

## On-line Partial Discharge Testing

### Overview:

This interactive 3-5 day course combines theoretical background with practical field experience to provide engineers and technicians with the vital knowledge to understand conventional IEC 60270 and unconventional field partial discharge (PD) diagnostic techniques focusing on power transformers/reactors, capacitor banks, GIS, power cables, and cable terminations.

Doble will provide an introduction to PD, when they occur and what impact they can have on insulation systems. Recommendations included in IEC 60270 standard regarding PD testing circuit and its components will be discussed. Demand for assessing condition of HV assets when in-service has increased utilities interest in un-conventional PD detection approach taking into consideration interferences that occur in on-line field measurements.

Practical PD diagnostic field testing demonstrations could extend training for a fourth and fifth day provided they can be coordinated well in advance along with information about objects to be tested.

### Learning Outcomes:

Upon completion of this course, the participant will be able to:

- Understand PD, when they occur and what impact they can have on insulation systems.
- Properly apply of conventional IEC 60270 and unconventional PD diagnostic techniques.
- Understand instruments used to measure PD and how to analyze/interpret data. Recognize different PD test arrangements for transformers, GIS, and power cables.
- Understand principles of UHF and acoustic techniques along with a range of sensors.
- Improve asset management through accurate electrical asset condition assessment.
- Manage critical asset risk by learning to detect faults early.

### Course Audience:

Electrical engineers working in operations, maintenance, engineering, or other service field in which knowledge of electrical testing methods and evaluation is required part of job responsibility.

### Duration:

Three to Five Days

### Class Size:

8 - 15 Attendees

### Credits:

Up to 2.4 CEUs or 24 Professional Development Hours

## COURSE OUTLINE

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The course program contains the following training outline:

### Day 1:

- **Introduction to PD diagnostics**
  - o Basics about PD theory
  - o Conventional PD measurements in compliance to IEC 60270
  - o Unconventional PD measurements
  - o Background interference and source location
  - o Implementation of PD diagnostic into a company maintenance strategy

### Day 2:

- **PD testing of Transformers**
  - o Factory and field testing – different approach
  - o Conventional electrical PD measurements
  - o HFCT/UHF testing
  - o Acoustic PD location
  - o Interpretation of test results, case studies and examples
- **PD Testing of Gas Insulated Switchgear**
  - o Typical PD sources in GIS
  - o Conventional electrical PD measurements
  - o UHF testing of GIS with preinstalled internal sensors
  - o UHF testing of GIS with external sensors
  - o Acoustic testing of GIS
  - o Interpretation of test results, case studies and examples

### Day 3:

- **PD Testing of Power Cables**
  - o Conventional electrical PD measurements
  - o Testing of cable terminations using UHF and HFCT sensors
  - o Interpretation of test results, case studies and examples
- **PD Monitoring Systems**
  - o Implementation of monitoring system for key HV assets
  - o Interpretation of data, case studies and examples

### Presenter(s):

Falk Werner, Principal Application Engineer Watertown, MA, USA

### Division of Responsibilities:

If the course is hosted at a customer location, to ensure smooth training course delivery, Doble requests the following division of responsibilities:

#### Doble will provide:

- Confirmed training dates upon receipt of a purchase order.
- Technical agenda for 3-5 day program.
- One experienced instructor including their travel/living expenses.
- Training manual (soft copy) to each participant.
- If applicable, all required measurement test equipment and tools for class and site training.
- All personnel safety equipment for Doble's instructor.

#### Customer will provide:

- Confirmed training schedule at least 60 days in advance.
- Training coordinator through whom all contractor requests will be coordinated.
- Training facility, AV equipment, whiteboard and pens.
- Printing hard copy training material as required.
- If applicable, site access for any areas of the program outlined above for practical on-site training. Responsible for all safety issues before, during, and after the field demonstration.

