MINISTRY OF AVIATION DLRD/RRE

VALVE ELECTRONIC **CV4003**

Specification MOA/CV4003
Issue 4A Dated 4.9.63
To be read in conjunction with K1001, BS.448 and B.S.1409

SECURITY

Specification	Valve
UNCLASSIFIED	UNCLASSIFIED

Indicates a change ←

TYPE OF VALVE - Reliable Low Impedance Double Triode
CATHODE - Indirectly-heated
ENVELOPE - Glass
PROTOTYPE - CV.491
RETMA Designation - 6189/12AU7WA
Nearest equivalent American Specification MIL-E-1/246

MARKING

See K1001/4
Note H

BASE

See B.S.448/B9A/1.1

RATING Note B

			Note
Heater Voltage	(V)	12.6	A,G
Heater Current	(A)	0.15	A
Max. Anode Voltage	(V)	330	C
Max. Anode Dissipation	(W)	3.0	C
Max. Peak Negative Grid Voltage	(V)	200	J
Max. Negative Grid Voltage	(V)	55	C
Max. Cathode Current	(mA)	20	C,F
Mutual Conductance	(mA/V)	2.2	C,D
Amplification Factor		17	C,D
Anode Impedance	(ohms)	7700	C,D
Max. Heater-Cathode Voltage	(V)	±200	C
Max. Bulb Temperature	(°C)	200	G
Max. Shock (short duration)	(g)	500	
Max. Acceleration (continuous operation)	(g)	2.5	

CONNECTIONS

Pin	Electrode
1	Anode 2 a"
2	Grid 2 g"
3	Cathode 2 k"
4	Heater h
5	Heater h
6	Anode 1 a'
7	Grid 1 g'
8	Cathode 1 k'
9	Heater CT hct.

DIMENSIONS

See B.S.448/B9A/2.1
Size ref. No.2

CAPACITANCES (pF)

			Note
Ca,g (nom.)		1.5	C,E
C in (nom.)		1.6	C,E
C out' (nom.)		0.5	E
→ C out" (nom.)		0.45	E

Dimension mm.	Min.	Max.
A seated height	-	49.0
C diameter	19.0	22.2
D overall length	-	56.0

MOUNTING POSITION

Any

NOTES

A. Centre-tapped heater; for operation on 6.3V connections should be made to pins 4 and 5 strapped together and pin 9.

B. All limiting values are absolute.

C. Each Section

D. Measured at Va = 250V; Vg = -8.5V (Ia = 10.5 mA)

E. Measured without a metal screen.

F. Difficulty may be encountered if this valve is operated for long periods of time with very small values of cathode current.

G. 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 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 is exceeded: life and reliability performance are directly related to the degree that regulation of the heater voltage is maintained at its centre-rated value.

H. In addition to the requirements of K1001/4, the RETMA number shall be clearly and indelibly marked on the valve.

J. This rating applies providing the following conditions are not exceeded. Pulse 800 µsecs long not more frequently than once in every 20 milliseconds. Duty ratio not more than 5%.

TESTS

To be performed in addition to those applicable in K1001
Tests to be performed in the specified order unless otherwise agreed with the Inspection Authority

Test Conditions - unless otherwise stated.

Vh (V)	Va(V)	Vg (V)	Vhk (V)	
12.6	250	-8.5	0	Note 1

K1001	Test	Test Conditions	AQL %	Insp. Level	Sym-bol	LIMITS Min.	LAL	Bogey	UAL	Max.	ALD	Units
7.1	Glass Strain	No voltages	6.5	I								
	GROUP A	Note 7										
5.2	Insulation	Vg -all = -100V		100%		100						Mohms.
		Va -all = 300V		100%		100						Mohms.
	Reverse Grid Current	Rg = 500kohms. Max.		100%	Ig	-	-	-	-	0.5	-	µA
	GROUP B	Combined AQL	1.0									
	Heater Current		0.65	II	Ih	138	-	150	-	162	-	mA
	Heater Cathode	Note 3	0.65	II	Ihk	-	-	-	-	10	-	µA
	Leakage Current	Vhk = ± 100V		V2		-	-	-	2	-	-	µA
	Anode Current		0.65	II	Ia	6.5	-	-	-	14.5	-	mA
				V2		-	9.0	10.5	12.0	-	3.5	mA
	Mutual Conductance		0.65	II	gm	1.75	-	-	-	2.65	-	mA/V
				V2		-	2.0	2.2	2.4	-	.45	mA/V
	GROUP C	Combined AQL	6.5									
	Anode Current	Vg = -25V Note 2	2.5	I	Ia	-	-	-	-	20	-	µA
	Anode Current	Vg = -18V	2.5	I	Ia	5	-	-	-	-	-	µA
	Change in Mutual Conductance	Vh = 11.4V Note 4	2.5	I	Δgm	-	-	-	-	15	-	%
	Reverse Grid Current	Vh = 14V Rg = 500kohms Max. Note 5	2.5	I	Ig	-	-	-	-	1.5	-	µA

TESTS (Cont'd)

K1001	Test	Test Conditions	AQL %	Insp. Level	Sym-bol	LIMITS Min.	LAL	Bogey	UAL	Max.	ALD	Units
	Group C (Cont'd)											
	Noise and Microphony	Vh = 12.6V Va(b) = 300V Vg=0 RL = 50 kohms. Notes 3 & 6.	2.5	I	Va(AC)	-	-	-	-	50	-	mV r.m.s.
11.1	or alternatively Vibration Noise	Va(b) = 250V RL = 2kohms. Notes 3 & 9	2.5	I	Va(AC)	-	-	-	-	100 -		mV r.m.s.
	Anode Current difference between sections		2.5	I	Ia	-	-	-	-	3.5	-	mA
	GROUP D											
7.2	Base Strain	No voltages	6.5	IA								
	Capacitances	The capacitances shall be measured on a 1 Mc/s bridge with the valve mounted in a fully screened socket. No Shield.	6.5	IC	Cag	1.1	-	1.5	-	1.9	-	pF
					C in	1.2	-	1.6	-	2.0	-	pF
					C out'	0.3	-	0.50	-	0.7	-	pF
					C out"	0.3	-	0.45	-	0.6	-	pF
	Amplification Factor		6.5	IA	μ	15.5	-	-	-	18.5	-	
				V1		-	16.2	17.0	17.8	-	1.8	
	Mutual Conductance	Va = 100V; Vg = 0	6.5	IA	gm	2.25	-	-	-	3.75		mA/V
				V1		-	2.60	3.0	3.4	-	0.9	mA/V

TESTS (Cont'd)

K1001	Test	Test Conditions	AQL %	Insp. Level	Sym-bol	LIMITS Min.	LAL	Bogey	UAL	Max.	ALD	Units
	GROUP E											
11.2	Resonance Search	Va(b) = 250V RL = 2kohms Frequency range: 25 - 500 c/s	2.5	IC	Va AC	-	-	-	-	record		mV rms
					f	200	-	-	-			c/s
11.3	Fatigue	Frequency = 170c/s: Min. peak Acceleration = 5g Duration = 30, 39, 30 hrs. Vh = 14V; switched 1 min. on, 3 mins. off. Va = Vg = 0		IA								
	Post-Fatigue Tests	Combined AQL	6.5									
11.1	Vibration Noise	Va(b) = 250V RL = 2kohms. Notes 3 & 9	2.5		Va AC	-	-	-	-	150		mV rms
	Heater Cathode Leakage Current	Vhk = ± 100V Note 3	2.5		Ihk	-	-	-	-	30		µA
	Reverse Grid Current	Rg = 500kohms. Max.	2.5		Ig	-	-	-	-	1.5		µA
	Mutual Conductance		2.5		gm	1.6	-	-	-	-		mA/V
11.4	Shock	Hammer angle = 30° No voltages		IA								
	Post-Shock Tests	Combined AQL	6.5									
11.1	Vibration Noise	Va(b) = 250V RL = 2kohms Notes 3 & 9	2.5		Va AC	-	-	-	-	150		mV rms.

TESTS (Cont'd)

K1001	Test	Test Conditions	AQL %	Insp. Level	Sym-bol	LIMITS Min.	LAL	Bogey	UAL	Max.	ALD	Units
11.1	**GROUP E** (Cont'd)											
	Heater Cathode Leakage Current	Vhk = ± 100V Note 3	2.5		Ihk	-	-	-	-	30		µA
	Reverse Grid Current	Rg = 500kohms.Max	2.5		Ig	-	-	-	-	1.5		µA
→	Mutual Conductance		2.5		gm	1.6	-	-	-	-		mA/V
	GROUP F											
AVI/ 5	Life	Vhk = 175V Heater positive Rg = 500k Nom										
AVI/ 5.1	**Stability Life Test** Change in Mutual Conductance		1.0	I	Δgm	-	-	-	-	10		%
AVI/ 5.3	**Intermittent Life Test**	See above										
	Life Test End-point 500 hrs.	Combined AQL	6.5	IA								
	Inoperatives		2.5									
	Heater Cathode Leakage Current	Vhk = ± 100V	2.5		Ihk	-	-	-	-	20		µA
	Reverse Grid Current	Rg = 500 k Max	2.5		Ig	-	-	-	-	0.5		µA
	Mutual Conductance		2.5		gm	1.6	-	-	-	2.65		mA/V
	-do- Average change				Δgm	-	-	-	-	15		%
	Anode Current		4.0		Ia	5.5	-	-	-	14.5		mA
→	Insulation	Vg- all = -100V	4.0		R	50	-	-	-	-		Mohms.
→		Va- all = -300V			R	50	-	-	-	-		Mohms.

TESTS (Cont'd)

K1001	Test	Test Conditions	AQL %	Insp. Level	Sym-bol	Limits Min.	LAL	Bogey	UAL	Max.	ALD	Units
	GROUP F (Cont'd)											
	Life Test End-point 1000 hrs.	Combined AQL	10	IA								
	Inoperatives		4.0									
	Heater Cathode Leakage Current	Vhk = ± 100V	4.0		Ihk	-	-	-	-	20		µA
	Reverse Grid Current	Rg = 500k Max	4.0		Ig		-	-	-	0.5		µA
	Mutual Conductance		4.0		gm	1.5	-	-	-	2.65		mA/V
	Anode Current		6.5		Ia	5.0	-	-	-	14.5		mA
	Electrode Insulation	Vg -all = -100V			R	30	-	-	-	-		Mohms.
		Va -all = -300V			R	30	-	-	-	-		Mohms.
AIX/ 2.5	GROUP G			100%								
	Electrical re-test after 28 days holding period.											
	Inoperatives		0.5									
	Reverse Grid Current	Rg = 500kohms.Max.	0.5		Ig	-	-	-	-	0.5		µA

NOTES

1. Test each unit separately with the elements of the opposite section connected to the cathode of the active section.

2. Test each unit separately with the test voltages applied to the opposite section.

3. Connect the two sections in parallel. Parasitic suppression of 50 ohms. maximum is permissible.

4. The value of mutual conductance shall apply to individual valves and is expressed:-

$$\frac{(\text{gm at } 12.6) - (\text{gm at } 11.4)}{(\text{gm at } 12.6)} \times 100\%$$

5. Prior to this test the valves shall be pre-heated for five (5) minutes under the conditions specified below. Test immediately after pre-heating.

Vh(V)	Vg(V)	Rk(ohms)	Va(V)	Rg(megohm)
14.0	-8.5	0	250	0.5

6. Connect the cathode together and connect to earth through a 1.5k resistor. Grids shall also be earthed; Ck = 1000 µF.

7. At least one of the tests in Group A shall be performed with the heater sections connected in parallel to a 6.3 volt supply.

8. Deleted

9. Alternatively, Va(b) = 250V, RL = 2k, Vg = 0, Rk = 410 ohms with the cathodes connected together, Ck = 1000 µF.