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.

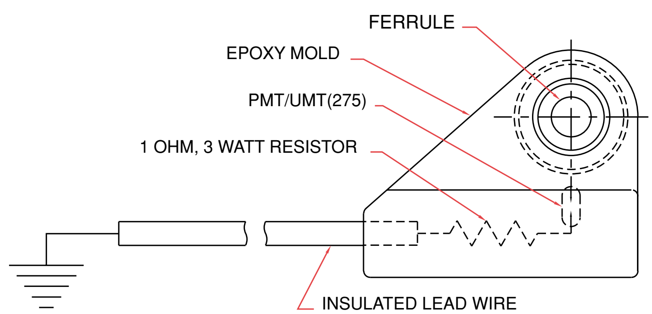
Within this series of Power Gaps, the UMT(275)900 has been specifically designed for protecting the windshield heater system on commercial aircraft, which is operated from the 440Vrms, 400 cycle supply.

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_{bd}) 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 @25ºC

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

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 @25ºC

Parameter	Test Conditions	Symbol	Min	Nom	Max	Units
DC Breakdown	100 V/s	V_{BD}	900	1000	1100	V
Impulse Breakdown	5kV/µs	V_{bd}	-	-	1380	V
Insulation Resistance	100Vdc	IR	-	10^{10}	-	Ohms
Capacitance	1 MHz	C	-	-	3.5	pF

Life Ratings

Parameter	Test Conditions	Symbol	Min	Nom	Max	Units
Discharge Life	1,000A (8/20)	-	500	-	-	shots
Maximum Surge Current	20kA (8/20)	-	-	1	-	shot

Environmental Ratings

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

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