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Measurement of the rigidity of polymeric cables

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Polymeric cables of robust and stiff design can be difficult to install in compact MV/LV substations. The cost of the installation and the risk of industrial injury or cable damage are higher than when using a cable which more easily is bent into the shape needed for the installation. Therefore, utilities and other cable users will benefit from being able to specify and measure the rigidity and elasticity of cables. Evaluation of the rigidity is also useful for cable manufacturers when comparing alternative cable designs.

In 1988 a joint Nordic project led to the development of a method for measuring the rigidity and elasticity of MV cables. This method has since 1988 been used by some electric utilities and cable manufacturers in the Nordic countries. However, when using the method it turned out that the results obtained were not always reproducible, especially when the method was applied to LV cables. Therefore, additional investigations of the method were initiated in 1998.

A mechanical analysis and a comparison of how the users carried out the test led to the identification of a number of details in the test procedure that had to be improved or specified more precisely.

In the revised test procedure, six samples of cable are bent twice: first against the natural curvature of the cable and then with the natural curvature. The maximum bending force is recorded in both bendings for each test object. From these recordings, the corresponding bending moments are calculated. After the first bending, the cable is released, the spring-back of the cable is measured, and a value characterising the elasticity of the cable is calculated.

The relatively poor reproducibility of the results in previous test set-ups has been improved with the present method. This can be documented partly by the fact that the standard deviations of the values of the individual tests are small, and partly by the nearly identical results obtained when repeating the tests of a specific cable type.

On the basis of these results, a Task Force under the umbrella of CENELEC TC20 WG9 has written a proposal for a test method to be included in HD 605 Electric Cables - Additional Test Methods. CENELEC TC 20 supported this proposal in May 2002.

In this paper the new method and the improvements compared to the formerly used method are described. The application of the method is illustrated by results obtained by three Nordic cable manufacturers on different MV and LV cable designs.