PD TESTING IN THE FIELD - REFLECTIONS ON THE LEARNINGS FROM CIGRE B1.28

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ABSTRACT

Partial Discharge (PD) testing in the field is an important tool available to an end user, with which to mangae their transmission cable assets. Considerable field experience has been developed and these have been collated through an international collaboration under CIGRE B1.This paper takes the many findings detailed in CIGRE Technical Brochure TB728 and discusses them to support current PD testing activities around the world.

KEYWORDS

Asset Management, Field Tests, Partial Discharge.

INTRODUCTION

Partial Discharge (PD) measurement is one of the suite of diagnostics that is used for a wide variety of purposes (see chart below) and has been proven to be very effective at helping to assure the reliability insulated cables and accessories

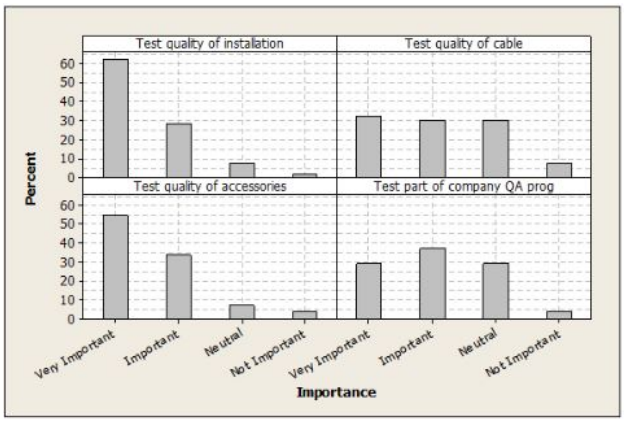

Figure 1: Applicability of PD Test

The improvements in PD detection, identification and noise management technologies has resulted in an increased effectiveness of measuring PD signals in the noisy environment ofthe field. This has allowed a dramatic increase in the amount of Partial Discharge testing of new cable system installations being conducted as part of the AC withstand commissioning test throughout the world. The effectiveness of this combination has been reinforced by the good reliability experienced by the cable systems and experience in identifying and range of defects located.

Experts from 12 countries worked as part of WG B1.28 of CIGRE to study and evaluate the usage of PD testing on extruded dielectric cable systems. The CIGRE Technical Brochure (TB728) that resulted from these studies outlines the findings and associated recommendations and provided guidance to asset owners when considering the most suitable testing methodologies and parameters for the specific site conditions

This paper discusses a number of the important topics that have contributed to the recommendations presented by the Working Group. The topics will include:

- the choice of the critical parameters associated with the length of time selected for the testing process and the voltage used for the energization over this test time
- the inter relationship between the instance when Partial Discharge can be detected and when it becomes un detectable
- PD testing is critically dependent upon the propagation of pulses from the discharging site to the point or point of detection; thus the technical aspects of attenuation, dispersion and internal reflections (typically off joints between the source and the detection)
- the discharge physics associated with the discharging site, i.e. the nature of the defect
- practical site conditions such as electrical clearances, ambient noise environment etx

CONTEXT OF PD MEASUREMENTS (MV / HV / EHV)

Field Partial Discharge measurements are performed widely on Medium Voltage (MV) cable systems and, as well, on High Voltage (HV) and Extra High Voltage (EHV) cable systems. While the physics of PD do not change widely bewteen the three classes of cable sytems the coupling of PD from the point of origin to the inner HV conductor or outer metallic shield does. While this is well described in littérature [2,3,4] the practicalities are often not considered : The same defect placed in a medium voltage cable system will give rise to smaller induced charges on the inner HV conductor and metallic shield for an HV cable and even less for an EVH cable system [2,6]. Thus, detection of partial discharge activity in HV and EHV cable system is correspondingly more difficult comparatively speaking. As well, PD signal deterioration due to attenuation and reflection at cable/accessory interfaces due to mismatching wave impedances [6,7,8] are also different between MV and HV and EHV cable systems. Therefore, the criterion for a succesfull PD test on an HV or EHV cable system can not easily be derived from experiences from MV cable systems. Thus, Cigre WG B1.28 undertook a larger study to provide recommendations specifically for optimizing PD measurements peformed on HV & EHV cable systems.

As well, it should be remembered that the electrical design stress levels differ between MV, HV & EHV cable systems – see Table 1. It it is well understood that electrical stresses affect PD behaviour specifically with respect to