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Electrical and acoustical PD on-site diagnostics of service aged medium voltage power cables

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Résumé

Ce rapport présente une philosophie de diagnostic pour câbles à moyenne tension, illustrée de quelques exemples de mesure in situ. L'attention se concentre particulièrement sur la détermination d'état de l'isolation électrique d'un câble vieilli en service. Pour cette détermination on utilise des méthodes de détection de décharges partielles avancées, aussi bien électriques qu'accoustiques.

Introduction

Power utility companies have growing interest for, internationally accepted [1] and non-destructive, partial discharge (PD) analysis of their existing medium voltage cable networks. The main goal of such analysis is detection, location and recognition of possible insulation failures in cables and cable accessories, at an early stage. The network operator has the opportunity to plan repair programs, reduce in-service failures (figure 1) and decrease the costs as a result. In most cases, a progress in ageing is manifested by the presence of PD (i.e. treeing, figure 2), long time before failures occur.

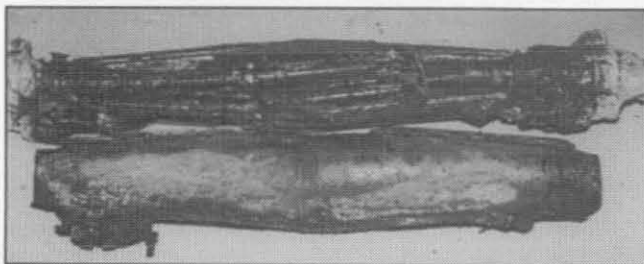


Figure 1: Exploded oil filled cable joint. Due to water entering in the joint, a three phase short circuit occurred.

To detect these PD and to observe the degradation process, detection and location of PD at power frequencies and voltage levels similar to the normal operating conditions is preferable [2]. One of the methods for testing cable systems on PD activity is the Oscillating Wave Test System (OWTS) [3,4]. In

Abstract

In this paper, a medium voltage power cable diagnostic philosophy is presented, along with several field experiences. In particular, it discusses the application of advanced electrical and acoustical tool for determining the condition of service aged cable insulation.

addition to observe sensitively on-site degradation of cable terminations, detection of PD by acoustical diagnostics (AIA) can be used [5].

In this paper, on the basis of field experiences with advanced diagnostics of MV cable network and the Energie Noord West utility philosophy on the medium voltage cable network is discussed.

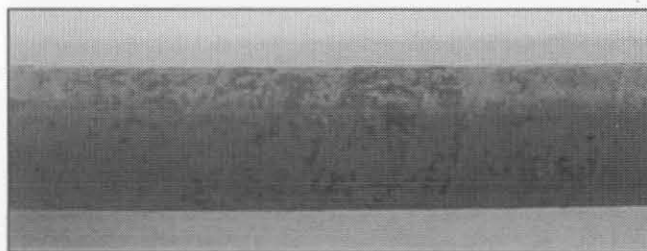


Figure 2: Treeing in the insulation of a 45 years old 50 kV mass impregnated paper power cable.

Diagnostic tools

Oscillating Wave Test System (OWTS)

With this method (see figure 3), the cable sample is charged with DC power supply over a period of just a few seconds to the usual service voltage. At this moment, a specially designed solid state switch connects an air-cored inductor to the cable sample in a closure time of less than 1 μ s. Now series of voltage cycles start oscillating with the resonant frequency of the circuit: