



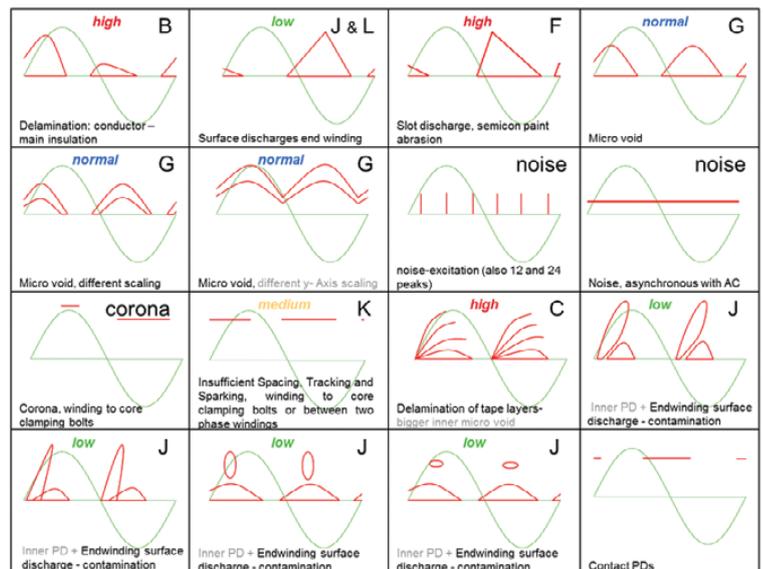
PD Measurement on Rotating Machines

Stator insulation faults are the second most common cause of failure in large rotating machines. Partial discharge (PD) is a reliable measurement parameter used to assess the condition of insulation in rotating machines. PD occurs in the insulation system of rotating machines, where the local electric field stress exceeds the local electrical strength. The insulation materials typically used for rotating machines are resistant to a certain level of PD. An increase of PD activity can indicate insulation degradation caused by overheating, load cycling or mechanical stress.

Successful PD measurement in stator windings is based on the separation of parallel PD sources, and the distinction between harmful PD, normal PD occurrences and external noise inevitably present in industrial surroundings. To achieve this, the following techniques are applied:

- Synchronous multi-channel data acquisition
- Multi-spectral evaluation
- Advanced noise suppression
- Source separation techniques, including:
 - 3PARAD (3-Phase Amplitude Relation Diagram)
 - Automated cluster separation

Figure 1



Classification of PD patterns for a rotating machine

The accessibility of star point determines the measurement setup to be used. Figure 2 shows a basic measurement setup for an off-line, single-channel PD measurement on the open star point of a rotating machine. The voltage (no specific voltage source) is applied at the open star point. The measurements are performed phase by phase (Phase U1) where the unused terminals are grounded. The setup is as described in IEC 60034-27: *open star point*. This measurement setup aims to achieve an assessment of the winding insulation between the phase and the laminated core.

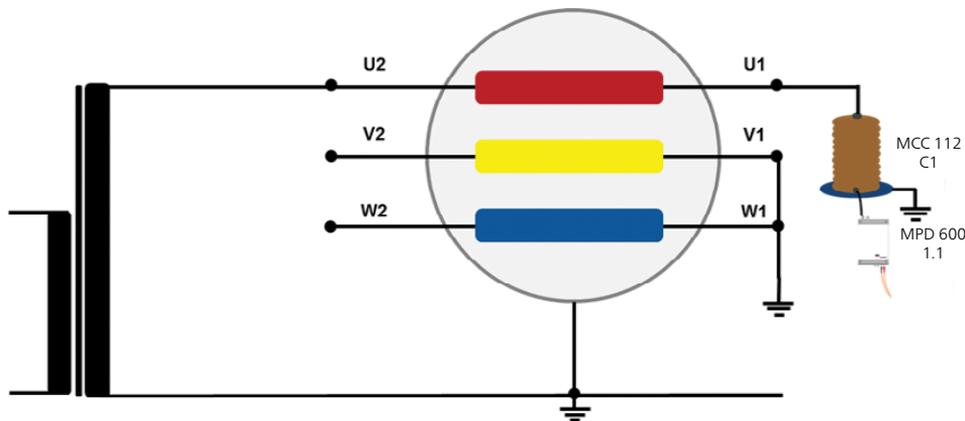


Figure 2

Basic setup for PD measurement on the open star point of a rotating machine

OMICRON even supports the setup of a combined measurement system as shown in Figure 3. This includes the measurement of winding insulation capacitance, Power Factor/Dissipation Factor (PF/DF) and PD in one setup using the CPC 100 + CP TD1 as the voltage source and the CP CR 500 for reactive power compensation with the open star point (if accessible) using 3 channels. The additional BLI1 on top of the coupling capacitor is used as a blocking impedance to filter undesired PD from the voltage supply (CP TD1) in the standard IEC measurement frequencies of 100 - 500 kHz.

This measurement setup presents many advantages. It is lightweight with a portable voltage source due to the compensation of losses. The parallel measurement of capacitance, PF/DF and PD is possible with no additional setup. Complete information about the condition of winding insulation can also be obtained. This measurement setup can also save a lot of time.

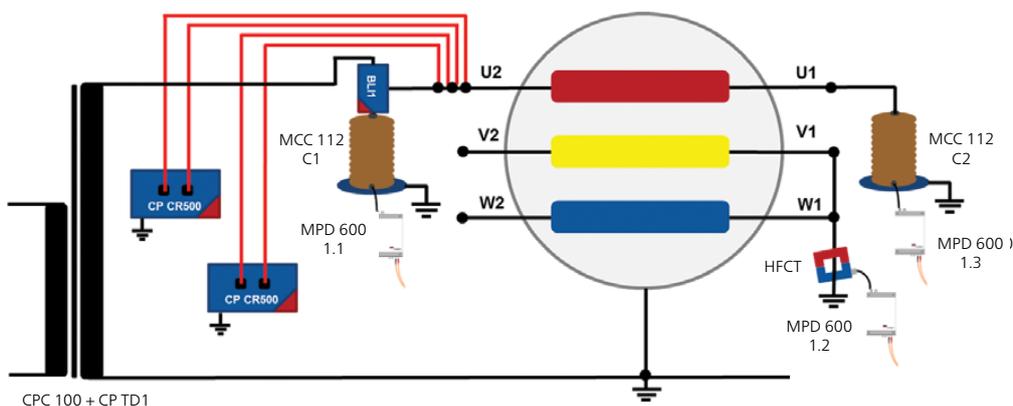


Figure 3

Combined measurement setup for capacitance, $\tan(\delta)$ and PD

More information about PD measurement and analysis on rotating machines is available [HERE](#).

Hands-on training is also available from OMICRON Academy, where you can learn how to perform PD measurement and analysis on a variety of electrical assets. Please click [HERE](#) for more information.