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Electronic Specifier

Tailormade EMP & HEMP filters from MPE safeguard vital electronics against pulse threats

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For general commercial use, the performance of ElectroMagnetic Pulse (EMP) filters has traditionally been accepted as 60dB at 10kHz rising to 80dB from 100kHz to 1GHz. All lines in these multi-line systems feature high-energy transient suppressors, such as varistors, spark gaps or silicon avalanche diodes, at the input end.

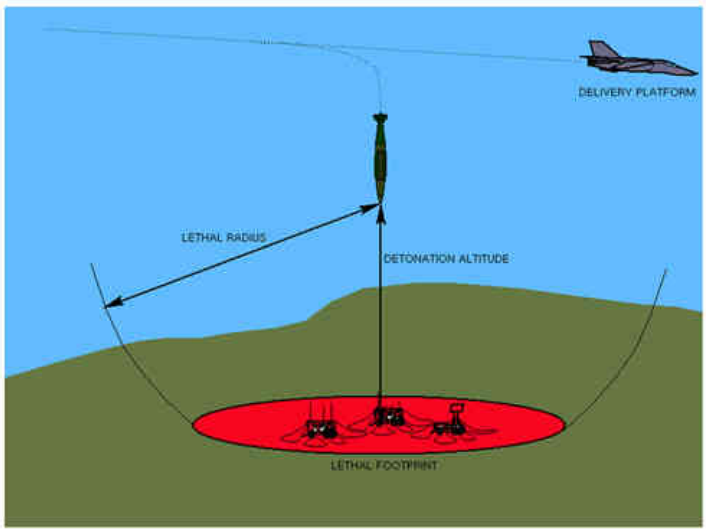
Each transient suppressor has to give an ultra high-speed response to arrest the incoming pulse. The purpose of this front-end transient suppressor (primary protector) is to shunt the bulk of the pulse energy to earth. Secondary and tertiary protection may be provided by further transient suppressors fitted at later stages of the filter to help further reduce the remaining pulse voltage to a safe level. To provide delay to the incoming pulse, filtering components are either mounted at a distance from the primary protector or separated by a discrete inductor.

For national defence and homeland security use, a sub-category of EMP, High-altitude ElectroMagnetic Pulse (HEMP) filters are there to safeguard equipment systems against the devastating effects of nuclear blasts high in the atmosphere. The EMP caused by such an event could knock out military computer and communications networks as well as civil and commercial infrastructure.

For example, the intense electromagnetic pulse created by a nuclear blast more than 25 miles up could disable, damage or destroy electrical power supply networks, unprotected items of electrical equipment and electrical controls for key service industries over a wide area of the Earth's surface. Any equipment containing microchips would be particularly vulnerable and would be damaged or destroyed in a fraction of a second.

A solar flare or geomagnetic storm, over which we have no control but which will inevitably happen from time to time, could produce a similar catastrophic result. An historical example of this was the Carrington super-flare of September 1859, when semiconductor electronics lay far in the future, so effects will depend on what vulnerable technology may be in existence at the time of the event.

Tests show that purpose-designed HEMP filters to protect the cable entry points of AC mains power lines are far more effective than adapted EMI catalogue filters in terms of performance, size and weight. The latest HEMP specifications MIL-STD 188-125 Parts 1 and 2 and DEF STAN 59-188 have no stated insertion loss requirement, but it is accepted that the value should be 20dB at 10kHz rising to 80dB in the frequency range 10MHz to 1GHz, in order not to compromise the required shielding effectiveness.



LETHAL FOOTPRINT OF LOW FREQUENCY E- BOMB IN RELATION TO ALTITUDE

Three different threat levels are defined in the MIL-STD – an E1, E2 and E3 pulse – with the objective of protecting critical infrastructure against a HEMP bomb. MPE Ltd of Knowsley, Liverpool, started designing and manufacturing tailormade MIL-STD HEMP filters to deal with all three pulse

types in 2004. Most importantly MPE designs these filters for pulse performance not insertion loss and treats the transient suppressor, input inductor and filter as an integrated solution. The company tests the pulse currents and voltages at each stage in circuit to confirm the operating function of each component, prior to arranging testing of the whole under full load conditions.

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