Cable Lore

ANACONDA

BY POWER CABLE ENGINEERING AND RESEARCH

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CABLE PROPERTIES IN WET LOCATIONS

All power cables must have components compatible with each other for stable electrical and physical properties. Such compatibility and stability is more difficult to obtain for cables to be used in wet environments, since water, especially at elevated temperatures, produces one of the most hostile environments encountered in cable service. Water can affect cables in three significant ways. It can produce:

1. Incompatibility between the insulation and outer coverings. Migration of plasticizers from PVC is well known to anyone who has seen a shower curtain get stiff and boardy. Sometimes plasticizers and other addivities in a covering can migrate and poison the insulation, reducing its electrical properties. Over the years, these bad actors have been fairly well screened out by a series of oven tests, which are relatively short, yet effective. However, for cables for use in wet locations, the situation is complicated because the water permeating the cable produces effects not found in dry locations. In one case, a covering which performed very well in the cyclic loading test over cross-linked polyethylene insulation, caused a serious deterioration of electrical properties in EMA tests, which is one reason why we always run our EMA test on complete cables to make certain the components are all compatible.

2. A change in the type of shield. A cable with a properly grounded, low resistant metallic shield is a safe cable. But a shielded cable which is not grounded is a hazard. Such a condition can result due to corrosion of the metallic shields, a process which requires water. Similarly, a non-shielded cable with an adequate high resistance covering in a dry location, is relatively safe, but in a wet location films of water can act as floating shields and create a safety hazard.

3. Deterioration in insulation electrical properties. All cables which operate satisfactorily in the absence of water, deteriorate in the presence of water – some much more rapidly than others. An oil-paper insulation, for example, when hermetically sealed is an outstanding dielectric, but when exposed to water deteriorates very rapidly. Polyethylene and cross-linked polyethylene exhibit outstanding performance regarding retention of electrical properties in cyclic loading tests in the absence of water. But, to everyone's surprise, after six years in service in wet locations, some of these cables begin to fail as the result of "tree" growth and the resulting deterioration of their electrical properties. Impulse breakdown

strength decreases, dielectric loss increases, and insulation resistance decreases. Usually, the "trees" are water or electro-chemical trees (See Cable Lore No. 40) in the insulation due to the combination of electrical stress and water. When these conditions are simulated in the Anaconda EMA test (See Cable Lore No. 46), we find that a UniShield Cable with an EP insulation and a chlorinated polyethylene stress relief layer and jacket will last more than twice as long as a cross-linked polyethylene insulated cable for the same service.

We believe that a cable designed properly with compatible materials that show a high degree of stability in water at the rated cable temperature stands the best change of survival in wet locations.

Steve Bunish