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# Power Transformer Condition Assessment and Fault Diagnosis Training Course

4 – 8 January 2027  
Rome





## Power Transformer Condition Assessment and Fault Diagnosis Training Course

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### Programme Summary

Power transformer condition assessment and fault diagnosis is the subject of this five-day training course for electrical engineering managers, asset managers and heads of function, ending in a fleet health and response plan. Transformers fail rarely but at great cost, and sound decisions depend on reading the evidence that oil samples, insulation tests and loading records already hold. The programme moves from operating principles, through diagnostic interpretation, to the design of a monitoring and replacement plan, then applies it to one fleet. Mars Training Centre UK delivers this power transformer condition assessment programme for senior electrical asset owners.

### The Business Case

When transformer decisions rest on age alone, utilities and plants replace sound units early and miss the units that are failing. A forced outage of a large transformer interrupts supply, damages neighbouring equipment and takes months to repair or replace. Managers who can read diagnostic evidence, question laboratory reports and rank units by risk can spend maintenance and capital budgets where they reduce exposure most.

- Outage Exposure: Falls as high-risk units are identified before they fail in service.
- Capital Efficiency: Improves as replacement is timed by condition and not by calendar age.
- Response Readiness: Rises as spares, procedures and failure investigations are agreed in advance.

### Principles and Evidence Base

- IEEE C57.104: The guide for interpreting gases in oil-immersed transformers frames the gas limits and trend reading used in Session 2.
- IEC 60599: The standard for interpreting dissolved gas results in service supports the fault classification applied in Session 3.
- Condition-based decision making: It replaces fixed intervals with evidence when maintenance and monitoring plans are set in Session 4.
- Risk ranking by likelihood and consequence: It structures the prioritisation of units in Session 4 and the fleet review in Session 5.

### Intended Participants

- Engineering managers who are accountable for the availability of power and distribution transformers.
- Asset managers who set maintenance, monitoring and replacement budgets for transformer fleets.
- Heads of function who approve specifications, spares holdings and outage windows.
- Technical reviewers who must challenge laboratory reports and failure investigations.



The programme serves electricity utilities, oil and gas facilities, industrial plants and infrastructure operators that own medium and high voltage transformers.

## Learning Outcomes

1. Participants will be able to explain how loading, temperature and cooling drive insulation ageing in a power transformer.
2. Participants will be able to specify and compare transformers against operating duty and failure history.
3. Participants will be able to evaluate oil quality and dissolved gas analysis interpretation results against recognised guidance.
4. Participants will be able to diagnose likely fault types from gas patterns, relay operations and test records.
5. Participants will be able to construct a health index and rank units by risk.
6. Participants will be able to justify a repair, refurbish or replace decision to a finance or executive committee.

## Programme Structure

### Day 1: Transformer Operating Principles and Selection

What determines how a power transformer behaves, ages and should be specified?

- Core and Winding Construction Types
- Loading, Temperature and Insulation Ageing
- Cooling Methods and Tap Changers
- Specification and Selection Criteria
- Failure Mode Catalogue

### Day 2: Condition Monitoring and Oil Diagnostics

What do oil and insulation tests reveal about internal condition?

- Oil Sampling Procedure and Chain of Custody
- Gas Limits and Trend Interpretation Tables
- Moisture, Acidity and Oil Quality Tests
- Insulation Resistance and Power Factor Methods
- Winding Resistance and Ratio Test Records

### Day 3: Fault Diagnosis and Failure Investigation

How is a fault identified, and what caused it?



- Gas Ratio Fault Classification
- Gas Relay and Pressure Device Trip Analysis
- Thermal and Partial Discharge Signatures
- Failure Investigation Timeline
- Evidence Preservation and Root Cause Tree

## Day 4: Health Indexing, Risk and Replacement Planning

How are transformers ranked for action and for budget?

- Health Index Scoring Matrix
- Likelihood and Consequence Risk Ranking
- Refurbish or Replace Cost Comparison
- Spares and Emergency Response Plan
- Monitoring Interval Schedule

## Day 5: Applying Transformer Condition Assessment to One Fleet

Is the fleet plan ready for an investment committee?

- Applying the Session 1 Failure Mode Catalogue to the Fleet
- Reading the Session 2 Test Results for Selected Units
- Diagnosing a Session 3 Fault Scenario
- Ranking Units with the Session 4 Health Index
- Completing the Fleet Health and Response Plan

## Methodology

The programme uses a data exercise built on anonymised oil reports, transformer insulation testing records, relay logs and loading profiles from utility and industrial fleets. Participants work in small teams as asset manager, laboratory reviewer and finance lead, interpreting evidence, disagreeing about causes and recording what further data would change each decision.

- Suggested activity: Classifying faults from three sets of gas results and explaining the reasoning.
- Suggested activity: Reconstructing a transformer failure from relay and test records.
- Suggested activity: Defending a replacement ranking to a panel acting as an investment committee.

## Capstone Output

Each participant completes a fleet health and response plan for a set of transformers. It holds a health index, a risk ranking, diagnostic findings for selected units, a monitoring schedule and a repair or replacement recommendation. The plan is used to brief an executive committee, set maintenance and spares budgets and guide the response when a unit trips.



## Frequently Asked Questions

### **Is power transformer condition assessment suitable for managers who are not test engineers?**

Yes. Power transformer condition assessment is taught for managers who review evidence and decide, assuming familiarity with electrical networks but no laboratory or test experience.

### **Which standards does power transformer condition assessment rest on in this training?**

Power transformer condition assessment here rests on IEEE C57.104 and IEC 60599 for gas interpretation, plus condition-based decision making and likelihood and consequence risk ranking.

### **How is the plan from power transformer condition assessment used at work?**

You use the fleet health and response plan to brief executives, set maintenance and spares budgets and guide your response when a transformer trips.

### **How does power transformer condition assessment differ from a switchgear maintenance programme?**

Power transformer condition assessment centres on oil, insulation and fault evidence for transformers, while a switchgear programme centres on breakers, protection and arc flash risk.