1. Joints

The joints for the 400 kV cables are prefabricated joints. They must be linked on site under controlled conditions, free of water and dirt. Jointing is a manual operation which must be carried out by specialists. The cable supplier Sagem is responsible for the jointing.

Drawing of joint. Figure 29

The joints are fitted in lightweight shelters with open floors. Before the cable is pulled, a concrete slab measuring 3 by 12 m is cast to which the three joints in one cable circuit will be fitted and rest on. When the cables have been pulled out along the cable trench, the workman's shelters are moved into position in the joint trenches and here a closed area is established for the joint work – a so-called "clean room". It is important that the work on the joints can be done in an environment which is protected from rain, dust etc.
Outside this area the cable curves away (so-called "snaking"), giving several metres of excess cable length. If a joint fails, there is then sufficient cable to make a new joint.

During this work on the cable, account is taken of the fact that induced voltages can occur on the cable shield. The induced voltages are due to nearby 150 and 400 kV lines. In the event of high-voltage faults in particular, high voltages can occur. It is therefore important that the work area is carefully earthed.

The work on the joints is largely manual. A very important component is the stress-cone which controls the electrical fields in the joint. This part is factory-made and tested beforehand.

The cable length is adjusted. The outer sheath, semi-conducting layer and some of the polyethylen insulation are shaved away. All the insulation is removed at the point where the conductor will be joined.

The cable shield is joined together with the shield from the other part of the cable or led out to a so-called link box where the shield can be cross-bonded or earthed.

The two conductors are joined using aluminium. Cooling elements are fitted prior to casting to prevent damage to the PE insulation. The mould and the conductor are heated to such a high temperature that the aluminium melts. Extra aluminium is added which fills the space between the aluminium strands, creating a connection between the two cable ends.

The casting process is followed by thorough checks. Surplus material is removed from the conductor. The join now consists of solid aluminium.

An aluminium block is then fitted on top of the conductor which precisely fits the hole left behind by the PE insulation which was removed. Around the joint, the electrical fields must be controlled to ensure that the insulation in the joint is not damaged. The prefabricated stress-cone is positioned over the joint, after which it is supplemented with insulation tape. Conducting tape is then wrapped around the insulation which also helps to control the electrical fields in the joint. Any space left by the removal of the screen wires is filled with a plastic compound.

Finally, a protective layer of plastic material is poured around the joint. The joint is attached with clamps to a frame which is secured to the concrete slab.

In the transition compounds, the cables run into so-called terminations. The terminations are also assembled in shelters which protect against rain, dust and so forth. One shelter is used for each termination. Again, this is manual work as with the joints. The entire termination is encapsulated in an insulator made of a polymer material. The termination is filled with SF_6 gas, which creates the necessary insulation in relation to the surrounding insulating material.

Drawing of a termination. Figures 30 and 31