

Specification RRE/CV4020 Incorporating MIL-E-1/290A Issue 1 Dated 12. 12. 55 To be read in conjunction with K1006	<u>SECURITY</u> Specification Valve UNCLASSIFIED UNCLASSIFIED
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TYPE OF VALVE - Reliable Miniature Voltage Regulator CATHODE - Cold ENVELOPE - Glass-unmetallised PROTOTYPE - OA2WA	<u>MARKING</u> K1001/4 <u>Additional Marking</u> OA2WA
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<u>RATING</u> Min Total Darkness Starting Voltage (V) 225 Min Ambient Light Starting Voltage (V) 165 Approx Operating Voltage (V) 150 Min Operating Current (mA) 5 Max Operating Current (mA) 30 Max Altitude (ft) 60,000 Min Ambient Temperature (°C) -55 Max Bulb Temperature (°C) 150	Note	<u>BASE</u> B7G BS448: B7G/2.1/4																								
		<u>CONNECTIONS</u>																								
		<table border="1"> <thead> <tr> <th>Pin</th> <th colspan="2">Electrode</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Anode</td> <td>a</td> </tr> <tr> <td>2</td> <td>Cathode</td> <td>k</td> </tr> <tr> <td>3</td> <td>Int: con:</td> <td>I.C.</td> </tr> <tr> <td>4</td> <td>Cathode</td> <td>k</td> </tr> <tr> <td>5</td> <td>Anode</td> <td>a</td> </tr> <tr> <td>6</td> <td>Int: con:</td> <td>I.C.</td> </tr> <tr> <td>7</td> <td>Cathode</td> <td>k</td> </tr> </tbody> </table>	Pin	Electrode		1	Anode	a	2	Cathode	k	3	Int: con:	I.C.	4	Cathode	k	5	Anode	a	6	Int: con:	I.C.	7	Cathode	k
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<u>MOUNTING POSITION</u> Any																										

<p style="text-align: center;"><u>NOTES</u></p> <p>A. All limiting values are absolute</p>
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MIL-E-1/290A
16 July 1954
Superseding
MIL-E-1/290
9 July 1953

INDIVIDUAL MILITARY SPECIFICATION SHEET
ELECTRON TUBE, RECEIVING, VOLTAGE REGULATOR, TYPE

JAN-OA2WA

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

Description: Reliable Miniature Voltage Regulator, Receiving

Caution. To Electronic Equipment Design Engineers. Special attention should be given to the temperature at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if absolute maximum ratings are exceeded.

Ratings:	Ebb Voltage Vdc	Total Darkness Starting Voltage Vdc	Ambient Light Starting Voltage Vdc	Operating Voltage Vdc	Operating Current mAdc	Bulb Temperature °C	Amb. Temp. °C	Alt Ft
Absolute Maximum:	---	---	---	150 (approx)	30	150	---	60,000
Minimum:	---	225	165	---	5	---	-55	---

Test Cond.: 300 (Note 1)

*Height: Min. 2-3/8 in; Max. 2-5/8 in.
**Base: Miniature glass button, 7-pin, E7-1.

*Diameter: Max. 3/4 in.
**Cathode: Glow Discharge

**Pin No.: 1 2 3 4 5 6 7
Element: a k Int. k a Int. k

**Envelope: T-5 1/2 (6-5)

For miscellaneous requirements, see Paragraph 3.3, Inspection Instructions for Electron Tubes.

Ref.	Test	Conditions	ACI %	Insp. Levels	Min.	LAL	Boote	UAL	Max.	ALT
	<u>Qualification Approval Tests</u>			Note 2						
3.1	Qualification Approval:	Required for JAN Marking								
4.9.18.1.4	Carton Drop:	(d) Package Group 1; Carton Size C								
---	**Altitude:	Note 3								
4.9.20.3	**Vibration:	No Voltages								
	<u>Acceptance Tests - Group A</u>									
4.9.20.6	Fatigue:	No Voltages; Note 4	6.5		---	---	---	---	---	---
4.9.20.5	Shock:	Hammer angle=30°; No Voltages								
---	Post Shock & Fatigue Test End Points:									
	Ionisation Voltage (1):	Rp/Ip=5-30mAdc			Ex: ---	---	---	---	165	--- Vdc
	Plate Voltage (1):	Rp/Ip=30mAdc			(1)Eb: ---	---	---	---	158	--- Vdc
	Plate Voltage (2):	Rp/Ip=5mAdc			(2)Eb: 142	---	---	---	---	--- Vdc
	Regulation:	(1)Eb-(2)Eb			Reg: ---	---	---	---	5	--- Vdc
	<u>Acceptance Tests - Group B</u>									
---	Glass Strain:	Note 5	2.5	I	---	---	---	---	---	---
	<u>Acceptance Tests - Group C</u>									
4.7.5	Continuity & Short:		0.4	II	---	---	---	---	---	---
	<u>Acceptance Tests - Group D - Note 6</u>									
4.13.1	Ionisation Voltage (1):	Rp/Ip=5-30mAdc; Illumination = 5-50 ft. candles	0.65	II	Ex: ---	---	---	---	165	--- Vdc
4.13.2	Plate Voltage (1):	Rp/Ip=30mAdc; Note 7			(1)Eb: ---	---	150	152	---	6 --- Vdc

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Ref.	Test	Conditions	AQL %	Insp. Levels	Min.	LAL	Boole	UAL	Max	UAL	Max
4.13.2	Plate Voltage (1):	Rp/Id=30mAdc	0.65	II	(1)Eb: ---	---	---	---	156	---	Vdc
4.13.2	Plate Voltage (2):	Rp/Id=5mAdc; Note 7			(2)Eb: ---	147	149	---	---	6	Vdc
4.13.2	Plate Voltage (2):	Rp/Id=5mAdc	0.65	II	(2)Eb: 145	---	---	---	---	---	Vdc
4.13.2.1	Regulation:	(1)Eb-(2)Eb	0.65	II	Req: ---	---	---	---	5	---	Vdc
<u>Acceptance Tests - Group E</u>											
4.13.4.3	Noise:	Rp/Id=30mAdc	2.5	I	Eb: ---	---	---	---	5	---	mVac
4.13.4.2	Oscillation:	Estg=100mVac; Rp/Id=5-30mAdc	2.5	I							
<u>Acceptance Tests - Group F</u>											
4.13.1	Ionisation Voltage (2):	Note 8	6.5	Note 9	Es: ---	---	---	---	225	---	Vdc
4.13.3	Leakage Current:	Eb=50Vdc; Rb=3000 ohms;	6.5	Note 9	LDb: ---	---	---	---	5.0	---	uAdc
Ref.	Test	Conditions	AQL %	Insp. Level	Allowable Defects/charac.				Min.	Max.	
					1st sample	Comb sample					
<u>Acceptance Life Tests</u>											
---	Survival Rate Life Test (1):	Rp/Id=20, Adc; Notes 10, 16									
---	Survival Rate Life Test End Points (1): (100 hours)	Inoperatives; Note 11	0.4	II							
		Plate Voltage (1): Note 12	1.0	II			ΔEb: ---	---	5	%	
		Plate Voltage (2): Note 12	1.0	II			ΔEb: ---	---	5	%	
4.11.5	Intermittent Life Test (2):	Bulb T=150°C min; Notes 13, 14, 16									
4.11.4	Intermittent Life Test End Points (2): (500 hours)	Regulation Plate Voltage (2) Plate Voltage (1) Ionization Voltage (1) ΔPlate Voltage (1) Note 15 ΔPlate Voltage(2) Note 15			2 1 1 2	5 3 3 5	Reg: --- (2)Eb: 142 (1)Eb: ---	---	8 156	Vdc Vdc Vdc	←
							Es: --- ΔEb: ---	---	165 2	Vdc %	
							ΔEb: ---	---	2	%	

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- Note 1: A fixed resistor may be used and Ebb varied to give the desired current.
- Note 2: If it is desired to check quality subsequent to lot acceptance, the conditions and acceptance limits set forth in this specification shall apply. When 100% testing is performed and the results indicate that the percentage of defectives is equal to or less than the specified AQL values, the lot is deemed as complying with the intent of the specification.
- Note 3: There shall be no evidence of flashover or corona at the leads of the tubes at the absolute maximum rated voltages at 60,000 feet.
- Note 4: This Test shall be conducted on the initial production lot and thereafter on a lot every 30 days approximate. In the event of lot failure, the lot is rejected and the succeeding lot is subjected to this test. Once a lot has passed, the 30 day rule shall apply. MIL-STD-105, sample size code letter F, Normal and Tightened inspection tables to apply.
- Note 5: Glass Strain Test consists of completely submerging the tube into boiling water (97° C-100° C) for a period of 15 seconds, then immediately plunging into cold water (0° C-3° C). The amount of water shall be at least two (2) liters per fifteen tubes. Tubes for this test shall have been exhausted a minimum of 48 hours prior to performance of this test. Reject for loss of vacuum. This is not considered to be a destructive test.
- Note 6: The AQL for the combined defectives for attributes in Group D 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 7: Test for Lot-Average Acceptance: Select a 35 tube sample at random for the lot. Number these tubes consecutively. See Par. 5.3.3.8.2 of "Inspection Instructions for Electron Tubes".
- Test for Lot - Dispersion Acceptance: Select a 35 tube sample at random for the lot. Number these tubes consecutively. See Par. 5.3.3.8.1 of "Inspection Instructions for Electron Tubes". A lot failing to comply with the requirements of this test, may be resubmitted but once for re-evaluation of the failed parameter.
- Note 8: 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 have been exposed to light for at least 24 hours prior to testing.
- Note 9: Reference MIL-STD-105, sample size code letter G. Normal and Tightened inspection tables to apply.
- Note 10: Means of Assuring Survival Rate - 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 plans for use at 100 hours. The sample size is dependent upon lot size, and transfer between normal, reduced and tightened inspection is dependent upon quality history.

Selection of Inspection Scheme

Normal Inspection - Normal inspection shall be used initially and shall be continued until reduced or tightened inspection is used.

Reduced Inspection - Reduced inspection may be used if the conditions for reduced inspection specified in MIL-STD-105 (par. 9.3.3.) are met, or if no lot in the last 10 lots inspected shall have been declared non-conforming for life test qualities. A tube that has qualified for reduced inspection shall revert to normal inspection under either of the following conditions:

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Note 10: Continued

- (1) If a lot is indicated to be non-conforming by the reduced inspection plan.
- (2) If the present 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.

Tightened Inspection - Tightened inspection shall be used when called for by MIL-STD-105, (paragraph 9.3.2) or when two or more lots in the last 10 lots inspected are declared non-conforming for life test qualities. Tightened inspection shall be used to re-evaluate the quality of any lot previously declared non-conforming. Normal inspection may replace tightened inspection in accordance with the provisions of MIL-STD-105.

Selection of Sampling Plans - The requisite rate of failure (AQL's) shall be designated as acceptance inspection conditions in the applicable tube specification sheets.

The Survival Rate Life Test Sample - The sampling plans used with the Survival Rate Life Test sample shall be as follows:

Normal Inspection Plan - The sampling plan used in conjunction with the Survival Rate Life Test Sample when normal inspection is in effect shall be selected by using Inspection Level II in Table III of MIL-STD-105 to determine the Sample Size Code Letter and Table IVA (Single Sampling) or Table IV-B (Double Sampling) to determine 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 8001 tubes.

Either single or double sampling may be used at the option of the manufacturer. Multiple Sampling is not recommended for this application because of the time element.

Reduced Inspection Plan - The sampling plan used in conjunction with the Survival Rate Life Test Sample when reduced inspection is in effect shall be selected by using Inspection Level II in Table III of MIL-STD-105 to determine the Sample Size Code Letter and Table V to determine 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 8001 tubes.

If the indicated sample is less than 22 tubes, the actual sampling plan shall be that called for by use of the specified AQL and sample size code letter "K".

Tightened Inspection Plan - The sampling plan used in conjunction with the Survival Rate Life Test Sample when tightened inspection is in effect shall be selected by using Inspection Level II in Table III of MIL-STD-105 to determine the Sampling Size Code Letter and the tightened sampling plans in table IV-A (Single Sampling) or table IV-B (Double Sampling) to determine 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 8001 tubes. Either single or double sampling may be used at the option of the manufacturer.

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.

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Note 10: Continued

If such selection results in a sample containing one or more tubes which are defects as described in "Short and Continuity Test for Reliable Tubes" (4.7.5, MIL-E-1), or Δ the Plate Voltage (1) or Δ Plate Voltage (2) tests, such tubes shall be replaced by randomly selected good tubes. The selection of tubes for Survival Rate Life Test Sample shall be made in a manner approved by the Service inspector. At the end of 100 hours those tubes which meet the initial test requirements shall not be considered to have undergone a destructive test.

Inspection Procedure

- a. Conduct Survival Rate Life Test Sample for 100 hours under specified life test conditions or equivalent.
- b. Tubes to be tested at 100 hour period as provided in "Short and Continuity Test for Reliable Tubes", paragraph 4.7.5 MIL-E-1.
- c. Determine the number of defective tubes at the 100 hour period.
- d. If more than the allowable number of defectives occur, declare the lot non-conforming.
- e. A lot failing to comply with the requirements of this test may be resubmitted but once for re-evaluation. The resubmitted lot shall comply to all test requirements of this TSS except those of Groups A, B and F.

Note 11: An inoperative as referenced in Life Test shall be defined as a tube having one (1) or more of the following defects: discontinuity (Ref. MIL-E-1, par. 4.7.1), shorts (Ref. MIL-E-1, par. 4.7.2) and air leaks.

Note 12: Δ Plate Voltage (1) is the change of plate voltage (1) from its value at the beginning of life to that at the specified life hour. Δ Plate Voltage (2) is a similar quantity relative to plate voltage (2). They should be expressed as percentages. Plate voltages ΔE_b are changes in individual tubes.

Note 13: Conditions are the same as "Survival Rate" Life Test except that plate voltage should be cycled intermittently on a schedule of 100 min. "on" and 20 min. "off". Life hours shall consist of "on" time only.

Note 14: Intermittent Life Tests:

- a. Paragraph 4.11 of MIL-E-1 shall be revised so that the mean electrode potentials (except heater or filament) shall not deviate by more than five (5) percent from the specified values.
- b. The life test sample shall consist of 20 tubes selected at random or as indicated in note 10. In the event of failure on the first sample, a second sample shall be selected from the lot (Ref. MIL-STD-105, sample size code letter I, Normal Inspection Tables). The first 40 tubes from this sample which meet the initial test characteristics limit of Intermittent Life Test after being operated at life conditions for one (1) hour (plus 30 minutes; minus 0 minutes) shall become the second Intermittent Life Test Sample. Acceptance shall than be based on the combined first and second samples.
- c. The life test sample shall be read at the following times:
0 hours
500 hours (plus 48 hours; minus 24 hours)
Additional reading periods may be used at the discretion of the electron tube manufacturer.
- d. Acceptance Criteria: The lot shall be considered satisfactory for acceptance providing:

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Note 14: Continued

1. The change of the average of any characteristic in the life test sample specified for Life Test control of averages is not exceeded. The average percentage change shall be ascertained from the determination of the individual changes for each tube in the Life Test sample from the zero (0) hour value for the referenced characteristic or characteristics. For purposes of computation of this average percentage change, the absolute values of the individual changes for each tube in the Life Test sample shall be used. Any tube found inoperative during Life Testing shall not be considered in the calculation of this average.
2. The specified allowable defects per item are not exceeded.
3. Not more than a total of three (3) defectives occur in the first sample or six (6) defectives occur in the combined first and second samples for the 500 hours tests.
- e. A lot failing to comply with the requirements of this test, may be resubmitted but once for re-evaluation. The resubmitted lot shall comply to all test requirements specified except those of groups A, B and F.

Note 15: Plate voltages ΔE_b are the average changes of plate voltage from 0 to 500 hours. Inoperatives shall not be considered in the calculation of this average.

Note 16: Order for Evaluation of Life Test Defects: In the event that a tube is defective for more than one (1) attribute characteristic, the lowest number characteristic in the table shall constitute the failure:

- | | |
|-------------------------------|-------------------------------|
| 1. Regulation | 6. Δ Plate voltage (2) |
| 2. Plate voltage (2) | 7. Δ Plate voltage (1) |
| 3. Plate voltage (1) | 8. Ionization voltage (1) |
| 4. Δ Plate voltage (2) | 9. Ionization voltage (2) |
| 5. Δ Plate voltage (1) | |

Note 17: Reference specification shall be of the issue in effect on the date of invitation for bid.