EMI varian

Reflex Klystrons and Cavities

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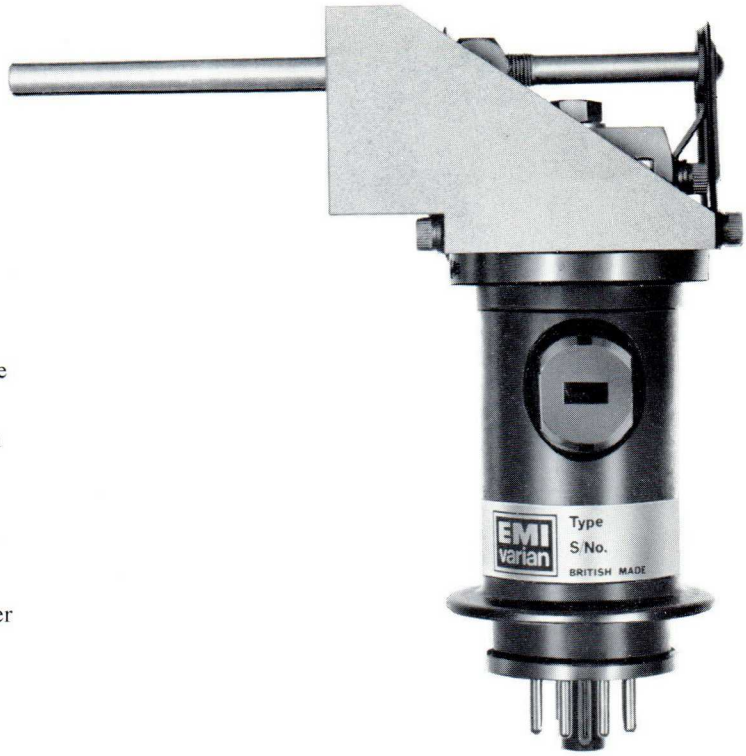
Reflex Klystron Selection Chart

Millimetre Klystrons



A series of 2 kV tubes covers the frequency range 12·4 to 40 GHz. They are of all metal construction with integral tunable cavities and indirectly heated cathodes. The tuner is of unique design and gives excellent frequency stability and freedom from microphony.

Developed from the 2 kV tubes is a series of $2\frac{1}{2}$ kV pump oscillator tubes. Operation at $2\frac{1}{2}$ kV has been made possible by improved manufacturing techniques and better internal insulation. They typically give about $\frac{1}{4}$ watt and are tunable over 5% in their respective bands.

Brief Specifications

		RATINGS All voltages referred to cathode						OPERATION Under standard voltage conditions								
		Resonator Voltage (kV)		Reflector Voltage (Volts)		Heater Voltage (Volts)		Resonator Current (mA)		Reflector Current (μA)	Heater Current (Amps)		E.T.R. MHz	Power into matched load mW		
TYPE NUMBER	FREQUENCY RANGE (GHz)	Standard	Maximum	Minimum	Maximum	Standard	Maximum	Typical	Maximum	Maximum	Typical	Maximum	Typical	Minimum	Typical	**OUTPUT SYSTEM**
R9624	12·4 to 15·0	2·0	2·2	–100	–600	6·3	6·9	12	15	30	0·8	0·95	60	40*	100	**WG18 (WR62) 5985–99–083–0030 (UG 419/U) Flange**
R9625	13·5 to 16·5	2·0	2·2	–100	–600	6·3	6·9	12	15	30	0·8	0·95	60	50	100	
R9626	15·0 to 18·0	2·0	2·2	–100	–600	6·3	6·9	12	15	30	0·8	0·95	60	50	100	
R9622	18·0 to 22·5	2·0	2·2	–100	–600	6·3	6·9	12	15	30	0·8	0·95	60	40	100	**WG20 (WR42) 5985–99–011–9658 (UG 595/U) Flange**
R9521	20·0 to 24·0	2·0	2·2	–100	–600	6·3	6·9	12	15	30	0·8	0·95	60	50	100	
R9602	22·5 to 26·0	2·0	2·2	–100	–600	6·3	6·9	12	15	30	0·8	0·95	60	40	100	
R9729	26·0 to 29·0	2·0	2·2	–100	–500	6·3	6·9	12	15	30	0·8	0·95	68	15	70	**WG22 (WR28) 5985–99–083–0018 Flange**
R9518	27·8 to 32·2	2·0	2·2	–100	–500	6·3	6·9	12	15	30	0·8	0·95	68	15	80	
R9651	31·25 to 33·7	2·0	2·2	–100	–500	6·3	6·9	12	15	30	0·8	0·95	70	15	60	
R5146	34·2 to 35·5	2·0	2·2	–100	–500	6·3	6·9	10	15	30	0·8	0·95	70	30	90	
R9546	32·3 to 37·5	2·0	2·2	–100	–500	6·3	6·9	12	15	30	0·8	0·95	77	15	60	
R9521	35·0 to 40·0	2·0	2·2	–100	–500	6·3	6·9	12	15	30	0·8	0·95	85	15	60	
R9676	12·4 to 18·0	2·5	2·7	–100	–600	6·3	6·9	18	20	30	0·8	0·95	60	175	300	**WG18** } **Flange as above**
R9675	18·0 to 26·5	2·5	2·7	–100	–600	6·3	6·9	18	20	30	0·8	0·95	60	175	250	**WG20**
R9674	26·5 to 37·5	2·5	2·7	–100	–600	6·3	6·9	18	20	30	0·8	0·95	70	175	200	**WG22**

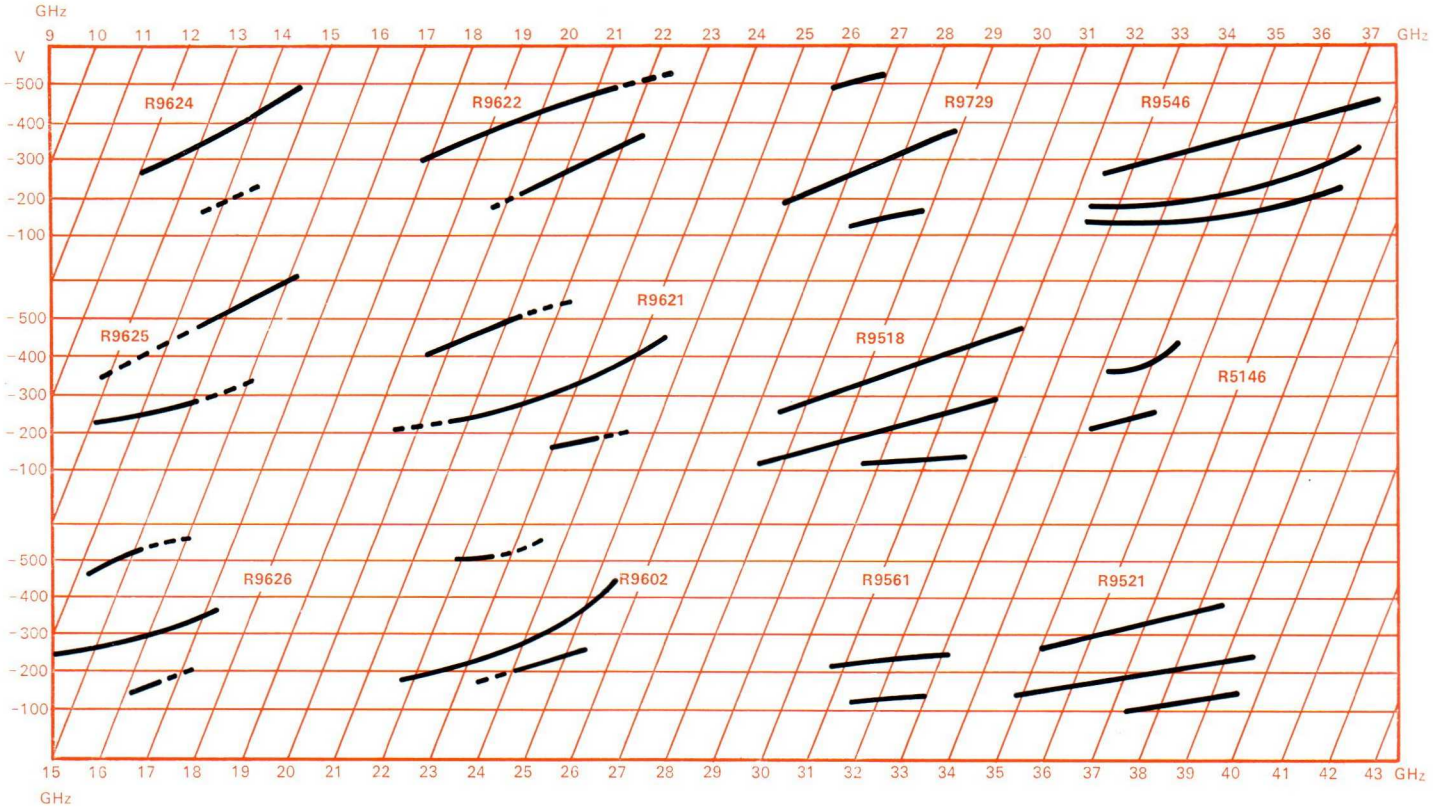
**20 mW minimum between 12·4 and 13 GHz*

Octal Base. B80

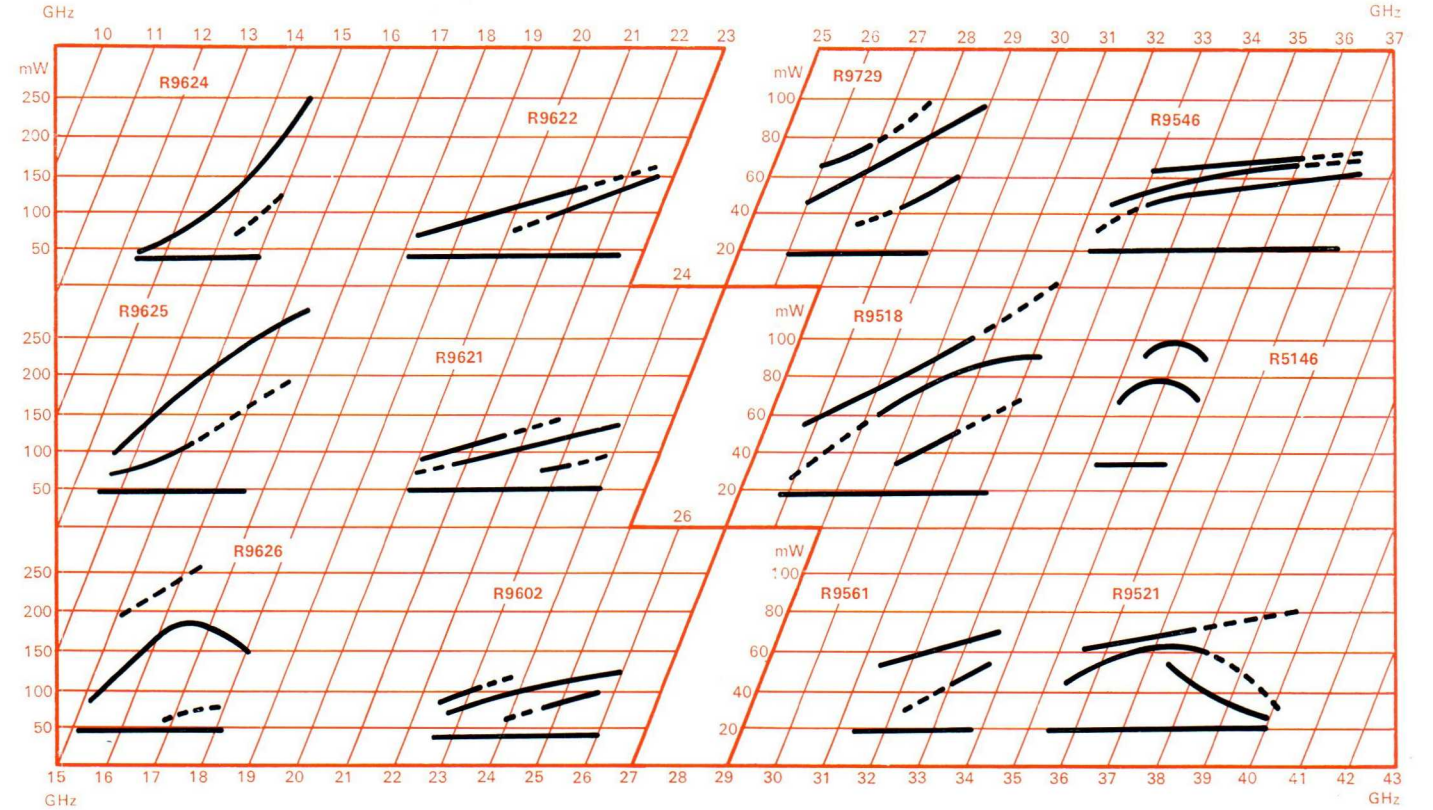
PIN No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Fixing Holes**
CONNECTION	Grid	Heater	Internal Connection	Internal Connection	Reflector	Internal Connection	Heater Cathode	Internal Connection	Resonator

Grid voltage optimised in the range 0 to –200V: maximum Grid current 1mA
N.B. The R5146 is available to the CV6001 specification

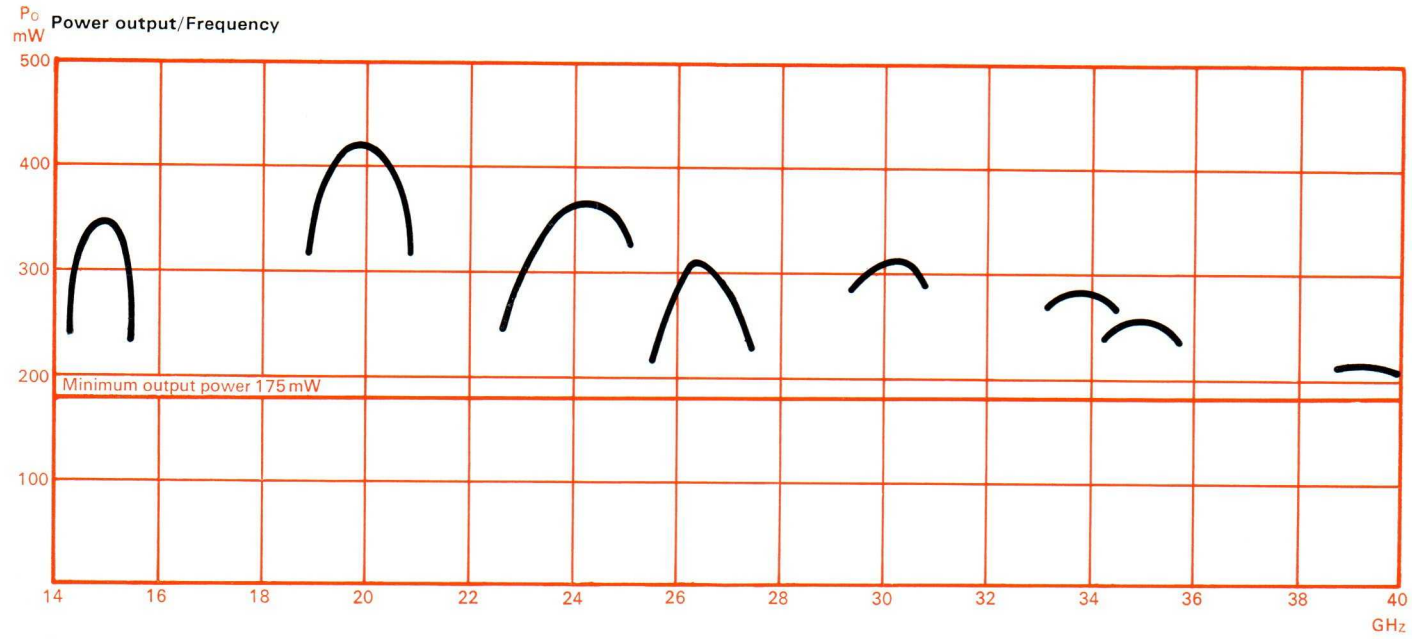
Reflector Volts vs Frequency (typical curves)

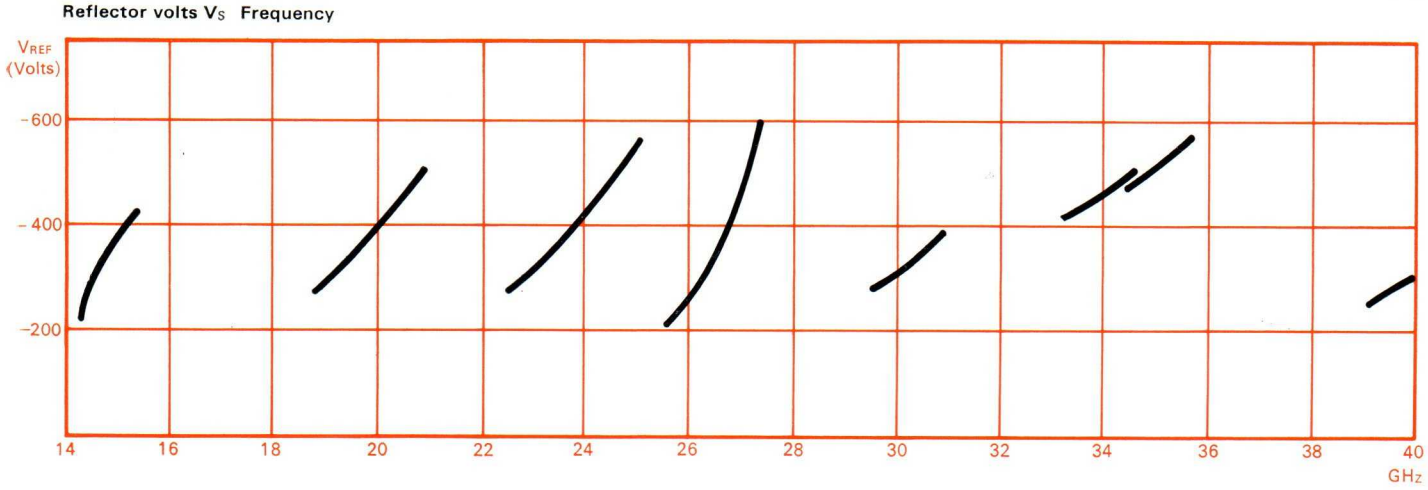


Power Output vs Frequency (typical curves)



Pump Oscillators (some typical curves)



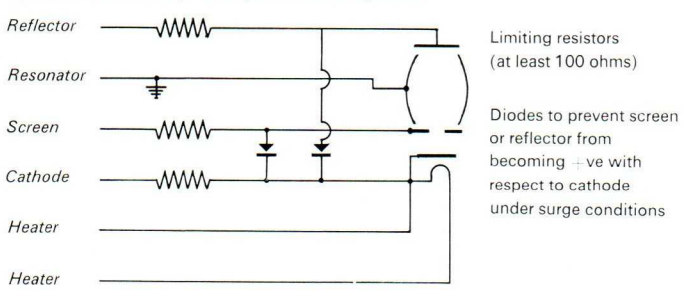


Operational Notes

The tubes are normally operated with the resonator at earth potential. The cathode should be preheated at normal voltage for a minimum of one minute before the resonator voltage is applied. The maximum impedance of the reflector and grid supplies is 75000 ohms. The h.t. supply must never be applied to the resonator in the absence of negative reflector and grid volts.

Power supply 100 ohm limiting resistors should be incorporated in the power supply leads to cathode reflector and screen in order to protect both the klystron and the circuit breaker in the power unit. A suitable diode should be connected between the reflector and cathode and also between screen and cathode to avoid damage to the tube in the event of failure in the power supply and limiting resistors (at least 100 ohms) diodes to prevent screen or reflector from becoming positive with respect to cathode under surge conditions.

Recommended circuitry for the protection of Klystrons.



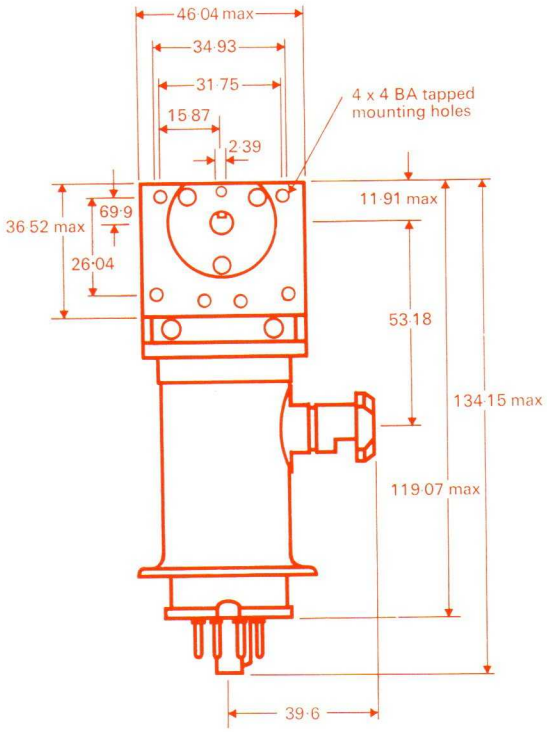
Where complete freedom is necessary from both fluctuations in the output power and frequency a choke should be connected in series with the resonator supply. The inductance of this choke should be 4H with a d.c. resistance of about 60 ohms. It should be insulated for at least 2½ kV. This choke may be connected in either the positive or negative side of the supply but care should be taken to avoid stray capacitance from leads or sub units which might have a shunting effect.

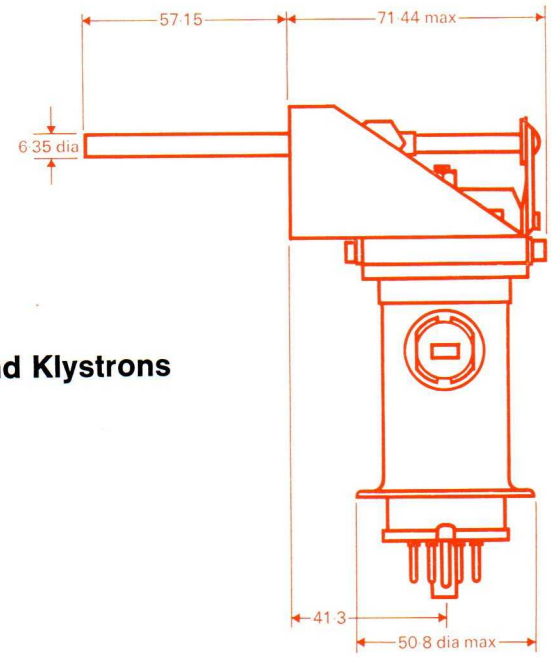
Mounting The tube is designed with a floating base socket and no undue strain should be put upon this or on the output coupler which is located with respect to the mounting face of the tuner block. Any orientation may be used and it is recommended that the four 4BA tapped holes in the mounting face be used. Tuning may be impaired if the spindle is constrained axially or radially. No screws on the tuner assembly should be loosened.

Cooling The temperature of the envelope or any external metal part should not be allowed to exceed 150°C at any point and forced air cooling will normally be required.

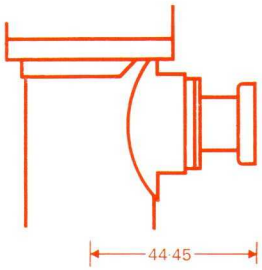
Warm up time With full ventilation but without forced air cooling operation within 50 MHz of final frequency is possible within 15 minutes of switching on. This period is considerably reduced with forced air cooling.

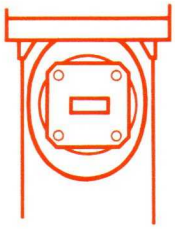
Weight J Band 15 oz 430 g K Band 14 oz 400 g
Q Band 13 oz 370 g.



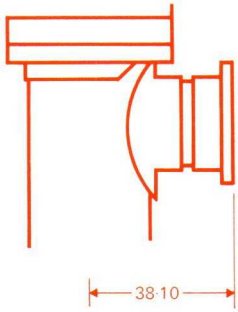


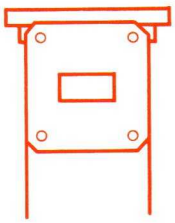
Q Band Klystrons





K Band Klystrons

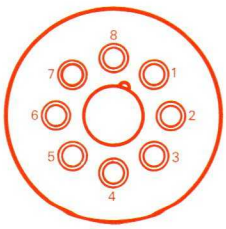




J Band Klystrons

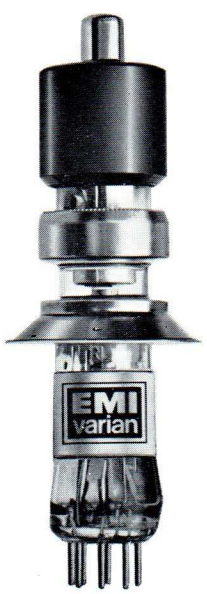
All dimensions in mm

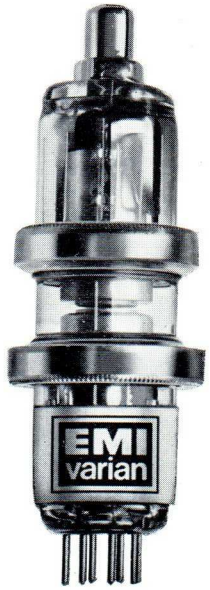
Base B80



Plug-in Klystrons

The EMI-Varian range of plug-in klystrons covers the frequency range 1·0 to 11·7 GHz. Included in the range are both commercial and military types. These tubes find numerous applications in radar systems, communications networks and many fields of research work both in universities and other institutions. The plug-in klystron enables manufacturers to design their own cavities to fit systems or to give emphasis to one or more parameters which may be of importance in a particular application. Also available is a range of cavities outlined on page 14.





		CV2346			R5222			R9689			R9687			R9696			R9701			CV6071			R9559			CV2116		
RATINGS																												
Vres Resonator Voltage	Standard V		300			300			300			350			350			350			300			300			250		
	Maximum V		350			350			350			370			370			370			350			350			300		
Vref Reflector Voltage	Minimum V		−50			−50			−50			−50			−50			−50			−30			−30			−50		
	Maximum V		−500			−500			−500			−500			−500			−500			−500			−500			−500		
Vh Heater Voltage	Minimum V		5·8			5·8			5·8			5·8			5·8			5·8			5·8			5·8			5·8		
	Standard V		6·3			6·3			6·3			6·3			6·3			6·3			6·3			6·3			6·3		
	Maximum V		6·8			6·8			6·8			6·8			6·8			6·8			6·8			6·8			6·8		
All voltages w.r.t. cathode																													
OPERATION (AT STANDARD INPUT VOLTAGES)		MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX
Usable frequency range	GHz	3·0		12·0	3·0		12·0	3·0		12·0	6·8		7·8	7·0		12·0	5·0		8·2	1·0		5·4	1·0		5·4	1·8		4·5
Tested frequency range	GHz	8·5		10·0	8·5		10·0	7·0		11·5		7·0		7·0	†	10·3	5·4		8·2	3·15		3·58	3·15		3·58	2·6		4·2
														8·2	‡	11·7												
Ires Resonator current	mA	22	28	35	20	30	40	20	32	40	20	40	50	20	40	55	20	40	55	25	35	45	23	35	48	20	26	32
Iref Reflector current	μA			4			4			4			4			4			4			4			4			4
Ih Heater current	A	0·6	0·65	0·7	0·6	0·65	0·75	0·7	0·8	0·9	0·7	0·8	0·9	0·7	0·8	0·9	0·7	0·8	0·9	1·0	1·2	1·35	1·0	1·2	1·4	0·6	0·65	0·7
Sample test oscillation	GHz		10·1			10·1			9·2		**	7·0			7·0			5·4			3·15			3·15			3·2	
Reflector mode			4¾			4¾			3¾			3¾			3¾			2¾			2¾			2¾			2¾	
Reflector volts	V	−195	−210	−225	*	−210	*	−280	−320	−360	*	−140	*	*	−140	*	*	−170	*	−130	−160	−190	−130	−160	−190	−126	−175	−224
Frequency variation between tubes	MHz	−50		+50	−60		+60	−50		+50	−20		+20							−30		+30	−35		+35	−15		+15
Power output	MW	30	45	75	25	45	*	15§	100	*	40	70	*	30	100	*	30	100	*	100	150	*	100	150	*	100	140	*
Electronic tuning	MHz	*	15	*	*	15	*	*	8	*	10	16	*	*	30	*	*	25	*	25	35	*	*	35	*	17	23	29
½ power mode width	V	*	25	*	*	25	*	*	40	*	*	35	*	*	40	*	*	50	*	35	45	65	*	45	*	35	42	49
Slope at mode peak	MHz/V	0·35	0·45	*	*	0·45	*	*	0·15	*	*	0·2	*	*	0·4	*	*	0·3	*	0·25	0·5	0·85	*	0·5	*	*	0·5	*
Sample test oscillation	GHz		8·5			8·5			7·0						10·3			8·2			3·58			3·58			2·64	
Reflector mode			4¾			4¾			3¾						3¾			2¾			2¾			2¾			2¾	
Reflector volts	V	*	−150	*	*	−150	*	−120	−145	−170				*	−360	*	*	−470	*	−180	−220	−260	*	−220	*	−58	−95	−132
Frequency variation between tubes	MHz	−50		+50	−60		+60	−50		+50										−25		+25	−30		+30	−15		+15
Power output	MW	30	45	75	*	45	*	30	100	*				30	170	*	30	50	*	60	100	*	*	100	*	100	140	*
Electronic tuning	MHz	*	15	*	*	15	*	*	15	*				*	20	*	*	6	*	23	35	*	*	35	*	18	24	30
½ power mode width	V	*	18	*	*	18	*	*	35	*				*	43	*	*	90	*	35	50	65	*	50	*	22	30	37
Slope at mode peak	MHz/V	*	0·45	*	*	0·45	*	*	0·2	*				*	0·3	*	*	0·05	*	0·25	0·6	0·85	*	0·6	*	*	0·6	*

*Not specifically limited
†In 25157 cavity—see page 14
‡In 25182 cavity—see page 14

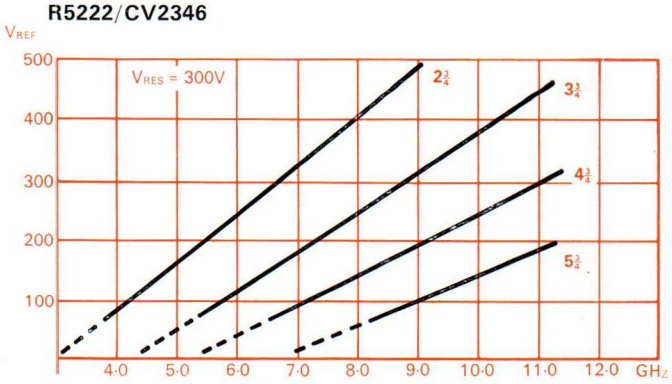
**Supplied for EMI microwave link local oscillator
§15MW limit in 5¾ mode

Connections

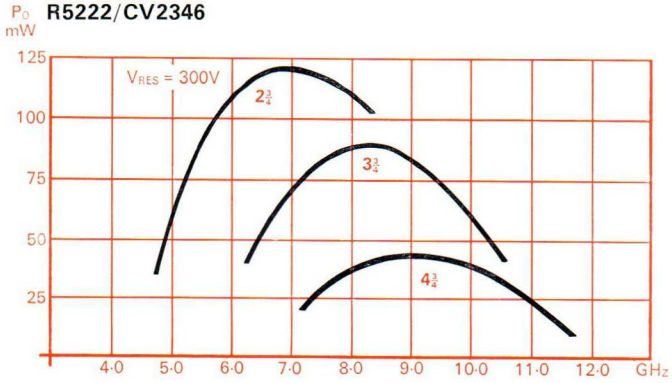
	Base	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Top Cap BS448 (CT1)	Disc Seals
CV2116	B7G	Internal Connection	Cathode	Internal Connection	Internal Connection	Heater	Cathode Screen	Heater	Reflector	Resonator
R5222/CV2346 R9687/R9689 R9696 R9701	B7G	Cathode Screen	Cathode	No Connection	Cathode Screen	Heater	Cathode Screen	Heater	Reflector	Resonator
R9559 CV6071	Pee Wee 4 Pin	Internal Connection	Heater	Internal Connection	Heater Cathode	——	——	——	Reflector	Resonator

Performance Data on Plug-in Klystrons

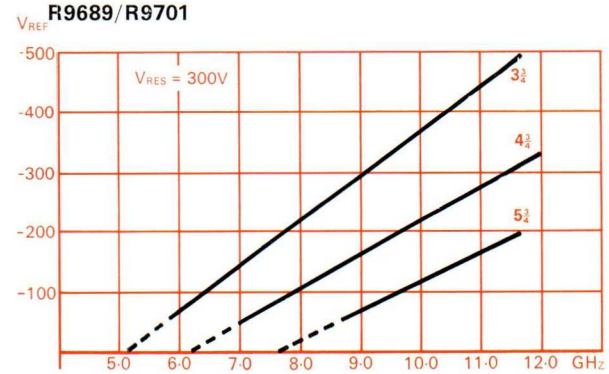
R5222/CV2346



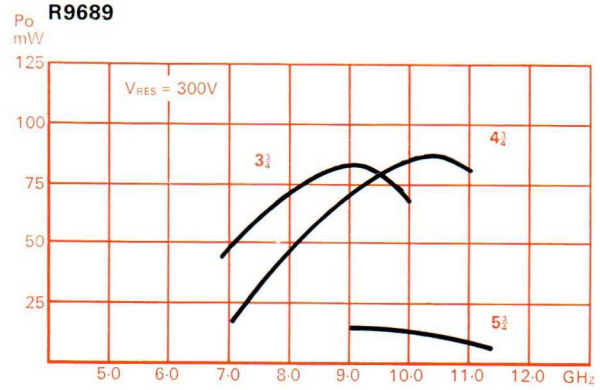
R5222/CV2346



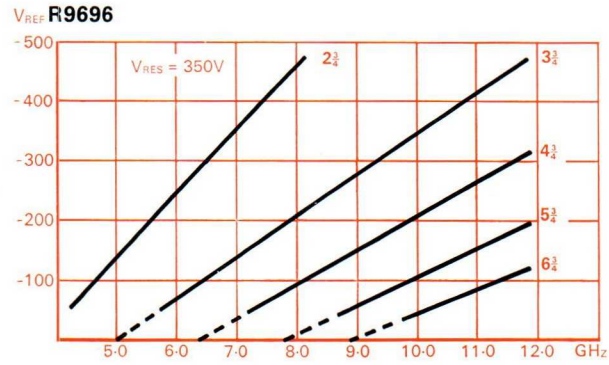
R9689/R9701



R9689



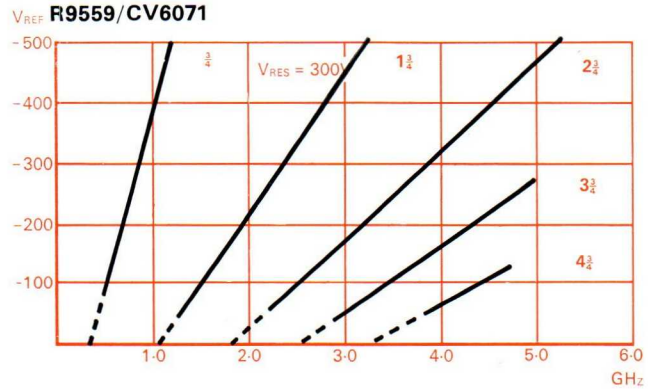
R9696



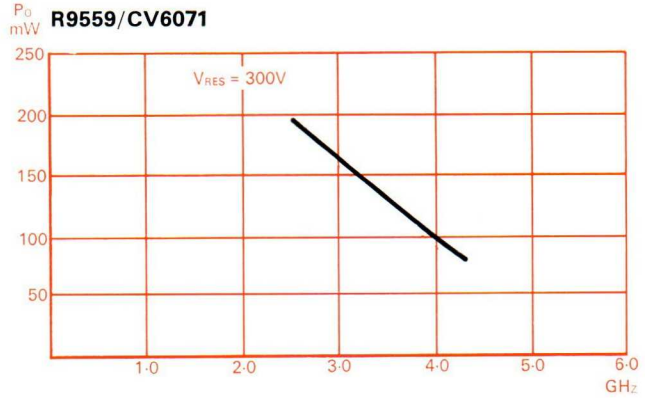
R9696

For Output Power/Frequency Curves
for R9696 and R9701 see page 14

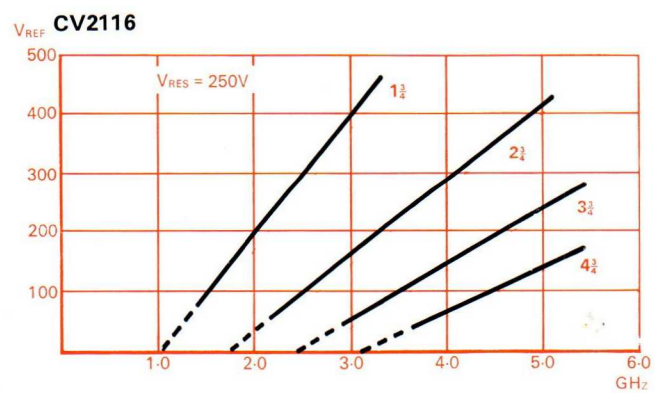
R9559/CV6071



R9559/CV6071



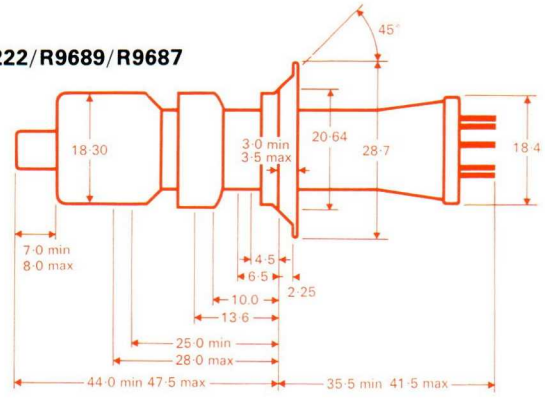
CV2116



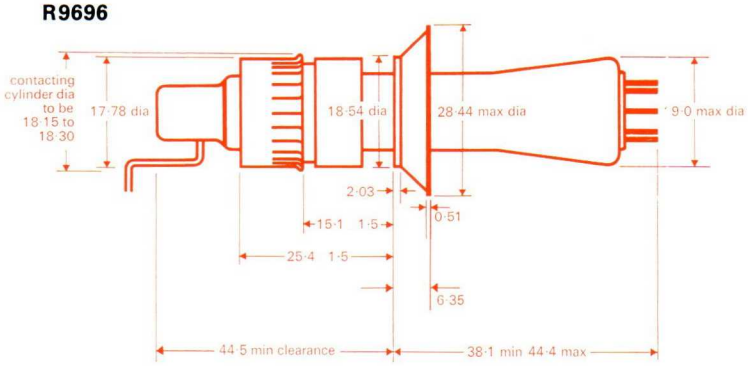
CV2116

Plug-in Klystrons

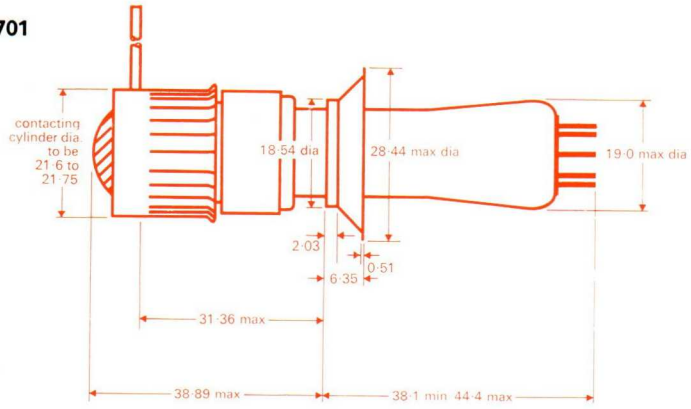
CV2346/R5222/R9689/R9687



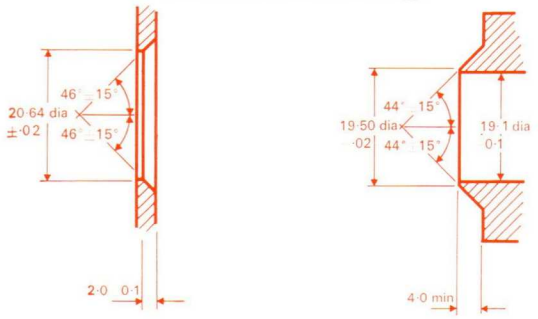
R9696



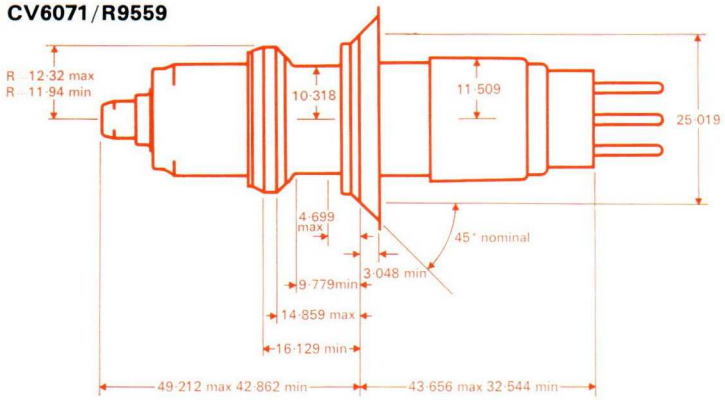
R9701



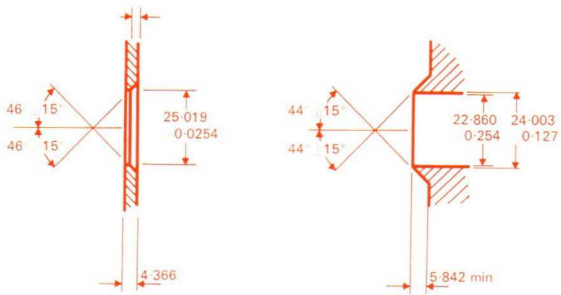
Recommended Seatings



CV6071/R9559



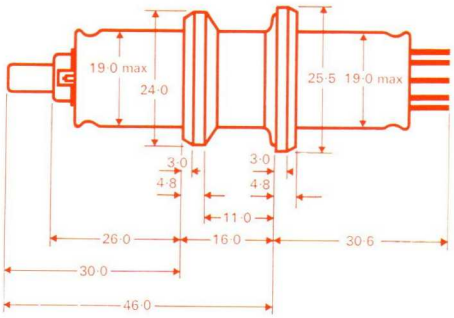
CV2346 and similar types



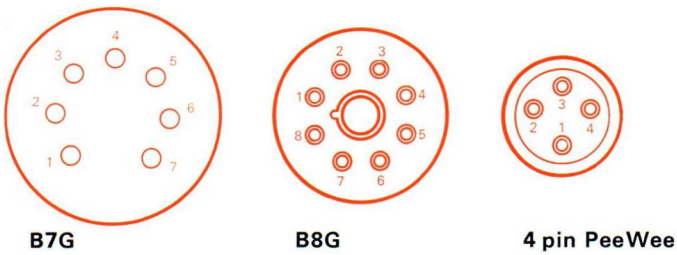
CV6071/R9559

All dimensions in mm

CV2116



Bases



Operational Notes

The temperature of the valve envelope and of the external metal parts at any point should not exceed 150°C. Forced air cooling will be necessary if the valve is mounted in an enclosed space.

Care should be taken when inserting types fitted with a conical lower copper into cavities. The valve should be fully seated in the cavity before the clamp is tightened. Any distortion of the coppers will result in frequency shift and may cause the glass/metal seal to fracture. Recommended mounting methods are described above.

Where a cathode screen is fitted this should normally be connected to the cathode. By applying a negative bias of 100 to 200 volts, it is usually possible to prevent oscillation, but factory tests do not guarantee this.

Notes on tube types:

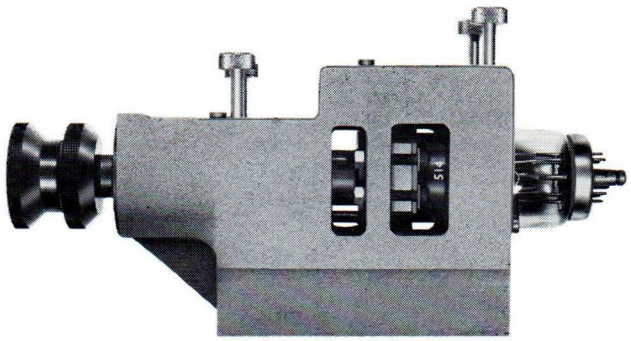
The **R9689** is an improved version of the **R5222 (CV2346)** and is free from ion oscillation thus making it ideal for applications using frequency modulation. Developed from the **R9689** are the **R9696** and **R9701** tubes which are designed for use in EMI-Varian cavities type **25157, 25182** and **25181.** These tubes are fitted with spring contact fingers in place of the upper copper electrode.

The **R9687** is a selected **R9689** for use as the local oscillator in television link equipment at 7 GHz.

The **R9559 (CV6071)** covers a frequency range similar to the **RK6112A (CV2116)**, but is virtually hysteresis free in operation.

Klystrons for Microwave Links

Klystrons are available giving 2 to 4 watts in both the 4 and 7cm communications bands. A series of five transmitter klystrons cover the frequency band 6875 to 7800 MHz each with a tuning range of 250 MHz. These tubes have a waveguide output system which connects to WG 14 waveguide. In the 7 cm band a transmitter tube gives $3\frac{1}{2}$ watts over the range 4400 to 4800 MHz. A similar local oscillator gives over 150 mW over a similar range. All of the tubes have integral cavity resonators and are ideally suited for television links where reliability and long life are of paramount importance.



		RATINGS						OPERATION Under standard voltage conditions								
		Resonator Voltage (Volts)		Reflector Voltage (Volts)		Heater Voltage (Volts)		Resonator Current (mA)		Reflector Current (μA)	Heater Current (Amps)		Power Output into matched load (Watts)		E.T.R. to ½ power points (MHz)	
TYPE NUMBER	FREQUENCY RANGE	Standard	Maximum	Minimum	Maximum	Standard	Maximum	Typical	Maximum	Maximum	Typical	Maximum	Minimum	Typical	Minimum	Typical
R9556	6875 to 7125	1000	1200	−200	−550	12·6	13·6	120	140	30	1·0	1·25	1·8	2·0	10	60
R9516	7050 to 7300	1000	1200	−200	−550	12·6	13·6	120	140	30	1·0	1·25	1·8	2·0	10	60
R9704	7150 to 7400	1000	1200	−200	−550	12·6	13·6	120	140	30	1·0	1·25	1·8	2·0	10	60
R9630	7300 to 7550	1000	1200	−200	−550	12·6	13·6	120	140	30	1·0	1·25	1·8	2·0	10	60
R9655	7550 to 7800	1000	1200	−200	−550	12·6	13·6	120	140	30	1·0	1·25	1·8	2·0	10	60
R6015	4270 to 4760	250	300	−50	−250	6·3	6·8	50	70	10	0·8	1·0	30mW	150mW	20	50
R6010	4400 to 4800	700	750	−150	−550	6·3	6·8		150	30	0·8	1·0	3·0	3·7	20	45

BASE CONNECTIONS B8G BASE

PIN No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Top Cap**	**Metal Body**
4mm Types	**K**	**IC**	**KS**	**H**	**IC**	**H**	**IC**	**KS**	**Reflector**	**Resonator**
7mm Types	**K**	**IC**	**KS**	**H**	**KS**	**H**	**IC**	**KS**	**Reflector**	**Resonator**

K = Cathode IC = Internal Connection H = Heater KS = Cathode Screen
Tubes available to CV Specification R6010 = CV2353 R6015 = CV2354

Operational Notes

A suitable diode should be connected directly between the reflector and the cathode to avoid damage to the tube on positive excursions of the reflector potential. The h.t. supply must never be applied to the resonator in the absence of negative reflector volts.

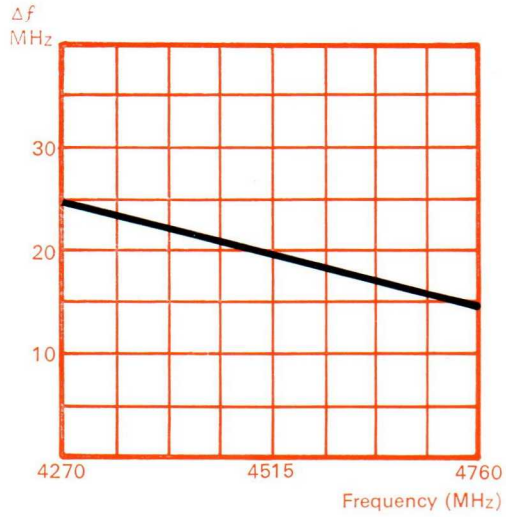
The tubes are normally operated with the resonator at earth potential. The cathode should be preheated for a minimum period of $1\frac{1}{2}$ minutes at normal heater voltage before the reflector voltage is applied.

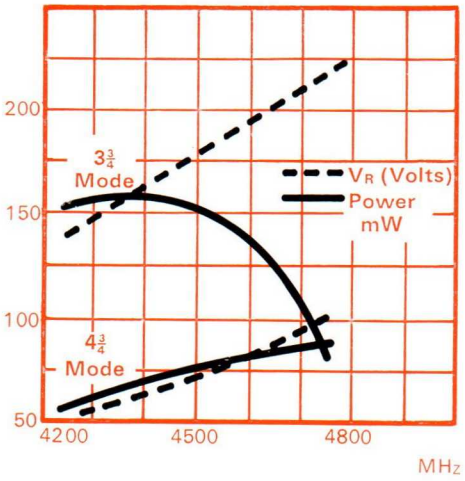
The temperature of the valve envelope and of the external metal parts must not exceed 150°C. Forced air cooling is necessary in the case of all transmitter types. For the R6010 a minimum flow of 5 cu.ft³/min (0·142 cu.m³/min) is normally satisfactory.

The R6010 and R6015 are fitted with an output system using a coaxial output line and launching probe. These valves are designed to fit a mounting plate, and secured directly to a waveguide of internal dimensions 2in x 1in. One end of the waveguide should be terminated with an adjustable reflecting piston approximately 2cm from the launching probe.

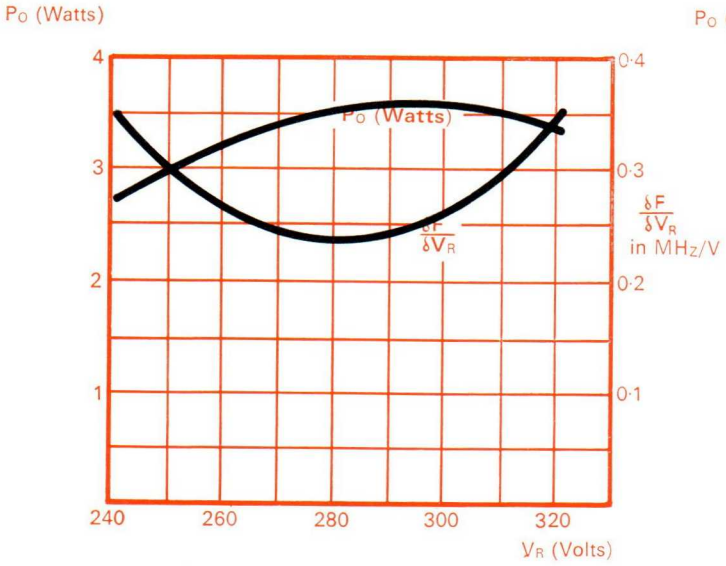
Klystrons for Microwave Links

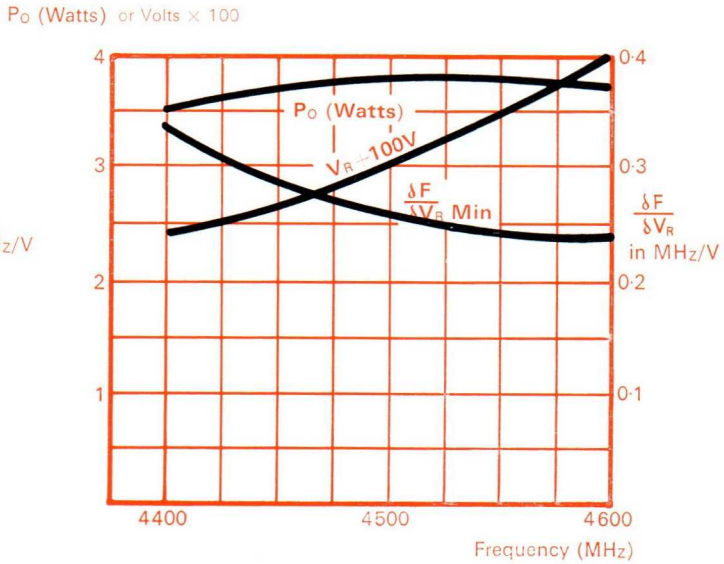
Type R6015 7cm Link Klystron





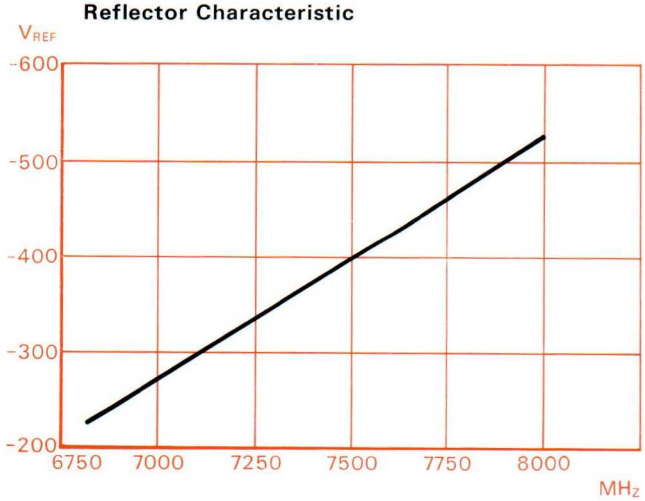
Type R6010 7cm Link Klystron



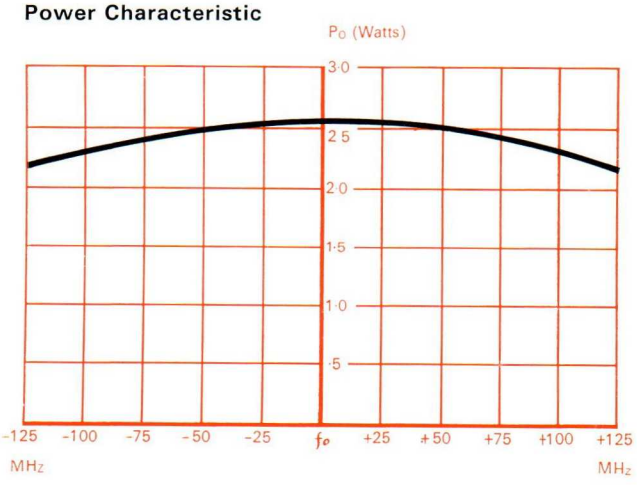


R9556 R9516 R9704 R9630 R9655 4cm Link Klystrons

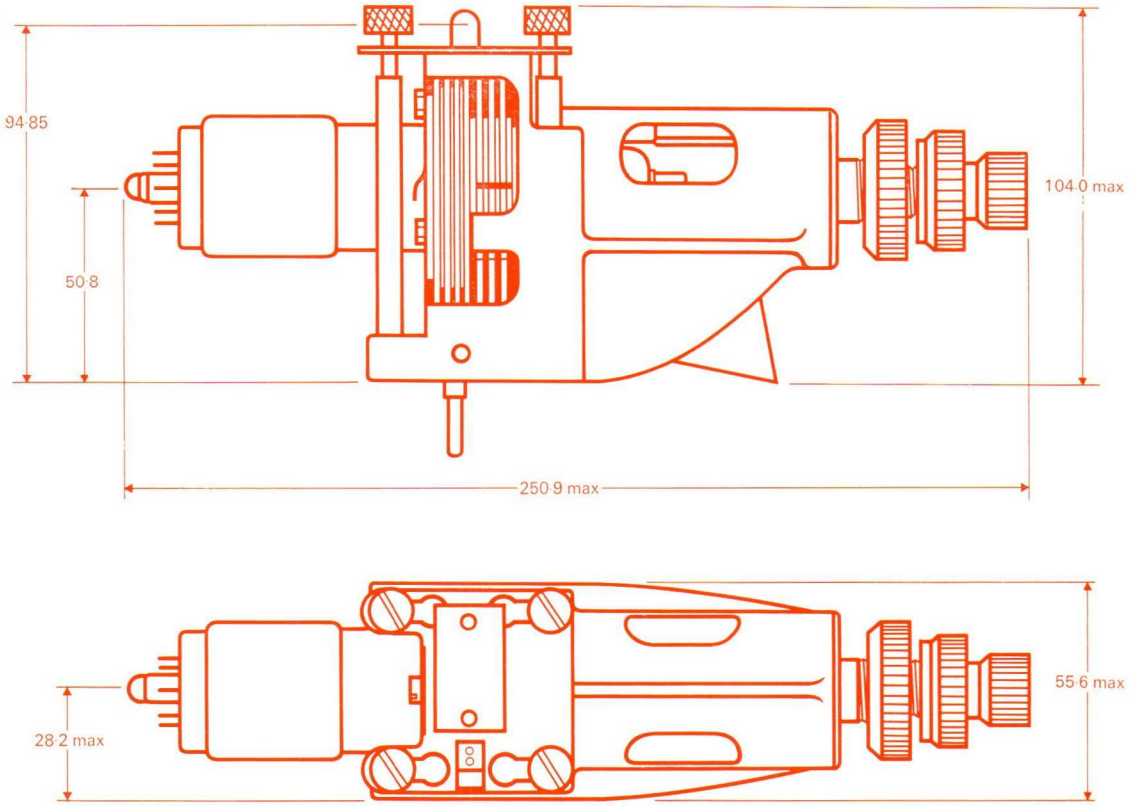
Reflector Characteristic



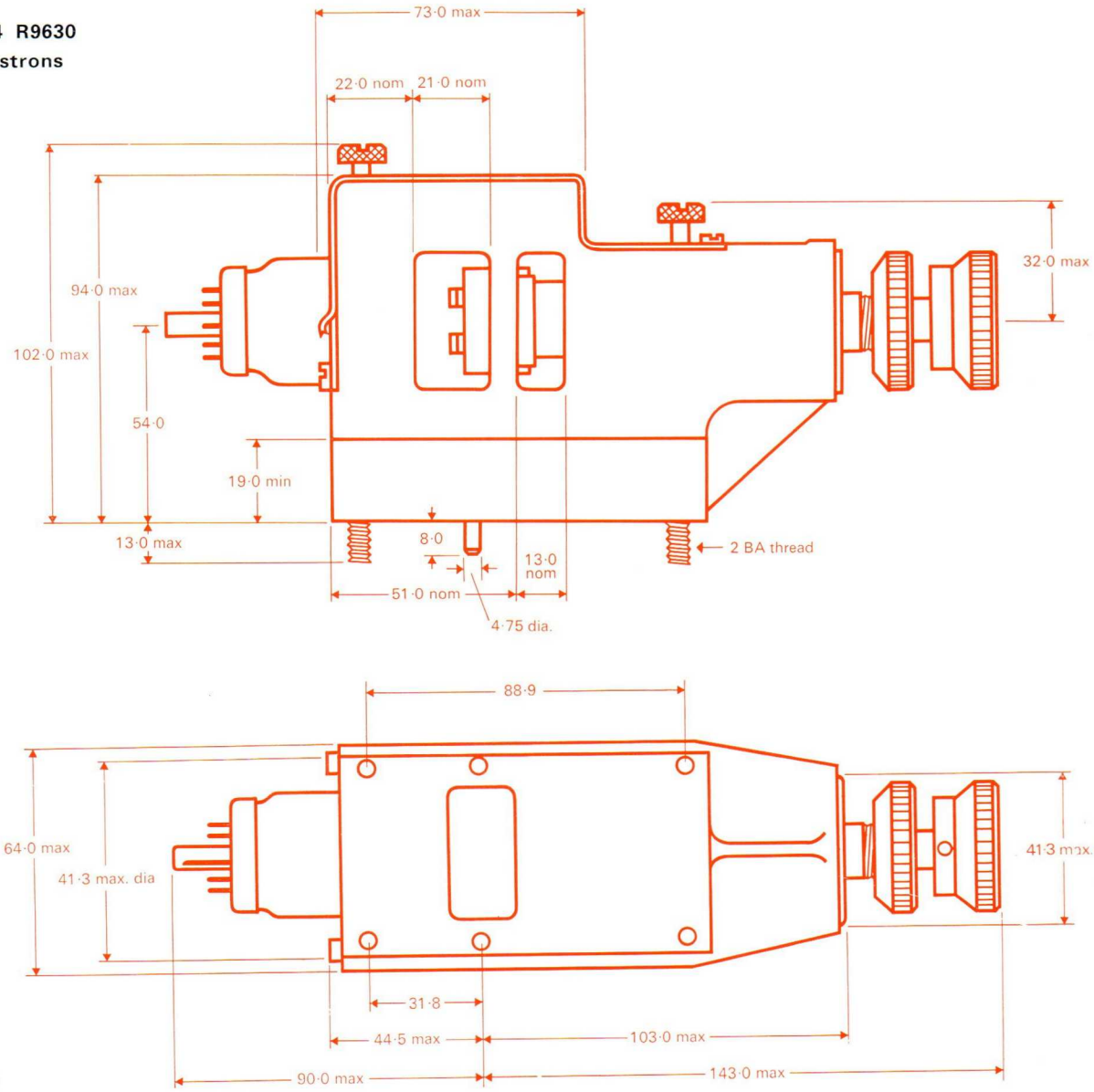
Power Characteristic



R6010 7cm Link Klystron



R9556 R9516 R9704 R9630
R9655 4cm Link Klystrons



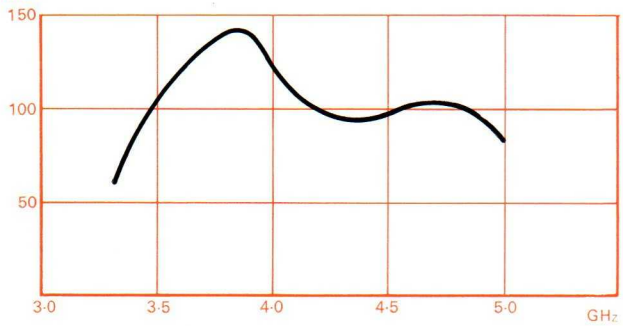
All dimensions in mm

Klystron Cavities

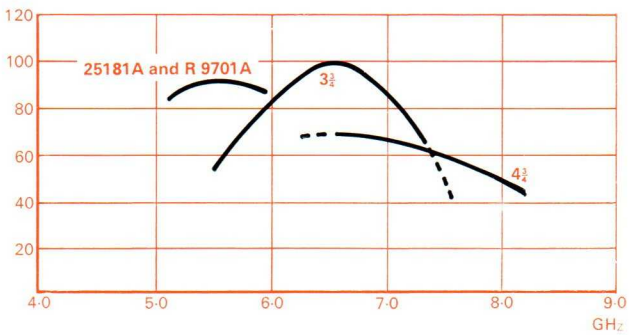
This range of wide band cavities covers the frequency range 2·6 to 11·7 GHz. The valves used are the R9559, R9696 and R9701. The last two are developments of the R9689 and have spring contacts in place of the reflector copper.
The cavities are all of the capacity screen type and are tuned using a micrometer head. A high degree of resetting accuracy is obtainable and once the cavity has been calibrated a wavemeter is rendered unnecessary for many applications.
The power output against frequency curves are given for the cavity/valve combinations and the reflector volt/frequency curves are given in the section dealing with plug-in tubes.

Operational Notes:
Operational notes for plug-in tubes apply (see page 10).

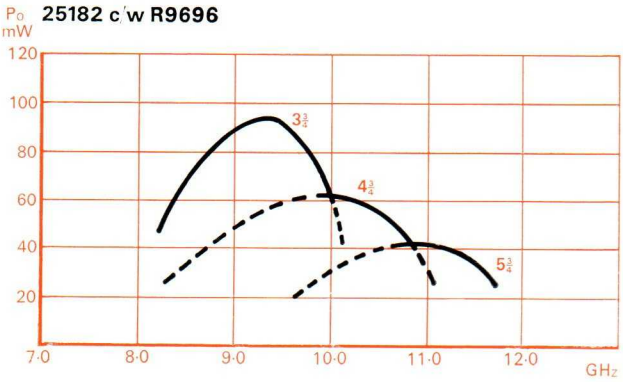
25221 c w R9559



25181 c w R9701 and 25181A c w 9701A

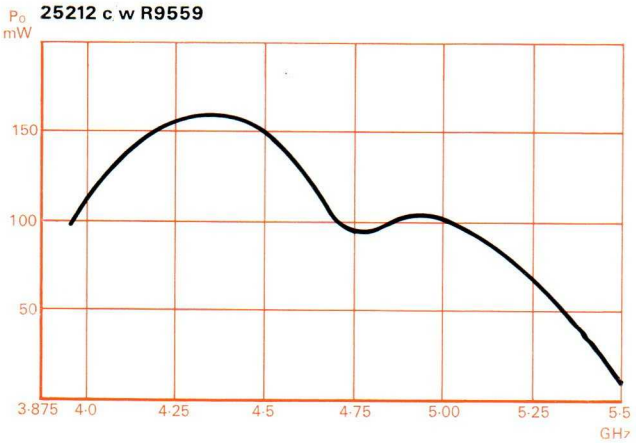


25182 c w R9696

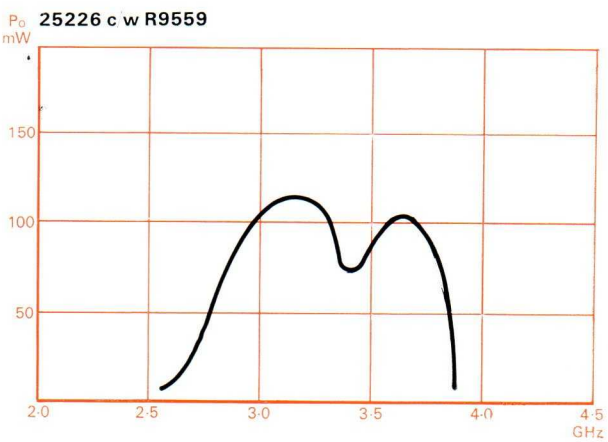


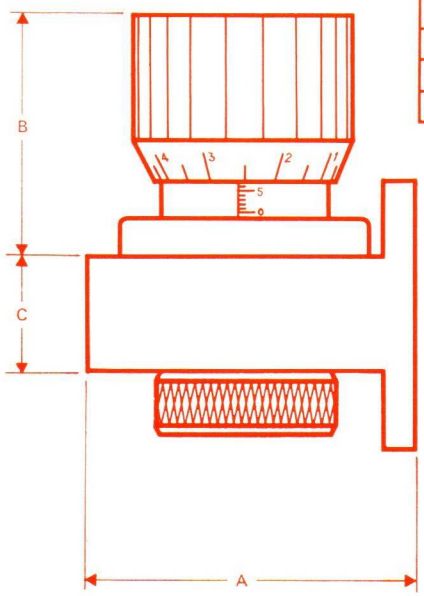
25157 c w R9696

25212 c w R9559



25226 c w R9559



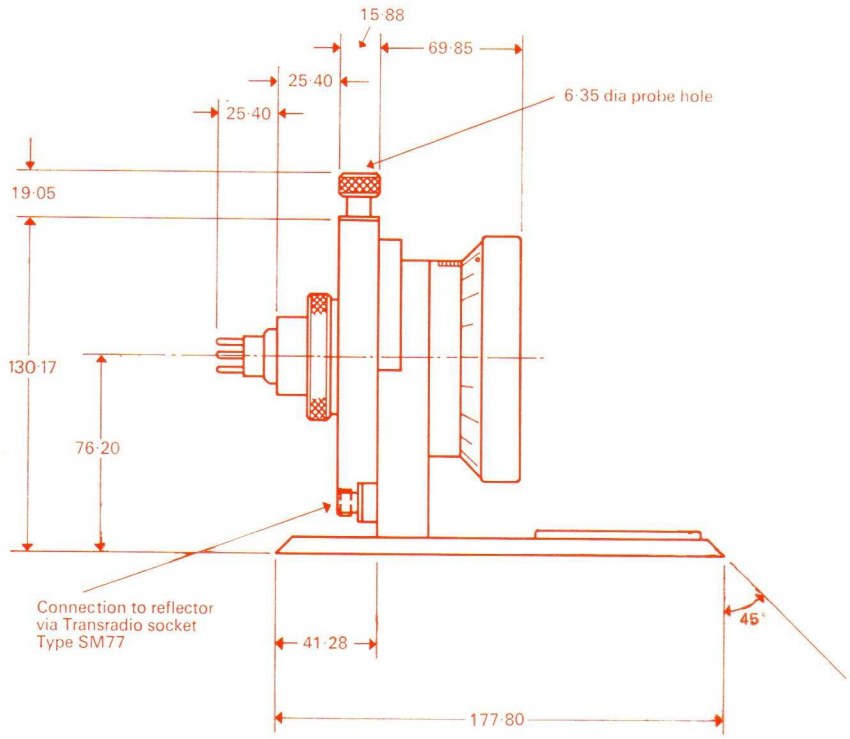


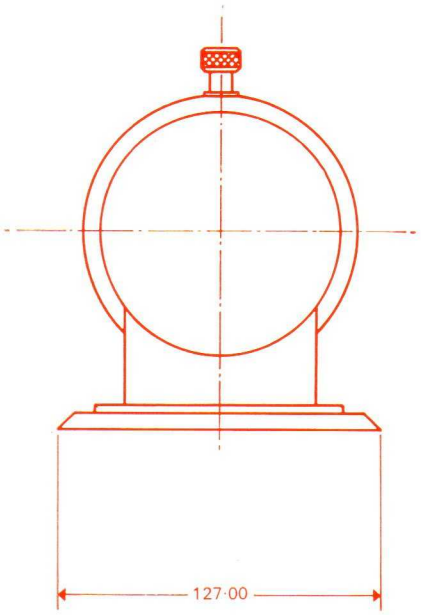
	25181	25157	25182
A	58·7	45·2	48·4
B min	44·5	38·1	38·1
B max	54·0	47·6	47·6
C	17·5	15·9	15·9

Flange Details

Cavity	Remarks
25157	WG 15 Flange as 5985–99–083–0033(4) except holes 4BA tapped
25181	As 25157. Cavity tested via Taper into WG 14
25182	WG 16 Flange as 5985–99–083–0051(2) except holes 4BA tapped
25212	Flange mates with 5985–99–083–0041(2)
25221A	Mates with Flange 5985–99–083–1563
25221B	As 25221A
25226	Coaxial output

Note: 25221 Cavities **'A'** and **'B'** differ only in mechanical design.





All dimensions in mm

Guarantee Terms

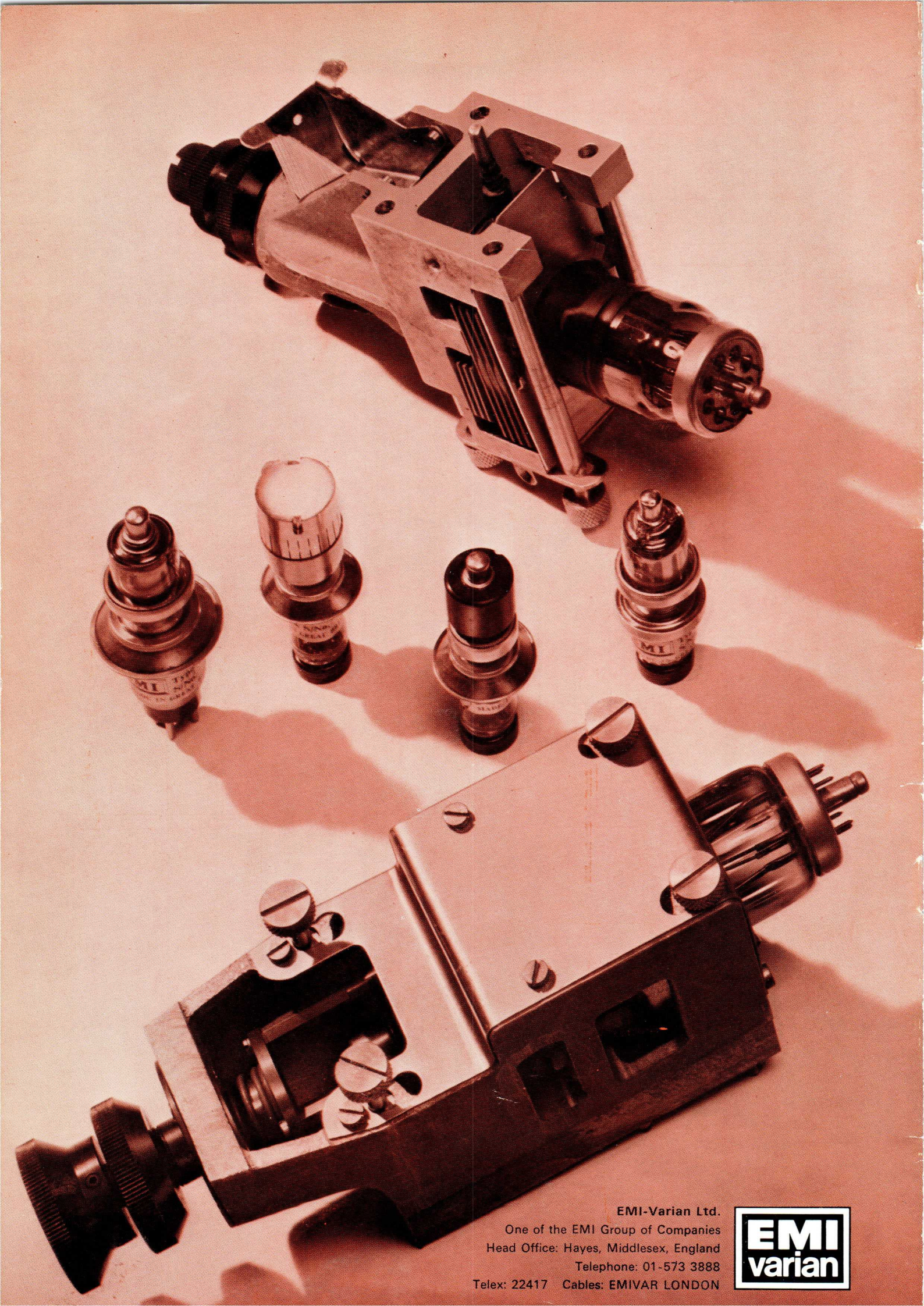
Subject to the General Terms of Guarantee applicable to special valves and tubes, the following specific conditions apply to the klystrons covered by this catalogue:–

Reflex Klystrons (Plug-in types)

1,000 hours of continuous operation (switched not more than once every 24 hours of running) or 500 hours of intermittent operation or 6 months following installation, whichever period expires first.

Other Reflex Klystrons

500 hours of operation or 12 months following despatch from our works, whichever period expires first.



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