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# Substation Maintenance Training

View Course Details

## COURSE DATES AND TIMES

**April 7-8 , 2026**

10:00 am - 4:30 pm ET

**December 1-2 , 2026**

10:00 am - 4:30 pm ET

Our Substation Maintenance Training course is a 12-hour, instructor-led live online program designed to equip electrical professionals with practical knowledge on testing and maintenance procedures for substation equipment. This training is ideal for utility personnel, substation technicians, and engineers responsible for the reliability and operation of medium- to high-voltage systems.

Substation maintenance is a critical component of a comprehensive electrical asset management strategy. Failure to properly maintain substation equipment like circuit breakers, switchgear, relays, and racking mechanisms can lead to serious power system disruptions and unplanned outages. Our course emphasizes proactive testing, routine diagnostics, and inspection techniques that extend the life of substation assets and reduce operational risk.

The program covers a wide range of **electrical substation components**, including:

- Power transformers
- Air, oil, and vacuum circuit breakers
- Grounding systems
- Switchgear

- Batteries and chargers
- Protective relays
- Insulating fluids and liquids

Participants will gain a solid understanding of real-time maintenance planning, how to interpret test data, and how to troubleshoot early signs of equipment failure using data analytics and field-based inspections.

## What You'll Learn

This course delivers practical skills and in-depth knowledge, including:

- Differences in substation types, layouts, and safety protocols
- Maintenance and testing methods for medium-voltage circuit breakers
- Performing insulation resistance and contact resistance tests
- Tank loss index and vacuum bottle integrity testing
- Switchgear inspection techniques and torque requirements
- Maintenance intervals for protective relays, batteries, and bus systems
- Testing protocols for ground grid integrity and power factor analysis

## LEARNING OBJECTIVES

- Substation types, applications, components and safety procedures
- Maintenance and testing methods for medium-voltage circuit breakers
- How to perform insulation resistance, contact resistance on air, oil and vacuum breakers, and tank loss index on oil circuit breaker and vacuum bottle integrity tests on

vacuum breaker

- Switchgear arrangement, torque requirements, insulation systems and maintenance intervals

- How to perform switchgear inspection and maintenance

**Related Training and Resources**

To enhance your understanding of electrical infrastructure, see our related courses and guides:

- Substation Training
- Electrical Substation Design Training
- Substation Automation Training
- Substation Relay Protection Training
- Substation SCADA Monitoring Training
- Substation Grounding Training

## WHO SHOULD ATTEND

This course is designed for engineering project managers, engineers, and technicians from utilities who have built or are considering building or retrofitting substations or distribution systems with SCADA and substation integration and automation equipment.

- Substation operation and planning Managers
- Transmission maintenance engineers
- Distribution maintenance engineers
- Substation Design Engineers
- Consulting Engineers
- maintenance Engineers & technologists
- Substation network maintenance engineers
- Substation operation/maintenance engineers & technologists

- Substation protection & control engineers & technologists

### STUDENTS RECEIVE

- 1.2 Continuing Education Unit (CEU) Credits (12 Professional Development Hours)
- Substation Maintenance Training Certificate of Course Completion
- $100 Coupon Toward any Future Electricity Forum Event (Restrictions Apply)
- FREE Electricity Today Magazine Subscription (Value $25.00)
- Forum Presentations in PDF Format

### COURSE OUTLINE

# Substation Maintenance Training Course Outline

**DAY ONE**

**Session 1: Substation Overview**

- Purpose of a Substation
- Components of a Power System
- Types of Substations
- Substation Switching Configurations
- Distribution Substation Configurations
- Substation Components
- Metering in Substations
- Relaying in Substations
- Substation SCADA

**Session 2: Air and Disconnect Switches**

- Maintenance and Testing
- Components
- Interlocking
- Motor-Operated Mechanism
- Vacuum Interrupters
- Maintenance Requirements
- Testing

**Session 3: Circuit Breaker Maintenance and Testing**

- Overall Maintenance
- Electrical Testing

- High-Potential Testing (Hi-Pot)
- Principles of Power Factor Testing
- Operation and Timing Tests

**Session 4: Switchgear Maintenance and Testing**

- Arrangement of Components
- Maintenance Intervals
- Maintaining the Insulation System
- Maintaining Auxiliary Components
- Torque Requirement for Switchgear Assemblies
- Electrical Testing of Switchgear

**Session 5: Transformer DC and AC Testing**

- General Safety Precautions
- DC Testing
- Insulation Resistance
- Winding Resistance Testing
- AC Testing
- Power Factor Testing Fundamentals
- Transformer Winding Testing
- Typical Tests Performed Using Power Factor/Dissipation Factor Test Sets
- Transformer Bushing Testing
- Liquid Insulating Power Testing
- Core Excitation Current Testing

# DAY TWO

**Session 6: Transformer Oil Testing**

- Insulating Liquids
- Liquid Sampling
- Sampling for Power Factor Testing
- Sampling for Gas-In-Oil Analysis ASTM D-3613
- Silicone Insulating Fluid
- Dielectric Breakdown Voltage Test
- Color Testing (ASTM D-1500)
- Visual Examination (ASTM D-1524)
- Neutralization Number Test (ASTM D-1534)
- Interfacial Tension Test
- Moisture Content Test (ASTM D-1533)
- Evaluation of Test Data
- Other Insulating Liquids

**Session 7: Transformer Gas Testing**

- Gas Detection
- Oxygen Testing
- Combustible Gas Testing
- Gas Analysis Interpretation

**Session 8: Current and Voltage Transformers**

- Elementary Connections
- Instrument Transformers
- Types of Current Transformers
- Understanding CT Ratios
- Determining CT Polarity
- Measuring Current
- Shorting CT Secondary
- Current Circuits
- Operation of Current Transformers at Excessive Burden
- Open-Circuit Voltage
- Understanding CTs in a Schematic
- Voltage Transformers
- Coupling Capacitors Voltage
- Transformer Design Fundamentals
- Application: High-Voltage
- Transmission (115 kV – 500 kV)
- Understanding Voltage Transformers in a Schematic

**Session 9: Ground Testing**

- Types of Connections
- Applications
- Reasons for Special Treatment
- The Hazard
- Surface Resistivity
- Bulk Soil Resistivity Measurement
- Design of Grid
- Operating Handles
- Fences
- Principles Involved in Earth Resistance Testing
- Basic Test Methods for Earth Resistance
- Effects of Different Reference Probe Locations
- Tests at a Large Substation
- General Comments
- Other Tests
- Maintenance

**Session 10: Battery Maintenance and Testing**

- Battery In-Service Operation
- Temperature and Battery Life

- Battery Safety Factors
- Safety Hazards
- Safety Equipment
- Safety Precautions
- Battery Inspections
- Corrective Actions
- Equalizing Charge (Lead-Acid Only)
- Battery Measurement Techniques

**Session 11: Overview of Protective Relays**

- Classification of Relays
- Protective Zones
- Fundamentals of Electromechanical Design
- Relay Construction
- Time Characteristics
- Protective Relay Maintenance and Testing
- Mechanical and Visual Inspections
- Preventive Maintenance Testing
- Acceptance Testing
- Testing Techniques
- General Tests
- Relays in Substations

**COURSE SCHEDULE:**

**Both days:**

Start: 10 a.m. Eastern Time
Finish: 4:30 p.m. Eastern Time