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.

This hands-on course is intended for new or experienced electricians and technicians that install, maintain, repair or troubleshoot SF₆ circuit breakers rated at 34.5 kV and higher. The student should have basic knowledge of AC/DC electricity and circuit breaker fundamentals. Students must wear long pants and safety toe shoes to complete the lab portion of this course.

Learning Objectives:
Upon completion of this course the student will be qualified to:
• List the safety hazards involved in working with SF₆ gas
• Describe the procedure for adding gas to an SF₆ circuit breaker
• Describe the electrical and mechanical operating principles of an SF₆ puffer circuit breaker
• Perform circuit breaker inspection, per manufacturer’s technical manual
• Perform electrical and mechanical tests that are required by the manufacturer
• Evaluate test results
• Interpret an electrical schematic for an SF₆ puffer circuit breaker

SCOPE

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
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 Before Service Work
   E. Filling an SF₆ Circuit Breaker – (From a Gas Cart)
   F. Adding Gas (In-Service)
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
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
IX. Final Exam and Paperwork