VOLTAGE REGULATOR
MINIATURE TYPE

COLD CATHODE
ANY MOUNTING POSITION

BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE

THE OB2 IS A TWO ELECTRODE, INERT-GAS-FILLED COLD CATHODE MINIATURE TUBE INTENDED FOR USE AS A VOLTAGE REGULATOR. THE TUBE HAS A MAINTAINING VOLTAGE OF APPROXIMATELY 108 VOLTS OVER A CURRENT RANGE OF 5 TO 30 MA. THE OB2 IS EXCELLENT FOR APPLICATIONS WHICH REQUIRE GOOD VOLTAGE REGULATION AND LONG LIFE.

ELECTRICAL DATA
CATHODE COLD

MECHANICAL DATA

MOUNTING POSITION ANY
MAXIMUM OVERALL LENGTH 2 5/8 INCHES
MAXIMUM SEATED LENGTH 2 3/8 INCHES
MAXIMUM DIAMETER 3/4 INCH
WEIGHT (APPROX.) 0.3 OUNCES
BULB T-5 1/2
BASE SMALL-BUTTON MINIATURE
7-PIN

RATINGS

MAXIMUM AVERAGE STARTING CURRENT $^A$ 75 MA.
MAXIMUM DC CATHODE CURRENT 30 MA.
MINIMUM DC CATHODE CURRENT 5 MA.
MAXIMUM INVERSE VOLTAGE 50 VOLTS
AMBIENT TEMPERATURE -55 to +90 °C

$^A$ AVERAGED OVER STARTING PERIOD NOT EXCEEDING 10 SECONDS. NORMAL OPERATION SHOULD BE CONTINUED FOR AT LEAST TWENTY MINUTES AFTER PASSING THIS CURRENT TO STABILIZE THE TUBE.

CONTINUED ON FOLLOWING PAGE
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CIRCUIT VALUES

MAXIMUM SHUNT CAPACITOR  0.1 μF
SERIES RESISTOR

SEE OPERATION NOTES

EQUIPMENT DESIGN AND RANGE VALUES

<table>
<thead>
<tr>
<th></th>
<th>MINIMUM VOLTS</th>
<th>AVERAGE VOLTS</th>
<th>MAXIMUM VOLTS</th>
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<tbody>
<tr>
<td>DC ANODE SUPPLY VOLTAGE</td>
<td>135.6</td>
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<td>---</td>
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<tr>
<td>ANODE BREAKDOWN VOLTAGE</td>
<td>---</td>
<td>114</td>
<td>133</td>
</tr>
<tr>
<td>TUBE VOLTAGE DROP</td>
<td>101</td>
<td>108</td>
<td>114</td>
</tr>
<tr>
<td>REGULATION (5 TO 30 MA.)</td>
<td>---</td>
<td>1.1</td>
<td>4</td>
</tr>
</tbody>
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8 IN ORDER TO ASSURE STARTING THROUGH TUBE LIFE NOT LESS THAN THE SPECIFIED SUPPLY VOLTAGE SHOULD BE PROVIDED.

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TYPICAL AVERAGE TUBE VOLTAGE DROP VS. TUBE CURRENT

<table>
<thead>
<tr>
<th>TUBE CURRENT (MILLIAMPERES)</th>
<th>TUBE VOLTAGE DROP (VOLTS)</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>106</td>
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<tr>
<td>10</td>
<td>107</td>
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<tr>
<td>20</td>
<td>108</td>
</tr>
<tr>
<td>30</td>
<td>109</td>
</tr>
<tr>
<td>40</td>
<td>110</td>
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</tbody>
</table>
IN THE OPERATION OF A GLOW TUBE THERE ARE SEVERAL REQUIREMENTS WHICH MUST ALWAYS BE MET. THE FIRST IS THAT THE SUPPLY VOLTAGE MUST ALWAYS BE GREATER THAN THE ANODE BREAKDOWN VOLTAGE AND THE SECOND IS THAT SUFFICIENT RESISTANCE MUST ALWAYS BE PUT IN SERIES WITH THE TUBE IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM AND MAXIMUM VALUES GIVEN IN THE RATINGS.

IN ORDER TO ILLUSTRATE HOW TO CALCULATE THE VALUE OF THE SERIES RESISTANCE A TYPICAL REGULATOR CIRCUIT IS SHOWN IN FIGURE 1.

FROM FIGURE 1 WE SEE THAT $V_1$ IS THE UNREGULATED SUPPLY VOLTAGE, $V_2$ IS THE TUBE VOLTAGE DROP ON THE REGULATED VOLTAGE SUPPLIED TO THE LOAD, $R_1$ IS THE SERIES LIMITING RESISTOR, $R_L$ IS THE VARIABLE LOAD, $I_T$ IS THE TUBE CURRENT AND $I_L$ IS THE LOAD CURRENT.

WE SEE THAT THE TUBE CURRENT WILL BE A MAXIMUM WHEN THE SUPPLY VOLTAGE IS A MAXIMUM ($V_1$ MAX.); WHEN THE LOAD CURRENT IS A MINIMUM ($I_L$ MIN.); AND WHEN THE TUBE VOLTAGE DROP IS A MINIMUM ($V_2$ MIN.). THEREFORE THE CONDITIONS WHICH DETERMINE THE LOWER LIMIT FOR THE SERIES RESISTANCE $R_1$ ARE THAT

$$R_1 > \frac{V_1 \text{ MAX.} - V_2 \text{ MIN.}}{I_T \text{ MAX.} + I_L \text{ MIN.}}$$

IN A LIKE MANNER IT CAN BE SHOWN THAT THE VALUE OF $R_1$ IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM VALUE REQUIRES THAT

$$R_1 < \frac{V_1 \text{ MIN.} - V_2 \text{ MAX.}}{I_T \text{ MIN.} + I_L \text{ MAX.}}$$

WHEN THESE VALUES HAVE BEEN COMPUTED, ONE SHOULD CHECK TO SEE IF THERE IS SUFFICIENT STARTING VOLTAGE BY THE FOLLOWING RELATION

$$V_1 \text{ MIN.} \cdot \frac{R_L}{R_1 + R_L} < V \text{ STARTING}$$

---

**FIGURE 1**
OPERATION OF REGULATOR TUBES IN SERIES

**Figure 2**

TO D-C VOLTAGE SUPPLY

B<sub>2+</sub>

TO D-C VOLTAGE SUPPLY

REGULATED VOLTAGE OF 258 VOLTS

REGULATED VOLTAGE OF 150 VOLTS

SERIES RESISTOR

**Figure 3**

TO D-C VOLTAGE SUPPLY

REGULATED VOLTAGE

LOAD

CONTINUED ON FOLLOWING PAGE
WHEN THESE CALCULATIONS HAVE BEEN MADE AND THERE IS INSUFFICIENT STARTING VOLTAGE, A NEW LOAD CURRENT OF LOWER VALUE MUST BE USED AND THE CALCULATIONS REPEATED.

CIRCUITS WHICH HAVE A CAPACITOR IN SHUNT WITH THE OB2 SHOULD BE LIMITED IN VALUE TO TO 0.1 µF, LARGER VALUES MIGHT CAUSE OSCILLATIONS.

OPERATION OF THE OB2 IN PARALLEL IS NOT RECOMMENDED UNLESS A RESISTANCE OF APPROXIMATELY 100 OHMS IS USED IN SERIES WITH EACH OB2 TO EQUILIZE DIVISION OF CURRENT. HOWEVER, IT SHOULD BE NOTED THAT WHILE THIS ENABLES ONE TO HANDLE MORE LOAD CURRENT IT REDUCES THE REGULATION THAT CAN BE OBTAINED.

IF IT IS DESIRED TO OBTAIN HIGHER REGULATING VOLTAGES, TUBES MAY BE OPERATED IN SERIES AS INDICATED IN FIGURE 2. HOWEVER, CARE SHOULD BE TAKEN TO SEE THAT SUFFICIENT SUPPLY VOLTAGE IS AVAILABLE TO START BOTH TUBES.

TYPICAL APPLICATION OF OB2
USED IN VOLTAGE REGULATED POWER SUPPLY

FIGURE 4