



## ELECTRONIC TUBE REFERENCE

## 0A2

Voltage Regulator electronic tube

CONSOLIDATED TECHNICAL DATA

## 1 SECTION

CONSTRUCTION

## VOLTAGEREGULATOR

Cold-cathode gas voltage regulator providing a nominal 150 V stabilized reference over roughly 5–30 mA without heater power.

## 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                                                   | 185 V |
| MAINTAINING VOLTAGE                                                | 150 V |
| Published handbook ratings and operating characteristics reviewed. |       |

## 0A2 — Cold-Cathode Gas-Filled Voltage Regulator

A cold-cathode, glow-discharge, gas-filled miniature diode designed to provide a stable 150-volt DC output across a variable load or from a fluctuating supply voltage.

## Overview

The **0A2** is a cold-cathode, gas-filled voltage regulator (also referred to as a voltage stabilizer) housed in a miniature glass envelope. It is designed to maintain a sensibly constant DC operating voltage of approximately 150 V across a load, accommodating moderate variations in both the load current and the unregulated supply voltage.

The tube operates on the principle of a glow discharge within an inert gas atmosphere. Unlike vacuum tubes with heated filaments, the 0A2 does not contain a heater, making it a cold-cathode device. It is widely utilized in power supply regulation, voltage reference circuits, and industrial applications. The device is also designated under service types such as [CV1832](#) and [CV8161](#).

## Mechanical Construction, Base, and Pinout

The 0A2 is constructed using a miniature glass bulb (T-5 1/2 outline) with a miniature button 7-pin base. The physical dimensions of the tube are highly standardized:

| Dimension      | Maximum Value (Inches) | Maximum Value (Metric) |
|----------------|------------------------|------------------------|
| Overall Length | 2.618 in (or 2 5/8 in) | 66.5 mm                |
| Seated Height  | 2.366 in               | 60.1 mm                |
| Bulb Diameter  | 0.748 in (or 3/4 in)   | 19.0 mm                |

The tube uses the **B7G** (or **B.S.448-B7G**, JETEC **5BO**) base configuration. The pin connections, viewed from the bottom of the base, are assigned as follows:

- **Pin 1:** Anode
- **Pin 2:** Cathode
- **Pin 3:** Internal Connection (IC)
- **Pin 4:** Cathode
- **Pin 5:** Anode
- **Pin 6:** Internal Connection (IC)
- **Pin 7:** Cathode

The duplicate anode (Pins 1 and 5) and cathode (Pins 2, 4, and 7) connections are not merely redundant; they are designed to be wired as an integrated safety disconnect. By routing the unregulated input voltage through Pin 5 and taking the regulated output from Pin 1, removing the 0A2 from its socket physically breaks the connection to the load. This prevents high, unregulated voltage from reaching and potentially damaging downstream components.

The 0A2 can be mounted and operated in **any position**.

# Electrical Characteristics and Operating Parameters

The electrical behavior of the 0A2 is defined by its ionization (striking) voltage, its nominal operating voltage, and its current-handling limits.

## Striking and Operating Voltages

Before the tube can conduct and regulate, the voltage across its electrodes must reach the striking (or ionization) voltage to initiate the gas discharge. This striking voltage is sensitive to ambient light levels:

- **Under Normal Illumination (50 to 500 foot-candles / lux):** The striking voltage is typically 155 V to 180 V, with a maximum limit of 185 V.
- **In Complete Darkness:** The striking voltage can rise up to a maximum of 225 V.

To guarantee reliable starting throughout the operating life of the tube, a minimum DC anode supply voltage of **185 V** must be provided under normal lighting conditions.

Once ionization occurs, the voltage across the tube drops to its nominal operating voltage of **150 V**. At a typical operating current of 17.5 mA, the regulated voltage is guaranteed to fall within the range of **144 V to 164 V** (with some specifications defining a wider range of 140 V to 168 V).

## Current Range and Regulation

The 0A2 is rated for a continuous DC operating current range of **5 mA to 30 mA**. Within this range, the tube exhibits excellent voltage regulation:

- **Nominal Regulation:** 2 V variation across the 5 to 30 mA range.
- **Maximum Regulation:** 6 V variation across the 5 to 30 mA range.

The tube also exhibits low electrical noise, with a maximum root-mean-square (r.m.s.) noise voltage of **5.0 mV** over a frequency range of 50 to 5000 Hz when operating within its rated current limits.

## Absolute Maximum Ratings

To prevent damage and ensure stable operation, the 0A2 must be operated within its absolute maximum limits:

| Parameter                                     | Absolute Limit   |
|-----------------------------------------------|------------------|
| Maximum Continuous DC Cathode Current         | 30 mA            |
| Minimum Continuous DC Cathode Current         | 5 mA             |
| Maximum Average Starting Current              | 75 mA            |
| Maximum Averaging Time (for starting current) | 10 seconds       |
| Maximum Parallel (Shunt) Capacitance          | 0.1 $\mu$ F      |
| Ambient Temperature Range                     | -55 °C to +90 °C |

| Parameter                      | Absolute Limit         |
|--------------------------------|------------------------|
| Maximum Operating Frequency    | 0 cycles/sec (DC only) |
| Maximum Unpressurized Altitude | 3000 meters            |

The tube must always be operated with the correct polarity: the anode must be positive with respect to the cathode. Reverse polarity will degrade the tube and prevent proper regulation.

## Circuit Design and Application Considerations

### Series Resistor Selection

The 0A2 cannot be connected directly across a voltage source. A series resistor must always be placed between the unregulated supply voltage and the tube's anode. This resistor serves two critical functions:

1. It limits the continuous operating current through the tube to a value between 5 mA and 30 mA under all load conditions.
2. It limits the initial starting current during the ionization phase so that it does not exceed the absolute maximum starting rating of 75 mA (averaged over a maximum of 10 seconds).

The value of the series resistor is calculated based on the maximum unregulated supply voltage, the minimum load current, and the nominal 150 V operating drop of the tube.

### Shunt Capacitance and Parasitic Oscillation

To prevent parasitic relaxation oscillations, any capacitor connected in parallel with the 0A2 must be strictly limited to a maximum value of **0.1  $\mu$ F**. If a larger capacitance is placed directly across the tube, the combination of the tube's negative resistance characteristic and the capacitor will form an oscillator, causing severe voltage instability and potential damage to the tube.

### Thermal and Operational History Effects

As a gas-filled device, the 0A2 exhibits specific behaviors related to its operational history and temperature:

- **Starting Current Overload:** If the tube is subjected to high starting currents near its maximum limit, it may take up to **20 minutes** of continuous operation for the regulated voltage to settle back down to its normal, stable operating value.
- **Current History Effects:** The regulation characteristic is slightly affected by the immediate history of the current flow. For example, if the tube has been operating at a low current of 5 mA for an extended period and is suddenly shifted to 25 mA, the resulting regulated voltage may differ slightly from the voltage obtained if the tube had been running at 25 mA continuously.
- **Rest Periods:** Slight variations in regulated voltage may also be observed after the tube has been left in an inoperative state (rest period) for a long duration.

## Multi-Tube Configurations

For applications requiring higher regulated voltages, multiple 0A2 tubes can be connected in series. For example, two 0A2 tubes connected in series can provide a stabilized output of approximately **300 V**, with an intermediate regulated tap of **150 V** available at the junction between the two tubes. In such configurations, the safety disconnect wiring should be maintained across all tubes in the string so that removing any single tube safely de-energizes the entire load circuit.

## Premium and Related Designations

Several ruggedized and military-grade versions of the 0A2 exist to meet specialized requirements:

- **6073 (and 6073/0A2):** A premium version of the 0A2 designed specifically for critical industrial and military applications where the tube is subjected to severe shock and continuous vibration.
- **6626 (and 6626/0A2-WA):** A high-reliability variant designed to meet strict military specifications, such as the MIL-E-1/939B standard.
- **OD3/VR150:** An older, larger octal-base gas regulator tube that shares similar electrical ratings and characteristics (150 V nominal regulation, 5 to 30 mA current range) but is not physically interchangeable due to its different base and envelope size.

## Technical Summary

The **0A2** is a miniature, cold-cathode, gas-filled voltage regulator designed to provide a stable **150 V** DC output. Operating over a current range of **5 mA to 30 mA**, it maintains voltage stability within a maximum of **6 V** (typically **2 V**). It features a 7-pin miniature base (B7G) with duplicate anode and cathode pins that can be wired as a safety disconnect. To ensure reliable starting, a minimum supply voltage of **185 V** is required under normal lighting, which must be increased to **225 V** if the device is operated in complete darkness. Ruggedized equivalents include the **6073** for high shock and vibration environments, and the military-grade **6626/0A2-WA**.



## SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

# 1953 Amperex

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

## 1953 AMPEREX

## Section 1 · Voltage Regulator

## CHARACTERISTICS

| PARAMETER                 | PUBLISHED VALUE | CONDITION / NOTE |
|---------------------------|-----------------|------------------|
| Operating voltage nominal | 150 V           | —                |

## OTHER

| PARAMETER                    | PUBLISHED VALUE | CONDITION / NOTE |
|------------------------------|-----------------|------------------|
| Minimum anode supply voltage | 185 V           | —                |



## SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

# 195X General Electric Essential Characteristics

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

## 195X GENERAL ELECTRIC ESSENTIAL CHARACTERISTICS

## Section 1 · Voltage Regulator

## OTHER

| PARAMETER                    | PUBLISHED VALUE | CONDITION / NOTE        |
|------------------------------|-----------------|-------------------------|
| Minimum anode supply voltage | 185 V           | VoltageRegulatorService |
| Maximum operating current    | 30 mA           | VoltageRegulatorService |

## CHARACTERISTIC

| PARAMETER                 | PUBLISHED VALUE | CONDITION / NOTE        |
|---------------------------|-----------------|-------------------------|
| Minimum operating current | 5 mA            | VoltageRegulatorService |
| Operating voltage         | 150 V           | VoltageRegulatorService |

| PARAMETER          | PUBLISHED VALUE | CONDITION / NOTE        |
|--------------------|-----------------|-------------------------|
| Ionization voltage | 155 V           | VoltageRegulatorService |
| Regulation         | 2 V             | 5 to 30 mA              |


SOURCE DATA APPENDIX

#### SOURCE OPERATING CONDITIONS

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# 195X Raytheon Special Purpose Tubes

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

#### 195X RAYTHEON SPECIAL PURPOSE TUBES

### Section 1 · Voltage Regulator

| CHARACTERISTIC     |                 |                  |
|--------------------|-----------------|------------------|
| PARAMETER          | PUBLISHED VALUE | CONDITION / NOTE |
| Operating voltage  | 150 V           | —                |
| Maximum regulation | 6 V             | 5to30mA          |

| OTHER                           |                 |                  |
|---------------------------------|-----------------|------------------|
| PARAMETER                       | PUBLISHED VALUE | CONDITION / NOTE |
| Minimum operating current       | 5 mA            | —                |
| Maximum operating current       | 30 mA           | —                |
| Minimum starting-voltage supply | 185 V           | —                |


SOURCE DATA APPENDIX

#### SOURCE OPERATING CONDITIONS

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# 1961 Tung Sol

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

#### 1961 TUNG SOL

## Section 1 · Voltage Regulator

| OTHER                           |                 |                  |
|---------------------------------|-----------------|------------------|
| PARAMETER                       | PUBLISHED VALUE | CONDITION / NOTE |
| Minimum DC Anode Supply Voltage | 185 V           | —                |

| CHARACTERISTIC |                 |                  |
|----------------|-----------------|------------------|
| PARAMETER      | PUBLISHED VALUE | CONDITION / NOTE |
| Regulation     | 2 V             | 5 to 30 mA       |



SOURCE DATA APPENDIX

### SOURCE OPERATING CONDITIONS

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# 1966 Tung Sol Electronic Tubes 1 of 4

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

1966 TUNG SOL ELECTRONIC TUBES 1 OF 4

## Section 1 · Voltage Regulator

| OTHER                        |                 |                  |
|------------------------------|-----------------|------------------|
| PARAMETER                    | PUBLISHED VALUE | CONDITION / NOTE |
| DC operating voltage         | 150 V           | —                |
| DC operating current minimum | 5— mA           | —                |
| DC operating current maximum | —30 mA          | —                |

| CHARACTERISTIC      |                 |                  |
|---------------------|-----------------|------------------|
| PARAMETER           | PUBLISHED VALUE | CONDITION / NOTE |
| DC starting voltage | 155 V           | Approximate      |
| Voltage regulation  | —2 V            | Ia=5-30mA        |



SOURCE DATA APPENDIX

# 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 DATA APPENDIX

# 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 | 185 V           | —                |
| Striking voltage in total darkness  | 225 V           | —                |

## SOURCE OPERATING CONDITIONS

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# 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             | I <sub>a</sub> =5-30 mA |

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