MINISTRY OF SUPPLY (D.L.R.D.(A)RAE) VALVE ELECTRONIC

CV4046

Specification MOS(A)/CV.4046
Issue 2 Dated 1.11.56
To be read in conjunction with BS.448, BS.1409 and K.1001

SECURITY	
Specification	Valve
UNCLASSIFIED	UNCLASSIFIED

→ Indicates a change

TYPE OF VALVE - Reliable Double Tetrode beam power amplifier

CATHODE - Indirectly heated

ENVELOPE - Glass, lower portion in metal shell

PROTOTYPE - CV.415

MARKING

K1001/4

BASE

BS448/B9G

RATING
(All limiting values are absolute)

			Note
Heater Voltage	(V)	6.3	B
Heater Current	(A)	1.6	
Max. Heater-Cathode Voltage	(V)	±150	
Max. Operating Anode Voltage	(V)	400	
Max. Anode Voltage (Ia = 0)	(V)	500	
Max. Dissipation per Anode	(W)	8.0	
Max. Operating Screen Voltage	(V)	400	
Max. Screen Voltage (Ig2 = 0)	(V)	425	
Max. Screen Dissipation (Both Screens)	(W)	3.0	
Mutual Conductance	(mA/V)	3.9	A
Inner Amplification Factor (μg1g2)		6.5	A
Anode Impedance	(kΩ)	100	A
→ Max. Grid 1 - Cathode Resistance for Cathode bias	(kΩ)	100	
→ Max. Grid 1 - Cathode Resistance for fixed bias	(kΩ)	50	
Max. Bulb Temperature	(°C)	225	B
Max. Shock (Short Duration)	(g)	500	
Max. Acceleration (continuous operation)	(g)	2.5	
Max. Operating Frequency for Full Ratings	(Mc/s)	200	
Max. Mean Cathode Current (per section)	(mA)	60	
Max. Peak Cathode Current (per section)	(mA)	375	

CONNECTIONS

Pin	Electrode	
1	Heater	h
2	Grid (1)	g'1
3	Cathode + BP	k +bp
4	Anode (1)	a'
5	Scr.(1) + Scr.(2)	g'2+g"2
6	Anode (2)	a"
7	Cathode + BP	k +bp
8	Grid (2)	g"1
9	Heater	h

DIMENSIONS

See K1001/A1/D2 with the following exceptions

Dimensions (mm)	Min.	Max.
E	-	70
P	-	41
Q	-	45

CAPACITANCES (pF)

C in (nom.))		9.0
C out (nom.)) (per section)		7.5
Ca,g1 (nom.))		0.05
Ca',a" (nom.)		0.3

MOUNTING POSITION

Any

NOTES

A. Measured at Va = 250V, Vg2 = 135V, Ia = 30 mA.

B. 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.

Z.13146.R.

CV4046

To be peformed 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)	Vg1(V)	Vg2(V)	Ia(mA)	Note 2
6.3	250	Vary	135	30	

K1001 Ref.	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	LAL	Bogey	UAL	Max.	ALD	Units
7.1	Glass Strain	No Voltages	6.5	I								
	Group A											
	Electrode Insulation	Vh = 6.3 Note 1										
		Vg'1 - all = -100V		100%	R	100	-	-	-	-	-	MΩ
		Vg"1 - all = -100V		100%	R	100	-	-	-	-	-	MΩ
		Va' - all = ~~-400V~~ -300V		100%	R	100	-	-	-	-	-	MΩ
		Va" - all = ~~-400V~~ -300V		100%	R	100	-	-	-	-	-	MΩ
	Reverse Grid Current	Rg1 = 50KΩ max.		100%	Ig1	-	-	-	-	2.0	-	µA ←
	Output Power	Va(b) = 400V Adjust Vg2 Note 3		100%	P out	17	-	-	-	-	-	Watts
	Emission	Note 13		100%	Ik	33	-	-	-	-	-	mA ←
	Group B											
		Combined AQL	1.0									
	Heater Current		0.65	II	Ih	1.48	-	-	-	1.72	-	A
5.3	hk Leakage Current	Vhk = ±100V Note 4	0.65	II	Ihk	-	-	-	-	20	-	µA
	Grid Voltage		0.65	II	-Vg1	~~9.8~~ 12	-	-	-	~~18.2~~ 20	-	V
	Screen Current		0.65	II	Ig2	-	-	2	-	~~5.0~~ 3.5	-	mA
	Mutual Conductance		0.65	II	Δgm	2.9	-		-	4.9	-	mA/V
	Change of Mutual Conductance	Vh = 5.7V	0.65	II	Δgm	-	-	-	-	15	-	%
	Group C											
		Combined AQL	6.5									
	Anode Current	Vg1 = -50V	2.5	I	Ia	-	-	-	-	1	-	mA
	Inner Amplification Factor	Max. grid swing 1V	2.5	I	µg1g2	~~5.25~~ 4.0	-	~~6.5~~ 5.25	-	~~7.75~~ 6.5	-	
	Reverse Grid Current	Vh = 6.9V Note 5	2.5	I	Ig1	-	-	-	-	4	-	µA
	Vibration Noise	RL = 2k Notes 6 and 7	2.5	I	Va AC	-	-	-	-	20	-	mV rms

TESTS (Cont'd)

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K1001 Ref.	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	LAL	Bogey	UAL	Max.	ALD	Units
	Group D											
5.9	Capacitances	Measured on 1 Mc/s bridge with valve mounted in a fully screened socket. No external screen.	6.5	IA	C in'	-	-	-	-	10.25	-	pF
					C out'	-	-	-	-	9.5	-	pF
					Ca',g'1	-	-	-	-	0.06	-	pF
					C in"	-	-	-	-	10.25	-	pF
					C out"	-	-	-	-	9.5	-	pF
					Ca",g"1	-	-	-	-	0.06	-	pF
					C out'+						-	
					C out"	-	-	-	-	20.25	-	pF
					Ca',Ca"	-	-	-	-	0.5	-	pF
	Group E											
		Combined AQL	6.5									
11.2	Resonance Search	Frequency 25 - 1000 c/s Note 7	2.5	IA	Va AC	-	-	-	-	50	-	mV rms
	Fatigue	Vh = 6.9 switched 1 min. ON 3 mins. OFF Va = 0 Acceleration = 5g min. Frequency = 170 c/s ±5 c/s Note 8		IA								
	Post Fatigue Tests											
		Combined AQL	2.5									
5.3	hk Leakage Current	Vhk = ± 100V Note 4			Ihk	-	-	-	-	40	-	µA
	Reverse Grid Current	Rg1 = 50KΩ max.			Ig1	-	-	-	-	4.0	-	µA
	Mutual Conductance				gm	2.55	-	-	-	4.9	-	mA/V
	Vibration Noise	As in Group C			Va AC	-	-	-	-	30	-	mV rms
11.4	Shock	Hammer Angle = 30° No Voltages		IA								
	Post Shock Tests											
		Combined AQL	2.5									
5.3	hk Leakage Current	Vhk = ± 100V Note 4			Ihk	-	-	-	-	40	-	µA
	Reverse Grid Current	Rg1 = 50KΩ max.			Ig1	-	-	-	-	4.0	-	µA
	Mutual Conductance				gm	2.55	-	-	-	4.9	-	mA/V
	Vibration Noise	As in Group C			Va AC	-	-	-	-	30	-	mV rms

K1001 Ref.	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	LAL	Bogey	UAL	Max.	ALD	Units
	Group F											
	Life	Note 9		IA								
	1 Hour Test Point											
	Change in Mutual Conductance		1.0		Δgm	-	-	-	-	10	-	%
	500 Hour Test Point											
		Combined AQL	6.5									
	Output Power	Note 10	2.5		P out	8.5	-	-	-	-	-	watts
	Peak Emission	Notes 2 and 11	2.5		Ia+Ig2	500	-	-	-	-	-	mA
A VI/5.6	Inoperatives		2.5									
	Heater Current		2.5		Ih	1.48	-	-	-	1.72	-	A
5.3	hk Leakage Current	Vhk = ± 100V Note 4	2.5		Ihk	-	-	-	-	20	-	μA
	Reverse Grid Current	Rg1 = 50KΩ max. Note 12	2.5		Ig1	-	-	-	-	15.0	-	μA
	Mutual Conductance		2.5		gm	2.55	-	-	-	4.9	-	mA/V
	Average Change of Mutual Conductance		2.5		Δgm	-	-	-	-	15	-	%
	Group G											
A IX/2.5	Electrical Re-Test after 28 days holding period			100%								
A VI/5.6	Inoperative		0.5									
→	Reverse Grid Current	Rg1 = 50KΩ max.	0.5		Ig1	-	-	-	-	2.5	-	μA

NOTES - See Overleaf

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NOTES

1. For the purpose of this test the heater and cathode shall be strapped and considered as one electrode.

2. Test to be performed on each section in turn. In the section not under test g1 = -50 volts, except where otherwise stated.

3. Test in Class C amplifier at frequency = 100 Mc/s. Duration of test = 5 minutes. Final emission test to be performed immediately after output power test.

4. Heater positive and negative successively.

5. Prior to this test the valve shall be pre-heated for 5 minutes under test conditions. Ig1 shall not be rising or out of limit, after a total of 10 minutes.

6. 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 = 2g. The test shall be of sufficient duration to obtain a steady reading of noise output.

7. Vibration and Resonance Noise Test. See drawing on page 6.

8. Valves shall be vibrated in each of the three planes, for not less than 30 hours. (100 hours total).

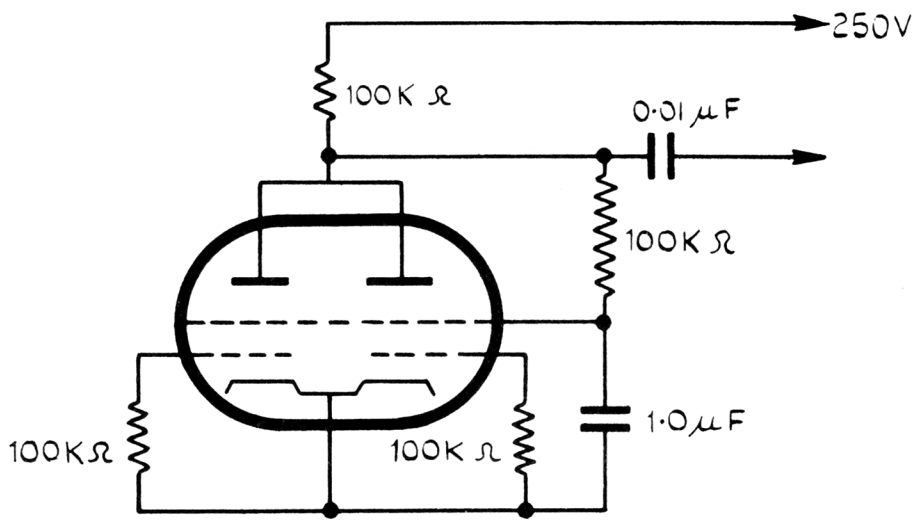
9. Test in Class C amplifier at frequency = 100 Mc/s. Anode and screen grid supplies modulated not less than 90% at 400 ± 100 c/s. Va = 320V; adjust Vg2 to give Ia = 80 mA. ←
The valves shall be switched off and allowed to cool for not less than 10 minutes at least twelve times in every 24 hours. During the "on" period of the heaters the H.T. is to be applied for 20 minutes in each hour of this "on" time. The accumulated heater operating time constitutes the total life test time.

10. Measured unmodulated.

11. To be performed under the following conditions.
Vg1 = 0; Va +g2 = 400V pulses 2 μsec. long. 50 c/s repetition frequency.

12. Gas current shall not exceed 3 μA.

13. Vh = 5.7V; Va +Vg2 = 250V; Vg1 = -100V d.c. plus 100V peak 50 c/s sinusoidal a.c. ←



VIBRATION AND RESONANCE NOISE TEST CIRCUIT

AMENDMENT NO.1

TO ISSUE 2 DATED 1.11.56

OF ELECTRONIC VALVE SPECIFICATION CV.4046

On Page 3, one third down page, under "Group E" against "Fatigue Test".

Amend entry in Inspection Level column to read "IA" instead of "I".

T.V.C. for R.R.E.

June, 1958
N.31928R

ELECTRONIC VALVE SPECIFICATIONS

SPECIFICATION CV4046

ISSUE 2 DATED 1st NOVEMBER 1956

AMENDMENT NO. 2

Page 2 - Group A - Electrode Insulation

In column headed "Test Conditions"

Amend:-

Va' - all = -400V to read Va' - all= -300V
and
Va" - all = -400V to read Va" - all= -300V

March 1960 A.A.E.

NK.16545

95/60

ELECTRONIC VALVE SPECIFICATIONS
SPECIFICATION CV 4046
ISSUE 2. DATED 1.11.56

AMENDMENT NO.3

PAGE 2.

GROUP B.

Grid Voltage. Amend Limits Min. from 9.8 to 12
" Limits Max. from 18.2 to 20

Screen Current. Amend Limits Max from 5.0 to 2.5

GROUP C

Inner Amplification Factor.
Amend Limits Min. from 5.25 to 4.0
" Limits Bogey from 6.5 to 5.25
" Limits Max from 7.75 to 6.5

March 1960
N.16633

Royal Radar Establishment.

9/60