

## **1. Earthworks**

Prior to trenching, the topsoil is scraped off in a 20 to 30-metre-wide belt, depending on the number of circuits being laid. The spacing between the circuits is 6 m.

Depots of sand, cable drums, marker tape, drainage pipes etc. are established.

Along the cable route and on unsurfaced roads, steel plates are laid to allow access by large items of machinery, almost regardless of the weather conditions. The steel plates also help to protect the affected fields and countryside.

In damp areas, cut-off drains or open ditches are established to improve working conditions. A drainage pipe is ploughed into the cable route, deeper down than the final cable depth. This allows dewatering of the area during the establishment of the system. In some places it is necessary to lay a drainage pipe on top of the cable so as not to create soft spots above the cables.

In decidedly wet areas many pumps are used to keep the open cable trench and the joint bays free from water. Normally, the cable trench is excavated in the course of a day, and the cable is laid the day after. Immediately after the cable is laid, it is covered with sand.

The cable trench is approx. 1.5 m deep. The bottom of the trench is filled with sand so that the cable lies approx. 1.2 m below ground level, measured from the top of the cable.

Immediately after the laying of the cable and prior to the filling of the trench, the exact position of the cables is determined in a nationwide grid system. Moreover, the cable elevation is entered so that it is subsequently possible to find the earth cover above the cable along the entire cable route. The depth at which the cable is laid is a central factor in determining the transmission capacity of the cable.

Any crossing lines are also registered and entered in the system.

Prior to the start of the excavation work, all line owners are contacted with a view to providing an overview of all crossing lines in the route. Some lines can be crossed through normal digging-up, while in other instances casing pipes are laid for the 400 kV cables in order to protect them from the work being performed. The laying of pipes also means that any crossing lines can be covered again prior to the laying of the cables. In connection with large sewers, water, gas or oil pipes, controlled directional drillings may be performed to cross the lines. The choice of crossing method is determined by the conditions at the individual sites.

Roads are crossed by means of controlled directional drillings. It is important to know in advance how deep the directional drilling will be, as this affects the heat dissipation of the cables. In some cases a total of three pipes have been included in a directional drilling, lying in a close trefoil formation. In other cases, primarily in connection with very long or deep directional drillings, each directional drilling has involved only one pipe, with the pipes being laid with a spacing of approx. 1 m.

After the cables have been laid and then covered with 10 cm of sand, empty pipes are laid for fibre-optic cables which will be used for communications purposes.

Furthermore, marker tape and warning tape is laid. The cable trench is filled with the earth which was originally excavated. In so far as is possible, no earth is transported away, depending on the conditions at individual sites.

Damaged drains are re-established and the entire exposed area is finally levelled.

The joint bays are left open until the joints have been fitted. This means that any pumps must keep running for a long period of time. After the joints have been fitted, the joint bays can be covered. However, where link boxes are involved, access must still be allowed. When the entire system is finished, and the final sheath test has been performed, the link boxes are buried next to the joints.

Following the laying of the cables, all casing pipes along the section are filled with bentonite. Bentonite is as thin as water, but assumes a jelly-like consistency after a few days. The bentonite ensures good thermal conductivity around cables which are placed in pipes.

Following reestablishment, marker stands are erected at selected spots. The stands are typically erected at field boundaries and where roads are crossed and where it is likely that excavations may take place at a later date. The marker stands are guiding and informative, but cannot be used to determine the exact location of the cables in connection with work being performed close to the cables. Such work requires exact surveying and plotting of the cable.

As a matter of curiosity, and something which is seen quite often, it should be mentioned that the excavation work resulted in historical finds, which affected the time schedule.

In the cable route in Indkilledalen, archaeologists from Aalborg Museum of History unearthed a number of prehistoric finds dating from the Stone Age.