MINISTRY OF AVIATION - D.L.R.D.(T)

VALVE ELECTRONIC

CV4523

Specification MOA/CV 4523

Issue 1 dated 16th August, 1960

To be read in conjunction with B.S.448, B.S.1409 and K.1001 excluding clauses 5.2 and 5.8.

SECURITY

Specification	Valve
UNCLASSIFIED	UNCLASSIFIED

→ Indicates a change

TYPE OF VALVE - Reliable Sub-Miniature Xenon filled Tetrode with Flying Leads.

CATHODE - Indirectly - heated

ENVELOPE - Glass

PROTOTYPE - CV.474, VX.9192, VX.9181

MARKING

See K.1001/4

BASE

See B.S.448/B8D/F/1.1

RATINGS (Note B)

(All limiting values are absolute)

			Note
Heater Voltage	(V)	6.3	
Heater Current	(mA)	150	
Min. Cathode Heating Time	(Secs)	10	C
Max. Heater - Cathode Voltage, Cathode + ve	(V)	100	D
Cathode - ve	(V)	25	D
Max. Peak Anode Voltage	(V)	500	
Max. Peak Inverse Voltage	(V)	500	
Max. Mean Anode Current	(mA)	20	
Max. Peak Anode Current	(mA)	250	E
Max. Grid Circuit Resistance	(M)	10	
Max. Vibration (100 Hours duration Max.)	(g)	5	F
(10 Minutes duration Max.)	(g)	20	G
Max. Shock (short duration)	(g)	500	
Max. Bulb Temperature	(°C)	165	
Minimum Operating Pressure	(mm.Hg)	55	
Max. Ambient Storage Temperature Range	(°C)	-60/+85	

Typical Operating Conditions

Anode Voltage Drop (Ia = 20mA)	(V)	10
Grid Control Ratio (Va = 500V, Rg1 = 0, Vg2 = 0)		200
Screen Control Ratio (Va = 500V, Rg1 = 0, Vg1 = 0)		200
Max. Operating Frequency as Controlled Rectifier	(c/s)	200

CONNECTIONS

Lead	Electrode	
1	Anode	a
2	Screen	g2
3	Heater	h
4	Screen	g2
5	Cathode	k
6	Heater	h
7	Grid	g1
8	Screen	g2

DIMENSIONS

See B.S. 448/B8D/F/2.1
Size Ref. No. 2.

Dimensions (mm)	Min.	Max.
A. Seated height	29.0	32.0
B. Overall length	-	38.1
C. Diameter	9.3	10.16
D. Lead length (Note H)	38.1	-

MOUNTING POSITION

Any

TYPE APPROVAL

See K1001/15
Minimum quantity for submission 225
See Note I.

APPLICATIONS DATA

Issue 1. - See section following Page 8.

NOTES

A. Joint Service Catalogue Number is 5960-99-037-2287

/B

NOTES

B. 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 ± 5% from the rated value.

C. This time must elapse before the anode voltage is applied.

D. For reliable operation the applied potentials between heater and cathode should be kept as low as possible especially when the heater is positive with respect to cathode. When anode current is flowing this potential should be zero.

E. Half microsecond pulses, 2,000 p.p.s.

F. The maximum peak acceleration under continuous random vibration conditions specified assumes that the vibration frequency components are varying continuously over the band 20 to 1,000 c/s in a random manner.

G. The maximum peak acceleration under short term random vibration conditions specified assumes that the vibration frequency components are varying continuously over the band 20 to 1,000 c/s in a random manner.

H. Direct soldered connections to the leads to be at least 5 mm. from the seal and any bending of the leads must be at least 1.5 mm. from the glass base.

I. 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

CV4523

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)	Vg2(V)	Rg2(Ohms)	Vhk(V)
6.3	0	0	0

K1001	TEST	TEST CONDITIONS	AQL %	INSP LEVEL	SYMBOL	LIMITS MIN	LAL	BOGEY	UAL	MAX	ALD	UNITS
AIX/2.1	GROUP A											
	Visual Inspection	Note: 1 No Voltages		100%								
5.14	Inoperatives			100%								
	Critical Grid Voltage (1)	Va(b) = 350V r.m.s., 50 c/s. Ra = 50k Rg1 = 100k Vg1-adjust, Note 2.		100%	Vg1	-2	-	-	-	-4	-	V
	Change of Critical Grid Voltage (1) under Vibration	Note: 3 As for Critical Grid Voltage (1) Acceleration = 15g peak min. Frequency = 50 c/s		100%	ΔVg1	-	-	-	-	0.2	-	V
AIX/2.2		Note: 4										
AIX/2.3												
	GROUP B											
5.3	Heater-Cathode Leakage Current (1)	Vhk = 100V, Cathode + ve	0.4	II	Ihk	-	-	-	-	20	-	μA
				V2	Ihk	-	-	-	4	-	-	μA
5.3	Heater-Cathode Leakage Current (2)	Vhk = 25V, Cathode - ve	0.4	II	Ihk	-	-	-	-	20	-	μA
				V2	Ihk	-	-	-	4	-	-	μA
	Critical Grid Voltage (1)	As in Group A		V2	Vg1	-	2.65	3.0	3.35	-	-	V
	Critical Grid Voltage (2)	As in Critical Grid Voltage (1) except that Rg1 = 10M	0.4	II	Vg1	-2	-	-	-	-5	-	V
	Pulse Emission	Note: 5	0.4	II	V pulse	16	-	-	-	-	-	V peak

K1001	TEST	TEST CONDITIONS	AQL %	INSP. LEVEL	SYMBOL	LIMITS						UNITS
						MIN	LAL	BOGEY	UAL	MAX	ALD	
	GROUP C											
	Heater Current		1.0	I	Ih	135	-	150	-	165	-	mA
	D.C. Anode Striking Voltage (1)	Rg1 = 100k, Vg1 = 0 Ra - Note: 6 Va - adjust to striking point	1.0	I	Va	-	-	-	-	26	-	V
	D.C. Anode Striking Voltage (2)	As for D.C. Anode Striking Voltage (1) except that Rg1=10M	1.0	I	Va	-	-	-	-	35	-	V
	D.C. Anode Voltage Drop (1)	Rg1 = 100k Ia = 20mA, Vg1 = 0 Ra = 500 Ohms. Note 7	1.0	I	Va	-	-	-	-	15	-	V
	D.C. Anode Voltage Drop (2)	As for D.C. Anode Voltage Drop (1) Vh = 5.7V	1.0	I	Va	-	-	-	-	16	-	V
	GROUP E											
AIX/ 2.4.2.3	Lead Fragility	No Voltages	1.5	Code H								
AIX/ 2.4.2.1	Glass Strain	No Voltages Note: 8	2.5	Code G								
AIX/ 2.4.2. 4.2.	Vibration Fatigue	Acceleration = 5g peak min. Time = 200 hours Note: 9		Code L								
	Vibration Strike	Note: 10 Acceleration = 20g peak min. Va = 350V r.m.s., 50c/s. Ra = 50k; Rg1 = 100k Vg1 - adjust Frequency = 60 - 2000 c/s.	0.4									
	Post Vibration Strike Tests	Combined AQL	2.5									
5.3	Heater-Cathode Leakage Current (1)	As in Group B	1.0		Ihk	-	-	-	-	20	-	µA
5.3	Heater-Cathode Leakage Current (2)	As in Group B	1.0		Ihk	-	-	-	-	20	-	µA
	Critical Grid Voltage (2)	As in Group B	1.0		Vg1	-	-	-	-	-5.5	-	V
	Change of Critical Grid Voltage (1) under Vibration	As in Group A	1.0		Δ Vg1	-	-	-	-	0.2	-	V
5.14	Inoperatives		0.4									
AIX/ 2.4.2. 4.3.	Shock	Hammer Angle = 30° No Voltages (T/A only)										
	Post Shock Tests	As for Post Vibration Strike Tests.										

K1001	TEST	TEST CONDITIONS	AQL %	INSP. LEVEL	SYMBOL	LIMITS MIN	LAL	BOGEY	UAL	MAX	ALD	UNITS
	GROUP F											
AIX/2.4.3.	Life	Va(b) = 230V r.m.s., 50 c/s Rg1 = 0, Vg1 = 0 Ra - Note: 11										
AVI/5.1	Stability Life											
	Change in Critical Grid Voltage (1)		1.0	I	ΔVg1	-	-	-	-	10	-	%
AVI/5.3	Intermittent Life	Note: 12										
	Test Point 200 hours	Combined AQL	2.5	Code I								
5.14	Inoperatives		1.0									
	Heater Cathode Leakage Current (1)	As in Group B	1.0		Ihk	-	-	-	-	20	-	µA
	Heater Cathode Leakage Current (2)	As in Group B	1.0		Ihk	-	-	-	-	20	-	µA
	Critical Grid Voltage (1)	As in Group A	1.0		Vg1	-1.8	-	-	-	-4.5	-	V
	Pulse Emission	Note: 5	1.0		Vpulse	15.5	-	-	-	-	-	V Peak
	Test Point 1000 hours	Combined AQL	6.5	Code H								
5.14	Inoperatives		2.5									
	Heater Cathode Leakage Current (1)	As in Group B	1.5		Ihk	-	-	-	-	20	-	µA
	Heater Cathode Leakage Current (2)	As in Group B	1.5		Ihk	-	-	-	-	20	-	µA
	Critical Grid Voltage (1)	As in Group A	2.5		Vg1	-1.8	-	-	-	-5	-	V
	Pulse Emission	Note: 5	1.5		Vpulse	15	-	-	-	-	-	V Peak
	GROUP G											
AIX/2.5	Electrical Re-test after 28 days holding Period			100%								
5.14	Inoperatives		0.5									
	Critical Grid Voltage (1)	As in Group A	0.5		Vg1	-2.0	-	-	-	-4.0	-	V
	Critical Grid Voltage (2)	As in Group B	-		Vg1	-2.0	-	-	-	-5.0	-	V

NOTES

1. The valves 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.

2. Vg1 shall be applied to g1 through Rg1 and increased in a +ve direction until the valve conducts.

3. The valve shall be mounted so that the direction of vibration is parallel to the minor axis of the electrode structure. The difference between the value of the critical grid voltage with the valve vibrated and the value obtained in the Critical Grid Voltage (1) Test shall be noted.

4. At this stage the lot shall be formed. It shall be an identifiable lot not exceeding 3,200 valves, manufactured in a period not exceeding 20 consecutive working days. Normal Sampling (Single)shall apply.

5. The test circuit and conditions for this test are as shown in page 7.

6. Sufficient series circuit resistance shall be included to limit the current on striking to 20 mA. Part of this resistance may be on the supply side of the voltmeter provided that the voltage is noted at the instant of striking.

7. Va found by measuring volts drop across the valve and 500 ohm resistance in series. The drop across the 500 ohm resistor at 20 mA is then subtracted. Additional circuit resistance may be included on the supply side of the voltmeter.

8. This is a destructive test and valves used for this test will not be accepted for delivery.

9. This test shall be carried out under the following conditions. Vg1 = -20 Volts; Rg1 = 100K; Vh = 6.9. Volts switched 1 min. on and 3 mins. off throughout the duration of the test. Va = 250 Volts; Ra = 4.7 M switched 50 seconds on and 3 mins. 10 seconds off so that the heater voltage is on 10 seconds before the anode voltage. The sample shall be vibrated over the frequency range 20 to 1,000 c/s. at a sweep rate of approximately 1 octave/minute in 3 mutually perpendicular planes of vibration i.e. one third of the valves of each batch in each plane of vibration.

10. This test to be applied to the total sample previously subjected to the Vibration Fatique Test. Vg1 to be adjusted to -0.2 Volts below that required for Critical Grid Voltage (1) 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 to 2,000 c/s. swept once only at a sweep rate of approximately 1 octave/minute. Any striking of the valve shall be deemed to be a failure.

11. Ra shall consist of a 230V, 15W lamp in series with a 2.2k Ohms 5%, 2W resistor.

12. During Intermittent Life the HT voltage is to be removed simultaneously with the Heater Voltage. The HT voltage is to be re-applied 10 seconds after the re-application of the heater voltage.

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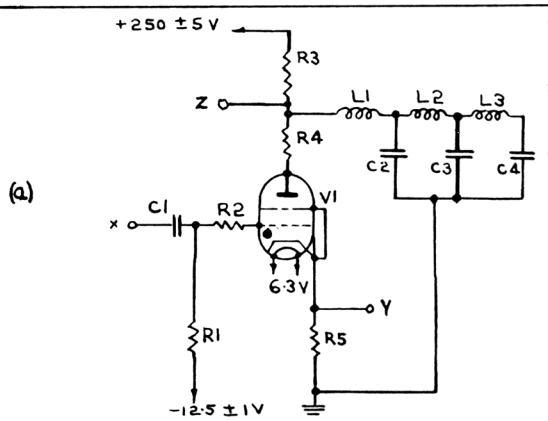


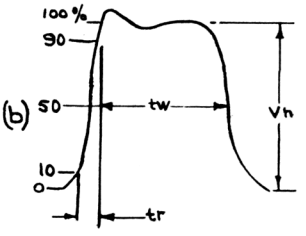
V1 VALVE UNDER TEST.

R1	100K	10%	½W	RC7H
R2	2·2K	10%	½W	RC7H
R3	470K	2%	½W	RC2D
R4	240Ω	2%	¼W	RC2E
R5	75Ω	2%	¼W	RC2E

C1 68 pf 10% CMMIG
C2, C3, C4 } 220 pf 2% CMMIG

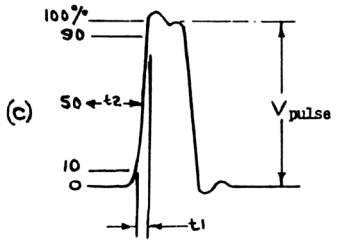
L1, L2, L3 } 32 μH

SEE DRAWING Nº 2 AND 3



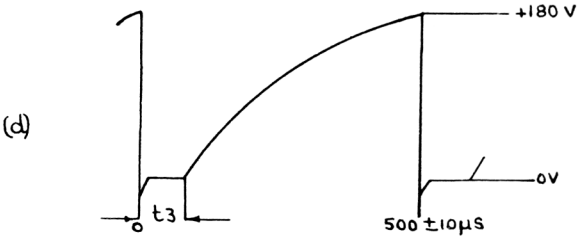
Vh = 47 ± 3V
tw = 2·5 ± 0·3μS
tR ≯ 0·3μS (RISE TIME 10-90% HEIGHT)

TRIGGER PULSE AT "X"



t2 ≯ 1μS
t1 ≯ 0·15μS (RISE TIME 10-90% HEIGHT)

OUTPUT PULSE AT "Y"

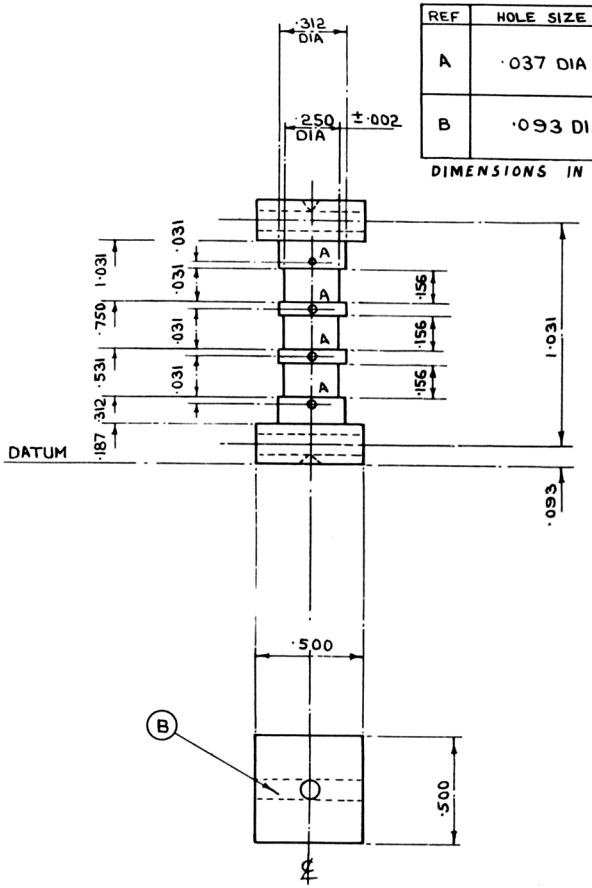


t3 ≯ 85μS (DEIONIZATION TIME)

CHARGING WAVEFORM AT "Z"

THYRATRON PULSE TEST SPECIFICATION.

DRAWING Nº 1



REF	HOLE SIZE	QTY
A	·037 DIA	4
B	·093 DIA	2

DIMENSIONS IN INCHES

DELAY LINE FORMER.

DRAWING Nº 2

MAT'L S.R.B.P. GRADE 2P.

WRAP & SOLDER LEAD OUT WIRES FIRMLY TO PINS.

3-COILS:- TO BE CLOSE WOUND IN 3 LAYERS WITH NO INTERLEAVING.

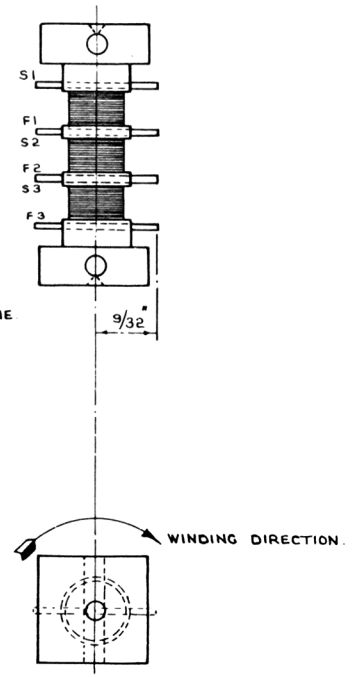
EACH TO CONSIST OF:- 70 TURNS 40 S.W.G. H.C. COPPER WIRE-POLYURETHANE

BEFORE REMOVAL FROM M/C LOCK FINAL TURNS WITH NECOL CEMENT.

FINALLY SEAL WINDINGS WITH ARALDITE TYPE 'D'

INDUCTANCE PER COIL TO BE 32 µH. ± 2%

TOTAL INDUCTANCE TO BE 113 µH.



DELAY LINE WINDING

DRAWING Nº 3