

Specification MOA/CV4504	<u>SECURITY</u>	
Issue 2A dated 16th May, 1962	<u>Specification</u>	<u>Valve</u>
To be read in conjunction with K.1001, B.S.448 and B.S.1409	UNCLASSIFIED	UNCLASSIFIED

—————> Indicates a change

TYPE OF VALVE - Reliable Sub-Miniature Diode with Flying Leads				<u>MARKING</u>		
CATHODE - Indirectly - heated				See K.1001/4		
ENVELOPE - Glass				<u>BASE</u>		
PROTOTYPE - CV469, VX7126, VX8123				See B.S.448/BSB/1.1		
<u>RATINGS</u> (Note A)				<u>CONNECTIONS</u>		
(All Limiting values are absolute)				Lead	Electrode	
Heater Voltage	(V)	6.3	Note	1	Heater	h
Heater Current	(mA)	150		2	Anode	a
Max. Heater - Cathode Voltage, Cathode +ve	(V)	300	B	3	Cathode	k
				4	Heater	h
				5	Anode	a
Max. Peak Inverse Voltage	(V)	460	F			
Max. R.M.S. Input Voltage	(V)	165				
Max. Mean Anode Current	(mA)	10	G			
Max. Peak Anode Current	(mA)	60	G			
Max. Surge Anode Current	(mA)	200				
Min. Source Impedance	(Ohms)	300				
Max. Reservoir Capacitor	(μ F)	8				
Max. Vibration (100 hours duration Max.)	(g)	5	C			
				D		
Max. Shock (short duration)	(g)	500				
Max. Bulb Temperature	($^{\circ}$ C)	165				
Min. Operating Pressure	(mm. Hg)	55	F			
Max. Ambient Storage Temperature Range	($^{\circ}$ C)	-60/+85				
				<u>DIMENSIONS</u>		
				See B.S.448/BSB/2.1		
				Dimensions (mm)	Min.	Max.
				A. Diameter	4.6	5.4
				B. Overall length	-	28.5
				C. Seated Height	19.7	22.7
				D. Lead length (Note E)	38.1	-
				<u>MOUNTING POSITION</u>		
				Any		
				<u>TYPE APPROVAL</u>		
				See K1001/15		
				Minimum quantity for submission 225		
				See Note H.		
<u>CAPACITANCES</u> (pF)				<u>APPLICATIONS DATA</u>		
Ca, k + h (Nom). Shielded		4.0		Issue 1. - See section following		
Ck, a + h (Nom). Shielded		4.0		Page 8.		
<u>NOTES</u>						
See next page.						

(40481)

NOTES

- A. Caution to Electronic Equipment Design Engineers: Special attention should be given to the temperature of valves to be operated in Guided Weapons and Aircraft. Reliability will be seriously impaired if the maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions other than those specified for life test are imposed on the valve and will be reduced appreciably if absolute maximum ratings are exceeded. Both reliability and performance will be jeopardized if heater voltage ratings are exceeded; life and reliability performance are directly related to the degree that regulation of the heater voltage is maintained at its centre-rated value. Under no circumstances should the heater voltage supply be allowed to deviate more than $\pm 5\%$ from the rated value.
- B. For greater reliability, the potential between heater and cathode, when cathode is positive with respect to heater, should not be allowed to exceed 150 volts. When cathode is negative with respect to heater the potential should not be allowed to exceed 10 volts.
- C. The maximum peak acceleration under continuous random vibration conditions specified assumes that the vibration frequency components are varying continuously over the band 10 to 1,000 cycles/sec. in a random manner.
- D. The maximum peak acceleration under short term random vibration conditions specified assumes that the vibration frequency components are varying continuously over the band 10 to 1,000 cycles/sec. in a random manner.
- E. Direct soldered connections to the leads must be at least 5 mm. from the seal and any bending of the leads must be at least 1.5 mm. from the seal.
- F. For greater reliability, the Peak Inverse Voltage should be kept as low as possible. This is especially important when operation is required at high altitude.
- G. For greater reliability, the Mean Anode Current should be kept below 5mA, and the Peak Anode Current below 30mA.
- H. When submitting samples for Type Approval the manufacturer must have drawn the samples from a lot which has met the requirements of the specification. The manufacturer shall provide the test results for that particular lot; together with detailed results on the samples, as required by the Type Approval Authority.

TESTS

CV 4504

TO BE PERFORMED IN ADDITION TO THOSE APPLICABLE IN K.1001

TESTS IN ANY ONE GROUP SHALL BE PERFORMED IN THE SPECIFIED ORDER.

TEST CONDITIONS - UNLESS OTHERWISE SPECIFIED												
Vh(V) 5.3												
K1001	TEST	TEST CONDITIONS	AQL %	INSP. LEVEL	SYMBOL	LIMITS						UNITS
						MIN.	LAL	BOGEY	UAL	MAX.	ALD	
AIX/2.1	<u>GROUP A</u>											
	Visual Inspection	Notes: 1, 2 No voltages		100%								
5.14	Inoperatives			100%								
	Insulation	Va-all = -300V		100%	R	200	-	-	-	-	-	M
	Vibration Noise(1)	Notes: 2, 3. Acceleration = 15g peak min. Frequency = 50 c/s Va(b) = 250V Ra = 39k		100%						5	-	mV r.m.s.
AIX/2.2		Note 4			Vout	-	-	-	-			
AIX/2.3												
	<u>GROUP B</u>											
5.3	Heater-Cathode Leakage Current	Vhk = -k/h+ 100V	0.4	II	Ihk	-	-	-	-	9	-	μA
		Vhk = +k/h- 100V		V2	Ihk	-	-	-	2	-	-	μA
					Ihk	-	-	-	-	4.5	-	μA
				V2	Ihk	-	-	-	2	-	-	μA
		Vhk = +k/h- 20V	1.5	II	Ihk	-	-	-	-	1.0	-	μA
	Anode Current (1)	Va = 5V Note: 5	0.4	II	Ia	20	-	-	-	50	-	mA
	<u>GROUP C</u>											
	Heater Current		2.5	I	Ih	135	-	150	-	165	-	mA
	Anode Current(2)	Va(b) = 0V Note: 6	2.5	I	Ia	5	-	-	-	25	-	μA
	Change of Anode Current (1)	Vh = 5.7V Va = 5V Notes: 5, 7	2.5	I	ΔIa	-	-	-	-	15	-	%
	<u>GROUP D</u>											
5.9	Capacitances	Measured on a 1 Mc/s bridge, valve mounted in a fully screened socket. Shielded Note: 8	2.5	Code C	Ca, k+h Ck, a+h	3.2 2.8	- -	- -	- -	4.7 5.8	- -	pF pF

K1001	TEST	TEST CONDITIONS	AQL %	INSP. LEVEL	SYMBOL	LIMITS						UNITS
						MIN.	LAL	BOGEY	UAL	MAX.	ALD	
	<u>GROUP E</u>											
AIX/ 2.4.2.3.	Lead Fragility	No Voltages	1.0	Code I								
AIX/ 2.4.2.1	Glass Strain	No Voltages Note: 9	2.5	Code O								
	Low Pressure Voltage Breakdown	Pressure = 55 ± 5 mm.Hg Temperature = $25 \pm 5^\circ\text{C}$ Voltage = 360V r.m.s. 50 c/s No other voltages applied Note: 10	1.0	Code I								
	Vibration Fatigue	Acceleration = 5g peak min. Time = 200 hours Note: 11		Code L								
	Vibration Noise (2)	Note: 12 Acceleration = 20g peak min.; Frequency = 60 - 2000 c/s Va(b) = 250V Ra = 39k	1.0		Vout	-	-	-	-	15	-	mV(pk-pk) ←
	<u>Post Vibration Noise (2) Tests:</u>	Combined AQL	4.0									
	Heater-Cathode Leakage Current	Vhk = -k/h- 100V Vhk = +k/h- 100V	1.0	Ihk	-	-	-	-	9.0	-	μA	
		Vhk = +k/h- 20V	1.5	Ihk	-	-	-	-	4.5	-	μA	
	Anode Current(1)	Va = 5V Note: 5	1.0	Ia	18	-	-	-	1.0	-	μA	
	Catastrophics Shock	Note: 13 Hammer Angle = 30° No Voltages (T/A only)	0.25						50	-	mA	
AIX/ 2.4.2.4.3.	<u>Post Shock Tests:</u>	As for Post Vibration Noise (2) Tests										
	<u>GROUP F</u>											
AVI/5	Life	Va = 165V r.m.s. 50 c/s C = 8 μF Vhk = V out + 117V r.m.s. 50 c/s I out = 10 mA nom. Peak Ia = 60mA min. Note: 14										
AVI/5.3	<u>Intermittent Life</u>											
	<u>Test Point 200 hours</u>	Combined AQL	4.0	Code I								
5.14	Inoperatives	Note: 15	0.25									
	Heater-Cathode Leakage Current	Vhk = -k/h + 100V Vhk = +k/h - 100V	1.5	Ihk	-	-	-	-	9.0	-	μA	
		Vhk = +k/h - 20V	1.5	Ihk	-	-	-	-	4.5	-	μA	
	Anode Current(1)	Va = 5V Note: 5	1.0	Ia	18	-	-	-	1.0	-	μA	
	Average Change of Anode Current (2)			Δ Ia	-	-	-	-	50	-	mA	
	Insulation	Va - all = -300V	1.5	R	100	-	-	-	3	-	μA	
												M

K1001	TEST	TEST CONDITIONS	AQL %	INSP. LEVEL	SYMBOL	LIMITS						UNITS
						MIN.	LAL	BOGEY	UAL	MAX.	ALD	
5.14	<u>GROUP F (Contd.)</u>											
	Test Point 1000 hours	Combined AQL	6.5	Code H								
	Inoperatives		1.5									
	Heater-Cathode Leakage Current	Vhk = - k/h + 100V Vhk = + k/h - 100V	2.5		Ink	-	-	-	-	13	-	μ A
		Vhk = + k/h - 20V	2.5		Ink	-	-	-	-	1.5	-	μ A
	Anode Current (1)	Va = 5V Note: 5	1.5		Ia	16	-	-	-	50	-	mA
	Insulation	Va-all = -300V	2.5		R	50	-	-	-	-	-	M
AIX/2.5	<u>GROUP G</u>											
	<u>Electrical Re-test after 28 days holding period</u>											
5.14	Inoperatives		0.5	100%								
	Anode Current (1)	Va = 5V Note: 5			Ia	20	-	-	-	50	-	mA

NOTES

- The valve shall be visually inspected for good workmanship, using a visual aid having a X10 magnification. Particular attention shall be paid to the following:-
Structure quality, quality of welds, quality of lead tinning, external dimensions and shape, and freedom from harmful loose particles.
- This test may be done alternatively in Group G, at the discretion of the manufacturer.
- The valve shall be mounted so that the direction of vibration is parallel to the minor axis of the electrode structure. The test shall be of sufficient duration to obtain a steady reading of noise output.
- At this stage the lot shall be formed. It shall be an identifiable lot not exceeding 5,000 valves. Normal Sampling (Single) shall apply.
- As this test overloads the valve, the specified Anode Voltage shall be applied for as short a duration as possible. This test may be carried out alternatively with a constant Anode Current of 20 mA and appropriate Va limits apply.
- Total external resistance between anode and cathode, including meter, shall be 4Ω.
- The change in anode current is expressed:

$$\frac{(Ia \text{ at } 6.3V) - (Ia \text{ at } 5.7V)}{(Ia \text{ at } 6.3V)} \times 100\%$$
- The capacitance Test Jig connections shall be as follows:-

Test	Links to H.P.	Links to L.P.	Links to E
Ca, k + h	2,5	1,3,4,5h	-
Ck, a + h	3	1,2,4,5,5h	-

NOTES (Contd.)

9. This is a destructive test and valves used for this test will not be accepted for delivery.
10. The voltage to be applied between anode base leads and adjacent leads. There shall be no evidence of corona or arcing.
11. The valves shall be randomly mounted on the vibrator mount in such a manner that each valve experiences an acceleration of at least 5g peak.
The frequency of vibration shall be swept continuously over the range 60-1000 c/s at a rate of change of frequency not greater than 1 octave per minute.
The heater supply shall be 6.6 V and switched approximately 8 minutes on 16 minutes off throughout the duration of the test.
No other voltages are to be applied.
12. This test to be applied to the total sample previously subjected to the Vibration Fatigue test. Each valve shall be mounted so that the direction of vibration is parallel to the minor axis of the electrode structure and shall be vibrated over the frequency range 60 - 2,000 c/s. swept once only at a rate of change of frequency not greater than 1 octave per 30 secs. The voltage to be recorded shall be the value of noise output at the maximum resonance in the specified frequency band, as measured in terms of peak to peak voltage using an approved equipment.
See pages 7 and 8.
13. A valve shall be deemed to be catastrophic if it is either an inoperative as defined in K.1001 App.VI/5.6 or has either or both the following defects:
 - (i) Anode current as measured in Group B, outside the range of 10 to 50 mA.
 - (ii) Vibration noise output, as measured in Group A, greater than 10 mV r.m.s.
14. The valve shall be operated in a half wave rectifier circuit. Vhk should be phased so that Vh and the 117V r.m.s. subtract.
15. Accept lot if 0 inoperatives in sample, reject lot if 2 or more inoperatives. If 1 inoperative, take further sample of 50 and accept if no further inoperatives.

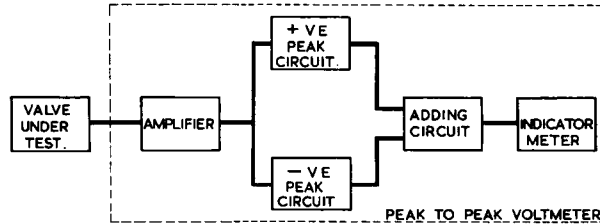
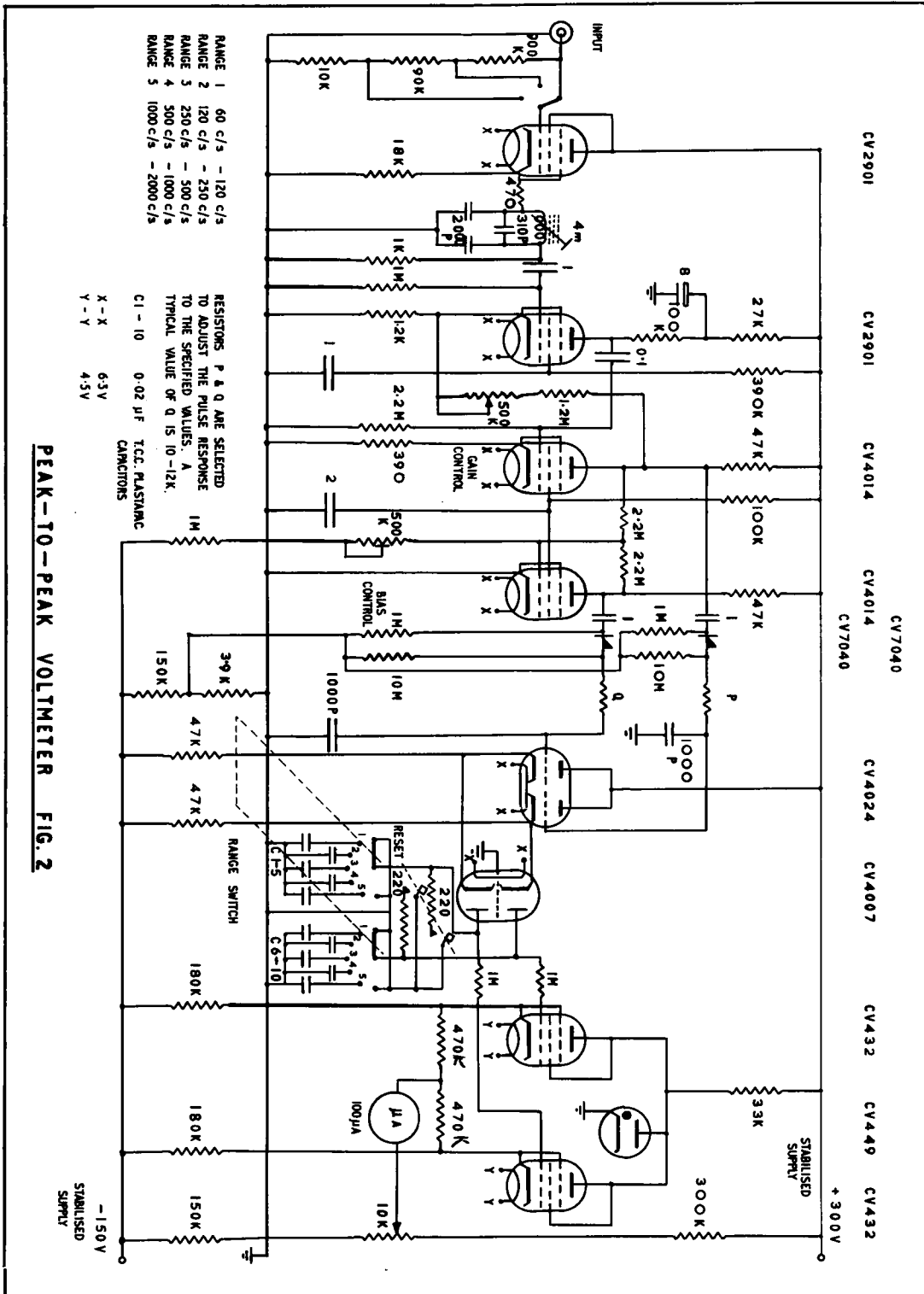
MEASUREMENT OF PEAK-TO-PEAK NOISE OUTPUT1. Specification for Peak-to-Peak Voltmeter1.1 Block Schematic DiagramARRANGEMENT OF APPARATUS.

FIG.1.

- 1.2 The Peak-to-Peak Voltmeter shall consist of an Amplifier, Charging Circuits, Adding Circuit and an Indicator Meter; a Block Schematic Diagram is shown at Figure 1.
- 1.3 Amplifier The Amplifier shall have an input impedance of 1 Megohm and shall be coupled through a 0.1 μ F capacitor to the valve under test. With constant input, the output shall be within ± 1 db of that at 1000 c/s over the frequency range 60 c/s to 50 kc/s; above 50 kc/s the output shall fall off by at least 15 db per octave to a level at least 50 db below the 1000 c/s reference output.
- 1.4 Charging Circuits The positive peak and negative peak charging circuits shall each consist of a diode in series with the capacitor to be charged. The time constants shall be such that a single input pulse of substantially rectangular form, of 25 μ s duration and of either polarity, applied to the input of the charging circuit will result in an indicated reading of not less than 6% of the pulse amplitude. With this value of time constant a pulse of 100 μ s will give a reading of at least 9% of the pulse amplitude. The difference between the indicated amplitudes of two similar single 25 μ s pulses of positive and negative polarity respectively, separately applied, shall not exceed 5%. The leakage rate shall not exceed that which would cause the full scale deflection meter reading to decay by more than 2% per minute.
- 1.5 Adding Circuit The adding circuit shall be capable of summing the voltages developed across the respective charging capacitors, with an error not exceeding 2%.
- 1.6 Indicator Meter The Indicator Meter shall be calibrated to give the peak-to-peak voltage value of the Noise Output developed at the anode of the valve under test.
2. Calibration The peak-to-peak voltmeter shall be calibrated by applying a 1000 c/s sinusoidal waveform of known amplitude to the input and adjusting the gain of the amplifier as required.
3. A circuit diagram of an apparatus which fulfills the requirements of the specification is shown in Figure 2 on page 8. The five pairs of capacitors C1, C6, C2, C7, etc. are provided to store the peak-to-peak value for each frequency range. At maximum sensitivity this circuit gives a full scale meter deflection with an input of approximately 200 μ V. Other circuit arrangements meeting the specification requirements may be used at the discretion of the Approving Authority.



PEAK-TO-PEAK VOLTMETER FIG. 2