Extracting optimal value from a medium voltage (MV) Qualification (wet ageing) Test?

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ABSTRACT

MV cables in Europe are qualified to Cenelec HD 605/620. In this specification is an ageing test and is usually done with the cables immersed in water. The cables then have to meet the appropriate minimum performance criteria specific in each country. This paper considers the data from qualification procedures and investigates what can be done with these results to extract more value, beyond a simple qualification.

KEYWORDS

MV Cables, Reliability of Supply, Wet ageing, HD 605, HD 620

SUMMARY

In certain countries the wet ageing test for cables insulation systems is a well established qualification procedure. However, it is often considered just as a means to pass a certain set of criteria. The authors believe that there is considerably more value within these test data, and this knowledge can be used to manage cable system assets.

In this paper the authors examine a number of long term wet ageing data and develop approaches to extract deeper understanding from them. The approaches include:

- Translation from laboratory test lengths to lengths used within the network
- Establishing estimates for in service safety margins using survival criteria relevant for utility operation
- Assessing impact of joints, after ageing, to the network

INTRODUCTION

HD605 supports the installation of new MV cables in the distribution system by providing details of appropriate test protocols and acceptance criteria. These initial qualification programs often, but not always, include ageing tests under combined electrical and thermal stresses for periods of years. In certain European countries the two year wet ageing test is part of the type test and has to be repeated on a specific interval. In Germany this test is even used to monitor the consistency of the production over the whole year. This means that twelve cable samples have to be taken out over the year and aged according to Cenelec HD 605 protocol at 3 Uo, 40 °C, 50 Hz. This test procedure is undertaken on a 10 m lengths with commercial insulation thicknesses (3.4 to 8 mm, though 5.5 mm is most common). Additionally, the conductor size can vary. Prior to the ageing test, the samples are conditioned for 500 hours at 50 °C in tap water. After one year these samples are subjected to a breakdown test with a second breakdown test being made after another year. Thus, the total ageing time without mandatory pre-conditioning takes roughly two and half years. These data are then reported to the utilities and the German certification board, VDE and certain utilities monitor these data very carefully [1].

In the HD605 protocol there is also a possibility to age the cables for 3000 h at 500 Hz.

This test has also been proposed in the recent Cigre TB 722 to type test wet high voltage cables up to 66 kV [2].

This protocol has proven to deliver highly reliable cables and can discriminate between designs /manufacturing choices. However, it is important to note that this test is undertaken only a cable length of 10 m and that for example water blocking and different sheathing materials are not evaluated. Thus, translation of the results directly from the protocol to service conditions requires extra activities. These include:

- Extension to the lengths of cable used in practice
- The impact of accessories (joints) [3].
- increased temperature stress on cables and joints due to connector performance [4].

In this paper we point out what you can do with the data in the two year test besides just have a 'go' or 'no-go' signal.

SOURCE OF DATA

Lab Aged Cables

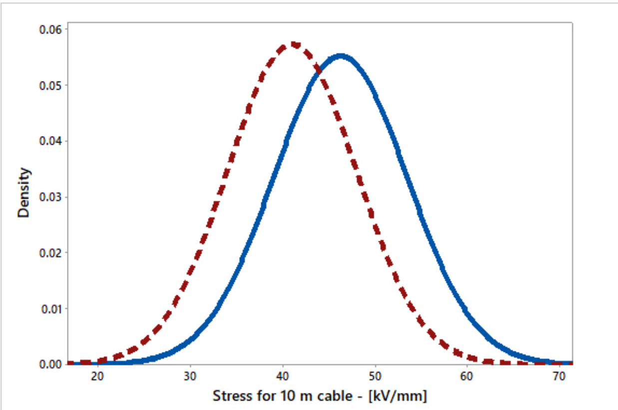

Figure 1: Normal distribution of production monitoring test results of cables supplied into Germany – solid line 1 year ageing, broken line 2 year of ageing

The data on which this work is based cables supplied into Germany. The data cover a period from 1995 to 2015. It is also worth noting that the electrical ageing stress for these data is 50 Hz.