Advanced Power Transformer Maintenance and Diagnostics Training Course



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4100 € (Per Person)

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Course Introduction / Overview:

Power transformers are the cornerstone of any electrical grid, representing a significant capital investment and a critical point of failure. Ensuring their reliability and longevity is paramount for operational continuity and financial stability. This comprehensive course provides an A-to-Z guide on the essential practices for power transformer maintenance, testing, and diagnostics. Drawing upon foundational principles outlined by experts like Leonard L. Grigsby in works such as "The Electric Power Engineering Handbook," this program moves from fundamental concepts to advanced diagnostic techniques. Participants will gain a deep understanding of transformer construction, failure modes, and the most effective preventative and predictive maintenance strategies. At BIG BEN Training Center, we have designed this curriculum to empower professionals with the practical skills needed to interpret complex test data, make informed decisions about asset management, and ultimately extend the operational life of these critical assets, thereby preventing costly outages and enhancing grid stability.

Target Audience / This training course is suitable for:

- Electrical Engineers and Technicians.
- Substation Maintenance and Operations Staff.
- Asset Management Professionals.
- Power System Protection Engineers.
- Testing and Commissioning Engineers.
- Reliability and Maintenance Planners.
- Industrial Electricians and Supervisors.
- Consultants in the power sector.

Target Sectors and Industries:

- Electric Power Generation Utilities.
- Transmission and Distribution Networks.
- Renewable Energy Facilities (Wind and Solar Farms).
- Oil, Gas, and Petrochemical Industries.
- Heavy Manufacturing and Mining Operations.
- Large Industrial and Commercial Facilities.
- Governmental bodies and regulatory agencies overseeing energy infrastructure.
- Railway and Transportation Power Systems.

Target Organizations Departments:

- Maintenance and Operations.
- Engineering and Technical Services.
- Asset Management and Strategy.
- Substation Engineering and Construction.
- Health, Safety, and Environment (HSE).
- Planning and Reliability.
- Testing and Commissioning Units.
- Procurement and Technical Specification Teams.

Course Offerings:

By the end of this course, the participants will have able to:

- Develop comprehensive maintenance plans based on transformer type, age, and criticality.
- Perform and supervise standard electrical tests such as winding resistance and insulation power factor.
- Interpret Dissolved Gas Analysis (DGA) results to diagnose incipient faults accurately.
- Utilize advanced diagnostic tools like Sweep Frequency Response Analysis (SFRA) for mechanical integrity assessment.
- Implement effective condition monitoring programs for critical transformer fleets.
- Analyze transformer failures to identify root causes and prevent future occurrences.
- Evaluate the condition of transformer accessories, including bushings and on-load tap changers.
- Formulate life extension strategies and make data-driven decisions on transformer repair or replacement.

Course Methodology:

The training methodology at BIG BEN Training Center is designed to be highly interactive and participant-centered, ensuring a deep and practical understanding of the subject matter. We move beyond traditional lectures by integrating a blended learning approach that includes detailed presentations, real-world case studies of transformer failures, and group-based problem-solving workshops. Participants will engage in interactive sessions where they analyze actual test data, fostering critical thinking and diagnostic skills. The course emphasizes the practical application of knowledge through simulated scenarios and guided discussions on international standards like IEEE and IEC. Our expert instructors facilitate a collaborative environment, encouraging participants to share their experiences and challenges. Continuous feedback is provided throughout the sessions to reinforce learning and ensure that all attendees can confidently apply the acquired skills and strategies to their specific operational contexts upon returning to their workplaces.

Course Agenda (Course Units):

Unit One: Fundamentals of Power Transformers and Safety Principles

- Introduction to power transformer theory and operation.
- Classification of transformers by design, cooling, and application.
- Key components: core, windings, insulation, bushings, and tap changers.
- Understanding transformer nameplate data and specifications.
- Principles of transformer protection systems and relays.
- Electrical safety procedures and lockout-tagout (LOTO) protocols.
- Hazard identification and risk assessment for transformer maintenance.

Unit Two: Routine Maintenance and On-Load Tap Changer (OLTC) Management

- Developing effective preventative maintenance schedules.
- Visual inspection techniques and maintenance checklists.
- Maintenance of transformer cooling systems: fans, pumps, and radiators.
- Transformer oil handling, sampling, and preservation techniques.
- Principles and types of On-Load Tap Changers (OLTCs).
- Routine inspection and maintenance procedures for OLTCs.
- Troubleshooting common OLTC mechanical and electrical issues.

Unit Three: Standard Electrical Testing and Interpretation

- Insulation Resistance (IR) and Polarization Index (PI) testing.
- Winding Resistance Measurement (WRM) and its significance.
- Transformer Turns Ratio (TTR) test procedures and analysis.
- Excitation current measurement for core integrity assessment.
- Insulation Power Factor (Doble) and Capacitance testing.
- Interpreting test results according to IEEE and IEC standards.
- Documenting and trending electrical test data for condition monitoring.

Unit Four: Advanced Diagnostic Techniques and Oil Analysis

- Principles of Dissolved Gas Analysis (DGA) for fault detection.
- Interpreting DGA results using Duval's Triangle and Key Gas methods.
- Analysis of Furan compounds for assessing paper insulation degradation.
- Sweep Frequency Response Analysis (SFRA) for detecting winding deformation.
- Partial Discharge (PD) measurement and localization techniques.
- Dielectric Frequency Response (DFR) for moisture assessment.
- Vibration analysis and infrared thermography for condition assessment.

Unit Five: Condition Assessment, Failure Analysis, and Asset Management

- Integrating all test and maintenance data for a holistic condition assessment.
- Transformer asset health indexing and ranking methodologies.
- Root cause analysis of common transformer failure modes.
- Strategies for extending the life of aging transformers.
- Developing a long-term transformer asset management plan.
- Modern trends in online transformer monitoring systems.
- Decision-making for transformer repair, refurbishment, or replacement.

FAQ:

Qualifications required for registering to this course?

There are no requirements.

How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

Something to think about:

With the rise of renewable energy sources introducing more variability to the grid, how must traditional transformer maintenance and diagnostic strategies evolve to ensure reliability and longevity?

What unique qualities does this course offer compared to other courses?

This course distinguishes itself by offering a holistic, lifecycle-based approach to transformer asset management, rather than focusing on isolated testing procedures. We emphasize the critical skill of data integration, teaching participants how to synthesize information from various sources such as DGA, SFRA, and electrical tests to build a comprehensive picture of asset health. The curriculum is deeply rooted in practical application, using real-world case studies of transformer failures to illustrate the consequences of misinterpretation and the benefits of a proactive diagnostic strategy. Unlike programs that may only cover the "how" of testing, we dedicate significant time to the "why" and "what next," empowering attendees to make sound, data-driven engineering and financial decisions. The content is continuously updated to reflect the latest international standards and address contemporary challenges, such as managing aging infrastructure and integrating transformers into modern, dynamic power grids, ensuring the knowledge gained is both relevant and enduring.