

Failures in underground power cables - return of experience

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For many years already, DNV GL's branch on operational excellence (formerly known as KEMA), is performing failure analyses on all types of power equipment. On a regular basis also underground power cables are being investigated after having failed. An investigation is normally focused on finding the root cause, but behind this root cause finding, there are drivers as

- avoiding future failures by
 - having a better design, production, installation, testing or service circumstances
 - tracing back which other components might suffer from the same problem and have to be replaced (in order to prevent outages and related safety problems, costs and reputation issues)
- Identification of the party that is responsible for the root cause of the failure.

Failures as mentioned above, can be a full breakdown, but can also be a defect, like a void in the insulation material as shown in Figure 1.

In this paper, common experience as obtained by DNV GL with failure analyses over the many years will be shared with the reader. It will focus on the following questions:

- when did the failure happen: during testing of the design, the production, the installation or during service operation?
- which components did fail: cable, joint, termination or others?
- what are the voltage classes involved: LV, MV, HV or EHV?
- what are the cable types involved: land cable, submarine cable, AC cable, DC cable, paper insulated cable, extruded cable, etc.?
- what are the most common root causes? This will be treated only for cases in which is not possible to link a specific failure to a certain cable manufacturer, network owner or other third party.

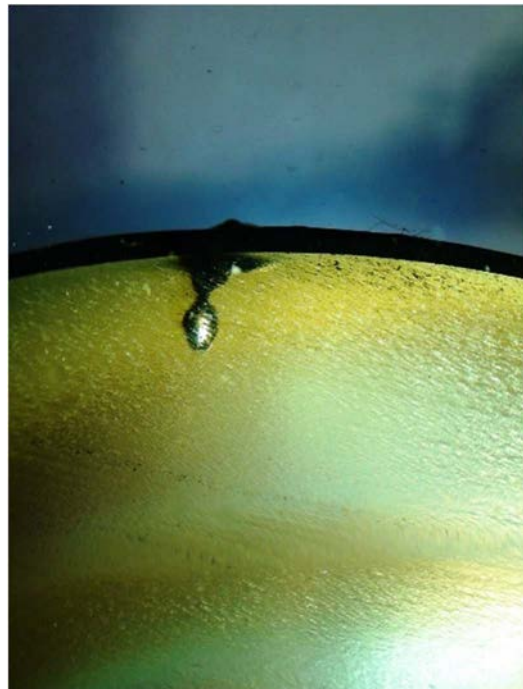


Figure 1 - void in the insulation material of an extruded HV cable, causing intense PD activity during the factory acceptance test.

The final aim of this paper is to provide concise information, based on the described return of experience, to network owners, cable manufacturers and third parties like installation companies world-wide to avoid similar mistakes leading to a reduced failure probability and thus increased reliability of the cable system.