Local effects of water entering XLPE insulation through damaged sheaths

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Abstract
Long term tests carried out by NKT Cables according to DIN/VDE 0276-620 have shown that the breakdown voltages after ageing are dependent on the way in which water is supplied to volume between the sheath and the cable core. A series of investigations has been carried out to clarify whether local effects of water entering the insulation through the sheath opening could be the cause of this effect.

The investigations comprise long term tests under varying conditions, measurement of water transport in the insulation and of the extraction of soluble residual products and by-products. New test methods applying traceable water have been developed for these measurements.

in collaboration between the Danish electric utilities and NKT Cables.

Long term tests

Cable type
All long term tests were carried out at NKT Cables and the cables used in the tests were 24 kV single core XLPE cables with 150 mm² stranded aluminium conductor, manufactured by NKT (Type NA2XS2Y 1x150 RM/16 12/20 kV).

Aging conditions
During the tests, the cables were installed in thermally insulated pipes filled with water. An AC voltage of 48 kV (4Us) was applied and in four tests, cyclic heating of the conductor was added. In the ageing tests without heating cycles, the temperature of the water was maintained at 50°C±5°C.

In the heat cycling tests, heating current was applied to the conductor for 8 hours followed by a