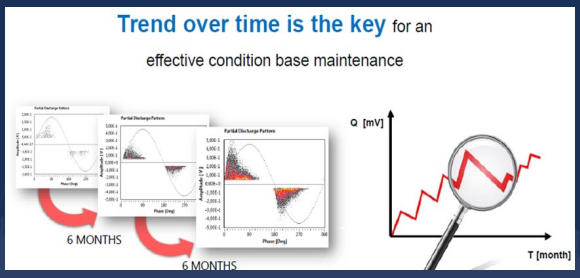
TechTalk

What is Partial Discharge?

Compiled by John Sherriff | January 2019 | Rev 1



The scope

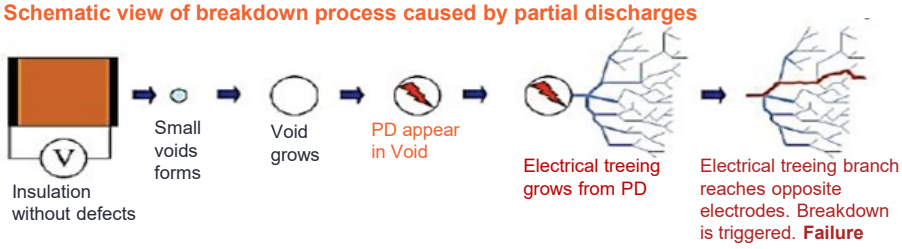
Partial Discharge (PD) could appear in any point of the insulation system as electrical stress, by exceeding the dielectric strength. When referring to surrounding media, we think of air or other gas that fills the cavities or voids present in solid dielectrics (polymers, ceramics, paper), or air bubbles present in liquid dielectrics (insulating oil for example).

PD represent tiny little arcs that, only partially bridge small portion of electrical insulation between phase conductor and ground or between two phase conductors. Each discharge is the result of an electrical breakdown of an air pocket within the insulation.

PD could appear on the surface of solid dielectrics (surface PDs) and partial discharges are also those generated in gaseous insulation surrounding the protrusions presented on electrodes, then called corona discharges. The main objective is to identify partial discharge defects before they can turn into failures.

Visual Inspection of MV components
Visual inspection is valuable, but insufficient for a comprehensive condition assessment of most items of electrical plant and equipment. In conducting a visual inspection, visible defects are evident, but many defects remain unseen because they are hidden below the surface or out of sight. In many instances it is impossible to take the asset out of service and assessments must be conducted during operations. Therefore, it is best to combine visual investigation with objective, systematic engineering processes including on-line condition assessments. Note that an untrained eye can miss small critical defects that could turn into failure.

Schematic view of breakdown process caused by partial discharges



Key features

There are two primary causes of failure of power electrical equipment, viz. overheating or insulation breakdown. Partial discharge is both a leading cause and indicator of insulation failure, so is particularly valuable for condition assessment of the electrical plant.

The main objective is to identify defects before they can turn into failures. By implementing on-line condition assessment methods, (On-line assessment method = Component in operation at system voltage and operating temperature under mechanical and electrical stresses.), this will greatly enhance the reliability of the task.

Condition risk levels can be assigned to all the critical electrical components within the power circuits. Understanding and identifying the high risk components within the electrical system will provide information to permit timely replacement or corrective action to prevent unwanted and costly failures during production.

Tools and technologies

PD Detectors are hand held indicators of the presence of PD activity. Their purpose is to advise the operator of PD activity either for safety reasons or as an early warning to maintenance personnel that unwanted PD activity has started.

When PD activity has been detected several questions usually follow,

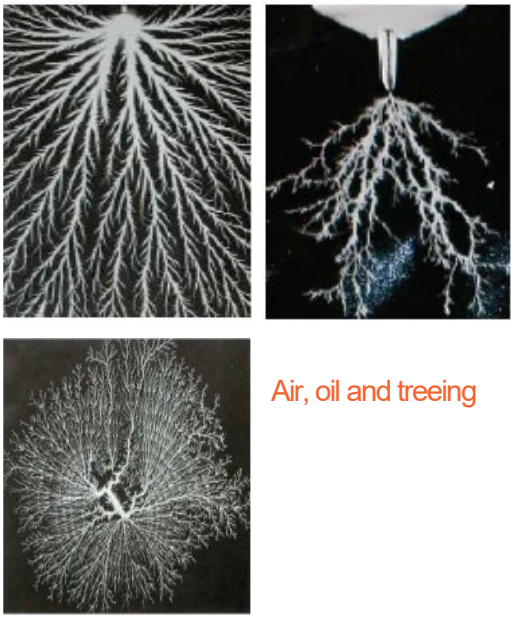
- Where is the PD taking place? (Eg. Which phase?) What component in the switchgear cubicle?
- What is the magnitude or severity of the PD?
- What type of PD is it?
- What are the implications for equipment life?
- What action should be taken in light of the finding?

In order to answer these questions it is often necessary to employ more sophisticated equipment and techniques.

The key to the solution is the use of special sensors and purpose designed instrumentation that allows accurate measurement and analysis of PD in terms of,

- The pulse magnitude and shape
- The repetition rate
- The power and pattern in relation to the applied power voltage wave
- Analysis which may be conducted in the time or frequency domain or both.

Electrical Discharges



Air, oil and treeing