EXPERIENCE WITH JOINT FAILURES IN NEW SMART-GRID MV CABLE CIRCUITS

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ABSTRACT

Over the last decades, the operation of medium voltage electricity networks has changed, caused by more and more distributed generation units (such as wind farms, heat-power couplers, etc.) that are applied in the network. In the last 4 to 5 years, dozens of MV joint failures were experienced in the Netherlands, especially in heavy and dynamic loaded circuits. The failures were caused by thermal problems coming from the compression type connector on a solid aluminium conductor. In this contribution the results of the failure investigations, several laboratory tests and the strategy for the future are presented and discussed.

KEYWORDS

MV Joint failures, Solid Aluminium conductor, compression type connector, Thermal problems, Failure investigation, Smart Grid, Wind farm, Distributed generators, After Installation tests.

INTRODUCTION

Nowadays, insight in the condition and reliability of network components are very important issues for AM strategy. For older components in the network, aging and the remaining lifetime are interesting parameters in order to determine the most beneficial replacement moment. For newer components the quality of installation is very important for a reliable operation. Under normal conditions, components in their “midlife” (5-25years) are considered to be most reliable because they have survived for instance production or jointing failures and do not yet have to deal with significant aging of materials. In this period of lifetime damage due to digging activities is the main cause of failures.

Over the last decade Liander AM has paid more and more attention to the condition of their components to improve reliability of the network. In order to control imperfections within the joint, and to be sure that fitting is done properly, Liander decided that for each new installed MV cable circuit a complete after installation test program should be executed (according the Dutch standard NEN3620) before taking the cable circuit into operation.

This test program includes the following:

- Voltage withstand test of cable sheath: 5kV, DC, 5minutes
- Voltage withstand test of cable insulation: 3xUo, 0,1Hz, 15min
- PD measurements up to 2xUo (for circuits where joints are installed)
- Tan. delta measurement (as a fingerprint)

Fig. 1 Example of insufficient installation of a MV joint

This approach has proven to be successful. In figure 1 an example of poor workmanship can be seen because of the presence of sand within the joint body which has been found by PD measurement. Besides after laying tests, Liander is also involved in the training of contractors and employees to improve installation work and to minimize failures caused by poor workmanship.

For older cable circuits complementary diagnostic tests are applied depending on:

- Age and type of cable and accessories
- Number of failures in particular circuit
- Importance of the cable circuit (risk management)

Besides condition assessment (after installation and diagnostic tests) the cause of failures is also a very important issue for AM to determine possible failure events in the future. In general all failed components (joints, cables and terminations) are investigated systematically by a special internal team of experts. The failure investigation process is given in the following figure 2:

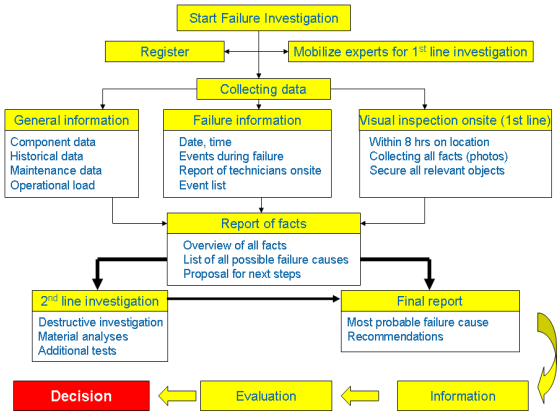

Fig. 2 Process of failure investigation at Liander