



ELECTRONIC TUBE REFERENCE

0A2WA

Voltage Regulator electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

VOLTAGEREGULATOR

Ruggedized special-quality 150 V gas regulator for military and industrial equipment, emphasizing controlled regulation, reliability, vibration resistance, and long life.

GENERAL CHARACTERISTICS

BASE DESIGNATION	B7G	BASE PINS	7
NOMINAL HEATER	0 V / 0 mA	PARALLEL HEATER	– / –
HEATING	Indirect; cold cathode	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Voltage Regulator	
REGULATOR VOLTAGE	150 V
MINIMUM REGULATOR CURRENT	5 mA
MAXIMUM REGULATOR CURRENT	30 mA
STARTING VOLTAGE	165 V
MAINTAINING VOLTAGE	150 V
<i>Published ratings and characteristics promoted semantically from the approved source; repeated identical sections compressed where applicable.</i>	

0A2WA — Cold-Cathode Gas-Filled Voltage Regulator

The **0A2WA** (also written as **0A2WA** or **OA 2 WA**) is a Special Quality, cold-cathode, gas-filled diode designed for highly reliable voltage stabilization. Developed for the French "Service Technique des Télécommunications de l'AIR" and manufactured by Société Française Radio-Électrique (which later

merged with C.S.F.), this tube provides a substantially constant 150 V output over a wide operating current range. It is engineered to withstand severe environmental conditions, including high temperatures, mechanical shock, and intense vibration, making it ideal for stabilized power supplies and high-voltage bias sources in mobile and industrial electronics.

Mechanical Design, Base, and Pinout

The 0A2WA is constructed with a robust glass envelope (T-5½ bulb, outline A 19-4 UTE) and a miniature 7-pin button base (B7G / 7C10). The tube has a net weight of approximately 10.5 grams and can be mounted in any position.

Physical Dimensions

- **Maximum Diameter:** 19.0 mm
- **Height (excluding pins):** 50.8 ± 2.3 mm
- **Maximum Seated Height:** 60.1 mm
- **Maximum Overall Length:** 66.7 mm
- **Pin Diameter:** 1.02 ± 0.05 mm (0.040 inches nominal)
- **Pin Circle Diameter:** 9.53 mm to 11.1 mm

Pinout Configuration

The 7-pin miniature base utilizes the following connections (viewed from the bottom):

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

The dual anode (pins 1 and 5) and triple cathode (pins 2, 4, and 7) connections provide a built-in safety feature. By wiring the load through the redundant pins, removing the tube from its socket automatically breaks the circuit and disconnects the high voltage from the load, protecting downstream components.

Electrical Characteristics and Operating Limits

The 0A2WA operates as a single-gap shunt regulator. It requires a minimum supply voltage to initiate ionization (striking), after which it maintains a stable voltage drop across its terminals.

Absolute Maximum Ratings

- **Cathode Current (Continuous):** 5.0 mA minimum to 30 mA maximum
- **Starting Current (Transient):** 75 mA maximum (for a duration not exceeding 10 seconds)
- **Inverse Anode Voltage:** 125 V maximum
- **Shunt Capacitance:** 0.1 μ F maximum
- **Bulb Temperature:** -55 °C minimum to +150 °C maximum
- **Ambient Temperature:** -55 °C minimum to +90 °C maximum
- **Altitude (Unpressurized):** 120,000 feet (36 km) maximum

Ionization and Operating Voltages

To ensure reliable starting in both ambient light (50 to 500 lux) and total darkness, the minimum supply voltage must be at least 165 Vdc. Under typical conditions, the ionization voltage averages 152 Vdc in ambient light and 156 Vdc in total darkness. Once ionized, the nominal regulated voltage is approximately 150 Vdc (typically 149 Vdc, with an allowable range of 140 Vdc to 158 Vdc depending on current and tube age).

Quality Control and Typical Performance

Under MIL-E-1 quality control testing, the 0A2WA exhibits highly stable electrical characteristics. Typical performance parameters for new tubes include:

- **Tube Voltage Drop (at 5 mA):** 144 Vdc minimum, 149.0 Vdc average, 153 Vdc maximum
- **Tube Voltage Drop (at 20 mA):** 144 Vdc minimum, 149.8 Vdc average, 153 Vdc maximum
- **Tube Voltage Drop (at 30 mA):** 144 Vdc minimum, 150.6 Vdc average, 153 Vdc maximum
- **Regulation (5 to 30 mA):** 5.0 Vdc maximum
- **Voltage Jump (5 to 30 mA):** <100 mVdc average, 600 mVdc maximum (measured by slowly cycling the current)
- **Noise Output (at 30 mA, 500 Ω load):** <1.0 mVac average, 5.0 mVac maximum (50 to 5000 Hz)
- **Leakage Current (at 50 Vdc, 3000 Ω series resistance):** <1 μ Adc average, 5 μ Adc maximum
- **Repeatability (at 10 mA, 1 min on / 1 min off):** 300 mVdc average, 600 mVdc maximum shift between firings

Long-Term Stability and Degradation

The 0A2WA is designed for extended service life, but its characteristics gradually shift over time. Equipment designers must account for these end-of-life and aging limits:

Parameter	Initial (New)	After 500 Hours	After 1000 Hours
Minimum Voltage Drop (at 5 mA)	>144 V	>142 V	>140 V

Parameter	Initial (New)	After 500 Hours	After 1000 Hours
Maximum Voltage Drop (at 30 mA)	<153 V	<155 V	<158 V
Maximum Regulation (5 to 30 mA)	<5.0 V	<6.0 V	<8.0 V
Anode Voltage Drift (at 20 mA, 150 °C)	—	2.0 V typ (<6.0 V max)	3.0 V typ (<8.0 V max)

A 1-hour stability life test at room temperature with a 20 mA operating current permits a maximum individual change in voltage drop of 2.0 Vdc. Over a 100-hour survival test, this change is limited to 5.0 Vdc.

Circuit Design and Operating Guidelines

To achieve stable regulation and prevent premature failure, several circuit design guidelines must be observed:

Series Resistor Selection

A series resistor must always be placed between the unregulated supply voltage and the 0A2WA anode. The resistor value must satisfy three conditions:

1. It must allow the anode voltage to rise above the 165 V striking threshold before ionization occurs, even at the minimum supply voltage and maximum load current.
2. It must limit the continuous tube current to a maximum of 30 mA when the supply voltage is at its maximum and the load current is at its minimum.
3. It must maintain at least 5 mA of tube current when the supply voltage is at its minimum and the load current is at its maximum.

Shunt Capacitance and Oscillation

The total capacitance in parallel with the 0A2WA must not exceed 0.1 μ F. Because gas-discharge tubes exhibit negative resistance characteristics, any capacitance above this limit can form a relaxation oscillator, causing severe voltage instability and output noise.

Transient and Thermal Behavior

- **Starting Current:** The tube can tolerate a brief turn-on current spike of up to 75 mA for up to 10 seconds. However, passing this high current alters the gas equilibrium; it can take up to 20 minutes of normal operation for the tube to return to its nominal regulated voltage.
- **Warm-up Period:** A minimum warm-up of 3 minutes is recommended after power-on to allow the bulb temperature to stabilize and minimize initial voltage drift.

- **Current History and Rest Effects:** The exact regulated voltage is slightly dependent on the tube's recent current history and can shift slightly after a long period of rest.
- **Storage:** Storing the tube at high ambient temperatures without drawing current can cause marked deterioration of its electrical characteristics.

Parallel and Series Configurations

- **Parallel Operation:** Placing multiple 0A2WA tubes in parallel to handle higher load currents is generally discouraged. It requires a series resistor of approximately 100 ohms in series with each individual tube to force current sharing. This significantly degrades the overall regulation efficiency and can lead to ignition failures.
- **Series Operation:** Two 0A2WA tubes can be connected in series to form a stable 300 V supply, which also provides a convenient 150 V intermediate tap. Removing either tube from its socket safely disconnects the load from the supply.

Environmental and Ruggedness Ratings

The 0A2WA is built to withstand extreme physical stress in military and industrial environments. These ratings are verified through rigorous quality control testing:

- **Shock Resistance:** Capable of withstanding impact accelerations up to 900 G. This is evaluated using five successive blows of 450 G applied in four directions along three perpendicular axes, or via standard hammer impact tests.
- **Vibration Resistance:** Designed to withstand continuous vibration fatigue of 2.5 G peak acceleration. This is tested by applying sinusoidal vibrations at 25 Hz or 50 Hz for up to 96 hours across three perpendicular axes.

Technical Summary

The **0A2WA** is a ruggedized, cold-cathode, gas-filled voltage stabilizer designed to provide a constant **150 V** reference. Operating over a current range of **5 to 30 mA**, it features a miniature 7-pin base with redundant pin connections that act as an automatic load-disconnect safety switch. With its high resistance to mechanical shock (up to **900 G**) and vibration (up to **2.5 G**), the 0A2WA is a highly reliable component for military, aeronautical, and industrial power supplies.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1938 Raytheon

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1938 RAYTHEON

Section 1 · Voltage Regulator

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
it maintains a substantially constant operating voltage of	150 volts	it maintains a substantially constant operating voltage of 150 volts, Three cathode pins are pro-
Ionization Voltage (	165 mAdc	Ionization Voltage (1): $R_p/I_b=5-30$ mAdc 0.4 (1)Ez: -ceee eeus 152 «ees 165 aeee Vde
Tube Voltage Drop (	153 mAdc	Tube Voltage Drop (1): $R_p/I_b=30$ mAdc 0.4 (1)Erd: 144 == 150.6 --- 153 ases Ydc
Tube Voltage Drop (	153 mAdc	Tube Voltage Drop (2): $R_p/1b=5$ mAdc 0.4 (2)Etd: 144 .-. 149 «ee. 153 ~eee Vde
Regulation: (	50 Vdc	Regulation: (1) Etd - (2) Etd 0.4 Reg.: sere sers aeae ceee £50 eees Vdc
Noise: $R_p/ b=$	0 mAdc	Noise: $R_p/ b= 30$ mAdc; 1.0 Eb: sese cone L1,0
RL=	50 ohms	RL=500 ohms eeee 50 aeen mVac
$R_p/$	-30 mAdc	$R_p/1b=5-30$ mAdc;
Voltage Jump: $R_p/b=$	600 mAdc	Voltage Jump: $R_p/b=5\sim 30$ mAdc. 25 Jump: seee eeve 2100 cees 600 e... mVde
Ionization Voltage (	165 mAdc	Ionization Voltage (2): $R_p/I_b=5-30$ mAdc; 2.5 (2)Ez: cese eaan 156 eceee 165 cece Vde
Leakage: Efi	5 Vdc	Leakage: Efi: 50 Vdc; $R_p=3000$ 2,5 Lib: vees mnae &) cene 5 eeee pAde
Tube Voltage $R_p/$	153 mAdc	Tube Voltage $R_p/1b=20$ mAdc 2.5 (3)Etd: 144 --- c 149.8 +..e 153 ceoe Vdc
Repeatability: $R_p/b=$	600 mAdc	Repeatability: $R_p/b=10$ mAdc; 2.5 AEtd: nees e- . 300 <--- 600 -. mVde
Ebb=	200 Vdc	Ebb=200 Vdc; $R_p/ b=$
Vibration (	100 ohms	Vibration (2): $R_p= 10,000$ ohms;Ebb/ $I_b= 2.5$ Ep: cees cene &l0 ee-. 100 «eee mVac

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Ionization Voltage R_p/I_b	165 mA_{dc}	Ionization Voltage $R_p/I_b=5-30$ mA _{dc} I (NEZ: ecae eeee eese eees 165 cone V _{dc})
Tube Voltage Drop $R_p/I_b=$	155 mA_{dc}	Tube Voltage Drop $R_p/I_b= 30$ mA _{dc} --es (1) E _{rd} : 142 ceee een ae-n 155 eee- V _{dc}
Tube Voltage Drop $R_p/i_b=$	155 mA_{dc}	Tube Voltage Drop $R_p/i_b=5$ mA _{dc} seee (2) E _{td} : 142 ceee veee aune 155 eeee V _{dc}
Change in Tube Voltage (Note 7)	50 V_{dc}	Change in Tube Voltage (Note 7) 1.0 A' (3)E _{td} : e --e. 50 V _{dc}
Intermittent High Temp- T Bulb=	150 °C	Intermittent High Temp- T Bulb=150°C sase sesa ceve eesw seae P
perature Life Test: R_p/I_b	20 mA_{dc}	perature Life Test: $R_p/I_b=20$ mA _{dc}
Regulations: «<s» Reg.: .-«	3 V_{dc}	Regulations: «<s» Reg.: .-« 1.8 6.0 V _{dc} 1 3
Tube Voltage Drop (1)	3 V_{dc}	Tube Voltage Drop (1): cees (1)E _{td} : 142 150 155 V _{dc} 1 3
Tube Voltage Drop (2)	3 V_{dc}	Tube Voltage Drop (2): cees (2)E _{td} : 142 148 155 V _{dc} 1 3
Tube Voltage Drop (3)	3 V_{dc}	Tube Voltage Drop (3): e« (3) E _{td} : 142 149 155 V _{dc} 1 3
Ionization Voltage (1)	3 V_{dc}	Ionization Voltage (1): eeee (1)EZ: eees 151 165 V _{dc} 1 3
Regulations: see» Reg	4 V_{dc}	Regulations: see» Reg.: ---- 2.0 8.0 V _{dc} 2 4
Tube Voltage Drop (2)	4 V_{dc}	Tube Voltage Drop (2): seen (2)E _{td} : 140 147.8 158 V _{dc} 2 4
Tube Voltage Drop (3)	4 V_{dc}	Tube Voltage Drop (3): -ee+ (3)E _{td} : 140 1495 158 V _{dc} 2 4
Note	5 mA	Note 4: The current shall be varied from 5 to 30 mA and back to 5 mA (by adjusting R or E _{bb} stowly). Sudden voltage jumps registered

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
When a shunt capacitor is used its maximum value should be limited to	0.1 pF	When a shunt capacitor is used its maximum value should be limited to 0.1 pF. A larger value may cause the tube to oscillate
V _{de} : V _{dc} : V _{de} : mA _{dc} (Note 4)	4 V_{dc}	V _{de} : V _{dc} : V _{de} : mA _{dc} (Note 4) °C (Note 4) °C (Note 4)
made in the following manner. The tube voltage drop shall be read at	10 mA	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



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1958 Compagnie General

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1958 COMPAGNIE GENERAL

Section 1 · Voltage Regulator

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Nominal Maintaining Voltage	150 V	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Starting Voltage	165 V	Dark condition where applicable
Regulating Current Minimum	5 mA	—
Regulating Current Maximum	30 mA	—
Maximum Shunt Capacitance	0.1 uF	—



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1960 RCA Industrial and Communications Types

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1960 RCA INDUSTRIAL AND COMMUNICATIONS TYPES

Section 1 · Voltage Regulator

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MilitarySpecificationDesign	1 boolean	PremiumTube



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1968 Mazda Belvu

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1968 MAZDA BELVU

Section 1 · Voltage Regulator

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
StrikingVoltage	185 V	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MaintainingCurrentMinimum	5 mA	—
MaintainingCurrentMaximum	30 mA	—



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1971 English Electric Valve

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1971 ENGLISH ELECTRIC VALVE

Section 1 · Voltage Regulator

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Operating voltage	150 V	Approximate

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Cathode current range	5 mA–30 mA	—
Striking voltage in normal lighting	165 V	—

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Striking voltage in total darkness	165 V	—



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

SOURCE PDF

1999 Philips 0-D

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1999 PHILIPS 0-D
Section 1 · Voltage Regulator

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
StartingCurrent	75 mA	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Regulation	6 V	Ia=5-30 mA