TechTalk

Introduction Partial Discharges vs Partial Arcing

Compiled by John Sherriff | January 2019 | Rev 1

The scope

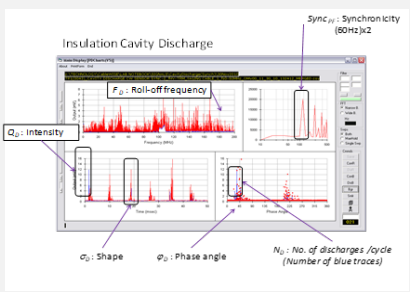
Electrical discharges (ED) in MV power circuits are (1) Partial Discharges (PD) and (2) Partial Arcing (PA). Partial Arcing is a term coined by Martec to explain multiple findings in the field over many years which exhibit some common characteristics of PD. It is best described as an equivalent, but a current related phenomenon, as opposed to partial discharge being voltage related.

Partial Discharges (PD) vs Partial Arcing (PA)

Partial Discharges (Voltage and insulation related phenomenon)	Partial Arcing (Current and conductor related phenomenon)
Definition of partial discharge (IEC): PD is a localised electrical discharge in an insulation system that does not completely bridge the electrodes.	**Definition of partial arcing (Martec):** PA is a localised electrical discharge at an inter-face between conductors when a portion of the current in the conductor circuit is in the form of an intermitted arc.
Partial electrical breakdown occurs in an insulation system between electrodes energised by the system supply voltage. The breakdown does not bridge the electrodes.	Partial electrical current flow in the form of an intermitted arc between two conductive components in the same conductor circuit. This can be in the active load circuit or cable shield and earth circuit. There is no sustained plasma.
Usually associated with poor electrical potential (voltage) stress control in the insulation system.	Usually associated with poor electrical contact between two or more conductors in the current circuit.
Occurs during plant operations.	Occurs during plant operations.
Electrical discharge with characteristic pulse shape produce wide band electrical signals of small amplitude.	Electrical discharge with random wave shape produces wide band electrical signals of a large amplitude.
Presence of PD is normal in certain insulation systems and does not necessarily indicate a defect.	Presence of PA is always abnormal, is never tolerable and always indicates a defect condition.
High localised intense heat damages organic insulation at a microscopic level, May lead to conductive electrical trees. Produce aggressive chemical by-products.	Relatively localised intense heat damages conductors and insulation. Can lead to welding of components, but usually temporary as joint very brittle. (Lead to high resistant defects).
Voltage dependent and current independent.	Current dependent and voltage independent.
Low energy electrical discharges.	High energy electrical discharges.
Seldom detectable with infra-red thermography.	Readily detected with infra-red thermography.
Influenced by air pressure and moisture in air.	Independent of air pressure and moisture in air.
Destructive, rate of degradation usually slow.	Highly destructive, rapid rate of degradation.

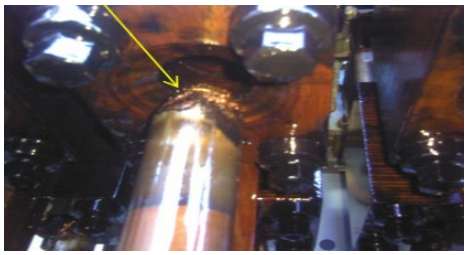
Key features

Cost effective technology to identify defects before they can turn into failures. By implementing PDFSA on-line condition assessment methods. (On-line assessment method = Component in operation at system voltage and operating temperature under mechanical and electrical stresses.).

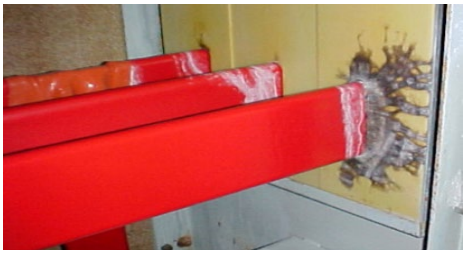


PA – Circulating currents in the earth system

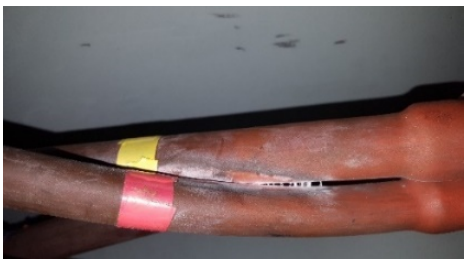
PA – High resistant connections



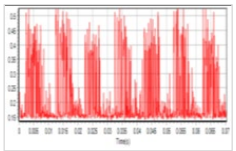
PD – Surface tracking creating electrical trees



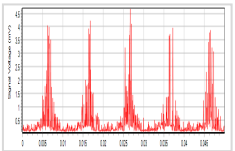
PD - damages insulation. Produce aggressive chemical by-products.



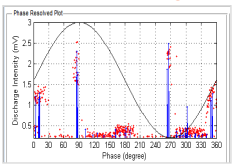
Surface Tracking



Insulation PD



Contact Discharge



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