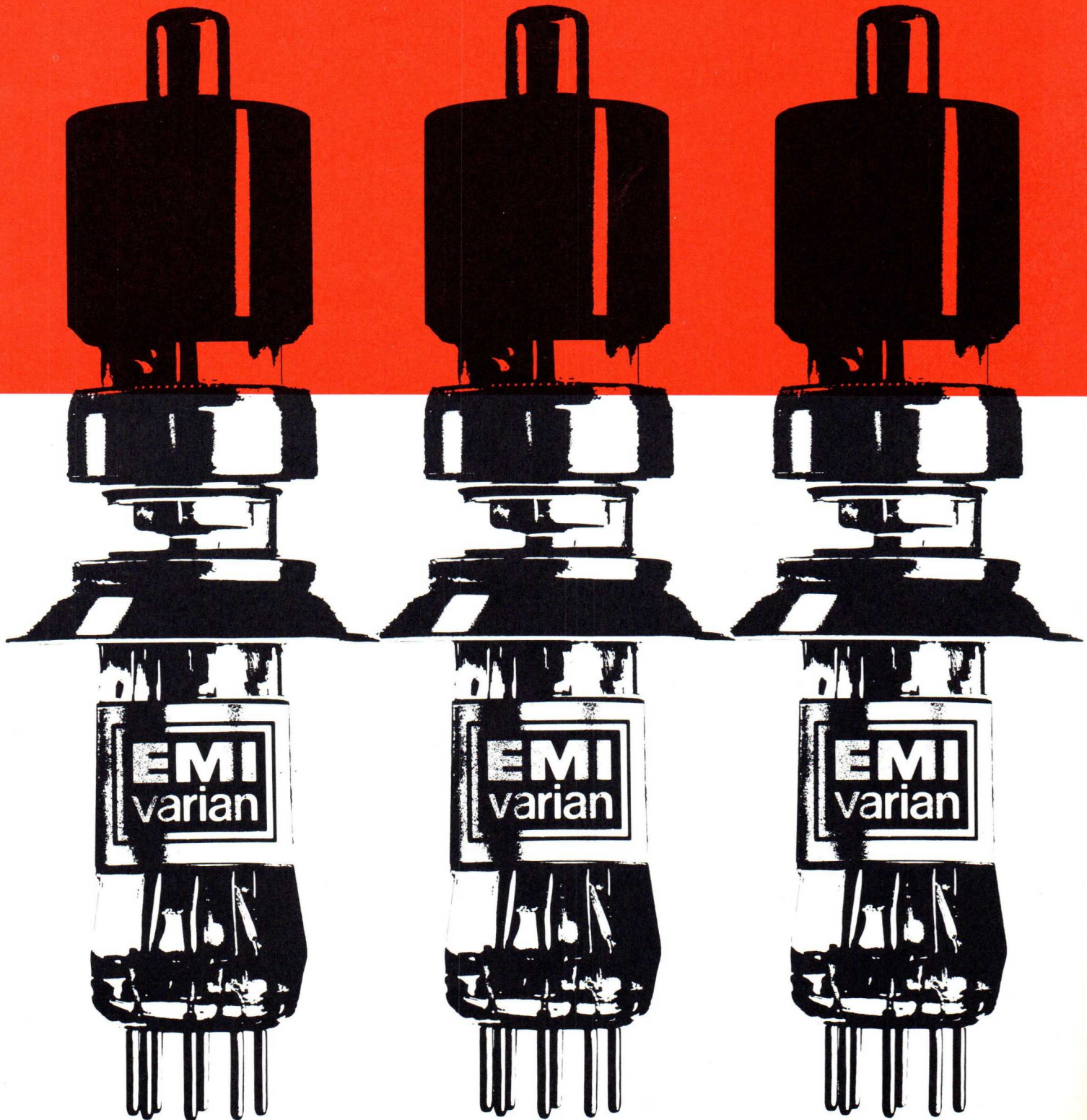


Reflex Klystrons and Cavities



Contents

- 2 Millimetre klystrons
- 4 Plug-in klystrons
- 10 Klystron cavities
- 11 Klystrons for Microwave links.

Guarantee terms

Subject to the general terms of guarantee applicable to special valves the following specific conditions apply to the klystrons listed in this catalogue.

Plug-in klystrons:—

1000 hours of operation or 12 months following despatch from our works, whichever period expires first.

Millimetre klystrons, Pump oscillators, Microwave link klystrons:—

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

EMI-Varian market a wide range of microwave tubes and associated devices for use in radar, communications and broadcasting systems.

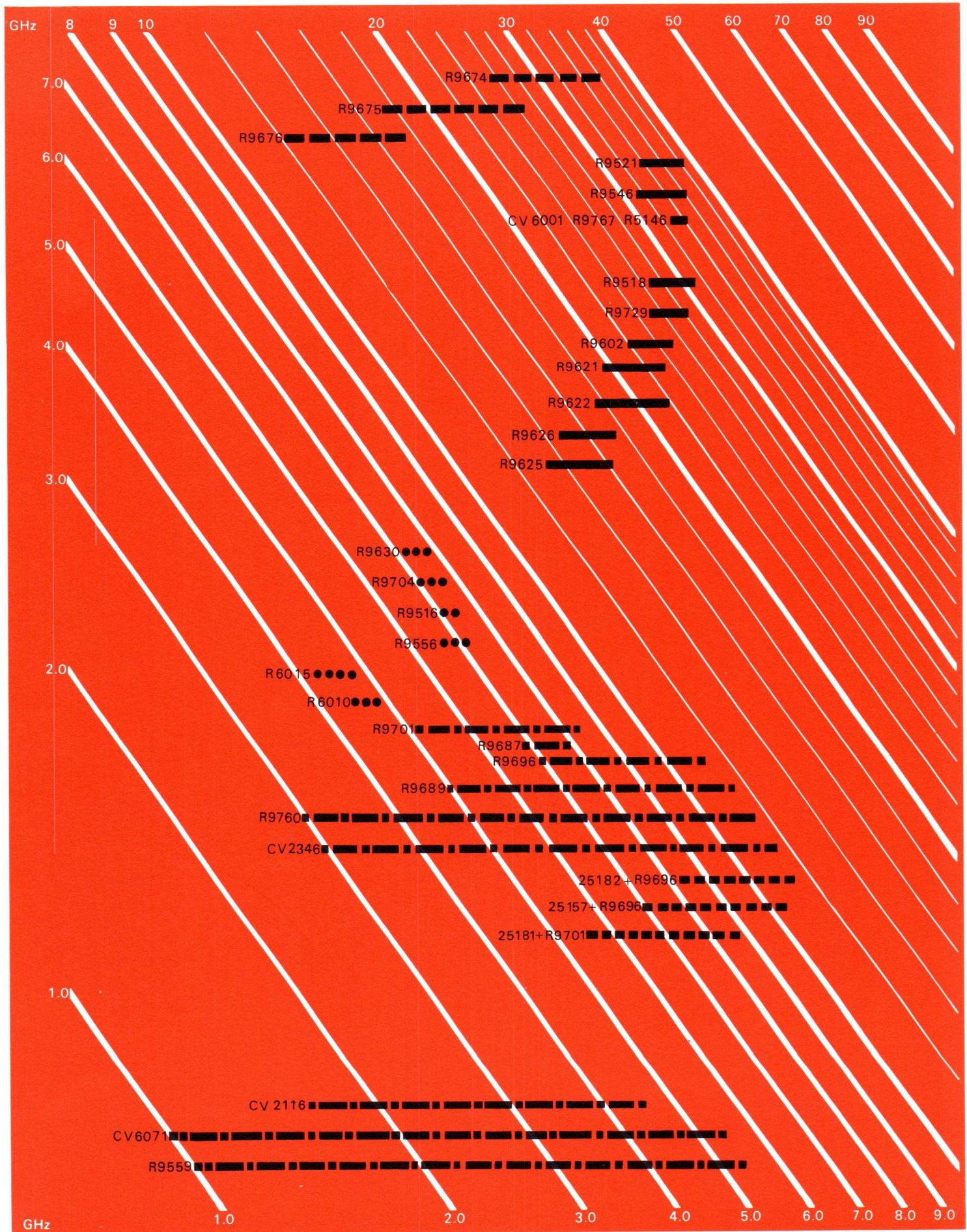
The range includes,
UHF television klystrons.
Reflex klystrons.
2-Cavity klystron oscillators.
Backward wave oscillators.
Magnetron oscillators.
Travelling wave tubes.
High and low power klystron amplifiers.
Solid state products.
Microwave components.
Microwave mixer pre-amplifiers.
R.F. amplifiers, converters and components.
I.F. amplifiers and components.
Microstrip circuits.
Strip transmission line components.
Pulse modulation receivers.
Xenon lamps.
Communication transistors.
Power grid tubes

Details of all these components and advice on their application and installation are readily available from EMI-Varian's team of specialist marketing engineers. For further information telephone either EMI-Varian or your nearest sales office, a list of which appears on the back cover.

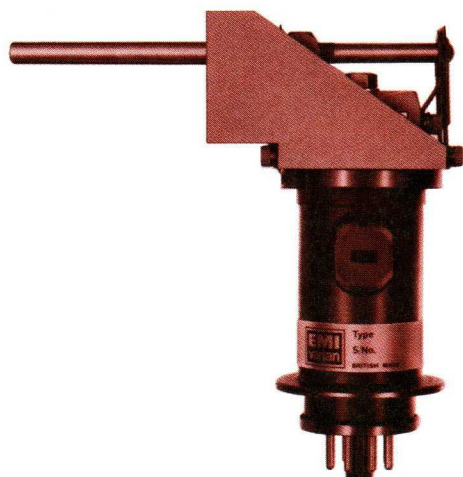
Reflex Klystron selection chart

Key to Selection Chart

- Pump Oscillator Klystrons 
- Standard Millimetre Klystrons 
- Link Transmitters 
- Plug-in Klystrons 
- Cavities 



Millimetre Klystrons



- Frequency range available – 13.5 to 40.0 GHz
- Integral cavity with 5% tuning range
- Good frequency stability
- Low microphony
- All metal construction

Brief specifications

Type Number	Available Frequency Range (GHz)	Ratings						Operation									Output System
		All voltages referred to cathode						Under standard voltage conditions									
		Heater Voltage (Volts)	Reflector Voltage (Volts)	Resonator ² Voltage (kV)	Heater Current (Amps)	Reflector Current (µA)	Resonator Current (mA)	ETR (MHz)	Power into matched load (mW)	Standard	Maximum	Typical	Maximum	Maximum	Typical	Maximum	
R9625	13.5-16.5	6.3	6.9	-100	-500	2.0	2.2	0.8	0.95	30	12	15	60	40	100	WG18 (WR62)	
R9626	15.0-18.0	6.3	6.9	-100	-500	2.0	2.2	0.8	0.95	30	12	15	60	40	100	5985-99-083-0030	
R9676	13.5-18.0 ³	6.3	6.9	-100	-600	2.5	2.7	0.8	0.95	30	18	20	60	175	300	Flange (UG419/U)	
R9622	18.0-22.5	6.3	6.9	-100	-500	2.0	2.2	0.8	0.95	30	12	15	60	40	100	WG20 (WR42)	
R9621	20.0-24.0	6.3	6.9	-100	-500	2.0	2.2	0.8	0.95	30	12	15	60	50	100	5985-99-011-9658	
R9602	22.5-26.0	6.3	6.9	-100	-500	2.0	2.2	0.8	0.95	30	12	15	60	40	100	Flange (UG595/U)	
R9675	18.0-26.0 ³	6.3	6.9	-100	-600	2.5	2.7	0.8	0.95	30	18	20	60	175	250		
R9729	26.0-29.0	6.3	6.9	-100	-500	2.0	2.2	0.8	0.95	30	12	15	68	15	70	WG22 (WR28)	
R9518	27.8-32.2	6.3	6.9	-100	-500	2.0	2.2	0.8	0.95	30	12	15	68	15	80	5985-99-083-0018	
R5146	34.2-35.5	6.3	6.9	-100	-500	2.0	2.2	0.8	0.95	30	10	12	70	30	90	Flange	
CV6001	34.2-35.6	6.3	6.8	-150	-375	2.0	2.2	0.8	0.95	30	10	12	70	30	60		
R9767	34.2-35.6	6.3	6.8	-150	-425	2.0	2.2	0.85	0.95	30	10	15	70	25	60		
R9546	32.3-37.5	6.3	6.9	-100	-500	2.0	2.2	0.8	0.95	30	12	15	77	15	60		
R9521	35.0-40.0	6.3	6.9	-100	-500	2.0	2.2	0.8	0.95	30	12	15	85	15	60		
R9674	26.0-37.5 ³	6.3	6.9	-100	-600	2.5	2.7	0.8	0.95	30	18	20	70	175	200		

Note 1. The operational notes on page 4 apply to these klystrons. The grid voltage is optimised in the range 0 to -200 V; maximum grid current 1.0 mA.

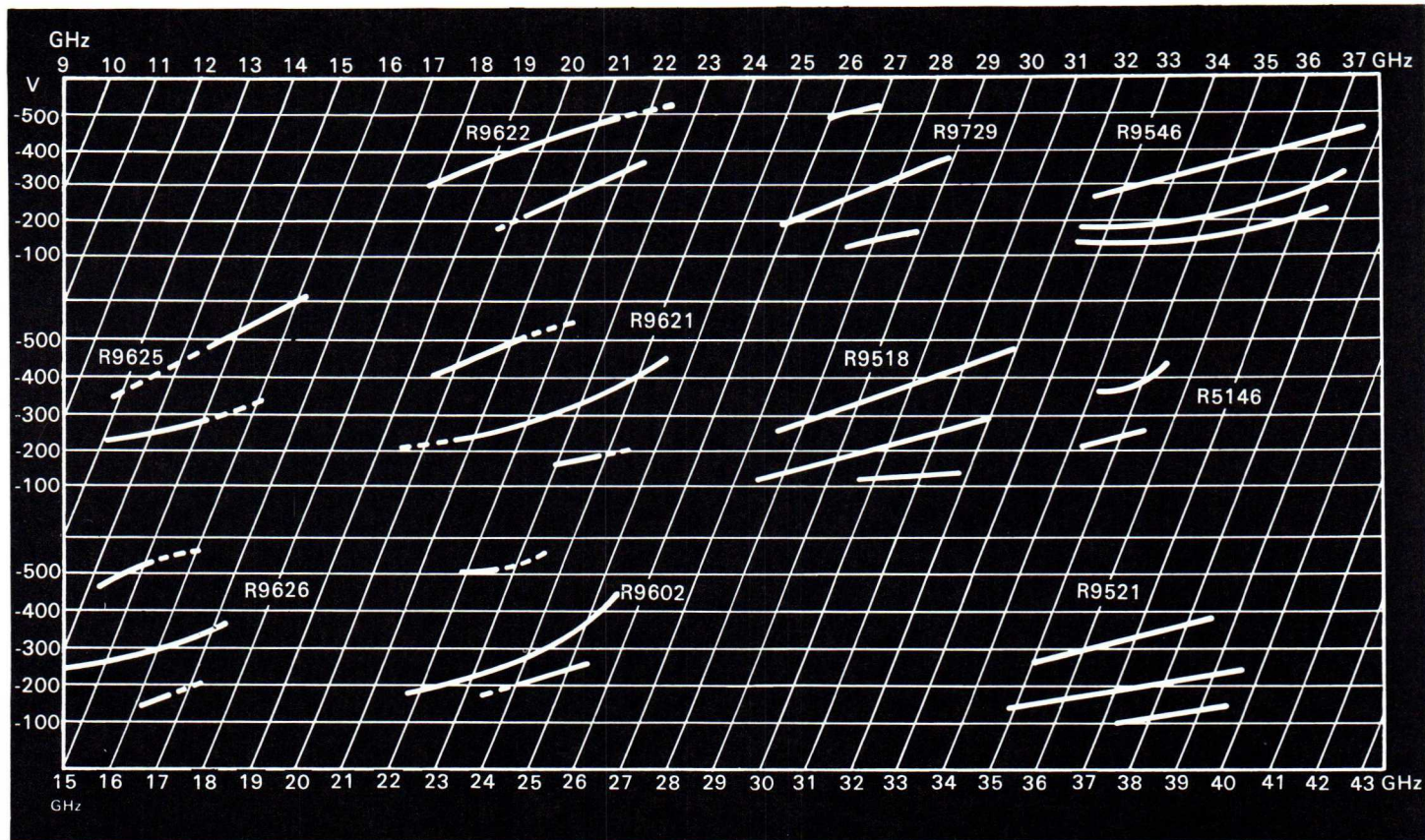
Note 2. The klystrons are normally operated with the resonator at earth potential.

Note 3. Specify the centre frequency required. Each klystron tunes $\pm 2\frac{1}{2}\%$ from centre frequency. Manufactured only to special order.

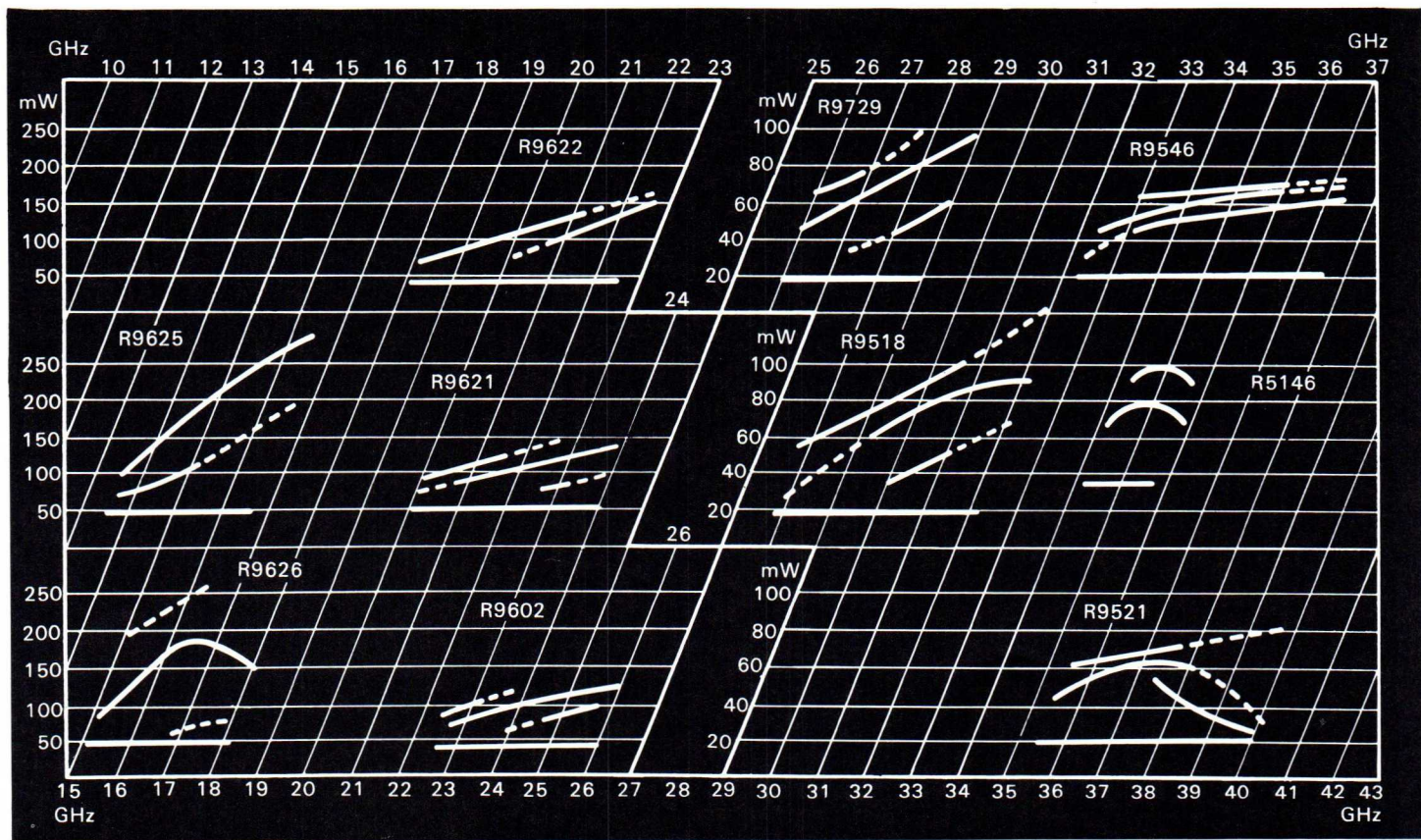
Octal Base

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

Reflector Volts vs Frequency (typical curves)

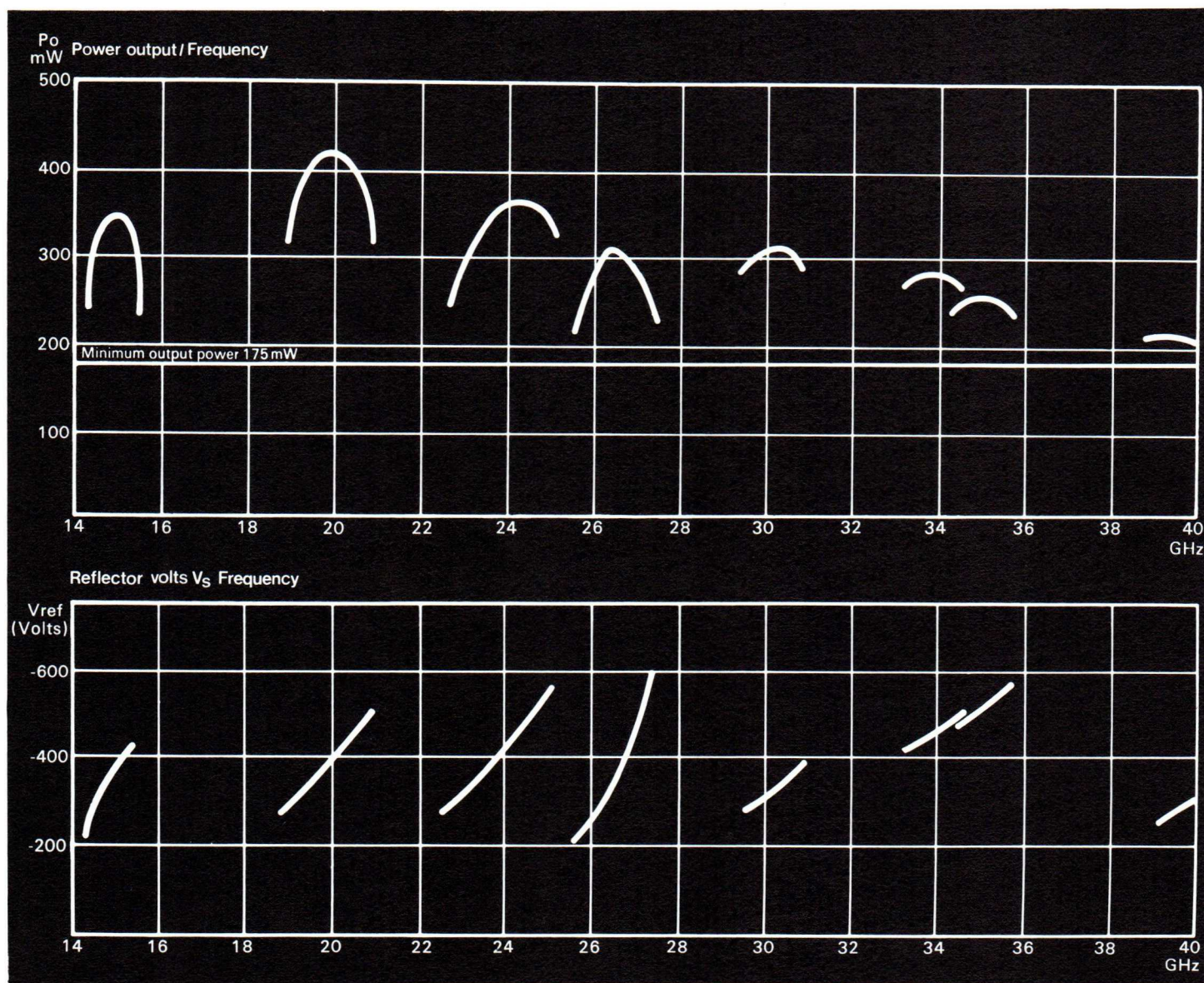


Power Output vs Frequency (typical curves)



Pump Oscillators

The R9674, R9675 and R9676 klystrons (detailed on page 2) typically give about $\frac{1}{4}$ watt and are tunable over 5% in their respective bands. These pump oscillators are manufactured only to special order. Some typical curves are given below.



Notes on Operation

Apply the negative grid and reflector volts first. Then allow the cathode to warm up for at least one minute with normal heater volts before applying the h.t. These klystrons will be damaged if the h.t. is applied without the negative voltages. The resonator is normally at earth potential.

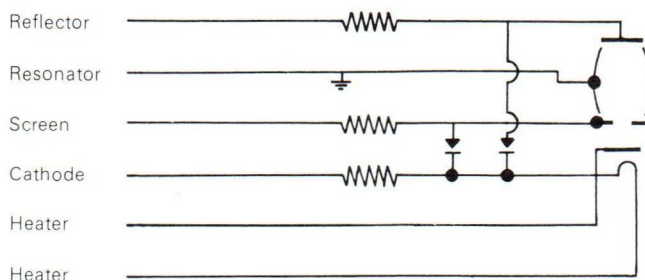
Recommended circuitry for klystron protection

The maximum permissible impedance of the reflector and grid supplies is 75,000 ohms.

A choke may be connected in series with the resonator supply, either in the positive or the negative side, to prevent fluctuations in the output power and in the frequency. This choke should have an inductance of 4 H, a d.c. resistance of about 60 ohms, and be insulated for at least 2.5 kV. Care should be taken to avoid stray capacitance from leads or sub-units which might shunt the choke.

Mounting

The klystron may be used in any orientation, and should be supported from the four 4BA tapped



Three limiting resistors of at least 100 ohms

Diodes to prevent screen or reflector from becoming + ve with respect to cathode under surge conditions

holes on the mounting face of the tuner. The tuner spindle must neither be constrained axially nor radially. No screws on the tuner assembly should be loosened.

The position of the output coupler is defined in the drawings, and no undue strain should be put either on the output coupler or on the klystron base. The klystron base is designed for a floating base socket to be used.

Cooling

Neither the temperature of the envelope nor of any external metal part may be allowed to

exceed 150°C at any point. Forced air cooling will normally be required.

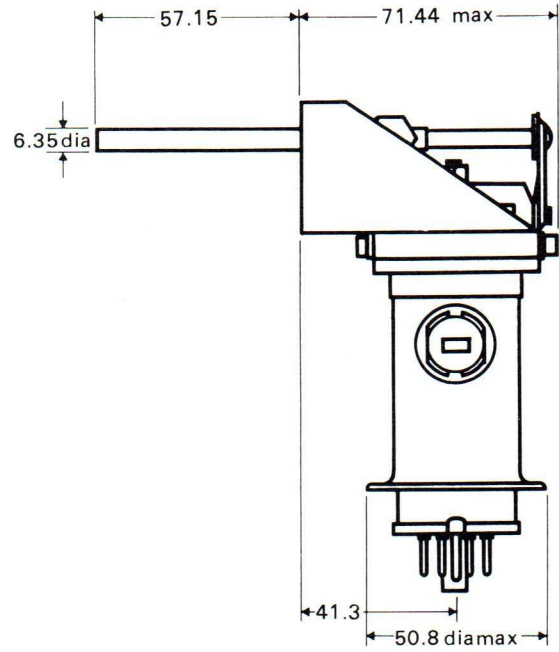
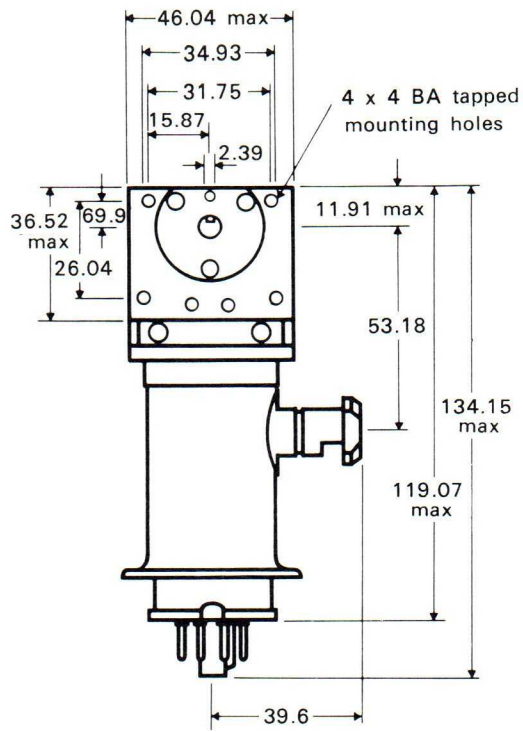
Warm up time

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

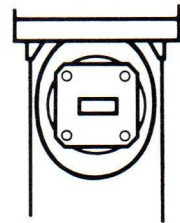
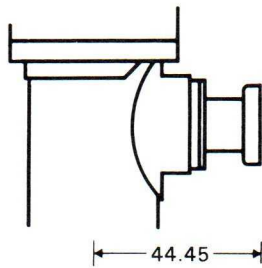
Weights

J Band 430 g.
K Band 400 g.
Q Band 370 g.

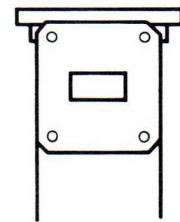
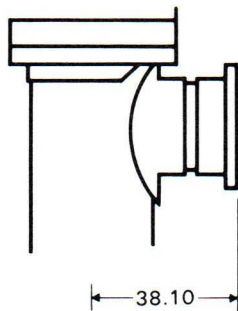
Q Band Klystrons



K Band Klystrons

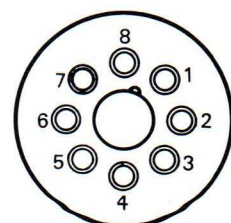


J Band Klystrons



All dimensions in mm

Base B80



Plug-in Klystrons



- Designed to allow customers to fit their own cavities to emphasise any parameter desired
- Frequency range from 1.0–11.7 GHz according to klystron type and customer's cavity
- A limited range of cavities is available from EMI-Varian Limited. See page 10

Notes on Operation

Apply the negative grid and reflector volts first. Then allow the cathode to warm up for at least one minute with normal heater volts, before applying the h.t. These klystrons will be damaged if the h.t. is applied without the negative voltages. The resonator is normally at earth potential.

A suitable diode must be connected directly between the reflector and the cathode to prevent the reflector becoming positive with respect to the cathode.

Where a cathode screen is fitted it should

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

Neither the temperature of the envelope nor of the external metal parts may be allowed to exceed 150°C at any point. Forced air cooling will be required if the valve is mounted in an enclosed space.

Care must be taken when inserting klystrons with a conical copper electrode into cavities. The valve must be fully sealed in the cavity before the clamp is tightened. Any distortion of the copper will result in frequency shift and may cause the glass/metal seal to fracture.

Brief Specifications

			CV2346	R9760	CV6002	R9689	
V_h	Heater voltage	minimum	V	5.8	5.8	5.8	5.8
		standard	V	6.3	6.3	6.3	6.3
		maximum	V	6.8	6.8	6.8	6.8
V_{ref}	Reflector voltage	minimum	V	-50	-195	-100	-50
		maximum	V	-500	-255	-300	-500
V_{res}	Resonator voltage	standard	V	300	300	300	300
		maximum	V	350	350	350	350

All voltages w.r.t. cathode

Operation at standard input voltages		Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
Usable frequency range	GHz	3.0		12.0	3.0		12.0	9.1		9.29	3.0		12.0
Tested frequency range	GHz	8.5		10.0	8.5		10.0	9.12		9.27	7.0		11.5
Heater current	A	0.6	0.65	0.7	0.6	0.65	0.7	0.6	0.65	0.7	0.7	0.8	0.9
Reflector current	μ A			4			4			4			4
Resonator current	mA	22	28	35	22	28	35	22	28	35	20	32	40
Sample test oscillation	GHz		10.1			10.1			9.2			9.2	
Reflector mode			$4\frac{3}{4}$			$4\frac{3}{4}$			—			$3\frac{3}{4}$	
Reflector volts	V	-195	-210	-225	-195	-210	-225	-140	-165	-210	-280	-320	-360
Frequency variation between valves	MHz	-50		+50	-50		+50				-50		+50
Output power	mW	30	50	75	75		*	20	50	80	15§	100	*
Electronic tuning	MHz	*	15	*	*	15	*	25	32	*	*	8	*
$\frac{1}{2}$ power mode width	V	*	25	*	*	25	*	*	25	*	*	40	*
Slope at mode peak	MHz/V	0.35	0.45	0.9	0.35	0.45	*	*	1.2	*	*	0.15	*
Sample test oscillation	GHz		8.5			8.5						7.0	
Reflector mode			$4\frac{3}{4}$			$4\frac{3}{4}$						$3\frac{3}{4}$	
Reflector volts	V	*	-150	*	*	-150	*				-120	-145	-170
Frequency variation between valves	MHz	-50		+50	-50		+50				-50		+50
Output power	mW	30	45	75	30	45	*				30	100	*
Electronic tuning	MHz	*	15	*	*	15	*				*	15	*
$\frac{1}{2}$ power mode width	V	*	18	*	*	18	*				*	35	*
Slope at mode peak	MHz/V	*	0.45	*	*	0.45	*				*	0.2	*

* not specifically limited

§15 mW limit in $5\frac{3}{4}$ mode

Notes on tube types

The R9689 is an improved version of the CV2346 and, being free from ion oscillation, is ideal for applications using frequency modula-

tion. The R9696 and R9701 have spring contact fingers in place of the upper electrode, and are designed for use in EMI-Varian cavities (see page 10). The R9559 (CV6071) covers a

frequency range similar to the CV2116, but is virtually hysteresis free in operation.

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
CV6002/CV2346 R9687/R9689 R9696/R9760 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

R9687			R9696			R9701			CV6071			R9559			CV2116		
5.8			5.8			5.8			5.8			5.8			5.8		
6.3			6.3			6.3			6.3			6.3			6.3		
6.8			6.8			6.8			6.8			6.8			6.8		
-50			-50			-50			-70			-30			-50		
-500			-500			-550			-500			-500			-500		
350			350			350			300			300			250		
370			370			370			350			350			300		
Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
6.8		7.8	7.0		12.0	5.0		8.2	1.0		5.4	1.0		5.4	1.8		4.5
	7.0		7.0	†	10.3	5.4		8.2	3.15		3.58	3.15		3.58	2.6		3.7
			8.2	‡	11.7												
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
		4			4			4			4			4			4
20	40	50	20	40	55	20	40	55	25	35	45	25	35	48	20	26	32
**	7.0		7.0			5.4			3.15			3.15					3.2
	3½		3½			2½			2½			2½					2½
*	-140	*	* -140	*	*	* -170	*	*	-130	-160	-190	-130	-160	-190	*	-175	*
-20		+20							-30		+30	-35		+35	-15		+15
40	70	*	30	100	*	30	100	*	100	150	*	90	150	*	100	140	*
10	16	*	*	30	*	*	25	*	25	35	*	*	35	*	17	23	29
*	35	*	*	40	*	*	50	*	35	45	65	*	45	*	35	42	49
*	0.2	*	*	0.4	*	*	0.3	*	0.25	0.5	0.85	*	0.5	*	*	0.5	*
				10.3			8.2			3.58			3.58			2.64	
				3½			2½			2½			2½			2½	
			*	-360	*	*	-470	*	-180	-220	-260	*	-220	*	*	-95	*
									-40		+40	-30		+30	-15		+15
			30	170	*	30	50	*	60	100	*	*	100	*	100	140	*
			*	20	*	*	6	*	23	35	*	*	35	*	18	24	30
			*	43	*	*	90	*	35	50	65	*	50	*	22	30	37
			*	0.3	*	*	0.05	*	0.25	0.6	0.85	*	0.6	*	*	0.6	*

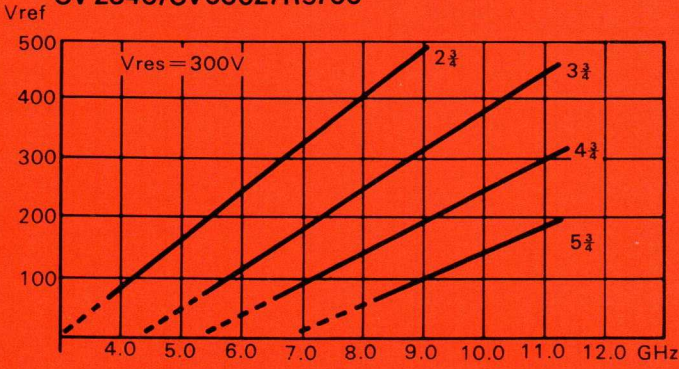
** Supplied for EMI microwave link local oscillator

† In 25157 cavity – see page 10

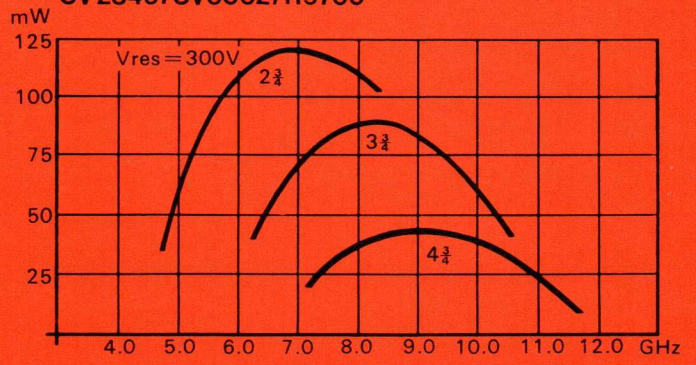
‡ In 25182 cavity – see page 10

Performance Data on Plug-in Klystrons

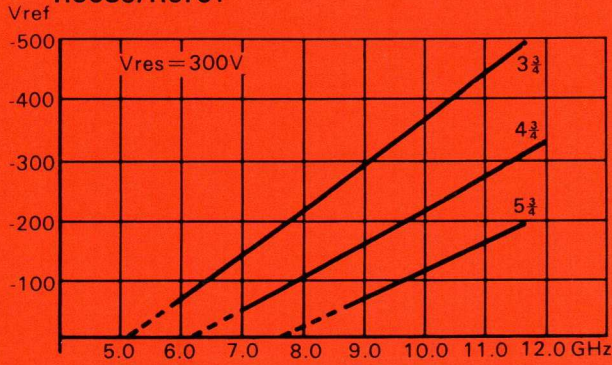
CV 2346/CV6002/R9760



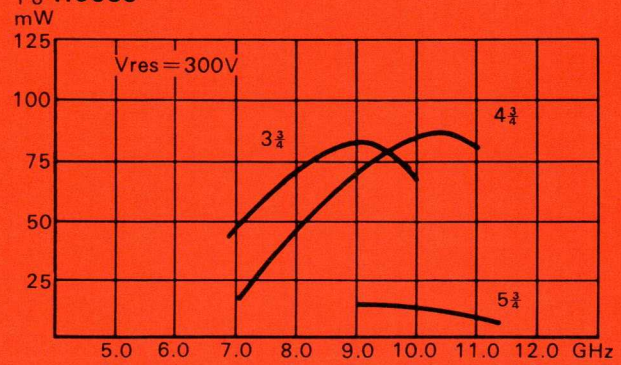
Po CV 2346/CV6002/R9760



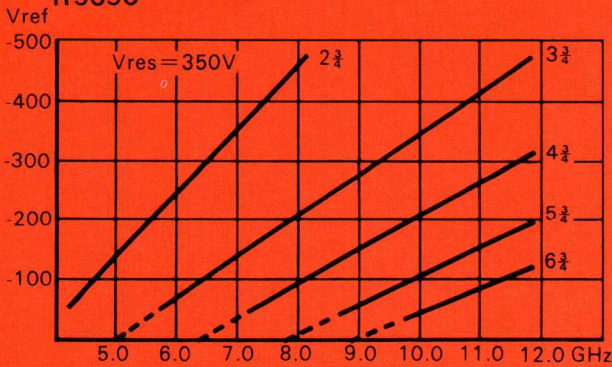
R9689/R9701



Po R9689

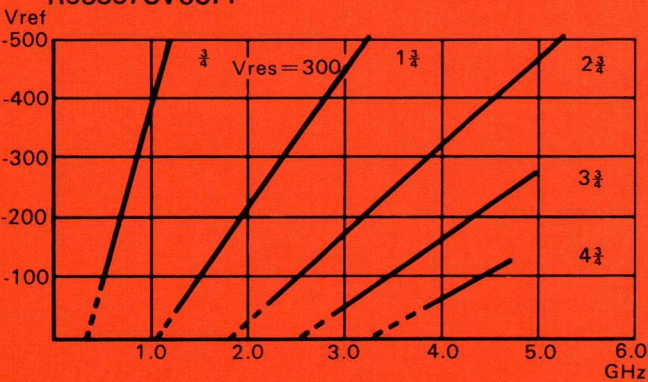


R9696

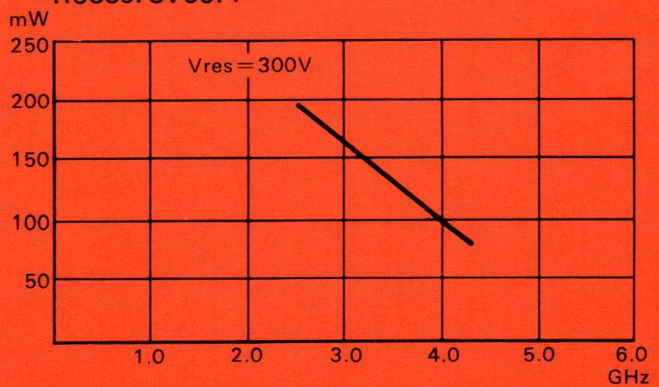


For Output Power/Frequency Curves for R9696 and R9701 see page 10

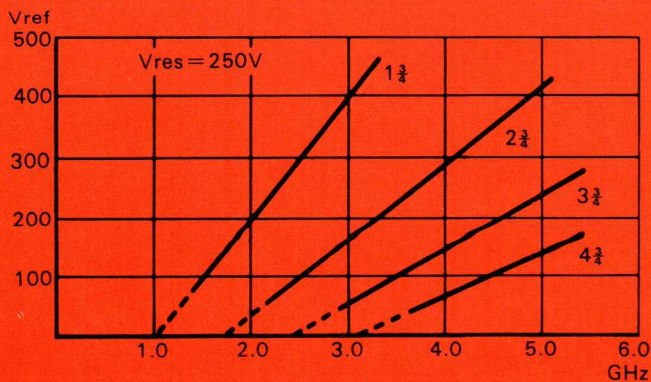
R9559/CV6071



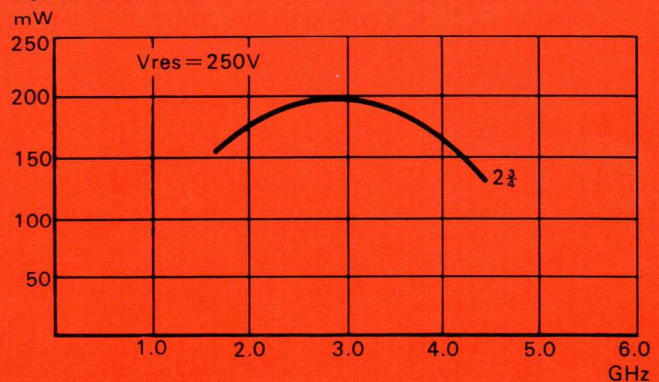
Po R9559/CV6071



CV2116

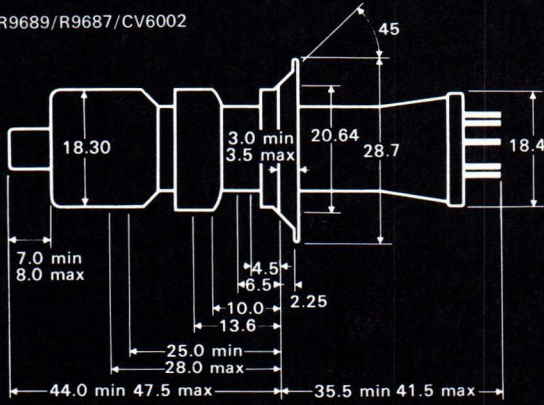


Po CV2116

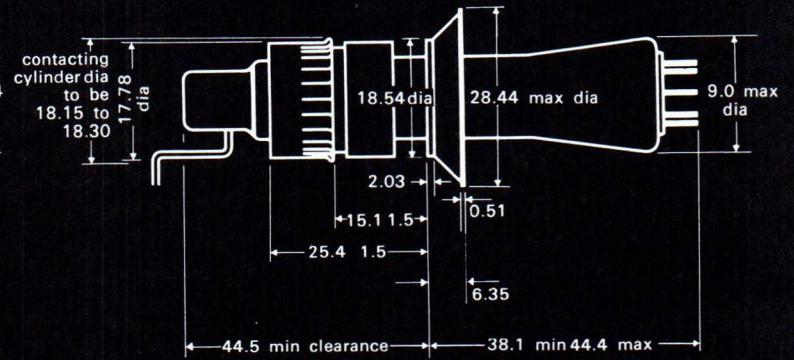


Performance Data on Plug-in Klystrons

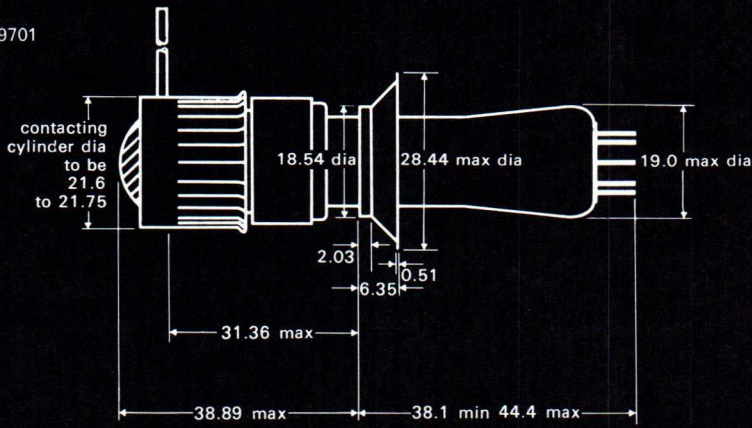
CV2346/R9760/R9689/R9687/CV6002



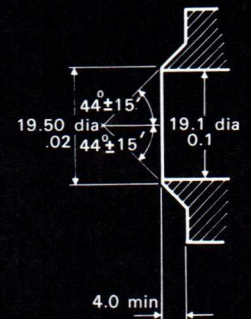
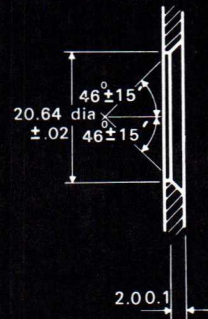
R9696



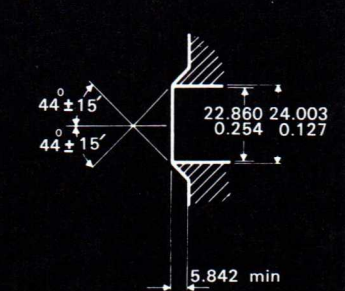
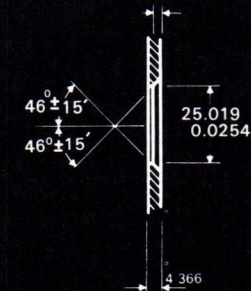
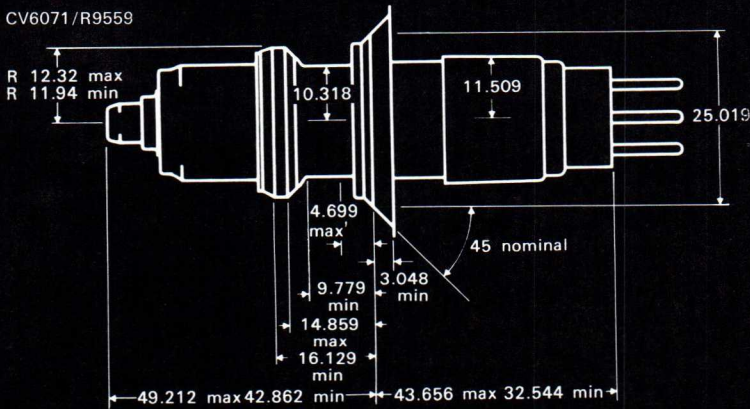
R9701



CV2346 R9696/R9701 and similar types
Recommended Seatings

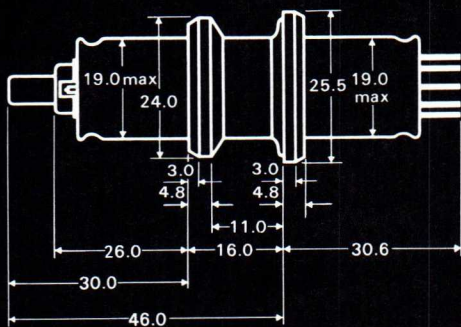


CV6071/R9559

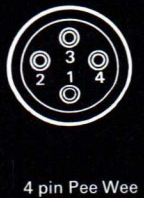
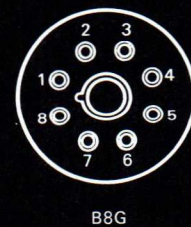
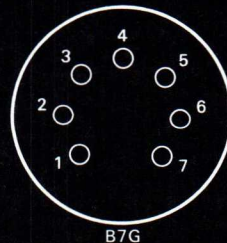


CV6071/R9559

CV2116



Bases



All dimensions in millimetres

Klystron Cavities

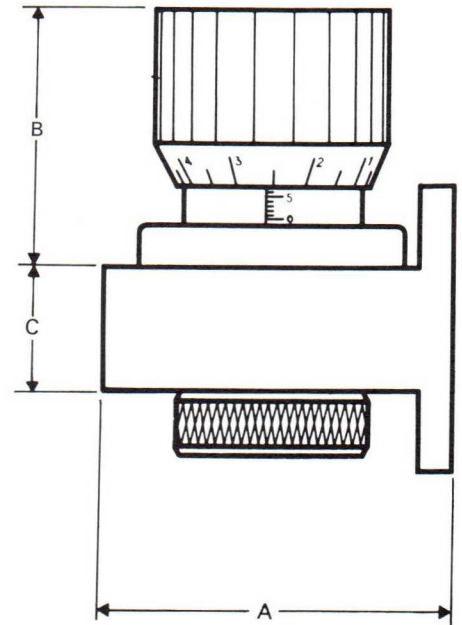


- Wide band cavities cover range 5.4–11.7 GHz
- Micrometer frequency adjustment gives accurate resetting
- Designed for use with plug-in klystrons types R9696 and R9701

	25181	25157	25182
A	58.7	48.4	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

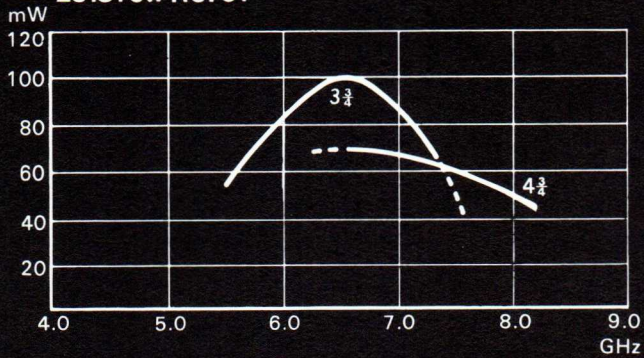
Flange Details

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

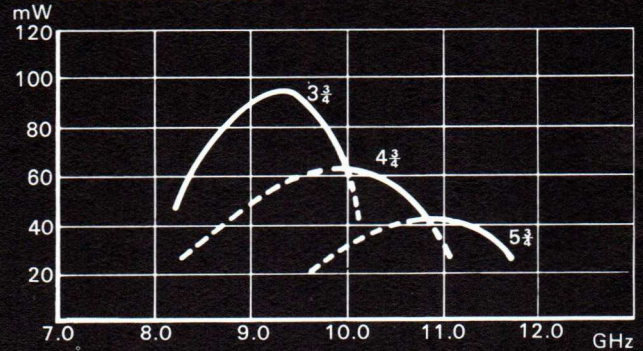


All dimensions in millimetres

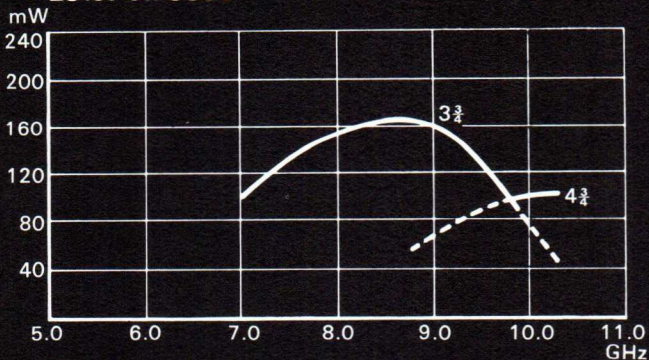
Po 25181 cw R9701



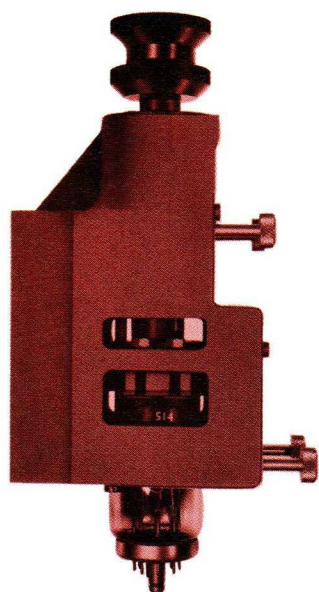
Po 25182 cw R9696



Po 25157 cw 9696



Klystron for Microwave Links



- Up to 4 watts in the 7 cm communication band
2 watts in the 4 cm band
- Connects direct to the appropriate waveguide
WG 14 for the 4 cm band,
5.08 cm x 2.54 cm waveguide for the 7 cm band
- Good linearity – ideal for television links. For a 20% change in electronic tuning slope the minimum electronic tuning range is 10 MHz

Brief specifications

Type Number	Frequency Range	Ratings All voltages referred to cathode						Operation Under standard voltage conditions								
		Standard	Maximum	Minimum	Maximum	Standard	Maximum	Heater Voltage (Volts)	Reflector Voltage (Volts)	Resonator ² Voltage (Volts)	Heater Current (Amps)	Reflector Current (μA)	Resonator Current (mA)	ETR to ½ power points (MHz)		Power Output into matched load (watts)
R9556 ³	6875–7125	12.6	13.6	–200	–550	1000	1200	1.0	1.25	30	120	140	10	60	1.8	2.0
R9516 ³	7050–7300	12.6	13.6	–200	–550	1000	1200	1.0	1.25	30	120	140	10	60	1.8	2.0
R9704 ³	7150–7400	12.6	13.6	–200	–550	1000	1200	1.0	1.25	30	120	140	10	60	1.8	2.0
R9630 ³	7300–7550	12.6	13.6	–200	–550	1000	1200	1.0	1.25	30	120	140	10	60	1.8	2.0
R6015	4270–4760	6.3	6.8	–50	–250	250	300	0.8	1.0	10	50	70	10	50	30mW	150mW
R6010 ⁴	4400–4800	6.3	6.8	–150	–550	700	750	0.8	1.0	30	143	150	20	45	3.0	3.7

Note 1. The grid voltage is optimised in the range 0 to –200V.

Note 2. The klystrons are normally operated with the resonator at earth potential.

Note 3. Minimum slope 0.25 MHz/V.

Note 4. Minimum slope 0.20 MHz/V.

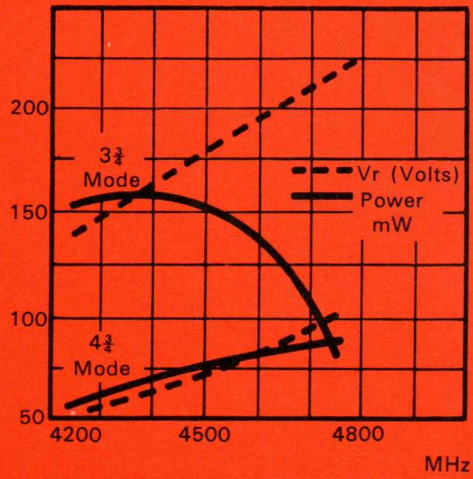
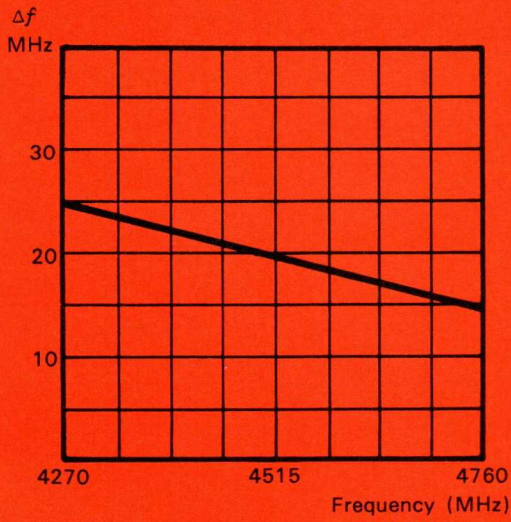
Base connections B8G base

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

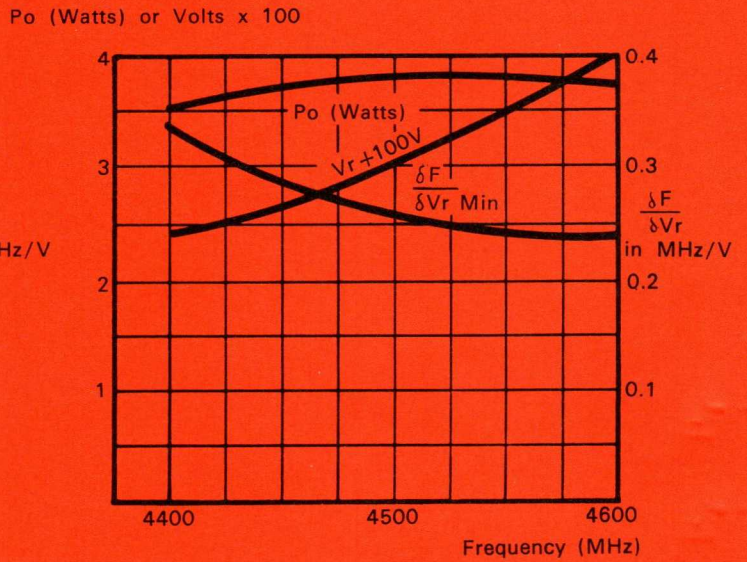
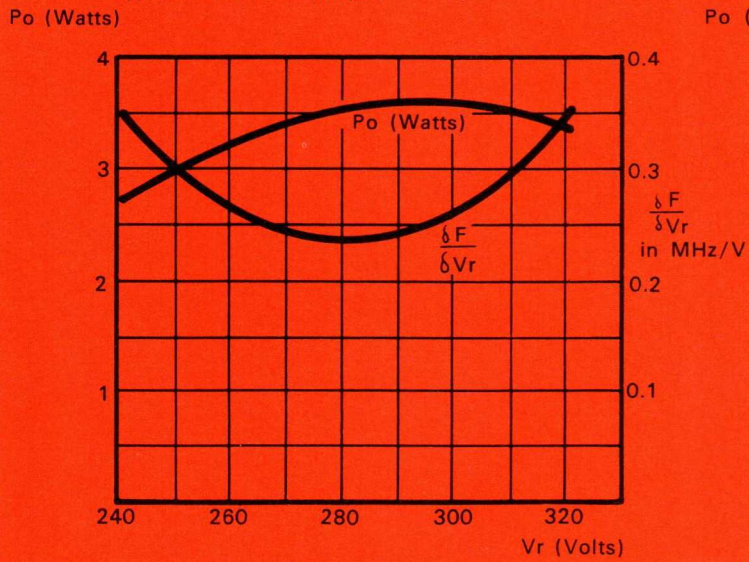
K = Cathode IC = Internal Connection H = Heater KS = Cathode Screen
 Tubes available to CV Specification R6010 = CV2353 R6015 = CV2354

Link Klystrons

Type R6015 7cm Link Klystron

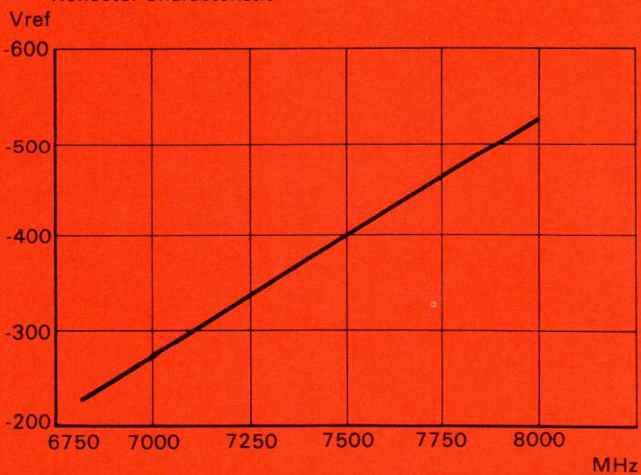


Type R6010 7cm Link Klystron

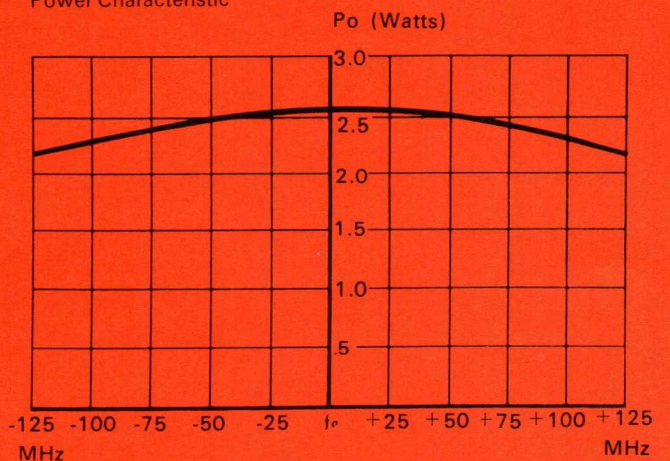


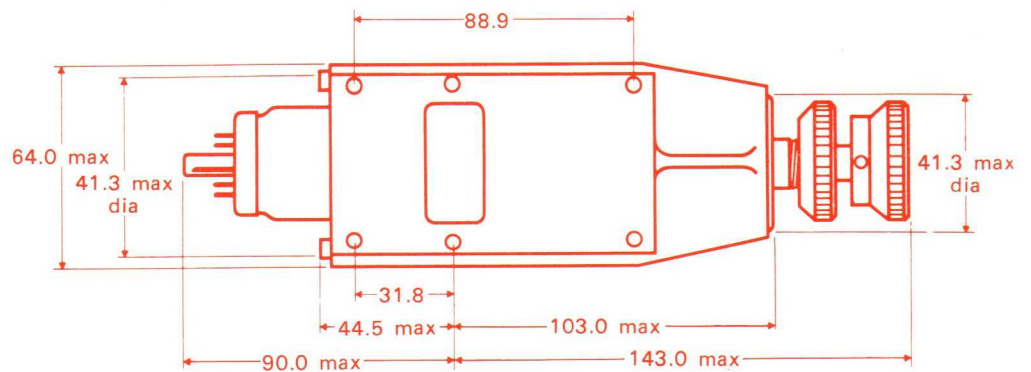
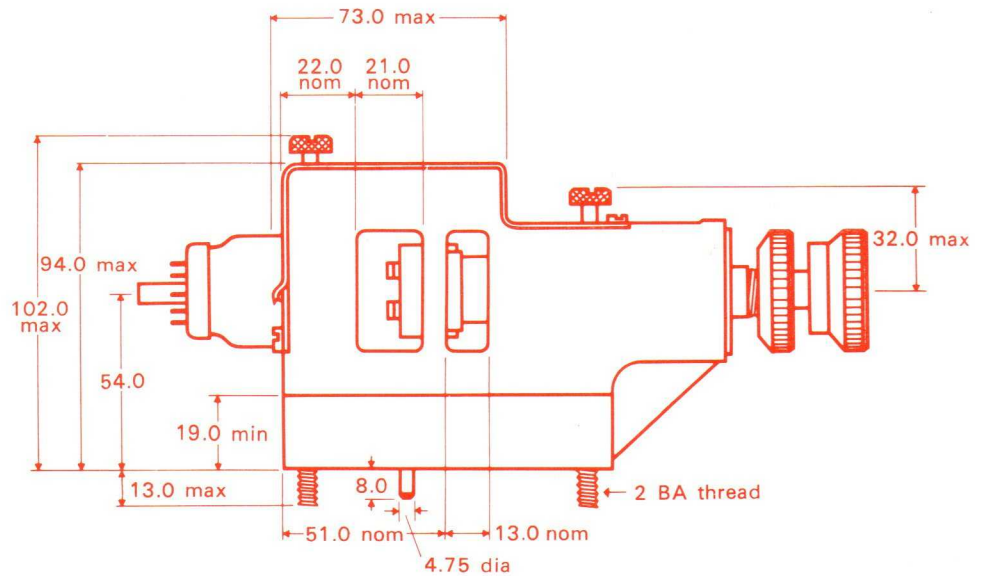
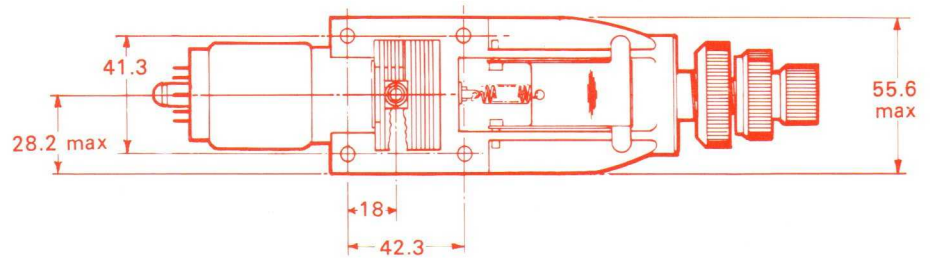
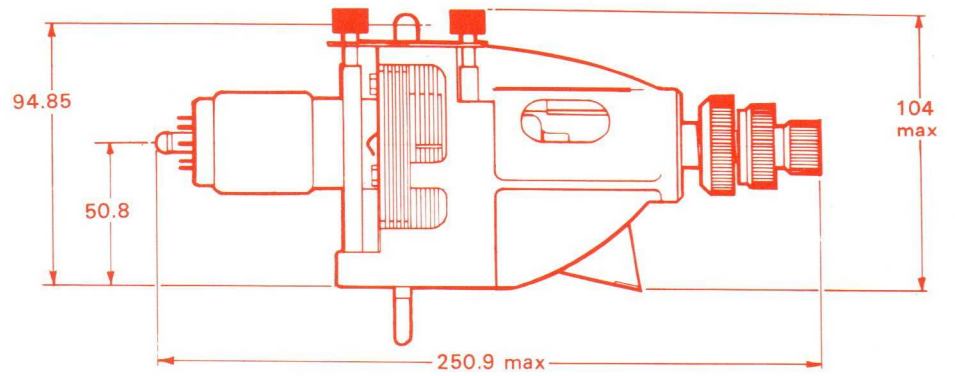
R9556 R9516 R9704 R9630 4cm Link Klystrons

Reflector Characteristic



Power Characteristic





All dimensions in millimetres

Notes on Operation

Apply the negative grid and reflector volts first. Then allow the cathode to warm up for at least one minute with normal heater volts, before applying the h.t. These klystrons will be damaged if the h.t. is applied without the negative voltages. The resonator is normally at earth potential.

A suitable diode must be connected directly

between the reflector and the cathode to prevent the reflector becoming positive with respect to the cathode.

Neither the temperature of the valve envelope nor the external metal parts may exceed 150°C at any point. Forced air cooling is needed for all transmitter types. The R6010 requires a minimum air flow of 0.15 m³/min.

The R6010 and R6015 are fitted with an output system using a coaxial output line and a launching probe. These valves are designed to fit a mounting secured directly to a waveguide of internal dimensions 2.54 x 5.08 cm. One end of the waveguide should be terminated with an adjustable reflecting piston approximately 2 cm from the launching probe.



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