New qualification tests for high loaded MV joints

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During Jicable 2011, a paper (B9.4) describing the thermo-mechanical behavior of joints in high loaded MV cable systems was presented by several Dutch companies. The project was started due to a high failure rate of MV joints in the Netherlands. Theoretical background of forces induced on connectors by thermal expansion of the conductors and results of mechanical push-pull cycle tests on different connectors were discussed.
Since 2011, other countries have joined the project, progress has been done in the understanding of the issue and tests have been developed.
On one hand, measurements of real forces due to thermal expansion of 240 mm² and 630 mm² aluminium conductors were measured and thermal cycles on fastened cable systems were performed.
On the other hand, in order to avoid an unmanageable quantity of costly tests on the various connector/joint combinations, it was decided to separately handle the three causes of failure due to high load: water ingress in joints, mechanical behavior of connectors and thermal behavior of joints.
The results of the different tests are described in the paper:

Cyclic mechanical loading
A test was set up to investigate the impact of cyclic mechanical loading on the performance of conductor connections.
The range of mechanical loads from 20 N/mm² up to 40 N/mm² was explored.
Hexagonal crimp, deep indent crimp and mechanical conductor connections, installed on solid and stranded aluminium cable conductors between 240 and 630 mm², were tested.
The relative displacement versus the conductor and the resistance of the connections were monitored.
The combinations tested are effectively installed in the power grids. Test results are compared with experience data.

Thermal behavior of joints
The thermal behavior of joints is evaluated by means of two separate tests.
A test to evaluate the performance of the connector inside the joint is done on several joint types. The temperature profiles of the joint and connector are recorded and used to evaluate the temperature of the connector during the cycles of HD629.
The second test is realized by means of injection of losses inside a “fake” connector in order to measure the ability of the joint to dissipate the heat.

Water tightness of joints
In order to verify the water tightness of joints especially under cyclic load, giving also lateral forces to the point where cables enter a joint (a weak point in a cable – joint connection), the water tightness of joints was studied. Results will be presented in the paper.