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B.3.1. L'effet du préconditionnement sur les performances de câbles MT à isolation PR pendant un essai de longue durée en immmersion

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Résumé

Ce rapport présente les résultats d'essais de vieillissement de longue durée en milieu humide, réalisée sur des câbles 12 kV isolés au PR. La durée d'essais était de trois ans. L'objectif principal était d'étudier l'effet de différentes procédures de préconditionnement avant le vieillissement : sans préconditionnement, avec préconditionnement à sec en étuve à air, ou dans l'eau chaude ordinaire.

Le rapport démontre que le préconditionnement a un effet sur les caractéristiques du câble. Les tensions de claquage initiales ont été réduites de 25 à 40 %. Après deux ans d'essais, les différences de tension de claquage ont disparu. Les trois procédures de préconditionnement ont également une influence sur le développement des arborescences ouvertes et en noeud papillon. Toutefois, il apparaît que les différences dans le développement de ces arborescences n'ont pas une influence significative sur les tensions de claquage après vieillissement.

B.3.1. The effect of preconditioning on the performance of MV-XLPE cables in long term water treeing tests

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Abstract

This paper presents results obtained in long term wet ageing tests performed on 12 kV XLPE cables. The test duration was three years. The main purpose is to study the effect of different preconditioning procedures used prior to the long term ageing. No preconditioning, dry preconditioning in an air ventilated oven and wet preconditioning in heated tap water is evaluated. Tests according to ten different ageing conditions are presented.

The paper demonstrates that the preconditioning has an effect upon the cable properties. The initial breakdown voltage levels were reduced by a factor of 25 to 40 %. After two years of ageing these differences in voltage levels had disappeared. Also bow-tie tree- and vented water tree growth were influenced by the three different preconditioning procedures. The observed differences in water tree growth do, however, not appear as significant differences in the breakdown voltage levels after ageing.

1. Introduction

In the Nordic countries polymeric cables for 12 and 24 kV were introduced more than 20 years ago. Since the introduction several improvements with respect to materials, production processes, constructions, etc. have been introduced.

One of the most important changes is probably the changeover from a painted/graphited to an extruded insulation screen. Service experience with the painted/graphited cable construction had shown an increase in failure rate after 10-15 years of service. The reason for this was in most cases water treeing. However, also one of these early strippable constructions with an extruded insulation screen containing a special additive has had problems. This cable has suffered some breakdowns that have proven to have the same cause of failure as the old cables with semiconducting tapes and paint as insulation screens. Also the time to failure for this early extruded strippable insulation screen with the special additive was the same as for the cables with insulation screens made of semiconducting tapes and paint, i.e. 10-12 years.

Service experience with other cables having strippable extruded insulation screens has been good since they were first introduced (1975 - 1981).

When this Nordic investigation started, several countries had already started work in order to develop a long term ageing test in a wet environment. International groups (for instance CIGRE WG 21-11) had also been working in this field for several years, but with limited success. Different procedures of preconditioning the cables before ageing has been proposed over the years ([1, 2, 3]).

In principle the methods can be categorized in three groups:

1) No preconditioning before ageing.
2) Drying and degassing the cables in an air ventilated oven at an elevated temperature.
3) Preconditioning the cables in water at an elevated temperature.

The objective of this investigation is to compare different preconditioning methods. The long term effect on the XLPE cables are evaluated on the premises that prior to the ageing the cables are exposed to three different preconditioning procedures.

2. Test objects

This work has been performed on cables produced in 1990. Cables from two manufacturers have been evaluated. Some of the cable features are shown in Table 1.

Table 1: XLPE cables: 12 kV - 150 mm² Al with swelling powder in the stranded conductor.

Cable	Manufacturer	Insulation screen	Comments
X1	A	Strippable	
Y1	B	Strippable	
Y2	B	Strippable	Other production

The IEC denomination of the cables is 6/10 (12) kV; nominal insulation thickness is 3.4 mm.

Before the ageing tests were started all external coverings of the cables were removed; PE-sheaths, copper screens, etc. If the cables were preconditioned this removal was performed **before** the preconditioning.