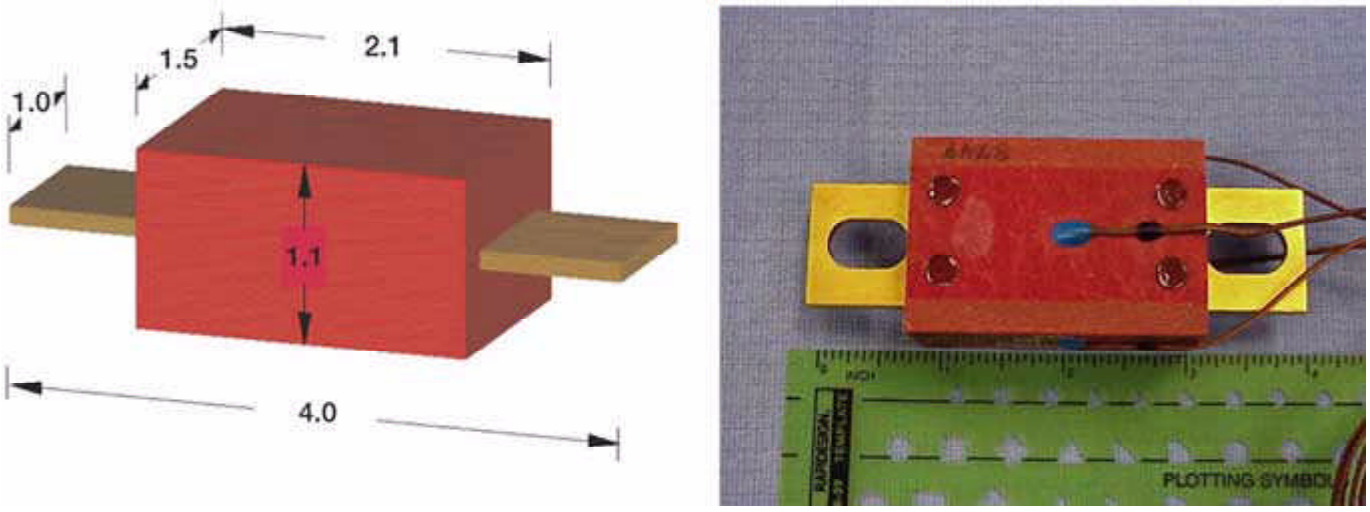
Solid-Body Fuse Developed for High-Voltage Space Power Missions

AEM Incorporated has completed the development, under a NASA Glenn Research Center contract, of a solid-body fuse for high-voltage power systems of satellites and spacecraft systems. High-reliability fuses presently defined by MIL-PRF-23419 do not meet the increased voltage and amperage requirements for the next generation of spacecraft. Solid-body fuses exhibit electrical and mechanical attributes that enable these fuses to perform reliably in the vacuum and high-vibration and -shock environments typically present in spacecraft applications. The construction and screening techniques for solid-body fuses described by MIL-PRF-23419/12 offer an excellent roadmap for the development of high-voltage solid-body fuses.



AEM's 400-V 100-A prototype fuse. Dimensions are in inches.
Illustration shows fuse dimensions. The fusible element is 2.1 in. long, 1.5 in. wide, and 1.1 in. high. The silver terminations at each end are 1.0 in. wide, and they make the entire fuse about 4.0 in. long.

Conventional fuses are constructed with a wire filament that passes through a hollow cavity; solid-body fuses are designed and constructed in a manner that ensures that the overall fuse package is substantially devoid of air. The fusible element is composed of thick-film gold or silver that is deposited on a thermally and electrically insulated substrate. A complete range of fusing values is achievable by precisely controlling the fusible element print thickness and geometry. Thick-film silver termination pads are placed at each end of the thick-film fusible element. The fusible element is completely covered with an arc-suppressive ceramic composite. Copper leads with gold plating are attached to the silver terminations with high-temperature solder. The final fuse package is insert-molded with an engineering thermoplastic to complete the fuse.

The fuses delivered to Glenn are rated at 400 Vdc at 100 A. Increased amperage can be realized if electrically paralleled fuses are used. For example, a 400-Vdc, 500-A fusing requirement would be satisfied by the installation of five electrically matched 400-Vdc, 100-A fuses. The short-circuit interrupt rating for the 400-Vdc fuses is 10,000 A. The total weight of each fuse is about 156 g, and the outside dimensions are 3.9 in. long, 1.5 in. wide, and 1 in. high.

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