WIDESCALE VLF TESTING STATISTICS OVER THE LAST DECADE AT WESTNETZ GMBH

Andreas **SCHRÖDER**, Maik **NEUSER**, Mike **NAGELSCHMIDT;** Westnetz GmbH, (Germany), andreas.schroeder@westnetz.de, maik.neuser@westnetz.de, mike.nagelschmidt@westnetz.de
Hein **PUTTER**, Robert **PROBST;** Megger Germany GmbH, (Germany), hein.putter@megger.com, robert.probst@megger.com

ABSTRACT

As outlined in national and international standards, one of the methods to increase reliability of MV systems is VLF withstand testing. VLF withstand testing of MV cables is a standard practice throughout the entire world, either being part of the commissioning procedure (after-installation), being part of the after-repair procedure, or as part of maintenance testing. During the introduction of the VLF technology quite a lot of research has been performed on the effectiveness of cable testing and also breakdown statistics. In the last two decades no broad statistics have been published, only minor projects not being representative enough to draw conclusions from.This paper will share the large scale experiences in VLF testing on MV cables gathered over the last 12 years by Westnetz GmbH, one of the largest utilities within Germany. These statistics will then be analysed and compared with published studies.

KEYWORDS

VLF testing; Withstand testing; Asset Management; After Laying Testing; Commissioning Testing; Condition Monitoring; Breakdown, Statistics.

INTRODUCTION

Westnetz GmbH is the largest utilitie within Germany. The area that is covered by Westnetz is roughly 51.000 km², see figure 1. The total length of cables and overhead lines owned is over 180.000 km, whereas the percentage of underground cables versus overhead lines is roughly 85 %. In total 5 Mio. customer are served in the most densely populated area of Germany resulting in a turnover of 5 to 6 billion euros.

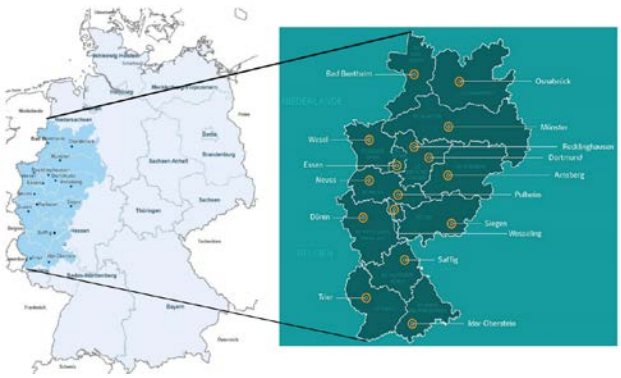

Fig. 1: Network coverage Westnetz GmbH, left part complete map of Germany, right part Westnetz area.

Going back to the beginning of the 1990's the testing strategy at Westnetz was purely based on DC testing. Test voltages up to 8·Uo were applied, later reduced to 6·Uo. Due to the space charge phenomena on the 1st generation of PE/XLPE cables causing outages after putting cables back into service after testing, Westnetz changed their testing strategy. By the mid 1990's, the first 0.1 Hz VLF tests were performed, apart from VLF testing also outer-sheath testing (with 5kV for 5~10 minutes) on all newly installed polymer insulated MV cables (10, 20, 30 kV cable class) was introduced. Main thought behind the outer-sheath testing was to prevent water ingress from outer-sheath damages as cables were not water-tight. Thus limiting the growth of water-trees and internal water-flow to joints

Fig. 2: Setting up the test van for VLF testing

From 1997 onwards DC testing was internally banned for polymer insulated cables, and since beginning of 2000's the 0.1 Hz VLF test was fully implemented. Testing voltage at that time was 3·Uo for 60 minutes at 0.1 Hz per phase. Based on the experiences gathered by Westnetz and other utilities the testing time for both polymer and paper insulated cables reduced to 30 minutes per phase in 2014. The 30 minutes testing time is not in-line with the german VDE standard nor in-line with the current IEC 60502-2 standard published in 2014. The DIN VDE 0276-620 currently still recommends 3·Uo for 60 minutes at 0.1 Hz whereas the IEC standard recommends 3·Uo for 15 minutes at 0.1 Hz only. Apart from the national and international standards, Westnetz is also using the VDE FNN notice for commissioning testing on medium voltage cable systems[8].

One of the main reasons for Westnetz to perform VLF testing is safety. Safety has highest priority, only if a cable is properly tested one can assure it is safe to energize and