

Issue No. 45

January 30, 1976

CABLE DEFORMATION

A cross sectional view of a well made medium voltage cable, UniShield for example, would show the following:

- (1) A conductor composed of a multiplicity of individual wires concentrically surrounding a center core wire.
- (2) A thin, round, smooth and well-centered extruded stress relief layer (strand shield) completely filling the outer layer of strand interstices.
- (3) A comparatively thick tube of extruded dielectric, well-centered and adhering to the strand shield as though they were one compound.
- (4) An outer layer - A combined protective sheath and stress relief layer (insulation shield) with six individual shield wires imbedded and spaced equally around the circumference.

The total visual affect would be one of symmetry and geometrical precision in composition. This symmetry and precision must be maintained throughout the total cable length for its entire service life to insure maximum efficiency, safety, and longevity.

Unfortunately, cables are sometimes exposed to heat and mechanical environments simultaneously, that could be severe enough to deform some cable components. Polymeric jackets and insulations, depending on their chemical structure, show varying degrees of resistance to deformation at temperatures above their normal rating. The combination of high temperature and mechanical pressure will accelerate flow or deformation of plastic compounds such as polyethylene and PVC to a fairly high degree. Unfilled XLP while classified as a thermosetting compound, behaves more like a plastic compound in the emergency temperature range. Thermosetting elastomers such as well compounded and cured EP insulations show no significant deformation in tests conducted in the emergency temperature range.

Whenever in an actual cable installation the load raises the conductor temperature above the rated temperature, the following can happen if the polymeric components do not have a high degree of resistance to distortion or deformation:

- (1) The weight of the conductor will cause it to migrate through the softened insulation, reducing or thinning the insulation wall.
- (2) Cables resting on supports or sharp edges will be indented or deformed. The degree depending on the area of surface contact. Low walls will result.
- (3) Insulations under tightly fitting prefabricated slip-on terminations or splices will flow and deform.
- (4) Deformation or flow at high temperatures will limit the emergency rating of a cable.
- (5) Deformation of the original cross-sectional resulting in thinning of insulation walls increases both the average and maximum voltage stress in that location and increases the probability of premature failure.

Deformation of cables under a combination of thermal and mechanical stress can be kept to a minimum by choosing coverings that exhibit low deformation under a mechanical load and high temperatures. EP insulations are far superior to polyethylene and significantly superior to XLP in the range of emergency and short circuit temperatures.

Steve Bunish