

Circuit Breaker Maintenance, SF₆

4 Days, 3.2 CEUs

This course covers all elements of routine SF₆ circuit breaker maintenance, and inspections. A balance of lecture and hands-on activities are utilized to emphasize operating characteristics and maintenance and testing requirements. Instruction includes the hazards involved in working with SF₆ gas as well as the important differences between SF₆ circuit breakers compared to conventional insulating mediums.

Who Should Attend

This hands-on course is intended for new or experienced electricians and technicians that install, maintain, repair or troubleshoot SF₆ circuit breakers rated at 1.2 kV and higher. Participants should have basic knowledge of AC/DC electricity and circuit breaker fundamentals.

Participants must wear long pants and safety-toed shoes to complete the lab portion of this course.

Learning Objectives:

Upon completion of this course and lab practice, the participant will demonstrate by attaining a minimum average of 80% (between lab and final exam), that he/she is able to:

- Describe the safety hazards involved in working with SF₆ gas.
- Explain the procedure for adding gas to an SF₆ circuit breaker.
- Summarize the electrical and mechanical operating principles of an SF₆ puffer circuit breaker.
- Perform circuit breaker inspection, per manufacturer's technical manual.
- Perform and evaluate electrical and mechanical tests that are required by the manufacturer.
- Interpret an electrical schematic for an SF₆ puffer circuit breaker.

SCOPE

Day 1*

- I. Introduction
- II. Safety for Technicians
 - A. Lab Safety Rules
 - B. On-the-Job Safety
- III. Introduction To SF₆ Circuit Breakers
 - A. Circuit Breaker Arc Interruption Mediums
 - B. Sulfur Hexafluoride (SF₆) Circuit Breakers
 - C. Characteristics of SF₆ Gas
 - D. SF₆ and the Environment
- IV. Safe Handling of SF₆ Gas
 - A. Asphyxiation
 - B. Toxicity
 - C. Arcing By-Products of SF₆ Gas
 - D. S₂F₁₀, Is It a Concern?
 - E. Additional Safety Concerns
 - F. Removal of Hazardous Solid By-Products
 - G. Transportation of SF₆
 - H. Storing SF₆ Gas Cylinders

Day 2

- V. SF₆ Circuit Breaker Types
 - A. Live Tank SF₆ Circuit Breakers
 - B. Dead Tank SF₆ Circuit Breakers
 - C. Dual Pressure SF₆ Circuit Breakers
 - D. Puffer SF₆ Circuit Breakers
 - E. Puffer Interrupter Operation
 - F. Self-Blast SF₆ Circuit Breakers
- VI. Evacuating, Reclaiming and Filling SF₆
 - A. SF₆ Gas Filling Physics
 - B. Filling Precharged SF₆ Circuit Breakers
 - C. Filling a New Circuit Breaker After Site Assembly
 - D. Reclaiming and Filling a Circuit Breaker Opened for Service Work
 - E. Filling an SF₆ Circuit Breaker – (From a Gas Cart)
 - F. Adding Gas (In-Service)

Day 3

- VII. SF₆ Circuit Breaker Components
 - A. SF₆ Gas Density Monitor
 - B. Other Pressure Monitoring Components
 - C. Rupture Discs
 - D. Entrance Bushings
 - E. Grading Rings
 - F. Pre-Insertion Resistors
 - G. Capacitors

- H. Heaters
- I. Operating Mechanisms
- J. Auxiliary Switches
- K. Lab (2 Hours)
 1. Contact Resistance

Day 4

- VIII. SF₆ Breaker Maintenance and Testing
 - A. Qualified Person
 - B. Inspections
 - C. Leak Rates and the Need for Testing
 - D. Field Leak Detection Methods
 - E. Leak Testing
 - F. Testing SF₆ Gas
 - G. Measuring Contact Resistance
 - H. Time Travel Analysis
 - I. Control Circuitry
 - J. Other Tests
 - K. Test Results Interpretation
 - L. Labs (5 Hours)
 1. Periodic Maintenance (2 Hours)
 2. Time/Travel Analysis (3 Hours)

IX. Final Exam

*Class scheduling times may vary based on discussions and size of class

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