'95 jicable

B.9.6. Techniques de diagnostic pour des câbles MT à isolation PR vieillis en service

KUSCHEL M., PLATH R., STEPPUTAT I.,
KALKNER W., TU of Berlin, Allemagne

Résumé

Les processus de polarisation et de conduction dans des matériaux isolants, tel le polyéthylène réticulé (PR), sont une fonction directe de la structure des matériaux. Aussi subissent-ils l'influence de l'âge, de la détérioration d'arborescences d'eau, du degré d'humidité, de la gaine isolante, etc. Les mesures du facteur de dissipation entreprises sur des câbles à tension moyen isolés par du PR démontrent qu'il est possible d'établir une évaluation de l'état de vieillissement. En outre, la méthode basée sur la mesure du tension de résorption, méthode employée lors du test des transformateurs isolés par du papier-huile, est appliquée pour tester des câbles isolés par du plastique. Dans ce rapport deux méthodes diagnostiques pour la mesure du facteur de dissipation (à 50 Hz et à 0,1 Hz) et pour la mesure du tension de résorption sont illustrées. En plus les premiers résultats obtenus sur des câbles à tension moyen isolés par du PE, du PR et du EPR sont présentés.

B.9.6. Diagnostic techniques for service-aged XLPE-insulated medium voltage cables

KUSCHEL M., PLATH R., STEPPUTAT I.,
KALKNER W., TU of Berlin, Germany

Abstract

Polarization and conduction processes in an insulating material such as XLPE are a direct function of the structure of the material. These processes are also influenced by the aging, the water-tree deterioration, the moisture content and thickness of the insulation, etc. The dissipation factor measurements on XLPE-insulated medium voltage cables show that an evaluation of the aging-state is possible. Furthermore it may be the case that the return voltage measurement which is also based on polarization and conduction processes and which is used in testing oil-paper-insulated transformers, can also characterize the aging-state of polymer-insulated cables. Both diagnostic test methods, the dissipation factor measurement (at 50 Hz and at 0.1 Hz, VLF) as well as the return voltage measurement, are illustrated and first results on PE, XLPE and EPR-insulated medium voltage cables are exemplified in this paper.

1 Introduction

Testing procedures are extremely important before putting cable systems into service, to ensure high reliability during permanent operation. Additionally, the users of cable systems are also interested in more detailed information about the aging state of the insulation. Fig. 1 shows an overall view of diagnostic techniques used resp. discussed today.

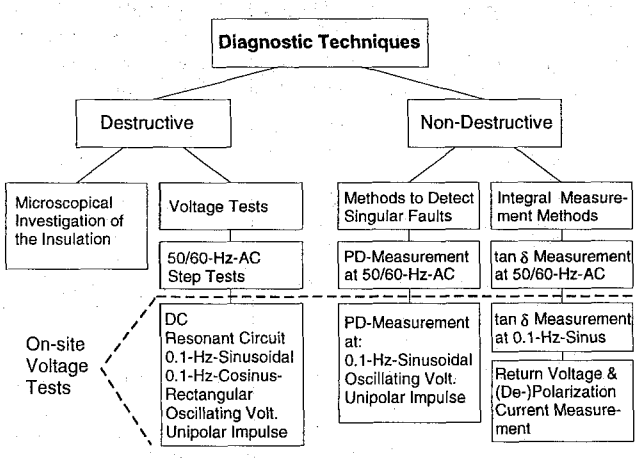

Fig. 1: Survey of diagnostic techniques

On the one hand there are (possibly) destructive methods like DC- or other voltage tests [1, 2] used before putting cable systems into service, and microscopical methods which are carried out to evaluate the insulation in the lab. On the other hand there are non-destructive techniques like PD-measurement, which is the only method to detect singular faults inside the insulation. However, this method is not able to detect water-trees respectively water-tree aged insulations, at least as long as no electrical trees have been generated [3].

The lifetime of XLPE-insulated medium voltage cables can significantly be reduced by aging processes, mainly caused by water treeing. Standard on-site test methods, like DC voltage tests, are not able to detect even severe water-tree degradation. The risk of predamaging still operating cable systems led to the suggestion to avoid DC tests of service-aged XLPE-insulated medium voltage cables completely [2]. Dissipation factor measurement, however, provides a reliable information about the aging-state of XLPE-insulation. This information is very helpful to decide, whether it is necessary to replace service-aged cable systems immediately, soon or not. For on-site tests, a very low frequency (VLF) test voltage is much easier to apply to cable systems, because of low capacitive currents compared to 50 Hz. VLF (0.1 Hz) voltage tests in combination with dissipation factor measurement on-site have proved as a good diagnostic tool for the evaluation of service-aged XLPE cables [4]. Based on this experience, a new diagnostic system is going to be developed which will make it possible to carry out voltage test and dissipation factor measurement at different frequencies and, in addition, to detect singular faults by a PD-measurement.

It may be the case that the return voltage or (de-)polarization current measurement, which both are based on conduction and polarization processes, too, can also characterize the aging-state of the XLPE-insulation [5, 6].