JICABLE '99

A.2.6

Technological advances in reliable HV XLPE foil laminate cable systems

FORD A., Formerly with London Electricity, United Kingdom
GREGORY B., KING S.M., SVOMA R., BICC Cables Ltd., United Kingdom

Sommaire

Le rapport décrit le premier câble Polyéthylene Reticulé de 132kV, installé dans un tunnel á Londres, et comportant une barrière d'étanchéité à l'eau en feuille métallique. Cette solution permet de réaliser de plus grandes longueurs d'acheminement, ce qui facilite la recherche de sites appropriés pour les puits d'accès. En effet, ceci devenait de plus en difficile depuis l'adoption, en 1989, de l'installation en tunnel pour les chemins de câble à travers le centre de Londres. Un nouveau systéme de barrière d'étanchéité à l'eau en feuille métallique et de mise à la terre répartie a été développé pour résister aux essais au choc qui sont destinés à simuler les dégâts occasionnés par des tiers. Le rapport décrit le régime d'essai, et donne les résultats des essais mécaniques, de corrosion et de performance électrique effectués pour satisfaire aux exigences de London Electricity.

INTRODUCTION

Early MV cables, particularly in the USA, were not provided with metallic sheaths. The phenomenon of water-treeing led to water tree retardent grades of insulation at MV and to the reintroduction of metallic sheaths at HV. HV cables in the UK (66 and 132kV) are usually laid-direct in the ground and operate well above the electrical design stresses required to initiate watertree growth. Extruded metallic sheaths are therefore considered necessary, not only as a moisture barrier but also to provide the most robust mechanical protection from third party damage, as well as carrying high earth fault currents without the need for an additional conductor. For close cable spacings the high electrical resistance of a lead alloy sheath has the advantage of reducing sheath eddy currents and circulating losses, but would require to have an increased thickness to carry the highest levels of short circuit current. The practice for laid-direct cables in London has historically been to select a lead sheath, for it's excellent corrosion resistance, and to install the three single core cables in a close trefoil formation, with solidly bonded sheaths, thereby eliminating circulating currents and minimising the risk of voltage driven corrosion.

Reference [1] reviews the design, installation and performance of HV cables with polymeric insulation in London's distribution system. The first laid-direct 66kV XLPE installation was completed in 1983 and the first 132kV XLPE installation in 1986. The first 132kV XLPE tunnel installation was completed in 1992. Reference [1] noted that tunnelling would continue to be the preferred option to overcome problems of finding routes under the congested London roadways. Allied to this, the paper referred to the preparation of a User specification which would, where installation conditions were appropriate, allow manufacturers to offer cables with a higher insulation design stress, a foil water barrier and a wire earth return conductor. The electrical performance of these higher design stress cables, together with their accessories, would be required to be demonstrated by Type Approval Testing.

In 1992 CIGRE published guidelines for tests on HV cables with extruded insulation and laminated protective coverings [2]. The purpose of the guidelines was to provide minimum requirements to assess the integrity of the laminated covering.

This paper describes the first application in London of a 132kV XLPE cable with a metallic foil laminate water barrier. Also described is the test specification and the test results.

ABSTRACT

The first tunnel installation in London of 132kV XLPE cable with a foil laminate water barrier is described. This construction permitted longer despatch lengths, thereby easing the pressure to find suitable sites for access shafts, which had become a growing problem since tunnelling was adopted in 1989 for cable routes through central London. This paper describes both the test regime and the results of the range of mechanical, corrosion and electrical performance tests. To meet the requirements specified by London Electricity a new design of foil laminate barrier and distributed wire earth conductor was developed to withstand the impact test which simulates third party damage.

CABLE DESIGN

The London Electricity purchasing specification for 66 and 132kV XLPE cables was prepared in late 1992, as a result of privatisation and ahead of the single European market. The specification was based on experience gained with XLPE installations in the 1980's and had the objective of delineating acceptable design variations for future applications in London's network.