ADVANCED SOLUTION FOR ON-SITE DIAGNOSIS OF DISTRIBUTION POWER CABELS

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ABSTRACT

Medium voltage cables are of key importance in the power distribution network. The enormous lengths of cable now installed in many countries, together with the socio-economic costs of failure, have identified MV cable networks as a target for further attention. This contribution discusses the use of advanced partial discharge diagnostics at Damped AC voltages in assessing the insulation condition of power cable systems. In particular, based on seven years of field application, integral approach of non-destructive partial discharge diagnosis, field application, data analysis and decision support are discussed for power cable networks up to 60 kV.

KEYWORDS

MV power cables, advanced diagnosis, condition assessment

INTRODUCTION

The detection, location and recognition of partial discharges (PD) at an early stage of possible insulation failure in medium voltage are of great importance for maintenance purposes [1-6]. As a result, maintenance actions can be planned more precisely to prevent unexpected discontinuities in operation of the cable network (figure 1). To obtain a sensitive picture of discharging faults in power cables the PD should be ignited, detected and located at power frequencies which are comparable to operating conditions at 50 or 60 Hz. In particular, using non-destructive e.g. off-line diagnostics realistic data and reproducible patterns of discharges in a power cable can be obtained. Moreover with regard to implementation of to support utility asset management (AM) in decision processes about maintenance and replacement policy integral approach is necessary, where the following steps have to be considered (see figure 2).

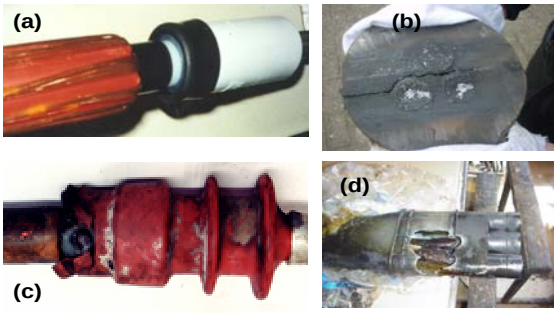

Figure 1: Examples of insulation degradation in MV power cables: (a) bad positioning of field grading, (b) large crack in the centre of a epoxy resin joint, (c) interfacial problems in a termination, (d) connector sharp edges inside mass insulated cable termination.

The above mentioned procedure is based on 7 years field experiences as obtained in world-wide implementation of PD diagnosis for condition assessment of MV power cables. In figure 2 the philosophy behind the above mentioned process is shown. It follows from this flowchart that the major carrier in the execution of condition assessment is the information about the cable system parameters, the diagnostics data and advanced analysis. In this paper based on these steps integral approach will be discussed more in details.

ON-SITE ENERGIZING AT DAMPED AC VOLTAGES

Nowadays a number of diagnostics has found his approval in the field [3, 4]. In this paper, based on worldwide practical experiences the current practices in PD detection and evaluation of distribution power cables using DAC voltages is presented, see figure 3.
To generate damped AC (DAC) voltages with duration of a few tens of cycles of AC voltage at frequencies up to a few hundreds of Hz a system has been developed [2-6] and in practical use for several years, (figures 4-6). This method is used to energize, to measure and to locate on-site partial discharges in power cables in accordance with IEC 60270 recommendations. The system consists of a digitally controlled flexible power supply to charge capacitive load of power cables with lengths up to 10km. With this method, the cable under test is charged during

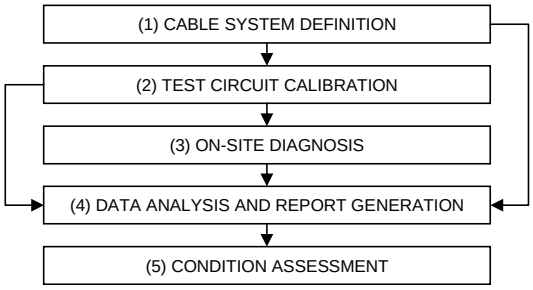

Figure 2: Integral approach for condition assessment of medium voltage power cables by means of on-site diagnosis.