MINISTRY OF SUPPLY - DLRD/RRE

VALVE ELECTRONIC **CV 4024**

Specification MOS/CV4024.	SECURITY	
	Specification	Valve
Issue 3 Dated 21.9.56.	UNCLASSIFIED	UNCLASSIFIED
To be read in conjunction with K1001, BS448 and BS1409		

→ Indicates a change

TYPE OF VALVE - Reliable Double Triode
CATHODE - Indirectly-heated
ENVELOPE - Glass
PROTOTYPE - CV455
RETMA DESIGNATION - 12AT7 WA

Nearest equivalent American Specification MIL-E-1/3.

MARKING
K1001/4
(See also Note G)

BASE
See BS.448/B9A/1.1

RATING

All limiting Valves are absolute

			Note
Heater Voltage	(V)	12.6	A,D
Heater Current	(A)	0.15	A
Max. Anode Voltage	(V)	380	C
Max. No-load Anode Voltage	(V)	550	C
Max. Anode Dissipation	(W)	2.8	C
Max. Heater-Cathode Voltage	(V)	100	C
Max. Negative Grid Voltage	(V)	55	C
Mutual Conductance	(mA/V)	5.5	C,E
Amplification Factor		60	C,E
Anode Impedance	(ohms)	10,900	C,E
Max. Bulb Temperature	(°C)	200	D
Max. Shock (short duration)	(g)	500	
Max. Acceleration (continuous operation)	(g)	2.5	
Max Peak Negative Grid Voltage	(V)	55	H

CAPACITANCES (pF)

Ca,g (nom.)	1.6	C,F
C in (nom.)	2.50	C,F
C out (nom.)	0.4	C,F
Ca',a" (max.)	0.33	F

CONNECTIONS

Pin	Electrode
1	Anode 2 a"
2	Grid 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 BS448 Section B9A/2.1.
Size ref.No.2

Dimensions (mm)	Min.	Max.
A Seated height	-	49
C Diameter	19	22.2
D Overall length	-	56

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.

C. Each section.

D. 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 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.

E. Measured at Va = 250V; Vg = 0; Rk = 200 ohms.

F. Measured without a metal screen.

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

Max. Duration 800 μsec 40% max. Duty Cycle Amendment H.

To be performed in addition to those applicable in K1001

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

Test Conditions - unless otherwise specified

Vh (V)	Va (V)	Vg (V)	Rk (ohms)	Ck (μF)	
12.6	250	0	200	1000	Note 1

K1001	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	Note 2										
	Insulation	Vg-all = -100V DC		100%	R	100	-	-	-	-	-	MΩ
		Va-all = -300V DC		100%	R	100	-	-	-	-	-	MΩ
	Reverse Grid Current	Rg = 500k Max		100%	Ig	-	-	-	-	0.7	-	μA
	GROUP B	Combined AQL	1.0	II								
	Heater Current		0.65	II	Ih	138	-	150	-	162	-	mA
	Heater Cathode Leakage Current	Vhk = ± 100V DC	0.65	II	Ihk	-	-	-	-	10	-	μA
		Note 3		V2	Ihk	-	-	-	2	-		μA
	Anode Current		0.65	II	Ia	7	-	-	-	14	-	mA
				V2	Ia	-	8.6	10.0	11.4	-	3.55	mA
	Anode Tail Current	Vg = -20V DC	0.65	II	Ia cut-off	-	-	-	-	10	-	μA
	Mutual Conductance		0.65	II	gm	4.5	-	-	-	6.5	-	mA/V
				V2	gm	-	4.9	5.5	6.1	-	1.33	mA/V
	GROUP C	Combined AQL	6.5	I								
	Anode Current difference between sections		2.5	I	ΔIa	-	-	-	-	3.2	-	mA
	Mutual Conductance	Vh = 11.6V 4V	2.5	I	gm	4.0	-	-	-	-	-	mA/V
		Note 4		VI	gm	-	4.4	-	-	-		mA/V
	Noise and Microphony	Va(b) = 300V RL = 10k Note 5	2.5	I	VaAC	-	-	-	-	100	-	mV rms
	or alternatively,											
11.1	Vibration Noise	Va(b) = 250V RL = 2k Frequency = 50 or 100 c/s Note 5	2.5	I	VaAC	-	-	-	-	25	-	mV rms

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TESTS (Cont'd)

K1001	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	LAL	Bogey	UAL	Max	ALL	Units
	GROUP D											
	Amplification Factor		6.5	IA	μ	50	-	60	-	70	-	
	Negative Grid Emission	Vh = 15.0V Vg = -20V Rg = 500k Max Rk = 0 Note 6	6.5	IA	Ig	-	-	-	-	1.5	-	μA
7.2	Base Strain	No voltages	6.5	IA								
	Capacitances	Measured on 1 Mc/s bridge with the valve mounted in a fully screened socket. No shield.	6.5	IC	Cag	1.30	-	1.60	-	1.90	-	pF
					Cin	2.00	-	2.50	-	3.00	-	"
					C out'	0.2	-	0.45	-	0.70	-	"
					C out"	0.16	-	0.38	-	0.60	-	"
					Ca'a"	0.15	-	0.24	-	0.33	-	"
					Cha-k	2.7	-	3.85	-	5.0	-	"
	GROUP E											
11.2	Resonance Search	RL = 2k; Va(b) = 250V Frequency = 25-500 c/s	2.5	IA	Va AC	-	-	-	-	record	-	mV rms
					f	200	-	-	-	-	-	c/s
11.3	Fatigue	Vh = 14V switched 1 min. on and 3 mins. off Va = 0, Vhk = 0 Min. peak Frequency = 170 c/s Acceleration = 5g Duration = 30, 39, 30 hrs.		IA								
	Post Fatigue Tests	Combind AQL	6.5									
11.1	Vibration Noise	Note 7	2.5		Va AC	-	-	-	-	100	-	mV rms
	Heater Cathode Leakage Current	Vhk = ± 100V Note 3	2.5		Ihk	-	-	-	-	30	-	μA
	Reverse Grid Current	Rg = 500k Max	2.5		Ig	-	-	-	-	1.5	-	μA
	Mutual Conductance		2.5		gm	3.8	-	-	-	-	-	mA/V
11.4	Shock	No voltages Hammer angle = 30°		IA								
	Post Shock Tests	Combined AQL	6.5									
11.1	Vibration Noise	Note 7	2.5		Va AC	-	-	-	-	100	-	mV rms
	Heater Cathode Leakage Current	Vhk = 100V Note 3	2.5		Ihk	-	-	-	-	30	-	μA
	Reverse Grid Current	Rg = 500k Max	2.5		Ig	-	-	-	-	1.5	-	μA
	Mutual Conductance		2.5		gm	3.8	-	-	-	-	-	mA/V
	GROUP F											
A VI/5	Life	Vhk = 135V, heater positive Rg = 500k Max Ck = 0 μF										
	Stability Life Test											
A VI/5.1	Change in Mutual Conductance		1.0	I	Δgm	-	-	-	-	10	-	%

TESTS (Cont'd)

K1001	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min	LAL	Bogey	UAL	Max	ALD	Units
	GROUP F (Cont'd)											
A VI/ 5.3	Intermittent Life Test	See above		IA								
	Life Test End Point - 500 hrs.	Combined AQL	6.5									
	Inoperatives		2.5									
	Heater Current		2.5		Ih	138	-	-	-	162		mA
	Heater Cathode Leakage Current	Vhk = ± 100V Note 3	2.5		Ihk	-	-	-	-	10		µA
→	Reverse Grid Current	Rg = 500k Max	2.5		Ig	-	-	-	-	1.0		µA
	Mutual Conductance		2.5		gm	3.8	-	-	-	6.5		mA/V
→	Average change in Mutual Conductance				Δgm	-	-	-	-	17		%
	Anode Current		4.0		Ia	6	-	-	-	14		mA
	Insulation	Vg-all = -100V	4.0		R	50	-	-	-	-		MΩ
		Va-all = -300V			R	50	-	-	-	-		MΩ
	Life Test End Point - 1000 hrs.	Combined AQL	10.0									
	Inoperatives		4.0									
	~~Heater Current~~		~~4.0~~		~~Ih~~	~~138~~	~~-~~	~~-~~	~~-~~	~~162~~		~~mA~~
	Heater Cathode Leakage Current	Vhk = ± 100V Note 3	4.0		Ihk	-	-	-	-	10		µA
→	Reverse Grid Current	Rg = 500k Max	4.0		Ig	-	-	-	-	1.5		µA
	Mutual Conductance		4.0		gm	3.55	-	-	-	6.5		mA/V
	Anode Current		6.5		Ia	5.35	-	-	-	14		mA
	~~Electrode to electrode insulation~~	~~Vg-all = -100V Va-all = -300V~~	6.5		R	30	-	-	-	-	-	MΩ
	GROUP G				R	30	-	-	-	-	-	MΩ
AIX /2.5	Electrical re-test after 28 days holding period			100%								
A VI /5.6	Inoperatives		0.5									
	Reverse Grid Current	Rg = 500k Max	0.5		Ig	-	-	-	-	0.7		µA

NOTES

1. Test each section separately with the elements of the opposite section earthed, except where otherwise stated.
2. At least one test in Group A shall be performed with the heaters of both sections connected in parallel and connected to a 6.3 volt supply.
3. Test with the sections connected together.
4. Pre-heat the valves for 5 minutes at Vh = 11.4V; Va = 250V; Rk = 200 ohms; Rg = 500k; Ck = 1000 µF before testing. Pre-heat with both sections operating separately, but test with the elements of the opposite section earthed.
5. Test with the two sections connected in parallel. Connect cathodes together and connect to earth through 100 ohms. Connect the grids to earth.
6. Pre-heat the valves for 5 minutes at Vh = 15.0V; Va = 250V; Rk = 200 ohms; Rg = 500k; Ck = 1000 µF before testing. Pre-heat with both sections operating. The maximum time between pre-heating and testing shall be 2 seconds. Test each section separately with the elements of the opposite section earthed.
7. The test conditions specified for the Vibration Noise test in Group C shall apply.

SPECIFICATION CV.4024 - ISSUE 3 dated 21-9-56

AMENDMENT NO. 1

Page 3. Group D.

Capacitances - last line.

AMEND the maximum limit of Chk' + k'' from 5.0 to 5.5.

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

May 1957.

N87784R

ELECTRONIC VALVE SPECIFICATION

SPECIFICATION CV.4024

ISSUE 3 - DATED 21st SEPTEMBER, 1956

AMENDMENT No.2.

GROUP F.

Intermittent Life Test Point (1000 hrs)

Electrode Insulation

Delete all reference to Heater Current Test

Add at the end of this Group (after anode Current) the following:-

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

December, 1957 T.V.C.

ELECTRONIC VALVE SPECIFICATIONS

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AMENDMENT NO. 3

Page 2. GROUP C.

Mutual Conductance

In column headed "Test Conditions"

Amend "Vh = 11.0V" to read "Vh = 11.4V"

Page 4. NOTE 4. First line.

Amend "Vh = 11.0V" to read "Vh = 11.4V"

September 1959.
N.71189/D.

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

ELECTRONIC VALVE SPECIFICATIONS

SPECIFICATION MOS/CV4024

ISSUE 3 DATED 21.9.56

AMENDMENT NO.4

Page 1 RATINGS

Add:-

"Max. Peak Negative Grid Voltage (V)	85	H"

NOTES

Add:-

"H. Max. Duration 800 u Sec., 40% Max. Duty Cycle."

March, 1961
N.56291/D

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

RRS 6/61