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Condition assessment of distribution PILC cables from electrical, chemical and dielectric measurements

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Abstract

The condition assessment of PILC cables is a crucial factor for many utilities and this paper is devoted to the evaluation of some new diagnostic techniques enabling users to effectively manage their PILC cable assets. We used electrical and chemical techniques to measure the electrical, chemical and dielectric properties of distribution PILC cables. The non-destructive electrical tests performed on several full-length field-aged PILC cables were : the isothermal relaxation current (IRC), the LIpATEST leakage current test, the harmonic distortion test and the return voltage method (RVM). These measurements were performed in the laboratory and in the field. In addition, AC breakdown was also performed in the laboratory. Difficulties and limits associated with the field measurements are discussed. Chemical tests were performed on small samples of paper tapes and oil taken from the same samples. They were : dielectric analysis, Fourier transform infra red (FTIR) spectroscopy and moisture content analysis. The electrical techniques ranked the cables consistently and it seems that the water content of the insulation is not a major factor influencing the dielectric losses and depolarization currents. In fact, the results of the electrical tests were not related at all with the actual moisture titration measurements. The presence of acids associated with thermal aging and/or pd activity is another parameter affecting the electrical life of the PILC cables examined. Although more data on more cables would be needed it already appears that the tested techniques could assess the condition of the insulation of PILC cables provided the data is interpreted with some care. Note that most, if not all, the diagnostic techniques evaluated in this work could also be used to assess the condition of crosslinked polyethylene cables.