

[WARNING : THIS VALVE MAY BE RADIOACTIVE]

Page A (No. of Pages - 1+6+3)

MINISTRY OF AVIATION - DLRD/RRE

VALVE ELECTRONIC **CV4101**

Specification MOA/CV4101 Incorporating MIL-E-1/9400 (Note B) Issue 1 dated 6.7.60 To be read in conjunction with K1006	<u>SECURITY</u> <table border="1"> <tr> <td><u>Specification</u> Unclassified</td><td><u>Valve</u> Unclassified</td></tr> </table>	<u>Specification</u> Unclassified	<u>Valve</u> Unclassified
<u>Specification</u> Unclassified	<u>Valve</u> Unclassified		

indicates a change

TYPE OF VALVE - Reliable miniature voltage regulator		<u>MARKING</u> K1001/4	
CATHODE	- Cold	<u>Additional Marking</u>	
ENVELOPE	- Glass	OB2WA	
PROTOTYPE	- OB2WA	Note C	
<u>RATING</u>		<u>BASE</u> B7G	
All limiting values are absolute		BS448 : B7G/2.1/4	
Min: Total Darkness Starting Voltage (V) 130		<u>CONNECTIONS</u>	
Min: Ambient Light Starting Voltage (V) 130			
Approx: Operating Voltage (V) 108			
Min: Operating Current (mA) 5			
Max: Operating Current (mA) 30			
Max: Altitude (ft) 120K			
Min: Ambient Temperature (°C) -55			
Max: Bulb Temperature (°C) 150			

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19 JANUARY 1960

SUPERSEDING

MIL-E-1/291

9 JULY 1953

MIL-E-1/940B

4 DECEMBER 1957

MILITARY SPECIFICATION SHEET

ELECTRON TUBE, RECEIVING, VOLTAGE REGULATOR, MINIATURE JAN-OB2WA¹

This specification sheet forms a part of the issue of Military Specification MIL-E-1.

Description: Voltage Regulator, Reliable

<i>Ratings:</i>	Total Darkness Ionization Voltage	Ambient Light Ionization Voltage	Operating Voltage	
Absolute:	Vdc	Vdc	Vdc	
Maximum:	...	...	118	
Minimum:	130	130	108	
Test Conditions:	...	...	...	

<i>Ratings:</i>	Operating Current	Ambient Temperature	Envelope Temperature	Altitude
Absolute:	mAdc	°C	°C	ft
Maximum:	80	...	150	120,000
Minimum:	5	-55	...	...
Test Conditions:	...	...	...	...

Cathode: Glow Discharge

Base: Miniature glass button 7-Pin

Diameter: Max. ¼ in.

Height: Max. 2⅝ in.

Pin No.:	1	2	3	4	5	6	7
Element:	a	k	int	k	a	int	k
			con			con	

Envelope: T-5½

JAN-OB2WA
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The following tests shall be performed:

For the purpose of inspection, use applicable reliable paragraphs of Specification MIL-E-1.

For miscellaneous requirements, see 3.6.

Ref.	Test	Conditions	AQL (%)	Insp. Level or Code	Sym	LIMITS					Unit
						Min			Max		
8.1	Qualification Approval Tests Qualification Approval:	Required for JAN Marking	...	...	...	...	...	...	...	...	...
...	Cathode	Glow Discharge	...	...	...	...	...	...	...	...	...
3.4.3	Base Connections	E7-1	...	...	...	...	...	...	...	...	...
4.9.20.3	Vibration (1):	Rp = 10,000; Ebb/Ib = 20mAdc	...	...	Ep	...	...	...	100	...	mVac
4.13.1	Measurements Acceptance Tests, Part 1, Note 1 ± Ionization Voltage (1):	Ebb/Ib = 5 — 30mAdc; Illumination = 5 — 50ft candles	0.25	II	Ez	...	...	...	130	...	Vdc
4.13.2	Tube Voltage Drop (1)	Ebb/Ib = 30mAdc	0.25	II	Etd	105	...	...	111	...	Vdc
4.13.2	Tube Voltage Drop (2)	Ebb/Ib = 5mAdc	0.25	II	Etd	105	...	...	111	...	Vdc
4.13.2.1	Regulation:	(1) Etd — (2) (Etd)	0.25	II	Reg	...	...	...	± 2.5	...	Vdc
4.7.5	Continuity and Shorts (Inoperatives)		0.25	II	...	...	...	...	...	...	...
4.9.1	Mechanical production tests	Envelope Outline No. 6-5	...	...	...	...	...	...	...	...	...
4.13.4.3	Measurements Acceptance Test, Part 2 Noise test	Ebb/Ib = 30mAdc	1.0	I	Eb:	...	...	...	5	...	mVac
4.13.4.2	Oscillation test	Esig = 100mVac; Ebb/Ib = 5 — 80mAdc	1.0	I	...	...	...	...	...	...	...
...	Voltage Jump	Ebb/Ib = 6 — 10mAdc; Note 2	2.5	Code G	Jump	...	...	...	100	...	mVdc
4.13.1	Ionization Voltage (2):	Note 3	2.5	Code G	Ez	...	...	...	130	...	Vdc
4.13.3	Leakage current	Eb = 50Vdc; Rp = 3000	2.5	Code G	Llb	...	...	...	5	...	uAdc
4.13.2	Tube Voltage Drop (3)	Ebb/Ib = 20mAdc	2.5	Code G	Etd	105	...	...	111	...	Vdc
...	Repeatability	Ebb/Ib = 10mAdc; Note 4	2.5	Code G	Etd	...	...	...	600	...	mVdc

Ref.	Test	Conditions	AQL (%)	Insp. Level or Code	Sym	LIMITS					Unit
						Min			Max		
...	Low Pressure Voltage Breakdown: Vibration (2)	Note 5 Rp = 10,000; Ebb/Ib = 20mAcd	6.5 2.5	Note 6 Code G	...	...	...	...	...	...	mVac
4.9.20.5 4.9.20.6	Degradation Rate Acceptance Tests, Note 7 Shock test Fatigue test	Hammer Angle = 60° G = 2.5; Fixed Frequency F = 25 min., 60 max.	...	Note 6	...	...	...	...	...	...	...
...	Post Shock and Fatigue Test End Points:	Vibration (2) Ionization Voltage (1) Tube Voltage Drop (1) Tube Voltage Drop (2) Regulation	...	Ez Ez Etd Etd Reg	...	...	...	...	100 130 113 113 ± 8	mVac Vdc Vdc Vdc Vdc	...
4.9.6.1	Miniature Tube Base Strain:		...	...	...	...	...	...	...	...	...
...	Glass Strain	Note 8	2.5	I	...	...	...	...	...	...	...

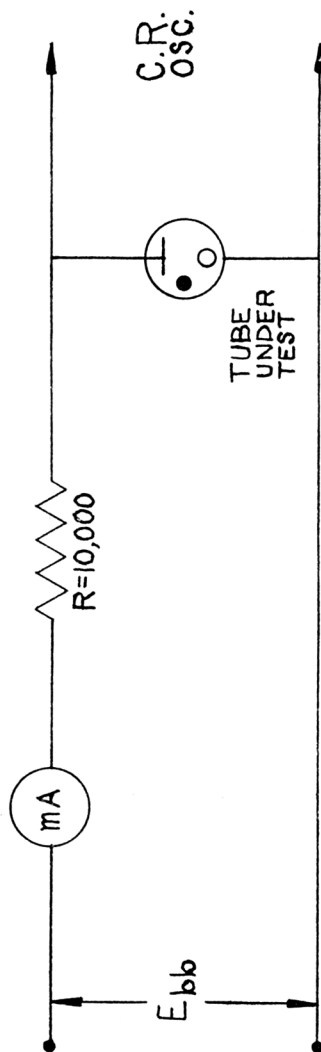
Ref.	Test	Conditions	AQL %	Insp. level or code	Allowable defectives per characteristic	Sym	LIMITS		Ref.
							1st sample	Combined sample	
4.11.3.1	Acceptance Life Tests, Note 7 Stability Life Test (1 hour)	Ebb/Ib = 20 mAcd; TA = Room; Note 9	1.0	Code I	...	...	...	...	...
4.11.4	Stability Life Test End Points	Change in Tube Voltage Drop (3) of individual tubes	...	...	...	Δ Etd _t	...	2.0	Vdc
4.11.3.1	Survival Rate Life Test (100 hours)	Stability Life Test Conditions or Equivalent Note 10	...	II	...	...	...	...	...
4.11.4	Survival Rate Life Test End Points	Continuity and Shorts (Inoperatives) Change in Tube Voltage Drop (3) of individual tubes	0.65 1.0	...	...	...	Δ Etd _t	...	Vdc

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Ref.	Test	Conditions	AQL %	Insp. level or code	Allowable defectives per characteristic		Sym	LIMITS		Ref.
					1st sample	Combined sample		Min	Max	
4.11.5	Intermittent Life Test	Stability Life Test Conditions or Equivalent; T Envelope = 150°C min.; Notes 11, 12	...	...	...	...	...	...	...	...
4.11.4	Intermittent Life Test End Points (500 hours)	Note 13 Inoperatives; Note 14 Regulation Tube Voltage Drop (1) Tube Voltage Drop (2) Tube Voltage Drop (3) Change in Tube Voltage Drop (3) of individual tubes	...	...	1	3	...	...	...	...
			...	...	1	3	Reg	...	± 8	Vdc
			...	...	1	3	Etd	103	113	Vdc
			...	...	1	3	Etd	103	113	Vdc
			...	...	1	3	Etd	103	113	Vdc
			...	...	1	3	Δ Etd	...	4.0	Vdc
			...	...	1	3	t	...	...	...
		Ionization Voltage (1)	...	...	1	3	Ez	...	130	Vdc
		Total Defectives	...	...	4	8	...	...	...	...
4.11.4	Intermittent Life Test End Points: (1000 hours)	Note 13 Inoperatives; Note 14 Regulation Tube Voltage Drop (1) Tube Voltage Drop (2) Tube Voltage Drop (3) Change in Tube Voltage Drop (3) of individual tubes	...	...	2	5	...	...	...	...
			...	...	2	5	Reg	...	± 4	Vdc
			...	...	2	5	Etd	103	116	Vdc
			...	...	2	5	Etd	103	116	Vdc
			...	...	2	5	Etd	103	116	Vdc
			...	...	2	5	Δ Etd	...	5.0	Vdc
			...	...	2	5	t	...	...	...
		Ionization Voltage (1)	...	...	2	5	Ez	...	130	Vdc
		Total Defectives	...	...	5	10	...	...	...	...
4.9.18.1.4	Packaging Requirements Container Drop:	(d) Package Group 1; Container Size C	...	...	...	...	...	...	...	...

Note 1: The AQL for the combined defectives for attributes in Measurements Acceptance Tests, Part 1, excluding Inoperatives and Mechanical, shall be one (1) percent. A tube having one (1) or more defects shall be counted as one (1) defective. MIL-STD-105, Inspection Level II shall apply.



Note 2: Vary current from 6mA_{dc} to 10mA_{dc} and back (by adjusting Ebb slowly). Sudden voltage jumps registered on the oscilloscope shall be not greater than the specified value.

Note 3: Conditions for this test shall be those of Ionization Voltage (1) except testing shall be done in total darkness and the tube shall not have conducted or been exposed to light for at least 24 hours prior to testing. The tube shall fire within 20 seconds maximum.

Note 4:

- a. The voltage drop shall be read at 10 mA_{dc} drain.
- b. The tube shall be turned off for one(1) minute.
- c. The tube shall be re-started and operated at the same current.
- d. Etd shall be read after one (1) minute of operation.
- e. The on-off cycle shall be repeated a minimum of five (5) times. The maximum difference in tube voltage drop shall be taken as the measure of repeatability.

Note 5: Place tube under test in a Bell jar with pressure maintained at 3.1 ± 0.2 mm Hg. Apply a potential of 200 V_{dc} to the K and A terminals through a variable series resistor. Adjust resistor to give a current of 20.0 mA_{dc}. There shall be no evidence of flashover or corona at the pins of the tube.

Note 6: This test shall be conducted on the initial lot and thereafter on a lot approximately every 30 days. When one lot has passed, the 30-day rule shall apply. In the event of lot failure, the lot shall be rejected and the succeeding lots shall be subjected to this test until a lot passes. MIL-STD-105, sample size code letter F shall apply.

Note 7: Destructive Tests:

Tubes subject to the following destructive tests are not to be accepted under this specification.
Shock
4.9.20.5
Fatigue
4.9.20.6
Intermittent Life Test
4.11.5

Note 8: Glass strain procedures — All tubes subjected to this test shall have been sealed a minimum of 48 hours prior to conducting this test. All tubes shall be at room temperatures. The entire tube shall be immersed in water at not less than 57°C for 15 seconds and immediately thereafter immersed in water at not more than 5°C for 5 seconds. The volume of water shall be large enough that the water temperature will not be appreciably affected by the test. The holder shall be in accordance with Drawing #245-JAN, and the tubes shall be immersed quickly. The tubes shall be so placed in the water that no contact is made with the containing vessel, nor shall the tubes contact each other. After the 5-second submersion period the tubes shall be removed and allowed to return to room temperature on a wooden surface. After drying at room temperature for a period of 48 hours, the tubes shall be inspected and rejected for evidence of air leaks (see 4.7.6). Electrical rejects, other than inoperatives, may be used in the performance of this test.

Note 9: Stability life test. See 20.2.5.1 of Appendix C.

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Note 10: *Survival-rate life test.* See 20.2.5.2 to 20.2.5.2.4, inclusive, of Appendix C.

Note 11: *Intermittent life tests.* See 20.2.5.3 of Appendix C.

Note 12: Envelope Temperature is defined as the highest temperature indicated when using a thermocouple of #40 BS or smaller diameter elements welded to a ring of 0.025 inch diameter phosphor bronze in contact with the envelope.

Note 13: *Order for evaluation of life-test defects.* See 4.11.3.1.2.

Note 14: An inoperative as referenced in life test is defined as a tube having one or more of the following defects: discontinuity (see 4.7.1), shorts (see 4.7.2.) air leaks (see 4.7.6).

Note 15: Referenced specification shall be of the issue in effect on the date of invitation for bid.

Preparing activity:

Navy—Bureau of Ships
(Project 5960-0801)

Custodians:

Army—Signal Corps
Navy—Bureau of Ships
Air Force

20.2.5.1.

APPENDIX CV4101STABILITY LIFE TEST

- (a) Life-test samples shall be selected from the lot at random in such a manner as to be representative of the lot. If such selection results in a sample containing tubes which are outside the specified initial limits for the specified life-test-end-point characteristics, such tubes shall be replaced by randomly selected acceptable tubes. (See 3.9)
- (b) Serially mark all tubes of the sample.
- (c) Record the specified characteristic measurements on the entire sample after a maximum operation of 15 minutes under specified voltage and current conditions. (See 3.9)
- (d) Operate at specified test conditions for 1 hour + 30 minutes. The life -0 test shall be conducted as specified in 4.11 and 4.11.5, except that the following shall be substituted for 4.11.1(b): The mean electrode potentials, except heater or filament, may be established at values differing by not more than 5 percent from the specified values provided the same average electrode dissipation is obtained that occur with the specified voltages (See 3.9) Fluctuations of all voltages, including heater or filament voltage, shall be as small as practicable.
- (e) Record the specified characteristic measurements at the end of this test period. The specified characteristic measurements shall be taken immediately following the test, or the tubes shall be preheated for 15 minutes under specified test voltage and current conditions and the characteristic immediately measured. (See 3.9). The 15-minute preheat shall be considered as part of the test time.
- (f) A defective shall be defined as a tube having change in the specified characteristic greater than that specified. (See 3.9)
- (g) A resubmitted lot shall be subjected to all measurements-acceptance tests except mechanical inspection, vibration, and low-pressure-voltage-breakdown tests.

20.2.5.2.

SURVIVAL-RATE LIFE TEST

The procedure for assuring the maintenance of a desirable quality level in terms of early life survival consists of a series of normal, reduced, and tightened-inspection sampling plans for use at 100 hours. The sample size is dependent on lot size, and the transfer between normal, reduced, and tightened inspection is dependent upon quality history.

20.2.5.2.1.

SELECTION OF INSPECTION PROCEDURE

- (a) Normal inspection. Normal inspection shall be used initially and shall be continued until the conditions for reduced inspection specified in Standard MIL-STD-105 are met, or if not in the last 10 lots inspected shall have been declared nonconforming for survival-rate-life -test qualities. A tube type that has qualified for reduced inspection shall revert to normal inspection under either of the following conditions:

1. If a lot is indicated to be nonconforming by the reduced-inspection plan.
2. If the percent defective, as computed from the defects found from the total first samples of the last 10 lots, is greater than the specified AQL.

The conditions for requalification for reduced inspection shall be the same as for initial qualification for reduced inspection.

- (c) Tightened inspection. Tightened inspection shall be used when specified in Standard MIL-STD-105 or when 2 or more lots in the last 10 lots inspected are declared nonconforming for survival-rate-life-test qualities. Tightened inspection shall be used to reevaluate the quality of any lot previously inspection may replace tightened inspection in accordance with the provisions of Standard MIL-STD-105.

20.2.5.2.2.

SELECTION OF SAMPLING PLANS The requisite rates of failure (AQL) shall be designated as the specified acceptance-inspection conditions. (See 3.9)

- (a) Normal-inspection sampling plan. This sampling plan shall be selected by using inspection level II of Standard MIL-STD-105 to determine the sample-size code letter. The use of single sampling or double sampling determines the actual sampling plan. When obtaining sample-size code letters any lot containing between 301 and 800 tubes shall be considered to consist of 800 tubes, and any lot containing more than 8,000 tubes shall be considered to consist of 8,001 tubes.
- (b) Reduced-inspection sampling plan. This sampling plan shall be selected by using inspection level II of standard MIL-STD-105 to determine the sample-size code letter and the actual sampling plan. If the indicated sample is less than 22 tubes, the actual sampling plan shall be that called for by use of the specified AQL (see 3.9) and sample-size code letter "K". This will provide a sample size of at least 22 tubes except for an AQL of 0.15 percent. In this particular case, sample-size code letter "L" shall be used. When obtaining sample-size code letters, any lot containing between 301 and 800 tubes shall be considered to consist of 800 tubes, and any lot containing more than 8,000 tubes shall be considered to consist of 8,001 tubes.
- (c) Tightened-inspection sampling plan. This sampling plan shall be selected by using inspection level II of Standard MIL-STD-105 to determine the sample-size code letter. Thus use of tightened sampling, or double sampling determines the actual sampling plan. When obtaining sample-size code letters, any lot containing between 301 and 800 tubes shall be considered to consist of 800 tubes, and any lot containing more than 8000 tubes shall be considered to consist of 8,001 tubes.

20.2.5.2.3.

SURVIVAL-RATE-LIFE-TEST SAMPLE. The survival-rate-life-test sample shall be selected from the lot at random in such a manner as to be representative of the lot. If such selection results in a sample containing one or more tubes which are defective as specified in 4.7.5 such tubes shall be replaced by randomly selected good tubes.

20.2.5.2.5.

INSPECTION PROCEDURES

- (a) Select sample in accordance with 20.2.5.1 (a) of this appendix
- (b) Test tubes at 100 hours as specified in 4.7.5. When any tap-short indication is obtained, the test shall be repeated. When any short indication is again obtained, the tube shall be rejected as inoperable.
- (c) Determine the number of defectives at the 100-hour period.
- (d) If more than the allowable number of defectives occur, declare the lot nonconforming.
- (e) A resubmitted lot shall be subjected to all measurements-acceptance tests except mechanical inspection, capacitance, vibration, and low-pressure-voltage-breakdown tests.

NOTE: For other references, i.e. 3.9, 4.7.5, 4.11.1(b) and 4.11.5, see K1006.