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Development and application of a sample test for water treeing in medium voltage cables

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Resumé

Une procédure d'essais pour comparer les câbles synthétiques soumis à un essai de pénétration d'eau est décrit. La procédure d'éxamination de la structure initiale du câble est aussi décrite. L'analyse des câbles est alors comparée en observant les arborescences après un court essais de vieillissement de 2000 heures. Les résultats sur environ 50 câbles en provenance de 19 fabriquants démontrent la mauvaise performance de certains câbles. L'objectif principal est de comparer la performance des câbles fournis par les fabriquants avec les résultats d'arborescences des essais de vieillissement de longue durée. Ces résultats sont alors comparés aux performances connues des câbles qui ont été en service.

Abstract

A sample test procedure for comparing polymeric cables subject to water ingress is described. The procedure to examine the initial structure of the cables is outlined. Water treeing in the cables is compared by observing the water trees after a short term ageing test of 2,000 hours duration. Results on over 50 cables from 19 manufacturers show that some poor performance is detected. The objective is to compare cables which are being supplied cables with cables subjected to a long term water treeing test. The results are then related to service using a cable with a known service performance.

Introduction

Water treeing in polymeric insulation can occur in service and it is recognised that tests for water tree deterioration in medium voltage 'wet' designs of cable are required before installations are undertaken. The most widely performed tests use an exposure to water and voltage at power frequency. The test criteria are based upon the breakdown strength of cables after a period of ageing or the survival at time at voltage. Significant changes in the breakdown strength only occur when the water tree lengths are an appreciable fraction of the insulation thickness, with the result that ageing times are prolonged, up to 2 years.

One difficulty of a long term test regime is ensuring that present production has the same quality as the cables which were originally tested. Some countries address this problem by undertaking a continuous programme of sampling production using a long term test. This results in an extensive and expensive routine of cable testing.

This paper describes an examination and short term water tree comparison procedure which has been used to compare cables. Over the last five years 51 cables with both XLPE and EPR insulation from 19 manufacturers have been subjected to this 'sample water treeing test' regime at our laboratory. Using tree counting and short ageing times does not differentiate between good cables, but excessive water tree growth will be detected, and some cables with poor performance under water treeing tests have been detected. This paper describes the objectives, methodology and results obtained from this procedure.

The cable users viewpoint

With European wide competitive tendering it is now common for a user to receive tenders for a wide range of insulation options. For example, cables with conventional XLPE insulation; a single copolymer addition; a