

ELECTRONIC TUBE REFERENCE

0B3

Voltage Regulator electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

VOLTAGEREGULATOR

Cold-cathode glow-discharge voltage regulator for heaterless shunt regulation and stable reference-voltage service.

GENERAL CHARACTERISTICS

BASE DESIGNATION	4AJ	BASE PINS	8
NOMINAL HEATER	– / –	PARALLEL HEATER	– / –
HEATING	Indirect; cold cathode	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

4AJ - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN2 – K	A	K – Cathode	CONNECTED
PIN5 – P	A	P – Plate (Anode)	CONNECTED

SECTION RATINGS

SECTION1 Voltage Regulator	
REGULATOR VOLTAGE	90 V
MINIMUM REGULATOR CURRENT	10 mA
MAXIMUM REGULATOR CURRENT	30 mA
STARTING VOLTAGE	125 V
MAINTAINING VOLTAGE	90 V
Published handbook ratings and operating characteristics reviewed.	

0B3 — Cold-Cathode Glow-Discharge Voltage Regulator

The **0B3** (also designated as **OB3**, **OB3/VR90**, or **GL-OB3**) is a cold-cathode, gas-filled, glow-discharge diode designed for voltage regulation. Its primary function is to maintain a practically constant DC output voltage of approximately **90 V** across a load, independent of variations in load current and moderate line-voltage fluctuations.

Unlike active thermionic vacuum tubes, the 0B3 does not contain a heater or filament. Instead, electron emission is achieved from its cold cathode via a potential gradient at the cathode surface. In addition to voltage stabilization, the 0B3 can be utilized in relaxation oscillator circuits and for spark-over protection.

Physical Construction and Basing

The 0B3 is housed in an **ST-12** glass envelope with a **Small Shell Octal 6-Pin** base (base designation **B6-3**). It features a **4AJ** basing arrangement. The tube is designed to be mounted in **any position**.

Physical Dimensions

- **Maximum Overall Length:** 4 1/8 inches
- **Maximum Seated Height:** 3 9/16 inches
- **Maximum Diameter:** 1 9/16 inches
- **Approximate Net Weight:** 1.3 to 2 ounces
- **Approximate Shipping Weight:** 3 pounds

Pin Connections and Safety Jumper

The 0B3 utilizes a 6-pin octal base with the following pinout, viewed from the bottom of the base:

Pin	Connection
1	No Connection (NC)
2	Cathode (K)
3	Internal Jumper
5	Anode (P)
7	Internal Jumper
8	No Connection (NC)

The internal jumper wire directly connects Pin 3 to Pin 7. This jumper is a safety feature designed to protect associated circuit components. By wiring this jumper in series with the primary of the power transformer or the load supply line, the power supply is automatically shut off if the regulator tube is removed from its socket, preventing high unregulated voltages from damaging downstream circuitry.

Electrical Characteristics and Ratings

The electrical ratings of the 0B3 are absolute values. To ensure reliable starting (ionization) throughout the operating life of the tube, the DC anode supply voltage must not fall below a specified minimum.

Parameter	Value / Range	Unit
Minimum DC Anode Supply Voltage	125 to 130	V
Approximate DC Operating Voltage	90	V
Approximate DC Starting (Ionization) Voltage	100 to 110	V
Maximum Anode Breakdown Voltage	130	V
Continuous DC Cathode Current (Minimum)	5 to 10	mA
Continuous DC Cathode Current (Maximum)	30	mA
Maximum Average Starting Current	100	mA
Maximum Averaging Time	10	s
Ambient Temperature Range	-55 to +90	°C
Maximum Operating Frequency	0 (DC only)	cps
Maximum Shunt Capacitor	0.1	μF

Voltage Regulation Performance

The regulation voltage represents the maximum variation in voltage drop across the tube over its operating current range. It is calculated as the difference between the voltage drop at the maximum current and the voltage drop at the minimum current:

- **Regulation (10 to 30 mA):** 8.0 V (typical)
- **Regulation (5 to 30 mA):** 5.0 V (typical, with some specifications listing up to 9.0 V maximum)
- **Regulation (5 to 40 mA):** 8.0 V (under certain extended operating conditions)

The exact regulation value is somewhat dependent on the tube's operational history. For instance, operating the tube at a low current (e.g., 5 mA) for a protracted period before switching to a higher

current (e.g., 30 mA) can result in a slightly different regulated voltage than expected. A similar drift in regulation may occur after the tube has been idle for a long period.

Theory of Operation

A glow tube operates on the principle of gas discharge within a partial atmosphere of inert gas.

Glow Discharge vs. Arc Discharge

- **Glow Discharge:** Under normal operating currents, a uniform glow covers all or part of the cold cathode's surface. In this region, the voltage drop across the tube remains essentially independent of the current flowing through it. This stable voltage drop is determined by the electrode spacing and the specific composition and pressure of the gas fill.
- **Arc Discharge:** If the current through the tube exceeds its maximum rating, the discharge transitions from a uniform glow to an arc discharge. In this state, a highly concentrated "cathode spot" forms, and the voltage drop plunges to a very low value (typically 10 to 20 V). Arc discharge must be strictly avoided, as it causes rapid cathode degradation and severely shortens the operating life of the tube.

Application and Circuit Design

Basic Regulator Circuit

In a standard voltage regulator configuration, the 0B3 is connected in parallel with the load. A series resistor must always be placed between the unregulated DC supply and the anode of the 0B3 to limit the current through the tube.

The value of the series resistor (R_s) is calculated using the maximum unregulated supply voltage (V_{in}), the regulated output voltage ($V_{reg} \approx 90$ V), and the combined current of the load (I_{load}) and the regulator (I_{tube}):

$$R_s = \frac{V_{in} - V_{reg}}{I_{load} + I_{tube}}$$

The designer must ensure that:

1. Under maximum supply voltage and minimum load current, the current through the 0B3 does not exceed its absolute maximum rating of **30 mA**.
2. Under minimum supply voltage and maximum load current, the current through the 0B3 does not drop below its minimum operating limit of **5 to 10 mA**, and the supply voltage remains high enough to initiate starting (at least **125 to 130 V**).
3. During the initial turn-on period (typically 5 to 10 seconds) when associated equipment is warming up and not yet drawing plate current, a temporary starting current of up to **100 mA** is permissible through the 0B3, provided it is followed by a steady-state operating period of several minutes.

Multi-Tube Configurations

- **Series Connection:** To achieve higher regulated voltages, two or more glow tubes can be connected in series. The tubes do not need to be of the same type (for example, an 0B3 can be wired in series with an 0C3). However, the operating current of the series string must be limited to the lowest maximum rating among the combined tubes. If an 0B3 (30 mA max) is placed in series with an 0C3 (40 mA max), the current through the entire combination must not exceed **30 mA**.
- **Parallel Connection:** To handle load currents that exceed the capacity of a single regulator, multiple 0B3 tubes may be connected in parallel. To ensure an equal division of current and prevent a single tube from hogging all the current (due to slight variations in individual breakdown and operating voltages), a resistor of approximately **100 ohms** must be placed in series with the anode of each parallel-connected tube.

Relaxation Oscillator Circuit

The 0B3 can also function as a relaxation oscillator. In this circuit, a DC voltage source charges a capacitor through a series resistor. The 0B3 is connected in parallel with the capacitor. As the capacitor charges, the voltage across it rises until it reaches the breakdown (starting) voltage of the 0B3 (approximately 100 to 110 V). At this point, the gas ionizes, and the tube rapidly discharges the capacitor down to its operating or extinguishing voltage. The cycle then repeats. The frequency of oscillation is determined by the RC time constant of the charging circuit and the specific breakdown characteristics of the tube. To prevent unstable operation or unwanted oscillations in standard regulator circuits, the maximum shunt capacitance across the 0B3 should be limited to **0.1 μ F**.

Technical Summary

The **0B3** is a cold-cathode, gas-filled, glow-discharge voltage regulator featuring an ST-12 glass bulb and a 6-pin octal base. It provides a stable **90 V** reference voltage over a continuous operating current range of **5 to 30 mA** (or **10 to 30 mA** depending on the specific regulation limits). It requires a minimum DC supply voltage of **125 to 130 V** to guarantee ionization. Featuring an internal safety jumper between Pins 3 and 7, the 0B3 offers built-in system protection. It is highly versatile, supporting series configurations for higher voltages, parallel configurations with balancing resistors for higher currents, and relaxation oscillator applications when paired with appropriate external RC networks.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1950 General Electric Transmitting Types

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

1950 GENERAL ELECTRIC TRANSMITTING TYPES

Section 1 · Voltage Regulator

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum average starting current	100 mA	10 second averaging time

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	125 V	VoltageRegulatorService
Maximum operating current	40 mA	VoltageRegulatorService

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Minimum operating current	5 mA	VoltageRegulatorService
Operating voltage	90 V	VoltageRegulatorService
Ionization voltage	110 V	VoltageRegulatorService

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Regulation	8 V	5 to 40 mA



SOURCE OPERATING CONDITIONS

195X Raytheon Special Purpose Tubes

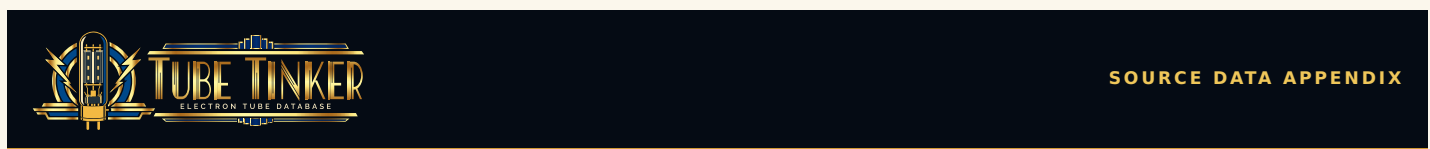
Published test conditions and operating points. Values on this page are preserved as reported by this source.

195X RAYTHEON SPECIAL PURPOSE TUBES

Section 1 · Voltage Regulator

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Operating voltage	90 V	—
Maximum regulation	8 V	10to30mA

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Minimum operating current	10 mA	—
Maximum operating current	30 mA	—
Minimum starting-voltage supply	125 V	—



SOURCE OPERATING CONDITIONS

1966 Tung Sol Electronic Tubes 1 of 4

[SOURCE PDF](#)

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	90 V	—
DC operating current minimum	10— mA	—

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
DC operating current maximum	—30 mA	—

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
DC starting voltage	125 V	Approximate
Voltage regulation	—5 V	I _a =10-30mA