



Content
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Transformer Maintenance Training

Contact us Today for a FREE quotation to deliver this course at your company's location.

<https://www.electricityforum.com/onsite-training-rfq>

COURSE DATES AND TIMES

November 2-3 , 2020

10:00 am - 4:30 pm ET

Transformer Maintenance Training - This 12-Hour live online instructor-led course covers the testing and maintenance of power transformers and auxiliary equipment.

Topics included are transformer fundamentals, transformer ratings, transformer cooling, nitrogen gas systems and insulation systems. The source concludes with in-depth discussions on transformer testing techniques. This course is applicable to technicians and engineers who need a sound understanding of power transformer operation and maintenance.

Students will learn safe and proper maintenance and testing procedures on pad-mounted, power transformers. The course covers transformers used in commercial and industrial power distribution systems, including oil and dry-type units. Larger power transformers used

in utility applications are also covered.

Load and no-load tap changer maintenance, ac and dc testing, routine inspections and oil sampling and testing are covered in detail. Students will learn how to perform routine oil tests, and understand how to perform the major tests that are required. A variety of electrical test equipment from various manufacturer's will be discussed.

- Risk Assessment & Asset Management
- Introduction to Transformer Testing
- Increase Transformer Reliability and Life Cycle Through Proper Maintenance of Load Tap Changers
- Dissolved Gas Analysis (DGA)
- In-Service Inspection & Sampling of Fluid-Filled Transformers
- Review of Transformer Failures

And the Following Testing Procedures:

- WINDING RESISTANCE
- TRANSFORMER RATIO/POLARITY
- EXCITATION CURRENT MEASUREMENT
- SHORT CIRCUIT IMPEDANCE MEASUREMENT
- SWEEP FREQUENCY RESPONSE ANALYSIS
- INSULATION RESISTANCE
- INSULATION CAPACITANCE AND POWER FACTOR
- PARTIAL DISCHARGE MEASUREMENT
- TRANSFORMER CORE TESTING
- INSULATING OIL
- BUSHING VISUAL CHECK
- TAP CHANGERS Maintenance
- TRANSFORMER TANK INSPECTIONS

Students will learn:

- Students will learn the causes of failures and how to assess the risk of failures.
- Develop or improve a risk-based asset management program for your company.
- Assess and implement proper maintenance practices to prevent unplanned and unscheduled outages.
- Understand test results and perform an analysis of your company's electrical system in order to improve operating conditions.
- Students will be able to perform a transformer assessment to determine the condition and risk of your transformer investment.
- Testing Dry Type Power Transformers
- Testing Oil Cooled Power transformers

STUDENTS RECEIVE

- This Course Includes Our Latest Electrical Transformer Digital Handbook!! (Value \$20)
- **\$100 Coupon** Toward Any Future Electricity Forum Event (Restrictions Apply)
- 1.4 Continuing Education Unit (CEU) Credits
- **FREE** Magazine Subscription (Value \$50.00)
- Course Materials In Paper Format

COURSE OUTLINE

Transformer Maintenance Training Course Outline

DAY ONE

Part 1. Risk Assessment & Asset Management

This presentation will show how to identify, assess and mitigate the risks associated with distribution and power transformers. Transformers and other electrical equipment are assets that have ongoing maintenance needs or are at risk for failure. The presentation will assist participants in developing an intelligent maintenance program that will evaluate risks and consequences of failure and prioritize maintenance needs according to our data and standards, industry standards and best engineering practices.

- Learn how to develop or improve a risk-based asset management program.
- Identify categories of assets within an organization.
- Define risk-based asset management and why it is important in managing the life cycle.
- Perform an analysis of an electrical system equipment with an emphasis on transformers.
- Identify advantages of various maintenance programs and the benefit of on-line monitors.
- Students will learn the causes of failures and how to assess the risk of failures.
- Develop or improve a risk-based asset management program for your company.
- Assess and implement proper maintenance practices to prevent unplanned and unscheduled outages.
- Understand test results and perform an analysis of your company's electrical system in order to improve operating conditions.
- Students will be able to perform a transformer assessment to determine the condition and risk of your transformer investment.

Part 2. Introduction to Transformer Testing

- Solid Insulation
- Transformer Oil
- Testing Transformer Oil
- Moisture in Transformers
- Dissolved Gas Analysis
- Analysis for Furanic Compounds and Non-Routine Oil Tests
- Electrical Testing Principles

- Interpreting Oil Test Results and Maintenance Options
- RECLAMATION of Transformer Oil
- Advanced DGA Testing
- Practical Example of a DGA Assessment

Part 3. Increase Transformer Reliability and Life Cycle Through Proper Maintenance of Load Tap Changers

- Brief History of Load Tap Changing
- Basic Electrical Theory
- Components and Configurations
- Operating Principles
- Monitoring and Testing
- Internal Inspections and Maintenance
- Developing a Detailed Maintenance Program

Part 4. Dissolved Gas Analysis (DGA)

How dissolved gas analysis (DGA) results are interpreted – an important tool in the overall transformer maintenance program. Includes hands-on break out groups. This session is intended to identify fault gases and what causes their formation; explain and provide examples of qualitative and quantitative interpretation of dissolved gasses. This class will also evaluate the condition of cellulose insulation and other non-routine tests, and how to determine if a transformer is at risk for failure due to presence of corrosive sulfur, and how to mitigate the risk.

- Maintenance and Sampling Oil
- Introduction to Oil Testing
- Dissolved Gas Analysis
- Non-Routine Oil Analysis
- DGA Case Studies

Part 5. In-Service Inspection & Sampling of Fluid-Filled Transformers

Learn how to properly inspect and safely obtain fluid samples from energized electrical transformers. This session is designed for substation personnel whose responsibilities include sampling and monitoring the overall condition of fluid filled transformers.

- Safety
- Special Care Transformers
- Transformer Part & Visual Inspection
- Inspection Forms/Nameplates/Gauges
- Sampling Containers
- Proper Sampling
- Nitrogen Blanket
- Packaging
- Why Oil Test
- The importance of monitoring the insulation

DAY TWO

Transformer Field Diagnostics Tests and Techniques

Part 6. Transformer Field Diagnostic Testing and Maintenance Techniques

WINDING RESISTANCE

- Testing techniques
- Voltmeter – Ammeter method
- Bridge technique
- Micro ohmmeter

TRANSFORMER RATIO/POLARITY

- Testing Techniques
- Inductive kick (DC method) polarity
- Alternative voltage (AC method) polarity
- Turn ratio test set
- Double voltage meters

EXCITATION CURRENT MEASUREMENT

- Hysteresis
- Eddy currents
- Copper losses

SHORT CIRCUIT IMPEDANCE MEASUREMENT

- Testing techniques
- Voltmeter – Ammeter method

SWEEP FREQUENCY RESPONSE ANALYSIS

- Testing techniques
- Problems detected
- Shifted winding/core
- Deformed windings
- Loose windings

INSULATION RESISTANCE

- Testing techniques
- Megger
- Polarization index test (PI)
- Can detect the following problems
- Insulation dryness
- Insulation contamination
- Sensitive to temperature

INSULATION CAPACITANCE AND POWER FACTOR

- Testing techniques
- Capacitance bridge method – DF
- AC Dielectric loss method - PF

PARTIAL DISCHARGE MEASUREMENT

- Can detect the following problems
- Insulation defects
- Insulation contamination
- Air bubbles trapped in insulation
- Localized high electrical stress
- PD is the "cancer" of insulation system
- PD detector
- RIV

TRANSFORMER CORE TESTING

- Problems
- Insulation resistance
- More grounding points
- Megger

- Separate external core ground lead from 250 resistor
- Measure core

INSULATING OIL

- Sulphur in transformer oil solutions
- Resolving moisture in transformer oil
- Proposed federal PCB transformer regulations
- Transformer on-line oil monitoring techniques
- Various tests performed on insulating oil
- Properties and parameters of insulating
- Why oil sample?
- Dielectric breakdown
- Water content
- Power factor
- DGA "key" fault gasses
- Benchmarks
- Rating system

BUSHING VISUAL CHECK

- Oil Level
- Leaking
- Chipped porcelain
- Fractured flange
- Poor gaskets
- Peeled painting
- Terminal connection
- Corrosion

TAP CHANGERS

- DETC
- Contact resistance increase
- Loose contact pressure
- Misalignment
- Electrical and mechanical centers

- LTC
- Contact continuity
- Arcing switch and tap selector
- Drive mechanism operation
- Motor
- Timing
- Oil compartment
- Protection and control

TRANSFORMER TANK

- Visual check
- Oil leaking
- Poor gaskets
- Peeled painting
- Rust/corrosion
- Temperature hot spot

COMPONENTS AND ACCESSORIES

- Visual check and function test
- Cooling system – radiators, fans or pumps
- Gauges and indicators – oil level, pressure and temperature
- Pressure relief device
- Gas relay
- Air breather
- Inert air system

- Oil filters

INFRARED TEMPERATURE MEASUREMENT

**Review of expectations
Questions and Answers**

COURSE TIMETABLE

Both days:

Start: 8:00 a.m.

Coffee Break: 10:00 a.m.

Lunch: 12:00 noon

Restart: 1:15 p.m.

Finish: 4:30 p.m.

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