CARE-N3 networking for HHH Conference
Held in Lueneberg, Germany
October 30th to December 1st, 2006

Meggitt Safety Systems Inc.
Report

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Abstract
The presentation provided by Meggitt Safety Systems Inc. (MSSI) was aimed at providing the overall information about the company and to highlight MSSI’s approach in designing and manufacturing the BPM and Feed-through for high energy physics communities worldwide. The goal was to inform the users about MSSI engineering and manufacturing capabilities in supplying hermetic BPM, feed-through and cable assemblies. It was of great value to interact directly with users and suppliers during the conference and be able to obtain the market needs and areas in need of improvement. MSSI has a long history of over 50 years manufacturing SiO2 insulated cable assemblies and hermetic connectors used by aerospace, nuclear and instrumentation market. The presentation also provided MSSI engineering and manufacturing capabilities and demonstrated BPM modeling using CST and HFSS. Although MSSI is capable of producing hermetic BPM and feed-through using ceramic to metal brazing, however, it was determined that the glass to metal sealing provides a more reliable seal and better electrical performance.

Outline
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- Quality Management
- MSSI Business nature
- Cable product Line history
- Cable construction
- SiO2 Cable types
- Advantages of SiO2 cable
- Qualified SiO2 cables for Nuclear application
- Cable/Connector, BPM, engineering Capabilities
- Process Capabilities
- BPM modeling using CST and HFSS

Meggitt PLC organizational chart
The intent of presenting Meggitt PLC organizational chart was to demonstrate the market Meggitt serves and to provide additional information about the corporate products offered in case there would be an interest. The chart also showed the various locations in the areas worldwide that Meggitt is operating in.

Quality Management
MSSI operates within the guide lines of highly recognized quality systems such as ISO 9001 and NRC, which are the industry’s standards and used worldwide. All products manufactured at MSSI go through vigorous inspections and all applicable requirements prior to shipment to the customer.
MSSI business nature
MSSI, based in Simi Valley, California, designs and manufactures various products such as silicon dioxide cable assemblies, BPM, feed-through, fire and smoke detectors and actuators. MSSI's key markets are located in USA, Europe, Asia and North and South Africa. The market segments being served by MSSI and its products are High Energy Physics, Petrochemical, Aerospace, Nuclear, and Defense.

Cable product line history
The basic cable product, which was the SiO2 mineral insulated cable assembly with hermetic connectors, was developed back in 1946 to fulfill the industry's need for high performance/high temperature cabling. The product line was later acquired by Whittaker Corporation in 1979. Because of the nature of the SiO2 insulated cables and its characteristics and ability to withstand very high radiation exposure without any degradation, the cable was introduced to Nuclear market in 1980.

The cable product line remained a separate entity within Whittaker Corporation as Electronic Resources until its merger with a sister division Safety Systems Inc. in 1997. Whittaker Corporation was acquired by Meggitt PLC in 1999 and to date remains as MSSI.

Throughout all the name changes and acquisitions, the cable product line maintained most of the original staff and operators involved with the product. MSSI cable and connector products have been successfully used on various platforms since its inception and have proven to provide high reliability. MSSI always strives to improve the performance and reliability of its products and accommodate the industry's needs.

Cable construction
MSSI has been manufacturing stainless steel, all-welded hermetic cables with non-organic materials for applications in extreme environments for more than 40 years. MSSI has designed, developed and delivered radiation and temperature resistive Silicon Dioxide (SiO2) insulated cable assemblies to the Military and Avionics Industry since 1960. The basic cable and connector technology is applied to a myriad of configurations in critical high temperature and vibration applications on various platforms. MSSI products are found wherever reliable performance in harsh environments is required.

The core technology in the MSSI cables is the use of silicon dioxide (SiO2) as the dielectric insulator, resulting in extraordinary stability of the electrical and mechanical properties of this material under severe environmental extremes. The SiO2 is extruded over the conductors, e.g., copper; or other alloys depending on the specific application. The extrusion process provides the design flexibility that facilitates the manufacture of an almost unlimited array of conductor configurations and sizes. The resulting extrusion is then loaded into a stainless steel (or other metal alloy) tube, and drawn down to size. In the final configuration, the SiO2 maintains conductor position in the tube relative to the other conductors and the outer sheath maintaining precise spacing for stable electrical performance. The unique spherical shape of the SiO2 particle holds the conductor spacing through cable bending operations, usually encountered during routine installation operations, hence electrical performance is not compromised in any way.

This characteristic permits forming and routing at installation with a very tight bend radius nominally three times the cable diameter without causing any damage to the cable. MSSI cable assemblies continue to operate in temperatures above 2000°F.

SiO2 Cable types
MSSI offers a wide variety of cable/connector types with different material and construction to suit required applications. The configurations offered are coaxial, triaxial, shielded coaxial and twisted pair and multi-conductors. All SiO2 cables are supplied with hermetic connectors, which are 100% helium leak tested.
The SiO2 cables offered by MSSI are used on a variety of applications in extreme environments and temperatures. Some of the most common applications are cryogenic, electrical power, RF/Microwave, control and instrumentation.

The type K thermocouple SiO2 cables are also available for application requiring such a device.

**Advantages of SiO2 cable**
The SiO2 cable is more superior than any other mineral insulated cable when it comes to performance and reliability. Some of the advantages are its amazing electrical performance stability at extreme temperature and pressure. SiO2 cables offer at least two decades better insulation resistance value at high temperature than any other mineral insulated cables.

**Qualified SiO2 cables for Nuclear application**
The SiO2 cable assemblies are widely used in nuclear power plants because of its resistance to high radiation dosage exposure in access of 100 Mega Rad. Different cable configurations utilizing various metals are used in different locations of nuclear power plants. The life expectancy of the SiO2 cables for nuclear application is 40 years.

**Cable/Connector, BPM, engineering Capabilities**
MSSI engineering department is staffed with wide range of disciplines such as electrical and electronic, mechanical, material, chemical, optical and software engineering group to provide solutions to customer needs. MSSI engineering uses a number of state of the art software that is available to simulate and analyze the design. The software used are HFSS, FE structural, SFD, solid works, AutoCAD and various others.
**Process capabilities**

MSSI possesses a range of manufacturing capacities in the areas of brazing, welding, glass to metal sealing, extrusion, heat treatment, metal forming and soldering. The brazing consists of different types; induction, filament, torch, and furnace. MSSI is equipped to use a GTAW, Laser, and resistance welding, as required and depending on application. For most applications the GTA or laser welding is used. The glass to metal sealing technique used by MSSI are either compression or matched/expansion. Heat treatments at MSSI are either vacuum, or annealing at H2 atmosphere.

**BPM modeling using CST and HFSS**

In order to demonstrate the engineering capabilities at MSSI and their utilization of available tools such as state of the art HFSS software a modeling of a known BPM and a new design BPM was presented. The modeling was conducted using the HFSS and CST to check the accuracy of the two systems. The first modeling was conducted on a known BPM with available actual capacitance test result. The modeling resulted in an acceptable capacitance value between the simulation and actual test result and proved a good correlation between the CST and HFSS.