

## PD ALARM - LIGHTWEIGHT AUTOMATED DIAGNOSTIC DEVICE FOR ONLINE DETECTION AND LOCATION OF PARTIAL DISCHARGES ON NON-SHIELDED ACCESSORIES OF A MEDIUM VOLTAGE DISTRIBUTION NETWORK

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### ABSTRACT

*PD Alarm is a device that offers a quick and safe method of detecting and locating partial discharges (PDs). The PD Alarm device (Fig. 1) includes two antennas that pick up the signals, an acquisition module, a processor, and a module to produce an alarm after detecting a partial discharge. The method includes the detection of two magnetic fields with the two sensors, the digitization of the two received signals, the processing of the two signals and the generation of a signal resulting from the processing. The processor is configured to issue alarm instructions if the resulting signal has a property representative of a partial discharge and remain in a standby state otherwise (ready for signal detection).*

*PD Alarm is able to detect the inversion of polarity of a PD produced between the two antennas at a range of operation below 30 MHz and centered around 18 MHz [1]. This low band frequency allows a much more standard and cheaper electronics for all necessary treatments than at higher frequencies. The development of antennas is also one of the keys to success.*



Fig. 1 – PD alarm unit with 2 antenna arms

### KEYWORDS

Partial discharge, manhole, transformer vault, underground, distribution, medium voltage, accessory, cable, differential antenna, passive antenna, active antenna, magnetic field, false positive, false negative.

### HISTORY OF PD DETECTION AT HYDRO-QUEBEC

Hydro-Québec is a major producer, carrier and electricity distributor with more than 3,800,000 customers. Some power outages occurring in the underground medium voltage distribution grid are caused by partial discharges (PD) occurring in electrical equipment or accessories.

Partial discharges may be due to a problem in the materials during manufacture, to the degradation of the electrical insulation or to a mounting error of these equipment or electrical accessories. In addition to power outages, the presence of partial discharges can also be associated with safety issues for workers doing maintenance or repairs on the network.

With more than 12,000 km of medium voltage underground distribution line and more than 600,000 accessories that can include PDs with potential for failure, Hydro-Québec Distribution (HQD) is a leader in online problem detection.

Hydro-Québec has been inspecting its underground network components using thermography and PD detection for more than 20 years. This represents an annual inspection of more than 100,000 accessories in 11,000 manholes. Approximately 500 anomalies are detected each year by thermography and 100 anomalies by detection of partial discharges.

PD measurement techniques were introduced in 1996 in an exploratory manner without any criteria to support this new type of inspection. Several market instruments have been tested.

In 2001, Hydro-Québec issued a standard. The criteria for measuring partial discharges were established with the device approved by the company at that time, namely the model DDP-540 (Fig. 2).



Fig. 2 - DDP-540

The DDP-540 has good detection sensitivity but low noise immunity transmitted by radiation or propagating along the cable. It was found that it was impossible to accurately determine if the measured PDs came from the accessory or the cables. It was also difficult at times to interpret the measured value (dB).