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Ceramic mat insulation, aluminum jacketing protect electrical raceways from fire

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Problem

As part of an ongoing program, the Ashland Petroleum Company began to investigate new methods of "physical insurance." Unlike an insurance policy, physical insurance methods are physically tangible means to assure plant safety.

Identified as a key element of the physical insurance program was effective fire protection of critical electrical and control systems in process units at three of Ashland's petrochemical plants; both #1 and #2 processing units at Catlettsburg, KY (combined 220,000 bbl/day), the St. Paul plant (60,000 bbl/day), and the Canton, OH refinery (60,000 bbl/day). Principal products produced at these locations include gasoline, petrochemical feedstocks, asphalt, and almost anything in between.

Documented losses by Ashland and other petrochemical plants coupled with a plant inspection pinpointed many specific areas where fire protection needed to be increased. Most power cables had been routed underground (according to a long-term in-house Electrical Engineering Department standard) and thus considered sufficiently protected. Equipment-to-control-room raceways and control systems, pumps, compressors, and major piping networks were identified as the most potentially hazardous areas.

Ashland engineers began to develop in-house standards and also testing methods to determine the effectiveness of various protection schemes. The overall goal was to provide effective fire protection of critical electrical and control systems to assure safe, controlled (automated) plant shutdown of any affected processing units without requiring manual assistance.

Installing the ceramic mat insulation on the complex conduit lines at Ashland's St. Paul plant was hastened by the ability to cut and fit the material with common tools

Solution

While considering another product, Ashland engineers were approached by the manufacturer of an endothermic fiber mat product. The ensuing discussion resulted in an offer to test products head-to-head in a fire test that was conducted in the manufacturer's testing laboratory.

In defining an acceptable degree of fire protection, Ashland Petroleum developed three essential pass/fail criteria.

The failure of the fire protection system will be defined as the time into the fire test that anyone of the following three events occurs:

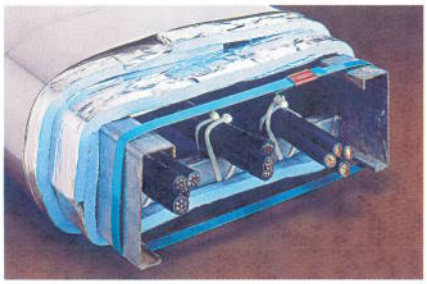
1. *the circuit continuity tester indicates a short in any of the monitored electrical conductors,*
2. *the pressure gauge on the pneumatic line (in the cable tray) drops from 30 psi to below 15 psi, or*
3. *the temperature on the surface of the electrical cable jacketing exceeds 350°F.*

The ceramic mats that were fire tested were endothermic blankets designed to be wrapped around equipment and materials requiring fire protection. A flexible felt-like material was constructed from a combination of ceramic fibers and an inorganic endothermic material, blocking heat penetration by chemically absorbing heat energy. When exposed to high temperatures, the mats release chemically bound water to cool the outer surface of the wrap material and significantly retard heat transfer.

The number of layers determined the total amount of protection afforded. To withstand a 30 minute exposure at up to 1600°F temperatures according to the ASTM E-119 Fire Test Standard or a 20 minute exposure at up to 2000°F according to the UL #1709 Fire Test, a 0.6" thickness was specified (also in accordance with HIFT fire test requirements).

After successful fire test performance, the endothermic material was accepted into the Mechanical Specifications for fire protection at the Ashland plants. In the summer of 1985, 715 sq ft of cables at the Catlettsburg #2 unit were covered with a 0.6" layer of the ceramic material. The cables were chosen because of their complex grouping and shape; there were several cross-sectional changes due to dropouts and the cables were not situated in a well defined tray.

The fire protection system consisted of there layers of 0.2" thick blankets, each with a 3 mil laminated aluminum covering. The material was installed quickly and rapidly with common tools and was



To meet Ashland's needs, 0.3" thick blankets were provided, cutting installation time

mechanically banded in place. A 10 mil aluminum jacketing was adhered to the outer layer of ceramic blankets for protection from the environment. Later in 1985, 3900 and 1300 sq ft of cable racks were protected at the St. Paul and Canton plants, respectively.

Meanwhile, Ashland foresaw the added labor needed in applying the 10 mil aluminum jacketing as a separate step. Because the manufacturer of the ceramic blankets was also a prominent adhesives producer, Ashland challenged the manufacturer to provide a blanket with a laminated 10 mil aluminum jacketing to cut down on installation costs. Ashland also requested 0.3" thick blankets so that a total of only two layers would need to be applied.

The following year, Ashland was able to use the newly developed 0.3" thick blankets with laminated 10 mil aluminum protective jacketing on additional equipment at the three plant sites; 2300 sq ft at Catlettsburg #1, 8100 sq ft at Canton, and 2000 sq ft at St. Paul. The product remained essentially the same, only the blanket thickness and the jacketing were changed in response to the specific requests made by Ashland.

Results

Although the protected electrical raceways have not been tested by a real emergency, the insurance that they provide is welcome. Ashland is currently in the third year of a three-year program to protect its critical electrical and control systems as well as its major structures.

Installation next summer will again utilize two layers of 0.3" blankets with a laminated 10 mil aluminum jacketing on the top layer (assuming that they remain cost competitive!). Ashland management has also been very impressed with the willingness on the part of the manufacturer to develop a modified product to meet the plant's specific needs.

Interam™ E-5 Series Endothermic Mat–3M Speciality Materials, Bldg. 223-6S-04, St. Paul, MN 55144-1000. URL: www.3m.com/foam