

MINISTRY OF SUPPLY - D.L.R.D. (A)/R.A.E.

Specification MOS(A)/CV4067	<u>SECURITY</u>	
Issue 1 Dated 17.10.56	<u>Specification</u>	<u>Valve</u>
To be read in conjunction with B.S.1409 and K.1001	UNCLASSIFIED	UNCLASSIFIED

TYPE OF VALVE	- Reliable Beam Power Amplifier with Flying Leads			<u>MARKING</u> K1001/4														
CATHODE	- Indirectly heated			<u>BASE</u> B7G/F														
ENVELOPE	- Glass																	
PROTOTYPE	- CV.471, VL.7131, VL.8167																	
<u>RATING</u> (All limiting values are absolute)				<u>CONNECTIONS</u>														
				Note	Lead	Electrode												
Heater Voltage	(V)	6.3	C															
Heater Current	(A)	0.45		1	Grid 1	g1												
Max. Anode Voltage ($I_a = 0$)	(V)	550		2	Cathode and BP	k, bp												
Max. Screen Voltage ($I_{g2} = 0$)	(V)	550		3	Heater	h												
Max. Operating Anode Voltage	(V)	250		4	Heater	h												
Max. Operating Screen Voltage	(V)	250		5	Anode	a												
Max. Anode Dissipation	(W)	5.5		6	Grid 2	g2												
Max. Screen Dissipation	(W)	1.1	C	7	Cathode and BP	k, bp												
Max. Heater - Cathode Voltage	(V)	175		<u>DIMENSIONS</u> See K.1001/A1/D11														
Max. Cathode Current	(mA)	55		<table><tr><td>Dimensions (mm)</td><td>Min.</td><td>Max.</td></tr><tr><td>A. seated height</td><td>-</td><td>47.5</td></tr><tr><td>B. diameter</td><td>16.0</td><td>19.0</td></tr><tr><td>D. lead length</td><td>38</td><td>-</td></tr></table>			Dimensions (mm)	Min.	Max.	A. seated height	-	47.5	B. diameter	16.0	19.0	D. lead length	38	-
Dimensions (mm)	Min.	Max.																
A. seated height	-	47.5																
B. diameter	16.0	19.0																
D. lead length	38	-																
Max. Grid - Cathode Resistance (fixed bias)	(Ω)	0.1																
Max. Grid - Cathode Resistance (Cathode bias)	(Ω)	0.5																
Max. Bulb Temperature	($^{\circ}\text{C}$)	210																
Max. Shock (short duration)	(g)	500																
Max. Acceleration (continuous operation)	(g)	2.5	A															
Max. Operating Frequency	(Mc/s)	50																
Mutual Conductance	(mA/V)	4.8																
Inner Amplification Factor (μg_{1g2})		5.5	A, D															
<u>CAPACITANCES (pF)</u>				<u>MOUNTING POSITION</u>														
C in (nom.)		7.0	B	Any														
C out (nom.)		8.75	B															
Ca, g1 (max.)		0.1	B															
<u>NOTES</u>																		
A. Measured at $V_a = V_{g2} = 120\text{V}$; $V_{g1} = 0$; $R_k = 250\ \Omega$. ($I_a = 35\text{ mA}$, $I_{g2} = 4.0\text{ mA}$).																		
B. Measured with close fitting metal screen.																		
C. <u>Caution to Electronic Equipment Design Engineers:</u> 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 life expectancy may be reduced if conditions other than these specified for life tests 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. The value for Inner Amplification Factor may fall anywhere between 3 and 8.																		

CV4067/1/1

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)		Vg1(V)		Va(V)		Vg2(V)		Rk(chms)		Ck(μF)		
6.3		0		120		120		250 ±5%		1000 min.		
K1001 Ref.	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits						Units
						Min.	LAL	Bogey	UAL	Max.	ALD	
7.1	Glass Strain	No Voltages	6.5	I								
	<u>GROUP A</u>											
	Electrode Insulation	Vh = 6.3V. Note 8 Va-all = -300V Vg2-all = -300V Vg1-all = -100V		100% 100% 100%	R R R	100 100 100	- - -	- - -	- - -	- - -	- - -	MΩ MΩ MΩ
	Reverse Grid Current	Rg1 = 500 kΩ max.		100%	Ig1	-	-	-	-	1.0	-	μA
5.3	<u>GROUP B</u>											
	Heater Current	Combined AQL	1.0	II	Ih	410	-	450	-	490	-	mA
	hk Leakage Current	Vhk = ±100V. Note 1 Vhk = -100V Cathode positive	0.65	II V2	Ihk Ihk	- -	- -	- -	- -	10 -	- -	μA μA
	Anode Current		0.65	II V2	Ia Ia	28 -	- -	35.0 -	- -	42 -	- -	mA mA
	Screen Current		0.65	II V2	Ig2 Ig2	- -	- -	- -	- -	5.2 -	- -	mA mA
	Mutual Conductance		0.65	II V2	gm gm	3.8 -	- -	4.8 -	- -	5.8 -	- -	mA/V mA/V
11.1	<u>GROUP C</u>											
	Change of Mutual Conductance	Vh = 5.7V Notes 6 & 7	2.5	I	Δgm	-	-	-	-	15	-	%
	Anode Current	Vg1 = -40V	2.5	I	Ia	-	-	-	-	200	-	μA
	Reverse Grid Current	Vh = 6.9V Note 4	2.5	I	Ig1	-	-	-	-	1.5	-	μA
	Vibration Noise	Va = Vg2 = 120V; Rk = 500Ω RL = 2kΩ Note 2	2.5	I	Va AC	-	-	-	-	35	-	mV rms

K1001 Ref.	Test	Test Conditions	ACL %	Insp. Level	Symbol	Limits						Units
						Min.	LAL	Bogey	UAL	Max.	ALD	
	<u>GROUP D</u>											
5.12	Lead Fragility		6.5	IA								
5.9	Capacitances	Measured on 1 Mc/s bridge with valve mounted in a fully shielded holder. Valve screened	6.5	IC	C in C out Ca, g1	6.0 7.5 -	- - -	7.0 8.75 -	- - -	8.0 10.0 0.1	- - -	pF pF pF
	Power Oscillation	Note 5	6.5	IC	PO	5.0	-	-	-	-	-	W
	<u>GROUP E</u>											
11.2	Resonance Search	Va(b) = 120V; Vg2 = 120V; Rk = 500 Ω ; RL = 2k Ω ; Ck = 1000 μ F Frequency:- (1) 25-200 c/s (2) 200-500 c/s (3) 500-2500 c/s	2.5	IC	Va AC Va AC Va AC							mV rms mV rms mV rms
11.3	Fatigue	Vh = 6.9V Note 3		IA								
	<u>Post Fatigue Tests</u>											
		Combined ACL	4.0									
5.3	hk Leakage Current	Vhk = $\pm$ 100V Note 1	2.5		Ihk	-	-	-	-	20	-	μ A
	Reverse Grid Current	Rg1 = 500k Ω	2.5		Ig1	-	-	-	-	1.5	-	μ A
	Mutual Conductance		2.5		gm	3.4	-	-	-	5.8	-	mA/V
11.1	Vibration Noise	As in Group C	2.5		Va AC	-	-	-	-	50	-	mV rms
11.4	Shock	Hammer Angle = 30°. No voltages		IA								
	<u>Post Shock Tests</u>											
		Combined ACL	4.0									
5.3	hk Leakage Current	Vhk = $\pm$ 100V Note 1	2.5		Ihk	-	-	-	-	20	-	μ A
	Reverse Grid Current	Rg1 = 500 k Ω max.	2.5		Ig1	-	-	-	-	1.5	-	μ A
	Mutual Conductance		2.5		gm	3.4	-	-	-	5.8	-	mA/V
11.1	Vibration Noise	As in Group C	2.5		Va AC	-	-	-	-	50	-	mV rms

K1001 Ref.	Test	Test Conditions	ACL %	Insp. Level	Symbol	Limits						Units
						Min.	LAL	Bogey	UML	Max.	ALD	
	<u>GROUP F</u>											
A VI/5	Life	Vhk = 150V D.C. Heater positive. Va = Vg2 = 120V; Rk = 250 Ω $\pm 10\%$ Rg1 = 100k Ω $\pm 20\%$										
	<u>Stability Life (1 hour)</u>			I								
	Change in Mutual Conductance		1.0		Δgm	-	-	-	-	10	-	%
	<u>Intermittent Life</u>			IA								
	<u>Test Point 500 hours</u>	Combined ACL	6.5									
AVI/5.6	Inoperatives		2.5									
5.3	hk Leakage Current	Vhk = $\pm 100V$ Note 1	2.5		Ihk	-	-	-	-	20	-	μA
	Heater Current		2.5		Ih	410	-	450	-	490	-	mA
	Reverse Grid Current		2.5		Ig1	-	-	-	-	1.5	-	μA
	Mutual Conductance		2.5		gm	3.3	-	-	-	5.8	-	mA/V
	Average Change in Mutual Conductance				Δgm	-	-	-	-	15	-	%
	Anode Current		4.0		Ia	24	-	-	-	42	-	mA
	Electrode	See Note 8 Vg-all = -300V	4.0		R	50	-	-	-	-	-	M Ω
	Insulation	Vg2-all = -300V Vg1-all = -100V			R	50	-	-	-	-	-	M Ω
					R	50	-	-	-	-	-	M Ω
	<u>Test Point 1000 Hours</u>	Combined ACL	10.0	IA								
AVI/5.6	Inoperatives		4.0									
5.3	hk Leakage Current	Vhk = $\pm 100V$ Note 1	4.0		Ihk	-	-	-	-	20	-	μA
	Heater Current		4.0		Ih	410	-	450	-	490	-	mA
	Reverse Grid Current	Rg1 = 500 k Ω max.	4.0		Ig1	-	-	-	-	1.5	-	μA
	Mutual Conductance		4.0		gm	3.1	-	-	-	5.8	-	mA/V
	Anode Current		6.5		Ia	22	-	-	-	42	-	mA
	Electrode Insulation	Vh = 6.3V Note 8 Vg-all = -300V Vg2-all = -300V Vg1-all = -300V	6.5		R	30	-	-	-	-	-	M Ω
					R	30	-	-	-	-	-	M Ω
					R	30	-	-	-	-	-	M Ω

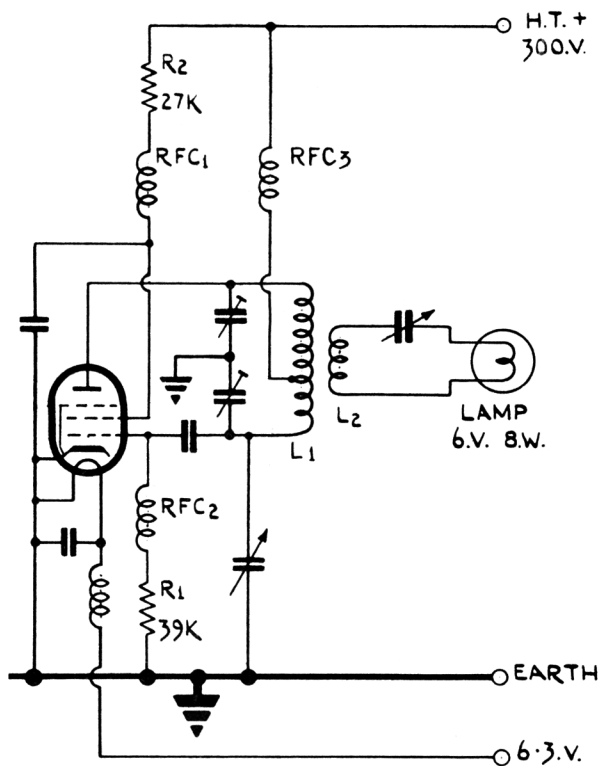
K1001 Ref.	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits						Units
						Min.	LAL	Bogey	UML	Max.	ALD	
AIX/2.4	<u>GROUP G</u> Electrical Re-test after 28 days holding period			100%								
	AV1/5.6 Inoperatives		0.5									
	Reverse Grid Current	Rg1 = 500 k Ω max.	0.5		Ig1	-	-	-	-	1.0	-	μ A

NOTES

1. Heater positive and negative successively.
2. The valve shall be mounted so that the direction of vibration is parallel to the minor axis of the electrode structure.
Vibration frequency = any fixed frequency in the range 25-100 c/s min. peak acceleration = 2.5g.
The test shall be of sufficient duration to obtain a steady reading of noise output.
3. Valves shall be vibrated in each of the three required planes for not less than 30 hours and not less than 100 hours total. Heater switched 1 minute on 3 minutes off. No other voltages applied. Min. peak acceleration = 5g; frequency = 170 $\pm$ 5 c/s.
4. Ig1 shall not be rising or out of limit after a total of 10 minutes running.
5. Measured in an approved test circuit with Va(b) = 300V; Rg2 = 27 k Ω ; Rg1 = 39 k Ω ; Ig1 = 1.1 mA approx.; frequency = 50 Mc/s min. Typical circuit is shown on page 6.
6. The change of Mutual Conductance is expressed as:

$$\frac{(\text{gm at } 6.3\text{V}) - (\text{gm at } 5.7\text{V})}{(\text{gm at } 6.3\text{V})} \times 100\%$$
7. Prior to the test the valve shall be preheated for not less than 10 minutes under the test conditions.
8. Heater and cathode strapped and considered as a single electrode.

TYPICAL 50 Mc/s. POWER OSCILLATOR CIRCUIT



$R_2 = 27K \pm 5\%$ 5W. WIRE WOUND

$RFC_1, 2 \text{ \& } 3 = 50 \text{ Mc/s CHOKES.}$

ELECTRONIC VALVE SPECIFICATIONS

SPECIFICATION CV.4067

ISSUE 1. DATED 17.10.56.

AMENDMENT No. 1.

PAGE 4. GROUP F. INTERMITTENT LIFE. TEST POINT (500 hours).

Electrode Insulation test insert "See Note 8".

TEST POINT (1000 hours).

Delete the Heater Current Test and add at the end of this group (after Anode Current Test) the following:

K1001 Ref.	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits						Units
						Min	LAL	Bogey	UAL	Max.	AID	
	Electrode Insulation	Vh = 6.3v. Note 8.	6.5									
		Vg - all = -300v.			R	30	-	-	-	-	-	MΩ
		Vg2 - all = -300v.			R	30	-	-	-	-	-	MΩ
		Vg1 - all = -100v.			R	30	-	-	-	-	-	MΩ

Director,
Royal Aircraft Establishment.

11/11