Cable Lore

ANACONDA

BY POWER CABLE ENGINEERING AND RESEARCH

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WATER PENETRATION

The adverse effect of water on cable life in service has been known for many years. How can designs be rated with respect to their resistance to water exposure? Power cables frequently come in contact with water during their service lives. It may be for short irregular periods of time, as during heavy rains, or may be on a continuous basis as when installed below the water table. The rate at which cables absorb water is determined by a number of parameters, for example, the ambient water temperature, conductor temperature, cable insulation temperature, and the permeabilities of the cable jacket insulation. In all cases, the water moves from areas of high vapor pressure into areas of low pressure until equilibrium is reached.

In an attempt to correlate water penetration with service life under wet conditions, the gravimetric moisture absorption test was developed many years ago. Samples are exposed to water, dried under specific conditions, and the total amount of weight increase established and reported as a function of the surface area of the specimen. No control is made of the total volume of the insulation. It is true that many years ago some water resistant insulations had lower gravimetric moisture absorpiton values than less resistant insulations, but there really is little significance to this value. As the industry moves more toward performance oriented standards, the gravimetric moisture absorption procedure will undoubtedly be removed from the standards.

We also find that the rate at which water permeates through an insulation is not relevant with respect to life under service conditions. At all temperatures, polyethylene has a lower water permeability, than cross-linked polyethylene, (XLPE), but reports in the literature also show it has a poorer service record in wet locations; failure-producing trees occur more readily than in XLPE.

Ethylene propylene rubber (EP) is more permeable to water than either XLPE or polyethylene,and has a higher water content when saturated. However, in EMA tests which simulate underground conditions (See Cable Lore #46) Anaconda EP lasts at least twice as long on the average compared to XLPE. It is clear that a cable's life in wet environments does not directly depend upon its moisture absorption or moisture permeability characteristics, but rather on an insulation's intrinsic resistance to water-induced deterioration. Since it is usually impractical to use a metallic moisture barrier or current loading to provide a thermal barrier against water, EP is the insulation of choice in wet locations.

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