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The Mechanism of Response of Detonators to AC Mains Voltage

ELIZABETH LEE, Atomic Weapons Establishment — High voltage EBW and EFI detonators are designed to fire from low inductance, low resistance energy sources with small capacitors delivering a few thousand volts in tens of nanoseconds. However, other electrical sources will always be present during a device's lifecycle. One such source is mains voltage, the AC mains test applies, in this case, 240V to the bridge of the device. AC mains can deliver electrical energies to detonators which can be greater than the detonation threshold energies but on a longer timescale. Although the delivered energies are greater than the energies required for detonation, typically the reactions are violent, sub-detonative reactions. Therefore, understanding the response of detonators to AC Mains provides valuable insight to the mechanisms determining the safety and performance characteristics. A number of different detonator types and designs have been subjected to different signals, the degree of response measured and possible design related trends identified. Where there was no external disruption X-ray CT scanning has been used to assess the internal damage to the detonator. The electrical, chemical and physical processes determining the response of detonators to mains electricity are identified.

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