

Feedback and case studies of the new partial discharge detection device developed by Hydro-Québec for unshielded medium voltage cable accessories: PD alarm

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ABSTRACT

In 2021, Hydro-Québec deployed a portable and easy to use partial discharge automated diagnosis tool designed for use by non-expert workers for their own safety in underground vaults: PD alarm.

PD alarm is a lightweight device with two antennas held in each hand that alerts the user in real time if a PD is detected when placed at each end of an unshielded MV component.

This article briefly explains Hydro-Québec's underground structure inspection strategy. Two years after the deployment of the PD alarm, its performance is reviewed through examples and case studies, including several cases of PD resulting from manufacturing issues.

KEYWORDS

Partial discharge, PD, manhole, underground, distribution, medium voltage, accessory, false positive, false negative, transformer vault, unshielded.

CONTEXT

Hydro-Québec has a comprehensive maintenance program in place that includes regular inspections of underground structures and testing of equipment to ensure their functionality. This proactive approach to maintenance helps to identify potential issues before they become critical hence reducing the risk of equipment failure and power outages.

Technologies, such as infrared cameras, partial discharge detectors, and online monitoring systems, are used to inspect the underground equipment and detect any signs of deterioration. These modern technologies allow a more precise and detailed inspection of the components of the underground electrical network. These new tools enable safe access for workers entering underground structures and detect problems at an early stage before they become major problems.

Hydro-Québec attaches great importance to the measurement of partial discharges as part of its maintenance strategy. It has been measuring partial discharges on its medium voltage accessories for about 30 years. This practice was implemented at the time on an exploratory basis without any criteria to support this new type of inspection. In 2001 a thermography standard was published, and the first partial discharge measurement criteria was established.

Since then, many innovations have been designed to keep workers safe. This is particularly the case for the Partial Discharge Analyzer (PDA) [1] [2], the PD Sniffer [3] [4] [5] (Fig. 1) and the PD alarm tool (Fig. 2), all developed at the Hydro-Québec research center (IREQ) and deployed in 2005, 2010 and 2022 respectively.



Fig. 1 - PD sniffer deployed in 2010



Fig. 2 - PD alarm original design

UNDERGROUND STRUCTURES INSPECTION

Several types of workers have access to underground structures: underground linemen, cable splicers, master agents, technicians, engineers and contractors. To ensure safe access for anyone, the structures are inspected on a cyclical basis to issue them a certificate valid for one year or inspected on demand if the certificate has expired.

The inspection includes several steps: thermography of low and medium voltage components, measurement of partial discharges on medium voltage components and 360° imaging for civil inspection. This inspection is performed by non-expert workers called thermographers who are neither technicians nor engineers.

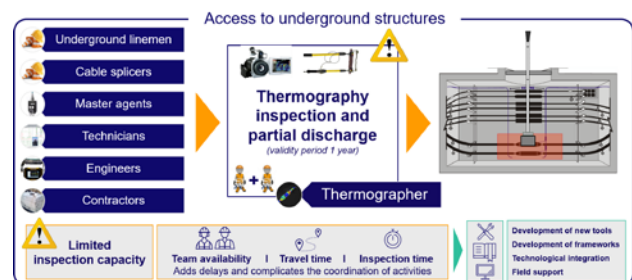


Fig. 3 - Access to underground structures