CONCEPT

# Partial Discharge Testing and HV Insulation Diagnostics: PRPD Analysis and Risk Ranking

31 May – 4 June 2027
London - Central London four-star



# Partial Discharge Testing and HV Insulation Diagnostics: PRPD Analysis and Risk Ranking

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## Introduction:

Partial discharge testing gives the earliest warning that high voltage insulation is failing, yet many asset owners collect PD readings they cannot interpret, mix incompatible units and act only after a cable joint, GIS compartment or winding breaks down. This Core Concept course trains diagnostics specialists to measure partial discharge offline and online, read phase-resolved patterns, reject interference, trend activity and weigh it against tan delta, dissolved gas, breaker motion and tap changer evidence. Participants produce a Partial Discharge Diagnostic Plan that ranks their fleet by risk.

## Course Objectives:

- Explain discharge physics, inception and extinction behaviour and defect types to judge how fast a given insulation fault is likely to progress
- Set up and calibrate apparent charge measurement to IEC 60270 and select HFCT, TEV, acoustic or UHF sensing for each asset class
- Classify phase-resolved PD patterns from cables, GIS, switchgear, transformers and stator windings and locate the defect source
- Separate genuine discharge from external interference and define trend thresholds and alarm rules that limit false positives
- Correlate PD findings with dissipation factor, dissolved gas, circuit breaker motion and OLTC dynamic resistance results to confirm a diagnosis
- Build a Partial Discharge Diagnostic Plan that scores asset health, ranks risk and sets test methods, intervals and escalation triggers

## Target Audience:

- HV test engineers who run offline PD, dielectric and breaker diagnostic tests during outages
- Condition monitoring specialists who operate online PD sensors and review alarm and trend data
- Insulation diagnostics analysts who interpret test reports from contractors and in-house teams
- Asset health and reliability engineers who convert diagnostic findings into replacement and repair decisions
- Commissioning engineers who carry out acceptance PD tests on new cables, GIS and transformers

## Course Outline:

### Day 1: Discharge Physics, Defect Types and Diagnostic Baseline

- Townsend Avalanche, Inception Voltage and Extinction Voltage in Gas-Filled Cavities
- Internal Void Discharge and Electrical Treeing Growth in Solid Dielectrics
- Surface Tracking Along Contaminated Insulator Interfaces
- Corona at Sharp Electrodes and Floating Potential Discharge
- Fleet Diagnostic Baseline: Asset Inventory, Test History and Defect Log Review

### Day 2: Measurement Standards, Sensor Physics and Detection Methods

- IEC 60270 Apparent Charge Circuit, Coupling Capacitor and Calibrator Charge Injection
- HFCT Sensors on Earth Straps and Cable Screens: Bandwidth and Placement
- TEV Probes and Airborne Ultrasonic Detection on Metal-Clad Enclosures
- UHF Couplers and Unconventional Methods Under IEC/TS 62478
- Offline Versus Online Measurement: Test Voltage Source, Sensitivity and Outage Trade-Offs

### Day 3: PRPD Pattern Interpretation Across Asset Classes

- PRPD Pattern Reading: Phase Position, Magnitude, Repetition Rate and Cluster Shape
- Cable Accessory Defect Mapping by Reflectometry and IEEE 400 Test Practice
- GIS Free Particle, Protrusion and Floating Electrode Signatures from UHF Data
- Transformer Discharge Location by Acoustic Triangulation
- Stator Winding Discharge Classification with IEC 60034-27 and IEEE 1434 Guidance

### Day 4: Noise Rejection, Trending and Complementary Diagnostic Evidence

- Interference Separation: Gating, Time-Frequency Clustering and Pulse Waveform Features
- Trend Thresholds, Rate-of-Change Alarms and False Positive Control
- Dissipation Factor Tan Delta and Tip-Up Correlation with Discharge Activity
- Dissolved Gas Interpretation with IEC 60599 Ratios and the Duval Triangle
- Circuit Breaker Travel Curve Analysis and OLTC Dynamic Resistance Signatures to IEEE Std C57.131

### Day 5: Case Work and the Partial Discharge Diagnostic Plan

- Cable Circuit Case: Online HFCT Trend Leading to a Joint Replacement Decision
- GIS and Metal-Clad Switchboard Case: Conflicting UHF and TEV Evidence
- Health Index Scoring and Probability-Consequence Risk Ranking of the Fleet
- Partial Discharge Diagnostic Plan Drafting: Methods, Intervals and Escalation Triggers
- Peer Challenge of Diagnostic Findings and Plan Defence

## Skills You Will Gain:

- Discharge Defect Classification
- Apparent Charge Calibration
- Sensor Selection by Asset Class
- Interference Discrimination
- Diagnostic Trend Analysis
- Multi-Test Evidence Correlation
- Asset Health Indexing
- Diagnostic Risk Ranking

## Why Attend This Course:

- Return with a Partial Discharge Diagnostic Plan that ranks your HV fleet by risk and sets test methods and intervals
- Challenge contractor PD reports with confidence by checking calibration, units, noise handling and pattern calls
- Avoid unplanned insulation failures and needless outages by knowing when discharge activity justifies intervention
- Compare diagnostic practice with specialists from transmission, distribution, generation, oil and gas and heavy industry

## Conclusion:

Insulation failures are rarely sudden; partial discharge usually announces them long before breakdown, provided the right sensor is used, the signal is separated from noise and the pattern is read correctly. The course moves from discharge physics and defect types, through IEC 60270 measurement and unconventional sensing, to PRPD interpretation on cables, GIS, transformers and machines, then noise rejection, trending and supporting evidence from dielectric, gas, breaker and tap changer tests. The final day applies these methods to cases and produces a Partial Discharge Diagnostic Plan.