ARC-QUENCHING FUSE TUBE LINER

IMPROVES PRODUCT PERFORMANCE

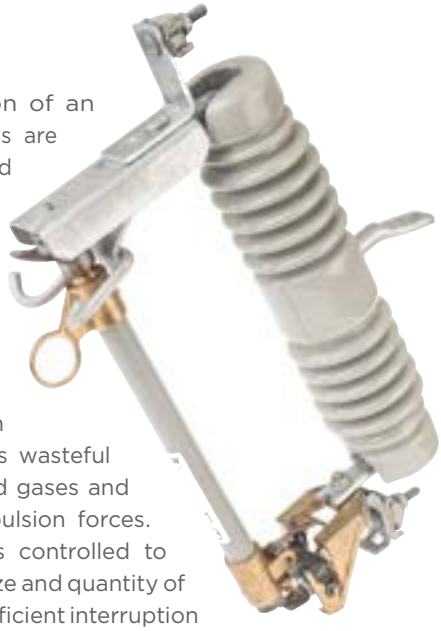
The Synthetic Arc Quenching Fuse T ube replaces the Type C cutout fusetube lined with “bone fiber”. This new fuse tube has a core made from a proprietary formulation, in part, consisting of polyester fiber, epoxy and Aluminum Tri Hydrate (ATH).

THE ARC EXTINCTION

In the presence of an arc, created by the melting of a fuse link, the core of an expulsion fuse is ablated (eroded). The carbon in the organic fragments reacts with water in the arc extinguishing material to form carbon monoxide, hydrogen and other gases. These gases create increased pressure within the fuse tube acting to expel the debris from the fuse tube. With removal of the arcing debris, the dielectric strength inside the fuse tube is re-established, enabling it to extinguish the arc at the next available current zero.

Until now, arc extinction was achieved through use of bone fiber as the arc extinguishing material. One of the characteristics of bone fiber is its tendency to absorb water. It is the absorbed water that helps bone fiber interrupt an arc. The moisture content, and therefore the interrupting ability of bone fiber, is sensitive to ambient humidity. Under normal atmospheric conditions the moisture content of a bone fiber core varies from 2 to 8% by weight. This level of moisture content is adequate to extinguish the arc within the range of interrupting capacity of commercially available cutouts. The variability of the moisture content does, however, contribute to an inconsistent rate of ablation of the bone fiber core during arc interruption.

Aluminum Tri Hydrate filler is used as the water source in the synthetic arc quenching core. The amount of filler is controlled to provide just the right amount of water for efficient interruption. The epoxy matrix used in the synthetic core has a high resistance to moisture absorption from humidity, particularly when compared with bone fiber. The moisture content, and therefore the interrupting ability of this system, is not affected by ambient humidity.



During the interruption of an arc, polymer fragments are ablated from the core, fed into the plasma of the arc, and converted into arc extinguishing gases by reaction with water. The erosion of the core must be sufficient to interrupt the arc. Any erosion in excess of this amount is wasteful and generates unneeded gases and results in increased expulsion forces. The epoxy chemistry is controlled to generate the optimum size and quantity of polymer fragments for efficient interruption at both low and high currents.

FEATURES AND BENEFITS

1. The moisture needed to achieve arc extinction comes from the molecular water of the ATH mixed into the tightly controlled epoxy matrix. Therefore, the release of moisture and resulting gases are much better controlled than in the case of the fuse tubes lined with bone fiber.

2. The epoxy matrix used in the core has a high resistance to moisture absorption from humidity, particularly when compared with bone fiber. The moisture content and therefore the interrupting ability of this system are not affected by ambient humidity. Bone fiber does absorb atmospheric moisture to a much greater extent as shown on the comparison chart. The values represent percent

Fuse tube core made of proprietary formula

gain in weight when the samples of the fuse tubes made with bone fiber and the synthetic arc quenching materials are left immersed in water. An added advantage is that if the fuse tube is left hanging upside down, the core will not swell. It is known that when a fuse tube lined with bone fiber is left hanging upside down and if the bore gets filled with rainwater, the bone fiber will swell. In many instances it will close the fuse tube bore making it inoperable. While the synthetic arc quenching material will not swell, it is not recommended to leave the fuse tube hanging upside down as the collected water can cause corrosion of fuse link, cap and castings.

3. The structure of a fuse tube consists of an arc-quenching core surrounded by a glass-reinforced shell for increased mechanical strength. The matrices of materials used for the core and shell of a synthetic arc quenching fuse tubes are epoxy resins. Since the shell is wound over an uncured core, the two epoxy matrices bond with each other forming a chemical bond. The chemical bond prevents the delamination of the core and the shell with aging and the thermal cycling.

BONE FIBER LINER

SYNTHETIC LINER

In case of fuse tubes with a bone fiber core, the core with its high moisture content makes it difficult to achieve a chemical bond and, therefore, the interface between them relies mainly on a mechanical interlock. With age and thermal cycling, this interface can and does delaminate. Decades of experience with bone fiber indicate that the performance of a bone fiber lined fuse tube is not compromised by such delamination. The pictures at left compare the synthetic and bone fiber fuse tubes after a thermal cycling test.

WATER ABSORPTION BY WEIGHT COMPARISON CHART