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## **Transformer Training - Fundamentals of Testing and Maintenance**

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

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

Our transformer training course discusses how units are used to reduce voltage for various day-to-day electrical applications. More than 50 million electrical distribution transformers are located on utility poles and cement pads across the United States and Canada. Electrical Transformers serve the crucial function of transforming voltage potential to a higher or lower values to meet the appliances and machinery voltage level requirements. Improper use, maintenance and neglect can cause heavy losses to businesses as well as to the environment. This electrical transformer training course introduces basic safe operational and field diagnostics of transformers with the focus on safe operation, testing and maintenance of the distribution transformers normally installed in substations and on poles.

Students will learn Electrical Transformer Basics - transformer design and operation, as well as safe and proper maintenance and testing procedures on 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.

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

- Understand the basic operation of a transformer.
- Understand turns ratios and calculate terminal voltage and current.
- Understand terminal markings and various single phase and three phase wiring schemes. (WYE vs DELTA).
- Understand how to perform a polarity test on a potential transformer.
- Understand the electrical testing methods performed on transformers such as insulation resistance testing, excitation and power factor testing.
- Understand the various tests performed on insulating oil.

**WHO SHOULD ATTEND**

Field and shop technicians, field engineers, supervisors and others responsible for the testing and maintenance of power transformers rated 750kVA to 500MVA and 4.16kV to 500kV.

**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**

**DAY ONE**

## **Part 1. Transformer Design and Construction**

Students will be introduced to the different types of single- and three-phase transformer construction, various types of core material, windings layout, connection, tap changers, voltage classifications and transformer applications, with an emphasis on explaining recent innovations in transformer design.

### **Transformer Construction and Main Parts**

- Sealed Transformer
- Breathing Transformers
- Nitrogen Blanket Transformer
- Dry Transformers

### **Transformer Core**

- Transformer core
- Core form and shell form
- Core loss
- Exciting current
- Noise level
- Structure
- Core Mechanical Assembly Requirements
- Special Requirements for Magnetic Core

### **Transformer Windings**

- Transformer core
- Core form and shell form

- Core loss
- Exciting current
- Noise level
- Structure
- Core Mechanical Assembly Requirements
- Special Requirements for Magnetic Core

### **Transformer Insulation**

- Winding conductors
- Load loss
- Impedance and voltage drop
- Winding insulation
- Cooling structure
- Short circuit withstand capability
- Core and coil assembly

### **Transformer Tank**

- Oil paper insulation system
- Two functions of insulation fluid
- Various insulation fluids
- Factors affecting quality
- Factors accelerating degradation
- Paper and pressboard insulation
- Two functions of solid insulation
- Factors affecting quality
- Factors accelerating aging
- Aging cycle

### **Oil Preservation Systems**

- Main tank
- Main tank components
- Seals, gaskets and valves, bushings

### **Transformer Bushings**

- Air cell systems
- Breathing systems
- Auto-recharging dehydrating breather
- Oil cooling systems

### **Tap Changers**

- Voltage class
- Current ratings
- Top and bottom terminal connections
- Mounting flange
- Test and voltage taps
- Air side dimensions
- Oil side dimensions
- CT pocket length
- Oil reservoir
- Many styles and types in use

### **Components and Accessories**

- LTC
- DETC (OCTC)
- ULTC
- Headboard links

## **Part 2. Transformer Operation and Application**

### **Transformer Applications and Types**

- Top oil temperature monitoring
- Devices/Indicators
- Winding temperature monitoring
- Liquid level Gauges/Indicators
- Pressure and vacuum Gauges/Indicators
- Pressure relief device
- Gas Detection Relays
- Alarm and trip functions are equipped and preset

### **Transformer Operation and Theory**

- Dry type
- Liquid filled
- Industrial vs public distribution
- Potential transformers (PTs)
- Current transformers (CTs)
- Control and power supply transformers
- Auto transformers

### **Transformer Cooling**

- Load vs no load
- Transformer losses
- Hysteresis losses

- Eddy current losses
- Copper losses
- Stray losses
- Relationship between primary and secondary values
- Transformer polarity
- Single phase transformer connections
- Transformer impedance
- Transformer ratings
- Optimum transformer rating

### **Three-Phase Theory/Transformer Types**

- Transformer cooling techniques and devices

### **Resistive Loads**

- Transformer configuration
- Three phase transformer connections
- Delta connection
- Wye 'star' (Y) connection
- Voltage and current in various combinations
- Transformer terminal markings and identifications

### **Transformer Failures**

- Inductive loads
- Capacitive loads
  
- Misapplication
- Vibration
- High operating temperature

- Lightning or line surges
- Overloading
- Care of control equipment
- Lack of cleanliness
- Care of idle or spare equipment
- Improper lubrication
- Careless or negligent operation

## **DAY TWO**

### **Installation, Testing and Maintenance**

#### **Installation and safety operation**

- Standards for Transformers
- Installation & Relocation
- Transformer Type Tests
- Transformer Routine Tests
- Transformer Commissioning Tests
- Transformer Maintenance: Concepts of preventive & condition based maintenance
- Case studies
- Discussion

#### **Transformer failure statistics**

- Connections and Vector groups
- Safe procedures relating to transformer operation in a utility or industry environment
- Thermal performance and Loading of Transformers
- Practical solutions for operating and maintaining power transformers



- Voltage Adjustment using Off-Load & On-Load Tap Changing
- Earthing of HV Transformers
  
- Transformer failure modes
- Lightning
- Internal Faults
- External Faults
- Insulation Damage
- Component Failures
- Transformer failure statistics
- How to categorize transformer failure modes

### **Protection methods**

- Oil temperature Alarm and Trip
- Winding temperature Alarm and Trip
- Buchholz relay, Oil Surge relay & Pressure relief relay
- Surge protection
- Fuse protection
- Protective relaying ?V Overcurrent, Earth fault, Differential & Overflux
- Example of a Power Transformer System Selection and Installation

### **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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