THE ST. JOHNS WOOD - ELSTREE EXPERIENCE – TESTING A 20KM LONG 400KV XLPE-INSULATED CABLE SYSTEM AFTER INSTALLATION

Simon SUTTON, National Grid, (UK), simon.sutton@uk.ngrid.com
Ronald PLATH, IPH Berlin, (Germany), plath@iph.de
Gero SCHRÖDER, Südkabel GmbH, (Germany), gero.schroeder@suedkabel.com

ABSTRACT

This paper deals with the 400kV cable connection between St. Johns Wood and Elstree, one of the largest XLPE cable projects in the world. This cable route is a connecting link to the city of London and was commissioned in 2005.

KEYWORDS

Power cables, testing after installation, partial discharges

INTRODUCTION

The 400 kV cable connection between St. Johns Wood and Elstree in London is one of the world's largest cable projects ever: 20 km XLPE three-phase cable system including 60 cross-bonding joints and 6 GIS terminations. The system with 2500 mm^2 copper conductor has a transmission capacity of 1600 MVA. The cable system was laid in a tunnel ~30 m below surface.

The motivation for this outstanding project goes back to 1997, when the national transmission operator of the networks in England and Wales, National Grid (NG), decided on an upgrade of London's electricity infrastructure. The key considerations were a large number of the existing 275 kV systems in London were approaching their predicted and agreed lifetime limits, the need to maintain the reliability and security of supply, and meet growing energy demand in the capital.

THE TUNNEL

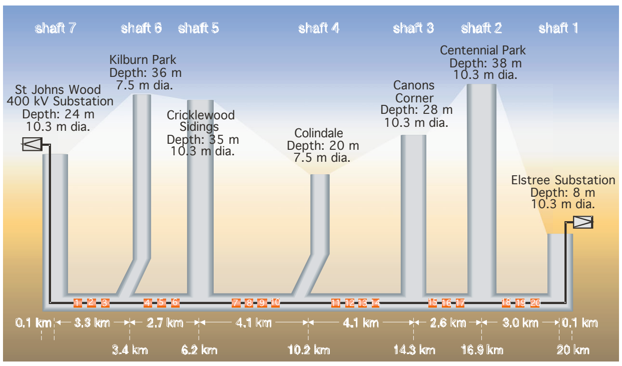

Fig. 1 The St. John´s Wood - Elstree cable tunnel

The cable system was installed in a 20-km-long tunnel running at an average depth of 30 m (see Fig. 1), which links the north-western outskirts of London (Elstree) with central London (St. Johns Wood).

THE CABLE

The cable type is: 2XS(FL)2Y 1x2500 RMS/400 230/400 kV. Its outer diameter is 150 mm, and it weighs 40 kg/m. The copper conductor has a cross section of 2500 mm^2 with 6 segments in order to reduce skin effect losses and the XLPE insulation thickness was chosen to be 28 mm. This leads to an electrical stress of 10.8 kV/mm at the inner semi-conductive layer and 5.8 kV/mm at the outer semi-conductive layer during normal operation voltage of 230 kV ($U_N/\sqrt{3}$).

The inner and outer semi-conducting layers are bonded to the insulation material. The production process is a triple head extrusion process followed by a dry curing process to avoid water penetration into the insulation material. The metallic screen consists of copper wires which are imbedded with crepe paper to reduce mechanical and thermal impact from the screen wires on the underlying insulation. A copper screen with a 400 mm^2 cross section was used to meet the short circuit current requirements. The gaps between the screen wires are filled with swelling powder to achieve longitudinal water tightness.

The outer protection of the cable is provided by a laminated sheath made of extruded PE over and bonded to an aluminium foil on its inside. The PE-oversheath delivers both, high mechanical and corrosion protection of the cable. The aluminium foil provides an effective water barrier between the insulation and the outside into the cable.

For subsequent temperature monitoring of the cable route, a thin steel tube with a fibre-optic cable has been integrated into the cable shield,