

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

Specification MOS(A)/CV.4015 Issue 2 Dated 6.12.55 To be read in conjunction with B.S.448, B.S.1409 and E.1001	SECURITY Specification UNCLASSIFIED Valve UNCLASSIFIED
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TYPE OF VALVE - Reliable Miniature Variable μ H.F. Pentode			MARKING		
CATHODE - Indirectly Heated			K.1001/4		
ENVELOPE - Glass			Additional Marking:-		
PROTOTYPE - CV131			6065		
R.E.T.M.A. DESIGNATION - 6065			BASE		
			B.S.448/B7C		
RATING			Note	CONNECTIONS	
				Pin	Electrode
Heater Voltage	(V)	6.3	C		
Heater Current	(A)	0.2		1	g1
Max. Heater-Cathode Voltage	(V)	± 150	A	2	k
Max. Operating Anode Voltage	(V)	300	A	3	h
Max. Anode Voltage ($I_a = 0$)	(V)	500	A, E	4	h
Max. Anode Dissipation	(W)	3.0	A	5	a
Max. Operating Screen Voltage	(V)	300	A	6	g3 + s
Max. Screen Voltage ($I_{g2} = 0$)	(V)	300	A, E	7	g2
Max. Screen Dissipation	(W)	0.7	A		
Mutual Conductance	(mA/V)	2.45	B		
Inner Amplification Factor ($\mu_{g1 \ g2}$)		30	B		
Max. Grid 1 - Cathode Resistance for Cathode Bias	(M Ω)	0.5			
Max. Grid 1 - Cathode Resistance for Fixed Bias	(M Ω)	0.1			
Max. Bulb Temperature	($^{\circ}$ C)	200	C		
Max. Shock (short duration)	(g)	500			
Max. Acceleration (continuous operation)	(g)	2.5			
CAPACITANCES (pF)				DIMENSIONS	
C in (nom.)		4.5	D	See B.S.448/B7C/2.1	
C out (nom.)		7.0	D	Size Ref. No. 2	
C _{a, g1} (max.)		0.01	D		
				Dimensions (mm)	Min. Max.
				A Seated height	- 47.5
				C Diameter	16.0 19.0
				D Overall length	- 54.5
				MOUNTING POSITION	
				Any.	

NOTES

- A. Absolute Value.
- B. Measured at $V_a = 250V$; $V_{g2} = 200V$; $V_{g3} = 0$; $V_{g1} = 2.5V$; $I_a = 8.25$ mA approx; $I_{g2} = 2.1$ mA approx.
- 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 life expectancy may be reduced if conditions other than those 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. Measured with a close fitting metal screen.
- E. With 5 k Ω resistor in series with the anode and 20 k Ω resistor in series with the screen grid.

To be performed in addition to those applicable in K.1001

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

Test Conditions - unless otherwise specified												
Vh (V)		Va (V)	Vg1 (V)	Vg2 (V)	Vg3 (V)							
6.3		200	-2.5	200	0							
K.1001 Ref.	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits						Units
						Min.	LAL	Bogey	UAL	Max.	ALD	
11.1 7.1	Vibration Glass Strain	No voltages No voltages		100% I								
<u>GROUP A</u>												
	Electrode Insulation	Vh = 6.3V. Note 1 Vg1 to all = -100V Vg2 to all = -300V Vg3 to all = -300V Va to all = -300V		100% 100% 100% 100%	R R R R	100 100 100 100	- - - -	- - - -	- - - -	- - - -	- - - -	MΩ MΩ MΩ MΩ
	Reverse Grid Current	Rg1 = 500 kΩ max.		100%	Ig1	-	-	-	-	0.5	-	μA
<u>GROUP B</u>												
		Combined AQL	1.0	II								
	Heater Current		0.65	II	Ih	184	-	-	-	216	-	mA
	hk Leakage Current	Vhk = ±100V. Note 2 Vhk = -100V Cathode Positive	0.65	II V2	Ihk Ihk	- -	- -	- -	- 3	10 -	- -	μA μA
	Anode Current		0.65	II V2	Ia Ia	6.0 -	7.5 7.8	- 8.25	9.0 8.9	10.5 -	1.3 0.6	mA mA
	Screen Current		0.65	II V2	Ig2 Ig2	1.2 -	- 1.8	- 2.1	- 2.4	3.0 -	- 0.9	mA mA
	Mutual Conductance		0.65	II V2	gm gm	1.8 -	2.3 2.25	- 2.45	2.6 2.65	3.1 -	0.3 0.65	mA/V mA/V
<u>GROUP C</u>												
		Combined AQL	6.5	I								
	Change of Mutual Conductance	Vh = 5.7V Note 7	2.5	I	Δgm	-	-	-	-	15	-	%
	Mutual Conductance	Vg1 = +66V	2.5	I	gm	4.0	-	-	-	60	-	μA/V
	Reverse Grid Current	Vg1 = -50V	2.5	I	Ig1	-	-	-	-	1.0	-	μA
	Reverse Grid Current	Vh = 6.9V; adjust Vg1; Va = 300V; Vg2 = 200V Note 5.	2.5	I	Ig1	-	-	-	-	1.0	-	μA
11.1	Vibration Noise	RL = 2 kΩ Note 3	2.5	I	Va AC		-	-	-	15	-	mV rms
<u>GROUP D</u>												
7.2	Base Strain	No Voltages	6.5	IA								

To be performed in addition to those applicable in K.1001

K.1001 Ref.	Test	Test Conditions	ACL %	Insp. Level	Symbol	Limits						Units
						Min.	LAL	Bogey	UAL	Max.	ALD	
	<u>GROUP D</u> (Contd.)											
	Capacitance	Measured on 1 Mc/s bridge with valve mounted in a fully shielded socket. Valve screened.	6.5	IC	C in C out C _{avg1}	3.8 5.8 -	- - -	- - -	- - -	5.2 8.2 0.01	- - -	pF pF pF
	g3 Control	Vg1 = -7V. Ia = 50μA	6.5	IA	-Vg3	50	-	-	-	95	-	V
	Inner Amplification Factor	Max. Grid swing = 1V Vg1 Vary. Ia = 8.0 mA	6.5	IA	μg1g2	23	-	30	-	39	-	
11.2	Resonance Search	RL = 2 kΩ Frequency 25 to 500 c/s 500 to 2500 c/s	2.5	IC	Va AC Va AC	- -	- -	- -	- -	50 250	- -	mV rms mV rms
11.3	Fatigue	Vh = 6.9V Note 4		IA								
	<u>Post Fatigue Tests</u>											
5.3	hk Leakage Current	Vhk = ±100V. Note 2	2.5		Ihk	-	-	-	-	20	-	μA
	Reverse Grid Current	Rg1 = 500 kΩ	2.5		Ig1	-	-	-	-	1.0	-	μA
	Mutual Conductance		2.5		gm	1.6	-	-	-	3.1	-	mA/V
11.1	Vibration Noise	RL = 2 kΩ Note 3	2.5		Va AC	-	-	-	-	25	-	mV rms
11.4	Shock	Hammer Angle = 30° No Voltages		IA								
	<u>Post Shock Tests</u>											
5.3	hk Leakage Current	Vhk = ±100V. Note 2	2.5		Ihk	-	-	-	-	20	-	μA
	Reverse Grid Current	Rg1 = 500 kΩ	2.5		Ig1	-	-	-	-	1.0	-	μA
	Mutual Conductance		2.5		gm	1.6	-	-	-	3.1	-	mA/V
	Vibration Noise	RL = 2 kΩ Note 3	2.5		Va AC	-	-	-	-	25	-	mV rms
	<u>GROUP F</u>											
AVI/5	Life	Rg1 = 100 kΩ ±20% Note 6										
AVI/5.1	<u>Stability Life (1 hour)</u>											
	Change in Mutual Conductance		1.0		Δ gm	-	-	-	-	10	-	%
	<u>Survival Rate Life (100 hours)</u>											
AVI/5.6	Inoperatives		0-65									

to be performed in addition to those applicable in K.1001

K.1001 Ref.	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits						Units
						Min.	LAL	Bogey	UAL	Max.	ALD	
AVI/5.6	<u>Intermittent Life</u>											
	<u>Test Point (500 hrs)</u>											
		Combined AQL	6.5	IA								
	Inoperatives		2.5									
	Heater Current		2.5	Ih	184	-	-	-	216	-	mA	
	hk Leakage Current	Vhk $\pm 100V$. Note 2	2.5	Ihk	-	-	-	-	20	-	μA	
	Reverse Grid Current	Rg1 = 500 k Ω max.	2.5	Ig1	-	-	-	-	0.75	-	μA	
	Mutual Conductance		2.5	gm	1.6	-	-	-	3.1	-	mA/V	
	Average Change of Mutual Conductance			Δgm	-	-	-	-	15	-	%	
	Electrode Insulation	Vg1 to all = -100V Vg2 to all = -300V Vg3 to all = -300V Va to all = -300V	4.0 4.0 4.0 4.0	R R R R	50 50 50 50	- - - -	- - - -	- - - -	- - - -	- - - -	M Ω M Ω M Ω M Ω	
AVI/5.6	<u>Test Point (1000 hrs)</u>											
		Combined AQL	10									
	Inoperatives		4.0									
	Heater Current		4.0	Ih	184	-	-	-	216	-	mA	
	hk Leakage Current	Vhk = $\pm 100V$. Note 2	4.0	Ihk	-	-	-	-	30	-	μA	
	Reverse Grid Current	Rg1 = 500 k Ω	4.0	Ig1	-	-	-	-	1.0	-	μA	
	Mutual Conductance		4.0	gm	1.5	-	-	-	3.1	-	mA/V	
AIX/2.5	<u>GROUP C</u>											
	Electrical Re-test after 28 days holding period			100%								
	Inoperatives		0.5									
	Reverse Grid Current	Rg1 = 500 k Ω	0.5	Ig1	-	-	-	-	0.75	-	μA	
	Add 15 g. wet life after Mutual Conductance											
	Electrode	Vg1 - all = -100V	6.5	R	30	-	-	-	-	-	-	M Ω
	Insulation	Vg2 - all = -300V		R	30	-	-	-	-	-	-	M Ω
		Vg3 - all = -300V		R	30	-	-	-	-	-	-	M Ω
		Va - all = -300V		R	30	-	-	-	-	-	-	M Ω

NOTES

1. Heater and Cathode strapped, and considered as a single electrode.
2. Heater positive and negative successively.
3. The valve shall be mounted so that the direction of vibration is parallel to the minor axis of the mounting structure. Vibration frequency = any fixed frequency in the range 25 to 100 c/s. Min. peak acceleration = 2.5 g. The test shall be of sufficient duration to obtain a steady reading of noise output.
4. Valves shall be vibrated in each of the three required planes for ~~not less than 33 hours~~ ^{30+30+30 hrs} (100 hours total). Heater switched 1 minute on, 3 minutes off. No other voltages. Min. peak acceleration = 5g; frequency 170 ± 5 c/s.
5. Adjust V_{g1} to give $I_a = 10$ mA. I_{g1} shall not be rising or out of limit after a total of 10 minutes including pre-heating time. Automatic Bias may be used; $R_k = 240\Omega \pm 5\%$.
6. The initial conditions shall be such that the anode and screen dissipations are not less than 2.4 and 0.56 watts respectively. The grid voltage may be any convenient value. Automatic Bias may be used. $V_{hk} = 135V$ with heater positive.
7. The change of mutual conductance is expressed:

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

SPECIFICATION CV.4015. ISSUE 2 dated 6.12.55

AMENDMENT NO. 1

(1) Group B. Screen Current Test.

Delete the figures of 1.8 and 0.9 in the LAL and ALD columns respectively.

(2) Group D. Capacitance Test

Amend the Inspection Level to read IC.

g³ Control Test.

Amend the minimum limit to 55 (from 50) and the maximum figure to 125 (from 95).

November 1956
N.50467.

T.V.C. Office.
for R.A.E.

✓ RAC

ELECTRONIC VALVE SPECIFICATIONS

SPECIFICATION CV.4015

ISSUE 2 - DATED 6th DECEMBER, 1955

AMENDMENT NO. 2.

GROUP F.

Intermittent Life Test Point (500 hrs)

Electrode Insulation

Delete the existing Electrode Insulation Test (at the end of group) and substitute the following:-

K.1001 Ref.	Test	Test Conditions	AQL %	INSP. LEVEL	Symbol	LIMITS						
						MIN	LAL	BOGEY	UAL	MAX	AID	UNITS
	ELECTRODE	Vg1 to all = -100V	4.0		R	50	-	-	-	-	-	MΩ
	INSULATION	Vg2 to all = -300V			R	50	-	-	-	-	-	MΩ
		Vg3 to all = -300V			R	50	-	-	-	-	-	MΩ
		Va to all -300V			R	50	-	-	-	-	-	MΩ

Test Point (1000 hrs)

Delete all reference to Heater Current Test
Add at the end of the Group the following:-

K.1001 Ref.	Test	Test Conditions	AQL %	INSP. LEVEL	Symbol	LIMITS						
						MIN	LAL	BOGEY	UAL	MAX	AID	UNITS
	ELECTRODE	Vg1 to all = -100V	6.5		R	30	-	-	-	-	-	MΩ
	INSULATION	Vg2 to all = -300V			R	30	-	-	-	-	-	MΩ
		Vg3 to all = -300V			R	30	-	-	-	-	-	MΩ
		Va to all = -300V			R	30	-	-	-	-	-	MΩ

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AMENDMENT NO. 3

Page 2 GROUP B.

Anode Current. Variables test V2.

<u>Limits</u>	<u>Column</u>		
LAL	Delete	7.6	Insert 7.43
UAL	"	8.9	" 9.07
ALD	"	2.2	" 1.85

Mutual Conductance. Variables test V2.

<u>Limits</u>	<u>Column</u>		
LAL	Delete	2.25	Insert 2.21
UAL	"	2.65	" 2.69
ALD	"	0.65	" 0.53

January, 1962.
(9165)

Royal Radar Establishment

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