The influence of operating conditions of cable lines in grids on selected properties of extruded cable insulation

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Medium voltage cable lines exploited by distribution companies operate in various configurations - in underground power network or in mixed configurations with overhead power lines. Tests of several dozen parts of MV cables with extruded insulation, exploited in real conditions, confirmed that the process of degradation of polyethylene cable insulation depends on the place of work location' of the cable line in the MV power network. Measurements of thermal properties and resistance to partial discharges, and assessments of molecular molar mass of particular insulation layers were conducted, with the samples of insulation obtained in the way shown in the figure 1. Analysis of the measurement results led to the conclusion that changes in selected properties of the extruded insulation of MV cables exploited in real conditions depend on the kind of the cable network. In cable insulation from the lines work in underground power networks faster deterioration of the physical and chemical properties of insulation is observed next to the return conductor, while in the cable cooperating with the overhead line the destruction processes are more prominent in the insulation next to the return cable.

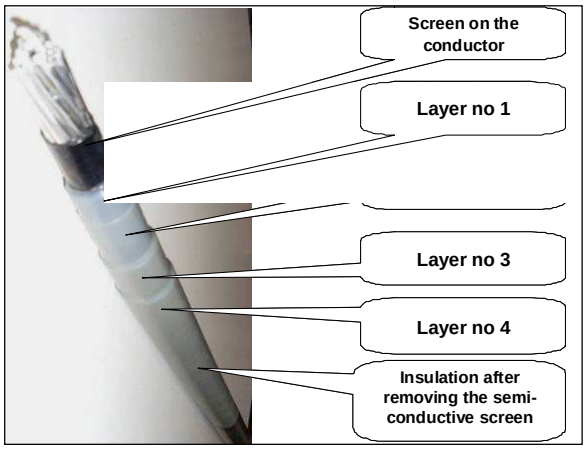
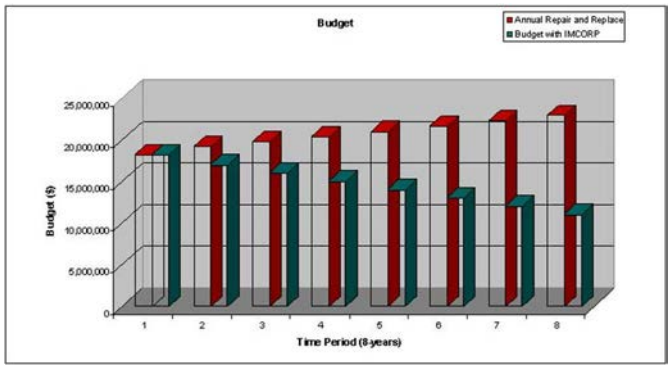


Fig. A way of obtaining of layers of cable insulation for testing

As a result of the laboratory tests and analysis of the work conditions of the underground cable lines, it was possible to establish that the process of degradation of polyethylene insulation is influenced by the electrical conditions typical for specific types of cable systems. Next, the factors contributing to fast insulation degradation have been identified. Finally, some recommendations for maintenance services have been formulated, regarding limiting the negative impact of thermal effects on extruded insulation.



Example: Budget comparison for alternative approaches

The construction of the model will also be examined. The model will be analyzed in detail through the review of input variables, an overview of the actual equations, and the resulting financial and reliability outputs. Based on actual field experience, specific examples in the form of case studies will be shared that demonstrate the resulting value of defect specific diagnostics as both an aging cable asset management strategy and a cable reliability tool. The paper will examine both the financial aspects and the reliability aspects of the examples in the case studies.

In summary, the discussion of this model to proactively deal with the problem of aging assets and the resulting decline in cable system reliability should offer affected utilities a way to more effectively evaluate alternatives to improve their system reliability.