C.8.1.10.

Partial Discharge Measurements on service aged Medium Voltage cables at different frequencies

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Diagnosis with very low frequency (VLF) test systems is well introduced and accepted for detecting potential defects by water trees in polymer cables. The main information is gathered by measuring the dissipation factor tan δ at different voltages. Most relevant for estimating the present condition of a cable insulation is the absolute value as well as the rate of rise of dissipation factor Δtanδ versus the testing voltage. Detailed values especially for VLF test frequencies have been published earlier by different authors.

Single defects are neither detectable nor located by tan δ measurement. Here partial discharge measurements have to be carried out. Still under discussion is the relevance of results at different test frequencies. This paper shall focus on characteristic PD measurements on service aged polymer cables. Results are compared with some results on model test installations. Experience with detecting faults on site by PD measurements on installed cable systems will be presented.

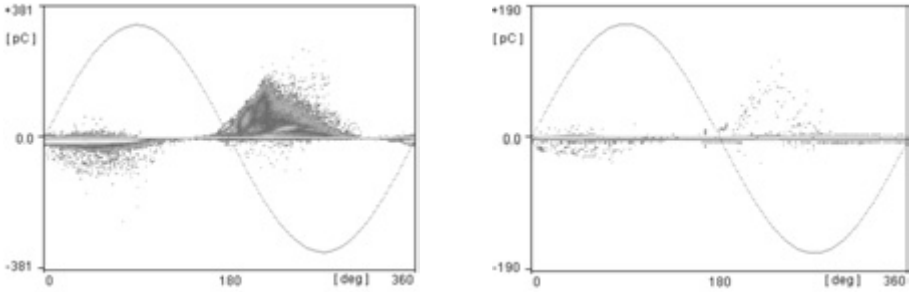
The shape of single partial discharge impulses is independent on the test frequency as well as propagation on the cable itself. Therefore if partial discharges are triggered by a defect in a cable system the position can be detected. A significant question is whether 50 Hz test will result in comparable signals as VLF tests. Especially the inception voltage of different faults have to be investigated and compared with the voltage endangering non defective insulation.

Experimental results on service aged cable show that the inception voltage at VLF is slightly higher compared with 50 Hz tests and the number of discharges may be significantly less. The PD level of the impulses used for detection itself is equal within reasonable limits. Because 50 Hz test voltages causes defects at significantly lower voltage levels compared with VLF voltages, VLF testing is despite the slightly higher inception voltage a preferable test method.

An example of measurements carried out on a 5 m sample of an 30 year old cable is given below.

20 kV polymeric cable Test in laboratory	**50 Hz**	**0,1 Hz**
Inception voltage	12 kV	16 kV
Extinction voltage	6,4 kV	14 kV
PD (max) at 24 kV	180 pC	130 pC
PD (avg.) at 24 kV	100 pC	20 pC

Characteristic values of PD measurements



20 kV Cable, PD at 24 kV, Duration of test 300 s, f = 50 Hz and f = 0.1 Hz

Present experience with on-site defect location:

Utility 1: Southern Germany
New XLPE cable with a fault in one joint during operation

Result: 8 joints of 12 detected as sources of PD
Inspection showed faulty installation
Test voltage: 1.5 U_0, duration of test: 0.5 days

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