> 15	dB
Out of balance	< 1.5	dB
Input v.s.w.r.	> 0.48	
Total output capacitance	14.5pF ± 1.0	pF

MECHANICAL DATA

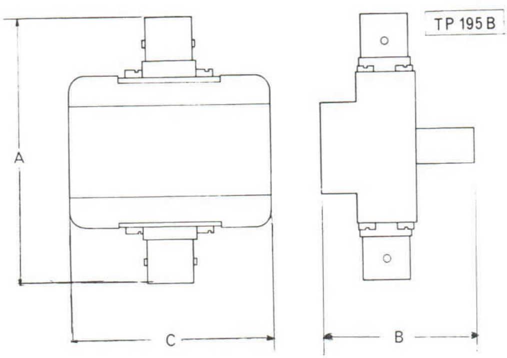
Construction	Coaxial Balanced Mixer
Terminations	Input } CL 7311—Type C, 50Ω Output } CL 7312—Type N, 50Ω
External finish	Silver plated to DTD919B and Rhodium flashed
Weight	15oz (425g)

OUTLINE DRAWING

Dimensions	CL 7311		CL 7312	
	Inches	*Millimetres*	*Inches*	*Millimetres*
A	$3\frac{1}{16}$	78	$3\frac{1}{2}$	89
B	2	51	2	51
C	$2\frac{5}{16}$	59	$2\frac{5}{16}$	59

ACCESSORIES

Crystal contacts and retaining cover CL 7051



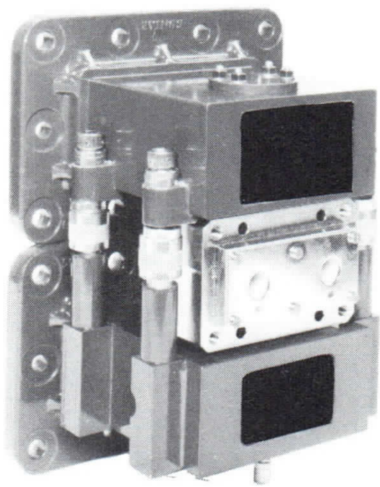
S-BAND WAVEGUIDE BALANCED MIXER

CL 7350

QUICK REFERENCE DATA

Unless otherwise shown data is applicable to both types

Type	Waveguide balanced mixer
Frequency	2.7 to 3.25 Gc/s



ELECTRICAL CHARACTERISTICS

Frequency range	2.7 to 3.25	Gc/s
Isolation	$>$ 20	dB
Out of balance	$<$ 1.0	dB
Input v.s.w.r.	0.4	
Total output capacitance	17pF$\pm$1.0	pF

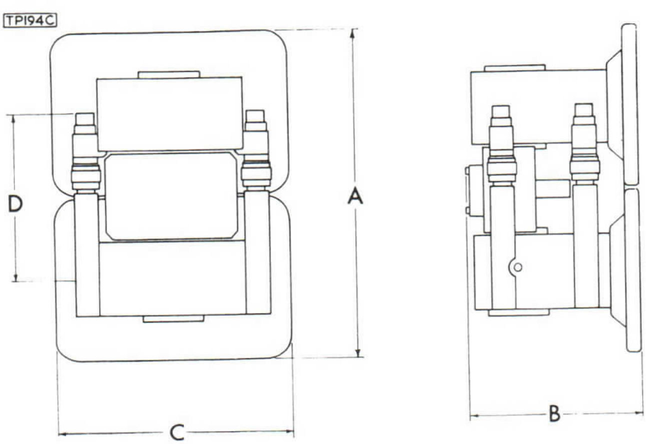
MECHANICAL DATA

Construction	Waveguide Balanced Mixer
Terminations	Input } J.S. Cat No. 5840-99-945-8243 plain flanges Output } fitted on both ports
External finish	Body—Crimson (B.S. 381C, Tint No. 540) Flanges—Silver plated to DTD919B and Rhodium flashed
Weight	7lb (3.2kg)

OUTLINE DRAWING

Dimensions

	Inches	*Millimetres*
A	6 23/32	170
B	3 5/8	92
C	4 13/16	122
D	3 3/8	86



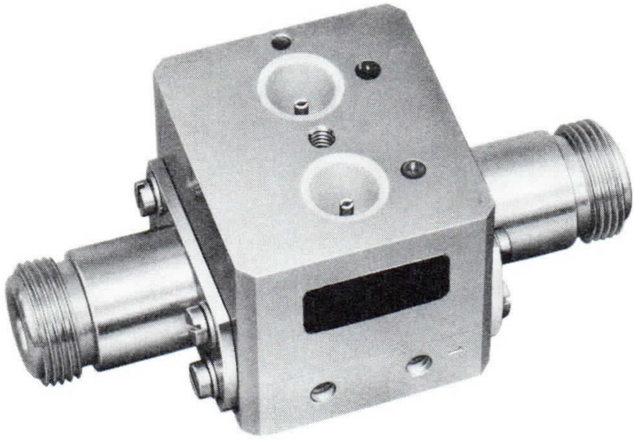
C-BAND COAXIAL BALANCED MIXER

CL 7411
CL 7412

QUICK REFERENCE DATA

Unless otherwise shown data is applicable to both types

Type	Coaxial balanced mixer
Frequency	4.1 to 7.0 Gc/s



ELECTRICAL CHARACTERISTICS

Frequency range	4.1 to 7.0	Gc/s
Isolation	$>$ 14	dB
Out of balance	$<$ 1.5	dB
*Input v.s.w.r.	$<$ 1.4	
Total output capacitance	11pF$\pm$1.0	pF

*Typical

MECHANICAL DATA

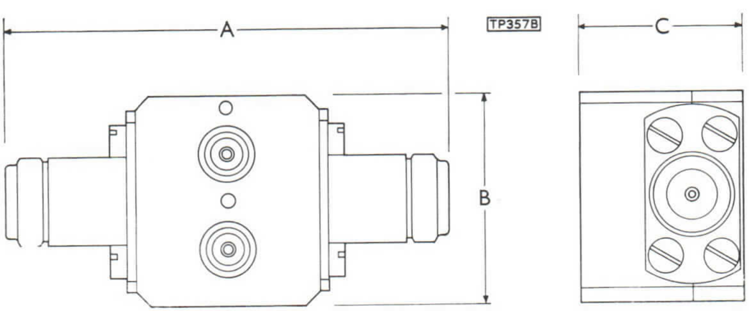
Construction	Coaxial Balanced Mixer
Terminations	Input } CL 7411—Type C, 50Ω Output } CL 7412—Type N, 50Ω
External finish	Silver plated to DTD919B and Rhodium flashed
Weight	14 oz (397g)

OUTLINE DRAWING

Dimensions	CL 7411		CL 7412	
	Inches	*Millimetres*	*Inches*	*Millimetres*
A	$2\frac{25}{32}$	70	$3\frac{7}{32}$	82
B	$1\frac{1}{2}$	38	$1\frac{1}{2}$	38
C	$1\frac{7}{32}$	31	$1\frac{7}{32}$	31

ACCESSORIES

Crystal contacts and retaining cover CL 7052



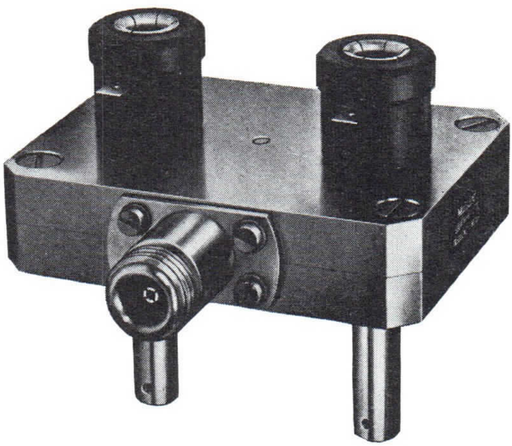
L2-BAND COAXIAL BALANCED MIXER

CL 7421
CL 7422

QUICK REFERENCE DATA

Unless otherwise shown data is applicable to both types

Type	Coaxial balanced mixer
Frequency	1.7 to 2.5 Gc/s



ELECTRICAL CHARACTERISTICS

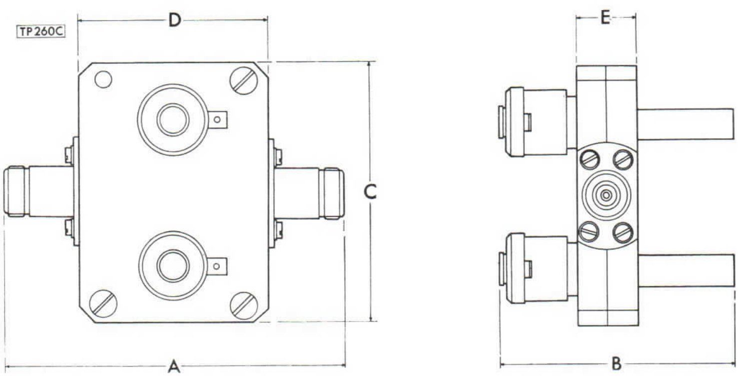
Frequency range	1.7 to 2.5	Gc/s
Isolation	> 20	dB
Out of balance	< 1.5	dB
Input v.s.w.r.	> 0.55	
Total output capacitance	15pF ± 1.0	pF

MECHANICAL DATA

Construction	Coaxial Balanced Mixer
Terminations	Input } **CL 7421—Type C, 50Ω** Output } **CL 7422—Type N, 50Ω**
External finish	Silver plated to DTD919B and Rhodium flashed
Weight	**1lb 4oz** (570g)

OUTLINE DRAWING

Dimensions	CL 7421 *Inches*	CL 7421 *Millimetres*	CL 7422 *Inches*	CL 7422 *Millimetres*
A	$3\frac{13}{16}$	97	$4\frac{1}{4}$	108
B	$2\frac{25}{32}$	70	$2\frac{25}{32}$	70
C	$3\frac{3}{16}$	81	$3\frac{3}{16}$	81
D	$2\frac{3}{8}$	60	$2\frac{3}{8}$	60
E	$\frac{3}{4}$	19	$\frac{3}{4}$	19



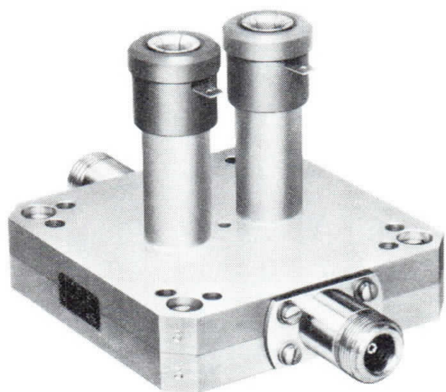
L1-BAND COAXIAL
BALANCED MIXER

CL 7431
CL 7432

QUICK REFERENCE DATA

Unless otherwise shown data is applicable to both types

Type	Coaxial balanced mixer
Frequency	1.0 to 1.7 Gc/s



ELECTRICAL CHARACTERISTICS

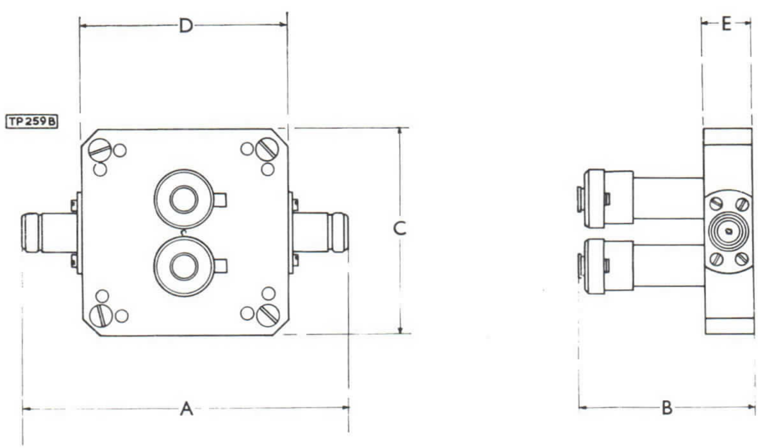
Frequency range	1.0 to 1.7	Gc/s
Isolation	$>$ 20	dB
Out of balance	$<$ 1.5	dB
Input v.s.w.r.	$>$ 0.3	
Total output capacitance	14.5 ± 1.0	pF

MECHANICAL DATA

Construction	Coaxial Balanced Mixer
Terminations	Input } CL 7431—Type C, 50Ω Output } CL 7432—Type N, 50Ω
External finish	Silver plated to DTD919B and Rhodium flashed
Weight	2lb 8oz (1.14kg)

OUTLINE DRAWING

Dimensions	CL 7431		CL 7432	
	Inches	*Millimetres*	*Inches*	*Millimetres*
A	$4\frac{11}{16}$	119	$5\frac{1}{8}$	130
B	$2\frac{5}{8}$	67	$2\frac{5}{8}$	67
C	$3\frac{1}{4}$	82	$3\frac{1}{4}$	82
D	$3\frac{1}{4}$	82	$3\frac{1}{4}$	82
E	$\frac{3}{4}$	19	$\frac{3}{4}$	19



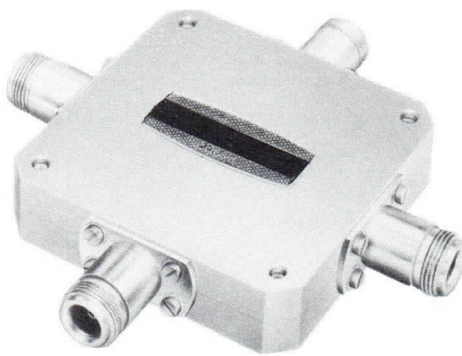
L1-BAND COAXIAL BALANCED HYBRID

CL 7461 CL 7462

QUICK REFERENCE DATA

Unless otherwise shown data is applicable to both types

Type	Coaxial balanced hybrid
Frequency	1.0 to 1.7 Gc/s



ELECTRICAL CHARACTERISTICS

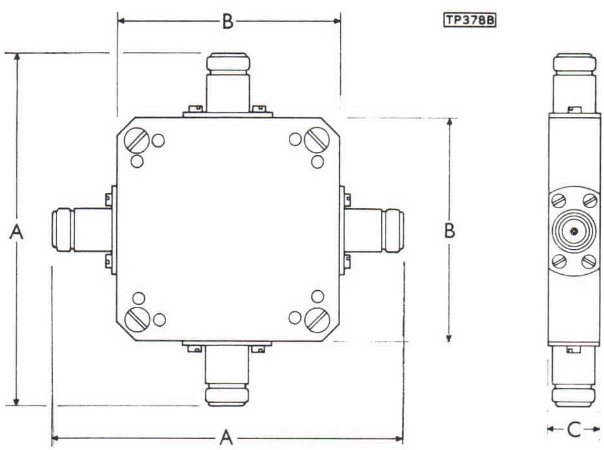
Frequency range	1.0 to 1.7	Gc/s
Isolation	$>$ 20	dB
Out of balance	$<$ 1.0	dB
Input v.s.w.r.	$>$ 0.6	

MECHANICAL DATA

Construction	Coaxial balanced hybrid
Terminations	Input / Output } CL 7461—Type C, 50Ω; CL 7462—Type N, 50Ω
External finish	Silver plated to DTD919B and Rhodium flashed
Weight	2lb 8oz (1.14kg)

OUTLINE DRAWING

Dimensions	CL 7461		CL 7462	
	Inches	*Millimetres*	*Inches*	*Millimetres*
A	$4\frac{11}{16}$	119	$5\frac{1}{8}$	130
B	$3\frac{1}{4}$	83	$3\frac{1}{4}$	83
C	$\frac{3}{4}$	19	$\frac{3}{4}$	19



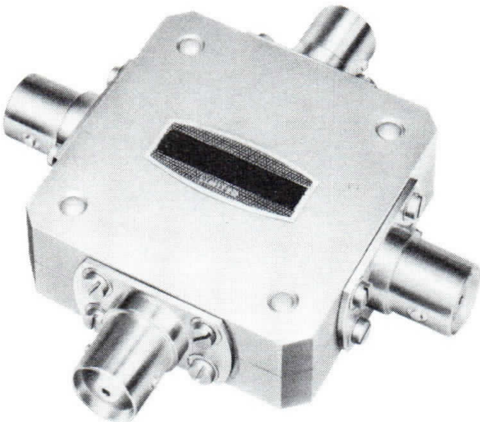
L2-BAND COAXIAL BALANCED HYBRID

CL 7471
CL 7472

QUICK REFERENCE DATA

Unless otherwise shown data is applicable to both types

Type	Coaxial balanced hybrid
Frequency	1.7 to 2.5 Gc/s



ELECTRICAL CHARACTERISTICS

Frequency range	1.7 to 2.5	Gc/s
Isolation	> 20	dB
Out of balance	< 1.0	dB
Input v.s.w.r.	> 0.65	dB

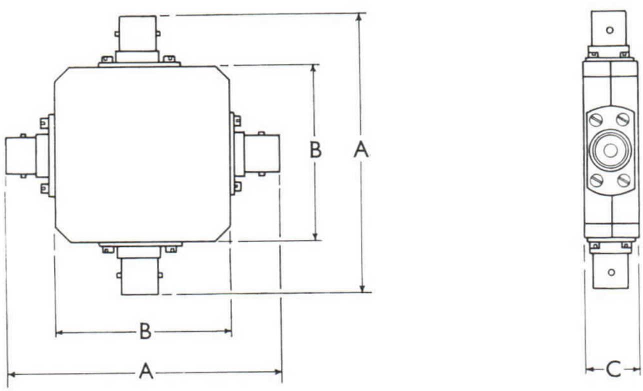
MECHANICAL DATA

Construction	Coaxial balanced hybrid
Terminations	Input } CL 7471—Type C, 50Ω Output } CL 7472—Type N, 50Ω
External finish	Silver plated to DTD919B and Rhodium flashed
Weight	1lb 6oz (640g)

OUTLINE DRAWING

Dimensions	CL 7471		CL 7472	
	Inches	*Millimetres*	*Inches*	*Millimetres*
A	$3\frac{13}{16}$	97	$4\frac{1}{4}$	108
B	$2\frac{3}{8}$	60	$2\frac{3}{8}$	60
C	$\frac{3}{4}$	19	$\frac{3}{4}$	19

TP340B



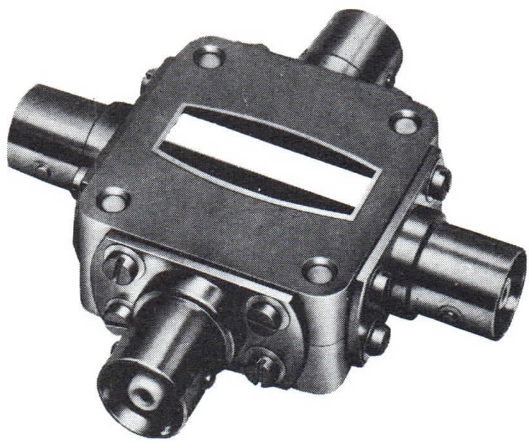
S-BAND COAXIAL BALANCED HYBRID

CL 7481
CL 7482

QUICK REFERENCE DATA

Unless otherwise shown data is applicable to both types

Type	Coaxial balanced hybrid
Frequency	2.5 to 4.1 Gc/s



ELECTRICAL CHARACTERISTICS

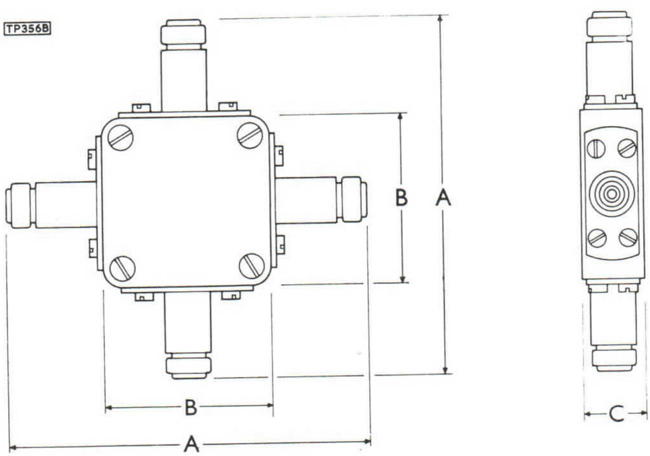
Frequency range	2.5 to 4.1	Gc/s
Isolation	$>$ 20	dB
Out of balance	$<$ 1.0	dB
Input v.s.w.r.	$>$ 0.65	

MECHANICAL DATA

Construction	Coaxial balanced hybrid
Terminations	Input / Output } CL 7481—Type C, 50Ω CL 7482—Type N, 50Ω
External finish	Silver plated to DTD919B and Rhodium flashed
Weight	$12\frac{1}{2}$oz (360g)

OUTLINE DRAWING

Dimensions	CL 7481		CL 7482	
	Inches	*Millimetres*	*Inches*	*Millimetres*
A	$3\frac{1}{16}$	78	$3\frac{1}{2}$	89
B	$1\frac{5}{8}$	41	$1\frac{5}{8}$	41
C	$\frac{3}{4}$	19	$\frac{3}{4}$	19



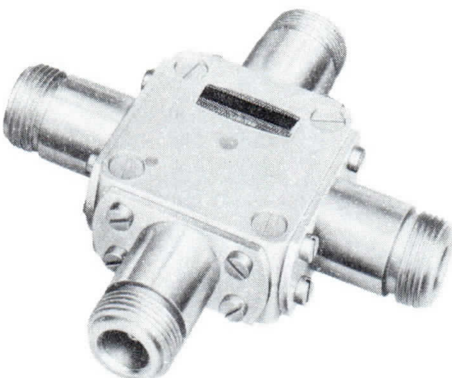
C1-BAND COAXIAL BALANCED HYBRID

CL 7491 CL 7492

QUICK REFERENCE DATA

Unless otherwise shown data is applicable to both types

Type	Coaxial balanced hybrid
Frequency	4.1 to 7.0 Gc/s



ELECTRICAL CHARACTERISTICS

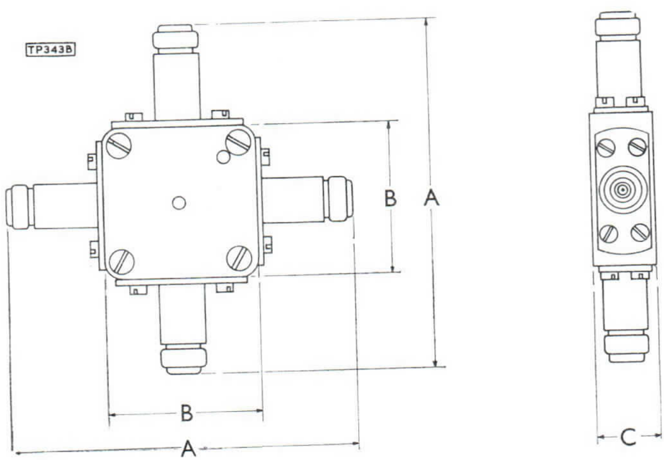
Frequency range	4.1 to 7.0	Gc/s
Isolation	> 20	dB
Out of balance	< 1.0	dB
Input v.s.w.r.	> 0.45	dB

MECHANICAL DATA

Construction	Coaxial balanced hybrid
Terminations	Input / Output: CL 7491—Type C, 50Ω; CL 7492—Type N, 50Ω
External finish	Silver plated to DTD919B and Rhodium flashed
Weight	11oz (300g)

OUTLINE DRAWING

Dimensions	CL 7491 *Inches*	CL 7491 *Millimetres*	CL 7492 *Inches*	CL 7492 *Millimetres*
A	$2\frac{27}{32}$	72	$3\frac{9}{32}$	83
B	$1\frac{13}{32}$	36	$1\frac{13}{32}$	36
C	$\frac{3}{4}$	19	$\frac{3}{4}$	19



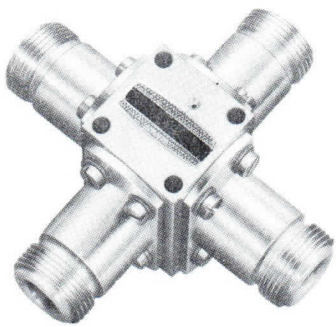
X-BAND COAXIAL BALANCED HYBRID

CL 7501 CL 7502

QUICK REFERENCE DATA

Unless otherwise shown data is applicable to both types

Type	Coaxial balanced hybrid
Frequency	7.0 to 11.5 Gc/s



ELECTRICAL CHARACTERISTICS

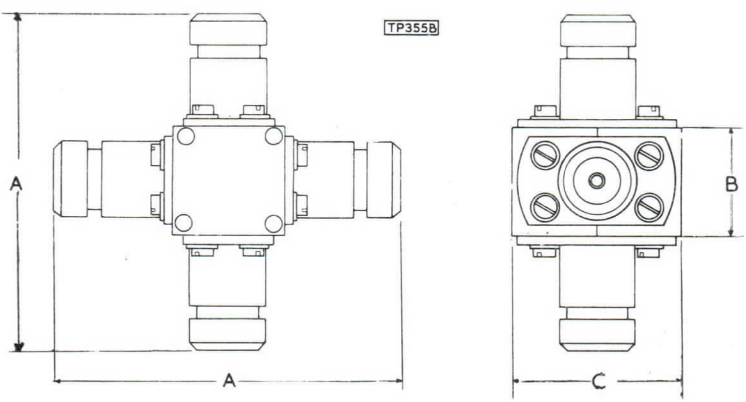
Frequency range	7.0 to 11.5	Gc/s
Isolation	$>$ 14	dB
Out of balance	$<$ 1.5	dB
Input v.s.w.r.	$>$ 0.55	

MECHANICAL DATA

Construction	Coaxial Balanced Mixer
Terminations	Input } CL 7501—Type C, 50Ω Output } CL 7502—Type N, 50Ω
External finish	Silver plated to DTD919B and Rhodium flashed
Weight	**8½oz (230g)**

OUTLINE DRAWING

Dimensions	CL 7501		CL 7502	
	Inches	*Millimetres*	*Inches*	*Millimetres*
A	**2 5/16**	**59**	**2¾**	**70**
B	**⅞**	**22**	**⅞**	**22**
C	**1⅜**	**35**	**1⅜**	**35**



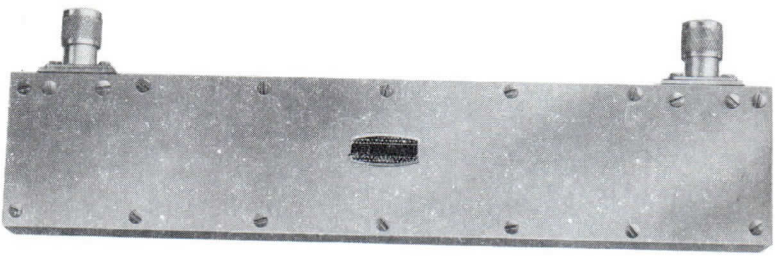
BAND-PASS FILTER

CL 7513

QUICK REFERENCE DATA

Type	Multicavity, direct coupled stripline filter
*Centre frequency (fo)	2.0 to 4.0 Gc/s

*According to requirement



ELECTRICAL CHARACTERISTICS

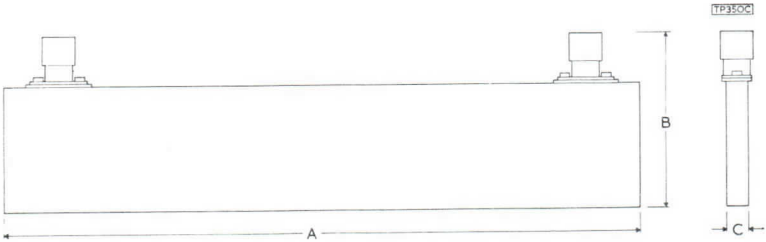
Centre frequency (f_o)	2.0 to 4.0	Gc/s
Insertion loss	<1.0	dB
V.s.w.r. in pass band	>0.4	
Cut-off slope	>45dB/100 Mc/s	
Frequencies for 30dB insertion loss	$0.9f_o$ and $1.1f_o$	

MECHANICAL DATA

Construction	Multicavity, direct coupled stripline filter
Terminations	Input } Coaxial 50Ω type N or C Output }
External finish	Silver plated to DTD919B and Rhodium flashed.

OUTLINE DRAWING

Dimensions	Type N–50Ω		Type C–50Ω	
	Inches	*Millimetres*	*Inches*	*Millimetres*
A	14	356	14	356
B	4	102	$3\frac{25}{32}$	97
C	$\frac{15}{32}$	12	$\frac{15}{32}$	12

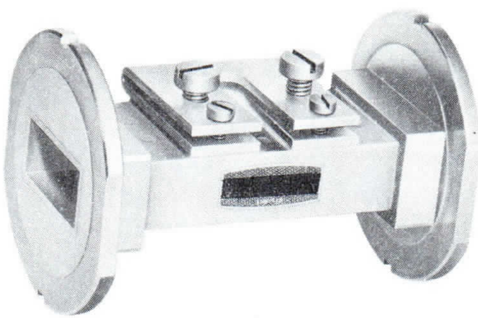


BAND-PASS FILTER

CL 7515

QUICK REFERENCE DATA

Type	Tunable narrow-band two-cavity filter
Frequency	9.0 to 9.5 Gc/s



ELECTRICAL CHARACTERISTICS

Frequency range	9.0 to 9.5		Gc/s
Insertion loss (band centre)	0.6 to 0.3		dB
Pass band to 3dB points	45	55	Mc/s
Rejection at 120Mc/s from tuned frequencies	23		dB

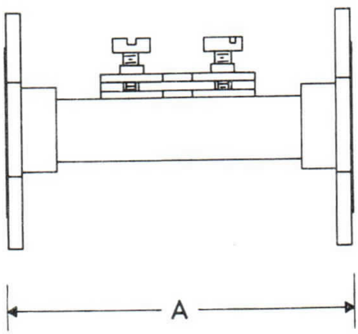
MECHANICAL DATA

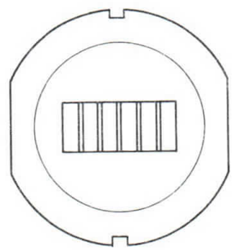
Construction	Tunable narrow-band two-cavity filter.
Terminations	Input, Output: Waveguide WG16 (I.E.C.100, WR90, RG52/U)
External finish	Silver plated to DTD919B and Rhodium flashed.

OUTLINE DRAWING

Dimension	*Inches*	*Millimetres*
A	$2\frac{3}{4}$	69.85

TP351A





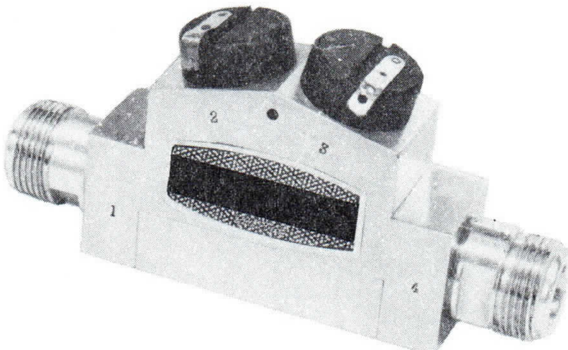
BROADBAND DIODE SWITCH OR ATTENUATOR

CL 7634
CL 7635

QUICK REFERENCE DATA

Unless otherwise shown data is applicable to both types.

Type	Coaxial to coaxial
Frequency	2.5 to 7.5 Gc/s



ELECTRICAL CHARACTERISTICS

Frequency range	2.5 to 7.5	Gc/s
Insertion loss	<2.0	dB
Isolation	>15	dB
Input v.s.w.r.	>0.42	
Switching time	<1	μs
Crystal currents	Switch on –	zero
	Switch off –	0.6mA

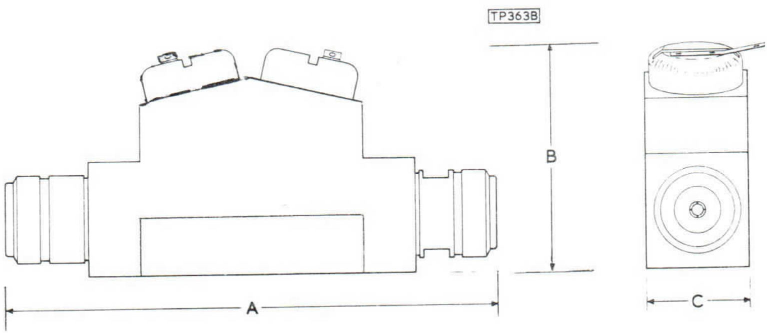
MECHANICAL CHARACTERISTICS

Coaxial connections	CL7634 – Type C, 50Ω
	CL7635 – Type N, 50Ω
External finish	Silver plated to DTD919B and Rhodium flashed.
Weight	$5\frac{1}{2}$ oz (156g)

OUTLINE DRAWING

Dimensions

	CL7634		CL7635	
	Inches	*Millimetres*	*Inches*	*Millimetres*
A	$3\frac{1}{16}$	78	$3\frac{1}{2}$	89
B	$1\frac{11}{16}$	43	$1\frac{11}{16}$	43
C	$\frac{3}{4}$	19	$\frac{3}{4}$	19



X-BAND GUNN OSCILLATORS

CL8360 CL8380 CL8370 CL8390

QUICK REFERENCE DATA

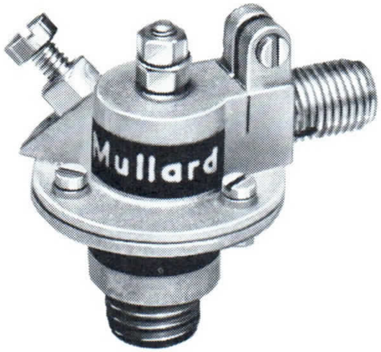
A range of four Gunn oscillators covering the X-band. Compact solid state oscillators for general purpose use.

Frequency range	CL8360	8 to 9	GHz
	CL8370	9 to 10	GHz
	CL8380	10 to 11	GHz
	CL8390	11 to 12	GHz
Power output (typ.)		5.0	mW
Operating voltage		-7.0	V

Unless otherwise shown, data is applicable to all types

OPERATING CONDITIONS

Operating voltage	-7.0	V
Operating current	120	mA
P_{out}	5.0	mW



CHARACTERISTICS (at 25^{o}C)

Nominal centre frequency	CL8360		8.5	GHz
	CL8370		9.5	GHz
	CL8380		10.5	GHz
	CL8390		11.5	GHz
	Min.	Typ.	Max.	
Mechanical tuning range	±500	±550	-	MHz
P_{out} over tuning range	2.0	5.0	-	mW
Variation in P_{out} over tuning range	-	-	3.0	dB

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

Operating voltage max.	-8.0	V

TEMPERATURE

Range max.	-25 to +85	^{o}C

OUTPUT CONNECTOR 50Ω O.S.M.

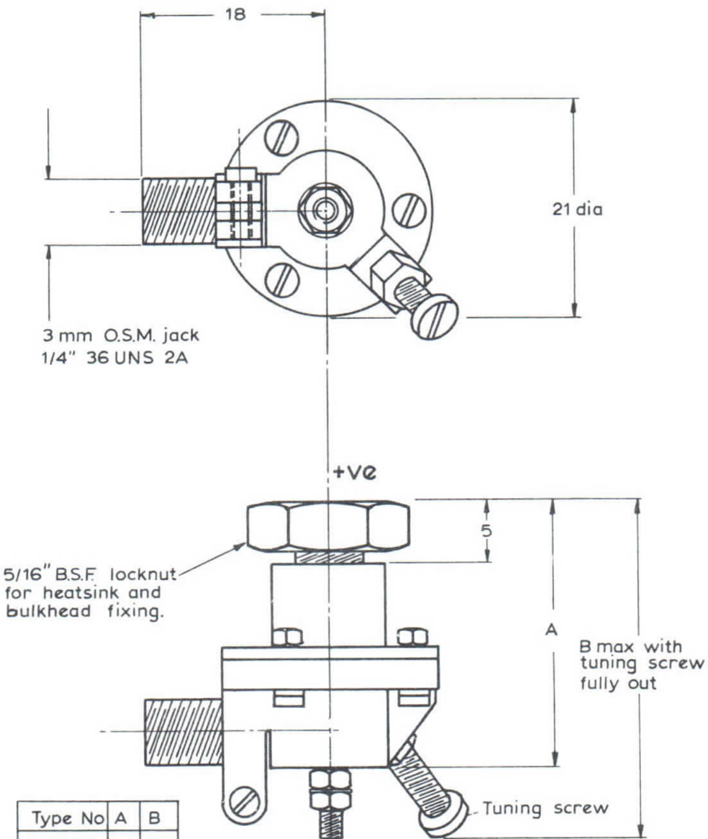
OPERATING NOTES

1. The output probe may be adjusted for maximum power at any frequency in the tuning range.

2. The active element will be damaged if the supply voltage is reversed. See outline drawing on page 3.

OUTLINE DRAWING

B8636



Type No	A	B
CL8360	25	32
CL8370	22	29
CL8380	20	27
CL8390	20	27

All dimensions in mm.