MODERN METHODS OF INSTALLATIN AND DIAGNOSTIC TESTING OF DISTRIBUTION POWER CABLES

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ABSTRACT

Insulation problems in medium voltage power cable networks (e.g. PILC and XLPE) may have different origins by new cables in joint and termination mounting faults or by cables in service due to degradation of cable insulation, or degradation of joints and terminations. Considering sensitive detection of critical discharging insulation defects by using damped AC voltages, in the last years this method has become worldwide accepted at power utilities. Based on the experiences as obtained after several years of use in the Netherlands, this contribution discusses its application for on-site testing of MV power cable networks.

KEYWORDS

MV power cables, advanced diagnosis, damped AC voltages, partial discharge diagnosis, condition assessment

INTRODUCTION

Reliability and availability of a medium voltage (MV) power network is determined by the condition of all components in that power network [1]. Due to the fact that more than half of the breakdowns in the cable network are caused by internal fault in the insulation systems or accessories of the cable network, testing of new installed (after-laying test) and diagnosis of service aged distribution power cable are very important to prevent such breakdowns and to get knowledge about actual condition of particular system, figure 1. By knowing the condition of the cable, the early action can be done before the breakdown occur during operation.

The most accepted on-site diagnostics of MV power cables are based on off-line energizing of a cable section using continuous or damped AC voltages and standardized PD detection and analysis, figure 2 [2, 3]. It is known that

a) due to physical and stochastic character of the PD phenomena in function of defect type and its electrical characteristics e.g. inception conditions, PD level in function of electric stresses on the one hand and
b) the complexity of the test objects like power cables e.g. different length, different insulation materials, different accessories, local electromagnetic interferences on the other hand,

the PD detection and analysis are complex. In order to minimize the problems in performing PD measurement and to provide an optimal use on-site PD diagnosis will be proposed in this paper covering the following procedures:

Fig 1: Example of wrong installation work (left) and insulation degradation (right) in a cable accessories. In all these types of insulation defects partial discharges are symptoms.

1. *Cable section*: most relevant information about the test object parameters e.g. insulation type cable length, number, type and the position of the joints is essential in the execution of all further steps,
2. *Standardized calibration*: to obtain correct measuring results application of standardized measurement is relevant,
3. *On-site testing*: test duration and the height of the test voltage are important to obtain most significant information e.g. about the PD occurrence,
4. *PD measurement and analysis*: the amount of diagnostic data, the way of data analysis are relevant to obtain a good picture about PD activity in the particular cable section,
5. *Condition assessment*: the transition from measuring into insulation condition information is based on key-data extraction and interpretation. Finally only this information is used in further decisions about maintenance, operation and/or replacement.

Fig 2: Example of on-site PD testing of 10kV XLPE insulated cable (tested in section) using damped AC voltages.