CV6024

VALVE ELECTRONIC

ADMIRALTY SURFACE WEAPONS ESTABLISHMENT

Specification AD/CV6024.
Issue 4 Dated 31. 8. 61.
To be read in conjunction with K1001, BS.448 and BS.1409.

SECURITY	
Specification	Valve
Unclassified	Unclassified

TYPE OF VALVE: Voltage Tuned Oscillator (X-band) with Electro-Magnet.

CATHODE: Indirectly heated.

ENVELOPE: Glass enclosed in a metal shell.

PROTOTYPE: VX2507, C043.

MARKING

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.

BASE

A7 - 13 (See Note H on page 2)

RATING

(All limiting values are absolute)

			Note
Heater Voltage (Nom.)	(V)	6.3	A
Max. Heater Current	(A)	2.5	
Surge Heater Current	(A)	4.0	
Max. Solenoid Voltage	(Vd.c.)	24.0	B
Max. Solenoid Current	(A)	7	B
Min. Delay Line Voltage	(V)	300	C
Max. Delay Line Voltage	(V)	1500	C
Max. Delay Line Current	(mA)	35	D
Max. Delay Line Dissipation	(W)	50	
Max. Anode Voltage	(V)	300	
Max. Anode Current	(mA)	10	
Max. Negative Grid Voltage	(V)	250	E
Min. Total Tuning Range	(Mc/s)	7000 to 11500	G
Min. Power Output.	(mW)	20	

CONNECTIONS

Pin	Electrode	
1	Heater	h
2	Cathode	k
3	Anode	a
4	Grid	g
5	Delay line and Collector	dl
6	As for Pin 5	dl
7	Heater	h

Solenoid (A.P.208600)

A	Negative supply.
B	Positive supply.

The power output terminal at the valve is an approved type N socket for Connection to a 50 ohm coaxial line plug J.S.No. 5935-99-940-1095. See Note J.

DIMENSIONS

See drawings on page 9 .

NOTES

A. The heater voltage shall be applied at least two minutes before the application of the H.T. voltages.

NOTES (Cont'd.)

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 16 min. to 24 max. is necessary. If the stability of the solenoid current (including transients, temperature effects etc.) is worse than ± 0.05 amps about the stated value, then variations in the output frequency (greater than 2 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 = - 100 volts 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 9. The valve oscillates at a frequency of 7000 Mc/s at V_{dl} not lower than 300V, and at a frequency of 11,500 Mc/s at V_{dl} not higher than 1,500 V.

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 2kV 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:-

5960-99-037-2120

CV6024

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)	V_g (V)	V_a (V)	Cooling	v.s.w.r.
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 Min.	Limits Max.	Units
a	Heater Current (After two minutes)	No voltages except V_h		100%	I_h	1.75	2.5	A
b	Vibration	Adjust V_{dl} for 9000 Mc/s Notes 4, 5 and 6.		T.A. and 10%				
	(i)Frequency Deviation	Note 7			$\pm \Delta F$	-	1	Mc/s
	(ii)Power Output Deviation				$\pm \Delta P_o$	-	5	%
	(iii)Carrier to Noise Ratio	Note 8			C/N	150	-	dB/c.p.s.
c	Vibration	Adjust V_{dl} for 7000 and 11500 Mc/s. Notes 4, 5 and 9.		T.A.				
	Frequency Deviation				$\pm \Delta F$	-	1	Mc/s
d	Oscillation at 7000 Mc/s	Adjust V_{dl} for 7000 Mc/s. Notes 4 and 10.		100%				
	(i)Delay line Voltage				V_{dl}	300	350	V
	(ii)Delay line Current				I_{dl}	-	25	mA
	(iii)Anode Current				I_a	-	10	mA
	(iv)Power Output				P_o	20	-	mW
e	Oscillation at 9000 Mc/s	Adjust V_{dl} for 9000 Mc/s Notes 4 and 10.		100%				
	(i)Delay line Voltage				V_{dl}	580	700	V
	(ii)Power Output				P_o	20	-	mW
f	Oscillation at 11500 Mc/s	Adjust V_{dl} for 11500 Mc/s. Notes 4 and 10.		100%				
	(i)Delay line Voltage				V_{dl}	1300	1500	V
	(ii)Delay line Current				I_{dl}	-	35	mA
	(iii)Anode Current				I_a	-	10	mA
	(iv)Power Output				P_o	20	-	mW
g	Anode Modulation	Adjust V_{dl} for 7000, 9000 and 11500 Mc/s. Adjust V_a from V_o to V_o - 100V.		100%				
	Ratio of max. to min. values of Power Output.	Notes 4 and 11.			$\frac{P_o(Max.)}{P_o(Min.)}$	3.5	-	

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)	V_g (V)	V_{g2} (V)	V_{g3} (V)	V_{g4} (V)	V_a (V)	Cooling	v.s.w.r.
6.3 a.c.	0				V_o (Note 1)	(Note 2)	< 1.2 : 1 (Note 3)

	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Limits Max.	Units
h	**Grid Characteristics**							
	(i) Cut-off	V_g= - 100V V_{d1}=Adjust from 300V to 1500V.		100%	P_o	-	0	mW
	(ii) Power Output	V_g= - 60V V_{d1}=Adjust from 300V to 1500V.			P_o	-	20	mW
	(iii) Slope	V_g= Varied from - 100V to zero V. V_{d1} = 1500V.			$\frac{\Delta P_o}{\Delta V_g}$	Must always be positive		mW/V
j	**Grid Insulation** Grid Current Record	V_g=Adjust for $I_{d1}+I_a$ = 10mA. Then reduce to zero V_{d1} = 1500V.		100%	$I_g(1)$	-	30	µA
k	**Vacuum Test**	V_g = as for test j V_{d1} = 1500V Note grid current [I_g (2)] I_g (2)-I_g (1)		100%	ΔI_g	-	10	µA
l	**Grid Pulse Modulation** Peak Power Output [P(pk)] Record C.W. Power Output [P_o(1)] Record	V_g =pulsed from cut-off value to zero V. Pulse length=0.2µsecs. (nom.) at 1000 p.p.s. V_{d1}=Adjust for 900 Mc/s Note 4. $\frac{P_o(1) - P(pk)}{P_o(1)}$		T.A.	-	-	20	%
m	**Valve Noise** Carrier to Noise Ratio	Adjust V_{d1} for all frequencies 7000 to 11500 Mc/s. Notes 8 and 12.		100%	C/N	150	-	dB/cps

CV6024

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

	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Limits Max.	Units
n	Stability	V_{dl} adjusted. I (solenoid) set to value best suited to particular valve (Note 2) plus 0.05 and less 0.05 amps in turn.		T.A.				
	(i)Power Output				P_o	20	-	mW
	(ii) Frequency Deviation. At 7000, 8000 9000, 10,000 and 11,500 Mc/s. Note 4.				ΔF	-	±2	Mc/s
	(iii)Carrier to Noise Ratio.				C/N	150	-	dB/cps
p	Frequency Pulling at 7000, 9000 and 11500 Mc/s.	Adjust V_{dl} for test frequencies. Notes 4 and 13.		100%	ΔF	-	8	Mc/s
q	Insulation Resistance	No operating voltages 2kV dc. 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_k	100	-	Megohms
	(iii)Shell to Grid				R_g	100	-	Megohms
	(iv)Shell to Anode				R_a	100	-	Megohms
		2kV dc. applied between test electrode and solenoid.						
	(i)Solenoid to Delay Line and Collector				R_{dl}	100	-	Megohms
	(ii)Solenoid to Cathode/Heater				R_k	100	-	Megohms
	(iii)Solenoid to Grid				R_g	100	-	Megohms
	(iv)Solenoid to Anode				R_a	100	-	Megohms
		50V d.c. applied between solenoid and shell of valve.			R_s	20	-	Megohms

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

	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Limits Max.	Units
r	Leakage Current Heater/Cathode Current.	No operating voltages. Note 14.		100%	I_{hk}	-	750	μA
s	Life Test	Adjust V_{dl} for 9000 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) and (f).

2. The valve must be air-cooled, the air at ambient temperature being directed onto 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 ± 0.05A). All tests shall be carried out with another CV6023/4 placed alongside the valve under test, the main axes of the 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 7000 - 11,500 Mc/s.

4. The frequency shall be set to within ± ½%.

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	± 1/16
15 - 30	± 0.010
30 - 50	± 0.005
50 - 80	± 0.002
80 - 100	± 0.001

NOTES (CONT'D)

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 resubmitted 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 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 bandwidth centred at 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 made available to the specifying authority. These measurements to be made at 7000, 9000 and 11,500 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 7000 to 11,500 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 7000 - 11,500 Mc/s. The power output shall not be less than 20 mW at any frequency in this range.

(ii) A frequency versus delay line voltage characteristic covering the range of frequencies 7000 - 11,500 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 7000 - 11,500 Mc/s shall not be less than two minutes.

NOTES (CONT'D)

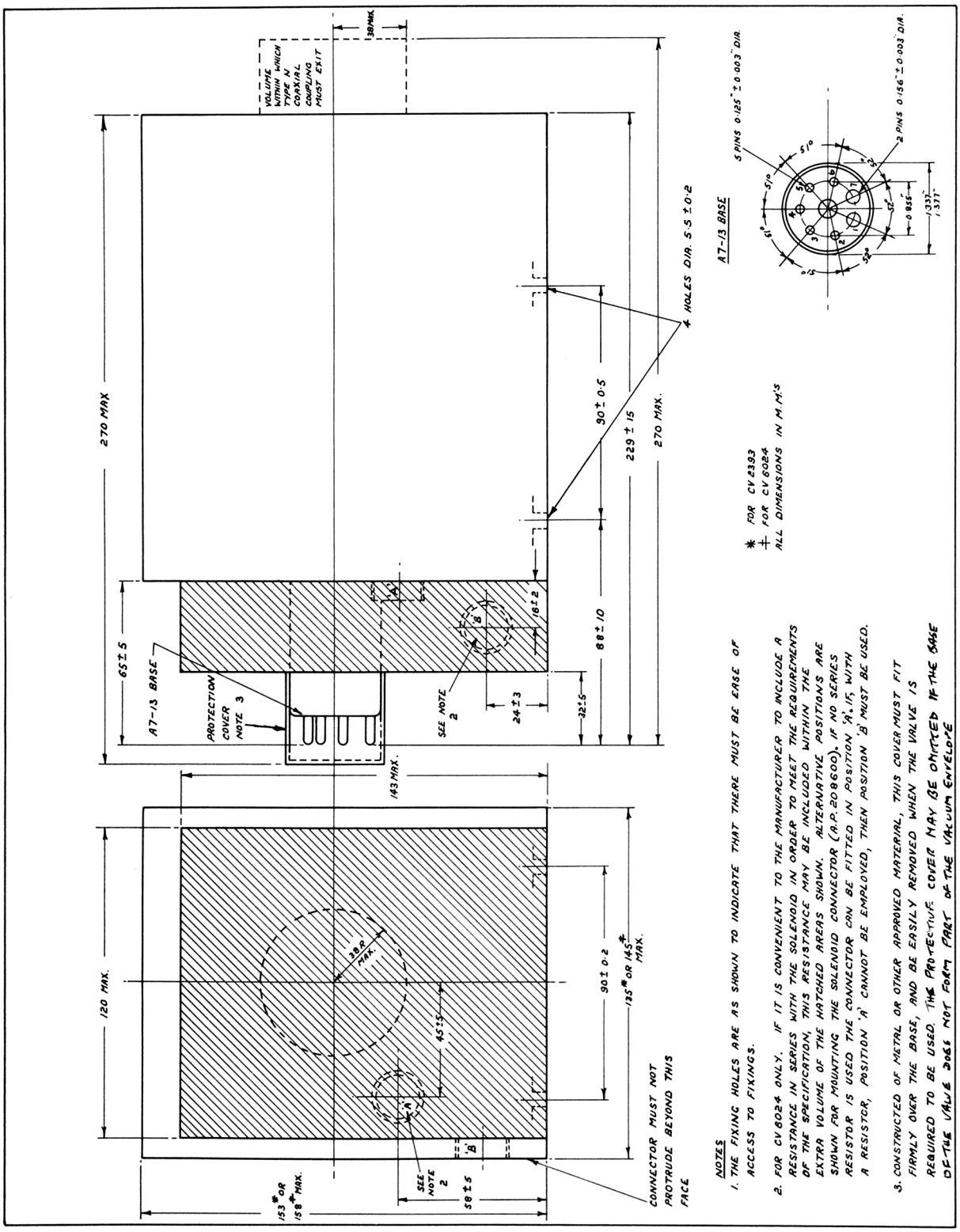
13. The pulling frequency is the difference between the max. and min. frequencies recorded when a mismatch placed in the output section is varied through all phases. The v.s.w.r. of the mismatch shall normally lie between 1.5 - 1.6 at each μ wave frequency, but the manufacturer may, at his discretion, exceed a v.s.w.r. of 1.6, during this test.

A curve showing variations 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 40V from V_{dl} = 300 to V_{dl} = 700V, and by intervals of 60 volts from V_{dl} = 700V to V_{dl} = 1420V. 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 para. 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 7000 - 11,500 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.

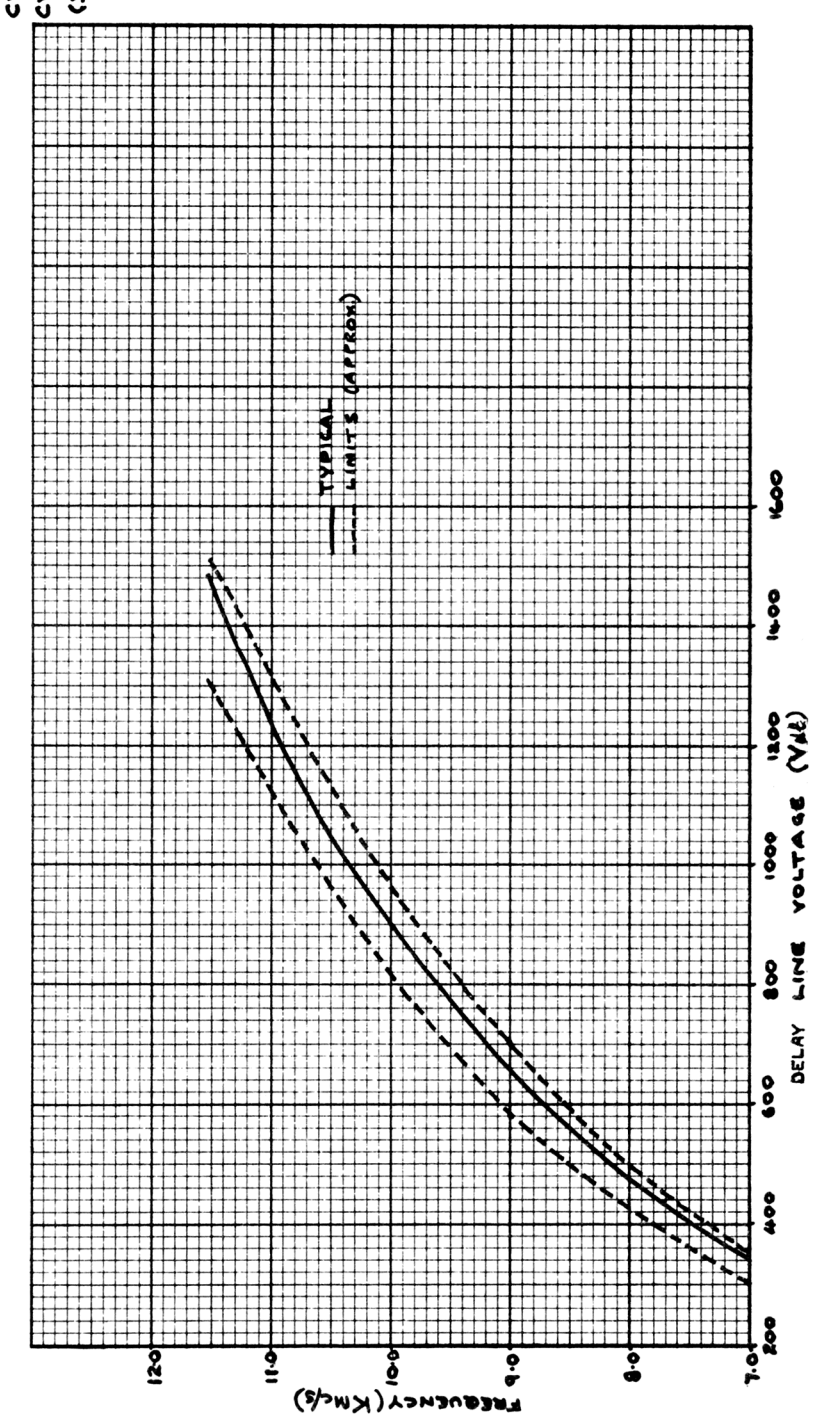


NOTES

1. THE FIXING HOLES ARE AS SHOWN TO INDICATE THAT THERE MUST BE EASE OF ACCESS TO FIXINGS.
2. FOR CV 6024 ONLY. IF IT IS CONVENIENT TO THE MANUFACTURER TO INCLUDE A RESISTANCE IN SERIES WITH THE SOLENOID IN ORDER TO MEET THE REQUIREMENTS OF THE SPECIFICATION, THIS RESISTANCE MAY BE INCLUDED WITHIN THE EXTRA VOLUME OF THE HATCHED AREAS SHOWN. ALTERNATIVE POSITIONS ARE SHOWN FOR MOUNTING THE SOLENOID CONNECTOR (A.P. 20860D). IF NO SERIES RESISTOR IS USED THE CONNECTOR CAN BE FITTED IN POSITION 'A', IF WITH A RESISTOR, POSITION 'A' CANNOT BE EMPLOYED, THEN POSITION 'B' MUST BE USED.
3. CONSTRUCTED OF METAL OR OTHER APPROVED MATERIAL, THIS COVER MUST FIT FIRMLY OVER THE BASE, AND BE EASILY REMOVED WHEN THE VALVE IS REQUIRED TO BE USED. THE PROTECTIVE COVER MAY BE OMITTED IF THE BASE OF THE VALVE DOES NOT FORM PART OF THE VACUUM ENVELOPE

* FOR CV 2393
† FOR CV 6024
ALL DIMENSIONS IN M.M'S

CV2398
CV6024
(Issue 4)



ELECTRONIC VALVE SPECIFICATIONS
SPECIFICATION AD/CV.6024 Issue No. 4 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.'

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

January, 1964

(N.213532)

28/1/64