

Dielectric diagnosis of extruded cable insulation by very low frequency and Spectroscopy techniques - A few case studies

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Electric Power Systems comprises a large number of power cables which are quite expensive. Wide variety of cables like PILC, EPR, PVC, XLPE are in use. Many of these cables which are in service are approaching their life span. These cables and their accessories, which are subjected to various kinds of stresses during their service life undergo degradation and deterioration of insulation and hence lead to forced outages. Forced outages are of serious concern and are not economical. In order to check the quality and healthiness of a cable system, it is important to perform diagnostic tests on laid cables before setting into operation and after definite period of operation. Though there are various diagnostic test methods available, there are certain merits and demerits in each technique and no each technique can give the complete information about the healthiness of the cable. Applying effective technologies and remedial measures can reduce costs and improve the performance of cable systems. Therefore lot of research efforts and activities are directed towards a better understanding of degradation phenomena and the finding tools for insulation diagnosis and remaining life estimation techniques.

Central Power Research Institute (CPRI) a premier institute in the field of power sector is rendering its services to various Electricity boards, Power Utilities, manufacturers and others in condition assessment of cables for the last few decades. Condition monitoring techniques like measurement of Insulation resistance, PI, Dissipation factor, Loss angle and capacitance, VLF testing methods are adopted to assess the condition of the cable insulation. In this paper some of the low frequency techniques are reviewed and some case are presented and discussed. Case studies include the assessment of distribution cables which were submerged under water for more than 45 days were assessed using VLF technique in addition to other techniques like insulation resistance and dc voltage withstand test. Technique used for extraction of water from the cable termination is discussed. The consequences of bad crimping of cable lugs and improper cable terminations on the penetration of water into the cable length are highlighted. The study showed abnormal dielectric losses in the cable insulation as a result of highly polar contaminants in the cable. The application of low frequency tan delta technique and its usefulness in assessing the failed cable are enumerated. Low frequency partial discharge measurements conducted on 33kV to identify localised incipient defects are presented and discussed. Few case studies using dielectric spectroscopy are presented and discussed.

Key words

Dielectric diagnosis; very low frequency tan delta; Very low frequency partial discharge, Waterlogged cables, VLF tests