Short-term partial discharge monitoring as a diagnostic tool on 400 kV XLPE cable

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ABSTRACT

This paper describes the full measurement method and the technique of distributed, fully synchronous short-term partial discharge monitoring at five groups of joints and two groups of terminations on a 400 kV cable in the cable tunnel of 50Hertz in Berlin. Besides the description of the technology used, first results of the measurements are shown.

KEYWORDS

Partial discharge, Monitoring, high-voltage cable

1. INTRODUCTION

Safe and uninterrupted energy supply is an important basic requirement of our modern life. Electrical equipment has a calculated lifetime of 30 years and more. It should be subject to regular monitoring, to detect, in time, possible faults or changes and to ensure safe operation. This is generally done during commissioning tests (fingerprint) and/or at regular intervals. In addition to many testing methods and diagnostic measurements, monitoring of various parameters is a way to gather important information about the equipment. The monitoring is usually carried out online, but offline is also possible. There are different methods and manufacturers of such systems on the market. At IPH another concept was developed, the short-term partial discharge monitoring. This system was successfully tested on a 400 kV cable system in the cable tunnel of 50Hertz in Berlin.

2. SHORT-TERM MONITORING

2.1 Concept

Conventional monitoring is continuous [1]. The data acquisition of all accessories is carried out simultaneously. The concept of short-term monitoring is different to conventional monitoring. The measuring time is reduced; periods of hours up to weeks are possible. Monitoring for partial discharges is continuously for this time (24 hours per day). The period of measurement is specified by the customer. The raw data are stored at an external Network Attached Storage (NAS) array, with four hard disks, four Terabytes each. The PD pattern and the trend file are also stored. Unfortunately a lot of storage is necessary. The data are checked periodically during the measurement time. An external access via Virtual Private Network (VPN) is used to check the system, validate the data or to change settings. After the measurement the data are evaluated by an expert. The results are written in a technical expert report and the customer gets information in a meeting. The short-time monitoring ends with advice from the expert.

2.2 Sensors

To detect partial discharges on-site High Frequency Current Transformers (HFCTs) are used normally [2]. The sensors are placed around the screen wire of the high voltage cable (Fig. 1). Other sensors e.g. UHF or acoustic sensors are also possible.

Fig. 1: HFCT used for the measurement

In the method described the HFCTs are installed permanently. Connection transfer boxes are installed in the tunnel to connect the HFCTs to the measuring equipment via BNC and for the transfer of the converted optical data signal (Fig. 2.). For this purpose a fibre optic cable is laid between all accessories and the place, where the computer is placed.

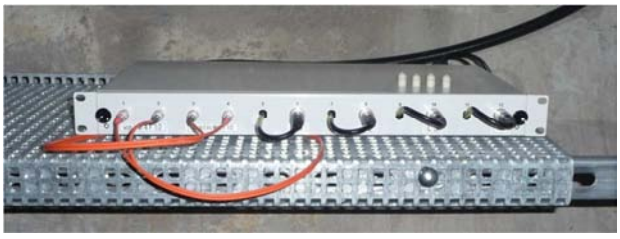

Fig. 2: Connection transfer box