RELIABLE SUB-MINIATURE VOLTAGE REGULATOR

DESCRIPTION
This tube is a gas filled, cold cathode, subminiature voltage regulator, Type 5787 WA. The construction of this tube is such that it will withstand conditions of severe shock and vibration. The tube is characterized by long life and is designed to operate under conditions of high temperature. This tube may be soldered directly into any circuit and is particularly adaptable where space is of prime importance.

ELECTRICAL RATINGS
- Anode Supply Voltage .......... 140 Vdc min.
- Ionization Voltage ............ 135 Vdc max.
(For Ionization Voltage
Distributions, See Fig. 2)
- Operating Voltage Range ...... 95 - 103 Vdc
(For Operating Voltage
Distributions, See Fig. 1)
- Operating Current Range ...... 5 - 25 mA dc
- Vibration Output (40 cps, 15G) .... 50 mVdc max.
- Shock (30° Hammer Angle)
- Fatigue (96 hrs., 2.5G, 25-60 cps)
- Ambient Temperature Range .... −55°C to +150°C
- Maximum Bulb Temperature .... +225°C

OPERATING NOTES
Attention should be given to the bulb temperature at which the tubes are to be operated. Reliability will be impaired if the maximum bulb temperature is exceeded. There are several requirements in the operation of a glow discharge tube, like the 5787 WA/ TD-63, which must be adhered to carefully. The first is that the supply voltage must always be greater than the anode breakdown voltage. The second condition is that sufficient resistance must always be in series with the tube to limit the current to the minimum and maximum values specified in the ratings.

PHYSICAL CHARACTERISTICS
- Envelope: T-3.
- Base: Pressed Stem: (.016” tinned flexible leads. Spacing 0.096” center to center. Length 1.5” minimum)
- Terminal Connections: Lead 1, Cathode; Lead 3, anode, Lead 5, cathode.
- Maximum Bulb Dia.: 0.400”.
- Maximum Sealed Bulb Height: 2.063”.
- Mounting Position: Any.

THE BENDIX CORPORATION
Red Bank DIVISION, EATONTOWN, NEW JERSEY
# ELECTRICAL CHARACTERISTICS & TEST CONDITIONS

<table>
<thead>
<tr>
<th>RATINGS</th>
<th>Total Darkness Ionization Voltage</th>
<th>Ambient Light Ionization Voltage</th>
<th>Operating Voltage</th>
<th>Operating Current</th>
<th>T Envelope</th>
<th>Alt</th>
<th>TA</th>
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<tbody>
<tr>
<td>Absolute</td>
<td>Vdc</td>
<td>Vdc</td>
<td>Vdc</td>
<td>mAdc</td>
<td>+225</td>
<td>60,000</td>
<td>+55</td>
</tr>
<tr>
<td>Maximum</td>
<td>—</td>
<td>—</td>
<td>98</td>
<td>25</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Minimum:</td>
<td>141</td>
<td>141</td>
<td>—</td>
<td>5</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Test Cond.:</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

| Cathode: | Glow Discharge                   |
| Base:    | Subminiature 5 Pin with Long Leads |
| Pin No.: | 1 2 3 4 5                       |
| Elements: | k nc p nc k                      |

The following tests shall be performed:

## MEASUREMENTS ACCEPTANCE TESTS PART 1 NOTE 1

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Test</th>
<th>Conditions</th>
<th>AQL (%)</th>
<th>Insp. Level or Code</th>
<th>Sym.</th>
<th>LIMITS Min.</th>
<th>LIMITS Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.13.1</td>
<td>Ionization Voltage(1):</td>
<td>Ebb/lb = 5 — 25 mAdc; Illumination = 5 — 50 ft. candles</td>
<td>0.65</td>
<td>II Ez:</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>135</td>
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<tr>
<td>4.13.2</td>
<td>Tube Voltage Drop(1):</td>
<td>Ebb/lb = 25 mAdc</td>
<td>0.65</td>
<td>II Etd:</td>
<td>95</td>
<td>—</td>
<td>—</td>
<td>103</td>
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<tr>
<td>4.13.2</td>
<td>Tube Voltage Drop(2):</td>
<td>Ebb/lb = 5 mAdc</td>
<td>0.65</td>
<td>II Etd:</td>
<td>95</td>
<td>—</td>
<td>—</td>
<td>103</td>
</tr>
<tr>
<td>4.13.2.1</td>
<td>Regulation:</td>
<td>(1)Etd — (2)Etd</td>
<td>0.65</td>
<td>II Reg:</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>±3</td>
</tr>
<tr>
<td>4.7.5</td>
<td>Continuity and Shorts: (Inoperatives)</td>
<td></td>
<td>0.4</td>
<td>II</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>4.9.1</td>
<td>Mechanical:</td>
<td>Envelope Outline No. 8-7 Except Dimension A = 2.063 max. Dimension B = 1.813 ± 0.100</td>
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<td></td>
<td>—</td>
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## MEASUREMENTS ACCEPTANCE TESTS PART 2

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<th>Ref.</th>
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<th>Conditions</th>
<th>AQL (%)</th>
<th>Insp. Level or Code</th>
<th>Sym.</th>
<th>LIMITS Min.</th>
<th>LIMITS Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.13.4.3</td>
<td>Noise:</td>
<td>Ebb/lb = 25 mAdc</td>
<td>1.0</td>
<td>I Ebb:</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>20</td>
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<tr>
<td>4.13.4.2</td>
<td>Oscillation:</td>
<td>Esig = 100 mVdc; RL = 500Ω; Ebb/lb = 5 — 25 mAdc</td>
<td>1.0</td>
<td>I</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>4.13.1</td>
<td>Ionization Voltage(2):</td>
<td>Note 2</td>
<td>6.5</td>
<td>Code G Ez:</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>141</td>
</tr>
<tr>
<td>4.13.3</td>
<td>Leakage:</td>
<td>Eb = 50 Vdc; Rp = 3000Ω</td>
<td>6.5</td>
<td>Code G Ebb:</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>5</td>
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<tr>
<td>—</td>
<td>Repeatability:</td>
<td>Ebb/lb = 10 mAdc; Note 3</td>
<td>6.5</td>
<td>Code G Etd:</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1.0</td>
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<tr>
<td>4.9.19.1</td>
<td>Vibration(2):</td>
<td>Rp = 10,000Ω; Ebb/lb = 25 mAdc; F = 40 cps; G = 15</td>
<td>6.5</td>
<td>Code G Ep:</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>50</td>
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## DEGRADATION RATE ACCEPTANCE TESTS

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<th>AQL (%)</th>
<th>Insp. Level or Code</th>
<th>Sym.</th>
<th>LIMITS Min.</th>
<th>LIMITS Max.</th>
<th>Units</th>
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<tr>
<td>4.9.5.3</td>
<td>Subminiature Lead Fatigue</td>
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<td>2.5</td>
<td>Code G</td>
<td>4</td>
<td>—</td>
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<tr>
<td>4.9.20.5</td>
<td>Shock:</td>
<td>Hammer Angle = 30°; G = 2.5; Fixed Frequency; F = 25 min.; 60 max.</td>
<td>6.5</td>
<td></td>
<td>—</td>
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<tr>
<td>4.9.20.6</td>
<td>Fatigue:</td>
<td></td>
<td></td>
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<td>—</td>
<td>—</td>
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<td>—</td>
<td>Post Shock and Fatigue Test End Points:</td>
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<td></td>
<td></td>
<td>—</td>
<td>—</td>
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<td>—</td>
<td>Glass Strain</td>
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<td>2.5</td>
<td>I</td>
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### ACCEPTANCE LIFE TESTS

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<th>Conditions</th>
<th>AQL (%</th>
<th>Insp. Level or Code</th>
<th>Allowable Defective per Characteristic</th>
<th>Sym.</th>
<th>LIMITS</th>
<th>Units</th>
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<tr>
<td></td>
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<td></td>
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<td>Min.</td>
<td>Max.</td>
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<tr>
<td>—</td>
<td>Stability Life Test</td>
<td>Ebb/Ib = 25 mAdc; TA = Room</td>
<td>6.5</td>
<td>Code I</td>
<td>—</td>
<td>—</td>
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<td>4.11.4</td>
<td>Stability Life Test</td>
<td>Change in Tube Voltage Drop(1) of individual tubes</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>△Etd:</td>
<td>—</td>
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<tr>
<td>End Points:</td>
<td>Change in Tube Voltage Drop(2) of individual tubes</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>△Etd:</td>
<td>—</td>
<td>1.0</td>
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<tr>
<td>—</td>
<td>Survival Rate Life Test:</td>
<td>Stability Life Test Conditions or equivalent</td>
<td>—</td>
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<td>—</td>
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<td>4.11.4</td>
<td>Survival Rate Life Test End Points:</td>
<td>Continuity and Shorts (Inoperatives)</td>
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<td>—</td>
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<td></td>
<td>Change in Tube Voltage Drop(1) of individual tubes</td>
<td>6.5</td>
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<td>—</td>
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<td>Change in Tube Voltage Drop(2) of individual tubes</td>
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<td>—</td>
<td>—</td>
<td>—</td>
<td>△Etd:</td>
<td>—</td>
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<td>4.11.5</td>
<td>Intermittent Life Test:</td>
<td>Stability Life Test Conditions; T Envelope = 225°F min.</td>
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<td>4.11.4</td>
<td>Intermittent Life Test End Points:</td>
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<td>—</td>
<td>1</td>
<td>3</td>
<td>—</td>
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<tr>
<td></td>
<td>Regulation</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>3</td>
<td>Reg:</td>
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<td>Tube Voltage Drop(1)</td>
<td>—</td>
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<td>3</td>
<td>Etd:</td>
<td>95</td>
<td>105</td>
<td>Vdc</td>
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<td>Tube Voltage Drop(2)</td>
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<td>—</td>
<td>3</td>
<td>△Etd:</td>
<td>—</td>
<td>3</td>
<td>%</td>
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<td>Change in Tube Voltage Drop(2) of individual tubes</td>
<td>—</td>
<td>—</td>
<td>3</td>
<td>△Etd:</td>
<td>—</td>
<td>3</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>Ionization Voltage(1)</td>
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<td>1</td>
<td>3</td>
<td>Ez:</td>
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<tr>
<td></td>
<td>Total Defectives</td>
<td>—</td>
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<td>8</td>
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<td>4.11.4</td>
<td>Intermittent Life Test End Points:</td>
<td>Inoperatives</td>
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<td>2</td>
<td>5</td>
<td>—</td>
<td>—</td>
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<tr>
<td></td>
<td>Regulation</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>5</td>
<td>Reg:</td>
<td>—</td>
<td>±0.6</td>
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<td>Tube Voltage Drop(1)</td>
<td>—</td>
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<td>5</td>
<td>Etd:</td>
<td>95</td>
<td>105</td>
<td>Vdc</td>
</tr>
<tr>
<td></td>
<td>Tube Voltage Drop(2)</td>
<td>—</td>
<td>—</td>
<td>5</td>
<td>Etd:</td>
<td>95</td>
<td>105</td>
<td>Vdc</td>
</tr>
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<td>Change in Tube Voltage Drop(1) of individual tubes</td>
<td>—</td>
<td>—</td>
<td>4</td>
<td>△Etd:</td>
<td>—</td>
<td>4</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>Change in Tube Voltage Drop(2) of individual tubes</td>
<td>—</td>
<td>—</td>
<td>4</td>
<td>△Etd:</td>
<td>—</td>
<td>4</td>
<td>%</td>
</tr>
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<td></td>
<td>Ionization Voltage(1)</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>5</td>
<td>Ez:</td>
<td>—</td>
<td>141</td>
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<td></td>
<td>Total Defectives</td>
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<td>—</td>
<td>5</td>
<td>10</td>
<td>—</td>
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</tbody>
</table>

**Note 1:** Characteristic Quality Control Test Procedures, Inspection Levels, and Inspection Instructions are made according to the appropriate paragraphs of MIL-E-1, and MIL-STD-105A.

**Note 2:** Conditions for this test shall be those of Ionization Voltage (1) except testing shall be done in total darkness and the tube shall not have conducted or have been exposed to light for at least 24 hours prior to testing.

**Note 3:** Repeatability shall be defined as the maximum shift in tube voltage drop between successive firings of the tube. The tube shall be tested in the following manner.

a. Etd shall be read at 10 mAdc drain.
b. The tube shall be turned off for one (1) minute.
c. The tube shall be re-started and operated at the same current.
d. Etd shall be read after one (1) minute of operation.
e. The on-off cycle shall be repeated a minimum of five times. The range of Etd shall be taken as the measure of repeatability.
**AVERAGE CHARACTERISTICS**

**FIG. 1**

- **TYPICAL LOT DISTRIBUTION**
- **AVERAGE PRODUCT DISPERSION**

**FIG. 2**

- **TYPICAL LOT DISTRIBUTION**
- **AVERAGE PRODUCT DISPERSION**

**FIG. 3**

**AVERAGE IONIZATION VOLTAGE vs AMBIENT TEMPERATURE**

**FIG. 4**

**AVERAGE TUBE DROP vs AMBIENT TEMPERATURE**

- $I_b = 25 \text{ ma}$
- $I_b = 5 \text{ ma}$
AVERAGE CHARACTERISTICS

AVERAGE REGULATION vs AMBIENT TEMPERATURE

NOTE: REGULATION = \[ \frac{E_{td}(25 \text{ ma}) - E_{td}(5 \text{ ma})}{E_{td}(25 \text{ ma})} \]

FIG. 5

IN THE APPLICATION OF THIS CIRCUIT THE DESIGNER SHOULD CAREFULLY CONSIDER LOAD AND LINE VARIATIONS SO THAT THE 5787 WA/TD-63 IS OPERATED WITHIN ITS RATED VALUES.

TYPICAL APPLICATION CIRCUIT FOR USE DIRECTLY FROM 110V AC LINE.

FIG. 6

BASE DIAGRAM (BOTTOM VIEW)

OUTLINE DRAWING (REF. FOR 1.813 DIM.)

FIG. 7
For Additional Information Write —

ELECTRON TUBE PRODUCTS

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