



C.8.2.4.

Aspects and implications of on-line PD detection and localization of MV cable systems

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Abstract: An on-line PD measuring system for medium-voltage cables that can find weak spots anywhere in a long cable with only one or two sensors (as existing off-line measuring systems can do) is not yet available on the market. However, development is now underway. This paper reports on the status of several important technical key issues as PD sensors, time synchronization, data communication and pattern recognition.

Keywords: power cable, partial discharge, diagnostics, on-line, monitoring, localization, time synchronization

1. Introduction

In order to find and localize weak spots in medium-voltage cables, various PD (partial discharge) measuring systems are being applied [1][2][3]. All these systems work off-line, which means that the cable has to be disconnected from the grid. This is a clear disadvantage compared to an on-line situation, but the step towards on-line PD detection is not simple for various reasons, as will be explained and which is also the reason that so far such systems are not on the market.

In this paper, in the first place the potential advantages of PD-online will be discussed, after which the potential technical barriers in making an on-line measuring system will be introduced. Looking to these potential barriers, in this paper some attention will be given to

- the choice of the PD sensor type and its location
- time synchronization
- communication
- types of cable and their impact on PD pattern information

Résumé: Un système de mesure des décharges partielles pour câbles moyenne tension capable de trouver des points faibles sur toute l'étendue d'un câble long avec seulement un ou deux capteurs (comme peuvent le faire les systèmes de mesure hors-ligne) n'est pas encore disponible sur le marché. Cependant, des développements sont actuellement en cours. Le présent article donne un rapport sur divers thèmes techniques clés importants tel que capteurs de décharges partielles, synchronisation du temps, communication de données et reconnaissance des formes.

Mots clés: câbles d'alimentation, décharges partielles, diagnostics, en ligne, monitoring, en-ligne, localisation, synchronisation du temps.

The authors are aware of the fact that there are already several PD on-line measuring systems for cables. But these measuring systems are mainly used for high-voltage cables with a sensor placed at each of the 'suspect' locations. Such a solution is far too expensive for medium-voltage cable. Therefore, in this paper, subject of discussion is on-line monitoring including weak spot localization based on one or two sensors placed at the end(s) of a medium-voltage cable only.

The authors also know, that on-line monitoring of PD's, but without localization, is already possible for several years [9]. Compared to off-line PD measuring methods this is certainly a step forward but since there is no localization of the PD sources, not an ideal solution. In this paper [9] also a possible method is described that localizes the measured PD's with help of a transponder. In short, a transponder receives a PD pulse at the far cable end and will inject a pulse on the cable system, which will be detected at the measuring side after a fixed time delay. It is an interesting alternative for on-line PD measuring and localization as described in this paper. But it is too early to conclude which of the solutions, with a transponder or with separate time synchronization as is described here, will be the most effective one. Probably both have their merits,