VALVE ELECTRONIC **CV2381**

ADMIRALTY SURFACE WEAPONS ESTABLISHMENT

Specification AD/CV2381. Issue 5 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 (S-band) with Permanent Magnet.

CATHODE: Indirectly Heated.

ENVELOPE: Glass enclosed in a metal shell.

PROTOTYPE: VX9164 and C0119.

MARKING

See K1001 Issue 5. The serial number shall be clearly included on the shell of the valve.

BASE

B7D

but see Note H on page 2.

RATING

(All limiting values are absolute)

			NOTE
Heater Voltage (Nom.)	(V)	6.3	A
Max. Heater Current	(A)	2.6	
Max. Surge Heater Current	(A)	4.0	
Min. Delay-Line Voltage	(V)	150	B
Max. Delay-Line Voltage	(V)	1170	B
Max. Delay-Line Current	(mA)	50	C
Max. Delay-Line Dissipation	(W)	60	
Max. Anode Voltage	(V)	200	
Max. Anode Current	(mA)	30	
Max. Negative Grid Voltage	(V)	100	D
Min. Power Output	(mW)	20	
Min. Total Tuning Range	(Mc/s)	2400 to 4500	G

CONNECTIONS

PIN	ELECTRODE	
1	Heater	h
2	Cathode	k
3	Anode	a
4	Grid	g
5	Delay line and Collector	dl, Col.
6	As pin 5	dl, Col.
7	Heater	h

The power output terminal at the valve is an approved N socket for connection to a 50 ohms co-axial line plug J.S.No. 5935-99-940-1095. See Note J.

DIMENSIONS

See drawing on page 8

NOTES

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

B. In all cases the delay-line voltage must be applied before the anode voltage.

C. The delay-line and collector are connected inside the valve and therefore the "delay-line current" includes collector current.

NOTES (Contd.)

D. For normal operation the grid is set at zero volts. At V_g = -100V oscillations are cut-off.

E. The magnetic field required to focus the electron beam is provided by a permanent magnet, which is an integral part of the valve. External magnetic fields or ferromagnetic objects may distort the focusing field and cause noise and modulation. The valve should be kept at least 8" away from other magnets or ferrous objects to prevent damage to the magnet, and should not be operated within 18" of such objects if low noise output is required. It is recommended that the valve be stored in its crate or in a similar stowage when it is not required to be in its associated equipment.

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 onto the radiating fins and side of the valve should be 20 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 2400 Mc/s at V_{dl} not lower than 150V, and at a frequency of 4500 Mc/s at V_{dl} 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, magnet, 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.

K. The Joint Service Catalogue No. is:-

5960-99-000-2381

TESTS

CV2381

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)		
6.3V a.c	0	V_o (Note 1)	see Note 2	<1.2 : 1 (see Note 3)

	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Limits Max.	Units
a	Heater Current (after two minutes)	No voltages except V_h		100%	I_h	2.1	2.6	A
b	Vibration	Adjust V_{dl} for 3400 Mc/s Notes 4, 5 and 6. Note 7.		T.A and 10%				
	(i) Frequency Deviation.				$\pm \Delta F$	-	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 2400 and 4500 Mc/s. Notes 4, 5 and 9.		T.A	$\pm \Delta F$	-	1	Mc/s
d	Oscillation at 2400 Mc/s	Adjust V_{dl} for 2400 Mc/s Notes 4 and 10.		100%				
	(i) Delay-line Voltage.				V_{dl}	150	200	V
	(ii) Delay-line Current.				I_{dl}	16	40	mA
	(iii) Anode Current				I_a	-	30	mA
	(iv) Power Output				P_o	20	-	mW
e	Oscillation at 2600 Mc/s	Adjust V_{dl} for 2600 Mc/s Notes 4 and 10.		100%				
	(i) Delay-line Voltage.				V_{dl}	180	235	V
	(ii) Power Output				P_o	50	500	mW
f	Oscillation at 3400 Mc/s	Adjust V_{dl} for 3400 Mc/s Notes 4 and 10.		100%				
	(i) Delay-line Voltage.				V_{dl}	400	460	V
	(ii) Delay-line Current.				I_{dl}	30	50	mA
	(iii) Anode Current				I_a	-	20	mA
	(iv) Power Output				P_o	150	1500	mW
g	Oscillation at 4500 Mc/s	Adjust V_{dl} for 4500 Mc/s Notes 4 and 10.		100%				
	(i) Delay-line Voltage.				V_{dl}	1030	1170	V
	(ii) Delay-line Current.				I_{dl}	30	50	mA
	(iii) Anode Current				I_a	-	20	mA
	(iv) Power Output				P_o	250	2200	mW

TESTS (Contd.)

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) 6.3 a.c.	(V) 0	(V) V_o (Note 1)	See Note 2	< 1.2:1 (See Note 3)

	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Limits Max.	Units
h	Anode Modulation Ratio of max. to min. values of Power Output	Adjust V_{d1} for 2400, 3400 and 4500 Mc/s. Adjust V_a from V_o to V_o - 100V. Notes 4 and 11		100%	$\frac{P_o(max.)}{P_o(min.)}$	3.5	-	
j	Grid Characteristics. (i) Cut-off.	V_g = -100V. V_{d1} = Adjust from 150V to 1170V.		100%	P_o	-	0	mW
	(ii) Power Output	V_g = -60V. V_{d1} = Adjust from 150V to 1170V.			P_o	-	20	mW
	(iii) Slope	V_g = Varied from -100V to 0V. V_{d1} = 1170V.			$\frac{\Delta P_o}{\Delta V_g}$	Must always be positive.		
k	Grid Insulation Grid Current Record	V_{d1} = 1200V V_g = Adjust for $I_{d1} + I_a$ = 10 mA then reduce V_a to zero.		100%	$I_g(1)$	-	40	µA
l	Vacuum Test	V_{d1} = 1200V V_g = as for test "k" Note Grid Current (I_{g2})		100%				
		$I_g(2) - I_g(1)$			ΔI_g	-	10	µA
m	Grid Pulse Modulation Peak Power Output Record	V_{d1} = Adjust for 3400 Mc/s (Note 4) V_g = Pulsed from cut-off Value to zero V. Pulse length = 0.2 µSec. (Nom.) at 1000 p.p.s.			$P_o(pk)$			
	C.W. Power Output Record	$\frac{P_o(1) - P_o(pk)}{P_o(1)}$			$P_o(1)$	-	20	%
n	Valve Noise Carrier to Noise Ratio.	Adjust V_{d1} for all frequencies from 2400 to 4500 Mc/s. Notes 8 and 12.		100%	C/N	150	-	dB/ c.p.s.

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TESTS (Contd.)

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)	See Note 2	<1.2:1 (see Note 3)

	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Limits Max.	Units
P	Frequency Pulling at 2400, 3400 and 4500 Mc/s.	Adjust V_{dl} for test frequencies. Notes 4 and 13.		100%	ΔF	-	7	Mc/s
q	Insulation Resistance	No operating voltages. ~~2.5~~ 2.0 [Amdt 2] [Amdt 1] ~~2.5~~ kV d.c. applied between test electrode pin and shell.		100%				
	(i) Shell to Delay-line and Collector.				R_{dl}	100	-	Meg-ohms
	(ii) Shell to Cathode/ Heater.				R_k	100	-	Meg-ohms
	(iii) Shell to Grid				R_g	100	-	Meg-ohms
	(iv) Shell to Anode				R_a	100	-	Meg-ohms
r	Leakage Current Heater/Cathode Current.	No operating Voltages. Note 14.		100%	I_{hk}	-	750	/uA
s	Life Test	Adjust V_{dl} for 3400 Mc/s. Notes 4 and 15.		T.A and 2%	t	500	-	hours
					P_o	10	-	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 20 cu. ft./min.

3. The input v.s.w.r. of the power and frequency measuring equipment must be less than 1.2 over the full /u-wave frequency range of 2400 - 4500 Mc/s

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

NOTES (Contd.)

5. The valve 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

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.

NOTES (Contd.)

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 $\pm$ 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.

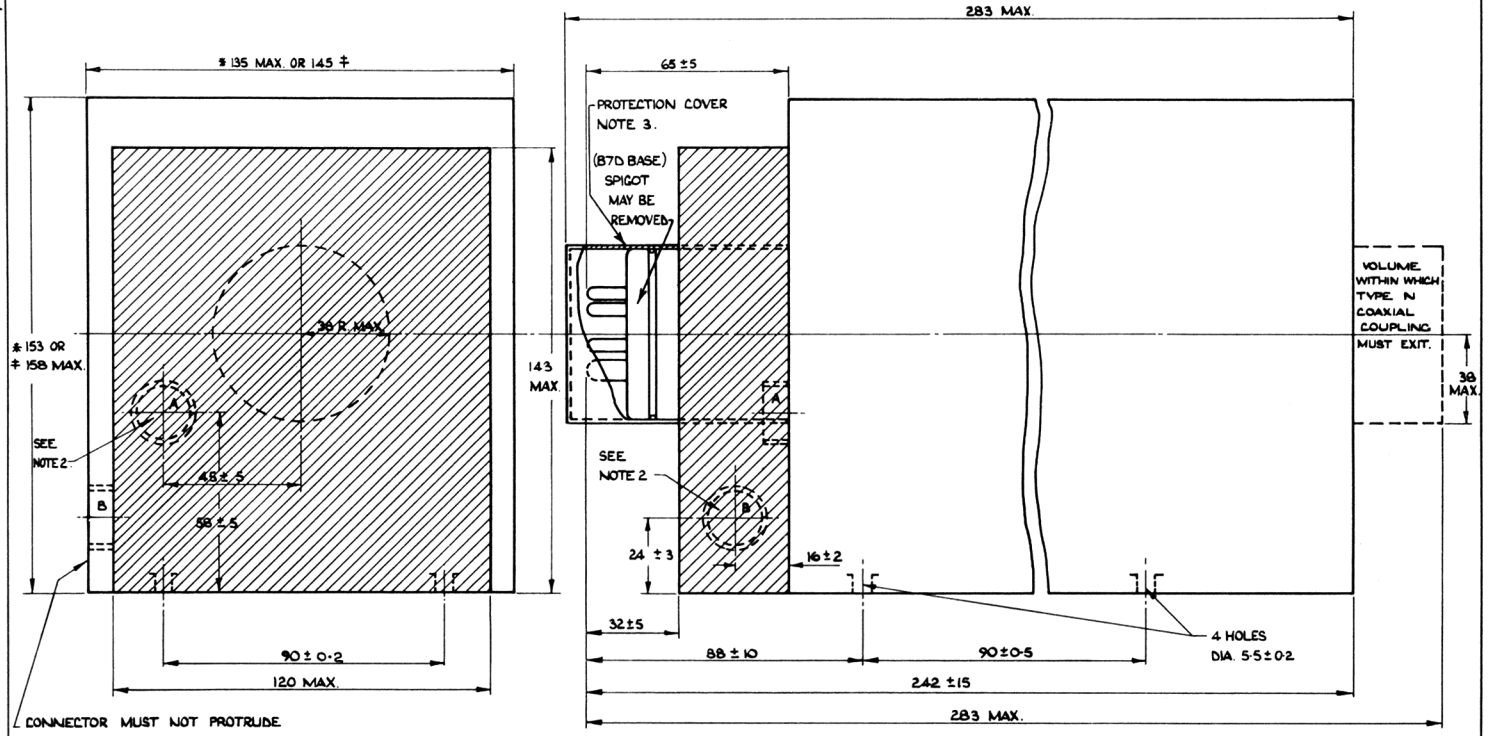
13. The pulling frequency is the difference between the max. and min. frequencies recorded when a mismatch placed in the output section is varied through all phases. The v.s.w.r. of the mismatch shall normally lie between 1.5 - 1.6 at each microwave frequency, but the manufacturer may, at his discretion,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

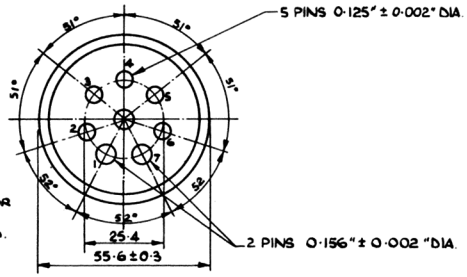
A curve showing variations in frequency pulling over the tuning range shall be recorded for each valve. Measurements shall be made at delay line voltages separated by intervals of 40 volts from V_{dl} = 150V to V_{dl} = 510V, and by intervals of 60 volts from V_{dl} = 510 to V_{dl} = 1170V. This information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





B7D BASE.

* FOR CV2381
‡ FOR CV6023.

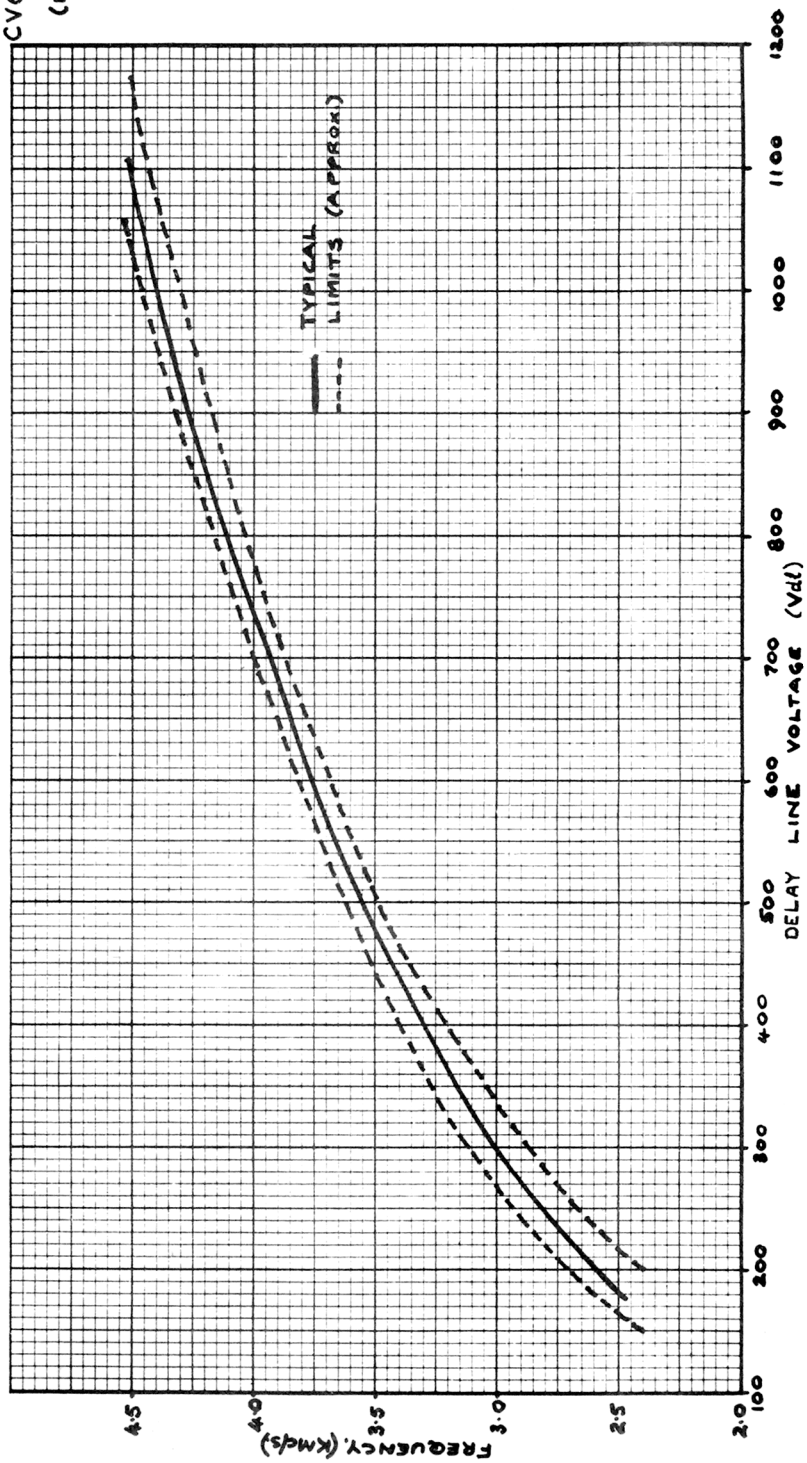
NOTES.

1. THE FIXING HOLES ARE AS SHOWN TO INDICATE THAT THERE MUST BE EASE OF ACCESS TO FIXINGS.
2. FOR CV6023 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. 208600). 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

ALL DIMENSIONS ARE IN MM's.

Amdt 3.

CV2381
CV6023
(ISSUES)



ELECTRONIC SPECIFICATIONS
SPECIFICATION FOR AD/CV2381
ISSUE 5 DATED 31.8.61

AMENDMENT NO. 1

Page 5. Test Clause q.

In Test Condition column, amend 25 kV d.c. to 2.5 kV d.c.

ADMIRALTY SURFACE WEAPONS ESTABLISHMENT

June, 1962

(40599)

VAAS
18/6/62

ELECTRONIC VALVE SPECIFICATIONS

SPECIFICATION AD/CV.2381 ISSUE 5 DATED 31.8.61

AMENDMENT No. 2

Page 5. Test Clause 9

In Test Condition column amend 2.5 kVd.c. (inserted by Amendment No.1) to read 2.0 kVd.c.

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

December, 1963.
(213604)

ARB
17/3/64

ELECTRONIC VALVE SPECIFICATIONS
SPECIFICATION AD/CV.2381 Issue No. 5 dated 31.8.61
AMENDMENTS No. 3

Page 8. 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

(213534)