



## THE 33 KM LONG 87/150(170)KV KOKSIJDE-SLIJKENS LINK



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### **ABSTRACT**

*A 87/150 kV underground link of 33 km has been built in the north of Belgium. This paper describes the different steps between the start of the project, to the final acceptance tests, with special consideration of the AC voltage test after installation on such a long link.*

### **KEYWORDS**

XLPE cables, long link, after installation tests, direct cross-bonding, thermal backfill, temperature measurement by optical fibres.

### **AN UNDERGROUND TURNKEY PROJECT**

Elia is the Belgian electricity transmission operator, dealing with voltage levels from 36 kV to 400kV. For the need of reinforcement and extension of its network, a 150 kV link was necessary in the north part of Belgium, between the Koksijde and Slijkens substations. For this project close to the coast, Elia decided that this link would be an underground XLPE system and a turnkey project.

#### **The system cable-accessories**

To transmit the required power a cross-section of 2000mm<sup>2</sup> aluminium XLPE cable has been chosen, with cross-bonding of the metallic screens.

The cross-bonding is a direct system, without SVL, as the joint and the cable have an intrinsic protection level allowing a surge voltage level of 75kV between screens and earth, and 150 kV between screens.

One phase of the three is equipped with optical fibres in the screen, in order to have a distributed temperature sensor integrated in the cable, allowing temperature measurement when needed.

The use of direct cross-bonding doesn't mean that there are no more boxes for connecting the metallic screens: there are still boxes at some parts of the link to allow disconnecting of the screens for DC testing of the outer sheath (to limit the charging current); these boxes also allow to have connections points to the optical fibres for temperature measurements, allowing a better precision on the temperature and on the location of an eventual hot spot than on the complete link.

This 33 km cross-bonded link is divided in 30 sections, with 29 joint pits.

On the Koksijde substation side, the terminations are of composite type, filled with oil with a silicon insulator. On the Slijkens substation side, the terminations are dry GIS terminations.

The cable, the joints and the composite termination were already qualified for former links for Elia. The dry GIS termination has been qualified during the execution of the project, following IEC 60840 and customer's requirements. A non-qualification at due time of the dry GIS termination would have led to the use of GIS terminations filled with oil, but this was not necessary, as the tests were successful.

#### **The civil works**

##### **The trench**

The cable was laid in trefoil, with the use of thermal backfill (dolomite) around the cables.

Several thermal resistivity measurements of the native soil were performed in order to check that the required ampacity could be met. At some places, a part of the native soil has been removed, as its thermal resistivity was not good enough.

At some road crossings, where the cable is laid at higher depth and where the thermal resistivity was poor, the cable has been laid in flat formation, in pipes filled with a mix of bentonite-sand and water, in order to meet the required ampacity.

##### **The technical tunnel**

On one part of the project, near the Slijkens substation, the link crosses the Oostende-Brugge channel and the cable has been laid in an existing technical tunnel under this channel.

This concrete tunnel has 25m depth shafts at both sides, a horizontal length of 120m, and a diameter of 2.5m. In order to avoid propagation of eventual fire in the tunnel, a special coating has been placed on the PE sheath of the cable after it was installed.