

Effect of supply voltage frequency on testing medium voltage cable in the grid

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To ensure a high level of performance of the underground medium voltage network, cable replacement is a major asset management issue for the EDF Group as it would be for any Distribution Network Operator.

French underground grid operated by ERDF is constituted, for the greater part, by cables with polymeric insulation. However, remaining paper-impregnated cables, even if they are still in good condition, can lead to a significant increase of the failure rate. The renewal of these cables is scheduled over several years. To help replacement, diagnostic tools can be applied to detect and remove weak points and avoid short-term failure and for definition of priority in medium and long term replacement operations.

A methodology for joint failure prevention and paper insulated cable condition gradation has been defined. Based on off-line measurements, this methodology have been deployed on the French networks since 2007 and provides a risk level to asset manager via a database. It is also used to continuously improve the decision criteria.

Two measurement systems of partial discharges are used for the cables diagnostic:

1. a very low frequency system with a 0,1 Hz generator,
2. an oscillating wave test system with a frequency between 20Hz and few hundreds of Hz

The question addressed is to appreciate and manage diagnostic results variation due to difference of frequency of the applied voltage in order to give homogeneous data to asset managers.

The paper presents the study of the frequency dependence of partial discharges measurements. Diagnostic of underground cables in our laboratory and on the grid are performed with both system: 0,1Hz and oscillating wave. Laboratory results are compared to see the effect of the supply voltage frequency on the inception and extinction voltage, magnitude and number of partial discharges.

On site measurements are performed in Lyon on sections with old impregnated paper cables and synthetic cable, over a period of two weeks, at the rate of two cables a day.

Then, to reference the measurements having a significant interest for the study, 5 samples, from 5 to 10 long on both sides of weak points identified are removed from network and complementary laboratory tests and visual expertise are performed on these sections.