HIGH ENERGY DEVICES LLC

Spark Gaps for Energy Transfer Applications
Application Note

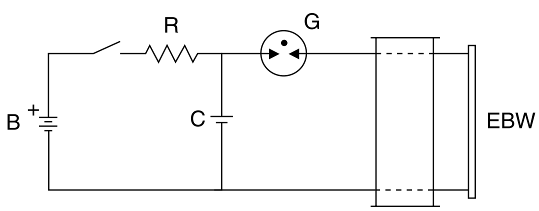
Many applications in electronic circuits require a fast-acting switch capable of transferring stored electrical energy, usually from a storage capacitor to a load circuit. Typical applications include the following:

- Discharge Lamp Ignitors (HID or Glow Lamps)
- Gas Ignitors (Gas Dryers or Water Heaters)
- Pulsed Light Sources (Xenon Photo Flash)
- Exploding Bridge Wires (EBW)
- Crowbarring Power Supplies

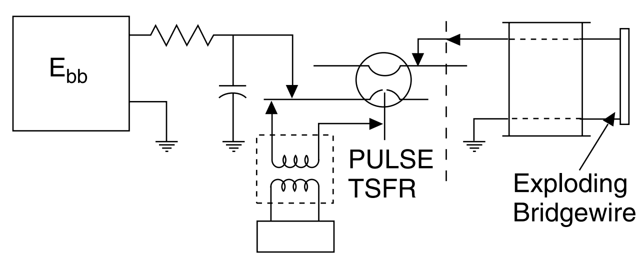
When the voltage level is low (<100V) and currents do not exceed 1A, transistor circuits may be used. When the voltages exceed several hundred volts and currents exceed 1-10A, spark gaps become especially suitable in terms of cost, size, standby readiness, and minimum associated circuit requirements. Spark gaps may be designed to handle extremely high currents for short durations and at high voltage levels while still contained in a relatively small space. These devices can operate over wide temperature extremes (as great as -55°C to +125°C), they are unaffected by variations in pressure and humidity, and can withstand high levels of shock and vibration. Since these devices are made for cold cathode operations, no heater circuits or standby power is required.

A two electrode spark gap requires the least amount of associated circuitry (see Figure 1A). For energy transfer, the storage capacitor must begin to charge from time zero until the breakdown voltage of the "switch" is reached. At this point, the impedance of the spark gap quickly drops from several thousand megohms to a few ohms and the storage capacitor discharges at a rate limited by the circuit impedance.

In applications where "instantaneous" switching is required, a triggered spark gap is used (see Figure 1B below). Here, the storage capacitor is charged prior to the energy demand. Since the main static breakdown voltage of the triggered spark gap is greater than the charge voltage of the storage capacitor, the storage capacitor remains charged. Upon application of an appropriate trigger pulse, the "switch" will rapidly close (typically 0.1µs delay time) and the stored energy will be transferred to the load circuit. (For more information, see our Application Note, "Use of Triggered Spark Gaps".)



1A



1B

Figure 1 - Connection of Two Electrode (A) and Triggered (B) Spark Gaps for Energy Transfer

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