

Study on thermal backfill materials for directly buried HV cables

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The increase of energy consumption and the pressure on permits (for overhead lines) in Belgium, as elsewhere in Europe, drive the Belgian TSO Elia to invest more in the development of its underground cable network. The common practice of cable installation in the Belgian HV network is directly burying in trenches. The maximal ampacity of the cable strongly depends on the surrounding soil capacity to evacuate the heat generated by the cable. To evacuate this heat Elia places a backfill material around the cables. This backfill material is a granular soil that meets defined thermal characteristics assuring a low thermal resistivity in dry state, which should also ensure safe cable installation.

A study of six different backfill materials was performed by Laborelec in collaboration with Elia, in laboratory and on site. After a pre-selection three materials were retained for further testing (including one of the qualified backfill materials to allow control sample during the tests).

The most important soil parameter in the heat transfer around the cable is the thermal resistivity in dry conditions; this is influenced by the soil's porosity, density, saturation degree and grain size distribution. During field research the in situ characteristics of the backfill material were tested and these results were used for additional laboratory testing. These combined results gave Elia experience feedback on the parameters for quality monitoring during backfill installation and on the general use and application methods for the backfill materials.

The study allowed us:

- to highlight the link between the grain size distribution, water content during installation, the compaction level and the resulting dry density of the analyzed backfills;
- to establish the optimum laying method on site and give the parameters for quality assurance (Figure 1);
- to assure the heat evacuation around the cables, with the hypothesis used during ampacity calculations;
- to reduce the price of our products by allowing more competition between the producers.



Figure 1: On site investigation of thermal backfills