

MINISTRY OF SUPPLY - DLKD/ARE

VALVE ELECTRONIC

CV4010

Specification MOS/CV4010	<u>SECURITY</u>	
Issue 5 Dated 6 Mar. 57	<u>Specification</u>	<u>Valve</u>
To be read in conjunction with K1001, BS440 and BS1409	UNCLASSIFIED	UNCLASSIFIED

→ Indicates a change.

TYPE OF VALVE - Reliable RF Pentode, Sharp Cut-off CATHODE - Indirectly-heated ENVELOPE - Glass PROTOTYPE - VX8100 RETMA DESIGNATION - 5654/6AK54/6096 Nearest equivalent American Specification - MIL-E-1/236				<u>MARKING</u> See K1001/4 (See also Note D)	
<u>RATING</u> All limiting values are absolute				<u>BASE</u> See BS448/B7G/1.1	
<u>CONNECTIONS</u>				<u>Pin</u> <u>Electrode</u>	
Heater Voltage	(V)	6.3	C	1	Grid 1
Heater Current	(A)	0.175		2	Cathode - Grid 3
Max. Anode Voltage	(V)	200	E	3	Heater
Max. Cathode Current	(mA)	20		4	Heater
Max. Anode Dissipation	(W)	1.65		5	Anode
Max. Screen Voltage	(V)	155		6	Grid 2
Max. Screen Dissipation	(W)	0.55		7	Cathode - Grid 3
Max Heater - Cathode Voltage	(V)	+130			
Mutual Conductance	(mA/V)	5.0	A		
Anode Impedance	(megohm)	0.34	A		
Max. Operating Frequency	(Mc/s)	400			
Max. Bulb Temperature	(°C)	165	C		
Max. Shock (short duration)	(g)	500			
Max. Acceleration (continuous operation)	(g)	2.5			
<u>CAPACITANCES (pF)</u>				<u>DIMENSION</u> See BS448/B7G/2.1 size ref. No. 1.	
C <sub>g1</sub> (max.)		0.02	B	Dimensions (mm)	MIN. MAX.
C <sub>ac</sub> (nom.)		2.85	B	A Seated height	- 38.0
C <sub>ge</sub> (nom.)		4.0	B	C Diameter	16.0 19.0
				D Overall length	- 45.0
				<u>FOOTING POSITION</u> any	

NOTES

- A. Measured at  $V_a = V_{g2} = 120V$ ,  $V_{g1} = -2V$ .
- B. Measured with a close-fitting metal can.
- C. Caution to Electronic Equipment Design Engineers: Special attention should be given to the temperature of valves to be operated in aircraft. Reliability will be seriously impaired if the maximum bulb temperature is exceeded. The indicated altitude may be exceeded at reduced ratings. 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 jeopardised 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.
- D. In addition to the requirements of K1001/4, the RETMA designation shall also be clearly and indelibly marked on the valve.
- E. Difficulty may be encountered if this valve is operated for long periods at very low values of cathode current.

## TESTS

To be performed in addition to those applicable in K1001

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

Test Conditions - unless otherwise specified												
Vh(V)		Va(V)	Vg2(V)	Vg1(V)								
6.3		120	120	-2								
K1001	Test	Test Conditions	AQL %	Insp. Level	Sym- bol	Limits						Units
						Min	LAL	Bogey	UAL	Max	ALD	
7.1	Glass Strain	No voltages	6.5	I								
	<u>GROUP A</u>											
	Insulation	Vg1 -all= -100V DC Vg2 -all= -300V DC Va -all= -300V DC		100% 100% 100%	R R R	100 100 100						M M M
	Reverse Grid Current	Rg1 = 500k max.		100%	Ig1	-	-	-	-	0.1	-	μA
	<u>GROUP B</u>	<u>Combined AQL</u>	1.0	II								
	Heater Current	Vhk = ± 100V	0.65	II	Ih	160	-	175	-	190		mA
	H-C Leakage Current		0.65	II	Ihc	-	-	-	-	10		μA
	Anode Current		0.65	II	Ia	5.0	-	-	-	11.0		mA
				V2	Ia		6.5	7.5	8.5		2.5	mA
	Screen Grid Current		0.65	II	Ig2	0.8	-	-	-	4.0		mA
				V2	Ig2	-	1.8	2.5	3.2	-	1.5	mA
	Mutual Conductance		0.65	II	gm	4.0	-	-	-	6.25		mA/V
				V2	gm	-	4.525	5.0	5.475		1.025	mA/V
	<u>GROUP C</u>	<u>Combined AQL</u>	6.5	I								
	Anode Current	Vg1 = -10V	2.5	I	Ia	-	-	-	-	200		μA
	Anode Current	Vg1 = -5.5V	2.5	I	Ia	5	-	-	-	-		μA
	Change in Mutual Conductance	Vh = 5.7V Note 1	2.5	I	Δgm	-	-	-	-	15		%
	Reverse Grid Current	Note 5 Vh = 7.0V; Rg1 = 100K	2.5	I	Ig1	-	-	-	-	0.5		μA
	Noise and Microphony	Va(b) = 200V; Vg1 = 0 Rk = 100K; Rf = 100K Rg2 = 500k Ck = 1000 μF Cg2 = 2 μF	2.5	I	Va AC	-	-	-	-	100		mV RMS
11.1	or alternatively Vibration Noise	Vht = 135V RL = 2000 Rg1 = 100k Rg2 = 10k Cg2 = 2 μF	2.5	I	V AC	-	-	-	-	45		mV RMS
	<u>GROUP D</u>											
7.2	Base Strain Capacitances	Measured on 1 Mc/s Bridge and the valve mounted in a fully screened socket, with shielding can.	6.5 6.5	IA IA	Cag Cge Cae	- 3.4 2.45	- - -	- - -	- - -	0.02 4.6 3.25		pF pF pF
	Noise Factor	Note 2	4.0	I	NF		-	-	-	2.5		db

K1001	Test	Test Conditions	AQL %	Insp. Level	SYM-bol	Limits						Units
						Min	LAL	Bogey	UAL	Max	ALD	
	<u>GROUP E</u>											
11.2	<u>Resonance Search</u>	RL = 10k Frequency 25-500c/s Vh = 6.3V switched 1 min on, 3 mins off Va = Vg1 = Vg2 = 0 Min pk accel. = 5g Duration = 30, 39, 30 hrs.	2.5	IC	Va AC f	- 200	-	-	-	record -	-	mV RMS c/s
11.3	<u>Fatigue Test</u>	Frequency = 170 c/s Combined AQL	6.5	IA								
	<u>Post Fatigue Test</u>	Note 6	2.5		Va AC	-	-	-	-	90		mV RMS
	Vibration Noise	Vhk = $\pm$ 100V	2.5		Ihc	-	-	-	-	30		$\mu$ A
	H-C Leakage Current	Rg1 = 500k max	2.5		Igl	-	-	-	-	0.2		$\mu$ A
	Reverse Grid Current		2.5		gm	3.5	-	-	-	-		mA/V
11.5	<u>Shock Test</u>	Hammer angle = 30° No voltages		IA								
	<u>Post Shock Tests</u>	Combined AQL	6.5									
	Vibration Noise	Note 6	2.5		Va AC	-	-	-	-	90		mV RMS
	H-C Leakage Current	Vhk = $\pm$ 100V	2.5		Ihc	-	-	-	-	30		$\mu$ A
	Reverse Grid Current	Rg1 = 500k max.	2.5		Igl	-	-	-	-	0.2		$\mu$ A
	Mutual Conductance		2.5		gm	3.5	-	-	-	-		mA/V
AVI/5	<u>GROUP F</u> <u>LIFE TEST</u>	Va = 150V Vg2 = 125V Vg1 = 0 Vhk = 135V, heater positive Rg1 = 100k Rk = 130 ohms										
AVI/5.1	<u>Stability Life Test</u> Change in Mutual Conductance		1.0	I	$\Delta$ gm	-	-	-	-	10		%
AVI/5.3	<u>Intermittent Life Test</u> <u>Life Test End-Point (500 hours)</u>	See above	6.5	IA								
	Inoperatives		2.5									
	Heater Current		2.5		Ih	0.16	-	-	-	0.19		A
	H-C Leakage Current	Vhk = $\pm$ 100V	2.5		Ihc	-	-	-	-	10		$\mu$ A
	Reverse Grid Current	Rg1 = 500k max	2.5		Igl	-	-	-	-	0.1		$\mu$ A
	Mutual Conductance		2.5		gm	3.75	-	-	-	6.25		mA/V
	do Average Change				$\Delta$ gm	-	-	-	-	15		%
	Anode Current		4.0		Ia	4.5	-	-	-	11.0		mA
	Electrode Insulation	Vg1- all = -100V Vg2- all = -300V Va = all = -300V	4.0		R	50	-	-	-	-		M
						50	-	-	-	-		M
						50	-	-	-	-		M
	Noise Factor	Note 2	4.0	NF		-	-	-	-	2.7		db

K1001	Test	Test Conditions	AQL %	Insp. Level	Sym-bol	Limits						Units
						Min	LAL	Bogey	UAL	Max	ALD	
	<u>Life Test End-Point (1000 Hours)</u>		10	1A								
	Inoperatives		4.0			-	-	-	-	-		
	Heater Current		4.0		Ih	0.16	-	-	-	0.19		A
	H-C Leakage Current	Vhk = ± 100V	4.0		Ihc	-	-	-	-	10		μA
	Reverse Grid Current	Rg1 = 500k max.	4.0		Ig1	-	-	-	-	0.1		μA
	Mutual Conductance		4.0		gm	3.5	-	-	-	6.25		mA/V
	Anode Current		6.5		Ia	4.0	-	-	-	11.0		mA
	Noise Factor	Note 2	6.5		NF	-	-	-	-	2.8		db
AIX/2.5	<u>GROUP C</u>											
	Electrical Re-test after 28 days holding period			100%								
	Inoperatives		0.5									
	Reverse Grid Current	Rg1 = 500k max	0.5		Ig1	-	-	-	-	0.15		μA

## NOTES

1. The change in mutual conductance is expressed as:-

$$\frac{gm \text{ at } 6.3V - gm \text{ at } 5.7V}{gm \text{ at } 6.3V} \times 100\%$$

2. The valve shall be tested at a convenient frequency within the range 40 to 50 Mc/s in an approved Head Amplifier - See circuit diagram on Page 5. The Noise Factor of the complete unit shall be measured for a bandwidth not exceeding one Mc/s. The noise contributed by the second stage shall not exceed 3% of the total noise. The input circuit losses measured at the grid shall not exceed an equivalent conductance of 30 micro-mhos at the test frequency. The measuring source shall be transformed to 2000 ohms at the grid. Initially the neutralisation shall be adjusted for an average valve, but the tuning of the input circuit shall be adjusted for each measurement.
3. Deleted
4. Deleted
5. Prior to this test the valve shall be preheated for five (5) minutes under the conditions specified below. Test immediately after pre-heating.

Vh (V)	Vg1 (V)	Rk (ohms)	Rg1 (ohms)	Va (V)	Vg2 (V)
7.0	0	130	100k	150	125

6. The conditions specified for the Vibration Noise Test in Group C shall apply.