Cable Lore

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INDISCRIMINATE REDUCTION OF INSULATION WALLS CAN RESULT IN A LOSS OF SAFETY FACTOR ELECTRICALLY. IN UNIT CONSTRUCTIONS THERE IS THE ADDITIONAL LOSS OF MECHANICAL PROTECTION

In order to perform its intended function, an electrical insulation must be capable of withstanding without rupture any voltage stress that may reasonably be expected to exist between the conductor and its surroundings.

The progress in insulation development in the last 15 years has encouraged the reduction of long established insulation thickness values. This reduction can be justified when based on sound engineering. It is risky business when based on commercial expediency.

At least four areas must be evaluated before reduced insulation walls can be considered.

(I) Voltage Gradient

The dielectric strength of an insulation is usually quoted as being so many volts per mil of insulation thickness. This is simply the dielectric breakdown voltage divided by the insulation thickness in mils. In reality, dielectric strength should be stated as kV at breakdown, and the volts per mil (vpm) is the breakdown gradient.

The breakdown gradient is influenced by: insulation thickness, frequency of the applied voltage, rate of increase of applied voltage and temperature.

When an insulation is applied to a conductor, additional complications arise because of the concentric geometry of the insulation. The voltage gradient across a cable insulation is no longer simply the conductor voltage divided by the insulation thickness. In a cable insulation, the gradient varies from a maximum at the surface of the conductor to a minimum at the outer surface of the insulation.

Significance in Reduced Walls of Insulation

(a) The average gradient occurs at only one point in this insulation.
(b) As the gradient increases the probability of corona increases.
(c) The probability of tracing occurring increases because of increased capacitance.

These factors put an added premium or emphasis on the quality of workmanship and installation.

(2) Safety Factor

In a well designed cable, UniBlend for example, the relationship between the kV at breakdown and the operating voltage remained within the same limits. This is one reason why full wall test voltages have been retained. This is an advance in the art.

If insulation walls are reduced with a proportional loss in kV breakdown, this results in a loss of safety factor. Only long-time field experience can justify this course of action.

Keep in mind that rated circuit voltages are only nominal values, in normal system operation. There may be a routine variation of ± 10% of this nominal voltage. Circuit switching, lighting surges, or equipment failures (other than cables) can and do cause transient voltage surges that are several times the rated voltage of the cables.

To make matters worse, system operators, or designers, either do not know or are slow to admit that these conditions exist, either when purchasing cable or when complaining of a cable failure.

(3) Mechanical Protection

It is fairly obvious that with less covering there will be less cushioning. In UniBlend cables there is an added feature in the fact that at least 2/64's of the semiconducting covering over the conductor plus the insulation wall provide a cushioning effect.

Extreme caution must be exercised on 600-volt constructions with reduced walls. While electrical requirements are less severe than high voltage cable, installation practices are more severe.

(4) Cable Design Must Be Sound in Theory Backed by Good Test Data

For maximum efficiency, the probability of corona must be reduced to a minimum; the dielectric must be homogeneous and free of contamination. The shielding system must have integrity over a wide range of application.

Extruded strand shields, isolated facilities, high grade compounds, and good workmanship enhance good cable design.

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