Effectiveness and comparability of condition tests on MV cables

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As most European utilities, Stedin operates a large population of ageing MV cables as part of its network. Many cables have reached an age of 40 years or more, and are nearing the end of their expected technical life span. As old cables tend to be less reliable, the issue of remaining life expectancy and condition of cables is an important factor in asset management.

To determine the condition of aged cable populations testing on (a statistical significant sample of) aged populations is necessary. The tests indicate changes in cable materials and other early warning signals of cable failures.

Even if we limit ourselves in this paper to the use of electrical tests, a large number of techniques are available for pro-active testing of cables. These include:

- PD measurements, both on-line and off-line
- Tan delta measurements
- Voltage tests: VLF, 50 Hz, 20-300 Hz oscillating voltage, Damped AC
- Impedance tests
- Etc.

Each technique is tailored to a specific effect and can be linked to certain failure modes of the cable system. Based on failure statistics from the past, the relative frequency of different failures modes can be determined. From this, the optimal mix of measurements, which effectively addresses the most common faults in our grid, can be chosen. Of course, this has to be re-evaluated periodically, as bad populations are replaced and remaining populations get older.

A second consideration on the number and type of tests, deals with the fact that all measurements imply the possibility of an induced failure. This can result from stressing the system (voltage tests), the need to switch in the system to perform a test (all off line tests) or due to expanding the system with measurement devices (on-line systems). We present the results of a survey, which indicated that the advantages for voltage tests outweigh the induced failures.

On a number of occasions, results of first measurement on an old cable proved indecisive. Then a second measurement with another technique was carried out. We present some examples of that, both with supportive and contradictory results. Further analyses are presented, which will explain these cases.

Key words

Condition assessment; Asset management; Test methods;