

ADMIRALTY SURFACE WEAPONS ESTABLISHMENT

Specification AD/CV6023 Issue 5 Dated 31.8.61 To be read in conjunction with K1001, BS.448 and BS.1409.	<table> <tr> <th colspan="2"><u>SECURITY</u></th></tr> <tr> <th><u>Specification</u></th><th><u>Valve</u></th></tr> <tr> <td>Unclassified</td><td>Unclassified</td></tr> </table>	<u>SECURITY</u>		<u>Specification</u>	<u>Valve</u>	Unclassified	Unclassified
<u>SECURITY</u>							
<u>Specification</u>	<u>Valve</u>						
Unclassified	Unclassified						

<u>TYPE OF VALVE:</u> Voltage tuned Oscillator (S-band) with Electro-magnet. <u>CATHODE:</u> Indirectly heated. <u>ENVELOPE:</u> Glass enclosed in a metal shell. <u>PROTOTYPE:</u> VX9164 and C0119	<u>MARKING</u> See K1001, issue 5. The serial number and the optimum working current level (see Note 2) for the solenoid shall be clearly indicated on the shell of the valve.
	<u>BASE</u> B7D (but see Note H on page 2)

<u>RATINGS</u>			<u>CONNECTIONS</u>	
(All limiting values are absolute)			Base:-	
		Note	PIN	ELECTRODE
Heater Voltage (Nom.) (V)	6.3	A	1. Heater	h.
Max. Heater Current (A)	2.6		2. Cathode	k.
Max. Surge Heater Current (A)	4.0		3. Anode	a.
Max. Solenoid Voltage (Vd.c.)	24	B	4. Grid	g.
Max. Solenoid Current (A)	7	B	5. Delay Line and	
Min. Delay-line Voltage (V)	150	C	Collector	dl, Col.
Max. Delay-line Voltage (V)	1170	C	6. As for pin 5.	"
Max. Delay-line Current (mA)	50	D	7. Heater	h.
Max. Delay-line			<u>Solenoid:</u> (A.P.208600)	
Dissipation (W)	60		A. Negative supply	
Max. Anode Voltage (V)	200		B. Positive supply	
Max. Anode Current (mA)	30		The power output terminal at	
Max. Negative Grid			the valve is an approved type	
Voltage (V)	100	E	N socket, for connection to a	
Min. Total Tuning			50 ohms co-axial line plug	
Range (Mc/s)	2400		J.S. No. 5935-99-940-1095.	
	to		See Note J on page 2.	
	4500	G		
Min. Power Output (mW)	20		<u>DIMENSIONS</u>	
			See Drawing on page 9.	

NOTES

- A. The heater voltages shall be applied at least two minutes before the application of the H.T. voltages.
- B. The magnetic field required to focus the electron beam is provided by a solenoid which is an integral part of the valve. The optimum value of solenoid current for each valve will be stated and marked on each valve by the manufacturer. The value of this current will lie between 3-7 amps, for which a d.c. supply voltage of 16V min. to 24V max. is necessary.

NOTES (CONT'D)

- B. If the stability of the solenoid current (including transients, cont'd. temperature, effects, etc.) is worse than ± 0.05 amps about the stated value, then variations in the output frequency (greater than 1 Mc/s) can be expected, accompanied by appreciable variations in power and noise output. Permanent magnets should be kept at least 12" away from valves during operation if deleterious effects are to be avoided.

Electro-magnets, transformers, etc., and non-magnetised ferrous materials should be kept at least 6" away from valves during operation if deleterious effects are to be avoided.

- C. In all cases the solenoid and delay line voltages must be applied before the anode voltage.
- D. The delay line and collector are connected inside the valve, and therefore the "delay line current" includes collector current.
- E. For normal operation the grid is set at zero volts. At $V_g = -100V$ oscillations are cut-off.
- F. The temperature at any point on the external surface of the metal shell must not be allowed to exceed 120°C. Minimum air flow directed on to the radiating fins and side of the valve should be 50 cu. ft./min.
- G. The valve is tuned by varying the delay line voltage V_{dl} . The relationship between frequency and V_{dl} is approximately given by the curve shown on page 10.

The valve oscillates at a frequency of 2400 Mc/s at V_{dl} not lower than 150V, and at a frequency of 4500 Mc/s at V_L not higher than 1170V.

- H. The base is rigidly attached to the metal shell and its pins are connected to the valve terminals by flexible leads.
- J. The output terminal and shell of the valve are intended to be operated at earth potential, and are isolated from the delay line, other electrodes, and leads. The insulation resistance with 2 kV d.c. applied is greater than 100 Megohms. The insulation resistance between the solenoid and delay line, other electrodes and leads is also greater than 100 Megohms with 2 kV d.c. applied. The insulation resistance between the solenoid and shell of the valve is greater than 20 Megohms with 50V d.c. applied.
- K. The Joint Service Catalogue No. is:-

5960-99-037-2119

TESTS

To be performed in addition to those applicable in K1001.

Tests are to be performed in the specified order unless otherwise agreed with the Inspecting Authority.

Test conditions - unless otherwise stated:-

V_h V_g V_a Cooling v.s.w.r.
 (V) (V) (V)
 6.3 a.c. 0 V_o (Note 1) (Note 2) $\leq 1.2 : 1$ (Note 3)

	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits		Units
						Min.	Max.	
a	<u>Heater Current</u> (After two minutes)	No voltages except V_h		100%	I_h	2.1	2.6	A
b	<u>Vibration</u> (i) Frequency Deviation (ii) Power Output Deviation (iii) Carrier to Noise Ratio	Adjust V_{dl} for 3400 Mc/s Notes 4, 5 and 6. Note 7. Note 8.		T.A. and 10%	$\pm \Delta F$ $\pm \Delta P_o$ C/N	- - 150	1 5 -	Mc/s % dB/c.p.s.
c	<u>Vibration Frequency Deviation</u>	Adjust V_{dl} for 2400 and 4500 Mc/s. Notes 4, 5 and 9		T.A.	$\pm \Delta F$	-	1	Mc/s
d	<u>Oscillations at 2400 Mc/s</u> (i) Delay-line Voltage (ii) Delay-line Current (iii) Anode Current (iv) Power Output	Adjust V_{dl} for 2400 Mc/s Notes 4 and 10.		100%	V_{dl} I_{dl} I_a P_o	150 16 - 20	200 40 30 -	V mA mA mW
e	<u>Oscillation at 2600 Mc/s</u> (i) Delay-line Voltage (ii) Power Output	Adjust V_{dl} for 2600 Mc/s Notes 4 and 10.		100%	V_{dl} P_o	180 50	235 500	V mW
f	<u>Oscillation at 3400 Mc/s</u> (i) Delay-line Voltage (ii) Delay-line Current (iii) Anode Current (iv) Power Output	Adjust V_{dl} for 3400 Mc/s Notes 4 and 10.		100%	V_{dl} I_{dl} I_a P_o	400 30 - 150	460 50 20 1500	V mA mA mW
g	<u>Oscillation at 4500 Mc/s</u> (i) Delay-line Voltage	Adjust V_{dl} for 4500 Mc/s Notes 4 and 10		100%	V_{dl}	1030	1170 (Cont'd)	V

TESTS (CONT'D)

To be performed in addition to those applicable in K1001.

Tests are to be performed in the specified order unless otherwise agreed with the Inspecting Authority.

Test conditions - unless otherwise stated:-

V_h V_g V_a Cooling v.s.w.r.
 (V) (V) (V)
 6.3 a.c. 0 V_o (Note 1) (Note 2) $< 1.2 : 1$ (Note 3)

	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits		Units
						Min.	Max.	
g	(ii) Delay-line Current (iii) Anode Current (iv) Power Output				I_{dl} I_a P_o	30 - 250	50 20 2200	mA mA mW
h	<u>Anode Modulation</u> Ratio of max. to min. values of Power Output	Adjust V_{dl} for 2400, 3400 and 4500 Mc/s. Adjust V_a from V_o to $V_o - 100V$. Notes 4 and 11	100%		P_o (Max.) P_o (Min.)	3.5	-	
j	<u>Grid Characteristics</u> (i) Cut-off (ii) Power Output (iii) Slope	$V_g = -100V$ $V_{dl} =$ Adjusted from 150V to 1170V $V_g = -60V$ $V_{dl} =$ Adjusted from 150V to 1170V $V_g =$ varied from -100V to 0V. $V_{dl} = 1170V$	100%		P_o P_o $\frac{\Delta P_o}{\Delta V_g}$	- - Must always be positive	0 20	mW mW mW/V
k	<u>Grid Insulation</u> Grid Current Record	$V_g =$ Adjust for $I_{dl} + I_a = 10$ mA $V_{dl} = 1200V$ Then reduce V_a to zero	100%		$I_{g(1)}$	-	40	μA
l	<u>Vacuum Test</u>	$V_g =$ as for test k. $V_{dl} = 1200V$ Note Grid Current ($I_{g(2)}$) $I_{g(2)} - I_{g(1)}$	100%		ΔI_g	-	10	μA
m	<u>Grid Pulse Modulation</u> Peak Power Output $P(pk)$ Record C.W. Power Output $P_o(1)$ Record	$V_g =$ pulsed from cut-off value to zero volts Pulse length = 0.2 μ Sec. (Nom.) at 1000 p.p.s. $V_{dl} =$ adjust for 3400 Mc/s Note 4 $P_o(1) = P(pk)$ $P_o(1)$		T.A.		-	20	%

TESTS (CONT'D)

To be performed in addition to those applicable in K1001.

Tests are to be performed in the specified order unless otherwise agreed with the Inspecting Authority.

Test conditions - unless otherwise stated:-

V_h V_g V_a Cooling v.s.w.r.
 (V) (V) (V)
 6.3 a.c. 0 V_o (Note 1) (Note 2) $<1.2 : 1$ (Note 3)

	Test	Test Conditions	AQL %	Insp. Level	Sym-bol	Limits		Units
						Min.	Max.	
n	<u>Valve Noise</u> Carrier to noise ratio	Adjust V_{dl} for all frequencies between 2400 and 4500 Mc/s. Notes 8 and 12.		100%	C/N	150	-	dB/c.p.s.
p	<u>Stability</u>	V_{dl} adjusted - I (solenoid) set to value best suited to the particular valve (Note 2) plus 0.05 and less 0.05 amps. in turn.		T.A.				
	(i) Power Output				P_o	20	-	mW
	2400 - 2600 Mc/s.				P_e	50	-	mW
	2600 - 4500 Mc/s.							
	(ii) Frequency Deviation at 2400, 2900, 3400, 4000, and 4500 Mc/s	Note 4			ΔF	-	± 1	Mc/s
	(iii) Carrier to Noise Ratio				C/N	150	-	dB/c.p.s.
q	<u>Frequency Pulling</u> at 2400, 3400 and 4500 Mc/s.	Adjust V_{dl} for test frequencies. Notes 4 and 13.		100%	ΔF	-	7	Mc/s
r	<u>Insulation Resistance</u>	No operating voltages. 2 kV d.c. applied between test electrode pin and shell.		100%				
	(i) Shell to Delay-line and Collector				R _{dl}	100	-	Megohms
	(ii) Shell to Cathode/Heater.				R _c	100	-	Megohms
	(iii) Shell to Grid				R _g	100	-	Megohms
	(iv) Shell to Anode				R _a	100	-	Megohms
		2 kV d.c. applied between test electrode and solenoid						

(Cont'd)

CV6023/5/5

TESTS (CONT'D)

To be performed in addition to those applicable in K1001

Tests are to be performed in the specified order unless otherwise agreed with the Inspecting Authority.

Test conditions - unless otherwise stated:-

V_h V_g V_a Cooling v.s.w.r.
 (V) (V) (V) (Note 2) 1.2 : 1 (Note 3)
 6.3 a.c. 0 V_o (Note 1)

	Test	Test Conditions	AQL %	Insp. Level	Sym- bol	Limits		Units
						Min.	Max.	
r cont'd	(i) Solenoid to Delay-line and Collector	50V d.c. applied between solenoid and shell of valve			R_{dl}	100	-	Megohms
	(ii) Solenoid to Cathode/Heater				R_c	100	-	Megohms
	(iii) Solenoid to Grid				R_g	100	-	Megohms
	(iv) Solenoid to Anode				R_a	100	-	Megohms
					-	20	-	Megohms
s	<u>Leakage Current</u> Heater/Cathode Current.	No operating voltages Note 14.		100%	$I_{h,k}$	-	750	μA
t	<u>Life</u>	Adjust V_{dl} for 3400 Mc/s Notes 4 and 15.		T.A. and 2%	t P_o	500 10	- -	hours mW

NOTES

1. V_o which must be within the limits 100-200 volts d.c., must be quoted on the data sheets supplied with each valve. V_o is a single fixed value of V_a which is compatible with tests (d), (e), (f) and (g).
2. The valve must be air cooled, the air at ambient temperature being directed on to the side of the metal shell and radiator. Air flow to be not greater than 50 cu. ft./min.

The solenoid current shall be adjusted to the value best suited to the particular valve. This current must lie between the limits 3-7 amps. (Stabilised to $\pm 0.05A$). All tests shall be carried out with another CV6023/4 placed alongside the valve under test, the main axes of the two valves being parallel and the distance between the nearest points of the valves to be 6". The Output socket of the valve undergoing test should be opposite the Output socket of the second valve, which should also have its solenoid energised as for normal operation.
3. The input v.s.w.r. of the power and frequency measuring equipment must be less than 1.2 over the full μ -wave frequency range of 2400 - 4500 Mc/s.

NOTES (CONT'D)

4. The frequency shall be set to within $\pm 1\%$.
5. The valves shall be mounted rigidly on a vibration table, and while operating shall be vibrated with simple harmonic motion, in the direction of each of the three mutually perpendicular axes successively, at the following vibration frequencies and amplitudes:

Vibration Frequency Range (c.p.s.)	Amplitude of Vibration (inches)
1 - 15	$\pm 1/16$
15 - 30	± 0.010
30 - 50	± 0.005
50 - 80	± 0.002
80 - 100	± 0.001

The vibration frequency range shall be continuously explored once. The rate of change of this frequency shall not exceed 20 c/s per minute.

6. One valve in ten shall be tested. In the event of failure, a second valve shall be vibrated. If this valve proves satisfactory, the batch shall be accepted: if unsatisfactory, the batch shall normally be rejected. At the discretion of the Government Authority concerned, however, a rejected batch may be re-submitted for acceptance following a joint investigation by the contractor and the Government Authority. Valves satisfying this test, which is considered to be non-destructive, may be accepted as part of the order.
7. The test requirement is that frequency modulation of the RF output by the vibration shall not exceed ± 1 Mc/s at any frequency in the μ -wave tuning range for the range of vibration frequencies tabulated under Note 5.
8. The heater supply shall be d.c. or rectified and smoothed a.c. A broadband non-balanced mixer shall be used throughout noise tests. The noise output shall be indicated on a visual display. The following tests are to be made:-
 - (a) The ratio of signal to average noise over 10 Mc/s bandwidths centred at frequencies of 60 Mc/s and 120 Mc/s shall not be less than 150 dB/c.p.s.
 - (b) The ratio of signal to average noise over a 20 Kc/s bandwidth centred at 1.0 Mc/s shall be measured for record purposes only, and test results for all valves, shall be made available to the specifying authority. These measurements to be made at 2400, 3400, and 4500 Mc/s only.

For all noise measurements the load v.s.w.r. shall be less than 1.5.

9. Additionally, if necessary, valves shall be vibrated over the full carrier frequency range at any vibration frequency at which mechanical resonances are observed to occur. The value of ΔF must not, with these vibration frequencies, exceed ± 1 Mc/s at any carrier frequency in the range 2400 to 4500 Mc/s.

10. The manufacturer is to supply with each valve:-

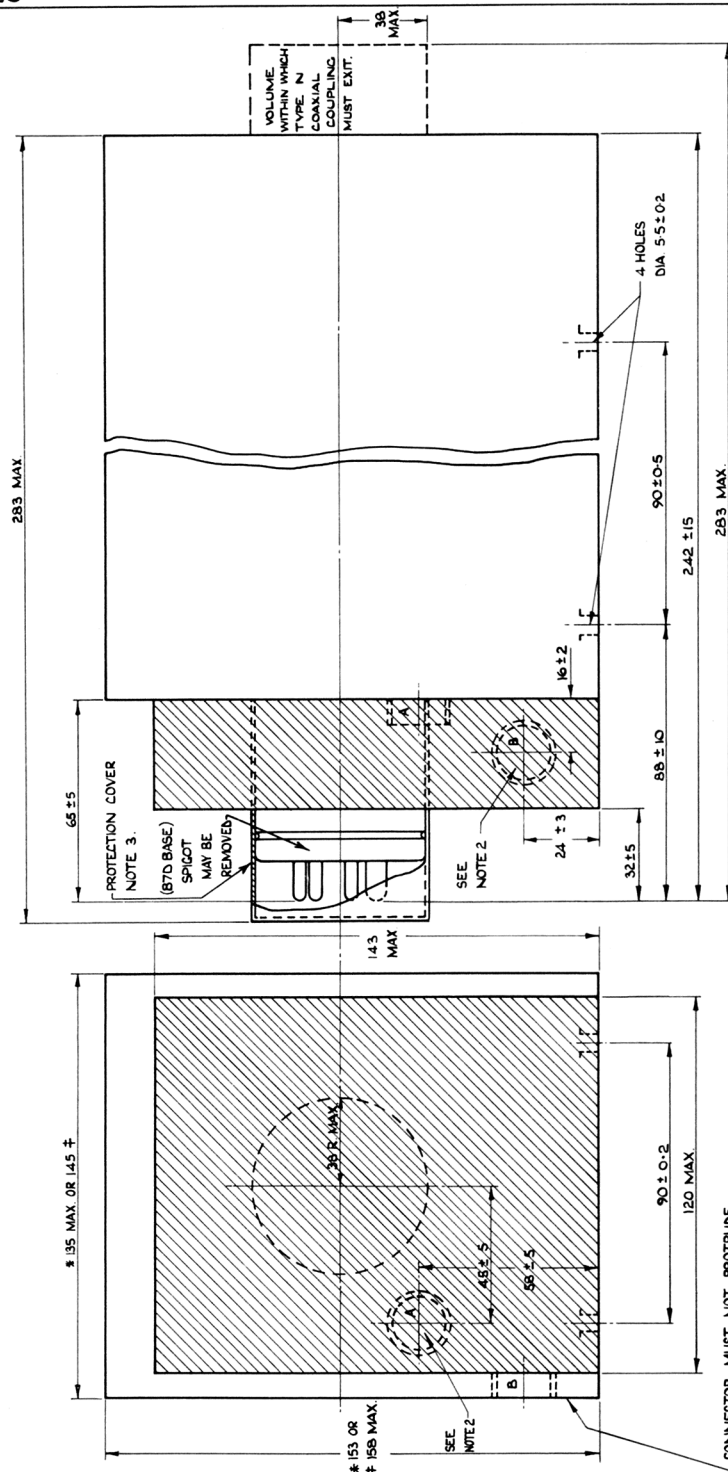
- (i) A power output versus delay line voltage characteristic covering the range of frequencies 2400 to 4500 Mc/s. The power output shall not be less than 50 mW at any frequency above 2600 Mc/s, nor be less than 20 mW at any frequency below 2600 Mc/s.
- (ii) A frequency versus delay line voltage characteristic covering the range of frequencies 2400 to 4500 Mc/s. There must be no frequency discontinuities over this tuning range.

- 11. With each valve, the manufacturer is to supply anode modulation characteristics showing power output versus anode voltage for each test frequency.
- 12. The time taken in this test for each sweep over the carrier range of 2400 - 4500 Mc/s shall not be less than two minutes.
- 13. The pulling frequency is the difference between the max. and min. frequencies recorded when a mismatch placed in the output section is varied through all phases. The v.s.w.r. of the mismatch shall normally lie between 1.5 - 1.6 at each microwave frequency, but the manufacturer may, at his discretion, exceed a v.s.w.r. of 1.6 during this test.

A curve showing variation in frequency pulling over the tuning range shall be recorded for each valve. Measurements shall be made at delay line voltages separated by intervals of 40 volts from $V_{dl} = 150V$ to $V_{dl} = 510V$, and by intervals of 60 volts from $V_{dl} = 510$ to $V_{dl} = 1170V$. This information must be made available to the specifying authority.

- 14. The maximum permissible leakage current to apply in this case for the Heater/Cathode Leakage Test (K1001 paragraph 5.3), shall be 750 μA .
- 15. The life of a valve shall be considered to be terminated when, at any frequency in the range 2400 to 4500 Mc/s, the power output falls below 10 mW, and the performance of the valve falls outside any of the limits specified in all other tests, except test (b).

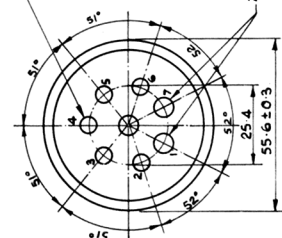
The test and release sequence, and the procedure to be adopted in the event of failure in life testing, will be decided by the purchasing authority. For production contract orders of less than 50 valves, the quantity of valves for life tests shall be decided by the purchasing authority.



* FOR CV2381
FOR CV6023.

— 5 PINS $0.125" \pm 0.002" \text{ DIA.}$

ALL DIMENSIONS ARE IN MM'S.



B7D BASE

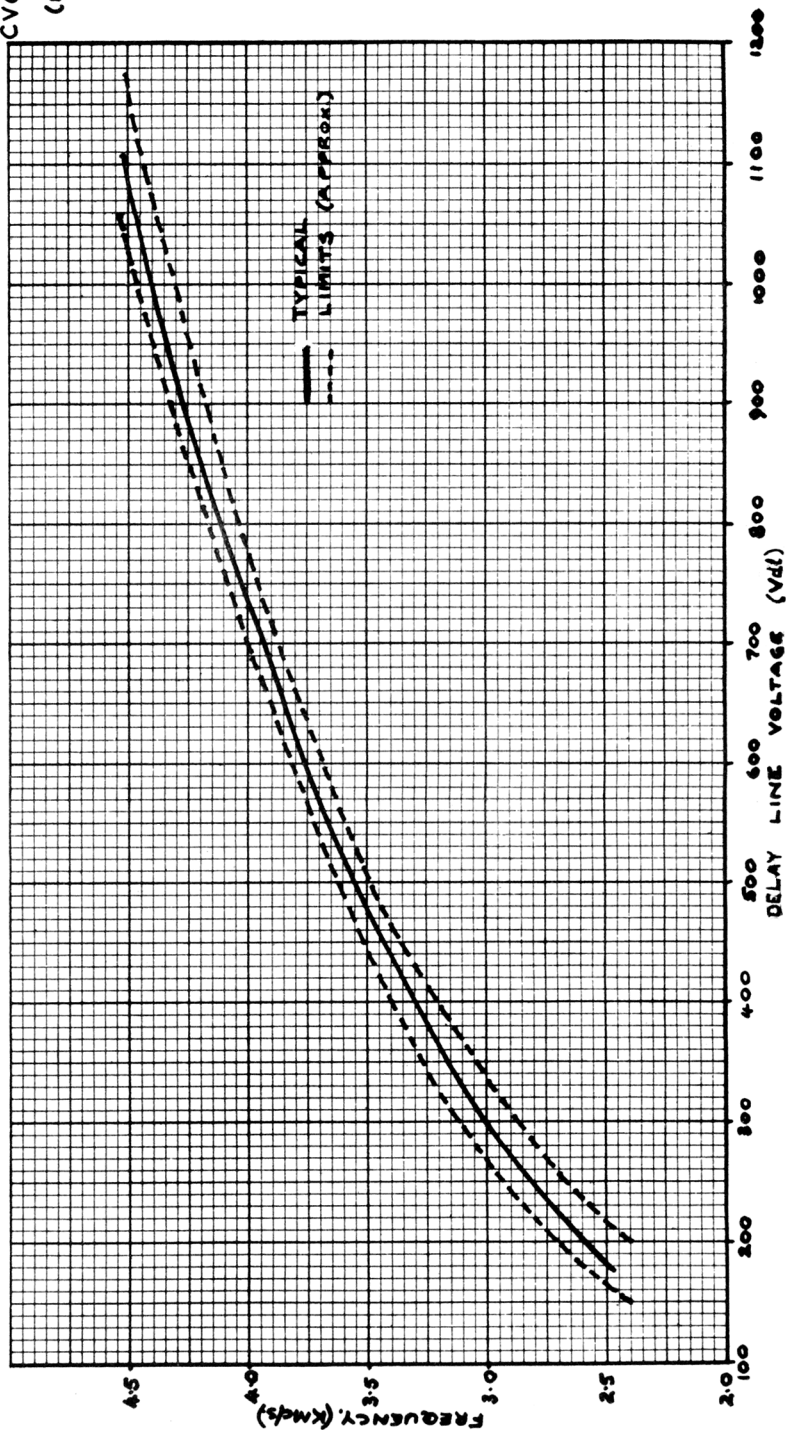
— 2 PINS 0.156" ± 0.002 "DIA

NOTES.

- THE FIRING HOLES ARE AS SHOWN TO INDICATE THAT THERE MUST BE EASE OF ACCESS TO FINN68.

$$\underline{A_{mdt} = 1.}$$

CV2381
CV6023
(issue 5)



ELECTRONIC VALVE SPECIFICATIONS

SPECIFICATION AD/CV6023 ISSUE No.5 DATED 31.8.61

AMENDMENT No. 1

Page 9 Note 3

Add to the end of Note 3 the following:-

'The protective cover may be omitted if the base of the valve does not form part of the vacuum envelope'.

January 1964
(213531)

T.V.C. for A.S.W.E.

✓ AAS
28/8/64