

**B1.4****Local effects of water entering XLPE insulation through damaged sheaths**

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Résumé

Essais de longue durée conformes à DIN/VDE 0276-620 ont été réalisées par NKT Cables. Les essais ont démontré, que les tensions de claquage dépendent de la façon en quelle l'eau est amenée au volume entre la gaine et l'âme.

Une série des recherches ont été réalisées pour clarifier si des effets locaux du pénétration d'eau à l'enveloppe isolante par une ouverture en la gaine pourraient être la cause.

Les recherches comprennent des essais de longue durée en conditions variées, des mesures du transport d'eau dans l'enveloppe isolante et de l'extraction des sous-produits et des produits résiduels solubles.

Des méthodes nouvelles, qui utilisent de l'eau tritiée, ont été développées pour ces essais.

Introduction

Long-term tests are now well established as a means for verifying the resistance to water of polymeric cables. The different methods are described in [1].

When carrying out a long-term test according to DIN/VDE 0276/620 [2], NKT Cables found that the results were dependent on the way in which the water was supplied to the volume between the cable core and the sheath [3].

Tests in which the water was let in through an opening in the sheath of the submersed cable resulted in breakdown voltages which were 40 to 50% lower than obtained when the water was supplied from the ends of the cable samples. Furthermore, the breakdowns occurred in the part of the sample where the sheath had been removed. These unexpected results have led to an investigation of the causes of this effect and of whether a similar effect is observed for cables in normal operation. The investigation has been carried out

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).

Ageing conditions

During the tests, the cables were installed in thermally insulated pipes filled with water. An AC voltage of 48 kV (4U₀) 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