B.9.1.

Accelerated long term evaluation of MV-XLPE cables

J. T. Benjaminsen and H. Faremo, SINTEF Energy Research, Norway
P.B. Larsen, A. Ryen and A. Wolden, Nexans Norway AS

Internationally it is agreed that the ageing time necessary to test the properties for XLPE cables for use in wet environment is two years to be able to reveal typical weaknesses related to water treeing in such cables.

The main purpose of this work has been to develop a long term ageing test, which gives a reliable result after considerably shorter ageing time than the harmonized two years "Long Duration Test" in CENELEC HD 620. This test could be used as a screening test or even as a pretest assessment. It can also give both manufacturers and cable users a quicker answer of the consequences of changes in the insulation system.

The ageing has been performed in a large tank with diameter 1,8 m at the following conditions:

- Preconditioning: 1000 h in tap water added 0,3 g NaCl /l at a temperature of 80 °C
- Ageing voltage: 20 kV AC voltage on cables with insulation thickness of 3,4 mm
- Ageing temperature: 55 0C in tap water added 0,3 g NaCl /l at a temperature of 80 °C
- Ageing frequency: 50 Hz
- Ageing time: 2 000 h

Internationally breakdown voltages are often used in order to evaluate ageing performance. At the end of the ageing period the aged cable length was therefore cut into test samples of 5 m active lengths (terminations in addition). Each test sample was tested to breakdown with an AC step test within 72 h after removal from the ageing tank, according to the following procedure:

- Start at $5U_o$ (30 kV) for 5 minutes.
- Voltage increasing in steps of Uo every 5 minutes to breakdown occurs.

Water treeing analysis was performed on ~10 cm^3 of the cable insulation of each cable length including all breakdown sites. These procedures are in agreement with the proposal of CIGRE WG 21-11, "Characterization test".

The observed parameters in all slices were:

- Longest bow-tie tree
- Density of bow-tie trees
- Longest vented water tree from the conductor screen
- Density of vented water trees from the conductor screen
- Longest vented water tree from the insulation screen
- Density of vented water trees from the insulation screen

Where results are available, the test results will be compared with results from the two years harmonized "Long Duration Test".