Introduction
The PMT(275)/UMT(275) Series has been designed for use in applications where a rugged miniature sized surge arrester is needed capable of high speed of response. This Power Gap series is an ultra fast acting surge arrester, which protects components against over-voltage, without regard to rate of voltage rise.

These gaps are used to protect signal and power lines from transients generated by sources such as inductive circuit effects, lightning and electromagnetic radiation. Applications are found in avionics and military equipment as well as industrial systems.

Within this series of Power Gaps, the UMT(275)900 has been specifically designed for protecting the windshield heater system on commercial aircraft, which is operated from the 440Vrms, 400 cycle supply.

Description
Power Gaps consist of two metal electrodes in a coaxial configuration that are hermetically sealed at high braze temperatures in a gas filled ceramic-metal enclosure. The fast response is obtained by incorporating a high dielectric ceramic, which results in a concentrated electric field between the electrodes during application of the impulse voltage. The concentrated field creates a low level pre-ionization of the gas prior to the breakdown avalanche, thereby resulting in fast impulse breakdown. The impulse breakdown tests for this product are conducted at 5kV per microsecond.

These gaps are small in size with a body length of .75 inches and a gap diameter of 0.315 inches. Nickel-plated axial contacts on each end make the device suitable for soldering of connecting leads. They are also available in an epoxy molded package for convenient ground terminal mounting.

For avionic, shipboard or landline applications, when the gap is used to protect power line components a one ohm, three watt resistor is connected in series with the gap to insure the turn off of the current at the AC zero crossing. The molded tube and resistor assembly includes a ferrule that may be bolted to a terminal in common with the component to be protected. A 42 inch insulated lead is supplied for ground connection.

Definitions Applied to Two Electrode Gaps
DC Breakdown Voltage \( (V_{BD}) \) is the voltage level at which a gap sparks over (breakdown occurs) when a slowly rising dc voltage is applied. The typical rate of rise for DC breakdown measurement is 100 volts per second. The rate of voltage rise is slow compared with the avalanche buildup time of the electrode-gas-pressure combination, which is in the order of nanoseconds.

Impulse Breakdown Voltage \( (V_{iB}) \) is the voltage level at which a gap sparks over when a fast rising voltage is applied. Due to the time required to ionize the inert gas of the tube, the impulse breakdown of the gap may exceed the DC breakdown voltage by a substantial amount. The impulse breakdown is a function of the rise time of the impulse and increases in value with decreasing rise time.
Insulation Resistance (IR) is the resistance across the terminals of a gap when measured at 100Vdc at ambient conditions.

Maximum Surge Current is that level, which the gap can withstand without failing in any of the failure modes listed when a surge current of 8/20 microseconds is applied. (8 represents the rise time and 20 represents the time at half amplitude).

Failure Modes During Life Tests
A. Short circuit failure mode - In this mode, the gap shall become permanently short-circuited.
B. Low breakdown voltage failure mode - In this mode, the gap shall have a DC breakdown voltage less than 80% of the minimum breakdown voltage.
C. High breakdown voltage failure mode - In this mode, a gap shall have a DC breakdown voltage of greater than 20% of the maximum breakdown voltage.
D. Low insulation resistance failure mode - In this mode, the gap shall have a resistance of less than 1 megohm.

Applications
• Avionics
The UMT(275)900 is designed to protect avionic components, which are operated from the 440V, 400 cycle power supply aboard commercial aircraft against inductive circuit transients, lightning and electro-magnetic interferences.

• Military
Military use of the PMT(275)/UMT(275) gaps has been extensive due to the need for enhanced reliability of total system performance. The number of failures of components and circuits has been greatly reduced by eliminating the destructive transients.

Any component in an electric circuit having a maximum voltage rating may be protected by use of a Power Gap. The Power Gap is essentially transparent in the circuit having a very high insulation resistance and very low capacitance. For example: capacitors, inductors, resistors, tubes and solid state rectifiers may all be protected by connecting a gap with suitable voltage rating in parallel with the component.

• Industrial
PMT(275)/UMT(275) gaps are commonly connected across the secondary of power transformers to prevent line transients from getting into the power supply components or load circuits.

Power Gaps are used for antenna input protection against lightning or excessive electromagnetic induced voltages.
Availability
The PMT(275)/UMT(275) series is available with DC Breakdown Voltages of 350-2500V as shown in Table 1.

Table 1
Operating Specifications @25°C

<table>
<thead>
<tr>
<th>High Energy Devices Part Number</th>
<th>DC Breakdown Voltage @ 100V/s (Nominal Vdc)</th>
<th>DC Breakdown Voltage Limits @ 100V/s (Min - Max Vdc)</th>
<th>Impulse Breakdown Voltage @ 5kV/µs (Maximum Vdc)</th>
<th>Surge Current @ 8/20µs (Maximum kA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMT(275)350</td>
<td>350</td>
<td>315-385</td>
<td>750</td>
<td>20</td>
</tr>
<tr>
<td>PMT(275)400</td>
<td>400</td>
<td>360-440</td>
<td>750</td>
<td>20</td>
</tr>
<tr>
<td>PMT(275)450</td>
<td>450</td>
<td>405-495</td>
<td>750</td>
<td>20</td>
</tr>
<tr>
<td>PMT(275)500</td>
<td>500</td>
<td>450-550</td>
<td>750</td>
<td>20</td>
</tr>
<tr>
<td>UMT(275)550</td>
<td>550</td>
<td>495-605</td>
<td>760</td>
<td>20</td>
</tr>
<tr>
<td>UMT(275)600</td>
<td>600</td>
<td>540-660</td>
<td>825</td>
<td>20</td>
</tr>
<tr>
<td>UMT(275)650</td>
<td>650</td>
<td>585-715</td>
<td>895</td>
<td>20</td>
</tr>
<tr>
<td>UMT(275)750</td>
<td>750</td>
<td>675-825</td>
<td>1030</td>
<td>20</td>
</tr>
<tr>
<td>UMT(275)800</td>
<td>800</td>
<td>720-880</td>
<td>1100</td>
<td>20</td>
</tr>
<tr>
<td>UMT(275)850</td>
<td>850</td>
<td>765-935</td>
<td>1170</td>
<td>20</td>
</tr>
<tr>
<td>UMT(275)900</td>
<td>900</td>
<td>810-990</td>
<td>1240</td>
<td>20</td>
</tr>
<tr>
<td>UMT(275)1.0</td>
<td>1000</td>
<td>900-1100</td>
<td>1380</td>
<td>20</td>
</tr>
<tr>
<td>UMT(275)1.5</td>
<td>1500</td>
<td>1350-1650</td>
<td>2060</td>
<td>20</td>
</tr>
<tr>
<td>UMT(275)2.0</td>
<td>2000</td>
<td>1800-2200</td>
<td>2750</td>
<td>20</td>
</tr>
<tr>
<td>UMT(275)2.5</td>
<td>2500</td>
<td>2250-2750</td>
<td>3440</td>
<td>20</td>
</tr>
</tbody>
</table>

As an example, the operating characteristics of UMT(275)1.0 are shown in Table 2.

Table 2
Operating Characteristics of UMT(275)1.0 @25°C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Symbol</th>
<th>Min</th>
<th>Nom</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Breakdown</td>
<td>100 V/s</td>
<td>(V_{BD})</td>
<td>900</td>
<td>1000</td>
<td>1100</td>
<td>V</td>
</tr>
<tr>
<td>Impulse Breakdown</td>
<td>5kV/µs</td>
<td>(V_{bd})</td>
<td>-</td>
<td>-</td>
<td>1380</td>
<td>V</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>100Vdc</td>
<td>IR</td>
<td>-</td>
<td>10^{10}</td>
<td>-</td>
<td>Ohms</td>
</tr>
<tr>
<td>Capacitance</td>
<td>1 MHz</td>
<td>C</td>
<td>-</td>
<td>-</td>
<td>3.5</td>
<td>pF</td>
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Life Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Symbol</th>
<th>Min</th>
<th>Nom</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge Life</td>
<td>1,000A (8/20)</td>
<td>-</td>
<td>500</td>
<td>-</td>
<td>-</td>
<td>shots</td>
</tr>
<tr>
<td>Maximum Surge Current</td>
<td>20kA (8/20)</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>shot</td>
</tr>
</tbody>
</table>
### Environmental Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Specifications</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration Mil-Std 202D</td>
<td>Method 107</td>
<td>Test at 10g’s, 3 axis, 3 hours/axis 10Hz - 500 Hz</td>
</tr>
<tr>
<td></td>
<td>Condition A</td>
<td></td>
</tr>
<tr>
<td>Shock Mil-Std 202D</td>
<td>Method 204</td>
<td>Test at 100g’s, 6 milliseconds, 3 axis 3 shocks each direction 18 shocks total</td>
</tr>
<tr>
<td></td>
<td>Condition A</td>
<td></td>
</tr>
<tr>
<td>Altitude Test Mil-Std 202D</td>
<td>Method 105</td>
<td>No degradation at 30,000 ft. non-operating</td>
</tr>
<tr>
<td></td>
<td>Condition A</td>
<td>No degradation at 15,000 ft. operating</td>
</tr>
</tbody>
</table>