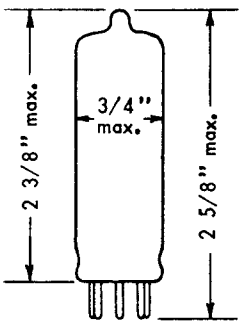
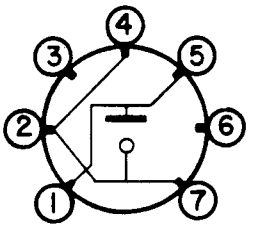
Excellence in Electronics

TYPE 0A2WA

The 0A2WA is a cold cathode, gas-filled diode of miniature construction designed for reliable service as a voltage regulator. It has an operating current range of 5 to 30 milliamperes over which it maintains a substantially constant operating voltage of 150 volts. Three cathode pins are provided which may be used to disconnect the load when the tube is removed from the socket. This type is characterized by long life and it is designed for service where severe conditions of high temperature and mechanical shock or vibration are encountered.





BOTTOM VIEW

5B0

MECHANICAL DATA

ENVELOPE: T-5½ Glass

BASE: Miniature Button 7-Pin

TERMINAL CONNECTIONS:

Pin 1 Anode	Pin 5 Anode
Pin 2 Cathode	Pin 6 Internal Connection
Pin 3 Internal Connection	Pin 7 Cathode
Pin 4 Cathode	

MECHANICAL RATINGS:

Maximum Impact Acceleration (Shock Test - Note 2)	900 G
Maximum Vibrational Acceleration (96 Hour Fatigue Test - Note 3)	2.5 G
Maximum Bulb Temperature	150 °C

MOUNTING POSITION: Any

APPLICATION DATA

A warm up period of 3 minutes should be allowed each time the equipment is turned on in order to insure minimum voltage drift. After this time the bulb temperature should have reached its equilibrium level.

Attention should be given to the specified minimum supply voltage to insure operation in the darkness.

A series resistor must always be used with the 0A2WA. The resistance value must be chosen so the maximum current is not exceeded at the highest anode-supply voltage and so that the minimum current rating is always exceeded at the lowest anode-supply voltage.

When a shunt capacitor is used its maximum value should be limited to 0.1 μf. A larger value may cause the tube to oscillate and thus give unstable performance.

Special attention should be given to the bulb temperature of the tubes. Reliability will be severely impaired if the maximum bulb temperature is exceeded.

Tube characteristics may deteriorate markedly if the tubes are stored at elevated ambient temperatures without drawing current.

ELECTRICAL DATA

Ratings:	Ebb Vdc:	Total Darkness Ionization Voltage Vdc:	Ambient Light Ionization Voltage Vdc:	Operating Voltage Vdc:	Operating Current Range mAdc (Note 4)	Bulb Temperature °C (Note 4)	Ambient Temperature °C (Note 4)
Design Maximum:	----	----	----	158	30	+150	----
Minimum:	----	165	165	140	5	----	–55

Tentative Data

Printed in U.S.A.

RAYTHEON MANUFACTURING COMPANY

RECEIVING TUBE AND SEMICONDUCTOR OPERATIONS

NEWTON 58, MASS.

ELECTRICAL DATA (Cont'd.)

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)

TEST	CONDITIONS	AQL %	MIL-E-1 SYMBOL	MIN	LAL	AVG.	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS – PART 1		**(Combined AQL = 1.0% excluding Mechanical and Inoperatives)**								
Ionization Voltage (1):	Rp/Ib = 5 – 30 mAdc Ambient Light	0.4	(1) Ez:	----	----	152	----	165	----	Vdc
Tube Voltage Drop (1):	Rp/Ib = 30 mAdc	0.4	(1) Etd:	144	----	150.6	----	153	----	Vdc
Tube Voltage Drop (2):	Rp/Ib = 5 mAdc	0.4	(2) Etd:	144	----	149	----	153	----	Vdc
Regulation:	(1) Etd – (2) Etd	0.4	Reg.:	----	----	----	----	± 5.0	----	Vdc
Continuity and Shorts: (Inoperatives)		0.4	----	----	----	----	----	----	----	----
Mechanical:	Envelope 6 – 5	----	----	----	----	----	----	----	----	----
MEASUREMENTS ACCEPTANCE TESTS – PART 2										
Noise:	Rp/Ib = 30 mAdc; R_L = 500 ohms	1.0	Eb:	----	----	<1.0	----	5.0	----	mVac
Oscillation:	Esig = 100 mVac; Rp/Ib = 5 – 30 mAdc; R_L = 500 ohms	1.0	----	----	----	----	----	----	----	----
Voltage Jump:	Rp/Ib = 5 – 30 mAdc. (Note 6)	2.5	Jump:	----	----	<100	----	600	----	mVdc
Ionization Voltage (2):	Rp/Ib = 5 – 30 mAdc; Total Darkness (Note 5)	2.5	(2) Ez:	----	----	156	----	165	----	Vdc
Leakage:	Eb = 50 Vdc; Rp = 3000 ohms	2.5	Llb:	----	----	<1	----	5	----	μAdc
Tube Voltage Drop (3):	Rp/Ib = 20 mAdc	2.5	(3) Etd:	144	----	149.8	----	153	----	Vdc
Repeatability:	Rp/Ib = 10 mAdc; 1 min. on; 1 min off. (Note 8)	2.5	Δ Etd:	----	----	300	----	600	----	mVdc
Low Pressure Voltage Breakdown:	Pressure = 3.1 ± 0.2 mmHg; Ebb = 200 Vdc; Rp/Ib = 20 mAdc	6.5	----	----	----	----	----	----	----	----
Vibration (2):	Rp = 10,000 ohms; Ebb/Ib = 20 mAdc; F = 25 cps; G = 2.5	2.5	Ep:	----	----	<10	----	100	----	mVac
DEGRADATION RATE ACCEPTANCE TESTS										
Shock:	Hammer Angle = 60°; (Note 2)	20	----	----	----	----	----	----	----	----
Fatigue:	G = 2.5; Fixed Frequency F = 25 min., 60 max. (Note 3)	6.5	----	----	----	----	----	----	----	----
Post Shock and Fatigue Test End Points:										
Vibration (2):	F = 25 cps; G = 2.5; Ebb/Ib = 20 mAdc; Rp = 10,000 ohms	----	Ep:	----	----	----	----	100	----	mVac
Ionization Voltage (1):	Rp/Ib = 5 – 30 mAdc	----	(1) Ez:	----	----	----	----	165	----	Vdc
Tube Voltage Drop (1):	Rp/Ib = 30 mAdc	----	(1) Etd:	142	----	----	----	155	----	Vdc
Tube Voltage Drop (2):	Rp/Ib = 5 mAdc	----	(2) Etd:	142	----	----	----	155	----	Vdc
Regulation:	(1) Etd – (2) Etd	----	Reg.:	----	----	1.5	----	5.0	----	Vdc
Miniature Base Strain Test:		----	----	----	----	----	----	----	----	----
Glass Strain (Thermal Shock):		2.5	----	----	----	----	----	----	----	----

ELECTRICAL DATA (Cont'd.)

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1) (cont'd.)

TEST	CONDITIONS	AQL %	MIL-E-1 SYMBOL	MIN	AVG.	MAX	MIL-E-1 UNITS	Allowable Defects per Characteristic 1st Sample	Allowable Defects per Characteristic Combined Samples
ACCEPTANCE LIFE TESTS									
1 Hour Stability Life Test:	TA= Room; Rp/Ib= 20 mAdc	1.0	----	----	----	----	----		
1 Hour Stability Life Test End Points:	(Typical Sample Size= 50 tubes)	----	----	----	----	----	----		
Change in Tube Voltage Drop (3) of individual tubes:	(Note 7)	----	Δ_t (3) Etd:	----	----	2.0	Vdc		
100 Hour Survival Rate Life Test:	TA= Room; Rp/Ib= 20 mAdc	----	----	----	----	----	----		
100 Hour Survival Rate Life Test End Points:	(Typical Sample Size = 200 tubes)	----	----	----	----	----	----		
Continuity and Shorts (Inoperatives):		0.65	----	----	----	----	----		
Change in Tube Voltage Drop (3) of individual tubes:	(Note 7)	1.0	Δ_t (3) Etd:	----	----	5.0	Vdc		
Intermittent High Temperature Life Test:	T Bulb= 150°C Rp/Ib= 20 mAdc	----	----	----	----	----	----		
500 Hour Intermittent High Temperature Life Test End Points:	(Typical Sample Size= 20 tubes 1st sample, 40 tubes 2nd sample)	----	----	----	----	----	----		
Inoperatives:		----	----	----	----	----	----	1	3
Regulations:		----	Reg.:	----	1.8	6.0	Vdc	1	3
Tube Voltage Drop (1):		----	(1) Etd:	142	150	155	Vdc	1	3
Tube Voltage Drop (2):		----	(2) Etd:	142	148	155	Vdc	1	3
Tube Voltage Drop (3):		----	(3) Etd:	142	149	155	Vdc	1	3
Change in Tube Voltage Drop (3) of individual tubes:	(Note 7)	----	Δ_t (3) Etd:	----	1.0	6.0	Vdc	1	3
Ionization Voltage (1):		----	(1) EZ:	----	151	165	Vdc	1	3
Total Defectives:		----	----	----	----	----	----	4	8
1000 Hour Intermittent High Temperature Life Test End Points:	(Typical Sample Size= 20 tubes 1st sample, 40 tubes 2nd sample)	----	----	----	----	----	----	---	---
Inoperatives:		----	----	----	----	----	----	2	4
Regulations:		----	Reg.:	----	2.0	8.0	Vdc	2	4
Tube Voltage Drop (1):		----	(1) Etd:	140	149.7	158	Vdc	2	4
Tube Voltage Drop (2):		----	(2) Etd:	140	147.8	158	Vdc	2	4
Tube Voltage Drop (3):		----	(3) Etd:	140	149.5	158	Vdc	2	4
Change in Tube Voltage Drop (3) of individual tubes:	(Note 7)	----	Δ_t (3) Etd:	----	1.2	8.0	Vdc	2	4
Ionization Voltage (1):		----	(1) EZ:	----	151	165	----	2	4
Total Defectives:		----	----	----	----	----	----	5	10

NOTES:

Note 1: Characteristics, Quality Control Test Procedures, and Inspection Levels are made according to the appropriate paragraphs of MIL-E-1, "Inspection Instructions for Electron Tubes" and MIL-STD-105A.

Note 2: Test conditions and acceptance criteria per Shock test procedures of MIL-E-1 basic specifications.

ELECTRICAL DATA (Cont'd.)

NOTES (Cont'd.)

Note 3: Test Conditions and acceptance criteria per Fatigue Test Procedures of MIL-E-1 basic specifications.

Note 4: Limits beyond which normal tube performance and tube life may be impaired.

Note 5: This test conducted in total darkness after tubes have been held in darkness for 24 hours.

Note 6: The current shall be varied from 5 to 30 mA and back to 5 mA (by adjusting R or Ebb slowly). Sudden voltage jumps registered on an oscilloscope shall not be greater than 600 millivolts.

Note 7: Δ_t Tube Voltage drop is the change in tube voltage drop from its value at the beginning of life to that at the life hour specified. This applies to individual tubes.

Note 8: Repeatability shall be defined as the maximum shift in tube voltage drop between any two firings of the tube. The test shall be made in the following manner. The tube voltage drop shall be read at 10 mA drain at the end of the specified "on" time. The tube is then turned off for the specified "off" time. The tube is restarted and operated at the same current. The voltage drop is read after the specified on time. The on-off cycle must be repeated a minimum of 5 times. The maximum difference in tube voltage drop shall be taken as the measure of repeatability.