



B1.1

Long term wet ageing of extruded dielectric cables

VAIL J. , NOYES R.P., BANKS V.A A., BICC Cables Energy, Wrexham, United Kingdom
HAMPTON R.N., BICC Cables Ltd, Erith, United Kingdom

Resume

L'expérience en dehors du UK sur les défaillances des câbles diélectriques extrudés MV, a abouti à la réalisation d'études approfondies dans le monde entier. Ce document décrit les travaux effectués à BICC depuis les 1970's et passe en revue les résultats d'essais à long terme (jusqu'à 10 ans) réalisés dans des conditions de service, sur des câbles fabriqués dans les 1970's et 1980's. Les résultats sont comparés aux d'essais de l'UNIPEDE sur deux ans à 2,5U₀, sur un câble des 1990; ils démontrent la bonne qualité de service obtenue avec ces câbles. Les données européennes et nord-américaines concernant les défaillances, tirées de la documentation, sont alors utilisées avec les données de survie en service concernant les câbles ci-dessus, pour produire une estimation de la durée de vie qu'on peut en attendre.

Abstract

Experience outside the UK with service failures of wet MV extruded dielectric cables has led to extensive world wide studies. This paper describes work carried out at BICC since the 1970's and reviews the results of long term tests (up to 10 years) under working conditions on cables manufactured in the 1970's and 1980's. The results are compared with data from 2 year UNIPEDE tests at 2.5U₀ on 1990's cable and demonstrate the good service performance obtained with these cables. European and North American service failure data, obtained from the literature, is then used with the service survival data on the above cables to estimate their expected lifetime.

Introduction

This paper describes the long term testing carried out at BICC Distribution Cable Systems over the last 25 years to study the ageing of extruded dielectric cables under wet conditions.

The early stages of this work on cables manufactured in the 1970's has been reported previously [1]. These results are updated in this paper and compared with test data on cables manufactured in the 1980's. The ageing was carried out at working voltage, 50Hz or 500Hz, and maximum operating temperature (90°C) for up to 85,000 hours (over 10 years) immersed in water.

The above data is compared with data from 1990's cable tested to the UNIPEDE regime [2]. The ageing was carried out at 2.5 times working voltage, 50Hz, and a temperature of 30°C for 17,500 hours (2 years) immersed in water.

Ramp breakdown data from these laboratory tests and service survival data have been analysed to provide data for an endurance model for cables in wet conditions. This endurance model is similar to the Cable System Endurance Model for ageing under dry conditions [3]. This analysis was then used to

estimate the probable lifetime of extruded dielectric cables operating in wet conditions.

Tests on cables manufactured in the 1970's and 1980's

Cable details

The cable construction is given in Table 1.

Table 1 - Cable construction

Layer	Details
Conductor	25mm ² stranded copper
Conductor Screen	Semiconducting extruded
Insulation	Extruded (3.4mm wall)
Core Screen	Semiconducting extruded or varnish / coated fabric tape
Earth Screen	Copper wires
Oversheath	Extruded

The oversheath was extruded oversize to allow water to be introduced into the underlying radial gap and be in direct contact with the core screen. Cables were manufactured with cross-linked polyethylene (XLPE) and ethylene propylene rubber (EPR) using either the CCV or the Monosil process.