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## B.9.2.

### Assessment of cable life as measured by a variety of accelerated ageing tests

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The cable industry is continuously striving to improve the performance of MV cables. Increased reliability of the system and the potential of extended life in service bring obvious economic advantages. When using polymeric cable insulation systems, degradation of cable performance in wet conditions is still a major consideration. The primary mechanism of degradation is water treeing. Although the treeing phenomenon is not yet completely understood a number of practical solutions exist for MV cables.

The performance of the MV cable insulation system are assessed by accelerating the growth of water trees using factors that are closely related to those that may occur in operation. Since cables in the field are exposed to a multitude of conditions it is practically impossible to perform accelerated tests representative for each field situation. Therefore several test protocols using different accelerating parameters are often used to assess the amount of degradation in wet conditions. The goal is to improve the lifetime of the cable through a reduced amount of degradation in the accelerated tests. The output of the accelerated tests fall into two broad categories: endurance under constant acceleration (Figure 1) and retained electrical strength (usually AC) after constant acceleration (Figure 2).

Accelerated tests are today included in several cable standards, however beyond the typical accelerating factors and final assessment methods there is no common agreed test protocol.

To investigate the sort of information that may be presented to a cable or utility engineer, we have performed accelerated tests on different material systems using a variety of accelerated tests. The following test protocols, familiar in the Americas, have been used in this study; AEIC CS5 and CS8, ACLT 4.4, ACLT 3,7, ASTM D6097, Model Cable Test, Square Wire Test and CTL Low Temperature Test. The objective of this study is to understand the factors that influence how a material system responds to the different test protocols and to provide guidance on how the results from numerous accelerated tests may be interpreted.

The key findings, that will be fully discussed within the text, are:

- the important influence of the insulation system
- the selected test methods consistently ranked the tested material systems in the same order
- the importance of the test method for assessing influence of conductor shield material:

Figures 1 & 2 demonstrate how the advantages of a supersmooth shield can be quantified differently using two tests, whilst displaying the same ranking

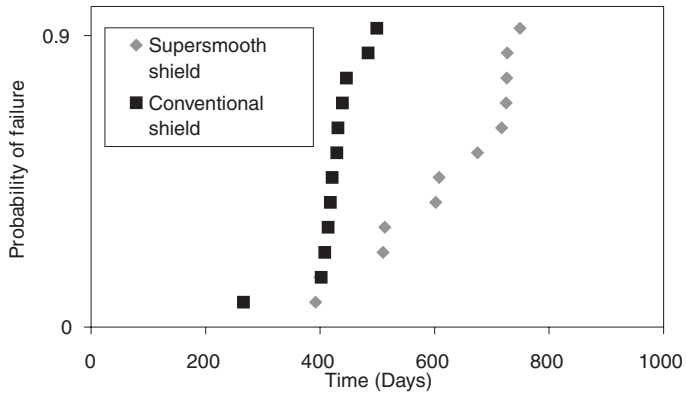


Fig. 1. ACLT (Accelerated Lifetime Test) Comparison of Supersmooth and conventional shield with "XLPE1" insulation

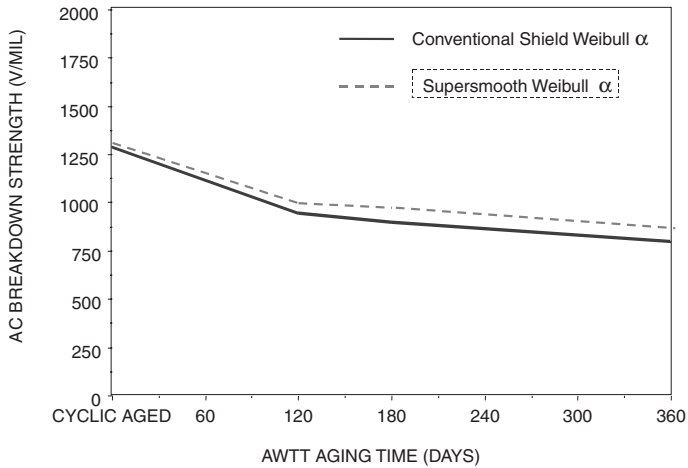


Figure 2. AEIC CS5. Comparison of Supersmooth and conventional conductor shields with "XLPE 1" insulation.

#### References

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