The effect of long-term partial discharges on MV cable joints for cables with fluoropolymer insulation (FEP)

Abstract

The doctoral dissertation presents an innovative design of a cable joint adapted to work with MV cables with FEP (fluoropolymer) insulation at high temperature. Since FEP insulation has a maximum operating temperature of 200 ºC, the joint design was adapted to be used in this temperature range. The work contains the results of electrical tests on the Habia Cable reference cable from the Zeroarc® family designed for a working voltage of 3.8/6.6 kV, which were compared with the results of the proposed joint in relation to uninterrupted operation for 20 years at a temperature of at least 120 ºC.

The paper contains a description of the current state of knowledge on the design of cable joints, together with determining the best methodology for the selected case study. In order to confirm the possibility of the joint operating in the designated environmental conditions, a series of electrical tests were performed on the cable joints with the selected production methodology. These tests were compared to the results of tests on the cable itself in order to determine the suitability of the joint design for further research and possible serial production.

The influence of long-term partial discharges at high temperatures on the morphology of the proposed cable joint was determined. For this purpose, aging (electrothermal) tests were designed to examine the impact of PD. This paper presents the results and analyses for a long-term aging test at a temperature of 190 ºC under a voltage of 20 kV and the results and analyses for a cyclic temperature test performed on cable-joint-cable test objects.

The results obtained in this work allow to determine that the results of partial discharge measurements in the cable joint at low temperature differ from the results obtained at high temperature. This suggests the validity of performing partial discharge measurements at the operating temperature of the cable and joint in order to correctly assess the health of the system.

The result of the research is a tested cable joint design, which will be implemented into production at Habia Cable.

Keywords

Cable joint, FEP insulation, partial discharge, high temperature, MV cables